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**Date of meeting** Wednesday, 9th December, 2020

**Time** 2.00 pm

**Venue** Cabinet - Hybrid Meeting - Conference

**Contact** democraticservices@newcastle-staffs.gov.uk

NEWCASTLE UNDER LYME
BOROUGH COUNCIL

**Castle House**
**Barracks Road**
**Newcastle-under-Lyme**
**Staffordshire**
**ST5 1BL**

# Cabinet

# AGENDA

## PART 1 – OPEN AGENDA

**12** **URGENT BUSINESS**

To consider any business which is urgent within the meaning of Section 100B(4) of the Local Government Act 1972.

**13** **DISCLOSURE OF EXEMPT INFORMATION**

To resolve that the public be excluded from the meeting during consideration of the following reports, because it is likely that there will be disclosure of exempt information as defined in the paragraphs of Part 1 of Schedule 12A (as amended) of the Local Government Act 1972.

## ATTENDANCE AT CABINET MEETINGS

**Councillor attendance at Cabinet meetings:**

(1) The Chair or spokesperson of the Council's scrutiny committees and the mover of any motion referred to Cabinet shall be entitled to attend any formal public meeting of Cabinet to speak.

(2) Other persons including non-executive members of the Council may speak at such meetings with the permission of the Chair of the Cabinet.

**Public attendance at Cabinet meetings:**

(1) If a member of the public wishes to ask a question(s) at a meeting of Cabinet, they should serve two clear days' notice in writing of any such question(s) to the appropriate committee officer.
(2) The Council Leader as Chair of Cabinet is given the discretion to waive the above deadline and assess the permissibility if the question(s). The Chair's decision will be final.
(3) The maximum limit is three public questions at any one Cabinet meeting.
(4) A maximum limit of three minutes is provided for each person to ask an initial question or make an initial statement to the Cabinet.
(5) Any questions deemed to be repetitious or vexatious will be disallowed at the discretion of the Chair.

**Members:** Councillors Simon Tagg (Chair), Stephen Sweeney (Vice-Chair), Trevor Johnson, Helena Maxfield, Paul Northcott and Jill Waring

**Members of the Council: If you identify any personal training/development requirements from any of the items included in this agenda or through issues raised during the meeting, please bring them to the attention of the Democratic Services Officer at the close of the meeting.**

**Meeting Quorums :- 16+= 5 Members; 10-15=4 Members; 5-9=3 Members; 5 or less = 2 Members.**

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# CABINET

Wednesday, 11th November, 2020
Time of Commencement: 2.00 pm

| | |
|---|---|
| **Present:-** | Councillor Simon Tagg – Chair |
| Councillors | Stephen Sweeney, Trevor Johnson, Helena Maxfield, Paul Northcott and Jill Waring |
| Officers | David Adams, Martin Hamilton, Jan Willis, Simon McEneny, Daniel Dickinson and Denise French |

38. **APOLOGIES**

There were no Apologies for Absence.

39. **DECLARATIONS OF INTEREST**

There were no declarations of interest stated.

40. **MINUTES**

**Resolved**: that the minutes of the meeting held on 14th October be agreed as a correct record.

41. **CORONAVIRUS UPDATE**

Cabinet considered a report on the actions being taken across the Council in response to the Coronavirus restrictions on the Borough.

The report outlined the two key areas where work had been stepped up as a priority in response to the current national restrictions:

(1) Support for Businesses – the Portfolio Holder for Finance and Efficiency, Councillor Stephen Sweeney, outlined the range of funding available to local businesses, funded by the Government. Some non-discretionary grant payments had already been made.
(2) Support for Vulnerable People – the Portfolio Holder for Community Safety and Wellbeing, Councillor Helena Maxfield, outlined the increased work to support vulnerable people:
- the support service delivered through the Realise Foundation had stepped up its support via the call centre and web portal;
- Revenues and Benefits staff were processing applications for payments under the scheme to support those required to self-isolate and subsequently unable to work and the Test and Trace Self Isolations Support Scheme was also available to support those in receipt of

particular benefits who were required to self-isolate but would lose income by so doing;
- The Homelessness Team continued its support for those sleeping rough or at risk of homelessness.

In addition, the Severe Weather Protocol was also in place.

There had been an impact on some Council Services although this was less severe than previously. The Portfolio Holder for Leisure, Culture and Heritage, Councillor Jill Waring, updated that both J2 and the Brampton Museum were currently closed but were offering online services. A recent initiative included online exercise classes available to staff. Face to face services at Castle House had been restricted with Customer Services available on line or over the phone.
The Portfolio Holder for Environment and Recycling, Councillor Trevor Johnson, reported that all frontline services were running. There was some delay with food hygiene inspections due to the additional pressure and workload on that team.

In terms of economic recovery the Council was making preparations for a successful reopening of Newcastle town centre and other high streets in the Borough in time for Christmas.

The financial support from the Government was outlined. The Leader reported that the Council continued to work closely with Members of Parliament and the Local Government Association to lobby for ongoing support.

**Resolved**: that the report be noted and the work being undertaken in response to the Coronavirus restrictions be endorsed.

42. **MEDIUM TERM FINANCIAL STRATEGY 2021/22 TO 2025/26**

Cabinet considered the Medium Term Financial Strategy (MTFS) outlining financial forecasts for the period 2021/22 to 2025/26 and how the Council would allocate its resources over the medium term to deliver its objectives.

Councillor Sweeney reported that, to date, funding of £2,409,600m had been received from Government. The current projections anticipated a figure of over £4m would be received in grant funding and compensation for lost income. The Coronavirus pandemic would continue to impact negatively on the financial position of the Council and the effect on the Collection Fund was unclear at the moment.

The Capital Strategy had been agreed in February 2020 and was for a ten year period. The Strategy had been reviewed and updated in light of the impact of the pandemic, expected capital receipts and the decision to progress the Kidsgrove Sports Centre refurbishment project. Work on the 2021/22 budget was at an advanced stage and draft proposals would be presented to Cabinet and Finance, Assets and Performance Scrutiny Committee in December.

The Leader noted the thoroughness of the MTFS and thanked those staff who had worked to produce the Strategy; other Members endorsed those thanks.

**Resolved**: That:
1. The draft Medium Term Financial Strategy be endorsed.
2. The funding gap of £1.790m in 2021/22 and £5.911m over the 5 year period covered by the MTFS be noted.
3. The approach to develop savings and income generation proposals in the medium term be agreed.

4. The current uncertainty regarding the medium term impact of Covid and local government funding and the need for scenario planning and identification of savings options for best, worst and medium case scenarios be noted.
5. The draft MTFS be referred to Finance, Assets and Performance Scrutiny Committee for their views.

43. **KIDSGROVE TOWN DEAL**

Cabinet considered an update on work to produce the Town Investment Plan for the Kidsgrove Town Deal area and the next steps in its delivery. A video had been produced highlighting the key proposals and this was played at the meeting.

The Leader outlined the 3 strategic objectives and their associated projects:

- Objective 1: this related to driving growth and opportunity through enhanced enterprise infrastructure and included a project around enabling an employment site at Chatterley Valley and investment in enterprise units;
- Objective 2: this focused on creating a connected, accessible town centre and included upgrades to the train station and canal enhancements;
- Objective 3: this was about maximising leisure and recreation opportunities with a key project relating to the Kidsgrove Sports Centre along with improvements to parks.

The Council had been awarded Advance Town Deal funding and some had already been allocated towards a sports pitch at the school which had received planning permission on 10th November; funds were also allocated to the Leisure Centre refurbishment which was progressing well with handover due from the County Council.

**Resolved**: That:
1. Cabinet formally endorses the Kidsgrove Town Deal Investment Plan and will receive a further report on the outcome of the Town Investment Plan submission at the point that this is received from government;
2. The Executive Director Commercial Development & Economic Growth is authorised to work within existing Council resources to continue to support the Town Deal Board and other organisations as necessary to progress development of projects in the Kidsgrove Town Deal Investment; and
3. That a multi-disciplinary officer group is established to oversee delivery of the Kidsgrove Town Investment Plan and will report into the Portfolio Holder for Corporate and Service Improvement, People and Partnerships and then into Cabinet.

44. **FINANCIAL AND PERFORMANCE REVIEW REPORT SECOND QUARTER (JULY - SEPTEMBER) 2020 - 2021**

Cabinet considered a report on the Knutton Masterplan. The document had been jointly commissioned and overseen by the Borough and County Councils and Aspire Housing. The Masterplan assessed opportunities to bring forward new housing investment and improve community facilities and the physical environment in Knutton. The key features of the Plan were outlined and included a new village hall, creation of a village green and play facilities along with redevelopment of a number of sites for housing and replacement office business accommodation. There were also a number of highway reconfigurations and improvements.

**Resolved**: That:

1. The Knutton Masterplan be approved in principle for public consultation and the result of that consultation be reported back for Cabinet's consideration;.
2. Opportunities be explored and taken to pursue funding through the Government's Town Deal programme for Newcastle to provide some of the resources necessary to deliver some of the investment proposals contained in the Knutton Masterplan.
3. When the outcome of the Newcastle Town Deal submission is known and therefore the fuller financial implications of delivering the Knutton masterplan are clearer, a more complete report is brought to Cabinet.
4. A Project Board be established to take forward the masterplan and any subsequent delivery plan, with membership including Newcastle Borough Council, Aspire Housing and Staffordshire County Council and that this council's representation to include officers, the Portfolio Holder for Planning and Growth and the Portfolio Holder for Finance and Efficiency.
5. Discussions are held with Aspire Housing to explore options for the early redevelopment of the Borough Council-owned sites identified for possible housing development as a means for expediting the delivery of this aspect of the masterplan.
6. Should any suitable sites become available in the area that authority is given for the Council to directly purchase or work in partnership with Aspire to make appropriate purchases.

45. **PROPOSED EXTENSION TO NEWCASTLE CREMATORIUM GROUNDS AND DEVELOPMENT OF ADJACENT LAND OFF CHATTERLEY CLOSE**

Cabinet considered a report seeking approval to extend the grounds of Newcastle Crematorium into adjacent land within the Council's ownership and to develop the remainder of adjacent land for residential use with associated green infrastructure and community facilities.

**Resolved:** That:

1. The Masterplan to extend Newcastle Crematorium and to redevelop the remaining Council owned land off Chatterley Close is received.
2. The scheme to extend the grounds of the Crematorium is approved in principle.
3. The Executive Director - Commercial Development & Economic Growth is authorised to consult with appropriate stakeholders on the proposals in accordance with the Asset Management Strategy 2018-21 and to report the results to a future meeting of the Cabinet.
4. The Executive Director - Commercial Development & Economic Growth is authorised to engage consultancy support to prepare a hybrid planning application for the extension to the crematorium grounds (full) and, subject to the outcome of the consultation with stakeholders and public, residential development to the remainder of the site (outline).
5. Subject to a detailed financial analysis, the scheme to extend the crematorium grounds is funded from the capital receipt gained from the sale of the remaining land for development.
6. The Head of Operations is authorised to engage consultancy support to prepare an outline business case for an improved memorialisation offer in the crematorium grounds with a view to generating increased revenue and provision of £14,000 is made available for this support in the General Fund Capital Programme/Borough Growth Fund in 2020/21.

46. **NEWCASTLE CREMATORIUM - PROPOSED REFURBISHMENT OF THE CREMATORS**

Cabinet considered a report on options and funding strategies for the refurbishment of the cremators at Newcastle Crematorium. Councillor Johnson outlined the proposed works which it was anticipated would ensure the cremators would last a further ten years provided regular maintenance was undertaken.

**Resolved:** That:

1. The planned improvements at Bradwell Crematorium be supported.
2. The preferred option is approved and an exception to Council Contract Procedure Rules be agreed to enable a direct award of contract without a call for competition for the refurbishment of the Council's two cremators by the manufacturer and incumbent service provider as set out in the report.

## 47. LAND AT MARKET DRAYTON ROAD, LOGGERHEADS

Cabinet considered a report on the disposal of land at Market Drayton Road, Loggerheads. Councillor Northcott referred to the report that detailed the proposal to dispose of the land to Loggerheads Parish Council by way of a long lease. The land had been identified as a surplus site for disposal in the Borough Council's Asset Management Strategy 2018 – 22. The Parish Council wished to acquire it for community and sporting facilities.

**Resolved**: That:

1. The disposal of this land, by way of a long lease, to Loggerheads Parish Council for £1, be authorised.
2. The Executive Director – Commercial Development and Economic Growth, in consultation with the Portfolio Holder, be authorised to agree the terms and conditions of this lease with Loggerheads Parish Council.

## 48. FINANCIAL AND PERFORMANCE REVIEW REPORT SECOND QUARTER (JULY - SEPTEMBER) 2020 - 2021

Cabinet considered a report detailing the financial position and Council performance for quarter 2. The report outlined broad financial information and service performance. Quarter 2 was the peak period of the Covid lockdown when a number of customer facing services were required to close or the customer base stopped using the service.

The report outlined funding support from Government and Councillor Sweeney referred to funding secured to date of £1.742m. To date a number of grant payments had been made. The Council had a good history of collection rates but the longer term impact on the Collection Fund would not be known until the following financial year.

The performance for Quarter 2 was presented with a total 17 indicators monitored for the period. The Leader explained the target relating to percentage of calls not answered had not been met due to a 25% increase in number of calls through the contact centre together with the introduction of the new Recycling Service and the Election canvass during the quarter both of which affected a high number of residents of the Borough. Sickness levels, staff turnover and staff vacancy rates were all low for the quarter. Both Council tax and Business Collection rates were now back on track.

Councillor Northcott reported performance was well within target in the indicators relating to Property and Planning and Development.

Councillor Maxfield reported that there were currently 21 cases being discussed at the ASB, Youth Violence and Gangs Case conference. Councillor Waring referred to the leisure and cultural facilities which had experienced significant impact by Covid 19 and when services had been required to close. The staff were working hard to be prepared for when the services could open.

In relation to Priority 4 'A Town Centre for All', there were 3 indicators relating to car park usage, footfall and stall occupancy for markets. These had all been impacted by Covid 19 although Councillor Sweeney reported that the markets that had been able to be held had performed extremely well and were very popular. He explained that a small business market was planned for December.

**Resolved**: That:

1. The contents of the attached report and Appendices A and B be noted and Cabinet will continue to monitor and Challenge the Council's performance alongside its financial performance for the same period.
2. The supplementary estimates (item 4.4 Appendix A) be noted and approved in order for them to be included in this year's budget.

## 49. FORWARD PLAN

Consideration was given to the Forward Plan listing upcoming key decisions to be made by Cabinet.

**Resolved**: That the Forward Plan be received.

## 50. URGENT BUSINESS

There was no Urgent Business.

**COUNCILLOR SIMON TAGG**
**Chair**

Meeting concluded at 3.15 pm

Published 8th December 2020

**NEWCASTLE-UNDER-LYME BOROUGH COUNCIL**

**EXECUTIVE MANAGEMENT TEAM'S**

**REPORT TO CABINET**

Choose an item.
**09 December 2020**

**Report Title:** **Coronavirus Update**

**Submitted by:** **Chief Executive**

**Portfolios:** **All**

**Ward(s) affected:** **All**

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|---|
| **Purpose of the Report**<br><br>To inform the Cabinet of the actions being taken across the Council in response to the Coronavirus restrictions on the Borough. |
| **Recommendation**<br><br>**1. It is recommended that Cabinet note this report and endorse the work being undertaken in response to the Coronavirus restrictions.** |
| **Reasons**<br><br>To allow Cabinet to publicly consider the actions being undertaken in relation to the coronavirus pandemic and the associated restrictions. |

1. **Background**

1.1 Cabinet has regular reports detailing the Council's response to the Coronavirus pandemic and delivery of the recovery plan.

1.2 At time of writing, the 7 day infection case rate in Newcastle under Lyme was 231cases per 100,000 population. This is above the England average (147/100,000), and the Staffordshire average of 185/100,000. The figure reflected a marked decrease in infections over the past few weeks, having been over 400 cases per 100,000 population during November.

1.3 From 5th November to 2nd December the Borough was subject to the national restrictions announced by the Government as part of the national lockdown. When the national restrictions ended, the Borough, along with the rest of Staffordshire, was placed under Tier 3 restrictions. The Council's efforts have shifted to responding to the new restrictions, as detailed in this report.

1.4 With the infection rate at its current level, the Council is heavily engaged in its outbreak control work, with specific avenues of work being progressed:

- The Leader of the Council sits on the County-wide Local Outbreak Board which has regular oversight infection rates and action being taken to respond.

- The Leader of the Council is chairing a Local Incident Management Team, drawing together expertise from the Borough Council, County Council, health sector, and other agencies actively involved in responding to the pandemic;

- A multi-agency board, under the chairmanship of the Deputy Leader, Cllr Sweeney, has been convened to ensure that all possible steps are being taken across the key anchor institutions to reduce infection rates in the Town Centre, particularly in the 18 to 25 year old age group.

- Colleagues from Environmental Services continue to work closely with the Director of Public Health and colleagues from across the public sector to investigate infections in high risk premises in the borough and provide advice to those running high risk premises to minimise infection spread;

- A team of colleagues has been assembled from across the Council to work as “Covid Marshalls”, delivering a mix of public engagement to encourage social distancing in key retail areas, and engagement with businesses to encourage and advise on good practice on Covid security.

2. **<u>Priority Actions</u>**

2.1 In response to the move to Tier 3 restrictions, the Council has maintained its focus on support for businesses and support for the vulnerable.

**Support for Businesses**

2.2 The Local Restrictions Support Grant (LRSG) will be paid by Government to support businesses forced to close or severely affected by local or national restrictions. There are four elements of funding:

- Local Restrictions Grant (Closed) - to meet the cost of payments to businesses within the business rates system that are required to close. Newcastle’s initial allocation is £1.674m.

- Additional Restrictions Grant - to be used as discretionary grant funding to support businesses that are either closed but not in the business rating or open but severely impacted (e.g. because of closure of their suppliers or the customers they supply to). (£2.588m Newcastle allocation).

- Local Restrictions Grant (Open) – backdated funding for the period between NUL going into tier 2 restrictions and the start of the national lockdown to enable grants to be made to businesses that were severely impacted during that period.

- Local Restrictions Grant (Sector) – backdated funding from 1st November to meet the cost of grants to businesses that have been required to close on a national basis since 23 March 2020 – i.e. nightclubs, dance halls, discotheques, hostess bars, etc.

2.3 This funding is crucial to enable businesses to weather this particular phase of the pandemic, and be in a position to recover once restrictions have been eased.

**Extended Opening Hours**

2.4 Under Tier 3 restrictions both essential and non-essential retail businesses are able to open and trade. The Government has directed that businesses will be able to trade 24hrs per day during December and January in order to maximise the trading opportunity whilst spreading the footfall over a longer period of time, and thereby reducing crowding and the risks associated with that. In response, Newcastle under Lyme Borough Council will not be taking enforcement action against any retail business which opens beyond the times set out in their planning or licensing conditions for the duration of this trading incentive.

**Attracting Footfall**

2.5 In the run up to Christmas the Council has permitted three Special Markets to attract shoppers to the town to benefit all traders. These events, detailed below, will be run with social distancing measures in place to ensure good compliance with covid secure practice:

- Thursday 17th December – Love Local evening market (5.30 – 9.00pm)
- Sunday 13th December – Artisan Market (9.45am – 3.00pm)
- Sunday 20th December – Artisan Market (9.45am – 3.00pm)

**Support for Vulnerable People**

2.6 The Council has stepped up its support to vulnerable people, with three specific lines of work being prioritised:

- The support service delivered through the Realise Foundation has stepped up to receive calls from people made vulnerable by the restrictions. Typically this call centre and web portal provides advice and support to individuals who are isolated, or who need help to access food and medicine.

- The Revenues and Benefits team are processing applications for payments to individuals who have been required to self-isolate as a result of either contracting the virus, or being in contact with someone who has, and as a result are unable to work. The Test & Trace Self Isolations Support Scheme is focussed on individuals in receipt of particular benefits and aims to incentivise people required to self-isolate, but who would lose income by doing so.

- The Council's homelessness team continues to work with vulnerable people who are sleeping rough, or who are at risk of homelessness, placing them into temporary accommodation.

**Council Services**

2.7 As with the previous national restrictions, some Council services have been impacted, although the nature of the current restrictions has meant that this is less severe than previously. Key areas of impact are:

- J2 Leisure Centre has re-opened for personal fitness training and swimming, but is not able to offer group activities such as fitness classes. The centre is providing an extensive on-line offer to the centre's membership.

- Brampton Museum, in line with other such venues nationally, has been required to close.
- Customer Services – all services continue to be available on-line or on the phone, but face to face service at Castle House is now restricted.

2.8 Other services continue to be available with minimal disruption.

**Economic Recovery**

2.9 Notwithstanding the restrictions in place, the Council is continuing to work towards the recovery of the local economy, focussed on progressing the major regeneration and growth schemes.

- As previously reported, a bid has been submitted to the Future High Streets Fund for schemes to facilitate the regeneration of Newcastle Town Centre, with a specific focus on the Ryecroft site;
- Advance Town Deal Funds of £1.75m have been secured for initiatives in Newcastle & Kidsgrove
- Town Investment Plan for Kidsgrove has been submitted to Government for consideration under the Town Deal programme
- Town Investment Plan for Newcastle is in preparation with the Town Deal Board

**3. Financial Recovery**

3.1 The Council has secured over £4.5m from central government to cover income losses and activities required to mitigate the impact of covid in areas ranging from support for the homeless to the Council Tax Hardship Relief Fund. In addition it has received just over £30m to fund grants to businesses in the borough impacted by the pandemic, bringing the total amount of financial support provided by central government to over £34m. This financial support covers financial pressure which has been put on Council services together with income losses and support provided to small business within the Borough. Further details are provided below.

3.2 The Council's revenue budget relies on service income from fees and charges of c£850k per month across a wide range of services, with a significant proportion coming from J2 and car parking. Taking account of the current lockdown period it is forecast that income losses for the financial year will amount to £2.475m. The Government's income compensation scheme offset these income losses to the amount of £1.700m, the first instalment of this was received in November. In conjunction with the income compensation scheme the Council has received £196k from the Furlough job retention scheme in connection with those income loss services.

3.3 To date emergency Coronavirus Government funding of £2.152m has been secured (including £170k of new burdens funding to offset the costs of administering Coronavirus business support grant and hardship relief schemes), which has reduced the immediate pressure on additional spending and on the Council finances. The current forecast continues to be a net revenue overspend of around £0.350m in this financial year. Close management of the financial position will continue and remains absolutely essential.

3.4 Further Government funding to assist with the Council's response to the Coronavirus has also been secured in relation to rough sleepers (£0.196m), outbreak control (£0.179m), enforcement (£0.061m) and the reopening of the high street (£0.115m).

3.5 In addition to the initial business grants funding administered by the Council (£21.673m paid over to businesses), a further £4.326m has already started to be distributed (as per para 2.2).

This is in addition to funding allocated by Government for the Council to administer to assist with Council Tax Hardship (£1.036m) and self-isolation (£0.109m).

3.6 The Council continues to work closely with the Borough's Members of Parliament and the Local Government Association to lobby central government for the ongoing support which will be required.

## 4. Proposal

4.1 Cabinet are recommended to note this report.

## 5. Reasons for Proposed Solution

5.1 This report serves to brief Cabinet on the work being undertaken to address the Coronavirus pandemic, and the financial impact that the pandemic is having on the Council, and the recovery arrangements being put in place.

## 6. Options Considered

6.1 N/A

## 7. Legal and Statutory Implications

7.1 Addressing the impact of Coronavirus locally has involved adjustment to some service provision. When making such changes there are a number of legal and statutory implications to take into account. These are all appropriately factored into decision taking by the Incident Management Team.

## 8. Equality Impact Assessment

8.1 None directly arising from this report.

## 9. Financial and Resource Implications

9.1 The Council's General Fund balance as at 1st April 2020 was £1.548m. Careful monitoring of the financial position will be required over coming weeks and months leading to prompt corrective action where necessary to ensure that reserves are not exhausted and the Council remains in a stable position in the current financial year and beyond.

## 10 Major Risks

10.1 The Coronavirus pandemic, in the round, represents a significant risk to the Council. This report sets out how that risk is being addressed.

## 11. Sustainability and Climate Change Implications

11.1 N/A

## 12. Key Decision Information

12.1 This is not a key decision.

## 13. Earlier Cabinet/Committee Resolutions

13.1 None

14. **List of Appendices**

14.1 None

15. **Background Papers**

15.1 None

Published 4th December 2020

**NEWCASTLE-UNDER-LYME BOROUGH COUNCIL**

**EXECUTIVE MANAGEMENT TEAM'S REPORT TO**

**Cabinet**
**09 December 2020**

**Report Title:** **Revenue and Capital Budget 2021/22 – First Draft Savings Plans**

**Submitted by:** **Portfolio Holder (Finance and Efficiency)**

**Portfolios:** **Finance and Efficiency**

**Ward(s) affected:** **All**

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| **Purpose of the Report**<br>To present the first draft proposals being considered to balance the 2021/22 revenue budget and the proposed capital programme for 2021/22 to 2023/24. |
| **Recommendation**<br><br>**Cabinet are asked to:**<br><br>**1. Note the first draft proposals as set out in the Appendix 1 and Appendix 2 to the report.**<br>**2. Note the amendment to the Medium Term Financial Strategy (MTFS) funding gap as a result of public sector pay freeze assumptions.**<br>**3. Refer the first draft proposals to the Finance, Assets and Performance Scrutiny Committee for their views.**<br>**4. Approve a supplementary revenue estimate of £250k for the blueprint and mobilisation phase of the "One Council" programme.** |
| **Reasons**<br>To ensure the Council meets its statutory duty to set a balanced budget in February 2021. |

1. **Background**

1.1 The Council's Draft MTFS for 2021/22 to 2025/26 was endorsed by Cabinet on 11 November 2020. It indicated that there will be a budget "gap" of £1.790m in respect of 2021/22 and that this will need to be closed in order to produce a balanced budget.

2. **Issues**

2.1 The COVID-19 pandemic has changed the position significantly creating financial challenge and uncertainty in equal measure. Most challenging is the forecast of the tax base for both Council Tax and Business Rates. The Draft MTFS provides for a gap in 2021/22 of £1.790m and over the 5 year period of the MTFS of £5.911m. The Comprehensive Spending Review announcements on 25 November 20202 and other issues detailed below reduce this gap to £1.275m in 2021/22 and to £5.047m over the 5 year period of the MTFS.

2.2 The Comprehensive Spending Review announced that a public sector pay freeze would be imposed with the exception of those employees earning below the United Kingdom's median wage of £24,000, who will be entitled to a £250 pay award.

2.3 If implemented within Local Government the pay freeze will reduce the gap by £0.377m in 2021/22 and the gap over the 5 year period of the MTFS by £0.425m.

2.4 The spending review announced that there would be an equitable sharing of local taxation collection losses between local authorities and the Treasury. The Spending Review papers show that the government intends to use a scheme similar to the income compensation and cover 75% of local government's collection fund deficits. Whilst further detail is awaited, it is assumed that this will reduce the gap by £0.039m in 2021/22 in relation to the Council's share of the Council Tax collection fund forecast deficit and by £0.094m in 2021/22 in relation to the Council's share of the Business Rates collection fund forecast deficit. The gap over the 5 year period of the MTFS will reduce by £0.398m.

2.5 It was also announced that there would be an extension to the Income Compensation Scheme for fees and charges to the end of the first quarter in 2021/22 which will help reduce the income pressure together with further funding for temporary accommodation costs.

2.6 The capital programme as shown in appendix 2 and the updated financing assumptions for this expenditure have resulted in a reduction in the pressure included in the MTFS of £0.005m in 2021/22 and a reduction of £0.041m over the 5 year period of the MTFS (i.e. minimum revenue provision and interest payable)

2.7 It is also proposed that in order to boost environmental sustainability within the Borough, £0.100m per annum over the life of the MTFS be ring-fenced from the Borough Growth Fund to enable such projects to be fully funded.

2.8 As a result of the COVID-19 pandemic and the financial challenge the pandemic has raised, the Council has commissioned a full organisational review. This has identified a requirement to make significant changes to the way Council services are delivered, recognising both the impact of the pandemic in terms of creating more and different demands on Council services and the need to retain focus on the most vulnerable and disadvantaged in the community, whilst maximising opportunities for residents to help themselves, ensuring that they have a consistent and efficient interaction with the council when needed. A major programme of work (the One Council Programme) will be undertaken over the period 2021/22 to 2022/23 to implement the necessary changes, which will involve extensive redesign of organisational structures, processes and technology, underpinned by changes in culture, leadership and governance. The programme will be overseen by the ICT and Digital Steering Group chaired by the Leader of the Council and regular updates provided to Cabinet and FAPS.

2.9 Efficiencies and savings expected to be achieved through the One Council Programme will amount to circa £0.922m over a three year period and are recurring. These savings will replace the digital delivery savings in the MTFS – currently estimated at £0.150m per annum for the next three years.

2.10 In order to achieve the revenue savings set out above implementation costs of c£1m will need to be funded. This includes £250k in the current financial year for the blueprint and mobilisation phase of the programme which is due to commence in January 2021. These implementation costs consist of website development, ICT costs, staff time including enhanced HR support, external delivery partner and training costs together with programme assurance and contingency. It is proposed these costs will be funded via the flexible use of capital receipts and contributions from the Borough Growth Fund over a two year period.

3. **<u>Proposed Savings and Funding Strategies to eliminate the Budget Gap for 2021/22</u>**

3.1 A number of savings and funding strategies have been identified as being both feasible and sustainable, via a vigorous Financial Recovery Board process including challenge sessions for each of the Portfolios involving Cabinet Members, the Executive Management Team, Heads of Service and the Finance Manager. The proposed savings identified to date for the period of the MTFS, and the remaining funding gaps have enabled a balanced financial position to be proposed for 2021/22. Further details for 2021/22 are shown in Appendix 1.

## 4. Capital

4.1 The Capital Programme for 2021/22 to 2023/24 (Appendix 2) is based on new schemes which are vital to ensure continued service delivery and in assisting the Council to achieve its corporate and service objectives as set out in the Council Plan 2018-22. These schemes total £29.624m.

4.2 The capital programme will require to be part funded by borrowings starting in 2021/22. The total amount of borrowing over the next three years will amount to £17.589m. The associated borrowing costs have been factored into the MTFS.

4.3 It should be noted that work is currently being untaken on the Planned Maintenance Programme which will form part of the Capital Programme when finalised. An update on this work and the costs associated will be provided in the January Cabinet Report.

## 5. Timetable

5.1 The table below sets out the key dates of the events still to take place before the budget for 2021/22 is finally approved.

| Event | Body Affected | Date |
|---|---|---|
| Budget consultation | Proposed to run from 10 December to 10 January | |
| Scrutiny of draft MTFS and savings proposals | Finance, Assets and Performance Scrutiny Committee | 14 December |
| Approval of final MTFS and consideration of draft Budget proposals | Cabinet | 13 January |
| Scrutiny of draft budget | Finance, Assets and Performance Scrutiny Committee | January - TBC |
| Final budget proposals recommended for approval by Full Council | Cabinet | 2 February |
| Full Council to approve Budget | Full Council | 17 February |

## 6. Equality Impact Assessment

6.1 There are no adverse equality impact identified as a consequence of this report.

## 7. Financial and Resource Implications

7.1 These are addressed in the body of the report.

7.2 As referred to in section 2.10 the Council will need to incur implementation costs to fund the blueprint and mobilisation phase of the One Council programme. These implementation costs will be funded via the flexible use of capital receipts and Borough Growth Fund.

8. **Risk Statement and Major Risks**

8.1 The assessment of the Section 151 Officer is that the draft proposals included in this report are robust and will ensure an adequate level of reserves. However, it should be noted that a number of assumptions and proposals are provisional or draft, and as such this opinion will be confirmed in the Revenue and Capital Budgets and Council Tax 2021/22 reports to Cabinet on 2 February 2021 and to Council on 17 February 2021.

9. **Key Decision Information**

9.1 Affects all wards within the Borough and monetary values involved are highly significant.

10. **Earlier Cabinet/Committee Resolutions**

10.1 Medium Term Financial Strategy 2021/22 to 2025/26 (Cabinet 11 November 2020).

11. **List of Appendices**

11.1 Appendix 1: 2021/22 MTFS Funding Strategy
11.2 Appendix 2: 2021/22 to 2023/24 Capital Programme

12. **Background Papers**

12.1 CIPFA Treasury Management Code of Practice (revised December 2017)
12.2 Council's Treasury Management Policy Statement
12.3 Local Government Act
12.4 Local Authorities (Capital Finance and Accounting) (England) Regulations
12.5 Ministry of Housing, Communities and Local Government's Guidance on Local Government
12.6 Investments
12.7 Statutory Guidance on the Flexible Use of Capital Receipts

## 2021/22 MTFS Funding Strategy

**Appendix 1**

| Ref | Service Area | Description | £000's | Detail |
|---|---|---|---|---|
| | | **Income** | | |
| I1 | Recycling and Fleet | Trade Waste Income | 50 | Increased marketing and sales regarding the trade waste service, as agreed in the 2020/21 budget setting process |
| | | | **50** | |
| | | **One Council** | | |
| O1 | Corporate | One Council/Digital Delivery | 195 | Efficiencies to be generated from the continuation of prioritising digital delivery processes and services |
| | | | **195** | |
| | | **Staffing Related Efficiencies** | | |
| S1 | Revenues and Benefits/Customer Services | Restructure | 131 | Phase 2 of restructure of Revenues and Benefits and Customer Services |
| S2 | Finance | Car Leasing Scheme | 3 | Car leases not renewed following expiry |
| S3 | Finance | Section 151 Officer Appointment | 110 | Designation of Section 151 Officer role to Head of Finance |
| S4 | Recycling and Fleet | Restructure | 40 | Restructure of Recycling and Fleet managerial team |
| S5 | Operational | Grounds Maintenance | 60 | Saving from contract brought back in house |
| S6 | All | Vacant Posts, Retirements, Reprioritisation | 255 | Vacant posts, service reprioritisation and employees retirement |
| | | | **599** | |
| | | **Good Housekeeping/More Efficient Processes** | | |
| G1 | ICT Services | Staffordshire Connects | 13 | Saving in partnership contribution following change of IT system |
| G2 | Housing, Regeneration and Assets | Cash Collections | 24 | Saving from contract to be brought back in house |
| G3 | Communications | Printing | 9 | Saving from reduced levels of printing across the Council |
| | | | **46** | |
| | | **Alternative Sources of Finance/Other** | | |
| A1 | Corporate | Council Tax Increase | 187 | Assumed increase of £5 per Band D equivalent property |
| A2 | Corporate | Business Rates Reserve | 31 | Use of accumulated surplus from Business Rates Retention scheme to offset 2020/21 forecast business rates collection fund deficit |
| A3 | Corporate | Alternative Financing | 167 | Equipment that was previously provided for via contributions to reserves from revenue will now be funded directly from capital |
| | | | **385** | |
| | | ***Grand Total*** | ***1,275*** | |

## 2021/22 to 2023/24 Capital Programme

**Appendix 2**

| CAPITAL PROGRAMME | 2021/22 | 2022/23 | 2023/24 | TOTAL |
|---|---|---|---|---|
| | £ | £ | £ | £ |
| **PRIORITY - Local Services that work for Local People** | | | | |
| Service Area – ICT and Digital | 649,000 | 110,000 | 102,000 | 861,000 |
| **Total** | **649,000** | **110,000** | **102,000** | **861,000** |
| **PRIORITY - Growing our People and Places** | | | | |
| Service Area - Housing Improvements | 1,080,000 | 2,615,000 | 2,625,000 | 6,320,000 |
| Service Area - Managing Property & Assets | 318,922 | 410,846 | 14,922 | 744,690 |
| **Total** | **1,398,922** | **3,025,846** | **2,639,922** | **7,064,690** |
| **PRIORITY - A Healthy, Active and Safe Borough** | | | | |
| Service Area - Environmental Health | 0 | 0 | 60,000 | 60,000 |
| Service Area - Streetscene and Bereavement Services | 610,450 | 2,210,600 | 1,125,600 | 3,946,650 |
| Service Area - Recycling and Fleet | 971,500 | 351,000 | 2,899,500 | 4,222,000 |
| Service Area - Leisure | 5,671,000 | 687,000 | 17,000 | 6,375,000 |
| Service Area - Museum | 240,000 | 40,000 | 0 | 280,000 |
| Service Area - Managing Property & Assets | 64,749 | 273,403 | 220,498 | 558,650 |
| Service Area - Engineering | 320,193 | 806,287 | 1,287,105 | 2,413,585 |
| **Total** | **7,877,892** | **4,368,290** | **5,609,703** | **17,855,885** |
| **PRIORITY - A Town Centre for All** | | | | |
| Service Area - Managing Property & Assets | 1,385,586 | 1,177,126 | 279,250 | 2,841,962 |
| **Total** | **1,385,586** | **1,177,126** | **279,250** | **2,841,962** |
| | | | | |
| **CONTINGENCY** | 1,000,000 | 0 | 0 | **1,000,000** |
| **TOTAL** | **12,311,400** | **8,681,262** | **8,630,875** | **29,623,537** |

| | | | | |
|---|---|---|---|---|
| **FUNDING** | | | | |
| Capital Receipts | 3,075,000 | 3,128,000 | 550,000 | **6,753,000** |
| External Contributions | 2,252,000 | 2,015,000 | 1,015,000 | **5,282,000** |
| Borrowing/Leasing | 6,984,400 | 3,538,262 | 7,065,875 | **17,588,537** |
| **TOTAL** | **12,311,400** | **8,931,262** | **8,630,875** | **29,623,537** |

**NEWCASTLE-UNDER-LYME BOROUGH COUNCIL**

**EXECUTIVE MANAGEMENT TEAM'S REPORT TO CABINET**

**9th December 2020**

| | |
|---|---|
| **Report Title:** | **NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN – OUTLINE BUSINESS CASE** |
| **Submitted by:** | **Head of Environmental Services** |
| **Portfolio:** | **Environment & Recycling** |
| **Ward(s) affected:** | **May Bank** |

**Purpose of the Report**

To outline the legal requirements on Stoke-on-Trent City and Newcastle-under-Lyme Borough Councils to prepare the North Staffordshire Local Air Quality Plan (NSLAQP), and to seek Cabinet approval to submit the Outline Business Case (OBC) to Central Government, including the preferred option for delivering compliance with statutory limits on roadside nitrogen dioxide ($NO_2$) concentrations across the study area in the shortest possible time.

**RECOMMENDATIONS**

**That:-**

**(a) Cabinet considers the comments received in relation to the North Staffordshire Local Air Quality Plan from Economy, Environment & Place Scrutiny Committee held on 12 November 2020.**

**(b) Cabinet approve the Outline Business Case for the North Staffordshire Local Air Quality Plan for tackling roadside nitrogen dioxide exceedances, including technical addenda, as contained in Appendices C and D, for submission to Government, in line with the requirements of the Environment Act 1995 (Implementation of Measures for Nitrogen Dioxide Compliance) Air Quality Direction 2018 (the "2018 Direction") and subsequent amendments by the Secretary of State for the Environment.**

**(c) Subject to approval of (a), that Cabinet request a further report from the Head of Environmental Health Services in June 2021, setting out the Full Business Case, including the detailed costs and proposed funding bid to Government.**

**(d) Subject to approval of (a), that Cabinet delegates authority to the Director of Operational Services alongside Portfolio Holder for Environment & Recycling to enter into a legal agreement with Staffordshire County Council (SCC) and Stoke-on-Trent City Council (SOTCC) to jointly submit the Full Business Case and deliver the**

**preferred option in line with the requirements of the Environment Act 1995 (Implementation of Measures for Nitrogen Dioxide Compliance) Air Quality Direction 2018 and subsequent amendments by the Secretary of State for the Environment.**

**(e) The Chief Executive is authorised to enter into a contract to complete the Full Business Case (and inform the Cabinet Member for Environment and Recycling), by direct award to the supplier for the delivery of the Outline Business Case for the North Staffordshire Local Air Quality Plan.**

**(f) Members note the progress made in relation to the delivery of the Ministerial Direction requiring a bus retrofit scheme for busses operating on the A53.**

**Reasons**

To complete the transport, air quality and economic assessments of the proposed option as identified in the Outline Business Case, to complete the Business Case and progress towards compliance with the requirements of the Ministerial Direction issued to the Borough of Newcastle-under-Lyme and City of Stoke-on-Trent on 4 October 2018, and subsequent requirements of the Parliamentary Under-Secretary of State (Department for Environment, Food and Rural Affairs).

## 1. Background

1.1 In October 2018, Ministers Coffey and Norman for the Department for Environment, Food and Rural Affairs (DEFRA) and Department for Transport (DfT) respectively, served two ministerial directions on the Council; these were served under the provisions of The Environment Act 1995 (Feasibility study for nitrogen dioxide compliance) (No 2) and (Implementation of measures for nitrogen dioxide compliance) Air Quality Direction 2018. This work is being co-ordinated by the Governments Joint Air Quality Unit (JAQU).

1.2 The two directions and associated JAQU guidance require:

NULBC and SOTCC to jointly further investigate EU exceedances of nitrogen dioxide ($NO_2$) on roads within the Borough and identify measures that could bring forward compliance with $NO_2$ limits as soon as possible **or** review the implementation of a chargeable clean air zone. (referred to as the NSLAQP);

and

NULBC to implement a bus engine retrofit programme to busses that operate on the A53 to be implemented as soon as possible in order to bring forward compliance of $NO_2$ levels.

1.3 Staffordshire County Council (as Highway Authority) is supporting the project although not included within any Ministerial Direction to date.

1.4 The background to the development of the NSLAQP, along with a summary of the work undertaken to assess the initial evidence and appraise options, the development of the preferred option and the next steps to submit the FBC to Government, is provided in Appendix A.

1.5 A description, along with a schematic plan of the physical components of the preferred option, is provided in Appendix B.

1.6 Cabinet have received four previous reports in respect of this matter. In February 2019 Cabinet noted that the Ministerial Direction has been served and resolved that the leader would actively engage to lobby against any charging Clean Air Zone (CAZ) on the A53. In March 2019, Cabinet noted the content of the strategic outline case and approved the shortlist of measures to be further evaluated. A further report for the procurement of a contractor to assist with the delivery of this project was approved at April 2019 Cabinet. In addition, this matter was also reported to Council on 3 April 2019, where the previous Cabinet decisions were reported and it was noted that Cabinet firmly believes that there is a highways/transport solution to help reduce the pollution levels and that any form of parking levy of chargeable CAZ would be damaging to business and our town centre. A further report for extensions to the previously approved contracts was considered and approved in October 2019. Lastly a report was presented to Economy, Environment and Place Scrutiny Committee in February 2020, member's recommendation to Cabinet that any form or charging scheme should be avoided

1.7 The governance structure for the project as shown in Appendix A, has supported the project and provided assurance for the development of the preferred option and the benchmark CAZ.

## 2. **Issues**

2.1 The unapproved OBC was submitted to central Government on 15 May 2020, in line with the requirements of the 2018 Direction and subsequent requirements of the Minister. The entire OBC is attached in Appendix C and includes draft technical layout drawings for components of the preferred option.

2.2 Feedback on the OBC from the Government's Joint Air Quality Unit are being received and will be incorporated into the FBC which is to be submitted to Government by July 2021.

2.3 The OBC was required by Government to be submitted to the above timescale, despite the local authorities' concerns over the impact of the coronavirus outbreak at that time. In July 2020, Government issued a requirement for the local authorities to undertake a sensitivity analysis of the preferred option to the likely impacts of coronavirus on the local economy, and hence travel patterns and vehicle emissions. This work was undertaken between July and September 2020 and the results of this analysis are summarised in Appendix D. In issuing this requirement, Government advised that the required year for Stoke-on-Trent and Newcastle-under-Lyme to achieve compliance with statutory limits for roadside $NO_2$ concentrations had been changed from 2022 to 2023, to take account of the impacts of coronavirus, both on the local economy and also on the authorities' ability to complete the feasibility study caused by conflicting service pressures.

2.4 In short the sensitivity analysis demonstrates that various factors will affect vehicle emissions and hence roadside $NO_2$ concentrations, including:

- A slower rate at which individuals and businesses renew their vehicles, meaning that older (and more polluting vehicles) stay in use for longer than was originally assumed.
- The acceleration of the trend to more flexible working patterns, in particular homeworking and flexible start/finish times.
- The propensity of people to use public transport, especially for those who use public transport on a discretionary basis and may choose to avoid public transport due to fears about social distancing.
- The impact of coronavirus on people's awareness of needing to improve personal health and fitness levels, resulting in a willingness to walk and cycle more, especially for shorter journeys.
- The impact of coronavirus on the local economy, including impacts on unemployment and changing demand in various sectors.

2.5 The analysis has shown that whilst fleet renewal and economic downturn have negative impacts on vehicle emissions, the additional year to deliver compliance provides time for natural fleet replacement to counter these negative impacts. The other listed factors have been found to have small impacts within the period that the study is seeking to deliver compliance with the statutory limit for roadside $NO_2$ concentrations. However, these small impacts do not affect the overall viability of the preferred option to achieve the primary aim. This means that the preferred option is still able to deliver the primary aim of achieving compliance with the requirements of the 2018 Direction.

2.6 Government is reviewing our conclusions and has confirmed that the study can progress towards completion of the FBC by July 2021. Subject to Cabinet approval of the OBC, it is planned to progress the completion and submission of the FBC by July 2021, following its review by Cabinet.

2.7 Assuming Government then approve the FBC and issue the funding and a further Ministerial Direction for implementation, contractors will be appointed to commence delivery of the preferred option, completed by the end of 2022 and thereby achieving compliance in 2023 with the statutory limit for nitrogen dioxide concentrations

2.8 This report on the NSLAQP has been presented to Economy, Environment and Place Scrutiny Committee on 12 November. SOTCC and SCC are also presenting the NSLAQP to their respective Overview or Scrutiny Committees. Cabinet are asked to consider the comments received, the Committee resolved that Cabinet be advised that the Economy Environment and Place Scrutiny Committee support the preferred option and outline business case and request that additional specific detail on the tree removal is provided at the Full Business Case stage.

**Bus Retrofit:**

2.9 The separate ministerial direction in respect of bus retrofitting requires Newcastle-under-Lyme Borough Council to implement the retrofitting works to upgrade the busses that operate on the A53 from euro 3 engines so they operate at euro 6 standards. This work is to be completed as soon as possible and by the end of 2020 at the latest, in order to bring forward compliance in $NO_2$ levels.

2.10 It has since been established that this equates to 25 buses operated by First PMT, on bus routes 3, 4 and 4a that travel on the A53.

2.11 This requires NULBC (this direction has not been served on SOTCC) to undertake additional $NO_2$ monitoring along this route, to implement a bus retrofit scheme, to continue to monitor $NO_2$ following the works and provide reports to JAQU on air quality and traffic changes.

2.12 There are a number of conditions that the Borough Council and the bus company are required to meet in respect of this work, including a requirement for the busses to remain in service for 5 years or 150,000 miles or be replaced with a euro 6 engine bus.

2.13 First PMT and NULBC have recently entered into a contract for the completion of this work. First PMT has commenced the work and it is anticipated that all the busses will have been retrofitted by the end of 2020

## 3. **Proposal**

3.1 Considerable options have been reviewed, as detailed in Appendix A, in order to determine the 'preferred option' as detailed in Appendix B.

3.2 The OBC as attached in Appendix C, considered the options tested alongside the comparison of a benchmark Clean Air Zone – Type D.

3.3 The conclusion of the OBC is that the air quality standard can be achieved in the shortest possible time through the completion of the preferred option.

## 4. **Reasons for Proposed Solution**

4.1 The OBC is required in order to meet the Council obligation under the Ministerial Direction.

## 5. **Options Considered**

5.1 The October 2018 Ministerial Direction places a statutory duty upon Stoke-on-Trent City and Newcastle-under-Lyme Borough Councils to undertake a feasibility study and identify a preferred option, which had to be assessed against a benchmark clean air zone.

5.2 A further Ministerial Direction will be issued after submission of the FBC, legally obliging the three local authorities to fully implement the preferred option.

5.3 At this stage in the study, the authorities have the options to:

5.3.1 Approve the OBC for submission to Government. This will enable the authorities to progress the preferred option for inclusion in the FBC, and funding will then be secured for its delivery in late 2021 and 2022, delivering compliance with the requirements of the Ministerial Direction and achieving compliance in 2023 with the statutory limit for nitrogen dioxide concentrations. **This is the preferred option.**

5.3.2 Not approve the OBC for submission to Government. This option will result in Government reviewing the local authorities' failure to respond to the requirements of the Ministerial Direction, and risks the imposition of a further Direction requiring the implementation of a charging Clean Air Zone across parts or all of the City and Newcastle-under-Lyme.

6. **Legal and Statutory Implications**

**Ministerial Direction:**

6.1 A Ministerial Direction - the "Environment Act 1995 (Feasibility Study for Nitrogen Dioxide Compliance) (No. 2) Air Quality Direction 2018" was issued to Stoke-on-Trent City and Newcastle-under-Lyme Borough Councils on 4 October 2018. This imposes a legal requirement on the two authorities to undertake a feasibility study in accordance with HM Treasury's Green Book approach, to identify the option(s) which will deliver compliance with legal limits for $NO_2$ in the shortest time possible

6.2 Following Government approval of the Full Business Case in August/September 2021, a further Ministerial Direction will be issued by Government, using the power conferred by section 85(5) of the Environment Act 1995, imposing a legal duty on the local authorities to implement the preferred option.

6.3 The Ministerial Direction served on the Council under the provision of The Environment Act 1995 (Feasibility Study for Nitrogen Dioxide Compliance) (No. 2) Air Quality Direction 2018 is legally binding. Failure to comply with this Direction may result in judicial review proceedings being brought against the Council. Any such proceedings could result in adverse costs awards being made against the Council

**Procurement:**

6.4 The procurement approach that has been adopted involves the use of a compliant framework and as such offers some mitigation and reduces the risk to the Council of a challenge being made concerning the appointment of the preferred supplier. Officers have identified the Project Management & Full Design Team Services Framework RM 3741 (Lot 5) https://ccs-agreements.cabinetoffice.gov.uk/contracts/rm3741 which is operated by Crown Commercial Services (CCS) as the most appropriate OJEU compliant procurement framework.

6.5 Under this OJEU compliant framework, relevant services can be procured via either a mini competition amongst the relevant framework suppliers listed or via a direct award to one of these suppliers (so long as the Council can evidence the reason for such an approach). Following discussions with CCS this contract will be awarded by way of a direct award

6.6 The appointment of the preferred provider for technical consultancy services will be subject to them meeting the Council's insurance requirements, demonstrating adequate risk management and health and safety arrangements and having the relevant skill sets in place to meet the needs of the specification issued.

## 7. Equality Impact Assessment

7.1 A joint Equality, Environmental and Community Impact assessment will be undertaken as part of the Full Business Case process and will be reported to Cabinet in June 2021.

## 8. Financial and Resource Implications

8.1 The costs associated with developing the Outline and Full Business Cases, and subsequent implementation, monitoring and evaluation of the preferred option, will be met through Central Government grants, administered by the Government's Joint Air Quality Unit (JAQU).

8.2 The preparation of the NSLAQP is being carried out in-house, working jointly with officers from Newcastle-under-Lyme Borough and Staffordshire County Councils, plus transport, air quality and project management consultancy support. Whilst the work places a significant additional burden on existing staff, all costs including staff time are being met through Central Government grants

8.3 There has been, and will continue to be, a requirement to procure additional grants to fund the completion of specific tasks, including the appointment of contractors to implement the preferred option and specialist consultants to manage its delivery and also to monitor and evaluate the impacts, in order to demonstrate to government that the requirements of the legal directions have been met.

8.4 The cost of the contract for technical consultancy services for the completion of the FBC is estimated to be £400,000.

8.5 It should be noted that all costs incurred in the delivery of this project will continue to be recorded and reported to JAQU to be fully reimbursed.

8.6 The costs to complete the OBC have already been fully met through grants from Defra, and they have confirmed commitment to cover all approved costs associated with the further work required to complete the FBC.

8.7 By the 31st May 2020, and the delivery of the OBC, £1.599m of grant funding had been received in relation to the project. The split of this expenditure was as follows:

- Employee costs across the three Authorities, £428k
- Project Management costs, £109k
- External Consultant costs, £1.062m.

8.8 Subsequently, due to the tight deadlines and the requirement to do a Covid-19 sensitivity test, work has been ongoing and an additional £84.4k has been received in grant funding. Additional expenditure has therefore been incurred or committed in relation to:

- Project Management costs, £17k
- External Consultant costs, £67k.

8.9 Any additional expenditure incurred in relation to time spent on the project by employees during the period of 1st June 2020 to 30th September 2020 is included with the grant claim for FBC.

8.10 Indicative costings for the FBC stage are £1.659m, and a grant application will be made to JAQU in order to cover these costs.

8.11 The OBC also outlines the costs of the implementation of the measures, this is detailed in Appendix C. In brief the 10 year costs are:

- Preferred option - capital expenditure of £7,842K, operational costs of £1,524K giving a total scheme cost of £12,966K.
- Benchmark CAZ - capital expenditure of £36,577K, operational costs of £59,892K giving a total scheme cost of £96,496K

## 9. **Major Risks**

9.1 A comprehensive risk assessment has been undertaken as part of the OBC development, which has identified the following key risks:

- The uncertainty associated with the Covid-19 pandemic, although a sensitivity analysis has been completed which demonstrates that the Covid-19 linked factors that may affect travel patterns, and hence vehicle emissions and pollution, are relatively small and counterbalance each other.
- Highways England's support for the preferred option, which is critical given the importance of the A500 and A50 in the local road network. These roads form part of the national Strategic Road Network (SRN) and are managed by Highways England on behalf of the Department for Transport. The preferred option includes measures which help to mitigate the impacts of the preferred option on the SRN.

9.2 The Management Case in the OBC (within Appendix C) details the risk management strategy in place to minimise the impact of risks whilst ensuring potential opportunities are maximised.

## 10. **Sustainability and Climate Change Implications**

10.1 Any option that is implemented to tackle nitrogen dioxide exceedances may have indirect sustainability and climate change benefits or impacts.

10.2 The OBC (Appendix C) assesses climate change implications through the assessment of the carbon dioxide ($CO_2$) change throughout a 10 year operation period. This utilises data obtained through the TUBA assessment. The preferred option is calculated to have 13,324 tonne $CO_2$ Increase. The benchmark CAZ D is calculated to have a 194,854 tonne $CO_2$ decrease.

10.3 The increase for the preferred option reflects the increase in travel distance as some vehicles reroute to avoid the bus gates. The improvement under the CAZ scenario mostly reflects vehicle upgrades to avoid the CAZ charge.

## 11. **Key Decision Information**

11.1 This item is a key decision as it affects all wards, this has been included on the forward plan.

11.2 The contract values of over £100,000 make this a key decision item.

## 12.1 **Earlier Cabinet/Committee Resolutions**

The following reports have been submitted:

1. Air Quality Ministerial Direction - 6 February 2019.
2. Air Quality Ministerial Direction – Strategic Outline Case - 20 March 2019.
3. Award of Air Quality Local Development Plan - Technical Consultant Contract 24th April 2019.
4. Air Quality Ministerial Direction Update 10 July 2019.
5. Air Quality Local Plan Contracts 16 October 2019.
6. Air Quality Briefing – Economy, Environment & Place Scrutiny Committee – 5 February 2020.
7. NSLAQP – OBC – Economy, Environment & Place Scrutiny Committee – 12 November 2020.

## 13. **List of Appendices**

A - Summary of the Feasibility Study.
B - The Preferred Option
C - NSLAQP Outline Business Case
D - NSLAQP Covid Sensitivity Test Results

## 14. **Background Papers**

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**Appendix A**

## North Staffordshire Local Air Quality Plan (NSLAQP) –

## Summary of feasibility study

### 1 Background and legislative requirements

1.1 The current statutory limit for nitrogen dioxide ($NO_2$) concentrations related to air pollution was originally specified in the 2008 EU Ambient Air Quality Directive, which, amongst other requirements, set the assumed safe annual average limit for $NO_2$ concentrations at 40 micrograms per cubic metre (µg/m$^3$) of air.

1.2 The UK Government's National Air Quality Plan was published in 2015 and updated in 2017, and this Plan embraced the requirements of the EU Directive. In progressing the delivery of the Plan, the Government identified around 60 local authority areas where these limits are likely to be exceeded as a result of pollution from traffic on local road networks.

1.3 In October 2018, a further supplement to the National Air Quality Plan required a number of local authorities across the UK to work to tackle predicted exceedances. Newcastle-under-Lyme Borough and Stoke-on-Trent City Councils were issued with a Ministerial Direction, under the requirements of the Environment Act 1995. The Direction requires the authorities to tackle air quality issues at specific locations in the North Staffordshire area where nitrogen dioxide ($NO_2$) concentrations are predicted to exceed statutory limits set by the EU in 2008. Specifically, the Direction requires the authorities to undertake:

- "… a Feasibility Study … to identify the option which will deliver compliance with legal limits for nitrogen dioxide in the area for which the authority is responsible, in the shortest possible time."

1.4 In summary, the Ministerial Direction legally obliges the local authorities to identify and deliver a plan that results in:

- **all local road links in the study area having annual average $NO_2$ concentrations of 40µg/m$^3$ or less, in the shortest possible time and by the start of 2022.**

This is the **"primary aim".** The time period has since been amended by Government to 2023, to reflect the impacts of the coronavirus pandemic. This is explained further in Section 6.

1.5 The Ministerial Direction also includes the requirement for the local authorities to assess the viability of a "Clean Air Zone", (CAZ) which is a defined area related to the identified exceedance location(s), that imposes a daily charge on motor vehicles in some or all classes (with the exception of motor cycles), if they are of an age that does not meet the latest emissions standards.

1.6 The benchmark option (against which other options will need to be measured) is required to be a charging CAZ of a high enough classification to bring about compliance in the shortest possible time. There are four classes of CAZ identified within the "UK Plan for tackling roadside nitrogen dioxide concentrations 2017", and these are summarised in Figure A1 below, including vehicle type and minimum euro engine classification allowed to enter a CAZ without payment of a charge.

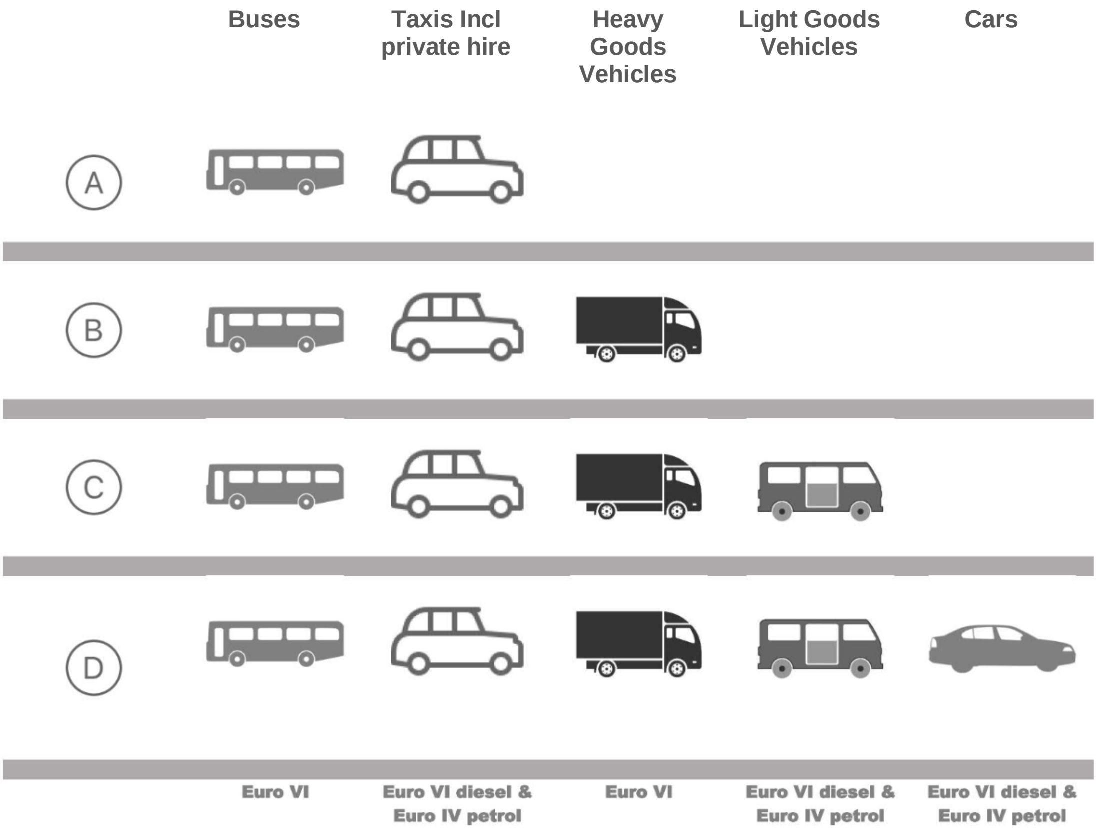


**Figure A1 – CAZ types as identified in "UK Plan for tackling nitrogen dioxide concentrations 2017"**

1.7 The 2018 Ministerial Direction required Newcastle-under-Lyme Borough and Stoke-on-Trent City Councils to work together on a joint plan, and Staffordshire County Council has also supported the work, as it is the highway and transport authority for the Newcastle-under-Lyme part of the study area.

1.8 This requirement to assess a CAZ solution enables the authorities to "benchmark" their preferred option against the CAZ for its ability to deliver compliance with the statutory limit in the shortest possible time and more quickly than a CAZ.

1.9 In the case of cars and light goods vehicles, the vehicle ages that would be liable to payment of the CAZ charge would be those vehicles registered before September 2015 for diesel vehicles (i.e. not a Euro 6 engine), or before January 2006 for petrol vehicles (i.e. not a Euro 4 engine).

## 2 Governance arrangements

2.1 Early in the feasibility study process, Newcastle-under-Lyme Borough, Stoke-on-Trent City and Staffordshire County Councils agreed a governance structure to manage the study process and to work jointly to develop the NSLAQP in line with government requirements. Central to managing the process is the existence of the Joint Advisory Group (JAG) which is chaired by a Cabinet Member from one of the authorities and is responsible for overseeing the work of the project team – the Joint Officer Group (JOG). The JAG meets as required and at least quarterly to ensure timely progress and to make decisions on what proposals should be progressed for inclusion within the Outline Business Case (OBC) and Full Business Case (FBC) and to coordinate the decision making process via the Cabinets of the three local authorities.

2.2 This work is undertaken in conjunction with dialogue with the Government's Joint Air Quality Unit (JAQU). JAQU also employs the services of Local Partnerships to provide a project assurance role, in particular ensuring that the Commercial and Management Cases for the proposals are robust and provide value for money.

2.3 Figure A2 provides a summary of the governance structure and working arrangements.

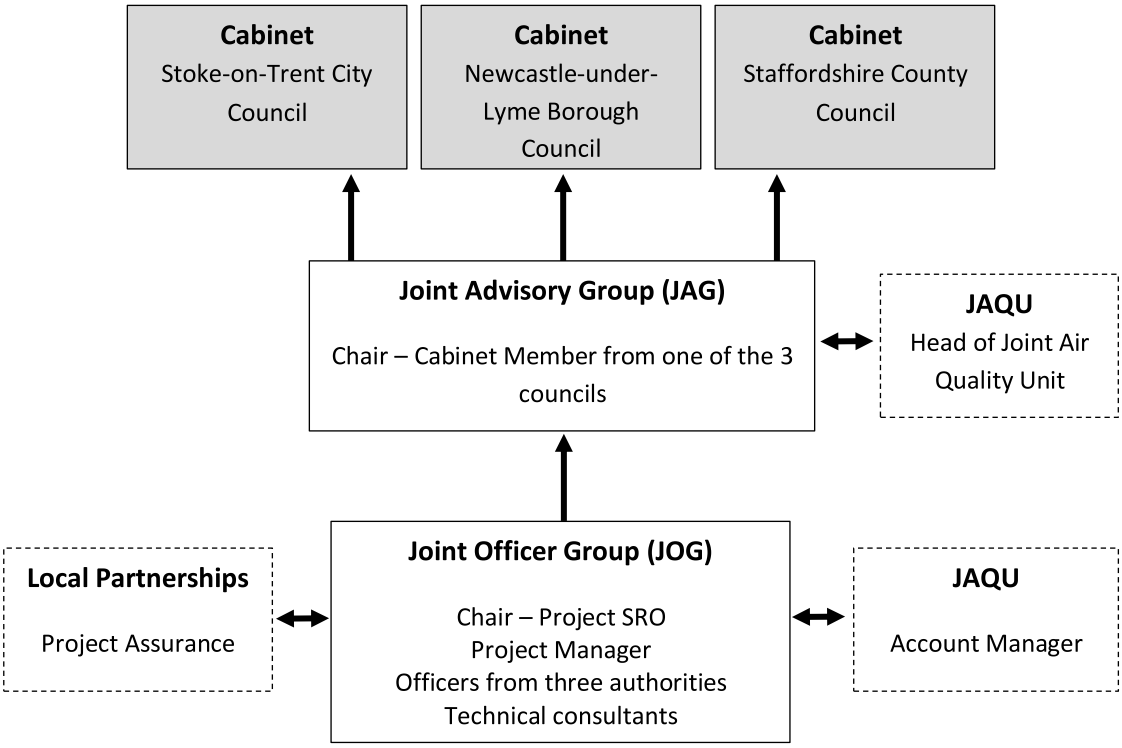


**Figure A2 – NSLAQP Governance structure**

## 3 Initial Evidence

3.1 The initial evidence phase of the study involved the gathering of traffic and air quality data and its analysis, using transport and air quality modelling techniques, to determine the scale of the problem in relation to identifying those locations on the local road network where $NO_2$ concentrations were predicted to exceed the statutory limit by the prescribed date. This identified three locations in the study area where $NO_2$ concentrations are predicted to exceed the statutory limit and hence action needs to be taken to bring them into compliance in the shortest possible time.

3.2 The locations are:

A. The A53 (Etruria Road) between Victoria Street and Basford Park Road.
B. The section of the A50 (Victoria Road) in Fenton, between Maud Street and Hitchman Street.
C. The A5008 (Bucknall New Road) between Potteries Way and Lindop Street.

3.3 Figure A3 shows the above locations highlighted in red. Those road links highlighted in orange are the ones where the modelling predicted $NO_2$ concentrations within 5µg/$m^3$ of the statutory limit and hence a need to focus on ensuring that any plans to tackle the exceedance locations does not result in other increases in $NO_2$ concentrations to or above the statutory limit.

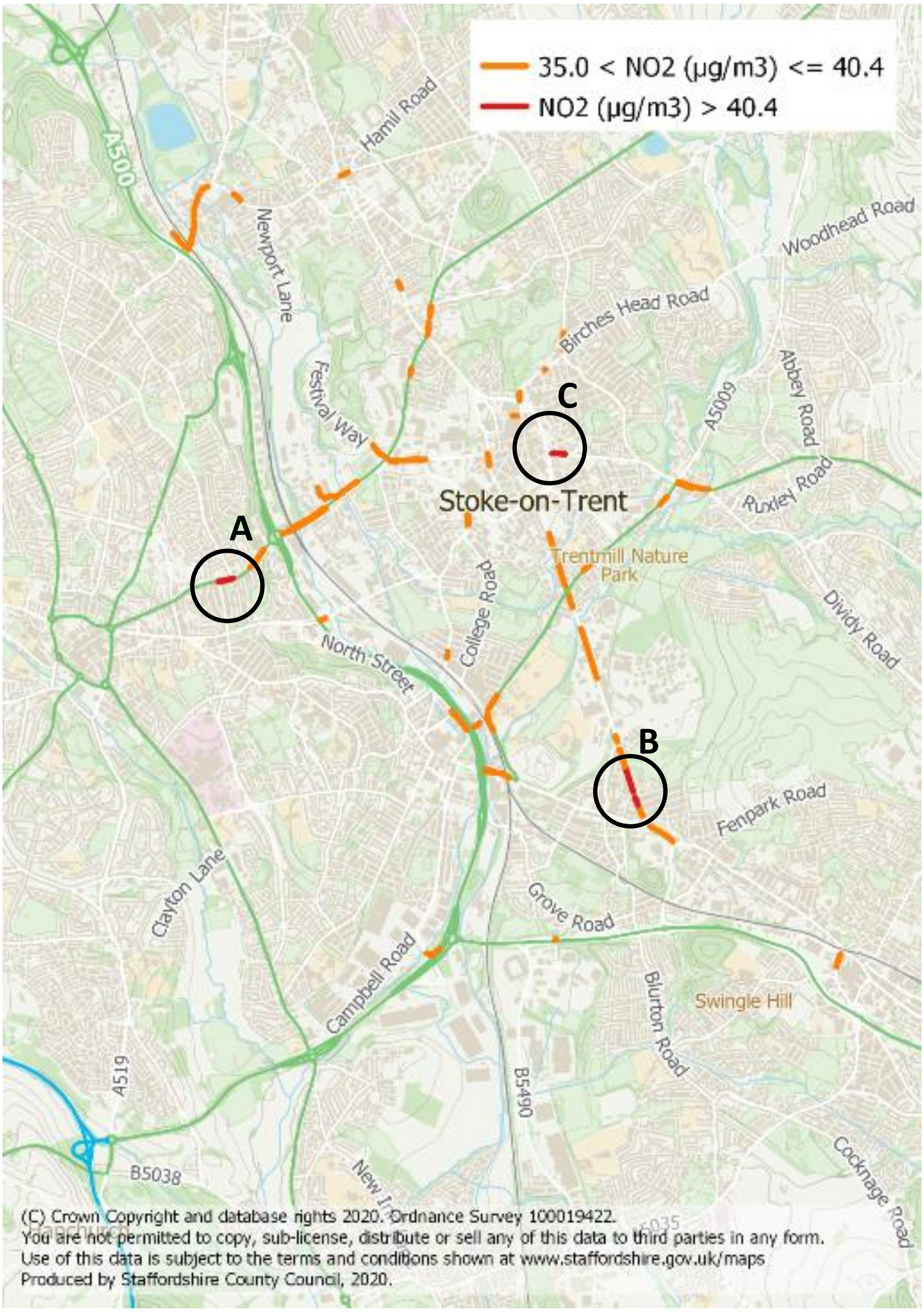


**Figure A3 – $NO_2$ exceedance locations on local road network in 2022 from local modelling**

## 4 Options appraisal and the preferred option

4.1 A range of options were identified through the transport and air quality modelling process and assessment of their outputs, stakeholder workshops and through dialogue with Government and these were appraised against their ability to deliver the primary aim.

4.2 These options included the consideration of charging clean air zones (CAZs). As explained in section 1.6, a CAZ is an area where targeted action is taken to improve air quality, potentially including charging vehicles a daily fee, to drive in the area if they fail to meet specified emissions standards. For example, Birmingham is planning to introduce a charging CAZ in its central area which will require drivers of specific vehicles to pay a charge (£8 for cars, more for other vehicle classes) if they do not meet the latest "Euro" emissions standards.

4.3 A summary of the shortlisted options considered is provided in Table A1 below. The summary of the assessment of the options' ability to deliver the primary aim is summarised by the predicted $NO_2$ concentrations in 2022. The timescales to achieve the primary aim of compliance are those that were assessed "pre-Covid", and as explained in Section 6, the post-Covid timescales are one year later.

| Option | Description | Predicted $NO_2$ concentrations in 2022 ($\mu g/m^3$) |
|---|---|---|
| | | A53 = Etruria Road, BNR = Bucknall New Road, VR = Victoria Road |
| Reference case | **Do nothing** | • A53 42.7<br>• BNR 42.2<br>• VR 45.6<br>**$NO_2$ compliance not achieved** |
| 1 | **Benchmark CAZ D**<br>• A benchmark charging CAZ covering the area of the three exceedances and imposing daily charges (cars/taxis £5, LGVs £9, HGVs/buses £35) on non-compliant vehicles (all categories) entering or driving within the area. See Figure A4 for proposed CAZ D area. | • A53 33.4<br>• BNR 30.9<br>• VR 36.1<br>**$NO_2$ compliance achieved**<br><br>**Timescale to deliver – slow (est. 2023)** |
| 2 | **Low impact traffic management scheme**<br>• A53 Etruria Road - Basford Park Road right turn ban<br>• Bucknall New Road - 50% bus retrofit<br>• Victoria Road - Bus gate plus 100% bus retrofit | • A53 41.7<br>• BNR 40.8<br>• VR 40.1<br>**$NO_2$ compliance not achieved**<br><br>Also created new exceedances<br><br>**Timescale to deliver – fast (est. late 2021)** |
| 3 | **High impact traffic management plus Victoria Road mini-CAZ**<br>• A53 Etruria Road – Westbound peak period bus gate | • A53 39.9<br>• BNR 37.0<br>• VR 34.8<br>**$NO_2$ compliance achieved** |

| | | |
|---|---|---|
| | • Bucknall New Road – 100% bus retrofit<br>• Victoria Road – Mini-CAZ around immediate vicinity of Victoria Road | **Timescale to deliver – slow (est. 2023)** |
| 4 | **High impact traffic management scheme**<br>(Core schemes of the preferred option)<br>• A53 Etruria Road – Westbound peak period bus gate plus alterations to nearby signals<br>• Bucknall New Road – 75% bus retrofit<br>• Victoria Road – Northbound peak period bus gate plus upgraded traffic calming / management on adjacent residential streets. 100% bus retrofit | • A53 38.9<br>• BNR 39.4<br>• VR 39.3<br>**$NO_2$ compliance achieved**<br><br>**Timescale to deliver – fast (est. late 2021)** |
| 5 | **Alternative Benchmark CAZ C**<br>• A benchmark charging CAZ covering the area of the three exceedances and imposing daily charges on non-compliant vehicles (all categories EXCEPT cars) entering or driving within the area. See Figure A4 for proposed CAZ C area. | • A53 39.7<br>• BNR 35.4<br>• VR 41.4<br>**$NO_2$ compliance not achieved**<br><br>**Timescale to deliver – slow (est. 2023)** |
| 6 | **High impact traffic management scheme plus complementary measures**<br>• As option 4 plus other measures including travel planning, bus route enhancements, electric vehicle charging, vegetation removal on A53 Etruria Road. | • A53 38.6<br>• BNR 39.3<br>• VR 39.2<br>**$NO_2$ compliance achieved**<br><br>**Timescale to deliver – fast (est. late 2021)** |

**Table A1 – summary of options tested and their ability to achieve compliance with the primary aim**

NOTE – “post-Covid” dates to achieve compliance are as indicated in the Table, plus one year.

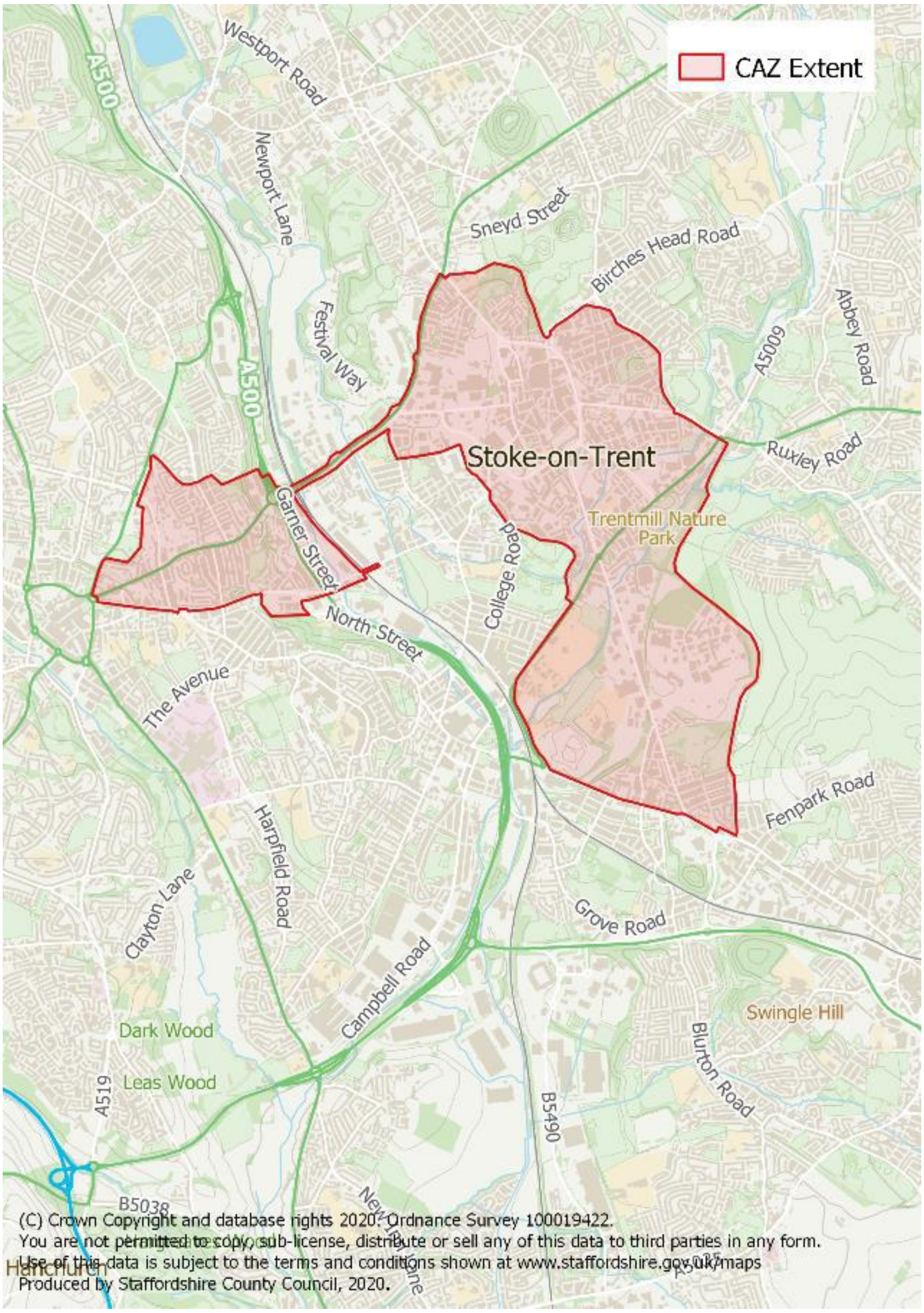


**Figure A4 – Benchmark CAZ C and D areas for appraisal of Options 1 and 5**

4.4 The options appraisal demonstrated that a non-charging option was capable of delivering the primary aim of compliance with the statutory limit for $NO_2$ concentrations in the shortest possible time. This option was progressed and discussed with Members and local MPs resulting in its submission within the unapproved OBC in May 2020 as the "preferred option".

4.5 The dialogue between local MPs and the Air Quality Minister in March 2020 resulted in additional proposals being appraised for inclusion within the preferred option or as alternatives. These proposals were appraised through transport and air quality modelling for their ability to support delivery of the primary aim and are listed in Table A2 along with a summary (in *italics*) of the conclusions from the analysis and/or response from JAQU for each.

| | |
|---|---|
| **Option A** | Hybrids of option 4, which could add: |
| **A1** | • A permit scheme, which for an annual fee would allow motorists to exempt themselves from the proposed two bus gates<br><br>*The assessment demonstrated that the demand for permits would result in an increase in use of the bus gates by non-compliant vehicles and due to the closeness of the predicted $NO_2$ concentrations to the statutory limit this would result in a high risk of future exceedances of the statutory limit.* |
| **A2** | • An Ultra-Low Emission Vehicle (ULEV) exemption, allowing ultra-low emission vehicles to drive through the two bus gates<br><br>*JAQU and the Department for Transport have identified issues with approval for signing that would allow ULEV exemptions. Discussions continue with JAQU given the fact that Nottingham has trialled such a scheme in a bus lane.* |
| **A3** | • A restriction on taxi use of the bus gates to those only licensed within Stoke-on-Trent or Newcastle-under-Lyme to support policy objectives to maintain service quality<br><br>*JAQU and the Department for Transport have indicated that they would not support the installation of the required signing, citing enforcement challenges.* |
| **A4** | • Permits for small businesses within Victoria Road and A53 areas.<br><br>*The assessment demonstrated that the demand for permits would result in an increase in use of the bus gates by non-compliant vehicles, and due to the closeness of the predicted $NO_2$ concentrations to the statutory limit this would result in a high risk of future exceedances of the statutory limit.* |
| **Option B** | One or two “mini-CAZs” – one related to Victoria Road (as in option 3) and one around the A53 exceedance site.<br><br>*The timescale required to deliver any CAZ solutions is significantly longer than that for option 4 and therefore this solution does not comply with the shortest possible time component of the primary aim.* |
| **Option C** | Relocation of the proposed Victoria Road bus gate to a point just north of Dewsbury Road.<br><br>*Relocation of the bus gate would still restrict through traffic along the whole of Victoria Road (i.e. City Road to Joiners Square) but was* |

| | |
|---|---|
| | *assessed to result in too much additional traffic leading to non-compliance in terms of $NO_2$ concentrations.* |
| **Option D** | 24 hour diesel ban covering the large CAZ D area.<br><br>*Likely to receive adverse impact from businesses and individual motorists who have invested in modern Euro 6 fleet/vehicles thinking they are compliant and meeting latest emissions standards.*<br><br>*A part time diesel ban is unlikely to remove sufficient vehicles to achieve compliance in terms of $NO_2$ concentrations.* |
| **Option E** | A part-time CAZ D for the area.<br><br>*The timescale required to deliver any CAZ solutions is significantly longer than that for option 4 and therefore this solution does not comply with the shortest possible time component of the primary aim.* |

**Table A2 – Additional proposals appraised**

4.6 Following their dialogue with the Air Quality Minister and the above assessments, a workshop with the local MPs concluded that further consideration should also be given to:

- A diesel vehicle scrappage scheme, to support the acceleration of fleet renewal and/or modal shift to sustainable modes, across the urban area but providing demonstrable contributions to tackling $NO_2$ concentrations at the three exceedance sites.
- A re-review of the complementary measures within option 6 to promote and support public transport even further given the importance of public transport to securing the specific requirements of the Direction.
- A review in relation to the traffic management measures that are required within option 4 to mitigate against potential displaced traffic, in particular in relation to Manor Street which has been cited as a specific concern due to its proximity to Victoria Road and potential use as a “rat-run”.

4.7 JAQU subsequently dismissed the viability of a scrappage scheme linked to the preferred option stating that “The preferred option does not involve charging vehicles and therefore in comparison to CAZs in other (local authorities) the scale of impact realised by individuals and businesses are significantly less”, and that “A scrappage scheme … cannot be justified … based on the distributional analysis provided and the objectives of the Clean Air Fund”. In view of this feedback this option has been dismissed as it is highly unlikely to be considered favourably for funding and evidence from other authorities has shown that such area-based proposals are not supported by JAQU for funding when seeking to tackle localised exceedances in $NO_2$ concentrations.

4.8 The remaining options of the complementary measures and the traffic management measures linked to Victoria Road are under review as the detailed design of the preferred option progresses.

4.9 MPs and the three Council Leaders also agreed that no form of CAZ will be pursued as part of any preferred option.

4.10 Government agreed to a further time period of six weeks to enable these proposals to be appraised ahead of submission of the unapproved OBC by 15 May 2020.

## 5 Unapproved OBC submission

5.1 Following the appraisal of the additional proposals outlined in section 4.5, the feasibility study culminated in the submission of an unapproved OBC to Government on 15 May 2020, as required by the Air Quality Minister, which set out the rationale for the measures that are contained within the preferred option.

5.2 The OBC was submitted as an unapproved document due to the onset of the Covid-19 pandemic which prevented debate through the three Councils' Scrutiny and Select Committees and subsequent approval by the three Cabinets. This was agreed with the Government Minister responsible for air quality.

5.3 The OBC and preferred option are based on assumptions about traffic flows and travel patterns that take no account of the impact of Covid-19 on the local economy and it was made clear to Government that the submission, including details of the preferred option, had not been consulted on or debated by Members, except for those attending JAG.

5.4 The unapproved OBC submission included the details of the preferred option for tackling the predicted $NO_2$ exceedances which is evidenced by the feasibility study to deliver the primary aim in the shortest possible time.

5.5 The preferred option avoids the need for a charging CAZ and is based on a series of traffic management measures designed to manage traffic flows at peak times and hence vehicle emissions at the predicted exceedance locations.

5.6 In summary, the preferred option comprises:

- The "retrofit" of parts of the local bus fleet with equipment to bring their emissions into line with the latest emissions standards.
- Two peak period "bus gates" which only permit buses, authorised emergency service vehicles, taxis and pedal cycles between the hours of 0700-1000 and 1600-1900, Monday to Friday, located at:
  - A53 Etruria Road, westbound (i.e. towards Newcastle-under-Lyme), immediately to the west of the roundabout with the A500.
  - A50 Victoria Road, Fenton, northbound (i.e. towards Joiners Square) just to the north of the City Road roundabout.

  A bus gate is a short section of carriageway in which traffic is restricted in one direction to buses, taxis and pedal cycles. There is no gate as such, and it is enforced using automatic number plate recognition cameras. Further exemptions may be included to enable emergency service vehicles to use the bus gates.
- The enhancement of existing traffic calming and management measures in the areas either side of Victoria Road, Fenton, to minimise and/or prevent the use of these streets by non-local traffic.
- A series of bus network enhancements to improve the attractiveness of the bus networks that use these routes.

5.7 The preferred option is described in full in Appendix B of this report.

## 6 Covid-19 sensitivity testing

6.1 Following the submission of the unapproved OBC, Government reasserted its commitment to tackle $NO_2$ exceedances and expects mandated authorities to deliver their air quality plans in the shortest possible time. In July 2020, Government then asked the local authorities to look at the potential impacts of the coronavirus pandemic on traffic and hence vehicle emissions through a process of sensitivity testing which considered a specified range of factors linked to:

- Higher prevalence of **home working**, including flexible working
- Lower use of **public transport**, either due to the requirements of social distancing and/or changes in the commercial bus network
- Higher use of **active transport**, in particular walking and cycling
- Fewer business trips due to **suppressed economic activity**, including the potential impacts linked to higher unemployment levels
- Delayed **vehicle fleet renewal** due to fewer new vehicle sales, resulting in more older (and more polluting) vehicles staying on the road for longer.

6.2 This testing has assessed the level of uncertainty regarding whether the current preferred option is able to deliver compliance with the statutory $NO_2$ concentration limits in the shortest possible time.

6.3 Government also extended its deadline for delivery of our air quality plan and FBC by up to four months. This extension allowed time for the requirement for the above extra work and also for the impact of the pandemic on officers' workloads, meaning the FBC must now be completed by July 2021 and the preferred option implemented by September 2022. Government also amended the required year for achieving compliance with the $NO_2$ statutory limit to 2023, although compliance is still expected to be achieved in the shortest possible time.

6.4 The parameters of the sensitivity testing were agreed with JAQU and endorsed through JAG, which took two months to complete, and in summary concluded that:

- The delay in vehicle fleet renewal has a small negative impact on emissions, in effect because older, more polluting vehicles are being kept on the road for longer.
- The impact of the pandemic on public transport use within the study area is very minimal, basically because the vast majority of public transport users are "tied" to its use and have no viable alternative.
- The increase in homeworking is having a short term but marginal beneficial impact, but the longer term impacts (at least in relation to the compliance year) are minimal.
- The increase in active travel is again marginal, for example linked to leisure travel, which is a welcome impact. However, any impacts were considered to be insufficient to justify reductions in predicted vehicle journeys.
- The negative impacts of the pandemic on the local economy are complex and potentially long-lasting, but in relation to the required compliance year for $NO_2$ concentrations the impacts are minimal.

6.5 In summary, there are small negative impacts of the pandemic on vehicle emissions and hence $NO_2$ concentrations, but these negative impacts are countered by the additional “year to compliance” from 2022 to 2023 that Government has specified. The net impacts are therefore assumed to be nil overall in relation to the ability of the preferred option to deliver compliance in the shortest possible time.

6.6 The results and conclusions of the sensitivity analysis are set out in more detail in Appendix D of this report.

## 7 Full Business Case (FBC) development and submission

7.1 The sensitivity testing has clearly confirmed that the current preferred option is still likely to be valid to tackle the predicted $NO_2$ exceedances in the shortest possible time.

7.2 Government is reviewing the unapproved OBC and has confirmed that the study should progress towards completion of the FBC by July 2021. Further JAQU funding is being sought to undertake this phase of the work. Subject to Cabinet approval of the OBC, it is planned to progress the completion and submission of the FBC by July 2021 with this being reported to Cabinets in each local authority.

7.3 Subject to receipt of full funding for the scheme from Government by September 2021, contractors will then be appointed to implement the preferred option. Construction of the traffic management measures, implementation of traffic orders and installation of retrofit technology on the buses will take approximately 12 months to complete meaning that the preferred option will be completed by the end of 2022. This will ensure the infrastructure is in place to deliver the required changes to travel patterns to deliver the required compliance with statutory limits for $NO_2$ concentrations by the Government’s revised specified year of 2023.

7.4 During the development of the FBC there will be full engagement with local communities and stakeholders as the project progresses.

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**Appendix B**

**The Preferred Option – Full Description**

## 1 A50 Victoria Road Bus Gate

A bus gate will be installed on the A50 Victoria Road exit of the King Street/City Road/Victoria Road junction. Traffic will be restricted to buses, cyclists and taxis between Monday and Friday from 7am to 10am and 4pm to 7pm.

The splitter island will be widened and the kerbs re-aligned to provide a single lane bus gate. An ANPR camera will be located at the bus gate to monitor compliance and two rotating prism signs will be installed at the entrance to the bus gate. The prism signs will enable the display of multiple messages and will be blank when the bus gate is not in use.

Bus gate advanced direction signing will be provided on the local highway network on all approaches to the Victoria Road/City Road and A50/King Street junctions, including Prism and Variable Message Signs.

The scheme costs include installation, the Traffic Regulation Order, ten-years of maintenance, monitoring and operation, and decommissioning at the end of the project. It is expected that the cameras may need to be replaced after five years.

A ULEV exemption, allowing ultra-low emission vehicles to drive through the bus gate will be assessed and if considered deliverable will be added to the scheme in the Full Business Case (FBC).

## 2 A53 Etruria Road Bus Gate

A two-lane bus gate will be installed on the A53 Etruria Road westbound exit of the A53/A500 roundabout, with appropriate amendments to the existing road markings at the bus gate and on the circulatory carriageway. Traffic will be restricted to buses, cyclists and taxis between Monday and Friday from 7am to 10am and 4pm to 7pm. Two rotating prism signs will be installed at the entrance to the bus gate to enable the display of multiple messages and will be blank when the bus gate is not in use. Two ANPR cameras will be installed to manage compliance.

Advanced direction signing will include prism signs on all approaches to the A500/A53 Etruria Road roundabout. Changes to destination signs on the A500 mainline carriageway in both directions are also proposed. This will include appropriate re-routing to the hospital and will also include variable message signs.

The scheme costs include installation, the Traffic Regulation Order, ten-years of maintenance, monitoring and operation, and decommissioning at the end of the project. It is expected that the cameras may need to be replaced after five years.

A ULEV exemption, allowing ultra-low emission vehicles to drive through the bus gate will be assessed and if considered deliverable will be added to the scheme in the Full Business Case (FBC).

## 3 Traffic Management East and West of Victoria Road

Traffic management measures will be required on roads to the east and west of Victoria Road in order to ensure that the adjacent local communities are not adversely impacted by traffic re-routeing through these areas when the bus gates are in operation.

The following measures will be required to the East of Victoria Road:

- Replace existing worn and ineffective road humps in Beville Street, Stanier Street, Wileman Street, Philip Street, Elliot Road, Wedgwood Road, Warrington Street and Vivian Road and enhance the impact of the scheme by providing additional humps and carriageway re-surfacing.
- Provide new road humps and carriageway re-surfacing along Park Street, Minerva Road, Frederick Street, Cumberland Street and Clarence Street.
- Introduce one-way operation (direction of travel west to east) in Wileman Street (part) and Stanier Street (part).
- Provide an environmental weight restriction on the traffic calmed routes to prevent inappropriate large vehicles travelling through the area.
- Extend 20 mph zone to cover the whole traffic calmed area.

The following measures will be required to the West of Victoria Road:

- Replace existing worn and ineffective road humps in Manor Street, George Street, Edward Street and Hitchman Street and enhance the impact of the scheme by providing additional humps and carriageway re-surfacing.
- Provide new road humps and carriageway re-surfacing in Maud Street, Fountain Street and William Street. This includes two raised tables to improve safety at Christ Church C of E Primary School.
- Enhance signage to improve the enforcement of the existing environmental weight restriction in Manor Street.
- Closure of Hitchman Street at its junction with Victoria Road, maintaining access for pedestrians and cyclists.
- The existing western footway along Victoria Road at Hitchman Street will be extended to enhance the pedestrian environment.
- A 20mph zone to include the whole traffic calmed area.

## 4 Transport Improvements along A53 Etruria Road

The bus gate on A53 Etruria Road will significantly reduce traffic flows in the peak periods along this corridor and improve bus reliability. This will necessitate the review of signal timings at junctions along the corridor in order to maximise air quality benefits.

The increase in spare capacity along the corridor will create the opportunity for the provision of signalised pedestrian crossing facilities on all arms of the A53/Gladstone Street/Basford Park Road junction and the A53/Albert Street/Sandy Lane junction.

An existing bus stop along the A53 Etruria Road is located on the hill where it is observed that traffic can queue behind buses serving the stop. It is recommended that the bus stop is relocated to the east of Kingsfield Oval, opposite the New Vic Theatre where it is likely to have a reduced impact on air quality. Accessibility will be enhanced through the provision of bus access kerbs and levelled footways. Real Time Bus Passenger Information will also be provided along the A53 corridor.

## 5 Bus Retrofit Programme

To deliver compliance on Bucknall New Road and Victoria Road the buses that use these routes will be retrofitted to achieve Euro VI emission standards. This involves the installation of the appropriate exhaust modification depending on vehicle type and age and associated e-cooling fan to minimise ongoing maintenance. This will be an expansion of the existing bus retrofit programme being delivered on the A53 as part of the separate Newcastle-under-Lyme Borough Council Ministerial Direction.

75% of buses that travel along the Bucknall New Road corridor and all buses travelling along Victoria Road require this improvement to ensure that compliance is achieved. Funding will be required for the retrofitting of 50 buses to ensure that the appropriate number of scheduled services can continue to operate on Bucknall New Road and Victoria Road. The two main operators are First Bus and D&G, and the smaller operators include Scraggs and Stantons of Stoke.

To market the cleaner bus fleet, enhance their visibility and encourage greater bus use, it is recommended that all buses that have been retrofitted are provided with a new branding in the form of a partial bus wrap. To monitor bus operator use of retrofit vehicles, ANPR cameras will be installed on Victoria Road, Bucknall New Road, at the junction with St Ann Street, and on the A53 to the east of the junction with Albert Street/Sandy Lane.

## 6 Bus Infrastructure Improvements

Enhanced bus infrastructure will be installed on routes that pass through or are parallel to the exceedance locations. This includes bus routes:

- To Abbey Hulton, Milton, Bentilee and Longton that converge at Bucknall New Road
- Along Victoria Road and parallel routes along College Road and A5007 City Road
- Along A53 Etruria Road between Newcastle town centre and Hanley City Centre, and parallel routes along the A52 and Shelton New Road.

The improvements are required to ensure that bus patronage is maximised along corridors that are at risk of air quality exceedances and where traffic modelling suggests that traffic flows and journey times may increase as traffic re-routes to avoid the bus gates. The cost of the package includes the installation and ten-year maintenance of:

- 89 real time bus passenger information (RTPI) screens
- 17 new bus shelters of which 8 are replacement and 9 are new facilities
- 27 accessible kerbs at bus stops
- Installation of CCTV at 71 bus stops.

Figure 1 provides a schematic summary of the key components of the preferred option.

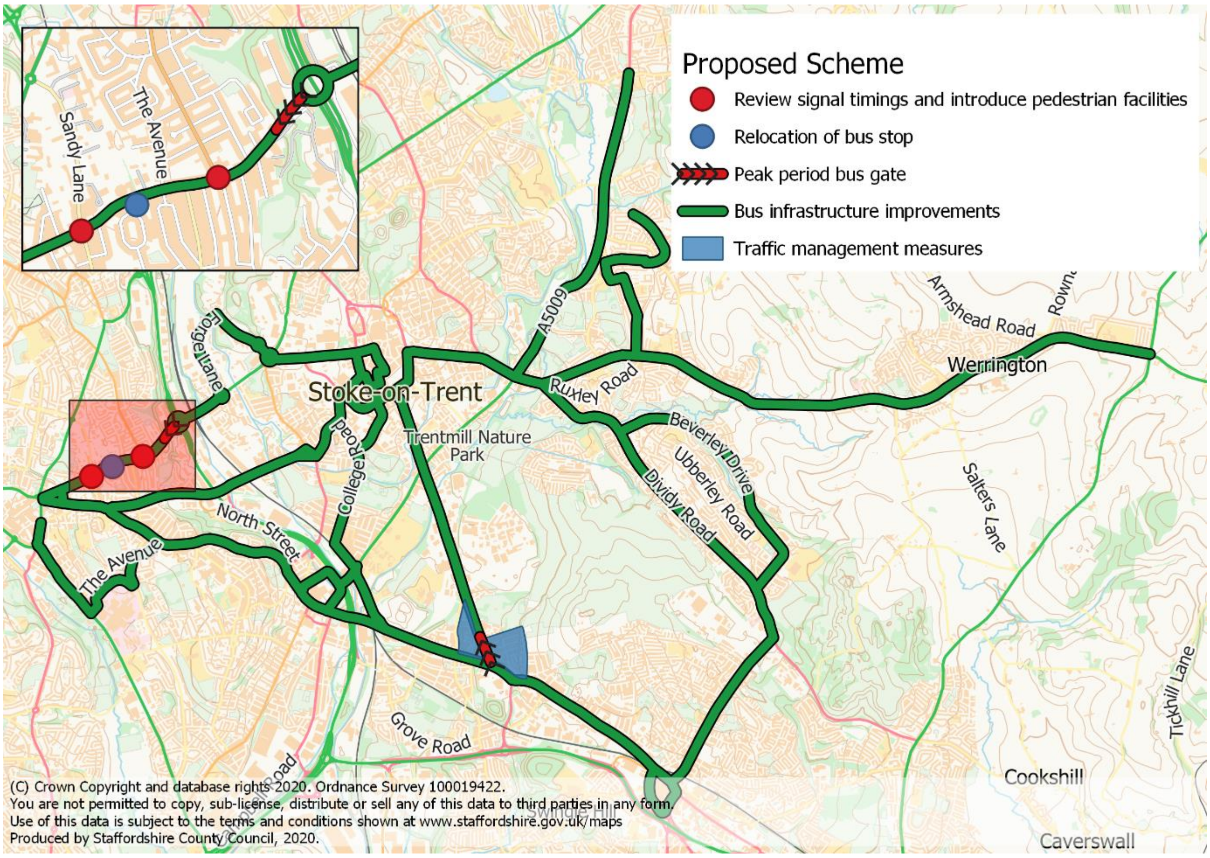


**Figure 1 – Preferred Option – schematic summary**

## 7 Monitoring and Evaluation Package

Funding will be required to deliver the Monitoring and Evaluation Plan as there is not expected to be adequate revenue generated from the bus gates to cover the costs.

Funding will be required to collect monthly air quality data at the 664 diffusion tube locations over the ten-year period. This includes 59 new sites.

ANPR will be collected at the five locations set up to enforce the bus gates and retrofitted buses. In order to monitor network wide changes in vehicle compliance, these ANPR cameras will need to be supplemented by a one-off ANPR data collection survey covering 15 additional sites.

The aim of the preferred option is to reduce emissions below the exceedance level by re-distributing traffic away from the three exceedance locations, whilst avoiding the creation of new exceedance locations. Funding will be required to monitor the actual changes in traffic flows compared to modelled flows. 13 new permanent traffic counters will be required at the exceedance sites and along two screen lines on the local highway network that intercept the key routes that are predicted to be affected by the re-assignment of traffic.

Funding is required to measure the change in passenger numbers over the ten-year period as a result of improved bus reliability and investment in bus infrastructure. Where available, data by fare stage collected from ticket equipment will be received from the bus operators and concessions data can provide a broad indication of the number of passengers on each service each month.

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE

Executive Summary

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

# Table of contents

# 1 Executive Summary

## 1.1 Overview

This Executive Summary and supporting documents form an unapproved Outline Business Case (OBC) for the North Staffordshire Local Air Quality Plan (NSLAQP). It has been prepared on behalf of the three authorities, Stoke-on-Trent City Council (SoTCC), Newcastle-under-Lyme Borough Council (NuLBC) and Staffordshire County Council (SCC) for consideration by the Joint Air Quality Unit (JAQU) at the Department for Transport (DfT) and Department for Environment, Food and Rural Affairs (Defra).

It is submitted to JAQU as a politically unapproved document on 15 May 2020. The OBC is written in accordance with the requirements of a Ministerial Direction and subsequent correspondence from the Parliamentary Under Secretary of State. This sets out the requirement for SoTCC and NuLBC to identify measures that could bring forward compliance with $NO_2$ limits as soon as possible.

The structure of the business case, and the appraisal described in it, follows published guidance including HM Treasury Green Book – Central Government Guidance on Appraisal and Evaluation (2018).

The OBC explains why the scheme should receive support and provides a clear audit trail for the purposes of public accountability. The OBC is more than just a bid for financial support. It also explains how and why the councils have decided to put the scheme forward in its current form. It shows that the proposals are based on a realistic analysis of the current situation, a clear vision of how things should be in the future, a careful consideration of options, a robust appraisal of costs and benefits, and a clear plan for delivering the scheme.

It must be noted that the work undertaken is based on the appraisal of initial evidence that was completed by October 2019, before the onset of the current coronavirus pandemic. The implications of coronavirus on public health, the local economy and on people's attitudes to travel, is unknown and will remain uncertain for some months to come. These implications will need to be considered by the Government in determining the requirements for the next stage of this project.

## 1.2 Introduction

The three authorities are committed to working together to transform the urban area of North Staffordshire into a cleaner and healthier area.

In October 2018, SoTCC and NuLBC were issued a Ministerial Direction to produce a local air quality plan to address their respective nitrogen dioxide ($NO_2$) problems related to roadside traffic pollution. Given their proximity to one another and nature of the urban area, they were tasked with producing a joint plan.

As the highway authority for the Borough of Newcastle-under-Lyme, SCC has been assisting the authorities and together the three authorities have developed a plan to tackle $NO_2$ exceedances at the roadside – known as the North Staffordshire Local Air Quality Plan.

The Plan will help to protect and promote the health of the local population by improving air quality and reducing the impact of air pollution on the environment. In so doing, the local authorities are complying with the UK Air Quality Plan and bringing $NO_2$ concentrations within statutory limits in the shortest possible time.

## 1.3 Why is this plan needed?

It is widely recognised that air pollution poses the largest environmental public health risk in the UK, and it continues to threaten the lives of more vulnerable members of the population. In England, the annual number of deaths attributed to air pollution is roughly 25,000 and there is extensive evidence that details the correlation between poor air quality and increased prevalence of respiratory and cardiovascular diseases. The impacts of pollution usually surface in the long-term and the problems caused by it are experienced disproportionately by the elderly, infants and those with existing chronic ailments. The impacts are greater on those who reside, work or are educated in more deprived areas. Areas within North Staffordshire suffer deprivation[1], based on domains such as income, employment, education and health – this increases the need to address air pollution and health problems in this area.

Air pollution affects the health of people living, working and travelling in North Staffordshire. Pollutants such as nitrogen dioxide ($NO_2$) which is the harmful oxide of nitrogen ($NO_X$), and particulate matter ($PM_{2.5}$ and $PM_{10}$) that are not visible to the naked eye are found at dangerous levels in many urban areas and on busy roads. Road transport causes two-thirds of $NO_X$ emissions and nearly 80% of PM emissions at the roadside. The main sources of road-based $NO_X$ emissions are diesel vehicles with older vehicles typically more polluting than newer vehicles. Breathing in polluted air contributes to the equivalent of approximately 200 deaths a year in North Staffordshire.

Although air quality in the UK has improved significantly over recent decades, it is recognised that there is still plenty of room for improvement, whilst meeting the objective of supporting economic growth. This is especially important, given the correlation between poor air quality and health-related diseases. To deliver change, the problem needs to be targeted at source. However, action must be geographically relevant, ensuring that any interventions must align with the interests of local people, given that people are the main driver for improving air quality.

### 1.3.1 Ministerial Direction

In the air quality directive (2008/EC/50) the EU set two limit values for nitrogen dioxide ($NO_2$) for the protection of human health: the $NO_2$ hourly mean value may not exceed 200 micrograms per cubic metre (µg/m3) more than 18 times in a year and the $NO_2$ annual mean value may not exceed 40 micrograms per cubic metre ($\mu g/m^3$).

In December 2015, the UK Government published the plan for 'Tackling nitrogen dioxide in our towns and cities – UK overview document' naming the first wave of five cities, Birmingham, Leeds, Southampton, Nottingham and Derby, to implement Clean Air Zones and bring $NO_2$ to within the limit values.

In July 2017, the UK Government published the UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations – An Overview,[2] which set out Government's plan to achieve a cleaner and healthier environment along with actions to lower $NO_2$ air pollution to levels that comply with established EU limits in the shortest possible time. As a result, the Government initially identified 28 local authorities with the worst $NO_2$ problems in the country and directed them to produce local air quality plans. These plans aim to detail how each authority will attempt to reduce its $NO_2$ concentrations to compliant levels in the shortest time.

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[1] Ministry of Housing, Communities & Local Government – The English Indices of Deprivation 2019

[2] UK plan for tackling nitrogen dioxide concentrations, Detailed plan, Defra, July 2017

In March 2018, the Government continued pursuing the Ministerial Direction to further advise more authorities to address their $NO_2$ issues. A further 33 local authorities were required to produce plans on potential pollution mitigation measures to be implemented in their areas.

In October 2018, another supplement to the $NO_2$ plan was issued in which a further eight local authorities were directed to produce a local air quality plan to address their respective $NO_2$ problems. These 'third wave' authorities included both Stoke-on-Trent and Newcastle-under-Lyme; owing to their proximity to one another, they were tasked with producing a joint plan pertaining to their pollution issues. SCC is assisting the authorities in its role as highway authority for the Borough of Newcastle-under-Lyme.

The October 2018 Ministerial Direction required the authorities to assess other areas of the city and borough where local modelling identified predicted exceedances in $NO_2$ concentrations, and to consider the displacement effects of any measures that may be implemented to tackle these exceedances. The study area is shown in Figure 1-1 and covers the central urban areas and the surrounding communities in both Newcastle-under-Lyme and Stoke-on-Trent. Together these areas form part of the North Staffordshire conurbation which is identified in the Midlands Connect Strategy as one of four Strategic Economic Hubs.

*Figure 1-1: Study area*

### 1.3.2 $NO_2$ exceedances

The Strategic Outline Case (SOC) was submitted in line with the requirements of the 2018 Direction in January 2019. The SOC set out the existing problems, the work to be undertaken to develop robust evidence and identified potential options to be explored.

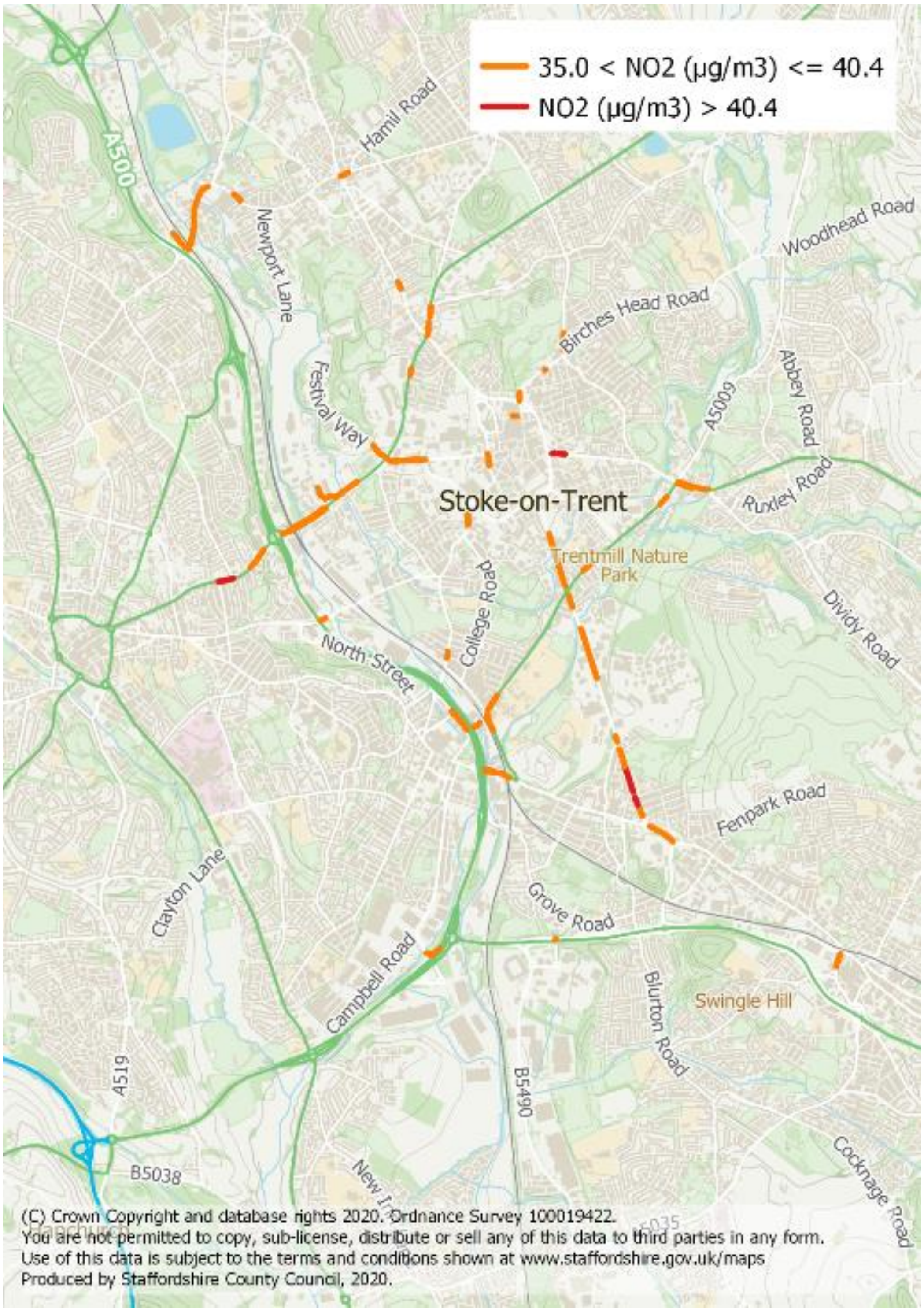
Following the SOC, work progressed to refine the evidence which culminated in the completion of the Initial Evidence Submission (IES) in October 2019. The suite of reports that form the IES conclude that in 2022, the study area will contain three links on the local road network where $NO_2$ concentrations are predicted to exceed the legal limits. The work undertaken also highlighted that within the study area there are sections of the Strategic Road Network (SRN) where $NO_2$ concentrations are predicted to exceed the legal limits. It is important to note that the SRN is outside the scope of this project.

The three predicted $NO_2$ exceedance locations on the local road network, based on the local model are shown in Figure 2 and comprise:

- The A53 (Etruria Road) between Victoria Street and Basford Park Road.
- The A5008 (Bucknall New Road) between Potteries Way and Lindop Street.
- The section of the A50 (Victoria Road) between Maud Street and Hitchman Street.

Figure 1-2 also shows road links which are within 5 ug/m$^3$ of the limit value, this is important as the NSLAQP cannot create additional exceedances, therefore it has been necessary to ensure no significant traffic displacement or increase in pollution levels on these roads.

*Figure 1-2: $NO_2$ exceedance locations on local road network in 2022 from local modelling*



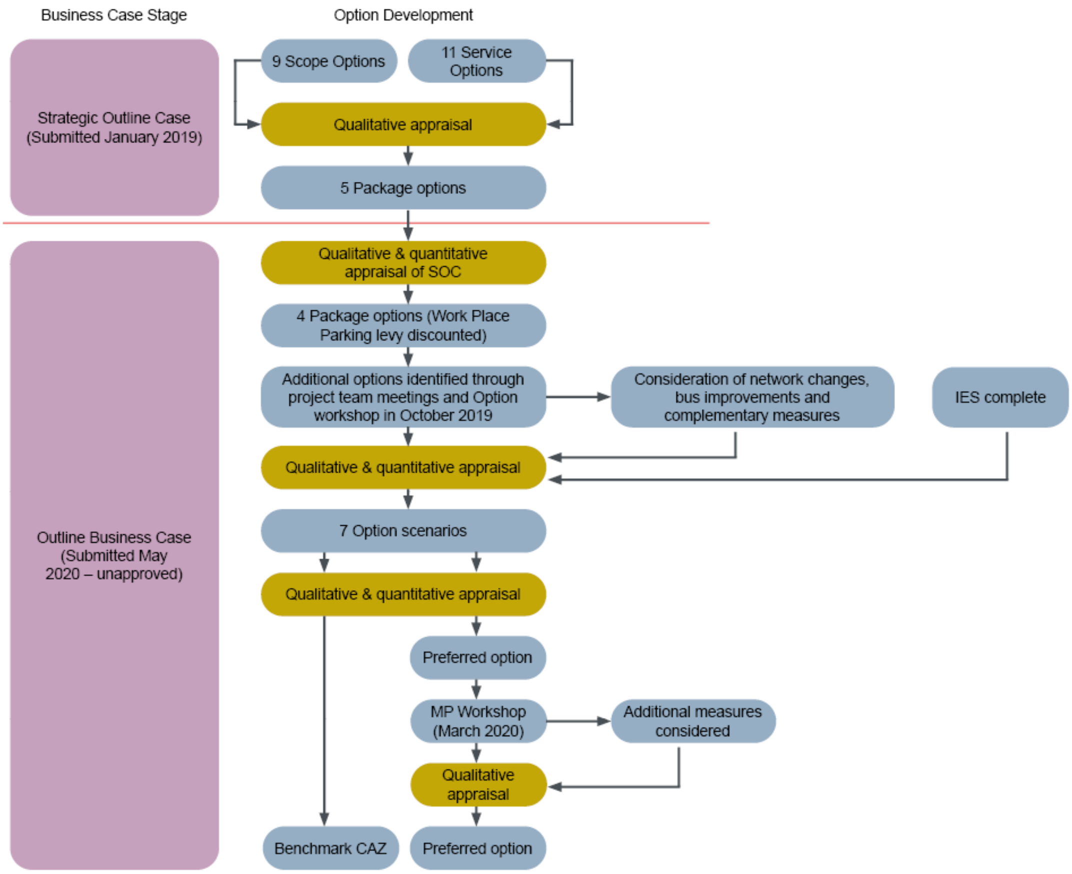
## 1.4 The proposal

By working together and with relevant consultants with expertise in transport and air quality assessments, SoTCC, NuLBC and SCC have sought to develop a package of measures that will reduce $NO_2$ concentrations at exceedance locations to below the EU Limit in the shortest time possible. In addition to achieving this, the Councils have sought to ensure the NSLAQP supports the wider strategic goals of the region to minimise any risk of unintended negative consequences.

This joint approach has been necessary because it is recognised that air pollution does not respect local authority boundaries and therefore a consistent and co-ordinated approach is required to maximise air quality benefits for all people living and working in North Staffordshire. By working together, the authorities can also help to ensure, as far as possible, alignment between the NSLAQP and wider authority strategies.

The identification of the Preferred Option has built on the work undertaken in the preparation of the SOC and has been supplemented by further option development and appraisal as summarised in Figure 1-3. This approach has involved additional option identification workshops, the qualitative and quantitative testing of options to ensure the best package has been selected to address the exceedance locations and promote ongoing improvements in air quality.

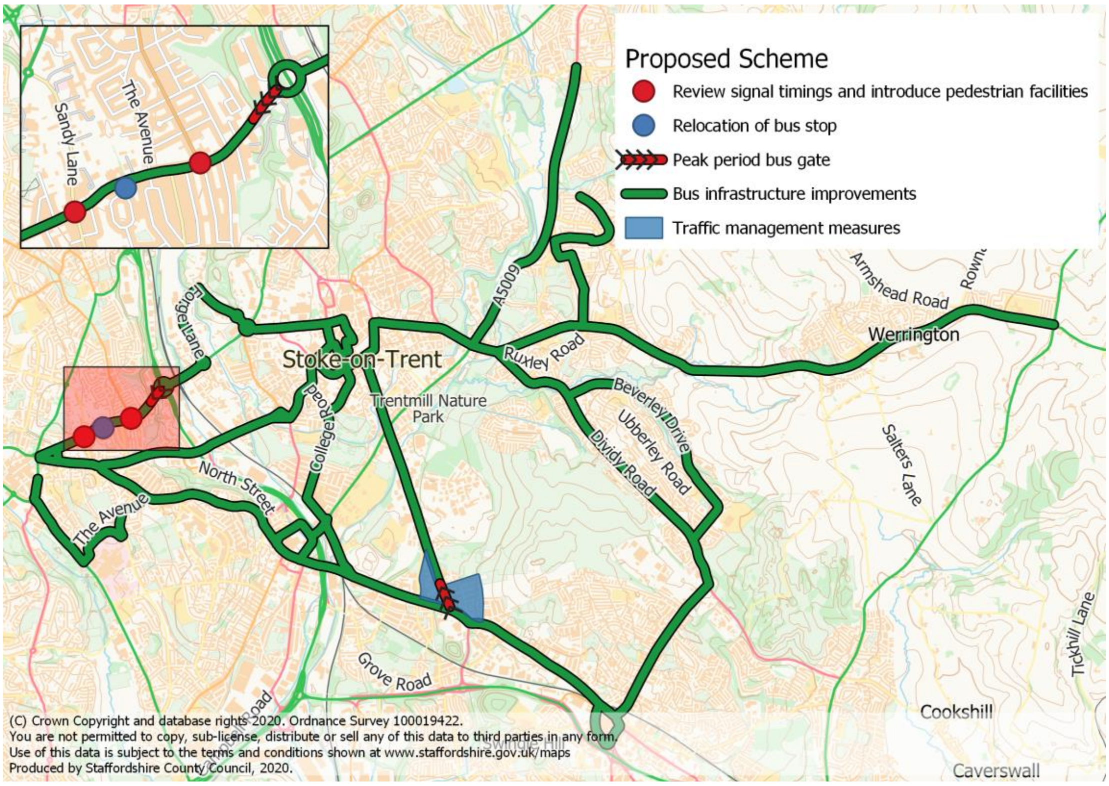
*Figure 1-3: Summary of option appraisal*



The outcome of this work has identified that the Preferred Option for the NSLAQP is not a CAZ (although a Benchmark CAZ D has been identified) but a range of transportation improvements. These improvements include traffic management measures, junction improvements, bus emission reductions and bus network enhancements. This option achieves compliance in the shortest possible time and helps to deliver wider objectives.

The NSLAQP is summarised in Figure 1-4 and comprises a package of transport and travel related proposals, described below:

*Figure 1-4: Visual summary of the NSLAQP*




### 1.4.1 A50 Victoria Road bus gate

A bus gate will be installed on the A50 Victoria Road exit of the King Street/City Road/Victoria Road junction. Traffic will be restricted to buses, cycle users and taxis between Monday and Friday from 7am to 10am and 4pm to 7pm. An Ultra-Low Emission Vehicle (ULEV) exemption, allowing ULEVs to drive through the bus gate will be assessed and if considered deliverable will be added to the scheme in the Full Business Case (FBC).

The splitter island will be widened and the kerbs re-aligned to provide a single lane bus gate on the exit to A50 Victoria Road. An ANPR camera will be located at the bus gate to monitor compliance and two rotating prism signs will be installed at the entrance to the bus gate. The prism signs will enable the display of multiple messages and will be blank when the bus gate is not in use. Bus gate advanced direction signing will be provided on the local highway network on approaches to the Victoria Road/City Road and A50/King Street junctions, including Prism and Variable Message Signs (VMS).

1.4.2 A53 Etruria Road bus gate

A two-lane bus gate will be installed on the A53 Etruria Road westbound exit of the A53/A500 roundabout, with appropriate amendments to the existing road markings at the bus gate and on the circulatory carriageway. Traffic will be restricted to buses, cycle users and taxis between Monday and Friday from 7am to 10am and 4pm to 7pm. An ULEV exemption, allowing ultra-low emission vehicles to drive through the bus gate will be assessed and if considered deliverable will be added to the scheme in the FBC.

Two rotating prism signs will be installed at the entrance to the bus gate to enable the display of multiple messages and will be blank when the bus gate is not in use. Two ANPR cameras will be installed to manage compliance. Advanced direction signing will include prism signs on all approaches to the A500/A53 Etruria Road roundabout. Changes to destination signs on the A500 mainline carriageway in both directions are also proposed. This will include appropriate re-routing to the hospital and will also include VMS.

1.4.3 Traffic management east and west of Victoria Road

Traffic management measures will be required on roads to the east and west of Victoria Road in order to ensure that the adjacent local communities are not adversely impacted by traffic re-routing through these areas when the bus gates are in operation. This includes a range of interventions in specific locations including:

- Replacing existing worn and ineffective road humps
- Providing additional humps and carriageway re-surfacing
- Introduce one-way operation (direction of travel west to east) in Wileman Street (part) and Stanier Street (part)
- Two raised tables to improve safety at Christ Church C of E Primary School.
- Providing an environmental weight restriction on the traffic calmed routes to prevent inappropriate large vehicles travelling through the area
- Extending 20 mph zone to cover the whole traffic calmed area
- Enhancing signage to improve the enforcement of the existing environmental weight restriction in Manor Street
- Closure of Hitchman Street at its junction with Victoria Road, maintaining access for pedestrians and cycle users
- Existing the western footway along Victoria Road at Hitchman Street to enhance the pedestrian environment.

1.4.4 Transport improvements along A53 Etruria Road

The bus gate on A53 Etruria Road will significantly reduce traffic flows in the peak periods along this corridor and improve bus reliability. This will necessitate the review of signal timings at junctions along the corridor in order to maximise air quality benefits. The increase in spare capacity along the corridor will create the opportunity for the provision of signalised pedestrian crossing facilities on all arms of the A53/Gladstone Street/Basford Park Road junction and the A53/Albert Street/Sandy Lane junction.

An existing bus stop along the A53 Etruria Road is located on the hill where it is observed that traffic can queue behind buses serving the stop. It is recommended that the bus stop is relocated to the east of Kingsfield Oval, opposite the New Vic Theatre where it is likely to have a reduced impact on air quality. Real Time Bus Passenger Information will also be provided along the A53 corridor.

#### 1.4.5 Bus retrofit programme

To deliver compliance on Bucknall New Road and Victoria Road the buses that use these routes will be retrofitted with exhaust technology to achieve Euro VI emission standards. This involves the installation of the appropriate exhaust modification depending on vehicle type and age and associated e-cooling fan to minimise ongoing maintenance. This will be an expansion of the existing bus retrofit programme being delivered on the A53 as part of the separate Newcastle-under-Lyme Borough Council Ministerial Direction.

A total of 75% of buses that travel along the Bucknall New Road corridor and all buses travelling along Victoria Road require this improvement to ensure that compliance is achieved. Funding will be required for the retrofitting of 50 buses to ensure that the appropriate number of scheduled services can continue to operate on Bucknall New Road and Victoria Road. The two main operators are First Bus and D&G, with a number of smaller operators including Scraggs and Stantons of Stoke.

To market the cleaner bus fleet, enhance their visibility and encourage greater bus use, it is recommended that all buses that have been retrofitted are provided with a new branding in the form of a partial bus wrap. To monitor bus operator use of retrofit vehicles, ANPR cameras will be installed on Victoria Road, Bucknall New Road, at the junction with St Ann Street, and on the A53 to the east of the junction with Albert Street/Sandy Lane.

#### 1.4.6 Bus infrastructure improvements

Enhanced bus infrastructure will be installed on routes that pass through or are parallel to the exceedance locations. This includes bus routes:

- To Abbey Hulton, Milton, Bentilee and Longton that converge at Bucknall New Road
- Along Victoria Road and parallel routes along College Road and A5007 City Road
- Along A53 Etruria Road between Newcastle town centre and Hanley City Centre, and parallel routes along the A52 and Shelton New Road.

The improvements are required to ensure that bus patronage is maximised along corridors that are at risk of air quality exceedances and where traffic modelling suggests that traffic flows and journey times may increase as traffic re-routes to avoid the bus gates. The package includes:

- 89 real time bus passenger information (RTPI) screens
- 17 new bus shelters of which 8 are replacement and 9 are new facilities
- 27 accessible kerbs at bus stops
- Installation of CCTV at 71 bus stops

### 1.5 The five cases

The business case has been prepared in line with guidance by HM Treasury for business cases and is commensurate with the scale of the problem and scale of the proposed strategy to tackle the problem. It sets out the supporting evidence necessary for justification of the Preferred Option. It includes potential delivery timescales to achieve the primary aim of delivering compliance with statutory limits on roadside $NO_2$ concentrations across the study area in the shortest possible time.

The business case comprises five separate cases, as prescribed by the HM Treasury guidance:

- **The Strategic Case** which shows that there is a robust 'case for change', closely aligned to wider strategic and public policy objectives
- **The Economic Case** which demonstrates the proposals optimise value for money, by determining the net value to society of the Preferred Option, compared with other options
- **The Financial Case** which explains how much the scheme will cost and how it will be paid for, showing that it is affordable
- **The Commercial Case** which demonstrates the proposals are commercially viable and sets out the risks and strategy for risk management
- **The Management Case** which shows that the scheme is achievable in practical terms and explains how the project will be managed to ensure it achieves its objectives.

## 1.6 Summary of the Strategic Case

The Strategic Case sets out the reasons why the NSLAQP is needed. It shows how the proposed investment achieves the critical success factors and fits into a wider strategy for the region to further the strategic objectives of SoTCC, NuLBC and SCC.

### 1.6.1 Policy and strategic fit

The policy and strategic context are determined by national, sub-national and local plans and investment programmes including:

- UK Air Quality Plan (2017)
- Clean Growth Strategy (2017)
- CAZ Framework (2017)
- Supplement to UK Air Quality Plan (2018)
- 25 Year Environment Plan (2018)
- Clean Air Strategy (2019)
- Stoke-on-Trent and Newcastle-under-Lyme Core Spatial Strategy (2006-2026)
- Joint Local Plan (2013-2033)
- Stoke-on-Trent Local Transport Plan (2011/12 – 2025/26)
- Newcastle-under-Lyme Borough Integrated Transport Strategy (2015-2026)
- Council Strategic Plans (2020-2024 and 2018-2022)
- Etruria Valley Link Road Project
- Transforming Cities Fund
- Town and Future High Streets

There are common themes in these policies and programmes:

- To improve air quality and reduce pollution
- To enhance public health and well-being

- To encourage a shift to sustainable transport and cleaner transportation
- To support local residents and businesses
- To tackle congestion and issues of social inclusion
- To assist in future economic growth

The NSLAQP has a strong strategic fit with national, regional and local policy and shows how investment in the proposed package will further the aims of each local authority and the Government.

### 1.6.2 Problems

The predicted $NO_2$ concentration exceedance locations as shown in Figure 1-2 are on the key road corridors that connect key commercial and residential areas together and provide connectivity to the strategic road network. As a result, these corridors are heavily trafficked and therefore suffer congestion, especially during peak periods. Targeted interventions have been identified and developed on a corridor-basis to address the problem and minimise displacement.

The table below summarises predicted $NO_2$ concentration data at locations on the local road network (Table 1-1) that are close to (above 39) or exceed the limit value (of 40.4) in the 2022 Reference Case.

*Table 1-1: $NO_2$ concentration levels on local road network (2022 baseline)*

| Location (local road network) | $NO_2$ concentration ($\mu g/m^3$) | Exceeds limit value |
|---|---|---|
| **Victoria Road at the south end near City Rd / King St junction** | **45.6** | **Y** |
| **A53 between Basford Park Rd and Victoria Street** | **42.7** | **Y** |
| **Bucknall New Road close to the junction with the A50** | **42.2** | **Y** |
| Quadrant Road / Town Road | 40.4 | N |
| A5272 Chell Street between Eldon St and Acton St | 40.0 | N |
| A527 Porthill Road | 39.8 | N |
| Lichfield Street | 39.5 | N |

### 1.6.3 Objectives and outcomes

The three councils – Stoke-on-Trent City Council, Newcastle-under-Lyme Borough Council and Staffordshire County Council have defined objectives to shape a clear way forward and outcomes that are measurable. Further detail is provided within the logic map in the Strategic case.

The primary spending objective and primary outcome for the NSLAQP is:

- To achieve the statutory limit values for roadside $NO_2$ concentration limits at the exceedance locations in the shortest possible time.

The secondary outcomes are:

- Traffic redistribution across the network without creating new sites of $NO_2$ exceedance
- Lower exhaust emissions of $NO_X$ released from buses
- Local buses more attractive, encouraging greater use
- Increased awareness of air quality problems.

The associated secondary spending objectives for the NSLAQP include:

- Demonstrating that for Central Government and the councils the scheme delivers the best option in terms of value for money.
- Minimising the impacts on local residents and businesses, including disadvantaged groups
- Enabling and aligning with local objectives including improving health and encouraging a shift to sustainable transport
- Minimising the impacts on economic growth and development across North Staffordshire

The NSLAQP has been developed to achieve all of these objectives and contribute to the desired outcomes.

1.6.4 Options

A very comprehensive set of strategies, options, and scenarios has been considered and subject to detailed appraisal as summarised in section 1.4. The proposed scheme which forms the NSLAQP is the one which is best able to deliver $NO_2$ compliance in the shortest possible time and deliver wider objectives.

1.6.5 Stakeholders

Stakeholder engagement is a key activity in successfully delivering the NSLAQP. During the OBC development process early engagement has taken place with key stakeholders to discuss and understand their attitudes towards the proposed scheme to help inform options and manage potential conflict. This engagement will continue as the project progressed.

A stakeholder management and communications plan has been developed to support the scheme through its development, implementation and delivery stages. The aim of the Plan, is to engage stakeholders, raise awareness and understanding of the NSLAQP, and to minimise impacts of the scheme.

To support the development of the OBC and find out how poor air quality affects the local community and measure awareness of the simple actions that can help improve air quality the three Councils launched an online air quality survey in February 2020. The survey was open until 30th April and anyone aged 16 or over who lives in, or travels to, Stoke-on-Trent or Newcastle-under-Lyme was invited to complete it. The response rate was badly affected by the impact of the onset of the COVID-19 pandemic, with a total of 459 responses received. Once the situation regarding COVID-19 is resolved the Councils intend to re-run the survey later in 2020, at a more appropriate time.

The results from early engagement and the survey have helped to understand stakeholder awareness, the perceptions about air quality and improvement methods, and have been used to inform the development of the communications plan.

#### 1.6.6 Impacts

With the NSLAQP in place the results of the $NO_2$ concentration modelling in 2022 on the local road network demonstrate that compliance will be achieved. As illustrated in Table 1-2.

*Table 1-2: $NO_2$ concentrations on local road network (2022)*

| Location (local road network) | $NO_2$ concentration baseline ($\mu g/m^3$) | $NO_2$ concentration with NSLAQP ($\mu g/m^3$) |
|---|---|---|
| **Victoria Road** | 45.6 | 39.3 |
| **A53** | 42.7 | 38.9 |
| **Bucknall New Road** | 42.2 | 39.4 |
| **Quadrant Road / Town Road** | 40.4 | 39.7 |
| **A5272 Chell Street** | 40.0 | 38.8 |
| **A527 Porthill Road** | 39.8 | 39.8 |
| **Lichfield St** | 39.5 | 38.3 |

In summary, there is a clear case for change and the NSLAQP is expected to deliver on all of the spending objectives and critical success factors to bring $NO_2$ concentrations with EU limits in the shortest possible timeframe whilst minimising the social and economic impacts on local communities and residents.

### 1.7 Summary of the Economic Case

The Economic Case outlines the work undertaken to assess and identify the proposed solution by considering value for money. It takes account of the costs of developing, building, operating and maintaining the scheme, and a full range of its impacts, including those impacts which can be monetised.

#### 1.7.1 Present value of costs and benefits

The monetised costs, benefits and Net Present Value (NPV) assessed are set out in Table 1-3 which demonstrates both the Preferred Option and Benchmark CAZ D deliver a net cost, but from an economic perspective, the Preferred Option performs better than the Benchmark CAZ D, where the Preferred Option has a significantly less NPV.

*Table 1-3: Present value of impacts and costs in 2018 prices, discounted to 2019, £000s*

| Costs & Benefits/Impacts | NSLAQP | Benchmark CAZ D |
|---|---|---|
| **IMPACT TO THE USER** | | |
| Air quality | 2,341 | 18,868 |
| Greenhouse gases | -518 | 8,449 |
| Travel time | -48,261 | 32,989 |
| Fuel and non-fuel VOC | -8,366 | 31,593 |

| Costs & Benefits/Impacts | NSLAQP | Benchmark CAZ D |
|---|---|---|
| Indirect tax | -2,270 | 23,399 |
| Welfare | 0 | -27,047 |
| Vehicle upgrade | 0 | -26,399 |
| Bus improvements | 34,071 | 0 |
| Bus gate cost to user | -404 | 0 |
| CAZ charge cost to user | 0 | -206,641 |
| **IMPACT TO THE GOVERNMENT** | | |
| Indirect tax (wider public finances) | 2,270 | -23,399 |
| Bus gate revenue to government | 404 | 203,191 |
| Implementation costs | -14,482 | -198,561 |
| **NPV** | **-35,215** | **-163,557** |

#### 1.7.2 Non-monetised impacts

Other wider economic impacts including air quality impacts outside modelling domain, active travel benefits, severance, accessibility, noise and accidents. These effects have been assessed qualitatively due to limitations in data or methodologies available.

Specifically, the qualitatively assessed impacts can be summarised as follows:

- Active travel impacts are expected to be insignificant in both options
- Vehicle upgrades associated with the CAZ D option will carry transaction costs
- The implementation of CAZ D option is expected to reduce the traffic volume within the bounded area and generate an increase in traffic volumes outside of it.

#### 1.7.3 Risks, bias, sensitivities and uncertainties

The risk register is set out in Appendix 18. The financial impact of a range of risks has been considered in a Quantified Risk Assessment (QRA) and the costs included in the calculation of the Present Value of Costs (PVC) have been adjusted for risk. Optimism Bias (OB) has been applied following TAG guidance, using 15% OB for tor the road infrastructure elements and 105% OB for other equipment and development aspects.

Sensitivity tests have been undertaken to test the impact of altering assumptions underpinning the economic appraisal. The analysis involves developing lower and upper bounds for significant assumptions and input values used in the economic appraisal. The following key inputs have been considered for the sensitivity analysis:

- Behavioural responses to charging zone
- Damage costs
- Carbon prices
- Scrappage costs
- Welfare impacts
- Optimism bias

The sensitivity analysis undertaken has shown that there are not further unquantifiable impacts affecting the economic analysis. In addition, it has shown that the NPVs of each option are sensitive to the assumptions but the uncertainty around parameters does not influence the relative ranking of the options in terms of NPV.

### 1.7.4 Social and distributional impacts

The analysis of social and distributional impacts has considered the impacts of each option in relation to the following key indicators:

- Air quality
- Affordability for businesses
- User benefits
- Personal affordability
- Accidents
- Noise
- Accessibility
- Severance
- Security

The overall impact to vulnerable groups is found to be more beneficial in the Preferred Option. The Preferred Option only notes disbenefits in both affordability areas and user benefits. The Benchmark CAZ D also notes disbenefits in these areas, but to a greater extent.

## 1.8 Summary of the Financial Case

The Financial Case presents evidence of a robust estimation of the package costs (for both implementation and operation), the key funding risks, sources, and forecast revenue generation.

The NSLAQP will seek to address the identified air quality exceedances in the shortest possible time. The measures will be delivered by 2022 and include capital and operating costs as described below.

Capital costs will be incurred on the following elements:

- Installation of the bus gate on the A50 Victoria Road which includes ANPR cameras and new signage, as well as the traffic regulation order (TRO)
- Installation of the bus gate on the A53 Etruria Road, ANPR cameras, new signage and road resurfacing, as well as the TRO
- Traffic management to the east and west of the A50 Victoria Road which includes road resurfacing, replacement of road humps and new signage
- Transport improvements along the A53 Etruria Road which includes signalised pedestrian crossing facilities, relocation of a bus stop, new kerbing and levelled footways
- Bus retrofitting programme which includes the installation of exhaust modification and e-cooling fans to 50 buses
- Bus infrastructure improvements which includes real time passenger information (RTPI) screens, new bus shelters, accessible kerbs at bus stops and CCTV cameras
- Monitoring and evaluation costs which includes diffusion tubes to measure air quality, ANPR cameras to monitor the use of the bus retrofit, traffic counts and the costs associated with analysing relevant data

Operating costs will be incurred on the following elements:

- Operation and maintenance associated with the ANPR system
- Maintenance associated with the bus gate, signals, signage, traffic management and bus network enhancements
- Other operating costs associated with overheads, staffing and customer service
- Monitoring and evaluation costs
- Communications and publicity
- Project management costs

The costs in the OBC have been developed by the local authorities and early contractor involvement and have been calculated using bottom-up estimates where a per-item cost is applied to the estimated required quantity. The indicative item costs are taken from similar schemes, initial estimates from possible service providers and market intelligence. A risk register and Quantified Risk Assessment has been developed to identify and cost the risks to delivering the project.

The three councils do not have funding available for implementation of the preferred package of measures coming out of the modelling and appraisal process. These are measures that are additional to current spending commitments. The councils will therefore be seeking all funding from the government's Implementation Fund to help achieve $NO_2$ compliance in the shortest possible time. A Clean Air Fund bid has not been costed for at this OBC stage but will be included at FBC stage as the authorities look to mitigate against the negative impacts of the measures proposed in the Preferred Option.

The indicative cost of delivering the NSLAQP including allowances for inflation, contingencies and risk is estimated to be £12.966 million. This comprises:

- £7.842m for capital expenditure
- £5.124m for operational expenditure over ten years

By comparison the indicative cost of delivering the Benchmark CAZ D including allowances for inflation, contingencies and risk is estimated to be £96.469 million. This comprises:

- £36.577m for capital expenditure
- £59.892m for operational expenditure over ten years

Whilst the Benchmark CAZ D would generate revenue, the overall implementation and operating costs of the Preferred Option are considerably less and therefore offering a more affordable and better value for money solution. It should also be noted that the Preferred Option meets the primary critical success factor of achieving air quality compliance in the shortest timeframe possible, unlike the Benchmark CAZ which cannot be delivered until 2023.

Confirmation will be sought from the Section 151 Officers that as the responsible financial officers they are comfortable with the financial position regarding the Preferred Option, including its affordability. Approval to bid for implementation funding will be sought in consultation with the relevant cabinet members and the Section 151 officers. A letter of support from each of the Section 151 officers will be included in the approved OBC and FBC submissions.

### 1.9 Summary of the Commercial Case

The Commercial Case provides evidence of the commercial viability of the proposed scheme. It explains the procurement options available and describes the preferred procurement route that is expected be used to implement the key services and deliverables This will be reviewed by JAQU and Local Partnerships and once the FBC is approved the contracts with the selected contractors will be signed.

Where possible, the local authorities plan to utilise existing contracts and undertake appropriate tendering processes using existing frameworks This will help to reduce the time taken in the procurement process, so to adhere to the Ministerial Direction of delivering the scheme in the shortest possible timeframe.

The outcomes which the preferred procurement strategy and contracts based on are:

- Achieve cost certainty, or certainty that the scheme can be delivered within the available funding constraints
- Minimise further preparation costs with respect to scheme design by ensuring best value, and appropriate quality
- Obtain contractor experience and input to the construction programme to ensure the implementation programme is robust and achievable
- Obtain contractor input to risk management and appraisals, including mitigation measures, to capitalise at an early stage on opportunities to reduce construction risk and improve out-turn certainty thereby reducing risks to a level that is 'As Low as Reasonably Practicable'

#### 1.9.1 Procurement management

Procurement decisions will be made through the governance process that has been set up for the project. Key procurement routes will also need to be approved by the Cabinets and Chief Officers of the three authorities. The procurement sub-group will provide the opportunity for the procurement managers to oversee and deal with any issues that arise to ensure that timescales and budgets are met.

The lead contracting authority/organisation has been identified for each key service and they will be responsible for individual procurement requirements. The details will be set out in the local authority Delivery Agreement and a legal agreement with the bus operators.

#### 1.9.2 Risk allocation

It is considered that the risks identified in the risk register are currently owned by the three authorities or JAQU as the Implementation Funding agreement has not been finalised and delivery timescales have not been approved. Once the individual contracts have been approved, risks will be apportioned appropriately between the contractors and the local authorities. During implementation it is expected that risks will be allocated to the party that is best placed to manage them.

#### 1.9.3 Contract management

The contracts procured will fall under the local authorities' responsibility to ensure that the contract scopes and budgets are adhered to. The three councils will work together through the governance process identified in the Management Case in the management and monitoring of the contracts.

To date, the NEC3 suite of contracts have been used to procure the relevant consultants, and the Councils plan to continue using the NEC3 suite of contracts to develop and deliver the Preferred Option. This form of contract is well understood through the supply chain and relies on a pre-defined risk register to allocate and manage anticipated risk.

A turnkey solution for the back-office function, cameras and civil works would need to be procured for the Benchmark CAZ. This would take up to 17 months from starting the design and specification to awarding the contract. Initial work demonstrates that the Benchmark CAZ D option would require a complex legal agreement adding to the length of the programme. The preferred option has a simpler procurement route which can be delivered quicker.

## 1.10 Summary of the Management Case

The Management Case demonstrates that the NSLAQP is capable of being delivered successfully in line with recognised best practice. It describes the processes that are being put in place to ensure that the project is effectively delivered, and properly evaluated.

### 1.10.1 Governance

A robust governance arrangement has been developed to ensure that the project is managed effectively; taking into consideration any potential risks that might arise, whilst continuing to adhere to the project timeline. To ensure successful delivery of the scheme, the councils have established and will continue to resource the following bodies:

- Joint Advisory Group (JAG) – comprises of key members and senior officers of all three local authorities, chaired by a senior member of one of the three authorities
- Joint Officer Group (JOG) – comprises of key officers and consultants involved in the project, chaired by the project SRO
- Delivery sub-groups including: Procurement, Finance, Legal, Risk and Communications and Engagement

Recommendations are taken to the Cabinets of the three authorities for key decisions. Prior to key decisions, being considered by Cabinet they will be reviewed by the relevant cross-party Scrutiny or Select Committee at each authority. The Management case describes the membership, responsibilities and accountability of these groups, and the relationship between them. The Management case also outlines the project organogram for the implementation stage of the project.

### 1.10.2 Programme

The scheme is programmed to be fully constructed and operational by May 2022. The project programme is included in Appendix 14 of the OBC. Compared to the Preferred Option, the design and delivery phase of the Benchmark CAZ D option is a considerably lengthier process and would not adhere to the primary Critical Success Factors of deliverance in the shortest timeframe possible as the CAZ scheme would not be operational until June 2023.

### 1.10.3 Risk management

A Risk Register and Quantified Risk Assessment (QRA) has been developed to identify any possible risks to the project, for both the Preferred Option and the Benchmark CAZ D. The full risk registers and QRAs can be found in Appendices 17-20 of the OBC.

The most significant risks at the time of this submission are regarding the uncertainty associated with the COVID 19 pandemic, and the risk linked to Highways England support of the scheme. These risks are both owned by JAQU / DfT. The Management case details the risk management strategy in place to minimise the impact of risks whilst ensuring potential opportunities are maximised.

1.10.4 Benefits realisation, monitoring and evaluation

The Management case details the approach to benefits realisation and plans for post-opening monitoring and evaluation to examine the benefits realised, compare actual costs to forecast costs, identify lessons learned and capture opportunities to increase benefits through further works. The Benefits Realisation Plan is included in Appendix 21, and the Monitoring and Evaluation Plan is included in Appendix 22.

## 1.11 Conclusion

The OBC for the proposed NSLAQP demonstrates a robust case for investment – the Preferred Option has been identified through a comprehensive development process to achieve compliance in the shortest possible time whilst also supporting wider council objectives.

The scheme offers a better value for money and more affordable option when compared to the Benchmark CAZ D option, and the OBC demonstrates the thorough approach to cost identification and appraisal.

The NSLAQP also presents a more straightforward commercial procurement as the authorities propose to utilise existing contracts and frameworks, and bring the scheme through design, development and implementation to be operational in 2022. By comparison, the Benchmark CAZ D option would present a more complex and lengthy procurement and would ultimately result in approximately an additional year before the scheme could be operational, hence delaying compliance with the requirements of the Ministerial Direction.

Therefore, the NSLAQP demonstrates the optimum solution to addressing $NO_2$ exceedance in Newcastle-under-Lyme and Stoke-on-Trent. It must be noted the OBC has not been formally approved by the three authorities. The Preferred Option, whilst clearly demonstrated to achieve the primary aim, does not constitute a formal approval of the Preferred Option by the authorities.

The OBC does not take account of the impacts of the current global emergency, linked to the outbreak of COVID-19. The impact on public health, the local economy and on people's attitudes to travel, is unknown and will remain uncertain for some months to come.

Whilst the authorities welcome the opportunity to complete this OBC and submit it to Government, they also urge the Government to review the requirements to progress and complete the FBC this year. It is highly likely that the initial evidence submission (IES), upon which the Preferred Option is based and designed to tackle, will be unsound as we emerge from the coronavirus pandemic.

The authorities therefore believe that the work on finalising the business case and submission of the FBC should be suspended, whilst a review is undertaken at national and local levels to ensure that any revised plans for tackling roadside $NO_2$ are value for money and proportionate to the nature of any problems that exist in the future.

If Government requires the authorities to progress the submission of an FBC, without review of the programme due to the coronavirus situation, then the Preferred Option will be reviewed by the authorities' Scrutiny and Select Committees, and then submitted to the authorities' Cabinets for approval, during the summer/autumn of 2020. The FBC will then be submitted to Government.

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MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

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# 1 Strategic Case

## 1.1 Introduction

Stoke-on-Trent City Council (SoTCC), Newcastle-under-Lyme Borough Council (NuLBC) and Staffordshire County Council (SCC) are committed to working together to transform the urban area of North Staffordshire into a cleaner and healthier area.

In October 2018, Stoke-on-Trent and Newcastle-under-Lyme Councils (who have responsibility for Environmental Health) were issued a Ministerial Direction to produce a local air quality plan to address their respective nitrogen dioxide ($NO_2$) problems related to roadside traffic pollution. Given their proximity to one another and nature of the urban area, they were tasked with producing a joint plan.

As the highway authority for the Borough of Newcastle-under-Lyme, SCC has been assisting the authorities and together the three authorities have developed a plan to tackle $NO_2$ exceedances at the roadside – known as the North Staffordshire Local Air Quality Plan (NSLAQP).

This Plan will help to protect and promote the health of the local population by improving air quality and reducing the impact of air pollution on the environment. In so doing, the local authorities are complying with the UK Air Quality Plan and bringing $NO_2$ air pollution within statutory limits in the shortest possible time.

The joint approach has also been necessary because it is recognised that air pollution does not respect local authority boundaries and therefore a consistent and co-ordinated approach is required to maximise air quality benefits for all people living and working in North Staffordshire. By working together, the authorities can also minimise the risk of unintended consequences and help to ensure, as far as possible, alignment between the NSLAQP and wider authority strategies.

This OBC explains how the authorities have determined the Preferred Option which forms the NSLAQP for Stoke-on-Trent and Newcastle-under-Lyme. The Preferred Option, which is described in detail in section 1.15 comprises a package of measures, including:

- The installation of bus gates, ANPR cameras and advanced direction signing at two locations (A50 Victoria Road and A53 Etruria Road) that restrict access to buses, cycle users and taxis during peak times (Monday to Friday from 7am to 10am and 4pm to 7pm). If deliverable, a ULEV exemption may also be added to the scheme in the Full Business Case (FBC).
- Traffic management measures adjacent to Victoria Road to ensure local communities are not negatively impacted by traffic re-routing to avoid the bus gate.
- Improvements to signal timings along the A53 to maximise air quality benefits, and the installation of new signalised pedestrian crossing facilities to enhance pedestrian connectivity and relocation of an existing bus stop.
- Expansion of the existing bus retrofit programme being delivered as part of the separate NuLBC Ministerial Direction so that buses travelling along two key corridors (Bucknall New Road and Victoria Road) are retrofitted to achieve Euro VI emission standards.

- Enhanced bus infrastructure on routes that pass through or are parallel to the exceedance locations including the provision of real time passenger information (RTPI) screens, new bus shelters, accessible kerbs and CCTV.
- Package of monitoring and evaluation to assess the impact of the different measures and identify when compliance is achieved.

### 1.2 Purpose of this case

This Strategic Case which forms part of the Outline Business Case (OBC) sets out the underlying rationale for the NSLAQP, including a robust case for change in relation to the requirements of the Ministerial Direction to tackle predicted annual mean $NO_2$ exceedances in the North Staffordshire area. It describes how the proposed package has been identified and how it will reduce $NO_2$ and promote improved air quality across Stoke-on-Trent and Newcastle-under-Lyme.

The Strategic Case demonstrates that the proposed package achieves the Government's Critical Success Factors, and aligns with wider growth, health and environmental strategies for the region. This OBC explains why this proposed package is the optimum solution to bring illegally high roadside $NO_2$ levels within legal limits as soon as possible.

### 1.3 The need for change

Air pollution affects the health of people living, working and travelling in North Staffordshire. Pollutants such as $NO_2$ which is the harmful oxide of nitrogen ($NO_X$), and particulate matter ($PM_{2.5}$ and $PM_{10}$) that are not visible to the naked eye are found at dangerous levels in many urban areas and on busy roads. Road transport causes two-thirds of $NO_X$ emissions and nearly 80% of PM emissions at the roadside. The main sources of road-based $NO_X$ emissions are diesel vehicles with older vehicles typically more polluting than newer vehicles. Large vehicles such as lorries are the most polluting from the exhaust pipe.

Breathing in polluted air contributes to the equivalent of approximately 200 deaths a year in North Staffordshire. Both long- and short-term exposure to air pollution are known to adversely affect health. It affects people's lungs in the short and long term, worsening respiratory issues such as asthma or bronchitis, as well as cardiovascular problems, and reduces life expectancy. The most vulnerable in society are hit hardest – children, older people and those already in poor health. Everyone is at risk, but people who spend more time in areas with a high concentration of air pollution are most affected – which can include drivers.

The UK Government has illustrated its vision to deliver a cleaner, healthier environment that benefits people and the economy. Although air quality in the UK has improved significantly over recent decades, it is recognised that there is still plenty of room for improvement, whilst meeting the objective of supporting economic growth. This is especially important, given the correlation between poor air quality and health-related diseases. To deliver change, the problem needs to be targeted at source. However, action must be geographically relevant, ensuring that any interventions must align with the interests of local people, given that people are the main driver for improving air quality.

This is why the proposed package, that comprises the NSLAQP, includes physical traffic management measures and targeted bus network enhancements to reduce vehicle use, encourage the use of cleaner vehicles and help embed a longer-term shift in travel choice. The package will bring illegally high roadside $NO_2$ levels within legal limits and as a result will deliver wider benefits including:

- Quality of life improvements for the population of North Staffordshire
- Reduction in pollution-related health and wellbeing impacts and years of life lost
- More sustainable transport options, such as cleaner buses

### 1.3.1 Ministerial Direction

In December 2015, the UK Government published the plan for 'Tackling nitrogen dioxide in our towns and cities – UK overview document' naming the first wave of five cities, Birmingham, Leeds, Southampton, Nottingham and Derby, to implement Clean Air Zones (CAZ).

In July 2017, the UK Government published the UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations – An Overview,[1] which set out the Government's plan to achieve a cleaner and healthier environment along with actions to lower $NO_2$ air pollution to levels that comply with established EU limits in the shortest possible time. As a result, the Government initially identified 28 local authorities with the worst $NO_2$ problems in the country and directed them to produce local air quality plans. These plans aim to detail how each authority will attempt to reduce its $NO_2$ concentrations to compliant levels in the shortest time.

In March 2018, the Government continued pursuing the Ministerial Direction to further advise more authorities to address their $NO_2$ issues. A further 33 local authorities were required to produce plans on potential pollution mitigation measures to be implemented in their areas.

In October 2018, another supplement to the $NO_2$ plan was issued in which a further eight local authorities were directed to produce a local air quality plan to address their respective $NO_2$ problems. These 'third wave' authorities included both SoTCC and NuLBC; owing to their proximity to one another, they were tasked with producing a joint plan pertaining to their pollution issues. SCC is assisting the authorities in its role as highway authority for Newcastle-under-Lyme.

## 1.4 Area of interest

The October 2018 Ministerial Direction required the authorities to assess other areas of the city and borough where local modelling identified predicted exceedances in $NO_2$ concentrations and to consider the displacement effects of any measures that may be implemented to tackle these exceedances. The study area is shown in Figure 1-1 and covers the central urban areas and the surrounding communities in both Newcastle-under-Lyme and Stoke-on-Trent. Together these areas form part of the North Staffordshire conurbation which is identified in the Midlands Connect Strategy as one of four Strategic Economic Hubs highlighting the regional significance of the area as illustrated in Figure 1-2.

[1] UK plan for tackling nitrogen dioxide concentrations, Detailed plan, Defra, July 2017

*Figure 1-1: Study area*

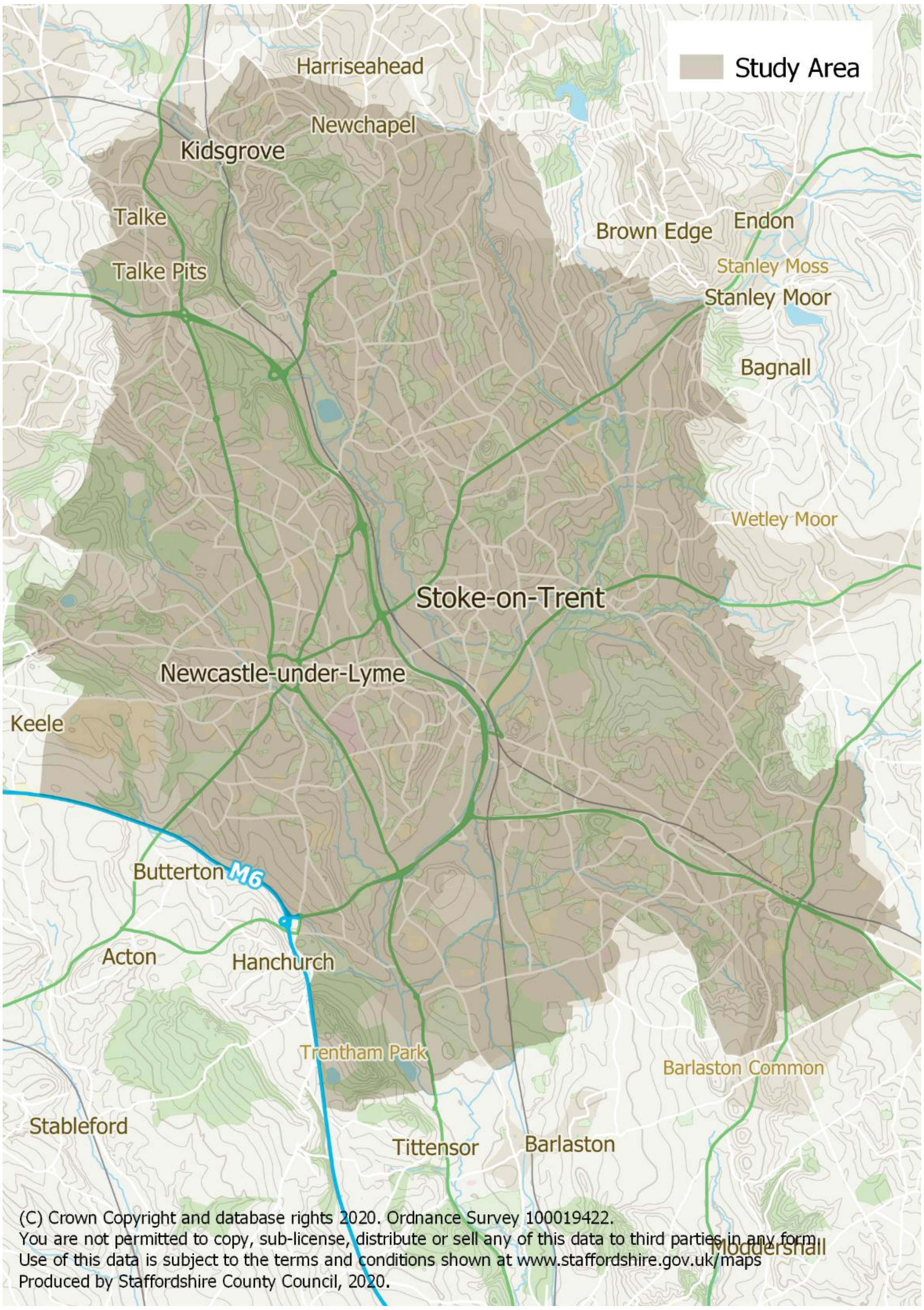
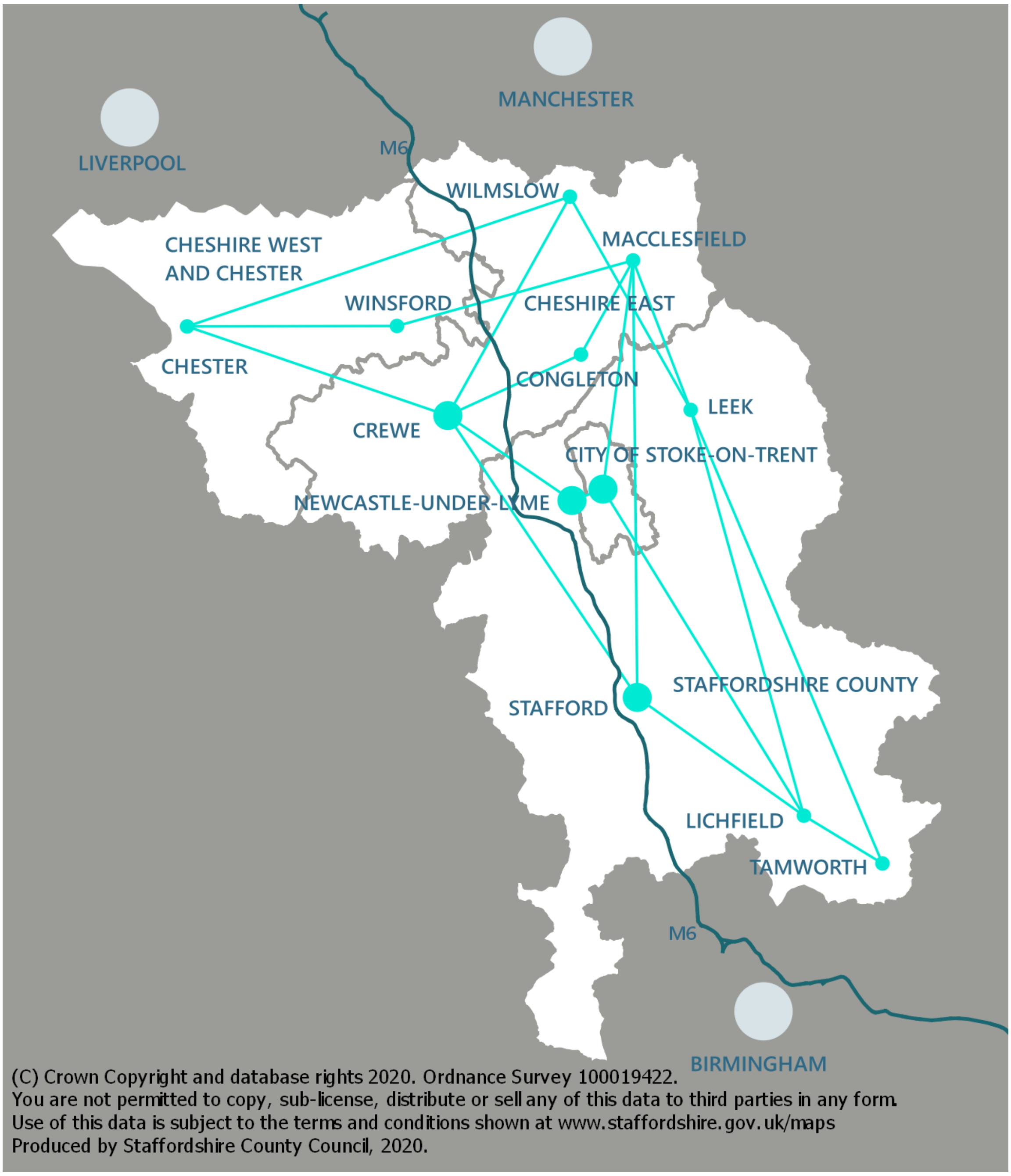


*Figure 1-2: Regional significance*




## 1.5 Policy and strategic fit

The NSLAQP has a strong strategic fit with national, regional and local policy and shows how investment in the proposed package will further the aims of each local authority and the Government. The relationship with the various policies and strategies is discussed below.

### 1.5.1 UK Air Quality Plan, 2017

The national Air Quality Plan outlines how the UK Government aims to fulfil its commitment to improve air quality in the shortest possible time in accordance with the Ambient Air Quality Direction 2008 (2008/50/EC, the 'Air Quality Direction') requirements. The Direction sets the legal limits for concentrations of air pollutants, such as particulate matter and nitrogen dioxide, that are recognised to impact public health and even contribute to the genesis of potent greenhouse gases. These legal limits were introduced into English law by the Air Quality Standards Regulations in 2010, in which the EU limit values for $NO_2$ are as follows:

- The annual mean concentration of $NO_2$ cannot exceed 40µg/m3 (micrograms per cubic metre) at a given location
- The hourly mean concentration of $NO_2$ cannot exceed 200µg/m3 more than 18 times per year at a given location

One potential area of uncertainty surrounding these laws is the possible amendments that may be made to the regulatory framework now the UK has left the European Union (EU). However, the UK Government has not announced that it intends to change any aspect of air quality law.

The UK Government has made commitments to reduce air pollution in towns and cities by targeting behaviour change amongst communities, employers, education establishments and policy makers. The Plan notes that the UK Government is currently committed to investing over £2.7 billion for air quality improvements and cleaner transportation. This includes funding for:

- £1 billion – Ultra low emission vehicles
- £290 million – National Productivity Investment Fund
- £11 million – Air Quality Grant
- £89 million – Green Bus Fund
- £27 million – Clean Bus Technology Fund and Clean Vehicle Technology
- £1.2 billion – Cycle and Walking
- £100 million – National Road Network

The national plan document is clear that addressing air quality problems must be done in a way that 'does not unfairly penalise ordinary working families who bought diesel vehicles in good faith'. The NSLAQP has been developed to:

- reflect the needs of the local residential and business community to ensure working families and businesses are not unfairly penalised
- contribute to the Government's target by reducing roadside $NO_2$ to below EU limit values in the shortest possible time.

### 1.5.2 Clean Growth Strategy, 2017

The Government's Clean Growth Strategy is focussed on growing the economy whilst cutting greenhouse gas emissions. The Strategy includes a number of key policies including Accelerating the Shift to Low Carbon Transport and also acknowledges the commitment made to address air quality which it states, "remains the largest environmental risk to public health in the UK”. The NSLAQP will help to support these ambitions by actively encouraging a shift to more sustainable modes of travel.

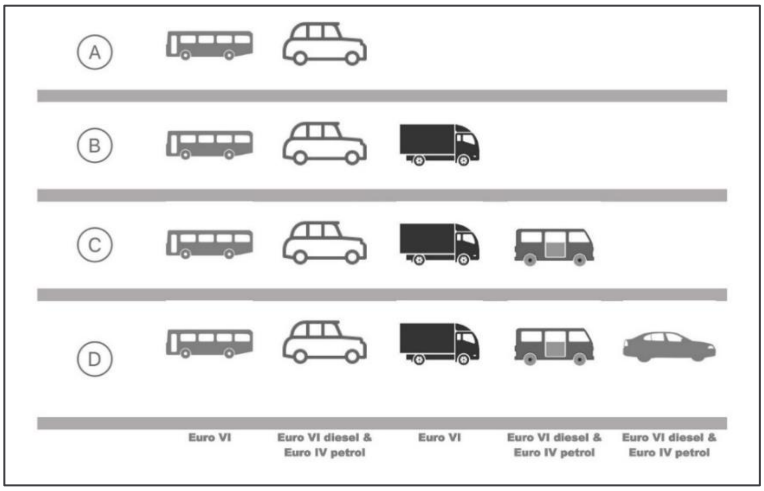
### 1.5.3 Clean Air Zone Framework, 2017

The Clean Air Zone Framework (2017) was designed to help support local authorities in their approach to implementing and operating a CAZ.[2]. The framework also classifies CAZs into two main categories:

- Charging CAZ – These are zones in which vehicle owners are required to pay a charge to enter or move within the zone, depending on whether the vehicle meets the emissions standard. A charging CAZ is also the Benchmark scenario which is used to compare alternative measures against, with respect to finding the optimal solution to meet compliance in the shortest possible time.
- Non-charging CAZ – These are simply geographic areas used as a focus to improve air quality using a range of measures (excluding charge-based access restrictions). These measures may include traffic management options, travel planning, workplace parking, optimising of traffic signal timings and exploring vehicle retrofitting and new fuels.

Charging CAZs are grouped into four classes, with class A being the least severe and class D impacting the greatest range of vehicles. Figure 1-3 the minimum fuel standard required for each vehicle type within each CAZ class that would meet emissions regulations and ultimately avoid the CAZ charge.

*Figure 1-3: CAZ classes and euro standards*




It is recognised that a CAZ D scheme will likely result in the greatest reduction in air pollution, as it will impose a charge on the greatest number of vehicle types. However, consideration must be given to other factors, including: governmental emphasis on achieving compliance to within the legal limits in the shortest possible time; and the potential impacts on individuals and businesses. Therefore, other classes of CAZ and non-CAZ schemes should also be considered.

2 Clean Air Zone Framework (2017). Department for Environment Food and Rural Affairs, DfT

In fact, the 2017 Air Quality Plan and the 2019 Clean Air Strategy state that if a local authority can identify measures other than charging zones that are as effective at reducing $NO_2$, those measures should be preferred as long as the local authority can demonstrate that this will deliver compliance as quickly as a charging CAZ.

The NSLAQP has been developed to achieve compliance without the need for a charging zone, and the proposed interventions, set out in the Preferred Option (see section 1.15), will enable the Councils to bring $NO_2$ levels below the EU limit values quicker than a CAZ.

#### 1.5.4 Supplement to UK Air Quality Plan, 2018

The Supplement sets out the additional work carried out since publication of the 2017 Plan with local authorities identified as having shorter term NO2 exceedances.

In March 2018 the Government directed 33 English local authorities with shorter-term NO2 problems ("the third wave local authorities") to carry out studies to find out whether there are measures they can take to reduce NO2 air pollution in their areas in the shortest possible time. The 33 local authorities were identified based on national PCM modelling. It was determined that local authorities know their own areas best, and it is possible that local assessment will identify measures that could speed up compliance within statutory limits.

Examples of the potential measures that the third wave local authorities could explore have been identified in a consultation for the Supplement to the Air Quality Plan, including:

- Encouraging use of public transport, cycling, walking, park and ride schemes and car clubs, including via communications campaigns;
- Delivering measures to optimise traffic flow (e.g. via changes to traffic signalling); and
- Working with local businesses and accessing clean technology.

The Government provided support to each local authority for the development of feasibility studies. As a result of the feasibility studies the Government directed eight local authorities (including NuLBC and SoTCC) to carry out a more detailed study to develop a plan to identify the most suitable measures to address the exceedance in the shortest possible time. The NSLAQP responds to this Supplement.

#### 1.5.5 25 Year Environment Plan, 2018

This Plan is the 'sister' document to the Government's Clean Growth Strategy and sets out the Government's ambition to leave our environment in a better state than we found it. The Plan includes six key policy targets, including achieving clean air by meeting legally binding targets to reduce emissions of five damaging air pollutants to halve the effects of air pollution on health by 2030. The NSLQP supports the ambitions of the 25 Year Plan.

#### 1.5.6 Clean Air Strategy, 2019

This Strategy spans many sectors that generate air pollution, including transport. The strategy sets out actions required from all parts of Government and society and offers the prospect of new legislation to create a more coherent framework for action to tackle air pollution. This will be 'underpinned by new England-wide powers to control major sources of air pollution, in line with the risk they pose to public health and the environment, plus new local powers to take action in areas with an air pollution problem.

The Strategy includes an aim to reduce emissions of nitrogen oxides (to which transport is a major contributor) against the 2005 baseline level by 55% by 2020, and by 73% by 2030.

The NSLAQP should help contribute to this national target at a local level.

#### 1.5.7 Stoke-on-Trent and Newcastle-under-Lyme Core Spatial Strategy (2006-2026)

The Stoke-on-Trent and Newcastle-under Lyme Core Spatial Strategy 2006-2026 was jointly produced with the assistance of both SoTCC and NuLBC. This approach helps to make sure that the two Councils are working together to achieve the best results for both areas. It seeks to ensure that public and private investment is properly co-ordinated, with a focus on promoting the principles of sustainable development. The Core Spatial Strategy has its own Strategic Aims, Spatial Principles and Area Spatial Policies for the area.

Several policies and aims are included in the Core Spatial Strategy, for example:

- To facilitate delivery of the best of healthy urban living in the development of the conurbation
- To reduce the need to travel, improve accessibility and increase the opportunities for development of sustainable and innovative modes of travel to support the regeneration of the plan area
- Improvement in the levels of productivity, modernisation, and competitiveness of existing economic activities, whilst attracting new functions to the conurbation
- Improving the accessibility and therefore the social inclusion of previously poorly connected communities to maximise the range of services and facilities available to people
- Public transport access to the city centre will be enhanced by the development of bus routes along radiating roads and linking to improvements for all public transport modes within the centre and to a new bus station
- Public places and green spaces within the city centre will be improved for the benefit of pedestrians and better connections provided between Central Forest Park, Festival Park, and Hanley Park via the city centre
- Addressing the environmental impacts of travel including congestion, air quality and noise pollution.

The NSLAQP will support the realisation of these aims by helping to improve air quality, the health of the urban environment and encouraging a shift to sustainable modes of travel.

#### 1.5.8 Joint Local Plan (2013-2033)

SoTCC and NuLBC, supported by SCC, are working together to guide the future development of both areas up to 2033. The Joint Local Plan (2013-2033) looks to ensure that long-term policies and plans are in place to make sure that the borough and city manage and meet the needs of local people and businesses.

The Joint Local Plan will shape where new residential developments and transport infrastructure will be erected in both Stoke-on-Trent and Newcastle-under-Lyme. To achieve the development goals in the region, a minimum of 199 hectares of employment land and 27,800 new homes will need to be introduced in the 2013-2033 timeframe. New housing along with job protection and creation are crucial for the future prosperity of the region.

This 2033 vision for the Joint Local Plan is[3]:

*Together Stoke-on-Trent and Newcastle-under-Lyme are great places to live, learn, work and visit with active, healthy and prosperous communities at their heart. By 2033 the area will provide a great central innovative hub for investment and growth, having increased the amount of high quality employment, retail and residential choice, whilst protecting and enhancing the distinctive historic built and cultural heritage, natural environment and landscapes and minimising the impact on climate change within their urban and rural areas.*

There are six key aims to support this vision and to achieve:

- UK central hub for innovation and investment
- Healthy and active communities
- Dynamic and diverse neighbourhoods
- Utilising our natural assets and resources
- Strong city centre and market town with a diverse network of towns and villages
- Making our historic past work for the future

1.5.9 Stoke-on-Trent Local Transport Plan

The three goals of the Stoke-on-Trent LTP3 are:

- Economy - improving the local economy through increasing productivity for existing businesses and encouraging new investment by making the area more attractive.
- Environment - improving the local environment through reducing the impact of traffic (air and noise) and moving towards more sustainable transport technology and modes, coupled with improving the appearance of local areas. The following objectives are relevant to the NSLAQP:
  - Reducing air pollution
  - Reducing noise impacts of transport
  - Reducing carbon emissions
- Health - caring for local health through improving access to transport, transport safety and encouraging walking and cycling.

1.5.10 Etruria Valley Link Road

The Etruria Valley Link Road (EVLR) Project being led by SoTCC is a crucial transportation improvement scheme. It will provide connectivity between the Etruria Valley development area, the A500, and key centres for employment, retail and commerce. The scheme is also expected

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[3] Joint Local Plan Preferred Options consultation, January 2018

to reduce congestion and speed up journey times on the congested A500 and A53 when it opens in 2022.

The core scheme includes the following key elements:

- Construction of a new viaduct spanning the WCML railway and Fowlea Brook flood plain from the A500/Wolstanton junction into the Etruria Valley site.
- Improvements to the two existing dumb-bell roundabouts at the A500/Wolstanton junction including a dedicated segregated left-turn from the southbound A500 slip road into the Etruria Valley site.
- To the east of the new viaduct, new highway infrastructure running south to north from the end of Shelton Boulevard to Newport Lane with pedestrian/cycle only access to the existing Newport Lane route
- A new west to east road linking the new viaduct to Festival Way which also includes a new canal bridge crossing.

The scheme also includes the following off-site Mitigation Measures:

- Improvement to the existing Festival Way/Marina Way roundabout.
- Signalisation of the approach to the A53 Etruria Road/Festival Way roundabout.
- Improvement to the existing A527 Grange Lane/B5368 High Street junction.

In addition to the investment from Government into the EVLR Project, Highways England has also commenced the delivery of lane-widening improvements to the A500 between the Porthill and Wolstanton junctions aligned to the EVLR Project and in line with their 2015-2020 Road Investment Strategy Delivery Plan. The scheme is expected to be completed in 2020. The EVLR Project will help to reduce $NO_2$ levels and as a committed scheme was included within the future Base/Do Minimum scenarios as part of the development and appraisal of the NSLAQP.

1.5.11 Newcastle-under-Lyme Borough Integrated Transport Strategy (2015-2026)

SCC produces eight Integrated Transport Strategies, one for each District/Borough. They include current transport policies, strategies and proposals for Staffordshire and have now replaced the 2011 Local Transport Plan. Delivery of the transport strategies helps to achieve SCC's vision for Staffordshire and three interconnected priority outcomes that are identified in the County Council's Strategic Plan for 2018 to 2022:

- Have access to more good jobs and share the benefits of economic growth
- Be healthier and independent for longer
- Feel safer, happier and more supported in their community

The Newcastle-under-Lyme Borough Integrated Transport Strategy will be revised to incorporate the highway measures that are required to deliver the Ministerial Direction. A further update will be produced to support the emerging Joint Local Plan.

### 1.5.12 Transforming Cities Fund programme

The development of the NSLAQP has taken place in parallel with development of bids for funding to the Department for Transport's Transforming Cities Fund (TCF). The two initiatives are considered complementary, with the proposed TCF-funded works reinforcing the NSLAQP.

The aim of the Transforming Cities initiative for Stoke-on-Trent is to improve public transport connectivity by addressing key barriers associated with journey times and journey quality. SoTCC was awarded £5.6m in funding in response to its 'Tranche 1' funding bid in early 2019 for major improvements to progress development of an integrated transport hub to create seamless transfer between rail and bus.

The Council's Tranche 2 bid was submitted in November 2019 and updated bid is due to be submitted in July 2020 and includes further plans to revolutionise public transport in the city. The plans aim to improve connectivity between the commercial, transport, retail and university hubs to encourage a shift from private vehicles to public transport. If funding is secured the schemes will also help to improve air quality in the city and therefore help to de-risk the achievement of air quality compliance through the NSLAQP.

### 1.5.13 Town and Future High Streets

NuLBC has been invited to submit Implementation Plans for Town Funds and Future High Street Funds. They will be submitted in Summer 2020. Details will be emerging shortly, but it is expected that they will include transport improvements in Newcastle-under-Lyme town centre that will support air quality objectives. These will be major bids of up to £25m and with the NSLAQP will help to support the broader aims and objectives for the region.

### 1.5.14 Council Strategic Plans

Each Council has a Strategic Plan, the SoTCC Strategic Plan (2020-2024) includes five strategic priorities including: supporting vulnerable people; enabling residents to fulfil their potential; helping businesses to thrive; working with communities to make them healthier, safer and more sustainable; and being an innovative and commercial Council. The SCC Strategic Plan (2018-2022) identified five priorities including: Economic growth; and Health, Care and Wellness. The NuLBC Council Plan (2018-2022) sets out four priorities including creating a healthy, active and safe borough. The NSLAQP has the potential to support these ambitions to make North Staffordshire a healthier and happier place to live.

## 1.6 Air quality in North Staffordshire

This section considers the wider air quality issues in the area by considering the existing Air Quality Management Areas and reviewing current and future schemes being brought forward to deliver improvement before the specific issue associated with $NO_2$ exceedance is described.

### 1.6.1 Air Quality Management Areas

As a result of the Environment Act 1995, local authorities have a duty to assess the local air quality and compare concentrations of recorded pollutants to legally set objectives. In instances where exceedances are identified, authorities are required to declare an Air Quality Management Area (AQMA) and therefore prepare an Air Quality Action Plan (AQAP).

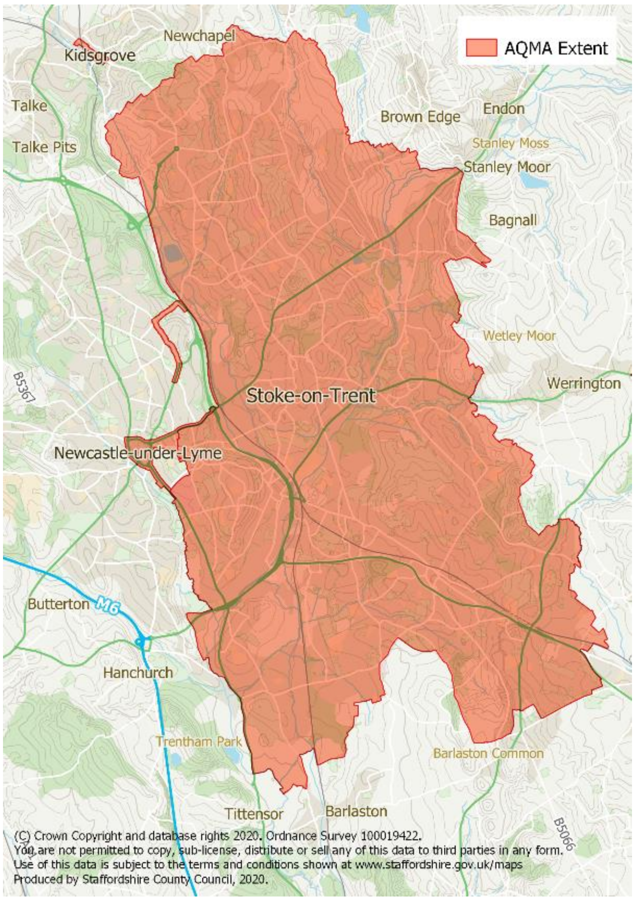
The whole of Stoke-on-Trent was declared as an AQMA for $NO_2$ in 2006 and although the long-term pollutant monitoring throughout the city generally shows an improving trend of air quality in Stoke-on-Trent, the only pollutant in which levels exceed legal values is nitrogen dioxide. The

AQMA applies to the whole city to allow for the fact that future monitoring may reveal other areas that are also subject to poor air quality and it also ensures solutions to air pollution exceedances do not involve pushing a problem to a nearby location.

Newcastle-under-Lyme has an AQMA covering Newcastle-under-Lyme Town Centre including the ring road A53, King Street, George Street, and London Road to the boundary with the City of Stoke-of-Trent AQMA. There are also AQMAs covering Porthill/Wolstanton, and Kidsgrove.

Figure 1-4 shows the extents of both AQMAs for Stoke-on-Trent and Newcastle-under-Lyme.

*Figure 1-4: Air quality management areas*




### 1.6.2 Air quality in Stoke-on-Trent

In 2013 SoTCC produced an Air Quality Strategy, replacing the 2002 Local Air Quality Strategy, and setting out how the Council will continue to work towards improving air quality in the city. The Strategy acknowledges that the main pollutant of concern is $NO_2$ and makes commitments to work with partners on AQAPs, consider all options available, assess the wider economic, social and environmental impacts of action plans, and seek contributions to action from industry, transport and individuals.

In 2014 SoTCC declared an AQAP under the 2013 Strategy. The AQAP sets out a series of actions that have been identified to reduce levels of $NO_2$ city-wide, including actions for selected hotspots. The measures contained within the action plan are those considered to be the most cost effective and appropriate for Stoke-on-Trent. It focuses largely on transport-related schemes and feeds into a range of relevant documents produced by the authority, including the Local Transport Plan and the Local Development Framework. There are a variety of schemes proposed and completed, most notably this includes traffic management improvements and specific road/junction improvements to lower $NO_2$ emissions derived from congestion and traffic.

Each year the Council sends an Annual Status Report (ASR) to Government about air quality. The 2019 ASR from SoTCC acknowledges the work being undertaken to comply with the Ministerial Direction, the NSLAQP is an integral part of the ASR. The actions to improve air quality across the city will be documented in a Third Wave Local Plan and sit alongside the Council's existing AQAP.

#### 1.6.3 Air quality in Newcastle-under-Lyme

Newcastle-under-Lyme does not have a standalone Air Quality Strategy, however, in 2018 the Council published an AQAP identifying air quality related policy, including: the Joint Newcastle-under-Lyme and Stoke-on-Trent Core Spatial Strategy, Newcastle-under-Lyme Local Plan saved policies, Staffordshire LTP3, the Newcastle-under-Lyme Borough Integrated Transport Strategy and Staffordshire Freight Strategy. The AQAP details how the Council is going to be improving air quality in the four Air Quality Action Areas and across the borough as a whole.

Newcastle-under-Lyme has dual transport pressures due to its location as a link to the M6 motorway, and close links to Stoke-on-Trent, thus local transport issues are addressed alongside regional and shared issues with neighbouring Stoke-on-Trent.

Each year the Council sends an ASR to Government about air quality. The 2019 ASR from NuLBC acknowledges the work being undertaken to comply with the Ministerial Direction, the NSLAQP is an integral part of the ASR. The Report identifies a range of priorities centred on:

- The amount of traffic on the road can be reduced
- Assessing and improving the vehicles using the roads within the Borough
- Road traffic can be better managed to reduced stop-start, idling and congestion.
- Traffic light signalling systems can be improved to enable a more fluid movement of traffic, particularly around the Town Centre ring road.
- Residents can be encouraged to take up other forms of transport, including public transport, cycling and walking

#### 1.6.4 Current and future schemes to improve air quality

SCC and SoTCC, as the two highway authorities, recognise the importance of improving the highway network and encouraging sustainable travel. Transport policies are supported by the planning authorities in the adopted and emerging Joint Local Plan. The overarching goals of these transport policies, such as the Core Spatial Strategy and Stoke-on-Trent Local Transport Plan (LTP3), are to reduce the need to travel and improve accessibility across the region.

SCC sets out its transport objectives and strategy in the Newcastle-under-Lyme Borough Integrated Transport Strategy[4] which was published in May 2015. A key objective within the Transport Strategy is delivering transport improvements that help to improve air quality. The strategy is being delivered through a number of funding sources including developer contributions, DfT bidding opportunities and the County Council's Integrated Transport block. Some of the current schemes identified that will support the AQAP include:

- Newcastle-under-Lyme town centre road signing review to help ease delays on the ring road
- Newcastle-under-Lyme town centre Traffic Regulation Order (TRO) amendments and provision for cycle users to control traffic movements within the ring road and improve accessibility for cycle users
- HGV routing around Newcastle-under-Lyme to improve access to local industrial estates

Furthermore, SoTCC and SCC continue to invest in network improvements to keep traffic flowing, including ongoing maintenance and upgrades to signals and messaging. Furthermore, the EVLR Project, described earlier in section 1.5.10, will help to address problems associated with congestion on the A500 and the surrounding local highway network.

The authorities' 'Air Aware' strategy went live in 2019. Air Aware is a campaign currently funded by DEFRA until the end of March 2020 across Staffordshire and Stoke-on-Trent to raise awareness of the impact of poor air quality and inspire long-term behaviour change. It is centred around a 'monthly message' targeting schools, commuters and businesses. Travel to school surveys completed at six schools that have been targeted by the campaign indicate an average 12% reduction in car journeys to school over an 18-month period. The communications activities associated with the NSLAQP will seek to build on local awareness of air quality – already established through the Air Aware campaign.

In addition to these planned measures the Councils are also developing a funding submission to the Clean Air Fund (CAF) to support individuals and businesses impacted by the NSLAQP. The proposals will introduce measures that will make it easier, more attractive or more affordable for individuals and businesses to change to cleaner modes and will reduce transport costs for local people and businesses. The scope of the CAF submission is being developed alongside the completion of the business case process and submission of the FBC, but the proposed measures currently being explored include:

- A restriction on taxi use of the bus gates to those only licensed within Stoke-on-Trent or Newcastle-under-Lyme, to support policy objectives to maintain service quality for local business;
- A diesel vehicle scrappage scheme, to support the acceleration of fleet renewal and/or modal shift to sustainable modes, across the urban area; and
- Complementary 'nudge' measures targeted at promoting and encouraging a greater shift to public transport.

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[4] https://www.staffordshire.gov.uk/Transport/transportplanning/District-integrated-transport-strategies/Documents/draftnewcastleboroughtransportstrategy.pdf

## 1.7 Future air quality problems

A critical early part of developing the NSLAQP involved establishing the extent of air quality problems, in terms of exceedances of the annual mean $NO_2$ limit values. This built on an initial picture from investigations that led to the issue of the Ministerial Direction, which was based on local automatic air quality monitoring data and on Defra national level PCM modelling.

The Councils progressed to review the work requirements, engaging with JAQU throughout that review, and developed their modelling and technical resources to complete the feasibility study and identify a Preferred Option, as presented in this OBC. Early stages of this review identified that further exceedances were likely to be identified, requiring much more robust and detailed transport and air quality modelling to be completed, in order to determine a robust appraisal and hence a Preferred Option.

The Strategic Outline Case (SOC) was submitted in line with the requirements of the Ministerial Direction, in January 2019. The SOC set out the existing problems and explained the start of the work to develop a robust initial evidence and the specific, measurable and achievable objectives and how these will be achieved. It also explained the options development process and set out the options that had been identified at that stage, together with options that may be taken forward. The options considered included:

- City centre/A53 chargeable access restriction
- City centre/A53 traffic management scheme, plus Council boundary scale Low Emission Strategy
- City centre/A53 Workplace Parking Levy, plus Council boundary scale Low Emission Strategy
- Council boundary scale Workplace Parking Levy, plus Council boundary scale Low Emissions Strategy
- Etruria Valley Road and A500 Improvements, plus Council boundary scale Low Emission Strategy

Following the SOC, work progressed to refine the baseline and reference case assessments and culminated in the completion of the Initial Evidence Submission (IES) in October 2019. The suite of reports that form the IES conclude that in 2022, the study area will contain three links on the local road network where $NO_2$ concentrations are predicted to exceed the legal limits. The locations of these exceedances are identified in Figure 1-5, shown in red.

The work undertaken has also highlighted that within the study area there are sections of the Strategic Road Network (SRN) where $NO_2$ concentrations are predicted to exceed the legal limits. The locations of these exceedances are identified in Figure 1-6. It is important to note that the SRN is outside the scope of this project and does not form part of the consideration of options in the NSLAQP. However, engagement with Highways England is ongoing to seek their support for the Preferred Option – the risk associated with this is captured within the risk register as described within the Management Case and attached in Appendix 18.

In identifying the Preferred Option for tackling the exceedances on the local road network, caution has been taken to ensure that $NO_2$ concentrations on links where $NO_2$ concentrations are close to the EU limits (within 5µg/m$^3$), shown in orange, are not adversely affected to the point where they are predicted to exceed the limits.

The three predicted $NO_2$ exceedance locations on the local road network, based on the local modelling are:

- The A53 (Etruria Road) between Victoria Street and Basford Park Road. The maximum predicted annual mean $NO_2$ concentration in 2022 along these links is 43µg/m$^3$.
- The A5008 (Bucknall New Road) between Potteries Way and Lindop Street. The maximum predicted annual mean $NO_2$ concentrations in 2022 along this link is 42µg/m$^3$.
- The section of the A50 (Victoria Road) between Maud Street and Hitchman Street. The maximum predicted annual mean concentration in 2022 along this link is 46µg/m$^3$.

The background to the identification of these three locations is contained in the IES. The conclusion reached from the modelling of current and future air quality is that intervention is needed to bring about compliance with annual mean $NO_2$ limit values in the shortest time possible.

Options were developed and assessed to establish the best way of achieving compliance, and the Preferred Option which forms the NSLAQP has looked to help address $NO_2$ without having significant economic disbenefits for local residents and businesses.

*Figure 1-5: $NO_2$ exceedance locations on local road network in 2022 from local modelling*

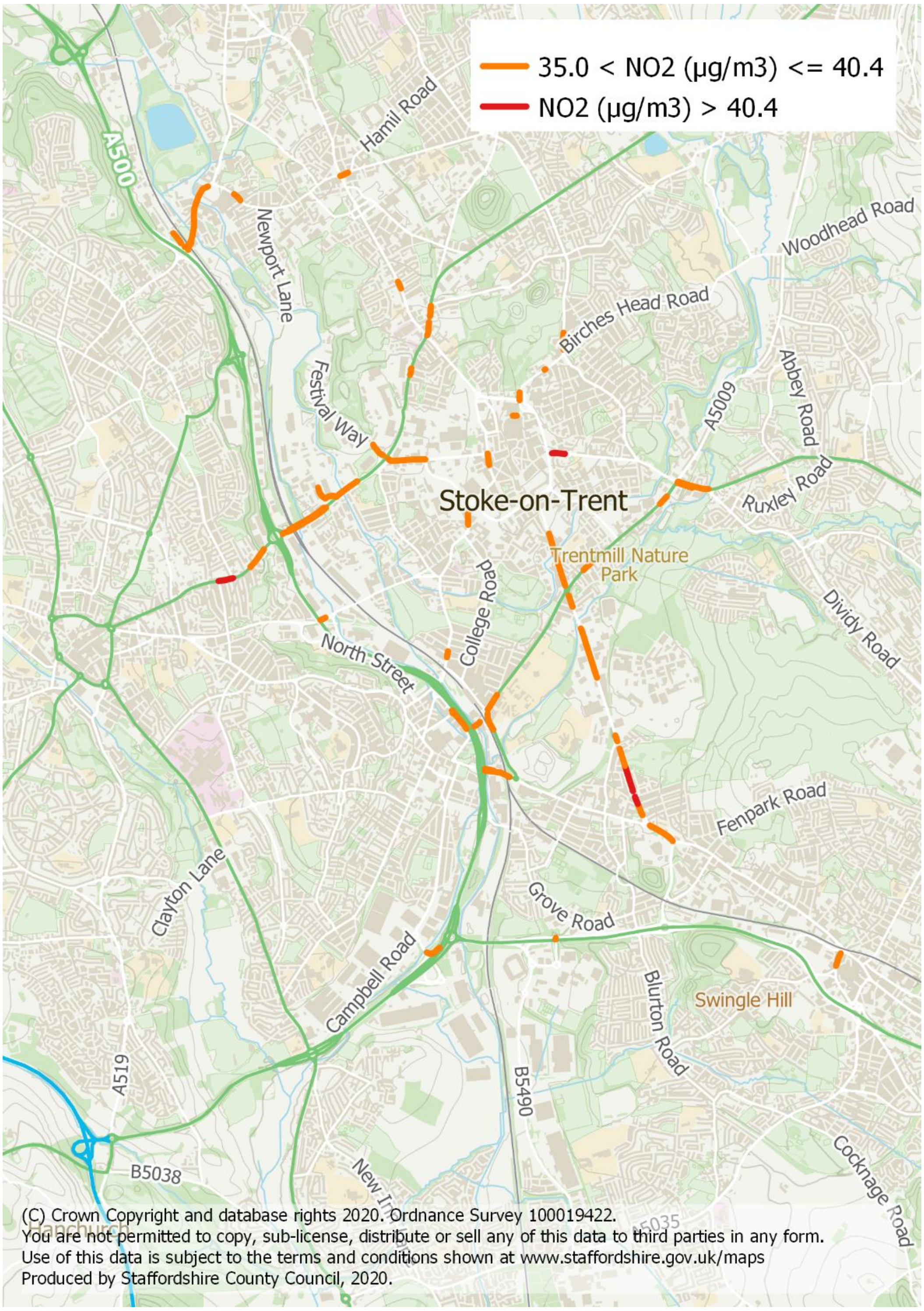
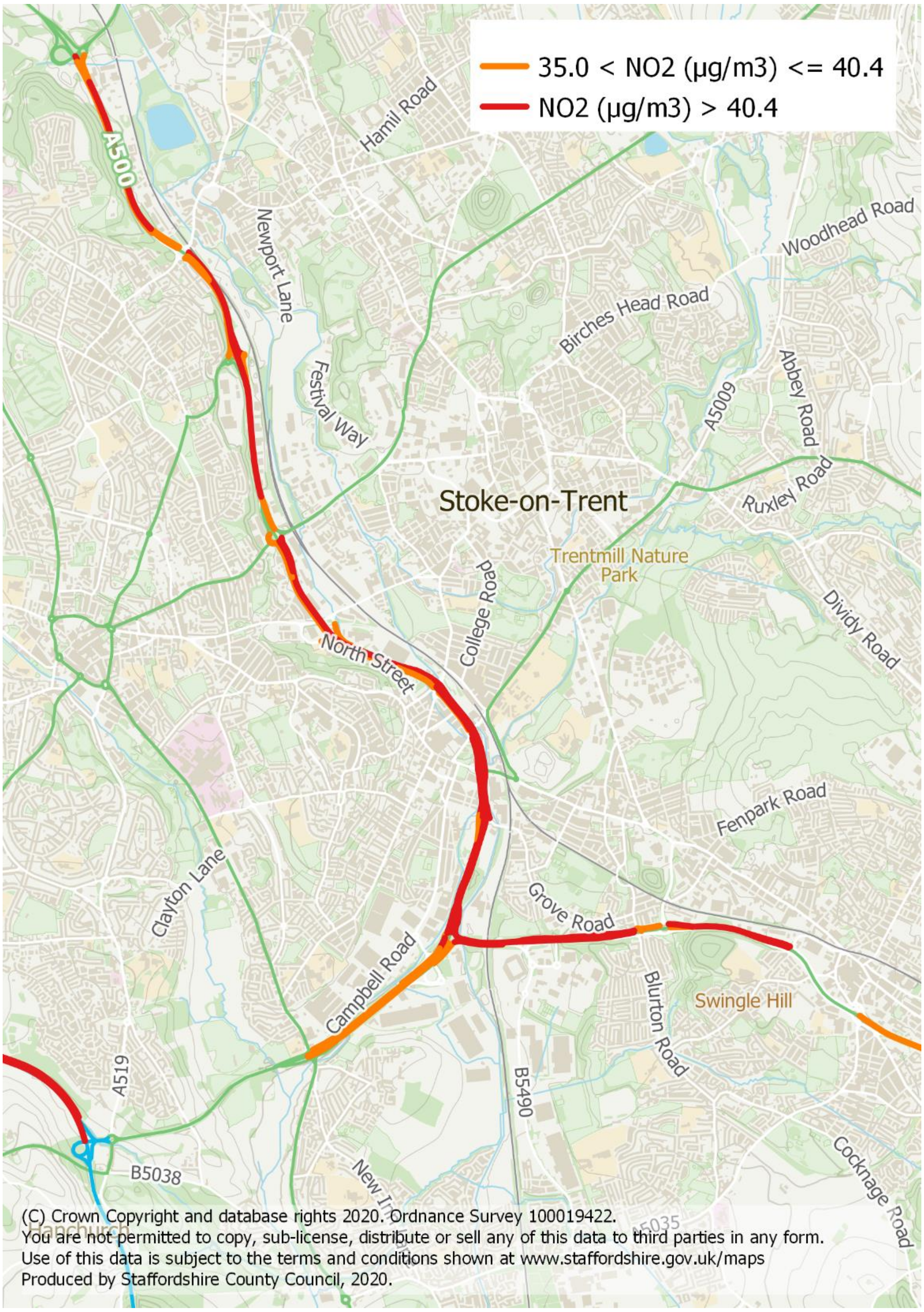


*Figure 1-6: $NO_2$ exceedance locations on Strategic Road Network in 2022 from local modelling*



## 1.8 Causes and problems

The predicted $NO_2$ concentration exceedance locations shown in Figure 1-5 above are on the key road corridors that connect key commercial and residential hubs together and provide connectivity to transport hubs and the SRN. As a result, these corridors are heavily trafficked and therefore suffer congestion, especially during peak periods. Targeted interventions have been identified and developed on a corridor-basis to address the problem and avoid displacement.

The tables below summarise $NO_2$ concentration data at locations on the local road network (Table 1-1) and on the SRN (Table 1-2) that are close to (above 39) or exceed the limit value in the 2022 reference case.

*Table 1-1: $NO_2$ modelled concentration levels on local road network (2022 baseline)*

| Location (local road network) | $NO_2$ concentration (µg/m$^3$) | Exceeds limit value |
|---|---|---|
| Victoria Road at the south end near City Rd/King St junction | 45.6 | Y |
| A53 between Basford Park Rd and Victoria Street | 42.7 | Y |
| Bucknall New Road close to the junction with the A50 | 42.2 | Y |
| Quadrant Road/Town Road | 40.4 | N |
| A5272 Chell Street between Eldon St and Acton St | 40.0 | N |
| A527 Porthill Road | 39.8 | N |
| Lichfield Street | 39.5 | N |

*Table 1-2: $NO_2$ modelled concentration levels on Strategic Road Network (2022 baseline)*

| Location (SRN) | $NO_2$ concentration (µg/m$^3$) | Exceeds limit value |
|---|---|---|
| A500 | 53.2 | Y |
| M6 J16 to 15 | 47.6 | Y |
| A50 | 47.3 | Y |

The three exceedance locations on the local authority highway network (as shown in Table 1-1) are discussed further below.

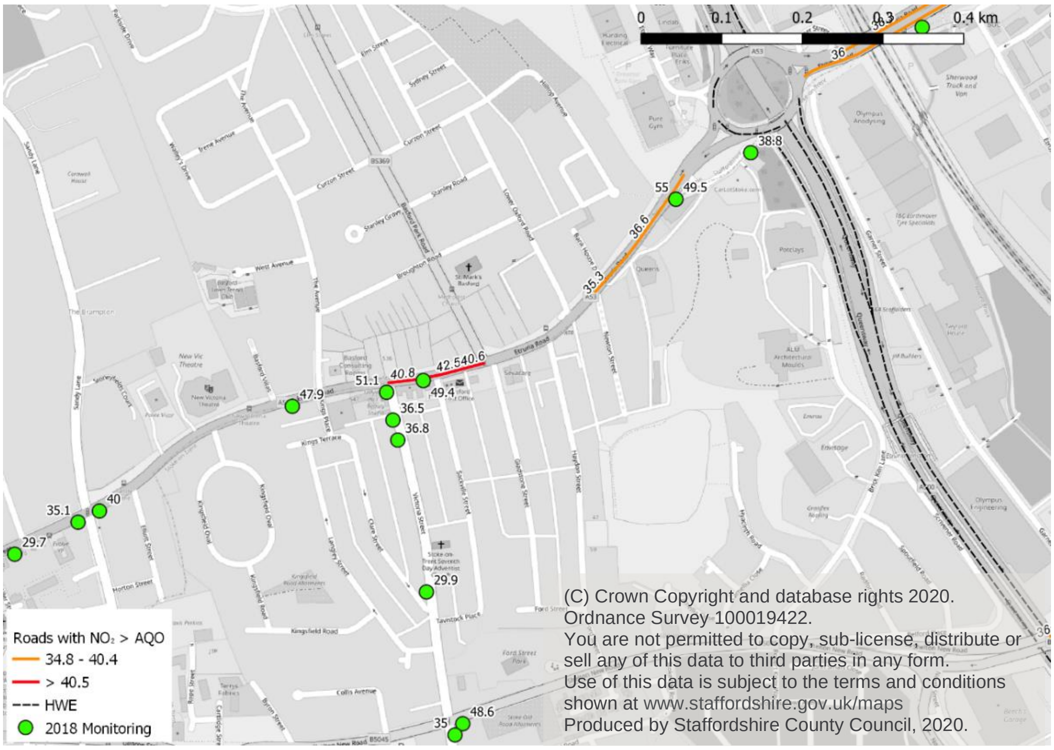
### 1.8.1 <u>Exceedance along the A53</u>

The first of the three exceedance locations can be found along the A53 corridor, as shown in Figure 1-7 below. This link sits on the boundary between Newcastle-under-Lyme and Stoke-on-Trent, therefore tackling the predicted exceedance requires the collaboration of three authorities: NuLBC, SoTCC and SCC. This section of road is heavily congested during peak periods and also has a significant uphill gradient, exacerbating $NO_2$ emissions. The A53 joins the A500 which also suffers from heavy congestion.

*Table 1-3: Traffic data on A53 (2022 baseline)*

| Description | Data/Description | |
|---|---|---|
| AADT flows | 20,900 | |
| HGV % | 3% | |
| Daily average speed | 26kph WB | 7kph EB |
| Local v Non-Local trips | Select link analysis from the NSMM transport model has identified that the majority of trips are local. Of the trips passing through the exceedance location 81% had an origin and 91% had a destination within the NSMM internal zones. | |

*Figure 1-7: Annual mean $NO_2$ concentrations along the A53 west (2022 baseline)*




## 1.8.2 Exceedance along Bucknall New Road

The second of the three exceedance locations can be found along Bucknall New Road close to the junction with Potteries Way, as shown in Figure 1-8 below. There are slow traffic speeds entering this junction that contribute to these pollution levels. Furthermore, approximately 14 bus routes operate along this road in both directions, with most of the buses used being older and more polluting vehicles. Additionally, the dispersion of pollutants is likely to be inhibited by the proximity of nearby buildings to the roadside forming a street canyon.

*Table 1-4: Traffic data on Bucknall New Road (2022 baseline)*

| Description | Data/Description | |
|---|---|---|
| AADT flows | 15,200 | |
| HGV % | 3% | |
| Daily average speed | 15kph WB | 41kph EB |
| Local v Non-Local trips | Select link analysis from the NSMM transport model has identified that the majority of trips are local. Of the trips passing through the exceedance location 71% had an origin and 85% had a destination within the NSMM internal zones. | |

*Figure 1-8: Annual mean $NO_2$ concentrations in Hanley (2022 baseline)*


### 1.8.3 <u>Exceedance along Victoria Road</u>

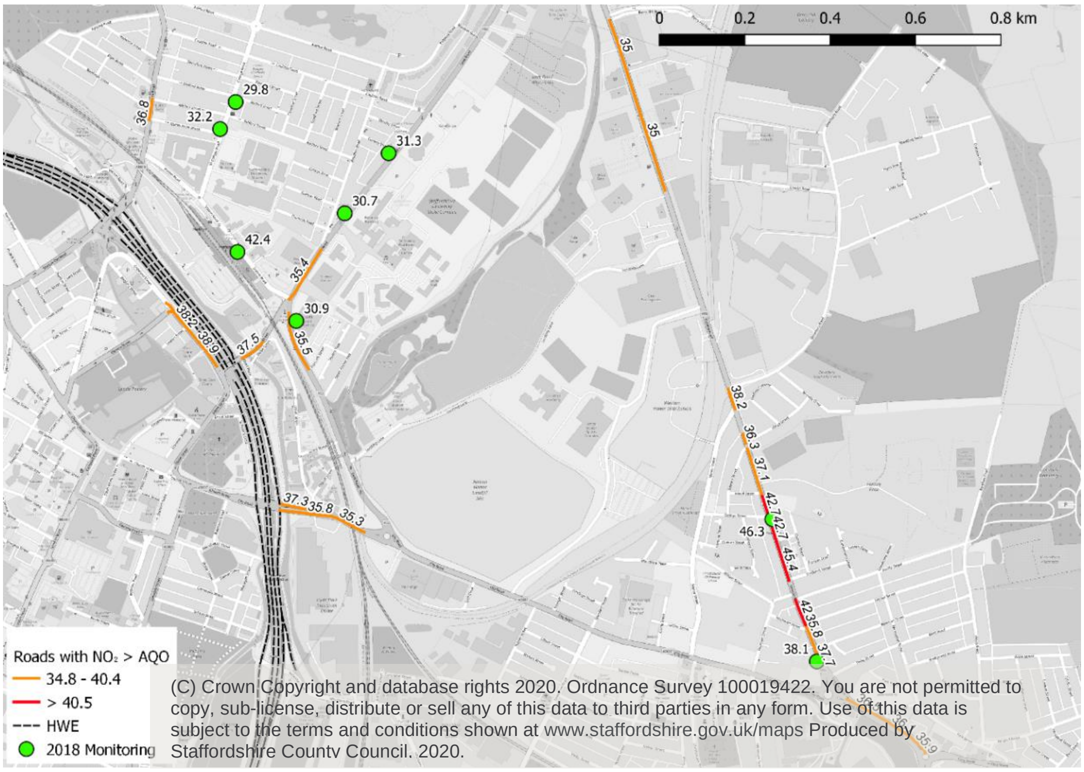
The highest annual mean roadside concentrations are found at the south end of Victoria Road, as shown in Figure 1-9 below. This road experiences high levels of congestion at all times of the day, with the contribution to $NO_2$ emissions being split across all types of vehicles. Fenton

Industrial Estate is accessed from Victoria Road only, meaning goods vehicles use this route frequently. The A52 intersects the north end of Victoria Road, with the A52 being a heavily congested route as well. The exceedances are exacerbated by the relatively low traffic speeds and narrow street canyons i.e. a narrow street with relatively tall buildings on both sides, along particular segments of this road.

*Table 1-5: Traffic data on Victoria Road (2022 baseline)*

| Description | Data/Description | |
|---|---|---|
| AADT flows | 23,800 | |
| HGV % | 5% | |
| Daily average speed | 25kph WB | 25kph EB |
| Local v non-local trips | Select link analysis from the NSMM transport model has identified that the majority of trips are local. Of the trips passing through the exceedance location 84% had an origin and 90% had a destination within the NSMM internal zones. | |

*Figure 1-9: Annual mean $NO_2$ concentrations along Victoria Road (2022 baseline)*




## 1.8.4 Source apportionment

A source apportionment exercise of road emissions by vehicle type was calculated for an average of links, and for each link shown to be in exceedance of the annual mean limit levels under the Do Minimum scenario. The pie charts shown in Figure 1-10 to Figure 1-12 show the results of the source apportionment of $NO_X$ concentrations at the location of the maximum predicted annual mean $NO_2$ concentration along each of the three-exceedance links for the 2022 baseline.

While diesel cars, LGVs and HGVs are responsible for most of the emissions, there are notable contributions from buses particularly on the A5008 and to a lesser extent on the A50.

*Figure 1-10: Source apportionment Victoria Road*

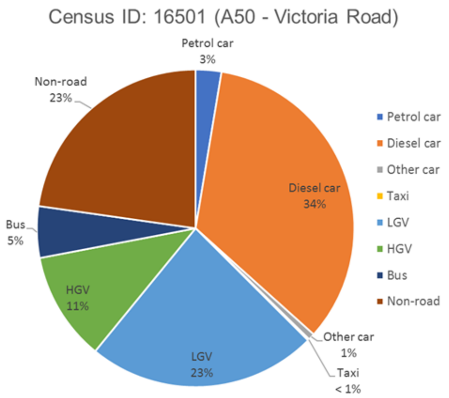



*Figure 1-11: Source apportionment Bucknall New Road*

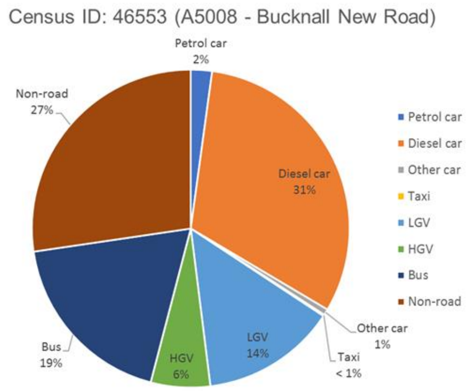
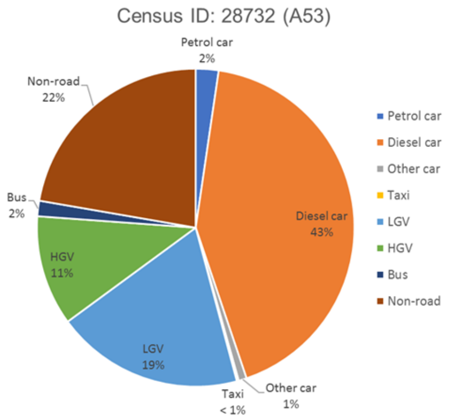


*Figure 1-12: Source apportionment A 53 Etruria Road*




## 1.9 Case for change

It is widely recognised that air pollution poses the largest environmental public health risk in the UK and it continues to threaten the lives of more vulnerable members of the population. In England, the annual number of deaths attributed to air pollution is roughly 25,000 and there is countless evidence that details the correlation between poor air quality and increased prevalence of respiratory and cardiovascular diseases. The impacts of pollution usually surface in the long-term and the problems caused by it are experienced disproportionately by the elderly, infants and those with existing chronic ailments. The impacts are greater on those who reside, work or are educated in more deprived areas. Stoke-on-Trent is one of England's most deprived local authorities[5] based on domains such as income, employment, education and health – this increases the need to address air pollution and health problems in this area.

The Department for Environment, Food & Rural Affairs (Defra) estimates that $NO_2$ contributes to curtailing life expectancy by an average of 5 months, which ranges from healthy individuals experiencing negligible effects to susceptible individuals whose poor health is seriously worsened by $NO_2$ pollution. The overall population burden is estimated to result in over 23,000 premature deaths in the UK per year[6].

Data from the Public Health Outcomes Framework[7] indicates that the 'under 75 mortality rates from respiratory disease', between 2015 and 2017, was 49.8 per 100,000 for Stoke-on-Trent and 34.3 per 100,000 for England. It can be deduced that the negative impacts of poor air quality in Stoke-on-Trent are likely to be a contributing factor to the higher than average mortality rates experienced in the city. Table 1-6 compares the number of hospital admissions for respiratory diseases in North Staffordshire, Stoke-on-Trent and England as a whole. It highlights that the number of admissions in both North Staffordshire and Stoke-on-Trent

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[5] Ministry of Housing, Communities & Local Government – The English Indices of Deprivation 2019

[6] Air Quality, A Briefing for Directors of Public Health, March 2017, Defra and Public Health England

[7] Public Health Outcomes Framework, Healthcare and premature mortality, https://fingertips.phe.org.uk/profile/public-health-outcomes-framework/data#page/0/gid/1000044/pat/6/par/E12000005/ati/102/are/E06000021/iid/40701/age/163/sex/4 [accessed 02/05/19]

frequently exceeds the national average for these types of diseases, which could directly be linked to poor air quality in the local areas.

*Table 1-6: Hospital admissions for respiratory diseases (per 100,000 people)* [8]

| Indicator Name | England | NHS North Staffordshire CCG | NHS Stoke-on-Trent CCG |
|---|---|---|---|
| Emergency hospital admissions for COPD, all ages | 248 | 261 | 463 |
| Emergency hospital admissions for asthma in adults aged 19 years and over | 90 | 87 | 128 |
| Hospital admissions for asthma (under 19 years) | 185 | 254 | 260 |
| Emergency hospital admissions for pneumonia | 463 | 598 | 794 |
| Emergency hospital admissions for respiratory disease | 1523 | 1983 | 2566 |

For the county of Staffordshire approximately 5% of deaths in adults over 30 can be attributed to fine particulate matter ($PM_{2.5}$) air pollution[9]. In Newcastle-under-Lyme this figure is estimated at 4.7% and for Stoke-on-Trent is estimated at 4.9%. The financial burden associated with the health impacts of air pollution is estimated to cost approximately £16 billion[10]. It is widely acknowledged that measures to tackle $NO_2$ concentrations can have beneficial effects on concentrations of particulate matter, thereby widening the health benefits.

Additionally, air pollution problems can be multi-faceted as they not only impact public health, but also incur social costs and contribute to damaging the natural environment. Economically, sickness and ill health caused by air pollution can accumulate and severely impact on economic productivity due to absenteeism. From an environmental perspective, excessively high $NO_2$ concentrations can have detrimental impacts on animals, plants and biodiversity by accelerating harmful processes such as acidification and eutrophication.

The case for change was evidenced in the feasibility study and strengthened through further air quality modelling, where local modelling highlighted three areas of exceedance within Stoke-on-Trent and Newcastle-under-Lyme, with other PCM links experiencing near exceedance levels, as outlined above. These $NO_2$ exceedances do not comply with EU regulations and thus the Ministerial Direction presented to Stoke-on-Trent and Newcastle-under-Lyme focuses on addressing non-compliance with the statutory limit for roadside $NO_2$ concentrations.

The NSLAQP has been developed to bring $NO_2$ concentrations in line with the Ministerial Direction whilst maintaining all three Councils' aims and objectives for the local area. Intervention will target traffic patterns and behaviours in Stoke-on-Trent and Newcastle-under-Lyme as a result of road transport being recognised as one of the primary contributors to air

[8] Public Health England – INteractive Health Atlas of Lung conditions in England
[9] 2018 Air Quality Annual Status Report In fulfilment of Part IV of the Environment Act 1995 Stoke-on-Trent City Council June 2018
[10] Defra. Abatement cost guidance for valuing changes in air quality, May 2013

pollution. The wider impacts resulting from this scheme have also been carefully considered to avoid any unintended consequences.

### 1.10 Spending objectives

Underpinned by the rationale for intervention and the case for change, the three Councils – SoTCC, NuLBC and SCC have defined spending objectives to shape a clear way forward.

The primary spending objective for the NSLAQP is:

- **Compliance** – to achieve the statutory limit values for roadside $NO_2$ concentration limits in the shortest possible time

The associated secondary objectives for the NSLAQP include:

- **Value for money** – demonstrating that for Central Government and the Councils the scheme delivers value for money
- **Fair and proportionate** – minimising the impacts on local residents and businesses, including disadvantaged groups
- **Support local objectives** – enabling and aligning with local objectives including improving health and encouraging a shift to sustainable transport
- **Enabling transition to lower emission economy** – minimising the impacts on economic growth and development across North Staffordshire

To support the realisation of these spending objectives, a number of Critical Success Factors were identified to appraise and refine the options to ensure the NSLAQP delivers the outcomes sought by the national Air Quality Plan and supports local policies.

### 1.11 Critical success of the NSLAQP

The UK Government is focussed on tackling air quality issues and aims to address the exceedingly high levels of $NO_2$ concentrations found at a national level. The breach of EU air quality limits is attributable to traffic problems and, as such, the UK Government is determined to enhance vehicle innovation and promote safer, cleaner travel. This is typified by the publishing of strategies such as the Clean Air Strategy which outlines the need to shift to greener infrastructure by encouraging the public to use cleaner transport modes and encourage the use and uptake of zero emission vehicles and focus on controlling major sources of air pollution.

The primary critical success factor in this study is that the package of measures that form the NSLAQP must 'bring about compliance with $NO_2$ limit values in the shortest possible time'.

Additionally, in developing the NSLAQP, the assessment has taken account of the need to:

- Deliver a high level of confidence that compliance with the EU Limit Value will be achieved
- Minimise the social and economic impacts on local communities and residents

Secondary success factors, as per JAQU guidance, have also been considered – these include:

- Likely value for money

- Affordability
- Distributional impacts
- Strategic and wider air quality
- Supply side capacity and capability
- Achievability

This OBC demonstrates how the NSLAQP aligns with each of these factors.

Ultimately, by working together SoTCC, NuLBC and SCC have sought to develop a package of measures that will reduce $NO_2$ concentrations at exceedance locations to below the EU Limit in the shortest time possible. In addition to achieving this, the Councils have sought to ensure the NSLAQP supports the wider strategic goals of the region to minimise any risk of unintended negative economic, social or environmental consequences.

### 1.12 Scope of the NSLAQP

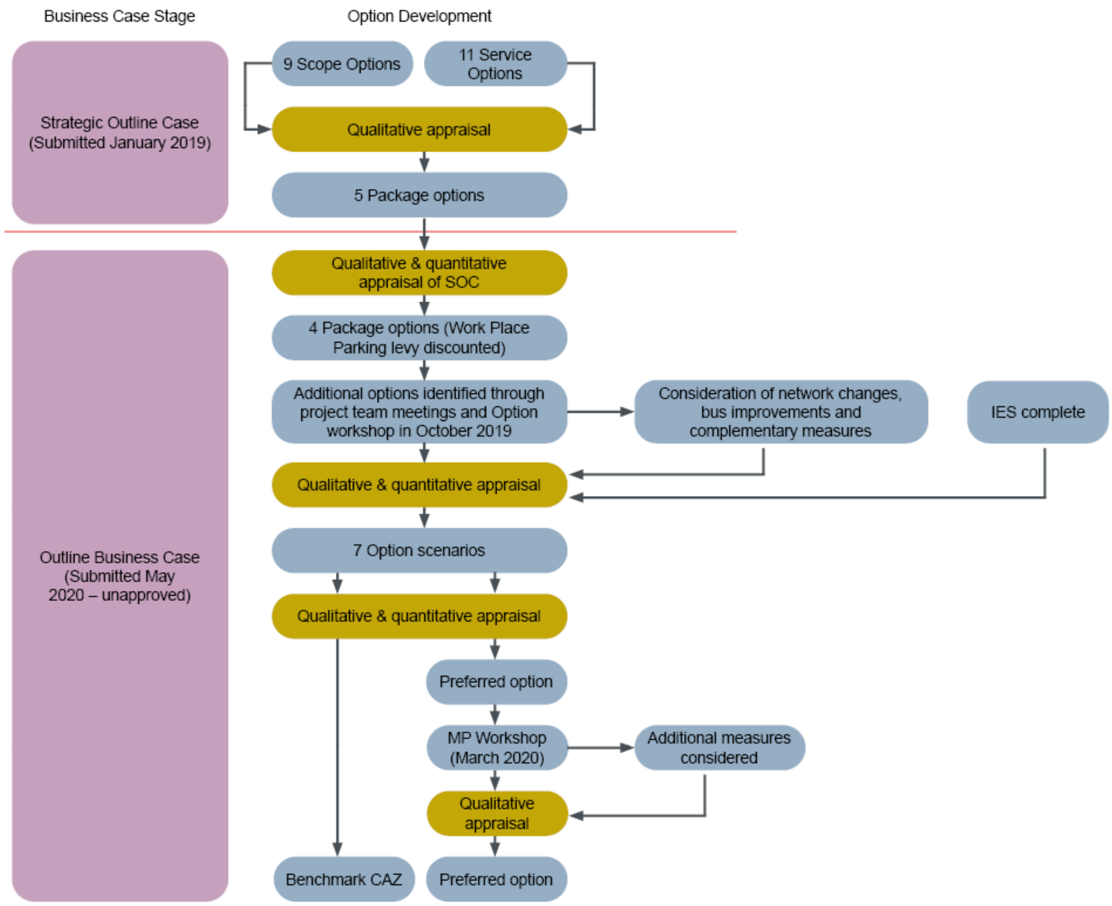
The NSLAQP has been developed to respond to the problems, issues and objectives identified in previous sections to achieve compliance in the shortest possible timeframe whilst minimising the impact on local people and supporting wider policy aims. The geographic extent of the NSLAQP represents the most feasible, practical and deliverable solution to bring forward compliance in SoTCC and NuLBC. Consideration has been given to the potential for vehicle displacement as a result of the introduction of measures and to the fact that it may be unavoidable for high emitting vehicles to be driven into an area (i.e. the delivery of goods or services).

When considering the options, the geographical extent of the NSLAQP has taken in to account that certain roads in the study area are not under the control of SoTCC or SCC as the Highways Authorities. The SRN is the responsibility of Highways England and is outside the scope of this work.

### 1.13 Identification of the Preferred Option

The identification of the Preferred Option has built on the work undertaken in the preparation of the SOC and has been supplemented by further option development and appraisal as summarised in Figure 1-13. This approach has involved additional option identification workshops and the qualitative and quantitative testing of options to ensure the best package has been selected to address the exceedance locations and promote ongoing improvements in air quality.

*Figure 1-13: Summary of option appraisal*




### 1.13.1 Options development

A thorough option development and appraisal process has been undertaken to identify and evaluate the impact of different scenarios against the objectives. This process is described below with further detail provided within the Economic Case.

The SOC, as submitted in January 2019, included a longlist and shortlist of measures. A qualitative assessment of the longlist of measures was undertaken to identify a shortlist of Preferred Option packages to take forward to the next stages of the business case process. The shortlist was developed by assessing each option against a list of critical success factors as defined in JAQU guidance and included both charging and non-charging measures

A summary of the shortlist of options and how they have been taken forward into this OBC is given in Table 1-7 below.

*Table 1-7: Progress of SOC shortlist options to OBC stage*

<table>
<tr><th>Shortlisted options in SOC</th><th>Development as part of the OBC</th></tr>
<tr><td>City centre/A53 chargeable access restriction</td><td>Various options for a chargeable CAZ were developed including analysis of different classifications (C and D) and different boundaries.<br><br>This analysis has informed the Preferred Option and Benchmark Option.</td></tr>
<tr><td>City centre/A53 traffic management scheme, plus Council boundary scale Low Emission Strategy</td><td>Various traffic management measures were developed and appraised and a range of complementary measures were identified as part of a Low Emissions Strategy.<br><br>This has informed the final Preferred Option.</td></tr>
<tr><td>City centre/A53 Workplace Parking Levy, plus Council boundary scale Low Emission Strategy</td><td rowspan="2">Initial analysis was conducted on the possible impacts of a Workplace Parking Levy and it was found that the reduction in traffic flows in the conurbation would be minimal. A summary of this work is included as Appendix 2.<br><br>The WPL measure was not considered further.</td></tr>
<tr><td>Council boundary scale Workplace Parking Levy, plus Council boundary scale Low Emissions Strategy</td></tr>
<tr><td>Etruria Valley Road and A500 Improvements, plus Council boundary scale Low Emission Strategy</td><td>The EVLR Project including the widening of the A500 are committed schemes and were therefore included as part of the baseline/Do Minimum scenario.</td></tr>
</table>

The project team, comprising the three Councils and their consultants, undertook further option development work. This included internal officer meetings and workshops to identify and review potential options including early engagement with local councilors and key stakeholders. The options developed can be broadly categorised under six headings:

- Clean Air Zone
- Traffic Management including changes to network operation, for example, banning turns, restricting traffic during peak periods, improving existing links, creating one-way systems, and implementing speed restrictions
- Junction improvement and traffic signal optimisation
- Retrofitting the bus fleet
- Bus network enhancement including improved bus stops and shelters, real-time information and promotion of low emissions buses

- Complementary measures including a wide range of options such as Electric Vehicle infrastructure, park and ride, marketing and behaviour change programmes, car sharing, parking strategies and eco-driving campaigns.

To support the development of options for testing an options development workshop was held in October 2019 involving: Council officers, specialist consultants, Cabinet members from all three local authorities, Highways England, Royal Stoke University Hospital, NuLBC town centre manager, NuLBC and SoTCC planning officers and JAQU.

The main purpose of this event was to work collaboratively to identify potential options to tackle the predicted exceedances, including traffic management and highway interventions, as well as potential charging CAZ options to tackle all or some of the exceedances. The workshop highlighted possible measures at each exceedance location and it was agreed that a minimum of five tests would need to be undertaken by the authorities and their specialist consultants, to determine whether localised traffic management and associated measures could deliver the compliance outcome for each location, or whether a wider Benchmark CAZ D would ultimately form the Preferred Option to deliver the compliance required.

The outcomes of the workshop and further review work informed the development of seven scenarios to be tested in the transport model and where appropriate in the air quality models. The measures were packaged together to create the most effective solution to deliver compliance in the shortest timeframe possible and consideration was also given to produce packages that were both time and cost effective.

The seven option scenarios are summarised in Table 1-8.

*Table 1-8: Option summary*

| Options | CAZ | Traffic Management | Junction improvements | Bus retrofit | Bus network enhancement | Complementary measures |
|---|---|---|---|---|---|---|
| **Option 1: Benchmark** | CAZ D<br>Full boundary<br>Charge:<br>• Cars/Taxis - £5<br>• LGVs - £9<br>• HGVs - £35<br>• Buses - £5 | n/a | n/a | | n/a | n/a |
| Option 2: | n/a | Basford Park right turn ban<br>Victoria Rd northbound peak restrictions (except buses) on the southern end of Victoria Road | Junction improvements at both ends of Academy Road | 50% retrofit on Bucknall New Road<br>100% retrofit on Victoria Road | n/a | n/a |
| Option 3: | CAZ D<br>Local boundary on Victoria Road<br>Charge:<br>• Cars/Taxis - £5<br>• LGVs - £9<br>• HGVs - £35<br>• Buses - £0 | A53 westbound peak restrictions except buses, cycle users and taxis | n/a | 100% retrofit on Bucknall New Road<br>100% retrofit on Victoria Road | n/a | n/a |
| Option 4: | n/a | A53 westbound peak restriction except buses, cycle users and taxis<br>Victoria Rd northbound peak restrictions on southern end of Victoria Rd except buses, cycle users and taxis | Signal improvements at Albert St and Basford Park | 75% retrofit on Bucknall New Road<br>100% retrofit on Victoria Road | n/a | n/a |
| Option 5: | CAZ C<br>Full boundary<br>Charge:<br>• LGVs - £9<br>• HGVs - £35<br>• Buses - £5 | n/a | n/a | | n/a | n/a |

| | | | | | | |
|---|---|---|---|---|---|---|
| Option 6: | n/a | A53 westbound peak restriction except buses, cycle users and taxis<br>Victoria Rd northbound peak restrictions on southern end of Victoria Rd except buses, cycle users and taxis | Signal improvements at Albert St and Basford Park | 75% retrofit on Bucknall New Road<br>100% retrofit on Victoria Road | Improved bus stops and shelters<br>Bus wrap advertising<br>Real-time information | Travel planning<br>Vegetation planting/removal<br>Cycling/walking infrastructure<br>EV infrastructure |
| **Option 7: Preferred Option** | n/a | A53 westbound peak restriction except buses, cycle users and taxis<br>Victoria Rd northbound peak restrictions on southern end of Victoria Rd except buses, cycle users and taxis | Signal improvements at Albert St and Basford Park | 75% retrofit on Bucknall New Road<br>100% retrofit on Victoria Road | Improved bus stops and shelters<br>Bus wrap advertising and RTPI | n/a |

The analysis of $NO_2$ concentration for the seven option scenarios is shown in Table 1-9.

*Table 1-9: Option scenarios and $NO_2$ concentrations*

| Option | Description | $NO_2$ concentration in 2022 | | | | | |
|---|---|---|---|---|---|---|---|
| | | A53 | | Bucknall New Road | | Victoria Road | |
| | | Baseline | With measures | Baseline | With measures | Baseline | With measures |
| 1 | CAZ D – Full boundary<br><br>Benchmark | 42.7 | 33.4 | 42.2 | 30.9 | 45.6 | 36.1 |
| 2 | Traffic Management (1) | | 41.7 | | 40.8 | | 40.1 |
| 3 | CAZ D – Local boundary + Traffic management | | 39.9 | | 37.0 | | 34.8 |
| 4 | Traffic Management (2) | | 38.9 | | 39.4 | | 39.3 |
| 5 | CAZ C | | 39.7 | | 35.4 | | 41.4 |
| 6 | Traffic Management (3) | | 38.6 | | 39.3 | | 39.2 |
| 7 | Traffic Management (4)<br><br>Preferred Option | | 38.9 | | 39.4 | | 39.3 |

This work has demonstrated that a non-CAZ option can achieve compliance and will support wider objectives – therefore, the Preferred Option for the NSLAQP is a range of traffic management measures, junction improvements, bus retrofitting and bus network enhancements as outlined in section 1.15. This option achieves compliance in the shortest possible time and helps to deliver objectives associated with traffic reduction at the three exceedance locations. Further details on the Air Quality and Transport modelling can be found within the accompanying AQ1-3, T1-4 and Analytical Assurance Statement.

As per JAQU guidance, a Benchmark CAZ D option has also been identified.

It is important to note that the Preferred Option can be full constructed and operational in 2022 and will therefore bring $NO_2$ compliance in 2022. By comparison, the design and delivery of the

Benchmark CAZ D is a considerably lengthier process would not be operational or achieve compliance until 2023. As discussed within the Management Case the Benchmark CAZ D would not adhere to the primary Critical Success Factor of deliverance in the shortest timeframe possible.

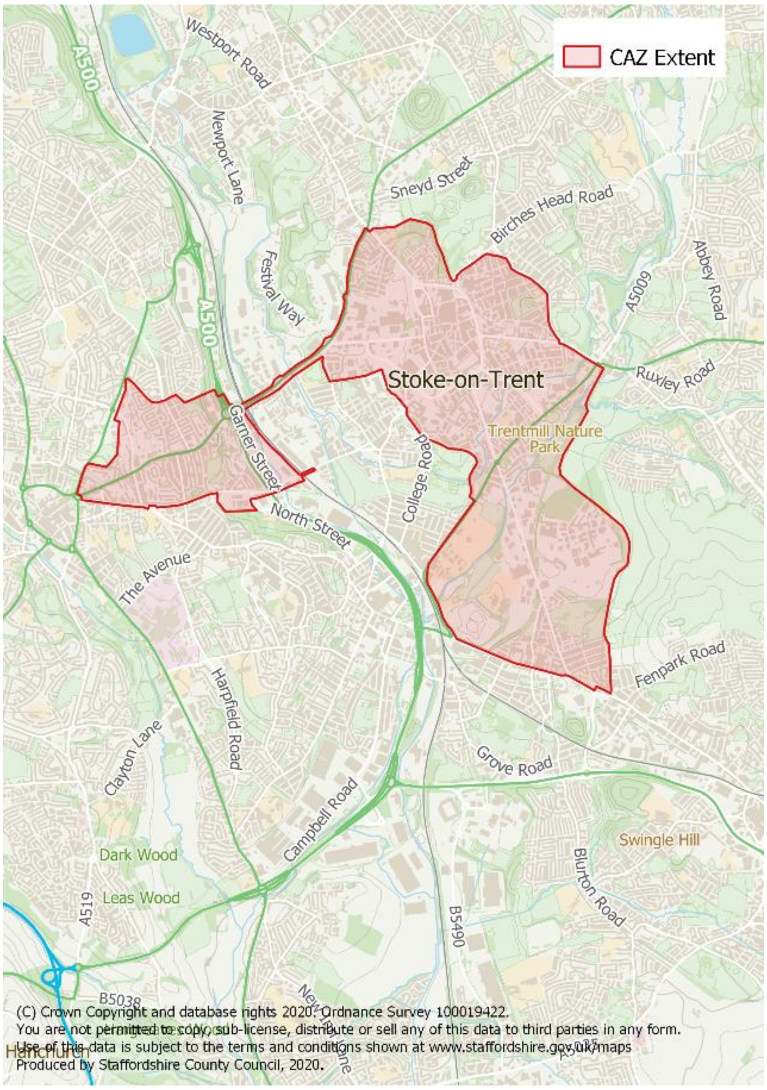
The following sections describe the Benchmark CAZ D and the Preferred Option in further detail. Technical details on the full options appraisal and analysis can be provided upon request.

### 1.14 The Benchmark CAZ D

Based on the work undertaken during the options appraisal stage, the Benchmark CAZ was defined as a class D. The boundary is shown in Figure 1-14 below and covers the main areas affected by $NO_2$ in Newcastle-under-Lyme and Stoke-on-Trent including: Hanley, Victoria Road and east Newcastle-under-Lyme, as well as the A53 Etruria Road between Newcastle-under-Lyme and Hanley. The proposed charge rates for non-compliant vehicles would be:

- Cars/Taxis - £5
- LGVs - £9
- HGVs - £35
- Buses - £5

*Figure 1-14: Boundary for CAZ D Benchmark option*




## 1.15 The Preferred Option

Through the option appraisal the Preferred Option has been developed to include a range of measures targeting the specific areas of $NO_2$ exceedances, as described below and summarised in Figure 1-15:

### 1.15.1 A50 Victoria Road bus gate

A bus gate will be installed on the A50 Victoria Road exit of the King Street/City Road/Victoria Road junction. Traffic will be restricted to buses, cycle users and taxis between Monday and Friday from 7am to 10am and 4pm to 7pm. A ULEV exemption, allowing ultra-low emission vehicles to drive through the bus gate will be assessed and if considered deliverable will be added to the scheme in the FBC.

The splitter island will be widened and the kerbs re-aligned to provide a single lane bus gate on the exit to A50 Victoria Road. An ANPR camera will be located at the bus gate to monitor compliance and two rotating prism signs will be installed at the entrance to the bus gate. The prism signs will enable the display of multiple messages and will be blank when the bus gate is not in use. Bus gate advanced direction signing will be provided on the local highway network on all approaches to the Victoria Road/City Road and A50/King Street junctions, including Prism and Variable Message Signs

An indicative design drawing is attached in Appendix 3.

#### 1.15.2 A53 Etruria Road bus gate

A two-lane bus gate will be installed on the A53 Etruria Road westbound exit of the A53/A500 roundabout, with appropriate amendments to the existing road markings at the bus gate and on the circulatory carriageway. Traffic will be restricted to buses, cycle users and taxis between Monday and Friday from 7am to 10am and 4pm to 7pm. A ULEV exemption, allowing ultra-low emission vehicles to drive through the bus gate will be assessed and if considered deliverable will be added to the scheme in the FBC.

Two rotating prism signs will be installed at the entrance to the bus gate to enable the display of multiple messages and will be blank when the bus gate is not in use. Two ANPR cameras will be installed to manage compliance. Advanced direction signing will include prism signs on all approaches to the A500/A53 Etruria Road roundabout. Changes to destination signs on the A500 mainline carriageway in both directions are also proposed. This will include appropriate re-routing to the hospital and will also include variable message signs.

An indicative design drawing is attached in Appendix 3.

#### 1.15.3 Traffic management east and west of Victoria Road

Traffic management measures will be required on roads to the east and west of Victoria Road in order to ensure that the adjacent local communities are not adversely impacted by traffic re-routing through these areas when the bus gates are in operation.

The following measures will be required to the East of Victoria Road:

- Replace existing worn and ineffective road humps in Beville Street, Stanier Street, Wileman Street, Philip Street, Elliot Road, Wedgwood Road, Warrington Street and Vivian Road and enhance the impact of the scheme by providing additional humps and carriageway re-surfacing.
- Provide new road humps and carriageway re-surfacing along Park Street, Minerva Road, Frederick Street, Cumberland Street and Clarence Street.
- Introduce one-way operation (direction of travel west to east) in Wileman Street (part) and Stanier Street (part).
- Provide an environmental weight restriction on the traffic calmed routes to prevent inappropriate large vehicles travelling through the area.
- Extend the existing 20mph zone to cover the whole traffic calmed area.

The following measures will be required to the West of Victoria Road:

- Replace existing worn and ineffective road humps in Manor Street, George Street, Edward Street and Hitchman Street and enhance the impact of the scheme by providing additional humps and carriageway re-surfacing.
- Provide new road humps and carriageway re-surfacing in Maud Street, Fountain Street and William Street. This includes two raised tables to improve safety at Christ Church C of E Primary School.
- Enhance signage to improve the enforcement of the existing environmental weight restriction in Manor Street.
- Closure of Hitchman Street at its junction with Victoria Road, maintaining access for pedestrians and cycle users.
- The existing western footway along Victoria Road at Hitchman Street will be extended to enhance the pedestrian environment.
- Introduction of a 20mph zone to include the whole traffic calmed area.

An indicative design drawing is attached in Appendix 3.

#### 1.15.4 Transport improvements along A53 Etruria Road

The bus gate on A53 Etruria Road will significantly reduce traffic flows in the peak periods along this corridor and improve bus reliability. This will necessitate the review of signal timings at junctions along the corridor in order to maximise air quality benefits.

The increase in spare capacity along the corridor will create the opportunity for the provision of signal controlled pedestrian crossing facilities on all arms of the A53/Gladstone Street/Basford Park Road junction and the A53/Albert Street/Sandy Lane junction.

An existing bus stop on the A53 Etruria Road is located on the hill where it is observed that traffic can queue behind buses serving the stop. It is recommended that the bus stop is relocated to the east of Kingsfield Oval, opposite the New Vic Theatre where it is likely to have a reduced impact on air quality. Accessibility will be enhanced through the provision of bus access kerbs and levelled footways. Real Time Bus Passenger Information will also be provided along the A53 corridor.

An indicative design drawing is attached in Appendix 3.

#### 1.15.5 Bus retrofit programme

To deliver compliance on Bucknall New Road and Victoria Road the buses that use these routes will be retrofitted to achieve Euro VI emission standards. This involves the installation of appropriate exhaust modification depending on vehicle type and age and associated e-cooling fan to minimise ongoing maintenance. This will be an expansion of the existing bus retrofit programme being delivered on the A53 as part of the separate NuLBC Ministerial Direction.

A total of 75% of buses that travel along the Bucknall New Road corridor and all buses travelling along Victoria Road require this improvement to ensure that compliance is achieved. Funding will be required for the retrofitting of 50 buses to ensure that the appropriate number of scheduled services can continue to operate on Bucknall New Road and Victoria Road. The two main operators are First Bus and D&G and the smaller operators include Scraggs and Stantons of Stoke.

To market the cleaner bus fleet, enhance their visibility and encourage greater bus use, it is recommended that all buses that have been retrofitted are provided with a new branding in the form of a partial bus wrap. To monitor bus operator use of retrofit vehicles, ANPR cameras will be installed on Victoria Road, Bucknall New Road, at the junction with St Ann Street, and on the A53 to the east of the junction with Albert Street/Sandy Lane.

1.15.6 Bus infrastructure improvements

Enhanced bus infrastructure will be installed on routes that pass through or are parallel to the exceedance locations. This includes bus routes:

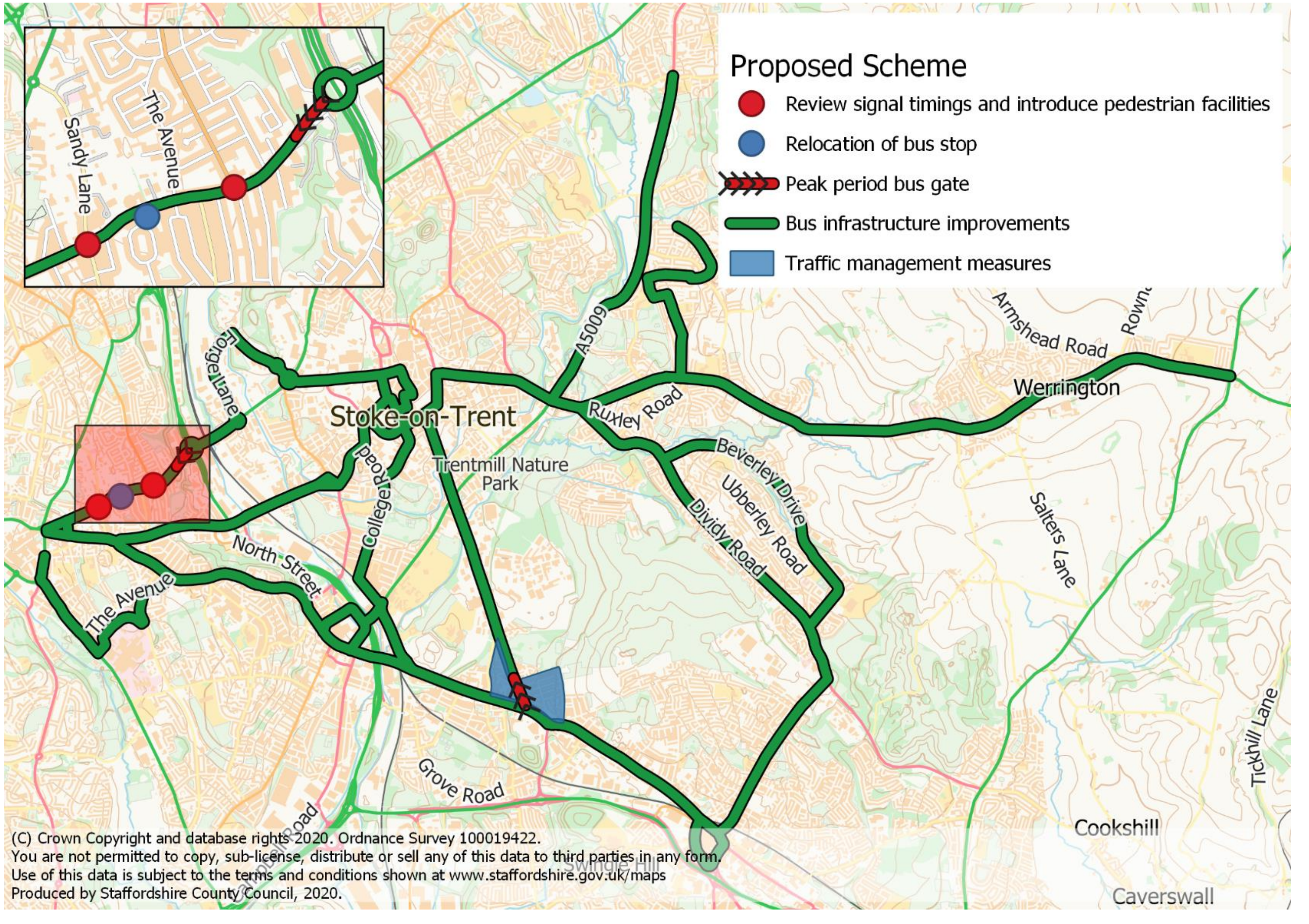
- To Abbey Hulton, Milton, Bentilee and Longton that use Bucknall New Road
- Along Victoria Road and parallel routes along the College Road and A5007 City Road
- Along A53 between Newcastle town centre and Hanley City centre, and parallel routes along the A52 and Shelton New Road

The improvements are required to ensure that bus patronage is maximised along corridors that are at risk of air quality exceedances and where traffic modelling suggests that traffic flows and journey times may increase as traffic re-routes to avoid the bus gates. The package includes:

- 89 real time bus passenger information (RTPI) screens
- 17 new bus shelters of which 8 are replacement and 9 are new facilities
- 27 accessible kerbs at bus stops
- Installation of CCTV at 71 bus stops

An indicative design drawing is attached in Appendix 3.

*Figure 1-15: Summary of the proposed NSLAQP*



1.15.7 Impact of the Preferred Option

It is acknowledged that the two bus gates predominantly redistribute existing traffic. Flow difference plots with and without the Preferred Option are included in Appendix 4 and illustrate this redistribution of traffic on the network. Table 1-10 below summarises the traffic flows and speeds with the NSLAQP in place.

*Table 1-10: Traffic data (2022)*

| Description | A53 | | Bucknall New Road | | Victoria Road | |
|---|---|---|---|---|---|---|
| | Baseline | With Preferred Option | Baseline | With Preferred Option | Baseline | With Preferred Option |
| AADT flows | 20,900 | 18,000 | 15,200 | 15,400 | 23,800 | 19,700 |
| HGV % | 3% | 3% | 3% | 3% | 5% | 5% |
| Daily average speed | 26kph WB<br><br>7kph EB | 27kph WB<br><br>6kph EB | 15kph WB<br><br>41kph EB | 15kph WB<br><br>41kph EB | 25kph WB<br><br>25kph EB | 25kph WB<br><br>25kph EB |

The targeted bus network enhancements have been developed to support the bus gate and bus retrofit solution and align with wider aspirations of the TCF to encourage a shift from private vehicles to public transport. The bus network enhancements are based on UK good practice coupled with local experience of what worked in previous Local Sustainable Transport Funds packages. The measures include improvements to bus stops and shelters, and real time bus passenger information and will be targeted on corridors where there are areas of exceedance/or areas approaching exceedance.

Table 1-11 and Figure 1-16 below illustrate the results of the $NO_2$ concentration modelling in 2022 on the local road network with the Preferred Option in place. Table 1-12 and Figure 1-17 illustrate the results of the $NO_2$ concentration modelling in 2022 on the SRN with the NSLAQP in place.

*Table 1-11: $NO_2$ concentrations on local road network (2022)*

| Location (local road network) | $NO_2$ concentration baseline ($\mu g/m^3$) | $NO_2$ concentration with Preferred Option ($\mu g/m^3$) |
|---|---|---|
| Victoria Road | 45.6 | 39.3 |
| A53 | 42.7 | 38.9 |
| Bucknall New Road | 42.2 | 39.4 |
| Quadrant Road/Town Road | 40.4 | 39.7 |

| | | |
|---|---|---|
| A5272 Chell Street | 40.0 | 38.8 |
| A527 Porthill Road | 39.8 | 39.8 |
| Lichfield St | 39.5 | 38.3 |

*Table 1-12: $NO_2$ concentrations on SRN (2022)*

| Location (SRN) | $NO_2$ concentration baseline ($\mu g/m^3$) | $NO_2$ concentration with Preferred Option ($\mu g/m^3$) |
|---|---|---|
| A500 | 53.2 | 53.5 |
| M6 J16 to 15 | 47.6 | 47.6 |
| A50 | 47.3 | 48.0 |

This data illustrates that the Preferred Option will reduce $NO_2$ concentrations across the local road network to achieve compliance.

*Figure 1-16: $NO_2$ concentration modelling on local road network in 2022 with Preferred Option*

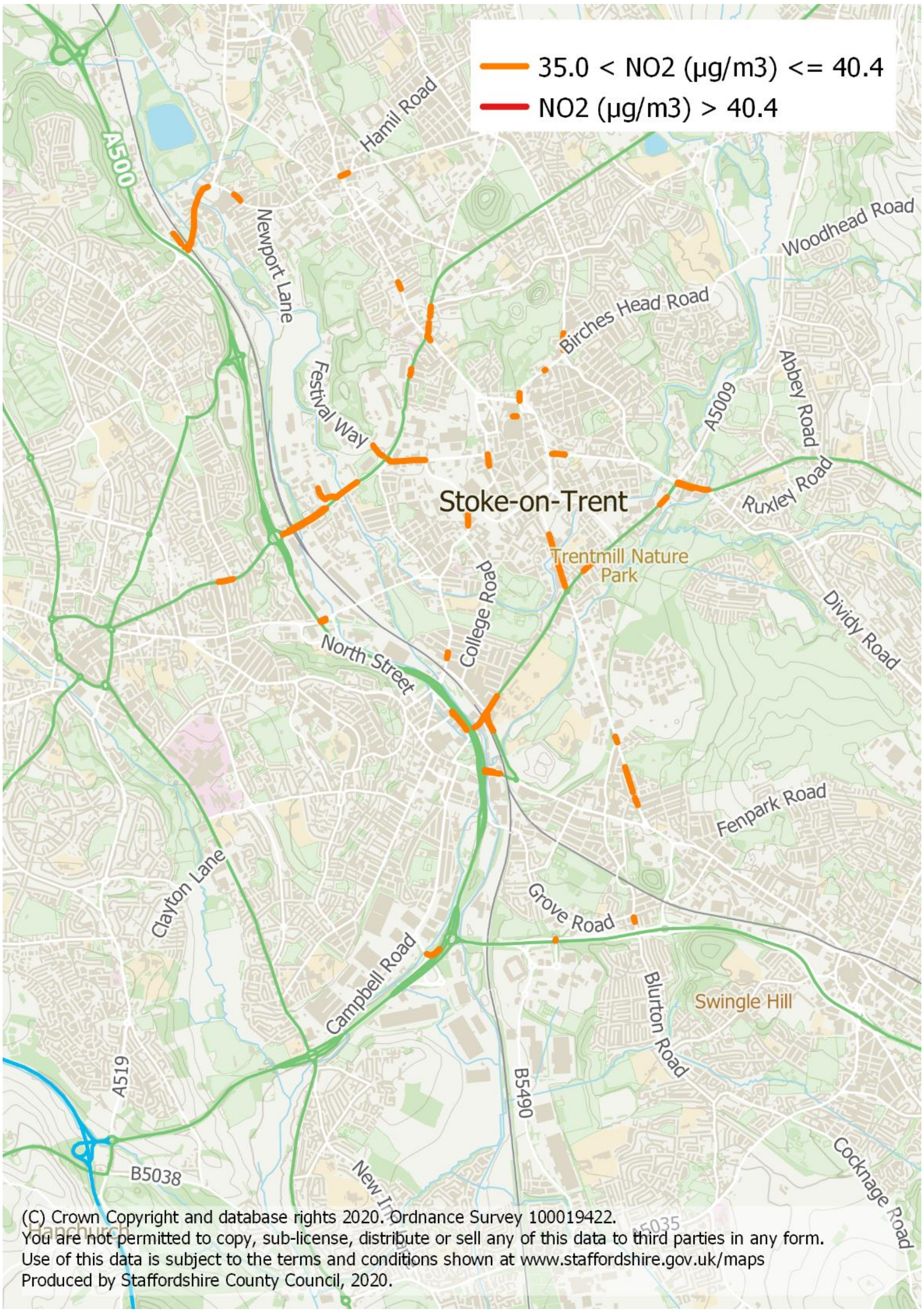
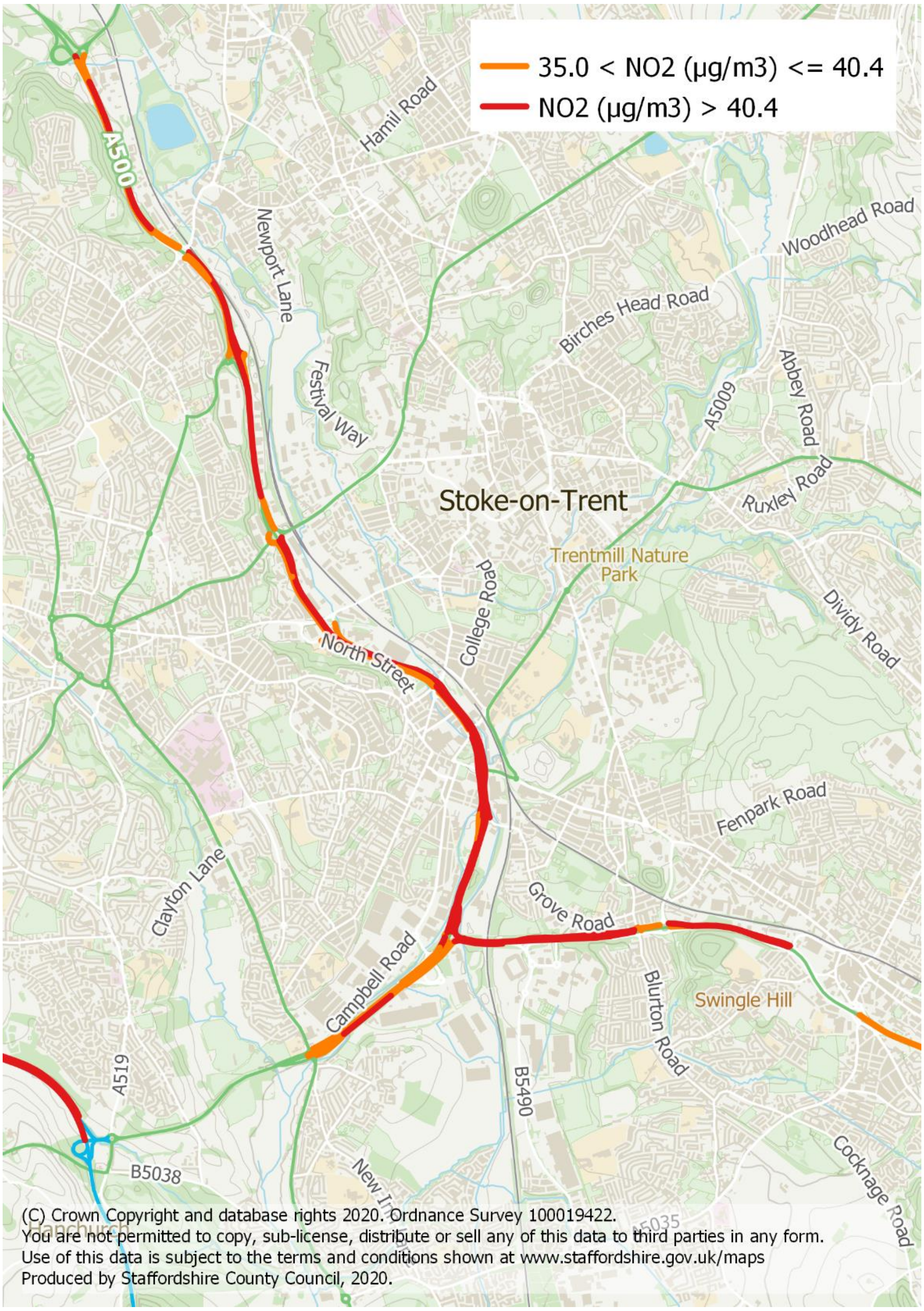


*Figure 1-17: $NO_2$ concentration modelling on SRN in 2022 with Preferred Option*



## 1.16 Stakeholder engagement

Stakeholder engagement is a key activity in successfully delivering the NSLAQP as discussed within the Management Case. The authorities' approach and strategy to engage stakeholders is focussed around five strands:

- Early engagement with key stakeholders
- Engagement with stakeholders as part of the stated preference survey work
- Developing a communication strategy and plan
- Stakeholder engagement survey
- Stakeholder consultation

### 1.16.1 Early engagement with stakeholders

During the OBC development process early engagement has taken place with key stakeholders to discuss and understand their attitudes towards the proposed scheme to help inform options and manage potential conflict. Specifically, meetings and discussions have been held with:

- Officers and Cabinet Members for SoTCC, NuLBC, and SCC
- Joint Air Quality Unit (JAQU)
- Highways England
- Local Partnerships
- Department for Transport (DfT)
- Department for Environment, Food & Rural Affairs (Defra)
- Transport operators
- Ambulance service
- Road haulage association
- University Hospital

Engagement with these key groups will continue as the project progresses and further engagement with other groups that are affected is planned to take place after the OBC is finalised.

### 1.16.2 Engagement as part of the stated preference survey work

To inform the development of the OBC it was identified that a programme of stated preference surveys would be required to help determine the local transport reactions and preferences to a charging CAZ. The surveys, across all vehicle types, were undertaken during September and early October 2019. These surveys involved direct engagement and dialogue with drivers, businesses, operators and associations to help understand the likely responses of local people to the introduction of a charging CAZ. The survey was covered via the Councils' own news channels and in local media.

Whilst the key objective of the surveys was to gather data and views, the surveys also helped to raise local understanding and awareness of the need for action, the potential plans and the work being undertaken. The results of the work have been used to influence various aspects of the options appraisal, including the sensitivity of travel demand to charging levels associated with a charging CAZ. A report summarising the stated preference survey work is attached as Appendix 1.

### 1.16.3 Developing a communications plan

A stakeholder management and communications plan has been developed to support the scheme through its development, implementation and delivery stages and is provided as Appendix 1. Due to the high-profile nature of the work, it is key that this plan is executed appropriately and effectively.

The aim of the Plan is to engage stakeholders, raise awareness and understanding of the NSLAQP and to minimise impacts of the scheme. Key objectives include:

- Delivering coordinated communications across the different authority areas to keep stakeholders informed and updated
- Promoting key health messages and the health reasoning for improving air quality
- Ensuring appropriate levels of engagement and consultation take place

Key aspects and tasks involved in the development of the Plan include:

- Stakeholder mapping and analysis to define stakeholder and public personae. These will be based on common attributes of the relevant groups to help the team understand stakeholders' needs, experiences, behaviours and goals and create a marketing and communication plan to target these.
- Analysis of existing Council websites, local news and related social media channels to establish any trends that can be used to support the ongoing development of the NSLAQP and communications plan. For example, understanding topics of greatest engagement, reviewing the impact of language used and considering how and when people engage.

Using this intelligence and understanding the approach to effective communication and engagement for the NSLAQP is based around two phases:

- Building an understanding of the key issues around air quality in Stoke-on-Trent and Newcastle-under-Lyme and why action is needed through open engagement (discussed further in section 1.16.4)
- Gathering feedback and opinion on the proposed options to address the air quality challenges in Stoke-on-Trent and Newcastle-under-Lyme through targeted consultation (discussed further in section 1.16.5)

### 1.16.4 Stakeholder engagement survey

To support the development of the OBC and find out how poor air quality affects the local community and measure awareness of the simple actions that can help improve air quality the three Councils launched an online air quality survey in February 2020. The survey was open until 30th April and anyone aged 16 or over who lives in, or travels to, Stoke-on-Trent or Newcastle-under-Lyme was invited to complete it.

A summary of the survey is attached as Appendix 5 – some of the headlines from the survey include:

- 459 respondents (27% work in Newcastle-under-Lyme and 39% work in Stoke-on-Trent)
- 33% are regular visitors to Newcastle-under-Lyme and 30% to Stoke-on-Trent
- 86% use a car when travelling to and through Newcastle-under-Lyme and Stoke-on-Trent
- 34% would generally describe the air quality in their local area as good, 46% would describe it as poor
- When considering the activities that respondents would be willing to do to improve air quality in their local area and reduce exposure to air pollution
    - 69% claim they would walk or cycle instead
    - 41% claim they would consider switching to a less polluting vehicle
    - 35% would consider using public transport
    - Only 7% would be willing to pay a charge to enter areas

As a result of the COVID-19 pandemic the survey results were lower than anticipated, therefore, the Councils are currently considering re-issuing the survey later in the year. However, these results help our understanding of stakeholder awareness, knowledge and perceptions about air quality and improvement methods and have been used to inform the development of the communications plan.

1.16.5 Stakeholder consultation

Following submission of the OBC, the work will focus on engaging and consulting on the measures set out in the NSLAQP. Analysis of this will then feed into finalising the plan as part of the FBC to ensure that it is deliverable and supported by key stakeholders. At present a total of four consultation events are planned to take place in central locations close to the affected sites, which will be easily accessible by the community.

The consultation events will be an opportunity for the Councils to understand how stakeholders feel about the chosen measures, and what support and information different stakeholder groups will require to help them adapt to any change/disruptions caused by implementation of the NSLAQP.

As a result of COVID-19 and the revised OBC submission timescales the timings for the delivery of the stakeholder consultation events is yet to be agreed but the intention is that the communications plan to be a live document that evolves as the communication activities take place with further detail provided at FBC.

In addition to wider consultation activities, the delivery of the NSLAQP involves the implementation of a TRO. As such, the Councils will follow appropriate statutory procedures to consult, advertise and make the Orders.

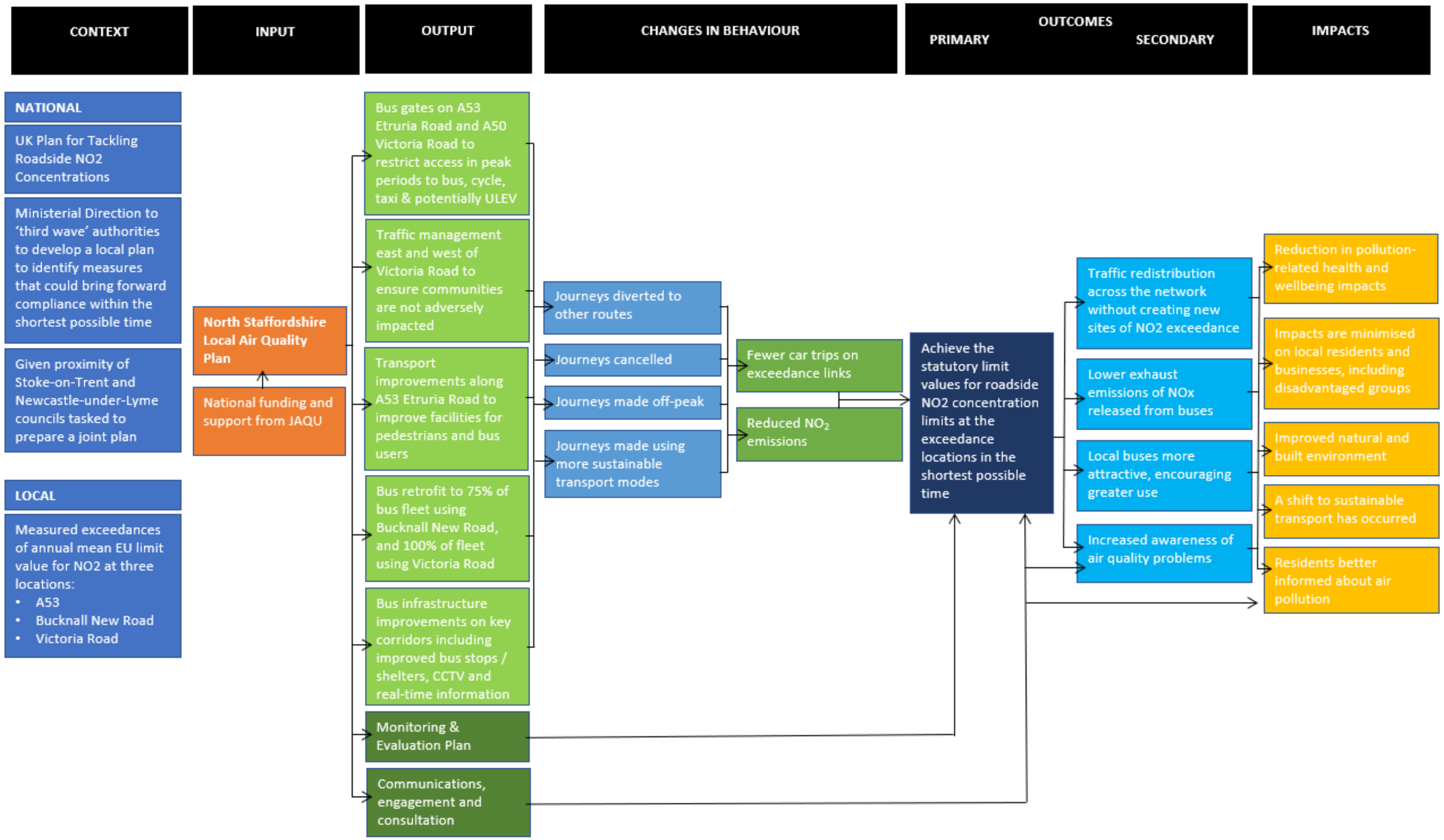
## 1.17 Benefits, risks, constraints, dependencies of the project

### 1.17.1 Benefits

A logic map is a systems-oriented approach to represent the 'theory of change' that underlies a policy. In summary, it relates to the introduction of inputs (such as resources and funding) which produce outputs (the proposed options) resulting in outcomes and then impacts, from which the benefits flow. The logic map, in Figure 1-18 below, sets out the change process which underpins the development of the OBC. The map demonstrates how the inputs, delivered through the timely receipt of funds from the Implementation Fund, will generate the outputs (the components of the preferred scheme that are delivered) that then drive a set of outcomes related to traffic and air quality objectives.

Achievement of these outcomes secures the desired impacts for the preferred scheme, which in terms of the project delivery relate to achieving and maintaining compliance with the Ministerial Direction and an improved awareness regarding air quality. These are closely aligned to the primary critical success factor and the secondary critical success factors. The success of the outputs in achieving the desired impacts is then confirmed through the monitoring and evaluation process (to be provided as a separate document with the final OBC). The more important and significant impacts on society relate to improved air quality and its consequences for public health and these are linked to the project impacts through the benefits assessment.

*Figure 1-18: Logic map*



The Ministerial Direction as a whole, aims to improve air quality which would ultimately improve health in the local area. The Preferred Option actions this Direction by achieving compliance at current sites of exceedance, as well as providing a range of quantifiable and non-quantifiable benefits. A more detailed assessment of these benefits is presented in the Economic Case.

*Table 1-13: Wider benefits resulting from the project*

| Benefit | Impacts |
|---|---|
| Health and well-being | The correlation between poor air quality and poor public health is noted in numerous studies. In 2013, the World Health Organisation's (WHO) International Agency for Research on Cancer (IARC) classified particulate matter (PM) as a cause of lung cancer. Other cardiovascular and respiratory diseases are also contributed to by air pollution, which can lead to premature deaths. Emerging evidence from the Royal College of Physicians (amongst others) indicates links with other adverse health effects including diabetes, cognitive decline and dementia, and effects on the unborn child.[11] Therefore, improving air quality can deliver improved health benefits, including:<br>• Reduced morbidity<br>• Reduced mortality<br>• Reduced public health expenditure<br>• Reduced absenteeism and therefore increased worker productivity<br>Road transport is responsible for 80% of $NO_2$ concentrations at the roadside and the growth in diesel cars has exacerbated this problem.[12] Defra and DfT have identified the need for local knowledge to aid finding a solution to the local air quality problems and so the NSLAQP focuses on removing higher polluting vehicles from the roads, such as non-compliant buses, as well as discouraging road travel during peak times. |
| Natural and Built Environment | Improvements in air quality can also lead to positive externalities associated with the natural and built environment, such as:<br>• Reduced impact on ecosystems<br>• Reduced impact on climate change<br>• Reduced damage to soil, crops and rivers<br>• Reduced impact on the local townscape |

[11] Royal College of Physicians - 'Every breath we take. The lifelong impact of air pollution' (2016)
[12] Defra & DfT – 'UK plan for tackling roadside nitrogen dioxide concentrations' (2017)

| | |
|---|---|
| Encourage a shift to sustainable transport | Restrictions on vehicle access along certain routes during peak times, and investment to improve bus infrastructure facilities will encourage a shift to public transport, specifically bus, as individuals seek to reach their destination in the most efficient and timely manner. Bus operators will benefit in the Preferred Option scenario as they will receive subsidies to upgrade and/or retrofit their vehicles, allowing them to continue to operate in the local areas. |
| Support local residents, businesses and disadvantaged groups | The Preferred Option has sought to minimise the impact on local people and businesses by not applying a charging CAZ and by providing enhanced public transport options. |
| Residents better informed about air pollution | The associated communications and engagement that will support the delivery of the measures will help to raise awareness of the problems caused by air pollution. |

1.17.2 Wider Policy Benefits

The improvement of air quality can have both direct and indirect impacts which can contribute to benefits for wider policies.

Vulnerable people, such as elderly people, children and people with pre-existing health conditions such as respiratory and cardiovascular conditions, are more likely to be seriously affected because of air pollution. Studies have suggested that the most deprived areas of Britain contain a disproportionate share of poor air quality.

The natural environment will also be affected as a result of air pollution. $NO_2$ contributes to acidification and eutrophication of soil and watercourses, which effects animal and plant life and biodiversity. $NO_2$ also impacts on local ozone production contributing to public health impacts, damages in agricultural crops, forests and plants. Cleaner air will lead to increased productivity through improvements in public health, leading to reduced workplace absence and effect the creation of an environment that is appealing to businesses and the public alike. Particulate matter, $NO_2$ and ozone were estimated to have had the total cost of up to £2.7 billion of productivity losses in the UK, 2012[13].

The reduction of petrol and diesel vehicles through innovative transport technologies and increasing active travel uptake, will improve air quality whilst positively impacting other policies. For example, some studies suggest that physical inactivity is associated with higher mortality rates than smoking. Due to the decline in petrol and diesel vehicles there should be a reduction in traffic congestion as more people walk, cycle or even use public transport, improving the health of the public as people become more active, relieving pressure on the healthcare sector.

[13] Clean Air Strategy, 2019, Defra

### 1.17.3 Risks

As well as there being a multitude of benefits, there are a number of risks that must also be taken into account. Three risk workshops were held in early 2020 to support a quantitative assessment of risk. Through this process the top risks associated with the NSLAQP have been identified – these are presented and discussed in further detail within the Management Case and identify how the Councils plan to manage and mitigate the risk.

The top five project risks identified are:

- Coronavirus results in change in national policy or leads to design, build and procurement delay
- Highways England require network upgrades to deliver capacity improvements on the SRN
- The public/businesses do not accept the proposals
- Data protection/GDPR issues arise
- Utility costs are higher than expected due to timescales and site access

### 1.17.4 Constraints

Constraints are aspects that are externally imposed and need to be identified and managed from the outset. For the NSLAQP the following constraints have been identified and considered in the preparation of this OBC:

**Physical constraints** – some physical constraints were identified when developing the Preferred Option, where highway boundaries, environmental landscapes or building lines prevent the implementation of some specific measures. These constraints were taken into consideration and alternative measures were developed in order to prevent any negative consequences resulting from the proposed scheme.

**Financial constraints** – the Councils do not have the resources to deliver the NSLAQP without funding support from the Government. For this reason, the delivery of the plan is dependent upon funding from the Government's Implementation Fund.

**Time-related constraints** – the Ministerial Direction requires compliance to be delivered within the shortest timeframe possible. This constricts the time that the local authorities have to plan, develop and implement a scheme. The Preferred Option is relatively simple and quick to procure and implement as discussed within the Commercial and Management Cases. The Preferred Option can be delivered in 2022, whereas the complexity associated with the charging CAZ would mean a CAZ would not be delivered until 2023. The local authorities are committed to developing a wider and more holistic strategy in the future, aligning with other local plans in the area, so that air quality and environmental issues continue to be mitigated against whilst bringing about an array of economic and social benefits as well.

**Planning and legal constraints** – the proposed measures that form the NSLAQP have been developed to be relatively straightforward to implement, without the need for complex or time-consuming planning or legal procedures.

**Stakeholder acceptability** – the Preferred Option has been developed based on early engagement and has a high degree of stakeholder acceptance compared to the Benchmark CAZ D option.

**Technological constraints** – the proposed scheme involves the retrofitting of some the existing bus fleet along key corridors. To ensure this is feasible, discussions have taken place with the bus operators during the development of the Preferred Option.

**Impacts on vulnerable groups** – distributional impacts have been considered within the study (as detailed within the Economic Case) as it was recognised that some measures could disproportionately negatively affect vulnerable population groups. The NSLAQP has been developed to minimise the potential negative impacts on vulnerable groups.

1.17.5 Dependencies

Dependencies are the actions or developments required of others that need to be considered where the ultimate success of the NSLAQP is dependent upon them. Two key dependencies have been identified:

- Decision making processes
- Other transport schemes

There is the potential for decision making processes to constrain the delivery of the programme, especially with multiple authorities and approval bodies involved. The delay in approvals could happen at both a local level (i.e. if there is a decision to review strategy) or at a national level (i.e. if there is a delay in funding being approved). The local authorities have taken steps to mitigate against this through robust project governance and frequent review of the project plan. Possible approvals delays have also been outlined in the risk register (as described in the Management Case).

The delivery and success of the NSLAQP is dependent on a variety of stakeholders, of which their support and engagement throughout the whole development and implementation process of the scheme is vital. Highways England is one of these key stakeholders, particularly as the A500 and A50, which is operated by Highways England, provides a strategic link through the middle of Stoke-on-Trent and Newcastle-under-Lyme. The A50 and A500 already experience significant levels of $NO_2$ concentrations and so any increase in traffic along these routes could exacerbate these issues.

The local authorities consider that the impacts of the Preferred Option on the SRN can be made acceptable with the potential for signing mitigation at the A50/A500 junction. This has not been included in the scheme costs but has been recognised in the risk register. The authorities have sought engagement with Highways England from an early phase in the feasibility study and since completion of the IES the project team and Highways England have begun to work collaboratively. Highways England are also working to develop their own proposals which should complement the Preferred Option. Future collaborative working is expected to involve the project team, Highways England, JAQU and DfT in order to reach an acceptable solution.

# 2 Economic Case

## 2.1 Introduction

The Economic Case outlines the work undertaken to assess and identify the optimum solution by considering the Value for Money (VfM) of each of the shortlisted options, and their evaluation against the critical success factors (CSF) aligned with the project.

The core stages of analysis included within this Economic Case are as follows:

1. Assessment of the CSFs in relation to this project
2. Review of the appropriateness and development of the options shortlisted within the Strategic Outline Case (SOC)
3. A Cost-Benefit Analysis (CBA) of the Benchmark and Preferred Option
4. A Distributional Impact Analysis of the Benchmark and Preferred Option

In October 2018, Stoke-on-Trent City Council (SoTCC) and Newcastle-under-Lyme Borough Council (NuLBC), who both have responsibility for environmental health, were issued a Ministerial Direction to produce a local air quality plan to address their respective nitrogen dioxide ($NO_2$) problems. Given their proximity to one another, they were tasked with producing a joint plan.

As the highway authority for the Newcastle-under-Lyme area, Staffordshire County Council (SCC) has been assisting the authorities and together, the three authorities have developed a plan to tackle $NO_2$ exceedances at the roadside – known as the North Staffordshire Local Air Quality Plan (NSLAQP).

The Economic Case supports the identification of the preferred scheme through the evaluation of the Net Present Value (NPV) of the shortlisted option, whilst ensuring that the preferred scheme continues to deliver compliance within the shortest timeframe possible.

This Economic Case intends to identify the optimum solution that brings about air quality compliance through an extensive analysis of the shortlisted options' costs, benefits and distributional impacts to different socio-economic groups.

## 2.2 Case for change

The need for change has been evident through the feasibility study and further strengthened through the air quality modelling outputs that detected and indicated three exceedance locations in the areas of Stoke-on-Trent and Newcastle-under-Lyme, as outlined in the Strategic Case.

The NSLAQP has been developed in order to meet the Ministerial Directions and deliver compliance, whilst underpinning the vision, aims and objectives of all three councils and ensuring at the same time that there are no unintended consequences resulting from the delivery of the preferred scheme.

The need to achieve compliance levels of $NO_2$ concentrations within the shortest timeframe possible was a key consideration during the options development process among other objectives that are of secondary importance.

## 2.3 Critical Success Factors (CSF)

The CSFs are the key objectives of which a project should be delivering to so as to ensure that the project brief is met and successful.

The primary CSF in this project, as outlined by the Ministerial Direction, is for both NuLBC and SoTCC to deliver a scheme that complies with $NO_2$ limits in the shortest timeframe possible. The options taken forward to the shortlist must pass the primary CSF test. Cost is only considered once the options are proven to be equally effective in achieving compliance in the shortest possible timeframe.

The secondary CSFs are considered where more than one option adhere to the primary pass/fail CSF. The secondary CSFs help determine which option might be optimal relative to other criteria. These factors are outlined in Table 2-1 below.

*Table 2-1: Secondary critical success factors*

| Secondary CSF | Description |
|---|---|
| Value for money | • Is the option economically advantageous and provides value for money?<br>• Does it minimise risks and uncertainties?<br>• Does it maximise benefits and minimises costs for Government, the local authority and wider society? |
| Distributional impacts | • Does the scheme significantly discriminate against specific groups in the society? |
| Strategic and wider air quality fit | • Does the scheme meet the primary air quality objective and support the longer-term requirement to maintain compliance? |
| Supply side capacity and capability | • Are there willing and capable suppliers to deliver all measures of the scheme? |
| Affordability | • Has the option got the potential to generate revenue which can be reinvested in the scheme to cover any ongoing costs in both the short and long term? |
| Achievability | • Can the measure bring forward compliance with the $NO_2$ objective?<br>• Can the measure be delivered given available local authority financial resources and skills?<br>• Is the measure likely to be delivered given available funding from Government?<br>• Have all the technical issues been resolved that could affect deliverability? |

## 2.4 Option identification

### 2.4.1 Long list assessment

The CSFs were applied to an initial long list of measures that were determined during the Feasibility Study and SOC stages in order to identify a shortlist of options to be taken forward to the Outline Business Case stage. The longlist of measures identified during the Feasibility

Study can be found in Appendix 6. The longlist of measures considered at SOC stage looked at the potential scope of the Preferred Option, the service solution options available and the delivery and funding routes. These measures included:

- City centre targeting commercial vehicles
- City centre targeting public transport/taxis
- City centre targeting private vehicles
- City centre targeting all vehicles
- Within council boundary targeting public transport/taxis
- Within council boundary targeting private vehicles
- Within council boundary targeting all vehicles
- Focusses around specific exceedance area targeting all vehicles
- Chargeable Access Restriction – Class A/B
- Chargeable Access Restriction – Class C/D
- Traffic management scheme ('Smart Traffic')
- Air Quality/Low Emission Strategy (LES)
- Employee parking strategy/priority parking
- Park & ride scheme
- Etruria Valley Link Road (EVLR) development
- A500 improvements
- Information campaign/improve driver awareness
- Business travel plans
- Freight consolidation centre

The longlist to shortlist sifting process considered the factors, as detailed in Table 2-2, that were used to refine and develop the shortlist of options to be taken forward to OBC stage.

*Table 2-2: Factors considered in the development of the shortlist of options*

| Considerations | Details |
|---|---|
| **Scope** | The Preferred Option needs to meet the requirements of the Ministerial Direction and deliver compliance in the shortest possible timeframe. |
| **Service solution** | The assessment reviewed the relative merits of the various technologies available in each option and their relative costs, ease of understanding and their potential to contribute to the objectives. |
| **Service delivery** | The assessment considered deliverability factors in relation to technical issues, time to deliver and risks associated with technology |

| | |
|---|---|
| | and enforcement. It considered internal and external resource requirements, dependencies, marketing, communication and stakeholder impacts. |
| **Implementation** | The assessment reviewed whether there would be contractors available and able to implement the scheme, whilst adhering to the shortest possible time requirement |
| **Funding** | The assessment considered the value for money of the options, particularly in relation to determining the best value way to deliver compliance in the shortest possible time. |

Considering the above factors, the SOC provided the following shorter list of options:

- A city centre/A53 chargeable access restriction (Class A/B)
- A city centre/A53 traffic management scheme, plus council boundary scale LES
- A city centre Workplace Parking Levy (WPL), plus council boundary scale LES
- A Council boundary scale WPL, plus council boundary scale LES
- Etruria Valley Link Road (EVLR) Project and A500 improvements, plus council boundary scale LES

Going forward, the above list was used as a starting point for the transport and air quality modelling for the OBC. However, following further air quality modelling, additional locations of $NO_2$ exceedance were identified, not only along the A53 corridor, but also on the A50 Victoria Road and Bucknall New Road.

The EVLR Project obtained planning permission in late 2019 and was therefore considered to form part of the future year reference case as a committed scheme, rather than being included in an option package.

The WPL was analysed using transport model data and Nottingham's WPL experience (the only such operational scheme) and concluded that very few non-compliant cars would be removed from the network on the basis of:

- The number of through trips
- The number of exemptions
- the number of employers that would cover the levy
- The number of employees that would pay the levy
- The single journey purpose policy focus

Further detail on this analysis can be found in Appendix 2. It should also be noted that there was no political support for such a measure and in the example of Nottingham, it has been used more as a revenue raising measure rather than a measure to remove non-compliant vehicles from the network.

### 2.4.2 Shortlist of Options

The optioneering process involved an initial options development workshop, which was attended by council members and officers from the three authorities, as well as various stakeholders and consultants. A SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis approach was used throughout the refinement of the longlist to shortlist in combination with the consideration of each of the CSFs.

Appendix 7 shows various tests that were carried out in the transport model only to test particular traffic management measures in isolation. Combining the results from these tests and discussions had at the options development workshop, Options 1-7 evolved, forming the shortlist of options (represented in Appendix 8).

The air quality modelling work found that the $NO_2$ exceedances along Victoria Road in particular, were being driven by all vehicle types. As a result, it was deemed that a class D CAZ would be the only charging solution that might be feasible. This CAZ D (also known as Option 1) has been identified as the benchmark option, as required by JAQU, against which the Preferred Option must be tested against for delivery of the primary CSF of achieving compliance in the shortest possible time. A CAZ C was also tested to see if a less stringent CAZ class would meet the primary CSF. However, this was not the case and the CAZ D was found to be the only CAZ class that achieved compliance. The CAZ D will form the default option if an alternative option cannot be found that delivers compliance in the shortest possible timeframe.

Following the air quality modelling, Option 3 and 4 were found to achieve compliance. Option 3 was discounted as it included a small CAZ boundary, which would not meet the primary CSF in being implemented in the shortest possible timeframe in comparison to Option 4.

Option 6 was developed as an extension of Option 4 and included additional complementary measures with the aim of mitigating against any negative distributional impacts that might arise as a result of the scheme. However, Option 6 did not bring about significant reductions in $NO_2$ compared with Option 4 and would also not prove to perform better than Option 4 against the secondary CSFs, namely:

- Value for money – the additional complementary measures would likely deliver few benefits to society for the relative additional cost
- Affordability – with fewer measures to implement that would continue to achieve compliance, proves Option 4 would be cheaper to implement

The most impacting and deliverable measures from Option 4 and 6 were collated to form Option 7, where elements were included to mitigate the impacts on vulnerable groups.

A further options workshop was held, following concerns raised by some Members and officers regarding the potential traffic impacts of Option 7. The workshop recommended amendments to Option 7 to further mitigate against any negative impacts that might arise from the scheme.

Consequently, the final shortlisted options taken forward for detailed economic appraisal are the benchmark charging CAZ D and a package of non-charging traffic management measures, Option 7, which will herein be referred to as the Preferred Option. Table 2-3 details the final shortlist of options.

*Table 2-3: Summary of the resulting shortlist of options*

| Option | Details |
|---|---|
| **Benchmark CAZ D** | Bounded area incorporating all areas of modelled $NO_2$ exceedances.<br><br>All non-compliant vehicles will be charged based on the vehicle type when entering or passing through this boundary.<br>• Car = £5<br>• Taxi = £5<br>• LGV = £9<br>• HGV = £35<br>• Bus = £5 |
| **Preferred Option** | • A50 Victoria Road bus gate, operational Monday to Friday between 07:00-10:00 and 16:00-19:00. ANPR cameras will be used to restrict access except for buses, taxis and cyclists.<br>• A53 Etruria Road two-lane bus gate, operational Monday to Friday between 07:00-10:00 and 16:00-19:00. ANPR cameras will be used to restrict access except for buses, taxis and cyclists.<br>• Traffic management measures on roads to the east and west of Victoria Road, including:<br>  ○ Traffic calming<br>  ○ One-way restrictions<br>  ○ Speed restrictions<br>  ○ Weight restrictions<br>  ○ Extension of footways<br>  ○ Carriageway re-surfacing<br>• Transport improvements along the A53 Etruria Road in the form of signalised pedestrian crossing facilities and the relocation of a bus stop to avoid unnecessary queuing.<br>• Targeted bus retrofit programme where 75% of buses using Bucknall New Road and 100% of buses using Victoria Road will be retrofitted to achieve Euro VI emissions standards.<br>• Bus infrastructure improvements will be installed on routes that pass through or are parallel to the identified exceedance locations. The improvements will include Real Time Passenger Information (RTPI) screens, new bus shelters, accessible kerbs at bus stops and installation of CCTV at bus stops.<br>An ultra-low emission vehicle (ULEV) exemption, allowing ULEVs to drive through the bus gate, will be assessed in the air quality model and if |

| | |
|---|---|
| | considered deliverable, will be added to the scheme in the Full Business Case (FBC). |

### 2.5 Economic appraisal methodology

#### 2.5.1 Overview of approach and assumptions

As stated in JAQU's Option Appraisal Guidance, only the shortlisted options that pass the primary and secondary CSFs will be accepted. The Preferred Option will result from an economic analysis that will assess the deliverability of the final shortlisted options in the shortest possible time, the NPV and the distributional impacts.

Transport modelling was undertaken using the North Staffordshire Multi-Modal (NSMM) transport model and air quality modelling was undertaken using the RapidAir model. Further details on how the transport and air quality modelling has been carried out can be found in the technical reports (T1-4 and AQ1-3). Outputs from the models were used in the economic assessment following both JAQU and TAG guidance.

It should be noted that:

- All impacts are presented in real terms in a 2018 price base year
- All impacts are discounted to 2019 by applying a discount factor of 3.5%
- All impacts are corrected to market prices
- All impacts are assessed over a 10-year appraisal period from 2022-2031.

The transport and air quality models have assessed 2022 as the opening year of both options, despite the Benchmark CAZ D later being found to not be deliverable until 2023 (see the Management Case for more details). As a result, the economic assessment undertaken has assumed both options' appraisal periods to be between 2022 and 2031, to remain in line with the modelling outputs and allow for direct comparison.

The technical reports (E1-3) should be referred to for more information on the full economic methodologies and results presented.

#### 2.5.2 Scope of economic impacts assessed

The implementation of a CAZ or a traffic management scheme will deliver a wide range of impacts that will be assessed either quantitively or qualitatively. The scope of impacts considered in this analysis are the following:

- Air quality emissions
- Greenhouse gas impacts
- Travel time impacts
- Fuel and Vehicle Operating Cost (VOC) impacts
- Indirect tax
- Welfare costs of trip cancellation
- Vehicle upgrades

- Bus improvements
- Implementation and operating costs
- Revenue
- Distributional impacts

## 2.6 Cost-benefit analysis

The headline results of the economic analysis are set out in the following sections. Costs have been presented as negative values and benefits are presented as positive values. Further details of the CBA can be found in the E1 Economic Methodology Report and E2 Economic Model.

### 2.6.1 Air quality impacts

Reducing air pollution emitted by road transport sources is a primary CSF of the Ministerial Direction. Table 2-4 shows the total reduction in $NO_x$ and $PM_{2.5}$ concentrations across all vehicles for both the Preferred Option and the Benchmark CAZ D compared with the Reference Case scenario.

*Table 2-4: Emissions savings compared to the Reference Case*

| Impact | Benchmark CAZ D | Preferred Option |
| --- | --- | --- |
| $NO_x$ change (annual tonnes/year) | -555 | -101 |
| $PM_{2.5}$ change (annual tonnes/year) | -35 | -3 |
| **Total air quality impacts (annual tonnes/year)** | **-590** | **-104** |

(Cumulative discounted impact (PV) from 2022-31)

The monetised impact of a change in $NO_x$ and $PM_{2.5}$ emissions due to the implementation of both options is presented in Table 2-5. The robust economic assessment methodology is set out extensively in the E1 report.

It is assumed that benefits reduce over time as the reference case experiences natural fleet renewal and gradually aligns with the impacts generated from implementing the options.

*Table 2-5: Monetised air pollutant impacts*

| Impact | Benchmark CAZ D | Preferred Option |
|---|---|---|
| $NO_x$ change | 8,543 | 1,534 |
| $PM_{2.5}$ change | 10,325 | 807 |
| **Total air quality impacts** | **18,868** | **2,341** |

(Cumulative discounted impact (PV) from 2022-31, 2018 prices, discounted to 2019, £000s)

As shown in Table 2-5, the Benchmark CAZ D charging scheme is expected to generate a significantly greater benefit of £18.9m over the ten-year appraisal period, while the Preferred Option generates a benefit of £2.3m.This is expected as the impacts of the Benchmark CAZ D on air quality are predicted to be significantly greater and more widespread than that of the Preferred Option, although both achieve $NO_2$ compliance levels as instructed by the Ministerial Direction.

For the purpose of the economic assessment it has been assumed that both options are implemented in 2022. However, as set out in the Management Case, the Benchmark CAZ D can only be implemented from 2023. Hence the Preferred Option in practice will deliver emissions reductions and associated health benefits sooner. By assuming the Benchmark CAZ D begins to deliver emissions reductions in 2022, the analysis overstates the size of the air pollution benefits associated with this option.

### 2.6.2 Greenhouse gas (GHG) impacts

The policies implemented in both options will affect, either directly or indirectly, on the travel patterns of the general population; this change of travel behaviour will consequently affect the levels of greenhouse gas emissions and specifically $CO_2$.

Changes to travel time and distance for both the Preferred Option and the benchmark CAZ will impact on the levels of greenhouse gas emissions.

With respect to the Benchmark CAZ D, in order for vehicle owners to avoid paying the charge imposed they might either:

- Upgrade their vehicle to compliant ones
- Change their route or potentially even their destination
- Shift to public transport, walking or cycling
- Cancel their trip altogether

The greenhouse gas emissions, as a result of this behavioural change, is expressed in monetary terms in Table 2-6. Changes in GHG emissions have been derived from Transport User Benefit Appraisal software (TUBA) for both the Preferred Option and the Benchmark CAZ D. In the case of the Benchmark CAZ D these results were combined with carbon values from BEIS' Green Book Supplementary Guidance to assess the impact on GHG emissions from vehicles being upgraded.

*Table 2-6: Monetised GHG impacts*

| Impact | Benchmark CAZ D | Preferred Option |
|---|---|---|
| Cumulative difference in $CO_2$ emissions 2022 - 2031 (£000s) | 5,346 | -518 |
| BEIS carbon prices 2022 – 2031 (£/tonne) | 3,103 | 0 |
| **GHG impacts (£000s)** | **8,449** | **-518** |

(Cumulative discounted impact (PV) from 2022-31, 2018 prices, discounted to 2019)

As the Preferred Option will likely lead to rerouting around the proposed bus gates but does not explicitly encourage upgrading to cleaner vehicles, it can be expected that the impact of GHGs is negative. This might be offset to an extent with a mode shift to bus travel through the bus infrastructure improvements that are proposed as of the Preferred Option.

On the other hand, the Benchmark CAZ D encourages vehicle upgrade due to the charge imposed and so it is expected that GHG emissions will drop and result in the significant monetised benefit as identified in Table 2-6 through cleaner vehicles operating in North Staffordshire.

### 2.6.3 Travel time impacts

The response of vehicle owners to change route or destination or shift their mode of transport will inevitably affect traffic volume and ultimately journey times in both scenarios.

Regarding the Preferred Option, changes in traffic flow levels can be expected as drivers reroute around the proposed bus gates. Some drivers may also shift to bus travel as a result of the bus network enhancements.

In response to a charging CAZ D, a proportion of vehicle owners are expected to upgrade their vehicles, whilst some might switch from a more polluting diesel-fuelled vehicle to petrol. Alternatively, some individuals might choose to change their route, cancel their trip or pay the imposed charge. This change in behaviour will likely impact traffic flow on selected routes in and around the CAZ boundary and as a result, journey times would be affected.

All of the aforementioned changes are captured using DfT's TUBA software. For the Preferred Option, TUBA represents 253 working days during the AM, inter-peak (IP) and PM periods which includes the peak-times when the bus gates would be in operation. In the case of the Benchmark CAZ D, TUBA analyses 24 hours in a day for 365 days in the year, which is representative of when the CAZ would be enforced.

Table 2-7 indicates the impact on travel time for transport users, expressed in monetary terms as per TAG guidance.

*Table 2-7: Travel time impacts*

| Impact | Benchmark CAZ D | Preferred Option |
|---|---|---|
| Travel time impacts | 32,989 | -48,261 |

(Cumulative discounted impact (PV) from 2022-31, 2018 prices, discounted to 2019, £000s)

As indicated in Table 2-7, the Preferred Option is expected to note an increase in journey times from the rerouting that results from the proposed peak-time bus gates. The Benchmark CAZ D reduces travel times as the daily charge imposed to non-compliant vehicle owners will reduce traffic congestion within the CAZ boundary.

However, it is important to note that this analysis does not include the implications of the CAZ charge and so these impacts would in fact represent disbenefits greater than that of the Preferred Option. The annualised cost to the user as a result of the CAZ charge is presented in Table 2-16.

### 2.6.4 Fuel and Vehicle Operating Cost (VOC) impacts

For the Preferred Option the rerouting of vehicles and possible shift to bus travel will impact on fuel consumption and VOC, such as tyre wear, maintenance and depreciation.

With the Benchmark CAZ D, it can be expected that some drivers will upgrade their vehicles to compliant vehicles, whilst others might switch to petrol-based vehicles as opposed to diesel-based vehicles as compliant petrol cars can be significantly older than compliant diesel cars and represent a cheaper upgrade. Others may reroute to avoid the charging boundary impacting on journey distances. As a result, changes to fuel consumption and VOC will occur.

These impacts are captured in TUBA and in the economic model of assessing the upgrading of vehicles. Fuel and non-fuel VOC impacts are expressed in monetary terms in Table 2-8. The Preferred Option leads to increased travel time whilst overall the Benchmark CAZ D results in reduced travel time. It should be noted that the negative impact of cancelled journeys within the Benchmark CAZ D scenario are assessed in section 2.6.6 welfare costs.

*Table 2-8: Fuel change and VOC impacts*

| Impact | Benchmark CAZ D | Preferred Option |
|---|---|---|
| Fuel VOC impacts | 2,356 | -4,991 |
| Non-fuel VOC impacts | 29,238 | -3,375 |

(Cumulative discounted impact (PV) from 2022-31, 2018 prices, discounted to 2019, £000s)

### 2.6.5 Indirect Tax

Changes in fuel consumption and expenditure, as discussed in the section above, will also impact on the indirect tax revenue paid by users in the form of fuel duty.

Indirect tax impacts have been estimated through TUBA and are expressed in monetary terms in Table 2-9.

*Table 2-9: Indirect tax impact*

| Impact | Benchmark CAZ D | Preferred Option |
|---|---|---|
| Indirect tax | 23,399 | -2,270 |

(2018 prices, discounted to 2019, £000s)

The higher proportion of indirect tax generated as a result of the Benchmark CAZ D follows the pattern of changes in travel time and is likely driven by the higher non-fuel VOC benefits as presented in the sections above.

### 2.6.6 Welfare costs of trip cancellation

The Preferred Option is not expected to result in the cancellation of any trips and so no loss of utility has been estimated.

On the other hand, the expected trip cancellation associated with the Benchmark CAZ D will adversely affect individuals' utility function since transport users will not be able to go to their preferred destination point. The welfare loss calculation takes into consideration a range of impacts associated with switching transport behaviour, not just the utility of making the trip but also the time required to travel, changes in fuel and operating costs as well as journey quality.

JAQU guidance states that the loss of utility is equal to half of the relevant CAZ charge as individuals will weigh up the cost of paying the charge against the monetary value of the journey purpose and where the journey value outweighs the CAZ charge then payment of the charge is expected.

Table 2-10 indicates the welfare loss resulting from the cancellation of trips in the Benchmark CAZ D scenario, expressed in monetary terms as per TAG.

*Table 2-10: Welfare loss due to trip cancellation*

| Impact | Benchmark CAZ D |
|---|---|
| Welfare loss – cancelled trips (vehicles/year) | 2,234,394 |
| **Welfare impacts of trip cancellation (£000s)** | **-27,047** |

(Cumulative discounted impact (PV) from 2022-31, 2018 prices, discounted to 201)

The consumer welfare loss is estimated to be approximately £27m in the Benchmark CAZ D scenario. This demonstrates that there is a significant loss in welfare to the user.

### 2.6.7 Vehicle upgrade

As a result of the Benchmark CAZ D some vehicle owners will respond to the CAZ charge by either scrapping or selling their non-compliant vehicle and buying a second-hand or new compliant vehicle. Table 2-11 presents the impacts associated with upgrading to compliant vehicles.

It should be noted that the measures in the Preferred Option do not explicitly encourage owners to upgrade their vehicles and so the Preferred Option has been excluded from the vehicle upgrade analysis since it will not generate significant impacts.

*Table 2-11: Vehicle upgrade impacts*

| Impact | Benchmark CAZ D |
|---|---|
| Vehicle upgrade | -26,399 |

(Cumulative discounted impact (PV) from 2022-31, 2018 prices, discounted to 2019, £000s)

### 2.6.8 Bus infrastructure improvements

The Preferred Option includes a range of bus infrastructure improvements involving the following:

- Real time passenger information (RTPI) at bus shelters
- Addition of new shelters
- Accessible kerbs at bus stops
- CCTV at bus shelters

The aforementioned interventions have been appraised as part of the economic assessment and a summary is presented in Table 2-12. The total NPV for these improvements has been calculated and presented in more detail in the E1 report. The Benchmark CAZ D does not include any specific bus infrastructure improvements and so has not been included in this assessment.

*Table 2-12: Bus infrastructure impacts*

| Impact | Preferred Option |
|---|---|
| Bus infrastructure improvement | 34,844 |

(Cumulative discounted impact (PV) from 2022-31, 2018 prices, discounted to 2019, £000s)

The bus infrastructure improvements will generate a benefit of £34.8m which relate to improved journey quality, security and accessibility. The specific benefits associated with these improvements are discussed in more detail throughout the E3 Distributional Impact Analysis.

Bus retrofitting also forms part of the Preferred Option, in particular along Bucknall New Road and Victoria Road, where 75% and 100% of buses, respectively, will be retrofitted. These impacts are presented in Table 2-13.

*Table 2-13: Bus retrofitting impacts*

| Impact | Preferred Option |
|---|---|
| Bus retrofitting | -773 |

(Cumulative discounted impact (PV) from 2022-31, 2018 prices, discounted to 2019, £000s)

Bus retrofitting delays the purchase of new vehicles meaning that older vehicles will be in operation for longer. This would reduce the costs associated with vehicle upgrade but would subsequently increase fuel and non-fuel VOCs that accompany older vehicles. Whilst the bus retrofitting measures appears as an overall disbenefit, the benefits derived from this measure can be captured in the air quality assessment through the use of cleaner buses in the short-term.

### 2.6.9 Revenue

#### *2.6.9.1 Preferred Option*

The Preferred Option is not directly associated with the generation of revenue, however some revenue is likely to be received due to enforcement activity associated with the two bus gates. Table 2-14 forecasts the predicted revenue associated with Penalty Charge Notices (PCNs) based on currently enforced bus gates within North Staffordshire.

Adjustments have been made to account for the times of operation which the proposed bus gates will be enforced. It has also been acknowledged that existing bus gates do not have the communications and engagement support that will accompany the Preferred Option and so contraventions of the proposed bus gates are likely to be lower. There is likely to be a spike in PCNs issued following the opening of the new bus gates, however, this may not necessarily result in additional revenue as there may also be a higher rate of appeal to PCNs in the initial few months of the scheme. This trend is likely to drop off significantly after the first year of operation as drivers acclimatise to the bus gate restrictions and so any revenue generated from PCNs is likely to be limited in the medium to longer term. Charge levels are fixed and were set by Central Government in 2008, therefore adjustments for inflation have not been applied. It is therefore assumed that income from the bus gates will remain constant after the first year of operation.

At this stage, the cost to the user is assumed to be equal to the revenue generated to government.

*Table 2-14: Bus gate revenue through PCNs*

| Year | Bus gate income |
|---|---|
| **2022** | £87 |
| **2023** | £40 |
| **2024** | £39 |
| **2025** | £38 |
| **2026** | £36 |
| **2027** | £35 |
| **2028** | £34 |
| **2029** | £33 |
| **2030** | £32 |
| **2031** | £31 |
| **Total** | **£404** |

(2018 prices, discounted to 2019, in market prices, £000s)

#### *2.6.9.2 Benchmark CAZ D*

The Benchmark CAZ D includes a bounded area where charges will be levied on all non-compliant vehicle types. Through the ten-year appraisal period it is expected that due to the greater amount of non-compliant vehicles in the early years of the project's implementation, the revenue generated from these charges will be high, with a gradual decline over time as more and more vehicle owners upgrade their vehicles. It has been assumed that revenue in the year 2031 will be £0 as this is when decommissioning will commence.

The total estimated revenue generated to both local and Central Government from the charging CAZ D is represented in Table 2-15. It should be noted that 20% of this revenue will be taken by Central Government to pay for the Central CAZ Service. The remaining 80% will be revenue out of which the significant CAZ operating costs will need to be paid.

*Table 2-15: CAZ D revenue to the government*

| | Car Business | Car Commuting | Car Other | Taxi | LGV Personal | LGV Freight | HGV | Buses | Total |
|---|---|---|---|---|---|---|---|---|---|
| **2022** | £1,327 | £7,035 | £16,840 | £7 | £2,030 | £12,965 | £1,935 | £151 | **£42,290** |
| **2023** | £1,158 | £6,139 | £14,695 | £7 | £1,839 | £11,748 | £1,408 | £122 | **£37,117** |
| **2024** | £999 | £5,295 | £12,676 | £6 | £1,660 | £10,599 | £915 | £95 | **£32,246** |
| **2025** | £849 | £4,502 | £10,777 | £6 | £1,490 | £9,515 | £453 | £69 | **£27,661** |
| **2026** | £684 | £3,625 | £8,677 | £5 | £1,199 | £7,661 | £365 | £56 | **£22,272** |
| **2027** | £529 | £2,802 | £6,707 | £4 | £927 | £5,921 | £282 | £43 | **£17,215** |
| **2028** | £383 | £2,030 | £4,860 | £3 | £672 | £4,291 | £204 | £31 | **£12,475** |
| **2029** | £247 | £1,308 | £3,131 | £2 | £433 | £2,764 | £132 | £20 | **£8,035** |
| **2030** | £119 | £632 | £1,512 | £1 | £209 | £1,335 | £64 | £10 | **£3,882** |
| **2031** | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | **£0** |

(Cumulative discounted impact (PV) from 2022-31, 2018 prices, discounted to 2019, in market prices, £000s)

The cost of the CAZ charge to the user differs from the revenue generated to the government as it is expected that the local authorities will pay a fee to process card payments. Further details on how the resultant CAZ revenue was derived can be found in the E1 report. The cost of the charge to the user can be seen in Table 2-16.

*Table 2-16: Benchmark CAZ D cost to the user*

| | Car Business | Car Commuting | Car Other | Taxi | LGV Personal | LGV Freight | HGV | Buses | Total |
|---|---|---|---|---|---|---|---|---|---|
| **2022** | £1,354 | £7,166 | £17,153 | £8 | £2,058 | £13,160 | £1,951 | £155 | **£43,004** |
| **2023** | £1,182 | £6,253 | £14,969 | £7 | £1,865 | £11,925 | £1,420 | £125 | **£37,745** |
| **2024** | £1,019 | £5,394 | £12,913 | £6 | £1,682 | £10,759 | £922 | £97 | **£32,793** |
| **2025** | £867 | £4,586 | £10,978 | £6 | £1,510 | £9,658 | £457 | £71 | **£28,133** |
| **2026** | £698 | £3,692 | £8,839 | £5 | £1,216 | £7,776 | £368 | £57 | **£22,651** |
| **2027** | £539 | £2,854 | £6,832 | £4 | £940 | £6,010 | £284 | £44 | **£17,508** |
| **2028** | £391 | £2,068 | £4,951 | £3 | £681 | £4,355 | £206 | £32 | **£12,687** |
| **2029** | £252 | £1,332 | £3,189 | £2 | £439 | £2,805 | £133 | £21 | **£8,172** |
| **2030** | £122 | £644 | £1,541 | £1 | £212 | £1,355 | £64 | £10 | **£3,948** |
| **2031** | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | **£0** |

(Cumulative discounted impact (PV) from 2022-31, 2018 prices, discounted to 2019, in market prices, £000s)

## 2.7 Implementation costs

The implementation costs of each option are indicated in Table 2-17. These are the total costs over the 10-year appraisal period and are inclusive of risk, contingency and optimism bias. These elements are discussed in more detail in sections 2.10 and 2.11.

A further breakdown of the costs can be found in the Financial Model in Appendix 11 and 12.

*Table 2-17: Implementation costs*

| Cost component | Benchmark CAZ D | Preferred Option |
|---|---|---|
| Total implementation cost | -198,561 | -14,482 |

(Cumulative discounted impact (PV) from 2022-31, 2018 prices, discounted to 2019, £000s)

The capital and operating costs are significantly lower under the Preferred Option compared to the Benchmark CAZ D, accounting for £14.5m and £198.6m respectively.

## 2.8 Comparing the options

An NPV has been generated for both schemes through the combination of their associated costs and benefits. A positive NPV indicates that the scheme would bring about various benefits, whilst a negative NPV is associated with disbenefits. Table 2-18 and Table 2-19 indicate the NPV for the Preferred Option and the Benchmark CAZ D, respectively. Figure 2-1 provides a diagrammatic summary of the NPVs for both options.

*Table 2-18: Preferred Option NPV*

| Impact to the user | Preferred Option |
|---|---|
| Air quality | 2,341 |
| Greenhouse gases | -518 |
| Travel time | -48,261 |
| Fuel and non-fuel VOC | -8,366 |
| Indirect tax | -2,270 |
| Bus improvements | 34,071 |
| Bus gate cost to user | -404 |
| | |
| **Impact to the government** | |
| Indirect tax (wider public finances) | 2,270 |
| Bus gate revenue to government | 404 |
| Implementation costs | -14,482 |
| | |
| **NPV** | **-35,215** |

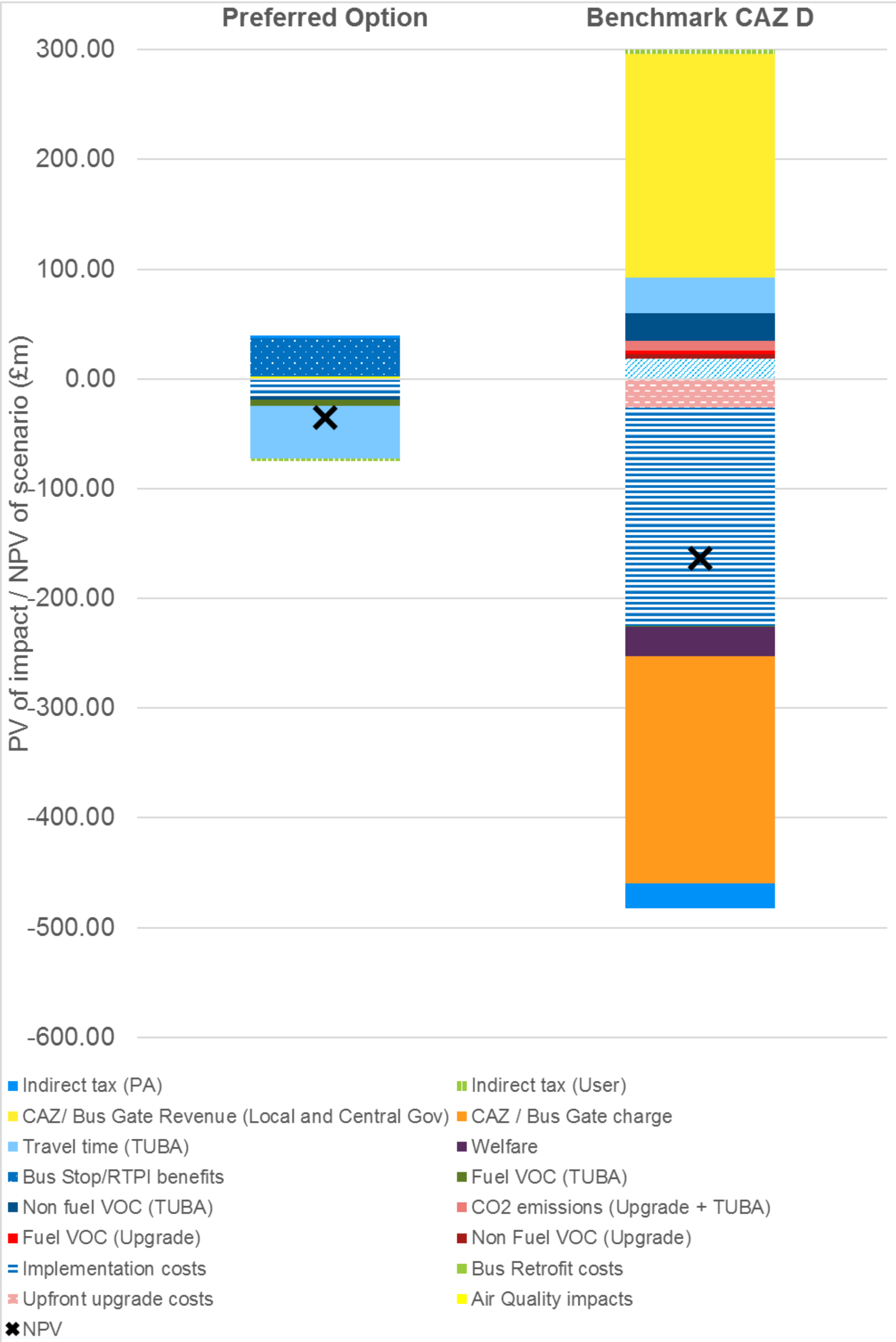
Notes: +ve values denote revenue; -ve values denote a cost
(Cumulative discounted impact (PV) from 2022-31, 2018 prices, discounted to 2019, £000s)

*Table 2-19: Benchmark CAZ D NPV*

| Impact to the user | Benchmark CAZ D |
|---|---|
| Air quality | 18,868 |
| Greenhouse gases | 8,449 |
| Travel time | 32,989 |
| Fuel and non-fuel VOC | 31,593 |
| Indirect tax | 23,399 |
| Welfare | -27,047 |
| Vehicle upgrade | -26,399 |
| CAZ charge cost to user | -206,641 |
| | |
| **Impact to the government** | |
| Indirect tax (wider public finances) | -23,399 |
| CAZ charge revenue to government | 203,191 |
| Implementation costs | -198,561 |
| | |
| **NPV (£000s)** | **-163,557** |

Notes: +ve values denote revenue; -ve values denote a cost
(Cumulative discounted impact (PV) from 2022-31, 2018 prices, discounted to 2019, £000s)

*Figure 2-1: NPV for the Preferred Option and the Benchmark CAZ D*



From an economic perspective, the Preferred Option performs better than the Benchmark CAZ D, where the Preferred Option has a significantly less NPV of -£35.2m compared to -£163.6m for the Benchmark CAZ D. The negative NPVs imply that the costs outweigh the benefits in both cases.

Although the Benchmark CAZ D is expected to deliver greater improvements in air quality than the Preferred Option, these benefits are outweighed by its significantly higher implementation and operating costs. Therefore, in relation to the secondary CSF of presenting value for money, it can be noted that the Preferred Option delivers this over the Benchmark CAZ D.

## 2.9 Non-quantifiable impacts

### 2.9.1 Wider impacts

Due to limitations in data and methodologies available, it was not possible to assess some impacts quantitatively, as so the following impacts have instead been assessed qualitatively:

- Air quality impacts outside of the modelling domain
- Active travel benefits
- Noise
- Accidents

It was found that both options will deliver additional air quality emission reductions outside of the modelling domain. The impacts in the Benchmark CAZ D are likely to have greater significance, both positively and negatively on the current assessment of air quality.

The impacts of active travel on both the Preferred Option and Benchmark CAZ D are likely to be limited as neither option directly incentivises modal shift towards active travel. It may in fact be a fallout from the improvements to bus infrastructure in the Preferred Option where private car users might shift to bus travel, which often is accompanied by additional walking to form the full journey.

Noise benefits might occur as a result of the reduction in traffic flow, particularly along the bus gate routes and within the CAZ boundary. However, this might be offset through noise disbenefits occurring in areas where traffic is rerouting through. There may also be a similar impact to the level of accidents in the North Staffordshire area. The impacts on noise and accidents are unlikely to be significant in light of a full impact assessment. Further details of these assessments can be found in the E1 and E3 reports.

Additional impacts were identified for the Benchmark CAZ D but were deemed less significant to be taken forward to full assessment. These included transaction costs and welfare loss associated with upgrading vehicles.

The full qualitative assessment can be found in the E1 report.

## 2.10 Risks and uncertainties

Economic modelling approximates the real world and assumptions are used to calculate future costs and benefits. Naturally, there will be uncertainties involving the validity of these assumptions, as well as those that are incorporated in the transport and air quality models, where the outputs form the basis of much of the economic appraisal. Using data from areas outside of North Staffordshire to form assumptions or even using expert judgement where no data is available, are potential sources where uncertainty might arise.

A Quantitative Risk Assessment (QRA) has been undertaken to identify and cost for any possible risks to the project, for both the Preferred Option and the Benchmark CAZ D. The key risks to the project are based around:

- Deliverability
- Political acceptance
- Cost uncertainties

Three risk workshops were held and focussed on the identification of risks, mitigation of risks and the quantification of the risks. Risks were quantified based on the assumed cost to the project that would incur if the risk were to be realised. As a result, a quantified risk layer has been calculated and incorporated into the economic cost-benefit analysis. See the Management Case for further information on the QRA.

### 2.11 Optimism bias

Optimism bias (OB) should be applied to account for human’s tendency to favour optimism, more specifically, where scheme costs and delivery time may be underestimated.

OB has been applied following TAG guidance. For the road infrastructure based elements of both options, an OB level of 15% has been assigned which is applicable to standard engineering scheme elements at OBC stage. For other equipment and development projects, as defined in the Green Book, an OB of 105% has been assigned to the elements of which this relates, taken as a midpoint between the lower and upper bounds that are suggested in the guidance. In this instance this relates to the IT elements of the schemes.

A sensitivity test adjusting the OB upper and lower bounds has been conducted. More details on this can be found in the section below and in the E1 report.

### 2.12 Sensitivity tests

Sensitivity tests have been undertaken to test the impact of altering assumptions underpinning the economic appraisal. The analysis involves developing lower and upper bounds for significant assumptions and input values used in the economic appraisal. The following sensitivity tests have been undertaken:

- Behavioural responses to a charging zone through a 0% vehicle upgrade scenario in face of a CAZ D
- Damage costs
- Carbon prices
- Welfare costs – associated only with the CAZ D option
- Scrappage cost and vehicle upgrade impact – associated only with the CAZ D option
- Optimism bias

The full sensitivity test assessments can be found in the E1 report and the E2 economic model.

Table 2-20 and Table 2-21 provide a summary output of the sensitivity tests undertaken for the Preferred Option and the Benchmark CAZ D respectively. The analysis demonstrates that both options are sensitive to the assumptions. However, the sensitivity tests demonstrate that uncertainty around parameters does not influence the relative comparison of the options in terms of NPV.

*Table 2-20: Preferred Option sensitivity tests – NPV*

| Area of uncertainty | Description | Low | Central | High |
|---|---|---|---|---|
| **Damage cost** | Lower and upper bound damage costs from UK AQ damage cost update 2019 | -37.25 | -35.22 | -29.15 |
| **Carbon price** | BEIS low/high assumptions | -34.92 | -35.22 | -35.51 |
| **Optimism bias** | For non-IT elements: low (3%), central (15%) and high (44%)<br><br>For IT elements: low (10%), central (105%) and high (200%) | -33.69 | -35.22 | -38.87 |

(2018 prices, discounted to 2019, £m)

*Table 2-21: Benchmark CAZ D sensitivity tests - NPV*

| Area of uncertainty | Description | Low | Central | High |
|---|---|---|---|---|
| **Behavioural response** | Vehicle upgrade is assumed to be zero | - | -163.56 | -115.88 |
| **Damage cost** | Lower and upper bound damage costs from UK AQ damage cost update 2019 | -179.53 | -163.56 | -117.62 |
| **Carbon price** | BEIS low/high assumptions | -160.12 | -163.56 | -158.99 |
| **Welfare cost** | Low (0%), central (50%) and high (100%) | -136.51 | -163.56 | -190.60 |
| **Scrappage cost and vehicle upgrade impact** | Low (20%), central (25%) and high (30%) | -155.06 | -163.56 | -178.16 |
| **Optimism bias** | For non-IT elements: low (3%), central (15%) and high (44%)<br><br>For IT elements: low (10%), central (105%) and high (200%) | -87.13 | -163.56 | -246.40 |

(2018 prices, discounted to 2019, £m)

## 2.13 Distributional analysis

The objective of the Distributional Impact (DI) Assessment is to identify how the benefits and costs are distributed among different groups, either from a social or economic perspective.

The DI appraisal consists of the following key indicators

- Air quality
- Affordability for businesses
- User benefits
- Personal affordability
- Accidents
- Noise
- Accessibility
- Severance
- Security

The DI process involves the following stages as shown in Table 2-21. The full detailed analysis of the DI assessment can be found in the E3 report.

*Table 2-21: DI assessment process*

| Step | | Description | Output |
|---|---|---|---|
| **Screening** | 1 | Identification of likely impacts for each indicator. | Screening proforma |
| **Full appraisal** | 2 | Assessment:<br>• Confirmation of the area impacted by the transport intervention (impact area)<br>• Identification of social groups in the impact area (including transport users, people living in those areas affected by the scheme and people travelling in areas affected by the scheme)<br>• Identification of amenities in the impact area | DIs social groups statistics and amenities affected within the impact area. |
| | 3 | Appraisal of impacts:<br>• Core analysis of the impacts (including providing an assessment score for each indicator based on a seven-point scale – large beneficial to large adverse) | Appraisal tables |

### 2.13.1 Air quality

The air quality assessment was carried out quantitatively and was undertaken to determine the change in $NO_2$ emissions by Lower Super Output Area (LSOA) for both options. The analysis was undertaken for each income quintile and for vulnerable groups, in particular the low-income population, youngest (under 16) and elderly (over 65).

#### *2.13.1.1 Preferred Option*

The Preferred Option provides an overall improvement in air quality most notably within the central impact area. This is to be expected as the measures proposed as part of the Preferred Option target the A53 Etruria Road, Bucknall New Road and the A500 Victoria Road, all of which fall within the central impact area. Beyond the central impact area, the majority of LSOAs observe a slight improvement in air quality following scheme implementation, with a few LSOAs, predominantly situated adjacent to the A500, noting a small worsening in air quality. The extent of this impact is negligible in comparison to the 2022 Reference Case.

The Preferred Option reduces the impacts of air quality across all sensitive receptors tested, in particular, nurseries, playgrounds, public open spaces and nature reserves. The analysis suggests that there will be a disproportionate benefit for more deprived areas and areas with higher numbers of children. All in all, the Preferred Option is expected to deliver positive impacts in air quality, whilst in fact benefiting particular vulnerable groups.

##### *2.13.1.2 Benchmark CAZ D*

The Benchmark CAZ D shows a more significant improvement in air quality. It too notes a greater change within the central impact area than compared to across the wider North Staffordshire area. With the introduction of the charging zone, non-compliant vehicles are likely to be discouraged from entering the charging zone, which covers the same area as the central impact area. Again, air quality improvements across the wider area is not of any great magnitude in comparison to the 2022 Reference Case.

The Benchmark CAZ D reduces the impact of air pollution across all sensitive receptors, specifically for residential education. This is a result of both Staffordshire University and Keele University being positively impacted from the scheme. The analysis suggests that the Benchmark CAZ D will not have a disproportionate impact on any vulnerable group although it can be noted that benefits might be greater for more deprived areas and areas with higher numbers of children.

##### *2.13.1.3 Summary assessment*

The analysis has revealed that both the Benchmark CAZ D and the Preferred Option will generate a positive distributional effect in terms of air quality. The most deprived areas, as well as the areas with the higher proportion of children, will experience the greatest benefits under both options. The Benchmark CAZ D is expected to generate a greater magnitude of benefits than the Preferred Option.

Table 2-22 summarises the distributional impacts of air quality as a result of the Benchmark CAZ D and Preferred Option.

*Table 2-22: Air quality – summary assessment*

| Impact | Benchmark CAZ D | Preferred Option |
|---|---|---|
| Air quality | ✓✓ | ✓✓ |

✓✓✓: *Large beneficial*, ✓✓: *Moderate beneficial*, ✓:*Slight beneficial*, -: *Neutral*, ×: *Slight adverse*, ××: *Moderate adverse*, ×××: *Large adverse*

#### 2.13.2 Affordability for businesses

Analysis undertaken to assess affordability for businesses is primarily a qualitative assessment of the perceived impacts to businesses. Where possible, data has been included to support the assessment and conclusions. However, given the complex responses by businesses and the myriad of other factors that will impact their decisions, businesses' responses cannot be certain.

##### *2.13.2.1 Preferred Option*

The measures proposed in the Preferred Option does not place a direct cost on vehicle owners although businesses are likely to be affected through having to reroute around the peak-time bus gates. This rerouting is likely to have a small adverse impact on businesses' vehicle operating costs through increased fuel and non-fuel related costs.

The main impact from the Preferred Option might be felt by businesses based in Fenton Industrial Estate accessing from the south during the peak periods when the bus gate is in operation. However, this would represent a small proportion of all businesses within North Staffordshire and should not have a significant impact on affordability for businesses.

The only business type to see any direct impact are bus operators. Measures to encourage the use of buses, such as RTPI and retrofitted buses are expected to have a positive impact on bus patronage.

#### *2.13.2.2 Benchmark CAZ D*

The Benchmark CAZ D would significantly impact all businesses based within the charging area, the immediate surrounding area, and North Staffordshire as a whole. Those that rely on vehicles to move goods and services would be most affected as an introduction of a charge would increase businesses' costs. In order to avoid paying the CAZ charge, businesses will need to upgrade their vehicle to a compliant standard or adopt another approach such as altering their supply routes or supplier, relocating their business or exiting the market altogether. All behavioural responses will carry some burden to the business.

HGV and LGV vehicle types are most significantly impacted under the Benchmark CAZ D primarily due to the higher charge imposed and the higher cost of purchasing a compliant vehicle.

Micro and small businesses are also likely to be at greater risk from the implementation of the Benchmark CAZ D as they are less likely to have the available capital to purchase a compliant vehicle, they do not have large fleets where non-compliant vehicles could be redistributed to operate in areas outside of the CAZ boundary, and they are more likely to have locally-focused operations therefore facing the charge more frequently. This is of significant important in North Staffordshire as 92% of all businesses based within the CAZ boundary are classified as micro or small businesses.

Taxi drivers are noted to be some of the poorest in the community and so any additional cost to their operation would place further strain on their businesses and families.

It is anticipated that there will only be a limited impact on bus operators as the CAZ charge has been purposely set at a level where the charge can be absorbed by the bus operators to avoid any further withdrawals of operators from the North Staffordshire area.

Not only does the charge impose a direct cost on businesses but the subsequent rerouting around the charging zone could also impact their fuel and non-fuel VOCs. This impact is examined more thoroughly in the cost-benefit analysis.

#### *2.13.2.3 Summary assessment*

With the Benchmark CAZ D imposing direct costs to businesses through the introduction of a charge, it is apparent that the impact of the Preferred Option on business affordability is less. Micro and small businesses face a greater risk under the Benchmark CAZ D as the Preferred Option does not discriminate against vehicle age or type. The costs of rerouting to businesses under the Preferred Option are smaller than potential costs and induced behavioural changes imposed under the Benchmark CAZ D, Table 2-23 summarises these impacts.

*Table 2-23: Affordability for businesses – summary assessment*

| Impact | Benchmark CAZ D | Preferred Option |
|---|---|---|
| Affordability for businesses | XX | X |

*✓✓✓: Large beneficial, ✓✓: Moderate beneficial, ✓:Slight beneficial, -: Neutral, ×: Slight adverse, ××: Moderate adverse, ×××: Large adverse*

### 2.13.3 User benefits

Results from TUBA have been used in the distributional assessment of user benefits, focussing on time benefits, VOCs, indirect tax and user charges at an LSOA level. Both the Preferred Option and Benchmark CAZ D are anticipated to significantly impact on traffic flows and as such, user benefits are an important consideration in this distributional analysis.

#### *2.13.3.1 Preferred Option*

Under the Preferred Option, the operation of peak period bus gates on Victoria Road and Etruria Road will lead to a mixture of improved and longer travel times. Whilst journeys that would otherwise utilise the bus gates are likely to be longer, it may be that journeys utilising adjacent routes make journey time savings due to reductions in overall traffic.

This user benefit analysis focussed on AM and inter-peak (IP) trips for cars and LGVs only. As a result, a more negative assessment under the Preferred Option may have been observed due to the one-way bus gate restrictions not being captured in the PM period. Nonetheless, the analysis noted a moderate adverse impact across all quintiles and so no specific distributional effect is experienced. Considering the size of impact however, the reduction in user benefits will be greatest for the most deprived households.

#### *2.13.3.2 Benchmark CAZ D*

The population predicted to disbenefit the most from the implementation of the Benchmark CAZ D lives within the CAZ boundary or its vicinity. This population is relatively poor and so these impacts will be exacerbated. The analysis suggests that a moderate adverse impact will be felt across all quintiles and so no specific distributional effect. However, the most deprived households will experience the greatest reduction in user benefits.

#### *2.13.3.3 Summary assessment*

Both options show a moderate adverse impact across all IMD quintiles and as such, show no disproportionate effect. Considering the size of these impacts however, the Benchmark CAZ D notes a much greater disbenefit to the most deprived quintile. The most deprived quintile will in fact experience an even greater impact as the same cost placed on the most deprived quintile compared to the least deprived will represent a greater proportion of their disposable impact and therefore a greater disproportionate effect. Hence it could be concluded that although both options will have an adverse effect on the most deprived households, the Benchmark CAZ D will have a greater disproportionate effect. Table 2-24 summarises these impacts.

*Table 2-24: User benefits – summary assessment*

| Impact | Benchmark CAZ D | Preferred Option |
|---|---|---|
| User benefits | XXX | XX |

*✓✓✓: Large beneficial, ✓✓: Moderate beneficial, ✓:Slight beneficial, -: Neutral, ×: Slight adverse, ××: Moderate adverse, ×××: Large adverse*

### 2.13.4 Personal affordability

Personal affordability is concerned with changes in the monetary cost of travel which forms part of the decision-making process for travellers. The most significant impacts of the costs of travel are on young people, the elderly and low-income households. Although low-income households spend less money on transport in absolute terms, this expense can represent a larger proportion of their total income (Social Exclusion Unit, 2003). People with disabilities may also suffer significant disbenefits when faced with higher costs due to limited transport choices.

As North Staffordshire contains a larger proportion of low-income households than the national average, the potential impacts of the Preferred Option and the Benchmark CAZ D on personal affordability will be particularly important as they will impact accessibility and community severance.

#### *2.13.4.1 Preferred Option*

The Preferred Option will increase costs to individuals who have to reroute around the proposed bus gates through an increase in VOC (fuel costs and non-fuel related costs). The cost of this impact is relatively small. The Preferred Option may also provide positive indirect impacts to households through the improvements to bus infrastructure. Public transport is more commonly used by vulnerable people and so these improvements might have a positive distributional effect.

#### *2.13.4.2 Benchmark CAZ D*

The disbenefits to users noted in the section above, as a result of the Benchmark CAZ D, suggests that this option would have a greater disproportionate adverse effect on more deprived households. This analysis has been supplemented by including the impact of the CAZ charge and by using a proxy for all costs based on ownership of non-compliant vehicles.

It was found that poorer households make significantly more trips into the CAZ boundary and are more likely to own non-compliant cars. This therefore suggests that a higher proportion of costs will fall greatest on areas with greater levels of deprivation, greater numbers of elderly residents and those with disabilities. It is again important to note that the same cost placed on the most deprived quintile will represent a greater proportion of their disposable income and would therefore have an even greater impact.

#### *2.13.4.3 Summary assessment*

The Benchmark CAZ D is expected to disproportionally impact vulnerable groups through the imposition of a direct charge to travellers in a way that the Preferred Option does not. In fact, in terms of personal affordability, the Preferred Option may bring about some benefits to the most deprived quintile through improvements to bus infrastructure. The results of these impacts are shown in Table 2-25.

*Table 2-25: Personal affordability - summary assessment*

| Impact | Benchmark CAZ D | Preferred Option |
|---|---|---|
| Personal affordability | XXX | X |

✓✓✓: *Large beneficial*, ✓✓: *Moderate beneficial*, ✓:*Slight beneficial*, -: *Neutral*, ×: *Slight adverse*, ××: *Moderate adverse*, ×××: *Large adverse*

### 2.13.5 Accidents

TAG guidance states that certain groups are known to be at greater risk of experiencing transport related accidents. These include children and the elderly (particularly, as pedestrians or cyclists), young males, people with a disability, Black and Minority Ethnic (BME) communities, people without access to a car and people on low incomes. The changes in traffic flow resulting from both the Preferred Option and the Benchmark CAZ D might lead to changes in accident rates.

#### *2.13.5.1 Preferred Option*

In the Preferred Option, potential accident risk impacts are concentrated in areas around the two proposed bus gates on the A53 Etruria Road and the A50 Victoria Road. The option results in a combination of benefits and disbenefits, as traffic is primarily rerouted rather than being removed through modal shift. However, there is an overall small net benefit. 2.2% of road links are predicted to experience a reduction in traffic flows greater than 10%, while 1.3% of road links are predicted to experience an increase. Roads where significant increases are predicted include Manor Street, Porthill Bank Road, and some road links which form connections to the A500. Traffic management measures will be implemented on the roads to the east and west of Victoria Road in order to ensure that the adjacent local communities are not adversely impacted by traffic rerouting through these areas when the bus gate is in operation. The scheme aims to alter the nature of the areas to signal to drivers to proceed with greater care and so minimise the level of accidents.

Distributional analysis of these impacts demonstrates that low-income households will benefit disproportionately, as will households with a registered disability, as both these areas are located in LSOAs with a high proportion of these groups. No distributional effects are predicted to occur for the over 65 and under 16 groups.

#### *2.13.5.2 Benchmark CAZ D*

The Benchmark CAZ D is substantially more aggressive, and as a result delivers small reductions in traffic flows across a wider area as the result of modal shift; together with decreases in traffic flows inside the boundary and increases outside as non-compliant vehicles reroute to avoid the charge. 9.3% of all road links in the modelled domain are predicted to experience significant reductions in traffic flows under this option.

As the CAZ boundary encompasses an area with a high proportion of low-income households and a high proportion of residents with a registered disability, these groups will benefit disproportionately from the scheme. The over 65 group will not benefit as much as other groups, whilst no distributional effects were predicted for the under 16 group.

#### *2.13.5.3 Summary assessment*

Both options are found to deliver disproportional benefits towards low-income households and residents with a disability. Due to the Benchmark CAZ D's greater impact on traffic flows, particularly within the CAZ boundary, it is expected that the impact on accidents as a result of this option is greater than that of the Preferred Option (see Table 2-26).

*Table 2-26: Accidents – summary assessment*

| Impact | Benchmark CAZ D | Preferred Option |
|---|---|---|
| Accidents | ✓✓ | ✓ |

✓✓✓: *Large beneficial*, ✓✓: *Moderate beneficial*, ✓:*Slight beneficial*, -: *Neutral*, ×: *Slight adverse*, ××: *Moderate adverse*, ×××: *Large adverse*

### 2.13.6 Noise

The implementation of both the Preferred Option and the Benchmark CAZ D will lead to changes in traffic flows through rerouting of vehicles, potentially leading to changes in noise levels. Specific modelling of changes in noise has not been undertaken for either option. Instead, the change in Annual Average Daily Traffic (AADT) between the 2022 Reference Case and each option has been used as a proxy for changes in noise.

#### *2.13.6.1 Preferred Option*

In the Preferred Option, no road link is predicted to experience a change in traffic volume greater than 50% or change in speed greater than 10 kph; as such, this option is considered to have negligible impacts on noise.

#### *2.13.6.2 Benchmark CAZ D*

In the Benchmark CAZ D, no road link is predicted to experience a change in traffic volume greater than 50% or change in sped greater than 10kph. With the introduction of a CAZ, vehicle upgrades may lead to older (generally louder) vehicles being replaced with newer vehicles that are subject to tighter noise limits in accordance with Regulation (EU) No 540/2014. However, these changes are small and as such are not expected to result in a perceivable reduction in noise levels.

##### *2.13.6.2.1 Summary assessment*

Neither option is expected to produce significant noise impacts and so the DI from both options are negligible, as can be seen in Table 2-27.

*Table 2-27: Noise - summary assessment*

| Impact | Benchmark CAZ D | Preferred Option |
|---|---|---|
| Noise | - | - |

✓✓✓: *Large beneficial*, ✓✓: *Moderate beneficial*, ✓:*Slight beneficial*, -: *Neutral*, ×: *Slight adverse*, ××: *Moderate adverse*, ×××: *Large adverse*

### 2.13.7 Accessibility

The approach for the appraisal of distributional impacts on accessibility involved a qualitative assessment of how the implementation of the Benchmark CAZ D and the Preferred Option may affect access to community facilities for vulnerable groups. An additional quantitative assessment was carried out for the Preferred Option only, focussing on the bus infrastructure improvements.

While there may be some indirect effects on public transport travel time or timetables due to changes in traffic volumes, there are no planned changes to scheduled bus timetables, routes or fares included in either option. However, there is potential that changes to public transport services would be made by operators in response to either scheme to reflect changes in demand as an indirect effect that is not yet known. Neither of the options introduce physical barriers to the network and so any resulting limitations around travel are inherently associated with affordability related to the increased costs of travel by car or community transport.

*2.13.7.1 Preferred Option*

The A53 Etruria Road and A50 Victoria Road bus gates will act as a physical barrier to private vehicles but not to buses. However, limiting the bus gate restrictions to peak times and to one direction of travel only will help to mitigate any negative distributional impacts associated with private vehicle travel. Vulnerable groups using public transport might be positively impacted through faster journey times at peak times.

Pedestrian access to the existing bus stops along the A53 Etruria Road will be enhanced through improvements to the signalised pedestrian crossing facilities on this route.

Improvements to bus infrastructure could serve to improve accessibility through bus users as there will be an increased availability of information through RTPI as well as the provision of accessible kerbs at bus stops. The bus infrastructure measures associated with the Preferred Option are anticipated to deliver a disproportionate benefit to more deprived households, those with a higher proportion of children and disabled and those with a lower proportion of elderly residents

*2.13.7.2 Benchmark CAZ D*

As there are no direct changes to public transport proposed within the Benchmark CAZ D the impacts on accessibility have been assessed to be neutral.

*2.13.7.2.1 Summary assessment*

The Preferred Option actively looks to improve accessibility to vulnerable groups through enhanced RTPI facilities, accessible kerbs and bus gates. On the other hand, the Benchmark CAZ D provides no mitigating measures to dampen the negative impacts on accessibility associated with the CAZ charge and boundary. Therefore, the Preferred Option has a slight beneficial impact compared to the Benchmark CAZ D's impact of slight adverse (see Table 2-28).

*Table 2-28: Accessibility - summary assessment*

| Impact | Benchmark CAZ D | Preferred Option |
|---|---|---|
| Accessibility | - | ✓ |

✓✓✓: *Large beneficial*, ✓✓: *Moderate beneficial*, ✓:*Slight beneficial*, -: *Neutral*, ×: *Slight adverse*, ××: *Moderate adverse*, ×××: *Large adverse*

## 2.13.8 Severance

Severance is defined as the separation of residents from facilities and services they use within their community caused by new or improved roads or by changes in traffic flows. Community severance effects are not equally experienced amongst the people in an affected area, with disabled people, the elderly and children being particularly vulnerable to disruption in their travel patterns. As the changes in severance associated with both of the options are relatively small, a full distributional analysis was not considered proportionate.

*2.13.8.1 Preferred Option*

The majority of severance impacts from the Preferred Option are improvements resulting from the diversion of traffic from congested road links, potentially improving the ability of pedestrians to take their preferred line to nearby amenities. As the bus gates will operate at peak times, benefits to severance will be felt particularly strongly at these times. The amenities affected cover a wide range of groups. In particular, residents using amenities on the A53 will benefit from the additional signalised pedestrian crossings along this road.

Manor Street is the only route to be assessed with a slight adverse impact on severance as it acts as a displacement route from the bus gate on the A50 Victoria Road. This route is of relevance as it acts as the entrance to Christ Church C of E Primary School and so will impact children. Additional measures form part of the Preferred Option to help alleviate the impacts of possible increased traffic flow on this route including the provision of new road humps, carriageway resurfacing and enhanced signage.

However, reductions in traffic are predicted along City Road and Victoria Road which will improve the ability of pedestrians to access nearby amenities, in particular the retail facilities along these routes.

*2.13.8.2 Benchmark CAZ D*

The Benchmark CAZ D leads to moderate changes in traffic flows across a wide area in the model domain, particularly around the City Centre. In particular, the reduction in AADT flows on the portions of Potteries Way which partly encircles the City Centre will improve accessibility to the wide range of amenities located in there, affecting all groups. Smaller improvements in severance are also noticed along a number of routes around the model domain.

However, displacement of traffic around the CAZ boundary leads to some areas of adverse impact. Of particular relevance are impacts on North Road, which will impact access to North Road Academy and Honey Bears Day Nursery, which are relevant to vulnerable parents with pushchairs and children.

*2.13.8.3 Summary assessment*

The Preferred Option is expected to produce a combination of low-magnitude, locally constrained positive and negative severance impacts. In contrast, the Benchmark CAZ D is expected to produce low-magnitude positive impacts over a relatively wide area with a small number of locally focussed negative impacts. As the measures in the Preferred Option are closely targeted on local areas of exceedance, the overall impacts on severance are smaller than those of the Benchmark CAZ D, which affects traffic flows across a larger area. The summary of these impacts are noted in Table 2-29.

Table 2-29: Severance - summary assessment

| Impact | Benchmark CAZ D | Preferred Option |
|---|---|---|
| Severance | ✓ | ✓ |

*✓✓✓: Large beneficial, ✓✓: Moderate beneficial, ✓:Slight beneficial, -: Neutral, ×: Slight adverse, ××: Moderate adverse, ×××: Large adverse*

### 2.13.9 Security

Research evidence citied in the TAG guidance demonstrates that there are several groups with particular concerns about their personal security. Women, younger people, older people, people with disabilities and BME communities all tend to perceive risk more acutely when using public transport. Furthermore, public transport users tend to be from lower income groups, and as such may be disproportionately affected, even more so in the North Staffordshire region where it is one of the poorest in the country.

This section presents an assessment of improvements in security for public transport users, based on the measures included in the Preferred Option. The Benchmark CAZ D does not include any measures that will directly affect security when using public transport, so impacts from this option were scoped out.

#### *2.13.9.1 Preferred Option*

The Preferred Option includes a substantial investment in CCTV cameras at bus stops which will have a positive impact on both the actual and perceived security of bus users. It might also encourage those who previously had concerns regarding the security of the bus network to in fact utilise it.

The proposed CCTV camera locations are predominantly in areas with a relatively low-income population, with a high ratio of persons with disabilities and a high proportion of BME. As previously described, these demographic groups are likely to travel by public transport and therefore will benefit disproportionately from these security improvements.

#### *2.13.9.2 Summary assessment*

The implementation of CCTV cameras across the bus network in the Preferred Option will deliver benefits to bus users, who are often from vulnerable groups. There is no existing formal surveillance at the majority of bus stops within North Staffordshire and therefore the baseline level for formal surveillance can be considered to be poor. Installation of effective CCTV cameras at 71 locations across the study area will result in a high level of formal surveillance.

With no specific measures applied to enhance or detract from security in the Benchmark CAZ D option, the impacts to vulnerable groups in this scheme is neutral, as seen in Table 2-30.

Table 2-30: Security – summary assessment

| Impact | Benchmark CAZ D | Preferred Option |
|---|---|---|
| Security | - | ✓✓ |

*✓✓✓: Large beneficial, ✓✓: Moderate beneficial, ✓:Slight beneficial, -: Neutral, ×: Slight adverse, ××: Moderate adverse, ×××: Large adverse*

## 2.14 Comparing the options

The overall impact to vulnerable groups is found to be more beneficial in the Preferred Option. The Preferred Option only notes disbenefits in both affordability areas and user benefits. The Benchmark CAZ D also notes disbenefits in these areas, but to a greater extent. Table 2-31 summarises the distributional impact analysis.

*Table 2-31: Summary of the distributional analysis*

| Impact | Benchmark CAZ D | Preferred Option |
|---|---|---|
| Air quality | ✓✓ | ✓✓ |
| Affordability for businesses | XX | X |
| User benefits | XXX | XX |
| Personal affordability | XXX | X |
| Accidents | ✓✓ | ✓ |
| Noise | -. | - |
| Accessibility | - | ✓ |
| Severance | ✓ | ✓ |
| Security | - | ✓✓ |

✓✓✓: *Large beneficial*, ✓✓: *Moderate beneficial*, ✓:*Slight beneficial*, -: *Neutral*, ×: *Slight adverse*, ××: *Moderate adverse*, ×××: *Large adverse*

## 2.15 Summary

The economic assessment determines that the NPV of the Preferred Option is -£35.2m compared with -£163.6m of the Benchmark CAZ D and as such, greater benefits are generated in the Preferred Option relative to its cost. The implementation and operational costs of the Benchmark CAZ D are significantly higher than that of the Preferred Option.

The main benefits related to the Preferred Option come in the form of improvements in air quality, distributional benefits related to bus infrastructure improvements and improved accessibility and security for vulnerable groups. Disbenefits associated with the Preferred Option include longer journey times resulting from the proposed bus gates and consequential rerouting.

On the other hand, the Benchmark CAZ D identifies its greatest benefits in improved air quality, improved travel time and reductions in accidents, particularly within the CAZ boundary. However, the Benchmark CAZ D brings about numerous disbenefits including a loss in welfare, reduced user benefits and disbenefits associated with both business and personal affordability.

Although the sensitivity analysis shows that the NPV of each option is sensitive to the assumptions, it demonstrates that the uncertainty around parameters does not influence the relative comparison of the options in terms of NPV.

Both options adhere to the primary CSF of reducing $NO_2$ concentration levels below the directed limit, however, the Preferred Option does so in the shortest possible time whilst also being better value for money than the Benchmark CAZ D and thus satisfying additional CSFs. Therefore, the Councils propose that this is the Preferred Option to be taken forward to FBC stage and implementation.

# 3 Commercial Case

## 3.1 Introduction

Stoke-on-Trent City Council (SoTCC), Newcastle-under-Lyme Borough Council (NuLBC) and Staffordshire County Council (SCC) are committed to working together to transform the urban area of North Staffordshire into a cleaner and healthier area.

In October 2018, Stoke-on-Trent and Newcastle-under-Lyme (the authorities with responsibilities for environmental health) were issued a Ministerial Direction to produce a local air quality plan to address their respective nitrogen dioxide ($NO_2$) problems. Given their proximity to one another, they were tasked with producing a joint plan.

As the highway authority for the Newcastle-under-Lyme area, SCC has been assisting the authorities and together, the three authorities have developed a plan to tackle $NO_2$ exceedances at the roadside – known as the North Staffordshire Local Air Quality Plan (NSLAQP).

This Plan will help to protect and promote the health of the local population by improving air quality and reducing the impact of air pollution on the environment. In so doing, the local authorities are complying with the UK Air Quality Plan and bringing $NO_2$ air pollution within statutory limits in the shortest possible time.

The joint approach has been necessary because it is recognised that air pollution does not respect local authority boundaries and therefore a consistent and co-ordinated approach is required to maximise air quality benefits for all people living and working in North Staffordshire. By working together, the Councils can also minimise the risk of unintended consequences and help to ensure, as far as possible, alignment between the NSLAQP and other authority strategies.

The NSLAQP for Stoke-on-Trent and Newcastle-under-Lyme comprises of a package of measures:

- A50 Victoria Road bus gate, operational Monday to Friday between 07:00-10:00 and 16:00-19:00. ANPR cameras will be used to restrict access except for buses, taxis and cyclists
- A53 Etruria Road two-lane bus gate, operational Monday to Friday between 07:00-10:00 and 16:00-19:00. ANPR cameras will be used to restrict access except for buses, taxis and cyclists
- Traffic management measures on roads to the east and west of Victoria Road, including:
    - Traffic calming
    - One-way restrictions
    - Speed restrictions
    - Weight restrictions
    - Extension of footways
    - Carriageway re-surfacing

- Transport improvements along the A53 Etruria Road in the form of a review of signal times, signalised pedestrian crossing facilities and the relocation of a bus stop to avoid unnecessary queuing
- Targeted bus retrofit programme where 75% of buses using Bucknall New Road and 100% of buses using Victoria Road will be retrofitted to achieve Euro VI emissions standards
- Bus infrastructure improvements will be installed on routes that pass through or are parallel to the identified exceedance locations. The improvements will include Real Time Passenger Information (RTPI) screens, new bus shelters, accessible kerbs at bus stops and installation of CCTV at bus stops.

An Ultra-Low Emission Vehicle (ULEV) exemption, allowing ultra-low emission vehicles to drive through the bus gate, will be assessed and if considered deliverable will be added to the preferred scheme in the Full Business Case (FBC). If this is added to the preferred scheme, information in relation to procurement will be approved in advance of the FBC.

The local authorities will also seek further funding through the Clean Air Fund (CAF) for additional measures that will look to mitigate any impacts that might arise as a result of the scheme.

A separate Ministerial Direction[14] concerns the retrofitting of buses operating along the A53 corridor. This is separately funded by JAQU and excluded from this Outline Business Case (OBC).

### 3.2 Purpose of this case

This Commercial Case presents the key services that are to be funded through the Implementation Fund. It describes the proposed delivery route for the key services and the preferred procurement strategy. It demonstrates that the Preferred Option can be effectively delivered through a workable and viable procurement strategy and sets out how the three Councils will work together to procure the necessary services.

### 3.3 Key services and procurement requirements

Where there are insufficient resources or skills in-house, works and services will need to be procured from external providers. The local authorities intend to utilise existing contracts and undertake appropriate tendering processes using existing frameworks where available, in order to procure services to progress the scheme to OBC. The use of existing contracts and frameworks will help to reduce the time taken in the procurement process and therefore adhere to the Ministerial Direction of delivering the scheme in the shortest possible timeframe.

In the development of the Preferred Option and preparation of the OBC, a number of key services have been procured using contracts that are already in place. Further details are provided in section 3.5 outlining these contracts to undertake the following activities:

- Project management support

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[14]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/746119/air-quality-no2-plan-direction-2018-implement-measures.pdf

- Transport modelling
- Dispersion modelling
- Preliminary design
- Business case reporting, including economic analysis and distributional impact analysis
- Automatic Number Plate Recognition (ANPR) data collection
- Stated preference (SP) surveys
- Risk workshops
- Design costing
- Communications and marketing support.

To progress the Preferred Option from OBC to FBC and to implement it, the Councils propose to make use of internal resources and utilise existing contracts and frameworks to carry out the following works and services:

- Project management support throughout the project
- Business case reporting to support development of the FBC
- Communications and marketing support including planned stakeholder engagement events between OBC and FBC
- Detailed scheme design and costing
- Implementation, maintenance and operation of the Preferred Option

### 3.4 Performance measures

#### 3.4.1 Output based specification

The Commercial Case is based on strategic outcomes and outputs against which alternative procurement and contractual options are assessed.

The outcomes which the preferred procurement strategy and contract is based on are:

- Achieve cost certainty, or certainty that the scheme can be delivered within the available funding constraints
- Minimise further preparation costs with respect to scheme design by ensuring best value and appropriate quality
- Obtain contractor experience and input to the construction programme to ensure the implementation programme is robust and achievable
- Obtain contractor input to risk management and appraisals, including mitigation measures, to capitalise at an early stage on opportunities to reduce construction risk and improve out-turn certainty, thereby reducing risks to a level that is ‘as low as reasonably practicable’

### 3.5 Procurement strategy

A range of contracts are available to deliver the varying nature of the activities within the project. The local authorities propose to use these existing contracts and utilise existing frameworks which will expedite timescales of delivery. Where necessary, these frameworks and contracts can be tailored to address the requirements of the project, including adapting any terms and conditions.

#### 3.5.1 Procurement management

Three levels of project hierarchy exist in relation to key decision-making such as procurement and approvals:

- The Joint Officer Group (JOG) – comprises of key officers and consultants involved in the project, chaired by the project Senior Responsible Officer (SRO)
- The Joint Advisory Group (JAG) – comprises of key members and senior officers of all three local authorities, chaired by a senior member of one of the three authorities
- The Cabinets and Chief Officer Delegated Decisions of the three authorities – where recommendations are taken for key decisions.

In addition to the above, support is provided from several internal teams within each local authority, including procurement, legal, finance, risk management, communications and engagement and delivery partners/consultants. These teams form sub-groups that liaise with both the JOG and JAG. The legal sub-group plays a key role in ensuring that the appropriate legal agreements are in place between the authorities and their respective contractors. The procurement sub-group will provide the opportunity for the procurement managers to oversee and deal with any issues that arise to ensure that timescales and budgets are met.

JOG, JAG, the Cabinets and the legal and procurement teams from each local authority have been involved in determining the preferred procurement strategy for the key services required to deliver the Preferred Option. This has included looking at the range of contracts and frameworks available.

Each lead authority/organisation will be responsible for the individual procurement requirements for each scheme element and this will be set out in the local authority Delivery Agreement and the agreement with the bus operators as described in the Management Case. The Delivery Agreement will be a key document that will be included in the FBC. The proposed procurement strategy has been discussed with Local Partnerships acting in a critical friend capacity and has been agreed by the three Councils who are committed to working together. This commitment has been demonstrated through the development of this OBC and the forming of the JOG and JAG, as discussed in the Management Case. These groups have an agreed Terms of Reference and have worked collaboratively to identify the Preferred Option and agree the preferred joint procurement strategy - this joint working arrangement will evolve and continue to exist, as discussed below.

#### 3.5.2 Procurement options

The Councils, through agreement at the JOG and JAG meetings, propose to utilise existing frameworks and contracts where possible which will ensure rapid mobilisation. These existing contracts have already been demonstrated to deliver value for money and achieve quality requirements. A summary of the existing frameworks and contracts available to the Councils are summarised in Table 3-1.

Single or open tendering can be used to procure works to provide a greater degree of competition, but this option can extend delivery timescales and prevents early contractor involvement.

*Table 3-1: Existing frameworks and contracts*

| Framework/contracts | Contract length | Services covered |
|---|---|---|
| Crown Commercial Services (CCS) Project Management and Full Design Team Services (PMFDTS) (RM3741) (open to all local authorities) | May 2017 – May 2021 | Awarded by NuLBC:<br>Project management<br>Transport modelling<br>Dispersion modelling<br>Business case reporting<br>ANPR data collection<br>SP surveys & analysis<br>Risk workshops<br>Communications & marketing support |
| Infrastructure+<br>(Awarded to Amey) | 2014 – 2034 | Awarded by SCC and available for use by SoTCC for the design, costing and delivery of all works on the local highway network within the Preferred Option. Works can be completed on the trunk road network through this contract following completion of a Section 6 agreement between the local highway authorities and Highways England. Highways England have indicated that this is their preferred delivery method |
| Midlands Highway Alliance (MHA) Professional Services Partnership 3 (MHA-PSP3) (Amey are on the Framework) | April 2019 – April 2022 with the possibility of a one-year extension | The framework was used to allow SoTCC to use Amey for the design and costing of the works on the local highway network included in the OBC |
| JMW contract | 2017 – 2025 (with contract break points) | Awarded by SCC and available for SoTCC to use for the delivery of Real Time Passenger Information (RTPI) |
| JC Decaux Agreement | March 2002 - December 2022 with an option to extend | SoTCC's existing commercial contract for bus shelters |
| Crown Commercial Services Traffic Management Technology (Lot 2 and Lot 15 (RM1089) | October 2016 – October 2021 | Framework available to use by SoTCC and SCC for delivery of ANPR cameras, CCTV and traffic data |

| | | |
|---|---|---|
| Eastern Shires Procurement Organisation (ESPO) Framework, Lot 664-17, Lot 5 Highways, Transport and Logistics, (Goods and Services). ESPO Framework 628 – Security and Surveillance | To be determined | Framework available to use by SoTCC and SCC for delivery of ANPR cameras and CCTV |
| Stoke-on-Trent Street Lighting PFI Contract (SSE Contracting) | 2003 for period of 25 years | The contract is awarded to SSE Contracting and is available for use by SoTCC for signs, VMS and Prism within Stoke-on-Trent |
| Stoke-on-Trent internal Highways Commercial Works Team | | Commercial team within SoTCC available to deliver highway works within Stoke-on-Trent |
| Highways Multi-Lot Framework Contract (Stoke-on-Trent) | August 2019 and is a 2 year +1 +1 year contract, subject to performance monitoring | Available for use by SoTCC for highway works. Framework was OJEU tendered and a contractor would be selected from the framework through a mini tender process to ensure value for money |
| SOTCC Framework 'CCTV, Intruder Alarms and Access Control Services' | April 2020 and is a 2 + 1 +1 year term up to March 2024. | Available for the provision of all CCTV equipment requirements of SoTCC |
| CVRAS accredited (Clean Vehicle Retrofit Accreditation Scheme) | | A competitive tender across the five CVRAS providers |
| Municipal Trading arrangements compliant with the Public Contract Regulations 2015 | Contract arrangements reviewed every 3 years | Contract available for diffusion tube purchase and data analysis |

#### *3.5.2.1 Crown Commercial Services*

Crown Commercial Services (CCS) operates a series of frameworks which are open to any public sector body across the UK and are free for the local authorities to use. The frameworks are fully EU compliant, saving time and money in conducting procurement exercises. The PMFDTS provides fast access to building, asset design and management services focused on improving value to the public sector. NuLBC appointed Sweco for the modelling and business case work through Lot 5 - Civil and Structural Engineering Services and Environmental Services. This lot covers core services such as civil engineering, structural engineering and public health engineering, as well as non-core service disciplines including, but are not limited to, environmental services advisors (including air), lead designers, principal designers, risk advisors and technical authors.

During implementation, CCS Traffic Management Technology (Lot 2) (RM1089) could be used to purchase and install the ANPR cameras required to monitor the bus gates and retrofitted buses and CCTV at bus shelters. This framework covers traffic signals and CCTV, parking and access control, street lighting, intelligent transport systems and professional services.

The CCS framework (Lot 15) Traffic Management Technology could also be used for traffic data collection. Existing equipment in Staffordshire and Stoke-on-Trent is supplied by CA Traffic who are on Lot 15.

The CCS framework uses simple call-off contracts where local authorities can either use a form of agreement based upon NEC3 Professional Service Agreement or a CCS standard form through direct award or mini-competition. Sweco, with their sub-consultants Ricardo, were direct awarded the work due to their prior experience in undertaking transport modelling and air quality modelling for the local authorities.

#### *3.5.2.2 Infrastructure +*

SCC chose Amey in March 2014 as its strategic partner of choice for Infrastructure+ (I+) following a rigorous and highly competitive twelve-month procurement process. It provides Amey with exclusivity to deliver capital works up to the value of £0.5m and the ability to deliver works above this value, with no fixed upper limit, subject to the demonstration of ‘Best Value’. This is demonstrated on a scheme by scheme basis through the production of a Best Value Business Case which is considered for approval through the I+ governance boards. The partnership has been specifically designed to build capacity, add value and ensure highway projects are delivered in the most efficient manner. The partnership seeks to:

- Maintain and improve the condition and usability of physical assets
- Reduce cost of delivering the services and reach the lowest whole life cost of asset ownership
- Involve communities in decisions and delivery of infrastructure
- Improve customer satisfaction in SCC and to enhance its reputation

Amey is co-located in SCC’s offices. Amey designers and specialists have worked alongside the three authorities and have been involved throughout the production of the OBC. The contract is also used by private developers (s.278 projects) offering a further ‘commercial test’ of the end-to-end value it provides as a design and or design and delivery solution. SCC remains a member of the MHA and uses it to provide an extra opportunity to benchmark I+.

I+ is set up in a way that means it is fully available to the City and Borough/District Councils to ‘call-off’ services as required without the need for further procurement. They can do this via SCC or directly to Amey. The specification provides for all elements of infrastructure and environmental professional/consultancy services and delivery of improvement or maintenance works.

#### *3.5.2.3 Midlands Highway Alliance (MHA)*

SCC and SoTCC are members of the MHA. SCC uses it to provide an extra opportunity to benchmark I+. SoTCC has used this framework to enable Amey to complete the design and costs included in the OBC.

*3.5.2.4 Stoke-on-Trent Internal Commercial Team for Civil Engineering Delivery.*
One procurement option available for the delivery of the Highway Civil Engineering works is to utilise SoTCC's in-house Commercial Team. The Commercial Team operate on a competitive commercial basis. They are both local, very experienced and have an excellent track record of delivering projects to time and budget; working from their own Highways Depot in Stoke-on Trent they operate with low overheads. This team either use their own resources for undertaking the work or using their OJEU compliant 'Highways Multi-Lot Framework Contract' in which they have access to up to 17 contractors within 5 Lots, depending on the type of work being undertaken.

*3.5.2.5 Highways Multi-Lot Framework Contract*
The £16m Highways Multi-Lot Framework Contract covers all highway construction works. The successful contractors have all submitted and met the required contract Quality and Health & Safety Assessment criteria. Contractors within each Lot are invited to submit a mini-tender for each new commission, whose award will be based solely on lowest price.

*3.5.2.6 JMW Contract*
RTPI can be delivered using the contract awarded by SCC to JMW as an 8-year contract ending in 2025 and can be used to deliver RTPI within Staffordshire and Stoke-on-Trent. The contact was procured via a full OJEU process. JMW finished first in all criteria as per the evaluation process, including quality, pricing and demonstration (60% quality and 40% price).

The contract allows for collaborative working, enabling SoTCC to complete their own due diligence to make a decision on whether to use of SCC's contract with JMW.

*3.5.2.7 JC Decaux Agreement*
The JC Decaux Agreement has been awarded by SoTCC for the provision and maintenance of all bus shelters in Stoke-on-Trent.

*3.5.2.8 Eastern Shires Procurement Organisation (ESPO) Framework*
The Eastern Shires Procurement Organisation (ESPO) Framework, Lot 664-17, Lot 5 Highways, Transport and Logistics, (Goods and Services) is available for ANPR and CCTV installation and maintenance. It has 26 suppliers but not all of whom will have the specific capability to bid for this commission. ESPO is a public sector owned professional buying organisation, offering 25,000 products, over 120 frameworks and bespoke procurement contracts. ESPO provide a standard form of contract and call-off terms which each organisation completes or slightly amends to suit each contract.

ESPO Framework 628 – Security and Surveillance is also available for the purchase and maintenance of CCTV cameras.

*3.5.2.9 SOTCC Framework 'CCTV, Intruder Alarms and Access Control Services'*
SoTCC's Framework 'CCTV, Intruder Alarms and Access Control Services' is available to use for the delivery of CCTV in bus shelters. This would ensure consistency and conformity with other equipment and systems purchased by SoTCC. The framework agreement was awarded to Bryan Enterprises Ltd t/a Security Services. This framework is currently used for the provision of all of SoTCC's CCTV equipment requirements.

#### *3.5.2.10 Clean Vehicle Retrofit Accreditation Scheme (CVRAS)*

There are currently five accredited suppliers of retrofit technology, but not all suppliers are able to fit technology to all types of buses/engines, thereby limiting the market. In addition to the retrofit works, some buses require an EFAN system which replaces the hydraulic fan systems and ensures efficient operation of the bus post retrofitting. EFAN systems are not CVRAS accredited but funding for their fitment has been accepted for appropriate vehicles under a range of Clean Bus Technology Fund (CBTF) schemes run around the country. There is only one supplier for EFAN. The CBTF is being utilised as a template for eligibility and monitoring.

#### *3.5.2.11 Stoke-on-Trent City Council Street Lighting PFI Contract*

This complex contract awarded to SSE Contracting is now a well-established £103m PFI contract in the City, having operated successfully since 2003. It is a cost-effective solution for the design, build and operation of SoTCC's Lighting and Street Furniture. This contract includes the efficient and cost-effective design, installation and maintenance of new illuminated and non-illuminated signs on the highway over the 25-year contract.

#### *3.5.2.12 Municipal Trading Arrangements compliant with Public Contract Regulations 2015*

The diffusion tubes and the analysis of them is undertaken via Municipal Trading arrangements between local authorities. SCC procure diffusion tubes for both SoTCC and NuLBC (along with many other local authorities). Through these arrangements, the Councils remain compliant with the Public Contract Regulations 2015 and the Council's own Constitution. Municipal trading ensures value for money as it drives value from volume which has been proven through the comparison of quotations for diffusion tubes for Local Air Quality Management purposes.

#### *3.5.2.13 Market capacity*

It is acknowledged that there is some risk regarding market capacity, however, feedback from supplier workshops hosted by JAQU and other local authorities suggest there is sufficient capacity in the market to deliver the required works and services. To minimise risk, early engagement with the market has commenced and will take place through to FBC. The procurement risks are discussed further in section 3.7.

### 3.5.3 Procurement routes

The procurement of the deliverables associated with the development of the OBC and FBC are summarised in Table 3-2. JAQU and Local Partnerships approved the use of Amey to help the authorities prepare indicative costs for the OBC.

*Table 3-2: Procurement of deliverables to OBC and FBC*

| Deliverable | Company | Procurement route | Lead authority | Status |
|---|---|---|---|---|
| Transport modelling | Sweco | CCS Framework | NuLBC | Live |
| Dispersion modelling | Sweco & Ricardo | CCS Framework | NuLBC | Live |
| Business case reporting | Sweco | CCS Framework | NuLBC | Live |

| | | | | |
|---|---|---|---|---|
| ANPR data collection | Sweco & Nationwide Data Collection | CCS Framework | NuLBC | Complete |
| Stated Preference survey implementation | Sweco & Watermelon Research | CCS Framework | NuLBC | Complete |
| Project management support | Pete Price | Direct award | NuLBC | Live |
| Preliminary and detailed design and costing | Amey | Infrastructure+ | SCC | Live |
| Communications and marketing support | Sweco & Ricardo | CCS Framework | NuLBC | Live |

The proposed procurement route for the implementation of the key services/deliverables within the Preferred Option is summarised in Table 3-3. This will be reviewed by JAQU and Local Partnerships and once the FBC is approved the contracts with the selected contractors will be signed.

*Table 3-3: Proposed procurement route of key services/deliverables at implementation*

| Proposed procurement route | Key service/ deliverable | Indicative cost of deliverables (excluding contingencies, risk, inflation) | Lead contracting authority | Local approval processes |
|---|---|---|---|---|
| Amey (I+) proposed for SCC. SoTCC preferred route - to be confirmed | Highway Civil Engineering Works on the local highway network | Around £3m + £1m ten-year maintenance (Staffs and Stoke combined total) | Joint SCC and SoTCC | SoTCC Cabinet approval / SCC / I+ Board |
| SoTCC Lighting PFI contract | Signs, Prism, VMS on SoTCC's local highway network | £1m install + £170k ten-year maintenance (SCC, SoTCC and Highways England combined total) | SoTCC | SoTCC Chief Officer Delegated Approval |
| Supplier to be confirmed | Direction signing on trunk road | Cost included in the total above | Highways England | Highways England approval process |

| | | | | |
|---|---|---|---|---|
| Eastern Shires Procurement Organisation (ESPO) Framework, Lot 664-17, Lot 5 | ANPR cameras | £650k install + £270k ten-year maintenance + £180k 5-year replacement (Staffs and Stoke combined total) | SoTCC | SoTCC Cabinet Approval and SCC Chief Officer Delegated Approval |
| Clean Vehicle Retrofit Accreditation Scheme | Bus retrofit | £0.96m | Bus operators (First, D&G Scraggs and Stantons) | Bus operator approvals |
| JMW | RTPI | £500k install + £300k ten-year maintenance | SCC | SoTCC Cabinet approval |
| J C Decaux | shelters | £0 | SoTCC | SoTCC Chief Officer Delegated Approval |
| SoTCC Framework 'CCTV, Intruder Alarms and Access Control Services' | CCTV | £280k install + ten-year maintenance | SoTCC | SoTCC Chief Officer Delegated Approval |
| Municipal Trading Arrangements compliant with Public Contract Regulations 2015 | Diffusion tubes | £470k+ ten-year data analysis | NuLBC and SoTCC | NuLBC and SoTCC Chief Officer Delegated Approval |
| CCS RM1089 - Traffic Management Technology 2 – Lot 15 | Traffic counts | £73k install + £200k operation | SoTCC and SCC | SCC and SoTCC Chief Officer Delegated Approval |

*3.5.3.1 Highway Civil Engineering Works*

It is proposed that the Highway Civil Engineering works will be procured through either or both of the following:

- Staffordshire Infrastructure+ Contract with Amey

- Stoke-on-Trent internal Highways Commercial Works Team

It is proposed that the design, delivery and maintenance of physical measures on the local highway network within Staffordshire will be delivered by Amey through the County Council's I+ partnership. This would include the purchase, installation and maintenance of advanced direction signs on Staffordshire's local highway network at Porthill and on the A527 at Wolstanton and towards Newcastle-under-Lyme town centre. The supply chain for signs that is expected to be chosen by Amey would be agreed in their Best Value Business Case.

As the project is valued over £500,000 a project specific Best Value Business Case would need to be considered by the I+ Operational Commissioning Board/Strategic Partnership Board before final approval is given to use Amey. If SoTCC choose to use the I+ partnership for detailed design and delivery, they will also require Cabinet approval.

The benefit of using Amey is that they have already engaged in ECI for the project to understand the key constraints and provide construction support. Access to the I+ framework has already been beneficial to the project in undertaking additional ground investigation works, initial designs and costs, avoiding lengthy tendering processes. Amey will continue to provide ECI until a procurement route is selected.

SoTCC could choose to utilise Stoke-on-Trent City Council's in-house Commercial Team, rather than I+. This team has the option of either using their own resources for undertaking the work or they can draw on their OJEU compliant Highways Multi-Lot Framework Contract. The Commercial Team have an excellent track record of delivery of projects to time and budget, working from their own Highways Depot in Stoke-on Trent they operate with low overheads.

It is proposed that the installation of the advanced direction signs on the trunk road would be delivered by the chosen contractor through a Section 6 agreement with Highways England allowing the local authority's contractor to work on Highways England's network. Alternatively, Highways England could choose to use their own contractor through a Section 274 agreement. The purchase of the advanced direction signs is expected to be through Highways England's own panel of suppliers who they would receive quotes from and assess tenders based on quality and value for money. Further details will be confirmed at FBC.

*3.5.3.2 Signs, Prism and Variable Message Signs (VMS) in Stoke-on-Trent*

The majority of the signs on the local highway network that are required for this project are at locations that are maintainable by SoTCC. The use of Stoke-on-Trent City Council Street Lighting PFI Contract for the procurement of advanced direction signs, Variable Message Signs and Prism signs in Stoke-on-Trent is therefore proposed as the preferred procurement route. The contract has already been awarded to SSE Contracting which will help to reduce delays in procurement. The specification for the VMS signs has already been established through a very recent procurement exercise by SoTCC.

If signs are not designed and installed by the PFI contractor they would need to be subject to additional charges for checking, and accruing onto the Contract, which would add to delay in their installation.

SoTCC is contractually obliged to use the PFI for all street lighting changes and new illuminated street furniture including signs and bollards. SoTCC retains the option to seek separate tenders or quotations for all non-illuminated street furniture. However, due to the size and purchasing power of SSE, they have demonstrated value for money on previous cases where separate quotations have been sought.

*3.5.3.3 ANPR cameras*

In order to minimise delays, the preferred procurement route for ANPR is the ESPO Framework. The main advantage is that this will ensure that there is compatibility of the camera specification with SoTCC's existing back-office hardware and software. There is the option to make a direct award or seek a mini tender.

ESPO provide a standard form of contract and call-off terms which each organisation completes or slightly amends to suit each contract. This again saves time and costs related to the drafting of new agreements by SoTCC's legal team.

Each Lot within the ESPO Framework has evaluated one or more suppliers against criteria such as financial stability, track record, experience and technical and professional ability within their market. This framework is structured to enable customers to define their own specific requirements and either make a direct appointment or run a further competition to identify the best solution if required.

*3.5.3.4 Bus retrofit*

First Bus Group have recently undertaken a competitive tender across CVRAS providers for the whole of the fleet. First have identified a single supplier based on cost and experience to supply and fit CVRAS accredited retrofit solutions to the fleet. For the E Fans solution there is only one supplier in the market making this equipment.

First provided two comparator prices as evidence to show best value for the chosen supplier. Costings for both technologies have been discussed with Defra officials within JAQU and are in line with other similar projects undertaken by Councils in the UK. It is expected that the other main operator, D&G, will follow the same process.

The local authority will enter into a legal agreement with the bus company to secure the retrofit of qualifying buses with appropriate emissions abatement technology to bring them up to Euro 6 emission standards. The agreement will detail the financial arrangements; monitoring, reporting and change; deliverability and technical consideration. Contract management procedures will be active throughout the contract.

*3.5.3.5 Real Time Passenger Information*

The preferred procurement route for RTPI is the contract awarded by SCC to JMW through a full OJEU procurement process. This will speed up the process of delivery and is expected to offer value for money. It will ensure a consistent approach to RTPI delivery across North Staffordshire, making sure that any new infrastructure ties in with existing infrastructure within Staffordshire. An open procurement process may not fit with the current RTPI provision in Staffordshire.

*3.5.3.6 Bus shelter*

The preferred procurement route is to utilise the existing JC Decaux Agreement. No capital or maintenance costs are allocated to this element of the project as the proposal is that the 17 required sites will be prioritised for shelter provision and sought as part of a refreshed Agreement with JC Decaux. This is the most appropriate option that is expected to enable quick delivery and demonstrate good value for money. An open procurement exercise would add time to delivery and ongoing maintenance costs and does not fit with SoTCC's management of bus shelters in the city

*3.5.3.7 CCTV*

The Preferred Option is to use the existing SoTCC framework that is available to use for the purchase and maintenance of CCTV at bus shelters. CCTV units and ancillaries such as communications to the CCTV hub are expected to be included under the Framework. Open procurement has been discounted due to the availability of this framework.

The ESPO Framework 628 – Security and Surveillance could be utilised, but the SoTCC framework is preferred due to delivery timescales and consistency/conformity with other equipment and systems purchased through SoTCC's own framework.

*3.5.3.8 Diffusion tubes*

The preferred route is the use of the existing Municipal Trading Arrangement with SCC. The quality of analysis is key to the performance of this contract, the spread in the bias correction factors and the precision of tubes analysed in previous years has been considered. Additional information on the QA/QC framework that is used to evaluate the performance of analytical laboratories that supply and analyse the diffusion tubes, namely the AIR-PT scheme is considered. This is completed in accordance with the procedures detailed in Local Air Quality Management Technical Guidance TG16.

The performance is reviewed annually upon collation of the annual results. The contract arrangements are reviewed every 3 years to ensure value for money is being maintained.

*3.5.3.9 Traffic counts*

The preferred procurement route is Crown Commercial Services (CCS) RM1089 - Traffic Management Technology 2 – Lot 15. SCC recommend a direct award to CA Traffic who are on the framework. SCC have compared the pricing of CA Traffic against alternate suppliers on the RM1089 catalogue, and it is considered that value for money can be achieved. CA Traffic already support and maintain existing equipment within Staffordshire and Stoke-on-Trent and there are benefits of maintaining continuity of the supplier. Loop cutting and the installation of cabinets is expected to be completed by Telent Ltd in Stoke-on-Trent and Crown Cutting in Staffordshire.

## 3.6 Payment mechanisms

### 3.6.1 Key Performance Indicators

Part of the agreed procurement strategy includes the use of Key Performance Indicators (KPIs) once the preferred contracts have been approved. This aims to motivate contractors and suppliers to deliver value for money. The KPIs will vary with each contract but it is expected that they will be focussed on:

- Client satisfaction – quality of output
- Client satisfaction – availability
- Time – delivery to agreed programme
- Cost – delivery to agreed budget

- Innovation
- Social value

For example, there are specific KPIs for capital schemes awarded through the I+ partnership. However, generally I+ contract awards are primarily based on performance within the wider service. Each month, the Delivery Partnership Boards for the various I+ activities meet and review the performance of each service area and collaboratively work together on delivering improvement.

The I+ partnership is based around a standard contract but is subject to governance arrangement with agreed long-term objectives and outcomes that will inform contract performance targets and payments.

#### 3.6.2 Payment terms

The payment schedule and mechanism will be in line with the provisions of the chosen contracts and frameworks. Payments for systems and infrastructure provision are expected to be based on delivery milestones. There is expected to be flexibility in contract payment terms over the life of the project as changes might be required to the operation of the schemes to follow government policy or as a result of behavioural change.

The terms of payment will be in line with the local authorities' standard terms of payment. Payment will be made to the contractor/supplier by monthly valuation with a BACS payment within 30 days after the due date for payment, receipt of invoice or delivery of goods/services.

Sub-contracts within a contract, for the purpose of fulfilling the main contract specification, shall also require payments to be made by the contractor to the sub-contractor within a specified period not exceeding 30 days from the receipt of a valid invoice.

The contractor will be expected to provide regular information outlining how the activity on the programme relates to the operation of the programme before any payments are approved.

Allocated risks will be tied into the payment approach where payments could be withheld if deliverables are not considered to be met and contractors are expected to hold appropriate levels of insurance provision in case of such risks being realised.

The details relating to financial arrangements with suppliers will be duly updated at the FBC stage.

### 3.7 Risk allocation and transfer

The risk registers are discussed in the Management Case and attached in Appendix 18 and 20. It is a live document that will be updated regularly throughout the life of the project to ensure risks are identified and mitigated through effective programme management. The key risks to the project include:

- Highways England insist on having network upgrades
- Design and build procurement risks and public criticism due to the coronavirus
- Public/business acceptance to bus gates and criticism of the scheme

- Timescale and delay issues relating to retrofitting, terms and conditions, permits, roadworks, detailed design and road safety audits
- Insufficient funding from JAQU and higher than expected utility costs
- Implementation issues including camera interface software, power location, data protection, back office agreements and bus gate enforcement
- Scheme cost increase related to Victoria Road community consultations and introduction of ULEV bus gate exemptions

Three risk workshops were led by Bentley Project Management and attended by officers from each of the authorities who have expertise on the measures to be delivered in the Preferred Option. Each workshop covered the following areas:

- Identification of the risks
- Mitigation of the risks
- Quantification of the risks

Following these workshops, a risk register and Quantified Risk Assessment (QRA) was produced and analysed against the required contingency needs for the project. An effective risk management strategy will be in place to minimise the impact of risks whilst ensuring potential opportunities are maximised. The risks have been categorised and allocated an owner to ensure that they are managed effectively.

The authorities' approach to risk is dynamic and proactive. Identified risks are not just accounted for through financial provisions but are managed and mitigated against in the first instance.

Table 3-4 outlines the key risks identified at the OBC stage in the process. It describes how these risks will be managed between OBC and FBC.

It is considered that the risks identified in the risk register are currently owned by the three authorities or JAQU as the Implementation Funding agreement has not been finalised and delivery timescales have not been approved. Once the individual contracts have been approved, risks will be apportioned appropriately between the contractors and the local authorities. During implementation it is expected that risks will be allocated to the party that is best placed to manage them. Risks will be reviewed at contract award stage before FBC approval through a further risk workshop. A final shared risk register will be produced at FBC to allocate ownership and determine the value of the residual risks to be included within target costs.

*Table 3-4: Risk allocation*

| Risk | Risk allocation at OBC | Description |
|---|---|---|
| Highways England insist on having network upgrades | JAQU and DfT | Delays to the project related to extended Highways England negotiations and new junction improvements, resulting in a requirement for increased funding from JAQU or other DfT funding sources |
| Design, build, procurement risks and public criticism due to the coronavirus | JAQU | Decisions related to progressing or delaying the scheme due to coronavirus would be made by JAQU |
| Public/business acceptance to bus gates and criticism of the scheme | Local authorities | Resources will be provided by JAQU to enable intensive consultations managed by the local authorities |
| Timescale and delay issues relating to retrofitting, terms and conditions, permits, roadworks, detailed design and road safety audits | Local authorities | Management procedures in place through the governance process |
| Insufficient funding from JAQU and higher than expected utility costs | JAQU and Local authorities | Local authorities will need to review project delivery timescales and costs in accordance with final JAQU funding approval |
| Implementation issues including camera interface software, power location , data protection, back office agreements and bus gate enforcement | Local authorities | Management procedures in place through the governance process |
| Scheme cost increase related to Victoria Road community consultations and introduction of ULEV bus gate exemptions | JAQU and local authorities | Resources will be required from JAQU to deliver scheme amendments between OBC and FBC. If these resources are not approved, the local authorities will manage feedback to MPs and local communities |

## 3.8 Contract length

A key requirement for the successful implementation of the project is compliance with $NO_2$ concentration limits within the shortest possible time and therefore the Councils will ensure delivery is as quick as possible.

An indicative programme can be found in Appendix 14, which outlines the timescales for the delivery of the Preferred Option. The key milestones and associated dates are provided in the Management Case.

The programme includes the anticipated duration of each of the contracts to allow for all elements of the scheme to be delivered within the designated timeframe. Break clauses will be considered during the drafting of individual contracts.

By using existing frameworks and contracts and engaging early with contractors, particularly those who already have a relationship with the three authorities, the risk of extended procurement processes and costs are minimised, helping to deliver additional programme certainty.

## 3.9 Human resource

Some services have been resourced internally within the local authorities such as transport planners, environmental health officers, air quality officers, traffic managers, finance, legal and procurement personnel.

Other services have been resourced externally through contracted consultants. Their fees have been agreed either through the Framework of the contract or through the contract itself. Revenue costs have been factored into the final cost and are presented in the Financial Case.

## 3.10 Contract management

The contracts procured fall under the local authorities’ responsibility to ensure that the contract scopes and budgets are adhered to. The three Councils will work together through the governance process identified in the Management Case in the monitoring of the contracts. Support in this is provided internally by the local authorities’ designated project manager, transport planners, environmental health officers, air quality officers, traffic managers, procurement, legal and finance teams.

To date, the NEC3 suite of contracts has been used to procure the relevant consultants and the Councils plan to continue using the NEC3 suite of contracts to develop and deliver the Preferred Option. This form of contract is well understood through the supply chain and relies on a pre-defined risk register to allocate and manage anticipated risk. It is currently expected that the engineering works will be awarded under the NEC3 suite, utilising the ‘Engineering and Construction Contract (ECC), Option C – Target Cost with Priced Activity Schedule’.

The construction contract will be managed in accordance with SoTCC and SCC’s Contract Management Manuals. The contract data will define the works information for the contract that will include scheme drawings and the specification.

Any failure on the part of the service provider to deliver contracted services on time, to specification or price then contract management will intervene. Contract failures will be investigated thoroughly with any disputes or disagreements between the parties resolved in accordance with the outlined arbitration process.

Successful delivery of these contracts relies on high quality project management skills with cost control expertise and sufficient support services in place. This is required throughout the project's lifespan and will be carried out through the governance process identified in the Management Case.

### 3.11 Procurement success factors

Throughout the lifecycle of the project, the identified governance arrangements described in the Management Case will track, monitor and audit progress and quality.

The JAG will receive updates on the status of the outputs (and the likelihood of benefit realisation), considering them against the primary and secondary Critical Success Factors (CSFs) and expected benefits (as described in Section 1.11 of the Strategic Case).

During project implementation, the JOG will continue to liaise with JAQU's Account Manager to determine and agree any appropriate actions that might be required to maintain progress in accordance with the requirements of the Ministerial Direction and grant conditions.

#### 3.11.1 Change management

Where changes to contracts are required in order to deliver the NSLAQP, these will be managed through a structured change management process. To ensure there is control over any contractual changes, the JOG will review and discuss necessary changes and the SRO will have delegated powers to authorise changes associated with cost or programme within a threshold of the agreed contract terms. This threshold will be agreed at FBC.

#### 3.11.2 Social value

The Public Services (Social Value) Act 2012 requires bodies who commission public services to think about how they can also secure wider social, economic and environmental benefits. This is supported by SCC (and their contractors Amey), SoTCC and NuLBC.

As part of the procurement strategy for the procurement activities outlined in the Commercial Case, Social Value will be considered in the evaluation of any tenders with the aim of maximising the Social Value opportunities from the investments made in delivering the NSLAQP.

SoTCC's Stronger Together message provides a clear vision for the city and its objectives provide a framework and set of principles through which the Council delivers its services and a template for viewing Social Value in the City. Sitting beneath this vision are five strategic priorities and these set the agenda for SoTCC's interventions:

- Support vulnerable people in our communities to live their lives well
- Enable our residents to fulfil their potential
- Help businesses to thrive and make our city prosperous
- Work with our communities to make them healthier, safer and more sustainable
- An innovative and commercial council, providing effective leadership to help transform outcomes

The Council recognises that its procurement activity can play an important role in delivering the Stronger Together objectives.

Amey's Social Value Plan sets out their plan to achieve their goal through living their values and thereby maximising on the huge potential they must create positive social impact in the communities in which they operate. It is guided by the following commitments:

- Social value will form an integral part of our overall business strategy, corporate planning and decision making
- We will engage our employees to understand our social value policy and priorities, and how these are relevant to their day-to-day work
- We will embed social value into procurement activity

### 3.12 Benchmark CAZ D

Initial investigation demonstrates that the Benchmark CAZ D option would require a complex legal agreement which could add around one year to the programme. The Preferred Option is a simpler commercial procurement exercise and can be delivered quicker.

A lengthy procurement process would also be required to deliver a CAZ. The Benchmark CAZ project plan is provided in the Management Case and outlined in more detail in Appendix 14. It identifies that a turnkey solution for the back office function, cameras and civil works would take up to 17 months from starting the design and specification to awarding the contract. The process would include:

- Design and specification for a turnkey solution
- Approval of specification
- Supplier engagement
- Publish tender
- Tender evaluation
- Cabinet approvals
- Award of contract

The procurement and installation of ANPR cameras including operation and maintenance would be part of a turnkey solution utilising the appropriate framework. The supporting systems would include supporting software to interface with local and external systems and host data. The CAZ payment system would be provided centrally by JAQU and the associated pay.gov.uk central payments system.

The turnkey solution would include the final design and installation of signage on the strategic and local road network and enforcement of CAZ charges. This would be the most efficient manner of delivery for a joint project involving three authorities and where only two of those have the legal powers to deliver a CAZ.

Procurement would be led by SoTCC with a procurement sub-group to support the process. the project would also need to procure specialist legal support to provide advice to develop charging orders. The complexity of the arrangements would necessitate each local authority to procure additional legal resources as the existing in-house resources would be insufficient.

Challenges to procurement include the operational level CAZ agreement and the cost recovery model which are not yet fully developed by JAQU, which may result in changes to responsibilities and there being limited experience within the sector that can be drawn upon as specific operational parameters have evolved since initial procurement was undertaken by Leeds and Birmingham. There is a lack of published business cases from consortium projects upon which to take best practise.

# 4 Financial Case

## 4.1 Introduction

Stoke-on-Trent City Council (SoTCC), Newcastle-under-Lyme Borough Council (NuLBC) and Staffordshire County Council (SCC) are committed to working together to transform the urban area of North Staffordshire into a cleaner and healthier area.

In October 2018, Stoke-on-Trent and Newcastle-under-Lyme (the authorities with responsibilities for Environmental Health) were issued a Ministerial Direction to produce a local air quality plan to address their respective nitrogen dioxide ($NO_2$) problems. Given their proximity to one another, they were tasked with producing a joint plan.

As the highway authority for the Newcastle-under-Lyme area, Staffordshire County Council has been assisting the authorities and together, the three authorities have developed a plan to tackle $NO_2$ exceedances at the roadside – known as the North Staffordshire Local Air Quality Plan (NSLAQP).

This Plan will help to protect and promote the health of the local population by improving air quality and reducing the impact of air pollution on the environment. In so doing, the local authorities are complying with the UK Air Quality Plan and bringing $NO_2$ air pollution within statutory limits in the shortest possible time.

The joint approach has been necessary because it is recognised that air pollution does not respect local authority boundaries and therefore a consistent and co-ordinated approach is required to maximise air quality benefits for all people living and working in North Staffordshire. By working together, the Councils can also minimise the risk of unintended consequences and help to ensure, as far as possible, alignment between the NSLAQP and wider authority strategies.

The NSLAQP for Stoke-on-Trent and Newcastle-under-Lyme comprises of a package of measures:

- A50 Victoria Road bus gate, operational Monday to Friday between 07:00-10:00 and 16:00-19:00. ANPR cameras will be used to restrict access except for buses, taxis and cyclists
- A53 Etruria Road two-lane bus gate, operational Monday to Friday between 07:00-10:00 and 16:00-19:00. ANPR cameras will be used to restrict access except for buses, taxis and cyclists
- Traffic management measures on roads to the east and west of Victoria Road, including:
    - Traffic calming
    - One-way restrictions
    - Speed restrictions
    - Weight restrictions
    - Extension of footways
    - Carriageway re-surfacing

- Transport improvements along the A53 Etruria Road in the form of a review of singal times, signalised pedestrian crossing facilities and the relocation of a bus stop to avoid unnecessary queuing
- Targeted bus retrofit programme where 75% of buses using Bucknall New Road and 100% of buses using Victoria Road will be retrofitted to achieve Euro VI emissions standards
- Bus infrastructure improvements will be installed on routes that pass through or are parallel to the identified exceedance locations. The improvements will include Real Time Passenger Information (RTPI) screens, new bus shelters, accessible kerbs at bus stops and installation of CCTV at bus stops.

A ULEV exemption, allowing ultra-low emission vehicles to drive through the bus gates, will be assessed and if considered deliverable will be added to the preferred scheme in the Full Business Case (FBC). The local authorities will also seek further funding through the Clean Air Fund (CAF) for additional measures that will look to mitigate any impacts that might arise as a result of the scheme.

A separate Ministerial Direction concerns the retrofitting of buses operating along the A53 corridor. These are separately funded by JAQU and excluded from this Outline Business Case (OBC).

## 4.2 Purpose of this case

This Financial Case is primarily concerned with affordability and funding requirements. It presents evidence of a robust estimation of the package costs (for both implementation and operation), the key funding risks, sources and forecast revenue generation.

The Financial Case is supported with a financial model that is submitted with this Outline Business Case (OBC) document, it identifies the scale and sources of proposed funding and timing of expenditure. This model will be updated as the costs and identified risks are amended as the project progresses towards FBC.

Costs and financial information are presented in detail for the Preferred Option that forms the NSLAQP, comparative details are then presented for the benchmark Clean Air Zone (CAZ), including revenue forecasts associated with the scheme.

## 4.3 Preferred Option

### 4.3.1 Summary of costs

The preferred package of measures, as identified in section 4.1, aims to address the identified air quality exceedances in the shortest possible time. As noted in the project plan (see Appendix 14) the measures will be delivered by May 2022.

Capital costs will be incurred on the following elements:

- Installation of the bus gate on the A50 Victoria Road which includes ANPR cameras and new signage, as well as the Traffic Regulation Order (TRO).
- Installation of the bus gate on the A53 Etruria Road, ANPR cameras, new signage and road resurfacing, as well as the TRO.

- Traffic management to the east and west of the A50 Victoria Road which includes road resurfacing, replacement of road humps and new signage.
- Transport improvements along the A53 Etruria Road which includes signalised pedestrian crossing facilities, a new bus stop, new kerbing and levelled footways.
- Bus retrofitting programme which includes the installation of exhaust modification and e-cooling fans to 50 buses.
- Bus infrastructure improvements which includes real time passenger information (RTPI) screens, new bus shelters, accessible kerbs at bus stops and CCTV cameras.
- Monitoring and evaluation costs which includes diffusion tubes to measure air quality, ANPR cameras to monitor the use of the bus retrofit, traffic counts and the costs associated with analysing relevant data.

Operating costs will be incurred on the following elements:

- Operation and maintenance associated with the ANPR system
- Maintenance associated with the bus gate, signals, signage, traffic management and bus network enhancements
- Other operating costs associated with overheads, staffing and customer service
- Monitoring and evaluation costs
- Communications and publicity
- Project management costs

#### 4.3.2 Funding source

The three Councils do not have funding available for the implementation of the preferred package of measures identified from the modelling and appraisal process. These are measures that are additional to current spending commitments (which were included in the 'Do Minimum' scenario in the modelling and appraisal process).

The Council will therefore be seeking all funding from the Government's Implementation Fund to help achieve $NO_2$ compliance in the shortest possible time. It is expected that the funding will be provided by JAQU on an annual basis drawn down over the life span of the project. This will all be in accordance with the financial rules and regulations of the lead authority for the delivery phase of the project.

The bus gates, bus infrastructure and traffic management components of the NSLAQP will be delivered by the authorities using funding secured from the Implementation Fund. No local contributions are available or would be appropriate for these components of the scheme.

The bus retrofit component will be delivered directly by the bus operators involved, primarily First Group and D&G, using funding secured from the Implementation Fund. First Group have their own contracted provider and D&G have an identified supplier. No local contributions are available for this component of the scheme.

The Councils expect to put forward a bid to the Clean Air Fund (CAF) at FBC stage to support mitigating measures suggested by local Members of Parliament (MPs) that will complement the Preferred Option. As such, CAF measures have not been costed for nor included in the OBC's

Financial Case and the benefits of any CAF measures have not been included in the Economic Case.

Where possible, the Councils will seek to take advantage of other funding opportunities such as those from other government sources, or partnerships, in order to help support the wider air quality agenda and complement the outcomes of the Preferred Option, as detailed in the Strategic Case. Examples include:

- Funding for the provision of electric vehicle charging points
- Other Defra air quality funds
- DfT funding for highway and sustainable transport measures
- Transforming Cities Fund
- Town Funds
- Future High Street Funds
- ADEPT SMART Places funds

#### 4.3.3 Assumptions and limitations

Detail on the derivation of scheme costs is set out in the following section. They have been developed by the local authorities and contractors procured to support the preparation of the OBC, including Amey and JMW. Scheme costs are calculated using bottom-up estimates where a per-item cost is applied to the estimated required quantity. Bus retrofit costs are based on the separate bus retrofit Ministerial Direction being delivered by Newcastle-under-Lyme Borough Council. The costs are taken from similar schemes, initial estimates from possible service providers and market intelligence. More details on these costings and assumptions can be found in Appendix 11.

To inform the OBC, preliminary designs of all engineering schemes on the local highway have been produced and are provided in Appendix 3. In general, the Benchmark CAZ D scheme has been based on assumptions, professional judgement, additional analysis and relevant costs from other proposed charging CAZ schemes.

Decommissioning costs have been included for the bus gates as it is assumed that they will not be required once there is clear evidence through the monitoring and evaluation process that $NO_2$ compliance can be maintained without them. Elements to be decommissioned include civil engineering works associated with reinstating parts of the highway to their original layouts prior to scheme implementation, signage on the local and strategic road networks, ANPR cameras and enforcement technology, and monitoring equipment. Decommissioning will take place when the evidence shows that compliance can be maintained without the bus gates in place. The year of decommissioning is currently unknown.

As detailed within the Commercial Case the Councils intend to procure the construction works and retrofit delivery through existing frameworks and contracts, ensuring value for money. The ANPR camera operation, penalty notices, Prism signage operation and CCTV operation will be incorporated into the existing back office function managed by SoTCC via the existing joint set up between SCC and SoTCC.

As explained in the Commercial Case, early contractor involvement has significantly benefited the production of the OBC providing confidence in delivery. Amey are SCC's strategic partner of choice for highway project delivery through the Infrastructure+ contract. They are co-located in SCC's offices. Amey designers and specialists have worked alongside the three authorities and have been involved throughout the production of the OBC. SoTCC has procured Amey through the Midlands Highways Alliance Professional Services Partnerships (MHAPSP3) for the support of work at OBC stage. At the design and delivery stage, SoTCC and SCC would look to use the Infrastructure+ contract for the procurement of the selected contractor. If the OBC is approved, the costs will continue to be further refined as the project progresses through the development of the FBC.

#### 4.3.4 Cost derivation

Table 4-1 provides details on how cost estimates for each of the package elements have been derived as well as the key assumptions.

*Table 4-1: Derivation of cost estimates*

| Measures | Costing method | Key assumptions / caveats |
|---|---|---|
| Bus gate on the A50 Victoria Road | Based on previous experience of similar measures and also using schedule of rates. | Costs based on preliminary designs and initial site investigations. |
| Bus gate on the A53 Etruria Road | Based on previous experience of similar measures and also using schedule of rates. | Costs based on preliminary designs and initial site investigations. |
| Traffic management to the east and west of the A50 Victoria Road | Based on previous experience of similar measures and also using schedule of rates. | Costs based on preliminary designs and initial site investigations. |
| Transport improvements along the A53 Etruria Road | Based on previous experience of similar measures and also using schedule of rates. | Costs based on preliminary designs and initial site investigations. |
| Bus retrofitting programme | Based on experience from retrofitting undertaken in Newcastle-under-Lyme and First Group's experience. | Costs taken from NuLBC's current retrofitting programme. Number of buses required for retrofitting determined through air quality modelling and discussions with bus operators.<br><br>More detailed costs cannot be derived until it is known |

| | | |
|---|---|---|
| | | which precise vehicles will receive the retrofit. |
| Bus infrastructure improvements | Based on previous experience of similar measures and also using schedule of rates. | Costs based on preliminary designs and initial site investigations. |
| Back office cost for monitoring, data processing and charging | Based on previous experience of similar measures and also using schedule of rates. | Costs based on preliminary designs and initial site investigations. |
| Communications, engagement and consultation | Based on 1 Full Time Equivalent (FTE) and materials for three years. | |
| Monitoring and evaluation | Based on previous experience of similar measures. | Costs based on schedule of rates. |
| Decommissioning costs | Bottom up estimate. Estimate based on previous similar work. | Removal cost per item of scheme infrastructure. |

#### 4.3.5 Risks and contingency

A Risk Register and Quantified Risk Assessment (QRA) have been developed to identify and cost any possible risks to the project for both the Preferred Option and the CAZ benchmark. The full risk register for the Preferred Option can be found in Appendix 18. It is a live document that is updated regularly throughout the life of the project so to ensure risks are identified and mitigated through effective programme management. The key risks to the project are based around the:

- Deliverability of the Preferred Option
- Political acceptance of the required option
- Cost uncertainties of the Preferred Option

An effective risk management strategy is in place to minimise the impact of risks whilst ensuring potential opportunities are maximised. The risks have been categorised and allocated an owner to ensure that they are managed effectively.

Three Risk Workshops were led by Bentley Project Management and attended by officers from each of the authorities who have expertise in the specific areas of focus outlined in the Preferred Option. The workshops were set out as follows:

- Identification of the risks
- Mitigation of the risks

- Quantification of the risks

Following these workshops, a risk register and QCRA was produced and analysed against the required contingency needs for the project.

In the development of the financial model a financial risk layer has been calculated based on the work undertaken in the development of the risk register and QRA. Due to the early stage of the project, it has been decided that the 85th percentile will be incorporated into the financial model. The QRA identifies a risk allowance of £1,060,000. As the project progresses, the QRA will be adjusted as the status of identified risks change and new risks arise.

In addition, contingencies have been included as part of the construction scheme costs provided by the contractor. As such, the values stated include a 15% contingency for capital works to allow for any uncertainties within the development of the costs. This level of contingency has been based on guidance obtained from other similar schemes.

TAG unit A1.2 states that optimism bias is only applicable to the Economic Case and so it has not been included in the costs presented in this Financial Case. The costs presented in this Financial Case concerns the actual costs of the scheme that funding is being sought for. Details of how optimism bias has been applied to the economic assessment can be found in the E2 Economic Model.

#### 4.3.6 Financial modelling

Table 4-2 below provides a summary of the capital and operational funding requirements to deliver the preferred package as developed in the financial model. The operating costs are included for a ten-year period.

These costs are based on resource accounting and budgeting (RAB) principles and show the resource costs over the lifetime of the proposal. They allow for inflation on top of the base cost estimates made at 2020 prices and include an allowance for uncertainty/contingency associated with the capital costs, as well as a risk allowance.

*Table 4-2: Summary of costs (£000s)*

| Measure | Capital expenditure | Operating expenditure over 10 years | Total |
|---|---|---|---|
| A50 Victoria Road bus gate | 755 | 242 | **997** |
| A53 Etruria Road bus gate | 1,012 | 308 | **1,320** |
| Traffic management east and west of Victoria Road | 2,111 | - | **2,111** |
| Transport improvements along A53 Etruria Road | 825 | 46 | **871** |
| Bus retrofit programme | 1,813 | 207 | **2,020** |
| Bus infrastructure improvements | 1,240 | 948 | **2,188** |
| Back office cost for monitoring, data processing and charging | - | 1,650 | **1,650** |
| Communications, engagement and consultation | - | 125 | **125** |

| | | | |
|---|---|---|---|
| Monitoring and evaluation | 86 | 991 | **1,077** |
| Decommissioning costs | - | 608 | **608** |
| **Total** | **7,842** | **5,124** | **12,966** |

As the implementation of a charging CAZ is not part of the preferred scheme, there will be no direct revenue generated; however, some revenue is likely to be received due to enforcement activity associated with the two bus gates which will be controlled by ANPR cameras. The authorities will operate the bus gate enforcement in accordance with their existing policies for civil enforcement. Table 4-3 forecasts the predicted revenue associated with Penalty Charge Notices (PCNs) based on currently enforced bus gates within North Staffordshire. Adjustments have been made to account for the times of operation which the proposed bus gates will be enforced. It has also been acknowledged that existing bus gates do not have the communications and engagement support that will accompany the Preferred Option and so contraventions of the proposed bus gates are likely to be lower. There is likely to be a spike in PCNs issued following the opening of the new bus gates, however, this may not necessarily result in additional revenue as there may also be a higher rate of appeal to PCNs in the initial few months of the scheme. This trend is likely to drop off significantly after the first year of operation as drivers acclimatise to the bus gate restrictions and so any revenue generated from PCNs is likely to be limited in the medium to longer term. Charge levels are fixed and were set by Central Government in 2008, therefore adjustments for inflation have not been applied. It is therefore assumed that income from the bus gates will remain constant after the first year of operation.

*Table 4-3: Annualised revenue from PCNs in the Preferred Option (2020 prices) (£000s)*

| Year | Bus gate income |
|---|---|
| **2022** | £84 |
| **2023** | £40 |
| **2024** | £40 |
| **2025** | £40 |
| **2026** | £40 |
| **2027** | £40 |
| **2028** | £40 |
| **2029** | £40 |
| **2030** | £40 |
| **2031** | £40 |
| **Total** | **£447** |

Table 4-4 presents the cashflow profile over ten years for delivery of the preferred package of measures. Prices have been adjusted for inflation per annum as outlined in TAG guidance.

*Table 4-4: Preferred option cashflow profile for the 10-year appraisal period (£000s)*

| | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Capital costs | 3,806 | 3,801 | - | - | - | 236 | - | - | - | - | - |
| O&M costs | 160 | 336 | 401 | 367 | 580 | 384 | 393 | 514 | 411 | 420 | 1,158 |
| Revenue | | -84 | -40 | -40 | -40 | -40 | -40 | -40 | -40 | -40 | -40 |
| **Net cashflow** | **3,966** | **4,053** | **361** | **326** | **540** | **580** | **352** | **474** | **371** | **380** | **1,118** |

*NB: Costs are shown as positive and revenues are shown as negative as per DfT Public Accounts table guidance*

### 4.3.7 Sensitivity analysis

In line with JAQU guidance, a range of sensitivity tests have been undertaken to consider the impact of higher than expected capital and operating costs. Further details on this can be found in the financial model in Appendix 11.

*Table 4-5: Sensitivity test summary for the preferred option*

| Sensitivity test | Test description | Impact |
|---|---|---|
| Increased capital costs | 20% increase in capital costs | The greatest impact on an adjustment of capital costs occurs at the beginning and end of the project lifespan. Capital costs usually incur at the beginning of a scheme whilst it is being constructed. The spike at the end of the project is due to decommissioning costs.<br><br>Even if capital costs were to increase by 20%, the Preferred Option would still be considerably cheaper to operate than the Benchmark CAZ D. |
| Increased operating costs | Operating costs increased by 20% | The impact on operating costs is less significant than the impact on capital costs as operating costs are spread across the 10-year period.<br><br>Even if operating costs were to increase by 20%, the Preferred Option would still be considerably cheaper to operate than the Benchmark CAZ D. |

Additional sensitivity tests have been conducted on both the Preferred Option and Benchmark CAZ D of which the results are set out in the Economic Case and subsequent technical reports.

### 4.3.8 Accounting treatment

As detailed within the Management Case, the development of the project has been led and overseen by the Joint Officer Group (JOG) and a Member-led Joint Advisory Group (JAG) with input from other Council departments as required. Of particular relevance to the Financial Case has been the involvement of finance, legal and procurement personnel.

Each of the Councils will provide written evidence from their responsible financial officers (as defined under Section 151 of the Local Government Act 1972) to demonstrate that the finance teams have been involved in developing the scheme through its various stages and have assessed the impact of the project on the authorities' balance sheets. The letters will be included along with the approved OBC submission and at FBC stage.

The accountancy treatment will follow the authority's guidance:

- As the bid consists of both capital and revenue expenditure, assets will be held on the balance sheet and the revenue costs associated with both sets of measures shown as operating costs are held in the income and expenditure account.
- Expenditure on the acquisition, creation or enhancement of assets is treated as capital expenditure.
- Depreciation on assets is not charged in the year of acquisition but is applied in the year of disposal and is calculated on a straight-line basis.
- Costs to establish the traffic management measures will be treated as capital expenditure and depreciated over the life of the asset.
- Expenditure that maintains but does not add to an asset's potential to deliver future economic benefits or service potential is charged as a revenue expense when it is incurred.
- Activity is accounted for on an accruals basis in the year that it takes place and not when cash payments are made or received.
- Grants used to finance the preferred scheme for which conditions have not been satisfied are held on the balance sheet as creditors and amortized (taken to revenue) over the life of the project.
- A provision has been created to account for decommissioning costs in accordance with Accounting Standard IAS37 for Provisions, Contingent Liabilities and Contingent Assets.

## 4.4 Benchmark CAZ D

### 4.4.1 Summary of costs

In accordance with JAQU guidance a benchmark charging CAZ option has also been considered.

The forecast project plan for the implementation of a charging CAZ (as discussed and included in Appendix 16) demonstrates that the measures will not be delivered until June 2023. Costs were benchmarked against Birmingham as they are delivering a CAZ D. Several meetings were held with Birmingham colleagues during the costing process. Final costs were not available as the scheme has not yet been delivered and due to commercial sensitivities, no CAZ schemes were able to share more than generic costs and processes. JAQU guidance regarding the specification of CAZ signage has also been applied in developing the costs.

Capital costs will be incurred on the following elements:

- CAZ D charging and enforcement system (purchased through a turnkey contract as a single system), including:
    - Signage
    - ANPR camera network
    - Central system
    - Local system
    - Other capital costs (specification, design, project management)

- Monitoring and evaluation costs for significant additional monitoring equipment

Operating costs will be incurred on the following elements:

- CAZ D charging and enforcement system, including:
    - Roadside equipment operation and maintenance
    - Enforcement vehicle operation and maintenance
    - Central system operation and maintenance
    - Local CAZ system costs
    - Other operating costs – accommodation costs, overheads, staffing, customer service
    - Payment process charges from pay.gov.uk
- Monitoring and evaluation costs
- Communications and publicity
- Project management costs (forming part of the turnkey solution)

#### 4.4.2 Funding source

The three Councils do not have funding available for implementation of a charging CAZ and therefore all funding would be needed from the Government's Implementation Fund.

#### 4.4.3 Assumptions and limitations

Detail on the derivation of scheme costs is set out in the following section, these have been developed by Amey (SCC's appointed contractor) and calculated through discussion and liaison with other local authorities, in particular Birmingham, that are in the process of procuring a charging CAZ scheme for implementation.

#### 4.4.4 Cost derivation

Table 4-6 provides details on how cost estimates for each of the package elements have been derived, as well as the key assumptions.

*Table 4-6: Derivation of cost estimates*

| Measures | Costing method | Key assumptions / caveats |
|---|---|---|
| CAZ D boundary signs | JAQU guidance, similar schemes and previous experience | Cost based on sign size and typical unit costs from other similar schemes. All boundary locations have been reviewed in detail to ascertain an accurate number of boundary signage required.<br>Cost includes installation and reinstatement. |

| | | |
|---|---|---|
| CAZ D boundary ANPR | Based on guidance from other similar schemes and previous similar experience. | Cost based on typical unit cost from other similar schemes. All boundary locations have been reviewed in detail to ascertain an accurate number of ANPR cameras required. |
| Other signage, ANPR and traffic management costs | Based on guidance from other similar schemes and previous similar experience. | Advanced signage has been costed separately with an allowance having been made.<br><br>Cost based on typical unit cost for signage from other schemes. |
| Maintenance | JAQU guidance and similar schemes | Cost based on typical unit cost from other similar schemes.<br><br>Costs based on per shift/day as applicable |
| Back Office Cost for monitoring, data processing and charging | Based on guidance from other similar schemes not yet operational. | Costs based on per shift as applicable. |
| Communications, engagement and consultation | Based on 1 FTE and materials. | - |
| Monitoring and evaluation | Based on guidance from JAQU and other similar schemes not yet operational. | Cost based on typical unit cost from other similar schemes. |
| Decommissioning costs | Bottom up estimate. Estimate based on previous similar work in terms of roadside equipment. | Costs are for removal of cameras and signs, including labour, van, materials and equipment. |
| Sinking fund | Based on guidance from other similar schemes not yet operational. | Value has been assumed to be equal to that of the decommissioning costs. |

#### 4.4.5 Risks and contingency

For completeness the same approach to risk identification and management has been adopted for the Benchmark CAZ as the Preferred Option to provide an accurate allowance for risk. The risk register is discussed in more detail in the Management Case.

In the development of the financial model a financial risk layer has been calculated based on the work undertaken in the development of the risk register QRA. Due to the early stage of the project, it has been decided that the 85th percentile will be incorporated into the financial model. The QRA identifies a risk allowance of £11,690,000. As the project progresses, the QRA will be adjusted as the status of identified risks change and new risks arise.

In addition, contingencies have been included as part of the construction scheme costs provided by the contractor. As such, the values stated include a 15% contingency for capital works to allow for any uncertainties within the development of the costs. This level of contingency has been based on guidance provided by Birmingham City Council and other similar schemes that are not yet operational.

A sinking fund is in place in order to mitigate against any unforeseen risks that are realised throughout the operation of the scheme. The value of the sinking fund has been calculated as being equal to that of decommissioning costs. The sinking fund will be ring-fenced within the NSLAQP accounts to ensure its availability as contingency.

TAG unit A1.2 states that optimism bias is only applicable to the Economic Case and so it has not been included in the costs presented in this Financial Case. The costs presented in this Financial Case concerns the actual costs of the scheme that funding is being sought for. Details of how optimism bias has been applied to the economic assessment can be found in the E2 Economic Model.

#### 4.4.6 Financial modelling

Table 4-7 below provides a summary of the capital and operational funding requirements to deliver the Benchmark CAZ as developed in the financial model.

These costs are based on RAB principles and show the resource costs over the lifetime of the proposal. They allow for inflation on top of the base cost estimates made at 2020 prices and include an allowance for uncertainty/contingency associated with the capital costs, as well as a risk allowance.

*Table 4-7: Summary of costs (£000s)*

| Measure | Capital expenditure | Operating expenditure over 10 years | Total |
|---|---|---|---|
| CAZ D boundary signs | 901 | - | **901** |
| CAZ D boundary ANPR | 11,330 | - | **11,330** |
| CAZ D advanced signing local network | 1,304 | - | **1,304** |
| CAZ D advanced signing Highways England network (including gantries) | 5,161 | - | **5,161** |
| CAZ D internal ANPR and signing | 5,724 | - | **5,724** |
| Back office cost for monitoring, data processing and charging | 3,513 | 42,706 | **46,218** |
| Maintenance | 5,474 | 11,765 | **17,238** |
| Communications, engagement and consultation | - | 2,394 | **2,394** |
| Monitoring and Evaluation | 191 | 1,000 | **1,191** |
| Decommissioning Costs | - | 2,027 | **2,027** |
| Sinking fund | 2,979 | - | **2,979** |
| **Total** | **36,577** | **59,892** | **96,469** |

The Benchmark CAZ D option will generate revenue through charging non-compliant vehicles to enter the CAZ boundary. Table 4-8 below presents the predicted revenue generation to the local authorities associated with the charging CAZ. Revenue is assumed to be zero in the final year of appraisal (2031), as the scheme will no longer be operational. Inflation has not been applied, as it is assumed that charge levels will be fixed, in line with other penalty charge schemes. Further detail on how this revenue has been calculated can be found in the E1 Economic Methodology Report. As the Benchmark CAZ D will not become operational until 2023, this will be the first year of revenue. 20% of this total revenue (£43.1m over 10 years) will be taken by Central Government to pay for the Central CAZ Service. The remaining 80% (£172.3m over 10 years) will be used to fund the operating costs of the Benchmark CAZ D. Any surplus revenue will be reinvested into other local transport policies.

*Table 4-8: Annualised CAZ D revenue to the local authorities (£000s) (2020 prices)*

| | Car Business | Car Commuting | Car Other | Taxi | LGV Personal | LGV Freight | HGV | Buses | Total |
|---|---|---|---|---|---|---|---|---|---|
| **2023** | £1,284 | £6,807 | £16,295 | £7 | £1,964 | £12,545 | £1,872 | £146 | **£40,922** |
| **2024** | £1,160 | £6,148 | £14,718 | £7 | £1,842 | £11,766 | £1,410 | £122 | **£37,173** |
| **2025** | £1,036 | £5,489 | £13,140 | £7 | £1,720 | £10,987 | £948 | £98 | **£33,425** |
| **2026** | £911 | £4,830 | £11,563 | £6 | £1,598 | £10,208 | £486 | £74 | **£29,677** |
| **2027** | £759 | £4,025 | £9,635 | £5 | £1,332 | £8,507 | £405 | £62 | **£24,731** |
| **2028** | £608 | £3,220 | £7,708 | £4 | £1,066 | £6,805 | £324 | £50 | **£19,784** |
| **2029** | £456 | £2,415 | £5,781 | £3 | £799 | £5,104 | £243 | £37 | **£14,838** |
| **2030** | £304 | £1,610 | £3,854 | £2 | £533 | £3,403 | £162 | £25 | **£9,892** |
| **2031** | £152 | £805 | £1,927 | £1 | £266 | £1,701 | £81 | £12 | **£4,946** |
| **2032** | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | **£0** |

Table 4-9 presents the cashflow profile for delivery of the Benchmark CAZ D. Prices have been adjusted for inflation per annum as outlined in TAG guidance

*Table 4-9: Benchmark CAZ D cashflow profile for the 10-year appraisal period (£000s)*

| | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Capital costs | 18,970 | 9,154 | - | - | - | 5,474 | - | - | - | - | 2,979 |
| O&M costs | 73 | 5,197 | 5,316 | 5,439 | 5,666 | 5,692 | 5,823 | 5,956 | 6,093 | 6,234 | 8,404 |
| Revenue | - | -40,922 | -37,173 | -33,425 | -29,677 | -24,731 | -19,784 | -14,838 | -9,892 | -4,946 | - |
| **Net cashflow** | **19,043** | **-26,571** | **-31,857** | **-27,986** | **-24,011** | **-13,565** | **-13,962** | **-8,882** | **-3,799** | **1,287** | **11,383** |

*NB: Costs are shown as positive and revenues are shown as negative as per DfT Public Accounts table guidance*

#### 4.4.7 Accounting treatment

As detailed above and within the Management Case the development of the project has been led and overseen by the JOG and JAG, with input from other Council departments as required. Of particular relevance to the Financial Case has been the involvement of finance, legal and procurement personnel.

The Benchmark CAZ D is not supported by the Councils and therefore the accountancy treatment for this option has not been explored in further detail.

### 4.5 Conclusion and financial approval

A proportionate yet robust approach has been adopted in the development of scheme costs and allowance for risk, contingency and sinking fund, which provides a high level of confidence in the scheme costs presented. Table 4-10 summarises the overall grant request from the three authorities from the Implementation Fund.

*Table 4-10: Summary of cost estimates over 10 years (£000s)*

| | Preferred Option | Benchmark CAZ D |
|---|---|---|
| Capital costs | 7,842 | 36,577 |
| Operating & maintenance costs | 5,124 | 59,892 |
| Revenue | -447 | -215,388 |
| **Net cash flows** | **12,520** | **-118,920** |

*NB: Costs are shown as positive and revenues are shown as negative as per DfT Public Accounts table guidance*

Cost and revenue forecasts indicate that the revenues generated from the Benchmark CAZ D exceed the capital and operating costs of the scheme. However, the overall capital and operating costs of the Preferred Option are considerably less than that of the Benchmark CAZ D. Crucially, the Preferred Option also meets the primary critical success factors of achieving air quality compliance in the shortest timeframe possible, unlike the Benchmark CAZ D, and therefore the local authorities do not support the Benchmark CAZ D option, which cannot be delivered until May 2023.

The North Staffordshire local authorities do not have sufficient funds available to deliver the preferred scheme and so funding is requested through the Government's Implementation Fund. It is expected that a grant will be received subject to approval. The funding will be drawn down over the course of the project as it is spent. It should be noted that if 100% of funding is not received, there is a real risk that the Councils will not be able to deliver 100% of the scheme required to achieve compliance in the shortest possible time.

A Clean Air Fund bid has not been costed for at this OBC stage but is currently expected to be included at FBC stage as the authorities look to potentially mitigate against any negative impact of the measures proposed in the Preferred Option that may emerge.

In the development of the business case, the Section 151 Officers will be involved in the governance process and hence kept fully informed. Letters from the s151 Officer from each of the three authorities will be presented along with the approved OBC submission and at FBC stage. They will demonstrate that:

- As the responsible financial officer, they are comfortable with the financial position related to the delivery of the preferred option
- Delivery of the scheme is dependent on JAQU funding
- They approve the submission of this OBC and bid for funding

# 5 Management Case

## 5.1 Introduction

Stoke-on-Trent City Council (SoTCC), Newcastle-under-Lyme Borough Council (NuLBC) and Staffordshire County Council (SCC) are committed to working together to transform the urban area of North Staffordshire into a cleaner and healthier area.

In October 2018, Stoke-on-Trent and Newcastle-under-Lyme authorities, who both have responsibility for environmental health, were issued a Ministerial Direction to produce a local air quality plan to address their respective nitrogen dioxide ($NO_2$) problems. Given their proximity to one another, they were tasked with producing a joint plan.

As the highway authority for the Newcastle-under-Lyme area, SCC has been assisting the authorities and together, the three authorities have developed a plan to tackle $NO_2$ exceedances at the roadside – known as the North Staffordshire Local Air Quality Plan (NSLAQP).

This Plan will help to protect and promote the health of the local population by improving air quality and reducing the impact of air pollution on the environment. In so doing, the local authorities are complying with the primary aim of the UK Air Quality Plan and bringing $NO_2$ air pollution within statutory limits in the shortest possible time.

The joint approach has been necessary because it is recognised that air pollution does not respect local authority boundaries and therefore a consistent and co-ordinated approach is required to maximise air quality benefits for all people living and working in North Staffordshire. By working together, the Councils can also minimise the risk of unintended consequences and help to ensure, as far as possible, alignment between the NSLAQP and other authority strategies.

The NSLAQP for Stoke-on-Trent and Newcastle-under-Lyme comprises of a package of measures:

- A50 Victoria Road bus gate, operational Monday to Friday between 07:00-10:00 and 16:00-19:00. ANPR cameras will be used to restrict access except for buses, taxis and cyclists
- A53 Etruria Road two-lane bus gate, operational Monday to Friday between 07:00-10:00 and 16:00-19:00. ANPR cameras will be used to restrict access except for buses, taxis and cyclists
- Traffic management measures on roads to the east and west of Victoria Road, including:
    - Traffic calming
    - One-way restrictions
    - Speed restrictions
    - Weight restrictions
    - Extension of footways
    - Carriageway re-surfacing

- Transport improvements along the A53 Etruria Road in the form of a review of signal times, signalised pedestrian crossing facilities and the relocation of a bus stop to avoid unnecessary queuing
- Targeted bus retrofit programme where 75% of buses using Bucknall New Road and 100% of buses using Victoria Road will be retrofitted to achieve Euro VI emissions standards
- Bus infrastructure improvements will be installed on routes that pass through or are parallel to the identified exceedance locations. The improvements will include Real Time Passenger Information (RTPI) screens, new bus shelters, accessible kerbs at bus stops and installation of CCTV at bus stops.

An ultra-low emission vehicle (ULEV) exemption, allowing ULEVs to drive through the bus gate, will be assessed in the air quality model and if considered deliverable, will be added to the scheme in the Full Business Case (FBC).The local authorities will also seek further funding through the Clean Air Fund (CAF) for additional measures that will look to mitigate any impacts that might arise as a result of the preferred scheme.

A separate Ministerial Direction concerns the retrofitting of buses operating along the A53 corridor. These are separately funded by the Joint Air Quality Unit (JAQU) and excluded from this Outline Business Case (OBC) Management Case.

### 5.2 Purpose of this case

This Management Case sets out the framework that NuLBC, SoTCC and SCC are using to deliver the programme of measures to meet $NO_2$ compliance levels and achieve the primary aim. The purpose of the Management Case is to set out the framework through which the delivery of the preferred scheme will be managed and to determine whether the proposal is deliverable within the timescales.

In line with the JAQU guidance, the Management Case builds on the Strategic Outline Case (SOC) by:

- Outlining the arrangements required to ensure successful delivery of the Preferred Option
- Including an achievable project plan
- Putting together a risk management strategy and mitigation programme
- Identifying potential benefits through benefits realisation
- Developing an appropriate Monitoring and Evaluation Plan
- Highlighting resource requirements
- Developing a communications and marketing strategy

This case focuses on the detailed arrangements involved in ensuring the successful delivery of the Preferred Option, including the project governance arrangements and the approach taken to identify and mitigate risks associated with the project’s development and delivery.

### 5.3 Project governance

A robust governance arrangement has been developed to ensure that the project is managed effectively; taking into consideration any potential risks that might arise, whilst continuing to adhere to the project timeline (outlined in Appendix 14). The three authorities' Cabinets play key roles as the final decision makers in the governance structure. Technical specialist consultants with relevant expertise and experience in other authorities' air quality local plans have been supporting the Council officers to carry out the more technical aspects of the project, alongside project management and coordination support.

The Joint Officer Group (JOG) comprises of relevant officer representation from each of the three Councils, as well as independent consultants and project management support. The JOG assesses the evidence and identifies the key deliverables of the project and makes appropriate recommendations to the Joint Advisory Group (JAG) and JAQU. The JOG deals with any exceptional issues arising from project activity and manages budget and resources accordingly,

The three authorities have set up the JAG, which includes relevant Cabinet members from each authority, to guide officers and consultants and to review progress and steer the decision-making process regarding identification of a Preferred Option for meeting the requirements of the Ministerial Direction. The JAG considers reports from the JOG in relation to making decisions that effectively coordinate all three Councils. Meetings occur at least quarterly and more frequently where the project plan identifies key decisions which require Cabinet approvals or approval of key submissions to JAQU. The JAG supports the production of effective and deliverable policies on strategic cross-boundary matters as well as considering the key infrastructure requirements associated with the delivery of the Preferred Option.

Fourteen JAG meetings have taken place as part of the OBC approval process. Table 5-1 summarises the approvals and decisions that have been made at these meetings:

*Table 5-1: JAG approvals*

| Meeting date | Approval and decisions up to OBC |
|---|---|
| 31st July 2019 | Cllr Carl Edwards nominated as Chair |
| | Project Governance document approved |
| | Project plan & key milestones approved |
| 3rd September 2019 | Project Definition Document approved |
| | Stated Preference Surveys started |
| 14th October 2019 | Options Development workshop |
| 28th October 2019 | Progress Report approved for submission |
| 30th October 2019 | Leaders letter to Minister of State |
| 6th November 2019 | Preferred Options for modelling agreed |
| 19th November 2019 | IES submission |
| 19th December 2019 | Option 5 & 6 testing approved |
| | Financial report approved |
| | CAZ workshop report approved |
| | Member engagement report approved |

| | | 
|---|---|
| 29th January 2020 | Highways England risk noted |
| | Option 4+ and CAZ D approved as options |
| | Preferred Option not approved |
| 18th February 2020 | Communications survey approved |
| | Stoke on Trent City Council appointed SRO role for implementation phase |
| 6th March 2020 | Report presented to O&S/Select committee |
| 25th March 2020 | MP's workshop complete |
| | Option 4 + approved |
| | JAG letter to Minister |
| | Joint response to JAQU in relation to COVID -19 |
| | Additional OBC funding request submitted |
| | OBC – FBC funding re-assessed |
| 30th April 2020 | Preferred Option approved |
| | JAG approve the submission of the unapproved OBC |
| | Letter sent to the Parliamentary Under Secretary of State by the Chair |
| | Submission of Unapproved OBC |
| | Decision/approval |

The action logs from the JAG will also be reported to the MPs who will be given the opportunity to scrutinise the decisions made. This will ensure that MPs are fully informed and will, help to reduce the risk of delays to the project.

Regular discussions between JAQU's account manager and relevant members of the project team are held on at least a weekly basis to monitor the project's progress, discuss any issues and to formulate a path towards timely and robust OBC and FBC submissions. It allows Government to be kept aware of the planned activity associated with the project, including any areas that require approvals and reviews by Government itself. The authorities will continue to submit the relevant documents (such as project tracker documents, technical notes and draft business cases) to JAQU as required by the grant conditions, throughout the lifetime of the project.

The project's Senior Responsible Officer (SRO) and project manager, along with senior Council officers, attend update meetings with JAQU's SRO, account manager and other technical support staff, where the project's progress and its strategic direction is discussed. The outcomes from these meetings are cascaded to both the JOG and JAG.

An independent project manager, with significant transport planning experience and having worked with one of the Government's "first wave" local authorities, has also been appointed. The project manager works as a key part of the JOG, working closely with all parties involved to ensure successful delivery of the OBC and FBC in line with the project plan that has been agreed with JAQU, following submission of a progress report in October 2018.

As the project progresses the governance and management arrangements will be reviewed regularly to ensure they remain fit for purpose. They will also be confirmed in the FBC. Handover of the SRO position from NuLBC to SoTCC will take place following the submission of the FBC, due to the fact that delivery of the project will mainly relate to highways and transport initiatives within the Stoke-on-Trent area. The project SRO role beyond FBC will be held by Stoke-on-Trent City Council's Strategic Manager for Population and Well-being. This will ensure the governance and management of the project is effective and relevant. Close working will continue between the technical specialists and Council officers through implementation and delivery of the scheme.

#### 5.3.1 Governance structure

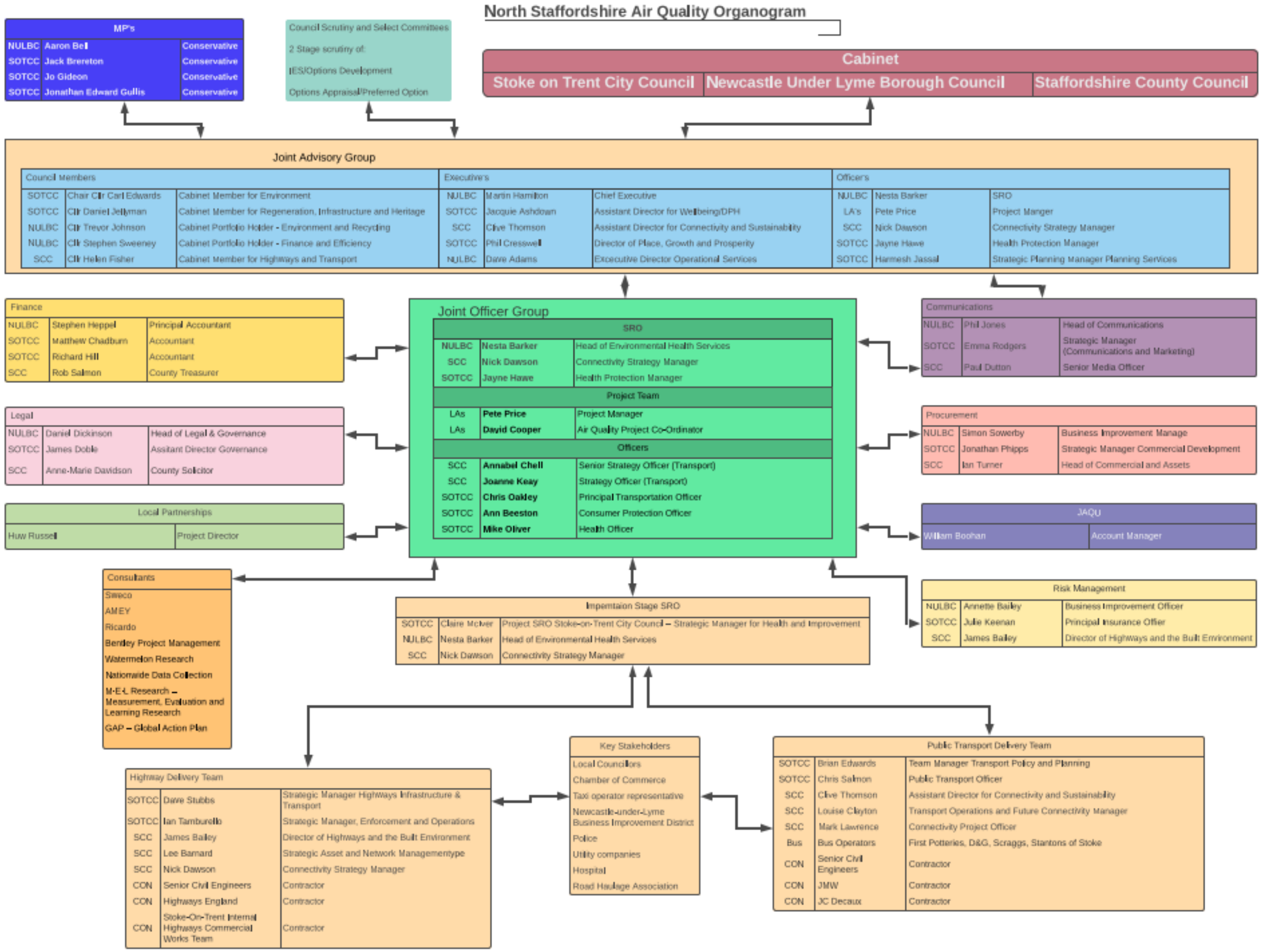
Three levels of project hierarchy exist in relation to managing progress and key decision-making:

- The JOG – comprises of key officers and consultants involved in the project, chaired by the project SRO
- The JAG – comprises of key members and senior officers of all three local authorities, chaired by a senior member of one of the three authorities. JAG action logs will be reported to the MPs who will be given the opportunity to scrutinise the decisions made
- The Cabinets of the three authorities – where recommendations are taken for key decisions. Prior to Cabinet(s) the intention is to take reports to the relevant cross-party Scrutiny and Select Committee to reduce the risk of a subsequent call-in.

The project organogram, Figure 5-1[15], sets out the key decision makers and the reporting mechanisms for those decision makers from officer and member groups. Inputs from JAQU and Local Partnerships are also outlined, with the latter providing a project assurance role for JAQU.

[15] Also found in Appendix 13

*Figure 5-1: Project governance organogram*



Support will be provided by several internal teams within each local authority, including procurement, legal, finance, risk management, communications and engagement and delivery partners/consultants. These teams form sub-groups that liaise with both the JOG and JAG. Table 5-2 identifies the lead officers at each of the local authorities for these teams.

To ensure continuity, the JOG and Project SRO will identify deputies for key support team roles and put succession plans in place to enable the seamless replacement of team members when necessary.

*Table 5-2: Lead officers of the key support teams*

| Support Team | SoTCC | NuLBC | SCC |
|---|---|---|---|
| Procurement | Jonathan Phipps | Simon Sowerby | Ian Turner |
| Legal | James Doble | Daniel Dickinson | Ann-Marie Davidson |
| Finance | Matthew Chadburn & Richard Hill | Stephen Hepple | Rob Salmon |
| Risk Management | Julie Keenan | Annette Bailey | James Bailey |
| Communications and Engagement | Emma Rodgers | Phil Jones | Paul Dutton |

#### *5.3.1.1 Role of legal sub-group*

With three local authorities involved in implementing and delivering the NSLAQP, the legal sub-group plays a key role in ensuring that the appropriate legal agreements are in place between the authorities and their respective contractors.

The following legal agreements will be required:

- Delivery Agreement between the three local authorities, outlining working, funding and scheme implementation arrangements
- JMW are the proposed contractor for the delivery of RTPI, as they have already been procured by SCC. SoTCC need to agree to the contract in order for RTPI to be delivered within the boundaries of Stoke-on-Trent
- Agreement to be drawn up between the local authorities and the bus operators in relation to retrofitting buses and bus wraps arrangements
- Highways England Section 6 Agreement to allow the selected contractor to deliver signs on the trunk road

Further details of the contracts can be found in the Commercial Case. The Delivery Agreement will be a key document that will be included in the FBC and is expected to confirm that all three authorities agree to the following:

- The role of SoTCC as Project SRO during the implementation stage

- The roles designated to the lead authorities/organisation for each scheme element of the Preferred Option, particularly in terms of procurement and risk management related to delivering to required timescales and budgets
- Financial accounting arrangements between the three authorities and how funding is paid to the designated lead authorities

The designated lead authority for each scheme element is shown in Table 5-3.

*Table 5-3: Designated lead authorities*

| Scheme element | Designated lead authority/organisation |
|---|---|
| Overall project management | SoTCC |
| A50 Victoria Road bus gate | SoTCC |
| A53 Etruria Road bus gate | SCC |
| ANPR cameras | SoTCC |
| Back office operation for bus gates | SoTCC |
| Traffic management east and west of Victoria Road | SoTCC |
| Transport improvements along A53 Etruria Road | SCC |
| Bus retrofitting | Bus operator and SoTCC |
| RTPI | SCC and SoTCC |
| Bus shelters and CCTV | SoTCC |
| Air quality monitoring | NuLBC and SoTCC |
| Traffic monitoring | SCC and SoTCC |

##### *5.3.1.2 Role of procurement sub-group*

The delivery routes and the associated procurement requirements for each element of the Preferred Option are detailed in the Commercial Case. Each lead authority/organisation will be responsible for the individual procurement requirements for each scheme element and this will be set out in the local authority Delivery Agreement and the agreement with the bus operators.

The procurement sub-group will provide the opportunity for the procurement managers to oversee and deal with any issues that arise to ensure that timescales and budgets are met. This is particularly relevant for scheme elements such as the purchase of ANPR cameras where it is currently expected that SoTCC will lead the procurement process for cameras to be installed both in Staffordshire and Stoke-on-Trent.

#### *5.3.1.3 Role of finance sub-group*

The role of the finance sub-group focuses on budget management and the distribution of funding for the scheme across the three authorities in line with the local authority Delivery Agreement.

#### *5.3.1.4 Role of risk management sub-group*

The risk management sub-group is in place in order to oversee, mitigate against and manage any potential risks arising from the scheme. Reviews of the risk register will also be agreed at this sub-group. Risks will evolve over the lifetime of the scheme and so the risk management sub-group will continue to be in place across the scheme's lifetime and will work to identify any upcoming risks and how best to manage them.

#### *5.3.1.5 Role of communications and engagement sub-group*

The communications and engagement sub-group are in place to promote and support engagement with stakeholders and the general public. The sub-group will deliver all communication and engagement activities, including surveys and consultation events, and will proactively and reactively manage any feedback and responses, as well as media coverage. More details of the role of the communications and engagement sub-group can be found in the Communication Plan in Appendix 23.

There will be two project delivery teams that report to JOG to ensure the seamless delivery of the project through its design and implementation. The lead officers from each of the local authorities for these two teams can be seen in Table 5-4.

*Table 5-4: Lead officers of the project delivery teams*

| | SoTCC | NuLBC | SCC |
|---|---|---|---|
| Highway infrastructure | David Stubbs | N/A | James Bailey/Nick Dawson |
| Public transport infrastructure | Brian Edwards | N/A | Clive Thomson/Louise Clayton |

### 5.3.2 Roles and responsibilities

An overview of the members and responsibilities for the different levels of project governance is provided in Table 5-5.

*Table 5-5: Project governance*

| Governance Level | Members | Key Responsibilities & Outcomes |
|---|---|---|
| Joint Advisory Group | • Senior member and officer representation | • Consider reports from the Joint Officer Group relating to progress on the project, and in particular to consider and make |

| | | |
|---|---|---|
| | from Newcastle-under-Lyme Borough Council<br>• Senior member and officer representation from Stoke-on-Trent City Council<br>• Senior member and officer representation from Staffordshire County Council | recommendations for the sign off of the Outline Business Case (OBC) and Full Business Case (FBC) as required by the respective decision maker in each authority<br>• To ensure that decision making on key issues related to the project, including approval of the OBC and FBC, is coordinated effectively across the three Councils<br>• To consider reports on specific aspects of the OBC and FBC development and seek to ensure an aligned approach to the three Councils' approach to approving the OBC and FBC and the subsequent delivery of any Preferred Option<br>• To engage with relevant senior officers at the Department for Environment, Food & Rural Affairs (Defra) and JAQU, regarding the project<br>• To support compliance with the duty to cooperate by working constructively to facilitate positive outcomes in respect of cross boundary matters<br>• To support the production of effective and deliverable policies on strategic cross boundary matters<br>• Support the consideration of key infrastructure requirements associated with the delivery of the Preferred Option |
| Joint Officer Group | • Project SRO<br>• Project Manager (consultant)<br>• Newcastle-under-Lyme Borough Council officers<br>• Stoke-on-Trent City Council officers<br>• Staffordshire County Council officers<br>• Sweco (consultants) | • To manage and update the project plan as required<br>• To ensure effective project management, including reviewing risks and impact assessments<br>• To deal with any exceptional issues arising from project activity<br>• To manage budgets and resources associated with the project and report issues accordingly<br>• To consider and make recommendations to the Joint Advisory Group (JAG)<br>• To agree the development of the Local Air Quality Plan incorporating outputs from transport and air quality modelling and associated option appraisals and deal with any cross-boundary issues |

| | | |
|---|---|---|
| | • Ricardo Energy & Environment (consultants)<br>• Selected highway contractor<br>• Supported by procurement, legal, finance and communications officers as necessary | • To produce technical evidence to support the development of a Preferred Option and completion/submission of OBC and FBC.<br>• Project delivery<br>• Production of OBC and FBC for the Preferred Option.<br>• Production of relevant reports for JAG and other decision-making meetings |

### 5.4 Key stakeholders

There are a number of organisations who have a direct strategic role in the delivery of the NSLAQP and there are wider stakeholders who will be engaged through consultations during the design, implementation and operation stages of the project. These stakeholders are outlined in Table 5-6.

*Table 5-6: Key stakeholders and their strategic roles*

| Stakeholder | Strategic Role |
|---|---|
| Joint Air Quality Unit (JAQU) | Delivering the UK Plan for tackling roadside nitrogen dioxide concentrations<br><br>Developing and implementing national initiatives to improve air quality<br><br>Providing funding to local authorities<br><br>Guiding and managing local authorities to deliver the most effective air quality measures in the shortest timeframe possible |
| Local MPs | Overseeing and scrutinising the decisions made by the local authorities<br><br>Engaging directly with JAQU on wider strategic issues |
| Newcastle-under-Lyme Borough Council | Second-tier authority and legally responsible for improving air quality to within statutory limits for $NO_2$ concentrations<br><br>Supporting appropriate traffic management measures to tackle $NO_2$ levels in the area<br><br>Monitoring $NO_2$ concentrations<br><br>Engaging with local public to raise awareness of the changes and the need for change<br><br>Managing the project until FBC stage and liaising with JAQU and technical consultants |

| | |
|---|---|
| Staffordshire County Council | The strategic highways and transport authority for Newcastle-under-Lyme and is therefore delivering the required traffic management measures to assist the improvements in air quality within the Borough/County boundary<br><br>Monitoring traffic flows and fleet composition<br><br>Engaging with local public to raise awareness of the changes and the need for change<br><br>Liaising with JAQU and technical consultants<br><br>Providing public health inputs |
| Stoke-on-Trent City Council | Unitary authority for the city part of the study area and legally responsible for improving air quality in Stoke-on-Trent to within statutory limits for $NO_2$ concentrations<br><br>Implementing appropriate traffic management measures to tackle $NO_2$ levels in the area<br><br>Monitoring $NO_2$ concentrations, traffic flows and fleet composition<br><br>Engaging with local public to raise awareness of the changes and the need for change<br><br>Managing the project post-FBC stage and liaising with JAQU and technical consultants<br><br>Providing public health inputs |
| Technical Consultants | Delivering air quality modelling and transport modelling to develop options and possible mitigation measures<br><br>Design and preparation of cost estimates for scheme delivery<br><br>Conducting Stated Preference surveys<br><br>Collecting ANPR data<br><br>Conducting risk workshops and developing the Quantified Risk Assessment (QRA) and risk registers<br><br>Developing the 5 business cases making up the OBC in preparation for submission<br><br>Supporting the local authorities in the management and execution of the marketing and communications strategy<br><br>Construction of the preferred scheme |

| | |
|---|---|
| Highways England | Government owned company, responsible for the management of the Strategic Road Network, which includes the A50 and A500 roads, which provide critical local network capacity as well as accommodating strategic traffic movements between the East Midlands and the M6, as well as other key linkages across Staffordshire and with parts of Cheshire.<br><br>The interdependency between the local and strategic networks means careful consideration is required for close correlation of plans to manage or improve the networks.<br><br>Effective engagement with Highways England is critical to ensure that key components of the Preferred Option are deliverable in line with the project plan and requirements of the Ministerial Directions. |
| Bus operators | There are two main bus operators within Stoke-on-Trent and Newcastle-under-Lyme: First and D&G. A number of smaller companies are also in operation within the area. Bus operators will be impacted through the bus retrofitting measures and Real Time Passenger Information (RTPI) provisions that are being made to the network. Early engagement was undertaken to ensure that the bus operators were in agreement with the proposed plans. |
| Local Partnerships | Appointed by JAQU to assist the local authorities in the development of the Commercial, Financial and Management Cases of the OBC, and to assist JAQU in reviewing the submissions. They also provide independent project assurance and expert support to the local authorities. |
| Wider stakeholders | Wider stakeholders will be consulted and engaged as the Local Air Quality Plan is progressed and delivered. This engagement will be overseen by the Communication and Engagement sub-group and recommendations and suggestions will be considered by the Highway and Public Transport Project Delivery Teams.<br><br>Wider stakeholders will include Chamber of Commerce, local councillors, taxi operators, Newcastle-under-Lyme Business Improvement District, police, statutory undertakers, Royal Stoke University Hospital and Road Haulage Association |

### 5.5 Engagement and communication strategy

A robust communication and stakeholder management strategy has been developed to achieve efficient and effective communication between the local authorities, relevant stakeholders and the general public. Delivery of the strategy will be managed by the communications and engagement sub-group. The plan aims to raise stakeholders' awareness and understanding of air quality and the consequences that might arise in a 'do nothing' scenario, reinforcing the reasons behind why this local plan is being implemented. It aims to identify any areas of concern at an early stage in order to be able to take appropriate action to mitigate the issue.

The communication strategy will be jointly led by the local authorities and supported by consultants. The strategy ensures that appropriate levels of consultation and communication are conducted throughout the project's lifespan. Regular and coordinated communication is delivered to stakeholders to keep them updated about developments in the project and the reasoning for these developments so that the authorities will be able to robustly defend any potential challenges to the scheme. The content of any comments, enquiries or objections received would need to be considered by the relevant Council services, including JOG and JAG as required, for them to have an input into providing an appropriate response. The communications teams would facilitate the best method in which to respond corporately, as is their usual role, according to the source, nature and extent of the comments received. Alongside this, the communication strategy promotes and offers assurances about mitigating actions that intend to alleviate the impacts arising from the scheme.

Each of the three local authorities had planned to obtain Cabinet approval of the Preferred Option ahead of its submission to JAQU as part of the OBC. The OBC document was to be presented at the authorities' Scrutiny and Select Committees in March and April 2020, followed by Cabinet approvals in May 2020.

In March 2020, some Members and officers raised concerns about the impact of aspects of the Preferred Option, backed by local Members of Parliament (MPs). This led to a short review period which involved a workshop being held on 16th March. This workshop recommended amendments to the Preferred Option to include measures that would mitigate any negative impacts that might arise from the original Preferred Option. These amendments were approved at JAG on 25th March.

The first phase of the communications and engagement strategy involved an online survey being circulated to the general public to gather information on people's current behaviours and attitudes towards air quality. The survey was divided into the following sections:

- Health and environmental issues
- Air quality
- Sources of information

The results of the survey were collated and analysed by an independent consultant, MEL Research Ltd.

The second phase includes hosting four stakeholder consultation workshops which will take place in the second half of 2020. These will engage the public and relevant stakeholders on the preferred scheme, whilst exploring existing attitudes and awareness of air quality. The local authorities and consultants will work together to ensure that sufficient evidence is presented at the workshops, so stakeholders are adequately informed. The feedback from the consultations will be analysed and incorporated in the FBC, confirming that the scheme is deliverable and supported by key stakeholders.

In addition to these engagements, the authorities' 'Air Aware' strategy went live in 2019. Air Aware is a campaign currently funded by Defra until the end of March 2020 across Staffordshire and Stoke-on-Trent to raise awareness of the impact of poor air quality and inspire long-term behaviour change. It is centred around a 'monthly message' targeting schools, commuters and businesses. Travel to school surveys completed at six schools that have been targeted by Air Aware indicate an average 12% reduction in car journeys to school during an 18-month period.

Prior to implementation the communications plan will be updated to include an approach and activities to inform and engage local residents and stakeholders of the Preferred Option and its likely impacts.

Consultation at the scheme delivery stage will be carried out by the selected contractor, with support from the local authorities. This will include informal and formal consultations required as part of the Traffic Regulation Order (TRO) process.

More detail on the communication strategy and stakeholder management can be found in Appendix 23.

### 5.6 Project management

Effective project management ensures that all aspects of the project is delivered on time and to a high standard. It ensures that the various consultants and local authorities work together to achieve the project objectives. The project is managed in accordance with NuLBC and SoTCC's project management processes in accordance with PRINCE2 principles.

The project manager supports the project teams and coordinates the three local authorities' internal processes and relevant stakeholders. The project manager is instrumental in ensuring all project elements are managed, monitored and delivered in accordance with the project plan.

The project team (JOG) has been assembled and includes key members from each of the three local authorities and consultants. Fortnightly JOG meetings are held to discuss the status of the project work and to ensure that all parties are aligned; with further technical meetings scheduled either face-to-face or via conference call as appropriate. Weekly conference calls between JOG officers and JAQU are also conducted to report on the progress of the work identified in the project plan and to discuss issues, risks or additional requirements that have resulted, or may result in, deviations from the agreed plan.

Where specific expertise is required and is not contained within JOG, the project team tasks other Council officers and teams with specific works packages so that the optimal outcome can be achieved in that workstream. If resources are still not available internally, local authority procurement processes are followed to contract external consultants. The procurement process is discussed in more detail in the Commercial Case.

Officers from each of the authorities' finance, procurement, legal, risk and marketing teams also form part of the project team and are involved in the relevant processes.

The three authorities have engaged with BDB Pitmans for external legal advice in relation to the submission of a Progress Report in place of an OBC on the original Ministerial Direction deadline on 31st October. The authorities may continue to engage with them as necessary. Any additional external advice for specific services, such as from financial and procurement specialists, will be considered as appropriate as the project develops.

### 5.7 Programme

5.7.1 <u>Preferred Option</u>

The programme will be regularly reviewed and the project plan will be updated as a live document as the scheme progresses. The full project plan (Appendix 14) outlines all tasks in relation to the scheme leading up to OBC and through to final scheme opening. Appendix 15 summarises the implementation programme beyond OBC. It identifies responsibilities, accountabilities and dependencies with predecessor and successor actions. Resources and risks can be identified through the project plan and thereby managed in an appropriate manner. Funding requirements for the ten-year period of operation and decommissioning are detailed in the Financial Case.

The MPs' review of the emerging Preferred Option in March coincided with the outbreak of the coronavirus pandemic, and these two factors have led to the Scrutiny and Cabinet approvals no longer being possible within the timeframes, hence the requirement to submit this OBC as an unapproved document.

Dependent on Government advice, the authorities will seek approval of the Preferred Option through a Scrutiny/Cabinet process during summer 2020. However, the authorities are recommending a 'pause and review' phase to allow the impact of coronavirus on the Initial Evidence Submission (IES) to be reviewed.

The focus on traffic management and bus retrofit as the Preferred Option allows for the scheme to be delivered quickly and therefore within the timeframe set out in the Ministerial Direction. The project plan is a live document and will be refined between OBC and FBC. The extent of these changes will be dependent on the JAQU decision concerning the 'pause and review' phase. Table 5-7 sets out the key dates and milestones of the project for the Preferred Option at unapproved OBC stage.

*Table 5-7: Programme key milestones – Preferred Option*

| Milestone | Date(s) |
|---|---|
| **To OBC approval** | |
| Strategic Outline Case (SOC) submission | 31/01/2019 |
| Initial Evidence Submission (IES) | 08/10/2019 |
| Engagement survey | 26/02/2020 |
| Unapproved OBC | 15/05/2020 |
| TiRP & DiRP submission | May 2020 |
| OBC approval (by Cabinet and JAQU) | September 2020 |
| | |

| To FBC approval | |
|---|---|
| Scheme delivery agreement between 3 authorities | September 2020 – February 2021 |
| Stakeholder consultations | October – November 2020 |
| Detailed Design | September 2020 – February 2021 |
| FBC approval (by Cabinet and JAQU) | March 2021 |
| TiRP & DiRP submission | April 2021 |
| S151 officer sign off | February 2021 |
| | |
| **Implementation of the Preferred Option** | |
| JAQU funds for implementation received | March 2021 |
| TRO consultation period | April 2021 – June 2021 |
| Orders confirmed | August 2021 |
| HE approval process | January 2021 – August 2021 |
| HE construction notice period | September 2021 – November 2021 |
| Highway construction period | November 2021 – April 2022 |
| Bus infrastructure lead-in period | April 2021 – June 2021 |
| Bus infrastructure delivery period | June 2021 – April 2022 |
| Full scheme operational | May 2022 |

The programme ensures that time is allocated to the completion of all necessary JAQU approval processes. It also includes adequate time for the following local approval processes:

- JAG approvals
- Local authority Cabinet meetings and relevant Scrutiny Committees
- Local authority Chief Officer Delegated Decisions
- Local authority S151 Officer sign-off
- Infrastructure+ Operational Commissioning Board and Strategic Partnership Board
- Highways England approvals
- Department for Transport (DfT) signage approvals

- Bus operator approvals related to the retrofit programme

5.7.2 Benchmark CAZ D

For comparison, Table 5-8 identifies the key programme milestones for the delivery of the Benchmark CAZ D option. This timeline is based on the assumption that there will be a framework in place to procure through. If this is not the case, then there is a risk that the programme will be delayed as a tender process will need to be undertaken instead. Compared to the Preferred Option, the design and delivery phase of the Benchmark CAZ D is a considerably lengthier process and would not adhere to the primary Critical Success Factor (CSF) of deliverance in the shortest timeframe possible, nor would compliance be achieved in 2022. The proposed implementation project plan for the Benchmark CAZ D is included in Appendix 16.

*Table 5-8: Programme key milestones – Benchmark CAZ D*

| Milestone | Date(s) |
|---|---|
| **Implementation of the Benchmark CAZ D** | |
| Scheme design and procurement | October 2020 – February 2022 |
| S151 officer sign off | March 2022 |
| JAQU funds for implementation received | March 2022 |
| Scheme delivery | April 2022 – May 2023 |
| Scheme operational | June 2023 |

One potential risk that needs to be monitored is the ability of the local authorities to keep pace with the challenging timescale originally outlined. As a result of this, changes to the programme are made accordingly as milestone dates approach.

Budget expenditure is monitored on at least a monthly basis. Progress reports are prepared regularly and cross-referenced against the programme schedule. Any delays or emerging risks are recorded and reported to JAQU with mitigation measures outlined.

## 5.8 Financial management

The Project Manager and SRO are responsible for regular financial reporting to inform JAQU and relevant stakeholders of the project's progress. In addition, a Finance Sub-group for the project, including representatives from the three authorities' finance teams, has been formed and meets at critical project milestones. The Delivery Agreement to be finalised at FBC will confirm that all three authorities agree to the financial accounting arrangements between the three authorities and how funding is paid to the designated lead authorities.

Subject to approval by JAG, the SRO is responsible for submitting bids to the Implementation Fund, to secure funding to progress the feasibility study, submission of the OBC and FBC and delivery of the Preferred Option.

The authorities expect to deliver the preferred scheme using suppliers procured through Government frameworks. This approach reduces the possibility of delay between the funding being granted and the work being formally commissioned.

### 5.9 Change management

Where changes to work scope or detailed design are required in order to deliver the NSLAQP, these will be managed through the comprehensive governance structure that has been set up for the project. Changes to scheme details can occur following consultation periods and also once on site and any recommended changes will be reported and agreed through the JOG and JAG to ensure that the project outcomes can still be met. The comprehensive risk register will be reviewed, and all risks have been appropriately allocated to ensure that any changes to delivery timescales and costs for each element of the Preferred Option are managed within the total budget and delivery period.

To ensure there is control over any contractual changes, the local authority Cabinets are required to authorise changes in excess of £500,000.

More detailed information on the change management process in reference to the term of contracts can be found in the Commercial Case.

### 5.10 Contract management

The Councils are committed to investing the necessary level of resource to ensure effective contract management. More detail regarding Contract Management can be found in the Commercial Case.

#### 5.10.1 Contingency

As described in the Commercial Case, the Councils will, as part of the procurement and contract strategy, strive to ensure that all elements are delivered to agreed cost and time to enable delivery and impact in the shortest possible time.

If implementation is delayed, the Councils will:

- Pursue contractual remedies against suppliers, and enact a contract break if necessary
- Ensure that JAQU are informed of any issues with delivery at the earliest opportunity
- Follow a risk-based approach with contractors, with regular reporting intervals and a 'no surprises' policy enshrined within contractual terms

### 5.11 Risk management

A Risk Register and Quantified Risk Assessment (QRA) has been developed to identify any possible risks to the project, for both the Preferred Option and the Benchmark CAZ D. The Preferred Option risk register will be a live document that is updated regularly throughout the life of the project so as to ensure risks are identified and mitigated through effective programme management.

The Benchmark CAZ D risk register and QRA have been completed for comparison purposes to inform the likely cost of delivering a CAZ D and to highlight the extent of the risks associated with delivering a CAZ D compared to the Preferred Option, particularly in terms of meeting the primary outcome of removing exceedances in the shortest possible time. It is not currently expected that the CAZ D risk register will be reviewed and updated. An effective risk management strategy for the Preferred Option is in place to minimise the impact of risks whilst ensuring potential opportunities are maximised. The risks have been categorised and allocated an owner to ensure that they are managed effectively.

In line with this, three Risk Workshops were led by Bentley Project Management and attended by officers from each of the authorities who have expertise in the specific areas of focus outlined in the Preferred Option. The workshops were set out as follows:

- Identification of the risks
- Mitigation of the risks
- Quantification of the risks

Following these workshops, a risk register and QRA was produced and analysed against the required contingency needs for the project. The risk registers and QRA reports for both the Preferred Option and Benchmark CAZ D can be found in Appendices 17 to 20.

There are fifteen individual key risks identified for the Preferred Option and a further five finance-only risks. They are detailed in the appended risk register and QRA report and are grouped as follows:

- Highways England insist on having network upgrades
- Design and build procurement risks and public criticism due to the coronavirus
- Public/business acceptance to bus gates and criticism of the scheme
- Timescale and delay issues relating to retrofitting, terms and conditions, permits, roadworks, detailed design and road safety audits
- Insufficient funding from JAQU and higher than expected utility costs
- Implementation issues including camera interface software, power location, data protection, back office agreements and bus gate enforcement
- Scheme cost increase related to Victoria Road community consultations and introduction of ULEV bus gate exemptions

The project teams will continuously monitor and manage the risks associated with the project, in accordance with the authorities' accepted approach to risk management. The risk management sub-group will take the lead on managing and mitigating against any potential risks, with any high-level risks being escalated to the JAG for assessment and review. Risk allocation is detailed in the Commercial Case.

JAQU will continue to be informed of any risks that have the potential to impact on the delivery of the scheme. JAQU can also be re-assured that the following mitigation measures will be applied to help manage the risks:

- Early engagement with Highways England and DfT concerning the impact on the trunk road
- Ongoing engagement with JAQU on the impact of coronavirus

- Ongoing consultation with MPs to ensure potential refinements to the scheme are agreed at the earliest opportunity
- Dedicated communications officer employed to complete ongoing and intensive engagement to raise awareness of the scheme and why it is needed
- Early engagement with key stakeholders, including all bus operators
- Regular and extensive early contractor involvement with Amey through Infrastructure+
- Lessons learnt from the NuLBC bus retrofit Ministerial Direction
- Ensure Stoke-on-Trent City Council back office function is fully engaged ensuring potential IT issues are dealt with at the earliest opportunity
- Early completion of thorough site investigations
- Continued dialogue with statutory undertakers and all highway consultees
- Time allowed in the programme for detailed design, approval processes and consultations
- Regular review of the risk register, raising issues with JAQU at the earliest opportunity
- Use of existing contracts and frameworks to reduce the length of procurement processes at the same time as ensuring value for money

### 5.12 Benefits realisation

Evaluation and monitoring throughout the delivery of the programme is crucial to ensure benefits are realised. All benefits of the Preferred Option have been tracked and reported on, including evidence gathered through monitoring and evaluation work. Any benefits identified are accompanied by a recommendation on how potential issues or concerns relating to this benefit will be addressed. Table 5-9 summarises the benefits realised, whilst a detailed benefits realisation register can be found in Appendix 21.

*Table 5-9: Summary of scheme benefits register*

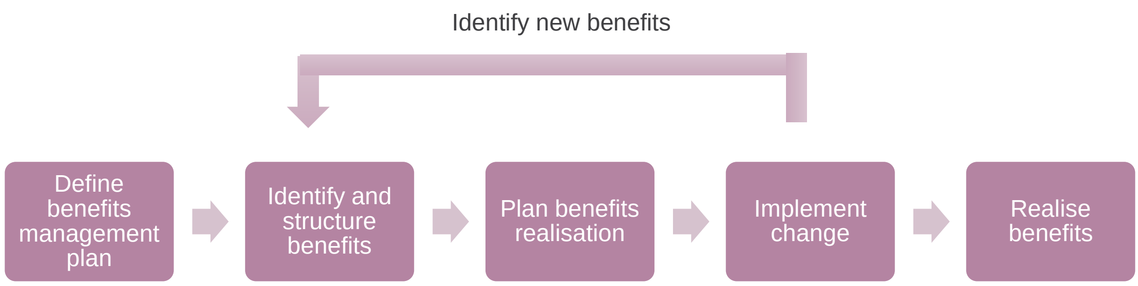
| Primary outcome | How the benefit will be realised |
|---|---|
| Achieve the statutory limit values for roadside $NO_2$ concentration limits at the exceedance locations in the shortest possible time | Improved public health, better air quality should improve health and reduce the risk of illnesses such as heart disease, lung disease or asthma. |
| **Secondary outcome** | |
| Increased awareness of air quality problem | Residents and businesses better informed about air pollution |
| Local buses more attractive due to bus infrastructure improvements | Increase in bus patronage and journey quality |
| Traffic redistribution across the network without creating new sites of $NO_2$ exceedance | Traffic management measures aim to reroute traffic away from the exceedance sites without creating new exceedance locations. |
| Lower exhaust emissions of $NO_x$, PM and other pollutants released from buses | Bus retrofitting will reduce the amount of exhaust emissions released from more polluting, older bus engines, therefore reducing emissions across the designated bus routes. |

Measures within the Preferred Option will be implemented as quickly as possible to ensure the realisation of benefits within the shortest timeframe possible. Effective realisation of benefits can lead to the enhancement of existing measures and the identification of further benefits.

The three authorities will ensure that flexibility throughout the implementation of the Preferred Option is considered so that measures can be altered during the consultation and approval process if necessary. This will ensure that the Preferred Option will be supported both publicly and politically and any risks are flagged at an early stage and mitigated against.

All benefits will be tracked and monitored. Figure 5-2 depicts the benefits management process of identifying and realising benefits.

*Figure 5-2: Benefits management process*




## 5.13 Monitoring and evaluation

JAQU will undertake a central evaluation of the NSLAQP. The central evaluation aims to understand the impacts of measures introduced through a local authority's local plan and ensure that local authorities are on track to reduce $NO_2$ concentrations in the shortest possible time. This will draw on both existing local and national monitoring.

The central evaluation will produce quarterly bulletins on the progress of local plans on reducing $NO_2$ concentrations and other key factors (such as changing traffic flows). This will be based on a comparison between the expected (as presented in the local authority's feasibility study) and the actual, monitored situation. The bulletins will be communicated regularly to local authorities. Should these bulletins show that a local plan is performing below expectation, JAQU will seek to determine the cause by working with the local authority.

North Staffordshire has an existing network of monitoring stations to monitor both traffic data and air quality. This existing network will be supplemented with new monitoring stations, particularly at sites of intervention and modelled exceedance.

JAQU stipulates that North Staffordshire should achieve compliance in the year 2022, demonstrated through annual average $NO_2$ concentration levels. It is currently expected that the Preferred Option will be delivered by May 2022. Data collected between June and December 2022 will determine whether the primary critical success factor of $NO_2$ compliance has been achieved, as stipulated by JAQU.

The authorities plan to share collected data with JAQU every three months, in line with guidance. Data will continue to be collected and shared with JAQU up to one-year after compliance is achieved. Bus patronage data will be reported locally.

Appendix 22 provides a more detailed Monitoring and Evaluation Plan.

Table 5-10 outlines monitoring outputs that are already in place across North Staffordshire. Table 5-11 outlines monitoring measures that will need to be implemented as part of the Preferred Option monitoring and evaluation plan. The tables identify which authority/organisation has been assigned each monitoring responsibility.

*Table 5-10: Existing monitoring*

| Metric | Monitoring Method | Data Collection Frequency | Quantity | Data Type | Control |
|---|---|---|---|---|---|
| Air quality data | Diffusion tubes | Monthly | Network of 605 diffusion tubes collecting $NO_2$ data focussed on the previously identified Air Quality Management Areas (AQMAs) | $NO_2$ concentration levels | NULBC, SoTCC |
| Air quality data | Automatic Monitors | Quarterly | 3 monitors (located in Hanley, Basford, Newcastle-under-Lyme) | $NO_2$ concentration levels | NULBC, SoTCC |
| Strategic Road Network traffic flow data | Automatic counts | Monthly | 1 relevant site (located on the A50 between Stanley Matthews Way and A500, source - WebTRIS database) | 1-way hourly vehicle flows by vehicle classification averaged over a month by day/hour | Highways England |
| Bus patronage | Bus operator ticket data | Monthly | Total patronage for Stoke-on-Trent and separately Staffordshire administrative areas only (excludes analysis by service) for concessionary fare purposes | Bus passenger numbers per service | Bus operators, SCC, SoTCC |
| Vehicle Fleet Composition | ANPR data | Undertaken in 2019 | 15 locations | Vehicle composition split by vehicle type, fuel type, euro standards and compliance | NULBC, SoTCC |

*Table 5-11: Measures in the Preferred Option that require additional monitoring*

| Metric | Monitoring Method | Data Collection Frequency | Quantity | Control |
|---|---|---|---|---|
| Air quality data | Diffusion tubes | Monthly | 59 additional diffusion tubes to collect $NO_2$ data at the identified exceedance locations | NULBC, SoTCC |
| Local traffic data | Automatic Traffic Counts | Monthly | 13 | SoTCC, NULBC |
| Vehicle fleet composition | ANPR cameras | Monthly | 5 locations | SCC, SoTCC |
| Vehicle fleet composition | ANPR | One off cordon study | 15 locations | SCC, SoTCC |
| Bus patronage | Bus operator ticket data | Monthly | Data by fare stage providing a broad indication of the number of passengers on each bus service. Will require analysis. | Bus operators, SCC, SoTCC |

### 5.14 Project assurance

Local Partnerships have been appointed by JAQU to assist the local authorities in the development of the Commercial, Financial and Management Cases of the OBC, and to assist JAQU in reviewing the submissions. They also provide independent project assurance and expert support to the local authorities, therefore maximising the likelihood of successful delivery.

Internally, project assurance is delivered through regular reporting to JAG and also by the SRO, the Project Manager and NuLBC's Finance Department who scrutinizes and manages the project's budget, ensuring the project remains to timeframe and cost. Any monetary risks are therefore able to be flagged at an early stage, so that this can be managed appropriately.

The independence of the project manager is crucial to the effective working across the three local authorities. The project manager is able to remain impartial when it comes to making key critical decisions that is likely to impact on each of the authorities. The project manager frequently reviews the project programme in relation to the project's current progress and expected progress and outlines any risks that may arise as a result. This process provides a regular health check of the project and is regularly reported to JAQU. The project manager ensures that the authorities work closely together in order to achieve the common goal, that is, achieving roadside nitrogen dioxide levels compliance within the shortest timeframe possible.

#### 5.14.1 Gateway reviews

It is not proposed to adopt a gateway review process as it is not a JAQU requirement.

### 5.15 Decommissioning

Decommissioning costs have been included for some elements due to the nature and type of scheme being implemented. It is assumed that the scheme will be in place and maintained for a ten-year period. When it can be demonstrated that the primary outcome has been achieved, agreement needs to be reached that the bus gates can be removed. It will be necessary to remove those elements of the project:

- That will no longer be required
- Where funding is no longer available to support the operational or maintenance element of the asset
- Where the asset is considered obsolete

Costs are associated with the removal and decommissioning of a wide range of elements, including:

- The civil engineering works associated with reinstating parts of the highway to their original layouts prior to scheme implementation
- Signage on the local and strategic road networks, including variable message signing
- CCTV and ANPR cameras and enforcement technology

The majority of the elements of the scheme, except for the bus gates, will still be considered appropriate and useful once the project lifetime has passed. In particular, the wider network management assets provide additional functionality to the system that can be utilised beyond the lifetime of the project, not only for addressing issues associated with the air quality agenda, but also for wider highway network management capabilities. Some elements will also be too costly or inappropriate to be decommissioned.

### 5.16 Benchmark CAZ D

In the event of the Benchmark CAZ D becoming the option for delivery, the management of the project, governance structures, key people involved, and communications would need to be significantly different to that proposed for the Preferred Option.

Project governance would need to be expanded to include:

- Financial sub-group for implementation period
- Procurement sub-group for OBC to FBC
- A model for continued liaison with the operating company

- A framework for contract compliance
- A significantly expanded role for the legal sub-group

Procedural differences include the need to undertake the formal process associated with traffic charging orders and associated consultation with the Traffic Penalty Tribunal.

Legal processes would be greatly expanded as each Local Authority would be required to enter into an Operational Level Agreement with the DfT. Legal agreement between the three authorities would be more extensive and a contract would be required between local authorities and the tender winner to deliver and operate the CAZ.

Engagement and communications would be significantly expanded and need to be ongoing throughout the operational period of the CAZ to provide updates to the local community. CAZ schemes are required to undertake statutory consultation between OBC and FBC which has previously resulted in scheme amendments.

Day to day project management would be undertaken by the operating company.

The financial management role would be expanded due to the significant income and expenditure associated with operating a CAZ and the associated financial obligations local authorities have. Management and disbursement of any CAZ income surplus would need to be agreed and the Low Emissions Strategy refreshed to reflect the potential funding stream.

Contract management would be expanded to include the significant operational and maintenance elements of a CAZ.

The monitoring and evaluation plan would be expanded to include:

- Monitoring of impacts of the economy and local businesses
- CAZ ANPR enforcement cameras would be available for fleet composition monitoring
- Expanded number of diffusion tubes to monitor $NO_2$ concentrations
- Expanded number of permanent traffic counters

Decommissioning the CAZ would also be a significantly larger process than for the Preferred Option.

# 6 Appendices

Appendices are attached as separate documents to this unapproved OBC. The full list of appendices is outlined below:

1. Stated Preference Survey Report
2. Workplace Parking Levy Review
3. Indicative Design Drawings
4. Flow Difference Plots
5. Comms Survey Summary
6. Longlist of Measures
7. Refined Longlist of Options
8. Refined Shortlist of Options
9. AST – Preferred Option
10. AST – Benchmark CAZ D
11. Financial Model – Preferred Option
12. Financial Model – Benchmark CAZ D
13. Project Organogram
14. Project Programme Outline
15. Implementation Programme Summary – Preferred Option
16. Implementation Programme Summary – Benchmark CAZ D
17. Quantified Risk Assessment – Preferred Option
18. Risk Register – Preferred Option
19. Quantified Risk Assessment – Benchmark CAZ D
20. Risk Register – Benchmark CAZ D
21. Benefits Realisation Plan
22. Monitoring & Evaluation Plan
23. Communications and Engagement Strategy
24. T1 – Transport Modelling Tracker Table
25. T2 – Transport Modelling Report
26. T3 – Model Methodology Report
27. T4 – Forecasting Report
28. AQ1 – Air Quality Tracker Table
29. AQ2 – Air Quality Modelling Methodology Report
30. AQ3 – Air Quality Modelling Results Report
31. AAS – Analytical Assurance Statement
32. TD1 – Target Determination 1
33. TD2 – Target Determination 2
34. E1 – Economic Methodology Report

35. E2 – Economic Model
36. E3 – Distributional Impact Analysis

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 1 - Stated Preference Survey Report

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

## Table of contents



## Appendices

## Executive Summary

The need to develop options to improve Nitrogen Dioxide (NO2) levels within Stoke-on-Trent and Newcastle-under-Lyme, comes as a result of the UK's Plan for Tackling Roadside NO2 Concentrations. This follows ClientEarth successfully winning their court case against the Government that not enough was being done to stop the UK breaching EU limits for NO2. In March 2018, Stoke-on-Trent and Newcastle-under-Lyme were identified by the Government as two areas in which NO2 levels exceed EU regulations as part of 33 "third-wave authorities". These two authorities, alongside Staffordshire County Council (SCC) (the County being the Highway Authority for the road network in Newcastle-under-Lyme) were mandated under Government ministerial direction to produce an North Staffordshire Local Air Quality Plan (NSLAQP). The NSLAQP should address these NO2 exceedances in the shortest possible timeframe. In March 2019, Sweco was appointed by Newcastle-under-Lyme Borough Council (NuLBC) to produce an NSLAQP and a Business Case submission to the Department for Environment, Food and Rural Affairs (Defra). The NSLAQP is required to include analysis and modelling to test the impact of a list of possible options against the benchmark option of a charging Clean Air Zone (CAZ). In order to understand the likely behavioural response of drivers to a potential charging CAZ, a multinomial logistic regression model was created. The model has been developed from a local stated preference (SP) survey that was conducted between September 2$^{nd}$ and October 2$^{nd}$, 2019 and was designed for residents' and businesses' in North Staffordshire. The survey targeted those that had recently driven within the proposed CAZ boundary in a non-compliant vehicle as defined under the Defra Clean Air Zone Framework for England. Separate questionnaires were created for private car users, taxi drivers and operators, and for commercial LGV and HGV drivers and operators.

The SP surveys consisted of several demographic questions and other questions relevant to the respondents current and future choice of vehicles and the frequency that they utilised the road network within the proposed CAZ boundary. It also contained two questions that asked the participant to consider their last trip within the CAZ region and what changes they might have made if a charging CAZ was operational.

The data acquired was used to fit two statistical models for each vehicle type. These logistic regression models were then combined for each vehicle type to predict the response to a range of potential charges and so provide input to inform the transport modelling for the proposed Clean Air Zone.

# 1 Introduction

## 1.1 Background

In July 2011, ClientEarth commenced legal proceedings against Defra. They claimed that the UK Government was not doing enough to tackle $NO_2$ emissions that breached EU limits. ClientEarth won three rulings forcing the Government to make urgent changes to air quality policy. This led to Defra introducing the UK's Plan for Tackling Roadside $NO_2$ which directs relevant local authorities to produce an NSLAQP to address these $NO_2$ exceedances in the shortest possible timeframe. In October 2018, Stoke-on-Trent and Newcastle-under-Lyme were identified by the Government as two areas in which $NO_2$ levels exceed EU regulations. These two authorities, alongside SCC (the County being the Highway Authority for the road network in Newcastle-under-Lyme) were mandated under Government ministerial direction to produce an Air Quality Local Plan. The NSLAQP is required to include analysis and modelling to test the impact of possible options against the benchmark option of a charging CAZ.

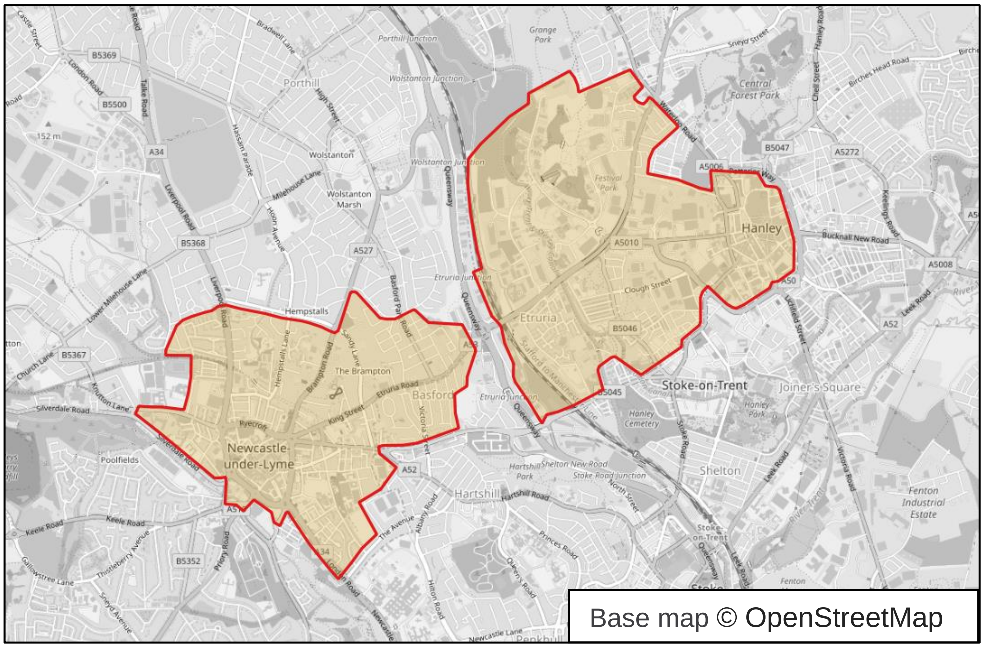
In March 2019, Sweco was appointed by NuLBC to produce an NSLAQP and an Outline Business Case (OBC) submission to Defra. This OBC is written to support the NSLAQP and includes details of the SP surveys undertaken to determine the behavioural response to the potential introduction of a charging CAZ.

## 1.2 Study overview

To understand the travel behaviour within the study area and how this could change following the introduction of a chargeable CAZ, a SP survey was commissioned. SP respondents were chosen from individuals and companies that travel through the proposed CAZ charge area. The survey also collected respondents' demographic details and their current vehicle replacement plans.

The study area can be seen in Figure 1-1 where the extent of the original proposed CAZ around both Newcastle-under-Lyme and Hanley/Etruria are identified.

*Figure 1-1: Study area*




The purpose of the CAZ is to improve air quality by reducing the use of non-compliant vehicles. Therefore, this survey was focused on motorists who own or drive vehicles that do not comply with limits in Defra's CAZ Framework, namely:

- Petrol vehicles with emission standards earlier than Euro 4 (registered before 1st January 2006)
- Diesel vehicles with emission standards earlier than Euro 6 (registered before 1st September 2015

This report refers to such vehicles as "non-compliant" whilst later vehicles are "compliant".

The surveys were conducted by specialist survey company Watermelon Ltd, between 2nd of September and the 2nd of October 2019.

## 1.3 Purpose of report

The purpose of this report is to outline the key stages in the development and implementation of the SP survey, the processing of the results and the analysis of the data to inform the transport modelling.

## 1.4 Report structure

The report covers the following sections:

- **Introduction**: A high-level overview of the location and purpose of the surveys
- **Survey Design:** An overview of the design choices made when developing the SP survey

- **Implementation and Sampling:** A description of the implementation of the survey including an overview of the returned data
- **Logic Checks:** A description of the logic checks and data cleansing processes applied to the data
- **Stated Preference Analysis and Results:** An overview of the analysis and results
- **Applying the Combined Model:** A description of how the model has been applied in order to determine potential daily CAZ charges for a range of vehicle types
- **Conclusion:** The headline results and conclusions from the survey

# 2 Survey design

## 2.1 Overview

The study was undertaken using a variety of data collection methodologies specifically chosen to best reach the target respondent group. These were:

- CAWI (Computer Assisted Web Interviewing) - Private car
- CAPI (Computer Assisted Personal Interview) – Private car, taxi
- CATI (Computer Assisted Telephone Interview) - Commercial LGV and HGV

The web-based (CAWI) surveys targeted the residents of Stoke-on-Trent and Newcastle-under-through an on-line panel supplied by Dynata.

Face to face fieldwork (CAPI) was conducted using a tablet device. The questionnaire was scripted in Confirmit and hosted on each interviewers' tablets. This enabled the fieldwork staff to easily switch to the appropriate vehicle type. Fieldwork was conducted at the following locations that were chosen to likely have large proportions of people who would be impacted by a proposed charging CAZ.

- Newcastle-under-Lyme Town Centre (Private car survey)
- Hanley Town Centre (Private car survey)
- Royal Stoke Hospital (Private car survey)
- Newcastle-under-Lyme Borough Council Depot (Taxi survey)
- City Transport MOT Centre, Stoke-on-Trent (Taxi survey)

Telephone call surveys (CATI) were conducted for the 01782 (Stoke-on-Trent) area code numbers.

CAWI and CATI surveys were included to ensure a representative sample of the population was captured including age, gender and income.

The questionnaire used to test responses to the potential CAZ was based on the Bath CAZ survey which in turn was based on the Bristol CAZ study, and the London Ultra Low Emissions Zone (ULEZ) SP survey conducted for Transport for London.

The full survey for all vehicle types can be found in Appendix A to C.

## 2.2 Screening questions

To exclude non-eligible respondents, the survey began with a series of screening questions.

For private vehicle owners, the screening questions were based on the following criteria:

- Age of respondent (to check eligibility to drive)
- Main mode of transport (to ensure they use private transport)
- Whether or not they make the decisions concerning replacement of the vehicle
- Fuel type (to ensure their standard vehicle was either petrol or diesel fuelled)
- Year of registration of main model of transport (to ensure respondents main vehicle is non-compliant)
- Whether or not they have travelled through the study area in past 6 months

For taxi operators, the screening questions were based on the following criteria:

- Fleet size by fuel type (to ensure they operate either petrol or diesel fuelled vehicles)
- non-compliant fleet size (to ensure respondent operates a non-compliant fleet)

For LGV/HGV vehicle operators, the screening questions were based on the following criteria:

- Whether or not the company operates using Light Goods Vehicles (twin axle not exceeding 3.5 tonnes) or Heavy Goods Vehicles (exceeding 3.5 tonnes)
- Whether or not they have travelled through the study area in the past 6 months
- LGV/HGV non-compliant fleet size (to ensure respondent operates a non-compliant fleet)

## 2.3 Vehicle questions

The questions within this section were specific to the respondent type (private car, taxi or commercial LGV/HGV). They were designed to obtain information about the vehicles the respondent either operated or had access to and included vehicle age and fuel type (to understand compliance) and vehicle replacement plans. The probable age of the replacement vehicle, and its fuel type enables the future make-up of the vehicles that will enter the charge zone to be predicted, thereby enabling forecasting future charge revenue.

## 2.4 Frequency question

The frequency that the respondent’s vehicle or fleet entered the proposed CAZ area was obtained in order to determine if a relationship existed between the regularity of entering the charging CAZ area and the respondents’ actions and if statistical testing indicates a requirement to apply factoring based on this answer.

## 2.5 Clean air zone exercise 1

The first exercise is designed to help understand respondent’s short-term behaviour to the introduction of a potential charging CAZ. The data gathered from this question is used to build a statistical model which is combined with another model created from Exercise 2. This combined model allows predictions of behavioural response to a potential charging CAZ to be made.

To determine the likely response to the introduction of a CAZ charge, respondents were given a series of possible alternatives in relation to their most frequent journey through the proposed CAZ area. Asking specifically for the most frequent journey rather than the most recent is intended to obtain an accurate representation of the most likely response to the charge. The available multiple choices are listed below for each survey type for what the respondent would choose following the introduction of a charging CAZ.

For private car owners:

- Made the same journey using your own vehicle and paid the charge
- Made the same journey by cycling or walking
- Made the same journey using public transport
- Upgraded to a compliant vehicle at a cost of £2,500 to avoid paying the charge and made the same journey
- Changed your destination to avoid paying the charge
- Changed your route to avoid paying the charge
- Used a compliant vehicle already available in your household
- Would not have made this journey

For taxi operators:

- Made the same journey using your existing vehicle and paid the charge
- Made the same journey by using another compliant vehicle already within the fleet
- Purchase compliant vehicle for £12,000 and made the same journey
- Stop operating
- Other (please state)

For LGV operators:

- Made the same journey using current vehicles and paid the charge
- Made the same journey but used compliant vehicles within your current fleet to avoid paying the charge
- Relocated business
- Would not have made this journey at all
- Changed your route to the same destination to avoid the charge
- Upgraded to compliant vehicle at a cost of £9,000 to avoid charge

For HGV operators:

- Made the same journey using current vehicles and paid the charge
- Made the same journey but used compliant vehicles within your current fleet to avoid paying charge

- Relocated business
- Would not have made this journey at all
- Changed your route to the same destination to avoid the charge
- Upgraded to compliant vehicle at a cost of £45,000 to avoid charge

The exercise consisted of three different scenarios for each of the vehicle types, consisting of a low, medium and high charge level. These daily charges are presented in Table 2-1.

*Table 2-1: Exercise 1 charge levels*

| | Low charge (£) | Medium charge (£) | High charge (£) |
|---|---|---|---|
| **Car/Taxi** | £2.00 | £5.00 | £8.00 |
| **LGV** | £6.00 | £9.00 | £12.00 |
| **HGV** | £25.00 | £50.00 | £75.00 |

## 2.6 Clean air zone exercise 2

The second exercise examined the respondent's potential long-term behaviour assuming a CAZ charge was in place. The only options provided in this scenario were to continue paying the charge when travelling in or through the zone using the current non-compliant vehicle or to replace the vehicle with a compliant one at a given hypothetical cost. The data from this exercise was used to build a statistical model that was combined with that produced from Exercise 1.

Each respondent type (private car, taxi, commercial LGV and commercial HGV) was asked nine different scenarios as shown in Table 2-2.

*Table 2-2: Exercise 2 charge levels*

| Private car | | Taxi | | Commercial LGV | | Commercial HGV | |
|---|---|---|---|---|---|---|---|
| **Charge (£)** | **Replace (£)** | **Charge (£)** | **Replace (£)** | **Charge (£)** | **Replace (£)** | **Charge (£)** | **Replace (£)** |
| £2.00 | £1,000.00 | £2.00 | £12,000.00 | £6.00 | £9,000.00 | £20.00 | £45,000.00 |
| £2.00 | £2,500.00 | £2.00 | £14,000.00 | £6.00 | £12,000.00 | £20.00 | £55,000.00 |
| £2.00 | £5,000.00 | £2.00 | £16,000.00 | £6.00 | £15,000.00 | £20.00 | £65,000.00 |
| £5.00 | £1,000.00 | £5.00 | £12,000.00 | £9.00 | £9,000.00 | £35.00 | £45,000.00 |
| £5.00 | £2,500.00 | £5.00 | £14,000.00 | £9.00 | £12,000.00 | £35.00 | £55,000.00 |
| £5.00 | £5,000.00 | £5.00 | £16,000.00 | £9.00 | £15,000.00 | £35.00 | £65,000.00 |
| £8.00 | £1,000.00 | £8.00 | £12,000.00 | £12.00 | £9,000.00 | £50.00 | £45,000.00 |
| £8.00 | £2,500.00 | £8.00 | £14,000.00 | £12.00 | £12,000.00 | £50.00 | £55,000.00 |
| £8.00 | £5,000.00 | £8.00 | £16,000.00 | £12.00 | £15,000.00 | £50.00 | £65,000.00 |

## 2.7 Demographic questions

Respondents to the private vehicle questionnaire were invited to provide demographic information including address, household size, number of householders in work, occupation, income, ethnic group, gender and disabilities. This information was gathered to analyse the demographic makeup of the sample and to allow the model to be applied to the transport model which is segmented on income class.

# 3 Implementation and sampling

## 3.1 Implementation and sampling

By using mobile devices to undertake the survey, the experienced survey team ensured a representative sample of the population was questioned by interactively monitoring the respondents based on sex, age, and demographic information. For example, should a high proportion of respondents belong to a specific gender or age, a directive would then be in place to target respondents of the opposite gender and different age groups. While it is difficult to assign potential respondents to a specific age group, analysis of the survey data shows that the age ranges and gender of those that were surveyed closely match census data for the area (see Figure 3-1).

## 3.2 Survey testing

The questionnaires were fully tested prior to release for collection. The testing focused on the following areas,

- The question sequence and logic
- That screening questions were adequate
- No technical issues occur during survey completion

## 3.3 Survey pilot

As this survey was based on the recently completed Bath CAZ survey, it was deemed unnecessary to undertake a specific pilot of this survey.

## 3.4 Quotas achieved

Table 3-1 shows the target and achieved sample size for responses that passed initial screening. The actual response for private car owners exceeded the target and the taxi response met the target. Responses fell below the target for commercial LGV and HGV operators, this was due to greater difficulty in finding respondents who operated non-compliant vehicles in the affected area and that were willing to be interviewed.

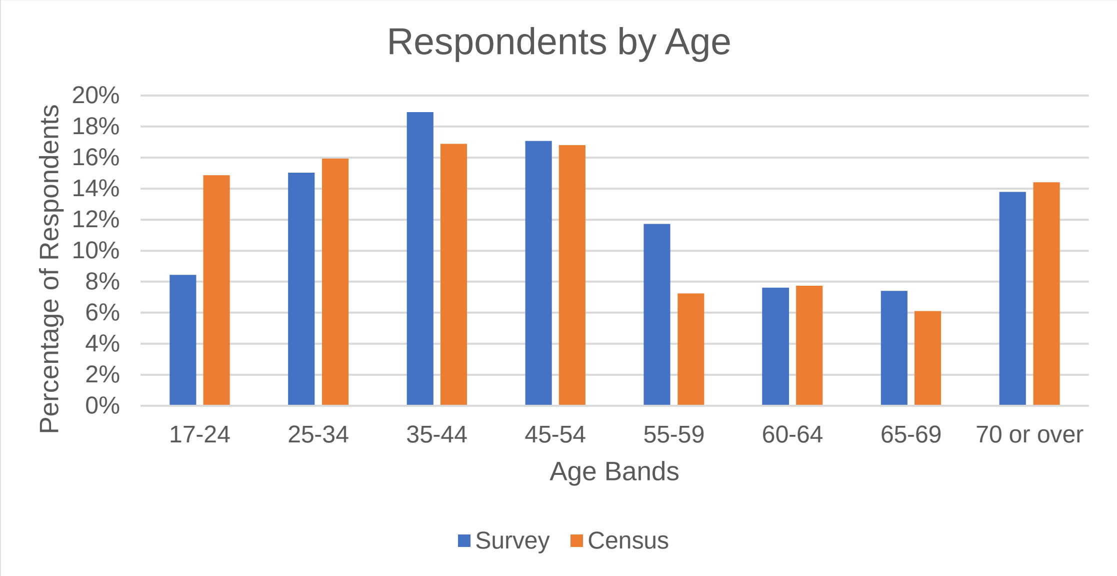
*Table 3-1: Targets and achieved sample*

| Questionnaire | Target | %Target | Actual | %Actual |
|---|---|---|---|---|
| **Private Car** | 350 | %74 | 492 | %141 |
| **Taxi** | 25 | %5 | 50 | %200 |
| **Commercial LGV** | 50 | %11 | 38 | %76 |
| **Commercial HGV** | 50 | %11 | 25 | %50 |
| **TOTAL** | **475** | **%100** | **605** | **%127** |

## 3.5 Sample profile

The proportion of respondents for the private car respondent group in each age range that passed initial screening is shown in Figure 3-1 where it is compared against the 2011 census data for Stoke-on-Trent and Newcastle-under-Lyme. As can be seen, for most age ranges, the survey counts are proportionate to the census figures. However, fewer respondents were identified for the 17-24 age range and more were identified for the 55-59 age range than predicted by census data. In part, this may be due to the difficulty in reaching younger age groups using traditional survey techniques that are more likely to engage with older, mobile, time-rich respondents.

*Figure 3-1: Respondents age*




For all vehicle types, participants were asked the fuel type of their vehicle(s), this is shown in Figure 3-2. The responses show a good match with previously acquired Automatic Number Plate Recognition (ANPR) data as seen in Figure 3-3. The difference between fuel types for taxi vehicles between the survey and the ANPR dataset can be explained by the ANPR survey reporting on Hackney Carriages which are traditionally diesel powered whilst the survey also included private-hire drivers who may choose petrol fuelled vehicles.

*Figure 3-2: Non-compliant vehicles by fuel type (survey)*

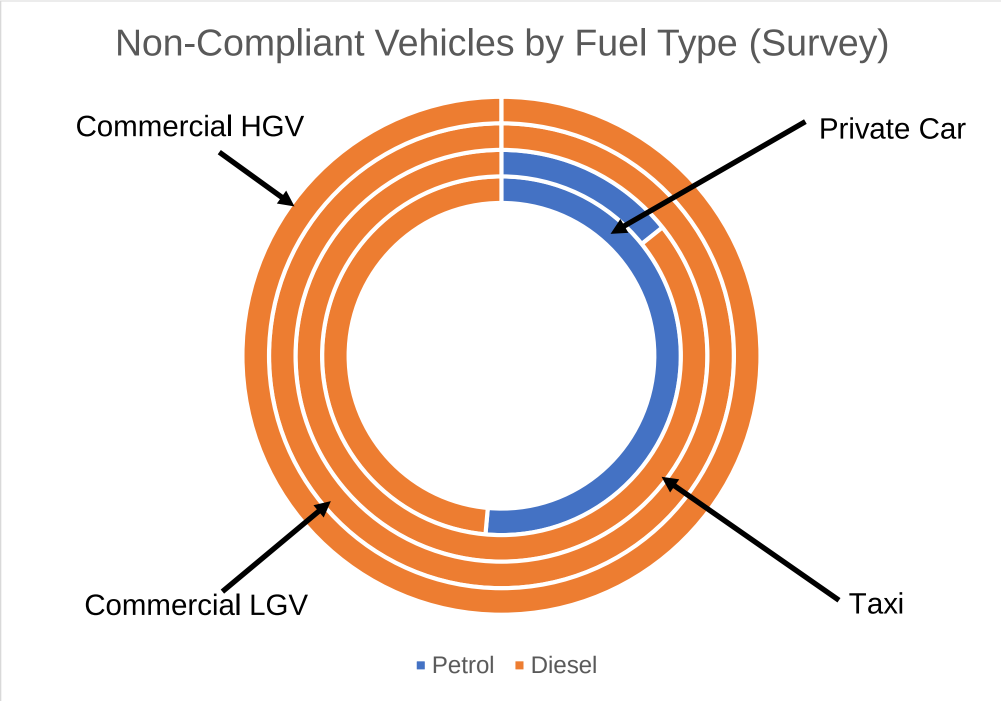
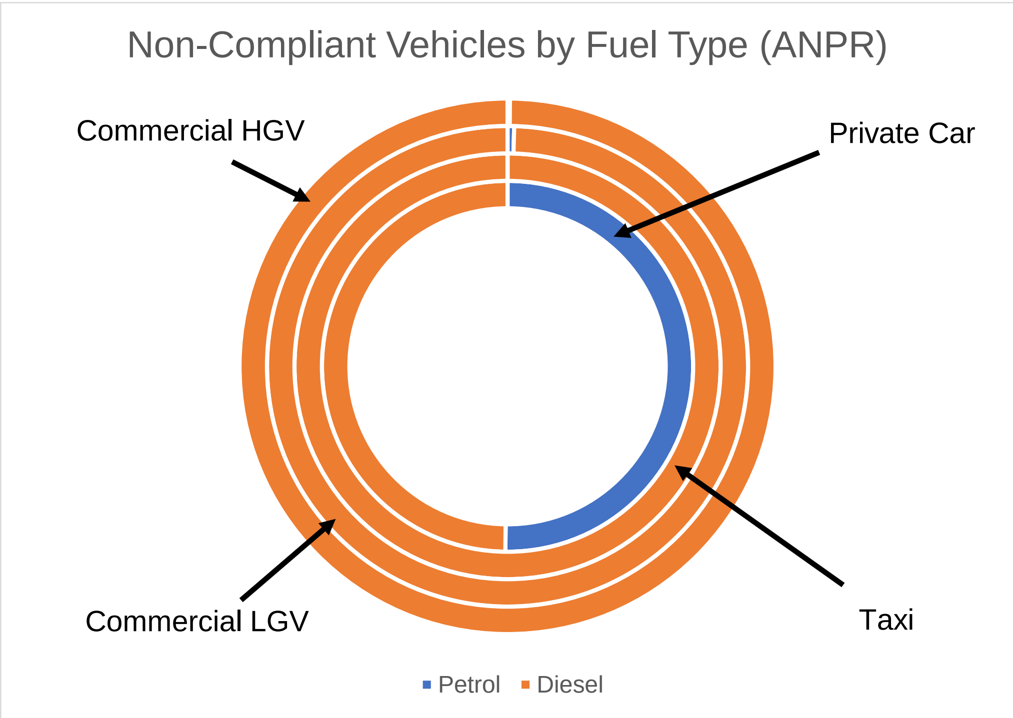



*Figure 3-3: Non-compliant vehicles by fuel type (ANPR)*



Respondents for the private car vehicle type were asked their occupation; these results are shown in Figure 3-4. Whilst the largest category is “retired”, the sum of the employment related categories is significantly greater than the sum for those categories out of employment.

*Figure 3-4: Respondents occupation*

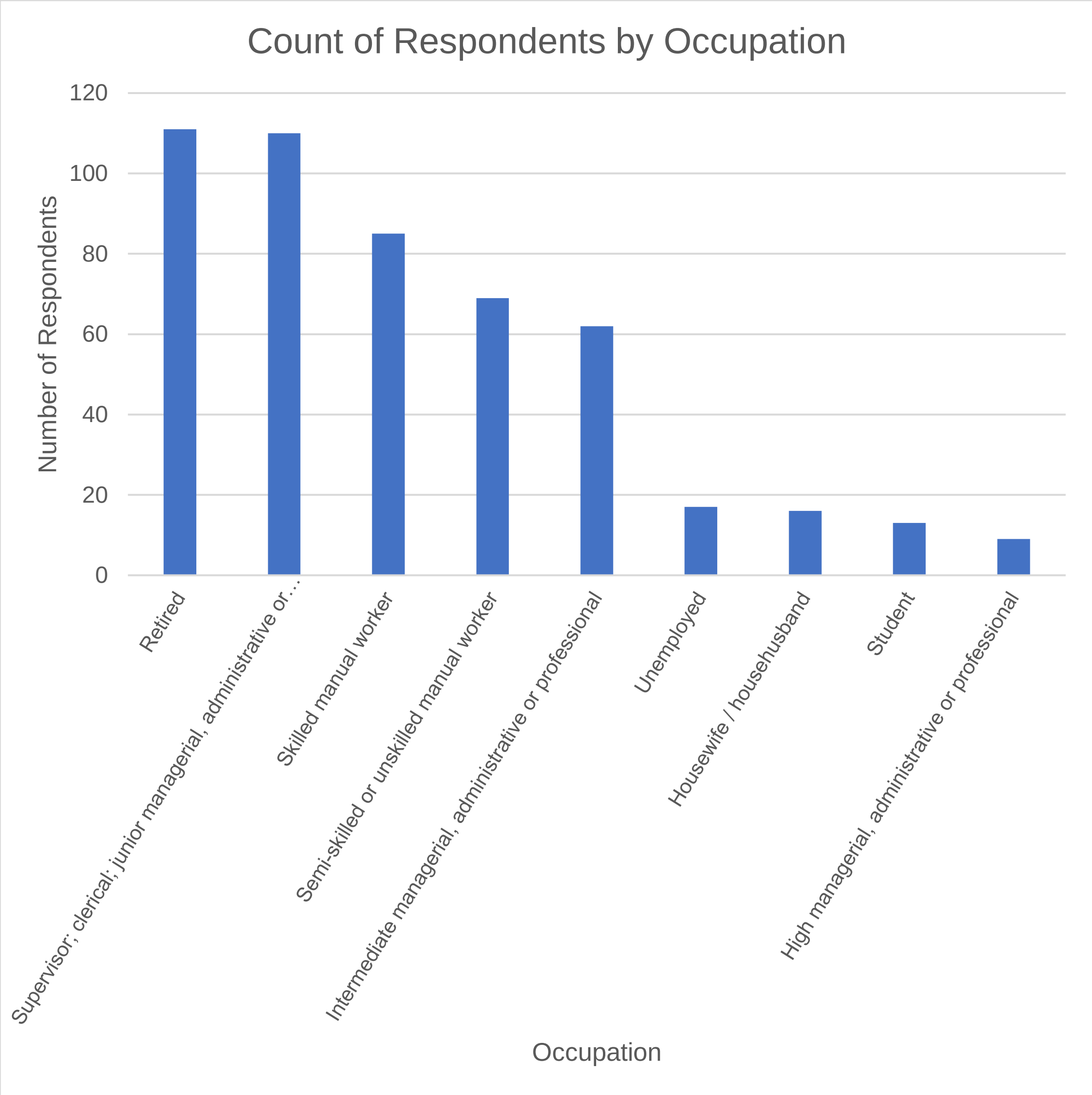



Figure 3-5 shows respondents’ income for the private car vehicle type survey. As can be seen, a large proportion of respondents chose not to state their income; This is likely a result of respondents feeling unwilling to disclose such information during a publicly located personal interview. The process used to compute income where the data is missing is explained in “Section 5-1 - Segmentation”.

*Figure 3-5: Respondents income*

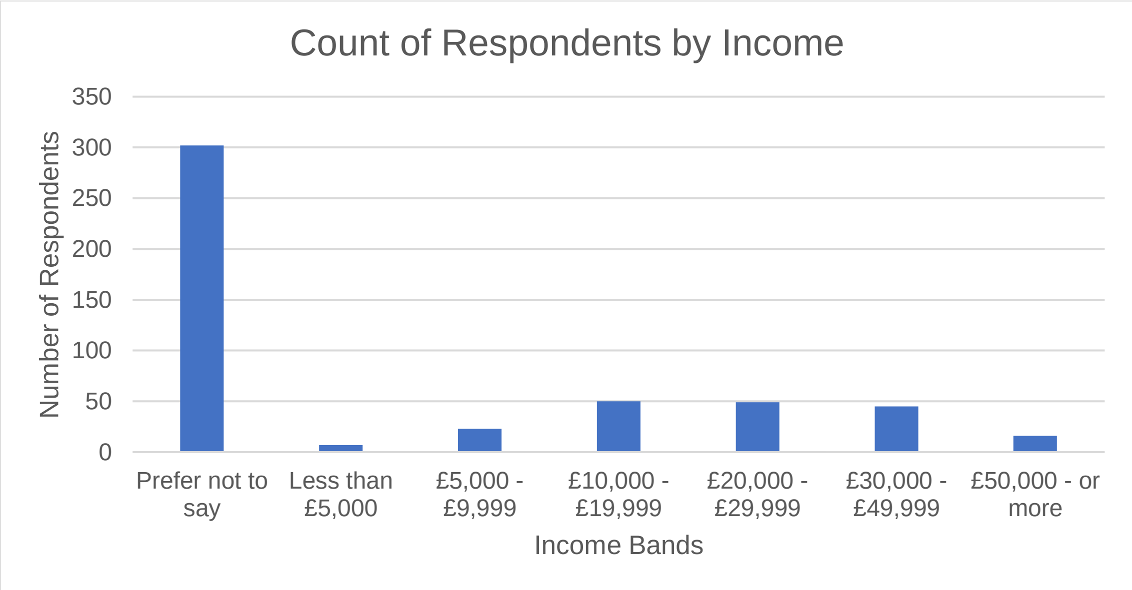



Figure 3-6 shows private car respondents trip purposes. Shopping and commuting trips make up the largest share of trip purposes.

*Figure 3-6: Trip purpose*

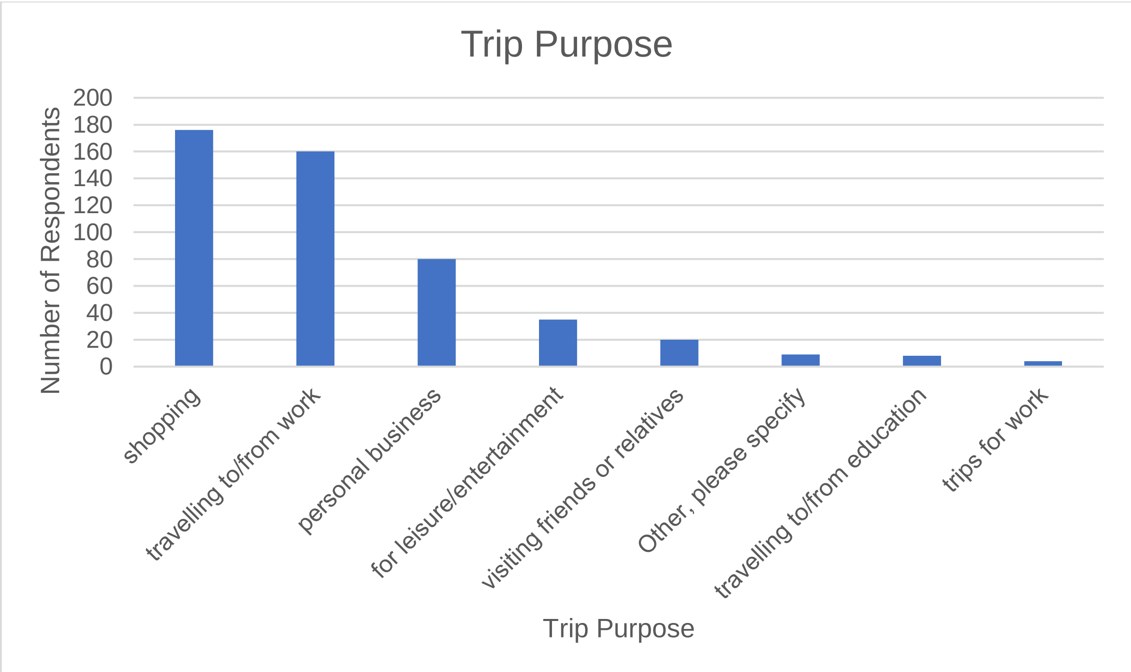
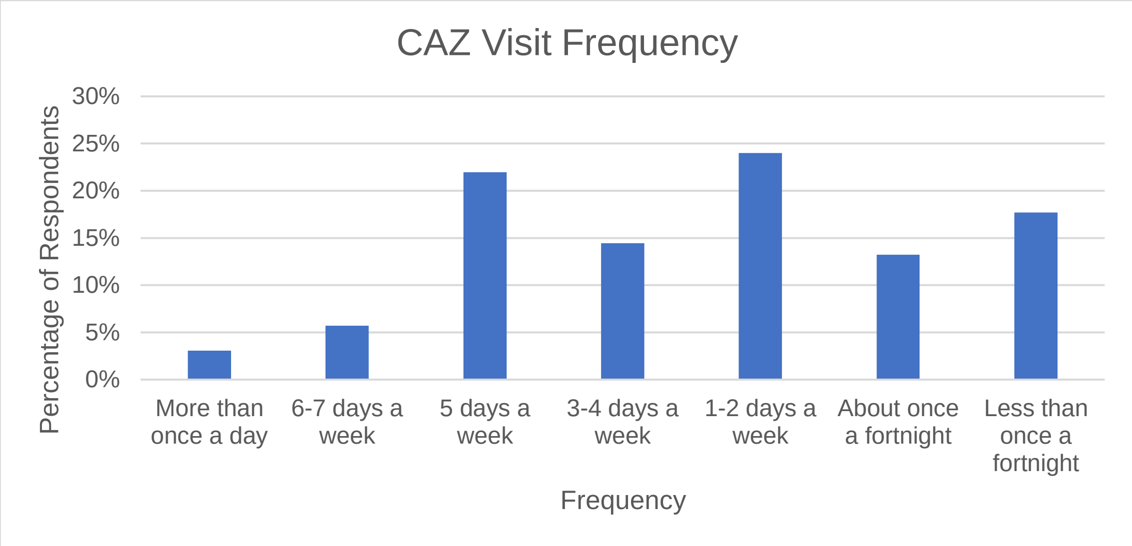


Figure 3-7 shows trip frequency to the study area as reported by private car respondents. This shows 31% of respondents visit the area at least five days a week whilst 69% visit at least every week.

*Figure 3-7: CAZ visit frequency*



# 4 Logic checks

The collected data underwent several checks to help exclude any illogical responses. Rather than automatically excluding a response based on automated criteria, suspect responses were flagged for review. Flagged records were then manually reviewed to determine if they should be discarded.

## 4.1 Exercise 1: pay charge vs behaviour change

This exercise presents incremental hypothetical CAZ charges and asks the respondent for their expected response to the charge. It is considered illogical that a respondent would choose to change behaviour for a lower CAZ charge though be content to continue to use their non-compliant vehicle and pay the CAZ charge when the charge is higher. Such responses were flagged for review for removal from Exercise 1 only.

## 4.2 Exercise 2: pay charge vs replace vehicle

This exercise gave the respondent the choice of paying the CAZ or upgrading to a compliant vehicle for a range of CAZ charges and upgrade costs. Responses where the respondent stated in Exercise 2 that they would always pay the CAZ whilst in Exercise 1 that they would never pay the CAZ were flagged. Likewise, those responses where the respondent stated they would always upgrade in Exercise 2 though stated they would always pay the CAZ in Exercise 1 were also flagged for review for removal from both Exercise 1 and 2.

## 4.3 Summary

As a result of logic checks, 108 records (17.9%) were removed from Exercise 1 whilst 7 records (1.2%) were removed from Exercise 2. Removing this suspected erroneous data should improve the quality of the data being used for further analysis.

# 5 Stated preference analysis and results

This section describes how the data was segmented, factored and weighted prior to analysis. It then describes the statistical models built for both Exercise 1 and Exercise 2 before describing how these were combined into a single model. This section also describes how the model can predict the percentage of respondents likely to pay the charge for different charge levels and income categories or the likelihood of other demand responses. Such predictions were then used in the North Staffordshire Multi-Modal transport model (NSMM)

## 5.1 Segmentation

To allow integration with the NSMM model, the Private Car vehicle type data was segmented by income into three categories as shown in Table 5-1. The three income ranges were chosen to reflect an evenly distributed demand across the groups as recommended by TAG.

*Table 5-1: NSMM income segmentation*

| NSMM Income Class | Income Range |
|---|---|
| **1** | £0 - £20,000 |
| **2** | £20,000 - £45,000 |
| **3** | < £45,000 |

For those records where income was not stated though an address was given, an estimated income was established. This was achieved by geocoding the respondents' home location then identifying what NSMM zone the respondent lived in. If this was an internal zone, an income class was selected based on the probability of each class existing in the chosen zone. Such a methodology gives a balanced distribution of assigned incomes that should better match the pattern within each zone. This method allowed income to be established for 40% of records where the respondent had omitted it. Based on best practise, for all records where income was either not given, location was not given or couldn't be geocoded or lay outside the NSMM internal zones, the modal income class of 2 was assigned.

## 5.2 Factoring

It was considered that the relationship between the respondent's frequency of travel to the proposed CAZ zone and their decision to either upgrade to a CAZ-compliant vehicle or pay the charge should be tested in order to determine wherever factoring should be applied based on travel frequency.

A statistical test was performed to determine the significance of the results in relation to a null hypothesis. The null hypothesis states that there is no relationship between the frequency of respondents' trips to the proposed CAZ and their responses to Exercise 2 (Pay Charge or Replace Vehicle). The level of statistical significance is expressed as a p-value between 0 and 1 with smaller P-Values indicating stronger evidence against the null hypothesis. The test gave a P-Value of 0.08 which is greater than the typically used threshold of 0.05 used for statistical significance indicating there to be no significance between frequency of travel and behavioural response to a CAZ. As no significant relationship was found, no attempt was made to factor the observed data by trip frequency.

### 5.3 Weighting

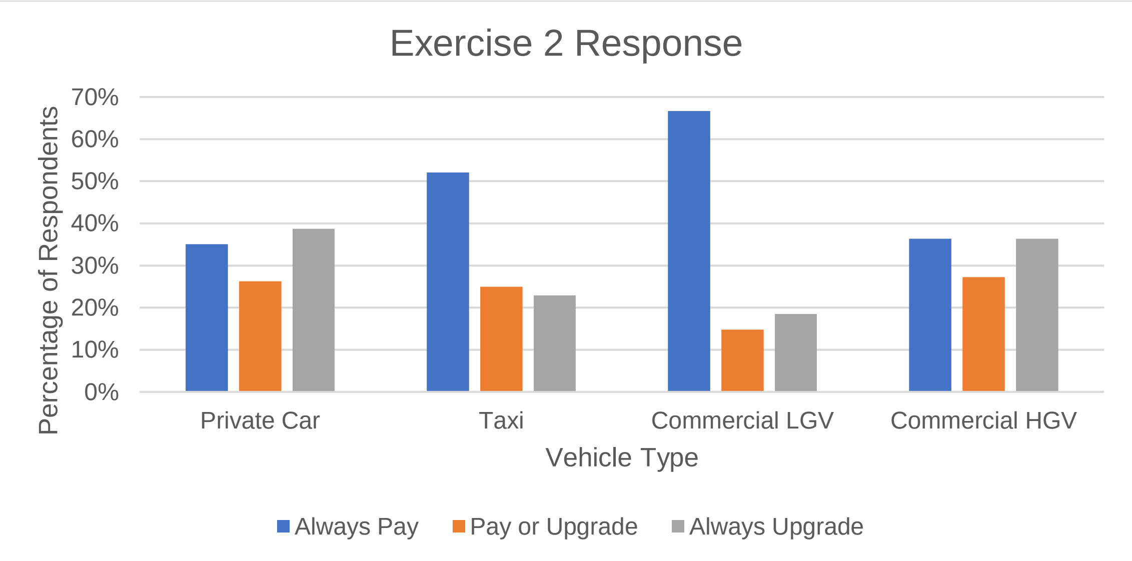
Due to the good match between the survey and ANPR/census data for fuel type and respondents age (see Figure 3-1, Figure 3-2 and Figure 3-3), it was decided that weighting of the survey data to account for variations in the observed data for these fields was not required.

### 5.4 Exercise 2 model and results (pay charge or replace vehicle)

Both Exercise 1 and Exercise 2 were used to construct the final statistical model with the results of Exercise 2 considered first. Exercise 2 consists of a series of nine individual questions where the respondent is asked to choose between keeping their non-compliant vehicle and paying the CAZ or upgrading to a compliant vehicle for a range of hypothetical CAZ charges and upgrade costs.

The expectation is that the costs and charges are well defined and evenly balanced so that respondents will provide a mix of answers to the different choice sets therefore providing a trade-off and that evenly proportioned minorities will choose to always upgrade or always pay. The results for this exercise are shown in Figure 5-1 and show a different pattern for each vehicle type. Both private car and commercial HGV show the expected even balance between "Always Pay" and "Always Upgrade". Both taxi and commercial LGV show a willingness to always pay the CAZ charge.

*Figure 5-1: Exercise 2 response*




Exercise 2 presented the respondent with a binary choice of either paying the CAZ charge or upgrading the vehicle. This allows the use of a logistic regression model to calculate the probability of paying the charge for a given combination of charge and upgrade cost for each of the questionnaires, with the private car response segmented by income.

The resulting coefficients from the logistic regression are shown in Table 5-2. Note that Income only exists for the private car vehicle type and is slightly negative indicating a slight shift to upgrading as income increases. For all vehicle types, Charge is positive, and Upgrade is negative. This is as expected and indicates that as the CAZ Charge increases and Upgrade cost decreases, the probability of a respondent choosing to upgrade their vehicle increases.

*Table 5-2: Exercise 2 coefficients*

| Coefficients | Private Car | Taxi | Commercial LGV | Commercial HGV |
|---|---|---|---|---|
| **Constant** | -0.014963 | -0.00008 | -0.00003 | -0.00004 |
| **Income** | -0.009434 | N/A | N/A | N/A |
| **Charge** | 0.103096 | 0.00871 | 0.00141 | 0.00125 |
| **Upgrade** | -0.000317 | -0.00006 | -0.00005 | -0.00007 |

The coefficients can be applied to the following equation to calculate upgrade probabilities for a range of CAZ and Upgrade costs.

$$P(charge) = \frac{1}{1 + e^{-(Const\ - coefIncome\ \times Income\ -\ coefCharge\ \times\ Charge\ -\ coefUpgrade\ \times Upgrade)}}$$

For private car vehicle types, the P-Values are shown in Table 5-3 Whilst this shows a strong correlation between CAZ Charge and Upgrade Cost and the respondents decision, there isn't a statistically significant correlation for Income. This may be a result of the boundaries of the three TAG derived income bands and that once a threshold of income is reached, any additional income won't affect the respondent's viewpoint. A sensitivity test was undertaken against the unsegmented income bands which showed that there was a slight correlation between Income and response to the CAZ charge. However, this test omitted records where Income was not stated as they could not be estimated so the sample size was significantly reduced.

*Table 5-3: Exercise 2 - private car P-Values*

| Input | P-Value |
|---|---|
| **Income** | 0.799862107 |
| **CAZ Charge** | 4.40E-14 |
| **Upgrade Cost** | 5.03E-44 |

From the results of the logistic regression, a surface plot can be constructed for a given set of coefficients for each vehicle type. Figure 5-2 shows a plot for private cars for Income Class of 2 (the modal income). As CAZ charge rises and upgrade cost falls, the probability of upgrading rather than paying the charge increases. When the CAZ charge falls, and the upgrade cost rises the probability of upgrading rather paying the charge decreases. For example,

- CAZ charge = £2, Upgrade Cost = £1,000 - Upgrade Probability = %47

- CAZ charge = £2, Upgrade Cost = £2,500 - Upgrade Probability = %36
- CAZ charge = £9, Upgrade Cost = £1,000 - Upgrade Probability = %65
- CAZ charge = £9, Upgrade Cost = £2,500 - Upgrade Probability = %53

*Figure 5-2: Private car upgrade probabilities (income = 2)*

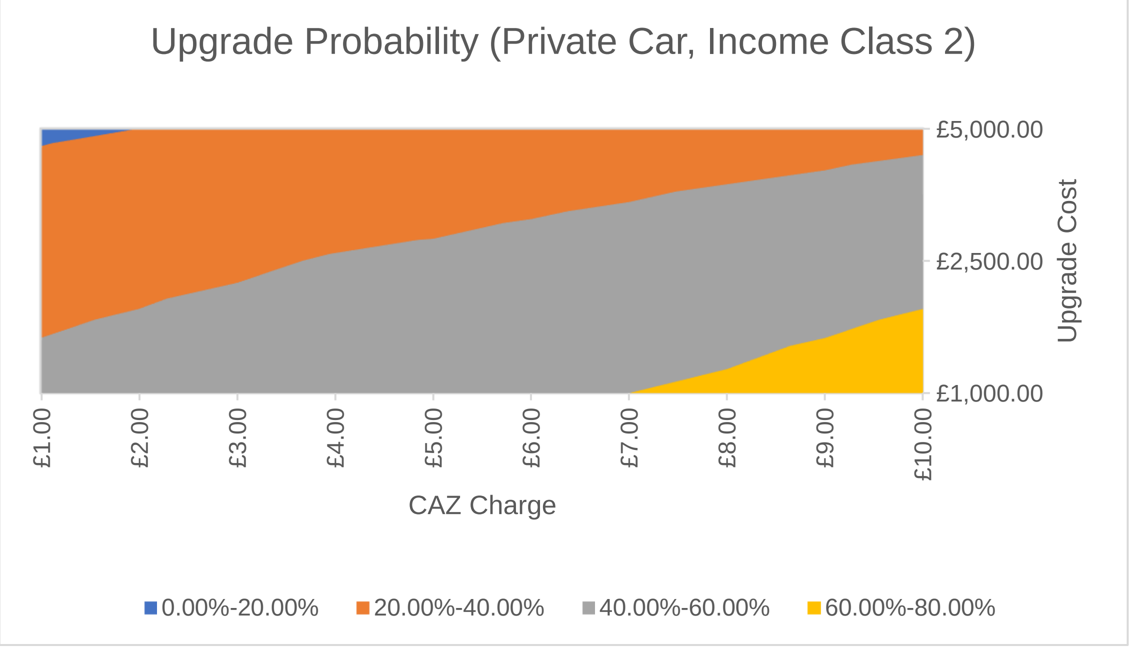
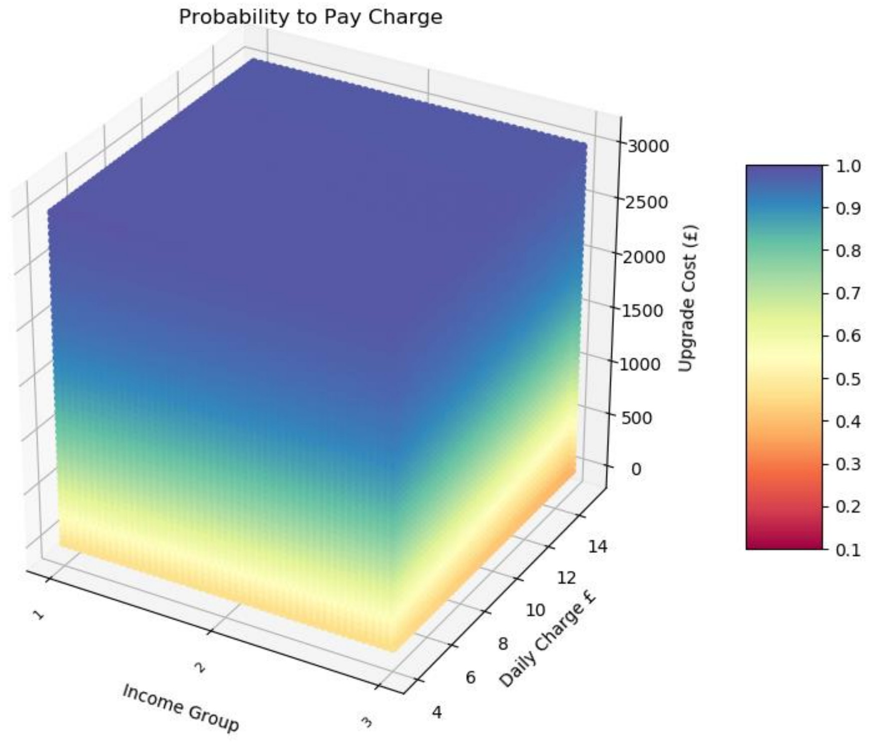



Figure 5-3 shows a similar plot for the private car vehicle type though now includes income on an additional axis. The same pattern as shown Figure 5-2 can be observed on the Daily Charge/Upgrade Costs axis. Figure 5-2 can be interpreted as a slice of Figure 5-3 taken where Income Group is 2. There is a slight increase in the probability of paying the charge as income increases though this is not significant and is not strong enough to clearly see on the plot.

*Figure 5-3: Private car upgrade probabilities*




## 5.5 Exercise 1 model and results (pay charge or changing travel behaviour)

For Exercise 1, respondents were asked how they would have modified their last journey into the study area had a charging CAZ been in place. Respondents were given the same choice of responses for three incrementally increasing CAZ charges with differing charges and responses for each of the questionnaire types (private car, taxi, commercial LGV/HGV).

As seen for Exercise 1, it was decided that the use of logistic regression would allow the creation of a model to predict the responses to differing charge levels. Unlike Exercise 2, Exercise 1 utilises a multinomial logistic regression which can consider the multiple-choice nature of this exercise.

The results from the multinomial logistic regression are shown in Table 5-4 to Table 5-7. Paying the charge is chosen as the reference outcome so is given a coefficient of zero. All other outcomes are appropriately adjusted so as not to impact the final model.

*Table 5-4: Exercise 2 coefficients (private car)*

| Coefficients | Pay Charge | Change Mode | Not Travel | Change Destination | Change Route | Switch Vehicle |
|---|---|---|---|---|---|---|
| **Constant** | 0 | -2.13601 | -2.68468 | -1.82567 | -1.67879 | -5.92286 |
| **Income** | 0 | 0.25199 | -0.22862 | -0.13943 | -0.15320 | 1.01417 |
| **Charge** | 0 | 0.34674 | 0.40137 | 0.28818 | 0.34008 | 0.36762 |

*Table 5-5: Exercise 2 coefficients (taxi)*

| Coefficients | Pay Charge | Switch Vehicle | Stop Operating |
|---|---|---|---|
| **Constant** | 0 | 1.07862277 | 1.01616727 |
| **Charge** | 0 | 0.1741951 | 0.19387649 |

*Table 5-6: Exercise 2 coefficients (commercial LGV)*

| Coefficients | Pay Charge | Switch Vehicle | Relocated Business | Not made journey | Changed Route |
|---|---|---|---|---|---|
| **Constant** | 0 | -1.94887273 | -3.53653985 | -2.87194768 | -0.38471851 |
| **Charge** | 0 | 0.0003193 | -0.00186174 | 0.00104001 | 0.03245195 |

*Table 5-7: Exercise 2 coefficients (commercial HGV)*

| Coefficients | Pay Charge | Switch Vehicle | Relocated Business | Not made journey | Changed Route |
|---|---|---|---|---|---|
| **Constant** | 0 | -1.31060116 | -5.09613855 | -2.6004546 | -0.54955764 |
| **Charge** | 0 | 0.03366961 | 0.06448078 | 0.04129855 | 0.01348811 |

Table 5-8 shows the P-Values for both income and CAZ charge change for each option. This shows a strong correlation between income and choosing to not travel, change route, change mode and switch vehicle. Income has no significant effect on choosing to pay the charge or changing destination. There is strong correlation between the value of the CAZ charge and choosing to either pay the charge, not travel, change route or change mode however there was no correlation between the value of the charge and changing destination or switching vehicle.

*Table 5-8: Exercise 1 P-Values*

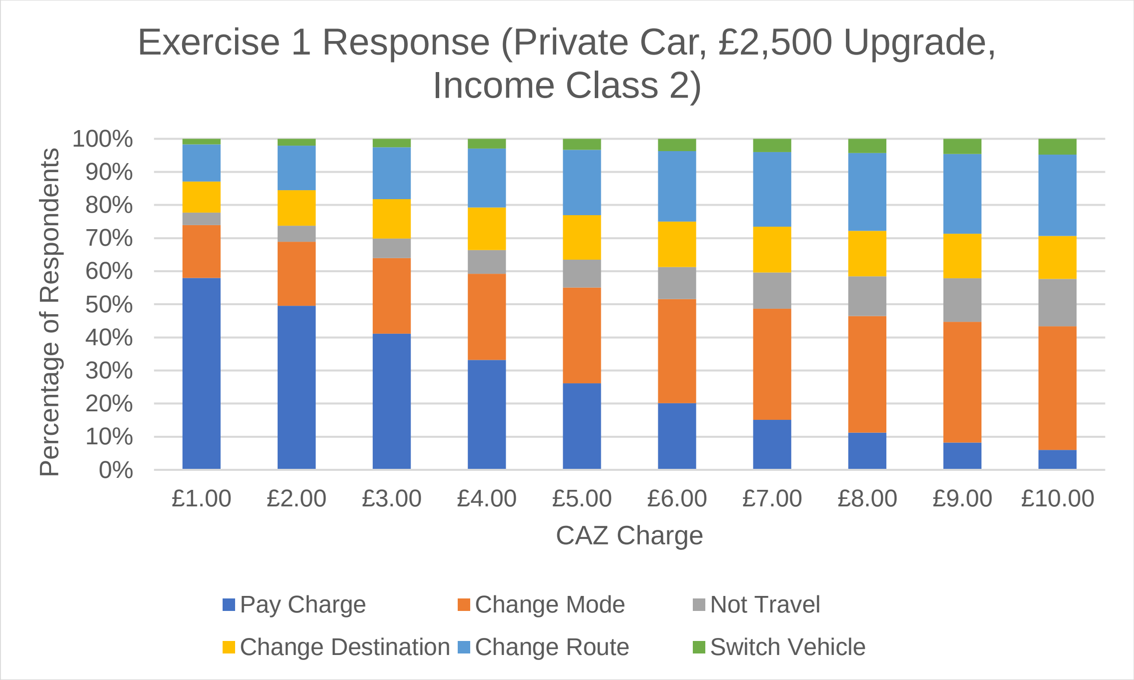
| | Income | CAZ Charge |
|---|---|---|
| **Pay Charge** | 0.9999703 | 1.28E-32 |
| **Not Travel** | 0.0379828 | 1.56E-05 |
| **Change Destination** | 0.9704317 | 0.17506814 |
| **Change Route** | 0.0122207 | 0.00050955 |
| **Change Mode** | 0.031911 | 2.22E-10 |
| **Switch vehicle** | 1.44E-05 | 0.232854917 |

The coefficients can be applied to the following equation to calculate upgrade probabilities for a range of CAZ and Upgrade costs.

$$P(Y) = \frac{e^{\beta_{0_Y} + \beta_{1_Y} C}}{\sum_{k=1}^{K} e^{\beta_{0_k} + \beta_{1_k} C}}$$

Figure 5-4 shows the results of the multinomial logistic regression model constructed for Exercise 2 applied to Private Car usage with an upgrade cost of £2,500 and for income class of 2. It can be clearly seen how increasing the CAZ charge leads to a reduction in those willing to pay and an increase in other choices with switch vehicle and pay charge being the key beneficiaries.

Figure 5-4: Exercise 1 response - private car




## 5.6 Combined model

In order to calculate an overall response to changes in CAZ charge and Upgrade cost, the results of the two models constructed for Exercises 1 and 2 for each vehicle type were combined. This methodology assumes that all of those who indicated that they would replace their vehicle for Exercise 2 would choose to do so whilst the remaining proportion that had said they would pay the CAZ charge for Exercise 2 are split between the probabilities established for Exercise 1. This process also combined some of the options from Exercise 1 for certain vehicle types in order to simplify the results for transport modelling.

Figure 5-5 to Figure 5-8 show the results of the combined models for each of the questionnaire types and for a range of input variables appropriate for that questionnaire. The response to change in a CAZ charge was quite flat for taxi and commercial LGV with the majority choosing to upgrade to a compliant vehicle irrespective of the level of the charge. For private car and commercial HGV vehicle types, the change in response due to a rising CAZ charge is more pronounced. For car drivers, a rising CAZ charge would encourage drivers to change mode or cancel as well as upgrading their vehicles. For HGV operators, an increased CAZ would lead to changes in route.

*Figure 5-5: Combined model - private car*

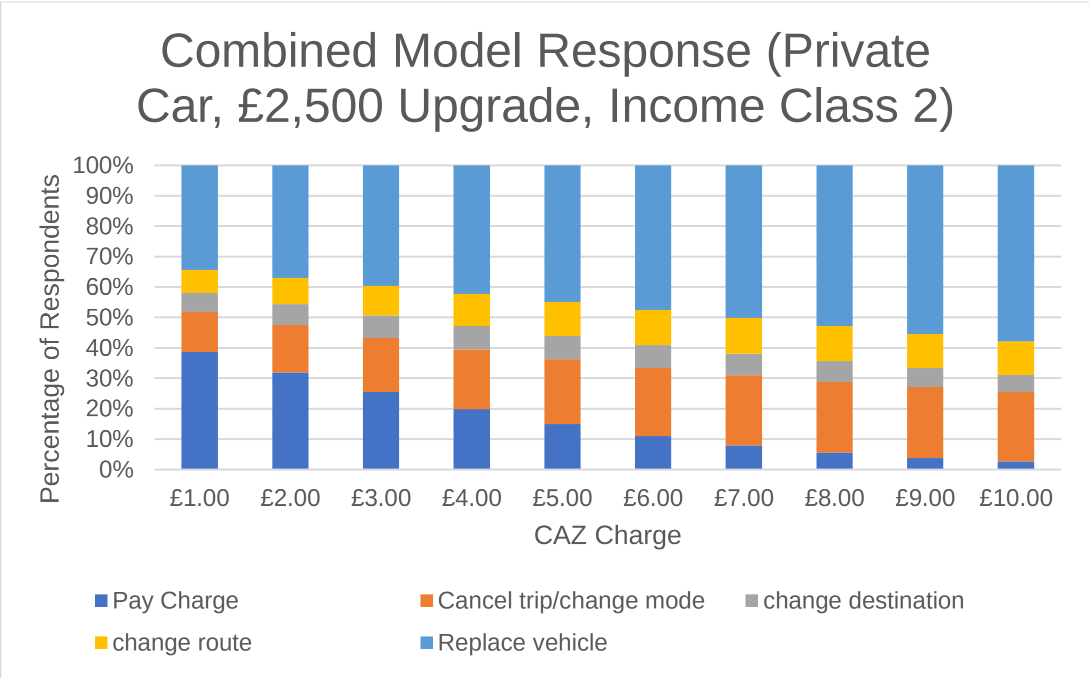



*Figure 5-6: Combined model – taxi*

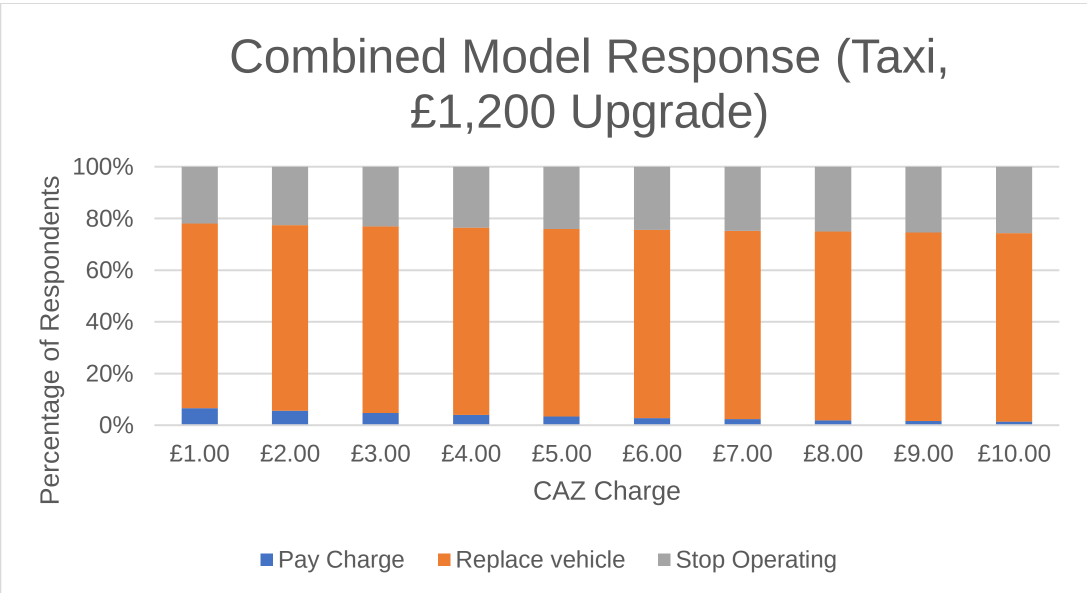


Figure 5-7: Combined model - commercial LGV

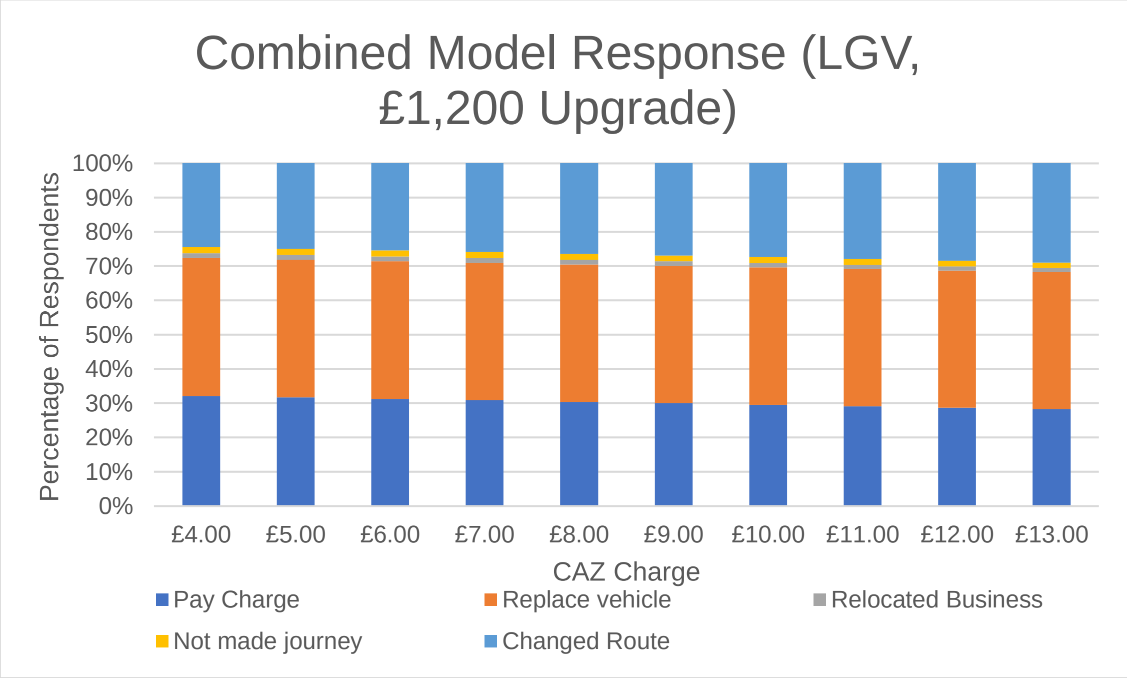
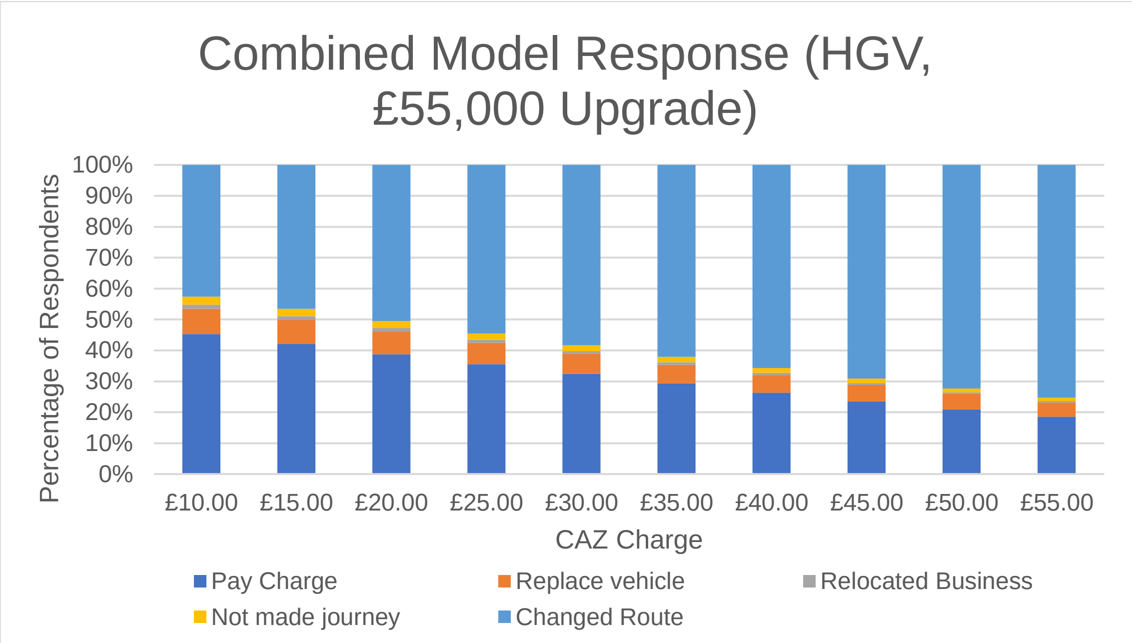



Figure 5-8: Combined model - commercial HGV



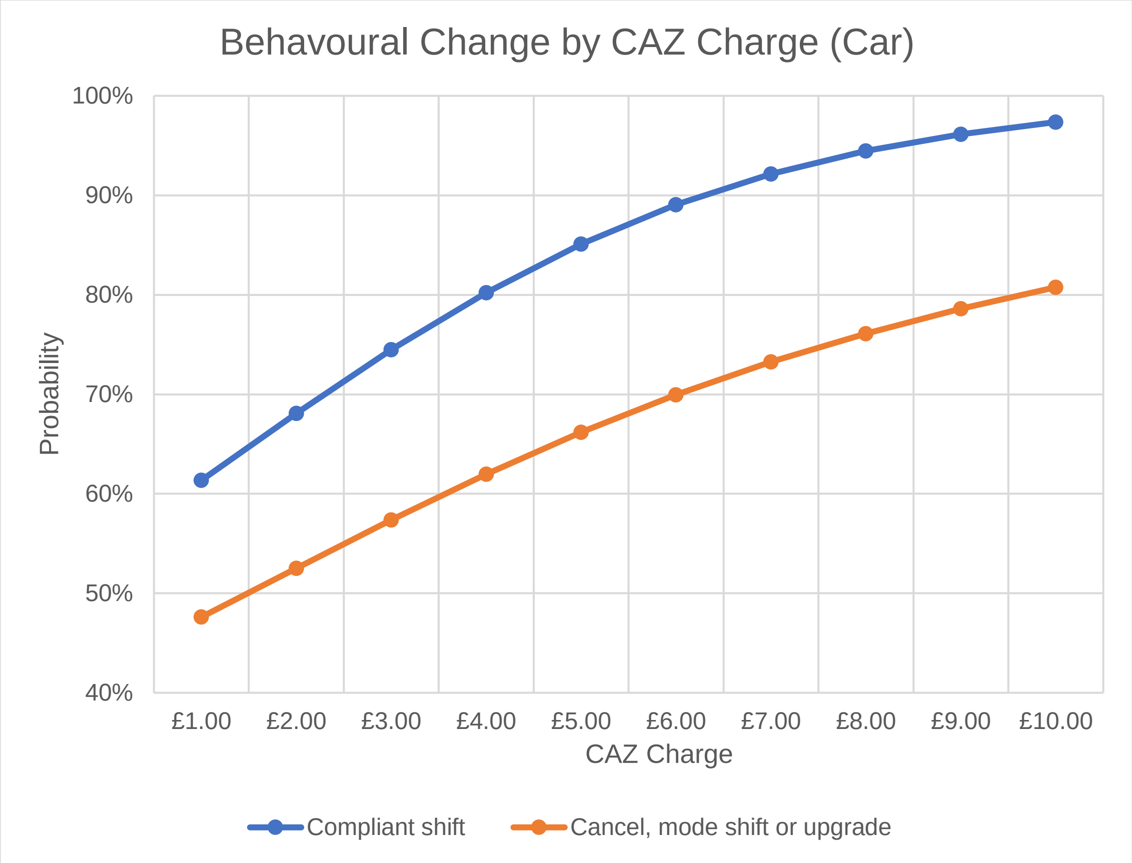
# 6 Applying the combined model

This section describes how the combined model discussed previously was used as a tool for defining potential daily CAZ charges for a range of vehicle types.

## 6.1 Deriving charging CAZ daily charges

Figure 5-5 to Figure 5-8 show the results of the combined models created from the SP data. The same data is displayed in Figure 6-1 for car usage. The chart has been simplified to show two probabilities per charge level; the shift to compliant behaviour (all responses except paying the CAZ) and the subset that will cancel, mode shift or upgrade (excluding those who would change route) Behaviour changes that exclude re-routing have the additional benefit of reducing the use of more polluting vehicles in the greater area.

*Figure 6-1: Probability of paying CAZ charge*




Both lines show a flattening in probability as charge increases. Therefore, the change in rate of drivers choosing to pay the charge and drive through the CAZ is not constant and reduces as the charge increases. This indicates that further increases in charge result in progressively weaker behavioural change. This observation allows charges per vehicle type to be identified that will be high enough to have a strong positive effect in encouraging a change in driver behaviour without being excessive. Higher charges would not only show diminishing results for discouraging drivers though also risk creating an economic barrier for some financially disadvantaged drivers. The potential CAZ charge for Stoke-on-Trent and Newcastle-under-Lyme is shown in *Table 6-1* along with those from other potential Benchmark CAZ D locations.

*Table 6-1: Potential Benchmark CAZ D charges*

| Vehicle Type | North Staffordshire | Birmingham | Bath (Proposed) |
|---|---|---|---|
| **Cars** | £5.00 | £8.00 | £9.00 |
| **Taxis** | £5.00 | £8.00 | £9.00 |
| **LGVs** | £9.00 | £8.00 | £9.00 |
| **HGVs** | £35.00 | £50.00 | £100.00 |
| **Buses** | £35.00 | £50.00 | £100.00 |

The charges established for North Staffordshire are based on the results of the combined model and are set at a point where a rising CAZ charge gives the greatest positive return. The charges also consider that North Staffordshire is a comparatively poorer region than the others in Table 6-1 making it more price-sensitive and with public transport options more limited than the other locations due to the polycentric nature of the region. Therefore, care has been taken to ensure the charge does not have a disproportionate effect on lower income residents.

As can be seen, the proposed charges for Stoke-on-Trent and Newcastle-under-Lyme compare favourably to other locations.

# 7 Conclusion

The report summarised the process of designing, analysing and applying a SP survey undertaken in Newcastle-under-Lyme, Stoke-on-Trent and surrounding areas for respondents who had recently driven within the proposed CAZ region in a vehicle considered non-compliant under the Defra Clean Air Zone Framework for England. The utilisation of a SP survey was shown to be a good source of data to construct a robust model based on logistic regression methods. This model could be successfully used for the prediction of behavioural responses to a potential chargeable CAZ for different vehicles.

The analysis of the SP surveys was composed by two exercises. For Exercise 1, respondents were asked how they would have modified their last journey into the study area had a CAZ been in place. Exercise 2 investigated the trade-off between paying the CAZ charge and upgrading to a compliant vehicle for a range of hypothetical CAZ charges and upgrade costs. Statistical models were produced using the responses from each exercise and they were then combined to one statistical model.

The combined models constructed for each of the vehicle types reflect different priorities for each of these groups of respondents and the analysis indicates what factors are statistically significant when individuals contemplate modifications to their travel behaviour following the introduction of a chargeable CAZ.

Models for all vehicle types showed a flattening in response for an increasing CAZ charge. This indicates that beyond a threshold, increasing the CAZ charge will have less pronounced behavioural effects and should be balanced against the negative financial consequences of a larger CAZ on lower income residents.

The final model was utilised as a predictor of future behaviour to a potential CAZ charge in order to assist the initial charging levels for different vehicle types. The resultant charges compare favourably with those identified for other CAZ schemes.

The combined models derived from the SP surveys provide the behavioural response to a charging Benchmark CAZ D. The predicted splits were used in the NSMM model to adjust the traffic demand prior to the assignment to reflect the impact of a Benchmark CAZ D policy.

## Appendix A – Stated preference questionnaires (private car)

***SP1: This questionnaire is to be used only for private vehicles (Registered to a single individual and not to a Company)***

North Staffordshire Local Air Quality Questionnaire

Good morning/afternoon/evening.

My name is …………, I represent Watermelon Research an independent market research agency. I am conducting a survey on behalf of the three local authorities in relation to a Local Air Quality Plan that is being developed for North Staffordshire.

**Interviewer instruction: SHOW THE LAMINATED PRIVACY NOTICE TO THE PARTICIPANT WHEN YOU READ OUT 'THIS PRIVACY NOTICE' BELOW**

In parts of Newcastle-under-Lyme and Stoke-on-Trent traffic related pollution is above legal limits which is affecting the health of local people. Central Government requires your councils to consider the introduction of a Clean Air Zone which would involve charging higher polluting vehicles to enter a defined area. At the same time, the local authorities are working to identify an alternative non-charging traffic management solution that improves air quality and avoids the need for a charging Clean Air Zone.

To help us identify the most appropriate solution to the air quality problem, we need to understand the likely responses of local people to the introduction of a charging Clean Air Zone and this survey will allow us to collect the necessary information.

The survey will take no more than 15 minutes and is completely confidential. We will retain any personal contact details you provide for quality control purposes only under ISO20252/IQCS. In line with GDPR guidelines, the data will not be retained for any longer than is required for this study.

The information that you provide will not be sold or passed to any other persons or organisations, you will receive no marketing material because of completing this questionnaire, and all results will be reported anonymously. Thank you for taking the time to complete this survey.

**Interviewer instruction: IF RESPONDENT IS NOT WILLING TO UNDERTAKE SURVEY, MENTION THAT THEY COULD WIN £100**

*Do you have any questions?*

*Are you happy to proceed?*

**Part A: This part of the survey is to determine whether it is of relevance to you. *All questions relate to your main vehicle used.***

*Q1. What age group do you fall into?*

□ *Under 17*

□ *17-24*

□ *25-34*

□ *35-44*

□ *45-54*

□ *55-64*

□ *65-74*

□ *75 or over*

***If under 17 then: Unfortunately, only people aged 17 or over are eligible to complete the remainder of the questionnaire. Thank you for your time.* Interviewer instruction: Go to end of questionnaire to get contact details for entry into prize draw.**

*Q2a. What is the main mode of transport you use?*

□ *Private Car*

□ *Van*

□ *Pre-booked taxi*

□ *Do not use private transport*

***If main vehicle is pre-booked taxi, please proceed to Part E. If 'do not use private transport' then unfortunately you are not eligible to complete the remainder of the questionnaire. Thank you for your time.* Interviewer instruction: Go to end of questionnaire to get contact details for entry into prize draw.**

*Q2b. Do you make decisions concerning the replacement of your vehicle?*

□ *Yes*

□ *No*

***If 'no' then: This survey is for people who make the decision about replacing their vehicle so unfortunately you are not eligible to complete the remainder of the questionnaire.***

***Thank you for your time.*** **Interviewer instruction: Go to end of questionnaire to get contact details for entry into prize draw.**

*Q3. What type of fuel does the vehicle you normally drive use?*

□ *Petrol*

□ *Diesel*

□ *Electric/Plug-In*

□ *Hybrid*

□ *Gas/LPG*

□ *Other*

***If not petrol or diesel then: This survey is focused on non-compliant vehicles, so unfortunately you are not eligible to complete the remainder of the questionnaire. Thank you for your time.*** **Interviewer instruction: Go to end of questionnaire to get contact details for entry into prize draw.**

*Q4. If your vehicle is petrol, was it registered before 1st January 2006? If it is diesel, was it registered before 1st September 2015?*

□ *Yes*

□ *No*

***If 'no' then: This survey is focused on non-compliant vehicles, so unfortunately you are not eligible to complete the remainder of the questionnaire. Thank you for your time.*** **Interviewer instruction: Go to end of questionnaire to get contact details for entry into prize draw.**

*Q5. In the past 6 months have you used your main vehicle to travel in the areas shown on the map?*

□ *Yes*

□ *No*

**Interviewer Instruction: Show Map of Areas Under Consideration**

***If 'no' then: This survey is focused on trips in these areas, so unfortunately you are not eligible to complete the remainder of the questionnaire. Thank you for your time*****. Interviewer instruction: Go to end of questionnaire to get contact details for entry into prize draw.**

**Part B: Information on vehicle most frequently driven**

*Q6. When do you expect to replace this vehicle?*

□ *By 2020*

□ *By 2021*

□ *By 2022*

□ *By 2023*

□ *After 2023*

□ *I have no specific plans at this time*

*Q7. How old do you expect your replacement vehicle will be?*

□ *It will be a new vehicle*

□ *Under 2 years old*

□ *2-4 years old*

□ *Over 4 years old*

□ *Don't know*

*Q8. What type of fuel do you expect your replacement vehicle will use?*

□ *Petrol*

□ *Diesel*

□ *Electric/Plug In*

□ *Hybrid*

□ *Gas/LPG*

□ *Other*

□ *Don't Know*

***Part C: Travel in the areas depicted on the map***

***Thinking about your main vehicle:***

*Q9. You stated that you have made at least one journey in the areas shown on the map in Q5 in the last 6 months. What was the most frequent purpose for your journey?*

□ *to/from work (commuting)*

□ *to/from education (as a student or escort for others)*

□ *for leisure/entertainment*

□ *shopping*

□ *to visit friends or relatives*

□ *for personal business (e.g. doctors, dentist, bank appointment)*

□ *trips for work (e.g. meeting)*

□ *Other please specify*____________________

*Q10. How often do you use your vehicle in these areas for the most frequent purpose mentioned above?*

□ *More than once a day*

□ *6-7 days a week*

□ *5 days a week*

□ *3-4 days a week*

□ *1-2 days a week*

□ *About once a fortnight*

□ *Less than once a fortnight*

*Q11.* Are there any other reasons you travel in these areas and approximately how often do you travel for these reasons?

________________________________________

*Purpose* *How often?*

**Part D: Clean Air Zone*: This part of the survey is to understand your response to the following scenario: Journeys made by your main vehicle in the areas shown on the map in Q5 would be subject to a "one-off" daily charge. Camera enforcement would be in place to identify non-compliant vehicles.***

*Question 12a to be answered if respondent uses **car***

*<u>Q12a. Thinking about your most frequent journey driving in these areas, what would you have done, assuming a Clean Air Zone was in place?</u>*

***Clean Air Zone Daily Charge (£2)**

□ *Made the same journey using your own vehicle and paid the £2 charge*

□ *Made the same journey by cycling or walking*

□ *Made the same journey using public transport*

□ *Upgraded to a compliant vehicle at a cost of £2,500 to avoid paying the charge and made the same journey*

□ *Changed your destination to avoid paying the charge*

□ *Changed your route to avoid paying the charge*

□ *Used a compliant vehicle already available in your household*

□ *Would not have made this journey*

***Clean Air Zone Daily Charge (£5)**

□ *Made the same journey using your own vehicle and paid the £5 charge*

□ *Made the same journey by cycling or walking*

□ *Made the same journey using public transport*

□ *Upgraded to a compliant vehicle at a cost of £2,500 to avoid paying the charge and made the same journey*

□ *Changed your destination to avoid paying the charge*

□ *Changed your route to avoid paying the charge*

□ *Used a compliant vehicle already available in your household*

□ *Would not have made this journey*

***Clean Air Zone Daily Charge (£8)**

◻ *Made the same journey using your own vehicle and paid the £8 charge*

◻ *Made the same journey by cycling or walking*

◻ *Made the same journey using public transport*

◻ *Upgraded to a compliant vehicle at a cost of £2,500 to avoid paying the charge and made the same journey*

◻ *Changed your destination to avoid paying the charge*

◻ *Changed your route to avoid paying the charge*

◻ *Used a compliant vehicle already available in your household*

◻ *Would not have made this journey*

*Question 12b to be answered if respondent uses* ***van***

*Q12b. Thinking about your most frequent journey driving in these areas, what would you have done, assuming a Clean Air Zone was in place?*

***Clean Air Zone Daily Charge (£6)**

◻ *Made the same journey using your own vehicle and paid the £6 charge*

◻ *Made the same journey by cycling or walking*

◻ *Made the same journey using public transport*

◻ *Upgraded to a compliant vehicle at a cost of £7,500 to avoid paying the charge and made the same journey*

◻ *Changed your destination to avoid paying the charge*

◻ *Changed your route to avoid paying the charge*

◻ *Used a compliant vehicle already available in your household*

◻ *Would not have made this journey*

***Clean Air Zone Daily Charge (£9)**

◻ *Made the same journey using your own vehicle and paid the £9 charge*

◻ *Made the same journey by cycling or walking*

◻ *Made the same journey using public transport*

◻ *Upgraded to a compliant vehicle at a cost of £7,500 to avoid paying the charge and made the same journey*

□ *Changed your destination to avoid paying the charge*

□ *Changed your route to avoid paying the charge*

□ *Used a compliant vehicle already available in your household*

□ *Would not have made this journey*

***Clean Air Zone Daily Charge (£12)**

□ *Made the same journey using your own vehicle and paid the £12 charge*

□ *Made the same journey by cycling or walking*

□ *Made the same journey using public transport*

□ *Upgraded to a compliant vehicle at a cost of £7,500 to avoid paying the charge and made the same journey*

□ *Changed your destination to avoid paying the charge*

□ *Changed your route to avoid paying the charge*

□ *Used a compliant vehicle already available in your household*

□ *Would not have made this journey*

*Question 13a to be answered if respondent uses* ***car****.*

*Q13a. If you had to choose between paying the Clean Air Zone charge or upgrading your vehicle, which option would you choose in the following 9 scenarios?*

*Please select one answer for each scenario.*

*** £2 charge or £1,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £2*

□ *Change to a compliant vehicle for an upgrade cost of £1,000 and pay no charge when driving through the zone*

*** £2 charge or £2,500 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £2*

□ *Change to a compliant vehicle for an upgrade cost of £2,500 and pay no charge when driving through the zone*

*** £2 charge or £5,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £2*

◻ *Change to a compliant vehicle for an upgrade cost of £5,000 and pay no charge when driving through the zone*

*** £5 charge or £1,000 vehicle upgrade**

◻ *Use current vehicle and pay a daily charge of £5*

◻ *Change to a compliant vehicle for an upgrade cost of £1,000 and pay no charge when driving through the zone*

*** £5 charge or £2,500 vehicle upgrade**

◻ *Use current vehicle and pay a daily charge of £5*

◻ *Change to a compliant vehicle for an upgrade cost of £2,500 and pay no charge when driving through the zone*

*** £5 charge or £5,000 vehicle upgrade**

◻ *Use current vehicle and pay a daily charge of £5*

◻ *Change to a compliant vehicle for an upgrade cost of £5,000 and pay no charge when driving through the zone*

*** £8 charge or £1,000 vehicle upgrade**

◻ *Use current vehicle and pay a daily charge of £8*

◻ *Change to a compliant vehicle for an upgrade cost of £1,000 and pay no charge when driving through the zone*

*** £8 charge or £2,500 vehicle upgrade**

◻ *Use current vehicle and pay a daily charge of £8*

◻ *Change to a compliant vehicle for an upgrade cost of £2,500 and pay no charge when driving through the zone*

*** £8 charge or £5,000 vehicle upgrade**

◻ *Use current vehicle and pay a daily charge of £8*

◻ *Change to a compliant vehicle for an upgrade cost of £5,000 and pay no charge when driving through the zone*

*Question 13b to be answered if respondent uses* ***van***

*Q13b. If you had to choose between paying the Clean Air Zone charge or upgrading your vehicle, which option would you choose in the following 9 scenarios?*

*Please select one answer for each scenario.*

*** £6 charge or £7,500 vehicle upgrade**

◻ *Use current vehicle and pay a daily charge of £6*

◻ *Change to a compliant vehicle for an upgrade cost of £7,500 and pay no charge when driving through the zone*

*** £6 charge or £10,000 vehicle upgrade**

◻ *Use current vehicle and pay a daily charge of £6*

◻ *Change to a compliant vehicle for an upgrade cost of £10,000 and pay no charge when driving through the zone*

*** £6 charge or £12,500 vehicle upgrade**

◻ *Use current vehicle and pay a daily charge of £6*

◻ *Change to a compliant vehicle for an upgrade cost of £12,500 and pay no charge when driving through the zone*

*** £9 charge or £7,500 vehicle upgrade**

◻ *Use current vehicle and pay a daily charge of £9*

◻ *Change to a compliant vehicle for an upgrade cost of £7,500 and pay no charge when driving through the zone*

*** £9 charge or £10,000 vehicle upgrade**

◻ *Use current vehicle and pay a daily charge of £9*

◻ *Change to a compliant vehicle for an upgrade cost of £10,000 and pay no charge when driving through the zone*

*** £9 charge or £12,500 vehicle upgrade**

◻ *Use current vehicle and pay a daily charge of £9*

◻ *Change to a compliant vehicle for an upgrade cost of £12,500 and pay no charge when driving through the zone*

*** £12 charge or £7,500 vehicle upgrade**

◻ *Use current vehicle and pay a daily charge of £12*

◻ *Change to a compliant vehicle for an upgrade cost of £7,500 and pay no charge when driving through the zone*

*** £12 charge or £10,000 vehicle upgrade**

◻ *Use current vehicle and pay a daily charge of £12*

◻ *Change to a compliant vehicle for an upgrade cost of £10,000 and pay no charge when driving through the zone*

*** £12 charge or £12,500 vehicle upgrade**

◻ *Use current vehicle and pay a daily charge of £12*

◻ *Change to a compliant vehicle for an upgrade cost of £12,500 and pay no charge when driving through the zone*

*This section only to be answered by respondents who use a pre-booked taxi as main form of transport specified in Q.2a*

**Part E: Clean Air Zone*: This part of the survey aims to understand the response to an increase in the fare price paid for pre-booked taxis due to the Clean Air Zone charge***

*Q14. In the past 6 months have you used a pre-booked taxi to travel in the areas shown on the map?*

◻ *Yes*

◻ *No*

**Interviewer Instruction: Show Map of Areas Under Consideration**

***If 'no' then: This survey is focused on trips in these areas, so unfortunately you are not eligible to complete the remainder of the questionnaire. Thank you for your time. Interviewer instruction: Go to end of questionnaire to get contact details for entry into prize draw.***

*Q15. In general, how often do you use a pre-booked taxi to travel in these areas?*

◻ *More than once a day*

◻ *6-7 days a week*

◻ *5 days a week*

◻ *3-4 days a week*

◻ *1-2 days a week*

□ *About once a fortnight*

□ *Less than once per fortnight*

*Q16. Thinking about the journey you usually make using a pre-booked taxi in these areas, what would you have done, assuming an increase in the taxi fare as a result of the Clean Air Zone?*

***Clean Air Zone Journey Charge (Additional fare of 20p per trip)**

□ *Made the same journey using the taxi and paid the additional fare*

□ *Made the same journey by cycling or walking*

□ *Made the same journey using public transport*

□ *Changed your drop-off/pick-up point to outside the charge areas and walk to destination/pick-up point to avoid paying additional fare*

□ *Requested that the taxi re-route to avoid the Clean Air Zone additional fare*

□ *Changed destination to avoid the Clean Air Zone additional fare*

□ *Would not have made this journey*

***Clean Air Zone Journey Charge (Additional fare of 40p per trip)**

□ *Made the same journey using the taxi and paid the additional fare*

□ *Made the same journey by cycling or walking*

□ *Made the same journey but using public transport*

□ *Changed your drop-off/pick-up point to outside the charge areas and walk to destination/pick-up point to avoid paying additional fare*

□ *Requested that the taxi re-route to avoid the Clean Air Zone additional fare*

□ *Changed destination to avoid the Clean Air Zone additional fare*

□ *Would not have made this journey*

***Clean Air Zone Journey Charge (Additional fare of 60p per trip)**

□ *Made the same journey using the taxi and paid the additional fare*

□ *Made the same journey by cycling or walking*

□ *Made the same journey but using public transport*

□ *Changed your drop-off/pick-up point to outside the charge areas and walk to destination/pick-up point to avoid paying additional fare*

□ *Requested that the taxi re-route to avoid the Clean Air Zone additional fare*

□ *Changed destination to avoid the Clean Air Zone additional fare*

□ *Would not have made this journey*

**Part G: About You**

*Q17. Please would you be able to confirm your home address and postcode? This information will be used by Sweco only for the purpose of classifying your answers to our transport models, with the data being destroyed within 6 months.*

*Address line 1:* ___________________________________

*Address line 2:* ___________________________________

*County:* ___________________________________

*Post-code:* ___________________________________

REFUSED

*Q18. How many people live in your household?*

___________________________________

*Q19. How many people in your household are working?*

___________________________________

*Q20: What best describes your occupation?*

| | | |
|---|---|---|
| 1 | High managerial, administrative or professional<br><br>*– e.g. doctor, lawyer, company director (50+ people), judge, surgeon, school headmaster etc.* [SEG ‘A’] | |
| 2 | Intermediate managerial, administrative or professional<br><br>*– e.g. school teacher, office manager, junior doctor, bank manager, police inspector, accountant etc.* [SEG ‘B’] | |
| 3 | Supervisor; clerical; junior managerial, administrative or professional<br><br>*– e.g. policeman, nurse, secretary, clerk, self-employed (5+ people) etc.* [SEG ‘C1’] | |
| 4 | Skilled manual worker<br><br>*– e.g. mechanic, plumber, electrician, lorry driver, train driver etc.* [SEG ‘C2’] | |
| 5 | Semi-skilled or unskilled manual worker<br><br>*– e.g. baggage handler, waiter, factory worker, receptionist, labourer, gardener etc.* [SEG ‘D’] | |
| 6 | Housewife / househusband [SEG ‘E’] | |
| 7 | Unemployed [SEG ‘E’] | |
| 8 | Student [SEG ‘C1’] | |
| 9 | Retired | |

*Q21. Which category corresponds to your annual household income before tax?*

□ *Less than £5,000*

□ *£5,000 - £9,999*

□ *£10,000 - £19,999*

□ *£20,000 -£29,999*

□ *£30,000 - £49,999*

□ *£50,000 - or more*

□ *Prefer not to say*

*Q22. Choose one option that best describes the ethnic group you belong to:*

□ *White*

□ *Asian/Asian British*

□ *Black/African/Caribbean/Black British*

□ *Mixed/multiple ethnic group*

□ *Other (please specify)* ____________________

□ *Prefer not to say*

*Q23. Do you identify as:*

□ *Male*

□ *Female*

□ *Other*

□ *Prefer not to say*

*Q24. Do you suffer from any long-term illness or disability which limits your ability to travel and/or carry out day-to-day activities?*

□ *Yes*

□ *No*

□ *Prefer not to say*

*Q25. Are you a Blue Badge holder?*

□ *Yes*

□ *No*

*Q26. Do you have any further comments about this topic or the survey itself?*

□ *Yes* ____________________________________________

________________________________________________________________

____

□ *No comments*

*Q27. And finally, Watermelon or the local authorities' consultants (Sweco) may wish to contact you again with any follow up questions relating to this research. Would you be willing to be re-contacted? Any re-contact would take place within the next 2 months.*

□ *Yes*

□ *No*

*By what e-mail address or telephone number would you like to be contacted?*

_________________________________________

*As a thank you for taking part you can chose to be entered into a prize draw to either win one of five cash prizes of £100 or an equivalent donation to a charity of your choice. The prize draw will take place on <DATE>*

*If you would you like to be entered into the prize draw, please provide your name and telephone number. Your details will only be used if you are a winner.*

*Name*_________________________________________

*Telephone number* _________________________________________

***This survey has been completed successfully. Thank you once again for your time and effort.***

# Appendix B – Stated preference questionnaires (taxi)

***SP2: This questionnaire to be used only for Taxi vehicles used for Business***

North Staffordshire Local Air Quality Questionnaire

Good morning/afternoon/evening.

My name is …………, I represent Watermelon Research an independent market research agency. I am conducting a survey on behalf of the three local authorities in relation to a Local Air Quality Plan that is being developed for North Staffordshire.

**Interviewer instruction: SHOW THE LAMINATED PRIVACY NOTICE TO THE PARTICIPANT WHEN YOU READ OUT 'THIS PRIVACY NOTICE' BELOW**

In parts of Newcastle-under-Lyme and Stoke-on-Trent traffic related pollution is above legal limits which is affecting the health of local people. Central Government requires your councils to consider the introduction of a Clean Air Zone which would involve charging higher polluting vehicles to enter a defined area. At the same time, the local authorities are working to identify an alternative non-charging traffic management solution that improves air quality and avoids the need for a charging Clean Air Zone.

To help us identify the most appropriate solution to the air quality problem, we need to understand the likely responses of local businesses to the introduction of a charging Clean Air Zone and this survey will allow us to collect the necessary information.

The survey will take no more than 15 minutes and is completely confidential. We will retain any personal contact details you provide for quality control purposes only under ISO20252 / IQCS. In line with GDPR guidelines, the data will not be retained for any longer than is required for this study.

The information that you provide will not be sold or passed to any other persons or organisations, you will receive no marketing material because of completing this questionnaire, and all results will be reported anonymously. Thank you for taking the time to complete this survey.

Do you have any questions?

Are you happy to proceed?

**Part A: This part of the survey is to determine whether it is of relevance to you**

***Q1.*** *Do you or your company own or hire your vehicle?*

◻ *Own*

◻ *Hire*

◻ *Not my vehicle*

***If 'Not my vehicle' then: This survey is only applicable to people who own or hire vehicles, therefore unfortunately you are not eligible to complete the remainder of the questionnaire. Thank you for your time.***

***Q2****. In the past 6 months have you or your business operated in the areas shown on the map?*

◻ *Yes*

◻ *No*

*Interviewer Instruction: Show Map of Areas Under Consideration*

***If 'no' then: This survey is focused on trips in these areas, so unfortunately you are not eligible to complete the remainder of the questionnaire. Thank you for your time.***

***Part B: This part of the survey is about your business and operation***

***Q3.*** *Which of the following best describes the size of your business?*

◻ *1 vehicle*

◻ *Small, 2 to 4 vehicles*

◻ *Medium, 5 to 25 vehicles*

◻ *Large, 26 vehicles and over*

***Q4a****. How many of your vehicles are petrol driven?*

_________________________________________

*Of those vehicles, how many are 55 registration or older (registered before January 2006)?*

____________

***Q4b****. How many of your vehicles are diesel driven?*

_________________________________________

*Of those vehicles, how many are 15 registration or older (registered before September 2015)?*

___________

***If no vehicles are either***

- ***55 registration or older for petrol or***
- ***15 registration or older for diesel,***

***then: This survey is focused on non-compliant vehicles, so unfortunately you are not eligible to complete the remainder of the questionnaire. Thank you for your time.***

***Q5a****. When do you expect to replace the non-compliant vehicle in your fleet? If replacement is to be phased over time, please provide all appropriate years.*

◻ *By 2020*

◻ *By 2021*

◻ *By 2022*

◻ *By 2023*

□ *After 2023*

□ *I have no specific plans at this time.*

***Q5b**. How old do you expect your replacement taxis will be?*

□ *They will be new vehicles*

□ *After registration year 67 (2017/2018)*

□ *Before registration year 67 but after 14 (2014/2015 – 2016/2017)*

□ *Before registration year 14 (before 2014)*

□ *Don't know*

***Q5c**. What type of fuel do you expect your replacement taxis will use?*

□ *Petrol*

□ *Diesel*

□ *Electric/Plug In*

□ *Hybrid*

□ *Gas/LPG*

□ *Other*

□ *Don't Know*

***Q6**. Typically, how often do you or your taxi drivers operate within the areas shown on the map in Q2?*

□ *21 times per day or more*

□ *11 – 20 times per day*

□ *1 – 10 times per day*

□ *Less frequent*

**Part D: Clean Air Zone*:***

***This part of the survey is to understand your response to the following scenario: Journeys made in the areas shown on the map in Q2 would be subject to a "one-off" daily charge. Camera enforcement would be in place to identify non-compliant vehicles.***

***Q7**. Thinking about the last journey you made in these areas, what would your response be, assuming the Clean Air Zone was in place?*

***Clean Air Zone Daily Charge (Taxi £2)**

□ *Made the same journey using your existing vehicle and paid the charge*

□ *Made the same journey by using another compliant vehicle already within the fleet*

□ *Purchase compliant vehicle for £12,000 and made the same journey*

□ *Stop operating*

□ *Other (please state)* ________________________________________

***Clean Air Zone Daily Charge (Taxi £5)**

□ *Made the same journey using your existing vehicle and paid the charge*

□ *Made the same journey by using another compliant vehicle already within the fleet*

□ *Purchase compliant vehicle for £12,000 and made the same journey*

□ *Stop operating*

□ *Other (please state)* ________________________________________

***Clean Air Zone Daily Charge (Taxi £8)**

□ *Made the same journey using your existing vehicle and paid the charge*

□ *Made the same journey by using another compliant vehicle already within the fleet*

□ *Purchase compliant vehicle for £12,000 and made the same journey*

□ *Stop operating*

□ *Other (please state)* ________________________________________

***Q8**. If the Clear Air Zone was in place, which option would you choose in the following 9 scenarios?*

*Please select one answer for each scenario.*

*** £2 charge or £12,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £2*

□ *Change to a compliant vehicle for an upgrade cost of £12,000 per taxi vehicle and pay no charge when driving through the zone*

*** £2 charge or £14,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £2*

□ *Change to a compliant vehicle for an upgrade cost of £14,000 per taxi vehicle and pay no charge when driving through the zone*

*** £2 charge or £16,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £2*

□ *Change to a compliant vehicle for an upgrade cost of £16,000 per taxi vehicle and pay no charge when driving through the zone*

*** £5 charge or £12,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £5*

□ *Change to a compliant vehicle for an upgrade cost of £12,000 per taxi vehicle and pay no charge when driving through the zone*

*** £5 charge or £14,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £5*

□ *Change to a compliant vehicle for an upgrade cost of £14,000 per taxi vehicle and pay no charge when driving through the zone*

*** £5 charge or £16,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £5*

□ *Change to a compliant vehicle for an upgrade cost of £16,000 per taxi vehicle and pay no charge when driving through the zone*

*** £8 charge or £12,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £8*

□ *Change to a compliant vehicle for an upgrade cost of £12,000 per taxi vehicle and pay no charge when driving through the zone*

*** £8 charge or £14,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £8*

□ *Change to a compliant vehicle for an upgrade cost of £14,000 per taxi vehicle and pay no charge when driving through the zone*

*** £8 charge or £16,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £8*

□ *Change to a compliant vehicle for an upgrade cost of £16,000 per taxi vehicle and pay no charge when driving through the zone*

***Q9.*** *How would a Clean Air Zone affect the future plans for you or your business?*

***Q10****.* *Do you have any further comments about this topic or the survey itself?*

□ *Yes*

◻ *No comments*

***Q11**. And finally, Watermelon or the local authorities' consultants (Sweco) may wish to contact you again with any follow up questions relating to this research. Would you be willing to be re-contacted? Any re-contact would take place within the next 2 months.*

◻ *Yes*

◻ *No*

*By what e-mail address or telephone number would you like to be contacted?*

***This survey has been completed successfully. Thank you once again for your time and effort.***

## Appendix C – Stated preference questionnaires (commercial LGV/HGV)

***SP3: This questionnaire to be used only for Light Goods Vehicles and Heavy Goods Vehicles used for Business***

North Staffordshire Local Air Quality Questionnaire

Good morning/afternoon/evening.

My name is …………, I represent Watermelon Research an independent market research agency. I am conducting a survey on behalf of the three local authorities in relation to a Local Air Quality Plan that is being developed for North Staffordshire.

*Are you responsible for making decisions regarding the operation of the vehicle fleet?*

□ *Yes*

□ *No*

***If 'no' then: Could you provide a contact name and telephone number of the person responsible (transport manager or fleet manager for example) within your business who will be able to respond to questions regarding the operation of the vehicle fleet***

____________________________________________________________

***If 'no' then: This survey is for people who make the decision about replacing their vehicle so unfortunately you are not eligible to complete the remainder of the questionnaire. Thank you for your time.***

In parts of Newcastle-under-Lyme and Stoke-on-Trent traffic related pollution is above legal limits which is affecting the health of local people. Central Government requires your councils to consider the introduction of a Clean Air Zone which would involve charging higher polluting vehicles to enter a defined area. At the same time, the local authorities are working to identify an alternative non-charging traffic management solution that improves air quality and avoids the need for a charging Clean Air Zone.

To help us identify the most appropriate solution to the air quality problem, we need to understand the likely responses of local businesses to the introduction of a charging Clean Air Zone and this survey will allow us to collect the necessary information.

The survey will take no more than 15 minutes and is completely confidential. We will retain any personal contact details you provide for quality control purposes only under ISO20252 / IQCS. In line with GDPR guidelines, the data will not be retained for any longer than is required for this study.

The information that you provide will not be sold or passed to any other persons or organisations, you will receive no marketing material because of completing this questionnaire, and all results will be reported anonymously. Thank you for taking the time to complete this survey.

*Do you have any questions?*

*Are you happy to proceed?*

**Part A: This part of the survey is to determine whether it is of relevance to you**

***Q1.*** *Are you a business that operates Light Goods Vehicles (twin axle not exceeding 3.5 tonnes) or Heavy Goods Vehicles (exceeding 3.5 tonnes)?*

□ *Light Goods Vehicles only*

□ *HGVs only*

□ *Both Light Goods Vehicles and HGVs*

□ *None of the above*

***If 'None of the above' then: This survey is focused on Light Goods Vehicles or HGVs, so unfortunately you are not eligible to complete the remainder of the questionnaire. Thank you for your time.***

***Q2****. In the past 6 months have you or your business operated any services in the following areas:*

- *Newcastle-under-Lyme town centre*
- *City centre (Hanley)*
- *Festival Park and Etruria*
- *Basford*

□ *Yes*

□ *No*

***If 'no' then: This survey is focussed on services or deliveries in these areas, and there is no requirement for you to complete the remainder of this questionnaire. Thank you for your time.***

***Q3****. How often do any of your vehicles operate in these areas?*

□ *More than once a day*

□ *6-7 days a week*

□ *5 days a week*

□ *3-4 days a week*

□ *2 days a week*

◻ *1 day a week*

◻ *About once a fortnight*

◻ *Less than once a fortnight*

***Part B: This part of the survey is about your business and operation***

***Q4**. What is the primary nature of your business:*

___________________________________

***Q5**. Which of the following do you consider appropriately describes the size of your business?*

◻ *Micro: employing less than 10 employees*

◻ *Small: employing 10 - 49 employees*

◻ *Medium: employing 50 -249 employees*

◻ *Large: employing 250 or more*

***Q6.** How many vehicles are in your company's fleet that operate in the areas described in Q2?*

◻ *1-10*

◻ *11-20*

◻ *21-30*

◻ *31-40*

◻ *41-50*

◻ *50 - over*

*Question 7 should be asked subject to the responses received for Q1 regarding the use of Light Goods Vehicles and HGVs.*

***Q7.** Of the number of vehicles stated in Q6, how many are;*

◻ *Light Goods Vehicles ___________*

◻ *HGVs __________*

*Question 8 should be asked subject to the responses received for Q7.*

***Q8 Only for Light Goods Vehicles:***

***Q8a**. How many of your Light Goods Vehicles stated in Q7 are:*

| | |
|---|---|
| *Petrol* | *………………… vehicles* |
| *Diesel* | *………………… vehicles* |

***Q8b**. Of these vehicles, how many are not compliant with:*

| | |
|---|---|
| *Euro 4 (Petrol) registered before 1st January 2006* | *………………… vehicles* |
| *Euro 6 (Diesel) registered before 1st September 2015* | *………………… vehicles* |

***If the response in Q1 is Light Goods Vehicles only and the response to Q8b is zero, then: the remainder of this questionnaire relates to non-compliant vehicles. Thank you for your time.***

*Question 9 should be asked subject to the responses received for Q7.*

***Q9 Only for Heavy Goods Vehicles***

***Q9a**. How many of your HGVs stated in Q7 are:*

| | |
|---|---|
| *Rigid* | *………………… vehicles* |
| *Articulated* | *………………… vehicles* |

***Q9b**. Of these vehicles, how many are non-compliant with Euro 6? (registered before 1st September 2015)*

***If the response in Q1 is HGV only and the response in Q9b is zero, then: the remainder of this questionnaire is related to questions to non-compliant vehicles. Thank you for your time.***

***If the response in Q1 is both Light Goods Vehicles and HGV and the responses in Q8b and Q9b are zero then, the remainder of this questionnaire is related to questions for non-compliant vehicles. Thank you for your time.***

*Q10. Only to be used if the response in Q1 is 'Light Goods Vehicles Only' or 'Light Goods Vehicles and HGVs'.*

***Q10a**. When do you expect to replace the non-compliant Light Goods Vehicles in your fleet? If replacement is to be phased over time, please provide all appropriate years.*

□ *By 2020*

□ *By 2021*

□ *By 2022*

□ *By 2023*

□ *After 2023*

□ *I have no specific plans at this time*

***Q10b**. How old do you expect your replacement Light Goods Vehicles will be?*

□ *They will be new vehicles*

□ *Under 2 years old*

□ *2-4 years old*

□ *Over 4 years old*

□ *Don't know*

***Q10c**. What type of fuel do you expect your replacement Light Goods Vehicles will use?*

□ *Petrol*

□ *Diesel*

□ *Electric/Plug In*

□ *Hybrid*

□ *Gas/LPG*

□ *Other*

□ *Don't Know*

*Q11. Only to be used if the response in Q1 is 'HGVs Only' or 'Light Goods Vehicles and HGVs'.*

***Q11a**. When do you expect to replace the non-compliant HGVs in your fleet? If replacement is to be phased over time, please provide all appropriate years.*

□ *By 2020*

□ *By 2021*

□ *By 2022*

□ *By 2023*

□ *After 2023*

□ *I have no specific plans at this time*

***Q11b**. How old do you expect your replacement HGVs will be?*

□ *They will be new vehicles*

□ *Under 2 years old*

□ *2-4 years old*

□ *Over 4 years old*

□ *Don't know*

***Q11c**. What type of fuel do you expect your replacement HGVs will use?*

□ *Diesel*

□ *Hybrid*

□ *Gas/LPG*

□ *Electric/Plug In*

□ *Other*

□ *Don't Know*

**Part D: Clean Air Zone*:***

*First Part of Question 12 to be asked if respondent uses Light Goods Vehicles and Q8b is greater than zero.*

*Second Part of Question 12 to be asked if respondent uses HGVs and Q9b is greater than zero.*

***This part of the survey is to understand what you would have done in response to a one-off daily charge being made at the time that your vehicles were operating in the areas described in Q2.***

***Q12**. If a charge had been in place at the times your vehicles had been operating in these areas, what would have been your response? Please select one answer.*

***For Light Goods Vehicles Only***

***Clean Air Zone Daily Charge (£6)**

□ *Made the same journey using current vehicles and paid the charge*

◻ *Made the same journey but used compliant vehicles within your current fleet to avoid paying the charge*

◻ *Relocated business*

◻ *Would not have made this journey at all*

◻ *Changed your route to the same destination to avoid the charge*

◻ *Upgraded to compliant vehicle at a cost of £9,000 to avoid charge*

***Clean Air Zone Daily Charge (£9)**

◻ *Made the same journey using current vehicles and paid the charge*

◻ *Made the same journey but used compliant vehicles within your current fleet to avoid paying the charge*

◻ *Relocated business*

◻ *Would not have made this journey at all*

◻ *Changed your route to the same destination to avoid the charge*

◻ *Upgraded to compliant vehicle at a cost of £9,000 to avoid charge*

***Clean Air Zone Daily Charge (£12)**

◻ *Made the same journey using current vehicles and paid the charge*

◻ *Made the same journey but used compliant vehicles within your current fleet to avoid paying the charge*

◻ *Relocated business*

◻ *Would not have made this journey at all*

◻ *Changed your route to the same destination to avoid the charge*

◻ *Upgraded to compliant vehicle at a cost of £9,000 to avoid charge*

**For HGVs Only**

***Clean Air Zone Daily Charge (£20)**

◻ *Made the same journey using current vehicles and paid the charge*

□ *Made the same journey but used compliant vehicles within your current fleet to avoid paying the charge*

□ *Relocated business*

□ *Would not have made this journey at all*

□ *Changed your route to the same destination to avoid the charge*

□ *Upgraded to compliant vehicle at a cost of £45,000 to avoid charge*

***Clean Air Zone Daily Charge (£35)**

□ *Made the same journey using current vehicles and paid the charge*

□ *Made the same journey but used compliant vehicles within your current fleet to avoid paying the charge*

□ *Relocated business*

□ *Would not have made this journey at all*

□ *Changed your route to the same destination to avoid the charge*

□ *Upgraded to compliant vehicle at a cost of £45,000 to avoid charge*

***Clean Air Zone Daily Charge (£50)**

□ *Made the same journey using current vehicles and paid the charge*

□ *Made the same journey but used compliant vehicles within your current fleet to avoid paying the charge*

□ *Relocated business*

□ *Would not have made this journey at all*

□ *Changed your route to the same destination to avoid the charge*

□ *Upgraded to compliant vehicle at a cost of £45,000 to avoid charge*

*Question 13a to be asked if respondent uses Light Goods Vehicle and Q8b is greater than zero.*

*Q13a. If you had to choose between paying the Clean Air Zone charge or upgrading your vehicle, which option would you choose in the following 9 scenarios?*

*Please select one answer for each scenario.*

*** £6 charge or £9,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £6*

□ *Change to a compliant vehicle for an upgrade cost of £9,000 and pay no charge when driving through the zone*

*** £6 charge or £12,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £6*

□ *Change to a compliant vehicle for an upgrade cost of £12,000 and pay no charge when driving through the zone*

*** £6 charge or £15,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £6*

□ *Change to a compliant vehicle for an upgrade cost of £15,000 and pay no charge when driving through the zone*

*** £9 charge or £9,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £9*

□ *Change to a compliant vehicle for an upgrade cost of £9,000 and pay no charge when driving through the zone*

*** £9 charge or £12,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £9*

□ *Change to a compliant vehicle for an upgrade cost of £12,000 and pay no charge when driving through the zone*

*** £9 charge or £15,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £9*

□ *Change to a compliant vehicle for an upgrade cost of £15,000 and pay no charge when driving through the zone*

*** £12 charge or £9,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £12*

□ *Change to a compliant vehicle for an upgrade cost of £9,000 and pay no charge when driving through the zone*

*** £12 charge or £12,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £12*

□ *Change to a compliant vehicle for an upgrade cost of £12,000 and pay no charge when driving through the zone*

*** £12 charge or £15,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £12*

□ *Change to a compliant vehicle for an upgrade cost of £15,000 and pay no charge when driving through the zone*

*Question 13b to be asked if respondent uses HGV and response to Q9b is greater than zero.*

*Q13b. Of the HGVs mentioned in Q9b, are the vehicles mostly:*

□ *Rigid-axle*

□ *Articulated-axle (tractor unit)*

*Interviewer directive: If **Rigid-axle, go to Q13c**, if **Articulated-axle (tractor unit) go to Q13d***

*Q13c. If you had to choose between paying the Clean Air Zone or upgrading your vehicle, which option would you choose in the following 9 scenarios?*

*Please select one answer for each scenario.*

*** £20 charge or £45,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £20*

□ *Change to a compliant vehicle for an upgrade cost of £45,000 and pay no charge when driving through the zone*

*** £20 charge or £55,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £20*

□ *Change to a compliant vehicle for an upgrade cost of £55,000 and pay no charge when driving through the zone*

*** £20 charge or £65,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £20*

□ *Change to a compliant vehicle for an upgrade cost of £65,000 and pay no charge when driving through the zone*

*** £35 charge or £45,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £35*

□ *Change to a compliant vehicle for an upgrade cost of £45,000 and pay no charge when driving through the zone*

*** £35 charge or £55,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £35*

□ *Change to a compliant vehicle for an upgrade cost of £55,000 and pay no charge when driving through the zone*

*** £35 charge or £65,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £35*

□ *Change to a compliant vehicle for an upgrade cost of £65,000 and pay no charge when driving through the zone*

*** £50 charge or £45,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £50*

□ *Change to a compliant vehicle for an upgrade cost of £45,000 and pay no charge when driving through the zone*

*** £50 charge or £55,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £50*

□ *Change to a compliant vehicle for an upgrade cost of £55,000 and pay no charge when driving through the zone*

*** £50 charge or £65,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £50*

□ *Change to a compliant vehicle for an upgrade cost of £65,000 and pay no charge when driving through the zone*

*Q13d. If you had to choose between paying the Clean Air Zone or upgrading your vehicle, which option would you choose in the following 9 scenarios?*

*Please select one answer for each scenario.*

*** £20 charge or £75,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £20*

□ *Change to a compliant vehicle for an upgrade cost of £75,000 and pay no charge when driving through the zone*

*** £20 charge or £85,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £20*

□ *Change to a compliant vehicle for an upgrade cost of £85,000 and pay no charge when driving through the zone*

*** £20 charge or £95,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £20*

□ *Change to a compliant vehicle for an upgrade cost of £95,000 and pay no charge when driving through the zone*

*** £35 charge or £75,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £35*

□ *Change to a compliant vehicle for an upgrade cost of £75,000 and pay no charge when driving through the zone*

*** £35 charge or £85,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £35*

□ *Change to a compliant vehicle for an upgrade cost of £85,000 and pay no charge when driving through the zone*

*** £35 charge or £95,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £35*

□ *Change to a compliant vehicle for an upgrade cost of £95,000 and pay no charge when driving through the zone*

*** £50 charge or £75,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £50*

□ *Change to a compliant vehicle for an upgrade cost of £75,000 and pay no charge when driving through the zone*

*** £50 charge or £85,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £50*

□ *Change to a compliant vehicle for an upgrade cost of £85,000 and pay no charge when driving through the zone*

*** £50 charge or £95,000 vehicle upgrade**

□ *Use current vehicle and pay a daily charge of £50*

□ *Change to a compliant vehicle for an upgrade cost of £95,000 and pay no charge when driving through the zone*

*Q14. How would a Clean Air Zone affect the future plans for your business, for example review expansion plans, review staff numbers or promote environmental credentials?*

______________________________________________

______________________________________________

*Q15. Do you have any further comments about this topic or the survey itself?*

□ *Yes* ______________________________________________

______________________________________________

□ *No comments*

*Q16. And finally, Watermelon or the local authorities' consultants (Sweco) may wish to contact you again with any follow up questions relating to this research. Would you be willing to be re-contacted? Any re-contact would take place within the next 2 months*

□ *Yes*

□ *No*

*By what e-mail address or telephone number would you like to be contacted?*

______________________________

***This survey has been completed successfully. Thank you once again for your time and effort.***

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 2 - Workplace Parking Levy Investigation

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

Table of contents

# 1 Introduction

This technical report provides a high-level assessment of the traffic demand impacts of a potential Workplace Parking Levy (WPL) for the North Staffordshire Local Air Quality Plan (NSLAQP). The Transport Act 2000 provides the enabling legislation for local authorities outside London to introduce a charge on workplace parking. Such a scheme would make employers who currently provide free private parking for employees liable to an annual charge. Whilst this levy is initially paid by the employer, they have the option of passing the cost to the employee.

A WPL has been operational in Nottingham since 2012 and was introduced to help reduce traffic congestion with income from the WPL going towards improved public transport. The legislation that permits the establishment of a WPL allows for a broad set of rules in how a scheme is designed. A WPL for the NSLAQP could be designed to encourage staff to switch to compliant modes of transportation in line with the Ministerial Direction and potentially therefore help to lower nitrogen dioxide ($NO_2$) emissions in locations exceeding compliance limits.

This high-level assessment utilises the North Staffordshire Multi-Modal Model (NSMM) to identify the volume of incoming commuter trips to key employment areas, the amount of those trips that would terminate at private parking and the amount where a WPL is estimated to be passed to the employee. It also investigates using a study of available parking spaces as an alternate method of estimating work-place parking demand. The number of employees who may be required to pay a WPL is of importance as the key motivation in the consideration of a WPL is to encourage a reduction in the use of non-compliant vehicles and encourage the use of either compliant vehicles or a mode shift to public transport. Where a potential WPL cost is absorbed by the employer, these benefits are less likely of occur.

## 2 The Nottingham WPL

Nottingham was the first region in the UK to introduce a WPL scheme in Europe and it is still the only WPL in the United Kingdom. The Nottingham WPL was introduced in October 2011 with no charge and with charging commencing in April 2012. The extent of the scheme is within the Nottingham City Council administrative boundaries with the scheme designed to help alleviate congestion and fund public transport schemes. Employers are liable for the levy if they make available 11 or more parking spaces, these need not be marked out or in a designated parking area. Where a parking area is shared by multiple employers, each is responsible for paying the levy on vehicles related to their business. Exemptions are available for car park users such as customers, business visitors, display vehicles, fleet vehicles, delivery vehicles, blue badge holders and emergency services. WPL licenses are issued for 12 months and are issued on the maximum number of permitted vehicles, not necessarily the number of available spaces. Enforcement is conducted by site visits included the use of ANPR cameras; the local authority having legal rights to enter property to conduct compliance checks[1].

From April 2019, the levy was set to £415 per vehicle and rises annually with the RPI (Retail Price Index). Within the area covered by the WPL, 18% of employers have parking that is liable to the WPL due to the parking capacity, 42% of all workspace parking spaces are liable for the levy[2] and 80% of employers pass the levy on to their staff. The supply of liable parking spaces fell by 17.5% prior to the WPL being introduced and then levelled to 75% of pre-WPL levels[3]. Since 2012, over £44M of revenue has been raised, this is ring-fenced for transport initiatives such as a tram network extension and improvements to the main railway station.

The expectation is that the WPL on its own will only lead to a slight mode shift to public transport due to fees being set at a level that will be absorbed by employees rather than causing them to switch to public transport. Additional positive impact is likely by way of the reduction in available parking spaces and the levy being invested in making public transport more attractive[4]. Between 2013 and 2014, Nottingham saw an increase of 4.3% in bus and tram usage. Public transport is now used by more than 40% of commuters. Between July 2014 and 2015, Nottingham was the only core English city to show a reduction in journey time per vehicle-mile on locally managed roads in the AM peak period.

Nottingham, like other UK core cities has seen a rise in congestion levels and it’s not been possible to observe the impact that the introduction of the WPL has had on congestion[5]. There is no evidence that the WPL has led to job losses, employment moving out of the region or putting off potential inwards investment.

[1] Nottingham City Council. Workplace Parking Levy Employer Handbook. 2013, Retrieved from http://documents.nottinghamcity.gov.uk/download/1233

[2] Hallam, N. Workplace Parking Levy, Nottingham, UK. 2016, Retrieved from WWF: https://www.wwf.org.uk/sites/default/files/2016-12/nottingham%20case%20study%20-%20Workplace%20parking%20levy.pdf

[3] Nottingham City Council. Workplace Parking Levy (WPL) Evaluation Update, 2016

[4] Butcher, L. Roads: Workplace Parking Levy (WPL). 2012, Retrieved from House of Commons Library: http://researchbriefings.files.parliament.uk/documents/SN00628/SN00628.pdf

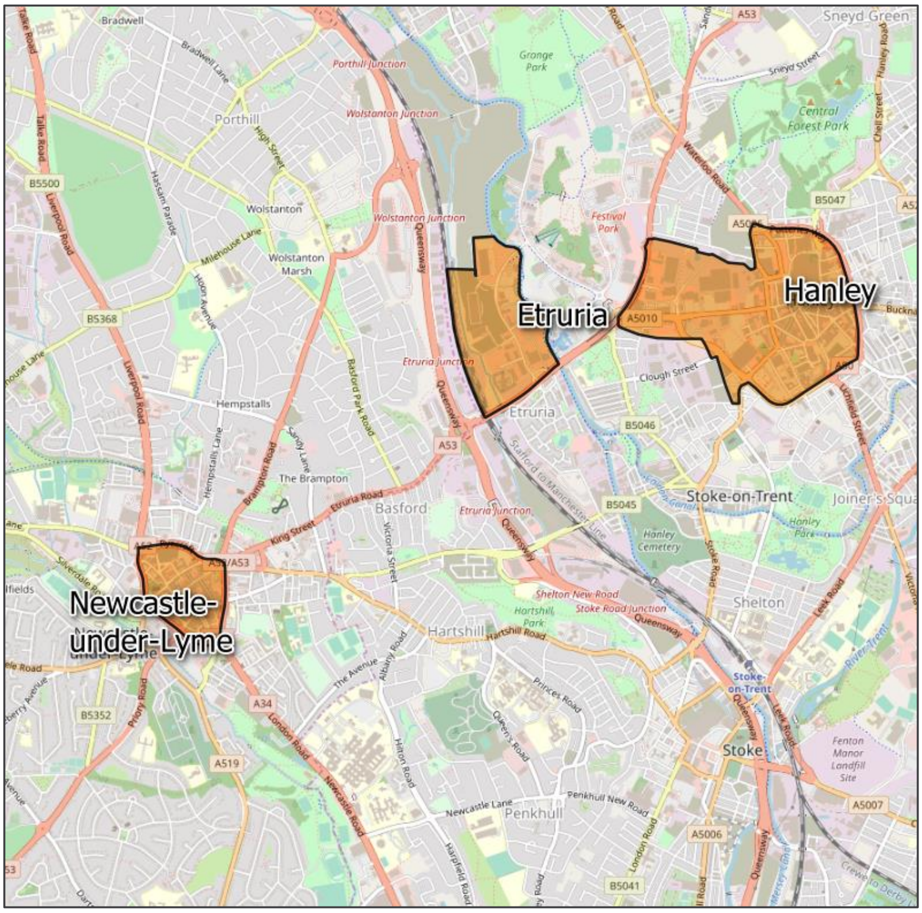
[5] Dale, S., Frost, M., Ison, S., Quddud, M., & Warren, P. Evaluating the impact of a workplace parking levy on local traffic congestion: The case of Nottingham UK. Transport Policy, 153-164. 2017

# 3 Methodology

## 3.1 Select-link analysis

Three potential WPL sites were identified around Hanley, Etruria and Newcastle-under-Lyme (Figure 3-1). The perimeters of these were chosen to include known key employment and parking sites.

*Figure 3-1: Identified sites*




The NSMM model was utilised to conduct a select-link analysis for each site. The select-link analysis included all links into the cordon areas for the two centres and was undertaken for each direction on the A53 to capture Etruria movements (selected links shown in green in Figure 3-2, Figure 3-3 and Figure 3-4). AM (0800 - 0900) flows were analysed as these are most appropriate for understanding commuting behaviour. A factor was applied to convert peak hour flow to the 0700-1000 AM commute period. Separate select-link analysis was conducted for both compliant car journeys and non-compliant car journeys yielding a pair of matrices for each site containing journey flows passing through each site cordon.

*Figure 3-2: Cordon sites in Newcastle-under-Lyme*

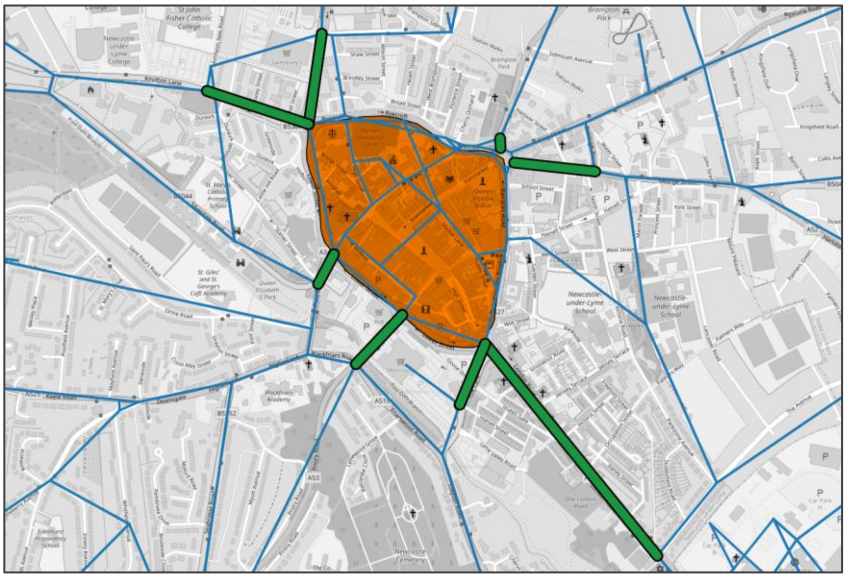



*Figure 3-3: Cordon sites in Etruria*

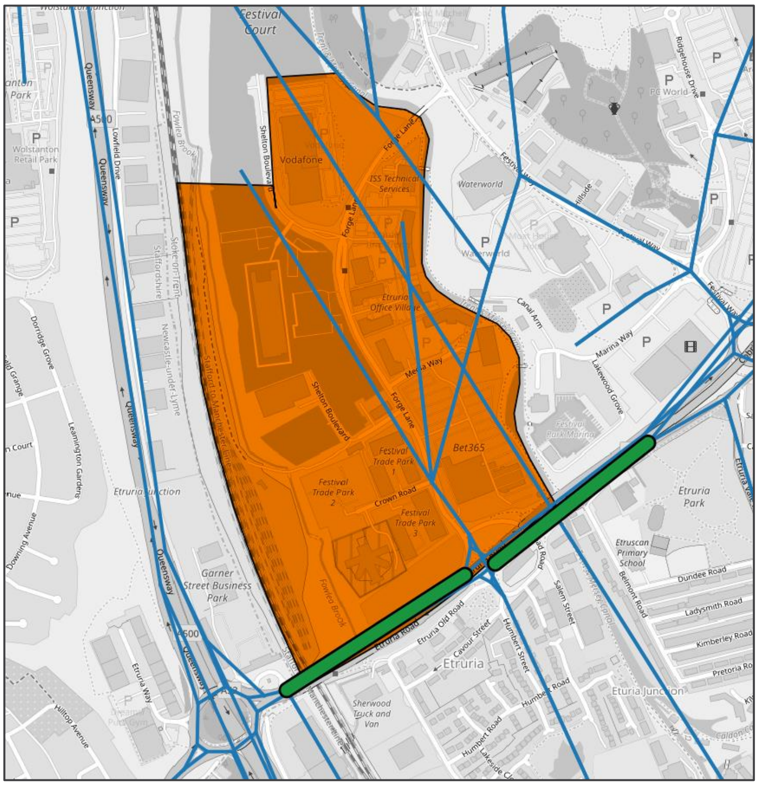


*Figure 3-4: Cordon sites in Hanley*

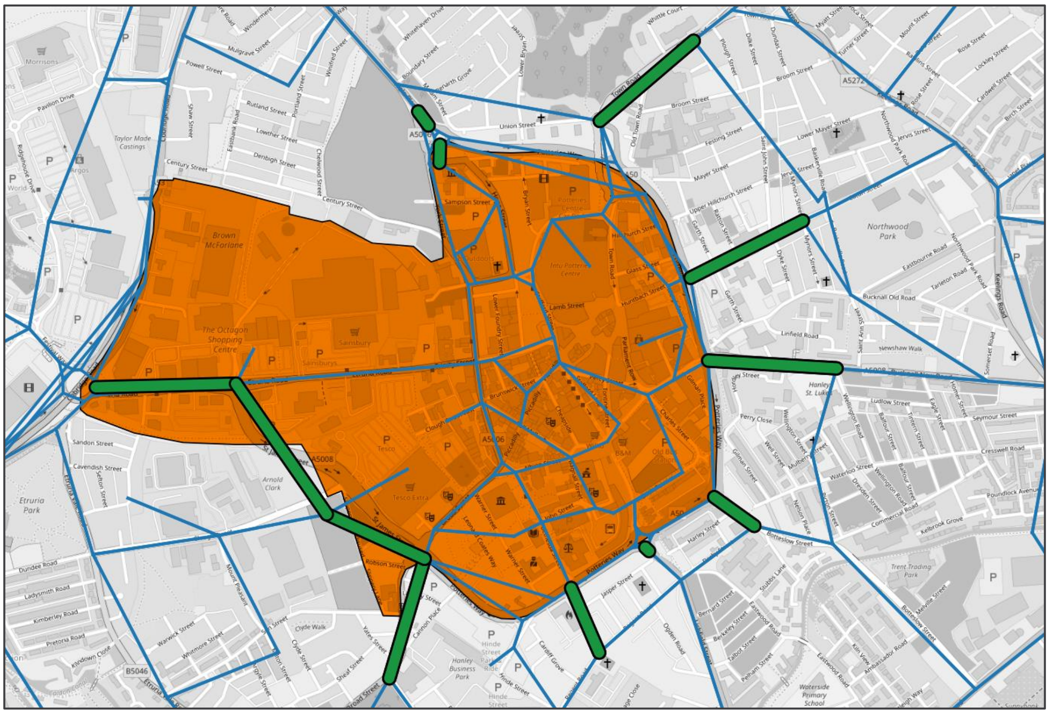



Figure 3-5 shows how the car demand matrices from each potential WPL site were derived to yield estimated amounts of employee-paid-WPL commuting journeys to the selected sites. Non-compliant Car Home-Based Work (HBW) journeys were extracted from all non-compliant car journeys by applying the proportion of HBW journeys for the relevant zones. These journeys for all three sites were collated and only the journeys terminating in each of the identified sites were considered for further analysis. These totals were further reduced to 16% based on the observation that in Nottingham, 42% of work-place parking spaces are liable to the levy whilst for 38% of liable spaces, employers pass the levy to their staff. Therefore for 16% of work-place parking spaces, the levy is paid by the employee.

The total number of incoming journeys potentially liable for a WPL per zone was calculated as a percentage of all incoming journeys.

*Figure 3-5: WPL Demand analysis steps*


## 3.2 Car parking capacity study

A count was made of public and private parking within each site. This was made using on-line parking information and analysis of aerial photographic data. “Public” carparks were defined as those where there is predominantly public access allowed for visitors and customers such as supermarket, pay-and-display and council car-parks. “Private” car-parks were defined as those associated with business where usage would have been likely to be liable under the Nottingham WPL regulations. Spaces obviously used for fleet and display vehicles were not counted (e.g. at police stations or car dealers). Where land was obviously used for car-parking though spaces were un-marked, an estimate was made based on the current usage from aerial photography. Extents of individual car-parks were estimated from observed boundary features such as walls and fences.

# 4 Results

## 4.1 Select-links analysis

Figure 4-1 shows incoming journeys liable for a potential WPL. This is expressed both as a percentage of total incoming car journeys and as absolute car journeys. The numbers are comparatively small and only make up a small proportion of all car journeys into the regions.

*Figure 4-1: Incoming journeys liable to WPL*

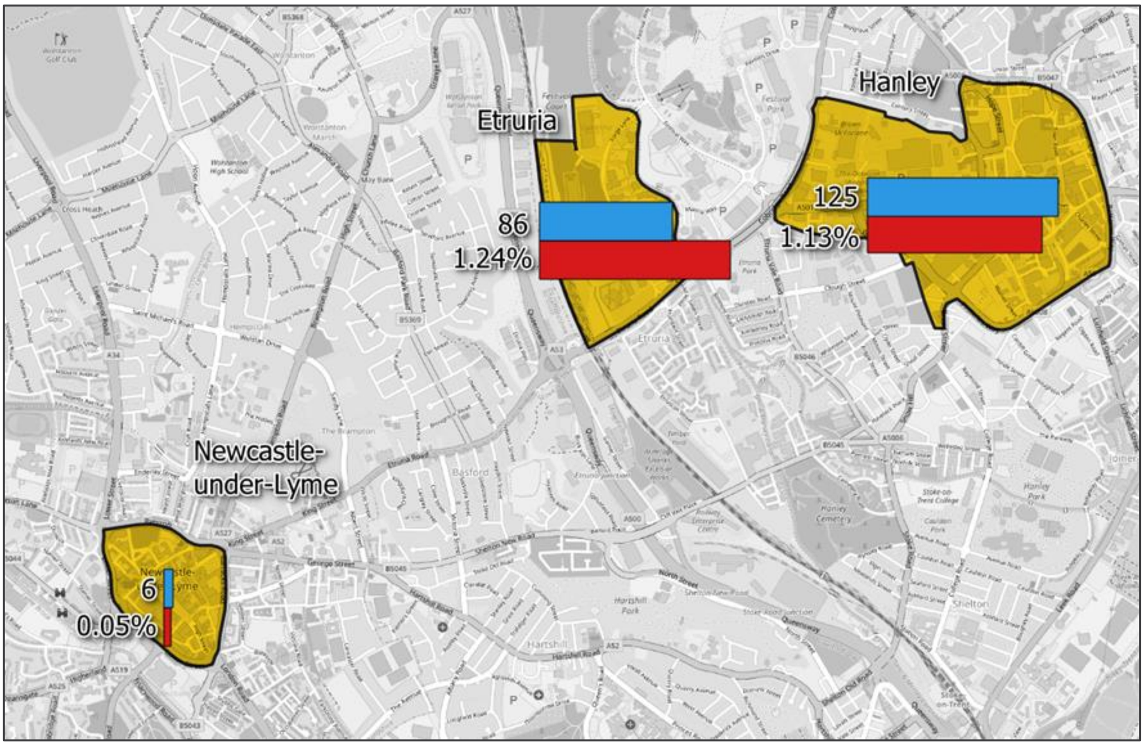
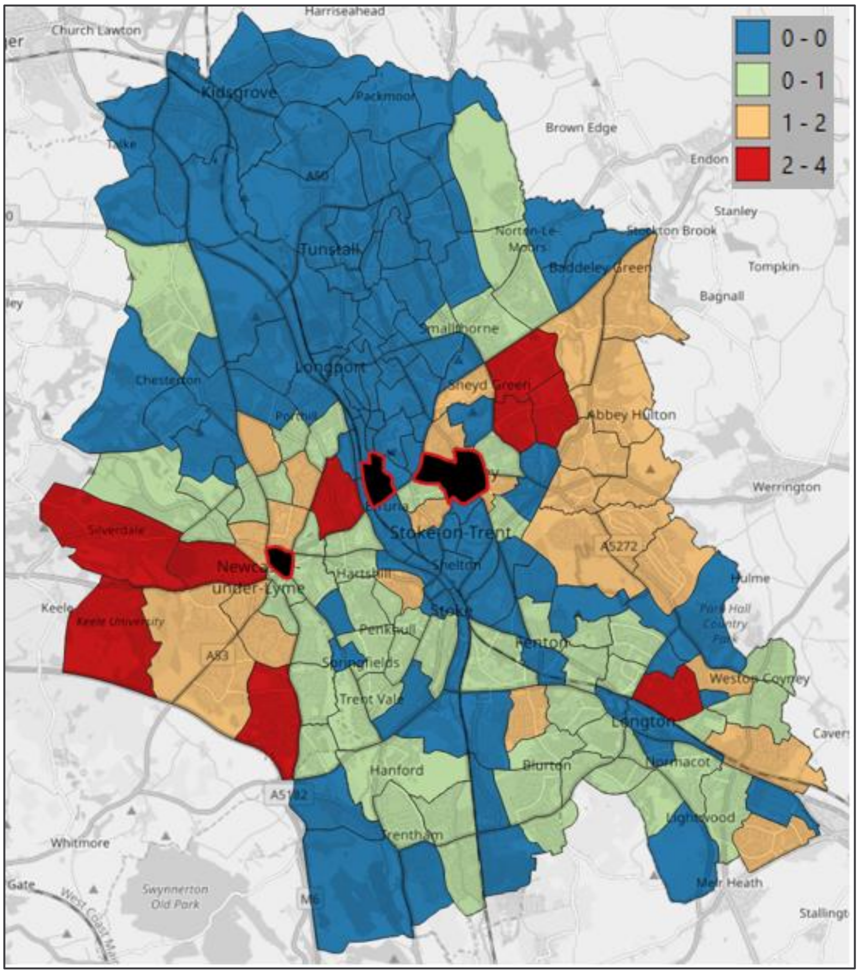



Figure 4-2 shows trips liable for a WPL per internal zone. Most journeys were generated from the areas of Keele, Silverdale, Westbury Park, Basford, Sneyd Green and Longton.

*Figure 4-2: Source of incoming journeys liable to WPL per zone*




## 4.2 Carparking capacity study

Table 4-1 shows the results of counting totals of public and private parking in Newcastle-under-Lyme, Etruria and Hanley. It can be clearly seen that there are very different patterns of parking availability across the three sites. Newcastle-under-Lyme and Hanley have a predominance of public parking whilst Etruria is exclusively private parking. The table shows an estimate for the potential number of spaces liable for a potential WPL.

Table 4-1: Results of carpark capacity study

| | Newcastle-under-Lyme | Etruria | Hanley | Totals |
|---|---|---|---|---|
| Private Spaces | 342 | 2958 | 1057 | 4357 |
| Private Sites with >10 Spaces | 12 | 23 | 34 | 34 |
| Potential WPL Spaces | 60 | 976 | 281 | 1317 |
| Capacity reduction Following WPL | 45 | 732 | 211 | 988 |
| 16% Spaces Paid by employee | 7 | 117 | 34 | 158 |

The locations of these car parks are identified for Newcastle-under-Lyme, Hanley and Etruria in Figure 4-3, Figure 4-4 and Figure 4-5 respectively.

*Figure 4-3: Potential WPL liable car parks in Newcastle-under-Lyme*

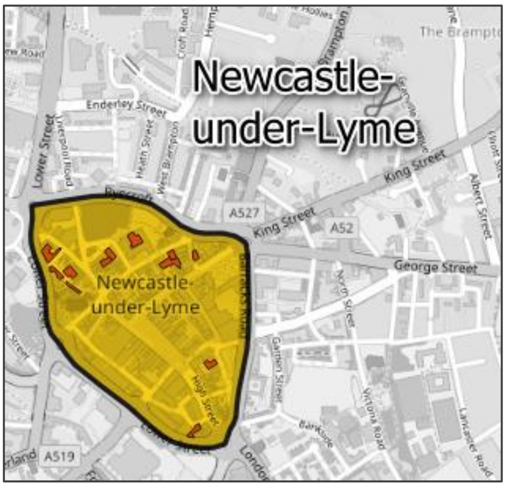


*Figure 4-4: Potential WPL liable car-parks in Hanley*

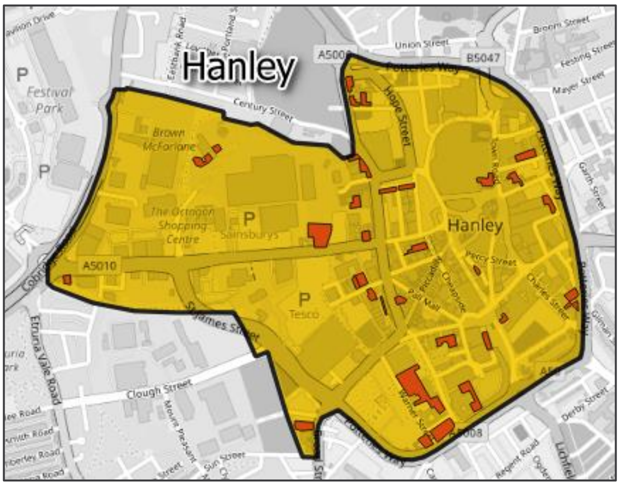
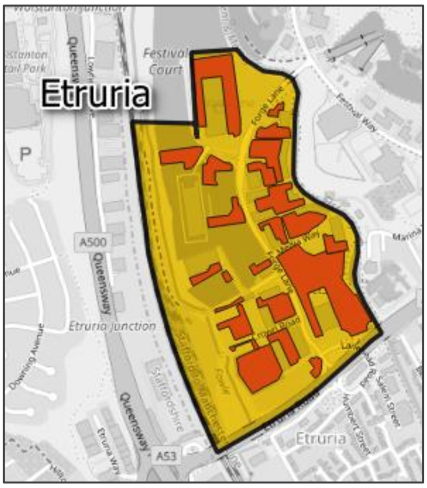



*Figure 4-5: Potential WPL liable car-parks in Etruria*




Not all these spaces may be utilised, and Nottingham saw a 25% reduction in available work-place parking following the introduction of the WPL.

If a reduction of 25% in capacity is assumed, along with a 16% level of employee payment, 158 spaces may be liable to a potential WPL and paid for by the employee.

To produce this estimate, several assumptions were made. These include,

- A potential WPL would be constructed along similar lines to the Nottingham model (charge per organisation on spaces used, exemptions for some user classes and small carparks < 10 spaces)
- Only private spaces would be liable for a WPL (some public spaces may also be liable if leased to a private company)
- Individual private car-parks are used exclusively by a single organisation (where these may be shared, the number of spaces per organisation may fall below where a potential WPL is required to be paid)
- All private car parks are used to capacity (If a car park is knowingly not used to capacity, an organisation may choose to acquire permission for fewer vehicles than they have spaces available)

## 5 Conclusion

This study has specifically investigated a potential WPL in North Staffordshire where the aim is to encourage a shift from non-compliant vehicles. This is different to the purpose of the Nottingham WPL which was to reduce congestion and promote a mode shift to public transport through additional investment. The other key difference is the difference in extents with the Nottingham WPL extending to the entire administrative area whilst the WPL proposed here only extents to key areas of work-place parking.

Both the results from the select-link analysis and car park study show independently that only a small percentage of AM peak car journeys would be impacted by a potential WPL where the cost is passed to the employee. Whilst Nottingham saw notable mode shift to public transport since the introduction of the WPL, this is linked to large investments in public transport infrastructure that was part-financed from the extensive WPL. The size of the WPL proposed here would be unlikely to fund similar improvements. It's therefore doubtful that such a measure would offer substantial reductions in $NO_2$ emissions through the reduction in non-compliant vehicle journeys.

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

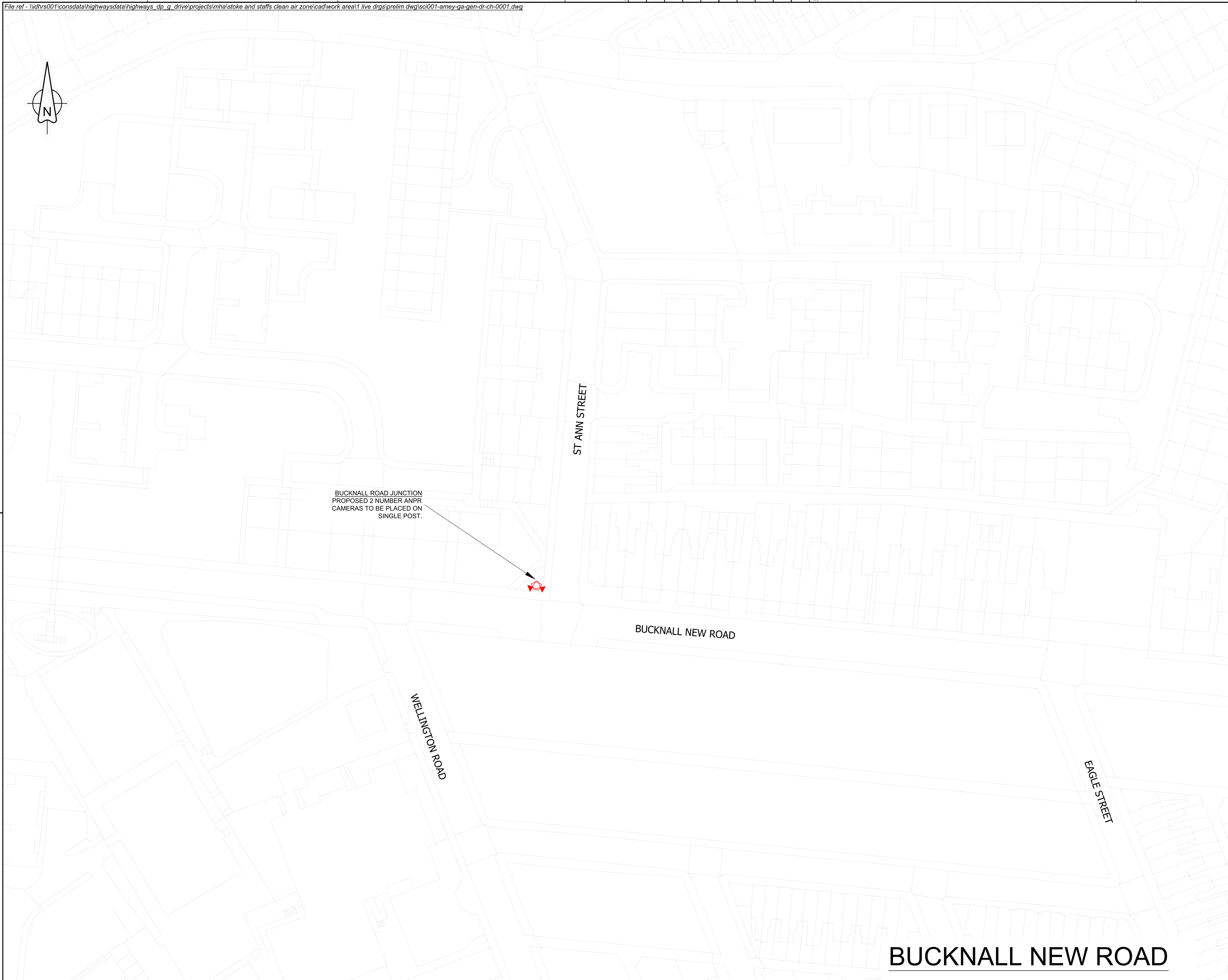
## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 3a - Indicative Design Drawings

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-ga-gen-dr-ch-0001.dwg






# NOTES

1. ANPR CAMERAS TO MONITOR BUS RETROFIT.

## KEY:

ANPR CAMERA

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Designed: | UH | Date: | 05.03.20 |
| Drawn: | UH | Date: | 05.03.20 |
| Checked: | HH | Date: | 13.03.20 |
| Approved: | OG | Date: | 13.03.20 |



ameyconsulting

www.amey.co.uk

Client

Staffordshire County Council

Project Name

NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title

BUCKNALL NEW ROAD ANPR CAMERA FOR BUS RETROFIT

Original Drawing Size : A1 Scale : 1:500

Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL

Suitability: S4

Drawing No: SCI001-AMEY-GA-GEN-DR-CH-0001

Rev: P01

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

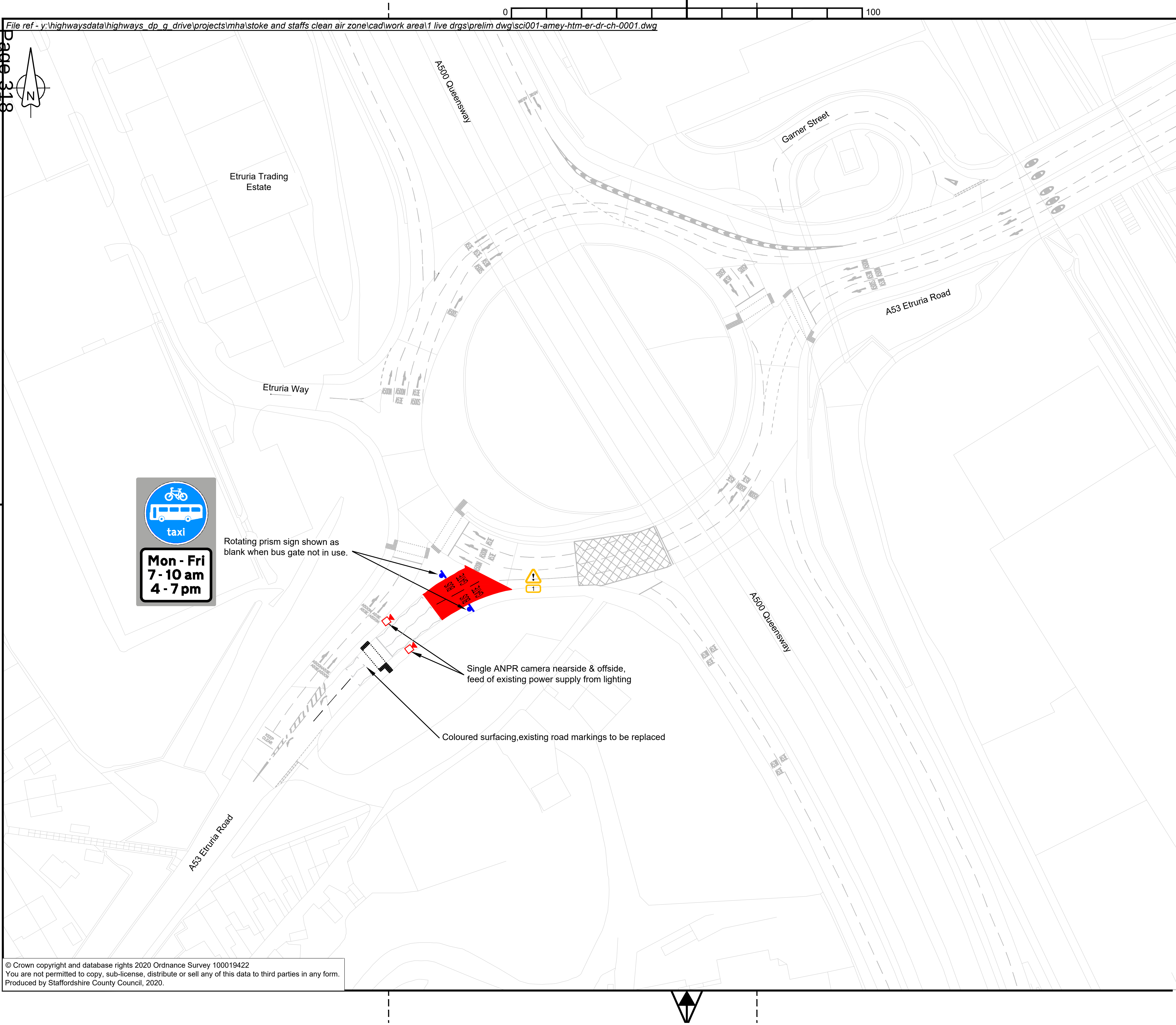
## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 3b - Indicative Design Drawings

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

*File ref - y:\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-htm-er-dr-ch-0001.dwg*






**RESIDUAL DESIGN HAZARDS**

*(The following information has been collected from Preconstruction Information and the Amey CDM Hazard Management Process.)*

1. Western Power Distribution 11kV Underground Cable running across A53 Etruria Road.

## NOTES

1. Road markings and traffic signs to be in accordance with TSRGD 2016 and chapter 5 of the Traffic Signs Manual.
2. Existing road markings for the circulatory approaches and exits to be renewed. Lane designation will be indicated by arrows with destinations to be removed. Lane designation to remain as existing.
3. For details of advanced signing, please refer to drawings please refer to: SCI001-AMEY-HSN-ER-DR-CH-001 to 007.

## Key:

**Bus Gate Surface Course**
Bus Gate surface course to be RED coloured asphalt. Ulticolour 6mm Thin Surfacing System, or similar approved product.
Shade to be agreed with Staffordshire County Council prior to application.

Proposed Bus Gate Signs with Supplementary Plate

Proposed ANPR Cameras

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | |
|---|---|
| Designed: UH | Date: 13.03.20 |
| Drawn: UH | Date: 13.03.20 |
| Checked: HH | Date: 13.03.20 |
| Approved: OG | Date: 13.03.20 |



ameyconsulting
www.amey.co.uk

Client
Staffordshire County Council

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

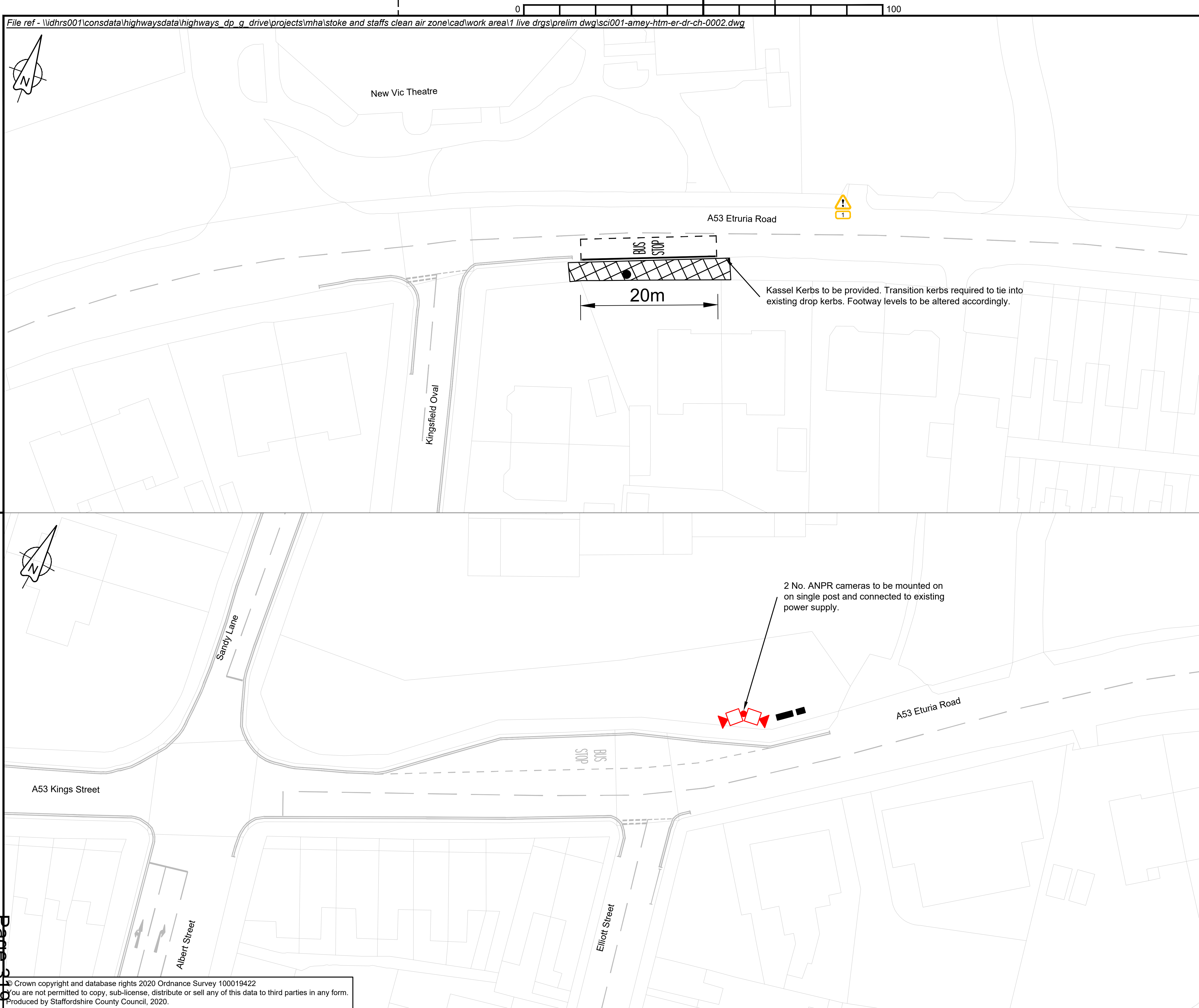
Drawing Title
A53 ETRURIA ROAD BUS GATE

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
|---|---|
| SCI001-AMEY-HTM-ER-DR-CH-0001 | P01 |

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-htm-er-dr-ch-0002.dwg






RESIDUAL DESIGN HAZARDS

*(The following information has been collected from Preconstruction Information and the Amey CDM Hazard Management Process.)*

1. Western Power Distribution 11kV Underground Cable running across A53 Etruria Road.

## NOTES

1. Road markings to be in accordance with TSRGD 2016 and chapter 5 of the Traffic Signs Manual.
2. Existing road markings to be renewed where required.
3. Existing bus stop located outside 553 Etruria Road to be removed.

**Key:**

- Proposed ANPR Cameras
- Existing electrical cabinets
- Real Time Passenger Information Board
- Area to be surfaced with 50-150mm Type 1, 50mnm AC/20 Binder and 25mm AC/6 surface course.

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | |
|---|---|
| Designed: UH | Date: 06.03.20 |
| Drawn: UH | Date: 06.03.20 |
| Checked: HH | Date: 13.03.20 |
| Approved: OG | Date: 13.03.20 |



ameyconsulting

www.amey.co.uk

Staffordshire County Council

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title
A53 ETURIA ROAD / KINGSFIELD OVAL JUNCTION

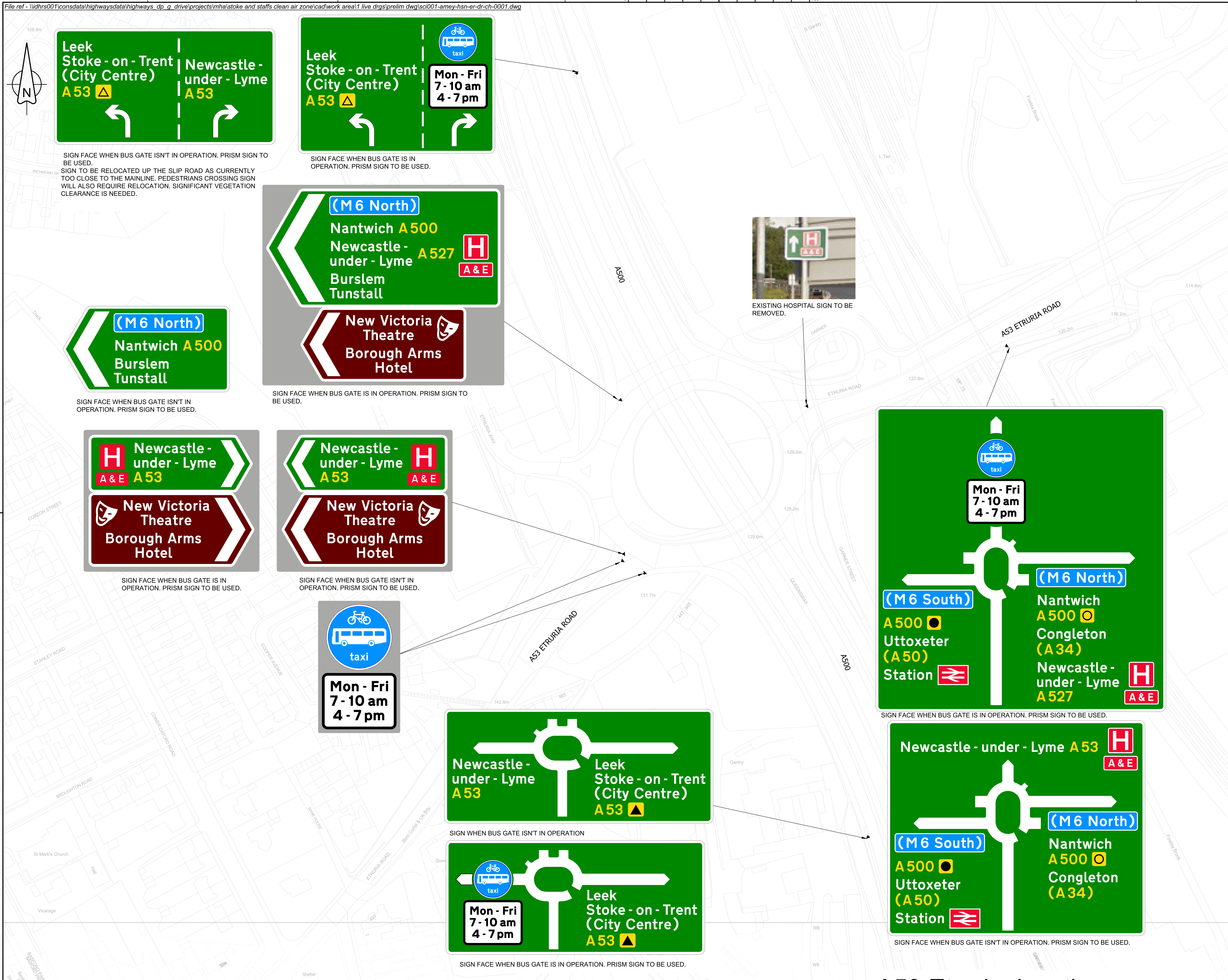
PROPOSED WEST BOUND BUS STOP RELOCATION

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:500 |
| Dimensions : - | |

| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
|---|---|
| SCI001-AMEY-HTM-ER-DR-CH-0002 | P01 |

File ref - \\ldhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-hsn-er-dr-ch-0001.dwg






# A53 Etruria Junction

## NOTES

1. ALL SIGNS SHALL BE IN ACCORDANCE WITH TSRGD 2016 UNLESS AUTHORISED BY DfT.
2. WHERE SIGN FACES ARE TO CHANGE. WHEN THE BUS GATE IS IN OPERATION THEY SHALL CHANGE 15 MINUTES BEFORE AND AFTER THE PERIODS OF OPERATIONS.
3. ROTATING PRISM SIGNS SHALL BE USED FOR SIGNS THAT CHANGE DURING THE HOURS OF OPERATION.

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Designed: | UH | Date: | 05.03.20 |
| Drawn: | UH | Date: | 05.03.20 |
| Checked: | HH | Date: | 13.03.20 |
| Approved: | OG | Date: | 13.03.20 |



amey consulting
www.amey.co.uk

Client
Staffordshire County Council
Newcastle under Lyme
City of Stoke-on-Trent

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title
A53 ETRURIA ROAD BUS GATE SIGNING
SHEET 1 of 7

Original Drawing Size : A1 | Scale : 1:1000
Dimensions : -

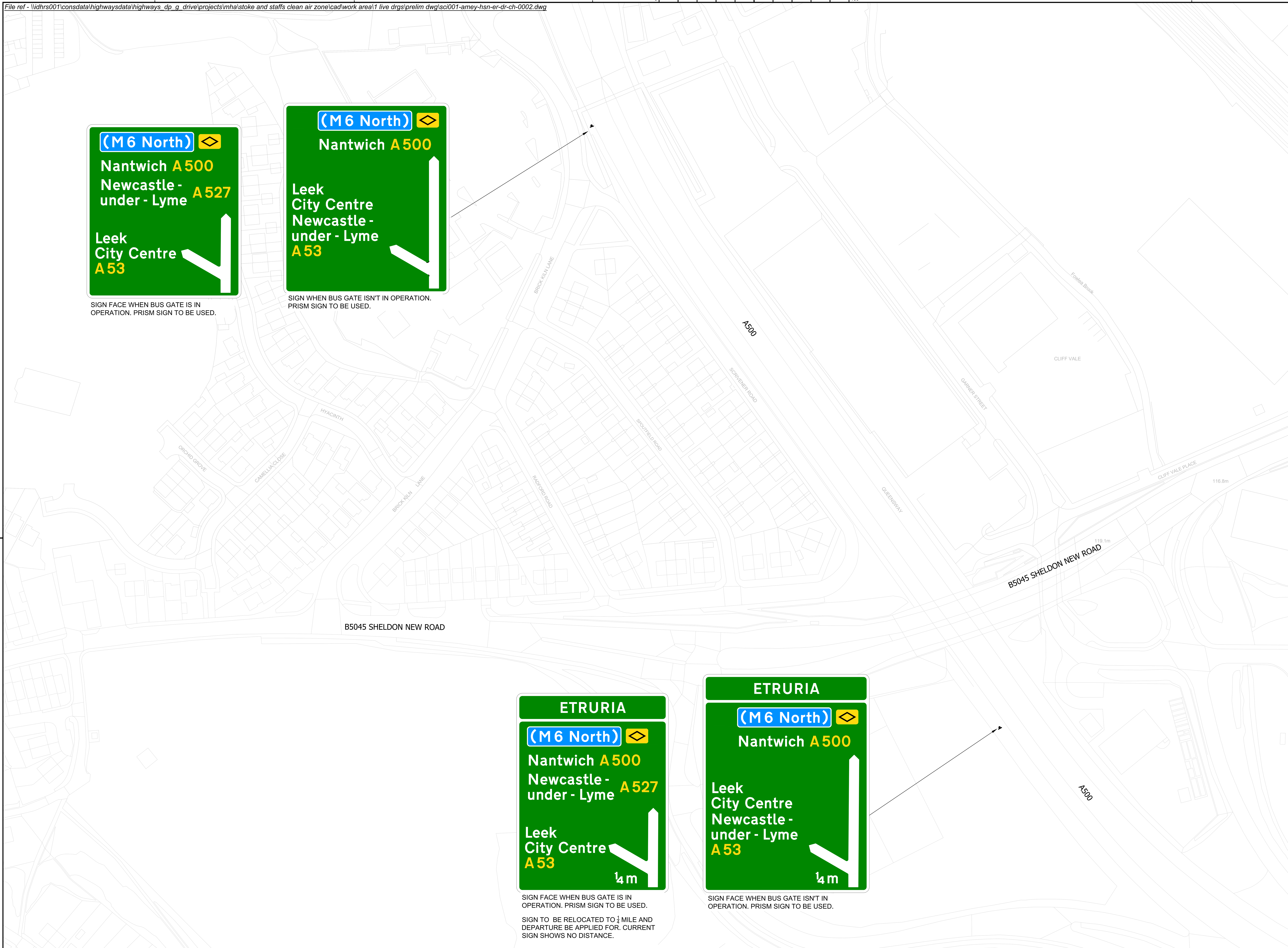
Drawing Status
SUITABLE FOR STAGE APPROVAL

Suitability
S4

Drawing No
SCI001-AMEY-HSN-ER-DR-CH-0001

Rev
P01

File ref - \\dhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-hsn-er-dr-ch-0002.dwg




# A53 Etruria Junction - A500 Northbound Approach



## NOTES

1. ALL SIGNS SHALL BE IN ACCORDANCE WITH TSRGD 2016 UNLESS AUTHORISED BY DfT.
2. WHERE SIGN FACES ARE TO CHANGE. WHEN THE BUS GATE IS IN OPERATION THEY SHALL CHANGE 15 MINUTES BEFORE AND AFTER THE PERIODS OF OPERATION.
3. ROTATING PRISM SIGNS SHALL BE USED FOR SIGNS THAT CHANGE DURING THE HOURS OF OPERATION.

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Designed: | UH | Date: | 05.03.20 |
| Drawn: | UH | Date: | 05.03.20 |
| Checked: | HH | Date: | 13.03.20 |
| Approved: | OG | Date: | 13.03.20 |



ameyconsulting

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Client

Staffordshire County Council

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

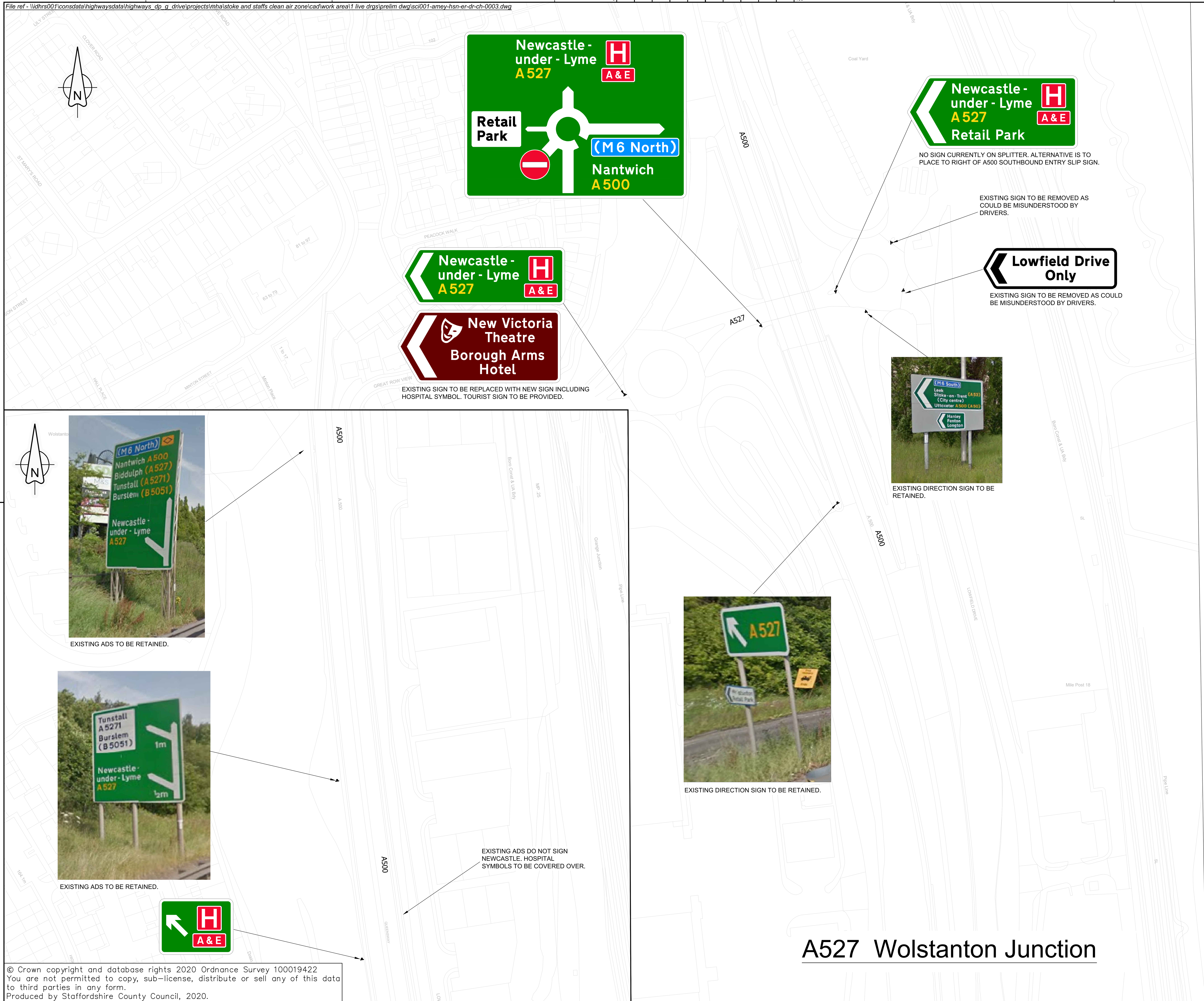
Drawing Title
A53 ETRURIA ROAD BUS GATE SIGNING
SHEET 2 of 7

Original Drawing Size : A1 Scale : 1:1000
Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL
Suitability: S4

Drawing No: SCI001-AMEY-HSN-ER-DR-CH-0002
Rev: P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-hsn-er-dr-ch-0003.dwg






# A527 Wolstanton Junction

## NOTES

1. ALL SIGNS SHALL BE IN ACCORDANCE WITH TSRGD 2016 UNLESS AUTHORISED BY DFT.
2. DESIGN BASED UPON EXISTING SITUATION. WOLSTANTON JUNCTION WILL BE IMPACTED BY THE ETRURIA VALLEY LINK ROAD. THE IMPACT WILL BE ASSESSED AND DESIGN AMENDED AS REQUIRED DURING DETAILED DESIGN. A RISK ALLOWANCE HAS BEEN MADE FOR THIS.
3. WHERE SIGN FACES ARE TO CHANGE. WHEN THE BUS GATE IS IN OPERATION THEY SHALL CHANGE 15 MINUTES BEFORE AND AFTER THE PERIODS OF OPERATIONS.
4. ROTATING PRISM SIGNS SHALL BE USED FOR SIGNS THAT CHANGE DURING THE HOURS OF OPERATION.

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Designed: | UH | Date: | 05.03.20 |
| Drawn: | UH | Date: | 05.03.20 |
| Checked: | HH | Date: | 13.03.20 |
| Approved: | OG | Date: | 13.03.20 |



ameyconsulting
www.amey.co.uk

Client
Staffordshire County Council
Newcastle under Lyme Borough Council
City of Stoke-on-Trent

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

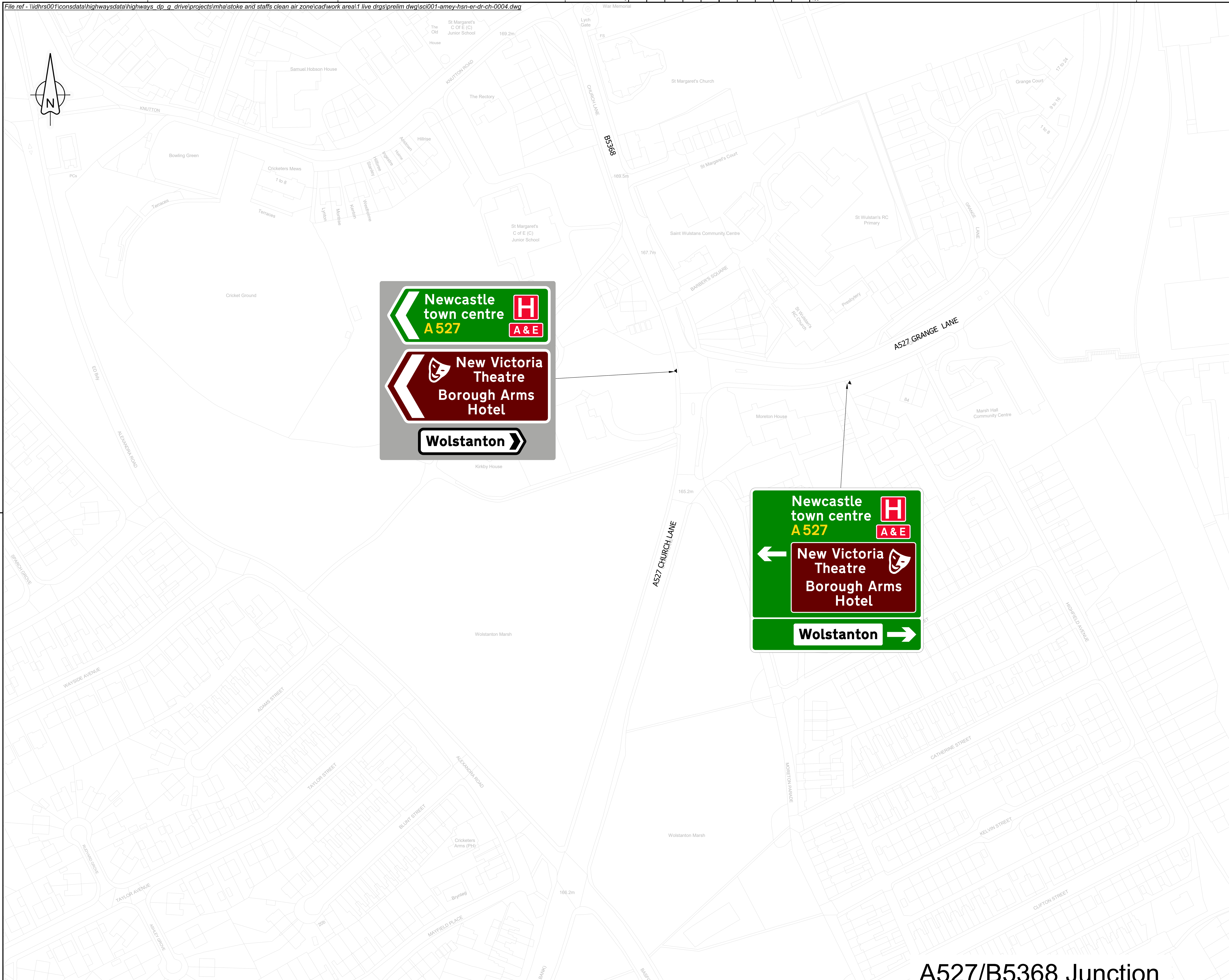
Drawing Title
A53 ETRURIA ROAD BUS GATE SIGNING
SHEET 3 of 7

Original Drawing Size : A1 | Scale : 1:1000
Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL | Suitability: S4

Drawing No: SCI001-AMEY-HSN-ER-DR-CH-0003 | Rev: P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-hsn-er-dr-ch-0004.dwg






## NOTES

1. ALL SIGNS SHALL BE IN ACCORDANCE WITH TSRGD 2016 UNLESS AUTHORISED BY DfT.
2. WHERE SIGN FACES ARE TO CHANGE. WHEN THE BUS GATE IS IN OPERATION THEY SHALL CHANGE 15 MINUTES BEFORE AND AFTER THE PERIODS OF OPERATIONS.
3. ROTATING PRISM SIGNS SHALL BE USED FOR SIGNS THAT CHANGE DURING THE HOURS OF OPERATION.

| Rev | Revision details | Drwn | Chkd | Appd | Date |
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| Designed: | UH | Date: | 05.03.20 |
| Drawn: | UH | Date: | 05.03.20 |
| Checked: | HH | Date: | 13.03.20 |
| Approved: | OG | Date: | 13.03.20 |



ameyconsulting

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Client

Staffordshire County Council

Newcastle under Lyme Borough Council

City of Stoke-on-Trent

Project Name

NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title

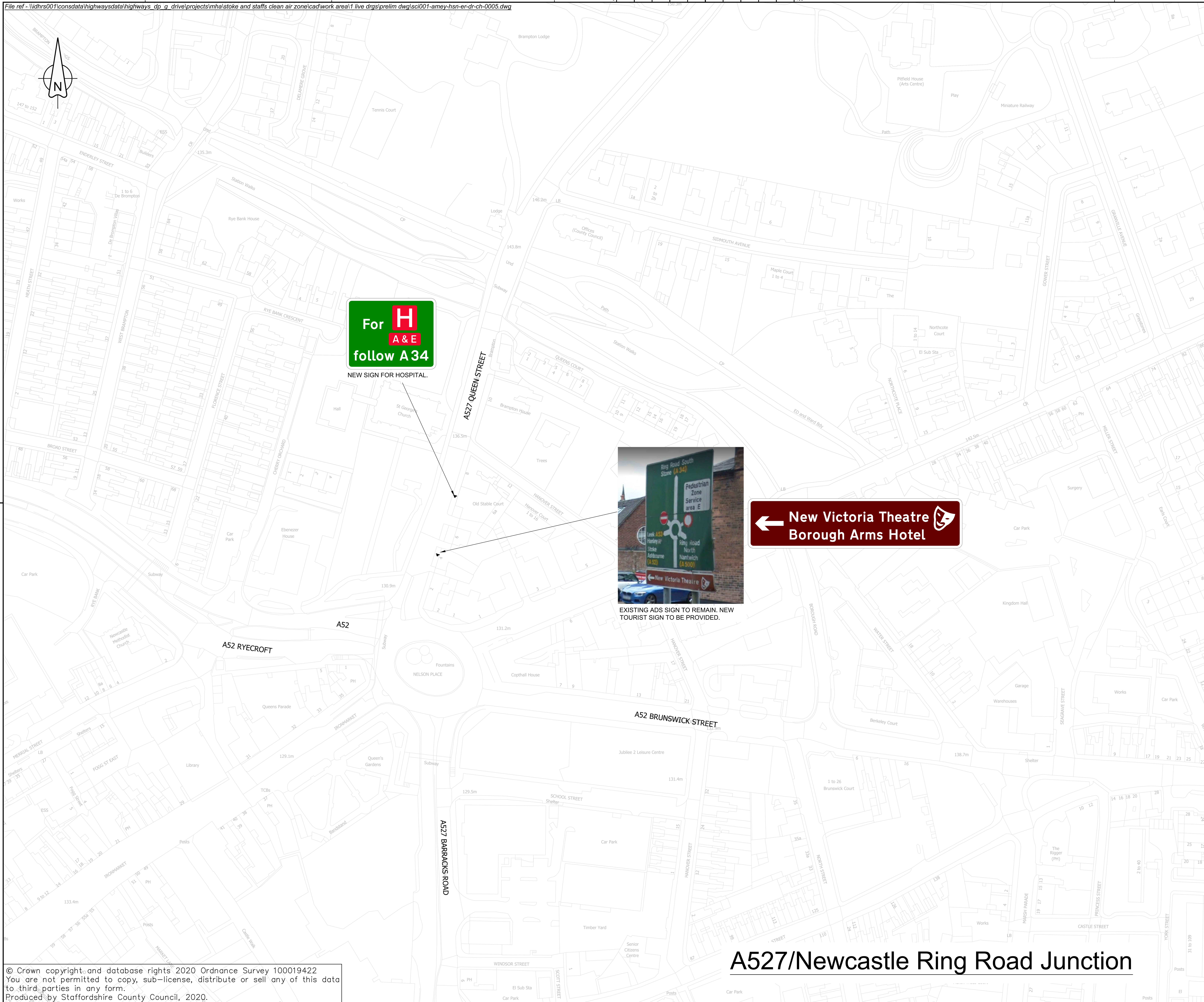
A53 ETRURIA ROAD BUS GATE SIGNING
SHEET 4 of 7

Original Drawing Size : A1 — Scale : 1:1000
Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL — Suitability: S4

Drawing No: SCI001-AMEY-HSN-ER-DR-CH-0004 — Rev: P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-hsn-er-dr-ch-0005.dwg






## NOTES

1. ALL SIGNS SHALL BE IN ACCORDANCE WITH TSRGD 2016 UNLESS AUTHORISED BY DfT.
2. WHERE SIGN FACES ARE TO CHANGE. WHEN THE BUS GATE IS IN OPERATION THEY SHALL CHANGE 15 MINUTES BEFORE AND AFTER THE PERIODS OF OPERATIONS.
3. ROTATING PRISM SIGNS SHALL BE USED FOR SIGNS THAT CHANGE DURING THE HOURS OF OPERATION.

| Rev | Revision details | Drwn | Chkd | Appd | Date |
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| Designed: | UH | Date: | 05.03.20 |
| Drawn: | UH | Date: | 05.03.20 |
| Checked: | HH | Date: | 13.03.20 |
| Approved: | OG | Date: | 13.03.20 |



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Client

Staffordshire County Council

NEWCASTLE UNDER LYME

City of Stoke-on-Trent

Project Name

NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title

A53 ETRURIA ROAD BUS GATE SIGNING
SHEET 5 of 7

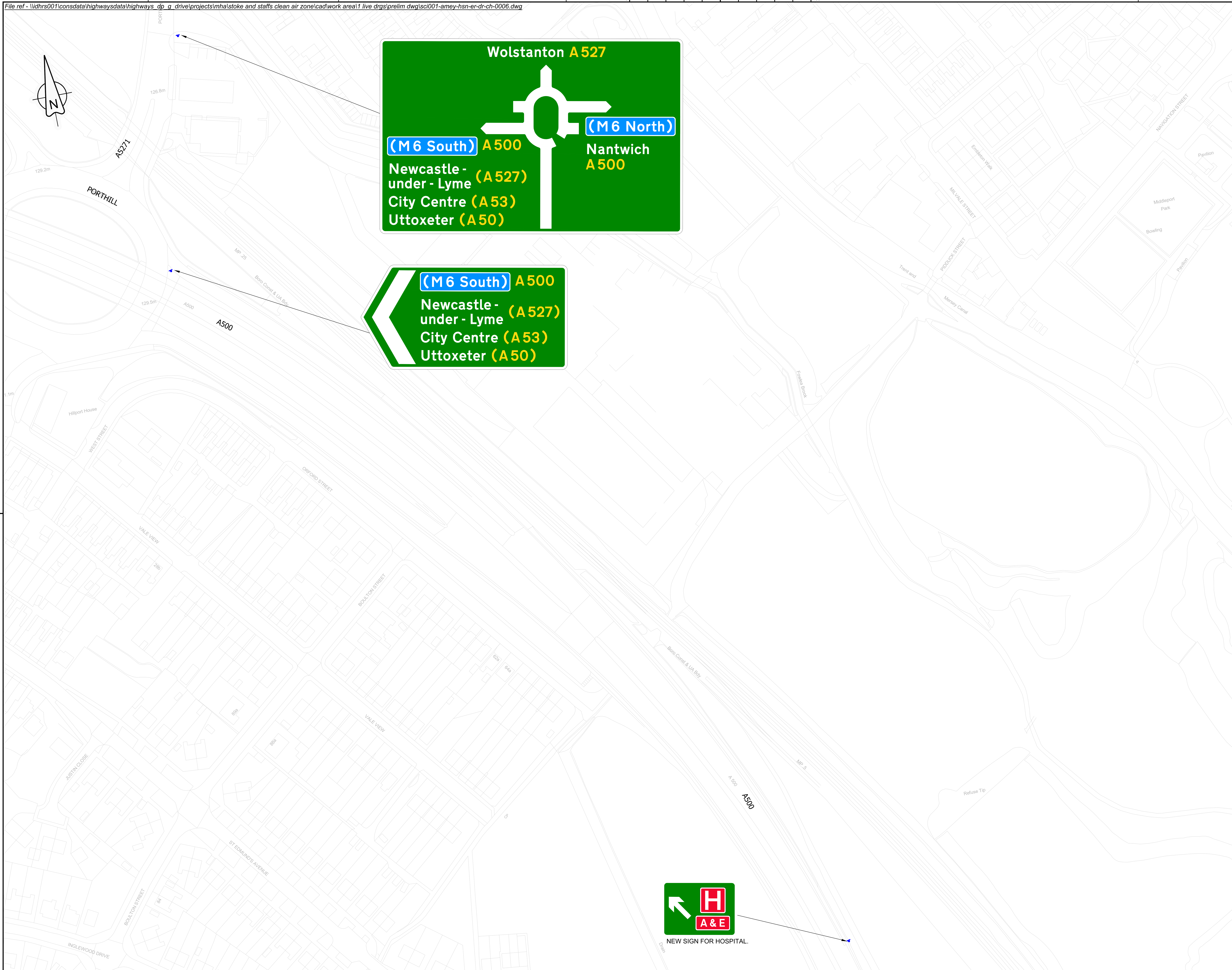
Original Drawing Size : A1 | Scale : 1:1000

Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL | Suitability: S4

Drawing No: SCI001-AMEY-HSN-ER-DR-CH-0005 | Rev: P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-hsn-er-dr-ch-0006.dwg




# PORTHILL JUNCTION



## NOTES

1. ALL SIGNS SHALL BE IN ACCORDANCE WITH TSRGD 2016 UNLESS AUTHORISED BY DfT.
2. WHERE SIGN FACES ARE TO CHANGE. WHEN THE BUS GATE IS IN OPERATION THEY SHALL CHANGE 15 MINUTES BEFORE AND AFTER THE PERIODS OF OPERATIONS.
3. ROTATING PRISM SIGNS SHALL BE USED FOR SIGNS THAT CHANGE DURING THE HOURS OF OPERATION.

| Rev | Revision details | Drwn | Chkd | Appd | Date |
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| Designed: | HH | Date: | 05.03.20 |
| Drawn: | UH | Date: | 05.03.20 |
| Checked: | HH | Date: | 13.03.20 |
| Approved: | OG | Date: | 13.03.20 |



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Client
Staffordshire County Council
Newcastle under Lyme
City of Stoke-on-Trent

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title
A53 ETRURIA ROAD BUS GATE SIGNING
SHEET 6 of 7

Original Drawing Size : A1 | Scale : 1:1000
Dimensions : -

Drawing Status
SUITABLE FOR STAGE APPROVAL

Suitability
S4

Drawing No
SCI001-AMEY-HSN-ER-DR-CH-0006

Rev
P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-hsn-er-dr-ch-0007.dwg




## NOTES

1. ALL SIGNS SHALL BE IN ACCORDANCE WITH TSRGD 2016 UNLESS AUTHORISED BY DFT.
2. DESIGN BASED UPON EXISTING SITUATION. WOLSTANTON JUNCTION WILL BE IMPACTED BY THE ETRURIA VALLEY LINK ROAD. THE IMPACT WILL BE ASSESSED AND DESIGN AMENDED AS REQUIRED DURING DETAILED DESIGN. A RISK ALLOWANCE HAS BEEN MADE FOR THIS.

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

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|---|---|---|---|
| Designed: | UH | Date: | 05.03.20 |
| Drawn: | UH | Date: | 05.03.20 |
| Checked: | HH | Date: | 13.03.20 |
| Approved: | OG | Date: | 13.03.20 |



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Client

Staffordshire County Council

Newcastle under Lyme

City of Stoke-on-Trent

Project Name

NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title

A53 ETRURIA ROAD BUS GATE SIGNING SHEET 7 of 7

Original Drawing Size : A1 Scale : 1:1000

Dimensions : -

Drawing Status

SUITABLE FOR STAGE APPROVAL

Suitability

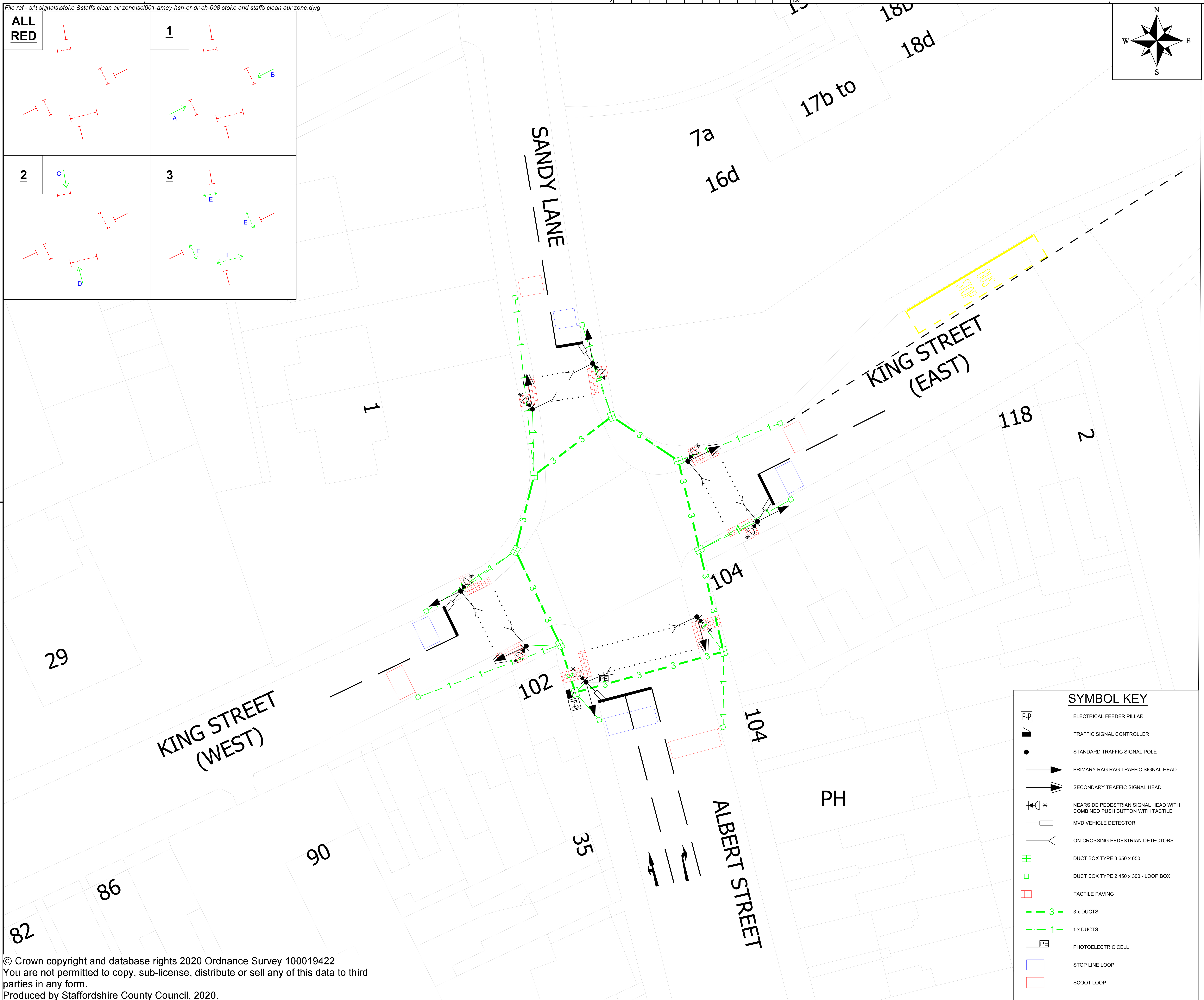
S4

Drawing No

SCI001-AMEY-HSN-SW-DR-CH-0007

Rev

P01






| Rev | Revision details | Drwn | Chkd | Appd | Date |
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|---|---|---|---|
| Designed: | AY | Date: | FEB 2020 |
| Drawn: | AY | Date: | FEB 2020 |
| Checked: | . | Date: | . |
| Approved: | . | Date: | . |



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www.amey.co.uk

Client
Staffordshire County Council
NEWCASTLE UNDER LYME
City of Stoke-on-Trent

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title
PRELIMINARY TRAFFIC SIGNAL DESIGN

Original Drawing Size : A1 | Scale : 1:200 @ A1
Dimensions : m

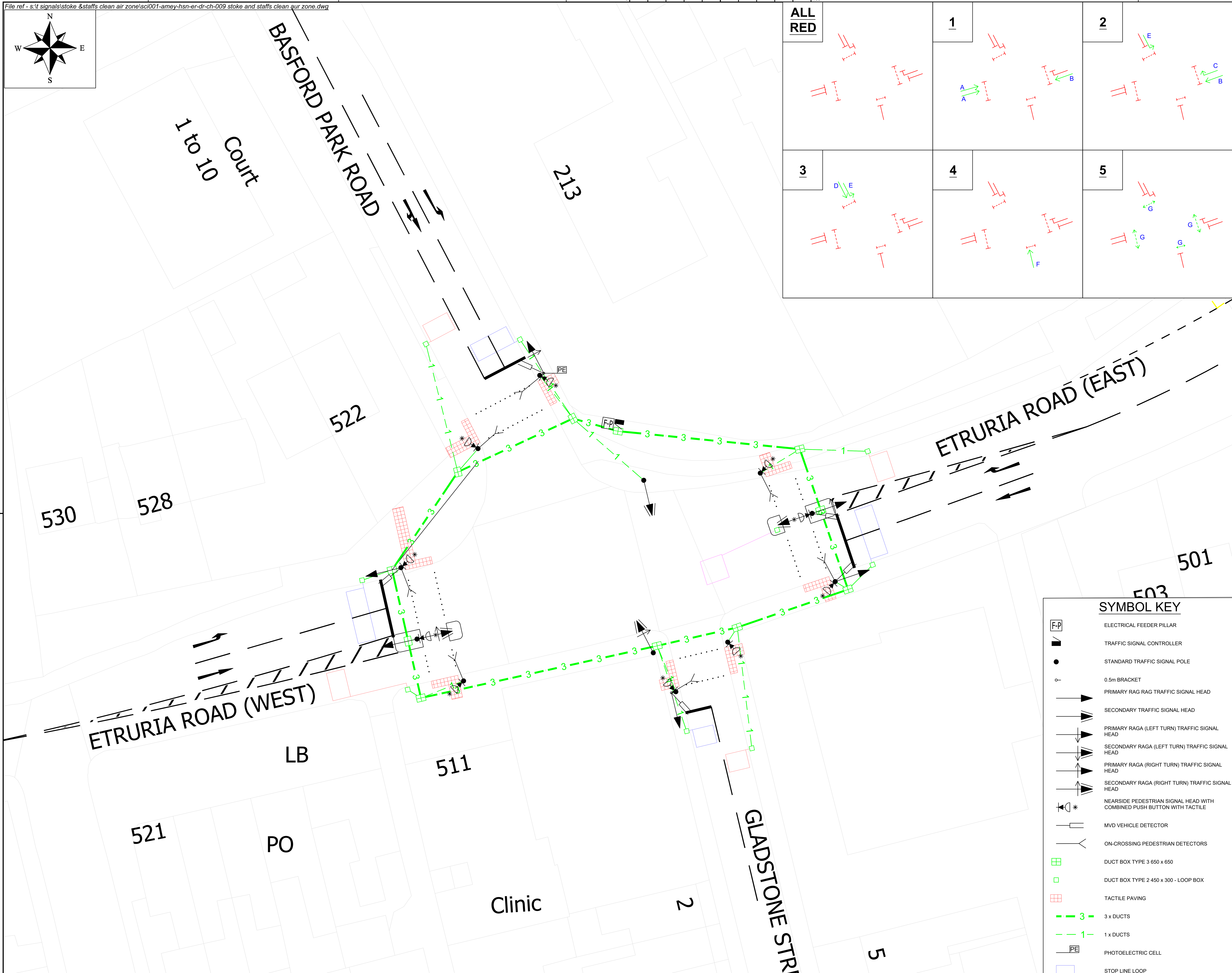
Drawing Status
SUITABLE FOR STAGE APPROVAL

Suitability
S4

Drawing No
SCI001-AMEY-HSN-ER-DR-CH-008

Rev
P01

File ref - s:\t signals\stoke &staffs clean air zone\sci001-amey-hsn-er-dr-ch-009 stoke and staffs clean aur zone.dwg




## SYMBOL KEY

| | |
|---|---|
| F-P | ELECTRICAL FEEDER PILLAR |
| | TRAFFIC SIGNAL CONTROLLER |
| | STANDARD TRAFFIC SIGNAL POLE |
| | 0.5m BRACKET |
| | PRIMARY RAG RAG TRAFFIC SIGNAL HEAD |
| | SECONDARY TRAFFIC SIGNAL HEAD |
| | PRIMARY RAGA (LEFT TURN) TRAFFIC SIGNAL HEAD |
| | SECONDARY RAGA (LEFT TURN) TRAFFIC SIGNAL HEAD |
| | PRIMARY RAGA (RIGHT TURN) TRAFFIC SIGNAL HEAD |
| | SECONDARY RAGA (RIGHT TURN) TRAFFIC SIGNAL HEAD |
| | NEARSIDE PEDESTRIAN SIGNAL HEAD WITH COMBINED PUSH BUTTON WITH TACTILE |
| | MVD VEHICLE DETECTOR |
| | ON-CROSSING PEDESTRIAN DETECTORS |
| | DUCT BOX TYPE 3 650 x 650 |
| | DUCT BOX TYPE 2 450 x 300 - LOOP BOX |
| | TACTILE PAVING |
| 3 | 3 x DUCTS |
| 1 | 1 x DUCTS |
| PE | PHOTOELECTRIC CELL |
| | STOP LINE LOOP |
| | SCOOT LOOP |
| | CALL CANCEL LOOP |



| Rev | Revision details | Drwn | Chkd | Appd | Date |
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|---|---|---|---|
| Designed: | AY | Date: | FEB 2020 |
| Drawn: | AY | Date: | FEB 2020 |
| Checked: | . | Date: | . |
| Approved: | . | Date: | . |



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Client
Staffordshire County Council
NEWCASTLE UNDER LYME BOROUGH COUNCIL
City of Stoke-on-Trent

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title
PRELIMINARY TRAFFIC SIGNAL DESIGN

Original Drawing Size : A1 | Scale : 1:200 @ A1
Dimensions : m

Drawing Status: SUITABLE FOR STAGE APPROVAL | Suitability: S4

Drawing No: SCI001-AMEY-HSN-ER-DR-CH-009 | Rev: P01

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 3c - Indicative Design Drawings

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\victoria road bus gate options sheet 1 of 2.dwg




Key:

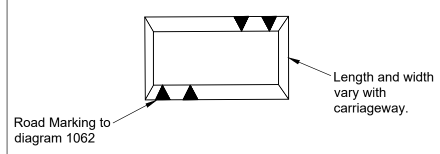
Area East of Victoria Road to be resurfaced. For pricing purposes it has been assumed the whole area will require 50mm surface course with 25% also requiring a binder course with a 100mm total depth.

Existing road humps to be removed and replaced as per Staffordshire County Council standard detail 07.02.

Proposed road humps to be built to Staffordshire County Council standard detail 07.02.

Bus Gate

Direction of one way street



Typical Road Hump Detail

Notes:

For details of advanced signing, please refer to drawings SCI001-AMEY-HSN-VR-DR-CH-0001-0006

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

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|---|---|---|---|
| Designed: | UH | Date: | 13.03.20 |
| Drawn: | UH | Date: | 13.03.20 |
| Checked: | HH | Date: | 13.03.20 |
| Approved: | CB | Date: | 13.03.20 |



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Client
Staffordshire County Council
Newcastle under Lyme
City of Stoke-on-Trent

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

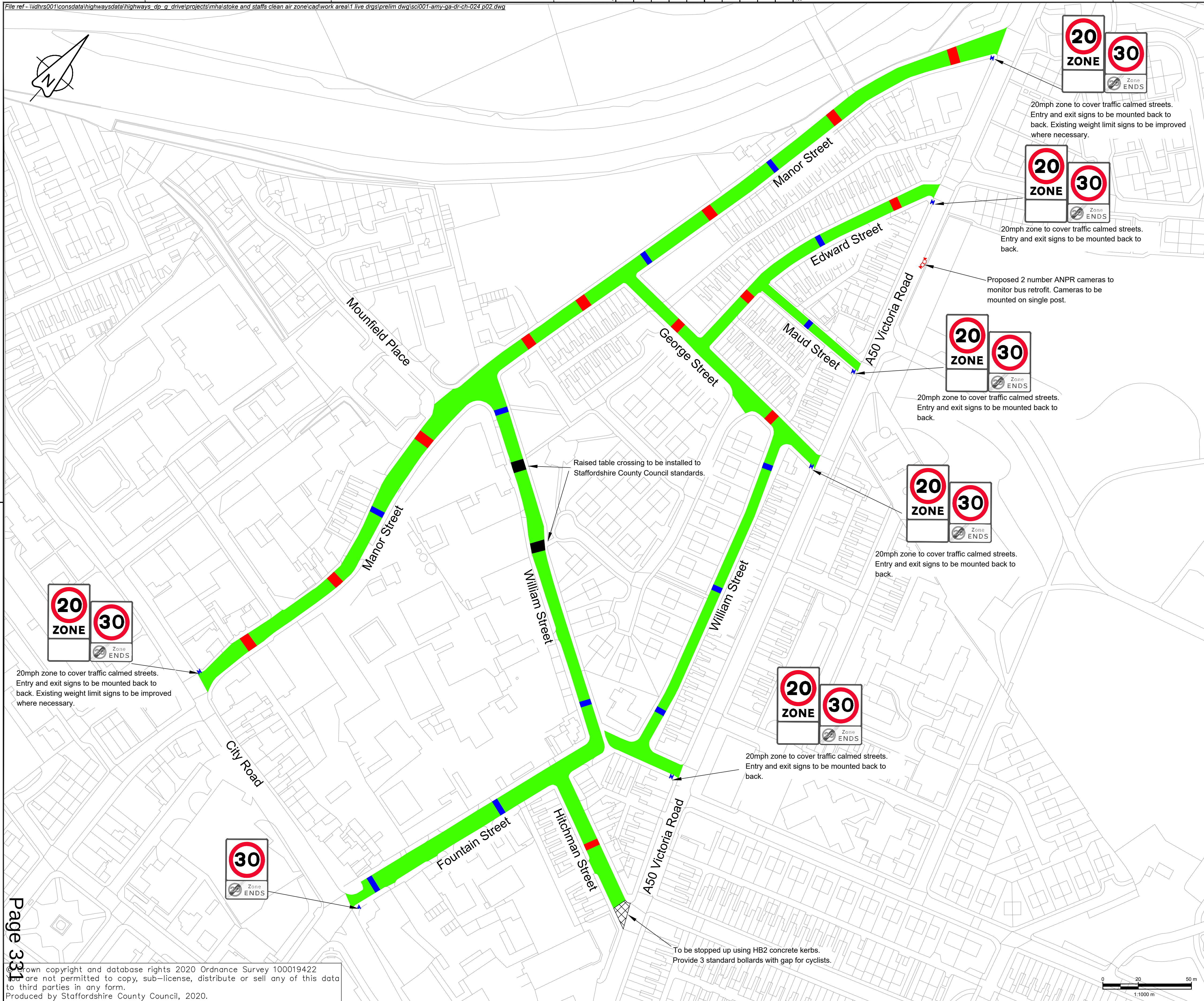
Drawing Title
VICTORIA ROAD BUS GATE
SHEET 1 OF 3

Original Drawing Size : A1 Scale : 1:1000
Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL
Suitability: S4

Drawing No: SCI001-AMY-GA-DR-CH-023
Rev: P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-ga-dr-ch-024 p02.dwg








Key:

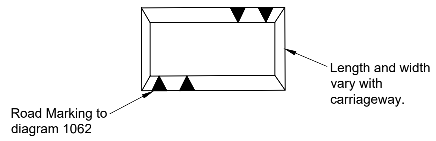
Area West of Victoria Road to be resurfaced. For pricing purposes it has been assumed the whole area will require 50mm surface course with 25% also requiring a binder course with a 100mm total depth.

Existing road humps to be removed and replaced as per Staffordshire County Council standard detail 07.02.

Proposed road humps to be built to Staffordshire County Council (standard detail 07.02).

Area to be surfaced with 50-75mm Type 1, 50mm AC/20 Binder and 25mm AC/6 surface course.

ANPR camera




Typical Road Hump Detail

| P02 | 20mph Zone Added | HH | DM | CB | 24/03/20 |
|---|---|---|---|---|---|
| Rev | Revision details | Drwn | Chkd | Appd | Date |

| | | | |
|---|---|---|---|
| Designed: | UH | Date: | 13.03.20 |
| Drawn: | UH | Date: | 13.03.20 |
| Checked: | HH | Date: | 13.03.20 |
| Approved: | CB | Date: | 13.03.20 |



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Staffordshire County Council | Newcastle under Lyme | City of Stoke-on-Trent

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

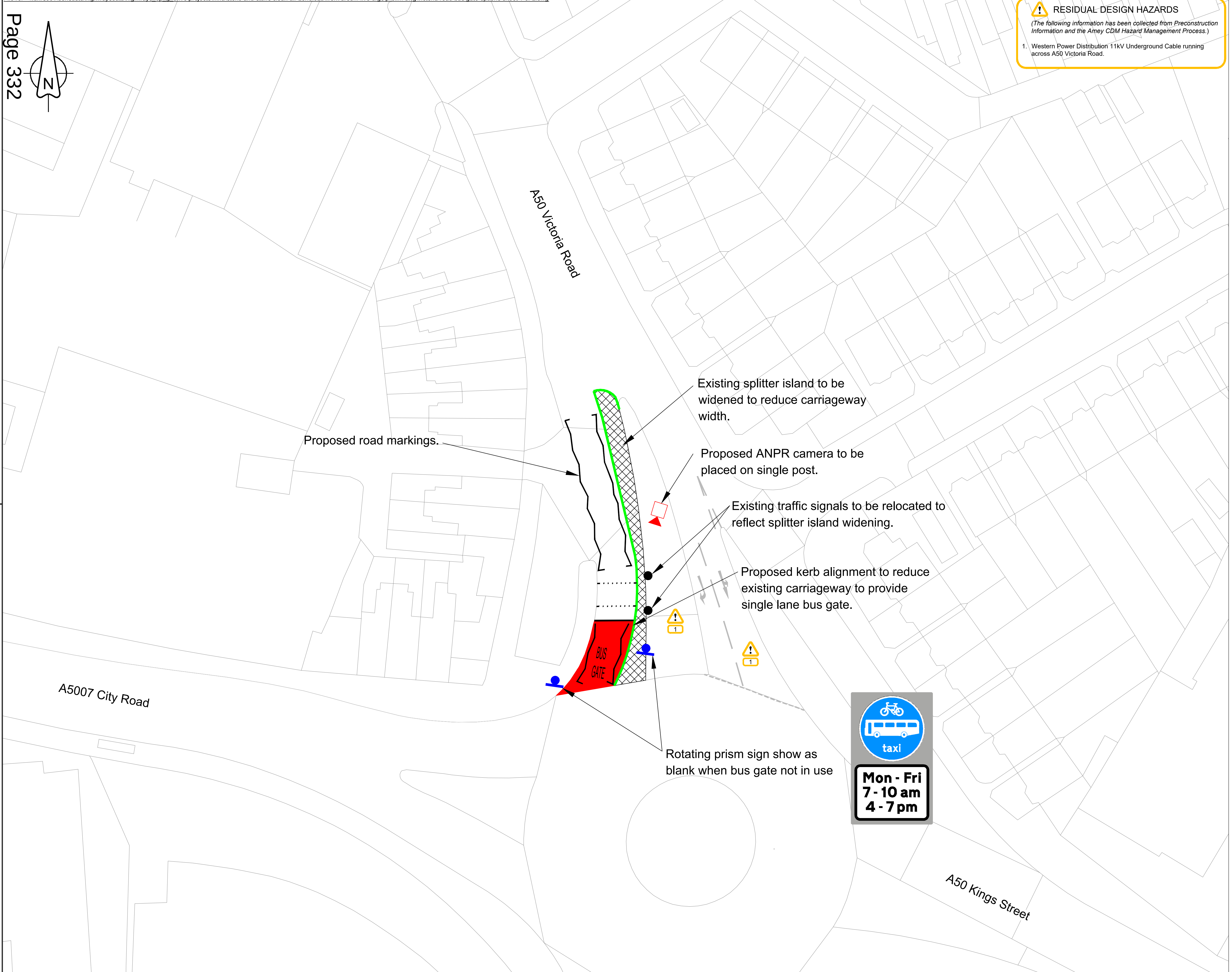
Drawing Title
VICTORIA ROAD BUS GATE SHEET 2 OF 3

Original Drawing Size: A1 | Scale: 1:10000
Dimensions: -

Drawing Status: SUITABLE FOR STAGE APPROVAL | Suitability: S4

Drawing No: SCI001-AMEY-GA-DR-CH-024 | Rev: P02

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\victoria road bus gate options sheet 1 of 2.dwg




RESIDUAL DESIGN HAZARDS

(The following information has been collected from Preconstruction Information and the Amey CDM Hazard Management Process.)

1. Western Power Distribution 11kV Underground Cable running across A50 Victoria Road.

## Key:

**Bus Gate Surface Course**
Bus Gate surface course to be RED coloured asphalt. Ulticolour 6mm Thin Surfacing System, or similar approved product. Shade to be agreed with City of Stoke Council prior to application

Area to be surfaced with 50-75mm Type 1, 50mm AC/20 Binder and 25mm AC/6 surface course.

Proposed Traffic Sign

Proposed Traffic Signals

Proposed HB2 Kerb

ANPR Camera

## Notes:

For details of advanced signing, please refer to drawings SCI001-AMEY-HSN-VR-DR -CH-0001-0006

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Designed: | UH | Date: | 13/03/2020 |
| Drawn: | UH | Date: | 13/03/2020 |
| Checked: | HH | Date: | 13/03/2020 |
| Approved: | CB | Date: | 13/03/2020 |



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Staffordshire County Council

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

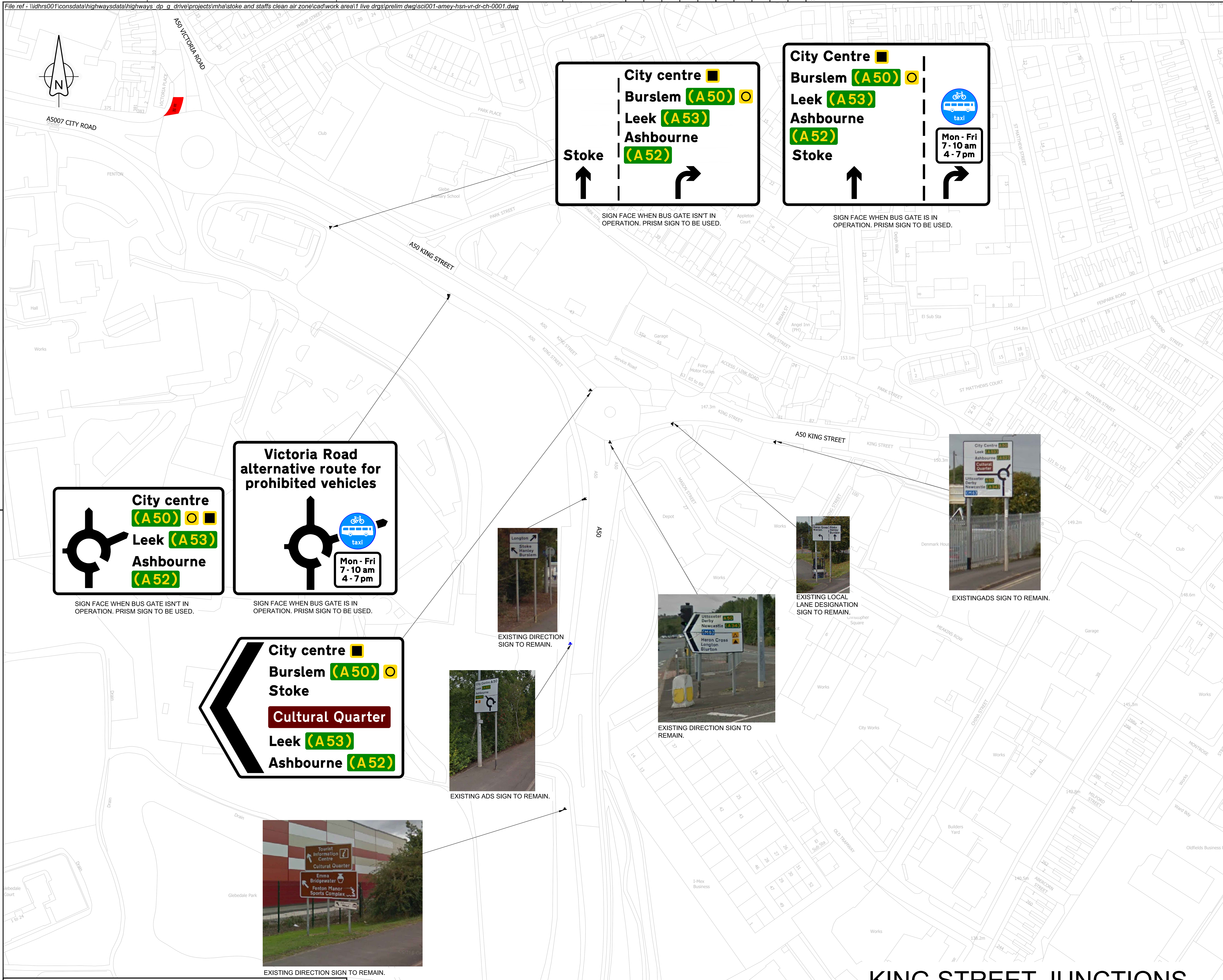
Drawing Title
VICTORIA ROAD BUS GATE
SHEET 3 OF 3

Original Drawing Size : A1 Scale : 1:250
Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL
Suitability: S4

Drawing No: SCI001-AMY-GA-DR-CH-025
Rev: P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-hsn-vr-dr-ch-0001.dwg






## NOTES

1. ALL SIGNS SHALL BE IN ACCORDANCE WITH TSRGD 2016 UNLESS AUTHORISED BY DfT.
2. WHERE SIGN FACES ARE TO CHANGE. WHEN THE BUS GATE IS IN OPERATION THEY SHALL CHANGE 15 MINUTES BEFORE AND AFTER THE PERIODS OF OPERATIONS.
3. ROTATING PRISM SIGNS SHALL BE USED FOR SIGNS THAT CHANGE DURING THE HOURS OF OPERATION.
4. REFER TO BUS GATE DRAWINGS FOR FULL DETAILS OF BUS GATE AND ASSOCIATED TM MEASURES.

## KEY

Bus Gate. For details refer to drawing SCI001_AMY_GA_DR_CH_25

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Designed: | UH | Date: | 05.03.20 |
| Drawn: | UH | Date: | 05.03.20 |
| Checked: | HH | Date: | 09.03.20 |
| Approved: | OG | Date: | 13.03.20 |



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Client
Staffordshire County Council
Newcastle Under Lyme
City of Stoke-on-Trent

Project Name
North Staffordshire Local Air Quality Plan

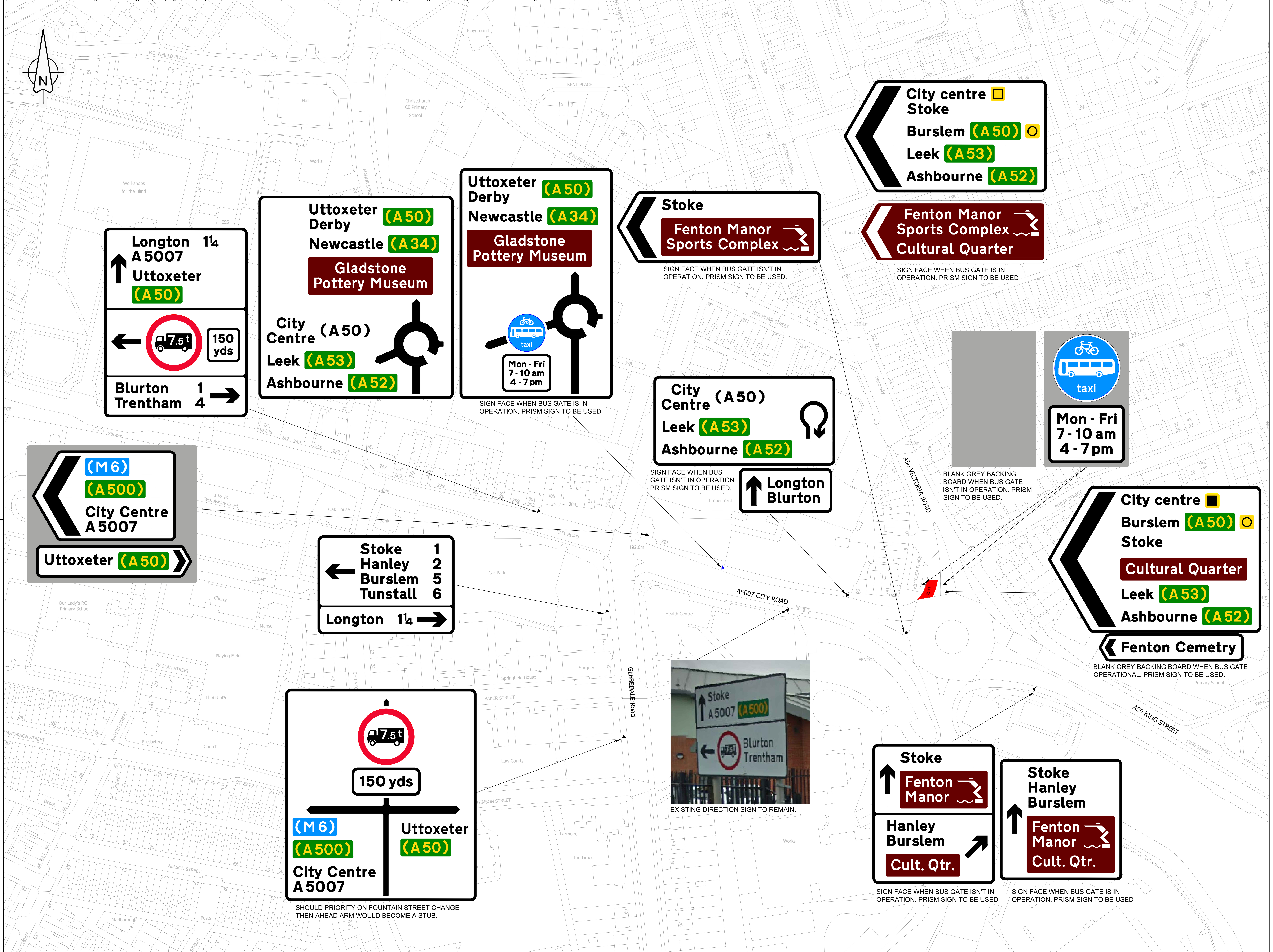
Drawing Title
VICTORIA ROAD BUS GATE SIGNING
SHEET 1 of 6

Original Drawing Size : A1
Scale : 1:1000
Dimensions : -

Drawing Status
SUITABLE FOR STAGE APPROVAL
Suitability
S4

Drawing No
SCI001-AMEY-HSN-VR-DR-CH-0001
Rev
P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-hsn-vr-dr-ch-0002.dwg




# KING STREET/VICTORIA ROAD and CITY ROAD/FOUNTAIN STREET JUNCTIONS



## NOTES

1. ALL SIGNS SHALL BE IN ACCORDANCE WITH TSRGD 2016 UNLESS AUTHORISED BY DfT.
2. WHERE SIGN FACES ARE TO CHANGE. WHEN THE BUS GATE IS IN OPERATION THEY SHALL CHANGE 15 MINUTES BEFORE AND AFTER THE PERIODS OF OPERATIONS.
3. ROTATING PRISM SIGNS SHALL BE USED FOR SIGNS THAT CHANGE DURING THE HOURS OF OPERATION.
4. REFER TO BUS GATE DRAWINGS FOR FULL DETAILS OF BUS GATE AND ASSOCIATED TM MEASURES.

## KEY

Bus Gate. For details refer to drawing SCI001_AMY_GA_DR_CH_25

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Designed: | UH | Date: | 05.03.20 |
| Drawn: | UH | Date: | 05.03.20 |
| Checked: | HH | Date: | 09.03.20 |
| Approved: | OG | Date: | 13.03.20 |



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Client
Staffordshire County Council
Newcastle under Lyme
City of Stoke-on-Trent

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title
VICTORIA ROAD BUS GATE SIGNING
SHEET 2 of 6

Original Drawing Size : A1 Scale : 1:1000
Dimensions : -

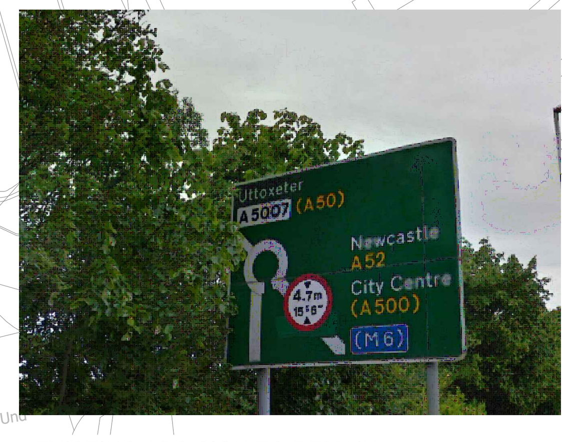
Drawing Status
SUITABLE FOR STAGE APPROVAL

Suitability
S4

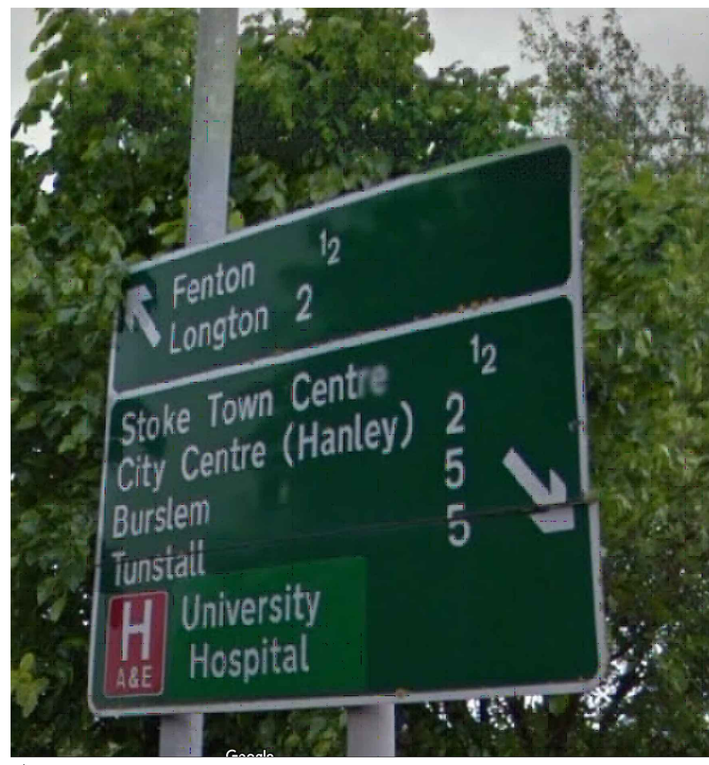
Drawing No
SCI001-AMEY-HSN-VR-DR-CH-0002

Rev
P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-hsn-vr-dr-ch-0003.dwg




EXISTING ADS SIGN TO REMAIN.




EXISTING DIRECTION SIGN TO REMAIN.



EXISTING DIRECTION SIGN TO REMAIN.

A5007 CITY ROAD

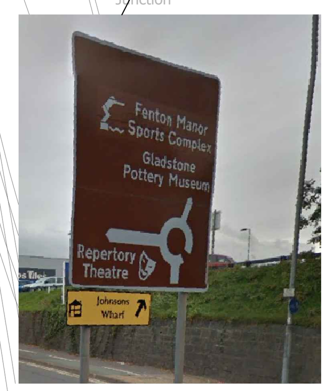
A52 LEEK ROAD

CITY ROAD JUNCTION

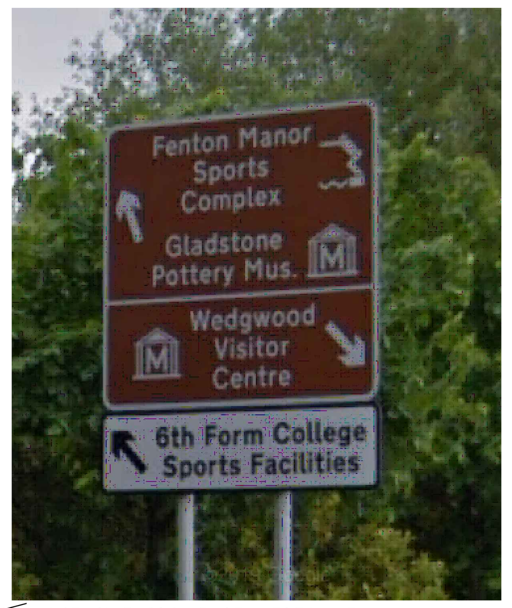
SIGNING TO REMAIN UNCHANGED. BUS GATE DOES NOT IMPACT ROUTING HERE. BURSLEM AND HANLEY ARE SIGNED NORTH AT THIS POINT.


EXISTING ADS SIGN TO REMAIN.


EXISTING DIRECTION SIGN TO REMAIN.

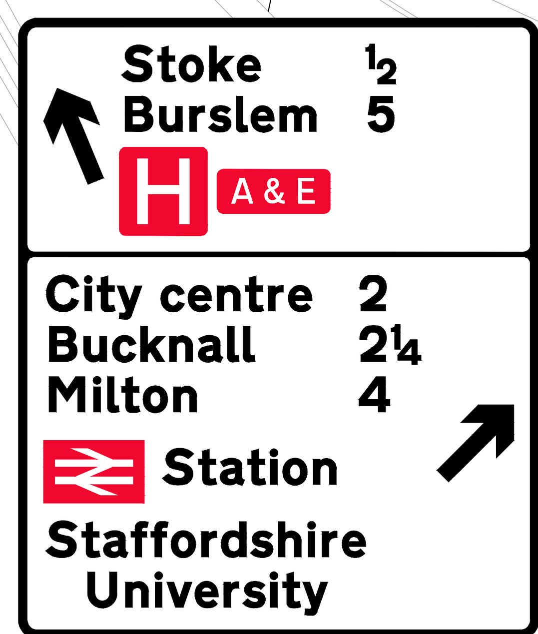


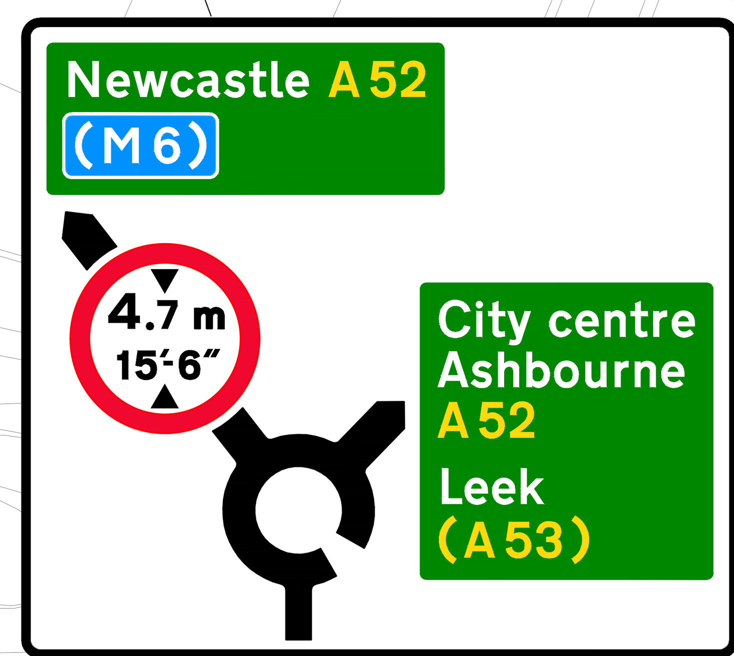
EXISTING DIRECTION SIGN TO REMAIN.




EXISTING DIRECTION SIGN TO REMAIN.

A5007 CITY ROAD




# CITY ROAD JUNCTIONS



## NOTES

1. ALL SIGNS SHALL BE IN ACCORDANCE WITH TSRGD 2016 UNLESS AUTHORISED BY DfT.
2. WHERE SIGN FACES ARE TO CHANGE. WHEN THE BUS GATE IS IN OPERATION THEY SHALL CHANGE 15 MINUTES BEFORE AND AFTER THE PERIODS OF OPERATIONS.
3. ROTATING PRISM SIGNS SHALL BE USED FOR SIGNS THAT CHANGE DURING THE HOURS OF OPERATION.
4. REFER TO BUS GATE DRAWINGS FOR FULL DETAILS OF BUS GATE AND ASSOCIATED TM MEASURES.

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Designed: | UH | Date: | 05.03.20 |
| Drawn: | UH | Date: | 05.03.20 |
| Checked: | HH | Date: | 09.03.20 |
| Approved: | OG | Date: | 13.03.20 |



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Client
Staffordshire County Council
Newcastle under Lyme
City of Stoke-on-Trent

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

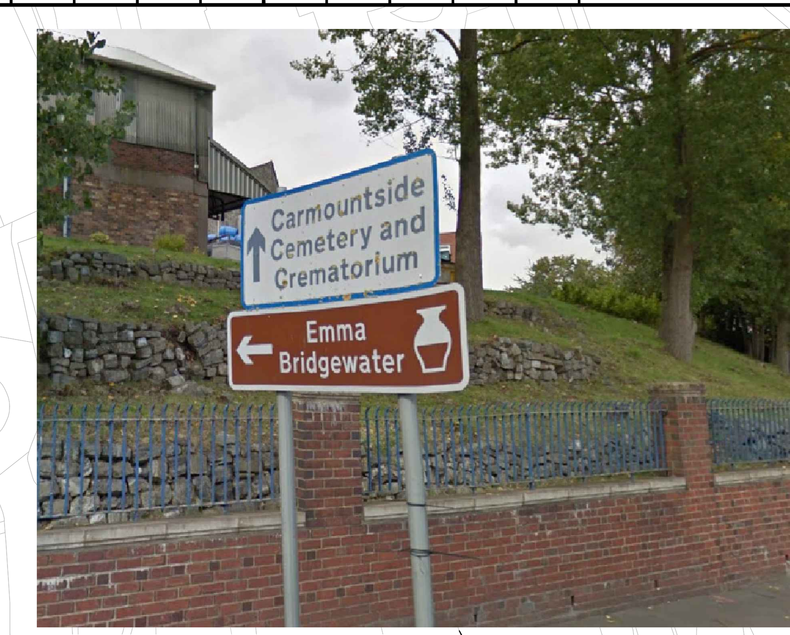
Drawing Title
VICTORIA ROAD BUS GATE SIGNING
SHEET 3 of 6

Original Drawing Size : A1 Scale : 1:1000
Dimensions : -

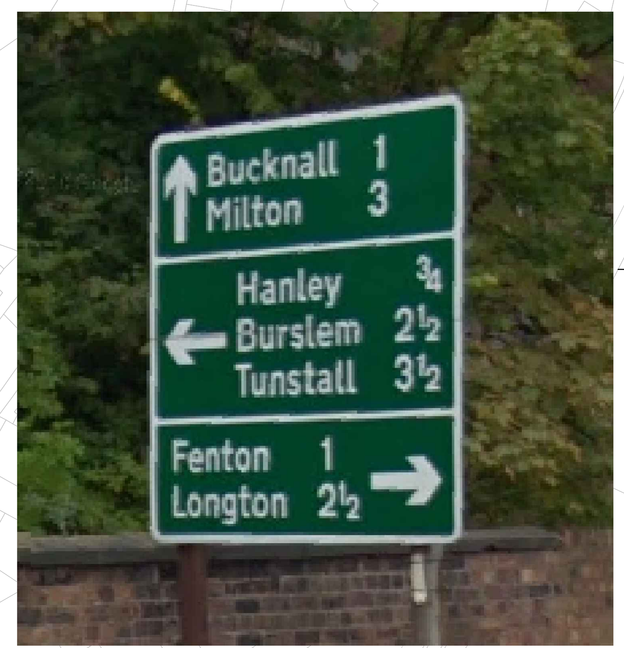
Drawing Status
SUITABLE FOR STAGE APPROVAL
Suitability
S4

Drawing No
SCI001-AMEY-HSN-VR-DR-CH-0003
Rev
P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-hsn-vr-dr-ch-0004.dwg



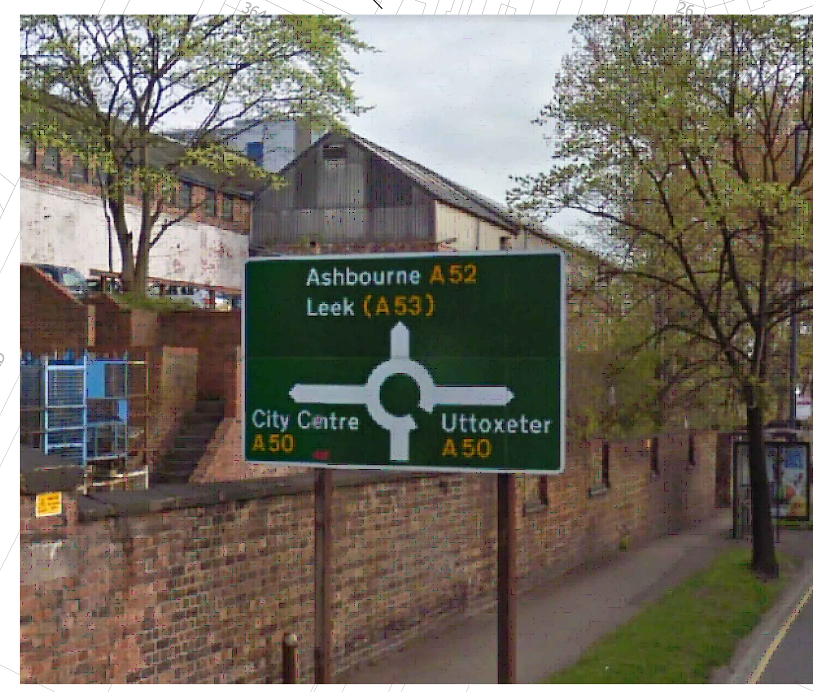

EXISTING LOCAL DIRECTION SIGN TO REMAIN.



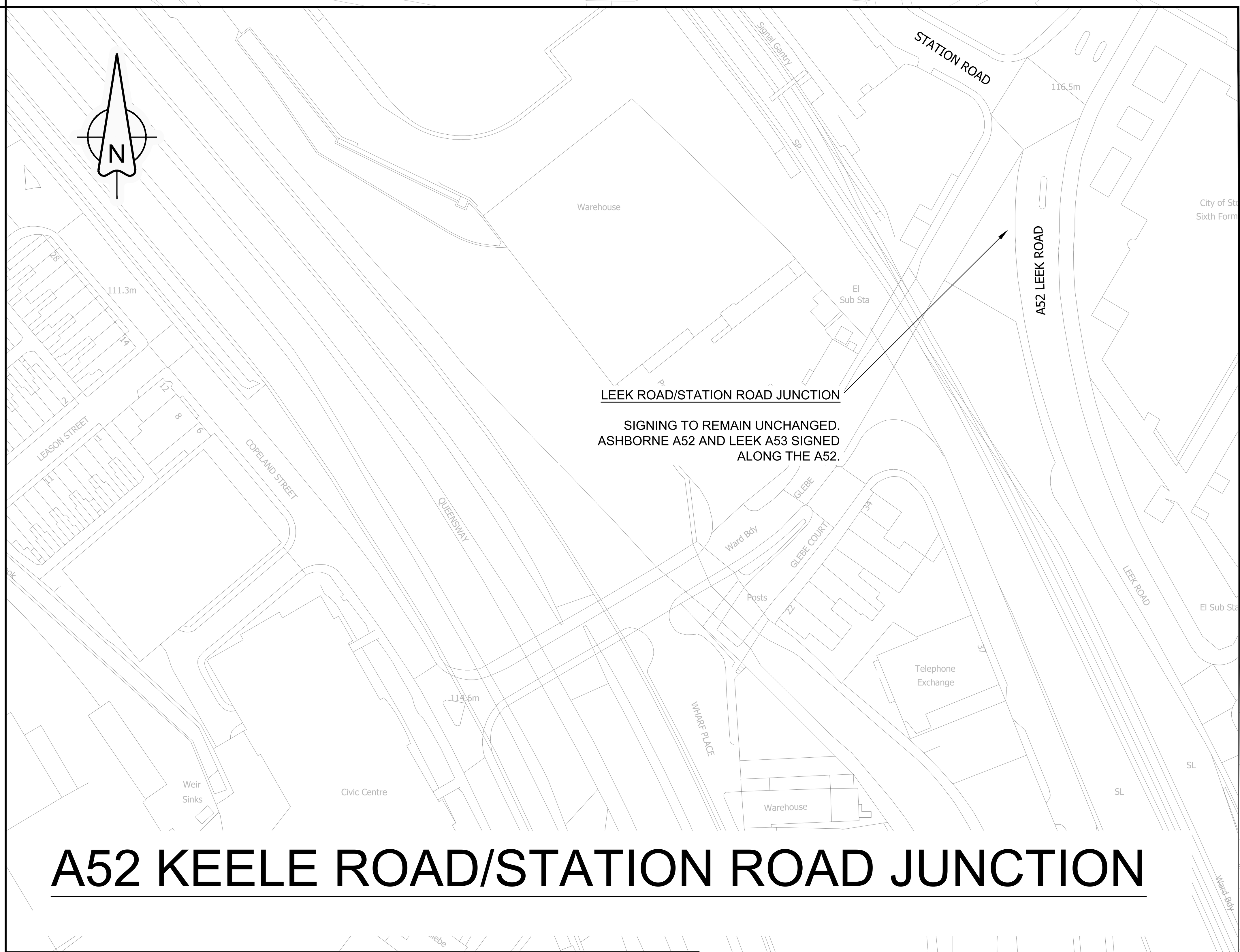

EXISTING LOCAL DIRECTION SIGN TO REMAIN.

VICTORIA ROAD/LEEK ROAD

SIGNING TO REMAIN UNCHANGED.




EXISTING ADS TO REMAIN.



LEEK ROAD/STATION ROAD JUNCTION

SIGNING TO REMAIN UNCHANGED.
ASHBORNE A52 AND LEEK A53 SIGNED ALONG THE A52.

# A52 KEELE ROAD/STATION ROAD JUNCTION

# A50/A52 JUNCTION



## NOTES

1. ALL SIGNS SHALL BE IN ACCORDANCE WITH TSRGD 2016 UNLESS AUTHORISED BY DFT.
2. WHERE SIGN FACES ARE TO CHANGE. WHEN THE BUS GATE IS IN OPERATION THEY SHALL CHANGE 15 MINUTES BEFORE AND AFTER THE PERIODS OF OPERATIONS.
3. ROTATING PRISM SIGNS SHALL BE USED FOR SIGNS THAT CHANGE DURING THE HOURS OF OPERATION.
4. REFER TO BUS GATE DRAWINGS FOR FULL DETAILS OF BUS GATE AND ASSOCIATED TM MEASURES.

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Designed: | UH | Date: | 05.03.20 |
| Drawn: | UH | Date: | 05.03.20 |
| Checked: | HH | Date: | 09.03.20 |
| Approved: | OG | Date: | 13.03.20 |



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Client
Staffordshire County Council
Newcastle under Lyme
City of Stoke-on-Trent

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title
VICTORIA ROAD BUS GATE SIGNING
SHEET 4 of 6

Original Drawing Size : A1 | Scale : 1:1000
Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL | Suitability: S4

Drawing No: SCI001-AMEY-HSN-VR-DR-CH-0004 | Rev: P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-hsn-vr-dr-ch-0005.dwg




## NOTES

1. ALL SIGNS SHALL BE IN ACCORDANCE WITH TSRGD 2016 UNLESS AUTHORISED BY DfT.
2. WHERE SIGN FACES ARE TO CHANGE. WHEN THE BUS GATE IS IN OPERATION THEY SHALL CHANGE 15 MINUTES BEFORE AND AFTER THE PERIODS OF OPERATIONS.
3. ROTATING PRISM SIGNS SHALL BE USED FOR SIGNS THAT CHANGE DURING THE HOURS OF OPERATION.
4. REFER TO BUS GATE DRAWINGS FOR FULL DETAILS OF BUS GATE AND ASSOCIATED TM MEASURES.

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | | |
|---|---|---|
| Designed: | UH | Date: 05.03.20 |
| Drawn: | UH | Date: 05.03.20 |
| Checked: | HH | Date: 09.03.20 |
| Approved: | OG | Date: 13.03.20 |



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Client

Staffordshire County Council

Newcastle under Lyme

City of Stoke-on-Trent

Project Name

NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title

VICTORIA ROAD BUS GATE SIGNING SHEET 5 of 6

Original Drawing Size : A1 | Scale : 1:1000

Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL | Suitability: S4

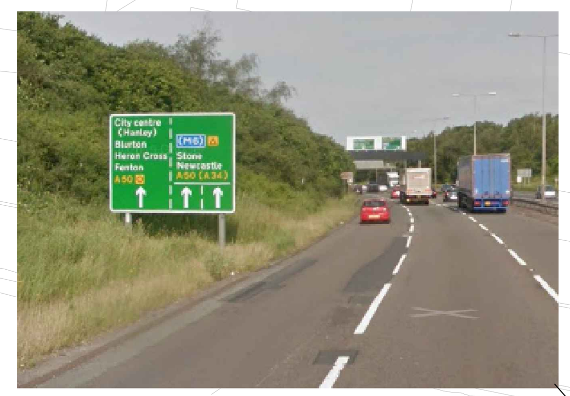
Drawing No: SCI001-AMEY-HSN-VR-DR-CH-0005 | Rev: P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-hsn-vr-dr-ch-0006.dwg

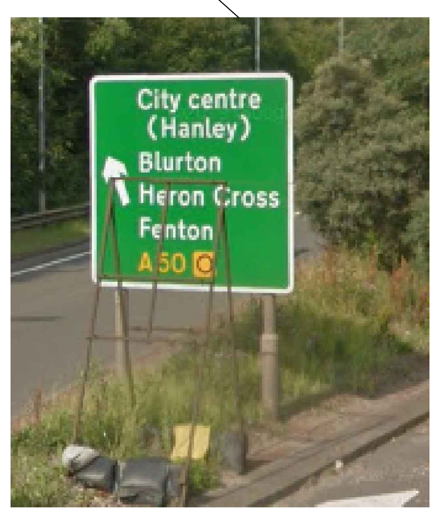
A50

To A500

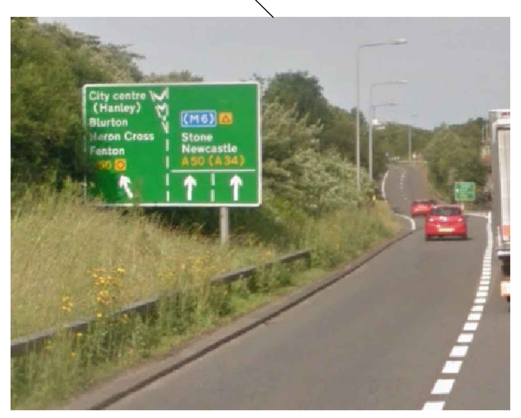
To Uttoxeter



EXISTING ADS SIGN TO REMAIN.



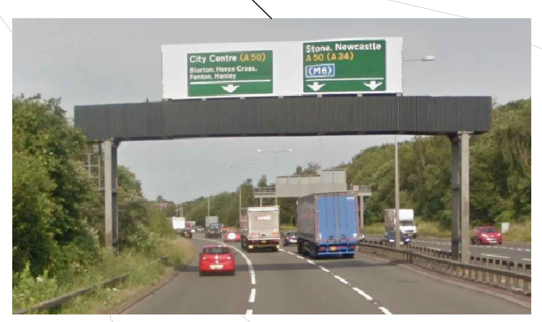

EXISTING DIRECTION SIGN TO REMAIN.



EXISTING ADS SIGN TO REMAIN.

A50 OPTIONS

1. DO NOTHING AND LEAVE EXISTING SIGNING IN PLACE. ALLOW DRIVERS TO PICK UP LOCAL SIGNING.
2. RE-SIGN CITY CENTRE VIA A50/A500.



EXISTING ADS SIGN TO REMAIN.

# A50 HERON CROSS JUNCTION



## NOTES

1. ALL SIGNS SHALL BE IN ACCORDANCE WITH TSRGD 2016 UNLESS AUTHORISED BY DfT.
2. WHERE SIGN FACES ARE TO CHANGE. WHEN THE BUS GATE IS IN OPERATION THEY SHALL CHANGE 15 MINUTES BEFORE AND AFTER THE PERIODS OF OPERATIONS.
3. ROTATING PRISM SIGNS SHALL BE USED FOR SIGNS THAT CHANGE DURING THE HOURS OF OPERATION.
4. REFER TO BUS GATE DRAWINGS FOR FULL DETAILS OF BUS GATE AND ASSOCIATED TM MEASURES.

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Designed: | EOB | Date: | 05.03.20 |
| Drawn: | EOB | Date: | 05.03.20 |
| Checked: | HH | Date: | 09.03.20 |
| Approved: | . | Date: | . |



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Client

Staffordshire County Council · Newcastle under Lyme · City of Stoke-on-Trent

Project Name

NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title

VICTORIA ROAD BUS GATE SIGNING
SHEET 6 of 6

Original Drawing Size : A1 | Scale : 1:1000
Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL | Suitability: S4

Drawing No: SCI001-AMEY-HSN-VR-DR-CH-0006 | Rev: P01

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

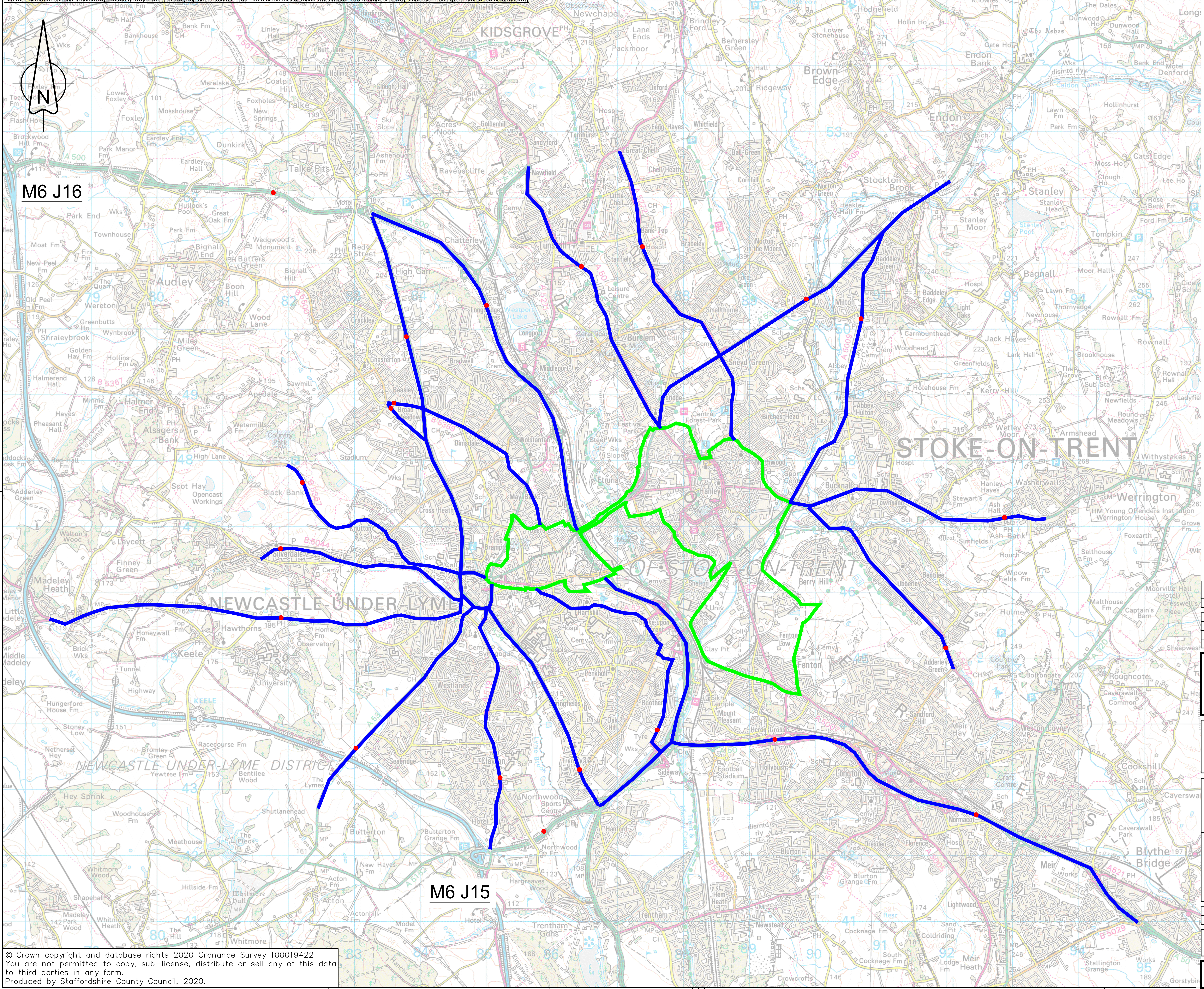
## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 3d - Indicative Design Drawings

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

File ref - \\ldhrs001\consdata\highwaysdata\highways_do_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\clean air zone type d advanced signage.dwg





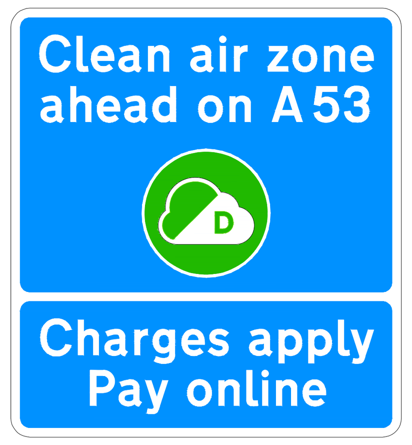

## NOTES

1. All ADS on approach junctions to have CAZ D symbol added
2. Sign locations are indicative and have been placed using a 2 mile radius, locations to be finalised at detailed design.
3. All signs subject to DFT and HE approval as appropriate.
4. For standard sign details refer to drawings SCI001-AMEY-HSN-GEN-DR-CH-0001-0003

## Key

- Proposed sign locations
- CAZ area
- Major routes into city centre


Typical arrangement for 2 mile advance sign.




Typical arrangement for advanced signing on A500 and A53, route number and text to be varied as appropriate.

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Designed: | UH | Date: | 13.03.20 |
| Drawn: | UH | Date: | 13.03.20 |
| Checked: | HH | Date: | 13.03.20 |
| Approved: | OG | Date: | 13.03.20 |



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Client

Staffordshire County Council
Newcastle Under Lyme Borough Council
City of Stoke-on-Trent

Project Name
NORTH STAFFORDSHIRE
LOCAL AIR QUALITY PLAN

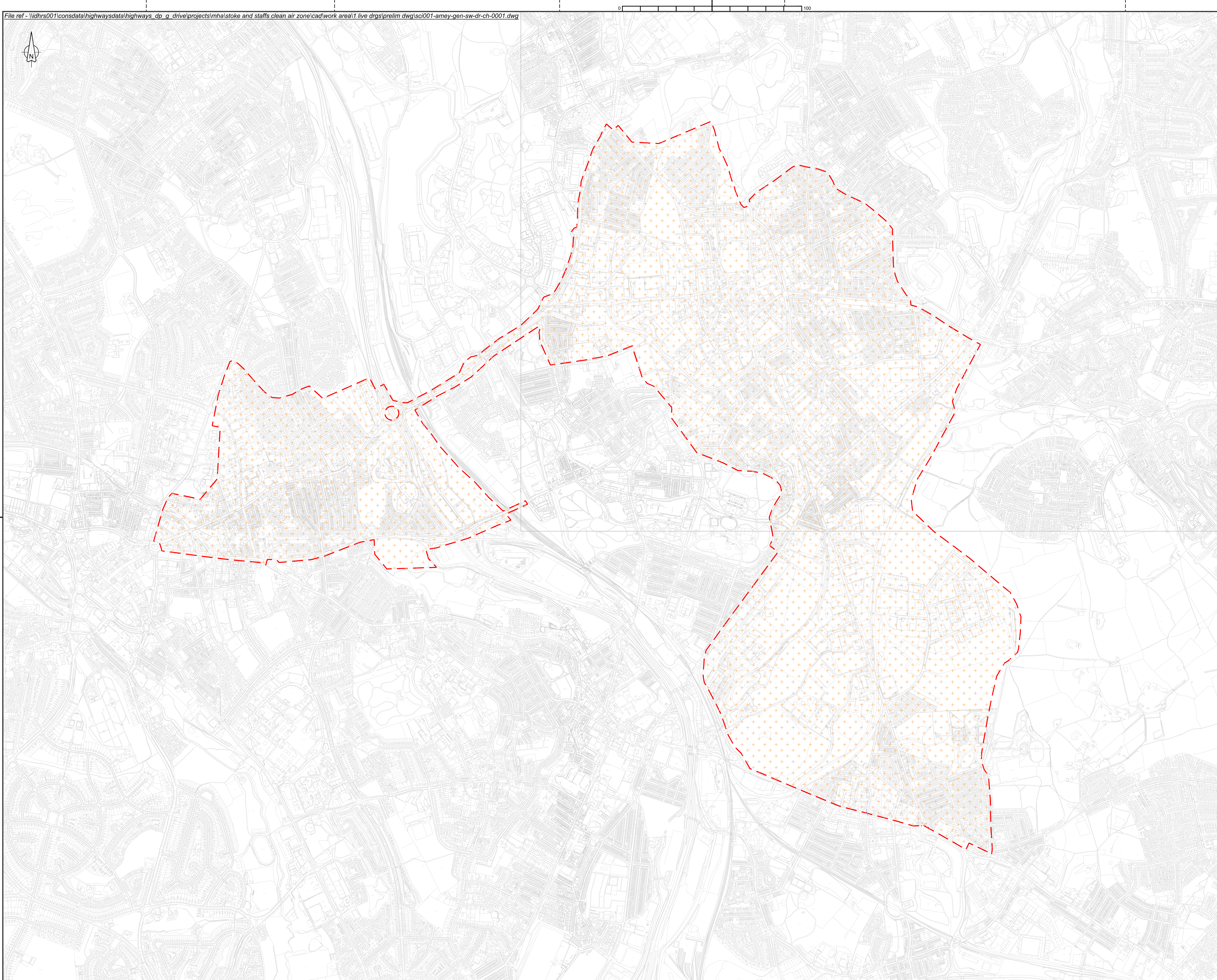
Drawing Title
# CLEAN AIR ZONE TYPE D ADVANCED SIGNING

Original Drawing Size : A1 | Scale : NTS
Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL | Suitability: S4

Drawing No: SCI001-AMEY-GEN-SW-DR-CH-0002 | Rev: P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-gen-sw-dr-ch-0001.dwg






# NOTES

1. CLEAN AIR ZONE BOUNDARY BASED UPON MODELING AND REVIEW OF ROADS AROUND THE BOUNDARY AREA.
2. THIS BOUNDARY HAS BEEN ESTABLISHED FROM AIR QUALITY MONITORING OUTPUTS AND IN CONSULTATION WITH THE LOCAL AUTHORITIES.

KEY:

- CLEAN AIR ZONE
- CLEAN AIR ZONE BOUNDARY

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Designed: | UH | Date: | 05.03.20 |
| Drawn: | UH | Date: | 05.03.20 |
| Checked: | HH | Date: | 09.03.20 |
| Approved: | OG | Date: | 13.03.20 |



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Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

Project Name

NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title

CLEAN AIR ZONE BOUNDARY

Original Drawing Size : A1 | Scale : 1:10000

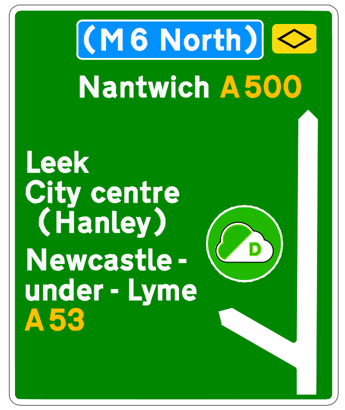
Dimensions : -

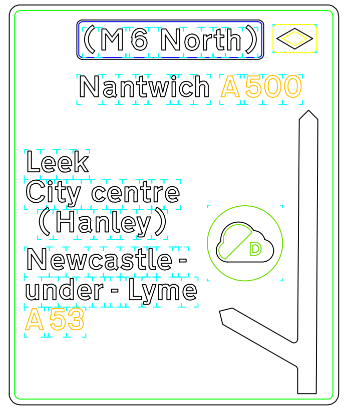
Drawing Status: SUITABLE FOR STAGE APPROVAL | Suitability: S4

Drawing No: SCI001-AMEY-GEN-SW-DR-CH-0001 | Rev: P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-hsn-gen-dr-ch-0003.dwg


Examples of potential signs for Stoke Clean Air Zone Boundary. Individual or combined authority names and badges to be used as shown. Sizes to be as per DfT Std Details.




| | | | |
|---|---|---|---|
| Scheme Ref. | Clean Air Zone Type D | | |
| Sign Ref. | Typical Verge ADS | x-height | 250.0 |
| Letter colour | YELLOW / WHITE | SIGN FACE | |
| Background | DARK GREEN | Width | 5470 mm |
| Border | WHITE | Height | 6660 mm |
| Material | Class RA2 (12899-1:2007) | Area | 36.43 m² |

CAZ D Symbol to be included on ADS. Symbol to be positioned adjacent or below destinations as appropriate.



| | | | |
|---|---|---|---|
| Scheme Ref. | Clean Air Zone Type D | | |
| Sign Ref. | Advanced Sign - Alternative 1 | x-height | 250.0 |
| Letter colour | WHITE | SIGN FACE | |
| Background | BLUE | Width | 3870 mm |
| Border | WHITE | Height | 4250 mm |
| Material | Class RA2 (12899-1:2007) | Area | 16.45 m² |

| | | | |
|---|---|---|---|
| Scheme Ref. | Clean Air Zone Type D | | |
| Sign Ref. | Advanced - Alternative 2 | x-height | 250.0 |
| Letter colour | WHITE | SIGN FACE | |
| Background | BLUE | Width | 3920 mm |
| Border | WHITE | Height | 4250 mm |
| Material | Class RA2 (12899-1:2007) | Area | 16.66 m² |

| | | | |
|---|---|---|---|
| Scheme Ref. | Clean Air Zone Type D | | |
| Sign Ref. | Advanced - Alternative 3 | x-height | 250.0 |
| Letter colour | WHITE | SIGN FACE | |
| Background | BLUE | Width | 4650 mm |
| Border | WHITE | Height | 4250 mm |
| Material | Class RA2 (12899-1:2007) | Area | 19.76 m² |

| | | | |
|---|---|---|---|
| Scheme Ref. | Clean Air Zone Type D | | |
| Sign Ref. | Advanced - Alternative 4 | x-height | 250.0 |
| Letter colour | WHITE | SIGN FACE | |
| Background | BLUE | Width | 4040 mm |
| Border | WHITE | Height | 4250 mm |
| Material | Class RA2 (12899-1:2007) | Area | 17.17 m² |

NOTES

1. THESE SIGNS ARE BASED UPON DfT NON PRESCRIBED SIGNS WORKING DRAWINGS:
   - NP 677.1
   - NP 818.8
   - NP 894.1
   - NP 664.4

2. THE CAZ D SYMBOL IS DfT S68 SYMBOL WORKING DRAWING

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Designed: | UH | Date: | 05.03.20 |
| Drawn: | EOB | Date: | 05.03.20 |
| Checked: | HH | Date: | 09.03.20 |
| Approved: | OG | Date: | 09.03.20 |



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Staffordshire County Council

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title
CLEAN AIR ZONE TYPE D - TYPICAL ADVANCED AND BOUNDARY SIGNS

Original Drawing Size : A1 | Scale : NTS
Dimensions : -

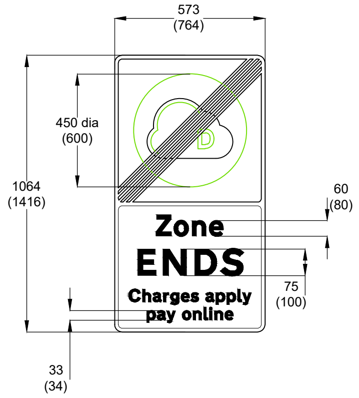
Drawing Status: SUITABLE FOR STAGE APPROVAL | Suitability: S4

Drawing No: SCI001-AMEY-HSN-GEN-DR-CH-0003 | Rev: P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-hsn-gen-dr-ch-0002.dwg

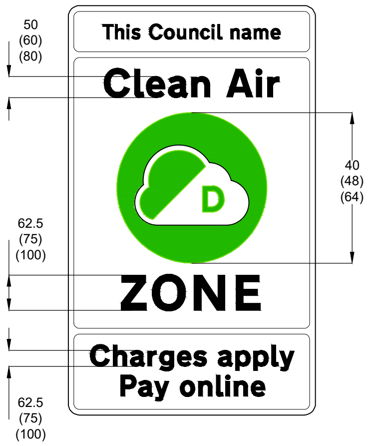
NOTES
1. THESE SIGNS ARE FROM THE FOLLOWING DfT NON PRESCRIBED SIGNS WORKING DRAWINGS:
 - NP 677.1
 - NP 818.8
 - NP 894.1
 - NP 664.4

2. THE CAZ D SYMBOL IS DfT S68 SYMBOL WORKING DRAWING

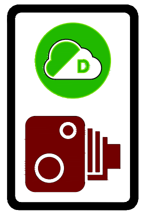

| | | | |
|---|---|---|---|
| Scheme Ref. | Clean Air Zone Type D | | |
| Sign Ref. | BOUNDARY - EXIT | x-height | 75.0 |
| Letter colour | BLACK | SIGN FACE | |
| Background | WHITE | Width | 1064 mm |
| Border | BLACK | Height | 573 mm |
| Material | Class RA2 (12899-1:2007) | Area | 0.60 m² |

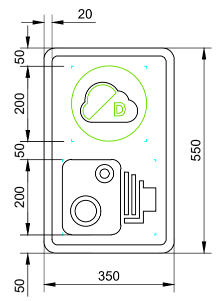
Alternative larger x-heights are as shown.


| | | | |
|---|---|---|---|
| Scheme Ref. | Clean Air Zone Type D | | |
| Sign Ref. | BOUNDARY - ENTRY | x-height | 75.0 |
| Letter colour | BLACK | SIGN FACE | |
| Background | WHITE | Width | 1160 mm |
| Border | BLACK | Height | 1265 mm |
| Material | Class RA2 (12899-1:2007) | Area | 1.47 m² |

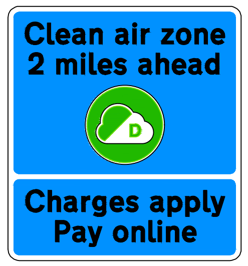
Alternative larger x-heights are as shown.






| | | | |
|---|---|---|---|
| Scheme Ref. | Clean Air Zone Type D | | |
| Sign Ref. | CAMERA REPEATER 1 | x-height | 40.0 |
| Letter colour | N/A | SIGN FACE | |
| Background | WHITE | Width | 350 mm |
| Border | BLACK | Height | 550 mm |
| Material | Class RA2 (12899-1:2007) | Area | 0.19 m² |

Alternative larger size 700mm x 1100mm also permitted.




| | | | |
|---|---|---|---|
| Scheme Ref. | Clean Air Zone Type D | | |
| Sign Ref. | ADVANCED | x-height | 100.0 |
| Letter colour | WHITE | SIGN FACE | |
| Background | BLUE | Width | 1545 mm |
| Border | WHITE | Height | 1685 mm |
| Material | Class RA2 (12899-1:2007) | Area | 2.60 m² |

X-Height can be between 60mm and 300mm and shall be determined in accordance with Appendix E in Chapter 7 of Traffic Signs Manual.

| Rev | Revision details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| Designed: | UH | Date: | 05.03.20 |
| Drawn: | EOB | Date: | 05.03.20 |
| Checked: | HH | Date: | 09.03.20 |
| Approved: | OG | Date: | 09.03.20 |



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Staffordshire County Council

Newcastle under Lyme Borough Council

City of Stoke-on-Trent

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title
DfT STANDARD CLEAN AIR ZONE SIGN DETAILS

Original Drawing Size : A1 | Scale : NTS
Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL | Suitability: S4

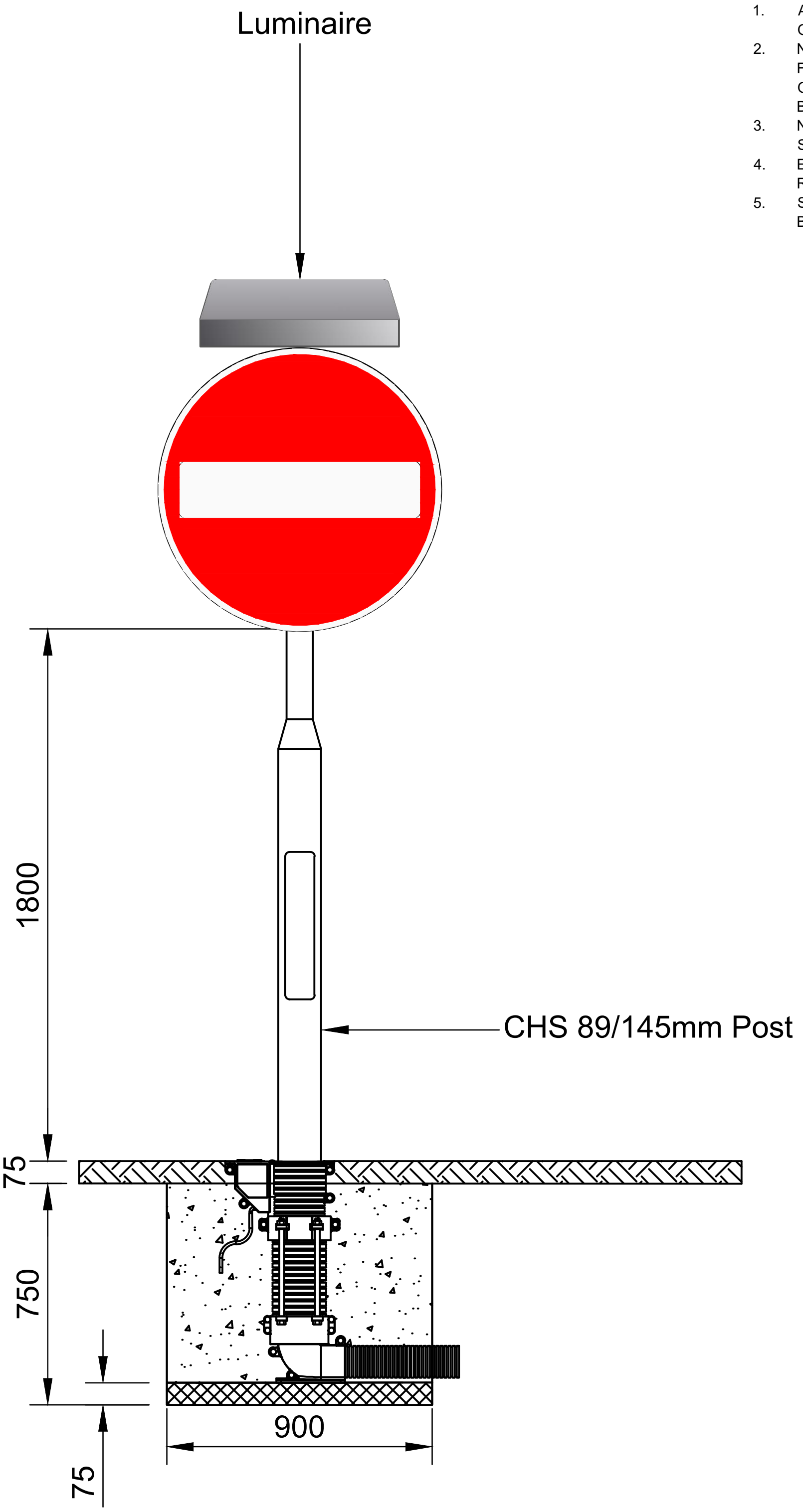
Drawing No: SCI001-AMEY-HSN-GEN-DR-CH-0002 | Rev: P01

0 100

*File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001-amey-hsn-gen-dr-ch-0001.dwg*

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
2. NAL RS89 DUCKFOOT RETENTION SOCKET AND INDIVIDUAL FOUNDATION IS SHOWN FOR ILLUSTRATIVE PURPOSES ONLY. FOUNDATIONS ARE SQUARE WITH TYPE 1 MATERIAL BELOW SOCKET WITH CONCRETE PAD.
3. NON DUCKFOOT SOCKET ALSO AVAILABLE. THIS USES THE SAME FOUNDATION.
4. EARTH COVER TO VARY AND EXISTING SURFACE TO BE REINSTATED.
5. SOCKETS CAN BE USED FOR ANPR CAMERA POSTS AND BOLLARDS.




# NAL RS89 Duckfoot Retention Socket and Individual Foundation

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |

Designed: UH Date: 05.03.20
Drawn: EOB Date: 05.03.20
Checked: HH Date: 05.03.20
Approved: OG Date: 09.03.20
Original Drg Size : A4 Scale : NTS
Dimensions : mm

Project Name
NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

Drawing Title
TYPICAL DETAIL FOR NAL SOCKET FOUNDATION

Drawing Status: SUITABLE FOR STAGE APPROVAL
Suitability: S4



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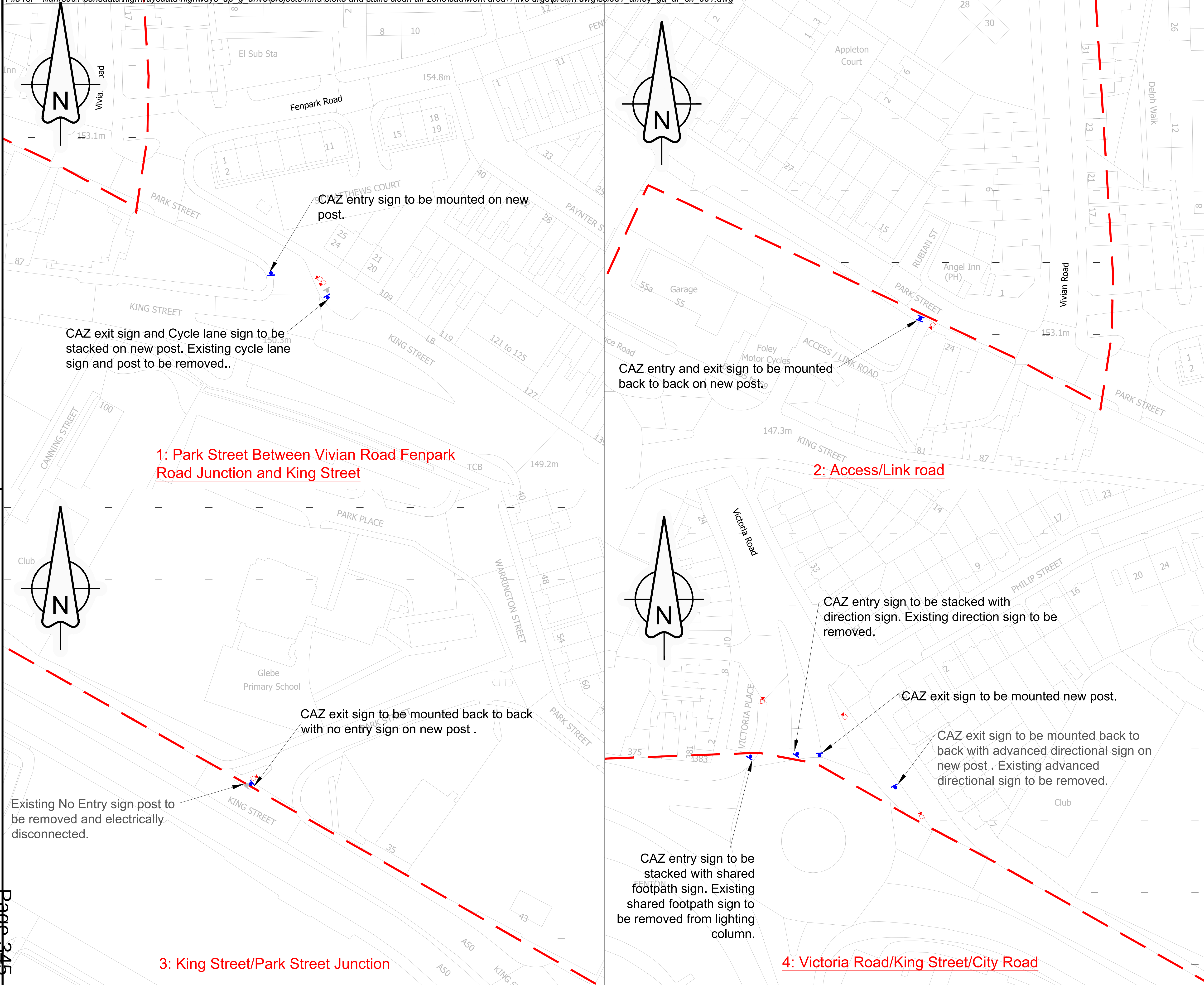
Client
Staffordshire County Council
Newcastle under Lyme Borough Council
City of Stoke-on-Trent

Drawing No: SCI001-AMEY-HSN-GEN-DR-CH-0001
Revision: P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001_amey_ga_dr_ch_001.dwg




NOTES

1. Location of statutory undertakers is yet to be determined and may affect the proposed design.

Key:

- Proposed Signs
- Existing Signs To Be Removed
- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
- Existing Vegetation Clearance
- Clean Air Zone Marking

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

Designed: UH Date: 17.02.20
Drawn: UH Date: 17.02.20
Checked: HH Date: 06.03.20
Approved: OG Date: 06.03.20



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Staffordshire County Council

Project Name
North Staffordshire Local Air Quality Plan

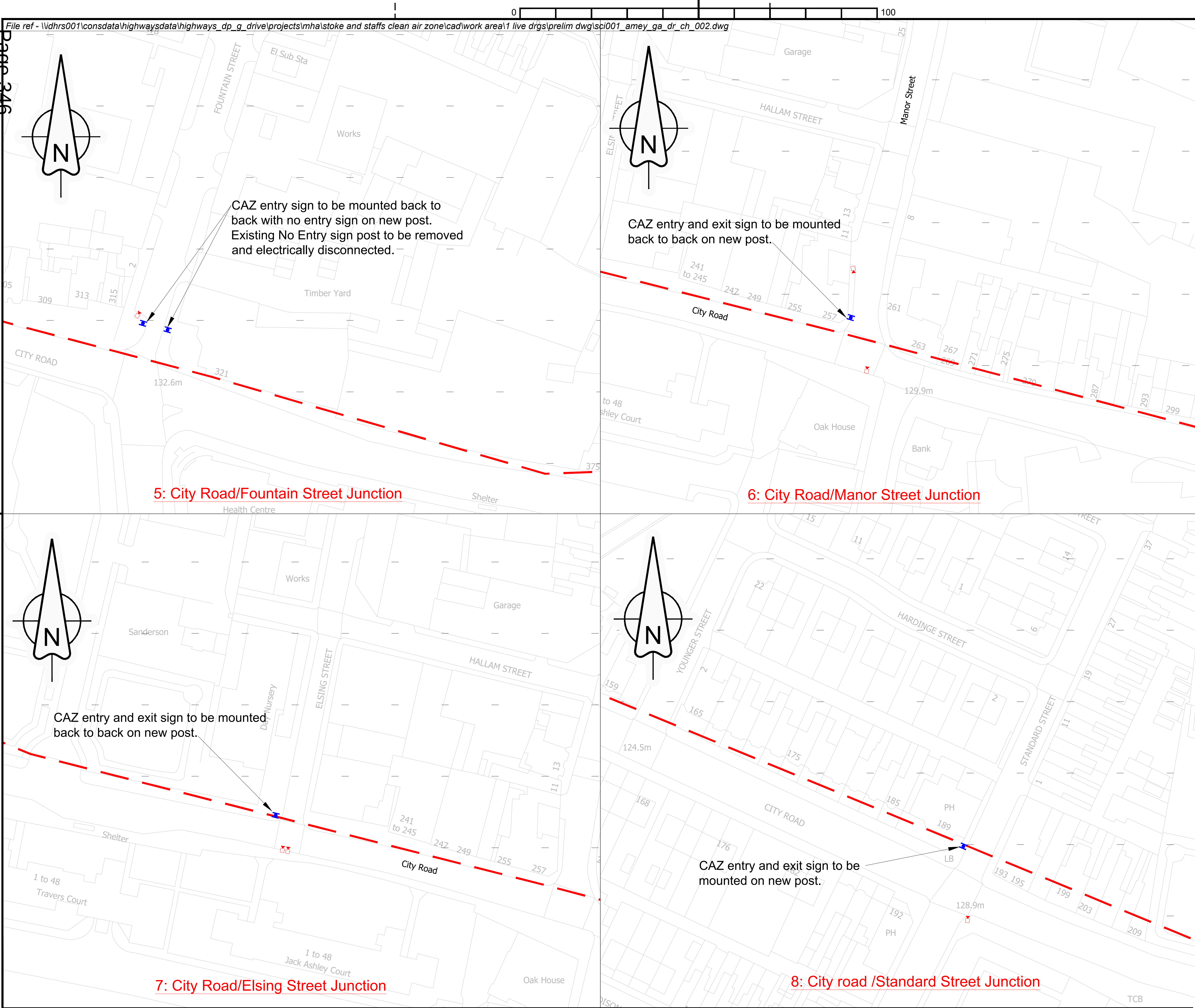
Drawing Title
Clean Air Zone
Sites 1-4

Original Drg Size : A3 Scale : 1:1000
Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL
Suitability: S4

Drawing No: SCI001/AMEY/GA/DR/CH/001
Revision: P01

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001_amey_ga_dr_ch_002.dwg




## NOTES

1. Location of statutory undertakers is yet to be determined and may affect the proposed design.

Key:

- Proposed Signs
- Existing Signs To Be Removed
- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
- Existing Vegetation Clearance
- Clean Air Zone Boundary

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | |
|---|---|
| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name
North Staffordshire Local Air Quality Plan

Drawing Title
Clean Air Zone
Sites 5-8

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
|---|---|
| SCI001-AMEY-GA-DR-CH-002 | P01 |

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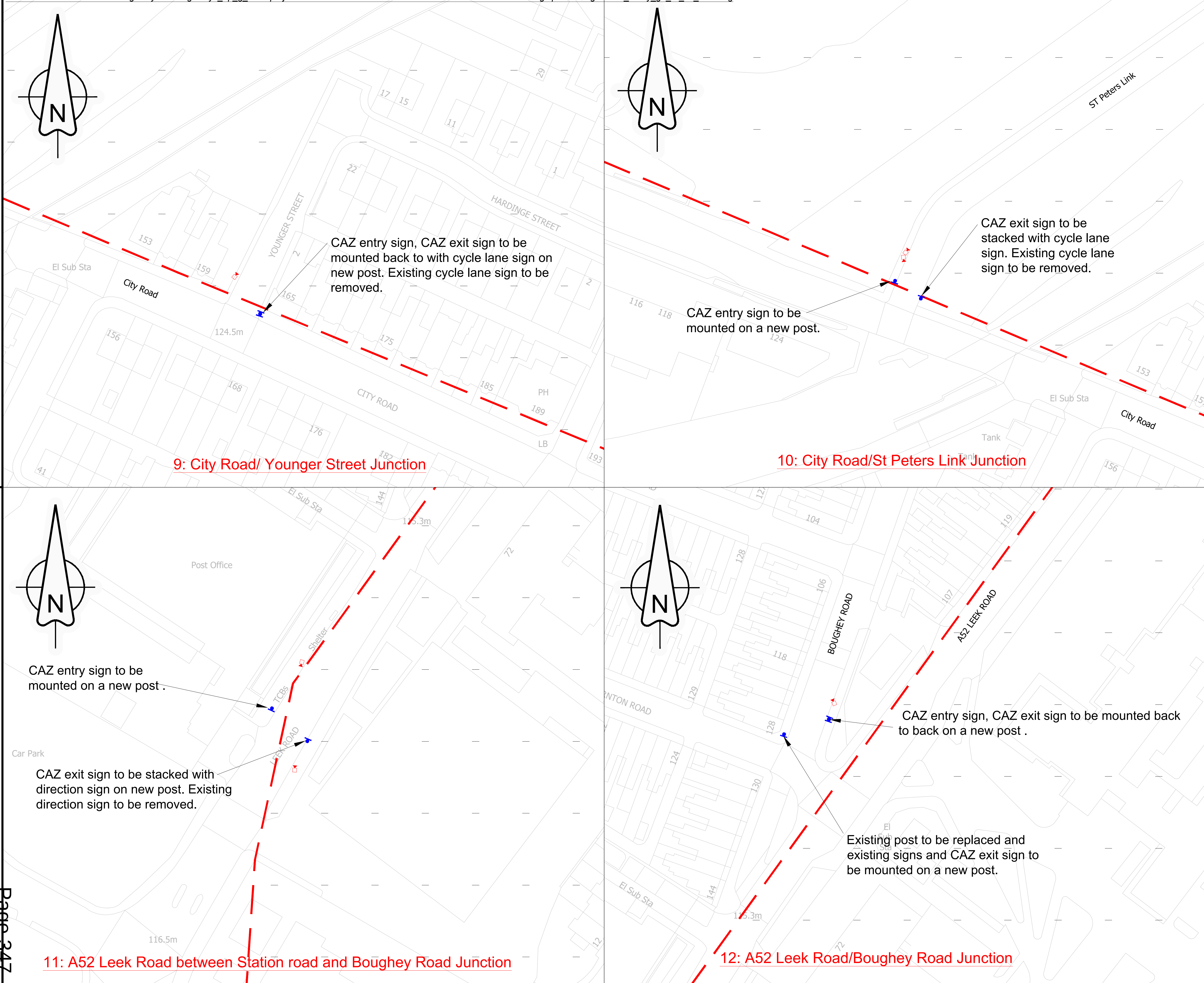


## NOTES

1. Location of statutory undertakers is yet to be determined and may affect the proposed design.

Key:

- Proposed Signs
- Existing Signs To Be Removed
- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
- Existing Vegetation Clearance
- Clean Air Zone Marking

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | |
|---|---|
| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name
North Staffordshire Local Air Quality Plan

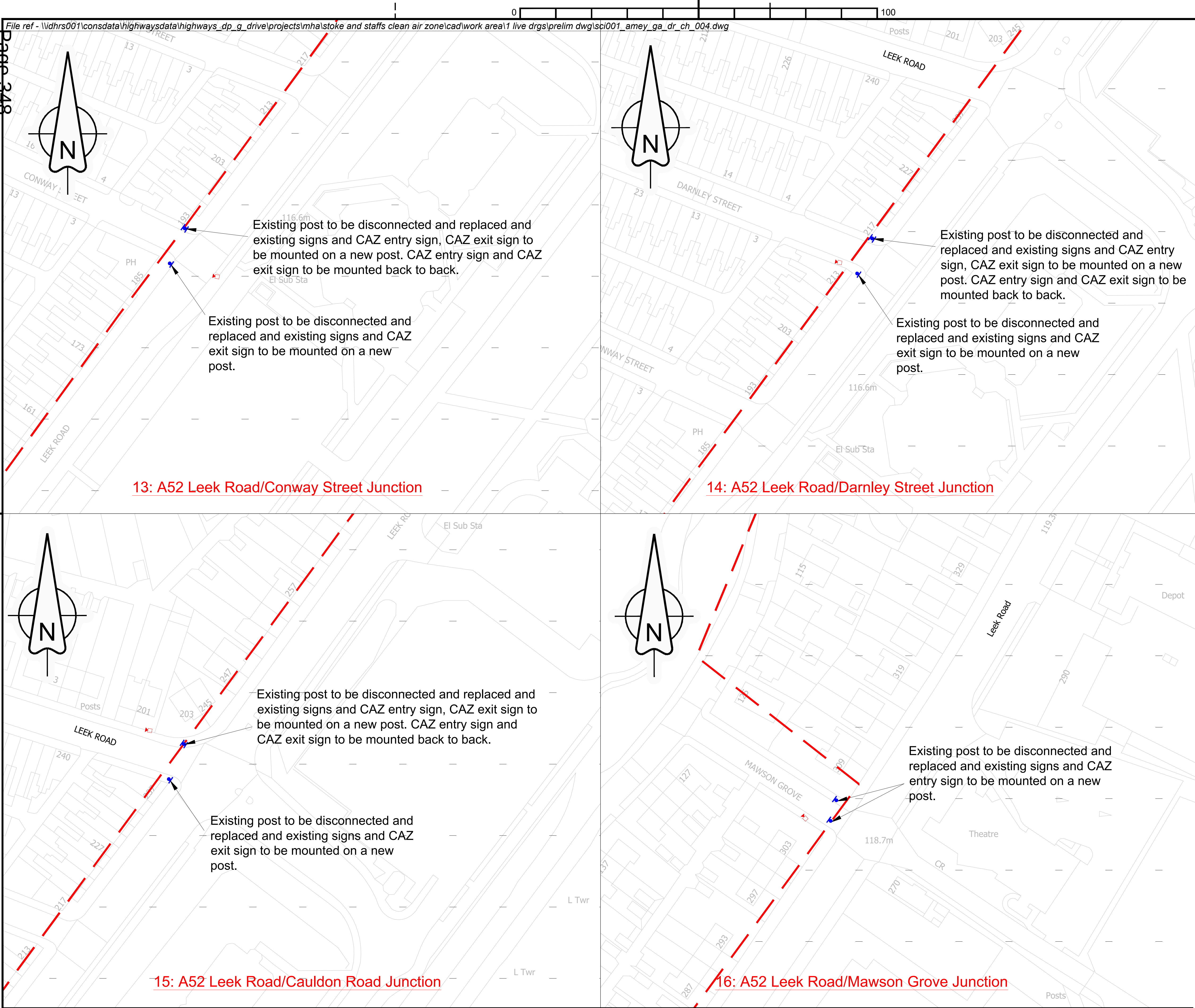
Drawing Title
Clear Air Zone
Sites 9-12

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
|---|---|
| SCI001-AMEY-GA-DR-CH-003 | P01 |

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001_amey_ga_dr_ch_004.dwg




## NOTES

1. Location of statutory undertakers is yet to be determined and may affect the proposed design.

Key:

- Proposed Signs
- Existing Signs To Be Removed
- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
- Existing Vegetation Clearance
- Clean Air Zone Marking

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | |
|---|---|
| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

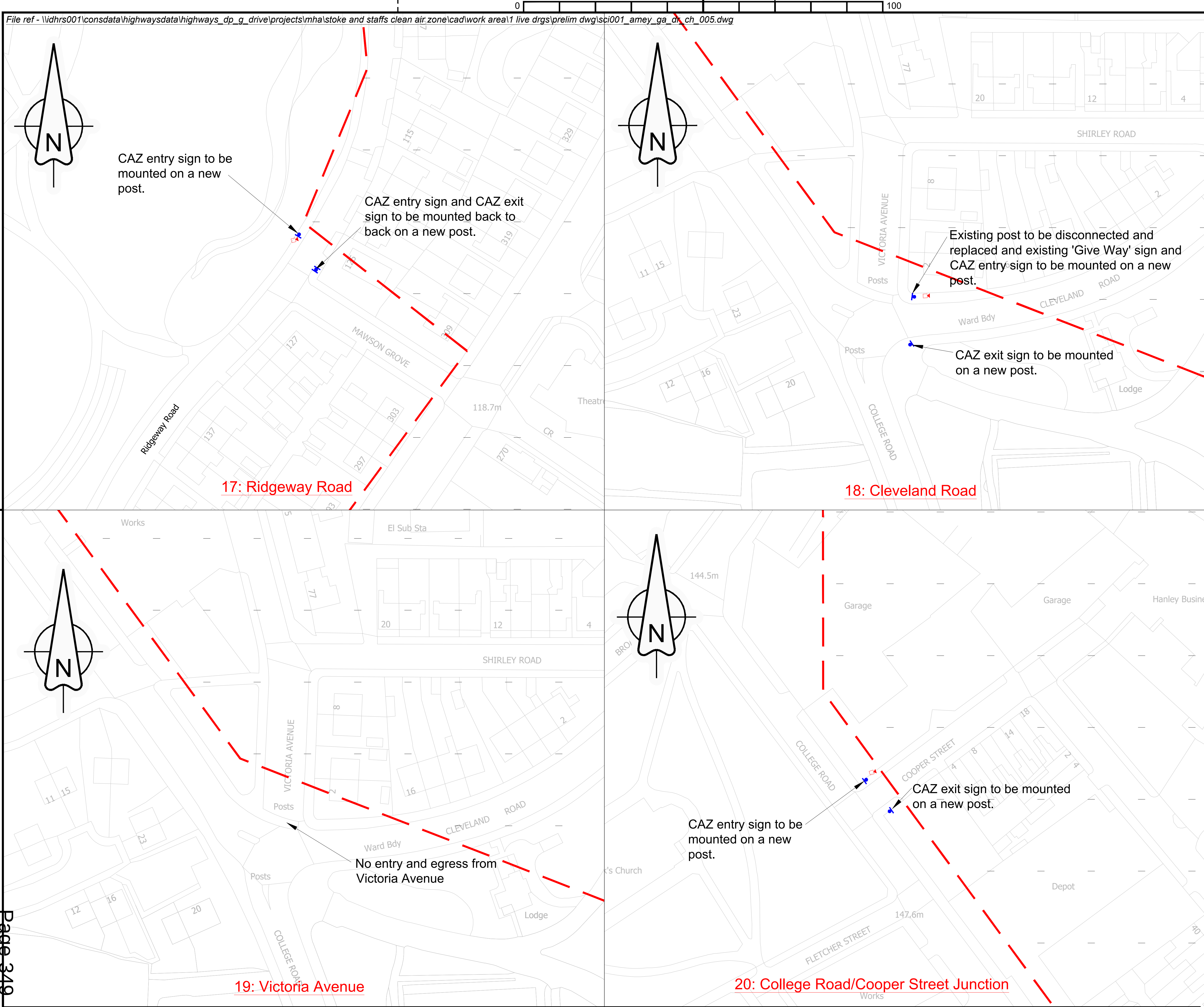
Project Name
North Staffordshire Local Air Quality Plan

Drawing Title
Clean Air Zone
13-16

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
|---|---|
| SCI001-AMEY-GA-DR-CH-004 | P01 |




## NOTES

1. Location of statutory undertakers is yet to be determined and may affect the proposed design.

Key:

- Proposed Signs
- Existing Signs To Be Removed
- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
- Existing Vegetation Clearance
- Clean Air Zone Marking

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | |
|---|---|
| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name
North Staffordshire Local Air Quality Plan

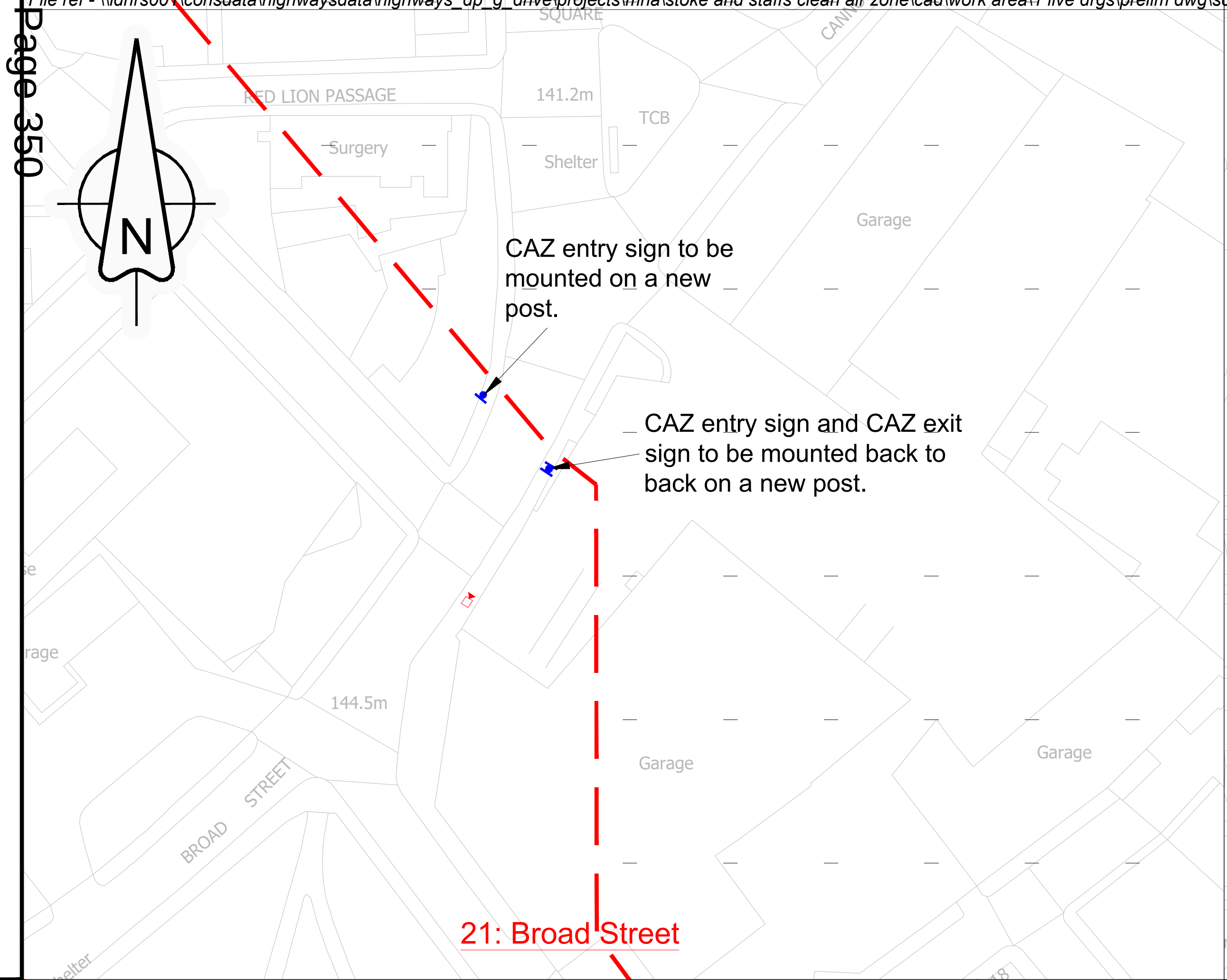
Drawing Title
Clean Air Zone
Sites 17-20

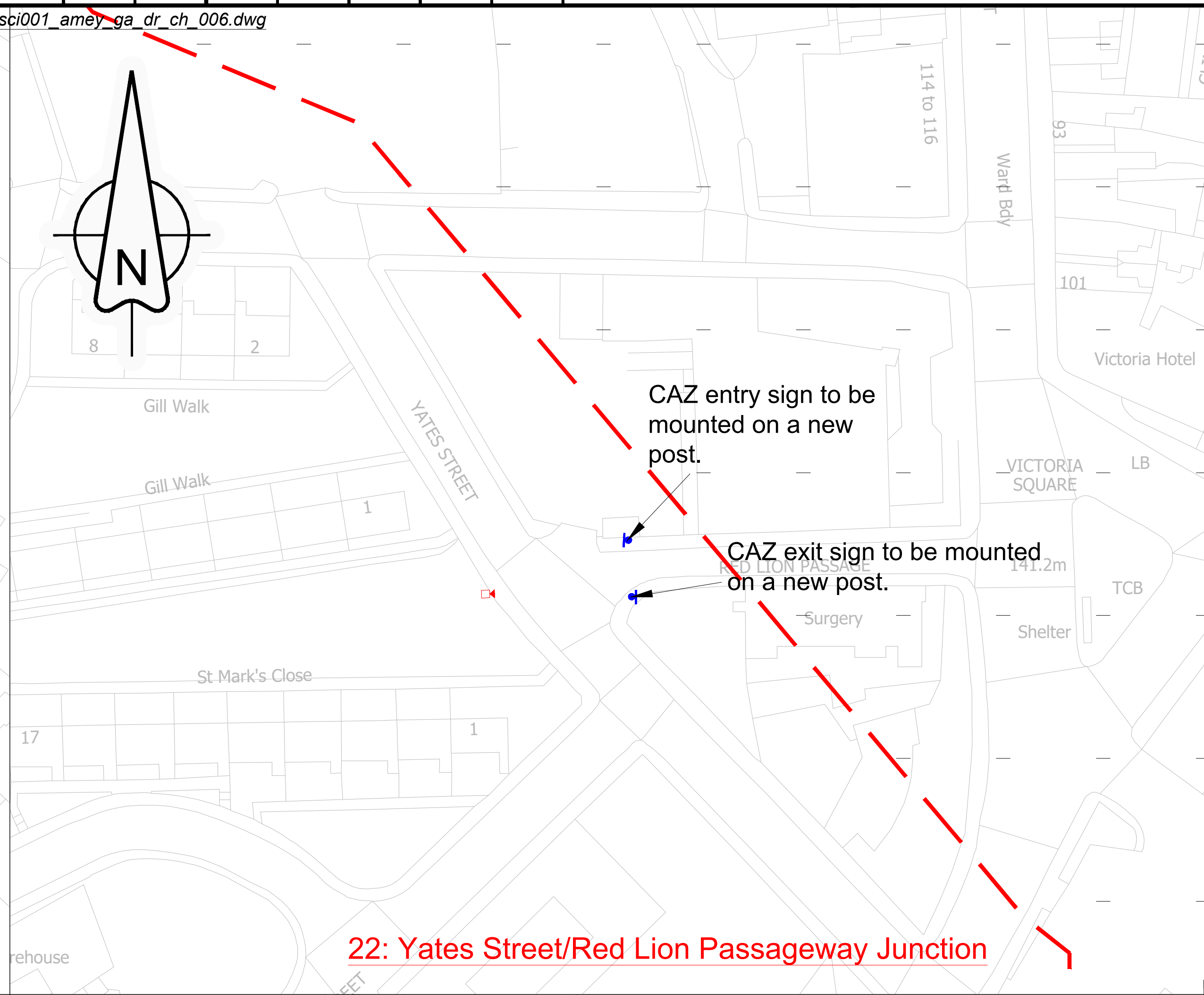
| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

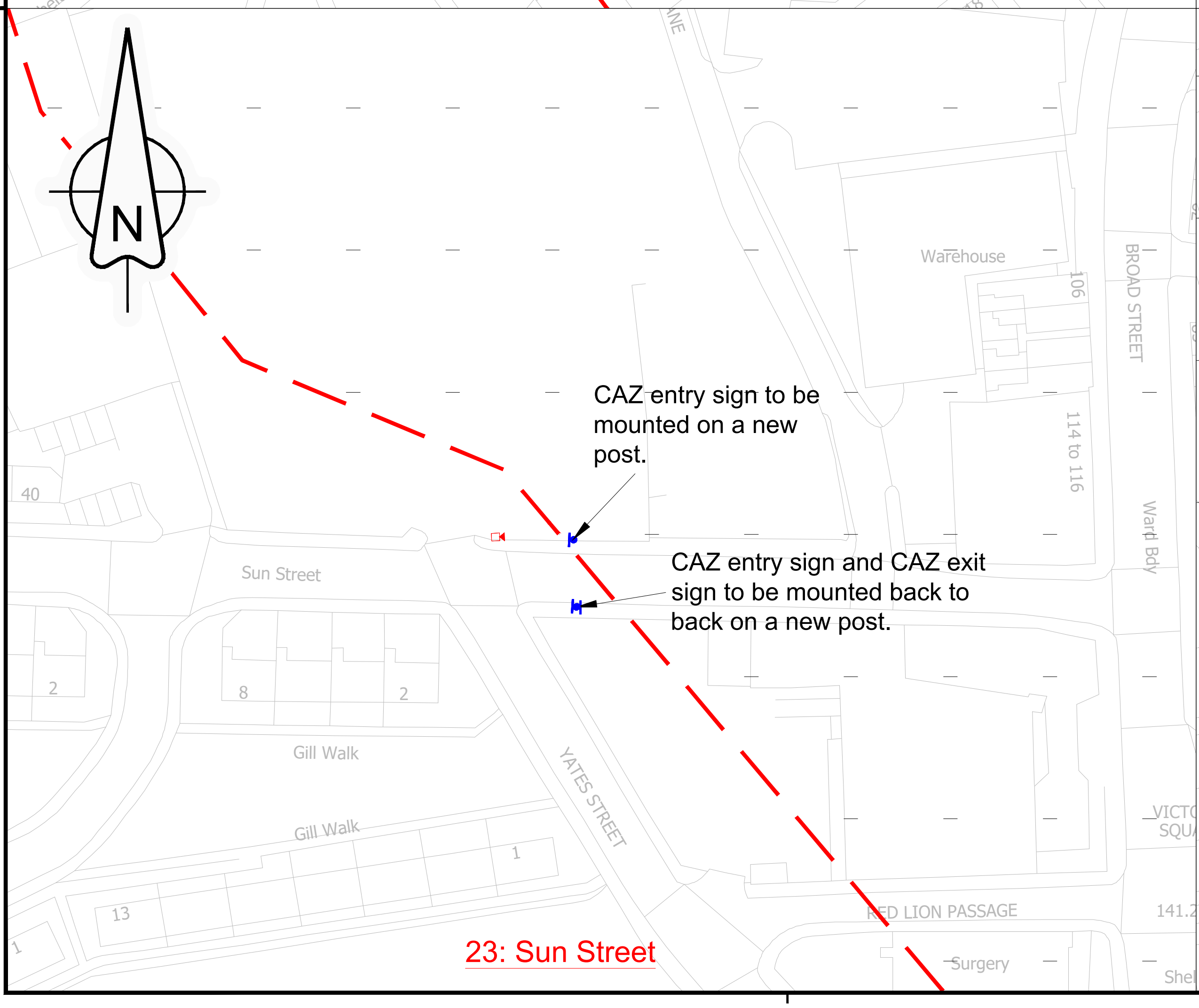
| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

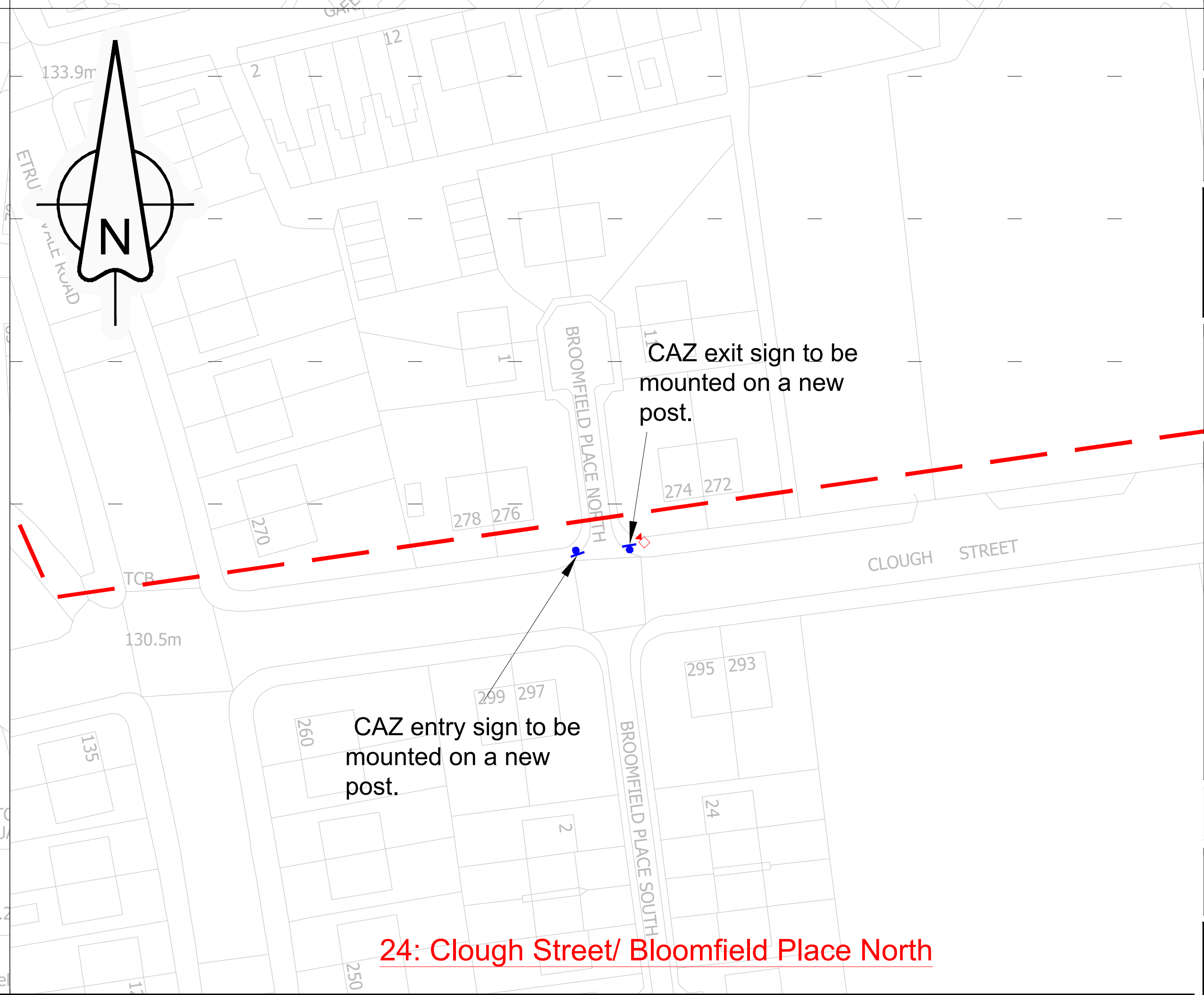
| Drawing No | Revision |
|---|---|
| SCI001-AMEY-GA-DR-CH-005 | P01 |

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001_amey_ga_dr_ch_006.dwg




0 — 100

## NOTES

1. Location of statutory undertakers is yet to be determined and may affect the proposed design.

Key:

- Proposed Signs
- Existing Signs To Be Removed
- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
- Existing Vegetation Clearance
- Clean Air Zone Marking

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | |
|---|---|
| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name

North Staffordshire Local Air Quality Plan

Drawing Title

Clean Air Zone 21-24

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
|---|---|
| SCI001-AMEY-GA-DR-CH-006 | P01 |

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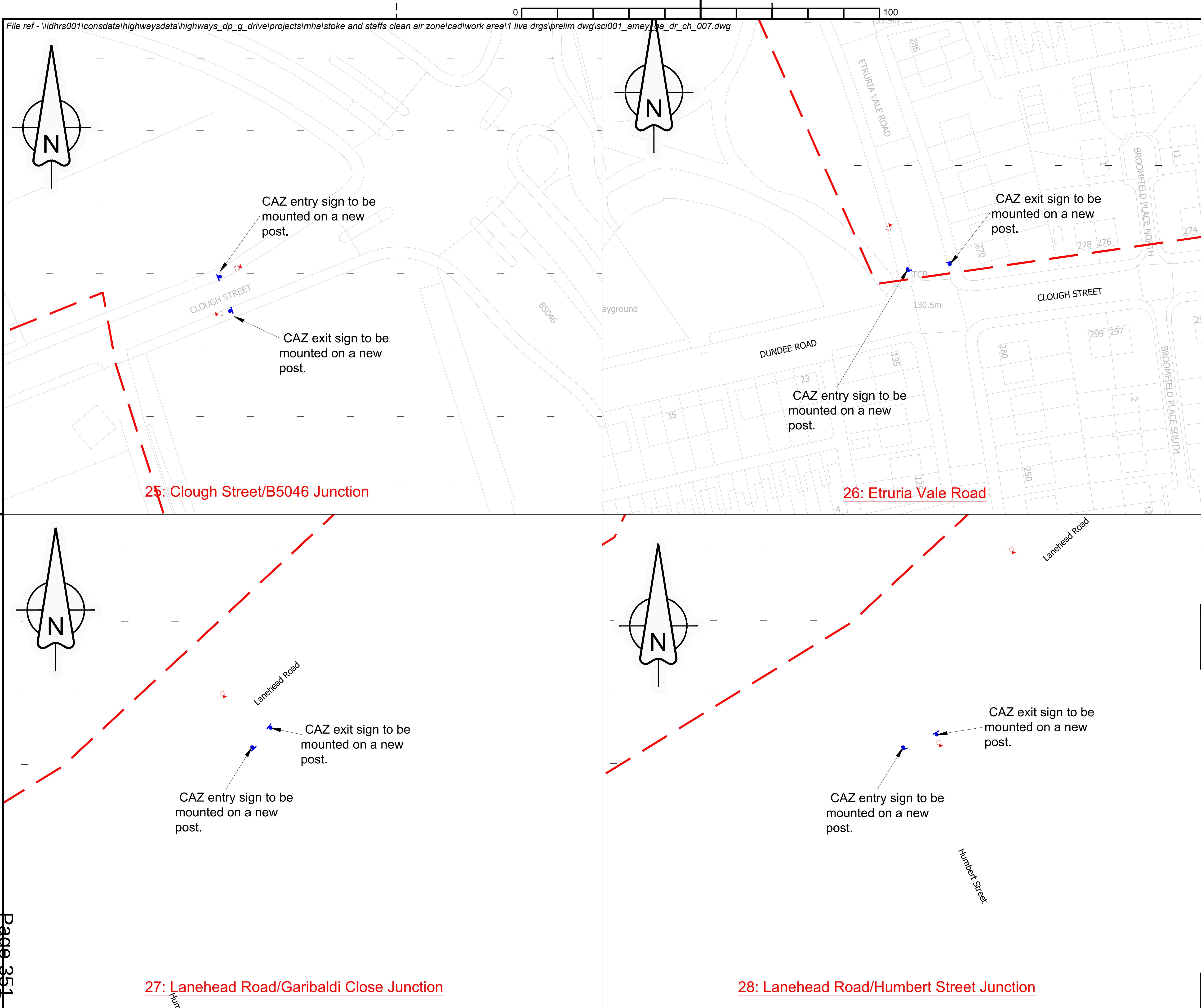


NOTES

1. Location of statutory undertakers is yet to be determined and may affect the proposed design.

Key:

- Proposed Signs
- Existing Signs To Be Removed
- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
- Existing Vegetation Clearance
- Clean Air Zone Marking

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | |
|---|---|
| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name

North Staffordshire Local Air Quality Plan

Drawing Title

Clean Air Zone Sites 25-28

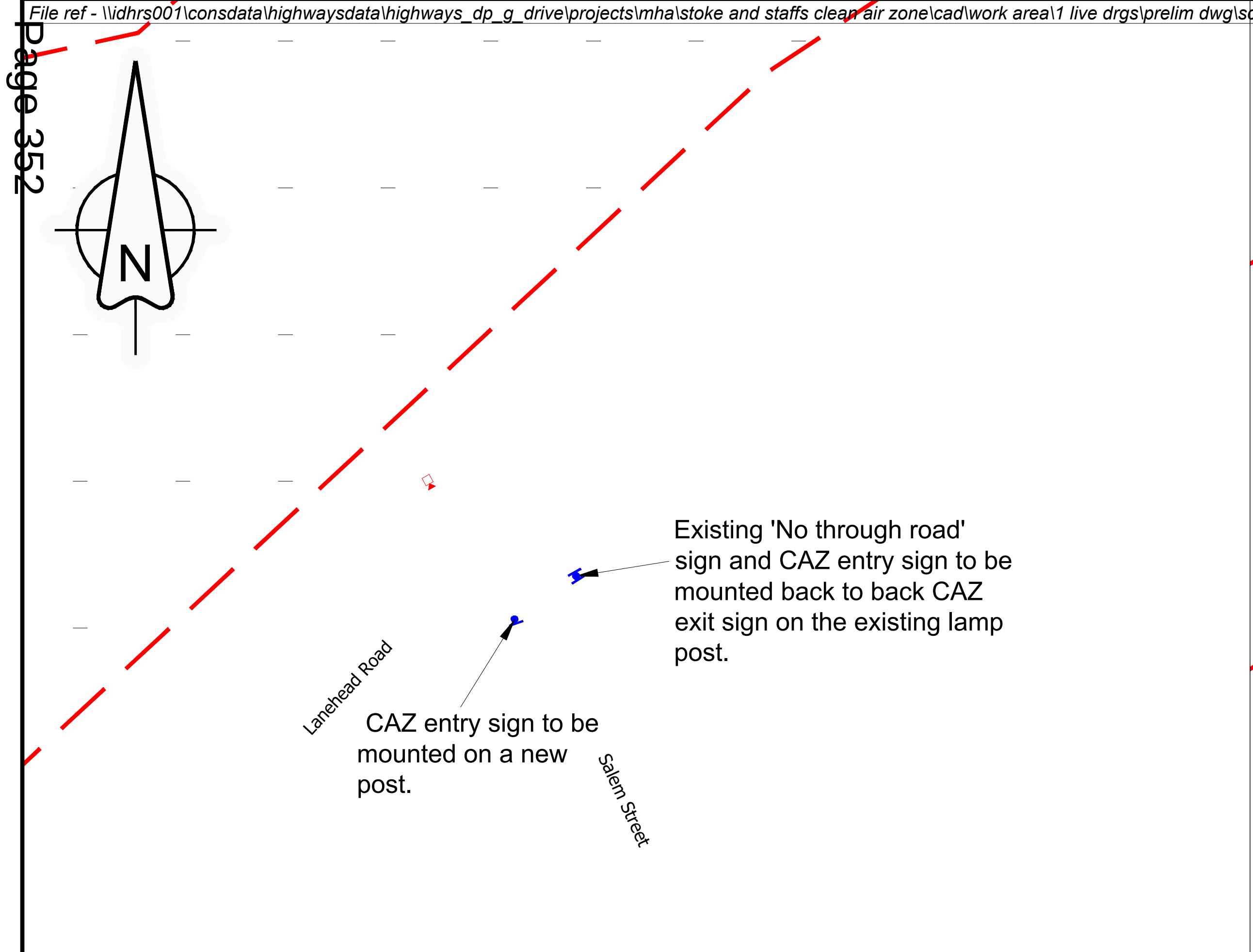
Original Drg Size : A3 | Scale : 1:1000

Dimensions : -

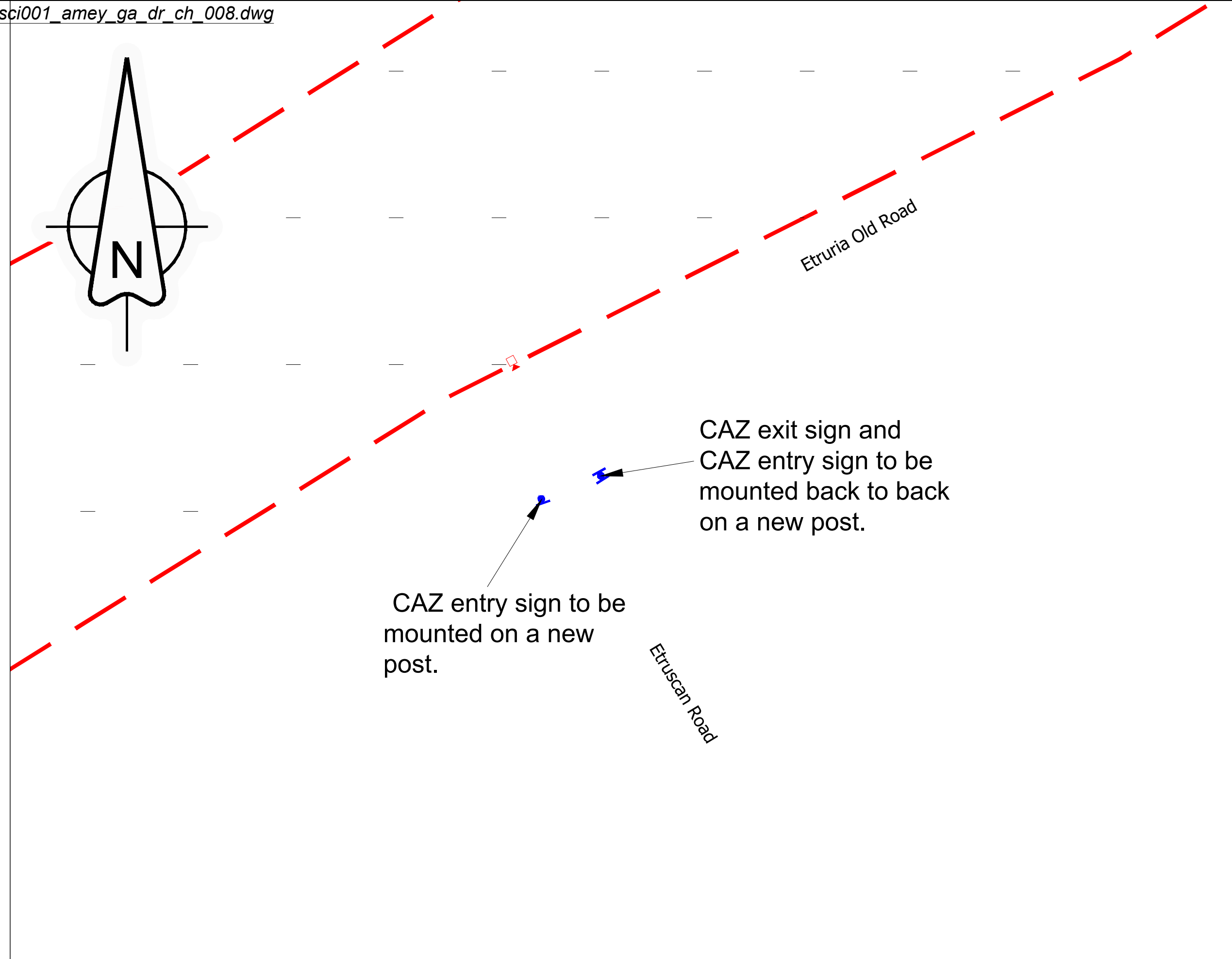
Drawing Status: SUITABLE FOR STAGE APPROVAL | Suitability: S4

Drawing No: SCI001-AMEY-GA-DR-CH-007 | Revision: P01

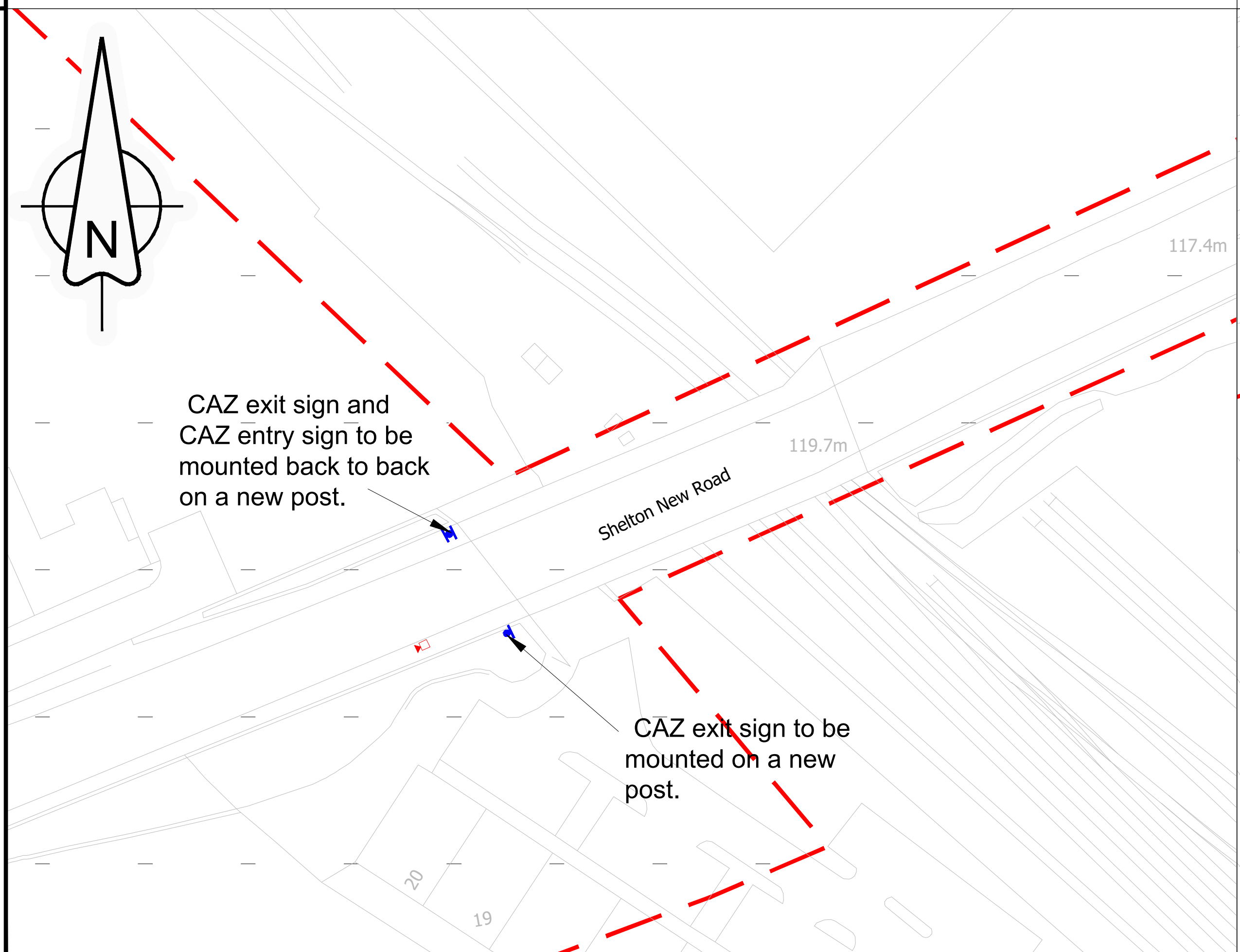
File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001_amey_ga_dr_ch_008.dwg



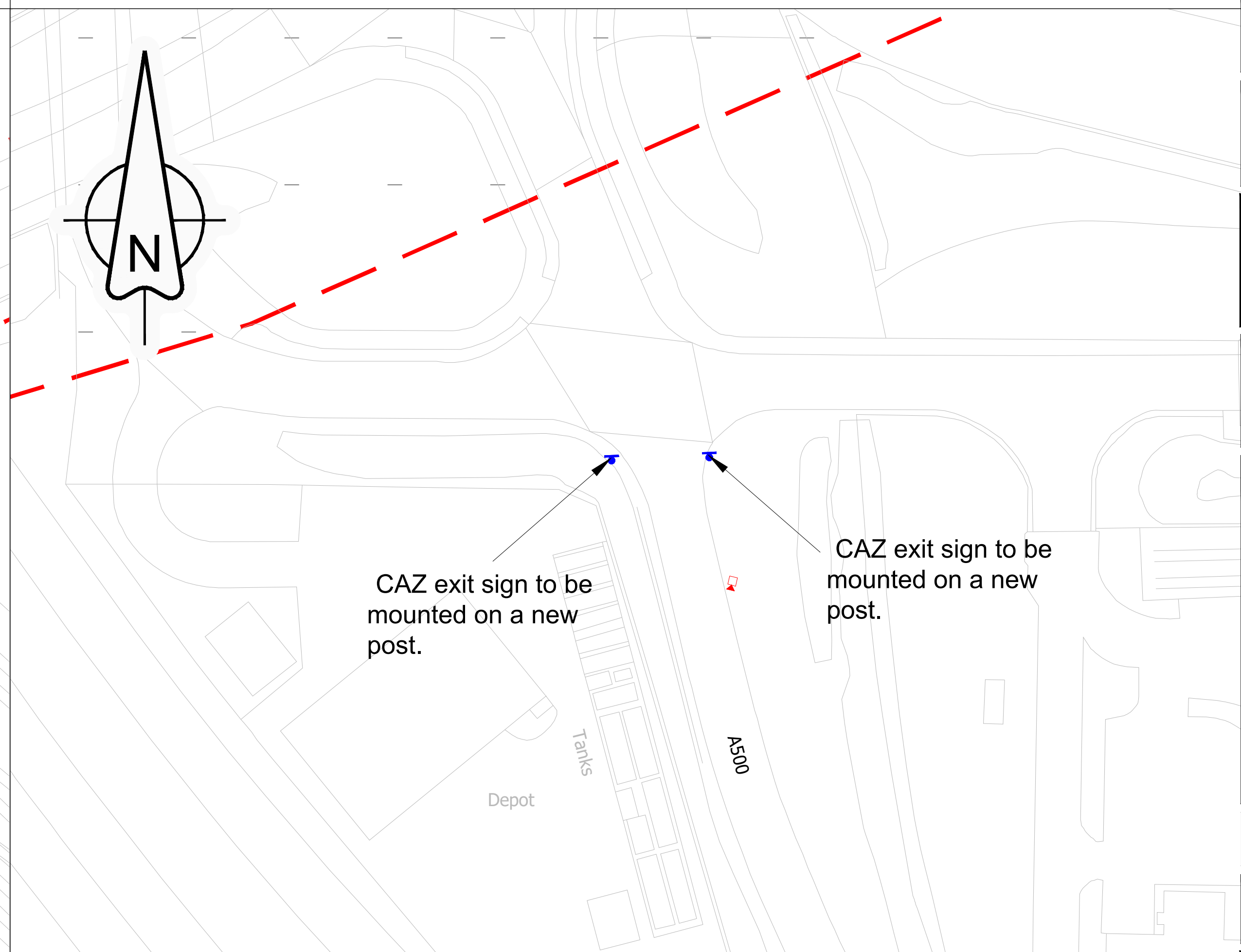

29: Lanehead Road/Salem Street Junction




30: Etruscan Street/Etruria Old Road Junction




31: Shelton New Road Immediately West of Rail Bridge




32: A500 Entry Slip/Garner Street Junction

NOTES

1. Location of statutory undertakers is yet to be determined and may affect the proposed design.

Key:

- Proposed Signs
- Existing Signs To Be Removed
- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
- Existing Vegetation Clearance
- Clean Air Zone Marking

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | |
|---|---|
| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name
North Staffordshire Local Air Quality Plan

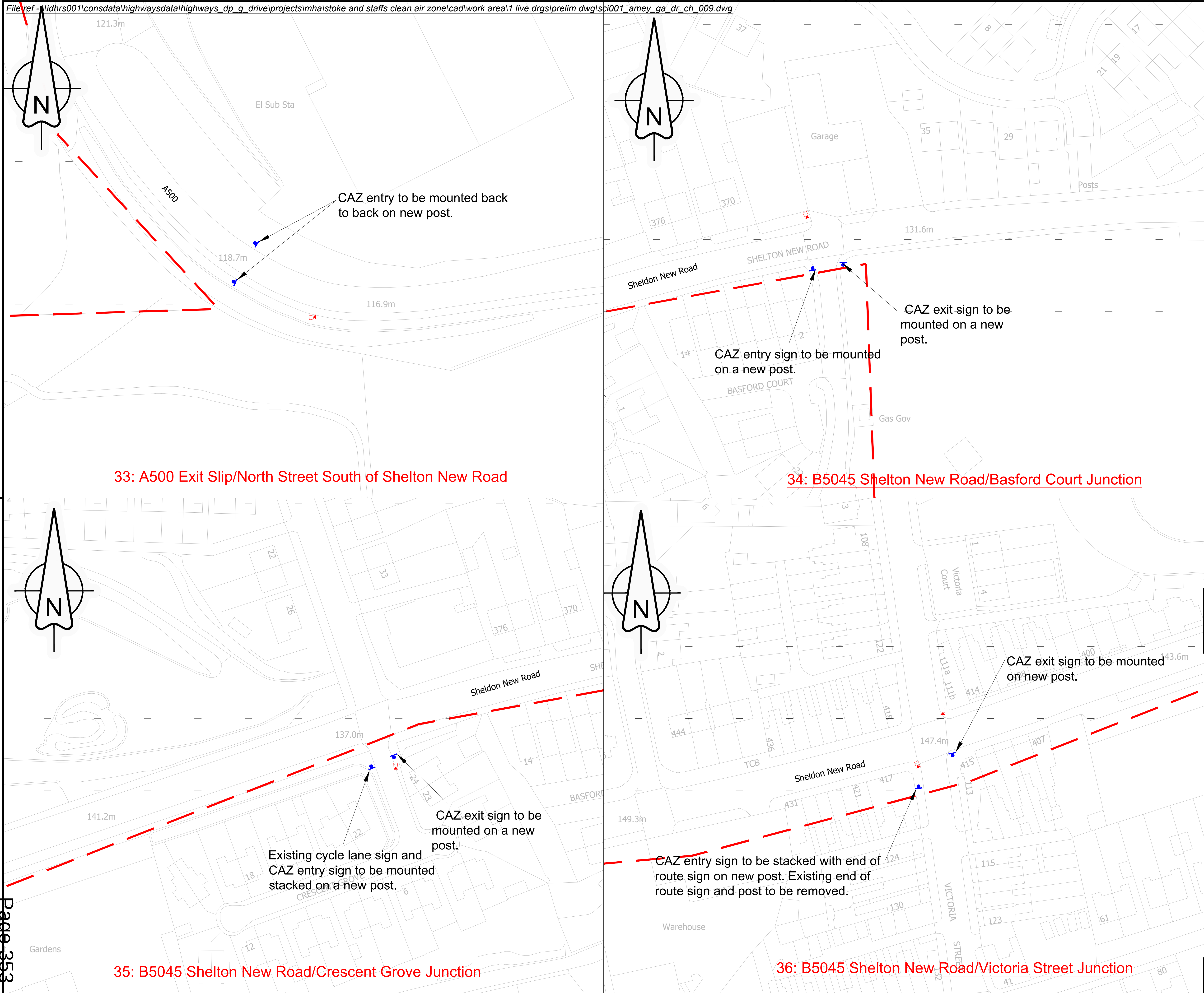
Drawing Title
Clean Air Zone
Sites 29-32

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
|---|---|
| SCI001-AMY-GA-DR-CH-008 | P01 |

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001_amey_ga_dr_ch_009.dwg




## NOTES

1. Location of statutory undertakers is yet to be determined and may affect the proposed design.

Key:

- Proposed Signs
- Existing Signs To Be Removed
- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
- Existing Vegetation Clearance
- Clean Air Zone Marking

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | |
|---|---|
| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name
North Staffordshire Local Air Quality Plan

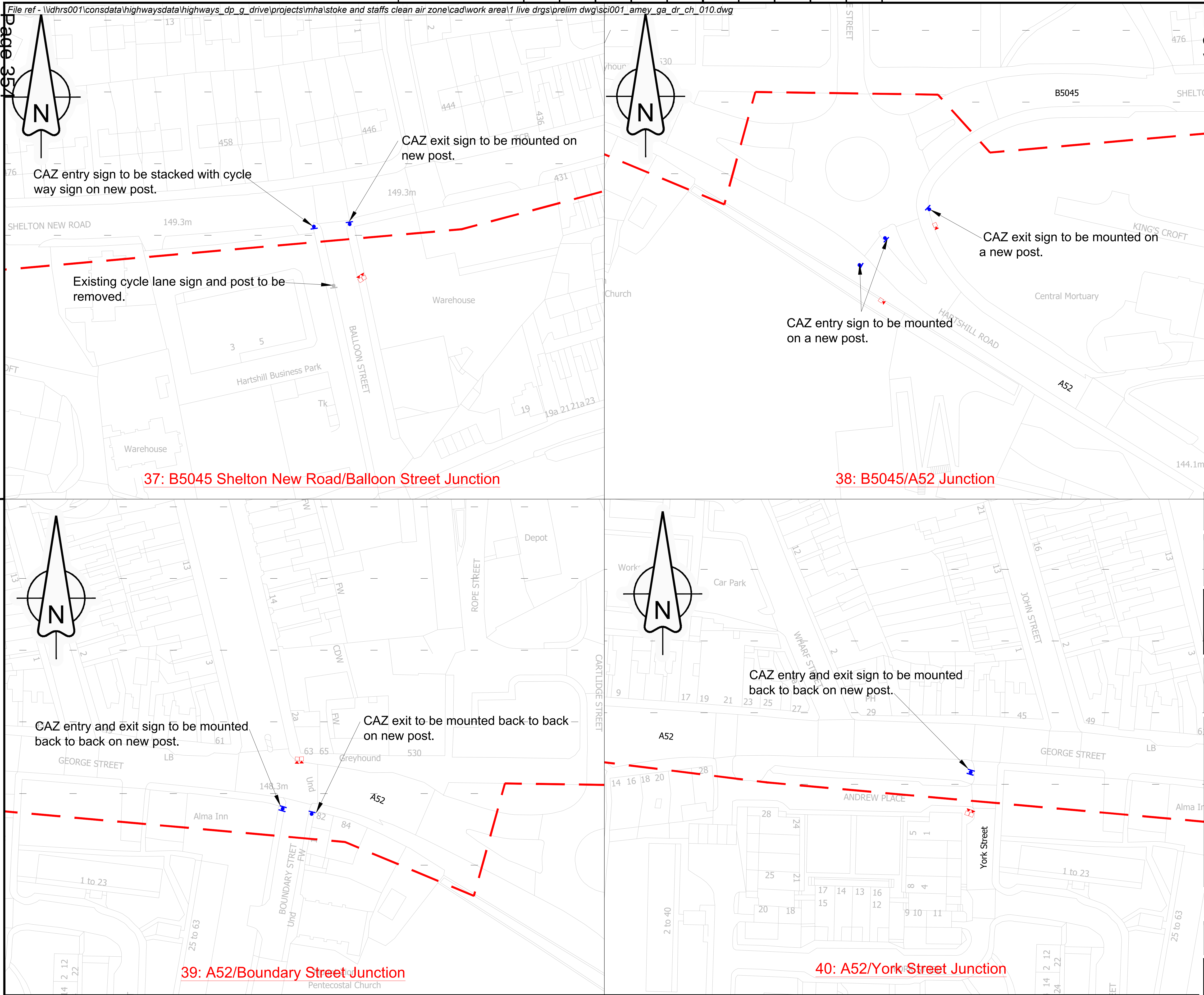
Drawing Title
Clean Air Zone
Sites 33-36

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
|---|---|
| SCI001-AMEY-GA-DR-CH-009 | P01 |

File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001_amey_ga_dr_ch_010.dwg




NOTES

1. Location of statutory undertakers is yet to be determined and may affect the proposed design.

Key:

- Proposed Signs
- Existing Signs To Be Removed
- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
- Existing Vegetation Clearance
- Clean Air Zone Marking

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | |
|---|---|
| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name
North Staffordshire Local Air Quality Plan

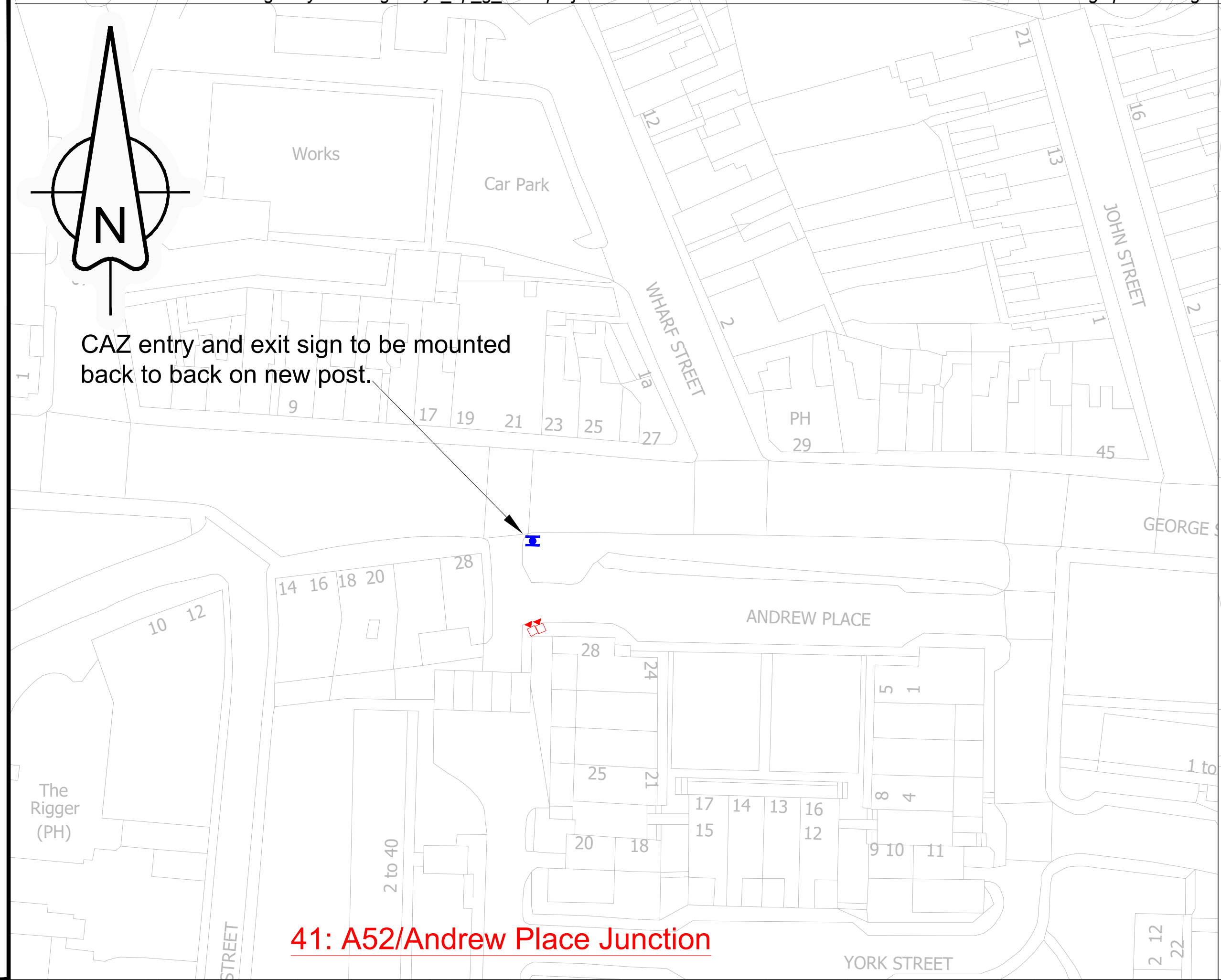
Drawing Title
Clean Air Zone
Sites 37-40

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

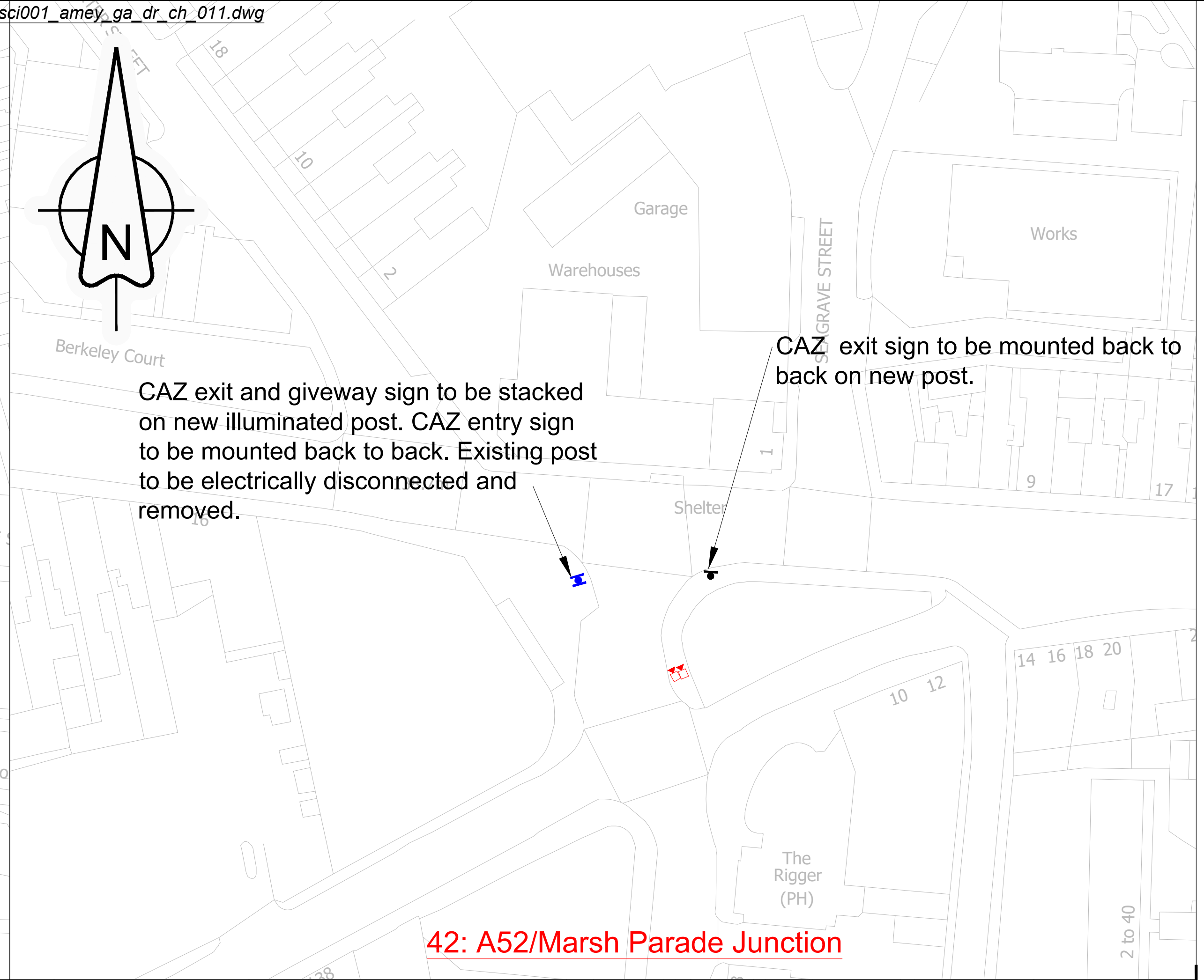
| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
|---|---|
| SCI001-AMEY-GA-DR-CH-010 | P01 |

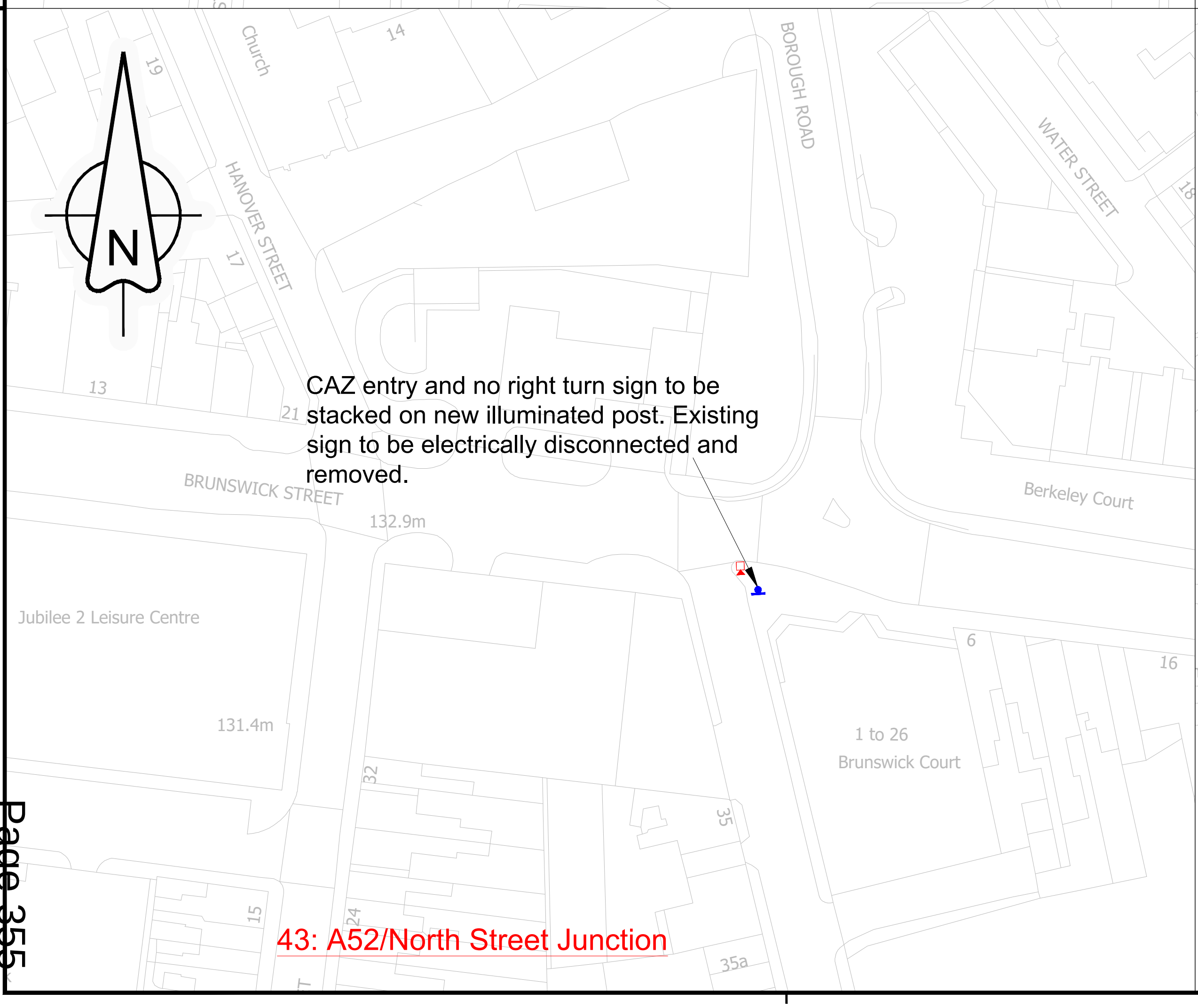
File ref - \\idhrs001\consdata\highwaysdata\highways_dp_g_drive\projects\mha\stoke and staffs clean air zone\cad\work area\1 live drgs\prelim dwg\sci001_amey_ga_dr_ch_011.dwg



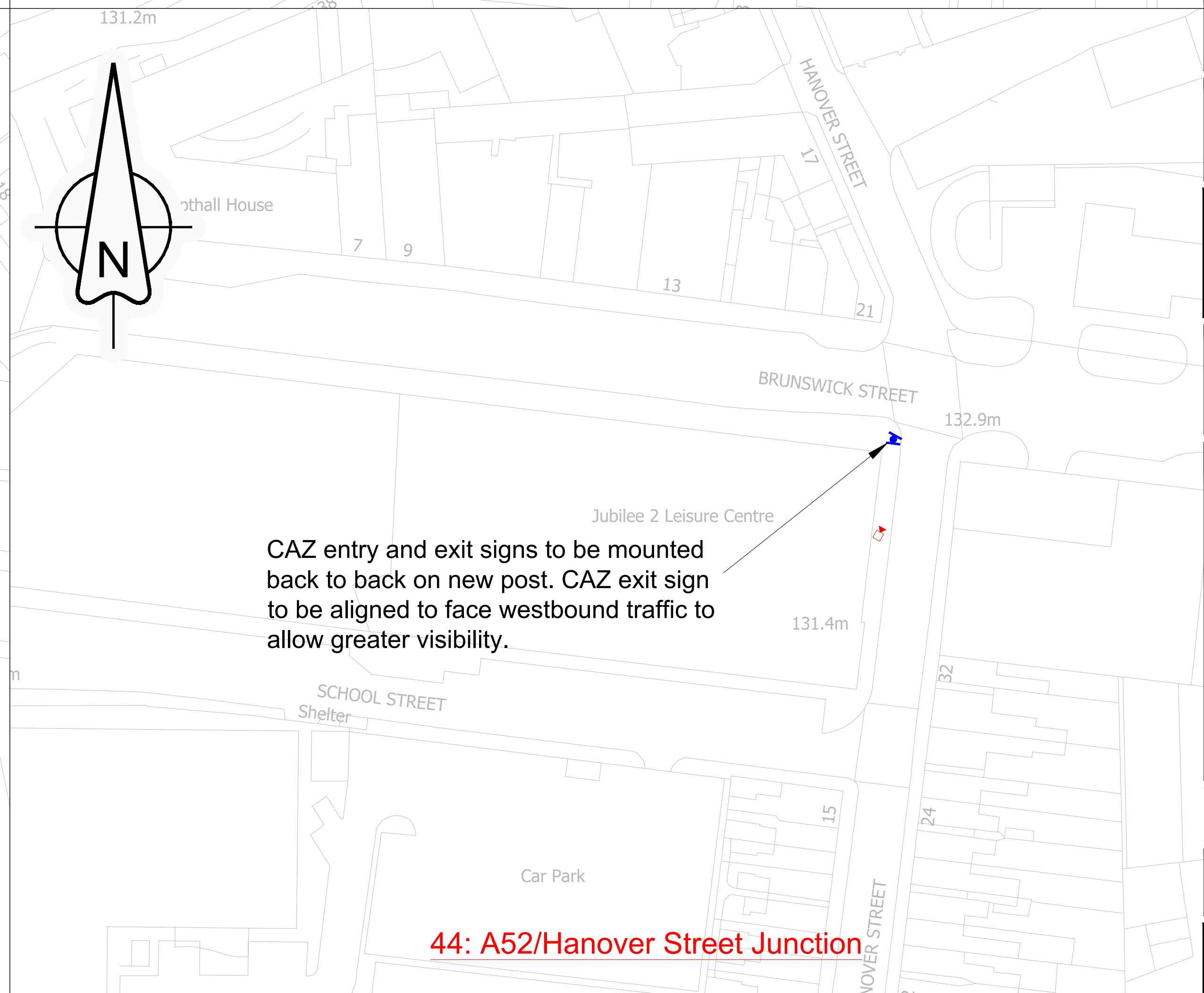

41: A52/Andrew Place Junction




42: A52/Marsh Parade Junction




43: A52/North Street Junction




44: A52/Hanover Street Junction

NOTES

1. Location of statutory undertakers is yet to be determined and may affect the proposed design.

Key:

- Proposed Signs
- Existing Signs To Be Removed
- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
- Existing Vegetation Clearance

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | |
|---|---|
| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name

North Staffordshire Local Air Quality Plan

Drawing Title

Clean Air Zone
Sites 41-44

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
|---|---|
| SCI001-AMEY-GA-DR-CH-011 | P01 |

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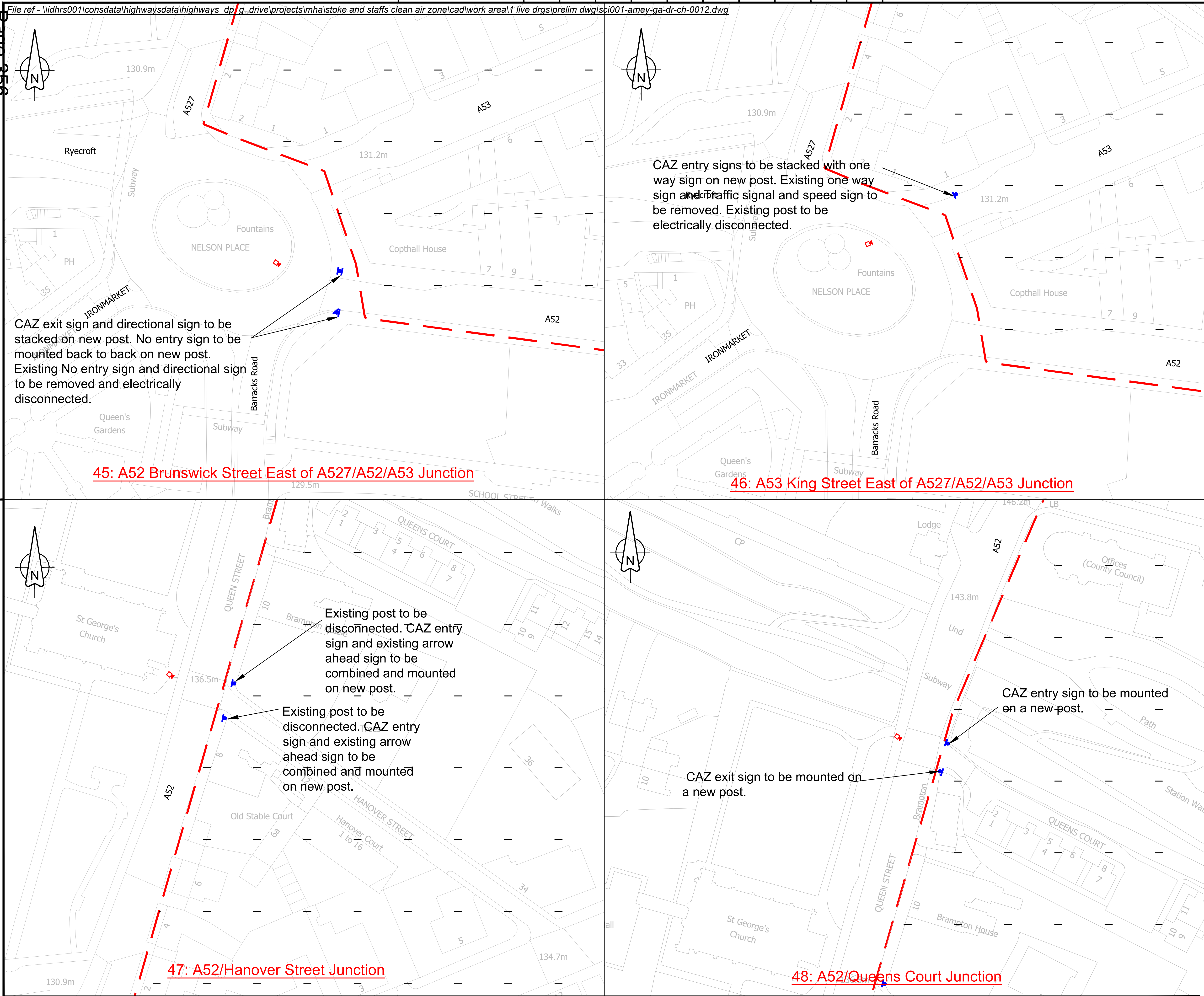


NOTES

1. Location of statutory undertakers is yet to be determined and may affect the proposed design.

Key:

- Proposed Signs
- Existing Signs To Be Removed
- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
- Existing Vegetation Clearance
- Clean Air Zone Marking

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

Designed: UH — Date: 17.02.20
Drawn: UH — Date: 17.02.20
Checked: HH — Date: 06.03.20
Approved: OG — Date: 06.03.20



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Staffordshire County Council

Project Name
North Staffordshire Local Air Quality Plan

Drawing Title
Clean Air Zone
Sites 45-48

Original Drg Size : A3 — Scale : 1:1000
Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL — Suitability: S4

Drawing No: SCI001-AMEY-GA-DR-CH-012 — Revision: P01

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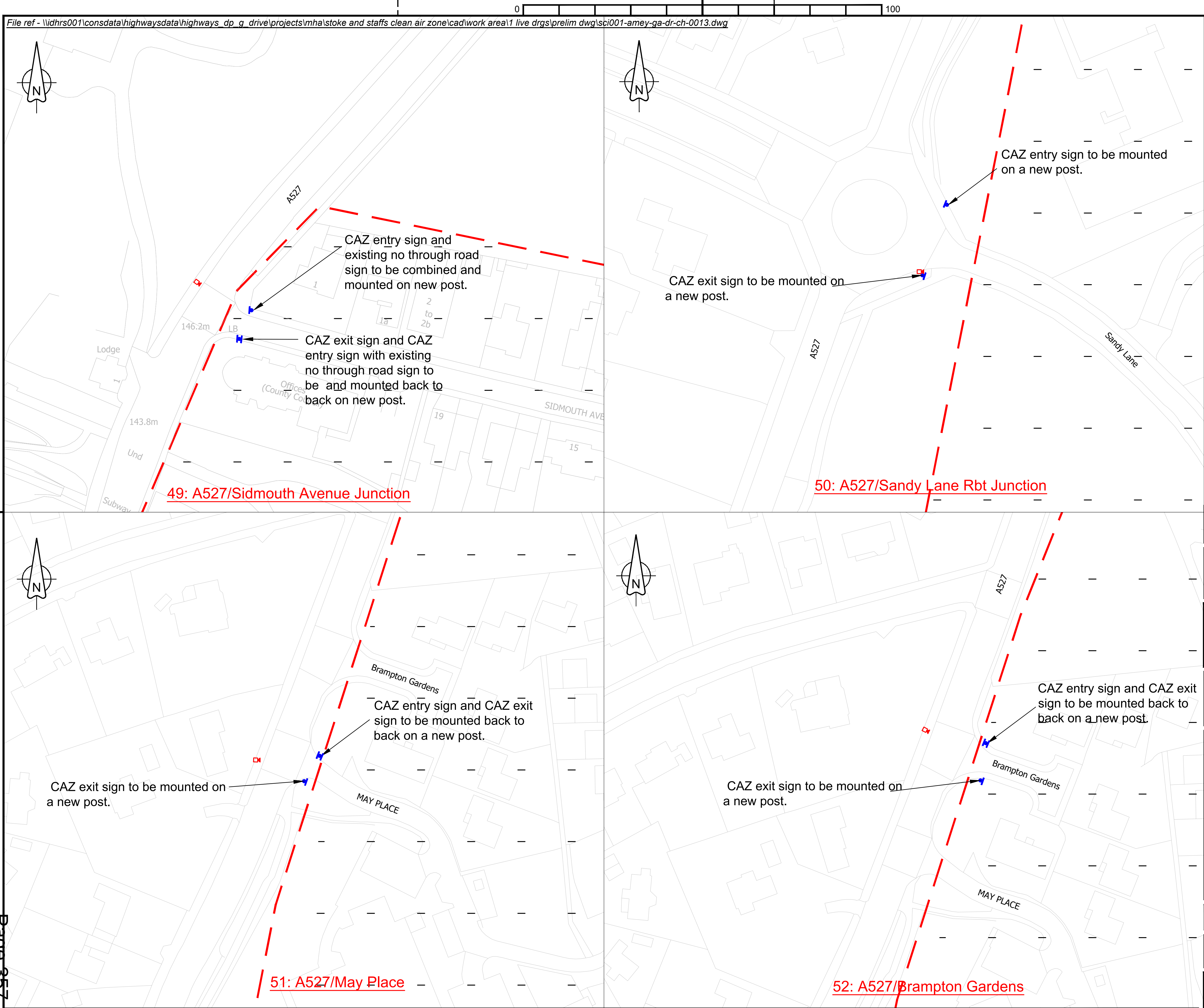


NOTES

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Key:

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- Existing Signs To Be Removed
- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
- Existing Vegetation Clearance
- Clean Air Zone Marking

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | |
|---|---|
| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name

North Staffordshire Local Air Quality Plan

Drawing Title

Clean Air Zone Sites 49-52

Original Drg Size : A3 | Scale : 1:1000

Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL | Suitability: S4

Drawing No: SCI001-AMEY-GA-DR-CH-013 | Revision: P01

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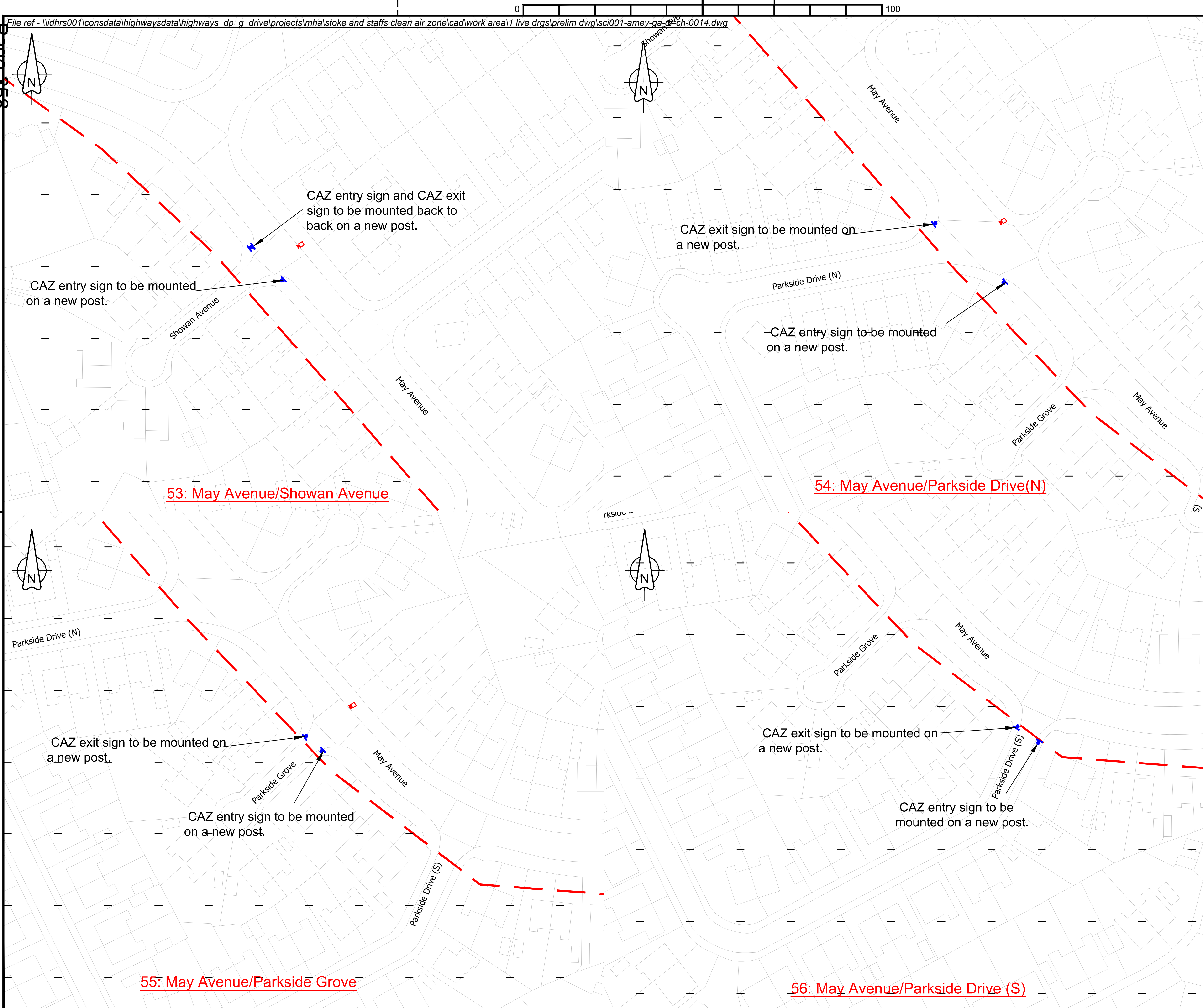


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- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
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- Clean Air Zone Marking

| Rev | Rev details | Drwn | Chkd | Appd | Date |
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| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name
North Staffordshire Local Air Quality Plan

Drawing Title
Clean Air Zone
Sites 53-56

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
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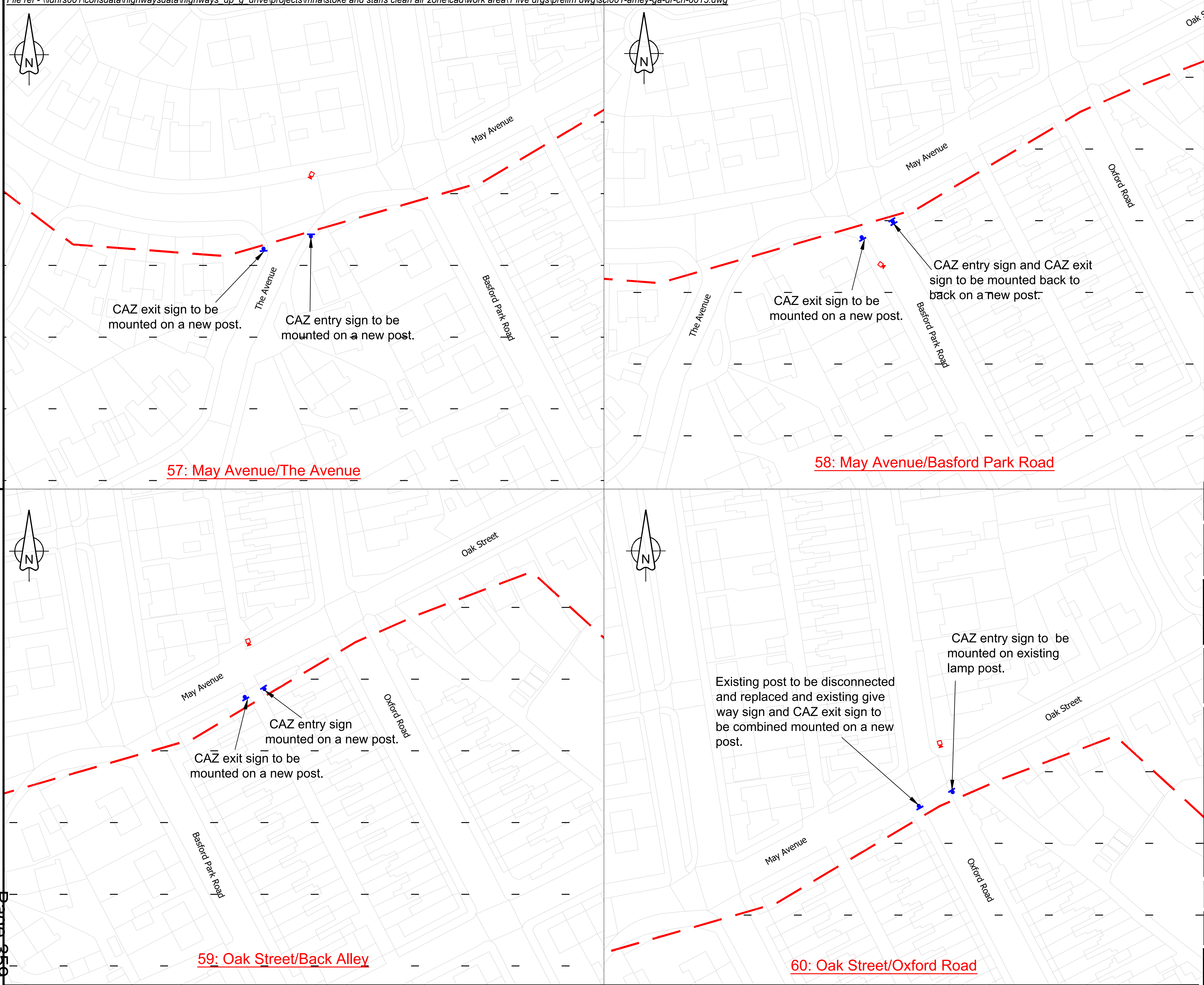


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- Proposed ANPR Cameras Fixed to existing pillar
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|---|---|---|---|---|---|

| | |
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| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name

North Staffordshire Local Air Quality Plan

Drawing Title

Clean Air Zone Sites 57-60

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
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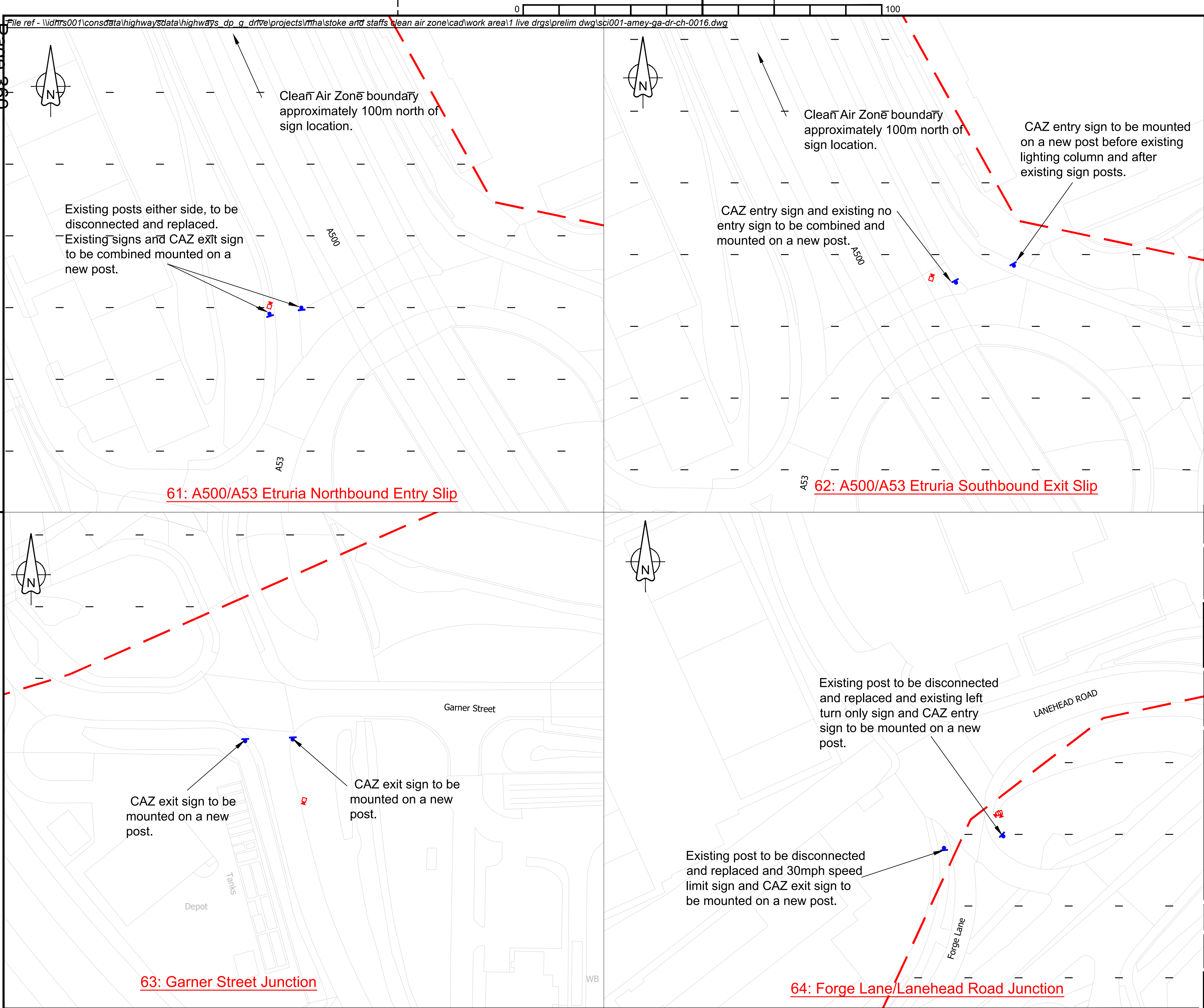


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| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

NEWCASTLE UNDER LYME

City of Stoke-on-Trent

Project Name
North Staffordshire Local Air Quality Plan

Drawing Title
Clean Air Zone
Sites 61-64

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
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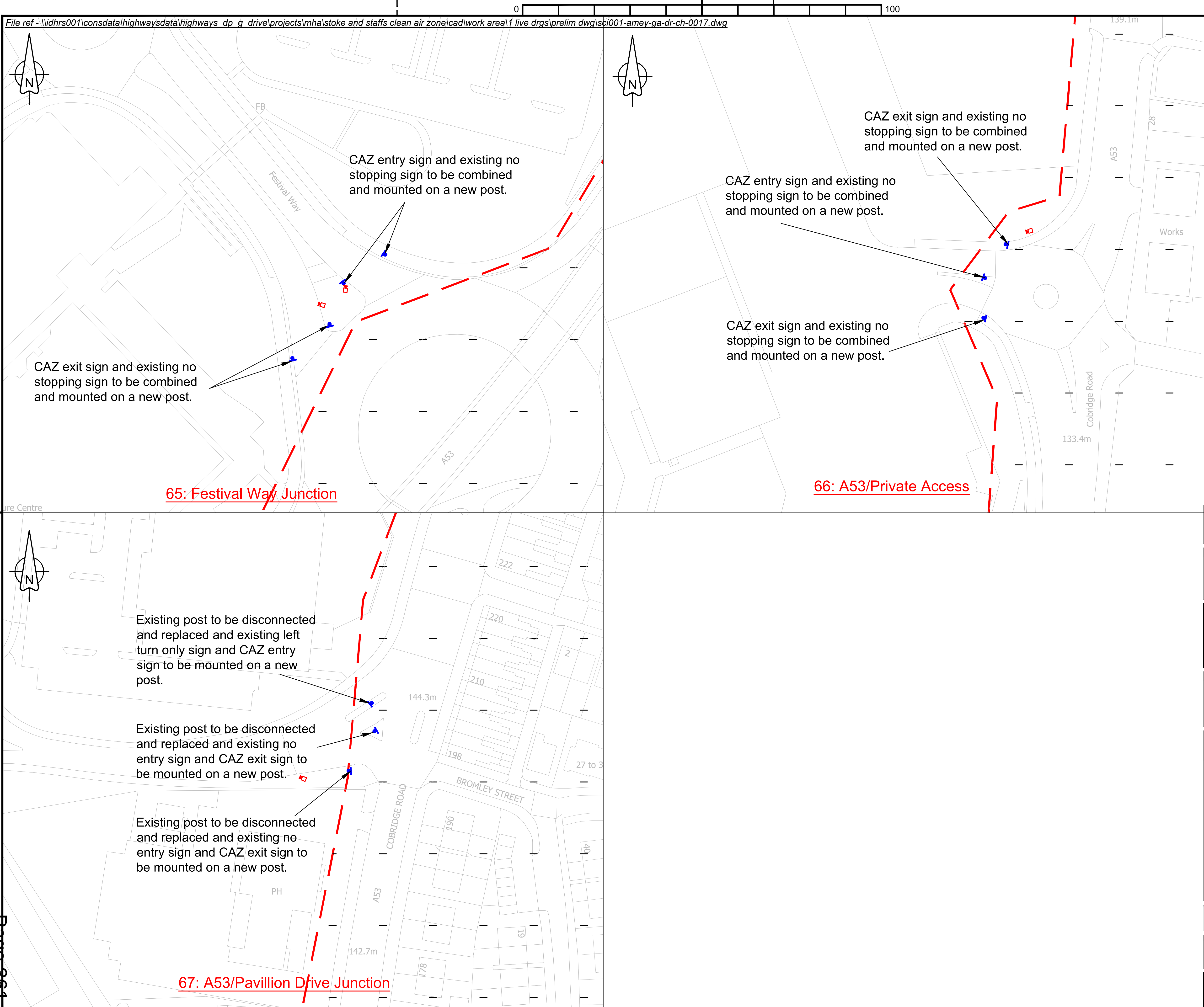


NOTES

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- Proposed ANPR Cameras stand alone
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| Rev | Rev details | Drwn | Chkd | Appd | Date |
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| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name
North Staffordshire Local Air Quality Plan

Drawing Title
Clean Air Zone
Sites 65-67

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
|---|---|
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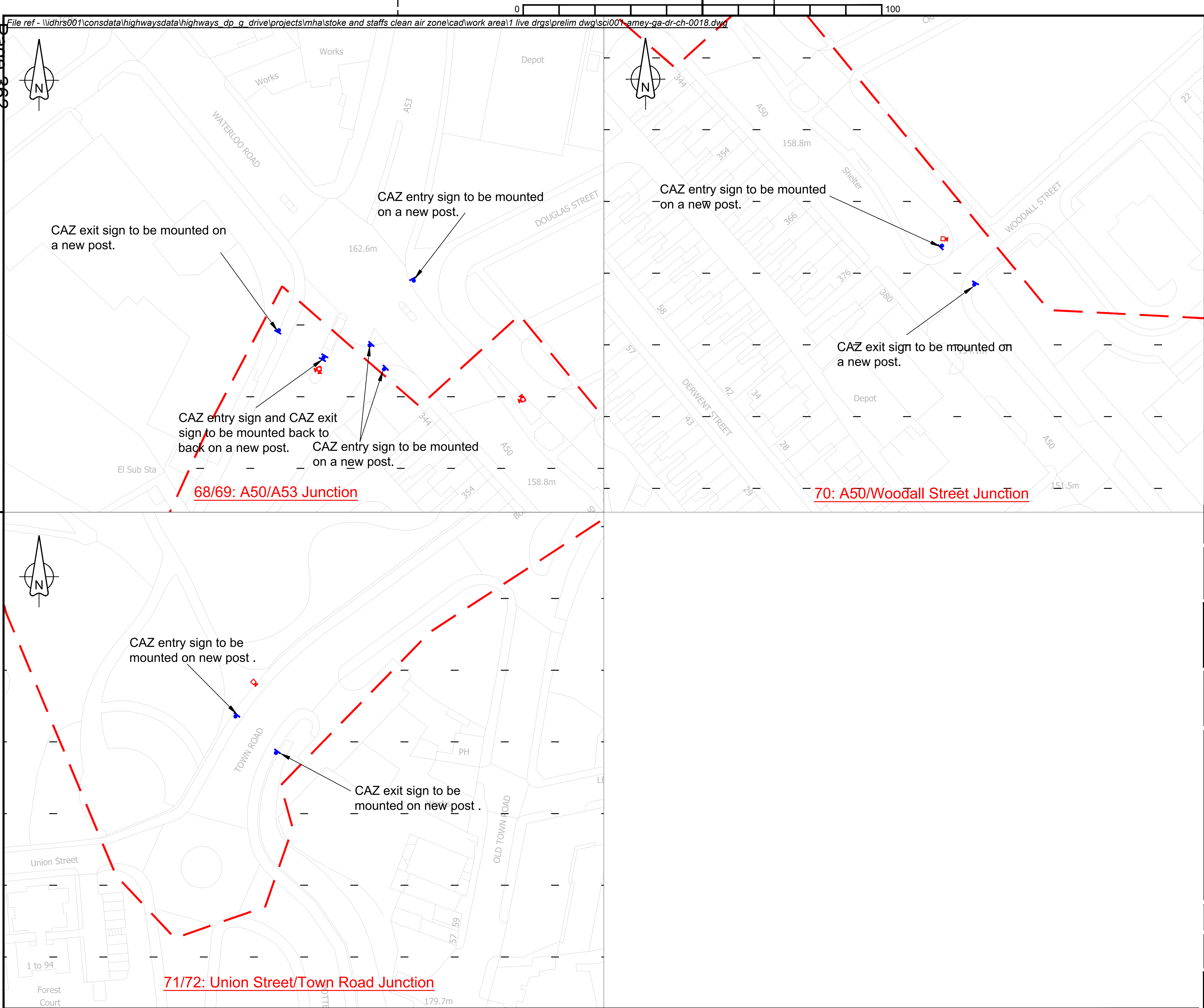


NOTES

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- Proposed ANPR Cameras Fixed to existing pillar
- Existing Vegetation Clearance
- Clean Air Zone Marking

| Rev | Rev details | Drwn | Chkd | Appd | Date |
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| --- | --- |
| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name

North Staffordshire Local Air Quality Plan

Drawing Title

Clean Air Zone Sites 68-72

Original Drg Size : A3 Scale : 1:1000

Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL

Suitability: S4

Drawing No: SCI001-AMEY-GA-DR-CH-018

Revision: P01

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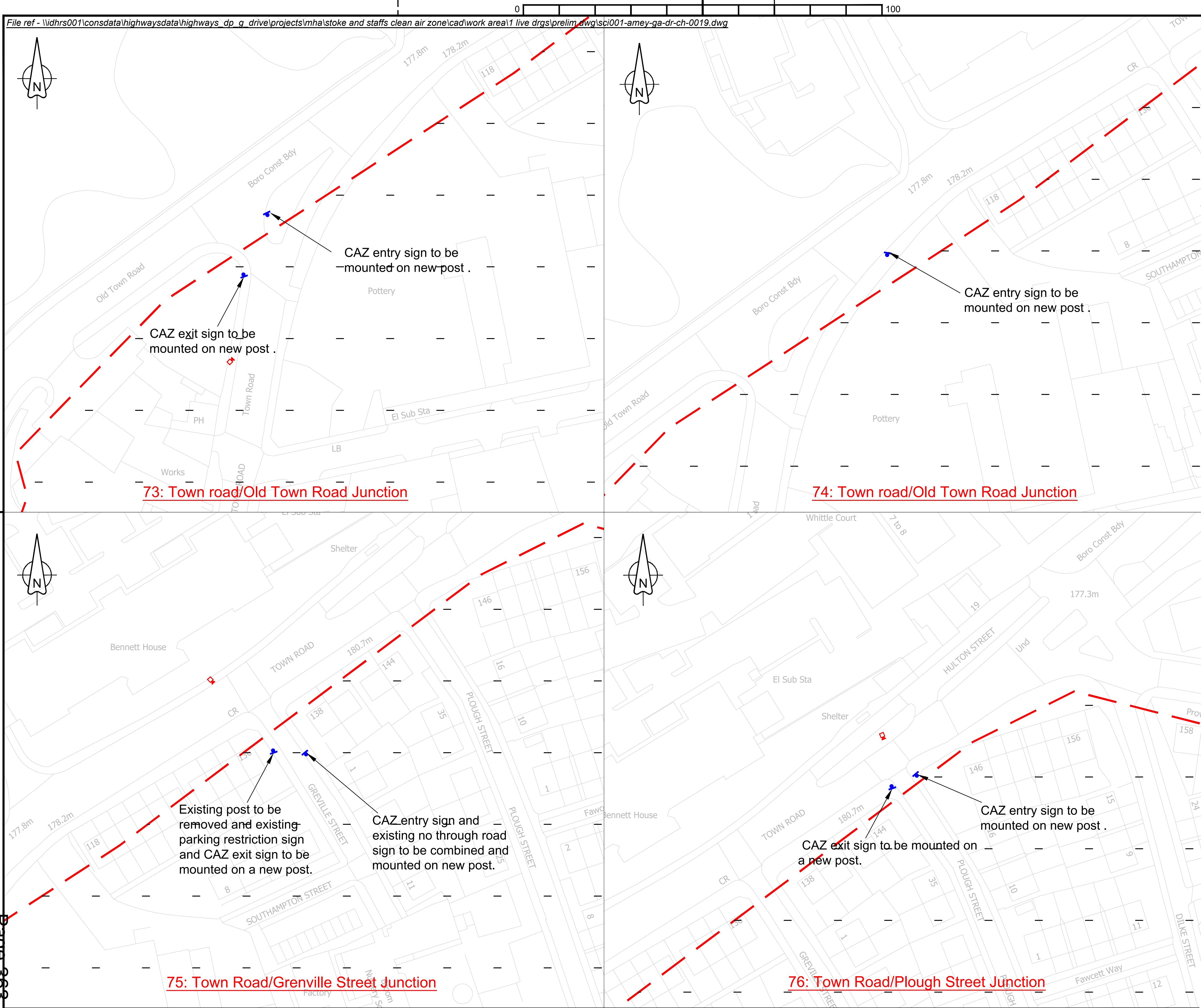


## NOTES

1. Location of statutory undertakers is yet to be determined and may affect the proposed design.

Key:

- Proposed Signs
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- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
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| Rev | Rev details | Drwn | Chkd | Appd | Date |
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| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name
North Staffordshire Local Air Quality Plan

Drawing Title
Clean Air Zone Sites 73-76

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
|---|---|
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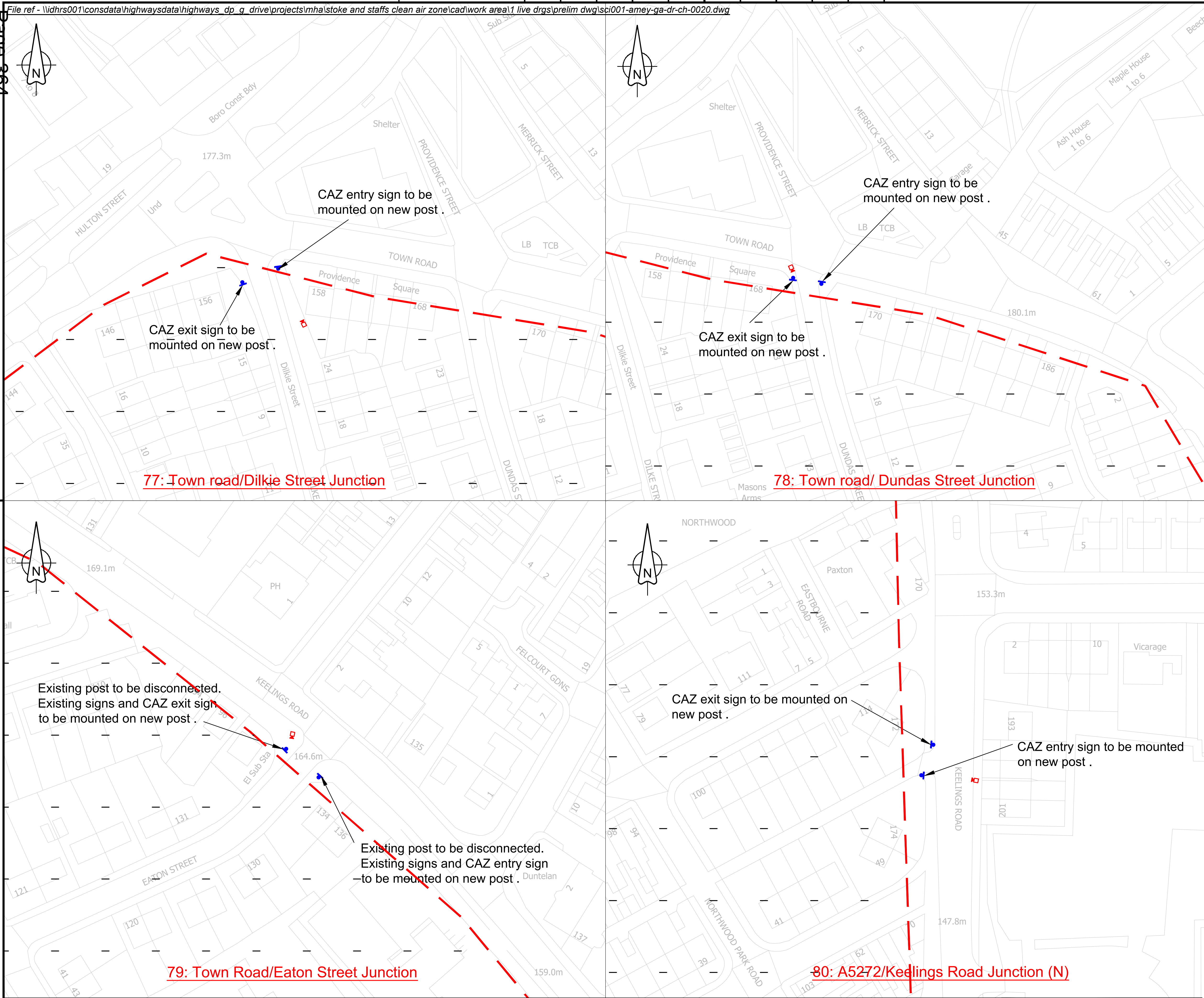


## NOTES

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| Rev | Rev details | Drwn | Chkd | Appd | Date |
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| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name

North Staffordshire Local Air Quality Plan

Drawing Title

Clean Air Zone Sites 77-80

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

| Drawing Status | Suitability |
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| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
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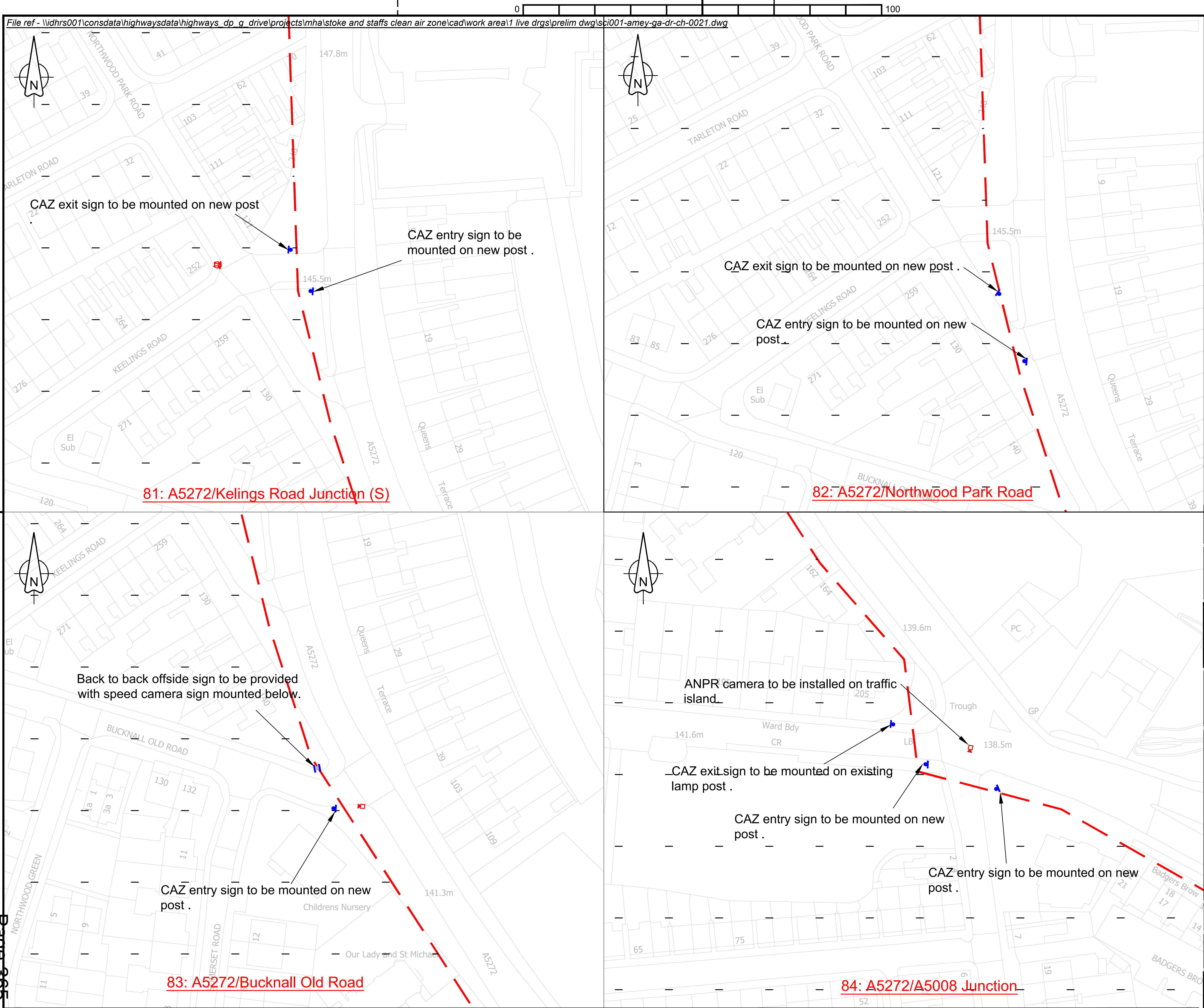


NOTES

1. Location of statutory undertakers is yet to be determined and may affect the proposed design.

Key:

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- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
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- Clean Air Zone Marking

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

| | |
|---|---|
| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name

North Staffordshire Local Air Quality Plan

Drawing Title

Clean Air Zone
Sites 81-84

| | |
|---|---|
| Original Drg Size : A3 | Scale : 1:1000 |
| Dimensions : - | |

| Drawing Status | Suitability |
|---|---|
| SUITABLE FOR STAGE APPROVAL | S4 |

| Drawing No | Revision |
|---|---|
| SCI001-AMEY-GA-DR-CH-021 | P01 |

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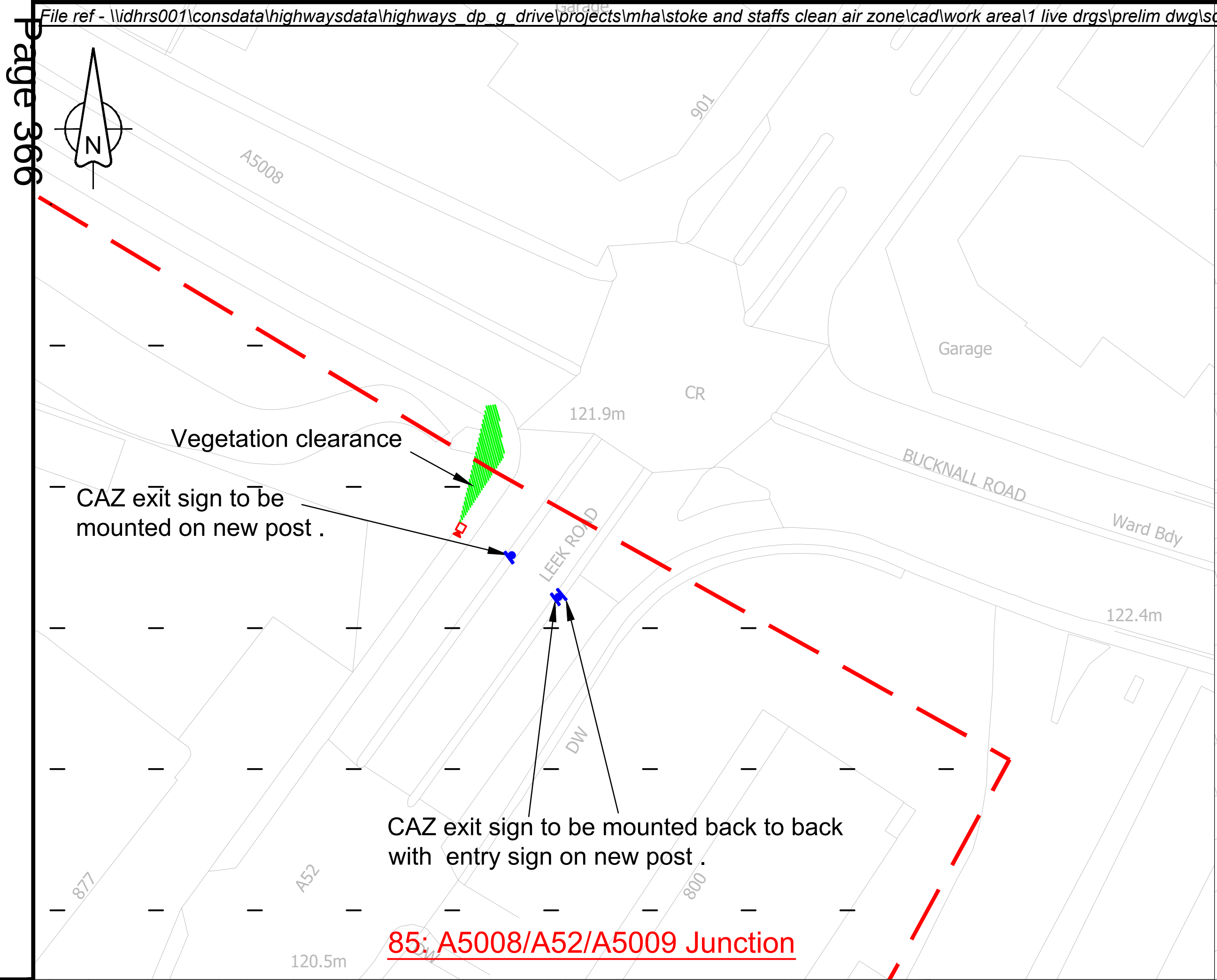


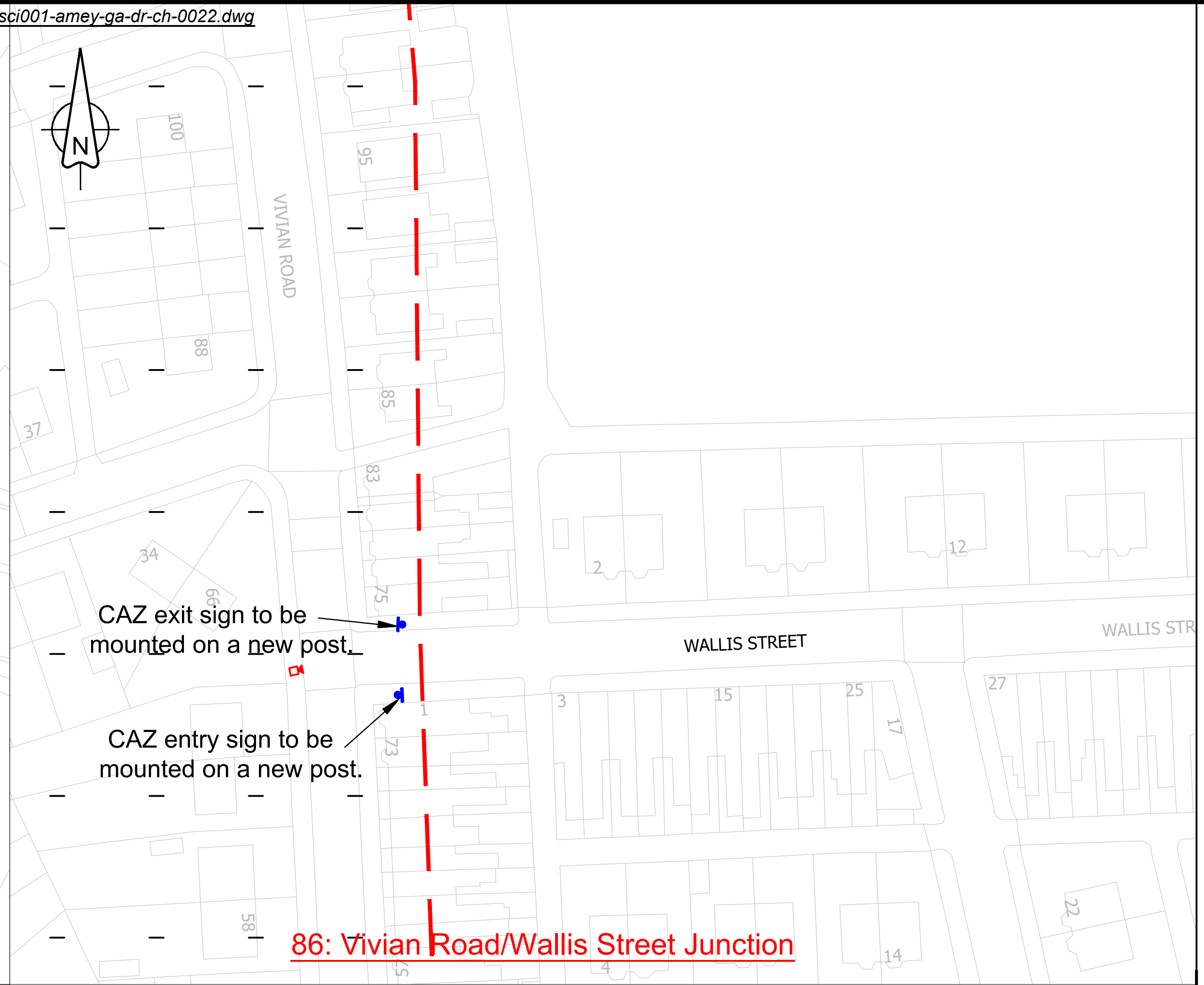


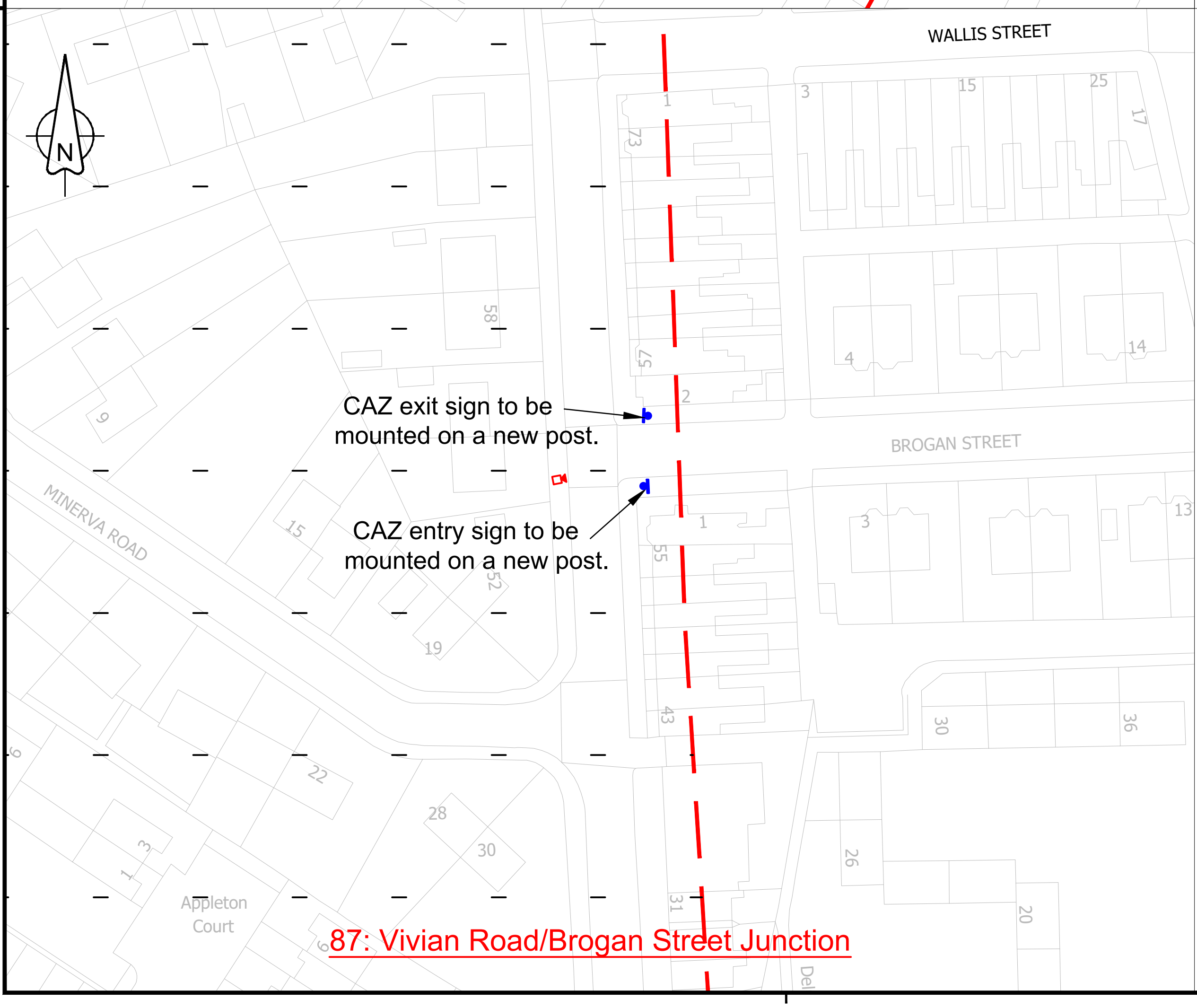


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NOTES

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- Proposed ANPR Cameras stand alone
- Proposed ANPR Cameras Fixed to existing pillar
- Existing Vegetation Clearance
- Clean Air Zone Marking

| Rev | Rev details | Drwn | Chkd | Appd | Date |
|---|---|---|---|---|---|

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|---|---|
| Designed: UH | Date: 17.02.20 |
| Drawn: UH | Date: 17.02.20 |
| Checked: HH | Date: 06.03.20 |
| Approved: OG | Date: 06.03.20 |



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Staffordshire County Council

Project Name

North Staffordshire Local Air Quality Plan

Drawing Title

Clean Air Zone Sites 85-87

Original Drg Size : A3 Scale : 1:1000

Dimensions : -

Drawing Status: SUITABLE FOR STAGE APPROVAL

Suitability: S4

Drawing No: SCI001-AMEY-GA-DR-CH-022

Revision: P01

MAY 2020

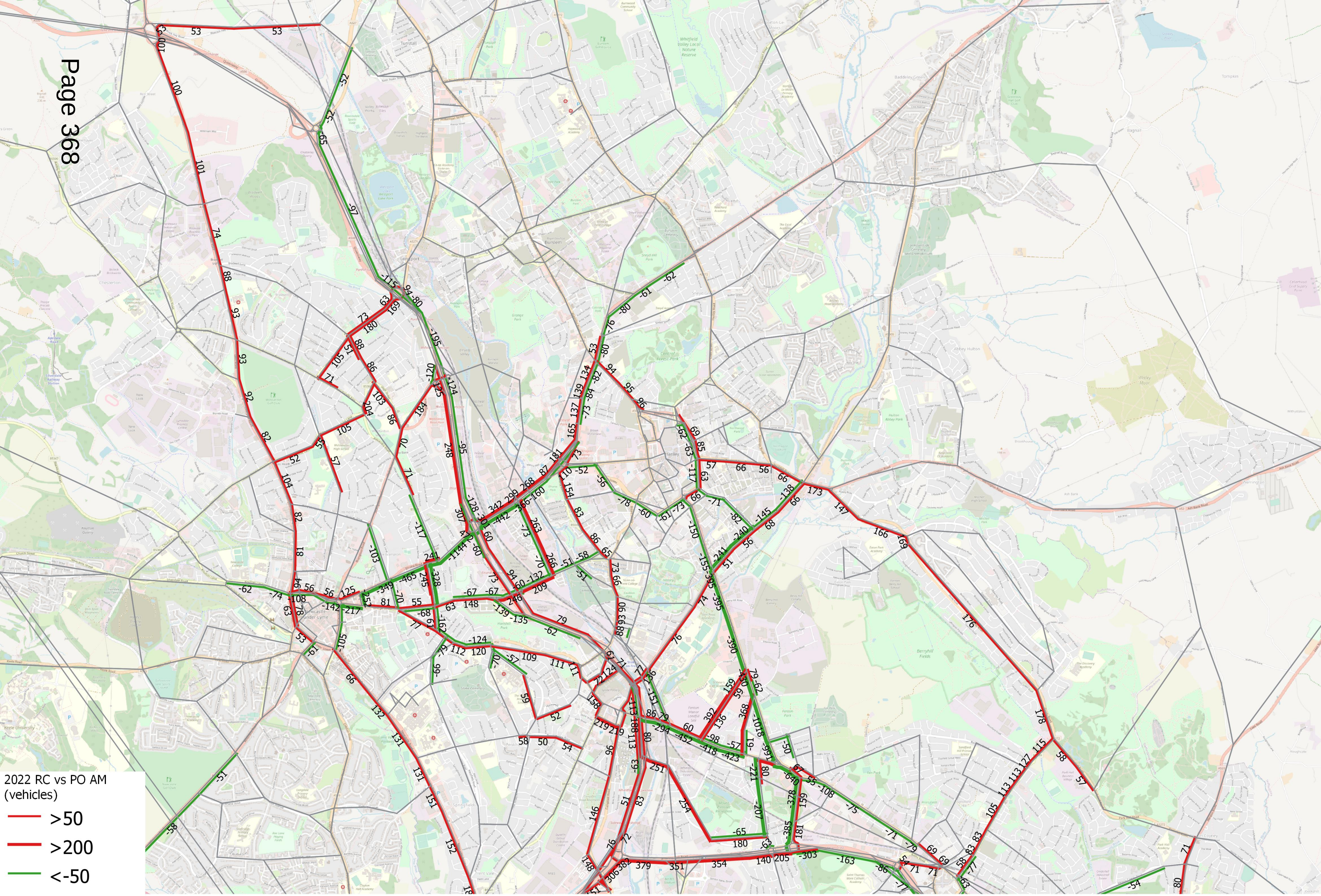
# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

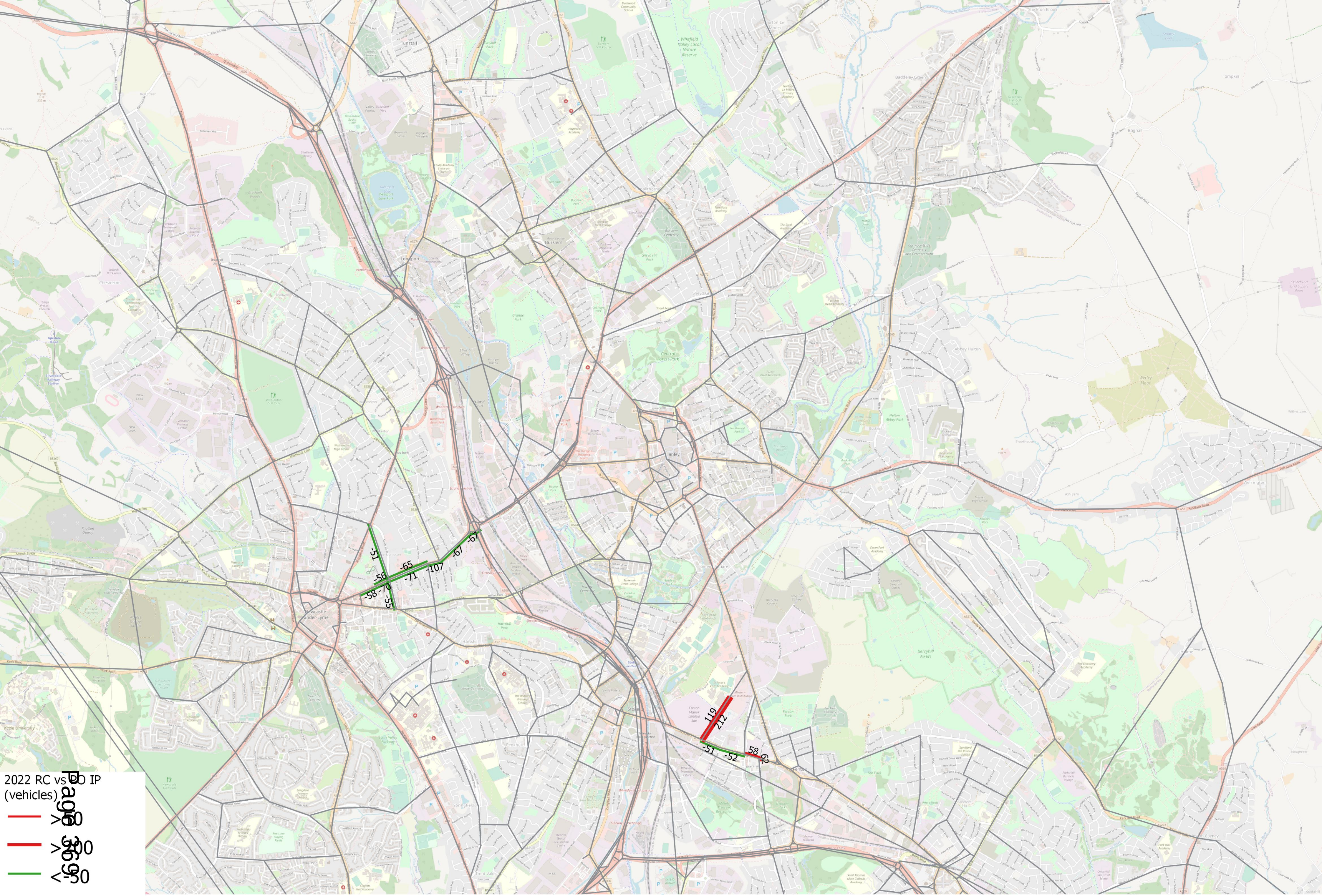
## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 4 - Flow difference plots

Staffordshire County Council

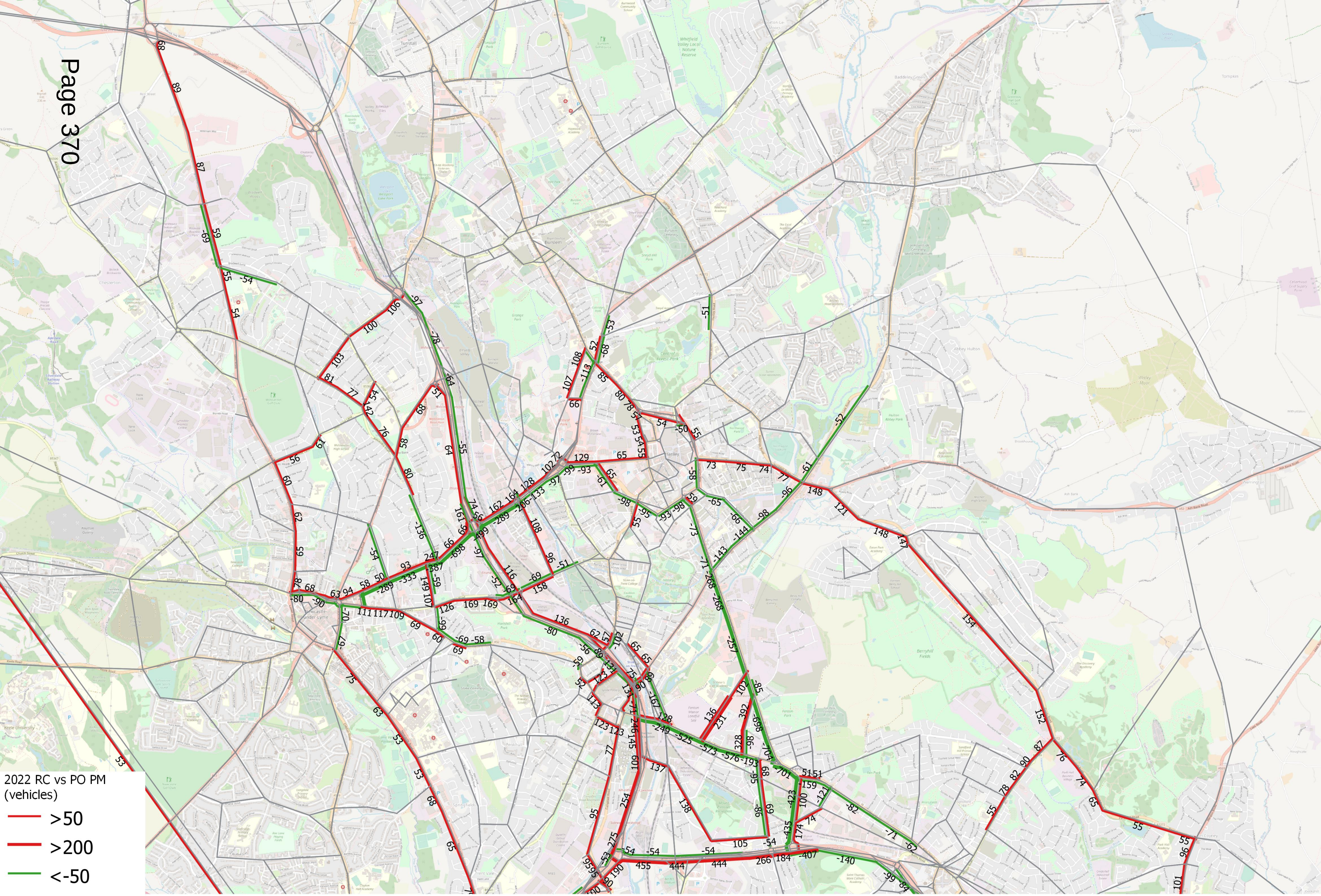
NEWCASTLE UNDER LYME BOROUGH COUNCIL

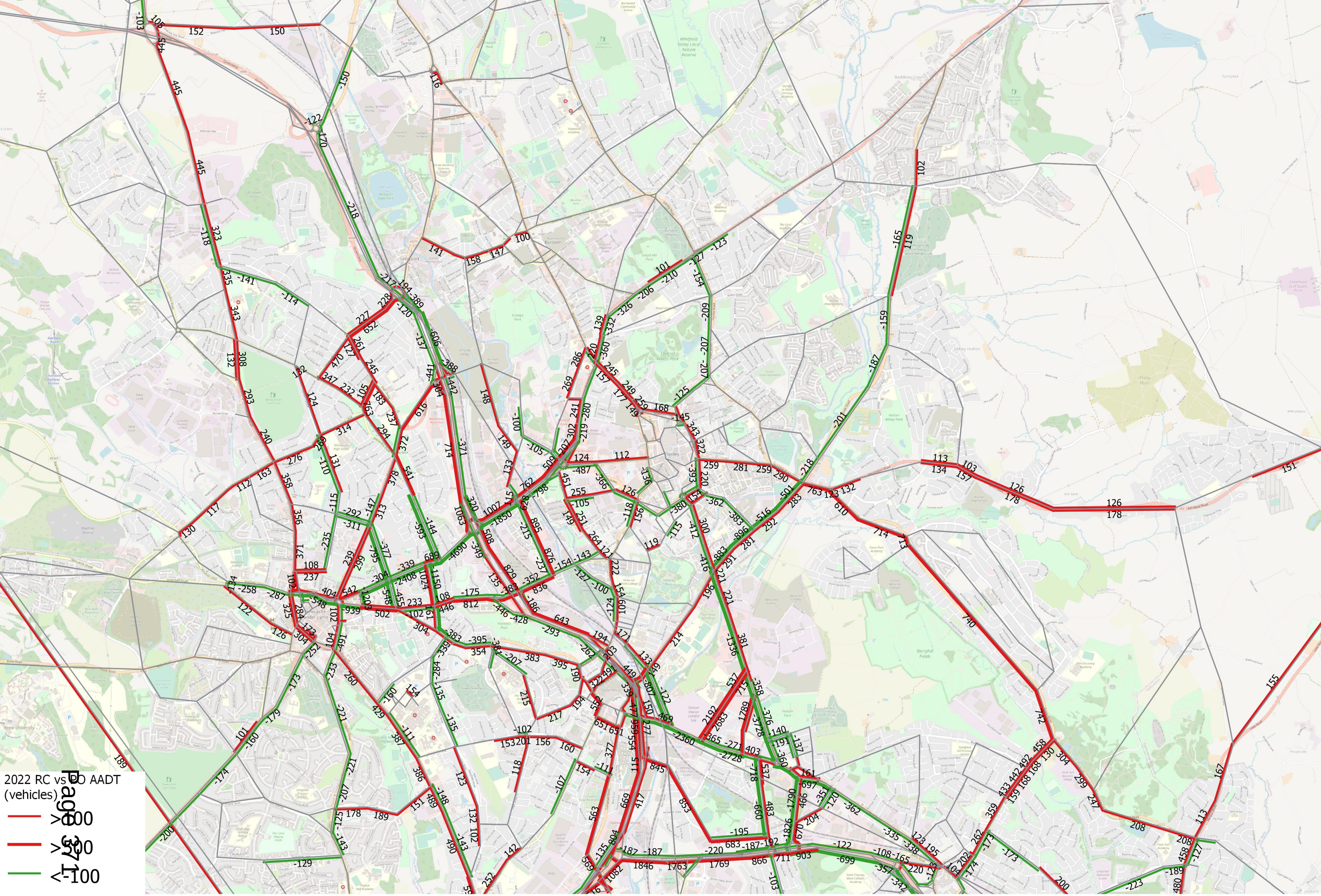
City of Stoke-on-Trent


2022 RC vs PO AM
(vehicles)
>50
>200
<-50
<-200




Background Map © OpenStreetMap contributors www.openstreetmap.org/copyright. Use of this data is subject to the terms and conditions shown at www.staffordshire.gov.uk/maps. Produced by Staffordshire County Council, 2020.


2022 RC vs PO PM
(vehicles)
>50
>200
<-50
<-200




Background Map © OpenStreetMap contributors www.openstreetmap.org/copyright. Use of this data is subject to the terms and conditions shown at www.staffordshire.gov.uk/maps. Produced by Staffordshire County Council, 2020.

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MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 5 - Communications Survey Summary

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

# Stoke-on-Trent and Newcastle-under-Lyme Air quality survey 2020

## Interim Results Summary

## April 2020

# Contents Page

# Project details

| | |
|---|---|
| **Title** | Stoke-on-Trent and Newcastle-under-Lyme Air quality survey 2020 |
| **Client** | Ricardo EE |
| **Project number** | 19095 |
| **Author** | David Chong Ping |
| **Project Manager** | Sophi Ducie |
| **Version** | 22/04/2020 V1.0 |


**M·E·L Research Ltd**

Somerset House, 37 Temple Street, Birmingham, B2 5DP

Email: info@melresearch.co.uk

Web: www.melresearch.co.uk

Tel: 0121 604 4664

# Background

The Government has set a legal level for air quality in certain cities around the UK. Stoke-on-Trent City Council and Newcastle-under-Lyme Borough Council have been instructed by the Government to develop a plan which assesses a range of measures to reduce pollution – against the benchmark of a Clean Air Zone – in the shortest possible time.

A Clean Air Zone (CAZ) is a specific location where immediate action is taken locally to improve air quality and health. It aims to reduce public exposure to all sources of pollution, including nitrogen dioxide, by enforcing restrictions and encouraging cleaner vehicles.

The councils are considering a range of measures to reduce pollution in the region. Stoke-on-Trent City Council, Newcastle-under-Lyme Borough Council and Staffordshire County Council are exploring the introduction of bus retrofit schemes and other highway changes. This is in addition to strategies for raising awareness of air pollution and increasing awareness of actions that individuals can take. These could include reducing private car use, and using more sustainable and active ways of travelling.

# Research

The Councils have launched an online survey to seek people's views on local air pollution. This will enable the councils to understand the support the community would like from the councils, to protect the health of people in those districts. The councils want to engage with residents, schools, businesses and community groups to find out how air quality affects them and measure awareness of the simple actions that can help improve air quality.

The survey information will enable the councils to better understand local opinion and be used to inform the strategy development and action for local air quality. The insight provided through the survey will also help the councils to better engage residents in the air quality conversation.

Ricardo Energy & Environment is a sustainability consultancy specialising in providing policy support and marketing communications expertise in the fields of transport, energy, and environment. Ricardo is advising Stoke-on-Trent City Council, Newcastle-under-Lyme Borough Council and Staffordshire County Council on strategy development for delivery of the survey communications.

Global Action Plan (GAP) is a sustainability charity, whose UK team is part of the international GAP network. GAP is supporting Stoke-on-Trent City Council, Newcastle-under-Lyme Borough Council and Staffordshire County Council on promotion and digital engagement of the survey, to raise awareness and encourage local participation.

M·E·L Research are an independent social research company and we are carrying out an air quality survey in partnership with Ricardo, Staffordshire County Council, Stoke on Trent and Newcastle-under-Lyme councils.

# Approach

M·E·L Research were asked to design and deliver a two-phased online consultation across Stoke on Trent and Newcastle-under-Lyme. The initial phase aims to capture attitudes to air quality, as well as feeding into the business plan. The second stage will be focused on getting feedback on the proposed Local Air Quality Plan from a range of stakeholders.

The survey is being carried out via an open online link and should take about 5 minutes to answer all the questions. The initial phase deadline was originally set for midnight on the 30th April 2020. However, due to the impact of the coronavirus pandemic, the survey will be paused on this date and extended at a point to be agreed.

Responses to the survey are being collected by M·E·L Research who are processing the data on behalf of Staffordshire County Council, Stoke on Trent City Council and Newcastle-under-Lyme Borough Council, who are the data controllers. The councils will use the information provided to help them make decisions about how to improve air quality in the area.

Information provided will only be used for research purposes and individuals will not be personally identifiable in any analysis or reports. Work will be carried out in line with the code of conduct of the Market Research Society. All information will be held securely and strictly in line with the Data Protection Act 2018 and the General Data Protection Regulation (GDPR).

**This interim report summarises the results from the initial stage up until 20th April 2020.**

# Response to date

As at 9:00am on 20th April 2020, we had received 459 responses to the online survey. The majority of responses were from residents of Newcastle-under-Lyme.

| In which area do you live (which council do you pay your council tax) | Qty | % |
|---|---|---|
| Newcastle-under-Lyme | 258 | 56% |
| Stoke-on-Trent | 164 | 36% |
| Stafford | 13 | 3% |
| Staffordshire Moorlands | 12 | 3% |
| Cannock Chase | 1 | *% |
| Lichfield | 1 | *% |
| South Staffordshire | 1 | *% |
| East Staffordshire | 0 | 0% |
| Tamworth | 0 | 0% |
| Another council area (5 x Cheshire East, 2 x Shropshire, 1 x North West Leicestershire, 1 x Warrington) | 9 | 2% |
| TOTAL | 459 | 100% |

* Less than 0.3%

# Interim Results

- Of the 459 respondents, 27% work in Newcastle-under-Lyme and 39% work in Stoke-on-Trent. One third (33%) are regular visitors to Newcastle-under-Lyme and 30% to Stoke-on-Trent.  Only a small proportion of survey respondents run businesses in the two areas.

| Base 459 | **Newcastle-under-Lyme** | | **Stoke-on-Trent** | |
|---|---|---|---|---|
| Work in… | 122 | 27% | 180 | 39% |
| Regularly visit… | 152 | 33% | 139 | 30% |
| Run a business in… | 12 | 2.6% | 13 | 2.8% |
| Operate taxi/taxi business in… | 2 | 0.4% | 2 | 0.4% |
| Operate a business outside area but travel through… | 2 | 0.4% | 5 | 1.1% |

- For the **18 businesses** that travel into or through Newcastle-under-Lyme, half do so every day (5 to 7 times per week).

- For the **15 businesses** that travel into or through Stoke-on-Trent, 40% do so every day (5 to 7 times per week).

# Modes of transport used

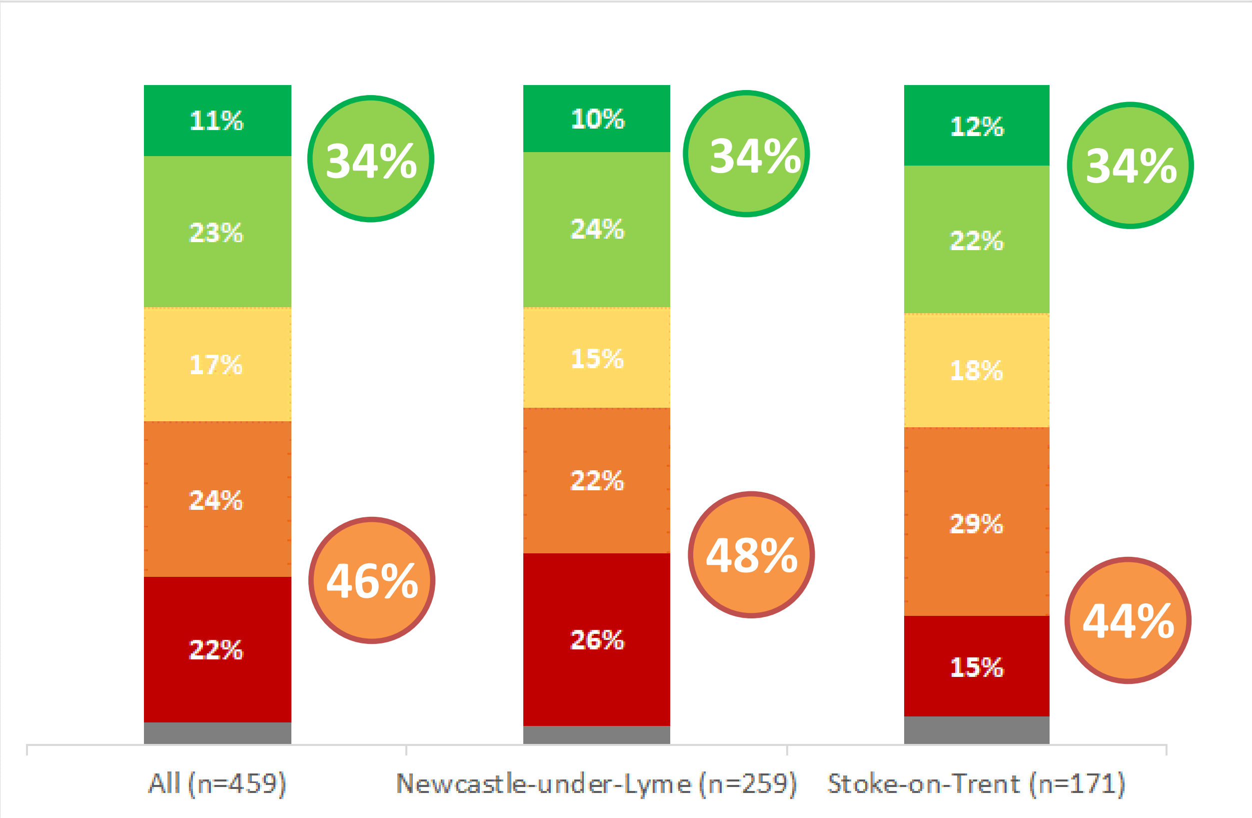
- When asked what modes of transport they personally use (not related to business travel) when travelling to and through Newcastle-under-Lyme and Stoke-on-Trent, the vast majority (86%) use a car; 40% of those travelling into or through Newcastle-under-Lyme do so daily, while 37% do so in Stoke-on-Trent.

| Base 459 | All | | Newcastle-under-Lyme | | Stoke-on-Trent | |
|---|---|---|---|---|---|---|
| Private car... | 395 | 86% | 321 | 70% | 319 | 69% |
| Walk... | 242 | 53% | 179 | 39% | 142 | 31% |
| Bus... | 113 | 25% | 90 | 20% | 86 | 19% |
| Taxi... | 94 | 20% | 71 | 15% | 66 | 14% |
| Cycle... | 61 | 13% | 47 | 10% | 36 | 8% |
| Private van... | 20 | 4% | 16 | 3% | 14 | 3% |
| Motorcycle... | 14 | 3% | 10 | 2% | 10 | 2% |
| Motor scooter... | 6 | 1% | 3 | 1% | 4 | 1% |

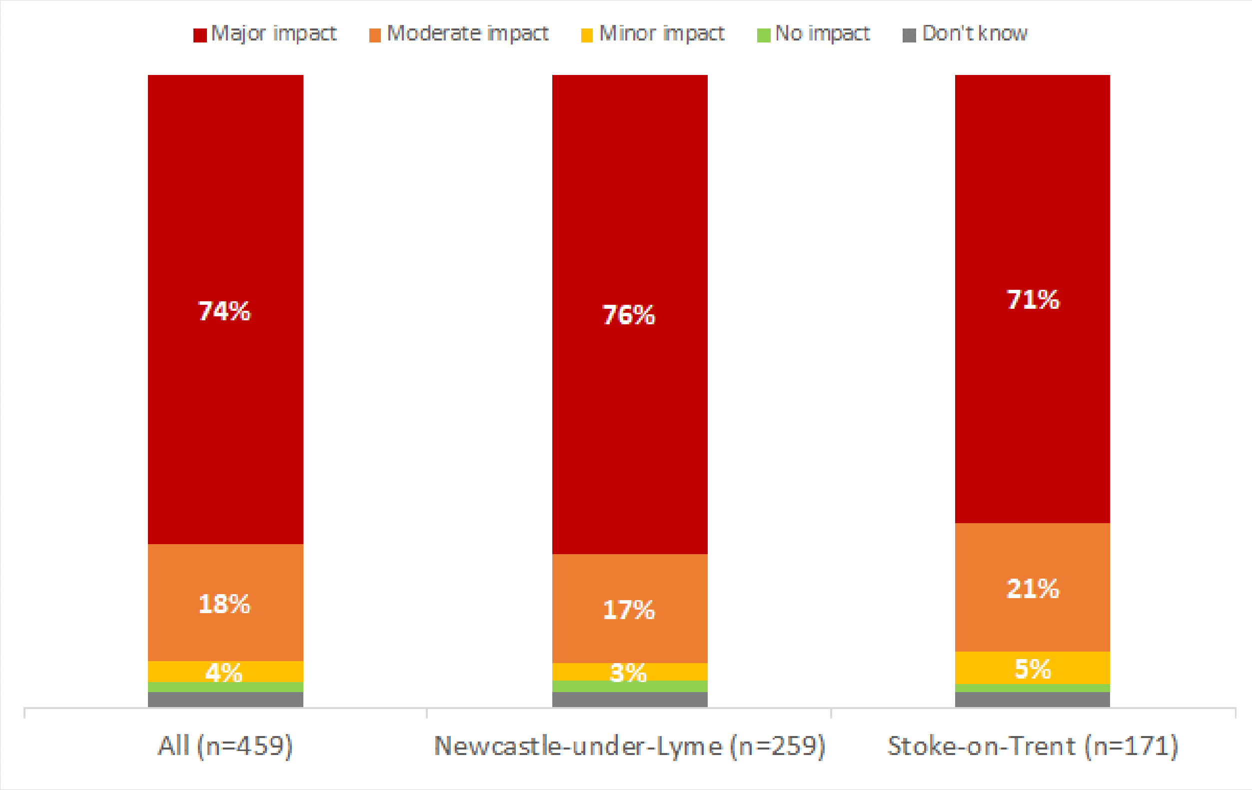
- 16% of those travelling into or through Stoke-on-Trent use the train.
- Of those using a private car, 19 are electric powered vehicles (5%).
- Of those using a bicycle, 5 are electric powered (8%).
- Of the 47 people that cycle in Newcastle-under-Lyme, 10 (21%) do so everyday (5 to 7 times per week). For the 36 people that cycle in Stoke-on-Trent, 8 (22%) do so everyday.
- Most commonly, those that cycle into or through the two areas do so 1 to 3 times per week.
- Those using the bus typically do so less than once a week; 59% indicate this in both areas.

# Thoughts on air quality

- Overall, just over one-third (34%) would generally describe the air quality in their local area as good (either very or fairly good). However, a greater proportion would describe it as poor – particularly those living in Newcastle-under-Lyme.



- Overall, around three-quarters (74%) of respondents think that poor air quality can have a major impact on people's breathing. This figure rises to 76% for those living in Newcastle-under-Lyme and falls to 71% for those living in Stoke-on-Trent. Few believe it has no or minor impact.




# Environmentally friendly behaviours

- When looking at environmentally friendly behaviours, one-half (50%) of respondents claim to avoid idling a vehicle when the vehicle is not moving, primarily to reduce pollution.

- Just over one-third (35%) claim to drive in a eco-driving fashion, primarily to reduce pollution.

- Around one-quarter (28%) claim that they have walked or cycled short distances instead of driving, primarily to reduce pollution.

- Just 17% have changed to an eco-friendly, lower emission vehicle and 12% have used public transport instead, primarily to reduce pollution.

| Behaviours | All (n=459) | Newcastle-under-Lyme (n=259) | Stoke-on-Trent (n=171) |
|---|---|---|---|
| **Avoided idling a vehicle (i.e. running a vehicle's engine when the vehicle is not moving)** | | | |
| I have done this, primarily to reduce pollution | 50% | 49% | 48% |
| I have done this, but not primarily to reduce pollution | 20% | 19% | 21% |
| I have not done this | 30% | 32% | 31% |
| | | | |
| **Eco-driving (e.g. minimising breaking and acceleration, limiting driving speed)** | | | |
| I have done this, primarily to reduce pollution | 35% | 38% | 32% |
| I have done this, but not primarily to reduce pollution | 29% | 27% | 30% |
| I have not done this | 36% | 36% | 38% |
| | | | |
| **Walked or cycled instead of driving short distances** | | | |
| I have done this, primarily to reduce pollution | 28% | 28% | 26% |
| I have done this, but not primarily to reduce pollution | 50% | 51% | 48% |
| I have not done this | 23% | 22% | 26% |
| | | | |
| **Switched to driving a less polluting vehicle (i.e. with lower emissions)** | | | |
| I have done this, primarily to reduce pollution | 17% | 15% | 18% |
| I have done this, but not primarily to reduce pollution | 8% | 7% | 11% |
| I have not done this | 76% | 78% | 72% |
| | | | |
| **Used public transport instead of making journeys in an individual vehicle** | | | |
| I have done this, primarily to reduce pollution | 12% | 10% | 15% |
| I have done this, but not primarily to reduce pollution | 26% | 27% | 23% |
| I have not done this | 62% | 63% | 63% |

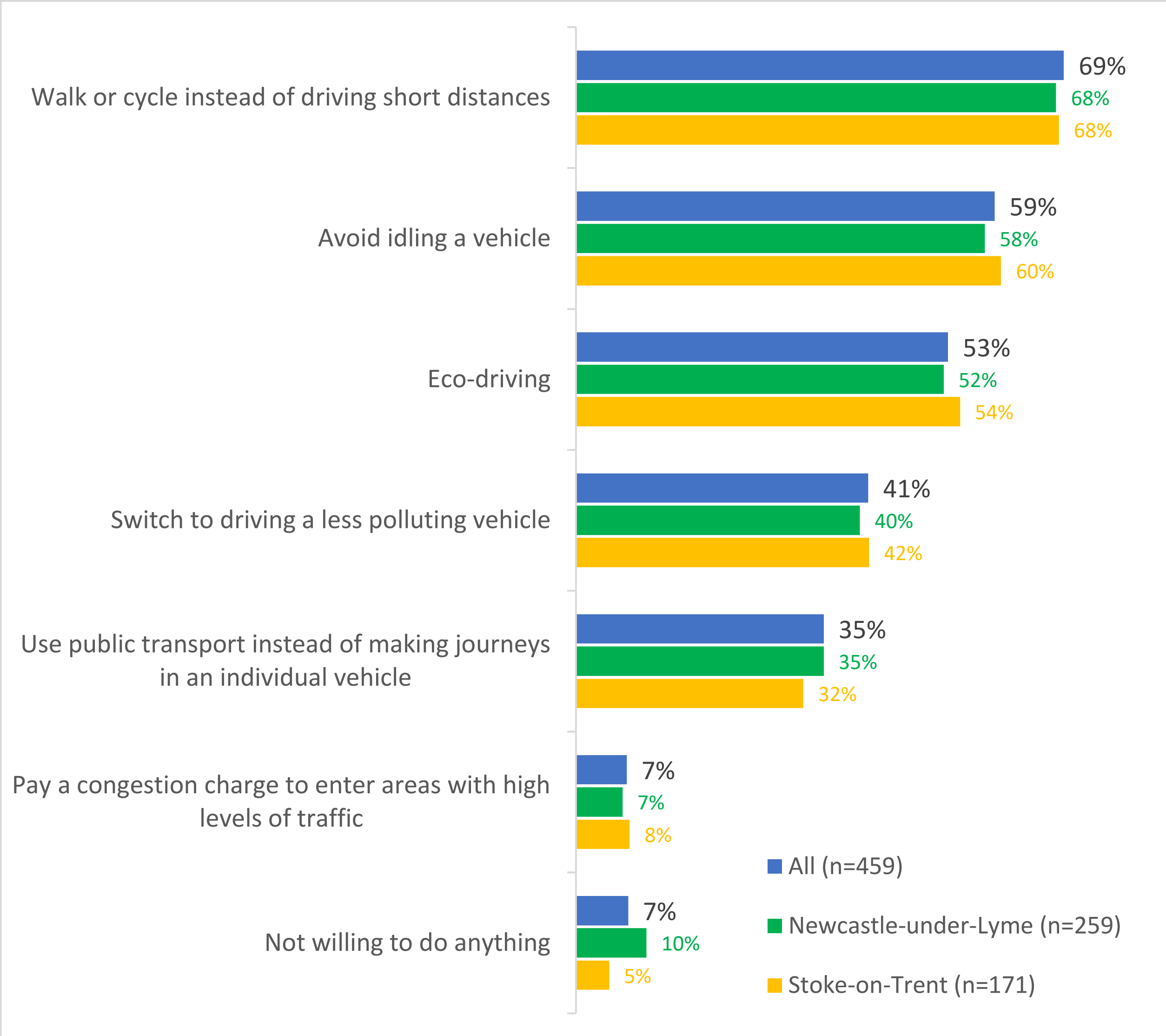
- When considering the activities that respondents would be willing to do to improve air quality in their local area and reduce exposure to air pollution, around seven in ten (69%) claim they would walk or cycle instead of driving short distances.

- Around six in ten (59%) claim they would avoid idling vehicles and just over one-half (53%) claim they would eco-drive, minimising breaking and acceleration, limiting driving speed.

- Some two-fifths (41%) claim they would consider switching to a less polluting vehicle while around one-third (35%) would consider using public transport.

- Only 7% would be willing to pay a congestion charge to enter areas with high levels of traffic.

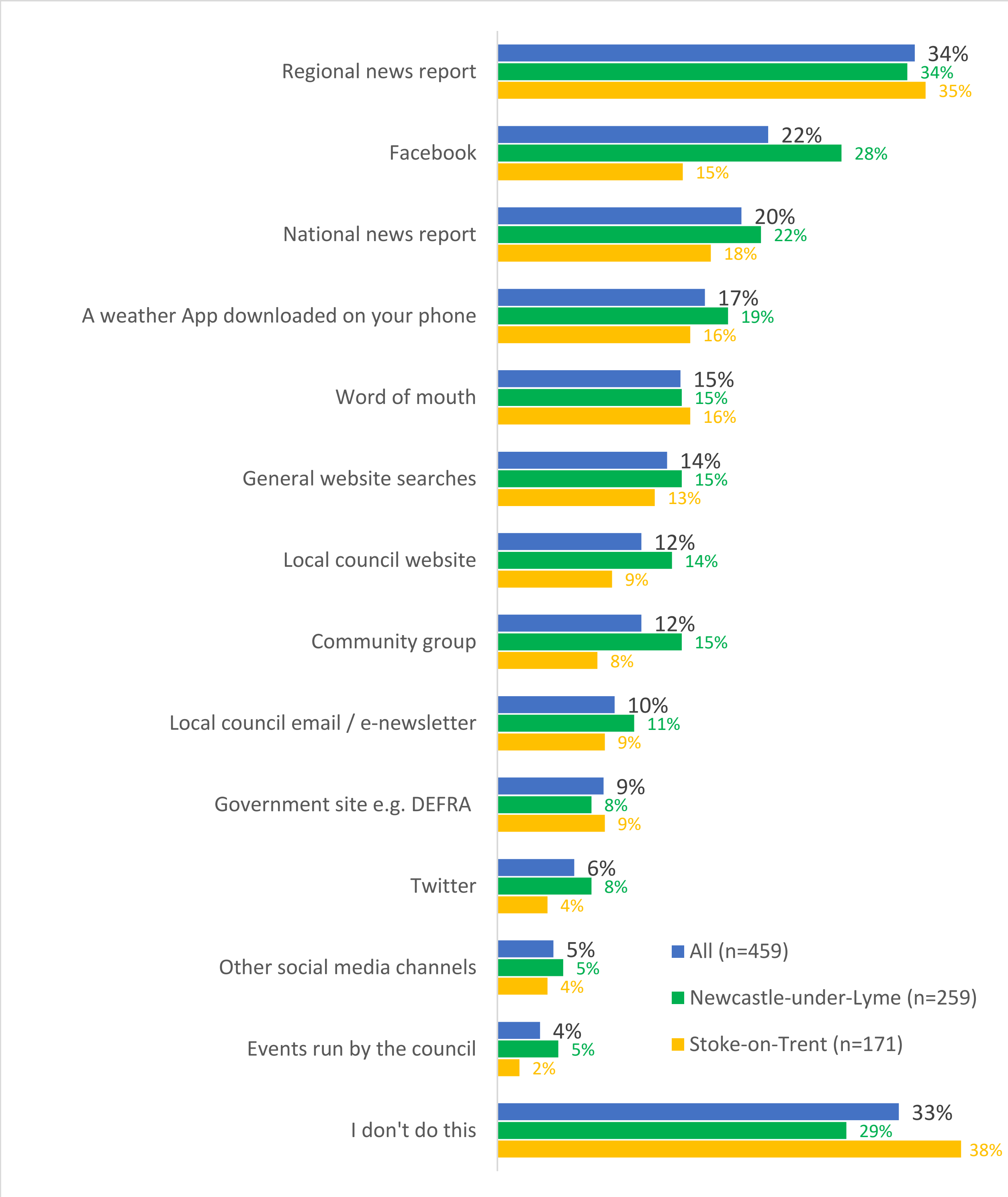
**Activities willing to do to improve air quality in local area/ reduce exposure to air pollution**



# Air quality information

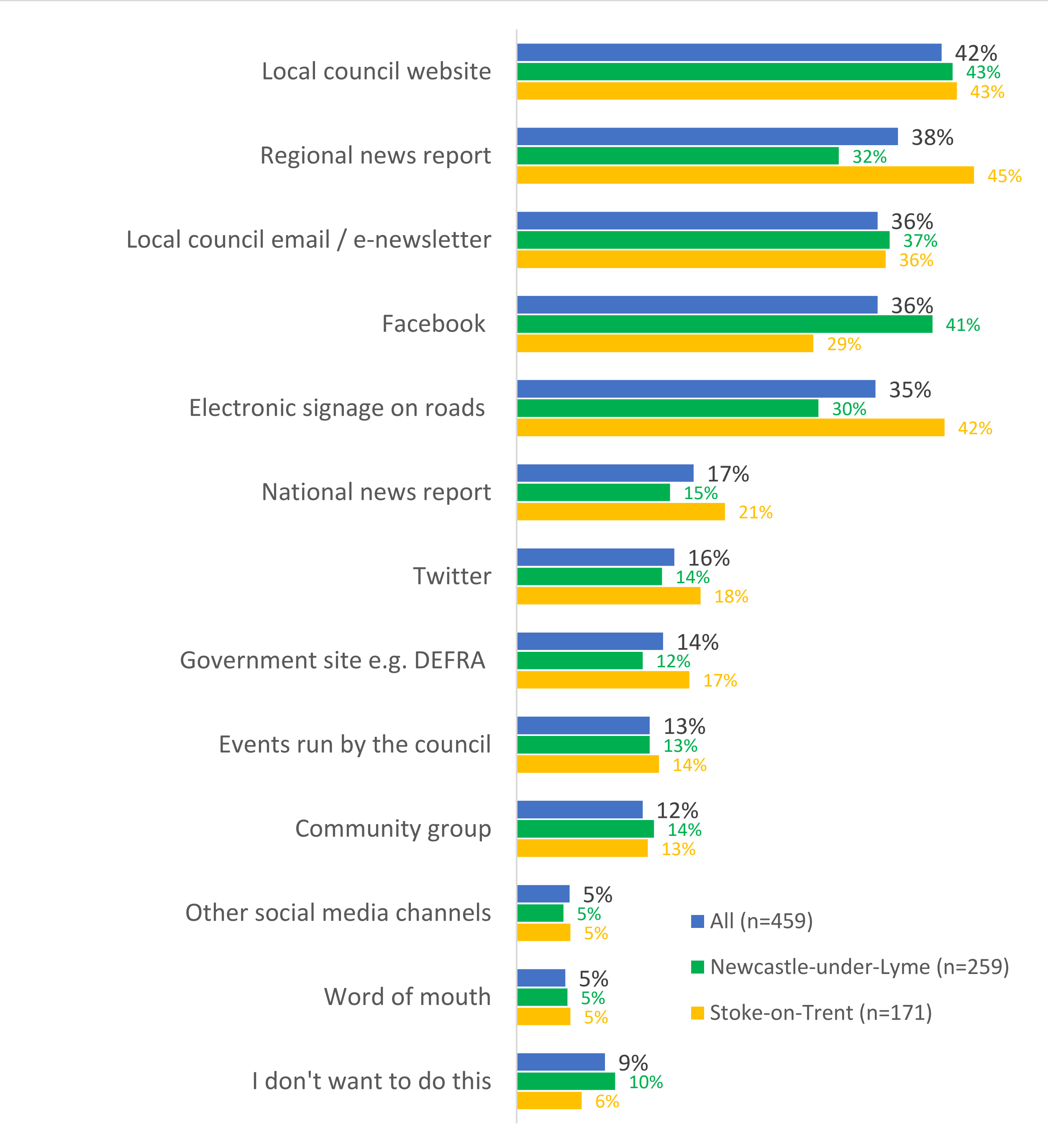
**Current sources of information on levels of air quality**

- Two-thirds of respondents indicate they currently find out about levels of air quality from one of the listed sources of information; most commonly it is via regional news reports.



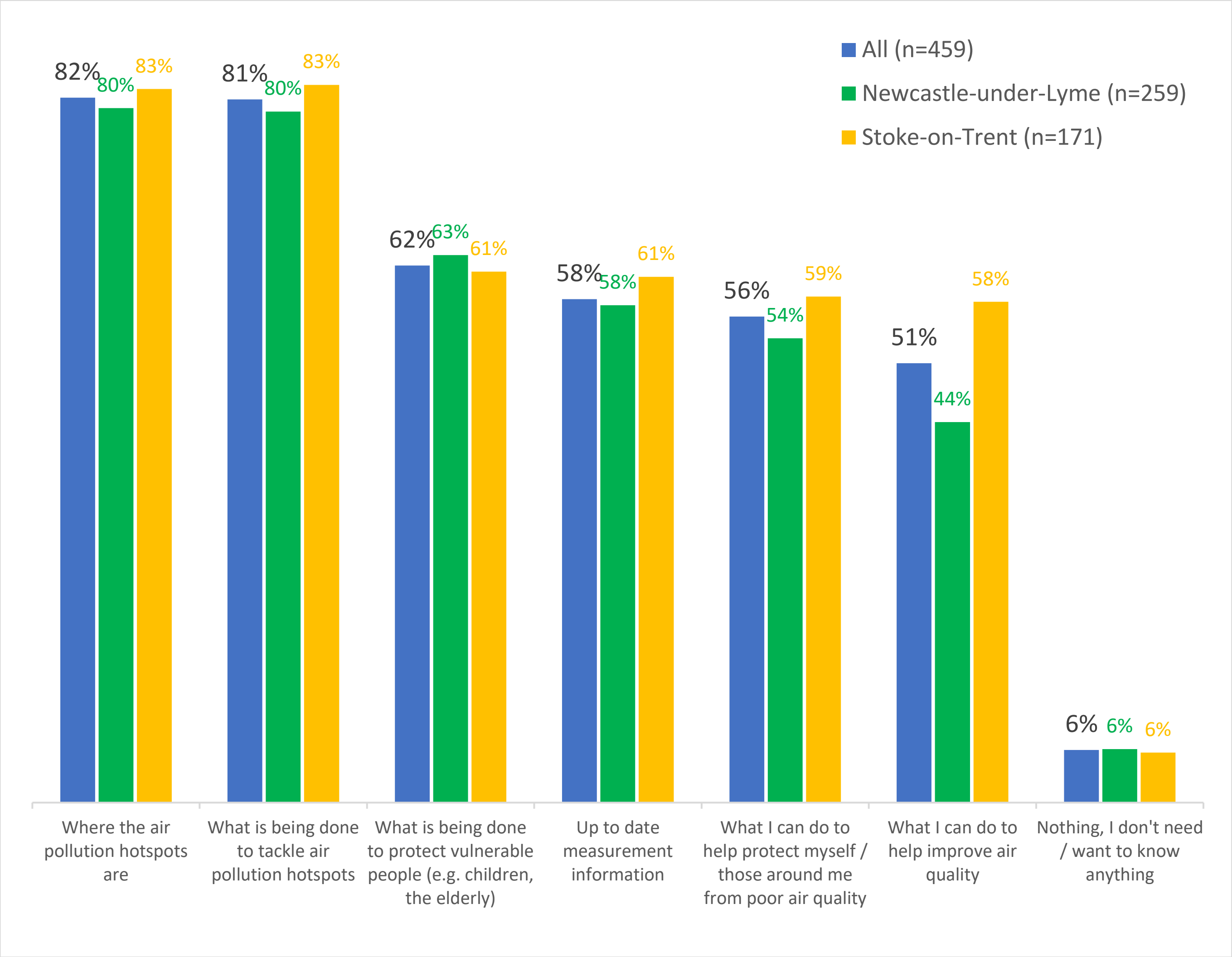
### Future sources of information on levels of air quality

- When considering where to find out about levels of air quality in the future, around two-fifths (42%) would prefer to use their local council website and a similar proportion (38%) would be interested in a local council email or e-newsletter.



### Future topics of information on levels of air quality

- When considering future topics about levels of air quality in the future, around four-fifths (82%) would like to know where the air pollution hot spots area and what is being done to tackle air pollution.



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MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 6 - Longlist of measures

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

## Longlist of measures

| Grouped | Longlist of measures |
|---|---|
| **AQ/LES Strategy** | Development of comprehensive air quality strategy. |
| | Development of air quality developers' guide. |
| **Priority parking** | Priority parking for LEVs. |
| | Priority parking for electric vehicles. |
| **Charging/refuelling infrastructure** | Improve alternative refuelling infrastructure. |
| | Install electric charging points on Festival Park and Etruria Valley. |
| | Scope for improving EV charging network generally. |
| **Electric taxis/vehicles** | Encourage change to electric taxis. |
| | Promotion of electric vehicles including taxi and council fleet. |
| **Park & Ride Scheme** | Bus based Park & Ride and more dedicated bus lanes. |
| | Investigate park and ride scheme. |
| **Low emission buses** | Bus retrofitting - upgrade buses to Euro VI by retrofitting current Euro III buses. |
| | Encourage cleaner buses (e.g. electric, hydrogen). |
| **Promotion of alternative transports** | Promotion of cycling/introduce public cycle hire scheme/improve cycle network/cycle training. |
| | Promotion/facilitation of walking. |
| **Car sharing scheme** | Car and lift sharing schemes and/or APPs. |
| | Investigate car share apps. |
| **Etruria Valley Link Road (EVLR) Project Development** | Review likelihood of EVLR providing an alternative route between Newcastle-under-Lyme, Etruria Valley, Festival Park and the city centre. |
| | EVLR development. |
| **Automatic traffic control systems** | Urban Traffic Control systems, signalling improvement, congestion management. |
| | Investigate roundabout traffic light optimisation and investigate options to change road layout/road discipline. |
| | Explore use of smart traffic signs to promote alternative routes, transport options and to deliver air quality messages. |
| | Review traffic light operation times - switch off outside peak periods. |
| | Traffic optimisation at King Street one-way junctions. |
| **A500 improvements** | Working with Highways England to identify and secure further improvements to congestion management on the A500. |
| | Investigate traffic light timings at A500 and Festival Park roundabouts. |
| **Road layout changes** | Investigate options to change road layout/road discipline. |
| | Examine traffic flow through junctions. |
| **Improved driver awareness** | VMS to inform drivers of alternative routes during periods of congestion at A500 and Festival Park roundabouts. |
| | Erect signs on the flyover to highlight alternative route/entrance to Festival Park. |
| | Investigate apps to warn of journey times/congestion. |
| **Reduced speed limits** | Reduction of speed limits, introduction of more 20 mph zones. |
| **Business travel plans** | Workplace Travel Planning with local employers. |
| | Encourage/facilitate home-working. |
| | Travel plans for the Hospital, Universities and key tourist attractions. |
| | Use of travel diaries/black boxes to understand journeys, especially start-stop-end. |

| | |
|---|---|
| | HGV routing strategy to and from major employment centres within Newcastle under Lyme promoting use of strategic highway network. |
| | Provide access to a workplace travel adviser for businesses. |
| | Review commitments of new businesses to adhere to travel plans. |
| | Investigate employee travel expenses. |
| | Investigate Festival Park retail delivery times - arrange outside peak period. |
| **Freight consolidation centre** | Investigate freight/logistics consolidation hub. |
| | Investigate freight/logistics routing strategies. |
| **Employee parking strategies** | Explore if employers would charge employees to park on site. |
| | Have priority car share parking spaces at businesses on Festival Park and Etruria Valley. |
| | Examine Festival Park retail parking policy. |
| | Reallocate or restrict parking. |
| | Consider introducing subsidised travel. |
| **Business travel club** | Encourage businesses to become members of Eco Stars or similar fleet recognition scheme. |
| | Review "click and collect" policies of retailers on Festival Park to reduce trips to area. |
| **Public / school awareness campaign** | Campaign to raise public awareness of air quality issues. |
| | Work with schools and Science Scope to monitor air quality and educate parents on the impact of the school run. |
| | Encourage sustainable travel to school through Modeshift Stars. |
| **Eco-driving campaign** | Encourage taxi drivers to complete eco-driving sessions. |
| **Anti-idling campaign** | Anti-idling promotion and/or enforcement. |
| | Display 'turn off engine' signs on approach to traffic lights at A500 and Festival Park roundabouts. |
| **Green infrastructure** | Install green walls. |
| | Install living wall street furniture, bus shelters etc. |
| **Reinstate rail link** | Reinstate Etruria rail link and station. |

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# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 7 - Refined longlist of options

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

### Refined longlist of options

| Transport Modelling Test | Tested | Viable | Reason | Final Options |
|---|---|---|---|---|
| Etruria Valley Link Road (EVLR) Project | Yes | No | It has been included in the Reference Case as a committed scheme | N/A |
| Workplace Parking Levy (WPL) | Yes | No | Small numbers would be liable to pay WPL. The charge would only be to non-compliant vehicles therefore, complicated to administrate. The employer would be unlikely to pass the charge onto the employee as a result the employee is unlikely to change mode of transport. Limited benefit. | No |
| Bus Retrofitting | Yes | Yes | This option has been implemented as part of options 2 to 7.. | Yes |
| TM1 - Victoria Street as one-way SB | Yes | No | Reduction in flows along the A53 insufficient. | No |
| TM2 - Increased green timings at Basford | Yes | No | Flows along the A53 increased. | No |
| TM3 - Banned right turn out of Basford Park | Yes | Yes | Good reduction in flow at exceedance location. This option has been implemented as part of option 2. | Yes |
| TM4 - Restrictions on WB movement along the A53 Etruria Road from the A500 | Yes | Yes | Good reduction in flow at exceedance location. This option has been implemented as part of options 3, 4, 6 and 7. | Yes |
| TM13 - Banned Right Turn out of Basford Park and Victoria Street as one-way SB | Yes | No | Large reductions seen but rerouting may impact other areas close to exceedance. | No |
| TM5 - Addition of the two-way Fenton Manor Link Road between City Road and Victoria Road | Yes | No | Measures result in required reduction of vehicles, however, the feasibility of delivering Fenton Manor Link as a two-way link is unlikely. | No |
| TM6 - Banning of the right turn into Dewsbury Road and Beville Street | Yes | No | Reduction in flows on Victoria Road are insufficient. | No |
| TM7 - New one-way northwest link between City Road and Victoria Road | Yes | No | Reduction in flows on Victoria Road are insufficient. | No |
| TM8 - Removal of the link going from Meigh Street car park Via Goodson Street to Old Hall Street | Yes | No | Negligible impact on traffic flows on Bucknall New Road corridor. | No |
| TM9 - Signalisation of Joiners Square and banning the Right turn from A50 Victoria Road to A52 Leek Road | Yes | No | Controversial - would require major reconstruction and unlikely to be delivered within timescales. | No |
| TM10 - Existing Manor Street link converted to one-way NB and Victoria Road as one-way SB between the Manor Street junction and the southern roundabout (buses still allowed NB movement) | Yes | No | Reductions are sufficient. However, levels of traffic which would be routing along Manor Street, would be unacceptable for this type of road. This link runs through a residential area and is the access to a school. | No |
| TM11 - Addition of the two-way Fenton Manor Link and Victoria Road traffic calmed | Yes | No | Reduction in flows along the A50 Victoria Road are sufficient. However, the feasibility of delivering a two-way Fenton Manor Link is unlikely. | No |
| TM12 - Addition of a one-way Fenton Manor Link and Victoria Road as SB only (buses still allowed NB movement) | Yes | No | Reduction in flows along the A50 Victoria Road are sufficient. However, the acceptance of Fenton Manor Link as a through route is unlikely. | No |
| 'Egg and Spoon' CAZ area | Yes | Yes | The boundary covers a smaller area and addressed all exceedance locations. There were less taxis operating within the CAZ boundary. The university and station are outside of the CAZ boundary. Used to inform Option 1. | Yes |
| 'Dragon's Head' CAZ area | Yes | No | The boundary covers the university and station. The boundary also contains a higher number of taxis operating. This test addresses all exceedances but not as strongly as the 'egg and spoon' area. Used to inform Option 1. | Yes |
| Original Low Impact Scenario - - Basford Park Road Right-Turn ban , 50% bus retro fit on Bucknall New Rd, Two-Way Fenton Manor Road Link and Victoria Road traffic calmed and 100% bus retrofitting on Victoria Road | No | No | Delivery of two-way Fenton Manor Link not feasible in timescales | No |
| Original High Impact Scenario – A53 WB peak restrictions, 100% bus retro fit on Bucknall New Rd, Manor Street NB only and Victoria Road SB only except | No | No | Levels of traffic which would be routing along Manor Street would be unacceptable for this type of road. This link runs through a residential area and is the access to a school.<br><br>Air quality exceedances not addressed on A53. | No |

| | | | | |
|---|---|---|---|---|
| buses and 100% bus retrofitting on Victoria Road | | | | |
| High impact scenario 3 + banned right turn at Basford Park | Yes | No | As above. | No |
| High Impact scenario 3 + Ped phase at Basford Park | Yes | No | As above. | No |
| High Impact Scenario 3 + Ped Phase at Albert Street | Yes | No | As above | No |
| High Impact Scenario 3 + Ped phase at Basford Park and Ped phase at Albert Street | Yes | Yes | This has been used to inform the development of Option 4 | Yes |

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# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 8 - Refined shortlist of options

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

### Refined shortlist of options

| Options | CAZ | Traffic Management | Junction improvements | Bus retrofit | Bus network enhancement | Complementary measures |
|---|---|---|---|---|---|---|
| Option 1<br>(Benchmark Option) | CAZ D<br>Full boundary<br>Charge:<br>• Cars / Taxis - £5<br>• LGVs - £9<br>• HGVs - £35<br>• Buses - £5 | n/a | n/a | n/a | n/a | n/a |
| Option 2 | n/a | Basford Park right turn ban<br>Victoria Rd northbound peak restrictions (except buses) on the southern end of Victoria Road | Junction improvements at both ends of Academy Road | 50% retrofit on Bucknall New Road<br>100% retrofit on Victoria Road | n/a | n/a |
| Option 3: | CAZ D<br>Local boundary on Victoria Road<br>Charge:<br>• Cars / Taxis - £5<br>• LGVs - £9<br>• HGVs - £35<br>• Buses - £0 | A53 westbound peak restrictions except buses, cyclists and taxis | n/a | 100% retrofit on Bucknall New Road<br>100% retrofit on Victoria Road | n/a | n/a |
| Option 4 | n/a | A53 westbound peak restriction except buses, cyclists and taxis<br>Victoria Rd northbound peak restrictions on southern end of Victoria Rd except buses, cyclists and taxis | Signal improvements at Albert St and Basford Park | 75% retrofit on Bucknall New Road<br>100% retrofit on Victoria Road | n/a | n/a |
| Option 5 | CAZ C<br>Full boundary<br>Charge:<br>• LGVs - £9<br>• HGVs - £35<br>• Buses - £5 | n/a | n/a | 100% retrofit on Bucknall New Road<br>100% retrofit on Victoria Road | n/a | n/a |
| Option 6 | n/a | A53 westbound peak restriction except buses, cyclists and taxis<br>Victoria Rd northbound peak restrictions on southern end of Victoria Rd except buses, cyclists and taxis | Signal improvements at Albert St and Basford Park | 75% retrofit on Bucknall New Road<br>100% retrofit on Victoria Road | Improved bus stops and shelters<br>Bus wrap advertising<br>Real-time information | Travel planning<br>Vegetation planting/removal<br>Cycling/walking infrastructure<br>EV infrastructure |
| Option 7<br>(Preferred Option) | n/a | A53 westbound peak restriction except buses, cyclists and taxis<br>Victoria Rd northbound peak restrictions on southern end of Victoria Rd except buses, cyclists and taxis | Signal improvements at Albert St and Basford Park | 75% retrofit on Bucknall New Road<br>100% retrofit on Victoria Road | Improved bus stops and shelters<br>Bus wrap advertising<br>Real-time information | n/a |

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE

## APPENDIX 9 - Appraisal Summary Table - Preferred Option

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

| Appraisal Summary Table | | Date Produced: | 15 May 2020 | Contact: | |
|---|---|---|---|---|---|
| Name of Scheme: | North Staffordshire Local Air Quality Plan | | | Name | Nesta Barker |
| Description of Scheme: | In October 2018, Stoke-on-Trent and Newcastle-under-Lyme authorities, who both have responsibility for environmental health, were issued a Ministerial Direction to produce a local air quality plan to address their respective nitrogen dioxide ($NO_2$) problems. Given their proximity to one another, they were tasked with producing a joint plan. As the highway authority for the Newcastle-under-Lyme area, Staffordshire County Council has been assisting the authorities and together, the three authorities have developed a plan to tackle $NO_2$ exceedances at the roadside – known as the North Staffordshire Local Air Quality Plan (NSLAQP).<br><br>This Plan will help to protect and promote the health of the local population by improving air quality and reducing the impact of air pollution on the environment. In so doing, the local authorities are complying with the primary aim of the UK Air Quality Plan and bringing $NO_2$ air pollution within statutory limits in the shortest possible time.<br><br>This Appraisal Summary Table presents the appraisal results for the NSLAQP Preferred Option. | | | Organisation | Newcastle-under-Lyme |
| | | | | Role | Senior Responsible Officer |

| Impacts | | Summary of Key Impacts | Assessment | | | |
|---|---|---|---|---|---|---|
| | | | Quantitative (£000's) | Qualitative | Monetary £(000's NPV) | Distributional 7-pt Scale / Vulnerable Group |
| Economy | Business Users & Transport Providers | The Preferred Option will achieve the main aim of bringing $NO_2$ air pollution within statutory limits by 2022. As a result, business users will disbenefit from the provision of the package of measures making up the Preferred Option through increased travel times and vehicle operating costs amounting to -£16.1m PV and -£4.1m PV, respectively. The introduction of the bus gates and potential issue of Penalty Charge Notices (PCNs) will also be a disbenefit to users of -£0.02m PV, giving an overall net disbenefit of -£20.3m PV.<br><br>The Preferred Option includes a range of bus infrastructure improvements involving real time passenger information (RTPI), addition of new shelters, accessible kerbs at bus stops and CCTV at bus shelters. The bus infrastructure improvements mentioned will generate a benefit of £0.7m for business users.<br><br>The measures proposed in the Preferred Option do not place a direct cost on vehicle owners although businesses are likely to be affected through having to reroute around the peak-time bus gates. The main impact from the Preferred Option might be felt more by businesses based in Fenton Industrial Estate, where access will be limited as a result of the A50 Victoria Road bus gate. However, this would represent a small proportion of all businesses within North Staffordshire and should not have a significant impact on affordability for businesses. The only business type to see any direct impact are bus operators. Measures to encourage the use of buses, such as RTPI and retrofitted buses is expected to have a positive impact on bus patronage. | -£19,557 | Slight Adverse | -£19,557 | Slight adverse impact on businesses especially located in the Fenton Industrial Estate and a slight beneficial impact to bus operators. |
| | Reliability Impact on Business Users | Journey time reliability has not been assessed as part of the project. | N/A | N/A | N/A | |
| | Regeneration | Regeneration has not been assessed as part of the project. | N/A | N/A | N/A | |
| | Wider Impacts | Wider economic impacts have not been assessed as part of the project. | N/A | N/A | N/A | |
| Environmental | Noise | No road links are predicted to experience a change in traffic volumes greater than 50% or changes in speed greater than 10 kph; as such, this option is considered to have negligible impacts on noise. | N/A | Neutral | N/A | No vulnerable groups are adversely affected. |
| | Air Quality | No exceedances of air quality for $NO_2$ are predicted for the Preferred Option and is expected to generate £2.3m air quality benefits due to its implementation.<br><br>The Preferred Option reduces the impacts of air quality across all sensitive receptors tested, in particular, nurseries, playgrounds, public open spaces and nature reserves. The analysis suggests that there will be a disproportionate benefit for more deprived areas and areas with higher numbers of children. All in all, the Preferred Option is expected to deliver positive impacts in air quality, whilst in fact benefiting particular vulnerable groups. | Assessment :<br>$NO_x$ Change: £1,534<br>$PM_{2.5}$: £807 | Moderate Beneficial | £2,341 | Beneficial outcome for all vulnerable groups. |
| | Greenhouse Gases | Changes in GHG emissions have been derived from Transport User Benefit Appraisal software (TUBA). As the Preferred Option will likely lead to rerouting around the proposed bus gates but does not explicitly encourage upgrading to cleaner vehicles, it can be expected that the impact of GHGs is negative. This might be offset to an extent with a mode shift to bus travel through the bus infrastructure improvements that are proposed as of the Preferred Option. | Change in non-traded carbon over 10y (CO2e): 8,539<br>Change in traded carbon over 10y (CO2e): 66 | N/A | -£518 | |
| | Landscape | Landscape has not been assessed as part of the project. | N/A | N/A | N/A | |
| | Townscape | Townscape has not been assessed as part of the project. | N/A | N/A | N/A | |
| | Historic Environment | Historic environment has not been assessed as part of the project. | N/A | N/A | N/A | |
| | Biodiversity | Biodiversity has not been assessed as part of the project. | N/A | N/A | N/A | |
| | Water Environment | Water environment has not been assessed as part of the project. | N/A | N/A | N/A | |
| Social | Commuting and Other Users | The Preferred Option will achieve the main aim of bringing $NO_2$ air pollution within statutory limits by 2022. As a result, commuting and other users will disbenefit from the provision of the package of measures making up the Preferred Option through increased travel times and vehicle operating costs amounting to -£32.1m PV and -£4.3m PV, respectively. The introduction of the bus gates and potential issue of Penalty Charge Notices (PCNs) will also be a disbenefit users of -£0.4m PV, giving an overall net disbenefit of -£36.8m PV.<br><br>The Preferred Option includes a range of bus infrastructure improvements involving real time passenger information (RTPI), addition of new shelters, accessible kerbs at bus stops and CCTV at bus shelters. The bus infrastructure improvements mentioned will generate a benefit of £34.1m for commuting and other users.<br><br>Under the Preferred Option, the operation of peak period bus gates on Victoria Road and Etruria Road will lead to a mixture of improved and longer travel times. Whilst journeys that would otherwise utilise the bus gates are likely to be longer, it may be that journeys using adjacent routes will make journey time savings due to reductions in overall traffic. The Preferred Option results in a moderate adverse impact across all quintiles and so no specific distributional effect is experienced. Considering the size of impact however, the reduction in user benefits will be greatest for the most deprived households. | -£2,630 | Moderate Adverse | -£2,630 | Moderate adverse impact for all vulnerable groups. |
| | Reliability Impact on Commuting and Other Users | Journey time reliability has not been assessed as part of the project. | N/A | N/A | N/A | |
| | Welfare and Upgrade Impacts | Bus retrofitting delays the purchase of new vehicles meaning that older vehicles will be in operation for longer. This would reduce the costs associated with vehicle upgrade but would subsequently increase fuel and non-fuel VOCs that accompany older vehicles. Whilst the bus retrofitting measures appears as an overall disbenefit, the benefits derived from this measure can be captured in the air quality assessment through the use of cleaner buses in the short-term. | -£773 | N/A | -£773 | |
| | Physical Activity | The impacts of active travel and so physical activity as a result of the Preferred Option are likely to be limited as the option does not directly incentivise modal shift towards active travel. | N/A | Neutral | N/A | |
| | Journey Quality | The Preferred Option includes a range of bus infrastructure improvements involving real time passenger information (RTPI), addition of new shelters, accessible kerbs at bus stops and CCTV at bus shelters. In addition, to the bus improvements, the Preferred Option will also improve pedestrian access across the A53 and reductions in traffic flows on some routes. | N/A | Moderate Beneficial | N/A | |
| | Accidents | In the Preferred Option, potential accident risk impacts are concentrated in areas around the two proposed gates on the A53 Etruria Road and the A50 Victoria Road. The option results in a combination of benefits and disbenefits, as traffic is primarily rerouted rather than being removed through modal shift. However, there is an overall small net benefit. 2.2% of road links are predicted to experience a reduction in traffic flows greater than 10%, while 1.3% of road links are predicted to experience an increase. Roads where significant increases are predicted include Manor Street, Porthill Bank Road and some road links which form connections to the A500. Distributional analysis of these impacts demonstrates that low-income households will benefit disproportionately, as will households with a registered disability, as both these areas are located in LSOAs with a high proportion of these groups. No distributional effects are predicted to occur for the over 65 and under 16 groups. | N/A | Slight Beneficial | N/A | Beneficial outcome for all vulnerable groups. |
| | Security | The Preferred Option includes a substantial investment in CCTV cameras at bus stops which will have a positive impact on both the actual and perceived security of bus users. It might also encourage those who previously had concerns regarding the security of the bus network to in fact utilise it. The proposed CCTV camera locations are predominantly in areas with a relatively low-income population, with a high ratio of persons with disabilities and a high proportion of BME. As previously described, these demographic groups are likely to travel by public transport and therefore will benefit disproportionately from these security improvements. | N/A | Moderate Beneficial | N/A | Beneficial outcome for all vulnerable groups. |
| | Access to Services | The A53 Etruria Road and A50 Victoria Road bus gates will act as a physical barrier to private vehicles but not to buses. However, limiting the bus gate restrictions to peak times and to one direction of travel only will help to mitigate any negative distributional impacts associated with private vehicle travel. Vulnerable groups using public transport might be positively impacted through faster journey times at peak times.<br><br>Pedestrian access to the existing bus stop along the A53 Etruria Road will be enhanced through improvements to the signalised pedestrian crossing facilities on this route.<br>Improvements to bus infrastructure could serve to improve accessibility through bus users as there will be an increased availability of information through RTPI as well as the provision of accessible kerbs at bus stops. The bus infrastructure measures associated with the Preferred Option are anticipated to deliver a disproportionate benefit to more deprived households, those with a higher proportion of children and disabled and those with a lower proportion of elderly residents. | N/A | Slight Beneficial | N/A | Beneficial outcome for the more deprived households, those with a higher proportion of children and disabled and those with a lower proportion of elderly residents. |
| | Affordability | The Preferred Option will increase costs to individuals who have to reroute around the proposed bus gates through an increase in fuel costs and VOC. The cost of this impact is relatively small. The Preferred Option may also provide positive indirect impacts to households through the improvements to bus infrastructure. Public transport is more commonly used by vulnerable people and so these improvements might have a positive distributional effect. | N/A | Slight Adverse | N/A | Slight adverse impact to the majority of vulnerable groups. This adverse impact is slightly offset for vulnerable people able to utilise public transport. |
| | Severance | The majority of severance impacts from the Preferred Option are improvements resulting from the diversion of traffic from congested road links, potentially improving the ability of pedestrians to take their preferred line to nearby amenities. The amenities affected cover a wide range of groups. Manor Street has been assessed to have a slight adverse impact on severance as it acts as a displacement route from the bus gate on the A50 Victoria Road. This route is of relevance as it acts as the entrance to Christ Church C of E Primary School and so will impact children. Additional measures form part of the Preferred Option to help alleviate the impacts of possible increased traffic flow on this route including the provision of new road humps, carriageway resurfacing and enhanced signage. | N/A | Slight Beneficial | N/A | Slight beneficial impact to the majority of vulnerable groups with children being slightly adversely impact. |
| | Option and Non-Use Values | Option and non-use values have not been assessed as part of this project. | N/A | N/A | N/A | |
| Public Accounts | Cost to Broad Transport Budget | The Preferred Option will require an investment in the transport network of £14.5m. Revenues are treated as part of wider public finances for appraisal purposes. When the potential revenues from PCNs of £0.4m PV are offset against costs, the overall PV of net costs is £14.1m. | Implementation costs of £14,482 offset by public sector revenue of £404 | N/A | £14,482 costs, offset by £404 revenue | |
| | Indirect Tax Revenues | As a result of significant changes to vehicle routing and the subsequent impact on travel times and fuel consumption, there will be an indirect taxation revenue to the government of £2.3m PV. | £2,270 | N/A | £2,270 | |

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE

## APPENDIX 10 - Appraisal Summary Table - Benchmark CAZ D

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

**Appraisal Summary Table**

| | | | |
|---|---|---|---|
| **Date Produced:** | 15 May 2020 | **Contact:** | |
| **Name of Scheme:** | North Staffordshire Local Air Quality Plan | **Name** | Nesta Barker |
| **Description of Scheme:** | In October 2018, Stoke-on-Trent and Newcastle-under-Lyme authorities, who both have responsibility for environmental health, were issued a Ministerial Direction to produce a local air quality plan to address their respective nitrogen dioxide (NO2) problems. Given their proximity to one another, they were tasked with producing a joint plan. As the highway authority for the Newcastle-under-Lyme area, Staffordshire County Council has been assisting the authorities and together, the three authorities have developed a plan to tackle $NO_2$ exceedances at the roadside – known as the North Staffordshire Local Air Quality Plan (NSLAQP).<br><br>This Plan will help to protect and promote the health of the local population by improving air quality and reducing the impact of air pollution on the environment. In so doing, the local authorities are complying with the primary aim of the UK Air Quality Plan and bringing NO2 air pollution within statutory limits in the shortest possible time.<br><br>This Appraisal Summary Table presents the appraisal results for the NSLAQP Benchmark Charging Clean Air Zone. | **Organisation** | Newcastle-under-Lyme |
| | | **Role** | Senior Responsible Officer |

| Impacts | | Summary of Key Impacts | Assessment: Quantitative (£000's) | Assessment: Qualitative | Assessment: Monetary £(000's NPV) | Assessment: Distributional 7-pt Scale / Vulnerable Group |
|---|---|---|---|---|---|---|
| Economy | Business Users & Transport Providers | The Benchmark CAZ D will achieve the main aim of bringing $NO_2$ air pollution within statutory limit by 2023. As a result, business users will benefit from the CAZ D through decreased travel times amounting to £9.8m PV and slight disbenefit through increased vehicle operating costs amounting to -£0.8m PV. The introduction of the CAZ D user charge will disbenefit users by -£80.7m PV, giving an overall net disbenefit of -£71.7m PV.<br><br>The Benchmark CAZ D would significantly impact all businesses based within the charging area, the immediate surrounding area and North Staffordshire as a whole. Those that rely on vehicles to move goods and services would be most affected as an introduction of a charge would increase businesses' costs. In order to avoid paying the CAZ charge, businesses will need to upgrade their vehicles to a compliant standard or adopt another approach such as altering their supply routes or supplier, relocating their business or exiting the market altogether. Micro and small businesses are also likely to be at greater risk from the implementation of the Benchmark CAZ D as they are less likely to have the available capital to purchase a compliant vehicle, they do not have large fleets where non-compliant vehicles could be redistributed to operating in areas outside of the CAZ boundary and they are more likely to have locally-focused operations therefore facing the charge more frequently. This is of significant importance in North Staffordshire as 92% of al businesses based within the CAZ boundary are classified as micro or small businesses. Taxi drivers are noted to be some of the poorest in the community and so any additional cost to their operation would place further strain on their businesses and families. It is anticipated that there will only be a limited impact on bus operators as the CAZ charge has been purposely set at a level where the charge can be absorbed by the bus operators to avoid any further withdrawals of operators from the North Staffordshire area. | -£71,702 | Moderate Adverse | -£71,702 | Moderate adverse impact to businesses. |
| | Reliability Impact on Business Users | Journey time reliability has not been assessed as part of the project. | N/A | N/A | N/A | |
| | Regeneration | Regeneration has not been assessed as part of the project. | N/A | N/A | N/A | |
| | Wider Impacts | Wider economic impacts have not been assessed as part of the project. | N/A | N/A | N/A | |
| Environmental | Noise | For the Benchmark CAZ D, no road link is predicted to experience a change in traffic volumes greater than 50% or changes in speed greater than 10 kph. With the introduction of a CAZ, vehicle upgrades may lead to older (generally louder) vehicles being replaced with newer vehicles that are subject to tighter noise limits in accordance with Regulation (EU) No 540/2014. However, these changes are small. Therefore, there are not to be any perceivable changes in noise levels. | N/A | Neutral | N/A | No vulnerable groups are adversely affected. |
| | Air Quality | No exceedances of air quality for $NO_2$ are predicted with the Benchmark CAZ D. The Benchmark CAZ D is expected to generate £18.9m air quality benefits due to its implementation.<br><br>With the introduction of the CAZ D, non-compliant vehicles are likely to be discouraged from entering the charging zone. There is a resultant reduction in the impact of air pollution across all sensitive receptors, specifically for residential education. This is as a result of both Staffordshire University and Keele University being positively impacted. The analysis suggests that the Benchmark CAZ D will not have a disproportionate impact on any vulnerable group although it can be noted that benefits might be greater for more deprived areas and areas with higher numbers of children. | Assessment :<br>$NO_x$ Change: £8,543<br>$PM_{2.5}$: £10,325 | Moderate Beneficial | £18,868 | Moderate beneficial outcome for all vulnerable groups. |
| | Greenhouse Gases | Changes in GHG emissions have been derived from Transport User Benefit Appraisal software (TUBA) and were combined with carbon values from BEIS' Green Book Supplementary Guidance. The Benchmark CAZ D encourages vehicle upgrade due to the charge imposed and so it is expected that GHG emissions will drop and result in a significant monetised benefit. | Change in non-traded carbon over 10y (CO2e): -88,546<br>Change in traded carbon over 10y (CO2e): -1,439 | N/A | £8,449 | |
| | Landscape | Landscape has not been assessed as part of this project. | N/A | N/A | N/A | |
| | Townscape | Townscape has not been assessed as part of this project. | N/A | N/A | N/A | |
| | Historic Environment | Historic environment has not been assessed as part of this project. | N/A | N/A | N/A | |
| | Biodiversity | Biodiversity has not been assessed as part of this project. | N/A | N/A | N/A | |
| | Water Environment | Water environment has not been assessed as part of this project. | N/A | N/A | N/A | |
| Social | Commuting and Other Users | The Benchmark CAZ D will achieve the main aim of bringing $NO_2$ air pollution within statutory limits by 2023. As a result, commuting and other users will benefit from the CAZ D through decreased travel times and vehicle operating costs amounting to £23.2m PV and £25.2m PV, respectively. The introduction of the CAZ D user charge will disbenefit users by -£126.0m PV, giving an overall net disbenefit of -£77.6m PV.<br><br>The population predicted to disbenefit the most from the implementation of the Benchmark CAZ D lives within the CAZ boundary or its vicinity. This population is relatively poor and so these impacts will be exacerbated. The analysis suggests that a moderate adverse impact will be felt across all quintiles and so no specific distributional effect. However, the most deprived households will experience the greatest reduction in user benefits. | -£77,581 | Large Adverse | -£77,581 | Large adverse impact on all vulnerable groups. |
| | Reliability Impact on Commuting and Other Users | Journey time reliability has not been assessed as part of this project. | N/A | N/A | N/A | |
| | Welfare and Upgrade Impacts | The expected trip cancellation associated with the Benchmark CAZ D will adversely affect individuals' utility function since transport users may not be able to go to their preferred destination. The consumer welfare loss is estimated to be approximately -£27.0m PV in the Benchmark CAZ D scenario. This demonstrates that there is a significant loss in welfare to the user.<br><br>As a result of the Benchmark CAZ D some vehicle owners will respond to the CAZ charge by either scrapping and buying a new compliant vehicle, or by selling their non-compliant vehicle and replacing it with a second-hand compliant vehicle. The vehicle upgrade impact is estimated to be approximately -£26.4m. | -£53,446 | N/A | -£53,446 | |
| | Physical Activity | The impacts of active travel and so physical activity as a result of the Benchmark CAZ D are likely to be limited as the option does not directly incentivise modal shift towards active travel. | N/A | Neutral | N/A | |
| | Journey Quality | The impacts on journey quality as a result of the Benchmark CAZ D are likely to be limited as the option does not directly improve journey quality. | N/A | Neutral | N/A | |
| | Accidents | The Benchmark CAZ D is substantially more aggressive, and as a result 9.3% of all road links in the modelled domain are predicted to experience significant reductions in traffic flows under this option. As the CAZ boundary encompasses an area with a high proportion of low-income households and a high proportion of residents with a registered disability, these groups will benefit disproportionately from the scheme. The over 65 group will not benefit as much as other groups, whilst no distributional effects were seen for the under 16 group. | N/A | Moderate Beneficial | N/A | Moderate beneficial impact on low-income households and the disabled. The elderly and under 16 are expected to be impacted to a lesser degree. |
| | Security | The Benchmark CAZ D does not include any measures that will directly affect security when using public transport. | N/A | Neutral | N/A | No vulnerable groups are adversely affected. |
| | Access to Services | The Benchmark CAZ D might reduce accessibility for all vulnerable groups travelling into or around the CAZ boundary as the charge may impose affordability restrictions to the traveller. The CAZ charge is likely to impact private vehicle users more. This may include people with limited mobility, children or the elderly, who might prefer the comfort of a private vehicle but with accessibility restrictions may be forced to use alternative modes of transport or to change their route or destination. The charge applied to buses has deliberately been set at a nominal price so not as to discourage bus operators from servicing the CAZ area. This should therefore have a minimal impact on vulnerable groups relying on bus services. | N/A | Slight Adverse | N/A | Slight adverse impact to all vulnerable groups. |
| | Affordability | The disbenefits to users as a result of the Benchmark CAZ D, suggests it would have a greater disproportionate adverse effect on more deprived households. It was found that poorer households make significantly more trips into the CAZ boundary and are more likely to own non-compliant cars. This therefore suggests that a higher proportion of costs will fall greatest on areas with greater levels of deprivation, greater numbers of elderly residents and those with disabilities. It is again important to note that the same cost placed on the most deprived quintile will represent a greater proportion of their disposable income and would therefore have an even greater impact. | N/A | Large Adverse | N/A | Large adverse impact to all vulnerable groups. |
| | Severance | The Benchmark CAZ D leads to moderate changes in traffic flows across a wide area in the model domain, particularly around the City Centre. In particular, the reduction in AADT flows around portions of Potteries Way, which partly encircles the City Centre, will improve accessibility to the wide range of amenities located there and affects all groups. Smaller improvements in severance are also noticed along a number of routes around the model domain.<br><br>However, displacement of traffic around the CAZ boundary leads to some areas of adverse impact. Of particular relevance are impacts on North Road, which will impact access to North Road Academy and Honey Bears Day Nursery, which are relevant to vulnerable parents with pushchairs and children. | N/A | Slight Beneficial | N/A | Slight beneficial outcome for the majority of vulnerable groups, with children experiencing a slight adverse impact. |
| | Option and Non-Use Values | Option and non-use values has not been assessed as part of this project. | N/A | N/A | N/A | |
| Public Account | Cost to Broad Transport Budget | The Benchmark CAZ will require an investment in the transport network of £198.6m. Revenues are treated as part of wider public finances for appraisal purposes. When the potential revenues from the introduction of the CAZ D charge of £203.2m PV are offset against costs, the overall PV of net costs is -£4.6m. | Implementation costs of £198,561 offset by public sector revenue of £203,191 | N/A | £198,561 costs, offset by £203,191 revenue | |
| | Indirect Tax Revenues | As a result of significant changes to vehicle routing and the subsequent impact on travel times and fuel consumption, there will be an indirect taxation cost to the government of £23.4m PV. | -£23,399 | N/A | -£23,399 | |

*Preferred Option, Summary of costs, adjusted for inflation and risk*

| Measure | Capital expenditure | Operating expenditure over 10 years | Total |
|---|---|---|---|
| A50 Victoria Road Bus Gate | £ 754,940 | £ 242,284 | **£ 997,224** |
| A53 Etruria Road Bus Gate | £ 1,012,028 | £ 307,628 | **£ 1,319,656** |
| Traffic Management East and West of Victoria Road | £ 2,110,950 | £ - | **£ 2,110,950** |
| Transport Improvements along A53 Etruria Road | £ 825,112 | £ 46,013 | **£ 871,126** |
| Bus Retrofit Programme | £ 1,813,394 | £ 207,061 | **£ 2,020,455** |
| Bus Infrastructure Improvements | £ 1,239,980 | £ 947,812 | **£ 2,187,792** |
| Monitoring and evaluation | £ 86,033 | £ 990,801 | **£ 1,076,834** |
| Back Office Cost for Monitoring, Data Processing and Charging | £ - | £ 1,650,007 | **£ 1,650,007** |
| Communications, engagement and consultation | £ - | £ 124,726 | **£ 124,726** |
| Decommissioning costs | £ - | £ 607,641 | **£ 607,641** |
| **Total** | **£ 7,842,436** | **£ 5,123,973** | **£ 12,966,409** |

*Preferred Option, Summary of costs, adjusted for inflation and risk (£000's)*

| Measure | Capital expenditure | Operating expenditure over 10 years | Total |
|---|---|---|---|
| A50 Victoria Road Bus Gate | 755 | 242 | **997** |
| A53 Etruria Road Bus Gate | 1,012 | 308 | **1,320** |
| Traffic Management East and West of Victoria Road | 2,111 | - | **2,111** |
| Transport Improvements along A53 Etruria Road | 825 | 46 | **871** |
| Bus Retrofit Programme | 1,813 | 207 | **2,020** |
| Bus Infrastructure Improvements | 1,240 | 948 | **2,188** |
| Monitoring and evaluation | 86 | 991 | **1,077** |
| Back Office Cost for Monitoring, Data Processing and Charging | - | 1,650 | **1,650** |
| Communications, engagement and consultation | - | 125 | **125** |
| Decommissioning costs | - | 608 | **608** |
| **Total** | **7,842** | **5,124** | **12,966** |

*Preferred Option, cash flow profile, adjusted for inflation and risk*

| | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Capital costs | £ - | £ 3,805,583 | £ 3,800,709 | £ - | £ - | £ - | £ 236,145 | £ - | £ - | £ - | £ - | £ - |
| Operating costs | £ - | £ 160,330 | £ 336,474 | £ 400,865 | £ 366,719 | £ 579,965 | £ 383,782 | £ 392,609 | £ 514,045 | £ 410,877 | £ 420,327 | £ 1,157,977 |
| Revenue | | | -£ 83,822 | -£ 40,332 | -£ 40,332 | -£ 40,332 | -£ 40,332 | -£ 40,332 | -£ 40,332 | -£ 40,332 | -£ 40,332 | -£ 40,332 |
| **Net cashflow** | **£ -** | **£ 3,965,912** | **£ 4,053,361** | **£ 360,533** | **£ 326,387** | **£ 539,633** | **£ 579,595** | **£ 352,277** | **£ 473,713** | **£ 370,545** | **£ 379,995** | **£ 1,117,645** |

*Costs are presented as negative values, revenues are presented as positive values as per DfT's Public Accounts table*

*Preferred Option, cash flow profile, adjusted for inflation and risk (£000s)*

| | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Capital costs | - | 3,806 | 3,801 | - | - | - | 236 | - | - | - | - | - |
| Operating costs | - | 160 | 336 | 401 | 367 | 580 | 384 | 393 | 514 | 411 | 420 | 1,158 |
| Revenue | - | - | - 84 | - 40 | - 40 | - 40 | - 40 | - 40 | - 40 | - 40 | - 40 | - 40 |
| **Net cashflow** | **-** | **3,966** | **4,053** | **361** | **326** | **540** | **580** | **352** | **474** | **371** | **380** | **1,118** |

*Costs are presented as negative values, revenues are presented as positive values as per DfT's Public Accounts table*

*Sensitivity Test, Summary of costs adjusted for inflation and risk (20% increase to CAPEX & OPEX)*

| | Measure | Capital expenditure | Operating expenditure | Total |
|---|---|---|---|---|
| 1 | A50 Victoria Road Bus Gate | £905,928 | £290,741 | **£1,196,669** |
| 2 | A53 Etruria Road Bus Gate | £1,214,433 | £369,154 | **£1,583,587** |
| 3 | Traffic Management East and West of Victoria Road | £2,533,139 | £0 | **£2,533,139** |
| 4 | Transport Improvements along A53 Etruria Road | £990,135 | £55,216 | **£1,045,351** |
| 5 | Bus Retrofit Programme | £2,176,073 | £248,473 | **£2,424,546** |
| 6 | Bus Infrastructure Improvements | £1,487,976 | £1,137,374 | **£2,625,350** |
| 7 | Monitoring and evaluation | £103,239 | £1,188,961 | **£1,292,201** |
| 8 | Back Office Cost for Monitoring, Data Processing and Charging | £0 | £1,980,008 | **£1,980,008** |
| 9 | Communications, engagement and consultation | £0 | £149,671 | **£149,671** |
| 10 | Decommissioning costs | £0 | £729,169 | **£729,169** |
| | Risk | | | **£1,272,000** |
| | **Total** | **£9,410,923** | **£6,148,767** | **£16,831,691** |

*Sensitivity Test, Summary of costs adjusted for inflation and risk (20% increase to CAPEX & OPEX) (£000s)*

| | Measure | Capital expenditure | Operating expenditure | Total |
|---|---|---|---|---|
| 1 | A50 Victoria Road Bus Gate | 906 | 291 | **1,197** |
| 2 | A53 Etruria Road Bus Gate | 1,214 | 369 | **1,584** |
| 3 | Traffic Management East and West of Victoria Road | 2,533 | - | **2,533** |
| 4 | Transport Improvements along A53 Etruria Road | 990 | 55 | **1,045** |
| 5 | Bus Retrofit Programme | 2,176 | 248 | **2,425** |
| 6 | Bus Infrastructure Improvements | 1,488 | 1,137 | **2,625** |
| 7 | Monitoring and evaluation | 103 | 1,189 | **1,292** |
| 8 | Back Office Cost for Monitoring, Data Processing and Charging | - | 1,980 | **1,980** |
| 9 | Communications, engagement and consultation | - | 150 | **150** |
| 10 | Decommissioning costs | - | 729 | **729** |
| | Risk | - | - | **1,272** |
| | **Total** | **9,411** | **6,149** | **16,832** |

*Sensitvity Test, Cash flow profile adjusted inflation and risk (20% increase to CAPEX & OPEX)*

| | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Capital costs | £ - | £ 3,949,455 | £ 3,944,396 | £ - | £ - | £ - | £ 245,073 | £ - | £ - | £ - | £ - | £ - |
| Operating costs | £ - | £ 192,396 | £ 403,769 | £ 481,039 | £ 440,063 | £ 695,958 | £ 460,539 | £ 471,131 | £ 616,854 | £ 493,053 | £ 504,393 | £ 1,389,573 |
| **Net cashflow** | **£ -** | **£ 4,141,850** | **£ 4,348,165** | **£ 481,039** | **£ 440,063** | **£ 695,958** | **£ 705,611** | **£ 471,131** | **£ 616,854** | **£ 493,053** | **£ 504,393** | **£ 1,389,573** |
| Original costs minus sensitivity costs | | £ 175,938 | £ 294,805 | £ 120,505 | £ 113,676 | £ 156,325 | £ 126,016 | £ 118,854 | £ 143,141 | £ 122,507 | £ 124,397 | £ 271,927 |

*Sensitvity Test, Cash flow profile adjusted inflation and risk (20% increase to CAPEX & OPEX) (£000s)*

| | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Capital costs | - | 3,949 | 3,944 | - | - | - | 245 | - | - | - | - | - |
| Operating costs | - | 192 | 404 | 481 | 440 | 696 | 461 | 471 | 617 | 493 | 504 | 1,390 |
| **Net cashflow** | **-** | **4,142** | **4,348** | **481** | **440** | **696** | **706** | **471** | **617** | **493** | **504** | **1,390** |

**Capital Costs Cash Flow Profile (2020 prices)**

| Header | Heading | Item | Final cost | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A50 Victoria Road Bus Gate | Bus Gate ANPR camera (incl TM, PM and civils) | £71,875.00 | | £28,750 | £43,125 | | | | | | | | | | £71,875 |
| 1 | A50 Victoria Road Bus Gate | Bus Gate narrowing of existing c'way (incl electric supplies and feeder pillar) | £43,125.00 | | £17,250 | £25,875 | | | | | | | | | | £43,125 |
| 1 | A50 Victoria Road Bus Gate | New TRO for bus gate | £14,375.00 | | £14,375 | | | | | | | | | | | £14,375 |
| 1 | A50 Victoria Road Bus Gate | Bus Gate Signing (VMS) | £150,937.50 | | £60,375 | £90,563 | | | | | | | | | | £150,938 |
| 1 | A50 Victoria Road Bus Gate | Bus Gate Advance Signing | £106,375.00 | | £42,550 | £63,825 | | | | | | | | | | £106,375 |
| 1 | A50 Victoria Road Bus Gate | TRO costs for Stopping Up and One Way | £17,250.00 | | £6,900 | £10,350 | | | | | | | | | | £17,250 |
| 1 | A50 Victoria Road Bus Gate | TTRO costs for temporary road closures | £4,312.50 | | £1,725 | £2,588 | | | | | | | | | | £4,313 |
| 1 | A50 Victoria Road Bus Gate | Five year camera replacement costs | £20,000.00 | | | | | | | £20,000 | | | | | | £20,000 |
| 1 | A50 Victoria Road Bus Gate | IT Infrastructure and Storage Capacity | £3,833.33 | | £1,533 | £2,300 | | | | | | | | | | £3,833 |
| 1 | A50 Victoria Road Bus Gate | Prism Sign Costs | £199,237.50 | | £79,695 | £119,543 | | | | | | | | | | £199,238 |
| 2 | A53 Etruria Road Bus Gate | Bus Gate ANPR camera (incl TM, PM and civils) | £143,750.00 | | £57,500 | £86,250 | | | | | | | | | | £143,750 |
| 2 | A53 Etruria Road Bus Gate | Bus Gate Signing (VMS) | £150,937.50 | | £60,375 | £90,563 | | | | | | | | | | £150,938 |
| 2 | A53 Etruria Road Bus Gate | Bus Gate Advance Signing | £240,421.88 | | £96,169 | £144,253 | | | | | | | | | | £240,422 |
| 2 | A53 Etruria Road Bus Gate | New TRO for bus gate | £14,375.00 | | £14,375 | | | | | | | | | | | £14,375 |
| 2 | A53 Etruria Road Bus Gate | Five year camera replacement costs | £40,000.00 | | | | | | | £40,000 | | | | | | £40,000 |
| 2 | A53 Etruria Road Bus Gate | Facilitating Works | £8,101.21 | | £3,240 | £4,861 | | | | | | | | | | £8,101 |
| 2 | A53 Etruria Road Bus Gate | IT Infrastructure and Storage Capacity | £3,833.33 | | £1,533 | £2,300 | | | | | | | | | | £3,833 |
| 2 | A53 Etruria Road Bus Gate | Prism Sign Costs | £243,512.50 | | £97,405 | £146,108 | | | | | | | | | | £243,513 |
| 3 | Traffic Management East and West of Victoria Road | Road Hump Regulation Notice | £5,750.00 | | £5,750 | | | | | | | | | | | £5,750 |
| 3 | Traffic Management East and West of Victoria Road | Removal Type A roadhump (excavate) | £62,100.00 | | £24,840 | £37,260 | | | | | | | | | | £62,100 |
| 3 | Traffic Management East and West of Victoria Road | Removal Type B roadhump (excavate) | £10,781.25 | | £4,313 | £6,469 | | | | | | | | | | £10,781 |
| 3 | Traffic Management East and West of Victoria Road | Removal Type C roadhump (plane out) | £2,156.25 | | £863 | £1,294 | | | | | | | | | | £2,156 |
| 3 | Traffic Management East and West of Victoria Road | Plane out existing c'way and resurface 50mm | £733,160.94 | | £293,264 | £439,897 | | | | | | | | | | £733,161 |
| 3 | Traffic Management East and West of Victoria Road | EO plane out 100mm deep (25% of total area) | £146,632.19 | | £58,653 | £87,979 | | | | | | | | | | £146,632 |
| 3 | Traffic Management East and West of Victoria Road | New kerbing to roadhumps | £34,500.00 | | £13,800 | £20,700 | | | | | | | | | | £34,500 |
| 3 | Traffic Management East and West of Victoria Road | Take down existing sign and post | £1,437.50 | | £575 | £863 | | | | | | | | | | £1,438 |
| 3 | Traffic Management East and West of Victoria Road | Take down sign and post including electrics and make safe | £8,625.00 | | £3,450 | £5,175 | | | | | | | | | | £8,625 |
| 3 | Traffic Management East and West of Victoria Road | New Roadhumps in Bituminous Materials | £99,187.50 | | £39,675 | £59,513 | | | | | | | | | | £99,188 |
| 3 | Traffic Management East and West of Victoria Road | Road Markings | £8,625.00 | | £3,450 | £5,175 | | | | | | | | | | £8,625 |
| 3 | Traffic Management East and West of Victoria Road | Removal of existing 20mph zone terminal signs | £718.75 | | £288 | £431 | | | | | | | | | | £719 |
| 3 | Traffic Management East and West of Victoria Road | New signing for 20mph zone incl post and foundations | £2,875.00 | | £1,150 | £1,725 | | | | | | | | | | £2,875 |
| 3 | Traffic Management East and West of Victoria Road | Removal of existing illuminated hump signs | £1,437.50 | | £575 | £863 | | | | | | | | | | £1,438 |
| 3 | Traffic Management East and West of Victoria Road | Electrical Disconnection for existing illuminated hump signs | £2,875.00 | | £1,150 | £1,725 | | | | | | | | | | £2,875 |
| 3 | Traffic Management East and West of Victoria Road | New signing for one way sections | £1,437.50 | | £575 | £863 | | | | | | | | | | £1,438 |
| 3 | Traffic Management East and West of Victoria Road | One Way Signs | £8,625.00 | | £3,450 | £5,175 | | | | | | | | | | £8,625 |
| 3 | Traffic Management East and West of Victoria Road | No Entry Signs | £8,625.00 | | £3,450 | £5,175 | | | | | | | | | | £8,625 |
| 3 | Traffic Management East and West of Victoria Road | New signing for 7.5T weight limit "Except for Access" | £14,375.00 | | £5,750 | £8,625 | | | | | | | | | | £14,375 |
| 3 | Traffic Management East and West of Victoria Road | Removal Type A roadhump (excavate) 2 | £10,350.00 | | £4,140 | £6,210 | | | | | | | | | | £10,350 |
| 3 | Traffic Management East and West of Victoria Road | Removal Type C roadhump (plane out) 2 | £6,468.75 | | £2,588 | £3,881 | | | | | | | | | | £6,469 |
| 3 | Traffic Management East and West of Victoria Road | Plane out existing c'way and resurface 50mm 2 | £339,846.56 | | £135,939 | £203,908 | | | | | | | | | | £339,847 |
| 3 | Traffic Management East and West of Victoria Road | EO plane out 100mm deep (20% of total area) | £113,282.19 | | £45,313 | £67,969 | | | | | | | | | | £113,282 |
| 3 | Traffic Management East and West of Victoria Road | New kerbing to roadhumps 2 | £15,812.50 | | £6,325 | £9,488 | | | | | | | | | | £15,813 |
| 3 | Traffic Management East and West of Victoria Road | New footway construction to Hitchman Street Closure including kerbing works and Manchester Bollards | £21,562.50 | | £8,625 | £12,938 | | | | | | | | | | £21,563 |
| 3 | Traffic Management East and West of Victoria Road | Take down existing signs | £1,437.50 | | £575 | £863 | | | | | | | | | | £1,438 |
| 3 | Traffic Management East and West of Victoria Road | Take down signs including electrics and make safe | £4,312.50 | | £1,725 | £2,588 | | | | | | | | | | £4,313 |
| 3 | Traffic Management East and West of Victoria Road | New roadhumps in bituminous materials 2 | £64,687.50 | | £25,875 | £38,813 | | | | | | | | | | £64,688 |
| 3 | Traffic Management East and West of Victoria Road | New raised table adjacent to school. | £21,562.50 | | £8,625 | £12,938 | | | | | | | | | | £21,563 |
| 3 | Traffic Management East and West of Victoria Road | New signing for 20mph zone | £14,375.00 | | £5,750 | £8,625 | | | | | | | | | | £14,375 |
| 3 | Traffic Management East and West of Victoria Road | New signing for road closure | £2,875.00 | | £1,150 | £1,725 | | | | | | | | | | £2,875 |
| 4 | Transport Improvements along A53 Etruria Road | New bus stop | £28,750.00 | | £11,500 | £17,250 | | | | | | | | | | £28,750 |
| 4 | Transport Improvements along A53 Etruria Road | Traffic Signals Sandy Lane/King Street Junction | £215,625.00 | | £86,250 | £129,375 | | | | | | | | | | £215,625 |
| 4 | Transport Improvements along A53 Etruria Road | Plane and resurface | £51,750.00 | | £20,700 | £31,050 | | | | | | | | | | £51,750 |
| 4 | Transport Improvements along A53 Etruria Road | EO plane out 100mm deep (10% of total area) | £3,450.00 | | £1,380 | £2,070 | | | | | | | | | | £3,450 |
| 4 | Transport Improvements along A53 Etruria Road | Removal Kerbs, tactile slabs and existing footway, and new kerbs,footway, tactile slabs and road markings | £35,937.50 | | £14,375 | £21,563 | | | | | | | | | | £35,938 |
| 4 | Transport Improvements along A53 Etruria Road | Traffic Signals Basford Park Road/Etruria Road (West) Junction | £244,375.00 | | £97,750 | £146,625 | | | | | | | | | | £244,375 |
| 4 | Transport Improvements along A53 Etruria Road | Plane and resurface 2 | £64,687.50 | | £25,875 | £38,813 | | | | | | | | | | £64,688 |
| 4 | Transport Improvements along A53 Etruria Road | EO plane out 100mm deep (10% of total area) 2 | £4,312.50 | | £1,725 | £2,588 | | | | | | | | | | £4,313 |
| 4 | Transport Improvements along A53 Etruria Road | Removal Kerbs, tactile slabs and existing footway, and new kerbs,footway/splitters and tactile slabs, new splitters and road markings islands | £43,125.00 | | £17,250 | £25,875 | | | | | | | | | | £43,125 |
| 5 | Bus Retrofit Programme | ANPR to monitor bus retrofit compliance - A53 Etruria | £143,750.00 | | £86,250 | £57,500 | | | | | | | | | | £143,750 |
| 5 | Bus Retrofit Programme | ANPR to monitor bus retrofit compliance - A50 Victoria Road Bus Gate and Supporting Measures | £143,750.00 | | £86,250 | £57,500 | | | | | | | | | | £143,750 |
| 5 | Bus Retrofit Programme | Bucknall New Road Bus ANPR camera (incl TM, PM and civils) | £143,750.00 | | £86,250 | £57,500 | | | | | | | | | | £143,750 |
| 5 | Bus Retrofit Programme | Five year camera replacement costs | £120,000.00 | | | | | | | £120,000 | | | | | | £120,000 |
| 5 | Bus Retrofit Programme | IT Infrastructure and Storage Capacity | £3,833.33 | | £2,300 | £1,533 | | | | | | | | | | £3,833 |
| 5 | Bus Retrofit Programme | Cost of component | £743,700.00 | | £446,220 | £297,480 | | | | | | | | | | £743,700 |
| 5 | Bus Retrofit Programme | Cost of the e-cooling fan | £190,438.00 | | £114,263 | £76,175 | | | | | | | | | | £190,438 |
| 5 | Bus Retrofit Programme | Bus wrap | £25,000.00 | | £15,000 | £10,000 | | | | | | | | | | £25,000 |
| 6 | Bus Infrastructure Improvements | CCTV | £284,000.00 | | £202,857 | £81,143 | | | | | | | | | | £284,000 |
| 6 | Bus Infrastructure Improvements | Kerbs | £237,600.00 | | £169,714 | £67,886 | | | | | | | | | | £237,600 |
| 6 | Bus Infrastructure Improvements | RTPI | £524,705.00 | | £374,789 | £149,916 | | | | | | | | | | £524,705 |
| 6 | Bus Infrastructure Improvements | New Shelters | £0.00 | | £0 | £0 | | | | | | | | | | £0 |
| 6 | Bus Infrastructure Improvements | Upgraded Shelters | £0.00 | | £0 | £0 | | | | | | | | | | £0 |
| 7 | Monitoring and evaluation | Traffic Data - procurement, installation of the ATC sites | £73,000.00 | | £73,000 | | | | | | | | | | | £73,000 |
| | Total | | | £0.00 | £3,229,098.16 | £3,163,189.79 | £0.00 | £0.00 | £0.00 | £180,000.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £6,572,287.96 |

**Capital Costs Cash Flow Profile adjusted for inflation**

| Header | Heading | Item | Final cost | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A50 Victoria Road Bus Gate | Bus Gate ANPR camera (incl TM, PM and civils) | £71,875 | £0 | £29,303 | £44,813 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £74,116 |
| 1 | A50 Victoria Road Bus Gate | Bus Gate narrowing of existing c'way (incl electric supplies and feeder pillar) | £43,125 | £0 | £17,582 | £26,888 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £44,470 |
| 1 | A50 Victoria Road Bus Gate | New TRO for bus gate | £14,375 | £0 | £14,652 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £14,652 |
| 1 | A50 Victoria Road Bus Gate | Bus Gate Signing (VMS) | £150,938 | £0 | £61,536 | £94,107 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £155,643 |
| 1 | A50 Victoria Road Bus Gate | Bus Gate Advance Signing | £106,375 | £0 | £43,368 | £66,323 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £109,692 |
| 1 | A50 Victoria Road Bus Gate | TRO costs for Stopping Up and One Way | £17,250 | £0 | £7,033 | £10,755 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £17,788 |
| 1 | A50 Victoria Road Bus Gate | TTRO costs for temporary road closures | £4,313 | £0 | £1,758 | £2,689 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £4,447 |
| 1 | A50 Victoria Road Bus Gate | Five year camera replacement costs | £20,000 | £0 | £0 | £0 | £0 | £0 | £0 | £22,692 | £0 | £0 | £0 | £0 | £0 | £22,692 |
| 1 | A50 Victoria Road Bus Gate | IT Infrastructure and Storage Capacity | £3,833 | £0 | £1,563 | £2,390 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £3,953 |
| 1 | A50 Victoria Road Bus Gate | Prism Sign Costs | £199,238 | £0 | £81,228 | £124,221 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £205,449 |
| 2 | A53 Etruria Road Bus Gate | Bus Gate ANPR camera (incl TM, PM and civils) | £143,750 | £0 | £58,606 | £89,626 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £148,232 |
| 2 | A53 Etruria Road Bus Gate | Bus Gate Signing (VMS) | £150,938 | £0 | £61,536 | £94,107 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £155,643 |
| 2 | A53 Etruria Road Bus Gate | Bus Gate Advance Signing | £240,422 | £0 | £98,019 | £149,899 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £247,918 |
| 2 | A53 Etruria Road Bus Gate | New TRO for bus gate | £14,375 | £0 | £14,652 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £14,652 |
| 2 | A53 Etruria Road Bus Gate | Five year camera replacement costs | £40,000 | £0 | £0 | £0 | £0 | £0 | £0 | £45,384 | £0 | £0 | £0 | £0 | £0 | £45,384 |
| 2 | A53 Etruria Road Bus Gate | Facilitating Works | £8,101 | £0 | £3,303 | £5,051 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £8,354 |
| 2 | A53 Etruria Road Bus Gate | IT Infrastructure and Storage Capacity | £3,833 | £0 | £1,563 | £2,390 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £3,953 |
| 2 | A53 Etruria Road Bus Gate | Prism Sign Costs | £243,513 | £0 | £99,279 | £151,826 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £251,105 |
| 3 | Traffic Management East and West of Victoria Road | Road Hump Regulation Notice | £5,750 | £0 | £5,861 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £5,861 |
| 3 | Traffic Management East and West of Victoria Road | Removal Type A roadhump (excavate) | £62,100 | £0 | £25,318 | £38,718 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £64,036 |
| 3 | Traffic Management East and West of Victoria Road | Removal Type B roadhump (excavate) | £10,781 | £0 | £4,395 | £6,722 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £11,117 |
| 3 | Traffic Management East and West of Victoria Road | Removal Type C roadhump (plane out) | £2,156 | £0 | £879 | £1,344 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £2,223 |
| 3 | Traffic Management East and West of Victoria Road | Plane out existing c'way and resurface 50mm | £733,161 | £0 | £298,906 | £457,114 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £756,020 |
| 3 | Traffic Management East and West of Victoria Road | EO plane out 100mm deep (25% of total area) | £146,632 | £0 | £59,781 | £91,423 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £151,204 |
| 3 | Traffic Management East and West of Victoria Road | New kerbing to roadhumps | £34,500 | £0 | £14,065 | £21,510 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £35,576 |
| 3 | Traffic Management East and West of Victoria Road | Take down existing sign and post | £1,438 | £0 | £586 | £896 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £1,482 |
| 3 | Traffic Management East and West of Victoria Road | Take down sign and post including electrics and make safe | £8,625 | £0 | £3,516 | £5,378 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £8,894 |
| 3 | Traffic Management East and West of Victoria Road | New Roadhumps in Bituminous Materials | £99,188 | £0 | £40,438 | £61,842 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £102,280 |
| 3 | Traffic Management East and West of Victoria Road | Road Markings | £8,625 | £0 | £3,516 | £5,378 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £8,894 |
| 3 | Traffic Management East and West of Victoria Road | Removal of existing 20mph zone terminal signs | £719 | £0 | £293 | £448 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £741 |
| 3 | Traffic Management East and West of Victoria Road | New signing for 20mph zone incl post and foundations | £2,875 | £0 | £1,172 | £1,793 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £2,965 |
| 3 | Traffic Management East and West of Victoria Road | Removal of existing illuminated hump signs | £1,438 | £0 | £586 | £896 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £1,482 |
| 3 | Traffic Management East and West of Victoria Road | Electrical Disconnection for existing illuminated hump signs | £2,875 | £0 | £1,172 | £1,793 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £2,965 |
| 3 | Traffic Management East and West of Victoria Road | New signing for one way sections | £1,438 | £0 | £586 | £896 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £1,482 |
| 3 | Traffic Management East and West of Victoria Road | One Way Signs | £8,625 | £0 | £3,516 | £5,378 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £8,894 |
| 3 | Traffic Management East and West of Victoria Road | No Entry Signs | £8,625 | £0 | £3,516 | £5,378 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £8,894 |
| 3 | Traffic Management East and West of Victoria Road | New signing for 7.5T weight limit "Except for Access" | £14,375 | £0 | £5,861 | £8,963 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £14,823 |
| 3 | Traffic Management East and West of Victoria Road | Removal Type A roadhump (excavate) 2 | £10,350 | £0 | £4,220 | £6,453 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £10,673 |
| 3 | Traffic Management East and West of Victoria Road | Removal Type C roadhump (plane out) 2 | £6,469 | £0 | £2,637 | £4,033 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £6,670 |
| 3 | Traffic Management East and West of Victoria Road | Plane out existing c'way and resurface 50mm 2 | £339,847 | £0 | £138,553 | £211,889 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £350,442 |
| 3 | Traffic Management East and West of Victoria Road | EO plane out 100mm deep (20% of total area) | £113,282 | £0 | £46,184 | £70,630 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £116,814 |
| 3 | Traffic Management East and West of Victoria Road | New kerbing to roadhumps 2 | £15,813 | £0 | £6,447 | £9,859 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £16,306 |
| 3 | Traffic Management East and West of Victoria Road | New footway construction to Hitchman Street Closure including kerbing works and Manchester Bollards | £21,563 | £0 | £8,791 | £13,444 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £22,235 |
| 3 | Traffic Management East and West of Victoria Road | Take down existing signs | £1,438 | £0 | £586 | £896 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £1,482 |
| 3 | Traffic Management East and West of Victoria Road | Take down signs including electrics and make safe | £4,313 | £0 | £1,758 | £2,689 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £4,447 |
| 3 | Traffic Management East and West of Victoria Road | New roadhumps in bituminous materials 2 | £64,688 | £0 | £26,373 | £40,332 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £66,704 |
| 3 | Traffic Management East and West of Victoria Road | New raised table adjacent to school. | £21,563 | £0 | £8,791 | £13,444 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £22,235 |
| 3 | Traffic Management East and West of Victoria Road | New signing for 20mph zone | £14,375 | £0 | £5,861 | £8,963 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £14,823 |
| 3 | Traffic Management East and West of Victoria Road | New signing for road closure | £2,875 | £0 | £1,172 | £1,793 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £2,965 |
| 4 | Transport Improvements along A53 Etruria Road | New bus stop | £28,750 | £0 | £11,721 | £17,925 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £29,646 |
| 4 | Transport Improvements along A53 Etruria Road | Traffic Signals Sandy Lane/King Street Junction | £215,625 | £0 | £87,909 | £134,439 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £222,348 |
| 4 | Transport Improvements along A53 Etruria Road | Plane and resurface | £51,750 | £0 | £21,098 | £32,265 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £53,363 |
| 4 | Transport Improvements along A53 Etruria Road | EO plane out 100mm deep (10% of total area) | £3,450 | £0 | £1,407 | £2,151 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £3,558 |
| 4 | Transport Improvements along A53 Etruria Road | Removal Kerbs, tactile slabs and existing footway, and new kerbs,footway, tactile slabs and road markings | £35,938 | £0 | £14,652 | £22,406 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £37,058 |
| 4 | Transport Improvements along A53 Etruria Road | Traffic Signals Basford Park Road/Etruria Road (West) Junction | £244,375 | £0 | £99,630 | £152,364 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £251,994 |
| 4 | Transport Improvements along A53 Etruria Road | Plane and resurface 2 | £64,688 | £0 | £26,373 | £40,332 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £66,704 |
| 4 | Transport Improvements along A53 Etruria Road | EO plane out 100mm deep (10% of total area) 2 | £4,313 | £0 | £1,758 | £2,689 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £4,447 |
| 4 | Transport Improvements along A53 Etruria Road | Removal Kerbs, tactile slabs and existing footway, and new kerbs,footway/splitters and tactile slabs, new splitters and road markings islands | £43,125 | £0 | £17,582 | £26,888 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £44,470 |
| 5 | Bus Retrofit Programme | ANPR to monitor bus retrofit compliance - A53 Etruria | £143,750 | £0 | £87,909 | £59,751 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £147,660 |
| 5 | Bus Retrofit Programme | ANPR to monitor bus retrofit compliance - A50 Victoria Road Bus Gate and Supporting Measures | £143,750 | £0 | £87,909 | £59,751 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £147,660 |
| 5 | Bus Retrofit Programme | Bucknall New Road Bus ANPR camera (incl TM, PM and civils) | £143,750 | £0 | £87,909 | £59,751 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £147,660 |
| 5 | Bus Retrofit Programme | Five year camera replacement costs | £120,000 | £0 | £0 | £0 | £0 | £0 | £0 | £136,151 | £0 | £0 | £0 | £0 | £0 | £136,151 |
| 5 | Bus Retrofit Programme | IT Infrastructure and Storage Capacity | £3,833 | £0 | £2,344 | £1,593 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £3,938 |
| 5 | Bus Retrofit Programme | Cost of component | £743,700 | £0 | £454,803 | £309,123 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £763,927 |
| 5 | Bus Retrofit Programme | Cost of the e-cooling fan | £190,438 | £0 | £116,461 | £79,157 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £195,617 |
| 5 | Bus Retrofit Programme | Bus wrap | £25,000 | £0 | £15,289 | £10,391 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £25,680 |
| 6 | Bus Infrastructure Improvements | CCTV | £284,000 | £0 | £206,759 | £84,319 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £291,078 |
| 6 | Bus Infrastructure Improvements | Kerbs | £237,600 | £0 | £172,979 | £70,543 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £243,522 |
| 6 | Bus Infrastructure Improvements | RTPI | £524,705 | £0 | £381,999 | £155,783 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £537,782 |
| 6 | Bus Infrastructure Improvements | New Shelters | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 |
| 6 | Bus Infrastructure Improvements | Upgraded Shelters | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 |
| 7 | Monitoring and evaluation | Traffic Data - procurement, installation of the ATC sites | £73,000 | £0 | £74,404 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £74,404 |
| | Total | | | £0 | £3,291,212 | £3,286,997 | £0 | £0 | £0 | £204,227 | £0 | £0 | £0 | £0 | £0 | £6,782,436 |

| | | |
|---|---|---|
| Risk | | 1,060,000 |
| | | |
| Cap costs | | £6,782,436 |

**Capital Costs Cash Flow Profile adjusted for inflation and risk**

| Header | Heading | Item | Final cost | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A50 Victoria Road Bus Gate | Bus Gate ANPR camera (incl TM, PM and civils) | £71,875 | £0 | £33,883 | £51,817 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £85,699 |
| 1 | A50 Victoria Road Bus Gate | Bus Gate narrowing of existing c'way (incl electric supplies and feeder pillar) | £43,125 | £0 | £20,330 | £31,090 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £51,420 |
| 1 | A50 Victoria Road Bus Gate | New TRO for bus gate | £14,375 | £0 | £16,941 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £16,941 |
| 1 | A50 Victoria Road Bus Gate | Bus Gate Signing (VMS) | £150,938 | £0 | £71,154 | £108,815 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £179,968 |
| 1 | A50 Victoria Road Bus Gate | Bus Gate Advance Signing | £106,375 | £0 | £50,146 | £76,688 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £126,835 |
| 1 | A50 Victoria Road Bus Gate | TRO costs for Stopping Up and One Way | £17,250 | £0 | £8,132 | £12,436 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £20,568 |
| 1 | A50 Victoria Road Bus Gate | TTRO costs for temporary road closures | £4,313 | £0 | £2,033 | £3,109 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £5,142 |
| 1 | A50 Victoria Road Bus Gate | Five year camera replacement costs | £20,000 | £0 | £0 | £0 | £0 | £0 | £0 | £26,238 | £0 | £0 | £0 | £0 | £0 | £26,238 |
| 1 | A50 Victoria Road Bus Gate | IT Infrastructure and Storage Capacity | £3,833 | £0 | £1,807 | £2,764 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £4,571 |
| 1 | A50 Victoria Road Bus Gate | Prism Sign Costs | £199,238 | £0 | £93,923 | £143,635 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £237,558 |
| 2 | A53 Etruria Road Bus Gate | Bus Gate ANPR camera (incl TM, PM and civils) | £143,750 | £0 | £67,765 | £103,633 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £171,398 |
| 2 | A53 Etruria Road Bus Gate | Bus Gate Signing (VMS) | £150,938 | £0 | £71,154 | £108,815 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £179,968 |
| 2 | A53 Etruria Road Bus Gate | Bus Gate Advance Signing | £240,422 | £0 | £113,338 | £173,326 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £286,664 |
| 2 | A53 Etruria Road Bus Gate | New TRO for bus gate | £14,375 | £0 | £16,941 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £16,941 |
| 2 | A53 Etruria Road Bus Gate | Five year camera replacement costs | £40,000 | £0 | £0 | £0 | £0 | £0 | £0 | £52,477 | £0 | £0 | £0 | £0 | £0 | £52,477 |
| 2 | A53 Etruria Road Bus Gate | Facilitating Works | £8,101 | £0 | £3,819 | £5,840 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £9,659 |
| 2 | A53 Etruria Road Bus Gate | IT Infrastructure and Storage Capacity | £3,833 | £0 | £1,807 | £2,764 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £4,571 |
| 2 | A53 Etruria Road Bus Gate | Prism Sign Costs | £243,513 | £0 | £114,795 | £175,554 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £290,349 |
| 3 | Traffic Management East and West of Victoria Road | Road Hump Regulation Notice | £5,750 | £0 | £6,777 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £6,777 |
| 3 | Traffic Management East and West of Victoria Road | Removal Type A roadhump (excavate) | £62,100 | £0 | £29,275 | £44,769 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £74,044 |
| 3 | Traffic Management East and West of Victoria Road | Removal Type B roadhump (excavate) | £10,781 | £0 | £5,082 | £7,772 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £12,855 |
| 3 | Traffic Management East and West of Victoria Road | Removal Type C roadhump (plane out) | £2,156 | £0 | £1,016 | £1,554 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £2,571 |
| 3 | Traffic Management East and West of Victoria Road | Plane out existing c'way and resurface 50mm | £733,161 | £0 | £345,620 | £528,555 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £874,175 |
| 3 | Traffic Management East and West of Victoria Road | EO plane out 100mm deep (25% of total area) | £146,632 | £0 | £69,124 | £105,711 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £174,835 |
| 3 | Traffic Management East and West of Victoria Road | New kerbing to roadhumps | £34,500 | £0 | £16,264 | £24,872 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £41,136 |
| 3 | Traffic Management East and West of Victoria Road | Take down existing sign and post | £1,438 | £0 | £678 | £1,036 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £1,714 |
| 3 | Traffic Management East and West of Victoria Road | Take down sign and post including electrics and make safe | £8,625 | £0 | £4,066 | £6,218 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £10,284 |
| 3 | Traffic Management East and West of Victoria Road | New Roadhumps in Bituminous Materials | £99,188 | £0 | £46,758 | £71,507 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £118,265 |
| 3 | Traffic Management East and West of Victoria Road | Road Markings | £8,625 | £0 | £4,066 | £6,218 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £10,284 |
| 3 | Traffic Management East and West of Victoria Road | Removal of existing 20mph zone terminal signs | £719 | £0 | £339 | £518 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £857 |
| 3 | Traffic Management East and West of Victoria Road | New signing for 20mph zone incl post and foundations | £2,875 | £0 | £1,355 | £2,073 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £3,428 |
| 3 | Traffic Management East and West of Victoria Road | Removal of existing illuminated hump signs | £1,438 | £0 | £678 | £1,036 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £1,714 |
| 3 | Traffic Management East and West of Victoria Road | Electrical Disconnection for existing illuminated hump signs | £2,875 | £0 | £1,355 | £2,073 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £3,428 |
| 3 | Traffic Management East and West of Victoria Road | New signing for one way sections | £1,438 | £0 | £678 | £1,036 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £1,714 |
| 3 | Traffic Management East and West of Victoria Road | One Way Signs | £8,625 | £0 | £4,066 | £6,218 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £10,284 |
| 3 | Traffic Management East and West of Victoria Road | No Entry Signs | £8,625 | £0 | £4,066 | £6,218 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £10,284 |
| 3 | Traffic Management East and West of Victoria Road | New signing for 7.5T weight limit "Except for Access" | £14,375 | £0 | £6,777 | £10,363 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £17,140 |
| 3 | Traffic Management East and West of Victoria Road | Removal Type A roadhump (excavate) 2 | £10,350 | £0 | £4,879 | £7,462 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £12,341 |
| 3 | Traffic Management East and West of Victoria Road | Removal Type C roadhump (plane out) 2 | £6,469 | £0 | £3,049 | £4,663 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £7,713 |
| 3 | Traffic Management East and West of Victoria Road | Plane out existing c'way and resurface 50mm 2 | £339,847 | £0 | £160,207 | £245,004 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £405,212 |
| 3 | Traffic Management East and West of Victoria Road | EO plane out 100mm deep (20% of total area) | £113,282 | £0 | £53,402 | £81,668 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £135,071 |
| 3 | Traffic Management East and West of Victoria Road | New kerbing to roadhumps 2 | £15,813 | £0 | £7,454 | £11,400 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £18,854 |
| 3 | Traffic Management East and West of Victoria Road | New footway construction to Hitchman Street Closure including kerbing works and Manchester Bollards | £21,563 | £0 | £10,165 | £15,545 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £25,710 |
| 3 | Traffic Management East and West of Victoria Road | Take down existing signs | £1,438 | £0 | £678 | £1,036 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £1,714 |
| 3 | Traffic Management East and West of Victoria Road | Take down signs including electrics and make safe | £4,313 | £0 | £2,033 | £3,109 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £5,142 |
| 3 | Traffic Management East and West of Victoria Road | New roadhumps in bituminous materials 2 | £64,688 | £0 | £30,494 | £46,635 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £77,129 |
| 3 | Traffic Management East and West of Victoria Road | New raised table adjacent to school. | £21,563 | £0 | £10,165 | £15,545 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £25,710 |
| 3 | Traffic Management East and West of Victoria Road | New signing for 20mph zone | £14,375 | £0 | £6,777 | £10,363 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £17,140 |
| 3 | Traffic Management East and West of Victoria Road | New signing for road closure | £2,875 | £0 | £1,355 | £2,073 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £3,428 |
| 4 | Transport Improvements along A53 Etruria Road | New bus stop | £28,750 | £0 | £13,553 | £20,727 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £34,280 |
| 4 | Transport Improvements along A53 Etruria Road | Traffic Signals Sandy Lane/King Street Junction | £215,625 | £0 | £101,648 | £155,450 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £257,098 |
| 4 | Transport Improvements along A53 Etruria Road | Plane and resurface | £51,750 | £0 | £24,396 | £37,308 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £61,703 |
| 4 | Transport Improvements along A53 Etruria Road | EO plane out 100mm deep (10% of total area) | £3,450 | £0 | £1,626 | £2,487 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £4,114 |
| 4 | Transport Improvements along A53 Etruria Road | Removal Kerbs, tactile slabs and existing footway, and new kerbs,footway, tactile slabs and road markings | £35,938 | £0 | £16,941 | £25,908 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £42,850 |
| 4 | Transport Improvements along A53 Etruria Road | Traffic Signals Basford Park Road/Etruria Road (West) Junction | £244,375 | £0 | £115,201 | £176,176 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £291,377 |
| 4 | Transport Improvements along A53 Etruria Road | Plane and resurface 2 | £64,688 | £0 | £30,494 | £46,635 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £77,129 |
| 4 | Transport Improvements along A53 Etruria Road | EO plane out 100mm deep (10% of total area) 2 | £4,313 | £0 | £2,033 | £3,109 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £5,142 |
| 4 | Transport Improvements along A53 Etruria Road | Removal Kerbs, tactile slabs and existing footway, and new kerbs,footway/splitters and tactile slabs, new splitters and road markings islands | £43,125 | £0 | £20,330 | £31,090 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £51,420 |
| 5 | Bus Retrofit Programme | ANPR to monitor bus retrofit compliance - A53 Etruria | £143,750 | £0 | £101,648 | £69,089 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £170,737 |
| 5 | Bus Retrofit Programme | ANPR to monitor bus retrofit compliance - A50 Victoria Road Bus Gate and Supporting Measures | £143,750 | £0 | £101,648 | £69,089 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £170,737 |
| 5 | Bus Retrofit Programme | Bucknall New Road Bus ANPR camera (incl TM, PM and civils) | £143,750 | £0 | £101,648 | £69,089 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £170,737 |
| 5 | Bus Retrofit Programme | Five year camera replacement costs | £120,000 | £0 | £0 | £0 | £0 | £0 | £0 | £157,430 | £0 | £0 | £0 | £0 | £0 | £157,430 |
| 5 | Bus Retrofit Programme | IT Infrastructure and Storage Capacity | £3,833 | £0 | £2,711 | £1,842 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £4,553 |
| 5 | Bus Retrofit Programme | Cost of component | £743,700 | £0 | £525,883 | £357,435 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £883,318 |
| 5 | Bus Retrofit Programme | Cost of the e-cooling fan | £190,438 | £0 | £134,662 | £91,528 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £226,190 |
| 5 | Bus Retrofit Programme | Bus wrap | £25,000 | £0 | £17,678 | £12,015 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £29,693 |
| 6 | Bus Infrastructure Improvements | CCTV | £284,000 | £0 | £239,073 | £97,497 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £336,569 |
| 6 | Bus Infrastructure Improvements | Kerbs | £237,600 | £0 | £200,013 | £81,568 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £281,581 |
| 6 | Bus Infrastructure Improvements | RTPI | £524,705 | £0 | £441,700 | £180,130 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £621,830 |
| 6 | Bus Infrastructure Improvements | New Shelters | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 |
| 6 | Bus Infrastructure Improvements | Upgraded Shelters | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 |
| 7 | Monitoring and evaluation | Traffic Data - procurement, installation of the ATC sites | £73,000 | £0 | £86,033 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £86,033 |
| | Total | | | £0 | £3,805,583 | £3,800,709 | £0 | £0 | £0 | £236,145 | £0 | £0 | £0 | £0 | £0 | £7,842,436 |

£1,060,000

**Operating Costs cash flow profile (2020 prices)**

| Header | Heading | Item | 2020 (Base Costs) | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A50 Victoria Road Bus Gate | General Maintenance | 6,000 | | | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 60,000 | TRUE |
| 1 | A50 Victoria Road Bus Gate | Maintenance ANPR system | 3,000 | | | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 30,000 | TRUE |
| 1 | A50 Victoria Road Bus Gate | Maintenance of Prism Signs | 12,062 | | | 12,062 | 12,062 | 12,062 | 12,062 | 12,062 | 12,062 | 12,062 | 12,062 | 12,062 | 12,062 | 120,620 | TRUE |
| 2 | A53 Etruria Road Bus Gate | General Maintenance | 6,000 | | | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 60,000 | TRUE |
| 2 | A53 Etruria Road Bus Gate | Maintenance ANPR system | 6,000 | | | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 60,000 | TRUE |
| 2 | A53 Etruria Road Bus Gate | Maintenance of Prism Signs | 14,742 | | | 14,742 | 14,742 | 14,742 | 14,742 | 14,742 | 14,742 | 14,742 | 14,742 | 14,742 | 14,742 | 147,424 | TRUE |
| 4 | Transport Improvements along A53 Etruria Road | Traffic Signals Maintenance | 4,000 | | | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 40,000 | TRUE |
| 5 | Bus Retrofit Programme | Maintenance ANPR system | 18,000 | | | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 180,000 | TRUE |
| 6 | Bus Infrastructure Improvements | CCTV | 94,667 | | | | | | 94,667 | | | 94,667 | | | 94,667 | 284,000 | TRUE |
| 6 | Bus Infrastructure Improvements | RTPI | 58,301 | | | | 58,301 | 58,301 | 58,301 | 58,301 | 58,301 | 58,301 | 58,301 | 58,301 | 58,301 | 524,705 | TRUE |
| 7 | Monitoring and evaluation | Additional processing / analysis of the bus patronage data | 8,000 | | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 88,000 | TRUE |
| 7 | Monitoring and evaluation | Combined Air Quality Monitoring and Evaluation - maintenance tubes | 39,840 | | 39,840 | 39,840 | 39,840 | 39,840 | 39,840 | 39,840 | 39,840 | 39,840 | 39,840 | 39,840 | 39,840 | 438,240 | TRUE |
| 7 | Monitoring and evaluation | Traffic Data Collection for Monitoring in 2025 | 90,000 | | | | | | 90,000 | | | | | | | 90,000 | TRUE |
| 7 | Monitoring and evaluation | Traffic Data -maintenance and monitoring of the ATC sites | 9,000 | | 9,000 | 9,000 | 9,000 | 9,000 | 9,000 | 9,000 | 9,000 | 9,000 | 9,000 | 9,000 | 9,000 | 99,000 | TRUE |
| 7 | Monitoring and evaluation | Combined Air Quality Monitoring and Evaluation - maintenance staff | 14,310 | | 14,310 | 14,310 | 14,310 | 14,310 | 14,310 | 14,310 | 14,310 | 14,310 | 14,310 | 14,310 | 14,310 | 157,410 | TRUE |
| 8 | Back Office Cost for Monitoring, Data Processing and Charging | Operating Costs New Staff | 100,000 | | | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 1,000,000 | TRUE |
| 8 | Back Office Cost for Monitoring, Data Processing and Charging | Maintenance, Monitoring, Operation Operating Costs Added PM time | 39,000 | | | 39,000 | 39,000 | 39,000 | 39,000 | 39,000 | 39,000 | 39,000 | 39,000 | 39,000 | 39,000 | 390,000 | TRUE |
| 8 | Back Office Cost for Monitoring, Data Processing and Charging | FT staff post | 46,154 | | 46,154 | 3,846 | | | | | | | | | | 50,000 | TRUE |
| 9 | Communications, engagement and consultation | Marketing | 40,000 | | 40,000 | 40,000 | 40000 | | | | | | | | | 120,000 | TRUE |
| 10 | Decommissioning costs | returning to existing conditions | 478,000 | | | | | | | | | | | | 478,000 | | |

**Operating Costs cash flow profile adjusted for inflation**

| Header | Heading | Item | 2020 (Base Costs) | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A50 Victoria Road Bus Gate | General Maintenance | 6,000 | - | - | 6,235 | 6,359 | 6,505 | 6,655 | 6,808 | 6,964 | 7,124 | 7,288 | 7,456 | 7,627 | 69,020 |
| 1 | A50 Victoria Road Bus Gate | Maintenance ANPR system | 3,000 | - | - | 3,117 | 3,179 | 3,252 | 3,327 | 3,404 | 3,482 | 3,562 | 3,644 | 3,728 | 3,814 | 34,510 |
| 1 | A50 Victoria Road Bus Gate | Maintenance of Prism Signs | 12,062 | - | - | 12,534 | 12,783 | 13,077 | 13,378 | 13,685 | 14,000 | 14,322 | 14,652 | 14,989 | 15,333 | 138,753 |
| 2 | A53 Etruria Road Bus Gate | General Maintenance | 6,000 | - | - | 6,235 | 6,359 | 6,505 | 6,655 | 6,808 | 6,964 | 7,124 | 7,288 | 7,456 | 7,627 | 69,020 |
| 2 | A53 Etruria Road Bus Gate | Maintenance ANPR system | 6,000 | - | - | 6,235 | 6,359 | 6,505 | 6,655 | 6,808 | 6,964 | 7,124 | 7,288 | 7,456 | 7,627 | 69,020 |
| 2 | A53 Etruria Road Bus Gate | Maintenance of Prism Signs | 14,742 | - | - | 15,319 | 15,624 | 15,983 | 16,351 | 16,727 | 17,111 | 17,505 | 17,908 | 18,319 | 18,741 | 169,588 |
| 4 | Transport Improvements along A53 Etruria Road | Traffic Signals Maintenance | 4,000 | - | - | 4,157 | 4,239 | 4,337 | 4,436 | 4,538 | 4,643 | 4,750 | 4,859 | 4,971 | 5,085 | 46,013 |
| 5 | Bus Retrofit Programme | Maintenance ANPR system | 18,000 | - | - | 18,705 | 19,076 | 19,515 | 19,964 | 20,423 | 20,892 | 21,373 | 21,865 | 22,367 | 22,882 | 207,061 |
| 6 | Bus Infrastructure Improvements | CCTV | 94,667 | - | - | - | - | - | 104,993 | - | - | 112,406 | - | - | 120,342 | 337,741 |
| 6 | Bus Infrastructure Improvements | RTPI | 58,301 | - | - | - | 61,786 | 63,207 | 64,660 | 66,148 | 67,669 | 69,225 | 70,817 | 72,446 | 74,113 | 610,070 |
| 7 | Monitoring and evaluation | Additional processing / analysis of the bus patronage data | 8,000 | - | 8,154 | 8,313 | 8,478 | 8,673 | 8,873 | 9,077 | 9,286 | 9,499 | 9,718 | 9,941 | 10,170 | 100,181 |
| 7 | Monitoring and evaluation | Combined Air Quality Monitoring and Evaluation - maintenance tubes | 39,840 | - | 40,606 | 41,399 | 42,221 | 43,193 | 44,186 | 45,202 | 46,242 | 47,305 | 48,394 | 49,507 | 50,645 | 498,901 |
| 7 | Monitoring and evaluation | Traffic Data Collection for Monitoring in 2025 | 90,000 | - | - | - | - | - | 99,818 | - | - | - | - | - | - | 99,818 |
| 7 | Monitoring and evaluation | Traffic Data -maintenance and monitoring of the ATC sites | 9,000 | - | 9,173 | 9,352 | 9,538 | 9,757 | 9,982 | 10,211 | 10,446 | 10,686 | 10,932 | 11,184 | 11,441 | 112,703 |
| 7 | Monitoring and evaluation | Combined Air Quality Monitoring and Evaluation - maintenance staff | 14,310 | - | 14,585 | 14,870 | 15,165 | 15,514 | 15,871 | 16,236 | 16,609 | 16,992 | 17,382 | 17,782 | 18,191 | 179,199 |
| 8 | Back Office Cost for Monitoring, Data Processing and Charging | Operating Costs New Staff | 100,000 | - | - | 103,914 | 105,978 | 108,415 | 110,909 | 113,460 | 116,069 | 118,739 | 121,470 | 124,263 | 127,122 | 1,150,337 |
| 8 | Back Office Cost for Monitoring, Data Processing and Charging | Maintenance, Monitoring, Operation Operating Costs Added PM time | 39,000 | - | - | 40,526 | 41,331 | 42,282 | 43,254 | 44,249 | 45,267 | 46,308 | 47,373 | 48,463 | 49,577 | 448,631 |
| 8 | Back Office Cost for Monitoring, Data Processing and Charging | FT staff post | 46,154 | - | 47,042 | 3,997 | - | - | - | - | - | - | - | - | - | 51,038 |
| 9 | Communications, engagement and consultation | Marketing | 40,000 | - | 40,769 | 41,566 | 42391.0316 | - | - | - | - | - | - | - | - | 124,726 |
| 10 | Decommissioning costs | returning to existing conditions | 478,000 | - | - | - | 0 | - | - | - | - | - | - | - | 607,641 | 607,641 |
| | | **Operating Cost Cash Flow** | | **-** | **160,330** | **336,474** | **400,865** | **366,719** | **579,965** | **383,782** | **392,609** | **514,045** | **410,877** | **420,327** | **1,157,977** | **5,123,973** |

**Operating Costs cash flow profile adjusted for inflation and risk**

| Header | Heading | Item | 2020 (Base Costs) | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A50 Victoria Road Bus Gate | General Maintenance | 6,000 | - | - | 6,235 | 6,359 | 6,505 | 6,655 | 6,808 | 6,964 | 7,124 | 7,288 | 7,456 | 7,627 | 69,020 |
| 1 | A50 Victoria Road Bus Gate | Maintenance ANPR system | 3,000 | - | - | 3,117 | 3,179 | 3,252 | 3,327 | 3,404 | 3,482 | 3,562 | 3,644 | 3,728 | 3,814 | 34,510 |
| 1 | A50 Victoria Road Bus Gate | Maintenance of Prism Signs | 12,062 | - | - | 12,534 | 12,783 | 13,077 | 13,378 | 13,685 | 14,000 | 14,322 | 14,652 | 14,989 | 15,333 | 138,753 |
| 2 | A53 Etruria Road Bus Gate | General Maintenance | 6,000 | - | - | 6,235 | 6,359 | 6,505 | 6,655 | 6,808 | 6,964 | 7,124 | 7,288 | 7,456 | 7,627 | 69,020 |
| 2 | A53 Etruria Road Bus Gate | Maintenance ANPR system | 6,000 | - | - | 6,235 | 6,359 | 6,505 | 6,655 | 6,808 | 6,964 | 7,124 | 7,288 | 7,456 | 7,627 | 69,020 |
| 2 | A53 Etruria Road Bus Gate | Maintenance of Prism Signs | 14,742 | - | - | 15,319 | 15,624 | 15,983 | 16,351 | 16,727 | 17,111 | 17,505 | 17,908 | 18,319 | 18,741 | 169,588 |
| 4 | Transport Improvements along A53 Etruria Road | Traffic Signals Maintenance | 4,000 | - | - | 4,157 | 4,239 | 4,337 | 4,436 | 4,538 | 4,643 | 4,750 | 4,859 | 4,971 | 5,085 | 46,013 |
| 5 | Bus Retrofit Programme | Maintenance ANPR system | 18,000 | - | - | 18,705 | 19,076 | 19,515 | 19,964 | 20,423 | 20,892 | 21,373 | 21,865 | 22,367 | 22,882 | 207,061 |
| 6 | Bus Infrastructure Improvements | CCTV | 94,667 | - | - | - | - | - | 104,993 | - | - | 112,406 | - | - | 120,342 | 337,741 |
| 6 | Bus Infrastructure Improvements | RTPI | 58,301 | - | - | - | 61,786 | 63,207 | 64,660 | 66,148 | 67,669 | 69,225 | 70,817 | 72,446 | 74,113 | 610,070 |
| 7 | Monitoring and evaluation | Additional processing / analysis of the bus patronage data | 8,000 | - | 8,154 | 8,313 | 8,478 | 8,673 | 8,873 | 9,077 | 9,286 | 9,499 | 9,718 | 9,941 | 10,170 | 100,181 |
| 7 | Monitoring and evaluation | Combined Air Quality Monitoring and Evaluation - maintenance tubes | 39,840 | - | 40,606 | 41,399 | 42,221 | 43,193 | 44,186 | 45,202 | 46,242 | 47,305 | 48,394 | 49,507 | 50,645 | 498,901 |
| 7 | Monitoring and evaluation | Traffic Data Collection for Monitoring in 2025 | 90,000 | - | - | - | - | - | 99,818 | - | - | - | - | - | - | 99,818 |
| 7 | Monitoring and evaluation | Traffic Data -maintenance and monitoring of the ATC sites | 9,000 | - | 9,173 | 9,352 | 9,538 | 9,757 | 9,982 | 10,211 | 10,446 | 10,686 | 10,932 | 11,184 | 11,441 | 112,703 |
| 7 | Monitoring and evaluation | Combined Air Quality Monitoring and Evaluation - maintenance staff | 14,310 | - | 14,585 | 14,870 | 15,165 | 15,514 | 15,871 | 16,236 | 16,609 | 16,992 | 17,382 | 17,782 | 18,191 | 179,199 |
| 8 | Back Office Cost for Monitoring, Data Processing and Charging | Operating Costs New Staff | 100,000 | - | - | 103,914 | 105,978 | 108,415 | 110,909 | 113,460 | 116,069 | 118,739 | 121,470 | 124,263 | 127,122 | 1,150,337 |
| 8 | Back Office Cost for Monitoring, Data Processing and Charging | Maintenance, Monitoring, Operation Operating Costs Added PM time | 39,000 | - | - | 40,526 | 41,331 | 42,282 | 43,254 | 44,249 | 45,267 | 46,308 | 47,373 | 48,463 | 49,577 | 448,631 |
| 8 | Back Office Cost for Monitoring, Data Processing and Charging | FT staff post | 46,154 | - | 47,042 | 3,997 | - | - | - | - | - | - | - | - | - | 51,038 |
| 9 | Communications, engagement and consultation | Marketing | 40,000 | - | 40,769 | 41,566 | 42391.0316 | - | - | - | - | - | - | - | - | 124,726 |
| 10 | Decommissioning costs | returning to existing conditions | 478,000 | - | - | - | 0 | - | - | - | - | - | - | - | 607,641 | 607,641 |
| | | **Operating Cost Cash Flow** | | **-** | **160,330** | **336,474** | **400,865** | **366,719** | **579,965** | **383,782** | **392,609** | **514,045** | **410,877** | **420,327** | **1,157,977** | **5,123,973** |

| Header | Heading | Item | Key lookup | No | Rate | 2020 prices | Prelim 25% | Contingency 15% | Final cost | Comments | Tab |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | £9,416,932 | £669,825 | | | | |
| 1 | A50 Victoria Road Bus Gate | Bus Gate ANPR camera (incl TM, PM and civils) | Capital expenditure | 1 | 50000 | £ 50,000 | £12,500 | £9,375 | £71,875.00 | Assumed single camera due to narrowing of carriageway | Victoria Road Bus Gate Cost |
| 1 | A50 Victoria Road Bus Gate | Bus Gate narrowing of existing c'way (incl electric supplies and feeder pillar) | Capital expenditure | 1 | 30000 | £ 30,000 | £7,500 | £5,625 | £43,125.00 | Kerbing, footpath infill and tactiles including moving existing signal poles and heads and ducting | Victoria Road Bus Gate Cost |
| 1 | A50 Victoria Road Bus Gate | New TRO for bus gate | Capital expenditure | 1 | 10000 | £ 10,000 | £2,500 | £1,875 | £14,375.00 | Based on estimate from Lee Barnard SCC Regulation Manager | Victoria Road Bus Gate Cost |
| 1 | A50 Victoria Road Bus Gate | Bus Gate Signing (VMS) | Capital expenditure | 3 | 35000 | £ 105,000 | £26,250 | £19,688 | £150,937.50 | This are additional to prism signs to warn drivers as requested by SCC | Victoria Road Bus Gate Cost |
| 1 | A50 Victoria Road Bus Gate | Bus Gate Advance Signing | Capital expenditure | 1 | 74000 | £ 74,000 | £18,500 | £13,875 | £106,375.00 | Local network signing only. Excludes prism signs and potential HE network signs which are itemised separately | Victoria Road Bus Gate Cost |
| 1 | A50 Victoria Road Bus Gate | TRO costs for Stopping Up and One Way | Capital expenditure | 1 | 12000 | £ 12,000 | £3,000 | £2,250 | £17,250.00 | | Victoria Road Bus Gate Cost |
| 1 | A50 Victoria Road Bus Gate | TTRO costs for temporary road closures | Capital expenditure | 1 | 3000 | £ 3,000 | £750 | £563 | £4,312.50 | | Victoria Road Bus Gate Cost |
| 1 | A50 Victoria Road Bus Gate | Five year camera replacement costs | Capital expenditure | 1 | 20000 | £ 20,000 | | | £20,000.00 | 20k per camera based on 9 cameras includes TM and electrical works | [illegible] |
| 1 | A50 Victoria Road Bus Gate | IT Infrastructure and Storage Capacity | Capital expenditure | 1 | 10000 | £ 3,333 | | £500 | £3,833.33 | Costs have been split across all 3 scheme locations | [illegible] |
| 1 | A50 Victoria Road Bus Gate | Prism Sign Costs | Capital expenditure | 1 | 385000 | £ 173,250 | | £25,988 | £199,237.50 | QUOTE FROM SWARCO £264,076.13. (additional signs expected 6No @ £20000) - assumed split between 2 sites. 9/20 signs | [illegible] |
| 1 | A50 Victoria Road Bus Gate | General Maintenance | Operating expenditure | 10 | 12000 | £ 60,000 | | | £60,000.00 | Assume £1k per month (£12k/yr) | [illegible] |
| 1 | A50 Victoria Road Bus Gate | Maintenance ANPR system | Operating expenditure | 10 | 27000 | £ 30,000 | | | £30,000.00 | Assumed £3000 per annum (Jenoptik Quote) (rounded up from £2,600 for Burton High Street estimate). Allowed for 9 cameras (3 [illegible] | [illegible] |
| 1 | A50 Victoria Road Bus Gate | Maintenance of Prism Signs | Operating expenditure | 10 | 26804 | £ 120,620 | | | £120,619.80 | Based on quotation from Prism Sign Supplier | [illegible] |
| 2 | A53 Etruria Road Bus Gate | Bus Gate ANPR camera (incl TM, PM and civils) | Capital expenditure | 2 | 50000 | £ 100,000 | £25,000 | £18,750 | £143,750.00 | Assumed two camera's due to width of road | Etruria Road Bus Gate Cost |
| 2 | A53 Etruria Road Bus Gate | Bus Gate Signing (VMS) | Capital expenditure | 3 | 35000 | £ 105,000 | £26,250 | £19,688 | £150,937.50 | | Etruria Road Bus Gate Cost |
| 2 | A53 Etruria Road Bus Gate | Bus Gate Advance Signing | Capital expenditure | 1 | 167250 | £ 167,250 | £41,813 | £31,359 | £240,421.88 | Including HE signing. Excludes prism signs | Etruria Road Bus Gate Cost |
| 2 | A53 Etruria Road Bus Gate | New TRO for bus gate | Capital expenditure | 1 | 10000 | £ 10,000 | £2,500 | £1,875 | £14,375.00 | | Etruria Road Bus Gate Cost |
| 2 | A53 Etruria Road Bus Gate | Five year camera replacement costs | Capital expenditure | 2 | 20000 | £ 40,000 | | | £40,000.00 | 20k per camera based on 9 cameras includes TM and electrical works | [illegible] |
| 2 | A53 Etruria Road Bus Gate | Facilitating Works | Capital expenditure | 1 | 7045 | £ 7,045 | | £1,057 | £8,101.21 | | [illegible] |
| 2 | A53 Etruria Road Bus Gate | IT Infrastructure and Storage Capacity | Capital expenditure | 1 | 10000 | £ 3,333 | | £500 | £3,833.33 | Costs have been split across all 3 scheme locations | [illegible] |
| 2 | A53 Etruria Road Bus Gate | Prism Sign Costs | Capital expenditure | 1 | 385000 | £ 211,750 | | £31,763 | £243,512.50 | QUOTE FROM SWARCO £264,076.13. (additional signs expected 6No @ £20000) - assumed split between 2 sites. 11/20 signs | [illegible] |
| 2 | A53 Etruria Road Bus Gate | General Maintenance | Operating expenditure | 10 | 12000 | £ 60,000 | | | £60,000.00 | Assume £1k per month (£12k/yr) | [illegible] |
| 2 | A53 Etruria Road Bus Gate | Maintenance ANPR system | Operating expenditure | 10 | 27000 | £ 60,000 | | | £60,000.00 | Assumed £3000 per annum (Jenoptik Quote) (rounded up from £2,600 for Burton High Street estimate). Allowed for 9 cameras (3 [illegible] | [illegible] |
| 2 | A53 Etruria Road Bus Gate | Maintenance of Prism Signs | Operating expenditure | 10 | 26804 | £ 147,424 | | | £147,424.20 | Based on quotation from Prism Sign Supplier | [illegible] |
| 3 | Traffic Management East and West of Victoria Road | Road Hump Regulation Notice | Capital expenditure | 1 | 4000 | £ 4,000 | £1,000 | £750 | £5,750.00 | | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | Removal Type A roadhump (excavate) | Capital expenditure | 24 | 1800 | £ 43,200 | £10,800 | £8,100 | £62,100.00 | 4 row granite sets, block paving and bituminous hump includes removal of drop kerbs to channels | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | Removal Type B roadhump (excavate) | Capital expenditure | 5 | 1500 | £ 7,500 | £1,875 | £1,406 | £10,781.25 | single row granite sets, block paving and bituminous hump includes removal of drop kerbs to channels | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | Removal Type C roadhump (plane out) | Capital expenditure | 3 | 500 | £ 1,500 | £375 | £281 | £2,156.25 | All bituminous materials Includes removal of drop kerbs to channels | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | Plane out existing c'way and resurface 50mm | Capital expenditure | 20401 | 25 | £ 510,025 | £127,506 | £95,630 | £733,160.94 | Based on SCC rates and includes plane 50mm, 50mm surfacing, clean | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | EO plane out 100mm deep (25% of total area) | Capital expenditure | 5100 | 20 | £ 102,005 | £25,501 | £19,126 | £146,632.19 | Includes extra 50mm plane and binder course | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | New kerbing to roadhumps | Capital expenditure | 480 | 50 | £ 24,000 | £6,000 | £4,500 | £34,500.00 | Based on SCC rates | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | Take down existing sign and post | Capital expenditure | 4 | 250 | £ 1,000 | £250 | £188 | £1,437.50 | | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | Take down sign and post including electrics and make safe | Capital expenditure | 4 | 1500 | £ 6,000 | £1,500 | £1,125 | £8,625.00 | | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | New Roadhumps in Bituminous Materials | Capital expenditure | 46 | 1500 | £ 69,000 | £17,250 | £12,938 | £99,187.50 | | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | Road Markings | Capital expenditure | 2 | 3000 | £ 6,000 | £1,500 | £1,125 | £8,625.00 | Allowed for single crew for two shifts | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | Removal of existing 20mph zone terminal signs | Capital expenditure | 2 | 250 | £ 500 | £125 | £94 | £718.75 | Existing signs on Park Street to be removed | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | New signing for 20mph zone incl post and foundations | Capital expenditure | 2 | 1000 | £ 2,000 | £500 | £375 | £2,875.00 | New signs prior to junction of Vivian Road and Park Street. To have NAL socket foundations to allow for ease of decommisioning | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | Removal of existing illuminated hump signs | Capital expenditure | 4 | 250 | £ 1,000 | £250 | £188 | £1,437.50 | No longer required for 20mph zone | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | Electrical Disconnection for existing illuminated hump signs | Capital expenditure | 4 | 500 | £ 2,000 | £500 | £375 | £2,875.00 | | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | New signing for one way sections | Capital expenditure | 4 | 250 | £ 1,000 | £250 | £188 | £1,437.50 | Allowance for repeater or intermediate signs | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | One Way Signs | Capital expenditure | 4 | 1500 | £ 6,000 | £1,500 | £1,125 | £8,625.00 | Assumed two pairs of illuminated signs (worst case) | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | No Entry Signs | Capital expenditure | 4 | 1500 | £ 6,000 | £1,500 | £1,125 | £8,625.00 | Assumed two pairs of illuminated signs (worst case) | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | New signing for 7.5T weight limit "Except for Access" | Capital expenditure | 10 | 1000 | £ 10,000 | £2,500 | £1,875 | £14,375.00 | Assumed worst case 5 pairs at each entry point. Non illuminated | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | Removal Type A roadhump (excavate)_2 | Capital expenditure | 4 | 1800 | £ 7,200 | £1,800 | £1,350 | £10,350.00 | 4 row granite sets, block paving and bituminous hump includes removal of drop kerbs to channels | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | Removal Type C roadhump (plane out)_2 | Capital expenditure | 9 | 500 | £ 4,500 | £1,125 | £844 | £6,468.75 | All bituminous materials Includes removal of drop kerbs to channels | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | Plane out existing c'way and resurface 50mm_2 | Capital expenditure | 15761 | 15 | £ 236,415 | £59,104 | £44,328 | £339,846.56 | Based on BCC rates and includes plane 50mm, 50mm surfacing, clean | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | EO plane out 100mm deep (20% of total area) | Capital expenditure | 3152 | 25 | £ 78,805 | £19,701 | £14,776 | £113,282.19 | Includes extra 50mm plane and binder course | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | New kerbing to roadhumps_2 | Capital expenditure | 220 | 50 | £ 11,000 | £2,750 | £2,063 | £15,812.50 | | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | New footway construction to Hitchman Street Closure including kerbing works and Manchester Bollards | Capital expenditure | 1 | 15000 | £ 15,000 | £3,750 | £2,813 | £21,562.50 | Based on BCC rates | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | Take down existing signs | Capital expenditure | 4 | 250 | £ 1,000 | £250 | £188 | £1,437.50 | | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | Take down signs including electrics and make safe | Capital expenditure | 2 | 1500 | £ 3,000 | £750 | £563 | £4,312.50 | | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | New roadhumps in bituminous materials_2 | Capital expenditure | 30 | 1500 | £ 45,000 | £11,250 | £8,438 | £64,687.50 | | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | New raised table adjacent to school | Capital expenditure | 2 | 7500 | £ 15,000 | £3,750 | £2,813 | £21,562.50 | | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | New signing for 20mph zone | Capital expenditure | 10 | 1000 | £ 10,000 | £2,500 | £1,875 | £14,375.00 | Allowed for 2 back to backsigns at each entry/exit point | Victoria Road Bus Gate Cost |
| 3 | Traffic Management East and West of Victoria Road | New signing for road closure | Capital expenditure | 4 | 500 | £ 2,000 | £500 | £375 | £2,875.00 | | Victoria Road Bus Gate Cost |
| 4 | Transport Improvements along A53 Etruria Road | New bus stop | Capital expenditure | 1 | 20000 | £ 20,000 | £5,000 | £3,750 | £28,750.00 | Removal of existing flag/pole and kerbing/footway, new kerbing, footway and reinstatement | Etruria Road Bus Gate Cost |
| 4 | Transport Improvements along A53 Etruria Road | Traffic Signals Sandy Lane/King Street Junction | Capital expenditure | 1 | 150000 | £ 150,000 | £37,500 | £28,125 | £215,625.00 | Including removing existing poles, heads, cabling, controller. New equipment and controller | Etruria Road Bus Gate Cost |
| 4 | Transport Improvements along A53 Etruria Road | Plane and resurface | Capital expenditure | 1200 | 30 | £ 36,000 | £9,000 | £6,750 | £51,750.00 | Based on SCC rates. Assumed 50mm plane and 50mm surfacing (68+ PSV) Approaches and centre junction (weekend working) | Etruria Road Bus Gate Cost |
| 4 | Transport Improvements along A53 Etruria Road | EO plane out 100mm deep (10% of total area) | Capital expenditure | 120 | 20 | £ 2,400 | £600 | £450 | £3,450.00 | Includes extra 50mm plane and binder course | Etruria Road Bus Gate Cost |
| 4 | Transport Improvements along A53 Etruria Road | Removal Kerbs, tactile slabs and existing footway, and new kerbs footway, tactile slabs and road markings | Capital expenditure | 1 | 25000 | £ 25,000 | £6,250 | £4,688 | £35,937.50 | Assumed weekend working | Etruria Road Bus Gate Cost |
| 4 | Transport Improvements along A53 Etruria Road | Traffic Signals Basford Park Road/Etruria Road (West) Junction | Capital expenditure | 1 | 170000 | £ 170,000 | £42,500 | £31,875 | £244,375.00 | Including removing existing poles, heads, cabling, controller. New equipment and controller | Etruria Road Bus Gate Cost |
| 4 | Transport Improvements along A53 Etruria Road | Plane and resurface_2 | Capital expenditure | 1500 | 30 | £ 45,000 | £11,250 | £8,438 | £64,687.50 | Assumed 50mm plane and 50mm surfacing (68+ PSV) Approaches and centre junction (weekend working) | Etruria Road Bus Gate Cost |
| 4 | Transport Improvements along A53 Etruria Road | EO plane out 100mm deep (10% of total area)_2 | Capital expenditure | 150 | 20 | £ 3,000 | £750 | £563 | £4,312.50 | Includes extra 50mm plane and binder course | Etruria Road Bus Gate Cost |
| 4 | Transport Improvements along A53 Etruria Road | Removal Kerbs, tactile slabs and existing footway, and new kerbs footway/splitters and tactile slabs, new splitters and road markings islands | Capital expenditure | 1 | 30000 | £ 30,000 | £7,500 | £5,625 | £43,125.00 | Assumed weekend working | Etruria Road Bus Gate Cost |
| 4 | Transport Improvements along A53 Etruria Road | Traffic Signals Maintenance | Operating expenditure | 10 | 4000 | £ 40,000 | | | £40,000.00 | Based on SCC typical signal junction maintenance costs | Combined Operation Costs |
| 5 | Bus Retrofit Programme | ANPR to monitor bus retrofit compliance - A53 Etruria | Capital expenditure | 2 | 50000 | £ 100,000 | £25,000 | £18,750 | £143,750.00 | Assumed two camera's on single post | Etruria Road Bus Gate Cost |
| 5 | Bus Retrofit Programme | ANPR to monitor bus retrofit compliance - A50 Victoria Road Bus Gate and Supporting Measures | Capital expenditure | 2 | 50000 | £ 100,000 | £25,000 | £18,750 | £143,750.00 | Assumed two camera's on single post | Victoria Road Bus Gate Cost |
| 5 | Bus Retrofit Programme | Bucknall New Road Bus ANPR camera (incl TM, PM and civils) | Capital expenditure | 2 | 50000 | £ 100,000 | £25,000 | £18,750 | £143,750.00 | Assumed two camera's on a single post | Bucknall New Road |
| 5 | Bus Retrofit Programme | Five year camera replacement costs | Capital expenditure | 6 | 20000 | £ 120,000 | | | £120,000.00 | 20k per camera based on 9 cameras includes TM and electrical works | Combined Operation Costs |
| 5 | Bus Retrofit Programme | IT Infrastructure and Storage Capacity | Capital expenditure | 1 | 10000 | £ 3,333 | | £500 | £3,833.33 | | Costings Summary |
| 5 | Bus Retrofit Programme | Cost of component | Capital expenditure | 50 | 14874 | £ 743,700 | | | £743,700.00 | | Bus Retrofit |
| 5 | Bus Retrofit Programme | Cost of the e-cooling fan | Capital expenditure | 50 | 3809 | £ 190,438 | | | £190,438.00 | | Bus Retrofit |
| 5 | Bus Retrofit Programme | Bus wrap | Capital expenditure | 50 | 500 | £ 25,000 | | | £25,000.00 | | Bus Retrofit |
| 5 | Bus Retrofit Programme | Maintenance ANPR system | Operating expenditure | 10 | 27000 | £ 180,000 | | | £180,000.00 | Assumed £3000 per annum (Jenoptik Quote) (rounded up from £2,600 for Burton High Street estimate). Allowed for 9 cameras (3 pairs for bus retrofit and 3 cameras | Combined Operation Costs |
| 6 | Bus Infrastructure Improvements | CCTV | Capital expenditure | 1 | 284000 | £ 284,000 | | | £284,000.00 | Installation of CCTV at 71 bus stops | Bus Interventions |
| 6 | Bus Infrastructure Improvements | Kerbs | Capital expenditure | 1 | 237600 | £ 237,600 | | | £237,600.00 | 27 accessible kerbs at bus stops | Bus Interventions |
| 6 | Bus Infrastructure Improvements | RTPI | Capital expenditure | 1 | 524705 | £ 524,705 | | | £524,705.00 | 89 real time bus passenger information (RTPI) screens | Bus Interventions |
| 6 | Bus Infrastructure Improvements | New Shelters | Capital expenditure | 1 | 0 | £ - | | | £0.00 | The proposal in all cases is to specify a new JC Decaux shelter, so again I would not allocate any costs to this - as per Brian Edwards email (SOTcc). 9 are new facilities | Bus Interventions |
| 6 | Bus Infrastructure Improvements | Upgraded Shelters | Capital expenditure | 1 | 0 | £ - | | | £0.00 | The proposal in all cases is to specify a new JC Decaux shelter, so again I would not allocate any costs to this - as per Brian Edwards email (SOTcc). 8 are replacement | Bus Interventions |
| 6 | Bus Infrastructure Improvements | CCTV maintenance | Operating expenditure | 3 | 53250 | £ 159,750 | | | £159,750.00 | 3 years worth of maintainance | Bus Interventions |
| 6 | Bus Infrastructure Improvements | RTPI maintenance | Operating expenditure | 9 | 34300 | £ 308,700 | | | £308,700.00 | 9 years maintainance | Bus Interventions |
| 7 | Monitoring and evaluation | Traffic Data - procurement, installation of the ATC sites | Capital expenditure | 1 | 73000 | £ 73,000 | | | £73,000.00 | Assumed single purchase at start of period | Combined Operation Costs |
| 7 | Monitoring and evaluation | Additional processing / analysis of the bus patronage data | Operating expenditure | 11 | 8000 | £ 88,000 | | | £88,000.00 | Supplied Chris Oakley - 10 years | Combined Operation Costs |
| 7 | Monitoring and evaluation | Combined Air Quality Monitoring and Evaluation - maintenance tubes | Operating expenditure | 11 | 39840 | £ 438,240 | | | £438,240.00 | air quality diffusion tube purchase and installation - 664 tubes (existing and proposed per month) over 10 years at £5 each | Combined Operation Costs |
| 7 | Monitoring and evaluation | Traffic Data Collection for Monitoring in 2025 | Operating expenditure | 1 | 90000 | £ 90,000 | | | £90,000.00 | Update from Stoke / N Staff teams | Combined Operation Costs |
| 7 | Monitoring and evaluation | Traffic Data -maintenance and monitoring of the ATC sites | Operating expenditure | 11 | 9000 | £ 99,000 | | | £99,000.00 | Monitoring / maintenance | Combined Operation Costs |
| 7 | Monitoring and evaluation | Combined Air Quality Monitoring and Evaluation - maintenance staff | Operating expenditure | 11 | 14310 | £ 157,410 | | | £157,410.00 | Officer time (2 days Stoke + 2 days Newcastle), to deploy/collect and collate data Stoke = £69,000 Newcastle = £ 74,100. Assumption made over 10 years | Combined Operation Costs |
| 8 | Back Office Cost for Monitoring, Data Processing and Charging | Operating Costs New Staff to cover ANPR and Prism signs using existing Stoke council back office | Operating expenditure | 10 | 100000 | £ 1,000,000 | | | £1,000,000.00 | 2.5 x £40k (assuming salary of £26,317 based on City of Stoke Council figure) including oncosts for additional FTE per annum to cover ANPR and Prism signs using existing Stoke council back office | Combined Operation Costs |
| 8 | Back Office Cost for Monitoring, Data Processing and Charging | Maintenance, Monitoring, Operation Operating Costs Added PM time | Operating expenditure | 10 | 39000 | £ 390,000 | | | £390,000.00 | £50/hr x 15hr/wk x 52 weeks per annum | Combined Operation Costs |
| 8 | Back Office Cost for Monitoring, Data Processing and Charging | FT staff post for RTPI | Operating expenditure | 1.083 | 46154 | £ 50,000 | | | £50,000.00 | RTPI - FT staff post for 13 months | Bus Interventions |
| 9 | Communications, engagement and consultation | Marketing | Operating expenditure | 3 | 40000 | £ 120,000 | | | £120,000.00 | 3 years of 1 FTE to cover part time staff + materials | Combined Operation Costs |
| 10 | Decommissioning costs | De-comissioning / Removal (inc TM and disposal) | Operating expenditure | 1 | 478000 | £ 478,000 | | | £478,000.00 | Includes returning to existing conditions with the exception of the traffic management (traffic calming). Scrap value of equipment offset against costs | Combined Operation Costs |

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*Benchmark CAZ D, Summary of costs, adjusted for inflation and risk*

| | Measure | Capital expenditure | Operating expenditure over 10 years | Total |
|---|---|---|---|---|
| 1 | CAZ D Boundary Signs | £901,176 | £0 | **£901,176** |
| 2 | CAZ D Boundary ANPR | £11,329,624 | £0 | **£11,329,624** |
| 3 | CAZ D Advanced Signing Local Network | £1,304,193 | £0 | **£1,304,193** |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | £5,161,286 | £0 | **£5,161,286** |
| 5 | CAZ D Internal ANPR and Signing | £5,724,198 | £0 | **£5,724,198** |
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | £3,512,679 | £42,705,804 | **£46,218,483** |
| 7 | Maintenance | £5,473,604 | £11,764,684 | **£17,238,289** |
| 8 | Communications, Engagement and Consultation | £0 | £2,394,113 | **£2,394,113** |
| 9 | Monitoring and Evaluation | £190,906 | £1,000,302 | **£1,191,208** |
| 10 | Decommissioning Costs | £0 | £2,027,010 | **£2,027,010** |
| 11 | Sinking Fund | £2,979,150 | £0 | **£2,979,150** |
| | **Total** | **£36,576,817** | **£59,891,914** | **£96,468,731** |

*Benchmark CAZ D, Summary of costs, adjusted for inflation and risk (£000s)*

| | Measure | Capital expenditure | Operating expenditure over 10 years | Total |
|---|---|---|---|---|
| 1 | CAZ D Boundary Signs | 901 | - | **901** |
| 2 | CAZ D Boundary ANPR | 11,330 | - | **11,330** |
| 3 | CAZ D Advanced Signing Local Network | 1,304 | - | **1,304** |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | 5,161 | - | **5,161** |
| 5 | CAZ D Internal ANPR and Signing | 5,724 | - | **5,724** |
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | 3,513 | 42,706 | **46,218** |
| 7 | Maintenance | 5,474 | 11,765 | **17,238** |
| 8 | Communications, Engagement and Consultation | - | 2,394 | **2,394** |
| 9 | Monitoring and Evaluation | 191 | 1,000 | **1,191** |
| 10 | Decommissioning Costs | - | 2,027 | **2,027** |
| 11 | Sinking Fund | 2,979 | - | **2,979** |
| | **Total** | **36,577** | **59,892** | **96,469** |

*Benchmark CAZ D, cashflow profile adjusted for inflation and risk*

| | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Capital costs | £ - | £ - | £ 18,969,763 | £ 9,154,299 | £ - | £ - | £ - | £ 5,473,604 | £ - | £ - | £ - | £ - | £ 2,979,150 |
| Operating costs | £ - | £ - | £ 72,896 | £ 5,196,770 | £ 5,316,295 | £ 5,438,570 | £ 5,665,771 | £ 5,691,621 | £ 5,822,529 | £ 5,956,447 | £ 6,093,445 | £ 6,233,594 | £ 8,403,977 |
| Revenue | | | | -£ 40,921,688 | -£ 37,173,350 | -£ 33,425,012 | -£ 29,676,673 | -£ 24,730,561 | -£ 19,784,449 | -£ 14,838,337 | -£ 9,892,224 | -£ 4,946,112 | £ - |
| **Net cashflow** | **£ -** | **£ -** | **£ 19,042,659** | **-£ 26,570,620** | **-£ 31,857,055** | **-£ 27,986,441** | **-£ 24,010,902** | **-£ 13,565,335** | **-£ 13,961,920** | **-£ 8,881,890** | **-£ 3,798,779** | **£ 1,287,482** | **£ 11,383,127** |

*Costs are presented as positive values and revenues are presented as negative values as per DfT's Public Accounts table*

*Benchmark CAZ D, cashflow profile adjusted for inflation and risk (£000s)*

| | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Capital costs | - | - | 18,970 | 9,154 | - | - | - | 5,474 | - | - | - | - | 2,979 |
| Operating costs | - | - | 73 | 5,197 | 5,316 | 5,439 | 5,666 | 5,692 | 5,823 | 5,956 | 6,093 | 6,234 | 8,404 |
| Revenue | - | - | | - 40,922 | - 37,173 | - 33,425 | - 29,677 | - 24,731 | - 19,784 | - 14,838 | - 9,892 | - 4,946 | - |
| **Net cashflow** | **-** | **-** | **19,043** | **- 26,571** | **- 31,857** | **- 27,986** | **- 24,011** | **- 13,565** | **- 13,962** | **- 8,882** | **- 3,799** | **1,287** | **11,383** |

*Costs are presented as positive values and revenues are presented as negative values as per DfT's Public Accounts table*

Capital Costs Cash Flow Profile (2020 prices)

| Header | Heading | Item | Final cost | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CAZ D Boundary Signs | Sign Cost | £583,625.00 | | | £259,389 | £324,236 | | | | | | | | | | £583,625 |
| 2 | CAZ D Boundary ANPR | ANPR Cost | £7,374,375.00 | | | £5,162,063 | £2,212,313 | | | | | | | | | | £7,374,375 |
| 3 | CAZ D Advanced Signing Local Network | Environmental (Vegetation Clearance, Tree Removal) | £11,500.00 | | | £11,500 | | | | | | | | | | | £11,500 |
| 3 | CAZ D Advanced Signing Local Network | Traffic Management (Boundary Installation) | £176,445.94 | | | £176,446 | | | | | | | | | | | £176,446 |
| 3 | CAZ D Advanced Signing Local Network | Local Signs | £627,468.75 | | | £278,875 | £348,594 | | | | | | | | | | £627,469 |
| 3 | CAZ D Advanced Signing Local Network | Traffic Management (Local Signs) | £31,265.63 | | | £13,896 | £17,370 | | | | | | | | | | £31,266 |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | A50 and A500 Signs | £1,495,000.00 | | | £664,444 | £830,556 | | | | | | | | | | £1,495,000 |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | Alternative Gantry Signs | £1,796,875.00 | | | £798,611 | £998,264 | | | | | | | | | | £1,796,875 |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | Traffic Management for Signs (HE) | £42,406.25 | | | £18,847 | £23,559 | | | | | | | | | | £42,406 |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | Traffic Management for Gantries (HE) | £8,301.56 | | | £3,690 | £4,612 | | | | | | | | | | £8,302 |
| 5 | CAZ D Internal ANPR and Signing | ANPR within CAZ D at 25 locations (50 ANPR Cameras) | £3,725,841.88 | | | £2,608,089 | £1,117,753 | | | | | | | | | | £3,725,842 |
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | Setting up back office / Upgrade to systems | £2,300,000.00 | | | £2,300,000 | | | | | | | | | | | £2,300,000 |
| 7 | Maintenance | Five year camera replacement costs | £3,208,635.00 | | | | | | | | £3,208,635.00 | | | | | | £3,208,635 |
| 9 | Monitoring and Evaluation | Traffic Monitoring Site Installation Costs | £125,000.00 | | | £125,000 | | | | | | | | | | | £125,000 |
| 11 | Sinking Fund | Sinking Fund | £1,558,695.00 | | | | | | | | | | | | | £1,558,695 | £1,558,695 |
| | **Total Capital Cost 2020 values** | | | £ - | £ - | £12,420,850 | £5,877,255 | £0 | £0 | £0 | £3,208,635 | £0 | £0 | £0 | £0 | £1,558,695 | **£ 23,065,435** |

Capital Costs Cash Flow Profile adjusted for inflation

| Header | Heading | Item | Final cost | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CAZ D Boundary Signs | Sign Cost | £583,625.00 | £ - | £ - | £ 269,541 | £ 343,618 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £613,159 |
| 2 | CAZ D Boundary ANPR | ANPR Cost | £7,374,375.00 | £ - | £ - | £ 5,364,105 | £ 2,344,555 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £7,708,661 |
| 3 | CAZ D Advanced Signing Local Network | Environmental (Vegetation Clearance, Tree Removal) | £11,500.00 | £ - | £ - | £ 11,950 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £11,950 |
| 3 | CAZ D Advanced Signing Local Network | Traffic Management (Boundary Installation) | £176,445.94 | £ - | £ - | £ 183,352 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £183,352 |
| 3 | CAZ D Advanced Signing Local Network | Local Signs | £627,468.75 | £ - | £ - | £ 289,790 | £ 369,431 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £659,221 |
| 3 | CAZ D Advanced Signing Local Network | Traffic Management (Local Signs) | £31,265.63 | £ - | £ - | £ 14,440 | £ 18,408 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £32,848 |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | A50 and A500 Signs | £1,495,000.00 | £ - | £ - | £ 690,451 | £ 880,203 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £1,570,653 |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | Alternative Gantry Signs | £1,796,875.00 | £ - | £ - | £ 829,869 | £ 1,057,936 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £1,887,805 |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | Traffic Management for Signs (HE) | £42,406.25 | £ - | £ - | £ 19,585 | £ 24,967 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £44,552 |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | Traffic Management for Gantries (HE) | £8,301.56 | £ - | £ - | £ 3,834 | £ 4,888 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £8,722 |
| 5 | CAZ D Internal ANPR and Signing | ANPR within CAZ D at 25 locations (50 ANPR Cameras) | £3,725,841.88 | £ - | £ - | £ 2,710,170 | £ 1,184,567 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £3,894,737 |
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | Setting up back office / Upgrade to systems | £2,300,000.00 | £ - | £ - | £ 2,390,022 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £2,390,022 |
| 7 | Maintenance | Five year camera replacement costs | £3,208,635.00 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ 3,724,233 | £ - | £ - | £ - | £ - | £ - | £3,724,233 |
| 9 | Monitoring and Evaluation | Traffic Monitoring Site Installation Costs | £125,000.00 | £ - | £ - | £ 129,892 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £129,892 |
| 11 | Sinking Fund | Sinking Fund | £1,558,695.00 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ 2,027,010 | £2,027,010 |
| | **Total Capital Cost** | | | £ - | £ - | £12,907,001 | £6,228,573 | £0 | £0 | £0 | £3,724,233 | £0 | £0 | £0 | £0 | £2,027,010 | **£ 24,886,817** |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Risk** | | | | | | | | | | | | | | | 11.690.000 |
| | | | | | | | | | | | | | | | |
| Capital costs total | | | | | | | | | | | | | | | £24,886,817 |

Capital Costs Cash Flow Profile adjusted for inflation and risk

| Header | Heading | Item | Final cost | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CAZ D Boundary Signs | Sign Cost | £583,625.00 | £ - | £ - | £ 396,152 | £ 505,024 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £901,176 |
| 2 | CAZ D Boundary ANPR | ANPR Cost | £7,374,375.00 | £ - | £ - | £ 7,883,768 | £ 3,445,855 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £11,329,624 |
| 3 | CAZ D Advanced Signing Local Network | Environmental (Vegetation Clearance, Tree Removal) | £11,500.00 | £ - | £ - | £ 17,563 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £17,563 |
| 3 | CAZ D Advanced Signing Local Network | Traffic Management (Boundary Installation) | £176,445.94 | £ - | £ - | £ 269,477 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £269,477 |
| 3 | CAZ D Advanced Signing Local Network | Local Signs | £627,468.75 | £ - | £ - | £ 425,912 | £ 542,963 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £968,875 |
| 3 | CAZ D Advanced Signing Local Network | Traffic Management (Local Signs) | £31,265.63 | £ - | £ - | £ 21,222 | £ 27,055 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £48,277 |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | A50 and A500 Signs | £1,495,000.00 | £ - | £ - | £ 1,014,774 | £ 1,293,657 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £2,308,431 |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | Alternative Gantry Signs | £1,796,875.00 | £ - | £ - | £ 1,219,680 | £ 1,554,877 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £2,774,557 |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | Traffic Management for Signs (HE) | £42,406.25 | £ - | £ - | £ 28,784 | £ 36,695 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £65,480 |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | Traffic Management for Gantries (HE) | £8,301.56 | £ - | £ - | £ 5,635 | £ 7,184 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £12,818 |
| 5 | CAZ D Internal ANPR and Signing | ANPR within CAZ D at 25 locations (50 ANPR Cameras) | £3,725,841.88 | £ - | £ - | £ 3,983,209 | £ 1,740,990 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £5,724,198 |
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | Setting up back office / Upgrade to systems | £2,300,000.00 | £ - | £ - | £ 3,512,679 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £3,512,679 |
| 7 | Maintenance | Five year camera replacement costs | £3,208,635.00 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ 5,473,604 | £ - | £ - | £ - | £ - | £ - | £5,473,604 |
| 9 | Monitoring and Evaluation | Traffic Monitoring Site Installation Costs | £125,000.00 | £ - | £ - | £ 190,906 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £190,906 |
| 11 | Sinking Fund | Sinking Fund | £1,558,695.00 | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ - | £ 2,979,150 | £2,979,150 |
| | **Total Capital Cost** | | | £ - | £ - | £18,969,763 | £9,154,299 | £0 | £0 | £0 | £5,473,604 | £0 | £0 | £0 | £0 | £2,979,150 | **£ 36,576,817** |

| Header | Operating Costs cash flow profile (2020 prices)<br>Heading | Item | 2020 (Base Costs) | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | Project Management costs | 230,000 | | | | 230,000 | 230,000 | 230,000 | 230,000 | 230,000 | 230,000 | 230,000 | 230,000 | 230,000 | 230,000 | 2,300,000 |
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | Processing | 800,000 | | | | 800,000 | 800,000 | 800,000 | 800,000 | 800,000 | 800,000 | 800,000 | 800,000 | 800,000 | 800,000 | 8,000,000 |
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | Staffing (internal) | 2,600,000 | | | | 2,600,000 | 2,600,000 | 2,600,000 | 2,600,000 | 2,600,000 | 2,600,000 | 2,600,000 | 2,600,000 | 2,600,000 | 2,600,000 | 26,000,000 |
| 7 | Maintenance | Maintenance | 1,000,000 | | | | 1,000,000 | 1,000,000 | 1,000,000 | 1,000,000 | 1,000,000 | 1,000,000 | 1,000,000 | 1,000,000 | 1,000,000 | 1,000,000 | 10,000,000 |
| 8 | Communications, Engagement and Consultation | Marketing | 103,500 | | | | 103,500 | 103,500 | 103,500 | 103,500 | 103,500 | 103,500 | 103,500 | 103,500 | 103,500 | 103,500 | 1,035,000 |
| 8 | Communications, Engagement and Consultation | Communications | 100,000 | | | | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 1,000,000 |
| 9 | Monitoring and Evaluation | Air Quality Monitoring | 54,150 | | | 54,150 | 54,150 | 54,150 | 54,150 | 54,150 | 54,150 | 54,150 | 54,150 | 54,150 | 54,150 | 54,150 | 595,650 |
| 9 | Monitoring and Evaluation | Annual Monitoring Costs | 16,000 | | | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 16,000 | 176,000 |
| 9 | Monitoring and Evaluation | Traffic Data Collection for Monitoring in 2025 | 90,000 | | | | | | | 90,000 | - | | | | | | 90,000 |
| 10 | Decommissioning Costs | De-commissioning / Removal | 1,558,695 | | | | | | | | | | | | | 1,558,695 | 1,558,695 |
| | | **Operating Cost Cash Flow** | | - | - | 70,150 | 4,903,650 | 4,903,650 | 4,903,650 | 4,993,650 | 4,903,650 | 4,903,650 | 4,903,650 | 4,903,650 | 4,903,650 | 6,462,345 | 50,755,345 |

| Header | Operating Costs cash flow profile adjusted for inflation<br>Heading | Item | 2020 (Base Costs) | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | Project Management costs | 230,000 | - | - | - | 243,748 | 249,355 | 255,090 | 260,957 | 266,959 | 273,099 | 279,380 | 285,806 | 292,379 | 299,104 | 2,705,877 |
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | Processing | 800,000 | - | - | - | 847,821 | 867,321 | 887,269 | 907,676 | 928,553 | 949,909 | 971,757 | 994,108 | 1,016,972 | 1,040,362 | 9,411,748 |
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | Staffing (internal) | 2,600,000 | - | - | - | 2,755,417 | 2,818,792 | 2,883,624 | 2,949,947 | 3,017,796 | 3,087,205 | 3,158,211 | 3,230,850 | 3,305,159 | 3,381,178 | 30,588,179 |
| 7 | Maintenance | Maintenance | 1,000,000 | - | - | - | 1,059,776 | 1,084,151 | 1,109,086 | 1,134,595 | 1,160,691 | 1,187,387 | 1,214,697 | 1,242,635 | 1,271,215 | 1,300,453 | 11,764,684 |
| 8 | Communications, Engagement and Consultation | Marketing | 100,000 | - | - | - | 109,687 | 112,210 | 114,790 | 117,431 | 120,131 | 122,895 | 125,721 | 128,613 | 131,571 | 134,597 | 1,217,645 |
| 8 | Communications, Engagement and Consultation | Communications | 54,150 | - | - | - | 105,978 | 108,415 | 110,909 | 113,460 | 116,069 | 118,739 | 121,470 | 124,263 | 127,122 | 130,045 | 1,176,468 |
| 9 | Monitoring and Evaluation | Air Quality Monitoring | 54,150 | - | - | 56,269 | 57,387 | 58,707 | 60,057 | 61,438 | 62,851 | 64,297 | 65,776 | 67,289 | 68,836 | 70,420 | 693,327 |
| 9 | Monitoring and Evaluation | Annual Monitoring Costs | 16,000 | - | - | 16,626 | 16,956 | 17,346 | 17,745 | 18,154 | 18,571 | 18,998 | 19,435 | 19,882 | 20,339 | 20,807 | 204,861 |
| 9 | Monitoring and Evaluation | Traffic Data Collection for Monitoring in 2025 | 90,000 | - | - | - | - | - | - | 102,114 | - | - | - | - | - | - | 102,114 |
| 10 | Decommissioning Costs | De-commissioning / Removal | 1,558,695 | - | - | - | - | - | - | - | - | - | - | - | - | 2,027,010 | 2,027,010 |
| | | **Operating Cost Cash Flow** | | **-** | **-** | **72,896** | **5,196,770** | **5,316,295** | **5,438,570** | **5,665,771** | **5,691,621** | **5,822,529** | **5,956,447** | **6,093,445** | **6,233,594** | **8,403,977** | **59,891,914** |

| Header | Operating Costs cash flow profile adjusted for inflation and risk<br>Heading | Item | 2020 (Base Costs) | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | Project Management costs | 230,000 | - | - | - | 243,748 | 249,355 | 255,090 | 260,957 | 266,959 | 273,099 | 279,380 | 285,806 | 292,379 | 299,104 | 2,705,877 |
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | Processing | 800,000 | - | - | - | 847,821 | 867,321 | 887,269 | 907,676 | 928,553 | 949,909 | 971,757 | 994,108 | 1,016,972 | 1,040,362 | 9,411,748 |
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | Staffing (internal) | 2,600,000 | - | - | - | 2,755,417 | 2,818,792 | 2,883,624 | 2,949,947 | 3,017,796 | 3,087,205 | 3,158,211 | 3,230,850 | 3,305,159 | 3,381,178 | 30,588,179 |
| 7 | Maintenance | Maintenance | 1,000,000 | - | - | - | 1,059,776 | 1,084,151 | 1,109,086 | 1,134,595 | 1,160,691 | 1,187,387 | 1,214,697 | 1,242,635 | 1,271,215 | 1,300,453 | 11,764,684 |
| 8 | Communications, Engagement and Consultation | Marketing | 54,150 | - | - | - | 109,687 | 112,210 | 114,790 | 117,431 | 120,131 | 122,895 | 125,721 | 128,613 | 131,571 | 134,597 | 1,217,645 |
| 8 | Communications, Engagement and Consultation | Communications | 54,150 | - | - | - | 105,978 | 108,415 | 110,909 | 113,460 | 116,069 | 118,739 | 121,470 | 124,263 | 127,122 | 130,045 | 1,176,468 |
| 9 | Monitoring and Evaluation | Air Quality Monitoring | 54,150 | - | - | 56,269 | 57,387 | 58,707 | 60,057 | 61,438 | 62,851 | 64,297 | 65,776 | 67,289 | 68,836 | 70,420 | 693,327 |
| 9 | Monitoring and Evaluation | Annual Monitoring Costs | 16,000 | - | - | 16,626 | 16,956 | 17,346 | 17,745 | 18,154 | 18,571 | 18,998 | 19,435 | 19,882 | 20,339 | 20,807 | 204,861 |
| 9 | Monitoring and Evaluation | Traffic Data Collection for Monitoring in 2025 | 90,000 | - | - | - | - | - | - | 102,114 | - | - | - | - | - | - | 102,114 |
| 10 | Decommissioning Costs | De-commissioning / Removal | 1,558,695 | - | - | - | - | - | - | - | - | - | - | - | - | 2,027,010 | 2,027,010 |
| | | **Operating Cost Cash Flow** | | **-** | **-** | **72,896** | **5,196,770** | **5,316,295** | **5,438,570** | **5,665,771** | **5,691,621** | **5,822,529** | **5,956,447** | **6,093,445** | **6,233,594** | **8,403,977** | **59,891,914** |

59,891,914

| Header | Heading | Item | Key lookup | 2020 prices | Prelims 25% | Contingency 15% | 10 year project value | 2020 Prices - Whole Project Cost | Comments |
|---|---|---|---|---|---|---|---|---|---|
| 1 | CAZ D Boundary Signs | Sign Cost | Capital expenditure | £406.000.00 | £101.500.00 | £76.125.00 | | £583.625.00 | Based on individual site assessment for 87 boundary sites. |
| 2 | CAZ D Boundary ANPR | ANPR Cost | Capital expenditure | £5.130.000.00 | £1.282.500.00 | £961.875.00 | | £7.374.375.00 | Cost supplied by Sweco for traffic monitoring to be undertaken in 2025. |
| 3 | CAZ D Advanced Signing Local Network | Environmental (Vegetation Clearance, Tree Removal) | Capital expenditure | £8.000.00 | £2.000.00 | £1.500.00 | | £11.500.00 | Based on individual site assessment for 87 boundary sites. |
| 3 | CAZ D Advanced Signing Local Network | Traffic Management (Boundary Installation) | Capital expenditure | £122.745.00 | £30.686.25 | £23.014.69 | | £176.445.94 | Based on individual site assessment for 87 boundary sites. |
| 3 | CAZ D Advanced Signing Local Network | Local Signs | Capital expenditure | £436.500.00 | £109.125.00 | £81.843.75 | | £627.468.75 | |
| 3 | CAZ D Advanced Signing Local Network | Traffic Management (Local Signs) | Capital expenditure | £21.750.00 | £5.437.50 | £4.078.13 | | £31.265.63 | |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | A50 and A500 Signs | Capital expenditure | £1.040.000.00 | £260.000.00 | £195.000.00 | | £1.495.000.00 | Based on 2 cameras per site. |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | Alternative Gantry Signs | Capital expenditure | £1.250.000.00 | £312.500.00 | £234.375.00 | | £1.796.875.00 | |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | Traffic Management for Signs (HE) | Capital expenditure | £29.500.00 | £7.375.00 | £5.531.25 | | £42.406.25 | Potential new gantry signs for Shelton New Road |
| 4 | CAZ D Advanced Signing HE Network (Including Gantries) | Traffic Management for Gantries (HE) | Capital expenditure | £5.775.00 | £1.443.75 | £1.082.81 | | £8.301.56 | |
| 5 | CAZ D Internal ANPR and Signing | ANPR within CAZ D at 25 locations (50 ANPR Cameras) | Capital expenditure | £2.591.890.00 | £647.972.50 | £485.979.38 | | £3.725.841.88 | 103 Cameras based on individual site assessment. |
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | Setting up back office / Upgrade to systems | Capital expenditure | £2.000.000.00 | | £300.000.00 | | £2.300.000.00 | Based on BCC assumed more cameras offset less volume of traffic so similar. Query from Jo that this would be 20000 vehicles per day as opposed to 60000 vehicles per day in Birmingham |
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | Project Management costs | Operating expenditure | £2.000.000.00 | | £300.000.00 | | £2.300.000.00 | Based on BCC costs |
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | Processing | Operating expenditure | £800.000.00 | | | £8.000.000.00 | £8.000.000.00 | |
| 6 | Back Office Cost for Monitoring, Data Processing and Charging | Staffing (internal) | Operating expenditure | £2.600.000.00 | | | £26.000.000.00 | £26.000.000.00 | Based on BCC costs |
| 7 | Maintenance | Maintenance | Operating expenditure | £1.000.000.00 | | | £10.000.000.00 | £10.000.000.00 | Based on BCC costs |
| 7 | Maintenance | Five year camera replacement costs | Capital expenditure | £3.208.635.00 | | | | £3.208.635.00 | Based on BCC |
| 8 | Communications, Engagement and Consultation | Marketing | Operating expenditure | £900.000.00 | | £135.000.00 | | £1.035.000.00 | Based on BCC at circa 900000-1000000 per annum over 10 years |
| 8 | Communications, Engagement and Consultation | Communications | Operating expenditure | £100.000.00 | | | £1.000.000.00 | £1.000.000.00 | Based on price provided by City of Stoke Council |
| 9 | Monitoring and Evaluation | Air Quality Monitoring | Operating expenditure | £54.150.00 | | | £595.650.00 | £595.650.00 | 20k per camera. Assumed 153 cameras. TM, Electrical and install costs assumed to be similar to decommissioning |
| 9 | Monitoring and Evaluation | Annual Monitoring Costs | Operating expenditure | £16.000.00 | | | £176.000.00 | £176.000.00 | Based on price provided by City of Stoke Council |
| 9 | Monitoring and Evaluation | Traffic Data Collection for Monitoring in 2025 | Operating expenditure | £90.000.00 | | | | £90.000.00 | Update from Stoke / N Staff call 29/04/2020 |
| 9 | Monitoring and Evaluation | Traffic Monitoring Site Installation Costs | Capital expenditure | £125.000.00 | | | | £125.000.00 | Based on Birmingham City Council OBC. Equal to decommissioning costs. |
| 10 | Decommissioning Costs | De-commissioning / Removal | Operating expenditure | £1.558.695.00 | | | | £1.558.695.00 | Based on BCC Costs |
| 11 | Sinking Fund | Sinking Fund | Capital expenditure | £1.558.695.00 | | | | £1.558.695.00 | |

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 13 - Project Organogram

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

# North Staffordshire Air Quality Organogram

## MP's

| | | |
|---|---|---|
| NULBC | Aaron Bell | Conservative |
| SOTCC | Jack Brereton | Conservative |
| SOTCC | Jo Gideon | Conservative |
| SOTCC | Jonathan Edward Gullis | Conservative |

## Council Scrutiny and Select Committees

2 Stage scrutiny of:

IES/Options Development

Options Appraisal/Preferred Option

## Cabinet

| Stoke on Trent City Council | Newcastle Under Lyme Borough Council | Staffordshire County Council |
|---|---|---|

## Joint Advisory Group

### Council Members

| | | |
|---|---|---|
| SOTCC | Chair Cllr Carl Edwards | Cabinet Member for Environment |
| SOTCC | Cllr Daniel Jellyman | Cabinet Member for Regeneration, Infrastructure and Heritage |
| NULBC | Cllr Trevor Johnson | Cabinet Portfolio Holder - Environment and Recycling |
| NULBC | Cllr Stephen Sweeney | Cabinet Portfolio Holder - Finance and Efficiency |
| SCC | Cllr Helen Fisher | Cabinet Member for Highways and Transport |

### Executive's

| | | |
|---|---|---|
| NULBC | Martin Hamilton | Chief Executive |
| SOTCC | Jacquie Ashdown | Assistant Director for Wellbeing/DPH |
| SCC | Clive Thomson | Assistant Director for Connectivity and Sustainability |
| SOTCC | Phil Cresswell | Director of Place, Growth and Prosperity |
| NULBC | Dave Adams | Excecutive Director Operational Services |

### Officer's

| | | |
|---|---|---|
| NULBC | Nesta Barker | SRO |
| LA's | Pete Price | Project Manger |
| SCC | Nick Dawson | Connectivity Strategy Manager |
| SOTCC | Jayne Hawe | Health Protection Manager |
| SOTCC | Harmesh Jassal | Strategic Planning Manager Planning Services |

## Finance

| | | |
|---|---|---|
| NULBC | Stephen Heppel | Principal Accountant |
| SOTCC | Matthew Chadburn | Accountant |
| SOTCC | Richard Hill | Accountant |
| SCC | Rob Salmon | County Treasurer |

## Legal

| | | |
|---|---|---|
| NULBC | Daniel Dickinson | Head of Legal & Governance |
| SOTCC | James Doble | Assitant Director Governance |
| SCC | Anne-Marie Davidson | County Solicitor |

## Local Partnerships

| | |
|---|---|
| Huw Russell | Project Director |

## Joint Officer Group

### SRO

| | | |
|---|---|---|
| NULBC | **Nesta Barker** | Head of Environmental Health Services |
| SCC | **Nick Dawson** | Connectivity Strategy Manager |
| SOTCC | **Jayne Hawe** | Health Protection Manager |

### Project Team

| | | |
|---|---|---|
| LAs | **Pete Price** | Project Manager |
| LAs | **David Cooper** | Air Quality Project Co-Ordinator |

### Officers

| | | |
|---|---|---|
| SCC | **Annabel Chell** | Senior Strategy Officer (Transport) |
| SCC | **Joanne Keay** | Strategy Officer (Transport) |
| SOTCC | **Chris Oakley** | Principal Transportation Officer |
| SOTCC | **Ann Beeston** | Consumer Protection Officer |
| SOTCC | **Mike Oliver** | Health Officer |

## Communications

| | | |
|---|---|---|
| NULBC | Phil Jones | Head of Communications |
| SOTCC | Emma Rodgers | Strategic Manager (Communications and Marketing) |
| SCC | Paul Dutton | Senior Media Officer |

## Procurement

| | | |
|---|---|---|
| NULBC | Simon Sowerby | Business Improvement Manage |
| SOTCC | Jonathan Phipps | Strategic Manager Commercial Development |
| SCC | Ian Turner | Head of Commercial and Assets |

## JAQU

| | |
|---|---|
| William Boohan | Account Manager |

## Risk Management

| | | |
|---|---|---|
| NULBC | Annette Bailey | Business Improvement Officer |
| SOTCC | Julie Keenan | Principal Insurance Offier |
| SCC | James Bailey | Director of Highways and the Built Environment |

## Consultants

- Sweco
- AMEY
- Ricardo
- Bentley Project Management
- Watermelon Research
- Nationwide Data Collection
- M·E·L Research – Measurement, Evaluation and Learning Research
- GAP – Global Action Plan

## Impemtaion Stage SRO

| | | |
|---|---|---|
| SOTCC | Claire McIver | Project SRO Stoke-on-Trent City Council – Strategic Manager for Health and Improvement |
| NULBC | Nesta Barker | Head of Environmental Health Services |
| SCC | Nick Dawson | Connectivity Strategy Manager |

## Highway Delivery Team

| | | |
|---|---|---|
| SOTCC | Dave Stubbs | Strategic Manager Highways Infrastructure & Transport |
| SOTCC | Ian Tamburello | Strategic Manager, Enforcement and Operations |
| SCC | James Bailey | Director of Highways and the Built Environment |
| SCC | Lee Barnard | Strategic Asset and Network Managementype |
| SCC | Nick Dawson | Connectivity Strategy Manager |
| CON | Senior Civil Engineers | Contractor |
| CON | Highways England | Contractor |

## Key Stakeholders

- Local Councillors
- Chamber of Commerce
- Taxi operator representative
- Newcastle-under-Lyme Business Improvement District
- Police
- Utility companies
- Hospital
- Road Haulage Association

## Public Transport Delivery Team

| | | |
|---|---|---|
| SOTCC | Brian Edwards | Team Manager Transport Policy and Planning |
| SOTCC | Chris Salmon | Public Transport Officer |
| SCC | Clive Thomson | Assistant Director for Connectivity and Sustainability |
| SCC | Louise Clayton | Transport Operations and Future Connectivity Manager |
| SCC | Mark Lawrence | Connectivity Project Officer |
| Bus | Bus Operators | First Potteries, D&G, Scraggs, Stantons of Stoke |
| CON | Senior Civil Engineers | Contractor |
| CON | JMW | Contractor (Proposed) |
| CON | JC Decaux | Contractor |

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

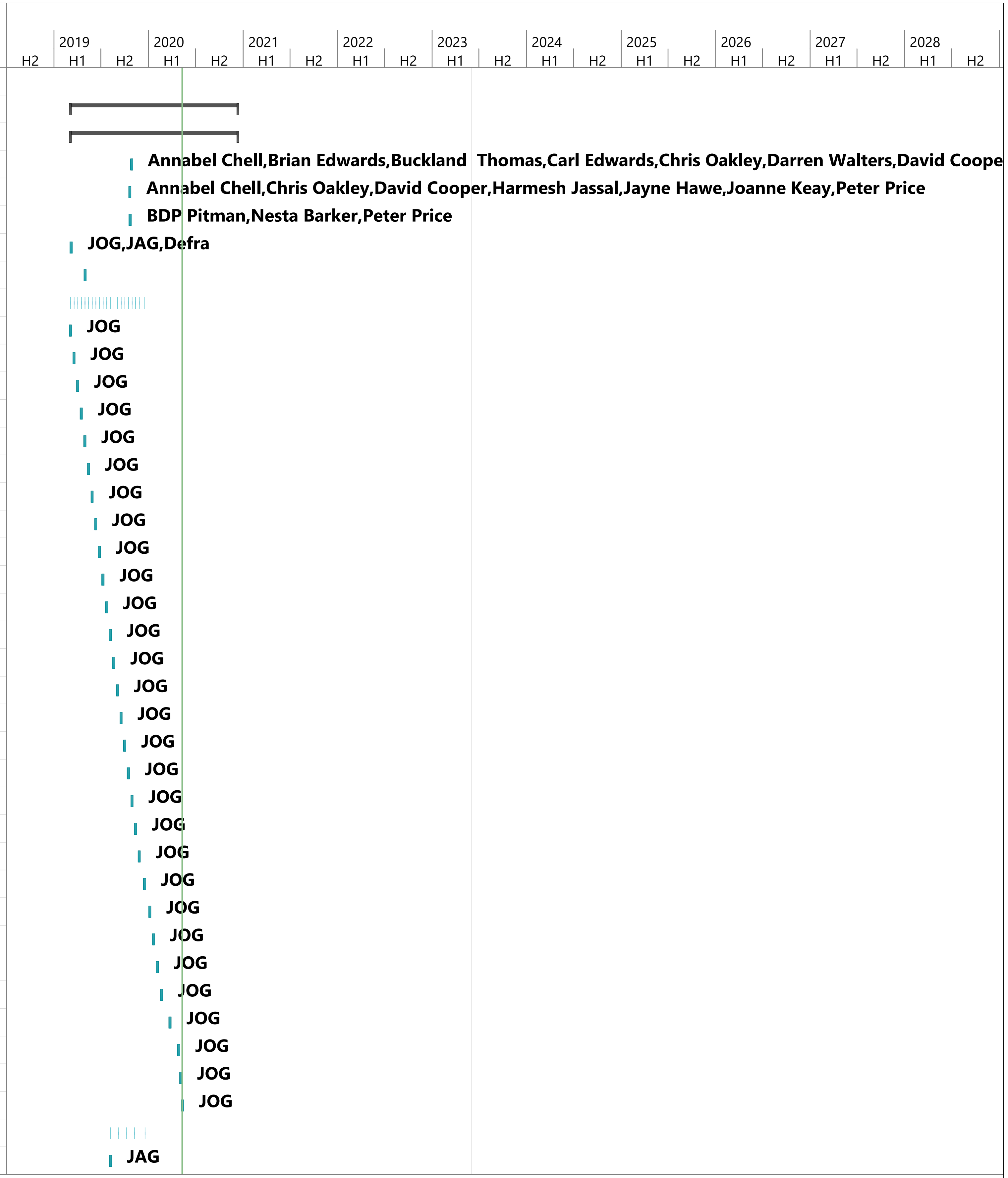
## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 14 - Project Programme Outline

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

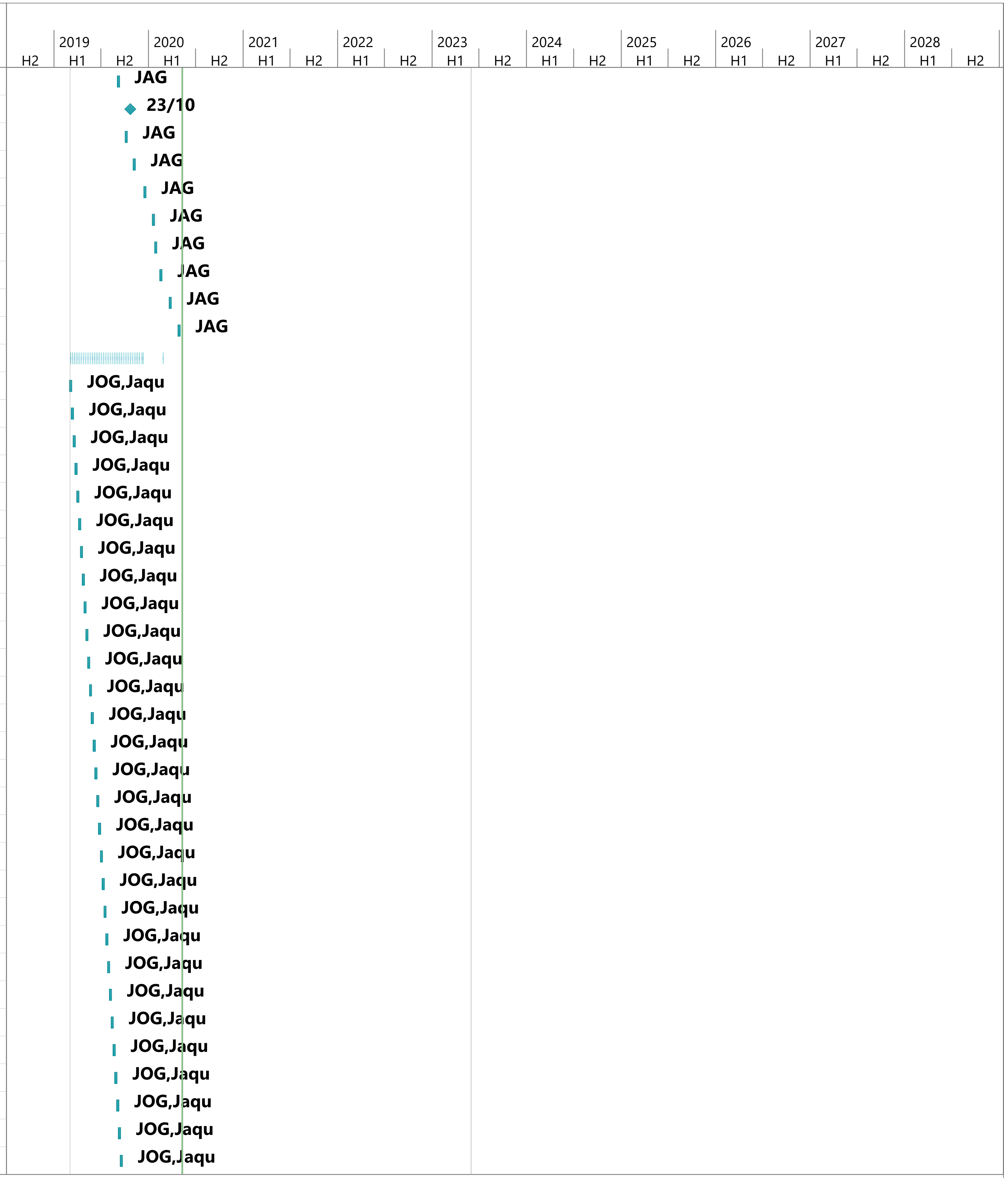
| ID | Task Mode | Task Name | Duration | Start | Finish |
|---|---|---|---|---|---|
| 1 | | **Air Quality Project Plan** | | | |
| 2 | | **Project Governance** | **464 days?** | **Tue 05/03/19** | **Fri 11/12/20** |
| 3 | | **Workshops / meetings** | **464 days** | **Tue 05/03/19** | **Fri 11/12/20** |
| 4 | | Further Options Meeting | 1 day | Mon 28/10/19 | Mon 28/10/19 |
| 5 | | Options Meeting | 1 day | Mon 21/10/19 | Mon 21/10/19 |
| 6 | | Legal Tele Conference | 1 day | Tue 22/10/19 | Tue 22/10/19 |
| 7 | | Defra Workshop | 1 day | Fri 08/03/19 | Fri 08/03/19 |
| 8 | | Local Partnerships Workshop | 1 day | Wed 01/05/19 | Wed 01/05/19 |
| 9 | | **Joint Office Group (JOG) Meetings** | 310 days | Tue 05/03/19 | Mon 11/05/20 |
| 10 | | Joint Office Group (JOG) Meetings 1 | 1 day | Tue 05/03/19 | Tue 05/03/19 |
| 11 | | Joint Office Group (JOG) Meetings 2 | 1 day | Tue 19/03/19 | Tue 19/03/19 |
| 12 | | Joint Office Group (JOG) Meetings 3 | 1 day | Tue 02/04/19 | Tue 02/04/19 |
| 13 | | Joint Office Group (JOG) Meetings 4 | 1 day | Tue 16/04/19 | Tue 16/04/19 |
| 14 | | Joint Office Group (JOG) Meetings 5 | 1 day | Tue 30/04/19 | Tue 30/04/19 |
| 15 | | Joint Office Group (JOG) Meetings 6 | 1 day | Tue 14/05/19 | Tue 14/05/19 |
| 16 | | Joint Office Group (JOG) Meetings 7 | 1 day | Tue 28/05/19 | Tue 28/05/19 |
| 17 | | Joint Office Group (JOG) Meetings 8 | 1 day | Tue 11/06/19 | Tue 11/06/19 |
| 18 | | Joint Office Group (JOG) Meetings 9 | 1 day | Tue 25/06/19 | Tue 25/06/19 |
| 19 | | Joint Office Group (JOG) Meetings 10 | 1 day | Tue 09/07/19 | Tue 09/07/19 |
| 20 | | Joint Office Group (JOG) Meetings 11 | 1 day | Tue 23/07/19 | Tue 23/07/19 |
| 21 | | Joint Office Group (JOG) Meetings 12 | 1 day | Tue 06/08/19 | Tue 06/08/19 |
| 22 | | Joint Office Group (JOG) Meetings 13 | 1 day | Tue 20/08/19 | Tue 20/08/19 |
| 23 | | Joint Office Group (JOG) Meetings 14 | 1 day | Tue 03/09/19 | Tue 03/09/19 |
| 24 | | Joint Office Group (JOG) Meetings 15 | 1 day | Tue 17/09/19 | Tue 17/09/19 |
| 25 | | Joint Office Group (JOG) Meetings 16 | 1 day | Tue 01/10/19 | Tue 01/10/19 |
| 26 | | Joint Office Group (JOG) Meetings 17 | 1 day | Tue 15/10/19 | Tue 15/10/19 |
| 27 | | Joint Office Group (JOG) Meetings 18 | 1 day | Tue 29/10/19 | Tue 29/10/19 |
| 28 | | Joint Office Group (JOG) Meetings 19 | 1 day | Mon 11/11/19 | Mon 11/11/19 |
| 29 | | Joint Office Group (JOG) Meetings 20 | 1 day | Tue 26/11/19 | Tue 26/11/19 |
| 30 | | Joint Office Group (JOG) Meetings 21 | 1 day | Tue 17/12/19 | Tue 17/12/19 |
| 31 | | Joint Office Group (JOG) Meetings 22 | 1 day | Mon 06/01/20 | Mon 06/01/20 |
| 32 | | Joint Office Group (JOG) Meetings 23 | 1 day | Mon 20/01/20 | Mon 20/01/20 |
| 33 | | Joint Office Group (JOG) Meetings 24 | 1 day | Tue 04/02/20 | Tue 04/02/20 |
| 34 | | Joint Office Group (JOG) Meetings 25 | 1 day | Thu 20/02/20 | Thu 20/02/20 |
| 35 | | Joint Office Group (JOG) Meetings 26 | 1 day | Tue 24/03/20 | Tue 24/03/20 |
| 36 | | Joint Office Group (JOG) Meetings 27 | 1 day | Mon 27/04/20 | Mon 27/04/20 |
| 37 | | Joint Office Group (JOG) Meetings 28 | 1 day | Mon 04/05/20 | Mon 04/05/20 |
| 38 | | Joint Officer Group (JOG) Meetings 29 | 1 day | Mon 11/05/20 | Mon 11/05/20 |
| 39 | | **Joint Action Group (JAG) Meetings** | **190 days** | **Wed 07/08/19** | **Tue 28/04/20** |
| 40 | | Joint Action Group (JAG) Meetings 1 | 1 day | Wed 07/08/19 | Wed 07/08/19 |




Project: N Staffs Project Plan_G
Date: Mon 11/05/20

| | | | | | |
|---|---|---|---|---|---|
| Task | Project Summary | Manual Task | Start-only | Deadline | |
| Split | Inactive Task | Duration-only | Finish-only | Progress | |
| Milestone | Inactive Milestone | Manual Summary Rollup | External Tasks | Manual Progress | |
| Summary | Inactive Summary | Manual Summary | External Milestone | | |

| ID | | Task Mode | Task Name | Duration | Start | Finish |
|---|---|---|---|---|---|---|
| 41 | | | Joint Action Group (JAG) Meetings 2 | 1 day | Sat 07/09/19 | Sat 07/09/19 |
| 42 | | | Pre Jag Meeting | 0 days | Wed 23/10/19 | Wed 23/10/19 |
| 43 | | | Joint Action Group (JAG) Meetings 3 | 1 day | Mon 07/10/19 | Mon 07/10/19 |
| 44 | | | Joint Action Group (JAG) Meetings 4 | 1 day | Thu 07/11/19 | Thu 07/11/19 |
| 45 | | | Joint Action Group (JAG) Meetings 5 | 1 day | Wed 18/12/19 | Wed 18/12/19 |
| 46 | | | Joint Action Group (JAG) Meetings 6 | 1 day | Mon 20/01/20 | Mon 20/01/20 |
| 47 | | | Joint Action Group (JAG) Meetings 7 | 1 day | Wed 29/01/20 | Wed 29/01/20 |
| 48 | | | Joint Action Group (JAG) Meetings 8 | 1 day | Tue 18/02/20 | Tue 18/02/20 |
| 49 | | | Joint Action Group (JAG) Meetings 9 | 1 day | Wed 25/03/20 | Wed 25/03/20 |
| 50 | | | Joint Action Group (JAG) Meetings 10 | 1 day | Tue 28/04/20 | Tue 28/04/20 |
| 51 | | | **JAQU Weekly Call** | 296 days | Wed 06/03/19 | Wed 22/04/20 |
| 52 | | | JAQU Weekly Call 1 | 1 day | Wed 06/03/19 | Wed 06/03/19 |
| 53 | | | JAQU Weekly Call 2 | 1 day | Wed 13/03/19 | Wed 13/03/19 |
| 54 | | | JAQU Weekly Call 3 | 1 day | Wed 20/03/19 | Wed 20/03/19 |
| 55 | | | JAQU Weekly Call 4 | 1 day | Wed 27/03/19 | Wed 27/03/19 |
| 56 | | | JAQU Weekly Call 5 | 1 day | Wed 03/04/19 | Wed 03/04/19 |
| 57 | | | JAQU Weekly Call 6 | 1 day | Wed 10/04/19 | Wed 10/04/19 |
| 58 | | | JAQU Weekly Call 7 | 1 day | Wed 17/04/19 | Wed 17/04/19 |
| 59 | | | JAQU Weekly Call 8 | 1 day | Wed 24/04/19 | Wed 24/04/19 |
| 60 | | | JAQU Weekly Call 9 | 1 day | Wed 01/05/19 | Wed 01/05/19 |
| 61 | | | JAQU Weekly Call 10 | 1 day | Wed 08/05/19 | Wed 08/05/19 |
| 62 | | | JAQU Weekly Call 11 | 1 day | Wed 15/05/19 | Wed 15/05/19 |
| 63 | | | JAQU Weekly Call 12 | 1 day | Wed 22/05/19 | Wed 22/05/19 |
| 64 | | | JAQU Weekly Call 13 | 1 day | Wed 29/05/19 | Wed 29/05/19 |
| 65 | | | JAQU Weekly Call 14 | 1 day | Wed 05/06/19 | Wed 05/06/19 |
| 66 | | | JAQU Weekly Call 15 | 1 day | Wed 12/06/19 | Wed 12/06/19 |
| 67 | | | JAQU Weekly Call 16 | 1 day | Wed 19/06/19 | Wed 19/06/19 |
| 68 | | | JAQU Weekly Call 17 | 1 day | Wed 26/06/19 | Wed 26/06/19 |
| 69 | | | JAQU Weekly Call 18 | 1 day | Wed 03/07/19 | Wed 03/07/19 |
| 70 | | | JAQU Weekly Call 19 | 1 day | Wed 10/07/19 | Wed 10/07/19 |
| 71 | | | JAQU Weekly Call 20 | 1 day | Wed 17/07/19 | Wed 17/07/19 |
| 72 | | | JAQU Weekly Call 21 | 1 day | Wed 24/07/19 | Wed 24/07/19 |
| 73 | | | JAQU Weekly Call 22 | 1 day | Wed 31/07/19 | Wed 31/07/19 |
| 74 | | | JAQU Weekly Call 23 | 1 day | Wed 07/08/19 | Wed 07/08/19 |
| 75 | | | JAQU Weekly Call 24 | 1 day | Wed 14/08/19 | Wed 14/08/19 |
| 76 | | | JAQU Weekly Call 25 | 1 day | Wed 21/08/19 | Wed 21/08/19 |
| 77 | | | JAQU Weekly Call 26 | 1 day | Wed 28/08/19 | Wed 28/08/19 |
| 78 | | | JAQU Weekly Call 27 | 1 day | Wed 04/09/19 | Wed 04/09/19 |
| 79 | | | JAQU Weekly Call 28 | 1 day | Wed 11/09/19 | Wed 11/09/19 |
| 80 | | | JAQU Weekly Call 29 | 1 day | Wed 18/09/19 | Wed 18/09/19 |




Project: N Staffs Project Plan_G
Date: Mon 11/05/20

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|---|---|---|---|---|---|---|---|---|---|
| Task | | Project Summary | | Manual Task | | Start-only | | Deadline | |
| Split | | Inactive Task | | Duration-only | | Finish-only | | Progress | |
| Milestone | | Inactive Milestone | | Manual Summary Rollup | | External Tasks | | Manual Progress | |
| Summary | | Inactive Summary | | Manual Summary | | External Milestone | | | |

| | | Task Mode | Task Name | Duration | Start | Finish |
|---|---|---|---|---|---|---|
| 81 | | | JAQU Weekly Call 30 | 1 day | Wed 25/09/19 | Wed 25/09/19 |
| 82 | | | JAQU Weekly Call 31 | 1 day | Wed 02/10/19 | Wed 02/10/19 |
| 83 | | | JAQU Weekly Call 32 | 1 day | Wed 09/10/19 | Wed 09/10/19 |
| 84 | | | JAQU Weekly Call 33 | 1 day | Wed 16/10/19 | Wed 16/10/19 |
| 85 | | | JAQU Weekly Call 34 | 1 day | Wed 23/10/19 | Wed 23/10/19 |
| 86 | | | JAQU Weekly Call 35 | 1 day | Wed 30/10/19 | Wed 30/10/19 |
| 87 | | | JAQU Weekly Call 36 | 1 day | Wed 06/11/19 | Wed 06/11/19 |
| 88 | | | JAQU Weekly Call 37 | 1 day | Wed 13/11/19 | Wed 13/11/19 |
| 89 | | | JAQU Weekly Call 38 | 1 day | Wed 20/11/19 | Wed 20/11/19 |
| 90 | | | JAQU Weekly Call 39 | 1 day | Wed 27/11/19 | Wed 27/11/19 |
| 91 | | | JAQU Weekly Call 40 | 1 day | Fri 06/12/19 | Fri 06/12/19 |
| 92 | | | JAQU Weekly Call 41 | 1 day | Wed 11/12/19 | Wed 11/12/19 |
| 93 | | | JAQU Weekly Call 42 | 1 day | Wed 18/12/19 | Wed 18/12/19 |
| 94 | | | JAQU Weekly Call 43 | 1 day | Wed 08/01/20 | Wed 08/01/20 |
| 95 | | | JAQU Weekly Call 44 | 1 day | Wed 15/01/20 | Wed 15/01/20 |
| 96 | | | JAQU Weekly Call 45 | 1 day | Wed 29/01/20 | Wed 29/01/20 |
| 97 | | | JAQU Weekly Call 46 | 1 day | Wed 05/02/20 | Wed 05/02/20 |
| 98 | | | JAQU Weekly Call 47 | 1 day | Wed 12/02/20 | Wed 12/02/20 |
| 99 | | | JAQU Weekly Call 48 | 1 day | Wed 19/02/20 | Wed 19/02/20 |
| 100 | | | JAQU Weekly Call 49 | 1 day | Wed 26/02/20 | Wed 26/02/20 |
| 101 | | | JAQU Weekly Call 50 | 1 day | Wed 04/03/20 | Wed 04/03/20 |
| 102 | | | JAQU Weekly Call 51 | 1 day | Wed 11/03/20 | Wed 11/03/20 |
| 103 | | | JAQU Weekly Call 52 | 1 day | Wed 18/03/20 | Wed 18/03/20 |
| 104 | | | JAQU Weekly Call 53 | 1 day | Wed 25/03/20 | Wed 25/03/20 |
| 105 | | | JAQU Weekly Call 54 | 1 day | Wed 01/04/20 | Wed 01/04/20 |
| 106 | | | JAQU Weekly Call 55 | 1 day | Wed 08/04/20 | Wed 08/04/20 |
| 107 | | | JAQU Weekly Call 56 | 1 day | Wed 15/04/20 | Wed 15/04/20 |
| 108 | | | JAQU Weekly Call 57 | 1 day | Wed 22/04/20 | Wed 22/04/20 |
| 109 | | | **Technical Meetings** | 176 days | Thu 20/06/19 | Thu 20/02/20 |
| 110 | | | Technical Meetings 1 | 1 day | Thu 20/06/19 | Thu 20/06/19 |
| 111 | | | Technical Meetings 2 | 1 day | Thu 11/07/19 | Thu 11/07/19 |
| 112 | | | Technical Meetings 3 | 1 day | Thu 01/08/19 | Thu 01/08/19 |
| 113 | | | AQ Plan - business case development | 1 day | Wed 27/11/19 | Wed 27/11/19 |
| 114 | | | Complimentary Measures Meeting | 1 day | Wed 20/11/19 | Wed 20/11/19 |
| 115 | | | Risk Workshop Session 1 | 1 day | Tue 04/02/20 | Tue 04/02/20 |
| 116 | | | Risk Workshop Session 2 | 1 day | Wed 12/02/20 | Wed 12/02/20 |
| 117 | | | Risk workshop Session 3 | 1 day | Thu 20/02/20 | Thu 20/02/20 |
| 118 | | | **Highways England** | **1 day** | **Fri 24/01/20** | **Fri 24/01/20** |
| 119 | | | Highways England Consultation | 1 day | Fri 24/01/20 | Fri 24/01/20 |
| 120 | | | **Communications Meeting** | **280 days** | **Mon 18/11/19** | **Fri 11/12/20** |


Project: N Staffs Project Plan_G
Date: Mon 11/05/20

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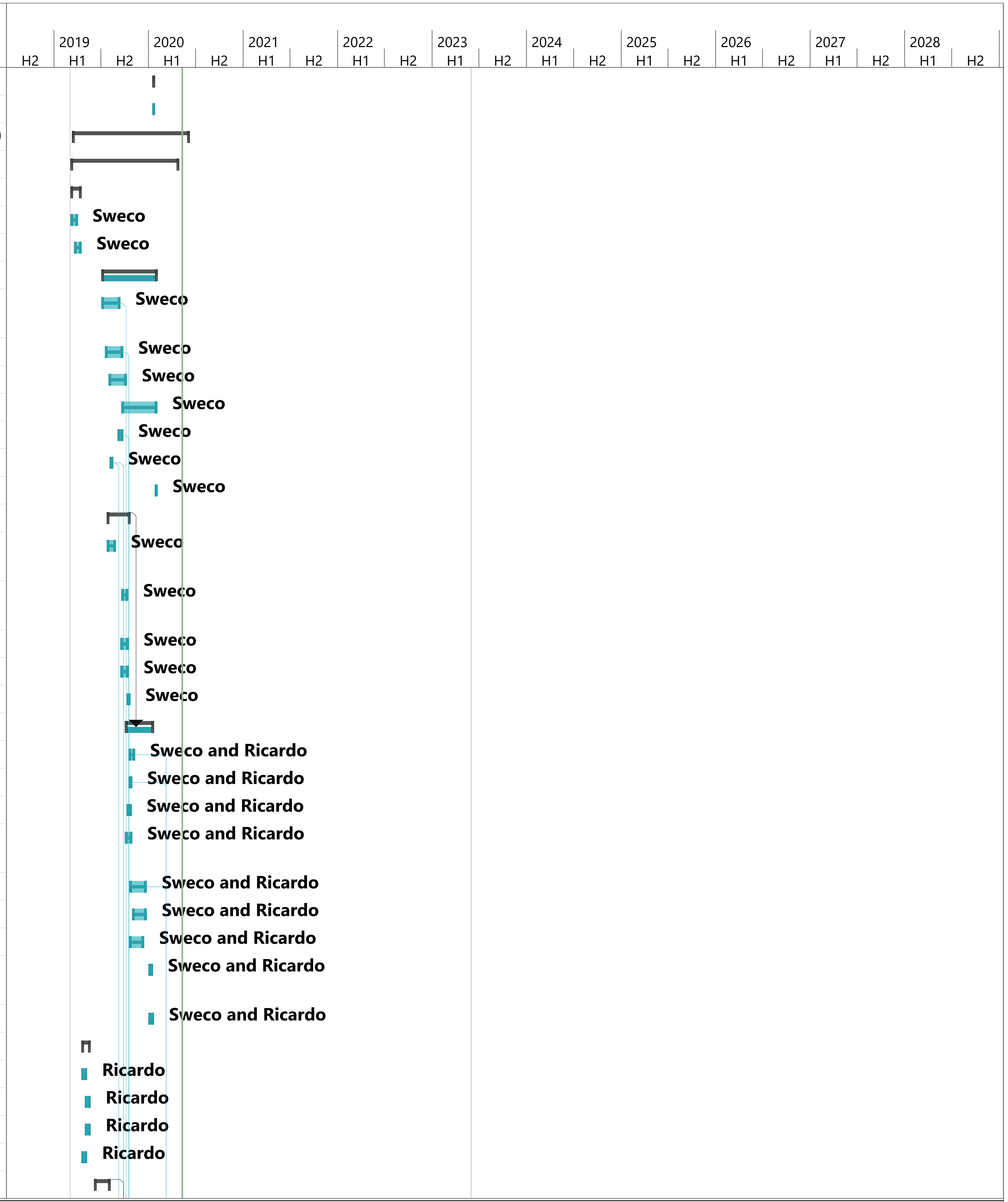
|---|---|---|---|---|
| Task | Project Summary | Manual Task | Start-only | Deadline |
| Split | Inactive Task | Duration-only | Finish-only | Progress |
| Milestone | Inactive Milestone | Manual Summary Rollup | External Tasks | Manual Progress |
| Summary | Inactive Summary | Manual Summary | External Milestone | |

| ID | Task Mode | Task Name | Duration | Start | Finish |
|---|---|---|---|---|---|
| 128 | | **Bus Operator Engagement** | **1 day** | **Tue 21/01/20** | **Tue 21/01/20** |
| 129 | | SOT Clean Air Meeting | 1 day | Tue 21/01/20 | Tue 21/01/20 |
| 130 | | **Cabinet Process (When Available)** | **318 days?** | **Sun 17/03/19** | **Wed 03/06/20** |
| 191 | | **Technical** | **294 days** | **Mon 11/03/19** | **Thu 23/04/20** |
| 192 | | **Initial Testing / Option Screening** | **25 days** | **Mon 11/03/19** | **Fri 12/04/19** |
| 193 | | Understanding existing situation | 15 days | Mon 11/03/19 | Fri 29/03/19 |
| 194 | | Testing several options using existing NSMM model | 15 days | Mon 25/03/19 | Fri 12/04/19 |
| 195 | | **Future Year Reference Case Modelling** | **150 days** | **Mon 08/07/19** | **Fri 31/01/20** |
| 196 | | Uncertainty log for new transport schemes and developments | 46 days | Mon 08/07/19 | Mon 09/09/19 |
| 197 | | Create 2021 Ref Case Model | 45 days | Mon 22/07/19 | Fri 20/09/19 |
| 198 | | Create 2022 Ref Case Model | 45 days | Mon 05/08/19 | Fri 04/10/19 |
| 199 | | Create 2025 Ref Case Model | 94 days | Mon 23/09/19 | Thu 30/01/20 |
| 200 | | Adjust future vehicle type proportions | 10 days | Mon 09/09/19 | Fri 20/09/19 |
| 201 | | Extract data for AQ 2021 | 2 days | Fri 09/08/19 | Mon 12/08/19 |
| 202 | | Extract data for AQ 2025 | 1 day | Fri 31/01/20 | Fri 31/01/20 |
| 203 | | **Update demand model** | **60 days** | **Mon 29/07/19** | **Fri 18/10/19** |
| 204 | | Segment matrices by income level and compliance status | 20 days | Mon 29/07/19 | Fri 23/08/19 |
| 205 | | Update demand model structure to allow for all behavioural responses / SP | 13 days | Mon 23/09/19 | Wed 09/10/19 |
| 206 | | Update distribution model | 16 days | Fri 20/09/19 | Fri 11/10/19 |
| 207 | | Update mode split model | 16 days | Fri 20/09/19 | Fri 11/10/19 |
| 208 | | Sensitivity testing | 5 days | Mon 14/10/19 | Fri 18/10/19 |
| 209 | | **Scenario Testing** | **75 days** | **Mon 07/10/19** | **Fri 17/01/20** |
| 210 | | Model the CAZ | 12 days | Mon 21/10/19 | Tue 05/11/19 |
| 211 | | CAZ Sensitivity Testing | 5 days | Mon 21/10/19 | Fri 25/10/19 |
| 212 | | Code short listed measures | 8 days | Mon 14/10/19 | Wed 23/10/19 |
| 213 | | GIS analysis / catchment analysis and matrix adjustment for some responses | 15 days | Mon 07/10/19 | Fri 25/10/19 |
| 214 | | Model non-CAZ/alternative options | 42 days | Thu 24/10/19 | Fri 20/12/19 |
| 215 | | Outputs results / impact analysis | 35 days | Mon 04/11/19 | Fri 20/12/19 |
| 216 | | Extract data for AQ | 35 days | Wed 23/10/19 | Tue 10/12/19 |
| 217 | | T4 - Transport Modelling Results Report update with future scenarios | 6 days | Mon 06/01/20 | Mon 13/01/20 |
| 218 | | Analytical Assurance Statement update | 10 days | Mon 06/01/20 | Fri 17/01/20 |
| 219 | | **AQ Data Collection** | **20 days** | **Mon 22/04/19** | **Fri 17/05/19** |
| 220 | | AQ monitoring data | 10 days | Mon 22/04/19 | Fri 03/05/19 |
| 221 | | Topographic data | 10 days | Mon 06/05/19 | Fri 17/05/19 |
| 222 | | Mastermap data | 10 days | Mon 06/05/19 | Fri 17/05/19 |
| 223 | | North Staffs transport model (2015) | 10 days | Mon 22/04/19 | Fri 03/05/19 |
| 224 | | **Update Base (observed) transport model** | **40 days** | **Mon 10/06/19** | **Fri 02/08/19** |




Project: N Staffs Project Plan_G
Date: Mon 11/05/20

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|---|---|---|---|---|---|---|---|---|---|
| Task | | Project Summary | | Manual Task | | Start-only | | Deadline | |
| Split | | Inactive Task | | Duration-only | | Finish-only | | Progress | |
| Milestone | | Inactive Milestone | | Manual Summary Rollup | | External Tasks | | Manual Progress | |
| Summary | | Inactive Summary | | Manual Summary | | External Milestone | | | |

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| | Task Mode | Task Name | Duration | Start | Finish |
|---|---|---|---|---|---|
| 225 | | Split the observed matrices into the compliance types | 20 days | Mon 10/06/19 | Fri 05/07/19 |
| 226 | | New base model assignment with disaggregated matrices | 15 days | Mon 01/07/19 | Fri 19/07/19 |
| 227 | | Comparisons of 2018/19 traffic counts/ANPR data with 2015 counts and model data | 10 days | Mon 08/07/19 | Fri 19/07/19 |
| 228 | | Updated highway model validation, production of new validation spreadsheets | 10 days | Mon 08/07/19 | Fri 19/07/19 |
| 229 | | Provide 2015 base model data for AQ | 15 days | Mon 15/07/19 | Fri 02/08/19 |
| 230 | | **Data Collection** | **187 days** | **Mon 01/04/19** | **Tue 17/12/19** |
| 231 | | ANPR Survey Specification | 5 days | Mon 01/04/19 | Fri 05/04/19 |
| 232 | | ANPR survey implementation | 10 days | Mon 08/04/19 | Fri 19/04/19 |
| 233 | | ANPR processing | 31 days | Fri 19/04/19 | Fri 31/05/19 |
| 234 | | ANPR Technical Note | 40 days | Mon 03/06/19 | Fri 26/07/19 |
| 235 | | DfT vehicle type categorisation | 25 days | Mon 29/04/19 | Fri 31/05/19 |
| 236 | | Analyse SP data from elsewhere | 30 days | Mon 27/05/19 | Fri 05/07/19 |
| 237 | | Local economic correction | 20 days | Mon 17/06/19 | Fri 12/07/19 |
| 238 | | SP survey preparation - 3 surveys | 36.9 days | Mon 17/06/19 | Tue 06/08/19 |
| 239 | | Pre-SP survey media engagement | 16 days | Mon 12/08/19 | Mon 02/09/19 |
| 240 | | SP Survey lead-in | 10 days | Mon 19/08/19 | Fri 30/08/19 |
| 241 | | SP survey implementation | 30 days | Mon 02/09/19 | Fri 11/10/19 |
| 242 | | Submission of SP survey data to consultants | 1 day | Fri 11/10/19 | Fri 11/10/19 |
| 243 | | SP analysis | 10 days | Mon 14/10/19 | Fri 25/10/19 |
| 244 | | SP Survey report | 37 days | Mon 28/10/19 | Tue 17/12/19 |
| 245 | | SP Survey report | 37 days | Mon 28/10/19 | Tue 17/12/19 |
| 246 | | **AQ Modelling** | **269 days** | **Mon 15/04/19** | **Thu 23/04/20** |
| 247 | | New EfT due | 5 days | Mon 27/05/19 | Fri 31/05/19 |
| 248 | | ANPR and base fleet | 10 days | Mon 27/05/19 | Fri 07/06/19 |
| 249 | | Create AQ model structure based on NSMM | 15 days | Mon 15/04/19 | Fri 03/05/19 |
| 250 | | Preliminary baseline screening model using NSMM traffic data | 20 days | Mon 06/05/19 | Fri 31/05/19 |
| 251 | | AQ screening assessments NSMM model runs and simple assumptions | 20 days | Mon 20/05/19 | Fri 14/06/19 |
| 252 | | Full baseline model using final transport model | 10 days | Tue 13/08/19 | Mon 26/08/19 |
| 253 | | Full baseline source apportionment | 5 days | Mon 12/08/19 | Fri 16/08/19 |
| 254 | | Modelling - Do minimum | 5 days | Mon 19/08/19 | Fri 23/08/19 |
| 255 | | Modelling - Future reference case | 6 days | Mon 23/09/19 | Mon 30/09/19 |
| 256 | | Further option sifting using final transport model | 16 days | Mon 23/09/19 | Mon 14/10/19 |
| 257 | | OBC short listed option 1 High Impact | 8 days | Wed 06/11/19 | Fri 15/11/19 |
| 258 | | OBC short listed option 2 Low Impact | 10 days | Thu 07/11/19 | Wed 20/11/19 |
| 259 | | OBC short listed option 3 Hybrid Option | 10 days | Mon 11/11/19 | Fri 22/11/19 |
| 260 | | OBC short listed option 4 | 9 days | Tue 26/11/19 | Fri 06/12/19 |
| 261 | | OBC short listed option 5 | 8 days | Thu 26/12/19 | Mon 06/01/20 |


Project: N Staffs Project Plan_G
Date: Mon 11/05/20

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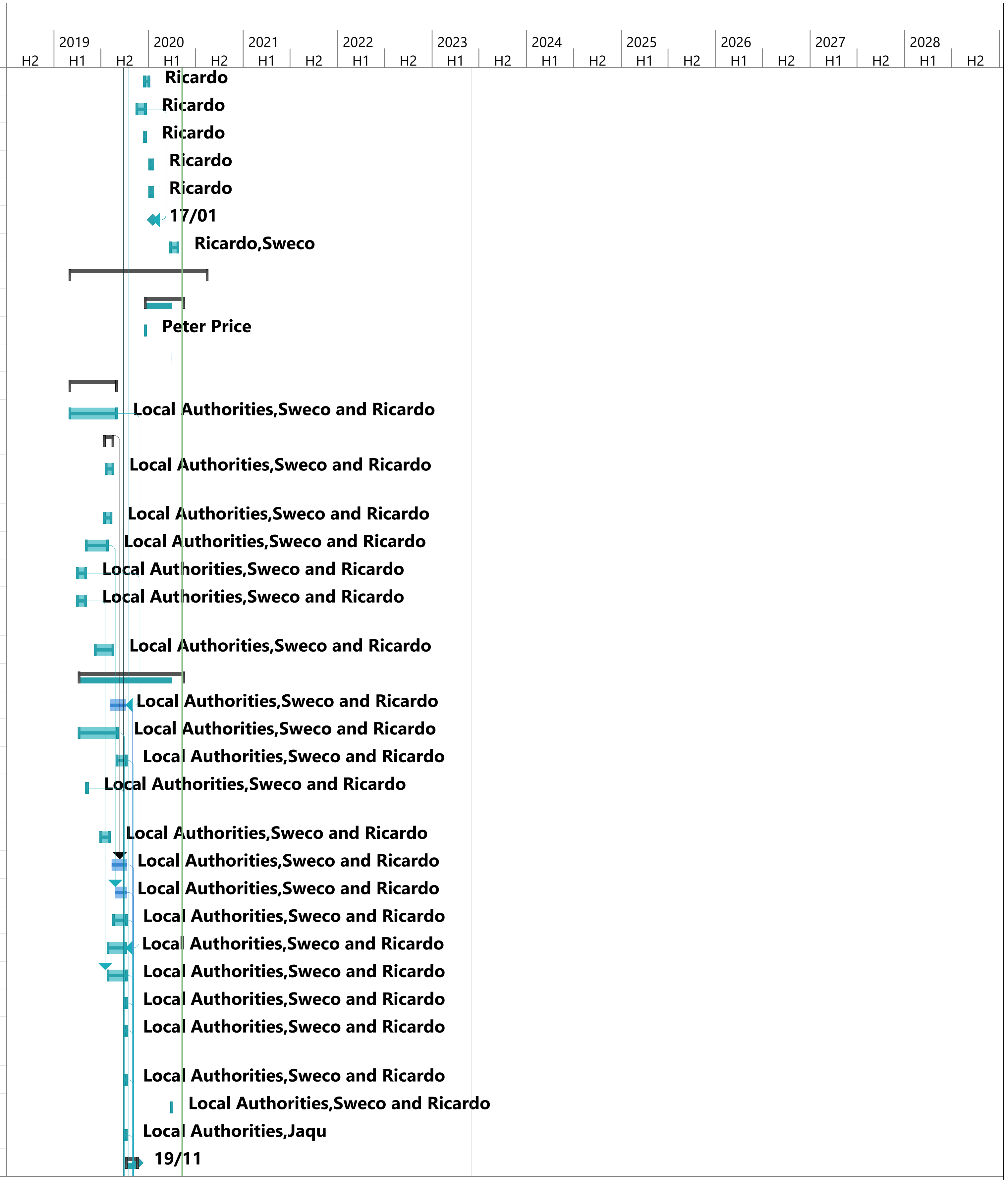
|---|---|---|---|---|---|---|---|---|---|
| Task | | Project Summary | | Manual Task | | Start-only | | Deadline | |
| Split | | Inactive Task | | Duration-only | | Finish-only | | Progress | |
| Milestone | | Inactive Milestone | | Manual Summary Rollup | | External Tasks | | Manual Progress | |
| Summary | | Inactive Summary | | Manual Summary | | External Milestone | | | |

| ID | | Task Mode | Task Name | Duration | Start | Finish |
|---|---|---|---|---|---|---|
| 262 | | | OBC Short Listed Option 6 | 13 days | Tue 17/12/19 | Thu 02/01/20 |
| 263 | | | Sensitivity tests | 25 days | Mon 18/11/19 | Fri 20/12/19 |
| 264 | | | PM modelling for HIA | 5 days | Mon 16/12/19 | Fri 20/12/19 |
| 265 | | | AQ3 Final results report | 10 days | Mon 06/01/20 | Fri 17/01/20 |
| 266 | | | Analytical assurance statements (AQ and economics) | 10 days | Mon 06/01/20 | Fri 17/01/20 |
| 267 | | | Options Tested | 53 days | Wed 06/11/19 | Fri 17/01/20 |
| 268 | | | Hybrid Option 4 | 21 days | Thu 26/03/20 | Thu 23/04/20 |
| 269 | | | **Submissions** | **380 days** | **Mon 04/03/19** | **Fri 14/08/20** |
| 270 | | | **Draft Document Dates for JAQU** | **106 days** | **Fri 20/12/19** | **Fri 15/05/20** |
| 271 | | | **Draft Preferred Options** | 1 day | Fri 20/12/19 | Fri 20/12/19 |
| 272 | | | **AQ1, AQ2 & AQ3 & T1,T2,T3, T4** | 1 day | Tue 31/03/20 | Tue 31/03/20 |
| 273 | | | **Evidence Methodology Submission** | **130 days** | **Mon 04/03/19** | **Fri 30/08/19** |
| 274 | | | T1 - Transport Modelling Tracker Table (ongoing) | 130 days | Mon 04/03/19 | Fri 30/08/19 |
| 275 | | | T2 - Validation Report for Transport Modelling | 25 days | Mon 15/07/19 | Fri 16/08/19 |
| 276 | | | T2a - Travel demand calibration and sensitivity test section | 20 days | Mon 22/07/19 | Fri 16/08/19 |
| 277 | | | T2b - Traffic assignment model validation section | 20 days | Mon 15/07/19 | Fri 09/08/19 |
| 278 | | | T3 - Transport Modelling Methodology Report | 60 days | Mon 06/05/19 | Fri 26/07/19 |
| 279 | | | AQ1 - Initial versions of AQ modelling tracker table | 25 days | Mon 01/04/19 | Fri 03/05/19 |
| 280 | | | AQ2 - Initial version of AQ modelling methodology report | 25 days | Mon 01/04/19 | Fri 03/05/19 |
| 281 | | | JAQU review | 50 days | Mon 10/06/19 | Fri 16/08/19 |
| 282 | | | **Initial Evidence Submission** | **290 days** | **Mon 08/04/19** | **Fri 15/05/20** |
| 283 | | | T1 - Finalise Transport Modelling Tracker | 45 days | Mon 05/08/19 | Fri 04/10/19 |
| 284 | | | Liaison with JAQU | 107 days | Mon 08/04/19 | Tue 03/09/19 |
| 285 | | | Analytical assurance statement | 26 days | Mon 02/09/19 | Mon 07/10/19 |
| 286 | | | Informal baseline for JAQU info only based on Existing NSMM | 5 days | Mon 06/05/19 | Fri 10/05/19 |
| 287 | | | Delivery of 2018 baseline traffic data to AQ | 25 days | Mon 01/07/19 | Fri 02/08/19 |
| 288 | | | T2 - Update validation report for transport model | 42 days | Mon 12/08/19 | Tue 08/10/19 |
| 289 | | | T3 - Update Model Methodology Report | 32 days | Mon 26/08/19 | Tue 08/10/19 |
| 290 | | | T4 - Transport Modelling Results Report | 37 days | Mon 19/08/19 | Tue 08/10/19 |
| 291 | | | AQ1 - Finalise AQ tracker template | 50 days | Mon 29/07/19 | Fri 04/10/19 |
| 292 | | | AQ2 - Update AQ modelling methodology report | 52 days | Mon 29/07/19 | Tue 08/10/19 |
| 293 | | | Target Determination | 6 days | Tue 01/10/19 | Tue 08/10/19 |
| 294 | | | AQ3 - AQ modelling results report with baseline output | 7 days | Mon 30/09/19 | Tue 08/10/19 |
| 295 | | | TD1 | 6 days | Tue 01/10/19 | Tue 08/10/19 |
| 296 | | | TD2 | 1 day | Tue 31/03/20 | Tue 31/03/20 |
| 297 | | | LA/JAQU review | 6 days | Mon 30/09/19 | Mon 07/10/19 |
| 298 | | | **IES Submission** | **31 days** | **Tue 08/10/19** | **Tue 19/11/19** |

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|---|---|---|---|---|---|---|---|---|---|
| Task | | Project Summary | | Manual Task | | Start-only | | Deadline | |
| Split | | Inactive Task | | Duration-only | | Finish-only | | Progress | |
| Milestone | | Inactive Milestone | | Manual Summary Rollup | | External Tasks | | Manual Progress | |
| Summary | | Inactive Summary | | Manual Summary | | External Milestone | | | |

| ID | Task Mode | Task Name | Duration | Start | Finish | |
|---|---|---|---|---|---|---|
| 299 | | IES Submission | 0 days | Tue 08/10/19 | Tue 08/10/19 | 08/10 |
| 300 | | T-iRP Evidence Submission | 1 day | Tue 08/10/19 | Tue 08/10/19 | |
| 301 | | T-iRP Meeting | 1 day | Tue 22/10/19 | Tue 22/10/19 | |
| 302 | | T-iRP Review | 21 days | Tue 22/10/19 | Tue 19/11/19 | |
| 303 | | **Outline Business Case (Unapproaved)** | **290 days** | **Mon 08/04/19** | **Fri 15/05/20** | |
| 304 | | Progress Report | 1 day | Thu 31/10/19 | Thu 31/10/19 | Local Authorities,Peter Price |
| 305 | | **Strategic Case** | **290 days** | **Mon 08/04/19** | **Fri 15/05/20** | |
| 306 | | CAZ benchmark and preferred option identified | 10 days | Mon 02/12/19 | Fri 13/12/19 | Local Authorities[20%],Sweco,Peter Price |
| 307 | | Report Options Development process | 5 days | Mon 16/12/19 | Fri 20/12/19 | Local Authorities[20%],Sweco,Peter Price |
| 308 | | Scheme Description/scope (CAZ benchmark) | 74 days | Tue 04/02/20 | Fri 15/05/20 | Local Authorities[20%],Sweco,Peter Price |
| 309 | | Scheme description/scope (preferred option - retrofit, TM, junctions, bus infra, TP) | 74 days | Tue 04/02/20 | Fri 15/05/20 | Local Authorities[20%],Sweco,Peter Price |
| 310 | | Policies and Strategies | 120 days | Mon 02/12/19 | Fri 15/05/20 | Local Authorities[20%],Sweco,Peter Price |
| 311 | | Project Objectives | 120 days | Mon 02/12/19 | Fri 15/05/20 | Local Authorities[20%],Sweco,Peter Price |
| 312 | | Evidence of Problems/case for change/IES summary | 120 days | Mon 02/12/19 | Fri 15/05/20 | Local Authorities[20%],Sweco,Peter Price |
| 313 | | Logic Mapping of preferred option (outputs and outcomes needed) | 55 days | Mon 02/03/20 | Fri 15/05/20 | Local Authorities[20%],Sweco,Peter Price |
| 314 | | Benefits, Risks, Constraints, Dependencies (CAZ benchmark) | 55 days | Mon 02/03/20 | Fri 15/05/20 | Local Authorities[20%],Sweco,Peter Price |
| 315 | | Benefits, Risks, Constraints, Dependencies (preferred option) | 55 days | Mon 02/03/20 | Fri 15/05/20 | Local Authorities[20%],Sweco,Peter Price |
| 316 | | Local Authority Review | 11 days | Tue 10/03/20 | Tue 24/03/20 | Local Authorities |
| 317 | | JAQU Review | 12 days | Tue 31/03/20 | Wed 15/04/20 | Jaqu |
| 318 | | **Management Case** | **97 days** | **Thu 02/01/20** | **Fri 15/05/20** | |
| 319 | | **Project Governance** | **87 days** | **Mon 02/12/19** | **Tue 31/03/20** | |
| 320 | | Governance approach (CAZ benchmark) | 64 days | Thu 02/01/20 | Tue 31/03/20 | Local Authorities[40%],Sweco |
| 321 | | Governance approach (preferred option) | 64 days | Thu 02/01/20 | Tue 31/03/20 | Local Authorities[40%],Sweco |
| 322 | | Project Plan (CAZ benchmark) | 87 days | Mon 02/12/19 | Tue 31/03/20 | Local Authorities[40%],Sweco |
| 323 | | Project Plan (preferred option) | 87 days | Mon 02/12/19 | Tue 31/03/20 | Local Authorities[40%],Sweco |
| 324 | | **Risk Management** | **47 days** | **Mon 27/01/20** | **Tue 31/03/20** | |
| 325 | | **Risk workshop (CAZ benchmark)** | **47 days** | **Mon 27/01/20** | **Tue 31/03/20** | Bentley Project Management |
| 326 | | **Risk workshop (preferred option)** | **47 days** | **Mon 27/01/20** | **Tue 31/03/20** | Bentley Project Management |
| 327 | | Risk register (CAZ benchmark) | 42 days | Mon 03/02/20 | Tue 31/03/20 | Local Authorities[40%],Sweco |
| 328 | | Risk register (preferred option) | 42 days | Mon 03/02/20 | Tue 31/03/20 | Local Authorities[40%],Sweco |
| 329 | | Report of Risk workshops (P50/P80 risk layers) | 42 days | Mon 03/02/20 | Tue 31/03/20 | Bentley Project Management,Sweco |
| 330 | | **Benefits Realisation** | **82 days** | **Mon 09/12/19** | **Tue 31/03/20** | |
| 331 | | Benefits realisation approach (CAZ benchmark) | 82 days | Mon 09/12/19 | Tue 31/03/20 | Local Authorities[40%],Sweco |
| 332 | | Benefits realisation approach (preferred option) | 82 days | Mon 09/12/19 | Tue 31/03/20 | Local Authorities[40%],Sweco |
| 333 | | **Monitoring & Evaluation** | **93 days** | **Mon 09/12/19** | **Wed 15/04/20** | |
| 334 | | Monitoring and Evaluation Framework | 82 days | Mon 09/12/19 | Tue 31/03/20 | Local Authorities[40%],Sweco |
| 335 | | Local Authority Review | 11 days | Tue 10/03/20 | Tue 24/03/20 | Local Authorities |

Timeline: 2019 H2 – 2028 H2 (H2, 2019 H1, H2, 2020 H1, H2, 2021 H1, H2, 2022 H1, H2, 2023 H1, H2, 2024 H1, H2, 2025 H1, H2, 2026 H1, H2, 2027 H1, H2, 2028 H1, H2)

Project: N Staffs Project Plan_G
Date: Mon 11/05/20

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress

| ID | Task Mode | Task Name | Duration | Start | Finish | Resources |
|---|---|---|---|---|---|---|
| 336 | | JAQU Review | 12 days | Tue 31/03/20 | Wed 15/04/20 | Jaqu,Local Partnerships |
| 337 | | **Commercial Case** | **75 days** | **Thu 02/01/20** | **Wed 15/04/20** | |
| 338 | | Procurement Strategy | 64 days | Thu 02/01/20 | Tue 31/03/20 | Local Authorities[40%],Sweco |
| 339 | | Services and required outputs | 64 days | Thu 02/01/20 | Tue 31/03/20 | Local Authorities[40%],Sweco |
| 340 | | Risk apportionment determined for requirements | 32 days | Mon 17/02/20 | Tue 31/03/20 | Local Authorities[40%],Sweco |
| 341 | | Payment mechanisms outlined | 64 days | Thu 02/01/20 | Tue 31/03/20 | Local Authorities[40%],Sweco |
| 342 | | Contract terms/approach and key issues identified | 64 days | Thu 02/01/20 | Tue 31/03/20 | Local Authorities[40%],Sweco |
| 343 | | Accounting treatment identified and agreed | 64 days | Thu 02/01/20 | Tue 31/03/20 | Local Authorities[40%],Sweco |
| 344 | | Local Authority Review | 11 days | Tue 10/03/20 | Tue 24/03/20 | Local Authorities |
| 345 | | JAQU Review | 12 days | Tue 31/03/20 | Wed 15/04/20 | Jaqu,Local Partnerships |
| 346 | | **Financial Case Preferred Option** | **77 days** | **Mon 16/12/19** | **Tue 31/03/20** | |
| 347 | | Detailed scheme design (preferred option retrofit, TM, junctions, bus infra, TP) | 52 days | Mon 20/01/20 | Tue 31/03/20 | SCC,Contractor and SOT |
| 348 | | Detailed scheme design (CAZ benchmark) | 52 days | Mon 20/01/20 | Tue 31/03/20 | Amey |
| 349 | | Costing of preferred option | 52 days | Mon 20/01/20 | Tue 31/03/20 | SCC,Contractor and SOT |
| 350 | | Costing of CAZ benchmark | 52 days | Mon 20/01/20 | Tue 31/03/20 | Contractor |
| 351 | | Independent cost review | 22 days | Mon 02/03/20 | Tue 31/03/20 | Contractor |
| 352 | | Financial model produced | 17 days | Mon 09/03/20 | Tue 31/03/20 | Sweco |
| 353 | | Financial model populated and agreed | 17 days | Mon 09/03/20 | Tue 31/03/20 | Sweco |
| 354 | | Commissioner's letter produced and agreed | 13 days | Fri 13/03/20 | Tue 31/03/20 | SCC,SOT,NBC |
| 355 | | Supporting activites for letter agreement by CEO/S151 officer | 6 days | Mon 23/03/20 | Tue 31/03/20 | SCC,SOT,NBC |
| 356 | | Local Authority Review | 11 days | Tue 10/03/20 | Tue 24/03/20 | Local Authorities |
| 357 | | JAQU Review | 12 days | Tue 31/03/20 | Wed 15/04/20 | Jaqu |
| 358 | | **Economic Case** | **64 days** | **Thu 02/01/20** | **Tue 31/03/20** | |
| 359 | | **Cost benefit analysis** | 42 days | Thu 02/01/20 | Fri 28/02/20 | |
| 360 | | Initial discussion with AQ/transport modellers | 93 days | Wed 23/10/19 | Fri 28/02/20 | Sweco and Ricardo |
| 361 | | Data collection | 93 days | Wed 23/10/19 | Fri 28/02/20 | Sweco and Ricardo |
| 362 | | Option scoping and model preparation | 75 days | Mon 18/11/19 | Fri 28/02/20 | Ricardo |
| 363 | | Assessment of costs and benefits | 42 days | Thu 02/01/20 | Fri 28/02/20 | Ricardo |
| 364 | | Sensitivity analysis | 25 days | Mon 27/01/20 | Fri 28/02/20 | Ricardo |
| 365 | | Develop inputs to finance case | 10 days | Mon 17/02/20 | Fri 28/02/20 | Ricardo |
| 366 | | Develop final version | 0 days | Fri 28/02/20 | Fri 28/02/20 | 28/02 |
| 367 | | **Distritubional analysis** | **42 days** | **Thu 02/01/20** | **Fri 28/02/20** | |
| 368 | | Screening | 42 days | Thu 02/01/20 | Fri 28/02/20 | Ricardo |
| 369 | | Assessment | 37 days | Thu 09/01/20 | Fri 28/02/20 | Ricardo |
| 370 | | Analysis of distributional impacts | 32 days | Thu 16/01/20 | Fri 28/02/20 | Ricardo |
| 371 | | Develop of final version | 0 days | Fri 28/02/20 | Fri 28/02/20 | 28/02 |
| 372 | | Inputs to HIA | 25 days | Mon 20/01/20 | Fri 21/02/20 | Ricardo,SCC,SOT |
| 373 | | Input to AAS | 0 days | Fri 28/02/20 | Fri 28/02/20 | 28/02 |
| 374 | | Inputs to financial case | 5 days | Mon 24/02/20 | Fri 28/02/20 | Sweco and Ricardo |

Project: N Staffs Project Plan_G
Date: Mon 11/05/20

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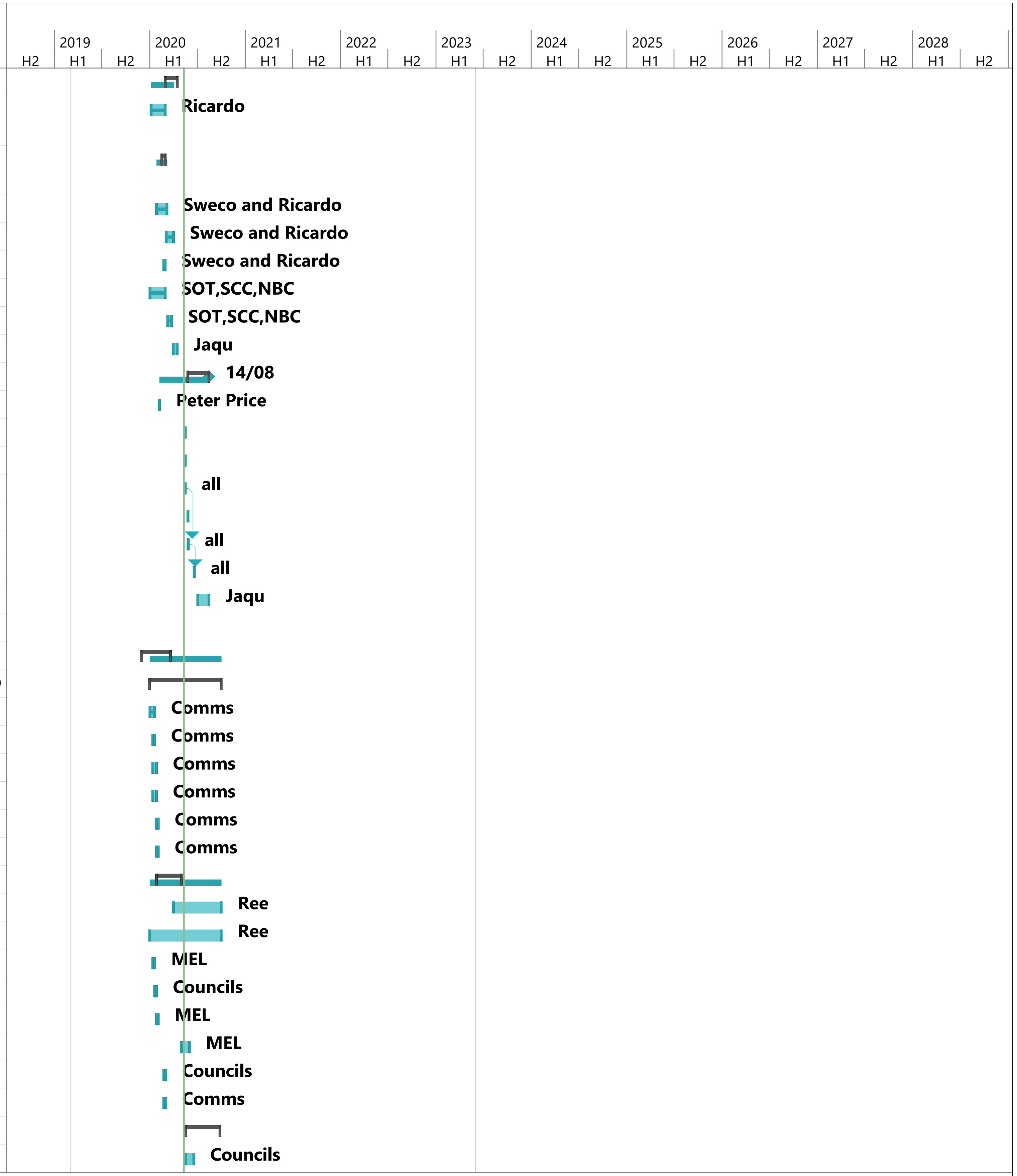
|---|---|---|---|---|---|---|---|---|---|
| Task | | Project Summary | | Manual Task | | Start-only | | Deadline | |
| Split | | Inactive Task | | Duration-only | | Finish-only | | Progress | |
| Milestone | | Inactive Milestone | | Manual Summary Rollup | | External Tasks | | Manual Progress | |
| Summary | | Inactive Summary | | Manual Summary | | External Milestone | | | |

| ID | Indicators | Task Mode | Task Name | Duration | Start | Finish |
|---|---|---|---|---|---|---|
| 375 | | | **Economic Reporting** | **32 days** | **Fri 28/02/20** | **Tue 14/04/20** |
| 376 | | | Economics methodology report (E1) and model (E2) | 40 days | Mon 06/01/20 | Fri 28/02/20 |
| 377 | | | Distributional analysis methodology report (E3) | 10 days | Mon 17/02/20 | Fri 28/02/20 |
| 378 | | | HIA | 30 days | Mon 27/01/20 | Fri 06/03/20 |
| 379 | | | Economic Case write up | 20 days | Wed 04/03/20 | Tue 31/03/20 |
| 380 | | | Easy to read economic summary report | 5 days | Mon 24/02/20 | Fri 28/02/20 |
| 381 | | | Local Authority Input | 42 days | Thu 02/01/20 | Fri 28/02/20 |
| 382 | | | Local Authority Review | 11 days | Tue 10/03/20 | Tue 24/03/20 |
| 383 | | | JAQU Review | 11 days | Tue 31/03/20 | Tue 14/04/20 |
| 384 | | | **OBC Submission** | **59 days** | **Tue 26/05/20** | **Fri 14/08/20** |
| 385 | | | **1st Draft Version of the OBC** | **1 day** | **Fri 07/02/20** | **Fri 07/02/20** |
| 386 | | | Unapproved OBC Submission | 1 day | Fri 15/05/20 | Fri 15/05/20 |
| 387 | | | T-iRP Evidence Submission | 1 day | Fri 15/05/20 | Fri 15/05/20 |
| 388 | | | D-iRP Evidence Submission | 1 day | Fri 15/05/20 | Fri 15/05/20 |
| 389 | | | T-iRP Meeting | 1 day | Tue 26/05/20 | Tue 26/05/20 |
| 390 | | | D-iRP Meeting | 1 day | Wed 27/05/20 | Wed 27/05/20 |
| 391 | | | T-iRP/D-iRP Review (allow 4-6 weeks for review) | 1 day | Fri 19/06/20 | Fri 19/06/20 |
| 392 | | | JAQU Review (allow 6-8 weeks) | 31 days | Fri 03/07/20 | Fri 14/08/20 |
| 393 | | | Approved OBC Submission ( TBC) | | | |
| 394 | | | **Engagement & Communications strategy** | **80 days** | **Mon 02/12/19** | **Fri 20/03/20** |
| 395 | | | **Phase 1 Stakeholder Engagement** | **196 days** | **Wed 01/01/20** | **Wed 30/09/20** |
| 396 | | | Design survey questionnaire | 13 days | Thu 02/01/20 | Sun 19/01/20 |
| 397 | | | QA review (REE/Sweco) | 6 days | Mon 13/01/20 | Sun 19/01/20 |
| 398 | | | Council review/sign-off | 11 days | Mon 13/01/20 | Sun 26/01/20 |
| 399 | | | Iterations | 11 days | Mon 13/01/20 | Sun 26/01/20 |
| 400 | | | Launch ready | 6 days | Mon 27/01/20 | Sun 02/02/20 |
| 401 | | | Council embedded link/signpost to central platform | 6 days | Mon 27/01/20 | Sun 02/02/20 |
| 402 | | | **Communicate and promote survey** | **69 days** | **Mon 27/01/20** | **Thu 30/04/20** |
| 403 | | | Communication plan | 131 days | Wed 01/04/20 | Wed 30/09/20 |
| 404 | | | Stakeholder analysis | 196 days | Wed 01/01/20 | Wed 30/09/20 |
| 405 | | | Draft survey comms/PR content | 6 days | Mon 13/01/20 | Sun 19/01/20 |
| 406 | | | Council review/sign-off of PR/comms | 6 days | Mon 20/01/20 | Sun 26/01/20 |
| 407 | | | PR/engagement - survey launch | 6 days | Mon 27/01/20 | Sun 02/02/20 |
| 408 | | | Analysis | 22 days | Fri 01/05/20 | Sun 31/05/20 |
| 409 | | | **Council to advise on draft OBC announcement** | 6 days | Mon 24/02/20 | Sun 01/03/20 |
| 410 | | | Agree related comms response (TBC) | 6 days | Mon 24/02/20 | Sun 01/03/20 |
| 411 | | | **Phase 2 : Consultation** | **95 days** | **Mon 18/05/20** | **Fri 25/09/20** |
| 412 | | | Define stakeholder groups for consultation | 23 days | Mon 18/05/20 | Wed 17/06/20 |




Project: N Staffs Project Plan_G
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|---|---|---|---|---|---|
| Task | Project Summary | Manual Task | Start-only | Deadline | |
| Split | Inactive Task | Duration-only | Finish-only | Progress | |
| Milestone | Inactive Milestone | Manual Summary Rollup | External Tasks | Manual Progress | |
| Summary | Inactive Summary | Manual Summary | External Milestone | | |

| ID | Task Name | Duration | Start | Finish | Resources |
|---|---|---|---|---|---|
| 413 | Design consultation workshops (venue, timings, format, location etc.) | 25 days | Mon 25/05/20 | Fri 26/06/20 | GAP/REE |
| 414 | Design questions and engagement info | 10 days | Mon 25/05/20 | Fri 05/06/20 | GAP |
| 415 | Council review/sign-off | 10 days | Mon 08/06/20 | Fri 19/06/20 | Councils |
| 416 | Iterations | 5 days | Mon 22/06/20 | Fri 26/06/20 | GAP |
| 417 | Communicate and promote consultation | 25 days | Mon 29/06/20 | Fri 31/07/20 | GAP,Councils |
| 418 | **Engagement events - Delivery** | 21 days | Mon 03/08/20 | Mon 31/08/20 | GAP,Councils |
| 419 | **Engagement events - Analysis** | 19 days | Tue 01/09/20 | Fri 25/09/20 | GAP |
| 420 | FBC (TBC) | 135 days | Wed 25/03/20 | Tue 29/09/20 | |
| 451 | **Implementation Phase Preferred Option** | **698 days** | **Wed 01/04/20** | **Fri 02/12/22** | |
| 452 | **LA / JAQU Approval Process** | **283 days** | **Mon 01/06/20** | **Wed 30/06/21** | |
| 453 | OBC Cabinet approval process | 87 days | Mon 01/06/20 | Tue 29/09/20 | Local Authorities |
| 454 | OBC JAQU approval | 87 days | Mon 01/06/20 | Tue 29/09/20 | Jaqu |
| 455 | FBC Cabinet approval process | 41 days | Fri 01/01/21 | Fri 26/02/21 | Local Authorities |
| 456 | FBC JAQU approval | 21 days | Mon 01/03/21 | Mon 29/03/21 | Jaqu |
| 457 | Cabinet approval for Stoke to use Amey for implementation | 43 days | Thu 01/10/20 | Mon 30/11/20 | SOT |
| 458 | Infrastructure+ Operational Commissioning Board/Strategic Partnership Board approval to use Amey | 22 days | Thu 01/10/20 | Fri 30/10/20 | Contractor |
| 459 | Victoria Road Community Counsultation Period | 43 days | Thu 01/10/20 | Mon 30/11/20 | Local Authorities,Contractor |
| 460 | Stakeholder information event | 21 days | Mon 02/11/20 | Mon 30/11/20 | Comms |
| 461 | TRO Consultation Period | 65 days | Thu 01/04/21 | Wed 30/06/21 | Contractor |
| 462 | **Legal agreements** | **174 days** | **Tue 01/09/20** | **Fri 30/04/21** | |
| 463 | Delivery agreement between three authorities | 129 days | Tue 01/09/20 | Fri 26/02/21 | NuLBC,SOT,SCC |
| 464 | JMW contract to be signed by Stoke | 88 days | Tue 01/09/20 | Thu 31/12/20 | SOT |
| 465 | local authorities and bus operator agreement | 88 days | Tue 01/09/20 | Thu 31/12/20 | NuLBC,SOT,SCC,Bus Operator |
| 466 | Potential agreement with Highways England (Section 6) | 86 days | Fri 01/01/21 | Fri 30/04/21 | Highways England,Local Authorities |
| 467 | **Financial approvals** | **151 days** | **Tue 01/09/20** | **Tue 30/03/21** | |
| 468 | JAQU funds OBC to FBC | 22 days | Tue 01/09/20 | Wed 30/09/20 | Jaqu |
| 469 | JAQU funds Implementation | 22 days | Mon 01/03/21 | Tue 30/03/21 | Jaqu |
| 470 | S151 Officer sign-off | 22 days | Tue 01/09/20 | Wed 30/09/20 | Local Authorities |
| 471 | S151 Officer sign-off | 20 days | Mon 01/02/21 | Fri 26/02/21 | Local Authorities |
| 472 | **Bus Gates / traffic management design and delivery** | **456 days** | **Tue 01/09/20** | **Tue 31/05/22** | |
| 473 | Site investigations | 22 days | Tue 01/09/20 | Wed 30/09/20 | Contractor |
| 474 | Detailed design | 129 days | Tue 01/09/20 | Fri 26/02/21 | Contractor |
| 475 | Road Safety Audit | 20 days | Mon 01/02/21 | Fri 26/02/21 | Contractor |
| 476 | HE approval process for signing and junction improvements | 173 days | Fri 01/01/21 | Tue 31/08/21 | Highways England,Contractor |
| 477 | DfT approval of signs | 64 days | Fri 01/01/21 | Wed 31/03/21 | DFT |
| 478 | Preparation and publication of Orders | 21 days | Thu 01/04/21 | Thu 29/04/21 | Contractor |

Project: N Staffs Project Plan_G
Date: Mon 11/05/20

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress

| | Task Mode | Task Name | Duration | Start | Finish | 2019–2028 |
|---|---|---|---|---|---|---|
| 479 | | TRO consultation period | 65 days | Thu 01/04/21 | Wed 30/06/21 | Contractor |
| 480 | | Review scheme design and costs | 22 days | Thu 01/07/21 | Fri 30/07/21 | Local Authorities,Contractor |
| 481 | | Order confirmed | 22 days | Mon 02/08/21 | Tue 31/08/21 | Contractor |
| 482 | | Camera purchase | 43 days | Wed 01/09/21 | Fri 29/10/21 | Local Authorities,Contractor |
| 483 | | Construction lead-in period (local network) | 21 days | Fri 01/10/21 | Fri 29/10/21 | Contractor |
| 484 | | Construction mobilisation (local network) | 130 days | Mon 01/11/21 | Fri 29/04/22 | Contractor |
| 485 | | Construction Notice period (trunk road HE network) | 65 days | Wed 01/09/21 | Tue 30/11/21 | Highways England,Contractor |
| 486 | | Construction mobilisation (trunk road HE network) | 130 days | Mon 01/11/21 | Fri 29/04/22 | Highways England,Contractor |
| 487 | | Bus gate operational | 22 days | Mon 02/05/22 | Tue 31/05/22 | SOT,SCC,Contractor |
| 488 | | Completion of traffic signal optimisation process | 22 days | Mon 02/05/22 | Tue 31/05/22 | Amey,Highways England |
| 489 | | **Bus Infrastructure (Retrofit, bus wraps, RTPI, shelters)** | **455 days** | **Tue 01/09/20** | **Mon 30/05/22** | |
| 490 | | site investigations (RTPI, shelters) | 21 days | Tue 01/09/20 | Tue 29/09/20 | Bus Operator,Local Authorities |
| 491 | | Detailed design (SCC, Stoke and JMW) | 129 days | Tue 01/09/20 | Fri 26/02/21 | Bus Operator,Local Authorities |
| 492 | | Retrofit procurement route approved | 66 days | Thu 01/10/20 | Thu 31/12/20 | Bus Operator,Local Authorities |
| 493 | | Agree bus retrofit programme | 66 days | Thu 01/10/20 | Thu 31/12/20 | Bus Operator,Local Authorities |
| 494 | | Retrofit lead-in period | 65 days | Thu 01/04/21 | Wed 30/06/21 | Bus Operator,Local Authorities |
| 495 | | Deliver bus retrofit and enforcement cameras | 217 days | Thu 01/07/21 | Fri 29/04/22 | Bus Operator,Local Authorities |
| 496 | | Bus wrap design approval | 43 days | Mon 02/11/20 | Wed 30/12/20 | Bus Operator,Local Authorities |
| 497 | | Bus wrap delivery | 217 days | Thu 01/07/21 | Fri 29/04/22 | Bus Operator,Local Authorities |
| 498 | | Supply of RTPI bus operator data | 64 days | Thu 01/04/21 | Tue 29/06/21 | Bus Operator,Local Authorities |
| 499 | | RTPI installation (screens, shelters, power) | 130 days | Tue 01/06/21 | Mon 29/11/21 | Bus Operator,JMW,Local Authorities |
| 500 | | RTPI review and testing process | 64 days | Wed 01/12/21 | Mon 28/02/22 | JMW,Bus Operator,Local Authorities |
| 501 | | Bus infrastructure completion | 21 days | Mon 02/05/22 | Mon 30/05/22 | Bus Operator,Local Authorities |
| 502 | | **Implementation Phase CAZ D Option** | **783 days** | **Mon 01/06/20** | **Wed 31/05/23** | |
| 503 | | **LA / JAQU Approval Process** | **479 days** | **Mon 01/06/20** | **Thu 31/03/22** | |
| 504 | | OBC Cabinet approval process | 88 days | Mon 01/06/20 | Wed 30/09/20 | Local Authorities |
| 505 | | OBC JAQU approval | 88 days | Mon 01/06/20 | Wed 30/09/20 | Jaqu |
| 506 | | FBC Cabinet approval process | 64 days | Wed 01/12/21 | Mon 28/02/22 | Local Authorities |
| 507 | | FBC JAQU approval | 23 days | Tue 01/03/22 | Thu 31/03/22 | Jaqu |
| 508 | | Stakeholder information event | 22 days | Thu 01/10/20 | Fri 30/10/20 | Local Authorities |
| 509 | | **Legal agreements** | **434 days** | **Thu 01/10/20** | **Tue 31/05/22** | |
| 510 | | Delivery agreement between three authorities | 130 days | Thu 01/10/20 | Wed 31/03/21 | Local Authorities |
| 511 | | Highways England Section 6 agreement | 66 days | Tue 01/03/22 | Tue 31/05/22 | Highways England,Local Authorities,Contractor |
| 512 | | **Financial approvals** | **411 days** | **Tue 01/09/20** | **Tue 29/03/22** | |
| 513 | | JAQU funds OBC to FBC | 22 days | Tue 01/09/20 | Wed 30/09/20 | Jaqu |
| 514 | | JAQU funds Implementation | 21 days | Tue 01/03/22 | Tue 29/03/22 | Local Authorities |
| 515 | | S151 Officer sign-off | 21 days | Tue 01/03/22 | Tue 29/03/22 | Local Authorities |
| 516 | | **Design and Procurement process (using Framework)** | **456 days** | **Thu 01/10/20** | **Thu 30/06/22** | |
| 517 | | Design and specification for Turn key solution | 130 days | Thu 01/10/20 | Wed 31/03/21 | Local Authorities |
| 518 | | HE approval process and delivery notice period | 390 days | Fri 01/01/21 | Thu 30/06/22 | Contractor,Local Authorities |

Project: N Staffs Project Plan_G
Date: Mon 11/05/20

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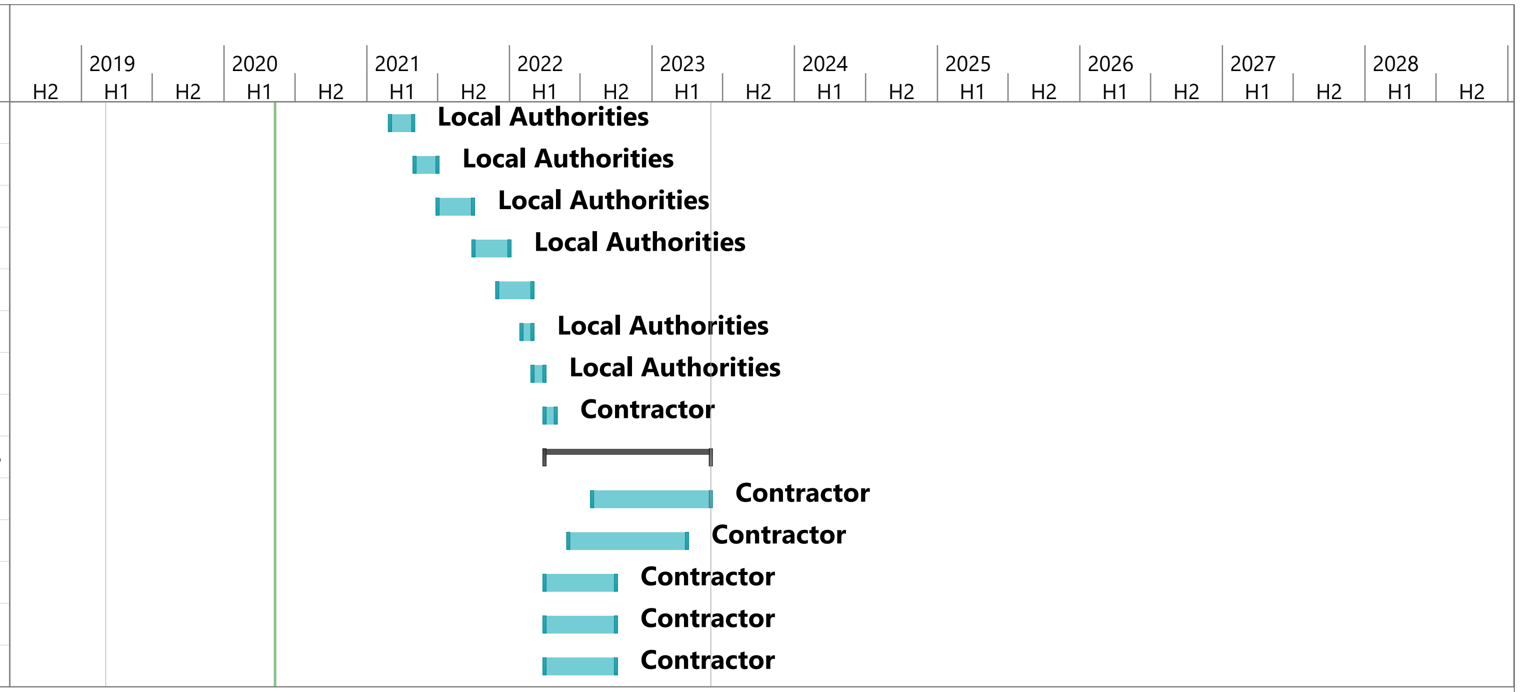
|---|---|---|---|---|
| Task | Project Summary | Manual Task | Start-only | Deadline |
| Split | Inactive Task | Duration-only | Finish-only | Progress |
| Milestone | Inactive Milestone | Manual Summary Rollup | External Tasks | Manual Progress |
| Summary | Inactive Summary | Manual Summary | External Milestone | |

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 519 | specification approved | 44 days | Mon 01/03/21 | Thu 29/04/21 |
| 520 | Supplier engagement | 43 days | Mon 03/05/21 | Wed 30/06/21 |
| 521 | Tender Live | 65 days | Thu 01/07/21 | Wed 29/09/21 |
| 522 | Tender Evaluation | 66 days | Fri 01/10/21 | Fri 31/12/21 |
| 523 | Cabinet Approvals | 64 days | Wed 01/12/21 | Mon 28/02/22 |
| 524 | Award contract | 20 days | Tue 01/02/22 | Mon 28/02/22 |
| 525 | Final design confirmed | 23 days | Tue 01/03/22 | Thu 31/03/22 |
| 526 | charge order process | 21 days | Fri 01/04/22 | Fri 29/04/22 |
| 527 | **CAZ D delivery** | **304 days** | **Fri 01/04/22** | **Wed 31/05/23** |
| 528 | signage delivery (civils) | 218 days | Mon 01/08/22 | Wed 31/05/23 |
| 529 | cameras delivery | 218 days | Wed 01/06/22 | Fri 31/03/23 |
| 530 | ICT system delivery | 131 days | Fri 01/04/22 | Fri 30/09/22 |
| 531 | Back office set-up delivery | 131 days | Fri 01/04/22 | Fri 30/09/22 |
| 532 | Financial reconciliation process delivery | 131 days | Fri 01/04/22 | Fri 30/09/22 |

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|---|---|---|---|---|---|---|---|---|---|
| Task | | Project Summary | | Manual Task | | Start-only | | Deadline | |
| Split | | Inactive Task | | Duration-only | | Finish-only | | Progress | |
| Milestone | | Inactive Milestone | | Manual Summary Rollup | | External Tasks | | Manual Progress | |
| Summary | | Inactive Summary | | Manual Summary | | External Milestone | | | |

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MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE

## APPENDIX 15 - Implementation Programme Summary - Preferred Option

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

| | Task Name | Resource Names |
|---|---|---|
| 1 | **Implementation Phase Preferred Option** | |
| 2 | **LA / JAQU Approval Process** | |
| 3 | OBC Cabinet approval process | Local Authorities |
| 4 | OBC JAQU approval | Jaqu |
| 5 | FBC Cabinet approval process | Local Authorities |
| 6 | FBC JAQU approval | Jaqu |
| 7 | Cabinet approval for Stoke to use Amey for implementation | SOT |
| 8 | Infrastructure+ Operational Commissioning Board/Strategic Partnership Board approval to use Amey | Contractor |
| 9 | Victoria Road Community Counsultation Period | Local Authorities,Contractor |
| 10 | Stakeholder information event | Comms |
| 11 | TRO Consultation Period | Contractor |
| 12 | **Legal agreements** | |
| 13 | Delivery agreement between three authorities | NuLBC,SOT,SCC |
| 14 | JMW contract to be signed by Stoke | SOT |
| 15 | local authorities and bus operator agreement | NuLBC,SOT,SCC,Bus Operator |
| 16 | Potential agreement with Highways England (Section 6) | Highways England,Local Authorities |
| 17 | **Financial approvals** | |
| 18 | JAQU funds OBC to FBC | Jaqu |
| 19 | JAQU funds Implementation | Jaqu |
| 20 | S151 Officer sign-off | Local Authorities |
| 21 | S151 Officer sign-off | Local Authorities |
| 22 | **Bus Gates / traffic management design and delivery** | |
| 23 | Site investigations | Contractor |
| 24 | Detailed design | Contractor |
| 25 | Road Safety Audit | Contractor |
| 26 | HE approval process for signing and junction improvements | Highways England,Contractor |
| 27 | DfT approval of signs | DFT |
| 28 | Preparation and publication of Orders | Contractor |
| 29 | TRO consultation period | Contractor |
| 30 | Review scheme design and costs | Local Authorities,Contractor |
| 31 | Order confirmed | Contractor |
| 32 | Camera purchase | Local Authorities,Contractor |
| 33 | Construction lead-in period (local network) | Contractor |
| 34 | Construction mobilisation (local network) | Contractor |
| 35 | Construction Notice period (trunk road HE network) | Highways England,Contractor |
| 36 | Construction mobilisation (trunk road HE network) | Highways England,Contractor |
| 37 | Bus gate operational | SOT,SCC,Contractor |

Timescale: Half 2, 2020 · Half 1, 2021 · Half 2, 2021 · Half 1, 2022 · Half 2, 2022 (months M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D)

Project: N Staffs Project Plan_G
Date: Mon 11/05/20

| | | | | | |
|---|---|---|---|---|---|
| Task | Project Summary | Manual Task | Start-only | Deadline | |
| Split | Inactive Task | Duration-only | Finish-only | Progress | |
| Milestone | Inactive Milestone | Manual Summary Rollup | External Tasks | Manual Progress | |
| Summary | Inactive Summary | Manual Summary | External Milestone | | |

| ID | Task Name | Resources |
|---|---|---|
| 38 | Completion of traffic signal optimisation process | Amey,Highways England |
| 39 | **Bus Infrastructure (Retrofit, bus wraps, RTPI, shelters)** | |
| 40 | site investigations (RTPI, shelters) | Bus Operator,Local Authorities |
| 41 | Detailed design (SCC, Stoke and JMW) | Bus Operator,Local Authorities |
| 42 | Retrofit procurement route approved | Bus Operator,Local Authorities |
| 43 | Agree bus retrofit programme | Bus Operator,Local Authorities |
| 44 | Retrofit lead-in period | Bus Operator,Local Authorities |
| 45 | Deliver bus retrofit and enforcement cameras | Bus Operator,Local Authorities |
| 46 | Bus wrap design approval | Bus Operator,Local Authorities |
| 47 | Bus wrap delivery | Bus Operator,Local Authorities |
| 48 | Supply of RTPI bus operator data | Bus Operator,Local Authorities |
| 49 | RTPI installation (screens, shelters, power) | Bus Operator,JMW,Local Authorities |
| 50 | RTPI review and testing process | JMW,Bus Operator,Local Authorities |
| 51 | Bus infrastructure completion | Bus Operator,Local Authorities |

Project: N Staffs Project Plan_G
Date: Mon 11/05/20

| | | | | |
|---|---|---|---|---|
| Task | Project Summary | Manual Task | Start-only | Deadline |
| Split | Inactive Task | Duration-only | Finish-only | Progress |
| Milestone | Inactive Milestone | Manual Summary Rollup | External Tasks | Manual Progress |
| Summary | Inactive Summary | Manual Summary | External Milestone | |

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MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE

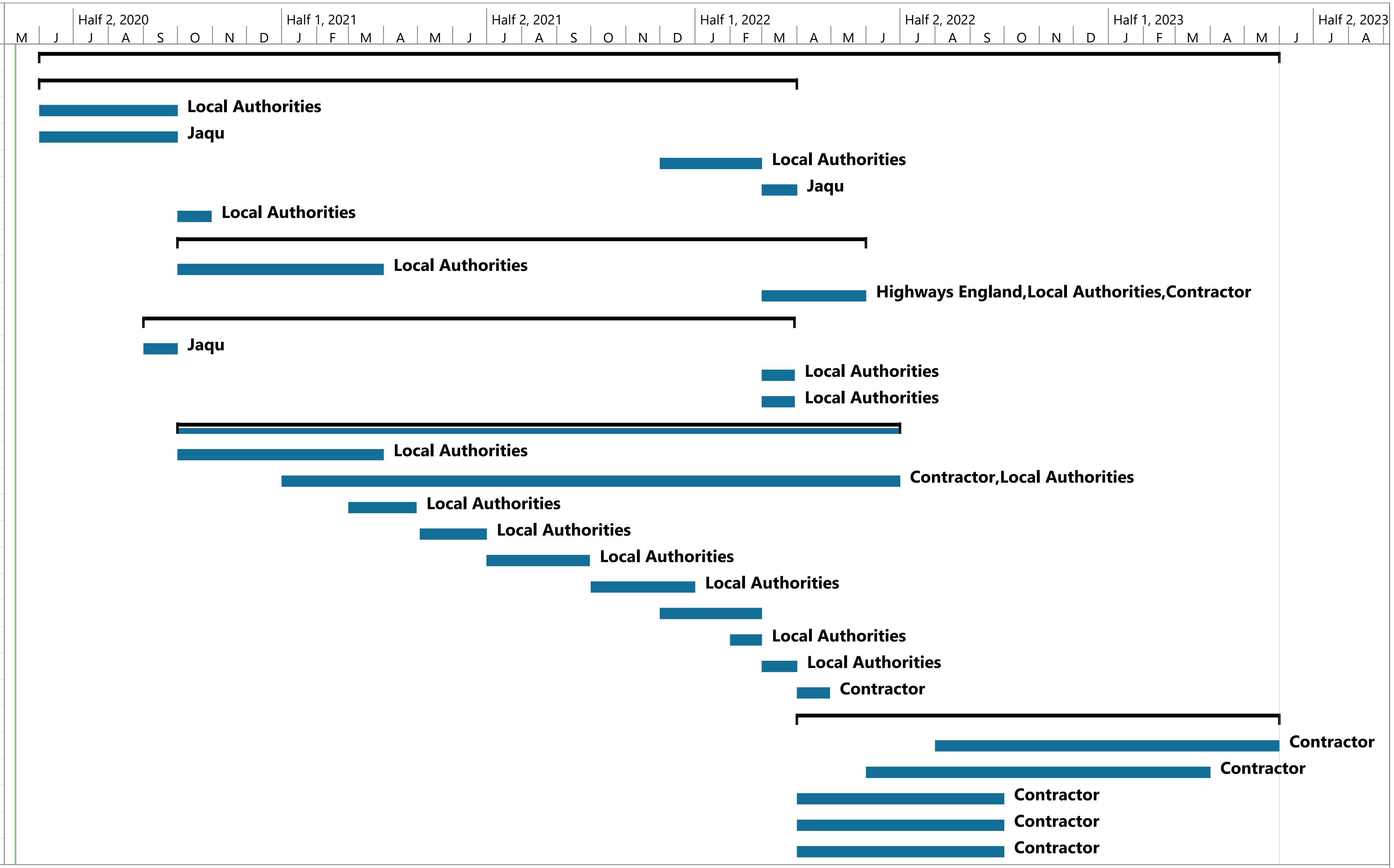
## APPENDIX 16 - Implementation Programme Summary - Benchmark CAZ D

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

| | Task Name | Resource |
|---|---|---|
| 1 | **Implementation Phase CAZ D Option** | |
| 2 | **LA / JAQU Approval Process** | |
| 3 | OBC Cabinet approval process | Local Authorities |
| 4 | OBC JAQU approval | Jaqu |
| 5 | FBC Cabinet approval process | Local Authorities |
| 6 | FBC JAQU approval | Jaqu |
| 7 | Stakeholder information event | Local Authorities |
| 8 | **Legal agreements** | |
| 9 | Delivery agreement between three authorities | Local Authorities |
| 10 | Highways England Section 6 agreement | Highways England,Local Authorities,Contractor |
| 11 | **Financial approvals** | |
| 12 | JAQU funds OBC to FBC | Jaqu |
| 13 | JAQU funds Implementation | Local Authorities |
| 14 | S151 Officer sign-off | Local Authorities |
| 15 | **Design and Procurement process (using Framework)** | |
| 16 | Design and specification for Turn key solution | Local Authorities |
| 17 | HE approval process and delivery notice period | Contractor,Local Authorities |
| 18 | specification approved | Local Authorities |
| 19 | Supplier engagement | Local Authorities |
| 20 | Tender Live | Local Authorities |
| 21 | Tender Evaluation | Local Authorities |
| 22 | Cabinet Approvals | |
| 23 | Award contract | Local Authorities |
| 24 | Final design confirmed | Local Authorities |
| 25 | charge order process | Contractor |
| 26 | **CAZ D delivery** | |
| 27 | signage delivery (civils) | Contractor |
| 28 | cameras delivery | Contractor |
| 29 | ICT system delivery | Contractor |
| 30 | Back office set-up delivery | Contractor |
| 31 | Financial reconciliation process delivery | Contractor |




Project: N Staffs Project Plan_G
Date: Mon 11/05/20

| | | | | |
|---|---|---|---|---|
| Task | Project Summary | Manual Task | Start-only | Deadline |
| Split | Inactive Task | Duration-only | Finish-only | Progress |
| Milestone | Inactive Milestone | Manual Summary Rollup | External Tasks | Manual Progress |
| Summary | Inactive Summary | Manual Summary | External Milestone | |

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE

## APPENDIX 17 - Quantified Risk Assessment - Preferred Option

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

# Quantitative Risk Assessment Report

Traffic Management Scheme

5 Garden Court
Main Street
Lockington
Derby
DE74 2RH

Development Management | Cost Management | Project Management
0115 983 0157
www.bentleyprojectmanagement.co.uk

| Version | Date | Author | Comments |
|---|---|---|---|
| 00 | 04 March 2020 | | |
| 01 | 27 April 2020 | | Updated due to Councils comments |

Contents



Appendices

# 1. Executive Summary

1.1 A quantitative risk assessment of cost was undertaken by the delivery team, facilitated by Bentley Project Management.

1.2 At this early stage in the project it would be beneficial to use the 85$^{th}$ Percentile. This would result in a risk allowance of £1,060,000.

1.3 It is recommended that the team update the risk register on a regular basis.

1.4 The QRA should be re-run when more detail is known.

## 2. Introduction

2.1 Bentley Project Management were commissioned to undertake a quantitative assessment of cost risks for the Traffic Management Scheme in Stoke-on-Trent, Newcastle-under-Lyme, and Staffordshire. The project is at a pre-planning stage and is in the process of submitting the outline business case.

2.2 The project is looking at various traffic management schemes in parts of Stoke-on-Trent, Newcastle-under-Lyme, and Staffordshire. These include bus gates, bus retro-fitting, and RTPI Facilities. It is intended that the Traffic Management Scheme will reduce air pollution within the areas of Stoke-on-Trent, Newcastle-under-Lyme, and Staffordshire where there is an illegal level.

2.3 Stoke-on-Trent City Council, Newcastle-under-Lyme Borough Council, and Staffordshire County Council are working together to bring the Traffic Management Scheme into force.

## 3. Objectives

3.1 The objective of the commission was to produce a qualitative risk register and quantitative cost risk assessment for the scheme.

QRA should

- Support the business plan;
- Be integrated with planning and cost management processes;
- Take account of both uncertainty and risk;
- Used to inform project affordability;
- Be integrated with risk management processes;
- Be reviewed by the project team on a regular basis.

## 4. QRA Methodology

4.1 Inputs into the QRA model are gained through identifying risk and uncertainties at risk workshops.

4.2 Probability of occurrence is modelled using Binomial distribution. Cost impacts are modelled depending on the nature of each risk, with highly uncertain risks modelled by Triangular distributions, whilst highly disruptive risks modelled by Pert distribution. Cost uncertainties should be modelled by Triangular distribution only.

4.3 The cost risk exposure should be modelled and analysed using Monte Carlo modelling technique, to provide a range of potential outcomes. The number of iterations (e.g.10,000) will be selected with reference to the number of inputs being modelled and hence the number necessary to reach a stable result.

4.4 The data for the risk register was collected with the project team in three risk workshops held in February 2020.

## 5. Systems and Tools

5.1 The QRA was produced using bespoke, Monte Carlo software, developed by Bentley Project Management.

5.2 Bentley Project Management facilitated three workshops. The first workshop was a group exercise to produce a qualitative risk register. The second workshop reviewed actions and agreed mitigations. The third workshop agreed the maximum, minimum and most likely cost for each risk.

5.3 Following the workshop, the data was reviewed by Bentley Project Management and the model was run to ensure that it produced a stable result.

5.4 The qualitative risk register and data was then reviewed by Stoke-on-Trent City Council, Newcastle-under-Lyme Borough Council, and Staffordshire County Council.

5.5 Following the feedback process, the model was run again by Bentley Project Management.

# 6. Results

6.1 The QRA results are as follows:

| Percentile | Risk Allowance |
|---|---|
| 50% | £880,000 |
| 85% | £1,060,000 |
| 90% | £1,090,000 |
| 99% | £1,240,000 |

| | Risk Allowance |
|---|---|
| Mean | £823,643 |
| Median | £890,000 |
| Mode | £910,000 |
| Iterations | 10,000 |

The Bentley Project Management Quantitative Risk Assessment Tool

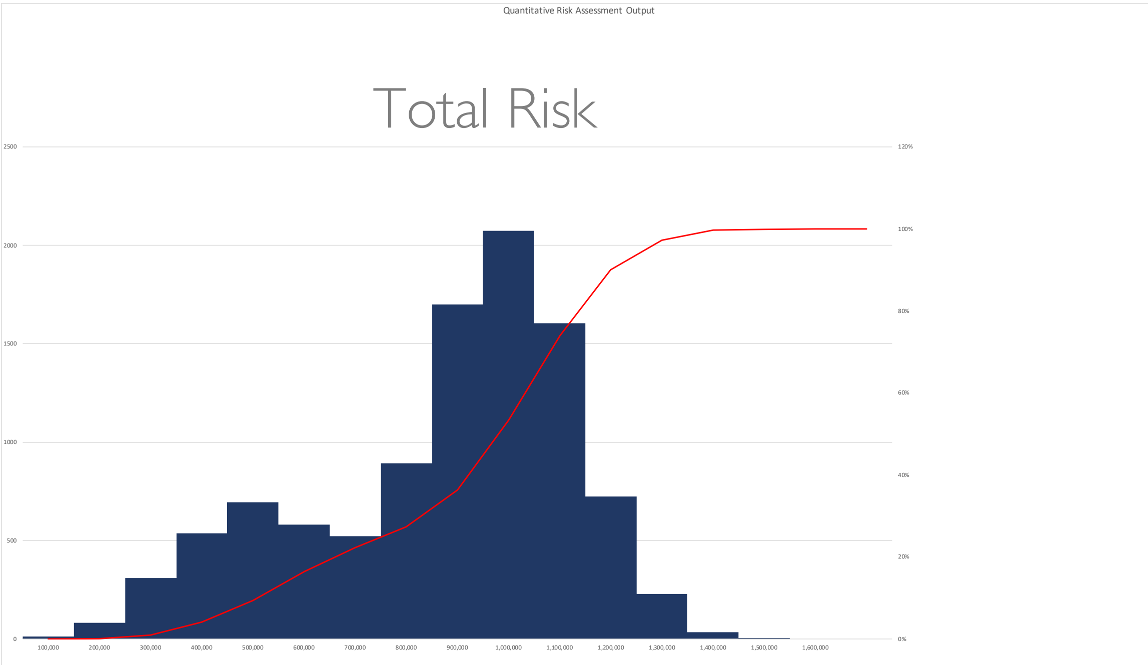
Project Title Traffic Managment Scheme Document Owner M Morrell Update 22 April 2020

Results

| Percentile | Risk Allowance |
|---|---|
| 50% | £880,000 |
| 85% | £1,060,000 |
| 90% | £1,090,000 |
| 99% | £1,240,000 |

BENTLEY
PROJECT MANAGEMENT

| | Risk Allowance |
|---|---|
| Mean | £823,643 |
| Median | £890,000 |
| Mode | £910,000 |
| Iterations | 10,000 |



6.2 At this early stage in the project it would be beneficial to use the 85th Percentile. This would result in a risk allowance of £1,060,000.

6.3 The top risk identified on the project are:

| Risk ID | Risk Title | Risk. There is a risk that.. | Mitigated Probability | Mitigated Impact | Mitigated Risk | Status |
|---|---|---|---|---|---|---|
| 1.009 | HE Network | HE insist on having network upgrades | 3 | 3 | 9 | Open |
| 1.032 | Coronavirus | Design build and procurement risk due to Coronavirus | 3 | 3 | 9 | Open |
| 1.006 | Public acceptance | Public / businesses do not accept proposal for bus gates | 3 | 2 | 6 | Open |
| 1.012 | Data protection | Data protection / GDPR issues arise | 2 | 3 | 6 | Open |
| 1.013 | Utility costs | Utility costs are higher than expected due to timescales available to do site investigations and estimate costs | 2 | 3 | 6 | Open |
| 1.014 | Terms and Conditions | Terms and Conditions and back-office agreements take longer to resolve than programmed | 2 | 3 | 6 | Open |
| 1.015 | Camera interface software | Camera interface software | 2 | 3 | 6 | Open |
| 1.019 | Timescales | Timescale for retro-fit to be delivered - UK wide demand | 2 | 3 | 6 | Open |
| 1.022 | Power location | Getting power to location and electrical connection isssues | 2 | 3 | 6 | Open |
| 1.023 | Permit system | New permit system results in delay | 2 | 3 | 6 | Open |
| 1.024 | Traffic management clashes | Roadworks clashes | 2 | 3 | 6 | Open |
| 1.026 | Detail design period | There is insufficient time to complete business case, detailed design and acceptable costs | 2 | 3 | 6 | Open |
| 1.027 | RSA | RSA content causes delay | 2 | 3 | 6 | Open |
| 1.029 | Insufficient funding | Delays in funding / insufficient funding from JAQU | 2 | 3 | 6 | Open |
| 1.034 | Government/local authority criticised | Government/local authority criticised for progressing delivery of the scheme following an international pandemic and global recession | 3 | 2 | 6 | Open |

6.4 The top financial risks are noted in the table below:

| Risk ID | Risk Title | Risk. There is a risk that.. | Minimum | Most Likely | Maximum | % |
|---|---|---|---|---|---|---|
| 1.033 | Changes due to Coronavirus | A change in national policy as a result in the changes in travel behaviour caused by the Coronavirus | £250,000 | £750,000 | £1,000,000 | 10% |
| 1.009 | HE Network | HE insist on having network upgrades | £50,000 | £250,000 | £1,000,000 | 75% |
| 1.032 | Coronavirus | Design build and procurement risk due to Coronavirus | £100,000 | £200,000 | £500,000 | 75% |
| 1.014 | Terms and Conditions | Terms and Conditions and back-office agreements take longer to resolve than | £40,000 | £100,000 | £200,000 | 50% |
| 1.031 | Traffic calming | Outcome of community consultations on Victoria Road result in amendments to the traffic calming scheme | £5,000 | £85,000 | £100,000 | 50% |
| 1.010 | Enforcement | Enforcement action fails | £10,000 | £80,000 | £150,000 | 5% |
| 1.016 | Break downs | System breaks down | £60,000 | £80,000 | £120,000 | 10% |
| 1.030 | ULEV exemptions | Refinement of the scheme to include ULEV exemptions at the two bus gates | £5,000 | £80,000 | £130,000 | 50% |
| 1.024 | Traffic management clashes | Roadworks clashes | £30,000 | £60,000 | £200,000 | 50% |

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MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 18 - Risk Register - Preferred Option

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

NEWCASTLE UNDER LYME BOROUGH COUNCIL

Staffordshire County Council

City of Stoke-on-Trent

BENTLEY PROJECT MANAGEMENT

Project Title Traffic Management Scheme

Document Owner M Morrell

Last Updated 21/04/2020

Today's date 21/04/2020

Quantitative Data

| Risk ID | Area | Category | Risk Title | Risk. There is a risk that.. | Cause. This is because... | Consequences. This will effect... | Date Raised | Probability | Probability Score | Impact | Impact Score | Project Risk | Certainty | Mitigation Response | Mitigation Measures | Assumptions | Consequence Assumption | Mitigated Probability | Mitigated Impact | Mitigated Risk | Status | Minimum | Most Likely | Maximum | % | Model Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.001 | Bus Gates | Political | Elections | Lack of political backing including due to change of national / local leadership | Local / national elections impact on project delivery | The scheme becomes politically sensitive and fails to meet its objectives | 04/02/2020 | 2 Possibly | 2 | 2 Low | 2 | 4 | Low | Mitigate | MP discussions are happening now which will be factoredinto the programme | assume elections will not effect the scheme | project delay with potential changes to the scope with corresponding costs | 1 | 2 | 2 | Open | £30,000 | £50,000 | £100,000 | 10% | Triangular |
| 1.002 | Bus Gates | Political | Change in national and local political leadership | Change in political leadership may result in changes to the scheme | New politicians may have different priorities, views, and policies on the project | The scheme becomes politically sensitive and fails to meet its objectives | 04/02/2020 | 1 Unlikely | 1 | 3 Moderate | 3 | 3 | Low | Mitigate | engage with all political parties | assume political leadership doesn't change | project development delay costs and inflation | 1 | 3 | 3 | Open | £0 | £30,000 | £60,000 | 5% | Triangular |
| 1.003 | Bus Gates | Public/consultation | TRO objection | Objections to TRO resulting in public inquiry | Local objections to the closures or restrictions | The scheme cannot move forward or is seriously delayed with additional costs to the scheme with redesigns and scope change | 04/02/2020 | 1 Unlikely | 1 | 4 High | 4 | 4 | Low | Mitigate | Comms intensification and public consultation on TROs | assume there will be no objections to the scheme | Going to public enquiry, dealing with objections, and possible slight redesign | 1 | 4 | 4 | Open | £5,000 | £10,000 | £100,000 | 5% | Triangular |
| 1.004 | Bus Gates | Public/consultation | Signage not successful | Local people don't use signs and there is more non-eligible vehicles than anticipated, with a general lack of compliance - signing strategy may not account for this | There is a lack of publicity or awareness | There is a political backlash and the scheme does not provide deliverables | 04/02/2020 | 2 Possibly | 2 | 2 Low | 2 | 4 | Low | Mitigate | stakeholder involvement in signage design and strategy | assume local people will be aware of the signs | public appeals will be above the level factored into the base costs, so there will be additional admin cost (resource for a few years) and rectifying signs. | 1 | 2 | 2 | Open | £10,000 | £40,000 | £80,000 | 10% | Triangular |
| 1.005 | Bus Gates | Public/consultation | ANPR cameras | Physical damage to signs and / or cameras | People object to ANPR cameras | The scheme becomes politically sensitive and is delayed | 04/02/2020 | 3 Likely | 3 | 2 Low | 2 | 6 | Low | Mitigate | Inform the public about ANPR cameras at consultation events, and make a allowance for damages | assume the ANPR cameras will be accepted | cameras and signsdamaged so replacement cameras needed | 2 | 2 | 4 | Open | £10,000 | £50,000 | £250,000 | 50% | Triangular |
| 1.006 | Bus Gates | Public/consultation | Public acceptance | Public / businesses do not accept proposal for bus gates | People / businesses do not like the restrictions placed upon them by the Bus Gates | The scheme becomes politically sensitive and is delayed | 04/02/2020 | 4 Almost Certain | 4 | 2 Low | 2 | 8 | Low | Mitigate | early engagement with the public | assume public / businesses support the scheme | Extra comms after delivery | 3 | 2 | 6 | Open | £5,000 | £10,000 | £25,000 | 75% | Triangular |
| 1.007 | Bus Gates | Construction/Implementation | Contractor skills shortage | Contractor shortage of skilled staff to implement to timescales including signs and back office | There is a skills shortage in the industry | Increased costs to address skill short falls | 04/02/2020 | 2 Possibly | 2 | 1 Negligible | 1 | 2 | Low | Mitigate | early Contractor involvement | assume a skilled contractor can be appointed | 1 month delay costs | 1 | 1 | 1 | Open | £20,000 | £50,000 | £100,000 | 10% | Triangular |
| 1.008 | Bus Gates | Construction/Implementation | Highways England (HE) signage objection | Schemes impact on HE network resulting in requirement for re-design of signage | Impact on HE network | The scheme cannot move forward or is seriously delayed with additional costs to the scheme with redesigns and scope change | 04/02/2020 | 3 Likely | 3 | 2 Low | 2 | 6 | Low | Mitigate | early engagement with HE | assume impact on network will not require signage re-design | 3 month delay | 2 | 2 | 4 | Open | £10,000 | £20,000 | £50,000 | 50% | Triangular |
| 1.009 | Bus Gates | Construction/Implementation | HE Network | HE insist on having network upgrades | HE do not have the capacity on their network to manage the additional traffic | There are additional costs and delays | 04/02/2020 | 4 Almost Certain | 4 | 3 Moderate | 3 | 12 | Low | Mitigate | early engagement with HE | assume network upgrades are not required | Delay to the project. Network design and construction costs. | 3 | 3 | 9 | Open | £50,000 | £250,000 | £1,000,000 | 75% | Triangular |
| 1.010 | Bus Gates | Construction/Implementation | Enforcement | Enforcement action fails | Due to poor signage design | The scheme does not generate the anticipated fees | 04/02/2020 | 1 Unlikely | 1 | 3 Moderate | 3 | 3 | Low | Mitigate | early engagement with stakeholders to ensure the signage design will not result in enforcement fails | assume signage is adequate to enforce the bus gates | additional staff required to respond to enforcement fails | 1 | 3 | 3 | Open | £10,000 | £80,000 | £150,000 | 5% | Triangular |
| 1.011 | Bus Gates | Design | Part-time operations | Difficulty in signing part-time operation | Design of part time signage is not adequate | Delays to the project and inflationary costs | 04/02/2020 | 2 Possibly | 2 | 3 Moderate | 3 | 6 | Low | Mitigate | stakeholder involvement in signage design and strategy | assume part-time operation can be successfully achieved | HE signs | 1 | 3 | 3 | Open | £10,000 | £20,000 | £50,000 | 10% | Triangular |
| 1.012 | Bus Gates | Design | Data protection | Data protection / GDPR issues arise | There will be a large amount of data produced from the cameras | Delays to the project and inflationary costs | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | ensure the data storage procedure is efficient or outsource the storage | assume there will be no data protection / GDPR issues | extra data storage costs | 2 | 3 | 6 | Open | £1,000 | £2,000 | £3,000 | 50% | Triangular |
| 1.013 | Bus Gates | Funding | Utility costs | Utility costs are higher than expected due to timescales available to do site investigations and estimate costs | The programme durations are too short | Increased project costs | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | ensure there is an allowance in the programme to obtain utility costs | assume utility costs can be obtained within the programme | costs for utility applications and extra over for the allowed supplies/diversions | 2 | 3 | 6 | Open | £15,000 | £50,000 | £100,000 | 50% | Triangular |
| 1.014 | Bus Gates | Legal | Terms and Conditions | Terms and Conditions and back-office agreements take longer to resolve than programmed | Legal agreements can be complex and take time | Delays to the project and inflationary costs | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | include time risk allowance in the programme | assume Terms and Conditions and Back Office Agreements are resolved within programme | few months delays - 3 authorities legal fees and resources | 2 | 3 | 6 | Open | £40,000 | £100,000 | £200,000 | 50% | Triangular |
| 1.015 | Bus Gates | Other | Jenoptik camera interface software | Camera interface software | Software system interface issues | Additional costs and delays | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | use the same software across all authorities | assume there will be no software issues | separate back office and more training | 2 | 3 | 6 | Open | £2,000 | £5,000 | £10,000 | 50% | Triangular |
| 1.016 | Bus Gates | Other | Break downs | System breaks down | Because there is not enough resilience in the system | Additional costs to address resilience | 04/02/2020 | 2 Possibly | 2 | 3 Moderate | 3 | 6 | Low | Mitigate | use two different networks (e.g. O2 and ee) to run system | assume the system is resilient | more break downs then assumed on the system | 1 | 3 | 3 | Open | £60,000 | £80,000 | £120,000 | 10% | Triangular |
| 1.017 | Bus Gates | Procurement | Legislation | PCR 2015 requirements and procurement timescales missed | There is a requirement to comply with all relevant procurement regulations | Delays to the project and inflationary costs | 04/02/2020 | 2 Possibly | 2 | 2 Low | 2 | 4 | Low | Mitigate | make an allowance (time and cost) for compiling with procurement regulations | assume this will not cause a delay | procurement fees | 1 | 2 | 2 | Open | £10,000 | £15,000 | £25,000 | 10% | Triangular |
| 1.018 | Bus Gates | Resource/Technology | IT Capacity | The existing IT systems do not have the capacity to deliver the scheme or grow to the capacity required to deliver the scheme | The system was not designed for the additional requirements | There are increases in costs and delays | 04/02/2020 | 1 Unlikely | 1 | 2 Low | 2 | 2 | Low | Mitigate | build in a allowance for additional requirements to the IT specification | assume the IT system has sufficient capacity | extra data storage costs | 1 | 2 | 2 | Open | £0 | £10,000 | £20,000 | 5% | Triangular |
| 1.019 | Bus Retrofitting | Programme | Timescales | Timescale for retro-fit to be delivered - UK wide demand | There are many schemes nationally that may need the same equipment | There are additional costs and delays | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | keep JAQU informed with the required timescales | assume the timescales for retro-fitting fit in with the programme | project delay for implementation or agreement by JAQU of delayed benefits | 2 | 3 | 6 | Open | £5,000 | £10,000 | £20,000 | 50% | Triangular |
| 1.020 | Bus Retrofitting | Third Parties | Bus fleet | Lack of appropriate buses to retro-fit | There are a limited number of buses that are acceptable | The scheme cannot move forward or is seriously delayed with additional costs to the scheme with redesigns and scope change | 04/02/2020 | 3 Likely | 3 | 2 Low | 2 | 6 | Low | Mitigate | engage with operators to resolve the possibility of buses not being suitable for retro-fitting. | assume a suitable bus fleet will be involved in the scheme | Only critical for BNR corridor. Further dialogue with bus operators and JAQU required to determine solution - delayed benefits or alternative TM / bus gate | 2 | 2 | 4 | Open | £5,000 | £10,000 | £50,000 | 50% | Triangular |
| 1.021 | Bus Retrofitting | Third Parties | Lack of commitment | Lack of commitment from bus operators | Bus operators may not see the value | The scheme cannot move forward or is seriously delayed with additional costs to the scheme with redesigns and scope change | 04/02/2020 | 2 Possibly | 2 | 2 Low | 2 | 4 | Low | Mitigate | early engagement with operators | assume the bus operators will support the scheme | 1 month delay costs | 1 | 2 | 2 | Open | £10,000 | £20,000 | £50,000 | 10% | Triangular |
| 1.022 | RTPI Facilities | Design | Power location | Getting power to location and electrical connection isssues | The site information is still unknown | There are increases in costs and delays | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | undertake a risk assessment for each site to ensure power can be brought to the selected locations | assume power will be available in the correct locations | getting power | 2 | 3 | 6 | Open | £20,000 | £50,000 | £100,000 | 50% | Triangular |
| 1.023 | Scheme Wide | Construction/Implementation | Permit system | New permit system results in delay | There is a lack of familiarity with the permit scheme | Delays to the project and inflationary costs | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | engagement with stakeholders and public regarding new system | assume the new permit system doesn't cause a delay | 1 month delay costs | 2 | 3 | 6 | Open | £10,000 | £20,000 | £50,000 | 50% | Triangular |
| 1.024 | Scheme Wide | Construction/Implementation | Traffic management clashes | Roadworks clashes | Other projects being undertaken in the city | Additional cost the scheme and delays to the project | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | include time risk allowance in the programme | assume this will be managed by the road space booking process | working in part of the network is delayed - 3 months | 2 | 3 | 6 | Open | £30,000 | £60,000 | £200,000 | 50% | Triangular |
| 1.025 | Scheme Wide | Legal | Lead Authority | Lead Authority for implementation stage is not resolved in a timely manner | There are added complexities to having the contracts across multiple authorities | Delays to the project and inflationary costs | 04/02/2020 | 2 Possibly | 2 | 2 Low | 2 | 4 | Low | Mitigate | Lead Authority to be determined | assume a Lead Authority will be determined in time | lead authority changes - 1 month delay | 1 | 2 | 2 | Open | £10,000 | £20,000 | £50,000 | 10% | Triangular |
| 1.026 | Scheme Wide | Programme | Detail design period | There is insufficient time to complete business case, detailed design and acceptable costs | There is a very short time period allocated for these | The price is incorrect and the programme is delayed | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | ensure there is sufficient resources to develop the detailed design with the timeframe allowed | assume the programme is realistic | project is delayed and design fees | 2 | 3 | 6 | Open | £20,000 | £40,000 | £80,000 | 50% | Triangular |
| 1.027 | Scheme Wide | Programme | RSA | RSA content causes delay | The design does not address RSA issues | There are additional costs and delays to address the findings | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | ensure design development considers the content of the RSA | assume the design addresses RSA issues | may need to rewrite RSA | 2 | 3 | 6 | Open | £5,000 | £15,000 | £30,000 | 50% | Triangular |
| 1.028 | Scheme Wide | Programme | JAQU, DfT, and HMT delays | There are delays in approvals from JAQU, DfT, and HMT. | JAQU/DfT work load, and issues raised by T-IRP and D-IRP not being resolved. | The scheme is not delivered on time | 04/02/2020 | 3 Likely | 3 | 2 Low | 2 | 6 | Low | Mitigate | early engagement with JAQU, DfT, and HMT | assume JAQU, DfT, and HMT will deliver within programme | JAQU, DfT, and HMT delays | 2 | 2 | 4 | Open | £20,000 | £50,000 | £100,000 | 50% | Triangular |
| 1.029 | Scheme Wide | Programme | Insufficient funding | Delays in funding / insufficient funding from JAQU | Business case sign off | The scheme is not deliverable without additional funding | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | ensure meaningful and acceptable costs are used to inform the business case | assume JAQU will deliver | delay while the authorities decide on a solution | 2 | 3 | 6 | Open | £20,000 | £50,000 | £100,000 | 50% | Triangular |
| 1.030 | Bus Gates | Other | ULEV exemptions | Refinement of the scheme to include ULEV exemptions at the two bus gates | The scheme did not include for the ULEV exemptions | Delays to the project and inflationary costs | 07/04/2020 | 3 Likely | 3 | 1 Negligible | 1 | 3 | Low | Mitigate | include a time risk allowance for making refinements to the scheme | assume ULEV exemptions have been included or refinement is not required | If undeliverable the scheme will be excluded from the project. If included, there may be 1 month delay, potentially larger signs and increased back office support | 2 | 1 | 2 | Open | £5,000 | £80,000 | £130,000 | 50% | Triangular |
| 1.031 | Scheme Wide | Public/consultation | Traffic calming | Outcome of community consultations on Victoria Road result in amendments to the traffic calming scheme | Public oppose the current traffic calming scheme | Delay to the project and a cost for redesign work | 07/04/2020 | 3 Likely | 3 | 1 Negligible | 1 | 3 | Low | Mitigate | early community consultation | assume the public support the traffic calming scheme | Scheme delivery cost increases if there is majority support for the scheme changes | 2 | 1 | 2 | Open | £5,000 | £85,000 | £100,000 | 50% | Triangular |
| 1.032 | Scheme Wide | Other | Coronavirus | Design build and procurement risk due to Coronavirus | Due to Coronavirus | Delays to the project and inflationary costs | 07/04/2020 | 4 Almost Certain | 4 | 3 Moderate | 3 | 12 | Low | Mitigate | follow government advice and engage with contractor | assume the project can continue | 6 months programme delay and associated design costs | 3 | 3 | 9 | Open | £100,000 | £200,000 | £500,000 | 75% | Triangular |
| 1.033 | Scheme Wide | Other | Changes due to Coronavirus | A change in national policy as a result in the changes in travel behaviour caused by the Coronavirus | Due to Coronavirus | Project is delayed while the scope is updated | 07/04/2020 | 2 Possibly | 2 | 4 High | 4 | 8 | Low | Mitigate | include a time and cost risk allowance to update the scope | assume a change in travel behaviour will only be temporary and the scheme is still required | New project scope and new traffic and air quality modelling | 1 | 4 | 4 | Open | £250,000 | £750,000 | £1,000,000 | 10% | Triangular |
| 1.034 | Scheme Wide | Political | Government/local authority criticised | Government/local authority criticised for progressing delivery of the scheme following an international pandemic and global recession | Public / businesses oppose the scheme following the impact of the pandemic | The scheme becomes politically sensitive cannot move forward or is seriously delayed with additional costs | 07/04/2020 | 4 Almost Certain | 4 | 2 Low | 2 | 8 | Low | Mitigate | Project review and engagement with stakeholders and public following the pandemic | assume there is no criticism and the scheme is supported | The scheme would be shelved (no cost to project delivery) or there would be a delay for a few months to gain public support | 3 | 2 | 6 | Open | £5,000 | £10,000 | £25,000 | 75% | Triangular |

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE

## APPENDIX 19 - Quantified Risk Assessment - Benchmark CAZ D

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

BENTLEY
PROJECT MANAGEMENT

# Quantitative Risk Assessment Report

Clean Air Zone

BENTLEY
PROJECT MANAGEMENT

5 Garden Court
Main Street
Lockington
Derby
DE74 2RH

Development Management | Cost Management | Project Management
0115 983 0157
www.bentleyprojectmanagement.co.uk

| Version | Date | Author | Comments |
|---|---|---|---|
| 00 | 04 March 2020 | | |
| 01 | 27 April 2020 | | Updated due to Councils comments |

Contents



Appendices

# 1. Executive Summary

1.1 A quantitative risk assessment of cost was undertaken by the delivery team, facilitated Bentley Project Management.

1.2 At this early stage in the project it would be beneficial to use the 85th Percentile. This would result in a risk allowance of £11,690,000.

1.3 It is recommended that the team update the risk register on a regular basis.

1.4 The QRA should be re-run when more detail is known.

# 2. Introduction

2.1 Bentley Project Management were commissioned to undertake a quantitative assessment of cost risks for the Clean Air Zone in Stoke-on-Trent, Newcastle-under-Lyme, and Staffordshire. The project is at a pre-planning stage and is in the process of submitting the outline business case.

2.2 The project is to enforce a Clean Air Zone in parts of Stoke-on-Trent, Newcastle-under-Lyme, and Staffordshire. This will include installing signage and ANPR cameras. It is intended that the Clean Air Zone will reduce air pollution within the areas of Stoke-on-Trent, Newcastle-under-Lyme, and Staffordshire where there is an illegal level.

2.3 Stoke-on-Trent City Council, Newcastle-under-Lyme Borough Council, and Staffordshire County Council working together to bring the Clean Air Zone into force.

# 3. Objectives

3.1 The objective of the commission was to produce a qualitative risk register and quantitative cost risk assessment for the scheme.

QRA should

- Support the business plan;
- Be integrated with planning and cost management processes;
- Take account of both uncertainty and risk;
- Used to inform project affordability;
- Be integrated with risk management processes;
- Be reviewed by the project team on a regular basis.

# 4. QRA Methodology

4.1 Inputs into the QRA model are gained through identifying risk and uncertainties at risk workshops.

4.2 Probability of occurrence is modelled using Binomial distribution. Cost impacts are modelled depending on the nature of each risk, with highly uncertain risks modelled by Triangular distributions, whilst highly disruptive risks modelled by Pert distribution. Cost uncertainties should be modelled by Triangular distribution only.

4.3 The cost risk exposure should be modelled and analysed using Monte Carlo modelling technique, to provide a range of potential outcomes. The number of iterations (e.g.10,000) will be selected with reference to the number of inputs being modelled and hence the number necessary to reach a stable result.

4.4 The data for the risk register was collected with the project team in three risk workshops held in February 2020.

# 5. Systems and Tools

5.1 The QRA will be produced using bespoke, Monte Carlo software, developed by Bentley Project Management.

5.2 Bentley Project Management facilitated three workshops. The first workshop was a group exercise to produce a qualitative risk register. The second workshop reviewed actions and agreed mitigations. The third workshop agreed the maximum, minimum and most likely cost for each risk.

5.3 Following the workshop, the data was reviewed by Bentley Project Management and the model was run to ensure that it produced a stable result.

5.4 The qualitative risk register and data was then reviewed by Stoke-on-Trent City Council, Newcastle-under-Lyme Borough Council, and Staffordshire County Council.

5.5 Following the feedback process, the model was run again by Bentley Project Management.

## 6. Results

6.1 The QRA results are as follows:

| Percentile | Risk Allowance |
|---|---|
| 50% | £7,150,000 |
| 85% | £11,690,000 |
| 90% | £11,340,000 |
| 99% | £11,340,000 |

| | Risk Allowance |
|---|---|
| Mean | £8,360,204 |
| Median | £7,160,000 |
| Mode | £6,930,000 |
| Iterations | 10,000 |

The Bentley Project Management Quantitative Risk Assessment Tool

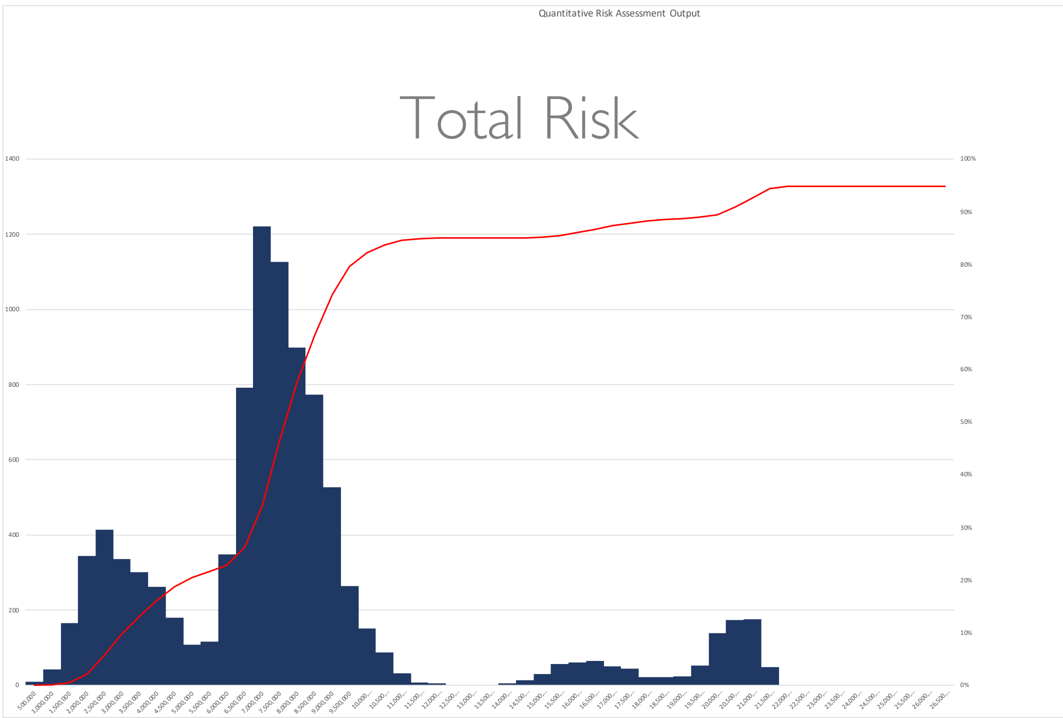
Project Title Clean Air Zone Document Owner M Morrell Update 21 April 2020

Results

| Percentile | Risk Allowance |
|---|---|
| 50% | £7,150,000 |
| 85% | £11,690,000 |
| 90% | £11,340,000 |
| 99% | £11,340,000 |

BENTLEY
PROJECT MANAGEMENT

| | Risk Allowance |
|---|---|
| Mean | £8,360,204 |
| Median | £7,160,000 |
| Mode | £6,930,000 |
| Iterations | 10,000 |



6.2 At this early stage in the project it would be beneficial to use the 85th Percentile. This would result in a risk allowance of £11,690,000.

6.3 The top risk identified on the project are:

| Risk ID | Risk Title | Risk. There is a risk that.. | Mitigated Probability | Mitigated Impact | Mitigated Risk |
|---|---|---|---|---|---|
| 2.001 | Local Government Act | Court Cases - Local Government Act causes delay | 3 | 4 | 12 |
| 2.035 | Skills shortage | Skills shortage in operating organisation results in system failure | 3 | 4 | 12 |
| 2.036 | High workload | Non-compliant vehicle numbers higher than anticipated resulting in workload issue for supplier | 3 | 4 | 12 |
| 2.030 | IT | Data storage capacity and flexibility, hosting issues | 3 | 3 | 9 |
| 2.037 | Coronavirus | Design build and procurement risk to Coronvirus | 3 | 3 | 9 |
| 2.013 | Turn-key insolvency | Risk of 'turn-key' supplier going into insolvency | 2 | 4 | 8 |
| 2.034 | Resilience | ICT network / comms infrastructure will need to be very capable with built in resilience | 2 | 4 | 8 |

6.4 The top financial risks are noted in the table below:

| Risk ID | Risk Title | Risk. There is a risk that.. | Minimum | Most Likely | Maximum | % |
|---|---|---|---|---|---|---|
| 2.031 | ECI | Very little ECI on project and lack of input from turn key supplier | £2,000,000 | £10,000,000 | £20,000,000 | 10% |
| 2.035 | Skills shortage | Skills shortage in operating organisation results in system failure | £1,000,000 | £4,000,000 | £8,000,000 | 10% |
| 2.001 | Local Government Act | Court Cases - Local Government Act causes delay | £1,000,000 | £2,000,000 | £10,000,000 | 75% |
| 2.013 | Turn-key insolvency | Risk of 'turn-key' supplier going into insolvency | £500,000 | £1,000,000 | £2,000,000 | 5% |
| 2.033 | H/A D/R | System will need H/A and D/R with guarantee of high up-time | £600,000 | £840,000 | £1,200,000 | 5% |
| 2.034 | Resilience | ICT network / comms infrastructure will need to be very capable with built in resilience | £600,000 | £840,000 | £1,200,000 | 50% |
| 2.038 | Changes due to Coronavirus | A change in national policy as a result in the changes in travel behaviour caused by the Coronavirus | £250,000 | £750,000 | £1,000,000 | 10% |
| 2.019 | Income | Income estimation inaccurate | £100,000 | £500,000 | £1,000,000 | 75% |
| 2.030 | IT | Data storage capacity and flexibility, hosting issues | £250,000 | £500,000 | £1,000,000 | 75% |
| 2.032 | 4G | The cameras do not run off 4G and need to be wired | £100,000 | £250,000 | £500,000 | 5% |

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MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 20 - Risk Register - Benchmark CAZ D

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

Project Title: Clean Air Zone

Document Owner: M Morrell

Last Updated: 21/04/2020

Today's date: 21/04/2020

Quantitative Data

| Risk ID | Area | Category | Risk Title | Risk. There is a risk that.. | Cause. This is because… | Consequences. This will effect… | Date Raised | Probability | Probability Score | Impact | Impact Score | Project Risk | Certainty | Mitigation Response | Mitigation Measures | Assumptions | Consequence Assumption | Mitigated Probability | Mitigated Impact | Mitigated Risk | Status | Minimum | Most Likely | Maximum | % | Model Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.001 | CAZ D | Programme | Local Government Act | Court Cases - Local Government Act causes delay | Procurement roles were not followed and CAZ not delivered within the programme | Increase legal fees, delays, increase costs | 04/02/2020 | 4 Almost Certain | 4 | 4 High | 4 | 16 | Low | Mitigate | stakeholder engagement and ensure the procurement roles are followed | assume legal requirements will be met and CAZ delivered within programme | Client Earth, Friends of the Earth etc take the Local Authorities to court | 3 | 4 | 12 | Open | £1,000,000 | £2,000,000 | £10,000,000 | 75% | Triangular |
| 2.002 | CAZ D | Programme | JAQU, DfT, and HMT delays | There are delays in approvals from JAQU, DfT, and HMT. | JAQU/DfT work load, and issues raised by T-IRP and D-IRP not being resolved. | The scheme is not delivered on time | 04/02/2020 | 2 Possibly | 2 | 3 Moderate | 3 | 6 | Low | Mitigate | early engagement with JAQU, DfT, and HMT | assume JAQU, DfT, and HMT will deliver within programme | JAQU, DfT, and HMT delays | 1 | 3 | 3 | Open | £30,000 | £70,000 | £100,000 | 10% | Triangular |
| 2.003 | CAZ D | Programme | Insufficient funding | Delays in funding / insufficient funding from JAQU | Business case sign off | The scheme is not deliverable without additional funding | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | ensure meaningful and acceptable costs are used to inform the business case | assume JAQU will deliver | delay while the authorities decide on a solution | 2 | 3 | 6 | Open | £20,000 | £50,000 | £100,000 | 50% | Triangular |
| 2.004 | CAZ D | Programme | Highways England (HE) Objection | HE objection on grounds of safety, network capacity impact, diversion route, and initial draft SRN signage strategy. | HE do not think the scheme is compliant. | The scheme cannot move forward or is seriously delayed with additional costs to the scheme with redesigns and scope change | 04/02/2020 | 2 Possibly | 2 | 3 Moderate | 3 | 6 | Low | Mitigate | early engagement with HE to provide evidence of compliance | Assume HE don't object and respond within a suitable timeframe | increase in project length | 1 | 3 | 3 | Open | £0 | £30,000 | £60,000 | 10% | Triangular |
| 2.005 | CAZ D | Programme | Signage design | Problems with design, including agreement of signing strategy on local and SRN | The scheme is complex and requires multi stakeholder sign off | Delays to the project and inflationary costs | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | stakeholder involvement in signage design and strategy | assume signage design is correct | project delay and redesign fees | 2 | 3 | 6 | Open | £20,000 | £40,000 | £60,000 | 50% | Triangular |
| 2.006 | CAZ D | Programme | RSA | RSA content causes delay | The design does not address RSA issues | There are additional costs and delays to address the findings | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | ensure design development considers the content of the RSA | assume the design addresses RSA issues | may need to redesign scheme | 2 | 3 | 6 | Open | £5,000 | £15,000 | £30,000 | 50% | Triangular |
| 2.007 | CAZ D | Programme | Utility costs | Utility costs are higher than expected due to timescales available to do site investigations and estimate costs | No allowance for utility applications in the programme | Additional costs for utilities and delays programme | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | ensure there is an allowance in the programme to obtain utility costs | assume utility costs can be obtained within the programme | costs for utility applications and extra over for the allowed supplies/diversions | 2 | 3 | 6 | Open | £60,000 | £150,000 | £1,000,000 | 50% | Triangular |
| 2.008 | CAZ D | Programme | Judicial review | Successful challenge via judicial review from environmental organisations to type of CAZ | Legal processes are not followed | There are additional legal costs and delays | 04/02/2020 | 2 Possibly | 2 | 3 Moderate | 3 | 6 | Low | Mitigate | stakeholder engagement (Client Earth, Friends of the Earth, etc) and ensure legal processes are followed | assume there will be no judicial review challenge | 6 month delay | 1 | 3 | 3 | Open | £30,000 | £150,000 | £300,000 | 10% | Triangular |
| 2.009 | CAZ D | Programme | Local Authority resources | Input from SCC, NuLBC and SoTCC technical teams cause delay (due to lack of resources / competing workload) | There is insufficient resources at the Authority | The programme is delayed | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | early engagement with the councils technical teams | assume the LA have sufficient resources | project delay and additional staff required | 2 | 3 | 6 | Open | £10,000 | £80,000 | £150,000 | 50% | Triangular |
| 2.010 | CAZ D | Programme | Turn-key procurement | SCC/SoTCC procurement teams concerned regarding method of securing 'turn-key' option and associated processes / systems | Due to complex contractual requirements | Increase legal fees, delays, increase costs | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | early engagement with procurement teams | assume procurement teams approve method of securing turn-key option | procurement route is wrong and new route causes a delay | 2 | 3 | 6 | Open | £10,000 | £20,000 | £50,000 | 50% | Triangular |
| 2.011 | CAZ D | Programme | Amendment of order | Amendment of order leading to need to re-advertising | Objection to the scheme | The scheme cannot move forward or is seriously delayed with additional costs to the scheme with redesigns and scope change | 04/02/2020 | 3 Likely | 3 | 2 Low | 2 | 6 | Low | Mitigate | consultation with the public / stakeholders | assume there will be no objections to the scheme | 1 month delay | 2 | 2 | 4 | Open | £10,000 | £20,000 | £100,000 | 50% | Triangular |
| 2.012 | CAZ D | Programme | Permit system | New permit system results in delay | There is a lack of familiarity with the permit scheme | Delays to the project and inflationary costs | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | engagement with stakeholders and public regarding new system | assume the new permit system doesn't cause a delay | 1 month delay | 2 | 3 | 6 | Open | £10,000 | £20,000 | £50,000 | 50% | Triangular |
| 2.013 | CAZ D | Programme | Turn-key insolvency | Risk of 'turn-key' supplier going into insolvency | The market is volatile | There are additional costs and delays | 04/02/2020 | 1 Unlikely | 1 | 4 High | 4 | 4 | Low | Mitigate | early engagement with turn-key supplier | assume turn-key supplier doesn't go into insolvency | cost of a new supplier and unnatural inflationary cost | 2 | 4 | 8 | Open | £500,000 | £1,000,000 | £2,000,000 | 5% | Triangular |
| 2.014 | CAZ D | Public/consultation | Objections | Public / stakeholder objections | Public are opposed to the charges for entering the CAZ and the boundary | The scheme becomes politically sensitive and is delayed | 04/02/2020 | 4 Almost Certain | 4 | 2 Low | 2 | 8 | Low | Mitigate | early engagement with the public | assume there will be no delays from public objections | Delay time likely to be short as public have little direct control | 3 | 2 | 6 | Open | £0 | £30,000 | £60,000 | 75% | Triangular |
| 2.015 | CAZ D | Public/consultation | Sunset period | Sunset periods change effectiveness and income | Public policy | Delays when the CAZ comes into effect | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | allow for sunset periods in the programme | assume sunset period will change the effectiveness of the CAZ | Delay time likely to be short as public have little direct control | 2 | 3 | 6 | Open | £0 | £30,000 | £60,000 | 50% | Triangular |
| 2.016 | CAZ D | Public/consultation | ANPR | ANPR perceived negatively | People object to ANPR cameras | The scheme becomes politically sensitive and is delayed | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | Inform the public about ANPR cameras at consultation events, and make a allowance for damages | assume the ANPR cameras will be accepted | Delay costs and replacement of cameras due to damage from them being perceived negatively £25k per camera. | 2 | 3 | 6 | Open | £0 | £50,000 | £250,000 | 50% | Triangular |
| 2.017 | CAZ D | Political | Approval from Local Authorities | Approval delay due to there being 3 Local Authorities making decisions | Differences in political views from the 3 Local Authorities | The scheme becomes politically sensitive and is delayed | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | early engagement and involvement from all 3 Local Authorities | assume the Local Authorities agree to the scheme | 3 month delay, greater delay won't be accepted by JAQU | 2 | 3 | 6 | Open | £30,000 | £60,000 | £150,000 | 50% | Triangular |
| 2.018 | CAZ D | Political | Political power | Lack of political backing including due to change of national / local leadership | Result of elections | The scheme is not supported and is delayed with funding being lost | 04/02/2020 | 1 Unlikely | 1 | 3 Moderate | 3 | 3 | Low | Mitigate | engage with all political parties | assume political support is continued | project development delay costs and inflation | 1 | 3 | 3 | Open | £30,000 | £50,000 | £100,000 | 5% | Triangular |
| 2.019 | CAZ D | Political | Income | Income estimation inaccurate | System will be expensive to run and is offset by income | Additional funding required | 04/02/2020 | 4 Almost Certain | 4 | 3 Moderate | 3 | 12 | Low | Mitigate | undertake a feasibility study | assume income estimate is accurate | additional funding required | 2 | 3 | 6 | Open | £100,000 | £500,000 | £1,000,000 | 75% | Triangular |
| 2.020 | CAZ D | Scope | CAZ area | Mis-match with stated preference surveyed area (different CAZ area assumed) | Incorrect surveys | Delay to project and increase costs | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | CAZ area to be confirmed before surveys are carried out | assume the correct CAZ area is surveyed | redesign costs and delays to the project, may need to tweak the model or remodel on a larger area | 2 | 3 | 6 | Open | £10,000 | £50,000 | £150,000 | 50% | Triangular |
| 2.021 | CAZ D | Legal | Terms and Conditions | Terms and Conditions and Back Office Agreements take longer to resolve than programmed | Legal agreements can be complex and take time | Delays to the project and inflationary costs | 04/02/2020 | 2 Possibly | 2 | 3 Moderate | 3 | 6 | Low | Mitigate | include time risk allowance in the programme | assume Terms and Conditions and Back Office Agreements are resolved within programme | few months delays - 3 authorities legal fees and resources | 1 | 3 | 3 | Open | £80,000 | £200,000 | £500,000 | 10% | Triangular |
| 2.022 | CAZ D | Legal | Data protection | Data protection / GDPR issues arise and retention periods are longer than anticipated | There will be a large amount of data produced from the cameras and Authority policy requires additional storage | Delays to the project and inflationary costs | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | ensure the data storage procedure is efficient and adheres to policy or outsource the storage | assume there will be no data protection / GDPR issues | extra data storage costs | 2 | 3 | 6 | Open | £120,000 | £240,000 | £600,000 | 50% | Triangular |
| 2.023 | CAZ D | Legal | Enforcement | Enforcement fails | Due to poor signage design | The scheme does not generate the anticipated fees | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | early engagement with stakeholders to ensure the signage design will not result in enforcement fails | assume signage is adequate to enforce the CAZ | additional staff required to respond to enforcement fails | 2 | 3 | 6 | Open | £10,000 | £80,000 | £150,000 | 50% | Triangular |
| 2.024 | CAZ D | Design | Traffic Management (TM) issues | TM issues, in particular on the SRN | TM clashes | Delays to project and increase costs | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | include time risk allowance in the programme | assume this will be managed by the road space booking process | working in part of the network is delayed - 3 months | 2 | 3 | 6 | Open | £30,000 | £60,000 | £200,000 | 50% | Triangular |
| 2.025 | CAZ D | Design | HE signage objection | New schemes on HE network resulting in re-design of signage required | HE have other projects on the network | The scheme cannot move forward or is seriously delayed with additional costs to the scheme with redesigns and scope change | 04/02/2020 | 2 Possibly | 2 | 3 Moderate | 3 | 6 | Low | Mitigate | early engagement with HE | assume other projects will not impact the signage design | 3 month delay in response | 1 | 3 | 3 | Open | £10,000 | £50,000 | £100,000 | 10% | Triangular |
| 2.026 | CAZ D | Design | Electrical connections | Electrical connection issues | The site information is still unknown | There are additional costs and delays | 04/02/2020 | 3 Likely | 3 | 3 Moderate | 3 | 9 | Low | Mitigate | carry out surveys to determine electrical connections | assume site information will be known | project delay and survey costs | 2 | 3 | 6 | Open | £40,000 | £70,000 | £150,000 | 50% | Triangular |
| 2.027 | CAZ D | Procurement | Legislation | PCR 2015 and procurement timescales missed | There is a need to comply with procurement regulations | Delays to the project and inflationary costs | 04/02/2020 | 1 Unlikely | 1 | 2 Low | 2 | 2 | Low | Mitigate | make an allowance (time and cost) for compiling with procurement regulations | assume this will not cause a delay | procurement fees | 1 | 2 | 2 | Open | £10,000 | £15,000 | £25,000 | 5% | Triangular |
| 2.028 | CAZ D | Procurement | Procurement | Communication with other authorities | Lack of communication with other Local Authorities regarding procurement | There are additional costs and delays | 04/02/2020 | 2 Possibly | 2 | 2 Low | 2 | 4 | Low | Mitigate | ensure the Local Authorities procurement share information and are engaging with each other | assume Local Authorities communicate with each other | 1 month delay | 1 | 2 | 2 | Open | £10,000 | £20,000 | £50,000 | 10% | Triangular |
| 2.029 | CAZ D | Procurement | Specification | The Specification is not correct or sufficient | There is limited timescales for the development of detailed design | Additional funding required to address the shortfall from incorrect pricing | 04/02/2020 | 2 Possibly | 2 | 4 High | 4 | 8 | Low | Mitigate | ensure there is sufficient time in the programme for detailed design | assume the specification is correct | re-write specification - project delay and fees | 1 | 4 | 4 | Open | £50,000 | £100,000 | £4,000,000 | 10% | Triangular |
| 2.030 | CAZ D | Procurement | IT | Data storage capacity and flexibility, hosting issues | The system is more complex than anticipated | Delay to project increase costs | 04/02/2020 | 4 Almost Certain | 4 | 3 Moderate | 3 | 12 | High | Mitigate | ensure the system is understand by those implementing the scheme | assume there will be no IT issues | extra data storage costs | 3 | 3 | 9 | Open | £250,000 | £500,000 | £1,000,000 | 75% | Triangular |
| 2.031 | CAZ D | Procurement | ECI | Very little ECI on project and lack of input from turn key supplier | Due to a tight programme there is not the time to get sufficient ECI | Increased project costs | 04/02/2020 | 2 Possibly | 2 | 4 High | 4 | 8 | Low | Mitigate | engagement from technology and suppliers | assume the risk can be managed and ECI is possible | turn-key is wrong | 1 | 4 | 4 | Open | £2,000,000 | £10,000,000 | £20,000,000 | 10% | Triangular |
| 2.032 | CAZ D | Resource/Technology | 4G | The cameras do not run off 4G and need to be wired | The cameras need to be wired | Increase costs and delays to project | 04/02/2020 | 1 Unlikely | 1 | 3 Moderate | 3 | 3 | Low | Mitigate | make an allowance for having wired in cameras or a mixture with 4G | assume cameras can run off 4G | The cost of a wired connection will be location specific and will vary depending on multiple factors, highest costs will be incurred with excess construction charges to actually run the cable to the camera. Assumption is that no camera will be more than 100m from a suitable FTTC location | 0 | 3 | 0 | Open | £100,000 | £250,000 | £500,000 | 5% | Triangular |
| 2.033 | CAZ D | Resource/Technology | H/A D/R | System will need H/A and D/R with guarantee of high up-time | As the system will need to run the majority of the time | Increased costs to allow for back up | 04/02/2020 | 1 Unlikely | 1 | 4 High | 4 | 4 | Low | Mitigate | make an allowance for H/A and D/R in the specification | assume this will be include for in the specification | Assumption is that system will need to be highly available and therefore resilient. It is very difficult to cost this without a specification but based on a mid-range server platform in Azure and appropriate back-up technology costs would be in the regions stated | 1 | 4 | 4 | Open | £600,000 | £840,000 | £1,200,000 | 5% | Triangular |

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.034 | CAZ D | Resource/Technology | Resilience | ICT network / comms infrastructure will need to be very capable with built in resilience | As the system will need to run the majority of the time | Increased costs to allow for back up | 04/02/2020 | 3 Likely | 3 | 4 High | 4 | 12 | Low | Mitigate | use two different networks (e.g. O2 and ee) to run system | assume the ICT network / comms infrastructure is resilient | Assumption is that system will need to be highly available and therefore resilient. It is very difficult to cost this without a specification but based on a mid-range server platform in Azure and appropriate back-up technology costs would be in the regions stated | 2 | 4 | 8 | Open | £600,000 | £840,000 | £1,200,000 | 50% | Triangular |
| 2.035 | CAZ D | Resource/Technology | Skills shortage | Skills shortage in operating organisation results in system failure | There is a lack of skills in organisations | There are additional costs and delays | 04/02/2020 | 2 Possibly | 2 | 4 High | 4 | 8 | Low | Mitigate | early engagement with operating organisation | assume skilled operators are available | By outsourcing or procuring a cloud based platform, a lack of organisational skill in the software layer could be removed. | 3 | 4 | 12 | Open | £1,000,000 | £4,000,000 | £8,000,000 | 10% | Triangular |
| 2.036 | CAZ D | Resource/Technology | High workload | Non-compliant vehicle numbers higher than anticipated resulting in workload issue for supplier | There are more people not using the scheme as anticipated | Additional funding required | 04/02/2020 | 4 Almost Certain | 4 | 4 High | 4 | 16 | Low | Mitigate | update model with correct stats foe non-compliant vehicle numbers | assume non-compliant vehicle numbers are known | Assumption is that PCN's will not account for a large proportion of the data storage costs, so even if PCN numbers grow more than anticipated, it should not adversely affect the overall storage requirements. (staff cost and IT costs) | 3 | 4 | 12 | Open | £30,000 | £100,000 | £150,000 | 75% | Triangular |
| 2.037 | CAZ D | Other | Coronavirus | Design build and procurement risk to Coronvirus | Due to Coronavirus | Delays to the project and inflationary costs | 05/02/2020 | 4 Almost Certain | 4 | 3 Moderate | 3 | 12 | Low | Mitigate | follow government advice and engage with contractor | assume the project can continue | 6 months programme delay and associated design costs | 3 | 3 | 9 | Open | £100,000 | £200,000 | £500,000 | 75% | Triangular |
| 2.038 | CAZ D | Other | Changes due to Coronavirus | A change in national policy as a result in the changes in travel behaviour caused by the Coronavirus | Due to Coronavirus | Project is delayed while the scope is updated | 06/02/2020 | 2 Possibly | 2 | 4 High | 4 | 8 | Low | Mitigate | include a time and cost risk allowance to update the scope | assume a change in travel behaviour will only be temporary and the scheme is still required | New project scope and new traffic and air quality modelling | 1 | 4 | 4 | Open | £250,000 | £750,000 | £1,000,000 | 10% | Triangular |
| 2.039 | CAZ D | Political | Government/local authority criticised | Government / Local Authority criticised for progressing delivery of the scheme following an international pandemic and global recession | Public / businesses oppose the scheme following the impact of the pandemic | The scheme becomes politically sensitive cannot move forward or is seriously delayed with additional costs | 07/02/2020 | 4 Almost Certain | 4 | 2 Low | 2 | 8 | Low | Mitigate | Project review and engagement with stakeholders and public following the pandemic | assume there is no criticism and the scheme is supported | The scheme would be shelved (no cost to project delivery) or there would be a delay for a few months to gain public support | 3 | 2 | 6 | Open | £5,000 | £10,000 | £25,000 | 75% | Triangular |

1. Programme
    a. Improved air quality ($NO_2$ and PM concentrations) at the exceedance locations
    b. Improved public health
2. Bus gates along A53 King Street and A50 Victoria Road
    a. Improved journey times for buses and taxis during the AM and PM peaks
    b. Traffic redistribution across the network without creating new sites of $NO_2$ exceedance
3. Bus retrofit
    a. Lower exhaust emissions of $NO_x$, PM and other pollutants released from buses

Encourage shift to more sutainable modes of transport

| Benefits Metric | Key Outcome | Method | Realisation Measure | | Dependencies - activity or trigger required to confirm realisation | Risks to realisation | Benefit Owner | Benefit review date | Date realised / achieved |
|---|---|---|---|---|---|---|---|---|---|
| | | | Baseline Value | Target Value | | | | | |
| Reductions in NO2 concentrations in the shortest timeframe possible so to ensure compliance with the Ministerial and EU Direction | Achieve the statutory limite values for roadside NO2 concentration limitis at the exceedance locations in the shortest possible time | Quantifiable - measured through diffusion tubes across North Staffordshire | 3 sites exceeding recommended limits of 40 µg/m3 | Annual average of < 40 µg/m3 across North Staffordshire (for all sites) | Implementation of the preferred scheme<br><br>Recording and reporting from diffusion tubes and monitoring stations | Delays to the project programme, such as delay in approval of the FBC or funds to be received<br><br>Inaccuracies in modelling causing overestimation of compliance levels or underestimating the level of NO2 concentration, as examples | NuLBC, SoTCC, SCC | Dec-22 | |
| Improved health of local citizens and reduced risk of illnesses such as heart disease, lung disease or asthma, as a result of air pollution | Achieve the statutory limit values for roadside NO2 concentration limits at the exceedance locations in the shortest possible time. | Quantifiable - data from Public Health England (PHE) to assess hospital admissions of specific diseases, however, these may not be a direct result of air quality issues and therefore not possible to directly attribute these results to the scheme | Number of hospital admissions for individual diseases that might result from poor air quality | Reduction from original recorded value | Implementation of the preferred scheme resulting in better air quality and therefore fewer air quality related illnesses | Failure to achieve compliance within EU regulations is unlikely to see health improvements in the local area | NuLBC, SoTCC, SCC | Dec-22 | |
| Cost and resource savings to the NHS as a result of fewer hospital admissions from poor air quality | Achieve the statutory limit values for roadside NO2 concentration limits at the exceedance locations in the shortest possible time. | Observable - data from Public Health England (PHE) to assess hospital admissions of specific diseases, however, these may not be a direct result of air quality issues and therefore not possible to directly attribute these results to the scheme | | | Implementation of the preferred scheme resulting in better air quality and therefore fewer air quality related illnesses | Failure to achieve compliance within EU regulations is unlikely to see health improvements in the local area | NuLBC, SoTCC, SCC | Dec-22 | |
| Improved bus journey quality through the RTPI, CCTV and accessible kerb facilities implemented as the quality of available information will increase, passengers will have an enhanced perception of safety, and accessibility for less able users will improve | Local buses more attractive, encouraging greater use | Quantifiable - data taken from bus operators' ticket sales by service. Increases in patronage may not be as a direct result from the scheme | Total bus patronage by service | Increased bus patronage by service | Implementation of additional RTPI, CCTV and accessible kerb facilities<br><br>Public perception on bus journey quality drawn out through bus operator ticket sales | Limited behavioural change towards bus usage | SCC, SoTCC & bus operators | Dec-22 | |
| Rerouting of traffic away from the exceedance sites without creating new exceedance locations | Traffic redistribution across the network without creating new sites of NO2 exceedance | Quantifiable - NO2 measured through diffusion tubes across North Staffordshire. Traffic counts measure traffic across individual routes | | Annual average of < 40 µg/m3 in areas surrounding original exceedance locations | Traffic management measures at the A53 and A50 and the surrounding areas ensures exceedances aren't experienced anywhere<br><br>Traffic counts measure the impact of the resulting rerouting | New exceedances are createed despite what the modelling anticipated | NuLBC, SoTCC, SCC | Dec-22 | |
| Reduced exhaust emissions released from more polluting, older bus engines | Lower exhaust emissions of NOx released from buses | Quantifiable - number of grants distributed and diffusion tubes to measure air quality across affected routes. Changes in air quality may not be a direct result of the scheme | Number of compliant buses in operation | Number of compliant buses in operation | Bus retrofitting 100% of buses that use Bucknall New Road and 75% of buses along Victoria Road | Bus operators cannot source enough vehicles that can be retrofitted<br><br>Retrofitting is a short-term solution | SCC, SoTCC & bus operators | Dec-22 | |
| Rerouting of traffic away from the exceedance sites without impacting on the residential streets around Victoria Road | Traffic redistribution across the network without creating new sites of NO2 exceedance | Traffic counts on local residential streets near A50 Victoria Road such as Manor Street | Existing traffic flows on Manor St | Not having a significant increase on existing flows on Manor St | The effectiveness of the traffic management measures being implemented to the west of Victoria Road following the introduction of the bus gate | High levels of re-routed traffic flows following the bus gate opening on Manor St resulting in issues with local residents and schools | SoTCC | Dec-22 | |
| Improved information and communication about air quality and its subsequent impacts | Increased awareness of air quality problem | Quantifiable - Surveys to local businesses and residents | | | Implementation of the preferred scheme along with the delivery of relevant information and communication to businesses and residents | Failure to deliver adequate level of information and communication to businesses and residents | NuLBC, SoTCC, SCC | Dec-22 | |

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 22 - Monitoring and Evaluation Plan

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

# Table of contents

# 1 Introduction

## 1.1 Background

In October 2018, Stoke-on-Trent and Newcastle-under-Lyme were issued a Ministerial Direction to produce a local air quality plan to address their respective nitrogen dioxide ($NO_2$) problems. Stoke-on-Trent City Council (SoTCC), Newcastle-under-Lyme Borough Council (NuLBC) and Staffordshire County Council (SCC) are working together to produce a joint plan.

This Plan will help to protect and promote the health of the local population by improving air quality and reducing the impact of air pollution on the environment. In so doing, the local authorities are complying with the UK Air Quality Plan and bringing $NO_2$ air pollution within statutory limits in the shortest possible time.

The three predicted $NO_2$ exceedance locations on the local road network, based on the local model are:

- The A53 (Etruria Road) between Victoria Street and Basford Park Road. The maximum predicted annual mean $NO_2$ concentration in 2022 along these links is 43µg/m$^3$.
- The A5008 (Bucknall New Road) at the junction between Potteries Way and Lindop Street. The maximum predicted annual mean $NO_2$ concentrations in 2022 along this link is 42µg/m$^3$.
- The section of the A50 (Victoria Road) between Maud Street and Hitchman Street. The maximum predicted annual mean concentration in 2022 along this link is 46µg/m$^3$.

The background to the identification of these three locations is contained in the Initial Evidence Summary (IES). The conclusion reached from the modelling of current and future air quality is that intervention is needed to bring about compliance with annual mean $NO_2$ limit values in the shortest time possible.

An Outline Business Case (OBC) is to be submitted to the Department for Transport (DfT) and Department for Environment, Food and Rural Affairs (Defra) Joint Air Quality Unit (JAQU) in May 2020 which explain how the authorities have determined their preferred option.

## 1.2 Preferred Option

A detailed description of the preferred options is as follows:

1. **A50 Victoria Road bus gate**
   A bus gate will be installed on the A50 Victoria Road exit of the King Street/City Road/Victoria Road junction. Traffic will be restricted to buses, cyclists and taxis between Monday and Friday from 7am to 10am and 4pm to 7pm.

   The splitter island will be widened and the kerbs re-aligned to provide a single lane bus gate. An Automatic Number Plate Recognition (ANPR) camera will be located at the bus gate to monitor compliance and two rotating prism signs will be installed at the entrance to the bus gate. The prism signs will enable the display of multiple messages and will be blank when the bus gate is not in use.

Bus gate advanced direction signing will be provided on the local highway network on all approaches to the Victoria Road/City Road and A50/King Street junctions, including Prism and Variable Message Signs.

The scheme costs include installation, the Traffic Regulation Order, ten-years of maintenance, monitoring and operation, and decommissioning at the end of the project. It is expected that the cameras may need to be replaced after five years.

An Ultra Low Emission Vehicle (ULEV) exemption, allowing ULEVs to drive through the bus gate, will be assessed, and if considered deliverable, will be added to the scheme in the Full Business Case (FBC).

**2. A53 Etruria Road bus gate**

A two-lane bus gate will be installed on the A53 Etruria Road westbound exit of the A53/A500 roundabout, with appropriate amendments to the existing road markings at the bus gate and on the circulatory carriageway. Traffic will be restricted to buses, cyclists and taxis between Monday and Friday from 7am to 10am and 4pm to 7pm. Two rotating prism signs will be installed at the entrance to the bus gate to enable the display of multiple messages and will be blank when the bus gate is not in use. Two ANPR cameras will be installed to manage compliance.

Advanced direction signing will include prism signs on all approaches to the A500/A53 Etruria Road roundabout. Changes to destination signs on the A500 mainline carriageway in both directions are also proposed. This will include appropriate re-routing to the hospital and will also include variable message signs.

The scheme costs include installation, the Traffic Regulation Order, ten-years of maintenance, monitoring and operation, and decommissioning at the end of the project. It is expected that the cameras may need to be replaced after five years.

A ULEV exemption, allowing ultra-low emission vehicles to drive through the bus gate will be assessed and if considered deliverable will be added to the scheme in the Full Business Case (FBC).

**3. Traffic Management east and west of Victoria Road**

Traffic management measures will be required on roads to the east and west of Victoria Road in order to ensure that the adjacent local communities are not adversely impacted by traffic re-routeing through these areas when the bus gates are in operation.

The following measures will be required to the East of Victoria Road:

- Replace existing worn and ineffective road humps in Beville Street, Stanier Street, Wileman Street, Philip Street, Elliot Road, Wedgwood Road, Warrington Street and Vivian Road and enhance the impact of the scheme by providing additional humps and carriageway re-surfacing.
- Provide new road humps and carriageway re-surfacing along Park Street, Minerva Road, Frederick Street, Cumberland Street and Clarence Street.
- Introduce one-way operation (direction of travel west to east) in Wileman Street (part) and Stanier Street (part).

- Provide an environmental weight restriction on the traffic calmed routes to prevent inappropriate large vehicles travelling through the area.
- Extend 20 mph zone to cover the whole traffic calmed area.

The following measures will be required to the West of Victoria Road:

- Replace existing worn and ineffective road humps in Manor Street, George Street, Edward Street and Hitchman Street and enhance the impact of the scheme by providing additional humps and carriageway re-surfacing.
- Provide new road humps and carriageway re-surfacing in Maud Street, Fountain Street and William Street. This includes two raised tables to improve safety at Christ Church C of E Primary School.
- Enhance signage to improve the enforcement of the existing environmental weight restriction in Manor Street.
- Closure of Hitchman Street at its junction with Victoria Road, maintaining access for pedestrians and cyclists.
- The existing western footway along Victoria Road at Hitchman Street will be extended to enhance the pedestrian environment.
- A 20mph zone to include the whole traffic calmed area.

4. **Transport improvements along A53 Etruria Road**

The bus gate on A53 Etruria Road will significantly reduce traffic flows in the peak periods along this corridor and improve bus reliability. This will necessitate the review of signal timings at junctions along the corridor in order to maximise air quality benefits.

The increase in spare capacity along the corridor will create the opportunity for the provision of signalised pedestrian crossing facilities on all arms of the A53/Gladstone Street/Basford Park Road junction and the A53/Albert Street/Sandy Lane junction.

An existing bus stop along the A53 Etruria Road is located on the hill where it is observed that traffic can queue behind buses serving the stop. It is recommended that the bus stop is relocated to the east of Kingsfield Oval, opposite the New Vic Theatre where it is likely to have a reduced impact on air quality. Accessibility will be enhanced through the provision of bus access kerbs and levelled footways. Real Time Bus Passenger Information (RTPI) will also be provided along the A53 corridor.

5. **Bus retrofit programme**

To deliver compliance on Bucknall New Road and Victoria Road the buses that use these routes will be retrofitted to achieve Euro VI emission standards. This involves the installation of the appropriate exhaust modification depending on vehicle type and age and associated e-cooling fan to minimise ongoing maintenance. This will be an expansion of the existing bus retrofit programme being delivered on the A53 as part of the separate NuLBC Ministerial Direction.

75% of buses that travel along the Bucknall New Road corridor and all buses travelling along Victoria Road require this improvement to ensure that compliance is achieved. Funding will be required for the retrofitting of 50 buses to ensure that the appropriate number of scheduled services can continue to operate on Bucknall New Road and Victoria Road. The two main operators are First Bus and D&G, and the smaller operators include Scraggs and Stantons of Stoke.

To market the cleaner bus fleet, enhance their visibility and encourage greater bus use, it is recommended that all buses that have been retrofitted are provided with a new branding in the form of a partial bus wrap. To monitor bus operator use of retrofit vehicles, ANPR cameras will be installed on Victoria Road, Bucknall New Road, at the junction with St Ann Street, and on the A53 to the east of the junction with Albert Street/Sandy Lane.

6. **Bus infrastructure improvements**

Enhanced bus infrastructure will be installed on routes that pass through or are parallel to the exceedance locations. This includes bus routes:

- To Abbey Hulton, Milton, Bentilee and Longton that converge at Bucknall New Road
- Along Victoria Road and parallel routes along College Road and A5007 City Road
- Along A53 Etruria Road between Newcastle town centre and Hanley City Centre, and parallel routes along the A52 and Shelton New Road

The improvements are required to ensure that bus patronage is maximised along corridors that are at risk of air quality exceedances and where traffic modelling suggests that traffic flows and journey times may increase as traffic re-routes to avoid the bus gates. The cost of the package includes the installation and ten-year maintenance of:

- 89 RTPI screens
- 17 new bus shelters of which 8 are replacement and 9 are new facilities
- 27 accessible kerbs at bus stops
- Installation of CCTV at 71 bus stops

## 1.3 Purpose

Funding for the preferred option described above, will be through JAQU's implementation fund. In accordance with JAQU's guidance, a monitoring and evaluation plan is therefore required with the OBC as set out in the supplementary note on monitoring and evaluation.

This document proposes a proportionate approach to monitoring and evaluation to reflect the traffic management focus of the preferred option and the project does not propose to undertake significant local work.

The focus for data collection is $NO_2$ concentrations obtained via diffusion tubes as this will provide evidence of compliance being achieved. Traffic flow data supports this by providing an understanding of why the $NO_2$ concentration results are the levels that they are. This data will be particularly useful should the $NO_2$ concentration data be unexpected in any way.

In addition to this, bus patronage data will continue to be collected to monitor delivery of the associated outcome and this will be reported locally.

## 1.4 JAQU Central Evaluation

JAQU will be undertaking a central evaluation of local authorities' $NO_2$ plans. Action undertaken by Highways England are excluded. The central evaluation aims to understand the impacts of measures introduced through a local authority's local plan and ensure that local authorities are on track to reduce $NO_2$ concentrations in the shortest possible time. This will draw on both existing local and national monitoring. Therefore, local authorities should maintain their current monitoring sites for $NO_2$ concentrations and traffic flows for the length of the evaluation.

The central evaluation will produce quarterly bulletins on the progress of local plans on reducing $NO_2$ concentrations and other key factors (such as changing traffic flows). This will be based on a comparison between the expected (as presented in the local authority's feasibility study) and the actual, monitored situation. The bulletins will be communicated regularly to local authorities. Should these bulletins show that a local plan is performing below expectation, JAQU will seek to determine the cause by working with the local authority.

Where it has been collected, local authorities are required to provide traffic data in the following types to the central evaluation:

**Traffic count data:** Local authorities are required to provide traffic flow, composition and speed data from Automatic Traffic Count sites (ATCs: two inductive loops per lane) or similar. This will allow the central evaluation team to track the ebb and flow of demand, before and after an intervention.

**ANPR data:** Local authorities are asked to collect ANPR data and upload it to the "ANPR - Monitoring and Evaluation" folder on Huddle.

**Other traffic data:** The central evaluation welcomes other traffic data that individual local areas might already collect, for example cycle counts, bus fleets, etc. The central evaluation team will liaise individually with local areas to agree on the reporting procedures for this data.

### 1.4.1 Local Monitoring and Evaluation of Plans

Local authorities have a responsibility to monitor the air quality outcomes in relevant areas but may choose to conduct further monitoring activity or evaluate the wider impacts of their measures in more detail. This could range from maintaining (and sharing) the existing monitoring to implementing new monitoring or undertaking a detailed local evaluation.

Any proposed local monitoring or evaluation activity should be considered an important part of running and implementing the proposed scheme.

Authorities should look to cover any associated running costs from the revenues generated by any proposed charging scheme. Where a local authority is not proposing to implement a charging scheme, or there is a shortfall, local authorities should clearly set this out in the monitoring and evaluation plan and should work with JAQU to find a suitable solution.

Local monitoring will be restricted to bus patronage data for this project as it directly relates to a secondary outcome.

## 1.5 Critical Success Factors and Scheme Outcomes

The primary critical success factor (CSF) in this study is that the package of measures that form the North Staffordshire Local Air Quality Plan (NSLAQP) must ‘bring about compliance with $NO_2$ limit values in the shortest possible time’.

Additionally, in developing the NSLAQP, the assessment has taken account of the need to:

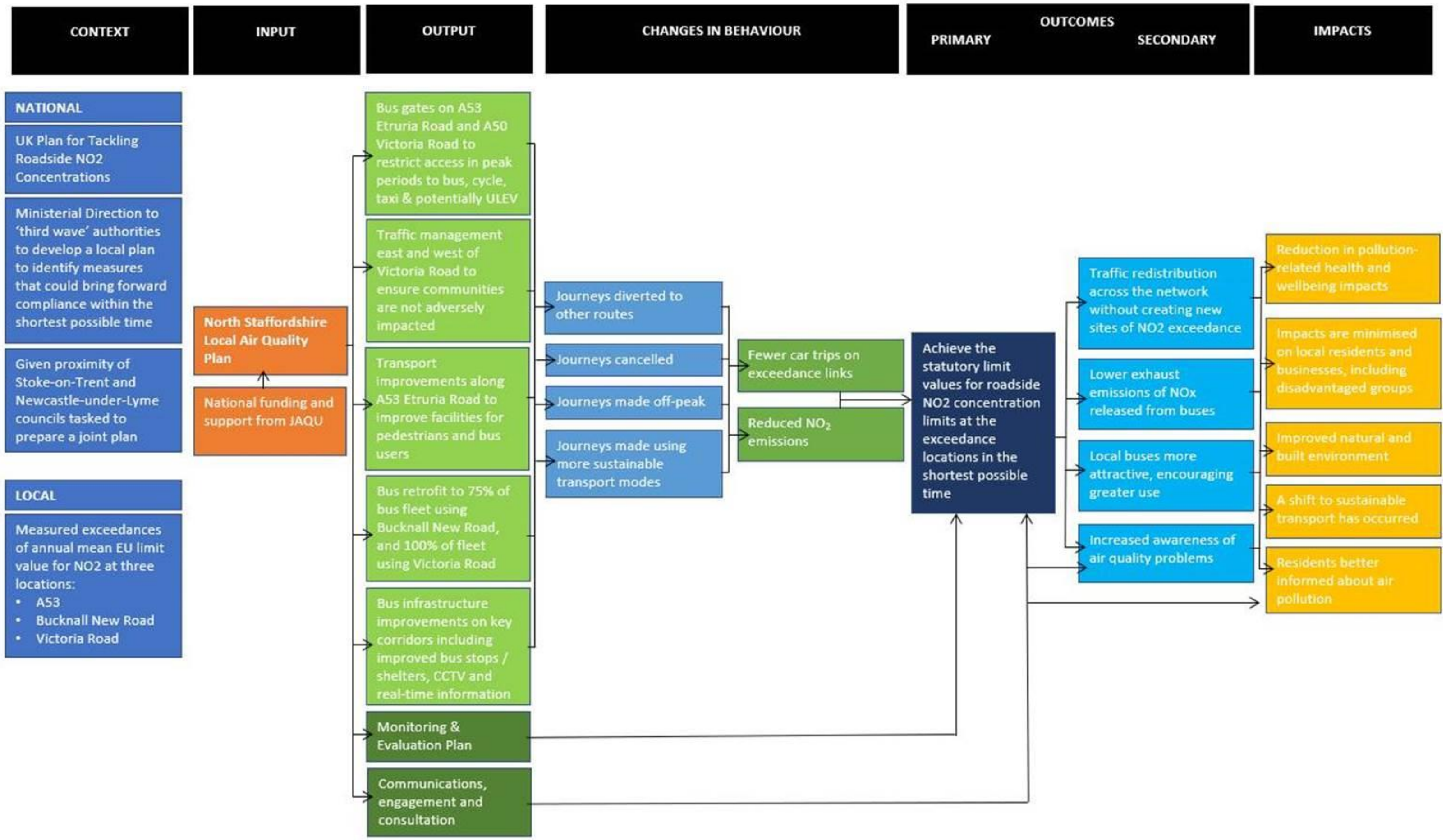
- Deliver a high level of confidence that compliance with the EU limit value will be achieved
- Minimise the social and economic impacts on local communities and residents

The scheme outcomes reflect this focus and are divided into primary and secondary outcomes. The primary outcomes relate to delivering $NO_2$ emission compliance and the secondary outcomes support this by ensuring that no new exceedances are created, local buses are more attractive and there is an increased use of sustainable modes.

## 1.6 Logic Map

The logic map, in Figure 1-1, shows how the inputs, delivered through the timely receipt of funds from the Implementation Fund, will generate the outputs (the components of the preferred scheme that are delivered) that then drive a set of outcomes related to transport and air quality objectives. Achievement of these outcomes secures the desired impacts for the preferred option, which in terms of the project delivery relate to achieving and maintaining compliance with the ministerial direction and an improved awareness regarding air quality. These are closely aligned to the primary CSF and the secondary CSFs. The success of the outputs in achieving the desired outcomes and impacts is then confirmed through the monitoring and evaluation process.

*Figure 1-1: Logic map*



# 2 Data Requirements

## 2.1 Existing Monitoring

Table 2-1 identifies existing monitoring that will continue to be required in order to monitor the key outcomes of the preferred option as outlined above. As shown below, except for the automatic traffic counts (ATCs) on the A50, there are no other suitable permanent traffic counters for monitoring. It should also be noted that although the diffusion tubes and monitors collect data on a monthly and quarterly basis, the data is corrected annually to allow for seasonal variability.

*Table 2-1: Existing Monitoring*

| Metric | Monitoring Method | Data Collection Frequency | Quantity | Data Type | Control |
|---|---|---|---|---|---|
| Air quality data | Diffusion tubes | Monthly | Network of 605 diffusion tubes collecting NO2 data focussed on the previously identified Air Quality Management Areas (AQMAs) | NO2 concentration levels | NULBC, SoTCC |
| Air quality data | Automatic Monitors | Quarterly | 3 monitors (located in Hanley, Basford, Newcastle-under-Lyme) | NO2 concentration levels | NULBC, SoTCC |
| Strategic Road Network traffic flow data | Automatic counts | Monthly | 1 relevant site (located on the A50 between Stanley Matthews Way and A500, source - WebTRIS database) | 1-way hourly vehicle flows by vehicle classification averaged over a month by day/hour | Highways England |
| Bus patronage | Bus operator ticket data | Monthly | Total patronage for Stoke-on-Trent and separately Staffordshire administrative areas only (excludes analysis by service) for concessionary fare purposes | Bus passenger numbers per service | Bus operators, SCC, SoTCC |
| Vehicle Fleet Composition | ANPR data | Undertaken in 2019 | 15 locations | Vehicle composition split by vehicle type, fuel type, euro standards and compliance | NULBC, SoTCC |

## 2.2 Additional Monitoring

The local authorities wish to undertake a proportionate amount of additional monitoring in order to understand the impact of the preferred option. There are several gaps in the existing data to enable an understanding of both the air quality and traffic impact of the preferred option, so additional monitoring requirements are outlined in Table 2-2. The locations of the planned air quality data collection across North Staffordshire that would be collated is shown in in Figure 2-2, this shows automatic monitoring sites, diffusion tubes at local air quality management sites, additional diffusion tubes since the ministerial direction and proposed sites for monitoring and evaluations. Figure 2-6, Figure 2-7, Figure 2-8 and Figure 2-9, show the same information but focussed on Wolstanton/Porthill, A53/Newcastle-under-Lyme, Hanley and Fenton respectively. The diffusion tubes are triple located as agreed with JAQU at the start of the project to help with the reduced accuracy of diffusion tubes compared to other data collection methods. Permanent monitoring sites require land, planning consent and a power supply, hence are costly and more difficult to implement. In addition, the layout of the street of interest prevent this method of data collection.

Figure 2-6, Figure 2-7, Figure 2-8 and Figure 2-9, shows other data collection for monitoring including traffic counts, ANPR cameras (both bus gate/retrofit enforcement and a one-off survey) and the corridors of bus infrastructure improvements where bus patronage by service would be collated. The monitoring data will need to be collected as soon as possible before the implementation of the schemes to ensure the appropriate “before” data is collected.

The traffic data will be automatic traffic counters with vehicle classification, given the number of months per year that the classified data is required it is both easier and cheaper to use permanent sites.

The one-off ANPR survey covering a wider area of North Staffordshire than the bus gate and retrofit enforcements cameras will be post implementation, its timing will be informed by the enforcement cameras.

*Table 2-2: Additional monitoring to support Central Evaluation*

| Metric | Monitoring Method | Data Collection Frequency | Quantity | Control |
|---|---|---|---|---|
| Air quality data | Diffusion tubes | Monthly | 59 additional diffusion tubes to collect NO2 data at the identified exceedance locations | NULBC, SoTCC |
| Local traffic data | Automatic Traffic Counts | Monthly | 13 | SoTCC, NULBC |
| Vehicle fleet composition | ANPR cameras | Monthly | 5 locations | SCC, SoTCC |
| Vehicle fleet composition | ANPR | One off cordon study | 15 locations | SCC, SoTCC |
| Bus patronage | Bus operator ticket data | Monthly | Data by fare stage providing a broad indication of the number of passengers on each bus service. Will require analysis. | Bus operators, SCC, SoTCC |

Funding will be required to deliver the Monitoring and Evaluation Plan as there is not expected to be adequate revenue generated from the bus gates to cover the costs.

Funding will be required to collect monthly air quality data at the 664 diffusion tube locations over the ten-year period. This includes 59 new sites.

ANPR data will be collected at the five locations set up to enforce the bus gates and retrofitted buses. In order to monitor network wide changes in vehicle compliance, these ANPR cameras will need to be supplemented by a one-off ANPR data collection survey covering 15 additional sites. These will be at the same locations as the previous ANPR data collection in 2019 which was used to disaggregate the North Staffordshire Multi Modal (NSMM) transport model demand into compliant and non-compliant vehicle matrices.

The aim of the preferred option is to reduce emissions below the exceedance level by re-distributing traffic away from the three exceedance locations, whilst avoiding the creation of new exceedance locations. Funding will be required to monitor the actual changes in traffic flows compared to modelled flows. 13 new permanent traffic counters will be required at the exceedance sites and along two screen lines on the local highway network that intercept the key routes that are predicted to be affected by the re-assignment of traffic.

Funding is required to measure the change in bus passenger numbers over the ten-year period as a result of improved bus reliability and investment in bus infrastructure. Where available, data by fare stage collected from ticket equipment will be received from the bus operators and concessions data can provide a broad indication of the number of passengers on each service each month.

*Figure 2-1 Air quality data collection - overview*

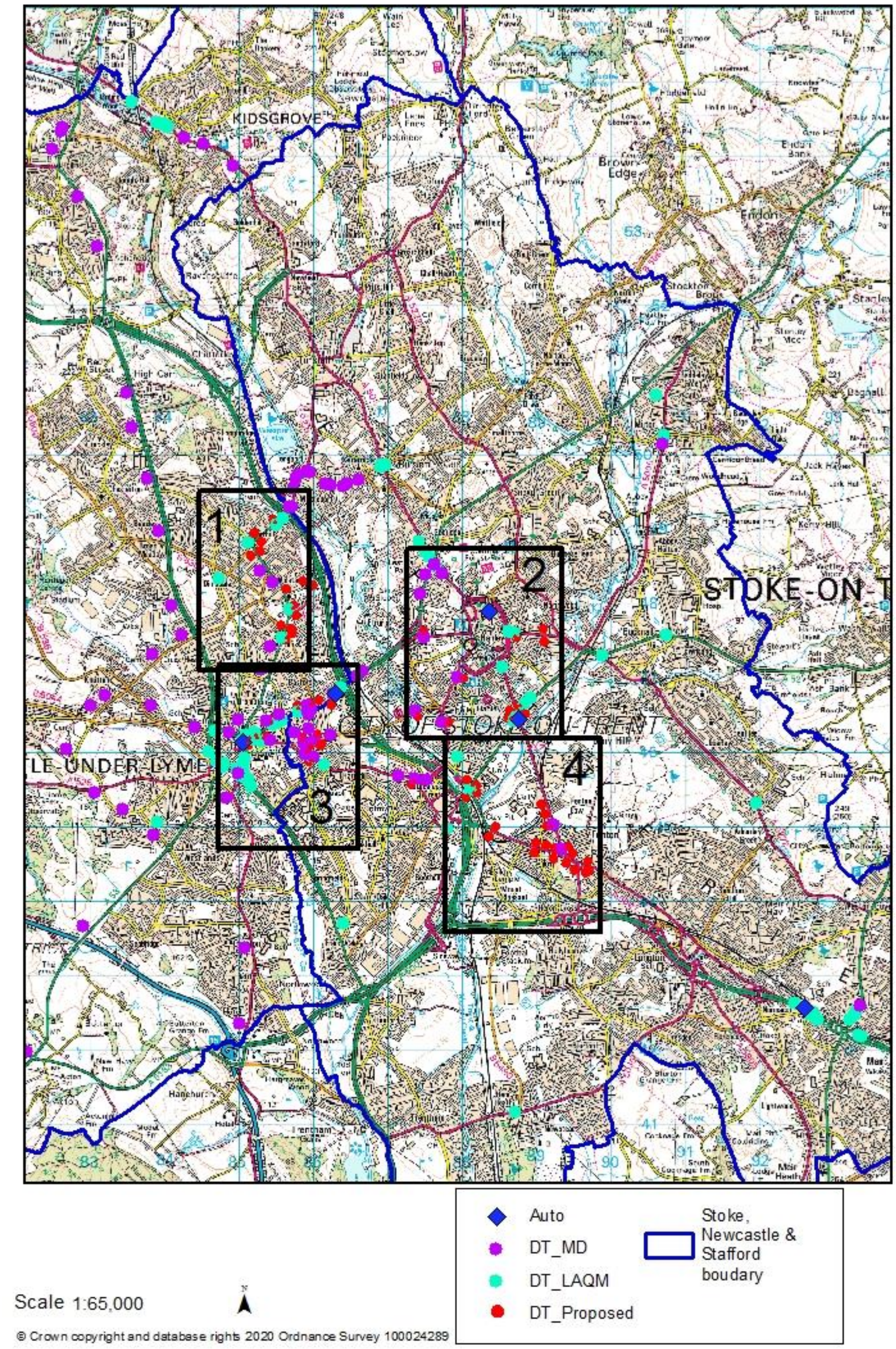


*Figure 2-2: Air quality data collection – Wolstanton / Porthill*

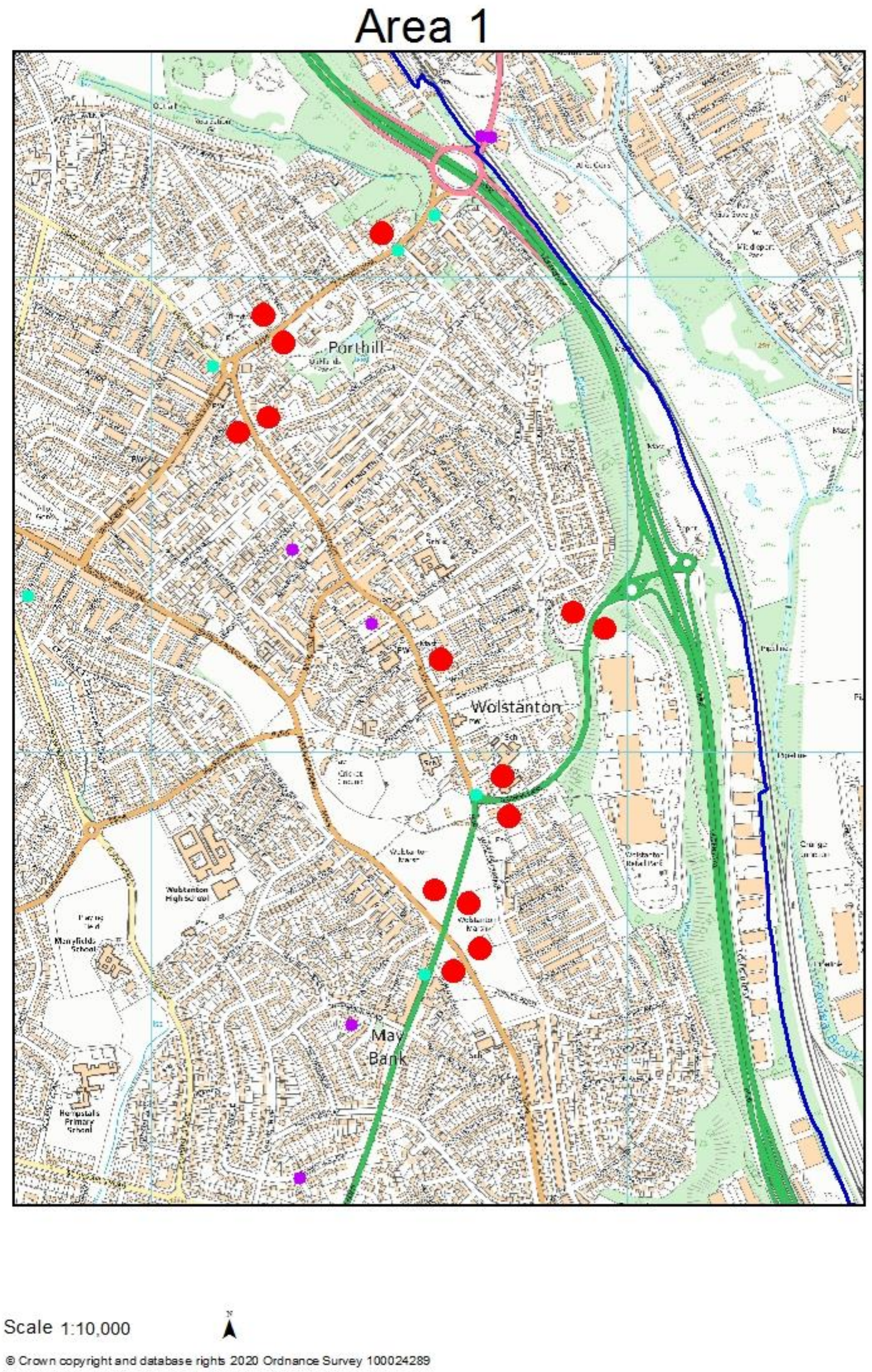


*Figure 2-3 Air quality data collection – Hanley*

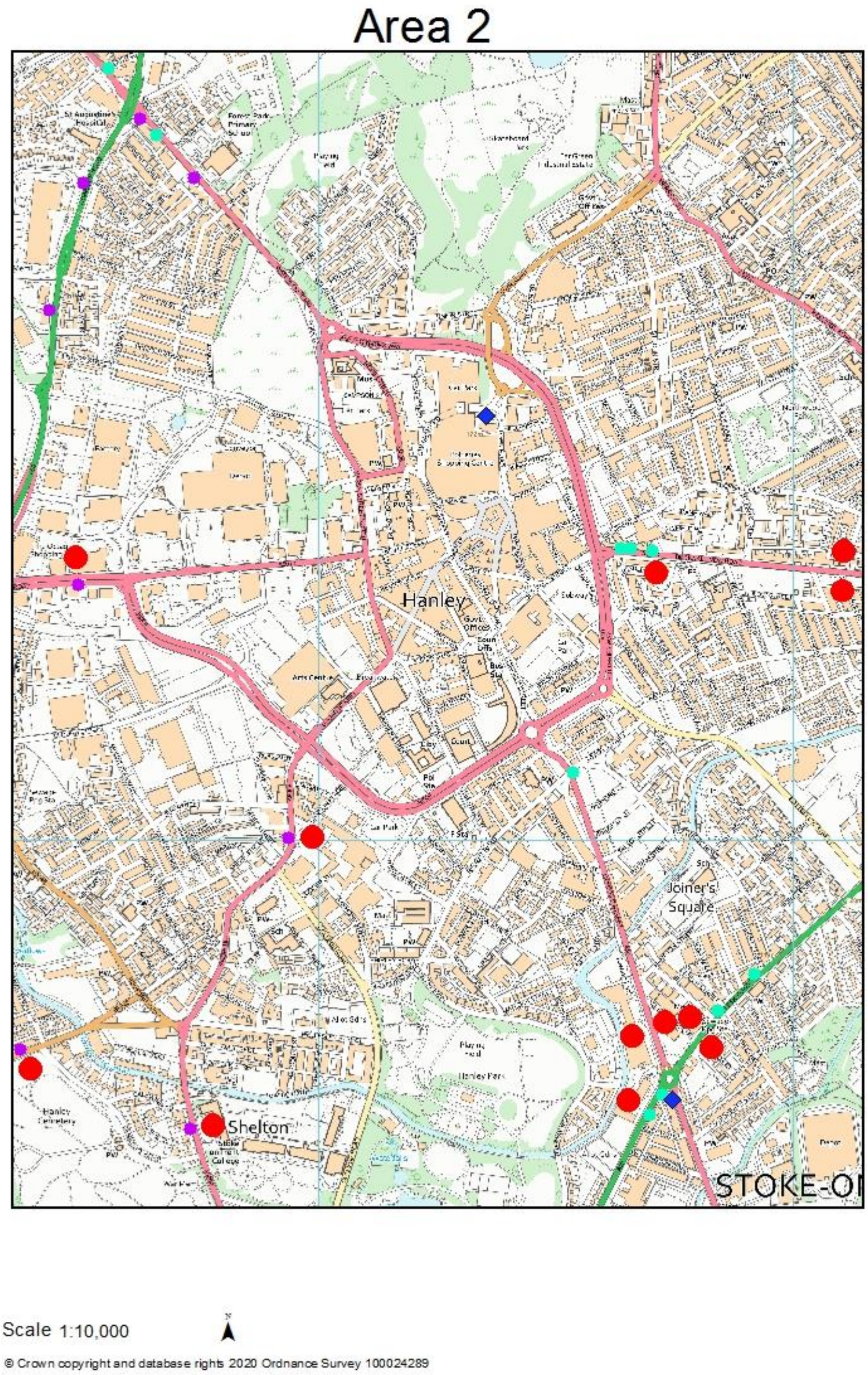


*Figure 2-4 Air quality data collection – A53 / Newcastle under Lyme*

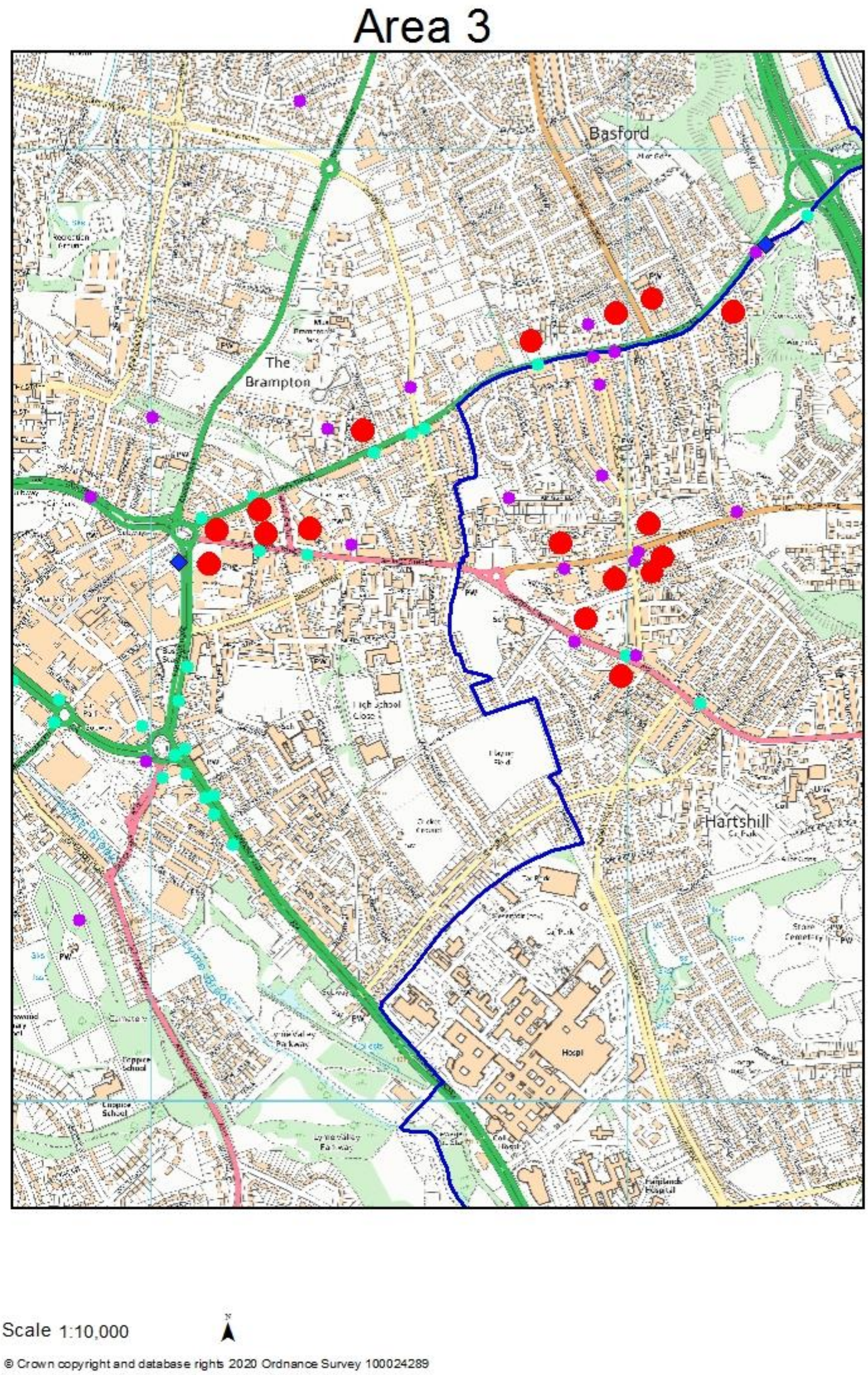
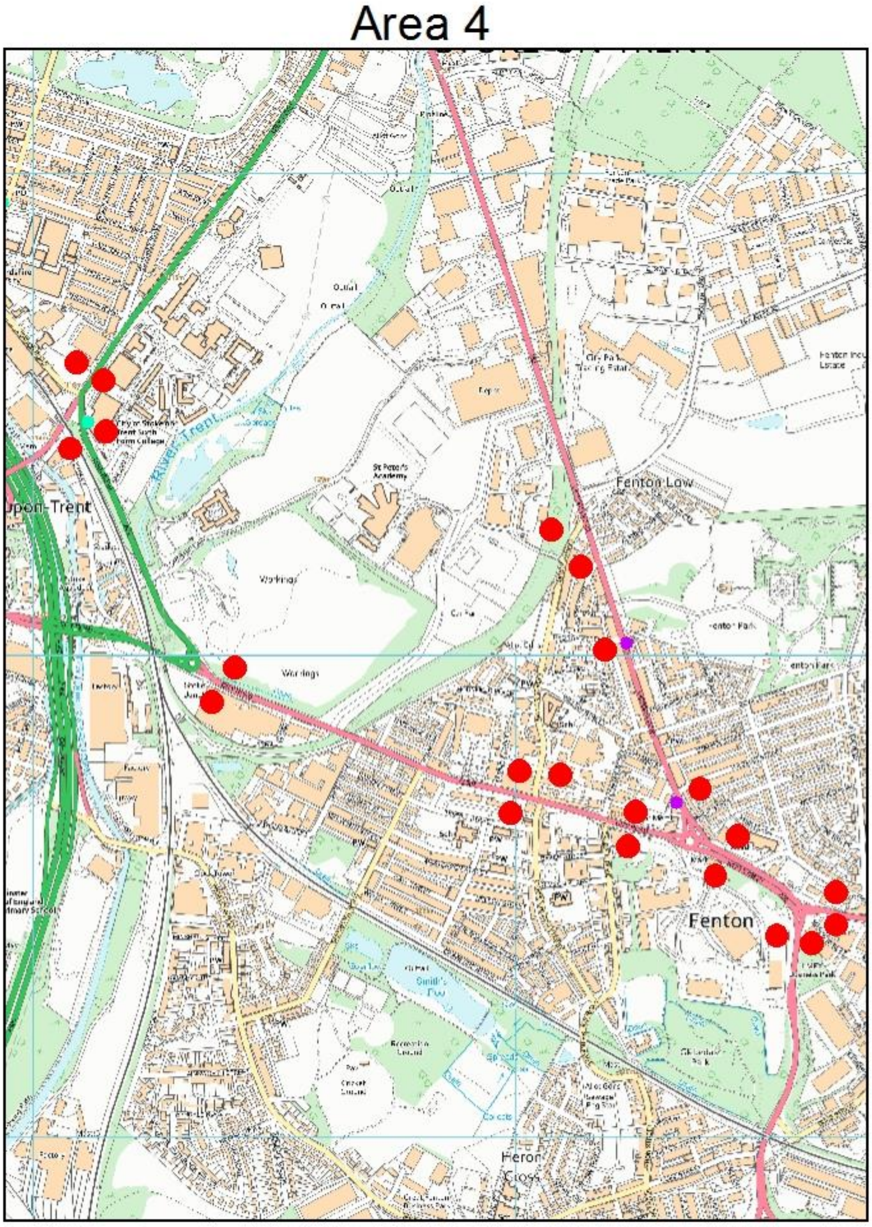


*Figure 2-5 Air quality data collection - Fenton*




Scale 1:10,000

*Figure 2-6: Automatic traffic count locations*

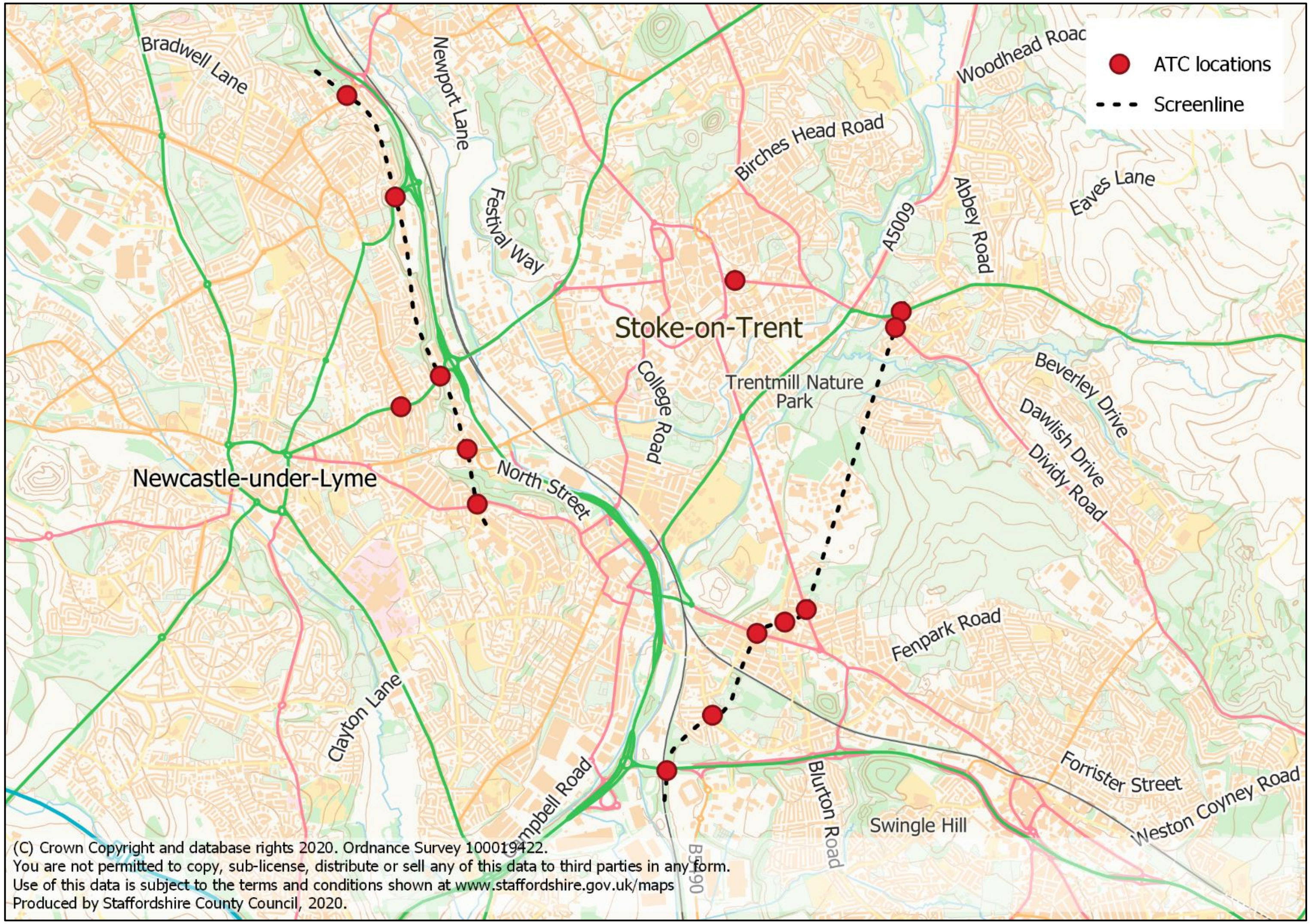


*Figure 2-7: ANPR camera locations for enforcement of bus gates and retrofit*

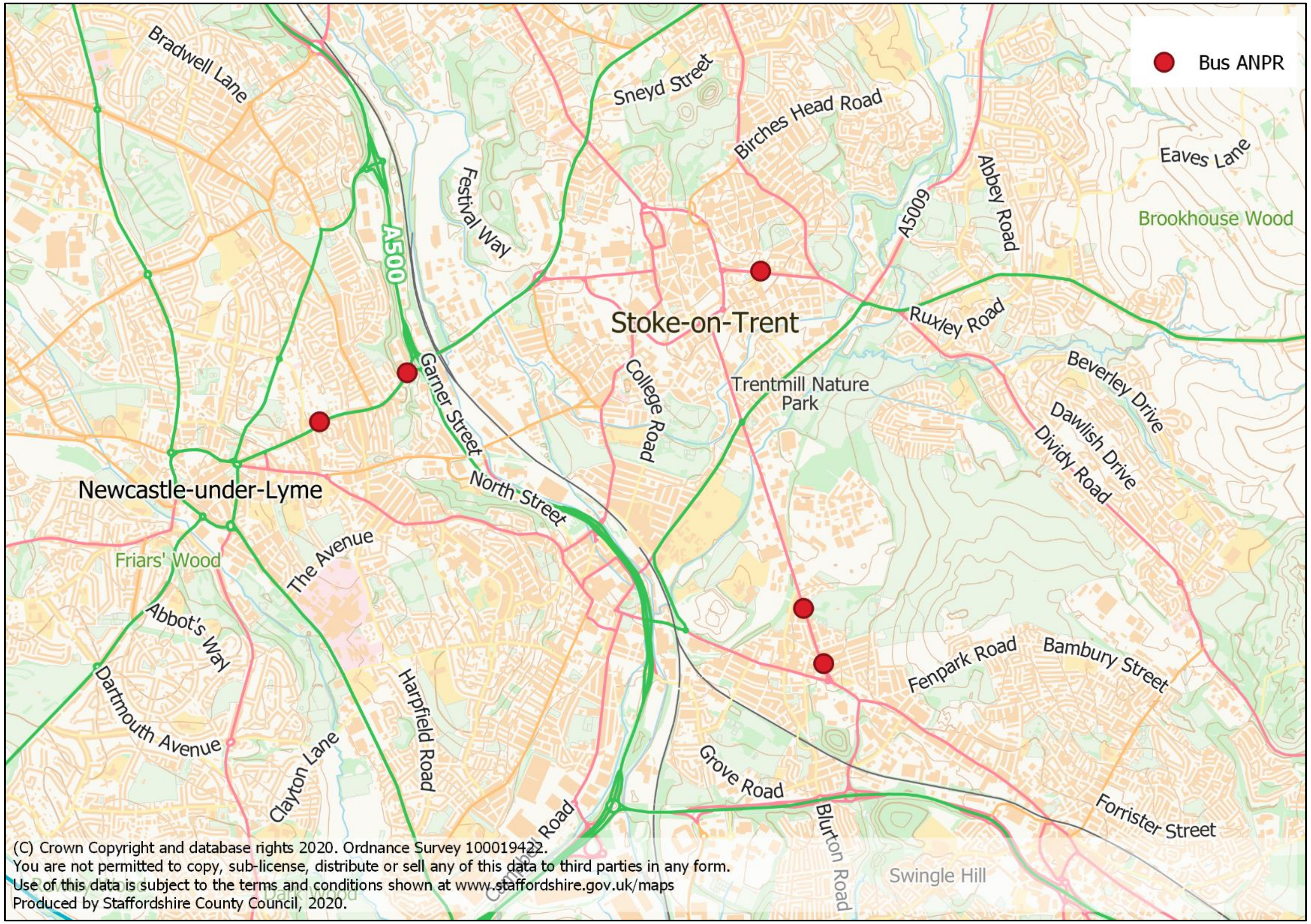


*Figure 2-8: ANPR camera location for one-off post implementation survey.*

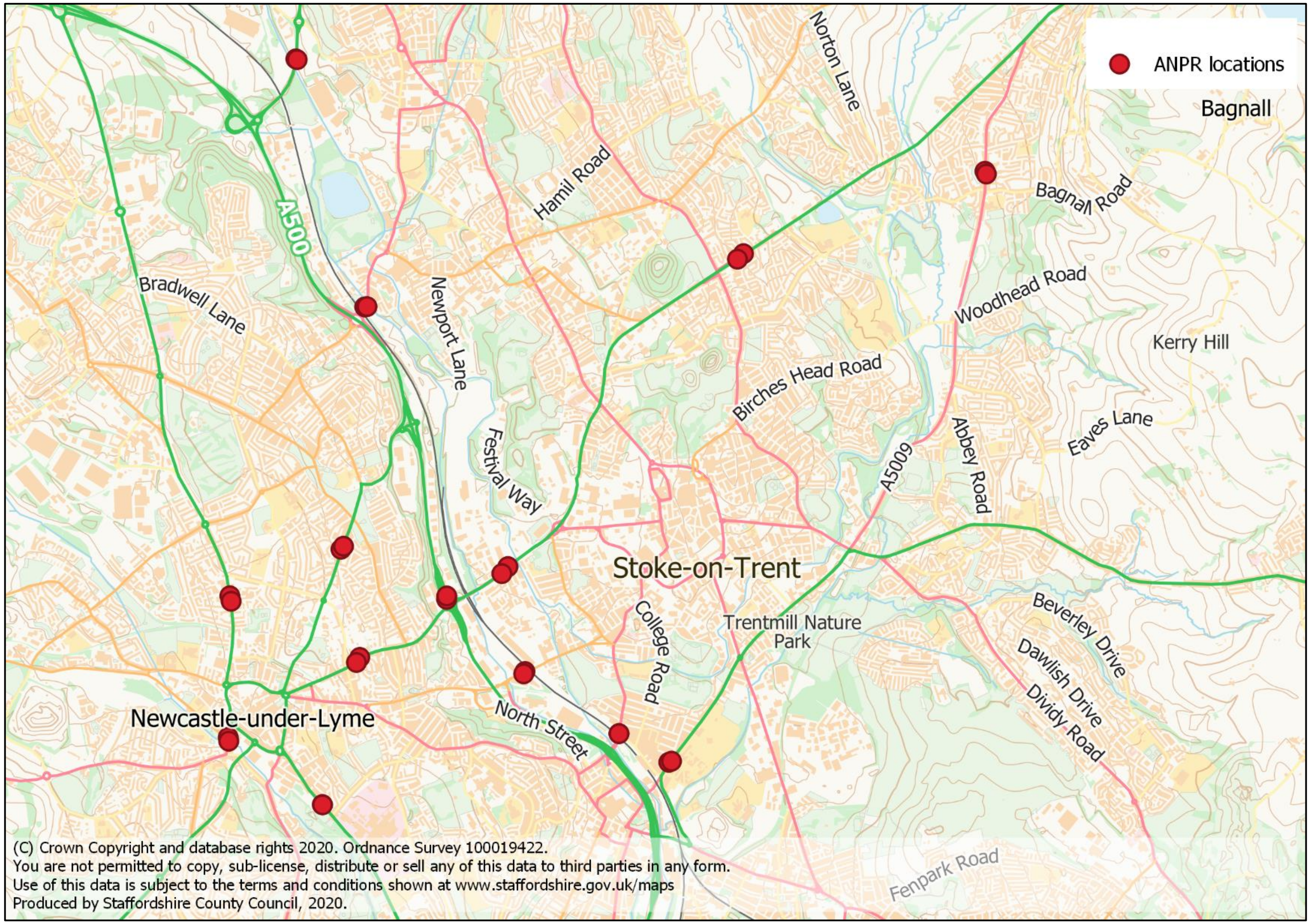
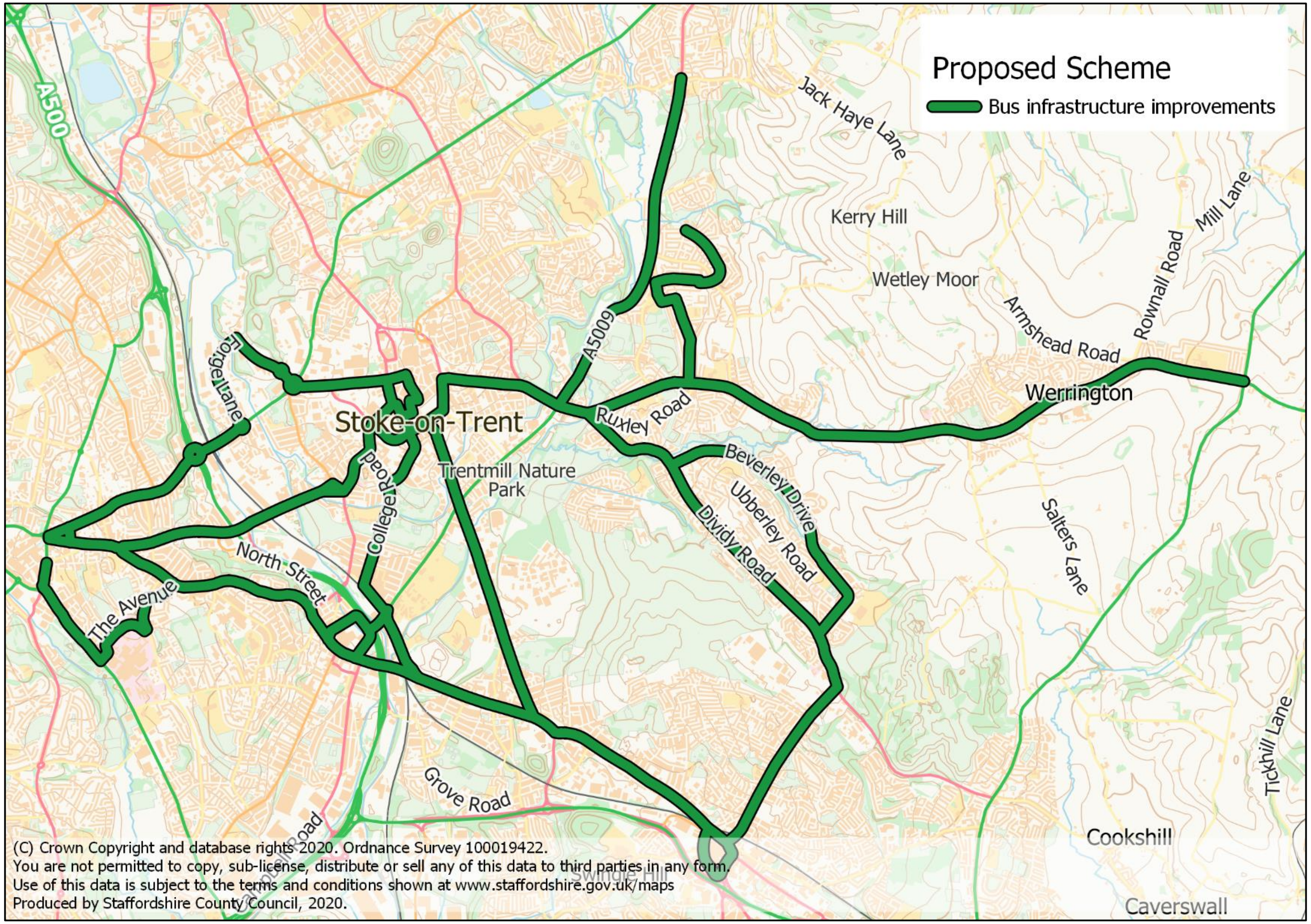


*Figure 2-9: Bus infrastructure improvements*



## 2.3 Additional Monitoring Justification

Table 2-3 outlines the intended purpose and justification for the additional monitoring described in Table 2-2.

*Table 2-3: Additional Monitoring Justification*

| Metric | Justification |
|---|---|
| Air quality data | There is currently a network of 605 diffusion tubes primarily located around AQMAs. It has been determined that an additional 59 diffusion tubes will be required in order to supplement the monitoring of NO2 levels across North Staffordshire as a result of the preferred option. These are located at the identified sites of exceedance and the surrounding roads that are likely to be impacted from the redistribution of traffic.<br>The monitoring of NO2 levels will help determine if the preferred scheme is delivering compliance in line with the Ministerial Direction and when compliance has been achieved. |
| Local Traffic Data | No traffic count data is currently collected within the study so the project cannot provide any data to the central evaluation team to undertake the mandatory analysis. A proportionate series of 13 permanent count locations is proposed forming two cordons and two isolated counts at two of the exceedance locations. Costs have been estimated for using the latest solar-powered equipment, which will provide accurate vehicle classification and where data is automatically uploaded to a cloud hosted system minimising staff resource cost. It is likely that some maintenance and equipment renewal will be required because of the duration for monitoring. |
| Vehicle Fleet Composition | The scheme specifies the delivery of ANPR cameras at the two bus gates and along the routes used by retrofitted buses. For the bus gates, this will enable enforcement and issuing of any Penalty Charge Notices (PCNs) as necessary. Enforcement of the use of retrofitted buses on the appropriate road links rests with the Traffic Commissioner, however it is standard practice for the Local Authority to be approached to provide evidence. ANPR data is a standard data source for this type of enforcement and the cameras will also serve as a deterrent.<br>The central evaluation team can also be provided with access to the raw data to enable them to undertake vehicle fleet composition monitoring and provide an initial indication of when the fleet may have reached natural compliance. An ANPR data collection study using the same locations as within the model submitted as part of the IES will then be undertaken to confirm this. The locations of these cameras would provide a better and wider sample of vehicles. |

# 3 Monitoring Costs

As the preferred option in the NSLAQP does not include a Clean Air Zone (CAZ), it is proposed that any shortfall in funding for monitoring and evaluation of the scheme is to be provided by JAQU. Table 3-1 notes the monitoring and evaluation metrics and their associated costs. Further detail on the funding required for monitoring and evaluation of the preferred scheme can be found in the Financial Case.

*Table 3-1: Cost estimate of monitoring, evaluation and benefits realisation metrics, over 10 years (2020 prices)*

| Monitoring and Evaluation Metrics | Cost Estimate | Details |
|---|---|---|
| Air quality data | £613,300 | 664 diffusion tubes (includes existing and new tubes) per month<br>Includes staff costs to collect and collate data for both NuLBC and SoT |
| One-off ANPR data collection | £150,000 | Based on 15 ANPR data collection locations over 7 full days (i.e. 7 days x 24 hours) in 2025, including staff costs for site monitoring. Excludes post-processing analysis of the data |
| ANPR network<br>Retrofitted buses<br>Bus gates on Victoria Road and A53 | £270,000 | Maintenance of 9 ANPR cameras – 3 pairs for bus retrofit and 3 cameras |
| Automated Traffic Count (ATC) data | £181,100 | 13 new ATC location to have data collection and analysis. This includes cost of purchase, installation, monitoring and analysis over an 11-year period (1 year before and 10 years post implementation) |
| Bus patronage | £102,300 | The data is free from the bus operators annually at a service level however it needs to be processed and analysed over an 11-year period (1 year before and 10 years post implementation) |

# 4 Delivery Plan

## 4.1 Timeline of data collection

Data will be collected for the purpose of monitoring and evaluation up until one year after compliance is achieved. Existing and additional monitoring will be undertaken during the period of scheme delivery to provide some before scheme data and then the data collection will be continuous throughout the period of operation.

## 4.2 Data reporting

The authorities plan to share collected data with JAQU every three months, in line with guidance. Data will continue to be collected and shared with JAQU up to one-year after compliance is achieved. Bus patronage data will be reported locally.

The following reporting will be undertaken as per JAQU guidance:

- Before and after reports – sharing monitoring of $NO_2$ and traffic flow data every three months. The authorities will liaise with JAQU regarding any issues.
- Feasibility study monitoring – including vehicle fleet composition and bus patronage data by service, some of which is readily available.

## 4.3 Corrective action plan

Members of JAG and JOG will receive copies of the quarterly bulletins produced by central evaluation and therefore, in the event that further investigation is required all three local authorities, will be fully informed and engaged.

In the case of any issues noted through the monitored data, such as air quality compliance not being achieved or additional sites of exceedance arising, the authorities will look to correct these through outlined action plans.

JAQU guidance refers to the following two case study measures which might be needed if an element of the preferred option underperforms, such as air quality compliance not being achieved.

- **Rapid assessment case study** – this will provide quick and targeted data collection and analysis to understand why a scheme (i.e. a bus gate) within the preferred option is underperforming, which could include additional data collection and analysis and will be used to help inform any required policy change in order to achieve the local plans objectives. It is possible there could be multiple rapid assessments dependent on performance.
- **Deep dive case study** – this has a broader scope in that it would either focus on multiple schemes within the preferred option to provide a wider understanding of its impacts or on one element but provide a comparison with how similar measures have performed in another local authority area. This approach is more likely to be used if compliance was not being achieved across multiple locations.

Members of JOG will liaise with colleagues in JAQU to determine the most appropriate course of action which will then be considered by JAG. Consideration will need to be given to the resource implications of additional data collection and analysis.

The Management Case provides details of the project organisational structure and these processes will be adhered to.

The monitoring and evaluation plan is based on the preferred option working as forecast and therefore no contingency costs have been allocated; instead this cost is allowed for in the risk register and resultant quantified risk assessment.

# 5 Benefits Realisation

The preferred scheme aims to bring benefits to North Staffordshire as soon as possible, with particular focus on improvements in air quality. This will therefore adhere to the primary Critical Success Factors (CSF) of the Ministerial Direction for air quality objectives and benefits to be realised within the shortest timeframe possible. Table 5-1 outlines the key outcomes, as identified earlier in this Plan and notes the potential benefits arising from each outcome.

*Table 5-1: Preferred scheme key outcomes and benefits realised*

| Primary outcome | How the benefit will be realised |
|---|---|
| Achieve the statutory limit values for roadside NO2 concentration limits at the exceedance locations in the shortest possible time. | Improved public health, better air quality should improve health and reduce the risk of illnesses such as heart disease, lung disease or asthma. |
| **Secondary outcome** | |
| Increased awareness of air quality problem | Residents and businesses better informed about air pollution |
| Local buses more attractive encouraging greater use | Increase in bus patronage and journey quality |
| Traffic redistribution across the network without creating new sites of NO2 exceedance | Traffic management measures aim to reroute traffic away from the exceedance sites without creating new exceedance locations. |
| Lower exhaust emissions of NOx, released from buses | Bus retrofitting will reduce the amount of exhaust emissions released from more polluting, older bus engines, therefore reducing emissions across the designated bus routes. |

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE

## APPENDIX 23 - Communications and Engagement Strategy

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# 1 Background

In parts of Stoke-on-Trent and Newcastle-under-Lyme, traffic-related pollution is above legal limits. Along with a number of other towns and cities in the UK, the Councils were highlighted by the Department for Environment, Food & Rural Affairs (Defra) as local authorities where the UK's national air quality assessment has identified road links that are currently exceeding the annual mean nitrogen dioxide ($NO_2$) limit value, with exceedances predicted to continue in 2021, if left unabated.

In October 2019, Stoke-on-Trent City Council (SoTCC) and Newcastle-under-Lyme Borough Council (NuLBC) received Ministerial Direction to "*develop and implement local plans to reduce pollution to compliant levels in the shortest time possible*" and by a specific target date which is set as the start of 2022.

This means identifying a viable option that will, within these timeframes, ensure that annual average $NO_2$ concentrations on all local road links in the study area are 40µg/m$^3$ or less.

Following this direction, the Councils began work on developing the North Staffordshire Local Air Quality Plan to meet $NO_2$ limit values and secure local public health benefits.

Subsequent work on options development and appraisal led to the identification of a potential Preferred Option which would most effectively achieve the primary aim of achieving compliance in the shortest time possible.

This option was then compared against a benchmark Clean Air Zone (CAZ) D for its ability to achieve the primary aim. Details of the two options are summarised below.

- **Benchmark CAZ D** – an area that encompasses the three exceedance sites and within which non-compliant motor vehicles would be charged a daily fee (enforced through a network of ANPR cameras and a turnkey back-office system) for driving into or within the CAZ area.
- **Preferred Option** – an enhanced traffic management option, comprising a series of measures to restrict traffic on the A53 Etruria Road and Victoria Road, with peak period bus gates, some traffic management at nearby junctions and to restrict through traffic on nearby residential streets, and the expansion of an existing programme of bus retrofit to reduce harmful emissions from bus exhausts.

Details of the work to test the Preferred Option is explained within the OBC.

Defra guidance states; *'Clean Air Zones should involve engaging and informing the community to ensure they understand the importance of good air quality, the choices available to them, the impacts they make and how these contribute to a successful zone.'* [1]

In line with best practice guidance, the Councils recognised the need to engage and inform the public and key stakeholder groups of the Councils' plans to move forward with developing

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[1] Defra, DfT, Clean Air Zone Framework: Principles for setting up Clean Air Zones in England, (2020).https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/863730/clean-air-zone-framework-feb2020.pdf

options to address air quality exceedances in the Stoke-on-Trent and Newcastle-under-Lyme region.

As such, the Councils contracted Sweco, in partnership with Ricardo Energy & Environment, to undertake a communications and engagement strategy to gather feedback for and about the Councils' Local Air Quality Plan. This is in addition to gathering stakeholder intelligence on public attitudes and behaviours towards air quality, to help inform and shape development of the Councils' future plans.

Details of the communication strategy for the Councils' Air Quality Plan are detailed below.

The work undertaken for the Councils by Sweco and Ricardo Energy & Environment, is being supported by the communication strategy sub-contractors M·E·L Research and Global Action Plan (GAP). M·E·L Research is an independent social research company responsible for the build and analysis of the Councils' stakeholder engagement survey. GAP is a sustainability charity, serving as lead delivery partner for press and media engagement regarding promotion of the Councils' survey and stakeholder engagement events.

# 2 Communications plan rationale

The aim of the Plan is to engage stakeholders, raise awareness and understanding of the NSLAQP and to minimise impacts of the scheme. Key objectives include:

- Delivering coordinated communications across the different authority areas to keep stakeholders informed and updated
- Promoting key health messages and the health reasoning for improving air quality
- Ensuring appropriate levels of engagement and consultation take place

The strategy to support the North Staffordshire Local Air Quality Plan (NSLAQP) consists of 2 parts, adopting a phased approach to stakeholder engagement:

- **Phase 1: Understand stakeholder awareness, attitudes and perceptions about air quality and travel habits.**
    - Gathering insight on existing stakeholder awareness, understanding and perceptions of air quality helps to inform development of the communications plan for implementation, and shape the messaging used to target different audiences. It also contributes to the formation of an evidence base the Councils can utilise to support the NSLAQP.
    - Insight on stakeholder attitudes and opinions on air quality will be gathered via a phase 1 stakeholder engagement survey, supported by secondary research into existing stakeholder data held by the Councils.
- **Phase 2: Engage on the options to address air quality challenges in Stoke-on-Trent and Newcastle-under-Lyme.**
    - Following submission of the OBC, communications activities will focus on engaging stakeholders in the Stoke-on-Trent and Newcastle-under-Lyme region on the options set out in the NSLAQP. Two consultation events are planned later in 2020.

- The stakeholder engagement events will be an opportunity for the Councils to understand how stakeholders feel about the chosen options, and what support and information different stakeholder groups will require to help them adapt to any change or disruptions caused by implementation of the options.

The intention behind this 2-phased approach is to gather valuable intelligence on how best to engage with different stakeholder groups and identify which parts of the Councils proposals will drive the most engagement with stakeholders, and which parts are likely to be more challenging to convey, either due the technical nature of them or because they are viewed negatively or as controversial by stakeholders.

Such insight provides the Councils with the benefit of early visibility regarding potential challenges/barriers to implementation further down-the-line and allows for time to plan accordingly.

In addition, gathering nuanced stakeholder intelligence on attitudes, behaviours and motivational drivers will help to create a more robust, data driven communications plan, that is effective in engaging key stakeholder groups and hopefully, encouraging a good level of stakeholder 'buy-in' for the NSLAQP.

# 3 Stakeholder identification

The approach to identifying stakeholders seeks to consider a range of questions:

- Who is directly impacted?
- Who is indirectly impacted?
- Who is potentially impacted?
- Whose help is needed?
- Who knows about the scheme?
- Who will have an interest in the scheme?

By considering these questions and using an interest-influence matrix, see Figure 3-1 below, the Councils are able to consider the impact the project will have on different stakeholders and the level of influence stakeholders have on its success.

The matrix helps to identify key stakeholder groups and suitable methods of communication.

*Figure 3-1: Stakeholder matrix*

Level of influence

| | |
|---|---|
| **Address concerns to keep satisfied**<br>• Third sector<br>• Emergency services<br>• Environment and sustainability groups | **Active involvement**<br>• Internal stakeholders<br>• Councillors and Cabinet Members<br>• Central Government<br>• Local Partnerships<br>• Bus operators<br>• Private hire / hackney carriage<br>• HGV operators<br>• Highway authorities<br>• Cycle and walk / Actove travel groups<br>• Health and well-being groups |
| **Monitor and keep informed**<br>• Neighbouring authorities<br>• Housing and developers<br>• Tourism / Visitors<br>• Trade unions | **Engage to address concerns**<br>• Businesses<br>• Local residents and resident associations<br>• Community groups<br>• Freight / Road Haulage associations<br>• Educational establishments<br>• University Hospital |

Level of interest

The full list of stakeholders identified to date is set out below, however, as the project progresses, this list will be continuously reviewed and stakeholders will be identified and added as necessary.

- Business
    - Chamber of Commerce
    - Federation of Small Businesses
    - Large employers
    - Local Enterprise Partnership
    - SMEs
- Community groups
    - Youth groups
    - Sports & recreation groups
    - Citizens advice
    - Age UK

- Education
    - Secondary schools and colleges
    - Parent teacher associations
- Environment
    - Client Earth
    - Campaign for better transport
    - Friends of the Earth
    - Living Streets
    - Sustrans
- Health & wellbeing
    - CCCGs
    - Health professionals
    - University Hospital
    - Emergency services
- Housing & developers
    - Housing associations
    - Property developers
- Political
    - LA leaders
    - All councillors
    - Member of Parliament
- Third sector
    - British Heart Foundation
    - British Lung Foundation
- Transport
    - Bus and coach operators
    - Taxis / private hire
    - Freight
- Trade unions
    - Unison
    - Unite
- Internal officers

## Phase 1 – Communication activities (Pre-OBC submission)

# 4 Overview of engagement

Although the Councils Preferred Option is that of a non-charging CAZ, the potentially controversial nature of the project meant that it is important for the phase 1 communication activities to a) create a case for why action on local air quality is important and b) open up a space in current public discourse to allow for a future dialogue on action to address local air quality.

### 4.1 Engagement aims and objectives

The purpose of the Councils' pre-OBC communication and engagement activities was to achieve the following:

- Gather feedback from the public and key stakeholder groups on existing awareness, attitudes and perceptions about air quality, the potential health impacts of poor air quality and preferred travel habits of locals and workers in Stoke-on-Trent and Newcastle-under-Lyme.
- Raise awareness of poor air quality as a priority area of concern for the Stoke-on-Trent and Newcastle-under-Lyme region
- Identify the variable factors (language, topics, motivations etc.) that may improve or impede the likelihood of different stakeholder groups to engage with communications messaging regarding implementation of the Council's Preferred Option.

### 4.2 Desired outcomes

The intention for the pre-OBC communications activities was to do the following:

- Gauge level of public understanding regarding the potential health impacts of poor air quality and identify where gaps in collective knowledge exist, to inform and shape the communications plan for implementation.
- Cultivate an atmosphere that supports more tolerant and measured dialogue regarding the Councils' Preferred Option and local implementation plans.
- Collate an evidence base regarding public and stakeholder views on whether air pollution is seen as an area of public concern in Stoke-on-Trent and Newcastle-under-Lyme, and if there is evidence of collective public support for mitigation action to be taken locally.
- Understand and identify preferred channels and sources of information the public and stakeholders use to access information regarding air pollution, to inform future communications activities for implementation.

# 5 Early engagement with key stakeholders

During the OBC development process early engagement has taken place with key stakeholders to discuss and understand their attitudes towards the proposed scheme to help inform options and manage potential conflict. Specifically, meetings and discussions have been held with:

- Officers and Cabinet Members for SoTCC, NuLBC, and SCC

- Joint Air Quality Unit (JAQU)
- Highways England
- Local Partnerships
- Department for Transport (DfT)
- Department for Environment, Food & Rural Affairs (Defra)
- Transport operators
- Ambulance service
- Road haulage association
- University Hospital

Engagement with these key groups will continue as the project progresses and further engagement with other groups that are affected is planned to take place after the OBC is finalised as described later in this document.

# 6 Stated Preference survey

To inform the development of the OBC it was identified that a programme of stated preference surveys would be required to help determine the local transport reactions and preferences to a charging CAZ. The surveys, across all vehicle types, were undertaken during September and early October 2019. These surveys involved direct engagement and dialogue with drivers, businesses, operators and associations to help understand the likely responses of local people to the introduction of a charging CAZ. To promote engagement and raise awareness, the survey was covered via the Councils' own news channels and in local media.

Whilst the key objective of the surveys was to gather data and views, the surveys also helped to raise local understanding and awareness of the need for action, the potential plans and the work being undertaken.

# 7 Stakeholder engagement survey

On 26 February 2020, the Councils launched a public stakeholder engagement survey, seeking views on local air quality from people living and working in the Stoke-on-Trent and Newcastle-under-Lyme region.

The purpose of the survey was to find out how air quality affects people in Stoke-on-Trent and Newcastle-under-Lyme and measure awareness, amongst stakeholder groups, of the simple actions that can be taken to help improve air quality. Feedback from the survey was intended to help the Councils better understand local opinion on air quality, how best to engage residents in the air quality conversation and help inform the Councils' thinking in regard to strategy development and action for local air quality and implementation.

*Table 7-1: Survey summary*

| Service | Summary/activities |
|---|---|
| Launch date | 26 February |
| Survey duration | 10 weeks |
| Number of responses | 459 |
| Target stakeholder groups | Local residents, bus operators, taxi associations, emergency services, businesses, freight haulage representatives, active travel groups, chambers of commerce and other relevant bodies in the Stoke-on-Trent and Newcastle-under-Lyme region |
| Promotional channels | Council websites, social/digital media channels, elected members, Locality Action Partnerships, relationships with parish and town Councils |
| Response targets | 1,000 responses (minimum) |

The survey ran for 10 weeks between 26 February until 30 April. Overall, the survey received 459 responses in total, which is lower than the Councils intended target to gather a minimum of 1,000 responses from residents, workers and local businesses in the Stoke-on-Trent and Newcastle-under-Lyme region (see Table 7-1).

It should be noted that in the first 14 days of launch, the survey generated 408 responses. From week 3 of the survey being live, responses saw a marked decline. During the same time, the UK Government was ramping up measures to deal with the growing Coronavirus (COVID-19) pandemic.

Noting less interest amongst media contacts to publish and/or promote content on the Stoke/Newcastle Air Quality Survey, the delivery partners for the communications strategy suspected growing national concerns over the virus may have significantly diminished public and stakeholder interest in the Councils' public stakeholder engagement survey on air quality.

On 1 April, the delivery partners advised Council leads that it was highly likely that Government measures introduced nationally to curb the spread of COVID-19 had likely had a detrimental impact on public responses to the survey. In addition, attempts to actively promote the survey to local trade press or raise awareness of the potential negative impacts of poor air quality to locals in Stoke-on-Trent and Newcastle-under-Lyme – may not be well received by the public, posing a risk to the successful delivery of the entire communications strategy. There were concerns amongst the delivery team that active promotion of the survey may be viewed as insensitive at best, or at worse, offensive and would likely reflect badly on the Councils.

As such, it was agreed with the Council leads to leave the survey open to run for the duration of the scheduled 10-week period but halt active promotion of the survey, until the situation with COVID-19 is resolved. Given that the survey closed on 30 April, whilst the UK is still under lockdown, the delivery partners have agreed with the Councils to re-run the survey later in 2020, at a more appropriate time.

A new date for re-launch is yet to be confirmed and will be determined once the Councils are confident that meaningful and effective engagement with stakeholders can be achieved.

At the time of finalising this report for inclusion with the unapproved OBC, the Government has made very minor modifications to the lockdown arrangements and it is unlikely the delivery partners will be able to resume survey promotion activities sooner than July 2020, at the earliest.

The timing of the re-launch could have implications on the nature and content of the survey, if it is re-launched after the OBC has been approved by the three Councils.

### 7.1 Promotion

To raise visibility of the stakeholder engagement survey and encourage widespread community and stakeholder participation in the region, all of the available communication channels for SoTCC, NuLBC and SCC were utilised during launch.

Promotional channels:

- Council websites: A link to the survey was hosted on all three Council websites.
    - To ensure the survey was accessible to all who wished to complete it – the option for paper copies of the survey with Freepost return envelopes was available upon request from local libraries, Citizens Advice offices and on request by email or telephone from M·E·L Research via the Councils transport teams.
- PR activity/Press engagement: A press release on the survey launch was circulated to local press in the Stoke-on-Trent and Newcastle-under-Lyme region on Wednesday 26 February.
    - 24hours prior to launch of the press release, GAP engaged local newspapers, media outlets and online publications to generate anticipation ahead of the survey launch and encourage local coverage.
    - Within the first week of launch, coverage of the survey featured in several news outlets, shown in Table 7-2:

*Table 7-2: PR activity/Press engagement summary*

| Medium | Date | Feature |
|---|---|---|
| TV Broadcast | 26 February | 26 February – Good Morning Britain (ITV), 'news-in-brief' feature ran in first two morning bulletins |
| Radio | 9 March | 9 March – Signal Radio ran as a bulletin |
| Online | 26 February | 26 February – Air Quality News - New survey to find out how air pollution impacts local communities |
| | 9 March | 9 March – Signal - Survey asks residents and workers in Stoke-on-Trent and Newcastle about air quality |
| Print | 6 March | March - Stoke Sentential |

- In addition, the Councils were also approached about a TV interview opportunity with BBC regional television involving a Council spokesperson (the status of which is currently still pending due to the COVID-19 pandemic).
- To maintain visibility of the survey locally and encourage widespread participation, 2 follow-on press releases were due to be issued and circulated throughout the survey's 10-week duration. However, neither follow-on release could be issued due to promotional activities being halted in light of the COVID-19 pandemic and changes to the project delivery timeline for the OBC. Similarly, plans to identify and develop news content on 'local voices' in the region on people who have been impacted in some way by poor air quality were put on hold until later in the year, after the situation with COVID-19 subsides.

- Digital and social media channels: To help raise visibility of the survey launch and encourage wide spread sharing of the survey link and related information, GAP prepared a stakeholder communications pack containing; sample social media content, pre-written newsletter and PR content that was shared digitally with local community groups, businesses, schools, public services and the Councils to disseminate to their contacts and networks.
    - To support the Councils' internal communications teams to maintain ongoing social media and digital engagement regarding the survey, GAP ran a coaching session on 5 February for Council communications leads and their wider communications teams, as well as key customer service personnel, who man the Councils' enquiry helplines – to brief internal teams on the rationale behind the survey and how to respond to survey-related enquiries.
    - In addition, the teams were briefed on best practice for developing and sharing social media content, including tips and advice on the best time of day/day of the week for sharing content, frequency of posts, use of hashtags and related imagery to increase reach of content, advice on persuasive language and ideas for drafting future content to maintain prolonged engagement e.g. posting about key milestones or emphasising timing deadlines to create a feeling of urgency.

- Existing contacts and networks: Whenever possible, the delivery partners sought to leverage the Councils' existing networks and relationships with relevant contacts and intermediaries (i.e. Local Action Partnerships, and relationships with parish and town Councils) to raise visibility of the survey and encourage awareness.

Table 7-3 lists the different stakeholder groups targeted during Phase 1.

*Table 7-3: Engagement matrix*

| | Residents | Businesses | Schools | Community groups |
|---|---|---|---|---|
| Channels | Social media<br>GP surgeries<br>Libraries<br>Local papers | Social media<br>Local papers<br>Industry press | Social media<br>School newsletters<br>Local papers | Social media<br>Libraries<br>Religious building noticeboards<br>Local papers |
| Organisations and intermediaries | Housing associations<br>Local residents' associations | Bus operators<br>Taxi associations<br>Emergency services<br>Freight haulage representatives<br>Local union groups | Parent teacher associations | Active travel groups<br>Sustainability groups |
| Influencers | | Union leaders | Head teachers | Community group leaders<br>Religious leaders |

## 7.2 Interim survey analysis

The following section provides an overview of the key findings from the interim survey results from the Phase 1 stakeholder engagement survey. As stated in the previous section, active promotion of the stakeholder survey was halted 5 weeks into delivery due to concerns over the impact of the COVID-19 pandemic on response rates.

As a result of this, the following results represent a much smaller sample size (459) than was originally intended by the Councils and delivery partners. As such, the following feedback results may not be indicative of the views of the majority of people living and/or working in the Stoke-on-Trent and Newcastle-under-Lyme region.

However, these interim results are useful to consider the general themes that may be present in a larger sample size.

*Table 7-4: Demographic breakdown*

| Category | Interim results |
|---|---|
| Location/ Geographic spread | • 27% work in Newcastle-under-Lyme and 39% work in Stoke-on-Trent.<br>• One third (33%) are regular visitors to Newcastle-under-Lyme and 30% to Stoke-on-Trent.<br>• Only a small proportion of survey respondents run businesses in the two areas. |
| Gender | • 54% of responses received were from women (including trans women)<br>• 39.4% responses were from men (including trans men)<br>• 0.9% of respondents identified as non-binary<br>• 4.6% of respondents did not wish to state a gender |
| Age | • The most common age of respondents was 55-64 (20.9%)<br>• The second most common age of respondents was 45-54 (20.5%)<br>• 35-44 year olds made up the third largest group of respondents (19.6%)<br>• People under the age of 24 were among the lowest proportion of respondents, representing less than 6% of overall responses. |
| Ethnicity | • White respondents made up the largest proportion of respondents at 91.9%<br>• Asian/Asian British and Mixed/multiple ethnic group respondents made up .9% of responses respectively<br>• Black/African/Caribbean/Black British respondents accounted for .2% responses<br>• 0.9% of respondents did not wish to state their ethnicity |
| Disability | • Non-disabled people made up 81.5% respondents<br>• People with disabilities accounted for 13.3% of respondents<br>• 5.2% respondents did not wish to state their ability |

Overall, the majority of responses to the survey were from people based either in Newcastle-under-Lyme or Stoke-on-Trent which shows the survey was successful in targeting respondents in the key target areas (see Table 7-4). The interim results show more women completed the survey than men and the most responsive age groups were those respondents aged 45 or more. People aged 35-44 were the next biggest group. These results indicate that people of middle-age or older, were more receptive to the communications messaging about the survey than those from a younger cohort. This could also indicate that more needs to be done to engage those under 35 moving forward and it may be worthwhile for the Councils and delivery partners to explore additional and/or alternate methods of engagement to reach underrepresented groups.

Thoughts on air quality:

- *Overall, the majority of respondents to the survey rated air quality in the region as being either 'Fairly poor' (23.7%) or 'Very poor' (22%).*
- *22.9% of respondents thought air quality in the region was 'Fairly good', whilst a smaller proportion rated local air quality as being 'Very good.'*

The combined proportion of respondents who found air quality to be either 'Fairly poor' or 'Very poor' is greater than the combined proportion who rated air quality positively. As such, these interim results indicate that air quality in the region is of concern for people living and working in the Stoke-on-Trent and Newcastle-under-Lyme area.

Links between poor air quality and breathing:

- *74.3% of respondents indicated that they think poor air quality can have a 'Major impact' on people's breathing. A further 18.3% of respondents indicated that they think poor air quality can have a 'Moderate impact' on people's breathing.*
- *Only 16% of respondents felt poor air quality can have an impact on people's breathing.*
- *2.4% did not know what impact poor quality can have on people's breathing.*

The above results indicate that the majority of respondents to the survey are already aware that poor air quality can impact respiratory health. Only a small proportion of respondents felt that the health risks posed by poor air quality were minor and an even smaller proportion were unaware of any link at all.

These interim results indicate that future communications messaging emphasising the negative impacts of exposure to poor air quality is likely to resonate with local people and carries a low risk of being rejected by different audiences. As such, including messaging around the health impacts of poor air quality should be effective in engaging interest in any local campaigns regarding the Councils' air quality measures.

*Table 7-5: Environmentally friendly behaviour*

| Behaviours | All (n=459) | NuLBC (n=259) | SoTCC (n=171) |
|---|---|---|---|
| **Avoided idling a vehicle (i.e. running a vehicle's engine when the vehicle is not moving)** | | | |
| I have done this, primarily to reduce pollution | 50% | 49% | 48% |
| I have done this, but not primarily to reduce pollution | 20% | 19% | 21% |
| I have not done this | 30% | 32% | 21% |
| **Eco-driving (e.g. minimising breaking and acceleration, limiting driving speed)** | | | |
| I have done this, primarily to reduce pollution | 35% | 38% | 32% |

| | | | |
|---|---|---|---|
| I have done this, but not primarily to reduce pollution | 29% | 27% | 30% |
| I have not done this | 36% | 36% | 38% |
| **Walked or cycled instead of driving short distances** | | | |
| I have done this, primarily to reduce pollution | 28% | 38% | 26% |
| I have done this, but not primarily to reduce pollution | 50% | 51% | 48% |
| I have not done this | 23% | 22% | 26% |
| **Switched to driving a less polluting vehicle (i.e. with lower emissions)** | | | |
| I have done this, primarily to reduce pollution | 17% | 15% | 18% |
| I have done this, but not primarily to reduce pollution | 8% | 7% | 11% |
| I have not done this | 76% | 78% | 72% |
| **Used public transport instead of making journeys in an individual vehicle** | | | |
| I have done this, primarily to reduce pollution | 12% | 10% | 15% |
| I have done this, but not primarily to reduce pollution | 26% | 27% | 23% |
| I have not done this | 62% | 63% | 63% |

Whilst the majority of respondents for both Stoke-on-Trent and Newcastle-under-Lyme claim to consciously adopt certain driving behaviours (i.e. avoid idling the vehicle's engine when the vehicle in not moving or minimising breaking and acceleration, limiting driving speed), the same level of consciousness does not appear to be present for alternative forms of travel (see Table 7-5).

Interestingly, the majority of people who walk or cycle instead of driving short distances, claim to do so for reasons that are not primarily to do with reducing pollution.

This indicates that future messaging encouraging use of alternative or 'cleaner' forms of travel are likely to be more effective if such messaging emphasises non-pollution related benefits. i.e. emphasise the benefits to personal health of individuals who opt to walk, run or cycle.

This is not to say that the positive impacts to air quality should not be mentioned. Indeed, there is no evidence to suggest that such messaging would be rejected, only that it doesn't seem to be the primary reason for such behaviours. It is possible that dovetailing messaging about improved personal health with messaging about also helping to improve air quality, may have a complementary effect and cause messaging to be more effective through; a) resonating with people who already adopt healthier travel habits; and b) reinforcing existing good behaviour by highlighting the positive impact on local air quality. A ‘2-for-1’ to put it another way.

Behaviours regarding switching to a less polluted vehicle or using public transport instead of making journeys in an individual vehicle – overall, have lower numbers of respondents that adopt such behaviours compared to those that don’t. This suggest that there is work to be done to encourage locals in the region to invest in less polluting vehicles and/or use public transport more often.

With this in mind, future messaging may need to emphasise the benefits of using public transport and consider ways to make this option more attractive to the local community.

Similarly, messaging about the benefits of investing in cleaner vehicles is probably an important theme to incorporate into long-term communications. Regular, consistent messaging over a long period of time may help to shift attitudes and encourage behaviour change that moves away from cheaper, more polluting vehicles – to seeing investment in cleaner models as a worthwhile investment that is better for individuals and local air quality.

Only 7% of respondents indicated a willingness to pay a congestion charge to enter areas with high levels of traffic. This low level of willingness to pay a congestion charge would suggest that the Councils’ preferred non-charging option is likely to be better received in the Stoke-on-Trent and Newcastle-under-Lyme region, than the Benchmark CAZ D option. If this interim response rate is indicative of similar trends in a larger sample size, it is likely that any charging option would carry with it far greater risk of being rejected by the local community.

Sources of information:

- *Regional news reports, Facebook and national news reports appear to be the top 3 most popular sources of information for info about levels of air quality amongst respondents. Response rates for these options range between 20%-34% of all respondents.*
- *Mobile phone weather apps, word of mouth, general web searches, local Council website, community groups and local Council email/newsletter make up the second tier of sources with response rates ranging from 10%-17% of all responses.*
- *Government websites (e.g. Defra), Twitter, other social media channels and Council events make up the 3rd tier sources – with the lowest response rates ranging between 4%-9%.*
- *One third of respondents indicated that they do not actively search for information on air quality.*

These interim responses suggest that future messaging regarding local air quality news is likely to reach more people in the Stoke-on-Trent and Newcastle-under-Lyme region if messaging is pushed through regional and national news outlets. As such, targeted/tailored PR content could be an effective tool in communicating future campaign messaging.

In addition, Facebook appears to be a more effective social media channel than other well-known social media channels like Twitter or LinkedIn. Any future communication activities should probably look to incorporate this low-cost option into regular communications delivery.

Council websites, emails and/or newsletters, and local community groups appear to be effective secondary sources of information so future communications planning should probably also look to utilise those channels to push targeted campaign messaging.

- *When considering where to find out about levels of air quality in the future, around two-fifths (42%) of respondents would prefer to use their local Council website and a similar proportion (38%) would be interested in a local Council email or e-newsletter.*

The above indicates that the majority of respondents would like their local Council to provide information on local air quality either via the Council website or in a Council email/newsletter. SoTCC already produce a Council newsletter that could be circulated to residents living in both Stoke-on-Trent and Newcastle-under-Lyme. As such, this may be a useful resource to disseminate campaign messaging regarding air quality in future.

- *When considering future topics about levels of air quality in the future, around four-fifths (82%) of respondents would like to know where the air pollution hot spots are and what is being done to tackle air pollution.*

The above results indicate that there is much interest amongst respondents for information on the distribution of air pollution locally and an appetite to know more about the Councils' plans regarding air pollution.

This feedback indicates that there is overwhelming support amongst respondents to see something done about air pollution locally – which should in turn mean, that the Councils decision to take action in regard to improving local air quality is more likely to be accepted than rejected by people in the region. Of course, support may vary depending according to specific measures but generally speaking, action to tackle air pollution should be more supported than inaction to address local value exceedances.

# Phase 2 – Communication activities (Post-OBC submission)

# 8 Overview of engagement

The Phase 2 communication activities will build on the work from Phase 1 – which sought to encourage the public and key stakeholder groups to consciously recognise local air quality as a priority area for public concern, requiring local action. With the Phase 2 activities, the delivery team aims to expand on local interest further by inviting the public and wider stakeholders to participate in an open dialogue regarding the Councils' plans to address local air quality.

This will primarily be done through the delivery of two public stakeholder engagement events.

### 8.1 Engagement aims and objectives

The aims and objectives for engagement during Phase 2 are:

- Clearly communicate to the public and relevant stakeholders the Councils' Preferred Option
- Provide opportunities for the public and stakeholders to ask questions and access information regarding the Preferred Option.

- Provide a forum by which to gather feedback from the public and stakeholders on the Preferred Option.
- Ensure feedback is analysed in a timely and meaningful fashion to enable the Councils and Elected Members to make informed decisions regarding implementation.

### 8.2 Desired outcomes

The intention for the post-OBC communications activities is that all residents and stakeholders in Stoke-on-Trent and Newcastle-under-Lyme:

- Have a good understanding of their Council's wider clean air plan and understand the importance of reducing air quality value exceedances locally in order to protect public health.
- Are aware of the proposed measures and understand the potential impacts of implementation on their lives, work and/or business.
- Feel engaged and well-informed about the decision-making process for local actions and how this fits with national directives from Government.

## 9 Stakeholder engagement events

The public stakeholder engagement events will provide an opportunity for local people and key stakeholders to come together with Council representatives to learn about the Preferred Option and implementation plans. The events will be designed to create an open and welcoming environment that allows for in-depth discussion on the finer points of the NSLAQP. Participants will be invited to ask questions regarding areas of uncertainty or where they feel more information is needed. The delivery partners and facilitators at the events, will work to capture feedback and insight from participants that can help to better inform the communication plan for implementation.

#### 9.1.1 Current delivery status

Kick-off of the Phase 2 activities was originally scheduled to begin from late March/early April 2020. However, due to uncertainties regarding progression of the Preferred Option and revisions to the OBC submission deadline, and the outbreak of COVID-19, the Phase 2 activities have been moved back until later in 2020.

Although, the timings for delivery of the phase 2 activities is yet to be agreed, the date of delivery is certain to take place after the submission of the unapproved OBC to JAQU on 15 May 2020. As such, it is not yet possible to report on the Phase 2 activities or indeed, the completion of the communications strategy in full. As the Phase 2 activities are designed to raise awareness of, and open up a dialogue about the Preferred Option, it would not be appropriate to publicise the intended plans before they have been finalised and agreed by the necessary oversight committees and governing bodies.

It is intended that this Communications Plan will be a 'live document' that evolves as the communication activities are developed, promoted and take place.

Once the OBC is published, communications and engagement activities will focus on engaging the public and wider stakeholders on the options set out in the plan. Analysis of this engagement will then feed into finalising the NSLAQP to ensure that it is deliverable and supported by key stakeholders.

### 9.2 Promotion

Once the OBC is published and details of the Preferred Option is in the public domain, the delivery team for the communications strategy will commence the following activities to raise awareness of and encourage participation in the Phase 2 public engagement events.

Promotional channels:

- Council websites: A press release announcing the Councils' intentions to hold public engagement events with local people and key stakeholders on the Preferred Option – will be coordinated to be publicised in the news section of all three Council websites on the same date and time.
- PR activity/press engagement: A press release announcing plans to hold public engagement events will be circulated to local press in the Stoke-on-Trent and Newcastle-under-Lyme region on an agreed date and time.
    - Prior to publication of the press release, GAP will once again reach out early to local newspapers, media outlets and online publications to generate interest in, and encourage coverage of the Councils' public engagement plans.
    - As the weeks leading up to the engagement events progress, GAP will work with the Council leads to generate regular news content that can be shared with local press and media to maintain visibility of the engagement events and provide information on how the public and stakeholder groups can participate.
        - Work will be done to identify and develop content on 'local voices' within the region. The 'local voices' content will focus on stories of people who have been impacted in some way by poor air quality. Publicising human stories about local people should help campaign messaging better resonate with the local community and maintain stakeholder interest in the topic of local air quality, as well as encourage participation in the public engagement events.
- Existing digital and social media channels: GAP will prepare an updated stakeholder communications pack for the Phase 2 launch, highlighting; the purpose of the engagement events, why people should attend and how members of the public can sign up/participate.
    - As before, the communications pack will contain sample social media content, pre-written newsletter and PR content that can be shared easily online.
- Existing contacts and networks: Similar to Phase 1, the delivery partners for the communications strategy will seek to leverage the Councils' existing networks and relationships with relevant contacts and intermediaries (i.e. Local Action Partnerships, and relationships with parish and town Councils) once again to raise visibility of the public engagement events.
- The delivery partners will seek to engage the same range of stakeholder groups as before, building on the groundwork laid during Phase 1.

- Target stakeholder groups: Local residents, bus operators, taxi associations, emergency services, businesses, freight haulage representatives, active travel groups, chambers of commerce and other relevant bodies in the Stoke-on-Trent and Newcastle-under-Lyme region.

## 9.3 Variable options for Phase 2 engagement

### 9.3.1 Timing of survey re-launch

As mentioned earlier, the timing for re-launching the stakeholder engagement survey is yet to be decided and the approved OBC is yet to be published. These two combined factors create two possible scenarios for re-launching the stakeholder engagement survey.

#### *9.3.1.1 Scenario A: Re-launch survey before OBC is in the public domain*

The same survey questions from Phase 1 can be re-used as details of the Preferred Option would not be in the public domain yet. Therefore, to update the survey content to reference them would be inappropriate.

#### *9.3.1.2 Scenario B: Re-launch survey Post-OBC being in the public domain*

The survey questions and design may need to be updated to incorporate details of the Preferred Option, as the OBC will be published and available. Once the OBC is available publicly, it is logical to anticipate the public and wider stakeholders will expect to see details of the Preferred Option reflected in the survey questions.

Re-launching the survey without updating the survey questions to directly reference the Preferred Option carries a risk of the survey and the Councils wider engagement activities being viewed as ‘closed’ and not transparent.

If the survey is re-launched once the OBC is in the public domain, it could serve as an effective support tool to the stakeholder engagement events. Effectively providing another avenue through which individuals who are unable to participate in the stakeholder events can feed through their views to the Councils on local air quality. Again, the possibility of running both activities in parallel would depend on the finalised timeline for the Phase 2 activities.

## 9.4 Format of stakeholder engagement events (Face-to-face vs. online)

Although the format for the stakeholder engagement events is intended to be face-to-face – UK lockdown restrictions due to the COVID-19 pandemic – may mean that the Councils will have to explore online, digital alternatives through which to host the events with the public and wider stakeholders. A potential option for online engagement could be the use of Zoom – a digital, video conferencing application that allows for multi-user participation and engagement.

At the time of finalising this report, there is no confirmed date for easing lockdown restrictions. Indeed, current Government advice is that social distancing measures should remain in place.

Depending on when timing for the stakeholder events has been formally agreed, the delivery partners will consult with the Council leads regarding the most appropriate format for delivery.

# 10 Implementation

Following approval from scrutiny and publication of the full and approved OBC, the Councils will proceed with consultation on the final option and development of plans for local implementation.

At this stage, the communications plan will be updated to include an approach and activities to inform and engage local residents and stakeholders of the option being taken forward and likely impacts of local implementation.

Communications on local implementation would aim to:

- Inform local people and key stakeholders of actions to be implemented locally, as part of the Preferred Option to improve air quality
- Provide on-going communications on progress of the implementation process and highlight any observed/measured improvements to air quality as a result of the local measures. (Highlighting any measured improvements or observable reduction in traffic-related air pollution once local measures are introduced, provides justification for their implementation and helps to validate the approach taken by the Councils. In addition, such messaging helps strengthen public engagement with stakeholders by demonstrating transparency of process – through providing regular updates on the real-life impacts/results of the Councils' Local Air Quality Plan as they emerge.)
- Continue to build on earlier engagement that has taken place to inform local awareness of air quality, through regular, ongoing local messaging that supports and reinforces adoption of better travel behaviours. i.e. regular issuing of communications around using alternative forms of travel (run, walk, cycle) to get around, coupled with highlighting of the positive impacts this has on the health of individuals and local air quality in general.

The key messages incorporated into the communications plan for implementation and beyond, will reflect the information and data gathered during phase 1 and 2 of the communications strategy.

Depending on the level of impact or transition required locally as a result of the final option selected, additional communication and engagement activity to the stakeholder engagement events, may be needed to effectively target specific stakeholder groups during implementation. This will be reviewed as part of the evolving communications plan as it is further developed.

Without completion of the phase 1 and phase 2 communications activities or the submission of the full OBC, it is difficult to define the exact nature of the communications activities that will be delivered during implementation. However, the approach taken will always seek to utilise the full range of communication channels available to the Councils, in order to maximise full reach of messaging – in addition to identifying the right mix of channels to successfully engage different stakeholder groups.

## 10.1 Tools and activities

Communication activity will be underpinned at every stage with key messaging – to be set out within a Key messages document – to ensure a consistent and positive message is delivered. The tools and activities to be used will be developed as the project progressed but it is anticipated will involve a mixture of the following:

- Face to face meetings
- Presentations
- Media FAQs
- NSLAQP briefing note
- Focus Groups
- Website and social media – particularly utilising existing resources such as the
- Letters, email and mail shots with project updates
- Project newsletter
- Community advocate engagement
- Advertisements
- Statutory notices
- Engagement with schools, hospitals, neighbourhoods and businesses

# 11 Challenges and risks

There are a number of challenges and risks associated with the success of the communications plan and stakeholder engagement. At present the COVID-19 pandemic means there is uncertainty around future timescales and also the impact on travel behaviour and local attitudes is unknown.

In addition, the following key challenges and risks are noted:

- Timescales associated with delivery and achieving exceedance in the shortest possible time may impact quality and scale of engagement
- Negative opinions and feedback received by stakeholders
- The implementation of NSLAQP is subject to funding approval, a delay to funding will delay roll-out of communications
- Reputational risk to the councils

# 12 Roles and responsibilities

As part of the project governance organogram (described within the OBC) a Communications Sub-Group has been established to support the Joint Advisory Group and Joint Officer Group. This sub-group consists of:

- Phil Jones, Heads of Communications at NuLBC
- Emma Rodgers, Strategy Manager for Communications at SoTCC
- Paul Dutton, Senior Media Officer at SCC

Together, they will be responsible for developing and implementing, both directly and with partners, the Communications Plan.

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Summary of the T-IRP's advice on XXX's Technical Evidence (TIRP1)

| | Initial Evidence Submission | | | | | | Full Business Case | | |
|---|---|---|---|---|---|---|---|---|---|
| | Panel comments | RAG | LA response (please cross reference updated report sections) | Page reference | RAG | LA response (please cross reference updated report sections) | Panel comments | RAG | LA response (please cross reference updated report sections) |
| **Transport modelling** | | | | | | | | | |
| **Scope and Suitability (extent and purpose of the tool given the policies potentially being considered)** | Please provide maps of the current traffic speeds across the links of interest, vs those modelled. | a/g | We propose to provide a comparison using GIS of the 2015 model speeds against 2018 Trafficmaster data by direction for each time period for the following corridors where we have exceedances:<br>1) A53 - Sandy Lane to A500<br>2) Bucknall New Road - Limekiln Junction to Potteries Way<br>3) Victoria Road - Joiners Square to City Road<br>The corridor approach is better given the differences in the defined links between Trafficmaster data and the NSMM model links | See T2, Figures 5-8 and 5-9 and accompanying text | | | | | |
| **Validation (keeping in mind the scope)** | Table 3-1 indicates no overall traffic growth between 2015 and 2018 and is useful evidence. Only LGV traffic has increased significantly, a pattern common to most urban areas. The decision to stick with the 2015 un-updated calibrated model to represent the 2018 situation seems reasonable based on the evidence presented | a | We are pleased there is agreement to use the 2015 model to represent 2018 | n/a | | | | | |
| | Where do Home based LGV commuting and EB trips get included, given that NHb LGVs are what is in the GV segment? (p.21) | | LGVs and HGVs cover all trip purposes (including commuting and employers business) in the demand model, the level of disaggregation by trip purpose is unlikely to have a material impact. In the assignment model LGVs and HGVs are assigned as all purpose vehicle matrices, so therefore there is no impact on forecasting / option testing work. The assignment model is only by vehicle/compliance type. It should also be noted that it is an incremental demand model, the base observed vehicle matrices for LGVs and HGVs are derived from factored RSI data capturing all purposes. | see T2 p22 (updated) | | | | | |
| | It appears the trip generation are not NTEM based, but this is not automatically problematic, provided the local rates have been derived with good data. Little information is provided about their source.<br>Page 22 and 23; is the trip generation model in future years applied only to the change in the number of households or to all future households? | | Trip generation rates are based on RSIs and household interview surveys, future trip generation rates have been further checked/benchmarked using TRICs. The future trip generation model covers all trips but the updated trip generation rates are only applied to the change in land use for the forecast years, i.e. the change in households, jobs and retail GFA between base and forecast year multiplied by the future trip generations rates. | see T2 p22 and 23 (updated) | | | | | |
| | "Roadside interview data have been used to derive origin and destination trip rates for employment, education, shopping and leisure." P.23<br>Does this imply that these NHB trip rates are for car trips only, excluding rail and bus? It would also be useful to know more about the date and the spatial coverage of these RSI surveys. The later p.28 indicates they are from 2009. To which trip end planning data are these rates applied? | | NHB trip rates are person trip rates covering all modes. More information will be provided on this, the planning data they are applied to and on the RSIs in an updated version of the report. | see T2 section 4.3.2 (updated) | | | | | |
| | P.24, T2 and p.36 T3 "2) The mean value of the LGV and HGV cost skims is taken." ??? Does this imply that the HGVs and LGVs are in a single distribution model. If so this would be inappropriate, given the major observed differences in their spread across road types and area types. Later discussions appear to indicate clearly that there are separate distribution models for HGV and LGV. | | Separate productions and attractions are derived for LGVs and HGVs and they are distributed separately through the distribution model to produce separate LGV and HGV trip matrices. | see T2 P24 and 25 (updated) | | | | | |
| | Section 4.8 Table 4.11, the high PT fare elasticities for NHBEB are dubious, while those for other modes are low. The network- based car elasticities of -14 for a 10% fuel cost change are low. But increase to -0.24 for a 20% change. The car time elasticity of -0.16 looks low. Could this be an indication of issues in the demand model? | | The 20% test is within TAG guidance for fuel costs, the lower number is likely due to the polycentric nature of N Staffs and the prevalence of shorter distance trips. For public transport again we are marginally outside the recommended TAG range however within it for the short term elasticity recommendation of -0.16 or above. The elasticities have come from local data as recommended by TAG, we also do not exclude concessionary fares which will likely have a significant impact. The car journey time elasticity is within the TAG range, i.e. less than 2. All the above is outlined in the provided reports. | see T2 P37, minor changes made | | | | | |
| | A5.8 looks at the GEH around the areas of air quality issues and indicates that the matches are perhaps adequate overall – What about by vehicle type GEHs, as the policies will impact differentially on vehicle types?<br>"Table 5 3 to Table 5 5 show the difference between modelled link flows and observed traffic counts for these locations" p.55,<br>Which Tables are these? If it means Tables 5.2 to 5.4, then a clearer explanation is needed of how to match up these three specific locations to the screenlines in the Tables. | | Further information will be provided in the updated reports regarding the flow validation by vehicle type at the exceedance locations. Appendix A provides flow validation by different vehicle types (cars, LGVs, HGVs etc) | See Table 5-9 and 5-10 | | | | | |
| **Baseline Forecasts (forecasting without measures)** | please indicate how the results would differ were NTEM trip rates and standard trip generation were used. | a/g | If NTEM trip rates were used this would affect the demand model matrices however the final car matrices are constrained to Tempro so the overall impact would likely be small | n.a | | | | | |
| **Modelling AQ Measures (forecasting after introducing the measures and the methodology for modelling those measures)** | T3:<br>Very little detail is provided about model structure and this makes the CAZ response modelling in Table 6.2 rather vague. However, such information as is provided generally appears suitable but of course much depends on the eventual application details, e.g. "Taxis are currently part of the car trip matrices; taxi demand will be separated out primarily using a universal factor from the ANPR survey data with some adjustment at locations of high taxi demand, such as the where taxi ranks are in the city/town centres and at Stoke-on-Trent rail station." P.20. | a | More detail on the how the charging CAZ has been modelled will be provided in a later version of the T3 report.<br>Note from the ANPR data taxi demand is very low in N Staffs representing less than 0.5% of all car traffic. | T3 report updated - sections 6 and 7 | | | | | |
| | "The NSMM transport model does not explicitly model walking and cycling trips, so a percentage reduction in car trips will be needed for related policies" P.37 | | Given the narrow congested corridors of the exceedance locations where there is not space to add in cycle facilities, cycling has not been looked at. It is not represented in the NSMM model. | See update to Table 6-2 in T3 report | | | | | |
| | A bit odd that there is no HbEB trip purpose distinguished, only NHbEB?, p.16 and p.33. Maybe the industrial structure with perhaps few management services within S&N make this an acceptable simplification. Into which other purpose is the HbEB added? | | HBEB is included in the commuting trip purpose in the NSMM transport model, i.e. home to work. Please note that the actual trip matrices that are assigned are all purpose by vehicles type and compliance, segmenting the demand model trip purposes further would unlikely have a tangible impact on the modelling work | n/a | | | | | |
| | Is it possible to include a light-touch active mode analyses in the places where there is likely to be mode shift? | | Given the narrow congested corridors of the exceedance locations where there is not space to add in cycle facilities, cycling has not been looked at. It is not represented in the NSMM model. | not required as active mode travel not modelled see updated Table 6-3 in T3 report | | | | | |
| **General** | The reports generally are clearly written but are rather short of detail on a number of important topics and with some sentences that raise questions that might or might not be significant | | Reports will be updated in due course with additional detail | | | | | | |
| **Behavioural assumptions** | | | | | | | | | |
| **Responses to measures** | It is not clear whether the model can represent the parking levies measures. How will these be incorporated? | a/g | The workplace parking levies measures have been screened out using demand analysis from select link analysis of the 2022 reference case traffic demand. From that work it became clear that the actual demand for non-compliant commuting cars that would be going to such zones would be very small especially when you allow for the spatial restrictions of the policy and the balance between private/parking spacing and the % of spaces that the employer rather than the employee would pay. The overall impact would be small and therefore it is was not worth undertaking further detail modelling or appraisal as part of the option testing. | See update to Table 6-2 in T3 report | | | | | |
| | The SP survey should if possible consider questions on the size of the charging zone, as multiple zone sizes are being considered. Is it possible to split the sample base for this purpose? If not possible, how will the results be applied to multiple zone sizes? | | The SP surveys did not consider different size charging zones given time constraints for carrying out the actual interviews but peoples response should not change significantly. The model will capture the impact of different sizes in terms of the amount of demand going to/from/within/through and across the cordon if different cordon sizes are tested. However the % demand responses will be constant unless the actual charge changes for any or all of the vehicle types. The SP surveys were based on other surveys provided by JAQU (Bradford and Bath), were also reviewed and agreed by JAQU and all comments incorporated. | See 7-1 in T3 report | | | | | |
| **Sensitivity analysis** | Please consult JAQU guidance and discuss with JAQU officers to agree best sensitivity testing to conduct for OBC | a/g | We are happy to discuss and agree with JAQU the sensitivity tests. | See updated section 4.1 in the T3 report | | | | | |
| **Overarching policies** | | | | | | | | | |
| **General** | Thanks for clear, well presented reports. | | | | | | | | |
| **Air quality modelling** | | | | | | | | | |
| **Tools** | Helpful to see maps of concentration distribution to determine areas of most concern | | | | | | | | |
| **Scope (incl. receptors)** | Please highlight the locations of the continuous monitors in AQ3 Fig 4. | a/g | This will be updated in the next issue of the report (pending additional feedback on results tables) | | | | | | |
| **Specific treatments (canyons, flyovers, gradients etc.)** | | | | | | | | | |
| **Calibration** | Zonal calibration should be avoided if possible as there is a risk it leads to overfitting of the base year data. Please justify the use of zones (by demonstrating suitability when compared to a single global calibration factor). | a | We have not used a zonal calibration factor for a number of measures, including the overfitting issue. Instead, a single global adjustment factor (1.89) was used as described in AQ3 section 3.2. All model results presented for the TIRP have used this global adjustment factor.<br>In AQ3 Section 2.3 ("Model verification"), figure 4 presents results for each area using different symbology, in order to allow patterns to be identified. However, these areas were not calibrated separately. The rationale for this decision (in line with the comments on the left) is given in Section 4.2 of AQ3.<br>In Section 4 of AQ3 ("Model uncertainty and sensitivity") we have presented results using zonal calibration as a sensitivity analysis, to illustrate roads which would exceed the AQO if this approach was used; this will allow the uncertainty in the global model calibration factor to be accounted for in the options development, but is not part of the model results for target determination. | | | | | | |
| **Meteorology** | | | | | | | | | |
| **Chemistry** | | | | | | | | | |
| **Emissions** | | | | | | | | | |
| **Outputs** | | | | | | | | | |
| **General** | Thanks for the well presented reports. | | | | | | | | |
| **Target determination** | | | | | | | | | |
| **TGL** | | | | | | | | | |
| **TGI** | | | | | | | | | |
| **General** | | | | | | | | | |
| **Analytical Assurance Statement** | | | | | | | | | |
| **Limitations of the analysis** | not reviewed at IES | | | | | | | | |
| **Risk of error / robustness of the analysis** | not reviewed at IES | | | | | | | | |
| **Uncertainty** | not reviewed at IES | | | | | | | | |
| **Use of the analysis** | not reviewed at IES | | | | | | | | |
| **General** | | | | | | | | | |
| **Measures Considered** | | | | | | | | | |
| | **In this section please provide a summary statement detailing:**<br>**the measure(s) being considered**<br>**the particular modifications to the transport model carried out to incorporate these measures**<br>**the locations in the documents where the details of these adjustments can be found**<br>**whether the measures require in model or off-model adjustments to incorporate the behavioural assumptions/responses to measures**<br>**the locations in the documents where the details of these assumptions can be found** | | | | | | | | |

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MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE

## APPENDIX 25 - T2 Local Plan Transport Model Validation Report

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

## Table of contents



## Appendices

# Executive Summary

The North Staffordshire Multi-Modal (NSMM) transport model has been successfully updated with Automatic Number Place Recognition (ANPR) data to allow the differentiation between compliant and non-complaint cars, LGVs, HGVs and taxis. This has then been successfully validated against traffic count and journey time data.

For most of the validation comparisons the validation is not significantly different to that achieved for the updated 2015 NSMM transport model which confirms that the disaggregation of the demand matrix has only resulted in small changes.

The 2015 base year model validates within acceptable tolerance levels from the previous validation exercise and as a result is suitable to be used for modelling emission strategies across compliant and non-compliant user classes to support the reduction of nitrogen dioxide ($NO_2$) emissions. Analysis of traffic count data has shown that traffic levels between 2015 and 2018 have not shown any net growth, with the model also validating well against 2018 traffic count data. This therefore removes any need to create an updated 2018 transport model.

This has been confirmed through three validation checks:

- Validation of the 2015 base model following disaggregation of the demand matrices against a conurbation wide dataset to ensure the disaggregation process has not unduly changed the level of validation
- Validation against the 2018 A500 screenline traffic count data
- Validation of the model against the 2019 ANPR data regarding the compliance splits

# 1 Introduction

## 1.1 Purpose of the Local Model Validation Report

The Local Model Validation Report (LMVR) describes the current model, the model development undertaken to improve its forecasting capabilities, and the resulting model validation.

The main body of this report is broken down into two sections:

1. **Travel Demand Calibration and Sensitivity Test Section (T2a) (Chapter 3)** that explains in detail the travel demand model calibration and the outcomes of the realism and sensitivity tests in line with TAG Unit M2 requirements
2. **Traffic Assignment Model Validation Section (T2b) (Chapter 4)** that explains in detail how the base year model validates and how it was modified using Automatic Number Plate Recognition (ANPR) data and is validated against real-world data.

This report is part of a suite of documents which must be viewed in collaboration with:

- T1 tracker table - a live document that demonstrates all the transport modelling requirements are being met
- T3 Local Plan Transport Modelling Methodology Report – which outlines the methodology for the transport modelling work to be undertaken

The purpose of the update to the NSMM transport model is to provide an analytical tool that will aid Newcastle-under-Lyme Borough Council (NuLBC), Stoke-on-Trent City Council (SoTCC) and Staffordshire County Council (SCC) in the development and implementation of Air Quality Local Plans. The work undertaken to enhance the model is designed specifically to give the user more granularity regarding classes of road vehicles and users which will enable greater certainty in forecasting the effectiveness of implementing a charging Clean Air Zone (CAZ). This additional detail will allow the users to focus on reducing $NO_2$ exceedances in North Staffordshire as required by the Ministerial Direction for third wave local authorities.

## 1.2 Development background

The need to develop this additional capability comes as a direct result from a High Court ruling, where ministers were required to set out any additional steps that could be taken by the councils to speed up compliance with the $NO_2$ limits, which have been exceeded since 2010. The Government said it will work with the authorities through its Joint Air Quality Unit (JAQU) to support and develop plans to help reduce $NO_2$ emissions.

## 1.3 Report structure

This LMVR is divided into the following sections:

Chapter 2 – provides background information on the NSMM transport model including the scope and specification of the modelled network and traffic zones as well as vehicle disaggregation

Chapter 3 – Travel Demand Calibration and Sensitivity Tests (T2a)

Chapter 4 – Traffic Assignment Model Validation Section (T2b)

Chapter 5 – Summary of the validation of the updated NSMM transport model and whether it is fit for purpose

## 2 Model description and specification

The NSMM transport model covers the whole of the urban areas of Stoke-on-Trent and Newcastle-under-Lyme and extends into the surrounding and wider areas. The full model extent is shown in Figure 2-1 with the detailed and peripheral model extents shown in Figure 2-2 and Figure 2-3. Both road and rail links are modelled. Within the detailed model area junctions are modelled as shown in Figure 2-4.

### 2.1 Structure of the NSMM transport model

The structure of the NSMM transport model consists of three main modules:

- Highway Assignment Model
- Public Transport Assignment Model
- Demand Model

The highway model is both link and junction based.

### 2.2 Transport modelling software

The NSMM transport model has been refined and updated using CUBE Voyager Version 6.4 transport modelling software.

### 2.3 Modelled time periods

The modelled time periods are as follows:

- AM peak hour (08:00 - 09:00hrs)
- Inter-Peak (IP) hour (14:00 - 15:00hrs)
- PM peak hour (17:00 - 18:00hrs)

### 2.4 NSMM transport model zones and sectors

The NSMM transport model has 288 zones which are split as follows:

- Internal zones 1 – 207 and 275 – 288 zones (see Figure 2-5, Figure 2-6 and Figure 2-7)
- Peripheral zones 208 – 233 (see Figure 2-8)
- Regional zones 234 – 255 (see Figure 2-9)
- National zones 256 – 274 (see Figure 2-10)

The internal zones and modelled transport network represent the greatest level of detail to capture local routing and travel demand responses. The peripheral zones form a ring of buffer zones just outside the detailed modelled area, with a dimension a little larger than the internal zones to provide realistic travel demand to and from these areas.

Regional and national zones are far coarser, for example Scotland is represented by a single zone, this permits representation of destination choice and travel opportunities between external zones and between internal and external zones. Capturing external to external demand is important in the NSMM transport model area, as it includes roads carrying significant through traffic such as the M6, A500 and A50 Trunk Roads.

As part of the NSMM model update for the Etruria Valley Link Road (EVLR) Project, an additional 14 zones (zones 275 to 288) were added in the Etruria Valley, Festival Park and Middleport areas and are shown in Figure 2-11.

*Figure 2-1: Extent of modelled road and rail network*

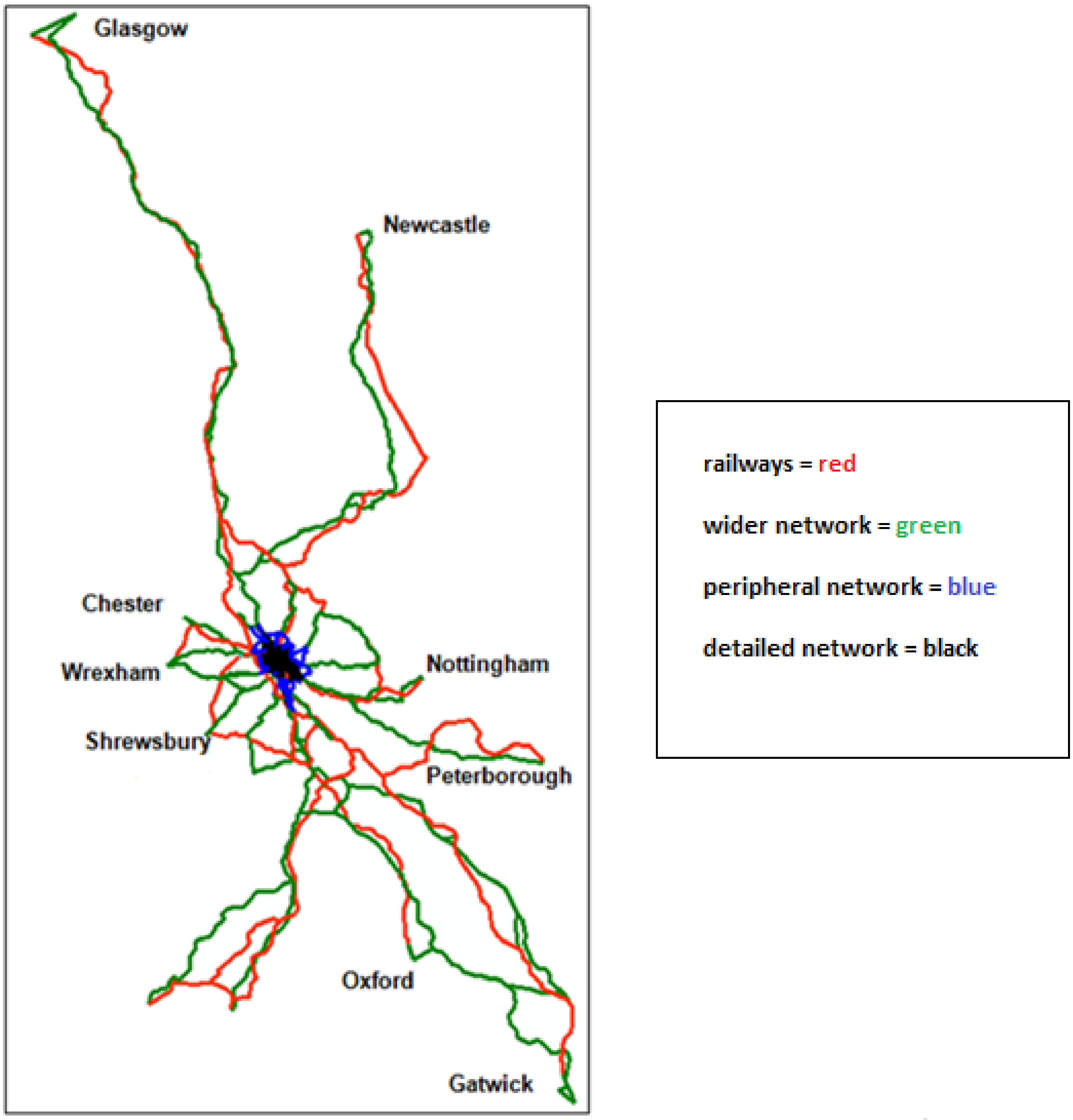


*Figure 2-2: Extent of modelled peripheral and internal road and rail networks*

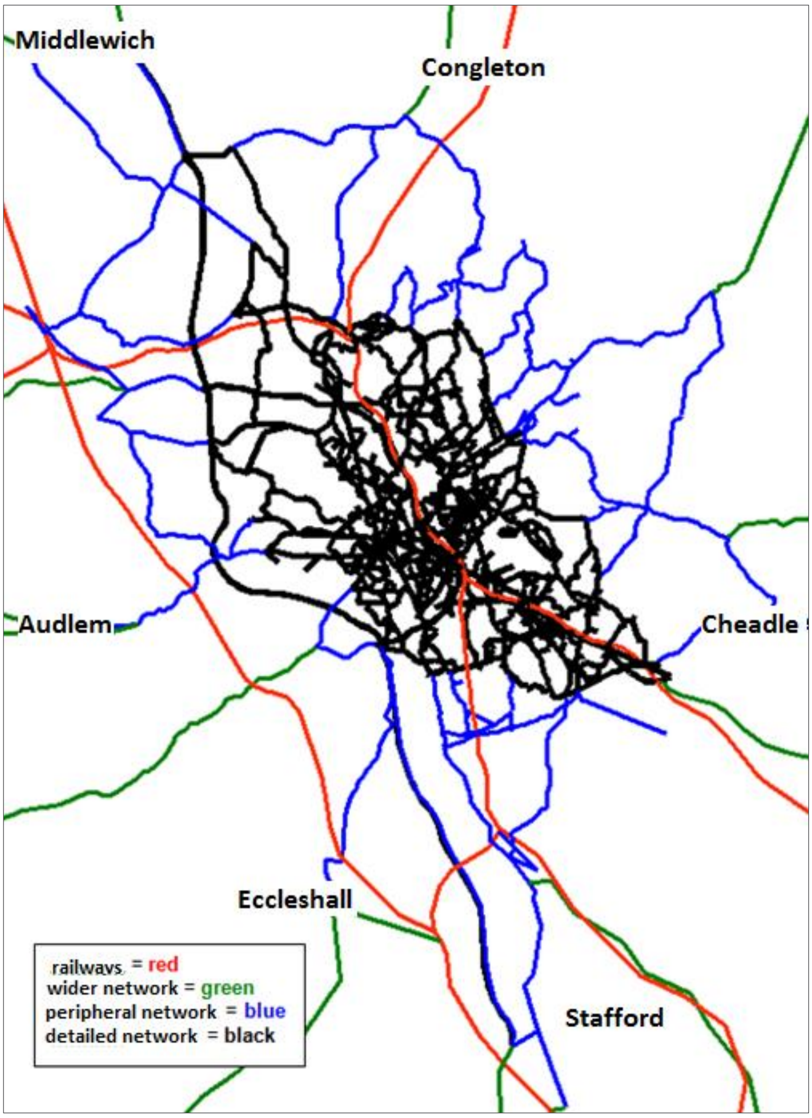
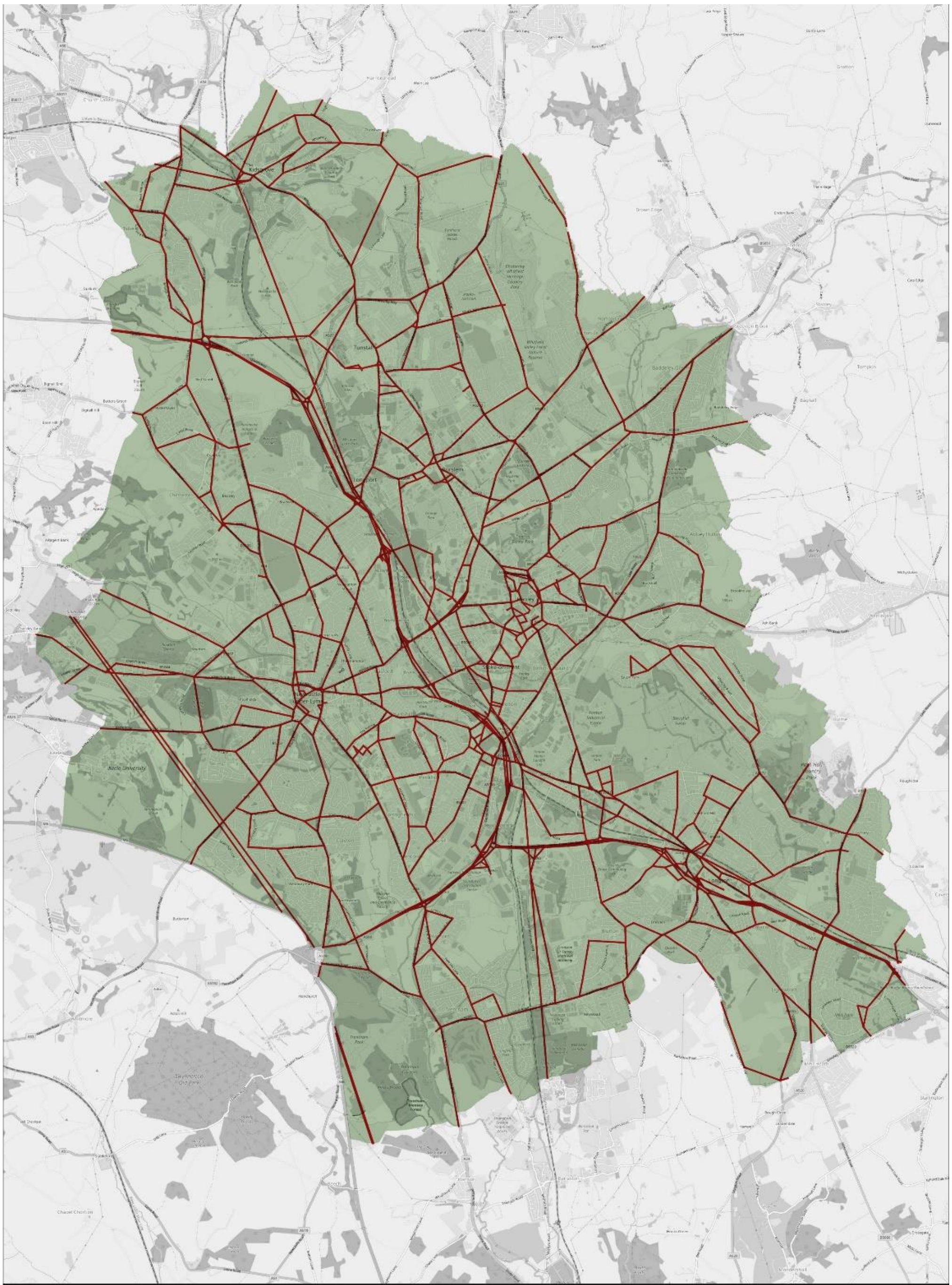


*Figure 2-3: Modelled internal road network*



| | |
|---|---|
| Modelled Internal Road Network | SWECO |
| © OpenStreetMap contributors, CC-BY-SA | |

*Figure 2-4: Modelled junction*

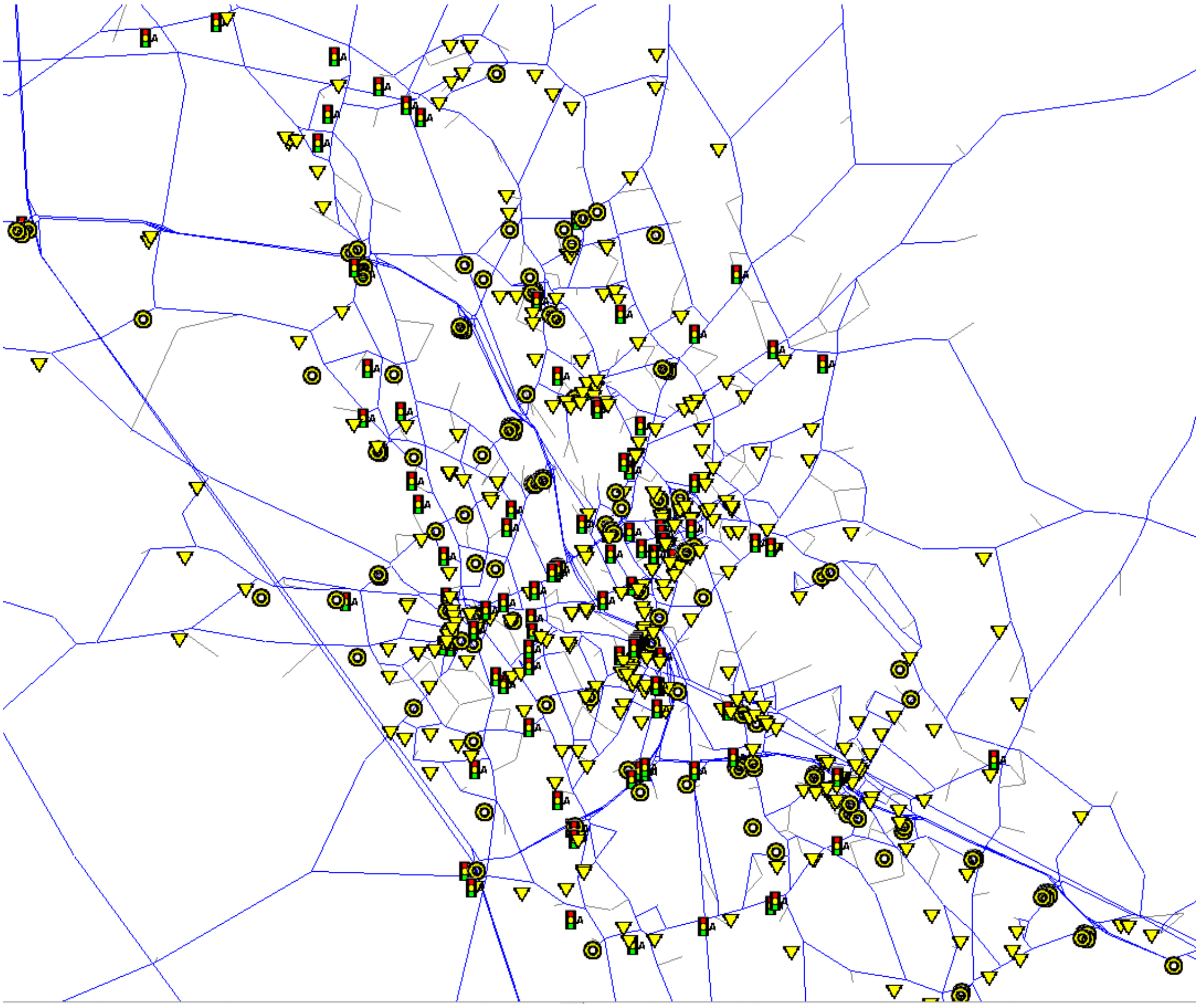


Figure 2-5: Internal transport model zones (north)

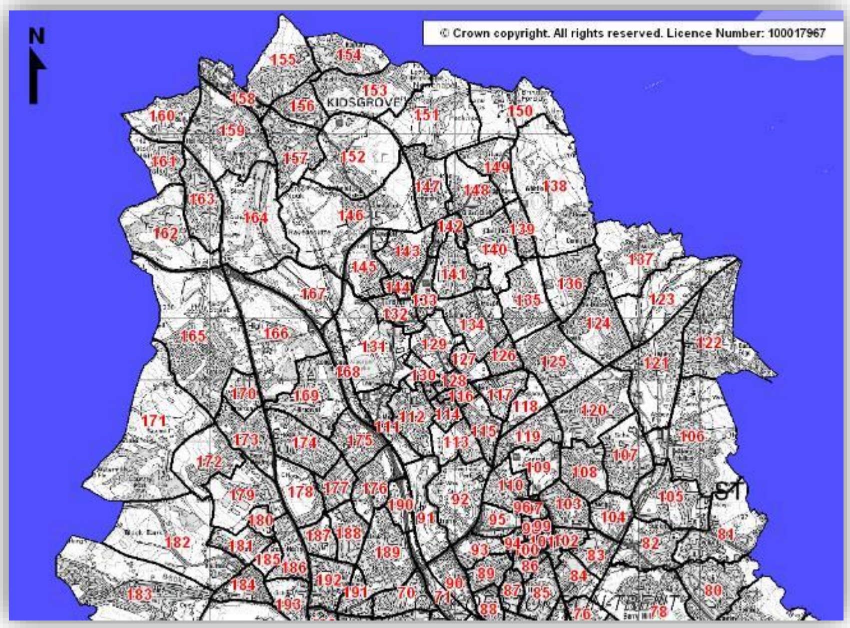



Figure 2-6: Internal transport model zones (south)

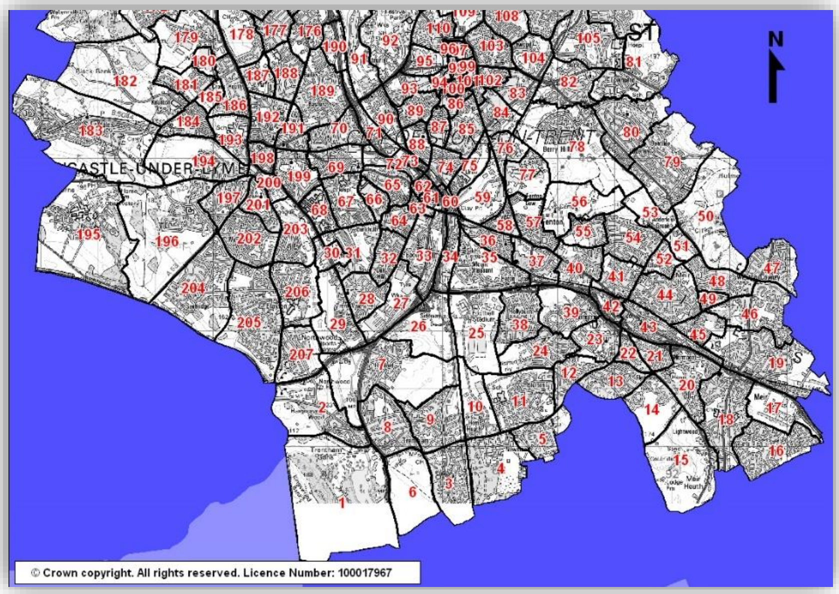


*Figure 2-7: Internal transport model zones (central area)*

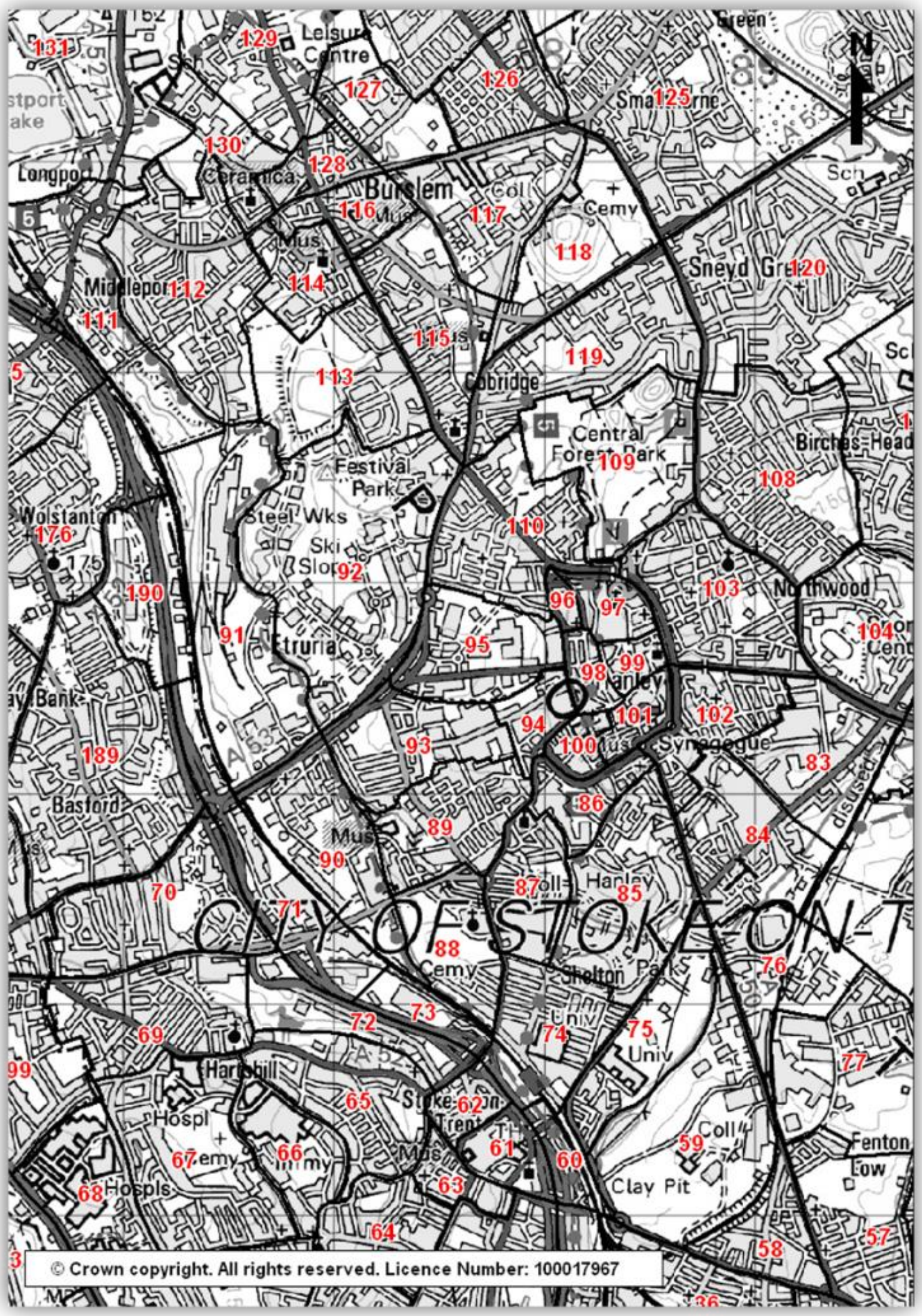


*Figure 2-8: Peripheral transport model zones*

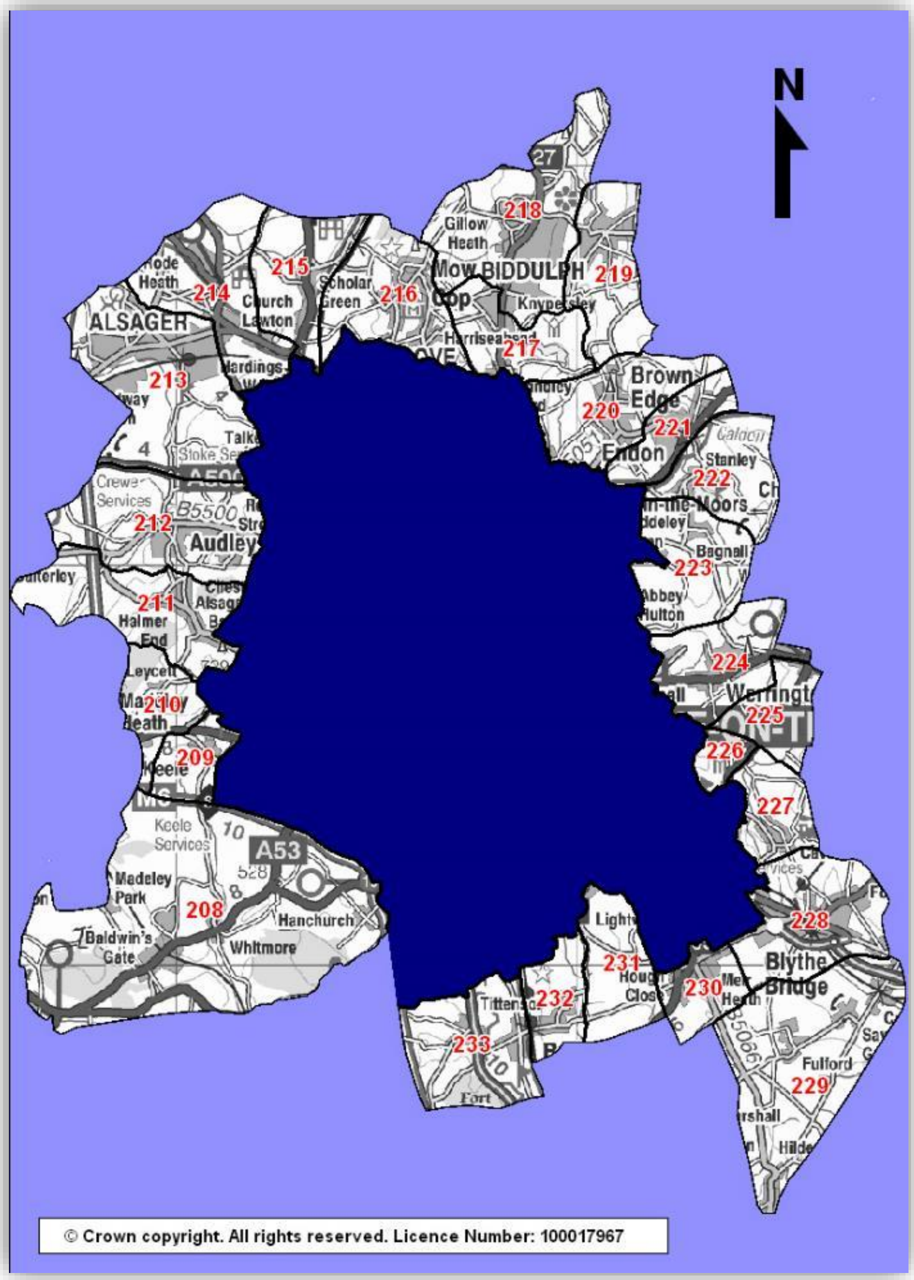


Figure 2-9: Regional transport model zones

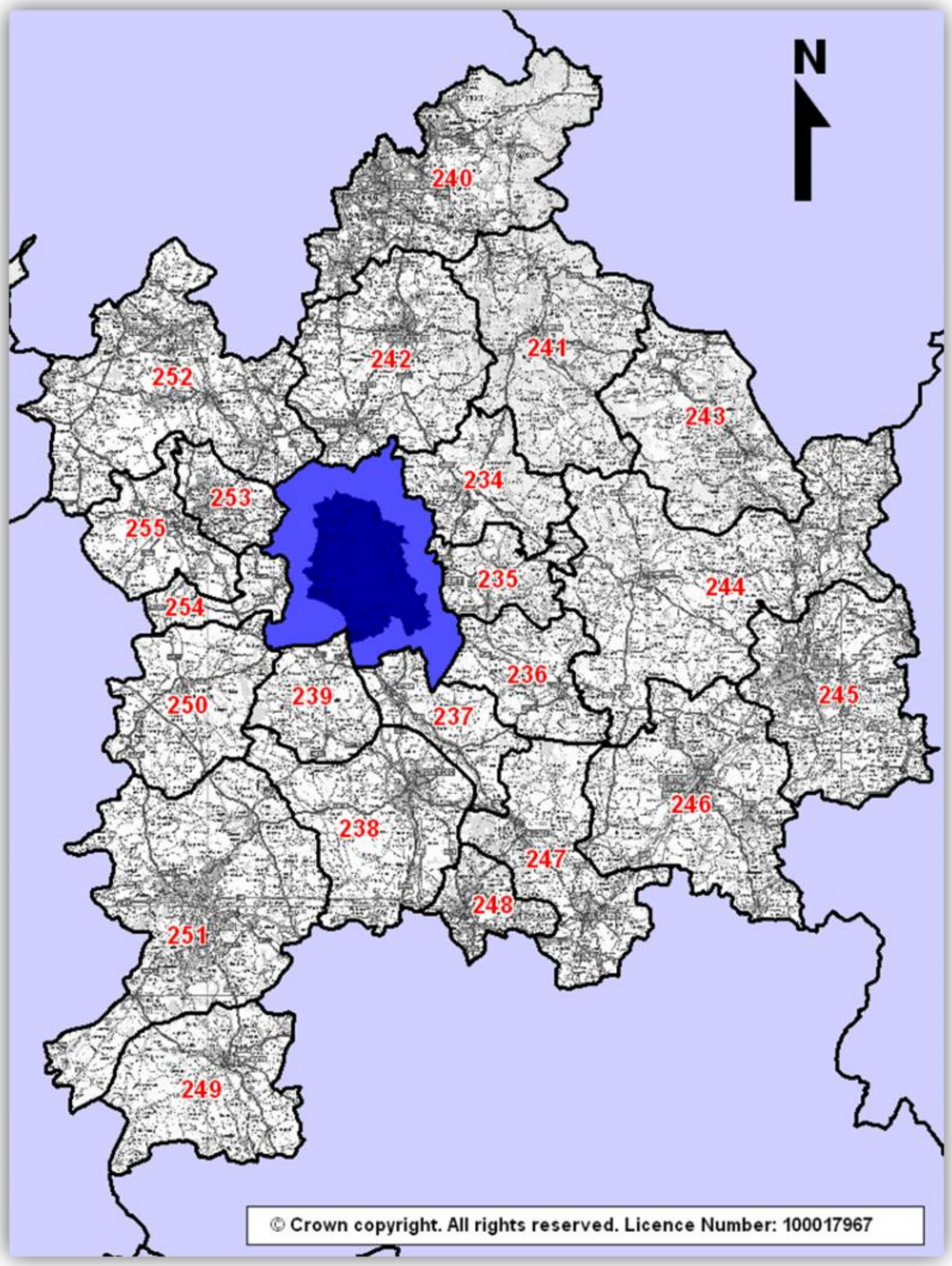


*Figure 2-10: National transport model zones*

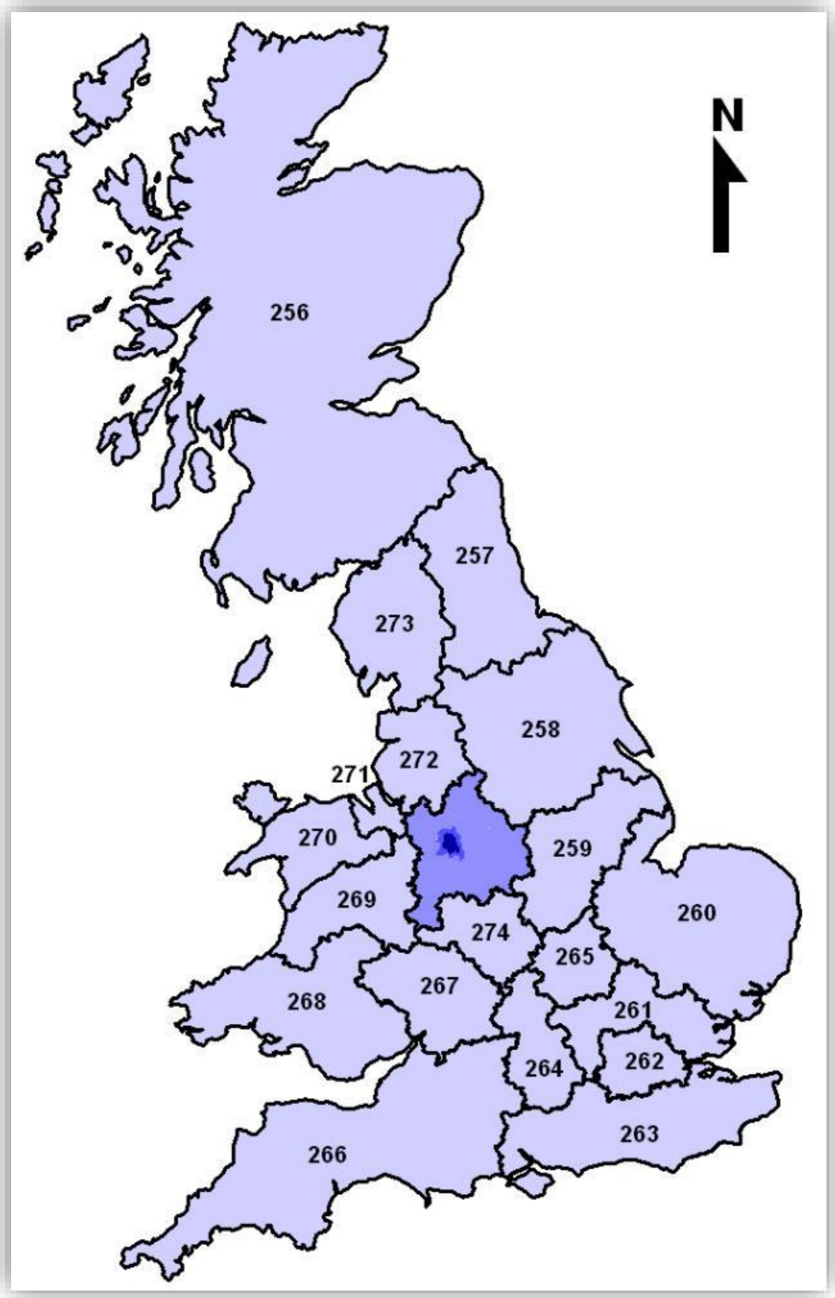
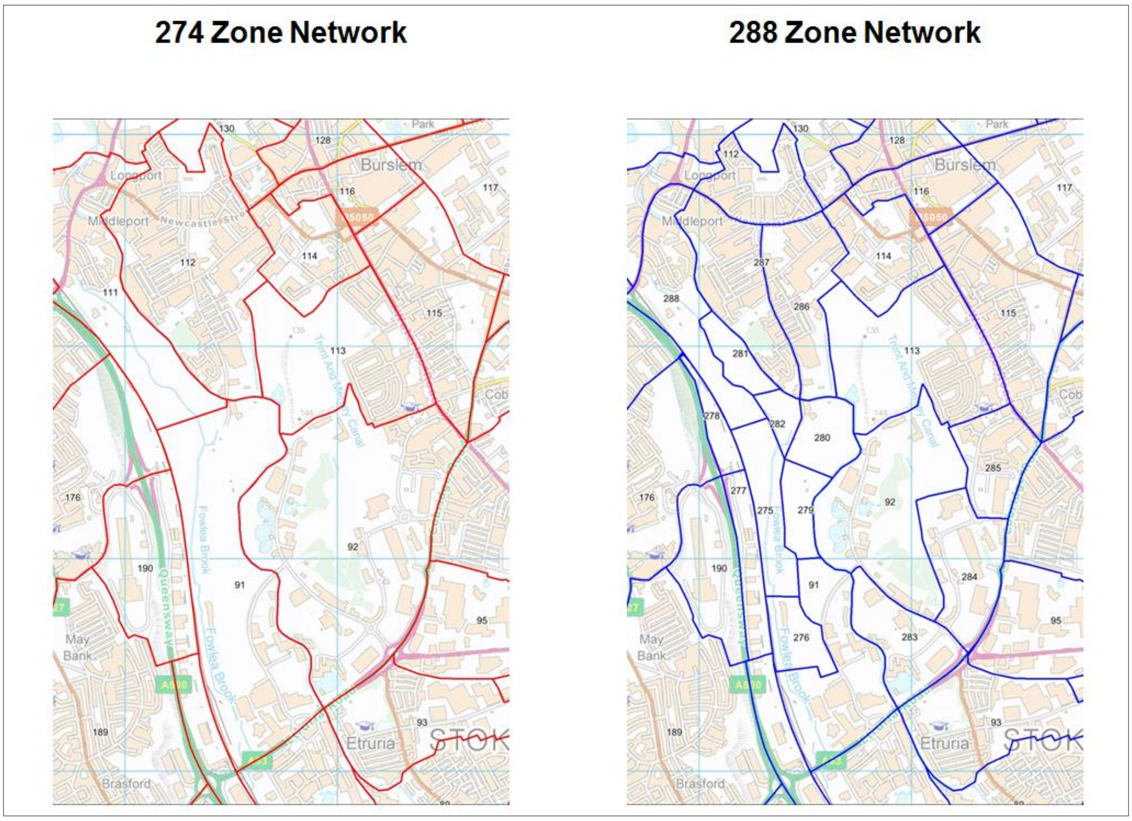


*Figure 2-11: Disaggregation of internal transport model zones (central area)*




## 2.5 Model Base Year

The NSMM transport model has a base year of 2015. As part of the refinement and update to the modelled trip matrices a review of the traffic growth between 2015 and 2018 was undertaken to determine if the model needed to be rebased to 2018.

Table 2-1 shows that the traffic growth on a screenline to the east of the A500 between 2015 and 2018 was either negative or marginal. Figure 2-12 shows the location of these counts. Given the lack of traffic growth and the extensive nature of the 2015 base model calibration and validation, as discussed in chapters 3 and 4, it was agreed with JAQU that the model development work would be undertaken on the previously calibrated and validated 2015 model, albeit that model would be disaggregated.

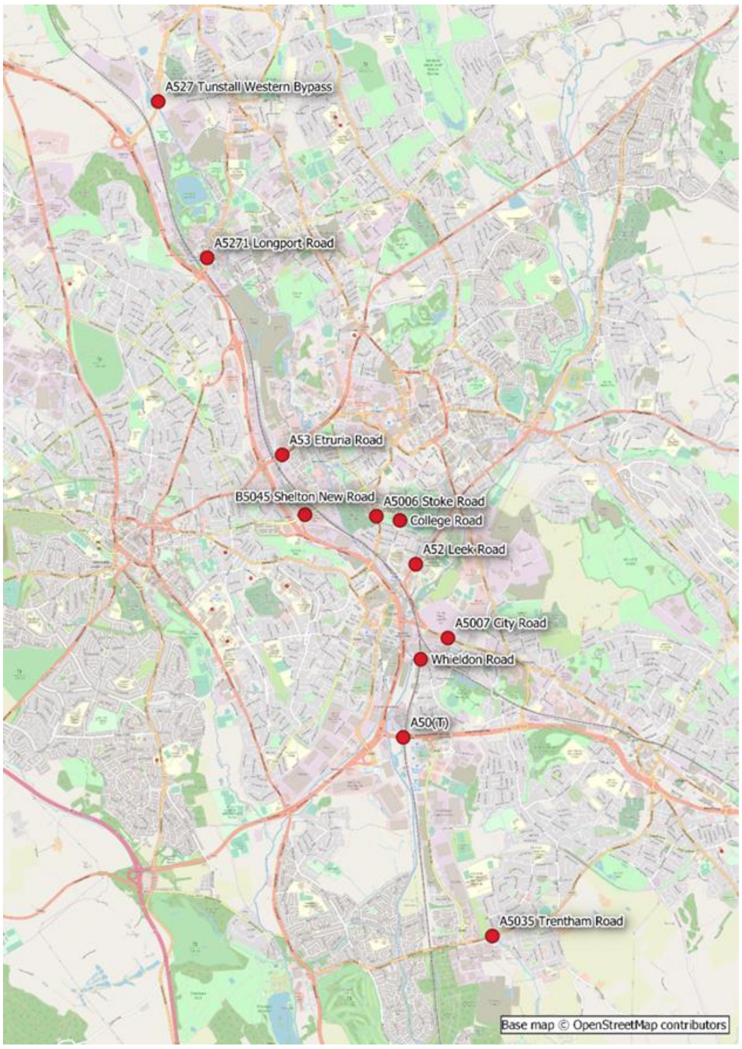
The traffic growth shows that the A50 trunk road has the highest growth in total and for cars, however this is only 4-5% growth between 2015 and 2018 and it is also on the strategic road network which would not form part of the air quality assessment. The A52 Leek Road has the lowest growth between 2015 and 2018 however this is likely to have been affected by roadworks. Leek Road aside, there are no locations that have big changes, total traffic growth between 2015 and 2018 at each location is within +/- 5%.

*Table 2-1: Traffic growth between 2015 and 2018*

| Road | 2015 - 2018 Growth | | | | |
|---|---|---|---|---|---|
| | Cars | LGVs | HGVs | Buses | Total |
| **A527 Tunstall Western Bypass** | 1.006 | 1.078 | 1.306 | 1.178 | 1.027 |
| **A5271 Longport Road** | 0.976 | 1.071 | 0.919 | 0.514 | 0.983 |
| **A53 Etruria Road** | 1.032 | 1.064 | 0.947 | 0.79 | 1.032 |
| **B5045 Shelton New Road** | 1.015 | 0.974 | 1.093 | 0.99 | 1.012 |
| **A5006 Stoke Road** | 0.957 | 0.897 | 1.27 | 1.432 | 0.956 |
| **College Road** | 1.005 | 1.141 | 0.629 | 0.64 | 0.981 |
| **A52 Leek Road*** | 0.624 | 0.557 | 0.822 | 0.487 | 0.617 |
| **A5007 City Road** | 0.947 | 1.134 | 0.908 | 0.769 | 0.964 |
| **Whieldon Road** | 1.029 | 0.833 | 0.583 | 0.667 | 0.982 |
| **A50(T)** | 1.046 | 1.117 | 0.929 | 1.204 | 1.041 |
| **A5035 Trentham Road** | 0.934 | 1.063 | 0.823 | 1 | 0.946 |
| **Total** | **0.99** | **1.051** | **0.953** | **0.785** | **0.994** |

** 2018 observed trafic flows affected by long-term major roadworks*

*Figure 2-12: Location of 2015 / 2018 traffic counts*



# 3 Travel demand calibration and sensitivity tests (T2a)

This section details the variable demand model and its update to enable the modelling of a charging Clean Air Zone (CAZ). It also covers the segmentation of vehicle type matrices by CAZ compliance status using ANPR survey data.

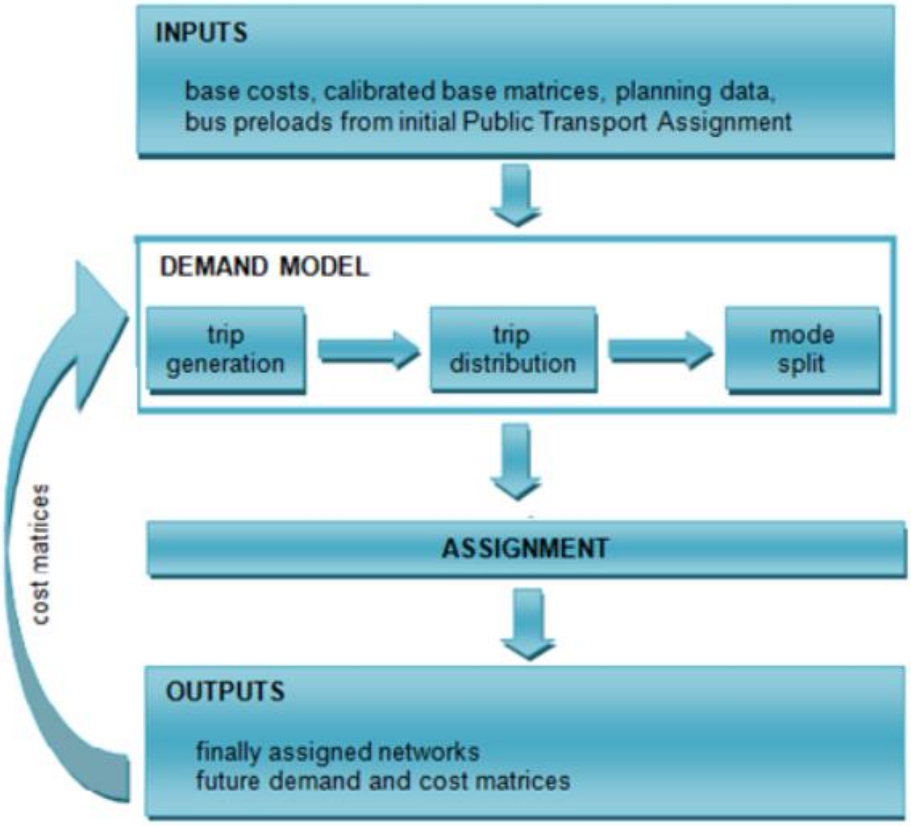
The NSMM demand model was recently calibrated as part of the EVLR Project in line with TAG unit M2 including appropriate realism testing. The demand model forecasts change in trip patterns in terms of trip generation, distribution and mode split due to changes to the highway network, public transport service provision and changes to planning data.

It is acknowledged that given the Stated Preference (SP) surveys were only undertaken in early September 2019, further work will be required to refine the demand model for option testing which will be detailed in due course, the approach is also outlined in the T3 report.

## 3.1 Form of the NSMM demand model

The demand model has the same spatial, geographic and temporal extent as the assignment model as outlined in sections 2.3 and 2.4 of this report. The basic structure of the NSMM demand model is shown diagrammatically in Figure 3-1. It is an absolute model applied incrementally in that the absolute change between the base and future synthetic trip matrices are added to the calibrated base assignment trip matrices. Any resultant negatives, following the addition of the absolute change to the calibrated base trip matrices are redistributed at sector level. This is as described in section 4.3.6 of TAG unit M2 – Variable Demand Modelling.

Figure 3-1: Demand model structure



### 3.2 Model segmentation

In order to produce a robust demand model, calculations at each stage are undertaken separately for each of the demand segments. 'Segmentation' is the division of travel, traveller and transport attributes into different categories so that all travellers in the same category can be treated in the same way. This segmentation assists the estimation of how much and what type of demand each zone produces or attracts and also reflects the different variation in responsiveness to changes in travel costs and conditions by traveller type.

At the trip generation stage, home based person trips are segmented into:

- Six socio-economic groupings (HH1 to HH6), see Table 3-1.
- Three car ownership categories (0, 1, 2 or more)
- Four trip purposes:
  - Home-based work (HBW)
  - Home-based education (HBE)
  - Home-based shopping (HBS)
  - Home-based other (HBO)

This gives a total of 72 home-based demand segments.

Non-home-based trips are divided into two segments:

- Non-home-based employer's business (NHBEB)
- Non-home-based other (NHBO)

Goods vehicle trips are divided into two segments:

- LGV trips (all purposes)
- HGV trips (all purposes)

The demand segmentation is largely derived from surveyed demand data. The six socio-economic groupings shown in Table 3-1 are based on the percentage of economic households within each Output Area using 2011 Census data. The information will be used to derive an approximation of household income for each socio-economic grouping which can be used to segment demand for modelling different charging schemes. This will be undertaken once the SP survey work is complete and this report will be appropriately updated.

*Table 3-1: NSMM transport model socio-economic groupings*

| Category | Household Size | No. Employed People |
|---|---|---|
| **1** | 1 | 0 |
| **2** | >1 | 0 |
| **3** | 1-2 | 1 |
| **4** | 3+ | 1 |
| **5** | 1-3 | 2+ |
| **6** | 4+ | 2+ |

## 3.3 Trip generation

The trip generation stage determines the number of trips that are being generated by and attracted to each zone in the transport model. This process is undertaken slightly differently for home based and non-home based person trips and for non-home based goods vehicle trips.

### 3.3.1 Home-Based person trips

Trip rates were derived from 2009 household interview surveys and roadside interviews. They have subsequently been reviewed and benchmarked against home-based trip rates from TRICS, resulting in the application of the home-based production trip rates detailed in Table 3-2 to the forecast changes in the number of households. Note the rates below are just applied to the changes in future households not the total number of future households. The same approach is applied for all future land use change.

Table 3-3 shows the target attraction rates which are used to calculate the home-based purpose splits in order to correct the trip attractions. To calculate productions and attractions for home-based trips the demand model uses the following planning data:

- Residential units (split by the 6 socio-economic categories)
- Number of jobs
- Number of school places
- Retail GFA

*Table 3-2: Target household production trip rates by time period*

| Land Use | AM Peak-Hour | Inter-Peak Hour | PM Peak-Hour |
|---|---|---|---|
| **Household (per house**) | 0.72 | 0.414 | 0.621 |

*Table 3-3: Target attraction trip rates by time period*

| Land Use | AM Peak-Hour | Inter-Peak Hour | PM Peak-Hour |
|---|---|---|---|
| **Employment (per job)** | 0.31 | 0.09 | 0.28 |
| **Primary School (per school place)** | 0.688 | 0.053 | 0.133 |
| **Secondary School (per school place)** | 0.298 | 0.306 | 0.034 |
| **College / University (per school place)** | 0.136 | 0.066 | 0.08 |
| **Food Superstore (GFA)** | 0.06032 | 0.13985 | 0.14824 |
| **Shopping Centre – Local Shops (GFA)** | 0.14888 | 0.17531 | 0.20459 |
| **Non-food Retail (GFA)** | 0.0066 | 0.07734 | 0.04583 |
| **Mixed Shopping Malls (GFA)** | 0.01428 | 0.04836 | 0.01785 |

The demand model calculates the number of home-based productions in each zone by multiplying the household information by an appropriate trip rate for each of the 72 home-based demand segments. For the forecast change in households these are then factored to the target household trip rates outlined in Table 3-2.

Target home-based attractions for the forecast change in other land uses are calculated using the trip rates in Table 3-3.The resulting target home-based attractions are then solely used to inform the home-based production split by purpose. This therefore ensures that the total attractions match the total productions.

#### 3.3.2 Non-Home-Based person trips

Non-home-based trips occur between employment, education, shopping and other locations. Roadside interview and public transport interview data have been used to derive origin and destination person trip rates for employment, education, shopping and leisure. Origin and destination person trip ends for non-home based activity are calculated by multiplying the planning data by these rates. 'Employer's business' trips are assumed to occur between employment locations while other trips may occur between any combinations of locations. In each modelled peak-hour the proportion of trips made on employer's business is given by the survey data and this is used to split the work-based trips into 'employer's business' trips and other trips. Both origins and destinations are factored to match their average total.

Non-home-based business trip ends are derived through multiplying the number of jobs by the non -home based business trip rate. The non-home-based other trips are derived by multiplying jobs, school places, retail gross floor area and leisure site gross floor area by the equivalent non home-based trip rate and adding these together.

#### 3.3.3 Non-Home-Based goods vehicle trips

All good vehicle trips are calculated using origin and destination rates calculated from roadside interview data. The origin and destination trip end values calculated are factored to match the average total.

### 3.4 Trip distribution

The trip distribution process takes the factored trip ends produced by the trip generation process and decides how to distribute movements to and from each zone across all of the zones. This is done automatically using CUBE Voyager's gravity model functionality. The inputs to this process are the trip ends, cost matrices and friction and K-factors.

#### 3.4.1 Derivation of composite costs

For person trips by private transport the initial composite cost matrix is produced as follows:

1. Private transport cost skims (in minutes) are taken from the appropriate calibrated model run
2. For home-based trips these matrices are partially transposed
3. Parking charges are converted to costs in minutes
4. Three separate values of time based on the TAG Databook are calculated for the following trip purposes:
    - Home-based work trips
    - Home-based education, shopping and other and non-home based other
    - Non-home-based employer's business

1. Production (or origin for non-home based) end walk times are added on as are attraction (or destination) end search and walk times and parking costs in minutes. To

be comparable with public transport fares the parking costs used are half of the anticipated actual parking costs

2. Intra-zonal costs are set to the lowest inter-zonal cost multiplied by 0.5

After the first run through of the demand model the input cost matrices used are those calculated from the integral assignment.

For person trips by public transport the initial composite cost matrix is produced in a similar fashion as follows:

1. Public transport total trip time (walk time + ride time), wait time and fare cost skims are taken from the appropriate model run
2. All time-based costs are summed to a single total
3. For home-based trips time and cost matrices are partially transposed
4. Fares are converted to costs in minutes
5. As previously, three separate values of time are used:
    - Home-based work trips
    - Home-based education, shopping and other and non-home based other
    - Non-home-based – employer's business
1. Fares (in minutes) are added to the time-based costs to give a total time-based cost
2. Intra-zonal costs are set to the lowest inter-zonal cost multiplied by 0.5

Again, after the first run through of the demand model the input cost matrices used are those calculated from the integral assignment.

For goods vehicles the process is simpler as they are assumed not to experience complications caused by a requirement to park at a distance from their destination and there is no mode choice and therefore no requirement for calculation of the composite cost. Separate productions and attractions are derived for LGVs and HGVs and they are distributed separately through the distribution model to produce separate LGV and HGV trip matrices. The goods vehicle cost matrices are calculated as follows:

1. Goods vehicle cost skims (in minutes) are taken from the appropriate model run
2. The mean values of the LGV and HGV cost skims are taken separately
3. Intra-zonal costs are set to the lowest inter-zonal cost multiplied by 0.5

It should be noted that the demand model excludes any cost damping.

Home-based shopping and home-based other are singly constrained gravity models at the production end, whilst home-based work, education, non-home-based, and goods vehicle trips are doubly constrained at both the production and attraction ends.

#### 3.4.2 Friction factors

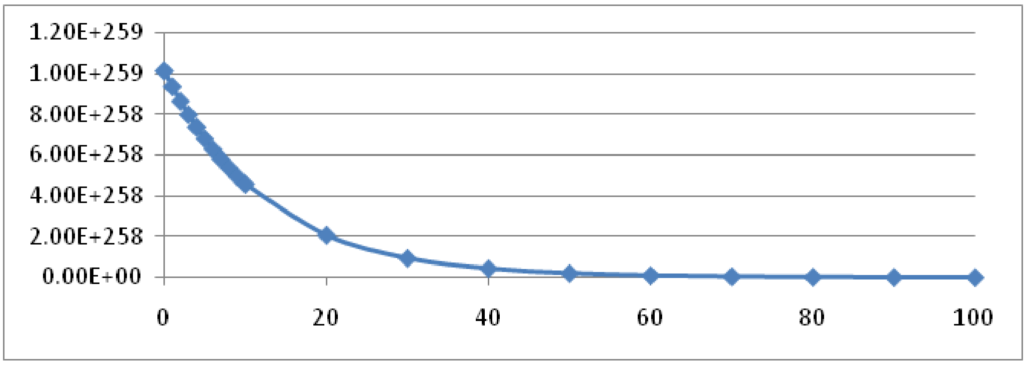
Friction factors are used to indicate how popular low-cost trips are in comparison to high cost trips. In this case a logit model has been used such that, at the most basic level, the friction factor is given by the exponential function $\exp(-\beta c_{ij})$. However, in practice even the most homogenous trip purposes include a range of behaviour types. An illustration of this is that while most trips to work will follow a standard distribution curve some people have journeys to work which are governed by the home location requirements of their families and so travel much further than is typical. This means that values of β which give a good result for the shorter sections of the trip length distribution are unable to match the longer sections. For this reason, the precise form of the friction factor equation used is:

$$Friction\ Factor = Ae^{-\beta_A c} + Be^{-\beta_B c} + Ce^{-\beta_C c}$$

The overall friction factor values are not important: it is only the relative values at different costs which are significant and so the values of A, B and C are chosen such that the widest possible range of costs have finite friction factor values. For this reason A is always equal to $1\ x\ 10^{259}$, this being the largest factor which can be accommodated by the software. The values of B and C are always at least an order of magnitude lower and so the greatest part of the friction factor curve comes from the first term.

The general form of a typical friction factor curve in shown in Figure 3-2.

*Figure 3-2: Typical friction factor curve*




### 3.4.3 K-Factors

The use of K-factors is generally advised against and in this case, they are all set to 1.

### 3.4.4 Calibration

The trip distribution model is calibrated by adjusting the $\beta$ values and constants used in the friction factor equation to calculate the friction factor curves.

In order to produce an overall total number of trips which is correct following distribution then blanking global correction factors are also applied. In most cases these are close to 1. The $\beta$ values and constants found to give the best match to the observed trip length distributions in each modelled peak hour are given in Table 3-4 to Table 3-6.

Table 3-4: AM peak-hour β values and constants

| Demand Segment | A | $\beta_A$ | B | $\beta_B$ | C | $\beta_C$ | Global Factor |
|---|---|---|---|---|---|---|---|
| **HBW** | $1x10^{259}$ | 0.08 | $1x10^{257}$ | 0.03 | $3x10^{255}$ | 0.010 | 1.49 |
| **HBE** | $1x10^{259}$ | 0.06 | $5x10^{255}$ | 0.02 | $5x10^{255}$ | 0.010 | 1.40 |
| **HBS** | $1x10^{259}$ | 0.80 | $1x10^{256}$ | 0.08 | $4x10^{253}$ | 0.020 | 0.81 |
| **HBO** | $1x10^{259}$ | 0.30 | $3x10^{257}$ | 0.06 | $1x10^{255}$ | 0.020 | 0.90 |
| **NHB** | $1x10^{259}$ | 0.60 | $1x10^{257}$ | 0.08 | $7x10^{254}$ | 0.020 | 0.73 |
| **LGV** | $1x10^{259}$ | 0.30 | $5x10^{257}$ | 0.06 | $1x10^{257}$ | 0.030 | 1.06 |
| **HGV** | $1x10^{259}$ | 0.30 | $6x10^{257}$ | 0.05 | $2x10^{255}$ | 0.010 | 1.10 |

Table 3-5: Inter-Peak hour β values and constants

| Demand Segment | A | $\beta_A$ | B | $\beta_B$ | C | $\beta_C$ | Global Factor |
|---|---|---|---|---|---|---|---|
| **HBW** | $1x10^{259}$ | 0.10 | $1x10^{258}$ | 0.06 | $1x10^{256}$ | 0.015 | 2.26 |
| **HBE** | $1x10^{259}$ | 0.20 | 0 | 0.02 | 0 | 0.010 | 3.17 |
| **HBS** | $1x10^{259}$ | 0.70 | $1x10^{256}$ | 0.06 | $4x10^{253}$ | 0.015 | 0.99 |
| **HBO** | $1x10^{259}$ | 0.50 | $2x10^{256}$ | 0.06 | $4x10^{253}$ | 0.015 | 0.88 |
| **NHB** | $1x10^{259}$ | 0.10 | $2x10^{257}$ | 0.06 | $4x10^{256}$ | 0.020 | 1.05 |
| **LGV** | $1x10^{259}$ | 0.30 | $1x10^{258}$ | 0.06 | $1x10^{256}$ | 0.019 | 1.05 |
| **HGV** | $1x10^{259}$ | 0.30 | $1x10^{258}$ | 0.06 | $1x10^{256}$ | 0.013 | 1.14 |

Table 3-6: PM Peak-hour β values and constants

| Demand Segment | A | $\beta_A$ | B | $\beta_B$ | C | $\beta_C$ | Global Factor |
|---|---|---|---|---|---|---|---|
| **HBW** | $1x10^{259}$ | 0.10 | $5x10^{258}$ | 0.06 | $2x10^{256}$ | 0.014 | 1.43 |
| **HBE** | $1x10^{259}$ | 0.20 | $3x10^{257}$ | 0.06 | $1x10^{254}$ | 0.010 | 2.30 |
| **HBS** | $1x10^{259}$ | 0.60 | $5x10^{256}$ | 0.08 | $2x10^{254}$ | 0.020 | 0.82 |
| **HBO** | $1x10^{259}$ | 0.50 | $1x10^{257}$ | 0.08 | $2x10^{254}$ | 0.020 | 0.90 |
| **NHB** | $1x10^{259}$ | 0.60 | $5x10^{256}$ | 0.08 | $3x10^{254}$ | 0.020 | 0.91 |
| **LGV** | $1x10^{259}$ | 0.20 | $2x10^{258}$ | 0.06 | $5x10^{256}$ | 0.020 | 0.99 |
| **HGV** | $1x10^{259}$ | 0.30 | $5x10^{257}$ | 0.06 | $7x10^{255}$ | 0.012 | 1.13 |

The trip distribution model for 2009 has been recalibrated as part of the update of the 2015 demand model to improve the level of validation of the car and goods vehicle trip distribution model against 2009 observed data. For this re-calibration of the distribution modelling, the $\beta$, A, B and C values have not been altered. Instead the friction factors have been reviewed and adjusted for the 38 generalised cost bands for which they are applied, in order to get a better fit between the output trip length distribution and the observed data.

### 3.5 Mode choice

The mode choice model splits the person trip matrix into car and public transport trip matrices on the basis of the respective costs of the use of each mode and lambda (or mode split) constants.

The zero car ownership demand segments (HBW0, HBE0, HBS0 and HBO0) are considered captive to public transport and are not included in the mode split model. For the one and two-plus car ownership demand segments CUBE Voyager's XCHOICE logit choice module is used to carry out mode choice on the basis of the input costs and lambda values.

The output car trip matrix is divided by a car occupancy factor to give a vehicle (rather than a person) trip matrix. Trips less than one kilometre by public transport are multiplied by 1/3 and those between one and two kilometres by 2/3 as it is assumed that a high proportion of these trips will actually be made on foot.

The mode choice model is calibrated by adjusting the lambda values used by XCHOICE and the mode constants used in the calculation of the cost matrices. The values found to give the best match to the observed mode splits in each modelled time period are given in Table 3-7.

*Table 3-7 Mode split lambda values and constants*

| Demand Segment | AM Peak Hour | | Inter-Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|---|
| | Lambda | Mode Constant | Lambda | Mode Constant | Lambda | Mode Constant |
| **HBW** | 0.096 | 20 (one car) 20 (two+ cars) | 0.2 | 20 (one car) 20 (two+ cars) | 0.21 | 20 (one car) 20 (two+ cars) |
| **HBE** | 0.096 | 20 (one car) 20 (two+ cars) | 0.12 | 20 (one car) 20 (two+ cars) | 0.42 | 20 (one car) 20 (two+ cars) |
| **HBS** | 0.96 | 30 (one car) 40 (two+ cars) | 0.91 | 26 (one car) 32 (two+ cars) | 0.9 | 26 (one car) 32 (two+ cars) |
| **HBO** | 0.48 | 30 (one car) 40 (two+ cars) | 0.75 | 35 (one car) 50 (two+ cars) | 0.85 | 30 (one car) 40 (two+ cars) |
| **NHB** | 0.96 | 24 | 0.2 | 30 | 0.9 | 24 |

### 3.6 Demand response to a CAZ

For modelling a charging CAZ, the NSMM transport model will be adapted to ensure it can model all the possible demand responses to trips entering, travelling within or routeing through a CAZ. This will include undertaking some sensitivity testing to sense check the reduction in highway demand following the introduction of a charging CAZ is logical as well as checking demand changes when applying different CAZ charges. The demand responses and the methodology for modelling them are outlined in Table 3-8. It should be noted that Table 3-8 does not provide a hierarchy of response but just outlines the different demand responses that will be captured in the updated NSMM transport model. This report will be updated following the SP surveys carried out in early September and the resultant completion of the demand model update.

*Table 3-8: CAZ demand responses*

| Response | Demand Response to CAZ | Methodology |
|---|---|---|
| **1** | Replacing or upgrading vehicle | Choice modelling will be applied using stated preference data to ascertain the likelihood of non-compliant car, taxis, LGV and HGV users that travel through, within or to and from the CAZ to upgrade their vehicle to a compliant one. This choice modelling for non-compliant cars will be undertaken using income segmentation making use of the socio-economic categories which will permit a calculation of the proportion of households in different income categories based on the number of people in employment. |
| **2** | Cancelling trip | A multinomial choice model will derive the percentage of non-compliant car demand by income category that cancel their trip for cars, this will also be undertaken for taxis, LGVs and HGVs that travel through, within or to and from the CAZ. These trips will be removed from the final assigned matrices. |
| **3** | Change of destination | A multinomial choice model will derive the percentage of non-compliant car demand by income category with a destination in the CAZ (but an origin outside). These trips will then be redistributed to non-CAZ destinations. Goods vehicles will be excluded from this demand response as they don't have a choice to change their destination as their delivery destinations would be fixed irrespective of a CAZ charge. |
| **4** | Modal shift | A multinomial choice model will derive the percentage of demand by income category that change mode from the car, for non-compliant car trips that travel through, within or to and from the CAZ.<br><br>The NSMM transport model does not explicitly model walking and cycling trips, so a percentage reduction in car trips will be needed for related policies. |

| | | |
|---|---|---|
| **5** | Change route to avoid CAZ | A multiple select link analysis will be undertaken on the 2022 Reference Case at the inbound cordon locations to the CAZ. Non-compliant cars, LGVs and HGVs select link matrices will be filtered to identify through trips only, external to the CAZ.<br><br>A multinomial choice model for non-compliant cars, LGVs and HGVs will derive the percentage of these through trips that would re-route to avoid the CAZ.<br><br>The NSMM assignment model will allow for a single cordon CAZ charge affecting trips currently routing through the CAZ and therefore reassigning some through demand onto more attractive (non -charged) routes. This will be represented on the network by having a CAZ charge on a cordon of links forming the charging zone in both directions which will be picked up by the model and allowed for in the generalised cost for the routing assignment. The charge on each charging link will be modally consistent however will be permitted to differ for cars, LGVs and HGVs as appropriate. Sense checks will be undertaken on the level of reassignment. Additional scripting will be required using demand matrices for specific OD movements to capture charges for internal movements only (i.e. within the CAZ charge area), in addition further scripting will be required to avoid anyone being charged more than once. |
| **6** | Pay the CAZ charge | Following the above demand responses, the remaining car, taxi, LGV and HGV trips that start or end their journey in the CAZ or go through it will continue to do so (but pay a daily charge). Modelling responsiveness and payment of CAZ charging will use income segmentation derived from the socio-economic groupings. |

### 3.7 Demand model calibration

The NSMM demand model will be further updated and calibrated using regression analysis on the SP survey to update the choice modelling to reflect responses to a charging CAZ. This will be reported in an updated version of this report.

This section therefore centres on the calibration of the existing demand model matrices against observed data. Checks of the 2015 synthetic demand trip matrices have been carried out by comparing the trip length distributions of these matrices with 2009 observed trip matrices derived from roadside interviews. The comparisons have been carried out using the 2009 matrices as these are based on observed data and will therefore accurately reflect actual travel patterns.

Table 3-9 shows the distance class banding used in the comparisons of the trip length distributions for the 2009 observed and 2015 synthetic trip matrices. The match between the observed and synthetic trip length distributions are shown in Figure 3-3 to Figure 3-5 for car and public transport trips for the AM peak hour, IP hour and PM peak hour time periods, respectively. The equivalent information for the LGV trip matrices are shown in Figure 3-6 to Figure 3-8 and for the HGV trip matrices in Figure 3-9 to Figure 3-11.

As can been seen from Figure 3-3 to Figure 3-11, the 2015 synthetic trip length distributions show a very close match with the equivalent observed information for all modes of travel and time periods confirming that the demand matrices have been calibrated to a very good level of accuracy.

*Table 3-9: Distance class banding for trip length distribution*

| Distance Class | Range (km) |
|---|---|
| 1 | < 1 |
| 2 | 1 – 2 |
| 3 | 2 – 3 |
| 4 | 3 – 5 |
| 5 | 5 – 10 |
| 6 | 10 – 15 |
| 7 | 15 – 25 |
| 8 | 25 – 35 |
| 9 | 35 – 50 |
| 10 | 50 – 100 |
| 11 | 100 – 200 |
| 12 | > 200 |

Figure 3-3: AM peak hour car and public transport trip length distribution comparisons

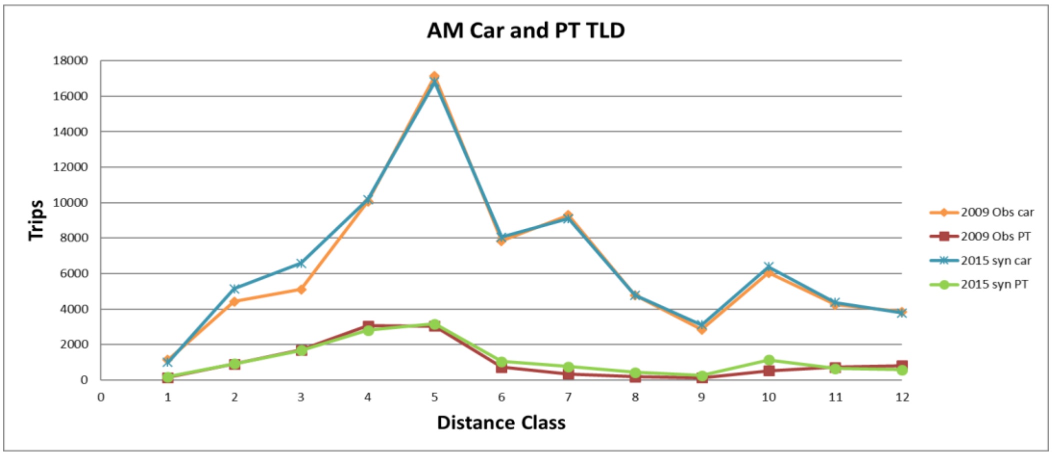



Figure 3-4: IP hour car and public transport trip length distribution comparisons

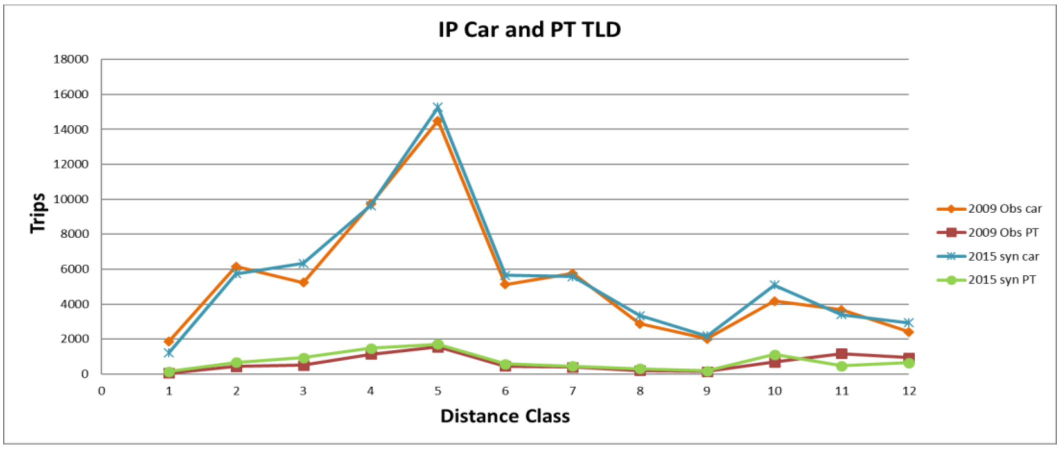



Figure 3-5: PM peak hour car and public transport trip length distribution comparisons

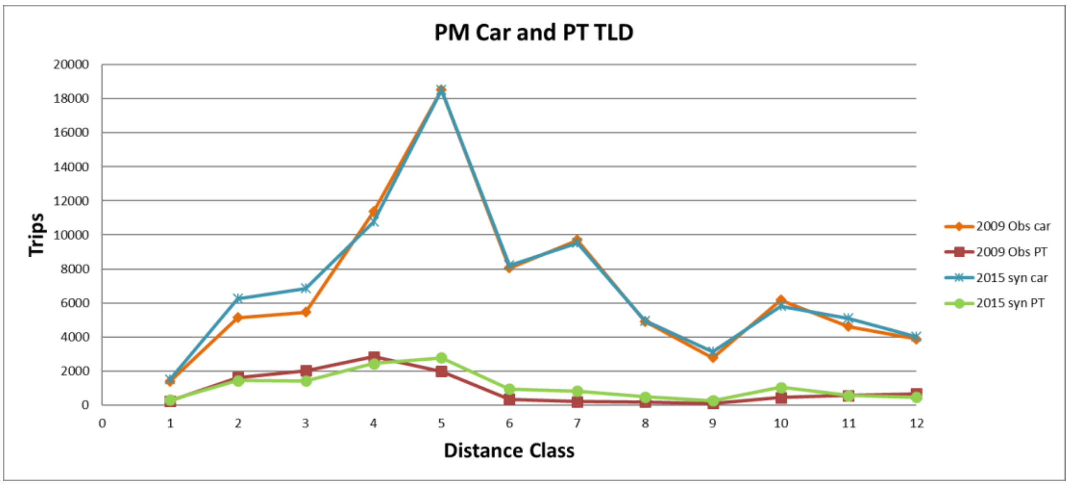


*Figure 3-6: AM peak hour LGV trip length distribution comparisons*

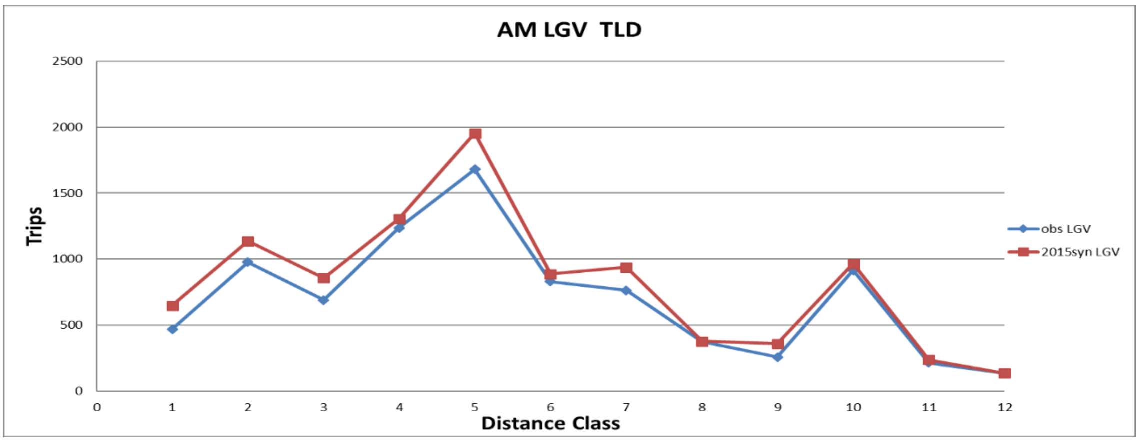



*Figure 3-7: IP hour LGV trip length distribution comparisons*

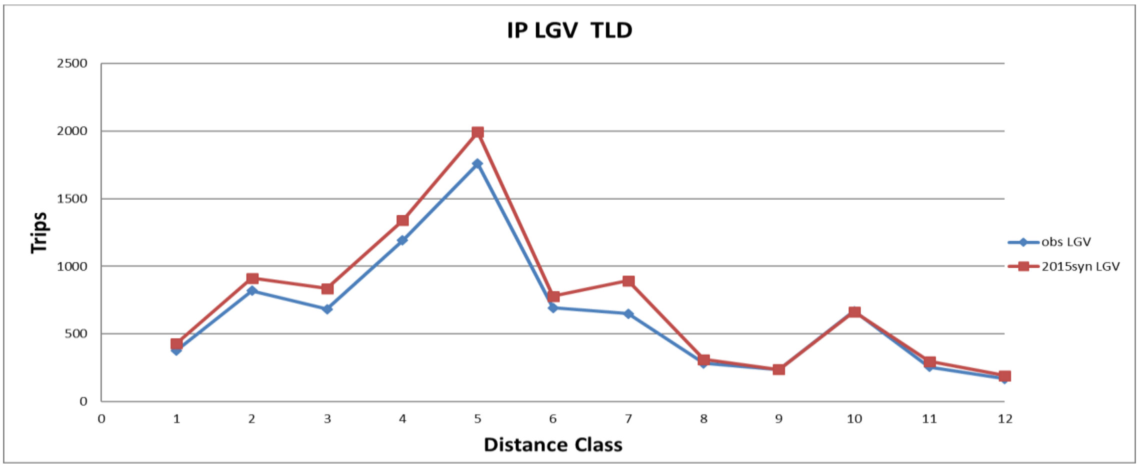



*Figure 3-8: PM peak hour LGV trip length distribution comparisons*

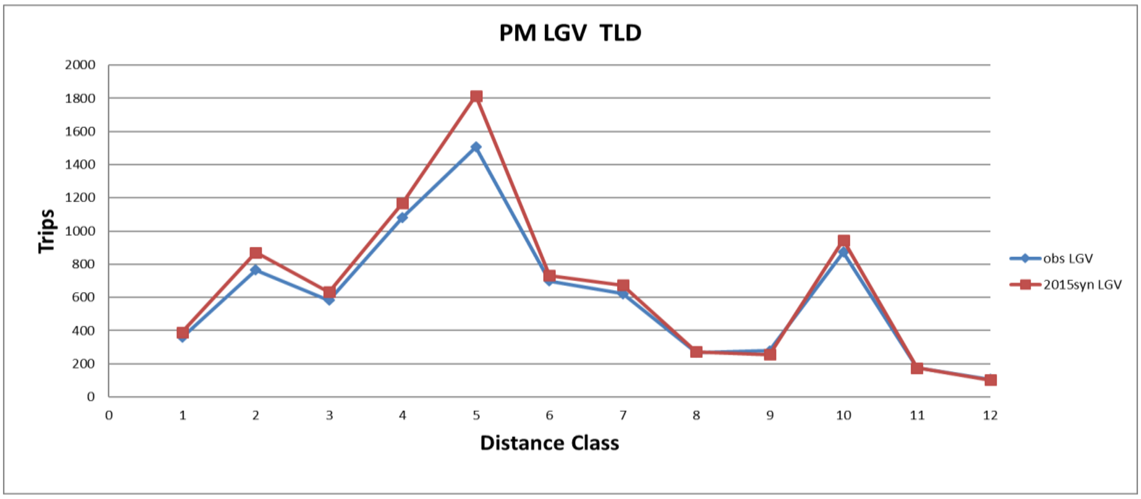


*Figure 3-9: AM peak hour HGV trip length distribution comparisons*

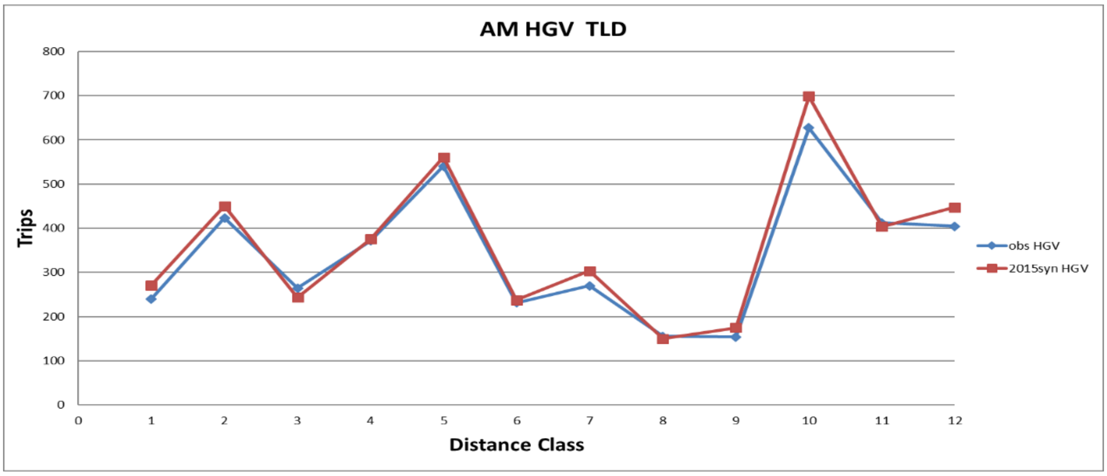



*Figure 3-10: IP peak hour HGV trip length distribution comparisons*

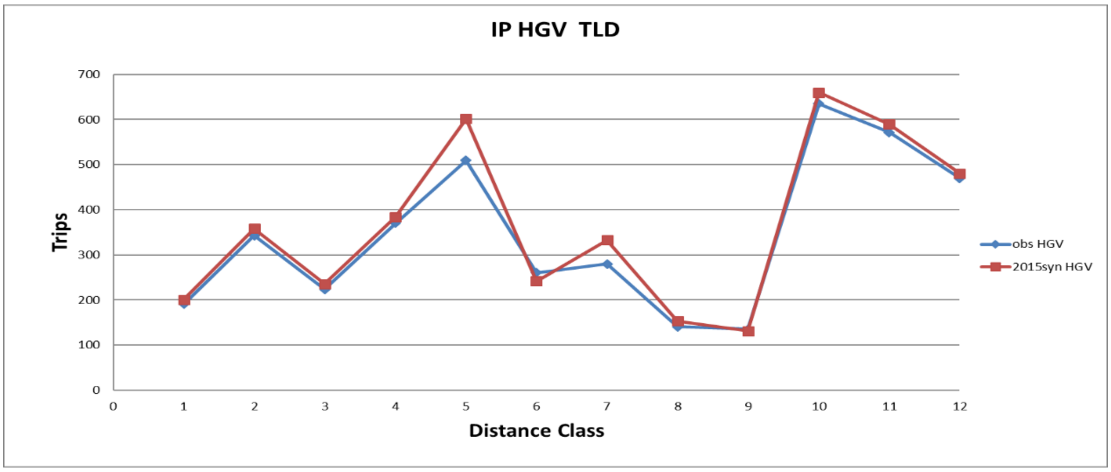
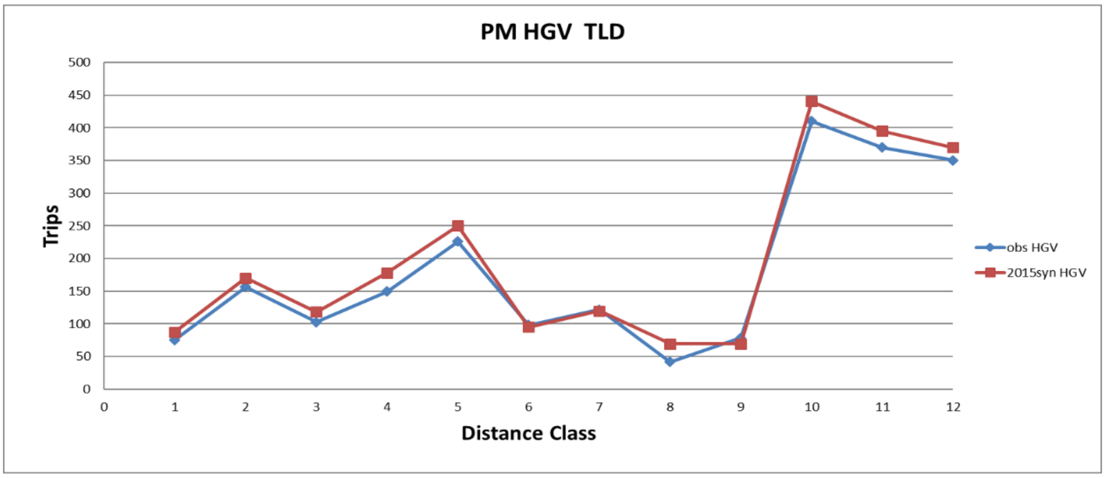



*Figure 3-11: PM peak hour HGV trip length distribution comparisons*



## 3.8 Realism testing

It is essential to ensure that a variable demand model behaves 'realistically' by changing the various components of travel costs and times and checking that the overall demand response accords with general experience. The acceptability of the demand model's responses is determined by its demand elasticities. These demand elasticities are calculated by changing a cost or time component by a small global proportionate amount and calculating the proportionate change in travel made.

In line with Section 6.4 of TAG Unit M2 – Variable Demand Modelling, three realism tests have been undertaken for the updated 2015 demand model by calculating its demand elasticities based on applying the following changes in travel costs and times as follows:

- Private transport fuel costs increased by 10% and 20%
- Public transport fares increased by 10% and 20%
- Private transport journey times increased by 10%

The realism tests for private transport fuel costs and public transport fares have been carried out by trip purpose (employer's business, commuting and other) and by time period (AM peak-hour, Inter-Peak hour, PM peak-hour and 12-hour time period) as well as for all traffic for an annual situation. The realism test for private journey times has been carried out for all traffic for an annual situation.

### 3.8.1 Calculation of demand elasticities

The modelled AM peak hour, inter-peak hour and PM peak hour demand figures have been converted to 12-hour figures using the following formula:

$$D_{12hr} = F_{AM}D_{AM} + F_{IP}D_{IP} + F_{PM}D_{PM}$$

Where: $D_{12hr}$, $D_{AM}$, $D_{IP}$ and $D_{PM}$ refer to the 12-hour, AM peak hour, inter-peak hour and PM peak hour demands, respectively.

The corresponding F values (detailed in Table 3-10) are factors which have been derived from observed traffic count information. A factor of 253 has been applied to the derived 12-hour demand figures to estimate an annual situation.

*Table 3-10: 12-hour time period factors*

| Factor | Correction | Value | |
|---|---|---|---|
| | | Private Transport | Public Transport |
| $\boldsymbol{F_{AM}}$ | Modelled morning peak-hour to 07:00 to 10:00 morning peak | 2.605 | 2.784 |
| $\boldsymbol{F_{IP}}$ | Modelled inter-peak hour to 10:00 to 16:00 inter-peak | 5.828 | 5.861 |
| $\boldsymbol{F_{PM}}$ | Modelled evening peak-hour to 16:00 to 19:00 evening peak | 2.696 | 2.721 |

The formula used to calculate the model's elasticity is the arc elasticity formation:

$$e = \frac{\log(T^1) - \log(T^0)}{\log(C^1) - \log(C^0)}$$

*Where:* *e = elasticity*

*T = demand*

*C = cost*

*the superscript 0 refers to the base model and 1 to the test model*

This can also be expressed as:

$$e = \frac{\log\left(\frac{T^1}{T^0}\right)}{\log\left(\frac{C^1}{C^0}\right)}$$

### 3.8.2 Private transport fuel costs

Two tests are required for the calculation of private transport fuel cost elasticities; one using matrix-based model outputs and the other using network-based outputs.

#### *3.8.2.1 Matrix-based outputs*

In order to calculate the private transport fuel cost elasticity for the matrix-based test, the converged synthetic matrices from the test run are compared to the converged synthetic matrices from the base year model and the zonal car kilometre totals compared across all zones.

#### *3.8.2.2 Network-based outputs*

To calculate the private transport fuel cost elasticity on a network basis then this is carried out on the model outputs pertaining only to the area of the modelled network that has been calibrated and validated using car vehicle kilometres from the output networks before and after the fuel cost change.

### 3.8.3 Public transport fares

In order to calculate the public transport fare cost elasticity, the converged demand model test is compared to the converged base demand model and the public transport demand compared across the full range of zones using a matrix-based approach.

The demand elasticities calculated for private transport fuel costs and public transport fares by trip purpose and time period using the above approaches and assuming a 10% and 20% increase in costs are detailed in Tables Table 3-11 and Table 3-12, respectively.

*Table 3-11: Demand elasticities for private transport fuel costs and public transport fares (10% increase in costs)*

| Trip Purpose | Time Period | Private Transport Fuel Costs | | Public Transport Fares |
|---|---|---|---|---|
| | | Matrix Based | Network Based | |
| Employer's Business | AM | -0.18 | -0.12 | -1.26 |
| | IP | -0.24 | -0.21 | -0.83 |
| | PM | -0.27 | -0.21 | -1.49 |
| | 12-hour | -0.24 | -0.19 | -1.00 |
| Commuting | AM | -0.21 | -0.13 | -0.20 |
| | IP | -0.29 | -0.18 | -0.15 |
| | PM | -0.31 | -0.17 | -0.22 |
| | 12-hour | -0.27 | -0.16 | -0.19 |
| Other | AM | -0.18 | -0.11 | -0.13 |
| | IP | -0.18 | -0.15 | -0.12 |
| | PM | -0.36 | -0.20 | -0.16 |
| | 12-hour | -0.21 | -0.15 | -0.13 |
| **All** | Annual | -0.23 | -0.14 | -0.18 |
| **Recommended Annual Average Elasticity Ranges (TAG Unit M2)** | | **-0.25 to -0.35** | **-0.25 to -0.35** | **-0.2 to -0.9** |

*Table 3-12: Demand elasticities for private transport fuel costs and public transport fares (20% increase in costs)*

| Trip Purpose | Time Period | Private Transport Fuel Costs | | Public Transport Fares |
|---|---|---|---|---|
| | | Matrix Based | Network Based | |
| Employer's Business | AM | -0.17 | -0.13 | -1.79 |
| | IP | -0.27 | -0.30 | -0.92 |
| | PM | -0.30 | -0.29 | -0.60 |
| | 12-hour | -0.26 | -0.27 | -0.99 |
| Commuting | AM | -0.26 | -0.21 | -0.20 |
| | IP | -0.31 | -0.28 | -0.15 |
| | PM | -0.30 | -0.23 | -0.18 |
| | 12-hour | -0.29 | -0.24 | -0.18 |
| Other | AM | -0.23 | -0.18 | -0.10 |
| | IP | -0.28 | -0.27 | -0.12 |
| | PM | -0.41 | -0.29 | -0.11 |
| | 12-hour | -0.30 | -0.26 | -0.11 |
| **All** | Annual | -0.28 | -0.24 | -0.17 |
| **Recommended Annual Average Elasticity Ranges (TAG Unit M2)** | | **-0.25 to -0.35** | **-0.25 to -0.35** | **-0.2 to -0.9** |

As can be seen from Table 3-11, for the 10% increase in private transport fuel costs the elasticities are generally lower than the recommended annual average elasticity range of -0.25 to -0.35 for the majority of trip purposes and time periods for both the matrix and network based approaches. The elasticity of -0.23 for the annual demand for all trip purposes using the matrix-based approach is marginally outside the accepted range and the value of -0.14 using the network-based approach is significantly outside the accepted range. However, these weaker values of fuel cost elasticities can readily be attributed to the significant number of shorter car trip lengths in the North Staffordshire conurbation due to its polycentric nature.

Similarly, for the 10% increase in public transport fares the elasticities do not fall within the recommended annual average elasticity range of -0.2 to -0.9 for the majority of trip purposes and time periods. The elasticity of -0.18 for the annual demand for all trip purposes is also marginally outside the accepted range.

As can be seen from Table 3-12, for the 20% increase in private transport fuel costs the elasticities are generally within the recommended annual average elasticity range of -0.25 to -0.35 for the majority of trip purposes and time periods for both the matrix and network-based approaches. The elasticity of -0.28 for the annual demand for all trip purposes using the matrix-based approach is within the accepted range and the value of -0.24 using the network-based approach is only marginally outside the accepted range. However, as previously discussed this slightly weaker value of fuel cost elasticity can readily be attributed to the significant number of shorter car trip lengths in the North Staffordshire conurbation.

For the 20% increase in public transport fares the elasticities still do not fall within the recommended annual average elasticity range of -0.2 to -0.9 for the majority of trip purposes and time periods. The elasticity of -0.17 for the annual demand for all purposes is also still marginally outside the accepted range. However, it should be noted that the elasticity for the annual demand is within the short-term elasticities reported in Table 6.1 of TAG Unit M2 where a low value of -0.16 is reported for a 1 year range. Furthermore, the elasticities are also logical when comparing peak period elasticities with inter-peak period values, with the latter generally being lower as per the guidance.

It should also be noted that the demand model parameters have been estimated from local data collected from public transport and household interviews as recommended by TAG. Concessionary fares are not excluded which will likely have a significant impact. The public transport and car trip length distributions and mode splits of the demand model have also been calibrated and validated against observed data to a very good level of accuracy. Therefore, since the demand model is based on local data rather than using imported model parameters then it is not appropriate to make adjustments to the parameters or values of time to ensure that the model satisfies the expected elasticities for each mode.

#### 3.8.4 Private transport journey times

To calculate the private transport journey time cost elasticity a single run of the demand model test is compared to the converged base demand model and the private transport demand compared across the full range of zones.

Assuming a 10% increase in private transport journey times, this gives an elasticity of -0.16 for an annual situation which is compatible with the requirements of TAG that it be less elastic than -2.0.

### 3.9 Sensitivity tests

As stated in section 6.6 of TAG Unit M2 – Variable Demand Modelling, sensitivity testing, as distinct from realism testing, is aimed at identifying the relative impact of altering key demand model parameters on the outcome of a scheme appraisal. It is important to understand how sensitive the appraisal results are to these uncertainties so that confidence can be invested in the conclusions.

It is therefore proposed that as part of the appraisal of the project that appropriate sensitivity tests will be undertaken as part of scheme forecasting and appraisal including changes in values of time and different economic growth forecasts.

### 3.10 Segmentation by vehicle type and CAZ compliance status

In order to provide the necessary euro vehicle classifications and associated vehicle compliance splits Automatic Number Plate Recognition (ANPR) data was collected. ANPR surveys were carried out at 15 locations across North Staffordshire, as agreed with JAQU (see Figure 3-12).

The ANPR data was collected by Nationwide Data Collection (NDC) and processed by DEFRA. The surveys were conducted over a 7-day period between the 2nd and 8th of April 2019 and between 00:00 and 24:00 each day. April was chosen as it is a neutral survey month. The survey utilised mast-based high definition (HD) ANPR cameras supplied by MAV Systems Ltd with infra-red illumination to give excellent quality image capture both day and night. After collection, accuracy checks were carried out before the data was passed to Defra for further processing.

From the processed data, the vehicle types were split into multiple categories which were then collated into five vehicle types, namely:

- Car
- Light Goods Vehicle (LGV)
- Heavy Goods Vehicle (HGV)
- Taxis
- Bus and coach

The propulsion type was also defined and then refined into three categories:

- Petrol, Petrol Gas and Gas
- Diesel, Gas Diesel
- Electric, Gas Bi-Fuel, Hybrid, Electric Diesel, New Fuel Technology

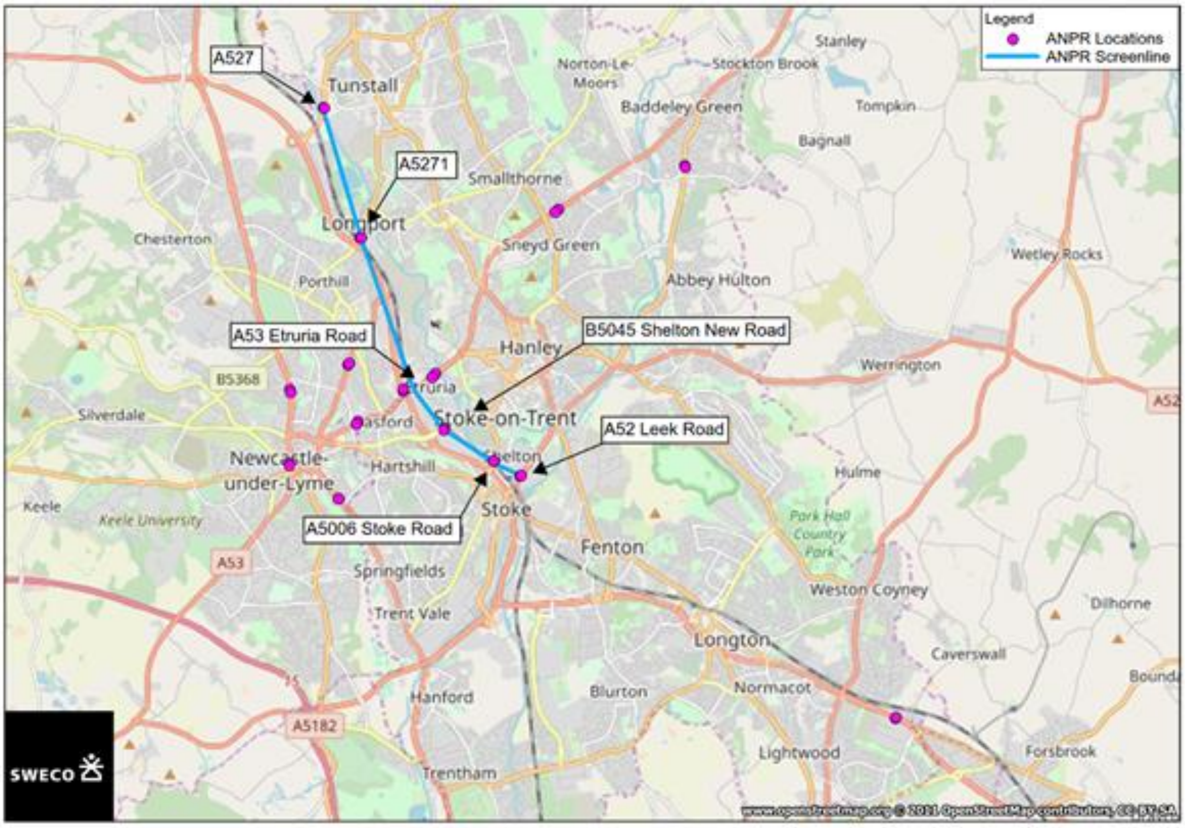
The collected ANPR data and information from the DVLA database has been used to identify different compliance types by fuel type and Euro Standard for emissions. This information was processed to determine the compliancy split by vehicle type to segment the NSMM transport model trip matrices into the following demand segments:

- Car compliant
- Car non-compliant
- LGV compliant
- LGV non-compliant
- HGV compliant
- HGV non-compliant

- Taxis compliant
- Taxis non-compliant

A screenline was used to determine the compliance splits, as it avoids double counting vehicles which might pass through multiple ANPR locations. Six sites to the east of the A500 were formed to construct a screenline, as shown in Figure 3-12, to ensure a robust and comprehensive sample of traffic movements are intercepted.

*Figure 3-12 ANPR screenline data collection locations*




The taxi compliance percentage split could not be derived from the ANPR surveys. Therefore, the percentage split was derived from licence data provided by NuLBC. This percentage split was then applied to the ANPR taxi count to identify the number of compliant taxi vehicles.

The resulting compliance splits are shown in Table 3-13 based on processed data for Monday to Thursday to be commensurate with the NSMM transport model modelled weekday.

*Table 3-13 ANPR compliance splits (2019)*

| Car | | HGV | | LGV | | Taxi | | Bus/Coach | |
|---|---|---|---|---|---|---|---|---|---|
| Comp | Non-comp | Comp | Non-comp | Comp | Non-comp | Comp | Non-comp | Comp | Non-comp |
| 61% | 39% | 63% | 38% | 30% | 70% | 18% | 82% | 19% | 81% |

# 4 Traffic assignment model validation (T2b)

## 4.1 Overview

This Section compares observed and modelled traffic flows at a screenline and link level, presents the results of the validation of modelled journey times, compares observed and modelled vehicle compliance splits and details the convergence of the highway assignment model.

It is important to understand the development of the NSMM model from its original build in 2009 to its update in 2015 as part of the modelling work for EVLR, sections 4.2 and 4.3 describe the network and matrix development.

## 4.2 Network development

This section provides a brief summary of the NSMM transport model network development.

The modelled highway network is defined by a series of link types which are defined on the basis of the following link characteristics:

- Location (detailed, peripheral or wider network and position in relation to central business districts)
- Road quality (good, typical, poor)
- Road width (wider than usual)
- Number of lanes
- Number of bus lanes
- Speed limit
- Allowed modes (i.e. bus only or not)
- Level of development
- Being a slip road

Road quality is primarily based on road class with adjustments for roads which are of an unusually good or poor quality for their class. Roads are classified as wide along stretches which have central pedestrian refuges or ghost islands.

Each individual link type has an associated speed flow curve. Link types 1 to 5 include railways, station access links, connectors and links in the wider network and all use fixed speeds.

All other link types vary speed according to link flow. These curves are based on COBA 11 curves and all take the following form down to a defined minimum speed, $V_{min}$:

*below Q = Qb then* $V = V_{max} - QS$

*above Q = Qb then* $V = V_b - (Q - Q_b)S_b$

- *V = speed on link in kph*

- *Vmax = free flow speed on link in kph*
- *Vb = speed on link in kph at break point*
- *Q = flow on link in vehicles*
- *Qb = flow on link in vehicles at break point*
- *S = slope of curve below break point*
- *Sb = slope of curve above break point*

Slip roads are constructed to allow vehicles to gain or lose speed before joining or after leaving a high-speed link. As a general rule these are constructed to the same standard and have the same speed limit as the high-speed links, they join but it is necessarily the case that vehicles maintain lower average speeds while on them than is the case for the high speed links themselves. To correct for this speed on slip roads are further corrected by multiplying by a factor of 0.6 (down to Vmin).

Within Cube Voyager it is not possible to code speed flow curves in this way and the following (essentially identical) format has been used.

$$V = MAX\left[V_{\min}, \frac{V_{\max} - QS - MAX(Q - Q_b, 0)(S_b - S)}{MAX\left(1, \frac{S^p}{0.6}\right)}\right]$$

- *$S^p$ = 1 for slip roads, 0 otherwise*
- *Q = flow on link in vehicles (weighted sum of all iterations up to the current one)*

In the peripheral network where junctions are not modelled the curves are tailed down to a comparatively low value for $V_{min}$. In the detailed network the curves are not tailed.

The following four types of junctions are explicitly modelled in the detailed network of the NSMM transport model:

- Priority Junctions
- Signals (Adaptive signals)
- Roundabouts (Empirical coding)
- Merges

Standard 'give-way' and 'stop' controlled priority junctions are modelled using Cube Voyager's "Priority/Two-Way Yield Controlled, Saturation Flows" option. This function uses a standard linear relationship to determine delay, based on the saturation of conflicting movements. The function requires information on the layout of the junction and turn saturation flow (per lane). Saturation flows are calculated using the PICADY formulae as shown in Table 4-1. For priority junctions, it is considered that vehicles are able to enter any flare lane faster than they can leave it and so any flare lanes present can be treated as though they are a full additional lane.

Signalised junctions were modelled using Cube Voyager's "Adaptive Signal, Saturation Flows" option which required information on junction geometry, phasing, minimum and maximum green times and saturation flows. This option optimises the signal settings at each junction to minimise delay for the modelled traffic flows using the junction. This replicates the behaviour of "real-world" signal controllers and produces representative levels of delay. The capacity of a signalised junction is affected by "flare lanes" which effectively provide an additional lane of capacity for a short period at the start of each green signal until they are discharged. Calculation of the capacity provided by the flare is therefore quite complicated and is dependent on the length of the flare, the cycle time of the signals, the length of the relevant signal stage and the number of vehicles making the relevant turning movement. Most of these parameters are likely to change between, and even during model assignments, but the junction modelling requires a fixed value for a saturation flow.

For longer flares (greater than 50m) at signalised junctions it has been assumed that the flare operates as effectively as a full additional lane and is modelled as such (see Table 3-1). Shorter flares will only provide additional capacity for a short time during each signal cycle and so the additional capacity will be lower. In order to model this effect, the short flare lanes were not explicitly coded as a separate lane in the junction layout. However, to approximate the effect on capacity of the flare the saturation flow of the flaring lane was adjusted as shown in Table 4-1.

*Table 4-1: Saturation flows for priority and signalised junctions*

| Junction Type | Turn | Saturation Flow |
|---|---|---|
| **Priority / Give-way** | Minor arm left | $745(1+0.094(w-3.65))$ |
| | Minor arm, ahead and right | $627(1+0.094(w-3.65))$ |
| | Major arm right | $745(1+0.094(w-3.65))$ |
| | Major arm left and ahead | As signals |
| **Signals** | From nearside lanes to all destinations (including flare lanes >50m in length) | $\frac{2080-140-42g+100(w-3.25)}{1+1.5/r}+FLA$<br>*g = gradient (%)*<br>*w = lane width (m)*<br>*r = turning radius (m)* |
| | From offside lanes to all destinations (including flare lanes >50m in length) | $\frac{2080-42g+100(w-3.25)}{1+1.5/r}+FLA$<br>*g = gradient (%)*<br>*w = lane width (m)*<br>*r = turning radius (m)* |
| | Adjustment for flare lanes <50m in length | $FLA = 8l/N$<br>*l = flare length (m)*<br>*N = number of turning movements from lane* |
| **A 5% slope was assumed for significant gradients** | | |

Small roundabouts with no more than four arms which do not have significant U-turn movements are modelled using Cube Voyager's "Roundabout/Merge, Empirical" option. This function uses the standard equations developed by TRL and which are used in ARCADY and other standard transport modelling software packages. Roundabouts are coded using the geometry of entry width, approach width, flare length, inscribed diameter, entry radius and entry angle for each approach arm. The same process is also used for large "exploded" roundabouts but the parameters for the circulating arm are set so that minimal delays are calculated.

For nodes representing merges, the methodology specified by COBA 11 is used to calculate delays. This specifies that the delay on both the main and merging arms of merges (in seconds per vehicle) is equal to 227(CapacityRatio - 0.75), with CapacityRatio being the total approach flow divided by the capacity of the downstream link (which is taken as 1900 multiplied by the number of lanes). As this methodology is not available within Cube Voyager these delays are calculated within a separate script and applied on the link downstream of the merge. In practice a value in minutes is required and when flows are low the value of (CapacityRatio – 0.75) can drop below zero resulting in a negative delay. Within the model the delay is therefore calculated as:

$$d = MAX\left(\frac{1}{60}, \frac{227(CapacityRatio - 0.75)}{60}\right)$$

4.2.1 <u>Public transport</u>

The model contains local bus services and rail services. Long distance coach services are excluded due to the low levels of service. Bus service routes, stopping patterns and frequencies are based on published timetables. Overall route run times are corrected to the full route run time as taken from the published timetables. Two wait curves are used in the model, namely; for initial and transfer waits. For initial waits (where users board their first bus or train) there is a minimum wait of 0.5 minutes. For services with headways between 1 and 20 minutes it is assumed that the user has no knowledge of the timetable and the wait is taken as half the headway. For less frequently running services it is assumed that the user has knowledge of the timetable and will only wait for 10 minutes. For transfers it is assumed that waits will be half the headway for headways of 1 to 60 minutes with a minimum wait of 0.5 minutes and a maximum wait of 30 minutes.

Bus fares are based on a simplified distance-based fare derived on the basis of the main operator and whether it is peak or off peak. Rail fares are derived in a similar way.

### 4.3 Matrix development

The NSMM transport model was originally developed in 2009. The 2009 observed trip matrices were derived from roadside interviews and traffic counts, with the resultant prior observed matrices being matrix estimated.

The 2009 NSMM base-year highway model has successfully been calibrated and validated in accordance with WebTAG. It represents the following vehicle classes:

- Car
- LGV
- HGV

Further details on the development of the 2009 base-year trip matrices are provided in the NSMM Model Calibration and Validation Report (SKM Colin Buchanan, March 2011).

Following liaison with the Department for Transport (DfT), it was agreed to develop the updated 2015 transport model using the existing forecast models. This required two runs of the demand model:

1) A 2009 run (identical to the calibrated version of the model) with the refined 288 zones (i.e. taking account of the disaggregation of the model zones in the Etruria Valley and Middleport areas)
2) A 2015 run with the latest planning data and transport network changes

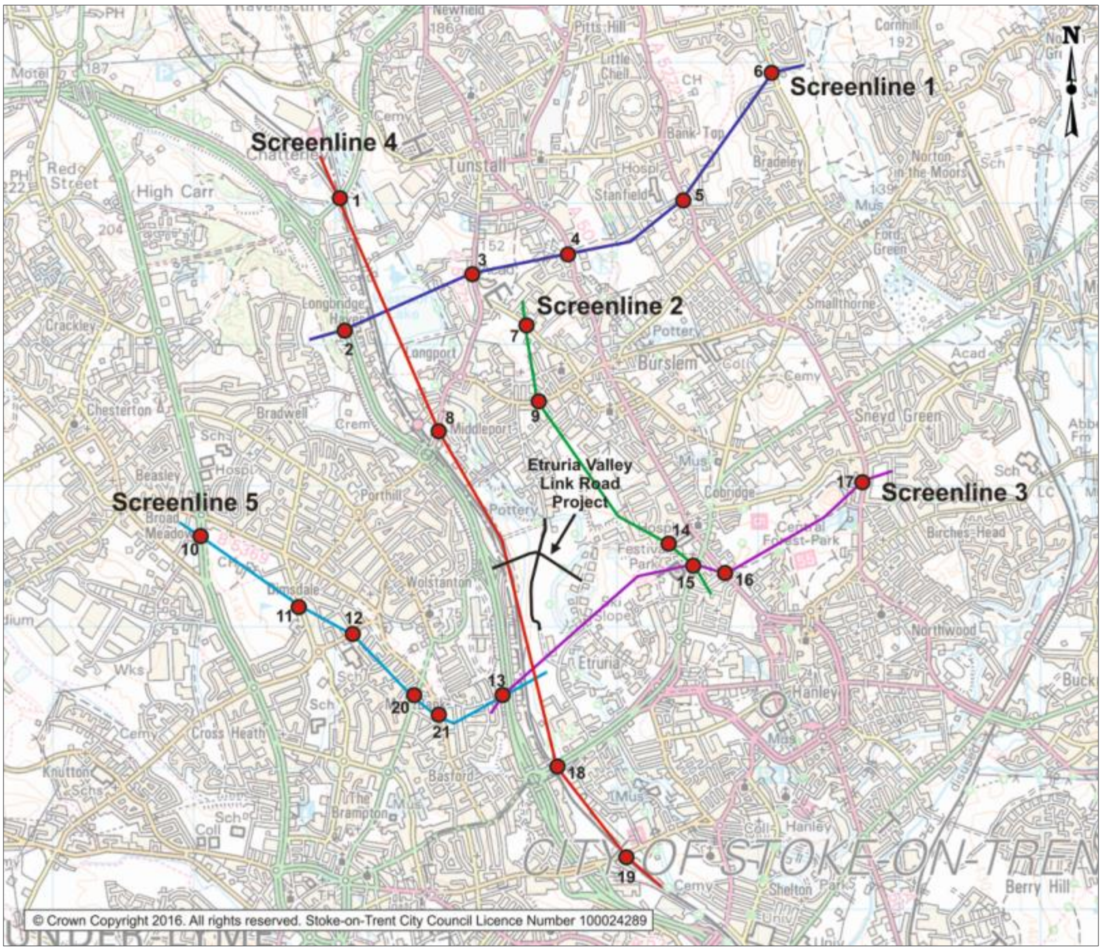
As the model is incremental, the change in the demand between scenarios (1) and (2) above was constrained to NTEM traffic forecasts and was additively applied to the 2009 assigned base-year trip matrices to produce updated 2015 trip matrices for each of the modelled time periods.

As part of the modelling work undertaken for EVLR, a Present Year Validation (PYV) was carried out of the updated 2015 NSMM transport model based on the 'forecast' 2015 trip matrices. The results of the PYV showed that an unacceptable level of fit was achieved between the modelled traffic flow and journey time data when compared with the corresponding observed data.

In order to improve the validation of the 2015 NSMM transport model, and as recommended by DfT, a calibration exercise was undertaken through the application of screenline factoring to the derived 2015 trip matrices using the five calibration screenlines shown in Figure 4-1. The screenline factoring was undertaken separately for cars, LGVs and HGVs, for each modelled time period and was applied by direction. This factoring was only undertaken once.

For the modelling work undertaken for air quality local plan, the 2015 EVLR modelling was used as a starting point. The 2015 matrices were segmented by vehicle type and CAZ compliant status, using ANPR data, as outlined in section 4.9 As agreed with JAQU, there was not time to undertake a full data collection exercise of new traffic count data for this work, nor to update and fully recalibrate and validate a 2018 model, given the timeframes of the ministerial direction.

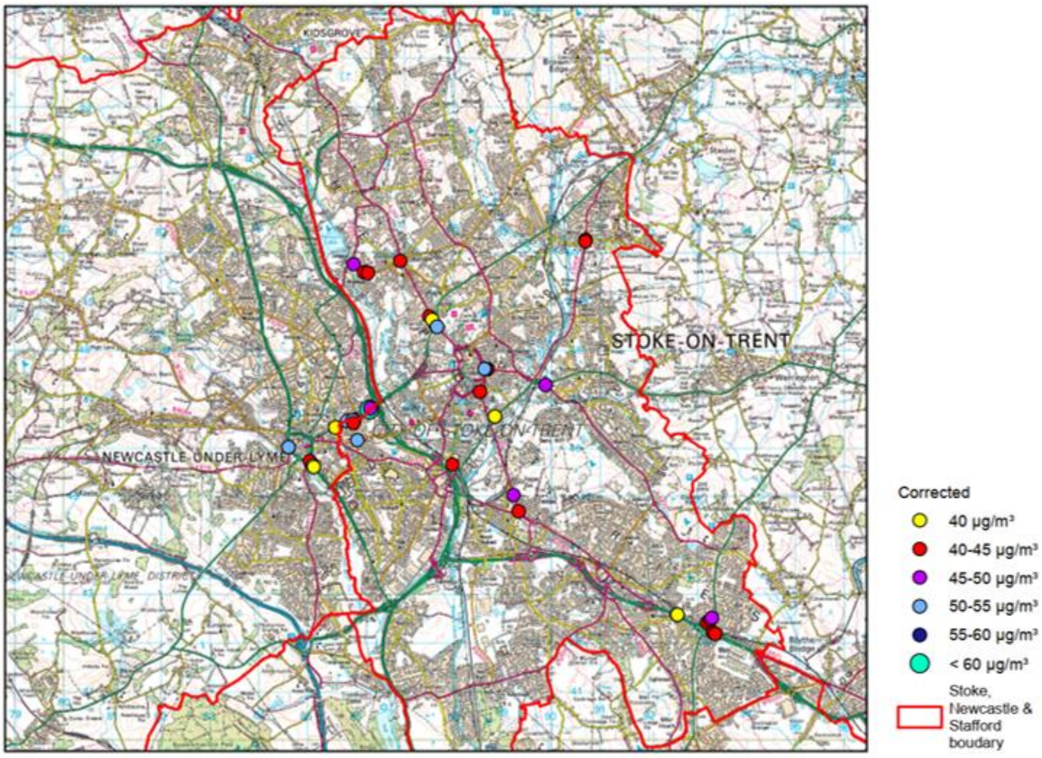
*Figure 4-1: EVLR modelling calibration screenlines used for screenline factoring*




## 4.4 Model validation

The model validation work for the air quality local plan centres on key local roads in the North Staffordshire conurbation including those links in exceedance of the annual average $NO_2$ limit value in 2017 based on the monitored locations shown in Figure 4-2. Further comparisons will be undertaken at the exceedance locations identified from the 2022 air quality modelling work.

Figure 4-2 Locations of monitored $NO_2$ exceedances in 2017 (SoTCC)




### 4.5 Observed traffic counts

Figure 4-3 shows the locations of the observed link counts and screenlines used to validate the NSMM transport model. In total there are 156 link counts for the AM, 141 for the PM and 156 for the inter-peak modelled periods. Four lots of bi-directional screenlines and a cordon have been formed from some of the counts, namely:

- Northbound/Southbound Screenline (to the north of Hanley City Centre and Newcastle-under-Lyme Town Centre)
- Eastbound/Westbound (to the east of the A500)
- West of A500 Screenline (to the east of the A500)
- East of A50 Screenline (Along the A50 from Tunstall towards Hanley)
- Cordon (around the North Staffordshire conurbation)

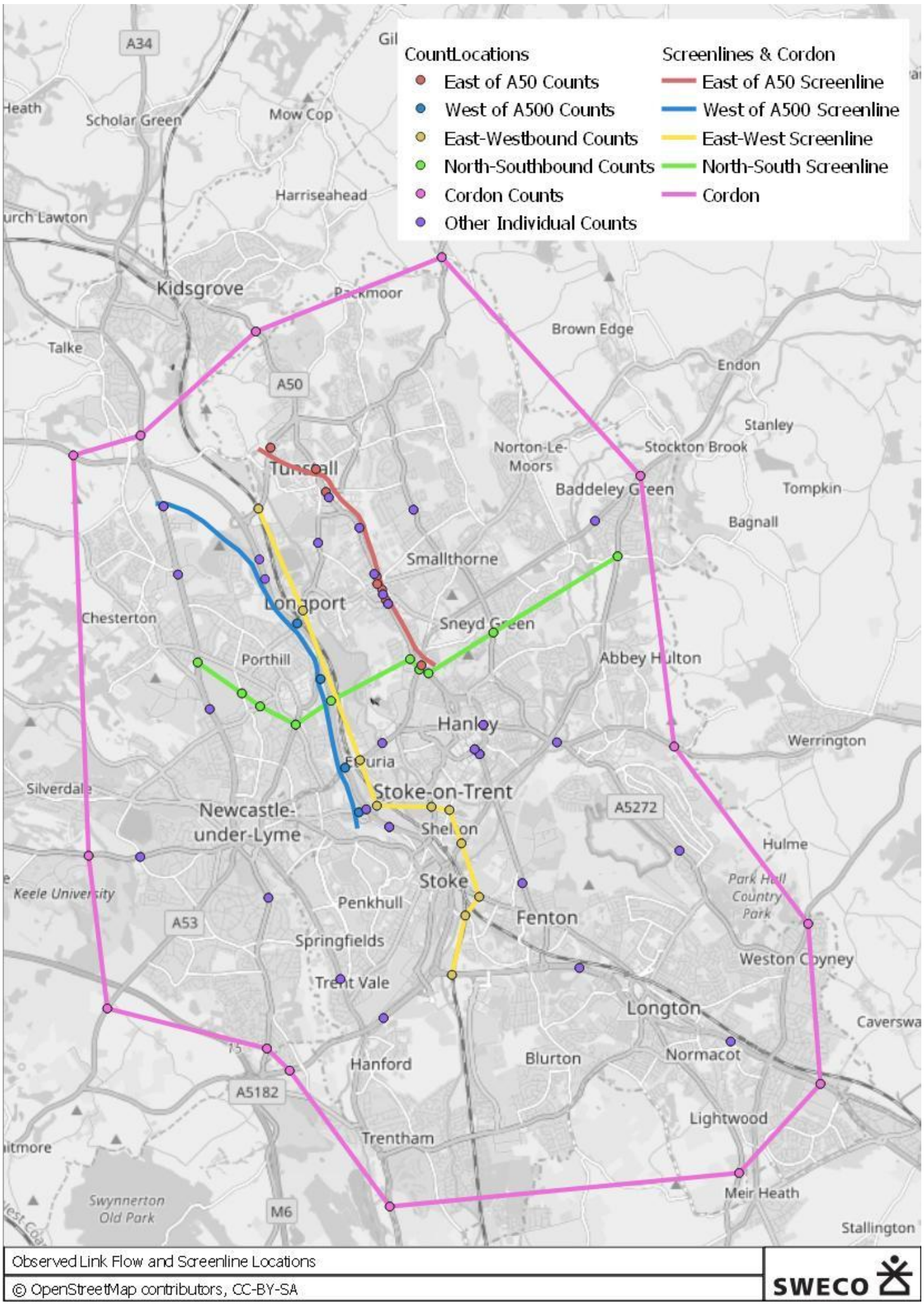
It should be noted that the cordon is not watertight but it does however capture the key roads into the conurbation.

The observed traffic counts are generally from 2015 and are formed from a range of sources, namely:

- Passing counts from data.gov.uk
- Staffordshire County Council turning counts
- Stoke-on-Trent City Council manual and automatic passing counts
- Sky High passing and turning counts

As detailed in Section 3.5, there has been no traffic growth between 2015 and 2018, hence the use of the 2015 NSMM model as a starting point for this work to inform the development of a 2018 base year air quality model.

*Figure 4-3: Observed link flow and screenline locations*



### 4.6 Screenline validation

The modelled screenline flows have been calibrated against the two criteria documented in the Design Manual for Roads and Bridges (DMRB) Volume 12, Section 2, Part 1, Chapter 4, Table 4.2 with the target that all (or nearly all) of the screenlines should pass these criteria. The first criterion relates to the modelled flow across the screenline being within 5% of the observed value. The second criterion is based on the GEH statistic which should have a value of less than 4 to pass the test.

The GEH statistic is defined by the formula:

$$GEH = \sqrt{\frac{(M - C)^2}{(M + C)/2}}$$

- *M = the modelled flow*
- *C = the observed flow*

Table 4-2 to Table 4-4 show the performance of the model for individual vehicles and total vehicles for each screenline in the AM peak-hour, Inter-Peak hour and PM peak-hour, respectively. The total modelled flows pass screenline criteria of being within 5% of the observed for 60% of screenlines in the AM peak-hour, 70% of screenlines in the Inter-Peak hour and 60% of the screenlines in the PM peak-hour.

In the AM peak hour the model is slightly over estimating northbound total vehicles across the North- South screenline and overestimating eastbound total vehicles across the East-West screenline. The opposite directions however provide a good match between total modelled and observed flows.

The inter-peak hour and PM peak hour show a good match between modelled and observed total vehicles, with screenline validation criteria only very narrowly outside the 5% or GEH 4 or less thresholds in the inter-peak.

The goods vehicles total do not validate so well across the screenlines due to the small numbers of LGVs and HGVs making it difficult to meet the tight criteria.

*Table 4-2: AM peak hour screenline validation (total vehicles)*

| | Observed Total | | | | Modelled | | | | Car | | LGV | | HGV | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Car | LGV | HGV | Total | Car | HGV | LGV | Total | Difference | % Diff | Difference | % Diff | Difference | % Diff | Difference | % Diff |
| **Cordon Validation Counts - In** | 10,401 | 1,350 | 695 | 14,953 | 11,674 | 890 | 1,316 | 16,445 | 1,273 | 12% | -34 | -2% | 195 | 28% | 1,492 | 10% |
| **Cordon Validation Counts - Out** | 7,326 | 1,762 | 820 | 11,888 | 7,650 | 909 | 1,424 | 12,224 | 324 | 4% | -338 | -19% | 89 | 11% | 336 | 3% |
| **North-South Screenline NB** | 6,271 | 1,032 | 505 | 7,810 | 6,989 | 484 | 809 | 8,282 | 718 | 11% | -223 | -22% | -21 | -4% | 472 | 6% |
| **North-South Screenline SB** | 8,578 | 1,053 | 485 | 10,912 | 8,864 | 555 | 596 | 10,872 | 286 | 3% | -457 | -43% | 70 | 14% | -40 | 0% |
| **East-West Screenline EB** | 8,660 | 1,364 | 530 | 10,617 | 9,589 | 668 | 1,171 | 11,431 | 929 | 11% | -193 | -14% | 138 | 26% | 814 | 7.66% |
| **East-West Screenline WB** | 9,184 | 1,522 | 518 | 11,224 | 9,684 | 688 | 1,080 | 11,464 | 500 | 5% | -442 | -29% | 170 | 33% | 240 | 2% |
| **West of A500 Screenline - EB** | 4,040 | 488 | 131 | 4,659 | 4,215 | 156 | 428 | 4,799 | 175 | 4% | -60 | -12% | 25 | 19% | 140 | 3.00% |
| **West of A500 Screenline - WB** | 3,381 | 548 | 128 | 4,057 | 3,671 | 177 | 431 | 4,279 | 290 | 9% | -117 | -21% | 49 | 38% | 222 | 5% |
| **East of A50 Screenline - EB** | 2,896 | 503 | 137 | 3,536 | 2,779 | 155 | 431 | 3,365 | -117 | -4% | -72 | -14% | 18 | 13% | -171 | -4.82% |
| **East of A50 Screenline - WB** | 4,449 | 617 | 134 | 5,200 | 5,063 | 198 | 410 | 5,671 | 614 | 14% | -207 | -34% | 64 | 48% | 471 | 9% |

| | Car | | | | LGV | | | | HGV | | | | Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GEH | Difference<5% | GEH<4 | DMRB or GEH | GEH | Difference<5% | GEH<4 | DMRB or GEH | GEH | Difference<5% | GEH<4 | DMRB or GEH | GEH | Difference<5% | GEH<4 | DMRB or GEH |
| **Cordon Validation Counts - In** | 12.1 | ✗ | ✗ | ✗ | 0.9 | ✓ | ✓ | ✓ | 6.9 | ✗ | ✗ | ✗ | 11.9 | ✗ | ✗ | ✗ |
| **Cordon Validation Counts - Out** | 3.7 | ✓ | ✓ | ✓ | 8.5 | ✗ | ✗ | ✗ | 3.0 | ✗ | ✓ | ✓ | 3.1 | ✓ | ✓ | ✓ |
| **North-South Screenline NB** | 8.8 | ✗ | ✗ | ✗ | 7.3 | ✗ | ✗ | ✗ | 1.0 | ✓ | ✓ | ✓ | 5.3 | ✗ | ✗ | ✗ |
| **North-South Screenline SB** | 3.1 | ✓ | ✓ | ✓ | 15.9 | ✗ | ✗ | ✗ | 3.1 | ✗ | ✓ | ✓ | 0.4 | ✓ | ✓ | ✓ |
| **East-West Screenline EB** | 9.7 | ✗ | ✗ | ✗ | 5.4 | ✗ | ✗ | ✗ | 5.6 | ✗ | ✗ | ✗ | 7.7 | ✗ | ✗ | ✗ |
| **East-West Screenline WB** | 5.2 | ✗ | ✗ | ✗ | 12.2 | ✗ | ✗ | ✗ | 6.9 | ✗ | ✗ | ✗ | 2.3 | ✓ | ✓ | ✓ |
| **West of A500 Screenline - EB** | 2.7 | ✓ | ✓ | ✓ | 2.8 | ✗ | ✓ | ✓ | 2.1 | ✗ | ✓ | ✓ | 2.0 | ✓ | ✓ | ✓ |
| **West of A500 Screenline - WB** | 4.9 | ✗ | ✗ | ✗ | 5.3 | ✗ | ✗ | ✗ | 3.9 | ✗ | ✓ | ✓ | 3.4 | ✗ | ✓ | ✓ |
| **East of A50 Screenline - EB** | 2.2 | ✓ | ✓ | ✓ | 3.3 | ✗ | ✓ | ✓ | 1.5 | ✗ | ✓ | ✓ | 2.9 | ✓ | ✓ | ✓ |
| **East of A50 Screenline - WB** | 8.9 | ✗ | ✗ | ✗ | 9.1 | ✗ | ✗ | ✗ | 5.0 | ✗ | ✗ | ✗ | 6.4 | ✗ | ✗ | ✗ |

*Table 4-3: IP hour screenline validation (total vehicles)*

| | Observed Total | | | | Modelled | | | | Car | | LGV | | HGV | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Car | LGV | HGV | Total | Car | HGV | LGV | Total | Difference | % Diff | Difference | % Diff | Difference | % Diff | Difference | % Diff |
| Cordon Validation Counts - In | 5,648 | 1,254 | 981 | 9,055 | 6,173 | 646 | 1,314 | 9,424 | 525 | 9% | 60 | 5% | -335 | -34% | 369 | 4% |
| Cordon Validation Counts - Out | 5,950 | 1,313 | 772 | 9,239 | 6,636 | 662 | 1,124 | 9,585 | 686 | 12% | -189 | -14% | -110 | -14% | 346 | 4% |
| North-South Screenline NB | 7,119 | 948 | 594 | 9,122 | 7,544 | 421 | 691 | 8,656 | 425 | 6% | -257 | -27% | -173 | -29% | -466 | -5% |
| North-South Screenline SB | 6,301 | 920 | 549 | 7,842 | 6,695 | 307 | 807 | 7,808 | 394 | 6% | -113 | -12% | -242 | -44% | -34 | 0% |
| East-West Screenline EB | 7,876 | 1,530 | 539 | 9,945 | 7,730 | 481 | 1,260 | 9,480 | -146 | -2% | -270 | -18% | -58 | -11% | -465 | -4.68% |
| East-West Screenline WB | 7,474 | 1,429 | 509 | 9,412 | 8,038 | 535 | 1,199 | 9,771 | 564 | 8% | -230 | -16% | 26 | 5% | 359 | 4% |
| West of A500 Screenline - EB | 2,524 | 358 | 139 | 3,021 | 2,912 | 156 | 389 | 3,457 | 388 | 15% | 31 | 9% | 17 | 13% | 436 | 14.45% |
| West of A500 Screenline - WB | 2,873 | 357 | 166 | 3,396 | 3,286 | 129 | 418 | 3,834 | 413 | 14% | 61 | 17% | -37 | -22% | 438 | 13% |
| East of A50 Screenline - EB | 3,722 | 492 | 173 | 4,387 | 3,641 | 144 | 429 | 4,214 | -81 | -2% | -63 | -13% | -29 | -17% | -173 | -3.93% |
| East of A50 Screenline - WB | 3,032 | 502 | 122 | 3,656 | 3,042 | 130 | 500 | 3,672 | 10 | 0% | -2 | 0% | 8 | 6% | 16 | 0% |

| | Car | | | | LGV | | | | HGB | | | | Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GEH | Difference<5% | GEH<4 | DMRB or GEH<4 | GEH | Difference<5% | GEH<4 | DMRB or GEH<4 | GEH | Difference<5% | GEH<4 | DMRB or GEH<4 | GEH | Difference<5% | GEH<4 | DMRB or GEH<4 |
| Cordon Validation Counts - In | 6.8 | × | × | × | 1.7 | ✓ | ✓ | ✓ | 11.8 | × | × | × | 3.8 | ✓ | ✓ | ✓ |
| Cordon Validation Counts - Out | 8.7 | × | × | × | 5.4 | × | × | × | 4.1 | × | × | × | 3.6 | ✓ | ✓ | ✓ |
| North-South Screenline NB | 5.0 | × | × | × | 9.0 | × | × | × | 7.7 | × | × | × | 4.9 | × | × | × |
| North-South Screenline SB | 4.9 | × | × | × | 3.9 | × | ✓ | ✓ | 11.7 | × | × | × | 0.4 | ✓ | ✓ | ✓ |
| East-West Screenline EB | 1.7 | ✓ | ✓ | ✓ | 7.2 | × | × | × | 2.6 | × | ✓ | × | 4.7 | ✓ | × | ✓ |
| East-West Screenline WB | 6.4 | × | × | × | 6.4 | × | × | × | 1.1 | × | ✓ | × | 3.7 | ✓ | ✓ | ✓ |
| West of A500 Screenline - EB | 7.4 | × | × | × | 1.6 | × | ✓ | ✓ | 1.4 | × | ✓ | × | 7.7 | × | × | × |
| West of A500 Screenline - WB | 7.4 | × | × | × | 3.1 | × | ✓ | ✓ | 3.0 | × | ✓ | × | 7.3 | × | × | × |
| East of A50 Screenline - EB | 1.3 | ✓ | ✓ | ✓ | 2.9 | × | ✓ | ✓ | 2.3 | × | ✓ | × | 2.6 | ✓ | ✓ | ✓ |
| East of A50 Screenline - WB | 0.2 | ✓ | ✓ | ✓ | 0.1 | ✓ | ✓ | ✓ | 0.7 | × | ✓ | × | 0.3 | ✓ | ✓ | ✓ |

SWECO

*Table 4-4: PM peak hour screenline validation (total vehicles)*

| | Observed Total | | | | Modelled | | | | Car | | LGV | | HGV | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Car | LGV | HGV | Total | Car | HGV | LGV | Total | Difference | % Diff | Difference | % Diff | Difference | % Diff | Difference | % Diff |
| Cordon Validation Counts - In | 9,158 | 1,398 | 515 | 13,273 | 9,914 | 777 | 1,338 | 14,265 | 756 | 8% | -60 | -4% | 262 | 51% | 992 | 7% |
| Cordon Validation Counts - Out | 10,533 | 1,188 | 446 | 14,690 | 12,162 | 651 | 1,194 | 16,555 | 1,629 | 15% | 6 | 1% | 205 | 46% | 1,865 | 13% |
| North-South Screenline NB | 10,538 | 981 | 237 | 11,756 | 10,326 | 398 | 799 | 11,522 | -212 | -2% | -182 | -19% | 161 | 68% | -234 | -2% |
| North-South Screenline SB | 7,826 | 804 | 258 | 9,389 | 7,550 | 357 | 671 | 9,057 | -276 | -4% | -133 | -17% | 99 | 38% | -332 | -4% |
| East-West Screenline EB | 10,605 | 1,252 | 224 | 12,081 | 10,639 | 409 | 1,208 | 12,263 | 34 | 0% | -44 | -4% | 185 | 82% | 182 | 1.51% |
| East-West Screenline WB | 10,193 | 985 | 272 | 11,450 | 10,101 | 414 | 1,131 | 11,649 | -92 | -1% | 146 | 15% | 142 | 52% | 199 | 2% |
| West of A500 Screenline - EB | 3,560 | 318 | 54 | 3,741 | 3,555 | 94 | 460 | 4,109 | -5 | 0% | 142 | 45% | 40 | 74% | 368 | 9.84% |
| West of A500 Screenline - WB | 4,834 | 409 | 77 | 5,320 | 4,387 | 143 | 527 | 5,057 | -447 | -9% | 118 | 29% | 66 | 86% | -263 | -5% |
| East of A50 Screenline - EB | 5,098 | 544 | 41 | 5,683 | 5,363 | 70 | 583 | 6,032 | 265 | 5% | 39 | 7% | 29 | 71% | 349 | 6.14% |
| East of A50 Screenline - WB | 3,561 | 387 | 48 | 3,996 | 3,319 | 62 | 450 | 3,831 | -242 | -7% | 63 | 16% | 14 | 28% | -165 | -4% |

| | Car | | | | LGV | | | | HGB | | | | Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GEH | Difference<5% | GEH<4 | DMRB or GEH<4 | GEH | Difference<5% | GEH<4 | DMRB or GEH<4 | GEH | Difference<5% | GEH<4 | DMRB or GEH<4 | GEH | Difference<5% | GEH<4 | DMRB or GEH<4 |
| Cordon Validation Counts - In | 7.7 | ✗ | ✗ | ✗ | 1.6 | ✓ | ✓ | ✓ | 10.3 | ✗ | ✗ | ✗ | 8.5 | ✗ | ✗ | ✗ |
| Cordon Validation Counts - Out | 15.3 | ✗ | ✗ | ✗ | 0.2 | ✓ | ✓ | ✓ | 8.8 | ✗ | ✗ | ✗ | 14.9 | ✗ | ✗ | ✗ |
| North-South Screenline NB | 2.1 | ✓ | ✓ | ✓ | 6.1 | ✗ | ✗ | ✗ | 9.0 | ✗ | ✗ | ✗ | 2.2 | ✓ | ✓ | ✓ |
| North-South Screenline SB | 3.1 | ✓ | ✓ | ✓ | 4.9 | ✗ | ✗ | ✗ | 5.7 | ✗ | ✗ | ✗ | 3.5 | ✓ | ✓ | ✓ |
| East-West Screenline EB | 0.3 | ✓ | ✓ | ✓ | 1.3 | ✓ | ✓ | ✓ | 10.4 | ✗ | ✗ | ✗ | 1.7 | ✓ | ✓ | ✓ |
| East-West Screenline WB | 0.9 | ✓ | ✓ | ✓ | 4.5 | ✗ | ✗ | ✗ | 7.6 | ✗ | ✗ | ✗ | 1.9 | ✓ | ✓ | ✓ |
| West of A500 Screenline - EB | 0.1 | ✓ | ✓ | ✓ | 7.2 | ✗ | ✗ | ✗ | 4.6 | ✗ | ✗ | ✗ | 5.9 | ✗ | ✗ | ✗ |
| West of A500 Screenline - WB | 6.6 | ✗ | ✗ | ✗ | 5.5 | ✗ | ✗ | ✗ | 6.3 | ✗ | ✗ | ✗ | 3.6 | ✓ | ✓ | ✓ |
| East of A50 Screenline - EB | 3.7 | ✗ | ✓ | ✓ | 1.6 | ✗ | ✓ | ✓ | 3.9 | ✗ | ✓ | ✗ | 4.6 | ✗ | ✗ | ✗ |
| East of A50 Screenline - WB | 4.1 | ✗ | ✗ | ✗ | 3.1 | ✗ | ✓ | ✓ | 1.8 | ✗ | ✓ | ✗ | 2.6 | ✓ | ✓ | ✓ |

### 4.7 Link flow validation

The DfT guidelines for the validation of highway models are described in TAG unit M3.1 and the DMRB Volume 12, Section 2, Part 1, Chapter 4.

There are two separate sets of criteria for link flow validation against which the modelled flow and count comparisons should be measured. In both cases the criteria are expected to be met in at least 85% of cases. The two sets of criteria are:

GEH Statistic:

- Links should have a GEH value of less than 5

DMRB Vehicle Flow Comparison (DMRB criteria 1-3):

- Where the observed flow is less than 700 vehicles per hour, the modelled flow should be within 100 vehicles of the observed flow
- Where the observed flow is between 700 and 2,700 vehicles per hour, the modelled flow should be within 15% of the observed flow
- Where the observed flow is greater than 2,700 vehicles per hour, the modelled flow should be within 400 vehicles of the observed flow

The DfT offers guidance on the suitability of validation statistics in TAG unit 3.19

Section 3.2.7. It provides guidance for counts meeting GEH and DMRB criteria, stating that: “These two measures are broadly consistent and link flows that meet either criterion should be regarded as satisfactory.” Validation checks have been undertaken in line with these criteria.

Table 4-5 to Table 4-7 show the AM peak hour, inter-peak hour and PM peak hour modelled link flow validation statistics for all of the observed count locations. For total flows, the model shows a good correlation between modelled and observed flows with 83%, 75% and 78% of links passing either the GEH or DMRB criteria in the AM peak hour, inter-peak hour and PM peak hour, respectively.

A good correlation can also be seen between the modelled and observed data for cars, LGVs and HGVs for each modelled time period with the GEH or DMRB criteria being met in at least of 75% of cases.

Appendix A details the validation results on a link by link basis for each modelled period.

*Table 4-5: AM peak-hour link validation statistics*

| | No. of Counts | DMRB | GEH <5 | GEH<5 or DMRB |
|---|---|---|---|---|
| **Cars** | 137 | 73% | 72% | 75% |
| **LGV** | 137 | 91% | 83% | 91% |
| **HGV** | 137 | 99% | 88% | 99% |
| **Total** | **156** | **79%** | **79%** | **83%** |

Table 4-6: Inter-peak-hour link validation statistics

| | No. of Counts | DMRB | GEH <5 | GEH<5 or DMRB |
|---|---|---|---|---|
| **Cars** | 135 | 75% | 74% | 80% |
| **LGV** | 135 | 90% | 86% | 90% |
| **HGV** | 135 | 89% | 80% | 89% |
| **Total** | **141** | **68%** | **69%** | **75%** |

Table 4-7: PM peak-hour link validation statistics

| | No. of Counts | DMRB | GEH <5 | GEH<5 or DMRB |
|---|---|---|---|---|
| **Cars** | 139 | 73% | 75% | 79% |
| **LGV** | 139 | 94% | 88% | 94% |
| **HGV** | 139 | 94% | 85% | 94% |
| **Total** | **156** | **74%** | **73%** | **78%** |

Figure 4-4 to Figure 4-6 illustrate the difference between modelled link flows and observed traffic counts based on the GEH statistic, for each modelled time period. Links coloured green have a GEH value less than 5 and therefore meet TAG criteria, links in orange narrowly fail with a GEH value between 5 and 7 and red show links with a GEH value of greater than 7, showing a poorer validation. The figures show no clear trend regarding locations that do not meet the criteria with a slight tendency for the poorer validates sites to be away from areas of monitored air quality exceedances.

*Figure 4-4: AM peak hour link flow validation performance against GEH criteria*

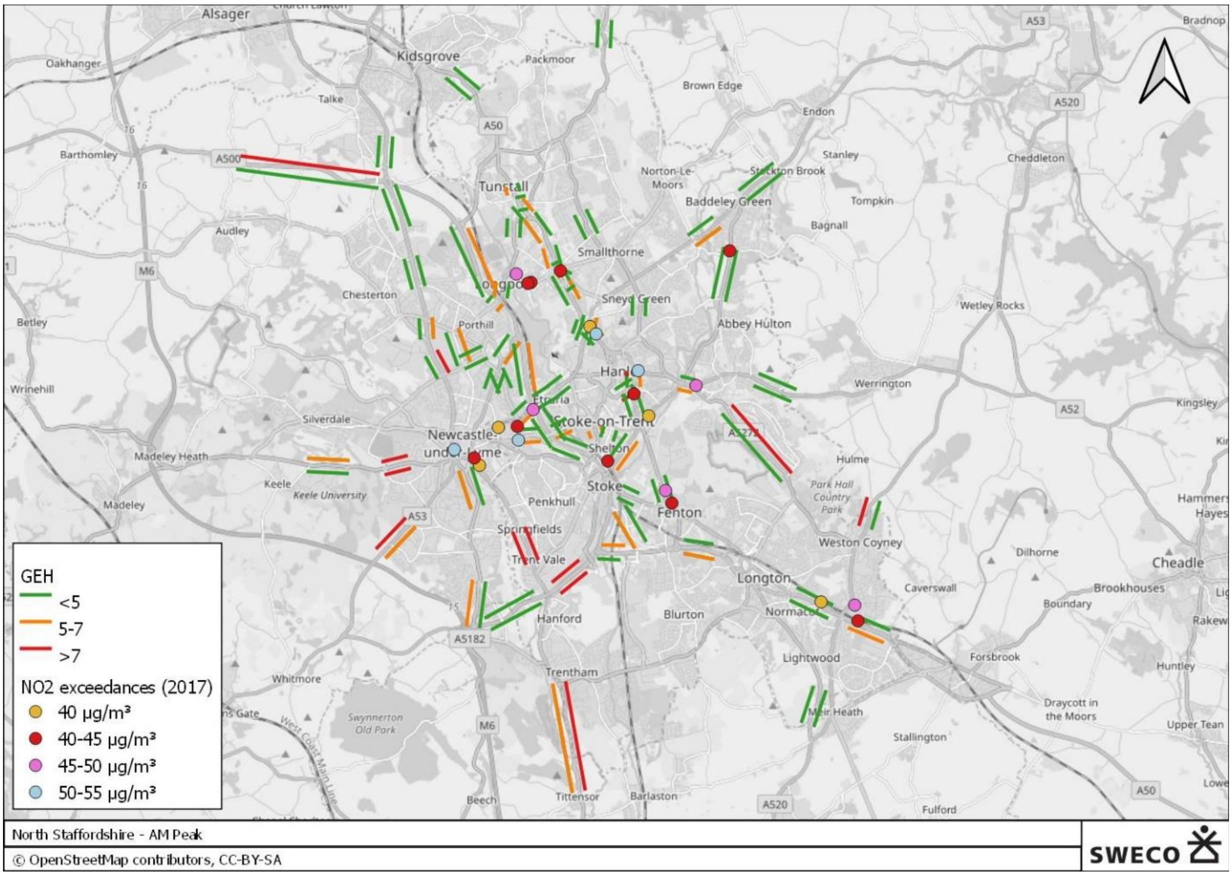


*Figure 4-5: Inter-peak hour link flow validation performance against GEH criteria*

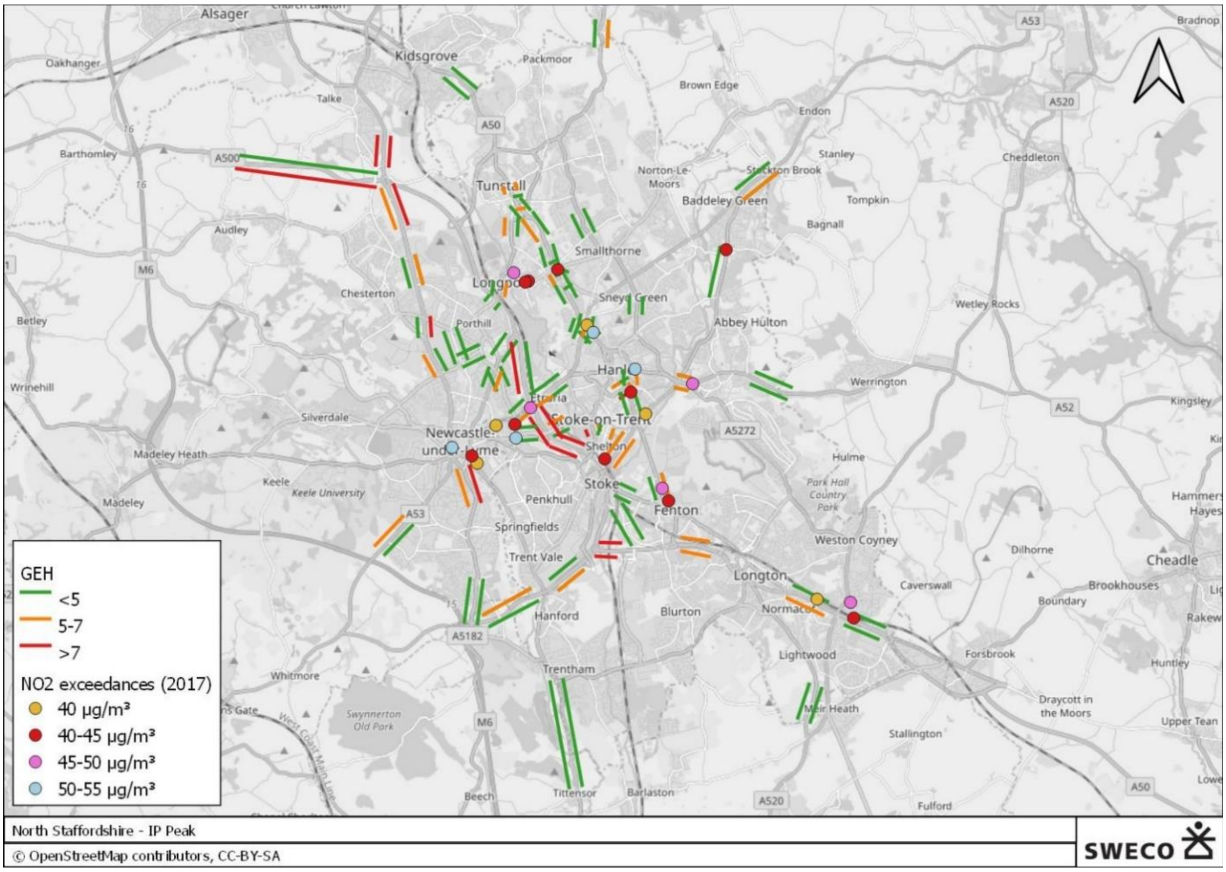
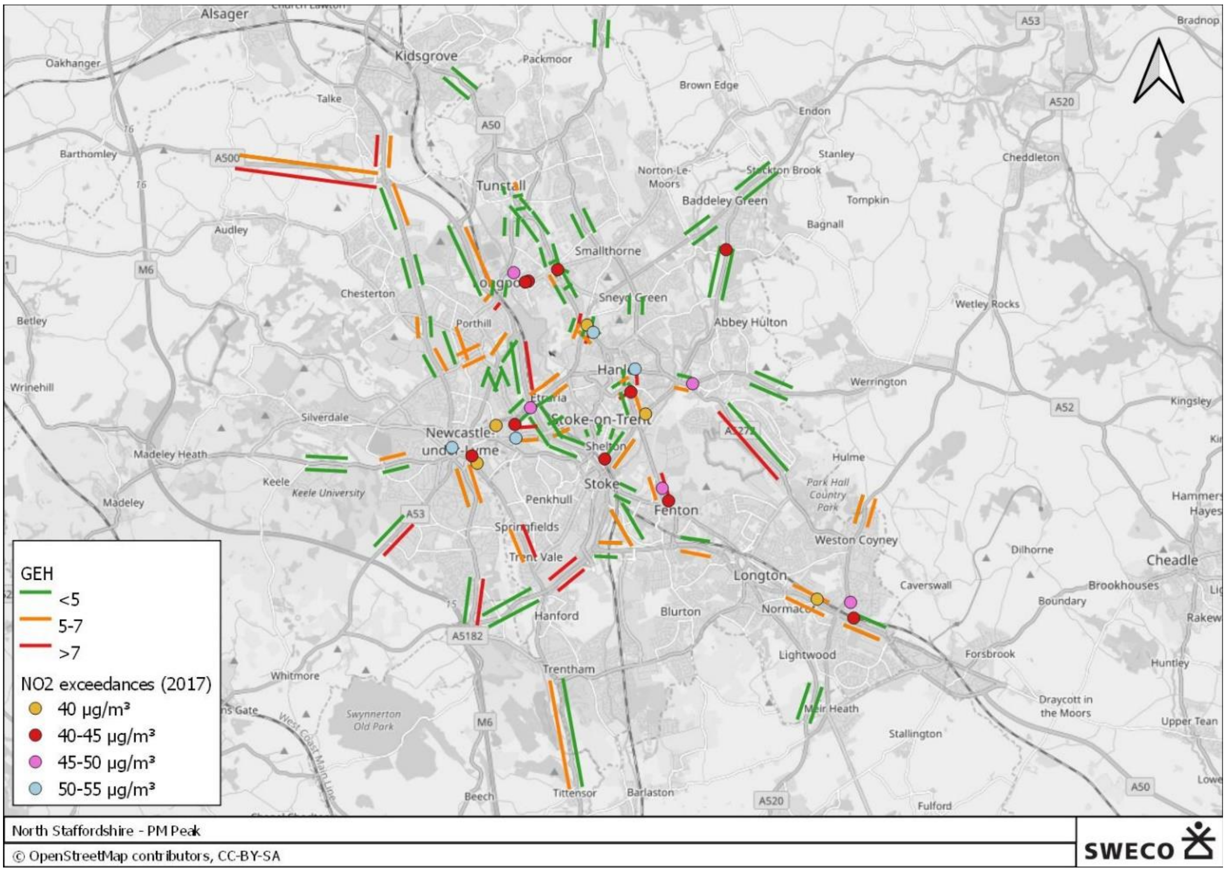


Figure 4-6: PM peak hour link flow validation performance against GEH criteria



### 4.8 Modelled flow validation at predicted exceedance locations

Table 4-8 identifies the locations predicted to be air quality exceedances in 2022 and provides commentary on the level of flow validation achieved in the base model. Figure 4-4 to Figure 4-6 show the difference between modelled link flows and observed traffic counts for these locations based on the GEH statistic, for each modelled time period. Links coloured green have a GEH less than 5 and therefore meet TAG criteria, links in orange narrowly fail with a GEH between 5 and 7 and red show links with a GEH of greater than 7, showing a poorer validation. Table 4-9 and Table 4-10 summarise the flow validation by vehicle type (cars, LGVs and HGVs) at the 3 exceedance locations for the AM and PM peaks.

*Table 4-8: Flow validation at predicted exceedance locations*

| Predicted Exceedance Location | Flow Validation Summary |
|---|---|
| **A53 – Basford** | The nearest count site is on the A53 just to the west of the A500 which shows a good match of model flows with observed flows. In the AM and IP, eastbound has a GEH of less than 5 whilst westbound has a GEH of less than 7. Traffic going up the hill towards Newcastle, which is more crucial in terms of air quality forecasts are therefore better represented. For PM, both directions have a GEH less than 5. |
| **Bucknall New Road** | The nearest count is on Bucknall Road to the east of the A52. Generally, a reasonable match, with the AM and PM eastbound flow comparison less than a GEH of 5 and the other time periods and direction just outside the range but less than a GEH of 7. |
| **Victoria Road** | The nearest count is adjacent to the point of exceedance and has an excellent match in the AM with both directions having a GEH of less than 5. In the IP, northbound is excellent whilst southbound has a GEH slightly outside 5 In the PM, northbound falls just slightly outside a GEH of 5 whilst southbound has a less good match. |

*Table 4-9: Flow validation at predicted exceedance locations (AM)*

| Name | Direction | Observed Flow | | | | Modelled Flow | | | | DMRB OR GEH<5 (Total) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Car | LGV | HGV | Total | Car | LGV | HGV | Total | |
| **A53 – Basford** | EB | 2373 | 270 | 91 | 2734 | 2481 | 308 | 94 | 2884 | ✓ |
| **A53 – Basford** | WB | 1476 | 325 | 84 | 1885 | 1716 | 241 | 89 | 2047 | ✓ |
| **Bucknall New Road** | EB | 760 | 165 | 25 | 950 | 810 | 110 | 50 | 970 | ✓ |
| **Bucknall New Road** | WB | 1502 | 149 | 17 | 1668 | 1720 | 166 | 54 | 1940 | × |
| **Victoria Road** | NB | 713 | 146 | 30 | 889 | 820 | 124 | 50 | 994 | ✓ |
| **Victoria Road** | SB | 430 | 191 | 56 | 677 | 532 | 169 | 50 | 751 | ✓ |

*Table 4-10: Flow validation at predicted exceedance locations (PM)*

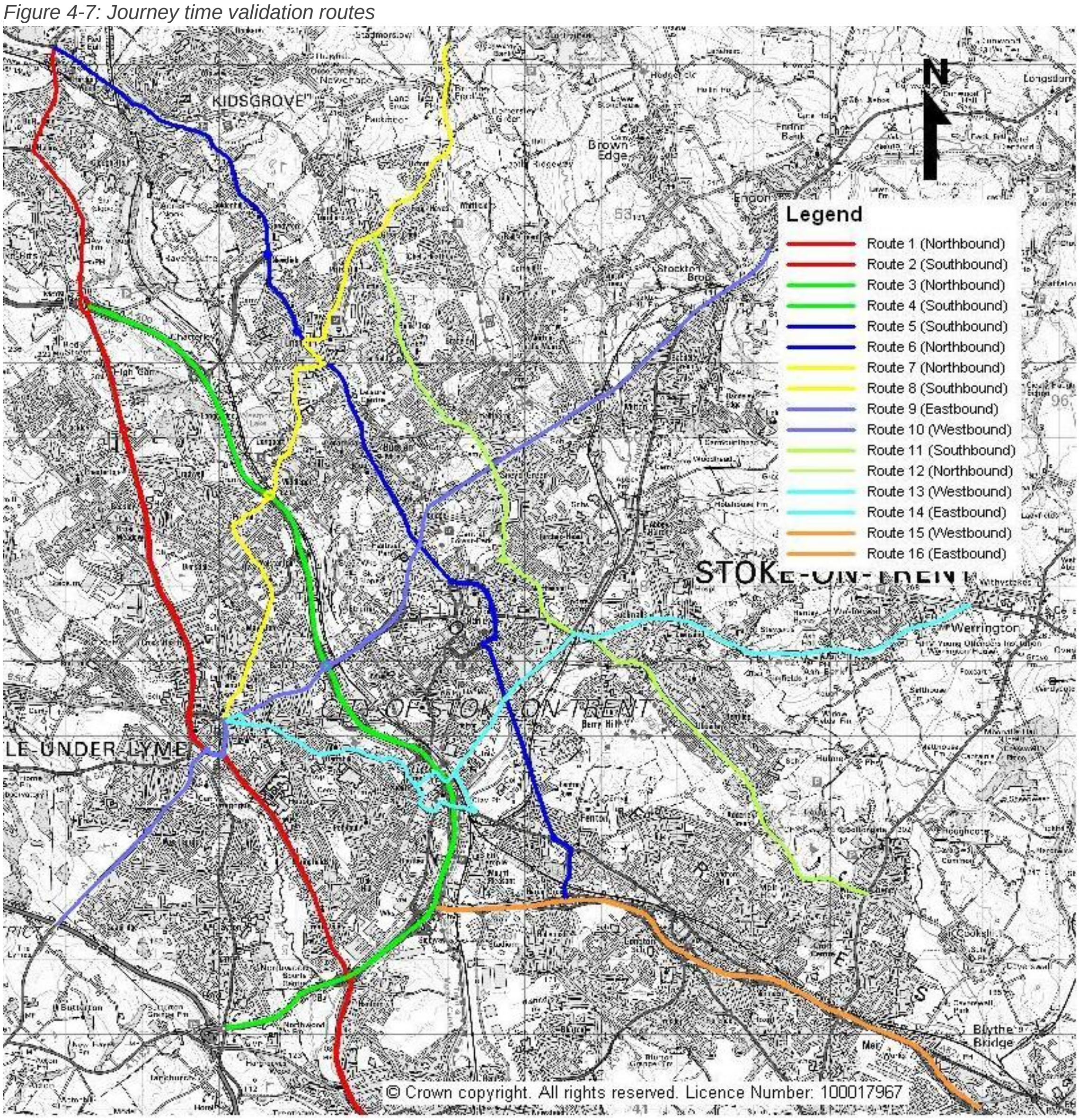
| Name | Direction | Observed Flow | | | | Modelled Flow | | | | DMRB OR GEH<5 (Total) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Car | LGV | HGV | Total | Car | LGV | HGV | Total | |
| **A53 – Basford** | EB | 1658 | 198 | 30 | 1886 | 1850 | 267 | 33 | 2150 | ✓ |
| **A53 – Basford** | WB | 2436 | 164 | 31 | 2631 | 2274 | 284 | 34 | 2593 | ✓ |
| **Bucknall New Road** | EB | 1552 | 146 | 6 | 1704 | 1507 | 126 | 15 | 1648 | ✓ |
| **Bucknall New Road** | WB | 1174 | 118 | 3 | 1295 | 983 | 114 | 23 | 1120 | ✓ |
| **Victoria Road** | NB | 469 | 50 | 18 | 537 | 571 | 83 | 11 | 665 | × |
| **Victoria Road** | SB | 730 | 95 | 2 | 827 | 1034 | 89 | 13 | 1136 | × |

### 4.9 Journey time validation

The DfT guidelines for the validation of modelled journey times are based on those described in WebTAG Unit M3.1 and the DMRB Volume 12, Section 2, Part 1, Chapter 4. The guidance suggests that at least 85% of the total modelled journey times should be within +/- 15% or 1 minute of the observed journey time.

The validation of modelled journey times has been undertaken for a total of eight routes in both directions for each of the modelled time periods. These routes cross the North Staffordshire conurbation and are based on journey times extracted from Trafficmaster data (as shown in Figure 4-7).

*Figure 4-7: Journey time validation routes*




The results of the journey time validation for each modelled time period are summarised in Table 4-11. As can be seen, 100% of the journey time routes in the inter-peak and over 85% of the routes in the AM and PM peak hour time periods have modelled times that are within +/-15% or 1 minute of the observed times.

The journey time validation results for each route can be found in Appendix B.

*Table 4-11: Journey time validation summary*

| Modelled Period | % Pass DMRB Criteria (+/-15% or 1 min) |
|---|---|
| **AM** | 88% |
| **IP** | 100% |
| **PM** | 88% |

Figure 4-8 and Figure 4-9 shows the differences in travel time between the 2015 NSMM model and 2018 Trafficmaster data for the AM and PM periods on three routes (both directions) along the predicted exceedance locations. These times include both link time and junction delay. The data has been extracted for a short corridor. The corridor approach is better for comparing commensurate times given the differences in defined links between Trafficmaster data and the NSMM model links. The 2015 model journey times match well with the 2018 observed data. For the AM peak 2 routes out of 6 very narrowly fail the TAG criteria (for model flows being less than 15% or 1 minute of observed times) by 1 second for the A53 eastbound and 8 seconds for Bucknall New Road westbound. For the PM peak 5 out of the 6 travel times pass the TAG criteria, showing that the model represents observed speeds well.

*Figure 4-8 Travel time difference between 2015 NSMM model and 2018 Trafficmaster data (AM)*

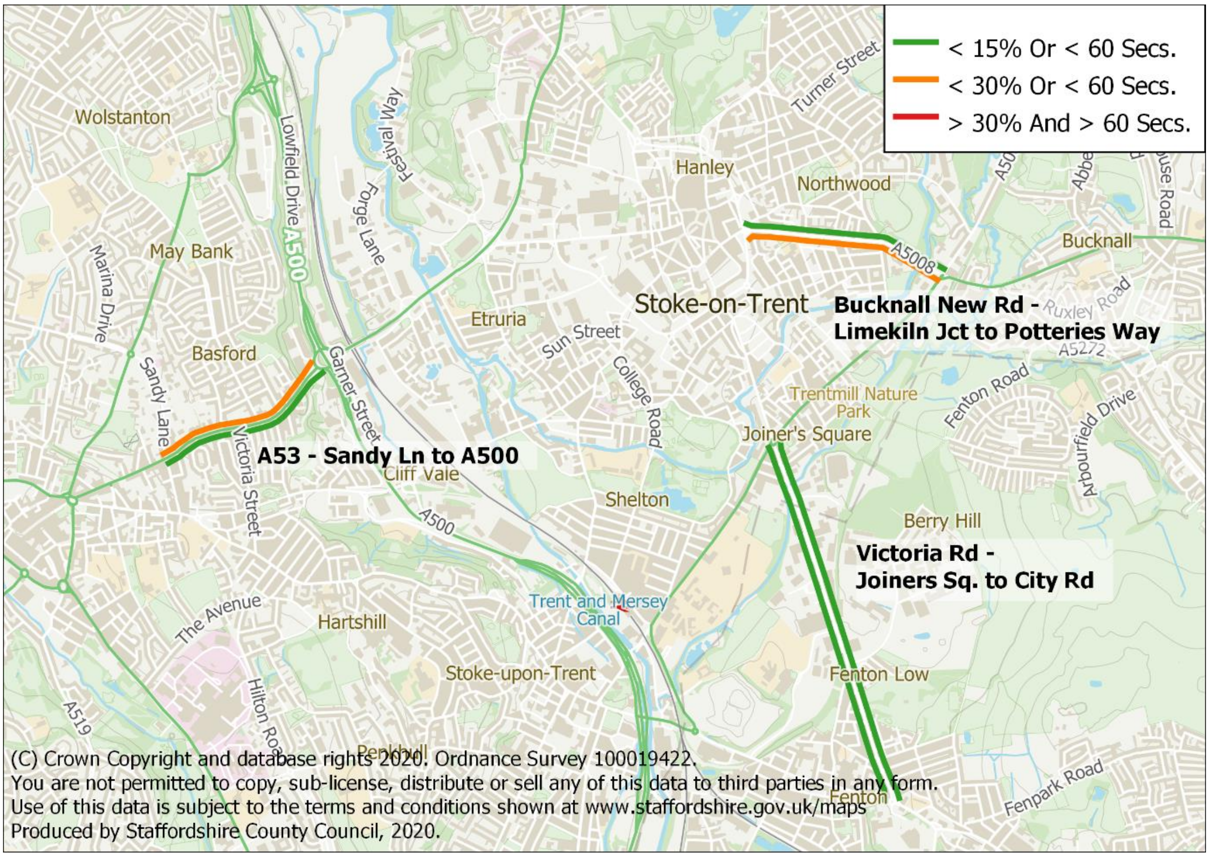
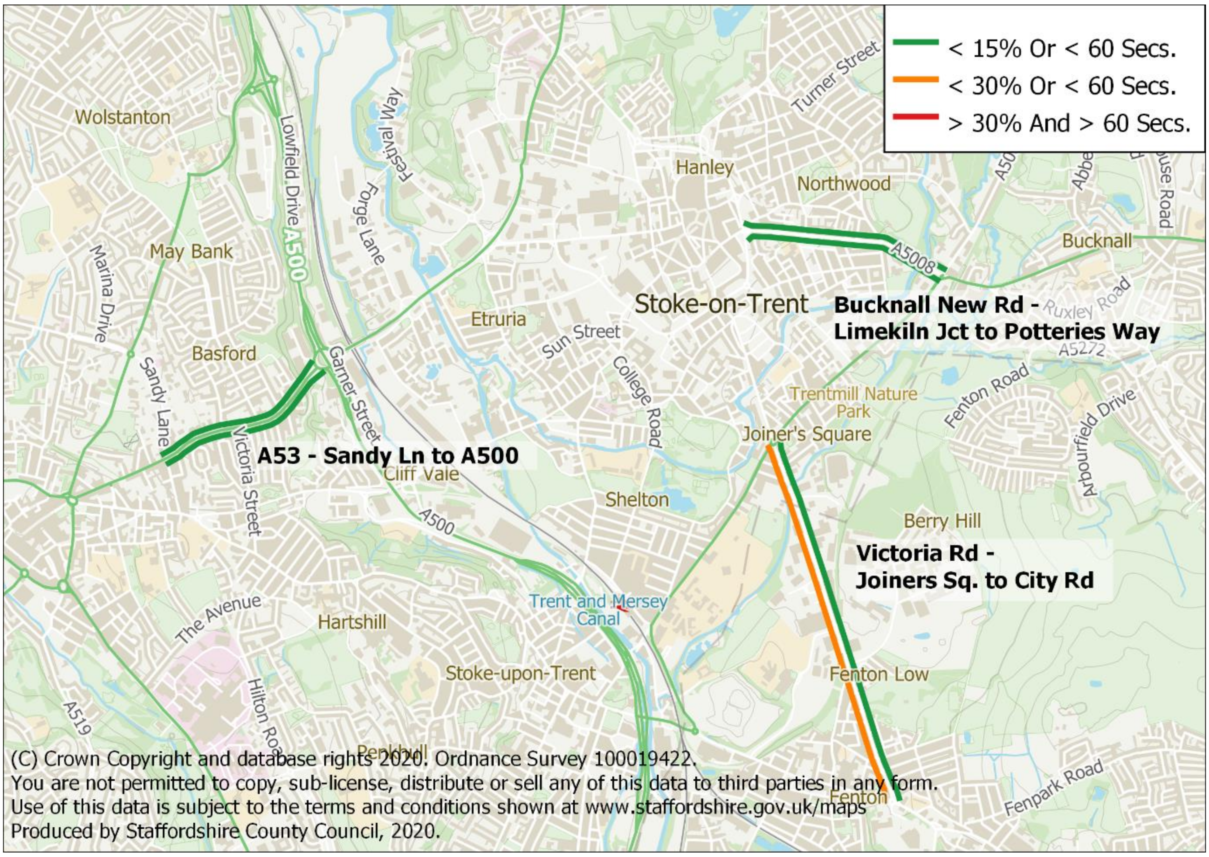


*Figure 4-9: Travel time difference between 2015 NSMM model and 2018 Trafficmaster data (PM)*




## 4.10 Highway assignment model convergence

The convergence of the final highway assignment model for each modelled time period is summarised in Table 5-9. TAG Unit M3.1 recommends a %GAP of 0.1% however experience has shown that %GAP values of less than 0.05%, which have been adopted for the NSMM transport model, often provides a more robust case for appraisal. This target was met within the last four assignment iterations as shown below.

Table 4-12 also shows that 100% of links had a flow change from the previous iteration of less than 5% (Pdiff.) for the final four iterations for all model time periods which further confirms the stability of the model.

*Table 4-12: Assignment convergence*

| Time Period | Number of Iterations | Convergence Criteria<br>%Gap<br>Less than 0.05 | Pdiff.<br>Greater than 95% for four consecutive iterations | AAD<br>Equal to/Less than 1 for four consecutive iterations | RAAD<br>Less than 1% for four consecutive iterations |
|---|---|---|---|---|---|
| **AM Peak** | 53 | 0.00004 | 100% | 0 | 0.001 |
| | | 0.00006 | 100% | 0 | 0.001 |
| | | 0.00001 | 100% | 0 | 0.001 |
| | | 0.0001 | 100% | 0 | 0.001 |
| **Inter Peak** | 20 | 0.00007 | 100% | 1 | 0.003 |
| | | 0.00007 | 100% | 1 | 0.003 |
| | | 0.00003 | 100% | 1 | 0.003 |
| | | 0.0001 | 100% | 1 | 0.002 |
| **PM Peak** | 57 | 0.000006 | 100% | 0 | 0.001 |
| | | 0.0001 | 100% | 0 | 0.001 |
| | | 0.000008 | 100% | 0 | 0.001 |
| | | 0.000002 | 100% | 0 | 0.001 |

### 4.11 Comparison with original aggregated NSMM transport model

The NSMM transport model was updated to 2015 as part of the modelling work undertaken for the appraisal of the EVLR Project. Given the lack of traffic growth shown by the analysis of appropriate traffic count information, this model has been used to inform the development of the 2018 base-line air quality model albeit further disaggregated into compliant and non-compliant vehicle types using ANPR data. Table 4-13 provides a comparison of the validation results between the aggregated transport model which only has 3 vehicle types (cars, LGVs and HGVs) and the disaggregated transport model which has 8 vehicle types including taxis and compliant and non-compliant splits. Following the disaggregation of the transport model, the level of validation remains at a high level with screenline and journey time validation results remaining unaltered. The link counts validation results for AM has improved but a very small reduction in the level of validation for IP and PM peak hour time periods has been achieved.

*Table 4-13: Validation comparison*

| Validation | Aggregated for EVLR (3 vehicle types) | | | Disaggregated Model for CAZ (8 vehicle types) | | |
|---|---|---|---|---|---|---|
| | AM | IP | PM | AM | IP | PM |
| **Screenline** | 60% | 60% | 60% | 60% | 60% | 60% |
| **Link Count** | 81% | 81% | 79% | 83% | 77% | 78% |
| **Journey Times** | 88% | 100% | 88% | 88% | 100% | 88% |

### 4.12 Validation against 2018 screenline counts

The 2015 disaggregated transport model will be used to inform the development of the 2018 baseline air quality model. A further validation check has therefore been undertaken on the 2015 disaggregated transport model flows against 22 counts undertaken in 2018 forming a screenline to the east of the A500 as shown in Figure 2-12. Table 4-14 and Table 4-15 summarises the level of validation against the 22 count sites using both the DRMB flow and GEH criteria. Given that no calibration has been undertaken and the 2015 modelled traffic flow data is being compared with 2018 count data, a good fit is still shown between the modelled and observed data. This underlines the point that there is no case for rebasing the 2015 transport model to a 2018 base year, as the 2015 transport model already provides a good representation of 2018 observed flows, which has been demonstrated to be due to the lack of traffic growth in the North Staffordshire area.

*Table 4-14: Comparison of 2015 modelled traffic flows against 2018 observed traffic counts - westbound*

| Vehicle Type | No. of Counts | DMRB | GEH <5 | GEH <5 or DMRB |
|---|---|---|---|---|
| | | **AM Peak-Hour** | | |
| **Car** | 11 | 55% | 45% | 55% |
| **LGV** | 11 | 64% | 64% | 64% |
| **HGV** | 11 | 100% | 91% | 100% |
| **Total** | **11** | **73%** | **64%** | **73%** |
| | | **Inter-Peak Hour** | | |
| **Car** | 11 | 73% | 64% | 73% |
| **LGV** | 11 | 91% | 73% | 91% |
| **HGV** | 11 | 100% | 91% | 100% |
| **Total** | **11** | **64%** | **64%** | **73%** |

| | | | | |
|---|---|---|---|---|
| **PM Peak-Hour** | | | | |
| **Car** | 11 | 55% | 55% | 55% |
| **LGV** | 11 | 91% | 73% | 91% |
| **HGV** | 11 | 91% | 91% | 91% |
| **Total** | **11** | **64%** | **64%** | **73%** |

*Table 4-15: Comparison of 2015 modelled traffic flows against 2018 observed traffic counts - eastbound*

| Vehicle Type | No. of Counts | DMRB | GEH <5 | GEH <5 or DMRB |
|---|---|---|---|---|
| **AM Peak-Hour** | | | | |
| **Car** | 11 | 73% | 82% | 82% |
| **LGV** | 11 | 91% | 91% | 91% |
| **HGV** | 11 | 100% | 91% | 100% |
| **Total** | **11** | **82%** | **82%** | **82%** |
| **Inter-Peak Hour** | | | | |
| **Car** | 11 | 64% | 64% | 73% |
| **LGV** | 11 | 82% | 82% | 82% |
| **HGV** | 11 | 91% | 91% | 91% |
| **Total** | **11** | **55%** | **55%** | **64%** |
| **PM Peak-Hour** | | | | |
| **Car** | 11 | 91% | 82% | 91% |
| **LGV** | 11 | 91% | 91% | 91% |
| **HGV** | 11 | 100% | 100% | 100% |
| **Total** | **11** | **91%** | **82%** | **100%** |

The detailed analysis of the 2015 disaggregated transport model against the 2018 screenline counts is detailed in Appendix C.

### 4.13 Validation of vehicle compliance splits

The primary purpose of the 2019 ANPR data was to derive compliance splits by vehicle type. Analysis was also undertaken on the total flow data from the 2019 ANPR surveys, however, following checks it became clear that there had been some under-reporting. It is known that

ANPR surveys are not as accurate as other methods for capturing total vehicle flows. This is because not all number plates get picked up, those that have plates on the rear of the vehicle only (i.e. motorcycles), have dirty or missing plates or plates in an irregular location can get missed. Comparing the 2019 ANPR data against 2018 count data confirmed this, with the ANPR flow data being consistently slightly lower than other observed sources. The ANPR data is, however, still appropriate for deriving compliance splits. A validation was therefore undertaken comparing the vehicle compliance splits recorded by the ANPR surveys across the A500 screenline (as shown in Figure 3-12) by direction against the 2015 disaggregated modelled flows.

Table 4-16 shows the difference between the 2015 disaggregated model flow vehicle compliance percentages and the equivalent percentages derived from the 2019 observed ANPR surveys. The table demonstrates that the 2015 disaggregated model compliance percentages are closely replicating the observed values within an acceptable tolerance level. This further demonstrates that the disaggregation process has been correctly carried out, including the disaggregation of the transport model trip matrices and the refinement of the assignment process.

*Table 4-16: Percentage difference between the 2015 disaggregated model and the 2019 ANPR data*

| Time Period / Direction | % Difference in Compliance Splits | | | | | |
|---|---|---|---|---|---|---|
| | Car Comp | Car Non-Comp | LGV Comp | LGV non-Comp | HGV Comp | HGV Non-comp |
| **AM – Westbound** | 1% | -1% | 1% | -1% | -7% | 7% |
| **AM – Eastbound** | 3% | -3% | 1% | -1% | -6% | 6% |
| **IP – Westbound** | -2% | 2% | 1% | -1% | -7% | 7% |
| **IP – Eastbound** | -1% | 1% | -1% | 1% | 0% | 0% |
| **PM – Westbound** | 3% | -3% | -1% | 1% | 2% | -2% |
| **PM – Eastbound** | 2% | -2% | 1% | -1% | -2% | 2% |
| **All Periods** | 1% | -1% | 0% | 0% | -3% | 3% |

# 5 Conclusion

## 5.1 Summary

Validation of the updated 2015 base NSMM transport model, which has had the modelled trip matrices segmented into CAZ compliant and non-compliant vehicle types, has been undertaken based on the following:

1. Comparison of the original 2015 NSMM base transport model and the updated 2015 disaggregated transport model
2. Comparison of the 2015 disaggregated transport model against 2018 traffic counts
3. Comparison of the 2015 disaggregated transport model flows by vehicle type and compliance splits against ANPR data
4. Validation of the 2015 disaggregated NSMM transport model against conurbation wide link counts, screenlines and journey times

The 2015 segmented transport model shows a good and similar level of validation between observed and modelled data (i.e. individual traffic counts, screenline flows and journey times) as per the original NSMM transport model, which is as would be expected. This confirms the demand segmentation carried out to update the transport model has only resulted in small changes in flows.

The comparison of 2015 and 2018 traffic count data on the screenline to the east of the A500 shows no net traffic growth, therefore confirming that the 2015 transport model could be used instead of creating a 2018 base or forecast year to inform the air quality modelling of a baseline situation. This is reaffirmed by a good fit between 2015 segmented model flows and the 2018 A500 screenline counts. Finally, the comparison of CAZ vehicle compliance splits across the A500 screenline shows a close match with the ANPR data. This demonstrates the demand segmentation process has been correctly carried out regarding updates to the model trip matrices and the refinement of the assignment process within the NSMM transport model.

## 5.2 Fit for purpose

The updated 2015 base-year NSMM transport model validates within acceptable tolerance levels and as a result is suitable to be used for modelling emission strategies across compliant and non-compliant user classes to support the reduction of $NO_2$ emissions. The output data from the updated NSMM transport model can be used for a 2018 baseline and future year air quality modelling.

SWECO

# Appendix A – 2015 Traffic count validation

## AM peak hour

Cordon Validation Counts - Inbound

| Ref. No. | Road | A-Junction | B-Junction | A-Node | B-Node | Source of Traffic Count | Type of Manual Classified Count | Grid Reference Easting | Grid Reference Northing | Day of Count | Date of Count | Direction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1a | A34 Stone Road | Tittensor Road | A5035 Longton Road | 1178 | 2012 | data.gov.uk | Passing | 387082 | 339993 | Monday | 42625 | Northbound |
| 2a | A500 | A519 Clayton Road | A34 Stone Road | 6035 | 1999 | data.gov.uk | Passing | 385500 | 342150 | Thursday | 41354 | Eastbound |
| 3a | A519 Clayton Road | A500 | Westbury Road | 2001 | 2222 | data.gov.uk | Passing | 385140 | 342500 | Friday | 42482 | Northbound |
| 4a | A53 Whitmore Road | A5182 Trentham Road | Seabridge Lane | 1960 | 2295 | data.gov.uk | Passing | 382611 | 343143 | Tuesday | 41898 | Northbound |
| 5a | A525 Keele Road | Keele Road | University Drive | 1962 | 2280 | SCC | Turning | 382323 | 345560 | Thursday | 42817 | Eastbound |
| 6a | A500 | Alsager Road | A34 Talke Road | 1299 | 1549 | data.gov.uk | Passing | 382105 | 351890 | Tuesday | 41163 | Eastbound |
| 7a | A34 Newcastle Road | Coalpit Hill | Talke Road | 5024 | 1575 | data.gov.uk | Passing | 383170 | 352200 | Friday | 41054 | Southbound |
| 8a | A50 Liverpool Road | Stonebank Road | Woodstock Street | 5021 | 1857 | data.gov.uk | Passing | 385000 | 353836 | Wednesday | 42508 | Eastbound |
| 9a | A527 Tunstall Road | Bemersley Road | Bridge Street | 1826 | 1830 | data.gov.uk | Passing | 387945 | 355000 | Wednesday | 41437 | Southbound |
| 10a | A53 Leek New Road | Nursery Avenue | Baddeley Green Lane | 1750 | 1748 | SoTCC | ATC Passing | 391082 | 351541 | n/a | 11-14/11/2013 | Southbound |
| 11a | A52 Werrington Road | Clough Lane | Corneville Road | 1954 | 2338 | SoTCC | ATC Passing | 391609 | 347261 | n/a | 9-12/6/2014 | Westbound |
| 12a | A520 Weston Road | Winterfield Lane | Main Street | 2082 | 2083 | SoTCC | ATC Passing | 393728 | 344455 | n/a | 29/06-07/07/2015 | Southbound |
| 13a | A50 | A521 Uttoxeter Road | A520 Weston Road | 1982 | 2096 | data.gov.uk | Passing | 393920 | 341921 | Monday | 41015 | Westbound |
| 14a | A5005 Lightwood Road | Common Lane | Gravelly Bank | 2041 | 2044 | SoTCC | ATC Passing | 392628 | 340512 | n/a | 28/09-01/10/2015 | Northbound |
| | | | | | | | | | Total | | | |

Cordon Validation Counts - Outbound

| Ref. No. | Road | A-Junction | B-Junction | A-Node | B-Node | Source of Traffic Count | Type of Manual Classified Count | Easting | Northing |
|---|---|---|---|---|---|---|---|---|---|
| 1b | A34 Stone Road | A5035 Longton Road | Tittensor Road | 2012 | 1178 | data.gov.uk | Passing | 387082 | 339993 |
| 2b | A500 | A34 Stone Road | A519 Clayton Road | 2184 | 6035 | data.gov.uk | Passing | 385500 | 342150 |
| 3b | A519 Clayton Road | Westbury Road | A500 | 2222 | 2001 | data.gov.uk | Passing | 385140 | 342500 |
| 4b | A53 Whitmore Road | Seabridge Lane | A5182 Trentham Road | 2295 | 1960 | data.gov.uk | Passing | 382611 | 343143 |
| 5b | A525 Keele Road | University Drive | Keele Road | 2280 | 1962 | SCC | Turning | 382323 | 345560 |
| 6b | A500 | A34 Talke Road | Alsager Road | 1620 | 1304 | data.gov.uk | Passing | 382105 | 351890 |
| 7b | A34 Newcastle Road | Talke Road | Coalpit Hill | 1575 | 5024 | data.gov.uk | Passing | 383170 | 352200 |
| 8b | A50 Liverpool Road | Woodstock Street | Stonebank Road | 1857 | 5021 | data.gov.uk | Passing | 385000 | 353836 |
| 9b | A527 Tunstall Road | Bridge Street | Bemersley Road | 1830 | 1826 | data.gov.uk | Passing | 387945 | 355000 |
| 10b | A53 Leek New Road | Baddeley Green Lane | Nursery Avenue | 1748 | 1750 | SoTCC | ATC Passing | 391082 | 351541 |
| 11b | A52 Werrington Road | Corneville Road | Clough Lane | 2338 | 1954 | SoTCC | ATC Passing | 391609 | 347261 |
| 12b | A520 Weston Road | Main Street | Winterfield Lane | 2083 | 2082 | SoTCC | ATC Passing | 393728 | 344455 |
| 13b | A50 | A520 Weston Road | A521 Uttoxeter Road | 2093 | 2098 | data.gov.uk | Passing | 393920 | 341921 |
| 14b | A5005 Lightwood Road | Gravelly Bank | Common Lane | 2044 | 2041 | SoTCC | ATC Passing | 392628 | 340512 |
| | | | | | | | | | Total |

North-South Screenline - Northbound

| Ref. No. | Road | A-Junction | B-Junction | A-Node | B-Node | Source of Traffic Count | Type of Manual Classified Count | Easting | Northing |
|---|---|---|---|---|---|---|---|---|---|
| 15a | A34 Liverpool Road | B5500 London Road | B5369 Dimsdale Parade West | 1598 | 1596 | Sky High | Passing | 384062 | 348611 |
| 16a | Hassam Parade | B5368 Milehouse Lane | B5369 Dimsdale Parade West | 2183 | 1341 | Sky High | Passing | 384761 | 348119 |
| 17a | B5368 Milehouse Lane | Hassam Parade | B5369 Alexandra Road | 2183 | 1692 | Sky High | Passing | 385050 | 347913 |
| 18a | A527 Brampton Road | Greenbank Road | B5369 Alexandra Road | 2193 | 2192 | Sky High | Turning | 385613 | 347622 |
| 19a | B5369 Basford Park Road | Downing Avenue | A527 Brampton Road | 2182 | 2192 | Sky High | Turning | 385613 | 347622 |
| 20a | A500 | A53 Etruria Road | A527 Grange Lane | 2266 | 1700 | data.gov.uk | Passing | 386174 | 347998 |
| 21a | Greyhound Way | Pavilion Drive | A50 Waterloo Road | 6101 | 1778 | Sky High | Passing | 387427 | 348653 |
| 22a | A53 Cobridge Road | Pavilion Drive | A50 Waterloo Road | 2075 | 1685 | Sky High | Passing | 387574 | 348488 |
| 23a | A50 Waterloo Road | Wayte Street | A53 Cobridge Road | 1686 | 1685 | Sky High | Passing | 387718 | 348427 |
| 24a | A5272 Hanley Road | Barthomley Road | Sneyd Street | 1753 | 1732 | Sky High | Passing | 388747 | 349070 |
| 25a | A5009 Leek Road | Barratt Gardens | | 1745 | 1746 | SoTCC | Turning | 390718 | 350270 |
| | | | | | | | | | Total |

North-South Screenline - Southbound

| Ref. No. | Road | A-Junction | B-Junction | A-Node | B-Node | Source of Traffic Count | Type of Manual Classified Count | Easting | Northing |
|---|---|---|---|---|---|---|---|---|---|
| 15b | A34 Liverpool Road | B5369 Dimsdale Parade West | B5500 London Road | 1596 | 1598 | Sky High | Passing | 384062 | 348611 |
| 16b | Hassam Parade | B5369 Dimsdale Parade West | B5368 Milehouse Lane | 1341 | 2183 | Sky High | Passing | 384761 | 348119 |
| 17b | B5368 Milehouse Lane | B5369 Alexandra Road | Hassam Parade | 1692 | 2183 | Sky High | Passing | 385050 | 347913 |
| 18b | A527 Brampton Road | B5369 Alexandra Road | Greenbank Road | 2192 | 2193 | Sky High | Turning | 385613 | 347622 |
| 19b | B5369 Basford Park Road | A527 Brampton Road | Downing Avenue | 2192 | 2182 | Sky High | Turning | 385613 | 347622 |
| 20b | A500 | A527 Grange Lane | A53 Etruria Road | 1698 | 1705 | data.gov.uk | Passing | 386174 | 347998 |
| 21b | Greyhound Way | A50 Waterloo Road | Pavilion Drive | 1778 | 6101 | Sky High | Passing | 387427 | 348653 |
| 22b | A53 Cobridge Road | A50 Waterloo Road | Pavilion Drive | 1685 | 2075 | Sky High | Passing | 387574 | 348488 |
| 23b | A50 Waterloo Road | A53 Cobridge Road | Wayte Street | 1685 | 1686 | Sky High | Passing | 387718 | 348427 |
| 24b | A5272 Hanley Road | Sneyd Street | Barthomley Road | 1732 | 1753 | Sky High | Passing | 388747 | 349070 |
| 25b | A5009 Leek Road | Millrise Rod | Barratt Gardens | 1746 | 1745 | SoTCC | Turning | 390718 | 350270 |
| | | | | | | | | | Total |

East-West Screenline - Eastbound

| Ref. No. | Road | A-Junction | B-Junction | A-Node | B-Node | Source of Traffic Count | Type of Manual Classified Count | Easting | Northing |
|---|---|---|---|---|---|---|---|---|---|
| 27a | A527 Tunstall Western Bypass | Chemical Lane | Chatterley Road | 1305 | 1634 | SoTCC | Passing | 385032 | 351038 |
| 28a | A5271 Longport Road | A500 | Scott Lidgett Road | 1629 | 1609 | SoTCC | Passing | 385732 | 349427 |
| 29a | A53 Etruria Road | A500 | Forge Lane | 1937 | 2257 | SoTCC | Passing | 386629 | 347058 |
| 30a | B5045 Shelton New Road | A500 | Etruscan Street | 1792 | 2242 | SoTCC | Passing | 386895 | 346336 |
| 31a | A5006 Stoke Road | Avenue Road | Cemetery Road | 2251 | 1385 | SoTCC | Passing | 387761 | 346317 |
| 32a | College Road | Avenue Road | Wellesley Street | 2252 | 1387 | SoTCC | Passing | 388045 | 346266 |
| 33a | A52 Leek Road | Boughey Road | Cauldon Road | 1427 | 2253 | SoTCC | Passing | 388234 | 345738 |
| 34a | A5007 City Road | A52 Leek Road | Napier Street | 1445 | 1436 | SoTCC | Passing | 388514 | 344891 |
| 35a | Whieldon Road | Old Whieldon Road | Sutherland Street | 2235 | 2139 | SoTCC | Passing | 388292 | 344596 |
| | | | | | | | | | Total |

East-West Screenline - Westbound

| Ref. No. | Road | A-Junction | B-Junction | A-Node | B-Node | Source of Traffic Count | Type of Manual Classified Count | Easting | Northing |
|---|---|---|---|---|---|---|---|---|---|
| 27b | A527 Tunstall Western Bypass | Chatterley Road | Chemical Lane | 1634 | 1305 | SoTCC | Passing | 385032 | 351038 |
| 28b | A5271 Longport Road | Scott Lidgett Road | A500 | 1609 | 1629 | SoTCC | Passing | 385732 | 349427 |
| 29b | A53 Etruria Road | Forge Lane | A500 | 1808 | 1806 | SoTCC | Passing | 386629 | 347058 |
| 30b | B5045 Shelton New Road | Etruscan Street | A500 | 2242 | 1792 | SoTCC | Passing | 386895 | 346336 |
| 31b | A5006 Stoke Road | Cemetery Road | Avenue Road | 1385 | 2251 | SoTCC | Passing | 387761 | 346317 |
| 32b | College Road | Wellesley Street | Avenue Road | 1387 | 2252 | SoTCC | Passing | 388045 | 346266 |
| 33b | A52 Leek Road | Cauldon Road | Boughey Road | 2253 | 1427 | SoTCC | Passing | 388234 | 345738 |
| 34b | A5007 City Road | Napier Street | A52 Leek Road | 1436 | 1445 | SoTCC | Passing | 388514 | 344891 |
| 35b | Whieldon Road | Sutherland Street | Old Whieldon Road | 2139 | 2235 | SoTCC | Passing | 388292 | 344596 |
| | | | | | | | | | Total |

**West of A500 Screenline - Eastbound**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21b | A34 Talke Road | A500 | Millennium Way | 1317 | 1167 | data.gov.uk | Passing | 383530 | 351079 | Monday | 22/09/2014 | Southbound | 1310 | 167 |
| 22b | B5370 Porthill Bank | St. Edmund's Avenue | A500 | 1656 | 1379 | Sky High | Turning | 385642 | 349223 | Wednesday | 29/04/2015 | Eastbound | 993 | 135 |
| 23b | A527 Grange Lane | A500 | A527 Church Lane | 1876 | 1875 | Sky High | Turning | 386009 | 348342 | Wednesday | 29/04/2015 | Southbound | 271 | 34 |
| 24b | A53 Etruria Road | B5369 Basford Park Road | A500 | 2238 | 2244 | Sky High | Turning | 386393 | 346939 | Wednesday | 29/04/2015 | Eastbound | 703 | 71 |
| 25b | B5045 Shelton New Road | Haydon Street | A500 | 5056 | 1795 | SoTCC | Turning | 386610 | 346234 | Monday | 23/05/2016 | Eastbound | 763 | 81 |
| | | | | | | | | | Total | | | | 4,040 | 488 |

**West of A500 Screenline - Westbound**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21a | A34 Talke Road | Millennium Way | A500 | 1167 | 1317 | data.gov.uk | Passing | 383530 | 351079 | Monday | 22/09/2014 | Northbound | 545 | 211 |
| 22a | B5370 Porthill Bank | A500 | St. Edmund's Avenue | 1379 | 1656 | Sky High | Turning | 385642 | 349223 | Wednesday | 29/04/2015 | Westbound | 805 | 109 |
| 23a | A527 Grange Lane | A527 Church Lane | A500 | 1875 | 1876 | Sky High | Turning | 386009 | 348342 | Wednesday | 29/04/2015 | Northbound | 631 | 57 |
| 24a | A53 Etruria Road | A500 | B5369 Basford Park Road | 2244 | 2238 | Sky High | Turning | 386393 | 346939 | Wednesday | 29/04/2015 | Westbound | 819 | 89 |
| 25a | B5045 Shelton New Road | A500 | Haydon Street | 1795 | 5056 | SoTCC | Turning | 386610 | 346234 | Monday | 23/05/2016 | Westbound | 581 | 82 |
| | | | | | | | | | Total | | | | 3,381 | 548 |

**East of A50 Screenline - Eastbound**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9a | A50 High Street | Roundwell Street | Furlong Road | 1611 | 1631 | SoTCC | Passing | 385944 | 351660 | Wednesday | 42130 | Northbound | 369 | 78 |
| 18a | A527 Reginald Mitchell Way | Chatterley Road | A50 High Street | 1634 | 1569 | data.gov.uk | Passing | 385227 | 352000 | Monday | 42135 | Northbound | 647 | 142 |
| 26b | A5271 The Boulevard | A5271 Scotia Road | A5271 Victoria Park Road | 1638 | 1610 | SoTCC | Passing | 386102 | 351298 | Wednesday | 42137 | Eastbound | 357 | 52 |
| 28b | B5051 Moorland Road | A50 Wedgwood Street | Hamil Road | 1664 | 1665 | Sky High | Turning | 386911 | 349842 | Wednesday | 42123 | Eastbound | 528 | 66 |
| 29 | Nile Street | A50 Swan Square | B5050 Zion Street | 1672 | 1712 | SoTCC | Passing | 386989 | 349752 | Wednesday | 41794 | Eastbound | 89 | 25 |
| 30 | B5050 Zion Street | A50 Waterloo Road | B5050 Nile Street | 1764 | 1712 | SoTCC | Turning | 387045 | 349583 | Wednesday | 42038 | Eastbound | 292 | 50 |
| 32a | A53 Elder Road | A50 Waterloo Road | Sneyd Street | 1685 | 1684 | Sky High | Turning | 387607 | 348554 | Wednesday | 42123 | Northbound | 614 | 90 |
| | | | | | | | | | Total | | | | 2,896 | 503 |

**East of A50 Screenline - Westbound**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9b | A50 High Street | Furlong Road | Roundwell Street | 1631 | 1611 | SoTCC | Passing | 385944 | 351660 | Wednesday | 42130 | Southbound | 618 | 58 |
| 18b | A527 Reginald Mitchell Way | A50 High Street | Chatterley Road | 1569 | 1634 | data.gov.uk | Passing | 385227 | 352000 | Monday | 42135 | Northbound | 1335 | 217 |
| 26a | A5271 The Boulevard | A5271 Victoria Park Road | A5271 Scotia Road | 1610 | 1638 | SoTCC | Passing | 386102 | 351298 | Wednesday | 42137 | Westbound | 641 | 52 |
| 27 | Jenkins Street | Hamil Road | A50 Scotia Road | 6002 | 5025 | SoTCC | Passing | 386901 | 349964 | Monday | 41778 | Westbound | 247 | 28 |
| 28a | B5051 Moorland Road | Hamil Road | A50 Wedgwood Street | 1665 | 1664 | Sky High | Turning | 386911 | 349842 | Wednesday | 42123 | Westbound | 368 | 77 |
| 31 | B5050 Pitt Street East | B5050 Nile Street | A50 Waterloo Road | 1769 | 1765 | SoTCC | Turning | 387081 | 349528 | Thursday | 42040 | Westbound | 303 | 67 |
| 32b | A53 Elder Road | Sneyd Street | A50 Waterloo Road | 1684 | 1685 | Sky High | Turning | 387607 | 348554 | Wednesday | 42123 | Northbound | 937 | 118 |
| | | | | | | | | | Total | | | | 4,449 | 617 |

**Other Individual Count Locations**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 39a | A500 | A527 Longport Road | A527 Tunstall Western Bypass | 1617 | 1618 | TRADS | ATC Passing | 385132 | 349925 | n/a | 2014/15 | Northbound | | |
| 39b | A500 | A527 Tunstall Western Bypass | A527 Longport Road | 1563 | 1603 | TRADS | ATC Passing | 385044 | 350236 | n/a | 2014/15 | Southbound | | |
| 40a | A500 | A5006 Stoke Road | B5045 Shelton New Road | 5086 | 2240 | data.gov.uk | Passing | 387091 | 346000 | Thursday | 42194 | Northbound | 2927 | 524 |
| 40b | A500 | B5045 Shelton New Road | A5006 Stoke Road | 2256 | 5085 | data.gov.uk | Passing | 387091 | 346000 | Thursday | 42194 | Southbound | 2662 | 527 |
| 41a | A500 | A34 Stone Road | A5006 Campbell Road | 2186 | 2233 | data.gov.uk | Passing | 386992 | 342977 | Wednesday | 42137 | Eastbound | 1915 | 401 |
| 41b | A500 | A5006 Campbell Road | A34 Stone Road | 2189 | 2185 | data.gov.uk | Passing | 386992 | 342977 | Wednesday | 42137 | Westbound | 2905 | 385 |
| 42a | A50 | A50 Victoria Place Link | Foley Road | 2072 | 2048 | data.gov.uk | Passing | 390100 | 343763 | Thursday | 42257 | Eastbound | 2100 | 434 |
| 42b | A50 | Foley Road | A50 Victoria Place Link | 2047 | 2071 | data.gov.uk | Passing | 390100 | 343763 | Thursday | 42257 | Westbound | 3130 | 395 |
| 43a | A50 | A5007 Uttoxeter Road | A520 Weston Road | 1986 | 1984 | data.gov.uk | Passing | 392497 | 342594 | Wednesday | 41528 | Eastbound | 1856 | 419 |
| 43b | A50 | A520 Weston Road | A5007 Uttoxeter | 2090 | 1985 | data.gov.uk | Passing | 392497 | 342594 | Wednesday | 41528 | Westbound | 2553 | 400 |
| 44a | A34 Talke Road | Millennium Way | A500 | 1167 | 1317 | data.gov.uk | Passing | 383530 | 351079 | Monday | 41904 | Northbound | 545 | 211 |
| 44b | A34 Talke Road | A500 | Millennium Way | 1317 | 1167 | data.gov.uk | Passing | 383530 | 351079 | Monday | 41904 | Southbound | 1310 | 167 |
| 45a | A34 Newcastle Road | Harpfield Road | Keelings Drive | 2227 | 2176 | SoTCC | ATC Passing | 386310 | 343596 | n/a | 23-26/09/2013 | Northbound | | |
| 45b | A34 Newcastle Road | Keelings Drive | Harpfield Road | 2176 | 2227 | SoTCC | ATC Passing | 386310 | 343596 | n/a | 23-26/09/2013 | Southbound | | |
| 46a | A50 Scotia Road | Chatterley Street | Williamson Street | 1707 | 1690 | Sky High | Passing | 386631 | 350729 | Wednesday | 42123 | Northbound | 392 | 43 |
| 46b | A50 Scotia Road | Williamson Street | Chatterley Street | 1690 | 1707 | Sky High | Passing | 386631 | 350729 | Wednesday | 42123 | Southbound | 489 | 66 |
| 47a | A50 Victoria Road | Beville Street | Manor Street | 2130 | 2129 | data.gov.uk | Passing | 389199 | 345106 | Friday | 42545 | Northbound | 713 | 146 |
| 47b | A50 Victoria Road | Manor Street | Beville Street | 2129 | 2130 | data.gov.uk | Passing | 389199 | 345106 | Friday | 42545 | Southbound | 430 | 191 |
| 48a | A52 Bucknall Road | A52 Leek Road | A5272 Dividy Road | 2117 | 2118 | data.gov.uk | Passing | 389751 | 347331 | Wednesday | 40989 | Eastbound | 760 | 165 |
| 48b | A52 Bucknall Road | A5272 Dividy Road | A52 Leek Road | 2118 | 2117 | data.gov.uk | Passing | 389751 | 347331 | Wednesday | 40989 | Westbound | 1502 | 149 |
| 49a | A53 Leek New Road | Norton Lane | Trentfields Road | 1723 | 1724 | SoTCC | ATC Passing | 390362 | 350830 | n/a | 24-27/6/2013 | Eastbound | | |
| 49b | A53 Leek New Road | Trentfields Road | Norton Lane | 1724 | 1723 | SoTCC | ATC Passing | 390362 | 350830 | n/a | 24-27/6/2013 | Westbound | | |
| 50a | A519 Clayton Road | Buckmaster Avenue | Friarswood Road | 2215 | 1403 | data.gov.uk | Passing | 385171 | 344885 | Monday | 41386 | Northbound | 762 | 62 |
| 50b | A519 Clayton Road | Friarswood Road | Buckmaster Avenue | 1403 | 2215 | data.gov.uk | Passing | 385171 | 344885 | Monday | 41386 | Southbound | 330 | 56 |
| 51a | A525 Keele Road | Cemetey Road | Orme Road | 2281 | 1420 | SCC | Turning | 383142 | 345539 | Thursday | 42878 | Eastbound | 452 | 19 |
| 51b | A525 Keele Road | Orme Road | Cemetery Road | 1420 | 2281 | SCC | Turning | 383142 | 345539 | Thursday | 42878 | Westbound | 535 | 33 |
| 52a | A5271 Brownhills Road | Westport Road | A5271 Williamson Street | 1608 | 1657 | Sky High | Passing | 385975 | 350495 | Wednesday | 42123 | Northbound | 397 | 51 |
| 52b | A5271 Brownhills Road | A5271 Williamson Street | Westport Road | 1657 | 1608 | Sky High | Passing | 385975 | 350495 | Wednesday | 42123 | Southbound | 383 | 47 |
| 53a | A5272 High Lane | Hamil Road | Haywood Road | 1648 | 1650 | Sky High | Passing | 387487 | 351013 | Wednesday | 42123 | Northbound | 603 | 78 |
| 53b | A5272 High Lane | Haywood Road | Hamil Road | 1650 | 1648 | Sky High | Passing | 387487 | 351013 | Wednesday | 42123 | Southbound | 659 | 75 |
| 54a | A5272 Dividy Road | Romer Side | Templeton Avenue | 2157 | 2165 | SoTCC | ATC Passing | 391690 | 345615 | n/a | 22-25/04/2013 | Eastbound | | |
| 54b | A5272 Dividy Road | Templeton Avenue | Romer Side | 2165 | 2157 | SoTCC | ATC Passing | 391690 | 345615 | n/a | 22-25/04/2013 | Westbound | | |
| 3a | A500 | B5045 Shelton New Road | A53 Etruria Road | 2240 | 2289 | data.gov.uk | Passing | 386726 | 346280 | Wednesday | 22/10/2014 | Northbound | 2565 | 468 |
| 3b | A500 | A53 Etruria Road | B5045 Shelton New Road | 2267 | 2256 | data.gov.uk | Passing | 386726 | 346280 | Wednesday | 22/10/2014 | Southbound | 2552 | 478 |
| 4a | A500 | A5006 Stoke Road | B5045 Shelton New Road | 5086 | 2240 | data.gov.uk | Passing | 387091 | 346000 | Thursday | 09/07/2015 | Northbound | 2927 | 524 |
| 4b | A500 | B5045 Shelton New Road | A5006 Stoke Road | 2256 | 5085 | data.gov.uk | Passing | 387091 | 346000 | Thursday | 09/07/2015 | Southbound | 2662 | 527 |
| 5a | A34 Talke Road | Bradwell Lane | Parkhouse Road West | 1590 | 1601 | data.gov.uk | Passing | 383756 | 350000 | Thursday | 25/04/2013 | Northbound | 780 | 171 |
| 5b | A34 Talke Road | Parkhouse Road West | Bradwell Lane | 1601 | 1590 | data.gov.uk | Passing | 383756 | 350000 | Thursday | 25/04/2013 | Southbound | 1314 | 172 |
| 6a | A34 Liverpool Road | B5368 Lower Milehouse Lane | Brymbo Road | 2269 | 1599 | data.gov.uk | Passing | 384250 | 347872 | Wednesday | 22/04/2015 | Northbound | 930 | 144 |
| 6b | A34 Liverpool Road | Brymbo Road | B5368 Lower Milehouse Lane | 1599 | 2269 | data.gov.uk | Passing | 384250 | 347872 | Wednesday | 22/04/2015 | Southbound | 1252 | 167 |
| 8a | A53 Etruria Road | Festival Way | Forge Lane | 2259 | 2260 | data.gov.uk | Passing | 386983 | 347327 | Wednesday | 08/07/2015 | Westbound | 1407 | 236 |
| 8b | A53 Etruria Road | Forge Lane | Festival Way | 2319 | 2258 | data.gov.uk | Passing | 386983 | 347327 | Wednesday | 08/07/2015 | Eastbound | 1810 | 199 |
| 10a | A50 Wedgwood Street | Market Place | Federation Road | 5025 | 1660 | SoTCC | Passing | 386864 | 350000 | Wednesday | 21/05/2014 | Northbound | 380 | 62 |
| 10b | A50 Wedgwood Street | Federation Road | Market Place | 1660 | 5025 | SoTCC | Passing | 386864 | 350000 | Wednesday | 21/05/2014 | Southbound | 417 | 74 |
| 11a | A50 Waterloo Road | B5050 Zion Street | Nile Street | 1764 | 1672 | data.gov.uk | Passing | 387000 | 349678 | Tuesday | 09/09/2014 | Northbound | 303 | 39 |
| 11b | A50 Waterloo Road | Nile Street | B5050 Zion Street | 1672 | 1764 | data.gov.uk | Passing | 387000 | 349678 | Tuesday | 09/09/2014 | Southbound | 302 | 40 |
| 12a | A50 Waterloo Road | Stonor Street | B5050 Pitt Street West | 1681 | 1765 | SoTCC | Turning | 387081 | 349528 | Thursday | 05/02/2015 | Northbound | 396 | 39 |
| 12b | A50 Waterloo Road | B5050 Pitt Street West | Stonor Street | 1765 | 1681 | SoTCC | Turning | 387081 | 349528 | Thursday | 05/02/2015 | Southbound | 332 | 52 |
| 13a | A50 Potteries Way | A5008 Bucknall New Road | Huntbach Street | 1355 | 1340 | SoTCC | Turning | 388583 | 347609 | Thursday | 28/01/2016 | Northbound | 540 | 69 |
| 13b | A50 Potteries Way | Huntbach Street | A5008 Bucknall New Road | 1340 | 1355 | SoTCC | Turning | 388583 | 347609 | Thursday | 28/01/2016 | Southbound | 1054 | 137 |
| 14a | A50 Potteries Way | Botteslow Street | A5008 Bucknall New Road | 1354 | 1355 | SoTCC | Turning | 388583 | 347609 | Thursday | 28/01/2016 | Northbound | 516 | 82 |
| 14b | A50 Potteries Way | A5008 Bucknall New Road | Botteslow Street | 1355 | 1354 | SoTCC | Turning | 388583 | 347609 | Thursday | 28/01/2016 | Southbound | 1198 | 139 |
| 15a | A50 Potteries Way | Botteslow Street | A50 Lichfield Street | 1354 | 2005 | SoTCC | Turning | 388446 | 347226 | Wednesday | 27/01/2016 | Westbound | 1435 | 142 |
| 15b | A50 Potteries Way | A50 Lichfield Street | Botteslow Street | 2005 | 1354 | SoTCC | Turning | 388446 | 347226 | Wednesday | 27/01/2016 | Eastbound | 465 | 91 |
| 33a | A50 Lichfield Street | Regent Road | A50 Potteries Way | 1358 | 2007 | SoTCC | Turning | 388526 | 347148 | Monday | 25/01/2016 | Northbound | 522 | 86 |
| 33b | A50 Lichfield Street | A50 Potteries Way | Regent Road | 2007 | 1358 | SoTCC | Turning | 388526 | 347148 | Monday | 25/01/2016 | Southbound | 548 | 80 |
| 34a | A50 Lichfield Street | Hampton Street | Regent Road | 2063 | 1358 | SoTCC | Turning | 388526 | 347148 | Monday | 25/01/2016 | Northbound | 561 | 85 |
| 34b | A50 Lichfield Street | Regent Road | Hampton Street | 1358 | 2063 | SoTCC | Turning | 388526 | 347148 | Monday | 25/01/2016 | Southbound | 528 | 87 |
| 35a | A5271 Scotia Road | Woodland Street | A5271 The Boulevard | 1653 | 1638 | SoTCC | Passing | 386147 | 351212 | Thursday | 21/05/2015 | Northbound | 388 | 80 |
| 35b | A5271 Scotia Road | A5271 The Boulevard | Woodland Street | 1638 | 1653 | SoTCC | Passing | 386147 | 351212 | Thursday | 21/05/2015 | Southbound | 819 | 111 |
| 20a | A5008 Potteries Way | A50 Lichfield Street | Bethesda Street | 1768 | 1369 | SoTCC | Turning | 388446 | 347226 | Wednesday | 27/01/2016 | Westbound | 1201 | 117 |
| 20b | A5008 Potteries Way | Bethesda Street | A50 Lichfield Street | 1369 | 1768 | SoTCC | Turning | 388446 | 347226 | Wednesday | 27/01/2016 | Eastbound | 293 | 75 |

## Inter-peak hour

Cordon Validation Counts - Inbound

| Ref. No. | Road | A-Junction | B-Junction | A-Node | B-Node | Source of Traffic Count | Type of Manual Classified Count | Easting | Northing | Day of Count | Date of Count | Direction | Total | Car Difference | Car % Diff | LGV Difference | LGV % Diff | HGV Difference | HGV % Diff | Total Difference | Total % Diff | GEH | Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1a | A34 Stone Road | Tittensor Road | A5035 Longton Road | 1178 | 2012 | data.gov.uk | Passing | 387082 | 339993 | Monday | 42625 | Northbound | 742 | -23 | -4% | 4 | 3% | 39 | 77% | 20 | 3% | 1.0 | 1 |
| 2a | A500 | A519 Clayton Road | A34 Stone Road | 6035 | 1999 | data.gov.uk | Passing | 385500 | 342150 | Thursday | 41354 | Eastbound | 1515 | -229 | -26% | -9 | -4% | -67 | -29% | 153 | 11% | 7.2 | 1 |
| 3a | A519 Clayton Road | A500 | Westbury Road | 2001 | 2222 | data.gov.uk | Passing | 385140 | 342500 | Friday | 42482 | Northbound | 558 | -52 | -13% | 20 | 34% | 6 | 38% | 78 | 16% | 2.5 | 1 |
| 4a | A53 Whitmore Road | A5182 Trentham Road | Seabridge Lane | 1960 | 2295 | data.gov.uk | Passing | 382611 | 343143 | Tuesday | 41898 | Northbound | 291 | -71 | -43% | 20 | 83% | 4 | 44% | 94 | 48% | 5.0 | 1 |
| 5a | A525 Keele Road | Keele Road | University Drive | 1962 | 2280 | SCC | Turning | 382323 | 345560 | Thursday | 42817 | Eastbound | | | | | | | | | | | |
| 6a | A500 | Alsager Road | A34 Talke Road | 1299 | 1549 | data.gov.uk | Passing | 382105 | 351890 | Tuesday | 41163 | Eastbound | 1399 | -133 | -15% | -28 | -10% | -124 | -53% | -19 | -1% | 4.2 | 1 |
| 7a | A34 Newcastle Road | Coalpit Hill | Talke Road | 5024 | 1575 | data.gov.uk | Passing | 383170 | 352200 | Friday | 41054 | Southbound | 681 | 145 | 22% | 39 | 34% | -102 | -84% | -208 | -23% | 6.0 | 1 |
| 8a | A50 Liverpool Road | Stonebank Road | Woodstock Street | 5021 | 1857 | data.gov.uk | Passing | 385000 | 353836 | Wednesday | 42508 | Eastbound | 512 | -42 | -11% | 31 | 58% | -1 | -12% | 72 | 16% | 2.1 | 1 |
| 9a | A527 Tunstall Road | Bemersley Road | Bridge Street | 1826 | 1830 | data.gov.uk | Passing | 387945 | 355000 | Wednesday | 41437 | Southbound | 529 | -116 | -35% | -1 | -1% | -7 | -35% | 109 | 26% | 5.9 | 1 |
| 10a | A53 Leek New Road | Nursery Avenue | Baddeley Green Lane | 1750 | 1748 | SoTCC | ATC Passing | 391082 | 351541 | n/a | 11-14/11/2013 | Southbound | 652 | | | | | | | 114 | 21% | | |
| 11a | A52 Werrington Road | Clough Lane | Corneville Road | 1954 | 2338 | SoTCC | ATC Passing | 391609 | 347261 | n/a | 9-12/6/2014 | Westbound | 501 | | | | | | | 30 | 6% | | |
| 12a | A520 Weston Road | Winterfield Lane | Main Street | 2082 | 2083 | SoTCC | ATC Passing | 393728 | 344455 | n/a | 29/06-07/07/2015 | Southbound | | | | | | | | | | | |
| 13a | A50 | A521 Uttoxeter Road | A520 Weston Road | 1982 | 2096 | data.gov.uk | Passing | 393920 | 341921 | Monday | 41015 | Westbound | 1907 | -52 | -4% | -16 | -5% | -83 | -28% | -48 | -2% | 1.4 | 1 |
| 14a | A5005 Lightwood Road | Common Lane | Gravelly Bank | 2041 | 2044 | SoTCC | ATC Passing | 392628 | 340512 | n/a | 28/09-01/10/2015 | Northbound | 138 | | | | | | | -25 | -16% | | |
| | | | | | | | | | Total | | | | 9,424 | 525 | 9% | 60 | 5% | -335 | -34% | 369 | 4% | 6.8 | 1 |

Cordon Validation Counts - Outbound

| Ref. No. | Road | A-Junction | B-Junction | A-Node | B-Node | Source of Traffic Count | Type of Manual Classified Count | Easting | Northing | Day of Count | Date of Count | Direction | Total | Car Difference | Car % Diff | LGV Difference | LGV % Diff | HGV Difference | HGV % Diff | Total Difference | Total % Diff | GEH | Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1b | A34 Stone Road | A5035 Longton Road | Tittensor Road | 2012 | 1178 | data.gov.uk | Passing | 387082 | 339993 | Monday | 42625 | Southbound | 659 | 65 | 12% | 16 | 15% | 8 | 17% | -41 | -6% | 2.9 | 1 |
| 2b | A500 | A34 Stone Road | A519 Clayton Road | 2184 | 6035 | data.gov.uk | Passing | 385500 | 342150 | Thursday | 41354 | Westbound | 1676 | -163 | -15% | -12 | -4% | -24 | -11% | 128 | 8% | 4.8 | 1 |
| 3b | A519 Clayton Road | Westbury Road | A500 | 2222 | 2001 | data.gov.uk | Passing | 385140 | 342500 | Friday | 42482 | Southbound | 578 | -91 | -24% | -23 | -23% | 21 | 174% | 89 | 18% | 4.4 | 1 |
| 4b | A53 Whitmore Road | Seabridge Lane | A5182 Trentham Road | 2295 | 1960 | data.gov.uk | Passing | 382611 | 343143 | Tuesday | 41898 | Southbound | 247 | -13 | -7% | 17 | 76% | -1 | -11% | 29 | 13% | 0.9 | 1 |
| 5b | A525 Keele Road | University Drive | Keele Road | 2280 | 1962 | SCC | Turning | 382323 | 345560 | Thursday | 42817 | Westbound | | | | | | | | | | | |
| 6b | A500 | A34 Talke Road | Alsager Road | 1620 | 1304 | data.gov.uk | Passing | 382105 | 351890 | Tuesday | 41163 | Westbound | 1572 | -384 | -44% | -72 | -32% | -25 | -13% | 287 | 22% | 11.8 | 1 |
| 7b | A34 Newcastle Road | Talke Road | Coalpit Hill | 1575 | 5024 | data.gov.uk | Passing | 383170 | 352200 | Friday | 41054 | Northbound | 660 | 192 | 26% | -33 | -31% | -4 | -8% | -229 | -26% | 7.6 | 1 |
| 8b | A50 Liverpool Road | Woodstock Street | Stonebank Road | 1857 | 5021 | data.gov.uk | Passing | 385000 | 353836 | Wednesday | 42508 | Westbound | 523 | -53 | -13% | 9 | 19% | 7 | 95% | 70 | 15% | 2.6 | 1 |
| 9b | A527 Tunstall Road | Bridge Street | Bemersley Road | 1830 | 1826 | data.gov.uk | Passing | 387945 | 355000 | Wednesday | 41437 | Northbound | 579 | -67 | -15% | -35 | -45% | 2 | 11% | 34 | 6% | 3.1 | 1 |
| 10b | A53 Leek New Road | Baddeley Green Lane | Nursery Avenue | 1748 | 1750 | SoTCC | ATC Passing | 391082 | 351541 | n/a | 11-14/11/2013 | Northbound | 562 | | | | | | | 21 | 4% | | |
| 11b | A52 Werrington Road | Corneville Road | Clough Lane | 2338 | 1954 | SoTCC | ATC Passing | 391609 | 347261 | n/a | 9-12/6/2014 | Eastbound | 450 | | | | | | | -74 | -14% | | |
| 12b | A520 Weston Road | Main Street | Winterfield Lane | 2083 | 2082 | SoTCC | ATC Passing | 393728 | 344455 | n/a | 29/06-07/07/2015 | Northbound | | | | | | | | | | | |
| 13b | A50 | A520 Weston Road | A521 Uttoxeter Road | 2093 | 2098 | data.gov.uk | Passing | 393920 | 341921 | Monday | 41015 | Eastbound | 1929 | -172 | -13% | -58 | -16% | -93 | -41% | 21 | 1% | 4.6 | 1 |
| 14b | A5005 Lightwood Road | Gravelly Bank | Common Lane | 2044 | 2041 | SoTCC | ATC Passing | 392628 | 340512 | n/a | 28/09-01/10/2015 | Southbound | 151 | | | | | | | 12 | 9% | | |
| | | | | | | | | | Total | | | | 9,585 | 686 | 12% | -189 | -14% | -110 | -14% | 346 | 4% | 8.7 | 1 |

North-South Screenline - Northbound

| Ref. No. | Road | A-Junction | B-Junction | A-Node | B-Node | Source of Traffic Count | Type of Manual Classified Count | Easting | Northing | Day of Count | Date of Count | Direction | Total | Car Difference | Car % Diff | LGV Difference | LGV % Diff | HGV Difference | HGV % Diff | Total Difference | Total % Diff | GEH | Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15a | A34 Liverpool Road | B5500 London Road | B5369 Dimsdale Parade West | 1598 | 1596 | Sky High | Passing | 384062 | 348611 | Wednesday | 29/04/2015 | Northbound | 838 | 7 | 1% | -2 | -2% | -3 | -4% | -11 | -1% | 0.3 | 1 |
| 16a | Hassam Parade | B5368 Milehouse Lane | B5369 Dimsdale Parade West | 2183 | 1341 | Sky High | Passing | 384761 | 348119 | Wednesday | 29/04/2015 | Northbound | 259 | 31 | 12% | -8 | -24% | -4 | -39% | -43 | -14% | 2.0 | 1 |
| 17a | B5368 Milehouse Lane | Hassam Parade | B5369 Alexandra Road | 2183 | 1692 | Sky High | Passing | 385050 | 347913 | Wednesday | 29/04/2015 | Eastbound | 278 | -44 | -22% | 3 | 13% | -4 | -37% | 43 | 18% | 3.0 | 1 |
| 18a | A527 Brampton Road | Greenbank Road | B5369 Alexandra Road | 2193 | 2192 | Sky High | Turning | 385613 | 347622 | Wednesday | 29/04/2015 | Northbound | 527 | -34 | -8% | -6 | -15% | -6 | -53% | 22 | 4% | 1.6 | 1 |
| 19a | B5369 Basford Park Road | Downing Avenue | A527 Brampton Road | 2182 | 2192 | Sky High | Turning | 385613 | 347622 | Wednesday | 29/04/2015 | Northbound | 270 | 13 | 5% | -7 | -34% | -6 | -52% | -26 | -9% | 0.8 | 1 |
| 20a | A500 | A53 Etruria Road | A527 Grange Lane | 2266 | 1700 | data.gov.uk | Passing | 386174 | 347998 | Monday | 15/06/2015 | Northbound | 2668 | -2 | 0% | -269 | -69% | -124 | -35% | -391 | -13% | 0.0 | 1 |
| 21a | Greyhound Way | Pavilion Drive | A50 Waterloo Road | 6101 | 1778 | Sky High | Passing | 387427 | 348653 | Wednesday | 29/04/2015 | Eastbound | 405 | -14 | -4% | -5 | -26% | 5 | 120% | 14 | 3% | 0.7 | 1 |
| 22a | A53 Cobridge Road | Pavilion Drive | A50 Waterloo Road | 2075 | 1685 | Sky High | Passing | 387574 | 348488 | Wednesday | 29/04/2015 | Northbound | 1174 | 20 | 2% | 3 | 2% | -33 | -38% | -49 | -4% | 0.6 | 1 |
| 23a | A50 Waterloo Road | Wayte Street | A53 Cobridge Road | 1686 | 1685 | Sky High | Passing | 387718 | 348427 | Wednesday | 29/04/2015 | Northbound | 847 | -90 | -13% | -18 | -24% | -7 | -31% | 65 | 8% | 3.4 | 1 |
| 24a | A5272 Hanley Road | Barthomley Road | Sneyd Street | 1753 | 1732 | Sky High | Passing | 388747 | 349070 | Wednesday | 29/04/2015 | Northbound | 863 | -374 | -96% | 31 | 63% | 7 | 47% | -50 | -5% | 15.6 | 1 |
| 25a | A5009 Leek Road | Barratt Gardens | | 1745 | 1746 | SoTCC | Turning | 390718 | 350270 | Wednesday | 14/06/2017 | Northbound | 527 | 64 | 13% | 21 | 32% | 3 | 282% | -40 | -7% | 3.0 | 1 |
| | | | | | | | | | Total | | | | 8,656 | 425 | 6% | -257 | -27% | -173 | -29% | -466 | -5% | 5.0 | 1 |

North-South Screenline - Southbound

| Ref. No. | Road | A-Junction | B-Junction | A-Node | B-Node | Source of Traffic Count | Type of Manual Classified Count | Easting | Northing | Day of Count | Date of Count | Direction | Total | Car Difference | Car % Diff | LGV Difference | LGV % Diff | HGV Difference | HGV % Diff | Total Difference | Total % Diff | GEH | Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15b | A34 Liverpool Road | B5369 Dimsdale Parade West | B5500 London Road | 1596 | 1598 | Sky High | Passing | 384062 | 348611 | Wednesday | 42123 | Southbound | 826 | -179 | -35% | 31 | 53% | -3 | -5% | 207 | 33% | 7.3 | 1 |
| 16b | Hassam Parade | B5369 Dimsdale Parade West | B5368 Milehouse Lane | 1341 | 2183 | Sky High | Passing | 384761 | 348119 | Wednesday | 29/04/2015 | Southbound | 279 | 15 | 6% | 2 | 10% | -2 | -13% | -14 | -5% | 0.9 | 1 |
| 17b | B5368 Milehouse Lane | B5369 Alexandra Road | Hassam Parade | 1692 | 2183 | Sky High | Passing | 385050 | 347913 | Wednesday | 29/04/2015 | Westbound | 319 | -64 | -28% | -8 | -26% | -4 | -51% | 53 | 20% | 4.0 | 1 |
| 18b | A527 Brampton Road | B5369 Alexandra Road | Greenbank Road | 2192 | 2193 | Sky High | Turning | 385613 | 347622 | Wednesday | 29/04/2015 | Southbound | 446 | 87 | 18% | -26 | -45% | -10 | -55% | -123 | -22% | 4.1 | 1 |
| 19b | B5369 Basford Park Road | A527 Brampton Road | Downing Avenue | 2192 | 2182 | Sky High | Turning | 385613 | 347622 | Wednesday | 29/04/2015 | Southbound | 297 | -20 | -8% | -10 | -38% | -6 | -63% | 3 | 1% | 1.2 | 1 |
| 20b | A500 | A527 Grange Lane | A53 Etruria Road | 1698 | 1705 | data.gov.uk | Passing | 386174 | 347998 | Monday | 15/06/2015 | Southbound | 2811 | -194 | -9% | -126 | -29% | -230 | -62% | -162 | -5% | 4.1 | 1 |
| 21b | Greyhound Way | A50 Waterloo Road | Pavilion Drive | 1778 | 6101 | Sky High | Passing | 387427 | 348653 | Wednesday | 42123 | Westbound | 340 | -62 | -26% | 12 | 78% | 12 | 406% | 86 | 34% | 3.8 | 1 |
| 22b | A53 Cobridge Road | A50 Waterloo Road | Pavilion Drive | 1685 | 2075 | Sky High | Passing | 387574 | 348488 | Wednesday | 42123 | Southbound | 1090 | 71 | 7% | 23 | 23% | 18 | 91% | -101 | -9% | 2.3 | 1 |
| 23b | A50 Waterloo Road | A53 Cobridge Road | Wayte Street | 1685 | 1686 | Sky High | Passing | 387718 | 348427 | Wednesday | 42123 | Southbound | 605 | 29 | 5% | -11 | -19% | -10 | -53% | -51 | -8% | 1.2 | 1 |
| 24b | A5272 Hanley Road | Sneyd Street | Barthomley Road | 1732 | 1753 | Sky High | Passing | 388747 | 349070 | Wednesday | 42123 | Southbound | 795 | -77 | -13% | -1 | -1% | -9 | -27% | 68 | 9% | 3.1 | 1 |
| 25b | A5009 Leek Road | Millrise Rod | Barratt Gardens | 1746 | 1745 | SoTCC | Turning | 390718 | 350270 | Wednesday | 42900 | Southbound | | | | | | | | | | | |
| | | | | | | | | | Total | | | | 7,808 | 394 | 6% | -113 | -12% | -242 | -44% | -34 | 0% | 4.9 | 1 |

East-West Screenline - Eastbound

| Ref. No. | Road | A-Junction | B-Junction | A-Node | B-Node | Source of Traffic Count | Type of Manual Classified Count | Easting | Northing | Day of Count | Date of Count | Direction | Total | Car Difference | Car % Diff | LGV Difference | LGV % Diff | HGV Difference | HGV % Diff | Total Difference | Total % Diff | GEH | Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27a | A527 Tunstall Western Bypass | Chemical Lane | Chatterley Road | 1305 | 1634 | SoTCC | Passing | 385032 | 351038 | Tuesday | 28/04/2015 | Northbound | 677 | 18 | 3% | -75 | -58% | -10 | -32% | -103 | -13% | 0.7 | 1 |
| 28a | A5271 Longport Road | A500 | Scott Lidgett Road | 1629 | 1609 | SoTCC | Passing | 385732 | 349427 | Tuesday | 29/04/2015 | Northbound | 1,290 | -86 | -9% | -60 | -27% | 13 | 23% | 39 | 3% | 2.7 | 1 |
| 29a | A53 Etruria Road | A500 | Forge Lane | 1937 | 2257 | SoTCC | Passing | 386629 | 347058 | Wednesday | 30/04/2014 | Eastbound | 1,892 | -53 | -4% | 50 | 18% | -17 | -19% | 86 | 5% | 1.4 | 1 |
| 30a | B5045 Shelton New Road | A500 | Etruscan Street | 1792 | 2242 | SoTCC | Passing | 386895 | 346336 | Thursday | 01/05/2014 | Eastbound | 563 | -94 | -26% | 32 | 54% | 1 | 9% | 128 | 29% | 4.7 | 1 |
| 31a | A5006 Stoke Road | Avenue Road | Cemetery Road | 2251 | 1385 | SoTCC | Passing | 387761 | 346317 | Wednesday | 03/05/2017 | Northbound | 423 | 228 | 39% | 5 | 9% | 10 | 982% | -213 | -33% | 10.6 | 1 |
| 32a | College Road | Avenue Road | Wellesley Street | 2252 | 1387 | SoTCC | Passing | 388045 | 346266 | Monday | 30/03/2014 | Northbound | 263 | -33 | -17% | 1 | 2% | 10 | 96453% | 43 | 20% | 2.3 | 1 |
| 33a | A52 Leek Road | Boughey Road | Cauldon Road | 1427 | 2253 | SoTCC | Passing | 388234 | 345738 | Wednesday | 22/04/2015 | Northbound | 758 | -106 | -20% | 4 | 5% | 3 | 16% | 113 | 17% | 4.4 | 1 |
| 34a | A5007 City Road | A52 Leek Road | Napier Street | 1445 | 1436 | SoTCC | Passing | 388514 | 344891 | Wednesday | 22/04/2015 | Eastbound | 669 | 73 | 12% | -9 | -9% | 5 | 18% | -77 | -10% | 3.0 | 1 |
| 35a | Whieldon Road | Old Whieldon Road | Sutherland Street | 2235 | 2139 | SoTCC | Passing | 388292 | 344596 | Wednesday | 09/04/2014 | Eastbound | 155 | -41 | -51% | -1 | -4% | 3 | 88% | 43 | 38% | 4.1 | 1 |
| | | | | | | | | | Total | | | | 6,690 | 95 | 2% | -54 | -5% | 8 | 3% | 59 | 1% | 1.3 | 1 |

East-West Screenline - Westbound

| Ref. No. | Road | A-Junction | B-Junction | A-Node | B-Node | Source of Traffic Count | Type of Manual Classified Count | Easting | Northing | Day of Count | Date of Count | Direction | Total | Car Difference | Car % Diff | LGV Difference | LGV % Diff | HGV Difference | HGV % Diff | Total Difference | Total % Diff | GEH | Count |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27b | A527 Tunstall Western Bypass | Chatterley Road | Chemical Lane | 1634 | 1305 | SoTCC | Passing | 385032 | 351038 | Tuesday | 28/04/2015 | Southbound | 726 | -67 | -12% | -45 | -31% | -20 | -78% | 2 | 0% | 2.8 | 1 |
| 28b | A5271 Longport Road | Scott Lidgett Road | A500 | 1609 | 1629 | SoTCC | Passing | 385732 | 349427 | Tuesday | 29/04/2015 | Southbound | 1,341 | -226 | -25% | -19 | -11% | 1 | 2% | 208 | 18% | 7.1 | 1 |
| 29b | A53 Etruria Road | Forge Lane | A500 | 1808 | 1806 | SoTCC | Passing | 386629 | 347058 | Wednesday | 30/04/2014 | Westbound | 2,212 | -217 | -13% | 11 | 4% | -19 | -26% | 210 | 10% | 5.1 | 1 |
| 30b | B5045 Shelton New Road | Etruscan Street | A500 | 2242 | 1792 | SoTCC | Passing | 386895 | 346336 | Thursday | 01/05/2014 | Westbound | 420 | 60 | 14% | -12 | -19% | -3 | -19% | -75 | -15% | 3.1 | 1 |
| 31b | A5006 Stoke Road | Cemetery Road | Avenue Road | 1385 | 2251 | SoTCC | Passing | 387761 | 346317 | Wednesday | 03/05/2017 | Southbound | 711 | -124 | -25% | 36 | 80% | 10 | 986% | 170 | 31% | 5.2 | 1 |
| 32b | College Road | Wellesley Street | Avenue Road | 1387 | 2252 | SoTCC | Passing | 388045 | 346266 | Monday | 30/03/2014 | Southbound | 337 | -82 | -37% | 4 | 18% | -2 | -33% | 85 | 34% | 5.1 | 1 |
| 33b | A52 Leek Road | Cauldon Road | Boughey Road | 2253 | 1427 | SoTCC | Passing | 388234 | 345738 | Wednesday | 22/04/2015 | Southbound | 718 | -135 | -30% | 12 | 13% | 27 | 668% | 173 | 32% | 5.9 | 1 |
| 34b | A5007 City Road | Napier Street | A52 Leek Road | 1436 | 1445 | SoTCC | Passing | 388514 | 344891 | Wednesday | 22/04/2015 | Westbound | 775 | -36 | -6% | 15 | 14% | 12 | 29% | 63 | 9% | 1.5 | 1 |
| 35b | Whieldon Road | Sutherland Street | Old Whieldon Road | 2139 | 2235 | SoTCC | Passing | 388292 | 344596 | Wednesday | 09/04/2014 | Westbound | 138 | -29 | -34% | -14 | -44% | 2 | 58% | 17 | 14% | 2.9 | 1 |
| | | | | | | | | | Total | | | | 7,377 | 855 | 16% | -12 | -1% | 9 | 4% | 852 | 13% | 11.2 | 1 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **West of A500 Screenline - Eastbound** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21b | A34 Talke Road | A500 | Millennium Way | 1317 | 1167 | data.gov.uk | Passing | 383530 | 351079 | Monday | 22/09/2014 | Southbound | 544 | 137 | 60 | 741 | 838 | 113 | 53 | 1,004 | -294 | -54% | -24 | -17% | -7 | -11% | 263 | 36% | 11.2 | 1 |
| 22b | B5370 Porthill Bank | St. Edmund's Avenue | A500 | 1656 | 1379 | Sky High | Turning | 385642 | 349223 | Wednesday | 29/04/2015 | Eastbound | 620 | 77 | 33 | 730 | 681 | 94 | 42 | 817 | -61 | -10% | 17 | 22% | 9 | 29% | 87 | 12% | 2.4 | 1 |
| 23b | A527 Grange Lane | A500 | A527 Church Lane | 1876 | 1875 | Sky High | Turning | 386009 | 348342 | Wednesday | 29/04/2015 | Southbound | 410 | 21 | 9 | 440 | 481 | 32 | 6 | 518 | -71 | -17% | 11 | 51% | -3 | -34% | 78 | 18% | 3.4 | 1 |
| 24b | A53 Etruria Road | B5369 Basford Park Road | A500 | 2238 | 2244 | Sky High | Turning | 386393 | 346939 | Wednesday | 29/04/2015 | Eastbound | 578 | 66 | 23 | 667 | 481 | 78 | 29 | 588 | 97 | 17% | 12 | 19% | 6 | 25% | -79 | -12% | 4.2 | 1 |
| 25b | B5045 Shelton New Road | Haydon Street | A500 | 5056 | 1795 | SoTCC | Turning | 386610 | 346234 | Monday | 23/05/2016 | Eastbound | 372 | 57 | 14 | 443 | 431 | 72 | 26 | 529 | -59 | -16% | 15 | 26% | 12 | 86% | 86 | 19% | 2.9 | 1 |
| | | | | | | | | | | Total | | | 2,524 | 358 | 139 | 3,021 | 2,912 | 389 | 156 | 3,457 | 388 | 15% | 31 | 9% | 17 | 13% | 436 | 14% | 7.4 | 1 |
| **West of A500 Screenline - Westbound** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21a | A34 Talke Road | Millennium Way | A500 | 1167 | 1317 | data.gov.uk | Passing | 383530 | 351079 | Monday | 22/09/2014 | Northbound | 530 | 106 | 86 | 722 | 769 | 103 | 50 | 922 | -239 | -45% | -3 | -3% | -36 | -42% | 200 | 28% | 9.4 | 1 |
| 22a | B5370 Porthill Bank | A500 | St. Edmund's Avenue | 1379 | 1656 | Sky High | Turning | 385642 | 349223 | Wednesday | 29/04/2015 | Westbound | 719 | 80 | 27 | 826 | 705 | 108 | 21 | 835 | 14 | 2% | 28 | 35% | -6 | -22% | 9 | 1% | 0.5 | 1 |
| 23a | A527 Grange Lane | A527 Church Lane | A500 | 1875 | 1876 | Sky High | Turning | 386009 | 348342 | Wednesday | 29/04/2015 | Northbound | 378 | 33 | 11 | 422 | 463 | 31 | 9 | 503 | -85 | -23% | -2 | -6% | -2 | -18% | 81 | 19% | 4.2 | 1 |
| 24a | A53 Etruria Road | A500 | B5369 Basford Park Road | 2244 | 2238 | Sky High | Turning | 386393 | 346939 | Wednesday | 29/04/2015 | Westbound | 826 | 78 | 27 | 931 | 944 | 118 | 22 | 1,084 | -118 | -14% | 40 | 51% | -5 | -17% | 153 | 16% | 4.0 | 1 |
| 25a | B5045 Shelton New Road | A500 | Haydon Street | 1795 | 5056 | SoTCC | Turning | 386610 | 346234 | Monday | 23/05/2016 | Westbound | 420 | 60 | 15 | 495 | 405 | 58 | 27 | 490 | 15 | 4% | -2 | -4% | 12 | 81% | -5 | -1% | 0.8 | 1 |
| | | | | | | | | | | Total | | | 2,873 | 357 | 166 | 3,396 | 3,286 | 418 | 129 | 3,834 | 413 | 14% | 61 | 17% | -37 | -22% | 438 | 13% | 7.4 | 1 |
| **East of A50 Screenline - Eastbound** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9a | A50 High Street | Roundwell Street | Furlong Road | 1611 | 1631 | SoTCC | Passing | 385944 | 351660 | Wednesday | 42130 | Northbound | 697 | 78 | 11 | 786 | 541 | 54 | 12 | 607 | 156 | 22% | -24 | -31% | 1 | 11% | -179 | -23% | 6.3 | 1 |
| 18a | A527 Reginald Mitchell Way | Chatterley Road | A50 High Street | 1634 | 1569 | data.gov.uk | Passing | 385227 | 352000 | Monday | 42135 | Northbound | 759 | 139 | 35 | 933 | 687 | 67 | 22 | 777 | 72 | 9% | -72 | -51% | -13 | -36% | -156 | -17% | 2.7 | 1 |
| 26b | A5271 The Boulevard | A5271 Scotia Road | A5271 Victoria Park Road | 1638 | 1610 | SoTCC | Passing | 386102 | 351298 | Wednesday | 42137 | Eastbound | 465 | 33 | 2 | 500 | 472 | 62 | 19 | 552 | -7 | -1% | 29 | 87% | 17 | 833% | 52 | 10% | 0.3 | 1 |
| 28b | B5051 Moorland Road | A50 Wedgwood Street | Hamil Road | 1664 | 1665 | Sky High | Turning | 386911 | 349842 | Wednesday | 42123 | Eastbound | 632 | 69 | 23 | 724 | 597 | 65 | 26 | 688 | 35 | 6% | -4 | -6% | 3 | 14% | -36 | -5% | 1.4 | 1 |
| 29 | Nile Street | A50 Swan Square | B5050 Zion Street | 1672 | 1712 | SoTCC | Passing | 386989 | 349752 | Wednesday | 41794 | Eastbound | 101 | 21 | 3 | 125 | 76 | 18 | 4 | 98 | 25 | 25% | -3 | -15% | 1 | 29% | -27 | -22% | 2.6 | 1 |
| 30 | B5050 Zion Street | A50 Waterloo Road | B5050 Nile Street | 1764 | 1712 | SoTCC | Turning | 387045 | 349583 | Wednesday | 42038 | Eastbound | 265 | 47 | 16 | 328 | 322 | 41 | 12 | 375 | -57 | -21% | -6 | -12% | -4 | -24% | 47 | 14% | 3.3 | 1 |
| 32a | A53 Elder Road | A50 Waterloo Road | Sneyd Street | 1685 | 1684 | Sky High | Turning | 387607 | 348554 | Wednesday | 42123 | Northbound | 803 | 105 | 83 | 991 | 946 | 123 | 49 | 1,117 | -143 | -18% | 18 | 17% | -34 | -41% | 126 | 13% | 4.8 | 1 |
| | | | | | | | | | | Total | | | 3,722 | 492 | 173 | 4,387 | 3,641 | 429 | 144 | 4,214 | -81 | -2% | -63 | -13% | -29 | -17% | -173 | -4% | 1.3 | 1 |
| **East of A50 Screenline - Westbound** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9b | A50 High Street | Furlong Road | Roundwell Street | 1631 | 1611 | SoTCC | Passing | 385944 | 351660 | Wednesday | 42130 | Southbound | 527 | 68 | 8 | 603 | 376 | 77 | 14 | 467 | 151 | 29% | 9 | 13% | 6 | 77% | -136 | -23% | 7.1 | 1 |
| 18b | A527 Reginald Mitchell Way | A50 High Street | Chatterley Road | 1569 | 1634 | data.gov.uk | Passing | 385227 | 352000 | Monday | 42135 | Northbound | 582 | 137 | 26 | 745 | 732 | 124 | 10 | 865 | -150 | -26% | -13 | -10% | -16 | -62% | 120 | 16% | 5.8 | 1 |
| 26a | A5271 The Boulevard | A5271 Victoria Park Road | A5271 Scotia Road | 1610 | 1638 | SoTCC | Passing | 386102 | 351298 | Wednesday | 42137 | Westbound | 400 | 39 | 4 | 443 | 469 | 65 | 25 | 559 | -69 | -17% | 26 | 68% | 21 | 529% | 116 | 26% | 3.3 | 1 |
| 27 | Jenkins Street | Hamil Road | A50 Scotia Road | 6002 | 5025 | SoTCC | Passing | 386901 | 349964 | Monday | 41778 | Westbound | 186 | 16 | 2 | 204 | 212 | 27 | 7 | 246 | -26 | -14% | 11 | 68% | 5 | 243% | 42 | 21% | 1.9 | 1 |
| 28a | B5051 Moorland Road | Hamil Road | A50 Wedgwood Street | 1665 | 1664 | Sky High | Turning | 386911 | 349842 | Wednesday | 42123 | Westbound | 391 | 50 | 14 | 455 | 250 | 47 | 24 | 321 | 141 | 36% | -3 | -6% | 10 | 68% | -134 | -30% | 7.9 | 1 |
| 31 | B5050 Pitt Street East | B5050 Nile Street | A50 Waterloo Road | 1769 | 1765 | SoTCC | Turning | 387081 | 349528 | Thursday | 42040 | Westbound | 277 | 65 | 10 | 352 | 324 | 54 | 14 | 391 | -47 | -17% | -11 | -17% | 4 | 36% | 39 | 11% | 2.7 | 1 |
| 32b | A53 Elder Road | Sneyd Street | A50 Waterloo Road | 1684 | 1685 | Sky High | Turning | 387607 | 348554 | Wednesday | 42123 | Northbound | 669 | 127 | 58 | 854 | 680 | 106 | 37 | 823 | -11 | -2% | -21 | -16% | -21 | -37% | -31 | -4% | 0.4 | 1 |
| | | | | | | | | | | Total | | | 3,032 | 502 | 122 | 3,656 | 3,042 | 500 | 130 | 3,672 | 10 | 0% | -2 | 0% | 8 | 6% | 16 | 0% | 0.2 | 1 |
| **Other Individual Count Locations** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 39a | A500 | A527 Longport Road | A527 Tunstall Western Bypass | 1617 | 1618 | TRADS | ATC Passing | 385132 | 349925 | n/a | 2014/15 | Northbound | | | | | | | | | | | | | | | | | | |
| 39b | A500 | A527 Tunstall Western Bypass | A527 Longport Road | 1563 | 1603 | TRADS | ATC Passing | 385044 | 350236 | n/a | 2014/15 | Southbound | | | | | | | | | | | | | | | | | | |
| 40a | A500 | A5006 Stoke Road | B5045 Shelton New Road | 5086 | 2240 | data.gov.uk | Passing | 387091 | 346000 | Thursday | 42194 | Northbound | 2301 | 519 | 407 | 3227 | 2167 | 372 | 261 | 2800 | 134 | 6% | -147 | -28% | -146 | -36% | -300 | -10% | 2.8 | 1 |
| 40b | A500 | B5045 Shelton New Road | A5006 Stoke Road | 2256 | 5085 | data.gov.uk | Passing | 387091 | 346000 | Thursday | 42194 | Southbound | 2161 | 500 | 439 | 3100 | 2072 | 442 | 158 | 2672 | 89 | 4% | -58 | -12% | -281 | -64% | -555 | -17% | 1.9 | 1 |
| 41a | A500 | A34 Stone Road | A5006 Campbell Road | 2186 | 2233 | data.gov.uk | Passing | 386992 | 342977 | Wednesday | 42137 | Eastbound | 1674 | 312 | 242 | 2228 | 1760 | 330 | 157 | 2247 | -86 | -5% | 18 | 6% | -85 | -35% | 19 | 1% | 2.1 | 1 |
| 41b | A500 | A5006 Campbell Road | A34 Stone Road | 2189 | 2185 | data.gov.uk | Passing | 386992 | 342977 | Wednesday | 42137 | Westbound | 1554 | 351 | 246 | 2151 | 1866 | 358 | 152 | 2375 | -312 | -20% | 7 | 2% | -94 | -38% | 224 | 10% | | 1 |
| 42a | A50 | A50 Victoria Place Link | Foley Road | 2072 | 2048 | data.gov.uk | Passing | 390100 | 343763 | Thursday | 42257 | Eastbound | 2379 | 457 | 435 | 3271 | 2479 | 282 | 216 | 2978 | -100 | -4% | -175 | -38% | -219 | -50% | -293 | -9% | 2.0 | 1 |
| 42b | A50 | Foley Road | A50 Victoria Place Link | 2047 | 2071 | data.gov.uk | Passing | 390100 | 343763 | Thursday | 42257 | Westbound | 2053 | 390 | 395 | 2838 | 2026 | 218 | 294 | 2538 | 27 | 1% | -172 | -44% | -101 | -26% | -300 | -11% | 0.6 | 1 |
| 43a | A50 | A5007 Uttoxeter Road | A520 Weston Road | 1986 | 1984 | data.gov.uk | Passing | 392497 | 342594 | Wednesday | 41528 | Eastbound | 1650 | 382 | 320 | 2352 | 1798 | 299 | 141 | 2238 | -148 | -9% | -83 | -22% | -179 | -56% | -114 | -5% | 3.6 | 1 |
| 43b | A50 | A520 Weston Road | A5007 Uttoxeter | 2090 | 1985 | data.gov.uk | Passing | 392497 | 342594 | Wednesday | 41528 | Westbound | 1582 | 377 | 326 | 2285 | 1472 | 267 | 227 | 1966 | 110 | 7% | -110 | -29% | -99 | -30% | -319 | -14% | 2.8 | 1 |
| 44a | A34 Talke Road | Millennium Way | A500 | 1167 | 1317 | data.gov.uk | Passing | 383530 | 351079 | Monday | 41904 | Northbound | 530 | 106 | 86 | 722 | 769 | 103 | 50 | 922 | -239 | -45% | -3 | -3% | -36 | -42% | 200 | 28% | 9.4 | 1 |
| 44b | A34 Talke Road | A500 | Millennium Way | 1317 | 1167 | data.gov.uk | Passing | 383530 | 351079 | Monday | 41904 | Southbound | 544 | 137 | 60 | 741 | 838 | 113 | 53 | 1004 | -294 | -54% | -24 | -17% | -7 | -11% | 263 | 36% | 11.2 | 1 |
| 45a | A34 Newcastle Road | Harpfield Road | Keelings Drive | 2227 | 2176 | SoTCC | ATC Passing | 386310 | 343596 | n/a | 23-26/09/2013 | Northbound | | | | | | | | | | | | | | | | | | |
| 45b | A34 Newcastle Road | Keelings Drive | Harpfield Road | 2176 | 2227 | SoTCC | ATC Passing | 386310 | 343596 | n/a | 23-26/09/2013 | Southbound | | | | | | | | | | | | | | | | | | |
| 46a | A50 Scotia Road | Chatterley Street | Williamson Street | 1707 | 1690 | Sky High | Passing | 386631 | 350729 | Wednesday | 42123 | Northbound | 530 | 58 | 20 | 608 | 636 | 69 | 22 | 727 | -106 | -20% | 11 | 19% | 2 | 10% | 119 | 20% | 4.4 | 1 |
| 46b | A50 Scotia Road | Williamson Street | Chatterley Street | 1690 | 1707 | Sky High | Passing | 386631 | 350729 | Wednesday | 42123 | Southbound | 508 | 59 | 26 | 593 | 491 | 100 | 21 | 612 | 17 | 3% | 41 | 70% | -5 | -20% | 19 | 3% | 0.8 | 1 |
| 47a | A50 Victoria Road | Beville Street | Manor Street | 2130 | 2129 | data.gov.uk | Passing | 389199 | 345106 | Friday | 42545 | Northbound | 581 | 147 | 42 | 770 | 569 | 115 | 48 | 732 | 12 | 2% | -32 | -22% | 6 | 14% | -38 | -5% | 0.5 | 1 |
| 47b | A50 Victoria Road | Manor Street | Beville Street | 2129 | 2130 | data.gov.uk | Passing | 389199 | 345106 | Friday | 42545 | Southbound | 676 | 142 | 24 | 842 | 773 | 155 | 44 | 973 | -97 | -14% | 13 | 9% | 20 | 85% | 131 | 16% | 3.6 | 1 |
| 48a | A52 Bucknall Road | A52 Leek Road | A5272 Dividy Road | 2117 | 2118 | data.gov.uk | Passing | 389751 | 347331 | Wednesday | 40989 | Eastbound | 1125 | 189 | 18 | 1332 | 1032 | 120 | 32 | 1183 | 93 | 8% | -69 | -37% | 14 | 77% | -149 | -11% | 2.8 | 1 |
| 48b | A52 Bucknall Road | A5272 Dividy Road | A52 Leek Road | 2118 | 2117 | data.gov.uk | Passing | 389751 | 347331 | Wednesday | 40989 | Westbound | 828 | 157 | 22 | 1007 | 975 | 146 | 51 | 1171 | -147 | -18% | -11 | -7% | 29 | 131% | 164 | 16% | 4.9 | 1 |
| 49a | A53 Leek New Road | Norton Lane | Trentfields Road | 1723 | 1724 | SoTCC | ATC Passing | 390362 | 350830 | n/a | 24-27/6/2013 | Eastbound | | | | | | | | | | | | | | | | | | |
| 49b | A53 Leek New Road | Trentfields Road | Norton Lane | 1724 | 1723 | SoTCC | ATC Passing | 390362 | 350830 | n/a | 24-27/6/2013 | Westbound | | | | | | | | | | | | | | | | | | |
| 50a | A519 Clayton Road | Buckmaster Avenue | Friarswood Road | 2215 | 1403 | data.gov.uk | Passing | 385171 | 344885 | Monday | 41386 | Northbound | 404 | 37 | 9 | 450 | 528 | 71 | 12 | 611 | -124 | -31% | 34 | 91% | 3 | 35% | 161 | 36% | 5.7 | 1 |
| 50b | A519 Clayton Road | Friarswood Road | Buckmaster Avenue | 1403 | 2215 | data.gov.uk | Passing | 385171 | 344885 | Monday | 41386 | Southbound | 413 | 37 | 17 | 467 | 569 | 65 | 5 | 639 | -156 | -38% | 28 | 75% | -12 | -70% | 172 | 37% | 7.1 | 1 |
| 51a | A525 Keele Road | Cemetey Road | Orme Road | 2281 | 1420 | SCC | Turning | 383142 | 345539 | Thursday | 42878 | Eastbound | | | | | | | | | | | | | | | | | | |
| 51b | A525 Keele Road | Orme Road | Cemetery Road | 1420 | 2281 | SCC | Turning | 383142 | 345539 | Thursday | 42878 | Westbound | | | | | | | | | | | | | | | | | | |
| 52a | A5271 Brownhills Road | Westport Road | A5271 Williamson Street | 1608 | 1657 | Sky High | Passing | 385975 | 350495 | Wednesday | 42123 | Northbound | 434 | 69 | 37 | 540 | 336 | 39 | 18 | 393 | 98 | 23% | -30 | -43% | -19 | -52% | -147 | -27% | 5.0 | 1 |
| 52b | A5271 Brownhills Road | A5271 Williamson Street | Westport Road | 1657 | 1608 | Sky High | Passing | 385975 | 350495 | Wednesday | 42123 | Southbound | 394 | 44 | 18 | 456 | 410 | 48 | 8 | 466 | -16 | -4% | 4 | 8% | -10 | -56% | 10 | 2% | 0.8 | 1 |
| 53a | A5272 High Lane | Hamil Road | Haywood Road | 1648 | 1650 | Sky High | Passing | 387487 | 351013 | Wednesday | 42123 | Northbound | 600 | 79 | 20 | 699 | 563 | 43 | 34 | 640 | 37 | 6% | -36 | -45% | 14 | 71% | -59 | -8% | 1.6 | 1 |
| 53b | A5272 High Lane | Haywood Road | Hamil Road | 1650 | 1648 | Sky High | Passing | 387487 | 351013 | Wednesday | 42123 | Southbound | 502 | 74 | 24 | 600 | 454 | 84 | 25 | 563 | 48 | 10% | 10 | 13% | 1 | 3% | -37 | -6% | 2.2 | 1 |
| 54a | A5272 Dividy Road | Romer Side | Templeton Avenue | 2157 | 2165 | SoTCC | ATC Passing | 391690 | 345615 | n/a | 22-25/04/2013 | Eastbound | | | | | | | | | | | | | | | | | | |
| 54b | A5272 Dividy Road | Templeton Avenue | Romer Side | 2165 | 2157 | SoTCC | ATC Passing | 391690 | 345615 | n/a | 22-25/04/2013 | Westbound | | | | | | | | | | | | | | | | | | |
| 3a | A500 | B5045 Shelton New Road | A53 Etruria Road | 2240 | 2289 | data.gov.uk | Passing | 386726 | 346280 | Wednesday | 22/10/2014 | Northbound | 1983 | 579 | 281 | 2843 | 1901 | 280 | 236 | 2417 | 82 | 4% | -299 | -52% | -45 | -16% | -426 | -15% | 1.9 | 1 |
| 3b | A500 | A53 Etruria Road | B5045 Shelton New Road | 2267 | 2256 | data.gov.uk | Passing | 386726 | 346280 | Wednesday | 22/10/2014 | Southbound | 2159 | 516 | 331 | 3006 | 1862 | 381 | 134 | 2377 | 297 | 14% | -135 | -26% | -197 | -60% | -629 | -21% | 6.6 | 1 |
| 4a | A500 | A5006 Stoke Road | B5045 Shelton New Road | 5086 | 2240 | data.gov.uk | Passing | 387091 | 346000 | Thursday | 09/07/2015 | Northbound | 2301 | 519 | 407 | 3227 | 2167 | 372 | 261 | 2800 | 134 | 6% | -147 | -28% | -146 | -36% | -427 | -13% | 2.8 | 1 |
| 4b | A500 | B5045 Shelton New Road | A5006 Stoke Road | 2256 | 5085 | data.gov.uk | Passing | 387091 | 346000 | Thursday | 09/07/2015 | Southbound | 2161 | 500 | 439 | 3100 | 2072 | 442 | 158 | 2672 | 89 | 4% | -58 | -12% | -281 | -64% | -428 | -14% | 1.9 | 1 |
| 5a | A34 Talke Road | Bradwell Lane | Parkhouse Road West | 1590 | 1601 | data.gov.uk | Passing | 383756 | 350000 | Thursday | 25/04/2013 | Northbound | 748 | 152 | 33 | 933 | 833 | 124 | 61 | 1019 | -85 | -11% | -28 | -18% | 28 | 84% | 86 | 9% | 3.0 | 1 |
| 5b | A34 Talke Road | Parkhouse Road West | Bradwell Lane | 1601 | 1590 | data.gov.uk | Passing | 383756 | 350000 | Thursday | 25/04/2013 | Southbound | 752 | 108 | 38 | 898 | 865 | 110 | 66 | 1040 | -113 | -15% | 2 | 2% | 28 | 73% | 142 | 16% | 4.0 | 1 |
| 6a | A34 Liverpool Road | B5368 Lower Milehouse Lane | Brymbo Road | 2269 | 1599 | data.gov.uk | Passing | 384250 | 347872 | Wednesday | 22/04/2015 | Northbound | 877 | 156 | 60 | 1093 | 757 | 101 | 49 | 907 | 120 | 14% | -55 | -35% | -11 | -18% | -186 | -17% | 4.2 | 1 |
| 6b | A34 Liverpool Road | Brymbo Road | B5368 Lower Milehouse Lane | 1599 | 2269 | data.gov.uk | Passing | 384250 | 347872 | Wednesday | 22/04/2015 | Southbound | 757 | 126 | 55 | 938 | 709 | 89 | 39 | 836 | 48 | 6% | -37 | -30% | -16 | -29% | -102 | -11% | 1.8 | 1 |
| 8a | A53 Etruria Road | Festival Way | Forge Lane | 2259 | 2260 | data.gov.uk | Passing | 386983 | 347327 | Wednesday | 08/07/2015 | Westbound | 1668 | 205 | 86 | 1959 | 1704 | 202 | 42 | 1948 | -36 | -2% | -3 | -2% | -44 | -52% | -11 | -1% | 0.9 | 1 |
| 8b | A53 Etruria Road | Forge Lane | Festival Way | 2319 | 2258 | data.gov.uk | Passing | 386983 | 347327 | Wednesday | 08/07/2015 | Eastbound | 1469 | 183 | 89 | 1741 | 1479 | 230 | 72 | 1780 | -10 | -1% | 47 | 25% | -17 | -19% | 39 | 2% | 0.2 | 1 |
| 10a | A50 Wedgwood Street | Market Place | Federation Road | 5025 | 1660 | SoTCC | Passing | 386864 | 350000 | Wednesday | 21/05/2014 | Northbound | 508 | 56 | 9 | 573 | 554 | 56 | 20 | 630 | -46 | -9% | 0 | 0% | 11 | 120% | 57 | 10% | 2.0 | 1 |
| 10b | A50 Wedgwood Street | Federation Road | Market Place | 1660 | 5025 | SoTCC | Passing | 386864 | 350000 | Wednesday | 21/05/2014 | Southbound | 438 | 63 | 22 | 523 | 503 | 78 | 22 | 602 | -65 | -15% | 15 | 23% | 0 | -1% | 79 | 15% | 3.0 | 1 |
| 11a | A50 Waterloo Road | B5050 Zion Street | Nile Street | 1764 | 1672 | data.gov.uk | Passing | 387000 | 349678 | Tuesday | 09/09/2014 | Northbound | 518 | 51 | 12 | 581 | 436 | 37 | 14 | 487 | 82 | 16% | -14 | -27% | 2 | 17% | -94 | -16% | 3.8 | 1 |
| 11b | A50 Waterloo Road | Nile Street | B5050 Zion Street | 1672 | 1764 | data.gov.uk | Passing | 387000 | 349678 | Tuesday | 09/09/2014 | Southbound | 378 | 46 | 6 | 430 | 340 | 28 | 12 | 380 | 38 | 10% | -18 | -39% | 6 | 96% | -50 | -12% | 2.0 | 1 |
| 12a | A50 Waterloo Road | Stonor Street | B5050 Pitt Street West | 1681 | 1765 | SoTCC | Turning | 387081 | 349528 | Thursday | 05/02/2015 | Northbound | 566 | 73 | 7 | 646 | 600 | 58 | 21 | 680 | -34 | -6% | -15 | -20% | 14 | 205% | 34 | 5% | 1.4 | 1 |
| 12b | A50 Waterloo Road | B5050 Pitt Street West | Stonor Street | 1765 | 1681 | SoTCC | Turning | 387081 | 349528 | Thursday | 05/02/2015 | Southbound | 452 | 65 | 6 | 523 | 452 | 44 | 14 | 509 | 0 | 0% | -21 | -33% | 8 | 131% | -14 | -3% | 0.0 | 1 |
| 13a | A50 Potteries Way | A5008 Bucknall New Road | Huntbach Street | 1355 | 1340 | SoTCC | Turning | 388583 | 347609 | Thursday | 28/01/2016 | Northbound | 733 | 105 | 11 | 849 | 808 | 94 | 25 | 927 | -75 | -10% | -11 | -10% | 14 | 125% | 78 | 9% | 2.7 | 1 |
| 13b | A50 Potteries Way | Huntbach Street | A5008 Bucknall New Road | 1340 | 1355 | SoTCC | Turning | 388583 | 347609 | Thursday | 28/01/2016 | Southbound | 808 | 116 | 14 | 938 | 996 | 119 | 31 | 1145 | -188 | -23% | 3 | 2% | 17 | 119% | 207 | 22% | 6.3 | 1 |
| 14a | A50 Potteries Way | Botteslow Street | A5008 Bucknall New Road | 1354 | 1355 | SoTCC | Turning | 388583 | 347609 | Thursday | 28/01/2016 | Northbound | 682 | 110 | 5 | 797 | 715 | 83 | 27 | 825 | -33 | -5% | -27 | -24% | 22 | 434% | 28 | 4% | 1.2 | 1 |
| 14b | A50 Potteries Way | A5008 Bucknall New Road | Botteslow Street | 1355 | 1354 | SoTCC | Turning | 388583 | 347609 | Thursday | 28/01/2016 | Southbound | 835 | 113 | 14 | 962 | 689 | 91 | 25 | 806 | 146 | 17% | -22 | -19% | 11 | 79% | -156 | -16% | 5.3 | 1 |
| 15a | A50 Potteries Way | Botteslow Street | A50 Lichfield Street | 1354 | 2005 | SoTCC | Turning | 388446 | 347226 | Wednesday | 27/01/2016 | Westbound | 773 | 128 | 16 | 917 | 833 | 115 | 32 | 980 | -60 | -8% | -13 | -10% | 16 | 100% | 63 | 7% | 2.1 | 1 |
| 15b | A50 Potteries Way | A50 Lichfield Street | Botteslow Street | 2005 | 1354 | SoTCC | Turning | 388446 | 347226 | Wednesday | 27/01/2016 | Eastbound | 660 | 90 | 14 | 764 | 619 | 65 | 12 | 696 | 41 | 6% | -25 | -28% | -2 | -17% | -68 | -9% | 1.6 | 1 |
| 33a | A50 Lichfield Street | Regent Road | A50 Potteries Way | 1358 | 2007 | SoTCC | Turning | 388526 | 347148 | Monday | 25/01/2016 | Northbound | 502 | 89 | 17 | 608 | 505 | 65 | 11 | 581 | -3 | -1% | -24 | -27% | -6 | -38% | -27 | -4% | 0.1 | 1 |
| 33b | A50 Lichfield Street | A50 Potteries Way | Regent Road | 2007 | 1358 | SoTCC | Turning | 388526 | 347148 | Monday | 25/01/2016 | Southbound | 511 | 67 | 12 | 590 | 662 | 86 | 21 | 769 | -151 | -30% | 19 | 29% | 9 | 74% | 179 | 30% | 6.2 | 1 |
| 34a | A50 Lichfield Street | Hampton Street | Regent Road | 2063 | 1358 | SoTCC | Turning | 388526 | 347148 | Monday | 25/01/2016 | Northbound | 457 | 86 | 16 | 559 | 560 | 74 | 22 | 656 | -103 | -23% | -12 | -14% | 6 | 38% | 97 | 17% | 4.6 | 1 |
| 34b | A50 Lichfield Street | Regent Road | Hampton Street | 1358 | 2063 | SoTCC | Turning | 388526 | 347148 | Monday | 25/01/2016 | Southbound | 479 | 71 | 11 | 561 | 531 | 71 | 18 | 620 | -52 | -11% | 0 | 0% | 7 | 66% | 59 | 11% | 2.3 | 1 |
| 35a | A5271 Scotia Road | Woodland Street | A5271 The Boulevard | 1653 | 1638 | SoTCC | Passing | 386147 | 351212 | Thursday | 21/05/2015 | Northbound | 730 | 60 | 9 | 799 | 615 | 61 | 28 | 704 | 115 | 16% | 1 | 2% | 19 | 213% | -95 | -12% | 4.5 | 1 |
| 35b | A5271 Scotia Road | A5271 The Boulevard | Woodland Street | 1638 | 1653 | SoTCC | Passing | 386147 | 351212 | Thursday | 21/05/2015 | Southbound | 724 | 95 | 9 | 828 | 681 | 123 | 26 | 829 | 43 | 6% | 28 | 29% | 17 | 187% | 1 | 0% | 1.6 | 1 |
| 20a | A5008 Potteries Way | A50 Lichfield Street | Bethesda Street | 1768 | 1369 | SoTCC | Turning | 388446 | 347226 | Wednesday | 27/01/2016 | Westbound | 719 | 102 | 15 | 836 | 396 | 56 | 17 | 468 | 323 | 45% | -46 | -45% | 2 | 11% | -368 | -44% | 13.7 | 1 |
| 20b | A5008 Potteries Way | Bethesda Street | A50 Lichfield Street | 1369 | 1768 | SoTCC | Turning | 388446 | 347226 | Wednesday | 27/01/2016 | Eastbound | 366 | 63 | 11 | 440 | 322 | 27 | 9 | 357 | 44 | 12% | -36 | -58% | -2 | -19% | -83 | -19% | 2.4 | 1 |

SWECO

## PM peak hour

| Ref. No. | Road | A-Junction | B-Junction | A-Node | B-Node | Source of Traffic Count | Type of Manual Classified Count | Grid Reference Easting | Grid Reference Northing | Day of Count | Date of Count | Direction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cordon Validation Counts - Inbound** | | | | | | | | | | | | |
| 1a | A34 Stone Road | Tittensor Road | A5035 Longton Road | 1178 | 2012 | data.gov.uk | Passing | 387082 | 339993 | Monday | 42625 | Northbound |
| 2a | A500 | A519 Clayton Road | A34 Stone Road | 6035 | 1999 | data.gov.uk | Passing | 385500 | 342150 | Thursday | 41354 | Eastbound |
| 3a | A519 Clayton Road | A500 | Westbury Road | 2001 | 2222 | data.gov.uk | Passing | 385140 | 342500 | Friday | 42482 | Northbound |
| 4a | A53 Whitmore Road | A5182 Trentham Road | Seabridge Lane | 1960 | 2295 | data.gov.uk | Passing | 382611 | 343143 | Tuesday | 41898 | Northbound |
| 5a | A525 Keele Road | Keele Road | University Drive | 1962 | 2280 | SCC | Turning | 382323 | 345560 | Thursday | 42817 | Eastbound |
| 6a | A500 | Alsager Road | A34 Talke Road | 1299 | 1549 | data.gov.uk | Passing | 382105 | 351890 | Tuesday | 41163 | Eastbound |
| 7a | A34 Newcastle Road | Coalpit Hill | Talke Road | 5024 | 1575 | data.gov.uk | Passing | 383170 | 352200 | Friday | 41054 | Southbound |
| 8a | A50 Liverpool Road | Stonebank Road | Woodstock Street | 5021 | 1857 | data.gov.uk | Passing | 385000 | 353836 | Wednesday | 42508 | Eastbound |
| 9a | A527 Tunstall Road | Bemersley Road | Bridge Street | 1826 | 1830 | data.gov.uk | Passing | 387945 | 355000 | Wednesday | 41437 | Southbound |
| 10a | A53 Leek New Road | Nursery Avenue | Baddeley Green Lane | 1750 | 1748 | SoTCC | ATC Passing | 391082 | 351541 | n/a | 11-14/11/2013 | Southbound |
| 11a | A52 Werrington Road | Clough Lane | Corneville Road | 1954 | 2338 | SoTCC | ATC Passing | 391609 | 347261 | n/a | 9-12/6/2014 | Westbound |
| 12a | A520 Weston Road | Winterfield Lane | Main Street | 2082 | 2083 | SoTCC | ATC Passing | 393728 | 344455 | n/a | 29/06-07/07/2015 | Southbound |
| 13a | A50 | A521 Uttoxeter Road | A520 Weston Road | 1982 | 2096 | data.gov.uk | Passing | 393920 | 341921 | Monday | 41015 | Westbound |
| 14a | A5005 Lightwood Road | Common Lane | Gravelly Bank | 2041 | 2044 | SoTCC | ATC Passing | 392628 | 340512 | n/a | 28/09-01/10/2015 | Northbound |
| | | | | | | | | | Total | | | |
| **Cordon Validation Counts - Outbound** | | | | | | | | | | | | |
| 1b | A34 Stone Road | A5035 Longton Road | Tittensor Road | 2012 | 1178 | data.gov.uk | Passing | 387082 | 339993 | Monday | 42625 | Southbound |
| 2b | A500 | A34 Stone Road | A519 Clayton Road | 2184 | 6035 | data.gov.uk | Passing | 385500 | 342150 | Thursday | 41354 | Westbound |
| 3b | A519 Clayton Road | Westbury Road | A500 | 2222 | 2001 | data.gov.uk | Passing | 385140 | 342500 | Friday | 42482 | Southbound |
| 4b | A53 Whitmore Road | Seabridge Lane | A5182 Trentham Road | 2295 | 1960 | data.gov.uk | Passing | 382611 | 343143 | Tuesday | 41898 | Southbound |
| 5b | A525 Keele Road | University Drive | Keele Road | 2280 | 1962 | SCC | Turning | 382323 | 345560 | Thursday | 42817 | Westbound |
| 6b | A500 | A34 Talke Road | Alsager Road | 1620 | 1304 | data.gov.uk | Passing | 382105 | 351890 | Tuesday | 41163 | Westbound |
| 7b | A34 Newcastle Road | Talke Road | Coalpit Hill | 1575 | 5024 | data.gov.uk | Passing | 383170 | 352200 | Friday | 41054 | Northbound |
| 8b | A50 Liverpool Road | Woodstock Street | Stonebank Road | 1857 | 5021 | data.gov.uk | Passing | 385000 | 353836 | Wednesday | 42508 | Westbound |
| 9b | A527 Tunstall Road | Bridge Street | Bemersley Road | 1830 | 1826 | data.gov.uk | Passing | 387945 | 355000 | Wednesday | 41437 | Northbound |
| 10b | A53 Leek New Road | Baddeley Green Lane | Nursery Avenue | 1748 | 1750 | SoTCC | ATC Passing | 391082 | 351541 | n/a | 11-14/11/2013 | Northbound |
| 11b | A52 Werrington Road | Corneville Road | Clough Lane | 2338 | 1954 | SoTCC | ATC Passing | 391609 | 347261 | n/a | 9-12/6/2014 | Eastbound |
| 12b | A520 Weston Road | Main Street | Winterfield Lane | 2083 | 2082 | SoTCC | ATC Passing | 393728 | 344455 | n/a | 29/06-07/07/2015 | Northbound |
| 13b | A50 | A520 Weston Road | A521 Uttoxeter Road | 2093 | 2098 | data.gov.uk | Passing | 393920 | 341921 | Monday | 41015 | Eastbound |
| 14b | A5005 Lightwood Road | Gravelly Bank | Common Lane | 2044 | 2041 | SoTCC | ATC Passing | 392628 | 340512 | n/a | 28/09-01/10/2015 | Southbound |
| | | | | | | | | | Total | | | |
| **North-South Screenline - Northbound** | | | | | | | | | | | | |
| 15a | A34 Liverpool Road | B5500 London Road | B5369 Dimsdale Parade West | 1598 | 1596 | Sky High | Passing | 384062 | 348611 | Wednesday | 29/04/2015 | Northbound |
| 16a | Hassam Parade | B5368 Milehouse Lane | B5369 Dimsdale Parade West | 2183 | 1341 | Sky High | Passing | 384761 | 348119 | Wednesday | 29/04/2015 | Northbound |
| 17a | B5368 Milehouse Lane | Hassam Parade | B5369 Alexandra Road | 2183 | 1692 | Sky High | Passing | 385050 | 347913 | Wednesday | 29/04/2015 | Eastbound |
| 18a | A527 Brampton Road | Greenbank Road | B5369 Alexandra Road | 2193 | 2192 | Sky High | Turning | 385613 | 347622 | Wednesday | 29/04/2015 | Northbound |
| 19a | B5369 Basford Park Road | Downing Avenue | A527 Brampton Road | 2182 | 2192 | Sky High | Turning | 385613 | 347622 | Wednesday | 29/04/2015 | Northbound |
| 20a | A500 | A53 Etruria Road | A527 Grange Lane | 2266 | 1700 | data.gov.uk | Passing | 386174 | 347998 | Monday | 15/06/2015 | Northbound |
| 21a | Greyhound Way | Pavilion Drive | A50 Waterloo Road | 6101 | 1778 | Sky High | Passing | 387427 | 348653 | Wednesday | 29/04/2015 | Eastbound |
| 22a | A53 Cobridge Road | Pavilion Drive | A50 Waterloo Road | 2075 | 1685 | Sky High | Passing | 387574 | 348488 | Wednesday | 29/04/2015 | Northbound |
| 23a | A50 Waterloo Road | Wayte Street | A53 Cobridge Road | 1686 | 1685 | Sky High | Passing | 387718 | 348427 | Wednesday | 29/04/2015 | Northbound |
| 24a | A5272 Hanley Road | Barthomley Road | Sneyd Street | 1753 | 1732 | Sky High | Passing | 388747 | 349070 | Wednesday | 29/04/2015 | Northbound |
| 25a | A5009 Leek Road | Barratt Gardens | | 1745 | 1746 | SoTCC | Turning | 390718 | 350270 | Wednesday | 14/06/2017 | Northbound |
| | | | | | | | | | Total | | | |
| **North-South Screenline - Southbound** | | | | | | | | | | | | |
| 15b | A34 Liverpool Road | B5369 Dimsdale Parade West | B5500 London Road | 1596 | 1598 | Sky High | Passing | 384062 | 348611 | Wednesday | 42123 | Southbound |
| 16b | Hassam Parade | B5369 Dimsdale Parade West | B5368 Milehouse Lane | 1341 | 2183 | Sky High | Passing | 384761 | 348119 | Wednesday | 29/04/2015 | Southbound |
| 17b | B5368 Milehouse Lane | B5369 Alexandra Road | Hassam Parade | 1692 | 2183 | Sky High | Passing | 385050 | 347913 | Wednesday | 29/04/2015 | Westbound |
| 18b | A527 Brampton Road | B5369 Alexandra Road | Greenbank Road | 2192 | 2193 | Sky High | Turning | 385613 | 347622 | Wednesday | 29/04/2015 | Southbound |
| 19b | B5369 Basford Park Road | A527 Brampton Road | Downing Avenue | 2192 | 2182 | Sky High | Turning | 385613 | 347622 | Wednesday | 29/04/2015 | Southbound |
| 20b | A500 | A527 Grange Lane | A53 Etruria Road | 1698 | 1705 | data.gov.uk | Passing | 386174 | 347998 | Monday | 15/06/2015 | Southbound |
| 21b | Greyhound Way | A50 Waterloo Road | Pavilion Drive | 1778 | 6101 | Sky High | Passing | 387427 | 348653 | Wednesday | 42123 | Westbound |
| 22b | A53 Cobridge Road | A50 Waterloo Road | Pavilion Drive | 1685 | 2075 | Sky High | Passing | 387574 | 348488 | Wednesday | 42123 | Southbound |
| 23b | A50 Waterloo Road | A53 Cobridge Road | Wayte Street | 1685 | 1686 | Sky High | Passing | 387718 | 348427 | Wednesday | 42123 | Southbound |
| 24b | A5272 Hanley Road | Sneyd Street | Barthomley Road | 1732 | 1753 | Sky High | Passing | 388747 | 349070 | Wednesday | 42123 | Southbound |
| 25b | A5009 Leek Road | Millrise Road | Barratt Gardens | 1746 | 1745 | SoTCC | Turning | 390718 | 350270 | Wednesday | 42900 | Southbound |
| | | | | | | | | | Total | | | |
| **East-West Screenline - Eastbound** | | | | | | | | | | | | |
| 27a | A527 Tunstall Western Bypass | Chemical Lane | Chatterley Road | 1305 | 1634 | SoTCC | Passing | 385032 | 351038 | Tuesday | 28/04/2015 | Northbound |
| 28a | A5271 Longport Road | A500 | Scott Lidgett Road | 1629 | 1609 | SoTCC | Passing | 385732 | 349427 | Tuesday | 29/04/2015 | Northbound |
| 29a | A53 Etruria Road | A500 | Forge Lane | 1937 | 2257 | SoTCC | Passing | 386629 | 347058 | Wednesday | 30/04/2014 | Eastbound |
| 30a | B5045 Shelton New Road | A500 | Etruscan Street | 1792 | 2242 | SoTCC | Passing | 386895 | 346336 | Thursday | 01/05/2014 | Eastbound |
| 31a | A5006 Stoke Road | Avenue Road | Cemetery Road | 2251 | 1385 | SoTCC | Passing | 387761 | 346317 | Wednesday | 03/05/2017 | Northbound |
| 32a | College Road | Avenue Road | Wellesley Street | 2252 | 1387 | SoTCC | Passing | 388045 | 346266 | Monday | 30/03/2014 | Northbound |
| 33a | A52 Leek Road | Boughey Road | Cauldon Road | 1427 | 2253 | SoTCC | Passing | 388234 | 345738 | Wednesday | 22/04/2015 | Northbound |
| 34a | A5007 City Road | A52 Leek Road | Napier Street | 1445 | 1436 | SoTCC | Passing | 388514 | 344891 | Wednesday | 22/04/2015 | Eastbound |
| 35a | Whieldon Road | Old Whieldon Road | Sutherland Street | 2235 | 2139 | SoTCC | Passing | 388292 | 344596 | Wednesday | 09/04/2014 | Eastbound |
| | | | | | | | | | Total | | | |
| **East-West Screenline - Westbound** | | | | | | | | | | | | |
| 27b | A527 Tunstall Western Bypass | Chatterley Road | Chemical Lane | 1634 | 1305 | SoTCC | Passing | 385032 | 351038 | Tuesday | 28/04/2015 | Southbound |
| 28b | A5271 Longport Road | Scott Lidgett Road | A500 | 1609 | 1629 | SoTCC | Passing | 385732 | 349427 | Tuesday | 29/04/2015 | Southbound |
| 29b | A53 Etruria Road | Forge Lane | A500 | 1808 | 1806 | SoTCC | Passing | 386629 | 347058 | Wednesday | 30/04/2014 | Westbound |
| 30b | B5045 Shelton New Road | Etruscan Street | A500 | 2242 | 1792 | SoTCC | Passing | 386895 | 346336 | Thursday | 01/05/2014 | Westbound |
| 31b | A5006 Stoke Road | Cemetery Road | Avenue Road | 1385 | 2251 | SoTCC | Passing | 387761 | 346317 | Wednesday | 03/05/2017 | Southbound |
| 32b | College Road | Wellesley Street | Avenue Road | 1387 | 2252 | SoTCC | Passing | 388045 | 346266 | Monday | 30/03/2014 | Southbound |
| 33b | A52 Leek Road | Cauldon Road | Boughey Road | 2253 | 1427 | SoTCC | Passing | 388234 | 345738 | Wednesday | 22/04/2015 | Southbound |
| 34b | A5007 City Road | Napier Street | A52 Leek Road | 1436 | 1445 | SoTCC | Passing | 388514 | 344891 | Wednesday | 22/04/2015 | Westbound |
| 35b | Whieldon Road | Sutherland Street | Old Whieldon Road | 2139 | 2235 | SoTCC | Passing | 388292 | 344596 | Wednesday | 09/04/2014 | Westbound |
| | | | | | | | | | Total | | | |

PM

| Ref. No. | Observed Car | Observed LGV | Observed HGV | Observed PM Peak-Hour (17-1800hrs) | Model Flow Car | Model Flow LGV | Model Flow HGV | Model Flow Total | Car Difference | Car % Diff | LGV Difference | LGV % Diff | HGV Difference | HGV % Diff | Total Difference | Total % Diff | Car GEH | Car Count | Car Count | Car DMRB Diff test | Car GEH<5 | Car DMRB OR GEH<5 | LGV GEH | LGV Count | LGV DMRB Diff test | LGV GEH<5 | LGV DMRB OR GEH<5 | HGV GEH | HGV Count | HGV DMRB Diff test | HGV GEH<5 | HGV DMRB OR GEH<5 | Total GEH | Total Count | Total DMRB Diff test | Total GEH<5 | Total DMRB OR GEH<5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cordon Validation Counts - Inbound** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1a | 895 | 130 | 31 | 1056 | 1064 | 131 | 43 | 1,237 | 169 | 19% | 1 | 0% | 12 | 38% | 181 | 17% | 5.4 | 1 | 1 | ✗ | ✗ | ✗ | 0.0 | 1 | ✓ | ✓ | ✓ | 1.9 | 1 | ✓ | ✓ | ✓ | 5.4 | 1 | ✗ | ✗ | ✗ |
| 2a | 1506 | 274 | 119 | 1899 | 1525 | 221 | 156 | 1,902 | -19 | -1% | -53 | -19% | 37 | 31% | 3 | 0% | 0.5 | 1 | 1 | ✓ | ✓ | ✓ | 3.3 | 1 | ✓ | ✓ | ✓ | 3.2 | 1 | ✓ | ✓ | ✓ | 0.1 | 1 | ✓ | ✓ | ✓ |
| 3a | 708 | 78 | 9 | 795 | 772 | 71 | 13 | 855 | -64 | -9% | -7 | -10% | 4 | 46% | 60 | 8% | 2.3 | 1 | 1 | ✓ | ✓ | ✓ | 0.9 | 1 | ✓ | ✓ | ✓ | 1.3 | 1 | ✓ | ✓ | ✓ | 2.1 | 1 | ✓ | ✓ | ✓ |
| 4a | 258 | 39 | 1 | 298 | 242 | 40 | 9 | 290 | 16 | 6% | 1 | 3% | 8 | 760% | -8 | -3% | 1.0 | 1 | 1 | ✓ | ✓ | ✓ | 0.2 | 1 | ✓ | ✓ | ✓ | 3.5 | 1 | ✓ | ✓ | ✓ | 0.5 | 1 | ✓ | ✓ | ✓ |
| 5a | 400 | 37 | 5 | 442 | 442 | 49 | 18 | 509 | -42 | -11% | 12 | 32% | 13 | 262% | 67 | 15% | 2.1 | 1 | 1 | ✓ | ✓ | ✓ | 1.8 | 1 | ✓ | ✓ | ✓ | 3.8 | 1 | ✓ | ✓ | ✓ | 3.1 | 1 | ✓ | ✓ | ✓ |
| 6a | 1621 | 305 | 143 | 2069 | 1718 | 316 | 241 | 2,274 | -97 | -6% | 11 | 4% | 98 | 68% | 205 | 10% | 2.4 | 1 | 1 | ✓ | ✓ | ✓ | 0.6 | 1 | ✓ | ✓ | ✓ | 7.1 | 1 | ✓ | ✗ | ✓ | 4.4 | 1 | ✓ | ✓ | ✓ |
| 7a | 677 | 94 | 22 | 793 | 803 | 88 | 40 | 931 | -126 | -19% | -6 | -6% | 18 | 82% | 138 | 17% | 4.6 | 1 | 1 | ✗ | ✓ | ✓ | 0.6 | 1 | ✓ | ✓ | ✓ | 3.3 | 1 | ✓ | ✓ | ✓ | 4.7 | 1 | ✗ | ✓ | ✓ |
| 8a | 475 | 68 | 3 | 546 | 482 | 54 | 10 | 546 | -7 | -1% | -14 | -20% | 7 | 234% | 0 | 0% | 0.3 | 1 | 1 | ✓ | ✓ | ✓ | 1.7 | 1 | ✓ | ✓ | ✓ | 2.7 | 1 | ✓ | ✓ | ✓ | 0.0 | 1 | ✓ | ✓ | ✓ |
| 9a | 503 | 101 | 2 | 606 | 583 | 92 | 11 | 686 | -80 | -16% | -9 | -9% | 9 | 429% | 80 | 13% | 3.4 | 1 | 1 | ✓ | ✓ | ✓ | 0.9 | 1 | ✓ | ✓ | ✓ | 3.4 | 1 | ✓ | ✓ | ✓ | 3.1 | 1 | ✓ | ✓ | ✓ |
| 10a | | | | 626 | | | | 607 | | | | | | | -19 | -3% | | | | | | | | | | | | | | | | | 0.8 | 1 | ✓ | ✓ | ✓ |
| 11a | | | | 685 | | | | 632 | | | | | | | -53 | -8% | | | | | | | | | | | | | | | | | 2.1 | 1 | ✓ | ✓ | ✓ |
| 12a | | | | 621 | | | | 768 | | | | | | | 147 | 24% | | | | | | | | | | | | | | | | | 5.6 | 1 | ✗ | ✗ | ✗ |
| 13a | 2115 | 272 | 180 | 2567 | 2284 | 276 | 237 | 2,797 | -169 | 0 | 4 | 0 | 57 | 0 | 230 | 9% | 3.6 | 1 | 1 | ✓ | ✓ | ✓ | 0.2 | 1 | ✓ | ✓ | ✓ | 4.0 | 1 | ✓ | ✓ | ✓ | 4.4 | 1 | ✓ | ✓ | ✓ |
| 14a | | | | 270 | | | | 230 | | | | | | | -40 | -15% | | | | | | | | | | | | | | | | | 2.5 | 1 | ✓ | ✓ | ✓ |
| Total | 9,158 | 1,398 | 515 | 13,273 | 9,914 | 1,338 | 777 | 14,265 | 756 | 8% | -60 | -4% | 262 | 51% | 992 | 7% | 7.7 | 1 | 1 | ✗ | ✗ | ✗ | 1.6 | 1 | ✓ | ✓ | ✓ | 10.3 | 1 | ✗ | ✗ | ✗ | 8.5 | 1 | ✗ | ✗ | ✗ |
| **Cordon Validation Counts - Outbound** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1b | 1125 | 94 | 30 | 1249 | 1171 | 104 | 41 | 1,316 | -46 | -4% | 10 | 10% | 11 | 37% | 67 | 5% | 1.4 | 1 | 1 | ✓ | ✓ | ✓ | 1.0 | 1 | ✓ | ✓ | ✓ | 1.8 | 1 | ✓ | ✓ | ✓ | 1.9 | 1 | ✓ | ✓ | ✓ |
| 2b | 1494 | 182 | 124 | 1800 | 1658 | 166 | 116 | 1,939 | -164 | -11% | -16 | -9% | -8 | -7% | 139 | 8% | 4.1 | 1 | 1 | ✓ | ✓ | ✓ | 1.2 | 1 | ✓ | ✓ | ✓ | 0.8 | 1 | ✓ | ✓ | ✓ | 3.2 | 1 | ✓ | ✓ | ✓ |
| 3b | 515 | 30 | 6 | 551 | 801 | 65 | 8 | 873 | -286 | -55% | 35 | 115% | 2 | 34% | 322 | 58% | 11.1 | 1 | 1 | ✗ | ✗ | ✗ | 5.0 | 1 | ✓ | ✗ | ✓ | 0.8 | 1 | ✓ | ✓ | ✓ | 12.1 | 1 | ✗ | ✗ | ✗ |
| 4b | 360 | 25 | 6 | 391 | 535 | 35 | 2 | 572 | -175 | -49% | 10 | 41% | -4 | -69% | 181 | 46% | 8.3 | 1 | 1 | ✗ | ✗ | ✗ | 1.9 | 1 | ✓ | ✓ | ✓ | 2.1 | 1 | ✓ | ✓ | ✓ | 8.2 | 1 | ✗ | ✗ | ✗ |
| 5b | 689 | 41 | 6 | 736 | 769 | 47 | 10 | 825 | -80 | -12% | 6 | 14% | 4 | 62% | 89 | 12% | 3.0 | 1 | 1 | ✓ | ✓ | ✓ | 0.9 | 1 | ✓ | ✓ | ✓ | 1.3 | 1 | ✓ | ✓ | ✓ | 3.2 | 1 | ✓ | ✓ | ✓ |
| 6b | 1619 | 192 | 111 | 1922 | 2070 | 166 | 205 | 2,441 | -451 | -28% | -26 | -13% | 94 | 84% | 519 | 27% | 10.5 | 1 | 1 | ✗ | ✗ | ✗ | 1.9 | 1 | ✓ | ✓ | ✓ | 7.5 | 1 | ✓ | ✗ | ✓ | 11.1 | 1 | ✗ | ✗ | ✗ |
| 7b | 842 | 75 | 22 | 939 | 981 | 152 | 52 | 1,184 | -139 | -16% | 77 | 103% | 30 | 135% | 245 | 26% | 4.6 | 1 | 1 | ✗ | ✓ | ✓ | 7.2 | 1 | ✓ | ✗ | ✓ | 4.9 | 1 | ✓ | ✓ | ✓ | 7.5 | 1 | ✗ | ✗ | ✗ |
| 8b | 653 | 87 | 4 | 744 | 657 | 85 | 7 | 749 | -4 | -1% | -2 | -3% | 3 | 81% | 5 | 1% | 0.2 | 1 | 1 | ✓ | ✓ | ✓ | 0.2 | 1 | ✓ | ✓ | ✓ | 1.4 | 1 | ✓ | ✓ | ✓ | 0.2 | 1 | ✓ | ✓ | ✓ |
| 9b | 733 | 98 | 5 | 836 | 823 | 90 | 17 | 930 | -90 | -12% | -8 | -8% | 12 | 233% | 94 | 11% | 3.2 | 1 | 1 | ✓ | ✓ | ✓ | 0.8 | 1 | ✓ | ✓ | ✓ | 3.5 | 1 | ✓ | ✓ | ✓ | 3.2 | 1 | ✓ | ✓ | ✓ |
| 10b | | | | 785 | | | | 730 | | | | | | | -55 | -7% | | | | | | | | | | | | | | | | | 2.0 | 1 | ✓ | ✓ | ✓ |
| 11b | | | | 904 | | | | 840 | | | | | | | -64 | -7% | | | | | | | | | | | | | | | | | 2.2 | 1 | ✓ | ✓ | ✓ |
| 12b | | | | 603 | | | | 726 | | | | | | | 123 | 20% | | | | | | | | | | | | | | | | | 4.8 | 1 | ✗ | ✓ | ✓ |
| 13b | 2503 | 364 | 132 | 2999 | 2698 | 285 | 195 | 3,177 | -195 | 0 | -79 | 0 | 63 | 0 | 178 | 6% | 3.8 | 1 | 1 | ✓ | ✓ | ✓ | 4.4 | 1 | ✓ | ✓ | ✓ | 4.9 | 1 | ✓ | ✓ | ✓ | 3.2 | 1 | ✓ | ✓ | ✓ |
| 14b | | | | 231 | | | | 252 | | | | | | | 21 | 9% | | | | | | | | | | | | | | | | | 1.3 | 1 | ✓ | ✓ | ✓ |
| Total | 10,533 | 1,188 | 446 | 14,690 | 12,162 | 1,194 | 651 | 16,555 | 1,629 | 15% | 6 | 1% | 205 | 46% | 1,865 | 13% | 15.3 | 1 | 1 | ✗ | ✗ | ✗ | 0.2 | 1 | ✓ | ✓ | ✓ | 8.8 | 1 | ✗ | ✗ | ✗ | 14.9 | 1 | ✗ | ✗ | ✗ |
| **North-South Screenline - Northbound** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15a | 1147 | 85 | 23 | 1255 | 1269 | 101 | 42 | 1,413 | -122 | -11% | 16 | 19% | 19 | 84% | 158 | 13% | 3.5 | 1 | 1 | ✓ | ✓ | ✓ | 1.7 | 1 | ✓ | ✓ | ✓ | 3.4 | 1 | ✓ | ✓ | ✓ | 4.3 | 1 | ✓ | ✓ | ✓ |
| 16a | 546 | 54 | 5 | 605 | 454 | 44 | 19 | 516 | 92 | 17% | -10 | -19% | 14 | 272% | -89 | -15% | 4.1 | 1 | 1 | ✓ | ✓ | ✓ | 1.5 | 1 | ✓ | ✓ | ✓ | 4.0 | 1 | ✓ | ✓ | ✓ | 3.8 | 1 | ✓ | ✓ | ✓ |
| 17a | 414 | 20 | 4 | 438 | 294 | 28 | 4 | 325 | 120 | 29% | 8 | 41% | 0 | -9% | -113 | -26% | 6.4 | 1 | 1 | ✗ | ✗ | ✗ | 1.7 | 1 | ✓ | ✓ | ✓ | 0.2 | 1 | ✓ | ✓ | ✓ | 5.8 | 1 | ✗ | ✗ | ✗ |
| 18a | 533 | 30 | 3 | 566 | 463 | 28 | 3 | 494 | 70 | 13% | -2 | -7% | 0 | -15% | -72 | -13% | 3.1 | 1 | 1 | ✓ | ✓ | ✓ | 0.4 | 1 | ✓ | ✓ | ✓ | 0.3 | 1 | ✓ | ✓ | ✓ | 3.1 | 1 | ✓ | ✓ | ✓ |
| 19a | 448 | 33 | 3 | 484 | 455 | 22 | 5 | 482 | -7 | -2% | -11 | -33% | 2 | 77% | -2 | 0% | 0.3 | 1 | 1 | ✓ | ✓ | ✓ | 2.1 | 1 | ✓ | ✓ | ✓ | 1.1 | 1 | ✓ | ✓ | ✓ | 0.1 | 1 | ✓ | ✓ | ✓ |
| 20a | 3434 | 392 | 154 | 3980 | 3553 | 212 | 272 | 4,037 | -119 | -3% | -180 | -46% | 118 | 77% | 57 | 1% | 2.0 | 1 | 1 | ✓ | ✓ | ✓ | 10.4 | 1 | ✗ | ✗ | ✗ | 8.1 | 1 | ✗ | ✗ | ✗ | 0.9 | 1 | ✓ | ✓ | ✓ |
| 21a | 602 | 31 | 1 | 634 | 540 | 15 | 1 | 557 | 62 | 10% | -16 | -51% | 0 | -11% | -77 | -12% | 2.6 | 1 | 1 | ✓ | ✓ | ✓ | 3.3 | 1 | ✓ | ✓ | ✓ | 0.1 | 1 | ✓ | ✓ | ✓ | 3.2 | 1 | ✓ | ✓ | ✓ |
| 22a | 995 | 104 | 20 | 1119 | 1142 | 163 | 22 | 1,327 | -147 | -15% | 59 | 57% | 2 | 10% | 208 | 19% | 4.5 | 1 | 1 | ✓ | ✓ | ✓ | 5.1 | 1 | ✓ | ✗ | ✓ | 0.4 | 1 | ✓ | ✓ | ✓ | 6.0 | 1 | ✗ | ✗ | ✗ |
| 23a | 878 | 64 | 9 | 951 | 761 | 48 | 14 | 822 | 117 | 13% | -16 | -26% | 5 | 50% | -129 | -14% | 4.1 | 1 | 1 | ✓ | ✓ | ✓ | 2.2 | 1 | ✓ | ✓ | ✓ | 1.4 | 1 | ✓ | ✓ | ✓ | 4.3 | 1 | ✓ | ✓ | ✓ |
| 24a | 956 | 86 | 12 | 1054 | 854 | 76 | 9 | 939 | 102 | 11% | -10 | -12% | -3 | -26% | -115 | -11% | 3.4 | 1 | 1 | ✓ | ✓ | ✓ | 1.1 | 1 | ✓ | ✓ | ✓ | 1.0 | 1 | ✓ | ✓ | ✓ | 3.7 | 1 | ✓ | ✓ | ✓ |
| 25a | 585 | 82 | 3 | 670 | 541 | 62 | 8 | 611 | 44 | 7% | -20 | -24% | 5 | 162% | -59 | -9% | 1.8 | 1 | 1 | ✓ | ✓ | ✓ | 2.4 | 1 | ✓ | ✓ | ✓ | 2.1 | 1 | ✓ | ✓ | ✓ | 2.3 | 1 | ✓ | ✓ | ✓ |
| Total | 10,538 | 981 | 257 | 11,756 | 10,326 | 799 | 398 | 11,522 | 212 | 2% | -182 | -19% | 141 | 69% | -234 | -2% | 2.1 | 1 | 1 | ✓ | ✓ | ✓ | 6.1 | 1 | ✗ | ✗ | ✗ | 9.0 | 1 | ✗ | ✗ | ✗ | 2.2 | 1 | ✓ | ✓ | ✓ |
| **North-South Screenline - Southbound** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15b | 798 | 85 | 29 | 912 | 744 | 82 | 17 | 843 | 54 | 7% | -3 | -4% | -12 | -40% | -69 | -8% | 2.0 | 1 | 1 | ✓ | ✓ | ✓ | 0.3 | 1 | ✓ | ✓ | ✓ | 2.4 | 1 | ✓ | ✓ | ✓ | 2.3 | 1 | ✓ | ✓ | ✓ |
| 16b | 355 | 32 | 1 | 388 | 249 | 24 | 12 | 285 | 106 | 30% | -8 | -24% | 11 | 1104% | -103 | -26% | 6.1 | 1 | 1 | ✗ | ✗ | ✗ | 1.4 | 1 | ✓ | ✓ | ✓ | 4.3 | 1 | ✓ | ✓ | ✓ | 5.6 | 1 | ✗ | ✗ | ✗ |
| 17b | 398 | 32 | 6 | 436 | 299 | 29 | 4 | 332 | 99 | 25% | -3 | -10% | -2 | -38% | -104 | -24% | 5.3 | 1 | 1 | ✓ | ✗ | ✓ | 0.6 | 1 | ✓ | ✓ | ✓ | 1.0 | 1 | ✓ | ✓ | ✓ | 5.3 | 1 | ✗ | ✗ | ✗ |
| 18b | 411 | 27 | 2 | 440 | 413 | 29 | 3 | 445 | -2 | 0% | 2 | 8% | 1 | 56% | 5 | 1% | 0.1 | 1 | 1 | ✓ | ✓ | ✓ | 0.4 | 1 | ✓ | ✓ | ✓ | 0.2 | 1 | ✓ | ✓ | ✓ | 0.2 | 1 | ✓ | ✓ | ✓ |
| 19b | 357 | 25 | 4 | 386 | 306 | 19 | 4 | 329 | 51 | 14% | -6 | -26% | 0 | 2% | -57 | -15% | 2.8 | 1 | 1 | ✓ | ✓ | ✓ | 1.4 | 1 | ✓ | ✓ | ✓ | 0.0 | 1 | ✓ | ✓ | ✓ | 3.0 | 1 | ✓ | ✓ | ✓ |
| 20b | 2732 | 346 | 174 | 3252 | 3266 | 227 | 280 | 3,782 | -534 | -20% | -119 | -34% | 106 | 61% | 530 | 16% | 9.7 | 1 | 1 | ✗ | ✗ | ✗ | 6.4 | 1 | ✗ | ✗ | ✗ | 7.0 | 1 | ✗ | ✗ | ✗ | 8.9 | 1 | ✗ | ✗ | ✗ |
| 21b | 288 | 13 | 1 | 302 | 245 | 8 | 3 | 255 | 43 | 15% | -5 | -42% | 2 | 152% | -47 | -16% | 2.6 | 1 | 1 | ✓ | ✓ | ✓ | 1.7 | 1 | ✓ | ✓ | ✓ | 1.1 | 1 | ✓ | ✓ | ✓ | 2.8 | 1 | ✓ | ✓ | ✓ |
| 22b | 1203 | 105 | 27 | 1335 | 773 | 131 | 21 | 924 | 430 | 36% | 26 | 24% | -6 | -23% | -411 | -31% | 13.7 | 1 | 1 | ✗ | ✗ | ✗ | 2.4 | 1 | ✓ | ✓ | ✓ | 1.3 | 1 | ✓ | ✓ | ✓ | 12.2 | 1 | ✗ | ✗ | ✗ |
| 23b | 581 | 52 | 7 | 640 | 574 | 48 | 5 | 627 | 7 | 1% | -4 | -8% | -2 | -27% | -13 | -2% | 0.3 | 1 | 1 | ✓ | ✓ | ✓ | 0.6 | 1 | ✓ | ✓ | ✓ | 0.8 | 1 | ✓ | ✓ | ✓ | 0.5 | 1 | ✓ | ✓ | ✓ |
| 24b | 703 | 87 | 7 | 797 | 680 | 66 | 9 | 756 | 23 | 3% | -21 | -24% | 2 | 15% | -41 | -5% | 0.9 | 1 | 1 | ✓ | ✓ | ✓ | 2.4 | 1 | ✓ | ✓ | ✓ | 0.8 | 1 | ✓ | ✓ | ✓ | 1.5 | 1 | ✓ | ✓ | ✓ |
| 25b | | | | 501 | | | | 478 | | | | | | | -23 | -5% | | | | | | | | | | | | | | | | | 1.0 | 1 | ✓ | ✓ | ✓ |
| Total | 7,826 | 804 | 258 | 9,389 | 7,550 | 671 | 357 | 9,057 | -276 | -4% | -133 | -17% | 99 | 38% | -332 | -4% | 3.1 | 1 | 1 | ✓ | ✓ | ✓ | 4.9 | 1 | ✗ | ✗ | ✗ | 5.7 | 1 | ✗ | ✗ | ✗ | 3.5 | 1 | ✓ | ✓ | ✓ |
| **East-West Screenline - Eastbound** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27a | 1380 | 207 | 17 | 1604 | 1227 | 157 | 26 | 1,409 | 153 | 11% | -50 | -24% | 9 | 52% | -195 | -12% | 4.2 | 1 | 1 | ✓ | ✓ | ✓ | 3.7 | 1 | ✓ | ✓ | ✓ | 1.9 | 1 | ✓ | ✓ | ✓ | 5.0 | 1 | ✓ | ✗ | ✓ |
| 28a | 1122 | 164 | 29 | 1315 | 1077 | 195 | 43 | 1,315 | 45 | 4% | 31 | 19% | 14 | 49% | 0 | 0% | 1.4 | 1 | 1 | ✓ | ✓ | ✓ | 2.3 | 1 | ✓ | ✓ | ✓ | 2.4 | 1 | ✓ | ✓ | ✓ | 0.0 | 1 | ✓ | ✓ | ✓ |
| 29a | 1658 | 198 | 30 | 1886 | 1850 | 267 | 33 | 2,150 | -192 | -12% | 69 | 35% | 3 | 11% | 264 | 14% | 4.6 | 1 | 1 | ✓ | ✓ | ✓ | 4.5 | 1 | ✓ | ✓ | ✓ | 0.6 | 1 | ✓ | ✓ | ✓ | 5.9 | 1 | ✓ | ✗ | ✓ |
| 30a | 683 | 69 | 12 | 764 | 683 | 62 | 9 | 753 | 0 | 0% | -7 | -11% | -3 | -25% | -11 | -1% | 0.0 | 1 | 1 | ✓ | ✓ | ✓ | 0.9 | 1 | ✓ | ✓ | ✓ | 0.9 | 1 | ✓ | ✓ | ✓ | 0.4 | 1 | ✓ | ✓ | ✓ |
| 31a | 612 | 40 | 0 | 652 | 508 | 61 | 2 | 571 | 104 | 17% | 21 | 52% | 2 | 2329% | -81 | -12% | 4.4 | 1 | 1 | ✗ | ✓ | ✓ | 2.9 | 1 | ✓ | ✓ | ✓ | 2.2 | 1 | ✓ | ✓ | ✓ | 3.3 | 1 | ✓ | ✓ | ✓ |
| 32a | 241 | 14 | 2 | 257 | 297 | 13 | 4 | 314 | -56 | -23% | -1 | -8% | 2 | 102% | 57 | 22% | 3.4 | 1 | 1 | ✓ | ✓ | ✓ | 0.3 | 1 | ✓ | ✓ | ✓ | 1.2 | 1 | ✓ | ✓ | ✓ | 3.4 | 1 | ✓ | ✓ | ✓ |
| 33a | 657 | 74 | 0 | 731 | 601 | 65 | 5 | 671 | 56 | 8% | -9 | -13% | 5 | 52852% | -60 | -8% | 2.2 | 1 | 1 | ✓ | ✓ | ✓ | 1.1 | 1 | ✓ | ✓ | ✓ | 3.3 | 1 | ✓ | ✓ | ✓ | 2.2 | 1 | ✓ | ✓ | ✓ |
| 34a | 840 | 76 | 6 | 928 | 719 | 88 | 20 | 827 | 127 | 15% | 12 | 15% | 14 | 230% | -101 | -11% | 4.5 | 1 | 1 | ✓ | ✓ | ✓ | 1.3 | 1 | ✓ | ✓ | ✓ | 4.0 | 1 | ✓ | ✓ | ✓ | 3.4 | 1 | ✓ | ✓ | ✓ |
| 35a | 146 | 13 | 2 | 161 | 146 | 20 | 2 | 168 | 0 | 0% | 7 | 51% | 0 | 12% | 7 | 5% | 0.0 | 1 | 1 | ✓ | ✓ | ✓ | 1.6 | 1 | ✓ | ✓ | ✓ | 0.2 | 1 | ✓ | ✓ | ✓ | 0.6 | 1 | ✓ | ✓ | ✓ |
| Total | 7,345 | 855 | 98 | 8,298 | 7,108 | 926 | 138 | 8,179 | -237 | -3% | 71 | 8% | 40 | 41% | -119 | -1% | 2.8 | 1 | 1 | ✓ | ✓ | ✓ | 2.4 | 1 | ✗ | ✓ | ✓ | 3.7 | 1 | ✗ | ✓ | ✓ | 1.3 | 1 | ✓ | ✓ | ✓ |
| **East-West Screenline - Westbound** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27b | 932 | 123 | 17 | 1072 | 833 | 107 | 18 | 958 | 99 | 11% | -16 | -13% | 1 | 3% | -114 | -11% | 3.3 | 1 | 1 | ✓ | ✓ | ✓ | 1.5 | 1 | ✓ | ✓ | ✓ | 0.1 | 1 | ✓ | ✓ | ✓ | 3.6 | 1 | ✓ | ✓ | ✓ |
| 28b | 1093 | 140 | 11 | 1244 | 1129 | 167 | 18 | 1,313 | -36 | -3% | 27 | 19% | 7 | 63% | 69 | 6% | 1.1 | 1 | 1 | ✓ | ✓ | ✓ | 2.2 | 1 | ✓ | ✓ | ✓ | 1.8 | 1 | ✓ | ✓ | ✓ | 1.9 | 1 | ✓ | ✓ | ✓ |
| 29b | 2436 | 164 | 31 | 2631 | 2274 | 284 | 34 | 2,593 | 162 | 7% | 120 | 73% | 3 | 11% | -38 | -1% | 3.3 | 1 | 1 | ✓ | ✓ | ✓ | 8.0 | 1 | ✗ | ✗ | ✗ | 0.6 | 1 | ✓ | ✓ | ✓ | 0.7 | 1 | ✓ | ✓ | ✓ |
| 30b | 848 | 57 | 19 | 924 | 683 | 92 | 11 | 786 | 165 | 19% | 35 | 61% | -8 | -40% | -138 | -15% | 6.0 | 1 | 1 | ✗ | ✗ | ✗ | 4.0 | 1 | ✓ | ✓ | ✓ | 2.0 | 1 | ✓ | ✓ | ✓ | 4.7 | 1 | ✓ | ✓ | ✓ |
| 31b | 593 | 31 | 1 | 625 | 640 | 36 | 3 | 679 | -47 | -8% | 5 | 15% | 2 | 160% | 54 | 9% | 1.9 | 1 | 1 | ✓ | ✓ | ✓ | 0.8 | 1 | ✓ | ✓ | ✓ | 1.4 | 1 | ✓ | ✓ | ✓ | 2.1 | 1 | ✓ | ✓ | ✓ |
| 32b | 274 | 12 | 0 | 286 | 303 | 18 | 3 | 324 | -29 | -11% | 6 | 52% | 3 | 2825% | 38 | 13% | 1.7 | 1 | 1 | ✓ | ✓ | ✓ | 1.6 | 1 | ✓ | ✓ | ✓ | 2.4 | 1 | ✓ | ✓ | ✓ | 2.2 | 1 | ✓ | ✓ | ✓ |
| 33b | 543 | 45 | 4 | 592 | 655 | 52 | 10 | 717 | -112 | -21% | 7 | 16% | 6 | 155% | 125 | 21% | 4.6 | 1 | 1 | ✗ | ✓ | ✓ | 1.0 | 1 | ✓ | ✓ | ✓ | 2.3 | 1 | ✓ | ✓ | ✓ | 4.9 | 1 | ✗ | ✓ | ✓ |
| 34b | 802 | 71 | 10 | 883 | 798 | 98 | 17 | 913 | 4 | 1% | 27 | 38% | 7 | 71% | 30 | 3% | 0.1 | 1 | 1 | ✓ | ✓ | ✓ | 2.9 | 1 | ✓ | ✓ | ✓ | 1.9 | 1 | ✓ | ✓ | ✓ | 1.0 | 1 | ✓ | ✓ | ✓ |
| 35b | 130 | 19 | 1 | 150 | 185 | 28 | 2 | 215 | -55 | -42% | 9 | 45% | 1 | 74% | 65 | 43% | 4.4 | 1 | 1 | ✓ | ✓ | ✓ | 1.8 | 1 | ✓ | ✓ | ✓ | 0.6 | 1 | ✓ | ✓ | ✓ | 4.8 | 1 | ✓ | ✓ | ✓ |
| Total | 7,651 | 662 | 94 | 8,407 | 7,500 | 881 | 113 | 8,497 | 151 | 2% | 219 | 33% | 19 | 20% | 90 | 1% | 1.7 | 1 | 1 | ✓ | ✓ | ✓ | 7.9 | 1 | ✗ | ✗ | ✗ | 1.9 | 1 | ✗ | ✓ | ✓ | 1.0 | 1 | ✓ | ✓ | ✓ |

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **West of A500 Screenline - Eastbound** | | | | | | | | | | | | | | | | | | | | | | | | |
| 21b | A34 Talke Road | 160 | 18% | 5.0 | 1 | 1 | ✗ | ✗ | ✗ | 0.3 | 1 | ✓ | ✓ | ✓ | 2.2 | 1 | ✓ | ✓ | ✓ | 5.1 | 1 | ✗ | ✗ | ✗ |
| 22b | B5370 Porthill Bank | -141 | -13% | 5.8 | 1 | 1 | ✗ | ✗ | ✗ | 3.0 | 1 | ✓ | ✓ | ✓ | 0.3 | 1 | ✓ | ✓ | ✓ | 4.5 | 1 | ✓ | ✓ | ✓ |
| 23b | A527 Grange Lane | -18 | -3% | 0.6 | 1 | 1 | ✓ | ✓ | ✓ | 1.0 | 1 | ✓ | ✓ | ✓ | 0.7 | 1 | ✓ | ✓ | ✓ | 0.8 | 1 | ✓ | ✓ | ✓ |
| 24b | A53 Etruria Road | 78 | 13% | 0.4 | 1 | 1 | ✓ | ✓ | ✓ | 7.7 | 1 | ✓ | ✗ | ✓ | 5.5 | 1 | ✓ | ✗ | ✓ | 3.0 | 1 | ✓ | ✓ | ✓ |
| 25b | B5045 Shelton New Road | 290 | 45% | 1.6 | 1 | 1 | ✓ | ✓ | ✓ | 6.4 | 1 | ✓ | ✗ | ✓ | 2.5 | 1 | ✓ | ✓ | ✓ | 10.3 | 1 | ✗ | ✗ | ✗ |
| | Total | 368 | 10% | 0.1 | 1 | 1 | ✓ | ✓ | ✓ | 7.2 | 1 | ✗ | ✗ | ✗ | 4.6 | 1 | ✗ | ✗ | ✗ | 5.9 | 1 | ✗ | ✗ | ✗ |
| **West of A500 Screenline - Westbound** | | | | | | | | | | | | | | | | | | | | | | | | |
| 21a | A34 Talke Road | 9 | 1% | 1.0 | 1 | 1 | ✓ | ✓ | ✓ | 1.5 | 1 | ✓ | ✓ | ✓ | 3.8 | 1 | ✓ | ✓ | ✓ | 0.2 | 1 | ✓ | ✓ | ✓ |
| 22a | B5370 Porthill Bank | -353 | -25% | 10.0 | 1 | 1 | ✗ | ✗ | ✗ | 1.7 | 1 | ✓ | ✓ | ✓ | 0.9 | 1 | ✓ | ✓ | ✓ | 10.1 | 1 | ✗ | ✗ | ✗ |
| 23a | A527 Grange Lane | -118 | -16% | 4.2 | 1 | 1 | ✗ | ✓ | ✓ | 2.0 | 1 | ✓ | ✓ | ✓ | 0.3 | 1 | ✓ | ✓ | ✓ | 4.5 | 1 | ✗ | ✓ | ✓ |
| 24a | A53 Etruria Road | 68 | 6% | 2.1 | 1 | 1 | ✓ | ✓ | ✓ | 8.8 | 1 | ✓ | ✗ | ✓ | 7.0 | 1 | ✓ | ✗ | ✓ | 2.0 | 1 | ✓ | ✓ | ✓ |
| 25a | B5045 Shelton New Road | 131 | 19% | 3.5 | 1 | 1 | ✓ | ✓ | ✓ | 4.3 | 1 | ✓ | ✓ | ✓ | 1.9 | 1 | ✓ | ✓ | ✓ | 4.7 | 1 | ✗ | ✓ | ✓ |
| | Total | -263 | -5% | 6.6 | 1 | 1 | ✗ | ✗ | ✗ | 5.5 | 1 | ✗ | ✗ | ✗ | 6.3 | 1 | ✗ | ✗ | ✗ | 3.6 | 1 | ✓ | ✓ | ✓ |
| **East of A50 Screenline - Eastbound** | | | | | | | | | | | | | | | | | | | | | | | | |
| 9a | A50 High Street | -73 | -8% | 2.2 | 1 | 1 | ✓ | ✓ | ✓ | 1.9 | 1 | ✓ | ✓ | ✓ | 2.0 | 1 | ✓ | ✓ | ✓ | 2.5 | 1 | ✓ | ✓ | ✓ |
| 18a | A527 Reginald Mitchell Way | 66 | 4% | 0.9 | 1 | 1 | ✓ | ✓ | ✓ | 0.8 | 1 | ✓ | ✓ | ✓ | 5.1 | 1 | ✓ | ✗ | ✓ | 1.6 | 1 | ✓ | ✓ | ✓ |
| 26b | A5271 The Boulevard | -86 | -11% | 3.7 | 1 | 1 | ✓ | ✓ | ✓ | 0.4 | 1 | ✓ | ✓ | ✓ | 5.4 | 1 | ✓ | ✗ | ✓ | 3.1 | 1 | ✓ | ✓ | ✓ |
| 28b | B5051 Moorland Road | 115 | 14% | 4.1 | 1 | 1 | ✗ | ✓ | ✓ | 0.1 | 1 | ✓ | ✓ | ✓ | 0.0 | 1 | ✓ | ✓ | ✓ | 3.9 | 1 | ✓ | ✓ | ✓ |
| 29 | Nile Street | -17 | -14% | 1.4 | 1 | 1 | ✓ | ✓ | ✓ | 1.4 | 1 | ✓ | ✓ | ✓ | 1.6 | 1 | ✓ | ✓ | ✓ | 1.6 | 1 | ✓ | ✓ | ✓ |
| 30 | B5050 Zion Street | -23 | -6% | 1.1 | 1 | 1 | ✓ | ✓ | ✓ | 0.8 | 1 | ✓ | ✓ | ✓ | 0.9 | 1 | ✓ | ✓ | ✓ | 1.2 | 1 | ✓ | ✓ | ✓ |
| 32a | A53 Elder Road | 366 | 35% | 9.3 | 1 | 1 | ✗ | ✗ | ✗ | 5.2 | 1 | ✓ | ✗ | ✓ | 0.3 | 1 | ✓ | ✓ | ✓ | 10.4 | 1 | ✗ | ✗ | ✗ |
| | Total | 349 | 6% | 3.7 | 1 | 1 | ✗ | ✓ | ✓ | 1.6 | 1 | ✗ | ✓ | ✓ | 3.9 | 1 | ✗ | ✓ | ✓ | 4.6 | 1 | ✗ | ✗ | ✗ |
| **East of A50 Screenline - Westbound** | | | | | | | | | | | | | | | | | | | | | | | | |
| 9b | A50 High Street | -145 | -24% | 6.7 | 1 | 1 | ✗ | ✗ | ✗ | 0.4 | 1 | ✓ | ✓ | ✓ | 1.6 | 1 | ✓ | ✓ | ✓ | 6.3 | 1 | ✗ | ✗ | ✗ |
| 18b | A527 Reginald Mitchell Way | 106 | 10% | 2.4 | 1 | 1 | ✓ | ✓ | ✓ | 1.7 | 1 | ✓ | ✓ | ✓ | 3.1 | 1 | ✓ | ✓ | ✓ | 3.2 | 1 | ✓ | ✓ | ✓ |
| 26a | A5271 The Boulevard | 45 | 9% | 0.9 | 1 | 1 | ✓ | ✓ | ✓ | 2.9 | 1 | ✓ | ✓ | ✓ | 2.8 | 1 | ✓ | ✓ | ✓ | 2.0 | 1 | ✓ | ✓ | ✓ |
| 27 | Jenkins Street | 10 | 6% | 0.6 | 1 | 1 | ✓ | ✓ | ✓ | 0.2 | 1 | ✓ | ✓ | ✓ | 1.1 | 1 | ✓ | ✓ | ✓ | 0.8 | 1 | ✓ | ✓ | ✓ |
| 28a | B5051 Moorland Road | -78 | -19% | 4.4 | 1 | 1 | ✓ | ✓ | ✓ | 0.2 | 1 | ✓ | ✓ | ✓ | 0.5 | 1 | ✓ | ✓ | ✓ | 4.0 | 1 | ✓ | ✓ | ✓ |
| 31 | B5050 Pitt Street East | -1 | 0% | 0.9 | 1 | 1 | ✓ | ✓ | ✓ | 2.6 | 1 | ✓ | ✓ | ✓ | 0.1 | 1 | ✓ | ✓ | ✓ | 0.0 | 1 | ✓ | ✓ | ✓ |
| 32b | A53 Elder Road | -102 | -11% | 5.0 | 1 | 1 | ✗ | ✗ | ✗ | 4.5 | 1 | ✓ | ✓ | ✓ | 2.1 | 1 | ✓ | ✓ | ✓ | 3.5 | 1 | ✓ | ✓ | ✓ |
| | Total | -165 | -4% | 4.1 | 1 | 1 | ✗ | ✗ | ✗ | 3.1 | 1 | ✗ | ✓ | ✓ | 1.8 | 1 | ✗ | ✓ | ✓ | 2.6 | 1 | ✓ | ✓ | ✓ |
| **Other Individual Count Locations** | | | | | | | | | | | | | | | | | | | | | | | | |
| 39a | A500 | | | | | | | | | | | | | | | | | | | 3.8 | 1 | ✓ | ✓ | ✓ |
| 39b | A500 | | | | | | | | | | | | | | | | | | | 6.2 | 1 | ✓ | ✗ | ✓ |
| 40a | A500 | 92 | 2% | 0.8 | 1 | 1 | ✓ | ✓ | ✓ | 1.0 | 1 | ✓ | ✓ | ✓ | 6.6 | 1 | ✗ | ✗ | ✗ | 2.0 | 1 | ✓ | ✓ | ✓ |
| 40b | A500 | 30 | 1% | 1.6 | 1 | 1 | ✓ | ✓ | ✓ | 1.1 | 1 | ✓ | ✓ | ✓ | 4.6 | 1 | ✓ | ✓ | ✓ | 0.0 | 1 | ✓ | ✓ | ✓ |
| 41a | A500 | -547 | -17% | | 1 | 1 | ✗ | ✗ | ✗ | 2.5 | 1 | ✓ | ✓ | ✓ | 4.7 | 1 | ✓ | ✓ | ✓ | 10.0 | 1 | ✗ | ✗ | ✗ |
| 41b | A500 | 569 | 21% | | 1 | 1 | ✗ | ✗ | ✗ | 3.7 | 1 | ✓ | ✓ | ✓ | 2.9 | 1 | ✓ | ✓ | ✓ | 10.5 | 1 | ✗ | ✗ | ✗ |
| 42a | A50 | 70 | 2% | 3.0 | 1 | 1 | ✓ | ✓ | ✓ | 7.6 | 1 | ✗ | ✗ | ✗ | 1.2 | 1 | ✓ | ✓ | ✓ | 1.1 | 1 | ✓ | ✓ | ✓ |
| 42b | A50 | -381 | -12% | 5.5 | 1 | 1 | ✓ | ✗ | ✓ | 8.5 | 1 | ✗ | ✗ | ✗ | 2.2 | 1 | ✓ | ✓ | ✓ | 6.8 | 1 | ✓ | ✗ | ✓ |
| 43a | A50 | 354 | 11% | 7.3 | 1 | 1 | ✓ | ✗ | ✓ | 6.6 | 1 | ✗ | ✗ | ✗ | 6.2 | 1 | ✓ | ✗ | ✓ | 6.2 | 1 | ✓ | ✗ | ✓ |
| 43b | A50 | -327 | -11% | 5.7 | 1 | 1 | ✓ | ✗ | ✓ | 7.3 | 1 | ✗ | ✗ | ✗ | 5.4 | 1 | ✓ | ✗ | ✓ | 6.1 | 1 | ✓ | ✗ | ✓ |
| 44a | A34 Talke Road | 9 | 1% | 1.0 | 1 | 1 | ✓ | ✓ | ✓ | 1.5 | 1 | ✓ | ✓ | ✓ | 3.8 | 1 | ✓ | ✓ | ✓ | 0.2 | 1 | ✓ | ✓ | ✓ |
| 44b | A34 Talke Road | 160 | 18% | 5.0 | 1 | 1 | ✗ | ✗ | ✗ | 0.3 | 1 | ✓ | ✓ | ✓ | 2.2 | 1 | ✓ | ✓ | ✓ | 5.1 | 1 | ✗ | ✗ | ✗ |
| 45a | A34 Newcastle Road | -156 | -18% | | | | | | | | | | | | | | | | | 5.5 | 1 | ✗ | ✗ | ✗ |
| 45b | A34 Newcastle Road | 239 | 37% | | | | | | | | | | | | | | | | | 8.6 | 1 | ✗ | ✗ | ✗ |
| 46a | A50 Scotia Road | -17 | -2% | 1.2 | 1 | 1 | ✓ | ✓ | ✓ | 1.7 | 1 | ✓ | ✓ | ✓ | 0.4 | 1 | ✓ | ✓ | ✓ | 0.6 | 1 | ✓ | ✓ | ✓ |
| 46b | A50 Scotia Road | -85 | -14% | 3.8 | 1 | 1 | ✓ | ✓ | ✓ | 0.9 | 1 | ✓ | ✓ | ✓ | 1.2 | 1 | ✓ | ✓ | ✓ | 3.6 | 1 | ✓ | ✓ | ✓ |
| 47a | A50 Victoria Road | 128 | 24% | 4.5 | 1 | 1 | ✗ | ✓ | ✓ | 4.0 | 1 | ✓ | ✓ | ✓ | 1.8 | 1 | ✓ | ✓ | ✓ | 5.2 | 1 | ✗ | ✗ | ✗ |
| 47b | A50 Victoria Road | 309 | 37% | 10.2 | 1 | 1 | ✗ | ✗ | ✗ | 0.6 | 1 | ✓ | ✓ | ✓ | 3.9 | 1 | ✓ | ✓ | ✓ | 9.9 | 1 | ✗ | ✗ | ✗ |
| 48a | A52 Bucknall Road | -56 | -3% | 1.2 | 1 | 1 | ✓ | ✓ | ✓ | 1.7 | 1 | ✓ | ✓ | ✓ | 2.9 | 1 | ✓ | ✓ | ✓ | 1.4 | 1 | ✓ | ✓ | ✓ |
| 48b | A52 Bucknall Road | -175 | -13% | 5.8 | 1 | 1 | ✗ | ✗ | ✗ | 0.3 | 1 | ✓ | ✓ | ✓ | 5.6 | 1 | ✓ | ✗ | ✓ | 5.0 | 1 | ✓ | ✗ | ✓ |
| 49a | A53 Leek New Road | -18 | -2% | | | | | | | | | | | | | | | | | 0.7 | 1 | ✓ | ✓ | ✓ |
| 49b | A53 Leek New Road | 73 | 14% | | | | | | | | | | | | | | | | | 3.1 | 1 | ✓ | ✓ | ✓ |
| 50a | A519 Clayton Road | 123 | 19% | 4.0 | 1 | 1 | ✗ | ✓ | ✓ | 2.2 | 1 | ✓ | ✓ | ✓ | 1.5 | 1 | ✓ | ✓ | ✓ | 4.6 | 1 | ✗ | ✓ | ✓ |
| 50b | A519 Clayton Road | 188 | 21% | 5.5 | 1 | 1 | ✗ | ✗ | ✗ | 2.9 | 1 | ✓ | ✓ | ✓ | 0.7 | 1 | ✓ | ✓ | ✓ | 6.0 | 1 | ✗ | ✗ | ✗ |
| 51a | A525 Keele Road | -145 | -24% | 8.0 | 1 | 1 | ✗ | ✗ | ✗ | 2.8 | 1 | ✓ | ✓ | ✓ | 2.8 | 1 | ✓ | ✓ | ✓ | 6.3 | 1 | ✗ | ✗ | ✗ |
| 51b | A525 Keele Road | -28 | -6% | 2.3 | 1 | 1 | ✓ | ✓ | ✓ | 2.1 | 1 | ✓ | ✓ | ✓ | 3.6 | 1 | ✓ | ✓ | ✓ | 1.4 | 1 | ✓ | ✓ | ✓ |
| 52a | A5271 Brownhills Road | -79 | -13% | 4.0 | 1 | 1 | ✓ | ✓ | ✓ | 3.1 | 1 | ✓ | ✓ | ✓ | 3.1 | 1 | ✓ | ✓ | ✓ | 3.2 | 1 | ✓ | ✓ | ✓ |
| 52b | A5271 Brownhills Road | -22 | -5% | 1.1 | 1 | 1 | ✓ | ✓ | ✓ | 0.8 | 1 | ✓ | ✓ | ✓ | 1.8 | 1 | ✓ | ✓ | ✓ | 1.1 | 1 | ✓ | ✓ | ✓ |
| 53a | A5272 High Lane | -37 | -4% | 1.7 | 1 | 1 | ✓ | ✓ | ✓ | 0.1 | 1 | ✓ | ✓ | ✓ | 3.0 | 1 | ✓ | ✓ | ✓ | 1.2 | 1 | ✓ | ✓ | ✓ |
| 53b | A5272 High Lane | 5 | 1% | 1.2 | 1 | 1 | ✓ | ✓ | ✓ | 4.2 | 1 | ✓ | ✓ | ✓ | 1.9 | 1 | ✓ | ✓ | ✓ | 0.2 | 1 | ✓ | ✓ | ✓ |
| 54a | A5272 Dividy Road | -61 | -9% | | | | | | | | | | | | | | | | | 2.4 | 1 | ✓ | ✓ | ✓ |
| 54b | A5272 Dividy Road | -240 | -30% | | | | | | | | | | | | | | | | | 9.2 | 1 | ✗ | ✗ | ✗ |
| 3a | A500 | 199 | 6% | 1.9 | 1 | 1 | ✓ | ✓ | ✓ | 3.1 | 1 | ✓ | ✓ | ✓ | 10.9 | 1 | ✗ | ✗ | ✗ | 3.4 | 1 | ✓ | ✓ | ✓ |
| 3b | A500 | 135 | 4% | 1.2 | 1 | 1 | ✓ | ✓ | ✓ | 1.6 | 1 | ✓ | ✓ | ✓ | 7.1 | 1 | ✗ | ✗ | ✗ | 2.4 | 1 | ✓ | ✓ | ✓ |
| 4a | A500 | 124 | 3% | 0.8 | 1 | 1 | ✓ | ✓ | ✓ | 1.0 | 1 | ✓ | ✓ | ✓ | 6.6 | 1 | ✗ | ✗ | ✗ | 2.0 | 1 | ✓ | ✓ | ✓ |
| 4b | A500 | -2 | 0% | 1.6 | 1 | 1 | ✓ | ✓ | ✓ | 1.1 | 1 | ✓ | ✓ | ✓ | 4.6 | 1 | ✓ | ✓ | ✓ | 0.0 | 1 | ✓ | ✓ | ✓ |
| 5a | A34 Talke Road | 59 | 4% | 1.0 | 1 | 1 | ✓ | ✓ | ✓ | 4.1 | 1 | ✓ | ✓ | ✓ | 7.4 | 1 | ✓ | ✗ | ✓ | 1.6 | 1 | ✓ | ✓ | ✓ |
| 5b | A34 Talke Road | -84 | -6% | 2.5 | 1 | 1 | ✓ | ✓ | ✓ | 0.6 | 1 | ✓ | ✓ | ✓ | 1.7 | 1 | ✓ | ✓ | ✓ | 2.3 | 1 | ✓ | ✓ | ✓ |
| 6a | A34 Liverpool Road | -64 | -4% | 2.2 | 1 | 1 | ✓ | ✓ | ✓ | 0.3 | 1 | ✓ | ✓ | ✓ | 3.2 | 1 | ✓ | ✓ | ✓ | 1.7 | 1 | ✓ | ✓ | ✓ |
| 6b | A34 Liverpool Road | -206 | -14% | 5.3 | 1 | 1 | ✓ | ✗ | ✓ | 2.4 | 1 | ✓ | ✓ | ✓ | 0.9 | 1 | ✓ | ✓ | ✓ | 5.6 | 1 | ✓ | ✗ | ✓ |
| 8a | A53 Etruria Road | -195 | -9% | 5.6 | 1 | 1 | ✓ | ✗ | ✓ | 4.9 | 1 | ✓ | ✓ | ✓ | 2.9 | 1 | ✓ | ✓ | ✓ | 4.3 | 1 | ✓ | ✓ | ✓ |
| 8b | A53 Etruria Road | 180 | 9% | 3.6 | 1 | 1 | ✓ | ✓ | ✓ | 3.5 | 1 | ✓ | ✓ | ✓ | 3.0 | 1 | ✓ | ✓ | ✓ | 4.0 | 1 | ✓ | ✓ | ✓ |
| 10a | A50 Wedgwood Street | -93 | -13% | 3.9 | 1 | 1 | ✓ | ✓ | ✓ | 0.4 | 1 | ✓ | ✓ | ✓ | 0.2 | 1 | ✓ | ✓ | ✓ | 3.6 | 1 | ✓ | ✓ | ✓ |
| 10b | A50 Wedgwood Street | 6 | 1% | 0.1 | 1 | 1 | ✓ | ✓ | ✓ | 0.2 | 1 | ✓ | ✓ | ✓ | 2.6 | 1 | ✓ | ✓ | ✓ | 0.3 | 1 | ✓ | ✓ | ✓ |
| 11a | A50 Waterloo Road | -161 | -25% | 6.8 | 1 | 1 | ✗ | ✗ | ✗ | 1.3 | 1 | ✓ | ✓ | ✓ | 0.7 | 1 | ✓ | ✓ | ✓ | 6.8 | 1 | ✗ | ✗ | ✗ |
| 11b | A50 Waterloo Road | -49 | -12% | 3.3 | 1 | 1 | ✓ | ✓ | ✓ | 1.9 | 1 | ✓ | ✓ | ✓ | 1.3 | 1 | ✓ | ✓ | ✓ | 2.5 | 1 | ✓ | ✓ | ✓ |
| 12a | A50 Waterloo Road | 58 | 8% | 2.9 | 1 | 1 | ✓ | ✓ | ✓ | 3.0 | 1 | ✓ | ✓ | ✓ | 1.2 | 1 | ✓ | ✓ | ✓ | 2.1 | 1 | ✓ | ✓ | ✓ |
| 12b | A50 Waterloo Road | -2 | -1% | 0.8 | 1 | 1 | ✓ | ✓ | ✓ | 1.8 | 1 | ✓ | ✓ | ✓ | 1.6 | 1 | ✓ | ✓ | ✓ | 0.1 | 1 | ✓ | ✓ | ✓ |
| 13a | A50 Potteries Way | 2 | 0% | 0.9 | 1 | 1 | ✓ | ✓ | ✓ | 1.9 | 1 | ✓ | ✓ | ✓ | 3.5 | 1 | ✓ | ✓ | ✓ | 0.1 | 1 | ✓ | ✓ | ✓ |
| 13b | A50 Potteries Way | 203 | 19% | 5.2 | 1 | 1 | ✗ | ✗ | ✗ | 1.7 | 1 | ✓ | ✓ | ✓ | 5.0 | 1 | ✓ | ✓ | ✓ | 6.0 | 1 | ✗ | ✗ | ✗ |
| 14a | A50 Potteries Way | -94 | -9% | 3.7 | 1 | 1 | ✓ | ✓ | ✓ | 0.3 | 1 | ✓ | ✓ | ✓ | 5.5 | 1 | ✓ | ✗ | ✓ | 3.0 | 1 | ✓ | ✓ | ✓ |
| 14b | A50 Potteries Way | -267 | -28% | 10.2 | 1 | 1 | ✗ | ✗ | ✗ | 0.0 | 1 | ✓ | ✓ | ✓ | 3.6 | 1 | ✓ | ✓ | ✓ | 9.4 | 1 | ✗ | ✗ | ✗ |
| 15a | A50 Potteries Way | 8 | 1% | 1.4 | 1 | 1 | ✓ | ✓ | ✓ | 3.5 | 1 | ✓ | ✓ | ✓ | 5.7 | 1 | ✓ | ✗ | ✓ | 0.3 | 1 | ✓ | ✓ | ✓ |
| 15b | A50 Potteries Way | -158 | -16% | 5.4 | 1 | 1 | ✗ | ✗ | ✗ | 1.5 | 1 | ✓ | ✓ | ✓ | 4.3 | 1 | ✓ | ✓ | ✓ | 5.2 | 1 | ✗ | ✗ | ✗ |
| 33a | A50 Lichfield Street | -156 | -23% | 6.7 | 1 | 1 | ✗ | ✗ | ✗ | 0.3 | 1 | ✓ | ✓ | ✓ | 2.3 | 1 | ✓ | ✓ | ✓ | 6.3 | 1 | ✗ | ✗ | ✗ |
| 33b | A50 Lichfield Street | 69 | 11% | 2.5 | 1 | 1 | ✓ | ✓ | ✓ | 0.1 | 1 | ✓ | ✓ | ✓ | 2.7 | 1 | ✓ | ✓ | ✓ | 2.7 | 1 | ✓ | ✓ | ✓ |
| 34a | A50 Lichfield Street | 4 | 1% | 1.0 | 1 | 1 | ✓ | ✓ | ✓ | 2.3 | 1 | ✓ | ✓ | ✓ | 4.5 | 1 | ✓ | ✓ | ✓ | 0.2 | 1 | ✓ | ✓ | ✓ |
| 34b | A50 Lichfield Street | 154 | 30% | 6.3 | 1 | 1 | ✗ | ✗ | ✗ | 0.3 | 1 | ✓ | ✓ | ✓ | 1.8 | 1 | ✓ | ✓ | ✓ | 6.3 | 1 | ✗ | ✗ | ✗ |
| 35a | A5271 Scotia Road | -71 | -8% | 3.3 | 1 | 1 | ✓ | ✓ | ✓ | 1.1 | 1 | ✓ | ✓ | ✓ | 5.0 | 1 | ✓ | ✗ | ✓ | 2.4 | 1 | ✓ | ✓ | ✓ |
| 35b | A5271 Scotia Road | -48 | -6% | 2.3 | 1 | 1 | ✓ | ✓ | ✓ | 1.4 | 1 | ✓ | ✓ | ✓ | 2.9 | 1 | ✓ | ✓ | ✓ | 1.7 | 1 | ✓ | ✓ | ✓ |
| 20a | A5008 Potteries Way | -269 | -35% | 11.7 | 1 | 1 | ✗ | ✗ | ✗ | 0.4 | 1 | ✓ | ✓ | ✓ | 3.2 | 1 | ✓ | ✓ | ✓ | 10.7 | 1 | ✗ | ✗ | ✗ |
| 20b | A5008 Potteries Way | -51 | -8% | 1.1 | 1 | 1 | ✓ | ✓ | ✓ | 5.6 | 1 | ✓ | ✗ | ✓ | 3.5 | 1 | ✓ | ✓ | ✓ | 2.1 | 1 | ✓ | ✓ | ✓ |
| | | | | Pass | | | 5 | 6 | 6 | Pass | | 2 | 5 | 5 | Pass | | 0 | 4 | 0 | Pass | | 6 | 6 | 6 |
| | | | | Screenline | | | 10 | 10 | 10 | Screenline | | 10 | 10 | 10 | Screenline | | 10 | 10 | 10 | Screenline | | 10 | 10 | 10 |
| | | | | Pass % | | | 50% | 60% | 60% | Pass % | | 20% | 50% | 50% | Pass % | | 0% | 40% | 0% | Pass % | | 60% | 60% | 60% |

## Appendix B – Journey time validation

**AM peak hour**

| Route No. | Route | Direction | Modelled Time (mins) | Observed Time (mins) | % Diff. | Within 15% | Within 1 Minute | Within 15% or 1 Minute |
|---|---|---|---|---|---|---|---|---|
| **Routes Across the Wider North Staffordshire Conurbation** | | | | | | | | |
| **1** | A34 | Northbound | 24.35 | 26.97 | -10% | Yes | No | Yes |
| **1** | A34 | Southbound | 25.83 | 26.40 | -2% | Yes | Yes | Yes |
| **2** | A500 (T) | Northbound | 10.20 | 9.44 | 8% | Yes | Yes | Yes |
| **2** | A500 (T) | Southbound | 12.12 | 14.00 | -13% | Yes | No | Yes |
| **3** | A50 | Southbound | 28.52 | 26.60 | 7% | Yes | No | Yes |
| **3** | A50 | Northbound | 27.31 | 25.61 | 7% | Yes | No | Yes |
| **4** | A527/ B5370/ A5271 | Northbound | 19.37 | 20.67 | -6% | Yes | No | Yes |
| **4** | A527/ B5370/ A5271 | Southbound | 20.57 | 22.36 | -8% | Yes | No | Yes |
| **5** | A53 | Northbound | 28.45 | 28.72 | -1% | Yes | Yes | Yes |
| **5** | A53 | Southbound | 28.21 | 30.37 | -7% | Yes | No | Yes |
| **6** | A5272 | Northbound | 18.57 | 22.32 | -17% | No | No | No |
| **6** | A5272 | Southbound | 20.54 | 21.18 | -3% | Yes | Yes | Yes |
| **7** | A52 | Westbound | 22.26 | 23.20 | -4% | Yes | Yes | Yes |
| **7** | A52 | Eastbound | 19.43 | 19.70 | -1% | Yes | Yes | Yes |
| **8** | A50(T) | Westbound | 8.77 | 12.97 | -32% | No | No | No |
| **8** | A50(T) | Eastbound | 5.86 | 6.43 | -9% | Yes | Yes | Yes |
| **AM Peak-Hour Total** | | | **320.36** | **336.94** | **% Pass** | **88%** | **44%** | **88%** |

SWECO

### Inter-peak hour

| Route No. | Route | Direction | Modelled Time (mins) | Observed Time (mins) | % Diff. | Within 15% | Within 1 Minute | Within 15% or 1 Minute |
|---|---|---|---|---|---|---|---|---|
| **Routes Across the Wider North Staffordshire Conurbation** | | | | | | | | |
| **1** | A34 | Northbound | 23.06 | 21.15 | 9% | Yes | No | Yes |
| **1** | A34 | Southbound | 23.23 | 22.33 | 4% | Yes | Yes | Yes |
| **2** | A500 (T) | Northbound | 9.16 | 9.40 | -3% | Yes | Yes | Yes |
| **2** | A500 (T) | Southbound | 9.28 | 9.45 | -2% | Yes | Yes | Yes |
| **3** | A50 | Southbound | 28.37 | 25.62 | 11% | Yes | No | Yes |
| **3** | A50 | Northbound | 26.62 | 25.36 | 5% | Yes | No | Yes |
| **4** | A527/ B5370/ A5271 | Northbound | 18.29 | 17.54 | 4% | Yes | Yes | Yes |
| **4** | A527/ B5370/ A5271 | Southbound | 18.32 | 17.36 | 6% | Yes | Yes | Yes |
| **5** | A53 | Northbound | 25.49 | 23.43 | 9% | Yes | No | Yes |
| **5** | A53 | Southbound | 25.16 | 22.60 | 11% | Yes | No | Yes |
| **6** | A5272 | Northbound | 19.01 | 17.88 | 6% | Yes | No | Yes |
| **6** | A5272 | Southbound | 19.64 | 17.89 | 10% | Yes | No | Yes |
| **7** | A52 | Westbound | 19.95 | 19.75 | 1% | Yes | Yes | Yes |
| **7** | A52 | Eastbound | 17.92 | 17.87 | 0% | Yes | Yes | Yes |
| **8** | A50(T) | Westbound | 5.79 | 6.08 | 5% | Yes | Yes | Yes |
| **8** | A50(T) | Eastbound | 5.71 | 6.38 | 11% | Yes | Yes | Yes |
| **Inter-Peak Hour Total** | | | **295.00** | **280.08** | **% Pass** | **100%** | **56%** | **100%** |

**PM Peak hour**

| Route No. | Route | Direction | Modelled Time (mins) | Observed Time (mins) | % Diff. | Within 15% | Within 1 Minute | Within 15% or 1 Minute |
|---|---|---|---|---|---|---|---|---|
| **Routes Across the Wider North Staffordshire Conurbation** | | | | | | | | |
| **1** | A34 | Northbound | 25.45 | 28.27 | -10% | Yes | No | Yes |
| **1** | A34 | Southbound | 25.18 | 25.45 | -1% | Yes | Yes | Yes |
| **2** | A500 (T) | Northbound | 12.42 | 10.98 | 13% | Yes | No | Yes |
| **2** | A500 (T) | Southbound | 11.90 | 12.48 | -5% | Yes | Yes | Yes |
| **3** | A50 | Southbound | 28.16 | 28.83 | -2% | Yes | Yes | Yes |
| **3** | A50 | Northbound | 27.81 | 28.34 | -2% | Yes | Yes | Yes |
| **4** | A527/ B5370/ A5271 | Northbound | 20.42 | 23.51 | -13% | Yes | No | Yes |
| **4** | A527/ B5370/ A5271 | Southbound | 19.81 | 19.24 | 3% | Yes | Yes | Yes |
| **5** | A53 | Northbound | 28.03 | 34.63 | -19% | No | No | No |
| **5** | A53 | Southbound | 27.02 | 25.47 | 6% | Yes | No | Yes |
| **6** | A5272 | Northbound | 19.41 | 19.57 | -1% | Yes | Yes | Yes |
| **6** | A5272 | Southbound | 20.84 | 19.31 | 8% | Yes | No | Yes |
| **7** | A52 | Westbound | 20.74 | 22.57 | -8% | Yes | No | Yes |
| **7** | A52 | Eastbound | 19.25 | 21.39 | -10% | Yes | No | Yes |
| **8** | A50(T) | Westbound | 6.44 | 6.45 | 0% | Yes | Yes | Yes |
| **8** | A50(T) | Eastbound | 8.72 | 6.79 | 29% | No | No | No |
| PM Peak-Hour Total | | | 321.60 | 333.28 | % Pass | 88% | 44% | 88% |

## Appendix C – Validation against 2018 traffic count data

### AM Peak Hour EB

| Road | AM Peak-Hour (08-0900hrs) - Survey | | | | | | | | | AM - Model | | | | | | | | | | | | | | | | | | | | | | | | Results - AM | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Model | | | | | | | | Summed | | | | Diff Car | | Diff LGV | | Diff HGV | | Difference | | GEH | | | | Results | | | | | | | | | | | | |
| | M'cycles | Cars | LGVs | HGVs - Rigid | HGVs - Artic | HGV | Buses | Total | Total (Car/LGV/HGV) | Car Com | Car Non Com | Taxi Com | Taxi No Com | LGV Com | LGV No Com | HGV Com | HGV No Com | Car | LGV | HGV | Total | Difference | % Diff | Difference | % Diff | Difference | % Diff | Difference | % Diff | Car GEH | LGV GEH | HGV GEH | Total GEH | Count | Car DMRB Diff Test | Car GEH<5 | Car DMRB OR GEH <% | LGV DMRB Diff Test | LGV GEH<5 | LGV DMRB OR GEH <% | HGV DMRB Diff Test | HGV GEH<5 | HGV DMRB OR GEH <% | DMRB Diff test | GEH<5 | DMRB AND GEH<5 |
| A527 Tunstall Western Bypass | 2 | 647 | 158 | 27 | 19 | 46 | 1 | 900 | 851 | 417 | 267 | 0 | 1 | 32 | 75 | 21 | 13 | 684 | 107 | 34 | 826 | -37 | -6% | 51 | 32% | 12 | 25% | 25 | 3% | 1.4 | 4.4 | 1.8 | 0.9 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A5271 Longport Road | 7 | 1026 | 216 | 37 | 9 | 46 | 5 | 1346 | 1288 | 761 | 487 | 0 | 2 | 46 | 106 | 38 | 23 | 1248 | 152 | 61 | 1461 | -222 | -22% | 64 | 30% | -15 | -33% | -173 | -13% | 6.6 | 4.7 | 2.1 | 4.7 | 1 | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A53 Etruria Road | 10 | 2526 | 282 | 35 | 22 | 57 | 8 | 2940 | 2865 | 1511 | 966 | 1 | 4 | 93 | 216 | 58 | 36 | 2476 | 308 | 94 | 2879 | 50 | 2% | -26 | -9% | -37 | -65% | -14 | 0% | 1.0 | 1.5 | 4.3 | 0.3 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| B5045 Shelton New Road[1] | 3 | 915 | 93 | 30 | 7 | 37 | 4 | 1089 | 1045 | 472 | 302 | 0 | 1 | 24 | 55 | 11 | 7 | 774 | 79 | 18 | 871 | 141 | 15% | 14 | 16% | 19 | 51% | 174 | 17% | 4.9 | 1.6 | 3.6 | 5.6 | 1 | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| A5006 Stoke Road | 3 | 516 | 49 | 6 | 0 | 6 | 1 | 581 | 571 | 242 | 155 | 0 | 1 | 13 | 29 | 7 | 4 | 397 | 42 | 11 | 450 | 119 | 23% | 7 | 15% | -5 | -86% | 121 | 21% | 5.6 | 1.1 | 1.8 | 5.4 | 1 | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| College Road | 0 | 214 | 23 | 1 | 0 | 1 | 12 | 251 | 238 | 142 | 91 | 0 | 0 | 7 | 17 | 2 | 1 | 232 | 25 | 3 | 260 | -18 | -9% | -2 | -7% | -2 | -184% | -22 | -9% | 1.2 | 0.3 | 1.3 | 1.4 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A52 Leek Road[2] | 0 | 582 | 90 | 20 | 1 | 21 | 3 | 717 | 693 | 333 | 213 | 0 | 1 | 32 | 74 | 11 | 7 | 545 | 106 | 17 | 669 | 37 | 6% | -16 | -18% | 4 | 18% | 24 | 3% | 1.5 | 1.7 | 0.9 | 0.9 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A5007 City Road | 1 | 460 | 69 | 14 | 4 | 18 | 10 | 576 | 547 | 329 | 210 | 0 | 1 | 19 | 45 | 15 | 9 | 539 | 64 | 25 | 628 | -79 | -17% | 5 | 7% | -7 | -37% | -81 | -15% | 3.5 | 0.6 | 1.4 | 3.4 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Whieldon Road | 0 | 117 | 23 | 0 | 0 | 0 | 0 | 140 | 140 | 76 | 48 | 0 | 0 | 4 | 10 | 8 | 5 | 124 | 14 | 13 | 151 | -7 | -6% | 9 | 40% | -13 | -126699% | -11 | -8% | 0.6 | 2.1 | 5.0 | 0.9 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ |
| A50(T)[3] | 16 | 2520 | 484 | 171 | 188 | 359 | 13 | 3751 | 3363 | 1555 | 994 | 1 | 4 | 82 | 192 | 244 | 150 | 2550 | 274 | 394 | 3218 | -30 | -1% | 210 | 43% | -35 | -10% | 145 | 4% | 0.6 | 10.8 | 1.8 | 2.5 | 1 | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A5035 Trentham Road | 1 | 400 | 62 | 9 | 0 | 9 | 7 | 488 | 471 | 217 | 139 | 0 | 1 | 19 | 45 | 6 | 4 | 356 | 65 | 10 | 431 | 44 | 11% | -3 | -4% | -1 | -15% | 40 | 8% | 2.2 | 0.3 | 0.4 | 1.9 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pass | 8 | 9 | 9 | 10 | 10 | 10 | 11 | 10 | 11 | 9 | 9 | 9 |
| Counts | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| % Pass | 73% | 82% | 82% | 91% | 91% | 91% | 100% | 91% | 100% | 82% | 82% | 82% |

### AM Peak Hour WB

| Road | AM Peak-Hour (08-0900hrs) - Survey | | | | | | | | | AM - Model | | | | | | | | | | | | | | | | | | | | | | | | Results - AM | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Model | | | | | | | | Summed | | | | Diff Car | | Diff LGV | | Diff HGV | | Difference (Total) | | GEH | | | | Results | | | | | | | | | | | | |
| | M'cycles | Cars | LGVs | HGVs - Rigid | HGVs - Artic | HGV | Buses | Total | Total (Car/LGV/HGV) | Car Com | Car Non Com | Taxi Com | Taxi No Com | LGV Com | LGV No Com | HGV Com | HGV No Com | Car | LGV | HGV | Total | Difference | % Diff | Difference | % Diff | Difference | % Diff | Difference | % Diff | Car GEH | LGV GEH | HGV GEH | Total GEH | Count | Car DMRB Diff Test | Car GEH<5 | Car DMRB OR GEH <% | LGV DMRB Diff Test | LGV GEH<5 | LGV DMRB OR GEH <% | HGV DMRB Diff Test | HGV GEH<5 | HGV DMRB OR GEH <% | DMRB Diff test | GEH<5 | DMRB AND GEH<5 |
| A527 Tunstall Western Bypass | 8 | 1159 | 182 | 26 | 14 | 40 | 5 | 1434 | 1381 | 740 | 473 | 0 | 2 | 10 | 23 | 30 | 18 | 1213 | 33 | 49 | 1294 | -54 | -5% | 149 | 82% | -9 | -21% | 87 | 6% | 1.6 | 14.4 | 1.3 | 2.4 | 1 | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A5271 Longport Road | 9 | 795 | 245 | 45 | 21 | 66 | 9 | 1190 | 1106 | 611 | 391 | 0 | 2 | 26 | 62 | 38 | 23 | 1002 | 88 | 62 | 1152 | -207 | -26% | 157 | 64% | 4 | 6% | -46 | -4% | 6.9 | 12.2 | 0.5 | 1.4 | 1 | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A53 Etruria Road | 2 | 1385 | 384 | 44 | 24 | 68 | 5 | 1912 | 1837 | 1045 | 668 | 1 | 3 | 72 | 169 | 55 | 34 | 1713 | 241 | 89 | 2044 | -328 | -24% | 143 | 37% | -21 | -32% | -207 | -11% | 8.3 | 8.1 | 2.4 | 4.7 | 1 | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| B5045 Shelton New Road[1] | 3 | 475 | 76 | 16 | 8 | 24 | 3 | 605 | 575 | 342 | 218 | 0 | 1 | 20 | 46 | 10 | 6 | 560 | 65 | 17 | 642 | -85 | -18% | 11 | 14% | 7 | 31% | -67 | -12% | 3.7 | 1.3 | 1.6 | 2.7 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A5006 Stoke Road | 2 | 489 | 43 | 8 | 0 | 8 | 2 | 552 | 540 | 205 | 131 | 0 | 1 | 11 | 27 | 7 | 4 | 336 | 38 | 12 | 385 | 153 | 31% | 5 | 12% | -4 | -45% | 155 | 29% | 7.5 | 0.8 | 1.1 | 7.2 | 1 | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| College Road | 1 | 383 | 38 | 0 | 0 | 0 | 17 | 439 | 421 | 111 | 71 | 0 | 0 | 12 | 29 | 2 | 1 | 183 | 41 | 3 | 227 | 200 | 52% | -3 | -7% | -3 | -34319% | 194 | 46% | 11.9 | 0.4 | 2.6 | 10.8 | 1 | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| A52 Leek Road[2] | 3 | 466 | 103 | 8 | 1 | 9 | 0 | 590 | 578 | 419 | 268 | 0 | 1 | 25 | 59 | 21 | 13 | 687 | 85 | 34 | 807 | -221 | -48% | 18 | 18% | -25 | -282% | -229 | -40% | 9.2 | 1.9 | 5.5 | 8.7 | 1 | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✗ | ✗ | ✗ |
| A5007 City Road | 7 | 863 | 146 | 33 | 4 | 37 | 14 | 1104 | 1046 | 512 | 328 | 0 | 1 | 40 | 92 | 30 | 19 | 840 | 132 | 49 | 1021 | 23 | 3% | 14 | 10% | -12 | -32% | 25 | 2% | 0.8 | 1.2 | 1.8 | 0.8 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Whieldon Road | 1 | 200 | 40 | 5 | 0 | 5 | 0 | 251 | 245 | 119 | 76 | 0 | 0 | 9 | 22 | 3 | 2 | 195 | 31 | 5 | 231 | 5 | 3% | 9 | 21% | 0 | -3% | 14 | 6% | 0.4 | 1.4 | 0.1 | 0.9 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A50(T)[3] | 15 | 2606 | 430 | 125 | 170 | 295 | 11 | 3652 | 3331 | 1791 | 1145 | 1 | 5 | 98 | 228 | 235 | 144 | 2937 | 326 | 380 | 3642 | -331 | -13% | 104 | 24% | -85 | -29% | -311 | -9% | 6.3 | 5.4 | 4.6 | 5.3 | 1 | ✓ | ✗ | ✓ | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ |
| A5035 Trentham Road | 1 | 822 | 116 | 8 | 3 | 11 | 1 | 962 | 949 | 451 | 288 | 0 | 1 | 21 | 49 | 10 | 6 | 739 | 69 | 16 | 824 | 83 | 10% | 47 | 40% | -5 | -44% | 125 | 13% | 3.0 | 4.9 | 1.3 | 4.2 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pass | 6 | 5 | 6 | 7 | 7 | 7 | 11 | 10 | 11 | 8 | 7 | 8 |
| Counts | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| % Pass | 55% | 45% | 55% | 64% | 64% | 64% | 100% | 91% | 100% | 73% | 64% | 73% |

### Inter-Peak Hour EB

| Road | Inter-Peak Hour (14-1500hrs) - Survey | | | | | | | | | IP - Model | | | | | | | | | | | | | | | | | | | | | | | | Results - IP | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Model | | | | | | | | Summed | | | | Difference Car | | Difference | | Difference HGV | | Difference | | GEH | | | | Results | | | | | | | | | | | | |
| | M'cycles | Cars | LGVs | HGVs - Rigid | HGVs - Artic | HGV | Buses | Total | Total (Car/LGV/HGV) | Car Com | Car Non Com | Taxi Com | Taxi No Com | LGV Com | LGV No Com | HGV Com | HGV No Com | Car | LGV | HGV | Total | Difference | % Diff | Difference | % Diff | Difference | % Diff | Difference | % Diff | Car GEH | LGV GEH | HGV GEH | Total GEH | Count | Car DMRB Diff Test | Car GEH<5 | Car DMRB OR GEH <% | LGV DMRB Diff Test | LGV GEH<5 | LGV DMRB OR GEH <% | HGV DMRB Diff Test | HGV GEH<5 | HGV DMRB OR GEH <% | DMRB Diff test | GEH<5 | DMRB OR GEH<5 |
| A527 Tunstall Western Bypass | 4 | 863 | 196 | 28 | 20 | 48 | 0 | 1111 | 1107 | 366 | 234 | 0 | 1 | 17 | 39 | 13 | 8 | 599 | 56 | 21 | 676 | 264 | 31% | 140 | 72% | 27 | 56% | 431 | 39% | 9.8 | 12.5 | 4.6 | 14.4 | 1 | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| A5271 Longport Road | 4 | 763 | 195 | 74 | 12 | 86 | 8 | 1056 | 1044 | 641 | 410 | 0 | 2 | 50 | 116 | 44 | 27 | 1051 | 166 | 71 | 1288 | -288 | -38% | 29 | 15% | 15 | 17% | -244 | -23% | 9.6 | 2.2 | 1.7 | 7.1 | 1 | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| A53 Etruria Road | 3 | 1717 | 302 | 79 | 22 | 101 | 13 | 2136 | 2120 | 914 | 584 | 1 | 2 | 96 | 224 | 44 | 27 | 1498 | 320 | 71 | 1889 | 219 | 13% | -18 | -6% | 30 | 30% | 231 | 11% | 5.5 | 1.0 | 3.2 | 5.2 | 1 | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ |
| B5045 Shelton New Road[1] | 3 | 384 | 78 | 11 | 5 | 16 | 3 | 484 | 478 | 276 | 176 | 0 | 1 | 28 | 65 | 11 | 7 | 452 | 92 | 17 | 562 | -68 | -18% | -14 | -18% | -1 | -9% | -84 | -18% | 3.3 | 1.6 | 0.4 | 3.7 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A5006 Stoke Road | 4 | 377 | 39 | 4 | 0 | 4 | 2 | 426 | 420 | 213 | 136 | 0 | 1 | 19 | 44 | 7 | 4 | 348 | 63 | 11 | 423 | 29 | 8% | -24 | -62% | -7 | -171% | -3 | -1% | 1.5 | 3.4 | 2.5 | 0.1 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| College Road | 3 | 194 | 12 | 0 | 0 | 0 | 15 | 224 | 206 | 139 | 89 | 0 | 0 | 7 | 17 | 6 | 4 | 228 | 25 | 10 | 263 | -34 | -18% | -13 | -105% | -10 | -96453% | -57 | -27% | 2.4 | 2.9 | 4.4 | 3.7 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A52 Leek Road[2] | 6 | 532 | 82 | 21 | 1 | 22 | 0 | 642 | 636 | 393 | 251 | 0 | 1 | 28 | 66 | 12 | 7 | 644 | 94 | 19 | 757 | -112 | -21% | -12 | -15% | 3 | 15% | -121 | -19% | 4.6 | 1.3 | 0.7 | 4.6 | 1 | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ |
| A5007 City Road | 5 | 553 | 93 | 25 | 3 | 28 | 10 | 689 | 674 | 328 | 209 | 0 | 1 | 29 | 68 | 21 | 13 | 537 | 98 | 33 | 668 | 16 | 3% | -5 | -5% | -5 | -18% | 6 | 1% | 0.7 | 0.5 | 0.9 | 0.2 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Whieldon Road | 0 | 116 | 30 | 1 | 0 | 1 | 0 | 147 | 147 | 75 | 48 | 0 | 0 | 8 | 19 | 4 | 2 | 122 | 27 | 6 | 155 | -6 | -5% | 3 | 10% | -5 | -465% | -8 | -5% | 0.6 | 0.6 | 2.6 | 0.6 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A50(T)[3] | 9 | 2372 | 471 | 159 | 212 | 371 | 7 | 3230 | 3214 | 1363 | 871 | 1 | 4 | 96 | 224 | 143 | 88 | 2234 | 319 | 231 | 2785 | 138 | 6% | 152 | 32% | 140 | 38% | 429 | 13% | 2.9 | 7.6 | 8.0 | 7.8 | 1 | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |
| A5035 Trentham Road | 4 | 572 | 50 | 8 | 1 | 9 | 11 | 646 | 631 | 244 | 156 | 0 | 1 | 14 | 33 | 9 | 6 | 400 | 47 | 14 | 461 | 172 | 30% | 3 | 6% | -5 | -61% | 170 | 27% | 7.8 | 0.4 | 1.6 | 7.3 | 1 | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pass | 7 | 7 | 8 | 9 | 9 | 9 | 10 | 10 | 10 | 6 | 6 | 7 |
| Counts | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| % Pass | 64% | 64% | 73% | 82% | 82% | 82% | 91% | 91% | 91% | 55% | 55% | 64% |

### Inter-Peak Hour WB

| Road | Inter-Peak Hour (14-1500hrs) - Survey | | | | | | | | | IP - Model | | | | | | | | | | | | | | | | | | | | | | | | Results - IP | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Model | | | | | | | | Summed | | | | Difference Car | | Difference (LGV) | | Difference HGV | | Difference (Total) | | GEH | | | | Results | | | | | | | | | | | | |
| | M'cycles | Cars | LGVs | HGVs - Rigid | HGVs - Artic | HGV | Buses | Total | Total (Car/LGV/HGV) | Car Com | Car Non Com | Taxi Com | Taxi No Com | LGV Com | LGV No Com | HGV Com | HGV No Com | Car | LGV | HGV | Total | Difference | % Diff | Difference | % Diff | Difference | % Diff | Difference | % Diff | Car GEH | LGV GEH | HGV GEH | Total GEH | Count | Car DMRB Diff Test | Car GEH<5 | Car DMRB OR GEH <% | LGV DMRB Diff Test | LGV GEH<5 | LGV DMRB OR GEH <% | HGV DMRB Diff Test | HGV GEH<5 | HGV DMRB OR GEH <% | DMRB Diff test | GEH<5 | DMRB OR GEH<5 |
| A527 Tunstall Western Bypass | 4 | 593 | 165 | 19 | 20 | 39 | 2 | 803 | 797 | 379 | 242 | 0 | 1 | 30 | 69 | 3 | 2 | 621 | 99 | 5 | 725 | -28 | -5% | 66 | 40% | 34 | 86% | 72 | 9% | 1.1 | 5.8 | 7.1 | 2.6 | 1 | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ |
| A5271 Longport Road | 9 | 832 | 211 | 33 | 3 | 36 | 7 | 1095 | 1079 | 691 | 442 | 0 | 2 | 45 | 105 | 34 | 21 | 1133 | 150 | 55 | 1339 | -301 | -36% | 61 | 29% | -19 | -53% | -260 | -24% | 9.6 | 4.5 | 2.8 | 7.5 | 1 | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| A53 Etruria Road | 4 | 1639 | 221 | 45 | 22 | 67 | 12 | 1943 | 1927 | 1149 | 735 | 1 | 3 | 81 | 190 | 33 | 20 | 1884 | 271 | 52 | 2208 | -245 | -15% | -50 | -23% | 15 | 22% | -281 | -15% | 5.8 | 3.2 | 1.9 | 6.2 | 1 | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ |
| B5045 Shelton New Road[1] | 5 | 474 | 68 | 15 | 7 | 22 | 3 | 572 | 564 | 217 | 139 | 0 | 1 | 15 | 36 | 7 | 5 | 356 | 51 | 12 | 419 | 118 | 25% | 17 | 25% | 10 | 45% | 145 | 26% | 5.8 | 2.2 | 2.4 | 6.5 | 1 | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| A5006 Stoke Road | 1 | 469 | 38 | 5 | 0 | 5 | 1 | 514 | 512 | 377 | 241 | 0 | 1 | 24 | 57 | 7 | 4 | 618 | 81 | 11 | 710 | -149 | -32% | -43 | -114% | -6 | -117% | -198 | -39% | 6.4 | 5.6 | 2.1 | 8.0 | 1 | ✗ | ✗ | ✗ | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| College Road | 3 | 276 | 22 | 2 | 0 | 2 | 17 | 320 | 300 | 186 | 119 | 0 | 1 | 9 | 20 | 2 | 1 | 305 | 28 | 3 | 336 | -29 | -10% | -6 | -29% | -1 | -66% | -36 | -12% | 1.7 | 1.3 | 0.8 | 2.0 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A52 Leek Road[2] | 2 | 500 | 93 | 7 | 3 | 10 | 0 | 605 | 603 | 356 | 228 | 0 | 1 | 30 | 71 | 19 | 12 | 584 | 102 | 31 | 717 | -84 | -17% | -9 | -9% | -21 | -207% | -114 | -19% | 3.6 | 0.9 | 4.6 | 4.4 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ |
| A5007 City Road | 5 | 539 | 120 | 26 | 2 | 28 | 9 | 701 | 687 | 366 | 234 | 0 | 1 | 36 | 83 | 34 | 21 | 600 | 119 | 54 | 774 | -61 | -11% | 1 | 1% | -26 | -93% | -87 | -13% | 2.6 | 0.1 | 4.1 | 3.2 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Whieldon Road | 0 | 80 | 27 | 0 | 0 | 0 | 0 | 107 | 107 | 70 | 44 | 0 | 0 | 5 | 12 | 4 | 2 | 114 | 18 | 6 | 138 | -34 | -43% | 9 | 34% | -6 | -63276% | -31 | -29% | 3.5 | 1.9 | 3.6 | 2.8 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A50(T)[3] | 15 | 1790 | 390 | 144 | 192 | 336 | 4 | 2535 | 2516 | 1101 | 704 | 1 | 3 | 84 | 196 | 189 | 116 | 1806 | 280 | 305 | 2390 | -16 | -1% | 110 | 28% | 31 | 9% | 126 | 5% | 0.4 | 6.0 | 1.7 | 2.5 | 1 | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A5035 Trentham Road | 1 | 423 | 59 | 11 | 2 | 13 | 2 | 498 | 495 | 251 | 160 | 0 | 1 | 21 | 50 | 12 | 8 | 411 | 71 | 20 | 501 | 12 | 3% | -12 | -20% | -7 | -52% | -6 | -1% | 0.6 | 1.5 | 1.7 | 0.3 | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pass | 8 | 7 | 8 | 10 | 8 | 10 | 11 | 10 | 11 | 7 | 7 | 8 |
| Counts | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| % Pass | 73% | 64% | 73% | 91% | 73% | 91% | 100% | 91% | 100% | 64% | 64% | 73% |

## PM Peak Hour EB

| Road | PM Peak-Hour (17-1800hrs) - Survey M'cycles | Cars | LGVs | HGVs - Rigid | HGVs - Artic | | Buses | Total | Total (Car/LGV/HGV) |
|---|---|---|---|---|---|---|---|---|---|
| A527 Tunstall Western Bypass | 9 | 1405 | 212 | 12 | 16 | 28 | 2 | 1656 | 1645 |
| A5271 Longport Road | 7 | 1195 | 165 | 27 | 15 | 42 | 6 | 1415 | 1402 |
| A53 Etruria Road | 9 | 2026 | 266 | 34 | 20 | 54 | 8 | 2363 | 2346 |
| B5045 Shelton New Road[1] | 10 | 649 | 59 | 5 | 7 | 12 | 5 | 735 | 720 |
| A5006 Stoke Road | 1 | 581 | 41 | 1 | 0 | 1 | 3 | 627 | 623 |
| College Road | 2 | 269 | 24 | 1 | 0 | 1 | 17 | 313 | 294 |
| A52 Leek Road[2] | 3 | 697 | 74 | 6 | 1 | 7 | 0 | 781 | 778 |
| A5007 City Road | 4 | 829 | 99 | 4 | 3 | 7 | 11 | 950 | 935 |
| Whieldon Road | 4 | 254 | 26 | 0 | 0 | 0 | 1 | 285 | 280 |
| A50(T)[3] | 31 | 3216 | 384 | 72 | 161 | 233 | 6 | 3870 | 3833 |
| A5035 Trentham Road | 8 | 746 | 65 | 1 | 0 | 1 | 4 | 824 | 812 |

| Road | PM - Model: Model Car Com | Car Non Com | Taxi Com | Taxi No Com | LGV Com | LGV No Com | HGV Com | HGV No Com | Summed Car | LGV | HGV | Total | Diff Car Difference | % Diff | Diff LGV Difference | % Diff | Diff HGV Difference | % Diff | Difference Difference | % Diff | GEH Car GEH | LGV GEH | HGV GEH | Total GEH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A527 Tunstall Western Bypass | 747 | 477 | 0 | 2 | 47 | 110 | 16 | 10 | 1224 | 157 | 26 | 1407 | 181 | 13% | 55 | 26% | 2 | 8% | 238 | 14% | 5.0 | 4.1 | 0.4 | 6.1 |
| A5271 Longport Road | 656 | 419 | 0 | 2 | 59 | 137 | 27 | 16 | 1075 | 195 | 43 | 1313 | 120 | 10% | -30 | -18% | -1 | -3% | 89 | 6% | 3.6 | 2.2 | 0.2 | 2.4 |
| A53 Etruria Road | 1126 | 720 | 1 | 3 | 80 | 187 | 21 | 13 | 1846 | 267 | 33 | 2147 | 180 | 9% | -1 | 0% | 21 | 38% | 199 | 8% | 4.1 | 0.1 | 3.1 | 4.2 |
| B5045 Shelton New Road[1] | 416 | 266 | 0 | 1 | 18 | 43 | 6 | 3 | 681 | 62 | 9 | 752 | -32 | -5% | -3 | -4% | 3 | 25% | -32 | -4% | 1.3 | 0.3 | 0.9 | 1.2 |
| A5006 Stoke Road | 309 | 198 | 0 | 1 | 18 | 43 | 1 | 1 | 507 | 61 | 2 | 570 | 74 | 13% | -20 | -49% | -1 | -133% | 53 | 9% | 3.2 | 2.8 | 1.0 | 2.2 |
| College Road | 181 | 116 | 0 | 0 | 4 | 9 | 3 | 2 | 296 | 13 | 4 | 313 | -27 | -10% | 11 | 47% | -3 | -304% | -19 | -7% | 1.6 | 2.6 | 1.9 | 1.1 |
| A52 Leek Road[2] | 366 | 234 | 0 | 1 | 19 | 45 | 3 | 2 | 600 | 65 | 5 | 670 | 97 | 14% | 9 | 13% | 2 | 24% | 108 | 14% | 3.8 | 1.1 | 0.7 | 4.0 |
| A5007 City Road | 438 | 280 | 0 | 1 | 26 | 61 | 13 | 8 | 718 | 88 | 20 | 826 | 111 | 13% | 11 | 12% | -13 | -191% | 109 | 12% | 4.0 | 1.2 | 3.6 | 3.7 |
| Whieldon Road | 89 | 57 | 0 | 0 | 6 | 14 | 1 | 1 | 146 | 20 | 2 | 168 | 108 | 42% | 6 | 24% | -2 | -22433% | 112 | 40% | 7.6 | 1.3 | 2.1 | 7.5 |
| A50(T)[3] | 2150 | 1375 | 1 | 6 | 85 | 197 | 168 | 103 | 3525 | 282 | 270 | 4077 | -309 | -10% | 102 | 27% | -37 | -16% | -244 | -6% | 5.3 | 5.6 | 2.4 | 3.9 |
| A5035 Trentham Road | 396 | 253 | 0 | 1 | 16 | 38 | 4 | 2 | 650 | 54 | 6 | 709 | 96 | 13% | 11 | 17% | -5 | -486% | 103 | 13% | 3.6 | 1.5 | 2.6 | 3.7 |

| Road | Results - PM: Count | Car DMRB Diff Test | Car GEH<5 | Car DMRB OR GEH <% | LGV DMRB Diff Test | LGV GEH<5 | LGV DMRB OR GEH <% | HGV DMRB Diff Test | HGV GEH<5 | HGV DMRB OR GEH <% | DMRB Diff test | GEH<5 | DMRB OR GEH<5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A527 Tunstall Western Bypass | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A5271 Longport Road | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A53 Etruria Road | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| B5045 Shelton New Road[1] | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ |
| A5006 Stoke Road | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ |
| College Road | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A52 Leek Road[2] | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A5007 City Road | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Whieldon Road | 1 | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ |
| A50(T)[3] | 1 | ✓ | ✗ | ✓ | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A5035 Trentham Road | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Pass | | 10 | 9 | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 10 | 9 | 11 |
| Counts | | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| % Pass | | 91% | 82% | 91% | 91% | 91% | 91% | 100% | 100% | 100% | 91% | 82% | 100% |

## PM Peak Hour WB

| Road | PM Peak-Hour (17-1800hrs) - Survey M'cycles | Cars | LGVs | HGVs - Rigid | HGVs - Artic | | Buses | Total | Total (Car/LGV/HGV) |
|---|---|---|---|---|---|---|---|---|---|
| A527 Tunstall Western Bypass | 4 | 811 | 102 | 8 | 8 | 16 | 1 | 934 | 929 |
| A5271 Longport Road | 5 | 1077 | 96 | 9 | 11 | 20 | 4 | 1202 | 1193 |
| A53 Etruria Road | 16 | 2124 | 157 | 12 | 9 | 21 | 4 | 2322 | 2302 |
| B5045 Shelton New Road[1] | 2 | 885 | 27 | 3 | 4 | 7 | 2 | 923 | 919 |
| A5006 Stoke Road | 1 | 463 | 27 | 1 | 0 | 1 | 2 | 494 | 491 |
| College Road | 1 | 384 | 26 | 0 | 0 | 0 | 16 | 427 | 410 |
| A52 Leek Road[2] | 4 | 531 | 53 | 1 | 1 | 2 | 2 | 592 | 586 |
| A5007 City Road | 3 | 634 | 90 | 3 | 4 | 7 | 10 | 744 | 731 |
| Whieldon Road | 0 | 177 | 10 | 3 | 0 | 3 | 1 | 191 | 190 |
| A50(T)[3] | 20 | 2209 | 324 | 44 | 142 | 186 | 9 | 2748 | 2719 |
| A5035 Trentham Road | 6 | 509 | 49 | 1 | 3 | 4 | 2 | 570 | 562 |

| Road | PM - Model: Model Car Com | Car Non Com | Taxi Com | Taxi No Com | LGV Com | LGV No Com | HGV Com | HGV No Com | Summed Car | LGV | HGV | Total | Diff Car Difference | % Diff | Diff LGV Difference | % Diff | Diff HGV Difference | % Diff | Difference (Total) Difference | % Diff | GEH Car GEH | LGV GEH | HGV GEH | Total GEH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A527 Tunstall Western Bypass | 507 | 324 | 0 | 1 | 32 | 75 | 11 | 7 | 831 | 107 | 18 | 956 | -20 | -2% | -5 | -5% | -2 | -10% | -27 | -3% | 0.7 | 0.5 | 0.4 | 0.9 |
| A5271 Longport Road | 687 | 439 | 0 | 2 | 50 | 117 | 11 | 7 | 1126 | 167 | 18 | 1311 | -49 | -5% | -71 | -74% | 2 | 10% | -118 | -10% | 1.5 | 6.2 | 0.5 | 3.3 |
| A53 Etruria Road | 1385 | 885 | 1 | 4 | 85 | 199 | 21 | 13 | 2270 | 284 | 34 | 2588 | -146 | -7% | -127 | -81% | -13 | -63% | -286 | -12% | 3.1 | 8.6 | 2.5 | 5.8 |
| B5045 Shelton New Road[1] | 416 | 266 | 0 | 1 | 28 | 64 | 7 | 4 | 682 | 92 | 11 | 785 | 203 | 23% | -65 | -240% | -4 | -63% | 134 | 15% | 7.3 | 8.4 | 1.4 | 4.6 |
| A5006 Stoke Road | 390 | 249 | 0 | 1 | 11 | 25 | 2 | 1 | 639 | 36 | 3 | 677 | -176 | -38% | -9 | -32% | -2 | -192% | -186 | -38% | 7.5 | 1.6 | 1.4 | 7.7 |
| College Road | 185 | 118 | 0 | 0 | 5 | 13 | 2 | 1 | 303 | 18 | 3 | 324 | 81 | 21% | 8 | 30% | -3 | -28252% | 86 | 21% | 4.4 | 1.6 | 2.4 | 4.5 |
| A52 Leek Road[2] | 399 | 255 | 0 | 1 | 16 | 37 | 6 | 4 | 653 | 52 | 10 | 716 | -122 | -23% | 1 | 2% | -8 | -409% | -130 | -22% | 5.0 | 0.1 | 3.3 | 5.1 |
| A5007 City Road | 486 | 311 | 0 | 1 | 29 | 68 | 11 | 7 | 796 | 98 | 17 | 911 | -162 | -26% | -8 | -9% | -10 | -145% | -180 | -25% | 6.1 | 0.8 | 2.9 | 6.3 |
| Whieldon Road | 113 | 72 | 0 | 0 | 8 | 19 | 1 | 1 | 185 | 28 | 2 | 214 | -8 | -4% | -18 | -176% | 1 | 42% | -24 | -13% | 0.6 | 4.1 | 0.8 | 1.7 |
| A50(T)[3] | 1584 | 1012 | 1 | 4 | 75 | 175 | 186 | 114 | 2596 | 250 | 300 | 3147 | -387 | -18% | 74 | 23% | -114 | -62% | -428 | -16% | 7.9 | 4.4 | 7.3 | 7.9 |
| A5035 Trentham Road | 266 | 170 | 0 | 1 | 19 | 45 | 6 | 4 | 435 | 64 | 10 | 510 | 74 | 14% | -15 | -31% | -6 | -149% | 52 | 9% | 3.4 | 2.0 | 2.3 | 2.3 |

| Road | Results - PM: Count | Car DMRB Diff Test | Car GEH<5 | Car DMRB OR GEH <% | LGV DMRB Diff Test | LGV GEH<5 | LGV DMRB OR GEH <% | HGV DMRB Diff Test | HGV GEH<5 | HGV DMRB OR GEH <% | DMRB Diff test | GEH<5 | DMRB OR GEH<5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A527 Tunstall Western Bypass | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A5271 Longport Road | 1 | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A53 Etruria Road | 1 | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| B5045 Shelton New Road[1] | 1 | ✗ | ✗ | ✗ | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A5006 Stoke Road | 1 | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| College Road | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ |
| A52 Leek Road[2] | 1 | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| A5007 City Road | 1 | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ |
| Whieldon Road | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A50(T)[3] | 1 | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |
| A5035 Trentham Road | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Pass | | 6 | 6 | 6 | 10 | 8 | 10 | 10 | 10 | 10 | 7 | 7 | 8 |
| Counts | | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| % Pass | | 55% | 55% | 55% | 91% | 73% | 91% | 91% | 91% | 91% | 64% | 64% | 73% |

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE

## APPENDIX 26 - T3 Local Plan Transport Modelling Methodology Report

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

Table of contents

# 1 Introduction

Sweco have been appointed by Newcastle-under-Lyme Borough Council (NuLBC) in conjunction with Stoke-on-Trent City Council (SoTCC) and Staffordshire County Council (SCC) to undertake transport modelling and appraisal work. This is to support the development and implementation of local plans to address nitrogen dioxide ($NO_2$) exceedances in the North Staffordshire conurbation. This is in accordance with the Ministerial Direction for third wave local authorities.

The transport modelling will inform the air quality modelling and economic appraisal work as part of the delivery of an Outline Business Case (OBC) submission to the Joint Air Quality Unit (JAQU) due by 31st of October 2019. The transport modelling work will centre on the use and update of the North Staffordshire Multi-Modal (NSMM) transport model.

This Local Plan Transport Modelling Methodology Report (T3) outlines the methodology for the transport modelling work to be undertaken to support the above. The proposed methodology is based on JAQU's guidance, documented the "Third Wave Local Authorities – Guidance, Evidence Package, Transport and Air Quality".

This report should be read alongside the T1 tracker table, a live document that demonstrates all the transport modelling requirements are being met, and the T2 Local Plan Transport Model Validation report which details how the NSMM base model was modified using Automatic Number Plate Recognition (ANPR) data and validated against real-world data. The rest of the report is divided into the following sections:

Chapter 2 provides background information on the NSMM model, its extent, structure, modelled time periods and zoning system.

Chapter 3 details some of the baseline forecasting assumptions for the transport modelling including the segmentation of base and future year demand using the ANPR surveys as well as forecast assumptions for the vehicle compositions.

Chapter 4 provides details on the future year uncertainty log, including what land use development and network improvements are included in the future year core scenario, as well as details of the sensitivity testing.

Chapter 5 provides a description of the NSMM demand model including its representation of travel cost assumptions.

Chapter 6 outlines the options to be tested and how the behavioural responses for both a charging Clean Air Zone (CAZ) and the other mitigation policies will be captured.

Chapter 7 details the use of Stated Preference (SP) survey data including the use and adaption of raw data from other cities, so it is adjusted to North Staffordshire, the conducting of a North Staffordshire SP survey and its incorporation into the NSMM demand model.

Chapter 8 summarises how the transport model outputs will be processed and used for the air quality modelling.

# 2 Background information

The NSMM transport model is to be used to derive appropriate traffic information to support the development and implementation of local plans to reduce pollution.

The NSMM transport model has been developed to allow the forecasting and assessment of the impact of proposed planning and infrastructure developments to be carried out. The demand model forecasts change in trip patterns in terms of trip generation, distribution and modal shift as a result of changes to the highway network, public transport service provision and changes to planning data. The transport model has been developed in accordance with appropriate WebTAG guidance.

The original base-year of the NSMM transport model is related to a 2009 base-year situation.

To support the design and assessment and the development of the Transport Business Case for the Etruria Valley Link Road (EVLR) project and following extensive liaison with the Department for Transport (DfT), the NSMM transport model has been updated to a 2015 base-year. To support the update of the NSMM transport model an extensive traffic data collection exercise has been carried out in order to calibrate modelled traffic flows, journey times and travel demand against observed information. The updated 2015 NSMM transport model has been validated in accordance with WebTAG guidance with further additional checks of the transport model carried out at the request of DfT.

The current scope and specification of the NSMM transport model is outlined further below.

## 2.1 Extent of the NSMM transport model

The NSMM transport model covers the whole of the urban areas of Stoke-on-Trent and Newcastle-Under-Lyme and extends into the surrounding and wider areas. The full extent of the modelled network is shown in Figure 2-1 with the detailed and peripheral model extents shown in Figure 2-2. Both road and rail links are modelled.

## 2.2 Structure of the NSMM transport model

The structure of the NSMM Transport Model consists of three main modules:

- Highway Assignment Model
- Public Transport Model
- Demand Model

The highway model is both link and junction based.

## 2.3 Transport modelling software

The NSMM transport model has been refined and updated using CUBE Voyager Version 6.4 transport modelling software.

## 2.4 Modelled time periods

The modelled time periods are as follows:

- AM peak hour (08:00-09:00hrs)
- Inter-Peak (IP) Hour (14:00-15:00hrs)
- PM peak hour (17:00-18:00hrs)

It should be noted that appropriate factors based on extensive observed traffic count information will be used to factor the modelled traffic data to an Annual Average Daily Traffic (AADT) situation for informing the air quality assessments.

## 2.5 NSMM transport model zones

The 2015 NSMM transport model has 288 zones which are split as follows:

- Internal zones 1 – 207 and 275 – 288 (See Figure 2-3 to Figure 2-5)
- Peripheral zones 208 – 233 (see Figure 2-6)
- Regional zones 234 – 255 (see Figure 2-7)
- National zones 256 – 274 (see Figure 2-8)

The internal zones and modelled transport network represent the greatest level of detail to capture the local routing and travel demand responses. The peripheral zones form a ring of buffer zones just outside the detailed modelled area, with a dimension a little larger than the internal zones to provide realistic travel demand to and from these areas.

Regional and national zones are far coarser, for example Scotland is represented by a single zone, this permits representation of destination choice and travel opportunities between external zones and between internal and external zones. Capturing external to external demand is important in the NSMM transport model area, as it includes roads carrying significant through traffic such as the M6, A500 and A50 trunk roads.

Figure 2-1: Extent of modelled road and rail network

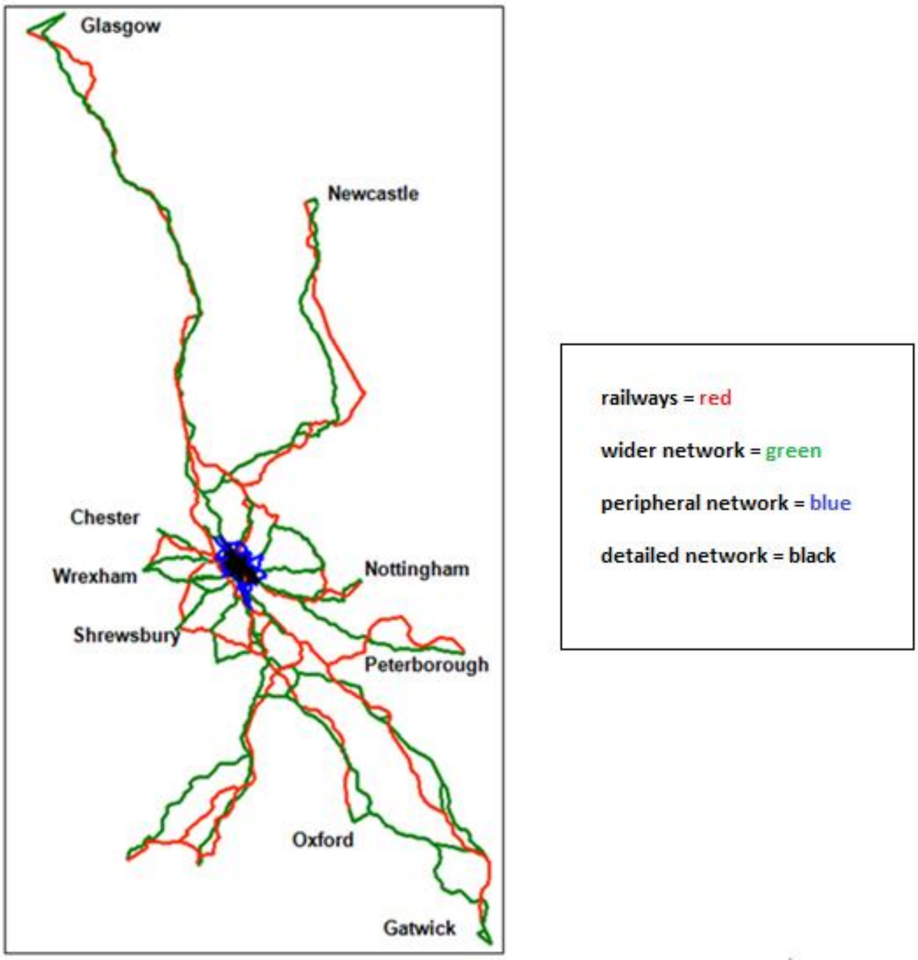


*Figure 2-2: Extent of modelled peripheral and internal road and rail networks*

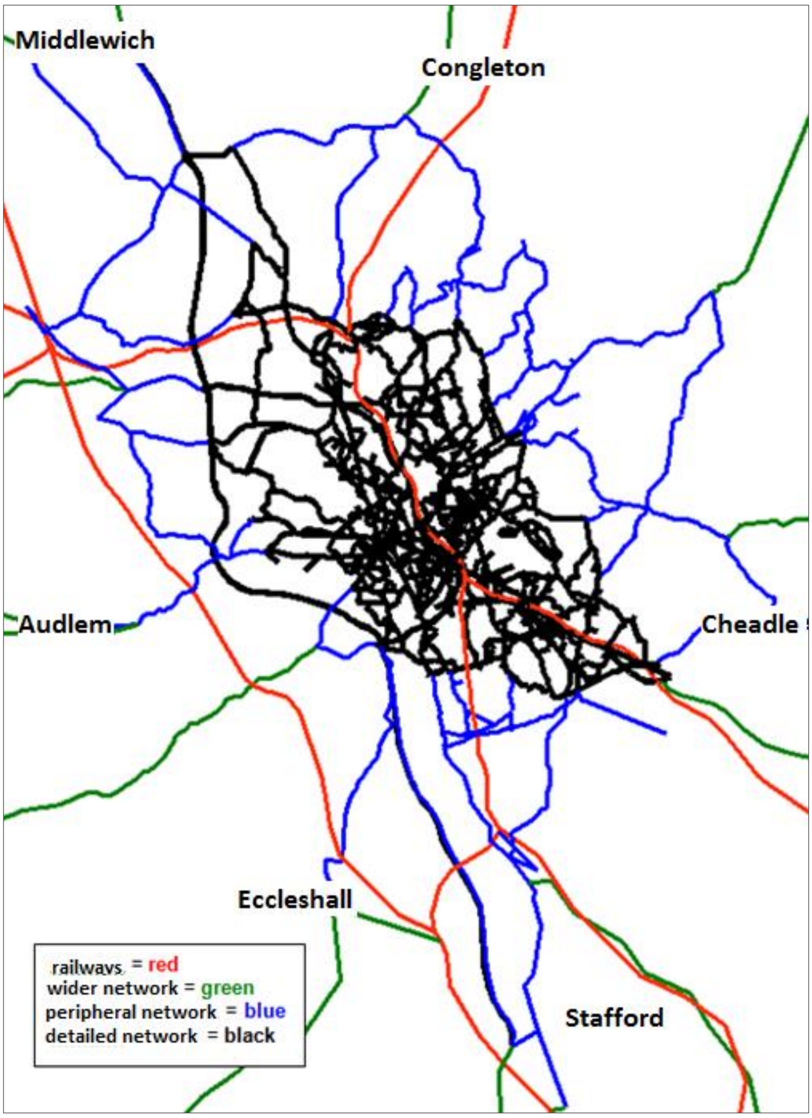


*Figure 2-3: Internal transport model zones (north)*

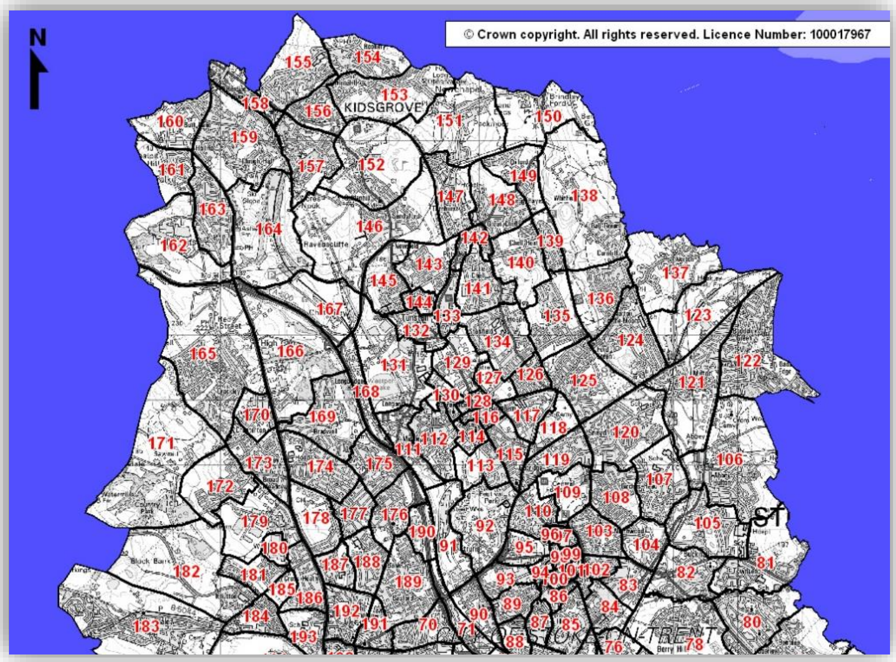



*Figure 2-4: Internal transport model zones (south)*

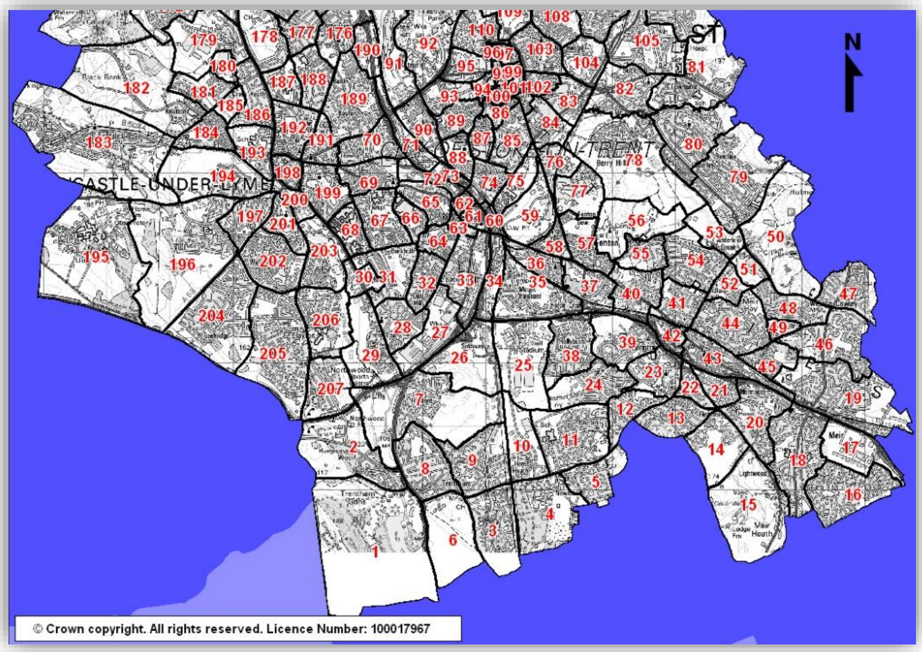


*Figure 2-5: Internal transport model zones (central area)*

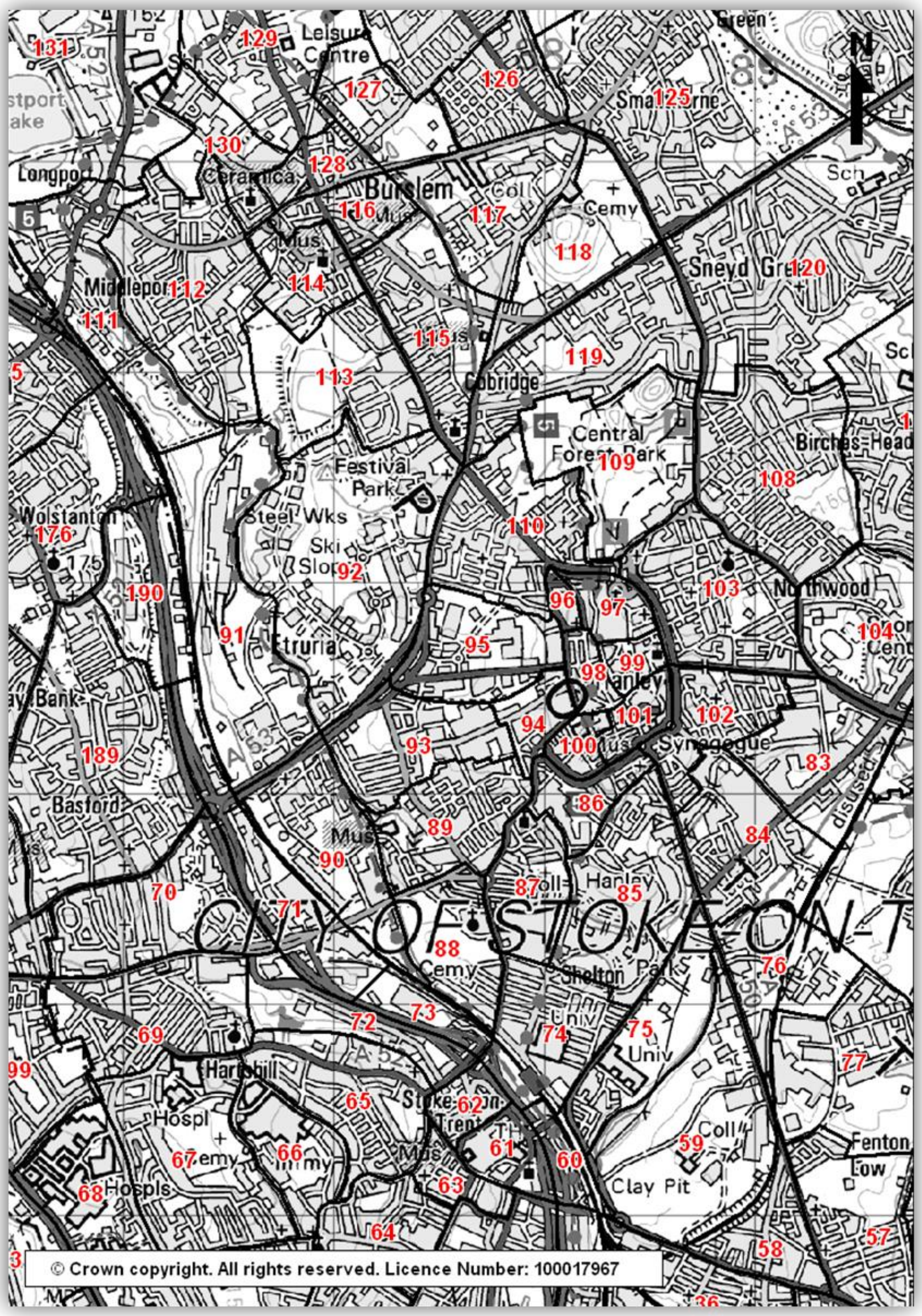


*Figure 2-6: Peripheral transport model zones*

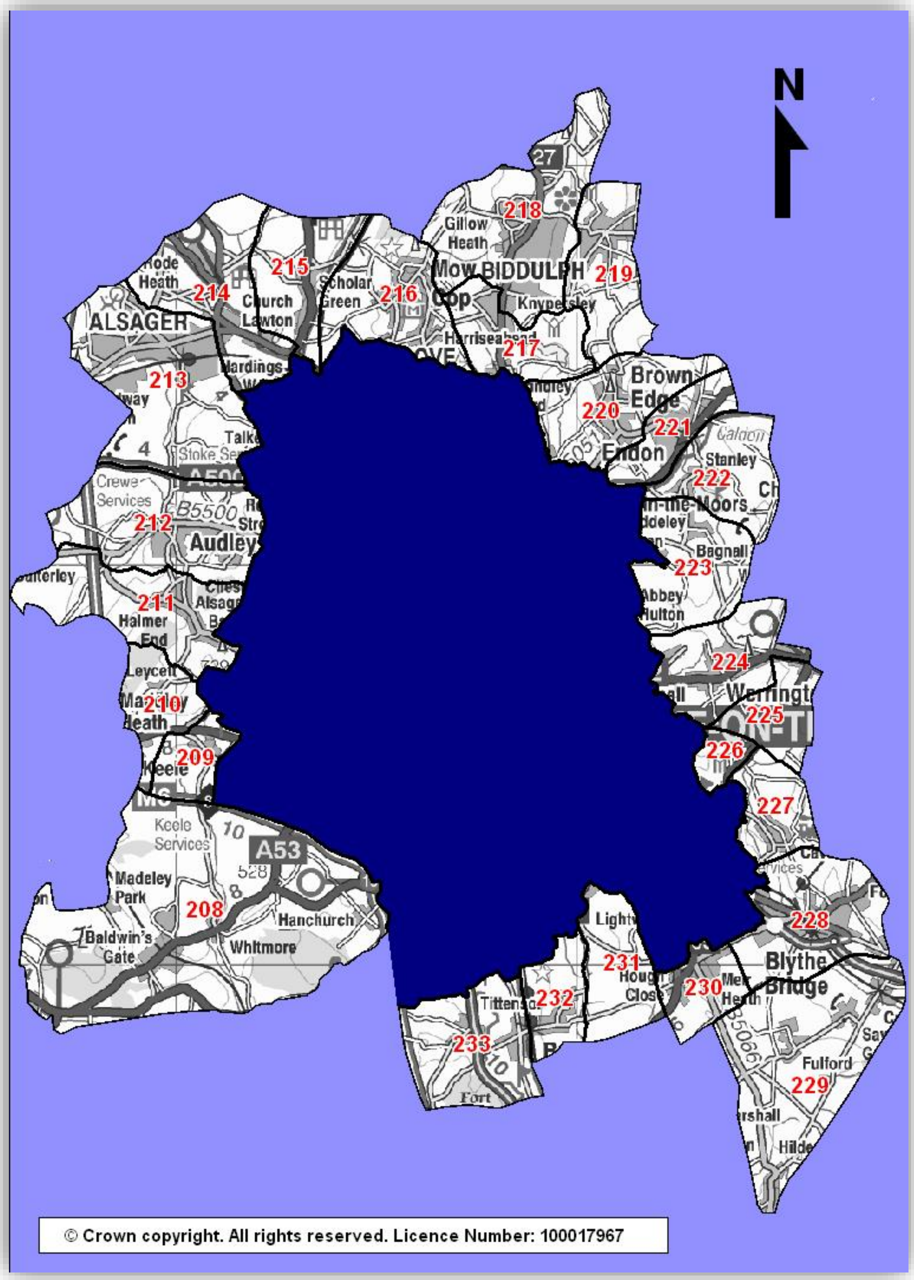


*Figure 2-7: Regional transport model zones*

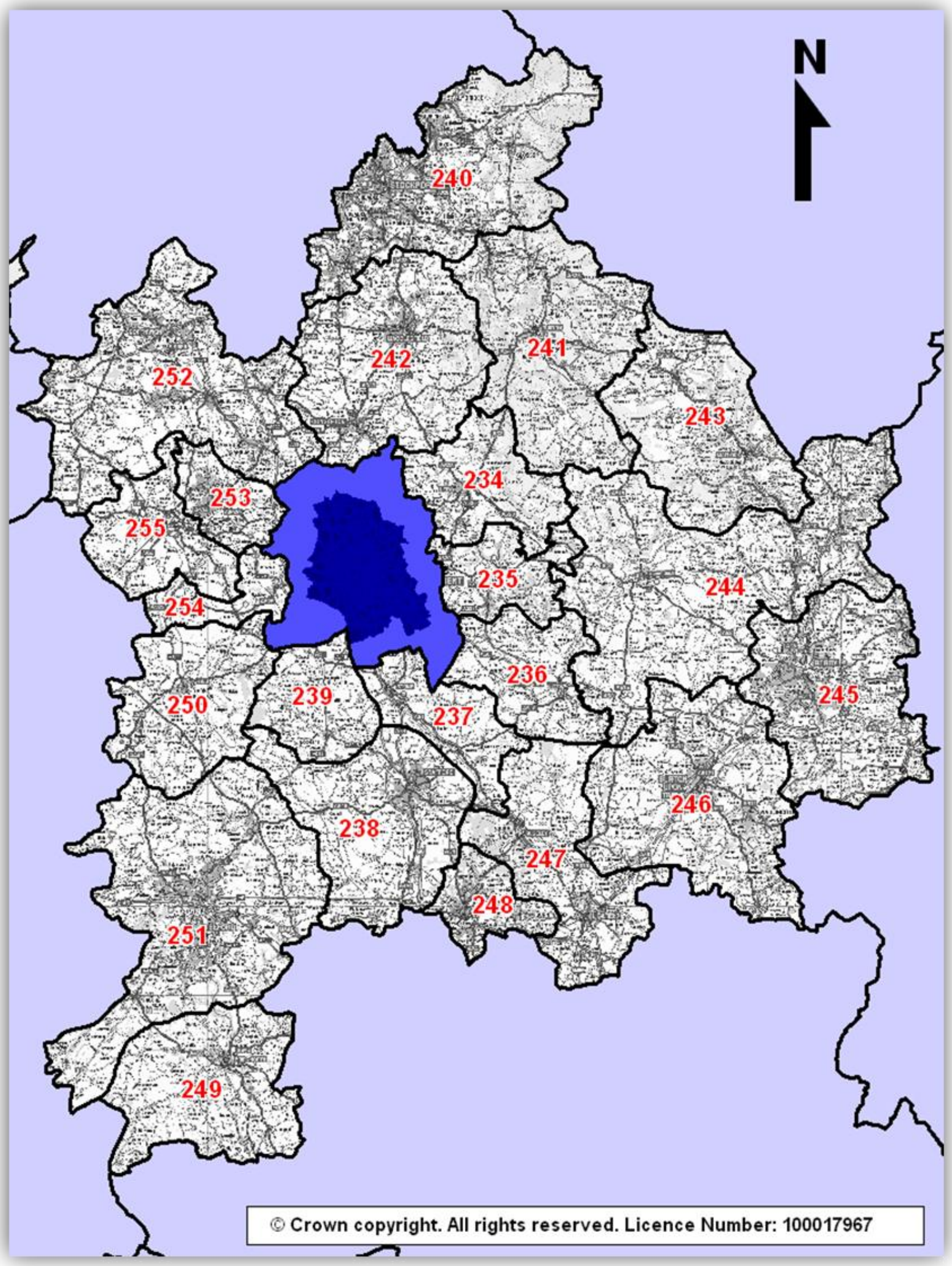
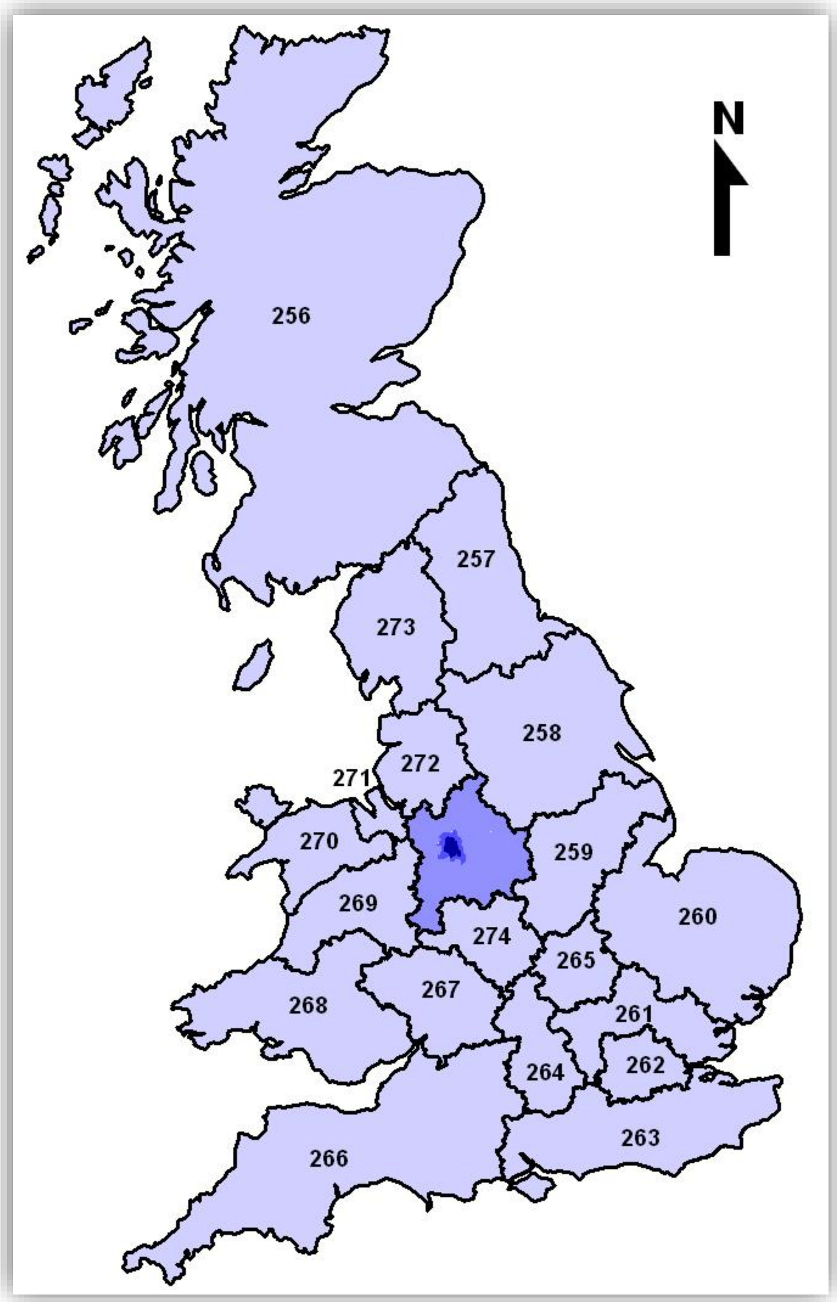


*Figure 2-8: National transport model zones*



# 3 Baseline forecast

## 3.1 Demand model

The following modes of transport are assigned in the final highway assignment:

- Car
- Light Goods Vehicles (LGVs)
- Heavy Goods Vehicles (HGVs)
- Public transport – for the highway assignment buses are loaded onto the highway network as fixed flows, for the separate public transport assignment bus and rail passenger demand is assigned to the public transport network.

Taxis would be partially represented in the car matrices. Coaches are not included in the public transport or highway assignments. Cycling and walking trips are not modelled, however, public transport passengers are assumed to access, and egress stops and stations at walking speed.

Freight demand is estimated from the trip end model and distributed rather than just growthed. All synthetic good vehicle trips are calculated using origin and destination trip rates calculated from the roadside interview data and applied to planning data. The origin and destination trip end values calculated are factored to match the average total. Goods vehicle trip ends are distributed using a gravity model with friction factors calibrated against observed trip length distribution data.

The goods vehicle cost matrices are calculated as follows:

1. Goods vehicle cost skims (in minutes) are taken from the appropriate model run
2. The mean value of the LGV and HGV cost skims is taken
3. Intra-zonal costs are set to the lowest inter-zonal cost multiplied by 0.5

Like the car and public transport matrices, the growth from the demand model good vehicle matrices is applied incrementally to the observed LGV and HGV matrices.

The three modelled time periods are used for both the demand and assignment models.

The trip generation, distribution and mode split parts of the demand model includes the following trip purposes for trips by car and public transport:

- Home based work (HBW)
- Home based education (HBE)
- Home based shopping (HBS)
- Home based other (HBO)
- Non-home-based employers' business (NHBEB)
- Non-home based other (NHBO)

For the trip generation stage, the home-based trips are further segmented by three car ownership categories (0,1 and 2+) and six socio-economic groupings (HH1 to HH6), outlined in Table 3-1. The information below can be used to derive an approximation of household income for each socio-economic grouping which can be used to segment demand for modelling different charging schemes.

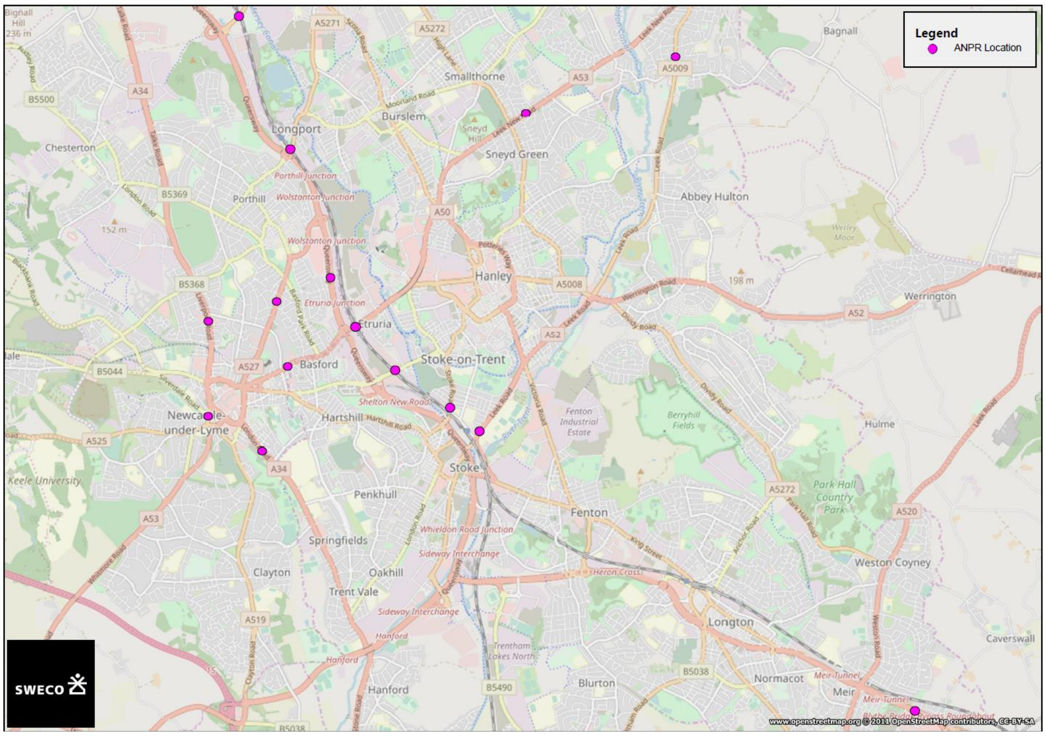
*Table 3-1: NSMM transport model socio-economic groupings*

| Category | Household Size | No. Employed People |
|---|---|---|
| **1** | 1 | 0 |
| **2** | >1 | 0 |
| **3** | 1-2 | 1 |
| **4** | 3+ | 1 |
| **5** | 1-3 | 2+ |
| **6** | 4+ | 2+ |

### 3.2 Updated demand segmentation

The NSMM demand and assignment models are not segmented to a suitably detailed level to distinguish between fuel type and CAZ compliance status. Therefore, the demand and assignment matrices will need to be further disaggregated. To achieve this categorisation, ANPR surveys were carried out at 15 locations across North Staffordshire, as per the location map shown in Figure 3-1. The locations were established to capture the main dispersal routes around the A53 corridor where there are the highest air quality exceedances and other locations of exceedance. A screenline of ANPR sites was also formed to the east of the A500 which will primarily be used to inform the further disaggregation of the modelled vehicle types. The ANPR surveys were carried out twenty-four hours per day for seven days in both directions. Surveys were carried out between the 2nd and 8th of April 2019.

*Figure 3-1: ANPR survey locations*




It is proposed that the vehicle assignment matrices are disaggregated as detailed in Table 3-2.

Taxis are currently part of the car trip matrices; taxi demand will be separated out primarily using a universal factor from the ANPR survey data with some adjustment at locations of high taxi demand, such as the where taxi ranks are in the city/town centres and at Stoke-on-Trent rail station.

Currently coaches are not included in the public transport model. Although they are not expected to form a significant number of vehicles they will be added as fixed routes to the public transport assignment and loaded on as pre-loads to the highway assignment.

Further processing of the trip matrices will be done to split them into polluting and non-polluting vehicles, this will be achieved through:

- The processing of the ANPR data carried out and information from the DVLA database to identify different compliance types by fuel type (diesel or petrol) and by euro standards by emissions (such as Euro IV, etc). These vehicles can then be categorised into polluting and non-polluting. Global factors will then be applied to disaggregate the NSMM transport model trip matrices as appropriate.
- DfT forecast of changes in the makeup of the vehicle fleet. This change will be applied to the current vehicle composition to provide future year 2022 vehicle compositions.

*Table 3-2: Changes to vehicles classes in the NSMM transport model*

| Existing Segmentation | Updated Segmentation | Polluting Type |
|---|---|---|
| **Car matrix** | Cars | Clean Vehicle |
| | Cars | Polluting Vehicle |
| | Taxis | Clean Vehicle |
| | Taxis | Polluting Vehicle |
| **LGVs** | LGVs | Clean Vehicle |
| | LGVs | Polluting Vehicle |
| **HGVs** | HGVs | Clean Vehicle |
| | HGVs | Polluting Vehicle |
| **PT Services – fixed routes** | Buses – fixed routes | Clean Vehicle |
| | Buses – fixed routes | Polluting Vehicle |
| | Coaches – fixed routes | Clean Vehicle |
| | Coaches – fixed routes | Polluting Vehicle |

### 3.3 Demand growth assumptions

Traffic forecasts using the NSMM transport model will be produced for the AM peak-hour, Inter-Peak hour, PM peak hour modelled time periods for the following forecast years:

- 2022 – When compliance should be reached
- 2025 – A second forecast year, required for benefit extrapolation

In accordance with Government guidance the forecasting approach used involves three basic steps:

- Development of future year transport networks
- Derivation of future year travel demand
- Assignment of the future year travel demand to the future transport networks

The following TAG Units will be adhered to in the development of the required traffic forecasts:

- TAG Unit M2 – Variable Demand Modelling
- TAG Unit M4 – Forecasting and Uncertainty
- TAG data book (July 2019)

The traffic forecasts will be constrained at a local authority level (i.e. Stoke-on-Trent and Newcastle-under-Lyme) to the forecast growth in the National Trip End Model (NTEM) dataset (last updated 1st March 2017)

LGV and HGV trip matrices will be constrained to the latest NTM growth forecasts which are the same for each modelled period and applied as a single factor to each goods vehicle matrix.

# 4 Uncertainty log

## 4.1 Overview

The purpose of an uncertainty log is to highlight all the local and external uncertainties and factors which could affect the traffic/patronage, revenues and delivery of scheme benefits. Typically, these factors include proposed land-use developments and transport infrastructure improvements.

An uncertainty log for the future year land-use developments has been prepared using the uncertainty levels defined in Table 4-1 as per TAG Unit M4. Only developments that are completed, near certain or more than likely have been included, as they form the core scenario.

An uncertainty log for the future year transport networks have been prepared using the uncertainty levels defined in Table 4-2. The focus of the work will be on the core scenario where transport schemes and land use developments are committed in terms of planning permission and funding (as per TAG Unit M4 – Forecasting and Uncertainty).

Sensitivity tests will be carried out on key assumptions around the core scenario to test the potential uncertainties in the associated outcomes. Sensitivity analysis will also be undertaken on different CAZ charging levels and assumptions around upgrading response and fleet composition changes.

The following sensitivity tests will be undertaken as per JAQU guidance:

- The charging Benchmark CAZ D with the assumption that no one upgrades their vehicle in response to the daily charge (zero upgrade). We will pro-rata the other demand responses.
- Benchmark CAZ D with double the daily charge (cars/taxis - £10, LGVs - £18, HGVs - £70)

*Table 4-1: Uncertainty level definition and categorisation for proposed land-use developments*

| Uncertainty Level | Probability | Status | Core Scenario |
|---|---|---|---|
| Completed | Happened | Built/open | ✓ |
| Near Certain | The outcome will happen or there is a high probability that it will happen | Intent announced by proponent to regulatory agencies.<br>Approved development proposals.<br>Projects under construction. | ✓ |
| More Than Likely | The outcome is likely to happen but there is some uncertainty | Submission of planning or consent application imminent.<br>Development application within the consent process. | ✓ |
| Reasonably Foreseeable | The outcome may happen but there is significant uncertainty | Identified within a development plan.<br>Not directly associated with the transport strategy/scheme but may occur if the strategy/scheme is implemented.<br>Development conditional upon a transport scheme proceeding.<br>Or, a committed policy goal, subject to tests (e.g. of deliverability) whose outcomes are subject to significant uncertainty. | |
| Hypothetical | There is considerable uncertainty whether the outcome will ever happen | Conjecture based on currently available information.<br>Discussed on a conceptual basis.<br>One of several possible inputs in an initial consultation process.<br>Or, a policy aspiration. | |

*Table 4-2: Uncertainty level definition and categorisation for proposed transport schemes*

| Uncertainty Level | Probability | Status | Core Scenario |
|---|---|---|---|
| Completed | Happened | Built/open | ✓ |
| Near Certain | The outcome will happen or there is a high probability that it will happen | Intent announced by proponent to regulatory agencies.<br>Approved proposals.<br>Projects under construction. | ✓ |
| More Than Likely | The outcome is likely to happen but there is some uncertainty | Submission of planning or consent application imminent. | ✓ |
| Reasonably Foreseeable | The outcome may happen but there is significant uncertainty | Identified within a development plan.<br>Not directly associated with the transport strategy/scheme but may occur if the strategy/scheme is implemented.<br>Development conditional upon a transport scheme proceeding.<br>Or, a committed policy goal, subject to tests (e.g. of deliverability) whose outcomes are subject to significant uncertainty. | |
| Hypothetical | There is considerable uncertainty whether the outcome will ever happen | Conjecture based on currently available information.<br>Discussed on a conceptual basis.<br>One of several possible inputs in an initial consultation process.<br>Or, a policy aspiration. | |

### 4.2 Planning status of local developments

Proposed changes in the following planning data will be collated to derive the forecast trip matrices:

- Number of households
- Number of jobs (derived from Gross Floor Area (GFA) from proposed employment developments)
- Retail floor space by GFA and retail type
- Education places for primary, secondary and tertiary levels

NSMM transport model trip rates will be applied to the future year planning data in order to derive forecast year person production and attraction trip ends segemented by modelled period, journey purpose, car ownership and household type.

The change in the synthetic matrices will be added to the base matrix and constrained to NTEM growth as outlined in Section 3. Table 4-3 shows the uncertainty log for the planning data

*Table 4-3: Uncertainty log for planning data*

| Land-Use by Local Authority Area | Completed by 2022 | |
|---|---|---|
| | More Than Likely | Near Certain |
| **Employment (Numbers of Jobs)** | | |
| **Newcastle-under-Lyme** | -642 | 613 |
| **Stoke-on-Trent** | 517 | 13,409 |
| **Residential (Numbers of Households)** | | |
| **Newcastle-under-Lyme** | 515 | 2,467 |
| **Stoke-on-Trent** | 708 | 3,846 |
| **Retail (GFA m$^2$)** | | |
| **Newcastle-under-Lyme** | -107 | -790 |
| **Stoke-on-Trent** | -1,785 | 44,364 |
| **Education (Numbers of Student Places)** | | |
| **Newcastle-under-Lyme** | 0 | 0 |
| **Stoke-on-Trent** | 0 | 1,350 |

## 4.3 Future year transport supply assumptions

The proposed schemes identified for the future year Reference Case scenarios are shown in Table 4-4.

*Table 4-4: Future year Reference Case transport schemes*

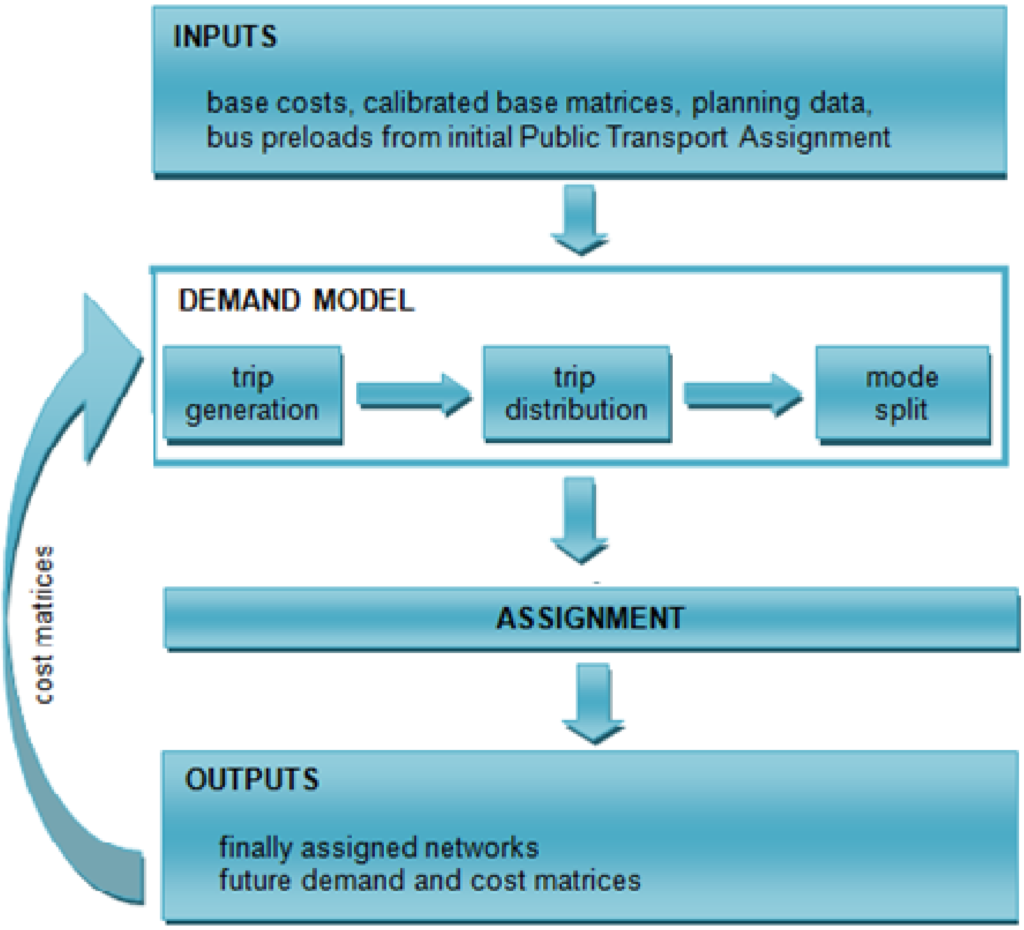
| Scheme No. | Scheme Name | Uncertainty Level |
|---|---|---|
| 1 | M6 J16 Improvements | Completed |
| 2 | A520 Weston Road/Weston Coyney Road Junction Improvement | Completed |
| 3 | Knutton Lane Road Safety Scheme | Completed |
| 4 | A5007 City Roa /Glebedale Road Junction Improvement | Completed |
| 5 | A50 Safety Schemes | Completed |
| 6 | A5006 Broad Street/A5010 Marsh Street Junction Improvement | Completed |
| 7 | A5010 Marsh Street/Trinity Street Improvements | Completed |
| 8 | A53 Etruria Road/Festival Way Roundabout Improvement - Removal of Bus Lane | Completed |
| 9 | Chatterley Valley Sustainable Transport Package | Near Certain |
| 10 | Unity Walk/City Centre Network Changes | Near Certain |
| 11 | A500 Widening (Porthill to Wolstanton) | Near Certain |
| 12 | A34 London Road – Removal of On-Street Parking and Reduction in Speed Limit | Near Certain |
| 13 | Newcastle-under Lyme Ring Road – Reduction in Speed Limit | Near Certain |
| 14 | A50 Kidsgrove Traffic Management Scheme | Near Certain |
| 15 | A50 Waterloo Road/A53 Cobridge Road (Cobridge Traffic Lights) Junction Improvement | Near Certain |
| 16 | A5007 Uttoxeter Road/Meir Hay Road Junction Improvement | Near Certain |
| 17 | A500/A52 City Road Junction Improvement | Near Certain |
| 18 | A52 Leek Road/Station Road Junction Improvement | Near Certain |
| 19 | A50 Waterloo Road – Removal of Bus Lane | Near Certain |
| 20 | Sutherland Road/Weston Coyney Road Junction Improvement | Near Certain |
| 21 | A53 Etruria Road Corridor Euro 6 Bus Retrofit | Near Certain |
| 22 | Etruria Valley Link Project Road | More than Likely |
| 23 | A50 Victoria Road/A52 Leek Road (Joiners Square) Junction Improvement | More Than Likely |
| 24 | A5008 Bucknall New Road Widening | More Than Likely |

# 5 Travel cost assumptions

## 5.1 NSMM demand model form

The basic structure of the NSMM demand model is shown diagrammatically in Figure 5-1 and covers trip generation, trip distribution and modal split responses. It is an absolute model applied incrementally in that the absolute change between the base and future synthetic trip matrices are added to the calibrated base trip matrices. Any resultant negatives, following the addition of the absolute change to the calibrated base trip matrices, are redistributed at sector level. This is as described in section 4.3.6 of TAG Unit M2 – Variable Demand Modelling.

*Figure 5-1: Demand model structure*



### 5.2 Derivation of costs

In the demand model, for person trips by private transport the initial composite cost matrix is produced as follows:

1. Private transport cost skims (in minutes) are taken from the appropriate calibrated model run
2. For home-based trips these matrices are partially transposed
3. Parking and other charges are converted to costs in minutes (i.e. CAZ charge)
4. Three separate values of time based on the TAG Databook are calculated for the following trip purposes:
    - home based work trips
    - home based education, shopping and other and non-home based other
    - non-home based – employer's business

   For the purposes for modelling a charging CAZ further income segmentation will be derived based on the number of people employed in each household, as outlined in chapter 3. Different values of time will be applied for each income category to reflect different levels of responsiveness to different charging levels.

5. Production (or origin for non-home based) end walk times are added on as are attraction (or destination) end search and walk times and parking costs (i.e. parking fares) in minutes. To be comparable with public transport fares the parking/other costs used are half of the anticipated actual costs.
6. Intra-zonal costs are set to the lowest inter-zonal cost multiplied by 0.5

After the first run through of the demand model the input cost matrices used are those calculated from the integral assignment.

For person trips by public transport the initial composite cost matrix is produced in a similar fashion as follows:

1. Public transport total trip time (walk time + ride time), wait time and fare cost skims are taken from the appropriate model run
2. All time-based costs are summed to a single total
3. For home-based trips time based and cost-based matrices are partially transposed
4. Fares are converted to costs in minutes
5. As previously, three separate values of time are used
    - Home based work trips
    - Home based education, shopping and other and non-home based other
    - Non-home based – employer's business
6. Fares (in minutes) are added to the time-based costs to give a total time-based cost
7. Intra-zonal costs are set to the lowest inter-zonal cost multiplied by 0.5

Again, after the first run through of the demand model the input cost matrices used are those calculated from the integral assignment.

For goods vehicles the process is simpler as they are assumed not to experience complications caused by a requirement to park at a distance from their destination and there is no mode choice and therefore no requirement for calculation of the composite cost. The goods vehicle cost matrices are calculated as follows:

1. Goods vehicle cost skims (in minutes) are taken from the appropriate model run. These would include any CAZ charge specific to goods vehicle, which will be skimmed from the network and added to the generalised cost.
2. The mean value of the LGV and HGV cost skims is taken
3. Intra-zonal costs are set to the lowest inter-zonal cost multiplied by 0.5

It should be noted that the demand model excludes any cost damping.

# 6 Methodology on option testing

## 6.1 Options

The Strategic Outline Case (SOC) shortlisted several options for an air quality plan for North Staffordshire, namely:

1. Etruria Valley Link Road and A500 improvement plus council boundary scale low emission strategy
2. A city centre/A53 traffic management scheme plus council boundary scale low emission strategy
3. A city centre/A53 workplace parking levy plus council boundary scale low emission strategy
4. A conurbation wide workplace parking levy plus council boundary scale low emission strategy
5. A city centre/A53 chargeable access restriction (Class A, B, C or D) – an assessment of each of the 4 CAZ categories

It should be noted that since the SOC, the EVLRs status has become more certain and it is now considered appropriate for its inclusion in the future year Reference Case rather than being treated as an option.

The following policies, some of which form the low emissions strategy, will therefore need to be taken account of in the transport modelling:

- Highway improvements
- Traffic management measures
- Travel planning
- Workplace parking levy (both for a city centre and council boundary wide)
- Bus strategy
- Taxi policies
- Different types, charge levels and boundaries for a charging CAZ

For reference the different CAZ types are defined in Table 6-1.

*Table 6-1: Clean air zone types*

| Class | Vehicles Affected |
|---|---|
| **Class A** | Buses, coaches, taxis and private hire vehicles |
| **Class B** | Buses, coaches, taxis and private hire vehicles, HGVs |
| **Class C** | Buses, coaches, taxis and private hire vehicles, HGVs, LGVs |
| **Class D** | Buses, coaches, taxis and private hire vehicles, HGVs, LGVs, Cars |

### 6.2 Behavioural responses to CAZ

Regarding a charging CAZ, the NSMM transport model will be adapted to ensure it can model all the possible demand responses to trips entering, travelling within or routeing through a CAZ. This will include undertaking some sensitivity testing to sense check the demand responses when applying different daily CAZ charges by vehicle type. The demand responses and the methodology for modelling them are outlined in Table 6-2. Please note the table does not provide a hierarchy of response but just outlines the different demand responses which will need to be captured in the updated NSMM transport model.

*Table 6-2: CAZ demand responses*

| Response | Demand Response to CAZ | Methodology |
|---|---|---|
| **1** | Replacing or upgrading vehicle | Choice modelling will be applied as outlined in section 7, using SP data to ascertain the likelihood of non-compliant car, taxis, LGV and HGV users that travel through, within or to and from the CAZ to upgrade their vehicle to a compliant one. This choice modelling for non-compliant cars will be undertaken using income segmentation making use of the socio-economic categories which will permit a calculation of the proportion of households in different income categories based on the number of people in employment. |
| **2** | Cancelling trip | A multinomial choice model will derive the percentage of non-compliant car demand by income category that cancel their trip for cars, this will also be undertaken for taxis, LGVs and HGVs that travel through, within or to and from the CAZ. These trips will be removed from the final assigned matrices. |
| **3** | Change of destination | A multinomial choice model will derive the percentage of non-compliant car demand by income category with a destination in the CAZ (but an origin outside). These trips will then be redistributed to non-CAZ destinations. LGVs, HGVs and taxis will be excluded from this demand response as they don't have a choice to change their destination as their delivery/customer destinations would be fixed irrespective of a CAZ charge. |

| | | |
|---|---|---|
| **4** | Modal shift | A multinomial choice model will derive the percentage of demand by income category that change mode from the car, for non-compliant car trips that travel through, within or to and from the CAZ.<br>Given the locations of exceedances (on busy roads in narrow corridors with a lack of space for cycle lanes for example) widescale active travel measures have not formed part of the Preferred Option or other options, beyond improvements to pedestrian crossing facilities on the A53. The NSMM transport model does not explicitly model walking and cycling trips, given the above, such measures have not been assessed, |
| **5** | Change route to avoid CAZ | A multiple select link analysis will be undertaken on the 2022 Reference Case at the inbound cordon locations to the CAZ. Non-compliant cars, LGVs and HGVs select link matrices will be filtered to identify through trips only, external to the CAZ.<br>A multinomial choice model for non-compliant cars, LGVs and HGVs will derive the percentage of these through trips that would re-route to avoid the CAZ.<br>The NSMM assignment model will allow for a single cordon CAZ charge affecting trips currently routing through the CAZ and therefore reassigning some through demand onto more attractive (non -charged) routes. This will be represented on the network by having a CAZ charge on a cordon of links forming the charging zone for inbound links which will be picked up by the model and allowed for in the generalised cost for the routing assignment. The charge on each charging link will be modally consistent however will be permitted to differ for cars, LGVs and HGVs as appropriate. Sense checks will be undertaken on the level of reassignment. |
| **6** | Pay the CAZ charge | Following the above demand responses, the remaining car, taxi, LGV and HGV trips that start or end their journey in the CAZ or go through it will continue to do so (but pay a daily charge). Modelling responsiveness and payment of CAZ charging will use income segmentation derived from the socio-economic groupings.<br>Those cars, taxis, LGVs and HGVs paying the charge as derived from the multinomial model and SP analysis will be segmented and assigned to the network separately.<br>CAZ revenue will be separately derived through looking at the pay CAZ charge matrices output from the model for each time period but removing reverse trips to ensure only one charge is paid over the day, this revenue with then be annualised using appropriate factors to convert to 365 days. |

## 6.3 Behavioural responses to other measures

Table 6-3 provides an outline of how alternative policy measures to a charging CAZ would be modelled.

*Table 6-3: modelling of alternative policy measures*

| Policy | Methodology |
|---|---|
| **Highway Improvements** | New highway schemes will be coded into the highway model and run through the NSMM demand model to understand the likely trip redistribution and re-assignment effects |
| **Traffic Management** | Banned turns, one-way links and other traffic management measures will be coded into the highway model and run through the NSMM demand model to understand the likely trip redistribution and re-assignment |
| **Travel Planning** | A percentage reduction to car trips will be applied on corridors or areas where travel planning would be implemented based on an agreed reduction with JAQU. |
| **Workplace parking levy** | A Select link analysis on the 2022 Reference Case was conducted to establish demand for routes that go into the central parking areas of Etruria, Newcastle-under-Lyme and Hanley. These are potential locations where a Workplace Parking Levy (WPL) could be introduced. The select link matrices were filtered to focus on only home to work non-compliant car trips to those parking zones, with non-work and through trips excluded. Assumptions regarding the excluded parking, the ratio of public and private spaces, the percentage of WPL spaces that will get paid by the employer and how much will be passed onto the employee were applied from the existing Nottingham WPL example. From analysis, the actual demand for non-compliant commuting cars that would be parking in these zones would be very small especially when allowed for the spatial restrictions of the policy, the balance between private/parking spacing and the percentage of spaces that the employer rather than the employee would pay. The overall impact would be small and therefore it is was not worth undertaking further detailed modelling or appraisal as part of the option testing. The analysis is detailed in a separate technical note which is appended to the strategic case. |
| **Bus strategy** | The NSMM public transport model includes all bus services in North Staffordshire, possible measures such as new or more frequent services or bus priority can be explicitly modelled to capture mode shift and forecast changes in outturn bus and passenger kilometres/hours. |
| **Taxi policies** | A taxi matrix will be segmented from the car matrix using the ANPR survey data proportions. It should be noted that the proportion of total traffic that are taxis in North Staffordshire is quite low. The segmentation is required in order to assess any charging CAZ for type A to C |

Scenario and sensitivity tests can be conducted on the above, with the analysis of specific origin-destination movements, to compare the demand responsiveness to measures against what has been observed elsewhere, as part of a benchmarking exercise.

# 7 Methodology for stated preference

## 7.1 Overview

In order to understand the demand responses to a charging CAZ in North Staffordshire we undertook a local SP survey. Sweco, the local authorities and JAQU worked together to devise the SP surveys. JAQU provided SP questionnaires used for Bradford and Bath as a useful reference for the SP questionnaire design.

## 7.2 North Staffordshire stated preference survey implementation

Sweco appointed Watermelon to undertake an SP survey in Autumn 2019 of the North Staffordshire public, businesses and taxi firms about how they would respond to a charging CAZ. The following SP surveys were undertaken in North Staffordshire:

1. A SP questionnaire focussed on car and LGV drivers for residents including how they would respond to a charging clean air zone of different charge levels, how they might trade off different charging levels with different vehicle upgrade costs. The Bradford approach has been followed by splitting LGVs into small and medium enterprises (SMEs)/services and large delivery companies given the different behavioural responses.
2. A SP questionnaire focussed on HGV and LGV drivers targeting businesses looking at demand responses for different CAZ charges. Drivers are often the decision makers for service vans while businesses decide on their LGV fleets (see #2 below for the SP survey of this market).
3. A SP questionnaire focussed on taxis targeting taxi drivers and asking how they would respond to different charge levels, including paying a charge and trading off vehicle upgrade cost with CAZ charge costs.

The SP surveys described above captured the following demand responses to a charging CAZ by vehicle type:

Cars:

- Change route
- Change destination
- Pay charge
- Cancel trip
- Change mode
- Upgrade vehicle
- Switch vehicle

LGVs/HGVs:

- Change route
- Pay charge
- Cancel trip

- Relocated business
- Upgrade vehicle
- Switch vehicle

Taxis:

- Cancel trip/stop operating
- Upgrade vehicle
- Switch vehicle

Due to time constraints, the SP surveys did not consider different size charging zones however people's response should not change significantly. The model will capture the impact of different sized charging zones in terms of the amount of demand going to, from, within, through or across the cordon for different sizes charging areas. The percentage demand responses will be constant unless the actual charge changes for any or all the vehicle types. This is the same approach as undertaken by Bradford and Bath and detailed in their SP surveys provided by JAQU.

A separate (non-SP) discussion was had with the main bus operators of North Staffordshire including First and D&G regarding their likely response to a charging CAZ in general, to different charging types and levels and the cost and likelihood of them upgrading their vehicles.

When conducting the SP surveys, several screening questions will be asked based on the participant's previous journey to the proposed CAZ area, whether the participant could drive and that they had a non-compliant vehicle.

A mixture of the following survey methods will be used:

- Face to face interviews
- Online surveys
- Telephone interviews

The face to face surveys, which will take between 10 to 20 minutes will be undertaken at identified strategic locations within the study area such as town and city centres and retail parks where there is a high footfall.

The taxi driver face to face surveys will be undertaken at the Newcastle-under-Lyme depot and Hanley Town Hall where taxi drivers obtain their licenses. In addition, we will make use of the regular trade association meetings too.

For the online panel surveys, respondents will be recruited using an online market research panel, which utilises members of the public who have signed up to undertake such surveys online. Respondents will be identified based on their location, demographic, behavioural and vehicle ownership details which enables a broad and comprehensive sample. For this survey, a representative sample of the population based on 2011 census data using age, gender and location will be contacted and invited to participate.

Prior to the telephone interview which would primarily focus on local businesses the survey company will undertake an investigation of local businesses identifying offices within or near the study area, or businesses that might feasibly travel through the study area.

A target sample of 475 responses across all three surveys for the above is considered appropriate for this study to obtain statistically significant outputs. In addition to the total sample target, percentage quotas by origin location based on demand analysis from the NSMM transport model will be also used. It should be noted that each survey elicits multiple responses.

### 7.3 Incorporation into the NSMM demand model

The following process will be adopted once the raw SP data for North Staffordshire has been collected:

- **Sense checking** – logic checks will be undertaken on responses as well as checks to ensure participants are making trade-offs rather than always selecting one outcome. Non-sensical responses where a respondent would be willing to pay a charge at a higher level but not a lower one, will be removed.
- **Segmentation** – the results will be segmented by income group. The groupings will be in accordance with TAG's corresponding annual household income bands, namely:
  - £0 - £20,000
  - £20,000 – £45,000
  - £45,000 +
- **Factoring** – we will review the results to the CAZ charging question including looking at factoring the reported trip frequency
- **Weighting** – we will review the SP responses to assess whether the sample will be weighted by trip purpose (including frequency), respondent age and fuel type. Any assessment and weighting will draw on the ANPR survey results and census household income distributions.

Statistical significance tests on variables will be undertaken coupled with the regression described above in order to derive the percentages of demand for each demand response and to ensure that only significant factors have been considered.

A comparison of the coefficients and outturn forecasts from the North Staffordshire SP survey analysis will be made with the data from other UK cities.

After this analysis, logistic regression will be applied to the SP data to derive the coefficients for a choice model to forecast the likely trade-off between the CAZ charge and the cost to replace the vehicle to a compliant one. This will permit a prediction of the compliance rate for any given charge. A multinomial logistic regression will also be undertaken accounting for household income categories, to derive the percentages of demand into the different responses such as cancel trip, change mode, re-route, change destination, pay charge and replace vehicle.

In addition to the above primary behavioural responses, JAQU have produce guidance on secondary responses to a charging CAZ which we have incorporated into our work.

For the upgrade vehicle behavioural response, the following has been assumed:

- 75% of these respondents will replace their non-compliant vehicle with a second-hand compliant vehicle
- 25% will scrap their vehicle and buy a new one of the same fuel-type
- For car owners, 75% of those replacing will purchase the cheapest compliant vehicle (so diesel will switch to petrol) while the remainder will stay with the same fuel type. For non-car owners there are limited alternatives, so this assumption does not apply.

# 8 Traffic model outputs for use in air quality modelling

## 8.1 Traffic model outputs

Traffic flow information will be output from the updated NSMM model for the following modelled years and scenarios:

1. 2015 Base Year – which count analysis and validation shows represent 2018
2. 2022 Reference Case
3. 2022 Do Something (DS) scenarios – see section 6
4. 2025 Reference Case
5. 2025 Do Something (DS) scenarios – see section 6

Traffic flow and speed information by cars, LGVs, HGVs and taxis for polluting and non-polluting vehicles can be extracted as well as further information on bus and coach vehicles.

The traffic data will be processed as 1-way links with allowance for junction delays.Traffic flows will be provided in units of vehicles and speeds in units of kph.

Factors will be applied using local traffic count data to convert from the model period traffic flows to daily flows.

Junction delays will need to be included in addition to link speeds and again consideration will be needed regarding the averaging of one-way or two-way link speeds and how these are converted to daily speeds.

## 8.2 Traffic data for air quality model

The following information will be provided from the NSMM transport model for use in the air quality model (RapidAir):

**Traffic flows**, the emission factor toolkit uses traffic flows split into the following vehicle subcategories:

- Petrol Cars (split post assignment using the ANPR data)
- Diesel Cars (split post assignment using the ANPR data)
- LGVs
- Rigid HGVs – HGV flow split applied post assignment based on an observed split
- Articulated HGVs - HGV flow split applied post assignment based on an observed split
- Buses
- Coaches
- Taxis
- Motorcycles – using a percentage uplift on total flows based on an observed split

Analysis of 2015 and 2018 traffic count data on the A500 screenline shows zero net traffic growth, the 2015 base year disaggregated traffic model flows can therefore be used to represent the 2018 base year for the air quality modelling work.

Hourly traffic profiles on a by-road or regional basis based on local traffic count profiles.

**Traffic Speed:**

- AM average speed
- IP average speed
- PM average speed
- Daily average speed

**Congestion:**

- Queue length from junctions, using an assumed average vehicle length
- Assumptions will need to be made around idling times and the number of lanes queuing on each link

**Vehicle fleet data (following assimilation of ANPR data):**

- Euro split for each vehicle type and by road (split post assignment)
- Fuel split by vehicle type (split post assignment)

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 27 - T4 Local Plan Traffic Forecasting Report

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

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# Executive Summary

The North Staffordshire Multi-Modal (NSMM) transport model has been updated and refined to provide an appropriate analytical tool that will aid Newcastle-under-Lyme Borough Council (NuLBC), Stoke-on-Trent City Council (SoTCC) and Staffordshire County Council (SCC) in the development and implementation of an Air Quality Local Plan. The need to develop a Local Plan comes as a direct result from a High Court ruling, where ministers were required to set out any additional steps that could be taken by the councils to speed up compliance with the $NO_2$ limits, which have been exceeded since 2010.

The NSMM transport model has been validated against extensive observed traffic data as described in the T2 - Local Plan Transport Model Validation Report with the methodology used to develop the transport model appropriately described in the T3 - Local Plan Transport Modelling Methodology Report.

This T4 - Local Plan Traffic Forecasting Report describes the application of the NSMM transport model to derive appropriate Reference Case forecast traffic information which will be used to inform the development of an air quality model, identify appropriate air quality initiatives and the subsequent appraisal of the Local Plan. These traffic forecasts will also be used to inform the benchmarking of the Local Plan against a charging Clean Air Zone (CAZ) type D. The development and application of the NSMM transport model has been carried out in accordance with the Department for Transport (DfT) TAG guidance and additional guidance issued by the Joint Air Quality Unit (JAQU).

The NSMM transport model has been used to derive traffic forecasts for a future year of 2022, the year by which compliance with air quality targets is expected to be achieved. The traffic forecasts take account of all committed transport schemes and land-uses developments which are expected to be implemented by 2022. The results of the traffic forecasting work carried out as part of the option and scenario testing work to develop and identify the preferred Air Quality Local Plan are detailed in this report.

Traffic forecasts for a second future year of 2025 have also been produced, this will be used to inform the economic assessment and wider appraisal of the Local Plan and a charging CAZ. The assumptions made in the derivation of the forecast 2025 traffic data are detailed in this report.

In summary, it has been demonstrated that the NSMM transport model is a robust tool for the purpose of deriving forecast traffic data to develop and assess the impact of an Air Quality Local Plan and comparison against a charging CAZ.

# 1 Introduction

## 1.1 Purpose of the Traffic Forecasting Report

The purpose of the Traffic Forecasting Report (TFR) is to detail the methodologies and assumptions used to produce traffic forecasts to inform the air quality modelling work and subsequent identification, development and appraisal of an appropriate Air Quality Local Plan.

It also demonstrates that the forecasts have been produced in accordance with guidance given by the DfT in TAG and additional guidance provided by the JACU.

This report forms part of a series of modelling documentation that includes:

- T1 - Tracker Table - a live document that demonstrates all the transport modelling requirements have been met.
- T2 - Local Plan Transport Model Validation Report – which demonstrates that the NSMM transport model accurately represents existing traffic conditions.
- T3 - Local Plan Transport Modelling Methodology Report – which outlines the methodology of the transport modelling work undertaken.

## 1.2 Scheme background

The need to develop options to improve $NO_2$ levels within Stoke-on-Trent and Newcastle-under-Lyme, comes as a result of the UK's Plan for Tackling Roadside Nitrogen Dioxide Concentrations. In October 2018, Stoke-on-Trent and Newcastle-under-Lyme were identified by Government as two areas in which $NO_2$ levels exceed EU regulations. These two authorities, alongside SCC (the County being the Highway Authority for the highway network in Newcastle-under-Lyme), are to produce an Air Quality Local Plan which will address these $NO_2$ exceedances in the shortest timeframe possible. The Government will work with the Authorities through its JAQU to support and develop their plans to reduce $NO_2$ emissions.

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# 2 Overview of the NSMM transport model

## 2.1 Purpose of the NSMM transport model

The NSMM transport model has been created in order to allow the impact of proposed land-use and infrastructure improvements to be forecast. The transport model has been developed in accordance with appropriate TAG guidance and is an appropriate tool to be used to inform the development, appraisal and implementation of an Air Quality Local Plan.

## 2.2 Extent of the NSMM transport model

The NSMM transport model has been developed entirely in CUBE Voyager and covers the whole of the urban areas of Stoke-on-Trent and Newcastle-Under-Lyme with both road and rail links modelled.

The transport model consists of the following three main modules:

- Highway Assignment Model
- Public Transport Assignment Model
- Variable Demand Model

The modelled time periods are as follows:

- AM Peak-Hour (08:00 - 09:00hrs)
- Inter-Peak Hour (14:00 - 15:00hrs)
- PM Peak-Hour (17:00 - 18:00hrs)

Figure 2-1 and Figure 2-2 show the extents of the modelled road and rail networks.

The transport model has 288 zones which are split as follows:

- Internal zones 1 – 207 and 275 – 288
- Peripheral zones 208 – 233
- Regional zones 234 – 255
- National zones 256 – 274

The Internal zones and modelled transport network represent the greatest level of detail in order to capture local routeing and travel demand responses. The Peripheral zones form a ring of buffer zones just outside the detailed modelled area, with a dimension a little larger than the internal zones in order to provide realistic travel demand to and from these areas.

The Regional and National zones are far coarser, for example Scotland is represented by a single zone, and this permits the representation of destination choice and travel opportunities between external zones and between internal and external zones. Capturing external to external demand is important in the NSMM transport model area, as it includes roads carrying significant through traffic such as the M6, A50 and A500 Trunk Roads.

Further details on the scope, specification and development of the NSMM transport model are detailed in the T2 - Local Plan Transport Model Validation Report and T3 - Local Plan Transport Modelling Methodology Report.

*Figure 2-1 : Extents of modelled road and rail networks*

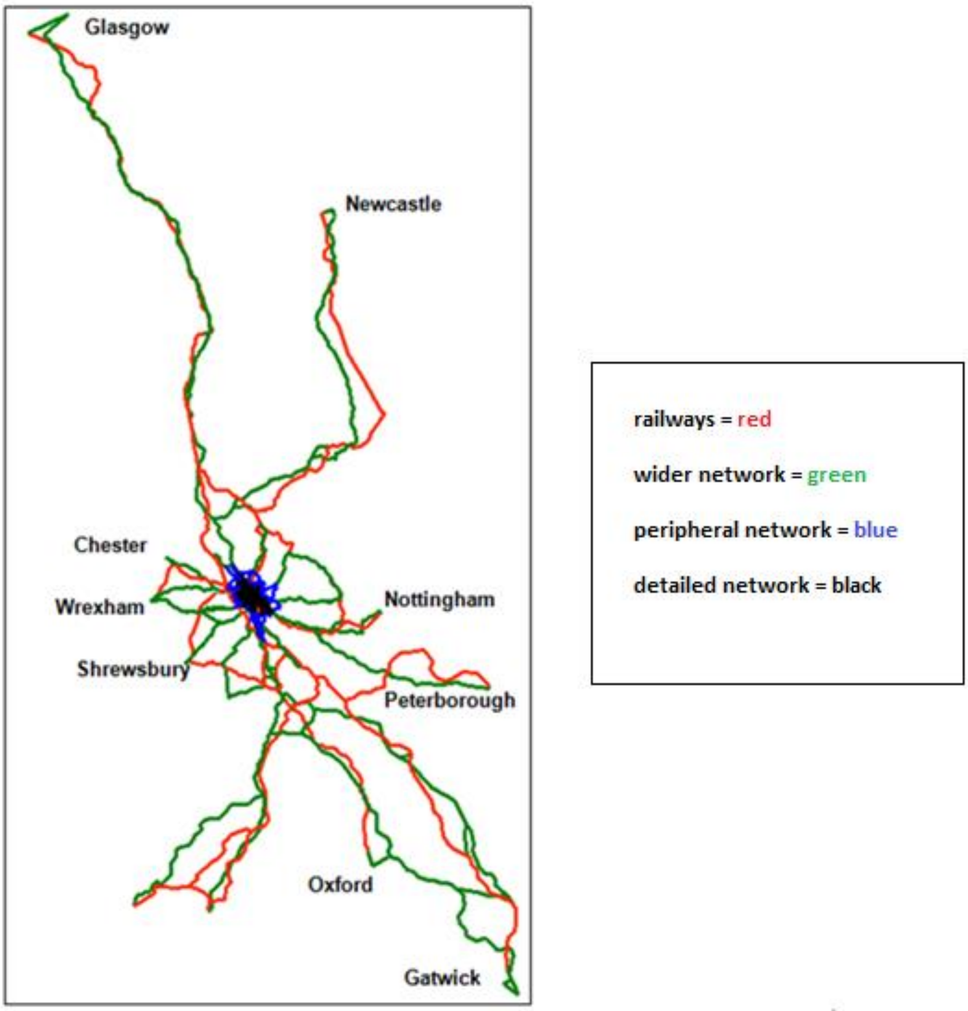
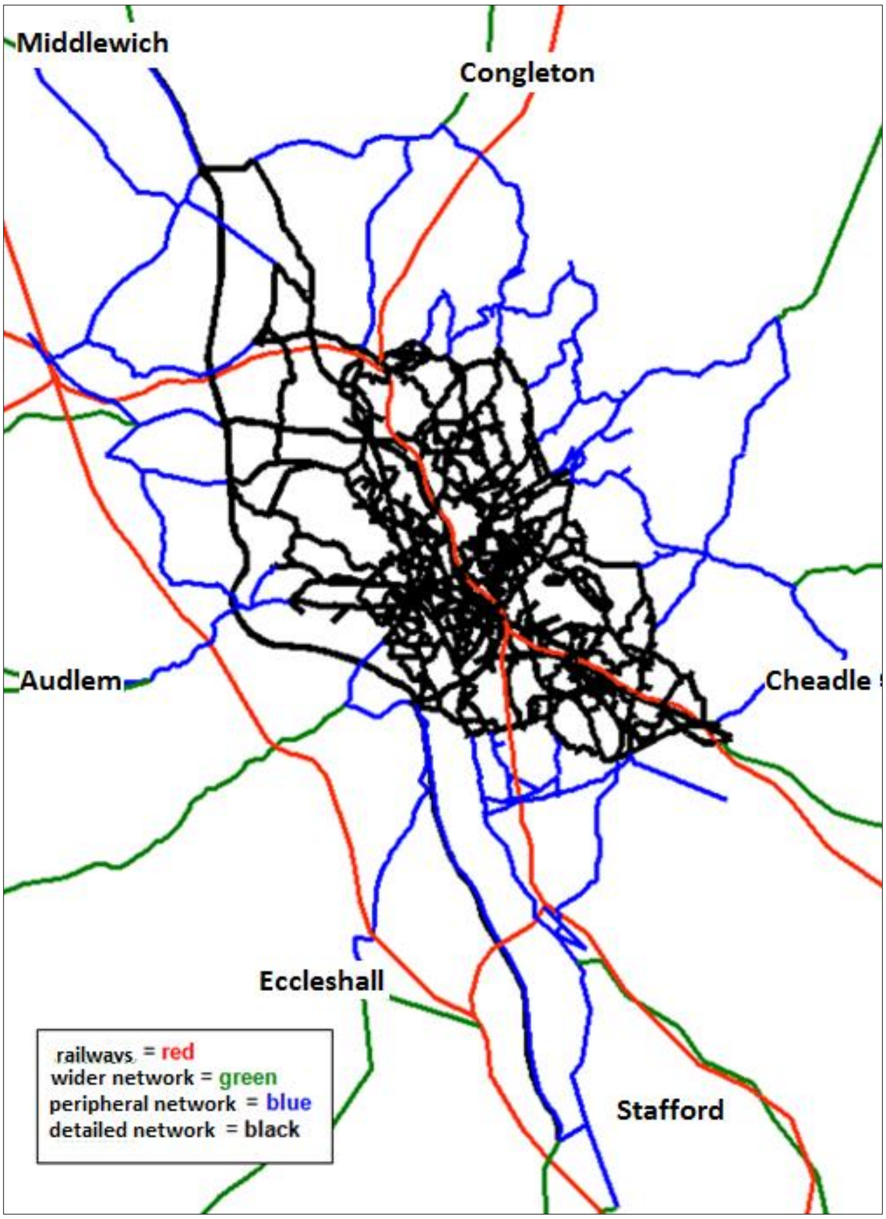


*Figure 2-2: Extents of modelled peripheral and internal road and rail networks*



## 2.3 Updated 2015 Base-Year model

The NSMM transport model has been updated from a 2009 base-year to a new base-year of 2015. The vehicle types represented by the transport model have also been disaggregated by compliant and non-compliant vehicles. The transport model has been validated against traffic counts at both a link and screenline level, observed journey time data and Automatic Number Plate Recognition (ANPR) data.

The results of the validation work are documented in the T2 - Local Plan Transport Model Validation Report. The updated and refined 2015 base-year NSMM transport model has been shown to be fit for purpose and ready to be taken forward for traffic forecasting and the development and appraisal of the required Air Quality Local Plan.

# 3 Forecasting approach

## 3.1 Overview of approach

Traffic forecasts using the NSMM transport model have been produced for the AM Peak-Hour, Inter-Peak Hour and PM Peak-Hour modelled time periods for the following forecast years:

- 2022 – The year by which compliance should be achieved.
- 2025 – Required for the extrapolation of benefits for the economic and environmental appraisal of the Air Quality Local Plan.

In accordance with Government guidance, the forecasting approach used involves three basic steps:

- Development of future year transport networks
- Derivation of future year travel demand
- Assignment of the future year travel demand to the future transport networks

## 3.2 Traffic forecasting guidance

The following TAG Units have been adhered to in the development of the required traffic forecasts:

- TAG Unit M2 – Variable Demand Modelling
- TAG Unit M4 – Forecasting and Uncertainty
- TAG Data Book (May 2019)

## 3.3 Uncertainty Log

The purpose of an uncertainty log is to identify all the local and external uncertainties and factors which could affect the traffic/patronage, revenues and delivery of scheme benefits. Typically, these factors include proposed land-use developments and transport infrastructure improvements.

An uncertainty log for the future year land-use developments and transport infrastructure improvements has been prepared using the uncertainty levels defined in Table 3-1. The modelled forecast Reference Case will include those developments and transport schemes which fall under the Near Certain and More Than Likely uncertainty levels, i.e. they are considered committed schemes in terms of having planning permission and available funding, which is consistent with the core scenario defined in TAG Unit M4 – Forecasting and Uncertainty.

All the proposed highway and public transport schemes which have been identified in the uncertainty log are described further in Chapter 4. Details of the future year land-use developments contained in the uncertainty log and how they have been converted into trips for inclusion in the forecast trip matrices are detailed in Chapter 5.

*Table 3-1: Uncertainty level definition and categorisation for proposed land-use developments and proposed transport infrastructure improvements*

| Uncertainty Level | Probability | Status | Reference Case |
|---|---|---|---|
| Completed | Happened | Built/open. | ✓ |
| Near Certain | The outcome will happen or there is a high probability that it will happen | Intent announced by proponent to regulatory agencies.<br>Approved development proposals.<br>Projects under construction. | ✓ |
| More Than Likely | The outcome is likely to happen but there is some uncertainty | Submission of planning or consent application imminent.<br>Development application within the consent process. | ✓ |
| Reasonably Foreseeable | The outcome may happen but there is significant uncertainty | Identified within a development plan.<br>Not directly associated with the transport strategy/scheme but may occur if the strategy/scheme is implemented.<br>Development conditional upon a transport scheme proceeding.<br>Or, a committed policy goal, subject to tests (e.g. of deliverability) whose outcomes are subject to significant uncertainty. | |
| Hypothetical | There is considerable uncertainty whether the outcome will ever happen | Conjecture based on currently available information.<br>Discussed on a conceptual basis.<br>One of a number of possible inputs in an initial consultation process.<br>Or, a policy aspiration. | |

### 3.4 Sensitivity tests

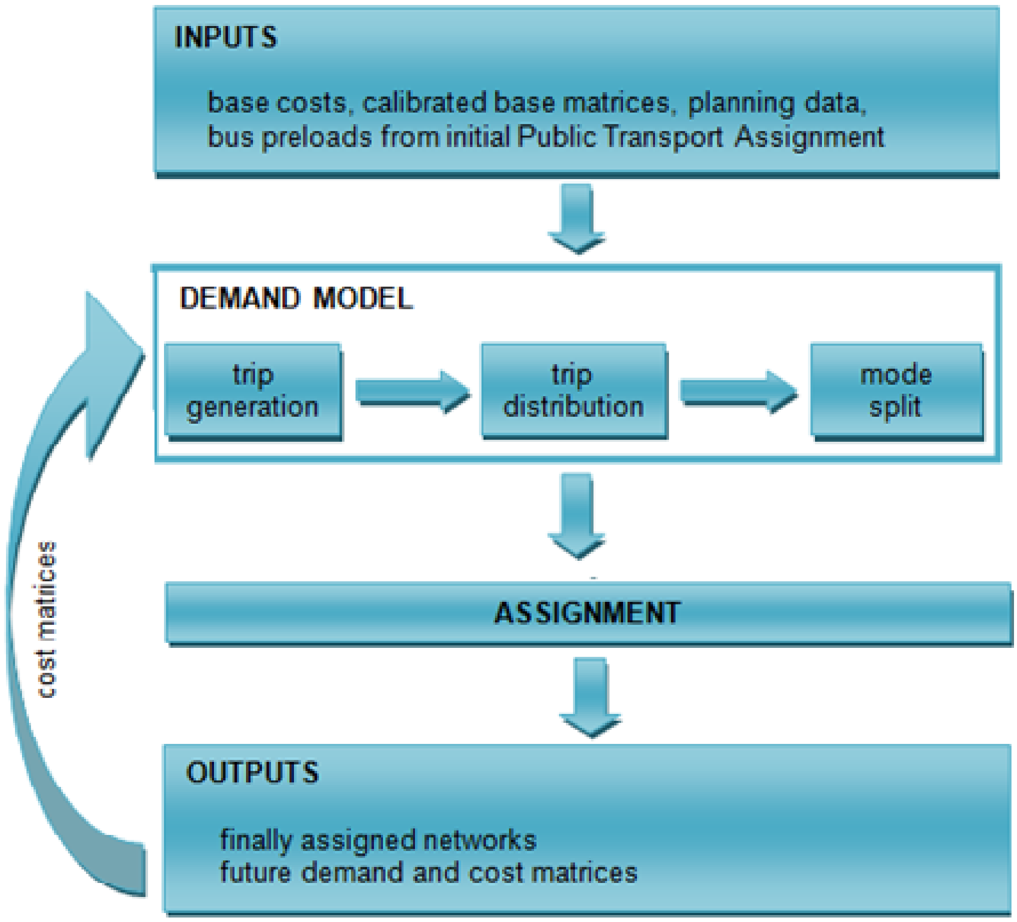
Appropriate sensitivity tests will be carried out on key assumptions made in the application of the Reference Case transport model to test any uncertainties in predicted outcomes. For example, with regards to the modelling of a charging CAZ, sensitivity tests will be undertaken on different charging levels and assumptions regarding the responses of vehicle upgrades.

### 3.5 NSMM demand model

Variable Demand Modelling (VDM) captures the principle that travel demand will be affected by proposed transport schemes. Demand model runs have therefore been undertaken for each scenario, forecast year and modelled time period to produce future year synthetic demand trip matrices.

The basic structure of the NSMM demand model is shown diagrammatically in Figure 3-1 and covers trip generation, trip distribution and modal split responses.

*Figure 3-1: Demand model structure*



Home based car and public transport trips are segmented as follows in the demand model:

- Six socio-economic groupings (HH1 to HH6)
- Three car ownership categories (0, 1, 2 or more)
- Four trip purposes:
    - home based work (HBW)
    - home based education (HBE)
    - home based shopping (HBS)
    - home based other (HBO)

This gives a total of 72 home based demand segments.

Non-home-based car and public transport trips are divided into two segments:

- Non-home based (employer's business) (NHBEB)
- Non-home based (other) (NHBO)

Goods vehicle trips are divided into two segments:

- Non-home based LGV trips
- Non-home-based HGV trips

The NSMM transport model is an incremental demand model using an additive approach, therefore the difference between the 2015 base-year and future year synthetic car trip matrices are applied to the 2015 validated car trip matrices to produce forecast car trip matrices. The resultant car trip matrices are subsequently constrained to NTEM traffic forecasts and assigned to the corresponding future year highway network.

Similarly, the future year synthetic LGV and HGV trip matrices derived from the demand model will be constrained to NTM growth. The difference between the 2015 base-year and constrained future year synthetic goods vehicle trip matrices are then applied to the validated 2015 goods vehicle trip matrices to create future year trip matrices and assigned to the corresponding future year highway network.

Further information on the scope, specification and calibration of the NSMM demand model can be found in the T2 - Local Plan Transport Model Validation Report and T3 - Local Plan Transport Modelling Methodology Report.

# 4 Forecast network development

## 4.1 Overview of approach

For the testing, appraisal and development of an Air Quality Local Plan and its subsequent economic and environmental appraisal, appropriate comparisons will be made between the traffic forecasts without and with the proposed mitigation measures. Thus, a Do-Minimum and Do-Something transport network will be prepared for each modelled scenario and forecast year.

The Do-Minimum (or Reference Case) transport network is based on the validated base-year network and includes those proposed transport schemes that are expected to be implemented by the forecast year.

The Do-Something transport networks are based on the Do-Minimum network. However, they will include the proposed mitigation measures to be tested and appraised to inform the development of the Air Quality Local Plan. These mitigations measures, modelled scenarios and resultant traffic forecasts will be reported in an updated version of this report.

## 4.2 Reference Case transport schemes

The proposed transport schemes identified for inclusion in the 2022 and 2025 Reference Cases have been allocated an uncertainty level as defined in Chapter 4 and are detailed in Table 4-1:

For the 2022 Reference Case, buses on routes 3, 3A, 4, 4A, 21 and 23 which use the A53 Etruria Road corridor will be retrofitted to make them compliant to Euro 6 standards. Furthermore, buses on other routes will be expected to achieve 49% compliance in accordance with the EFT. Therefore, the proportions of buses on other routes in the NSMM transport model have been appropriately adjusted to meet this compliance rate.

*Table 4-1: 2022 and 2025 Reference Case transport schemes*

| Scheme No. | Scheme Name | Uncertainty Level |
|---|---|---|
| 1 | M6 J16 Improvements | Completed |
| 2 | A520 Weston Road/Weston Coyney Road Junction Improvement | Completed |
| 3 | Knutton Lane Road Safety Scheme | Completed |
| 4 | A5007 City Road/Glebedale Road Junction Improvement | Completed |
| 5 | A50 Safety Schemes | Completed |
| 6 | A5006 Broad Street/A5010 Marsh Street Junction Improvement | Completed |
| 7 | A5010 Marsh Street/Trinity Street Improvements | Completed |
| 8 | A53 Etruria Road/Festival Way Roundabout Improvement - Removal of Bus Lane | Completed |
| 9 | Chatterley Valley Sustainable Transport Package | Near Certain |
| 10 | Unity Walk/City Centre Network Changes | Near Certain |
| 11 | A500 Widening (Porthill to Wolstanton) | Near Certain |
| 12 | A34 London Road – Removal of On-Street Parking and Reduction in Speed Limit | Near Certain |
| 13 | Newcastle-under Lyme Ring Road – Reduction in Speed Limit | Near Certain |
| 14 | A50 Kidsgrove Traffic Management Scheme | Near Certain |
| 15 | A50 Waterloo Road/A53 Cobridge Road (Cobridge Traffic Lights) Junction Improvement | Near Certain |
| 16 | A5007 Uttoxeter Road/Meir Hay Road Junction Improvement | Near Certain |
| 17 | A500/A52 City Road Junction Improvement | Near Certain |
| 18 | A52 Leek Road/Station Road Junction Improvement | Near Certain |
| 19 | A50 Waterloo Road – Removal of Bus Lane | Near Certain |
| 20 | Sutherland Road/Weston Coyney Road Junction Improvement | Near Certain |
| 21 | A53 Etruria Road Corridor Euro 6 Bus Retrofit | Near Certain |
| 22 | Etruria Valley Link Road Project | Near Certain |
| 23 | A50 Victoria Road/A52 Leek Road (Joiners Square) Junction Improvement | More Than Likely |
| 24 | A5008 Bucknall New Road Widening | More Than Likely |

### 4.3 Forecast network calibration

The modelling of the proposed transport schemes has been based on appropriate scheme drawings and designs. The modelling of new highway links has been defined by the coding of appropriate link lengths, speed/flow curves (as specified by the attribution of appropriate link types), numbers of lanes and speed limits. The modelling of new junction layouts has been based on measured junction geometry in order to derive appropriate saturation flows. In particular, the modelling of new or improved signalised junctions has been validated to ensure that sensible phasing's, cycle times and inter-green times are achieved and result in appropriate delays.

The modelling of all new transport schemes has been appropriately reviewed and tested to ensure that the resultant changes in traffic flows and routeing of traffic are logical and robust.

# 5 Forecast trip matrix development

## 5.1 Overview of approach

Future year trip matrices will be produced for the Do-Minimum and Do-Something scenarios for each forecast year and modelled time period. The NSMM demand model will take account of the appropriate predicted changes in planning data and transport schemes.

As the NSMM transport model is incremental, the change in the predicted travel demand between the 2015 base-year synthetic trip matrices and the future year synthetic trip matrices will be constrained to the appropriate NTEM and NTM forecasts and additively applied to the 2015 validated assignment trip matrices to produce the required forecast trip matrices.

The scope and specification of the NSMM demand model is detailed further in T2 - Local Plan Transport Model Validation Report and T3 - Local Plan Transport Modelling Methodology Report. The development of the forecast trip matrices is discussed further below.

## 5.2 Future year planning data

To derive the forecast trip matrices, proposed changes in the following planning data (since the 2015 base-year of the NSMM transport model) have been collated for the Internal and Peripheral zones of the transport model:

- Numbers of households
- Numbers of jobs (derived from Gross Floor Area (GFA) for proposed employment developments)
- Retail floor space by GFA and the following retail types:
    - Food Store
    - Local Shops
    - Non-Food Retail
    - Shopping Mall
- Education places for primary, secondary and tertiary levels

For the purpose of deriving changes in numbers of jobs from the GFA, the employment density factors for each employment land-use shown in Table 5-1: were used.

Table 5-1: Employment densities (employment densities guide, 2nd edition, Drivers Jonas Deloitte, 2010)

| Use Class | Use Type | Area per Full Time Equivalent ($m^2$) |
|---|---|---|
| B1(a) | General Office | 12 |
| B1(a) | Call Centres | 8 |
| B1(a) | IT/Data Centres | 47 |
| B1(a) | Business Park | 10 |
| B1(a) | Serviced Office | 10 |
| B1(c) | Light Industrial (Business Park) | 47 |
| B2 | General Industrial | 36 |
| B8 | General Warehouse | 70 |
| B8 | Large Scale and High Bay Warehouse | 80 |

Table 5-2 summarises the uncertainty log for the changes in planning data between the 2015 base-year and the 2022 Reference Case and between the 2015 Base-Year and the 2025 Reference Case. The changes in planning data since the 2015 base-year has been mapped to the NSMM transport model zones using GIS software. Figure 5-1 to Figure 5-8 show the change in jobs, households and retail development between 2015 and the future modelled years.

*Table 5-2: Uncertainty log for planning data*

| Land-Use by Local Authority Area | Completed by 2022 | | Completed by 2025 | |
|---|---|---|---|---|
| | More Than Likely | Near Certain | More Than Likely | Near Certain |
| **Employment (Numbers of Jobs)** | | | | |
| **Newcastle-under-Lyme** | -642 | 613 | -596 | 2,883 |
| **Stoke-on-Trent** | 517 | 13,409 | 965 | 15,048 |
| **Residential (Numbers of Households)** | | | | |
| **Newcastle-under-Lyme** | 515 | 2,467 | 650 | 3,271 |
| **Stoke-on-Trent** | 708 | 3,846 | 2,004 | 4,361 |
| **Retail (GFA m$^2$)** | | | | |
| **Newcastle-under-Lyme** | -107 | -790 | 9,818 | 3,030 |
| **Stoke-on-Trent** | -1,785 | 44,364 | -175 | 49,123 |
| **Education (Numbers of Student Places)** | | | | |
| **Newcastle-under-Lyme** | 210 | 0 | 210 | 0 |
| **Stoke-on-Trent** | 0 | 1,350 | 0 | 1,350 |

*Figure 5-1: Change in jobs between 2015 and 2022*

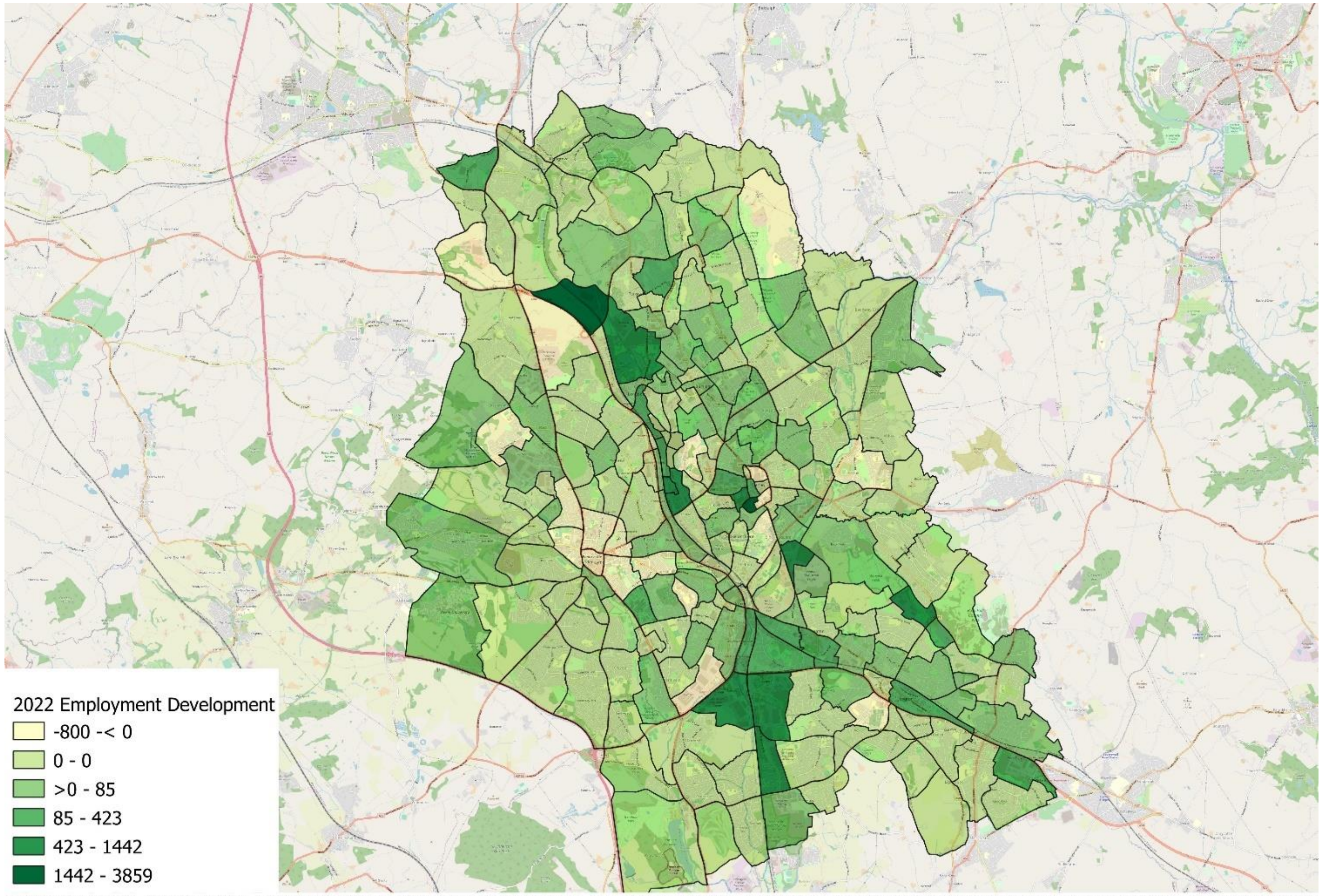



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*Figure 5-2: Change in jobs between 2015 and 2025*

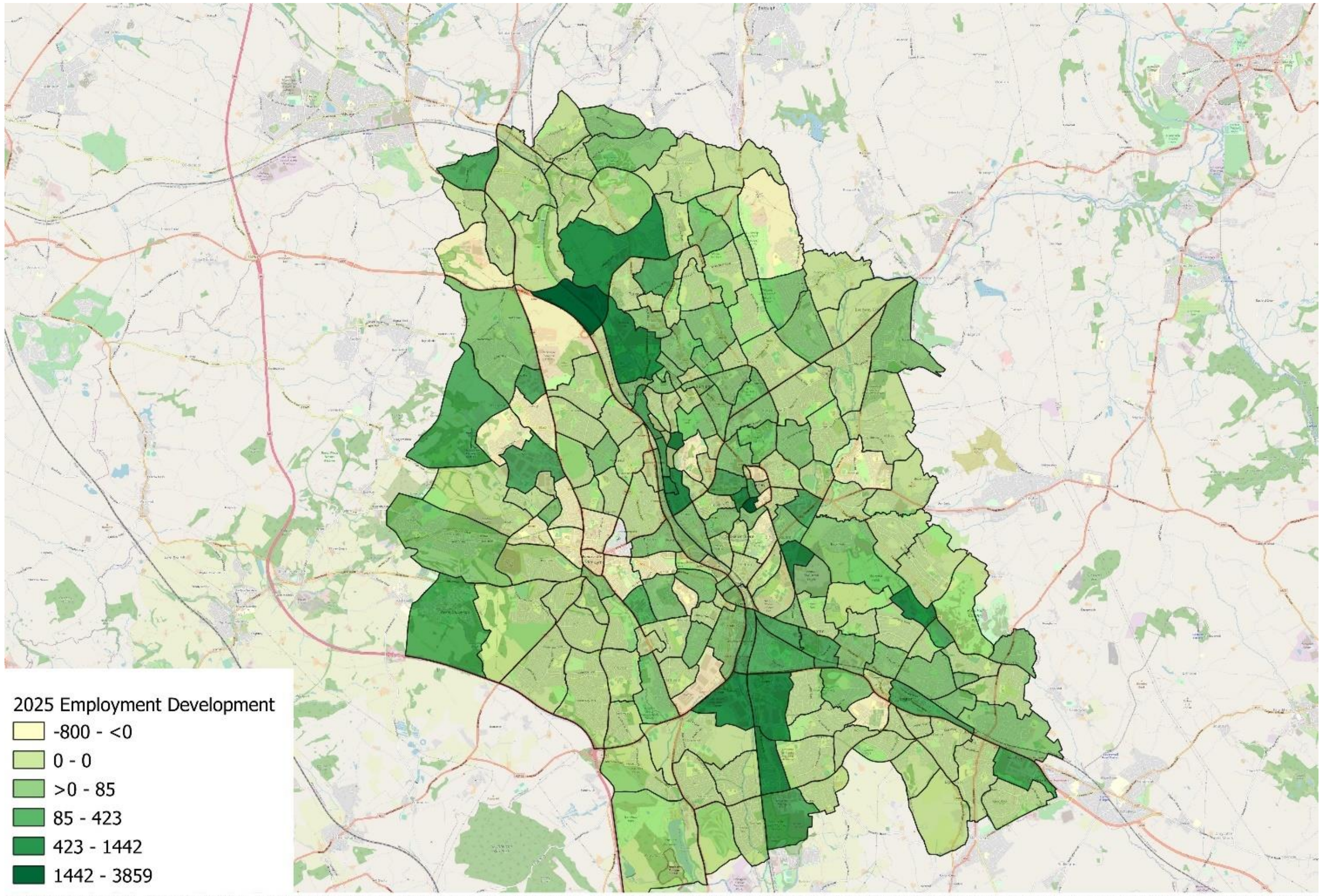


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*Figure 5-3: Change in households between 2015 and 2022*

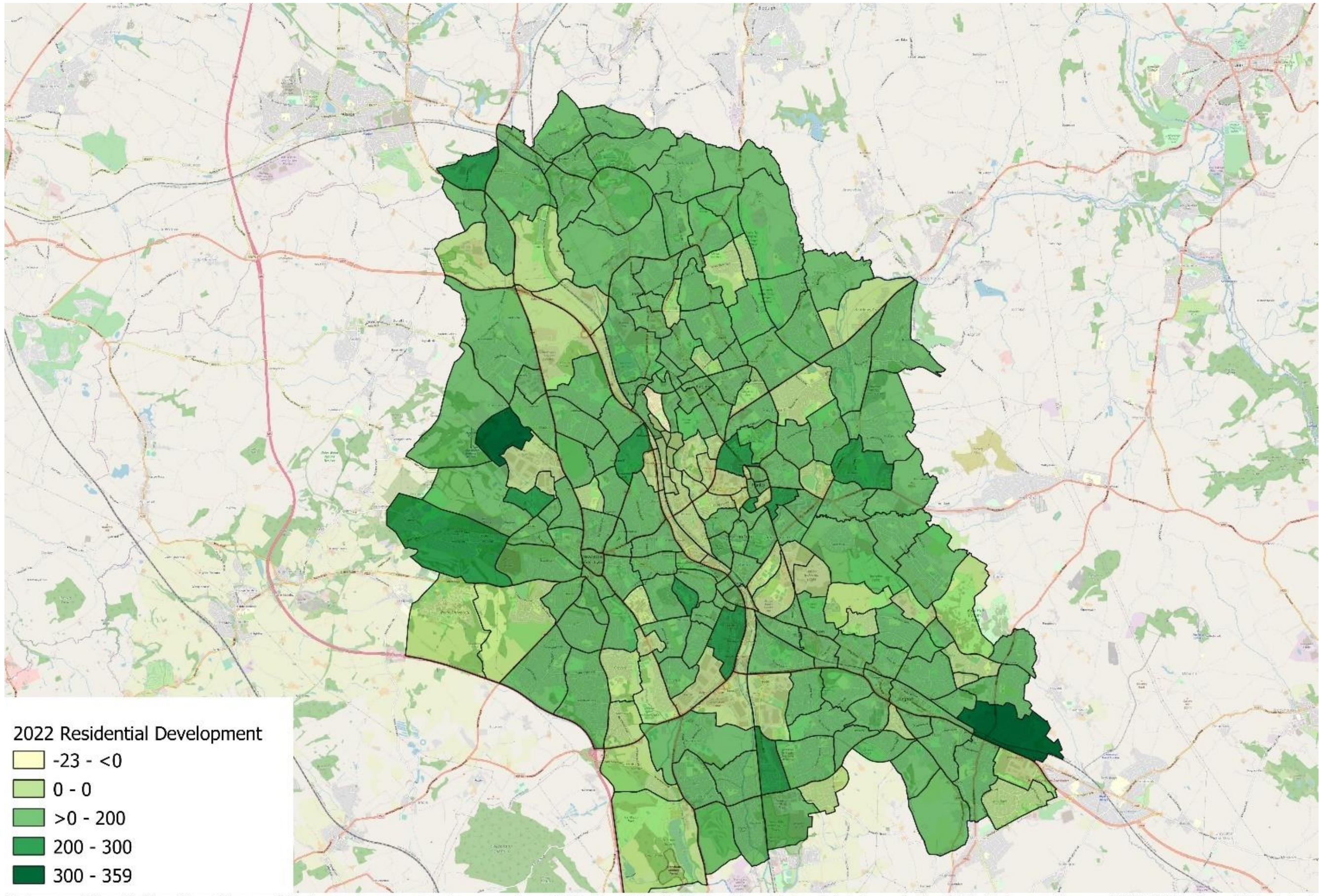


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*Figure 5-4: Change in households between 2015 and 2025*

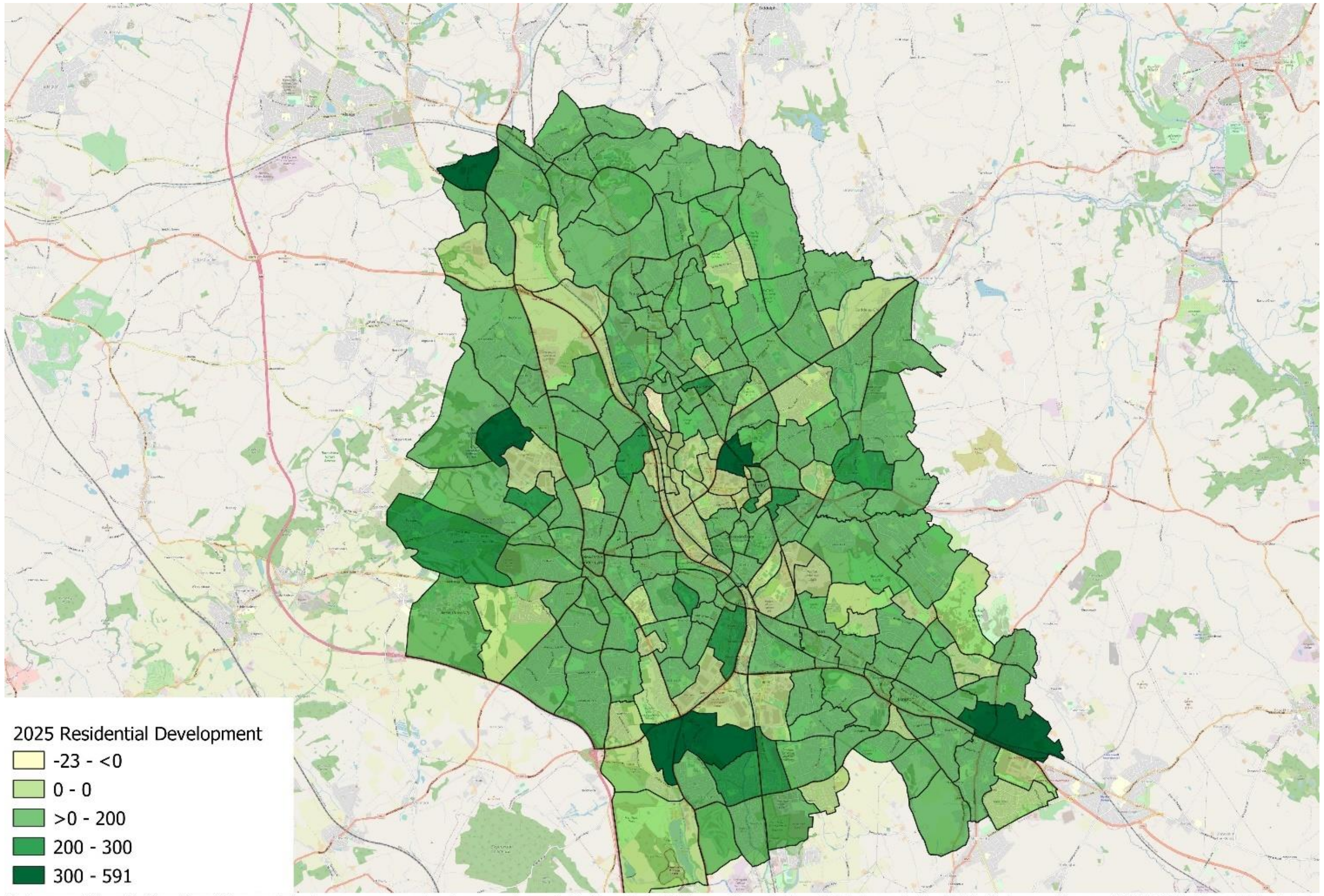

*Figure 5-5: Change in retail developments between 2015 and 2022 (GFA m2)*

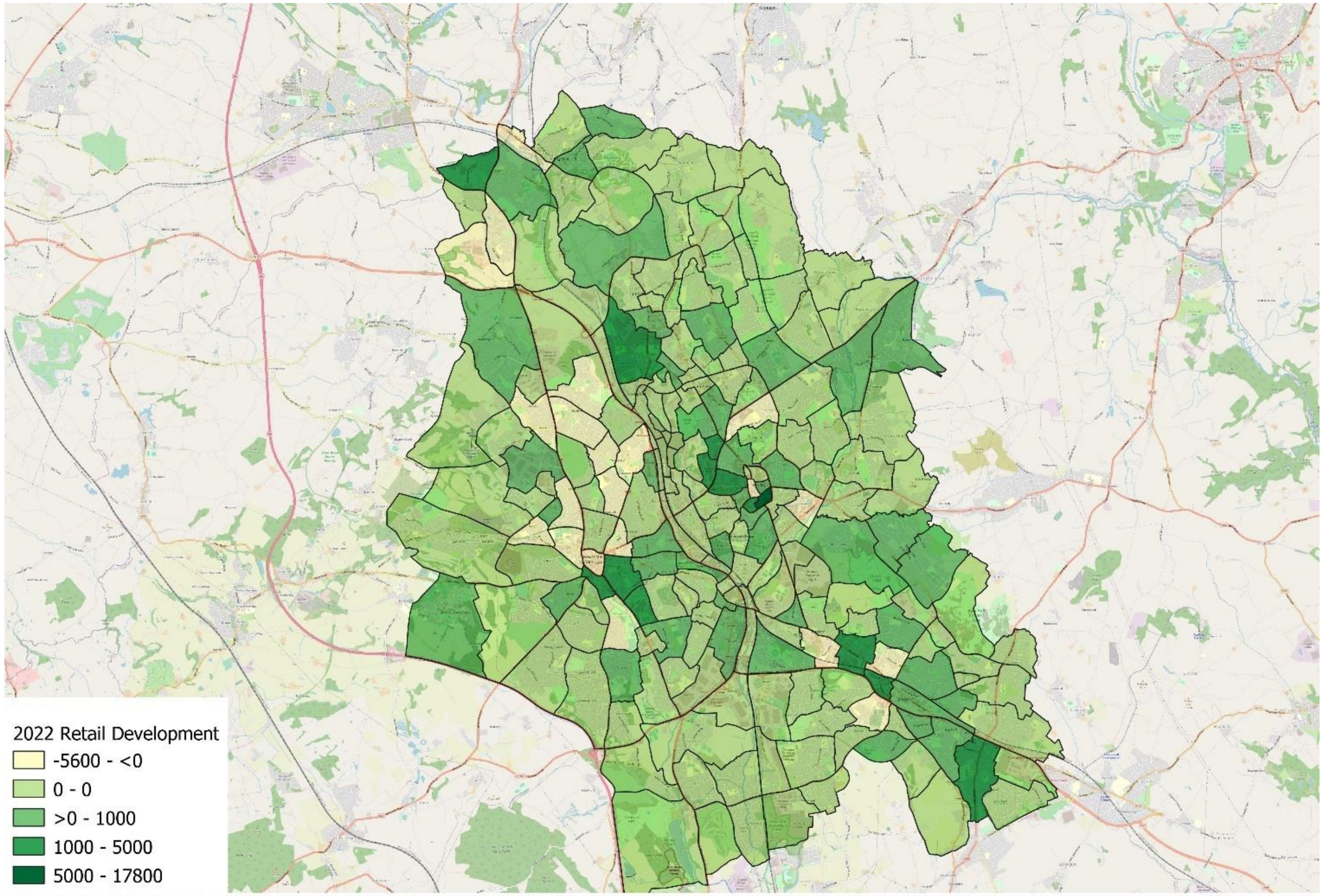


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*Figure 5-7: Change in retail developments between 2015 and 2025 (GFA m2)*

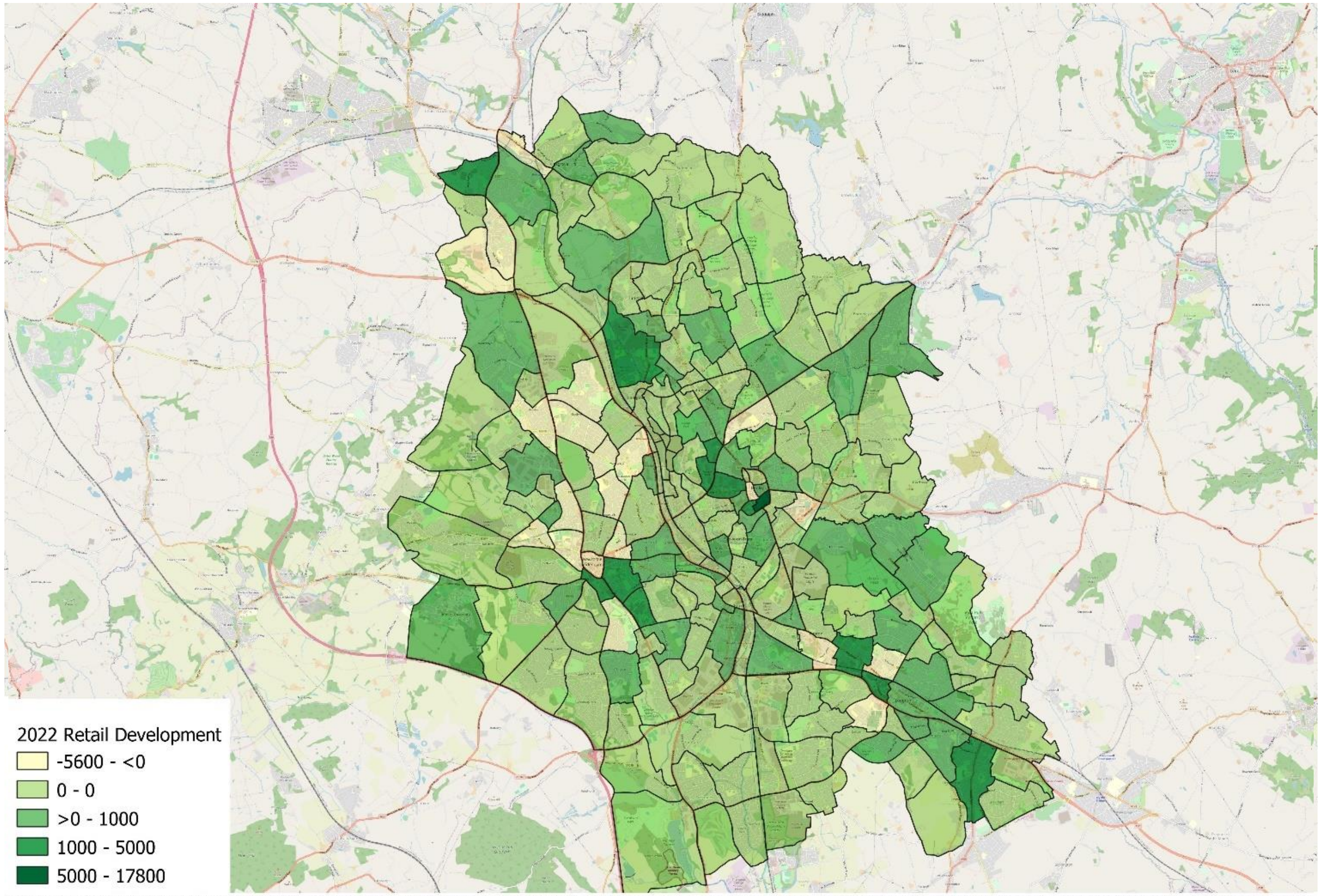
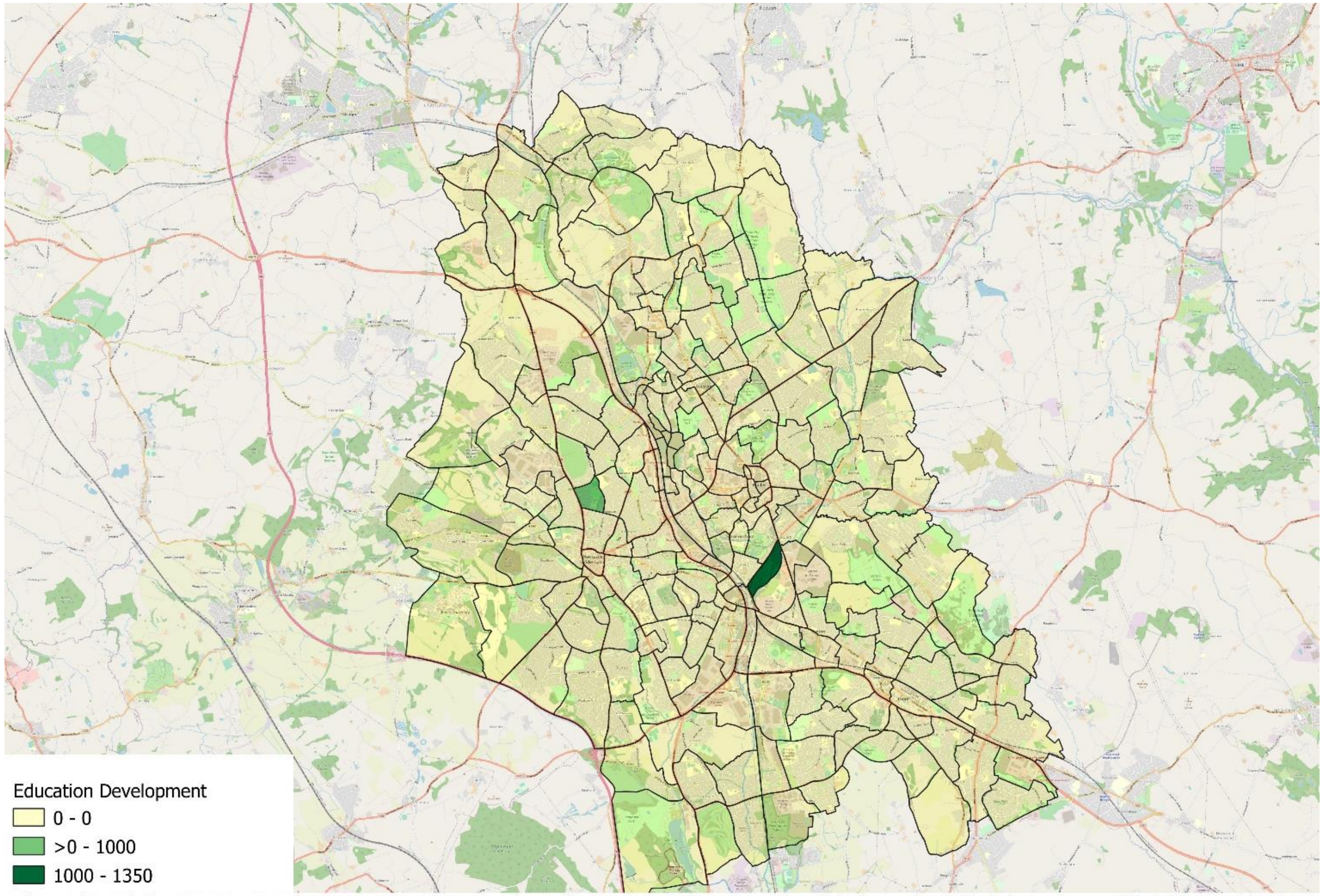


*Figure 5-8: Change in educational developments between 2015 and 2022/2025 (number of student places)*

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## 5.3 Matrix constraint

TAG Unit M4 – Forecasting and Uncertainty states that the forecast trip end growth should be consistent with NTEM growth at the study area level to ensure consistency between different geographical locations when assessing transport proposals. To accord with this, the growth in the forecast year car assignment trip matrices have been constrained to Version 7.2 of the NTEM traffic forecasts. The NTEM factors have been derived at an appropriate district level and applied at a zonal level for all internal, peripheral, regional and national zones.

NTEM factors have therefore extracted for origins and destinations between the 2015 base-year and the modelled future years of 2022 and 2025 for all trip purposes for the following time periods:

- Weekday AM Peak Period (07:00 - 09:59hrs)
- Weekday Inter Peak Period (10:00 - 15:59hrs)
- Weekday PM Peak Period (16:00 - 18:59hrs)

The LGV and HGV trip matrices have been constrained to NTM RTF18 growth factors, which are the same for each time period and are applied to the whole matrix. The RTF18 factors used to constrain the forecast LGV and HGV trip matrices for the forecast year of 2022 and 2025 are detailed in Table 5-3.

*Table 5-3: NTM goods vehicle factors*

| NTM | 2015 - 2022 | | 2015 - 2025 | |
|---|---|---|---|---|
| | LGV | HGV | LGV | HGV |
| **RTF18** | 1.137 | 0.993 | 1.179 | 0.993 |

## 5.4 Cost assumptions

Table 5-4 and Table 5-5 show the Values of Time (VOT) of private and public transport trips which have been used in the derivation of composite costs for the trip distribution model of the NSMM demand model. The VOT are based on the TAG Data Book (May 2019). Table 5-4details the VOT for car drivers which are required to convert parking costs to time values. Similarly, Table 5-5 shows the VOT for public transport trips which are required to convert fares to time values.

*Table 5-4: Values of time - car driver (pence per minute)*

| Mode (Purpose) | 2015 | 2022 | 2025 |
|---|---|---|---|
| **Car (Work)** | 26.5 | 28.3 | 29.4 |
| **Car (Commuting)** | 17.7 | 18.9 | 19.7 |
| **Car (Other)** | 8.1 | 8.6 | 9.0 |

Table 5-5: Values of time - public transport (pence per minute)

| Mode (Purpose) | 2015 | 2022 | 2025 |
|---|---|---|---|
| **PT (Work)** | 15.0 | 16.0 | 16.6 |
| **PT (Commuting)** | 17.7 | 18.9 | 19.7 |
| **PT (Other)** | 8.1 | 8.6 | 9.0 |

Table 5-6 and Table 5-7 show the VOT and associated factors for calculating the Vehicle Operating Costs (VOC) used during the assignment stage as derived from the TAG Data Book (May 2019). The formula for calculating VOC is given below:

$$VOC = (a/v + b + cv + dv^2 + a_1 + b_1/v) * l * VOT$$

where VOC = vehicle operating cost (in minutes)
v = average speed (in kms per hour)
l = link length (in kms)
VOT = value of time (in pence per minute)
a, b, c and d are the factors used to calculate fuel costs
$a_1$ and $b_1$ are the factors used to calculate non-fuel costs

Table 5-6: Values of time - assignment (pence per minute)

| Mode | 2015 | | | 2022 | | | 2025 | | |
|---|---|---|---|---|---|---|---|---|---|
| | AM | IP | PM | AM | IP | PM | AM | IP | PM |
| **Car** | 20.2 | 19.0 | 19.4 | 21.5 | 20.3 | 20.7 | 22.4 | 21.1 | 21.5 |
| **LGV** | 24.8 | 24.8 | 24.8 | 26.5 | 26.5 | 26.5 | 27.5 | 27.5 | 27.5 |
| **HGV** | 25.6 | 25.6 | 25.6 | 27.3 | 27.3 | 27.3 | 28.3 | 28.3 | 28.3 |

Table 5-7: Vehicle operating cost factors

| Factor | 2015 | | | 2022 | | | 2025 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Car | LGV | HGV | Car | LGV | HGV | Car | LGV | HGV |
| a | 48.677 | 41.890 | 378.348 | 43.678 | 41.522 | 400.932 | 41.218 | 40.806 | 413.176 |
| b | 8.579 | 10.450 | 19.776 | 7.730 | 10.275 | 20.957 | 7.413 | 10.145 | 21.597 |
| c | -0.091 | -0.151 | -0.135 | -0.082 | -0.148 | -0.143 | -0.078 | -0.145 | -0.147 |
| d | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| $a_1$ | 3.977 | 7.208 | 10.049 | 3.915 | 7.201 | 10.049 | 3.832 | 7.054 | 10.049 |
| $b_1$ | 16.394 | 41.459 | 392.392 | 16.394 | 41.459 | 392.392 | 16.394 | 41.459 | 392.392 |

## 5.5 Demand model convergence

Section 6.3 of TAG Unit M2 – Variable Demand Modelling stresses the importance of demonstrating the whole model system converges to a satisfactory degree in order to have confidence that the model results are as free from error and 'noise' as possible. To ensure convergence and stability of the NSMM transport model for scheme appraisal the application of an appropriate method of successive weighted averages has been applied to the demand model.

The recommended criterion for measuring convergence between the demand and supply models is the demand/supply gap (%GAP) as defined in paragraph 6.3.4 of the TAG Unit. It is stated in paragraph 6.3.8 of the TAG Unit that %GAP values of less than 0.1% can be achieved in many cases, although in more problematic systems this may be nearer to 0.2%.

The %GAP values for the forecast NSMM demand model are detailed in Table 5-8 for the 2022 and 2025 Reference Case scenarios for each mode and time period. As can be seen from Table 5-8, the levels of convergence are in some instances slightly outside the recommended TAG values after 10 iterations. A similar level of convergence is achieved for cars, LGVs and HGVs with better convergence generally achieved for the Inter-Peak Hours compared to the AM and PM Peak-Hours. Although the public transport demand model runs have a higher %GAP value compared to the other modes, this can be attributed to the coarser nature of the public transport model but is unlikely to affect scheme appraisal. Furthermore, the final iterations of the demand model generally show a good level of stability.

*Table 5-8: 2022 and 2025 Reference Case demand model convergence results (%GAP)*

| Year | Time Period and Mode | Iteration Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2022 | AM Car | 0 | 4.85 | 4.38 | 1.30 | 0.54 | 0.48 | 0.28 | 0.36 | 0.35 | 0.27 |
| | AM LGV | 0 | 4.79 | 4.21 | 1.47 | 0.58 | 0.48 | 0.28 | 0.35 | 0.29 | 0.19 |
| | AM HGV | 0 | 2.89 | 2.55 | 0.79 | 0.38 | 0.25 | 0.18 | 0.21 | 0.16 | 0.09 |
| | AM PT | 0 | 5.55 | 5.48 | 0.96 | 0.68 | 0.69 | 0.48 | 0.46 | 0.65 | 0.64 |
| | IP Car | 0 | 4.18 | 4.03 | 0.55 | 0.23 | 0.19 | 0.10 | 0.16 | 0.09 | 0.26 |
| | IP LGV | 0 | 3.54 | 3.52 | 0.73 | 0.28 | 0.33 | 0.12 | 0.24 | 0.17 | 0.34 |
| | IP HGV | 0 | 2.36 | 2.45 | 0.48 | 0.16 | 0.24 | 0.11 | 0.23 | 0.15 | 0.35 |
| | IP PT | 0 | 5.73 | 5.63 | 0.52 | 0.20 | 0.18 | 0.08 | 0.12 | 0.08 | 0.17 |
| | PM Car | 0 | 4.33 | 4.04 | 0.76 | 0.36 | 0.30 | 0.24 | 0.21 | 0.14 | 0.23 |
| | PM LGV | 0 | 4.05 | 3.72 | 0.89 | 0.41 | 0.31 | 0.31 | 0.23 | 0.23 | 0.28 |
| | PM HGV | 0 | 2.38 | 2.16 | 0.38 | 0.23 | 0.12 | 0.20 | 0.09 | 0.10 | 0.21 |
| | PM PT | 0 | 7.36 | 7.52 | 0.83 | 0.59 | 0.45 | 0.50 | 0.51 | 0.13 | 0.35 |
| 2025 | AM Car | 0 | 6.23 | 5.33 | 1.85 | 0.81 | 0.77 | 0.43 | 0.32 | 0.33 | 0.26 |
| | AM LGV | 0 | 6.53 | 5.47 | 2.28 | 0.79 | 0.81 | 0.45 | 0.39 | 0.33 | 0.28 |
| | AM HGV | 0 | 3.88 | 3.25 | 1.24 | 0.45 | 0.45 | 0.29 | 0.2 | 0.26 | 0.14 |
| | AM PT | 0 | 6.56 | 5.93 | 1.53 | 0.57 | 0.8 | 0.9 | 0.29 | 0.64 | 0.26 |
| | IP Car | 0 | 4.74 | 4.39 | 0.84 | 0.3 | 0.24 | 0.17 | 0.27 | 0.1 | 0.2 |
| | IP LGV | 0 | 4.41 | 4.05 | 1.14 | 0.44 | 0.34 | 0.22 | 0.36 | 0.17 | 0.23 |
| | IP HGV | 0 | 2.7 | 2.56 | 0.68 | 0.29 | 0.2 | 0.21 | 0.37 | 0.09 | 0.18 |
| | IP PT | 0 | 6.28 | 6.13 | 0.81 | 0.31 | 0.26 | 0.1 | 0.18 | 0.09 | 0.16 |
| | PM Car | 0 | 5.29 | 4.63 | 1.49 | 0.41 | 0.6 | 0.24 | 0.27 | 0.28 | 0.22 |
| | PM LGV | 0 | 5.43 | 4.65 | 1.71 | 0.58 | 0.63 | 0.29 | 0.36 | 0.33 | 0.29 |
| | PM HGV | 0 | 2.91 | 2.59 | 0.75 | 0.34 | 0.32 | 0.18 | 0.15 | 0.16 | 0.17 |
| | PM PT | 0 | 8.19 | 8.01 | 1.63 | 0.35 | 0.74 | 0.56 | 0.18 | 0.43 | 0.32 |

# 6 Reference Case traffic assignment results

## 6.1 Network performance statistics

Table 6-1 shows the network performance statistics, that is the total distance travelled (pcu-kms), total network travel time (pcu-hrs) and average network speed for the 2015 base-year, the 2022 and 2025 Reference Case by modelled time period and vehicle type.

As can be seen from Table 6-1, there is a general increase in network travel distance and travel time and a negligible change or small improvement in the average network speed between the 2015 base-year and the 2022 Reference Case. This is obviously due to the predicted increase in traffic growth and wider routeing of traffic on the highway network but with expected resultant increases in congestion mitigated by the effects of the Etruria Valley Link Road Project and other proposed transport improvements. An increase in travel distance and travel time can also be identified between 2022 Reference Case and the 2025 Reference Case with a reduction in network speed. This is due to traffic growth without additional network capacity.

It should be noted that the change in network performance statistics between the 2015 base-year and the 2022 Reference Case, especially with regards to average network speed, are relatively small as the statistics presented relate to the whole of the modelled highway network represented by the NSMM transport model.

*Table 6-1: Network performance statistics*

| Forecast Year | Time Period | Vehicle Type | Travel Distance (pcu-kms) | Travel Time (pcu-hrs) | Average Network Speed (kph) |
|---|---|---|---|---|---|
| **2015 Base-Year** | AM | Car | 3219791 | 50350 | 63.9 |
| | | LGV | 246180 | 4154 | 59.3 |
| | | HGV | 539892 | 7684 | 70.3 |
| | IP | Car | 2303564 | 34824 | 66.1 |
| | | LGV | 226733 | 3589 | 63.2 |
| | | HGV | 530713 | 7241 | 73.3 |
| | PM | Car | 3334307 | 52722 | 63.2 |
| | | LGV | 206579 | 3588 | 57.6 |
| | | HGV | 472351 | 6502 | 72.6 |
| **2022 Reference Case** | AM | Car | 3423073 | 53639 | 63.8 |
| | | LGV | 305762 | 5112 | 59.8 |
| | | HGV | 552482 | 7847 | 70.4 |
| | IP | Car | 2461164 | 37322 | 65.9 |
| | | LGV | 263042 | 4156 | 63.3 |
| | | HGV | 529344 | 7221 | 73.3 |
| | PM | Car | 3533990 | 56014 | 63.1 |
| | | LGV | 237857 | 4122 | 57.7 |
| | | HGV | 476612 | 6561 | 72.6 |
| **2025 Reference Case** | AM | Car | 3497315 | 54947 | 63.6 |
| | | LGV | 313912 | 5322 | 59.0 |
| | | HGV | 540868 | 7770 | 69.6 |
| | IP | Car | 2525331 | 38355 | 65.8 |
| | | LGV | 268755 | 4287 | 62.7 |
| | | HGV | 514618 | 7074 | 72.7 |
| | PM | Car | 3611050 | 57406 | 62.9 |
| | | LGV | 243075 | 4285 | 56.7 |
| | | HGV | 467955 | 6510 | 71.9 |

## 6.2 Forecast traffic flows

Figure 6-1 to Figure 6-3 and Figure 6-4 to Figure 6-6 show the modelled traffic flows for the 2015 base-year and 2022 Reference Case scenarios for the AM Peak-Hour, Inter-Peak Hour and PM Peak-Hour modelled time periods, respectively. The modelled traffic flows are show in terms of values and as bandwidths, where the thickness of the bandwidth is proportional to the magnitude of the modelled traffic flows, i.e. the thicker the bandwidth the greater the traffic flows.

Figure 6-7 shows the change in AADT between the 2015 base-year and the 2022 Reference Case. Figure 6-8 to Figure 6-10 show the change in traffic flows between the 2015 base-year and the 2022 Reference Case for each of the modelled time periods, respectively. The change in traffic flows are also shown as bandwidths with a green bandwidth indicating a predicted decrease in traffic flows between 2015 and 2022 and a red bandwidth indicating a predicted increase. The thickness of the bandwidth is proportional to the magnitude of the change in flows, i.e. the thicker the bandwidth the greater the change in traffic flows between 2015 and 2022.

As can be seen from Figure 6-8 to Figure 6-10, as expected there is a general increase in traffic across the North Staffordshire conurbation which can be attributed to the proposed developments and an increase in background traffic growth. Any reductions in traffic on the highway network can be attributed to the effects of proposed transport schemes, the loss/demolition of existing land-uses and trip redistribution effects. For example, the significant reductions in traffic on the A500 (between Wolstanton and the A53 Etruria Road) and along the A53 Etruria Road (between the A500 and Festival Way) is due to the predicted impact of the Etruria Valley Link Road Project.

Figure 6-11 Shows the change in AADT traffic flows between 2022 Reference Case and 2025 Reference Case. Figure 6-12 to Figure 6-14 show the change in model traffic flows between the 2022 and 2025 Reference Case scenarios for the AM, Inter-Peak and PM modelled periods. Flows change between 2022 Reference Case and 2025 Reference Case is small. This is to be expected given the closeness of forecast years and the identical networks. No additional transport schemes are anticipated to be implemented between 2022 and 2025 as detailed in Table 4-1

Figure 6-15 to Figure 6-17, Figure 6-18 to Figure 6-20 and Figure 6-21 to Figure 6-23 show the locations of links and junctions which are predicted to experience congestion problems in the 2015 base-year, the 2022 Reference Case and the 2025 Reference Case scenarios for the AM Peak-Hour, Inter-Peak Hour and PM Peak-Hour modelled time periods, respectively. Links are identified as being the source of congestion problems where the ratio of the modelled traffic flow to the capacity of the link are greater than 81%. For these assessments, the capacities of the links have been based on the Advice Note TA 79/99 – Traffic Capacity of Urban Roads (May 1999). Therefore, it should be borne in mind that these values are based on theoretical capacities which may not always reflect the ultimate or actual capacity of the road which may be affected by other local operational conditions and characteristics. Junctions are identified as being the source of congestion problems where the overall average junction delay is greater than 20 seconds.

As can be seen from Figure 6-15 to Figure 6-20, there is only a slight worsening in congestion problems predicted to be experienced between 2015 and 2022 which can be attributed to the relatively low increase in traffic growth predicted between these years. The same findings can be identified between the 2025 Reference Case and 2022 Reference Case. Figure 6-18 to Figure 6-23 show little change in congestion issues between the 2022 Reference Case and 2025 Reference Case.

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Figure 6-1 2015 Base-Year AM peak-hour traffic flows (PCUs)

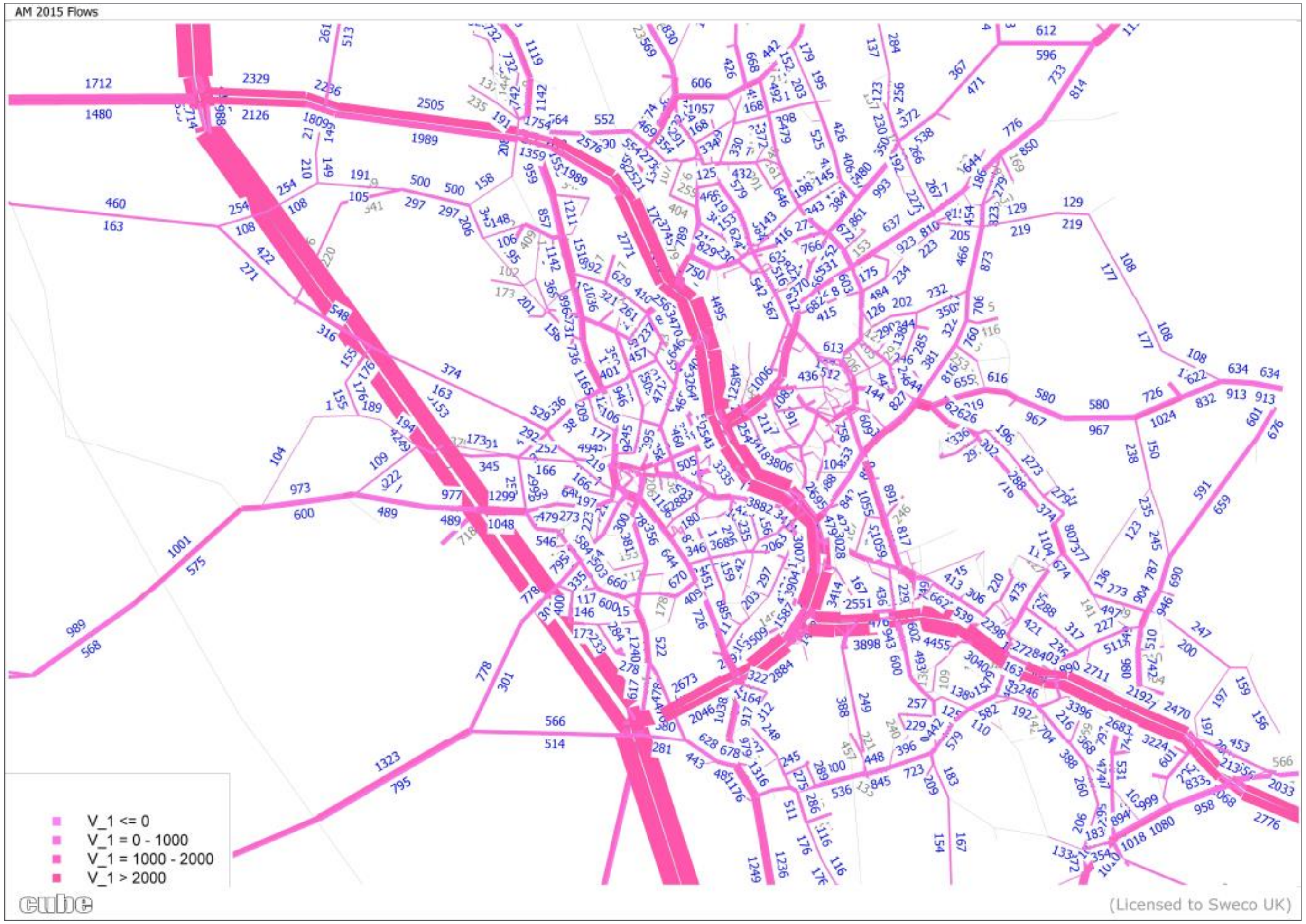

*Figure 6-2: 2015 Base-Year Inter-Peak hour traffic flows (PCUs)*

*Figure 6-3: 2015 Base-Year PM peak-hour traffic flows (PCUs)*

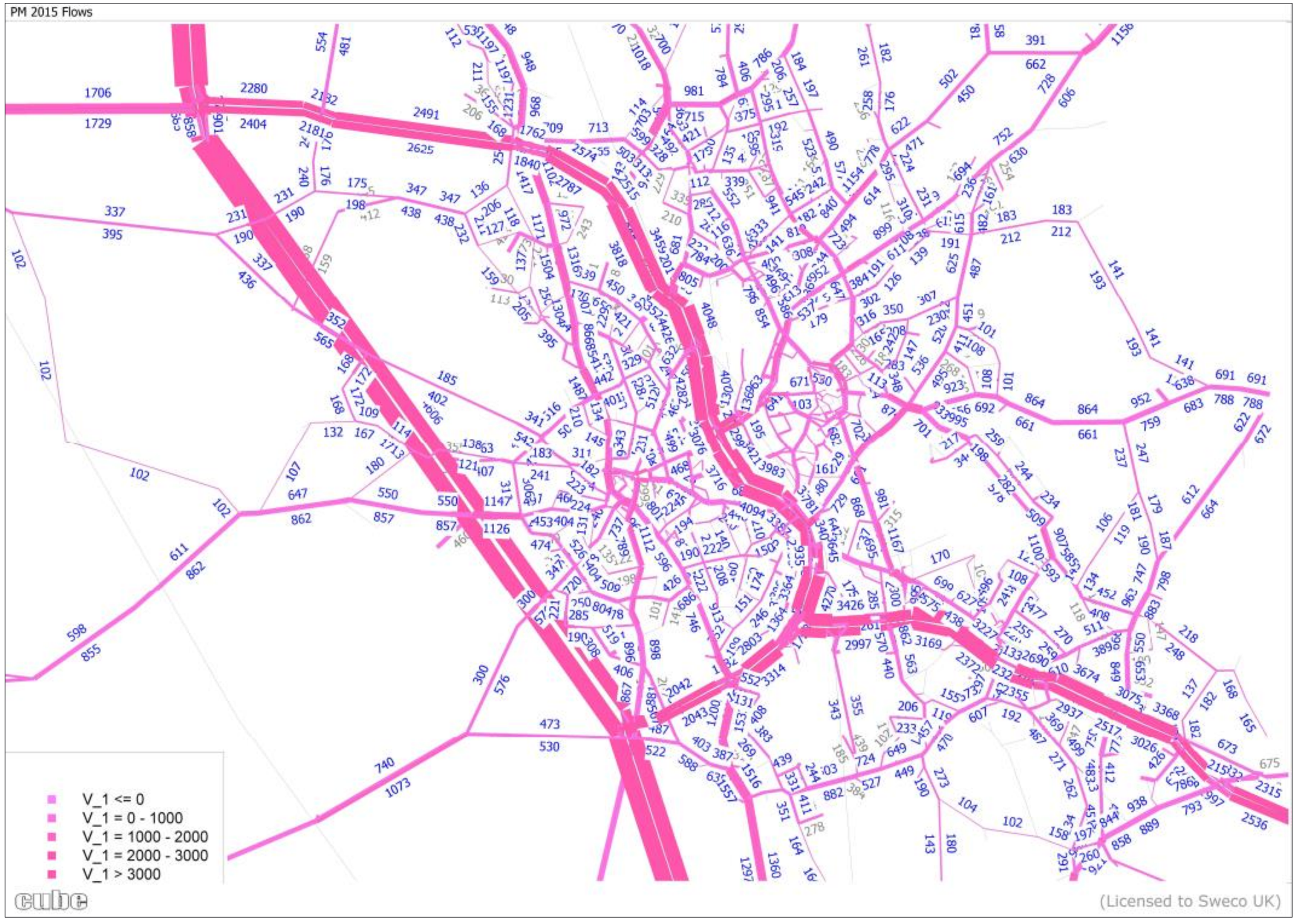

*Figure 6-4: 2022 Reference Case AM peak-hour traffic flows (PCUs)*

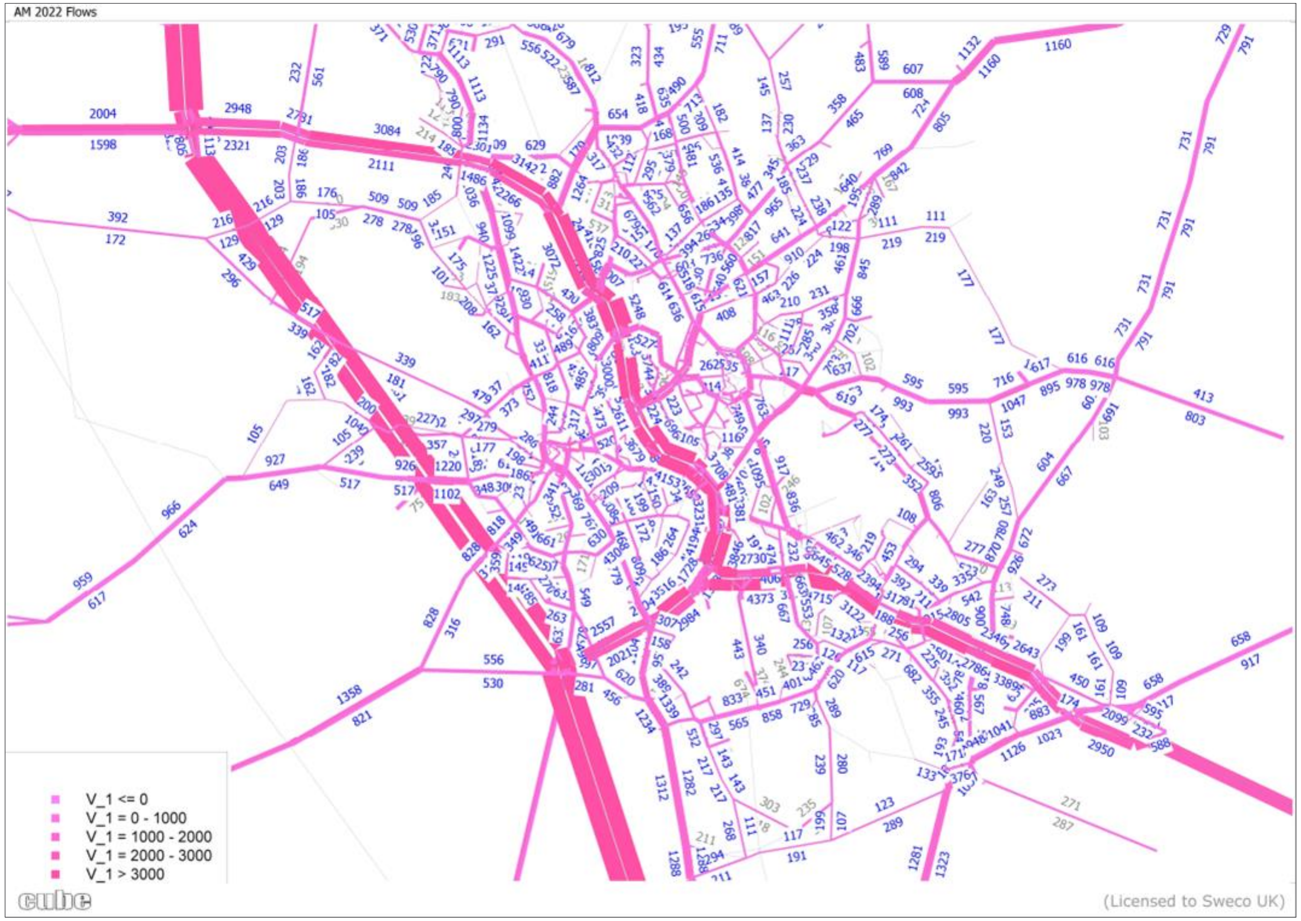

*Figure 6-5: 2022 Reference Case Inter-Peak hour traffic flows (PCUs)*

*Figure 6-6: 2022 Reference Case PM peak-hour traffic flows (PCUs)*

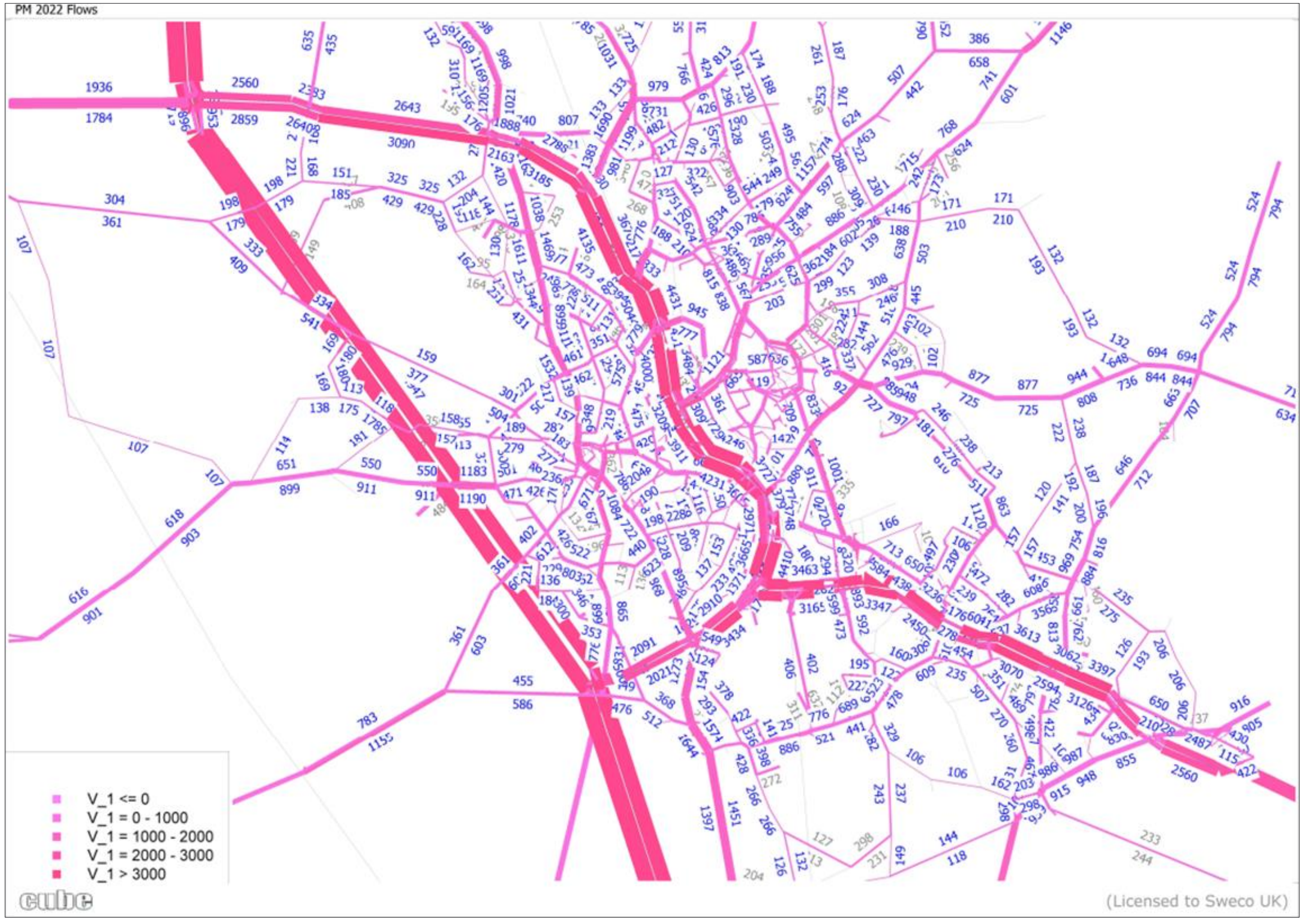

*Figure 6-7: Change in AADT traffic flows between 2015 Base-Year and 2022 Reference Case (vehicles)*

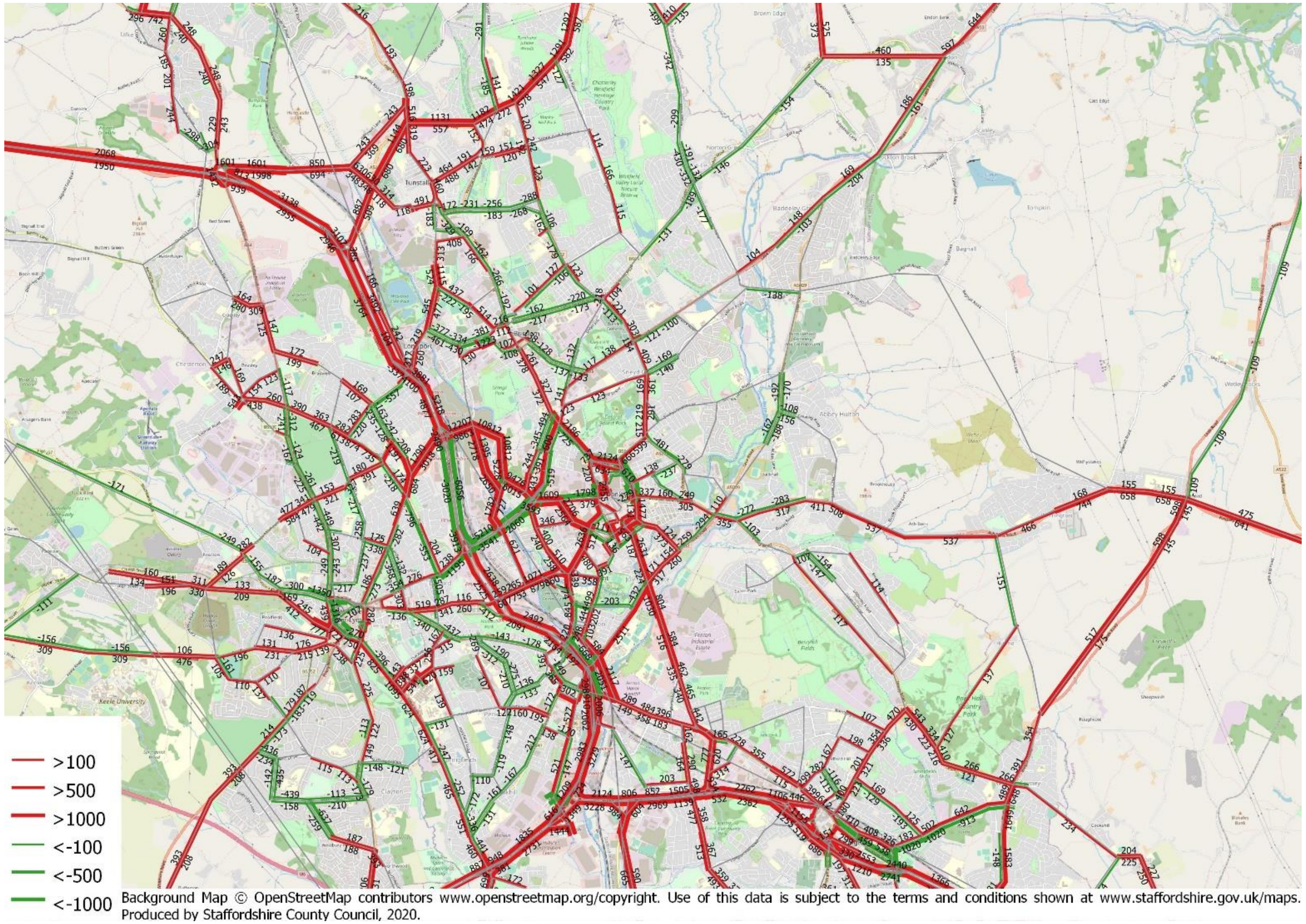

*Figure 6-8: Change in AM peak-hour traffic flows between 2015 Base-Year and 2022 Reference Case (vehicles)*

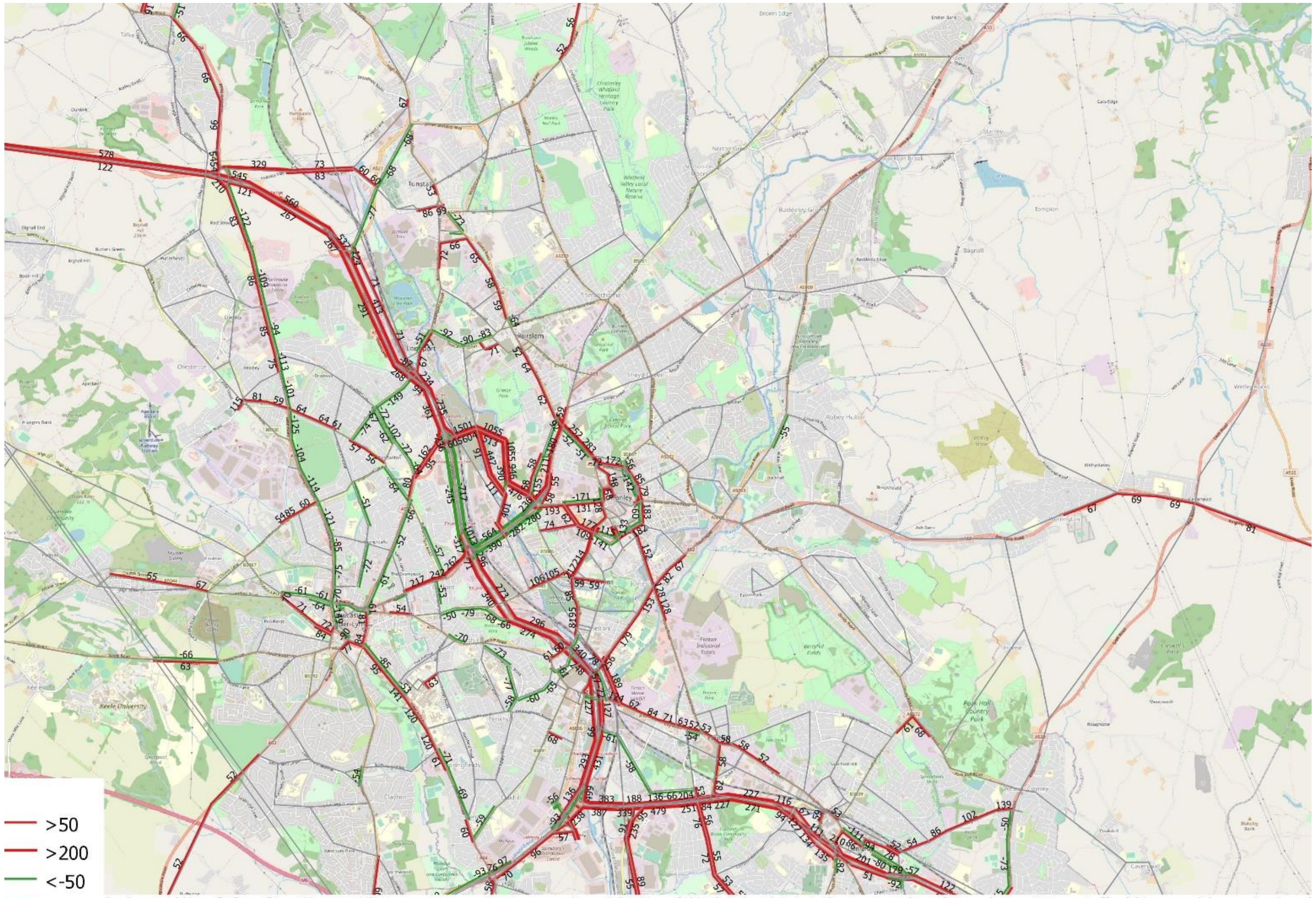

*Figure 6-9: Change in Inter-Peak hour traffic flows between 2015 Base-Year and 2022 Reference Case (vehicles)*


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*Figure 6-10: Change in PM peak-hour traffic flows between 2015 Base-Year and 2022 Reference Case (vehicles)*

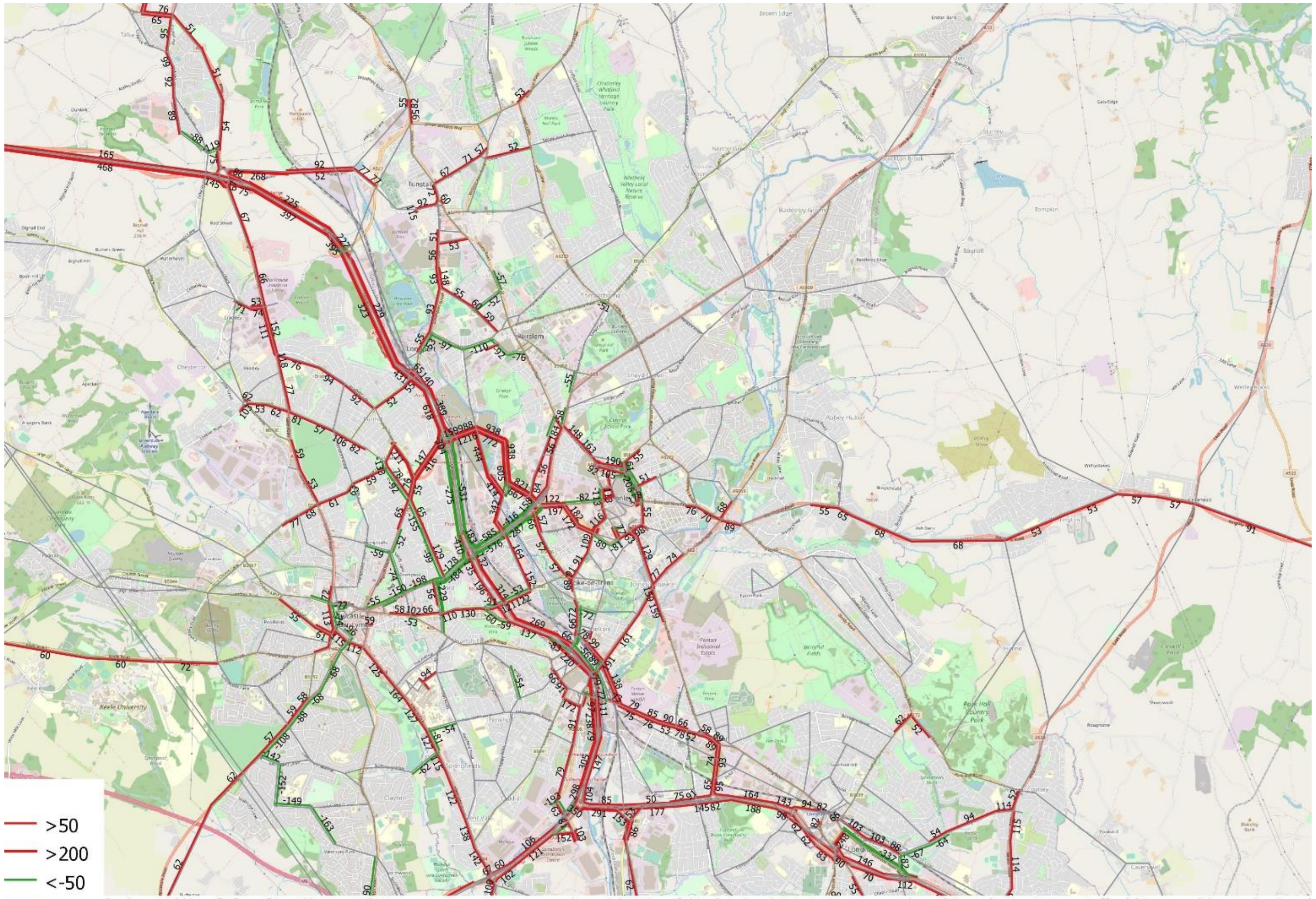

*Figure 6-11: Change in AADT traffic flows between 2022 Reference and 2025 Reference Case (vehicles)*

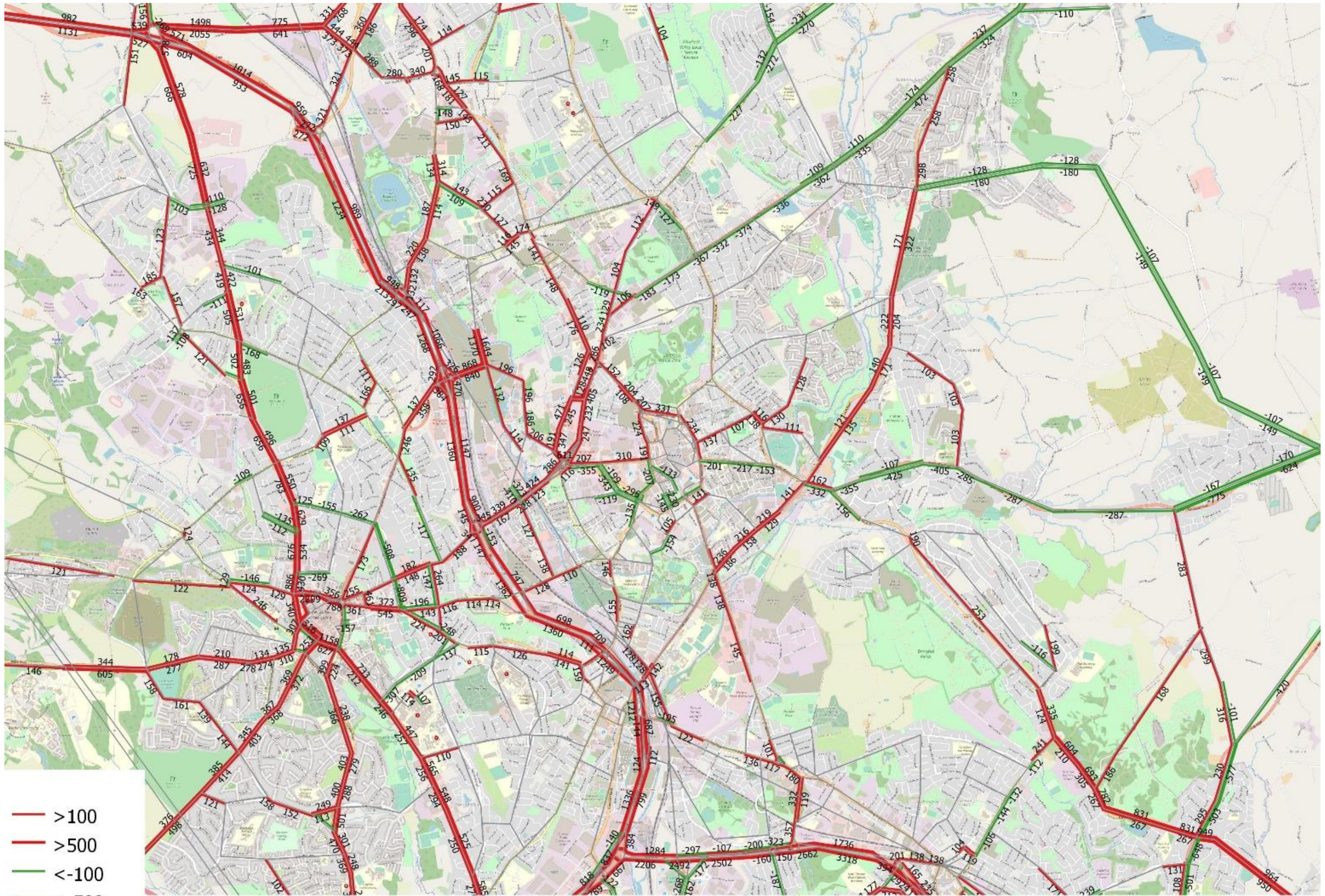


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*Figure 6-12: Change in AM Peak-Hour traffic flows between 2022 Reference and 2025 Reference Case (vehicles)*

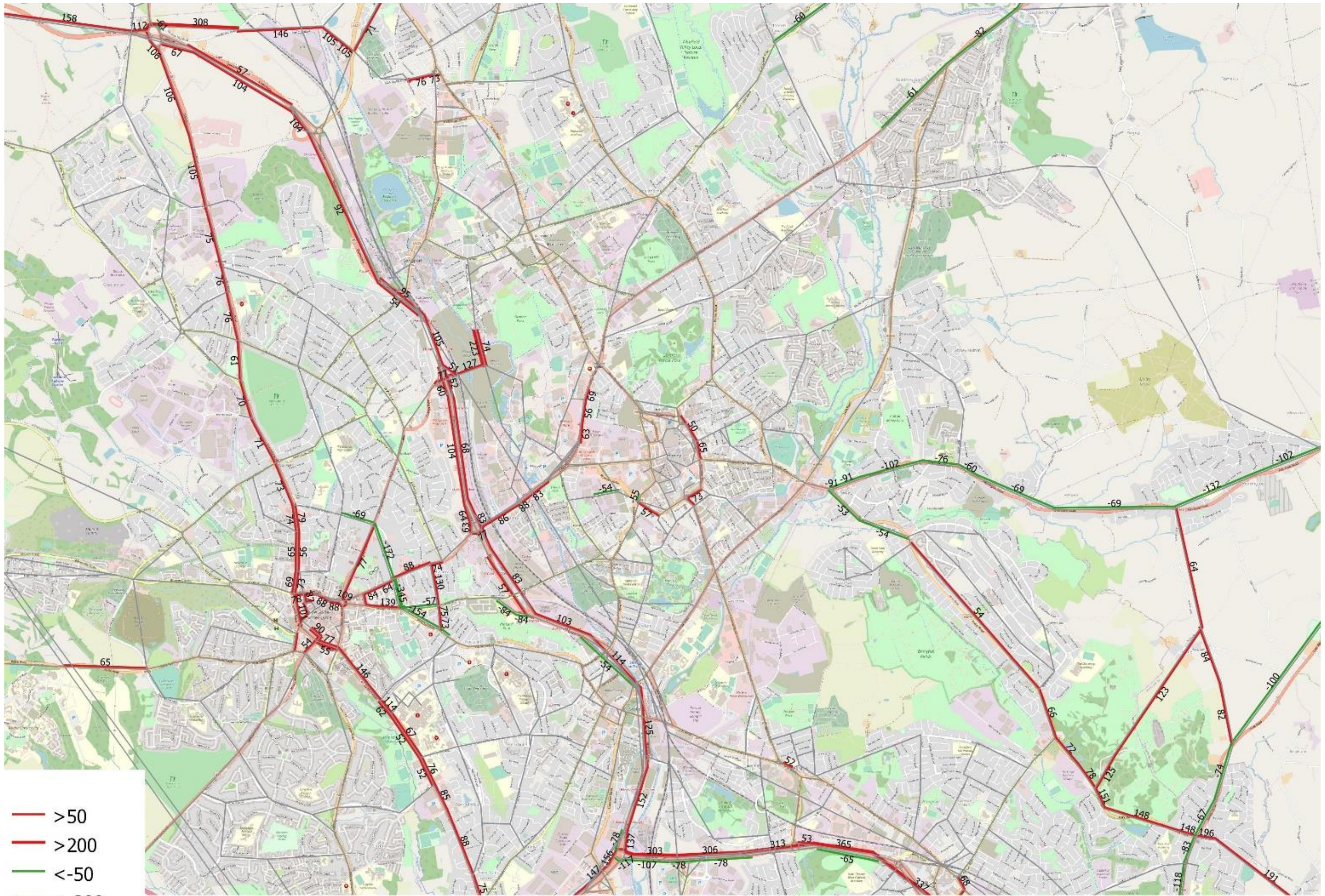


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Figure 6-13: Change in Inter-Peak Hour traffic flows between 2022 Reference and 2025 Reference Case (vehicles)

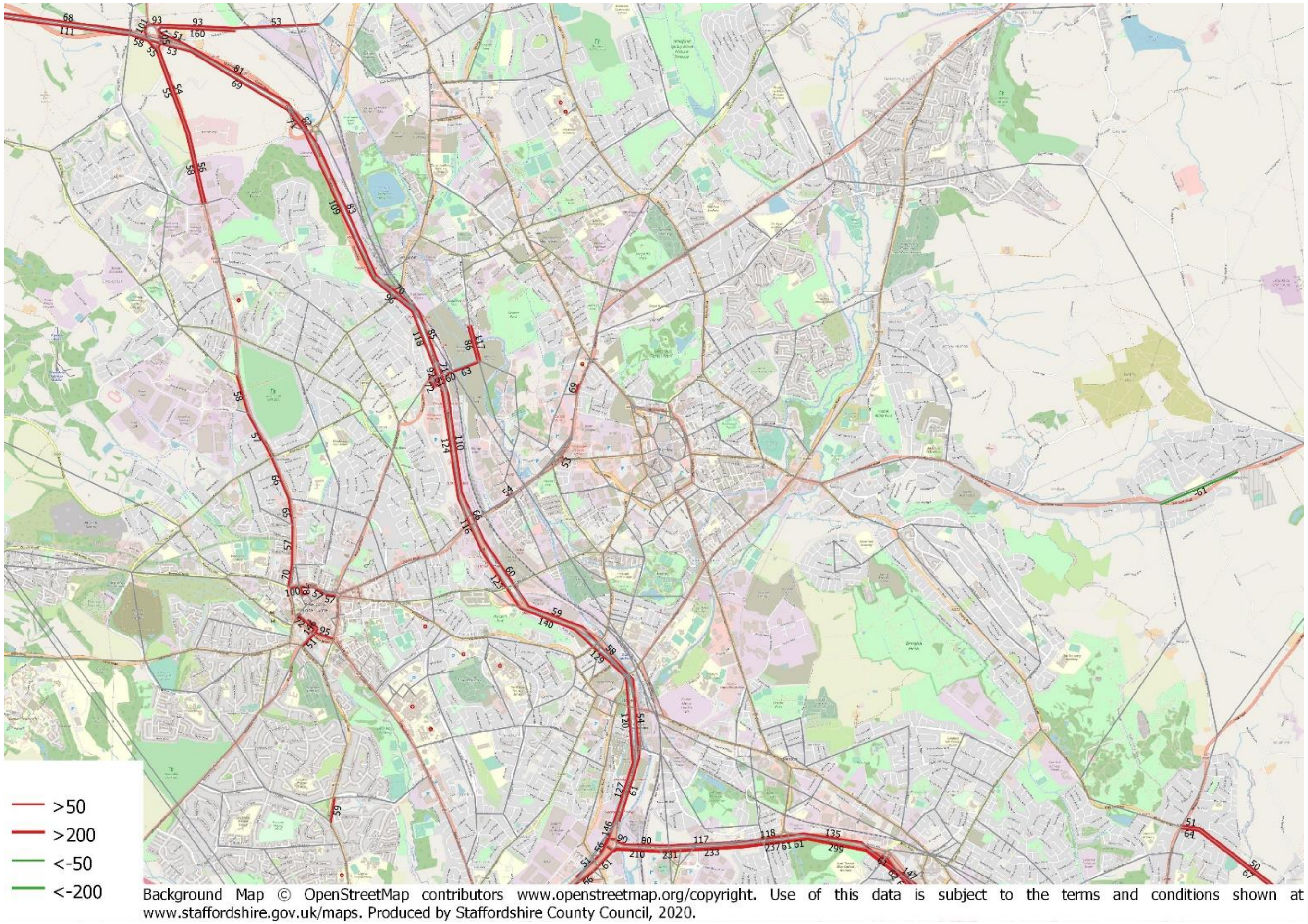

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*Figure 6-14: Change in PM Peak-Hour traffic flows between 2022 Reference and 2025 Reference Case (vehicles)*

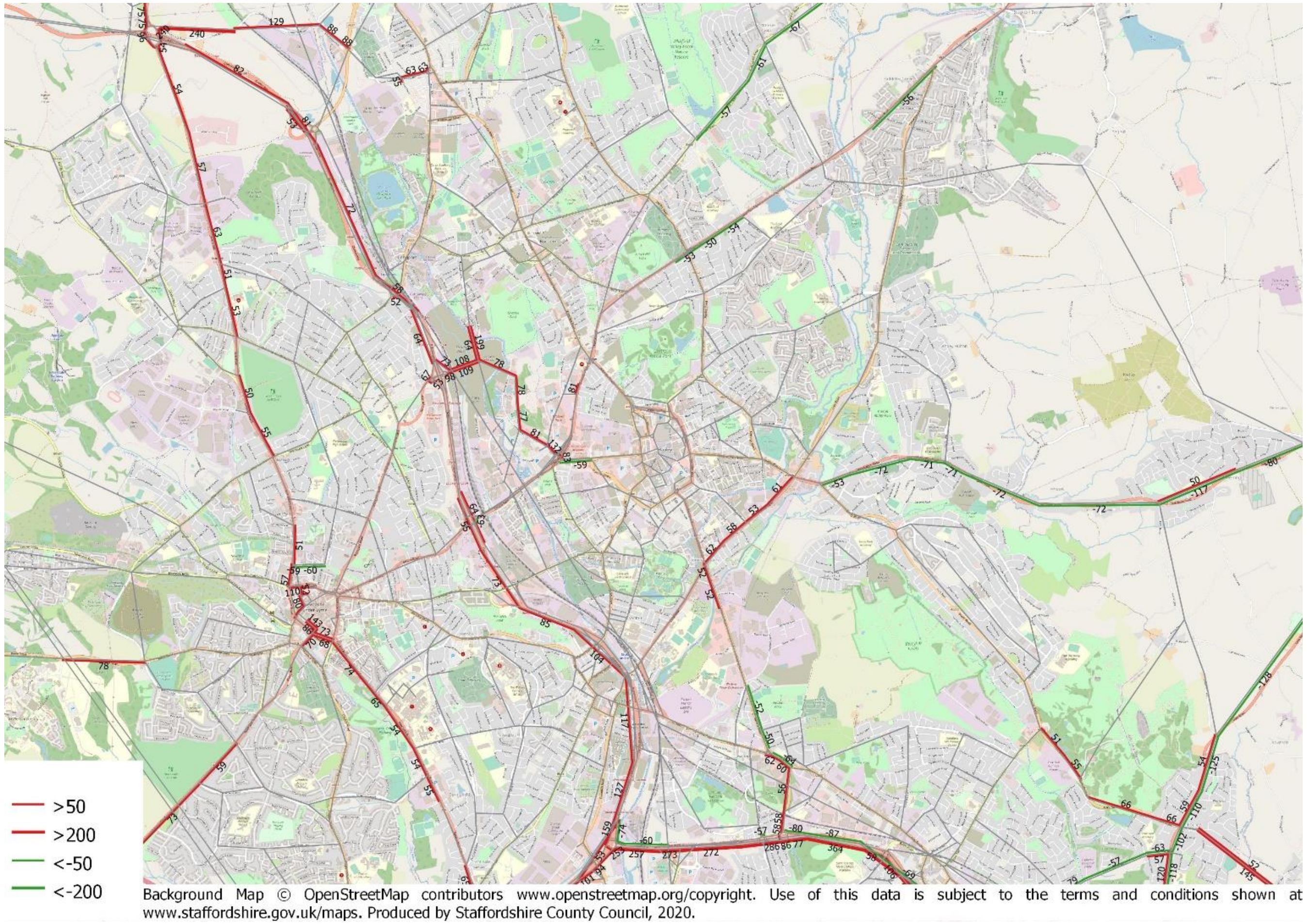

*Figure 6-15: 2015 Base-Year AM peak-hour overcapacity links and significant junction delays*

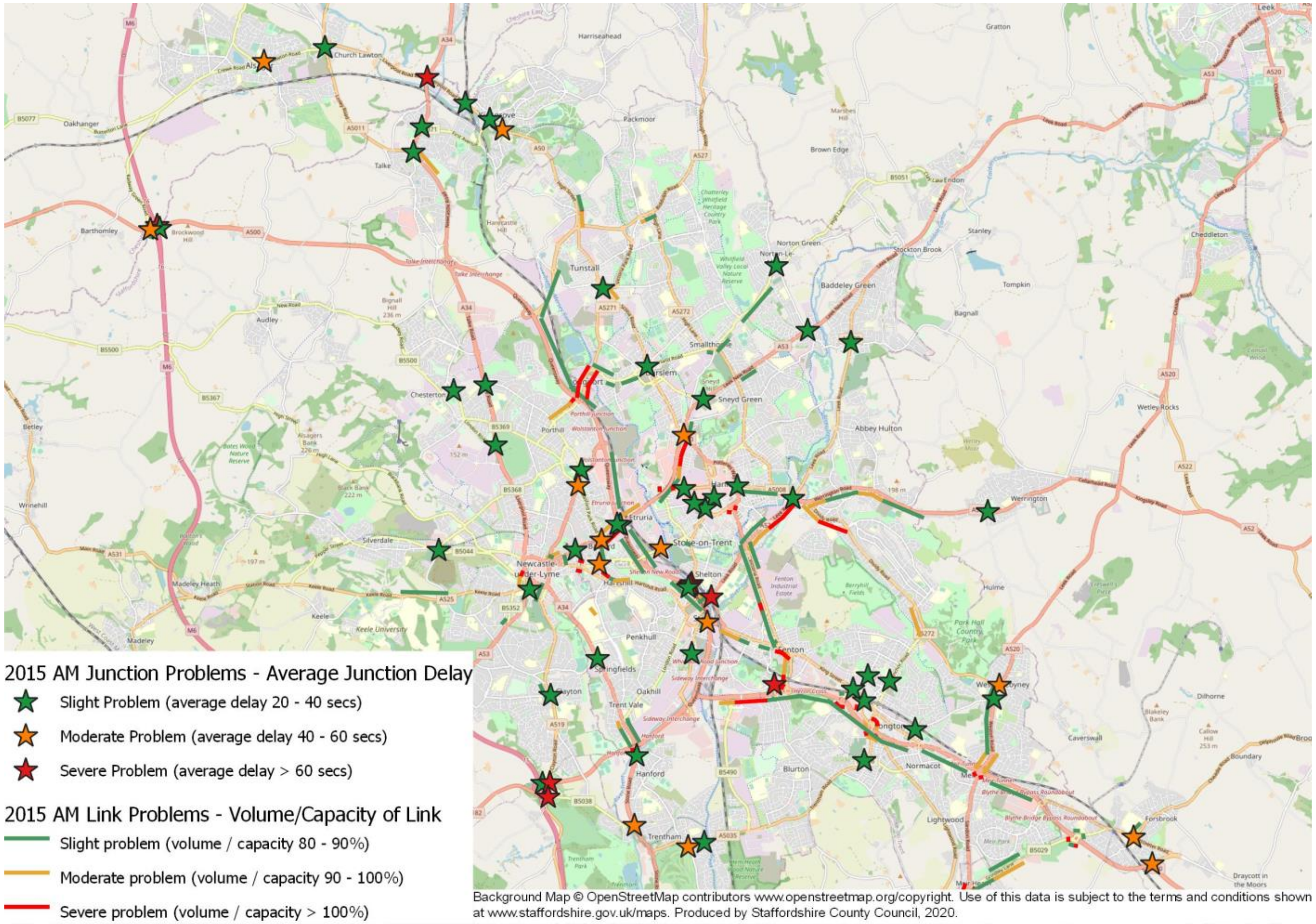

*Figure 6-16: 2015 Base-Year inter-peak hour overcapacity links and significant junction delays*

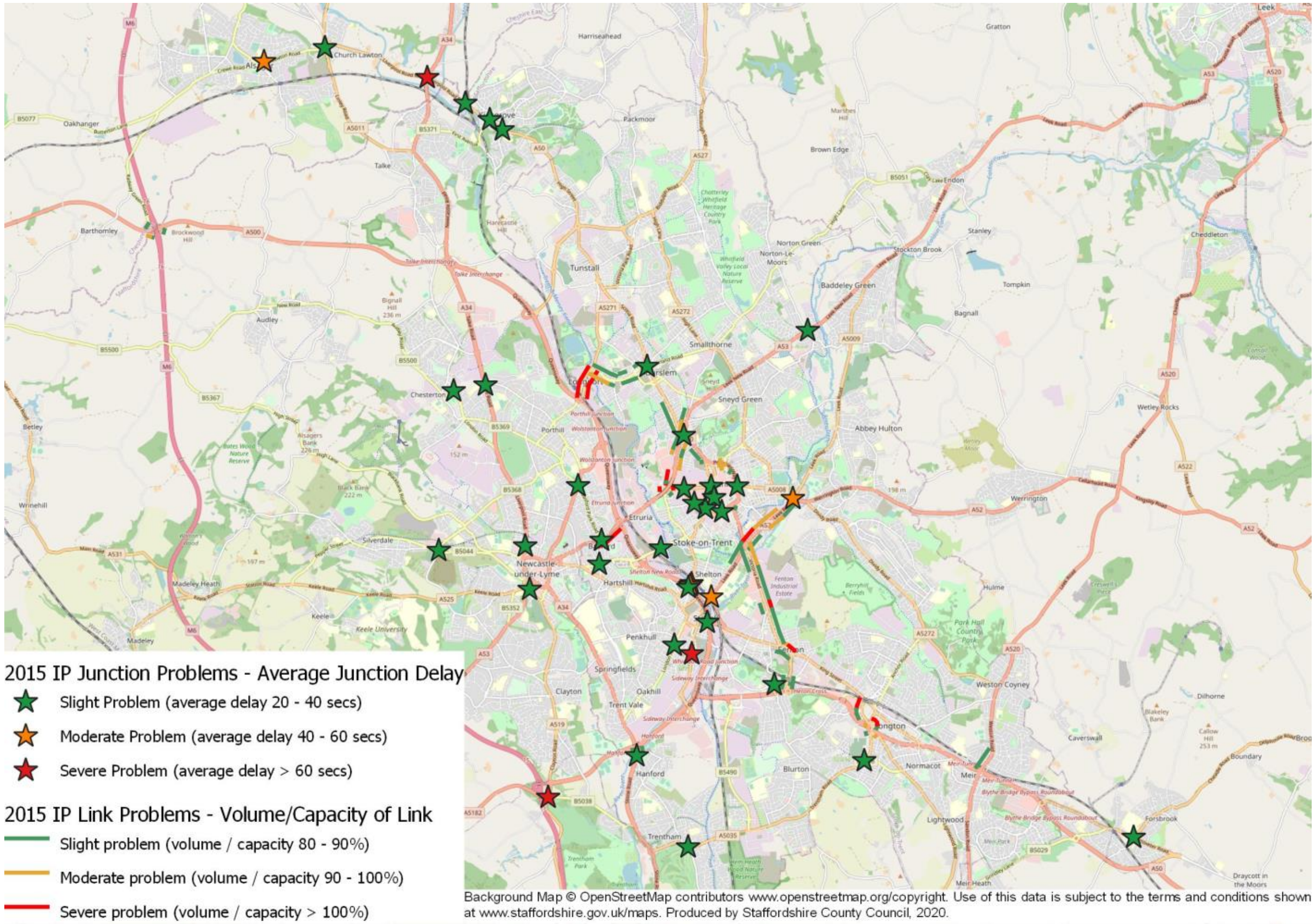

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Figure 6-17: 2015 Base-Year PM peak-hour overcapacity links and significant junction delays

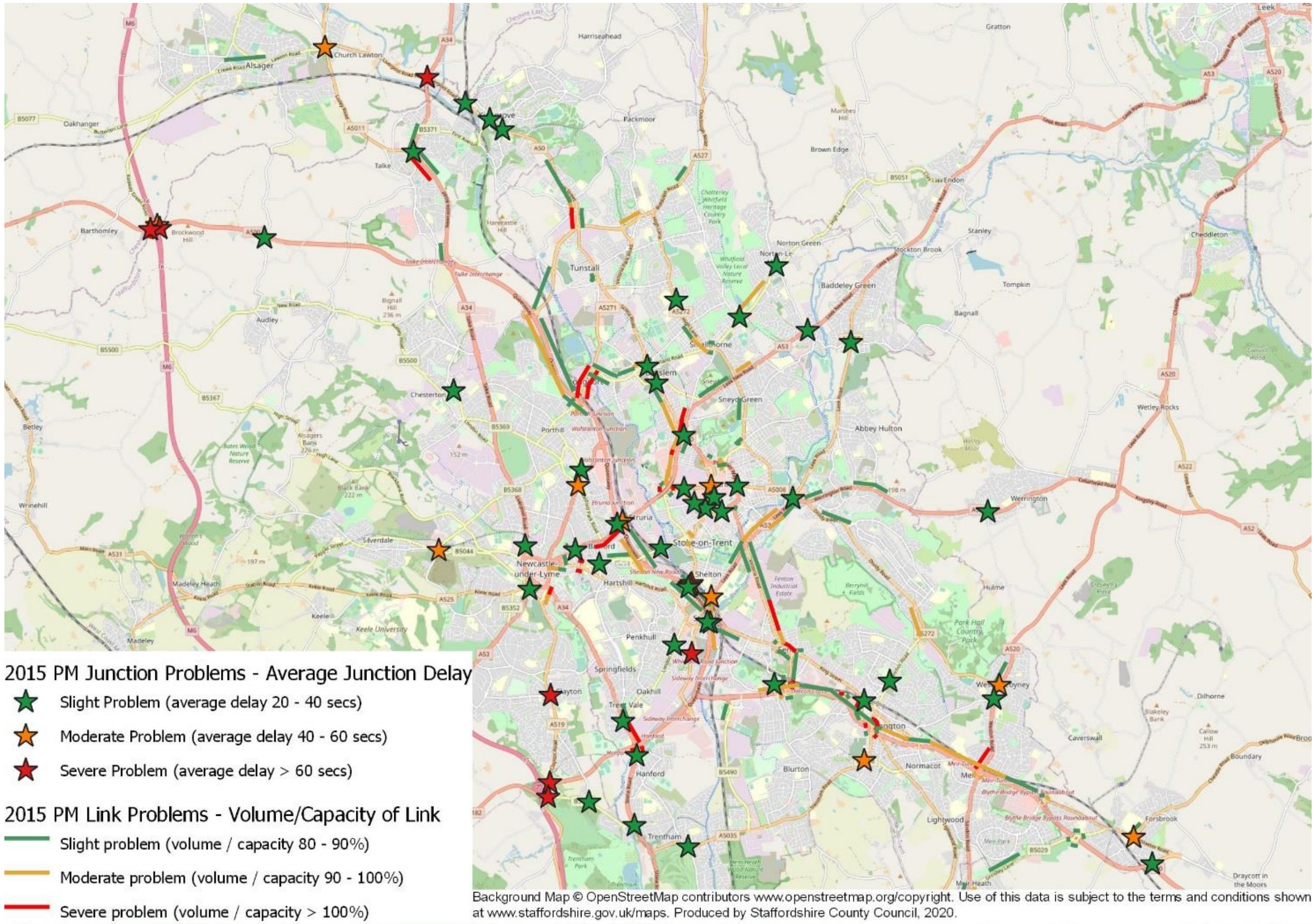


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Figure 6-18: 2022 Reference Case AM peak-hour overcapacity links and significant junction delays

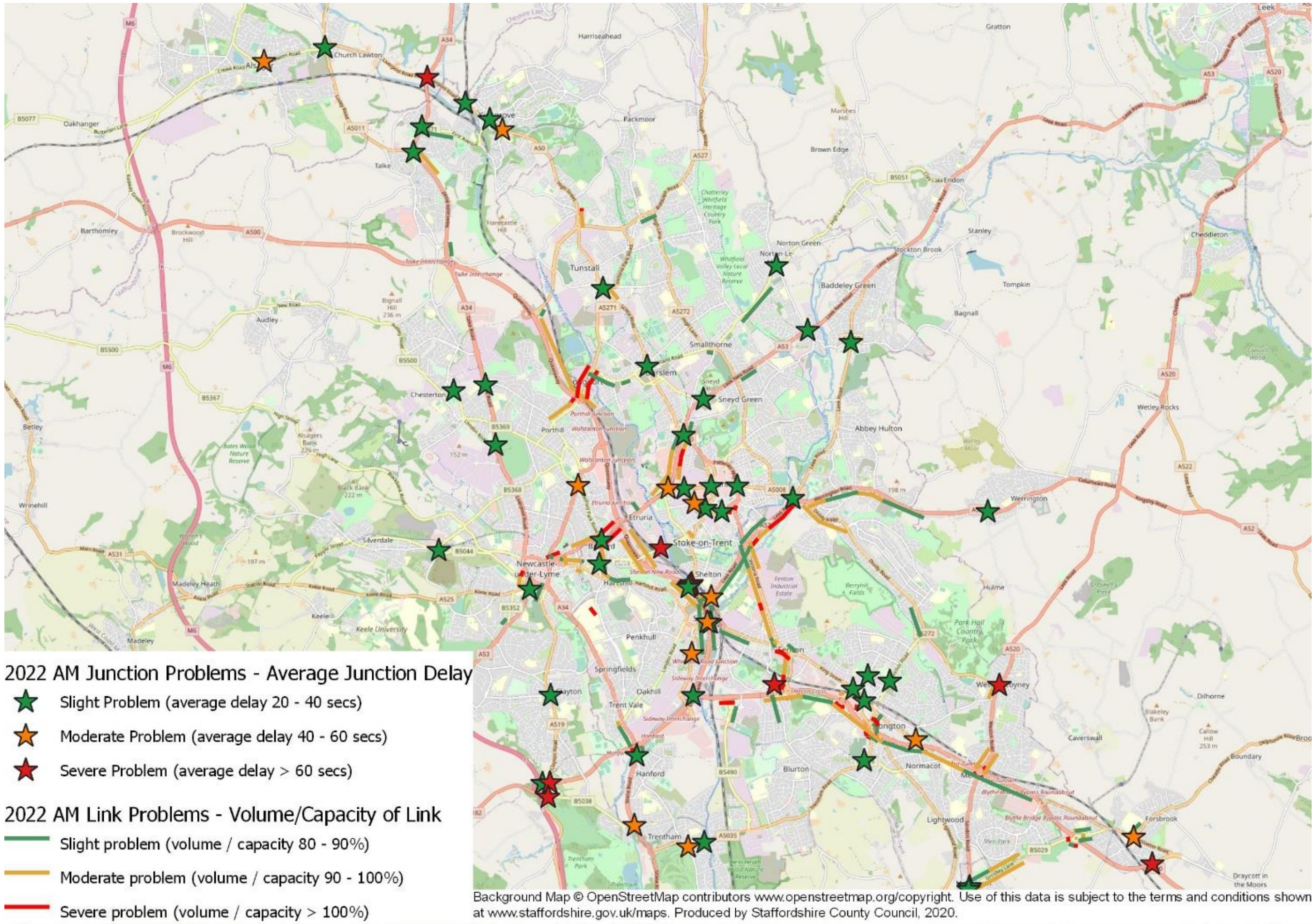

Figure 6-19: 2022 Reference Case IP peak-hour overcapacity links and significant junction delays

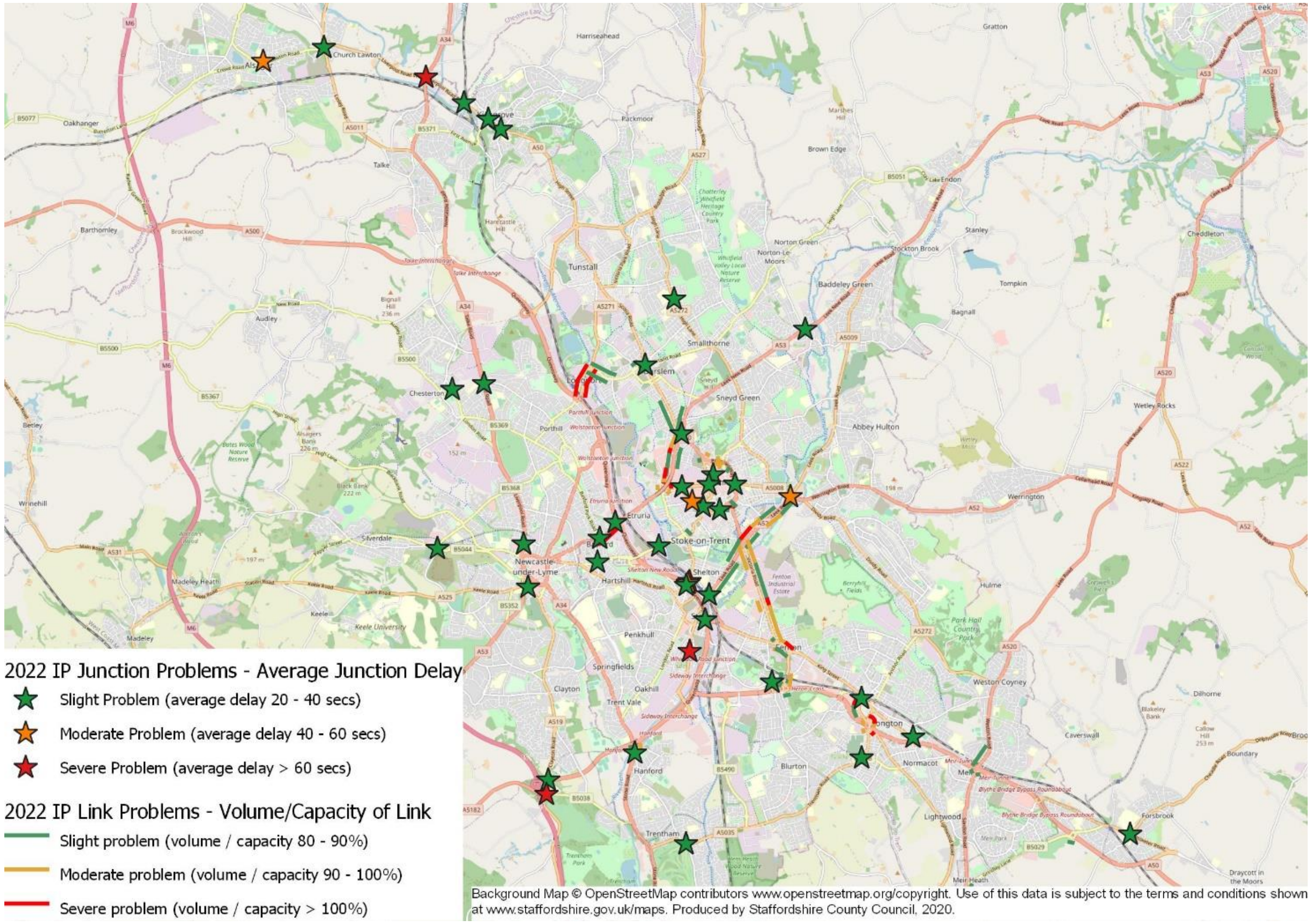


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*Figure 6-20: 2022 Reference Case PM peak-hour overcapacity links and significant junction delays*

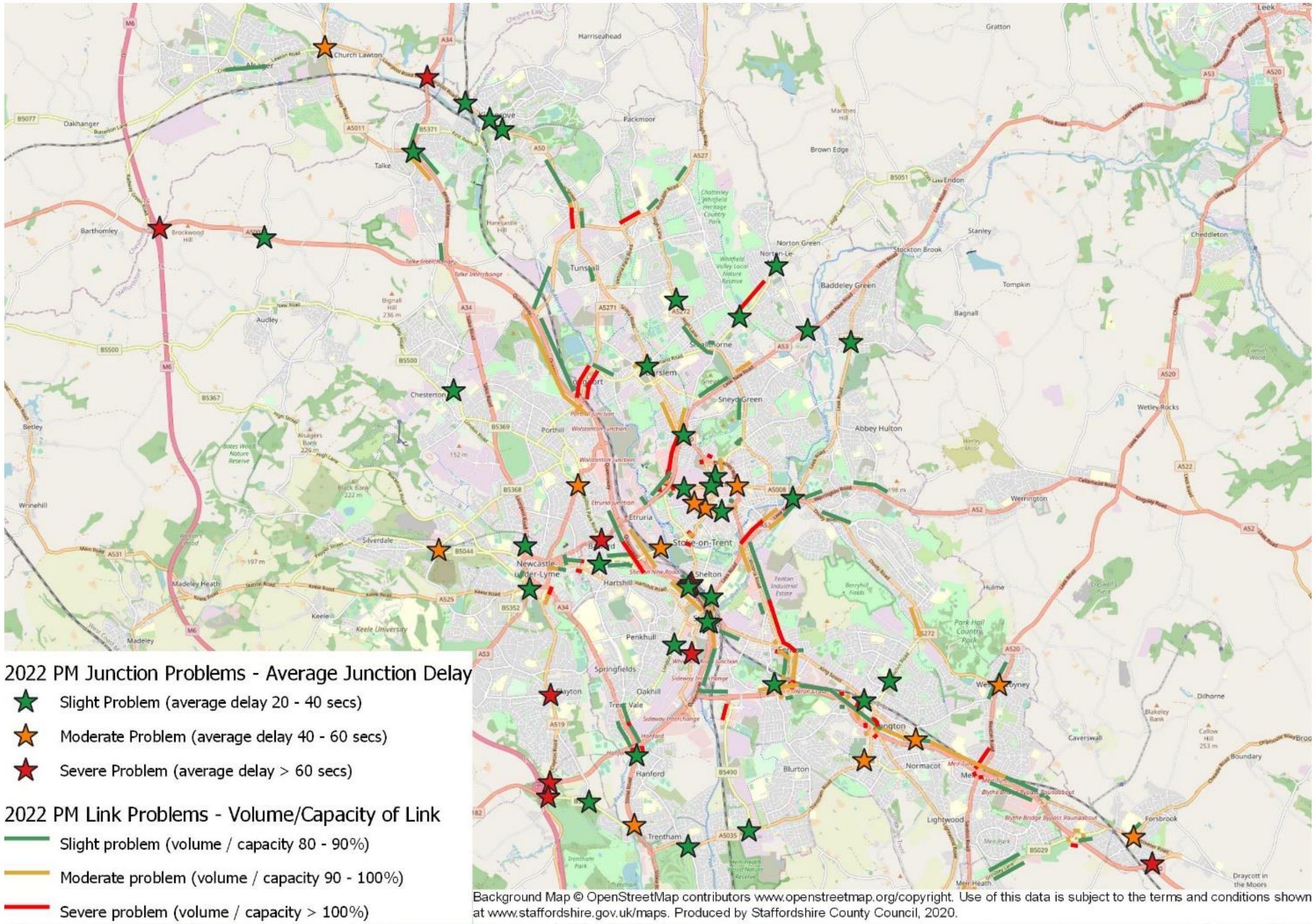


*Figure 6-21: 2025 Reference Case AM peak-hour overcapacity links and significant junction delays*

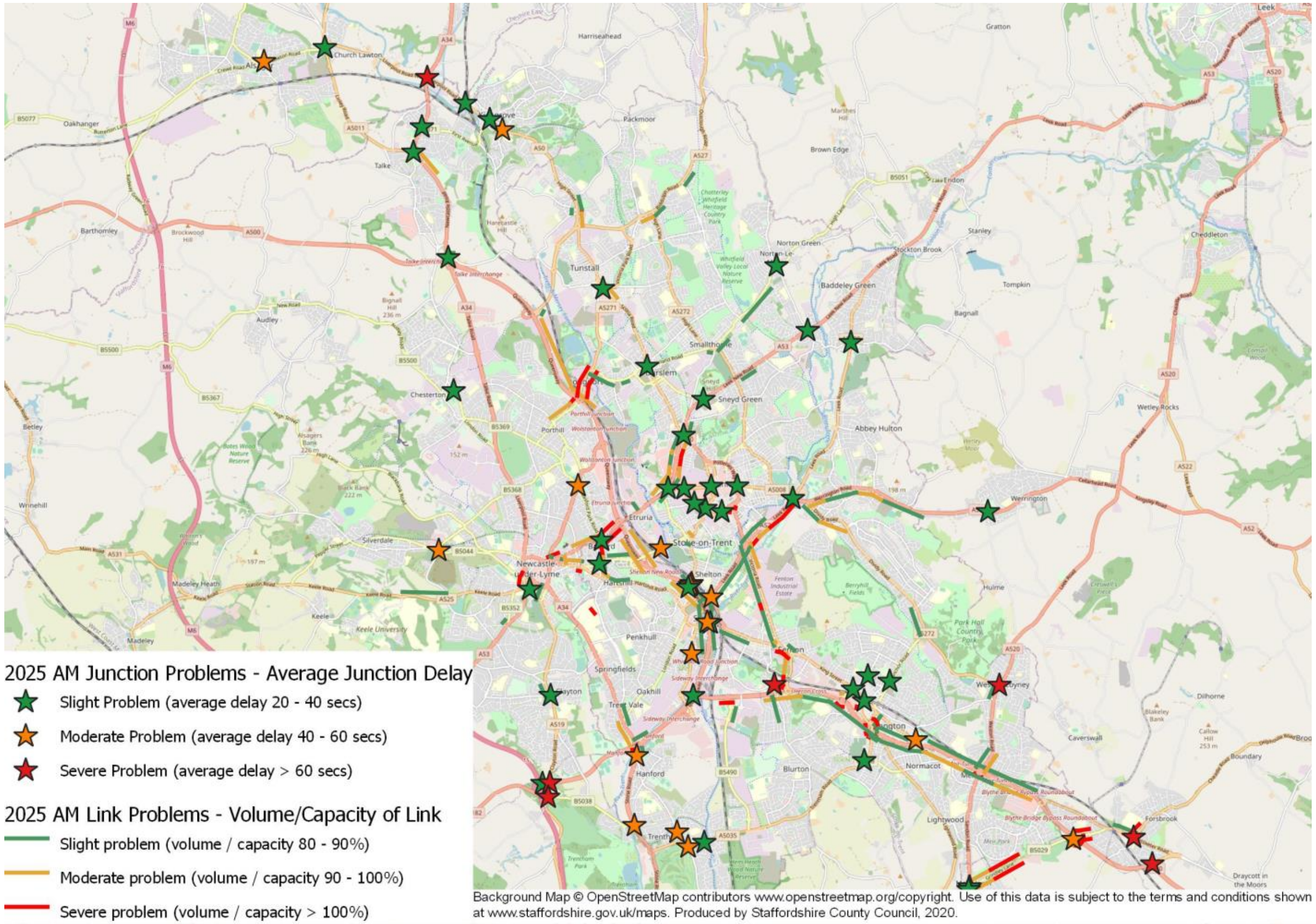


*Figure 6-22: 2025 Reference Case IP peak-hour overcapacity links and significant junction delays*

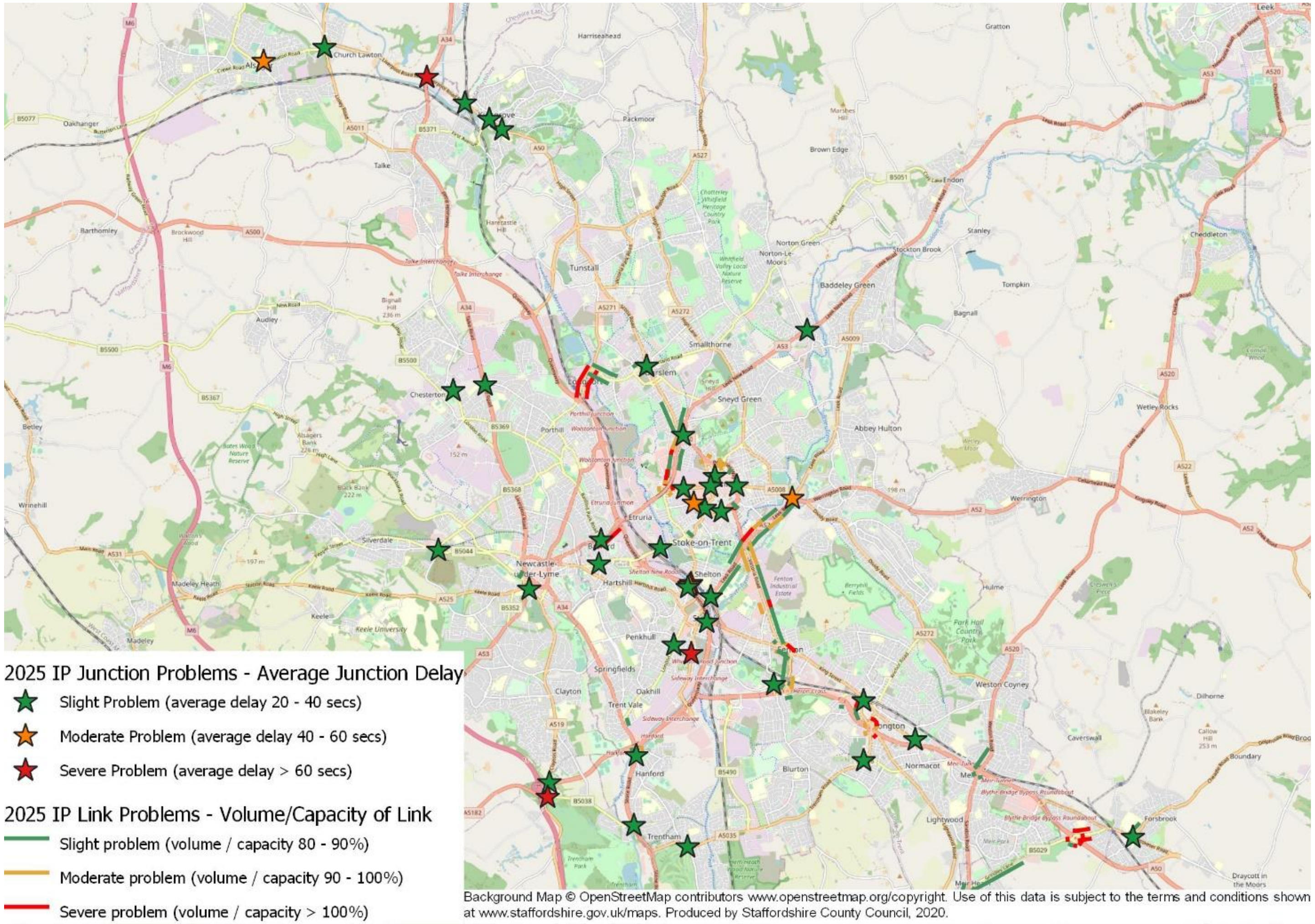
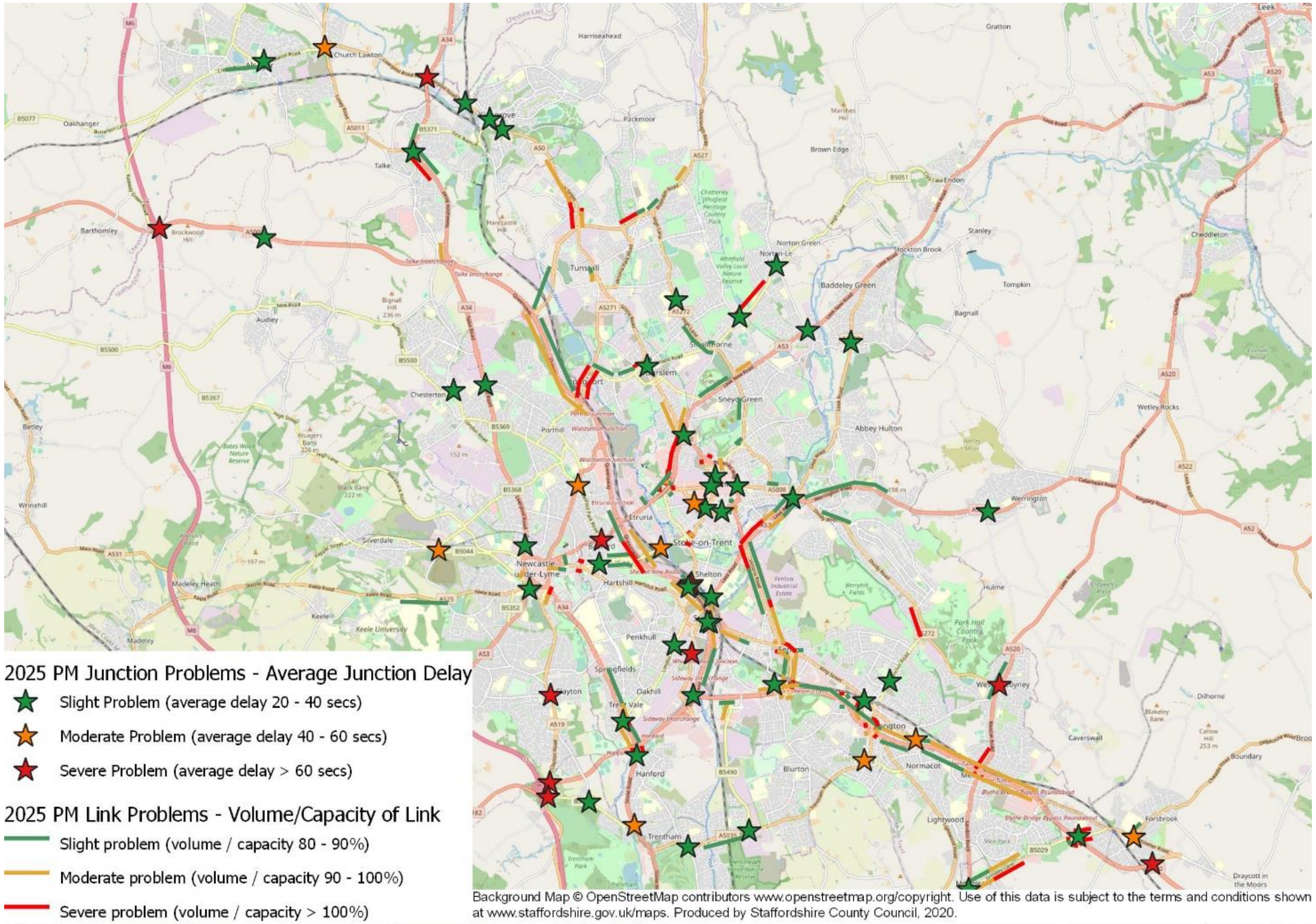


*Figure 6-23: 2025 Reference Case PM peak-hour overcapacity links and significant junction delays*



## 6.3 Forecast vehicle compliance splits and traffic growth

Table 6-2 shows existing and predicted vehicle compliance splits for North Staffordshire. These are based on ANPR surveys of the existing vehicle fleet and the application of Defra’s Emissions Factor Toolkit (EFT, Version 9.1b) to predict vehicle compliance splits in the 2022 and 2025 forecast years. The predicted compliance splits have been used to disaggregate the forecast 2022 and 2025 vehicle matrices into compliant and non-compliant vehicle types prior to assignment. As can be seen from Table 6-2, the EFT is forecasting a large shift to compliance for HGVs, taxis and coaches/buses by 2022. Between 2022 and 2025 the EFT forecasts a large shift to compliance for coaches/buses and cars. By 2025 HGV compliance is estimated to be at 96%.

Table 6-3 shows the resultant change in compliant and non-compliant trip matrix totals by vehicle type between the 2015 base-year, the 2022 Reference Case and the 2025 Reference Case from the application of the results of the ANPR surveys and EFT for each modelled time period.

Finally, Table 6-4 shows the trip matrix totals for the 2015 base-year, 2022 Reference Case and the 2025 Reference Case by vehicle type for each modelled time period and the resultant predicted traffic growth.

*Table 6-2: Existing and forecast vehicle compliance splits*

| Year | Car | | Taxi | | LGV | | HGV | | Bus/Coach | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Compliant | Non-Compliant | Compliant | Non-Compliant | Compliant | Non-Compliant | Compliant | Non-Compliant | Compliant | Non-Compliant |
| **Existing** | 61% | 39% | 20% | 80% | 32% | 68% | 62% | 38% | 19% | 81% |
| **2022** | 67% | 33% | 52% | 48% | 55% | 45% | 87% | 13% | 49% | 51% |
| **2025** | 77% | 23% | 59% | 41% | 62% | 38% | 96% | 4% | 74% | 26% |
| **Change Existing - 2022** | 7% | -7% | 32% | -32% | 23% | -23% | 25% | -25% | 30% | -30% |
| **Change 2022-2025** | 10% | -10% | 7% | -7% | 7% | -7% | 9% | -9% | 25% | -25% |

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*Table 6-3: 2015 Base-Year, 2022 and 2025 Reference Case trip matrix totals by vehicle type and compliance*

| Vehicle Type | Compliance | AM Peak-Hour | | | | | Inter-Peak Hour | | | | | PM Peak-Hour | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2015 | 2022 | 2025 | % Diff. 2015-2022 | % Diff. 2022-2025 | 2015 | 2022 | 2025 | % Diff. 2015-2022 | % Diff. 2022-2025 | 2015 | 2022 | 2025 | % Diff. 2015-2022 | % Diff. 2022-2025 |
| **Car** | **Compliant** | 47,481 | 54,526 | 63,905 | 15% | 17% | 40,402 | 46,940 | 55,163 | 16% | 18% | 51,154 | 58,626 | 68,677 | 15% | 17% |
| | **Non-Compliant** | 30,356 | 26,856 | 19,088 | -12% | -29% | 25,831 | 23,120 | 16,477 | -10% | -29% | 32,705 | 28,876 | 20,514 | -12% | -29% |
| **Taxi** | **Compliant** | 28 | 85 | 98 | 204% | 15% | 24 | 73 | 85 | 204% | 16% | 30 | 91 | 105 | 203% | 15% |
| | **Non-Compliant** | 128 | 78 | 68 | -39% | -13% | 109 | 67 | 59 | -39% | -12% | 138 | 84 | 73 | -39% | -13% |
| **LGV** | **Compliant** | 2,690 | 5,710 | 6,711 | 112% | 18% | 2,547 | 5,348 | 6,273 | 110% | 17% | 2,435 | 5,069 | 5,934 | 108% | 17% |
| | **Non-Compliant** | 6,277 | 4,672 | 4,113 | -26% | -12% | 5,944 | 4,375 | 3,844 | -26% | -12% | 5,682 | 4,147 | 3,637 | -27% | -12% |
| **HGV** | **Compliant** | 2,696 | 3,762 | 4,162 | 40% | 11% | 2,351 | 3,266 | 3,622 | 39% | 11% | 1,528 | 2,134 | 2,363 | 40% | 11% |
| | **Non-Compliant** | 1,652 | 562 | 173 | -66% | -69% | 1,441 | 488 | 151 | -66% | -69% | 937 | 319 | 98 | -66% | -69% |
| **Total** | | **91,308** | **96,251** | **98,318** | **5%** | **2%** | **78,649** | **83,677** | **85,674** | **6%** | **2%** | **94,609** | **99,346** | **101,401** | **5%** | **2%** |

*Table 6-4: 2015 Base-Year, 2022 and 2025 Reference Case trip matrix totals by vehicle type*

| Vehicle Type | AM Peak-Hour | | | | | Inter-Peak Hour | | | | | PM Peak-Hour | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2015 | 2022 | 2025 | % Diff. 2015-2022 | % Diff. 2022-2025 | 2015 | 2022 | 2025 | % Diff. 2015-2022 | % Diff. 2022-2025 | 2015 | 2022 | 2025 | % Diff. 2015-2022 | % Diff. 2022-2025 |
| **Car** | 77,837 | 81,382 | 82,993 | 5% | 2% | 66,233 | 70,060 | 71,640 | 6% | 2% | 83,859 | 87,502 | 89,191 | 4% | 2% |
| **Taxi** | 156 | 163 | 166 | 4% | 2% | 133 | 140 | 144 | 5% | 3% | 168 | 175 | 178 | 4% | 2% |
| **LGV** | 8,967 | 10,382 | 10,824 | 16% | 4% | 8,491 | 9,723 | 10,117 | 15% | 4% | 8,117 | 9,216 | 9,571 | 14% | 4% |
| **HGV** | 4,348 | 4,324 | 4,335 | -1% | 0% | 3,792 | 3,754 | 3,772 | -1% | 0% | 2,465 | 2,453 | 2,461 | 0% | 0% |
| **Total** | **91,308** | **96,251** | **98,318** | **5%** | **2%** | **78,649** | **83,677** | **85,674** | **6%** | **2%** | **94,609** | **99,346** | **101,401** | **5%** | **2%** |

# 7 Option testing

## 7.1 Preferred Option

A detailed description of the Preferred Option is as follows:

1. **A50 Victoria Road bus gate**

A bus gate will be installed on the A50 Victoria Road exit of the King Street/City Road/Victoria Road junction. Traffic will be restricted to buses, cyclists and taxis between Monday and Friday from 7am to 10am and 4pm to 7pm.

The splitter island will be widened, and the kerbs re-aligned to provide a single lane bus gate. An ANPR camera will be located at the bus gate to monitor compliance and two rotating prism signs will be installed at the entrance to the bus gate. The prism signs will enable the display of multiple messages and will be blank when the bus gate is not in use.

Bus gate advanced direction signing will be provided on the local highway network on all approaches to the Victoria Road/City Road and A50/King Street junctions, including Prism and Variable Message Signs.

The scheme costs include installation, the Traffic Regulation Order, ten-years of maintenance, monitoring and operation, and decommissioning at the end of the project. It is expected that the cameras may need to be replaced after five years.

An Ultra-Low Emission Vehicle (ULEV) exemption, allowing ULEVs to drive through the bus gate, will be assessed, and if considered deliverable, will be added to the scheme in the Full Business Case (FBC).

2. **A53 Etruria Road bus gate**

A two-lane bus gate will be installed on the A53 Etruria Road westbound exit of the A53/A500 roundabout, with appropriate amendments to the existing road markings at the bus gate and on the circulatory carriageway. Traffic will be restricted to buses, cyclists and taxis between Monday and Friday from 7am to 10am and 4pm to 7pm. Two rotating prism signs will be installed at the entrance to the bus gate to enable the display of multiple messages and will be blank when the bus gate is not in use. Two ANPR cameras will be installed to manage compliance.

Advanced direction signing will include prism signs on all approaches to the A500/A53 Etruria Road roundabout. Changes to destination signs on the A500 mainline carriageway in both directions are also proposed. This will include appropriate re-routing to the hospital and will also include variable message signs.

The scheme costs include installation, the Traffic Regulation Order, ten-years of maintenance, monitoring and operation, and decommissioning at the end of the project. It is expected that the cameras may need to be replaced after five years.

A ULEV exemption, allowing ultra-low emission vehicles to drive through the bus gate will be assessed and if considered deliverable will be added to the scheme in the FBC.

3. **Traffic Management east and west of Victoria Road**

Traffic management measures will be required on roads to the east and west of Victoria Road in order to ensure that the adjacent local communities are not adversely impacted by traffic re-routeing through these areas when the bus gates are in operation.

The following measures will be required to the East of Victoria Road:

- Replace existing worn and ineffective road humps in Beville Street, Stanier Street, Wileman Street, Philip Street, Elliot Road, Wedgwood Road, Warrington Street and Vivian Road and enhance the impact of the scheme by providing additional humps and carriageway re-surfacing.
- Provide new road humps and carriageway re-surfacing along Park Street, Minerva Road, Frederick Street, Cumberland Street and Clarence Street.
- Introduce one-way operation (direction of travel west to east) in Wileman Street (part) and Stanier Street (part).
- Provide an environmental weight restriction on the traffic calmed routes to prevent inappropriate large vehicles travelling through the area.
- Extend 20 mph zone to cover the whole traffic calmed area.

The following measures will be required to the West of Victoria Road:

- Replace existing worn and ineffective road humps in Manor Street, George Street, Edward Street and Hitchman Street and enhance the impact of the scheme by providing additional humps and carriageway re-surfacing.
- Provide new road humps and carriageway re-surfacing in Maud Street, Fountain Street and William Street. This includes two raised tables to improve safety at Christ Church C of E Primary School.
- Enhance signage to improve the enforcement of the existing environmental weight restriction in Manor Street.
- Closure of Hitchman Street at its junction with Victoria Road, maintaining access for pedestrians and cyclists.
- The existing western footway along Victoria Road at Hitchman Street will be extended to enhance the pedestrian environment.
- A 20mph zone to include the whole traffic calmed area.

4. **Transport improvements along A53 Etruria Road**

The bus gate on A53 Etruria Road will significantly reduce traffic flows in the peak periods along this corridor and improve bus reliability. This will necessitate the review of signal timings at junctions along the corridor in order to maximise air quality benefits.

The increase in spare capacity along the corridor will create the opportunity for the provision of signalised pedestrian crossing facilities on all arms of the A53/Gladstone Street/Basford Park Road junction and the A53/Albert Street/Sandy Lane junction.

An existing bus stop along the A53 Etruria Road is located on the hill where it is observed that traffic can queue behind buses serving the stop. It is recommended that the bus stop is relocated to the east of Kingsfield Oval, opposite the New Vic Theatre where it is likely to have a reduced impact on air quality. Accessibility will be enhanced through the provision of bus access kerbs and levelled footways. Real Time Bus Passenger Information (RTPI) will also be provided along the A53 corridor.

**5. Bus retrofit programme**

To deliver compliance on Bucknall New Road and Victoria Road the buses that use these routes will be retrofitted to achieve Euro VI emission standards. This involves the installation of the appropriate exhaust modification depending on vehicle type and age and associated e-cooling fan to minimise ongoing maintenance. This will be an expansion of the existing bus retrofit programme being delivered on the A53 as part of the separate NuLBC Ministerial Direction.

75% of buses that travel along the Bucknall New Road corridor and all buses travelling along Victoria Road require this improvement to ensure that compliance is achieved. Funding will be required for the retrofitting of 50 buses to ensure that the appropriate number of scheduled services can continue to operate on Bucknall New Road and Victoria Road. The two main operators are First Bus and D&G, and the smaller operators include Scraggs and Stantons of Stoke.

To market the cleaner bus fleet, enhance their visibility and encourage greater bus use, it is recommended that all buses that have been retrofitted are provided with a new branding in the form of a partial bus wrap. To monitor bus operator, use of retrofit vehicles, ANPR cameras will be installed on Victoria Road, Bucknall New Road, at the junction with St Ann Street, and on the A53 to the east of the junction with Albert Street/Sandy Lane.

**6. Bus infrastructure improvements**

Enhanced bus infrastructure will be installed on routes that pass through or are parallel to the exceedance locations. This includes bus routes:

- To Abbey Hulton, Milton, Bentilee and Longton that converge at Bucknall New Road
- Along Victoria Road and parallel routes along College Road and A5007 City Road
- Along A53 Etruria Road between Newcastle town centre and Hanley City Centre, and parallel routes along the A52 and Shelton New Road

The improvements are required to ensure that bus patronage is maximised along corridors that are at risk of air quality exceedances and where traffic modelling suggests that traffic flows and journey times may increase as traffic re-routes to avoid the bus gates. The cost of the package includes the installation and ten-year maintenance of:

- 89 RTPI screens
- 17 new bus shelters of which 8 are replacement and 9 are new facilities
- 27 accessible kerbs at bus stops
- Installation of CCTV at 71 bus stops

The proposed transport schemes for the Preferred Option have been developed in order to address $NO_2$ exceedances. A multitude of options have been tested in the NSMM transport model in order to produce the optimal package of measures. In addition to the transport schemes included in the Reference Case, the schemes that were modelled in the NSMM transport model for the Preferred Option are outlined in Table 7-1. Not all the measures could be tested in the NSMM transport model such as the bus infrastructures improvement and some of the local traffic management measures due to the nature of these schemes and the strategic nature of the NSMM transport model.

*Table 7-1: Preferred Option transport schemes*

| Location | Preferred Option |
|---|---|
| **A53 Etruria Road** | A53 westbound peak restriction (except bus, cycle and taxi) plus pedestrian phases at both Albert St and Basford Park traffic lights. |
| **Bucknall New Road** | 75% bus retrofit along Bucknall New Road |
| **Victoria Road** | Victoria Road northbound peak restrictions on southern end of Victoria Road (except bus, cyclists and taxi)<br><br>100% bus retrofit |

### 7.2 Modelling of options

In addition to the Preferred Option, several options were tested using the NSMM model. Table 7-2 outlines the different model runs undertaken for the 2022 forecast year (the compliance year) and details the respective mitigation measures.

The predicted $NO_2$ concentrations for 2022 are outlined for each option modelled in Table 7-3. Option 4 achieves compliance at all exceedance locations without generating additional exceedances elsewhere or using a charging scheme (such as option 1, 3 and 5). Option 7 (the Preferred Option) was then generated which combines Option 4 with bus network enhancements. The bus network enhancement, given their nature, were not modelled, so in transport modelling terms Option 4 and 7 are the same. Table 7-4 provides an assessment of each option.

*Table 7-2: Modelled options*

| | Option 1 (Benchmark) | Option 2 | Option 3 | Option 4 | Option 5 | Option 6 | Option 7 (Preferred Option) |
|---|---|---|---|---|---|---|---|
| CAZ | CAZ D<br><br>Daily charge for trips through, within, to or from the CAZ D area:<br>Cars/Taxis --£5<br>LGVs --£9<br>HGVs --£35<br>Buses --£5 | No CAZ | Local CAZ D around Victoria Road<br><br>Daily charge for trips through, within, to or from the CAZ D area:<br>Cars/Taxis --£5<br>LGVs --£9<br>HGVs --£35<br>Buses --£0 | No CAZ | CAZ C<br><br>Daily charge for trips through, within, to or from the CAZ C area:<br>LGVs --£9<br>HGVs --£35<br>Buses --£5 | No CAZ | No CAZ |
| A53 | | Basford Park right turn ban | A53 westbound peak restrictions (except bus, cyclists and taxi) | A53 westbound peak restriction (except bus, cyclists and taxi)<br><br>Pedestrian phases at both Albert Street and Basford Park traffic lights | | As option 4, plus further complementary measures including:<br>• Improved bus stops and shelters<br>• Bus wrap advertising<br>• Real-time information Travel planning<br>• Vegetation planting/removal<br>• Cycling/walking infrastructure<br>• EV infrastructure | As option 4, plus further bus network enhancements including:<br>• Improved bus stops and shelters<br>• Bus wrap advertising<br>• Real-time information |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Bucknall New Road | 100% bus retrofit for Bucknall New Road to mitigate impact of CAZ D | 50% bus retro fit on Bucknall New Road | 100% bus retro fit on Bucknall New Road | 75% bus retrofit along Bucknall New Road | | As option 4, plus further complementary measures as above | As option 4, plus further bus network enhancements |
| Victoria Road | 100% bus retrofit for Victoria Road to mitigate impact of CAZ D | Existing Academy Link Road with junction improvements at both ends (only NB north of Academy)<br><br>Victoria Rd northbound peak restrictions on the southern end of Victoria Road (except bus, cyclists and taxi)<br><br>100% bus retrofit on Victoria Road | Local CAZ D<br><br>100% bus retrofit on Victoria Road to mitigate impact of local CAZ D | Victoria Road northbound peak restrictions on southern end of Victoria Road (except bus, cyclists and taxi)<br><br>100% bus retrofit | | As option 4, plus further complementary measures as above | As option 4, plus further bus network enhancements |

*Table 7-3: predicted NO2 concentrations 2022*

| | Reference Case | Option 1 (Benchmark) | Option 2 | Option 3 | Option 4 | Option 5 | Option 6 | Option 7 (Preferred Option) |
|---|---|---|---|---|---|---|---|---|
| **A53** | 43 | 33 | 42 | 40 | 39 | 38 | 39 | 39 |
| **Bucknall New Road** | 42 | 31 | 41 | 37 | 39 | 35 | 39 | 39 |
| **Victoria Road** | 46 | 36 | 40 | 35 | 39 | 41 | 39 | 39 |

*Table 7-4: Assessment of options*

| | Option 1 (Benchmark) | Option 2 | Option 3 | Option 4 | Option 5 | Option 6 | Option 7 (Preferred Option) |
|---|---|---|---|---|---|---|---|
| **Impact on $NO_2$ concentrations** | Full compliance<br>Effect of rerouting: Increase in concentrations in London Road (Newcastle-under-Lyme) and Newport Lane, Newcastle Street and Moorland Road (Stoke-on-Trent) | A53 and Bucknall New Road remain in exceedance<br>New exceedance: entrance to the Intu Potteries car park | No exceedances Victoria Road<br>No more exceedances (decrease by around 10 µg/m³)<br>Increase in Leek Road (by around 1 µg/m³) | No exceedances.<br><br>All locations below the legal limit, suggesting that this option provides the most practical non-CAZ option. This option will be used to inform the Preferred Option. | Delivers compliance on A53 and Bucknall New Road, but Victoria Road is in exceedance at 41.3 µg/m³, and two other locations (Longport road and entrance to Potteries car park, Hanley) fall into exceedance. | No exceedances.<br><br>All locations are below the legal limit. However, complementary measures will not be used. | No exceedances.<br><br>All locations are below the legal limit suggesting that this option provides the most practical non-CAZ option. This option has therefore been progressed to the Preferred Option |
| **Summary of assessment** | Benchmark required by JAQU, against which the Preferred Option must be tested for delivery against the primary outcome of achieving compliance in the shortest possible time.<br>This forms the default option, if a Preferred Option cannot be found that delivers the primary aim.<br><br>Benchmark option | Does not quite achieve compliance at 2 of the 3 exceedances. Therefore officers have developed a more robust traffic-based option (option 4), for testing.<br><br>Dismissed as an option. | Achieves compliance, but still includes a CAZ D. Therefore it is not in line with JAG instructions to identify a non-CAZ Preferred Option.<br><br>Dismissed as an option. | Developed following review of option 2 results. Delivers a traffic-based solution that delivers full compliance.<br><br>This option has been built upon to produce the Preferred Option.<br><br>Dismissed as an option | Tested to determine whether a less severe CAZ C could be used as an alternative benchmark.<br><br>Dismissed as an option. | Developed following the review of option 4 results. Combined with complementary measures delivers full compliance but complementary measures will not be used.<br><br>Dismissed as an option. | Developed following the review of option 4 results. Combined with bus network enhancements delivers full compliance and is deliverable in the shortest possible time, compared to option 1.<br><br>Preferred Option |

### 7.3 Preferred Option traffic growth

Table 7-5 shows the 2022 and 2025 trip matrix totals by vehicle type and compliance for the Preferred Option. Table 7-6 shows the 2022 and 2025 trip matrix totals for each vehicle type for the Preferred Option.

*Table 7-5: 2022 and 2025 Preferred Option trip matrix totals by vehicle type and compliance*

| Vehicle Type | Compliance | AM Peak-Hour | | Inter-Peak Hour | | PM Peak-Hour | |
|---|---|---|---|---|---|---|---|
| | | 2022 | 2025 | 2022 | 2025 | 2022 | 2025 |
| **Car** | **Compliant** | 54,526 | 63,905 | 46,940 | 55,163 | 58,626 | 68,677 |
| | **Non-Compliant** | 26,856 | 19,088 | 23,120 | 16,477 | 28,876 | 20,514 |
| **Taxi** | **Compliant** | 85 | 98 | 73 | 84.7 | 91 | 105 |
| | **Non-Compliant** | 78 | 68 | 67 | 58.8 | 84 | 73 |
| **LGV** | **Compliant** | 5,710 | 6,711 | 5,348 | 6,273 | 5,069 | 5,934 |
| | **Non-Compliant** | 4,672 | 4,113 | 4,375 | 3,845 | 4,147 | 3,637 |
| **HGV** | **Compliant** | 3,762 | 4,162 | 3,266 | 3,622 | 2,134 | 2,363 |
| | **Non-Compliant** | 562 | 173 | 488 | 151 | 319 | 98 |
| **Total** | | **96,251** | **98,318** | **83,677** | **85,674** | **99,346** | **101,401** |

*Table 7-6: 2022 and 2025 Preferred Option trip matrix totals by vehicle type*

| Vehicle Type | AM Peak-Hour | | Inter-Peak Hour | | PM Peak-Hour | |
|---|---|---|---|---|---|---|
| | 2022 | 2025 | 2022 | 2025 | 2022 | 2025 |
| **Car** | 81,382 | 82,993 | 70,060 | 71,640 | 87,502 | 89,191 |
| **Taxi** | 163 | 166 | 140 | 144 | 175 | 178 |
| **LGV** | 10,382 | 10,824 | 9,723 | 10,117 | 9,216 | 9,571 |
| **HGV** | 4,324 | 4,335 | 3,754 | 3,772 | 2,453 | 2,461 |
| **Total** | **96,251** | **98,318** | **83,677** | **85,674** | **99,346** | **101,401** |

### 7.4 Forecast traffic flows – Preferred Option

Figure 7-1 shows the change in forecast daily traffic flow between the 2022 Reference Case and the 2022 Preferred Option. Figure 7-2 and Figure 7-3 show the difference in forecast traffic flows for the 2022 Reference Case against the 2022 Preferred Option for the AM and PM modelled periods. The following can be seen from the Figures:

- A large reduction in daily and peak flows on the A53 westbound and on Victoria Road northbound due to the traffic restrictions of the bus gate in the Preferred Option

- The Victoria Road bus gate results in traffic re-routing on a variety of routes including A5272 Dividy Road, Grove Road/Whieldon Road and the A50/A500 to avoid the area
- The A53 bus gate results in traffic re-routing onto the A527 Grange Lane to the north of the A53 and A52 Hartshill Road and B5045 Shelton New Road to the south
- There is little flow change in the inter-peak with the Preferred Option as the bus gates are only operational in the peak periods

Figure 7-4 shows the change forecast daily traffic flow (AADT) between the 2025 Reference Case and the 2025 Preferred Option. Figure 7-5 and Figure 7-6 show the equivalent for the AM and PM modelled periods. The re-routing trends for 2025 are very similar to 2022. Table 7-7 shows a similar level of flow reduction along the A53 and Victoria Road in 2022 and 2025, with the reduction being slightly higher in 2025.

Figure 7-7 shows the overcapacity links and junction delays for the 2022 Preferred Option. Links are identified as being the source of congestion problems where the ratio of the modelled traffic flow to the capacity of the link are greater than 81%. For these assessments, the capacities of the links have been based on the Advice Note TA 79/99 – Traffic Capacity of Urban Roads (May 1999). Therefore, it should be borne in mind that these values are based on theoretical capacities which may not always reflect the ultimate or actual capacity of the road which may be affected by other local operational conditions and characteristics. Junctions are identified as being the source of congestion problems where the overall average junction delay is greater than 20 seconds. When compared with Figure 6-18 the 2022 Reference Case over capacity links and junction delays, Figure 7-7 unsurprisingly shows big improvements on the A53 westbound between the A500 roundabout to Basford Park Road and Victoria Road northbound with the bus gates operational in the Preferred Option.

Given the spread of redistributed traffic there is little wider deterioration in network performance with the Preferred Option. The main adverse impact is close to the Victoria Road bus gate where there is an increase in delays at the junction of City Road and Manor Street. This is caused by the increase in right turners from City Road to Manor Street, avoiding the bus gate in both modelled periods.

*Table 7-7: Change in AADT between Reference Case and Preferred Option*

| Location | AADT | |
|---|---|---|
| | 2022 | 2025 |
| **A53 Westbound** | -4690 | -4795 |
| **Victoria Road Northbound** | -3728 | -3757 |

*Figure 7-1: Change in AADT traffic flows between 2022 Reference Case and 2022 Preferred Option (vehicles)*

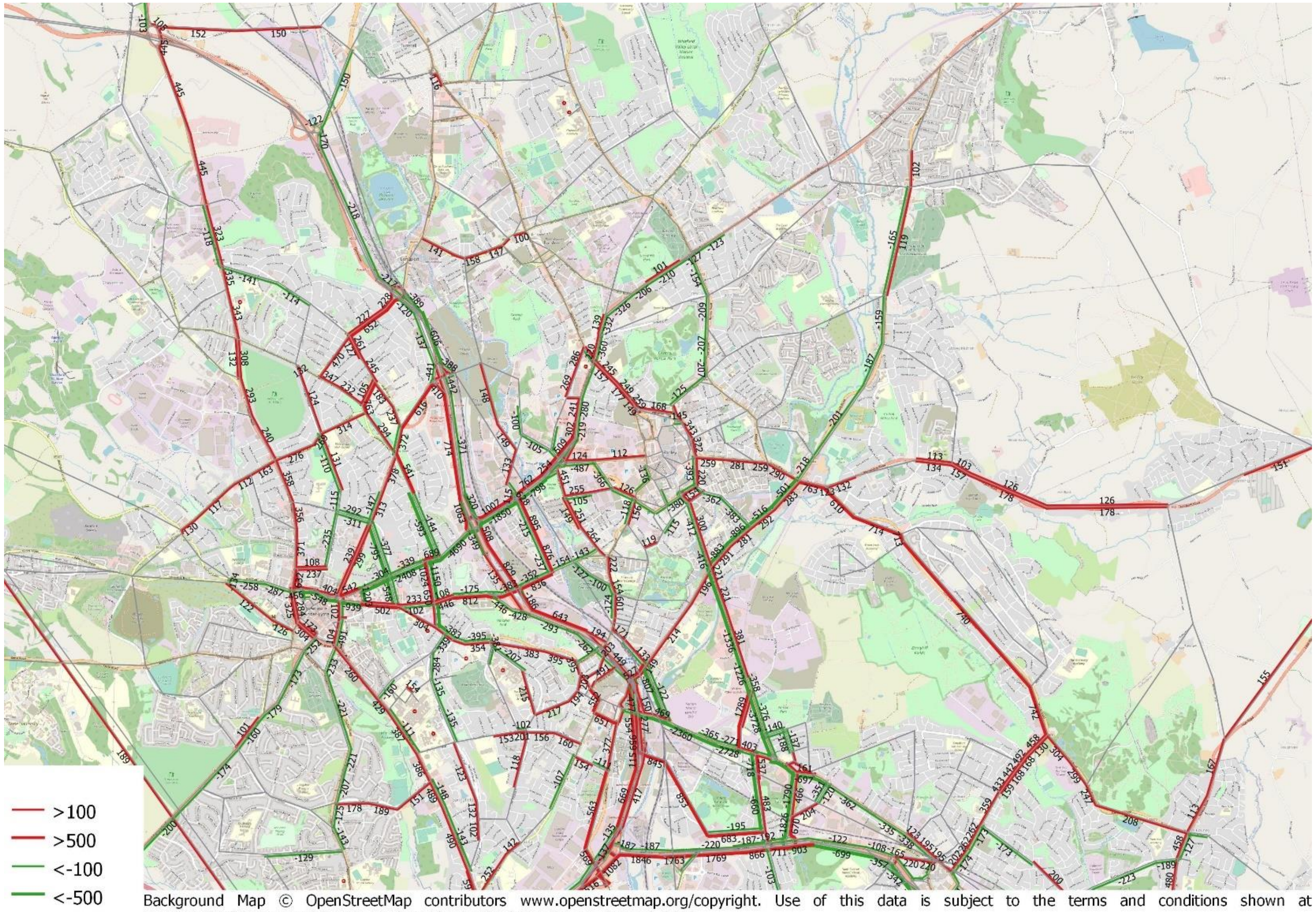


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*Figure 7-2: Change in AM peak-hour traffic flows between 2022 Reference Case and 2022 Preferred Option (vehicles)*

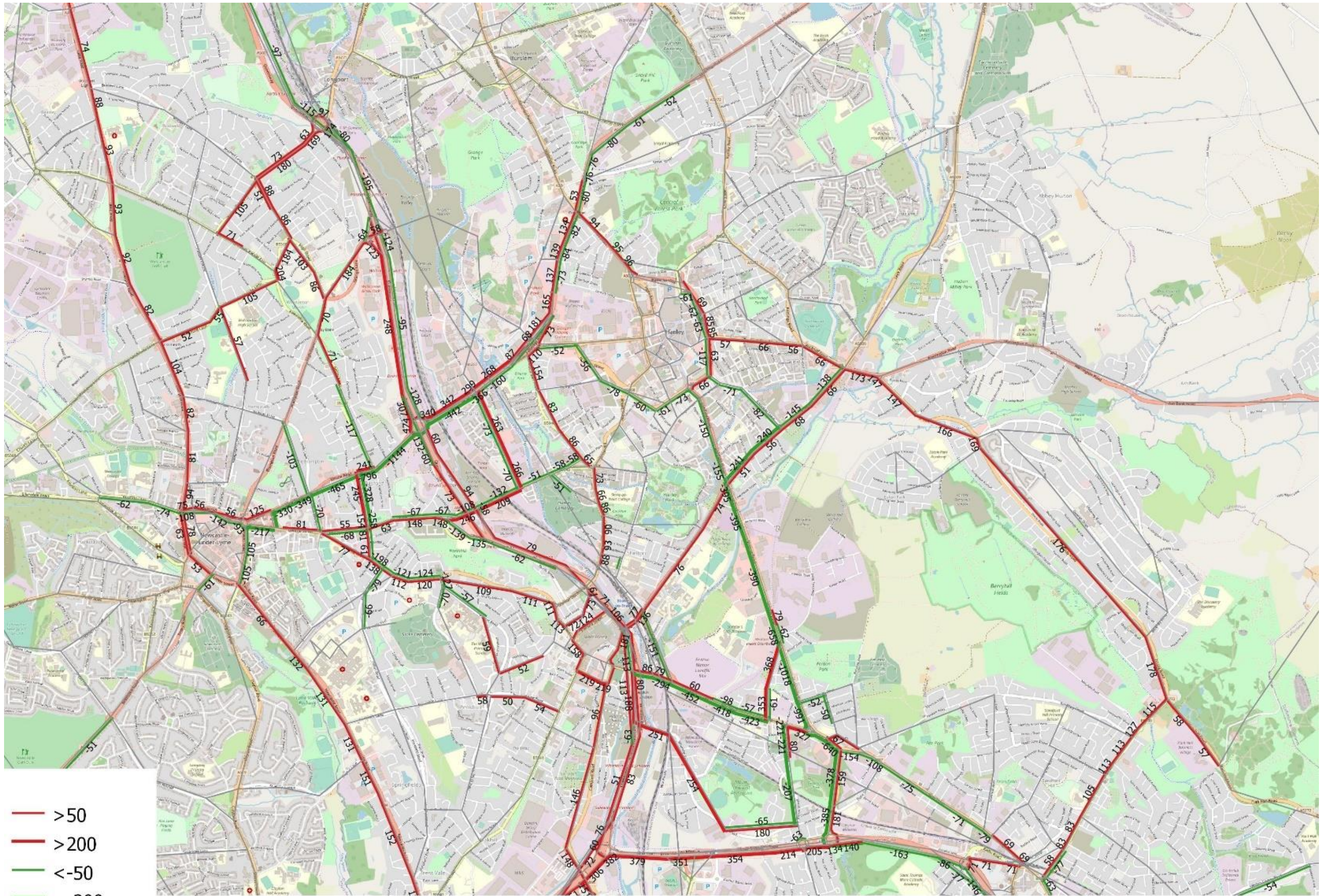

*Figure 7-3: Change in PM peak-hour traffic flows between 2022 Reference Case and 2022 Preferred Option (vehicles)*

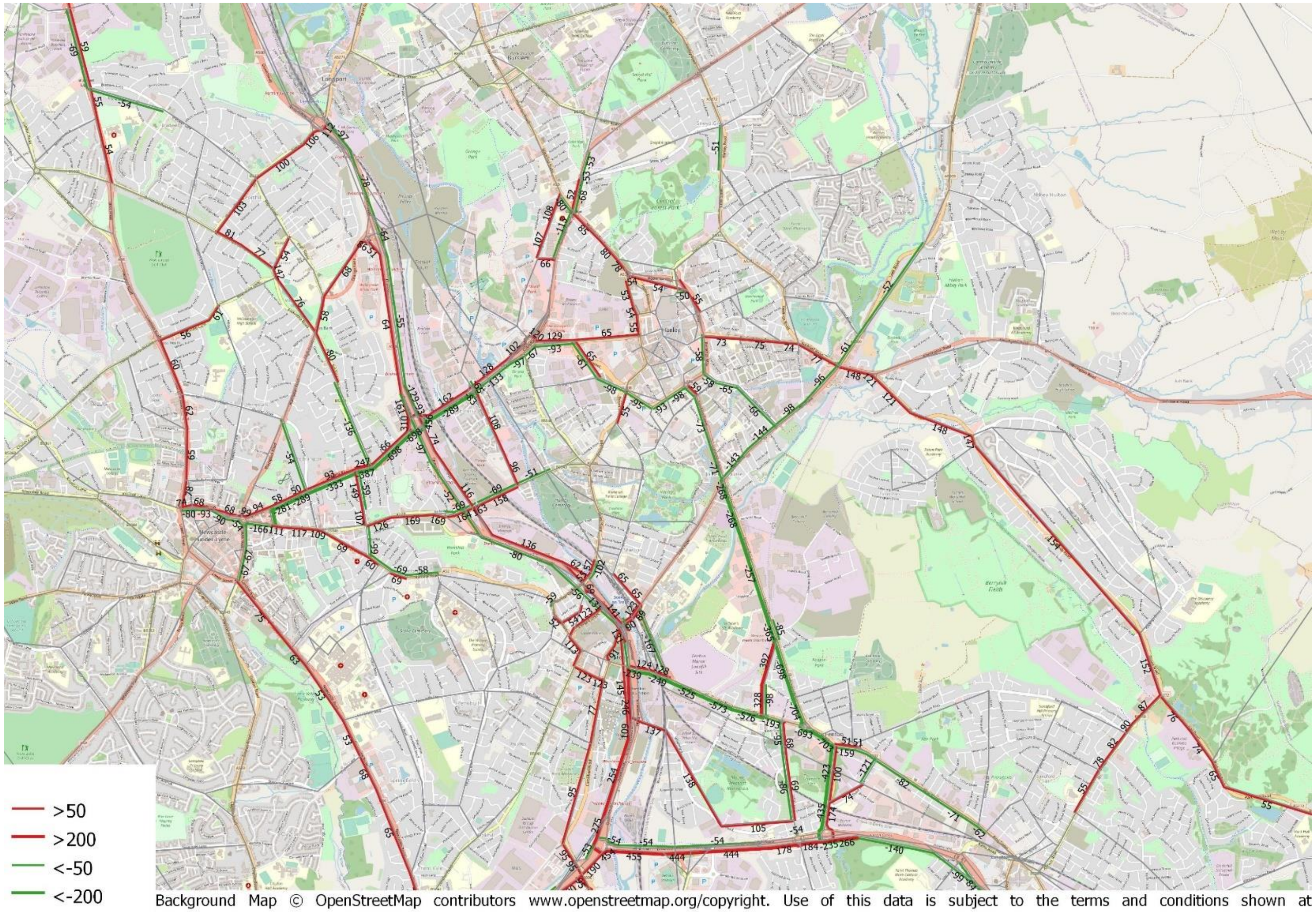


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*Figure 7-4: Change in AADT traffic flows between 2025 Reference Case and 2025 Preferred Option (vehicles)*

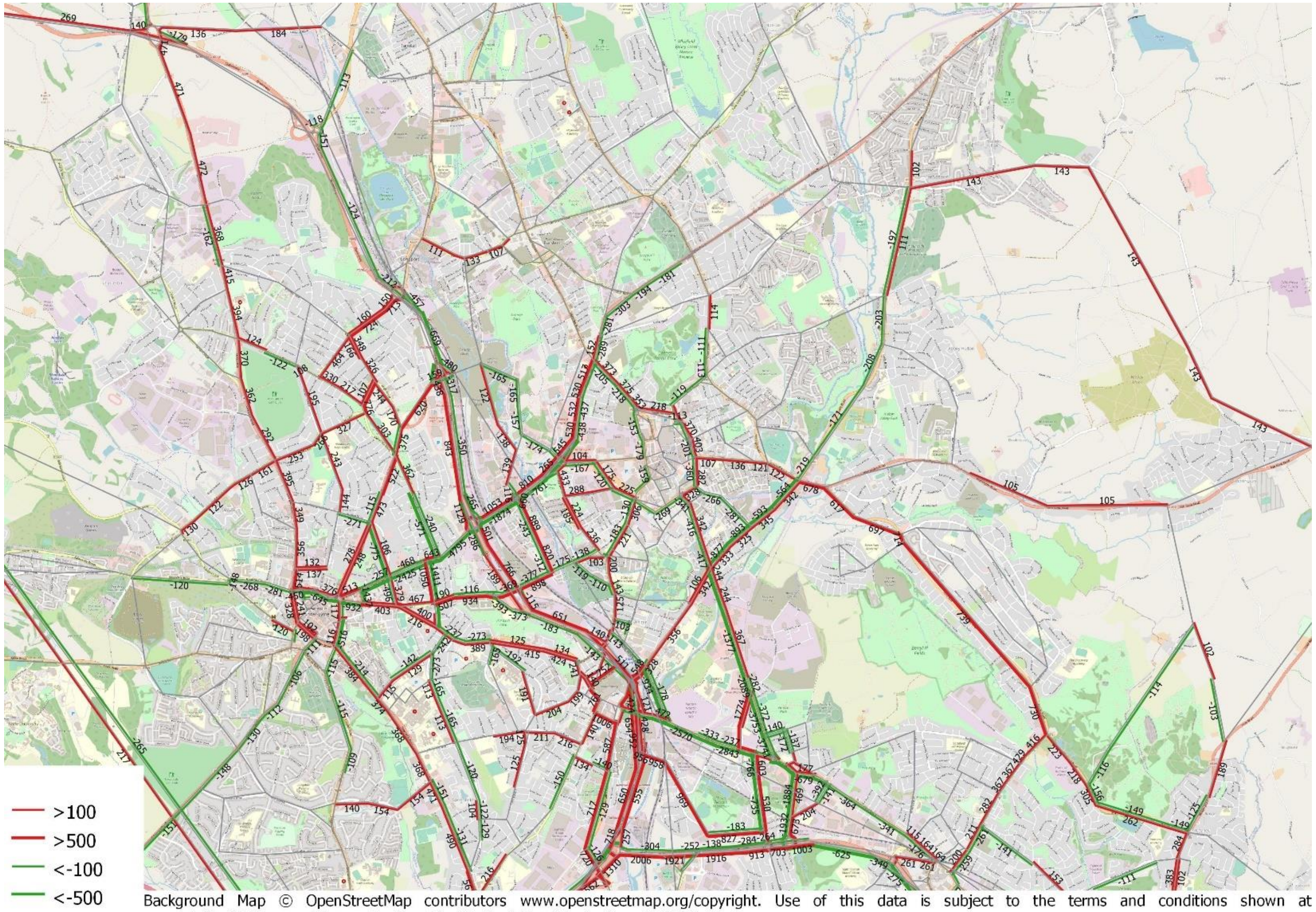


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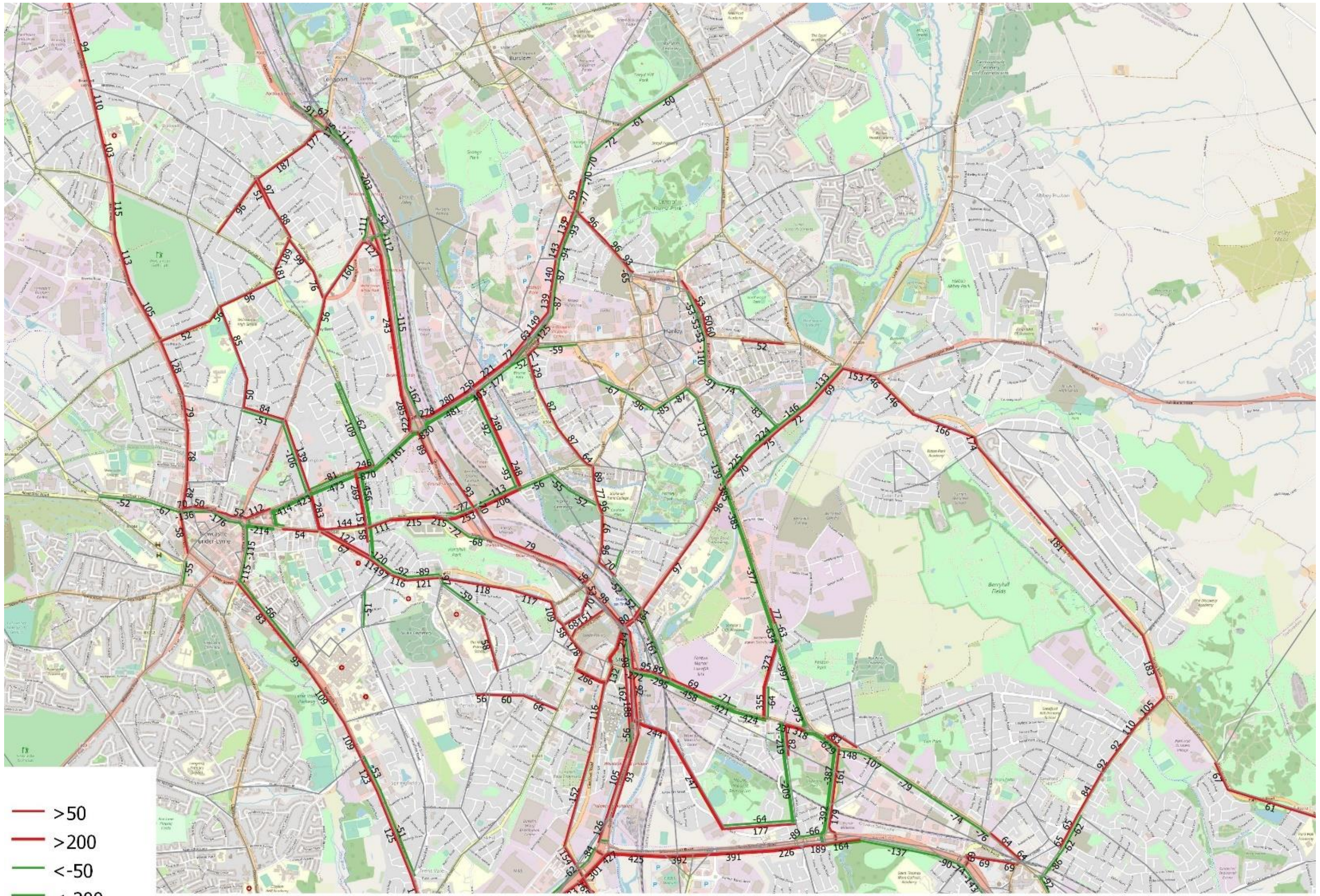
*Figure 7-5: Change in AM peak-hour traffic flows between 2025 Reference Case and 2025 Preferred Option (vehicles)*

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SWECO

*Figure 7-6: Change in PM peak-hour traffic flows between 2025 Reference Case and 2025 Preferred Option (vehicles)*

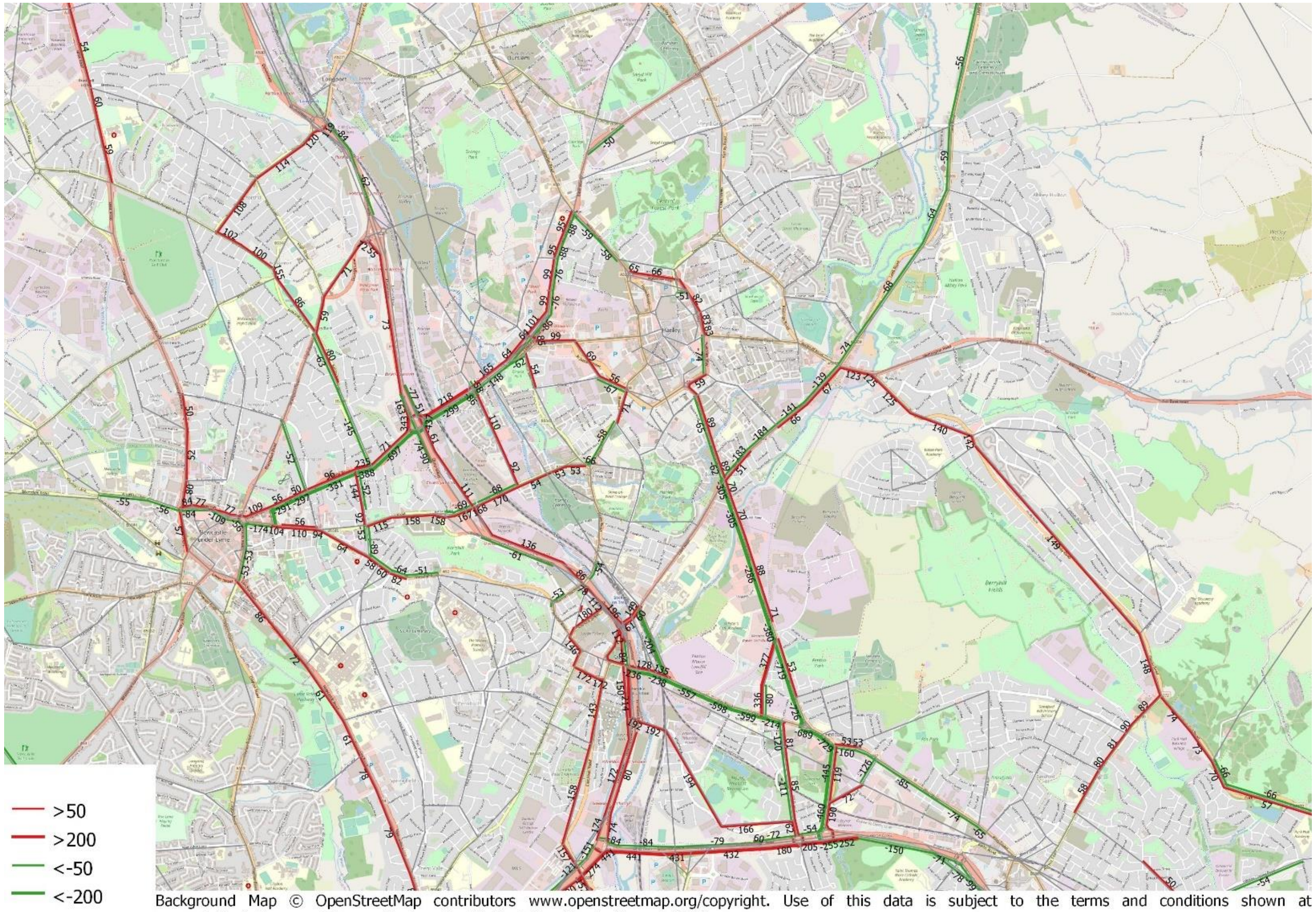


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*Figure 7-7: 2022 Preferred Option AM peak-hour overcapacity links and significant junction delays*

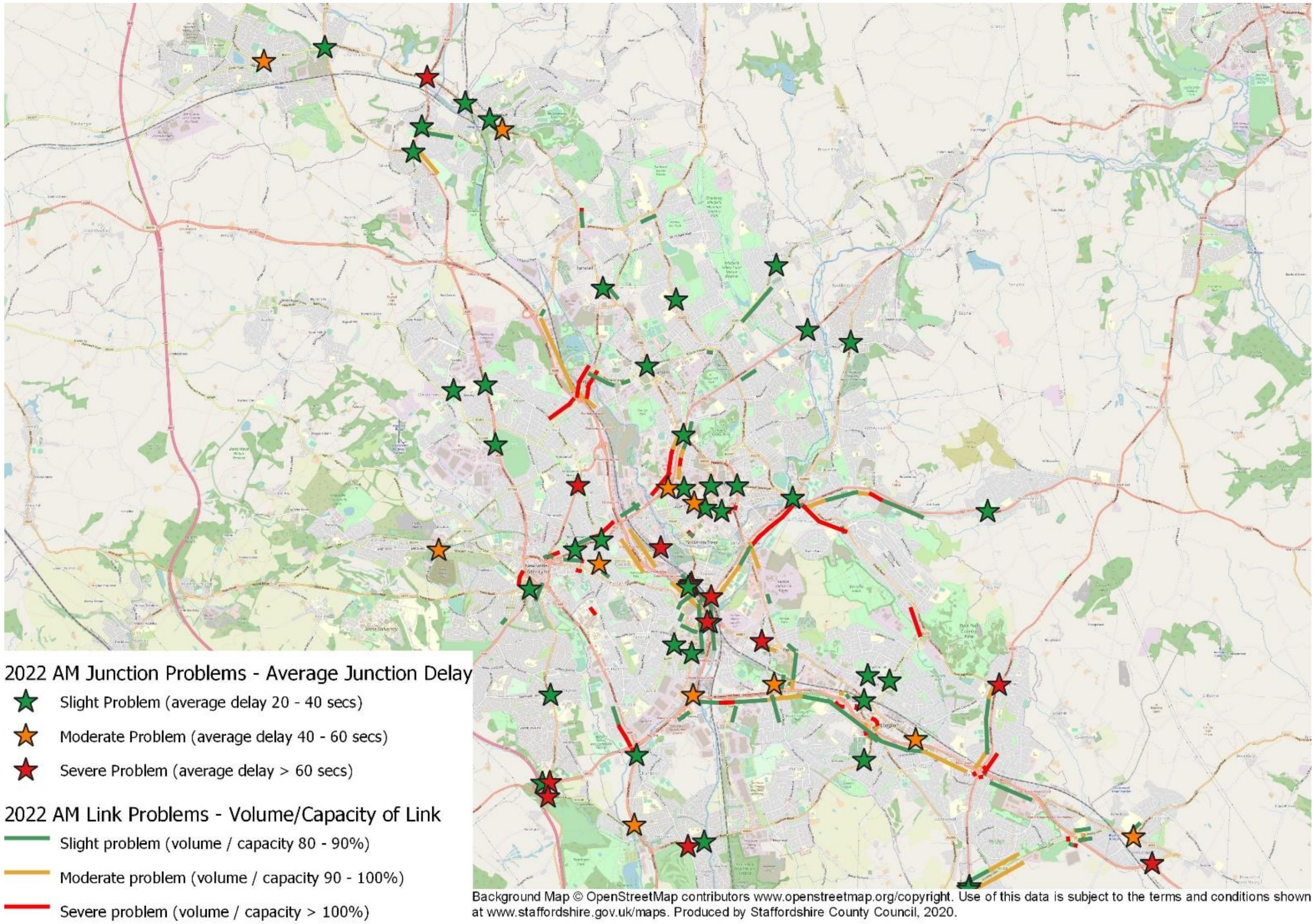
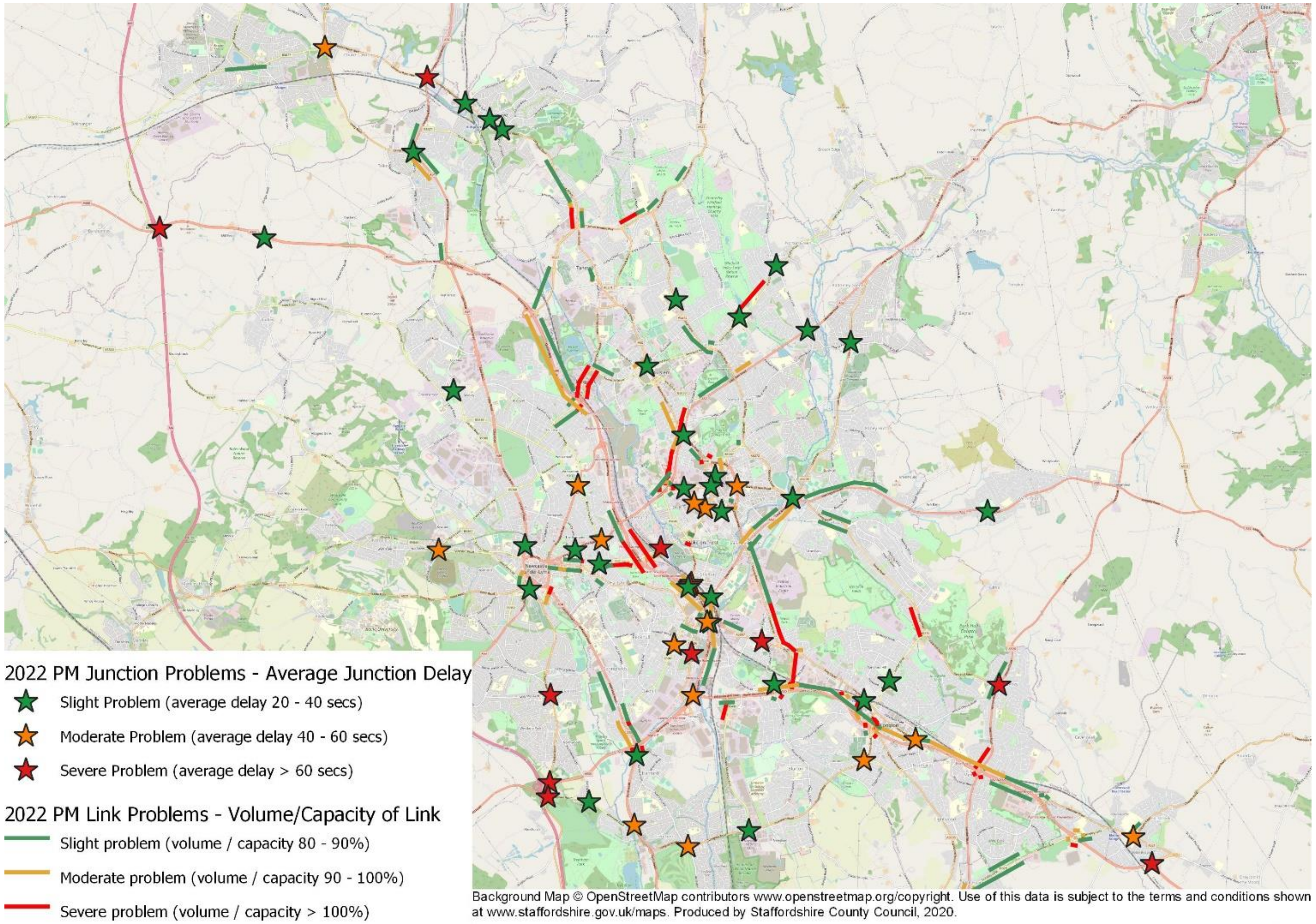


*Figure 7-8: 2022 Preferred Option PM peak-hour overcapacity links and significant junction delays*



# 8 Benchmark CAZ D traffic assignment results

## 8.1 Benchmark CAZ D modelling

A charging CAZ, type D, with a daily charge for all non-compliant vehicles, has been assessed as a benchmark option. The extent of the benchmark charging Benchmark CAZ D modelled is shown in Figure 8-1, it includes east of Newcastle-under-Lyme, the A50 Victoria Road, Bucknall New Road, the A53 between Newcastle-under-Lyme and Hanley and the City Centre (Hanley) but excludes Stoke-on-Trent railway station.

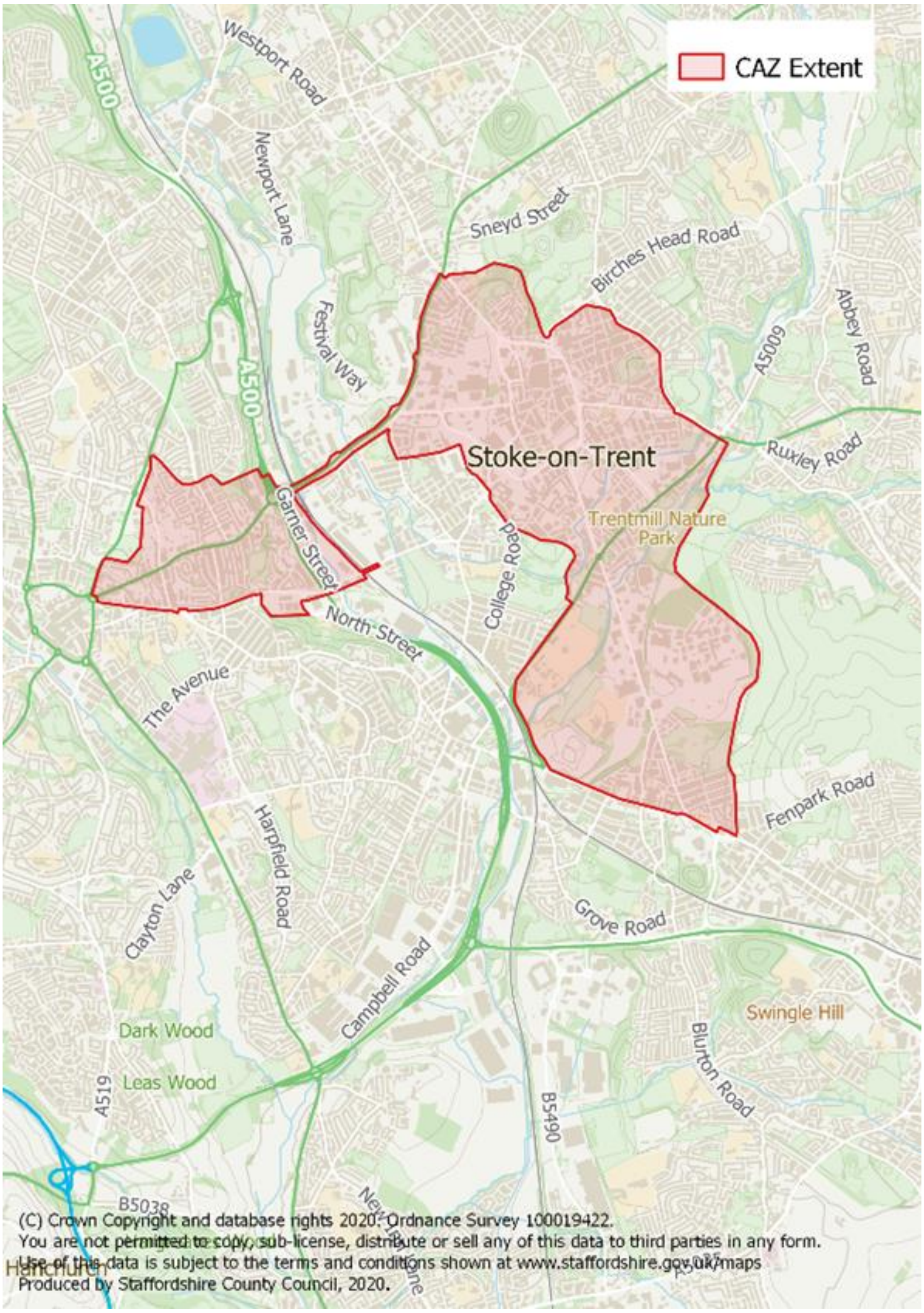
The methodology for modelling a charging Benchmark CAZ D is detailed in the T3 report. The modelling of the charging CAZ builds upon the 2022 Reference Case and includes the schemes shown in Table 4-1. The daily charges applied by vehicle type for the CAZ are shown in Table 8-1.

As seen in Table 7-3 the Benchmark CAZ achieves $NO_2$ compliance at all exceedance locations.

*Table 8-1: Benchmark CAZ D charges by vehicle type (option 1)*

| Vehicle Type | CAZ Daily Charge |
|---|---|
| **Cars/Taxis/Buses** | £5 |
| **LGVs** | £9 |
| **HGVs** | £35 |

*Figure 8-1: Benchmark CAZ D charging cordon*



## 8.2 Benchmark CAZ D comparison

The forecast demand responses for the North Staffordshire charging CAZ which have been applied in the NSMM transport model have been derived from the stated preference surveys described in a separate technical note. The demand responses have been compared with the responses for Bath and London for cars, taxis, LGVs and HGVs to ensure that they are appropriate. The demand responses are split into the following categories:

- Change route/destination – this includes vehicles avoiding the CAZ or redistributing to a destination away from the charging CAZ area
- Pay charge – this includes vehicles that do not alter journey plans instead choosing to pay the charge
- Cancel Trip/Mode Shift – this includes vehicles choosing to either cancel their trip or change mode of transport
- Upgrade/Switch Vehicle – This includes purchasing a compliant vehicle, retro-fitting a non-compliant vehicle or using an alternative available compliant vehicle

Table 8-2 to Table 8-5 show a comparison between demand responses forecast for North Staffordshire, London and Bath. The values for London are JAQU derived and provided as part of the JAQU Third Wave Evidence Package[1]. Table 8-2 identifies that forecast demand responses for North Staffordshire mostly fall between London and Bath. The percentage choosing to upgrade/switch vehicle is higher in North Staffordshire as opposed to London where a higher percentage choose to either cancel their trip or choose an alternative mode of transport. London of course has a wider choice of alternative transport options including an extensive public transport network. A higher percentage of those paying the charge for all vehicle types can be seen in London compared with North Staffordshire and Bath. With lower numbers choosing to upgrade or switch their vehicle. The higher percentage of those willing to pay the CAZ charge in London is reasonable as London is an affluent area.

*Table 8-2: Demand response comparison for car*

| Car | North Staffordshire | London | Bath |
|---|---|---|---|
| **Change Route/Destination** | 19% | 23% | 20% |
| **Pay Charge** | 15% | 16% | 5% |
| **Cancel Trip/Mode shift** | 21% | 39% | 18% |
| **Upgrade/Switch Vehicle** | 45% | 22% | 57% |

[1] JAQU Third Wave Evidence Package

*Table 8-3: Demand response comparison for taxi*

| Taxi | North Staffordshire | London | Bath |
|---|---|---|---|
| **Change Route** | 0% | 23% | 0% |
| **Pay Charge** | 3% | 16% | 4% |
| **Cancel Trip/Mode shift** | 24% | 39% | 0% |
| **Upgrade/Switch Vehicle** | 73% | 22% | 96% |

*Table 8-4: Demand response comparison for LGV*

| LGV | North Staffordshire | London | Bath |
|---|---|---|---|
| **Change Route** | 27% | 17% | 12% |
| **Pay Charge** | 28% | 42% | 17% |
| **Cancel Trip/Mode shift** | 2% | 16% | 4% |
| **Upgrade/Switch Vehicle** | 43% | 25% | 67% |

*Table 8-5: Demand response comparison for HGV*

| HGV | North Staffs | London | Bath |
|---|---|---|---|
| **Change Route** | 14% | 13% | 5% |
| **Pay Charge** | 15% | 29% | 11% |
| **Cancel Trip/Mode shift** | 5% | 13% | 2% |
| **Upgrade/Switch Vehicle** | 66% | 44% | 82% |

### 8.3 Benchmark CAZ D charge sensitivity test

Five pounds is the assumed daily Benchmark CAZ D charge for non-compliant cars and taxis to travel to, from, through or within the cordon. A sensitivity test was carried out doubling the daily charge to ten pounds. Table 8-6 shows the change in demand responses for car drivers if the daily charge was doubled. The higher charge results in less car drivers paying the charge and an increase in cancelled trips or a change in mode of transport and a higher percentage upgrading or switching to compliant vehicles. Table 8-7 shows that for taxi drivers there would be an increase in cancelled trips and a reduction in taxis paying the increased charge.

Table 8-8 shows the change in demand responses for LGVs with a doubling of the daily CAZ charge to eighteen pounds. The higher charge results in a decrease in LGVs paying the charge and an increase in rerouting to avoid paying the charge.

Table 8-9 shows the change in demand responses for HGVs with a doubling of the daily CAZ charge to seventy pounds. The higher charge results in a decrease in those willing to pay the charge with an increase in cancelled trips and switching or upgrading to compliant vehicles. It also shows no change in re-routing perhaps given the vehicle operating cost implications of a longer route.

*Table 8-6: Benchmark CAZ D car charge sensitivity test*

| Car | £5 charge | £10 charge | % Diff |
|---|---|---|---|
| Change Route | 11% | 11% | 0% |
| Change Destination | 8% | 6% | -2% |
| Pay Charge | 15% | 3% | -12% |
| Cancel Trip/Mode shift | 21% | 22% | 2% |
| Upgrade/Switch Vehicle | 45% | 58% | 13% |

*Table 8-7: Benchmark CAZ D taxi charge sensitivity test*

| Taxi | £5 charge | £10 charge | % Diff |
|---|---|---|---|
| Change Route | 0% | 0% | 0% |
| Pay Charge | 3% | 1% | -2% |
| Cancel Trip | 24% | 26% | 2% |
| Upgrade/Switch Vehicle | 73% | 73% | 0% |

*Table 8-8: Benchmark CAZ D LGV charge sensitivity test*

| LGV | £9 charge | £18 charge | % Diff |
|---|---|---|---|
| Change Route | 27% | 31% | 4% |
| Pay Charge | 28% | 25% | -3% |
| Cancel Trip | 2% | 1% | -1% |
| Upgrade/Switch Vehicle | 43% | 43% | 0% |

*Table 8-9: Benchmark CAZ D HGV charge sensitivity test*

| HGV | £35 charge | £70 charge | % Diff |
|---|---|---|---|
| Change Route | 14% | 14% | 0% |
| Pay Charge | 15% | 7% | -8% |
| Cancel Trip | 5% | 9% | 4% |
| Upgrade/Switch Vehicle | 66% | 72% | 6% |

### 8.4 Benchmark CAZ D traffic growth

Table 8-10 shows the Benchmark CAZ D trip matrix totals for 2022 and 2025 by compliant and non-complaint vehicle type, based on the core daily charge assumptions in Table 8-1. The Benchmark CAZ D scenario for 2022 and 2025 shows a reduction in non-compliant vehicles when compared with the 2022 Reference Case with a higher number of vehicles converting to compliant cars. Table 8-11 presents the total trip matrices by vehicle for the 2022 Reference Case, the 2022 Benchmark CAZ D and the 2025 Benchmark CAZ D. The 2022 and 2025 Benchmark CAZ D scenario shows a reduction in total trips when compared with the 2022 Reference Case as a result of cancelled trips or shift to other modes.

*Table 8-10: 2022 and 2025 Benchmark CAZ D trip matrix totals by vehicle type and compliance*

| Vehicle Type | Compliance | AM Peak-Hour | | | Inter-Peak Hour | | | PM Peak-Hour | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2022 RC | 2022 | 2025 | 2022 RC | 2022 | 2025 | 2022 RC | 2022 | 2025 |
| **Car** | **Compliant** | 54,526 | 57,747 | 66,236 | 46,940 | 49,906 | 57,269 | 58,626 | 62,271 | 71,203 |
| | **Non-Compliant** | 26,856 | 21,107 | 14,927 | 23,120 | 17,827 | 12,720 | 28,876 | 22,371 | 16,006 |
| **Taxi** | **Compliant** | 85 | 92 | 105 | 73 | 82 | 92 | 91 | 101 | 133 |
| | **Non-Compliant** | 78 | 63 | 59 | 67 | 55.6 | 48.6 | 84 | 71 | 62 |
| **LGV** | **Compliant** | 5,710 | 6,336 | 7,241 | 5,348 | 5,991 | 6,787 | 5,069 | 5,649 | 6,400 |
| | **Non-Compliant** | 4,672 | 3,609 | 3,215 | 4,375 | 3,284 | 2,972 | 4,147 | 3,163 | 2,847 |
| **HGV** | **Compliant** | 3,762 | 3,855 | 4,186 | 3,266 | 3,342 | 3,641 | 2,134 | 2,170 | 2,372 |
| | **Non-Compliant** | 562 | 442 | 141.8 | 488 | 389 | 125 | 319 | 272 | 87 |
| **Total** | | **96,251** | **93,249** | **96,110** | **83,677** | **80,875** | **83,654** | **99,346** | **96,067** | **99,109** |

*Table 8-11: 2022 and 2025 Benchmark CAZ D trip matrix totals by vehicle type*

| Vehicle Type | AM Peak-Hour | | | Inter-Peak Hour | | | PM Peak-Hour | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2022 RC | 2022 | 2025 | 2022 RC | 2022 | 2025 | 2022 RC | 2022 | 2025 |
| **Car** | 81,382 | 78854 | 81163 | 70,060 | 67733 | 69989 | 87,502 | 84642 | 87209 |
| **Taxi** | 163 | 155 | 164 | 140 | 137 | 141 | 175 | 172 | 195 |
| **LGV** | 10,382 | 9945 | 10456 | 9,723 | 9275 | 9758 | 9,216 | 8812 | 9247 |
| **HGV** | 4,324 | 4296 | 4328 | 3,754 | 3731 | 3766 | 2,453 | 2441 | 2459 |
| **Total** | **96,251** | **93,249** | **96,110** | **83,677** | **80,875** | **83,654** | **99,346** | **96,067** | **99,109** |

## 8.5 Demand response

Table 8-12 shows the demand response in vehicle numbers to the introduction of a charging Benchmark CAZ D in 2022 for the AM, IP and PM modelled periods. As can be seen from Table 8-12 most vehicles are upgraded or switched to a compliant vehicle. A high number of car drivers cancel their trip or change mode, goods vehicles do not have this choice and are more likely to pay the charge. A high proportion of LGVs also choose to change route to avoid the charge.

*Table 8-12: Demand response to implementation of charging Benchmark CAZ D*

| Action | Vehicle | | | |
|---|---|---|---|---|
| AM | | | | |
| | Cars | LGV | HGV | Taxi |
| Change Route | 794 | 393 | 20 | 0 |
| Change Destination | 559 | 0 | 0 | 0 |
| Pay Charge | 1,050 | 408 | 21 | 0 |
| Cancel Trip/Mode shift | 1,478 | 29 | 7 | 3 |
| Upgrade/Switch Vehicle | 3,221 | 626 | 93 | 8 |
| IP | | | | |
| | Cars | LGV | HGV | Taxi |
| Change Route | 743 | 404 | 16 | 0 |
| Change Destination | 523 | 0 | 0 | 0 |
| Pay Charge | 971 | 419 | 17 | 0 |
| Cancel Trip/Mode shift | 1,355 | 30 | 6 | 3 |
| Upgrade/Switch Vehicle | 2,966 | 643 | 76 | 9 |
| PM | | | | |
| | Cars | LGV | HGV | Taxi |
| Change Route | 909 | 364 | 8 | 0 |
| Change Destination | 639 | 0 | 0 | 0 |
| Pay Charge | 1191 | 378 | 8 | 0 |
| Cancel Trip/Mode shift | 1,668 | 27 | 3 | 3 |
| Upgrade/Switch Vehicle | 3,645 | 580 | 36 | 9 |
| Total pay | 3,212 | 1,204 | 47 | 1 |
| Total Cancel Trip/Mode Split | 4,502 | 86 | 16 | 8 |
| Total Upgrade/Switch Vehicle | 9,832 | 1,849 | 205 | 26 |

### 8.6 Forecast traffic flows

Figure 8-2 shows the change in forecast daily traffic flow (AADT) between the 2022 Reference Case and the 2022 Benchmark CAZ D. Figure 8-3 to Figure 8-5 show the difference in traffic flow in the AM, IP and PM modelled periods between the 2022 Reference Case and the 2022 Benchmark CAZ D. Figure 8-2 generally shows a large reduction in forecast daily traffic with the implementation of the charging Benchmark CAZ D.

Figure 8-6 shows the change in forecast daily traffic flow (AADT) between the 2025 Reference Case and the 2025 Benchmark CAZ D. Figure 8-7 to Figure 8-9 show the change in traffic flow in the AM, IP and PM modelled periods between the 2025 Reference Case and the 2025 Benchmark CAZ D. When compared with Figure 8-2, Figure 8-6 shows a lower level of reduction in 2025 with Benchmark CAZ D compared with 2022 Benchmark CAZ D, this is logical as the number of compliant vehicle rises in 2025 (in the Reference Case) as a result more vehicles would be able to travel through the CAZ without being charged.

Figure 8-10 and Figure 8-11 depict the overcapacity links and junction delay for the AM Peak-Hour and the PM Peak-Hour. Figure 8-10 compared with Figure 6-18 shows a reduction in over capacity links along Victoria Road with reduction in junction delays around Hanley. Comparing Figure 8-11 with Figure 6-20 shows similar results.

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*Figure 8-2: Change in AADT traffic flows between 2022 Reference Case and 2022 Benchmark CAZ D (vehicles)*

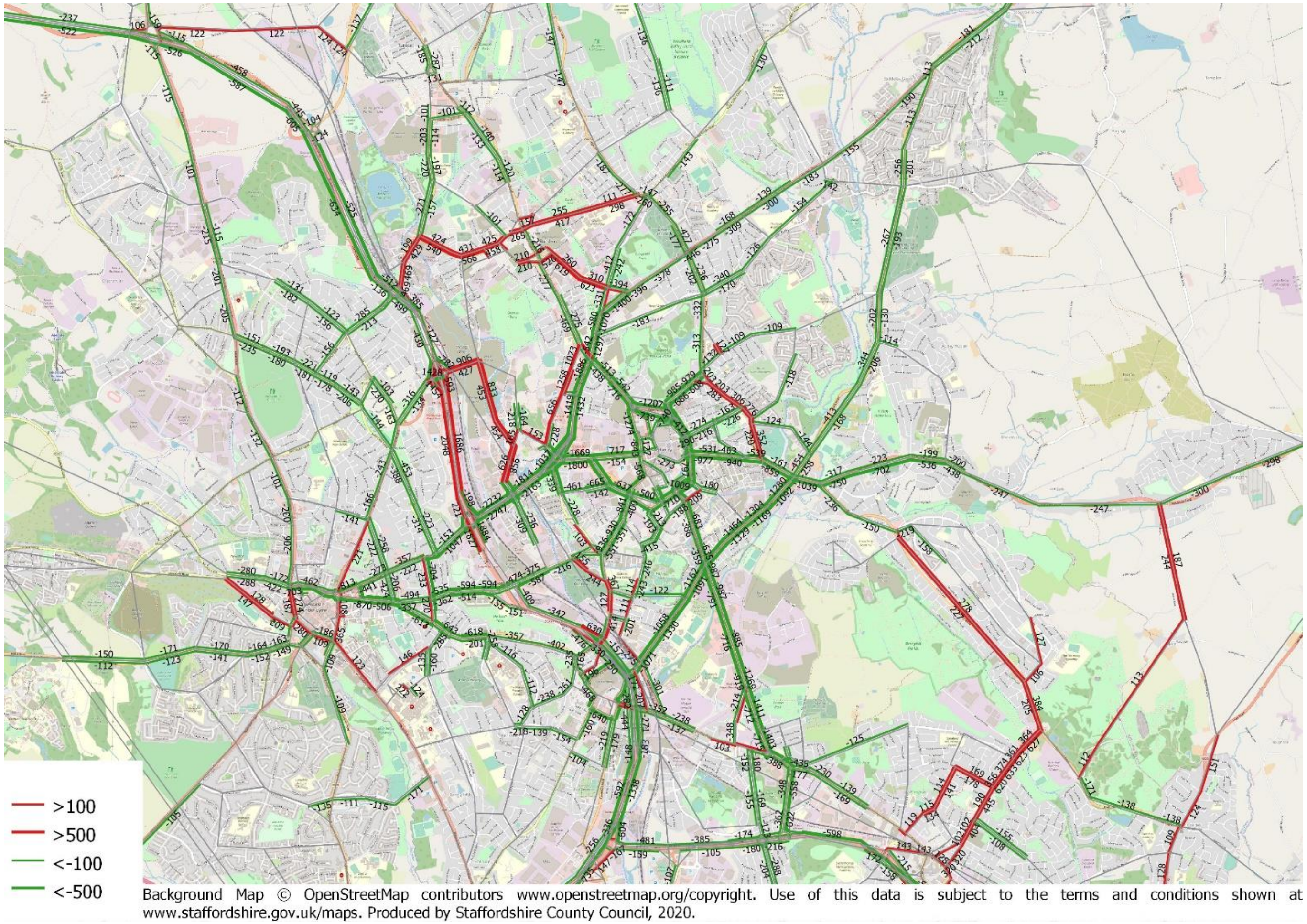

*Figure 8-3: Change in AM peak-hour traffic flows between 2022 Reference Case and 2022 Benchmark CAZ D (vehicles)*

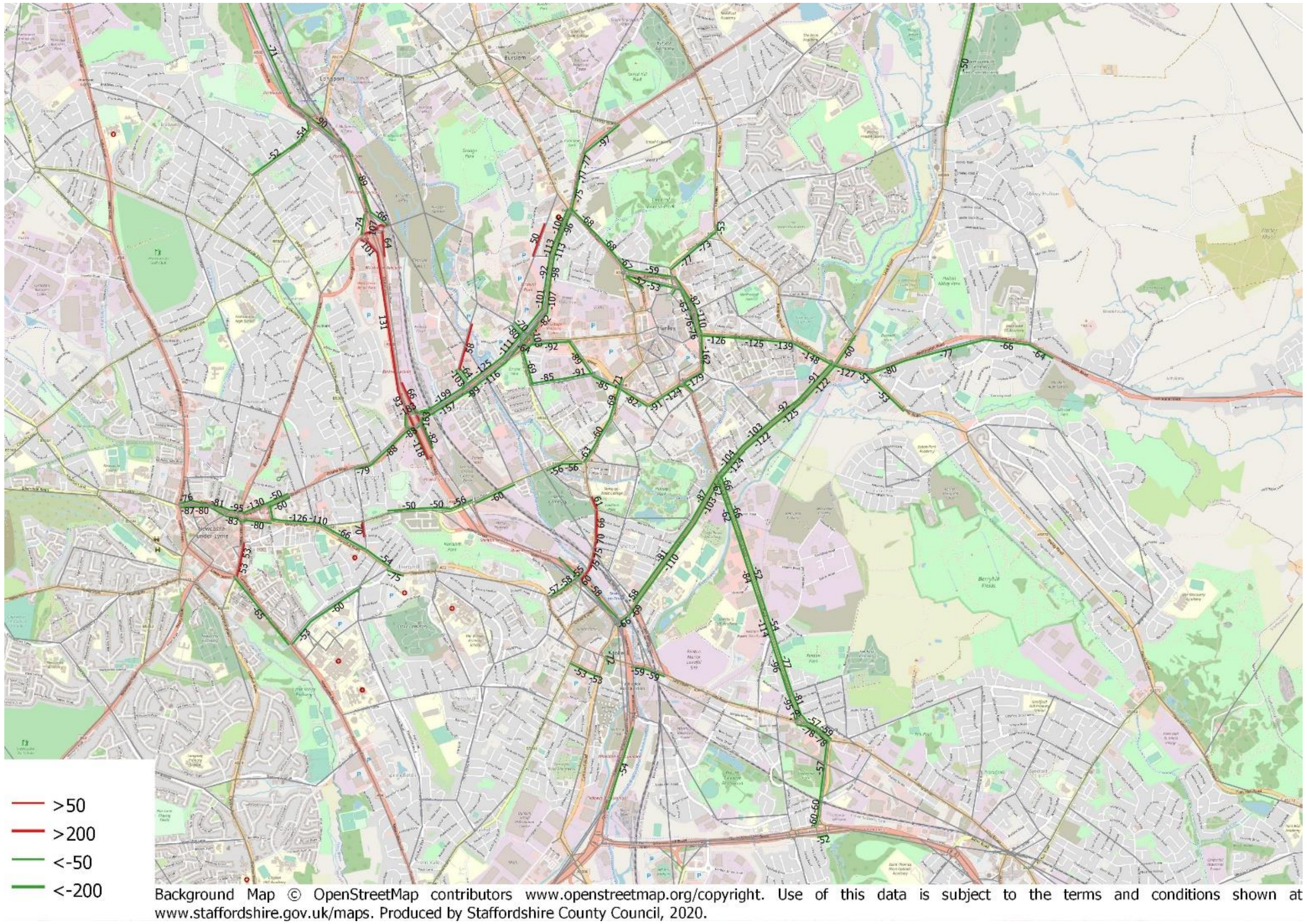

*Figure 8-4: Change in Inter-Peak hour traffic flows between between 2022 Reference Case and 2022 Benchmark CAZ D (vehicles)*

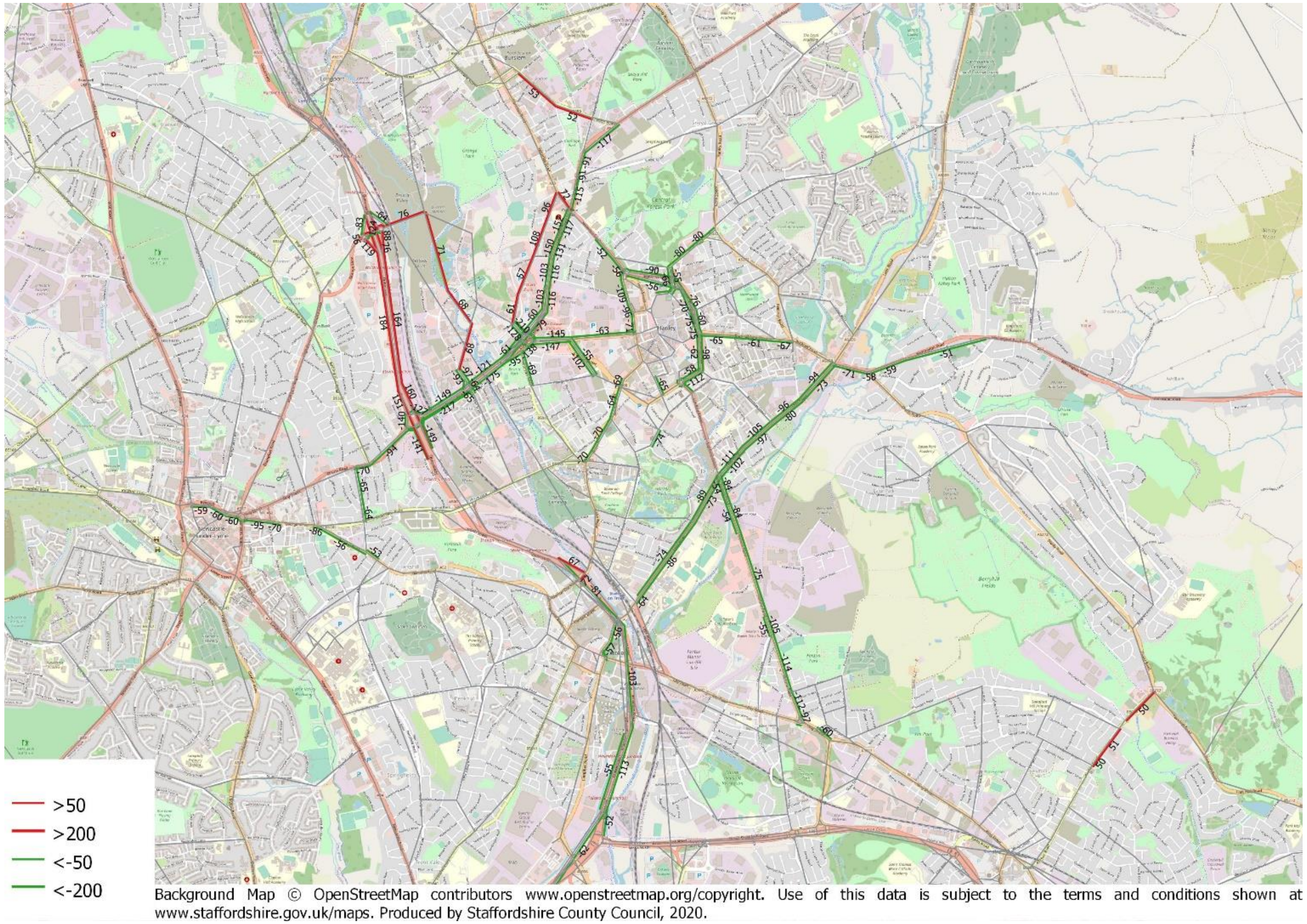

*Figure 8-5: Change in PM peak-hour traffic flows between 2022 Reference Case and 2022 Benchmark CAZ D (vehicles)*

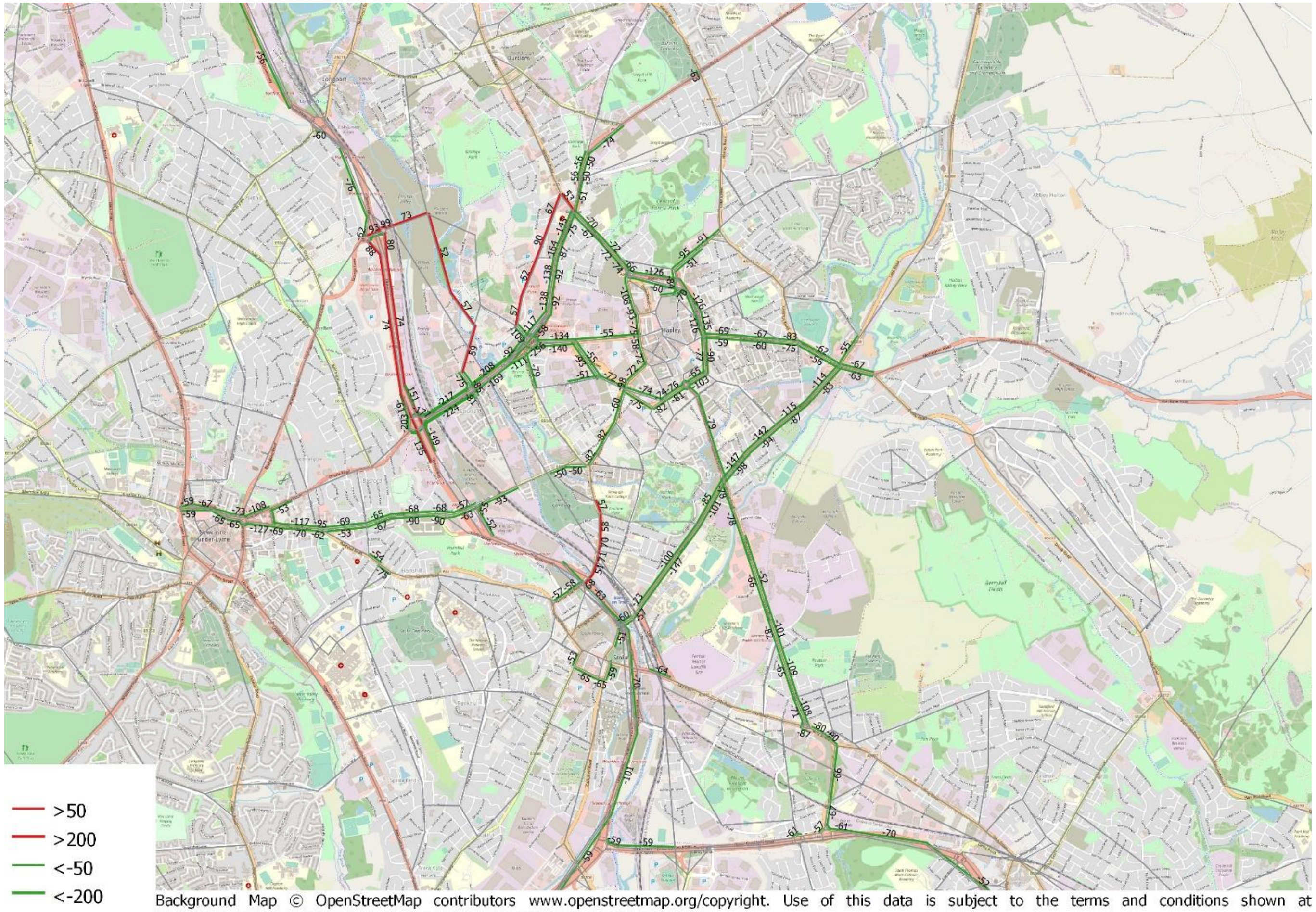

Figure 8-6: Change in AADT traffic flows between 2025 Reference Case and 2025 Benchmark CAZ D (vehicles)

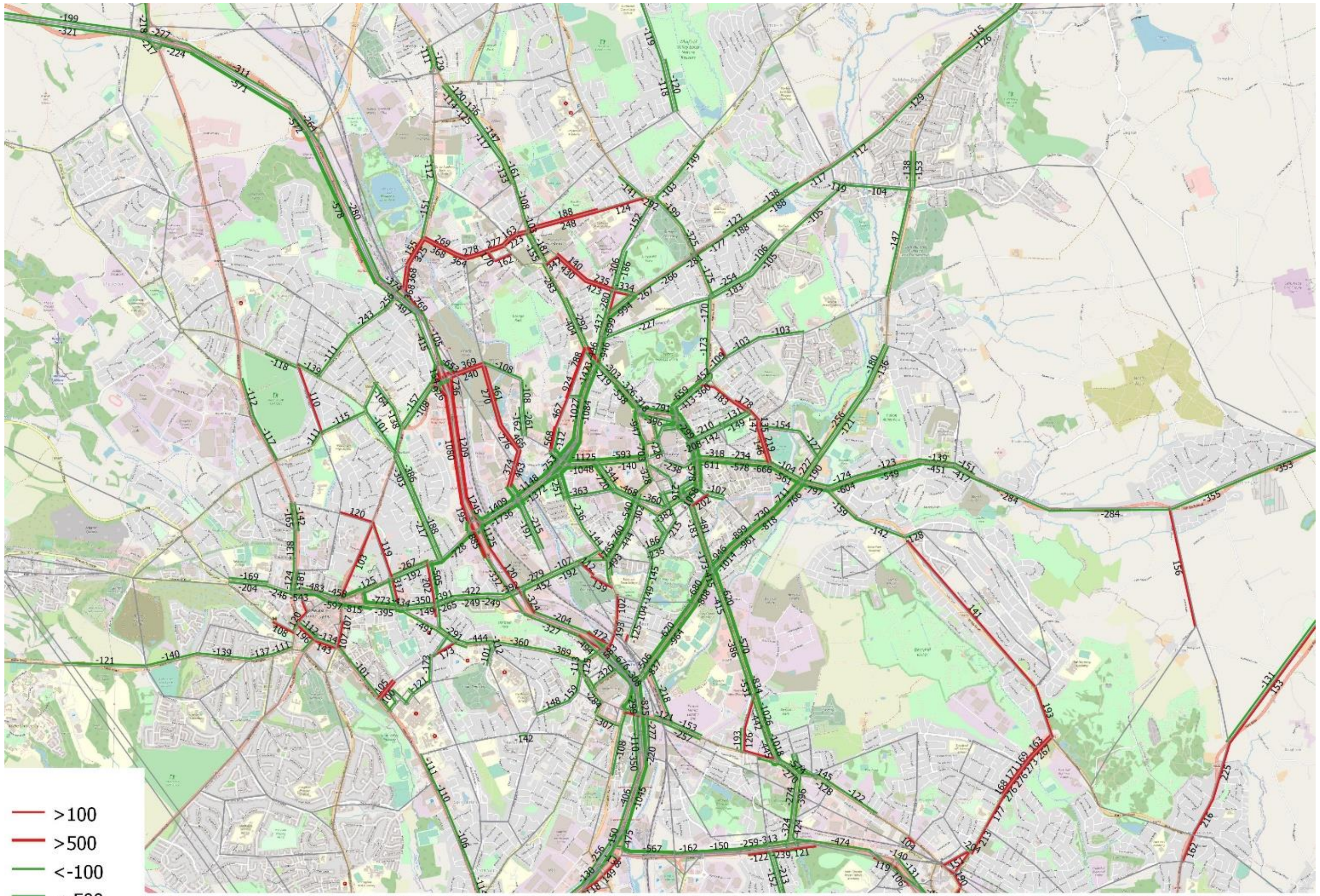


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*Figure 8-7: Change in AM peak-hour traffic flows between 2025 Reference Case and 2025 Benchmark CAZ D (vehicles)*

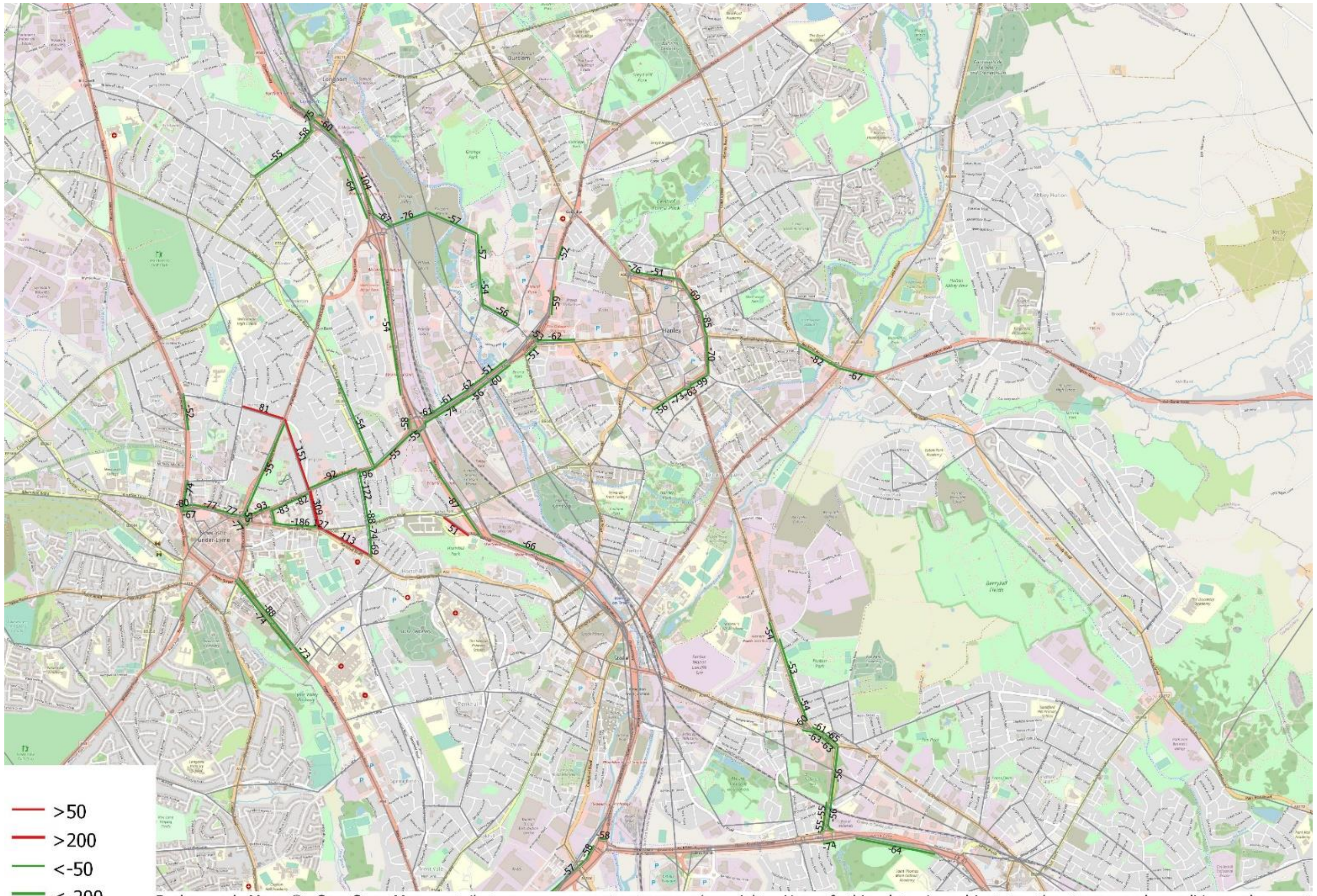

*Figure 8-8: Change in Inter-Peak hour traffic flows between 2025 Reference Case and 2025 Benchmark CAZ D (vehicles)*

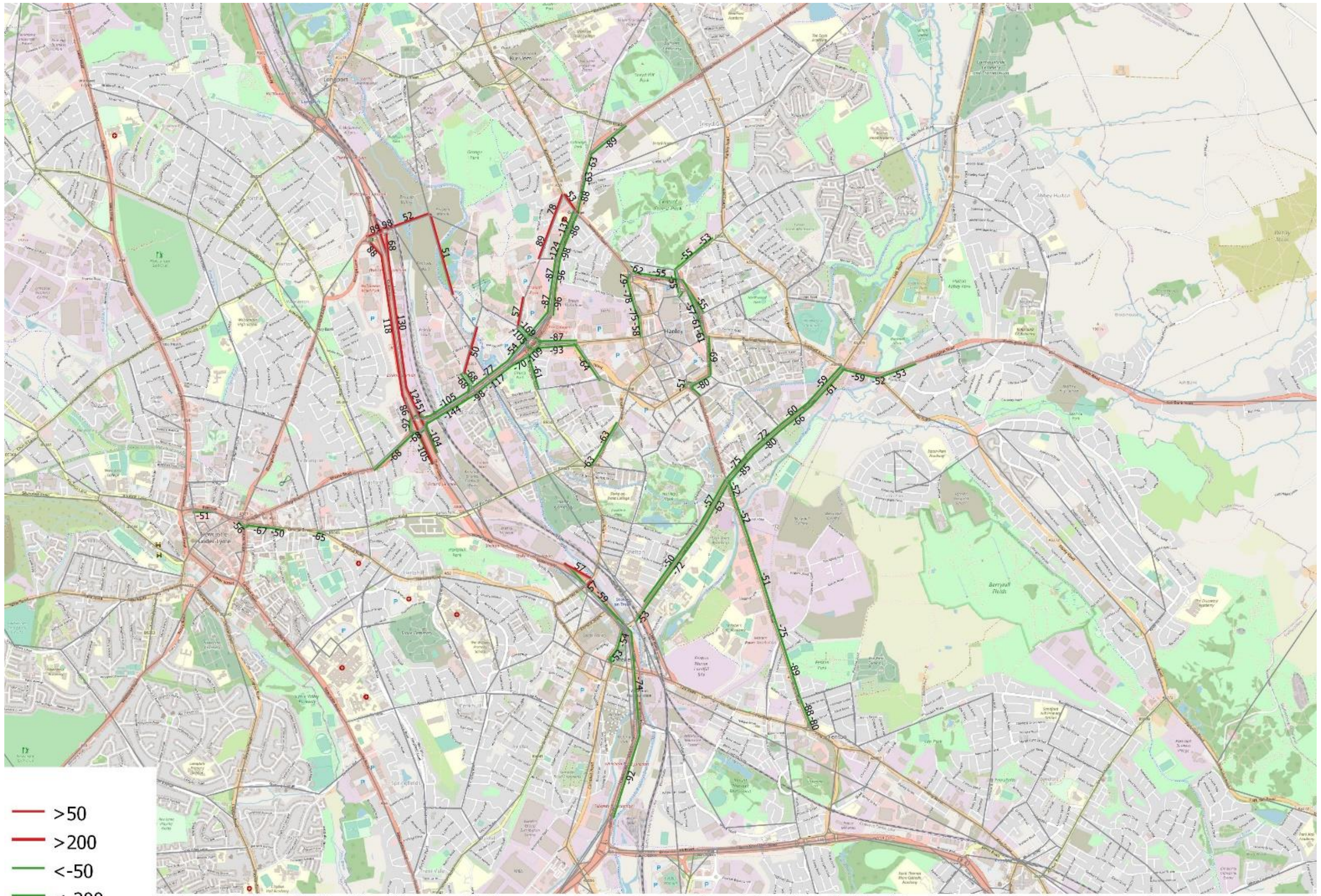


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*Figure 8-9: Change in PM peak-hour traffic flows between 2025 Reference Case and 2025 Benchmark CAZ D (vehicles)*

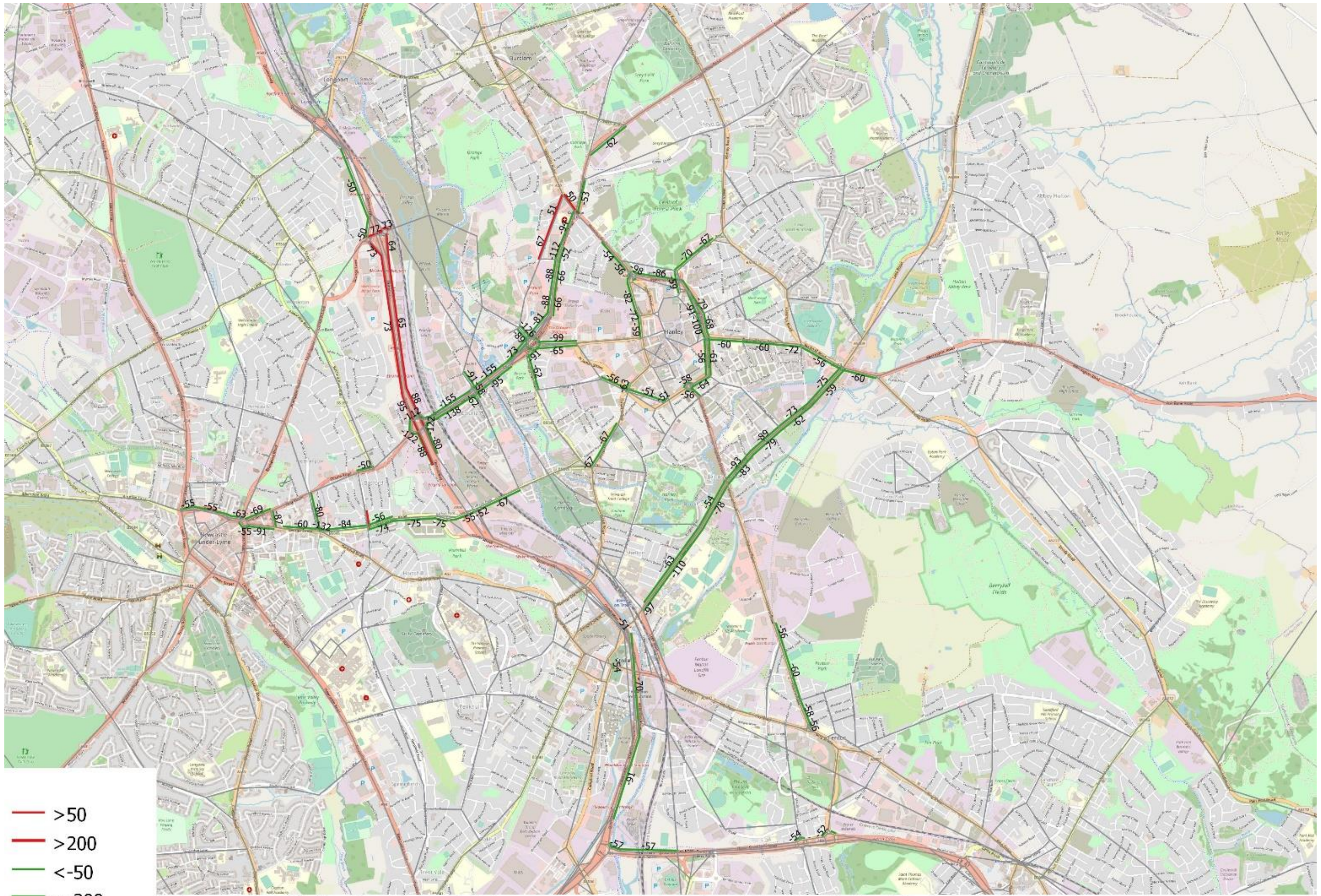


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*Figure 8-10: 2022 Benchmark CAZ D AM peak-hour overcapacity links and significant junction delays*

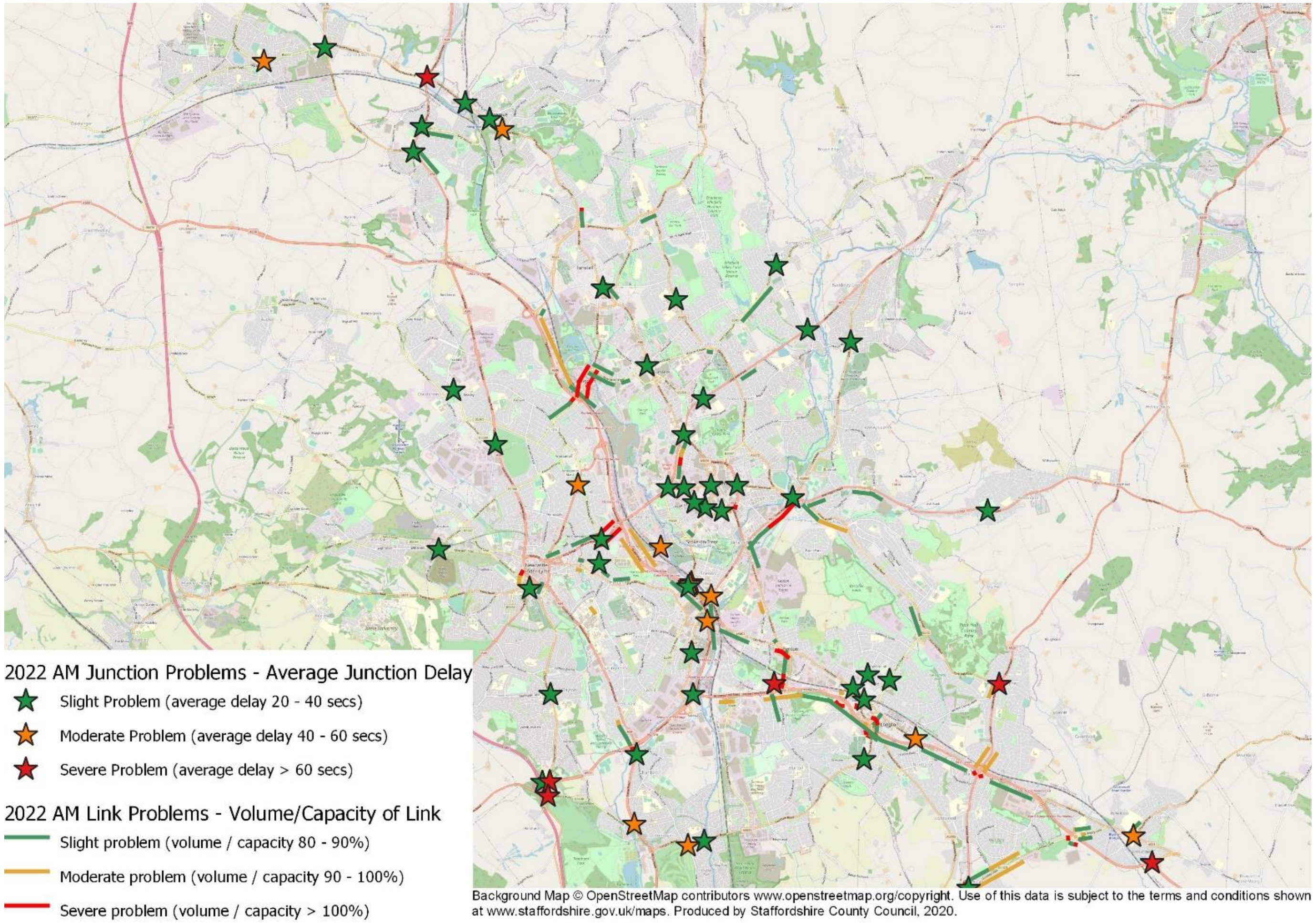


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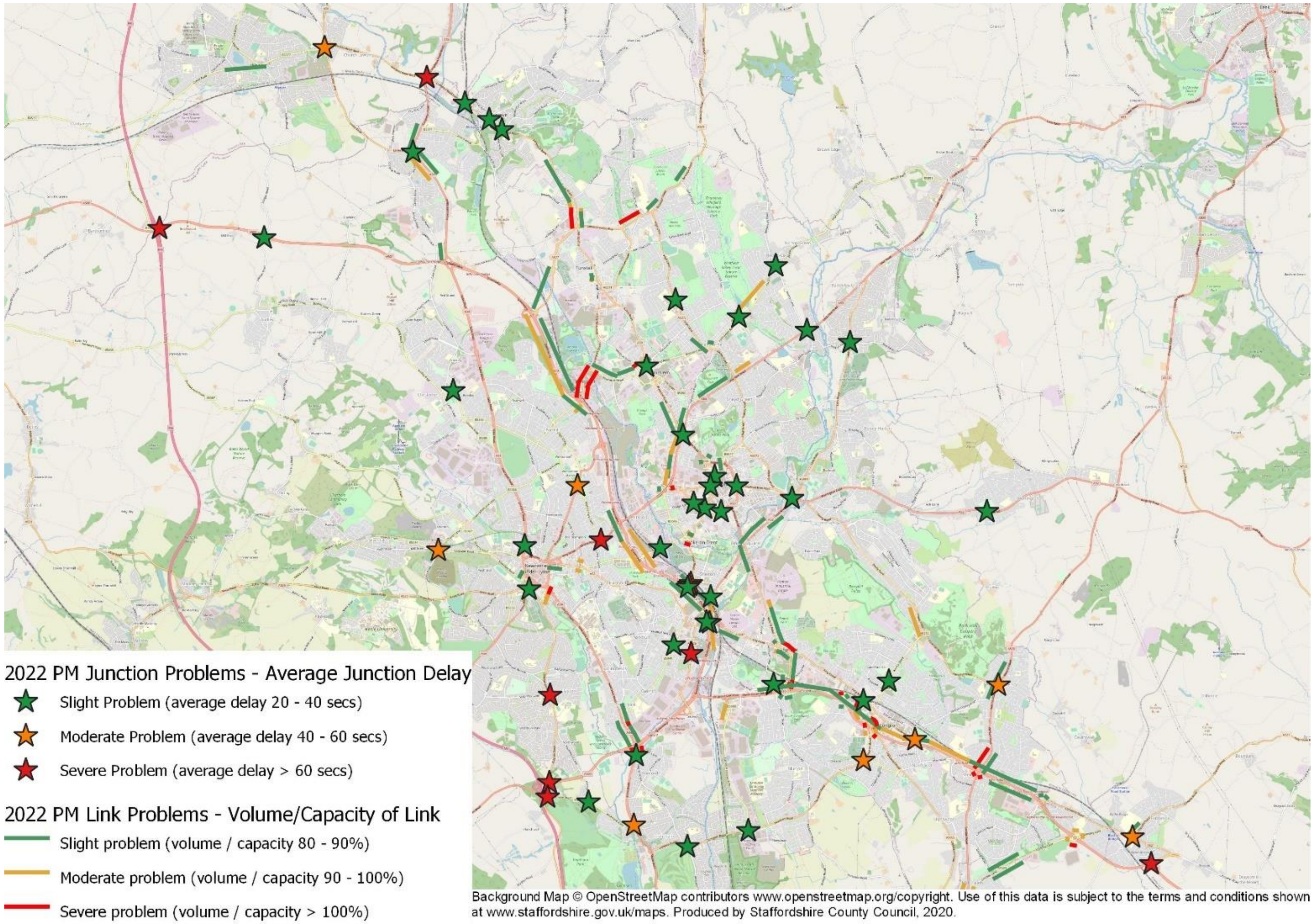
*Figure 8-11: 2022 Benchmark CAZ D PM peak-hour overcapacity links and significant junction delays*



# 9 No vehicle upgrade with a charging CAZ

The JAQU guidance requires a sensitivity test when modelling a charging CAZ. The test assumes that no vehicles would be upgraded to a compliant vehicle in response to the implementation of a charging CAZ. This sensitivity test has been undertaken on the core Benchmark CAZ D option described in chapter 9. The percentages of the other remaining demand responses to a charging CAZ have therefore been prorated upwards.

## 9.1 Demand response

Table 9-1 presents the demand responses to the implementation of a charging CAZ with the premise of a 0% uptake in compliant vehicles. As there are no assumed vehicles upgraded to compliant ones the number of cars cancelling their trips almost doubles when compared with the core Benchmark CAZ D. The number of LGVs paying the charge doubles with the zero-upgrade assumption as do the number of HGVs.

*Table 9-1: Demand response to implementation of charging Benchmark CAZ D with no upgrade*

| Action | Vehicle | | | |
|---|---|---|---|---|
| **AM** | | | | |
| | **Cars** | **LGV** | **HGV** | **Taxi** |
| **Change Route** | 1,440 | 684 | 57 | 0 |
| **Change Destination** | 1,041 | 0 | 0 | 0 |
| **Pay Charge** | 1,918 | 714 | 62 | 1 |
| **Cancel Trip/Mode shift** | 2,704 | 58 | 21 | 9 |
| **Upgrade/Switch Vehicle** | 0 | 0 | 0 | 0 |
| **IP** | | | | |
| | **Cars** | **LGV** | **HGV** | **Taxi** |
| **Change Route** | 1,344 | 703 | 47 | 0 |
| **Change Destination** | 969 | 0 | 0 | 0 |
| **Pay Charge** | 1,771 | 733 | 50 | 1 |
| **Cancel Trip/Mode shift** | 2,474 | 60 | 17 | 10 |
| **Upgrade/Switch Vehicle** | 0 | 0 | 0 | 0 |
| **PM** | | | | |
| | **Cars** | **LGV** | **HGV** | **Taxi** |
| **Change Route** | 1,645 | 634 | 23 | 0 |
| **Change Destination** | 1,186 | 0 | 0 | 0 |
| **Pay Charge** | 2,174 | 661 | 24 | 1 |
| **Cancel Trip/Mode shift** | 3,047 | 54 | 8 | 11 |
| **Upgrade/Switch Vehicle** | 0 | 0 | 0 | 0 |
| **Total Pay Charge** | 5,862 | 2,107 | 136 | 4 |
| **Total Cancel Trip/Mode Shift** | 8,225 | 172 | 47 | 31 |

## 9.2 Benchmark CAZ D no vehicle upgrade traffic growth

Table 9-2 and Table 9-3 show the trip matrix totals for the no vehicle upgrade Benchmark CAZ D for 2022 and 2025. When compared with the 2022 Reference Case and the 2022 Benchmark CAZ D in Table 8-10 and Table 8-11, the total number of vehicles in the trip matrix for the no vehicle upgrade sensitivity test in all of the time periods has dropped due to an increase in cancelled trips. The number of non-compliant vehicles is higher than in the Benchmark CAZ D trip matrix totals, given the increase number of vehicles paying the charge in the sensitivity test.

*Table 9-2: 2022 and 2025 Benchmark CAZ D No-Upgrade trip matrix totals by vehicle type and compliance*

| Vehicle Type | Compliance | AM Peak-Hour | | Inter-Peak Hour | | PM Peak-Hour | |
|---|---|---|---|---|---|---|---|
| | | 2022 | 2025 | 2022 | 2025 | 2022 | 2025 |
| Car | Compliant | 54,526 | 63,905 | 46,940 | 55,163 | 58,626 | 68,676 |
| | Non-Compliant | 22,235 | 15,743 | 18,874 | 13,463 | 23,654 | 16,895 |
| Taxi | Compliant | 85 | 98 | 73 | 85 | 91 | 105 |
| | Non-Compliant | 68 | 59 | 56 | 49 | 71 | 62 |
| LGV | Compliant | 5,710 | 6,711 | 5,348 | 6,273 | 5,069 | 5,934 |
| | Non-Compliant | 3,900 | 3,461 | 3,583 | 3,211 | 3,433 | 3,064 |
| HGV | Compliant | 3,762 | 4,162 | 3,266 | 3,622 | 2,134 | 2,363 |
| | Non-Compliant | 479 | 151.7 | 420 | 133 | 286 | 90 |
| **Total** | | **90,764** | **94,290** | **78,559** | **81,997** | **93,364** | **97,188** |

*Table 9-3: 2022 and 2025 Benchmark CAZ D No-Upgrade trip matrix totals by vehicle type*

| Vehicle Type | AM Peak-Hour | | Inter-Peak Hour | | PM Peak-Hour | |
|---|---|---|---|---|---|---|
| | 2022 | 2025 | 2022 | 2025 | 2022 | 2025 |
| Car | 76761 | 79648 | 65814 | 68626 | 82280 | 85571 |
| Taxi | 153 | 157 | 129 | 133 | 162 | 167 |
| LGV | 9610 | 10172 | 8931 | 9483 | 8502 | 8998 |
| HGV | 4241 | 4314 | 3686 | 3755 | 2420 | 2453 |
| **Total** | **90,764** | **94,290** | **78,559** | **81,997** | **93,364** | **97,188** |

## 9.3 Forecast Traffic Flows

Figure 9-1 shows the change in forecast daily traffic (AADT) flows between the 2022 Reference Case and the 2022 no vehicle upgrade CAZ sensitivity test. Figure 9-2 to Figure 9-4 show the difference in traffic flows for the AM, IP and PM modelled periods. Figure 9-1 shows high levels of reduction in traffic flows within the CAZ boundary. When compared with Figure 8-2, the 2022 Benchmark CAZ D zero upgrade shows a much higher reduction in traffic flows along the A53 with higher volumes along the A500 and re-routing along Dividy Road.

Figure 9-5 displays the change in forecast daily traffic (AADT) flows between the 2025 Reference Case and the 2025 Zero Upgrade CAZ. Figure 9-6 to Figure 9-8 show the difference in forecast traffic flows for the AM, IP and PM modelled periods. Figure 9-5 shows a high increase in traffic along the A500 when compared with Figure 8-6. Higher levels of reduction in vehicles can be seen on the A53 and along Victoria Road.

Figure 8-10 shows the 2022 Benchmark CAZ D no upgrade AM Peak-Hour over capacity links and junction delays. When compared with the 2022 Reference Case AM overcapacity links and junction delays plot, seen in Figure 6-18, reduced delays at the A53/Basford Park junction can be identified. In addition, the westbound link along the A53 between the A500 roundabout and Basford Park Road is no longer overcapacity. This is to be expected as seen from Table 9-1 most trips are cancelled thereby reducing the number of vehicles on the network. Figure 9-10 shows the 2022 Benchmark CAZ D no upgrade PM Peak-Hour over capacity links and junction delays. When compared with Figure 8-11, the overcapacity links and junction delays for the Benchmark CAZ D with assumed upgrade, Figure 9-10 shows little change in junction delays but shows a reduction in over capacity links along Victoria Road.

*Figure 9-1: Change in AADT traffic flows between 2022 Reference Case and 2022 Benchmark CAZ D – no-upgrade (vehicles)*

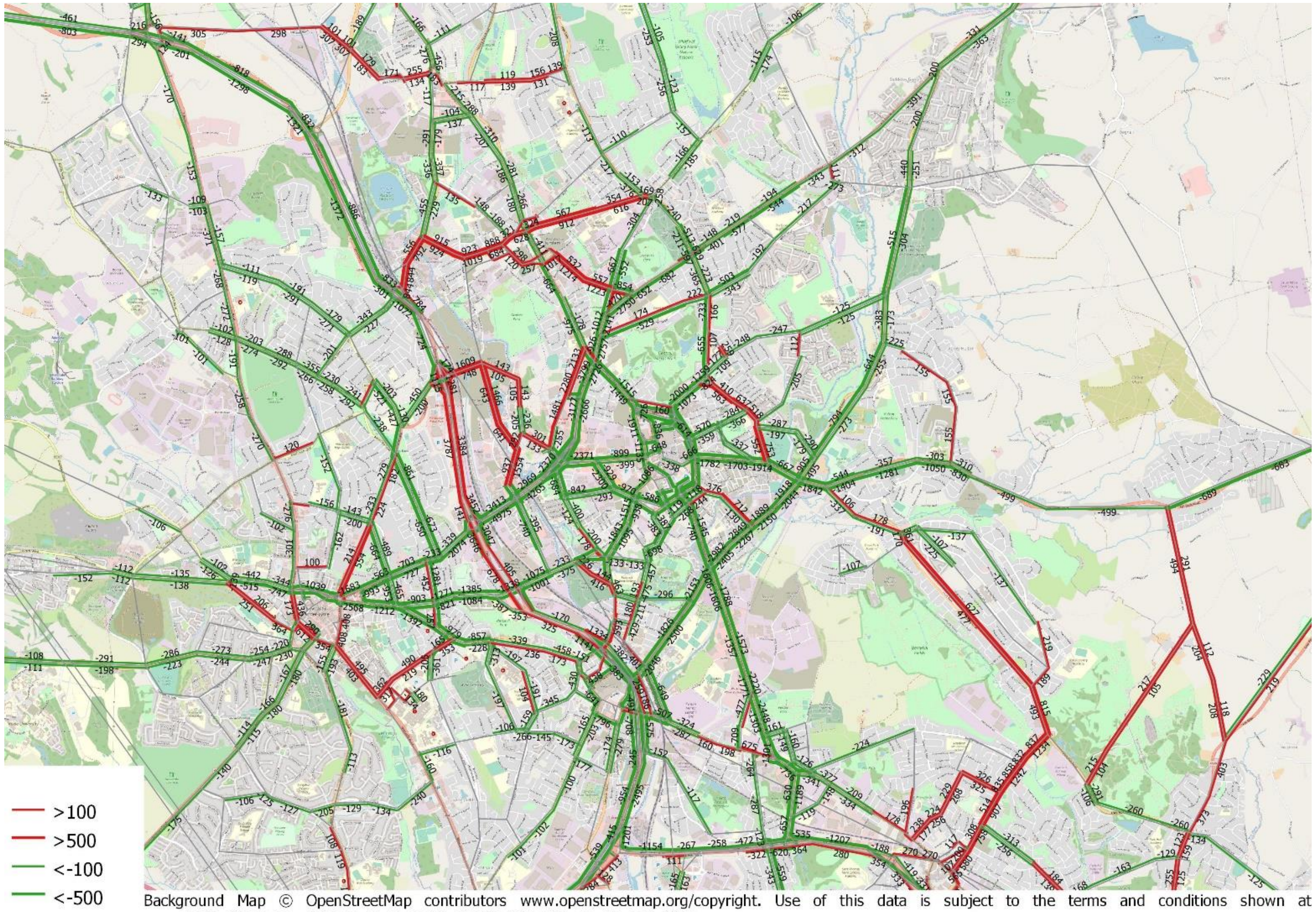



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*Figure 9-2: Change in AM peak-hour traffic flows between 2022 Reference Case and 2022 Benchmark CAZ D – no-upgrade (vehicles)*

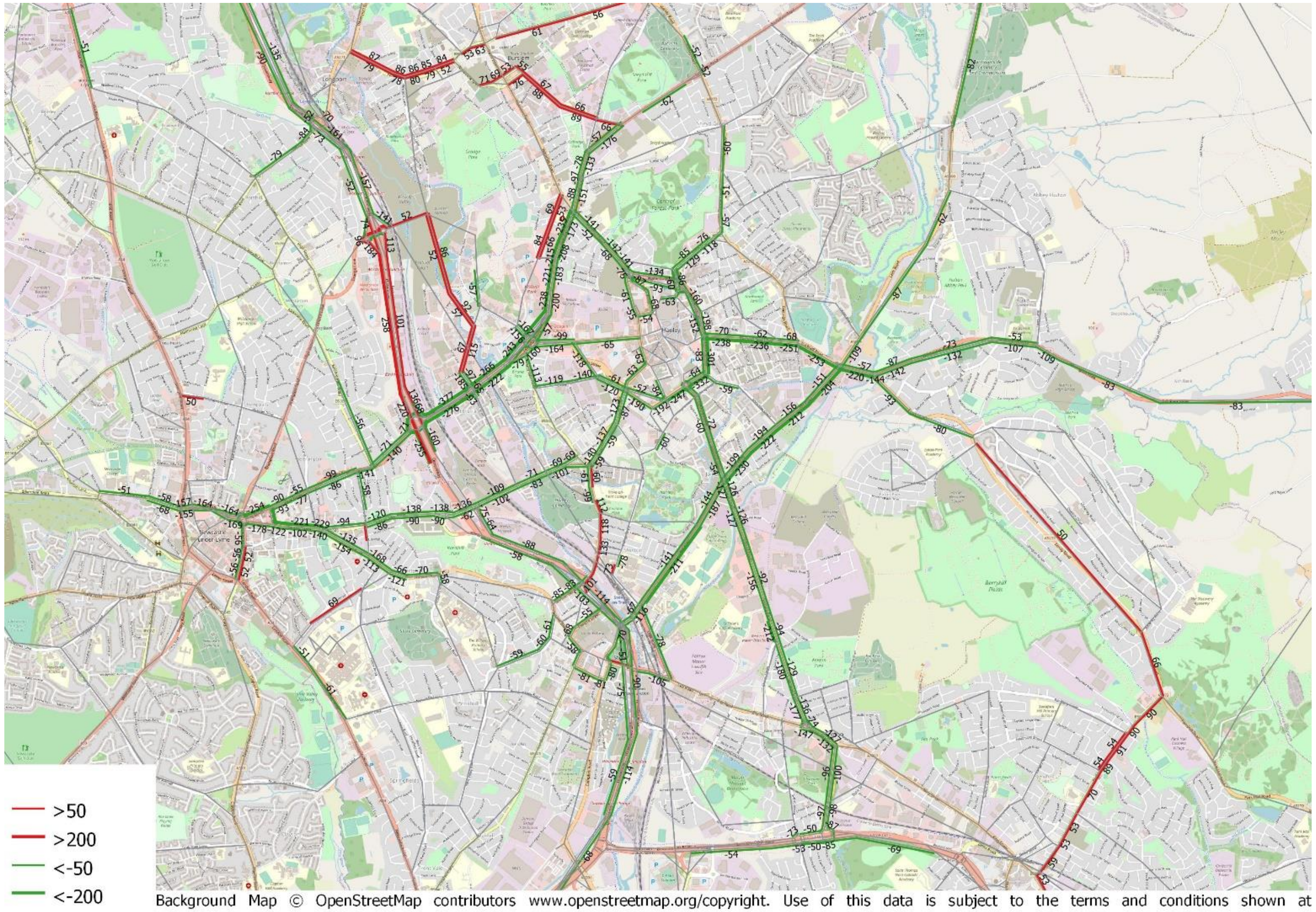


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*Figure 9-3: Change in Inter-Peak hour traffic flows between 2022 Reference Case and 2022 Benchmark CAZ D – no-upgrade (vehicles)*

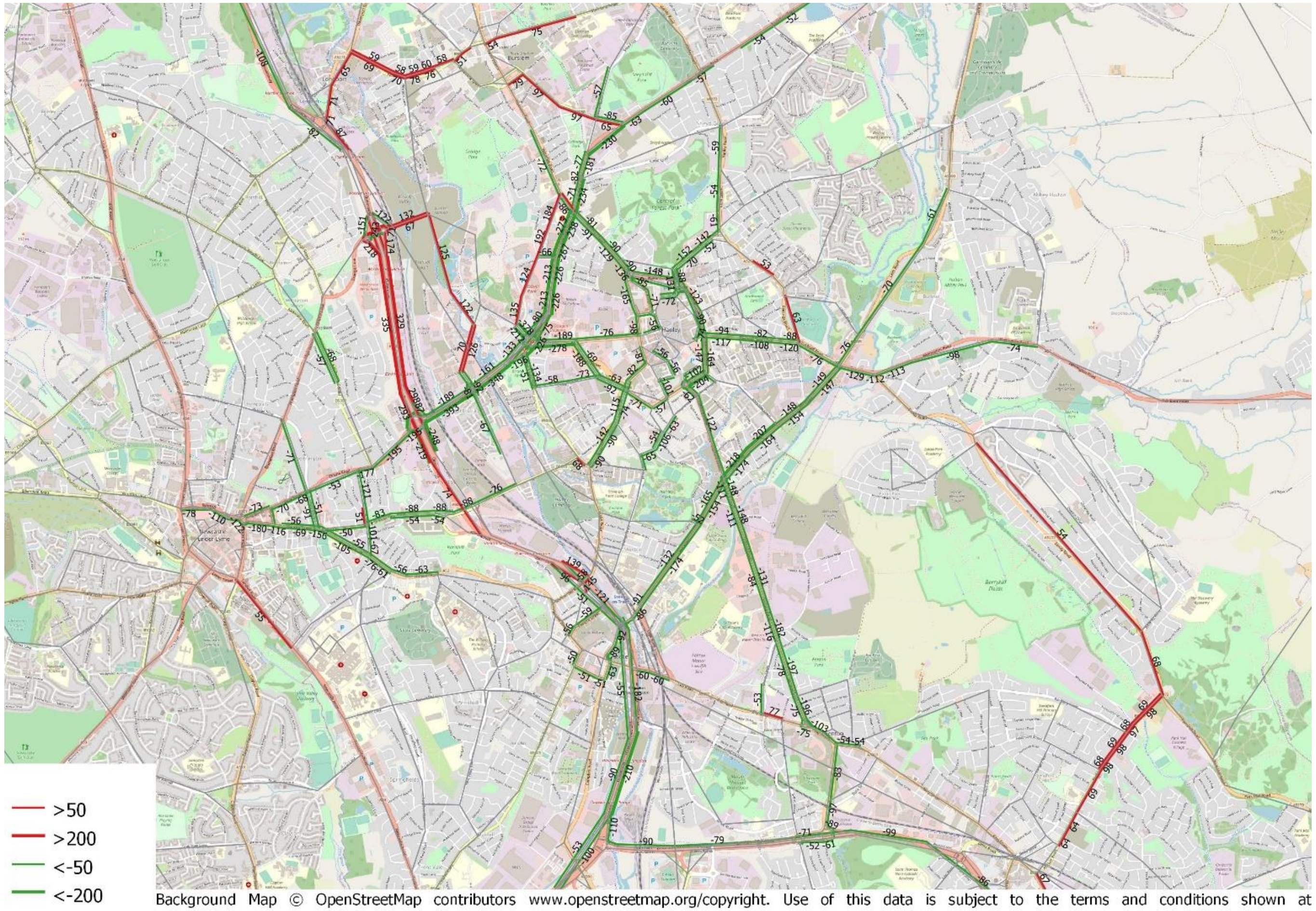


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*Figure 9-4: Change in PM peak-hour traffic flows between 2022 Reference Case and 2022 Benchmark CAZ D – no-upgrade (vehicles)*

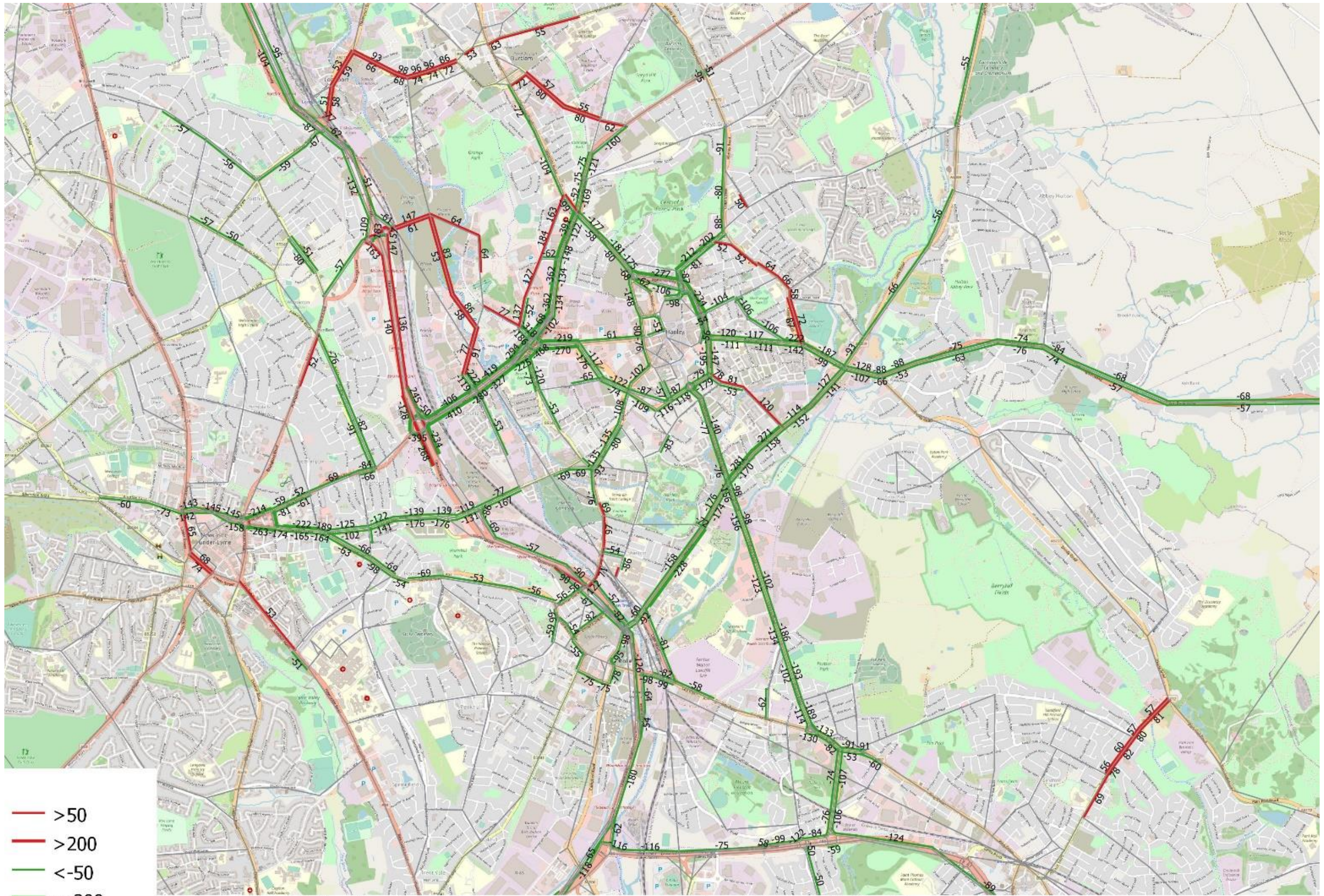

*Figure 9-5: Change in AADT traffic flows between 2025 Reference Case and 2025 Benchmark CAZ D – no-upgrade (vehicles)*

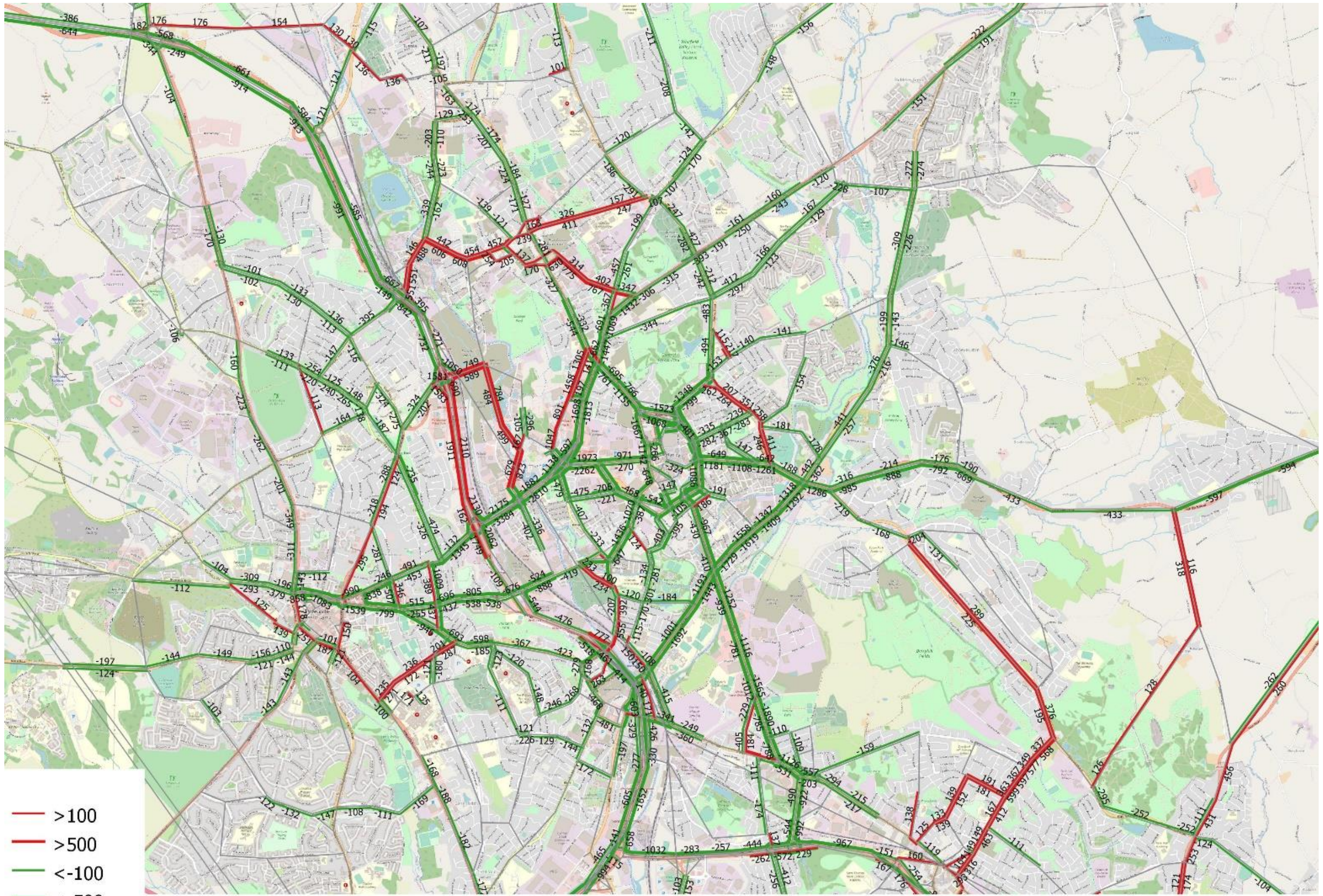


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*Figure 9-6: Change in AM peak-hour traffic flows between 2025 Reference Case and 2025 Benchmark CAZ D – no-upgrade (vehicles)*

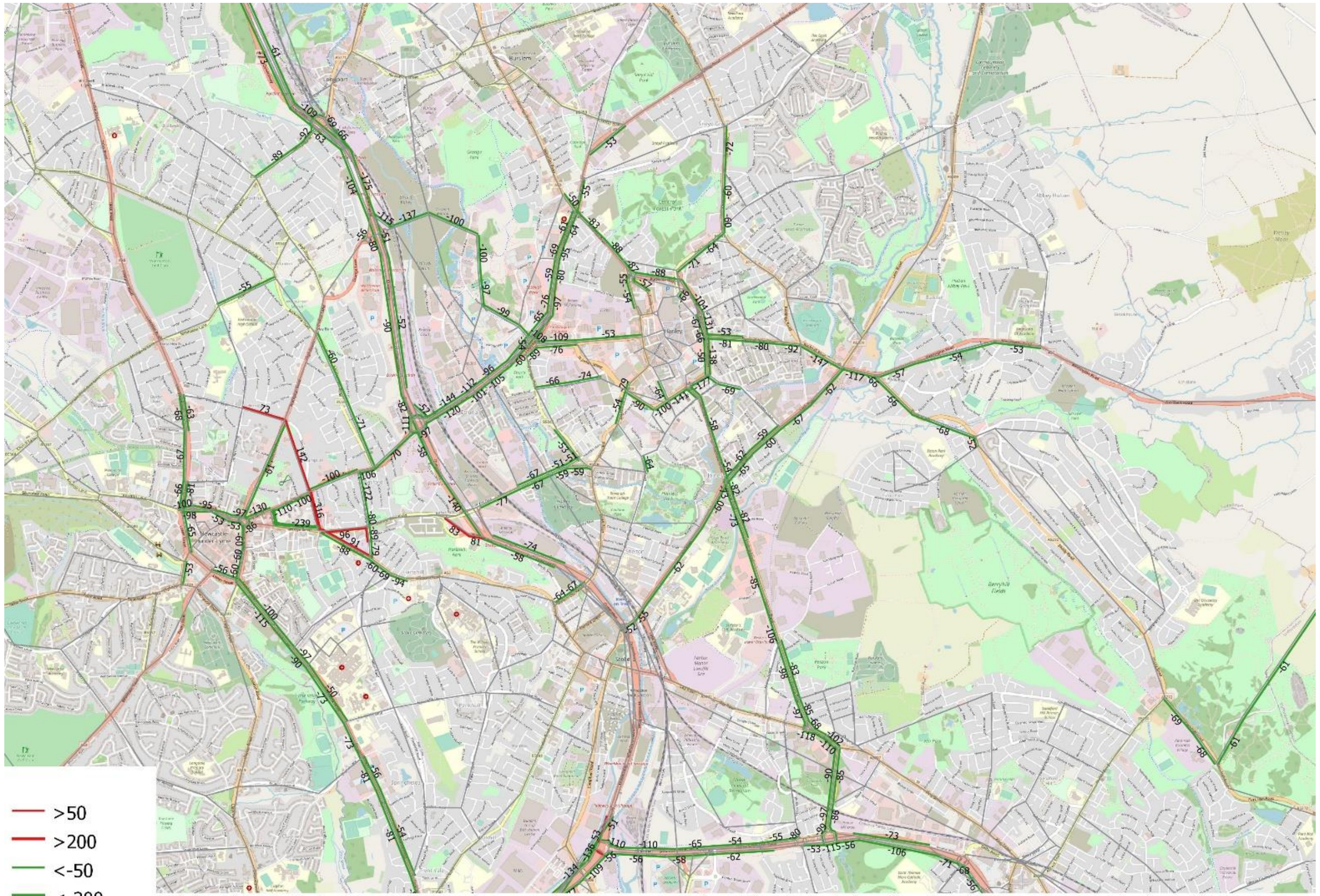

*Figure 9-7: Change in Inter-Peak hour traffic flows between 2025 Reference Case and 2025 Benchmark CAZ D – no-upgrade (vehicles)*

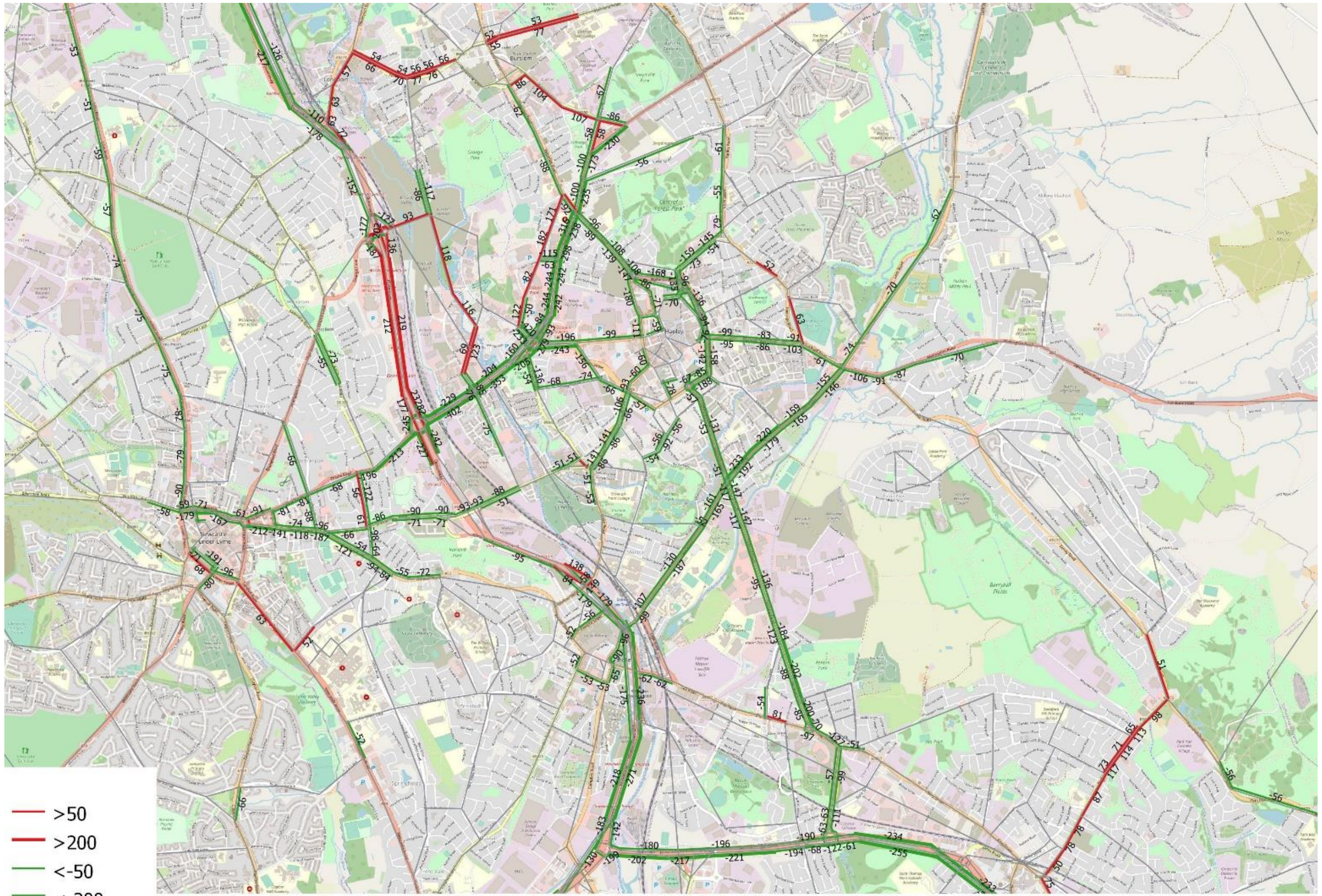


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*Figure 9-8: Change in PM peak-hour traffic flows between 2025 Reference Case and 2025 Benchmark CAZ D – no-upgrade (vehicles)*

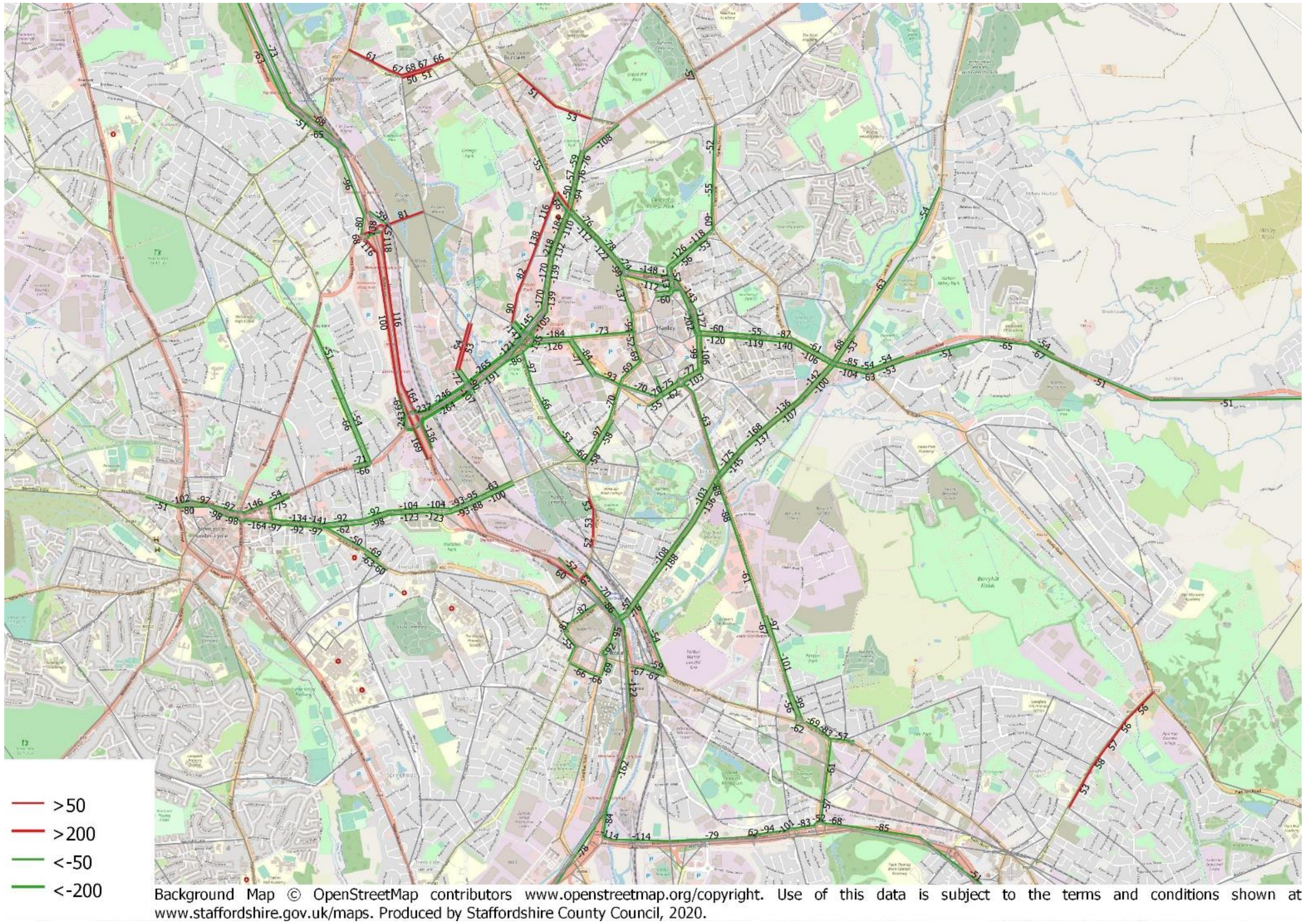

*Figure 9-9: 2022 Benchmark CAZ D No-Upgrade AM peak-hour overcapacity links and significant junction delays*

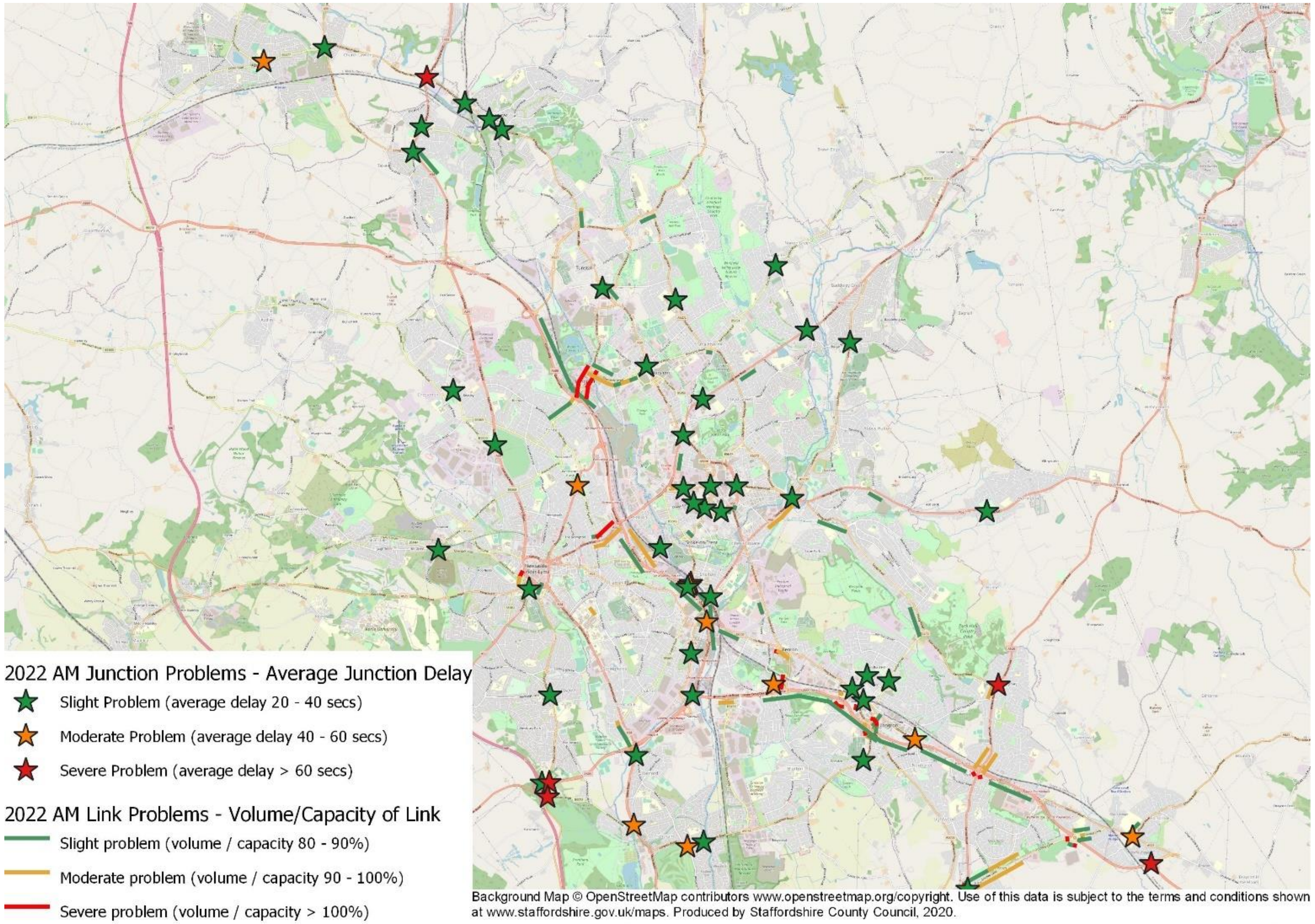

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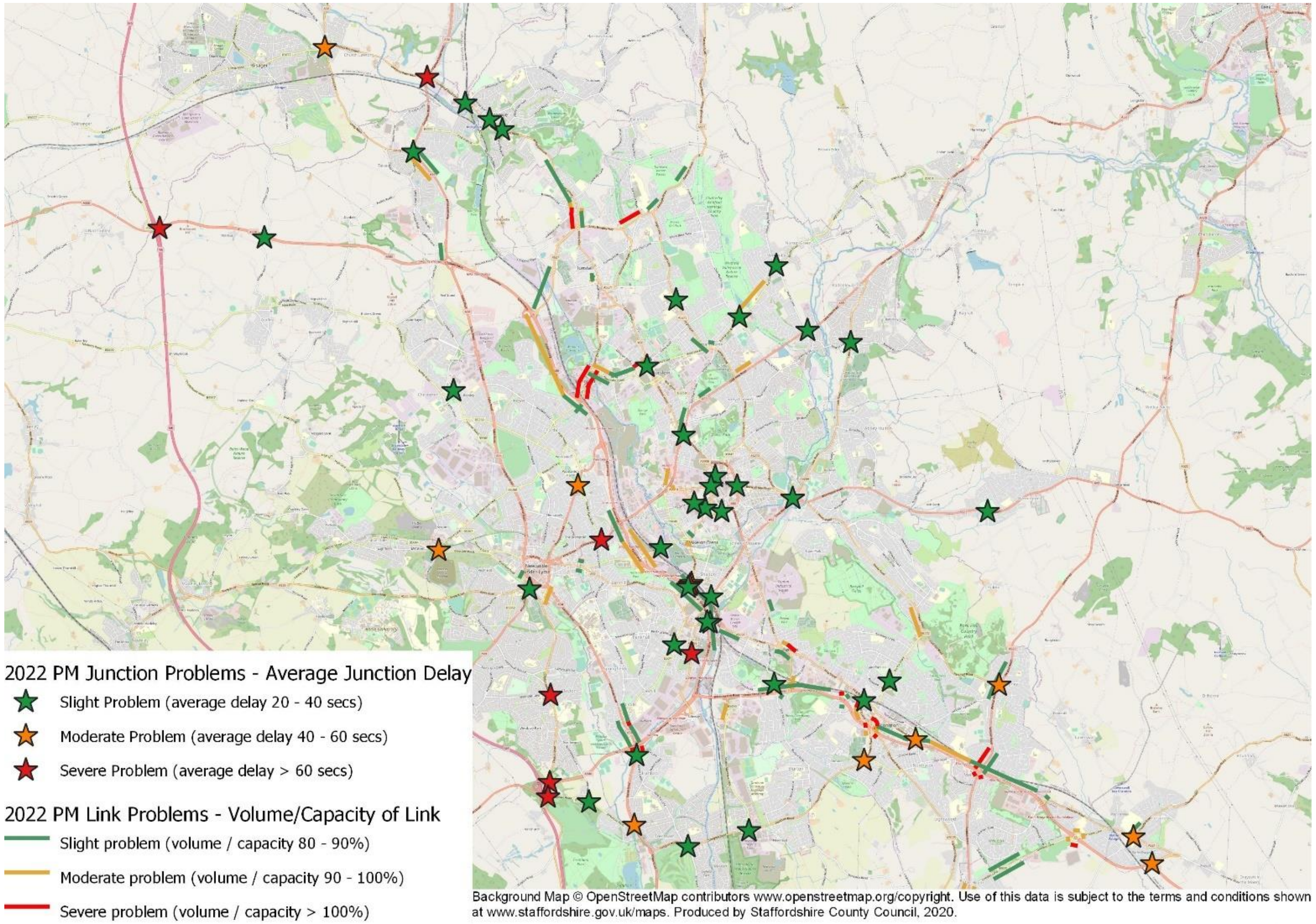
*Figure 9-10: 2022 Benchmark CAZ D No-Upgrade PM peak-hour overcapacity links and significant junction delays*



# 10 Conclusion

The NSMM transport model has been updated and refined to provide an appropriate analytical tool that will aid NuLBC, SoTCC and SCC in the development and implementation of an Air Quality Local Plan. The NSMM transport model has been used to derive appropriate Reference Case forecast traffic information and to inform the development of an air quality model, identify appropriate air quality initiatives and the subsequent appraisal of the Local Plan. These traffic forecasts have been used to inform the benchmarking of the Local Plan against a charging CAZ. The development and application of the NSMM transport model has been carried out in accordance with the DfT TAG guidance and additional guidance issued by the JAQU.

The NSMM transport model has been used to derive traffic forecasts for a 2022 forecast year, the year by which compliance with air quality targets is expected to be achieved. The traffic forecasts take account of all committed transport schemes and land-uses developments which are expected to be implemented by 2022. In addition, a 2025 forecast year has been produced too.

From the traffic forecasting work undertaken, total traffic is predicted to grow by approximately 5% between the 2015 base-year and the forecast year of 2022. Furthermore, the number of non-compliant car trips is predicted to reduce by approximately 6% with an even greater percentage shift to compliant vehicles for taxis, HGVs and buses. The implementation of the EVLR Project is also predicted to significantly reduce traffic flows on the A53 Etruria Road to the east of the A500.

Following testing of several mitigation measures, the identified Preferred Option removes the forecast $NO_2$ exceedances within North Staffordshire without resulting in additional exceedance locations and without the implementation of a charge scheme. Three exceedance locations were identified from the 2022 Reference Case transport model and air quality modelling. The exceedance locations are: A53 Etruria Road, A50 Victoria Road and Bucknall New Road. The Preferred Option includes the following measures:

- A53 Etruria Road westbound peak restrictions (bus gate) extending from the A500 roundabout to the Basford Park Road junction (except bus, cyclists and taxi)
- Pedestrian phases at both Albert Street and Basford Park traffic lights
- 75% bus retrofit along Bucknall New Road
- Victoria Road northbound peak restrictions (bus gate) on Victoria Road extending from the southern end of Victoria Road up to the Manor Street junction (except bus, cyclists and taxi)
- 100% bus retrofit along Victoria Road
- Traffic management measures to the east and west of Victoria Road in order to ensure that the adjacent local communities are not adversely impacted by traffic re-routeing through these areas when the bus gates are in operation

The Preferred Option reduces forecast daily traffic flows along both the A53 and A50 corridors due to the peak restrictions which therefore delivers compliance at these locations. The bus retro-fitting on Bucknall New Road addresses the exceedance at that location. The Preferred

Option reduces $NO_2$ and achieves air quality compliance at all exceedance areas without causing $NO_2$ exceedances in other locations.

The Benchmark CAZ D successfully reduces the number of non-compliant vehicles and is also effective in reducing flows at the exceedance locations.

| | |
|---|---|
| NAME | Newcastle-under-Lyme and Stoke-on-Trent |
| VERSION | v3052020 |
| DATE | 03/05/2020 |

| Ref | Requirement | LA Proposal Description | JAQU Review Comments | LA Updated Description 2 | JAQU Review Comments 2 | LA Updated Description 3 | JAQU Review Comments 3 | LA Updated Description 4 | JAQU Review Comments 4 | LA Comments 5 |
|---|---|---|---|---|---|---|---|---|---|---|
| C.1 | Model selection | | | | | | | | | |
| C.1.1 | Details of emissions model based on COPERT 5 emissions to be used. | COPERT 5 data either in the form of an update EFT or with JAQU's agreement Ricardo's in-house emission calculation tool pyCOPERT which is fully compatible with COPERT 5. | If using EFT, please use version 8.0.1a and be aware a new version of EFT may become available in time for baseline modelling. pyCOPERT is an accepted alternative. | [illegible] | [illegible] | [illegible] | [illegible] | The EFT version 9.1b has been used to calculate road transport emissions. This tool uses COPERT 5 emission factors. | | |
| C.1.2 | Gradient effects included? Map included in AQ2? | Further to the updated/clarification of the gradient method in LAQM.TG(16) we confirm that we will apply the gradient impact to all [illegible] | Green once a map is included. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | |
| C.1.3 | Details of air quality dispersion model to be used and any major adaptations made | [illegible] | | [illegible] | | [illegible] | | [illegible] | | |
| C.1.4 | Canyon effects included? Map included in AQ2? | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] vehicle length, receptor height, emission strength, wind speed and direction (taken from the same met record as the main RapidAir model). A map of modelled canyons will be provided following receipt of the updated traffic model from SWECO, in order to ascertain exact link locations for modelling. | [illegible] larger than the width of the road. Green once info provided | [illegible] recommended by the European Environment Agency for modelling canyons in compliance assessment . The model has terms to deal with canyon height, width, vehicle length, receptor height, emission strength, wind speed and direction. A complete map of modelled canyon locations is provided in AQ2 Section 2. | | |
| C.1.5 | Tunnels and flyovers included? Map included in AQ2? | No. | [illegible] | [illegible] | | Tunnels and flyovers will not be modelled. If modelling of flyovers will be considered to be beneficial for this assessment, we could model road links at a higher elevation using a dispersion kernel created with a different source height in AERMOD. It will not however be considered beneficial for this assessment. | | Tunnels and flyovers were not modelled. If modelling of flyovers will be considered to be beneficial for this assessment, we could model road links at a higher elevation using a dispersion kernel created with a different source height in AERMOD. It will not however be considered beneficial for this assessment. | | |
| C.2 | Air quality model domain | | | | | | | | | |
| C.2.1 | Please provide a map (in report) showing model domain in relation to exceedance locations identified in PCM model. | [illegible] | [illegible] | [illegible] | [illegible] | See Figure 1 of the Local Plan Study Area with inset showing the location of the local exceedance area. Figure 2 Census IDs detailing the location of PCM model locally. | | See Figure 1 of the Local Plan Study Area with inset showing the location of the local exceedance area. Figure 2 Census IDs detailing the location of PCM model locally. | PCM exceedances shown in figure 4 Local exceedances are shown in figure 2 | |
| C.2.2 | Locally identified exceedance locations included? | [illegible] | [illegible] | [illegible] | | Yes, the high-resolution nature of RapidAir and its inclusion of street canyons will make the model outputs naturally align with hotspots/exceedance locations. See Figure 1 in main report for model domain and Figure 2 for identified exceedances from PCM. | | Yes, the high-resolution nature of RapidAir and its inclusion of street canyons will make the model outputs naturally align with hotspots/exceedance locations. | Figure 4 not 2 | Amended |
| C.2.3 | Domain includes displacement routes? | [illegible] | [illegible] | [illegible] | [illegible] routes would be [illegible] includes the model [illegible] and displacement [illegible] | Yes. See Figure 4 in AQ2. | Green once text stated in AQ2 is added to expplain addition of displacement routes. | Now completed. | OK | |
| C.3 | Air quality model receptor locations | | | | | | | | | |
| C.3.1 | Details of receptor grid size (only if needed for distributional analysis) and other receptor locations. | For the Stoke/Newcastle domain (which is reasonably small) we can set RapidAir to model down to 1 m. The model can comfortably deal with about 500 million locations which provides for over 20,000 cells in the x and y axes. So, we can model 20km x 20km at 1m resolution, 40km x 40km at 2m resolution, 60km x 60km at 3m resolution and so on. The canyon model is set to the same resolution as the grid model so that they align perfectly spatially. Stoke-on-Trent and Newcastle-under-Lyme have a wide network of monitoring locations comprising a mix of passive and active sampling. RapidAir run time is not sensitive to the number of receptors so all available monitoring locations within the domain will be included. | Gridded receptors are only needed if population weighted mean concentrations are used as part in the cost-benefit analysis in economic modelling (see Options Appraisal package). Are you intending to calculate population weighted mean concentrations? What is the approach to modelling local (non-PCM) road links? | For the Stoke/Newcastle domain we can set RapidAir to model down to 1 m. The model can comfortably deal with about 500 million locations which provides for over 20,000 cells in the x and y axes. So, we can model 20km x 20km at 1m resolution, 40km x 40km at 2m resolution, 60km x 60km at 3m resolution and so on. The canyon model is set to the same resolution as the grid model so that they align perfectly spatially. Stoke-on-Trent and Newcastle-under-Lyme have a wide network of monitoring locations comprising a mix of passive and active sampling. RapidAir run time is not sensitive to the number of receptors so all available monitoring locations within the domain will be included. Local (non-PCM) road links are modelled as long as they are covered by the traffic model and an appropriate fleet age profile (e.g. ANPR-derived) can be assigned to it. | Gridded receptors are only needed if population weighted mean concentrations are used as part in the cost-benefit analysis in economic modelling (see Options Appraisal package). Are you intending to calculate population weighted mean concentrations? | For the Stoke/Newcastle domain we can set RapidAir to model down to 1 m. The model can comfortably deal with about 500 million locations which provides for over 20,000 cells in the x and y axes. So, we can model 20km x 20km at 1m resolution, 40km x 40km at 2m resolution, 60km x 60km at 3m resolution and so on. The canyon model is set to the same resolution as the grid model so that they align perfectly spatially. Stoke-on-Trent and Newcastle-under-Lyme have a wide network of monitoring locations comprising a mix of passive and active sampling. RapidAir run time is not sensitive to the number of receptors so all available monitoring locations within the domain will be included; determination of required outputs can then be carried out. All local (non-PCM) road links included in the traffic model will be modelled. | Are you intending to calculate population weighted mean concentrations? Receptor grid size is needed if you are not planning to do a damage cost approach to the economic assessment. Confirm which approach will be aken for the economic assessment and if not through damage costs then please provide details of receptor gid size. see section C.3.1 on pg 18 of the evidence package for details. Green once info provided | RapidAir runs for the North Staffordshire area were carried out at 3m resolution for all modelling years and scenarios. Stoke-on-Trent and Newcastle-under-Lyme Councils have a wide network of monitoring locations comprising a mix of passive and active sampling. RapidAir run time is not sensitive to the number of receptors so all available monitoring locations within the domain will be included; determination of required outputs can then be carried out. All local (non-PCM) road links included in the traffic model were modelled. A damage costs approach was taken for the economic assessment, so these gridded concentrations will not be required for this part of the study. However, they were used in the air quality analysis. | Explained in AQ2 2.3.2 | |
| C.3.2 | Methods to be used to assign subset of receptors for AQD assessment requirements. | Annex III of Directive 2008/50/EC (AQD) specifies that macroscale siting of sampling points should be representative of air quality for a street segment of no less than 100 m length at traffic-orientated sites. To provide results relevant to this requirement, for roadside locations where there is public access and the directive applies; road links with exceedances of the NO2 annual mean objective stretching over link lengths of 100m or greater can be presented as a separate GIS layer of model results. Annex III of the AQD also specifies that microscale sampling should be at least 25 m from the edge of major junctions. When reporting model results relevant to compliance with the AQD, locations up to 25m from the edge of major junctions in the model domain will therefore be excluded. | The receptor locations for all road links, including those below the limit value, must be compliant with the AQD macrositing and micrositing requirements. Receptors should be places at 2 m height and 4 m distance from the kerb. Will multiple receptors be modelled for each road link? In this case, the receptor location with the highest concentration which meets AQD requirements must be selected. At what spacing will receptors be placed and will they be placed on both sides of each road link? | Roadside receptor locations are placed at a distance of 4 m from the kerb, 2 m height and at 50 m intervals. Receptors are only considered for roads links with lengths greater than 100 m, where there is public access, and which are at least 25 m away from the edge of major junction. | Will non-AQD compliant receptors be screened out before or after modelling? | Roadside receptor locations are placed at a distance of 4 m from the kerb, 2 m height and at 4 m intervals. Receptors are only considered for roads links with lengths greater than 100 m, where there is public access, and which are at least 25 m away from the edge of major junction. | Will the screening exercise be undertaken before or after modelling? Green once info provided | Roadside receptor locations are placed at a distance of 4 m from the kerb, 2 m height and at 4 m intervals. Receptors are only considered for roads links with lengths greater than 100 m, where there is public access, and which are at least 25 m away from the edge of major junction. Non-AQD compliant receptors were screened out before modelling. | Explained in AQ2 2.3.2 | |
| D.1 | Air quality base Year modelling | | | | | | | | | |
| D.1.1 | Base year to be used. | The modelling base year will be 2017 in line with the latest traffic and air quality data and the base year of the proposed transport model. | | The modelling base year will be 2017 in line with the latest traffic and air quality data and the base year of the proposed transport model | | The modelling base year will be 2017 in line with the latest traffic and air quality data and the base year of the proposed transport model | Base year requires update. Green once info provided | The air quality modelling base year was 2018, in line with the latest available monitoring data when the project commenced | OK | |
| D.1.2 | Details of Meteorological data to be used. Details of surface roughness lengths at met site and dispersion site to be applied. | We will use surface meteorological data from Leek Thorncliffe monitoring station (NOAA Code 033300) processed in house using our own meteorological data management system. Our RapidAir model also takes account of upper air data which is used to determine the strength of turbulent mixing in the lower atmosphere- we will derive this from the closest radiosonde site and process in the USEPA AERMET model. We will utilise data filling where necessary following USEPA guidance which sets out the preferred hierarchy of routines to account for gaps (persistence, interpolation, substitution). Our modelling will be supplied with full meteorological discussion and if required we can supply the computer code used to process the data and details of any data filling that was required. | Data from which year will be used? | We will use surface meteorological data from Leek Thorncliffe monitoring station (NOAA Code 033300) processed in house using our own meteorological data management system. The selected year will be 2017. Our RapidAir model also takes account of upper air data which is used to determine the strength of turbulent mixing in the lower atmosphere- we will derive this from the closest radiosonde site and process in the USEPA AERMET model. We will utilise data filling where necessary following USEPA guidance which sets out the preferred hierarchy of routines to account for gaps (persistence, interpolation, substitution). Our modelling will be supplied with full meteorological discussion and if required we can supply the computer code used to process the data and details of any data filling that was required. | Please provide the surface roughness that will be used at the met site and the dispersion site. | We will use surface meteorological data from Leek Thorncliffe monitoring station (NOAA Code 033300) processed in house using our own meteorological data management system. The selected year will be 2017. Our RapidAir model also takes account of upper air data which is used to determine the strength of turbulent mixing in the lower atmosphere- we will derive this from the closest radiosonde site and process in the USEPA AERMET model. We will utilise data filling where necessary following USEPA guidance which sets out the preferred hierarchy of routines to account for gaps (persistence, interpolation, substitution). Our modelling will be supplied with full meteorological discussion and if required we can supply the computer code used to process the data and details of any data filling that was required. A uniform surface roughness value of 1.0 m will be modelled to represent a typical city/urban environment. A surface roughness of 0.3 m will be used to represent the meteorological measurement site. | Selected year requires update ? Green once info provided | Surface meteorological data from Leek Thorncliffe monitoring station (NOAA Code 033300) for 2018 was used, processed in house using our own meteorological data management system. We will utilise Data filling was used where necessary following USEPA guidance which sets out the preferred hierarchy of routines to account for gaps (persistence, interpolation, substitution). Our modelling will be supplied with full meteorological discussion and if required we can supply the computer code used to process the data and details of any data filling that was required. A uniform surface roughness value of 1.0 m was modelled to represent a typical city/urban environment. A surface roughness of 0.3 m will be used to represent the meteorological measurement site. | OK. Computer code not required. | |
| D.2 | Traffic input data | | | | | | | | | |
| D.2.1 | Source of traffic activity data and vehicle types. | The key source of traffic data will be the North Staffordshire Multi-Modal (NSMM) transport model which was run for the Etruria Valley Project in 2015. Traffic was adjusted to 2017 by using a growth factor of 1.0257. An ANPR study will be used to derive vehicle split and classification. | What is the traffic growth factor based on? Into what vehicle types and classifications will the fleet be split by the ANPR study? | The key source of traffic data will be the North Staffordshire Multi-Modal (NSMM) transport model which was run for the Etruria Valley Project in 2015. Traffic levels were adjusted to 2017 by using a specific Tempro-derived coefficient (1.0257) corresponding to an average day for the Staffordshire area for Urban Principal Roads. An ANPR study will be used to derive vehicle split and classification. | | The key source of traffic data will be the North Staffordshire Multi-Modal (NSMM) transport model which was run for the Etruria Valley Project in 2015. Traffic levels were adjusted to 2017 by using a specific Tempro-derived coefficient (1.0257) corresponding to an average day for the Staffordshire area for Urban Principal Roads. An ANPR study will be used to derive vehicle split and classification. | Please update this given the new developments with traffic traffic model and ANPR study. Green once info provided | Annual average daily traffic (AADT) link flows for each model link for 2015 and 2022 were provided by Sweco using a traffic model derived from the North Staffordshire Multi-Modal Model (NSMM). No traffic growth was assumed to occur between 2015 and the air quality model year of 2018 , following advice provided by the Councils. The traffic model provides vehicle flows for five highway user classes which are: Cars, Taxis, HGVs, LGVs and Buses. A further breakdown of the HGV into rigid and articulated categories was carried out using local traffic count data and ANPR data. Additional traffic from motorcycles was derived using a constant scaling factor (0.005) for the domain, derived from automatic traffic count data. The taxi fleet was split between cars and LGVs based on size data provided by the Councils. | Is it possible for this advice to be included in an annex? | An analysis of traffic growth from 2015 to 2018 is presented in T2 Section 2.5. |
| D.2.2 | Details of representation of road locations (achieved through use of a georeferenced transport model or another approach?) | See Figure 1 Local Plan Development Study Area . All modelling links have been snapped to the OS ITN road network for the best spatial representation through the use of a buffer-based approach and the manually quality-controlled. | | All modelling links will be snapped to the OS ITN road network for the best spatial representation through the use of a buffer-based approach and the manually quality-controlled. | | All modelling links will be snapped to the OS ITN road network for the best spatial representation through the use of a buffer-based approach and the manually quality-controlled. | | All modelling links will be snapped to the OS ITN road network for the best spatial representation through the use of a buffer-based approach and the manually quality-controlled. | | |
| D.2.3 | Source of vehicle fleet composition information (local/EFT). | ANPR | When is the survey planned? What vehicle types will it cover? | ANPR | When is the survey planned? What vehicle types will it cover? | ANPR | Please state any other sources of fleet coposition information other than ANPR .Green once info provided | ANPR data was used for cars, LGVs, HGVs, and buses. National fleet data for "Urban (not London) was used for motorcycles. For Taxis and private hire, fleet composition is derived from information on licenced vehicles in Stoke-on-Trent and Newcastle-under-Lyme provided by Newcastle-under-Lyme Borough Council. | Report states that taxi fleet composition was derived from the ANPR data. Please amend. | Amended |
| D.2.4 | Source of vehicle speed information. | Traffic speeds were provided for every road link considered by the North Staffordshire Multi-Modal (NSMM) transport model | Where does the speed data in the NSMM come from? | Traffic speeds will be provided for every road link considered by the North Staffordshire Multi-Modal (NSMM) transport model. | Where does the speed data in the NSMM come from? Are speeds derived from travel times in the NSMM? How does the accuracy of this data compare to trafficmaster? | Traffic speeds will be provided for every road link considered by the North Staffordshire Multi-Modal (NSMM) transport model. | Where does the speed data in the NSMM come from? Are speeds derived from travel times in the NSMM? How does the accuracy of this data compare to trafficmaster? Green once info provided | Traffic speeds were provided for every road link considered by the North Staffordshire Multi-Modal (NSMM) transport model. Journey time validation was carried out following DfT guidelines, based on those described in WebTAG Unit M3.1 and the DMRB Volume 12, Section 2, Part 1, Chapter 4. The transport model was found to perform within guidelines for both traffic flows and modelled speeds. For validated links, all modelled travel times were found to pass the DRMB criteria of being within 15% or 1 minute of the observed times. | | |
| D.3 | NOx/$NO_2$ emissions assumptions | | | | | | | | | |
| D.3.1 | Source of primary $NO_2$ emission fractions (f-$NO_2$). | Defra f-$NO_2$ fractions which we understand will be released in time to support this work. | Please use version 8.0.1a of the EFT in the meantime. A new version of EFT may become available in time for baseline modelling. f-$NO_2$ should be calculated on a link-by-link basis using the EFT having entered local fleet inputs. | Defra f-NO2 fractions | Please use version 8.0.1a of the EFT in the meantime. A new version of EFT may become available in time for baseline modelling. f-$NO_2$ should be calculated on a link-by-link basis using the EFT having entered local fleet inputs. | Defra f-NO2 fractions will be used using the emission factor toolkit version identified above. | EFT version 9.0.1a is now available for baseline modelling, please update. f-$NO_2$ should be calculated on a link-by-link basis using the EFT having entered local fleet inputs. Please confirm. Green once info provided | f-NO2 was calculated on a link-by-link basis using the EFT version 9.1b for each modelled year, having entered local fleet inputs. | | |
| D.3.2 | Details of method used to calculate projections for f-$NO_2$ and to calculate $NO_2$ concentrations from $NO_x$ concentrations. | Link-specific fractions of primary NO2 will be calculated using the COPERT v5 emission functions for all vehicles up to and including Euro 6/VI. Emission rates of primary NO2 and of total NOx will be calculated with our in-house emission calculation tool pyCOPERT as agreed by JAQU, which is fully consistent with COPERT v5 and links directly to our RapidAir dispersion modelling system. The specific fractions of primary NO2 for every projected year are calculated based on the projected average fleet composition for every year from the NAEI, which determine the predominance of specific primary emission factors (of any given emission standard). | If using EFT, please use version 8.0.1a and be aware a new version of EFT may become available in time for baseline modelling. pyCOPERT is an accepted alternative. What method will be used to convert NOx to NO2 concentrations? | Link-specific fractions of primary NO2 will be calculated using the COPERT v5 emission functions for all vehicles up to and including Euro 6/VI. Emission rates of primary NO2 and of total NOx will be calculated with our in-house emission calculation tool pyCOPERT as agreed by JAQU, which is fully consistent with COPERT v5 and links directly to our RapidAir dispersion modelling system. The specific fractions of primary NO2 for every projected year are calculated based on the projected average fleet composition for every year from the NAEI, which determine the predominance of specific primary emission factors (of any given emission standard). The Defra NOx to NO2 model will be used. This method is based on road specific fractions of primary NO2. | | Link-specific fractions of primary NO2 will be calculated using the COPERT v5 emission functions for all vehicles up to and including Euro 6/VI. Emission rates of primary NO2 and of total NOx will be calculated with our in-house emission calculation tool pyCOPERT as agreed by JAQU, which is fully consistent with COPERT v5 and links directly to our RapidAir dispersion modelling system. The specific fractions of primary NO2 for every projected year are calculated based on the projected average fleet composition for every year from the NAEI, which determine the predominance of specific primary emission factors (of any given emission standard). The Defra NOx to NO2 model will be used. This method is based on road specific fractions of primary NO2. | | Projections for f-NO2 were carried out using the EFT version 9.1b. The Defra NOx to NO2 model was used to calculate NO2 concentrations from NOx concentrations. This method is based on road specific fractions of primary NO2. | | |
| D.4 | Non-road transport modelling | | | | | | | | | |
| D.4.1 | Details of modelling for non-road transport sources and background. | No non-road transport sources were explicitly modelled. Their contribution has been taken into consideration through the use of the NOx background maps produced by the PCM model and made available online . | Will the sector removal tool be used to remove the minor road component from the background concentrations? | No non-road transport sources will be explicitly modelled for the baseline. Their contribution will be been taken into consideration through the use of the NOx background maps produced by the PCM model and made available online , after removal of the modelled roads. The contribution of minor roads was considered as additional. | | No non-road transport sources will be explicitly modelled for the baseline. Their contribution will be been taken into consideration through the use of the NOx background maps produced by the PCM model and made available online , after removal of the modelled roads. The contribution of minor roads was considered as additional. | | No non-road transport sources will be explicitly modelled for the baseline. Their contribution will be been taken into consideration through the use of the NOx background maps produced by the PCM model and made available online , after removal of the modelled roads. The contribution of minor roads was considered as additional. | | |
| D.5 | Measurement data for model calibration | | | | | | | | | |
| D.5.1 | Details used for the model calibration e.g. dates, locations and details of the model performance and uncertainty | | Please provide detail, including a map. | Details will be provided when the detailed modelling will take place. | Please provide detail, including a map in an updated AQ2. | Details of available monitoring data, including a map of all sites, are provided in AQ2. | AQ2 refers to model performance but not specifically to uncertainty. Please add in reference to uncertainty. Perhaps referring to section 7.536 onwards of LAQM.TG16. Green once info provided | Details of available monitoring data, including a map of all sites, are provided in AQ2. An analysis of model uncertainty is provided in AQ3. | | |
| D.5.2 | Type of monitoring data (automatic and/or diffusion tubes) used for the model calibration | Automatic and diffusion tubes. See Figure 1 for existing monitoring locations and Figure 5 for proposed monitoring locations. and type of monitoring points. | How many monitors of each type will be used? What methods will be used to correct bias in diffusion tube data and to carry out the calibration? | Automatic and diffusion tubes. See Figure 3 for existing monitoring locations. The data reported by the diffusion tubes will be bias and distance adjusted using the Local Air Quality Management (LAQM) Annual Status Report (ASR) for England, and the NO2 Fall-Off with Distance Calculator. | How many monitors of each type will be used? | Monitoring data from 5 automatic monitoring stations and 110 diffusion tubes in the two council areas will be used to calibrate the model. The data reported by the diffusion tubes will be bias and distance adjusted using the Local Air Quality Management (LAQM) Annual Status Report (ASR) for England, and the NO2 Fall-Off with Distance Calculator. | | Monitoring data from 5 automatic monitoring stations and 110 diffusion tubes in the two council areas will be used to calibrate the model. The data reported by the diffusion tubes will be bias and distance adjusted using the Local Air Quality Management (LAQM) Annual Status Report (ASR) for England, and the NO2 Fall-Off with Distance Calculator. | | |
| D.5.3 | All available automatic (and/or diffusion tube) monitoring data included in the model calibration | Yes. No monitoring locations were excluded | | Yes. No monitoring locations will be excluded | | Yes. No monitoring locations will be excluded | | Yes. No monitoring locations will be excluded | | |
| D.5.4 | Quality assurance of measurement data. | Automatic monitors - The local authority attended the monitoring stations at least every 2 or 4 weeks (depending on whether the location is experiencing high NO2 concentrations or not, respectively) to change the filter and check the calibration of the instrument. The instruments have the minimum data capture of 75% for the year. Diffusion tubes were supplied and analysed by Staffordshire Scientific Services in 2017. The Laboratory participates in the UK-PT scheme, inter-comparison exercises. Preparation method used for the diffusion tube was 20% Triethanolamine in water. A national bias adjustment factor applied to the data. Monitoring data was completed for at least 75% of the year (9 months) or data was annualised. Diffusion tubes were changed on a monthly basis. Monitoring sites comply with the microscale siting requirements set out in Annex III of the AAQD. | | Automatic monitors - The local authority attended the monitoring stations at least every 2 or 4 weeks (depending on whether the location is experiencing high NO2 concentrations or not, respectively) to change the filter and check the calibration of the instrument. The instruments have the minimum data capture of 75% for the year. Diffusion tubes were supplied and analysed by Staffordshire Scientific Services in 2017. The Laboratory participates in the UK-PT scheme, inter-comparison exercises. Preparation method used for the diffusion tube was 20% Triethanolamine in water. A national bias adjustment factor applied to the data. Monitoring data was completed for at least 75% of the year (9 months) or data was annualised. Diffusion tubes were changed on a monthly basis. Monitoring sites comply with the microscale siting requirements set out in Annex III of the AAQD. | | Automatic monitors - The local authority attended the monitoring stations at least every 2 or 4 weeks (depending on whether the location is experiencing high NO2 concentrations or not, respectively) to change the filter and check the calibration of the instrument. The instruments have the minimum data capture of 75% for the year. Diffusion tubes were supplied and analysed by Staffordshire Scientific Services in 2017. The Laboratory participates in the UK-PT scheme, inter-comparison exercises. Preparation method used for the diffusion tube was 20% Triethanolamine in water. A national bias adjustment factor applied to the data. Monitoring data was completed for at least 75% of the year (9 months) or data was annualised. Diffusion tubes were changed on a monthly basis. Monitoring sites comply with the microscale siting requirements set out in Annex III of the AAQD. | | Automatic monitors - The local authority attended the monitoring stations at least every 2 or 4 weeks (depending on whether the location is experiencing high NO2 concentrations or not, respectively) to change the filter and check the calibration of the instrument. The instruments have the minimum data capture of 75% for the year. Diffusion tubes were supplied and analysed by Staffordshire Scientific Services in 2017. The Laboratory participates in the UK-PT scheme, inter-comparison exercises. Preparation method used for the diffusion tube was 20% Triethanolamine in water. A national bias adjustment factor applied to the data. Monitoring data was completed for at least 75% of the year (9 months) or data was annualised. Diffusion tubes were changed on a monthly basis. Monitoring sites comply with the microscale siting requirements set out in Annex III of the AAQD. | | |
| E.1 | Baseline projections modelling | | | | | | | | | |
| E.1.1 | Years to be modelled. | Modelling years are:<br>• 2018<br>• 2019<br>• 2020<br>• 2021<br>• 2022<br>• 2023<br>• 2024<br>• 2025<br>• 2026<br>• 2027 | The base year (2017), the earliest year in which compliance is expected to be achieved through having taken measures, and all years in between (interim years) should be modelled. Concentrations in interim years can be derived using interpolation if there are no major changes in these years that would make interpolation inaccurate. At the moment, the base year is missing, and you suggest the earliest year in which you can achieve compliance through taking measures is 2027. | The years to be modelled will be determined once the shortlisted options are developed further. However, at this stage, these are anticipated to include:<br>• 2017 (baseline)<br>• 2020<br>• 2023<br>• 2026 | The base year (2017), the earliest year in which compliance is expected to be achieved through having taken measures, and all years in between (interim years) should be modelled. Concentrations in interim years can be derived using interpolation if there are no major changes in these years that would make interpolation inaccurate. What is the earliest year in which you can achieve compliance through taking measures (i.e. in what year do you suggest a CAZ benchmark would achieve compliance)? We expect to see 2 years here. The first year is the base year and the second yearis the year that the 'main' measure (e.g. CAZ) being modelled could be implemented. | The following years will be modelled:<br>•2018 (baseline);<br>•2021: the year that the main measures could be implemented;<br>•202X: earliest year compliance is achieved through taking measures. This year will be established during the detailed modelling, working backwards from 2031, 10 years after implementation.<br>Concentrations in interim years will be derived using interpolation. | Please provide update on earliest year of compliance is achieved through taking measures. Green once info provided | The following years were modelled:<br>• 2018: The base year<br>• 2022: the earliest year that compliance is achieved through taking measures.<br>Concentrations in interim years were derived using interpolation. | | |
| E.1.2 | Details of method for projected vehicle fleet composition. | Vehicle fleet compositions have been projected taking into consideration the evolution of the different vehicle types and ages estimated by the National Atmospheric Emissions Inventory (NAEI). The split between petrol and diesel passenger cars, light-goods vehicles (LGVs), rigid and articulated heavy-goods vehicles, buses, and motorcycles was based on ANPR data. These splits were applied directly on the traffic model outputs. In addition to this, the composition of buses in all the roads of the modelling domain was set to be 100% Euro III after a discussion with Stoke-on-Trent City Council, which confirmed that all the bus routes present in the modelled roads operate vehicles with such an age. | | Vehicle fleet compositions will be projected taking into consideration the evolution of the different vehicle types and ages estimated by the National Atmospheric Emissions Inventory (NAEI). The split between petrol and diesel passenger cars, light-goods vehicles (LGVs), rigid and articulated heavy-goods vehicles, buses, and motorcycles was based on ANPR data. These splits will be applied directly on the traffic model outputs. The composition of the bus fleet will reflect recent funding approvals for a bus retrofit scheme. The schedule for the implementation of this scheme will be confirmed with the operators. | | Vehicle fleet compositions will be projected taking into consideration the evolution of the different vehicle types and ages estimated by the National Atmospheric Emissions Inventory (NAEI). The split between petrol and diesel passenger cars, light-goods vehicles (LGVs), rigid and articulated heavy-goods vehicles, buses, and motorcycles was based on ANPR data. These splits will be applied directly on the traffic model outputs. The composition of the bus fleet will reflect recent funding approvals for a bus retrofit scheme. The schedule for the implementation of this scheme will be confirmed with the operators. | Okay but will EFT fleet projection tool be used to model future euro standard composition | Vehicle fleet compositions were projected taking into consideration the evolution of the different vehicle types and ages estimated by the National Atmospheric Emissions Inventory (NAEI) using the EFT fleet projection tool. The 2018 split between petrol and diesel passenger cars, light-goods vehicles (LGVs), rigid and articulated heavy-goods vehicles, buses, and motorcycles was based on ANPR data. These splits were applied directly on the traffic model outputs. | | |
| E.1.3 | Impact of RDE emission factors (subsequent Euro 6 stages) included? | Included within COPERT 5. | | Included within COPERT 5. | | Included within COPERT 5. | | Included within he EFT version 9.1b. | | |
| E.1.4 | Details of methods to calculate future fleet emissions 10 years beyond compliance to inform options appraisal (linked with C2.2). | Specific Tempro-derived growth factors were applied to the total traffic flows compared to the 2017 baseline. | How are emissions calculated from traffic data? | Emission calculations for every road are calculated as the sum-product of the annual average daily vehicle flows of every Euro standard class and their respective NOx emission factors. To do this calculation, three types of variables intervene: annual average daily flows for every vehicle type, an age profile in terms of Euro standards for each vehicle type, and emission factors by vehicle type and Euro standard. While this principle applies to all emission calculations irrespective of the year, the data needs to be projected:<br>• Vehicle flows will be projected for any of the considered years using Tempro-derived factors corresponding to an average day for the Staffordshire area for Urban Principal Roads.<br>• Fleet age profiles will be projected taking into consideration the evolution described in the National Atmospheric Emission Projections (NAEI). | For clarification, this is 10 years beyond implementation (in most cases 10 years beyond compliance has been reached). Only future fleet emissions need to be calculated in this year and not concentrations. | Emission calculations for every road are calculated as the sum-product of the annual average daily vehicle flows of every Euro standard class and their respective NOx emission factors. To do this calculation, three types of variables intervene: annual average daily flows for every vehicle type, an age profile in terms of Euro standards for each vehicle type, and emission factors by vehicle type and Euro standard. While this principle applies to all emission calculations irrespective of the year, the data needs to be projected:<br>• Vehicle flows will be projected for any of the considered years using Tempro-derived factors corresponding to an average day for the Staffordshire area for Urban Principal Roads.<br>• Fleet age profiles will be projected taking into consideration the evolution described in the National Atmospheric Emission Projections (NAEI). | | Emission calculations for every road were calculated as the sum-product of the annual average daily vehicle flows of every Euro standard class and their respective NOx emission factors. To do this calculation, three types of variables intervene: annual average daily flows for every vehicle type, an age profile in terms of Euro standards for each vehicle type, and emission factors by vehicle type and Euro standard. While this principle applies to all emission calculations irrespective of the year, the data needs to be projected:<br>• Vehicle flows were projected for any of the considered years using Tempro-derived factors corresponding to an average day for the Staffordshire area for Urban Principal Roads.<br>• Fleet age profiles were projected taking into consideration the evolution described in the National Atmospheric Emission Projections (NAEI). | Are these results detailed somewhere? | Advice was received from JAQU that modelling for future years was not be required at this stage, so results have not been included in this submission. |
| E.2 | With measures projections modelling | | | | | | | | | |
| E.2.1 | Years to be modelled. | Modelling years are:<br>• 2018<br>• 2019<br>• 2020<br>• 2021<br>• 2022<br>• 2023<br>• 2024<br>• 2025<br>• 2026<br>• 2027 | The base year (2017), the earliest year in which compliance is expected to be achieved through having taken measures, and all years in between (interim years) should be modelled. Concentrations in interim years can be derived using interpolation if there are no major changes in these years that would make interpolation inaccurate. At the moment, the base year is missing, and you suggest the earliest year in which you can achieve compliance through taking measures is 2027. | The years to be modelled will be determined once the shortlisted options are developed further. However, at this stage, these are anticipated to include:<br>• 2017 (baseline)<br>• 2020<br>• 2023<br>• 2026 | | The following years will be modelled with measures:<br>•2021: the year that the main measures could be implemented;<br>•202X: earliest year compliance is achieved through taking measures. This year will be established during the detailed modelling, working backwards from 2031, 10 years after implementation.<br>Concentrations in interim years will be derived using interpolation. | Please confirm the following: The base year (201x), The earliest year in which compliance is expected to be achieved through having taken measures (i.e. in what year do you suggest a CAZ benchmark would achieve compliance)?, All years in between (interim years) to be modelled. Green once info provided | The following years were modelled with measures:<br>•2018: The base year<br>•2022: the expected compliance year for the CAZ benchmark<br>Concentrations in interim years were derived using interpolation. | | |
| E.2.2 | Details of methods to calculate future fleet emissions 10 years beyond compliance to inform options appraisal. | Specific Tempro-derived growth factors were applied to the total traffic flows compared to the 2017 baseline. | How are emissions calculated from traffic data? Please note that only emissions need to be calculated for 10 years beyond compliance for the economic appraisal. This is separate to the compliance assessment itself. | Emission calculations for every road are calculated as the sum-product of the annual average daily vehicle flows of every Euro standard class and their respective NOx emission factors. To do this calculation, three types of variables intervene: annual average daily flows for every vehicle type, an age profile in terms of Euro standards for each vehicle type, and emission factors by vehicle type and Euro standard. While this principle applies to all emission calculations irrespective of the year, the data needs to be projected:<br>• Vehicle flows will be projected for any of the considered years using Tempro-derived factors corresponding to an average day for the Staffordshire area for Urban Principal Roads.<br>• Fleet age profiles will be projected taking into consideration the evolution described in the National Atmospheric Emission Projections (NAEI). | For clarification, this is 10 years beyond implementation (in most cases 10 years beyond compliance has been reached). Only future fleet emissions need to be calculated in this year and not concentrations. | Emission calculations for every road are calculated as the sum-product of the annual average daily vehicle flows of every Euro standard class and their respective NOx emission factors. To do this calculation, three types of variables intervene: annual average daily flows for every vehicle type, an age profile in terms of Euro standards for each vehicle type, and emission factors by vehicle type and Euro standard. While this principle applies to all emission calculations irrespective of the year, the data needs to be projected:<br>• Vehicle flows will be projected for any of the considered years using Tempro-derived factors corresponding to an average day for the Staffordshire area for Urban Principal Roads.<br>• Fleet age profiles will be projected taking into consideration the evolution described in the National Atmospheric Emission Projections (NAEI). | | Emission calculations for every road were calculated as the sum-product of the annual average daily vehicle flows of every Euro standard class and their respective NOx emission factors. Emissions were calculated using average AM, interpeak, PM and off-peak flows and speeds for each vehicle type, an age profile in terms of Euro standards for each vehicle typie, and emission factors by vehicle type and Euro standard. While this principle applies to all emission calculations irrespective of the year, the data needs to be projected:<br>• Traffic flows were derived from a projected traffic model, described in reports TD1 to TD4.<br>• Fleet age profiles were projected using the EFT fleet projection tool. | | |

| | |
|---|---|
| GREEN | Accepted, Information meets requirements |
| YELLOW | Requires further information or a response to a question to be provided either in the table or in the report |
| RED | Information provided does not meet the requirement |

The AQ modelling Tracker is complete when all listed requirements are green and all required additional information has been provided.

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# North Staffordshire Local Air Quality Plan - Air Quality Modelling Methodology Report (AQ2)

Report for Stoke-on-Trent City Council and Newcastle-under-Lyme Borough Council

ED 12487 | Date 15/05/2020

**Customer:**

**Newcastle-under-Lyme Borough Council**

Customer reference:

NuLBC & SoTCC AQ2

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Date:

15 May 2020

Ricardo Energy & Environment reference:

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**Appendices**

# 1 Introduction and outline modelling scope

North Staffordshire, like many areas across the UK, continues to experience areas of poor air quality. Stoke-on-Trent City Council and Newcastle-under-Lyme Borough Council (the Councils), along with 32 other Local Authorities, received a Ministerial Direction on the 23rd March 2018 to undertake a feasibility study into nitrogen dioxide ($NO_2$) compliance. Following this feasibility study, the Councils received another Ministerial Direction to undertake a $NO_2$ Local Plan Development.

## 1.1 Context

Stoke-on-Trent and Newcastle-under-Lyme have locations where $NO_2$ concentrations are in excess of national and European air quality standards. Newcastle-under-Lyme Borough Council (NULC) has declared 4 Air Quality Management Areas (AQMAs) for annual mean $NO_2$ concentrations across the borough to date, all of which are in the proposed model domain. Stoke-on-Trent City Council has declared a single AQMA encompassing the whole city for annual mean and hourly mean $NO_2$ concentrations. These AQMAs are detailed in Table 1-1 below. A map showing the locations of these AQMAs is presented in Figure 1-1. The associated Local Air Quality Management (LAQM) assessment work has concluded that these exceedances are mainly attributable to emissions from road traffic.

**Table 1-1: AQMAs in the model domain**

| Local Authority | AQMA | Description | Date Declared | Pollutants |
|---|---|---|---|---|
| Newcastle-under-Lyme | AQMA 1 - Kidsgrove | Declared due to exceedance of the $NO_2$ annual mean objective along Liverpool Road A50, Kidsgrove | 15/01/2015 | $NO_2$ (annual) |
| | AQMA 2 - Town | Covers Newcastle under Lyme Town Centre including the ring road, A53, King Street, George Street and London Road to the boundary with the City of Stoke on Trent AQMA | 15/01/2015 | $NO_2$ (annual) |
| | AQMA 3 - Maybank, Wolstanton, Porthill | Covers the principal routes between Maybank, Wolstanton and Porthill. | 15/01/2015 | $NO_2$ (annual) |
| | AQMA 4 - Little Madeley | Declared around two properties at Little Madeley. | 15/01/2015 | $NO_2$ (annual) |
| Stoke-on-Trent | Stoke AQMA | An area encompassing the whole city of Stoke-on-Trent. | 04/04/2006 Amended 09/05/2011 | $NO_2$ (hourly and annual) |

Defra compliance modelling has identified two road links which are predicted to exceed the UK Air Quality Objective for annual mean $NO_2$ concentrations in 2020; these links comprise the length of the A53 (Etruria Road) from Festival Park roundabout to the A500 roundabout. An $NO_2$ feasibility study carried out in 2018 extended the area of predicted non-compliance to include census IDs 28732 and 6545. The locations of monitored exceedances of the Air Quality Objective for annual mean $NO_2$ concentrations are presented in Figure 1-2.

**Figure 1-1: SOTC and NULC Air Quality Management Areas (AQMAs)**

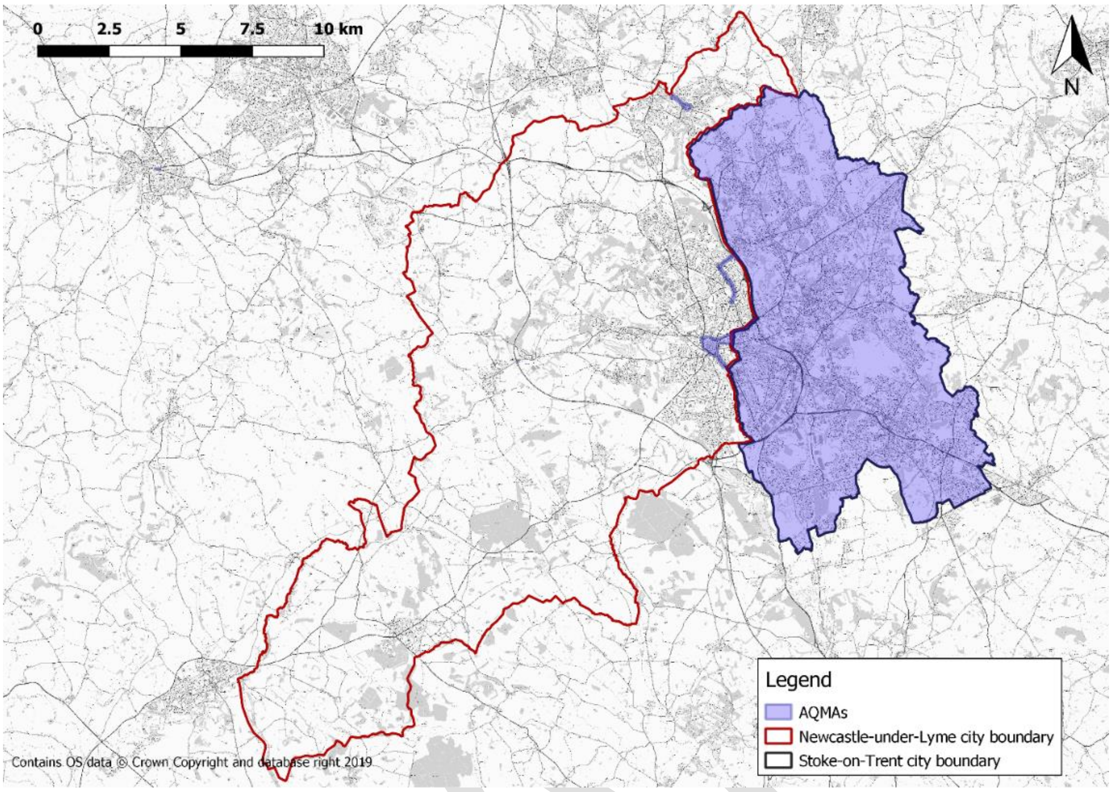
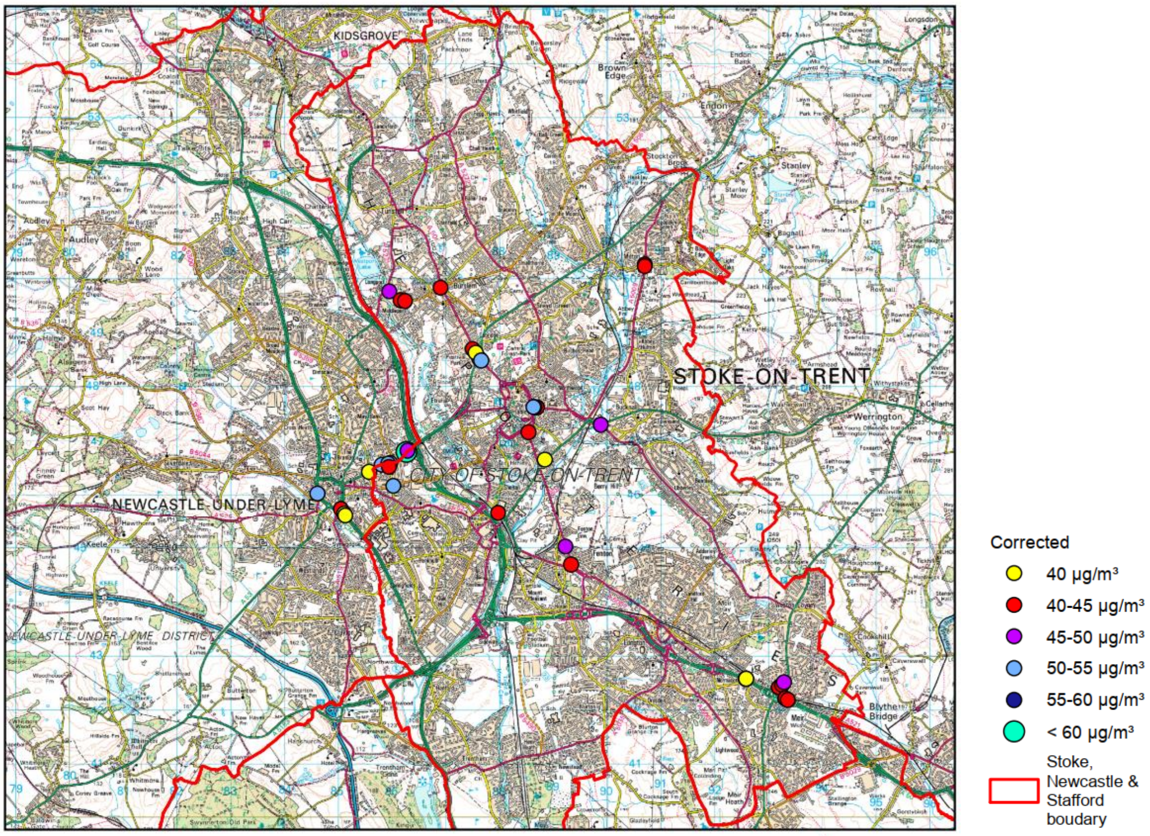



**Figure 1-2: Locations of monitored $NO_2$ exceedances in 2018 (provided by Stoke-on-Trent Council)**



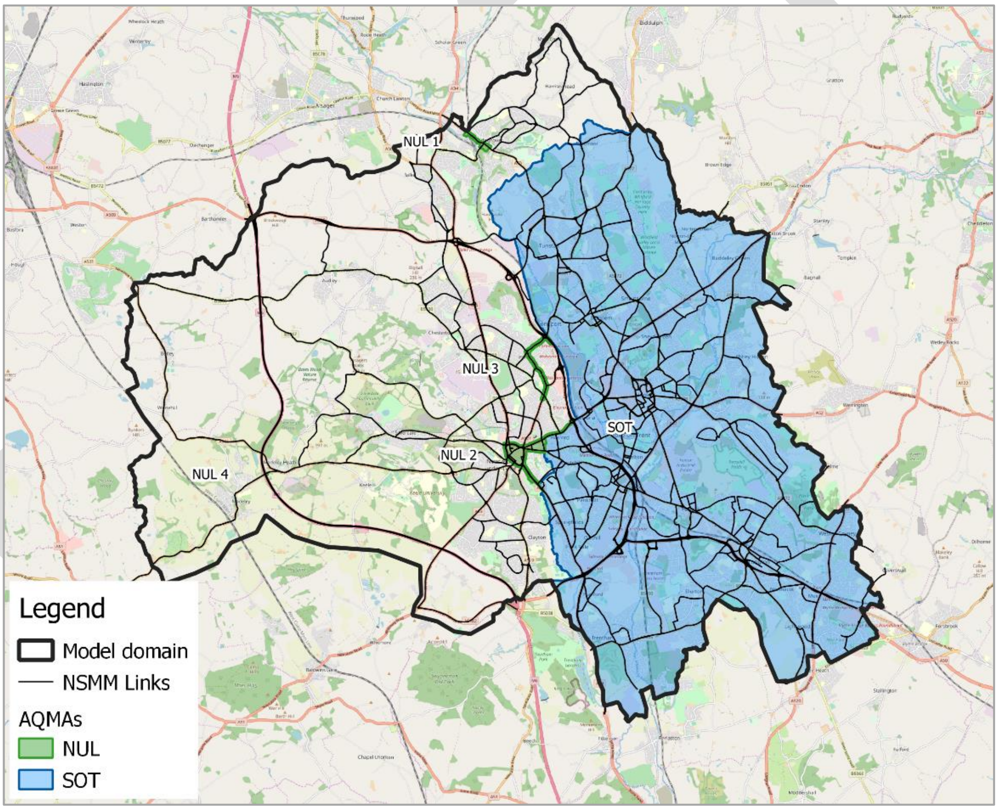
## 1.2 Model domain

To assess the transport and air quality impacts of the scheme, a model domain is required that covers the potential scheme options, relevant AQMAs and possible diversion routes. The core air quality model domain covers the Stoke-on-Trent and Newcastle-on-Lyme boundaries, based upon the district boundary from Ordnance Survey mapping products[1], and is derived from the extent of the North Staffordshire Multi-Modal traffic model (NSMM) on which the air quality modelling is based. The model domain used is shown in Figure 1-3 and has been chosen to cover the following:

- All of the AQMAs in Stoke-on-Trent and Newcastle-under-Lyme;
- The main areas of concern identified in the national modelling assessment at the A53 road link and the A500;
- Areas of concern identified from SOTC and NULC measurement data.
- All potential displacement routes from measures targeting areas of concern.

Concentrations were calculated across a grid covering this area at 3m resolution.

**Figure 1-3: CAZ study domain and relationship to transport model links**

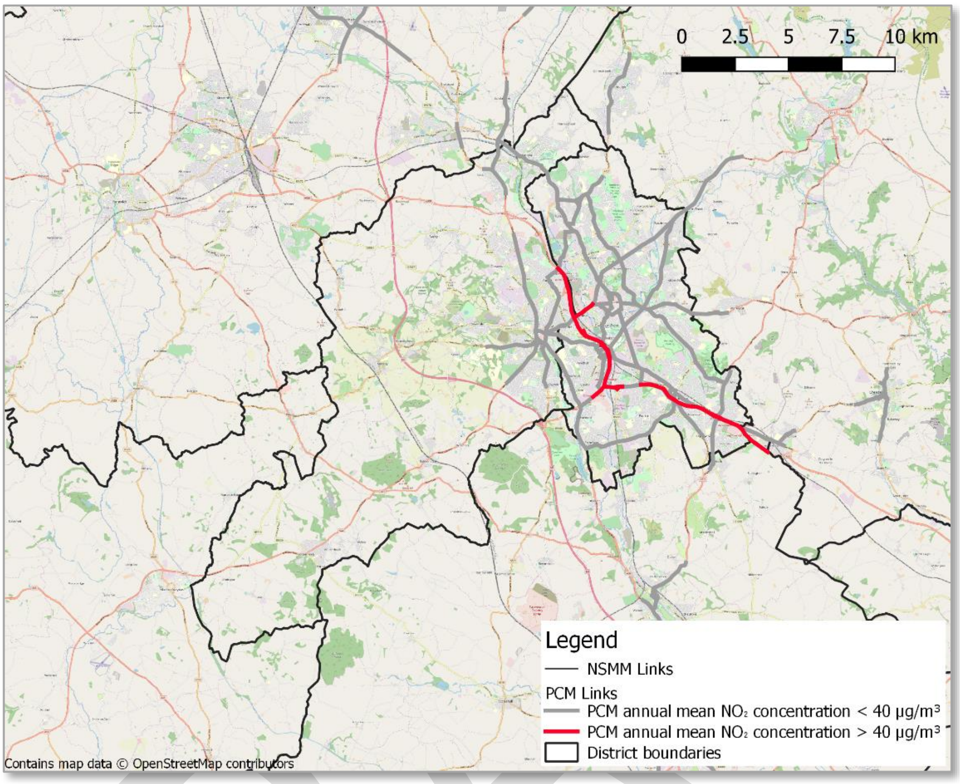



A map showing the model domain relative to roads included in the national Pollution Climate Mapping (PCM) model is presented in Figure 1-4. Note that all road links shown in Figure 1-3 are included in the model domain, including road links with no exceedances in PCM, and roads which are not present in

[1] https://www.ordnancesurvey.co.uk/opendatadownload/products.html

PCM. The model domain is sufficiently wide to include all displacement routes, allowing the impacts of traffic displacement due to implementation measures to be evaluated fully.

**Figure 1-4: PCM model road links with modelled annual mean $NO_2$ concentrations for 2015, $\mu g.m^{-3}$**






## 1.3 Model years

There are two key years used in the modelling work, as set out in Table 1-2 below, plus an additional future reference year. The baseline modelling year is 2018 as this allows use of the latest air quality and transport data.

The future baseline was modelled for the assumed compliance year with the introduction of measures, 2022. Any interim years were generated through interpolation rather than direct model tests.

**Table 1-2: Key model years**

| Year | Description |
|---|---|
| 2018 | **Base year** – using latest available data on air quality and traffic. |
| 2022 | **Compliance year** – earliest date when compliance could be achieved with measures. |

## 1.4 Background modelling

The primary cause of the localised air pollution problems in the model domain is road traffic emissions. As such the focus of the modelling study is on these emissions.

Background pollutant concentrations for the UK are published by Defra[2]. The background mapping data provides estimates of annual mean background concentrations of key pollutants at a resolution of 1 x 1 km for the UK projected from a base year of 2017. These background maps were used to provide spatially-varying background concentrations which included all other sources for all model years. Impacts from all road sources were removed from the background data.

# 2 Model description

## 2.1 Model selection

The RapidAir© dispersion modelling system was used for the study. This is Ricardo Energy & Environment's proprietary modelling system developed for urban air pollution assessment. Information regarding compliance with the JAQU technical requirements is set out in AQ1 the Air Quality Modelling Tracking Table with further description of the model also provided here.

The model is based on convolution of an emissions grid with dispersion kernels derived from the USEPA AERMOD[3] model. The physical parameterisation (release height, initial plume depth and area source configuration) closely follows guidance provided by the USEPA in their statutory road transport dispersion modelling guidance[4]. AERMOD provides the algorithms which govern the dispersion of the emissions and is an accepted international model for road traffic studies (it is one of only two mandated models in the US and is widely used overseas for this application). The combination of an internationally recognised model code and careful parameterisation matching international best practice makes RapidAir demonstrably fit for purpose for this study.

The model produces high resolution concentration fields at the city scale (1 to 3m scale) so is ideal for spatially detailed compliance modelling. A validation study has been conducted in London using the same datasets as the 2011 Defra inter-comparison study[5]. Using the LAEI 2008 data and the measurements for the same time period the model performance is consistent (and across some metrics performs better) than other modelling solutions currently in use in the UK. A RapidAIR model validation paper has also recently been published with our partners at Strathclyde University in the well-known Environmental Modelling and Software journal[6].

## 2.2 Core aspects of the modelling

### 2.2.1 Chemistry, meteorology and topology

NOx to $NO_2$ chemistry was modelled using the Defra NOx/$NO_2$ calculator (v7.1). Modelled annual mean road NOx concentrations were combined with background NOx and a receptor-specific f-$NO_2$ fraction to calculate $NO_2$ annual mean concentrations. The receptor-specific f-$NO_2$ fraction was calculated by dividing the modelled road primary $NO_2$ contribution by the modelled road NOx contribution at each receptor. Further information is provided in Section 3.

[2] https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html
[3] https://www3.epa.gov/ttn/scram/dispersion_prefrec.htm#aermod
[4] https://www.epa.gov/state-and-local-transportation/project-level-conformity-and-hot-spot-analyses
[5] https://uk-air.defra.gov.uk/research/air-quality-modelling?view=intercomparison

[6] Masey, Hamilton, Beverland (2018) Development and evaluation of the RapidAir® dispersion model, including the use of geospatial surrogates to represent street canyon effects

### 2.2.2 Meteorology

Modelling was conducted using the 2018 annual surface meteorological dataset measured at Leek Thorncliffe. The dataset was processed in house using our own meteorological data gathering and processing system. We used freely available overseas meteorological databases which hold the same observations as supplied by UK meteorological data vendors. Our RapidAir model also takes account of upper air data which is used to determine the strength of turbulent mixing in the lower atmosphere; this was obtained from the closest radiosonde site and processed with the surface data in the USEPA AERMET model. We have utilised data filling where necessary following USEPA guidance which sets out the preferred hierarchy of routines to account for gaps (persistence, interpolation, substitution). AERMET processing was conducted following the USEPA guidance. To account for differences between the meteorological site and the dispersion site, surface parameters at the meteorological site were included as recommended in the guidance and the urban option specified for the dispersion site.

Following sensitivity testing and model verification, a uniform surface roughness value of 1.0 m was used to represent a typical city/urban environment. A surface roughness of 0.3 m was used to represent the meteorological measurement site.

### 2.2.3 Road geometry

Road geometry information was derived from the Ordnance Survey Mastermap Integrated Transport Network Roads dataset; this is the most accurate available road geometry dataset at the time of writing, containing road centreline locations for all road categories.

### 2.2.4 Canyon modelling

The presence of buildings either side of a road can introduce ‘street canyon’ effects which result in pollutants becoming trapped, leading to increased pollutant concentrations. The densely packed buildings and narrow roads of central Hanley and Stoke produce a large number of street canyons, which contribute significantly to air quality issues in the city centre.

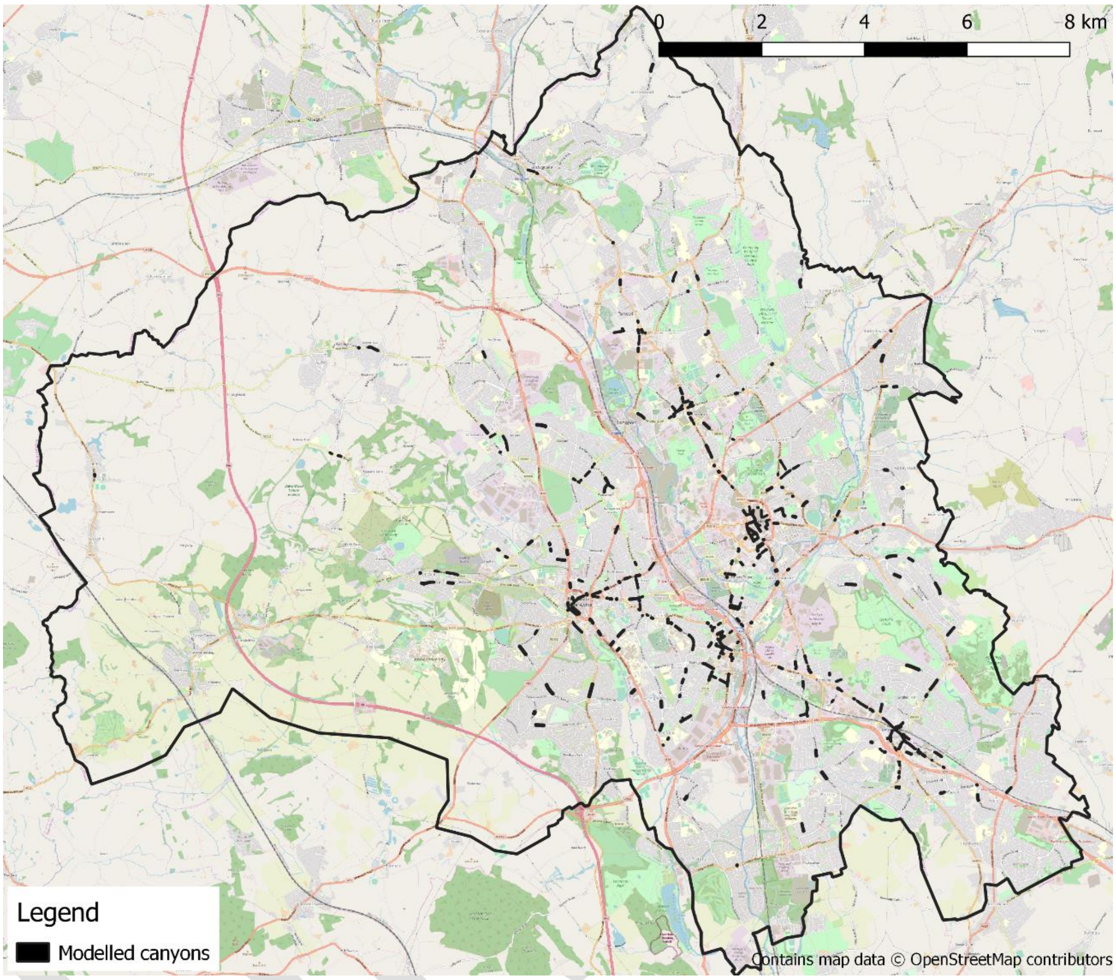
The RapidAir model includes the AEOLIUS model which was developed by the UK Met Office in the 1990s. The AEOLIUS model was originally developed as a nomogram procedure[7]. The scientific basis for the model is presented in a series of papers by the Met Office[8,9,10,11,12.] The model formulation shares a high level of commonality with the Operational Street Pollution Model[1314] (OSPM) which in turn forms the basis of the basic street canyon model included in the ADMS-Roads software. Therefore, the AEOLIUS based canyon suite in RapidAir aligns well with industry standards for modelling dispersion of air pollutants in street canyons, in accordance with guidance provided in LAQM .TG(16). The systems of equations used in each street canyon model are provided in Appendix 1.

Street canyon impacts were modelled using the RapidAir AEOLIUS model. Street canyons were identified using building height data sourced from Ordnance Survey (OS) Mastermap data provided by

[7] Buckland AT and Middleton DR, 1999, Nomograms for calculating pollution within street canyons, Atmospheric Environment, 33, 1017-1036.
[8] Middleton DR, 1998, Dispersion Modelling: A Guide for Local Authorities (Met Office Turbulence and Diffusion Note no 241: ISBN 0 86180 348 5), (The Meteorological Office, Bracknell, Berks).
[9] Buckland AT, 1998, Validation of a street canyon model in two cities, Environmental Monitoring and Assessment, 52, 255-267.
[10] Middleton DR, 1998, A new box model to forecast urban air quality, Environmental Monitoring and Assessment, 52, 315-335.
[11] Manning AJ, Nicholson KJ, Middleton DR and Rafferty SC, 1999, Field study of wind and traffic to test a street canyon pollution model, Environmental Monitoring and Assessment, 60(2), 283-313.
[12] Middleton DR, 1999, Development of AEOLIUS for street canyon screening, Clean Air, 29(6), 155-161, (Nat. Soc for Clean Air, Brighton, UK).
[13] Hertel O and Berkowicz R, 1989, Modelling pollution from traffic in a street canyon: evaluation of data and model development (Report DMU LUFT A129), (National Environmental Research Institute, Roskilde, Denmark).
[14] Berkowicz R, Hertel O, Larsen SE, Sørensen NN and Nielsen M, 1997, Modelling traffic pollution in streets, (Ministry of Environment and Energy, National Environmental Research Institute, Roskilde, Denmark).

the Councils.[15] These canyon locations were then confirmed using Google Street View and local knowledge. Modelled street canyon locations are shown in Figure 2-1.

**Figure 2-1: Modelled street canyons**




The canyon model is only turned on if the wind is blowing parallel across the canyon (± 5 degrees) i.e. the wind must be between 40 and 50 degrees from the orientation of the canyon. For each hour in the meteorological data with wind direction matching the criteria to turn the street canyon on, the leeward, windward and parallel street canyon concentrations were calculated. To provide annual street canyon concentrations, the sum of the data contained within each of leeward, windward and parallel was calculated.

The results from the street canyon module were subsequently combined with the concentrations modelled in the dispersion step of RapidAir. The annual leeward and annual windward concentrations were added together; this was then added to the dispersion modelled road $NO_X$. The concentrations from the parallel contribution of the street canyon model were not included as including this would result in double counting of the road $NO_X$ when combined with the dispersion $NO_X$.

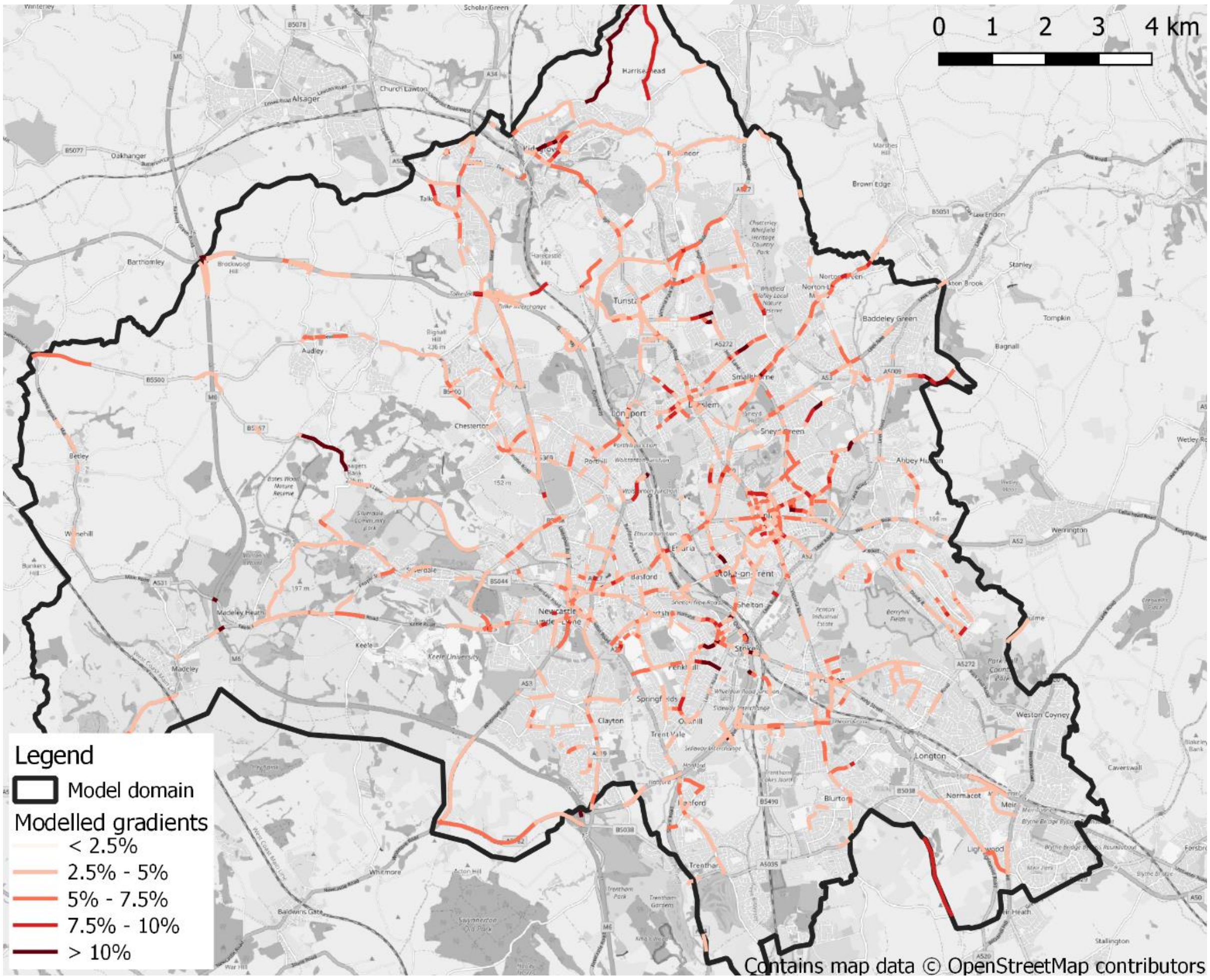
[15] https://www.ordnancesurvey.co.uk/business-and-government/products/mastermap-products.html

### 2.2.5 Gradients, tunnels and flyovers

Gradient effects were included for relevant road links during emissions calculations. LIDAR Composite Digital Terrain Model (DTM) datasets at 1m resolution are available over the model domain[16]. Link gradients across the model domain were calculated by extracting start and end node elevations for road links from the LIDAR DTM datasets.

The Emissions Factor Toolkit (EFT) v9.1b, provided for the Third Wave Authorities to use by JAQU, includes gradient effects in its emissions calculations, and was used in this assessment. The adjustment in the EfT applies to roads with gradients of 2.5% or greater. Figure 2-2 shows the roads where gradient effects were included during emission calculations.

**Figure 2-2: Modelled gradients**




No modelling of tunnels or flyovers is included in the modelling, as the RapidAir kernel approach applies the same source height across the model domain as a worst-case estimation of air quality impacts at a height of 2m.

[16] http://environment.data.gov.uk/ds/survey/#/survey

# 2.3 Air quality model receptor locations

## 2.3.1 Monitoring sites

Stoke-on-Trent City Council and Newcastle-under-Lyme Borough Council operate a wide network of monitoring locations comprising both automatic monitoring stations and passive diffusion tube samplers. All available locations where $NO_2$ monitoring data were measured during 2018 were specified as receptors in the model; and where appropriate, used for model verification and calculating model performance statistics including the Root Mean Square Error (RMSE). A map of the monitoring locations is presented in Figure 2-3; details of these locations are provided in Section 3.

**Figure 2-3: Monitoring stations operated in 2018**


## 2.3.2 Roadside receptors and grid

A set of gridded results with a resolution of at least 10m x10m is required by the JAQU guidance. For this study, RapidAir was used to model concentrations at 3m grid resolution. As RapidAir produces concentration grids (in raster format), modelled $NO_2$ concentrations can be extracted at receptor locations anywhere on the 3m resolution model output grid. For comparison with the PCM model results, annual mean concentrations at a distance of 4m from the kerb and at 2m height were extracted from the RapidAir model outputs at 4m intervals along each road. This provides an assessment of compliance at relevant roadside locations where there may be public access as specified in the Air Quality Directive (AQD) requirements Annex III A, B, and C3.

Annex III of the AQD specifies that macroscale siting of sampling points should be representative of air quality for a street segment of no less than 100 m length at traffic-orientated sites. To provide results for roadside locations, where there is public access and the Directive therefore applies, road links with exceedances of the $NO_2$ annual mean objective stretching over link lengths of 100m or greater were extracted and presented as a separate GIS layer of model results.

Annex III of the AQD also specifies that microscale sampling should be at least 25 m from the edge of major junctions. Therefore, when reporting model results relevant to compliance with the AQD, locations up to 25m from the edge of major junctions in the model domain were excluded.

# 3 Modelling methodology

## 3.1 Base year and meteorological dataset

The modelling used the 2018 annual surface meteorological dataset measured at Leek Thorncliffe (NOAA code 033300) which was processed using RapidAir. RapidAir takes account of upper air data which is used to determine the strength of turbulent mixing in the lower atmosphere; this was derived from the closest radiosonde site and combined with the surface data using the USEPA AERMET model. Where necessary data filling was used following USEPA guidance which sets out the preferred hierarchy of routines to account for gaps. A map showing the location and a wind rose for the 2018 Leek Thorncliffe met dataset are presented in Figure 3-1 and Figure 3-2, respectively.

**Figure 3-1: Leek Thorncliffe meteorological measurement site location**

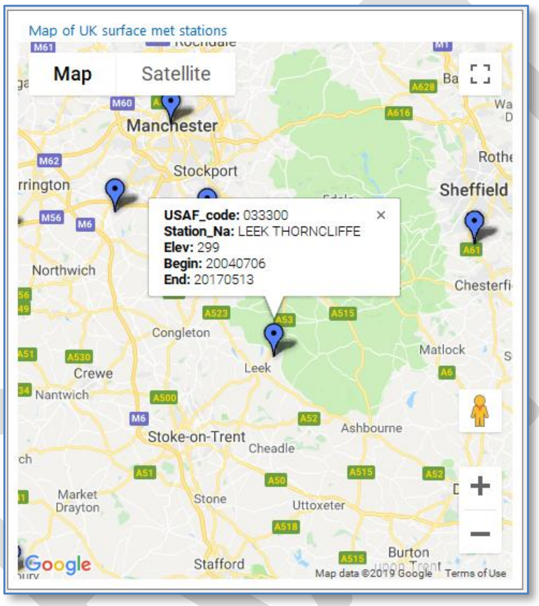
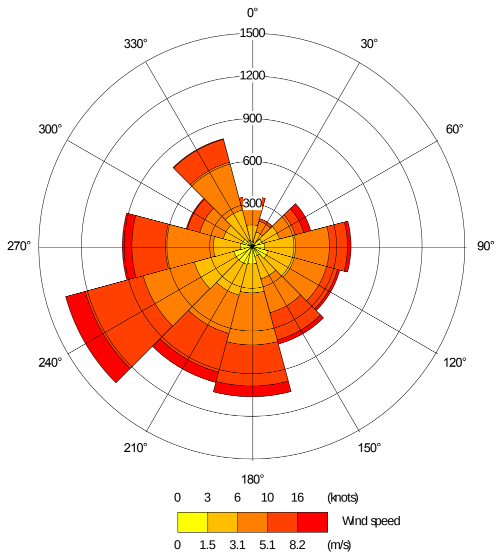



**Figure 3-2: Windrose from the Leek Thorncliffe meteorological 2018 data**



## 3.2 Road traffic modelling

### 3.2.1 Emission factors

Emissions from all modelled road traffic sources were calculated using speed-dependent vehicle emission factors for $NO_X$, primary $NO_2$, and particulates from the latest version of the Emission Factor Toolkit (EFT), version 9.1b. The emission factors for $NO_X$ and particulates are derived from COPERT, while the emission factors for primary $NO_2$ are derived from the National Atmospheric Emissions Inventory. COPERT is a European database of emission factors which is recommended for the quantification of road-transport emissions. These factors provide emission factors categorised by vehicle size, age, and Euro classification, taking into account average vehicle mileage and engine degradation.

The EFT uses these factors to calculate emissions along road links given traffic flow, vehicle split, speed, and gradient information.

### 3.2.2 Traffic flows and speeds

Total traffic flows and average speeds for each model link for 2015 and 2022 were provided by Sweco using a traffic model derived from the North Staffordshire Multi-Modal Model (NSMM) for the following periods:

- AM peak (07:00 to 10:00);
- Interpeak (10:00 to 16:00);
- PM peak (16:00 to 19:00);
- Outside peak (19:00 to 07:00).

These flows and speeds are subject to extensive validation, as detailed in the T2 report. Link flows were compared with two sets of criteria: the GEH statistic, and the Design Manual for Roads and Bridges (DMRB) Vehicle Flow Comparison. Journey time validation was carried out following DfT guidelines, based on those described in WebTAG Unit M3.1 and the DMRB Volume 12, Section 2, Part 1, Chapter 4. The transport model was found to perform within guidelines for both traffic flows and modelled speeds. For validated links, all modelled travel times were found to pass the DRMB criteria of being within 15% or 1 minute of the observed times.

No traffic growth was assumed to occur between the 2015 traffic model base year and the air quality model year of 2018, following advice provided by the Councils.

The traffic model provides vehicle flows for five highway user classes which are: Cars, Taxis, HGVs, LGVs and Buses. A further breakdown of the HGV into rigid and articulated categories was conducted using local traffic count data and ANPR data. Additional traffic from motorcycles was derived using a constant scaling factor of 0.005 for the domain, derived from automatic traffic count data and advice from the Councils. The taxi fleet was split between cars and LGVs based on size data for registered vehicles provided by the Councils.

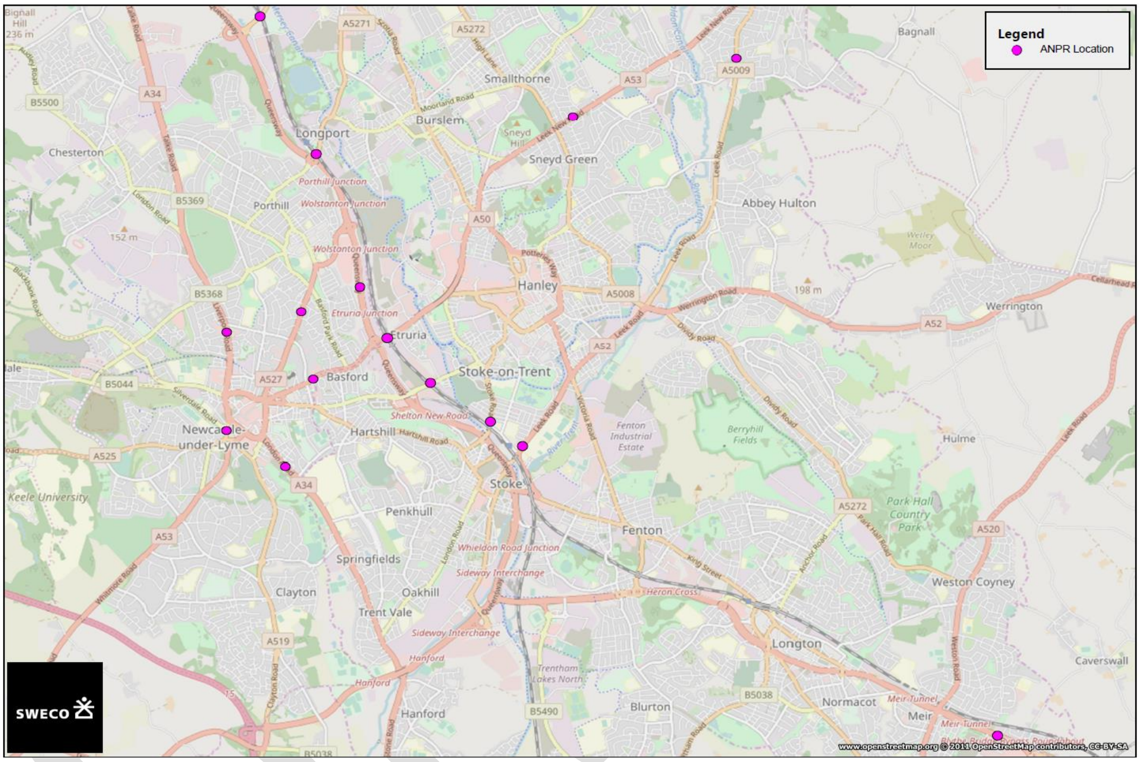
**Table 3-1: Size split information from ANPR survey**

| Vehicle category | Size category | % of total |
|---|---|---|
| Taxis | Cars | 95.6% |
| | LGVs | 4.4% |
| HGVs | Rigid (Urban) | 71.9% |
| | Articulated (Urban) | 28.1% |
| | Rigid (Motorway) | 39.8% |
| | Articulated (Motorway) | 60.2% |

### 3.2.3 Vehicle fleet composition

Emission calculations for each vehicle category are based on vehicle age split by Euro classification. Results from an ANPR survey were used to derive the vehicle fleet composition for the 2018 base year. For Taxis and private hire, fleet composition was derived from information on licenced vehicles in North Staffordshire provided by Newcastle-under-Lyme Borough Council. The ANPR survey locations are presented in Figure 3-3. Information on the baseline Euro standard mix (traffic composition & age) was collected during ANPR surveys. An average distribution of Euro classifications calculated from the complete ANPR dataset was applied across the entire model domain.

**Figure 3-3: ANPR survey locations**




Tables 4, 5 and 6 present the fleet age projections for light vehicles, taxis, and heavy vehicles, respectively. Note that Euro standards which are not present in the fleet are not included in the table. The fuel use composition for cars and taxis derived from the ANPR survey is presented in Table 3-5.

**Table 3-2: Compliant and non-compliant fleet age splits for 2018, light vehicles**

| Fleet component | Vehicle type | Pre-Euro 1 | Euro 1 | Euro 2 | Euro 3 | Euro 4 | Euro 5 | Euro 6 | Euro 6c |
|---|---|---|---|---|---|---|---|---|---|
| Compliant | Petrol Car | - | - | - | - | 29% | 31% | 17% | 23% |
| | Diesel Car | - | - | - | - | - | - | 53% | 47% |
| | Petrol LGV | - | - | - | - | 57% | 8% | 25% | 10% |
| | Diesel LGV | - | - | - | - | - | - | 59% | 41% |
| | Full Hybrid Petrol Car | - | - | - | - | 7% | 24% | 18% | 50% |
| Non-compliant | Petrol Car | 1% | 1% | 5% | 92% | - | - | - | - |
| | Diesel Car | - | - | - | 8% | 24% | 61% | - | - |
| | Petrol LGV | 57% | 2% | 3% | 38% | - | - | - | - |
| | Diesel LGV | < 1% | < 1% | < 1% | 5% | 34% | 60% | - | - |
| | Full Hybrid Petrol Car | - | - | - | 100% | - | - | - | - |

**Table 3-3: Fleet age splits for 2018, taxis**

| Vehicle type | Pre-Euro 1 | Euro 1 | Euro 2 | Euro 3 | Euro 4 | Euro 5 | Euro 6 | Euro 6c | Euro 6d |
|---|---|---|---|---|---|---|---|---|---|
| **Petrol Car** | 0.0% | 0.0% | 0.0% | 2.5% | 50.8% | 44.1% | 2.5% | 0.0% | - |
| **Diesel Car** | 0.0% | 0.0% | 0.0% | 2.0% | 24.4% | 64.4% | 9.2% | 0.0% | - |
| **Petrol LGV** | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | - |
| **Diesel LGV** | 0.0% | 0.0% | 1.0% | 25.5% | 48.0% | 21.4% | 4.1% | 0.0% | - |

**Table 3-4: Compliant and non-compliant fleet age splits for 2018, heavy vehicles**

| Fleet component | Vehicle type | Pre-Euro I | Euro I | Euro II | Euro III | Euro IV | Euro V EGR | Euro V SCR | Euro VI |
|---|---|---|---|---|---|---|---|---|---|
| **Compliant** | **Rigid HGV** | - | - | - | - | - | - | - | 100% |
| | **Artic HGV** | - | - | - | - | - | - | - | 100% |
| **Non-compliant** | **Rigid HGV** | 0% | 0% | 1% | 13% | 24% | 15% | 46% | - |
| | **Artic HGV** | 0% | 0% | 1% | 13% | 24% | 15% | 46% | - |
| **All** | **Buses / Coaches** | 1% | 1% | 3% | 28% | 27% | 5% | 16% | 19% |

**Table 3-5: 2018 fuel split projections for urban cars and taxis**

| Vehicle | Conventional Petrol % | Full Hybrid Petrol % | Plug-In Hybrid Petrol % | Conventional Diesel % | Full Hybrid Diesel % | Battery EV % |
|---|---|---|---|---|---|---|
| **Cars** | 49.9% | 1.6% | 0.5% | 47.8% | 0.1% | 0.2% |
| **Taxis** | 5.1% | - | - | 86.0% | 4.5% | - |

### 3.2.4 $NO_X$:$NO_2$ chemistry

The latest version (7.1) of the LAQM $NO_X$ to $NO_2$ conversion spreadsheet was used to convert road NOx, f-$NO_2$ and background $NO_X$ into $NO_2$ concentrations. The JAQU guidance note for assigning f$NO_2$ when calculating $NO_2$ acknowledges that for large model domains and high-resolution models, use of the spreadsheet tool is not practical because the calculator is limited to a maximum of 64.6K lines in the excel spreadsheet. The guidance note recommends the use of the NOx to $NO_2$ calculator to define statistical relationships between $NO_2$ concentrations and the input parameters and the use of these relationships to calculate $NO_2$. This approach was used to calculate the full set of gridded $NO_2$ results at the 3m resolution.

In this case the statistical relationship was derived using an ordinary least squares (OLS) regression model. The OLS model was derived by defining background $NO_X$, road $NO_X$ and road f$NO_2$ as the independent variables, and total $NO_2$ as the dependent variable.

## 3.3 Non-road transport modelling and background concentrations

For the 2018 baseline year we have used the 2017 base year LAQM background maps available to download from the Defra UK air web page. The contribution from local road transport source sectors that were modelled explicitly were subtracted from the background maps.

# 4 Projected future year scenario modelling

## 4.1 Road transport emissions

The 2022 Reference Case and six 2022 option scenarios were modelled using the following data:

- AM peak, interpeak, PM peak and outside peak traffic flows and speeds provided on a link-by-link basis by Sweco.
- Projections of fleet age and fuel use calculated using the EFT v9.1b fleet projection tool.

### 4.1.1 Traffic flows and speeds

Traffic flows and speeds matching the specification outlined in Section 3.2.2 were provided by Sweco, separated into "compliant" and "non-compliant" fleet components. Vehicle size splits within the provided categories were assumed to remain constant between 2018 and 2022.

The road geometry for the Etruria Valley Link Road was taken from the Etruria Valley Link Road Consultation documents published by Stoke-on-Trent City Council.[17]

### 4.1.2 Fleet age projections

The 2022 fleet data was projected from the 2018 fleet data described in Section 3.2.3 using the fleet projection tool in the EFT v9.1b in order to produce a robust local fleet for 2022 based on local data and national projections. Tables 5, 6 and 7 present the fleet age projections for light vehicles, taxis, and heavy vehicles, respectively. Note that Euro standards which are not present in the projected fleet are not included in the table.

**Table 4-1: Compliant and non-compliant fleet age splits for 2022, light vehicles**

| Fleet component | Vehicle type | Euro 3 | Euro 4 | Euro 5 | Euro 6 | Euro 6c | Euro 6d |
|---|---|---|---|---|---|---|---|
| Compliant | Petrol Car | - | 11.6% | 25.4% | 15.5% | 47.6% | - |
| | Diesel Car | - | - | - | 35.2% | 49.8% | 15.1% |
| | Petrol LGV | - | 20.9% | 31.3% | 21.3% | 26.5% | - |
| | Diesel LGV | - | - | - | 22.5% | 77.5% | - |
| | Full Hybrid Petrol Car | - | 8.0% | 8.1% | 10.1% | 73.9% | - |
| Non-compliant | Petrol Car | 100.0% | - | - | - | - | - |
| | Diesel Car | 2.6% | 20.2% | 77.2% | - | - | - |
| | Petrol LGV | 100.0% | - | - | - | - | - |
| | Diesel LGV | 2.1% | 26.6% | 71.3% | - | - | - |
| | Full Hybrid Petrol Car | 100.0% | - | - | - | - | - |

[17] https://burslem.info/sites/default/files/pdfs/etruria-valley-link-road-pull-up.pdf?361

**Table 4-2: Compliant and non-compliant fleet age splits for 2022, taxis**

| Fleet component | Vehicle type | Euro 2 | Euro 3 | Euro 4 | Euro 5 | Euro 6 | Euro 6c | Euro 6d |
|---|---|---|---|---|---|---|---|---|
| Compliant | Petrol Car | - | - | 20.5% | 24.9% | 12.4% | 42.1% | - |
| | Diesel Car | - | - | - | - | 33.8% | 50.8% | 15.4% |
| | Petrol LGV | - | - | 100.0% | - | - | - | - |
| | Diesel LGV | - | - | - | - | 59.4% | 40.6% | - |
| Non-compliant | Petrol Car | - | 100.0% | - | - | - | - | - |
| | Diesel Car | - | 0.4% | 22.2% | 77.4% | - | - | - |
| | Petrol LGV | - | 100.0% | - | - | - | - | - |
| | Diesel LGV | 0.2% | 8.8% | 32.7% | 58.3% | - | - | - |

**Table 4-3: Compliant and non-compliant fleet age splits for 2022, heavy vehicles**

| Fleet component | Vehicle type | Euro II | Euro III | Euro IV | Euro V EGR | Euro V SCR | Euro VI |
|---|---|---|---|---|---|---|---|
| Compliant | Rigid HGV | - | - | - | - | - | 100.0% |
| | Artic HGV | - | - | - | - | - | 100.0% |
| | Buses / Coaches | - | - | - | - | - | 100.0% |
| Non-compliant | Rigid HGV | - | 6.8% | 24.4% | 17.2% | 51.6% | - |
| | Artic HGV | 1.0% | 12.1% | 21.0% | 16.5% | 49.5% | - |
| | Buses / Coaches | 6.9% | 37.2% | 29.5% | 6.6% | 19.8% | - |

The fuel use composition for cars and taxis derived from the ANPR survey for 2018 was projected to 2022 using the "Petrol/Diesel Projection Tool" provided in the EFT v9.1b. This tool provides separate splits for urban roads, rural roads and motorways; all roads in the model domain were classified as "urban" or "motorway" due to the built-up nature of the model domain. Table 4-4 presents the projected fuel split use for cars and taxis for 2022.

**Table 4-4: 2022 fuel split projections for urban cars and taxis, compliant and non-compliant vehicles**

| Vehicle | Fleet component | Conventional Petrol % | Full Hybrid Petrol % | Plug-In Hybrid Petrol % | Conventional Diesel % | Full Hybrid Diesel % | Battery EV % |
|---|---|---|---|---|---|---|---|
| Cars | Urban compliant | 50.7% | 5.7% | 3.1% | 37.8% | 1.2% | 1.5% |
| | Urban non-compliant | 48.8% | 0.0% | 0.0% | 51.2% | 0.0% | 0.0% |
| | Motorway compliant | 53.1% | 5.2% | 2.7% | 36.1% | 1.5% | 1.5% |
| | Motorway non-compliant | 51.2% | 0.0% | 0.0% | 48.8% | 0.0% | 0.0% |
| Taxis | Urban compliant | 3.9% | 11.9% | 2.5% | 79.2% | 1.2% | 1.4% |
| | Urban non-compliant | 3.4% | 0.0% | 0.0% | 96.6% | 0.0% | 0.0% |
| | Motorway compliant | 6.6% | 11.3% | 2.0% | 77.2% | 1.5% | 1.4% |
| | Motorway non-compliant | 5.8% | 0.0% | 0.0% | 94.2% | 0.0% | 0.0% |

# Appendix 1 - RapidAir street canyon equations

**AEOLIUS/OSPM**

There are three principal contributions in the AEOLIUS model, a direct contribution from the source to the receptor, a recirculating component within a vertex caused by winds flowing across the top of the canyon, and the urban background. The RapidAir model only take the recirculating component from the canyon and sums this with the kernel derived concentrations.

The RapidAir implementation of AEOLIUS is written in python 2.7 and uses the same equations described in the referenced Met Office papers.

During the coding of the canyon model we tested the outputs of our code with calibration data provided with the FORTRAN version of AEOLIUS. Our implementation agrees almost perfectly ($R^2$ = 0.97) with the version supplied by the Met Office (which is in any case now out of circulation).

The AEOLIUS model is more complex than the STREET model. Concentrations are calculated for the windward and leeward sides of the road using the equations detailed below (based on equations from the Met Office). The leeward and windward concentrations described below are only calculated for streets that are perpendicular to the direction of the wind. Concentrations are calculated in ppb, and for NOx/$NO_2$ models are converted to µg/m$^3$ by multiplication by 1.91. The system of equations in Rapid Air's implementation of the AEOLIUS model are shown below.

<u>Inputs</u>:

Emission rates ($Q$, µg/m/s); traffic speeds ($v_t$, mph), traffic density ($f$, vehicles per hour), % of cars and heavy good vehicles ($f_c$ and $f_h$ respectively), wind speed at roof level ($u_r$, m/s), street canyon width ($w$, m), street canyon height ($h$, m), and angle of street ($\theta$).

<u>Leeward concentrations</u>:

The leeward concentrations = sum($C_{dlee}$ + $C_{rec}$) where $C_{dlee}$ is the direct contribution from vehicles and $C_{rec}$ is the pollution associated with recirculation.

Direct contribution ($C_{dlee}$):

$$Recirculation\ zone\ (l_r) = \min(w, l_v * \sin(\theta)) \quad \text{(meters)}$$

Where:

$$vortex\ length\ (l_v) = 2 * r * h \quad \text{(meters)}$$

And r = wind speed dependence factor = 1 if $u_r$ > 2 m/s and = $u_r$/2 otherwise.

If the recirculation zone is greater than the width of the canyon:

$$C_{dlee} = \sqrt{\frac{2}{\pi} * \frac{Q}{(w * \sigma_w)} * \ln\left[\left(\frac{\sigma_w * w}{h_o * u_s}\right) + 1\right]}$$

Where:

$\sigma_w$ = mechanical turbulence from wind and traffic (m/s) = $\sqrt{(\lambda * u_s)^2 + {\sigma_{wo}}^2}$

λ = constant for removal at the top of the canyon = 0.1

$\sigma_{wo}$ = traffic-created turbulence (m/s) = $b * \sqrt{\frac{v_t * f_c * s_c + v_t * f_h * s_h}{w}}$

where $s_c$ = mean surface area of cars (4 $m^2$), $s_h$ = mean surface area of heavy vehicles (16 $m^2$) and b = aerodynamic constant (0.18)

$u_s$ = wind speed at street level (m/s) = $u_r \left( \frac{\ln\left(\frac{h_o}{z_o}\right)}{\ln\left(\frac{h}{zo}\right)} \right) (1 - d * \sin(\theta))$

$h_o$ = effective height of emissions (2 m)

$z_o$ = effective roughness length (0.6 m)

d = model dependence (0.45)

If the recirculation zone is less than the width of the canyon:

$$C_{dlee} = \sqrt{\frac{2}{\pi}} \frac{Q}{(w * \sigma_w)} \left[ ln\left[\left(\frac{\sigma_w * d_1}{h_o * u_s}\right) + 1\right] + R * \ln\left(\frac{h_o + \sigma_w * \frac{d_6}{u_s}}{\frac{\sigma_w * l_r}{u_s} + h_o}\right) + \frac{\sigma_w}{\omega_t}\left[1 - e^{\left(\frac{-\omega_t d_7}{u_s h}\right)}\right] \right]$$

Where:

$d_1$ (m) = min(w, $l_r$)

R = max(0, $C_{ang}$)

$C_{ang}$ = cos(2*r* θ)

$d_6$ (m)= min(max($l_{max}$, $l_r$), $x_1$)

$l_{max}$ = w/sin(θ)

$x_1$ = vertical distance (m) at which pollutants can escape canyon = $\frac{u_s(h - h_o)}{\sigma_w}$

$\omega_t$ = removal at top of the canyon (m/s) = $\sqrt{(\lambda * u_r)^2 + 0.4(\sigma_{wo})^2}$

$d_7$ (m) = max($l_{max}$, $x_1$)-$x_1$

Recirculation contribution ($C_{rec}$):

$$C_{lee} = \frac{\left[\left(\frac{Q}{W}\right) d_1\right]}{\omega_t * d_2 + \omega_s * d_3}$$

Where

$d_2$ (m) = min(w, 0.5*$l_r$)

$d_3$ (m) = $l_s \left(\max\left(0, \frac{2w}{l_r} - 1\right)\right)$

$l_s$ (m) = $\sqrt{(0.5 * l_r)^2 + h^2}$

$\omega_s$ = removal speed at the side of the canyon (m/s) = $\sqrt{{u_s}^2 + {\sigma_{wo}}^2}$

Windward concentrations ($C_{dwind}$):

Final windward concentrations = $C_{dwind} + C_{rec}$. $C_{dwind} = 0$ if $l_r \geq w$, else:

$$C_{dwind} = \sqrt{\frac{2}{\pi}}\frac{Q}{w * \sigma_w}\left[ln\left(\frac{\sigma_w + d_4}{u_s + h_o} + 1\right) + \frac{\sigma_w}{\omega_t}\left[1 - e^{\left(\frac{-\omega_t d_5}{u_s h}\right)}\right]\right]$$

$d_4$ (m) = $\min[(w - l_r), x_1]$

$d_5$ (m) = $[\max[(w - l_r), x_1]] - x_1$

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# North Staffordshire Local Air Quality Plan - Air Quality Results Report (AQ3)

Report for Stoke-on-Trent City Council and Newcastle-under-Lyme Borough Council

ED 12487 | 30th October 2019

**Customer:**

**Newcastle-under-Lyme Borough Council**

Customer reference:

Newcastle-under-Lyme and Stoke-on-Trent Air Quality Local Development Plan

Confidentiality, copyright & reproduction:



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Ref: ED12487

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# 1 Introduction and outline scope of modelling

Newcastle-under-Lyme Borough Council (NuLBC) and Stoke-on-Trent City Council (SoTCC) were part of the third wave of UK cities required to carry out a Targeted Feasibility Study by the Government for non-compliance with the nitrogen dioxide ($NO_2$) limit values. As a result of this study, NULBC and SOTCC were required to carry out a further Clean Air Zone (CAZ) feasibility study to identify measures able to achieve compliance with the $NO_2$ objective. This report sets out the Air Quality modelling results for the base year in 2018, the future baseline year 2022, and six options that were assessed to determine their ability to achieve compliance with the $NO_2$ objective by 2022. This report also contains the results of a sensitivity analysis of the model results.

## 1.1 Background

Newcastle-under-Lyme and Stoke-on-Trent, like many other urban areas in the UK, have locations where $NO_2$ concentrations are in excess of national and European air quality standards.

Four Air Quality Management Areas (AQMAs) have been declared in Newcastle-under-Lyme, which cover the areas where exceedances of the $NO_2$ air quality standards are measured or are likely to be measured. The exceedances result mainly from transport emissions of $NO_2$. A map of the four AQMAs can be found in Appendix D of the most recent Air Quality Annual Status Report.[1] The AQMAs primarily cover the town centre, the ring road and areas affected by principle routes (e.g. the M6). Since the publication of the Air Quality Action Plan (AQAP) 2019 – 2024, only two of the AQMAs (Newcastle-under-Lyme Town Centre and Kidsgrove) have exhibited exceedances of the annual mean objective for $NO_2$.

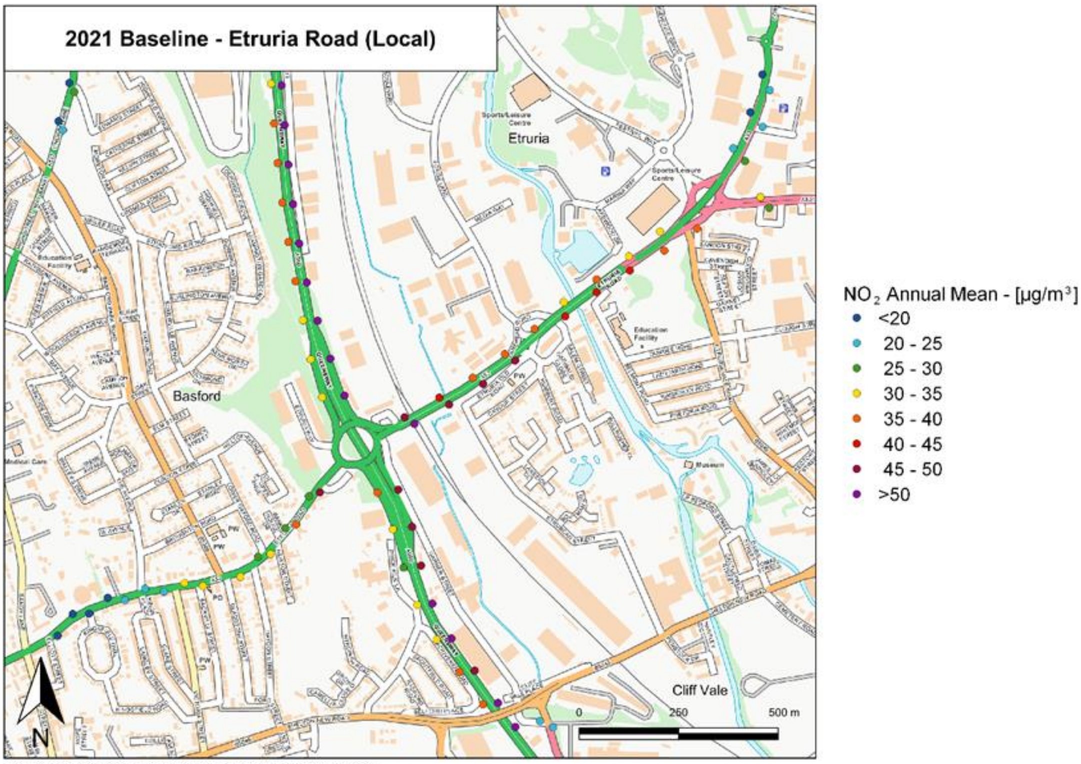
The whole of Stoke-on-Trent was designated as an AQMA for $NO_2$ in 2006. This was amended to include the $NO_2$ 1-hour mean in May 2011.

NuLBC and SoTCC were identified in the 2015 National Air Quality Plan as two of the 33 councils required to complete a Targeted Feasibility Study. The results of this Feasibility Study highlighted that compliance would not be achieved in Stoke-on-Trent until 2023 and Newcastle-under-Lyme until 2026 without intervention. The Feasibility Study found that the introduction of measures designed to reduce air pollution along the A53 would bring forward compliance in Newcastle-under-Lyme by one year. In 2018, NuLBC and SoTCC were directed to produce an $NO_2$ compliance plan, which may include a mandatory charging-based CAZ or a range of alternative measures able to deliver compliance as quickly as a charging-based CAZ.

The key areas identified in the Targeted Feasibility study that were modelled to exceed $NO_2$ limits in 2021 are along the A53 (Census ID: 26555, 28732 and 74058), and are shown in Figure 1-1. The annual $NO_2$ limit is 40 $\mu g.m^{-3}$.

[1] 2018 Air Quality Annual Status Report In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management Newcastle-under-Lyme Borough Council June 2018

**Figure 1-1: Areas of $NO_2$ exceedances in 2021 identified in the local Targeted Feasibility Study**






## 1.2 Outline scheme options

### 1.2.1 Strategic Outline Case

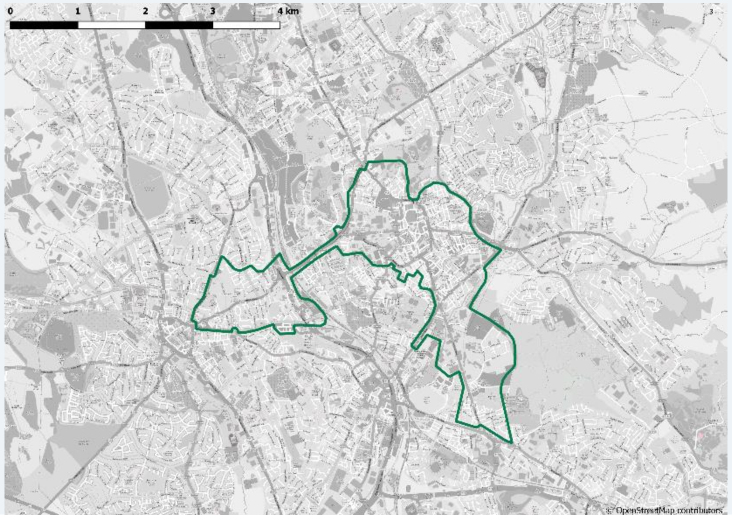
The Strategic Outline Case for measures to reduce the ambient concentrations of $NO_2$ in Stoke-on-Trent and Newcastle-under-Lyme outlined a shortlist of preferred options to be modelled for the Outline Business Case, including:

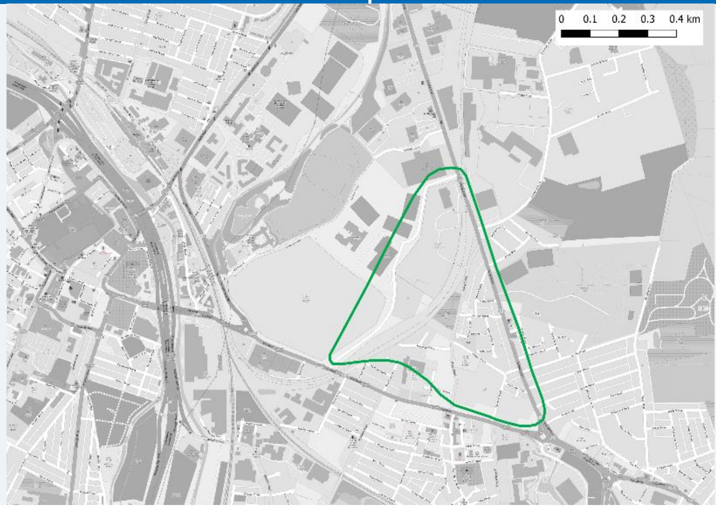
- A city centre / A53 chargeable access restriction (Class A – D).
- A city-wide chargeable access restriction (Class A – D).
- A city centre / A53 traffic management scheme.
- A Low Emission Strategy, comprising a package of measures designed to promote improvements to existing bus and taxi fleets, and encourage mode shift towards low emission transport options.

### 1.2.2 Outline Business Case

Future year baseline modelling was carried out for 2022. Six options for 2022 were modelled as part of the Outline Business Case and are summarised as below:

**Table 1: Description of modelled options**

| Option | Description | Assumptions |
|---|---|---|
| **Option 1**<br>Benchmark CAZ D | This is the benchmark CAZ that would likely be required for compliance if just a CAZ scheme were implemented. Class D implies charging scheme for all non-compliant vehicles. The CAZ boundary is as follows:<br><br> | The following daily charges through, within, or from the CAZ area are as follows:<br>Cars/Taxis: £5<br>LGVs: £9<br>HGVs/Buses: £35/tbc<br><br>On Bucknall New Road and Victoria Road, 100% bus retrofit<br><br>In order to account for secondary responses to a charging CAZ, the following assumptions were made, based on the JAQU Third wave Evidence Package report: “75% of non-compliant vehicles owners will replace their non-compliant vehicle with a second-hand compliant vehicle whilst 25% will scrap their vehicle and buy a new one on the same fuel type. Additionally, 75% of those replacing will purchase the cheapest compliant vehicle (so diesel will switch to petrol)”. As a modelling assumption, we assumed that 75% of 75% of additional diesel car vehicles in comparison with the baseline were in fact Euro 4 Petrol car vehicles. |
| **Option 2**<br>“High Impact no CAZ” | • Along the A53: Basford Park right turn ban<br>• On Bucknall New Road: 50% bus retrofit<br>• On Victoria Road: Existing Academy Link Road with limited improvements at both ends (only NB north of Academy) and Victoria Road northbound peak restrictions on the southern end of Victoria Road except buses. 100% bus retrofit on Victoria Road as well as complementary measures: Real-Time Passenger Information (RTPI) and bus shelters. | |
| **Option 3**<br>“High Impact with local CAZ D” | • Local CAZ D around Victoria Road (see map below), with daily charges same as option 1<br>• Along the A53: A53 westbound peak restrictions (except buses, cyclists and taxis)<br>• On Bucknall New Road: 100% bus retrofit<br>• On Victoria Road: In addition to the CAZ D, buses are permitted northbound of Victoria Road and 100% bus retrofit. | |

| Option | Description | Assumptions |
|---|---|---|
| |  | |
| **Option 4** | • Along the A53: A53 westbound peak restriction plus pedestrian phases at both Albert St and Basford Park traffic lights<br>• On Bucknall New Road: 75% bus retrofit<br>• On Victoria Road: Existing Academy Road Link Road, without junction improvements. Victoria Road northbound peak restrictions on southern end of Victoria Road except buses, cyclists and taxis. 100% bus retrofit | |
| **Option 5**<br>“Class C CAZ” | • Class C CAZ (charging scheme for all non-compliant vehicles except private passenger vehicles). The CAZ boundary and daily charges are the same as Option 1 | |
| **Option 6** | • Along A53, same as Option 4 with complementary measures:<br>Bus infrastructure<br>Targeted travel planning/marketing<br>Walking & Cycling<br>Electric Vehicle Infrastructure<br>Vegetation Removal and planting<br>• On Bucknall New Road, same as option 4 plus complementary measures as described for the A53<br>• On Victoria Road, same as option 4 plus complementary measures as described for the A53 | |

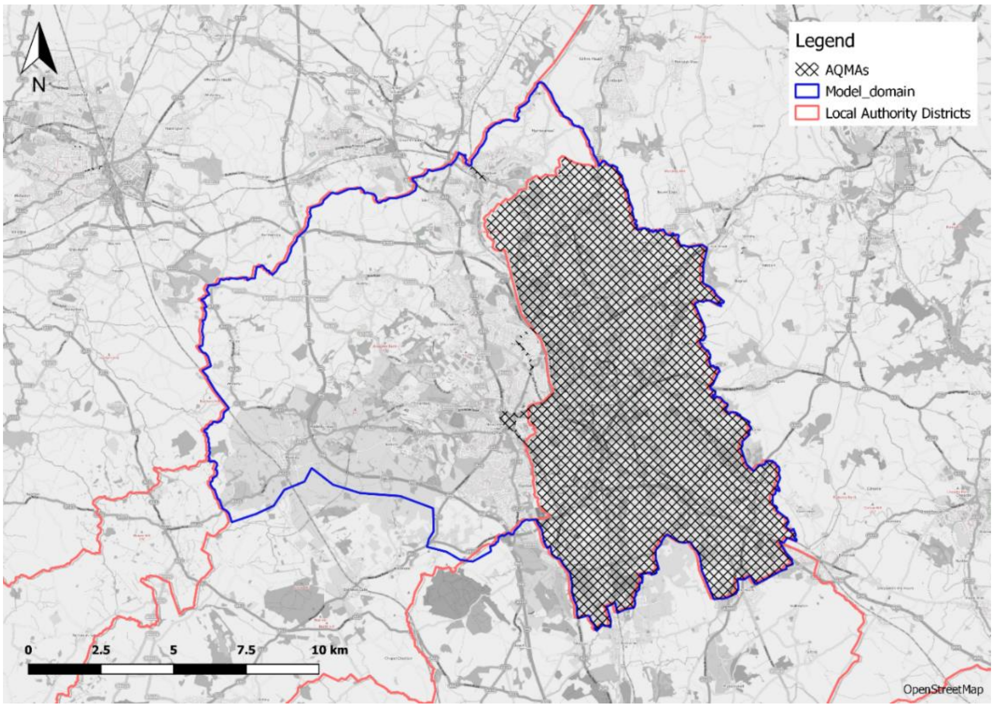
## 1.3 Model domain

To assess the transport and air quality impacts of the scheme, a model domain is required that covers the potential scheme options, relevant AQMAs and potential diversion routes. The core air quality model domain covers the Stoke-on-Trent and Newcastle-on-Lyme city boundaries, based upon the district boundary from Ordnance Survey mapping products, and is based on the extent of the North Staffordshire Multi-Modal (NSMM) traffic model on which the air quality modelling is based. The model domain used is shown in Figure 1-2 and has been chosen to cover the following:

- All of the AQMAs in Stoke-on-Trent and Newcastle-under-Lyme;
- The main areas of concern identified in the national modelling assessment at the A53 road link and the A500;
- Areas of concern identified from SOTC and NULC air pollutant measurement data.

Concentrations were calculated across a grid covering this area at 3m resolution.

**Figure 1-2: Air quality model domain**




## 1.4 Modelling years

There are two key years used in the modelling work, as set out in Table 2 below, plus an additional future reference year. The baseline modelling year of 2018 allows use of the latest air quality and transport data for model verification. The future baseline was modelled for the assumed compliance year in 2022. Data for interim years was generated through interpolation rather than direct model tests.

**Table 2: Key model years**

| Year | Description |
|---|---|
| 2018 | **Base year** – using latest available data on air quality and traffic. |
| 2022 | **Compliance year** – latest date when the effects of the scheme are assumed to occur. |

# 2 Model verification and adjustment

## 2.1 Measurement data for model calibration

Annual mean $NO_2$ measurements from all automatic monitors and diffusion tube sites operated by the Councils in 2018 were used to carry out model verification. Information on monitoring data QA/QC, diffusion tube bias adjustment factors, etc., are as described in the Stoke-on-Trent and Newcastle-under-Lyme 2019 LAQM Annual Status Reports[2].

Table 3 and Table 4 present monitoring sites operated by Newcastle-under-Lyme and Stoke-on-Trent Councils, respectively, together with the monitored $NO_2$ concentrations. A map showing the monitoring sites is presented in AQ2.

**Table 3: Annual mean $NO_2$ concentrations at Newcastle-under-Lyme monitoring sites, $\mu g.m^{-3}$, 2018**

| Site ID | Site Name | Monitoring | Site Type | Easting | Northing | Value |
|---|---|---|---|---|---|---|
| CM1 | Newcastle under Lyme Queen's Gardens | Automatic | Roadside | 385046 | 346147 | 22.75 |
| DTK1 | A34 Holy Trinity | Diffusion Tube | Kerbside | 385051 | 345726 | 37.2 |
| DTK2 | 76 King St, N/C | Diffusion Tube | Urban Centre | 385469 | 346362 | 26.0 |
| DTUB1 | Wolstanton (Harington St) | Diffusion Tube | Kerbside | 384739 | 348326 | 17.7 |
| DTUB2 | Westlands (4 Sneyd Crescent) | Diffusion Tube | Kerbside | 383916 | 345059 | 15.3 |
| DT3 | Collingwood 3 Newcastle Rd | Diffusion Tube | Rural | 378116 | 345488 | 24.8 |
| DT6 | 106 Liverpool Rd | Diffusion Tube | Suburban | 384014 | 354429 | 37.1 |
| DT9 | 32 Porthill Bank | Diffusion Tube | Suburban | 385519 | 349055 | 29.3 |
| DT11 | 34 London Road, N/C | Diffusion Tube | Suburban | 385112 | 345636 | 35.1 |
| DT24 | 26 High St, May Bank | Diffusion Tube | Roadside | 385574 | 347530 | 30.4 |
| DT28 | Limbrick Cottage Shraleybrook | Diffusion Tube | Rural | 377994 | 350105 | 25.2 |
| DT34 | 15 Barracks Road | Diffusion Tube | Urban Centre | 385059 | 345840 | 29.2 |
| DT 39 | 4/6 Liverpool Road, Kidsgrove | Diffusion Tube | Suburban | 383560 | 354739 | 31.7 |
| DT40 | Banktop Court, Porthill | Diffusion Tube | Suburban | 385128 | 348811 | 25.2 |
| DT46 | 1 London Road (Trinity Court) | Diffusion Tube | Urban Centre | 385073 | 345685 | 27.3 |
| DT47 | 1 London Rd (Brook La) | Diffusion Tube | Urban Centre | 385023 | 345678 | 24.7 |
| DT49 | 2 Vale View, Porthill | Diffusion Tube | Urban Centre | 385595 | 349129 | 27.2 |
| DT64 | Kidsgrove Carpets Liverpool Road | Diffusion Tube | Urban Centre | 383950 | 354445 | 32.7 |
| DT72 | 134 High Street Newcastle | Diffusion Tube | Roadside | 384980 | 345787 | 26.9 |
| DT73 | 21 London Road Newcastle | Diffusion Tube | Roadside | 385070 | 345738 | 29.3 |
| DT74 | 39 London Road Newcastle | Diffusion Tube | Roadside | 385132 | 345640 | 31.9 |
| DT76 | 11 Brunswick Street Newcastle | Diffusion Tube | Roadside | 385226 | 346156 | 33.1 |
| DT84 | 102 King Street Newcastle | Diffusion Tube | Roadside | 385548 | 346400 | 33.6 |
| DT85 | 106 King Street Newcastle | Diffusion Tube | Urban Centre | 385575 | 346413 | 38.8 |
| DT86 | Hassell C.P. School Barracks Road N/C | Diffusion Tube | Urban Centre | 385075 | 345910 | 27.9 |
| DT87 | Blue Chilli 1 King Street Newcastle | Diffusion Tube | Urban Centre | 385105 | 346225 | 34.9 |
| DT88 | 27 Lower Street Newcastle | Diffusion Tube | Urban Centre | 384709 | 345881 | 28.2 |
| DT89 | Queens Gardens Newcastle | Diffusion Tube | Urban Centre | 385054 | 346134 | 29.0 |
| DT90 | Queens Gardens Newcastle | Diffusion Tube | Urban Centre | 385054 | 346134 | 29.2 |
| DT91 | Queens Gardens, Newcastle | Diffusion Tube | Urban Centre | 385054 | 346134 | 31.1 |
| DT92 | 41/43 Liverpool Road Kidsgrove | Diffusion Tube | Urban Centre | 383890 | 354461 | 31.9 |
| DT93 | 118 Liverpool Road Kidsgrove | Diffusion Tube | Urban Centre | 384056 | 354393 | 28.2 |
| DT94 | 116 Liverpool Road Kidsgrove | Diffusion Tube | Urban Centre | 384030 | 354416 | 31.8 |
| DT95 | 76 London Road Newcastle | Diffusion Tube | Urban Centre | 385171 | 345539 | 28.5 |
| DT96 | 52/54 London Road Newcastle | Diffusion Tube | Roadside | 385131 | 345601 | 35.8 |
| DT97 | Blackfriars/ Lower Street | Diffusion Tube | Roadside | 384795 | 345796 | 27.6 |
| DT98 | Newcastle Taxis Brunswick Street | Diffusion Tube | Roadside | 385327 | 346148 | 36.5 |
| DT100 | Sainsbury's Carpark Near to Courts | Diffusion Tube | Roadside | 384689 | 346284 | 27.9 |
| DT101 | Blackburn House Lower Street Newcastle | Diffusion Tube | Roadside | 384806 | 345842 | 32.8 |
| DT102 | Maxims Lower Street Newcastle | Diffusion Tube | Roadside | 384609 | 346007 | 44.1 |
| DT103 | Grange Lange/High Street Wolstanton | Diffusion Tube | Roadside | 385682 | 347909 | 25.1 |
| DT104 | 7 King Street Newcastle | Diffusion Tube | Roadside | 385213 | 346270 | 37.9 |
| DT105 | The Avenue Kidsgrove | Diffusion Tube | Roadside | 383991 | 354418 | 26.0 |

[2] Stoke-on-Trent CC (2018) Stoke-on-Trent Council Air Quality Annual Status Report (ASR); June 2018. Newcastle-under-Lyme Borough Council (2019) Newcastle-under-Lyme Borough Council Air Quality Annual Status Report (ASR); June 2019.

**Table 4: Annual mean $NO_2$ concentrations at Stoke-on-Trent air quality monitoring sites, $\mu g.m^{-3}$, 2018**

| Site ID | Site Name | Monitoring | Site Type | Easting | Northing | Value |
|---|---|---|---|---|---|---|
| CM1 | Stoke-on-Trent Centre AURN | Automatic | Urban Background | 388355 | 347893 | 23.0 |
| CM2 | Joiners Square | Automatic | Roadside | 388743 | 346457 | 33.0 |
| CM5 | Basford | Automatic | Roadside | 386288 | 346802 | 55.0 |
| CM6 | Stoke-on-Trent A50 Roadside AURN | Automatic | Roadside | 392584 | 342569 | 53.0 |
| DT1 | 1994/01 | Diffusion Tube | Urban Background | 386402 | 343705 | 18.3 |
| DT2 | 1999/01 | Diffusion Tube | Roadside | 389884 | 347288 | 39.1 |
| DT3 | 1999/02 | Diffusion Tube | Urban Background | 390612 | 350793 | 16.2 |
| DT4 | 2001/04 | Diffusion Tube | Roadside | 392705 | 342518 | 31.9 |
| DT8 | 2003/02 | Diffusion Tube | Roadside | 388355 | 347893 | 29.0 |
| DT9 | 2005/01 | Diffusion Tube | Roadside | 387626 | 348515 | 44.8 |
| DT10 | 2005/02 | Diffusion Tube | Roadside | 386929 | 349855 | 34.9 |
| DT13 | 2005/07 | Diffusion Tube | Roadside | 392471 | 342631 | 35.2 |
| DT14 | 2005/08 | Diffusion Tube | Roadside | 392587 | 342578 | 37.4 |
| DT15 | 2005/11 | Diffusion Tube | Roadside | 389335.6 | 344693.4 | 38.1 |
| DT16 | 2005/13 | Diffusion Tube | Roadside | 385975 | 346574.6 | 49.4 |
| DT17 | 2005/14 | Diffusion Tube | Roadside | 386270 | 346782.4 | 72.5 |
| DT20 | 2005/17 | Diffusion Tube | Roadside | 388842 | 346642 | 35.4 |
| DT23 | 2005/22 | Diffusion Tube | Roadside | 388704 | 347607.7 | 39.3 |
| DT24 | 2005/23 | Diffusion Tube | Roadside | 393201 | 342409 | 41.6 |
| DT29 | 2005/34 | Diffusion Tube | Roadside | 386904 | 349828.4 | 38.4 |
| DT32 | 2005/41 | Diffusion Tube | Roadside | 388697.9 | 346421.5 | 34.4 |
| DT34 | 2005/45 | Diffusion Tube | Roadside | 389231.5 | 345026.3 | 46.3 |
| DT37 | 2005/50 | Diffusion Tube | Roadside | 393260 | 342460 | 41.9 |
| DT40 | 2005/56 | Diffusion Tube | Roadside | 392777 | 342409 | 38.7 |
| DT41 | 2005/57 | Diffusion Tube | Roadside | 392741 | 342435 | 36.7 |
| DT42 | 2005/58 | Diffusion Tube | Roadside | 392676.1 | 342481.4 | 34.3 |
| DT49 | 2008/13 | Diffusion Tube | Roadside | 388536 | 347143 | 37.7 |
| DT51 | 2009/04 | Diffusion Tube | Roadside | 386380.4 | 346860 | 38.8 |
| DT52 | 2009/05 | Diffusion Tube | Roadside | 385812.3 | 346545.9 | 47.9 |
| DT53 | 2010/01 | Diffusion Tube | Roadside | 387938 | 345939 | 32.2 |
| DT55 | 2010/05 | Diffusion Tube | Roadside | 393320 | 342206 | 34.6 |
| DT56 | 2012/01 | Diffusion Tube | Roadside | 386288 | 346802 | 49.5 |
| DT61 | 2014/01 | Diffusion Tube | Roadside | 390710 | 350261 | 35.0 |
| DT63 | 2016/01 | Diffusion Tube | Roadside | 385928.8 | 346563.2 | 51.1 |
| DT64 | 2016/02 | Diffusion Tube | Roadside | 385937 | 346531 | 36.5 |
| DT65 | 2016/03 | Diffusion Tube | Roadside | 385943 | 346504 | 36.8 |
| DT66 | 2016/04 | Diffusion Tube | Roadside | 385978.5 | 346315.8 | 29.9 |
| DT67 | 2016/05 | Diffusion Tube | Roadside | 386023.5 | 346152.6 | 48.6 |
| DT72 | 2017/01 | Diffusion Tube | Roadside | 386014 | 346137 | 35.0 |
| DT73 | 2017/02 | Diffusion Tube | Roadside | 386020.1 | 345932.7 | 31.7 |
| DT74 | 2017/03 | Diffusion Tube | Roadside | 393294.3 | 342508.6 | 43.6 |
| DT75 | 2017/04 | Diffusion Tube | Roadside | 393369.6 | 342177.6 | 37.6 |
| DT76 | 2017/05 | Diffusion Tube | Roadside | 385928.8 | 349765.3 | 36.9 |
| DT77 | 2017/06 | Diffusion Tube | Roadside | 385957.1 | 349756.5 | 47.7 |
| DT78 | 2017/07 | Diffusion Tube | Roadside | 386156.7 | 349596.1 | 38.4 |
| DT79 | 2017/08 | Diffusion Tube | Roadside | 386240 | 349581 | 37.8 |
| DT80 | 2017/09 | Diffusion Tube | Roadside | 386400 | 349571.1 | 31.8 |
| DT81 | 2017/10 | Diffusion Tube | Roadside | 386456 | 349598 | 34.0 |
| DT82 | 2017/11 | Diffusion Tube | Roadside | 386607.1 | 349656.3 | 33.2 |
| DT83 | 2017/12 | Diffusion Tube | Roadside | 390703.2 | 350221 | 36.6 |
| DT84 | 2017/13 | Diffusion Tube | Roadside | 386917.9 | 349850.5 | 36.4 |
| DT85 | 2017/14 | Diffusion Tube | Roadside | 386959 | 349850 | 36.6 |
| DT86 | 2017/15 | Diffusion Tube | Roadside | 386983 | 349861 | 35.6 |
| DT88 | 2017/17 | Diffusion Tube | Roadside | 387427.7 | 348830.1 | 30.4 |
| DT89 | 2017/18 | Diffusion Tube | Roadside | 387499.4 | 348695.4 | 36.9 |
| DT90 | 2017/19 | Diffusion Tube | Roadside | 387558.2 | 348623.1 | 35.2 |
| DT91 | 2017/20 | Diffusion Tube | Roadside | 387659.4 | 348482.3 | 43.4 |
| DT92 | 2017/21 | Diffusion Tube | Roadside | 388725 | 346464 | 31.7 |
| DT93 | 2017/22 | Diffusion Tube | Roadside | 388673.1 | 346372 | 29.6 |
| DT94 | 2017/23 | Diffusion Tube | Roadside | 388335 | 345880 | 31.3 |
| DT95 | 2017/24 | Diffusion Tube | Roadside | 388230 | 345742 | 30.7 |
| DT96 | 2017/25 | Diffusion Tube | Roadside | 388168.1 | 345663.4 | 29.3 |
| DT97 | 2017/26 | Diffusion Tube | Roadside | 387972 | 346002 | 29.8 |
| DT98 | 2017/27 | Diffusion Tube | Roadside | 388006.3 | 346155.9 | 27.1 |
| DT99 | 2017/28 | Diffusion Tube | Roadside | 388656 | 347612 | 48.6 |
| DT100 | 2017/29 | Diffusion Tube | Roadside | 388634.3 | 347613.8 | 44.8 |
| DT101 | 2017/30 | Diffusion Tube | Roadside | 385999 | 345936 | 30.1 |
| DT102 | 2017/31 | Diffusion Tube | Roadside | 386154.4 | 345834.5 | 33.0 |
| DT103 | 2017/32 | Diffusion Tube | Roadside | 388114 | 345483 | 30.9 |

| Site ID | Site Name | Monitoring | Site Type | Easting | Northing | Value |
|---|---|---|---|---|---|---|
| DT104 | 2017/33 | Diffusion Tube | Roadside | 387979 | 345650.1 | 42.4 |
| DT105 | 2018/01 | Diffusion Tube | Roadside | 386591.3 | 347017.5 | 34.2 |
| DT106 | 2018/02 | Diffusion Tube | Roadside | 386660 | 347088 | 33.0 |

Some clear outliers were apparent during the model verification process, whereby we were unable to refine the model inputs sufficiently to achieve acceptable model performance at these locations. There are a number of reasons why this could be the case, including:

- A site located next to a large car park, bus stop, or additional emission source that has not been explicitly modelled due to unknown activity data;
- Sites located underneath trees or vegetation i.e. unsuitable locations for diffusion tubes to measure $NO_2$ concentrations effectively;
- Sites located along roads which are not included in the traffic model, or at junctions with roads that are not included in the traffic model.

Ten out of 111 monitoring sites were considered as outliers and were therefore excluded from the verification process. These sites, and the reason for their exclusion, are detailed in Table 5.

**Table 5: Monitoring sites excluded from model verification**

| Council | Site ID | Monitoring | Site Type | Reason for exclusion |
|---|---|---|---|---|
| Newcastle-under-Lyme | DTUB2 | Diffusion Tube | Kerbside | Located on minor road not present in traffic model. |
| | DT11 | Diffusion Tube | Suburban | Located at the junction with Refinery Street, which is not included in the transport model. |
| | DT 39 | Diffusion Tube | Suburban | Located at the junction with Hardingswood Road, which is not included in the transport model. |
| | DT72 | Diffusion Tube | Roadside | Located at an entrance to a car park which is not included in the air quality model. |
| | DT96 | Diffusion Tube | Roadside | Located at the junction with Vessey Terrace, which is not included in the transport model. |
| | DT102 | Diffusion Tube | Roadside | Located alongside the entryway into a car park, which is not included in the model. |
| Stoke-on-Trent | DT3 | Diffusion Tube | Background | Located on Trentfields Road, which is not included in the transport model. |
| | DT17 | Diffusion Tube | Roadside | The tree canopy at this location produces canyon and tunnel effects, which cannot be adequately represented in the air quality model without significant uncertainty. The Basford continuous monitor (CM5) is located 20m from this location and is included in the model verification. |

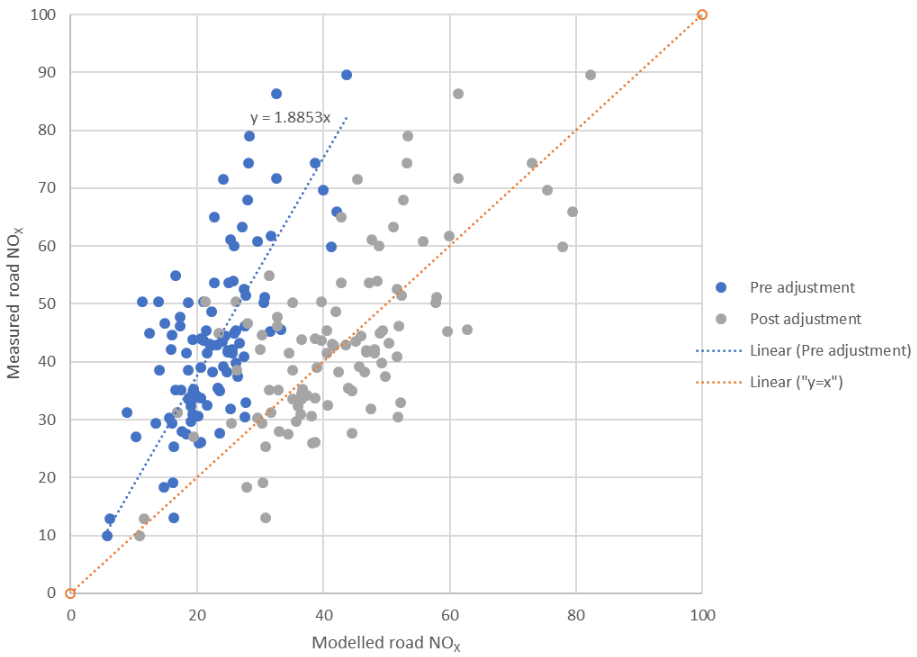
## 2.2 Model calibration

A total of 101 roadside automatic and diffusion tube $NO_2$ measurement sites operated by Stoke-on-Trent Council and Newcastle-under-Lyme District Council have been used for model verification.

Adjustment factors for emissions from roads were derived following the methodology described in LAQM.TG (16)[3], whereby the predicted road contribution to $NO_X$ concentrations was compared with measured values.

Diffusion tubes measure $NO_2$ rather than NOx; the road contribution to $NO_X$ concentrations at these sites was estimated using the latest version of the NOx to $NO_2$ calculator (version 7.1) published by Defra.[4] Background $NO_X$ concentrations for use in this tool were taken from the Defra background maps. This approach uses background concentrations of $NO_X$ as an input.

**Figure 2-1: Measured and modelled annual mean road NOx contributions at monitoring sites, 2018, µg.m$^{-3}$**




The gradient of the best fit line for the modelled road NOx contribution vs. measured road NOx contribution was determined using linear regression and used as a domain-wide road NOx adjustment factor. The total annual mean $NO_2$ concentrations were then determined using the NOx/$NO_2$ calculator to combine the background concentration and the adjusted road contribution. A global primary NOx adjustment factor (PAdj) of **1.89** was derived and applied to all modelled road NOx contributions prior to calculating an $NO_2$ annual mean.

[3] https://laqm.defra.gov.uk/documents/LAQM-TG16-February-18-v1.pdf, accessed 4th September 2018

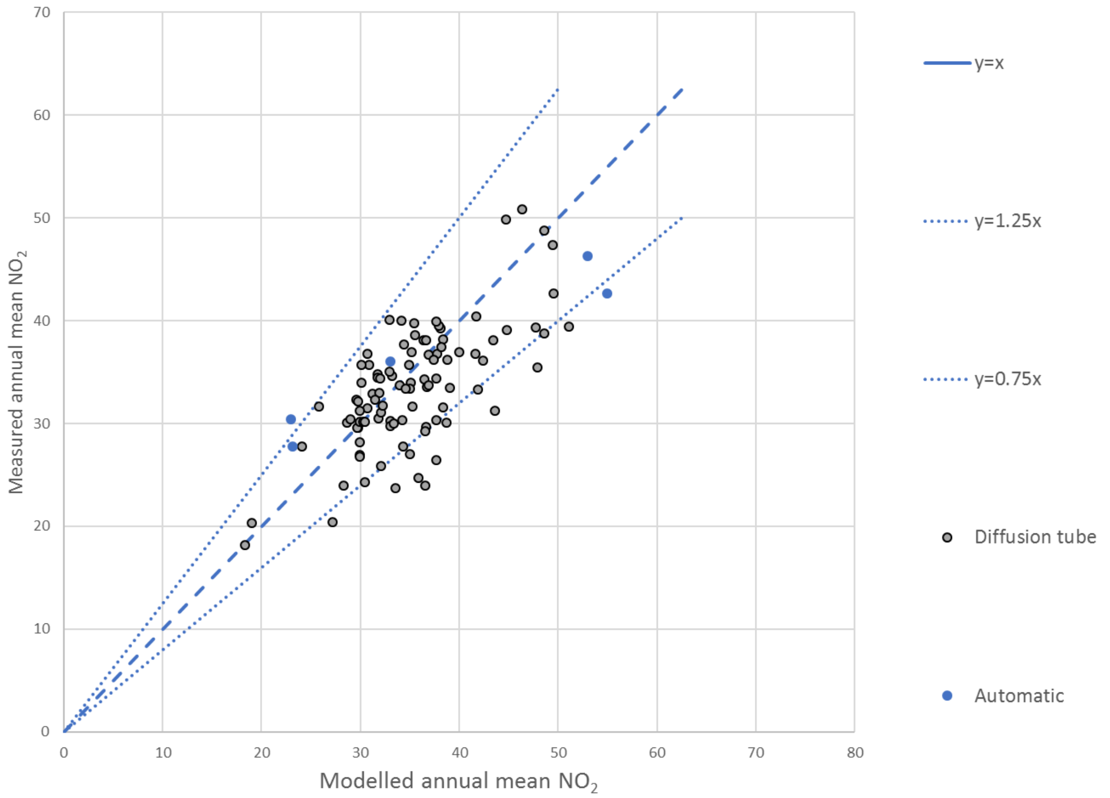
[4] https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

## 2.3 Model verification

The model was verified against annual average $NO_2$ concentrations using the 2018 baseline emissions inventory described in Section 3. $NO_2$ concentrations were derived from modelled road NOx contributions, primary $NO_2$ contributions, and background concentrations using the Defra NOx:$NO_2$ calculator.

A plot comparing modelled and monitored $NO_2$ concentrations during 2018 is presented in Figure 2-2.

**Figure 2-2: Modelled and measured annual mean $NO_2$ concentrations, 2018, post adjustment**




Following guidance in LAQM.TG(16)[4], the Root Mean Square Error (RMSE) was calculated to define the average error or uncertainty of the model, as described in Box 7.17 of this guidance. The calculation of the RMSE is presented in Table 6. The Root Mean Square Error for the model verification is 5.2 µg.m$^{-3}$, corresponding to 13% of the Air Quality Objective (AQO). This is above the 10% ideal threshold specified in LAQM.TG (16)[4], but significantly below the 25% acceptable threshold. The primary cause of the relatively high RMSE is model underprediction towards the edge of the model domain in Baddeley and in the Kidsgrove areas, where the traffic model is less detailed and as a result modelled link speeds may be overpredicted. No exceedances of the AQO were measured in these locations in 2018, and as improvements in the vehicle fleet to 2022 will tend to reduce road emissions in future years, it is considered highly unlikely that these roads will represent a compliance issue in 2022.

**Table 6: Root mean square error calculations**

| Council | Site ID | Measured $NO_2$ annual mean concentration 2018 ($\mu g.m^{-3}$) | Modelled $NO_2$ annual mean concentration 2018 ($\mu g.m^{-3}$) | Difference ($\mu g.m^{-3}$) |
|---|---|---|---|---|
| NC | CM1 | 23.1 | 27.7 | 4.6 |
| NC | DT100 | 30.0 | 31.1 | 1.2 |
| NC | DT101 | 33.0 | 34.9 | 2.0 |
| NC | DT103 | 24.1 | 27.7 | 3.6 |
| NC | DT104 | 38.2 | 37.3 | -1.0 |
| NC | DT105 | 27.2 | 20.3 | -6.8 |
| NC | DT24 | 35.3 | 31.5 | -3.8 |
| NC | DT28 | 29.9 | 26.6 | -3.3 |
| NC | DT3 | 30.7 | 36.6 | 5.8 |
| NC | DT34 | 32.1 | 31.0 | -1.1 |
| NC | DT40 | 28.3 | 23.9 | -4.4 |
| NC | DT46 | 30.1 | 33.8 | 3.8 |
| NC | DT47 | 25.8 | 31.5 | 5.7 |
| NC | DT49 | 31.5 | 32.2 | 0.7 |
| NC | DT6 | 37.7 | 26.4 | -11.3 |
| NC | DT64 | 35.9 | 24.7 | -11.2 |
| NC | DT73 | 32.0 | 34.3 | 2.2 |
| NC | DT74 | 33.0 | 29.6 | -3.4 |
| NC | DT84 | 36.5 | 29.2 | -7.3 |
| NC | DT85 | 35.1 | 33.9 | -1.3 |
| NC | DT86 | 40.0 | 36.8 | -3.2 |
| NC | DT87 | 29.7 | 29.5 | -0.2 |
| NC | DT88 | 37.9 | 39.4 | 1.5 |
| NC | DT89 | 29.9 | 28.1 | -1.8 |
| NC | DT9 | 30.4 | 30.0 | -0.3 |
| NC | DT90 | 33.4 | 29.9 | -3.5 |
| NC | DT91 | 30.0 | 30.0 | 0.1 |
| NC | DT92 | 30.3 | 30.0 | -0.3 |
| NC | DT93 | 33.5 | 23.7 | -9.9 |
| NC | DT94 | 30.4 | 24.2 | -6.2 |
| NC | DT95 | 32.1 | 25.8 | -6.3 |
| NC | DT97 | 34.3 | 27.6 | -6.7 |
| NC | DT98 | 28.6 | 30.0 | 1.3 |
| NC | DTK1 | 37.7 | 30.2 | -7.4 |
| NC | DTK2 | 41.7 | 40.2 | -1.5 |
| NC | DTUB1 | 29.7 | 29.5 | -0.2 |
| SOT | CM1 | 19.0 | 20.3 | 1.3 |
| SOT | CM2 | 23.0 | 30.3 | 7.3 |
| SOT | CM5 | 33.0 | 35.9 | 2.9 |
| SOT | CM6 | 55.0 | 42.5 | -12.5 |
| SOT | DT1 | 53.0 | 46.0 | -7.0 |
| SOT | DT10 | 18.3 | 18.1 | -0.2 |
| SOT | DT100 | 34.9 | 35.6 | 0.7 |
| SOT | DT101 | 44.8 | 49.6 | 4.9 |
| SOT | DT102 | 30.1 | 35.6 | 5.5 |
| SOT | DT103 | 33.0 | 30.1 | -2.9 |
| SOT | DT104 | 30.9 | 35.6 | 4.7 |
| SOT | DT105 | 42.4 | 36.0 | -6.4 |
| SOT | DT106 | 34.2 | 39.8 | 5.7 |
| SOT | DT13 | 33.0 | 39.9 | 6.9 |
| SOT | DT14 | 35.2 | 36.8 | 1.6 |
| SOT | DT15 | 37.4 | 36.0 | -1.4 |
| SOT | DT16 | 38.1 | 39.1 | 1.0 |
| SOT | DT2 | 49.4 | 47.1 | -2.3 |
| SOT | DT20 | 39.1 | 33.3 | -5.7 |
| SOT | DT24 | 35.4 | 39.6 | 4.2 |
| SOT | DT29 | 41.6 | 36.6 | -5.1 |

| Council | Site ID | Measured $NO_2$ annual mean concentration 2018 ($\mu g.m^{-3}$) | Modelled $NO_2$ annual mean concentration 2018 ($\mu g.m^{-3}$) | Difference ($\mu g.m^{-3}$) |
|---|---|---|---|---|
| SOT | DT32 | 38.4 | 31.5 | -6.9 |
| SOT | DT34 | 34.4 | 37.5 | 3.1 |
| SOT | DT37 | 46.3 | 56.1 | 9.8 |
| SOT | DT4 | 41.9 | 33.2 | -8.7 |
| SOT | DT40 | 31.9 | 32.8 | 0.9 |
| SOT | DT41 | 38.7 | 29.9 | -8.7 |
| SOT | DT42 | 36.7 | 29.6 | -7.1 |
| SOT | DT49 | 34.3 | 30.2 | -4.1 |
| SOT | DT51 | 37.7 | 39.8 | 2.1 |
| SOT | DT52 | 38.8 | 36.0 | -2.7 |
| SOT | DT53 | 47.9 | 35.3 | -12.6 |
| SOT | DT55 | 32.2 | 31.7 | -0.6 |
| SOT | DT56 | 34.6 | 33.3 | -1.3 |
| SOT | DT61 | 49.5 | 42.5 | -7.0 |
| SOT | DT63 | 35.0 | 26.9 | -8.1 |
| SOT | DT64 | 51.1 | 39.3 | -11.8 |
| SOT | DT65 | 36.5 | 34.2 | -2.3 |
| SOT | DT66 | 36.8 | 33.4 | -3.4 |
| SOT | DT67 | 29.9 | 26.9 | -3.0 |
| SOT | DT72 | 48.6 | 38.6 | -10.1 |
| SOT | DT73 | 35.0 | 33.3 | -1.8 |
| SOT | DT74 | 31.7 | 34.4 | 2.6 |
| SOT | DT75 | 43.6 | 31.1 | -12.4 |
| SOT | DT76 | 37.6 | 34.2 | -3.4 |
| SOT | DT78 | 36.9 | 36.6 | -0.3 |
| SOT | DT79 | 47.7 | 39.1 | -8.6 |
| SOT | DT8 | 38.4 | 38.0 | -0.4 |
| SOT | DT80 | 37.8 | 36.6 | -1.2 |
| SOT | DT81 | 29.0 | 30.3 | 1.3 |
| SOT | DT82 | 31.8 | 30.4 | -1.4 |
| SOT | DT83 | 34.0 | 33.6 | -0.4 |
| SOT | DT84 | 33.2 | 34.5 | 1.3 |
| SOT | DT85 | 36.6 | 23.9 | -12.7 |
| SOT | DT86 | 36.4 | 38.0 | 1.6 |
| SOT | DT88 | 36.6 | 38.0 | 1.3 |
| SOT | DT89 | 35.6 | 38.5 | 2.9 |
| SOT | DT9 | 30.4 | 30.0 | -0.4 |
| SOT | DT91 | 36.9 | 33.6 | -3.3 |
| SOT | DT92 | 44.8 | 38.9 | -5.9 |
| SOT | DT93 | 43.4 | 38.0 | -5.5 |
| SOT | DT94 | 31.7 | 34.7 | 2.9 |
| SOT | DT95 | 29.6 | 32.2 | 2.6 |
| SOT | DT97 | 31.3 | 32.8 | 1.5 |
| SOT | DT99 | 30.7 | 31.4 | 0.7 |
| **RMSE (excluding clear outliers)** | | **5.16** | | |

# 3 Baseline results

## 3.1 Comparison with PCM

A set of gridded results with a resolution of at least 10m x 10m is required by the JAQU guidance. For this study, RapidAir© was used to model at 3m grid resolution. As RapidAir produces concentration grids (in raster format), modelled $NO_2$ concentrations can be extracted at receptor locations anywhere on the 3m resolution model output grid. For comparison with the PCM model results, annual mean concentrations at a distance of 4m from the kerb and at 2m height were extracted from the RapidAir model outputs. This provides an assessment of compliance at relevant roadside locations where there may be public access as specified in the Air Quality Directive (AQD) requirements Annex III A, B, and C3.

Concentrations were sampled at 4m intervals along each road, in order to ensure that the maximum predicted concentrations along each link were identified and reported. Receptors within 25m of major road junctions, or inside minor road junctions, were removed, as these were considered not to be representative of relevant exposure.

A comparison of the local model maximum concentration modelled 4m from each PCM road link and the corresponding PCM results from 2018 to 2022 are presented in Table 7. The results for 2018 and 2022 were explicitly modelled; the interim years were interpolated. Maps showing the predicted annual mean $NO_2$ concentrations in 2018 and 2022 are presented in Figure 3-1 to Figure 3-7. These model results should be considered in context with the model uncertainty quantified during model verification and described in Section2.

The PCM model predicts no links with exceedances in the study area in 2022. The local model, however, identified a number of locations where exceedance of the $NO_2$ limit value occurs in 2022:

- The A53 (Etruria Road) between Victoria Street and Basford Park Road. The maximum predicted annual mean $NO_2$ concentration along these links is 43 µg.m$^{-3}$.
- The A5008 (Bucknall New Road), at the junction with Potteries Way on Census ID 46553. The maximum predicted annual mean $NO_2$ concentration along this link is 42 µg.m$^{-3}$. There are two $NO_2$ diffusion tube locations along this Census ID; both locations recorded exceedances in 2018 (44.8 µg.m$^{-3}$ and 48.6 µg.m$^{-3}$). The exceedance along this link is due to slow traffic speeds entering the junction, relatively high bus flows, and the presence of a street canyon.
- The section of the A50 (Victoria Road) in Fenton, leading towards the junction with King Street, and corresponding to Census ID 16501. The maximum predicted annual mean $NO_2$ concentration along this link is 46 µg.m$^{-3}$. Stoke-on-Trent Council carries out monitoring at two locations along this link, with one measuring an exceedance (46.3 µg.m$^{-3}$) in 2018, and the other measuring compliance (38.1 µg.m$^{-3}$). The exceedances at these locations are caused by relatively low speeds, and narrow street canyons along particular road segments.

**Table 7: $NO_2$ annual mean concentrations 2018 baseline year, 2022 future baseline year – Comparison of PCM vs local model results by Census ID (µg.m$^{-3}$)**

| Census ID | Road Name | Length (m) | Managed by | PCM baseline $NO_2$ concentrations (µg.m$^{-3}$) | | | | | Local baseline $NO_2$ concentrations (µg.m$^{-3}$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2018 | 2019 | 2020 | 2021 | 2022 | 2018 | 2019 | 2020 | 2021 | 2022 |
| 26355 | A34 | 1033 | HWE | 29 | 28 | 27 | 25 | 24 | 39 | 37 | 35 | 33 | 31 |
| 48067 | A34 | 226 | HWE | 27 | 26 | 25 | 23 | 22 | 36 | 34 | 33 | 31 | 29 |
| 17975 | A34 | 429 | HWE | 28 | 27 | 26 | 24 | 23 | 39 | 37 | 35 | 33 | 31 |
| 74065 | A34 | 468 | HWE | 25 | 24 | 23 | 22 | 20 | 36 | 34 | 32 | 31 | 29 |
| 6353 | A34 | 1873 | HWE | 24 | 23 | 22 | 21 | 20 | 30 | 29 | 27 | 26 | 24 |
| 56360 | A34 | 2064 | HWE | 31 | 30 | 28 | 26 | 25 | 33 | 31 | 30 | 28 | 26 |
| 16325 | A34 | 1916 | HWE | 29 | 27 | 26 | 25 | 23 | 32 | 31 | 29 | 28 | 26 |
| 77490 | A34 | 1284 | HWE | 25 | 24 | 23 | 21 | 20 | 29 | 28 | 27 | 25 | 24 |
| 73258 | A34 | 695 | HWE | 25 | 24 | 23 | 21 | 20 | 28 | 26 | 25 | 23 | 22 |
| 6352 | A34 | 1070 | HWE | 18 | 17 | 16 | 16 | 15 | 25 | 24 | 23 | 22 | 21 |
| 36360 | A34 | 2366 | HWE | 28 | 27 | 25 | 24 | 22 | 40 | 38 | 36 | 34 | 32 |
| 56326 | A34 | 652 | HWE | 30 | 29 | 27 | 25 | 24 | 30 | 29 | 27 | 26 | 25 |
| 26531 | A50 | 757 | HWE | 28 | 27 | 25 | 24 | 23 | 42 | 41 | 39 | 37 | 35 |
| 48668 | A50 | 1032 | HWE | 24 | 23 | 22 | 21 | 20 | 42 | 40 | 38 | 37 | 35 |
| 75448 | A50 | 581 | HWE | 29 | 28 | 26 | 25 | 24 | 33 | 31 | 30 | 29 | 27 |
| 99215 | A50 | 1531 | HWE | 26 | 25 | 24 | 23 | 22 | 39 | 37 | 35 | 34 | 32 |
| 6522 | A50 | 1407 | HWE | 27 | 26 | 25 | 23 | 22 | 41 | 39 | 38 | 36 | 35 |
| 36543 | A50 | 1115 | LA | 28 | 27 | 26 | 25 | 23 | 44 | 43 | 42 | 41 | 40 |
| 60023 | A50 | 636 | HWE | 30 | 29 | 28 | 26 | 24 | 40 | 38 | 37 | 35 | 33 |
| 60017 | A50 | 1038 | HWE | 24 | 23 | 22 | 20 | 19 | 32 | 31 | 30 | 29 | 28 |
| 46538 | A50 | 1237 | HWE | 22 | 21 | 20 | 19 | 18 | 26 | 25 | 24 | 23 | 22 |
| 16501 | A50 | 1491 | LA | 31 | 30 | 29 | 27 | 26 | 55 | 53 | 50 | 48 | 46 |

| Census ID | Road Name | Length (m) | Managed by | PCM baseline $NO_2$ concentrations ($\mu g.m^{-3}$) | | | | | Local baseline $NO_2$ concentrations ($\mu g.m^{-3}$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2018 | 2019 | 2020 | 2021 | 2022 | 2018 | 2019 | 2020 | 2021 | 2022 |
| 60024 | A50 | 332 | HWE | 28 | 27 | 26 | 25 | 23 | 39 | 37 | 35 | 33 | 32 |
| 74261 | A50 | 536 | LA | 35 | 33 | 32 | 30 | 28 | 46 | 44 | 42 | 40 | 39 |
| 99335 | A50 | 1838 | HWE | 47 | 44 | 41 | 39 | 36 | 52 | 49 | 46 | 43 | 40 |
| 99331 | A50 | 1048 | HWE | 42 | 40 | 38 | 36 | 33 | 55 | 53 | 50 | 48 | 46 |
| 99333 | A50 | 612 | HWE | 49 | 46 | 43 | 40 | 37 | 48 | 46 | 44 | 42 | 40 |
| 77492 | A50 | 1715 | HWE | 22 | 21 | 20 | 19 | 18 | 26 | 25 | 24 | 23 | 22 |
| 74586 | A50 | 758 | HWE | 19 | 19 | 18 | 17 | 16 | 39 | 37 | 35 | 33 | 32 |
| 75422 | A50 | 339 | HWE | 46 | 44 | 42 | 39 | 37 | 48 | 45 | 43 | 41 | 39 |
| 75424 | A50 | 226 | HWE | 19 | 18 | 17 | 16 | 15 | 38 | 37 | 35 | 33 | 31 |
| 74585 | A50 | 816 | HWE | 22 | 21 | 20 | 19 | 18 | 34 | 32 | 31 | 29 | 28 |
| 99337 | A50 | 1576 | HWE | 42 | 40 | 37 | 35 | 33 | 46 | 43 | 41 | 39 | 37 |
| 99329 | A50 | 1398 | HWE | 45 | 43 | 40 | 38 | 35 | 59 | 56 | 53 | 50 | 47 |
| 60026 | A50 | 1578 | HWE | 32 | 30 | 29 | 28 | 26 | 56 | 53 | 51 | 48 | 45 |
| 47243 | A500 | 2465 | HWE | 49 | 46 | 43 | 41 | 38 | 60 | 57 | 55 | 52 | 49 |
| 8147 | A500 | 1136 | HWE | 45 | 43 | 40 | 38 | 35 | 63 | 61 | 58 | 55 | 53 |
| 8340 | A500 | 2865 | HWE | 47 | 45 | 42 | 40 | 37 | 64 | 61 | 58 | 55 | 53 |
| 38230 | A500 | 1107 | HWE | 50 | 47 | 44 | 41 | 39 | 58 | 54 | 51 | 48 | 45 |
| 57783 | A500 | 1008 | HWE | 48 | 46 | 43 | 41 | 38 | 63 | 61 | 58 | 56 | 53 |
| 75418 | A500 | 130 | HWE | 48 | 45 | 43 | 40 | 38 | 47 | 45 | 43 | 41 | 39 |
| 75420 | A500 | 246 | HWE | 21 | 20 | 19 | 19 | 18 | 36 | 34 | 33 | 31 | 30 |
| 75421 | A500 | 472 | HWE | 50 | 47 | 45 | 42 | 40 | 45 | 44 | 42 | 40 | 39 |
| 18131 | A500 | 751 | HWE | 40 | 38 | 36 | 33 | 31 | 48 | 46 | 44 | 42 | 40 |
| 77480 | A5005 | 1126 | LA | 16 | 15 | 14 | 14 | 13 | 22 | 21 | 20 | 19 | 18 |
| 70279 | A5007 | 1728 | LA | 20 | 19 | 18 | 17 | 16 | 44 | 42 | 40 | 38 | 37 |

| Census ID | Road Name | Length (m) | Managed by | PCM baseline $NO_2$ concentrations ($\mu g.m^{-3}$) | | | | | Local baseline $NO_2$ concentrations ($\mu g.m^{-3}$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2018 | 2019 | 2020 | 2021 | 2022 | 2018 | 2019 | 2020 | 2021 | 2022 |
| 48214 | A5006 | 1313 | LA | 22 | 22 | 21 | 20 | 19 | 38 | 37 | 35 | 33 | 32 |
| 17648 | A5006 | 1859 | LA | 29 | 28 | 27 | 26 | 24 | 44 | 42 | 40 | 39 | 37 |
| 82001 | A5006 | 222 | LA | 24 | 23 | 22 | 20 | 19 | 42 | 41 | 40 | 39 | 39 |
| 80721 | A5006 | 982 | LA | 22 | 21 | 20 | 19 | 18 | 33 | 32 | 31 | 30 | 29 |
| 56539 | A5007 | 1188 | LA | 27 | 26 | 24 | 23 | 22 | 41 | 39 | 37 | 35 | 34 |
| 70277 | A5007 | 1100 | LA | 29 | 28 | 27 | 25 | 24 | 41 | 39 | 38 | 36 | 34 |
| 56306 | A5007 | 769 | LA | 22 | 21 | 20 | 19 | 18 | 37 | 35 | 33 | 31 | 29 |
| 99407 | A5007 | 947 | LA | 18 | 17 | 16 | 15 | 14 | 45 | 41 | 38 | 35 | 32 |
| 70280 | A5007 | 185 | LA | 22 | 21 | 20 | 19 | 18 | 26 | 24 | 23 | 22 | 21 |
| 81450 | A5008 | 572 | LA | 22 | 21 | 20 | 19 | 19 | 34 | 34 | 33 | 33 | 33 |
| 60022 | A5008 | 543 | LA | 27 | 26 | 25 | 24 | 22 | 37 | 36 | 35 | 33 | 32 |
| 46553 | A5008 | 713 | LA | 30 | 28 | 27 | 25 | 23 | 53 | 50 | 48 | 45 | 42 |
| 74903 | A5008 | 364 | LA | 31 | 30 | 28 | 27 | 25 | 44 | 42 | 40 | 37 | 35 |
| 47735 | A5009 | 4465 | LA | 23 | 22 | 21 | 20 | 19 | 44 | 41 | 39 | 37 | 35 |
| 81449 | A5010 | 648 | LA | 23 | 22 | 21 | 20 | 19 | 34 | 32 | 31 | 29 | 28 |
| 81448 | A5010 | 193 | LA | 30 | 29 | 28 | 26 | 25 | 42 | 40 | 39 | 38 | 37 |
| 73257 | A5011 | 400 | LA | 18 | 18 | 17 | 16 | 15 | 23 | 22 | 21 | 20 | 19 |
| 74900 | A5035 | 1065 | LA | 21 | 20 | 19 | 18 | 17 | 35 | 33 | 32 | 30 | 28 |
| 47740 | A5035 | 4073 | LA | 19 | 18 | 18 | 17 | 16 | 27 | 26 | 25 | 24 | 23 |
| 47268 | A519 | 2166 | LA | 22 | 21 | 20 | 19 | 18 | 33 | 31 | 30 | 28 | 27 |
| 38231 | A52 | 1563 | LA | 35 | 34 | 32 | 30 | 28 | 51 | 48 | 45 | 42 | 40 |
| 18584 | A52 | 892 | LA | 27 | 26 | 25 | 23 | 22 | 36 | 34 | 32 | 30 | 28 |
| 38521 | A52 | 363 | LA | 28 | 27 | 26 | 24 | 23 | 43 | 41 | 38 | 36 | 33 |
| 28176 | A52 | 1221 | LA | 24 | 23 | 22 | 21 | 20 | 39 | 37 | 35 | 32 | 30 |

| Census ID | Road Name | Length (m) | Managed by | PCM baseline $NO_2$ concentrations ($\mu g.m^{-3}$) | | | | | Local baseline $NO_2$ concentrations ($\mu g.m^{-3}$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2018 | 2019 | 2020 | 2021 | 2022 | 2018 | 2019 | 2020 | 2021 | 2022 |
| 17860 | A52 | 503 | LA | 27 | 26 | 24 | 23 | 22 | 36 | 34 | 32 | 30 | 28 |
| 6536 | A52 | 1034 | LA | 26 | 25 | 23 | 22 | 21 | 40 | 37 | 35 | 32 | 30 |
| 18132 | A52 | 196 | LA | 28 | 27 | 26 | 24 | 23 | 38 | 36 | 35 | 33 | 31 |
| 57472 | A52 | 266 | LA | 30 | 29 | 27 | 26 | 24 | 40 | 38 | 37 | 35 | 33 |
| 26546 | A52 | 2335 | LA | 19 | 18 | 17 | 16 | 15 | 26 | 25 | 24 | 23 | 21 |
| 99210 | A52 | 263 | LA | 30 | 28 | 27 | 25 | 24 | 41 | 39 | 37 | 35 | 33 |
| 75284 | A52 | 337 | LA | 28 | 27 | 26 | 24 | 23 | 44 | 42 | 39 | 37 | 34 |
| 99026 | A52 | 873 | LA | 30 | 29 | 27 | 26 | 25 | 40 | 39 | 37 | 36 | 34 |
| 56996 | A52 | 292 | LA | 33 | 31 | 30 | 28 | 26 | 46 | 44 | 42 | 40 | 38 |
| 70276 | A52 | 361 | LA | 26 | 25 | 24 | 23 | 21 | 39 | 38 | 36 | 35 | 33 |
| 8148 | A52 | 187 | LA | 28 | 27 | 26 | 25 | 23 | 37 | 36 | 34 | 33 | 31 |
| 27739 | A52 | 662 | LA | 26 | 25 | 24 | 23 | 22 | 46 | 44 | 42 | 40 | 38 |
| 57470 | A52 | 278 | LA | 26 | 25 | 24 | 23 | 22 | 39 | 37 | 36 | 34 | 32 |
| 48504 | A52 | 245 | LA | 27 | 26 | 25 | 23 | 22 | 41 | 39 | 37 | 35 | 33 |
| 57606 | A52 | 455 | LA | 26 | 25 | 24 | 23 | 21 | 48 | 46 | 43 | 41 | 39 |
| 36560 | A52 | 705 | LA | 32 | 31 | 29 | 28 | 26 | 46 | 44 | 41 | 39 | 37 |
| 74894 | A520 | 847 | LA | 24 | 23 | 22 | 20 | 19 | 31 | 29 | 27 | 26 | 24 |
| 99214 | A520 | 1804 | LA | 23 | 22 | 21 | 19 | 18 | 40 | 38 | 36 | 34 | 33 |
| 8605 | A520 | 1001 | LA | 24 | 23 | 21 | 20 | 19 | 31 | 30 | 29 | 27 | 26 |
| 48287 | A525 | 459 | LA | 23 | 22 | 21 | 20 | 18 | 40 | 39 | 37 | 35 | 33 |
| 77488 | A525 | 2113 | LA | 20 | 19 | 18 | 17 | 16 | 30 | 28 | 27 | 25 | 24 |
| 81251 | A527 | 285 | LA | 17 | 17 | 16 | 15 | 15 | 22 | 21 | 20 | 19 | 18 |
| 38303 | A527 | 1298 | LA | 28 | 27 | 26 | 24 | 23 | 37 | 35 | 33 | 30 | 28 |
| 47276 | A527 | 2696 | LA | 24 | 23 | 22 | 20 | 19 | 38 | 36 | 35 | 33 | 32 |

| Census ID | Road Name | Length (m) | Managed by | PCM baseline $NO_2$ concentrations ($\mu g.m^{-3}$) | | | | | Local baseline $NO_2$ concentrations ($\mu g.m^{-3}$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2018 | 2019 | 2020 | 2021 | 2022 | 2018 | 2019 | 2020 | 2021 | 2022 |
| 74060 | A527 | 1086 | LA | 23 | 22 | 21 | 19 | 18 | 27 | 26 | 25 | 24 | 23 |
| 81250 | A527 | 392 | LA | 29 | 28 | 27 | 25 | 24 | 28 | 27 | 26 | 25 | 24 |
| 81253 | A527 | 863 | LA | 27 | 26 | 25 | 24 | 22 | 30 | 28 | 27 | 26 | 25 |
| 74896 | A5271 | 2295 | LA | 25 | 24 | 23 | 22 | 21 | 48 | 46 | 44 | 42 | 40 |
| 81252 | A5271 | 1652 | LA | 19 | 18 | 17 | 17 | 16 | 39 | 37 | 35 | 33 | 31 |
| 74897 | A5271 | 541 | LA | 20 | 19 | 18 | 17 | 16 | 35 | 34 | 32 | 31 | 29 |
| 74895 | A5272 | 5100 | LA | 24 | 23 | 22 | 20 | 19 | 33 | 31 | 30 | 28 | 27 |
| 74898 | A5272 | 2564 | LA | 26 | 24 | 23 | 22 | 21 | 47 | 45 | 43 | 42 | 40 |
| 74899 | A5272 | 3626 | LA | 28 | 27 | 25 | 24 | 23 | 36 | 35 | 33 | 32 | 30 |
| 16526 | A53 | 1989 | LA | 26 | 25 | 23 | 22 | 21 | 28 | 26 | 25 | 24 | 23 |
| 74902 | A53 | 2099 | LA | 26 | 25 | 24 | 23 | 21 | 38 | 36 | 34 | 32 | 30 |
| 99212 | A53 | 1232 | LA | 25 | 24 | 23 | 21 | 20 | 24 | 23 | 22 | 21 | 20 |
| 16527 | A53 | 1773 | LA | 21 | 21 | 20 | 19 | 18 | 22 | 21 | 20 | 19 | 18 |
| 38088 | A53 | 757 | LA | 20 | 19 | 18 | 17 | 16 | 32 | 31 | 29 | 27 | 26 |
| 28732 | A53 | 545 | LA | 35 | 34 | 32 | 30 | 28 | 56 | 52 | 49 | 46 | 43 |
| 6545 | A53 | 643 | LA | 25 | 24 | 23 | 22 | 20 | 53 | 50 | 47 | 44 | 41 |
| 74058 | A53 | 492 | LA | 44 | 42 | 40 | 38 | 36 | 51 | 48 | 45 | 42 | 39 |
| 26555 | A53 | 588 | LA | 45 | 43 | 41 | 38 | 36 | 46 | 43 | 41 | 38 | 36 |
| 46563 | A53 | 1563 | LA | 36 | 35 | 33 | 31 | 29 | 47 | 45 | 42 | 40 | 38 |
| 75283 | A53 | 272 | LA | 27 | 26 | 24 | 23 | 22 | 36 | 34 | 32 | 30 | 28 |
| 75282 | A53 | 218 | LA | 27 | 25 | 24 | 23 | 21 | 41 | 39 | 37 | 34 | 32 |

**Table 8: $NO_2$ annual mean concentrations 2018 baseline year, 2022 future baseline year – Comparison of PCM vs local model results by road name (µg.m$^{-3}$)**

| Road Name | Managed by | PCM baseline $NO_2$ concentrations (µg.m$^{-3}$) | | | | | | Local baseline $NO_2$ concentrations (µg.m$^{-3}$) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2018 | 2019 | 2020 | 2021 | 2022 | | 2018 | 2019 | 2020 | 2021 | 2022 |
| A34 | HWE | 31 | 30 | 28 | 26 | 25 | | 40 | 38 | 36 | 34 | 32 |
| A50 | HWE/LA | 49 | 46 | 43 | 40 | 37 | | 59 | 56 | 53 | 50 | 47 |
| A500 | HWE | 50 | 47 | 45 | 42 | 40 | | 64 | 61 | 58 | 56 | 53 |
| A5005 | LA | 16 | 15 | 14 | 14 | 13 | | 22 | 21 | 20 | 19 | 18 |
| A5007 | LA | 29 | 28 | 27 | 25 | 24 | | 45 | 42 | 40 | 38 | 37 |
| A5006 | LA | 29 | 28 | 27 | 26 | 24 | | 44 | 42 | 40 | 39 | 39 |
| A5008 | LA | 31 | 30 | 28 | 27 | 25 | | 53 | 50 | 48 | 45 | 42 |
| A5009 | LA | 23 | 22 | 21 | 20 | 19 | | 44 | 41 | 39 | 37 | 35 |
| A5010 | LA | 30 | 29 | 28 | 26 | 25 | | 42 | 40 | 39 | 38 | 37 |
| A5011 | LA | 18 | 18 | 17 | 16 | 15 | | 23 | 22 | 21 | 20 | 19 |
| A5035 | LA | 21 | 20 | 19 | 18 | 17 | | 35 | 33 | 32 | 30 | 28 |
| A519 | LA | 22 | 21 | 20 | 19 | 18 | | 33 | 31 | 30 | 28 | 27 |
| A52 | LA | 35 | 34 | 32 | 30 | 28 | | 51 | 48 | 45 | 42 | 40 |
| A520 | LA | 24 | 23 | 22 | 20 | 19 | | 40 | 38 | 36 | 34 | 33 |
| A525 | LA | 23 | 22 | 21 | 20 | 18 | | 40 | 39 | 37 | 35 | 33 |
| A527 | LA | 29 | 28 | 27 | 25 | 24 | | 38 | 36 | 35 | 33 | 32 |
| A5271 | LA | 25 | 24 | 23 | 22 | 21 | | 48 | 46 | 44 | 42 | 41 |
| A5272 | LA | 28 | 27 | 25 | 24 | 23 | | 47 | 45 | 43 | 42 | 40 |
| A53 | LA | 45 | 43 | 41 | 38 | 36 | | 56 | 52 | 49 | 46 | 43 |

**Figure 3-1: Local modelled $NO_2$ annual mean concentrations, 2018 base year, ug.m$^{-3}$ – PCM links**

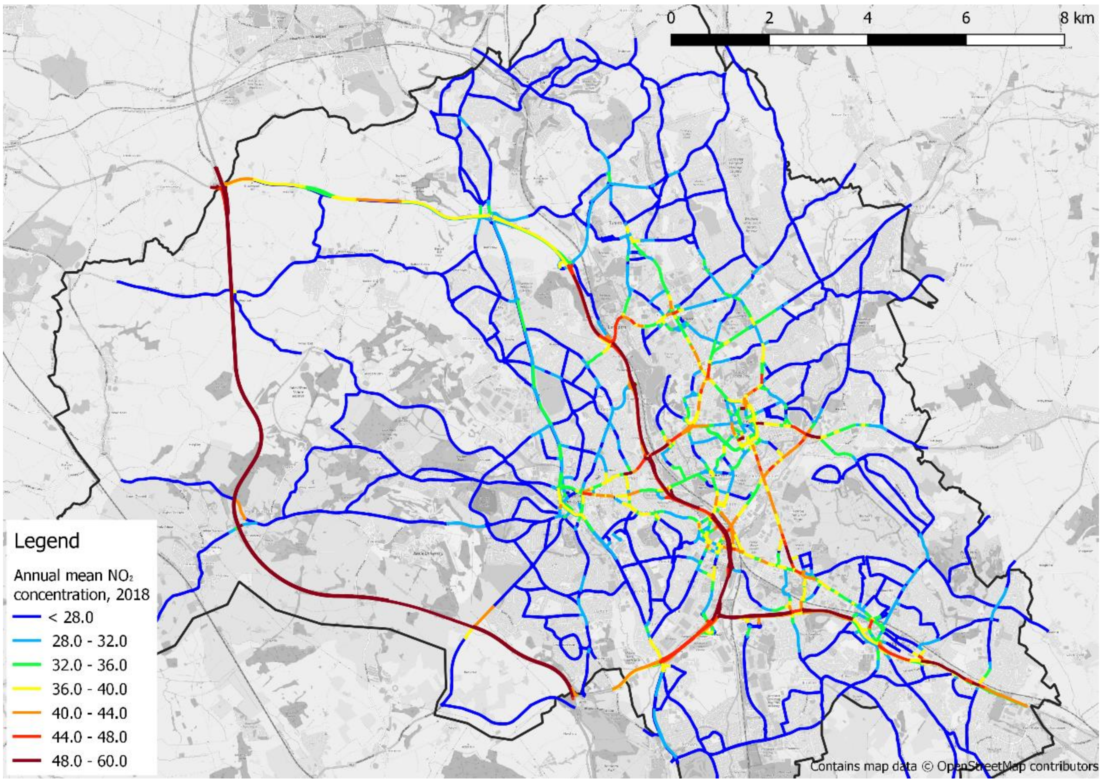
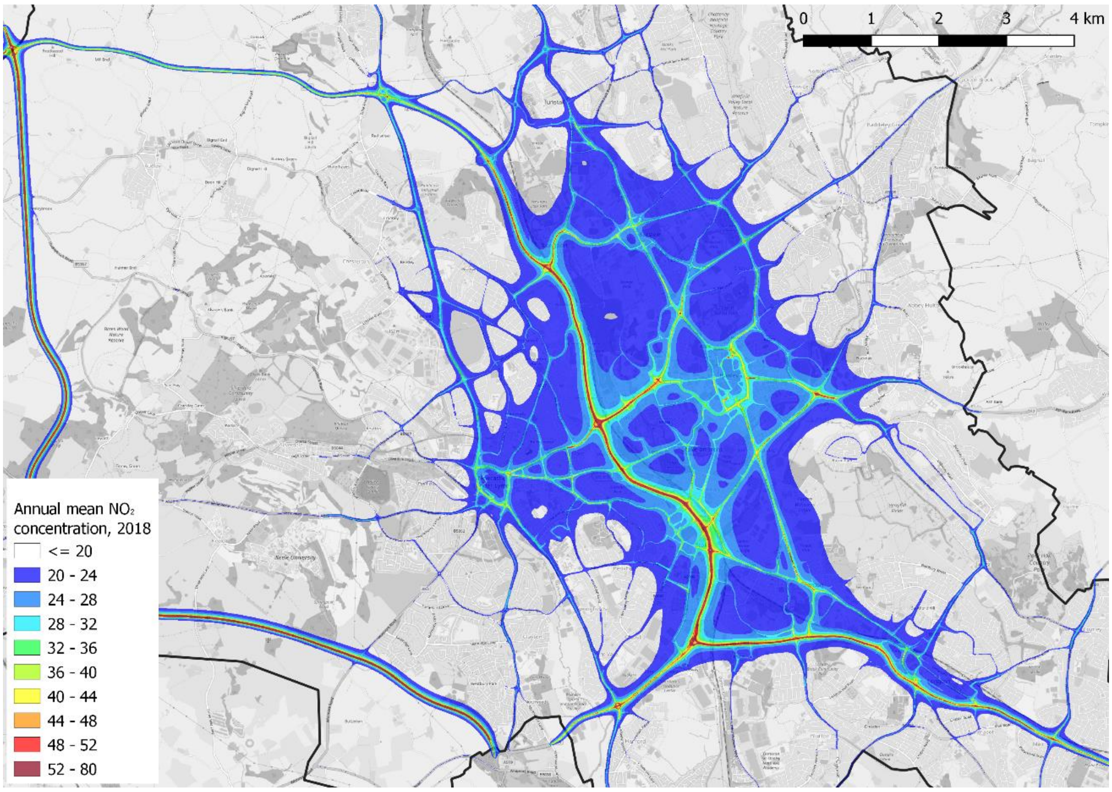



**Figure 3-2: Annual mean $NO_2$ concentrations, 2018, µg.m$^{-3}$, model domain**




Contains map data © OpenStreetMap contributors

**Figure 3-3: Local modelled $NO_2$ annual mean concentrations, 2022 baseline year, ug.m$^{-3}$ – PCM links**

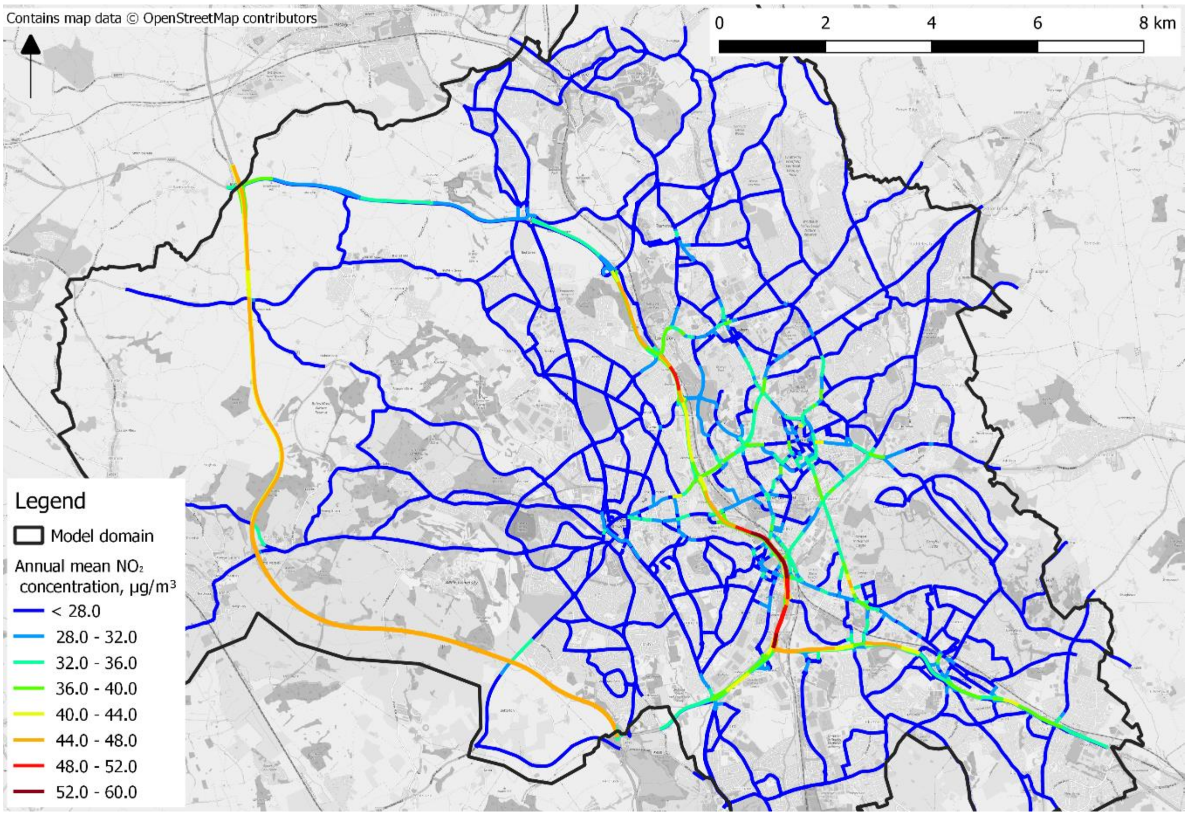



**Figure 3-4: Annual mean $NO_2$ concentrations, 2022, µg.m$^{-3}$, study domain**

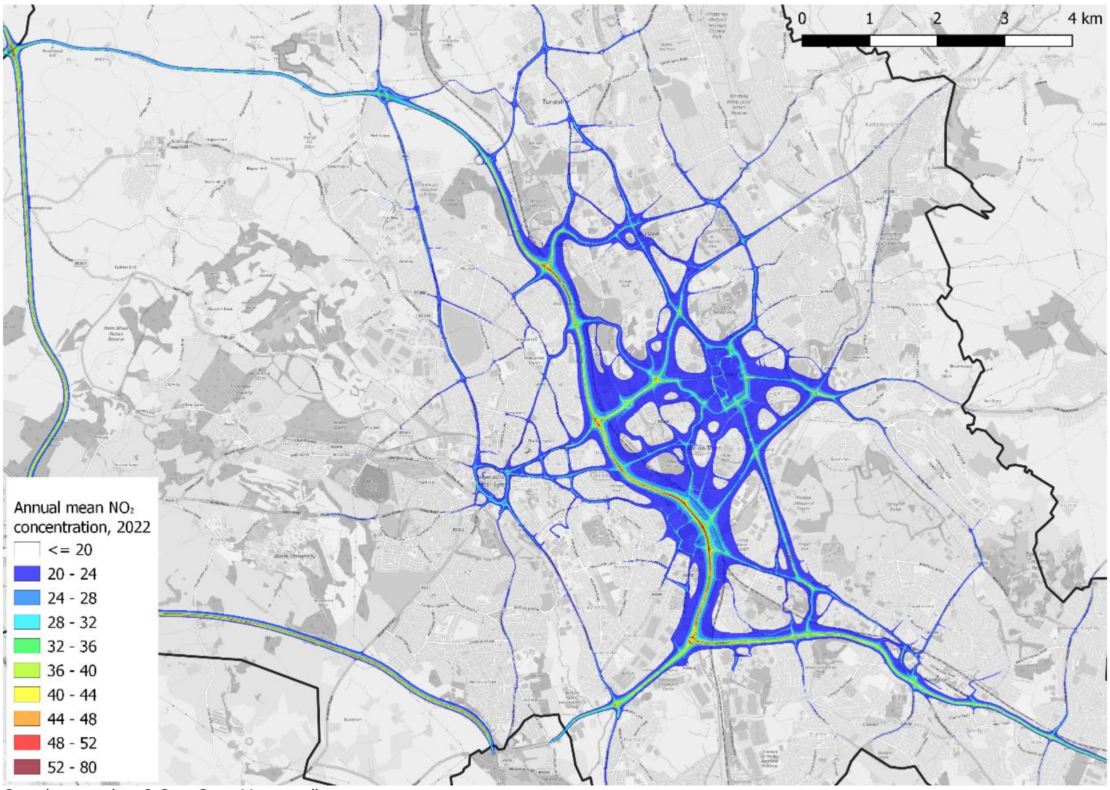



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**Figure 3-5: Annual mean $NO_2$ concentrations, 2022, $\mu g.m^{-3}$, centre of model domain**

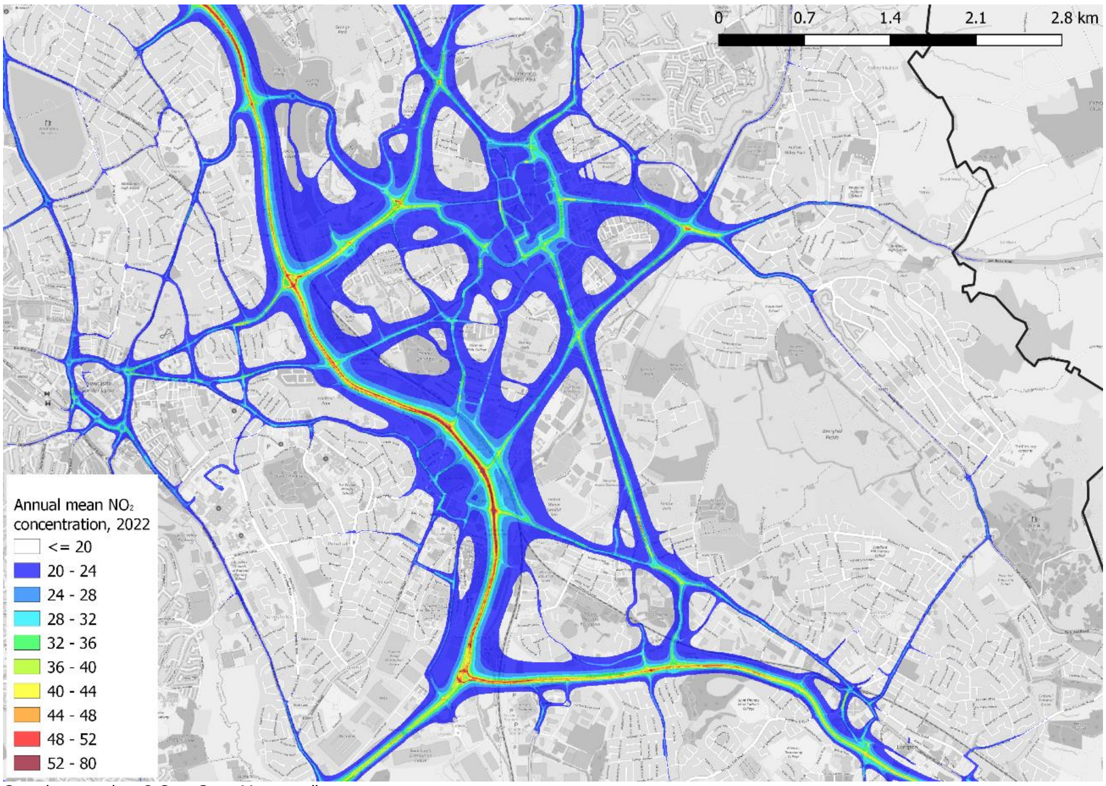


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**Figure 3-6 Annual mean $NO_2$ concentrations, 2022, $\mu g.m^{-3}$, Hanley**

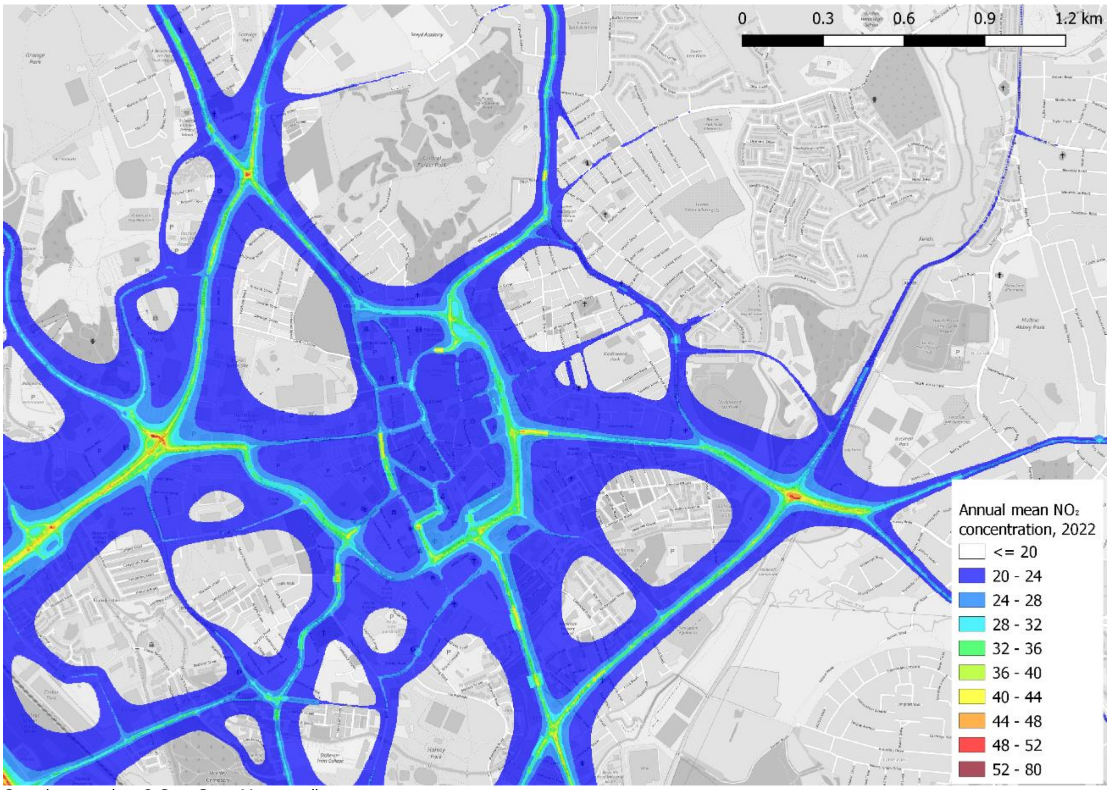


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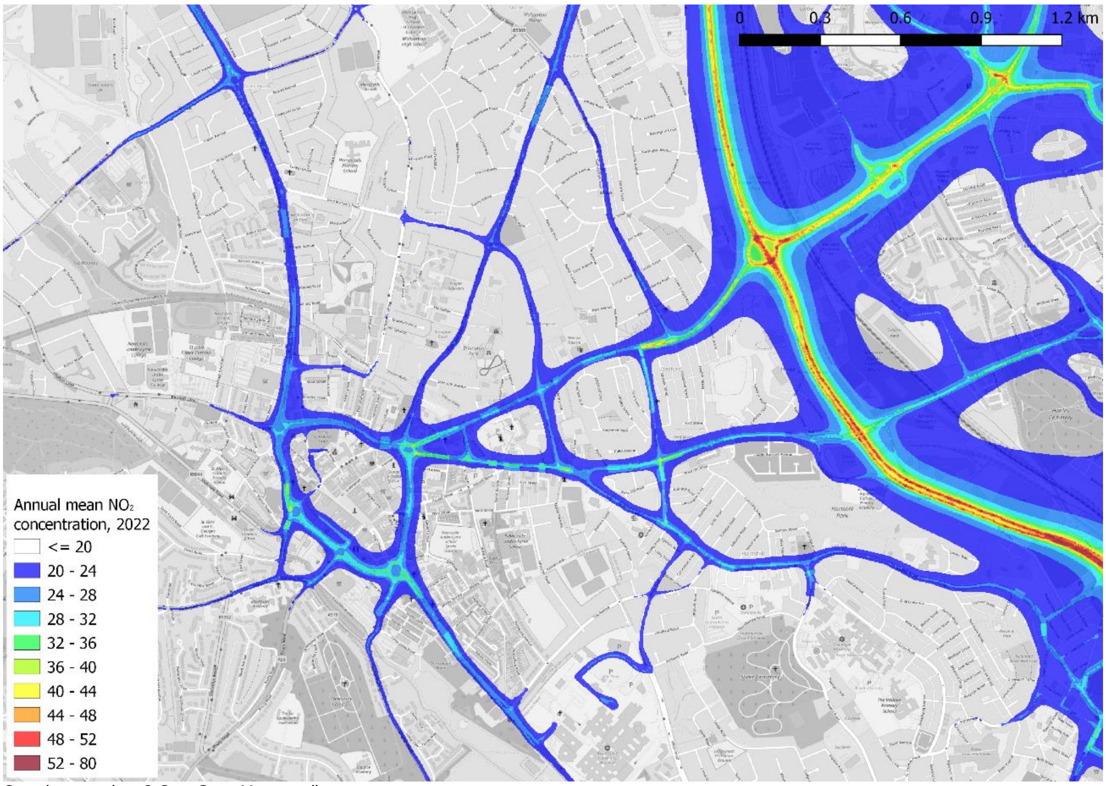
**Figure 3-7: Annual mean $NO_2$ concentrations, 2022, µg.m$^{-3}$, Newcastle-under-Lyme**



## 3.2 Results for AQMAs and local exceedances

Diffusion tubes have been sited to capture the ‘worst case’ exceedance locations on local roads in order to determine Air Quality Management Areas (AQMAs). As such, results at these locations provide a good indication of local air quality and potential exceedances in relation to the local air quality management regime. Annual mean $NO_2$ concentrations measured in 2018 and predicted annual mean $NO_2$ concentrations at each of these diffusion tube monitoring sites in 2022 are presented in Table 9.

The results indicate that in 2022, compliance with the 40 $\mu g.m^{-3}$ $NO_2$ annual mean objective will be achieved at the majority of current monitoring locations, with the exception of Stoke-on-Trent site DT34, located on Victoria Road.

**Table 9: Predicted $NO_2$ annual mean concentrations at monitoring site locations in 2022**

| Council | Monitoring site ID | Monitoring type | Site type | $NO_2$ annual mean ($\mu g.m^{-3}$) | | |
|---|---|---|---|---|---|---|
| | | | | Measured 2018 | Modelled 2018 | Modelled 2022 |
| Newcastle-under-Lyme | CM1 | Automatic | Roadside | 23.1 | 27.8 | 21.6 |
| | DTK1 | Diffusion tube | Kerbside | 41.7 | 40.4 | 32.6 |
| | DTK2 | Diffusion tube | Urban Centre | 29.7 | 29.6 | 23.0 |
| | DTUB1 | Diffusion tube | Kerbside | 19.0 | 20.3 | 16.5 |
| | DT3 | Diffusion tube | Rural | 30.7 | 36.8 | 28.9 |
| | DT6 | Diffusion tube | Suburban | 37.7 | 26.5 | 22.2 |
| | DT9 | Diffusion tube | Suburban | 33.4 | 30.0 | 24.6 |
| | DT24 | Diffusion tube | Roadside | 35.3 | 31.6 | 26.6 |
| | DT28 | Diffusion tube | Rural | 29.9 | 26.7 | 21.0 |
| | DT34 | Diffusion tube | Urban Centre | 32.1 | 31.1 | 24.4 |
| | DT40 | Diffusion tube | Suburban | 28.3 | 24.0 | 19.5 |
| | DT46 | Diffusion tube | Urban Centre | 30.1 | 34.0 | 27.7 |
| | DT47 | Diffusion tube | Urban Centre | 25.8 | 31.6 | 25.6 |
| | DT49 | Diffusion tube | Urban Centre | 31.5 | 32.3 | 26.8 |
| | DT64 | Diffusion tube | Urban Centre | 35.9 | 24.7 | 20.4 |
| | DT73 | Diffusion tube | Roadside | 32.0 | 34.4 | 27.6 |
| | DT74 | Diffusion tube | Roadside | 33.0 | 29.7 | 24.1 |
| | DT76 | Diffusion tube | Roadside | 36.5 | 29.3 | 23.0 |
| | DT84 | Diffusion tube | Roadside | 35.1 | 34.0 | 26.2 |
| | DT85 | Diffusion tube | Urban Centre | 40.0 | 36.9 | 28.5 |
| | DT86 | Diffusion tube | Urban Centre | 29.7 | 29.6 | 23.2 |
| | DT87 | Diffusion tube | Urban Centre | 37.9 | 39.5 | 30.6 |
| | DT88 | Diffusion tube | Urban Centre | 29.9 | 28.2 | 22.5 |
| | DT89 | Diffusion tube | Urban Centre | 30.4 | 30.1 | 23.3 |
| | DT90 | Diffusion tube | Urban Centre | 30.0 | 30.1 | 23.3 |
| | DT91 | Diffusion tube | Urban Centre | 30.3 | 30.1 | 23.3 |
| | DT92 | Diffusion tube | Urban Centre | 33.5 | 23.7 | 19.5 |
| | DT93 | Diffusion tube | Urban Centre | 30.4 | 24.3 | 20.5 |
| | DT94 | Diffusion tube | Urban Centre | 32.1 | 25.9 | 21.8 |
| | DT95 | Diffusion tube | Urban Centre | 34.3 | 27.7 | 22.7 |
| | DT97 | Diffusion tube | Roadside | 28.6 | 30.1 | 24.0 |
| | DT98 | Diffusion tube | Roadside | 37.7 | 30.3 | 23.9 |
| | DT100 | Diffusion tube | Roadside | 30.0 | 31.2 | 23.7 |
| | DT101 | Diffusion tube | Roadside | 33.0 | 35.1 | 27.4 |
| | DT103 | Diffusion tube | Roadside | 24.1 | 27.8 | 22.7 |

| Council | Monitoring site ID | Monitoring type | Site type | $NO_2$ annual mean (µg.m$^{-3}$) | | |
|---|---|---|---|---|---|---|
| | | | | Measured 2018 | Modelled 2018 | Modelled 2022 |
| | DT104 | Diffusion tube | Roadside | 38.2 | 37.4 | 29.1 |
| | DT105 | Diffusion tube | Roadside | 27.2 | 20.4 | 16.7 |
| Stoke-on-Trent | CM1 | Automatic | Urban Background | 23.0 | 30.4 | 24.5 |
| | CM2 | Automatic | Roadside | 33.0 | 36.1 | 31.1 |
| | CM5 | Automatic | Roadside | 55.0 | 42.6 | 32.8 |
| | CM6 | Automatic | Roadside | 53.0 | 46.3 | 35.8 |
| | DT1 | Diffusion tube | Urban Background | 18.3 | 18.2 | 14.8 |
| | DT2 | Diffusion tube | Roadside | 39.1 | 33.4 | 26.7 |
| | DT4 | Diffusion tube | Roadside | 31.9 | 32.9 | 25.8 |
| | DT8 | Diffusion tube | Roadside | 29.0 | 30.4 | 24.5 |
| | DT9 | Diffusion tube | Roadside | 44.8 | 39.1 | 33.5 |
| | DT10 | Diffusion tube | Roadside | 34.9 | 35.7 | 29.2 |
| | DT13 | Diffusion tube | Roadside | 35.2 | 37.0 | 28.8 |
| | DT14 | Diffusion tube | Roadside | 37.4 | 36.2 | 28.2 |
| | DT15 | Diffusion tube | Roadside | 38.1 | 39.3 | 32.6 |
| | DT16 | Diffusion tube | Roadside | 49.4 | 47.4 | 36.4 |
| | DT20 | Diffusion tube | Roadside | 35.4 | 39.7 | 32.3 |
| | DT24 | Diffusion tube | Roadside | 41.6 | 36.7 | 31.2 |
| | DT29 | Diffusion tube | Roadside | 38.4 | 31.6 | 26.0 |
| | DT32 | Diffusion tube | Roadside | 34.4 | 37.7 | 32.7 |
| | DT34 | Diffusion tube | Roadside | 46.3 | 50.8 | **41.9** |
| | DT37 | Diffusion tube | Roadside | 41.9 | 33.3 | 28.2 |
| | DT40 | Diffusion tube | Roadside | 38.7 | 30.1 | 23.8 |
| | DT41 | Diffusion tube | Roadside | 36.7 | 29.7 | 23.4 |
| | DT42 | Diffusion tube | Roadside | 34.3 | 30.3 | 24.1 |
| | DT49 | Diffusion tube | Roadside | 37.7 | 39.9 | 33.9 |
| | DT51 | Diffusion tube | Roadside | 38.8 | 36.2 | 28.7 |
| | DT52 | Diffusion tube | Roadside | 47.9 | 35.4 | 27.6 |
| | DT53 | Diffusion tube | Roadside | 32.2 | 31.8 | 24.8 |
| | DT55 | Diffusion tube | Roadside | 34.6 | 33.4 | 27.2 |
| | DT56 | Diffusion tube | Roadside | 49.5 | 42.6 | 32.8 |
| | DT61 | Diffusion tube | Roadside | 35.0 | 27.0 | 22.2 |
| | DT63 | Diffusion tube | Roadside | 51.1 | 39.5 | 30.5 |
| | DT64 | Diffusion tube | Roadside | 36.5 | 34.3 | 26.8 |
| | DT65 | Diffusion tube | Roadside | 36.8 | 33.5 | 26.2 |
| | DT66 | Diffusion tube | Roadside | 29.9 | 27.0 | 21.5 |
| | DT67 | Diffusion tube | Roadside | 48.6 | 38.7 | 31.6 |
| | DT72 | Diffusion tube | Roadside | 35.0 | 33.4 | 26.7 |
| | DT73 | Diffusion tube | Roadside | 31.7 | 34.5 | 27.1 |
| | DT74 | Diffusion tube | Roadside | 43.6 | 31.3 | 26.5 |
| | DT75 | Diffusion tube | Roadside | 37.6 | 34.4 | 28.0 |
| | DT76 | Diffusion tube | Roadside | 36.9 | 36.7 | 29.8 |
| | DT77 | Diffusion tube | Roadside | 47.7 | 39.3 | 31.6 |
| | DT78 | Diffusion tube | Roadside | 38.4 | 38.1 | 30.5 |
| | DT79 | Diffusion tube | Roadside | 37.8 | 36.8 | 29.5 |
| | DT80 | Diffusion tube | Roadside | 31.8 | 30.5 | 24.8 |
| | DT81 | Diffusion tube | Roadside | 34.0 | 33.7 | 27.2 |
| | DT82 | Diffusion tube | Roadside | 33.2 | 34.6 | 27.6 |

| Council | Monitoring site ID | Monitoring type | Site type | $NO_2$ annual mean (µg.m$^{-3}$) | | |
|---|---|---|---|---|---|---|
| | | | | Measured 2018 | Modelled 2018 | Modelled 2022 |
| | DT83 | Diffusion tube | Roadside | 36.6 | 24.0 | 19.7 |
| | DT84 | Diffusion tube | Roadside | 36.4 | 38.1 | 31.1 |
| | DT85 | Diffusion tube | Roadside | 36.6 | 38.1 | 30.9 |
| | DT86 | Diffusion tube | Roadside | 35.6 | 38.6 | 31.2 |
| | DT88 | Diffusion tube | Roadside | 30.4 | 30.1 | 25.2 |
| | DT89 | Diffusion tube | Roadside | 36.9 | 33.7 | 27.8 |
| | DT91 | Diffusion tube | Roadside | 43.4 | 38.1 | 32.9 |
| | DT92 | Diffusion tube | Roadside | 31.7 | 34.8 | 29.9 |
| | DT93 | Diffusion tube | Roadside | 29.6 | 32.3 | 27.8 |
| | DT94 | Diffusion tube | Roadside | 31.3 | 32.9 | 28.1 |
| | DT95 | Diffusion tube | Roadside | 30.7 | 31.5 | 26.7 |
| | DT97 | Diffusion tube | Roadside | 29.8 | 32.2 | 24.6 |
| | DT99 | Diffusion tube | Roadside | 48.6 | 48.7 | 38.5 |
| | DT100 | Diffusion tube | Roadside | 44.8 | 49.8 | 39.4 |
| | DT101 | Diffusion tube | Roadside | 30.1 | 35.7 | 27.2 |
| | DT102 | Diffusion tube | Roadside | 33.0 | 30.2 | 23.3 |
| | DT103 | Diffusion tube | Roadside | 30.9 | 35.7 | 29.5 |
| | DT104 | Diffusion tube | Roadside | 42.4 | 36.1 | 28.4 |
| | DT105 | Diffusion tube | Roadside | 34.2 | 40.0 | 30.8 |
| | DT106 | Diffusion tube | Roadside | 33.0 | 40.1 | 30.8 |

# 4 Option testing results

Each of the option model runs has been carried out using the assumptions set out in Section 1. The results have been extracted in the same way as for the baseline and are shown in the sections below.

## 4.1 Comparison with PCM

A summary of the modelled annual mean $NO_2$ results for each of the options is shown in Table 10 with details provided in Table 11; the predicted success of each option in delivering the primary objective of producing compliance by 2022 is also given.

**Table 10: Summary comparison of modelled $NO_2$ concentrations for PCM links for the options in 2022**

| Option | Links > 40 µg.m$^{-3}$ | Links > 35 and <= 40 µg.m$^{-3}$ | Local Authority links > 40 µg.m$^{-3}$ | Local authority links > 35 and <= 40 µg.m$^{-3}$ | Average change in $NO_2$ (%) | Delivers compliance |
|---|---|---|---|---|---|---|
| 2022 Reference Case | 12 | 23 | 4 | 16 | N/A | N/A |
| Benchmark CAZ D | 8 | 12 | 0 | 5 | -7.9% | ✓ |
| Option 2 | 10 | 23 | 2 | 16 | -1.1% | X |
| Option 3 | 8 | 22 | 0 | 15 | -2.7% | ✓ |
| Option 4 (Preferred Option) | 8 | 25 | 0 | 18 | -1.3% | ✓ |
| Option 5 (CAZ C) | 10 | 19 | 2 | 12 | -3.0% | X |
| Option 6 | 8 | 25 | 0 | 18 | -1.8% | ✓ |

The impact of each option can be summarised as follows:

**Benchmark Class D Charging CAZ scheme (Option 1)**: The scheme was included to provide a benchmark charging access restriction scheme against which the traffic management options could be assessed. The results show that the Class D Charging scheme would match the Preferred Option in removing links which exceed the $NO_2$ limit, and would reduce average $NO_2$ concentrations along links by 7.9%. However, it is unlikely that this scheme could be delivered by 2022, as discussed in the Strategic Case.

**Option 2 (High impact without charging CAZ scheme)**: This scheme is not predicted to deliver compliance along Victoria Road (A50) and Bucknall New Road (A5008). This option also produces the smallest average reduction in $NO_2$ concentrations along links.

**Option 3 (High impact including local Class D Charging CAZ scheme around Victoria Road)**: The combination of bus retrofits along affected routes, and a local class D charging CAZ around the Victoria Road area, delivers compliance and leads to an average reduction in $NO_2$ concentrations of 2.7%.

**Option 4 (Preferred Option)**: This combination of bus retrofit and traffic management schemes (with wider measures to improve accessibility of public transport) has been specifically designed to limit traffic levels along affected stretches of the A500, A5009, and A53 in order to solve the exceedance problem. This option delivers compliance, and leads to an average reduction in $NO_2$ concentrations of 1.3% along road links. The number of Strategic Road Network links predicted to exceed the Objective also decreases, showing that the scheme does not move compliance issues elsewhere.

**Option 5 (Class C Charging CAZ scheme)**: Although this option leads to a greater overall reduction in $NO_2$ concentrations along road links (3%), it does not deliver compliance along Victoria Road (A500).

Furthermore, rerouting of traffic to avoid the CAZ in this scheme leads to concentrations increasing to exceed the objective along Porthill Road (the A5271).

**Option 6**: This option adds complementary measures to the package of measures identified in Option 4. This option leads to a slightly larger average reduction in $NO_2$ concentrations of 1.8% along road links.

Table 11 presents the full $NO_2$ annual mean concentration results for each option in 2022. The mapped results for the PCM links are shown in Figure 12 to Figure 17.

**Table 11: $NO_2$ annual mean concentration results for each option in 2022 ($\mu g.m^{-3}$)**

| Census ID | Road Name | Road management description | X | Y | Reference Case | Benchmark CAZ D | Option 2 | Option 3 | Option 4 | Option 5 | Option 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 16325 | A34 | West Midlands | 383844 | 349709 | 26 | 26 | 26 | 27 | 27 | 26 | 27 |
| 16501 | A50 | The Potteries | 389274 | 344897 | 46 | 36 | 40 | 35 | 39 | 41 | 39 |
| 16526 | A53 | The Potteries | 389961 | 350538 | 23 | 22 | 23 | 23 | 23 | 22 | 23 |
| 16527 | A53 | The Potteries | 384291 | 345021 | 18 | 17 | 18 | 18 | 18 | 17 | 18 |
| 17648 | A5006 | The Potteries | 387782 | 345975 | 37 | 36 | 37 | 37 | 37 | 37 | 37 |
| 17860 | A52 | The Potteries | 384968 | 346229 | 28 | 24 | 28 | 28 | 28 | 27 | 28 |
| 17975 | A34 | The Potteries | 384967 | 345747 | 31 | 30 | 31 | 30 | 31 | 31 | 30 |
| 18131 | A500 | Highways England | 386684 | 342780 | 40 | 38 | 40 | 40 | 40 | 39 | 40 |
| 18132 | A52 | The Potteries | 387596 | 345087 | 31 | 29 | 31 | 31 | 32 | 31 | 31 |
| 18584 | A52 | The Potteries | 390780 | 347578 | 28 | 24 | 29 | 27 | 28 | 26 | 28 |
| 26355 | A34 | The Potteries | 384606 | 346067 | 31 | 30 | 31 | 31 | 32 | 31 | 31 |
| 26531 | A50 | The Potteries | 386877 | 349962 | 35 | 34 | 35 | 35 | 35 | 35 | 35 |
| 26546 | A52 | The Potteries | 391734 | 347229 | 21 | 19 | 21 | 21 | 21 | 20 | 21 |
| 26555 | A53 | The Potteries | 386899 | 347280 | 36 | 29 | 36 | 36 | 36 | 33 | 36 |
| 27739 | A52 | The Potteries | 388002 | 345419 | 38 | 34 | 38 | 38 | 38 | 37 | 38 |
| 28176 | A52 | The Potteries | 387441 | 345546 | 30 | 28 | 29 | 30 | 30 | 29 | 29 |
| 28732 | A53 | The Potteries | 386020 | 346599 | 43 | 33 | 42 | 40 | 39 | 40 | 39 |
| 36360 | A34 | The Potteries | 386659 | 342825 | 32 | 31 | 32 | 32 | 33 | 32 | 32 |
| 36543 | A50 | The Potteries | 388688 | 346674 | 38 | 32 | 36 | 33 | 36 | 36 | 36 |
| 36560 | A52 | The Potteries | 388887 | 346690 | 37 | 29 | 36 | 35 | 37 | 34 | 36 |
| 38088 | A53 | The Potteries | 384726 | 345706 | 26 | 25 | 26 | 26 | 26 | 26 | 26 |
| 38230 | A500 | Highways England | 386534 | 346672 | 44 | 43 | 44 | 44 | 44 | 44 | 44 |
| 38231 | A52 | The Potteries | 389669 | 347372 | 40 | 32 | 39 | 37 | 38 | 36 | 38 |
| 38303 | A527 | The Potteries | 385085 | 346011 | 28 | 26 | 28 | 27 | 27 | 27 | 27 |
| 38521 | A52 | The Potteries | 387441 | 345531 | 33 | 30 | 32 | 32 | 32 | 32 | 32 |
| 46538 | A50 | The Potteries | 385136 | 353707 | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| 46553 | A5008 | The Potteries | 388625 | 347613 | 42 | 31 | 41 | 37 | 39 | 35 | 39 |
| 46563 | A53 | The Potteries | 387629 | 348614 | 38 | 32 | 38 | 38 | 38 | 36 | 38 |
| 47243 | A500 | Highways England | 386235 | 347494 | 43 | 44 | 43 | 43 | 43 | 45 | 43 |

| Census ID | Road Name | Road management description | X | Y | Reference Case | Benchmark CAZ D | Option 2 | Option 3 | Option 4 | Option 5 | Option 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 47268 | A519 | The Potteries | 385007 | 345655 | 27 | 26 | 27 | 27 | 27 | 27 | 27 |
| 47276 | A527 | The Potteries | 385635 | 349171 | 32 | 31 | 32 | 32 | 32 | 32 | 32 |
| 47735 | A5009 | The Potteries | 389643 | 347400 | 35 | 29 | 34 | 32 | 34 | 32 | 34 |
| 47740 | A5035 | The Potteries | 388797 | 341183 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| 48067 | A34 | The Potteries | 384771 | 345867 | 29 | 28 | 29 | 29 | 29 | 29 | 29 |
| 48214 | A5006 | The Potteries | 387722 | 344492 | 32 | 30 | 32 | 31 | 32 | 31 | 32 |
| 48287 | A525 | The Potteries | 384624 | 345910 | 33 | 33 | 34 | 33 | 34 | 33 | 33 |
| 48504 | A52 | The Potteries | 387999 | 345083 | 33 | 30 | 32 | 32 | 32 | 31 | 32 |
| 48668 | A50 | The Potteries | 387396 | 348963 | 35 | 31 | 35 | 35 | 35 | 34 | 35 |
| 56306 | A5007 | The Potteries | 390946 | 343600 | 29 | 28 | 27 | 27 | 27 | 28 | 27 |
| 56326 | A34 | The Potteries | 386659 | 341254 | 25 | 24 | 25 | 25 | 25 | 25 | 25 |
| 56360 | A34 | The Potteries | 384618 | 346990 | 26 | 25 | 26 | 26 | 26 | 26 | 26 |
| 56539 | A5007 | The Potteries | 389723 | 344462 | 34 | 30 | 32 | 30 | 32 | 32 | 31 |
| 56996 | A52 | The Potteries | 388107 | 345064 | 38 | 34 | 37 | 36 | 37 | 36 | 37 |
| 57470 | A52 | The Potteries | 387933 | 345300 | 32 | 29 | 32 | 32 | 32 | 31 | 32 |
| 57472 | A52 | The Potteries | 387614 | 345090 | 33 | 31 | 33 | 33 | 34 | 33 | 34 |
| 57606 | A52 | The Potteries | 387916 | 345417 | 39 | 36 | 40 | 39 | 39 | 38 | 39 |
| 57783 | A500 | Highways England | 387869 | 343963 | 53 | 49 | 53 | 53 | 54 | 52 | 53 |
| 60017 | A50 | The Potteries | 385614 | 352712 | 28 | 27 | 28 | 27 | 28 | 27 | 28 |
| 60022 | A5008 | The Potteries | 388371 | 347160 | 32 | 27 | 30 | 29 | 30 | 29 | 30 |
| 60023 | A50 | The Potteries | 388587 | 347648 | 32 | 27 | 32 | 31 | 32 | 30 | 32 |
| 60024 | A50 | The Potteries | 388408 | 348016 | 32 | 27 | 31 | 31 | 31 | 30 | 31 |
| 60026 | A50 | Highways England | 388656 | 343695 | 45 | 44 | 46 | 45 | 46 | 45 | 46 |
| 60026 | A50 | The Potteries | 389529 | 343854 | 34 | 31 | 34 | 31 | 33 | 33 | 33 |
| 6352 | A34 | The Potteries | 382796 | 354472 | 21 | 20 | 21 | 21 | 21 | 21 | 21 |
| 6353 | A34 | The Potteries | 385548 | 345115 | 24 | 24 | 24 | 24 | 24 | 25 | 24 |
| 6522 | A50 | The Potteries | 387428 | 348883 | 35 | 31 | 35 | 34 | 35 | 33 | 34 |
| 6536 | A52 | The Potteries | 386239 | 345776 | 30 | 26 | 29 | 29 | 29 | 29 | 29 |
| 6545 | A53 | The Potteries | 385966 | 346586 | 41 | 32 | 40 | 38 | 37 | 38 | 37 |
| 70276 | A52 | The Potteries | 388191 | 345297 | 33 | 31 | 32 | 34 | 32 | 32 | 32 |

| Census ID | Road Name | Road management description | X | Y | Reference Case | Benchmark CAZ D | Option 2 | Option 3 | Option 4 | Option 5 | Option 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 70277 | A5007 | The Potteries | 388755 | 344799 | 34 | 32 | 31 | 34 | 31 | 33 | 31 |
| 70279 | A5005 | The Potteries | 390915 | 343478 | 37 | 35 | 33 | 33 | 33 | 35 | 33 |
| 70280 | A5007 | The Potteries | 391177 | 343365 | 22 | 22 | 21 | 21 | 21 | 22 | 21 |
| 73257 | A5011 | The Potteries | 382538 | 353855 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| 73258 | A34 | The Potteries | 382682 | 354204 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| 74058 | A53 | The Potteries | 386515 | 347007 | 39 | 31 | 39 | 38 | 38 | 35 | 38 |
| 74060 | A527 | The Potteries | 387084 | 352775 | 23 | 22 | 23 | 23 | 23 | 23 | 23 |
| 74065 | A34 | The Potteries | 385219 | 345513 | 29 | 29 | 29 | 29 | 29 | 30 | 29 |
| 74261 | A50 | The Potteries | 389336 | 344732 | 39 | 31 | 35 | 31 | 34 | 36 | 34 |
| 74585 | A50 | Highways England | 390684 | 343400 | 27 | 27 | 27 | 26 | 27 | 27 | 27 |
| 74586 | A50 | Highways England | 390651 | 343553 | 32 | 30 | 31 | 30 | 31 | 31 | 31 |
| 74894 | A520 | The Potteries | 393513 | 343914 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| 74895 | A5272 | The Potteries | 390067 | 347134 | 27 | 24 | 26 | 25 | 26 | 25 | 26 |
| 74896 | A5271 | The Potteries | 385711 | 349345 | 40 | 40 | 40 | 40 | 40 | 41 | 40 |
| 74897 | A5271 | The Potteries | 386262 | 351089 | 29 | 29 | 29 | 29 | 29 | 29 | 29 |
| 74898 | A5272 | The Potteries | 388718 | 348571 | 40 | 37 | 39 | 38 | 39 | 39 | 39 |
| 74899 | A5272 | The Potteries | 388544 | 349652 | 30 | 28 | 30 | 30 | 30 | 30 | 30 |
| 74900 | A5035 | The Potteries | 391079 | 342954 | 28 | 28 | 28 | 28 | 28 | 28 | 28 |
| 74902 | A53 | The Potteries | 387970 | 349235 | 30 | 29 | 31 | 30 | 30 | 30 | 30 |
| 74903 | A5008 | The Potteries | 389595 | 347400 | 35 | 29 | 34 | 32 | 34 | 32 | 34 |
| 75282 | A53 | The Potteries | 385105 | 346223 | 32 | 27 | 32 | 31 | 32 | 30 | 31 |
| 75283 | A53 | The Potteries | 385395 | 346346 | 27 | 23 | 28 | 26 | 26 | 26 | 26 |
| 75284 | A52 | The Potteries | 385117 | 346185 | 34 | 28 | 34 | 33 | 33 | 32 | 32 |
| 75418 | A500 | Highways England | 387748 | 343655 | 39 | 37 | 40 | 39 | 40 | 38 | 40 |
| 75420 | A500 | The Potteries | 387616 | 343545 | 30 | 29 | 30 | 30 | 30 | 30 | 30 |
| 75421 | A500 | Highways England | 387616 | 343503 | 38 | 37 | 39 | 38 | 39 | 38 | 39 |
| 75422 | A50 | Highways England | 391122 | 343069 | 39 | 37 | 38 | 37 | 38 | 38 | 38 |
| 75424 | A50 | Highways England | 391158 | 342998 | 31 | 30 | 31 | 30 | 31 | 31 | 31 |
| 75448 | A50 | The Potteries | 386654 | 350669 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |
| 77480 | A5005 | The Potteries | 391761 | 342203 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |

| Census ID | Road Name | Road management description | X | Y | Reference Case | Benchmark CAZ D | Option 2 | Option 3 | Option 4 | Option 5 | Option 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 77488 | A525 | The Potteries | 382853 | 345516 | 24 | 23 | 24 | 24 | 24 | 23 | 24 |
| 77490 | A34 | The Potteries | 382719 | 353663 | 24 | 23 | 24 | 24 | 24 | 24 | 24 |
| 77492 | A50 | The Potteries | 384221 | 354266 | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| 80721 | A5006 | The Potteries | 388077 | 347805 | 28 | 24 | 28 | 28 | 28 | 27 | 28 |
| 81250 | A527 | The Potteries | 386512 | 352448 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| 81251 | A527 | West Midlands | 386507 | 352331 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| 81252 | A5271 | The Potteries | 386129 | 351317 | 31 | 31 | 31 | 31 | 31 | 31 | 31 |
| 81253 | A527 | The Potteries | 385708 | 352470 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| 81448 | A5010 | The Potteries | 387351 | 347552 | 37 | 30 | 37 | 36 | 37 | 34 | 36 |
| 81449 | A5010 | The Potteries | 387640 | 347562 | 27 | 24 | 27 | 27 | 28 | 26 | 27 |
| 81450 | A5008 | The Potteries | 387964 | 347233 | 33 | 28 | 32 | 32 | 32 | 30 | 32 |
| 8147 | A500 | Highways England | 387442 | 345885 | 53 | 50 | 53 | 52 | 53 | 52 | 53 |
| 8148 | A52 | The Potteries | 387864 | 345072 | 27 | 25 | 26 | 27 | 27 | 26 | 27 |
| 82001 | A5006 | The Potteries | 388113 | 347549 | 38 | 34 | 38 | 37 | 38 | 36 | 37 |
| 8340 | A500 | Highways England | 388059 | 345097 | 53 | 48 | 52 | 52 | 53 | 51 | 52 |
| 8605 | A520 | The Potteries | 393354 | 342622 | 26 | 26 | 26 | 26 | 26 | 26 | 26 |
| 99026 | A52 | The Potteries | 388172 | 345666 | 34 | 29 | 34 | 35 | 34 | 33 | 34 |
| 99210 | A52 | The Potteries | 385399 | 346148 | 33 | 27 | 32 | 32 | 33 | 30 | 32 |
| 99212 | A53 | The Potteries | 391609 | 351969 | 20 | 19 | 20 | 19 | 20 | 19 | 20 |
| 99214 | A520 | The Potteries | 393130 | 342327 | 33 | 32 | 32 | 32 | 32 | 33 | 32 |
| 99215 | A50 | The Potteries | 386079 | 351324 | 31 | 31 | 31 | 31 | 31 | 31 | 31 |
| 99329 | A50 | Highways England | 388341 | 343682 | 47 | 46 | 48 | 47 | 48 | 47 | 48 |
| 99331 | A50 | Highways England | 389741 | 343803 | 46 | 43 | 45 | 44 | 45 | 45 | 45 |
| 99332 | NA | Highways England | 391059 | 343115 | 35 | 34 | 35 | 34 | 35 | 35 | 35 |
| 99333 | A50 | Highways England | 391600 | 342825 | 40 | 38 | 39 | 39 | 39 | 39 | 39 |
| 99335 | A50 | Highways England | 392363 | 342684 | 40 | 39 | 40 | 39 | 40 | 40 | 40 |
| 99337 | A50 | Highways England | 393206 | 342255 | 37 | 36 | 37 | 36 | 37 | 37 | 37 |
| 99407 | A5007 | The Potteries | 391954 | 342849 | 32 | 31 | 31 | 30 | 31 | 31 | 31 |

**Figure 4-1: Annual mean $NO_2$ concentrations, 2022, µg.m$^{-3}$, Option 1 (Benchmark Class D)**

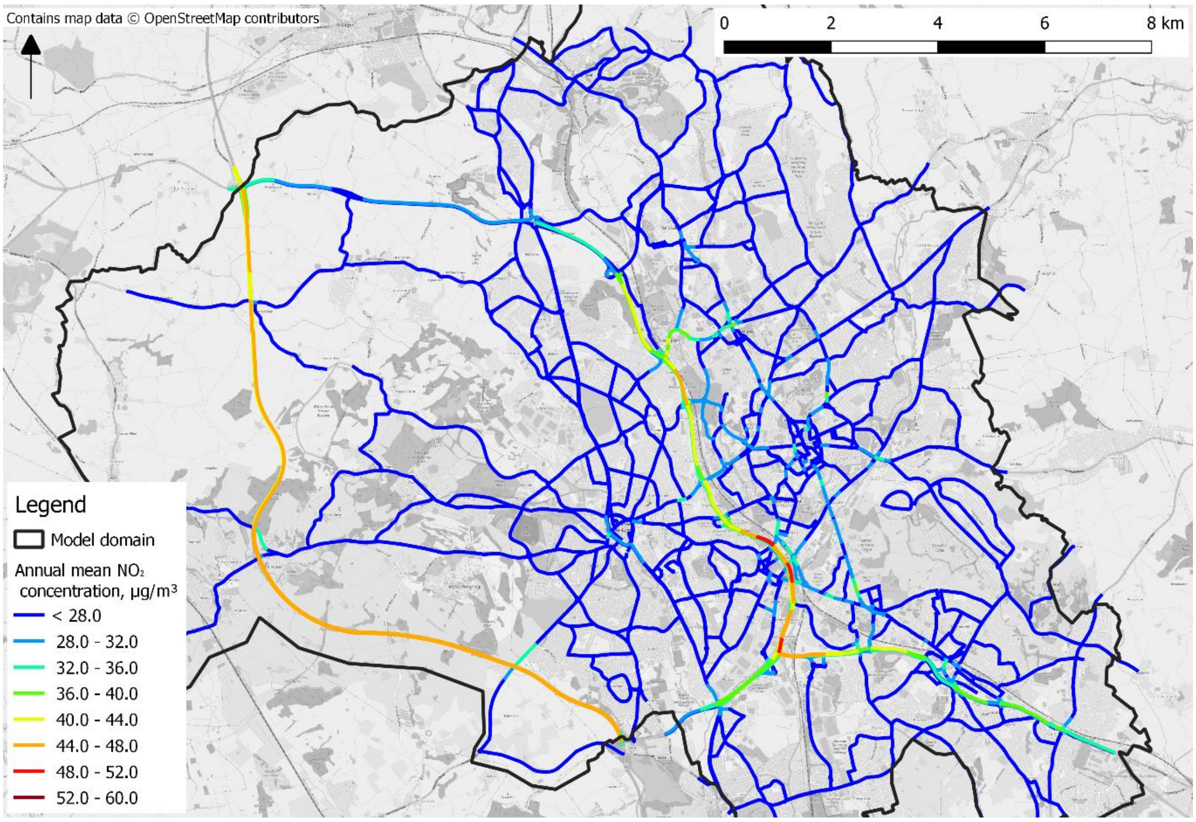



**Figure 4-2: Annual mean $NO_2$ concentrations, 2022, µg.m$^{-3}$, Option 2 (High impact without charging)**

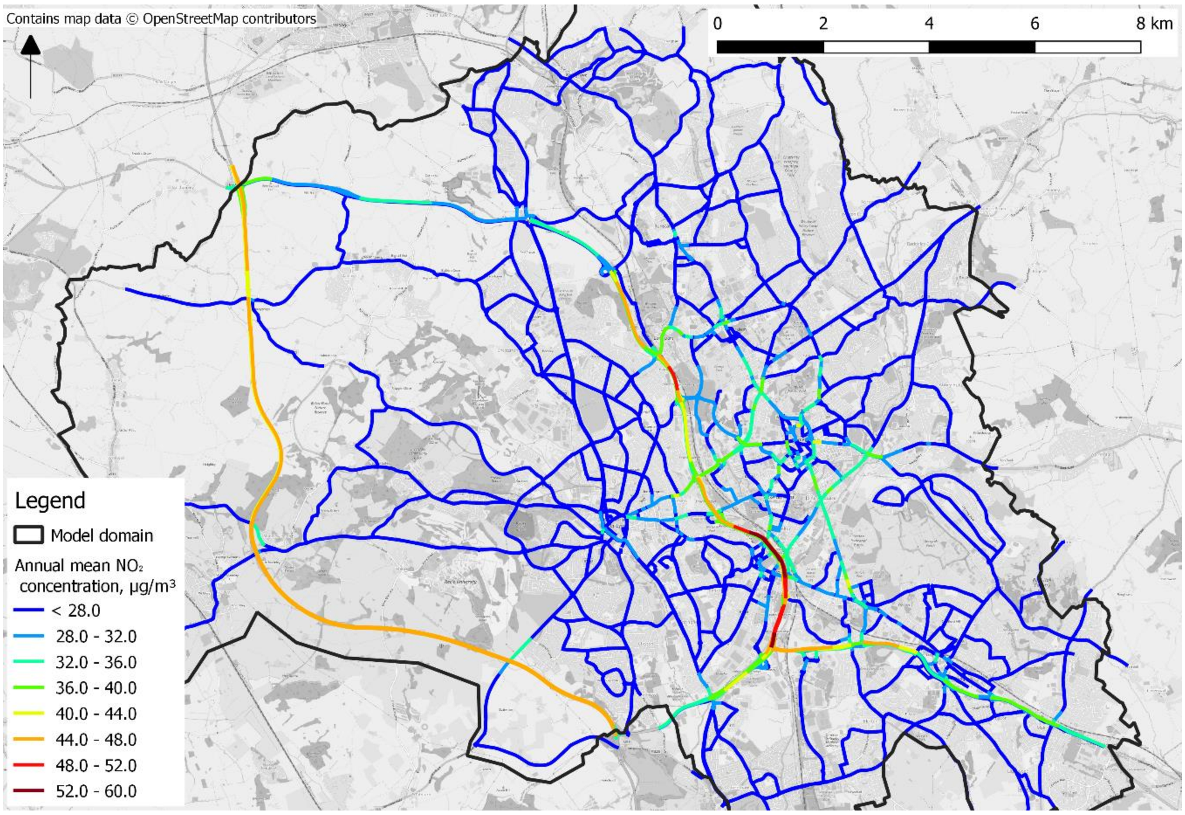


**Figure 4-3: Annual mean $NO_2$ concentrations, 2022, $\mu g.m^{-3}$, Option 3 (High impact)**

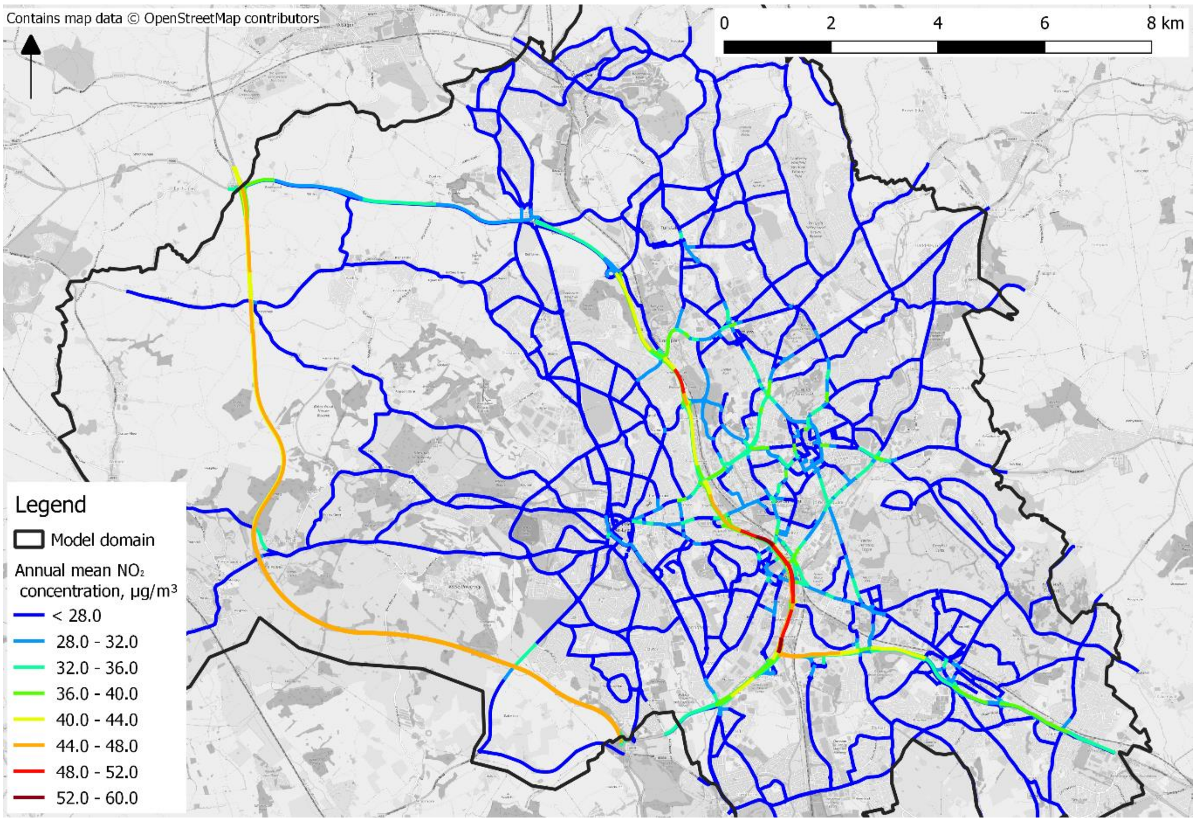



**Figure 4-4: Annual mean $NO_2$ concentrations, 2022, $\mu g.m^{-3}$, Option 4 (Preferred Option)**

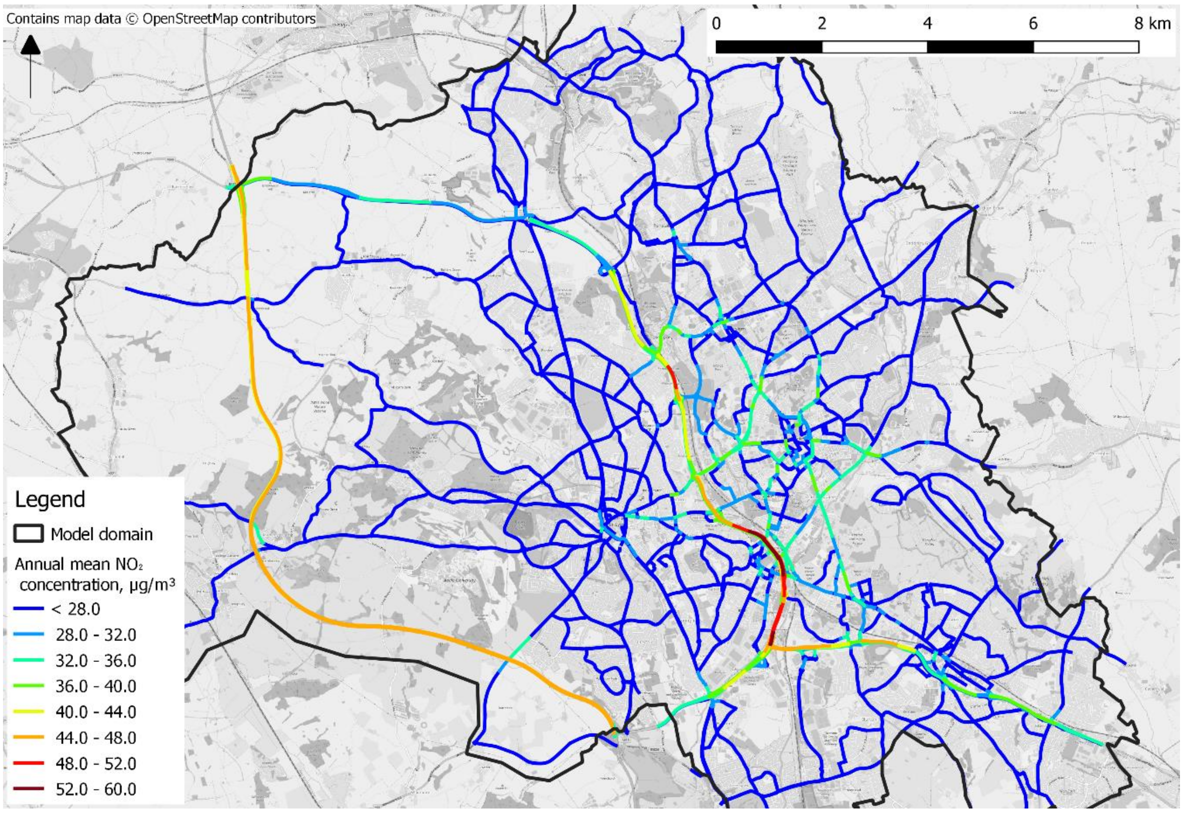


**Figure 4-5: Annual mean $NO_2$ concentrations, 2022, µg.m$^{-3}$, Option 5 (Class C Charging CAZ scheme)**

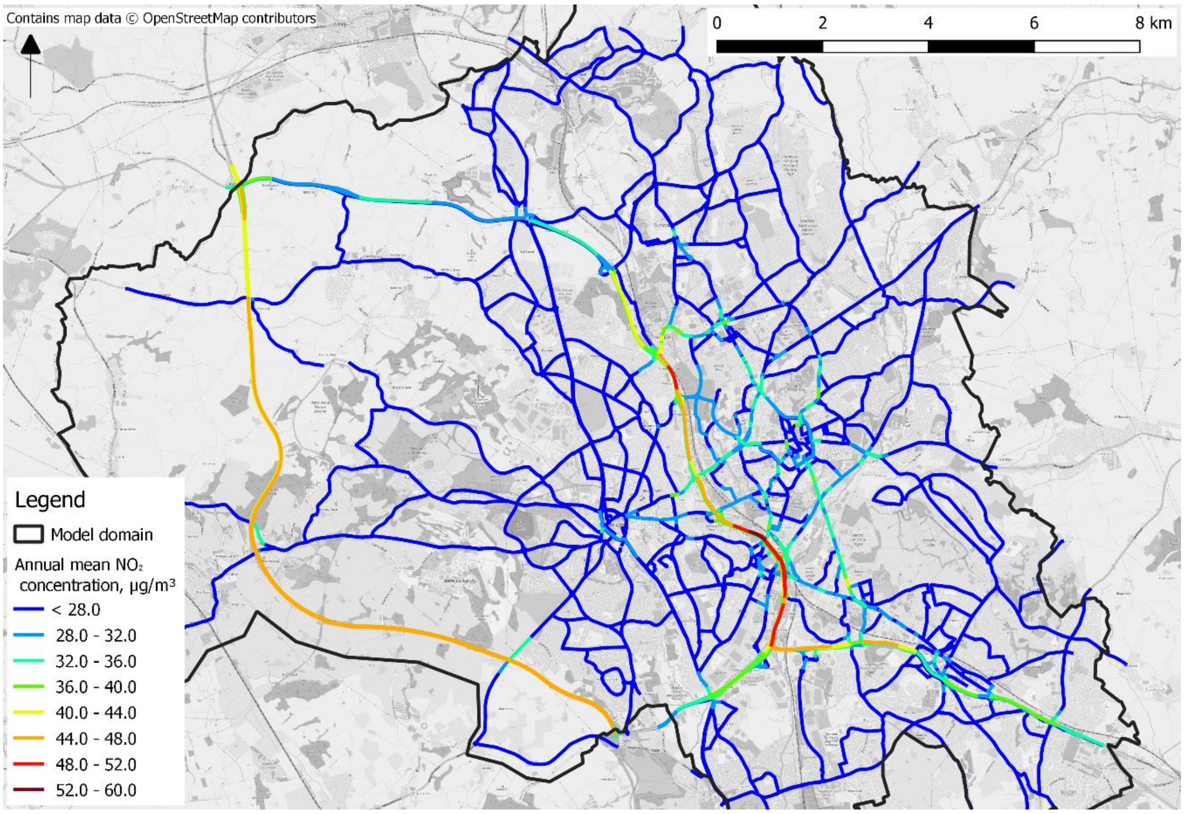
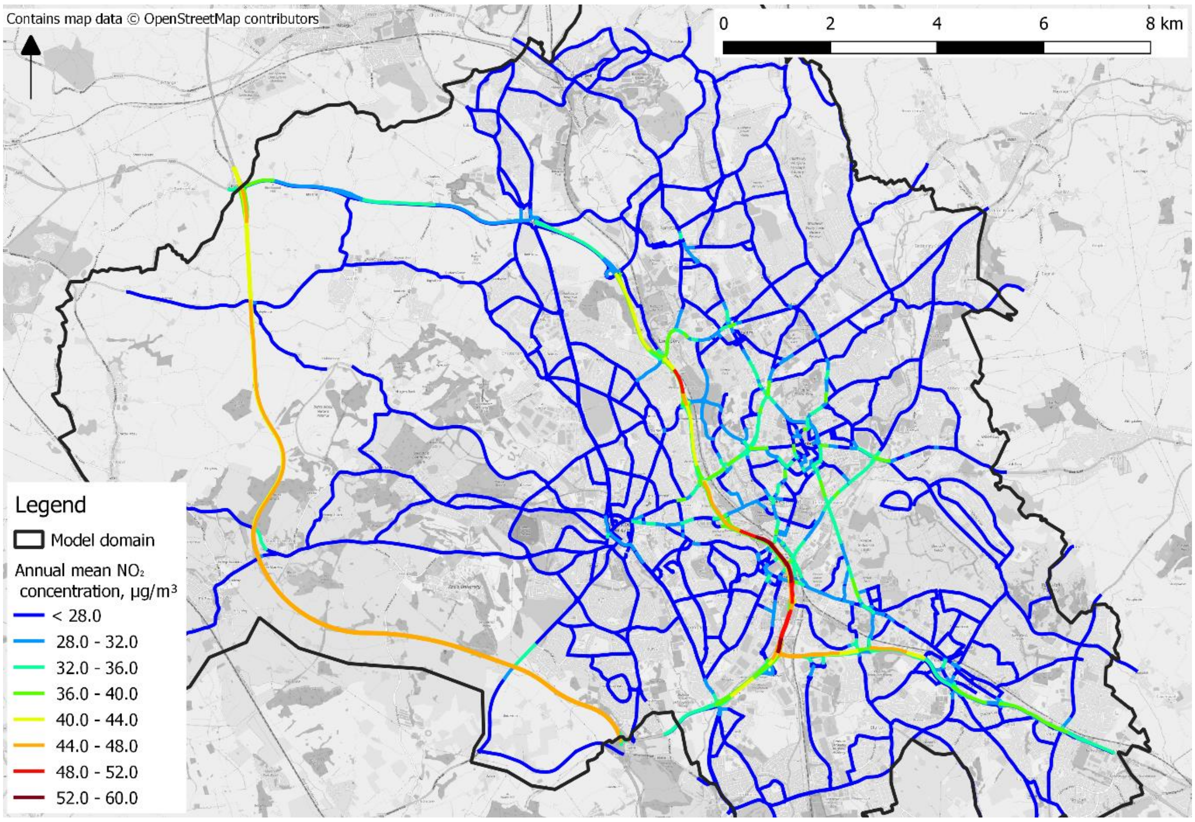



**Figure 4-6: Annual mean $NO_2$ concentrations, 2022, µg.m$^{-3}$, Option 6**



# 5 Model uncertainty and sensitivity analysis

Some clear outliers were apparent during the model verification process, whereby we were unable to refine the model inputs sufficiently to achieve good model performance at these locations. There are a number of reasons why this could be the case, including:

- A site located next to a large car park, bus stop or other emission source that has not been explicitly modelled due to unknown activity data.
- Sites located underneath trees or vegetation (i.e. unsuitable locations for diffusion tubes to measure $NO_2$ concentrations effectively).
- Uncertainties in the traffic model outputs (please refer to the traffic model validation report for further information on this).
- Uncertainties introduced by modelling background concentrations at 1 km resolution over such a wide area. In this case we have attempted to address this by interpolating the 1 km background maps to a finer 3 m resolution. This aims to smooth out the sudden changes in background concentrations at the edges of the $1km^2$ background maps.

To evaluate model performance and uncertainty, the Root Mean Square Error (RMSE) for the observed vs predicted $NO_2$ annual mean concentrations was calculated, as detailed in LAQM.TG(16). In this case the RMSE was calculated at 5.16 $\mu g.m^{-3}$.

Sensitivity testing has been carried out to assess the robustness of the outcomes from this study. Table 12 summarises the sensitivity testing carried out.

**Table 12: Wider sensitivity testing**

| *Priority or recommended?* | Test | Notes on Test |
|---|---|---|
| Priority | Future Emission standards | Euro-6d_temp not included in EFT v9.1.b, so no testing carried out. |
| | f-$NO_2$ projection | Rerun RapidAir for 2022 Reference Case applying adjustment to f-$NO_2$ emission rates |
| | Gradient based emission factors | Rerun RapidAir for 2022 Reference Case excluding gradients |
| | Benchmark CAZ: 0% Upgrade Assumption | Rerun RapidAir for 2022 Benchmark CAZ D scenario using traffic model sensitivity testing results |
| Recommended | Zonal vs full model domain calibration | Results at monitoring locations using site-specific adjustment factors presented; qualitative assessment of zonal calibration |
| | Surface roughness length | Qualitative assessment |
| | Meteorology | Qualitative assessment |

## 5.1 Results at monitoring locations using site-specific adjustment factors

When model verification is carried out this provides a clear indication of how the model is performing at each monitoring location. This can be used to provide an alternative set of results for the monitoring locations using a site-specific adjustment factor. The site-specific adjustment factor is simply derived from the ratio of measured and modelled road NOx at that specific site and used to adjust the predicted 2022 results rather than the global adjustment factor derived from model verification. The site-specific results aim to provide an indication of when compliance may be achieved at each monitoring site without any of the bias introduced by using an average road NOx adjustment factor across the entire domain.

The results at monitoring locations using the site-specific adjustment for the baseline and each of the modelled options are shown in Table 13. The results for the baseline indicate that in 2022, compliance with the 40 $\mu g.m^{-3}$ $NO_2$ annual mean objective will be achieved at the majority of current monitoring locations, with the exception of:

- The Stoke-on-Trent automatic monitoring station CM5, located on the A53 to the west of the A500; this link is identified as "at risk of exceeding" in the PCM modelling, and is adjacent to other link segments which are predicted to exceed the AQO in the 2022 Reference Case. Any options proposed will seek to further reduce concentrations along this link.

**Table 13: $NO_2$ concentrations at monitoring locations in 2022 using the site-specific adjustment factor**

| Council | Monitoring site ID | Monitoring type | Site type | Adjustment factor | Output $NO_2$ |
|---|---|---|---|---|---|
| Newcastle-under-Lyme | CM1 | Automatic | Roadside | 1.2 | 19.9 |
| | DTK1 | Diffusion tube | Kerbside | 1.7 | 24.5 |
| | DTK2 | Diffusion tube | Urban Centre | 1.7 | 27.4 |
| | DTUB1 | Diffusion tube | Kerbside | 1.2 | 21.0 |
| | DT3 | Diffusion tube | Rural | 1.9 | 30.7 |
| | DT6 | Diffusion tube | Suburban | 3.5 | 23.3 |
| | DT9 | Diffusion tube | Suburban | 2.3 | 31.2 |
| | DT24 | Diffusion tube | Roadside | 2.1 | 23.6 |
| | DT28 | Diffusion tube | Rural | 1.4 | 24.7 |
| | DT34 | Diffusion tube | Urban Centre | 1.9 | 26.3 |
| | DT40 | Diffusion tube | Suburban | 2.6 | 23.9 |
| | DT46 | Diffusion tube | Urban Centre | 1.5 | 26.1 |
| | DT47 | Diffusion tube | Urban Centre | 1.3 | 22.9 |
| | DT49 | Diffusion tube | Urban Centre | 1.5 | 25.8 |
| | DT64 | Diffusion tube | Urban Centre | 3.3 | 32.1 |
| | DT73 | Diffusion tube | Roadside | 3.6 | 30.5 |
| | DT74 | Diffusion tube | Roadside | 1.6 | 27.2 |
| | DT76 | Diffusion tube | Roadside | 2.3 | 28.3 |
| | DT84 | Diffusion tube | Roadside | 2.7 | 29.7 |
| | DT85 | Diffusion tube | Urban Centre | 1.9 | 28.5 |
| | DT86 | Diffusion tube | Urban Centre | 2.1 | 32.1 |
| | DT87 | Diffusion tube | Urban Centre | 1.8 | 24.6 |
| | DT88 | Diffusion tube | Urban Centre | 1.7 | 30.4 |
| | DT89 | Diffusion tube | Urban Centre | 2.1 | 25.5 |
| | DT90 | Diffusion tube | Urban Centre | 1.8 | 24.6 |
| | DT91 | Diffusion tube | Urban Centre | 2.0 | 27.1 |
| | DT92 | Diffusion tube | Urban Centre | 1.7 | 24.4 |
| | DT93 | Diffusion tube | Urban Centre | 1.8 | 24.6 |

| Council | Monitoring site ID | Monitoring type | Site type | Adjustment factor | Output $NO_2$ |
|---|---|---|---|---|---|
| | DT94 | Diffusion tube | Urban Centre | 3.6 | 28.7 |
| | DT95 | Diffusion tube | Urban Centre | 2.8 | 26.6 |
| | DT97 | Diffusion tube | Roadside | 2.6 | 27.9 |
| | DT98 | Diffusion tube | Roadside | 2.8 | 29.5 |
| | DT100 | Diffusion tube | Roadside | 1.7 | 24.5 |
| | DT101 | Diffusion tube | Roadside | 2.7 | 30.5 |
| | DT103 | Diffusion tube | Roadside | 1.9 | 34.6 |
| | DT104 | Diffusion tube | Roadside | 1.9 | 24.8 |
| | DT105 | Diffusion tube | Roadside | 1.7 | 17.6 |
| Stoke-on-Trent | CM1 | Automatic | Urban Background | 0.8 | 20.7 |
| | CM2 | Automatic | Roadside | 1.5 | 29.5 |
| | CM5 | Automatic | Roadside | 2.7 | **41.4** |
| | CM6 | Automatic | Roadside | 2.1 | 38.6 |
| | DT1 | Diffusion tube | Urban Background | 2.1 | 16.5 |
| | DT2 | Diffusion tube | Roadside | 1.7 | 29.5 |
| | DT4 | Diffusion tube | Roadside | 1.5 | 35.8 |
| | DT8 | Diffusion tube | Roadside | 1.3 | 24.2 |
| | DT9 | Diffusion tube | Roadside | 2.1 | 26.1 |
| | DT10 | Diffusion tube | Roadside | 1.2 | 25.5 |
| | DT13 | Diffusion tube | Roadside | 2.1 | 32.0 |
| | DT14 | Diffusion tube | Roadside | 1.2 | 26.3 |
| | DT15 | Diffusion tube | Roadside | 1.1 | 25.7 |
| | DT16 | Diffusion tube | Roadside | 1.4 | 25.9 |
| | DT20 | Diffusion tube | Roadside | 1.6 | 27.5 |
| | DT24 | Diffusion tube | Roadside | 1.7 | 32.1 |
| | DT29 | Diffusion tube | Roadside | 1.9 | 38.0 |
| | DT32 | Diffusion tube | Roadside | 2.4 | 31.9 |
| | DT34 | Diffusion tube | Roadside | 1.5 | 30.2 |
| | DT37 | Diffusion tube | Roadside | 2.1 | 34.2 |
| | DT40 | Diffusion tube | Roadside | 2.7 | 32.2 |
| | DT41 | Diffusion tube | Roadside | 1.5 | 31.0 |
| | DT42 | Diffusion tube | Roadside | 1.6 | 38.2 |
| | DT49 | Diffusion tube | Roadside | 2.4 | 34.5 |
| | DT51 | Diffusion tube | Roadside | 1.4 | 23.6 |
| | DT52 | Diffusion tube | Roadside | 2.4 | 28.8 |
| | DT53 | Diffusion tube | Roadside | 2.2 | 27.2 |
| | DT55 | Diffusion tube | Roadside | 1.9 | 25.5 |
| | DT56 | Diffusion tube | Roadside | 1.6 | 33.1 |
| | DT61 | Diffusion tube | Roadside | 1.8 | 30.0 |
| | DT63 | Diffusion tube | Roadside | 3.0 | 37.2 |
| | DT64 | Diffusion tube | Roadside | 1.6 | 25.1 |
| | DT65 | Diffusion tube | Roadside | 1.7 | 27.4 |
| | DT66 | Diffusion tube | Roadside | 2.2 | 37.4 |
| | DT67 | Diffusion tube | Roadside | 3.1 | 30.5 |
| | DT72 | Diffusion tube | Roadside | 2.8 | 39.8 |
| | DT73 | Diffusion tube | Roadside | 2.0 | 29.1 |
| | DT74 | Diffusion tube | Roadside | 2.1 | 29.4 |
| | DT75 | Diffusion tube | Roadside | 2.2 | 24.6 |
| | DT76 | Diffusion tube | Roadside | 2.6 | 40.0 |
| | DT77 | Diffusion tube | Roadside | 1.9 | 28.8 |

| Council | Monitoring site ID | Monitoring type | Site type | Adjustment factor | Output $NO_2$ |
|---|---|---|---|---|---|
| | DT78 | Diffusion tube | Roadside | 1.5 | 26.0 |
| | DT79 | Diffusion tube | Roadside | 2.9 | 35.9 |
| | DT80 | Diffusion tube | Roadside | 1.9 | 29.8 |
| | DT81 | Diffusion tube | Roadside | 1.7 | 29.7 |
| | DT82 | Diffusion tube | Roadside | 2.4 | 37.7 |
| | DT83 | Diffusion tube | Roadside | 1.7 | 30.7 |
| | DT84 | Diffusion tube | Roadside | 1.8 | 30.6 |
| | DT85 | Diffusion tube | Roadside | 1.5 | 24.9 |
| | DT86 | Diffusion tube | Roadside | 1.9 | 26.7 |
| | DT88 | Diffusion tube | Roadside | 1.8 | 28.3 |
| | DT89 | Diffusion tube | Roadside | 1.6 | 27.6 |
| | DT91 | Diffusion tube | Roadside | 4.4 | 31.9 |
| | DT92 | Diffusion tube | Roadside | 1.6 | 30.6 |
| | DT93 | Diffusion tube | Roadside | 1.7 | 30.7 |
| | DT94 | Diffusion tube | Roadside | 1.5 | 29.8 |
| | DT95 | Diffusion tube | Roadside | 1.8 | 26.8 |
| | DT97 | Diffusion tube | Roadside | 2.1 | 31.4 |
| | DT99 | Diffusion tube | Roadside | 2.3 | 39.3 |
| | DT100 | Diffusion tube | Roadside | 2.3 | 38.4 |
| | DT101 | Diffusion tube | Roadside | 1.5 | 28.5 |
| | DT102 | Diffusion tube | Roadside | 1.5 | 26.7 |
| | DT103 | Diffusion tube | Roadside | 1.6 | 27.5 |
| | DT104 | Diffusion tube | Roadside | 1.6 | 26.5 |
| | DT105 | Diffusion tube | Roadside | 1.3 | 23.0 |
| | DT106 | Diffusion tube | Roadside | 1.7 | 38.3 |

## 5.2 Priority testing

A summary of the sensitivity testing results for each of priority tests is provided in Table 14, with full results presented in Table 15.

**Table 14: Summary comparison of the $NO_2$ for PCM links for the priority sensitivity testing in 2022**

| Option | Links > 40 µg/m³ | Links > 35 and <= 40 µg/m³ | Local Authority links > 40 µg/m³ | Local authority links > 35 and <= 40 µg/m³ | Average change in $NO_2$ (%) |
|---|---|---|---|---|---|
| Baseline | 12 | 23 | 4 | 16 | N/A |
| Benchmark CAZ D | 8 | 12 | 0 | 5 | N/A |
| No gradients | 12 | 23 | 4 | 16 | -1.2% |
| fNO2 40% reduction | 3 | 4 | 0 | 1 | -16.7% |
| CAZ D 0% upgrade | 9 | 13 | 1 | 6 | 3.6% |

Lowering the proportion of primary $NO_2$ in the NOx to $NO_2$ conversion by 40% significantly reduces concentrations by an average of 17%, varying from 6% to 23% depending on the traffic composition. For the 2022 Reference Case, this reduction would reduce concentrations along all Local Authority road links below the objective of 40 µg.m$^{-3}$; only Victoria Road would remain above 35 µg.m$^{-3}$. As such, under this test most risk of exceedance is removed.

Remvoing gradient effects from the emission calculations has a small impact on modelled concentrations, leading to a 1.2% reduction in average $NO_2$ concentrations across the model domain. This does not lead to any change in compliance.

Under the 0% upgrade assumption, the Benchmark CAZ D no longer delivers compliance, as $NO_2$ concentrations are predicted to exceed the objective along the A5271 as a result of rerouting traffic. This would cause an exceedance along a link which is predicted to comply with the objective in the Reference Case.

**Table 15: Modelled NO2 annual mean concentrations for priority sensitivity tests by Census ID (µg.m-3)**

| Census ID | Road Name | 2022 $NO_2$ annual mean concentration (µg.m$^{-3}$) | | | | |
|---|---|---|---|---|---|---|
| | | Baseline | Benchmark CAZ D | % change from no gradients test | % change from $fNO_2$ 40% reduction test | % change from Benchmark CAZ D 0% upgrade test |
| 16325 | A34 | 26 | 26 | 0.0% | -11.5% | 0.0% |
| 16501 | A50 | 46 | 36 | 0.0% | -19.6% | 2.8% |
| 16526 | A53 | 23 | 22 | -4.3% | -13.0% | 4.5% |
| 16527 | A53 | 18 | 17 | 0.0% | -11.1% | 0.0% |
| 17648 | A5006 | 37 | 36 | 0.0% | -16.2% | 11.1% |
| 17860 | A52 | 28 | 24 | 0.0% | -14.3% | 4.2% |
| 17975 | A34 | 31 | 30 | -3.2% | -16.1% | 3.3% |
| 18131 | A500 | 40 | 38 | -2.5% | -22.5% | 2.6% |
| 18132 | A52 | 31 | 29 | 0.0% | -16.1% | 3.4% |
| 18584 | A52 | 28 | 24 | 0.0% | -14.3% | 4.2% |
| 26355 | A34 | 31 | 30 | 0.0% | -16.1% | 6.7% |
| 26531 | A50 | 35 | 34 | 0.0% | -17.1% | 2.9% |
| 26546 | A52 | 21 | 19 | 0.0% | -9.5% | 5.3% |
| 26555 | A53 | 36 | 29 | 0.0% | -16.7% | 0.0% |
| 27739 | A52 | 38 | 34 | -2.6% | -18.4% | 5.9% |
| 28176 | A52 | 30 | 28 | 0.0% | -13.3% | 3.6% |
| 28732 | A53 | 43 | 33 | -2.3% | -20.9% | 3.0% |
| 36360 | A34 | 32 | 31 | 0.0% | -18.8% | 3.2% |
| 36543 | A50 | 38 | 32 | -2.6% | -18.4% | 3.1% |
| 36560 | A52 | 37 | 29 | 0.0% | -16.2% | 0.0% |
| 38088 | A53 | 26 | 25 | 0.0% | -15.4% | 0.0% |
| 38230 | A500 | 44 | 43 | -2.3% | -20.5% | 7.0% |
| 38231 | A52 | 40 | 32 | -2.5% | -17.5% | 6.3% |
| 38303 | A527 | 28 | 26 | 0.0% | -14.3% | 3.8% |
| 38521 | A52 | 33 | 30 | 0.0% | -15.2% | 3.3% |
| 46538 | A50 | 22 | 22 | 0.0% | -13.6% | 0.0% |
| 46553 | A5008 | 42 | 31 | 0.0% | -16.7% | 0.0% |
| 46563 | A53 | 38 | 32 | 0.0% | -18.4% | 3.1% |
| 47243 | A500 | 43 | 44 | 0.0% | -18.6% | 9.1% |
| 47268 | A519 | 27 | 26 | 0.0% | -14.8% | 3.8% |
| 47276 | A527 | 32 | 31 | 0.0% | -15.6% | 6.5% |
| 47735 | A5009 | 35 | 29 | -2.9% | -17.1% | 3.4% |
| 47740 | A5035 | 23 | 23 | 0.0% | -13.0% | 0.0% |
| 48067 | A34 | 29 | 28 | -3.4% | -17.2% | 7.1% |
| 48214 | A5006 | 32 | 30 | -3.1% | -18.8% | 3.3% |
| 48287 | A525 | 33 | 33 | 0.0% | -18.2% | 3.0% |
| 48504 | A52 | 33 | 30 | -3.0% | -18.2% | 6.7% |
| 48668 | A50 | 35 | 31 | 0.0% | -14.3% | 6.5% |
| 56306 | A5007 | 29 | 28 | -3.4% | -17.2% | 3.6% |
| 56326 | A34 | 25 | 24 | 0.0% | -16.0% | 4.2% |
| 56360 | A34 | 26 | 25 | 0.0% | -15.4% | 4.0% |
| 56539 | A5007 | 34 | 30 | -2.9% | -17.6% | 3.3% |
| 56996 | A52 | 38 | 34 | -2.6% | -18.4% | 5.9% |
| 57470 | A52 | 32 | 29 | 0.0% | -15.6% | 3.4% |
| 57472 | A52 | 33 | 31 | 0.0% | -15.2% | 3.2% |
| 57606 | A52 | 39 | 36 | 0.0% | -17.9% | 5.6% |
| 57783 | A500 | 53 | 49 | -1.9% | -20.8% | 4.1% |
| 60017 | A50 | 28 | 27 | -3.6% | -14.3% | 0.0% |

| Census ID | Road Name | 2022 $NO_2$ annual mean concentration (μg.m$^{-3}$) | | | | |
|---|---|---|---|---|---|---|
| | | Baseline | Benchmark CAZ D | % change from no gradients test | % change from $fNO_2$ 40% reduction test | % change from Benchmark CAZ D 0% upgrade test |
| 60022 | A5008 | 32 | 27 | -3.1% | -15.6% | 3.7% |
| 60023 | A50 | 32 | 27 | 0.0% | -12.5% | 3.7% |
| 60024 | A50 | 32 | 27 | -3.1% | -15.6% | 0.0% |
| 60026 | A50 | 45 | 44 | -2.2% | -20.0% | 2.3% |
| 60026 | A50 | 34 | 31 | -2.9% | -17.6% | 3.2% |
| 6352 | A34 | 21 | 20 | -4.8% | -14.3% | 0.0% |
| 6353 | A34 | 24 | 24 | 0.0% | -12.5% | 4.2% |
| 6522 | A50 | 35 | 31 | -2.9% | -17.1% | 3.2% |
| 6536 | A52 | 30 | 26 | 0.0% | -16.7% | 7.7% |
| 6545 | A53 | 41 | 32 | 0.0% | -19.5% | 3.1% |
| 70276 | A52 | 33 | 31 | 0.0% | -15.2% | 3.2% |
| 70277 | A5007 | 34 | 32 | -2.9% | -14.7% | 6.3% |
| 70279 | A5005 | 37 | 35 | -2.7% | -18.9% | 0.0% |
| 70280 | A5007 | 22 | 22 | 0.0% | -13.6% | 0.0% |
| 73257 | A5011 | 19 | 19 | 0.0% | -10.5% | 0.0% |
| 73258 | A34 | 21 | 21 | 0.0% | -14.3% | 0.0% |
| 74058 | A53 | 39 | 31 | -2.6% | -17.9% | 3.2% |
| 74060 | A527 | 23 | 22 | 0.0% | -13.0% | 4.5% |
| 74065 | A34 | 29 | 29 | 0.0% | -17.2% | 6.9% |
| 74261 | A50 | 39 | 31 | -2.6% | -17.9% | 6.5% |
| 74585 | A50 | 27 | 27 | 0.0% | -14.8% | 3.7% |
| 74586 | A50 | 32 | 30 | -3.1% | -18.8% | 3.3% |
| 74894 | A520 | 24 | 24 | 0.0% | -16.7% | 4.2% |
| 74895 | A5272 | 27 | 24 | -3.7% | -14.8% | 4.2% |
| 74896 | A5271 | 40 | 40 | -2.5% | -17.5% | 5.0% |
| 74897 | A5271 | 29 | 29 | 0.0% | -13.8% | 0.0% |
| 74898 | A5272 | 40 | 37 | 0.0% | -17.5% | 5.4% |
| 74899 | A5272 | 30 | 28 | 0.0% | -13.3% | 7.1% |
| 74900 | A5035 | 28 | 28 | 0.0% | -17.9% | 3.6% |
| 74902 | A53 | 30 | 29 | 0.0% | -13.3% | 3.4% |
| 74903 | A5008 | 35 | 29 | 0.0% | -14.3% | 3.4% |
| 75282 | A53 | 32 | 27 | 0.0% | -15.6% | 3.7% |
| 75283 | A53 | 27 | 23 | 0.0% | -11.1% | 4.3% |
| 75284 | A52 | 34 | 28 | 0.0% | -17.6% | 3.6% |
| 75418 | A500 | 39 | 37 | 0.0% | -17.9% | 5.4% |
| 75420 | A500 | 30 | 29 | 0.0% | -16.7% | 3.4% |
| 75421 | A500 | 38 | 37 | 0.0% | -18.4% | 2.7% |
| 75422 | A50 | 39 | 37 | -2.6% | -20.5% | 5.4% |
| 75424 | A50 | 31 | 30 | 0.0% | -16.1% | 3.3% |
| 75448 | A50 | 27 | 27 | 0.0% | -11.1% | 0.0% |
| 77480 | A5005 | 18 | 18 | 0.0% | -11.1% | 0.0% |
| 77488 | A525 | 24 | 23 | -4.2% | -16.7% | 0.0% |
| 77490 | A34 | 24 | 23 | 0.0% | -16.7% | 4.3% |
| 77492 | A50 | 22 | 22 | 0.0% | -13.6% | 0.0% |
| 80721 | A5006 | 28 | 24 | 0.0% | -10.7% | 4.2% |
| 81250 | A527 | 24 | 24 | 0.0% | -12.5% | 0.0% |
| 81251 | A527 | 18 | 18 | 0.0% | -5.6% | 0.0% |
| 81252 | A5271 | 31 | 31 | 0.0% | -16.1% | 3.2% |
| 81253 | A527 | 25 | 25 | 0.0% | -12.0% | 0.0% |
| 81448 | A5010 | 37 | 30 | -2.7% | -18.9% | 3.3% |
| 81449 | A5010 | 27 | 24 | 0.0% | -11.1% | 0.0% |
| 81450 | A5008 | 33 | 28 | -3.0% | -15.2% | 3.6% |
| 8147 | A500 | 53 | 50 | -1.9% | -20.8% | 10.0% |
| 8148 | A52 | 27 | 25 | 0.0% | -14.8% | 4.0% |
| 82001 | A5006 | 38 | 34 | 0.0% | -13.2% | 2.9% |
| 8340 | A500 | 53 | 48 | -1.9% | -20.8% | 6.3% |
| 8605 | A520 | 26 | 26 | 0.0% | -15.4% | 3.8% |
| 99026 | A52 | 34 | 29 | 0.0% | -14.7% | 3.4% |
| 99210 | A52 | 33 | 27 | -3.0% | -18.2% | 0.0% |
| 99212 | A53 | 20 | 19 | -5.0% | -15.0% | 0.0% |

| Census ID | Road Name | 2022 $NO_2$ annual mean concentration (μg.m$^{-3}$) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Baseline | Benchmark CAZ D | % change from no gradients test | % change from $fNO_2$ 40% reduction test | % change from Benchmark CAZ D 0% upgrade test |
| 99214 | A520 | 33 | 32 | -3.0% | -21.2% | 3.1% |
| 99215 | A50 | 31 | 31 | 0.0% | -16.1% | 3.2% |
| 99329 | A50 | 47 | 46 | -4.3% | -21.3% | 2.2% |
| 99331 | A50 | 46 | 43 | -2.2% | -21.7% | 4.7% |
| 99332 | NA | 35 | 34 | -2.9% | -17.1% | 2.9% |
| 99333 | A50 | 40 | 38 | -2.5% | -20.0% | 2.6% |
| 99335 | A50 | 40 | 39 | -2.5% | -20.0% | 2.6% |
| 99337 | A50 | 37 | 36 | -2.7% | -21.6% | 2.8% |
| 99407 | A5007 | 32 | 31 | -3.1% | -18.8% | 3.2% |

## 5.3 Recommended testing

### 5.3.1 Zonal vs full model domain calibration

A single road NOx adjustment factor was derived from model verification and used to calculate:

- Citywide modelling results at receptor points adjacent to relevant PCM road links
- Citywide 3m resolution $NO_2$ annual mean concentration rasters, providing a continuous representation of the spatial variation in modelled concentrations.

The use of a zonal model adjustment factor was considered. However, this approach was not used due to the following considerations:

- Although two areas of the cities (Kidsgrove to the north, and the area around Baddeley to the northeast) agree less well with monitored data than the rest of the city, monitoring in these areas occurs in clusters, and is isolated from other monitoring sites in the cities; allocating zones between clusters of diffusion tubes would therefore have been a highly subjective process.
- There could be various factors contributing to variable model agreement at individual measurement sites across the domain. These include uncertainties or omissions in the modelled traffic activity data, uncertainties in estimates of background concentrations, and omission of other nearby sources that have not been explicitly modelled e.g. bus stops, car parks, etc. When modelling at the local scale, we typically model with a consistent background concentration across the model domain; and the impact of other sources such as car parks and bus stops can be modelled. However, including this amount of detail is not practical when modelling at city scale.
- Using a zonal approach could be considered relevant when the intention of the modelling is to focus on evidence relevant to specific areas or hotspots within the wider model domain e.g. small AQMAs. For these, applying a zone-specific road NOx adjustment factor may reduce the overall average error between measured and modelled concentrations at that location and hence increase confidence in the model results and associated conclusions. However, when generating evidence relevant to citywide impacts, applying different road NOx adjustment factors across the domain may create sudden step changes in modelled concentrations at the edge of each zone. It may also have led to inconsistencies in the modelled concentrations at receptor points adjacent to relevant PCM road links where these were at the edge of a (subjectively allocated) verification zone.

- We have however presented results using road NOx adjustment factors specific to each monitoring site, as described in Section 5.1, which could be considered as a site-specific zonal verification approach. This aims to provide an indication of when it is likely that compliance will be achieved at each measurement site even if the required road NOx adjustment factor is higher than the slope of the best fit line across all sites.

### 5.3.2 Surface roughness length

The supplementary guidance states that '*JAQU suggest that LAs model both high and low surface roughness sensitivity tests, scaling surface roughness by appropriate amounts (which will vary on a case by case basis)*.'

And: '*As with other sensitivity tests the focus should be on the baseline and with measures projected year modelling, although in this case LAs should strongly consider also running the sensitivity in the base year. This is because the surface roughness length will impact on concentrations in the base year, therefore could impact on the calibration factors derived in the base year (and applied in the projected year)*.

As described in the AQ2 modelling method report, we have modelled a uniform surface roughness across the entire domain representing a typical roughness for a large urban area.

We would argue that changing the surface roughness modelled would require re-running and re-verification of the 2018 baseline model to derive a Road NOx adjustment (model calibration) factor that is specific to modelling with that roughness input parameter. To model like for like with the updated baseline, all future year scenarios would also need to be re-modelled and the results processed and re-presented. We anticipate that this would not significantly change the future year modelled concentrations and hence conclusions of the assessment. The level of effort required to do this repeat modelling, combined with the current timescale pressures for delivery of the modelling evidence base, mean that exploring this sensitivity by re-modelling is not currently considered proportionate.

### 5.3.3 Meteorology

The sensitivity guidance contains some useful information regarding the potential for inter-annual variability in meteorological conditions to impact on modelled concentrations.

'*JAQU has attempted to quantify the potential for meteorologically driven inter-annual variability in $NO_2$ concentrations by investigating the impact of applying 3 different years of meteorological data from the same site (with all other inputs remaining constant) on $NO_2$ concentrations for a 'mock' LA.*

*The study suggests (though results are not statistically meaningful given that only one 'mock' area has been considered with 3 years of meteorological data) that inter-annual changes in meteorology may not have a large impact on the overall distribution of roadside $NO_2$ concentrations in a local area but can have a significant impact for particular road links (as reflected in the considerably higher maximum concentration in 2015).'*

This statement suggests that the use of meteorological data from alternative years would not significantly affect the overall outcome of the analysis. We also note that to conduct a statistically robust sensitivity test of inter-annual variation in meteorological conditions would require modelling using multiple annual datasets. As it is critical to achieve compliance as quickly as possible in Derby, and timescales for submission of evidence have been agreed, we do not currently have enough time or resources to conduct this repeat modelling; therefore exploring this sensitivity in detail by re-modelling multiple times is not currently considered proportionate.

# 6 Conclusions

This report has provided an overview of the air quality results, in terms of $NO_2$ concentrations, for the Stoke-on-Trent and Newcastle-under-Lyme CAZ study areas including the 2018 base year, the 2022 future baseline year and six options for 2022.. The results have been provided for the national air quality model (PCM) links and local monitoring locations.

The baseline results for 2022 indicate the following:

- There are 3 exceedances of the 40μ/m$^3$ limit within the model domain which are managed by the Local Authorities; these occur on sections of the A5008 (Bucknall New Road), A53 (Etruria Road), and A50 (Victoria Road). Further exceedances occur along Highways England roads on the Strategic Road Network;

- One monitoring location was predicted to exceed the 40μg/m$^{-3}$ limit by 2022; this monitoring site is located on the A53.

The air quality assessment has modelled 6 option scenarios. The impact of each option can be summarised as follows:

**Benchmark Class D Charging CAZ scheme (Option 1)**: The Class D Charging scheme would match the Preferred Option in removing links which exceed the $NO_2$ limit, and would reduce average $NO_2$ concentrations along links by 7.9%. However, it is unlikely that this scheme could be delivered by 2022, as discussed in the Strategic Case.

**Option 2 (High impact without charging CAZ scheme)**: This scheme is not predicted to deliver compliance along Victoria Road (A50) and Bucknall New Road (A5008).

**Option 3 (High impact including local Class D Charging CAZ scheme around Victoria Road)**: The combination of bus retrofits along affected routes, and a local class D charging CAZ around the Victoria Road area, delivers compliance and leads to an average reduction in $NO_2$ concentrations of 2.7%.

**Option 4 (Preferred Option)**: This combination of bus retrofit and traffic management schemes (with wider measures to improve accessibility of public transport) has been specifically designed to limit traffic levels along affected stretches of the A500, A5009, and A53 in order to solve the $NO_2$ exceedance problem. This option delivers compliance, and leads to an average reduction in $NO_2$ concentrations of 1.3% along road links. The number of Strategic Road Network links predicted to exceed the Objective also decreases, showing that the scheme does not move compliance issues elsewhere.

**Option 5 (Class C Charging CAZ scheme)**: Although this option leads to a greater overall reduction in $NO_2$ concentrations along road links (3%), it does not deliver compliance along Victoria Road (A500). Furthermore, rerouting of traffic to avoid the CAZ in this scheme leads to concentrations increasing to exceed the objective along Porthill Road (the A5271).

**Option 6**: This option adds complementary measures to the package of measures identified in Option 4. This option leads to a slightly larger average reduction in $NO_2$ concentrations of 1.8% along road links.

Overall, the assessment indicates that Option 4, the preferred targeted traffic management scheme, will deliver compliance and not cause knock on problems elsewhere within the city.

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# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 31 - Analytical Assurance Statement

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent

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# 1 Purpose of the Analytical Assurance Statement

Analysis is integral in reducing uncertainty in decision-making and plays an important role in shaping, ranking and informing investment and policy decisions. To be fully informed, decision-makers must be aware of the robustness of the analytical advice and consequently how much weight to attach to it in final decision making.

The Analytical Assurance Statement (AAS) outlines the main limitations, risks, uncertainties and gives guidance on the suitability for use (details below). This Analytical Assurance Statement is based on the Department for Transport (DfT) Analytical Assurance Framework approach as outlined in the Strength In Numbers (September 2014) and is summarised in Figure 1-1.

*Figure 1-1 Analytical Assurance Statement for Transport and Air Quality Modelling*

**Analytical Assurance Statement for transport and air quality modelling.**

1. Limitations of the Analysis
   - Has the Analysis been constrained by time or cost, meaning further proportionate analysis has not been undertaken?
   - Could the further analysis that could be done lead to different conclusions?
   - Does the analysis rely on appropriate sources of evidence?
   - How reliable are the underpinning assumptions?
2. Risk of Error / Robustness of the Analysis
   - Has there been sufficient time and space for proportionate levels of quality assurance to be undertaken?
   - Have sufficient checks been made on the analysis to ensure absence of errors in calculations?
   - Have sufficiently skilled staff been responsible for producing the analysis?
3. Uncertainty
   - What is the level of residual uncertainty (the level of uncertainty remaining at the end of the analysis)?
4. Use of analysis
   - Does the evidence provided support the business case?
   - Is there evidence the agreed target will be achieved?

# 2 Limitations of the Analysis

## 2.1 Has the analysis been constrained by time or cost, meaning further proportionate analysis has not been undertaken?

The modelling and analysis have been undertaken within a programme that has clearly defined deliverables and timescales which align with the necessary analysis and assurance needed to support the development of robust analytical advice.

The development and review of the analysis and evidence base has been undertaken by the consultancy team, Newcastle-under-Lyme Borough Council, Stoke-on-Trent City Council and Staffordshire County Council Officers. This process included:

- Checks on both transport and air quality modelling inputs and outputs to ensure robustness in the production of the future year forecasts and exceedance locations.
- Working in alignment with the Joint Air Quality Unit's (JAQU) guidance and seeking input from JAQU in determining suitable methodology and critical challenge throughout the development of the project.

As a result, we do not believe further proportionate analysis could usefully be carried out in the time available

It is recognised we are working to a tight programme given the Ministerial Direction and to an agreed budget. The analysis has not been constrained by cost however it is more restricted by time.

### 2.2 Could further analysis have been done that lead to different conclusions?

The modelling and analysis follow industry best practice and has proven to validate to these standards providing a robust platform to enable forecasting. As a result, additional analysis would not have led to different conclusions being established.

The base year 2015 NSMM transport model has been well calibrated and validated against a comprehensive set of traffic data and in accordance with WebTAG criteria. Indeed, it has been signed off recently by the DfT as part of the business case for the Etruria Valley Link Road. Checks against more recent traffic count data has shown there has been little flow change in the last few years making the NSMM model a reliable starting point for this work (see T2 report), Rating: HIGH

The vehicle composition has been derived from an extensive set of ANPR surveys carried out in the neutral month of April in 2019 for 15 locations across North Staffordshire, capturing traffic movements in both directions. As such it is considered a reliable evidence for the vehicle fleet composition for North Staffordshire. Rating: HIGH

Speed data has been taken from the NSMM transport model. The NSMM model times (and therefore speeds) have been validated against 16 journey time routes covering North Staffordshire and exceed WebTAG criteria of having 85% of modelled journey times within 1 minute or 15% of observed journey time data. The observed journey times were derived from Trafficmaster data. These routes however will not cover every road in North Staffordshire. Rating MODERATE

As for the transport modelling, the air quality modelling has been carried out following all relevant guidance, and the model is calibrated to measured concentrations following the approach outlined in LAQM TG(16). As a result, it is not expected that any additional analysis would lead to different conclusions being established.

The air quality models use the Emissions Factor Toolkit, published by Defra, to calculate emission rates from the traffic model data described above. The Defra NOx to NO2 calculator is used to calculate NO2 concentrations from NOx concentrations and primary NO2 fractions. These are industry-standard tools. Rating: MODERATE

The Emissions Factor Toolkit (version 9.1b) published by Defra, was used to project the vehicle fleet from the ANPR survey described above for future years. The EFT makes a range of assumptions, based on the latest available information, on fleet turnover and uptake of non-conventional (e.g. electric) vehicles. These assumptions are based on the latest available data, so are considered to be the best available representation of future fleet information. However, predictions of future fleet characteristics are inherently uncertain. Additional sensitivity testing has been carried out around uncertainties in the f-NO2 fraction as recommended by Defra; if the f-NO2 in future years proves to be lower than those predicted by the tool, it is possible that roads in North Staffordshire would achieve compliance without intervention more quickly. Rating: MODERATE

The model calibration uses 2018 air quality monitoring data from North Staffordshire to verify the model. This data is collected in accordance with LAWM TG(16), and is bias adjusted following current guidance. A large number of sites were available for use in this study, and as a result, this evidence is considered to be reliable. Rating: HIGH

Canyon effects have been calculated using building footprint and height information published by Ordnance Survey as part of the Mastermap dataset. This represents the highest-quality dataset available, and as such is considered reliable. Rating: HIGH

Background concentrations were taken from air pollution background concentration maps published by Defra. The current reference year for these maps is 2017. These maps are considered to be the best available source of information for projections of background concentrations in future years. Rating: MODERATE

### 2.3 Does analysis rely on appropriate sources of evidence?

The model development and resulting analysis has taken advantage of the best and most appropriate data available. All data collected has been from established sources, within neutral months and internally sense checked by the consultants and Local Authority officers before use. These have also been thoroughly documented and referenced within the appropriate supporting documentation.

The reliability of each assumption is summarised in Table 2-1.

*Table 2-1 Reliability of assumptions*

| Assumption | Source | Rating (High/Moderate/Low) |
|---|---|---|
| **Base year fleet composition** | ANPR data | High |
| **Base year traffic flows** | NSMM transport model | High |
| **Growth in traffic flows** | NTEM V7.2 (Tempro) | Moderate |
| **Traffic Speeds** | NSMM transport model | Moderate |
| **Fleet projections (fuel split and Euro standard split)** | EFT projections applied to ANPR data | Moderate |

| | | |
|---|---|---|
| **Background concentrations** | Defra background maps | Moderate |
| **Measured concentrations** | Diffusion tube and automatic monitoring sites | High |
| **Canyon effects** | OS Mastermap building footprint and height information; RapidAir canyon model | High |
| **Road widths** | OS Mastermap | High |
| **Gradients** | LIDAR data | Moderate |
| **Emission Factor Toolkit** | EFT version 9.1b | Moderate |
| **Meteorological data** | NOAA data from Leek Thorncliffe station | High |

### 2.4 How reliable are the underpinning assumptions?

There are a wide range of assumptions used in the transport and air quality modelling and economic assessment work which are reported within the modelling documentation.

The model development has used the assumptions as provided by the JAQU and within DfT's Transport Appraisal Guidance (TAG). Where methodologies, namely the adoption of area specific fleet composition splits using local collected data through the use of Automatic Number Plate Recognition (ANPR) have changed, these have been clearly recorded and justification given.

As with all data and analysis there are limitations and uncertainties in the assumptions and data used to develop suitable tools. However, we believe that an appropriate quality assurance and review process has been established to reduce any risk associated with these.

## 3 Risk of Error/Robustness of the Analysis

### 3.1 Has there been sufficient time and space for proportionate levels of quality assurance to be undertaken?

Quality Assurance (QA) is embedded in everything Sweco do. Appropriate processes and checks are established before modelling is undertaking ensuring a repeatable, auditable process is achieved. QA procedures have been put in place at all levels of the team meaning Sweco's Project Manager (PM) and Project Director (PD) lead in ensuring the project is undertaken in accordance with the current Sweco Quality Assurance processes and that the system is effective.

In accordance with Sweco's QA processes all deliverables and outputs are reviewed and signed off by both the Project Manager and Project Director before release.

The delivery team have worked collaboratively meaning drafts of results are often released early to allow a full review and sense check by the relevant Local Authority officers and JAQU.

Quality management for all Ricardo projects (and all deliverables produced) is delivered in accordance to the requirements of the International Standard ISO 9001:2008. Principles of QA are integrated in all of Ricardo's activities and at all levels through established and implemented procedures according to the international standard. The formally appointed sub-consultant Project Manager and Project Director take the lead in ensuring that the project is undertaken in accordance with the current Ricardo Quality Assurance processes and that the system is effective.

As noted above, the citywide modelling of the air quality improvement options is both complex and time consuming, whilst being carried out under tight delivery timescales. However, all analysis has been developed in accordance with these over-arching Ricardo QA policies and procedures to ensure high quality and accuracy of deliverables. Specifically, this includes:

- Use of the core principles from our modelling QA group in the design of analysis spreadsheets and scripts
- Technical oversight of methodological modelling issues from our modelling knowledge leader
- Day-to-day oversight of the modelling work by the lead modeller
- Checks of assumptions, input data, calculation sheets and output results
- Overall review and sign off by Ricardo's technical director

All models have been developed in accordance with Ricardo's 'best practice' modelling guidance for the construction of workbooks and tools. This includes having separate sheets for data import, manipulation and results. In addition, the model has been developed with strict version control procedures (to avoid version error) and with assigned governance and responsibilities (i.e. the PM holds overall responsibility for the quality of the model, with analysts holding joint responsibility for the elements they developed).

All data sources used in the model are appropriately referenced and clearly marked where data is inputted into the model. All assumptions and data sources will be logged, in particular as part of the Air Quality and Economic Methodology Reports.

In addition, for this specific work, additional QA checks have been performed with the input of the wider consultancy team. For example, where data and assumptions have been drawn from external models, we have discussed directly our interpretation of the data received, and its planned use in the economics model to sense check our approach (e.g. air quality emissions outputs and transport modelling outputs).

In accordance with Ricardo's QA processes, all deliverables and outputs have been signed off by both the Project Manager and/or Project Director before release. Also, where time has allowed, we have issued draft results to the councils and JAQU to allow them to review and scrutinise results prior to finalising.

### 3.2 Have sufficient checks been made on the analysis to ensure absence of errors in calculations?

Sweco have an established QA and audit process that is undertaken in parallel with our transport modelling work to reduce the risk of errors. DfT's best practice guidance on the development of models and programming has been incorporated into this.

An example of the checks followed are:

- Review and check all methods being used in the model set up and calculations focusing on the repeatability and removal of hard coded assumptions and values
- Review model input data for consistency which often involves established bespoke template for data so automated checks can be undertaken
- Peer review spreadsheets and formulas
- Sense check results using the lead modeller and local knowledge of the area through use of the Local Authority officers

We believe this level of check is proportionate for the time and resources available and have taken due diligence to remove possible errors that would negatively impact on the presented analysis.

Checks on modelling work are carried out as part of Ricardo's quality assurance process. Again, with complex models across several thousand road-links there is a large amount of data and calculations to check. Our approach has been as follows:

- Review and check all methods being used in the model set up and calculations
- Review model input data for consistency, this has focused on samples of data and key locations
- Check calculations in all scripts, again using a sampling approach to check calculation steps
- Sense check results using the experience of the lead modeller, knowledge leader, project director and Local Authority officers to ensure that they seem reasonable

Where any anomalies in results have been identified in the checking process these have then been explored for errors in data or calculations.

Finally, as part of the model validation process for the base year air quality model, the results are compared with monitoring data. Where there is a significant difference with the modelling data, + or – 30%, checks are carried out to explore why these differences occur.

We believe this level of checks is proportionate for the time available and has identified a number of issues that have had to be corrected. However, it is not an absolute guarantee that there are no errors, but it is sufficient to ensure that all results are reasonable and consistent.

### 3.3 Have sufficiently skilled staff been responsible for producing the analysis?

The development team have been specifically chosen due to their experience and knowledge in the development of transport models and appraisal of environmental impacts.


North Staffordshire Local Air Quality Plan

The transport modelling team have extensive demonstrable experience in the modelling of transport networks, particularly in the study area. Sweco's team have developed and worked with the North Staffordshire Multi-Modal (NSMM) transport model since 2009 and have relevant experience in providing outputs that feed into air quality models. The team working on this Air Quality Local Development Plan comprises of a Project Director who has over 15 years' experience in transport modelling, including both multi and uni-modal transport modelling and leads the Transport Modelling and Appraisal Team within Sweco. The Project Director is supported by the Project Manager who is an experienced transport economist and data analyst who has successfully led and managed complex modelling and analytical programmes. The day-to-day modelling is undertaken by an established team of modellers whose experience reflects the complexity of the modelling and the need for robust outcomes. The project has technical oversight in all areas by technical experts who can use their extensive modelling and project experience to guide the assessment and appraisal.

The air quality modelling team at Ricardo have significant experience of developing, assessing and recommending measures to reduce emissions and improve air quality at a city-wide scale, including extensive expertise in air pollution modelling from the development of inventories and baselines, to modelling the future impacts of abatement scenarios.

The team is led by a Technical Director who holds over 20 years of experience working on transport and emissions reduction projects. Their key areas of expertise include vehicle emissions modelling, low emission vehicle technologies, sustainable transport measures and local air quality management and policy and they have worked on a number of LES, LEZ and CAZ projects in the UK including in Southampton, Derby, Nottingham, Oxford, London, Leicester and South Oxfordshire.

The day-to-day modelling work is led by an experienced atmospheric scientist with a strong focus on modelling transport and industrial emissions and characterising their effects on ambient air quality. They are an advanced user of ADMS, ADMS-Roads, ADMS-Urban, AERMOD, CALPUFF, ArcGIS, QGIS and other air dispersion modelling tools, as well as meteorological modelling software such as WRF.

The modelling lead is supported by our modelling knowledge leader, who developed our RapidAir and PyCOPERT models, to explore and resolve any methodological issues. In addition, a team of experienced consultants specialising in air quality impact assessment and atmospheric dispersion modelling are carrying out aspects of the modelling work guided by the modelling lead.

All staff at Ricardo have had specific training on all the modelling tools being used for this work.

The transport and air quality modelling work is also supported by significantly skilled and experienced staff of the Local Authorities.

# 4 Uncertainty

## 4.1 What is the level of residual uncertainty (the level of uncertainty remaining at the end of the analysis)?

The 'T2 - Local Model Validation Report' reports the validation process of the model and the conclusion that it adheres to industry guidance, giving confidence that it can be used for forecasting purposes.

This validation note will be reviewed by JAQU/DfT with the intention of them approving the model as ‘Fit for Purpose’ to assess the highway impacts of the air quality improvement measures.

The model adheres to industry best practice, however as with all transport models there are areas that provide greater uncertainty in the forecasts, especially relating to predicted traffic growth based on proposed developments and transport schemes and background traffic growth assumptions. The following areas have been highlighted for areas of potential improvement, but neither are likely to have a significant impact on forecasts:

- Inclusion of new leisure development (2015- 2022) in the future planning data
- Updating the factors for producing daily flows to establish bespoke ones for each user class within the model

A direct assessment of uncertainty in the air quality results is only carried out for the baseline model as part of the validation process against monitored air quality data. In this process, model performance and uncertainty is assessed using the Root Mean Square Error (RMSE) for the observed vs predicted $NO_2$ annual mean concentrations, as detailed in Technical Guidance LAQM.TG(16). In this case the RMSE was calculated at 5.2 $\mu g.m^{-3}$. This can then be used as a measure of error on forecast results for future years. This error metric has been used when considering the results by considering locations over 35 $\mu g.m^{-3}$ as being at risk of exceedance. Therefore, the reduction in the number links over 35 $\mu g.m^{-3}$ will also be used to compare options.

However, when assessing options in future years there will also be uncertainty related to the assumptions made in modelling these options. The reliability of the assumptions used in the modelling has been discussed above with the key areas of uncertainty relating to the behavioural response generated by given measures and how the vehicle fleet evolves in the future.

No direct assessment has yet been made in relation to the uncertainty related to these assumptions. However, as noted above sensitivity testing is planned in relation to the preferred option to explore these uncertainties and the robustness of the options in meeting air quality limit compliance.

### 4.2 Uncertainty – COVID 19

The transport and air quality modelling work underpinning the OBC does not take account of the impacts of the current global emergency, linked to the outbreak of Coronavirus (COVID-19). The impact of coronavirus, on public health, the local economy and on people’s attitudes to travel, is unknown and will remain uncertain for some months to come. Future travel patterns could change following the outbreak including a greater propensity to work from home, an increase in active travel and a reduction in the use of public transport. We simply don’t know what the long-term trends might be.

Whilst the authorities welcome the opportunity to complete this OBC and submit it to Government, they also urge the Government to review the requirements to progress and complete the FBC this year.  It is highly likely that the initial evidence submission (IES), upon which the Preferred Option is based and designed to tackle, will be unsound as we emerge from the coronavirus pandemic.

## 4.3 Does the evidence provided - support the business case?

The assessment undertaken has provided evidence of the concentrations of $NO_2$ forecast for each modelled road link in the North Staffordshire conurbation. This has shown the preferred scheme delivers concentrations of $NO_2$ of 39.3-39.7µg/m3 in 2022 (the compliance year) at the three exceedance locations identified in the 2022 Reference Case. This therefore supports the business case that the preferred scheme delivers compliance.

The level of uncertainty is similar between each modelled future year scenario, as they have largely been completed with the same set of assumptions. All future year scenarios are based on the same set of:

- base year compliant / non-compliant split by vehicle type (from ANPR data)
- base year traffic flows
- future year planning assumptions
- national trip end model forecast traffic growth
- fleet projections from the Emissions Factor Toolkit
- background and measured concentrations
- air quality modelling assumptions

Future year options assessing a charging CAZ (which excludes the preferred scheme) including the benchmark CAZ D draw on local stated preference survey data in order to forecast the demand response of the local public and businesses to a charging CAZ. This does add greater uncertainty to the forecasts for these options. This additional uncertainty has however been addressed through undertaking sensitivity tests as per JAQU guidance on different charging levels and testing a 0% vehicle upgrade option. The forecast responses have also been benchmarked against the results obtained from other local authorities as a sense check.

The nature of modelling is such that it is never able to provide total certainty of a desired outcome. Given however that the preferred scheme is below the required 40µg/m3 threshold by around 1µg/m3, the most likely outcome is that it will deliver compliance and hence support the business case.

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| LA | Model | Census_ID | Road_no | Road_Man | X_coordina | Y_coordina | Managed.b | 2018 | 2019 | 2020 | 2021 | 2022 (Reference Case) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Newcastle- | RapidAir | 16325 | A34 | West Midla | 383843.8 | 349709.2 | Local Auth | 31 | 30 | 28 | 27 | 26 |
| Stoke-on-T | RapidAir | 16501 | A50 | The Potteri | 389273.6 | 344897.3 | Local Auth | 54 | 52 | 50 | 48 | 46 |
| Stoke-on-T | RapidAir | 16526 | A53 | The Potteri | 389961 | 350538 | Local Auth | 26 | 25 | 24 | 24 | 23 |
| Newcastle- | RapidAir | 16527 | A53 | The Potteri | 384290.7 | 345021.2 | Local Auth | 20 | 20 | 19 | 18 | 18 |
| Stoke-on-T | RapidAir | 17648 | A5006 | The Potteri | 387782 | 345975.1 | Local Auth | 42 | 41 | 40 | 38 | 37 |
| Newcastle- | RapidAir | 17860 | A52 | The Potteri | 384968.1 | 346228.9 | Local Auth | 35 | 33 | 32 | 30 | 28 |
| Newcastle- | RapidAir | 17975 | A34 | The Potteri | 384967 | 345746.6 | Local Auth | 37 | 36 | 34 | 32 | 31 |
| Stoke-on-T | RapidAir | 18131 | A500 | West Midla | 386684.3 | 342780 | Highways E | 47 | 45 | 44 | 42 | 40 |
| Stoke-on-T | RapidAir | 18132 | A52 | The Potteri | 387596.1 | 345087.4 | Local Auth | 37 | 36 | 34 | 32 | 31 |
| Stoke-on-T | RapidAir | 18584 | A52 | The Potteri | 390779.7 | 347577.6 | Local Auth | 35 | 33 | 32 | 30 | 28 |
| Newcastle- | RapidAir | 26355 | A34 | The Potteri | 384606 | 346066.5 | Local Auth | 38 | 36 | 34 | 33 | 31 |
| Stoke-on-T | RapidAir | 26531 | A50 | The Potteri | 386876.7 | 349962.3 | Local Auth | 41 | 40 | 38 | 36 | 35 |
| Stoke-on-T | RapidAir | 26546 | A52 | The Potteri | 391733.8 | 347228.5 | Local Auth | 25 | 24 | 23 | 22 | 21 |
| Stoke-on-T | RapidAir | 26555 | A53 | The Potteri | 386899.1 | 347279.6 | Local Auth | 44 | 42 | 40 | 38 | 36 |
| Stoke-on-T | RapidAir | 27739 | A52 | The Potteri | 388002.2 | 345418.9 | Local Auth | 44 | 42 | 41 | 40 | 38 |
| Stoke-on-T | RapidAir | 28176 | A52 | The Potteri | 387440.6 | 345546.1 | Local Auth | 37 | 35 | 34 | 32 | 30 |
| Newcastle- | RapidAir | 28732 | A53 | The Potteri | 386019.9 | 346598.5 | Local Auth | 54 | 51 | 48 | 46 | 43 |
| Stoke-on-T | RapidAir | 36360 | A34 | The Potteri | 386658.9 | 342824.9 | Local Auth | 39 | 37 | 36 | 34 | 32 |
| Stoke-on-T | RapidAir | 36543 | A50 | The Potteri | 388688.4 | 346673.6 | Local Auth | 42 | 41 | 40 | 39 | 38 |
| Stoke-on-T | RapidAir | 36560 | A52 | The Potteri | 388887.5 | 346690 | Local Auth | 44 | 42 | 40 | 39 | 37 |
| Newcastle- | RapidAir | 38088 | A53 | The Potteri | 384725.6 | 345706.1 | Local Auth | 31 | 30 | 28 | 27 | 26 |
| Stoke-on-T | RapidAir | 38230 | A500 | The Potteri | 386534.5 | 346672.3 | Highways E | 51 | 49 | 48 | 46 | 44 |
| Stoke-on-T | RapidAir | 38231 | A52 | The Potteri | 389668.7 | 347372.2 | Local Auth | 49 | 47 | 44 | 42 | 40 |
| Newcastle- | RapidAir | 38303 | A527 | The Potteri | 385085.2 | 346011.2 | Local Auth | 35 | 33 | 32 | 30 | 28 |
| Stoke-on-T | RapidAir | 38521 | A52 | The Potteri | 387440.7 | 345530.8 | Local Auth | 41 | 39 | 37 | 35 | 33 |
| Newcastle- | RapidAir | 46538 | A50 | The Potteri | 385136.2 | 353706.7 | Local Auth | 25 | 24 | 24 | 23 | 22 |
| Stoke-on-T | RapidAir | 46553 | A5008 | The Potteri | 388624.8 | 347612.7 | Local Auth | 51 | 49 | 46 | 44 | 42 |
| Stoke-on-T | RapidAir | 46563 | A53 | The Potteri | 387629.1 | 348614.4 | Local Auth | 45 | 43 | 42 | 40 | 38 |
| Newcastle- | RapidAir | 47243 | A500 | The Potteri | 386234.6 | 347494 | Highways E | 58 | 54 | 50 | 47 | 43 |
| Newcastle- | RapidAir | 47268 | A519 | The Potteri | 385007.4 | 345655.2 | Local Auth | 31 | 30 | 29 | 28 | 27 |
| Newcastle- | RapidAir | 47276 | A527 | The Potteri | 385635.5 | 349171.5 | Local Auth | 36 | 35 | 34 | 33 | 32 |
| Stoke-on-T | RapidAir | 47735 | A5009 | The Potteri | 389643.2 | 347399.8 | Local Auth | 42 | 40 | 38 | 37 | 35 |
| Stoke-on-T | RapidAir | 47740 | A5035 | The Potteri | 388797.1 | 341182.9 | Local Auth | 25 | 24 | 24 | 24 | 23 |
| Newcastle- | RapidAir | 48067 | A34 | The Potteri | 384770.8 | 345866.5 | Local Auth | 35 | 34 | 32 | 30 | 29 |
| Stoke-on-T | RapidAir | 48214 | A5006 | The Potteri | 387721.6 | 344491.9 | Local Auth | 37 | 36 | 34 | 33 | 32 |
| Newcastle- | RapidAir | 48287 | A525 | The Potteri | 384623.6 | 345909.8 | Local Auth | 39 | 38 | 36 | 34 | 33 |
| Stoke-on-T | RapidAir | 48504 | A52 | The Potteri | 387998.9 | 345083.4 | Local Auth | 39 | 38 | 36 | 34 | 33 |
| Stoke-on-T | RapidAir | 48668 | A50 | The Potteri | 387395.9 | 348962.7 | Local Auth | 40 | 39 | 38 | 36 | 35 |
| Stoke-on-T | RapidAir | 56306 | A5007 | The Potteri | 390945.7 | 343599.7 | Local Auth | 35 | 34 | 32 | 30 | 29 |
| Stoke-on-T | RapidAir | 56326 | A34 | The Potteri | 386659.4 | 341253.8 | Local Auth | 29 | 28 | 27 | 26 | 25 |
| Newcastle- | RapidAir | 56360 | A34 | The Potteri | 384617.9 | 346990 | Local Auth | 32 | 30 | 29 | 28 | 26 |
| Stoke-on-T | RapidAir | 56539 | A5007 | The Potteri | 389723 | 344462.4 | Local Auth | 39 | 38 | 36 | 35 | 34 |
| Stoke-on-T | RapidAir | 56996 | A52 | The Potteri | 388107.1 | 345063.8 | Local Auth | 45 | 43 | 42 | 40 | 38 |
| Stoke-on-T | RapidAir | 57470 | A52 | The Potteri | 387933.1 | 345299.8 | Local Auth | 37 | 36 | 34 | 33 | 32 |
| Stoke-on-T | RapidAir | 57472 | A52 | The Potteri | 387613.7 | 345090.1 | Local Auth | 39 | 38 | 36 | 34 | 33 |
| Stoke-on-T | RapidAir | 57606 | A52 | The Potteri | 387916.3 | 345417.2 | Local Auth | 46 | 44 | 42 | 41 | 39 |
| Stoke-on-T | RapidAir | 57783 | A500 | West Midla | 387869.5 | 343963.4 | Highways E | 62 | 60 | 58 | 55 | 53 |
| Stoke-on-T | RapidAir | 60017 | A50 | The Potteri | 385614 | 352711.5 | Local Auth | 30 | 30 | 29 | 28 | 28 |
| Stoke-on-T | RapidAir | 60022 | A5008 | The Potteri | 388370.9 | 347160.1 | Local Auth | 35 | 34 | 34 | 33 | 32 |
| Stoke-on-T | RapidAir | 60023 | A50 | The Potteri | 388587 | 347648.3 | Local Auth | 38 | 36 | 35 | 34 | 32 |
| Stoke-on-T | RapidAir | 60024 | A50 | The Potteri | 388407.8 | 348016.4 | Local Auth | 37 | 36 | 34 | 33 | 32 |
| Stoke-on-T | RapidAir | 60026 | A50 | The Potteri | 388655.6 | 343694.9 | Highways E | 55 | 52 | 50 | 48 | 45 |
| Stoke-on-T | RapidAir | 60026 | A50 | The Potteri | 389529 | 343853.8 | Local Auth | 39 | 38 | 36 | 35 | 34 |
| Newcastle- | RapidAir | 6352 | A34 | The Potteri | 382795.6 | 354471.8 | Local Auth | 24 | 23 | 22 | 22 | 21 |
| Stoke-on-T | RapidAir | 6353 | A34 | The Potteri | 385547.7 | 345115.5 | Local Auth | 29 | 28 | 26 | 25 | 24 |
| Stoke-on-T | RapidAir | 6522 | A50 | The Potteri | 387427.6 | 348882.7 | Local Auth | 39 | 38 | 37 | 36 | 35 |
| Stoke-on-T | RapidAir | 6536 | A52 | The Potteri | 386239.1 | 345776.3 | Local Auth | 38 | 36 | 34 | 32 | 30 |
| Newcastle- | RapidAir | 6545 | A53 | The Potteri | 385966 | 346586.5 | Local Auth | 52 | 49 | 46 | 44 | 41 |
| Stoke-on-T | RapidAir | 70276 | A52 | The Potteri | 388190.8 | 345296.6 | Local Auth | 37 | 36 | 35 | 34 | 33 |
| Stoke-on-T | RapidAir | 70277 | A5007 | The Potteri | 388755 | 344798.9 | Local Auth | 40 | 38 | 37 | 36 | 34 |
| Stoke-on-T | RapidAir | 70279 | A5005 | The Potteri | 390914.9 | 343477.6 | Local Auth | 43 | 42 | 40 | 38 | 37 |
| Stoke-on-T | RapidAir | 70280 | A5007 | The Potteri | 391176.9 | 343365.4 | Local Auth | 26 | 25 | 24 | 23 | 22 |
| Newcastle- | RapidAir | 73257 | A5011 | The Potteri | 382538.1 | 353854.5 | Local Auth | 22 | 21 | 20 | 20 | 19 |
| Newcastle- | RapidAir | 73258 | A34 | The Potteri | 382682.4 | 354204.2 | Local Auth | 26 | 25 | 24 | 22 | 21 |
| Stoke-on-T | RapidAir | 74058 | A53 | The Potteri | 386515 | 347006.7 | Local Auth | 49 | 46 | 44 | 42 | 39 |
| Stoke-on-T | RapidAir | 74060 | A527 | The Potteri | 387084.3 | 352775.2 | Local Auth | 25 | 24 | 24 | 24 | 23 |
| Newcastle- | RapidAir | 74065 | A34 | The Potteri | 385219.1 | 345512.6 | Local Auth | 34 | 33 | 32 | 30 | 29 |
| Stoke-on-T | RapidAir | 74261 | A50 | The Potteri | 389336.2 | 344731.7 | Local Auth | 45 | 44 | 42 | 40 | 39 |
| Stoke-on-T | RapidAir | 74585 | A50 | The Potteri | 390684.3 | 343399.9 | Highways E | 33 | 32 | 30 | 28 | 27 |
| Stoke-on-T | RapidAir | 74586 | A50 | The Potteri | 390650.6 | 343553.4 | Highways E | 38 | 36 | 35 | 34 | 32 |
| Stoke-on-T | RapidAir | 74894 | A520 | The Potteri | 393512.7 | 343914 | Local Auth | 29 | 28 | 26 | 25 | 24 |
| Stoke-on-T | RapidAir | 74895 | A5272 | The Potteri | 390067.3 | 347133.9 | Local Auth | 31 | 30 | 29 | 28 | 27 |
| Stoke-on-T | RapidAir | 74896 | A5271 | The Potteri | 385710.6 | 349345.1 | Local Auth | 45 | 44 | 42 | 41 | 40 |
| Stoke-on-T | RapidAir | 74897 | A5271 | The Potteri | 386262 | 351089.3 | Local Auth | 34 | 33 | 32 | 30 | 29 |
| Stoke-on-T | RapidAir | 74898 | A5272 | The Potteri | 388718.1 | 348571.4 | Local Auth | 45 | 44 | 42 | 41 | 40 |
| Stoke-on-T | RapidAir | 74899 | A5272 | The Potteri | 388544.2 | 349652 | Local Auth | 35 | 34 | 32 | 31 | 30 |
| Stoke-on-T | RapidAir | 74900 | A5035 | The Potteri | 391078.7 | 342954.2 | Local Auth | 34 | 32 | 31 | 30 | 28 |
| Stoke-on-T | RapidAir | 74902 | A53 | The Potteri | 387969.5 | 349235.4 | Local Auth | 36 | 34 | 33 | 32 | 30 |
| Stoke-on-T | RapidAir | 74903 | A5008 | The Potteri | 389594.8 | 347399.9 | Local Auth | 42 | 40 | 38 | 37 | 35 |
| Newcastle- | RapidAir | 75282 | A53 | The Potteri | 385104.7 | 346223.4 | Local Auth | 40 | 38 | 36 | 34 | 32 |
| Newcastle- | RapidAir | 75283 | A53 | The Potteri | 385395.2 | 346345.9 | Local Auth | 33 | 32 | 30 | 28 | 27 |
| Newcastle- | RapidAir | 75284 | A52 | The Potteri | 385117 | 346184.8 | Local Auth | 43 | 41 | 38 | 36 | 34 |
| Stoke-on-T | RapidAir | 75418 | A500 | West Midla | 387747.9 | 343654.7 | Highways E | 46 | 44 | 42 | 41 | 39 |
| Stoke-on-T | RapidAir | 75420 | A500 | The Potteri | 387615.9 | 343544.9 | Local Auth | 35 | 34 | 32 | 31 | 30 |
| Stoke-on-T | RapidAir | 75421 | A500 | West Midla | 387615.5 | 343502.8 | Highways E | 44 | 42 | 41 | 40 | 38 |
| Stoke-on-T | RapidAir | 75422 | A50 | The Potteri | 391122 | 343069.5 | Highways E | 46 | 44 | 42 | 41 | 39 |
| Stoke-on-T | RapidAir | 75424 | A50 | The Potteri | 391157.7 | 342998.3 | Highways E | 37 | 36 | 34 | 32 | 31 |
| Stoke-on-T | RapidAir | 75448 | A50 | The Potteri | 386654.1 | 350669.4 | Local Auth | 31 | 30 | 29 | 28 | 27 |
| Stoke-on-T | RapidAir | 77480 | A5005 | The Potteri | 391760.7 | 342203 | Local Auth | 21 | 20 | 20 | 19 | 18 |
| Newcastle- | RapidAir | 77488 | A525 | The Potteri | 382853.3 | 345515.8 | Local Auth | 29 | 28 | 26 | 25 | 24 |
| Newcastle- | RapidAir | 77490 | A34 | The Potteri | 382718.9 | 353662.9 | Local Auth | 28 | 27 | 26 | 25 | 24 |
| Newcastle- | RapidAir | 77492 | A50 | The Potteri | 384221 | 354266.4 | Local Auth | 25 | 24 | 24 | 23 | 22 |
| Stoke-on-T | RapidAir | 80721 | A5006 | The Potteri | 388076.6 | 347804.7 | Local Auth | 31 | 30 | 30 | 29 | 28 |
| Stoke-on-T | RapidAir | 81250 | A527 | The Potteri | 386511.6 | 352448 | Local Auth | 27 | 26 | 26 | 25 | 24 |
| Stoke-on-T | RapidAir | 81251 | A527 | West Midla | 386507.3 | 352331.2 | Local Auth | 20 | 20 | 19 | 18 | 18 |
| Stoke-on-T | RapidAir | 81252 | A5271 | The Potteri | 386129 | 351317.2 | Local Auth | 38 | 36 | 34 | 33 | 31 |
| Stoke-on-T | RapidAir | 81253 | A527 | The Potteri | 385708.2 | 352469.8 | Local Auth | 28 | 27 | 26 | 26 | 25 |
| Stoke-on-T | RapidAir | 81448 | A5010 | The Potteri | 387351.3 | 347551.8 | Local Auth | 40 | 39 | 38 | 38 | 37 |
| Stoke-on-T | RapidAir | 81449 | A5010 | The Potteri | 387639.9 | 347562 | Local Auth | 32 | 31 | 30 | 28 | 27 |
| Stoke-on-T | RapidAir | 81450 | A5008 | The Potteri | 387964 | 347233.5 | Local Auth | 32 | 32 | 32 | 33 | 33 |
| Stoke-on-T | RapidAir | 8147 | A500 | The Potteri | 387441.9 | 345884.9 | Highways E | 62 | 60 | 58 | 55 | 53 |
| Stoke-on-T | RapidAir | 8148 | A52 | The Potteri | 387863.9 | 345072.4 | Local Auth | 31 | 30 | 29 | 28 | 27 |
| Stoke-on-T | RapidAir | 82001 | A5006 | The Potteri | 388112.9 | 347548.7 | Local Auth | 40 | 40 | 39 | 38 | 38 |
| Stoke-on-T | RapidAir | 8340 | A500 | The Potteri | 388058.7 | 345097 | Highways E | 62 | 60 | 58 | 55 | 53 |
| Stoke-on-T | RapidAir | 8605 | A520 | The Potteri | 393353.8 | 342622.3 | Local Auth | 30 | 29 | 28 | 27 | 26 |
| Stoke-on-T | RapidAir | 99026 | A52 | The Potteri | 388172.2 | 345666 | Local Auth | 39 | 38 | 36 | 35 | 34 |
| Newcastle- | RapidAir | 99210 | A52 | The Potteri | 385398.6 | 346148.4 | Local Auth | 40 | 38 | 36 | 35 | 33 |
| Stoke-on-T | RapidAir | 99212 | A53 | The Potteri | 391608.9 | 351968.6 | Local Auth | 23 | 22 | 22 | 21 | 20 |
| Stoke-on-T | RapidAir | 99214 | A520 | The Potteri | 393129.6 | 342326.9 | Local Auth | 39 | 38 | 36 | 34 | 33 |
| Stoke-on-T | RapidAir | 99215 | A50 | The Potteri | 386078.7 | 351323.7 | Local Auth | 37 | 36 | 34 | 32 | 31 |
| Stoke-on-T | RapidAir | 99329 | A50 | West Midla | 388340.7 | 343682.3 | Highways E | 58 | 55 | 52 | 50 | 47 |
| Stoke-on-T | RapidAir | 99331 | A50 | The Potteri | 389741.1 | 343802.9 | Highways E | 54 | 52 | 50 | 48 | 46 |
| Stoke-on-T | RapidAir | 99332 | NA | The Potteri | 391058.8 | 343115.3 | Highways E | 42 | 40 | 38 | 37 | 35 |
| Stoke-on-T | RapidAir | 99333 | A50 | The Potteri | 391599.7 | 342824.9 | Highways E | 47 | 45 | 44 | 42 | 40 |
| Stoke-on-T | RapidAir | 99335 | A50 | The Potteri | 392363.2 | 342683.7 | Highways E | 51 | 48 | 46 | 43 | 40 |
| Stoke-on-T | RapidAir | 99337 | A50 | The Potteri | 393206.4 | 342254.6 | Highways E | 45 | 43 | 41 | 39 | 37 |
| Stoke-on-T | RapidAir | 99407 | A5007 | The Potteri | 391954.4 | 342848.9 | Local Auth | 44 | 41 | 38 | 35 | 32 |

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HOW WILL THE DATA IN THIS SPREADSHEET BE USED?

- Data in the 'Road link inputs' and 'General inputs' sheets will be used in the investigation stage of target determination (TD2)
- Data in the 'Euro standard inputs' sheet will be used in the investigation stage of target determination (TD2) and in the localisation of the road transport NAEI
- Data in the 'Fleet composition data' sheet will be used in the localisation of the road transport NAEI

Please fill out this template with modelling inputs for each census ID requested by JAQU in the TD1 report
The first two rows contain examples which should be deleted
For guidance, see the accompanying document, "Supplementary guidance on target determination data submissions"

| Modelled year | Census ID | PCM or Local model | Road number | Note (e.g. Northbound) | Receptor location x | Receptor location y | NOx concentration (ug/m³) | Background NO₂ concentration (ug/m³) | Annual average daily flow | Average vehicle speed (kph): Cars (and other vehicles) | Average vehicle speed (kph): Buses/Coaches | Average vehicle speed (kph): HGVs | $NO_x$ calibration factor | $NO_2$ calibration factor | $NO_x$ emissions (g/m/s) | $NO_x$ source apportionment (%): Petrol cars | Diesel cars | Taxis | Petrol LGVs | Diesel LGVs | Rigid HGVs | Artic HGVs | Buses/Coaches | Motorcycles | Transport contribution from other road links | Background | Source apportionment check | f-$NO_2$ | Canyon effect / Piston effect (tunnel) / Elevation (C/P/F/N) | Gradient effect | Fleet composition (%): Petrol cars | Diesel cars | Black cab taxis | Petrol LGVs | Diesel LGVs | Rigid HGVs | Artic HGVs | Buses and Coaches | Motorcycles | Fleet composition check |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2022 | 57783 | Local | A500 | NB - AM 07:00 - 10:00 | 387869.498 | 343963.443 | 53 | 15.3 | 8386.7 | 83.00 | 83.00 | 83.00 | 1.89 | 1.89 | 0.151 | 0.38% | 32.20% | 0.15% | 0.44% | 26.45% | 10.00% | 3.90% | 0.00% | 0.09% | 9.21% | 17.17% | TRUE | 0.2773 | N | N | 42.56% | 32.23% | 0.00% | 0.27% | 16.28% | 5.99% | 2.34% | 0.00% | 0.33% | TRUE |
| 2022 | 57783 | Local | A500 | NB - IP 10:00 - 16:00 | 387869.498 | 343963.443 | 53 | 15.3 | 8414.4 | 68.00 | 68.00 | 68.00 | 1.89 | 1.89 | 0.151 | 0.38% | 32.20% | 0.15% | 0.44% | 26.45% | 10.00% | 3.90% | 0.00% | 0.09% | 9.21% | 17.17% | TRUE | 0.2773 | N | N | 45.31% | 34.32% | 0.00% | 0.21% | 12.62% | 5.19% | 2.02% | 0.00% | 0.33% | TRUE |
| 2022 | 57783 | Local | A500 | NB - OP 19:00 - 07:00 | 387869.498 | 343963.443 | 53 | 15.3 | 16121.7 | 83.00 | 83.00 | 83.00 | 1.89 | 1.89 | 0.151 | 0.38% | 32.20% | 0.15% | 0.44% | 26.45% | 10.00% | 3.90% | 0.00% | 0.09% | 9.21% | 17.17% | TRUE | 0.2773 | N | N | 42.56% | 32.23% | 0.00% | 0.27% | 16.28% | 5.99% | 2.34% | 0.00% | 0.33% | TRUE |
| 2022 | 57783 | Local | A500 | NB - PM 16:00 - 19:00 | 387869.498 | 343963.443 | 53 | 15.3 | 8230.4 | 77.0 | 77.0 | 77.0 | 1.89 | 1.89 | 0.151 | 0.38% | 32.20% | 0.15% | 0.44% | 26.45% | 10.00% | 3.90% | 0.00% | 0.09% | 9.21% | 17.17% | TRUE | 0.2773 | N | N | 45.73% | 34.63% | 0.00% | 0.18% | 11.10% | 5.77% | 2.25% | 0.00% | 0.34% | TRUE |
| 2022 | 57783 | Local | A500 | SB - AM 07:00 - 10:00 | 387869.498 | 343963.443 | 53 | 15.3 | 18467.8 | 85.0 | 85.0 | 85.0 | 1.89 | 1.89 | 0.166 | 0.38% | 32.20% | 0.15% | 0.44% | 26.45% | 10.00% | 3.90% | 0.00% | 0.09% | 9.21% | 17.17% | TRUE | 0.2773 | N | N | 43.73% | 33.12% | 0.00% | 0.28% | 17.04% | 3.96% | 1.55% | 0.00% | 0.33% | TRUE |
| 2022 | 57783 | Local | A500 | SB - IP 10:00 - 16:00 | 387869.498 | 343963.443 | 53 | 15.3 | 7589.3 | 78.0 | 78.0 | 78.0 | 1.89 | 1.89 | 0.166 | 0.38% | 32.20% | 0.15% | 0.44% | 26.45% | 10.00% | 3.90% | 0.00% | 0.09% | 9.21% | 17.17% | TRUE | 0.2773 | N | N | 44.94% | 34.04% | 0.00% | 0.19% | 11.29% | 6.62% | 2.58% | 0.00% | 0.34% | TRUE |
| 2022 | 57783 | Local | A500 | SB - OP 19:00 - 07:00 | 387869.498 | 343963.443 | 53 | 15.3 | 9607.1 | 85.0 | 85.0 | 85.0 | 1.89 | 1.89 | 0.166 | 0.38% | 32.20% | 0.15% | 0.44% | 26.45% | 10.00% | 3.90% | 0.00% | 0.09% | 9.21% | 17.17% | TRUE | 0.2773 | N | N | 43.73% | 33.12% | 0.00% | 0.28% | 17.04% | 3.96% | 1.55% | 0.00% | 0.33% | TRUE |
| 2022 | 57783 | Local | A500 | SB - PM 16:00 - 19:00 | 387869.498 | 343963.443 | 53 | 15.3 | 10078.7 | 65.0 | 65.0 | 65.0 | 1.89 | 1.89 | 0.166 | 0.38% | 32.20% | 0.15% | 0.44% | 26.45% | 10.00% | 3.90% | 0.00% | 0.09% | 9.21% | 17.17% | TRUE | 0.2773 | N | N | 47.44% | 35.93% | 0.00% | 0.17% | 10.19% | 4.28% | 1.67% | 0.00% | 0.33% | TRUE |
| 2022 | 75421 | Local | A500 | WB - AM 07:00 - 10:00 | 387615.512 | 343502.759 | 38 | 15.9 | 8690.7 | 89.0 | 89.0 | 89.0 | 1.89 | 1.89 | 0.078 | 0.49% | 28.14% | 0.13% | 0.42% | 25.38% | 5.96% | 2.33% | 0.00% | 0.09% | 12.57% | 24.50% | TRUE | 0.291 | N | N | 43.44% | 32.90% | 0.00% | 0.31% | 18.96% | 2.92% | 1.14% | 0.00% | 0.33% | TRUE |
| 2022 | 75421 | Local | A500 | WB - IP 10:00 - 16:00 | 387615.512 | 343502.759 | 38 | 15.9 | 2850.8 | 89.0 | 89.0 | 89.0 | 1.89 | 1.89 | 0.078 | 0.49% | 28.14% | 0.13% | 0.42% | 25.38% | 5.96% | 2.33% | 0.00% | 0.09% | 12.57% | 24.50% | TRUE | 0.291 | N | N | 46.08% | 34.90% | 0.00% | 0.24% | 14.38% | 2.94% | 1.15% | 0.00% | 0.33% | TRUE |
| 2022 | 75421 | Local | A500 | WB - OP 19:00 - 07:00 | 387615.512 | 343502.759 | 38 | 15.9 | 4521.0 | 89.0 | 89.0 | 89.0 | 1.89 | 1.89 | 0.078 | 0.49% | 28.14% | 0.13% | 0.42% | 25.38% | 5.96% | 2.33% | 0.00% | 0.09% | 12.57% | 24.50% | TRUE | 0.291 | N | N | 43.44% | 32.90% | 0.00% | 0.31% | 18.96% | 2.92% | 1.14% | 0.00% | 0.33% | TRUE |
| 2022 | 75421 | Local | A500 | WB - PM 16:00 - 19:00 | 387615.512 | 343502.759 | 38 | 15.9 | 4206.5 | 89.0 | 89.0 | 89.0 | 1.89 | 1.89 | 0.078 | 0.49% | 28.14% | 0.13% | 0.42% | 25.38% | 5.96% | 2.33% | 0.00% | 0.09% | 12.57% | 24.50% | TRUE | 0.291 | N | N | 49.21% | 37.27% | 0.00% | 0.19% | 11.36% | 1.18% | 0.46% | 0.00% | 0.33% | TRUE |
| 2022 | 75421 | Local | A500 | EB - AM 07:00 - 10:00 | 387615.512 | 343502.759 | 38 | 15.9 | 3758.9 | 89.0 | 89.0 | 89.0 | 1.89 | 1.89 | 0.070 | 0.49% | 28.14% | 0.13% | 0.42% | 25.38% | 5.96% | 2.33% | 0.00% | 0.09% | 12.57% | 24.50% | TRUE | 0.291 | N | N | 43.10% | 32.64% | 0.00% | 0.32% | 19.41% | 3.02% | 1.18% | 0.00% | 0.33% | TRUE |
| 2022 | 75421 | Local | A500 | EB - IP 10:00 - 16:00 | 387615.512 | 343502.759 | 38 | 15.9 | 7225.7 | 89.0 | 89.0 | 89.0 | 1.89 | 1.89 | 0.070 | 0.49% | 28.14% | 0.13% | 0.42% | 25.38% | 5.96% | 2.33% | 0.00% | 0.09% | 12.57% | 24.50% | TRUE | 0.291 | N | N | 43.10% | 32.64% | 0.00% | 0.32% | 19.41% | 3.02% | 1.18% | 0.00% | 0.33% | TRUE |
| 2022 | 75421 | Local | A500 | EB - OP 19:00 - 07:00 | 387615.512 | 343502.759 | 38 | 15.9 | 3214.3 | 89.0 | 89.0 | 89.0 | 1.89 | 1.89 | 0.070 | 0.49% | 28.14% | 0.13% | 0.42% | 25.38% | 5.96% | 2.33% | 0.00% | 0.09% | 12.57% | 24.50% | TRUE | 0.291 | N | N | 46.27% | 35.04% | 0.00% | 0.25% | 15.14% | 2.14% | 0.84% | 0.00% | 0.33% | TRUE |
| 2022 | 75421 | Local | A500 | EB - PM 16:00 - 19:00 | 387615.512 | 343502.759 | 38 | 15.9 | 3592.8 | 89.0 | 89.0 | 89.0 | 1.89 | 1.89 | 0.070 | 0.49% | 28.14% | 0.13% | 0.42% | 25.38% | 5.96% | 2.33% | 0.00% | 0.09% | 12.57% | 24.50% | TRUE | 0.291 | N | N | 46.51% | 35.23% | 0.00% | 0.24% | 14.61% | 2.22% | 0.87% | 0.00% | 0.33% | TRUE |
| 2022 | 60026_HWE | Local | A50 | WB - AM 07:00 - 10:00 | 388655.557 | 343694.947 | 45 | 14.9 | 8755.6 | 65.0 | 65.0 | 65.0 | 1.89 | 1.89 | 0.120 | 0.28% | 20.11% | 0.09% | 0.21% | 12.44% | 5.47% | 2.13% | 0.00% | 0.07% | 40.43% | 18.77% | TRUE | 0.2672 | N | N | 47.63% | 36.08% | 0.00% | 0.14% | 8.35% | 5.37% | 2.10% | 0.00% | 0.34% | TRUE |
| 2022 | 60026_HWE | Local | A50 | WB - IP 10:00 - 16:00 | 388655.557 | 343694.947 | 45 | 14.9 | 13836.4 | 83.0 | 83.0 | 83.0 | 1.89 | 1.89 | 0.120 | 0.28% | 20.11% | 0.09% | 0.21% | 12.44% | 5.47% | 2.13% | 0.00% | 0.07% | 40.43% | 18.77% | TRUE | 0.2672 | N | N | 45.10% | 34.16% | 0.00% | 0.16% | 9.65% | 7.62% | 2.97% | 0.00% | 0.34% | TRUE |
| 2022 | 60026_HWE | Local | A50 | WB - OP 19:00 - 07:00 | 388655.557 | 343694.947 | 45 | 14.9 | 7197.9 | 83.0 | 83.0 | 83.0 | 1.89 | 1.89 | 0.120 | 0.28% | 20.11% | 0.09% | 0.21% | 12.44% | 5.47% | 2.13% | 0.00% | 0.07% | 40.43% | 18.77% | TRUE | 0.2672 | N | N | 45.10% | 34.16% | 0.00% | 0.16% | 9.65% | 7.62% | 2.97% | 0.00% | 0.34% | TRUE |
| 2022 | 60026_HWE | Local | A50 | WB - PM 16:00 - 19:00 | 388655.557 | 343694.947 | 45 | 14.9 | 7061.1 | 83.0 | 83.0 | 83.0 | 1.89 | 1.89 | 0.120 | 0.28% | 20.11% | 0.09% | 0.21% | 12.44% | 5.47% | 2.13% | 0.00% | 0.07% | 40.43% | 18.77% | TRUE | 0.2672 | N | N | 47.51% | 35.98% | 0.00% | 0.12% | 7.24% | 6.33% | 2.47% | 0.00% | 0.34% | TRUE |
| 2022 | 60026_HWE | Local | A50 | EB - AM 07:00 - 10:00 | 388655.557 | 343694.947 | 45 | 14.9 | 7889.2 | 84.0 | 84.0 | 84.0 | 1.89 | 1.89 | 0.102 | 0.28% | 20.11% | 0.09% | 0.21% | 12.44% | 5.47% | 2.13% | 0.00% | 0.07% | 40.43% | 18.77% | TRUE | 0.2672 | N | N | 49.93% | 37.82% | 0.00% | 0.09% | 5.50% | 4.55% | 1.77% | 0.00% | 0.34% | TRUE |
| 2022 | 60026_HWE | Local | A50 | EB - IP 10:00 - 16:00 | 388655.557 | 343694.947 | 45 | 14.9 | 5292.2 | 87.0 | 87.0 | 87.0 | 1.89 | 1.89 | 0.102 | 0.28% | 20.11% | 0.09% | 0.21% | 12.44% | 5.47% | 2.13% | 0.00% | 0.07% | 40.43% | 18.77% | TRUE | 0.2672 | N | N | 45.91% | 34.77% | 0.00% | 0.12% | 7.50% | 8.17% | 3.19% | 0.00% | 0.34% | TRUE |
| 2022 | 60026_HWE | Local | A50 | EB - OP 19:00 - 07:00 | 388655.557 | 343694.947 | 45 | 14.9 | 6367.3 | 88.0 | 88.0 | 88.0 | 1.89 | 1.89 | 0.102 | 0.28% | 20.11% | 0.09% | 0.21% | 12.44% | 5.47% | 2.13% | 0.00% | 0.07% | 40.43% | 18.77% | TRUE | 0.2672 | N | N | 47.52% | 35.99% | 0.00% | 0.16% | 9.44% | 4.72% | 1.84% | 0.00% | 0.33% | TRUE |
| 2022 | 60026_HWE | Local | A50 | EB - PM 16:00 - 19:00 | 388655.557 | 343694.947 | 45 | 14.9 | 12239.8 | 88.0 | 88.0 | 88.0 | 1.89 | 1.89 | 0.102 | 0.28% | 20.11% | 0.09% | 0.21% | 12.44% | 5.47% | 2.13% | 0.00% | 0.07% | 40.43% | 18.77% | TRUE | 0.2672 | N | N | 47.52% | 35.99% | 0.00% | 0.16% | 9.44% | 4.72% | 1.84% | 0.00% | 0.33% | TRUE |
| 2022 | 75418 | Local | A500 | SB - AM 07:00 - 10:00 | 387747.867 | 343654.666 | 39 | 15.6 | 4206.5 | 89.0 | 89.0 | 89.0 | 1.89 | 1.89 | 0.077 | 0.40% | 23.77% | 0.11% | 0.31% | 18.81% | 6.62% | 2.58% | 0.00% | 0.07% | 23.86% | 23.47% | TRUE | 0.2943 | N | N | 49.21% | 37.27% | 0.00% | 0.19% | 11.36% | 1.18% | 0.46% | 0.00% | 0.33% | TRUE |
| 2022 | 75418 | Local | A500 | SB - IP 10:00 - 16:00 | 387747.867 | 343654.666 | 39 | 15.6 | 8690.7 | 89.0 | 89.0 | 89.0 | 1.89 | 1.89 | 0.077 | 0.40% | 23.77% | 0.11% | 0.31% | 18.81% | 6.62% | 2.58% | 0.00% | 0.07% | 23.86% | 23.47% | TRUE | 0.2943 | N | N | 43.44% | 32.90% | 0.00% | 0.31% | 18.96% | 2.92% | 1.14% | 0.00% | 0.33% | TRUE |
| 2022 | 75418 | Local | A500 | SB - OP 19:00 - 07:00 | 387747.867 | 343654.666 | 39 | 15.6 | 2850.8 | 89.0 | 89.0 | 89.0 | 1.89 | 1.89 | 0.077 | 0.40% | 23.77% | 0.11% | 0.31% | 18.81% | 6.62% | 2.58% | 0.00% | 0.07% | 23.86% | 23.47% | TRUE | 0.2943 | N | N | 46.08% | 34.90% | 0.00% | 0.24% | 14.38% | 2.94% | 1.15% | 0.00% | 0.33% | TRUE |
| 2022 | 75418 | Local | A500 | SB - PM 16:00 - 19:00 | 387747.867 | 343654.666 | 39 | 15.6 | 4521.0 | 89.0 | 89.0 | 89.0 | 1.89 | 1.89 | 0.077 | 0.40% | 23.77% | 0.11% | 0.31% | 18.81% | 6.62% | 2.58% | 0.00% | 0.07% | 23.86% | 23.47% | TRUE | 0.2943 | N | N | 43.44% | 32.90% | 0.00% | 0.31% | 18.96% | 2.92% | 1.14% | 0.00% | 0.33% | TRUE |
| 2022 | 75418 | Local | A500 | NB - AM 07:00 - 10:00 | 387747.867 | 343654.666 | 39 | 15.6 | 3592.8 | 89.0 | 89.0 | 89.0 | 1.89 | 1.89 | 0.069 | 0.40% | 23.77% | 0.11% | 0.31% | 18.81% | 6.62% | 2.58% | 0.00% | 0.07% | 23.86% | 23.47% | TRUE | 0.2943 | N | N | 46.51% | 35.23% | 0.00% | 0.24% | 14.61% | 2.22% | 0.87% | 0.00% | 0.33% | TRUE |
| 2022 | 75418 | Local | A500 | NB - IP 10:00 - 16:00 | 387747.867 | 343654.666 | 39 | 15.6 | 3214.3 | 89.0 | 89.0 | 89.0 | 1.89 | 1.89 | 0.069 | 0.40% | 23.77% | 0.11% | 0.31% | 18.81% | 6.62% | 2.58% | 0.00% | 0.07% | 23.86% | 23.47% | TRUE | 0.2943 | N | N | 46.27% | 35.04% | 0.00% | 0.25% | 15.14% | 2.14% | 0.84% | 0.00% | 0.33% | TRUE |
| 2022 | 75418 | Local | A500 | NB - OP 19:00 - 07:00 | 387747.867 | 343654.666 | 39 | 15.6 | 7225.7 | 89.0 | 89.0 | 89.0 | 1.89 | 1.89 | 0.069 | 0.40% | 23.77% | 0.11% | 0.31% | 18.81% | 6.62% | 2.58% | 0.00% | 0.07% | 23.86% | 23.47% | TRUE | 0.2943 | N | N | 43.10% | 32.64% | 0.00% | 0.32% | 19.41% | 3.02% | 1.18% | 0.00% | 0.33% | TRUE |
| 2022 | 75418 | Local | A500 | NB - PM 16:00 - 19:00 | 387747.867 | 343654.666 | 39 | 15.6 | 3758.9 | 89.0 | 89.0 | 89.0 | 1.89 | 1.89 | 0.069 | 0.40% | 23.77% | 0.11% | 0.31% | 18.81% | 6.62% | 2.58% | 0.00% | 0.07% | 23.86% | 23.47% | TRUE | 0.2943 | N | N | 43.10% | 32.64% | 0.00% | 0.32% | 19.41% | 3.02% | 1.18% | 0.00% | 0.33% | TRUE |
| 2022 | 60026_LA | Local | A50 | NB - AM 07:00 - 10:00 | 389528.993 | 343853.826 | 34 | 13.8 | 2499.2 | 36.0 | 36.0 | 36.0 | 1.89 | 1.89 | 0.060 | 0.48% | 27.32% | 0.12% | 0.25% | 15.12% | 6.49% | 2.53% | 0.78% | 0.06% | 19.73% | 27.11% | TRUE | 0.2657 | N | N | 48.21% | 36.51% | 0.00% | 0.22% | 13.02% | 1.16% | 0.45% | 0.10% | 0.33% | TRUE |
| 2022 | 60026_LA | Local | A50 | NB - IP 10:00 - 16:00 | 389528.993 | 343853.826 | 34 | 13.8 | 2928.7 | 36.0 | 36.0 | 36.0 | 1.89 | 1.89 | 0.060 | 0.48% | 27.32% | 0.12% | 0.25% | 15.12% | 6.49% | 2.53% | 0.78% | 0.06% | 19.73% | 27.11% | TRUE | 0.2657 | N | N | 43.81% | 33.18% | 0.00% | 0.26% | 15.83% | 4.59% | 1.79% | 0.20% | 0.33% | TRUE |
| 2022 | 60026_LA | Local | A50 | NB - OP 19:00 - 07:00 | 389528.993 | 343853.826 | 34 | 13.8 | 5629.9 | 36.0 | 36.0 | 36.0 | 1.89 | 1.89 | 0.060 | 0.48% | 27.32% | 0.12% | 0.25% | 15.12% | 6.49% | 2.53% | 0.78% | 0.06% | 19.73% | 27.11% | TRUE | 0.2657 | N | N | 43.81% | 33.18% | 0.00% | 0.26% | 15.83% | 4.59% | 1.79% | 0.20% | 0.33% | TRUE |
| 2022 | 60026_LA | Local | A50 | NB - PM 16:00 - 19:00 | 389528.993 | 343853.826 | 34 | 13.8 | 2842.7 | 32.0 | 32.0 | 32.0 | 1.89 | 1.89 | 0.060 | 0.48% | 27.32% | 0.12% | 0.25% | 15.12% | 6.49% | 2.53% | 0.78% | 0.06% | 19.73% | 27.11% | TRUE | 0.2657 | N | N | 47.65% | 36.09% | 0.00% | 0.18% | 11.06% | 3.26% | 1.27% | 0.15% | 0.33% | TRUE |
| 2022 | 60026_LA | Local | A50 | SB - AM 07:00 - 10:00 | 389528.993 | 343853.826 | 34 | 13.8 | 5989.6 | 27.0 | 27.0 | 27.0 | 1.89 | 1.00 | 0.067 | 0.48% | 27.32% | 0.12% | 0.25% | 15.12% | 6.49% | 2.53% | 0.78% | 0.06% | 19.73% | 27.11% | TRUE | 0.2657 | N | N | 46.55% | 35.26% | 0.00% | 0.21% | 12.79% | 3.43% | 1.34% | 0.09% | 0.33% | TRUE |
| 2022 | 60026_LA | Local | A50 | SB - IP 10:00 - 16:00 | 389528.993 | 343853.826 | 34 | 13.8 | 3115.9 | 27.0 | 27.0 | 27.0 | 1.89 | 1.89 | 0.067 | 0.48% | 27.32% | 0.12% | 0.25% | 15.12% | 6.49% | 2.53% | 0.78% | 0.06% | 19.73% | 27.11% | TRUE | 0.2657 | N | N | 46.55% | 35.26% | 0.00% | 0.21% | 12.79% | 3.43% | 1.34% | 0.09% | 0.33% | TRUE |
| 2022 | 60026_LA | Local | A50 | SB - OP 19:00 - 07:00 | 389528.993 | 343853.826 | 34 | 13.8 | 3135.9 | 23.0 | 23.0 | 23.0 | 1.89 | 1.89 | 0.067 | 0.48% | 27.32% | 0.12% | 0.25% | 15.12% | 6.49% | 2.53% | 0.78% | 0.06% | 19.73% | 27.11% | TRUE | 0.2657 | N | N | 50.74% | 38.43% | 0.00% | 0.15% | 8.84% | 0.98% | 0.38% | 0.15% | 0.33% | TRUE |
| 2022 | 60026_LA | Local | A50 | SB - PM 16:00 - 19:00 | 389528.993 | 343853.826 | 34 | 13.8 | 1857.2 | 27.0 | 27.0 | 27.0 | 1.89 | 1.89 | 0.067 | 0.48% | 27.32% | 0.12% | 0.25% | 15.12% | 6.49% | 2.53% | 0.78% | 0.06% | 19.73% | 27.11% | TRUE | 0.2657 | N | N | 41.15% | 31.17% | 0.00% | 0.30% | 18.29% | 6.05% | 2.36% | 0.34% | 0.33% | TRUE |
| 2022 | 16501 | Local | A50 | Two-way - AM 07:00 - 10:00 | 389273.587 | 344897.324 | 46 | 15.4 | 3861.0 | 25.0 | 25.0 | 25.0 | 1.89 | 1.89 | 0.126 | 2.32% | 30.12% | 0.14% | 0.34% | 20.40% | 7.06% | 2.76% | 4.64% | 0.04% | 9.40% | 22.79% | TRUE | 0.2577 | N | N | 43.46% | 32.92% | 0.00% | 0.29% | 17.28% | 3.72% | 1.45% | 0.55% | 0.33% | TRUE |
| 2022 | 16501 | Local | A50 | Two-way - IP 10:00 - 16:00 | 389273.587 | 344897.324 | 46 | 15.4 | 4534.9 | 25.0 | 25.0 | 25.0 | 1.89 | 1.89 | 0.126 | 2.32% | 30.12% | 0.14% | 0.34% | 20.40% | 7.06% | 2.76% | 4.64% | 0.04% | 9.40% | 22.79% | TRUE | 0.2577 | N | N | 49.31% | 37.35% | 0.00% | 0.18% | 11.00% | 0.90% | 0.35% | 0.58% | 0.33% | TRUE |
| 2022 | 16501 | Local | A50 | Two-way - OP 19:00 - 07:00 | 389273.587 | 344897.324 | 46 | 15.4 | 10170.9 | 25.0 | 25.0 | 25.0 | 1.89 | 1.89 | 0.126 | 2.32% | 30.12% | 0.14% | 0.34% | 20.40% | 7.06% | 2.76% | 4.64% | 0.04% | 9.40% | 22.79% | TRUE | 0.2577 | N | N | 43.93% | 33.27% | 0.00% | 0.27% | 16.21% | 3.79% | 1.48% | 0.73% | 0.33% | TRUE |
| 2022 | 16501 | Local | A50 | Two-way - PM 16:00 - 19:00 | 389273.587 | 344897.324 | 46 | 15.4 | 5291.0 | 25.0 | 25.0 | 25.0 | 1.89 | 1.89 | 0.126 | 2.32% | 30.12% | 0.14% | 0.34% | 20.40% | 7.06% | 2.76% | 4.64% | 0.04% | 9.40% | 22.79% | TRUE | 0.2577 | N | N | 43.93% | 33.27% | 0.00% | 0.27% | 16.21% | 3.79% | 1.48% | 0.73% | 0.33% | TRUE |
| 2022 | 28732 | Local | A53 | Two-way - AM 07:00 - 10:00 | 386019.855 | 346598.535 | 43 | 14.9 | 4686.0 | 17.0 | 17.0 | 17.0 | 1.89 | 1.89 | 0.112 | 1.95% | 35.63% | 0.16% | 0.26% | 15.76% | 6.76% | 2.64% | 1.32% | 0.05% | 13.22% | 22.25% | TRUE | 0.2618 | C | Y | 48.44% | 36.68% | 0.00% | 0.19% | 11.27% | 1.86% | 0.73% | 0.51% | 0.33% | TRUE |
| 2022 | 28732 | Local | A53 | Two-way - IP 10:00 - 16:00 | 386019.855 | 346598.535 | 43 | 14.9 | 3060.6 | 16.0 | 16.0 | 16.0 | 1.89 | 1.89 | 0.112 | 1.95% | 35.63% | 0.16% | 0.26% | 15.76% | 6.76% | 2.64% | 1.32% | 0.05% | 13.22% | 22.25% | TRUE | 0.2618 | C | Y | 46.84% | 35.48% | 0.00% | 0.21% | 12.99% | 2.53% | 0.99% | 0.63% | 0.33% | TRUE |
| 2022 | 28732 | Local | A53 | Two-way - OP 19:00 - 07:00 | 386019.855 | 346598.535 | 43 | 14.9 | 4200.5 | 16.0 | 16.0 | 16.0 | 1.89 | 1.89 | 0.112 | 1.95% | 35.63% | 0.16% | 0.26% | 15.76% | 6.76% | 2.64% | 1.32% | 0.05% | 13.22% | 22.25% | TRUE | 0.2618 | C | Y | 49.89% | 37.79% | 0.00% | 0.14% | 8.37% | 2.21% | 0.86% | 0.41% | 0.33% | TRUE |
| 2022 | 28732 | Local | A53 | Two-way - PM 16:00 - 19:00 | 386019.855 | 346598.535 | 43 | 14.9 | 9008.0 | 17.0 | 17.0 | 17.0 | 1.89 | 1.89 | 0.112 | 1.95% | 35.63% | 0.16% | 0.26% | 15.76% | 6.76% | 2.64% | 1.32% | 0.05% | 13.22% | 22.25% | TRUE | 0.2618 | C | Y | 48.44% | 36.68% | 0.00% | 0.19% | 11.27% | 1.86% | 0.73% | 0.51% | 0.33% | TRUE |
| 2022 | 6545 | Local | A53 | Two-way - AM 07:00 - 10:00 | 385965.997 | 346586.482 | 41 | 14.7 | 4686.0 | 17.0 | 17.0 | 17.0 | 1.89 | 1.89 | 0.111 | 2.21% | 34.58% | 0.16% | 0.25% | 15.20% | 6.29% | 2.46% | 1.35% | 0.05% | 14.18% | 23.28% | TRUE | 0.2637 | C | Y | 48.44% | 36.68% | 0.00% | 0.19% | 11.27% | 1.86% | 0.73% | 0.51% | 0.33% | TRUE |
| 2022 | 6545 | Local | A53 | Two-way - IP 10:00 - 16:00 | 385965.997 | 346586.482 | 41 | 14.7 | 3060.6 | 16.0 | 16.0 | 16.0 | 1.89 | 1.89 | 0.111 | 2.21% | 34.58% | 0.16% | 0.25% | 15.20% | 6.29% | 2.46% | 1.35% | 0.05% | 14.18% | 23.28% | TRUE | 0.2637 | C | Y | 46.84% | 35.48% | 0.00% | 0.21% | 12.99% | 2.53% | 0.99% | 0.63% | 0.33% | TRUE |
| 2022 | 6545 | Local | A53 | Two-way - OP 19:00 - 07:00 | 385965.997 | 346586.482 | 41 | 14.7 | 4200.5 | 16.0 | 16.0 | 16.0 | 1.89 | 1.89 | 0.111 | 2.21% | 34.58% | 0.16% | 0.25% | 15.20% | 6.29% | 2.46% | 1.35% | 0.05% | 14.18% | 23.28% | TRUE | 0.2637 | C | Y | 49.89% | 37.79% | 0.00% | 0.14% | 8.37% | 2.21% | 0.86% | 0.41% | 0.33% | TRUE |
| 2022 | 6545 | Local | A53 | Two-way - PM 16:00 - 19:00 | 385965.997 | 346586.482 | 41 | 14.7 | 9008.0 | 17.0 | 17.0 | 17.0 | 1.89 | 1.89 | 0.111 | 2.21% | 34.58% | 0.16% | 0.25% | 15.20% | 6.29% | 2.46% | 1.35% | 0.05% | 14.18% | 23.28% | TRUE | 0.2637 | C | Y | 48.44% | 36.68% | 0.00% | 0.19% | 11.27% | 1.86% | 0.73% | 0.51% | 0.33% | TRUE |
| 2022 | 46553 | Local | A5008 | Two-way - AM 07:00 - 10:00 | 388624.767 | 347612.74 | 42 | 16.1 | 2807.5 | 30.0 | 30.0 | 30.0 | 1.89 | 1.89 | 0.089 | 1.44% | 20.94% | 0.10% | 0.15% | 9.04% | 2.90% | 1.13% | 12.43% | 0.03% | 24.81% | 27.03% | TRUE | 0.2238 | C | N | 48.71% | 36.89% | 0.00% | 0.15% | 9.10% | 2.00% | 0.78% | 2.05% | 0.33% | TRUE |
| 2022 | 46553 | Local | A5008 | Two-way - IP 10:00 - 16:00 | 388624.767 | 347612.74 | 42 | 16.1 | 3017.7 | 26.0 | 26.0 | 26.0 | 1.89 | 1.89 | 0.089 | 1.44% | 20.94% | 0.10% | 0.15% | 9.04% | 2.90% | 1.13% | 12.43% | 0.03% | 24.81% | 27.03% | TRUE | 0.2238 | C | N | 49.69% | 37.63% | 0.00% | 0.13% | 7.98% | 1.39% | 0.54% | 2.31% | 0.33% | TRUE |
| 2022 | 46553 | Local | A5008 | Two-way - OP 19:00 - 07:00 | 388624.767 | 347612.74 | 42 | 16.1 | 3212.2 | 28.0 | 28.0 | 28.0 | 1.89 | 1.89 | 0.089 | 1.44% | 20.94% | 0.10% | 0.15% | 9.04% | 2.90% | 1.13% | 12.43% | 0.03% | 24.81% | 27.03% | TRUE | 0.2238 | C | N | 47.81% | 36.21% | 0.00% | 0.16% | 9.72% | 1.90% | 0.74% | 3.13% | 0.32% | TRUE |
| 2022 | 46553 | Local | A5008 | Two-way - PM 16:00 - 19:00 | 388624.767 | 347612.74 | 42 | 16.1 | 6174.8 | 28.0 | 28.0 | 28.0 | 1.89 | 1.89 | 0.089 | 1.44% | 20.94% | 0.10% | 0.15% | 9.04% | 2.90% | 1.13% | 12.43% | 0.03% | 24.81% | 27.03% | TRUE | 0.2238 | C | N | 47.81% | 36.21% | 0.00% | 0.16% | 9.72% | 1.90% | 0.74% | 3.13% | 0.32% | TRUE |
| 2022 | 75422 | Local | A50 | WB - AM 07:00 - 10:00 | 391121.968 | 343069.488 | 39 | 12.8 | 5394.1 | 74.0 | 74.0 | 74.0 | 1.89 | 1.89 | 0.096 | 0.24% | 23.06% | 0.11% | 0.21% | 12.78% | 5.42% | 2.12% | 0.00% | 0.06% | 35.70% | 20.31% | TRUE | 0.2662 | N | N | 46.54% | 35.25% | 0.00% | 0.12% | 7.34% | 7.49% | 2.92% | 0.00% | 0.34% | TRUE |
| 2022 | 75422 | Local | A50 | WB - IP 10:00 - 16:00 | 391121.968 | 343069.488 | 39 | 12.8 | 5355.1 | 78.0 | 78.0 | 78.0 | 1.89 | 1.89 | 0.096 | 0.24% | 23.06% | 0.11% | 0.21% | 12.78% | 5.42% | 2.12% | 0.00% | 0.06% | 35.70% | 20.31% | TRUE | 0.2662 | N | N | 43.75% | 33.14% | 0.00% | 0.17% | 10.49% | 8.71% | 3.40% | 0.00% | 0.34% | TRUE |
| 2022 | 75422 | Local | A50 | WB - OP 19:00 - 07:00 | 391121.968 | 343069.488 | 39 | 12.8 | 6225.0 | 57.0 | 57.0 | 57.0 | 1.89 | 1.89 | 0.096 | 0.24% | 23.06% | 0.11% | 0.21% | 12.78% | 5.42% | 2.12% | 0.00% | 0.06% | 35.70% | 20.31% | TRUE | 0.2662 | N | N | 46.89% | 35.51% | 0.00% | 0.15% | 9.15% | 5.73% | 2.24% | 0.00% | 0.34% | TRUE |
| 2022 | 75422 | Local | A50 | WB - PM 16:00 - 19:00 | 391121.968 | 343069.488 | 39 | 12.8 | 10294.0 | 78.0 | 78.0 | 78.0 | 1.89 | 1.89 | 0.096 | 0.24% | 23.06% | 0.11% | 0.21% | 12.78% | 5.42% | 2.12% | 0.00% | 0.06% | 35.70% | 20.31% | TRUE | 0.2662 | N | N | 43.75% | 33.14% | 0.00% | 0.17% | 10.49% | 8.71% | 3.40% | 0.00% | 0.34% | TRUE |
| 2022 | 75422 | Local | A50 | EB - AM 07:00 - 10:00 | 391121.968 | 343069.488 | 39 | 12.8 | 12439.7 | 85.0 | 85.0 | 85.0 | 1.89 | 1.89 | 0.103 | 0.24% | 23.06% | 0.11% | 0.21% | 12.78% | 5.42% | 2.12% | 0.00% | 0.06% | 35.70% | 20.31% | TRUE | 0.2662 | N | N | 47.00% | 35.60% | 0.00% | 0.18% | 10.98% | 4.25% | 1.66% | 0.00% | 0.33% | TRUE |
| 2022 | 75422 | Local | A50 | EB - IP 10:00 - 16:00 | 391121.968 | 343069.488 | 39 | 12.8 | 6471.3 | 85.0 | 85.0 | 85.0 | 1.89 | 1.89 | 0.103 | 0.24% | 23.06% | 0.11% | 0.21% | 12.78% | 5.42% | 2.12% | 0.00% | 0.06% | 35.70% | 20.31% | TRUE | 0.2662 | N | N | 47.00% | 35.60% | 0.00% | 0.18% | 10.98% | 4.25% | 1.66% | 0.00% | 0.33% | TRUE |
| 2022 | 75422 | Local | A50 | EB - OP 19:00 - 07:00 | 391121.968 | 343069.488 | 39 | 12.8 | 7386.0 | 58.0 | 58.0 | 58.0 | 1.89 | 1.89 | 0.103 | 0.24% | 23.06% | 0.11% | 0.21% | 12.78% | 5.42% | 2.12% | 0.00% | 0.06% | 35.70% | 20.31% | TRUE | 0.2662 | N | N | 49.88% | 37.78% | 0.00% | 0.10% | 5.79% | 4.39% | 1.72% | 0.00% | 0.34% | TRUE |
| 2022 | 75422 | Local | A50 | EB - PM 16:00 - 19:00 | 391121.968 | 343069.488 | 39 | 12.8 | 4589.1 | 86.0 | 86.0 | 86.0 | 1.89 | 1.89 | 0.103 | 0.24% | 23.06% | 0.11% | 0.21% | 12.78% | 5.42% | 2.12% | 0.00% | 0.06% | 35.70% | 20.31% | TRUE | 0.2662 | N | N | 43.45% | 32.91% | 0.00% | 0.17% | 10.43% | 9.14% | 3.57% | 0.00% | 0.34% | TRUE |
| 2022 | 8147 | Local | A500 | WB - AM 07:00 - 10:00 | 387441.854 | 345884.865 | 53 | 16.3 | 7536.4 | 74.0 | 74.0 | 74.0 | 1.89 | 1.89 | 0.139 | 0.45% | 31.78% | 0.15% | 0.42% | 25.60% | 8.35% | 3.26% | 0.00% | 0.08% | 10.16% | 19.75% | TRUE | 0.2634 | N | N | 42.78% | 32.40% | 0.00% | 0.26% | 15.48% | 6.29% | 2.45% | 0.00% | 0.33% | TRUE |
| 2022 | 8147 | Local | A500 | WB - IP 10:00 - 16:00 | 387441.854 | 345884.865 | 53 | 16.3 | 8089.7 | 49.0 | 49.0 | 49.0 | 1.89 | 1.89 | 0.139 | 0.45% | 31.78% | 0.15% | 0.42% | 25.60% | 8.35% | 3.26% | 0.00% | 0.08% | 10.16% | 19.75% | TRUE | 0.2634 | N | N | 45.84% | 34.72% | 0.00% | 0.18% | 10.83% | 5.82% | 2.27% | 0.00% | 0.34% | TRUE |
| 2022 | 8147 | Local | A500 | WB - OP 19:00 - 07:00 | 387441.854 | 345884.865 | 53 | 16.3 | 7239.0 | 48.0 | 48.0 | 48.0 | 1.89 | 1.89 | 0.139 | 0.45% | 31.78% | 0.15% | 0.42% | 25.60% | 8.35% | 3.26% | 0.00% | 0.08% | 10.16% | 19.75% | TRUE | 0.2634 | N | N | 43.63% | 33.04% | 0.00% | 0.23% | 14.10% | 6.23% | 2.43% | 0.00% | 0.33% | TRUE |
| 2022 | 8147 | Local | A500 | WB - PM 16:00 - 19:00 | 387441.854 | 345884.865 | 53 | 16.3 | 14487.2 | 74.0 | 74.0 | 74.0 | 1.89 | 1.89 | 0.139 | 0.45% | 31.78% | 0.15% | 0.42% | 25.60% | 8.35% | 3.26% | 0.00% | 0.08% | 10.16% | 19.75% | TRUE | 0.2634 | N | N | 42.78% | 32.40% | 0.00% | 0.26% | 15.48% | 6.29% | 2.45% | 0.00% | 0.33% | TRUE |
| 2022 | 8147 | Local | A500 | EB - AM 07:00 - 10:00 | 387441.854 | 345884.865 | 53 | 16.3 | 6580.6 | 84.0 | 84.0 | 84.0 | 1.89 | 1.89 | 0.121 | 0.45% | 31.78% | 0.15% | 0.42% | 25.60% | 8.35% | 3.26% | 0.00% | 0.08% | 10.16% | 19.75% | TRUE | 0.2634 | N | N | 43.10% | 32.64% | 0.00% | 0.30% | 17.94% | 4.10% | 1.60% | 0.00% | 0.33% | TRUE |
| 2022 | 8147 | Local | A500 | EB - IP 10:00 - 16:00 | 387441.854 | 345884.865 | 53 | 16.3 | 6168.2 | 63.0 | 63.0 | 63.0 | 1.89 | 1.89 | 0.121 | 0.45% | 31.78% | 0.15% | 0.42% | 25.60% | 8.35% | 3.26% | 0.00% | 0.08% | 10.16% | 19.75% | TRUE | 0.2634 | N | N | 44.50% | 33.70% | 0.00% | 0.18% | 10.99% | 7.40% | 2.89% | 0.00% | 0.34% | TRUE |
| 2022 | 8147 | Local | A500 | EB - OP 19:00 - 07:00 | 387441.854 | 345884.865 | 53 | 16.3 | 12649.8 | 84.0 | 84.0 | 84.0 | 1.89 | 1.89 | 0.121 | 0.45% | 31.78% | 0.15% | 0.42% | 25.60% | 8.35% | 3.26% | 0.00% | 0.08% | 10.16% | 19.75% | TRUE | 0.2634 | N | N | 43.10% | 32.64% | 0.00% | 0.30% | 17.94% | 4.10% | 1.60% | 0.00% | 0.33% | TRUE |
| 2022 | 8147 | Local | A500 | EB - PM 16:00 - 19:00 | 387441.854 | 345884.865 | 53 | 16.3 | 7694.6 | 54.0 | 54.0 | 54.0 | 1.89 | 1.89 | 0.121 | 0.45% | 31.78% | 0.15% | 0.42% | 25.60% | 8.35% | 3.26% | 0.00% | 0.08% | 10.16% | 19.75% | TRUE | 0.2634 | N | N | 46.55% | 35.26% | 0.00% | 0.18% | 10.60% | 5.09% | 1.99% | 0.00% | 0.33% | TRUE |

| |
|---|
FALSEROWS

| | Comment - base year | Comment - projected year(s) |
|---|---|---|
| **$NO_X$ to $NO_2$ conversion** | The Defra NOx to NO2 model was used. This method is based on road specific fractions of primary NO2, which was calculated on a link-by-link basis using the EFT version 9.1b for each modelled year, having entered local fleet inputs. As calculations were carried out for annual average concentrations, an average fNO2 was calculated for each road link, rather than separate values for each modelled | See base year |
| **Line source parameters (height and width)** | Varies by road - single lane taken to be 3.5m, most roads 7m total. All roads were mod | See base year |
| **Surface roughness** | Following sensitivity testing and model verification, a uniform surface roughness valu | See base year |
| **Meteorology** | Modelling was conducted using the 2018 annual surface meteorological dataset meas | See base year |
| **Calibration approach** | LAQM.TG(16) approach was followed. A global primary NOx adjustment factor (PAdj) | See base year |
| **$NO_X$ emission factors** | EFT 9.1b | See base year |

One table should be filled out for each modelled year and for each modelled domain (e.g. euro standard inputs may be different for A-roads and motorways)
Please add rows to the tables if data on other vehicle types was collected during ANPR surveys
If data on a particular vehicle type was not collected during ANPR surveys, this row should be left blank in each table
The tables contain example data which should be deleted

**Year 2022, non-compliant fleet component**

| | Pre-Euro | Euro 1 | Euro 2 | Euro 3 | Euro 4 | Euro 5 | Euro 6 up to 2016 | Euro 6 2017-2019 | Euro 6 2020+ | Check |
|---|---|---|---|---|---|---|---|---|---|---|
| **Conventional petrol cars** | 0.00% | 0.00% | 0.00% | 100.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | TRUE |
| **Hybrid petrol cars** | 0.00% | 0.00% | 0.00% | 100.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | TRUE |
| **Plug-in hybrid petrol cars** | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% | 0.00% | 0.00% | 0.00% | TRUE |
| **Conventional diesel cars** | 0.00% | 0.00% | 0.00% | 2.62% | 20.16% | 77.22% | 0.00% | 0.00% | 0.00% | TRUE |
| **Full hybrid diesel cars** | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% | 0.00% | 0.00% | 0.00% | TRUE |
| **Conventional black cab taxis** | | | | | | | | | | FALSE |
| **Full hybrid black cab taxis** | | | | | | | | | | FALSE |
| **Battery electric black cab taxis** | | | | | | | | | | FALSE |
| **Conventional petrol LGVs** | 0.00% | 0.00% | 0.00% | 100.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | TRUE |
| **Hybrid petrol LGVs** | | | | | | | | | | FALSE |
| **Plug-in hybrid petrol LGVs** | | | | | | | | | | FALSE |
| **Conventional diesel LGVs** | 0.00% | 0.00% | 0.00% | 2.11% | 26.61% | 71.28% | 0.00% | 0.00% | 0.00% | TRUE |
| **Full hybrid diesel LGVs** | | | | | | | | | | FALSE |
| **Rigid HGVs** | 0.00% | 0.00% | 0.00% | 6.79% | 24.39% | 68.82% | 0.00% | 0.00% | 0.00% | TRUE |
| **Artic HGVs** | 0.00% | 0.00% | 0.97% | 12.05% | 20.98% | 66.00% | 0.00% | 0.00% | 0.00% | TRUE |
| **Conventional buses** | 0.00% | 0.00% | 6.88% | 37.20% | 29.52% | 26.40% | 0.00% | 0.00% | 0.00% | TRUE |
| **Hybrid buses** | | | | | | | | | | FALSE |
| **Battery electric buses** | | | | | | | | | | FALSE |
| **Methane/gas buses** | | | | | | | | | | FALSE |
| **Coaches** | 0.00% | 0.00% | 6.88% | 37.20% | 29.52% | 26.40% | 0.00% | 0.00% | 0.00% | TRUE |

**Year 2022, compliant fleet component**

| | Pre-Euro | Euro 1 | Euro 2 | Euro 3 | Euro 4 | Euro 5 | Euro 6 up to 2016 | Euro 6 2017-2019 | Euro 6 2020+ | Check |
|---|---|---|---|---|---|---|---|---|---|---|
| **Conventional petrol cars** | 0.00% | 0.00% | 0.00% | 0.00% | 11.57% | 25.39% | 15.46% | 47.58% | n/a | TRUE |
| **Hybrid petrol cars** | 0.00% | 0.00% | 0.00% | 0.00% | 7.99% | 8.08% | 10.06% | 73.87% | n/a | TRUE |
| **Plug-in hybrid petrol cars** | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 10.51% | 89.49% | n/a | TRUE |
| **Conventional diesel cars** | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 35.16% | 49.77% | 15.07% | TRUE |
| **Full hybrid diesel cars** | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 4.41% | 50.49% | 45.10% | TRUE |
| **Conventional black cab taxis** | | | | | | | | | | FALSE |
| **Full hybrid black cab taxis** | | | | | | | | | | FALSE |
| **Battery electric black cab taxis** | | | | | | | | | | FALSE |
| **Conventional petrol LGVs** | 0.00% | 0.00% | 0.00% | 0.00% | 20.88% | 31.30% | 21.31% | 26.50% | n/a | TRUE |
| **Hybrid petrol LGVs** | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 22.50% | 77.50% | n/a | TRUE |
| **Plug-in hybrid petrol LGVs** | | | | | | | | | | FALSE |
| **Conventional diesel LGVs** | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 44.56% | 55.44% | n/a | TRUE |
| **Full hybrid diesel LGVs** | | | | | | | | | | FALSE |
| **Rigid HGVs** | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% | n/a | n/a | TRUE |
| **Artic HGVs** | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% | n/a | n/a | TRUE |
| **Conventional buses** | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% | n/a | n/a | TRUE |
| **Hybrid buses** | | | | | | | | | | FALSE |
| **Battery electric buses** | | | | | | | | | | FALSE |
| **Methane/gas buses** | | | | | | | | | | FALSE |
| **Coaches** | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% | n/a | n/a | TRUE |

**Year 2022, compliant fleet component**

| | Pre-Euro | Euro 1 | Euro 2 | Euro 3 | Euro 4 | Euro 5 | Euro 6 up to 2016 | Euro 6 2017-2019 | Euro 6 2020+ | Check |
|---|---|---|---|---|---|---|---|---|---|---|
| **Conventional petrol cars** | 0.00% | 0.00% | 0.00% | 33.00% | 7.75% | 17.01% | 10.36% | 31.88% | 0.00% | TRUE |
| **Hybrid petrol cars** | 0.00% | 0.00% | 0.00% | 33.00% | 5.35% | 5.42% | 6.74% | 49.50% | 0.00% | TRUE |
| **Plug-in hybrid petrol cars** | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 33.00% | 7.04% | 59.96% | 0.00% | TRUE |
| **Conventional diesel cars** | 0.00% | 0.00% | 0.00% | 0.86% | 6.65% | 25.48% | 23.56% | 33.35% | 10.09% | TRUE |
| **Full hybrid diesel cars** | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 33.00% | 2.95% | 33.83% | 30.22% | TRUE |
| **Conventional black cab taxis** | | | | | | | | | | FALSE |
| **Full hybrid black cab taxis** | | | | | | | | | | FALSE |
| **Battery electric black cab taxis** | | | | | | | | | | FALSE |
| **Conventional petrol LGVs** | 0.00% | 0.00% | 0.00% | 58.00% | 8.77% | 13.15% | 8.95% | 11.13% | n/a | TRUE |
| **Hybrid petrol LGVs** | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 22.50% | 77.50% | n/a | TRUE |
| **Plug-in hybrid petrol LGVs** | | | | | | | | | | FALSE |
| **Conventional diesel LGVs** | 0.00% | 0.00% | 0.00% | 1.22% | 15.43% | 41.34% | 18.72% | 23.28% | n/a | TRUE |
| **Full hybrid diesel LGVs** | | | | | | | | | | FALSE |
| **Rigid HGVs** | 0.00% | 0.00% | 0.00% | 1.22% | 4.39% | 12.39% | 82.00% | n/a | n/a | TRUE |
| **Artic HGVs** | 0.00% | 0.00% | 0.17% | 2.17% | 3.78% | 11.88% | 82.00% | n/a | n/a | TRUE |
| **Conventional buses** | 0.00% | 0.00% | 4.20% | 22.69% | 18.01% | 16.10% | 39.00% | n/a | n/a | TRUE |
| **Hybrid buses** | | | | | | | | | | FALSE |
| **Battery electric buses** | | | | | | | | | | FALSE |
| **Methane/gas buses** | | | | | | | | | | FALSE |
| **Coaches** | 0.00% | 0.00% | 4.20% | 22.69% | 18.01% | 16.10% | 39.00% | n/a | n/a | TRUE |

**Both tables should be filled out for each modelled year and for each modelled domain (e.g. fleet composition may be different for A-roads and motorways)**
**Please add rows to the tables if data on other vehicle types was collected during ANPR surveys**
**If data on a particular vehicle type was not collected during ANPR surveys, this row should be left blank in each table**
**The tables contain example data which should be deleted**

**YEAR 2022: Average across model domain**

| | Average fleet composition (%) |
|---|---|
| Conventional petrol cars | 42.00% |
| Hybrid petrol cars | 3.22% |
| Plug-in hybrid petrol cars | 1.72% |
| Battery EV Cars | 0.86% |
| Conventional diesel cars | 35.47% |
| Full hybrid diesel cars | 0.66% |
| Conventional black cab taxis | 0.00% |
| Full hybrid black cab taxis | 0.00% |
| Battery electric black cab taxis | 0.00% |
| Conventional petrol LGVs | 0.19% |
| Hybrid petrol LGVs | 0.00% |
| Plug-in hybrid petrol LGVs | 0.00% |
| Conventional diesel LGVs | 11.18% |
| Full hybrid diesel LGVs | 0.00% |
| Rigid HGVs | 2.64% |
| Artic HGVs | 1.17% |
| Conventional buses | 0.40% |
| Hybrid buses | 0.00% |
| Battery electric buses | 0.00% |
| Methane/gas buses | 0.00% |
| Coaches | 0.16% |
| Motorcycle | 0.33% |
| CHECK | TRUE |

| *Buses* | With DPF | With DPF and SCR | CHECK |
|---|---|---|---|
| Euro 3 | | | FALSE |
| Euro 4 | | | FALSE |

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MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE

## APPENDIX 34 - E1 Economic Modelling Report

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

City of Stoke-on-Trent


# North Staffordshire Local Air Quality Plan - Economic Modelling Report (E1)

Report for Newcastle-under-Lyme Borough Council, Stoke-on-Trent City Council and Staffordshire County Council



ED 12487 | Issue Number 3 | Date 14/05/2020

**Customer:**

**Stoke-on-Trent City Council, Newcastle-under-Lyme City Council, Staffordshire County Council**

Customer reference:

Stoke CAZ Study

Confidentiality, copyright & reproduction:



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Approved By:

David Birchby

Date:

14 May 2020

Ricardo Energy & Environment reference:

Ref: ED12487– Issue Number 3

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# 1 Introduction

Newcastle-under-Lyme Borough Council (NuLBC) and Stoke-on-Trent City Council (SoTCC) were identified in the 2015 National Air Quality Plan as two of the 33 councils required to complete a Targeted Feasibility Study. The results of this feasibility study highlighted that compliance with $NO_2$ concentration limits would not be achieved in Stoke-on-Trent until 2023 and Newcastle-under-Lyme until 2026 without intervention. The feasibility study found that the introduction of measures designed to reduce air pollution along the A53 would bring forward compliance in Newcastle-under-Lyme by one year. The key areas identified in the Targeted Feasibility study that were modelled to exceed $NO_2$ limits in 2021 are along the A53 (Census IDs: 26555, 28732 and 74058).

In 2018, NULBC and SoTCC were issued a Ministerial Direction to produce a local air quality plan. This was required to consider a charging-based Clean Air Zone (CAZ) as a benchmark and a range of alternative measures able to achieve compliance within the shortest time possible.

Where actions are identified to tackle air pollution and achieve compliance with legal limits, these must be presented in a Business Case to JAQU, following HM Treasury's (HMT) Five Case model. A Strategic Outline Case (SOC) has already been submitted to JAQU.

One of the five cases is the Economics Case. This case must meet the following criteria (taken from the JAQU guidance: 'Business Cases for Local Plans'):

- Elements of the economic case are revisited, all changes to the underlying assumptions made in the SOC should be noted.
- The short list is to be assessed considering the benefits and costs in detail. Net Present Value (NPV) for each option should be considered to identify a preferred option; including a distributional analysis of the option.

Relevant annexes will include the full economic model with associated documentation, and the outputs of the scenario analysis of the air quality and transport modelling. This allows the assessment of the key Critical Success Factor on delivering compliance in the shortest possible time.

JAQU have shared with the Local Authorities detailed guidance around the methodologies and assumptions to adopt when appraising the options[1]. This guidance stipulates that deliverables to be provided by the Local Authority are:

1. SOC: options appraisal - within the SOC, detailing the case for change and a high-level assessment of the options being considered.
2. Economic Appraisal Methodology Report (E1).
3. The Economic Model (E2) and any linked documents (linked spreadsheets or user guide).
4. Write-up of the economic appraisal and results.
5. Distributional Analysis Methodology Report (E3).

This plan and supporting analysis must be developed in accordance with the HMT Green Book.

Sweco, together with Ricardo, have been commissioned by NuLBC and SoTCC to deliver the cost-benefit analysis and supporting model (E2), and the Economic Methodology Report (E1). This report sets out the detail of the methodology and data sources used to undertake the cost-benefit analysis of

[1] Latest version issued 27/11/17

the options. The purpose of this report is to meet deliverable E1 of the JAQU requirements as set out above.

The analysis inherently relies on other areas of the modelling undertaken to support the assessment of policy options, specifically the transport and air quality modelling undertaken outside of the scope of this project. This paper clearly references where the analysis has used the outputs of other modelling and describes how these outputs are used. However, it does not set out a detailed account of how this supporting modelling has been undertaken, which has been provided elsewhere (e.g. through the Modelling Needs Assessment reports).

This report sets out the approach and results of the core cost-benefit analysis (CBA) around the Preferred Option compared to a benchmark CAZ, as required by the Five Case Model. The CBA aims to identify, assess and place a monetary value on all impacts associated with a given policy option. In doing so, the impacts of a single option can be combined to judge the overall net effect. Options can be compared to assess which delivers the largest 'net benefit'. Hence, it explores the economic case for the Preferred Option and Benchmark CAZ D by demonstrating the comparative value for money (VfM).

This report does not present outputs of the distributional analysis. These are presented separately in the accompanying Distributional Analysis Methodology Report (deliverable E3).

# 2 Definition of Modelled Options

## 2.1 Setting Out the Options

The analysis is defined by the options that are included in the Outline Business Case (OBC) which are described in Table 2-1 below.

**Table 2-1: Shortlist for assessment**

| Scenario | Options appraised |
|---|---|
| **Do Minimum** | Providing an assessment of air pollutant concentrations with no further interventions |
| **Preferred Option** | The NSLAQP for Stoke-on-Trent and Newcastle-under-Lyme comprises of a package of measures:<br>• A50 Victoria Road bus gate, operational Monday to Friday between 07:00-10:00 and 16:00-19:00. ANPR cameras will be used to restrict access except for buses, taxis and cyclists<br>• A53 Etruria Road two-lane bus gate, operational Monday to Friday between 07:00-10:00 and 16:00-19:00. ANPR cameras will be used to restrict access except for buses, taxis and cyclists<br>• Traffic management measures on roads to the east and west of Victoria Road, including:<br>o Traffic calming<br>o One-way restrictions<br>o Speed restrictions<br>o Weight restrictions<br>o Extension of footways<br>o Carriageway re-surfacing<br>• Transport improvements along the A53 Etruria Road in the form of a review of signal times, signalised pedestrian crossing facilities and the relocation of a bus stop to avoid unnecessary queuing<br>• Targeted bus retrofit programme where 75% of buses using Bucknall New Road and 100% of buses using Victoria Road will be retrofitted to achieve Euro VI emissions standards<br>• Bus infrastructure improvements will be installed on routes that pass through or are parallel to the identified exceedance locations. The improvements will include Real Time Passenger Information (RTPI) screens, new bus shelters, accessible kerbs at bus stops and installation of CCTV at bus stops.<br>A ULEV exemption, allowing ultra-low emission vehicles to drive through the bus gates, will be assessed and if considered deliverable will be added to the preferred scheme in the Full Business Case (FBC). The local authorities will also seek further funding through the Clean Air Fund (CAF) for additional measures that will look to mitigate any impacts that might arise as a result of the scheme.<br><br>A separate Ministerial Direction concerns the retrofitting of buses operating along the A53 corridor. This is separately funded by JAQU and excluded from this Outline Business Case (OBC). |
| **Benchmark CAZ D** | As per JAQU guidance, a benchmark CAZ option has also been identified.<br><br>Based on the work undertaken during the options appraisal stage, the benchmark CAZ was defined as a class D. The boundary covers the main areas affected by $NO_2$ in Newcastle-under-Lyme and Stoke-on-Trent including Hanley, Victoria Road and east Newcastle-under-Lyme, as well as the A53 Etruria Road between Newcastle- |

| | |
|---|---|
| | under-Lyme and Hanley. The proposed charge rates for non-compliant vehicles would be:<br>• Cars / Taxis £5<br>• LGVs £9<br>• HGVs £35<br>• Buses £5<br>The Benchmark CAZ D applies to the boundary shown in Figure 2. |

**Figure 1: Preferred Option plan**

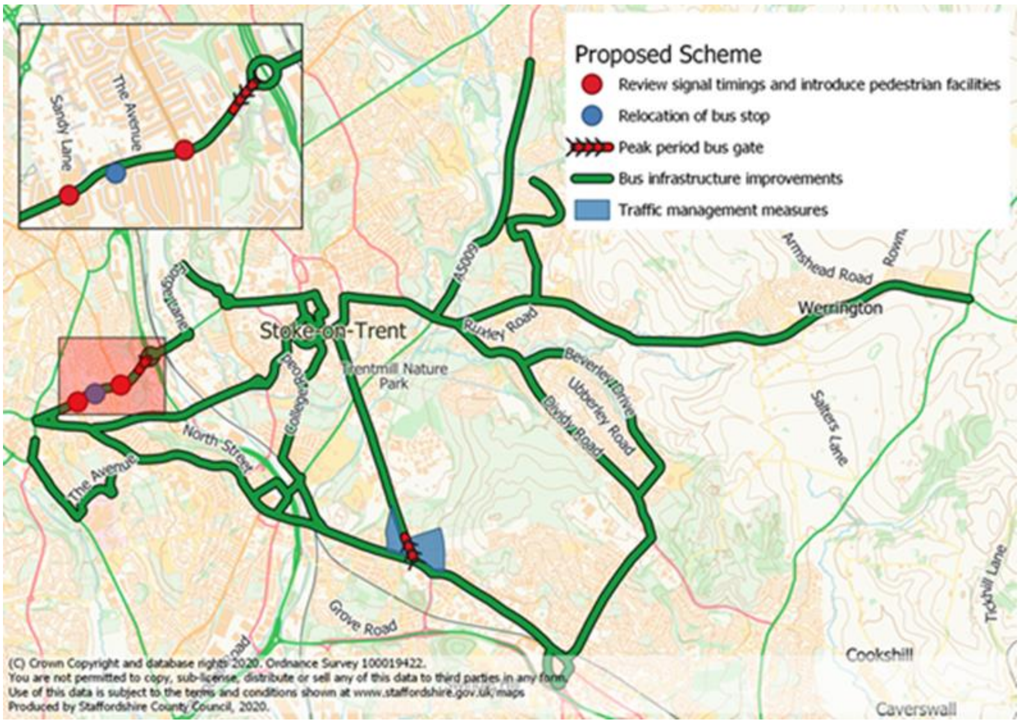
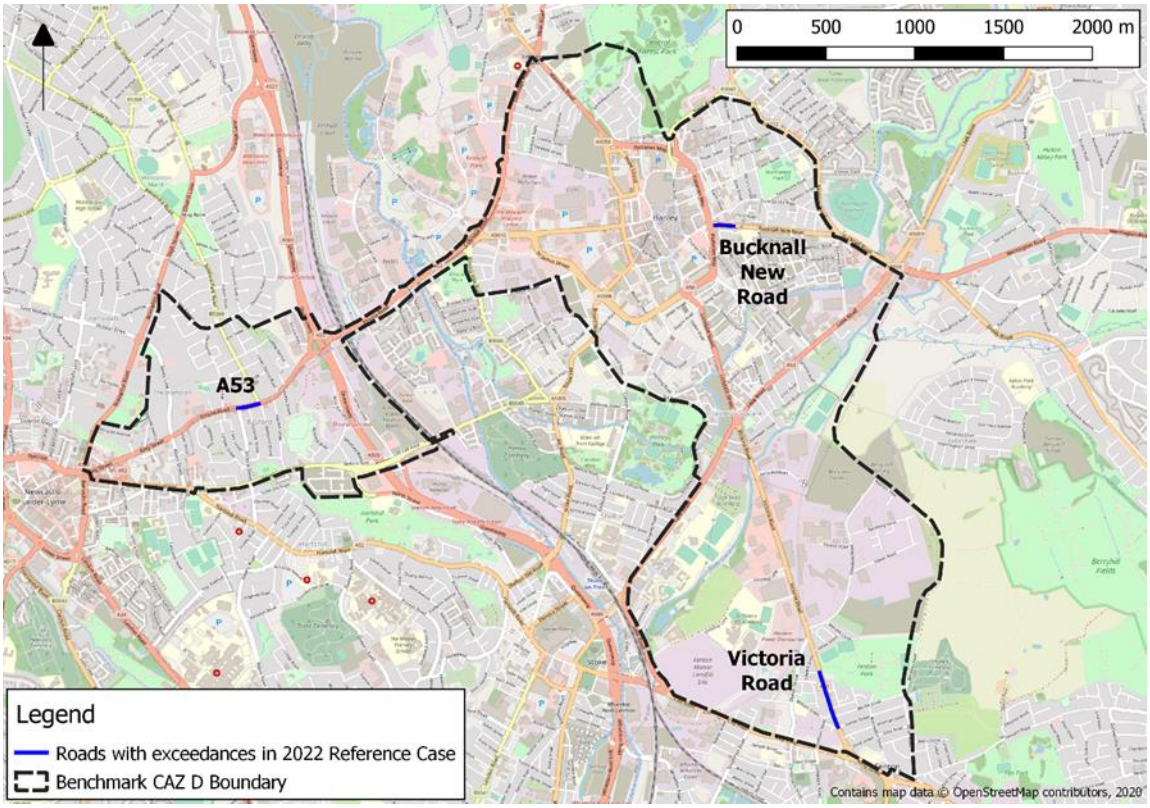


**Figure 2: Area for the Benchmark CAZ D Option**




## 2.2 CAZ Charges and Behavioural Response

The Benchmark CAZ D scheme covers buses, coaches, taxis (including private hire cars), LGVs, HGVs and cars, where vehicles not meeting the Euro 6/VI standard for diesel (or Euro 4 for petrol) are charged for entering the CAZ boundary. The charges for this assessment are presented in Table 2-2.

**Table 2-2: Benchmark CAZ D Charging Scheme (all charges noted are daily applied on first entry to the charging zone)**

| Vehicle Type | Benchmark CAZ D Charge |
|---|---|
| Cars and Taxis | £5.00 |
| LGVs | £9.00 |
| HGVs | £35.00 |
| Buses and Coaches | £5.00 |

Table 2-3 below shows the CAZ behavioural response assumptions adopted. These are the same as those applied in the transport model and are originally based on outputs of the stated preference (SP) survey conducted between 2 September and 2 October 2019 (See Stated Preference Survey Report[2]). For coaches, JAQU assumptions were used due to lack of granularity on separating coaches from buses in the transport model. A nominal charge has been set for buses so to mi

A nominal charge has been set for buses in order to avoid any change in the number of bus services. This was to avoid disproportionately impacting on deprived groups, particularly the elderly and disabled people, who often have greater reliance on public transport. Following consultation with the

[2] Sweco (2019). Air Quality Plan - Stated Preference Study Report – Unpublished.

bus operators it was determined that setting a significant daily charge would risk services being withdrawn. This would result in disadvantaged groups and vulnerable users not having an alternative mode of transport. This is in line with JAQU guidance which stipulates that if a local authority believes that introducing a CAZ will have an adverse effect on a particular group then a lower charge could be set. As a result of the nominal charge set, it is anticipated that bus operators would not upgrade their vehicles in response to the Benchmark CAZ D.

All responses to the options are assumed to occur in 2022 for simplicity, although the Management Case forecasts that a Benchmark CAZ D would not be operational until May 2023. In practice, these upgrades (and their associated impacts) could occur before or after the implementation of the CAZ.

Upgrade is only one of many responses which non-compliant vehicles can adopt in response to the CAZ. Vehicles can also 'cancel their trip', 'avoid the zone' or 'pay the charge'. Other possible responses were modelled endogenously within the transport model. Hence, it is assumed that these responses reflect the specific characteristics of the journeys and trip makers and are more appropriate than the standard JAQU national assumptions.

**Table 2-3: Behavioural responses to the Benchmark CAZ D**

<table>
<tr><th>Response</th><th>CAR</th><th>LGV</th><th>HGV</th><th>Bus</th><th>Coach</th><th>Taxis</th><th>Private Hire Car</th></tr>
<tr><td>Upgrade</td><td>45%</td><td>43%</td><td>66%</td><td>0%</td><td>41%</td><td>73%</td><td>73%</td></tr>
<tr><td>Cancel*</td><td rowspan="2">21%</td><td>2%</td><td>5%</td><td>0%</td><td>26%</td><td rowspan="2">24%</td><td rowspan="2">24%</td></tr>
<tr><td>Change mode*</td><td>0%</td><td>0%</td><td>0%</td><td>0%</td></tr>
<tr><td>Avoid</td><td>19%</td><td>27%</td><td>14%</td><td>0%</td><td>0%</td><td>0%</td><td>0%</td></tr>
<tr><td>Pay</td><td>15%</td><td>28%</td><td>15%</td><td>100%</td><td>33%</td><td>3%</td><td>3%</td></tr>
</table>

** For cars, taxis and PHC, the ratio between vehicles that cancel and those that change mode is not available.*

In addition to the above described primary behavioural responses to the CAZ, JAQU provides guidance on secondary behavioural responses. This sets out the proportions of people who, when upgrading their vehicle, buy a used or new vehicle, and whether they sell or scrap their old car:

- A proportion, 25%, of those people taking the upgrade response will scrap their old vehicle
- A proportion, 25%, of those people choosing to upgrade will buy a new vehicle
- A proportion, (75%*75%), of those people who elect to upgrade will sell their old vehicle and buy the cheapest unaffected one
- A proportion, (25%*75%), of those people who decide to upgrade will sell their old vehicle and buy the cheapest unaffected one of the same fuel type

# 3 Scope and Methodology

## 3.1 Impacts Assessed

Any scheme to tackle air quality will impact different parts of the environment, economy and society. The economic analysis seeks to quantify and value as many of these impacts as possible given the time, resource and modelling methodologies available.

JAQU have provided detailed guidance regarding the appraisal of options. This provides a steer for many of the key data inputs and assumptions that have framed the analysis undertaken.

The key guidance documents include:

- Options Appraisal – Guidance (2017)[3] (and preceding versions of this guidance)
- Third wave local authorities – guidance: options appraisal[4]
- National data inputs for Local Economic Models (2017)[5].

JAQU guidance sets the basis for the scope of impacts to be assessed. This report has adopted the same approach although in some cases, it has grouped impacts by the methodology taken to appraise them and, hence, may in places refer to different impacts using different terminology to that set out in the JAQU guidance.

A quantitative assessment of the impacts associated with the CAZ has been undertaken where possible. However, in some cases it has not been possible to complete a full quantitative assessment given limitations in the data available. Where impacts have not been assessed quantitatively, a qualitative assessment has been carried out. The results of the analysis are presented in Section 7.

The scope of impacts captured by the CBA, and their correspondence to the impact categories described in the JAQU guidance, are presented in Table 3-1.

**Table 3-1: Impact description and mapping**

| Impact name (Relevant Option) | Description | JAQU reference |
|---|---|---|
| Upgrade costs (CAZ D) | The impact on those vehicles owners that respond to the Benchmark CAZ D. These are the upfront costs for vehicle owners associated with switching from a non-compliant to a compliant vehicle. In calculating upgrade costs, secondary behavioural responses on whether users buy a used or new vehicle, and whether they scrap or sell their old vehicle, are considered (See Section 2.2). | 'Vehicle scrappage costs' and 'Consumer welfare impact' for 'upgrade vehicle response' |
| Vehicle Operating Cost (VOC) impacts (CAZ D and Preferred Option) | Those savings or additional costs that can result from the Benchmark CAZ D or Preferred Option. This includes both changes in fuel consumption and the associated cost and change in operating and maintenance costs. This can come about through additional distances travelled (handled by transport modelling and TUBA) or change in vehicle type (handled by REE model). | 'Fuel switch costs' |

[3] Unpublished – provided directly by JAQU to Local Authorities
[4]Ibid
[5]Ibid

| Impact name (Relevant Option) | Description | JAQU reference |
|---|---|---|
| Implementation costs (CAPEX and Operating Costs) (CAZ D and Preferred Option) | Cost of upfront and ongoing activity and assets required to implement, monitor and enforce the Benchmark CAZ D and Preferred Option. Includes the cost of bus retrofits in the Preferred Option. | 'Government costs' |
| Air quality emissions (CAZ D and Preferred Option | The impact on affected populations by a change in $NO_X$ and $PM_{2.5}$ emissions as a result of the Benchmark CAZ D and Preferred Option. | 'Health and environmental impact' |
| Greenhouse Gas impacts (CAZ D and Preferred Option) | The impact on affected populations by a change in greenhouse gas emissions that result from Benchmark CAZ D and the Preferred Option. This can come about through additional distances travelled or change in vehicle type. | 'Greenhouse Gas impacts' |
| Travel Time (CAZ D and Preferred Option | The impact of the Benchmark CAZ D and Preferred Option on traffic flow and the subsequent impact on travel time experienced by affected populations. | 'Traffic flow impact' |
| Welfare impacts (CAZ D) | Where vehicle users change their travel patterns in response to a charging CAZ, there will be a cost for the user associated with not being able to take their first preference. E.g. in the case of 'cancelled' journeys, the vehicle user will not be able to undertake the activity planned at the destination (e.g. shopping trip to city centre). The vehicle user will miss out on the happiness / value that they would have gained from that trip, which is captured by this impact category. | Welfare impacts |
| User Charges (CAZ D) | The cost to road users from paying the CAZ charges. This category includes for impact on consumer welfare associated with the user not being able to take their first preference. E.g. in the case of 'cancelled' journeys, the vehicle user will not be able to undertake the activity planned at the destination (e.g. shopping trip to city centre). The vehicle user will miss out on the happiness / value that they would have gained from that trip, which is captured by this impact category. | 'Consumer welfare impact' |
| User Charge Revenues (CAZ D) | The revenue generated through charging the non-compliant cars to travel through the CAZ. This should have no net impact on the model, although will not net off completely due to central Government credit/debit card fees. | 'Government costs' |
| PCN Charges and revenue (Preferred Option) | The cost to road users and revenue to public administration incurred from penalties from entering the bus gate restrictions. These are assumed to be equal as no credit/debit card fees have been accounted for. | 'Government costs' |
| Indirect Taxes and Revenues (CAZ D and Preferred Option) | The impact on revenues generated by the VAT, excises and duties levied on goods and services. This should have no net impact on the model. | 'Government costs' |
| Bus Stop/RTPI/CCTV Improvements (Preferred Option) | There will be a range of benefits associated with greater uptake of bus travel in the Preferred Option | TAG |

## 3.2 Models developed

The approach is designed to be consistent with the HMT's Green Book guidance for appraisal[6]. It also draws upon guidance provided by the JAQU[7] to inform the assessment in accordance with Department for Transport's Transport Appraisal Guidance (TAG).

The analysis has deployed two complementary modelling systems to appraise the impacts:

1. **REE CAZ model:** The approach to assessing the impacts associated with upgrading vehicles (and associated vehicle operating costs (VOCs): Non-fuel VOCs, fuel and $CO_2$ impacts) and air quality impacts has been tested in multiple CAZ cities.

2. **TUBA:** Changes to travel time, such as that resulting from altered trips to avoid the Preferred Option bus gates or Benchmark CAZ D zone or changes in congestion resulting from the operation of the bus gates or Benchmark CAZ D zone, are taken from the transport model and monetised using TUBA analysis along with associated impacts on fuel and non-fuel vehicle operating costs.

Ricardo's economic model is used to combine and monetise all individual impacts across the models to calculate the overall net present value (NPV).

The way in which these impacts are relevant to the different policy options is shown in Table 3-2.

**Table 3-2: Mapping of impacts to policy options**

| | Preferred Option | Benchmark CAZ D |
|---|---|---|
| **TUBA Model** | | |
| **Travel Time** | ✓ | ✓ |
| **Vehicle Operating Cost (VOC) Impacts (speed/distance)** | ✓ | ✓ |
| **User charges** | | ✓ |
| **User charge revenue** | | ✓ |
| **PCN charges** | ✓ | |
| **Implementation Costs** | ✓ | ✓ |
| **Indirect Tax Revenues** | ✓ | ✓ |
| **Greenhouse Gas Impacts (speed/distance)** | ✓ | ✓ |
| **REE CAZ Model** | | |
| **Air Quality Emissions** | ✓ | ✓ |
| **Upgrade costs** | ✓ (Bus retrofits) | ✓ |
| **Vehicle Operating Cost (VOC) Impacts (upgrades)** | | ✓ |
| **Greenhouse Gas Impacts (upgrades)** | | ✓ |
| **Bus Stop/RTPI/CCTV Improvements** | ✓ | |

## 3.3 Modelling years

The appraisal period for the economic modelling is 2022-2031, a 10 year period from implementation year, as per JAQU Guidance.

[6] https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent
[7] JAQU Third Wave City Guidance

There are three key years used in the modelling work, as set out in Table 3-3 below. The base modelling year is 2019 as this allows use of the latest air quality and transport data. The future baseline is modelled for the assumed implementation year in 2022. Other years required for the analysis of the appraisal period are generated through projection rather than direct model tests, with 2025 being the third key year.

**Table 3-3: Model years and appraisal period**

| Year | Description |
|---|---|
| **2019** | **Base year** – using latest available data on air quality and traffic (based on 2015 traffic model base year) |
| **2022** | **Implementation year** – latest date when the scheme is assumed to be in place. |
| **2025** | **Interim forecast year – used for interpolation/extrapolation of other forecast years** |
| **2022-2031** | **Appraisal period -** 10 years (from date that local implementation is estimated to begin) |

As noted above, all responses to the options are assumed to occur in 2022 for simplicity and consistency with the transport and air quality, although the Management Case forecasts that a Benchmark CAZ D would not be operational until May 2023.

## 3.4 Developing the Fleet Baseline

The economic analysis uses ANPR data from 2019 to calculate the number of unique vehicles that enter the North Staffordshire area over a given year. This data is then used to calculate the number of vehicles that upgrade in response to the CAZ to determine the associated costs.

ANPR data splits the fleet into passenger cars, LGVs, HGVs, buses and taxis, including fuel type and Euro standard split. In the case of buses and taxis, licence data was provided by the Councils which has been used as the baseline fleet, and so ANPR data was not used.

Vehicle-specific scaling factors were applied to get the annual number of unique vehicles from the weekly ANPR survey data. In addition to this, the coverage of the ANPR cameras in the survey was considered and uplift factors applied to reflect the incomplete coverage of routes into the CAZ. Additionally, annual fleet growth rates derived from the transport model were applied, and finally 2022 Euro standard splits used in the air quality model were applied to arrive at the final numbers of unique vehicles in 2022 (Table 3-4).

The baseline taxi fleet was derived from licence data and annual uplift and projected turnover applied to derive the baseline 2022 fleet (Table 3-5).

**Table 3-4: 2019 Weekly ANPR Survey Data on Unique Vehicles, and 2022 Estimated Baseline**

| Vehicle | Fuel | Euro | 2019 (One Week ANPR Survey Count) | 2022 (Annual) |
|---|---|---|---|---|
| Car | Petrol | Pre-Euro 1 | 632 | 0 |
| Car | Petrol | Euro 1 | 444 | 0 |
| Car | Petrol | Euro 2 | 1620 | 0 |
| Car | Petrol | Euro 3 | 21990 | 5393 |
| Car | Petrol | Euro 4 | 44989 | 36695 |
| Car | Petrol | Euro 5 | 49134 | 80556 |
| Car | Petrol | Euro 6 | 67541 | 200018 |
| **Car** | **Petrol** | **Total** | **186350** | **322662** |
| Car | Diesel | Pre-Euro 1 | 60 | 0 |
| Car | Diesel | Euro 1 | 133 | 0 |
| Car | Diesel | Euro 2 | 419 | 0 |
| Car | Diesel | Euro 3 | 11412 | 3479 |
| Car | Diesel | Euro 4 | 32646 | 26771 |

| | | | | |
|---|---|---|---|---|
| Car | Diesel | Euro 5 | 66042 | 102534 |
| Car | Diesel | Euro 6 | 70957 | 181772 |
| **Car** | **Diesel** | **Total** | **181669** | **314557** |
| HGV | Diesel | Pre-Euro 1 | 54 | 0 |
| HGV | Diesel | Euro 1 | 35 | 0 |
| HGV | Diesel | Euro 2 | 191 | 25 |
| HGV | Diesel | Euro 3 | 1376 | 945 |
| HGV | Diesel | Euro 4 | 2534 | 2815 |
| HGV | Diesel | Euro 5 | 9033 | 8122 |
| HGV | Diesel | Euro 6 | 27582 | 87973 |
| **HGV** | **Diesel** | **Total** | **40803** | **99880** |
| LGV | Petrol | Pre-Euro 1 | 95 | 0 |
| LGV | Petrol | Euro 1 | 14 | 0 |
| LGV | Petrol | Euro 2 | 8 | 0 |
| LGV | Petrol | Euro 3 | 53 | 29 |
| LGV | Petrol | Euro 4 | 153 | 196 |
| LGV | Petrol | Euro 5 | 32 | 294 |
| LGV | Petrol | Euro 6 | 77 | 449 |
| **LGV** | **Petrol** | **Total** | **429** | **969** |
| LGV | Diesel | Pre-Euro 1 | 129 | 0 |
| LGV | Diesel | Euro 1 | 186 | 0 |
| LGV | Diesel | Euro 2 | 185 | 0 |
| LGV | Diesel | Euro 3 | 2540 | 1419 |
| LGV | Diesel | Euro 4 | 17220 | 17894 |
| LGV | Diesel | Euro 5 | 32211 | 47931 |
| LGV | Diesel | Euro 6 | 24140 | 105710 |
| **LGV** | **Diesel** | **Total** | **76610** | **172953** |

**Table 3-5: 2019 Taxi Licence Data and estimated 2022 Baseline fleet**

| Vehicle | Fuel | Euro Standard | 2019 | 2022 |
|---|---|---|---|---|
| Taxis | Diesel | Pre-Euro 1 | 0 | 0 |
| Taxis | Diesel | Euro 1 | 0 | 0 |
| Taxis | Diesel | Euro 2 | 0 | 0 |
| Taxis | Diesel | Euro 3 | 48 | 14 |
| Taxis | Diesel | Euro 4 | 117 | 72 |
| Taxis | Diesel | Euro 5 | 232 | 175 |
| Taxis | Diesel | Euro 6 | 41 | 198 |
| **Taxis** | **Diesel** | **Total** | **438** | **459** |
| Private Hire Car | Petrol | Pre-Euro 1 | 0 | 0 |
| Private Hire Car | Petrol | Euro 1 | 0 | 0 |
| Private Hire Car | Petrol | Euro 2 | 0 | 0 |
| Private Hire Car | Petrol | Euro 3 | 3 | 2 |
| Private Hire Car | Petrol | Euro 4 | 54 | 14 |
| Private Hire Car | Petrol | Euro 5 | 55 | 30 |
| Private Hire Car | Petrol | Euro 6 | 2 | 74 |
| **Private Hire Car** | **Petrol** | **Total** | **114** | **120** |

| | | | | |
|---|---|---|---|---|
| Private Hire Car | Diesel | Pre-Euro 1 | 0 | 0 |
| Private Hire Car | Diesel | Euro 1 | 0 | 0 |
| Private Hire Car | Diesel | Euro 2 | 0 | 0 |
| Private Hire Car | Diesel | Euro 3 | 17 | 21 |
| Private Hire Car | Diesel | Euro 4 | 420 | 164 |
| Private Hire Car | Diesel | Euro 5 | 1192 | 627 |
| Private Hire Car | Diesel | Euro 6 | 206 | 1112 |
| **Private Hire Car** | **Diesel** | **Total** | **1835** | **1924** |

### 3.4.1 Sense-check of Unique Vehicles

The number of unique vehicles travelling into the CAZ area is a critical intermediary output of the analysis and defines a large proportion of the resultant impacts seen in the model. There is no perfect source for the number of unique vehicles. However, as part of the quality assurance of the analysis the number of unique vehicles has been sense checked.

The unique vehicles that resulted from the ANPR data and application of uplift factors were compared with the number of licenced vehicles in Stoke-on-Trent and Staffordshire according to DfT data[8]. The number of unique cars assumed to be affected by the proposed Benchmark CAZ D boundary is broadly similar to those registered in Stoke-on Trent and Staffordshire. In the case of LGVs and HGVs, the modelled baseline fleet is significantly greater than the numbers from licence data as a percentage. However, the West Midlands is densely populated with Birmingham nearby, and so it can be expected that goods vehicles will travel from outside Staffordshire and Stoke-on-Trent to businesses in the area.

**Table 3-6: Registered vehicles in 2018 and the difference between the baseline model fleet (2019 fleet)**

| Vehicle | Stoke-on Trent | Staffordshire | 2019 Modelled Fleet |
|---|---|---|---|
| **Cars** | 110,800 | 463,600 | 552,000 |
| **LGVs** | 15,200 | 56,300 | 116,000 |
| **HGVs** | 2,400 | 12,500 | 102,184 |

## 3.5 Discounting

As recommended by JAQU, the model uses a 2018 price base year as the basis for all calculations. This means that past costs (for example vehicle costs) are inflated to 2018 values using HMT's GDP Deflator series.

Discounting future costs and benefits considers the time preference of society. Discounting is applied in accordance with HMT's Green Book guidance. The model applies a discount rate of 3.5% to all impacts, which are discounted back to 2019[9].

[8] https://www.gov.uk/government/statistics/vehicle-licensing-statistics-2018
[9] Adjustment factors, TAG 2018.

# 4 Approach to assessing the impacts

## 4.1 Transport and Air Quality models

The Preferred Option and the Benchmark CAZ D have been modelled in the transport model to assess the potential displacement effects of vehicles. The North Staffordshire Multi-Modal (NSMM) transport model has been used to derive the required traffic forecasts to inform this economic appraisal. The traffic model provides flows for compliant vehicles (those meeting the CAZ standards naturally or through upgrade) and non-compliant vehicles (compliance in 2022 is provided by the air quality model, originally based on compliance from ANPR data in Table 3-4 and with fleet uplift and turnover assumptions applied).

The traffic data is then applied in the air quality model to assess the impacts of the scheme on emissions from compliant and non-compliant vehicles, and subsequently on air pollutant concentrations. The fleet for the 2022 vehicles uses the 2022 baseline fleet and applies baseline vehicle upgrade assumptions.

## 4.2 Ricardo Economic Upgrade Model

### 4.2.1 Air Quality Emissions

The key objective of the Preferred Option and Benchmark CAZ D is to reduce the emission (and subsequently concentrations) of air pollutant emissions from road transport sources in the three identified areas of exceedance. Reducing air pollutant emissions will have a range of subsequent benefits on human and environmental health, productivity and amenity.

The following approach to valuing the impacts associated with reductions in emissions is as follows:

1. Take quantities (tonnes) of emissions of $NO_X$ and $PM_{2.5}$ from underlying air quality modelling undertaken by Ricardo for both option scenarios and do minimum baseline
2. Calculate the total emissions impact relative to baseline
3. Value the impact applying damage costs provided by JAQU

Damage cost values (based on the value of ‘Urban big’ as defined within recent Defra Guidance for Air Quality Damage Costs[10]) are applied to calculate the monetary benefit of the change in emissions. It is assumed that the benefit reduces over time as the baseline scenario naturally catches up to the Preferred Option and Benchmark CAZ D as per JAQU Guidance. This effect is simulated using ‘impact extrapolation factor’, as explained in Information Box #1 below.

**Information Box #1: Impact extrapolation factors**

For air pollutant (and other) impacts, detailed modelling of the effects of all options was only available for 2022. Hence a detailed assessment of the emissions impacts of all options over the full appraisal period was not available. A methodology was developed to extrapolate these impacts over the whole appraisal period.

The supporting evidence for the national plans[11] included scenarios run by JAQU which presented resulting concentrations in cities for the baseline and illustrative CAZ scenarios. This information was analysed to produce a factor with which impacts can be extrapolated over the appraisal period to simulate the erosion of the impacts of the Benchmark CAZ D, as the vehicle fleet naturally catches up

[10] https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1902271109_Damage_cost_update_2018_FINAL_Issue_2_publication.pdf
[11] See ‘Baseline and with Measures projections’ available: https://uk-air.defra.gov.uk/library/no2ten/2017-no2-projections-from-2015-data

with the upgrades brought forward as part of the Benchmark CAZ D. The extrapolation factor is the difference in concentrations between baseline and Benchmark CAZ D scenario, expressed as a ratio relative to the difference in 2022.

In the Preferred Option, there are expected to also be a reduction in air quality benefits over time, but this will be less than in the Benchmark CAZ D, given the option does not incentivise bringing forward vehicle upgrades in the same way. For the Preferred Option, an average of the impact extrapolation factor and 1 was used to produce a more gradual erosion of effects.

The results of the analysis for 2022 are presented in Table 4-1. It should be noted that these are only impacts for a single year, and there is no application of extrapolation factors.

As noted above, it is assumed that both options are implemented in 2022. However, as set out in the Management Case, the Benchmark CAZ D can only be implemented from 2023. Hence the Preferred Option in practice will deliver emissions reductions and associated health benefits sooner. By assuming the Benchmark CAZ D begins to deliver emissions reductions in 2022, the analysis overstates the size of the air pollution benefits associated with this option.

**Table 4-1: Air pollutant ($NO_X$ and $PM_{2.5}$) impacts of the measures in 2022**

| Option | $NO_X$ | | | $PM_{2.5}$ | | |
|---|---|---|---|---|---|---|
| | **$NO_X$ Emissions (t/ year All vehicles)** | **Difference from Baseline (t)** | **Benefits per annum (£)** | **$PM_{2.5}$ Emissions (t/ year All vehicles)** | **Difference from Baseline (t)** | **Benefits per annum (£)** |
| **Baseline 2022** | 1,629 | | - | 285 | - | |
| **Preferred Option** | 1,616 | -13 | £230,099 | 285 | 0 | 0 |
| **Benchmark CAZ D** | 1,528 | -101 | £1,787,691 | 279 | -6 | £2,025,664 |

### 4.2.2 Vehicle Upgrade costs in Benchmark CAZ D

The costs associated with people who decide to upgrade their vehicle as a result of implementation of the Benchmark CAZ D is a critical impact category. The approach to estimating upgrade costs has been tested in a number of cities considering charging schemes.

The approach starts by calculating the number of vehicles to be upgraded. For the Benchmark CAZ D this is defined by applying behavioural responses to the non-compliant vehicles in the baseline. It is assumed that the oldest vehicles are the first to upgrade.

The cost to an owner of a change vehicle is then estimated through consideration of second order behavioural responses outlined in Section 2.2. Vehicle owners are assumed either to scrap and buy a new compliant vehicle, or to sell their non-compliant vehicle as used and replace with a used complaint vehicle. These transactions have the following impacts (With the impacts varying by transaction type):

- The lost residual value from scrapped vehicles (For those who elect to scrap their old vehicle)
- The resale value of an unwanted non-compliant vehicle based on the depreciated value of vehicle in 2022 (For those who choose to sell their old vehicle)
- New or used compliant vehicle purchase costs in 2022

These input values are combined to give the net cost.

Upgrades will also occur in the baseline and our approach to estimating these costs is very similar to that applied in the Benchmark CAZ D. The general assumption in the baseline is that the same upgrade decision will be undertaken as under the Benchmark CAZ D option but at a later date (defined by useful lives and ownership profiles). This future net cost is then discounted given it occurs in the future to allow comparison with costs under the Benchmark CAZ D option.

The upgrade cost assumptions, and the impacts associated with each second order behavioural response are set out in Table 4-2.

**Table 4-2 – Upgrade cost second order behavioural response calculation and associated impacts**

| | Scenario | Scrap | Buy new | Sell & Buy Same Fuel | Sell & Buy Different Fuel |
|---|---|---|---|---|---|
| **Numbers of vehicles** | **CAZ** | 25% of all vehicles upgraded<br>JAQU behavioural response applied.<br>Oldest vehicles scrapped first in 2022 | 25% of all vehicles upgraded<br>JAQU behavioural response applied.<br>Every vehicle scrapped is replaced with new vehicle in 2022 | 75% * 25% (for diesel)<br>75% for petrol<br>JAQU behavioural response applied.<br>Vehicles to be sold (those not scrapped) * behavioural response | 75% * 75% (for diesel)<br>0% for petrol<br>JAQU behavioural response applied.<br>Vehicles to be sold (those not scrapped) * behavioural response |
| | **Baseline** | Vehicles scrapped under CAZ are scrapped in baseline post 202 when end useful life reached | Every vehicle scrapped replaced with new in year after 2022 at end of useful life of scrapped non-compliant vehicle | Same activity as CAZ scenario<br>But some resell at end of ownership profile<br>Some scrap when reach end useful life | Same activity as CAZ scenario<br>But some resell at end of ownership profile<br>Some scrap when reach end useful life |
| **Costs** | **CAZ** | Loss of residual value determined by remaining life of vehicle | Purchase cost of new compliant vehicle in 2022 | Cost of compliant used vehicle less resale value of used non-compliant vehicle | Cost of compliant used vehicle less resale value of used non-compliant vehicle |
| | **Baseline** | No residual value of vehicles as they reach end useful life | Purchase cost of the same new vehicle in year post 2022 (real cost is same as CAZ scenario, but purchase delayed by remaining life of existing vehicle hence cost discounted to 2022) | Discounted cost of used compliant vehicle less resale value of existing vehicle (for those reaching end ownership profile)<br>Discounted cost of used compliant vehicle (for those reaching end useful life)<br>Resale/scrappage profile applied to vehicle depending on age of non-compliant vehicle | Discounted cost of used compliant vehicle less resale value of existing vehicle (for those reaching end ownership profile)<br>Discounted cost of used compliant vehicle (for those reaching end useful life)<br>Resale/scrappage profile applied to vehicle depending on age of non-compliant vehicle |

The upgrade costs are calculated taking the difference in aggregate upgrade costs for the Benchmark CAZ D option and baseline scenario. The cost of upgrade is hence calculated as the marginal impact of people upgrading earlier than they would do if the Benchmark CAZ D was not in place. This is to say that a person would upgrade in the future anyway, what is the economic impact of the person upgrading in the implementation year relative to the cost in the future year.

Upgrade costs in the CBA are assessed using societal costs. As such, VAT and profit are excluded, and actual upgrade costs to users will be higher in practice.

### 4.2.3 Vehicle operating costs (Fuel and Non-Fuel VOC) and Greenhouse Gas Emissions associated with vehicle upgrades in the Preferred Option and Benchmark CAZ D

#### 4.2.3.1 Benchmark CAZ

The Ricardo model takes into account changes in fuel and non-fuel vehicle operating costs (VOC) and greenhouse gas (GHG) impacts[12] associated with the upgraded fleet that has resulted from the option. (For changes in these metrics related to changes in trips and travel time/distance, outputs from the TUBA model were also used – see section 0).

The estimation of operating costs and GHG emissions focused on capturing the effect of upgrading vehicles switching vehicle-kilometres (vkm) travelled from one Euro class of vehicle to another. The following approach was taken:

1. Take numbers of vehicles upgraded from fleet upgrade calculations
2. Combine numbers of vehicles upgraded by different vehicle type and Euro standards with data around the average annual fuel consumption and average annual operating costs per vehicle type and age[13]
    a. By applying average non-fuel VOC and fuel consumption over the full year and average vkm travelled per annum, this illustrative modelling will likely capture an even wider domain of impacts – i.e. will include the impacts where upgraded vehicles travel outside the Air Quality modelling domain.
3. Changes in fuel consumption are combined with changes in fuel prices.
4. Changes in fuel consumption are combined with emissions factors from the Department for Business, Energy & Industrial Strategy (BEIS)' Green Book Supplementary Guidance to calculate changes in GHG emissions ($tCO_2e$) [14]
5. Changes in GHG emissions in each year are combined with carbon values from BEIS' Green Book Supplementary Guidance.

Note: for the effects associated with vehicle upgrades, these impacts are not forecast over the period using the extrapolation factor. This is because these impacts are associated with modelled vehicle upgrades. The model depicts the VOC costs and GHG emissions associated with the new vehicle, and with the vehicle replaced to identify the difference. Hence, the impacts are already depicted over the appraisal period and extrapolation is not required.

#### 4.2.3.2 Preferred Option

In addition to the upgrades that occur as a result of the Benchmark CAZ D, the changes in VOCs and GHG emissions from bus retrofits in the Preferred Option have been calculated. These changes are calculated using the same methodology as described above and result in disbenefits due to retrofits extending the life of existing (older and less efficient) buses and pushing back upgrades to new vehicles with improved fuel consumption/GHG emissions.

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[12] Annual fuel consumption and VOC source: Ricardo study for TfL (2014): 'Environmental Support to the Development of a London Low Emission Vehicle Roadmap' (unpublished)
[13] Consumption and VOC for general vehicle types came from: Ricardo study for TfL (2014): 'Environmental Support to the Development of a London Low Emission Vehicle Roadmap' (unpublished). Data for hybrid vehicles came from: Ricardo Energy & Environment (forthcoming). Car Choice Model (CCM) summary report.
[14] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/602657/5._Data_tables_1-19_supporting_the_toolkit_and_the_guidance_2016.xlsx

### 4.2.4 Welfare Loss for the benchmark CAZ

Where vehicle users change their travel patterns, there will be a cost for the user associated with not being able to take their first preference, e.g. in the case of 'cancelled' journeys, the vehicle user will not be able to undertake the activity planned at the destination (such as a shopping trip to the city centre). The vehicle user will miss the value or 'utility' that they would have gained from that trip and, hence, this represents a cost to the Benchmark CAZ D scenario.

The approach to assessing these impacts is consistent with the JAQU guidance and is as follows:

1. Take the number of trips which are cancelled from the transport model (for each scenario, split by vehicle type).
2. Scale up affected vehicles per day to affected vehicles per year
3. Combine the number of affected vehicles with half the CAZ charge
4. Extrapolate the impact in the first year over the appraisal period using the extrapolation factor.

This analysis therefore implicitly carries forward the proportion of transport users taking each alternative response modelled in the transport model.

There are a number of different impacts that the user will face associated with switching transport behaviour. Not just the utility of making the trip, but the time required to travel, the fuel, operating cost, comfort of the mode, etc. In theory, the user will consider all these impacts when considering the best way to make a trip and contrast them across alternatives. Under the Benchmark CAZ D scenario, users now face the additional cost of the CAZ charge and will therefore compare the net effect of all these supporting impacts, against the cost of the charge, and decide the appropriate course of action. This approach therefore should not only capture the utility change, but also the other impacts associated with changing behaviour and which are privately faced by the user.

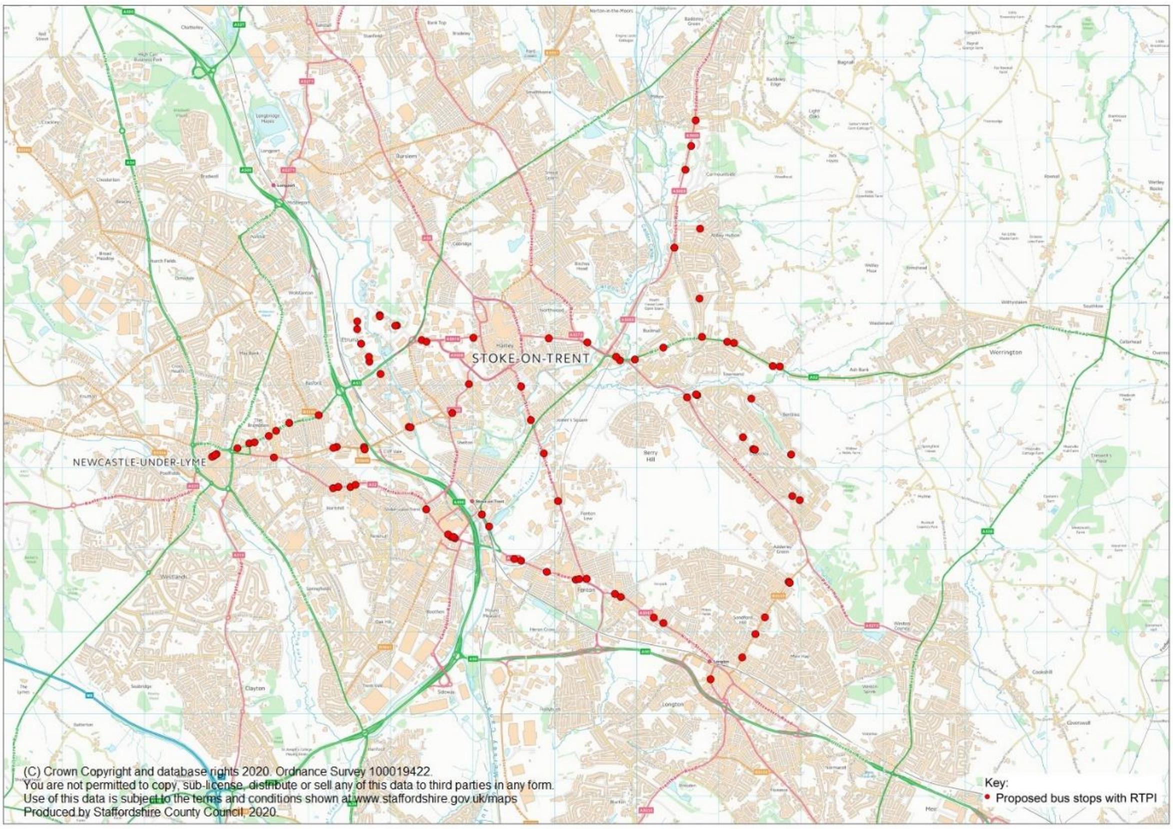
### 4.2.5 Bus Stop/RTPI/CCTV Improvements for the Preferred Option

SoTCC and SCC have proposed a range of interventions to the bus network infrastructure. The following interventions have been proposed and will be appraised as part of this economic assessment:

- Real time passenger information (RTPI) at bus shelters
- Addition of new shelters
- Accessible kerbs at bus stops
- Closed-circuit television (CCTV) cameras at bus shelters.

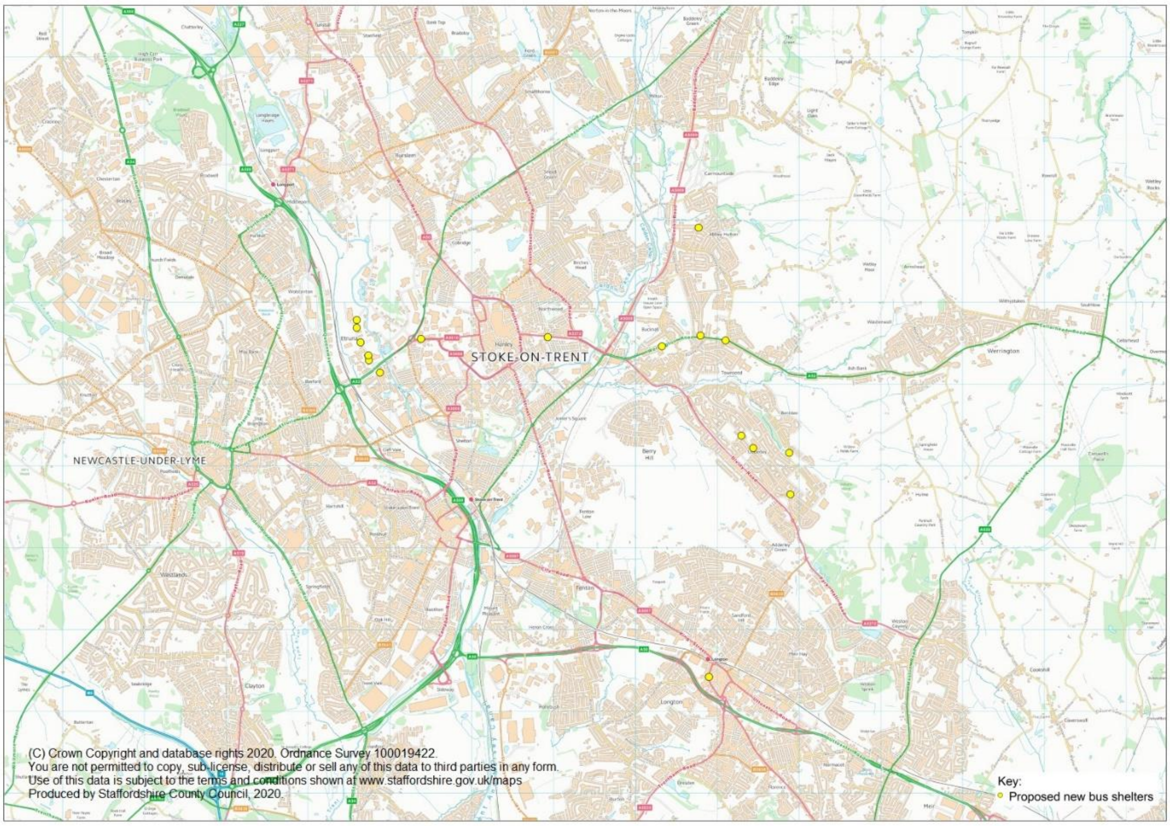
Bus stops with RTPI have been proposed for 89 locations within Stoke-on-Trent and for 12 locations within Staffordshire. A map of all proposed RTPI locations is shown in Figure 3 below.

**Figure 3: Proposed RTPI bus stops within North Staffordshire**



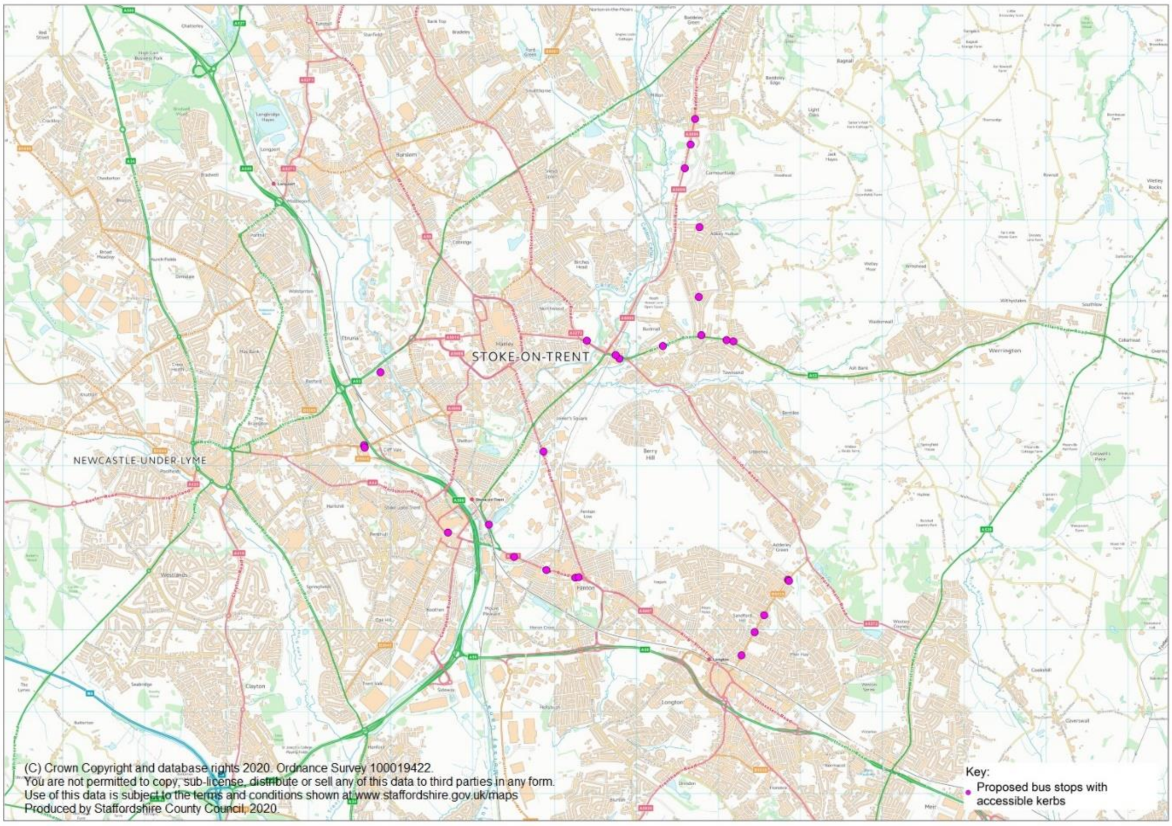
SoTCC have also proposed to add 17 new bus shelters, throughout Stoke-on-Trent. The location of the new bus shelters is shown below in Figure 4Figure 4.

**Figure 4: Proposed locations of new bus shelters**



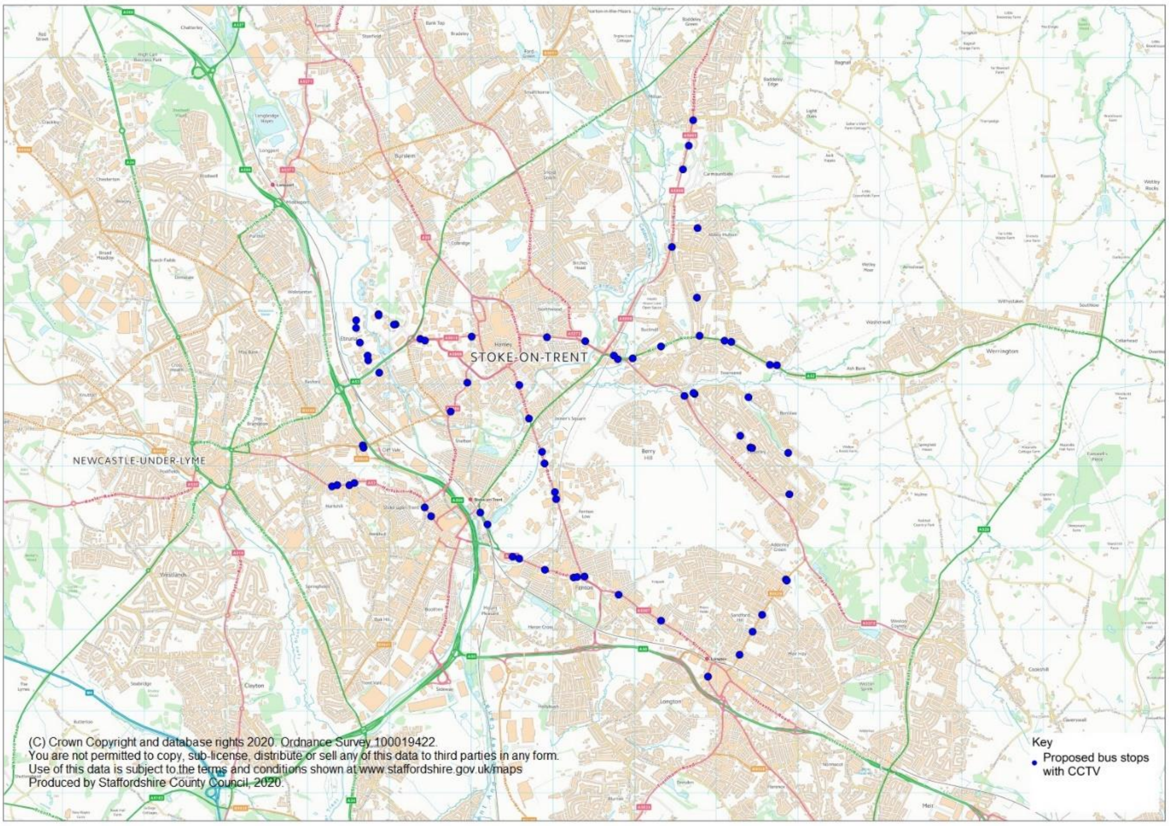
Accessible kerbs (Kassel kerbs) at bus stops have been proposed at 27 new locations as shown in Figure 5 Figure 5.

**Figure 5: Proposed locations of bus stops with accessible kerbs**



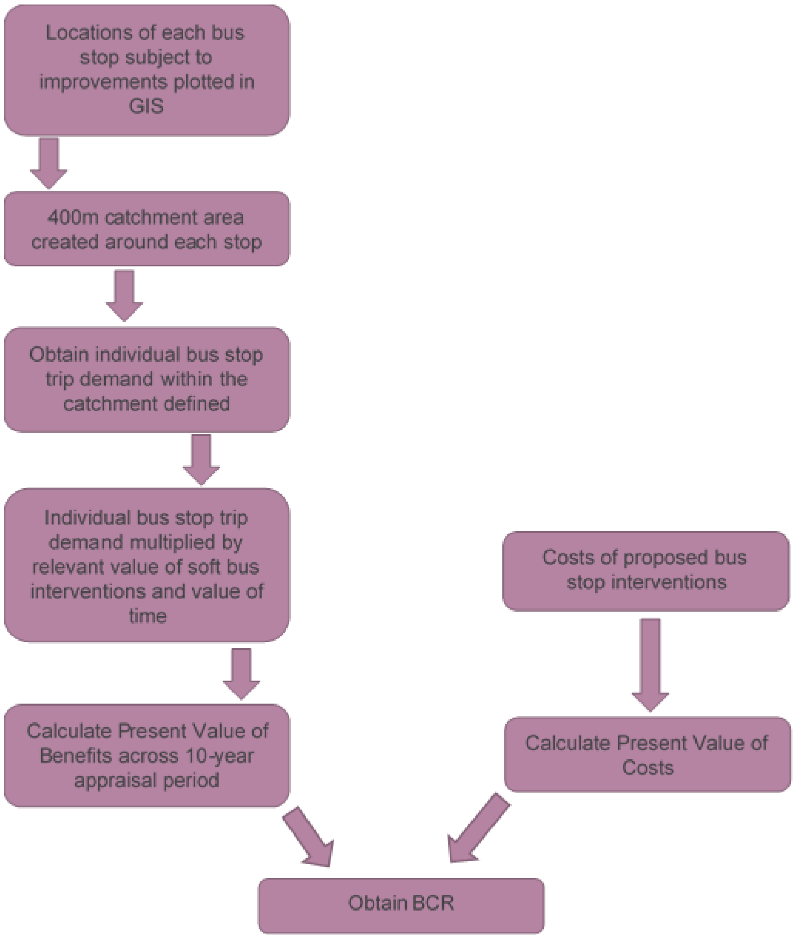
Finally, CCTV cameras at bus shelters has been proposed at 71 locations throughout Stoke-on-Trent, as shown in below in Figure 6.

**Figure 6: Proposed locations of bus stops with CCTV**



To be able to recognise the value for money of the proposed interventions, the methodology shown in Figure 7, was undertaken:

**Figure 7: Appraisal methodology flow chart**




The following assumptions have been used during the appraisal of the proposed interventions:

- Only origin trips (number of passengers boarding each bus stop) are assumed to benefit from the proposed interventions
- Trips are split by purpose according to default TAG values (May 2019 TAG Databook)
- Relevant values of time and values of soft bus interventions have been used from the latest TAG Databook (May 2019 TAG Databook)
- All monetary values are presented in 2018 prices and discounted to 2019 values
- The TAG M3.2.1 value for “New bus with low floor” has been used as a proxy for appraising accessible kerbs as there is no defined value for accessible kerbs
- The appraisal period is 10 years from the scheme opening year (2022) and includes an intermediate forecast year of 2025

Table 4-3 shows the present value of benefits and costs of all proposed interventions.

The combination of proposed interventions will generate a Present Value Benefit (PVB) of £34.8m and a Present Value Cost (PVC) of £3.12m across the 10-year appraisal period. This generates a BCR of 11.17, which according to the DfT’s Value for Money (VfM) framework is classed as very high value for money.

**Table 4-3: Appraisal results of all proposed bus stop interventions**

| Benefits and Costs | £ (2018 Prices) |
|---|---|
| **Present Value of Costs (PVC)** | £3,119,434 |
| **Present Value of Benefits (PVB)** | £34,844,455 |
| **NPV** | £31,725,021 |
| **Benefit Cost Ratio (BCR)** | 11.17 |

### 4.2.6 Implementation Costs

Implementation costs have been calculated by Amey and are consistent with those presented in the Finance Case (albeit presented in a different price year and discounted for inclusion in the social CBA).

This captures all capex and opex required to implement the Preferred Option or the Benchmark CAZ D.

In addition, central optimism bias has been applied. Optimism bias is the proven tendency for appraisers to be too optimistic about project parameters including capital and operating costs. JAQU guidance suggests that optimism bias should be considered using The Green Book guidelines, which recommends applying overall percentage adjustments that vary depending on the type of project, and also depending on the stage of the project (reducing to a lower bound close to implementation).

For the options assessed, the optimism bias to apply was discussed with the Councils. For non-IT elements of the options, a central optimism bias of 15% is used based on TAG Unit A1.2 guidance for Stage 2 Road projects.

For implementation costs related to IT, a higher optimism bias of 105% is used given:

1) it is a midpoint between stage 1 and stage 3 as per TAG guidance for IT projects

2) the IT cost elements for the CAZ have been based on Birmingham's assumptions, which used an optimism bias of 100%. Uncertainty related to optimism bias for this project can therefore not be lower than 100%.

**Table 4-4: Implementation Costs (£k 2018 price year, Discount year 2019, incl. optimism bias)**

| | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Preferred Option** | 10,124 | 451 | 451 | 451 | 451 | 749 | 451 | 451 | 451 | 451 |
| **Total** | 14,482 | | | | | | | | | |
| **Benchmark CAZ D** | 63,109 | 14,412 | 14,412 | 14,412 | 14,412 | 20,158 | 14,412 | 14,412 | 14,412 | 14,412 |
| **Total** | 198,561 | | | | | | | | | |

Bus retrofit costs in the Preferred Option will also comprise part of the implementation costs and hence are included. The upfront capex figures were provided by the Councils. Given retro-fit implies a change in lifetime of those buses (retrofitted buses must run for at least 5 years following retrofit), this measure will also have wider associated effects. To capture all upfront and VOC impacts of the bus retrofit, the CAZ economics model was used. In addition to the capital cost of retrofits themselves, the retrofits delay the purchase of new vehicles, unlike the Benchmark CAZ D which brings them forwards. This means the upgrade costs are less significant, and there is a greater cost associated with increased fuel and operating costs from extending the life of older buses (See Section 4.2.3).

## 4.3 TUBA - Travel Time, Fuel and Non-Fuel Vehicle Operating Costs, and $CO_2$ emissions (non-upgrade responses)

The impacts of the Preferred Option and Benchmark CAZ on travel times and vehicle operating costs have been assessed using the DfT's Transport User Benefits Appraisal (TUBA) program v1.9.13.

TUBA estimates the monetised impacts of transport schemes in terms of the costs and benefits experienced by users and providers of the transport system, and the associated indirect taxation revenue impacts. These costs and benefits are estimated by comparing transport conditions in the Do-Something (With Scheme) with those in Do-Minimum (Without Scheme) scenarios. To this end, TUBA uses information from transport models to:

- Calculate user benefits by vehicle type and for each element of journey cost (such as travel time and vehicle operating costs - fuel and non-fuel)
- Calculate the changes in the indirect tax income received by the government
- Calculate the changes in the GHG ($CO_2$) emissions

For the economic assessment, the user and provider related costs and benefits in each year produced by TUBA were given in 2010 prices and discount year, with a factor taken from TAG guidance to convert to a 2018 price base year and 2019 discount year, as per JAQU guidance. These factors are presented in Table 4-5.

**Table 4-5: Conversion factors**

| | Conversion factors from 2010 prices and values |
|---|---|
| **2018 Price Base Year** | 1.145 |
| **2019 Discount Year** | 1.363 |

TUBA provides a complete set of default economic parameters in its standard economics file, including values for variables such as values of time, vehicle operating cost data, tax rates and economic growth rates which have been used for this appraisal.

### 4.3.1 Modelled Years

The scheme related parameters defined in the TUBA scheme file were largely determined by the assumptions made in the derivation of appropriate traffic forecasts for the North Staffordshire Local Air Quality Plan; namely:

- First year – 2022 (scheme opening year).
- Last year – 2031 (10 years from opening year).
- Modelled forecast years – opening year of 2022 and intermediate forecast year of 2025

### 4.3.2 Time Periods and Annualisation Factors

The NSMM transport model represents single peak hours for the AM, Inter-Peak and PM and therefore there is the need to expand these single peak hours. Expansion factors have thus been derived to convert these peak hours to time slices / periods as required within TUBA.

The expansion factors have been derived from extensive traffic count information collected across the North Staffordshire conurbation. Observed traffic count information from neutral months were compared with average observed traffic count information for the whole year.

For the Benchmark CAZ scenario, the peak hour to TUBA time slice expansion factors were converted to annualisation factors based on 365 days per year. There was also the need to include the non-modelled off-peak (19:00 – 07:00hrs) within the TUBA assessment[15]. The similarity between the traffic in the inter-peak compared to that in the off-peak, allowed for the inter-peak model to be used when deriving off-peak user benefits within TUBA. This approach for the Benchmark CAZ was taken to ensure that the benefits of the scheme are directly comparable to the cost and revenue[16] due to the nature of the CAZ being operational 24hrs a day 365 days per year.

For the Preferred Option scenario, the peak hour to TUBA time slice expansion factors were converted to annualisation factors based on 253 working days per year. The off-peak and weekend have not been considered within the Preferred Option TUBA assessment because the impacts occurring in these periods are likely to be minimal due to the Preferred Option measures not being in place during these periods, apart from bus retrofitting.

The resultant annualisation factors are summarised in Table 4-6.

**Table 4-6: Annualisation factors for TUBA time slices**

| Period | Modelled Peak-Hour | TUBA Time Slice | Peak-Hour to TUBA Time Slice Factor | No. of days | Annualisation Factor |
|---|---|---|---|---|---|
| **Benchmark CAZ** | | | | | |
| AM | 08:00 - 09:00hrs | 07:00 - 10:00hrs | 2.131 | 365 | 778 |
| Inter-Peak | 14:00 - 15:00hrs | 10:00 - 16:00hrs | 5.693 | 365 | 2078 |
| PM | 17:00 - 18:00hrs | 16:00 - 19:00hrs | 2.400 | 365 | 876 |
| Off-Peak | Based on Inter-Peak | 19:00 - 07:00hrs | 2.954 | 365 | 1078 |
| **Preferred Option** | | | | | |
| AM | 08:00 - 09:00hrs | 07:00 - 10:00hrs | 2.605 | 253 | 659 |
| Inter-Peak | 14:00 - 15:00hrs | 10:00 - 16:00hrs | 5.826 | 253 | 1474 |
| PM | 17:00 - 18:00hrs | 16:00 - 19:00hrs | 2.696 | 253 | 682 |

### 4.3.3 User Classes

Eight TUBA User Classes were specified as follows:

- User Class 1: Car compliant, all purposes, all person-types.
- User Class 2: Car non-compliant, all purposes, all person-types.
- User Class 3: Taxi compliant, business, all person-types.
- User Class 4: Taxi non-compliant, business, all person-types.

[15] Weekend and bank holidays have not been explicitly modelled, these time slices are included within the AM, IP, PM and OP annualisation factors presented.
[16] The peak hour to TUBA time slice factors used for the Benchmark CAZ TUBA assessment are identical to those used within the revenue calculations.

- User Class 5: Light Goods Vehicles (LGVs) compliant, all purposes, all person-types.
- User Class 6: Light Goods Vehicles (LGVs) non-compliant, all purposes, all person-types.
- User Class 7: Heavy Goods Vehicles (HGVs/OGVs) compliant, business, all person-types.
- User Class 8: Heavy Goods Vehicles (HGVs/OGVs) non-compliant, business, all person-types.

The data input into TUBA comprised of trip, average travel time and average travel distance matrices. These matrices were produced for each combination of the three modelled time periods, eight user classes and two forecast years for both the do-Minimum and do-Something scenarios.

Vehicle occupancies have been based on TUBA default values for all vehicle and user class types.

It should be noted that changes in public transport benefits have not been included within the assessment due to the nature of how these trips are represented and treated within the NSMM transport model. The NSMM transport model treats public transport trips as trip chains, thus a combination of walking, bus and rail trips without separating them. Therefore, it is not possible to extract data only relating to bus trips that are required for TUBA.

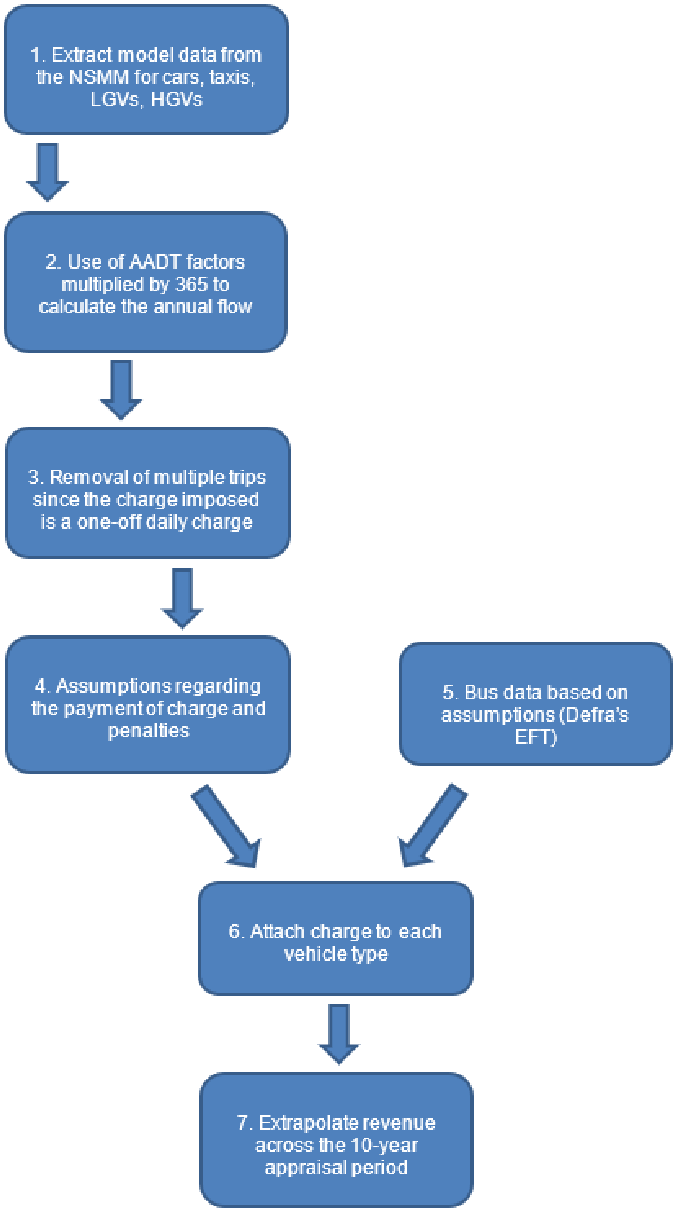
## 4.4 CAZ Charges and Revenues

Revenues from the Benchmark CAZ D have been calculated. This analysis is underpinned by the following:

- All impacts are presented in real terms in a 2018 price base year.
- All impacts are assessed over a 10-year appraisal period from 2022-2031.
- All impacts are discounted to 2019 applying a discount factor of 3.5%.
- All impacts are corrected to market prices.

The stages and process followed for the calculation of revenue is presented in Figure 8.

**Figure 8: Revenue calculation**




The Benchmark CAZ D includes a bounded area where charges will be levied on all non-compliant vehicles.

### Step 1: Extract Model Data

Model data has been extracted from the NSMM transport model for the years 2022 and 2025. The NSMM model provided the traffic flows for cars, taxis, LGVs and HGVs for the modelled time periods of AM, IP and PM.

### Step 2: Calculate annualised flow

The private car vehicle type data was segmented by income into three categories in order to reflect how demand responses to a CAZ charge varies by household income. The three income ranges were chosen to reflect an evenly distributed demand across the groups as recommended in the TAG. These are:

- Income Band 1: £0 - £20,000.
- Income Band 2: £20,000 - £40,000.
- Income Band 3: > £40,000.

Behavioural responses were derived from the statistical models based on SP survey data and used to model the future behavioural patterns of users in response to a CAZ charge. In order to calculate the journey purpose splits for work and non-work travel, the split factors as per TAG Data Book – Table A 1.3.4 (Percentage of Vehicle Trips) were used. These behavioural responses and split factors are outlined in Table 4-7.

**Table 4-7: Purpose split factors**

| Split Factors | | | | | |
|---|---|---|---|---|---|
| **Mode** | **Trip Purpose** | **Time Slice** | | | |
| | | **AM** | **IP** | **PM** | **OP** |
| Car | Business | 7.0% | 7.2% | 5.1% | 4.3% |
| | Commuting | 38.3% | 11.3% | 32.6% | 28.8% |
| | Other | 54.7% | 81.5% | 62.3% | 66.9% |
| LGV | Personal | 12.0% | 12.0% | 12.0% | 12.0% |
| | Freight | 88.0% | 88.0% | 88.0% | 88.0% |

The factors used to convert the modelled time periods to average annual equivalents are the following,

- $AM = 2.131 * 365 \Rightarrow AM = 778$
- $IP = 5.693 * 365 \Rightarrow IP = 2078$
- $PM = 2.400 * 365 \Rightarrow PM = 876$
- $OP = 2.954 * 365 \Rightarrow OP = 1078$

It should be noted that the off-peak time period was not included in the model and thus, inter-peak traffic data was used to simulate off-peak. Factors have been derived from traffic count data across the year.

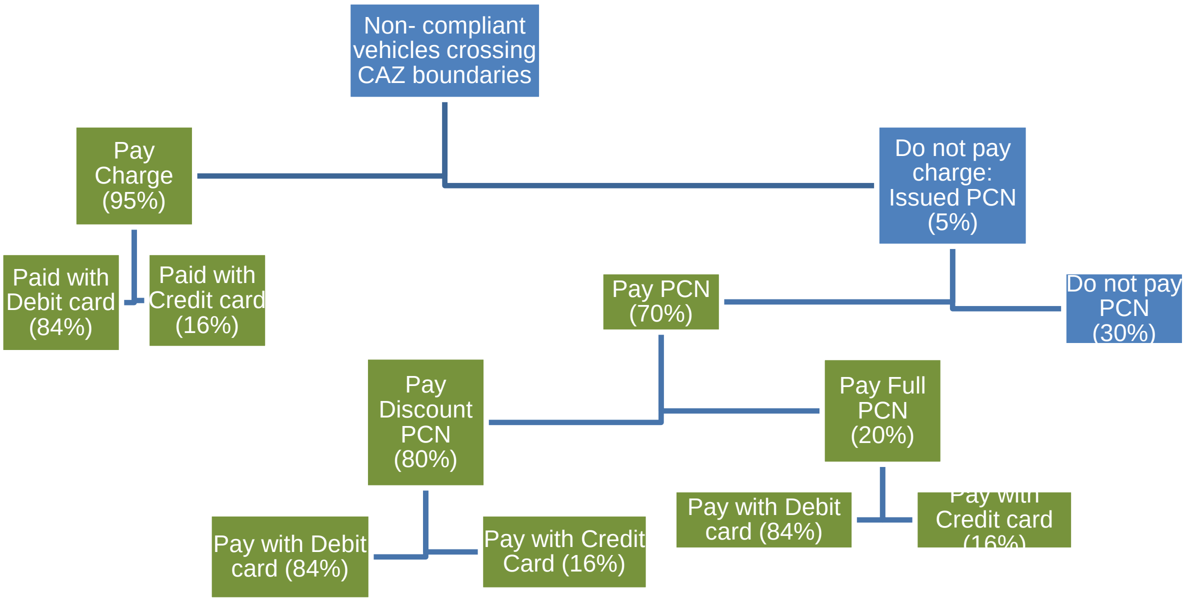
### Step 3: Removal of multiple cross-boundary trips

Trips crossing the CAZ boundaries more than once have been removed since the charge imposed is a one-off daily charge. The removal of the multiple trips has been based on the origin/destination (OD) matrices provided from the NSMM transport model.

### Step 4: Payment and Revenue Assumptions

The calculation of Benchmark CAZ D revenue was based on the assumptions represented in Figure 9.

**Figure 9: Benchmark CAZ D charge revenue assumptions**




The proportion of non-compliant vehicle owners that enter, exit or move within the boundaries without paying the daily charge will be subject to a penalty charge notice (PCN), which accounts for £60 if paid within 14 days or £120 if paid after this time period. Table 4-8 shows the penalty charges per vehicle type.

**Table 4-8: Penalty charge per vehicle type**

| Mode | Penalty Charge | |
|---|---|---|
| | Discounted | Full |
| Car | £60.00 | £120.00 |
| Taxi | £60.00 | £120.00 |
| LGV | £60.00 | £120.00 |
| HGV | £60.00 | £120.00 |
| Bus | £60.00 | £120.00 |

Users can pay this penalty as well as the daily CAZ charge either through a debit or a credit card. The card processing fees are shown in Table 4-9. The local authorities are expected to cover the cost of these fees and so this has been deducted from the overall revenue generated from the CAZ. Subsequently, the cost of the CAZ charge to the user differs from the revenue generated to the local authority.

**Table 4-9: Card payment fees**

| Payment Card | Card Payment Fee |
|---|---|
| Debit Card | Charge * 0.45% + £0.11 |
| Credit Card | Charge * 0.78% + £0.11 |

### Step 5: Bus data

The bus fleet composition has been based on assumptions rather than model data. From the total current bus fleet, Sweco have calculated that 51% of vehicles are non-compliant in 2022 while in the year 2025, that percentage has been presumed to drop to 26% according to the Defra Emission Factors Toolkit (EFT) - due to the upgrade of a proportion of bus vehicles to compliancy.

### Stage 6: Calculate charges

Table 4-10 notes the proposed daily charge for each non-compliant vehicle, by vehicle type, entering, exiting or moving within the CAZ boundary. These charges are based on the results of the statistical models developed using the SP data and are set at a point where a rising CAZ charge gives the greatest positive return. In addition, a comparison with the CAZ charges proposed in Bath and Birmingham was undertaken and consideration made on the basis that in comparison, North Staffordshire is a comparatively poorer region.

**Table 4-10 Benchmark CAZ D charge by vehicle type**

| Vehicle Type | Benchmark CAZ D charge (including VAT) |
|---|---|
| **Car** | £5.00 |
| **Taxi** | £5.00 |
| **LGV** | £9.00 |
| **HGV** | £35.00 |
| **Bus** | £5.00 |

### Stage 7: Extrapolate over ten-year appraisal period

Through the ten-year appraisal period, it is expected that due to a greater amount of non-compliant vehicles in the early years of the charging CAZ's operation, the revenue generated from these charges will be high. This revenue will gradually decline over time as more and more vehicle owners upgrade their vehicles to achieve compliancy. It has been assumed that revenue in the year 2031 will be £0, as this is when decommissioning will commence.

The charge to the user can be noted in Table 4-11 while the total estimated revenue generated from the Benchmark CAZ D is represented in Table 4-12. It is worth noting that the revenue calculated and presented is estimated for 2022 to ensure consistency with the traffic model and across the economic analysis, even though in reality the CAZ is likely to not open until 2023.

**Table 4-11: Benchmark CAZ D cost to the user (£m)**

| Annualised Cost to User (£millions) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Car | | | Taxi | LGV | | HGV | Bus | |
| Year | Business | Commuting | Other | | Personal | Freight | | | Total |
| 2022 | £1.35 | £7.17 | £17.15 | £0.01 | £2.06 | £13.16 | £1.95 | £0.16 | £43.00 |
| 2023 | £1.18 | £6.25 | £14.97 | £0.01 | £1.86 | £11.92 | £1.42 | £0.13 | £37.75 |
| 2024 | £1.02 | £5.39 | £12.91 | £0.01 | £1.68 | £10.76 | £0.92 | £0.10 | £32.79 |
| 2025 | £0.87 | £4.59 | £10.98 | £0.01 | £1.51 | £9.66 | £0.46 | £0.07 | £28.13 |
| 2026 | £0.70 | £3.69 | £8.84 | £0.00 | £1.22 | £7.78 | £0.37 | £0.06 | £22.65 |
| 2027 | £0.54 | £2.85 | £6.83 | £0.00 | £0.94 | £6.01 | £0.28 | £0.04 | £17.51 |
| 2028 | £0.39 | £2.07 | £4.95 | £0.00 | £0.68 | £4.36 | £0.21 | £0.03 | £12.69 |
| 2029 | £0.25 | £1.33 | £3.19 | £0.00 | £0.44 | £2.81 | £0.13 | £0.02 | £8.17 |
| 2030 | £0.12 | £0.64 | £1.54 | £0.00 | £0.21 | £1.36 | £0.06 | £0.01 | £3.95 |
| 2031 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 |

(Discounted impact (PV) from 2022-31, 2018 prices, discounted to 2019, in market prices)

**Table 4-12: Benchmark CAZ D revenue to the Local and central Government (£m)**

| Annualised Revenue to LA (£millions) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Car | | | Taxi | LGV | | HGV | Bus | |
| Year | Business | Commuting | Other | | Personal | Freight | | | Total |
| 2022 | £1.33 | £7.03 | £16.84 | £0.01 | £2.03 | £12.96 | £1.94 | £0.15 | £42.29 |
| 2023 | £1.16 | £6.14 | £14.70 | £0.01 | £1.84 | £11.75 | £1.41 | £0.12 | £37.12 |
| 2024 | £1.00 | £5.30 | £12.68 | £0.01 | £1.66 | £10.60 | £0.91 | £0.09 | £32.25 |
| 2025 | £0.85 | £4.50 | £10.78 | £0.01 | £1.49 | £9.51 | £0.45 | £0.07 | £27.66 |
| 2026 | £0.68 | £3.62 | £8.68 | £0.00 | £1.20 | £7.66 | £0.36 | £0.06 | £22.27 |
| 2027 | £0.53 | £2.80 | £6.71 | £0.00 | £0.93 | £5.92 | £0.28 | £0.04 | £17.21 |
| 2028 | £0.38 | £2.03 | £4.86 | £0.00 | £0.67 | £4.29 | £0.20 | £0.03 | £12.47 |
| 2029 | £0.25 | £1.31 | £3.13 | £0.00 | £0.43 | £2.76 | £0.13 | £0.02 | £8.04 |
| 2030 | £0.12 | £0.63 | £1.51 | £0.00 | £0.21 | £1.34 | £0.06 | £0.01 | £3.88 |
| 2031 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 |

(Discounted impact (PV) from 2022-31, 2018 prices, discounted to 2019, in market prices, £)

## 4.5 No Upgrade Sensitivity

It is recommended by JAQU that a behavioural response sensitivity test should be tested through a scenario in which 0% of vehicle users upgrade as a result of the CAZ. This scenario has been modelled in the transport model (refer to the T2 report for details on the modelling) and subsequently run through TUBA to understand the implications of such a behavioural response on the economics. The results of this sensitivity are reported in Section 6.1.

# 5 Results

## 5.1 Summary of results

The results of the economic analysis are summarised in Table 5-1 and Figure 10.

**Figure 10: PV of impacts and NPV of Preferred Option and Benchmark CAZ D (£m 2018 prices)**

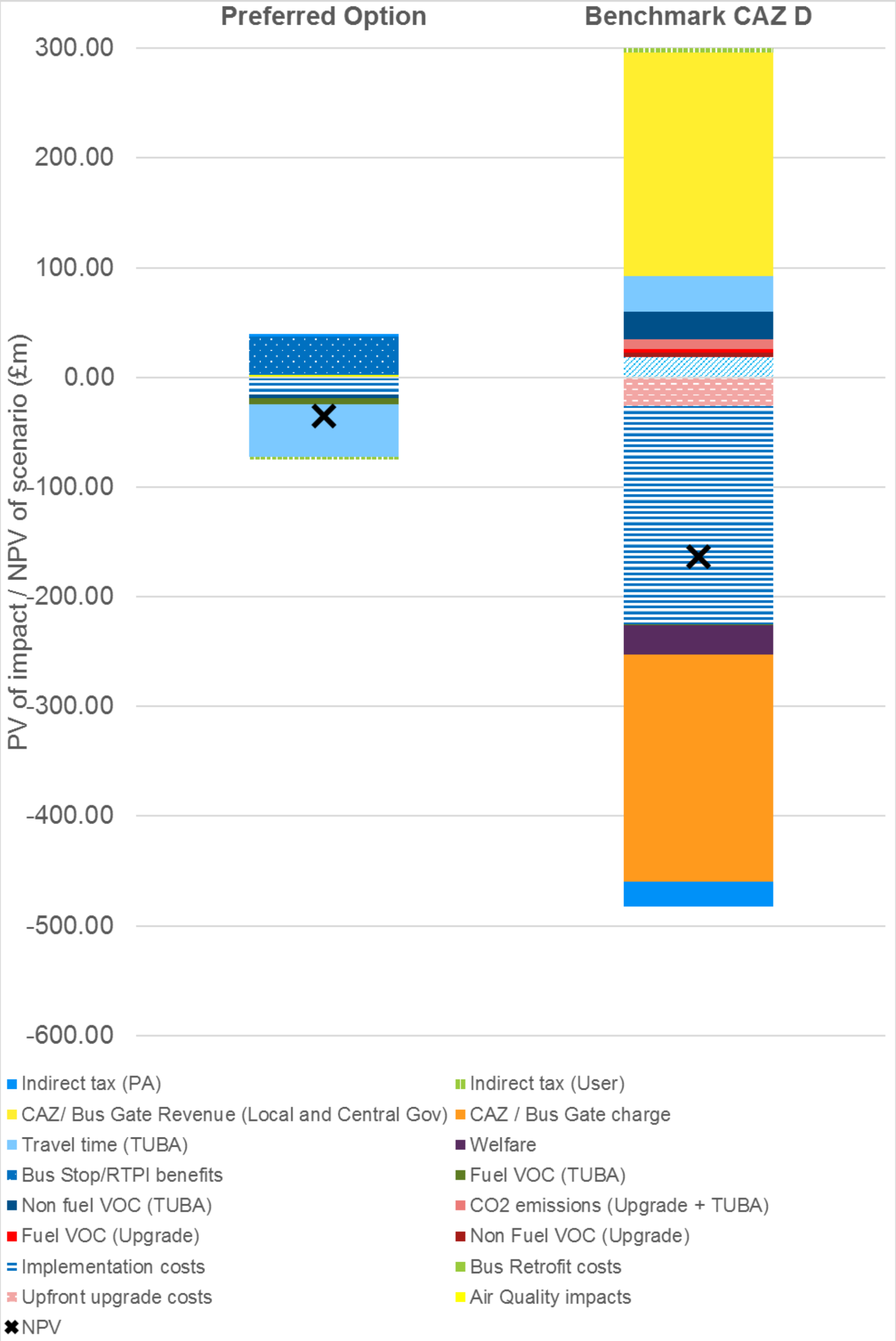


**Table 5-1: Monetised impacts for Preferred Option and Benchmark CAZ D (£m)**

| | Preferred | Benchmark CAZ D |
|---|---|---|
| AQ impacts | £2.34 | £18.87 |
| Upgrade costs | £- | -£26.40 |
| Bus Retrofits | -£0.77 | £- |
| Implementation costs | -£14.48 | -£198.56 |
| Non-fuel VOC (Upgrade) | £- | £4.09 |
| Fuel consumption (Upgrade) | £- | £3.13 |
| $CO_2$ emissions (Upgrade and TUBA) | -£0.52 | £8.45 |
| Non fuel VOC (TUBA) | -£3.37 | £25.15 |
| Fuel VOC (TUBA) | -£4.99 | -£0.78 |
| Bus Stop/RTPI | £34.84 | £- |
| Welfare | £- | -£27.05 |
| Travel time (TUBA) | -£48.26 | £32.99 |
| CAZ Charge/ Bus Gate Charge | -£0.40 | -£206.64 |
| CAZ Revenue/ Bus Gate Charge Revenue | £0.40 | £203.19 |
| Indirect tax (User) | -£2.27 | £23.40 |
| Indirect tax (Public Administration) | £2.27 | -£23.40 |
| **NPV** | **-£35.22** | **-£163.56** |

Notes: +ve values denote benefit / -ve values denote costs; all impacts are in 2018 prices; all impacts are discounted to 2019; cumulative discounted impact (PV) and NPV from 2022-31 (10-year appraisal period)

## 5.2 Impact comparison

### Air Quality Impacts

- Both policy options show a benefit in health improvements caused by reduced emissions of air pollutants.
- The benefits of the Benchmark CAZ D are significantly greater than those of Preferred Option (£18.87m and £2.34m respectively).

### Costs and Benefits associated with vehicle upgrades in the Benchmark CAZ D

- The Benchmark CAZ D is associated with high vehicle upgrade costs (£26.4m over the 10 year appraisal period) which outweigh additional benefits in fuel (£3.13), non-fuel VOC (£4.09m) and $CO_2$ (£3m - Note value in table includes TUBA $CO_2$ benefits) benefits associated with the vehicle upgrades.
- There are no upgrade costs associated with Preferred Option given no vehicles are anticipated to upgrade in response to this measure. That said, there is a small additional cost associated with bus retrofits.

### Implementation costs

- The implementation costs are far greater in the Benchmark CAZ D scenario (£198.56m) compared with Preferred Option (£14.48m), which has a large impact on the overall NPV of this option.

### Welfare costs under Benchmark CAZ D

- The welfare costs represent the costs associated with individuals not being able (or not choosing) to travel into the CAZ zone who otherwise would do, i.e., people that cancel their trip.

- The Benchmark CAZ D is associated with a large welfare impact associated with cancelled trips, valued at £27.05m over the 10-year appraisal period.
- The welfare impact is assumed to be half the cost of entering the zone.

Additional trip costs (captures impacts associated with non-upgrade responses, i.e. changes in travel time, fuel and non-fuel VOC and $CO_2$)

- Outputs from the TUBA modelling show a large benefit in the Benchmark CAZ D option associated with non-fuel vehicle operating costs (£25.15m) and travel time (£32.99m).
    - This occurs due to reduced congestion and improved trip times for vehicles travelling in the CAZ zone as some non-compliant vehicles re-route or cancel journeys in the CAZ area. Although non-compliant vehicles that choose to reroute face a disbenefit of increased travel time and non-fuel vehicle operating cost, the benefit to vehicles continuing to travel inside the CAZ outweighs the disbenefit to non-compliant.
- Conversely, for the Preferred Option the TUBA outputs indicate an increase (or disbenefit) in fuel vehicle operating costs (£5.0m), non-fuel vehicle operating costs (£3.4m) and particularly travel time (£48.26m).
    - This is due to rerouted trips that occur during the peak periods when the bus gates are in operation. Unlike under the Benchmark CAZ D, where charges are faced by non-compliant vehicles, the road closures affect all cars, LGVs and HGVs, irrespective of compliance.

Bus infrastructure improvements

- Deliver a significant benefit under the Preferred Option (£34.84m)

CAZ and PCN charges and revenues, and indirect taxes

- CAZ charges and revenues under the Benchmark CAZ D are the most significant impacts in the CBA. However, given the charge is a cost to users, and the revenue a benefit to Public Administration, these impacts mostly net off (save for a slight difference due to transaction costs of paying the charges).
- Bus gate (PCN) charges under the Preferred Option are significantly smaller, but again net off as a cost to user but revenue benefit to Public Administration
    - IN practice, there will be a transaction cost to these revenue flows through credit and debit card charges, so in practice these flows will not precisely net off between users and government accounts. These transaction costs are not currently reflected for bus gate charges (but are reflected for CAZ charges)
- Conversely, indirect taxes have an opposite and equal impact on users and for Public Administration, but again these impacts net off in the overall CBA.

# 6 Sensitivity analysis

Economic modelling approximates the real world and it is inevitable that there will be uncertainty around the inputs that form the model. Failing to accurately predict future states of the world, using input values developed in different locations or using expert judgement where no data is available are all potential sources of uncertainty in assumptions and input values. Those assumptions and input values where uncertainty is greater and potentially significant have been identified (i.e. could have a material effect on the results of the quantitative analysis and could affect the comparison of options).

To determine whether these uncertainties have a significant impact on the recommendations made in this report a sensitivity analysis was undertaken. The sensitivity analysis involves developing lower and upper bounds for significant assumptions and input values used in the analysis. If the recommendations stand up to this 'stress testing', the robustness of the analysis is confirmed.

The resultant NPV for each scenario is considerable but the difference in NPV between scenarios is relatively small. Therefore, it is critical that changes in assumptions and input values within sensible bounds do not change the recommendations.

The sensitivity analysis is constructed around the following key inputs:

- Behavioural responses to a charging zone – i.e. a 0% upgrade scenario under the Benchmark CAZ D
- Damage costs
- Carbon prices
- Scrappage costs
- Welfare impacts
- Optimism bias.

## 6.1 Behavioural Assumptions (Benchmark CAZ D only)

The behavioural assumptions define the response of vehicle owners to the implementation of the CAZ charge. The impacts of the CAZ will critically depend on the behavioural responses of transport users.

It is recommended by JAQU that behavioural response sensitivity be tested through a scenario in which 0% of vehicle users upgrade as a result of the CAZ. The behavioural responses of people to this scenario was derived from the statistical model created the Stated Preference survey data, by setting the upgrade to compliant option equal to zero while maintaining the same proportions for the other responses. These responses are represented in Table 6-1.

**Table 6-1: Behavioural demand responses by vehicle type to Benchmark CAZ D charges in the No upgrade scenario**

| Demand response | Car | | | LGV | HGV | Taxi |
|---|---|---|---|---|---|---|
| | Income Band | | | | | |
| | 1 | 2 | 3 | | | |
| **Change route** | 23% | 20% | 17% | 47% | 41% | 0% |
| **Change destination** | 16% | 15% | 12% | 0% | 0% | 0% |
| **Pay charge** | 27% | 27% | 27% | 49% | 44% | 11% |
| **Cancel trip / Mode shift** | 34% | 38% | 44% | 4% | 15% | 89% |

This scenario has been modelled in the transport and air quality models and impacts the economics through changes in air quality benefits, TUBA outputs on travel time, fuel and non-fuel operating costs as well as removing costs and secondary benefits associated with vehicle upgrades. The impact on the NPV of this scenario is shown in Table 6-2.

There is a large impact on NPV largely due to the removal of vehicle upgrade costs. Interestingly the NPV of the Benchmark CAZ D option becomes less negative. There is a reduction in upgrade costs and increase in travel time benefits (assumingly as more vehicles cancel trip and congestion in the CAZ area improves even more so). This impact outweighs the reduction in air pollutant and VOC benefits from upgrades and the increase in welfare costs associated with a higher level of cancelled trips.

This shows that while the results are highly sensitive to the behavioural response assumptions, it does not change the overall result, with the Benchmark CAZ D still having a more negative NPV than the Preferred Option.

**Table 6-2: Sensitivity Analysis for Behavioural Response to the Benchmark CAZ D (£m 2018)**

| | Benchmark CAZ D | | Benchmark CAZ D 0% Upgrade | |
|---|---|---|---|---|
| **AQ impacts** | £ | 2.34 | £ | 14.11 |
| **Upgrade costs** | £ | - | £ | - |
| **Bus retrofits** | -£ | 0.77 | £ | - |
| **Implementation costs** | -£ | 14.48 | -£ | 198.56 |
| **Non-fuel VOCs (Upgrade)** | £ | - | £ | - |
| **Fuel consumption (Upgrade)** | £ | - | £ | - |
| **$CO_2$ emissions (Upgrade and TUBA)** | -£ | 0.52 | -£ | 0.52 |
| **Non fuel VOC (TUBA)** | -£ | 3.37 | £ | 47.62 |
| **Fuel VOC (TUBA)** | -£ | 4.99 | £ | 0.83 |
| **Bus Stop/RTPI** | £ | 34.84 | £ | - |
| **Welfare** | £ | - | -£ | 53.89 |
| **Travel time (TUBA)** | -£ | 48.26 | £ | 81.01 |
| **CAZ Charge** | -£ | 0.40 | -£ | 391.49 |
| **CAZ Revenue** | £ | 0.40 | £ | 385.02 |
| **Indirect tax (User)** | -£ | 2.27 | £ | 42.05 |
| **Indirect tax (Public Administration)** | £ | 2.27 | -£ | 42.05 |
| **NPV** | -£ | 163.56 | -£ | 115.88 |

The annualised cost to users as well as the annualised revenue generated from the no upgrade scenario were based on the same assumptions used for the Benchmark CAZ D scenario and are shown in Table 6-3 and Table 6-4, respectively.

**Table 6-3: Annualised Cost to User derived from the No upgrade scenario (£m)**

| Annualised Cost to User (£m) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Car | | | Taxi | LGV | | HGV | Bus | Total |
| Year | Business | Commuting | Other | | Personal | Freight | | | |
| 2022 | £2.56 | £13.56 | £32.45 | £0.03 | £3.73 | £23.88 | £6.49 | £0.16 | £82.86 |
| 2023 | £2.24 | £11.83 | £28.32 | £0.03 | £3.36 | £21.51 | £4.77 | £0.13 | £72.18 |
| 2024 | £1.93 | £10.20 | £24.43 | £0.02 | £3.01 | £19.27 | £3.17 | £0.10 | £62.13 |
| 2025 | £1.64 | £8.68 | £20.77 | £0.02 | £2.68 | £17.16 | £1.66 | £0.07 | £52.68 |
| 2026 | £1.32 | £6.99 | £16.72 | £0.02 | £2.16 | £13.81 | £1.34 | £0.06 | £42.41 |
| 2027 | £1.02 | £5.40 | £12.93 | £0.01 | £1.67 | £10.68 | £1.03 | £0.04 | £32.78 |
| 2028 | £0.74 | £3.91 | £9.37 | £0.01 | £1.21 | £7.74 | £0.75 | £0.03 | £23.76 |
| 2029 | £0.48 | £2.52 | £6.03 | £0.01 | £0.78 | £4.98 | £0.48 | £0.02 | £15.30 |
| 2030 | £0.23 | £1.22 | £2.91 | £0.00 | £0.38 | £2.41 | £0.23 | £0.01 | £7.39 |
| 2031 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 |

(Discounted impact (PV) from 2022-31, 2018 prices, discounted to 2019, in market prices)

**Table 6-4: Annualised Revenue to Local and central Government in the No Upgrade scenario (£m)**

| Annualised Revenue to LA (£m) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Car | | | Taxi | LGV | | HGV | Bus | Total |
| Year | Business | Commuting | Other | | Personal | Freight | | | |
| 2022 | £2.51 | £13.31 | £31.86 | £0.03 | £3.68 | £23.53 | £6.44 | £0.15 | £81.51 |
| 2023 | £2.19 | £11.61 | £27.80 | £0.03 | £3.32 | £21.19 | £4.73 | £0.12 | £71.00 |
| 2024 | £1.89 | £10.02 | £23.98 | £0.02 | £2.97 | £18.98 | £3.14 | £0.09 | £61.10 |
| 2025 | £1.61 | £8.52 | £20.39 | £0.02 | £2.65 | £16.90 | £1.65 | £0.07 | £51.80 |
| 2026 | £1.29 | £6.86 | £16.42 | £0.02 | £2.13 | £13.61 | £1.33 | £0.06 | £41.71 |
| 2027 | £1.00 | £5.30 | £12.69 | £0.01 | £1.65 | £10.52 | £1.03 | £0.04 | £32.24 |
| 2028 | £0.72 | £3.84 | £9.19 | £0.01 | £1.19 | £7.62 | £0.74 | £0.03 | £23.36 |
| 2029 | £0.47 | £2.47 | £5.92 | £0.01 | £0.77 | £4.91 | £0.48 | £0.02 | £15.05 |
| 2030 | £0.23 | £1.20 | £2.86 | £0.00 | £0.37 | £2.37 | £0.23 | £0.01 | £7.27 |
| 2031 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 |

(Discounted impact (PV) from 2022-31, 2018 prices, discounted to 2019, in market prices)

## 6.2 Damage costs

The economic costs associated with air quality are driven by the damage costs supplied by JAQU. The damage costs applied in this case are those for ‘urban big’ and are applied to all PM and $NO_X$ emissions reductions for the Preferred Option and Benchmark CAZ D. This is not a value that has been tailored to the circumstances in North Staffordshire – hence, this is one source of uncertainty. Furthermore, there are underlying uncertainties in the methodologies and techniques used to construct the damage costs (e.g. impacts included, valuation of endpoints, etc.) which should be reflected in the analysis.

Upper and lower bound damage costs are taken from the UK Air Quality damage cost update 2019[17].

This analysis demonstrates that both scenarios are sensitive to damage costs, particularly the Benchmark CAZ D due to the larger air quality reductions that are valued. Although the results are sensitive to damage costs the relative weighting of the options remains unchanged, with the Preferred Option retaining a significantly less negative NPV.

**Table 6-5: Damage Cost Sensitivity analysis - NPV result (£m 2018 prices)**

| | Sensitivity | Preferred Option | Benchmark CAZ D |
|---|---|---|---|
| Damage cost | Low | -37.25 | -179.53 |
| | Central | -35.22 | -163.56 |
| | High | -29.15 | -117.62 |

## 6.3 Carbon Price

The carbon price is used to value the climate-mitigation benefits of reducing Greenhouse Gas emissions as an indirect effect of the air quality measures. The carbon price is based on the BEIS guidance, and rapidly increases in the study period opposed to the relatively stagnant development of real-world carbon prices in the preceding decade. BEIS guidance provides low and high prices for carbon which are applied to both $CO_2$ impacts from vehicle upgrades and from the TUBA analysis. The results are shown in Table 6-6 and reveal that the results are not very sensitive to carbon prices.

**Table 6-6 – Carbon price sensitivity analysis – NPV result (£m 2018 prices)**

| | Sensitivity | Preferred Option | Benchmark CAZ D |
|---|---|---|---|
| Carbon price | Low | -34.92 | -168.12 |
| | Central | -35.22 | -163.56 |
| | High | -35.51 | -158.99 |

## 6.4 Welfare costs (rule of half, Benchmark CAZ D only)

The welfare costs are calculated through taking half of the charge which users who avoid/cancel their trip would pay to enter the CAZ. This 'rule of half' assumption can be tested by assuming either no 'halving' and having all cancel/avoid actions be worth the full charge value and having no welfare costs at all. While this has a notable effect on the overall NPV of the Benchmark CAZ D option, this sensitivity is not high enough to change the relative comparison of the two options, with the Preferred Option still having a substantially less negative NPV.

[17] https://uk-air.defra.gov.uk/assets/documents/reports/cat09/1902271109_Damage_cost_update_2018_FINAL_Issue_2_publication.pdf

**Table 6-7 - Welfare sensitivity analysis – NPV result (£m 2018 prices)**

| | Sensitivity | Benchmark CAZ D |
|---|---|---|
| Welfare cost | Low 0% | -136.51 |
| | Central 50% | -163.56 |
| | High 100% | -190.6 |

## 6.5 Scrappage costs and Vehicle upgrade assumptions (Benchmark CAZ D only)

If vehicles are scrapped as a result of any proposed policies, the impacts of this will depend on vehicle values, depreciation rates and counterfactual upgrade assumptions. All of these values could be very uncertain. JAQU's guidance suggests three sensitivities could be tested:

1. Adjust the fixed assumption on the proportion of 'upgraded' vehicles that are scrapped: The CAZ charge could cause the value of a non-compliant vehicle to depreciate by less, leading to less vehicles to be scrapped and vice versa. Range tested 20 to 30% vehicles scrapped
2. Adjust the values of the vehicles: Higher vehicles values lead to an increase in scrappage cost and vice versa. Range tested +/- 10% on vehicle values
3. Adjust depreciation rates: If the value of a vehicle falls more quickly, then the cost of scrapping this vehicle will reduce more quickly too.

From previous CAZ work, of these impacts only the adjustment of the scrappage behavioural response had a significant effect on results, and as such this has been tested also in this study. The impact of this sensitivity analysis is shown to be small on the overall NPV for the Benchmark CAZ D as shown in Table 6-8.

**Table 6-8: Scrappage value sensitivity analysis - NPV result (£m 2018 prices)**

| | Sensitivity | Benchmark CAZ D |
|---|---|---|
| Scrap Proportion | Low 20% | -155.06 |
| | Central 25% | -163.56 |
| | High 30% | -178.16 |

## 6.6 Optimism bias

Optimism bias represents a systematic tendency for appraisers to be overly optimistic in their assessment of schemes, in particular regarding the costs (and time) associated with implementing a policy. An adjustment for optimism bias has already been included in the estimation of implementation costs. This is the most important adjustment and, hence, has been included as part of the core analysis given costs have been estimated directly for scheme implementation.

As a sensitivity, we vary the adjustment for optimism bias. TAG provides an upper and lower bound for optimism bias to be used.

- For non-IT elements, a lower bound of 3% and an upper bound of 44% is used.
- For IT elements, a lower bound of 10% and an upper bound of 200% is used.

The results are presented in Table 6-9. Adjusting for this does not provide a significant change in NPV for either option, although there is more of an effect on Benchmark CAZ D due to higher implementation costs.

**Table 6-9: – Optimism bias sensitivity analysis - NPV result (£m 2018 prices)**

| | Sensitivity | Preferred Option | Benchmark CAZ D |
|---|---|---|---|
| Optimism bias | Low | -33.69 | -87.13 |
| | Central | -35.22 | -163.56 |
| | High | -38.87 | -246.4 |

## 6.7 Conclusion

Although the sensitivity analysis shows that the NPV of each option is sensitive to the assumptions, it demonstrates that the uncertainty around parameters does not influence the relative comparison of the options in terms of NPV.

However, there are several important conclusions to draw specific to each option:

- The Benchmark CAZ D is highly sensitive to assumptions on first order behavioural responses, due to the high upgrade costs in this option. However, even at a 0% upgrade assumption, the NPV of this option is still more negative than the Preferred Option.
- The Benchmark CAZ D is also more sensitive to damage costs due to the larger air quality impacts of this option, although as above this does not affect the overall relative comparison of the two options.
- Other sensitivities have generally lower impacts on both options and do not significantly change the NPVs.

# 7 Wider impacts

The approach has sought to quantify and monetise the impacts associated with the Preferred Option and the Benchmark CAZ D. However, in some cases due to limitations in data or methodologies available, it has not been possible to assess all impacts quantitatively. In this case, these impacts have instead been assessed qualitatively and the results are presented in this section.

Through the development of the methodology, a number of impacts were identified as being unquantifiable. Specially:

a) Air Quality impacts outside modelling domain
b) Active travel benefits
c) Noise / accidents / infrastructure effects associated with charging and non-charging measures

Further several impacts were identified as associated with the Benchmark CAZ D but were deprioritised for assessment as less significant effects. These include:

- Transaction costs: associated with upgrading vehicles.
- Welfare (utility) loss associated with upgrading vehicles.

These impacts are explored in detail below, and a summary is presented in Table 7-1.

**a) Emissions impacts outside modelling domain from upgraded vehicles:** Health benefits from reduced air pollutant emissions due to vehicle upgrades have been calculated using outputs of the transport and air quality modelling. In reality, there will also be benefits in air quality outside the modelled domain as vehicles travel outside of it, in particular those who upgrade in response to the Benchmark CAZ D. These will scale in line with the number of vehicles replaced.

The value of emissions impacts outside the modelled zone could be significant. However, there is downside risk here too. The majority of upgraded vehicles are swapped (i.e. sold as a used vehicle and replaced with a compliant used vehicle). Where these vehicles are relocated outside the CAZ domain but remain operational in the fleet, this would simply have the effect of displacing emissions elsewhere – emission reductions achieved in the CAZ area would be offset against increases in emissions in other places. This would reduce the overall emissions impacts of the Benchmark CAZ D, and as a consequence could also reduce improvements in health. By focusing only on the Stoke-on-Trent and Newcastle-under-Lyme urban area, the central case simply captures the benefits of emissions reductions in the CAZ and the surrounding area, and does not consider increases in emissions elsewhere, akin to assuming the swapped non-compliant vehicles either exit the fleet or are used in a way where there is no or only limited exposure to their emissions.

It is uncertain what will happen to non-compliant vehicles swapped in the analysis. At one extreme, if all non-compliant vehicles exit the fleet and/or are used in a way with no, limited, or at least lower exposure to emissions (e.g. in rural areas or a greater proportion of mileage on motorways), the air quality benefits could be several times greater than those in the central analysis. However, at the other extreme, if non-compliant vehicles are swapped and undertake similar mileage in a comparable urban centre, the emissions impacts could be much smaller (but so too arguably should be other effects[18]).

The actual result is likely to be somewhere between the two, and the central case may offer an appropriate central point – it does not capture potential additional benefits where non-compliant vehicles are scrapped and their full mileage replaced by new, compliant vehicles (i.e. the 25% scrapped), but it

[18] If we adopt this more 'UK-wide' view for emissions impacts, we probably also should do so for costs. Where a used non-compliant vehicle is swapped for a used compliant, this represents a cost in the economic model as the compliant vehicle is typically more expensive than the non-compliant. In practice, there will also be a net benefit for the owner on the other side of the transaction, which buys the cheaper non-compliant vehicle in replacement of the more expensive compliant vehicle, which is not captured in the model. Hence if the emissions (and wider operational) benefits are to be 'netted-off' in this way, so too would the upgrade costs.

does not also capture where non-compliant vehicles are sold as used and undertake mileage outside the CAZ.

This uncertainty will not affect the Preferred Option in the same way. The air quality modelling domain has been designed to capture re-routing effects so should capture all associated air quality impacts. The only upgrade response would occur in response to potential exemptions for ULEVs on the bus gates which may encourage greater take up of these vehicles, but the impact is likely to be marginal.

Hence the potential impacts for the Benchmark CAZ D will be greater due to the greater impact on vehicle upgrades.

b) **Active travel benefits:** Although active transport is not directly incentivised in either of the options, modal shift from personal car use to active travel through walking and cycling is a further impact. According to transport modelling approximately 14,600 vehicles users will switch from private car to either walking, cycling or bus travel. Active travel has health benefits through reduction in all-cause mortality but will also have an impact through increased accidents. These effects have not been monetised as they are likely to be small and are covered in more detail in the Health Impact Assessment (HIA) included in the E3 Report.

c) **Noise / accidents / infrastructure impacts associated with changes in traffic flows:** Some further impacts resulting from changes to transport flows in both options have not been quantitatively assessed. This includes impacts on noise resulting from changes in magnitude of traffic flows, changes in numbers of accidents resulting from changes in vkm travelled due to trip rerouting and cancelling, and impacts on infrastructure such as long-term wear and tear to road surfaces. These impacts are low, have not been monetised, and are covered in more detail in the distributional analyses. The results of the TUBA analysis has shown that the Preferred Option has a more prominent impact on trip rerouting so impacts are likely to be larger in this option. In the HIA, it has been found that the Benchmark CAZ D may reduce accidents due to reductions in traffic flows at accident hotspots, while the Preferred Option may increase accidents. Effects on noise and traffic infrastructure are likely to be negligible due to the marginal impact on traffic flows.

**Table 7-1 Wider impacts of the Options**

| Impact Category | Preferred Option | Benchmark CAZ D |
|---|---|---|
| AQ impacts outside modelling domain ($NO_X$ and PM) | - | ✓✓/✗✗ |
| Active travel benefits | ✓ | ✓ (but larger than Preferred Option) |
| Noise/accidents/infrastructure | ✗/✓ | ✓ |

Key: Each impact is assigned a scoring – these attempts to judge the size and direction of impacts between different options, and the overall size / importance of impact relative to other impacts assessed both qualitatively and quantitatively. '✓✓' denotes large benefit associated with option; '✓' denotes small benefit; '-' denotes no significant impact; '✗' denotes small cost; '✗✗' denotes large cost; and '✓/✗' denotes where there are costs and benefits ('✓✓/✗✗' where there could be either large costs or benefits), with no discernible overall net effect.

In summary, the impacts not captured by the quantitative analysis include:

- Both options will deliver additional air quality emission reductions outside the modelling domain, but these are likely to be more significant in the Benchmark CAZ D but could both increase or reduce existing assessment of impacts.
- Both options could have impacts on active travel, but these impacts are likely to be small relative to the overall assessment.
- Upgrading of vehicles in the Benchmark CAZ D option will carry transaction costs which scale with the number of vehicles upgraded.

- Both options have effects on accidents and infrastructure. In the case of the Benchmark CAZ D, traffic is reduced in the CAZ and some trips are cancelled, however traffic may increase outside of the CAZ due to rerouted trips. In the case of the Preferred Option the peak traffic restriction generally leads to increased congestion and more rerouted trips leading to increased vkm travelled.

# 8 Commentary of results and conclusions

Cost-benefit analysis (CBA) has been performed on the two options under consideration: the Preferred Option and the Benchmark CAZ D. It is important to state that the CBA is only part of the evidence base. In particular, it does not help assess the primary critical success factor of whether the options achieve compliance and which achieves this quickest.

That said, the CBA is a useful tool to weigh up all impacts across society (both costs and benefits) that may be associated with each measure. This helps assess the balance of impacts for each measure alone (to assess whether an option will deliver an overall benefit or cost for society on its own), and to compare between the measures.

Both options deliver a net cost, i.e. costs outweigh the benefits from a perspective of the whole of society. However, given legal limits must be met and some action taken to achieve compliance, assessing against a ‘do-nothing’ baseline is perhaps not the most informative comparison. Instead the focus should lie on the relative comparison between the options and which minimises costs or maximises benefits whilst also achieving compliance.

The Preferred Option has a less negative (Net Present Value) NPV than the Benchmark CAZ D and, hence represents a lower cost or less burdensome option to achieve compliance.

The Preferred Option creates re-routing during the peak travel restriction, that results in a large cost of increased travel time. This alongside implementation costs outweigh the benefits of the option, which include significant benefits through improvements in bus travel and small improvements in air quality, resulting in a net negative cost overall.

The Benchmark CAZ D will deliver greater improvements in air quality than the Preferred Option (although the Preferred Option in practice will begin to deliver emissions reductions and associated health benefits sooner as it can be implemented a year earlier – something not reflected in this modelling), and is not affected by the same re-routing and increased travel time disbenefit. In fact, travel times are likely to reduce under the Benchmark CAZ D associated with a reduction in non-compliant traffic and, hence, congestion in the CAZ zone, delivering a large benefit. However, these benefits are outweighed by significantly higher implementation costs of the Benchmark CAZ D, the cost of vehicle upgrades and welfare loss from those who choose to cancel their trips as a result of the Benchmark CAZ D.

Although the sensitivity analysis shows that the NPV of each option is sensitive to the assumptions, it demonstrates that the uncertainty around parameters does not influence the relative comparison of the options in terms of NPV. Furthermore, the complementary qualitative analysis has not identified any impacts that have not been quantified which could affect the balance of costs and benefits.

It is also important to note that the CBA only assesses impacts in aggregate and does not reveal any distributional pattern to these impacts. This is explored further in the Distributional Analysis Methodology Report (E3). Most notably:

- The Benchmark CAZ D has higher costs falling largely on vehicle users/owners. Households and businesses will bear the majority of these costs.
- Poorer households are more likely to own older cars and be less likely to upgrade their vehicles, meaning they may be forced to pay a CAZ charge.
- The costs to businesses will be significantly greater under the Benchmark CAZ D and may put many businesses at risk of going out of business, particularly those that require regular entry into the CAZ zone, and smaller businesses with less capital.

The outputs of both the CBA and distributional analysis should be considered alongside the other components of the evidence base when selecting the best option to achieve compliance.

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# Title Page and Introduction

This sheet provides a first introduction to the workbook

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|
| OK | DB | 15/04/20 | | |

## Security classification

FOR CIRCULATION TO Newcastle-under-Lyme Borough Council, Stoke on Trent City Council, Staffordshire County Council AND JAQU ONLY - NOT FOR GENERAL CIRCULATION. CLIENT CONFIDENTIAL

## What is this workbook?

Economic assessment model - North Staffordshire Local Air Quality Plan

## What are these data for?

Undertaking cost-benefit analysis of potential options to improve air quality in North Staffordshire

## Disclaimer

This model has been prepared by Ricardo Energy & Environment (Ricardo). No representation, warranty or undertaking (expressed or implied) is made in relation to it. No responsibility is taken or accepted by Ricardo for the adequacy, completeness or accuracy of the model or the assumptions on which it is based, and all liability therefore is expressly excluded. Ricardo accepts no liability whatsoever to any third party for any loss or damage arising from any interpretation or use of the information contained in this model, or reliance on any views expressed therein.

## Copyright



## Check of Checks

The Map sheet contains the results of each sheet's autocheck - the overall result is presented below:

*Overall model check of checks:* **#NAME?**

## Version Control

| Version | Date | User | Description of changes made | Primary Meth Notes |
|---|---|---|---|---|

## Governance

| Details for latest Model Version | Value |
|---|---|
| Model Author/Owner | James Sykes |
| QA Reviewer | David Birchby |
| Date of last model review | 07/05/2020 |
| Senior Responsible Officer (SRO) | Guy Hitchcock |
| Project Manager (PM) | Mark Attree |
| Project Reference | ED12487 |
| Client organisation | Newcastle-under-Lyme Borough Council, Stoke on Trent City Council, Staffordshire County Council |
| Client individual(s) (if appropriate) | |
| Ricardo QA requirement | N/A |
| Ricardo QA score | N/A |

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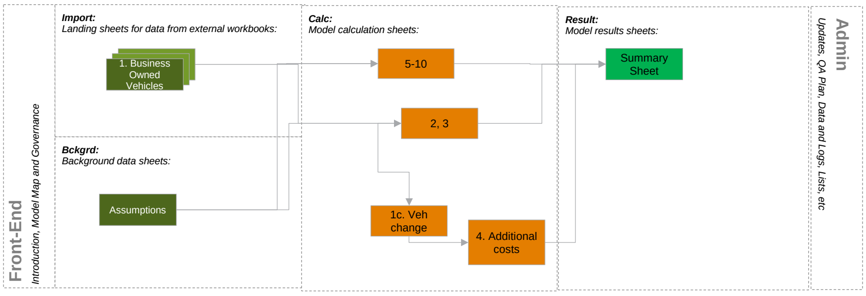
# Map: Navigation around the model and Key

This sheet provides a workbook map, sheet list and colour key

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|
| OK | DB | 15/04/20 | | |

## 1. Model map

The following schematic diagram shows how data flows through the model




## 2. Table of sheets

This table lists all the sheets in the workbook and re-presents key information recorded in the top rows

| Section | Link | Sheet Name | Explanation |
|---|---|---|---|
| **Front-end** | | | |
| | Goto | Title | This sheet provides a first introduction to the workbook |
| | Goto | Map | This sheet provides a workbook map, sheet list and colour key |
| **The Model Itself** | | | |
| | Goto | DataLog | This sheet logs the data and assumptions that underpin the workbook |
| | Goto | Assumptions | Contains general assumptions and data inputs which define calcualtions in the model; also c |
| | Goto | 1. Vehicle Ownership | [NOT USED] Data input from DfT on vehicle ownership |
| | Goto | 2. Fuel consumption | [NOT USED] Data input from Webtag on vehicle fuel consumption |
| | Goto | 3. Fuel prices | Fuel costs imported from BEIS guidance |
| | Goto | 4. Carbon Price | Carbon prices imported from BEIS guidance |
| | Goto | 5. GDP Deflators | Import of GDP deflators from HMT |
| | Goto | 6. Damage costs | Damage costs improted from JAQU guidance |
| | Goto | 7. GHG emission factors | GHG emission factors imported from BEIS guidance |
| | Goto | 8. AQ outputs | Outputs of air quality emissions modelling undertaken by Ricardo |
| | Goto | 9. Travel time | [NOT USED] |
| | Goto | 10a. ANPR data | Input of ANPR data with fleet euro split and uplift factors |
| | Goto | 10b. Licence data | Import of bus and taxi licence data |
| | Goto | 10c. 2020 fleet split | Import of fleet euro split in 2020 from Ricardo AQ Model |
| | Goto | 10d. Baseline vehicle fleet | Selection of data source for fleet baseline, and application of uplift factors |
| | Goto | 11. Time values | [NOT USED] |
| | Goto | 12. Opex Fuel | Import, sorting and extrapolation of vehicle opex, fuel consumption and CO2 emissions |
| | Goto | 13. Replacement costs | Import, sorting and depreciation of vehicle capex |
| | Goto | 14. Trip data | [NOT USED] |
| | Goto | 15. Impl. costs | Import of implementation costs provided by SWECO |
| **Calculation tabs** | | | |
| | Goto | 1. Veh change | Depicts changes in fleet (vehicles removed and added), over appraisal period |
| | Goto | 2. Vehicle values | Draws together upgrde costs and upgrade assumptions for different fates |
| | Goto | 3a. Upgrade costs ORR B | Calculates upgrade costs for ORR B options |
| | Goto | 3b. Upgrade costs ORR1 B | Calculates upgrade costs for reduced boundary B |
| | Goto | 3c. Upgrade costs ORR1 D | Calculates upgrade costs for reduced boundary D |
| | Goto | 3d. Upgrade costs results | Draws data from supporting cost calculation tabs and compares CAZ to baseline |
| | Goto | 4. Additional costs | Calculates savings/increases in opex, fuel consumption and CO2 associated with options |
| | Goto | 5. AQ impacts | Monetises changes in AQ emissions |
| | Goto | 6. Implementation | Calulates total implementation costs over appraisal period |
| | Goto | 7. Congest Trav time | Monetises changes in travel time (only used in sensitivity analysis) |
| | Goto | 9. welfare loss | Calulates total welfare costs associatd with alternative behavioural assumptions |
| **Results** | | | |
| | Goto | Summary sheet | Aggregates individual PV impacts into NPV summary |

*CheckOfChecks_n* OK

## 3. Colour key for model cells and text

The model uses the following colour-coding conventions to denote different sheet and cell functionalities.

| Style | Abbrev | Cell | Title/Tab | Description |
|---|---|---|---|---|
| Column1 | | | Data input | Cells where raw data imported to workbook |
| Column1 | | | Calculation | Cells where calculations undertaken |
| Column1 | | | Results | Cells where results are calculated / presented |

# Data and Assumptions Import Log

This sheet logs the data and assumptions that underpin the workbook

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|
| OK | DB | 15/04/20 | | |

## 1. Overview

## 2. Data Log: Primary data sources for this workbook

| Data Source | | | | | Nature | | | | Rating | | | | | Transformation Check | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Path** | **Filename** | **Version** | **Range Na** | **Date** | **Data Name** | **Brief Description of its Use** | **Public so** | **Depender** | **Security/C** | **Quality** | **Impact** | **Risk** | **Comments** | **Initials** | **Date** | **Comments** | **Result** |
| https://www | HMT Green Book | | | | Discount Rate | Used to discount all impacts | y | | | Green | amber | amber | | DB | 16-Nov | OK | |
| https://www | HMT GDP deflators | | | | Price Index | Used to inflate/deflate prices to common price base | y | | | Green | amber | amber | | DB | 16-Nov | OK | |
| N/A | N Staff Transport Model | | | | Vehicle fleet composition | Used to define vehicle euro split in 2022 | n | | | Green | red | red | | DB | 16-Nov | OK | |
| N/A | Ricardo AQ modelling | | | | Annual emissions of NOx and other pollutants (baseline and scenarios) | Used to represent CAZ impacts on emissions | n | | | Green | red | red | | DB | 16-Nov | OK | |
| N/A | N Staff Transport Model | | | | Fleet projection (vkms/vehicles) | Used to uplift fleet vehicle baseline to 2022 | n | | | Green | amber | amber | | DB | 16-Nov | OK | |
| N/A | ANPR data (N Staff); taxi licence data (N Staff); bus operator data (N Staff) | | | | Number of vehicles entering the target area | Used to depict baseline fleet | n | | | Red | REd | red | No perfect sour | DB | 16-Nov | OK | |
| N/A | JAQU Options Appraisal Guidance | | | | Damage Costs (air quality and GHGs) | Used to monetise air quality emissions changes | n | | | Green | red | red | | DB | 16-Nov | OK | |
| N/A | Ricardo study for TfL (2014): 'Environmental Support to the Development of a London Low Emission Vehicle Roadmap' (unpublished) Cost for hybrid vehicles taken from: Ricardo Energy & Environment (forthcoming): Car Choice Model (CCM) summary report | | | | Average value of new vehicle by type | Used to calculate upgrade costs of vehicles | n | | | Green | red | red | | DB | 16-Nov | OK | |
| N/A | JAQU Options Appraisal Guidance | | | | Vehicle depreciation | Used to calculate upgrade costs of vehicles | n | | | Green | amber | amber | | DB | 16-Nov | OK | |
| N/A | Ricardo study for TfL (2014): 'Environmental Support to the Development of a London Low Emission Vehicle Roadmap' (unpublished) Cost for hybrid vehicles taken from: Ricardo Energy & Environment (forthcoming): Car Choice Model (CCM) summary report | | | | Fuel consumption per vehicle | Used to calculate fuel cost savings associated with vehicle upgrads | n | | | Green | red | red | | DB | 16-Nov | OK | |
| https://www | BEIS Supplementary Green Book Guidance | | | | Fuel costs | Used to calculate fuel cost savings associated with vehicle upgrads | y | | | Green | red | red | | DB | 16-Nov | OK | |
| N/A | N Staff transport model and JAQU Options Appraisal Guidance | | | | Behavioural response proportions | Used to calculate number of non-compliant vehicles adopting different behavioural responses to CAZ | n | | | Amber | red | red | | DB | 16-Nov | OK | |
| https://uk-a | Defra Air Quality plan - scenario concentration results | | | | Impact extrapolation factor | Used to extrapolate impacts over appraisal period | y | | | Green | red | red | | DB | 16-Nov | OK | |
| N/A | Ricardo study for TfL (2014): 'Environmental Support to the Development of a London Low Emission Vehicle Roadmap' (unpublished) | | | | Average vkm per vehicle | Used to calculate fuel saving, opex and CO2 impacts of upgraded vehicles; also used an input to illustrative AQ emission impacts of PM and taxis | n | | | Green | red | red | | DB | 16-Nov | OK | |
| https://www | BEIS Supplementary Green Book Guidance | | | | CO2 Emission factors | Used to calculate GHG emission impacts of upgrades | y | | | Green | amber | amber | | DB | 16-Nov | OK | |
| https://ww | BEIS DUKES | | | | Conversion Factors | Used to convert fuel impacts between units | y | | | Green | amber | amber | | DB | 16-Nov | OK | |
| N/A | Ricardo study for TfL (2014): 'Environmental Support to the Development of a London Low Emission Vehicle Roadmap' (unpublished) | | | | Operating cost | Used to calculate operating cost impacts | n | | | Green | red | red | | DB | 16-Nov | OK | |
| N/A | JAQU Options Appraisal Guidance | | | | CAZ charge | Used to calculate charge revenue | n | | | Green | Green | Green | | DB | 16-Nov | OK | |
| N/A | Implementation Costs provided by SWECO | | | | Implementation costs | Used to calcualte implementation costs | n | | | Green | red | red | | DB | 16-Nov | OK | |

## 3. Assumptions Log: List of assumptions for this workbook

| Data Source (where relevant) | | | | | Nature | | | | Rating | | | | | Transformation Check | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Path** | **Filename** | **Version** | **Range Na** | **Date** | **Assumption Name** | **Brief Description of its Use** | **Public so** | **Depender** | **Security/C** | **Quality** | **Impact** | **Risk** | **Comments** | **Initials** | **Date** | **Comments** | **Result** |
| N/A | JAQU Options Appraisal Guidance | | | | Discount Year | 2019 - used to discount all monetary impacts | | | | Green | Green | Green | | DB | 16-Nov | OK | |
| N/A | JAQU Options Appraisal Guidance | | | | Price Year | 2018 - common price base for all monetary impacts | | | | Green | Green | Green | | DB | 16-Nov | OK | |
| N/A | JAQU Options Appraisal Guidance | | | | Appraisal Period | 10 years (2022 to 2031) - over which all impacts are assessed | | | | Green | Green | Green | | DB | 16-Nov | OK | |
| N/A | JAQU Options Appraisal Guidance | | | | Discount Rate | 3.5% - used to discount all monetary impacts | | | | Green | Green | Green | | DB | 16-Nov | OK | |
| N/A | JAQU Options Appraisal Guidance | | | | Upgrade to new | If upgrade response is triggered then 25% of those upgrading will purchase a new vehicle and 75% will replace their non-compliant vehicle with a second-hand compliant vehicle<br>Used in assessment of upgrade costs | | | | **Amber** | **red** | **red** | | DB | 16-Nov | OK | |
| N/A | JAQU Options Appraisal Guidance | | | | Fuel switch | Of those replacing their vehicle with a second-hand complaint variant, 25% will purchase the cheapest complaint vehicle of the same fuel type, while 75% will purchase the cheapest compliant vehicle (for example, in a charging clean air zone diesel will switch to petrol).<br>Used in assessment of upgrade costs | | | | **Amber** | **red** | **red** | | DB | 16-Nov | OK | |
| N/A | JAQU Options Appraisal Guidance | | | | Scrappage/Fleet size | For every vehicle purchased new, due to an upgrade response, another vehicle will be scrapped.<br>Used in assessment of upgrade costs | | | | **Amber** | **red** | **red** | | DB | 16-Nov | OK | |
| N/A | JAQU Options Appraisal Guidance | | | | Average days spent in the target a | Median days spent in the target area better represents the average driver than the mean (not directly applied in economic mo | | | | Green | Green | Green | | DB | 16-Nov | OK | |
| N/A | JAQU Options Appraisal Guidance | | | | Trips proportional to response | Those vehicles making the most trips into the zone are the most likely to upgrade. | | | | Green | Green | Green | | DB | 16-Nov | OK | |
| N/A | Expert judgement | | | | Optimism bias assumptions | Applied in sensitivity tests | | | | Green | Green | Green | | DB | 16-Nov | OK | |
| N/A | JAQU Options Appraisal Guidance / Expert judgement | | | | Vehicle Types | As defined by JAQU – but the model combines HGVs (rigid and articulate) and Coaches (coach, minibus) and buses (single a | | | | Green | Green | Green | | DB | 16-Nov | OK | |
| N/A | Expert judgement / LCC sense check | | | | ANPR assumptions | Conversions to inflate ANPR data from weekly to annual vehicle numbers and inflation factor to reflect the lack of complete ANPR coverage based on expert judgement<br>Used to derive fleet baseline | | | | **Amber** | **red** | **red** | | DB | 16-Nov | OK | |
| N/A | N Staff transport model | | | | Growth in overall vehicle fleet | How much will the vehicle fleet grow between 2019 (ANPR year) and 2022<br>Used to define fleet baseline | | | | Green | amber | amber | | DB | 16-Nov | OK | |
| N/A | JAQU Options Appraisal Guidance / LCC transport model | | | | Change in fleet composition projec | How will the fleet composition change between now and 2020. Private hire vehicles are assumed to have the same fleet composition and cars. Taxi fleet composition projection is based on JAQU assumptions<br>Used to define fleet baseline | | | | Green | **red** | **red** | | DB | 16-Nov | OK | |
| N/A | Expert judgement | | | | Ownership profile | A four-year ownership profile is assumed for vehicle users. I.e. on average vehicle users own vehicles for 4 years, before replacing them. In 2020 vehicles that are resold are expected to be halfway through this profile (2 years remaining).<br>Used in assessment of upgrade costs | | | | **Amber** | **red** | **red** | | DB | 16-Nov | OK | |
| N/A | Expert judgement | | | | Euro standard age | Vehicles of different Euro standards are assumed to the youngest possible age for that standard in 2020.<br>Used in assessment of upgrade costs | | | | Green | amber | amber | | DB | 16-Nov | OK | |
| N/A | Expert judgement | | | | Remaining life of vehicle | Where the age of the vehicle is greater than the life of vehicle, 2 more years is assumed.<br>Used in assessment of upgrade costs | | | | Green | amber | amber | | DB | 16-Nov | OK | |
| N/A | Expert judgement | | | | Price reduction in resale | It is assumed that with a number of CAZ operating across the UK, there will be an effect on the resale value of non-compliant vehicles. This is assumed to be 10%<br>Used in assessment of upgrade costs | | | | **Amber** | **Amber** | **Amber** | | DB | 16-Nov | OK | |
| N/A | Expert judgement | | | | Resale of used, non-compliant veh | Different resale profile for different Euro standards – different proportions of vehicles are either scrapped or resold depending on vehicle age. Older vehicles are more likely to be scrapped, newer vehicles likely to be resold.<br>Used in assessment of upgrade costs | | | | **Amber** | **red** | **red** | | DB | 16-Nov | OK | |
| N/A | Expert judgement | | | | Scrappage of non-compliant vehic | Older vehicles are likely to be scrapped first<br>Used in assessment of upgrade costs | | | | Green | **red** | **red** | | DB | 16-Nov | OK | |
| N/A | JAQU Options Appraisal Guidance | | | | Consumer Preference | Impact of welfare loss associated with an avoided, cancelled or mode-shifted trip can be valued as half of the CAZ charge.<br>Used to calculate welfare loss | | | | **Amber** | **red** | **red** | | DB | 16-Nov | OK | |

## 4. DECC guidance on Data and Assumptions Log ratings

Assumptions

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|

Sheet explanation

1. General Assumption List

2. Transport Assumption List

3. Behavioural Responses

STOKE CAZ D RESPONSE - From Sweco (Based on stated preference survey- Apart from Coaches which is JAQU)

Used to determine numbers adopting each behavioural

| Response | CAR | LGV | HGV | Bus | Coach | Taxis | Private Hire Car |
|---|---|---|---|---|---|---|---|
| Upgrade | 45% | 43.00% | 66% | 0% | 41% | 73% | 73% |
| Cancel | 10% | 2.00% | 5% | 0% | 26% | 12% | 12% |
| Change mode | 11% | 0.00% | 0% | 0% | 0% | 12% | 12% |
| Avoid | 19% | 27.00% | 14% | 0% | 0% | 0% | 0% |
| Buy | 15% | 28.00% | 15% | 0% | 33% | 3% | 3% |
| | 100% | 100% | 100% | 0% | 100% | 100% | 100% |

Source: Sweco - email 3/3 @07:34

Source: JAQU - National data inputs for Local Economic Models

| | | | |
|---|---|---|---|
| | 100% | Cancelled trips | |
| | 100% | Cancelled trips | |

Source: JAQU Options Appraisal Guidance

| | CAR | LGV | HGV | Bus | Coach | TAXI | Private Hire |
|---|---|---|---|---|---|---|---|

Source: Councils

4. Cost assumptions

Depicts remaining lifetime where vehicle Euro standard already older than average lifetime

Years remaining 2

5. Sensitivity analysis selections

Red cell can be changed to select whether low, midd or high estimates are used for weekly to annual conversion and

Selected

Used to uplift fleet baseline from 2016

Lower
Central
Upper

of ownership for

Assume half Ownership profile left in 2020 (on average users will be

2.00

5i. Optimism bias

5j. Behavioural response - Upgrade

| | CAR | LGV | HGV | Bus | Coach | Taxis | Private Hire Car |
|---|---|---|---|---|---|---|---|
| Low | 0% | 0.00% | #REF! | 10% | #REF! | 0.00% | 0.00% |

Lower
Central
Upper

# DataSet 03: Fuel Prices

| *Check-box* | *Last User* | *Date* |
|---|---|---|
| OK | GW | 15/04/20 |

## Sheet explanation

Imports fuel cost values from BEIS guidance
Used to value changes in fuel consumption associated with upgraded vehicles

## 1a. Price Year

**Price year of data** **2018**

## 1b. Retail fuel prices

Data input

| Year | Table 13 - Road Fuel LRVCs (real 2018 p/litre) Low Petrol | Low DERV | Central Petrol | Central DERV | High Petrol | High DERV |
|---|---|---|---|---|---|---|
| 2010 | 45.4 | 47.0 | 45.4 | 47.0 | 45.4 | 47.0 |
| 2011 | 56.3 | 60.7 | 56.3 | 60.7 | 56.3 | 60.7 |
| 2012 | 57.5 | 62.8 | 57.5 | 62.8 | 57.5 | 62.8 |
| 2013 | 55.4 | 60.4 | 55.4 | 60.4 | 55.4 | 60.4 |
| 2014 | 48.5 | 53.1 | 48.5 | 53.1 | 48.5 | 53.1 |
| 2015 | 33.9 | 36.6 | 33.9 | 36.6 | 33.9 | 36.6 |
| 2016 | 31.3 | 31.7 | 31.3 | 31.7 | 31.3 | 31.7 |
| 2017 | 38.0 | 39.5 | 38.0 | 39.5 | 38.0 | 39.5 |
| 2018 | 40.8 | 44.3 | 42.7 | 46.4 | 46.0 | 50.2 |
| 2019 | 30.9 | 32.9 | 41.2 | 44.7 | 51.0 | 55.9 |
| 2020 | 31.0 | 33.0 | 41.1 | 44.5 | 51.1 | 56.1 |
| 2021 | 31.1 | 33.1 | 41.0 | 44.5 | 51.8 | 56.9 |
| 2022 | 31.2 | 33.2 | 41.4 | 45.0 | 52.1 | 57.3 |
| 2023 | 31.6 | 33.7 | 41.9 | 45.5 | 53.5 | 58.8 |
| 2024 | 32.1 | 34.2 | 42.3 | 46.0 | 54.8 | 60.3 |
| 2025 | 32.5 | 34.8 | 42.8 | 46.5 | 55.7 | 61.3 |
| 2026 | 33.0 | 35.3 | 43.7 | 47.5 | 57.0 | 62.9 |
| 2027 | 33.4 | 35.8 | 44.1 | 48.1 | 57.9 | 63.9 |
| 2028 | 33.9 | 36.3 | 44.6 | 48.6 | 59.3 | 65.4 |
| 2029 | 34.3 | 36.8 | 45.4 | 49.6 | 60.1 | 66.5 |
| 2030 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2031 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2032 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2033 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2034 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2035 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2036 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2037 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2038 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2039 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2040 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2041 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2042 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2043 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2044 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2045 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2046 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2047 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2048 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2049 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2050 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2051 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2052 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2053 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2054 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2055 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2056 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2057 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2058 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2059 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2060 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2061 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2062 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2063 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2064 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2065 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2066 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2067 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2068 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2069 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2070 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2071 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2072 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2073 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2074 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2075 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2076 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2077 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2078 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2079 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2080 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2081 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2082 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2083 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2084 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2085 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2086 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2087 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2088 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2089 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2090 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2091 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2092 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2093 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2094 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2095 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2096 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2097 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2098 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2099 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |
| 2100 | 34.8 | 37.3 | 45.9 | 50.1 | 61.5 | 68.0 |

Data input

| Year | Table 9 - Electricity LRVC (real 2018 p/kWh) Low Domestic | Low Commercial/ Public sector | Low Industrial | Central Domestic | Central Commercial | Central Industrial | High Domestic | High Commercial | High Industrial |
|---|---|---|---|---|---|---|---|---|---|
| 2010 | 7.5 | 5.0 | 4.9 | 7.5 | 5.0 | 4.9 | 7.5 | 5.0 | 4.9 |
| 2011 | 8.0 | 5.9 | 5.7 | 8.0 | 5.9 | 5.7 | 8.0 | 5.9 | 5.7 |
| 2012 | 7.7 | 6.3 | 6.1 | 7.7 | 6.3 | 6.1 | 7.7 | 6.3 | 6.1 |
| 2013 | 8.5 | 7.0 | 6.8 | 8.5 | 7.0 | 6.8 | 8.5 | 7.0 | 6.8 |
| 2014 | 6.7 | 5.9 | 5.7 | 6.7 | 5.9 | 5.7 | 6.7 | 5.9 | 5.7 |
| 2015 | 7.0 | 5.4 | 5.2 | 7.0 | 5.4 | 5.2 | 7.0 | 5.4 | 5.2 |
| 2016 | 7.4 | 5.7 | 5.3 | 7.3 | 5.6 | 5.2 | 7.4 | 5.7 | 5.3 |
| 2017 | 9.0 | 7.3 | 6.8 | 9.0 | 7.3 | 6.8 | 9.0 | 7.3 | 6.8 |
| 2018 | 9.8 | 8.3 | 7.7 | 9.9 | 8.4 | 7.8 | 9.9 | 8.4 | 7.7 |
| 2019 | 9.4 | 8.0 | 7.3 | 10.4 | 9.0 | 8.3 | 11.4 | 10.1 | 9.4 |
| 2020 | 9.5 | 8.1 | 7.3 | 10.4 | 9.0 | 8.2 | 11.8 | 10.5 | 9.6 |
| 2021 | 9.6 | 8.2 | 7.3 | 10.6 | 9.2 | 8.4 | 11.8 | 10.5 | 9.6 |
| 2022 | 9.5 | 8.1 | 7.2 | 10.7 | 9.3 | 8.4 | 11.8 | 10.5 | 9.5 |
| 2023 | 9.7 | 8.3 | 7.3 | 10.8 | 9.4 | 8.4 | 11.8 | 10.5 | 9.5 |
| 2024 | 9.7 | 8.3 | 7.4 | 10.9 | 9.5 | 8.6 | 12.0 | 10.6 | 9.6 |
| 2025 | 9.9 | 8.5 | 7.5 | 11.2 | 9.8 | 8.8 | 12.1 | 10.8 | 9.7 |
| 2026 | 10.2 | 8.8 | 7.6 | 11.4 | 10.0 | 8.9 | 12.1 | 10.7 | 9.6 |
| 2027 | 10.0 | 8.5 | 7.4 | 11.1 | 9.8 | 8.7 | 11.8 | 10.4 | 9.4 |
| 2028 | 9.9 | 8.4 | 7.3 | 10.8 | 9.4 | 8.4 | 11.4 | 10.0 | 9.0 |
| 2029 | 10.0 | 8.4 | 7.3 | 10.8 | 9.4 | 8.3 | 11.3 | 9.8 | 8.8 |
| 2030 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2031 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2032 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2033 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2034 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2035 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2036 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2037 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2038 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2039 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2040 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2041 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2042 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2043 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2044 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2045 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2046 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2047 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2048 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2049 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2050 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2051 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2052 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2053 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2054 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2055 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2056 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2057 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2058 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2059 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2060 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2061 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2062 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2063 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2064 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2065 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2066 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2067 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2068 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2069 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2070 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2071 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2072 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2073 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2074 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2075 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2076 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2077 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2078 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2079 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2080 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2081 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2082 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2083 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2084 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2085 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2086 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2087 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2088 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2089 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2090 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2091 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2092 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2093 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2094 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2095 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2096 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2097 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2098 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2099 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |
| 2100 | 9.8 | 8.3 | 7.1 | 10.7 | 9.3 | 8.3 | 11.2 | 9.7 | 8.7 |

| Year | p/litre Central Petrol | p/litre Central Diesel | p/kWh Central Domestic Elec |
|---|---|---|---|
| 2010 | 45.41 | 47.03 | 7.53 |
| 2011 | 56.28 | 60.72 | 7.96 |
| 2012 | 57.52 | 62.82 | 7.73 |
| 2013 | 55.41 | 60.37 | 8.47 |
| 2014 | 48.52 | 53.12 | 6.71 |
| 2015 | 33.92 | 36.56 | 7.00 |
| 2016 | 31.26 | 31.65 | 7.29 |
| 2017 | 38.03 | 39.48 | 8.99 |
| 2018 | 42.71 | 46.45 | 9.90 |
| 2019 | 41.16 | 44.67 | 10.36 |
| 2020 | 41.05 | 44.54 | 10.42 |
| 2021 | 41.00 | 44.48 | 10.57 |
| 2022 | 41.44 | 44.99 | 10.69 |
| 2023 | 41.88 | 45.50 | 10.77 |
| 2024 | 42.33 | 46.01 | 10.90 |
| 2025 | 42.77 | 46.52 | 11.19 |
| 2026 | 43.66 | 47.54 | 11.38 |
| 2027 | 44.11 | 48.05 | 11.14 |
| 2028 | 44.55 | 48.56 | 10.83 |
| 2029 | 45.45 | 49.59 | 10.83 |
| 2030 | 45.89 | 50.10 | 10.74 |
| 2031 | 45.89 | 50.10 | 10.74 |
| 2032 | 45.89 | 50.10 | 10.74 |
| 2033 | 45.89 | 50.10 | 10.74 |
| 2034 | 45.89 | 50.10 | 10.74 |
| 2035 | 45.89 | 50.10 | 10.74 |
| 2036 | 45.89 | 50.10 | 10.74 |
| 2037 | 45.89 | 50.10 | 10.74 |
| 2038 | 45.89 | 50.10 | 10.74 |
| 2039 | 45.89 | 50.10 | 10.74 |
| 2040 | 45.89 | 50.10 | 10.74 |
| 2041 | 45.89 | 50.10 | 10.74 |
| 2042 | 45.89 | 50.10 | 10.74 |
| 2043 | 45.89 | 50.10 | 10.74 |
| 2044 | 45.89 | 50.10 | 10.74 |
| 2045 | 45.89 | 50.10 | 10.74 |
| 2046 | 45.89 | 50.10 | 10.74 |
| 2047 | 45.89 | 50.10 | 10.74 |
| 2048 | 45.89 | 50.10 | 10.74 |
| 2049 | 45.89 | 50.10 | 10.74 |
| 2050 | 45.89 | 50.10 | 10.74 |
| 2051 | 45.89 | 50.10 | 10.74 |
| 2052 | 45.89 | 50.10 | 10.74 |
| 2053 | 45.89 | 50.10 | 10.74 |
| 2054 | 45.89 | 50.10 | 10.74 |
| 2055 | 45.89 | 50.10 | 10.74 |
| 2056 | 45.89 | 50.10 | 10.74 |
| 2057 | 45.89 | 50.10 | 10.74 |
| 2058 | 45.89 | 50.10 | 10.74 |
| 2059 | 45.89 | 50.10 | 10.74 |
| 2060 | 45.89 | 50.10 | 10.74 |
| 2061 | 45.89 | 50.10 | 10.74 |
| 2062 | 45.89 | 50.10 | 10.74 |
| 2063 | 45.89 | 50.10 | 10.74 |
| 2064 | 45.89 | 50.10 | 10.74 |
| 2065 | 45.89 | 50.10 | 10.74 |
| 2066 | 45.89 | 50.10 | 10.74 |
| 2067 | 45.89 | 50.10 | 10.74 |
| 2068 | 45.89 | 50.10 | 10.74 |
| 2069 | 45.89 | 50.10 | 10.74 |
| 2070 | 45.89 | 50.10 | 10.74 |
| 2071 | 45.89 | 50.10 | 10.74 |
| 2072 | 45.89 | 50.10 | 10.74 |
| 2073 | 45.89 | 50.10 | 10.74 |
| 2074 | 45.89 | 50.10 | 10.74 |
| 2075 | 45.89 | 50.10 | 10.74 |
| 2076 | 45.89 | 50.10 | 10.74 |
| 2077 | 45.89 | 50.10 | 10.74 |
| 2078 | 45.89 | 50.10 | 10.74 |
| 2079 | 45.89 | 50.10 | 10.74 |
| 2080 | 45.89 | 50.10 | 10.74 |
| 2081 | 45.89 | 50.10 | 10.74 |
| 2082 | 45.89 | 50.10 | 10.74 |
| 2083 | 45.89 | 50.10 | 10.74 |
| 2084 | 45.89 | 50.10 | 10.74 |
| 2085 | 45.89 | 50.10 | 10.74 |
| 2086 | 45.89 | 50.10 | 10.74 |
| 2087 | 45.89 | 50.10 | 10.74 |
| 2088 | 45.89 | 50.10 | 10.74 |
| 2089 | 45.89 | 50.10 | 10.74 |
| 2090 | 45.89 | 50.10 | 10.74 |
| 2091 | 45.89 | 50.10 | 10.74 |
| 2092 | 45.89 | 50.10 | 10.74 |
| 2093 | 45.89 | 50.10 | 10.74 |
| 2094 | 45.89 | 50.10 | 10.74 |
| 2095 | 45.89 | 50.10 | 10.74 |
| 2096 | 45.89 | 50.10 | 10.74 |
| 2097 | 45.89 | 50.10 | 10.74 |
| 2098 | 45.89 | 50.10 | 10.74 |
| 2099 | 45.89 | 50.10 | 10.74 |
| 2100 | 45.89 | 50.10 | 10.74 |

## Source

BEIS supplementary Green Book Guidance
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/602657/5._Data_tables_1-19_supporting_the_toolkit_and_the_guidance_2016.xlsx
Tables 4-8: Retail fuel prices

**Used in Sheets 4. Additional Costs**

# DataSet 04: Carbon Prices

| Check-box | st Us | Date | Status | User Comments |
|---|---|---|---|---|
| OK | GW | 15/04/20 | | |

## Sheet explanation

Imports carbon prices from BEIS guidance
Used to value changes in GHG emissions associated with upgraded vehicles

## 1. Carbon prices and sensitivities 2010-2100 for appraisal, 2

Imported data

**2018 prices**
Conversion to 2018 prices

| | Traded | | | Non-traded | | | T | NT |
|---|---|---|---|---|---|---|---|---|
| | Lower | Central | Upper | Lower | Central | Upper | Central | Central |
| **2010** | 14 | 14 | 14 | 30 | 60 | 90 | 14.5873 | 62.12420506 |
| **2011** | 13 | 13 | 13 | 30 | 61 | 91 | 13.1413 | 63.05606814 |
| **2012** | 7 | 7 | 7 | 31 | 61 | 92 | 6.83645 | 64.00190916 |
| **2013** | 4 | 4 | 4 | 31 | 62 | 94 | 4.25743 | 64.9619378 |
| **2014** | 5 | 5 | 5 | 32 | 63 | 95 | 5.30091 | 65.93636686 |
| **2015** | 6 | 6 | 6 | 32 | 64 | 96 | 6.123 | 66.92541237 |
| **2016** | 5 | 5 | 5 | 33 | 65 | 98 | 4.70738 | 67.92929355 |
| **2017** | 5 | 5 | 5 | 33 | 66 | 99 | 5.39721 | 68.94823296 |
| **2018** | 2 | 13 | 26 | 34 | 67 | 101 | 13.2759 | 69.98245645 |
| **2019** | 0 | 13 | 26 | 34 | 68 | 102 | 13.6871 | 71.0321933 |
| **2020** | 0 | 14 | 28 | 35 | 69 | 104 | 14.4077 | 72.0976762 |
| **2021** | 4 | 21 | 37 | 35 | 70 | 106 | 21.3783 | 73.29930413 |
| **2022** | 8 | 27 | 46 | 36 | 72 | 107 | 28.349 | 74.50093207 |
| **2023** | 12 | 34 | 56 | 36 | 73 | 109 | 35.3196 | 75.70256001 |
| **2024** | 16 | 41 | 65 | 37 | 74 | 111 | 42.2902 | 76.90418794 |
| **2025** | 20 | 47 | 74 | 38 | 75 | 113 | 49.2608 | 78.10581588 |
| **2026** | 24 | 54 | 84 | 38 | 76 | 114 | 56.2315 | 79.30744382 |
| **2027** | 28 | 61 | 93 | 39 | 77 | 116 | 63.2021 | 80.50907175 |
| **2028** | 32 | 67 | 103 | 39 | 79 | 118 | 70.1727 | 81.71069969 |
| **2029** | 36 | 74 | 112 | 40 | 80 | 120 | 77.1433 | 82.91232763 |
| **2030** | 40 | 81 | 121 | 40 | 81 | 121 | 84.114 | 84.11395556 |
| **2031** | 44 | 88 | 132 | 44 | 88 | 132 | 91.9245 | 91.92453715 |
| **2032** | 48 | 96 | 144 | 48 | 96 | 144 | 99.7351 | 99.73511874 |
| **2033** | 52 | 103 | 155 | 52 | 103 | 155 | 107.546 | 107.5457003 |
| **2034** | 55 | 111 | 166 | 55 | 111 | 166 | 115.356 | 115.3562819 |
| **2035** | 59 | 118 | 178 | 59 | 118 | 178 | 123.167 | 123.1668635 |
| **2036** | 63 | 126 | 189 | 63 | 126 | 189 | 130.977 | 130.9774451 |
| **2037** | 67 | 133 | 200 | 67 | 133 | 200 | 138.788 | 138.7880267 |
| **2038** | 70 | 141 | 211 | 70 | 141 | 211 | 146.599 | 146.5986083 |
| **2039** | 74 | 148 | 223 | 74 | 148 | 223 | 154.409 | 154.4091899 |
| **2040** | 78 | 156 | 234 | 78 | 156 | 234 | 162.22 | 162.2197714 |
| **2041** | 82 | 163 | 245 | 82 | 163 | 245 | 170.03 | 170.030353 |
| **2042** | 85 | 171 | 256 | 85 | 171 | 256 | 177.841 | 177.8409346 |
| **2043** | 89 | 178 | 268 | 89 | 178 | 268 | 185.652 | 185.6515162 |
| **2044** | 93 | 186 | 279 | 93 | 186 | 279 | 193.462 | 193.4620978 |
| **2045** | 97 | 193 | 290 | 97 | 193 | 290 | 201.273 | 201.2726794 |
| **2046** | 100 | 201 | 301 | 100 | 201 | 301 | 209.083 | 209.083261 |
| **2047** | 104 | 208 | 313 | 104 | 208 | 313 | 216.894 | 216.8938426 |
| **2048** | 108 | 216 | 324 | 108 | 216 | 324 | 224.704 | 224.7044241 |
| **2049** | 112 | 223 | 335 | 112 | 223 | 335 | 232.515 | 232.5150057 |
| **2050** | 115 | 231 | 346 | 115 | 231 | 346 | 240.326 | 240.3255873 |
| **2051** | 118 | 239 | 360 | 118 | 239 | 360 | 248.824 | 248.8244557 |
| **2052** | 121 | 247 | 373 | 121 | 247 | 373 | 257.058 | 257.0577408 |
| **2053** | 124 | 255 | 386 | 124 | 255 | 386 | 265.331 | 265.3310756 |
| **2054** | 126 | 263 | 400 | 126 | 263 | 400 | 273.607 | 273.6072997 |
| **2055** | 129 | 271 | 413 | 129 | 271 | 413 | 281.62 | 281.6197182 |
| **2056** | 131 | 278 | 426 | 131 | 278 | 426 | 289.68 | 289.679685 |
| **2057** | 133 | 286 | 439 | 133 | 286 | 439 | 297.446 | 297.4462692 |
| **2058** | 135 | 293 | 451 | 135 | 293 | 451 | 305.028 | 305.0281374 |
| **2059** | 137 | 300 | 464 | 137 | 300 | 464 | 312.483 | 312.4827837 |
| **2060** | 138 | 307 | 476 | 138 | 307 | 476 | 319.75 | 319.7499838 |
| **2061** | 139 | 313 | 486 | 139 | 313 | 486 | 325.518 | 325.5178877 |
| **2062** | 140 | 318 | 497 | 140 | 318 | 497 | 331.251 | 331.2509598 |
| **2063** | 141 | 323 | 506 | 141 | 323 | 506 | 336.403 | 336.4032606 |
| **2064** | 141 | 328 | 515 | 141 | 328 | 515 | 341.279 | 341.2792062 |
| **2065** | 141 | 332 | 523 | 141 | 332 | 523 | 345.568 | 345.5676064 |
| **2066** | 141 | 336 | 531 | 141 | 336 | 531 | 349.797 | 349.7969448 |
| **2067** | 141 | 340 | 538 | 141 | 340 | 538 | 353.328 | 353.3280494 |
| **2068** | 140 | 343 | 545 | 140 | 343 | 545 | 356.557 | 356.5571885 |
| **2069** | 140 | 345 | 551 | 140 | 345 | 551 | 359.296 | 359.2962431 |
| **2070** | 139 | 348 | 556 | 139 | 348 | 556 | 361.659 | 361.6585417 |
| **2071** | 138 | 350 | 561 | 138 | 350 | 561 | 364.005 | 364.0049699 |
| **2072** | 137 | 352 | 566 | 137 | 352 | 566 | 365.95 | 365.9496536 |
| **2073** | 136 | 353 | 570 | 136 | 353 | 570 | 367.601 | 367.6010819 |
| **2074** | 135 | 354 | 574 | 135 | 354 | 574 | 368.591 | 368.5912416 |
| **2075** | 133 | 355 | 577 | 133 | 355 | 577 | 369.631 | 369.631045 |
| **2076** | 131 | 355 | 579 | 131 | 355 | 579 | 369.72 | 369.7199724 |
| **2077** | 130 | 355 | 581 | 130 | 355 | 581 | 369.853 | 369.8529671 |
| **2078** | 128 | 355 | 582 | 128 | 355 | 582 | 369.392 | 369.3923345 |
| **2079** | 126 | 354 | 583 | 126 | 354 | 583 | 368.71 | 368.7103932 |
| **2080** | 124 | 353 | 582 | 124 | 353 | 582 | 367.363 | 367.36282 |
| **2081** | 122 | 353 | 584 | 122 | 353 | 584 | 367.177 | 367.1769542 |
| **2082** | 120 | 352 | 584 | 120 | 352 | 584 | 366.346 | 366.3461166 |
| **2083** | 118 | 351 | 584 | 118 | 351 | 584 | 365.237 | 365.2369569 |
| **2084** | 115 | 350 | 584 | 115 | 350 | 584 | 363.897 | 363.8965493 |
| **2085** | 113 | 349 | 584 | 113 | 349 | 584 | 362.717 | 362.7174308 |
| **2086** | 111 | 347 | 582 | 111 | 347 | 582 | 360.834 | 360.8336277 |
| **2087** | 109 | 345 | 581 | 109 | 345 | 581 | 358.664 | 358.6639125 |
| **2088** | 106 | 343 | 579 | 106 | 343 | 579 | 356.438 | 356.4376723 |
| **2089** | 104 | 340 | 576 | 104 | 340 | 576 | 353.872 | 353.8720234 |
| **2090** | 101 | 338 | 574 | 101 | 338 | 574 | 351.282 | 351.2818568 |
| **2091** | 99 | 335 | 572 | 99 | 335 | 572 | 349.093 | 349.0929466 |
| **2092** | 97 | 333 | 570 | 97 | 333 | 570 | 346.844 | 346.8441011 |
| **2093** | 94 | 331 | 567 | 94 | 331 | 567 | 344.033 | 344.0333143 |
| **2094** | 92 | 328 | 564 | 92 | 328 | 564 | 341.154 | 341.1536848 |
| **2095** | 89 | 325 | 561 | 89 | 325 | 561 | 338.154 | 338.1541933 |
| **2096** | 87 | 322 | 557 | 87 | 322 | 557 | 335.076 | 335.0758689 |
| **2097** | 85 | 319 | 554 | 85 | 319 | 554 | 332.128 | 332.1275325 |
| **2098** | 82 | 316 | 549 | 82 | 316 | 549 | 328.645 | 328.6452914 |
| **2099** | 80 | 313 | 546 | 80 | 313 | 546 | 325.489 | 325.4894786 |
| **2100** | 77 | 309 | 541 | 77 | 309 | 541 | 322.003 | 322.0033783 |

## Source

BEIS supplementary Green Book Guidance
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/602657/5._Data_tables_1-19_supporting_the_toolkit_and_the_guidance_2016.xlsx
Tables 3: Carbon Prices and sensitivities

# DataSet 05: GDP Deflators

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|
| OK | GW | 15/04/20 | | |

## Sheet explanation

Import of HMT GDP Deflators
Used to inflate / deflate costs to same price base

## 1. GDP DEFLATORS AT MARKET PRICES, AND MONEY GDP

| Financial year | | | | |
|---|---|---|---|---|
| | GDP deflator at market prices | | Money GDP (3), (4) | |
| Financial year | 2016-17 = 100 | per cent change on previous year | Cash £ million Non-Seasonally Adjusted | Cash £ million Seasonally Adjusted |
| 2000-01 | 69.900 | 1.95 | 1,107,924 | 1,104,616 |
| 2001-02 | 70.772 | 1.25 | 1,147,395 | 1,151,712 |
| 2002-03 | 72.415 | 2.32 | 1,211,222 | 1,206,957 |
| 2003-04 | 73.871 | 2.01 | 1,272,293 | 1,273,436 |
| 2004-05 | 75.962 | 2.83 | 1,336,299 | 1,335,027 |
| 2005-06 | 77.813 | 2.44 | 1,420,214 | 1,420,135 |
| 2006-07 | 80.023 | 2.84 | 1,493,214 | 1,492,031 |
| 2007-08 | 82.151 | 2.66 | 1,569,164 | 1,571,317 |
| 2008-09 | 84.248 | 2.55 | 1,573,876 | 1,573,372 |
| 2009-10 | 85.637 | 1.65 | 1,557,283 | 1,557,542 |
| 2010-11 | 87.103 | 1.71 | 1,622,044 | 1,621,521 |
| 2011-12 | 88.433 | 1.53 | 1,668,699 | 1,666,988 |
| 2012-13 | 90.254 | 2.06 | 1,725,624 | 1,728,156 |
| 2013-14 | 91.996 | 1.93 | 1,806,329 | 1,803,916 |
| 2014-15 | 93.280 | 1.40 | 1,871,789 | 1,875,048 |
| 2015-16 | 94.084 | 0.86 | 1,934,600 | 1,934,489 |
| 2016-17 | 96.311 | 2.37 | 2,019,484 | 2,019,115 |
| 2017-18 (1), (2) | 97.975 | 1.73 | 2,085,654 | 2,086,798 |
| 2018-19 (1), (2) | 100.000 | 2.07 | 2,167,078 | 2,163,287 |
| 2019-20 (1), (2) | - | 2.00 | 2,199,839 | 2,199,987 |
| 2020-21 (1), (2) | - | 1.84 | 2,274,802 | 2,274,314 |
| 2021-22 (1), (2) | - | 1.94 | 2,355,228 | 2,355,501 |
| 2022-2023 | - | 1.95 | 2,439,946 | 2,439,921 |

| Calendar year | | | | 2014 to 2018 |
|---|---|---|---|---|
| | GDP deflator at market prices | | Money GDP (3) | |
| Calendar year | 2016 = 100 | per cent change on previous year | Cash £ million Non-Seasonally Adjusted | |
| 2000 | 70.030 | 1.86 | 1,095,651 | |
| 2001 | 70.727 | 1.00 | 1,139,479 | |
| 2002 | 72.219 | 2.11 | 1,190,601 | |
| 2003 | 73.848 | 2.26 | 1,257,474 | |
| 2004 | 75.732 | 2.55 | 1,320,128 | |
| 2005 | 77.627 | 2.50 | 1,396,274 | |
| 2006 | 79.781 | 2.77 | 1,474,923 | |
| 2007 | 81.840 | 2.58 | 1,549,821 | |
| 2008 | 84.211 | 2.90 | 1,589,931 | |
| 2009 | 85.592 | 1.64 | 1,547,563 | |
| 2010 | 86.903 | 1.53 | 1,601,927 | |
| 2011 | 88.677 | 2.04 | 1,659,784 | |
| 2012 | 90.147 | 1.66 | 1,712,321 | |
| 2013 | 91.855 | 1.89 | 1,782,109 | |
| 2014 | 93.535 | 1.83 | 1,861,964 | 1 |
| 2015 | 94.079 | 0.58 | 1,916,896 | 1.005814 |
| 2016 | 96.090 | 2.14 | 1,995,479 | 1.027313 |
| 2017 (1), (2) | 97.909 | 1.89 | 2,071,667 | 1.046756 |
| 2018 (1), (2) | 100.000 | 2.14 | 2,144,304 | 1.069115 |
| 2019 (1), (2) | - | 1.98 | 2,182,436 | 1.090332 |
| 2020 (1), (2) | - | 1.84 | 2,254,754 | 1.110396 |
| 2021 (1), (2) | - | 1.92 | 2,334,801 | 1.131755 |
| 2022 | - | 1.95 | 2,418,509 | |

| 2015 to 2018 | |
|---|---|
| 2015 | 1 |
| 2016 | 1.021375 |
| 2017 (1), (2) | 1.040705 |
| 2018 (1), (2) | 1.062935 |
| | 1.08403 |
| | 1.103978 |
| | 1.125214 |

| 2017 to 2018 | |
|---|---|
| 2015 | |
| 2016 | |
| 2017 (1), (2) | 1 |
| 2018 (1), (2) | 1.021361 |

## Source

https://www.gov.uk/government/statistics/gdp-deflators-at-market-prices-and-money-gdp-december-2019-quarterly-national-accounts
Last updated Jan 2020

# DataSet 06: Damage costs

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|
| OK | GW | 15/04/20 | | |

## Sheet explanation

Import of damage costs for air pollutants from JAQU guidance
Damage costs for both Nox and PM are converted to price year 2018 using 5. GDP deflators and have a 2% annual uplift applied as in JAQU guidance. Functionality is also built in for discounting at this stage (N15)
Damage costs then used to monetise changes in AQ emissions
**Used in sheets 5. AQ Impacts**

## 1a. Nox damage costs

£/tonne

| | |
|---|---|
| Lower | 1388 |
| Central | 16010 |
| Upper | 61834 |

| | Inner London | Central London | Outer London | Inner conurbation | Urban big | Urban large | Urban Medium | Transport average |
|---|---|---|---|---|---|---|---|---|
| **2017 (prices)** | | | | | £16,010 | | | |
| **Sensitivity** | | | | | | | | |
| **2018 prices** | | | | | | | | |
| **2018 price with uplift from 2015** | | | | | £16,352 | | | |

| | | |
|---|---|---|
| **Discount** | 1 | Note: Discounting not applied at this stage |
| **Annual Uplift** | 1.02 | |

| 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **£16,352** | £16,679.03 | £17,013 | £17,353 | £17,699.91 | £18,054 | £18,414.99 | £18,783 | £19,159 | £19,542 | £19,933 | £20,332 | £20,738 | £21,153 | £21,576 |

## 1a. PM damage costs

£/tonne

| | |
|---|---|
| Lower | £ 63,815.00 |
| Central | 305377 |
| Upper | £940,942.00 |

| | Inner London | Central London | Outer London | Inner conurbation | Urban big | Urban large | Urban Medium | Transport average |
|---|---|---|---|---|---|---|---|---|
| **2017 (prices)** | | | | | £305,377 | | | |
| **Sensitivity** | | | | | | | | |
| **2018 prices** | | | | | | | | |
| **2018 price with uplift from 2015** | | | | | £311,900 | | | |

| 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **£311,900** | £318,138.08 | £324,501 | £330,991 | £337,610.68 | £344,363 | £351,250.15 | £358,275 | £365,441 | £372,749 | £380,204 | £387,809 | £395,565 | £403,476 | £411,546 |

## Source

Source: JAQU - National data inputs for Local Economic Models
**2015 prices**

# DataSet 07: GHG Emission factors

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|
| | JS | 15/04/20 | | |

## Sheet explanation

GHG emission factors imported from BEIS guidance
CO2 emission factors expressed in kg CO2 equivalent per km travelled
Applied to calculate GHG emissions associated with vehicle upgrades

## 1a. GHG emissions factors

Table 2b: Converting road and rail fuels to CO2e (emissions factors), kgCO2e/litre

Table 1: Electricity emissions factors to 2100, kgCO2e/kWh
Long-run marginal

| Year | Petrol | Diesel | Gas oil | Domestic |
|---|---|---|---|---|
| 2010 | 2.229919977 | 2.5617129 | 2.92577 | 0.373558 |
| 2011 | 2.211100776 | 2.5665344 | 2.92577 | 0.368166 |
| 2012 | 2.210582656 | 2.6087021 | 2.92577 | 0.36127 |
| 2013 | 2.200901786 | 2.5973387 | 2.851836 | 0.352468 |
| 2014 | 2.189088734 | 2.6013091 | 2.855925 | 0.345938 |
| 2015 | 2.189088734 | 2.6014176 | 2.856036 | 0.336236 |
| 2016 | 2.189088734 | 2.6015089 | 2.85613 | 0.326995 |
| 2017 | 2.159500599 | 2.5561289 | 2.809405 | 0.31725 |
| 2018 | 2.129912463 | 2.5107488 | 2.762679 | 0.306973 |
| 2019 | 2.100324328 | 2.4653688 | 2.715953 | 0.296135 |
| 2020 | 2.070736192 | 2.4199888 | 2.669228 | 0.284706 |
| 2021 | 2.070736192 | 2.4199888 | 2.669228 | 0.272653 |
| 2022 | 2.070736192 | 2.4199888 | 2.669228 | 0.259942 |
| 2023 | 2.070736192 | 2.4199888 | 2.669228 | 0.246538 |
| 2024 | 2.070736192 | 2.4199888 | 2.669228 | 0.232402 |
| 2025 | 2.070736192 | 2.4199888 | 2.669228 | 0.217495 |
| 2026 | 2.070736192 | 2.4199888 | 2.669228 | 0.201774 |
| 2027 | 2.070736192 | 2.4199888 | 2.669228 | 0.185195 |
| 2028 | 2.070736192 | 2.4199888 | 2.669228 | 0.167712 |
| 2029 | 2.070736192 | 2.4199888 | 2.669228 | 0.149274 |
| 2030 | 2.070736192 | 2.4199888 | 2.669228 | 0.129831 |
| 2031 | 2.070736192 | 2.4199888 | 2.669228 | 0.118554 |
| 2032 | 2.070736192 | 2.4199888 | 2.669228 | 0.108257 |
| 2033 | 2.070736192 | 2.4199888 | 2.669228 | 0.098855 |
| 2034 | 2.070736192 | 2.4199888 | 2.669228 | 0.090269 |
| 2035 | 2.070736192 | 2.4199888 | 2.669228 | 0.082429 |
| 2036 | 2.070736192 | 2.4199888 | 2.669228 | 0.075269 |
| 2037 | 2.070736192 | 2.4199888 | 2.669228 | 0.068732 |
| 2038 | 2.070736192 | 2.4199888 | 2.669228 | 0.062762 |
| 2039 | 2.070736192 | 2.4199888 | 2.669228 | 0.057311 |
| 2040 | 2.070736192 | 2.4199888 | 2.669228 | 0.052333 |
| 2041 | 2.070736192 | 2.4199888 | 2.669228 | 0.049864 |
| 2042 | 2.070736192 | 2.4199888 | 2.669228 | 0.047394 |
| 2043 | 2.070736192 | 2.4199888 | 2.669228 | 0.044925 |
| 2044 | 2.070736192 | 2.4199888 | 2.669228 | 0.042455 |
| 2045 | 2.070736192 | 2.4199888 | 2.669228 | 0.039986 |
| 2046 | 2.070736192 | 2.4199888 | 2.669228 | 0.037516 |
| 2047 | 2.070736192 | 2.4199888 | 2.669228 | 0.035047 |
| 2048 | 2.070736192 | 2.4199888 | 2.669228 | 0.032577 |
| 2049 | 2.070736192 | 2.4199888 | 2.669228 | 0.030108 |
| 2050 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2051 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2052 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2053 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2054 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2055 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2056 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2057 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2058 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2059 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2060 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2061 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2062 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2063 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2064 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2065 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2066 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2067 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2068 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2069 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2070 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2071 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2072 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2073 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2074 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2075 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2076 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2077 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2078 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2079 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2080 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2081 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2082 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2083 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2084 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2085 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2086 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2087 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2088 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2089 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2090 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2091 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2092 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2093 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2094 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2095 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2096 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2097 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2098 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2099 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |
| 2100 | 2.070736192 | 2.4199888 | 2.669228 | 0.027638 |

## Source

BEIS supplementary Green Book Guidance
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/602657/5._Data_tables_1-19_supporting_the_toolkit_and_the_guidance_2016.xlsx

# DataSet 08: Air Quality Outputs

| Check-box | Last User | Date |
|---|---|---|
| | DB | 15/04/20 |

| Status | User Comments |
|---|---|
| | |

## Sheet explanation

Import of AQ modelling results from Ricardo modelling

Used to calculate emissions impact of scenarios for valuation

**Used in sheets 5. AQ Impacts**

## 1. Baseline AQ emissions

Units: Tonnes/year all vehicles

Baseline

| | Pollutant | 2022 |
|---|---|---|
| 1,629,200 | Nox | 1.629.20 |
| | PM | 285.3 |
| | | Ricardo Stoke Model |

## 2. Scenario AQ emissions

Units: Tonnes/year all vehicles

**PREFERRED OPTION (Option 4+)** Normal Boundary

| | Pollutant | 2022 |
|---|---|---|
| 1,616,100 | Nox | 1.616.10 |
| | PM | 284.8 |

CAZ D

| | Pollutant | 2022 |
|---|---|---|
| 1,528,200 | Nox | 1.528.20 |
| | PM | 278.90 |

CAZ D 0%

| | Pollutant | 2022 |
|---|---|---|
| 1,582,600 | Nox | 1.582.60 |
| | PM | 279.00 |

## DataSet 10a: ANPR data

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|
| | JS | 15/04/20 | | |

### Sheet explanation

Input of ANPR data from SToke
Combines original ANPR data with fleet euro split assumptions from transport model and uplift factors to fill ANPR gaps / uplift to 2022
**Feeds into sheet 10d, which depicts fleet baseline for assessment**

*2019 Euro standard splits are not actually used in calculations*

### 1a .2019 ANPR Count by Euro-Standard

| Vehicle | Fuel | Simplified F | Euro | Count | Unique Count |
|---|---|---|---|---|---|
| Car | PETROL | PETROL | 0 | 1,584 | 525 |
| Car | PETROL | PETROL | 1 | 1,778 | 359 |
| Car | PETROL | PETROL | 2 | 7,636 | 1,319 |
| Car | PETROL | PETROL | 3 | 126,374 | 18,314 |
| Car | PETROL | PETROL | 4 | 265,125 | 37,490 |
| Car | PETROL | PETROL | 5 | 295,883 | 40,945 |
| Car | PETROL | PETROL | 6 | 386,628 | 56,284 |
| Car | DIESEL | DIESEL | 0 | 224 | 50 |
| Car | DIESEL | DIESEL | 1 | 491 | 111 |
| Car | DIESEL | DIESEL | 2 | 2,253 | 349 |
| Car | DIESEL | DIESEL | 3 | 64,849 | 9,510 |
| Car | DIESEL | DIESEL | 4 | 203,555 | 27,204 |
| Car | DIESEL | DIESEL | 5 | 438,513 | 55,035 |
| Car | DIESEL | DIESEL | 6 | 367,129 | 59,128 |
| Car | ELECTRICITY | ELECTRICITY | 5 | 1,183 | 174 |
| Car | ELECTRICITY | ELECTRICITY | 6 | 2,540 | 353 |
| Car | GAS | PETROL | 3 | 4 | 1 |
| Car | GAS | PETROL | 4 | 2 | 1 |
| Car | PETROL/GAS | PETROL | 0 | 6 | 2 |
| Car | PETROL/GAS | PETROL | 1 | 30 | 11 |
| Car | PETROL/GAS | PETROL | 2 | 150 | 31 |
| Car | PETROL/GAS | PETROL | 3 | 41 | 10 |
| Car | GAS BI-FUEL | ELECTRICITY | 2 | 3 | 1 |
| Car | GAS BI-FUEL | ELECTRICITY | 3 | 453 | 71 |
| Car | GAS BI-FUEL | ELECTRICITY | 4 | 592 | 61 |
| Car | GAS BI-FUEL | ELECTRICITY | 5 | 207 | 11 |
| Car | HYBRID ELECTRIC | ELECTRICITY | 3 | 21 | 4 |
| Car | HYBRID ELECTRIC | ELECTRICITY | 4 | 3,649 | 382 |
| Car | HYBRID ELECTRIC | ELECTRICITY | 5 | 12,238 | 1,236 |
| Car | HYBRID ELECTRIC | ELECTRICITY | 6 | 30,680 | 5,045 |
| Car | GAS DIESEL | DIESEL | 4 | 17 | 1 |
| Car | GAS DIESEL | DIESEL | 6 | 18 | 3 |
| Car | ELECTRIC DIESEL | ELECTRICITY | 5 | 582 | 62 |
| Car | ELECTRIC DIESEL | ELECTRICITY | 6 | 605 | 120 |
| Car | NEW FUEL TECHNOLOGY | ELECTRICITY | 4 | 2 | 1 |
| HGV | PETROL | PETROL | 4 | 6 | 2 |
| HGV | PETROL | PETROL | 5 | 3 | 2 |
| HGV | PETROL | PETROL | 6 | 4 | 2 |
| HGV | DIESEL | DIESEL | 0 | 74 | 36 |
| HGV | DIESEL | DIESEL | 1 | 58 | 23 |
| HGV | DIESEL | DIESEL | 2 | 505 | 127 |
| HGV | DIESEL | DIESEL | 3 | 4446 | 917 |
| HGV | DIESEL | DIESEL | 4 | 8514 | 1689 |
| HGV | DIESEL | DIESEL | 5 | 28050 | 6022 |
| HGV | DIESEL | DIESEL | 6 | 87466 | 18388 |
| HGV | ELECTRICITY | ELECTRICITY | 0 | 4 | 1 |
| HGV | GAS | PETROL | 6 | 169 | 40 |
| HGV | PETROL/GAS | PETROL | 3 | 4 | 1 |
| LGV | PETROL | PETROL | 0 | 230 | 61 |
| LGV | PETROL | PETROL | 1 | 33 | 9 |
| LGV | PETROL | PETROL | 2 | 35 | 5 |
| LGV | PETROL | PETROL | 3 | 185 | 32 |
| LGV | PETROL | PETROL | 4 | 521 | 102 |
| LGV | PETROL | PETROL | 5 | 181 | 21 |
| LGV | PETROL | PETROL | 6 | 245 | 51 |
| LGV | DIESEL | DIESEL | 0 | 336 | 86 |
| LGV | DIESEL | DIESEL | 1 | 610 | 124 |
| LGV | DIESEL | DIESEL | 2 | 614 | 123 |
| LGV | DIESEL | DIESEL | 3 | 10629 | 1693 |
| LGV | DIESEL | DIESEL | 4 | 75260 | 11480 |
| LGV | DIESEL | DIESEL | 5 | 138234 | 21474 |
| LGV | DIESEL | DIESEL | 6 | 99860 | 16093 |
| LGV | ELECTRICITY | ELECTRICITY | 5 | 129 | 18 |
| LGV | ELECTRICITY | ELECTRICITY | 6 | 55 | 10 |
| LGV | GAS | PETROL | 3 | 4 | 1 |
| LGV | PETROL/GAS | PETROL | 0 | 6 | 2 |
| LGV | PETROL/GAS | PETROL | 3 | 8 | 2 |
| LGV | GAS BI-FUEL | ELECTRICITY | 3 | 75 | 8 |
| LGV | GAS BI-FUEL | ELECTRICITY | 4 | 49 | 12 |
| LGV | HYBRID ELECTRIC | ELECTRICITY | 6 | 3 | 2 |
| LGV | NEW FUEL TECHNOLOGY | ELECTRICITY | 3 | 4 | 1 |
| LGV | NEW FUEL TECHNOLOGY | ELECTRICITY | 4 | 9 | 1 |

### 1b .2019 ANPR - reformatted

*ANPR data Reformatted for calculations, and LPG and Electric removed*

| Vehicle | Fuel | Euro | Euro # | 2019 Count (Weekly) | Compiance standard | Compliance |
|---|---|---|---|---|---|---|
| Bus | Petrol | Pre-Euro 1 | 0 | 0 | 4 | Non-Compliant |
| Bus | Petrol | Euro 1 | 1 | 0 | 4 | Non-Compliant |
| Bus | Petrol | Euro 2 | 2 | 0 | 4 | Non-Compliant |
| Bus | Petrol | Euro 3 | 3 | 0 | 4 | Non-Compliant |
| Bus | Petrol | Euro 4 | 4 | 0 | 4 | Compliant |
| Bus | Petrol | Euro 5 | 5 | 0 | 4 | Compliant |
| Bus | Petrol | Euro 6 | 6 | 0 | 4 | Compliant |
| Bus | Diesel | Pre-Euro 1 | 0 | 0 | 6 | Non-Compliant |
| Bus | Diesel | Euro 1 | 1 | 0 | 6 | Non-Compliant |
| Bus | Diesel | Euro 2 | 2 | 0 | 6 | Non-Compliant |
| Bus | Diesel | Euro 3 | 3 | 0 | 6 | Non-Compliant |
| Bus | Diesel | Euro 4 | 4 | 0 | 6 | Non-Compliant |
| Bus | Diesel | Euro 5 | 5 | 0 | 6 | Non-Compliant |
| Bus | Diesel | Euro 6 | 6 | 0 | 6 | Compliant |
| Car | Petrol | Pre-Euro 1 | 0 | 527 | 4 | Non-Compliant |
| Car | Petrol | Euro 1 | 1 | 370 | 4 | Non-Compliant |
| Car | Petrol | Euro 2 | 2 | 1350 | 4 | Non-Compliant |
| Car | Petrol | Euro 3 | 3 | 18325 | 4 | Non-Compliant |
| Car | Petrol | Euro 4 | 4 | 37491 | 4 | Compliant |
| Car | Petrol | Euro 5 | 5 | 40945 | 4 | Compliant |
| Car | Petrol | Euro 6 | 6 | 56284 | 4 | Compliant |
| Car | Diesel | Pre-Euro 1 | 0 | 50 | 6 | Non-Compliant |
| Car | Diesel | Euro 1 | 1 | 111 | 6 | Non-Compliant |
| Car | Diesel | Euro 2 | 2 | 349 | 6 | Non-Compliant |
| Car | Diesel | Euro 3 | 3 | 9510 | 6 | Non-Compliant |
| Car | Diesel | Euro 4 | 4 | 27205 | 6 | Non-Compliant |
| Car | Diesel | Euro 5 | 5 | 55035 | 6 | Non-Compliant |
| Car | Diesel | Euro 6 | 6 | 59131 | 6 | Compliant |
| Coach | Petrol | Pre-Euro 1 | 0 | 0 | 4 | Non-Compliant |
| Coach | Petrol | Euro 1 | 1 | 0 | 4 | Non-Compliant |
| Coach | Petrol | Euro 2 | 2 | 0 | 4 | Non-Compliant |
| Coach | Petrol | Euro 3 | 3 | 0 | 4 | Non-Compliant |
| Coach | Petrol | Euro 4 | 4 | 0 | 4 | Compliant |
| Coach | Petrol | Euro 5 | 5 | 0 | 4 | Compliant |
| Coach | Petrol | Euro 6 | 6 | 0 | 4 | Compliant |
| Coach | Diesel | Pre-Euro 1 | 0 | 0 | 6 | Non-Compliant |
| Coach | Diesel | Euro 1 | 1 | 0 | 6 | Non-Compliant |
| Coach | Diesel | Euro 2 | 2 | 0 | 6 | Non-Compliant |
| Coach | Diesel | Euro 3 | 3 | 0 | 6 | Non-Compliant |
| Coach | Diesel | Euro 4 | 4 | 0 | 6 | Non-Compliant |
| Coach | Diesel | Euro 5 | 5 | 0 | 6 | Non-Compliant |
| Coach | Diesel | Euro 6 | 6 | 0 | 6 | Compliant |
| HGV | Petrol | Pre-Euro 1 | 0 | 0 | 4 | Non-Compliant |
| HGV | Petrol | Euro 1 | 1 | 0 | 4 | Non-Compliant |
| HGV | Petrol | Euro 2 | 2 | 0 | 4 | Non-Compliant |
| HGV | Petrol | Euro 3 | 3 | 1 | 4 | Non-Compliant |
| HGV | Petrol | Euro 4 | 4 | 2 | 4 | Compliant |
| HGV | Petrol | Euro 5 | 5 | 2 | 4 | Compliant |
| HGV | Petrol | Euro 6 | 6 | 42 | 4 | Compliant |
| HGV | Diesel | Pre-Euro 1 | 0 | 36 | 6 | Non-Compliant |
| HGV | Diesel | Euro 1 | 1 | 23 | 6 | Non-Compliant |
| HGV | Diesel | Euro 2 | 2 | 127 | 6 | Non-Compliant |
| HGV | Diesel | Euro 3 | 3 | 917 | 6 | Non-Compliant |
| HGV | Diesel | Euro 4 | 4 | 1689 | 6 | Non-Compliant |
| HGV | Diesel | Euro 5 | 5 | 6022 | 6 | Non-Compliant |
| HGV | Diesel | Euro 6 | 6 | 18388 | 6 | Compliant |
| LGV | Petrol | Pre-Euro 1 | 0 | 63 | 4 | Non-Compliant |
| LGV | Petrol | Euro 1 | 1 | 9 | 4 | Non-Compliant |
| LGV | Petrol | Euro 2 | 2 | 5 | 4 | Non-Compliant |
| LGV | Petrol | Euro 3 | 3 | 35 | 4 | Non-Compliant |
| LGV | Petrol | Euro 4 | 4 | 102 | 4 | Compliant |
| LGV | Petrol | Euro 5 | 5 | 21 | 4 | Compliant |
| LGV | Petrol | Euro 6 | 6 | 51 | 4 | Compliant |
| LGV | Diesel | Pre-Euro 1 | 0 | 86 | 6 | Non-Compliant |
| LGV | Diesel | Euro 1 | 1 | 124 | 6 | Non-Compliant |
| LGV | Diesel | Euro 2 | 2 | 123 | 6 | Non-Compliant |
| LGV | Diesel | Euro 3 | 3 | 1693 | 6 | Non-Compliant |
| LGV | Diesel | Euro 4 | 4 | 11480 | 6 | Non-Compliant |
| LGV | Diesel | Euro 5 | 5 | 21474 | 6 | Non-Compliant |
| LGV | Diesel | Euro 6 | 6 | 16093 | 6 | Compliant |
| PTW | Petrol | Pre-Euro 1 | 0 | 0 | 4 | Non-Compliant |
| PTW | Petrol | Euro 1 | 1 | 0 | 4 | Non-Compliant |
| PTW | Petrol | Euro 2 | 2 | 0 | 4 | Non-Compliant |
| PTW | Petrol | Euro 3 | 3 | 0 | 4 | Non-Compliant |
| PTW | Petrol | Euro 4 | 4 | 0 | 4 | Compliant |
| PTW | Petrol | Euro 5 | 5 | 0 | 4 | Compliant |
| PTW | Petrol | Euro 6 | 6 | 0 | 4 | Compliant |
| PTW | Diesel | Pre-Euro 1 | 0 | 0 | 6 | Non-Compliant |
| PTW | Diesel | Euro 1 | 1 | 0 | 6 | Non-Compliant |
| PTW | Diesel | Euro 2 | 2 | 0 | 6 | Non-Compliant |
| PTW | Diesel | Euro 3 | 3 | 0 | 6 | Non-Compliant |
| PTW | Diesel | Euro 4 | 4 | 0 | 6 | Non-Compliant |
| PTW | Diesel | Euro 5 | 5 | 0 | 6 | Non-Compliant |
| PTW | Diesel | Euro 6 | 6 | 0 | 6 | Compliant |

### 1c .2016 ANPR - compliance

*Not used in calculations - calc*

IRR

| Vehicle | Total | Compliant | % Compliant |
|---|---|---|---|
| Car | 306683 | 193851 | 0.63208916 |
| HGV | 27249 | 18434 | 0.67650189 |
| LGV | 51359 | 16267 | 0.316731245 |

### 2a. 2022 baseline fleet

*Projects to 2022 using sum of 2019 vehicle type, growth factor and applies euro split from as model*

| Vehicle | Fuel | Euro | Euro # | Growth Factor | Annual Uplift | ANPR Uplift | 2019 (Weekly) | 2019 (Annual) | 2022 (Annual) | Compliance standar | Compliance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Car | Petrol | Pre-Euro 1 | 0 | 1.049 | 1.5 | 1.2 | 632 | 949 | 0 | 4 | Non-Compliant |
| Car | Petrol | Euro 1 | 1 | 1.049 | 1.5 | 1.2 | 444 | 666 | 0 | 4 | Non-Compliant |
| Car | Petrol | Euro 2 | 2 | 1.049 | 1.5 | 1.2 | 1620 | 2430 | 0 | 4 | Non-Compliant |
| Car | Petrol | Euro 3 | 3 | 1.049 | 1.5 | 1.2 | 21990 | 32985 | 5393 | 4 | Non-Compliant |
| Car | Petrol | Euro 4 | 4 | 1.049 | 1.5 | 1.2 | 44989 | 67484 | 36695 | 4 | Compliant |
| Car | Petrol | Euro 5 | 5 | 1.049 | 1.5 | 1.2 | 49134 | 73701 | 80556 | 4 | Compliant |
| Car | Petrol | Euro 6 | 6 | 1.049 | 1.5 | 1.2 | 67541 | 101311 | 200018 | 4 | Compliant |
| Car | Diesel | Pre-Euro 1 | 0 | 1.049 | 1.5 | 1.2 | 60 | 90 | 0 | 6 | Non-Compliant |
| Car | Diesel | Euro 1 | 1 | 1.049 | 1.5 | 1.2 | 133 | 200 | 0 | 6 | Non-Compliant |
| Car | Diesel | Euro 2 | 2 | 1.049 | 1.5 | 1.2 | 419 | 628 | 0 | 6 | Non-Compliant |
| Car | Diesel | Euro 3 | 3 | 1.049 | 1.5 | 1.2 | 11412 | 17118 | 3479 | 6 | Non-Compliant |
| Car | Diesel | Euro 4 | 4 | 1.049 | 1.5 | 1.2 | 32646 | 48969 | 26771 | 6 | Non-Compliant |
| Car | Diesel | Euro 5 | 5 | 1.049 | 1.5 | 1.2 | 66042 | 99063 | 102534 | 6 | Non-Compliant |
| Car | Diesel | Euro 6 | 6 | 1.049 | 1.5 | 1.2 | 70957 | 106436 | 181772 | 6 | Compliant |
| HGV | Petrol | Pre-Euro 1 | 0 | 0.993 | 2.5 | 1.5 | 0 | 0 | 0 | 4 | Non-Compliant |
| HGV | Petrol | Euro 1 | 1 | 0.993 | 2.5 | 1.5 | 0 | 0 | 0 | 4 | Non-Compliant |
| HGV | Petrol | Euro 2 | 2 | 0.993 | 2.5 | 1.5 | 0 | 0 | 0 | 4 | Non-Compliant |
| HGV | Petrol | Euro 3 | 3 | 0.993 | 2.5 | 1.5 | 2 | 4 | 0 | 4 | Non-Compliant |
| HGV | Petrol | Euro 4 | 4 | 0.993 | 2.5 | 1.5 | 3 | 8 | 0 | 4 | Compliant |
| HGV | Petrol | Euro 5 | 5 | 0.993 | 2.5 | 1.5 | 3 | 8 | 0 | 4 | Compliant |
| HGV | Petrol | Euro 6 | 6 | 0.993 | 2.5 | 1.5 | 63 | 158 | 0 | 4 | Compliant |
| HGV | Diesel | Pre-Euro 1 | 0 | 0.993 | 2.5 | 1.5 | 54 | 135 | 0 | 6 | Non-Compliant |
| HGV | Diesel | Euro 1 | 1 | 0.993 | 2.5 | 1.5 | 35 | 86 | 0 | 6 | Non-Compliant |
| HGV | Diesel | Euro 2 | 2 | 0.993 | 2.5 | 1.5 | 191 | 476 | 25 | 6 | Non-Compliant |
| HGV | Diesel | Euro 3 | 3 | 0.993 | 2.5 | 1.5 | 1376 | 3439 | 945 | 6 | Non-Compliant |
| HGV | Diesel | Euro 4 | 4 | 0.993 | 2.5 | 1.5 | 2534 | 6334 | 2815 | 6 | Non-Compliant |
| HGV | Diesel | Euro 5 | 5 | 0.993 | 2.5 | 1.5 | 9033 | 22583 | 8122 | 6 | Non-Compliant |
| HGV | Diesel | Euro 6 | 6 | 0.993 | 2.5 | 1.5 | 27582 | 68955 | 87973 | 6 | Compliant |
| LGV | Petrol | Pre-Euro 1 | 0 | 1.146 | 1.5 | 1.5 | 95 | 142 | 0 | 4 | Non-Compliant |
| LGV | Petrol | Euro 1 | 1 | 1.146 | 1.5 | 1.5 | 14 | 20 | 0 | 4 | Non-Compliant |
| LGV | Petrol | Euro 2 | 2 | 1.146 | 1.5 | 1.5 | 8 | 11 | 0 | 4 | Non-Compliant |
| LGV | Petrol | Euro 3 | 3 | 1.146 | 1.5 | 1.5 | 53 | 79 | 29 | 4 | Non-Compliant |
| LGV | Petrol | Euro 4 | 4 | 1.146 | 1.5 | 1.5 | 153 | 230 | 196 | 4 | Compliant |
| LGV | Petrol | Euro 5 | 5 | 1.146 | 1.5 | 1.5 | 32 | 47 | 294 | 4 | Compliant |
| LGV | Petrol | Euro 6 | 6 | 1.146 | 1.5 | 1.5 | 77 | 115 | 449 | 4 | Compliant |
| LGV | Diesel | Pre-Euro 1 | 0 | 1.146 | 1.5 | 1.5 | 129 | 194 | 0 | 6 | Non-Compliant |
| LGV | Diesel | Euro 1 | 1 | 1.146 | 1.5 | 1.5 | 186 | 279 | 0 | 6 | Non-Compliant |
| LGV | Diesel | Euro 2 | 2 | 1.146 | 1.5 | 1.5 | 185 | 277 | 0 | 6 | Non-Compliant |
| LGV | Diesel | Euro 3 | 3 | 1.146 | 1.5 | 1.5 | 2540 | 3809 | 1419 | 6 | Non-Compliant |
| LGV | Diesel | Euro 4 | 4 | 1.146 | 1.5 | 1.5 | 17220 | 25830 | 17894 | 6 | Non-Compliant |
| LGV | Diesel | Euro 5 | 5 | 1.146 | 1.5 | 1.5 | 32211 | 48317 | 47931 | 6 | Non-Compliant |
| LGV | Diesel | Euro 6 | 6 | 1.146 | 1.5 | 1.5 | 24140 | 36209 | 105710 | 6 | Compliant |

**Table for Report**

| Vehicle | Fuel | Euro | 2019 (Week Surv | 2022 (Annual) |
|---|---|---|---|---|
| Car | Petrol | Pre-Euro 1 | 632 | 0 |
| Car | Petrol | Euro 1 | 444 | 0 |
| Car | Petrol | Euro 2 | 1620 | 0 |
| Car | Petrol | Euro 3 | 21990 | 5393 |
| Car | Petrol | Euro 4 | 44989 | 36695 |
| Car | Petrol | Euro 5 | 49134 | 80556 |
| Car | Petrol | Euro 6 | 67541 | 200018 |
| Car | | | **186350** | **322662** |
| Car | Diesel | Pre-Euro 1 | 60 | 0 |
| Car | Diesel | Euro 1 | 133 | 0 |
| Car | Diesel | Euro 2 | 419 | 0 |
| Car | Diesel | Euro 3 | 11412 | 3479 |
| Car | Diesel | Euro 4 | 32646 | 26771 |
| Car | Diesel | Euro 5 | 66042 | 102534 |
| Car | Diesel | Euro 6 | 70957 | 181772 |
| Car | | | **181669** | **314557** |
| HGV | Petrol | Pre-Euro 1 | 0 | 0 |
| HGV | Petrol | Euro 1 | 0 | 0 |
| HGV | Petrol | Euro 2 | 0 | 0 |
| HGV | Petrol | Euro 3 | 2 | 0 |
| HGV | Petrol | Euro 4 | 3 | 0 |
| HGV | Petrol | Euro 5 | 3 | 0 |
| HGV | Petrol | Euro 6 | 63 | 0 |
| HGV | | | **71** | **0** |
| HGV | Diesel | Pre-Euro 1 | 54 | 0 |
| HGV | Diesel | Euro 1 | 35 | 0 |
| HGV | Diesel | Euro 2 | 191 | 25 |
| HGV | Diesel | Euro 3 | 1376 | 945 |
| HGV | Diesel | Euro 4 | 2534 | 2815 |
| HGV | Diesel | Euro 5 | 9033 | 8122 |
| HGV | Diesel | Euro 6 | 27582 | 87973 |
| HGV | | | **40803** | **99880** |
| LGV | Petrol | Pre-Euro 1 | 95 | 0 |
| LGV | Petrol | Euro 1 | 14 | 0 |
| LGV | Petrol | Euro 2 | 8 | 0 |
| LGV | Petrol | Euro 3 | 53 | 29 |
| LGV | Petrol | Euro 4 | 153 | 196 |
| LGV | Petrol | Euro 5 | 32 | 294 |
| LGV | Petrol | Euro 6 | 77 | 449 |
| LGV | | | **429** | **969** |
| LGV | Diesel | Pre-Euro 1 | 129 | 0 |
| LGV | Diesel | Euro 1 | 186 | 0 |
| LGV | Diesel | Euro 2 | 185 | 0 |
| LGV | Diesel | Euro 3 | 2540 | 1419 |
| LGV | Diesel | Euro 4 | 17220 | 17894 |
| LGV | Diesel | Euro 5 | 32211 | 47931 |
| LGV | Diesel | Euro 6 | 24140 | 105710 |
| LGV | | | **76610** | **172953** |

# DataSet 10b: License Data

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|
| | JS | 15/04/20 | | |

## Sheet explanation
Imports taxi licence data provided by sweco

## 1. Taxi data
2019 values
Provided by Sweco

| Vehicle | Fuel | Euro Standard | euro# | 2019 | Growth Factor | 2022 Count |
|---|---|---|---|---|---|---|
| Taxis | Diesel | Pre-Euro 1 | 0 | 0 | 1.049 | 0 |
| Taxis | Diesel | Euro 1 | 1 | 0 | 1.049 | 0 |
| Taxis | Diesel | Euro 2 | 2 | 0 | 1.049 | 0 |
| Taxis | Diesel | Euro 3 | 3 | 48 | 1.049 | 15 |
| Taxis | Diesel | Euro 4 | 4 | 117 | 1.049 | 79 |
| Taxis | Diesel | Euro 5 | 5 | 232 | 1.049 | 193 |
| Taxis | Diesel | Euro 6 | 6 | 41 | 1.049 | 218 |
| Private Hire Car | Petrol | Pre-Euro 1 | 0 | 0.000 | 1.049 | 0 |
| Private Hire Car | Petrol | Euro 1 | 1 | 0 | 1.049 | 0 |
| Private Hire Car | Petrol | Euro 2 | 2 | 0 | 1.049 | 0 |
| Private Hire Car | Petrol | Euro 3 | 3 | 3 | 1.049 | 2 |
| Private Hire Car | Petrol | Euro 4 | 4 | 54 | 1.049 | 15 |
| Private Hire Car | Petrol | Euro 5 | 5 | 55 | 1.049 | 33 |
| Private Hire Car | Petrol | Euro 6 | 6 | 2 | 1.049 | 82 |
| Private Hire Car | Diesel | Pre-Euro 1 | 0 | 0 | 1.049 | 0 |
| Private Hire Car | Diesel | Euro 1 | 1 | 0 | 1.049 | 0 |
| Private Hire Car | Diesel | Euro 2 | 2 | 0 | 1.049 | 0 |
| Private Hire Car | Diesel | Euro 3 | 3 | 17 | 1.049 | 23 |
| Private Hire Car | Diesel | Euro 4 | 4 | 420 | 1.049 | 180 |
| Private Hire Car | Diesel | Euro 5 | 5 | 1192 | 1.049 | 690 |
| Private Hire Car | Diesel | Euro 6 | 6 | 206 | 1.049 | 1224 |

## 2. Bus Data

| | Vehicle | Fuel | Euro Standard | euro# | 2019 | Growth Factor | 2022 Count | | Camera pl | Annual adjust | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Data from adding numbers received from 2 main bus operators* | Bus | Diesel | Pre-Euro 1 | 0 | 0 | 1 | 0 | | 1.1 | 1.1 | |
| | Bus | Diesel | Euro 1 | 1 | 0 | 1 | 0 | | 1.1 | 1.1 | |
| | Bus | Diesel | Euro 2 | 2 | 0 | 1 | 0 | | 1.1 | 1.1 | |
| | Bus | Diesel | Euro 3 | 3 | 69 | 1 | 83.49 | | 1.1 | 1.1 | |
| | Bus | Diesel | Euro 4 | 4 | 9 | 1 | 10.89 | Buses rem | 1.1 | 1.1 | 25 |
| | Bus | Diesel | Euro 5 | 5 | 20 | 1 | 24.2 | | 1.1 | 1.1 | 25 |
| | Bus | Diesel | Euro 6 | 6 | 8 | 1 | 9.68 | | 1.1 | 1.1 | |
| For calculation only | BUSES & COACHES | Diesel | Pre-Euro 1 | 0 | 9 | 1 | #N/A | | #N/A | #N/A | |
| | BUSES & COACHES | Diesel | Euro 1 | 1 | 18 | 1 | #N/A | | #N/A | #N/A | |
| | BUSES & COACHES | Diesel | Euro 2 | 2 | 57 | 1 | #N/A | | #N/A | #N/A | |
| | BUSES & COACHES | Diesel | Euro 3 | 3 | 225 | 1 | #N/A | | #N/A | #N/A | |
| | BUSES & COACHES | Diesel | Euro 4 | 4 | 325 | 1 | #N/A | | #N/A | #N/A | |
| | BUSES & COACHES | Diesel | Euro 5 | 5 | 375 | 1 | #N/A | | #N/A | #N/A | |
| | BUSES & COACHES | Diesel | Euro 6 | 6 | 383 | 1 | #N/A | | #N/A | #N/A | |
| Estimate | Coach | Diesel | Pre-Euro 1 | 0 | 9 | 1.049 | 15 | | 1.2 | 1.2 | |
| | Coach | Diesel | Euro 1 | 1 | 18 | 1.049 | 30 | | 1.2 | 1.2 | |
| | Coach | Diesel | Euro 2 | 2 | 57 | 1.049 | 95 | | 1.2 | 1.2 | |
| | Coach | Diesel | Euro 3 | 3 | 156 | 1.049 | 259 | | 1.2 | 1.2 | |
| | Coach | Diesel | Euro 4 | 4 | 316 | 1.049 | 525 | | 1.2 | 1.2 | |
| | Coach | Diesel | Euro 5 | 5 | 355 | 1.049 | 590 | | 1.2 | 1.2 | |
| | Coach | Diesel | Euro 6 | 6 | 375 | 1.049 | 623 | | 1.2 | 1.2 | |

# DataSet 10c: 2022 Euro

## Sheet explanation

Imports 2022 Euro Standard Splits from Ricardo AQ Model

| Cars & LGVs | Pre-Euro 1 | Euro 1 | Euro 2 | Euro 3 | Euro 4 | Euro 5 | Euro 6 | Euro 6ab | Euro 6c | Euro 6d | Euro 1 DPF | Euro 2 DPF | Euro 3 DPFRF | Euro 4 DPFRF | ZEC | euro 3 | euro 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Petrol Car | - | - | - | 0.02 | 0.11 | 0.25 | 0.62 | 0.15 | 0.47 | | | | | | | | |
| Diesel Car | - | - | - | 0.01 | 0.09 | 0.33 | 0.58 | 0.20 | 0.29 | 0.09 | | | 0.00 | 0.02 | | 0.009019 | 0.068086 |
| Taxi (Black Cab) | - | - | - | 0.03 | 0.16 | 0.38 | 0.43 | - | 0.43 | - | | | | | - | | |
| Petrol LGV | - | - | - | 0.03 | 0.20 | 0.30 | 0.46 | 0.21 | 0.26 | | | | | | | | |
| Diesel LGV | - | - | - | 0.01 | 0.10 | 0.28 | 0.61 | 0.14 | 0.47 | - | - | - | - | | | | |
| Full Hybrid Petrol Car | | | | 0.01 | 0.08 | 0.08 | 0.83 | 0.10 | 0.73 | | | | | | | | |
| Plugin Hybrid Petrol Car | | | | | | 0.07 | 0.93 | 0.10 | 0.83 | | | | | | | | |
| Full Diesel Hybrid Car | | | | | | 0.06 | 0.94 | 0.04 | 0.48 | 0.43 | | | | | | | |
| E85 Bioethanol Car | - | - | - | 0.01 | 0.06 | 0.19 | 0.74 | 0.13 | 0.62 | | | | | | | | |
| LPG Car | | - | - | 0.01 | 0.05 | 0.23 | 0.71 | 0.13 | 0.58 | | | | | | | | |
| Full Hybrid Petrol LGV | | | | | 0.06 | 0.18 | 0.76 | 0.15 | 0.61 | | | | | | | | |
| Plug-In Hybrid Petrol LGV | - | | | | | 0.20 | 0.80 | 0.16 | 0.65 | | | | | | | | |
| E85 Bioethanol LGV | - | - | - | 0.02 | 0.06 | 0.18 | 0.74 | 0.14 | 0.60 | | | | | | | | |
| LPG LGV | | - | - | 0.02 | 0.06 | 0.22 | 0.71 | 0.14 | 0.57 | | | | | | | | |

| Cars & LGVs | Petrol Car | Diesel Car | Taxi (Black C | Petrol LGV | Diesel LGV | Full Hybrid P | Plugin Hybri | Full Diesel H | E85 Bioetha | LPG Car | Full Hybrid P | Plug-In Hybr | E85 Bioetha | LPG LGV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pre-Euro 1 | - | - | - | - | - | | | | - | | | - | - | |
| Euro 1 | - | - | - | - | - | | | | - | - | | | - | - |
| Euro 2 | - | - | - | - | - | | | | - | - | | | - | - |
| Euro 3 | 0.02 | 0.01 | 0.03 | 0.03 | 0.01 | 0.01 | | | 0.01 | 0.01 | | | 0.02 | 0.02 |
| Euro 4 | 0.11 | 0.09 | 0.16 | 0.20 | 0.10 | 0.08 | | | 0.06 | 0.05 | 0.06 | | 0.06 | 0.06 |
| Euro 5 | 0.25 | 0.33 | 0.38 | 0.30 | 0.28 | 0.08 | 0.07 | 0.06 | 0.19 | 0.23 | 0.18 | 0.20 | 0.18 | 0.22 |
| Euro 6 | 0.62 | 0.58 | 0.43 | 0.46 | 0.61 | 0.83 | 0.93 | 0.94 | 0.74 | 0.71 | 0.76 | 0.80 | 0.74 | 0.71 |
| Euro 6ab | 0.15 | 0.20 | - | 0.21 | 0.14 | 0.10 | 0.10 | 0.04 | 0.13 | 0.13 | 0.15 | 0.16 | 0.14 | 0.14 |
| Euro 6c | 0.47 | 0.29 | 0.43 | 0.26 | 0.47 | 0.73 | 0.83 | 0.48 | 0.62 | 0.58 | 0.61 | 0.65 | 0.60 | 0.57 |
| Euro 6d | | 0.09 | - | | - | | | 0.43 | | | | | | |
| Euro 1 DPF | | | | | - | | | | | | | | | |
| Euro 2 DPF | | | | | - | | | | | | | | | |
| Euro 3 DPFRF | | 0.00 | | | - | | | | | | | | | |
| Euro 4 DPFRF | | 0.02 | | | | | | | | | | | | |
| ZEC | | | - | | | | | | | | | | | |
| euro 3 | | 0.009019 | | | | | | | | | | | | |
| euro 4 | | 0.068086 | | | | | | | | | | | | |

| HGVs and Buses | Pre-Euro I | Euro I | Euro II | Euro III | Euro IV | Euro V_EGR | Euro V_SCR | Euro VI |
|---|---|---|---|---|---|---|---|---|
| Rigid HGV | - | - | - | 0.01 | 0.03 | 0.02 | 0.07 | 0.87 |
| Artic HGV | - | - | 0.00 | 0.01 | 0.02 | 0.02 | 0.05 | 0.91 |
| Buses | - | - | 0.03 | 0.16 | 0.13 | 0.03 | 0.08 | 0.57 |
| Coaches | - | - | 0.03 | 0.16 | 0.13 | 0.03 | 0.08 | 0.57 |
| B100 Rigid HGV | | - | - | 0.01 | 0.02 | 0.02 | 0.07 | 0.88 |
| B100 Artic HGV | | - | - | 0.00 | 0.00 | 0.01 | 0.03 | 0.96 |
| Biodiesel Buses | | - | - | 0.04 | 0.03 | 0.04 | 0.11 | 0.77 |
| Biodiesel Coaches | | - | - | 0.04 | 0.03 | 0.04 | 0.11 | 0.77 |
| Hybrid Buses - Single Decke | | | | | - | 0.20 | 0.59 | 0.21 |
| Hybrid Buses - Double Deck | | | | | - | 0.20 | 0.59 | 0.21 |
| Hybrid Buses - Articulated | | | | | - | 0.20 | 0.59 | 0.21 |

| HGVs and Buses | Rigid HGV | Artic HGV | Buses | Coaches | B100 Rigid H | B100 Artic H | Biodiesel Bu | Biodiesel Co | Hybrid Buse | Hybrid Buse | Hybrid Buses - Articulatec | Rigid | Artic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pre-Euro I | - | - | - | - | | | | | | | | 71.39% | 28.61% |
| Euro I | - | - | - | - | - | - | - | - | | | | | |
| Euro II | - | 0.00 | 0.03 | 0.03 | - | - | - | - | | | | | |
| Euro III | 0.01 | 0.01 | 0.16 | 0.16 | 0.01 | 0.00 | 0.04 | 0.04 | | | | | |
| Euro IV | 0.03 | 0.02 | 0.13 | 0.13 | 0.02 | 0.00 | 0.03 | 0.03 | - | - | - | | |
| Euro V | 0.0898502266873317 | ######## | ######## | ########### | ######## | ######## | ######## | ######## | ######## | ######## | ######## | | |
| Euro VI | 0.87 | 0.91 | 0.57 | 0.57 | 0.88 | 0.96 | 0.77 | 0.77 | 0.21 | 0.21 | 0.21 | | |
| Euro V_EGR | 0.02 | 0.02 | 0.03 | 0.03 | 0.02 | 0.01 | 0.04 | 0.04 | 0.20 | 0.20 | 0.20 | | |
| Euro V_SCR | 0.07 | 0.05 | 0.08 | 0.08 | 0.07 | 0.03 | 0.11 | 0.11 | 0.59 | 0.59 | 0.59 | | |

| vehicle | fuel | euro | euro # | Percentage |
|---|---|---|---|---|
| Car | Petrol | Pre-Euro 1 | 0 | - |
| Car | Petrol | Euro 1 | 1 | - |
| Car | Petrol | Euro 2 | 2 | - |
| Car | Petrol | Euro 3 | 3 | 0.02 |
| Car | Petrol | Euro 4 | 4 | 0.11 |
| Car | Petrol | Euro 5 | 5 | 0.25 |
| Car | Petrol | Euro 6 | 6 | 0.62 |
| Car | Diesel | Pre-Euro 1 | 0 | - |
| Car | Diesel | Euro 1 | 1 | - |
| Car | Diesel | Euro 2 | 2 | - |
| Car | Diesel | Euro 3 | 3 | 0.01 |
| Car | Diesel | Euro 4 | 4 | 0.09 |
| Car | Diesel | Euro 5 | 5 | 0.33 |
| Car | Diesel | Euro 6 | 6 | 0.58 |
| HGV | Diesel | Pre-Euro 1 | 0 | - |
| HGV | Diesel | Euro 1 | 1 | - |
| HGV | Diesel | Euro 2 | 2 | 0.00 |
| HGV | Diesel | Euro 3 | 3 | 0.01 |
| HGV | Diesel | Euro 4 | 4 | 0.03 |
| HGV | Diesel | Euro 5 | 5 | 0.08 |
| HGV | Diesel | Euro 6 | 6 | 0.88 |
| LGV | Petrol | Pre-Euro 1 | 0 | - |
| LGV | Petrol | Euro 1 | 1 | - |
| LGV | Petrol | Euro 2 | 2 | - |
| LGV | Petrol | Euro 3 | 3 | 0.03 |
| LGV | Petrol | Euro 4 | 4 | 0.20 |
| LGV | Petrol | Euro 5 | 5 | 0.30 |
| LGV | Petrol | Euro 6 | 6 | 0.46 |
| LGV | Diesel | Pre-Euro 1 | 0 | - |
| LGV | Diesel | Euro 1 | 1 | - |
| LGV | Diesel | Euro 2 | 2 | - |
| LGV | Diesel | Euro 3 | 3 | 0.01 |
| LGV | Diesel | Euro 4 | 4 | 0.10 |
| LGV | Diesel | Euro 5 | 5 | 0.28 |
| LGV | Diesel | Euro 6 | 6 | 0.61 |
| Taxis | Diesel | Pre-Euro 1 | 0 | - |
| Taxis | Diesel | Euro 1 | 1 | - |
| Taxis | Diesel | Euro 2 | 2 | - |
| Taxis | Diesel | Euro 3 | 3 | 0.03 |
| Taxis | Diesel | Euro 4 | 4 | 0.16 |
| Taxis | Diesel | Euro 5 | 5 | 0.38 |
| Taxis | Diesel | Euro 6 | 6 | 0.43 |
| Bus | Diesel | Pre-Euro 1 | 0 | - |
| Bus | Diesel | Euro 1 | 1 | - |
| Bus | Diesel | Euro 2 | 2 | 0.03 |
| Bus | Diesel | Euro 3 | 3 | 0.16 |
| Bus | Diesel | Euro 4 | 4 | 0.13 |
| Bus | Diesel | Euro 5 | 5 | 0.11 |
| Bus | Diesel | Euro 6 | 6 | 0.57 |

## DataSet 10d: baseline vehicle fleet

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|
| | DB | 15/04/20 | | |

### Sheet explanation

Takes data presented / manipulated from different sources to select values to set fleet baseline for analysis
Values then feed through into upgrade cost calculations and vehicle fleet projection
Where ANPR data used, uplift factors are applied to account for gaps in ANPR data

### 1 .Data Inputs (drawn fron

**ANPR**

CAZ D

Car subtracts PHC so c

| Vehicle | Fuel | Euro | Compliance | 2022 Count |
|---|---|---|---|---|
| Bus | Diesel | Pre-Euro 1 | Non-Compliant | 0.0 |
| Bus | Diesel | Euro 1 | Non-Compliant | 0.0 |
| Bus | Diesel | Euro 2 | Non-Compliant | 0.0 |
| Bus | Diesel | Euro 3 | Non-Compliant | 0.0 |
| Bus | Diesel | Euro 4 | Non-Compliant | 0.0 |
| Bus | Diesel | Euro 5 | Non-Compliant | 0.0 |
| Bus | Diesel | Euro 6 | Compliant | 0.0 |
| Car | Petrol | Pre-Euro 1 | Non-Compliant | 0.0 |
| Car | Petrol | Euro 1 | Non-Compliant | 0.0 |
| Car | Petrol | Euro 2 | Non-Compliant | 0.0 |
| Car | Petrol | Euro 3 | Non-Compliant | 5390.6 |
| Car | Petrol | Euro 4 | Compliant | 36680.2 |
| Car | Petrol | Euro 5 | Compliant | 80523.0 |
| Car | Petrol | Euro 6 | Compliant | 199936.7 |
| Car | Diesel | Pre-Euro 1 | Non-Compliant | 0.0 |
| Car | Diesel | Euro 1 | Non-Compliant | 0.0 |
| Car | Diesel | Euro 2 | Non-Compliant | 0.0 |
| Car | Diesel | Euro 3 | Non-Compliant | 3455.7 |
| Car | Diesel | Euro 4 | Non-Compliant | 26590.7 |
| Car | Diesel | Euro 5 | Non-Compliant | 101843.8 |
| Car | Diesel | Euro 6 | Compliant | 180548.4 |
| Coach | Diesel | Pre-Euro 1 | Non-Compliant | 0.0 |
| Coach | Diesel | Euro 1 | Non-Compliant | 0.0 |
| Coach | Diesel | Euro 2 | Non-Compliant | 0.0 |
| Coach | Diesel | Euro 3 | Non-Compliant | 0.0 |
| Coach | Diesel | Euro 4 | Non-Compliant | 0.0 |
| Coach | Diesel | Euro 5 | Non-Compliant | 0.0 |
| Coach | Diesel | Euro 6 | Compliant | 0.0 |
| HGV | Diesel | Pre-Euro 1 | Non-Compliant | 0.0 |
| HGV | Diesel | Euro 1 | Non-Compliant | 0.0 |
| HGV | Diesel | Euro 2 | Non-Compliant | 25.2 |
| HGV | Diesel | Euro 3 | Non-Compliant | 945.2 |
| HGV | Diesel | Euro 4 | Non-Compliant | 2815.4 |
| HGV | Diesel | Euro 5 | Non-Compliant | 8121.9 |
| HGV | Diesel | Euro 6 | Compliant | 87972.6 |
| LGV | Petrol | Pre-Euro 1 | Non-Compliant | 0.0 |
| LGV | Petrol | Euro 1 | Non-Compliant | 0.0 |
| LGV | Petrol | Euro 2 | Non-Compliant | 0.0 |
| LGV | Petrol | Euro 3 | Non-Compliant | 28.7 |
| LGV | Petrol | Euro 4 | Compliant | 196.3 |
| LGV | Petrol | Euro 5 | Compliant | 294.2 |
| LGV | Petrol | Euro 6 | Compliant | 449.3 |
| LGV | Diesel | Pre-Euro 1 | Non-Compliant | 0.0 |
| LGV | Diesel | Euro 1 | Non-Compliant | 0.0 |
| LGV | Diesel | Euro 2 | Non-Compliant | 0.0 |
| LGV | Diesel | Euro 3 | Non-Compliant | 1418.5 |
| LGV | Diesel | Euro 4 | Non-Compliant | 17893.5 |
| LGV | Diesel | Euro 5 | Non-Compliant | 47931.2 |
| LGV | Diesel | Euro 6 | Compliant | 105709.6 |
| Taxis | Petrol | Pre-Euro 1 | Non-Compliant | 0.0 |
| Taxis | Petrol | Euro 1 | Non-Compliant | 0.0 |
| Taxis | Petrol | Euro 2 | Non-Compliant | 0.0 |
| Taxis | Petrol | Euro 3 | Non-Compliant | 0.0 |
| Taxis | Petrol | Euro 4 | Compliant | 0.0 |
| Taxis | Petrol | Euro 5 | Compliant | 0.0 |
| Taxis | Petrol | Euro 6 | Compliant | 0.0 |
| Taxis | Diesel | Pre-Euro 1 | Non-Compliant | 0.0 |
| Taxis | Diesel | Euro 1 | Non-Compliant | 0.0 |
| Taxis | Diesel | Euro 2 | Non-Compliant | 0.0 |
| Taxis | Diesel | Euro 3 | Non-Compliant | 0.0 |
| Taxis | Diesel | Euro 4 | Non-Compliant | 0.0 |
| Taxis | Diesel | Euro 5 | Non-Compliant | 0.0 |
| Taxis | Diesel | Euro 6 | Compliant | 0.0 |

**License Data**

CAZ D

| Vehicle | Fuel | Euro | Compliance | 2022 Count | Vehicle | Fuel | Euro Standard | Compliance | 2022 Count | |
|---|---|---|---|---|---|---|---|---|---|---|
| Bus | Diesel | Pre-Euro 1 | Non-Complia | 0.0 | Taxis | Petrol | Pre-Euro 1 | Non-Compliant | 0.0 | |
| Bus | Diesel | Euro 1 | Non-Complia | 0.0 | Taxis | Petrol | Euro 1 | Non-Compliant | 0.0 | |
| Bus | Diesel | Euro 2 | Non-Complia | 0.0 | Taxis | Petrol | Euro 2 | Non-Compliant | 0.0 | |
| Bus | Diesel | Euro 3 | Non-Complia | 0.0 | Taxis | Petrol | Euro 3 | Non-Compliant | 0.0 | |
| Bus | Diesel | Euro 4 | Non-Complia | 0.0 | Taxis | Petrol | Euro 4 | Compliant | 0.0 | |
| Bus | Diesel | Euro 5 | Non-Complia | 0.0 | Taxis | Petrol | Euro 5 | Compliant | 0.0 | |
| Bus | Diesel | Euro 6 | Compliant | 0.0 | Taxis | Petrol | Euro 6 | Compliant | 0.0 | |
| Car | Petrol | Pre-Euro 1 | Non-Complia | 0.0 | Taxis | Diesel | Pre-Euro 1 | Non-Compliant | 0.0 | |
| Car | Petrol | Euro 1 | Non-Complia | 0.0 | Taxis | Diesel | Euro 1 | Non-Compliant | 0.0 | |
| Car | Petrol | Euro 2 | Non-Complia | 0.0 | Taxis | Diesel | Euro 2 | Non-Compliant | 0.0 | |
| Car | Petrol | Euro 3 | Non-Complia | 5390.6 | Taxis | Diesel | Euro 3 | Non-Compliant | 15.1 | |
| Car | Petrol | Euro 4 | Compliant | 36680.2 | Taxis | Diesel | Euro 4 | Non-Compliant | 79.4 | |
| Car | Petrol | Euro 5 | Compliant | 80523.0 | Taxis | Diesel | Euro 5 | Non-Compliant | 192.7 | |
| Car | Petrol | Euro 6 | Compliant | 199936.7 | Taxis | Diesel | Euro 6 | Compliant | 218.4 | |
| Car | Diesel | Pre-Euro 1 | Non-Complia | 0.0 | Private Hire Car | Petrol | Pre-Euro 1 | Non-Compliant | 0.0 | |
| Car | Diesel | Euro 1 | Non-Complia | 0.0 | Private Hire Car | Petrol | Euro 1 | Non-Compliant | 0.0 | |
| Car | Diesel | Euro 2 | Non-Complia | 0.0 | Private Hire Car | Petrol | Euro 2 | Non-Compliant | 0.0 | |
| Car | Diesel | Euro 3 | Non-Complia | 3455.7 | Private Hire Car | Petrol | Euro 3 | Non-Compliant | 2.2 | |
| Car | Diesel | Euro 4 | Non-Complia | 26590.7 | Private Hire Car | Petrol | Euro 4 | Compliant | 15.0 | |
| Car | Diesel | Euro 5 | Non-Complia | 101843.8 | Private Hire Car | Petrol | Euro 5 | Compliant | 32.9 | |
| Car | Diesel | Euro 6 | Compliant | 180548.4 | Private Hire Car | Petrol | Euro 6 | Compliant | 81.6 | |
| Coach | Diesel | Pre-Euro 1 | Non-Complia | 0.0 | Private Hire Car | Diesel | Pre-Euro 1 | Non-Compliant | 0.0 | |
| Coach | Diesel | Euro 1 | Non-Complia | 0.0 | Private Hire Car | Diesel | Euro 1 | Non-Compliant | 0.0 | |
| Coach | Diesel | Euro 2 | Non-Complia | 0.0 | Private Hire Car | Diesel | Euro 2 | Non-Compliant | 0.0 | |
| Coach | Diesel | Euro 3 | Non-Complia | 0.0 | Private Hire Car | Diesel | Euro 3 | Non-Compliant | 23.4 | |
| Coach | Diesel | Euro 4 | Non-Complia | 0.0 | Private Hire Car | Diesel | Euro 4 | Non-Compliant | 180.3 | |
| Coach | Diesel | Euro 5 | Non-Complia | 0.0 | Private Hire Car | Diesel | Euro 5 | Non-Compliant | 690.5 | |
| Coach | Diesel | Euro 6 | Compliant | 0.0 | Private Hire Car | Diesel | Euro 6 | Compliant | 1224.0 | |
| HGV | Diesel | Pre-Euro 1 | Non-Complia | 0.0 | Bus | Diesel | Pre-Euro 1 | Non-Compliant | 0.0 | Bus different formula as from different table |
| HGV | Diesel | Euro 1 | Non-Complia | 0.0 | Bus | Diesel | Euro 1 | Non-Compliant | 0.0 | |
| HGV | Diesel | Euro 2 | Non-Complia | 25.2 | Bus | Diesel | Euro 2 | Non-Compliant | 3.8 | |
| HGV | Diesel | Euro 3 | Non-Complia | 945.2 | Bus | Diesel | Euro 3 | Non-Compliant | 20.4 | |
| HGV | Diesel | Euro 4 | Non-Complia | 2815.4 | Bus | Diesel | Euro 4 | Non-Compliant | 16.2 | |
| HGV | Diesel | Euro 5 | Non-Complia | 8121.9 | Bus | Diesel | Euro 5 | Non-Compliant | 14.5 | |
| HGV | Diesel | Euro 6 | Compliant | 87972.6 | Bus | Diesel | Euro 6 | Compliant | 73.5 | 0.572976567 |
| LGV | Petrol | Pre-Euro 1 | Non-Complia | 0.0 | Coach | Diesel | Pre-Euro 1 | Non-Compliant | 0.0 | |
| LGV | Petrol | Euro 1 | Non-Complia | 0.0 | Coach | Diesel | Euro 1 | Non-Compliant | 0.0 | |
| LGV | Petrol | Euro 2 | Non-Complia | 0.0 | Coach | Diesel | Euro 2 | Non-Compliant | 62.8 | |
| LGV | Petrol | Euro 3 | Non-Complia | 28.7 | Coach | Diesel | Euro 3 | Non-Compliant | 339.6 | |
| LGV | Petrol | Euro 4 | Compliant | 196.3 | Coach | Diesel | Euro 4 | Non-Compliant | 269.5 | |
| LGV | Petrol | Euro 5 | Compliant | 294.2 | Coach | Diesel | Euro 5 | Non-Compliant | 241.0 | |
| LGV | Petrol | Euro 6 | Compliant | 449.3 | Coach | Diesel | Euro 6 | Compliant | 1224.8 | 0.572976567 |
| LGV | Diesel | Pre-Euro 1 | Non-Complia | 0.0 | | | | | | |
| LGV | Diesel | Euro 1 | Non-Complia | 0.0 | | | | | | |
| LGV | Diesel | Euro 2 | Non-Complia | 0.0 | | | | | | |
| LGV | Diesel | Euro 3 | Non-Complia | 1418.5 | | | | | | |
| LGV | Diesel | Euro 4 | Non-Complia | 17893.5 | | | | | | |
| LGV | Diesel | Euro 5 | Non-Complia | 47931.2 | | | | | | |
| LGV | Diesel | Euro 6 | Compliant | 105709.6 | | | | | | |
| Taxis | Petrol | Pre-Euro 1 | Non-Complia | 0.0 | | | | | | |
| Taxis | Petrol | Euro 1 | Non-Complia | 0.0 | | | | | | |
| Taxis | Petrol | Euro 2 | Non-Complia | 0.0 | | | | | | |
| Taxis | Petrol | Euro 3 | Non-Complia | 0.0 | | | | | | |
| Taxis | Petrol | Euro 4 | Compliant | 0.0 | | | | | | |
| Taxis | Petrol | Euro 5 | Compliant | 0.0 | | | | | | |
| Taxis | Petrol | Euro 6 | Compliant | 0.0 | | | | | | |
| Taxis | Diesel | Pre-Euro 1 | Non-Complia | 0.0 | | | | | | |
| Taxis | Diesel | Euro 1 | Non-Complia | 0.0 | | | | | | |
| Taxis | Diesel | Euro 2 | Non-Complia | 0.0 | | | | | | |
| Taxis | Diesel | Euro 3 | Non-Complia | 0.0 | | | | | | |
| Taxis | Diesel | Euro 4 | Non-Complia | 0.0 | | | | | | |
| Taxis | Diesel | Euro 5 | Non-Complia | 0.0 | | | | | | |
| Taxis | Diesel | Euro 6 | Compliant | 0.0 | | | | | | |

### 2. 2020 Baseline Vehicle Fleet

*Selects data from ANPR or License data and converts to annual numbers using Assumptions tab, subtracts private hire car from car*

| Source | Vehicle | Fuel | Euro | Euro # | Compliance (additional measures) | Compliance (CAZ D) | Annual CAZ D 2022 Count | Annual CAZ D 2022 Count |
|---|---|---|---|---|---|---|---|---|
| License Data | Bus | Diesel | Pre-Euro 1 | Euro 0 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Bus | Diesel | Euro 1 | Euro 1 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Bus | Diesel | Euro 2 | Euro 2 | Non-Compliant | Non-Compliant | 3.8 | 3.8 |
| License Data | Bus | Diesel | Euro 3 | Euro 3 | Non-Compliant | Non-Compliant | 20.4 | 20.4 |
| License Data | Bus | Diesel | Euro 4 | Euro 4 | Non-Compliant | Non-Compliant | 16.2 | 16.2 |
| License Data | Bus | Diesel | Euro 5 | Euro 5 | Non-Compliant | Non-Compliant | 14.5 | 14.5 |
| ANPR | Car | Petrol | Pre-Euro 1 | Euro 0 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| ANPR | Car | Petrol | Euro 1 | Euro 1 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| ANPR | Car | Petrol | Euro 2 | Euro 2 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| ANPR | Car | Petrol | Euro 3 | Euro 3 | Non-Compliant | Non-Compliant | 5390.6 | 5390.6 |
| ANPR | Car | Diesel | Pre-Euro 1 | Euro 0 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| ANPR | Car | Diesel | Euro 1 | Euro 1 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| ANPR | Car | Diesel | Euro 2 | Euro 2 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| ANPR | Car | Diesel | Euro 3 | Euro 3 | Non-Compliant | Non-Compliant | 3455.7 | 3455.7 |
| ANPR | Car | Diesel | Euro 4 | Euro 4 | Non-Compliant | Non-Compliant | 26590.7 | 26590.7 |
| ANPR | Car | Diesel | Euro 5 | Euro 5 | Non-Compliant | Non-Compliant | 101843.8 | 101843.8 |
| License Data | Coach | Diesel | Pre-Euro 1 | Euro 0 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Coach | Diesel | Euro 1 | Euro 1 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Coach | Diesel | Euro 2 | Euro 2 | Non-Compliant | Non-Compliant | 62.8 | 62.8 |
| License Data | Coach | Diesel | Euro 3 | Euro 3 | Non-Compliant | Non-Compliant | 339.6 | 339.6 |
| License Data | Coach | Diesel | Euro 4 | Euro 4 | Non-Compliant | Non-Compliant | 269.5 | 269.5 |
| License Data | Coach | Diesel | Euro 5 | Euro 5 | Non-Compliant | Non-Compliant | 241.0 | 241.0 |
| ANPR | HGV | Diesel | Pre-Euro 1 | Euro 0 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| ANPR | HGV | Diesel | Euro 1 | Euro 1 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| ANPR | HGV | Diesel | Euro 2 | Euro 2 | Non-Compliant | Non-Compliant | 25.2 | 25.2 |
| ANPR | HGV | Diesel | Euro 3 | Euro 3 | Non-Compliant | Non-Compliant | 945.2 | 945.2 |
| ANPR | HGV | Diesel | Euro 4 | Euro 4 | Non-Compliant | Non-Compliant | 2815.4 | 2815.4 |
| ANPR | HGV | Diesel | Euro 5 | Euro 5 | Non-Compliant | Non-Compliant | 8121.9 | 8121.9 |
| ANPR | LGV | Petrol | Pre-Euro 1 | Euro 0 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| ANPR | LGV | Petrol | Euro 1 | Euro 1 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| ANPR | LGV | Petrol | Euro 2 | Euro 2 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| ANPR | LGV | Petrol | Euro 3 | Euro 3 | Non-Compliant | Non-Compliant | 28.7 | 28.7 |
| ANPR | LGV | Diesel | Pre-Euro 1 | Euro 0 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| ANPR | LGV | Diesel | Euro 1 | Euro 1 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| ANPR | LGV | Diesel | Euro 2 | Euro 2 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| ANPR | LGV | Diesel | Euro 3 | Euro 3 | Non-Compliant | Non-Compliant | 1418.5 | 1418.5 |
| ANPR | LGV | Diesel | Euro 4 | Euro 4 | Non-Compliant | Non-Compliant | 17893.5 | 17893.5 |
| ANPR | LGV | Diesel | Euro 5 | Euro 5 | Non-Compliant | Non-Compliant | 47931.2 | 47931.2 |
| License Data | Taxis | Petrol | Pre-Euro 1 | Euro 0 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Taxis | Petrol | Euro 1 | Euro 1 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Taxis | Petrol | Euro 2 | Euro 2 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Taxis | Petrol | Euro 3 | Euro 3 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Taxis | Diesel | Pre-Euro 1 | Euro 0 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Taxis | Diesel | Euro 1 | Euro 1 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Taxis | Diesel | Euro 2 | Euro 2 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Taxis | Diesel | Euro 3 | Euro 3 | Non-Compliant | Non-Compliant | 15.1 | 15.1 |
| License Data | Taxis | Diesel | Euro 4 | Euro 4 | Non-Compliant | Non-Compliant | 79.4 | 79.4 |
| License Data | Taxis | Diesel | Euro 5 | Euro 5 | Non-Compliant | Non-Compliant | 192.7 | 192.7 |
| License Data | Private Hi | Petrol | Pre-Euro 1 | Euro 0 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Private Hi | Petrol | Euro 1 | Euro 1 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Private Hi | Petrol | Euro 2 | Euro 2 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Private Hi | Petrol | Euro 3 | Euro 3 | Non-Compliant | Non-Compliant | 2.2 | 2.2 |
| License Data | Private Hi | Diesel | Pre-Euro 1 | Euro 0 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Private Hi | Diesel | Euro 1 | Euro 1 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Private Hi | Diesel | Euro 2 | Euro 2 | Non-Compliant | Non-Compliant | 0.0 | 0.0 |
| License Data | Private Hi | Diesel | Euro 3 | Euro 3 | Non-Compliant | Non-Compliant | 23.4 | 23.4 |
| License Data | Private Hi | Diesel | Euro 4 | Euro 4 | Non-Compliant | Non-Compliant | 180.3 | 180.3 |
| License Data | Private Hi | Diesel | Euro 5 | Euro 5 | Non-Compliant | Non-Compliant | 690.5 | 690.5 |

# DataSet 12. Fuel and non Fuel VOCs

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|

## 1a. Operating costs / vehicle lifetime - data import

Calculates combined average for HGVs, based on

## 1b. Total operating costs - formatted

Formats opex cost data on basis of vehicle and fuel

## 1c. Annual % change

Calculates annual percentage change

Unusual trend created by ad-blue component meaning diesel costs increase over time - maybe ok between Euro V and Euro VI with ad blue, but not earlier euro standards. So have

## 1d. Trend over time

Using annual rates of change, opex cost forecasted

## 1e. Operating costs - Average for standard

From annual data, average for each Euro standard

## 1f. Operating costs - Sort to match - associated with NC vehicle replaced

Data is sorted to match vehicle / fuel type disaggregation used for model calculations. Also uplifted to 2018

## 2. Mileage by vehicle type

## 3a. Fuel consumption - input data

Calculated for HGV

Hybrid consumption will be mix of old and new so take value for used to be

## 3b. Conversion factors from DECC DUKES

## 3c. Fuel consumption in litres per km

## 3d. Annual % change

Calculate annual change in fuel

## 3e. Trend over time

Project annual trend of change in fuel

## 3f. Fuel - Average for standard

Calculate average fuel consumption per Euro standard based on annual

## 3g. Fuel - litres per annum

*Combine fuel consumption with average annual milage to calculate average fuel consumption per*

| Vehicle | Energy Source | Code | Euro 0 | Euro 1 | Euro 2 | Euro 3 | Euro 4 | Euro 5 | Euro 6 |
|---|---|---|---|---|---|---|---|---|---|

## 3h. Fuel consumption

*Sort to match - associated with NC*

Code

## 3i. GHG emissions

*Combine fuel consumed with emissions factors to calculate average GHG emissions per*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Buses | Petrol - Euro 0 | Bus | Petrol | Euro 0 | BusPetrol | litres/year | | | |
| Private Hire | *Petrol - Euro 0* | | Petrol | Euro 0 | Private Hire CarPetrol | litres/year | 10,446 | | 21,632 |
| Private Hire | *Petrol - Euro 1* | | Petrol | Euro 1 | Private Hire CarPetrol | litres/year | 9,529 | | 19,731 |
| Private Hire | *Petrol - Euro 2* | | Petrol | Euro 2 | Private Hire CarPetrol | litres/year | 8,107 | | 16,788 |
| Private Hire | *Petrol - Euro 3* | | Petrol | Euro 3 | Private Hire CarPetrol | litres/year | 6,586 | | 13,639 |
| Private Hire | *Petrol - Euro 4* | | Petrol | Euro 4 | Private Hire CarPetrol | litres/year | 5,342 | | 11,063 |
| Private Hire | *Petrol - Euro 5* | | Petrol | Euro 5 | Private Hire CarPetrol | litres/year | 4,340 | | 8,988 |
| Private Hire | *Petrol - Euro 6* | | Petrol | Euro 6 | Private Hire CarPetrol | litres/year | 3,292 | | 6,818 |
| Private Hire | *Diesel - Euro 0* | | Diesel | Euro 0 | Private Hire CarDiesel | litres/year | 5,988 | | 14,491 |
| Private Hire | *Diesel - Euro 1* | | Diesel | Euro 1 | Private Hire CarDiesel | litres/year | 5,550 | | 13,430 |
| Private Hire | *Diesel - Euro 2* | | Diesel | Euro 2 | Private Hire CarDiesel | litres/year | 4,857 | | 11,753 |
| Private Hire | *Diesel - Euro 3* | | Diesel | Euro 3 | Private Hire CarDiesel | litres/year | 4,091 | | 9,901 |
| Private Hire | *Diesel - Euro 4* | | Diesel | Euro 4 | Private Hire CarDiesel | litres/year | 3,443 | | 8,331 |
| Private Hire | *Diesel - Euro 5* | | Diesel | Euro 5 | Private Hire CarDiesel | litres/year | 2,900 | | 7,018 |
| Private Hire | *Diesel - Euro 6* | | Diesel | Euro 6 | Private Hire CarDiesel | litres/year | 2,308 | | 5,585 |
| TAXI | *ULEV* | | Elec | | | KWh/year | 11,244 | | 3,201 |
| Private Hire | *ULEV* | | Petrol | | | litres/year | 1681.94 | | 2,482.85 |

*Apply electricity*

*Taken from CCM*

DataSet 13: Replacement Costs

| Check box | Last User | Date | Status | User Comments |
|---|---|---|---|---|

## 1. Unit Cost of Vehicle Upgrade - Ricardo

Note: Price year assumed to be 2014

Note: Private Hire Car assumed same mileage as taxis, and vehicle values same as passenger car

Assumed same as taxi diesel

Note: BEV truck derived from uplifting diesel HGV by same proportion as diesel to BEV rigid trucks

Takes weighted average of artic and rigid

Note: BEV coach derived from uplifting diesel HGV by same proportion as diesel to BEV bus

Total Price includes margin VAT, purchase tax

| Vehicle | Fuel | Lifetime (years) | Mileage (Central) | Mileage (Low) | Mileage (High) | Cost (2010) | Cost (2020) | Cost (2030) | Cost (2040) | Margin 2010 | Margin 2020 | Margin 2030 | Margin 2040 | Total Price 2010 | Total Price 2020 | Total Price 2030 | Total Price 2040 | 2010 Cost (2018 price year) | 2020 Cost (2018 price year) | 2030 Cost (2018 price year) | 2040 Cost (2018 price year) | 2010 Total Price (2018 Price Year) | 2020 Total Price (2018 Price Year) | 2030 Total Price (2018 Price Year) | 2040 Total Price (2018 Price Year) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Car | Petrol | 14 | 13000 | 12000 | 15000 | £14,046 | £15,093 | £15,501 | £15,745 | 24.3% | 24.3% | 24.3% | 24.3% | £20,950 | £22,513 | £23,122 | £23,485 | £15,016 | £16,136 | £16,573 | £16,833 | £22,398 | £24,069 | £24,720 | £25,108 |
| Car | Diesel | 14 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| Car | BEV | 14 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| LGV | Petrol | 14 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| LGV | Diesel | 14 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| LGV | BEV | 14 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| Private Hire Car | Petrol | 14 | 45000 | 38000 | 70000 | £14,046 | £15,093 | £15,501 | £15,745 | 24.3% | 24.3% | 24.3% | 24.3% | £20,950 | £22,513 | £23,122 | £23,485 | £15,016 | £16,136 | £16,573 | £16,833 | £22,398 | £24,069 | £24,720 | £25,108 |
| Private Hire Car | Diesel | 14 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| Private Hire Car | BEV | 14 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| Taxi | Diesel | 15 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| Taxi | Petrol | 15 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| Taxi | BEV | 15 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| Rigid Truck (3.5t-...) | Diesel | 12 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| Rigid Truck (3.5t-...) | BEV | 12 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| Articulated Truck (... | Diesel | 9 | 74000 | 60000 | 99000 | £54,094 | £66,209 | £70,043 | £72,751 | 24.3% | 24.3% | 24.3% | 24.3% | £80,687 | £98,757 | £104,476 | £108,516 | £57,833 | £70,785 | £74,884 | £77,780 | £86,263 | £105,583 | £111,697 | £116,016 |
| Articulated Truck (... | BEV | 9 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| HGV | Diesel | 11.1 | 37435.5 | 32576.6 | 45676.7 | 34395.7 | 41051.8 | 43578.0 | 45764.6 | 0.2 | 0.2 | 0.2 | 0.2 | 51304.7 | 61232.9 | 65001.0 | 68262.5 | 36773.0 | 43889.1 | 46589.9 | 48927.6 | 54850.6 | 65465.0 | 69493.5 | 72980.5 |
| Bus | Diesel | 15 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| Bus | BEV | 15 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| Coach | Diesel | 15 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| Coach | BEV | 15 | 64360 | 59000 | 72000 | £218,979 | £206,569 | £198,280 | £189,300 | 24.3% | 24.3% | 24.3% | 24.3% | £326,630 | £308,118 | £295,755 | £282,360 | £234,114 | £220,846 | £211,984 | £202,384 | £349,205 | £329,414 | £316,196 | £301,876 |
| PTW | Petrol | 15 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| PTW | BEV | 15 | [illegible] | | | | | | | | | | | | | | | | | | | | | | |
| Private Hire Car | Hybrid | | | | | | | | | | | | | | | | | | | £0 | £0 | £0 | £0 | £0 | £0 | £0 | £0 |

**Source** Ricardo study for TfL (2014): 'Environmental Support to the Development of a London Low Emission Vehicle Roadmap' (unpublished)

## 2. Unit cost of upgrade (hybrids)

| Vehicle | Fuel Type | Size | Cost |
|---|---|---|---|
| Car | Petrol (efficient) | A+B | [illegible] |
| Car | Petrol (efficient) | C | [illegible] |
| Car | Diesel (efficient) | D+E | [illegible] |
| Car | Petrol Average (2014 values) | Average | [illegible] |
| Car | Petrol Average (2018 values) | Average | £19,980 |

Source (PH hybrid): Cost for hybrid vehicles taken from Ricardo Energy & Environment (forthcoming): Car Choice Model (CCM) summary report

## 3. Unit cost of upgrade - JAQU Vehicle Values

Takes weighted average of rigid and artic HGV

| Car | Private Hire Car | LGV | Rigid HGV | Articulated HGV | HGV | Single-decker Bus | Double-decker Bus | Bus | Coach |
|---|---|---|---|---|---|---|---|---|---|
| £ 18,000.00 | £ 18,000.00 | £ 25,000.00 | £ 68,000.00 | £ 81,000.00 | £ 71,719.30 | £ 160,000.00 | £ 215,000.00 | £187,500.00 | ######### |

Source JAQU appraisal guidance

## 4. Selection of upgrade costs used for analysis

| Vehicle | Fuel | Vehicle Cost (Selected) | JAQU | REE |
|---|---|---|---|---|
| Car | Petrol | £16,136 | £ 18,000.00 | £16,136 |
| Car | Diesel | £16,994 | £ 18,000.00 | £16,994 |
| LGV | Petrol | £12,988 | £ 25,000.00 | £12,988 |
| LGV | Diesel | £14,119 | £ 25,000.00 | £14,119 |
| LGV | BEV | £22,067 | £ 25,000.00 | £22,067 |
| HGV | Diesel | [illegible] | £ 71,719.30 | [illegible] |
| Taxi | Petrol | [illegible] | £ - | [illegible] |
| Taxi | Diesel | [illegible] | £ | [illegible] |
| Bus | Diesel | £156,604 | £ 187,500.00 | £156,604 |
| Coach | Diesel | £157,152 | £ 250,000.00 | £157,152 |
| PTW | Petrol | [illegible] | £ | [illegible] |
| PTW | Diesel | £0 | £ | £0 |
| Taxi | BEV | £26,752 | £ - | £26,752 |
| Private Hire Car | Petrol | £16,136 | £ 18,000.00 | £16,136 |
| Private Hire Car | Diesel | £16,994 | £ 18,000.00 | £16,994 |
| Private Hire Car | Hybrid | £19,980 | £ 18,000.00 | £19,980 |

## 5. Vehicle values with annual depreciation

Takes data from tables above

Progression in years

| Unique id | Vehicle | Fuel | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CarPetrol | Car | Petrol | [illegible] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | CarPetrol |
| CarDiesel | Car | Diesel | [illegible] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | CarDiesel |
| LGVPetrol | LGV | Petrol | [illegible] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | LGVPetrol |
| LGVDiesel | LGV | Diesel | [illegible] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | LGVDiesel |
| LGVBEV | LGV | BEV | [illegible] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | LGVBEV |
| HGVPetrol | HGV | Petrol | £0 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | HGVPetrol |
| HGVDiesel | HGV | Diesel | [illegible] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | HGVDiesel |
| TaxiPetrol | Taxi | Petrol | [illegible] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | TaxiPetrol |
| TaxiDiesel | Taxi | Diesel | [illegible] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | TaxiDiesel |
| BusPetrol | Bus | Petrol | £0 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | BusPetrol |
| BusDiesel | Bus | Diesel | [illegible] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | BusDiesel |
| CoachPetrol | Coach | Petrol | £0 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | CoachPetrol |
| CoachDiesel | Coach | Diesel | [illegible] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | CoachDiesel |
| Private Hire CarHybrid | Private Hire Car | Hybrid | £19,980 | £14,236.89 | £11,486.21 | £9,254.47 | £7,442.65 | £6,114.95 | £5,071.07 | £3,914.41 | £3,054.79 | £2,430.17 | £1,958.60 | £1,578.53 | £1,272.22 | £1,025.35 | £826.38 | £666.02 | £536.78 | £432.62 | £348.67 | £281.01 | £226.48 | £182.53 | £147.11 | £118.57 | £95.56 | £77.02 | £62.07 | £50.03 | £40.32 | £32.49 | £26.19 | £21.11 | £17.01 | Private Hire CarHybrid |
| TAXIBEV | TAXI | BEV | [illegible] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | TAXIBEV |
| Private Hire CarPetrol | Private Hire Car | Petrol | £16,136 | £11,497.73 | £9,276.28 | £7,473.92 | £6,010.69 | £4,938.44 | £4,095.41 | £3,161.28 | £2,467.05 | £1,962.60 | £1,581.76 | £1,274.83 | £1,027.45 | £828.07 | £667.39 | £537.88 | £433.51 | £349.39 | £281.59 | £226.95 | £182.91 | £147.41 | £118.81 | £95.75 | £77.17 | £62.20 | £50.13 | £40.40 | £32.56 | £26.24 | £21.15 | £17.05 | £13.74 | te Hire CarPetrol |
| Private Hire CarDiesel | Private Hire Car | Diesel | £16,994 | £12,108.88 | £9,769.35 | £7,871.19 | £6,330.19 | £5,200.94 | £4,313.09 | £3,329.32 | £2,598.18 | £2,066.93 | £1,665.84 | £1,342.59 | £1,082.06 | £872.09 | £702.86 | £566.47 | £456.55 | £367.96 | £296.56 | £239.01 | £192.63 | £155.25 | £125.12 | £100.84 | £81.28 | £65.50 | £52.79 | £42.55 | £34.29 | £27.64 | £22.27 | £17.95 | £14.47 | Private Hire CarDiesel |

# DataSet 15: Impl. costs

| Date | Status | User Comments |
|---|---|---|
| 15/04/20 | | |

## Sheet explanation

Imports estimated costs of implementing scheme
Provided by SWECO

## 1. Preferred option implementation costs

**Preferred Option Cost Summary**

| Heading | Item | Key lookup | 2018 Price Base, 2019 Discount Year, Not Adjust | Year | Notes | exclude | | % | Final |
|---|---|---|---|---|---|---|---|---|---|
| A50 Victoria Road Bus Gate | Bus Gate ANPR camera (incl TM, PM and civils) | Capital expenditure | 94,684.92 | 2022 | | | 94,684.92 | 1% | 103,397.39 |
| A50 Victoria Road Bus Gate | Bus Gate narrowing of existing c'way (incl electric supplies and feeder pil | Capital expenditure | 56,810.95 | 2022 | | | 56,810.95 | 0% | 62,038.44 |
| A50 Victoria Road Bus Gate | New TRO for bus gate | Capital expenditure | 18,936.98 | 2022 | | | 18,936.98 | 0% | 20,679.48 |
| A50 Victoria Road Bus Gate | Bus Gate Signing (VMS) | Capital expenditure | 198,838.32 | 2022 | | | 198,838.32 | 2% | 217,134.52 |
| A50 Victoria Road Bus Gate | Bus Gate Advance Signing | Capital expenditure | 140,133.68 | 2022 | | | 140,133.68 | 1% | 153,028.14 |
| A50 Victoria Road Bus Gate | TRO costs for Stopping Up and One Way | Capital expenditure | 22,724.38 | 2022 | | | 22,724.38 | 0% | 24,815.37 |
| A50 Victoria Road Bus Gate | TTRO costs for temporary road closures | Capital expenditure | 5,681.09 | 2022 | | | 5,681.09 | 0% | 6,203.84 |
| A50 Victoria Road Bus Gate | Five year camera replacement costs | Capital expenditure | 26,347.11 | £2,027 | Taken in 20 | | 26,347.11 | 0% | 28,771.45 |
| A50 Victoria Road Bus Gate | IT Infrastructure and Storage Capacity | Capital expenditure IT | 5,049.86 | 2022 | | | 5,049.86 | 0% | 5,514.53 |
| A50 Victoria Road Bus Gate | Prism Sign Costs | Capital expenditure | 262,466.59 | 2022 | | | 262,466.59 | 2% | 286,617.57 |
| A50 Victoria Road Bus Gate | General Maintenance | Operating expenditure | 79,041.32 | 2022 | | | 79,041.32 | 1% | 86,314.34 |
| A50 Victoria Road Bus Gate | Maintenance ANPR system | Operating expenditure | 39,520.66 | 2022 | | | 39,520.66 | 0% | 43,157.17 |
| A50 Victoria Road Bus Gate | Maintenance of Prism Signs | Operating expenditure | 158,899.14 | 2022 | | | 158,899.14 | 1% | 173,520.32 |
| A53 Etruria Road Bus Gate | Bus Gate ANPR camera (incl TM, PM and civils) | Capital expenditure | 189,369.83 | 2022 | | | 189,369.83 | 2% | 206,794.78 |
| A53 Etruria Road Bus Gate | Bus Gate Signing (VMS) | Capital expenditure | 198,838.32 | 2022 | | | 198,838.32 | 2% | 217,134.52 |
| A53 Etruria Road Bus Gate | Bus Gate Advance Signing | Capital expenditure | 316,721.04 | 2022 | | | 316,721.04 | 3% | 345,864.28 |
| A53 Etruria Road Bus Gate | New TRO for bus gate | Capital expenditure | 18,936.98 | 2022 | | | 18,936.98 | 0% | 20,679.48 |
| A53 Etruria Road Bus Gate | Five year camera replacement costs | Capital expenditure | 52,694.21 | 2027 | Taken in 20 | | 52,694.21 | 0% | 57,542.90 |
| A53 Etruria Road Bus Gate | Facilitating Works | Capital expenditure | 10,672.17 | 2022 | | | 10,672.17 | 0% | 11,654.18 |
| A53 Etruria Road Bus Gate | IT Infrastructure and Storage Capacity | Capital expenditure IT | 5,049.86 | 2022 | | | 5,049.86 | 0% | 5,514.53 |
| A53 Etruria Road Bus Gate | Prism Sign Costs | Capital expenditure | 320,792.50 | 2022 | | | 320,792.50 | 3% | 350,310.36 |
| A53 Etruria Road Bus Gate | General Maintenance | Operating expenditure | 79,041.32 | 2022 | | | 79,041.32 | 1% | 86,314.34 |
| A53 Etruria Road Bus Gate | Maintenance ANPR system | Operating expenditure | 79,041.32 | 2022 | | | 79,041.32 | 1% | 86,314.34 |
| A53 Etruria Road Bus Gate | Maintenance of Prism Signs | Operating expenditure | 194,210.06 | 2022 | | | 194,210.06 | 2% | 212,080.39 |
| Traffic Management East and W | Road Hump Regulation Notice | Capital expenditure | 7,574.79 | 2022 | | | 7,574.79 | 0% | 8,271.79 |
| Traffic Management East and W | Removal Type A roadhump (excavate) | Capital expenditure | 81,807.77 | 2022 | | | 81,807.77 | 1% | 89,335.35 |
| Traffic Management East and W | Removal Type B roadhump (excavate) | Capital expenditure | 14,202.74 | 2022 | | | 14,202.74 | 0% | 15,509.61 |
| Traffic Management East and W | Removal Type C roadhump (plane out) | Capital expenditure | 2,840.55 | 2022 | | | 2,840.55 | 0% | 3,101.92 |
| Traffic Management East and W | Plane out existing c'way and resurface 50mm | Capital expenditure | 965,833.49 | 2022 | | | 965,833.49 | 8% | 1,054,705.10 |
| Traffic Management East and W | EO plane out 100mm deep (25% of total area) | Capital expenditure | 193,166.70 | 2022 | | | 193,166.70 | 2% | 210,941.02 |
| Traffic Management East and W | New kerbing to roadhumps | Capital expenditure | 45,448.76 | 2022 | | | 45,448.76 | 0% | 49,630.75 |
| Traffic Management East and W | Take down existing sign and post | Capital expenditure | 1,893.70 | 2022 | | | 1,893.70 | 0% | 2,067.95 |
| Traffic Management East and W | Take down sign and post including electrics and make safe | Capital expenditure | 11,362.19 | 2022 | | | 11,362.19 | 0% | 12,407.69 |
| Traffic Management East and W | New Roadhumps in Bituminous Materials | Capital expenditure | 130,665.18 | 2022 | | | 130,665.18 | 1% | 142,688.40 |
| Traffic Management East and W | Road Markings | Capital expenditure | 11,362.19 | 2022 | | | 11,362.19 | 0% | 12,407.69 |
| Traffic Management East and W | Removal of existing 20mph zone terminal signs | Capital expenditure | 946.85 | 2022 | | | 946.85 | 0% | 1,033.97 |
| Traffic Management East and W | New signing for 20mph zone incl post and foundations | Capital expenditure | 3,787.40 | 2022 | | | 3,787.40 | 0% | 4,135.90 |
| Traffic Management East and W | Removal of existing illuminated hump signs | Capital expenditure | 1,893.70 | 2022 | | | 1,893.70 | 0% | 2,067.95 |
| Traffic Management East and W | Electrical Disconnection for existing illuminated hump signs | Capital expenditure | 3,787.40 | 2022 | | | 3,787.40 | 0% | 4,135.90 |
| Traffic Management East and W | New signing for one way sections | Capital expenditure | 1,893.70 | 2022 | | | 1,893.70 | 0% | 2,067.95 |
| Traffic Management East and W | One Way Signs | Capital expenditure | 11,362.19 | 2022 | | | 11,362.19 | 0% | 12,407.69 |
| Traffic Management East and W | No Entry Signs | Capital expenditure | 11,362.19 | 2022 | | | 11,362.19 | 0% | 12,407.69 |
| Traffic Management East and W | New signing for 7.5T weight limit "Except for Access" | Capital expenditure | 18,936.98 | 2022 | | | 18,936.98 | 0% | 20,679.48 |
| Traffic Management East and W | Removal Type A roadhump (excavate) 2 | Capital expenditure | 13,634.63 | 2022 | | | 13,634.63 | 0% | 14,889.22 |
| Traffic Management East and W | Removal Type C roadhump (plane out) 2 | Capital expenditure | 8,521.64 | 2022 | | | 8,521.64 | 0% | 9,305.77 |
| Traffic Management East and W | Plane out existing c'way and resurface 50mm 2 | Capital expenditure | 447,698.69 | 2022 | | | 447,698.69 | 4% | 488,893.89 |
| Traffic Management East and W | EO plane out 100mm deep (20% of total area) | Capital expenditure | 149,232.90 | 2022 | | | 149,232.90 | 1% | 162,964.63 |
| Traffic Management East and W | New kerbing to roadhumps 2 | Capital expenditure | 20,830.68 | 2022 | | | 20,830.68 | 0% | 22,747.43 |
| Traffic Management East and W | New footway construction to Hitchman Street Closure including kerbing v | Capital expenditure | 28,405.47 | 2022 | | | 28,405.47 | 0% | 31,019.22 |
| Traffic Management East and W | Take down existing signs | Capital expenditure | 1,893.70 | 2022 | | | 1,893.70 | 0% | 2,067.95 |
| Traffic Management East and W | Take down signs including electrics and make safe | Capital expenditure | 5,681.09 | 2022 | | | 5,681.09 | 0% | 6,203.84 |
| Traffic Management East and W | New roadhumps in bituminous materials 2 | Capital expenditure | 85,216.42 | 2022 | | | 85,216.42 | 1% | 93,057.65 |
| Traffic Management East and W | New raised table adjacent to school. | Capital expenditure | 28,405.47 | 2022 | | | 28,405.47 | 0% | 31,019.22 |
| Traffic Management East and W | New signing for 20mph zone | Capital expenditure | 18,936.98 | 2022 | | | 18,936.98 | 0% | 20,679.48 |
| Traffic Management East and W | New signing for road closure | Capital expenditure | 3,787.40 | 2022 | | | 3,787.40 | 0% | 4,135.90 |
| Transport Improvements along A | New bus stop | Capital expenditure | 37,873.97 | 2022 | | | 37,873.97 | 0% | 41,358.96 |
| Transport Improvements along A | Traffic Signals Sandy Lane/King Street Junction | Capital expenditure | 284,054.75 | 2022 | | | 284,054.75 | 2% | 310,192.18 |
| Transport Improvements along A | Plane and resurface | Capital expenditure | 68,173.14 | 2022 | | | 68,173.14 | 1% | 74,446.12 |
| Transport Improvements along A | EO plane out 100mm deep (10% of total area) | Capital expenditure | 4,544.88 | 2022 | | | 4,544.88 | 0% | 4,963.07 |
| Transport Improvements along A | Removal Kerbs, tactile slabs and existing footway, and new kerbs,footwa | Capital expenditure | 47,342.46 | 2022 | | | 47,342.46 | 0% | 51,698.70 |
| Transport Improvements along A | Traffic Signals Basford Park Road/Etruria Road (West) Junction | Capital expenditure | 321,928.71 | 2022 | | | 321,928.71 | 3% | 351,551.13 |
| Transport Improvements along A | Plane and resurface 2 | Capital expenditure | 85,216.42 | 2022 | | | 85,216.42 | 1% | 93,057.65 |
| Transport Improvements along A | EO plane out 100mm deep (10% of total area) 2 | Capital expenditure | 5,681.09 | 2022 | | | 5,681.09 | 0% | 6,203.84 |
| Transport Improvements along A | Removal Kerbs, tactile slabs and existing footway, and new kerbs,footwa | Capital expenditure | 56,810.95 | 2022 | | | 56,810.95 | 0% | 62,038.44 |
| Transport Improvements along A | Traffic Signals Maintenance | Operating expenditure | 52,694.21 | 2022 | | | 52,694.21 | 0% | 57,542.90 |
| Bus Retrofit Programme | ANPR to monitor bus retrofit compliance - A53 Etruria | Capital expenditure | 189,369.83 | 2022 | | | 189,369.83 | 2% | 206,794.78 |
| Bus Retrofit Programme | ANPR to monitor bus retrofit compliance - A50 Victoria Road Bus Gate a | Capital expenditure | 189,369.83 | 2022 | | | 189,369.83 | 2% | 206,794.78 |
| Bus Retrofit Programme | Bucknall New Road Bus ANPR camera (incl TM, PM and civils) | Capital expenditure | 189,369.83 | 2022 | | | 189,369.83 | 2% | 206,794.78 |
| Bus Retrofit Programme | Five year camera replacement costs | Capital expenditure | 158,082.64 | 2027 | taken in 202 | | 158,082.64 | 1% | 172,628.69 |
| Bus Retrofit Programme | IT Infrastructure and Storage Capacity | Capital expenditure IT | 5,049.86 | 2022 | | | 5,049.86 | 0% | 5,514.53 |
| Bus Retrofit Programme | Cost of component | Capital expenditure | 979,717.18 | | Costs incorp | | - | 0% | - |
| Bus Retrofit Programme | Cost of the e-cooling fan | Capital expenditure | 250,874.52 | | Costs incorp | | - | 0% | - |
| Bus Retrofit Programme | Bus wrap | Capital expenditure | 32,933.88 | | Costs incorp | | - | 0% | - |
| Bus Retrofit Programme | Maintenance ANPR system | Operating expenditure | 237,123.96 | 2022 | | | 237,123.96 | 2% | 258,943.03 |
| Bus Infrastructure Improvements | CCTV | Capital expenditure | 374,128.92 | 2022 | | | 374,128.92 | 3% | 408,554.56 |
| Bus Infrastructure Improvements | Kerbs | Capital expenditure | 313,003.63 | 2022 | | | 313,003.63 | 3% | 341,804.80 |
| Bus Infrastructure Improvements | RTPI | Capital expenditure | 691,222.94 | 2022 | | | 691,222.94 | 6% | 754,826.14 |
| Bus Infrastructure Improvements | New Shelters | Capital expenditure | - | 2022 | | | - | 0% | - |
| Bus Infrastructure Improvements | Upgraded Shelters | Capital expenditure | - | 2022 | | | - | 0% | - |
| Bus Infrastructure Improvements | CCTV maintenance | Operating expenditure | 210,447.52 | 2022 | | | 210,447.52 | 2% | 229,811.94 |
| Bus Infrastructure Improvements | RTPI maintenance | Operating expenditure | 406,667.60 | 2022 | | | 406,667.60 | 4% | 444,087.30 |
| Monitoring and evaluation | Traffic Data - procurement, installation of the ATC sites | Capital expenditure | 96,166.94 | | Monitoring a | | - | 0% | - |
| Monitoring and evaluation | Additional processing / analysis of the bus patronage data | Operating expenditure | 115,927.27 | | Monitoring a | | - | 0% | - |
| Monitoring and evaluation | Combined Air Quality Monitoring and Evaluation - maintenance tubes | Operating expenditure | 577,317.81 | | Monitoring a | | - | 0% | - |
| Monitoring and evaluation | Traffic Data Collection for Monitoring in 2025 | Operating expenditure | 118,561.98 | | Monitoring a | | - | 0% | - |
| Monitoring and evaluation | Traffic Data -maintenance and monitoring of the ATC sites | Operating expenditure | 130,418.18 | | Monitoring a | | - | 0% | - |
| Monitoring and evaluation | Combined Air Quality Monitoring and Evaluation - maintenance staff | Operating expenditure | 207,364.91 | | Monitoring a | | - | 0% | - |
| Back Office Cost for Monitoring, I | Operating Costs New Staff to cover ANPR and Prism signs using existin | Operating expenditure | 1,317,355.35 | 2022 | | | 1,317,355.35 | 11% | 1,438,572.41 |
| Back Office Cost for Monitoring, I | Maintenance, Monitoring, Operation Operating Costs Added PM time | Operating expenditure | 513,768.59 | 2022 | | | 513,768.59 | 4% | 561,043.24 |
| Back Office Cost for Monitoring, I | FT staff post for RTPI | Operating expenditure | 65,867.77 | 2022 | | | 65,867.77 | 1% | 71,928.62 |
| Communications, engagement a | Marketing | Operating expenditure | 158,082.64 | 2022 | | | 158,082.64 | 1% | 172,628.69 |
| Decommissioning costs | De-comissioning / Removal (inc TM and disposal) | Capital expenditure | 629,695.86 | 2022 | | | 629,695.86 | 5% | 687,637.61 |

| | | |
|---|---|---|
| Risk | Risk Allowance | 1,060,000 |

*Risk - email from Sweco (4/5/ @11:56)*

## 2. CAZ D implementation costs

| Heading | Item | Key lookup | 2018 Price Base, 2019 Discount Year, Not Adjust | Year | Notes | exclude | | % | final |
|---|---|---|---|---|---|---|---|---|---|
| CAZ D Boundary Signs | Sign Cost | Capital expenditure | 768,842 | 2022 | | | 768,841.52 | 1% | 861,350.24 |
| CAZ D Boundary ANPR | ANPR Cost | Capital expenditure | 9,714,672 | 2022 | | | 9,714,672.38 | 10% | 10,883,563.32 |
| CAZ D Advanced Signing Local | Environmental (Vegetation Clearance, Tree Removal) | Capital expenditure | 15,150 | 2022 | | | 15,149.59 | 0% | 16,972.42 |
| CAZ D Advanced Signing Local | Traffic Management (Boundary Installation) | Capital expenditure | 232,442 | 2022 | | | 232,442.00 | 0% | 260,409.94 |
| CAZ D Advanced Signing Local | Local Signs | Capital expenditure | 826,599 | 2022 | | | 826,599.32 | 1% | 926,057.58 |
| CAZ D Advanced Signing Local | Traffic Management (Local Signs) | Capital expenditure | 41,188 | 2022 | | | 41,187.94 | 0% | 46,143.76 |
| CAZ D Advanced Signing HE Ne | A50 and A500 Signs | Capital expenditure | 1,969,446 | 2022 | | | 1,969,446.25 | 2% | 2,206,414.40 |
| CAZ D Advanced Signing HE Ne | Alternative Gantry Signs | Capital expenditure | 2,367,123 | 2022 | | | 2,367,122.90 | 2% | 2,651,940.38 |
| CAZ D Advanced Signing HE Ne | Traffic Management for Signs (HE) | Capital expenditure | 55,864 | 2022 | | | 55,864.10 | 0% | 62,585.79 |
| CAZ D Advanced Signing HE Ne | Traffic Management for Gantries (HE) | Capital expenditure | 10,936 | 2022 | | | 10,936.11 | 0% | 12,251.96 |
| CAZ D Internal ANPR and Signir | ANPR within CAZ D at 25 locations (50 ANPR Cameras) | Capital expenditure | 4,908,258 | 2022 | | | 4,908,257.74 | 5% | 5,498,830.20 |
| Back Office Cost for Monitoring, I | Setting up back office / Upgrade to systems | Capital expenditure IT | 3,029,917 | 2022 | | | 3,029,917.31 | 3% | 3,394,483.69 |
| Back Office Cost for Monitoring, I | Project Management costs | Capital expenditure IT | 3,029,917 | 2022 | | | 3,029,917.31 | 3% | 3,394,483.69 |
| Back Office Cost for Monitoring, I | Processing | Operating expenditure IT | 10,538,843 | 2022 | | | 10,538,842.82 | 11% | 11,806,899.78 |
| Back Office Cost for Monitoring, I | Staffing (internal) | Operating expenditure IT | 34,251,239 | 2022 | | | 34,251,239.16 | 35% | 38,372,424.30 |
| Maintenance | Maintenance | Operating expenditure IT | 13,173,554 | 2022 | | | 13,173,553.52 | 14% | 14,758,624.73 |
| Maintenance | Five year camera replacement costs | Capital expenditure | 4,226,912 | 2027 | Taken in 20 | | 4,226,912.49 | 4% | 4,735,503.99 |
| Communications, Engagement a | Marketing | Operating expenditure | 1,363,463 | 2022 | | | 1,363,462.79 | 1% | 1,527,517.66 |
| Communications, Engagement a | Communications | Operating expenditure | 1,317,355 | 2022 | | | 1,317,355.35 | 1% | 1,475,862.47 |
| Monitoring and Evaluation | Air Quality Monitoring | Operating expenditure | 713,348 | | Monitoring a | | - | 1% | 85,831.61 |
| Monitoring and Evaluation | Annual Monitoring Costs | Operating expenditure | 210,777 | | Monitoring a | | - | 0% | 25,361.14 |
| Monitoring and Evaluation | Traffic Data Collection for Monitoring in 2025 | Operating expenditure | 118,562 | | Monitoring a | | - | 0% | 14,265.64 |
| Monitoring and Evaluation | Traffic Monitoring Site Installation Costs | Operating expenditure | 164,669 | | Monitoring a | | - | 0% | 19,813.39 |
| Decommissioning Costs | De-commissioning / Removal | Capital expenditure | 2,053,355 | 2022 | | | 2,053,355.20 | 2% | 2,300,419.46 |
| Sinking Fund | Sinking Fund | Capital expenditure | 2,053,355 | 2022 | | | 2,053,355.20 | 2% | 2,300,419.46 |

| | | |
|---|---|---|
| Risk | Risk Allowance | 11,690,000 |

*Risk - email from Sweco (4/5/ @11:56)*

# 1. Vehicle Change

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|

## Sheet explanation

## 1. Non-comlpiant vehicles removed

*This draws through data for each scenario for numbers of non-compliant vehicles removed from fleet*

*Draws through assumptions from 2. Vehicle values tab*

*Depicts vehicle switched to under CAZ scenario*

*Generates a code for formula matching*

| Same Fuel CAZ B C | | Switch Fuel CAZ B C | | Same Fuel CAZ D | | Switch Fuel CAZ D | |
|---|---|---|---|---|---|---|---|
| Used | New | Used | New | Used | New | Used | New |

*Calculates total vehicles upgraded*

## CAZ D

*Same as tables above, but for CAZ D*

**Reductions - scrap and buy new**

**Reductions - scrap used**

**Reductions - ownership cycle used**

*Same as tables above, but for*

## 2. Vehicle Values

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|
| OK | GW | 15/04/20 | | |

### Sheet explanation

Calculates /sorts vehicle upgrade values by vehicle type, taking into account remaining lifetime and depreciation

**Used in Sheets 1c. Veh change, 3a., 3b and 3c**

## 1. Vehicle Values

| | | | | | Replacement assumption under CAZ — CAZ B and C (Not used) | | | | Replacement assumption under CAZ — CAZ D | | | | Calculates value of non-compliant vehicle | Value of compliant vehicles — CAZ B and C (Not Used) | | | | Value of compliant vehicles — CAZ D | | | | Presents remaining lifetime for different replacement assumptions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Unique id | Vehicle | Fuel | Euro standard | Age | Same Fuel Used | Same Fuel New | Switch Fuel Used | Switch Fuel New | Same Fuel Used | Same Fuel New | Switch Fuel Used | Switch Fuel New | Scrappage Cos | Same Fuel Used | Same Fuel New | Switch Fuel Used | Switch Fuel New | Same Fuel Used | Same Fuel New | Switch Fuel Used | Switch Fuel New | Lifetime | Age | Remainin | Numbers | Ownersh | Age at res |
| BusDiesel | Bus | Diesel | Euro 0 | 31 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 264 | 56125 | 156604 | 0 | 0 | 56125 | 156604 | 0 | 0 | 15 | 31 | 2 | 100% | 2.00 | 33.00 |
| BusDiesel | Bus | Diesel | Euro 1 | 27 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 585 | 56125 | 156604 | 0 | 0 | 56125 | 156604 | 0 | 0 | 15 | 27 | 2 | 100% | 2 | 29 |
| BusDiesel | Bus | Diesel | Euro 2 | 23 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 1293 | 56125 | 156604 | 0 | 0 | 56125 | 156604 | 0 | 0 | 15 | 23 | 2 | 75% | 2 | 25 |
| BusDiesel | Bus | Diesel | Euro 3 | 18 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 3488 | 56125 | 156604 | 0 | 0 | 56125 | 156604 | 0 | 0 | 15 | 18 | 2 | 50% | 2 | 20 |
| BusDiesel | Bus | Diesel | Euro 4 | 14 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 7714 | 56125 | 156604 | 0 | 0 | 56125 | 156604 | 0 | 0 | 15 | 14 | 1 | 25% | 2 | 16 |
| BusDiesel | Bus | Diesel | Euro 5 | 9 | E6 Diesel | E6 Diesel | E5 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E5 Petrol | E6 Petrol | 20808 | 56125 | 156604 | 0 | 0 | 56125 | 156604 | 0 | 0 | 15 | 9 | 6 | 10% | 2 | 11 |
| BusDiesel | Bus | Diesel | Euro 6 | 4 | E6 Diesel | E6 Diesel | E6 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E6 Petrol | E6 Petrol | 56125 | 56125 | 156604 | 0 | 0 | 56125 | 156604 | 0 | 0 | 15 | 4 | 11 | 5% | 2 | 6 |
| CarPetrol | Car | Petrol | Euro 0 | 31 | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 17 | 667 | 16136 | 667 | 16136 | 667 | 16136 | 667 | 16136 | 14 | 31 | 2 | 100% | 2 | 33 |
| CarPetrol | Car | Petrol | Euro 1 | 27 | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 40 | 667 | 16136 | 667 | 16136 | 667 | 16136 | 667 | 16136 | 14 | 27 | 2 | 100% | 2 | 29 |
| CarPetrol | Car | Petrol | Euro 2 | 23 | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 96 | 667 | 16136 | 667 | 16136 | 667 | 16136 | 667 | 16136 | 14 | 23 | 2 | 75% | 2 | 25 |
| CarPetrol | Car | Petrol | Euro 3 | 18 | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 282 | 667 | 16136 | 667 | 16136 | 667 | 16136 | 667 | 16136 | 14 | 18 | 2 | 50% | 2 | 20 |
| CarPetrol | Car | Petrol | Euro 4 | 14 | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 667 | 667 | 16136 | 667 | 16136 | 667 | 16136 | 667 | 16136 | 14 | 14 | 0 | 25% | 2 | 16 |
| CarPetrol | Car | Petrol | Euro 5 | 9 | E5 Petrol | E6 Petrol | E5 Petrol | E6 Petrol | E5 Petrol | E6 Petrol | E5 Petrol | E6 Petrol | 1963 | 1963 | 16136 | 1963 | 16136 | 1963 | 16136 | 1963 | 16136 | 14 | 9 | 5 | 10% | 2 | 11 |
| CarPetrol | Car | Petrol | Euro 6 | 4 | E6 Petrol | E6 Petrol | E6 Petrol | E6 Petrol | E6 Petrol | E6 Petrol | E6 Petrol | E6 Petrol | 6011 | 6011 | 16136 | 6011 | 16136 | 6011 | 16136 | 6011 | 16136 | 14 | 4 | 10 | 5% | 2 | 6 |
| CarDiesel | Car | Diesel | Euro 0 | 31 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 18 | 6330 | 16994 | 667 | 16136 | 6330 | 16994 | 667 | 16136 | 14 | 31 | 2 | 100% | 2 | 33 |
| CarDiesel | Car | Diesel | Euro 1 | 27 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 43 | 6330 | 16994 | 667 | 16136 | 6330 | 16994 | 667 | 16136 | 14 | 27 | 2 | 100% | 2 | 29 |
| CarDiesel | Car | Diesel | Euro 2 | 23 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 101 | 6330 | 16994 | 667 | 16136 | 6330 | 16994 | 667 | 16136 | 14 | 23 | 2 | 75% | 2 | 25 |
| CarDiesel | Car | Diesel | Euro 3 | 18 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 297 | 6330 | 16994 | 667 | 16136 | 6330 | 16994 | 667 | 16136 | 14 | 18 | 2 | 50% | 2 | 20 |
| CarDiesel | Car | Diesel | Euro 4 | 14 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 703 | 6330 | 16994 | 667 | 16136 | 6330 | 16994 | 667 | 16136 | 14 | 14 | 0 | 25% | 2 | 16 |
| CarDiesel | Car | Diesel | Euro 5 | 9 | E6 Diesel | E6 Diesel | E5 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E5 Petrol | E6 Petrol | 2067 | 6330 | 16994 | 1963 | 16136 | 6330 | 16994 | 1963 | 16136 | 14 | 9 | 5 | 10% | 2 | 11 |
| CarDiesel | Car | Diesel | Euro 6 | 4 | E6 Diesel | E6 Diesel | E6 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E6 Petrol | E6 Petrol | 6330 | 6330 | 16994 | 6011 | 16136 | 6330 | 16994 | 6011 | 16136 | 14 | 4 | 10 | 5% | 2 | 6 |
| HGVDiesel | HGV | Diesel | Euro 0 | 31 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 125 | 17493 | 43889 | 0 | 0 | 17493 | 43889 | 0 | 0 | 11 | 31 | 2 | 100% | 2 | 33 |
| HGVDiesel | HGV | Diesel | Euro 1 | 27 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 244 | 17493 | 43889 | 0 | 0 | 17493 | 43889 | 0 | 0 | 11 | 27 | 2 | 100% | 2 | 29 |
| HGVDiesel | HGV | Diesel | Euro 2 | 23 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 477 | 17493 | 43889 | 0 | 0 | 17493 | 43889 | 0 | 0 | 11 | 23 | 2 | 75% | 2 | 25 |
| HGVDiesel | HGV | Diesel | Euro 3 | 18 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 1102 | 17493 | 43889 | 0 | 0 | 17493 | 43889 | 0 | 0 | 11 | 18 | 2 | 50% | 2 | 20 |
| HGVDiesel | HGV | Diesel | Euro 4 | 14 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 2153 | 17493 | 43889 | 0 | 0 | 17493 | 43889 | 0 | 0 | 11 | 14 | 2 | 25% | 2 | 16 |
| HGVDiesel | HGV | Diesel | Euro 5 | 9 | E6 Diesel | E6 Diesel | E5 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E5 Petrol | E6 Petrol | 4971 | 17493 | 43889 | 0 | 0 | 17493 | 43889 | 0 | 0 | 11 | 9.00000 | 2 | 10% | 2 | 11 |
| HGVDiesel | HGV | Diesel | Euro 6 | 4 | E6 Diesel | E6 Diesel | E6 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E6 Petrol | E6 Petrol | 17493 | 17493 | 43889 | 0 | 0 | 17493 | 43889 | 0 | 0 | 11 | 4 | 7 | 5% | 2 | 6 |
| LGVPetrol | LGV | Petrol | Euro 0 | 31 | #REF! | #REF! | #REF! | #REF! | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 19 | #REF! | #REF! | #REF! | #REF! | 570 | 12988 | 570 | 12988 | 14 | 31 | 2 | 100% | 2 | 33 |
| LGVPetrol | LGV | Petrol | Euro 1 | 27 | #REF! | #REF! | #REF! | #REF! | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 42 | #REF! | #REF! | #REF! | #REF! | 570 | 12988 | 570 | 12988 | 14 | 27 | 2 | 100% | 2 | 29 |
| LGVPetrol | LGV | Petrol | Euro 2 | 23 | #REF! | #REF! | #REF! | #REF! | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 94 | #REF! | #REF! | #REF! | #REF! | 570 | 12988 | 570 | 12988 | 14 | 23 | 2 | 75% | 2 | 25 |
| LGVPetrol | LGV | Petrol | Euro 3 | 18 | #REF! | #REF! | #REF! | #REF! | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 256 | #REF! | #REF! | #REF! | #REF! | 570 | 12988 | 570 | 12988 | 14 | 18 | 2 | 50% | 2 | 20 |
| LGVPetrol | LGV | Petrol | Euro 4 | 14 | #REF! | #REF! | #REF! | #REF! | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 570 | #REF! | #REF! | #REF! | #REF! | 570 | 12988 | 570 | 12988 | 14 | 14 | 0 | 25% | 2 | 16 |
| LGVPetrol | LGV | Petrol | Euro 5 | 9 | #REF! | #REF! | #REF! | #REF! | E5 Petrol | E6 Petrol | E5 Petrol | E6 Petrol | 1550 | #REF! | #REF! | #REF! | #REF! | 1550 | 12988 | 1550 | 12988 | 14 | 9 | 5 | 10% | 2 | 11 |
| LGVPetrol | LGV | Petrol | Euro 6 | 4 | #REF! | #REF! | #REF! | #REF! | E6 Petrol | E6 Petrol | E6 Petrol | E6 Petrol | 4109 | #REF! | #REF! | #REF! | #REF! | 4109 | 12988 | 4109 | 12988 | 14 | 4 | 10 | 5% | 2 | 6 |
| LGVDiesel | LGV | Diesel | Euro 0 | 31 | #REF! | #REF! | #REF! | #REF! | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 21 | #REF! | #REF! | #REF! | #REF! | 4467 | 14119 | 570 | 12988 | 14 | 31 | 2 | 100% | 2 | 33 |
| LGVDiesel | LGV | Diesel | Euro 1 | 27 | #REF! | #REF! | #REF! | #REF! | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 46 | #REF! | #REF! | #REF! | #REF! | 4467 | 14119 | 570 | 12988 | 14 | 27 | 2 | 100% | 2 | 29 |
| LGVDiesel | LGV | Diesel | Euro 2 | 23 | #REF! | #REF! | #REF! | #REF! | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 102 | #REF! | #REF! | #REF! | #REF! | 4467 | 14119 | 570 | 12988 | 14 | 23 | 2 | 75% | 2 | 25 |
| LGVDiesel | LGV | Diesel | Euro 3 | 18 | #REF! | #REF! | #REF! | #REF! | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 278 | #REF! | #REF! | #REF! | #REF! | 4467 | 14119 | 570 | 12988 | 14 | 18 | 2 | 50% | 2 | 20 |
| LGVDiesel | LGV | Diesel | Euro 4 | 14 | #REF! | #REF! | #REF! | #REF! | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 620 | #REF! | #REF! | #REF! | #REF! | 4467 | 14119 | 570 | 12988 | 14 | 14 | 0 | 25% | 2 | 16 |
| LGVDiesel | LGV | Diesel | Euro 5 | 9 | #REF! | #REF! | #REF! | #REF! | E6 Diesel | E6 Diesel | E5 Petrol | E6 Petrol | 1685 | #REF! | #REF! | #REF! | #REF! | 4467 | 14119 | 1550 | 12988 | 14 | 9 | 5 | 10% | 2 | 11 |
| LGVDiesel | LGV | Diesel | Euro 6 | 4 | #REF! | #REF! | #REF! | #REF! | E6 Diesel | E6 Diesel | E6 Petrol | E6 Petrol | 4467 | #REF! | #REF! | #REF! | #REF! | 4467 | 14119 | 4109 | 12988 | 14 | 4 | 10 | 5% | 2 | 6 |
| TAXIPetrol | TAXI | Petrol | Euro 0 | 31 | BEV | BEV | BEV | BEV | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 42 | 36752 | 36752 | 36752 | 36752 | 1228 | 24929 | 1228 | 24929 | 15 | 31 | 2 | 100% | 2 | 33 |
| TAXIPetrol | TAXI | Petrol | Euro 1 | 27 | BEV | BEV | BEV | BEV | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 93 | 36752 | 36752 | 36752 | 36752 | 1228 | 24929 | 1228 | 24929 | 15 | 27 | 2 | 100% | 2 | 29 |
| TAXIPetrol | TAXI | Petrol | Euro 2 | 23 | BEV | BEV | BEV | BEV | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 206 | 36752 | 36752 | 36752 | 36752 | 1228 | 24929 | 1228 | 24929 | 15 | 23 | 2 | 75% | 2 | 25 |
| TAXIPetrol | TAXI | Petrol | Euro 3 | 18 | BEV | BEV | BEV | BEV | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 555 | 36752 | 36752 | 36752 | 36752 | 1228 | 24929 | 1228 | 24929 | 15 | 18 | 2 | 50% | 2 | 20 |
| TAXIPetrol | TAXI | Petrol | Euro 4 | 14 | BEV | BEV | BEV | BEV | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 1228 | 36752 | 36752 | 36752 | 36752 | 1228 | 24929 | 1228 | 24929 | 15 | 14 | 1 | 25% | 2 | 16 |
| TAXIPetrol | TAXI | Petrol | Euro 5 | 9 | BEV | BEV | BEV | BEV | E5 Petrol | E6 Petrol | E5 Petrol | E6 Petrol | 3312 | 36752 | 36752 | 36752 | 36752 | 3312 | 24929 | 3312 | 24929 | 15 | 9 | 6 | 10% | 2 | 11 |
| TAXIPetrol | TAXI | Petrol | Euro 6 | 4 | BEV | BEV | BEV | BEV | E6 Petrol | E6 Petrol | E6 Petrol | E6 Petrol | 8934 | 36752 | 36752 | 36752 | 36752 | 8934 | 24929 | 8934 | 24929 | 15 | 4 | 11 | 5% | 2 | 6 |
| TAXIDiesel | TAXI | Diesel | Euro 0 | 31 | BEV | BEV | BEV | BEV | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 42 | 36752 | 36752 | 36752 | 36752 | 8934 | 24929 | 1228 | 24929 | 15 | 31 | 2 | 100% | 2 | 33 |
| TAXIDiesel | TAXI | Diesel | Euro 1 | 27 | BEV | BEV | BEV | BEV | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 93 | 36752 | 36752 | 36752 | 36752 | 8934 | 24929 | 1228 | 24929 | 15 | 27 | 2 | 100% | 2 | 29 |
| TAXIDiesel | TAXI | Diesel | Euro 2 | 23 | BEV | BEV | BEV | BEV | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 206 | 36752 | 36752 | 36752 | 36752 | 8934 | 24929 | 1228 | 24929 | 15 | 23 | 2 | 75% | 2 | 25 |
| TAXIDiesel | TAXI | Diesel | Euro 3 | 18 | BEV | BEV | BEV | BEV | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 555 | 36752 | 36752 | 36752 | 36752 | 8934 | 24929 | 1228 | 24929 | 15 | 18 | 2 | 50% | 2 | 20 |
| TAXIDiesel | TAXI | Diesel | Euro 4 | 14 | BEV | BEV | BEV | BEV | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 1228 | 36752 | 36752 | 36752 | 36752 | 8934 | 24929 | 1228 | 24929 | 15 | 14 | 1 | 25% | 2 | 16 |
| TAXIDiesel | TAXI | Diesel | Euro 5 | 9 | BEV | BEV | BEV | BEV | E6 Diesel | E6 Diesel | E5 Petrol | E6 Petrol | 3312 | 36752 | 36752 | 36752 | 36752 | 8934 | 24929 | 3312 | 24929 | 15 | 9 | 6 | 10% | 2 | 11 |
| TAXIDiesel | TAXI | Diesel | Euro 6 | 4 | BEV | BEV | BEV | BEV | E6 Diesel | E6 Diesel | E6 Petrol | E6 Petrol | 8934 | 36752 | 36752 | 36752 | 36752 | 8934 | 24929 | 8934 | 24929 | 15 | 4 | 11 | 5% | 2 | 6 |
| Private Hire | Private Hi | Petrol | Euro 0 | 31 | Hybrid | Hybrid | Hybrid | Hybrid | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 17 | 7443 | 19980 | 7443 | 19980 | 667 | 16136 | 667 | 16136 | 14 | 31 | 2 | 1 | 2 | 33 |
| Private Hire | Private Hi | Petrol | Euro 1 | 27 | Hybrid | Hybrid | Hybrid | Hybrid | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 40 | 7443 | 19980 | 7443 | 19980 | 667 | 16136 | 667 | 16136 | 14 | 27 | 2 | 1 | 2 | 29 |
| Private Hire | Private Hi | Petrol | Euro 2 | 23 | Hybrid | Hybrid | Hybrid | Hybrid | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 96 | 7443 | 19980 | 7443 | 19980 | 667 | 16136 | 667 | 16136 | 14 | 23 | 2 | 1 | 2 | 25 |
| Private Hire | Private Hi | Petrol | Euro 3 | 18 | Hybrid | Hybrid | Hybrid | Hybrid | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 282 | 7443 | 19980 | 7443 | 19980 | 667 | 16136 | 667 | 16136 | 14 | 18 | 2 | 1 | 2 | 20 |
| Private Hire | Private Hi | Petrol | Euro 4 | 14 | Hybrid | Hybrid | Hybrid | Hybrid | E4 Petrol | E6 Petrol | E4 Petrol | E6 Petrol | 667 | 7443 | 19980 | 7443 | 19980 | 667 | 16136 | 667 | 16136 | 14 | 14 | 0 | 0 | 2 | 16 |
| Private Hire | Private Hi | Petrol | Euro 5 | 9 | Hybrid | Hybrid | Hybrid | Hybrid | E5 Petrol | E6 Petrol | E5 Petrol | E6 Petrol | 1963 | 7443 | 19980 | 7443 | 19980 | 1963 | 16136 | 1963 | 16136 | 14 | 9 | 5 | 0 | 2 | 11 |
| Private Hire | Private Hi | Petrol | Euro 6 | 4 | Hybrid | Hybrid | Hybrid | Hybrid | E6 Petrol | E6 Petrol | E6 Petrol | E6 Petrol | 6011 | 7443 | 19980 | 7443 | 19980 | 6011 | 16136 | 6011 | 16136 | 14 | 4 | 10 | 0 | 2 | 6 |
| Private Hire | Private Hi | Diesel | Euro 0 | 31 | Hybrid | Hybrid | Hybrid | Hybrid | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 18 | 7443 | 19980 | 7443 | 19980 | 6330 | 16994 | 667 | 16136 | 14 | 31 | 2 | 1 | 2 | 33 |
| Private Hire | Private Hi | Diesel | Euro 1 | 27 | Hybrid | Hybrid | Hybrid | Hybrid | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 43 | 7443 | 19980 | 7443 | 19980 | 6330 | 16994 | 667 | 16136 | 14 | 27 | 2 | 1 | 2 | 29 |
| Private Hire | Private Hi | Diesel | Euro 2 | 23 | Hybrid | Hybrid | Hybrid | Hybrid | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 101 | 7443 | 19980 | 7443 | 19980 | 6330 | 16994 | 667 | 16136 | 14 | 23 | 2 | 1 | 2 | 25 |
| Private Hire | Private Hi | Diesel | Euro 3 | 18 | Hybrid | Hybrid | Hybrid | Hybrid | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 297 | 7443 | 19980 | 7443 | 19980 | 6330 | 16994 | 667 | 16136 | 14 | 18 | 2 | 1 | 2 | 20 |
| Private Hire | Private Hi | Diesel | Euro 4 | 14 | Hybrid | Hybrid | Hybrid | Hybrid | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 703 | 7443 | 19980 | 7443 | 19980 | 6330 | 16994 | 667 | 16136 | 14 | 14 | 0 | 0 | 2 | 16 |
| Private Hire | Private Hi | Diesel | Euro 5 | 9 | Hybrid | Hybrid | Hybrid | Hybrid | E6 Diesel | E6 Diesel | E5 Petrol | E6 Petrol | 2067 | 7443 | 19980 | 7443 | 19980 | 6330 | 16994 | 1963 | 16136 | 14 | 9 | 5 | 0 | 2 | 11 |
| Private Hire | Private Hi | Diesel | Euro 6 | 4 | Hybrid | Hybrid | Hybrid | Hybrid | E6 Diesel | E6 Diesel | E6 Petrol | E6 Petrol | 6330 | 7443 | 19980 | 7443 | 19980 | 6330 | 16994 | 6011 | 16136 | 14 | 4 | 10 | 0 | 2 | 6 |
| CoachDies | Coach | Diesel | Euro 0 | 31 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 265 | 56322 | 157153 | 0 | 0 | 56322 | 157153 | 0 | 0 | 15 | 31 | 2 | 100% | 2 | 33 |
| CoachDies | Coach | Diesel | Euro 1 | 27 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 587 | 56322 | 157153 | 0 | 0 | 56322 | 157153 | 0 | 0 | 15 | 27 | 2 | 100% | 2 | 29 |
| CoachDies | Coach | Diesel | Euro 2 | 23 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 1298 | 56322 | 157153 | 0 | 0 | 56322 | 157153 | 0 | 0 | 15 | 23 | 2 | 75% | 2 | 25 |
| CoachDies | Coach | Diesel | Euro 3 | 18 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 3500 | 56322 | 157153 | 0 | 0 | 56322 | 157153 | 0 | 0 | 15 | 18 | 2 | 50% | 2 | 20 |
| CoachDies | Coach | Diesel | Euro 4 | 14 | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E4 Petrol | E6 Petrol | 7741 | 56322 | 157153 | 0 | 0 | 56322 | 157153 | 0 | 0 | 15 | 14 | 1 | 25% | 2 | 16 |
| CoachDies | Coach | Diesel | Euro 5 | 9 | E6 Diesel | E6 Diesel | E5 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E5 Petrol | E6 Petrol | 20881 | 56322 | 157153 | 0 | 0 | 56322 | 157153 | 0 | 0 | 15 | 9 | 6 | 10% | 2 | 11 |
| CoachDies | Coach | Diesel | Euro 6 | 4 | E6 Diesel | E6 Diesel | E6 Petrol | E6 Petrol | E6 Diesel | E6 Diesel | E6 Petrol | E6 Petrol | 56322 | 56322 | 157153 | 0 | 0 | 56322 | 157153 | 0 | 0 | 15 | 4 | 11 | 5% | 2 | 6 |

## 2. Vehicle ages

| unique id | Fuel | Euro Standard | Date introduced | Date of next standard | Date of last | Youngest |
|---|---|---|---|---|---|---|
| E0 Petrol | Petrol | Euro 0 | N/A | 1992 | 1991 | 31 |
| E0 Diesel | Diesel | Euro 0 | N/A | 1992 | 1991 | 31 |
| E1 Petrol | Petrol | Euro 1 | 1992 | 1996 | 1995 | 27 |
| E1 Diesel | Diesel | Euro 1 | 1992 | 1996 | 1995 | 27 |
| E2 Petrol | Petrol | Euro 2 | 1996 | 2000 | 1999 | 23 |
| E2 Diesel | Diesel | Euro 2 | 1996 | 2000 | 1999 | 23 |
| E3 Petrol | Petrol | Euro 3 | 2000 | 2005 | 2004 | 18 |
| E3 Diesel | Diesel | Euro 3 | 2000 | 2005 | 2004 | 18 |
| E4 Petrol | Petrol | Euro 4 | 2005 | 2009 | 2008 | 14 |
| E4 Diesel | Diesel | Euro 4 | 2005 | 2009 | 2008 | 14 |
| E5 Petrol | Petrol | Euro 5 | 2009 | 2014 | 2013 | 9 |
| E5 Diesel | Diesel | Euro 5 | 2009 | 2014 | 2013 | 9 |
| E6 Petrol | Petrol | Euro 6 | 2014 | N/A | N/A | 4 |
| E6 Diesel | Diesel | Euro 6 | 2014 | N/A | N/A | 4 |
| Hybrid | Hybrid | - | - | - | - | 4 |
| BEV | BEV | - | - | - | - | 4 |

# 3c. Upgrade costs - CAZ D

| Check by | Last User | Date | Status | User Comments |
|---|---|---|---|---|
| | | | | |

## Sheet explanation

This sheet anticipates behavioural responses for non-compliant vehicles, i.e. upgrade, scrap, sell/replace.
This uses ANPR data and behavioural assumptions to produce changes in vehicles, which are valued using 2. Vehicle Values
**Total cost of scenarios is then compared to baseline, and feeds through to summarysheets**

## 1. Total Vehicles under CAZ scenario

### 1a .Non compliant vehicles * % Upgrade = total number upgraded

| Upgrade | Euro # | Cumulative Total |
|---|---|---|

### 1b. . Number of vehicles Scrapped

| 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|

### 1c. Scrap and buy New Vehicle Purchase

| 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|

### 1d. Vehicles to be sold

| 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|

### 1e. Sell & Replace with same fuel

### 2a. Residual Value (lost) of scrapped vehicles

### 2b. New Vehicle Purchase

### 2c. Sell & Replace with same fuel

Calculates value of used compliant vehicles (of same fuel) purchased

### 3a. Residual Value (lost) of scrapped vehicles

Calculates lost residual value of scrapped vehicles - in baseline

### 3b. New Vehicle Purchase

| 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|

### 3c. Sell & Replace with same fuel

Calculates value of used compliant vehicles (of same fuel) which would otherwise have been purchased under baseline (same vehicles just later)

Replace * (1-Scrappage%) * ( same fuel%) * (buy new %)

## 1f. Sell & Replace with different fuel

*Calculates number of non-compliant vehicles to be sold as used (i.e. not scrapped) and replaced with compliant vehicles of different fuel*

| 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | CHECK |
|---|---|---|---|---|---|---|---|---|---|---|---|

## 2d. Sell & Replace with different fuel

*Calculates value of used compliant vehicles (of different fuel) purchased*

| 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|

## 3d. Sell & Replace with different fuel

*Calculates value of used compliant vehicles (of different fuel) which would otherwise have been purchased under baseline (same vehicles just later)*
*Assumes some will run to end of useful life (oldest vehicles that have less life left to begin with) and some will be replaced at end of ownership cycle (newer non-compliant vehicles)*

| 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|

# 3d. Upgrade costs results

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|
| OK | GW | 15/04/20 | | |

## Sheet explanation

Draws data from supporting cost calculation tabs for both CAZ and baseline scenarios and compares CAZ to baseline
Compares CAZ scenario to baseline costs to calculate marginal impact
**Total cost of scenarios then feeds through to summary sheets**

## 3. CAZ D

### 3a. Scenario Results

| | | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | v<br>**Scrap** | ak<br>**Purchase** | bp<br>**Sell** | ce<br>**Sell** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CAZ D** | Bus | - | | | | | | | | | | | - | - | - | - | 1 |
| | HGV | 165,081,220 | | | | | | | | | | | 3,546,324 | 86,232,027 | 75,302,868 | - | 1 |
| | TAXI | 2,282,017 | | | | | | | | | | | 56,952 | 1,306,573 | 918,493 | - | 1 |
| | Coach | 27,615,242 | | | | | | | | | | | 270,761 | 14,703,738 | 12,640,743 | - | 1 |
| | Private Hire Car | 3,391,104 | | | | | | | | | | | 127,613 | 2,779,563 | 522,231 | - 38,302 | 1 |
| | LGV | 119,618,780 | | | | | | | | | | | 4,273,204 | 102,102,359 | 15,369,536 | - 2,126,318 | 1 |
| | Car | 318,358,960 | | | | | | | | | | | 11,763,895 | 261,933,327 | 48,144,452 | - 3,482,714 | 1 |
| Total | **ORR CAZ D** | **636,347,325** | | | | | | | | | | | 20,038,749 | 469,057,587 | 152,898,323 | - 5,647,334 | |

### 3b. Baseline

| | | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CAZ D** | Bus | - | | | | | | | | | | | 0 | 0 | 0 | 0 | 1 |
| | HGV | 153,508,765 | | | | | | | | | | | 0 | 80498520 | 73010245 | 0 | 1 |
| | TAXI | 2,145,211 | | | | | | | | | | | 0 | 1253419 | 891792 | 0 | 1 |
| | Coach | 26,019,255 | | | | | | | | | | | 0 | 13726097 | 12293158 | 0 | 1 |
| | Private Hire Car | 3,253,600 | | | | | | | | | | | 0 | 2720918 | 504190 | 28492 | 1 |
| | LGV | 116,886,724 | | | | | | | | | | | 0 | 101527074 | 15007591 | 352060 | 1 |
| | Car | 305,265,002 | | | | | | | | | | | 0 | 255989504 | 46684843 | 2590654 | 1 |
| Total | **Baseline ORR CA** | **607,078,556** | | | | | | | | | | | 0 | 455715532 | 148391819 | 2971205 | |

### 3c. Marginal Impact

| | | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | | **Scrap** | **Purchase** | **Sell** | **Sell** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CAZ D** | Bus | - | - | - | - | - | - | - | - | - | - | - | **Buses** | **-** | **-** | **-** | **-** | 1 |
| | HGV | - 11,572,455 | - | - | - | - | - | - | - | - | - | - | **HGVs** | **- 3,546,324** | **- 5,733,507** | **- 2,292,623** | **-** | 1 |
| | TAXI | - 136,807 | - | | - | - | - | - | - | - | - | - | **TAXIs** | **- 56,952** | **- 53,154** | **- 26,701** | **-** | 1 |
| | Coach | - 1,595,987 | - | | - | - | - | - | - | - | - | - | **Coaches** | **- 270,761** | **- 977,641** | **- 347,585** | **-** | 1 |
| | Private Hire Car | - 137,505 | - | | - | - | - | - | - | - | - | - | **Private hi** | **- 127,613** | **- 58,644** | **- 18,042** | **66,794** | 1 |
| | LGV | - 2,732,056 | - | - | - | - | - | - | - | - | - | - | LGV | **- 4,273,204** | **- 575,285** | **- 361,945** | **2,478,377** | 1 |
| | Car | - 13,093,959 | - | - | - | - | - | - | - | - | - | - | **Cars** | **- 11,763,895** | **- 5,943,823** | **- 1,459,609** | **6,073,369** | 1 |
| Total | **Marginal ORR CA** | **- 29,268,768** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **Marginal (** | **- 20,038,749** | **- 13,342,055** | **- 4,506,504** | **8,618,540** | |

## 4. Additional costs

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|

### Sheet explanation

### 1. Total change in vehicles each year

*Calculates overall net change in fleet between CAZ scenario and baseline, for first year and subsequent years over which non-compliant vehicles are 'lost' from fleet; aggregates across all*

CAZ D

### 2. Non fuel VOCs

*Combines change in fleet with annual average opex to calculate opex savings from non-compliant vehicles removed, and opex cost from compliant vehicles brought into fleet*

CAZ D

*Calculates totals for each*

**Totals**

### 3a. Fuel VOCs

*Combines change in fleet with annual average fuel consumption per vehicle type to calculate fuel savings from non-compliant vehicles removed, and additional consumption from compliant vehicles brought into fleet*

CAZ D

### 3b. Fuel costs

*Combines change in fuel consumption with fuel prices to calculate monetary impact*

CAZ D

### 4a. CO2 tonnes

*Combines change in fleet with annual average CO2 emissions per vehicle type to calculate emission savings from non-compliant vehicles removed, and additional emissions from compliant vehicles brought into fleet*

CAZ D

### 4b. CO2 value

*Combines CO2 emissions with carbon price to calculate monetary value of emissions changes*

CAZ D

## 5. Air Quality Impacts

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|
| OK | JS | 15/04/20 | | |

### Sheet explanation

Calculates emissions savings compared with baseline and then applies damage costs

### 1. Emissions Savings compared with Baseline

Units: annual tonnes/year all vehicles

Preferred Option

| | 1 | 1.2648129 | 1.0489596 | 0.6537597 | 0.4977465 | 0.36684081 | 0.2657519 | 0.19035828 | 0.11973683 | 0.08515793 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pollutant** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | |
| **Nox** | -13.100 | -14.835 | -13.421 | -10.832 | -9.810 | -8.953 | -8.291 | -7.797 | -7.334 | -7.108 | |
| **PM** | -0.500 | -0.632 | -0.524 | -0.327 | -0.249 | -0.183 | -0.133 | -0.095 | -0.060 | -0.043 | |

CAZ D

| Pollutant | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | Column1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Nox** | -101.000 | -127.746 | -105.945 | -66.030 | -50.272 | -37.051 | -26.841 | -19.226 | -12.093 | -8.601 | |
| **PM** | -6.400 | -8.095 | -6.713 | -4.184 | -3.186 | -2.348 | -1.701 | -1.218 | -0.766 | -0.545 | |

### 4. Emissions Savings Benefits

£

Preferred Option

| Pollutant | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Nox** | 231,869 | 267,821 | 247,142 | 203,463 | 187,954 | 174,957 | 165,258 | 158,523 | 152,100 | 150,351 | |
| **PM** | 168,805 | 217,777 | 184,224 | 117,113 | 90,948 | 68,370 | 50,520 | 36,911 | 23,682 | 17,180 | |

CAZ D

| Pollutant | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Nox** | 1,787,691 | 2,306,317 | 1,950,975 | 1,240,256 | 963,167 | 724,054 | 535,020 | 390,900 | 250,797 | 181,936 | |
| **PM** | 2,160,708 | 2,787,550 | 2,358,062 | 1,499,045 | 1,164,140 | 875,134 | 646,656 | 472,464 | 303,127 | 219,899 | |

# 6. Implementation costs

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|
| OK | DB | 15/04/20 | | |

## Sheet explanation

This sheet calculates costs of implentation 2022-2031 using data provided by SWECO/Amey

## 1. Projection of implementation costs

| | | | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Preferred Option | Capex | Capital expend | 8,382,058 | 0 | 0 | 0 | 0 | 258,943 | 0 | 0 | 0 | 0 |
| | | Capital expend | 16,544 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | opex | Operating expe | 392,226 | 392,226 | 392,226 | 392,226 | 392,226 | 392,226 | 392,226 | 392,226 | 392,226 | 392,226 |
| | | Operating expe | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CAZ D | Capex | Capital expend | 28,027,359 | 0 | 0 | 0 | 0 | 4,735,504 | 0 | 0 | 0 | 0 |
| | | Capital expend | 6,788,967 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | opex | Operating expe | 300,338 | 300,338 | 300,338 | 300,338 | 300,338 | 300,338 | 300,338 | 300,338 | 300,338 | 300,338 |
| | | Operating expe | 6,493,795 | 6,493,795 | 6,493,795 | 6,493,795 | 6,493,795 | 6,493,795 | 6,493,795 | 6,493,795 | 6,493,795 | 6,493,795 |

## 2. Application of optimism Bias

| | | | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Preferred Option | Capex | Civils | 9,639,367 | 0 | 0 | 0 | 0 | 297,784 | 0 | 0 | 0 | 0 |
| Preferred Option | | IT | 33,914 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Preferred Option | opex | Civils | 451,060 | 451,060 | 451,060 | 451,060 | 451,060 | 451,060 | 451,060 | 451,060 | 451,060 | 451,060 |
| Preferred Option | | IT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CAZ D | Capex | Civils | 32,231,463 | 0 | 0 | 0 | 0 | 5,445,830 | 0 | 0 | 0 | 0 |
| CAZ D | | IT | 13,917,383 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CAZ D | opex | Civils | 345,389 | 345,389 | 345,389 | 345,389 | 345,389 | 345,389 | 345,389 | 345,389 | 345,389 | 345,389 |
| CAZ D | | IT | 13,312,280 | 13,312,280 | 13,312,280 | 13,312,280 | 13,312,280 | 13,312,280 | 13,312,280 | 13,312,280 | 13,312,280 | 13,312,280 |

## 3.Projection of implementation costs (discounted)

| | | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
| Preferred Option | PV | 10,124,341 | 451,060 | 451,060 | 451,060 | 451,060 | 748,844 | 451,060 | 451,060 | 451,060 | 451,060 |
| | NPV | 14,481,663 | | | | | | | | | |
| CAZ D | PV | 63,108,558 | 14,411,737 | 14,411,737 | 14,411,737 | 14,411,737 | 20,158,242 | 14,411,737 | 14,411,737 | 14,411,737 | 14,411,737 |
| | NPV | 198,560,697 | | | | | | | | | |

**Notes** Initial inputs assume implementation in 2023 for CAZ, and discount back to 2018 / 2019 prices
In modelling, assume 2022 implementation. So remove one year of discounting / price base adjustment

| | | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Preferred ( | PV | 10,124 | 451 | 451 | 451 | 451 | 749 | 451 | 451 | 451 | 451 |
| | NPV | 14,482 | | | | | | | | | |
| CAZ D | PV | 63,109 | 14,412 | 14,412 | 14,412 | 14,412 | 20,158 | 14,412 | 14,412 | 14,412 | 14,412 |
| | NPV | 198,561 | | | | | | | | | |

# 7. TUBA

## Sheet explanation

This sheet compiles TUBA Model Outputs provided by SWECO for use in the CBA

## 1. Travel time, fuel and non-VOC operating

**Preferred Option**

| impact | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|
| Time | - 5,704,507 | - 5,392,689 | - 5,100,511 | - 4,825,439 | - 4,734,278 | - 4,649,856 | - 4,571,564 | - 4,496,746 | - 4,427,230 | - 4,358,527 |
| OPEX | - 392,750 | - 379,332 | - 366,114 | - 353,400 | - 341,506 | - 330,000 | - 318,815 | - 308,062 | - 297,566 | - 287,342 |
| Fuel | - 587,667 | - 570,114 | - 551,535 | - 532,303 | - 511,296 | - 488,684 | - 466,218 | - 447,839 | - 428,482 | - 407,319 |
| Indirect tax | 412,259 | 342,105 | 274,466 | 209,565 | 198,172 | 187,056 | 176,053 | 166,218 | 156,741 | 147,327 |

**CAZ D**

| impact | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | 5,775,733 | 4,740,719 | 3,756,514 | 2,816,668 | 2,763,560 | 2,714,214 | 2,668,568 | 2,624,779 | 2,584,215 | 2,544,140 | 32,989,110 |
| OPEX | 3,610,365 | 3,201,385 | 2,815,761 | 2,452,794 | 2,369,739 | 2,289,634 | 2,212,177 | 2,137,321 | 2,065,008 | 1,995,153 | 25,149,336 |
| Fuel | - 195,787 | - 144,080 | - 96,267 | - 52,987 | - 51,391 | - 49,952 | - 48,390 | - 47,324 | - 46,649 | - 45,767 | - 778,595 |
| Indirect tax | - 3,644,673 | - 3,175,924 | - 2,734,598 | - 2,319,974 | - 2,198,642 | - 2,081,651 | - 1,964,673 | - 1,860,512 | - 1,759,380 | - 1,659,405 | - 23,399,431 |

**CAZ D 0% Upgrade Sensitivity**

| impact | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | 10,250,120.30 | 9,431,088.34 | 8,659,043.80 | 7,927,121.06 | 7,777,476.90 | 7,638,817.74 | 7,510,405.53 | 7,387,364.12 | 7,272,995.24 | 7,160,197.66 | 81,014,630.70 |
| OPEX | 6,772,968.44 | 6,026,768.31 | 5,323,264.59 | 4,660,619.15 | 4,502,901.63 | 4,350,504.98 | 4,203,430.75 | 4,061,363.74 | 3,923,899.83 | 3,791,193.48 | 47,616,914.89 |
| Fuel | - 119,156.09 | - 21,408.28 | 68,473.72 | 149,929.71 | 143,159.26 | 135,855.17 | 128,304.54 | 122,044.34 | 114,470.30 | 106,626.32 | 828,299.00 |
| Indirect tax | - 6,482,103.00 | - 5,671,826.27 | - 4,908,944.23 | -4,191,815.35 | -3,970,849.80 | - 3,758,035.62 | -3,545,344.71 | -3,356,043.74 | - 3,172,065.20 | -2,990,369.48 | - 42,047,397.40 |

Email from Sweco 4/5 @ 9:18
NOTE: The cost of any EU Allowances (EUAs) purchased to cover traded emissions (i.e. emissions from sectors covered by the EU Emissions Trading System) will be reflected in the purchase price of traded sector goods (such as electricity). Since the purchase price is used in the costs, considered in transport appraisal, the cost of the relevant EUAs will be included in the cost benefit analysis, "internalising" the costs of emissions from traded sectors.
The CO2 EMISSIONS BY TIME PERIOD TRADED reported in the table below are therefore provided for information purposes only - they are not included in the Economic Efficiency of the Transport System (TEE) table.
For further information, please refer to TAG Unit A-3 para. 4.1.5 and 4.2.9

## 2. GHG impacts

**CAZ D compliant** *(2018 price base year, 2019 discount year)*

| | | Emissions | | | Cost (£000s) | | |
|---|---|---|---|---|---|---|---|
| Submode | Year | DM | DS | Increase | DM | DS | Increase |
| AM peak | 2022 | 505104 | 517895 | 12792 | 21023 | 21555 | 532 |
| AM peak | 2025 | 545952 | 555607 | 9656 | 21349 | 21727 | 378 |
| PM peak | 2022 | 544218 | 557909 | 13691 | 22650 | 23220 | 570 |
| PM peak | 2025 | 588264 | 597083 | 8819 | 23003 | 23348 | 345 |
| Inter-peak | 2022 | 1084231 | 1107568 | 23337 | 45126 | 46098 | 971 |
| Inter-peak | 2025 | 1170370 | 1185341 | 14972 | 45766 | 46351 | 585 |
| Off-peak | 2022 | 562463 | 574570 | 12107 | 23410 | 23914 | 504 |
| Off-peak | 2025 | 607151 | 614917 | 7768 | 23741 | 24045 | 304 |
| AM peak | Total | 5168431 | 5265935 | 97506 | 198373 | 202138 | 3765 |
| PM peak | Total | 5554124 | 5647012 | 92889 | 213201 | 216798 | 3597 |
| Inter-peak | Total | 11125304 | 11283628 | 158324 | 426942 | 433073 | 6131 |
| Off-peak | Total | 5771453 | 5853586 | 82133 | 221484 | 224664 | 3180 |
| | | | | | | Total GHG disbenefit | 16673 |

**CAZ D non-compliant** *(2018 price base year, 2019 discount year)*

| | | Emissions | | | Cost (£000s) | | |
|---|---|---|---|---|---|---|---|
| Submode | Year | DM | DS | Increase | DM | DS | Increase |
| AM peak | 2022 | 201784 | 184543 | -17241 | 8398 | 7680 | -718 |
| AM peak | 2025 | 127844 | 114411 | -13433 | 4999 | 4474 | -526 |
| PM peak | 2022 | 221935 | 203555 | -18380 | 9237 | 8473 | -765 |
| PM peak | 2025 | 140711 | 128819 | -11892 | 5502 | 5037 | -465 |
| Inter-peak | 2022 | 412309 | 382167 | -30142 | 17161 | 15906 | -1255 |
| Inter-peak | 2025 | 258318 | 239047 | -19271 | 10102 | 9348 | -754 |
| Off-peak | 2022 | 213892 | 198256 | -15636 | 8902 | 8251 | -651 |
| Off-peak | 2025 | 134006 | 124010 | -9997 | 5240 | 4850 | -392 |
| AM peak | Total | 1357667 | 1223147 | -134519 | 52581 | 47388 | -5193 |
| PM peak | Total | 1491771 | 1366736 | -125036 | 57779 | 52937 | -4842 |
| Inter-peak | Total | 2756695 | 2552935 | -203758 | 106778 | 98887 | -7891 |
| Off-peak | Total | 1430085 | 1324381 | -105703 | 55393 | 51299 | -4093 |
| | | | | | | Total GHG benefit | -22018 |

**Option 4+ compliant** *(2018 price base year, 2019 discount year)*

| | | Emissions | | | Cost (£000s) | | |
|---|---|---|---|---|---|---|---|
| Submode | Year | DM | DS | Increase | DM | DS | Increase |
| AM peak | 2022 | 427844 | 428537 | 693 | 17807 | 17837 | 28 |
| AM peak | 2025 | 462445 | 463071 | 626 | 18083 | 18108 | 25 |
| PM peak | 2022 | 423695 | 424315 | 619 | 17634 | 17660 | 27 |
| PM peak | 2025 | 457986 | 458655 | 668 | 17908 | 17935 | 27 |
| Inter-peak | 2022 | 769083 | 769401 | 318 | 32009 | 32023 | 12 |
| Inter-peak | 2025 | 830185 | 829772 | -413 | 32463 | 32446 | -16 |
| AM peak | Total | 4377886 | 4383980 | 6093 | 168030 | 168264 | 234 |
| PM peak | Total | 4324100 | 4330396 | 6296 | 165984 | 166226 | 242 |
| Inter-peak | Total | 7891577 | 7888901 | -2676 | 302846 | 302746 | -98 |
| | | | | | | Total GHG disbenefit | 378 |

**Option 4+ non-compliant** *(2018 price base year, 2019 discount year)*

| | | Emissions | | | Cost (£000s) | | |
|---|---|---|---|---|---|---|---|
| Submode | Year | DM | DS | Increase | DM | DS | Increase |
| AM peak | 2022 | 170920 | 171219 | 300 | 7114 | 7126 | 12 |
| AM peak | 2025 | 108290 | 108466 | 178 | 4235 | 4241 | 6 |
| PM peak | 2022 | 172784 | 173059 | 275 | 7192 | 7203 | 11 |
| PM peak | 2025 | 109549 | 109736 | 187 | 4283 | 4291 | 8 |
| Inter-peak | 2022 | 292465 | 292540 | 75 | 12172 | 12176 | 3 |
| Inter-peak | 2025 | 183234 | 183181 | -53 | 7165 | 7164 | -2 |
| AM peak | Total | 1150004 | 1151924 | 1922 | 44539 | 44613 | 75 |
| PM peak | Total | 1161402 | 1163354 | 1952 | 44982 | 45059 | 75 |
| Inter-peak | Total | 1955421 | 1955159 | -264 | 75740 | 75731 | -9 |
| | | | | | | Total GHG disbenefit | 140 |

**No upgrade compliant** *(2018 price base year, 2019 discount year)*

| | | Emissions | | | Cost (£000s) | | |
|---|---|---|---|---|---|---|---|
| Submode | Year | DM | DS | Increase | DM | DS | Increase |
| AM peak | 2022 | 505104 | 504262 | -843 | 21023 | 20987 | -34 |
| AM peak | 2025 | 545952 | 545137 | -816 | 21349 | 21316 | -31 |
| PM peak | 2022 | 544218 | 543377 | -841 | 22650 | 22616 | -34 |
| PM peak | 2025 | 588264 | 587652 | -612 | 23003 | 22980 | -23 |
| Inter-peak | 2022 | 1084231 | 1083346 | -885 | 45126 | 45090 | -37 |
| Inter-peak | 2025 | 1170370 | 1169745 | -624 | 45766 | 45741 | -25 |
| Off-peak | 2022 | 562463 | 562005 | -459 | 23410 | 23392 | -19 |
| Off-peak | 2025 | 607151 | 606826 | -325 | 23741 | 23729 | -12 |
| AM peak | Total | 5168431 | 5160534 | -7895 | 198373 | 198069 | -304 |
| PM peak | Total | 5554124 | 5547827 | -6298 | 213201 | 212958 | -243 |
| Inter-peak | Total | 11125304 | 11118799 | -6505 | 426942 | 426691 | -251 |
| Off-peak | Total | 5771453 | 5768078 | -3375 | 221484 | 221354 | -131 |
| | | | | | | Total GHG benefit | -930 |

**No upgrade non-compliant** *(2018 price base year, 2019 discount year)*

| | | Emissions | | | Cost (£000s) | | |
|---|---|---|---|---|---|---|---|
| Submode | Year | DM | DS | Increase | DM | DS | Increase |
| AM peak | 2022 | 201784 | 195009 | -6775 | 8398 | 8117 | -282 |
| AM peak | 2025 | 127844 | 122038 | -5805 | 4999 | 4772 | -226 |
| PM peak | 2022 | 221935 | 214457 | -7477 | 9237 | 8925 | -311 |
| PM peak | 2025 | 140711 | 135886 | -4826 | 5502 | 5313 | -189 |
| Inter-peak | 2022 | 412309 | 400934 | -11375 | 17161 | 16687 | -473 |
| Inter-peak | 2025 | 258318 | 251001 | -7317 | 10102 | 9815 | -286 |
| Off-peak | 2022 | 213892 | 207991 | -5901 | 8902 | 8657 | -245 |
| Off-peak | 2025 | 134006 | 130211 | -3795 | 5240 | 5091 | -148 |
| AM peak | Total | 1357667 | 1301121 | -56545 | 52581 | 50402 | -2180 |
| PM peak | Total | 1491771 | 1441194 | -50578 | 57779 | 55819 | -1958 |
| Inter-peak | Total | 2756695 | 2679932 | -76761 | 106778 | 103804 | -2973 |
| Off-peak | Total | 1430085 | 1390263 | -39821 | 55393 | 53850 | -1542 |
| | | | | | | Total GHG benefit | -8652 |

Source: TUBA outputs (Tara email 11/3)

## 3. User charges and revenue

Prices are in 2018 price base, 2019 discount year

### 3a. CAZ D

Annualised Cost to User (CAZ D)

| | Car Business | Car Commuting | Car Other | Taxi | LGV Personal | LGV Freight | HGV | Buses | Total |
|---|---|---|---|---|---|---|---|---|---|
| 2022 | £1,354,251.28 | £7,165,605.29 | £17,153,380.55 | £7,650.00 | £2,057,842.66 | £13,159,688.59 | £1,950,806.90 | £155,035.46 | **£43,004,260.72** |
| 2023 | £1,181,785.85 | £6,253,057.36 | £14,968,878.15 | £7,048.88 | £1,864,767.53 | £11,924,993.34 | £1,419,605.54 | £125,316.78 | **£37,745,453.42** |
| 2024 | £1,019,436.09 | £5,394,033.41 | £12,912,504.12 | £6,479.66 | £1,682,397.37 | £10,758,755.27 | £922,100.00 | £97,430.77 | **£32,793,136.70** |
| 2025 | £866,715.08 | £4,585,957.02 | £10,978,090.86 | £5,940.88 | £1,510,228.98 | £9,657,756.38 | £456,618.78 | £71,287.46 | **£28,132,595.43** |
| 2026 | £697,838.23 | £3,692,396.95 | £8,839,042.56 | £4,783.31 | £1,215,965.36 | £7,775,971.32 | £367,647.97 | £57,397.31 | **£22,651,043.02** |
| 2027 | £539,391.87 | £2,854,026.63 | £6,832,110.19 | £3,697.25 | £939,876.61 | £6,010,412.62 | £284,172.35 | £44,365.07 | **£17,508,052.58** |
| 2028 | £390,863.67 | £2,068,135.24 | £4,950,804.48 | £2,679.16 | £681,070.01 | £4,355,371.46 | £205,921.99 | £32,148.60 | **£12,686,994.62** |
| 2029 | £251,764.04 | £1,332,132.20 | £3,188,923.98 | £1,725.71 | £438,692.43 | £2,805,392.25 | £132,638.96 | £20,707.63 | **£8,171,977.21** |
| 2030 | £121,625.14 | £643,542.13 | £1,540,542.99 | £833.68 | £211,928.71 | £1,355,261.95 | £64,076.79 | £10,003.69 | **£3,947,815.08** |
| 2031 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | **£0.00** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| £1.35 | £7.17 | £17.15 | £0.01 | £2.06 | £13.16 | £1.95 | £0.16 | £43.00 |
| £1.18 | £6.25 | £14.97 | £0.01 | £1.86 | £11.92 | £1.42 | £0.13 | £37.75 |
| £1.02 | £5.39 | £12.91 | £0.01 | £1.68 | £10.76 | £0.92 | £0.10 | £32.79 |
| £0.87 | £4.59 | £10.98 | £0.01 | £1.51 | £9.66 | £0.46 | £0.07 | £28.13 |
| £0.70 | £3.69 | £8.84 | £0.00 | £1.22 | £7.78 | £0.37 | £0.06 | £22.65 |
| £0.54 | £2.85 | £6.83 | £0.00 | £0.94 | £6.01 | £0.28 | £0.04 | £17.51 |
| £0.39 | £2.07 | £4.95 | £0.00 | £0.68 | £4.36 | £0.21 | £0.03 | £12.69 |
| £0.25 | £1.33 | £3.19 | £0.00 | £0.44 | £2.81 | £0.13 | £0.02 | £8.17 |
| £0.12 | £0.64 | £1.54 | £0.00 | £0.21 | £1.36 | £0.06 | £0.01 | £3.95 |
| £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 |

Annualised Revenue (CAZ D)

| | Car Business | Car Commuting | Car Other | Taxi | LGV Personal | LGV Freight | HGV | Buses | Total |
|---|---|---|---|---|---|---|---|---|---|
| 2022 | £1,327,258.73 | £7,034,575.91 | £16,839,715.94 | £7,497.52 | £2,029,931.74 | £12,964,718.40 | £1,935,089.10 | £150,845.16 | **£42,289,632.51** |
| 2023 | £1,158,230.83 | £6,138,714.72 | £14,695,159.09 | £6,908.38 | £1,839,475.33 | £11,748,316.04 | £1,408,167.67 | £121,929.72 | **£37,116,901.77** |
| 2024 | £999,116.98 | £5,295,398.78 | £12,676,387.66 | £6,350.51 | £1,659,578.69 | £10,599,356.63 | £914,670.57 | £94,797.41 | **£32,245,657.23** |
| 2025 | £849,439.96 | £4,502,098.77 | £10,777,346.84 | £5,822.46 | £1,489,745.45 | £9,514,669.82 | £452,939.77 | £69,360.70 | **£27,661,423.78** |
| 2026 | £683,929.12 | £3,624,878.24 | £8,677,412.91 | £4,687.97 | £1,199,472.99 | £7,660,764.75 | £364,685.81 | £55,845.98 | **£22,271,677.76** |
| 2027 | £528,640.86 | £2,801,838.25 | £6,707,179.06 | £3,623.55 | £927,128.88 | £5,921,364.06 | £281,882.75 | £43,165.97 | **£17,214,823.39** |
| 2028 | £383,073.09 | £2,030,317.57 | £4,860,274.68 | £2,625.76 | £671,832.52 | £4,290,843.52 | £204,262.86 | £31,279.69 | **£12,474,509.70** |
| 2029 | £246,745.95 | £1,307,772.99 | £3,130,611.71 | £1,691.31 | £432,742.36 | £2,763,828.35 | £131,570.28 | £20,147.95 | **£8,035,110.92** |
| 2030 | £119,200.94 | £631,774.39 | £1,512,372.81 | £817.06 | £209,054.28 | £1,335,182.78 | £63,560.52 | £9,733.31 | **£3,881,696.10** |
| 2031 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | **£0.00** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| £1.33 | £7.03 | £16.84 | £0.01 | £2.03 | £12.96 | £1.94 | £0.15 | £42.29 |
| £1.16 | £6.14 | £14.70 | £0.01 | £1.84 | £11.75 | £1.41 | £0.12 | £37.12 |
| £1.00 | £5.30 | £12.68 | £0.01 | £1.66 | £10.60 | £0.91 | £0.09 | £32.25 |
| £0.85 | £4.50 | £10.78 | £0.01 | £1.49 | £9.51 | £0.45 | £0.07 | £27.66 |
| £0.68 | £3.62 | £8.68 | £0.00 | £1.20 | £7.66 | £0.36 | £0.06 | £22.27 |
| £0.53 | £2.80 | £6.71 | £0.00 | £0.93 | £5.92 | £0.28 | £0.04 | £17.21 |
| £0.38 | £2.03 | £4.86 | £0.00 | £0.67 | £4.29 | £0.20 | £0.03 | £12.47 |
| £0.25 | £1.31 | £3.13 | £0.00 | £0.43 | £2.76 | £0.13 | £0.02 | £8.04 |
| £0.12 | £0.63 | £1.51 | £0.00 | £0.21 | £1.34 | £0.06 | £0.01 | £3.88 |
| £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 |

### 3b. CAZ D (no upgrade)

Annualised Cost to User (No upgrade)

| | Car Business | Car Commuting | Car Other | Taxi | LGV personal | LGV Freight | HGV | Buses | Total |
|---|---|---|---|---|---|---|---|---|---|
| 2022 | £2,561,938.91 | £13,555,713.97 | £32,450,338.94 | £28,210.39 | £3,734,882.87 | £23,884,185.37 | £6,489,330.73 | £155,035.46 | **£82,859,636.63** |
| 2023 | £2,235,686.75 | £11,829,450.72 | £28,317,924.56 | £26,000.22 | £3,363,640.19 | £21,510,127.25 | £4,772,945.71 | £125,316.78 | **£72,181,092.17** |
| 2024 | £1,928,570.24 | £10,204,437.93 | £24,427,888.53 | £23,907.27 | £3,013,234.68 | £19,269,320.68 | £3,165,223.82 | £97,430.77 | **£62,130,013.92** |
| 2025 | £1,639,668.28 | £8,675,801.82 | £20,768,563.74 | £21,926.13 | £2,682,681.60 | £17,155,468.32 | £1,660,778.64 | £71,287.46 | **£52,676,176.00** |
| 2026 | £1,320,183.80 | £6,985,347.68 | £16,721,870.97 | £17,653.89 | £2,159,969.09 | £13,812,776.43 | £1,337,180.87 | £57,397.31 | **£42,412,380.04** |
| 2027 | £1,020,431.92 | £5,399,302.55 | £12,925,117.66 | £13,645.52 | £1,669,541.32 | £10,676,542.17 | £1,033,569.75 | £44,365.07 | **£32,782,515.97** |
| 2028 | £739,443.42 | £3,912,538.08 | £9,366,027.29 | £9,888.06 | £1,209,812.55 | £7,736,624.76 | £748,963.59 | £32,148.60 | **£23,755,446.35** |
| 2029 | £476,292.06 | £2,520,153.35 | £6,032,867.82 | £6,369.12 | £779,267.34 | £4,983,333.18 | £482,424.21 | £20,707.63 | **£15,301,414.72** |
| 2030 | £230,092.78 | £1,217,465.39 | £2,914,428.90 | £3,076.87 | £376,457.65 | £2,407,407.33 | £233,055.17 | £10,003.69 | **£7,391,987.79** |
| 2031 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | **£0.00** |

Annualised Revenue (No upgrade)

| | Car Business | Car Commuting | Car Other | Taxi | LGV personal | LGV Freight | HGV | Buses | Total |
|---|---|---|---|---|---|---|---|---|---|
| 2022 | £2,510,875.07 | £13,307,835.85 | £31,856,956.04 | £27,648.11 | £3,684,225.93 | £23,530,324.10 | £6,437,045.71 | £150,845.16 | **£81,505,755.96** |
| 2023 | £2,191,125.68 | £11,613,138.84 | £27,800,106.47 | £25,481.99 | £3,318,018.49 | £21,191,439.35 | £4,734,489.73 | £121,929.72 | **£70,995,730.26** |
| 2024 | £1,890,130.53 | £10,017,840.84 | £23,981,203.16 | £23,430.75 | £2,972,365.60 | £18,983,831.93 | £3,139,721.37 | £94,797.41 | **£61,103,321.59** |
| 2025 | £1,606,986.88 | £8,517,157.17 | £20,388,792.34 | £21,489.11 | £2,646,295.88 | £16,901,297.80 | £1,647,397.62 | £69,360.70 | **£51,798,777.51** |
| 2026 | £1,293,870.28 | £6,857,614.47 | £16,416,096.89 | £17,302.02 | £2,130,673.01 | £13,608,130.28 | £1,326,407.10 | £55,845.98 | **£41,705,940.02** |
| 2027 | £1,000,092.97 | £5,300,571.57 | £12,688,770.55 | £13,373.54 | £1,646,897.01 | £10,518,361.57 | £1,025,242.20 | £43,165.97 | **£32,236,475.38** |
| 2028 | £724,705.05 | £3,840,993.89 | £9,194,761.26 | £9,690.97 | £1,193,403.63 | £7,622,001.13 | £742,929.13 | £31,279.69 | **£23,359,764.77** |
| 2029 | £466,798.74 | £2,474,070.14 | £5,922,551.54 | £6,242.17 | £768,697.99 | £4,909,501.54 | £478,537.28 | £20,147.95 | **£15,046,547.35** |
| 2030 | £225,506.64 | £1,195,202.97 | £2,861,136.01 | £3,015.54 | £371,351.69 | £2,371,739.87 | £231,177.43 | £9,733.31 | **£7,268,863.46** |
| 2031 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | £0.00 | **£0.00** |

Source: Email from Eva @ Sweco (6/5 @15:41)

**Bus Gate Revenue**

| | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2018 price base, 2019 discount year, in market prices | £86,622.94 | £40,269.60 | £38,907.83 | £37,592.11 | £36,320.88 | £35,092.63 | £33,905.93 | £32,759.35 | £31,651.54 | £30,581.20 |

Email from Sweco (6/5 @ 12:48)

# 8. Bus Retrofits

## Sheet explanation

This sheet compiles Off Model Cost data produced by Ricardo to calculate net costs of Bus Retrofit Measures, using cost data provided by SWECO

| Cost | Variable | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upgrade c | Total upgra | - 632,704 | - | - | - | - | - | - | - | - | - |
| Additional | Fuel costs | - | - | - | - 52,132 | - 54,124 | - 55,453 | - | - | - | - |
| | Operationa | - | - | - | - 7,590 | - 7,590 | - 7,590 | - | - | - | - |
| | CO2 Value | - | - | - | - 23,969 | - 24,344 | - 24,718 | - | - | - | - |
| | | - 632,704 | - | - | - 83,691 | - 86,058 | - 87,761 | - | - | - | - |

1. Net Present Value

| | Variable | NPV | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Upgrade c | Total upgra | - 570,663 | - | - | - | - | - | - | - | - | - |
| Additional | Road fuel c | - | - | - | - 42,409 | - 42,541 | - 42,112 | - | - | - | - |
| | Road vehic | - | - | - | - 6,174 | - 5,966 | - 5,764 | - | - | - | - |
| | Road CO2 | - | - | - | - 19,499 | - 19,134 | - 18,771 | - | - | - | - |

3. Summary Table

| Option | Warnings | NPV |
|---|---|---|
| Preferred | | - 773,033 |

# 9. Welfare loss

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|
| OK | DB | 15/04/20 | | |

## Sheet explanation

takes trip data provided by SWECO from the transport model
Combines this with CAZ charge (half) to calculate welfare loss of 'alternative' behavioural responses
Results flow through to summary sheet

## 3b. Number of trips - cancelled (daily

| | CAZ D | DAZ D - no upgrade |
|---|---|---|
| Car | 5,629 | 10,279 |
| LGV | 385 | 823 |
| HGV | 71 | 252 |
| Taxi | 37 | 137 |

Source: Sweco email (9/3 @ 15:23)

## 3b. Number of trips - cancelled (annual)

| | | |
|---|---|---|
| Car | 2,054,610 | 3,751,729 |
| LGV | 140,363 | 300,571 |
| HGV | 25,920 | 91,855 |
| Taxi | 13,501 | 50,128 |

## 6a. Welfare cost rate

| | | | |
|---|---|---|---|
| Car | £/day | £ | 2.50 |
| LGV | £/day | £ | 4.50 |
| HGV | £/day | £ | 17.50 |
| Taxi | £/day | £ | 2.50 |
| | | | - |

## 7. Charges per year - extrapolated

*Projects charge revenue using extrapolation factor - charges reduce as baseline catches up with CAZ scenario*

| Sensitivity | Scenario | | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CAZ D | £/annum | 6,255,507 | 7,912,046 | 8,299,417 | 5,425,824 | 2,700,685 | 990,722 | 263,286 | 50,119 | 6,001 | 511 |
| | CAZ D - no upgrade | £/annum | 12,464,678 | 15,765,485 | 16,537,358 | 10,811,458 | 5,381,366 | 1,974,105 | 524,622 | 99,866 | 11,958 | 1,018 |

# 10. Bus Stop Improvements

## Sheet explanation

Takes benefits of bus stop/RTPI measures provided by SWECO for use in CBA

Source: Sweco model

| | | |
|---|---|---|
| PVB | £ 34,844,455.00 | Source: Bus infrastructure improvement Appraisal Note - Sweco (email 6/3) |
| PVC | £ 3,119,434.00 | |
| **NPV** | **£ 31,725,021.00** | |

2018 prices discounted to 2019 values

## Summary Sheet

| Check-box | Last User | Date | Status | User Comments |
|---|---|---|---|---|
| OK | DB | 15/04/20 | | |

### Sheet explanation

Pulls together outputs from all tabs to produce summary of total costs and benefits by scenario
Price Year - 2018; all results discounted to 2019

| | | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | PV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Discount ra | 1.00 | 0.97 | 0.93 | 0.90 | 0.87 | 0.84 | 0.81 | 0.79 | 0.76 | 0.73 | 0.71 | 0.68 | 0.66 | 0.64 | |

### Preferred option

| | | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | PV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Asset Cost calculations** | | | | | | | | | | | | | | | |
| Total | | | | | | | | | | | | | | | |
| NPV | | | | £0 | - | - | - | - | - | - | - | - | - | - | |
| **Bus Retrofits** | | | | | | | | | | | | | | | |
| Total | | | | | | | | | | | | | | | |
| NPV | | | | -£773,033 | | | | | | | | | | | |
| **Additional costs** | | | | | | | | | | | | | | | |
| CO2 Value | | | | | | | | | | | | | | | £0.00 |
| Fuel Costs | | | | | | | | | | | | | | | £0.00 |
| OPEX | | | | | | | | | | | | | | | £0.00 |
| NPV | | | | - | | | | | | | | | | | |
| **AQ Impacts** | | | | | | | | | | | | | | | |
| NOX | | | | 231,869 | 267,821 | 247,142 | 203,463 | 187,954 | 174,957 | 165,258 | 158,523 | 152,100 | 150,351 | | £1,534,036.50 |
| PM | | | | 168,805 | 217,777 | 184,224 | 117,113 | 90,948 | 68,370 | 50,520 | 36,911 | 23,682 | 17,180 | | £806,646.51 |
| NPV | | | | 2,340,683 | | | | | | | | | | | |
| **Travel Time (TUBA)** | | | | | | | | | | | | | | | |
| Total | | | | -5,704,507 | -5,392,689 | -5,100,511 | -4,825,439 | -4,734,278 | -4,649,856 | -4,571,564 | -4,496,746 | -4,427,230 | -4,358,527 | | |
| NPV | | | | -48,261,346.13 | | | | | | | | | | | |
| **Bus Gate (User Cost)** | | | | | | | | | | | | | | | |
| Total | | | | -86,623 | -40,270 | -38,908 | -37,592 | -36,321 | -35,093 | -33,906 | -32,759 | -31,652 | -30,581 | | |
| NPV | | | | -403,704 | | | | | | | | | | | |
| **Bus Gate (Gov Revenue)** | | | | | | | | | | | | | | | |
| Total | | | | 86,623 | 40,270 | 38,908 | 37,592 | 36,321 | 35,093 | 33,906 | 32,759 | 31,652 | 30,581 | | |
| NPV | | | | 403,704 | | | | | | | | | | | |
| **Bus Stop/RTPI Benefits** | | | | | | | | | | | | | | | |
| Total | | | | | | | | | | | | | | | |
| NPV | | | | 34,844,455 | | | | | | | | | | | |
| **Implementation Costs** | | | | | | | | | | | | | | | |
| Total | | | | -10,124,341 | -451,060 | -451,060 | -451,060 | -451,060 | -748,844 | -451,060 | -451,060 | -451,060 | -451,060 | | |
| NPV | | | | -14,481,663 | | | | | | | | | | | |
| **Indirect tax (user)** | | | | | | | | | | | | | | | |
| Total | | | | -412,259 | -342,105 | -274,466 | -209,565 | -198,172 | -187,056 | -176,053 | -166,218 | -156,741 | -147,327 | | |
| NPV | | | | -2,269,962.27 | | | | | | | | | | | |
| **Indirect tax (PA)** | | | | | | | | | | | | | | | |
| Total | | | | 412,259 | 342,105 | 274,466 | 209,565 | 198,172 | 187,056 | 176,053 | 166,218 | 156,741 | 147,327 | | |
| NPV | | | | 2,269,962.27 | | | | | | | | | | | |
| **CO2 (TUBA)** | | | | | | | | | | | | | | | |
| Total | | | | | | | | | | | | | | | |
| NPV | | | | -£518,043 | | | | | | | | | | | |
| **Fuel VOC (TUBA)** | | | | | | | | | | | | | | | |
| Total | | | | -587,667 | -570,114 | -551,535 | -532,303 | -511,296 | -488,684 | -466,218 | -447,839 | -428,482 | -407,319 | | |
| NPV | | | | -4,991,456.59 | | | | | | | | | | | |
| **Non-Fuel VOC (TUBA)** | | | | | | | | | | | | | | | |
| Total | | | | -392,750 | -379,332 | -366,114 | -353,400 | -341,506 | -330,000 | -318,815 | -308,062 | -297,566 | -287,342 | | |
| NPV | | | | -3,374,886.77 | | | | | | | | | | | |
| Total NPV | Asset Cost + Additional Costs + AQ Impacts + Implementation | | | -35,215,291 | | | | | | | | | | | |

### CAZ D

| | | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | PV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Asset Cost calculations** | | | | | | | | | | | | | | | |
| Total | | | | -29,268,768 | - | - | - | - | - | - | - | - | - | | |
| NPV | | | | -£26,398,752 | - | - | - | - | - | - | - | - | - | | |
| **Bus Retrofits** | | | | | | | | | | | | | | | |
| Total | | | | | | | | | | | | | | | |
| NPV | | | | £0 | | | | | | | | | | | |
| **Additional costs** | | | | | | | | | | | | | | | |
| CO2 Value | | | | 1,883,068 | 1,869,391 | -93,140 | -94,596 | -96,051 | 8,470 | - | - | - | - | | £3,103,046.90 |
| Fuel Costs | | | | 2,424,940 | 2,362,851 | -457,818 | -460,984 | -467,318 | 20,890 | - | - | - | - | | £3,134,320.36 |
| Non Fuel VOCs | | | | 2,230,159 | 2,215,986 | 58,957 | 58,957 | 58,957 | 2,462 | - | - | - | - | | £4,088,391.31 |
| NPV | | | | 10,325,759 | | | | | | | | | | | |
| **AQ Impacts** | | | | | | | | | | | | | | | |
| NOX | | | | 1,787,691 | 2,306,317 | 1,950,975 | 1,240,256 | 963,167 | 724,054 | 535,020 | 390,900 | 250,797 | 181,936 | | £8,542,591.46 |
| PM | | | | 2,160,708 | 2,787,550 | 2,358,062 | 1,499,045 | 1,164,140 | 875,134 | 646,656 | 472,464 | 303,127 | 219,899 | | £10,325,075.36 |
| NPV | | | | 18,867,667 | | | | | | | | | | | |
| **Travel time (TUBA)** | | | | | | | | | | | | | | | |
| Total | | | | 5,775,733 | 4,740,719 | 3,756,514 | 2,816,668 | 2,763,560 | 2,714,214 | 2,668,568 | 2,624,779 | 2,584,215 | 2,544,140 | | |
| NPV | | | | 32,989,110 | | | | | | | | | | | |
| **Welfare impacts** | | | | | | | | | | | | | | | |
| Total | | | | -6,255,507 | -7,912,046 | -8,299,417 | -5,425,824 | -2,700,685 | -990,722 | -263,286 | -50,119 | -6,001 | -511 | | -£27,047,037.04 |
| NPV | | | | -27,047,037 | | | | | | | | | | | |
| **CAZ Charge (User Cost)** | | | | | | | | | | | | | | | |
| Total | | | | -43,004,261 | -37,745,453 | -32,793,137 | -28,132,595 | -22,651,043 | -17,508,053 | -12,686,995 | -8,171,977 | -3,947,815 | - | | |
| NPV | | | | -206,641,329 | | | | | | | | | | | |
| **CAZ Charge (Gov Revenue)** | | | | | | | | | | | | | | | |
| Total | | | | 42,289,633 | 37,116,902 | 32,245,657 | 27,661,424 | 22,271,678 | 17,214,823 | 12,474,510 | 8,035,111 | 3,881,696 | - | | |
| NPV | | | | 203,191,433 | | | | | | | | | | | |
| **Implementation Costs** | | | | | | | | | | | | | | | |
| Total | | | | -63,108,558 | -14,411,737 | -14,411,737 | -14,411,737 | -14,411,737 | -20,158,242 | -14,411,737 | -14,411,737 | -14,411,737 | -14,411,737 | | |
| NPV | | | | -198,560,697 | | | | | | | | | | | |
| **Indirect tax (user)** | | | | | | | | | | | | | | | |
| Total | | | | 3,644,673 | 3,175,924 | 2,734,598 | 2,319,974 | 2,198,642 | 2,081,651 | 1,964,673 | 1,860,512 | 1,759,380 | 1,659,405 | | |
| NPV | | | | 23,399,431.42 | | | | | | | | | | | |
| **Indirect tax (PA)** | | | | | | | | | | | | | | | |
| Total | | | | -3,644,673 | -3,175,924 | -2,734,598 | -2,319,974 | -2,198,642 | -2,081,651 | -1,964,673 | -1,860,512 | -1,759,380 | -1,659,405 | | |
| NPV | | | | -23,399,431.42 | | | | | | | | | | | |
| **CO2 (TUBA)** | | | | | | | | | | | | | | | |
| Total | | | | | | | | | | | | | | | |
| NPV | | | | £5,345,828 | | | | | | | | | | | |
| **Fuel VOC (TUBA)** | | | | | | | | | | | | | | | |
| Total | | | | -195,787 | -144,080 | -96,267 | -52,987 | -51,391 | -49,952 | -48,390 | -47,324 | -46,649 | -45,767 | | |
| NPV | | | | -778,595 | | | | | | | | | | | |
| **Non-Fuel VOC (TUBA)** | | | | | | | | | | | | | | | |
| Total | | | | 3,610,365 | 3,201,385 | 2,815,761 | 2,452,794 | 2,369,739 | 2,289,634 | 2,212,177 | 2,137,321 | 2,065,008 | 1,995,153 | | |
| NPV | | | | 25,149,336 | | | | | | | | | | | |
| Total NPV | Asset Cost + Additional Costs + AQ Impacts + Implementation | | | -163,557,278 | | | | | | | | | | | |

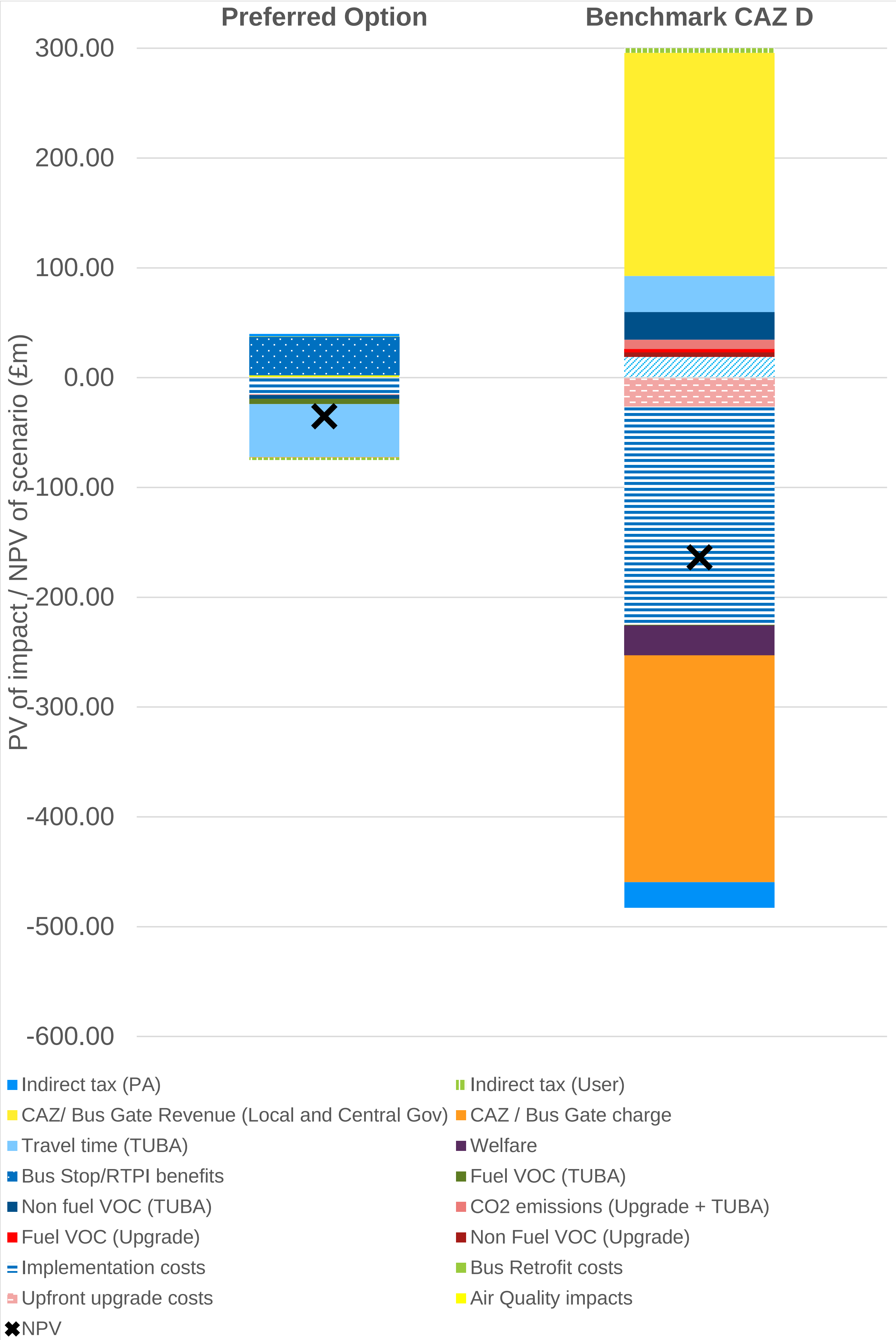
### 6. Summary tables

*Currently not added to NPV* (above CAZ Charge/ Bus Gate and CAZ/ Bus Gate Revenue)

| Option | AQ impacts | Upgrade costs | Bus Retrofits | Implementation costs | Non Fuel VOCs (Upgrade only) | Fuel costs (Upgrade only) | $CO_2$ costs (Upgrade +TUBA) | Non-fuel Vehicle Operating Costs (TUBA) | Fuel VOC (TUBA) | Bus Stop/RTPI | Welfare | Travel Time (TUBA) | CAZ Charge/ Bus Gate | CAZ/ Bus Gate Revenue (Local and Central Gov) | Indirect tax (user) | Indirect tax (PA) | NPV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Preferred | 2,340,683 | 0 | -773,033 | -14,481,663 | 0 | 0 | -518,043 | -3,374,887 | -4,991,457 | 34,844,455 | 0 | -48,261,346 | -403,704 | 403,704 | -2,269,962 | 2,269,962 | -35,215,291 |
| CAZ D | 18,867,667 | -26,398,752 | 0 | ########## | 4,088,391 | 3,134,320 | 8,448,874 | 25,149,336 | -778,595 | 0 | -27,047,037 | 32,989,110 | -206,641,329 | 203,191,433 | 23,399,431 | -23,399,431 | ########## |

| | Air Quality impacts | Upfront upgrade costs | Bus Retrofit costs | Implementation costs | Non Fuel VOC (Upgrade) | Fuel VOC (Upgrade) | $CO_2$ emissions (Upgrade + | Non fuel VOC (TUBA) | Fuel VOC (TUBA) | Bus Stop/RTPI benefits | Welfare | Travel time (TUBA) | CAZ / Bus Gate charge | CAZ/ Bus Gate Revenue (L | Indirect tax (User) | Indirect tax (PA) | NPV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Preferred Option | 2.34 | 0.00 | -0.77 | -14.48 | 0.00 | 0.00 | -0.52 | -3.37 | -4.99 | 34.84 | 0.00 | -48.26 | -0.40 | 0.40 | -2.27 | 2.27 | -35.22 |
| Benchmark CAZ D | 18.87 | -26.40 | 0.00 | -198.56 | 4.09 | 3.13 | 8.45 | 25.15 | -0.78 | 0.00 | -27.05 | 32.99 | -206.64 | 203.19 | 23.40 | -23.40 | -163.56 |

| | Preferred Option | | Benchmark CAZ D | | |
|---|---|---|---|---|---|
| Air Quality impacts | £ | 2.34 | £ | 18.87 | |
| Upfront upgrade costs | £ | - | -£ | 26.40 | |
| Bus Retrofit costs | -£ | 0.77 | £ | - | |
| Implementation costs | -£ | 14.48 | -£ | 198.56 | £19.39 |
| Non Fuel VOC (Upgrade) | £ | - | £ | 4.09 | |
| Fuel VOC (Upgrade) | £ | - | £ | 3.13 | |
| $CO_2$ emissions (Upgrade + TUE | -£ | 0.52 | £ | 8.45 | |
| Non fuel VOC (TUBA) | -£ | 3.37 | £ | 25.15 | |
| Fuel VOC (TUBA) | -£ | 4.99 | -£ | 0.78 | |
| Bus Stop/RTPI benefits | £ | 34.84 | £ | - | |
| Welfare | £ | - | -£ | 27.05 | |
| Travel time (TUBA) | -£ | 48.26 | £ | 32.99 | |
| CAZ / Bus Gate charge | -£ | 0.40 | -£ | 206.64 | |
| CAZ/ Bus Gate Revenue (Local | £ | 0.40 | £ | 203.19 | |
| Indirect tax (User) | -£ | 2.27 | £ | 23.40 | |
| Indirect tax (PA) | £ | 2.27 | -£ | 23.40 | |
| NPV | -£ | 35.22 | -£ | 163.56 | |


Preferred Option
Benchmark CAZ D
300.00
200.00
100.00
0.00
-100.00
-200.00
-300.00
-400.00
-500.00
-600.00
PV of impact / NPV of scenario (£m)
Indirect tax (PA)
Indirect tax (User)
CAZ/ Bus Gate Revenue (Local and Central Gov)
CAZ / Bus Gate charge
Travel time (TUBA)
Welfare
Bus Stop/RTPI benefits
Fuel VOC (TUBA)
Non fuel VOC (TUBA)
CO2 emissions (Upgrade + TUBA)
Fuel VOC (Upgrade)
Non Fuel VOC (Upgrade)
Implementation costs
Bus Retrofit costs
Upfront upgrade costs
Air Quality impacts
NPV

MAY 2020

# NORTH STAFFORDSHIRE LOCAL AIR QUALITY PLAN

## UNAPPROVED OUTLINE BUSINESS CASE
## APPENDIX 36 - E3 Distributional Analysis

Staffordshire County Council

NEWCASTLE UNDER LYME BOROUGH COUNCIL

VIS UNITA FORTIOR

City of Stoke-on-Trent


# North Staffordshire Local Air Quality Plan – Distributional Analysis Report (E3)

Report for Newcastle-under-Lyme Borough Council, Stoke-on-Trent City Council and Staffordshire County Council

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**Customer:**

**Newcastle-under-Lyme Borough Council**

**Customer reference:**

Newcastle-under-Lyme and Stoke-on-Trent Air Quality Local Development Plan

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# 1. Introduction

Newcastle-under-Lyme Borough Council (NuLBC) and Stoke-on-Trent City Council (SoTCC) were identified in the 2015 National Air Quality Plan as two of the 33 councils required to complete a Targeted Feasibility Study. The results of this feasibility study highlighted that compliance with Nitrogen Dioxide ($NO_2$) concentration limits would not be achieved in Stoke-on-Trent until 2023 and Newcastle-under-Lyme until 2026 without intervention. The key areas identified in the Targeted Feasibility study that were modelled to exceed $NO_2$ limits in 2021 are along the A53 (Census IDs: 26555, 28732 and 74058). The feasibility study found that the introduction of measures designed to reduce air pollution along the A53 would bring forward compliance in Newcastle-under-Lyme by one year.

In 2018, NuLBC and SoTCC were issued a Ministerial Direction to produce a local air quality plan to achieve compliance in the shortest time possible. This direction required the Councils to consider a charging Clean Air Zone (CAZ) as a benchmark, against which alternative measures would be assessed. Where actions are identified to tackle air pollution and achieve compliance with legal limits, these must be presented in a Business Case to the Joint Air Quality Unit (JAQU), following the HM Treasury's (HMT) Five Case model. A Strategic Outline Case (SOC) has already been submitted to JAQU.

One of the five cases is the Economics Case. This case must meet the following criteria (taken from the JAQU guidance: 'Business Cases for Local Plans'):

- The short list is to be assessed considering the benefits and costs in detail to identify a preferred option; including a distributional analysis of the option.
- Elements of the economic case are revisited, all changes to the underlying assumptions made in the SOC should be noted.
- All relevant costs and benefits should be evaluated at this stage. Net Present Value (NPV) for each option should be considered.

Relevant annexes will include the full economic model with associated documentation and the outputs of the scenario analysis of the air quality and transport modelling. This allows the assessment of the key Critical Success Factor (CSF) of delivering compliance in the shortest possible time.

JAQU have shared with the Local Authorities detailed guidance around the methodologies and assumptions to adopt when appraising the options directed to produce a $NO_2$ Compliance Plan[1]. This guidance stipulates that deliverables to be provided by the Local Authorities are:

1. SOC: options appraisal - within the SOC, detailing the case for change and a high-level assessment of the options being considered.
2. Economic Appraisal Methodology Report (E1).
3. Economic Model (E2) and any linked documents (linked spreadsheets or user guide).
4. Write-up of the economic appraisal and results.
5. Distributional Analysis Methodology Report (E3).

This plan and supporting analysis must be developed in accordance with the HMT Green Book.

Sweco, together with Ricardo, have been commissioned by NuLBC and SoTCC to deliver the Distributional Analysis Methodology Report (E3). This report sets out the detail of the methodology and data sources used to undertake distributional analysis of the options. The purpose of this report is to meet deliverable E3 of JAQU's requirements as set out above.

[1] Latest version issued 27/11/17

The distributional analysis inherently relies on other areas of the modelling undertaken to support the assessment of policy options, specifically the transport and air quality modelling undertaken. This report clearly references where the distributional analysis has used the outputs of other modelling and describes how these outputs are used. However, it does not set out a detailed account of how this supporting modelling has been undertaken, which has been provided elsewhere (e.g. through the Modelling Needs Assessment reports).

This report sets out the approach and results of the distributional analysis around the Preferred Option compared to a Benchmark CAZ D (described in Section 2). Unlike cost-benefit analysis, which assesses the impacts associated with the policy options in an aggregate way using average values, distributional analysis seeks to understand whether there are any specific patterns in the distribution of the impacts, and to explore whether any option unduly favours or disadvantages a particular demographic group. This can inform measures to mitigate the impact of the policy on those groups or amendment of the policy itself.

The JAQU Guidance stipulates that distributional analysis is necessary for local feasibility studies in two respects:

- To investigate the distributional impacts of measures proposed to achieve compliance with air quality limits, thereby fulfilling the public-sector equality duty; and
- To show how mitigation measures alleviate those impacts.

# 2. Methodology

## 2.1. Overview

JAQU have provided detailed guidance regarding the appraisal of policy options. This provides a steer for many of the key data inputs and assumptions that have formed the analysis undertaken. The key guidance documents include:

- Third wave local authorities – guidance: options appraisal (and preceding versions of this guidance)[2]
- National data inputs for Local Economic Models (2017)[3].

With respect to distributional analysis, the JAQU Guidance strongly leans on supporting Transport Appraisal Guidance (TAG) issued by the Department for Transport (DfT)[4]. The methodology used to undertake the distributional analysis is based on TAG Unit A4-2, Distributional Impact Appraisal. In some cases, alternative methods have been used, or existing approaches expanded upon where this would facilitate or improve the analysis. In particular, this is the case where additional output metrics were deemed useful to convey the distributional impacts of the policy options.

Results have been mapped where appropriate, but in many cases the scale of the map made it difficult to clearly identify the geographic variation of the topic of interest. In these cases, the data has been presented in tabular or graphical form.

The approach used is broadly defined by TAG covering the following three stages: screening, assessment and appraisal. Table 2-1 provides more detail of the stages of the distributional impact assessment process.

**Table 2-1: Distributional impact appraisal process**

| Step | | Description |
|---|---|---|
| Screening | 1 | Identification of likely impacts for each indicator. |
| Full Appraisal | 2 | Assessment:<br>Confirmation of the area impacted by the transport intervention (impact area);<br>Identification of social groups in the impact area (including transport users, people living in those areas affected by the scheme and people travelling in areas affected by the scheme); and<br>Identification of amenities in the impact area. |
| | 3 | Appraisal of Impacts:<br>Core analysis of the impacts; and<br>Full appraisal of DIs and input into AST. |

[2] Unpublished – provided directly by JAQU to Local Authorities
[3] Unpublished – provided directly by JAQU to Local Authorities
[4] DfT (2015): 'WebTAG: TAG unit A4-2 distributional impact appraisal, December 2015'; https://www.gov.uk/government/publications/webtag-tag-unit-a4-2-distributional-impact-appraisal-december-2015

## 2.2. Selecting options for assessment

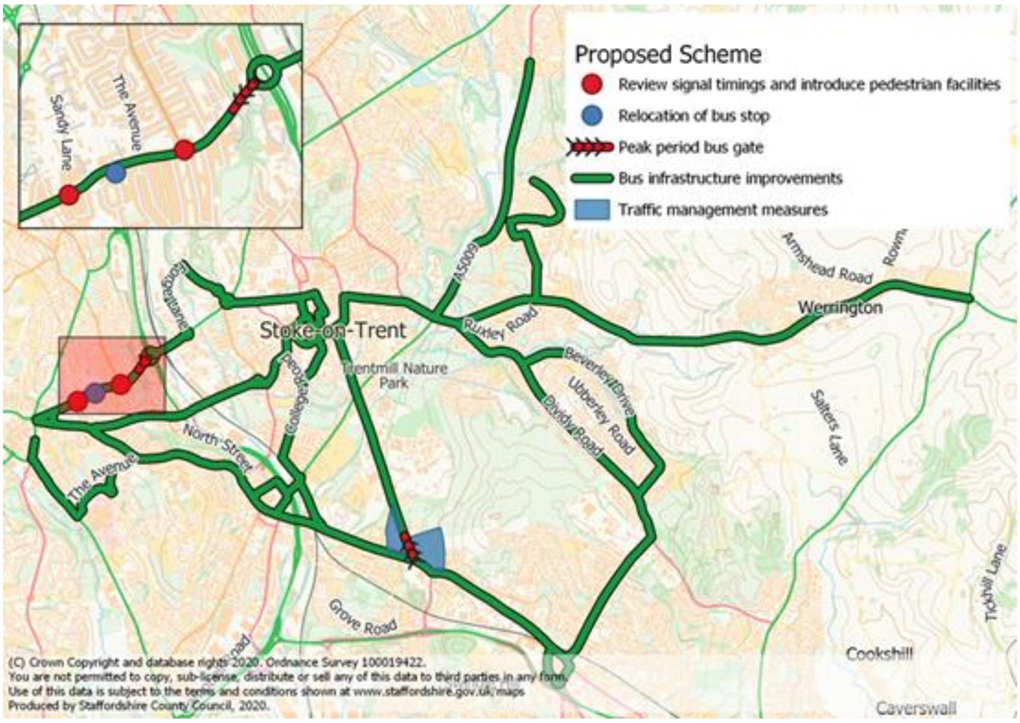
Distributional analysis was performed on the following two options:

The NSLAQP for Stoke-on-Trent and Newcastle-under-Lyme (referred to subsequently as the “Preferred Option”) comprises of a package of measures:

- A50 Victoria Road bus gate, operational Monday to Friday between 07:00-10:00 and 16:00-19:00. ANPR cameras will be used to restrict access except for buses, taxis and cyclists
- A53 Etruria Road two-lane bus gate, operational Monday to Friday between 07:00-10:00 and 16:00-19:00. ANPR cameras will be used to restrict access except for buses, taxis and cyclists
- Traffic management measures on roads to the east and west of Victoria Road, including:
  - Traffic calming
  - One-way restrictions
  - Speed restrictions
  - Weight restrictions
  - Extension of footways
  - Carriageway re-surfacing
- Transport improvements along the A53 Etruria Road in the form of a review of signal times, signalised pedestrian crossing facilities and the relocation of a bus stop to avoid unnecessary queuing
- Targeted bus retrofit programme where 75% of buses using Bucknall New Road and 100% of buses using Victoria Road will be retrofitted to achieve Euro VI emissions standards
- Bus infrastructure improvements will be installed on routes that pass through or are parallel to the identified exceedance locations. The improvements will include Real Time Passenger Information (RTPI) screens, new bus shelters, accessible kerbs at bus stops and installation of CCTV at bus stops.

The locations of the key measures in the Preferred Option are shown in Figure 2-1.

**Figure 2-1: Preferred Option measures**



A ULEV exemption, allowing ultra-low emission vehicles to drive through the bus gate, will be assessed in the air quality model and if considered deliverable, will be added to the scheme in the Full Business Case (FBC). The local authorities will also seek further funding through the Clean Air Fund (CAF) for additional measures that will look to mitigate any impacts that might arise as a result of the preferred scheme.

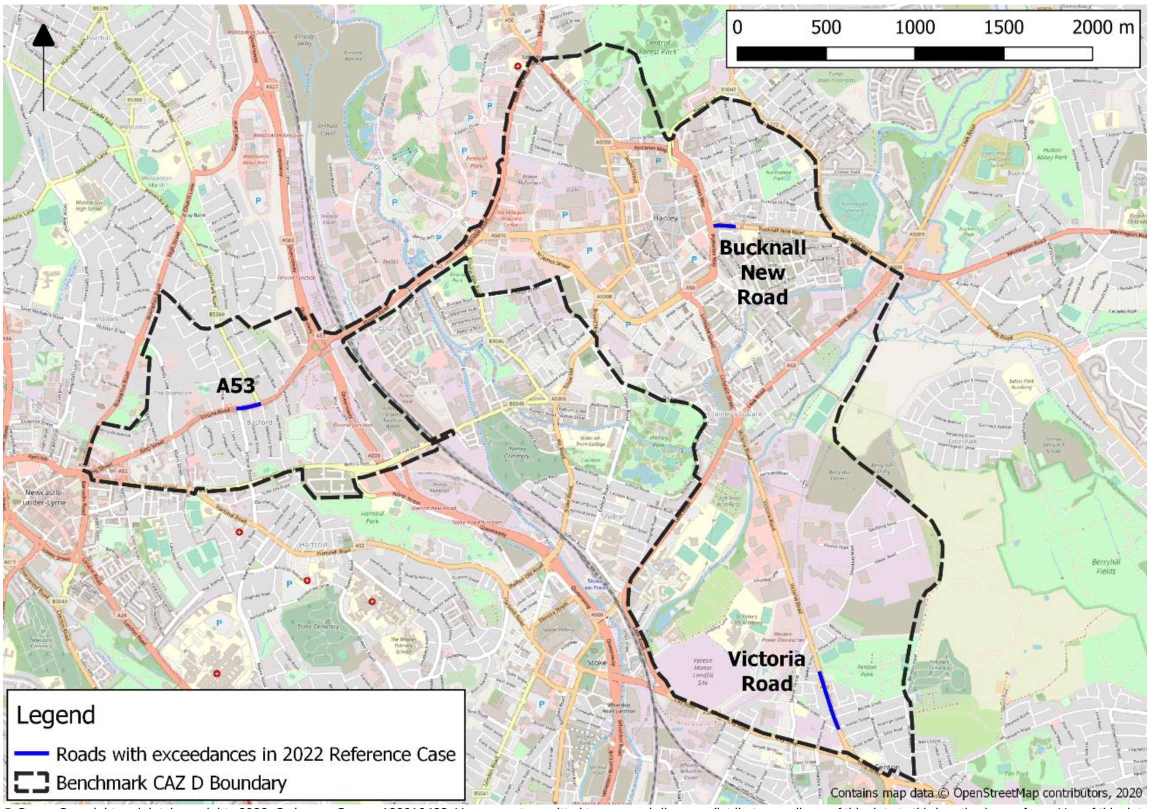
A separate Ministerial Direction concerns the retrofitting of buses operating along the A53 corridor. These are separately funded by JAQU and excluded from this Outline Business Case (OBC).

As required by JAQU guidance, a benchmark CAZ option has also been identified. Based on the work undertaken during the options appraisal stage, the benchmark CAZ was defined as a class D. The boundary is shown in Figure 2-2 below and covers the main areas affected by $NO_2$ in Newcastle-under-Lyme and Stoke-on-Trent including: Hanley, Victoria Road and east Newcastle-under-Lyme, as well as the A53 Etruria Road between Newcastle-under-Lyme and Hanley. The proposed charge rates for non-compliant vehicles would be:

- Cars / Taxis £5
- LGVs £9
- HGVs £35
- Buses £5

These options will be compared to the 2022 Reference Case. This is the 'business as usual' scenario.

**Figure 2-2: Benchmark CAZ D boundary and roads with exceedances in the 2022 Reference Case**



## 2.3. Screening of impacts

The screening process (Stage 1) undertaken has been based on the list of impacts listed in TAG A4.2, taking into account the likely local issues of the final shortlisted options. A summary of the screening is included in Table 2-2 below.

Based on the screening exercise undertaken, the following have been considered within the next stages (Stages 2 and 3) of the distributional analysis:

1. Air quality - changes in concentrations of $NO_2$
2. Affordability for businesses
3. Personal affordability
4. User benefits
5. Road safety
6. Noise
7. Accessibility
8. Severance
9. Security

**Table 2-2: Screening of TAG impacts**

| Impact | Description of impact | Screening assessment<br>Benchmark CAZ | Screening assessment<br>Preferred Option |
|---|---|---|---|
| Air quality | Change in $NO_2$ concentration | There will be changes in concentrations across the conurbation and for different user groups resulting from this option. | There will be changes in concentrations in the area surrounding the measures and for different user groups. |
| **Affordability and user benefits** | | | |
| Affordability for businesses | Changes in costs for businesses | Businesses may react in a number of ways to the implementation of a charging scheme, including through upgrading existing vehicles, paying the daily charge, or avoiding the CAZ charging area, or exiting the market entirely. | There will be rerouting to avoid routes with traffic management, and some private car users may switch to using public transport as a result of the improvements along key routes. |
| User benefits | Changes in vehicle operating costs met by the user | Vehicle changes will be generated by this option and so there will be changes in operating costs (both positive and negative).<br>Possible distributional impacts on travel times where diversion effects generate changes in traffic and journey times on individual links. | Changes in vehicle flows will be generated by this option and so there will be changes in operating costs (both positive and negative).<br>Redirecting the traffic will have both positive and negative impacts on vehicle journey times and wider congestion. |
| Personal affordability | Changes in user charges, including fares, tariffs and tolls | Charging CAZ will have significant impact on costs which will vary by vehicle ownership. | No charges will be applied. |
| **Traffic and transport** | | | |
| Noise | Changes in noise levels – move in line with traffic on roads | Possible distributional impacts where diversion effects generate changes in traffic on individual links. | Possible distributional impacts where diversion effects generate changes in traffic on individual links. |
| Accidents | Changes in accident rates – move in line with traffic / speed on roads | Possible distributional impacts where diversion effects generate changes in traffic on individual links. | Possible distributional impacts where diversion effects generate changes in traffic on individual links. |
| Security | Any change in public transport (PT) waiting / interchange facilities including pedestrian access expected to affect user perceptions of personal security | Charging CAZ will not directly impact on PT facilities and hence security. | This option encourages increase in use of Public Transport through the introduction of 71 new CCTV cameras. This will impact both security and perception of security among public transport users. There is evidence for differential experiences of security on public transport for some groups, such as women and some ethnic minorities. |

| | | | |
|---|---|---|---|
| Severance | Introduction or removal of barriers to pedestrian movement, either through changes to road crossing provision, or through introduction of new public transport or road corridors | CAZ will not impact on physical road crossings. Reductions in traffic flows inside the CAZ may improve the ability of pedestrians to maintain a desire line. | Pedestrian crossing facilities will be delivered at two signalised junctions along A53 Etruria Road. Anecdotal evidence from resident comments shows there is a latent demand for these facilities. The reduction in traffic flows when the bus gates are in operation will enable pedestrians to cross the road more easily and maintain desire lines. Access to the retail facilities along A50 Victoria Road will be easier for pedestrians. |
| Accessibility | Changes in routings or timings of current public transport services, any changes to public transport provision, including routing, frequencies, waiting facilities (bus stops / rail stations) and rolling stock, or any indirect impacts on accessibility to services (e.g. demolition & re-location of a school) | The charging scheme is not expected to change public transport services or impact on physical access to services. Could be indirect impacts on public transport provision if services are withdrawn, but bus charges set at level to minimise impact on bus operations. | No proposed changes to timing or routings of PT services. However, the Preferred Option includes a series of bus infrastructure improvements designed to improve accessibility. |
| **Key** | | | |
| Impacts screened in | | | |
| Impacts screened out | | | |

## 2.4. Approach to assessing impacts

The approach to appraising each of the impacts closely follows the methodology set out in the JAQU and supporting TAG guidance. Namely, the 'impact variables' (describing how the impacts vary or are distributed across a geographic area) are overlaid with the 'grouping variables' (describing how different societal groups are distributed across the same area) where appropriate.

The appraisal is then made on the basis of splitting both the grouping and impact variables into quintiles, and then judging whether the impact on a given population group is proportionate to the representation of that group in the wider population (this type of analysis is referred to as 'quintile analysis' throughout this document). Not all impacts need to be appraised for each grouping variable. Table 2-3 indicates the impacts that should be appraised for each group[5]. It should be noted that the "over 65" group was included in the scope for air quality, despite not being a basic requirement, as this group is one of the most vulnerable groups to changes in air quality.

**Table 2-3: Impact categories in scope**

| Group | Air quality | Affordability and User Benefits | Noise | Accidents | Accessibility | Severance | Security |
|---|---|---|---|---|---|---|---|
| Deprivation / income | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Under 16 (Children) | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Over 65 | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Disability | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Sex | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Ethnicity | | | ✓ | ✓ | | | ✓ |
| Businesses | | ✓ | | | | | |

The overlay of impacts and groups was then undertaken at a Lower Super Output Area (LSOA) basis, as defined in the guidance. The geospatial boundaries of each LSOA are available to download as a shapefile from the Office for National Statistics[6]. The datasets collected describing the social characteristics were joined to the spatial representation of the LSOAs to allow geospatial analysis of the social characteristics using a Geographical Information System (GIS).

In order to assess the impacts of the options on the population, a number of datasets were obtained to identify the social characteristics of the population within the study area. These datasets provided information on several characteristics at LSOA level. A description of the characteristics obtained, and their data source is provided in Table 2-4.

[5] Some summary results are also presented for air quality impacts on the elderly and disabled, as well as for different genders and ethnicities, but these are not as detailed as for the children and income groups.

[6] http://geoportal.statistics.gov.uk/datasets/lower-layer-super-output-areas-december-2011-full-extent-boundaries-in-england-and-wales

**Table 2-4: Key data sources**

| Dataset | Description |
|---|---|
| Index of Multiple Deprivation (IMD) | The IMD gives an indication of the overall levels of deprivation in each LSOA and takes into consideration several factors including crime and employment deprivation. Lower IMD values correspond to areas with higher deprivation. This data is available from the Department for Communities and Local Government: English Indices of Deprivation 2019. |
| Number of businesses | The number of businesses located in each LSOA is available, where a larger number represents a greater number of businesses located within the LSOA in question. This data is available from the Office for National Statistics website, from the 2011 census data (UK Business Counts – local units by industry and employment band size). |
| Number of children, elderly and data on gender | The number of individuals of each individual age, split by gender, is available for each LSOA. The larger values for this characteristic represent a larger number of individuals of this characteristic in the total population. This data was available from the Office of National Statistics (Table SAPE19DT1: Mid-2016 Population Estimates for Lower Layer Super Output Areas in England and Wales by Single Year of Age and Sex). The data for 2016 was the most recent population dataset available at the time of writing. The number of children was identified as the sum of those aged 16 or below, while the number of elderly people was identified as the sum of those aged 65 or over. The proportion of females was identified by dividing the number of females in the population by the total population in each LSOA. |
| Disability | The comparative illness and disability ratio indicates the number of individuals in the LSOA that receive benefits due to the inability to work. This information is gathered from the UK Department for Work and Pensions and a higher value indicates a higher level of deprivation. The data is available from the Department for Communities and Local Government: English Indices of Deprivation 2019. |
| Ethnicity | The ratio of the number of non-white to white individuals in each LSOA was calculated to obtain an estimate of ethnicity in the area. The larger the ratio the greater the number of non-white individuals in the population. The data on the number of individuals classifying themselves in each ethnic class was available from the Office for National Statistics nomis website (Table LC2101EW – Ethnic group by sex by age). |
| Sensitive receptor data | Shapefiles showing the location of education establishments, hospitals and parks were obtained from OS Open Data. The location of community centres was obtained from OS Address Base Plus as this was not available through Open Data. Staffordshire County Council also provided locations of additional sensitive receptors using local knowledge. |
| Operator license | The location (post codes) of businesses with HGV operator licences was obtained from data.gov.uk (Traffic Commissioners: goods and public service vehicle operator license records). |

In some cases, alternative output metrics have been produced to help further explore and present the distributional nature of some of the impacts. For example, alongside the 'quintile analysis' for air quality, average changes in concentration by grouping variable quintile and average changes in concentration at sensitive receptors have been produced. Table 2-5 sets out the appraisal approach for each of the impacts considering in Stages 2 and 3 of the distributional analysis.

**Table 2-5: Appraisal approach for each impact**

| Impact | Method | Notes | Outputs |
|---|---|---|---|
| Air quality | Overlay $NO_2$ concentrations with population data to calculate change in population-weighted concentrations[7]. Concentrations will be produced as an average for each LSOA. Overlay mapping of concentrations with mapping of different groups at LSOA level. Groups covered: deprivation / income, elderly and children.<br><br>Calculate average change in concentration by IMD / average children per household and elderly quintile. Calculate change in concentrations at sensitive receptors: schools, playgrounds, parks, hospitals, care homes, community centres. | Population weighted concentration results are used only as a single metric for each scheme for the whole modelling domain.<br><br>Average concentrations are used at the LSOA level as this is easier to understand and little is added by weighting population as each LSOA is based on a similar population. | Change in population weighted concentrations at the domain level for each scheme.<br><br>Average change in concentration by income decile / quintile of households with children and elderly.<br>Average change in concentration at sensitive receptors.<br><br>Quintile analysis (as described in TAG). |
| Affordability for businesses | Mapping likely business impacted by or benefitted by each scheme.<br><br>Explore key business datasets covering business numbers and type.<br><br>Explore impacts on public transport operators, taxis and PHVs, LGV operators, freight operators and wider businesses. | There will be a large level of uncertainty around any inferences drawn from mapping, as the location of a business in or around impacted areas does not necessarily imply it will be impacted.<br><br>It is also difficult to assess how exactly a given business will be impacted, and whether these impacts will be 'affordable'. | Key risks and opportunities faced by each policy option.<br><br>Narrative regarding what types of businesses will be affected and pathways of impacts. |
| User benefits | User cost / benefit analysis using TUBA. | Personal user benefits are assessed and quantified using the Transport Users Benefit Appraisal (TUBA) model. | Quintile analysis. |

[7] Air quality modelling will be drawn from wider modelling around the CAZ options. Hence domain of distributional analysis will match that of wider AQ modelling. This will cover intervention area and surrounding area to capture potential diversionary routes

| | | | |
|---|---|---|---|
| Affordability for households | Mapping of non-compliant vehicle ownership data for the core travel to Stoke-on-Trent and Newcastle-under-Lyme assessment area.<br><br>IMD is the only characteristic to be explored and will be overlaid with ownership data. | Use data on spatial ownership of non-compliant vehicles as a proxy for the areas of maximum impact. Overlay this with transport patterns to look generally at travel between areas and which LSOA tends to travel more often into the CAZ. But this will not specifically identify what journeys compliant / non-compliant vehicles from different areas take, nor how different households will respond to the charge.<br><br>Distribution of non-compliant vehicles and frequency of travel to CAZ used as a proxy for where upgrade costs will fall. | Key risks and opportunities faced by non-charging measures.<br><br>Count of non-compliant vehicles by LSOA. Overlay with travel to Stoke-on-Trent and Newcastle-under-Lyme and IMD quintiles. |
| Noise | Map changes in Annual Average Daily Traffic (AADT) flow by road link and average for each LSOA.<br>Overlay with impact groups. | Specific noise modelling is not available. Traffic changes are analysed as a correlation. | Proportion of links / LSOA experience increases in traffic flows.<br><br>Number of links experiencing significant change in traffic for each income decile / other characteristics.<br><br>Quintile analysis. |
| Accidents (safety) | Map changes in AADT flow by road link and average for each LSOA.<br>Overlay with impact groups. | Specific accident modelling is not available. Use of accident data published by Defra. | Proportion of links / LSOA experience increases in traffic flows.<br><br>Number of links experiencing significant change in traffic for each income decile / other characteristics.<br><br>Quintile analysis. |
| Accessibility | Map locations of accessibility improvements to LSOAs using a default walking distance of 400m from bus stops with improvements.<br><br>Overlay with impact groups. | Only assessed for Preferred Option, as no improvements are included in the Benchmark CAZ D. | Quintile analysis. |
| Severance | Map changes in AADT flow by road link and assess significance based on nearby amenities. | Qualitative. | Qualitative assessment. |

| | | | |
|---|---|---|---|
| Security | Qualitative – Preferred Option only. | Use of locations of CCTV surveillance to be installed at bus stops for the Preferred Option. No analysis for the Benchmark CAZ D. | Qualitative assessment. |

## 2.5. Defining the assessment domains

This document refers to the Ministerial Direction covering an area in North Staffordshire which includes the local authority areas of Stoke-on-Trent and Newcastle-under-Lyme . The area under discussion will be referred to as North Staffordshire throughout the report.

The effects of a charging scheme in Stoke-on-Trent and Newcastle-under-Lyme will be regional, and in some cases national (considering the travel patterns of coaches and HGVs). As a result, it is likely that vehicles registered in many LSOAs will be affected to some degree. To ensure proportionality, an overall Distributional Analysis domain (DA domain) within which the most significant effects of the options are considered to fall has been derived using the following approach.

The extent of this domain is primarily driven by the Benchmark CAZ D, as it is expected that impacts from this option will extend further than those from the locally targeted measures in the Preferred Option. The implementation of a charging scheme in Stoke-on-Trent and Newcastle-under-Lyme is assumed to impact workers living outside the CAZ boundary and commuting to the CAZ; this should therefore be accounted for in the distributional analysis. 2011 Census statistical data gathering wards of origin and destination travels in England and Wales, categorised by transport mode, were used to define the domain of study. The dataset WU03EW[8] provides the number of residents for a MSOA of origin travelling to a MSOA of destination by all transport modes. Three MSOAs were identified for the CAZ area and used a destination zone: E02002968, E02002966 and E02002965.

Using this data, the top 5% of LSOAs from which workers travel to the CAZ were identified, representing more than 96% of all residents commuting to the CAZ area. These were selected as the distributional analysis domain ('DA Domain') to define a geographical zone of the most impacted population by the options. To select these LSOAs from MSOAs, data for all different transport modes was included – simply selecting those who commute by car from the census data risks overlooking the transient nature of modes commuters use to travel to work day-to-day. In addition, other LSOAs have been included or removed to avoid any "holes" in the final domain. Those changes have no impacts on the number of residents included in the domain.

In order to allow impacts on a local scale to be considered, two subset domains were defined for use in the analysis where appropriate:

- The air quality modelling domain (AQ domain), corresponding to the area covered by the North Staffordshire Multi-Modal (NSMM) Transport Model, and the model domain of the air quality modelling study described in reports AQ1, AQ2 and AQ3.
- A Central Impact Area (CIA), encompassing the road links predicted to exceed the Air Quality Objective in 2022. For ease of comparison, this area was defined to match the Benchmark CAZ D boundary; the majority of Preferred Option measures also fall within this boundary.

The scope of these domains is shown in Figure 2-3. The DA Domain is the basis of the household affordability, traffic (noise/accidents) and accessibility impacts. The appraisal of air quality impacts is inherently limited to the domain of the air quality modelling. Given the business affordability analysis does not perform the demographic overlay in the same way, no strict domain is set: the focus of the analysis remains on businesses in and around North Staffordshire, but some impacts assessed can be regional or national in scope.

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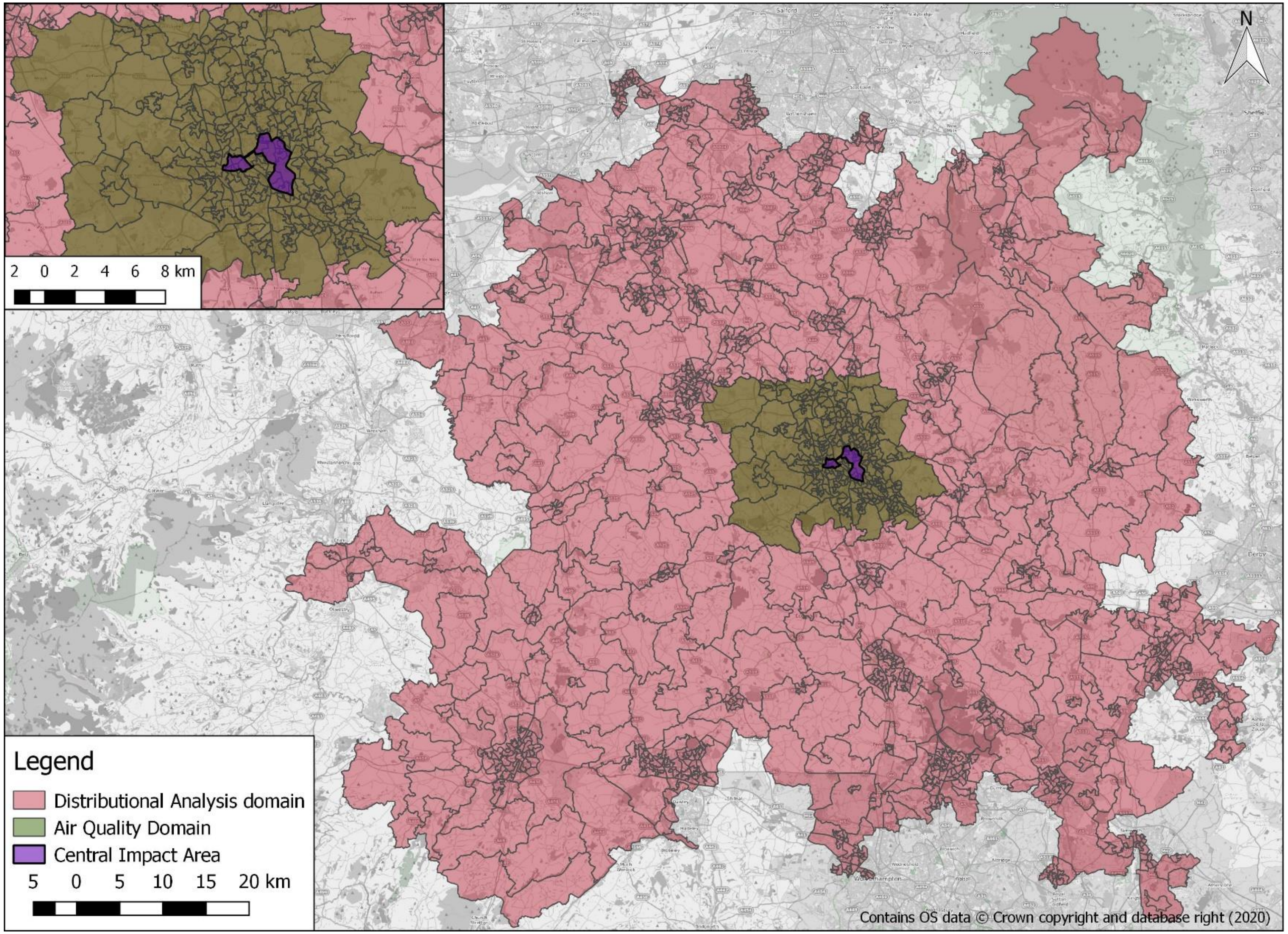
[8] https://www.nomisweb.co.uk/census/2011/wu03ew

**Figure 2-3: Domains used in the distributional analysis**



## 2.6. Distribution of impact groups

Six socio-economic impact groups, as defined by the JAQU guidance, have been analysed in this distributional analysis and ranked as quintiles, with the first quintile meaning the lowest 20% and the fifth quintile the highest 20% of the population. The quintile ranking was based on the whole of England and Wales. In addition, the IMD-Income category, used as reference for the income, has also been evaluated in relation to our study area only. All the socio-economic impact groups are summarised as follows:

**Table 2-6: Socio-economic impact groups**

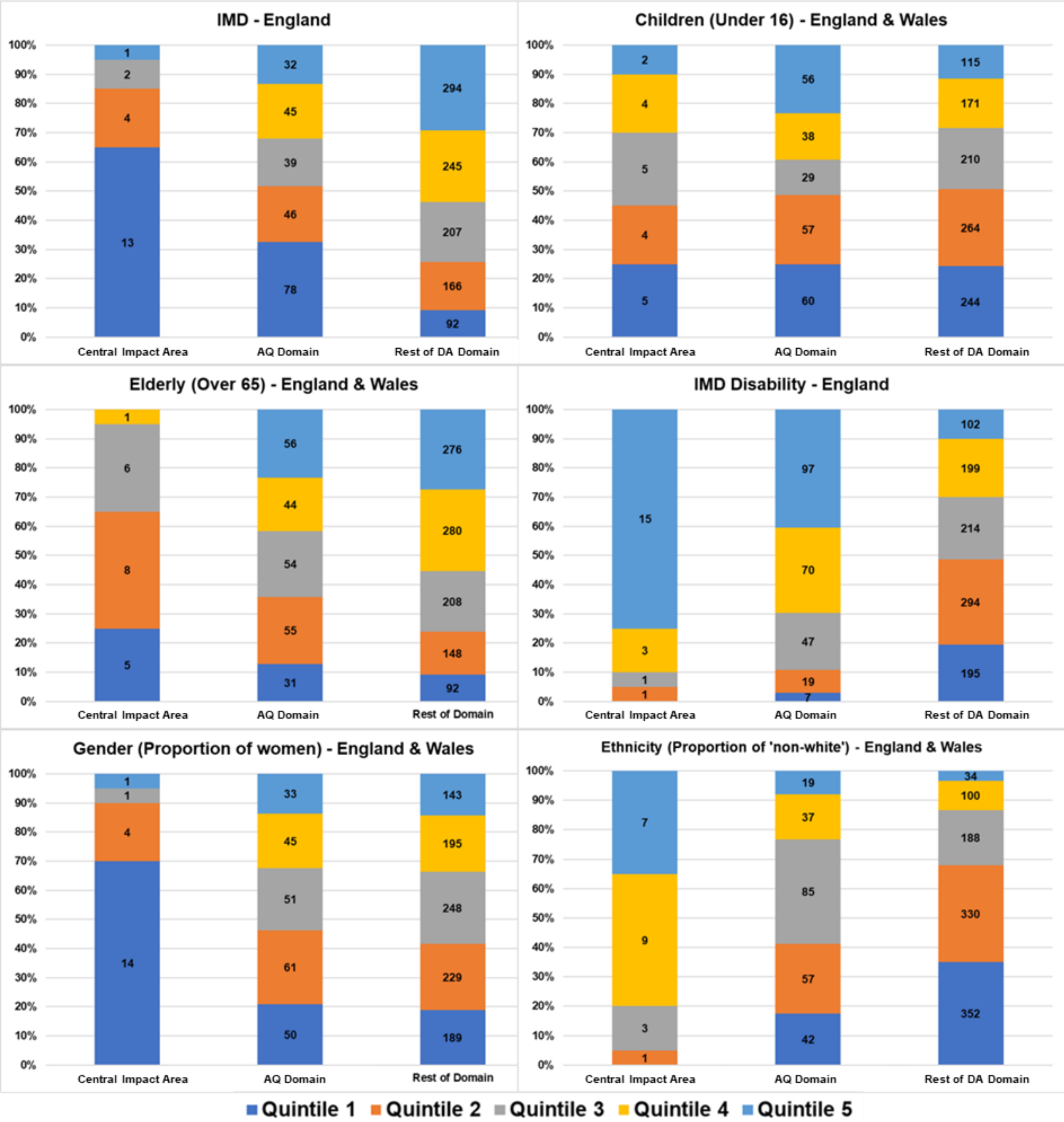
| Socio-economic group | Reference domain of study for quintile calculations | Quintile 1 reference | Quintile 5 reference |
|---|---|---|---|
| Income (referred to as IMD) | DA Domain; England | Most deprived population | Least deprived population |
| Under 16 (referred to as Children) | England and Wales | Lowest proportion of under 16 in the population | Highest proportion of under 16 in the population |
| Over 65 (referred to as Elderly) | England and Wales | Lowest proportion of over 65 in the population (at LSOA level) | Highest proportion of under 65 in the population (at LSOA level) |
| Proportion of women (referred to as Women) | England and Wales | Lowest proportion of women in the population (at LSOA level) | Highest proportion of women in the population (at LSOA level) |
| Percentage of “non-white” (referred to as Ethnicity) | England and Wales | Lowest proportion of “non-white” in the population (at LSOA level) | Highest proportion of “non-white” in the population (at LSOA level) |
| IMD disability (referred to as Disability) | England | Lowest ratio of population with disability in the population (at LSOA level) | Highest ratio of population with disability in the population (at LSOA level) |

The quintile distribution for each impact group living within each of the assessment domains (the Distributional Analysis (DA) Domain, the air quality (AQ) domain and the Central Impact Area) is summarised in Figure 2-4**.** Some of the key points from these charts can be summarised as follows:

- The Central Impact Area has a high proportion of low-income families and residents with a registered disability, compared to the areas outside the Benchmark CAZ D boundary, matching national trends.
- The Central Impact Area has the lowest proportion of women, but relatively high proportions of ethnicity.
- The wider Air Quality Domain still has a large proportion of low-income families and residents with a registered disability. The distribution of quintiles for children and the elderly are roughly equal.
- Conversely, the wider DA domain has a relatively low proportion of low-income households. It also has a greater proportion of elderly residents.
- The quintile distribution for proportion of women and proportion of ethnicity is almost identical for the AQ domain and the rest of the DA domain, but both differ from the charging scheme area.

- In general, the distribution of these socio-economic groups is more even outside the Central Impact Area.

**Figure 2-4: Relative percentage of quintiles for each geographical zone and demographic group**




Note: The number within each bar represents the number of LSOAs in each quintile and each demographic group. The total number of LSOAs within the different zones are as follows: 20 (Central Impact Area); 240 (Air Quality Domain excluding LSOAs inside the Central Impact Area); 1004 (Remaining LSOAs in the Distributional Analysis Domain).

# 3. Air quality

## 3.1. Context

The overall approach of the Air Quality Appraisal is to determine distributional impacts amongst the most vulnerable groups with regards to Air Quality, namely the low-income population, youngest (under 16) and elderly (over 65). A more detailed analysis of the Air Quality changes due to the measures defined in both options is performed and described in the AQ3 report.[9] The AQ2 report contains a detailed description of the air quality modelling methodology, and should be read in combination with this analysis.

Air quality forms one strand of the evidence base for the distributional impacts of the Preferred Option and the Benchmark CAZ D; for a full overview of the overall distributional impacts of the two options, this analysis should be considered in the context of the E3 report as a whole. The air quality analysis in this section is derived from the results of dispersion modelling.

## 3.2. Overview of air quality results

Each of the options identified in Section 2 aims to reduce annual mean concentrations of $NO_2$ in areas that exceed national objectives. This analysis therefore needs to consider the locations where annual mean $NO_2$ concentrations are likely to change and how this change may impact the local population.

To assess the average $NO_2$ concentration for each LSOA falling within the air quality modelling domain in the 2022 Reference Case and each of the modelled options, a zonal average (at LSOA level) of $NO_2$ concentrations was calculated from the 3m resolution annual mean $NO_2$ concentration maps described and presented in AQ3. Note that these averaged concentrations do not represent relevant concentrations for comparison with the Air Quality Objective of 40 $\mu g.m^{-3}$, which applies to individual receptor locations. The number of LSOAs within the air quality modelling domain was 260. The selection of LSOAs overlapping the boundary of the Air Quality model domain was based on expert judgement and by examining how much of the LSOA was covered by the air quality model outputs.

To evaluate the impact of the options on each LSOA, the change in the average $NO_2$ concentrations for each LSOA was calculated. The average $NO_2$ concentration for each shortlisted option was subtracted in turn from the average $NO_2$ concentration for the 2022 Reference Case for each LSOA. If the resulting change is ***positive,*** this means there is an ***improvement*** in air quality as a result of the introduction of the option.

**(2022 Reference Case) – (2022 Option) = (Change in Air Quality)**

The results of this analysis are summarised in Figure 3-1 for each of the three analysis zones. Figure 3-2 shows the average 2022 Reference Case $NO_2$ concentrations, per LSOA; Figure 3-3 and Figure 3-4 show the average difference in $NO_2$ concentrations between the 2022 Reference Case and the Benchmark CAZ D and the Preferred Option, respectively.

This analysis shows the following impacts in each area for both options:

- *Within the Central Impact Area:* The Benchmark CAZ D scenario shows the largest reduction in $NO_2$ concentration compared to the 2022 Reference Case, by an average of 1.28 $\mu g/m^3$. The impact inside the Central Impact Area is greater than across the rest of the domain. The Preferred Option delivers a reduction of 0.16 μg/m3 in air pollution within the Central Impact

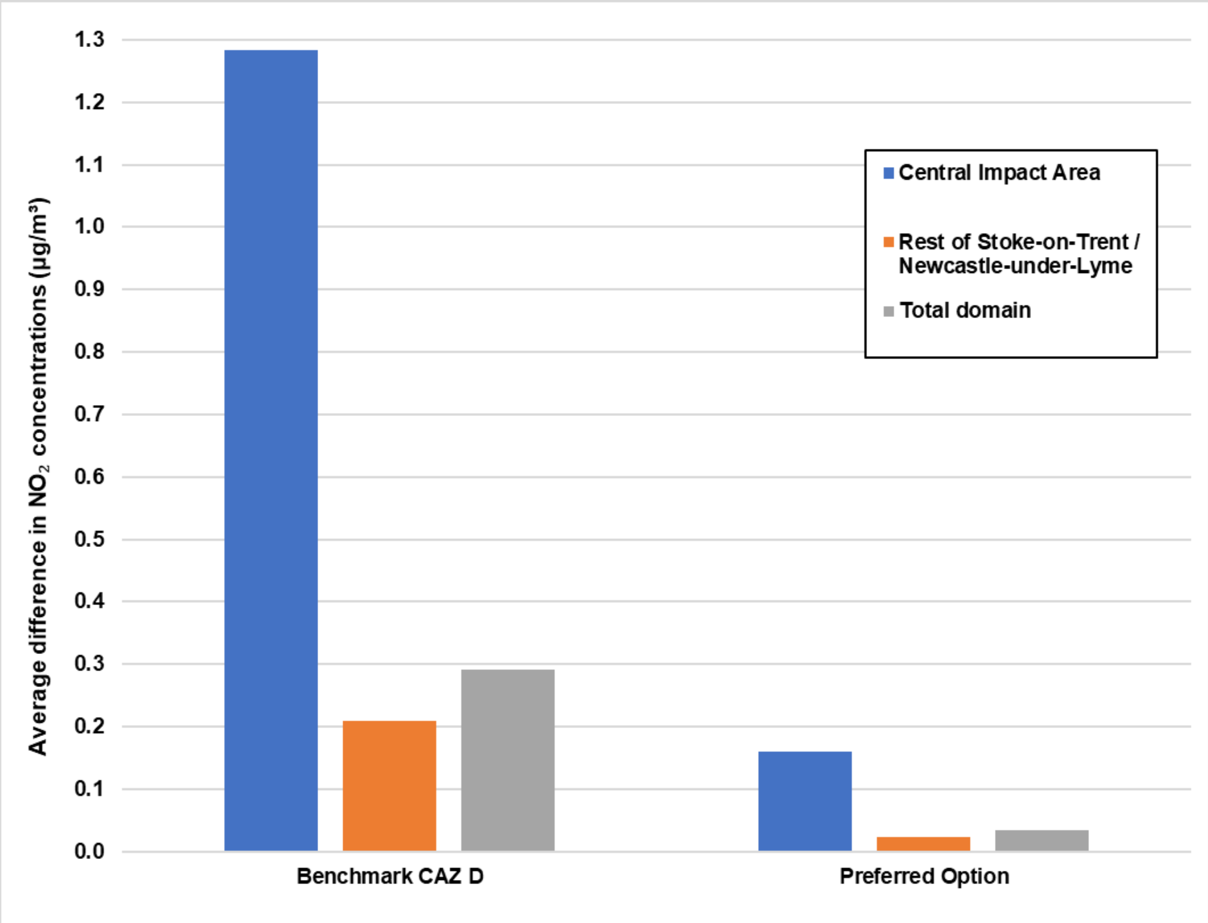
[9] Stoke-on-Trent and Newcastle-under-Lyme Air Quality Results Report (AQ3), Ricardo Energy and Environment, October 2019.

Area, and has a greater impact within the Central Impact Area than for the rest of the domain, as well. This is because the measures included in the Preferred Option target the A53, Bucknall New Road, and Victoria Road, which are all located within the Central Impact Area.

- *Across the whole of the air quality modelling domain:* The Benchmark CAZ D represents the greatest reduction, as in this scenario there is only one LSOA with a negative (worsening air quality) situation, meaning that a much larger area sees an improvement. Under the Preferred Option, the majority of LSOAs observe a very slight improvement in air quality but some observe a very small worsening in air quality. The majority of impacts for both the Benchmark CAZ D and Preferred Option were not of great magnitude, whether positive or negative, leading to very small average differences compared to the 2022 Reference Case across the whole domain.

Figure 3-1 shows that the LSOAs experiencing the highest average 2022 Reference Case $NO_2$ concentration are outside, but near to, the Central Impact Area.

**Figure 3-1: Difference in average $NO_2$ concentration in µg/m$^3$ between the modelled options and the 2022 Reference Case, for each of the assessment zones**




Note: Positive value is a reduction in $NO_2$ concentration.

**Figure 3-2: 2022 Reference Case $NO_2$ concentrations (in µg/m$^3$), averaged per LSOA**

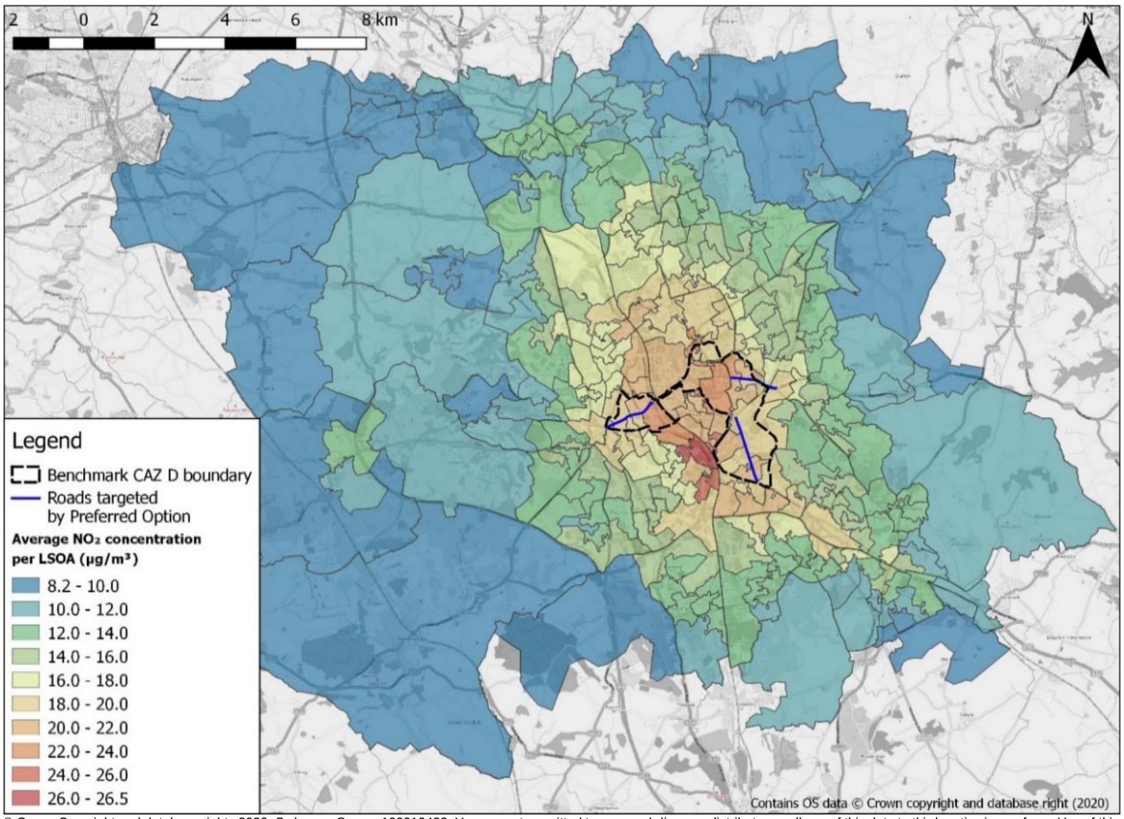
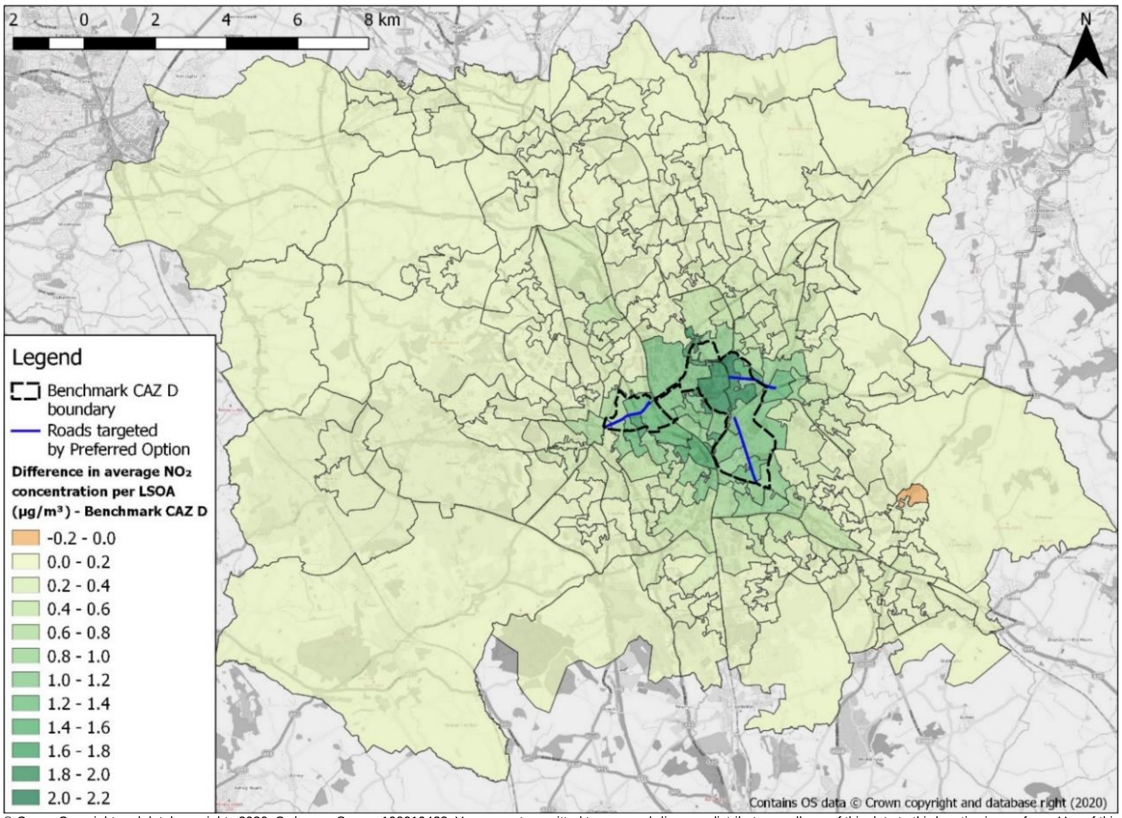




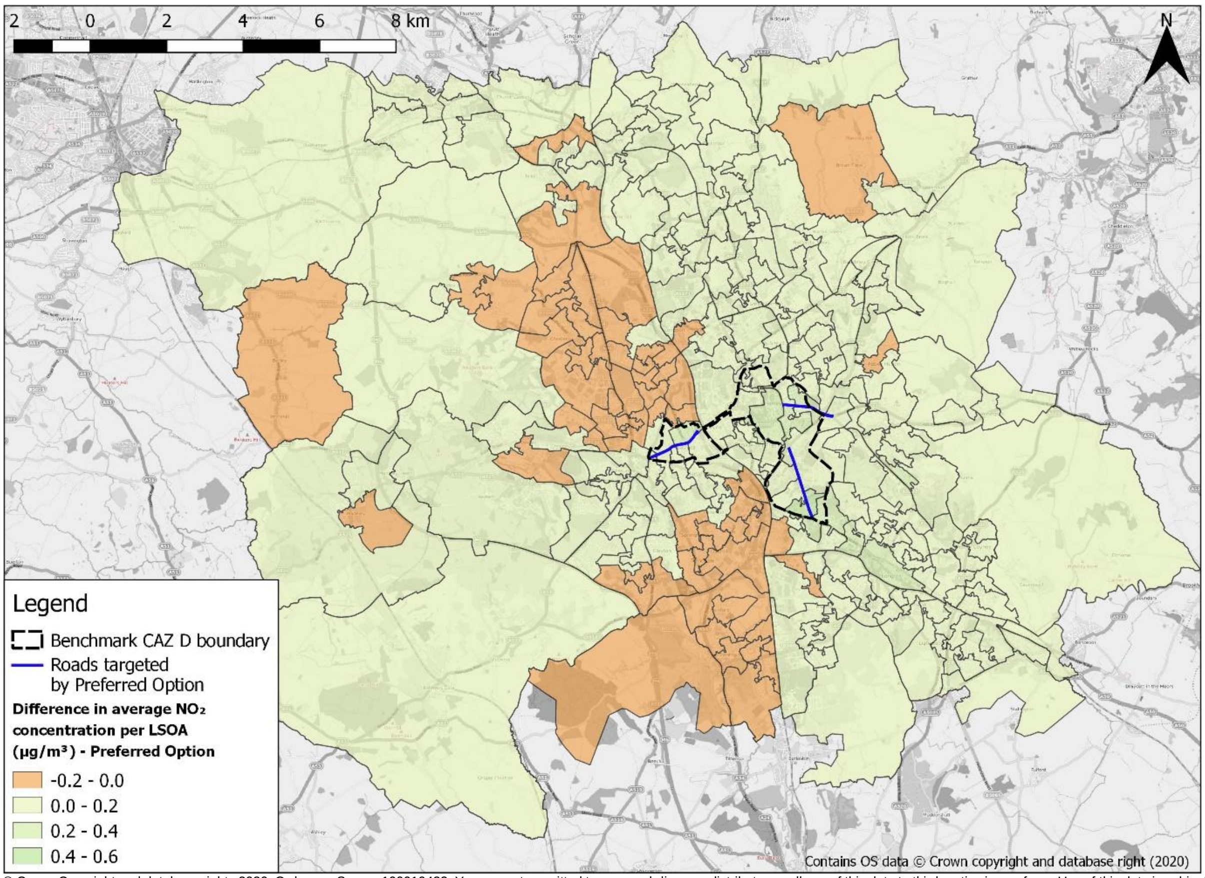

**Figure 3-3: Benchmark CAZ D $NO_2$ concentration difference (µg/m$^3$) to 2022 Reference Case per LSOA**






Note: Positive values is a reduction in $NO_2$ concentration.

**Figure 3-4: Preferred Option $NO_2$ concentration (µg/m³) difference to 2022 Reference Case per LSOA**






Note: Positive value is a reduction in $NO_2$ concentration.

## 3.3. Sensitive receptors

Sensitive receptors within the Air Quality domain are divided into 12 categories following the approach outlined in the TAG Unit A4.2 - Distributional Impact Appraisal guidance document as follows:

- CC04: Public and Village Halls
- CE02: Nursery/Crèche
- CE03: Primary, Junior, Infants or Middle School
- CE04: Secondary School
- CE06: Special Needs Establishment
- CM03: Medical, Hospitals and Hospices
- LP01: Public Parks and Gardens
- LP02: Public Open Spaces and Nature Reserves
- LP03: Playgrounds
- RI01: Care/Nursing Homes

- RI02: Communal Residences
- RI03: Residential Education

The annual mean $NO_2$ concentration has been calculated at each of these receptors for the 2022 Reference Case, the Preferred Option and the Benchmark CAZ D. From this, an average absolute difference in concentrations for each receptor type has been calculated for each scenario. The results of this analysis are illustrated in Figure 3-5. The total number of each sensitive receptor type within the air quality modelling domain is shown in bold beneath the bars. To provide some locational context, Figure 3-7 shows the proportion of each receptor type within the Central Impact Area, the area where the largest predicted changes in air quality are predicted to occur, as a percentage of all receptors of that type within the air quality modelling domain.

Overall, the models show that implementing either of the options generally has a positive effect across all receptor types.

Across receptor types, those receptors that have a greater prevalence within the Central Impact Area (residential education receptors, RI03, public parks/gardens, LP01, and nurseries/crèches, CE02) show larger improvements in air quality. The receptor type with the greatest average improvement under the Benchmark CAZ D scenario is residential education. Staffordshire University is located within the Central Impact Area where the greatest impact would be expected. Towards the edge of the air quality modelling domain there is another group of residential education receptors at Keele University; however, the improvements in air quality at these receptors are negligible.

The least impacted receptors are communal residences (RI02) and special needs establishments (CE06). These sensitive receptor types are both not present in the Central Impact Area where the Benchmark CAZ D scenario has most impact.

The highest 2022 Reference Case concentrations, considering only receptors within the Central Impact Area, are found at public and village halls, secondary schools, and nurseries and crèches (CC04, CE04 and CE02 respectively). Of these sensitive receptor types, CE04 experiences the greatest benefits under both policy options (see Figure 3-6 taking into account only those receptors within the Central Impact Area).

Between the options, the Benchmark CAZ D scenario provides significantly more positive changes in air quality, though the changes in concentrations are small overall (less than 0.8 $\mu g/m^3$ considering the whole AQ domain, and up to approximately 2.1 $\mu g/m^3$ considering receptors within the Central Impact Area only). The Preferred Option provides only very small changes in air quality (all less than 0.1 $\mu g/m^3$). For communal residences (RI02) there is a slight worsening of air quality under this scenario. However, this is of very small magnitude (an average of -0.00022 $\mu g/m^3$), hence it is not really visible in the chart, and there are only two small clusters of this type of receptor within the modelling domain. For the remaining receptor types, residential education (RI03), nurseries/crèches (CE02), public parks and gardens (LP01), and public open spaces and nature reserves (LP02) are the most positively affected for the Preferred Option.

**Figure 3-5: Difference in $NO_2$ concentration between the modelled options and the 2022 Reference Case, disaggregated by the 12 groups of sensitive receptors, across the entire modelling domain**

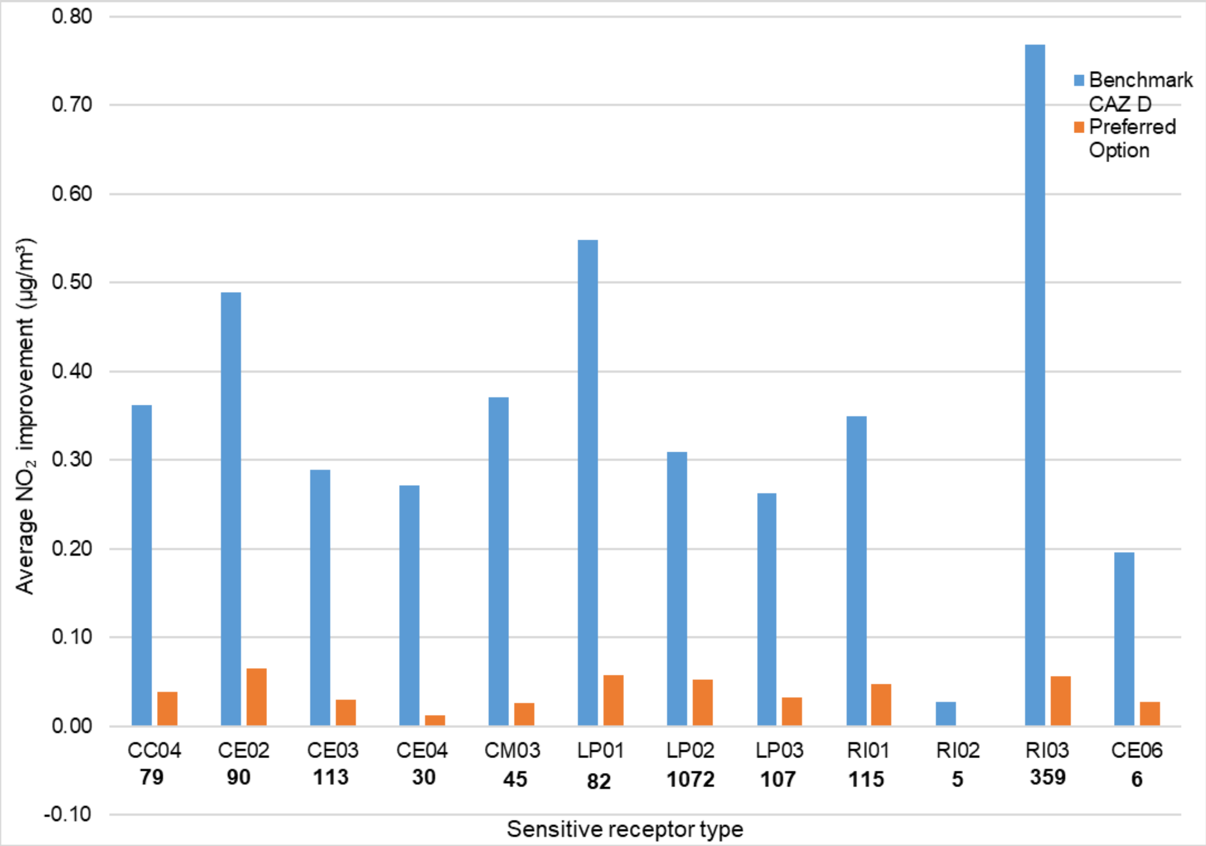



**Figure 3-6: Difference in $NO_2$ concentration between the modelled options and the 2022 Reference Case, disaggregated by the 12 groups of sensitive receptors, within the Central Impact Area**

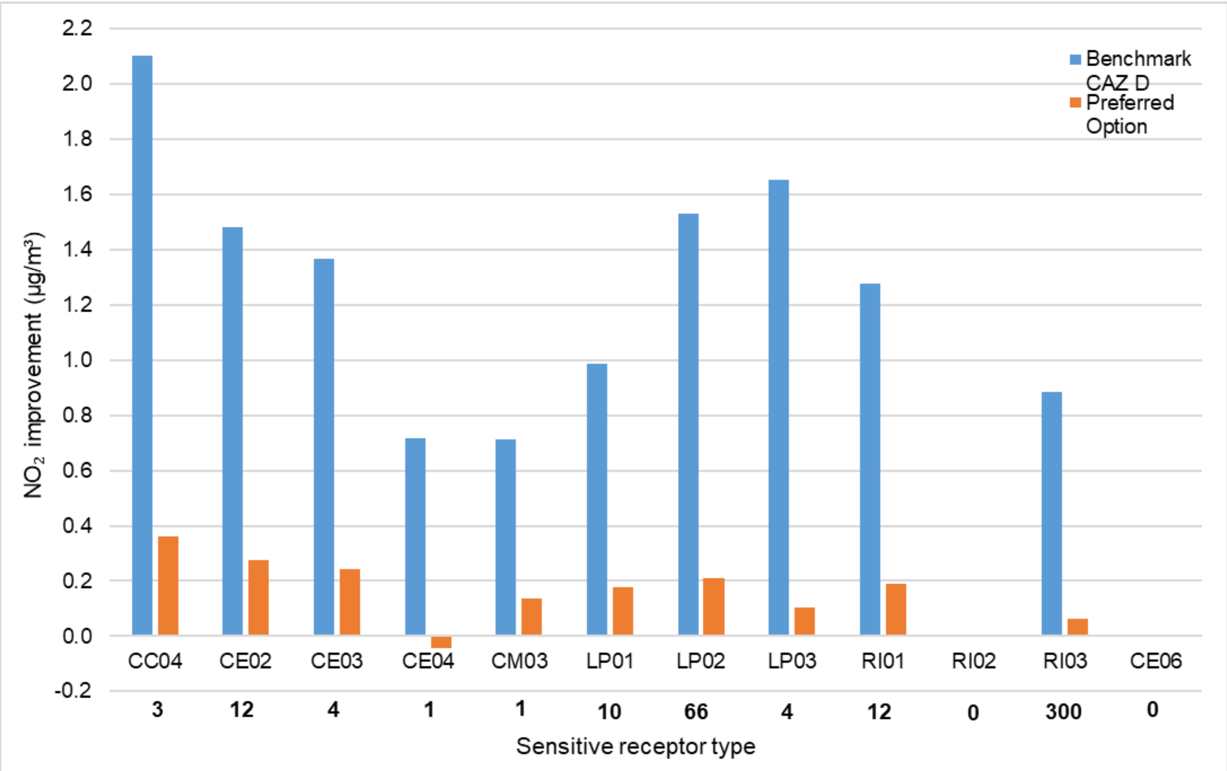
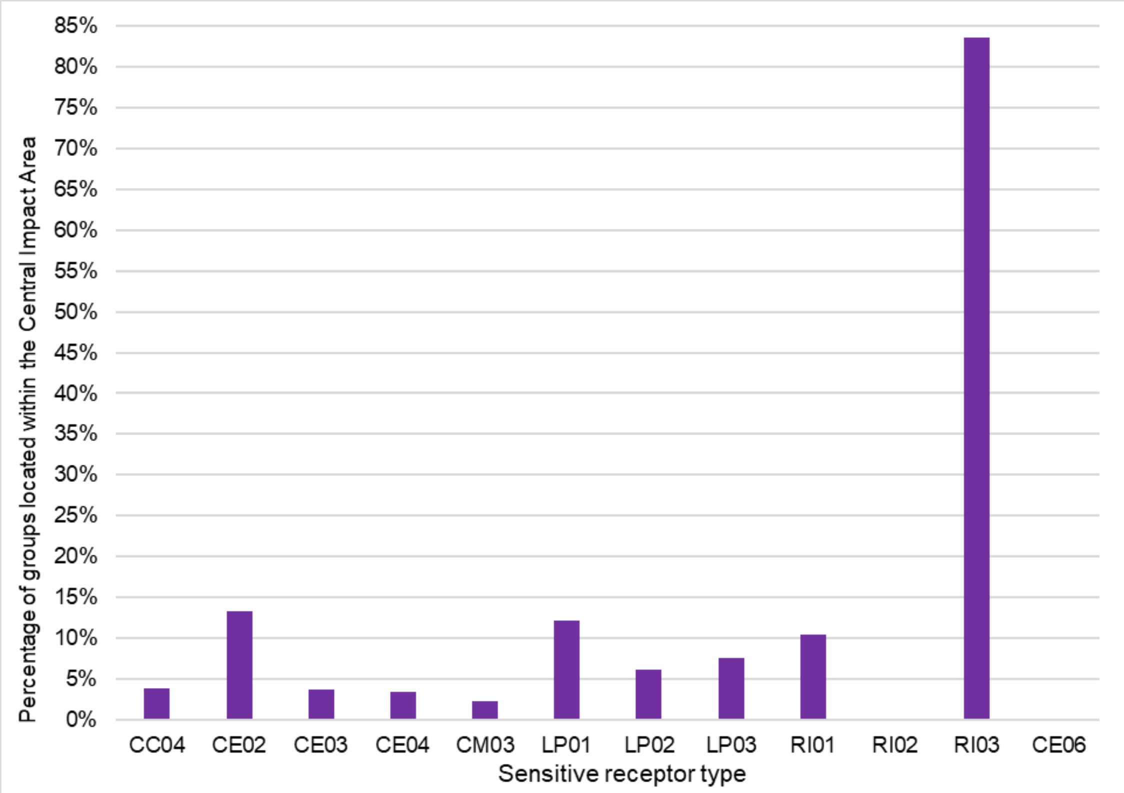


**Figure 3-7: Percentage of groups of receptors located within the Central Impact Area (of all receptors of that type across the AQ domain)**




## 3.4. Quintile analysis

The following analysis explores the distribution of average $NO_2$ concentrations for each of the socio-economic impact groups, with a focus on low income groups (IMD-Income), children under 16, and elderly (over 65). Table 3-1, Table 3-2 and Table 3-3 present the average concentration, and average change in concentration under the Benchmark CAZ D and the Preferred Option, split by IMD-Income, proportion of children, and proportion of elderly quintiles respectively, relative to the 2022 Reference Case.

Table 3-1 presents the impacts of the Preferred Option and Benchmark CAZ D on areas categorised by IMD-Income.

For the 2022 Reference Case, $NO_2$ concentrations are highest for the most deprived groups; these groups tend to live in areas with more traffic and congestion (i.e. in the central areas of the conurbation, particularly around the Central Impact Area). As such there is clearly an inequality in the burden of air pollution in North Staffordshire in terms of income distribution.

Both the Preferred Option and the Benchmark CAZ D will deliver the greatest benefits for the most deprived groups, as the Central Impact Area contains a greater proportion of these LSOAs, and this is where the maximum pollution reductions are achieved. As such, both the Preferred Option and the Benchmark CAZ D will reduce the air quality inequality.

The Preferred Option delivers a stronger relative benefit to deprived LSOAs; the benefit delivered for quintile 1 is four times that of the benefit delivered to quintile 5. Under the Benchmark CAZ D, the benefit delivered for quintile 1 is approximately two times that of the benefit delivered to quintile 5. Under the Benchmark CAZ D. However, the absolute improvements in air quality under the Benchmark CAZ D are larger for all quintiles.

**Table 3-1: Quintile analysis – IMD-Income**

| Option | Income IMD Quintile domain | Most deprived 1 | 2 | 3 | 4 | Least deprived 5 |
|---|---|---|---|---|---|---|
| 2022 Reference Case | Average $NO_2$ concentration (µg/m$^3$) | 16.1 | 15.4 | 14.3 | 12.5 | 12.0 |
| 2022 Benchmark CAZ D | Average $NO_2$ concentration (µg/m$^3$) | 15.7 | 15.0 | 14.0 | 12.4 | 11.9 |
| | Real difference in $NO_2$ concentration to Reference Case (µg/m$^3$) | 0.4 | 0.3 | 0.3 | 0.1 | 0.1 |
| | Relative difference in $NO_2$ concentration to Reference Case (%) | 2.6% | 2.2% | 1.9% | 1.0% | 1.1% |
| 2022 Preferred Option | Average $NO_2$ concentration (µg/m$^3$) | 16.1 | 15.4 | 14.2 | 12.5 | 12.0 |
| | Real difference in $NO_2$ concentration to Reference Case (µg/m$^3$) | 0.06 | 0.03 | 0.03 | 0.01 | 0.02 |
| | Relative difference in $NO_2$ concentration to Reference Case (%) | 0.4% | 0.2% | 0.2% | 0.0% | 0.1% |

Table 3-2 presents the impacts of the Preferred Option and Benchmark CAZ D on areas with low and high proportions of children under the age of 16. For the 2022 Reference Case, the middle quintile has the highest levels of pollution. Aside from this quintile there is a trend of greater air pollution in areas with a higher proportion of children and better air quality in areas with a lower proportion of children.

For the Benchmark CAZ D scenario, the same trend in average $NO_2$ concentrations applies. There is an improvement in air quality, compared to the 2022 Reference Case, across all quintiles. However, the greatest improvements are in areas experiencing the worst levels of pollution: quintile 3, followed by quintiles 4 and 5 (who have highest number of child residents).

For the Preferred Option, again the same trend in average $NO_2$ is present across the quintiles. There are slight improvements in air quality across all quintiles, compared to the 2022 Reference Case. The improvements are marginally greater for areas with a greater proportion of children than for those with a lower proportion of children. Therefore, the distributional impact that exists in terms of air pollution being worse for younger LSOAs would be slightly reduced by the Preferred Option and the Benchmark CAZ D scenario.

The distribution of children in North Staffordshire is not as clear-cut as for the most and least deprived households, and as a result, there is no distributional trend in the benefits delivered by the two options. Outside of the Central Impact Area, there is a weak trend of low numbers of children in LSOAs surrounding the centre, and greater numbers of children further out.

**Table 3-2: Quintile analysis – Children under 16**

| Option | Under 16 quintiles | Lower proportion | | | | Higher proportion |
|---|---|---|---|---|---|---|
| | Quintile domain | 1 | 2 | 3 | 4 | 5 |
| 2022 Reference Case | Average $NO_2$ concentration (µg/m$^3$) | 13.57 | 14.23 | 15.45 | 15.04 | 15.07 |
| 2022 Benchmark CAZ D | Average $NO_2$ concentration (µg/m$_3$) | 13.32 | 13.95 | 14.99 | 14.73 | 14.82 |
| | Real difference in $NO_2$ concentration to Reference Case (µg/m$_3$) | 0.25 | 0.28 | 0.46 | 0.30 | 0.24 |
| | Relative difference in $NO_2$ concentration to Reference Case (%) | 1.6% | 1.8% | 3.2% | 2.4% | 2.0% |
| 2022 Preferred Option | Average $NO_2$ concentration (µg/m$^3$) | 13.55 | 14.20 | 15.41 | 14.99 | 15.02 |
| | Real difference in $NO_2$ concentration to Reference Case (µg/m$^3$) | 0.02 | 0.03 | 0.04 | 0.05 | 0.04 |
| | Relative difference in $NO_2$ concentration to Reference Case (%) | 0.2% | 0.2% | 0.3% | 0.3% | 0.3% |

Table 3-3 presents the impacts of the Preferred Option and Benchmark CAZ D on areas with low and high proportions of elderly residents. In the 2022 Reference Case, Preferred Option and Benchmark CAZ D, areas with a higher proportion of elderly residents experience better air quality. For both modelled options, there are greater improvements in air quality for areas with fewer elderly residents. However, this is much more pronounced in the Benchmark CAZ D scenario.

As there are fewer elderly residents in the Central Impact Area, where greatest improvements in air quality occur, elderly residents general experience better air quality in the Reference Case, but experience a smaller improvement in air quality with the implementation of the Preferred Option or the Benchmark CAZ D.

**Table 3-3: Quintile analysis – Elderly (over 65)**

| Option | Over 65 quintiles | Lower proportion | | | | Higher proportion |
|---|---|---|---|---|---|---|
| | Quintile domain | 1 | 2 | 3 | 4 | 5 |
| 2022 Reference Case | Average $NO_2$ concentration (µg/m$^3$) | 17.35 | 15.67 | 14.83 | 13.28 | 12.17 |
| 2022 Benchmark CAZ D | Average $NO_2$ concentration (µg/m$^3$) | 16.75 | 15.32 | 14.54 | 13.11 | 12.05 |
| | Real difference in $NO_2$ concentration to Reference Case (µg/m$^3$) | 0.61 | 0.35 | 0.29 | 0.17 | 0.12 |
| | Relative difference in $NO_2$ concentration to Reference Case (%) | 3.5% | 2.2% | 2.0% | 1.3% | 1.0% |
| 2022 Preferred Option | Average $NO_2$ concentration (µg/m$^3$) | 17.30 | 15.62 | 14.79 | 13.26 | 12.15 |
| | Real difference in $NO_2$ concentration to Reference Case (µg/m$^3$) | 0.05 | 0.04 | 0.04 | 0.02 | 0.02 |
| | Relative difference in $NO_2$ concentration to Reference Case (%) | 0.3% | 0.3% | 0.3% | 0.2% | 0.1% |

## 3.5. TAG table analysis

### 3.5.1. Income disparity

The overlay of the impact and demographic variables following the TAG guidance for IMD-Income is presented in Table 3-5 and Table 3-6 for the Benchmark CAZ D and the Preferred Option, respectively. Each quintile is assigned a scoring to rank the distributional impacts based on the system shown in Table 3-4.

**Table 3-4: General system for grading of distributional impacts for each of the identified groups**

| Impact | Assessment |
|---|---|
| Beneficial and the population impacted is significantly greater than the proportion of the group in the total population. | Large Beneficial ✓✓✓ |
| Beneficial and the population impacted is broadly in line with the proportion of the group in the total population. | Moderate Beneficial ✓✓ |
| Beneficial and the population impacted is smaller than the proportion of the group in the total population. | Slight Beneficial ✓ |
| There are no significant benefits or disbenefits experienced by the group for the specified impact. | Neutral |
| Adverse and the population impacted is smaller than the proportion of the group in the total population. | Slight Adverse × |
| Adverse and the population impacted is broadly in line with the proportion of the group in the total population. | Moderate Adverse ×× |
| Adverse and the population impacted is significantly greater than the proportion of the group in the total population. | Large Adverse ××× |

**Table 3-5: TAG 'quintile' analysis for Benchmark CAZ D – IMD-Income overlay with air quality**

| Income IMD | Most deprived | | | Least deprived | | |
|---|---|---|---|---|---|---|
| Benchmark CAZ D | **0%-20%** | **20%-40%** | **40%-60%** | **60%-80%** | **80%-100%** | |
| | **1** | **2** | **3** | **4** | **5** | **Total** |
| Population with improved air quality | 150,618 | 79,888 | 62,016 | 69,658 | 53,324 | |
| Population with no changes[10] | 0 | 0 | 0 | 0 | 0 | |
| Population with deteriorating air quality | 0 | 0 | 1,588 | 0 | 0 | |
| Net winners/losers | 150,618 | 79,888 | 60,428 | 69,658 | 53,324 | |
| Total number of winners across all groups | | | | | | 413,916 |
| Net winners/losers in each area | 36.39% | 19.30% | 14.60% | 16.83% | 12.88% | |
| Share of the total population in the impact area | 36.11% | 19.15% | 15.25% | 16.70% | 12.78% | |
| Assessment | ✓✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓ | |

The Benchmark CAZ D does not deliver a distributional impact across IMD-Income, i.e. each quintile benefits in proportion with their share of the overall population.

[10] For this category it has been assumed a difference in $NO_2$ concentration between the modelled scenario and the 2022 Reference Case to be 0.

**Table 3-6: TAG ‘quintile’ analysis for the Preferred Option – IMD-Income overlay with air quality**

| Income IMD | Most deprived | | | | Least deprived | |
|---|---|---|---|---|---|---|
| Preferred Option | 0%-20% | 20%-40% | 40%-60% | 60%-80% | 80%-100% | |
| | 1 | 2 | 3 | 4 | 5 | Total |
| Population with improved air quality | 131,448 | 53,528 | 54,850 | 49,331 | 38,602 | |
| Population with no changes[11] | 0 | 0 | 0 | 0 | 0 | |
| Population with deteriorating air quality | 19,170 | 26,360 | 8,754 | 20,327 | 14,722 | |
| Net winners/losers | 112,278 | 27,168 | 46,096 | 29,004 | 23,880 | |
| Total number of winners across all groups | | | | | | 238,426 |
| Net winners/losers in each area | 47.09% | 11.39% | 19.33% | 12.16% | 10.02% | |
| Share of the total population in the impact area | 36.11% | 19.15% | 15.25% | 16.70% | 12.78% | |
| Assessment | ✓✓✓ | ✓ | ✓✓ | ✓ | ✓✓ | |

The Preferred Option will deliver a disproportionate benefit to more deprived areas.

### 3.5.2. TAG table analysis: Distribution of children

The overlay of the impact and demographic variables following the TAG guidance for under-16s is presented in Table 3-7 and Table 3-8. Each quintile is assigned a scoring to rank the distributional impacts based on the system shown in Table 3-4.

**Table 3-7: TAG ‘quintile’ analysis for Benchmark CAZ D – Under 16 overlay with air quality**

| Under 16 | Lower proportion | | | Higher proportion | | |
|---|---|---|---|---|---|---|
| Benchmark CAZ D | 0%-20% | 20%-40% | 40%-60% | 60%-80% | 80%-100% | |
| | 1 | 2 | 3 | 4 | 5 | Total |
| Population with improved air quality | 101,981 | 93,338 | 54,240 | 67,754 | 98,191 | |
| Population with no changes[12] | 0 | 0 | 0 | 0 | 0 | |
| Population with deteriorating air quality | 0 | 0 | 0 | 1,588 | 0 | |
| Net winners/losers | 101,981 | 93,338 | 54,240 | 66,166 | 98,191 | |
| Total number of winners across all groups | | | | | | 413,916 |
| Net winners/losers in each area | 24.64% | 22.55% | 13.10% | 15.99% | 23.72% | |
| Share of the total population in the impact area | 24.45% | 22.38% | 13.00% | 16.63% | 23.54% | |
| Assessment | ✓✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓ | |

The Benchmark CAZ D does not deliver a distributional impact across under-16s, i.e. each quintile benefits in proportion with their share of the overall population.

[11] For this category it has been assumed a difference in $NO_2$ concentration between the modelled scenario and the 2022 Reference Case to be 0.
[12] For this category it has been assumed a difference in $NO_2$ concentration between the modelled scenario and the 2022 Reference Case to be 0.

**Table 3-8: TAG 'quintile' analysis for the Preferred Option – Under 16 overlay with air quality**

| Under 16 | Lower proportion | | | Higher proportion | | |
|---|---|---|---|---|---|---|
| Preferred Option | **0%-20%** | **20%-40%** | **40%-60%** | **60%-80%** | **80%-100%** | |
| | **1** | **2** | **3** | **4** | **5** | **Total** |
| Population with improved air quality | 77,399 | 68,688 | 43,399 | 57,724 | 80,549 | |
| Population with no changes[13] | 0 | 0 | 0 | 0 | 0 | |
| Population with deteriorating air quality | 24,582 | 24,650 | 10,841 | 11,618 | 17,642 | |
| Net winners/losers | 52,817 | 44,038 | 32,558 | 46,106 | 62,907 | |
| Total number of winners across all groups | | | | | | 238,426 |
| Net winners/losers in each area | 22.15% | 18.47% | 13.66% | 19.34% | 26.38% | |
| Share of the total population in the impact area | 24.45% | 22.38% | 13.00% | 16.63% | 23.54% | |
| Assessment | ✓✓ | ✓ | ✓✓ | ✓✓ | ✓✓ | |

The Preferred Option will deliver a marginal disproportionate benefit to areas with greater numbers of children.

### 3.5.3. TAG table analysis: Distribution of elderly

The overlay of the impact and demographic variables following the TAG guidance for IMD-Income is presented in Table 3-9 and Table 3-10. Each quintile is assigned a scoring to rank the distributional impacts based on the system shown in Table 3-4.

**Table 3-9: TAG 'quintile' analysis for Benchmark CAZ D – over 65 overlay with air quality**

| Elderly (over 65) | Lower proportion | | | Higher proportion | | |
|---|---|---|---|---|---|---|
| BENCHMARK CAZ D | **0%-20%** | **20%-40%** | **40%-60%** | **60%-80%** | **80%-100%** | |
| | **1** | **2** | **3** | **4** | **5** | **Total** |
| Population with improved air quality | 65,919 | 104,459 | 92,357 | 70,347 | 82,422 | |
| Population with no changes[14] | 0 | 0 | 0 | 0 | 0 | |
| Population with deteriorating air quality | 0 | 0 | 1,588 | 0 | 0 | |
| Net winners/losers | 65,919 | 104,459 | 90,769 | 70,347 | 82,422 | |
| Total number of winners across all groups | | | | | | 413,916 |
| Net winners/losers in each area | 15.93% | 25.24% | 21.93% | 17.00% | 19.91% | |
| Share of the total population in the impact area | 15.80% | 25.04% | 22.52% | 16.87% | 19.76% | |
| Assessment | ✓✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓ | |

The Benchmark CAZ D does not deliver a distributional impact across over-65s, i.e. each quintile benefits in proportionate with their share of the overall population.

[13] For this category it has been assumed a difference in $NO_2$ concentration between the modelled scenario and the 2022 Reference Case to be 0.
[14] For this category it has been assumed a difference in $NO_2$ concentration between the modelled scenario and the 2022 Reference Case to be 0.

**Table 3-10: TAG 'quintile' analysis for the Preferred Option – over 65 overlay with air quality**

| Elderly (over 65) | Lower proportion | | | | Higher proportion | |
|---|---|---|---|---|---|---|
| Preferred Option | 0%-20% | 20%-40% | 40%-60% | 60%-80% | 80%-100% | |
| | 1 | 2 | 3 | 4 | 5 | Total |
| Population with improved air quality | 56,309 | 81,344 | 69,025 | 53,944 | 67,137 | |
| Population with no changes[15] | 0 | 0 | 0 | 0 | 0 | |
| Population with deteriorating air quality | 9,610 | 23,115 | 24,920 | 16,403 | 15,285 | |
| Net winners/losers | 46,699 | 58,229 | 44,105 | 37,541 | 51,852 | |
| Total number of winners across all groups | | | | | | 238,426 |
| Net winners/losers in each area | 19.59% | 24.42% | 18.50% | 15.75% | 21.75% | |
| Share of the total population in the impact area | 15.80% | 25.04% | 22.52% | 16.87% | 19.76% | |
| Assessment | ✓✓✓ | ✓✓ | ✓ | ✓✓ | ✓✓ | |

The Preferred Option will deliver a disproportionate benefit to areas with fewer numbers of over-65s.

## 3.6. Summary

The Benchmark CAZ D option will deliver reductions in concentrations as high as a 2.1 µg.m$^{-3}$ improvement. This improvement is predicted to occur in an LSOAs within the Central Impact Area, the area where the majority of air quality problems in North Staffordshire are currently concentrated.

Under the Preferred Option, predicted improvements in air quality are smaller; the predicted improvements are less than 0.5 µg/m$^3$ in all LSOAs. A slight deterioration of air quality is experienced by 58 LSOAs; however, this is of a magnitude no greater than 0.15 µg/m$^3$. All of these LSOAs are outside the Central Impact Area and only 12 of the 58 represent the most deprived residents. However, this analysis is more concerned with the distribution of impacts under each option, rather than the absolute size.

Looking at sensitive receptors, implementing either of the options has a positive effect across the majority of receptor types. The highest 2022 Reference Case concentrations within the Central Impact Area are found at public and village halls, nurseries and crèches, public open spaces and nature reserves, and playgrounds. Of these, the first two sensitive receptor types experience the greatest benefits under both policy options (when only taking into account those receptors within the Central Impact Area). The Benchmark CAZ D scenario provides significantly more positive changes in air quality than the Preferred Option, though the changes in concentrations are small overall (less than 1.0 µg/m$^3$). The receptor type with the greatest average improvement under the Benchmark CAZ D scenario is for "residential education; these receptors are clustered at Staffordshire University and Keele University. The Preferred Option provides only very small changes in air quality (below 0.1 µg/m$^3$). Nurseries/crèches, public open spaces and nature reserves, and playgrounds are the most positively affected.

Quintile analysis counting numbers of people affected in each quintile was performed as per TAG guidance. These results are summarised in Table 3-12 below. In this analysis, the Benchmark CAZ D does not deliver a distributional impact for IMD-Income, under-16 or over-65 groups - i.e. each quintile benefits in proportion with the overall population. However, the Preferred Option will deliver a disproportionate benefit to more deprived areas (and a marginal disproportionate benefit to areas with greater numbers of children).

[15] For this category it has been assumed a difference in $NO_2$ concentration between the modelled scenario and the 2022 Reference Case to be 0.

**Table 3-11: Impact appraisal matrix: Air quality**

| Grouping variable | Scenario | Distributional impact – quintile | | | | |
|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** |
| IMD-Income | Benchmark CAZ D | ✓✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓ |
| | Preferred Option | ✓✓✓ | ✓ | ✓✓ | ✓ | ✓✓ |
| Children | Benchmark CAZ D | ✓✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓ |
| | Preferred Option | ✓✓ | ✓ | ✓✓ | ✓✓ | ✓✓ |
| Over 65 | Benchmark CAZ D | ✓✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓ |
| | Preferred Option | ✓✓✓ | ✓✓ | ✓ | ✓✓ | ✓✓ |

However, the TAG analysis only considers the numbers of people experiencing different changes in air pollution and does not consider the size of change. To complement this, we also looked at the average change in concentration levels across different quintiles. This analysis revealed that under both options, areas with the most deprived populations and areas with the highest proportions of children will experience most significant air quality improvements, suggesting both options could deliver a disproportionate benefit to these vulnerable groups.

Although the absolute size of impacts is larger under the Benchmark CAZ D scenario, the relative reduction in air pollution for more deprived quintiles to less deprived quintiles is greater under the Preferred Option.

Table 3-12 presents a summary of the distributional impacts on air quality of the two options. Both options have a positive distributional effect.

**Table 3-12: Summary of air quality distributional impacts**

| Scenario | Summary assessment |
|---|---|
| Preferred Option | ✓✓<br><br>This option provides a small overall improvement in air quality, and minor improvements in most other areas of North Staffordshire. Some LSOAs, mainly adjacent to the A500, experience a small deterioration in air quality compared to the Reference Case. This is of no more than 0.15 $\mu g/m^3$.<br><br>This option reduces impacts across all sensitive receptors, suggesting a positive impact for vulnerable groups.<br><br>TAG analysis suggests that this option will have a disproportionate benefit for more deprived areas and areas with higher numbers of children (i.e. the proportion of all those that benefit in the most deprived quintile is greater than the proportion of the most deprived quintile in the overall population).<br><br>Analysis of size of impacts also suggests benefits will be greater for more deprived areas and areas with higher number of children (and relative impact for more deprived relative to less deprived is greater than that for Benchmark CAZ). |
| Benchmark CAZ D | ✓✓<br><br>This option provides an overall improvement in air quality and small improvements in all other areas of North Staffordshire. The absolute air quality benefits are greater than in the Preferred Option. One LSOA, outside of the CAZ boundary, experiences a slight deterioration in air quality compared to the Reference Case. However, this is less than 0.1 $\mu g/m^3$.<br><br>This option also reduces impacts across all sensitive receptors, suggesting a positive impact for vulnerable groups.<br><br>TAG analysis suggests this option will not have a disproportionate impact on any group, but analysis of the size of impacts suggests benefits will be greater for more deprived areas and areas with higher proportions of children. |

# 4. Affordability for businesses

## 4.1. Introduction

The North Staffordshire authorities are assessing two options to deliver compliance with the national air quality objective for annual mean $NO_2$ concentrations in the shortest time possible: a Benchmark CAZ D and a collection of non-charging options, collectively referred to as the Preferred Option. Both options will have a variety of direct and indirect impacts on the businesses that operate in the area. This section assesses the scope and severity of the impacts to businesses in North Staffordshire.

Affordability for businesses forms one strand of the evidence base for the distributional impacts of the Preferred Option and the Benchmark CAZ D; for a full overview of the overall distributional impacts of the two options, this analysis should be considered in the context of the E3 report as a whole.

The Preferred Option targets three roads in the Hanley, Stoke-on-Trent, Newcastle-under-Lyme areas: A50 Victoria Road, A53 Etruria Road and Bucknall New Road, and is described in detail in Section 2.

The benchmark CAZ option, defined as a CAZ D by JAQU guidance will charge non-compliant vehicles[16] when entering and travelling within the CAZ boundary[17]. The boundary covers the main areas affected by $NO_2$ including Hanley, Victoria Road and east Newcastle-under-Lyme, as well as the A53 Etruria Road between Newcastle-under-Lyme and Hanley. The proposed charge rates for non-compliant vehicles are set out in Table 4-1.

**Table 4-1: Charge rates for the benchmark CAZ**

| Vehicle | Cars | Taxis | LGVs | HGVs | Buses | Coaches |
|---|---|---|---|---|---|---|
| Charge rate (£) | £5 | £5 | £9 | £35 | £5 | £5 |

This will negatively impact businesses by changing the costs (and hence ability) of businesses to supply the market, and potentially by affecting the level of demand for goods and services, due to the potential increased cost for customers to access businesses by car. By not placing a direct cost on vehicles (and hence businesses), the Preferred Option has been designed to minimise the impact on drivers and businesses within North Staffordshire. Nevertheless, the Preferred Option will affect businesses through peak time traffic restrictions along key roads in North Staffordshire.

Table 4-2 sets out the range of responses people and businesses could take to both options. These behavioural responses, based on the economic, transport and user benefit analysis, underpin this businesses affordability assessment.

**Table 4-2: High level behavioural response to the introduction of the Benchmark CAZ D or the Preferred Option**

| Benchmark CAZ D | Preferred Option |
|---|---|
| • Upgrade existing vehicles to make them compliant<br>• Retrofit existing buses to make them compliant<br>• Reduce the number of trips undertaken into the CAZ<br>• Redistribute their fleet so that non-compliant vehicles are used outside these zones | • Rerouting to avoid traffic restrictions<br>• Some private car users may switch to using public transport as a result of the improvements along key routes<br>• Re-time journeys to avoid the peak hour bus gate operation |

[16] Non-compliance is defined as pre-Euro IV petrol vehicles or pre-Euro VI diesel.
[17] See Section 2 for the precise location of the CAZ boundary

| | |
|---|---|
| • Pay the daily charge applicable to a non-compliant vehicle<br>• Shift to another mode of transport<br>• Avoid the CAZ charging area<br>• Exit the market entirely | |

The response adopted by each vehicle will depend on a number of parameters specific to that vehicle, including origin and destination, and frequency of trip. In theory each vehicle owner will adopt a strategy to minimise their compliance cost. However, each of the different responses will place additional burden on the vehicle operator (even if the type and size of impacts vary between response type). Where the CAZ places a cost on businesses (as set out in the impacts explored in the section above), there is an inherent risk as to whether the business can 'afford' these costs. In some cases, it is not certain that the business can simply internalise these costs, as there may be further ramifications for the operation of the business, which may result in the impact being greater than the initial cost burden placed by the CAZ. If costs are unaffordable, a business may respond by cancelling trips, shifting location to outside the CAZ or leaving the market altogether.

Many businesses will make decisions prior to, and in anticipation of the chosen measure so not all of the responses to the policy will be seen after it has been introduced. Moreover, the reactions and responses to both options will change over time. For example, as the baseline vehicle fleet improves naturally over time, the responses deployed to avoid paying the CAZ charge will reduce.

Assessing the impacts on businesses is very challenging. A wide range of businesses can be impacted in a variety of different ways. In turn, these impacts will flow upwards and downwards through supply chains, with no formal model available to assess the full extent and flow of impacts through the economy, impacting businesses, staff and customers. Furthermore, only limited data and evidence exists around the number of businesses that could be affected, and even less regarding how they might respond to the CAZ D (or the measures included in the Preferred Option) and any additional costs placed on them. In addition, there are a wide range of factors which feed into the decision making of firms and it is extremely difficult to identify how either option interacts with all these other factors to produce a decision outcome, these complex interactions make it difficult to form an objective opinion on the type and extent to which businesses are impacted.

The Business Affordability analysis is primarily a qualitative assessment of the perceived impacts on businesses. Where possible data has been included to support the assessment and conclusions. However, given the complex responses by businesses and the myriad of other factors that will impact their decisions, businesses' responses cannot be certain.

Unlike other sections of the distributional analysis no formal methodology is currently available for the business analysis. The methodology used here is a vehicle-based approach which considers the different vehicles impacted by the two measures and then seeks to understand which, and the extent to which, businesses are impacted. This methodology has been used and refined on a number of business analysis conducted for similar policies in different cities.

## 4.2. Business context in North Staffordshire

The business context is primarily defined in relation to the Central Impact Area (CIA), the domain of this area is the same as CAZ zone which is set out in Figure 2-2. All three routes impacted by the Preferred Option are included in this Impact Area as well as all roads impacted by the Benchmark CAZ D. As a result, the CIA allows for a self-contained area where the impacts of both measures can be observed. This section does not discuss how the different options will impact businesses as this is discussed in the remainder of the report.

Table 4-3 and Table 4-4 show the business activity in the North Staffordshire area generally and around the bounded CIA respectively. Businesses are classified by the number of employees.

Impacts will be greatest on those businesses that dwell inside the potential charging zone. The CIA captures just over 10% of all business in the North Staffordshire area; a total of over 2,000 businesses.

The North Staffordshire geography and the transport links result in a number of enterprise corridors and business parks at key strategic sites outside the city centre. There are two enterprise zones located in the immediate vicinity of the CIA (Etruria Valley and Cliffe Vale) which would be impacted by both measures.

The CIA does cover one of three key business areas in the region: Hanley (it does not include the areas of Newcastle-under-Lyme town centre and the town of Stoke-on-Trent) and also captures Staffordshire University campus.

**Table 4-3: Total number of businesses by size (number of employees) in North Staffordshire***

| North Staffordshire total | Micro (0 – 9 employees) | | Small (10 – 49 employees) | | Medium size (50 – 249 employees) | | Large (250+ employees) | |
|---|---|---|---|---|---|---|---|---|
| 20,105 | 16,560 | (82%) | 2,845 | (14%) | 600 | (3%) | 95 | (0.5%) |

*Source: NOMIS (2020): UK Business Counts - local units by industry and employment size band*

**Table 4-4: Total number of businesses by size (number of employees) within the Central Impact Area****

| North Staffordshire total | Micro (0 – 9 employees) | | Small (10 – 49 employees) | | Medium size (50 – 249 employees) | | Large (250+ employees) | |
|---|---|---|---|---|---|---|---|---|
| 2,065 | 1,430 | (70%) | 480 | (23%) | 125 | (6%) | 20 | (1%) |

*Source: NOMIS (2020)*

* Numbers may not be internally consistent due to rounding errors.

** Data is based on super output areas – middle layer (MSOAs). Areas have been chosen to most closely reflect the CIA, however an exact match has not been possible. The numbers reported therefore may only give an approximation of the number and breakdown of businesses within a potential CIA.

Businesses that operate and exist in the immediate surrounding area will likely travel into the CIA frequently, either as part of the supply chain for businesses within the zone or conducting their own businesses within the area. Hence these businesses are also likely to be largely affected and as such, businesses located in other areas including the centre of Hanley, Newcastle-under-Lyme town centre and other retail areas such as Festival Retail Park, are also likely to be impacted in some way.

Micro businesses (those with less than 10 employees) account for 82% of all businesses in North Staffordshire, which is slightly lower than the national average of 84% of all businesses. This drops significantly to just under 70% within the CIA, far below the national average. In contrast, small enterprises account for 23% of businesses within the CIA, with medium and large employers accounting for 6% and 1% respectively. Although micro businesses are a smaller proportion of the local economy relative to the national picture, they still represent the largest business grouping: hence more micro and small businesses will be affected relative to larger businesses.

Ensuring that these measures do not disproportionately impact micro-businesses is important as small and medium sized enterprises (SMEs) can be disproportionately affected by regulation[18],given that they typically have smaller portfolios of activity across which they can spread costs. They are an important contributor to employment (60% of all private sector employment nationally) and revenue (52% of private sector turnover nationally)[19]. SMEs are particular important in the context of Stoke-on-Trent and Staffordshire's Strategic Economic Plan[20] which seeks to grow key sectors, including the Core

[18] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/827960/RPC_Small_and_Micro_Business_Assessment__SaMBA___August_2019.pdf
[19] https://publications.parliament.uk/pa/cm201719/cmselect/cmbeis/807/807.pdf
[20] https://www.stokestaffslep.org.uk/app/uploads/2019/01/SSLEP-Strategic-Economic-Plan-April-2018-.pdf

Advanced Manufacturing Sectors. Within the Economic Plan, SMEs were singled out as key contributors to economic growth in the area.

The size of the business can have a significant impact on the ability to comply with the Benchmark CAZ D. Micro-businesses tend to be run by individuals who are self-employed and may rely on cars or Light Goods Vehicles (LGVs) to carry out their business. Moreover, smaller operators are more likely to own or use older vehicles and have less available capital to invest in a compliant vehicle(s) if a charging zone is introduced[21]. Larger businesses may be better able to comply with CAZ related costs as they tend to have larger capital reserves and the flexibility to internalise the costs.

Table 4-5 shows the top industries operating within the 'travel to work areas' in North Staffordshire[22]. This was chosen due to the reasonable assumption that it is likely that these businesses will travel to, or operate in some form within, the proposed CAZ area. Figure 4-1 shows the main industries broken down by size, in this area.

**Table 4-5: Numbers of businesses in North Staffordshire by size (number of employees) and sector**

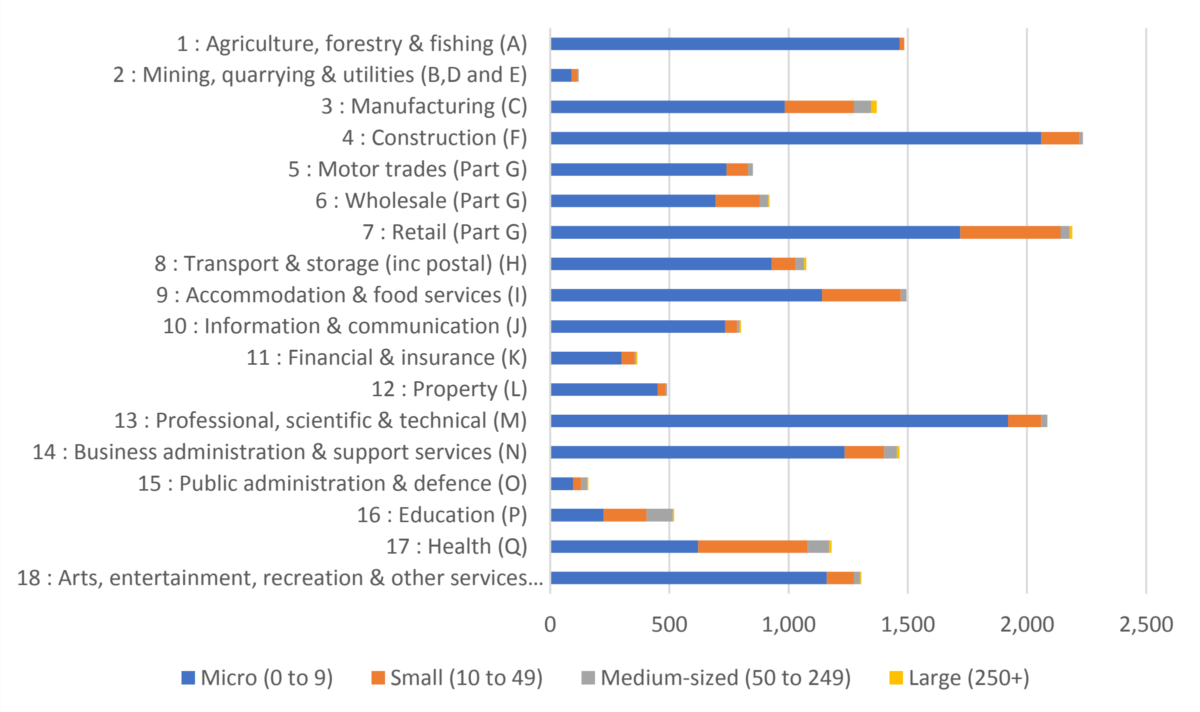
| Industry | All businesses | Micro (0 – 9 employees) | Small (10-49 employees) | Medium size (50 – 249 employees) | Large (250+ employees) |
|---|---|---|---|---|---|
| 1: Agriculture, forestry & fishing (A) | 1,485 | 1,465 | 20 | 0 | 0 |
| 2: Mining, quarrying & utilities (B,D and E) | 120 | 90 | 25 | 5 | 0 |
| 3: Manufacturing (C) | 1,370 | 985 | 290 | 70 | 25 |
| 4: Construction (F) | 2,235 | 2,060 | 160 | 15 | 0 |
| 5: Motor trades (Part G) | 850 | 740 | 90 | 20 | 0 |
| 6: Wholesale (Part G) | 920 | 695 | 185 | 35 | 5 |
| 7: Retail (Part G) | 2,190 | 1,720 | 420 | 40 | 10 |
| 8: Transport & storage (inc postal) (H) | 1,075 | 930 | 100 | 35 | 10 |
| 9: Accommodation & food services (I) | 1,495 | 1,140 | 330 | 25 | 0 |
| 10: Information & communication (J) | 800 | 735 | 50 | 10 | 5 |
| 11: Financial & insurance (K) | 365 | 300 | 55 | 5 | 5 |
| 12: Property (L) | 490 | 450 | 35 | 5 | 0 |
| 13: Professional, scientific & technical (M) | 2,085 | 1,920 | 140 | 25 | 0 |
| 14: Business administration & support services (N) | 1,465 | 1,235 | 165 | 55 | 10 |
| 15: Public administration & defence (O) | 160 | 95 | 35 | 25 | 5 |
| 16: Education (P) | 520 | 225 | 180 | 110 | 5 |
| 17: Health (Q) | 1,180 | 620 | 460 | 90 | 10 |

[21] https://www.racfoundation.org/assets/rac_foundation/content/downloadables/van_report_aecom_100414.pdf

[22] Travel to work areas (TTWAs) are approximations of self-contained labour markets based on commuting to work patterns, as defined by the Office for National Statistics (taken from NOMIS)

| | | | | | |
|---|---|---|---|---|---|
| 18: Arts, entertainment, recreation & other services (R,S,T and U) | 1,305 | 1,160 | 115 | 25 | 5 |
| Total | **20,100** | **16,560** | **2,845** | **600** | **95** |

**Figure 4-1: Business sectors in North Staffordshire by employee size**




The three largest sectors, each of which have over 2,000 businesses, are ‘Construction (F)’, ‘Retail (Part G)’, and ‘Professional, scientific and technical (M)’. These three sectors account for almost a third (32.4%) of all businesses in North Staffordshire.

The retail sector is likely to be greatly affected by the implementation of the Benchmark CAZ D due to the reliance of supply chains and frequent deliveries by Heavy Goods Vehicles (HGVs)/LGVs, and on the ability of customers to access their premises. Key retail businesses in the city centre include the Intu shopping centre. If the supply chains of these businesses face charges due to operating non-compliant vehicles, then retail businesses could be negatively affected by their suppliers attempting to pass these costs onto them. Moreover, under a CAZ D, retail businesses would be impacted by charges placed on non-compliant passenger cars seeking to enter the zone, which in turn place an additional cost for their customers (and workers). Given that two other shopping hubs within the surrounding area have not been included in the charging zone, retail businesses in the CAZ could be unduly disadvantaged as shoppers choose alternative places to shop (see section 4.7 for further analysis).

The construction sector, as the largest sector could also be significantly impacted by the two options under consideration, given their reliance on the movement of materials by LGVs and HGVs. In addition, over 90% of these businesses are micro-businesses and employ less than 10 people.

Professional, scientific and technical activities is another large sector, accounting for 10% of business activity. This sector is unlikely to rely (as much) on supply chains and frequent deliveries in comparison to other industries in the CIA and hence may face smaller risks from the implementation of a charging zone or impacts from measures in the Preferred Option.

While all sectors will be impacted to a greater or lesser extent, one further sector that may see a significant impact, which underpins much of North Staffordshire’s economic activity, is the Transport and Storage sector (including logistics). The sector accounts for 13,000 jobs in Newcastle-under-Lyme and Stoke-on-Trent and represents 8% of all jobs in the area, compared to 4.9% nationally[23]. Moreover, in the LSOA that covers the CIA (and the surrounding area) there are 2,400 jobs allocated to this sector, and this figure has grown by 25% since 2015. The Transport and Storage sector interacts with numerous other important sectors in the region (e.g. manufacturing and construction).

Finally, there are also a number of large retail businesses who operate logistics and distribution hubs in the North Staffordshire area[24] that will also be impacted by these measures that are not directly reflected in these statistics of the transport sector. These are located around the outskirts of the central conurbation but not within the CIA. Hence while some movements would be affected by the options, these hubs supply goods all over the country and therefore the majority of trips would not be impacted. The impact on HGVs and LGVs used by this sector will be discussed in greater detail in the subsequent sections.

## 4.3. Impacts on freight operators

### 4.3.1. Impact on heavy good vehicle (HGV) operators

#### 4.3.1.1. Impacts under the Preferred Option

The Preferred Option places some restrictions on HGVs using key routes into Hanley and the surrounding area. While these impacts will not be observed directly (i.e. by paying a charge) they will be observed through increases in travel time, fuel costs and other potential impacts. These impacts will be felt most acutely by businesses on the Fenton Industrial Estate, who will no longer be able to access the site in the most efficient manner if travelling from the south during peak times. Nevertheless, the Preferred Option is likely to be considered preferable by these businesses to paying a CAZ charge or buying new vehicles.

The Preferred Option imposes a one-way bus gate along the A50 Victoria Road northbound and the A53 Etruria Road westbound during peak times (Monday to Friday, 7am to 10am and 4pm to 7pm). Any HGVs found using these roads during these restricted periods would face a Penalty Charge Notice (PCN). However, clear signage will be added for alternative routes when the bus gates are in operation.

Table 4-6 presents data from the transport modelling of the Preferred Option and shows a small reduction in the number of vkm from HGVs inside the Central Impact Area, this is due to vehicles rerouting outside the central area to avoid the road changes. The larger reduction in compliant vkm reflects the current split between compliant and non-compliant vehicles in North Staffordshire – when considered as a percentage reduction, both show a 3% reduction in vkm. This is to be expected as the Preferred Option measures do not discriminate by vehicle age. Overall there is a small increase in vkm outside the CIA, however this is negligible when considered as a proportion of the total vkm. As traffic restrictions are only in place at peak times, operators may be able to change delivery schedules to avoid these times and reduce any possible rerouting.

**Table 4-6: Change in vehicle km for HGVs under the preferred option**

| | | HGVs (millions vkm) | |
|---|---|---|---|
| | | Compliant | Non-compliant |
| **Preferred Option** | Inside the CIA | -0.16 | -0.02 |
| | Outside the CIA | 0.18 | 0.02 |

[23] NOMIS 2018 Labour Market Profiles for Stoke-on-Trent and Newcastle-Under-Lyme
[24] A few key examples include Sainsbury's, Marks and Spencer, Dunelm Mill and H&M, as well as a number of logistic operators who work for multiple companies.

The rerouting outside of the CIA to avoid the road restrictions is also observed in the user benefit analysis, which shows a time disbenefit and a correlated increase in fuel and non-fuel VOC costs (as shown in Table 4-7). Unlike the Benchmark CAZ D, this change will impact compliant and non-compliant vehicles alike and so while the impact in each vehicle is small it will be uniform across the fleet.

The costs to businesses that use HGVs set out in Table 4-7 are relatively minimal when spread across the total appraisal period and the number of HGVs that operate in the area, there are approximately 10,000[25] HGVs that operate in the area which would result in each vehicle facing a cost of £430, over 10 years, as a result of the Preferred Option. However, 88% of all HGVs are assumed to be Euro VI[26] so while the impact on each vehicle is relatively small, the impact of the Preferred Option on the majority of HGVs would be greater than the impact of a CAZ D.

**Table 4-7: User benefits on HGVs (OGV1 and 2) under the Preferred Option: 2022:2031**

| | Total |
|---|---|
| **Time** | -£2,670,000 |
| **Non-fuel VOC** | -£750,000 |
| **Fuel VOC** | -£850,000 |
| **Total** | **-£4,270,000** |

The preferred option shows a similar net impact than the Benchmark CAZ D. This is due to the fact that the Preferred Option has a small but widely distributed impact on all HGV operators whereas the Benchmark CAZ D has a large but targeted impact on non-compliant HGVs. While the majority of HGV drivers would not be affected by the CAZ D and would be affected by the Preferred Option. Those impacted by the Benchmark CAZ D are likely to be the smaller businesses and the direct financial impact will be significantly larger.

The Preferred Option does not encourage vehicle upgrades and therefore there are no potential benefits associated with improvements in fuel VOCs, and non-fuel VOC, however the impact per vehicle over the 10 year appraisal period in negligible and therefore there is excepted to be minimal changes to the HGV sector as a result of the Preferred Option.

### 4.3.1.2. Impacts under a CAZ D

HGVs are typically operated by public haulage companies who provide goods transportation for a range of clients and goods. These companies make up the majority of HGV trips in the UK and tend to make longer journeys[27]. Other HGVs will operate for a single owner such as a supermarket chain and transport their own goods and products to their stores. The extent to which both types of HGV will be compliant with the CAZ requirements is dependent on the size of the HGV operator and the sector it operates in.

Operators with non-compliant HGVs will have to bear the cost of CAZ charges or vehicle upgrades themselves. This would be a significant cost consideration, particularly for SMEs. For illustration, a new Euro VI compliant HGV costs between £45,000 to £90,000 (including both rigid and artic trucks)[28]. Moreover, the haulage industry also faces increasing costs elsewhere (such as driver employment costs

[25] Based on ANPR data used for the Cost-Benefit Analysis
[26] Based on ANPR data
[27] DfT, Road Freight Statistics (2018)
[28] Road Haulage Association, Cost Tables, (2019); https://motortransport.co.uk/wp-content/uploads/2020/01/Binder1.pdf

and insurance), a 2019 review of the industry found that typical costs had risen 3.85% in the past year alone (excluding fuel) with further rises expected (RHA, 2019[29]).

Operators with large fleets will tend to renew vehicles more regularly to meet emission standards or lower the operating costs of the fleet. They also have more opportunity to avoid paying the CAZ charge by redistributing their fleet to move non-compliant vehicles away from CAZ areas.

Small to medium sized businesses tend not to have large capital reserves, have a narrower band of operations across which costs can be spread, operate on tighter margins and may find it more difficult to access capital or face higher borrowing charges. Hence upgrading to a compliant fleet may be unfeasible in the short term for smaller operators who face greater risk[30]. In addition, smaller firms may also face a greater burden due to their patterns of operation – being locally based they may operate in the CAZ more frequently.

The higher risks for smaller operators were exemplified in the London Low Emission Zone (LEZ), where an impact monitoring report noted that HGV owners with large fleets serving large geographical areas tended to react by conducting an in-depth analysis on the imposed measure to determine how they organised their transport activities. Fleets were then redistributed so that the newest and cleanest vehicles were used in the Greater London region, while older vehicles were operated in zones without charging schemes. HGV owners with smaller fleets or those serving smaller geographical areas were not able to adapt by redistributing their fleet. These businesses needed to put money aside ahead of time in order to purchase newer vehicles or retrofit existing vehicles. Where these options were not feasible due to financial constraints, these businesses rented newer vehicles, paid the charge or left the market[31].

Analysis of the transport model and its source, the Stated Preference survey shows us that the majority of HGV operators are likely to upgrade to a compliant vehicle in order to enter the city, which will have a significant acute impact on these businesses due to the cost of new, compliant HGVs. As HGV operators and businesses tend to operate on very small profit margins and therefore a large expense, like a purchasing a new vehicle, may significantly affect the viability of these businesses. As the number of CAZ areas increase, non-compliant vehicles increasingly become 'stranded' assets, placing further strain on businesses. Writing off the value of non-compliant vehicles reduces the value of businesses and therefore reducing the ability to secure a loan.

This greater risk for smaller operators is particularly notable given that across the four main industries in North Staffordshire that are likely to use HGVs regularly: construction, wholesale, retail, and transport and logistics, 98% of them are micro or small businesses (less than 50 employees).

Goods and public service vehicle licence records for the West Midlands, provided by the Traffic Commissioner[32] allows us to get a better understanding on the HGV operators that work in and around the proposed CAZ area. There are 996 unique HGV operators in the Stoke-on-Trent 4-digit post code area, with a combined 4,283 HGVs in operation. In the specific post codes ST1 and ST4, which cover the area of Hanley and its immediate vicinity and encompasses the entirety of the CAZ area, there are 155 HGV operators and 757 HGVs registered. There are significant portions of these post codes that are not within the CAZ boundary and therefore not all of these operators will be within the CAZ area,

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[29] https://www.rha.uk.net/getattachment/Membership/Member-Benefits/RHA-Cost-Movement-Survey-2016/RHA-Haulage-Cost-Movement-2019.pdf.aspx

[30] Cecilia Cruz and Antoine Montenon, "Implementation and impacts of low emission zones on freight activities in Europe: Local schemes versus national schemes

[31] Cecilia Cruz and Antoine Montenon, "Implementation and impacts of low emission zones on freight activities in Europe: Local schemes versus national schemes

[32] https://data.gov.uk/dataset/2a67d1ee-8f1b-43a3-8bc6-e8772d162a3c/traffic-commissioners-goods-and-public-service-vehicle-operator-licence-records

nevertheless, given their proximity to the CAZ area they are all likely to be impacted by the charging zone.

Table 4-8 shows the modelled changes in vehicle kilometres (vkm) for HGVs both inside and outside the CAZ area split by compliant and non-compliant vehicles. The transport model shows us that under the Benchmark CAZ D, the number of vkm driven by non-compliant vehicles inside the CAZ will reduce significantly and will be almost completely offset by a rise in compliant vkm. The reduction in 540,000 vkm accounts for an almost 60% reduction which is based on responses from the Stated Preference survey that are an input to the transport model and tells us that the majority of HGVs will upgrade and the rest will continue to pay the charge[33].

**Table 4-8: Change in vehicle km for HGVs under the Benchmark CAZ D**

| HGVs (millions vkm) | | | |
|---|---|---|---|
| | | Compliant | Non-compliant |
| **Benchmark CAZ D** | Inside CAZ | 0.51 | -0.54 |
| | Outside CAZ | 1.13 | -1.08 |

Data from the Cost Benefit Analysis (CBA) also shows how the HGV industry will be impacted by the introduction of the Benchmark CAZ D. Table 4-9 shows the monetised impacts on HGVs (both OGV1 and OGV2[34]) from the charging zone. While it is possible to split out the impacts on HGVs it is important to note that not all impacts will be felt equally, for example the CAZ charge will be a direct financial cost paid by HGV operators, whereas the time saving, a significant benefit, is unlikely to be seen as a monetary gain.

Moreover, the CBA looks at the marginal impact of the CAZ and therefore may not reflect the true cost felt by operators. This is specifically applicable to the vehicle upgrade costs, which has a net or marginal upgrade cost of £11 million. However, this does not reflect the purchase cost of all operators who upgrade to new vehicles, which is estimated at over £156 million (for details on how these costs are calculated see the E1 Economic Methodology Report)[35].

**Table 4-9: Costs and benefits to HGVs under the Benchmark CAZ D[36]**

| Impact | |
|---|---|
| Time | £1,976,445 |
| Non-fuel vehicle operating costs (VOC) | £3,367,521 |
| Fuel VOC | £10,632,011 |
| CAZ charges | -£6,930,863 |
| Welfare impact | -£2,174,389 |
| Upgrade cost | -£11,161,198 |
| **Total** | **-£4,290,743** |

[33] Note: vkm does not equate to the number of vehicles that will display a certain behavioural response however it is a sufficient proxy.
[34] OGV1 covers rigid HGVs with 2 or 3 axles, OGV2 covers larger rigid HGVs with 4 or more axles and all articulated HGVs
[35] The net cost is calculated by finding the difference between the net cost of purchasing new vehicles and selling old vehicles and comparing this to the cost under a baseline scenario where LGV drivers would have upgraded to a compliant vehicle at the end of the vehicle's life.
[36] Details on how these costs and benefits are derived can be found in the CBA report

Nevertheless, while this may not reflect the impact felt 'on the ground' by HGV operators, the benefits from reduced travel times, fuel savings and other non-fuel savings outweigh the more direct costs of either paying the CAZ charge, upgrading or rerouting (the impact of this is reflected in the welfare loss).[37] However, this does not negate the immediate impact felt by HGV operators (particularly smaller operators) who may not have the capital to purchase a compliant vehicle, or where the CAZ charge will significantly impact their (already small) profit margins[38].

One final piece of analysis for comparison: the combined benefits (excluding costs) to the HGV sectors is estimated at almost £21 million over 10 years, this is just £7,900 per vehicle that chooses to upgrade[39]. The cost of a Euro VI HGV is estimated at around £43,000 in the CBA, based on this, the benefits that the HGV operators would see are less than 20% of the cost of buying a new vehicle.

There is also likely to be in an impact on specialist vehicle operators such as those used by members of the British Association of Removers. Specialist vehicles tend to operate over a long lifecycle (e.g. removal trucks can be operational for 15-20 years) and therefore restrictions placed on pre-Euro VI vehicles will have a significant impact on the sector. The CAZ is also likely to have a greater impact on these vehicles as they enter urban areas on a daily basis, even though they will spend large portions of their trip stationary with their engines off[40], therefore contributing relatively little over all to the air quality problem in North Staffordshire.

The British Association of Removers also reported[41] that policies restricting older vehicles could present an existential threat to their industry given the nature of these businesses. The fallout of the 2008 financial crisis has meant that many of these businesses operate out of rented space and have little to no financial assets aside from the HGVs. Government restrictions on pre-Euro VI trucks are likely to negatively impact the second-hand truck market (which these businesses would be selling in to), turning some of the few assets these businesses have in to 'stranded assets'. Moreover, these businesses will be unable to purchase compliant vehicles due to a lack of capital and an inability to borrow due to the declining value of their only assets.

While there is concern for specialist vehicle operators, it is worth remembering that while important, these sectors are a small subsector within the road haulage industry: household removal accounted for 0.85% of all kilometre transport by HGVs in 2018[42]. Nevertheless, it is worth reiterating that they likely to form a greater proportion (relative to national vkm) of HGVs travelling in to urban, and therefore CAZ, areas.

With respect to HGVs, it is also worth noting the following points, which will impact on the affordability risk:

- There is currently no accredited retrofit option available, reducing the options available to HGV operators to respond to the Benchmark CAZ (retrofit typically carries a lower upfront cost).
- The Benchmark CAZ D introduction itself may increase the cost of upgrading to compliant vehicles. Lack of availability and increased demand has inflated Euro VI HGV prices due to simultaneous CAZ implementation across UK cities. Euro VI vehicles now exceed £150,000 in value. Further, the CAZ may also suppress the value of Euro IV and V vehicles, increasing the financial challenges to replacing vehicles.

[37] Benefits from reduced travel time may be limited due to the recent introduction of specific delivery times
[38] Road Haulage Association, Cost Tables, (2019); https://motortransport.co.uk/wp-content/uploads/2020/01/Binder1.pdf
[39] The CBA assumes the 7,859 HGVs will choose to upgrade to a Euro VI.
[40] As reported by the British Association of Removers
[41] Via stakeholder communication with the British Association of Removers.
[42] DfT Statistics table RFS0104

### 4.3.2. Impact on light good vehicle (LGV) operators

#### 4.3.2.1. Impacts under the Preferred Option

Impacts of the Preferred Option for businesses that use LGVs are similar to those felt by HGVs, and are likely to be minimal except for some minor restrictions at peak times. The key exemption to this is the Fenton Industrial Park which, as with HGVs, will see significant disruption at peak times due to its location on the A50 and the bus gate.

LGVs will see a small decrease in the vkm driven within the CIA for all vehicles. The reduction in distance is likely due to vehicles rerouting and avoiding the Hanley centre and the bus gates. It is highly unlikely that any vehicle will cancel their journey as a result of the traffic measures and therefore there is unlikely to be any insurmountable impact on business.

Moreover, the total increase in vehicle km outside the CIA is almost five times greater than the decrease inside the Impact Area. This suggests that vehicles are travelling significantly greater distances to re-route and avoid the bus gates. This can also be reflected in the cost implications set out in Table 4-11.

**Table 4-10: Change in vehicle km for LGVs under the Preferred Option**

| | | LGVs (million vkm) | |
|---|---|---|---|
| **Preferred Option** | | Compliant | Non-compliant |
| | Inside the CIA | -0.2 | -0.16 |
| | Outside the CIA | 0.48 | 0.39 |

User benefit impacts for the impacts of the Preferred Option on LGVs are similar to HGVs. The traffic model shows a small change in LGVs rerouting outside of the CIA to avoid the traffic restrictions. The net impact of rerouting as a result of the bus gate restrictions results in time, non- fuel VOC and fuel VOC disbenefits. Over the 10-year appraisal period, this results in a significant disbenefit to businesses of over £7 million. While this is a significant disbenefit, when considered per vehicle, ANPR suggests that over 170,000 LGVs enter the CAZ annually, which would result in an impact of just over £40 per vehicle.

**Table 4-11: User Benefit impacts on freight LGVs under the Preferred Option: 2022-2031**

| | Total |
|---|---|
| **Time** | -£ 6,160,801 |
| **Non- fuel VOC** | -£ 493,286 |
| **Fuel VOC** | -£ 517,665 |
| | **-£ 7,171,752** |

#### 4.3.2.2. Impacts under the Benchmark CAZ D

LGVs tend to be used by micro and small companies to transport goods across smaller distances, typically within the immediate locale[43], however they are increasingly employed by larger organisations (i.e., supermarkets) for short journeys such as home deliveries. The growth of freight deconsolidation and decentralisation over recent years, reflecting the increase in online shopping and ecommerce, has resulted in an increased use of smaller vehicles, particularly LGVs.

[43] RAC Foundation (2014)

Under the Benchmark CAZ D, all non-compliant LGVs will be restricted from entering the charging area without paying.

ANPR data shows that only 32% of LGVs recorded within the CAZ boundary are currently compliant, therefore the majority of current LGV users would be required to upgrade their vehicle or pay the charge. However, the transport model identifies that in the current situation, more vkm are driven by compliant LGVs than non-compliant. This suggests that while there may be more non-compliant vehicles in circulation, compliant vehicles will typically be driven more, or further, than non-compliant LGVs.

Nevertheless, the large number of non-compliant LGVs has a significant impact on the affordability for businesses. LGVs tend to be used by smaller, often self-employed businesses who will have less available capital required to either upgrade or retrofit in order to comply with the CAZ regulation[44]. If the business is located within the CAZ boundary, they may be forced to move out or close down completely due to the increase in operating costs as a result of the Benchmark CAZ D. Non-compliant LGV operators, in particular micro businesses such as plumbers and electricians will be required to travel into the zone for work, where their customers are located. Where these businesses are unable to move premises or accept a higher cost, LGV operators will have little option but to upgrade their vehicles or pay the charge, in order to avoid losing business and closing down.

Table 4-2 gives further insight in to how LGVs would behave under the Benchmark CAZ D and the potential impact this could have on businesses in and around the area. The reduction in non-compliant vkm inside the CAZ boundary is only partially offset by the increase in compliant vehicles. The greater increase in vkm outside the CAZ compared to the reduction in vkm outside the CAZ boundary suggests that even where LGVs are upgrading to compliant vehicles they are travelling more outside the CAZ area, which could have a further detrimental effect on businesses inside the CAZ boundary.

A 60% reduction in non-compliant vkm under the Benchmark CAZ D suggests that the majority of LGV drivers will upgrade their vehicles or reroute. Businesses operating within the CAZ boundary are likely to be impacted through a reduction in demand for their services as more vehicles reroute around the boundary, as well as through increased costs to supply, due to the implementation of the charge. A similar impact of stranded assets, as with HGV businesses, may also be observed for LGV businesses.

**Table 4-2: Change in vehicle km for LGVs under the Benchmark CAZ D**

| | | LGVs (million vkm) | |
|---|---|---|---|
| | | Compliant | Non-compliant |
| **Benchmark CAZ D** | Inside CAZ | 4.2 | -6.2 |
| | Outside CAZ | 10.8 | -7 |

It is worth reiterating that unlike HGVs, the use of LGVs is much more varied. In addition to transporting goods, LGVs are often used by micro-businesses and people who are self-employed. The RAC found that majority of new sales of LGVs are sold to fleet buyers[45]; while 86% of privately purchased LGVs, including those by micro-businesses with a single vehicle such as plumbers and electricians, are purchased second-hand. While the replacement cycles of LGVs vary, LGVs with the longest replacement cycle are likely to be registered to private individuals[46]. Smaller traders are therefore more likely to operate older vehicles and as a result, would be more greatly affected by the Benchmark CAZ D.

[44] RAC Foundation (2014)
[45] Commission for Integrated Transport (2010). Vans and the Economy: London: CfIT.

[46] https://www.racfoundation.org/assets/rac_foundation/content/downloadables/van_report_aecom_100414.pdf

Table 4-12 shows the costs and benefits for LGV operators. The most significant cost for LGVs is the CAZ charge, which will have a direct financial impact on drivers; unlike some of the benefits such as the time saving. The analysis that was based on a Stated Preference (SP) survey aimed at local businesses, reflects that only 43% of LGVs will upgrade their vehicles. This relatively low upgrade level is reflected in the outsized impact of the CAZ charge, as the majority of vehicles that continue to enter the CAZ boundary will be subject to the charge. The presence of petrol LGVs (unlike HGVs, although a smaller percentage of the market) means that many non-compliant diesel LGV owners might switch to compliant Euro IV/V petrol LGVs. This not only minimises the benefits from buying a newer vehicle (namely fuel, non-fuel VOC and $CO_2$ savings) but can also have a negative impact due to higher rate of fuel consumption[47].

The role that LGVs play in the local economy, in particular from micro businesses and delivery services, mean that very few LGV operators will choose to, or be able to, change or cancel their trip. This is reflected in the relatively low welfare cost. If the business that an LGV serves is located within the CAZ area then there is no way to reroute or change their trip to avoid the travelling in to the charging area, similarly, if the LGV business wishes to retain their business then they will be unable to cancel the trip

Finally, it is worth reiterating that the costs and benefits represent the marginal, societal cost to the LGV sector and may not correspond to how this policy is felt by LGV users and drivers. This is demonstrated by the marginal upgrade cost, calculated at almost £11.5 million, and the cost of purchasing new compliant LGVs in 2022, estimated to be over £120 million[48]. Overall, the cost benefit analysis shows that rather than incentivising LGVs to upgrade to a compliant vehicle, the majority of LGVs (57%[49]) will simply pay the entry charge which will not improve air quality and simply add an additional cost to local businesses, as reflected in the CAZ charge impact below.

**Table 4-12: User benefit and CBA impacts on freight LGVs under the Benchmark CAZ D**

| Impact | |
|---|---|
| Time | £921,557 |
| Non- fuel VOC | -£370,956 |
| Fuel VOC | -£2,474,175 |
| CAZ charges | -£79,810,704 |
| Welfare impact | -£3,027,823 |
| Upgrade cost | -£11,419,916 |
| **Total** | **-£96,182,017** |

## 4.4. Impact on public transport operators

The main form of local public transport in North Staffordshire is a privately operated bus network. Currently, there are two major bus operators that serve the North Staffordshire area – first Potteries and D&G. In 2019, 106 buses were used in the North Staffordshire area, of these just 7.5% were Euro VI compliant.

The other significant form of transport is train, with Stoke-on-Trent train station connecting the area to other major metropolitan hubs such as Crewe and Manchester to the north and Birmingham and London to the south.

[47] https://www.rac.co.uk/drive/advice/buying-and-selling-guides/petrol-or-diesel/

[48] The net cost is calculated by finding the difference between the net cost of purchasing new vehicles and selling old vehicles and comparing this to the cost under a baseline scenario where LGV drivers would have upgraded to a compliant vehicle at the end of the vehicle's life.

[49] Based on the number on non-compliant LGVs that will not upgrade as determined in the CBA model.

### 4.4.1. Impacts under the Preferred Option

There are three measures under the Preferred Option that will all have a meaningful impact on public transport operators, specifically bus companies, and the people that use them, namely:

- Peak time bus gates on the A53 Etruria Road and A50 Victoria Road
- Bus retrofits along Bucknall New Road and Victoria Road
- Improved bus infrastructure including real time passenger information (RTPI), bus shelters and CCTV

Broadly, these measures will benefit the bus companies by improving conditions of bus travel and therefore encouraging more users. However, it should be noted that all changes need to be considered in the context of the wider private bus operator market, such as increased fares and reduced services in recent years.

The bus gates along the A53 Etruria Road and A50 Victoria Road will reduce overall traffic levels along these routes during peak times, which might encourage the use of buses as the most direct and quickest mode of travel. As a result, bus operators would benefit from the possible additional revenue from increased passenger numbers.

Improvements to the environmental performance of the bus fleet, through the use of emissions retrofits, may encourage an increase in the number of passengers, particularly where these changes are combined with effective engagement and marketing campaigns. As part of the Local Authorities' Implementation Fund submission to JAQU, funding towards retrofitting buses has been included and will be distributed to bus operators as appropriate. This would ultimately ease the financial pressure on operators to retrofit their vehicles in order for $NO_2$ emissions to be brought in line with EU limits.

Finally, investment in bus infrastructure is expected to play a big role in increasing the attractiveness of bus travel. These investments are:

- The installation of RTPI at 89 bus stops
- Additional bus shelters (including 8 replacement shelters and 9 new ones)
- Accessible kerbsides at 27 bus stops
- CCTV (at 71 stops)
- Bus wraps

Improving the experience, ease and safety of using public transport will reduce the barriers to people using buses as a means of transport. These infrastructure plans are limited to specific routes and therefore any increases in uptake may be limited to these areas.

Nevertheless, these measures are expected to increase the ridership of local public transport, particularly along the impacted routes, and therefore public transport operators are expected to benefit through possible increases in revenue.

### 4.4.2. Impacts under Benchmark CAZ D

Under the Benchmark CAZ D all buses operating in the charging area will need to be Euro VI compliant or face the charge. The charges proposed as part of the Benchmark CAZ D have been designed to minimise the impact on public transport operators in the area and prevent any operators from withdrawing from the market. This is in recognition of the reductions in bus services and operators' profit levels in recent years. The number of annual bus journeys have been cut from 15.6 million in 2010 to 10.3 in 2017[50]. Maintaining the remaining bus links is vital to the health of the communities they serve.

The nominal charge rate imposed on buses in the event of the Benchmark CAZ D is unlikely to result in bus operators purchasing newer, compliant buses, as this would be a huge expense to the operator, many of whom are already operating with slim profit margins. Instead, bus companies could retrofit vehicles, pay the charge or withdraw routes. Given that the charge for buses is not intended to induce behaviour change, many will choose to pay the charge, costing the bus operators over £700,000 across the first 10 years of the scheme operation.

Under a Benchmark CAZ D scenario, the use on non-compliant cars within the central conurbation is also chargeable. If the cost of using the vehicle, when considering the daily charge, exceeds the cost of public transport, then car users may be more motivated to use public transport. This would lead to greater demand and revenue for bus operators who service routes into the CAZ boundary. However, analysis of bus use in the local area and the SP survey suggests there will be limited behavioural response from individuals shifting mode to bus travel in response to the Benchmark CAZ D. The SP survey asked car drivers in the local area how they might respond to the implementation of a CAZ D, of which less than 5% of respondents said they would shift modes and take up bus use.

In conclusion, charges have been set to minimise impacts on bus operators as a result of the Benchmark CAZ D, although these businesses will still face additional costs through having to pay the charge or retrofit their vehicle.

## 4.5. Coach operators and tourism

### 4.5.1. Impacts under the Preferred Option.

Impacts on coach operators and the tourism sector will be minimal, coaches are exempt from the bus gate restrictions and therefore will not be negatively impacted by the option. These coaches may also see a small benefit from reduced congestion along these routes, however the impact on total travel time will be negligible and it is not expected to have a significant effect overall.

### 4.5.2. Impacts under the Benchmark CAZ D

In 2018 there was almost 27 million trips to Staffordshire[51]. Stoke-on-Trent was recognised as one of the top destinations in the county (alongside the Peak District) and attracts a significant amount of the overall tourism. The areas of Newcastle-under-Lyme and Stoke-on-Trent are served by a principal bus stations and a train station.

Hanley bus station is located within the CAZ boundary and Newcastle Bus Station is located just outside the CAZ boundary. Therefore, coaches travelling to or from these stations will either need to be compliant or pay the associated CAZ charge.

Coach operators may respond to the charge by replacing vehicle fleets or by reducing the number of journeys they undertake into the CAZ. Operators who replace non-compliant vehicles with compliant vehicles would have the advantage of being able to operate within the CAZ without incurring the daily charge. Other operators might choose to reroute their services to avoid entering the CAZ boundary. This change in behaviours might result in a shift in market share, specifically relating to the tourism industry, and so possible impacts on operators' revenue could incur. It is estimated that almost 400 coaches serve the CAZ area in one form or another and that 40% of these will upgrade to be compliant.

[50] https://www.stokesentinel.co.uk/news/stoke-trent-bus-journeys-fall-2320536
[51] https://www.enjoystaffordshire.com/trade/what-we-do/facts-figures

Given that coaches will typically operate nationally, it is difficult to assess the impact of this Benchmark CAZ D on their business operations.

The implementation of the Benchmark CAZ D is likely to support and enhance current ambitions by coach operators to reduce the emissions from their fleets. In 2019 several coach companies pledged to only buy ultra-low or zero emission buses from 2025, and in February 2020 the coach operator National Express pledged never to buy another diesel vehicle[52]. This suggests that while coach operators with non-compliant vehicles may face an initial cost, this policy, coupled with the number of other charging zones, is likely to spur the green investment that is already happening in this sector. This suggests that while the purchase of new (low or zero emission) buses can be expensive, the fact that coach operators are already considering this suggests that it is both profitable, and that operators have the capital on hand to make the required upgrades.

However, whilst this is the case for larger, national operators, it is a different story for small, locally owned bus and coach companies. Smaller sized coach operators might not have the luxury of being able to replace their fleet in line with the implementation of the CAZ D and so might instead reduce the number of journeys they make into the bounded CAZ area. This could result in them becoming less competitive in the market and so would need to consider alternative long-term business strategies in order to continue operating.

The risk for smaller coach operators may also be exaggerated by the nature of the customers they serve. If smaller coach operators are more likely to serve regular routes within North Staffordshire (e.g. school buses), they will have a lower capacity to pass costs through to their customers. This is because the total cost passed through per customer will be much higher than a national operator, which sees a greater variance in its customer base. Some larger coach operators, such as National Express, have policies requiring its coach operators to use vehicles that are no more than seven years old, and would therefore be relatively well-positioned to adapt to the implementation of a charging zone[53]. In addition, some commuter services run by national operators, especially those on long-distance service lines, may be able to re-route their services to avoid passing through a charging zone.

Without smaller coach operators continuing to offer services into the CAZ boundary, a negative knock-on impact might be felt by businesses and attractions that are based within the CAZ boundary, as the availability to visitors from reaching these destinations would be reduced. As a result, attractions outside of the CAZ boundary might benefit from a transfer of demand.

## 4.6. Taxis and private hire vehicles (PHVs)

### 4.6.1. Impacts under the Preferred Option

The preferred option will impact taxis drivers and their businesses through the introduction of bus gates on the A53 Etruria Road and the A50 Victoria Road, restricting their access at peak times. Some roads will see an increase in flow and the road links directly associated with the bus gates will experience a significant reduction. Depending on the origins and destinations of the myriad of taxi journeys undertaken each shift and the timing of those journeys taxi drivers are likely to experience a mixture of impacts. However, these costs will be directly passed on to the customer through the fare price. As the price of trips is fixed per km, where the journey time will increase, the journey distance will also increase resulting in no overall impact for the taxi driver. While this could result in less demand for taxis,

[52] https://www.businessgreen.com/news/4011501/green-bus-boost-national-express-maps-route-zero-emission-bus-fleet-2030?utm_medium=email&utm_content=&utm_campaign=BG.Daily_RL.EU.A.U&utm_source=BG.DCM.Editors_Updates&utm_term=HUBBUB&utm_medium=email&utm_term=50%20to%2099&utm_term=HUBBUB

[53] Jacobs, "Ultra Low Emission Zone: Integrated Impact Assessment", and associated documents, prepared for Transport for London, October 2014, https://consultations.tfl.gov.uk/environment/air-quality-consultation-phase-3b/user_uploads/integrated-impact-assessment.pdf, accessed 24/04/2018.

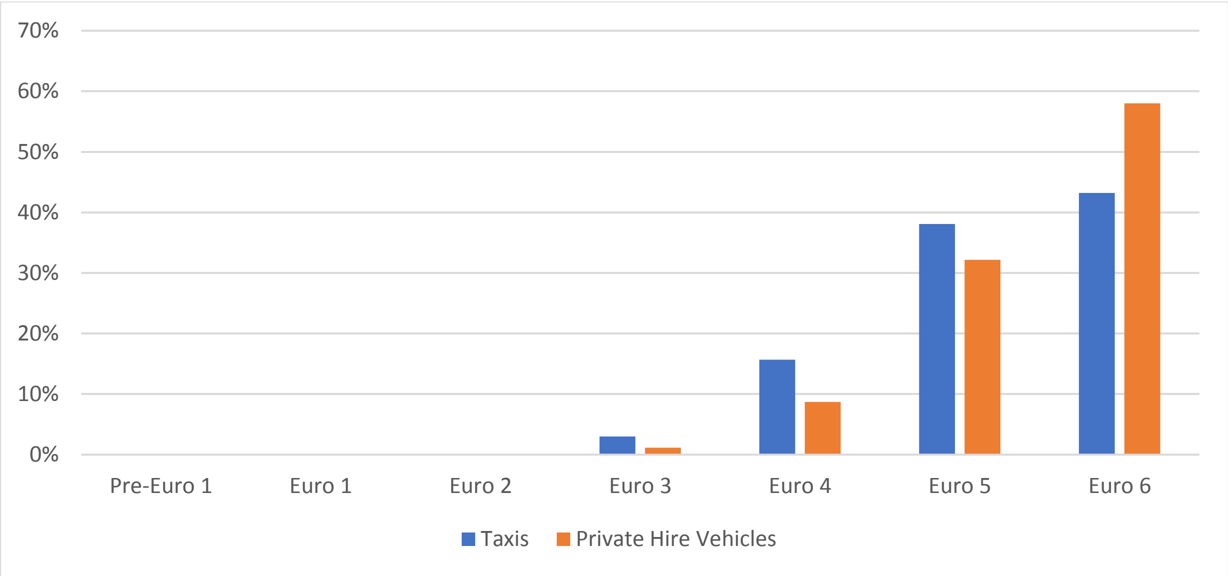
as the increased distance per trip (and only affect trips at key times on key roads) this is not expected as the journey price increase is not expected to be significant.

### 4.6.2. Impacts under the Benchmark CAZ D

Taxis and private hire vehicles (PHVs) based in the North Staffordshire area are likely to have to spend a large portion of their time traveling in and out of the CAZ boundary. Legally, taxis and PHVs are not allowed to refuse a fare if, for example, they wanted to avoid entering the CAZ boundary, and they are also required to travel the shortest and most sensible route. This therefore limits taxis and PHVs from being able to reroute their journeys, leaving them with little choice in response to the Benchmark CAZ D but to upgrade their vehicle, pay the CAZ charge or cease to operate as a taxi.

The cost-benefit analysis models 43% of all taxis (Hackney Carriages) and 60% of all PHVs are compliant (see Figure 4-3). It is assumed that the majority of non-compliant taxis and PHVs will upgrade[54] given the regularity of which they enter the CAZ boundary, so as to avoid paying the charge[55]. Annualised Revenue modelling and User Charge data suggests that the cost to taxi operators will be approximately £48,000 over the next 10 years. While this is relatively low cost, it will still be a significant financial impact to those drivers who do not upgrade because the burden is spread across a smaller number of drivers. Assuming that non-compliant taxi drivers still operate in the CAZ area daily then paying the entry fee will be a significant added expense.

**Figure 4-3: Euro split of Taxis and Private Hire vehicles in North Staffordshire**




On the other hand, taxis that do upgrade will be uniquely affected due to their ownership structure. Unlike other modes, taxis tend to be owned and operated by a single driver, rather than by larger businesses. Hence, the cost burden of the Benchmark CAZ D is faced by an individual, rather than a business. This has two impacts:

1. An individual inherently has lower capacity to spread any cost burden across multiple operations or revenue streams.
2. The impacts on taxi operators will impact directly on household income, rather than business revenue. Indeed, the London Ultra Low Emission Zone (ULEZ) impact assessment recognised

[54] Based on the CBA model
[55] Responses to the Stated Preference would seem to contract did as a large number of taxi drivers stated they would not be able to afford to upgrade. Regardless, the overall conclusion that there would be a significant compliance cost to a vulnerable business group in unchanged.

that virtually all taxi drivers are self-employed and therefore, would need to bear the cost of new vehicle purchase themselves.

Moreover, the price per km for Hackney Carriages is fixed under licence regulations (which by extension sets the price of Private Hire Vehicles), and therefore does not allow drivers to pass on the price increase through higher fares and forces the drivers to absorb the cost. Analysis of taxi drivers also shows that taxi drivers typically reside in the most deprived communities as defined by the Index of Multiple Deprivation (quintiles 1 and 2).

This is supported by comments received during a public consultation with businesses. Several taxi drivers stated explicitly that the introduction of any charge would mean they have to stop operating. other appreciated the effort to improve air quality, however stated it would do so at the expense of putting a large number of taxi drivers out of business.

The introduction of the Benchmark CAZ D therefore is likely to have a regressive impact, severely impacting those, in this case taxi drivers, who are already some of the poorest members of the community. The figures socio-economic status of the majority of taxi drivers and the cost of purchasing a compliant vehicle (between £5,000 and £7,300), will therefore have a significant financial burden on the drivers.

## 4.7. Impacts on wider businesses

### 4.7.1. Impacts under the Preferred Option

The Preferred Option sees a small number of passenger cars reroute outside of the Central Impact Area (CIA) in order to avoid the road restrictions, as the restriction are only in place along two roads and at certain times, the overall disruption to businesses is expected to be minimal. Most notably, anybody still wishing to travel into the central conurbation can still do without incurring any significant additional costs on their journey

Figure 7-2 shows the significant changes in traffic volume in the greater North Staffordshire areaIn the conurbation a small number of changes are seen along key roads where exceedances were previously located.

The User Benefit analysis shows us that passenger cars across all purpose types, will see an increase in fuel and non-fuel vehicle operating costs, as well as increased travel times (see Table 4-13). The increase in travel time (decrease in time benefit), and the scale of the disbenefit relative to the other costs suggests that this may be due rerouting as a result of the measures.

The biggest time delay is for commuters, given that the traffic restriction measures are active at peak times, when these drivers are on the road, this is to be expected.

Regarding direct financial impacts on businesses, 87% of the costs to businesses is the time impact from the implemented measures. While this will have an impact on businesses in terms of lost worker time, businesses themselves will not note direct financial losses from this disbenefit but may note financial losses through the lost productivity of workers, although any impact on businesses is expected to be small.

**Table 4-13: User Benefit impacts on cars used for commuting and business under the Preferred Option**

| | Commuter use | Business use | 'Other' use | Total |
|---|---|---|---|---|
| Time | -£17,910,713 | -£7,279,025 | -£13,856,313 | -£39,046,051 |
| Non- fuel VOC | -£551,881 | -£703,724 | -£577,526 | -£ 1,833,130 |
| Fuel | -£1,455,359 | -£1,140,463 | -£1,585,061 | -£ 4,180,883 |
| **Total** | -£19,917,953 | -£9,123,212 | -£16,018,900 | **-£ 45,060,065** |

### 4.7.2. Impacts under the Benchmark CAZ D

Other businesses that do not directly utilise or rely on transport will still be impacted by the introduction of the Benchmark CAZ D.

Businesses based within the CAZ boundary and continue to operate once the CAZ D is in operation will need to ensure that all their vehicles are compliant with the new emissions standards or face being charged every time they enter. This will primarily impact the use of HGVs and LGVs to bring goods and produce, but will also impact:

- Businesses that own and use cars
- Commuters
- Shoppers and other customers

The exact nature of the impact will depend on the type of business.

Table 4-14 shows the breakdown of the CBA that applies to all passenger cars, including those used for business, commuting and leisure. The design of the CAZ area and the relatively[56] low CAZ charge for passenger cars results in a low upgrade rate for cars and is also reflected in the large CAZ charge cost to non-upgrading vehicles. The impact of paying the charge outweighs any other any other impact in the CBA[57].

Moreover, as with the other CAZ charges analysed, the marginal costs reported here do not reflect the direct costs and impacts on car users, for example the financial cost from the fuel usage will be felt more acutely than the increased $CO_2$ emission[58].

Analysis of the Benchmark CAZ D model also allows for interpretation of the benefit per vehicle that chooses to upgrade. 61,777 cars are assumed to upgrade to a compliant model, 58% of these are assumed to be Euro IV petrol, and the remainder Euro VI diesel. By summing the impact associated with fuel, time and other non-fuel impacts the total level of benefits to the car user is over £30 million. Dividing this benefit by the number of upgrading vehicles gives an approximate benefit of £500 per upgrade[59].The cost of purchasing a compliant vehicle is assumed to be about £1,500 for a Euro IV petrol and £7,400 for a Euro VI diesel. Hence any benefits from upgrading, spread across the 10-year appraisal period, would account for between 33% and 7% of the cost of purchasing a new car.

**Table 4-14: Cost Benefit Analysis for passenger cars**

| Impact | |
|---|---|
| Time | £20,626,659 |
| Non- fuel VOC | £13,433,366 |
| Fuel VOC | -£3,043,618 |
| CAZ charges | -£137,103,731 |
| Welfare impact | -£24,622,733 |
| Upgrade cost | -£35,025,145 |
| **Total** | **-£165,735,202** |

[56] Relative to CAZ's in other cities. The CAZ charge for cars has been kept low to minimise the impact on passenger car users as North Staffordshire and the Stoke-on-Trent area is one of the most economically deprived areas in the country.
[57] In the CBA analysis the CAZ charge is not considered therefore has no net impact, although it is considered, as it is a transfer of costs. When we consider the impact to a specific sector or vehicle group it is included.
[58] As with LGVs, the availability of compliant Euro IV petrol vehicles and the greater fuel consumption and emissions of petrol cars results in a net cost for these impacts from upgrades.
[59] This analysis likely overemphasises the benefit of a new petrol vehicle and underestimated the benefit of new diesel benefits, the majority of additional petrol vehicles is switches from either Euro IV or V diesel, and so any benefit will be minimal.

The user benefit analysis also allows us to split some of these impacts by purpose. The time, fuel and non-fuel vehicle operating costs, as well as the CAZ charge are set out in Table 4-15. Car 'Other' use is shown to be the most impacted as a result of the Benchmark CAZ D. The CAZ charge for this group is significant and is likely due to the number of unique vehicles making a relatively small number of trips. This will have a direct impact on the businesses in the area who rely on shoppers and visitors for custom. The CAZ charge will place a significant barrier for customers, particularly where the same service can be received without paying the entry charge. One particular example of this is the Intu Potteries shopping centre, people may choose to avoid the charge and use other large shopping centres, such as the Festival Retail Park which are outside the CAZ area. Other shops which have locations both inside and outside the CAZ, such as supermarkets are also likely to be affected.

Another notable result is the significant time saving for commuting vehicles. Unlike 'other vehicles', commuters have less options to cancel their trip or reroute to avoid the charging zone, instead, they will benefit from the other trips that cancel or reroute resulting in reduced journey times within the CAZ boundary. In short, all journey types support the overall narrative that while there are some benefits associated with the charge and vehicles upgrading, these are entirely offset by the number of people that choose to pay the charge and therefore the overall cost to the population[60].

**Table 4-15: User benefits for cars used for commuting business and 'other' under a CAZ D**

| | Commuting use | Business use | 'Other' use | Total |
|---|---|---|---|---|
| Time | £10,240,820 | £5,130,377 | £6,808,767 | **£22,179,964** |
| Non- fuel VOC | £5,131,404 | £231,475 | £9,013,772 | **£14,376,651** |
| Fuel VOC | £349,907 | £37,170 | -£111,094 | **£275,983** |
| CAZ charge | -£47,265,364 | -£17,877,981 | -£71,960,386 | **-£137,103,731** |
| **Total** | **-£33,046,590** | **-£13,047,599** | **-£58,537,765** | **-£104,631,954** |

A unique aspect of the Benchmark CAZ D in North Staffordshire is that the area is polycentric by nature and as a result has three distinct shopping/commercial areas within close proximity of each other: Festival Park, Newcastle-under-Lyme town centre and Hanley. The charging zone only covers the Hanley commercial area and does not directly affect vehicles travelling to Festival Park or Newcastle-under-Lyme town centre, providing clear incentive for those who own non-compliant vehicles to redirect and travel to either of these locations instead of driving into Hanley

It is likely that the squeeze on businesses, both from the increased cost of transporting goods into the charging zone and the reduced custom from customers choosing to shop elsewhere, will place a significant stress on businesses operating in the Hanley area. Particularly micro and small firms which have previously been shown to make up a significant proportion of businesses in the CAZ area.

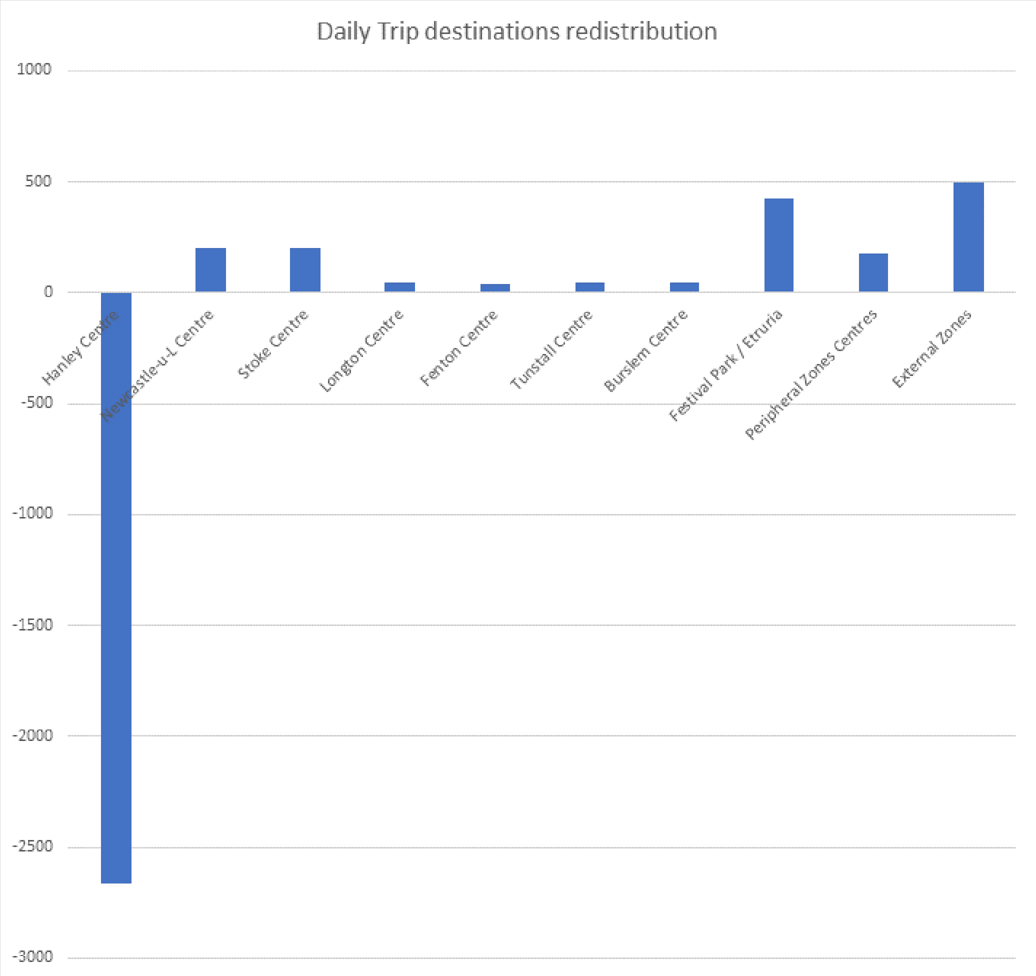
Figure 7-1 shows the change in traffic volumes in and around the CAZ area from the transport model. The figure highlights that many of the key roads in the area see a 10% or more decrease in Annual Average Daily Traffic (AADT). While the reduction in traffic will be a positive for those that still travel inside the boundary, through quicker journeys, reduced congestion and less air and noise pollution, it also visually shows the potential loss of economic activity that could occur.

This is supported by Figure 4-4 which shows a significant reduction in non-compliant vehicles travelling into Hanley. These trips are distributed between a number of other key towns and shopping areas in North Staffordshire. The reduction in non-compliant cars into Hanley will see similar corresponding reductions in visitors and shoppers, which will have a knock-on effect on workers and shop owners. As

[60] It is worth reiterating that the CAZ charge for cars was kept intentionally low as to minimise the impact of these users, many of whom would be severely financially impacted by being required to upgrade or pay a higher entry fee.

discussed in section 4.4, and further evidenced again in Figure 4-4, this is not being offset by increased modal shifts in order areas that could potentially offset this decline, therefore we can expect all businesses that operate in the charging zone to be negatively impacted by the Benchmark CAZ D.

**Figure 4-4: Change in the destination on non-compliant cars under a CAZ D**




While the Benchmark CAZ D and its related charge will affect all businesses to a greater or lesser extent who operate within the CAZ boundary, it will likely disproportionately impact smaller businesses who don't have the ability or flexibility to upgrade their fleet. These businesses will likely have smaller shops and therefore less opportunity or ability to store a large number of goods on the premise, as may be available at larger stores, and therefore will be more reliant on regular trips and deliveries from suppliers.

There are also specific businesses that are likely to be impacted in unique ways by the introduction of the Benchmark CAZ D. There are 845 motor vehicle related businesses in and around the CAZ area and in particular, the second-hand vehicle market and second-hand car dealers are likely to be further impacted by the introduction of the charging Benchmark CAZ D. There is some scope for businesses and individuals to purchase second-hand vehicles in order to be compliant, however the second-hand sale of diesel vehicles is likely to fall significantly as only vehicles purchased after 2015 will be compliant with the scheme. With numerous CAZ schemes being introduced across a number of UK cities at similar times, demand for compliant vehicles is likely to spike whilst demand for non-compliant vehicles will correspondingly fall; exacerbating the impacts to second-hand car dealers.

There are also a number of knock-on and secondary impacts and costs that occur for businesses as a result of the CAZ. Two of the most significant are:

- The CAZ will impact the retail property market and likely reduce rental values on properties inside the CAZ that are less attractive.
- Businesses with large fleets will face additional administrative costs associated with paying the charge.
- Businesses that are directly dependent on vehicle trips, such as car parks, will suffer lost revenue.

In conclusion, all businesses that operate within the CAZ boundary will be affected by it, either through the reliance on deliveries by HGVs/LGVs, the impact on commuters or the reduction in potential shoppers who will be disincentivised to travel into the charging area. Meanwhile, businesses situated outside of the CAZ boundary have the potential to benefit at the expense of these other businesses.

Finally, the type of business that operates in the CAZ boundary is not uniformly distributed. North Staffordshire's key sectors of logistics and transport manufacturing and engineering, including key growth sectors such as energy, applied material and agri-tech[61] are likely to be located outside the CAZ boundary , in key enterprise zones, and are unlikely to be significantly affected; with the exception of those in the transport sector making deliveries in the city.

## 4.8. Summary

Introducing the Benchmark CAZ D or the Preferred Option in North Staffordshire would result in two significantly different outcomes for businesses in the area.

**Benchmark CAZ D:** The Benchmark CAZ D would significantly impact all businesses in the charging area, the immediate surrounding area, and North Staffordshire as a whole. Those that rely on vehicles to move goods and services would be most affected by the charging zone. In fact, almost all businesses are reliant to some extent on vehicles from either a supply or demand side.

In order to avoid paying the CAZ charge businesses will need to upgrade their vehicle to a compliant standard or adopt another approach, but all behavioural responses will carry some burden for the business. HGVs and LGVs are the two vehicle types that will be most significantly impacted either through the requirement to pay the CAZ charge or the financial strain that upgrading will have on local businesses. In the HGV sector, the benefits seen by operators across 10 years is less than 20% of the immediate financial outlay of purchasing a compliant vehicle, however, 68% of HGVs are already Euro 6 compliant and would not be affected by the Benchmark CAZ at all.

70% of all businesses in the CAZ area are classified as micro businesses (less than 10 people) and 92% are considered micro or small (<50 people). Micro and small businesses are likely to be at greater risk from the CAZ D as they are less likely to have the available capital to purchase a compliant vehicle, they do not have large fleets which can redistribute non-compliant vehicles to areas not impacted by the CAZ charge and they are also more likely to have locally focused operations and hence face the charge more often. Across the North Staffordshire area there are over 16,000 micro businesses registered. It is likely that the vast majority will conduct some business inside the proposed CAZ area and therefore be impacted by either paying the charge or upgrading their vehicle(s).

Taxi drivers are some of the poorest in the community and targeting them will place further strain on these businesses and families.

It is anticipated that there will be only a limited impact on bus operators given the charge levels have been set such that the costs can be absorbed and the bus operators can continue 'as-usual'.

**The Preferred Option:** In contrast, the Preferred Option is likely to have a much more limited impact on businesses in terms of affordability. It does not place a direct cost on vehicle owners unlike the

[61] Stoke-on-Trent and Staffordshire Strategic Economic Plan (2018)

Benchmark CAZ D. However, businesses will be affected through indirect costs associated with rerouting to avoid the proposed bus gates.

The traffic model shows a small number of vehicles rerouting to avoid traffic measures on the A50 and A53. This results in time, non-fuel VOC and fuel VOC disbenefits for all vehicle types (as evidenced in the user benefit analysis). Nevertheless, the impact that this would have on businesses would be significantly less compared to restricting access to Hanley and the surrounding area as observed under the Benchmark CAZ D.

Aside from the costs associated with rerouting, the majority of businesses will not be significantly impacted by the Preferred Option as all vehicles who previously entered the city centre would be able to continue to do so without any significant changes. The key exception to this, as highlighted in the HGV and LGV sections is the Fenton Industrial Estate which will have access restricted by the bus gate on the A50.

The only business type to see any specific impact is public transport operators. Measures to encourage the use of buses, such as RTPI and retrofitted buses is expected to have a possible positive impact on the use of buses around North Staffordshire.

In addition, unlike under the Benchmark CAZ D where the burden is placed on the operators of non-compliant vehicles, the Preferred Option does not discriminate by type or age of vehicle. As such, all vehicles will be affected on a relatively equal basis, so the Preferred Option is unlikely to have a significantly greater impact on smaller businesses relative to larger ones given patterns of vehicle ownership, equivalent to the Benchmark CAZ D.

In conclusion, there is a clear divide between the impacts of the Benchmark CAZ D and the Preferred Option. The Benchmark CAZ D will impact a large number of businesses in North Staffordshire, in particular affecting smaller businesses which may not be able to afford a new vehicle and therefore face a greater risk to their business. The Preferred Option would be much better for businesses who would not face a charge, but would face costs associated with vehicle rerouting. Whilst these are not insignificant they are smaller than under the Benchmark CAZ D. The Preferred Option would also benefit public transport users and operators with new buses and RTPI which would make public transport a more appealing offer to the general public.

**Table 4-16: Overview of impacts to business sectors from the Benchmark CAZ D and the Preferred Option**

| Impact on: | CAZ D | The Preferred Option |
|---|---|---|
| **HGVs** | X X | X |
| **LGVs** | X X X | X |
| **Public transport** | X | -- |
| **Coach operators and other tourism** | X | -- |
| **Taxis and Private hire vehicles** | X X | -- |
| **Other business impacts** | XX | X |

X X X: significant negative impact; X X: negative impact X: some negative impact; -- : no overall impact; ✓ some positive impact; ✓✓: positive impact; ✓✓✓: significant positive impact.

# 5. User benefits

## 5.1. Context and Methodology

User benefits represent the overall net benefit that someone captures from making a given trip. TAG Unit A1.3[62] explains this as such:

*Users perceive both money costs and time costs associated with the trips they make. When someone makes a trip these costs will be outweighed by the opportunities and potential benefits at the destination. …The calculation of transport user benefits is based on the conventional consumer surplus theory where consumer surplus is defined as the benefit which a consumer enjoys, in excess of the costs which he or she perceives. ….The user impacts of a transport scheme which changes the perceived costs of travel should be assessed based on the change in this surplus… The assessment of consumer surplus should incorporate changes to the following components of perceived cost:*

- *changes in travel time;*
- *changes in user charges, including fares, tariffs and tolls; and*
- *changes in vehicle operating costs met by the user (i.e. for private transport).*

TAG Unit A4.2[63] proceeds to specify:

*User benefits are experienced in certain areas and by certain groups of people. Whilst it is not possible to attribute social impacts to user benefits, there are distributional impacts that have not, in most cases, been considered previously in the appraisal process.*

Both the Preferred option and the Benchmark CAZ D have the potential to impact significantly on user benefits, and their distribution, as they are likely to affect the flow of traffic around the network. In this section, personal user benefits are assessed and quantified for the Preferred Option and the Benchmark CAZ D using the Transport Users Benefit Appraisal (TUBA) model. Note that this section is closely linked with the Personal Affordability below, and the analysis of user benefits forms one strand of the evidence base regarding the distributional impacts of the Preferred Option and the Benchmark CAZ D; for a full overview of the overall distributional impacts of the two options, this analysis should be considered in the context of the E3 report as a whole.

## 5.2. Assessment

The Transport Users Benefit Appraisal (TUBA) model provides cost benefit analysis disaggregated by user groups. As shown in Table 5-1, both options are likely to have a significant impact on user benefits.

**Table 5-1 – Aggregate User Benefits (total 2022-31, 2019 prices, discounted to 2018), in £**

| | Preferred Option | Benchmark CAZ D |
|---|---|---|
| **Travel time (TUBA)** | -12,578,692 | 9,480,222 |
| **Fuel VOC (TUBA)** | -1,203,199 | -494,970 |
| **Non-Fuel VOC (TUBA)** | -892,007 | 10,588,661 |
| **Indirect taxes (TUBA)** | 639,891 | -9,593,313 |

[62] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/805260/tag-unit-a1-3-user-and-provider-impacts.pdf

[63] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/638644/TAG_unit_a4.2_distrib_imp_app_dec2015.pdf

| | | |
|---|---|---|
| **User charges** | 0 | -147,766,018 |
| **Total** | **-14,034,007** | **-137,785,418** |

Under the Preferred Option, the operation of peak period bus gates on Victoria Road and Etruria Road will lead to a mixture of improved and longer travel times and the associated changes in personal affordability. Whilst journeys that would otherwise utilise the bus gates are likely to be longer, it may be that journeys adjacent routes make journey time savings due to reductions in overall traffic. In urban areas junctions play an important role in traffic flow and changes to the movements being made at junctions will have complex results.

For the Distributional Analysis report, user time benefits, user vehicle operating costs (VOC) benefits, indirect taxes and user charge benefits have been analysed at LSOA level.

Raw TUBA outputs for both options covering time benefits, VOC and indirect taxes were provided by transport model sector (these sectors are described in further detail in the T2 report). These results were disaggregated to LSOA level assuming that user benefits were spread equally between LSOAs in each transport model zone.

For the Preferred Option, the impacts over only two time periods (AM Peak and Inter-Peak) were included as representative of the impacts. This is because in these periods we can more confidently assume trip origins are more closely aligned with where people live, and hence a better correspondence to the demographic data (e.g. IMD-Income) which is also spatially linked using residency. The PM time period was excluded given the origins of these trips is less likely to be associated with where people live. For the Preferred Option, exclusion of the PM peak in the analysis may result in a more negative assessment for this area than is realistic if flows in both peaks are not similar, as the bus gates operate in one direction only; the reverse flow on the other hand will be unimpeded.

Impacts associated with “commuter” and “other” (non-commuter) trips made by cars and personal LGVs were included in the assessment.

User charges in the Benchmark CAZ D scenario were not included in the TUBA calculations at sector level. Instead, only the total user charges have been calculated. To disaggregate this total by LSOA in order to explore the distributional impact, this total was disaggregated using the number of non-compliant trips to the CAZ area from each zone using detailed trip data from the transport modelling (described further in the TD reports). To make this adjustment, only AM and Inter-Peak trips for cars and LGVs are included, in order to avoid double-counting of commuter trips. As the charge is paid once a day, the majority of PM trips should already account for the daily charge (where the first trip into the CAZ is during the PM period, this is omitted and will skew the distribution of the allocation of the user charges). Furthermore, non-compliant trips were not disaggregated between business and non-business trips. Therefore, some trips used to distribute the user charges will reflect business trips. Again, this may potentially affect the accuracy of the distribution of user charges between model zones.

Figure 5-1 and Figure 5-2 present the mapped distribution of user benefits across the LSOAs in the study domain.

**Figure 5-1: Preferred Option user benefit (in £ for the year 2022 and per household)***

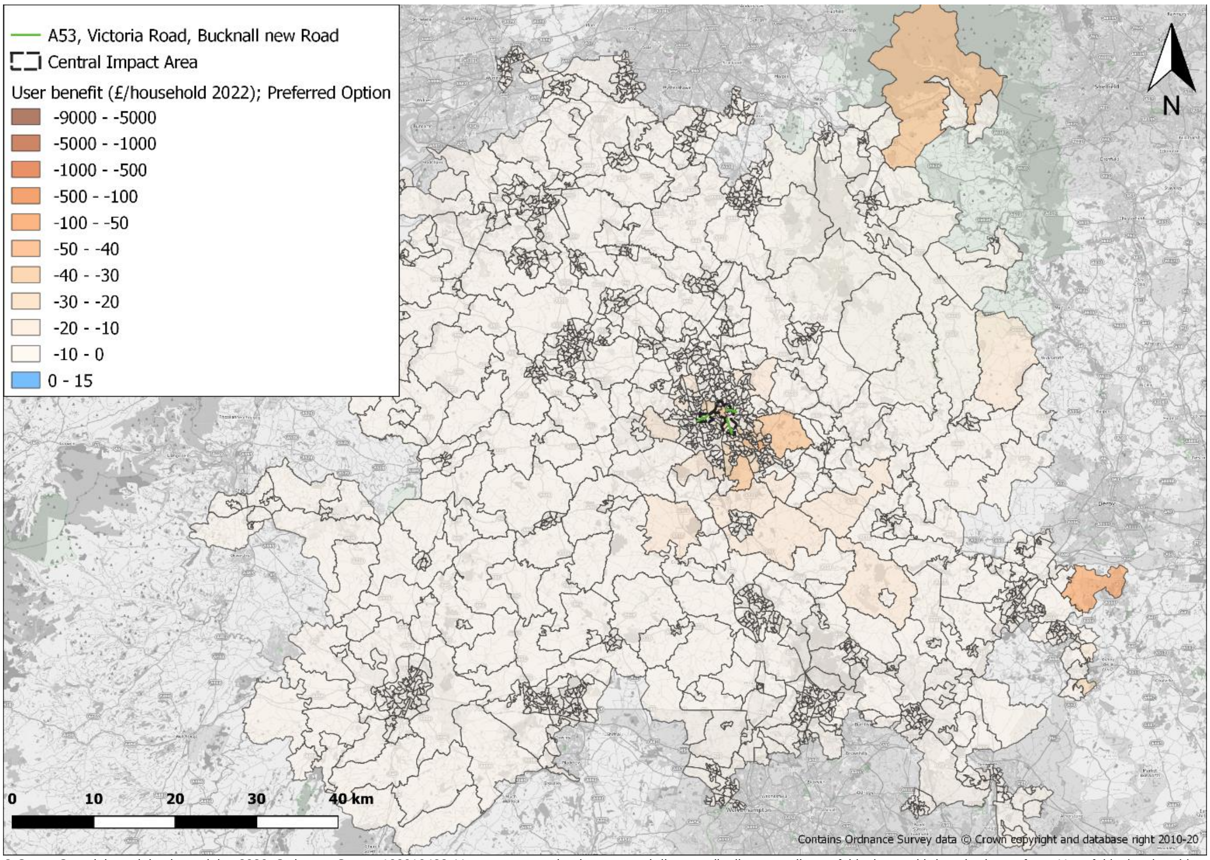
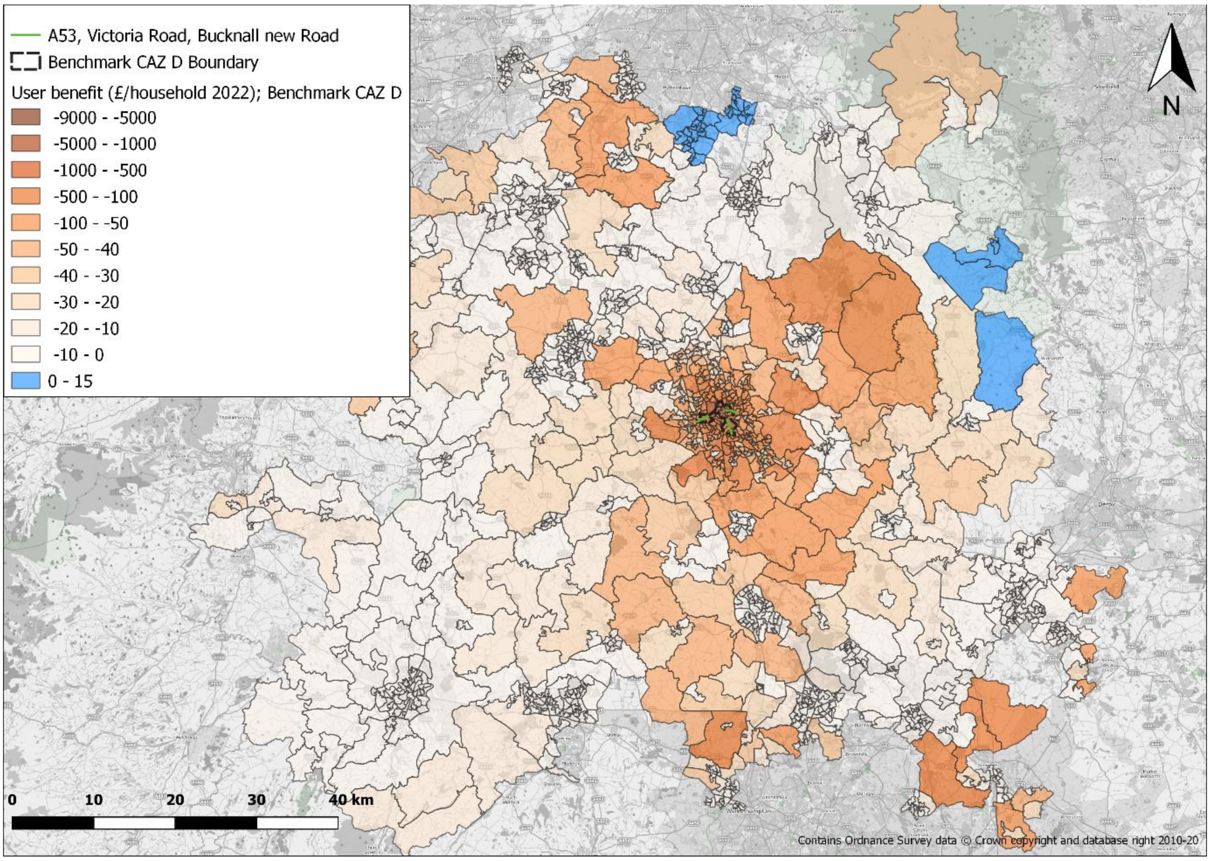





**Figure 5-2: Benchmark CAZ D user benefit in £ per household, 2022**



The largest negative user benefits associated with the Preferred Option are predicted to occur in the Longton area (to the southeast of Victoria Road), and in Hanley city centre (see Figure 5-1 and Figure 5-3). The geographical proximity of these locations to the Victoria Road bus gate will result in a longer diversion than for other origin-destination pairs. It should be noted that because this analysis excludes PM peak movements it does not include the return journey that can occur unimpeded along A50 Victoria Road southbound as the peak period bus gate only operates in a northbound direction.

The predicted magnitude of negative user benefits is substantially greater for the Benchmark CAZ D. These larger negative user benefits are also experienced over a wide area around the CAZ D boundary and within it, with the greatest disbenefits occurring within the CAZ area. As previously discussed, the majority of personal trips with non-compliant trips originate from the CAZ area and its vicinity. A few LSOAs do show a small benefit: these are located on the north-eastern edge of the domain, near Bakewell, as well as the northern edge of the domain, near Wilmslow and Poynton.

**Figure 5-3: Preferred Option user benefit in £ per household, 2022 ***

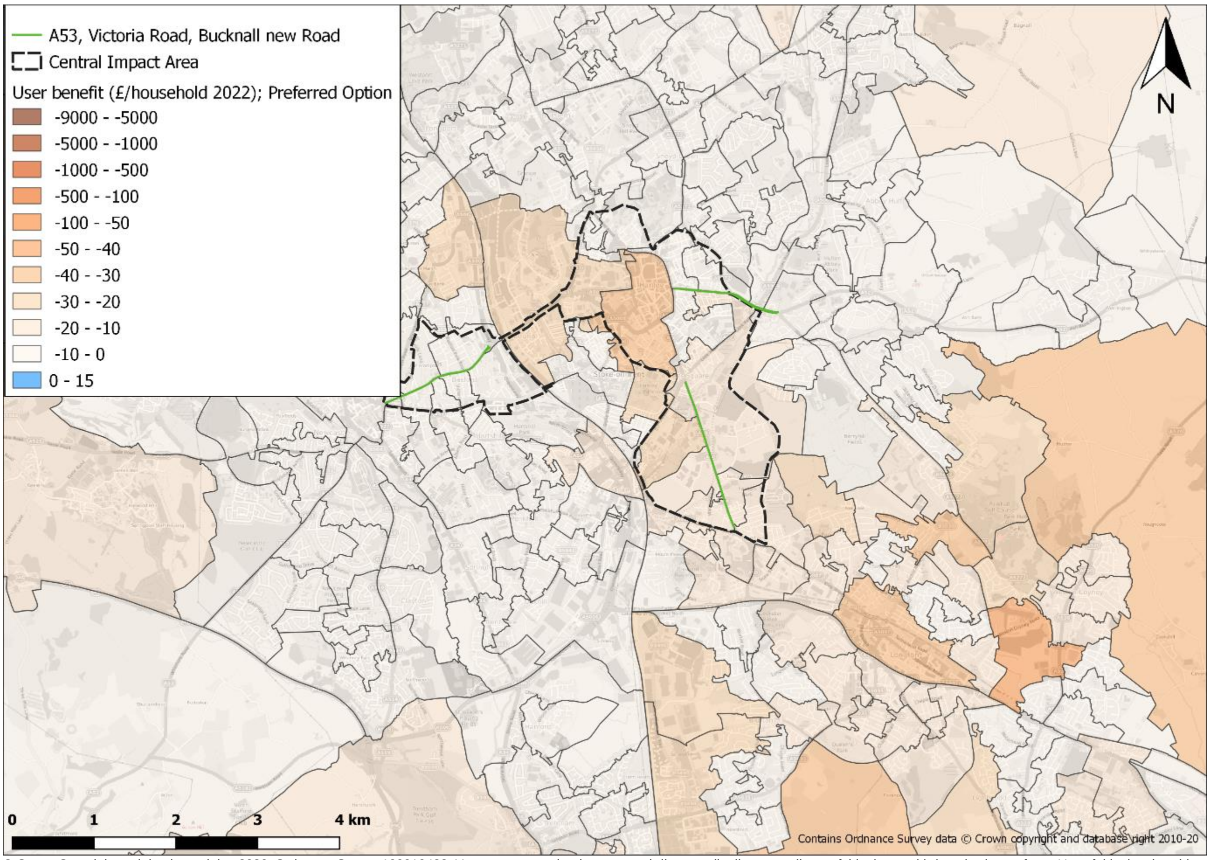
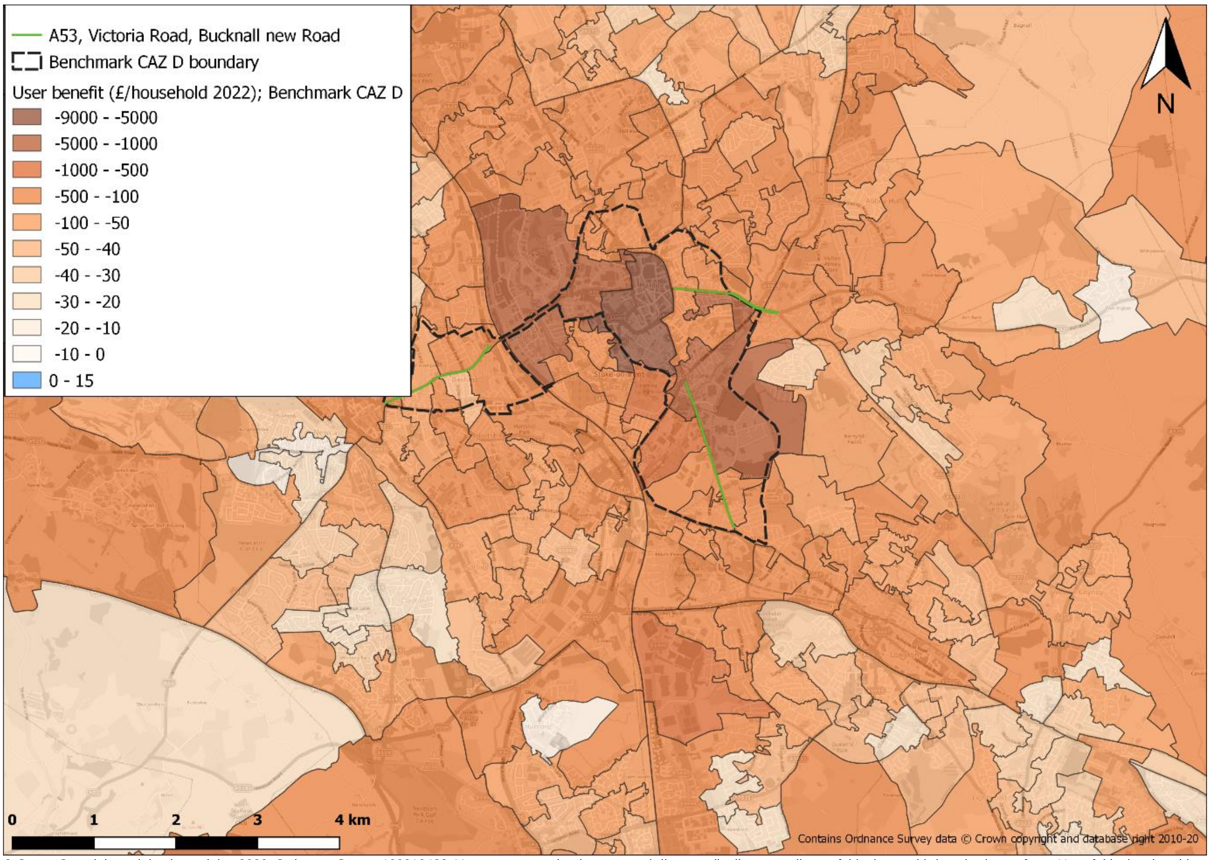


**Figure 5-4: Benchmark CAZ D user benefit in £ per household, 2022**






## 5.3. TAG Table analysis

Table 5-2 shows the tag quintile analysis for the Preferred Option, and Table 5-3 presents the analysis for the Benchmark CAZ D. In this analysis, where an LSOA experiences a negative user benefit, all households in that LSOA are assumed to experience the same average impact. In practice, there will be variation of impact between households within a given LSOA. However, this is a limitation inherent with the TAG approach.

The number of households forecast to experience negative user benefits is broadly equivalent in both the Preferred Option and the Benchmark CAZ D (i.e. the majority). The Benchmark CAZ D is also predicted to provide small benefits to 25,241 households (less than 3% of all households in the DA Domain). However, this small number of high-income households which will benefit from the Benchmark CAZ D are insignificant at the scale of the study area. As such, both options exhibit a moderate adverse impact across all quintiles, signalling no distributional effect.

**Table 5-2: Tag 'quintile' analysis for the Preferred Option – IMD-Income overlay with households**

| Income IMD | Most deprived | | | | Least deprived | |
|---|---|---|---|---|---|---|
| | 0%-20% | 20%-40% | 40%-60% | 60%-80% | 80%-100% | |
| Preferred Option | 1 | 2 | 3 | 4 | 5 | Total |
| Total households which benefit | 0 | 0 | 0 | 0 | 0 | |
| Total households which disbenefit | 125,760 | 147,894 | 170,126 | 199,169 | 211,297 | |
| Net winners/losers | -125,760 | -147,894 | -170,126 | -199,169 | -211,297 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Total number of losers across all groups | | | | | | 854,246 |
| Net winners/losers in each area | 14.72% | 17.31% | 19.92% | 23.32% | 24.73% | |
| Share of the total number of households in the impact area | 14.72% | 17.31% | 19.92% | 23.32% | 24.73% | |
| Assessment* | X X | X X | X X | X X | X X | |

* Crosses are based on the TAG Unit 4.2. XX demonstrates a "moderate adverse" impact.

**Table 5-3: Tag 'quintile' analysis for the Benchmark CAZ D– IMD-Income overlay with households**

| Income IMD<br>Benchmark CAZ | Most deprived | | | Least deprived | | |
|---|---|---|---|---|---|---|
| | 0%-20% | 20%-40% | 40%-60% | 60%-80% | 80%-100% | |
| | 1 | 2 | 3 | 4 | 5 | Total |
| Total households which disbenefit | 916 | 1,535 | 3,723 | 4,668 | 14,399 | |
| Total households which disbenefit | 124,844 | 146,359 | 166,403 | 194,501 | 196,898 | |
| Net winners/losers | -123,928 | -144,824 | -162,680 | -189,833 | -182,499 | |
| Total number of losers across all groups | | | | | | 803,764 |
| Net winners/losers in each area | 15.42% | 18.02% | 20.24% | 23.62% | 22.71% | |
| Share of the total households in the impact area | 14.72% | 17.31% | 19.92% | 23.32% | 24.73% | |
| Assessment* | X X | X X | X X | X X | X X | |

Although TAG is useful for looking at distributional impacts in terms of numbers of people experiencing a given direction of effect (i.e. either a negative or positive change in user benefits), it does not capture a second distributional effect driven by the different size of changes across different demographic groups. To explore this further, Table 5-4 presents the average cost per household split by IMD-income quintile.

It is shown that both options result in larger negative user benefit on the most deprived areas, and disbenefits decrease with increasing quintiles (from a low to a high-income population), suggesting both options could in fact have a disproportionate adverse effect on more deprived households. A key insight therefore is which option has a greater disproportionate adverse effect.

The magnitude of this disbenefit is lower for the Preferred Option compared with the Benchmark CAZ D across more deprived households (e.g. £4 in 2022 on average per household in comparison to £127 for the Benchmark CAZ D). However this is also the case for the least deprived quintiles. What is important therefore is the impact on the most deprived relative to the least deprived quintile. Table 5-4 also shows the relative impact (ratio of impact in quintile vs impact on quintile 5). The relative impact between the most deprived and least deprived quintiles is much wider under the Benchmark CAZ D (i.e. 14.8 times the impact relative to 4.8 times). Hence it can be concluded that although both options will have a disproportionate adverse effect on the most deprived households, but the Benchmark CAZ D will have a greater disproportionate effect.

**Table 5-4: 2022 costs averaged per household and disaggregated by IMD-Income**

| IMD-Income | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Preferred Option | -3.8 | -1.8 | -2.1 | -2.1 | -0.8 |
| Benchmark CAZ D | -127.4 | -24.9 | -19.2 | -16.0 | -8.6 |
| Relative impacts – ratio of impact in quintile vs impact on quintile 5 | | | | | |
| Preferred Option | 4.8 | 2.3 | 2.6 | 2.6 | 1.0 |

| | | | | | |
|---|---|---|---|---|---|
| Benchmark CAZ D | 14.8 | 2.9 | 2.2 | 1.9 | 1.0 |

## 5.4. Summary

Both options have the potential to impact on user benefits through direct charges and indirect costs associated with behavioural responses to the options. Using TUBA model outputs, results show that the population predicted to disbenefit the most from a Benchmark CAZ D is living within the CAZ area or in the vicinity; this population is relatively poor. The Preferred Option appears to have greatest impact on the population occur in the Longton area (to the southeast of Victoria Road), and in Hanley.

Using the TAG tables, both options show a moderate adverse impact across all IMD quintiles, hence showing no disproportionate effect. However, the TAG quintile analysis only takes into account the number of households experiencing a given direction of effect, either an overall increase or reduction in user benefits, and does not capture the size of those benefits.

Looking at the relative impacts across quintiles, it can be seen that the size of impact on the most relative to least deprived quintile is much greater under the Benchmark CAZ D relative to the Preferred Option. Hence, it could be concluded that although both options will have an adverse effect on the most deprived households, the Benchmark CAZ D will have a greater disproportionate effect.

Furthermore, it is important to note that the same cost placed on the most deprived quintile will represent a greater proportion of budget and therefore an even greater impact.

**Table 5-5: Summary of user benefits distributional impacts**

| Scenario | Summary assessment |
|---|---|
| Preferred Option | XX<br><br>• Exclusion of the PM peak in the analysis may result in a more negative assessment for this area than actually observed otherwise as the bus gates are only operational in a single direction.<br>• TAG analysis shows moderate adverse impact across all quintiles, hence no distributional effect.<br>• Looking at the size of impact, the reduction in user benefits will be greatest for most deprived households. In particular given for the same impact, this will represent a greater proportion of their disposable income.<br>• However, the relative impact between the most and least deprived is smaller than under Benchmark CAZ D (impact on quintile 1 is 4.8 times that on quintile 5). |
| Benchmark CAZ D | XXX<br><br>• Disbenefits in terms of personal affordability will be directly felt through the payment of the CAZ charge.<br>• TAG analysis shows moderate adverse impact across all quintiles, hence no distributional effect.<br>• Looking at the size of impact, the reduction in user benefits will be greatest for most deprived households. In particular given for the same impact, this will represent a greater proportion of their disposable income.<br>• Relative impact between most and least deprived is greater than under Preferred Option (impact on quintile 1 is 14.8 times that on quintile 5). Hence Benchmark CAZ D will have a more disproportionate adverse effect on most deprived households. |

# 6. Personal affordability

## 6.1. Context and Methodology

The personal affordability is concerned with changes in the monetary cost of travel that form part of the decision-making processes for travellers. There is a substantial body of research to demonstrate that the monetary costs of travel can be a major barrier to mobility for certain groups of people, with particularly acute effects on their ability to access key destinations. The most significant impacts of the costs of travel are on young and old people, and low-income households, particularly when travelling to employment or education. Although low income households spend less money on transport in absolute terms, this expense can represent a larger proportion of their total income (Social Exclusion Unit, 2003). People with disabilities may also suffer significant disbenefits when faced with higher costs, due to limited transport choices[64].

As North Staffordshire contains a larger proportion of low-income households than the national average, the potential impacts of the Preferred Option and the Benchmark CAZ D on personal affordability will be particularly important as they will impact accessibility and community severance.

There is an intrinsic link between personal affordability impacts and the user benefits appraised in the previous section. TAG Unit A4.2 highlights this link and how to address it:

*The personal affordability assessment is concerned with changes in the monetary cost of travel that form part of the decision making processes for travellers. It mirrors the user benefit appraisal component and can be based on the user charge assessment as considered in the Transport Economic Efficiency analysis, but requires a further qualitative analysis to ensure that all key monetary impacts can be considered by impact group irrespective of their inclusion in formal modelling processes.*

This study provides a qualitative and quantitative assessment of the personal affordability impacts of the Preferred Option and the Benchmark CAZ D. Due to the interconnectivity between affordability and user benefits, this section should be read in conjunction with the user benefits section, which includes the analysis of TUBA outputs relevant to personal affordability. For the Preferred Option, the TUBA analysis is likely to capture the majority of impacts on households, and hence forms a useful basis for the analysis of personal affordability. However, for the Benchmark CAZ D, the TUBA does not capture a number of important impacts on households which should be considered, in particular the upfront and VOC of upgrading vehicles and welfare impacts from redistributed trips.

In this section a qualitative assessment of potential indirect personal affordability impacts is provided, together with a supplementary analysis of vehicle ownership and travel data to assess the distributional impacts of the Benchmark CAZ D. Results are disaggregated by quintiles of Income (using the Index of Multiple Deprivation – Income from National Statistics) to allow a spatial description of the impacts.

In addition, the reader is encouraged to look at the other sections for an overall understanding of the different impacts of the Preferred Option on the population of North Staffordshire.

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64 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/638644/TAG_unit_a4.2_distrib_imp_app_dec2015.pdf

## 6.2. Overall impacts on personal affordability

Both the Preferred Option and the Benchmark CAZ D will affect operating costs, fuel costs and travel times, captured in the user benefits. In addition, the Benchmark CAZ D will also have the following direct costs for drivers and non-compliant vehicles:

- Upgrading to a compliant vehicle will have an upfront cost of purchasing a compliant vehicle (alongside other effects).
- Paying the charge of course carries the financial cost of the charge itself.
- The avoid the zone and cancel response will carry a welfare impact which will affect households.

These direct impacts are quantified in aggregate in the CBA across all network users. A split of these impacts facing households is presented in Table 6-1.

**Table 6-1: Impacts on households from options (£2019 prices, discounted to 2018)**

| Impact | Preferred Option | Benchmark CAZ D |
|---|---|---|
| **Upgrade costs** | 0 | -11,810,001 |
| **Fuel VOCs (Upgrade)** | 0 | -5,950,607 |
| **Non-Fuel VOCs (Upgrade)** | 0 | 823,464 |
| **Welfare** | 0 | -22,208,880 |
| **Travel time (TUBA)** | -12,578,692 | 9,480,222 |
| **Fuel VOC (TUBA)** | -1,203,199 | -494,970 |
| **Non-Fuel VOC (TUBA)** | -892,007 | 10,588,661 |
| **Indirect taxes (TUBA)** | 639,891 | -9,593,313 |
| **User charges** | 0 | -147,766,018 |
| **TOTAL** | **-14,034,007** | **-176,931,442** |

As shown in the table, the total impacts are significantly greater under the Benchmark CAZ D and hence this option is likely to have a much greater adverse impact on personal affordability than the Preferred Option.

## 6.3. Assessment of distribution of direct impacts of Benchmark CAZ D

The available TUBA model outputs have been disaggregated and used to assess distributional impacts as part of the User Benefits section above. A key advantage is that these impacts are available split by a transport sector basis. However, as discussed above TUBA does not capture all costs that will fall on households from the Benchmark CAZ D (although it does offer a good insight into the distributional personal affordability impacts of the Preferred Option).

The CBA has captured a greater range of key impacts, in particular the upfront and ongoing costs associated with upgrading vehicles and welfare costs. However, these have been assessed on an aggregate scale and are not available split spatially (either by transport sector or LSOA). Hence it is not possible to overlay these assessed impacts with demographic variables to explore any distributional effect.

In order to explore the total personal affordability effects of the Benchmark CAZ D, a proxy for the overall effects on households is developed by investigating patterns of non-compliant vehicle ownership given this data is available at LSOA level. This approach allows an understanding of which groups are going to the charging zone area and are therefore likely to face the greatest direct burden from the Benchmark CAZ D.

Table 6-2 shows the proportion of non-compliant vehicles owned in each quintile. As noted, data on ownership of non-compliant vehicle is available by LSOA and hence can be overlaid with demographic data. A slightly greater proportion of non-compliant cars are owned in lower quintiles. This result matches evidence from the literature, where studies[65] note that in general, there is a negative relationship between car age and household income. This suggests that the Benchmark CAZ D may have a regressive impact.

**Table 6-2: Percentage of cars that are non-compliant in the DA domain, split by IMD-Income quintile**

| IMD quintile | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| % cars owned by households in quintile which are non-compliant | 50.91% | 48.72% | 47.17% | 44.88% | 41.68% |

The impact of the Benchmark CAZ D will also depend on frequency of travel to the CAZ area. To account for travelling to the CAZ, 2011 census data was used. This data describes trips made by employees as their usual mode of travel. There are several caveats that should be noted to using this census data:

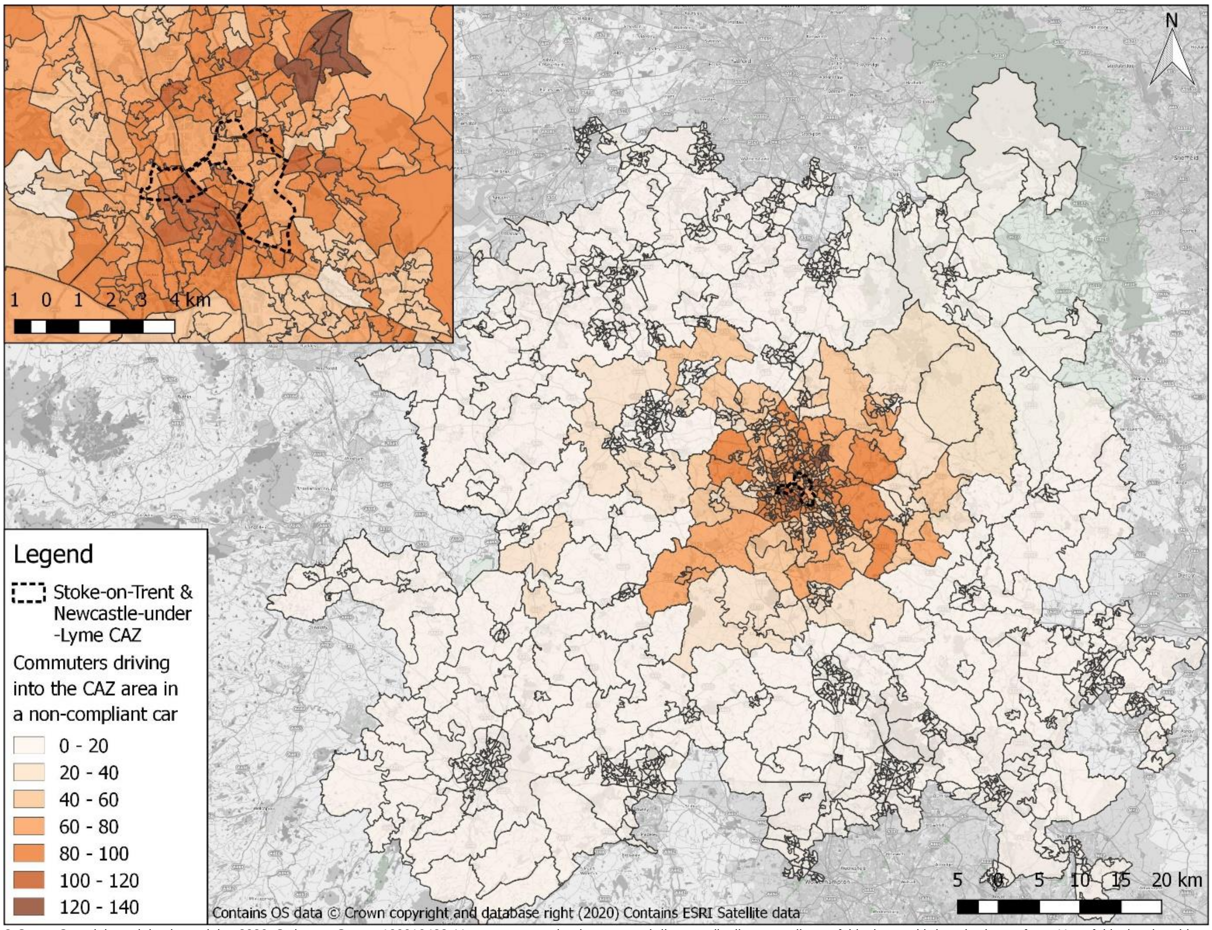
- Only commuters are considered in this dataset, the data does not represent all trips to the CAZ. It is assumed that the pattern of non-commuting trips is similar to that of commuting
- Data is only available at MSOA level, hence the number of trips into the CAZ boundary were disaggregated to LSOA of origin
- Data is from 2011
- Does not capture how vehicle owners will respond to the Benchmark CAZ D, which in turn will determine the size of the cost on different households.
- Persons driving through the Benchmark CAZ D are not accounted for in this approach which could affect the distribution of impacts across LSOAs.

Using the JAQU data for registered cars and compliance at LSOA level for England and Wales, the percentage of non-compliant cars was multiplied by the number of trips to the CAZ for each LSOA within the DA domain. The result is an estimate of the number of trips using non-compliant cars to the CAZ from each LSOA, a proxy of the likely cost burden of the CAZ impacting each LSOA.

The highest number of drivers commuting to the CAZ originate from just outside the CAZ area (see Figure 6-1). As such, the size of the impacts on different groups reflects the demography of those living in the central conurbation, namely the most deprived population.

[65] See for example: http://economics.ca/2009/papers/0455.pdf

**Figure 6-1: Number of commuters travelling to the CAZ area in non-compliant cars, per LSOA**






Combining this information on the potential spatial scale of costs with demographic data, it appears that the greatest burden (i.e. proxied by the highest number of estimated non-compliant trips performed) will fall on the most deprived population (quintile 1 of IMD-Income). This reflects:

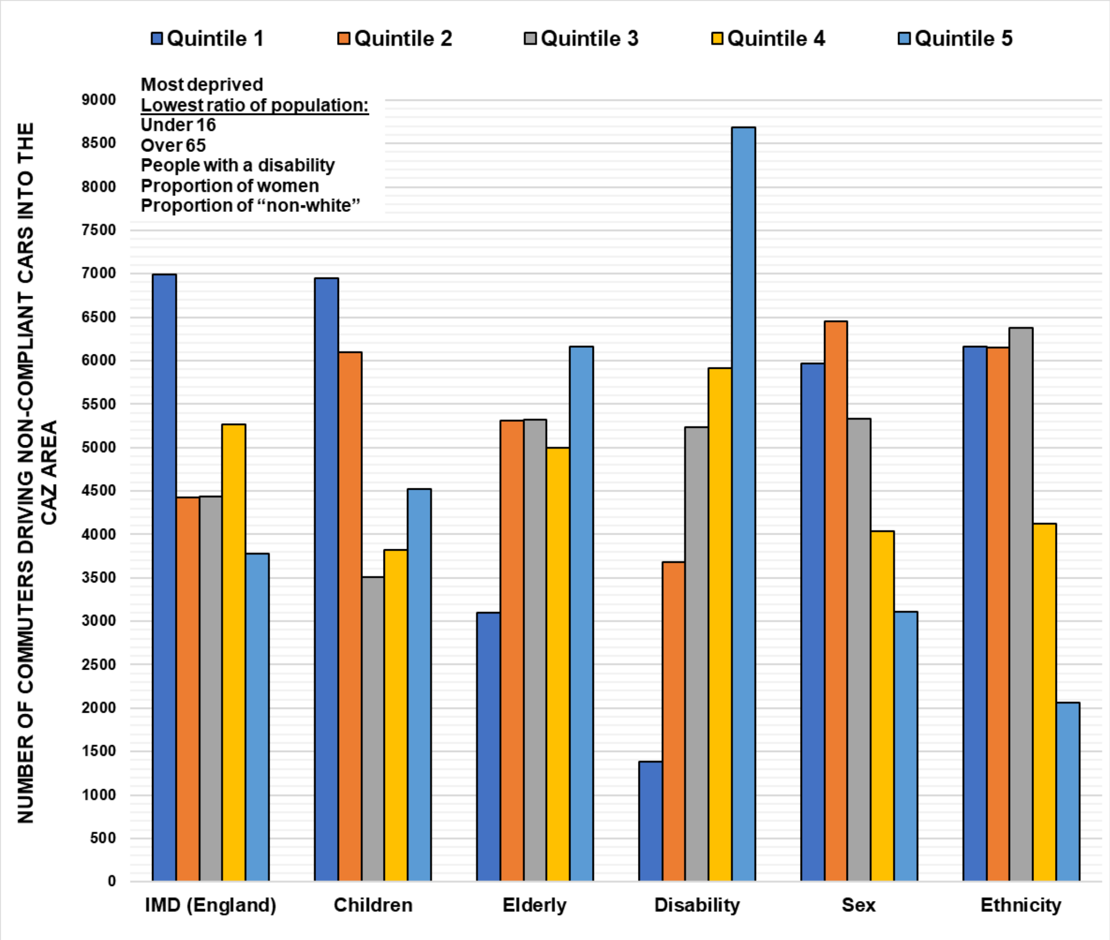
- The highest number of drivers travelling to the CAZ originate from just outside the CAZ area (see Figure 6-2, this is a relatively deprived population, based on Figure 2-4)
- The CAZ area itself is dominated by IMD-Income quintiles 1 and 2 – all trips made by these households will be affected by the CAZ
- The three highest quintiles of income have little to no representation in the CAZ area (Figure 6-2 – trips made by these households will be less affected by the CAZ)

Hence, CAZ compliance costs will be more important for the more deprived population as they contribute more trips to the CAZ area. There is not then a clear trend as one moves up the IMD quintiles.

Furthermore, the costs of the CAZ are likely to be higher for areas with a lower ratio of ethnic diversity and higher ratio of disabled populations. These are predominantly near the town centres in the North Staffordshire region, and as such it is these populations which will be most heavily impacted by the Benchmark CAZ D in terms of affordability.

Costs will also be higher for households with fewer children, households with a greater proportion of elderly (over 65), and male households.

**Figure 6-2: Commuters driving in non-compliant cars from LSOAs within the 'DA Domain' to LSOAs within the CAZ boundary, on a typical day**




## 6.4. Qualitative analysis of indirect effects

Alongside these direct impacts, there may also be indirect effects where costs are passed through to households by those who directly change behaviour in response to the options. For users of buses, taxis and community transport, the extent that businesses do pass on any additional costs to consumers will affect the level of change to personal affordability and there might be a disproportionate impact on vulnerable households:

- Personal affordability for the Benchmark CAZ D is heavily related to the ownership of a non-compliant vehicle as all choices will involve either a direct or indirect increase in costs. For users of buses and community transport, the extent that businesses do pass on any additional costs to consumers will affect the level of change to personal affordability but, there might be a disproportionate impact on vulnerable households. Passing on costs is only one way that businesses may be impacted; another potential response is to cease operating.

- Buses, as a cheaper mode of transport, are used more so by poorer households[66]. Hence these households will shoulder a greater proportion of any pass-through costs. Buses are also used

[66] https://www.ucl.ac.uk/transport-institute/pdfs/transport-poverty

more the young (0-16) and over-65s, who would also face a greater proportion of any pass-through costs[67].

- Taxis are often relied upon by disabled people who are unable to drive, and hence also could face a disproportionate share of any costs passed through. Taxi or private hire vehicle (PHV) usage makes up 3% of all trips made by people with mobility difficulties, relative to just 1% of people without these difficulties[68]. However, given the low percentage of overall trips, this suggests there are alternatives available to those with mobility difficulties
    - People over the age of 65 are more likely to have a disability than any other age group. Hence the disproportionate impact on accessibility for disabled people is also relevant to older people
    - DfT data from 2017 shows that women are slightly more likely to use taxis and PHVs than men. Hence there could also be a disproportionate adverse impact on women where taxi costs increase or withdraw services to the city centre
- Community transport is another important form of public transport for disabled people who are unable to make use of conventional public transport. The age profile of community transport vehicles is typically older than average, and hence more likely to be non-compliant

For the Preferred Option, bus gates will enable users reliant on buses, taxis and cycling a competitive advantage as compared to cars. Users of these modes are more likely to be low-income, elderly or disabled, as well as potentially young for bike users.

For the Benchmark CAZ D, there are likely to be much more significant indirect negative impacts on personal affordability through buses and coaches potentially passing on costs and/or reducing services. Taxi response options are limited and therefore may cease to travel. People with disabilities may also suffer significant disbenefits when faced with higher costs due to limited transport choices. A loss of taxis would have a significant effect on disabled and elderly passengers. Under 16s may be disproportionately affected as passengers in non-compliant vehicles as their journeys may not be considered essential when faced with explicit increased costs.

## 6.5. Summary

Both options have the potential to impact on user benefits and personal affordability through direct charges and indirect costs associated with behavioural responses to the options.

In the section assessing user benefits, the TUBA model outputs were used to explore the spatial pattern of results. Both options will result in large negative user benefits on areas with the highest proportion of deprived households, but these costs will be far greater under the Benchmark CAZ D. Looking at the relative impacts across quintiles, the impact on the most deprived relative to the least deprived quintile is much greater under the Benchmark CAZ D relative to the Preferred Option. Hence it could be concluded that although both options will have an adverse effect on the most deprived households, the Benchmark CAZ D will have a greater disproportionate effect. Although TUBA will capture the majority of the key impacts on households under the Preferred Option, it will not capture all key impacts of the Benchmark CAZ D. Hence additional analysis was undertaken using a proxy for all costs based on ownership of non-compliant vehicles.

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[67] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/666759/annual-bus-statistics-year-ending-march-2017.pdf

[68] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/642759/taxi-private-hire-vehicles-2017.pdf

Poorer households make significantly more trips into the CAZ area and are more likely to own non-compliant cars. Our analysis of the distribution of costs using vehicle ownership data therefore suggests under a Benchmark CAZ D, a higher proportion of the costs will fall greatest on areas with:

- Greater levels of deprivation
- Greater numbers of elderly residents
- Greater numbers of residents with disabilities

Furthermore, it is important to note that the same cost placed on the most deprived quintile will represent a greater proportion of budget and therefore an even greater impact.

Alongside direct impacts, the options have the potential to have indirect impacts (which will somewhat be captured by the TUBA analysis). The Preferred Option may provide a slight benefit to users of public transport, which are more likely to be vulnerable households. However, the Benchmark CAZ D is likely to have a much larger, negative indirect impact through placing a cost on:

- Buses: which are used more so by poorer households, the young (0-16) and the elderly (60+)
- Taxis: which are often relied upon by disabled persons who are unable to drive, and so could also face a disproportionate share of any costs passed through.

**Table 6-3: Summary of personal affordability distributional impacts**

| Scenario | Summary assessment |
|---|---|
| Preferred Option | X<br>• TAG analysis of User benefits suggests no disproportionate adverse effect. However, analysis of the relative size of impacts suggests Preferred Option will have a lesser disproportionate adverse effect on more deprived households.<br>• Preferred Option will place much smaller costs overall on households than Benchmark CAZ D.<br>• Indirect impacts of Preferred Option could provide positive indirect impact to households. Given Public Transport is more commonly used by vulnerable persons, this could have a positive distributional effect.<br>. |
| Benchmark CAZ D | XXX<br>• TAG analysis of User benefits suggests no disproportionate adverse effect. However, analysis of the relative size of impacts suggests Benchmark CAZ D will have a greater disproportionate adverse effect on more deprived households.<br>• Once additional costs are added to user benefits, Benchmark CAZ D will have a significantly greater impact on personal affordability overall.<br>• Additional analysis using non-compliant vehicle ownership suggests overall impacts of Benchmark CAZ D could have a disproportionate adverse effect on more deprived and older households, and those with a person with a disability. |

# 7. Accidents

## 7.1. Context

Transport interventions may alter the risk of individuals being killed or injured as a result of accidents. Accidents occur across all modes of transport and affect non-users as well as users. TAG guidance states that certain groups are known to be at greater risk of experiencing transport related accidents, including children and older people (particularly as pedestrians or cyclists), young males, people with a disability, Black and Minority Ethnic (BME) communities, people without access to a car and people on low incomes. The options in the study might have negative or positive impacts on specific social groups in North Staffordshire.

Road safety forms one strand of the evidence base for the selection of the Preferred Option; for a full overview of the overall distributional impacts of the two options, this analysis should be read in the context of the E3 report as a whole.

## 7.2. Methodology

Implementation of either the Preferred Option or the Benchmark CAZ D could lead to changes in the traffic flow through rerouting of vehicles to different roads, potentially leading to changes in accident rates. Any distributional impact will of course depend on the location and specific links where changes occur.

Changes in Annual Average Daily Traffic (AADT) flow between the 2022 Reference Case and the two options in the transport model have been assessed as a key driver for changes in accidents. Review of literature[69] relating to safety suggests that changes in AADT flow are likely to be the biggest influencer on improvements/deterioration in levels of traffic safety (rather than speed) and therefore is the main focus of this analysis.

Similarly to the approach followed for noise and severance, for each option, an initial screening was carried out using criteria identified in TAG. Roads were selected where:

- the change in total traffic flow or HDV traffic resulting from the option was greater than 10% of the AADT; or
- the change in average traffic flow speed resulting from the option was greater than 10%.

For roads meeting one of these criteria, the location of the significant changes is assessed together with its impact on vulnerable social groups.

Similar to the analysis undertaken in the air quality section of this report, 2011 national census, IMD and NHS data has been overlaid to identify the distributional impacts to road safety of these traffic changes. The changes in AADT flow have been examined by comparing the difference in traffic on individual road links defined by road junctions (and therefore corresponding to changes in flow conditions). The use of road links allows the analysis to clearly identify changes in AADT flow along specific sections of road and therefore allows for the micro-analysis required to determine whether a significant change is relevant to particular vulnerable demographics.

Although the methods outlined above provide a model for indicative understanding of the likely outcome of the implementation of either option, it should be noted that this analysis has multiple limitations. A

[69] Retallack, A.E & Ostendorf, B (2019) "*Current Understanding of the Effects of Congestion on Traffic Accidents*", International Journal of the Environmental Research and Public Health.

more strategic assessment is necessary when considering noise and accidents in relation to geo-demographic data at an LSOA level.

## 7.3. Screening

An initial review of the transport model data (described in TD1, TD2, TD3 and TD4) shows that the implementation of a Benchmark CAZ D scheme is likely to lead to an overall decrease in AADT flow in 2022 on road links. In contrast, the Preferred Option scheme is predicted to lead to an increase in AADT flow on more links than observe a decrease.

The screening advice provided in the DfT TAG unit A4 document[70] states that changes in AADT flow by 10% or more should be used to as an indicator as to whether a proposed scheme is likely to have a significant impact on road safety. The first quintile of road links representing the lowest absolute AADT flow for the 2022 Reference Case were also removed from this analysis, in order to eliminate roads with negligible absolute changes in traffic flows; for example, if a road link is predicted to increase its absolute AADT flow from 1 to 2, this will be screened in as a 100% increase. However, the absolute AADT flow remains small. This will be the same for all relatively low traffic flows.

Table 7-1 provides a summary of the impacts of the Preferred Option and the Benchmark CAZ D on traffic flows. The table also shows the absolute number of road links with an increase or decrease in AADT flow by each scheme, and the length of road these links represent. No roads were found to experience changes in average traffic flow speed greater than 10%, and as such only the AADT analysis is presented.

**Table 7-1: Summary of AADT flow impacts (figures in brackets are percentages of all links)**

| Type of change | Preferred Option | Benchmark CAZ D |
|---|---|---|
| Number of Traffic links in the transport model | 4,542 | |
| Absolute number of links which increase in AADT | 2,776 (61.1%) | 933 (20.5%) |
| Absolute number of links which decrease in AADT | 1,761 (38.8%) | 3,604 (79.4%) |
| Number of links which increase in AADT by more than 10 % | 60 (1.3%) | 37 (0.8%) |
| Number of links which decrease in AADT by more than 10% | 99 (2.2%) | 423 (9.3%) |
| Net impact on links seeing increase/decrease (negative figures represent an overall decrease) | 1,015 | -2,671 |
| Net number of roads with a percentage change of 10% (negative figures represent an overall decrease) | -39 | -386 |
| Net road length with a percentage change of 10% (km) | -1 | -23 |

Traffic is likely to reduce on 79% of the road links within the traffic domain should a Benchmark CAZ D option be implemented. A significant portion of these links (23 km) are predicted to have a traffic reduction of over 10%. The impacts of the Preferred Option are smaller, reflecting the targeted nature of the measures in this option; however, as for the Benchmark CAZ D, with the overall impact is a slight net benefit.

## 7.4. Assessment

The analysis of overall changes in traffic flows presented in Section 7.3 provides a basis for understanding the overall impacts of each proposed scheme but does not provide context regarding where the changes in AADT flow are happening or which demographic groups are likely to be affected.

[70] Document available from: https://www.gov.uk/government/publications/webtag-tag-unit-a4-2-distributional-impact-appraisal-december-2015

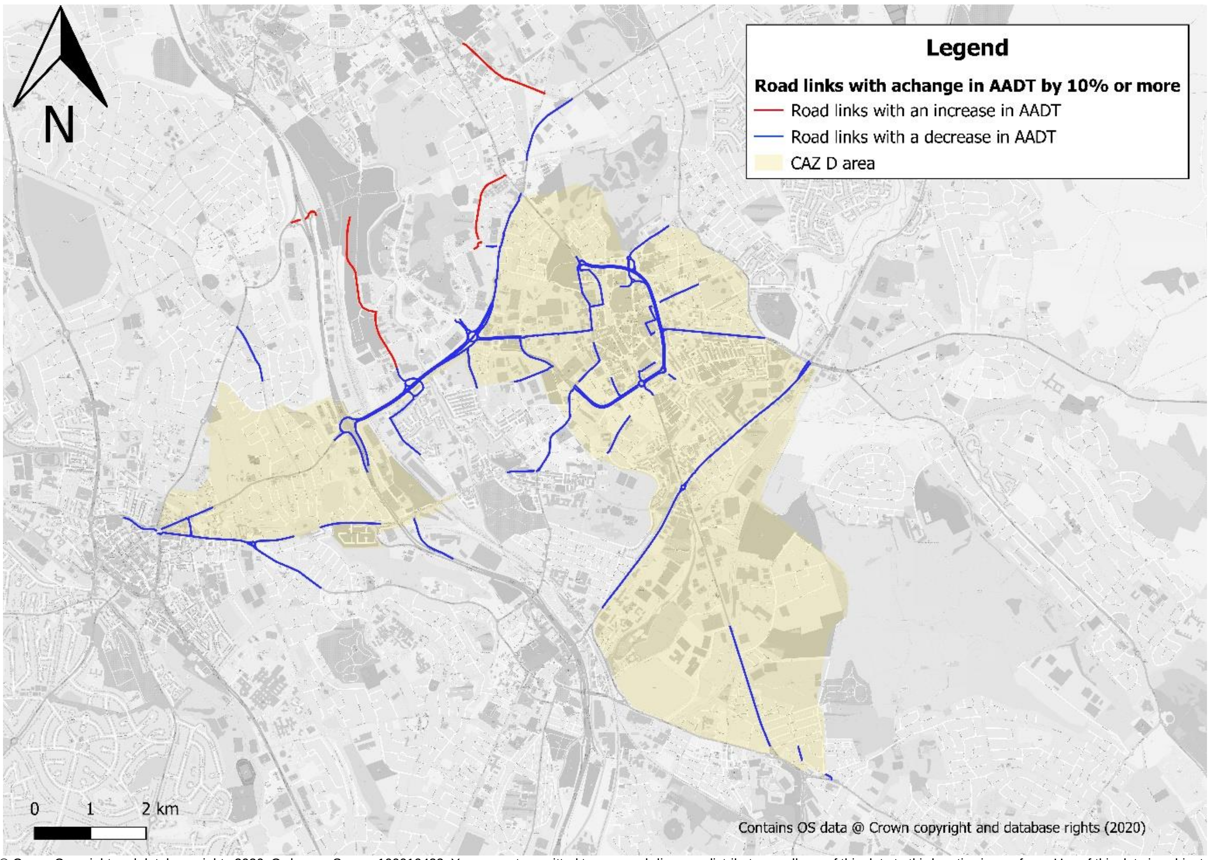
An increase in AADT flow generally represents an increased risk to older, younger and disabled residents. The TAG guidance additionally identifies that accidents are statistically more likely to occur in areas with a low average household income. This analysis primarily focuses on where significant changes in AADT are occurring in the vicinity of these vulnerable groups.

### 7.4.1. Benchmark CAZ D

Figure 7-1 illustrates changes in AADT flow within the traffic model due to the Benchmark CAZ D. Implementation of the Benchmark CAZ D option is predicted to lead to a reduction of AADT flow of 10% or more along 9.3% of the road links in the AQ domain. The Hanley area is predicted to experience a particularly significant decrease across many of the main road links, including Potteries Way. Reductions in traffic are also predicted to occur along Victoria Road and the A53.

Conversely, traffic flows on some roads outside the Benchmark CAZ D area are predicted to significantly increase, potentially due to the rerouting effect of non-compliant vehicles avoiding the charging zone. Roads with a significant increase include Shelton Boulevard, Forge Lane, North Road and Greyhound Way. 0.8% of all road links in the AQ domain experience an increase in AADT flow of 10% or greater.

**Figure 7-1: Road links where AADT is predicted to change by > 10% in the Benchmark CAZ D scenario**



### 7.4.2. Preferred Option

The Preferred Option differs to the Benchmark CAZ D option as it does not charge road use but instead places a physical restriction on traffic flow at peak times. In response, vehicle users will re-route or use an alternative to travel by private vehicle. Table 7-2 provides a visualisation of the road links where AADT flows are impacted by more than 10% by the implementation of the Preferred Option.

**Figure 7-2: Road links where AADT is predicted to change by > 10% if Preferred Option is implemented**

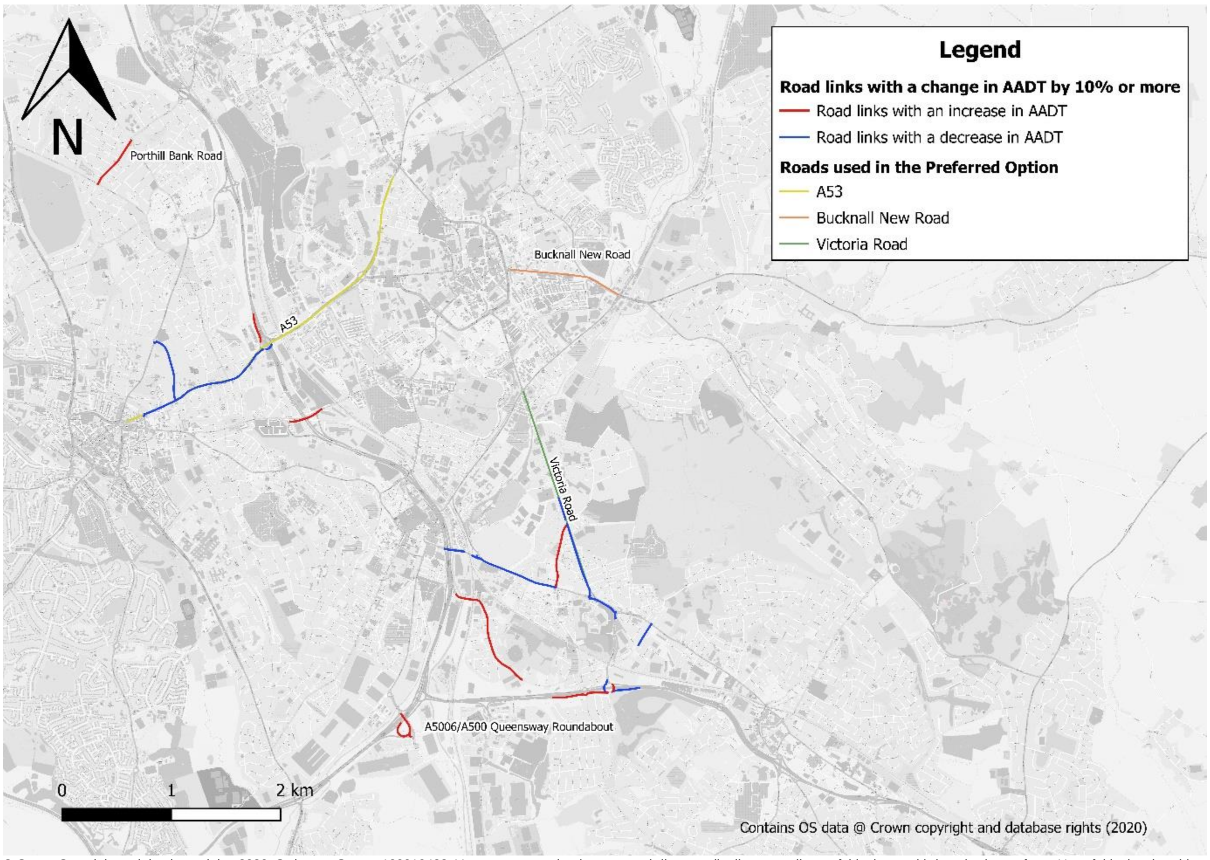





Figure 7-2 illustrates that the Preferred Option is likely to have a mixed impact on AADT flows on road links used within the transport model. Generally, the figure shows that increases are predicted along a small number of road links associated with rerouting:

- Manor Street, a road serving Christ Church C of E primary school. As such, this road will be heavily used by under-16s, identified as a vulnerable group in TAG guidance;
- Porthill Bank Road, a single carriageway that serves nearby housing estates;
- A small number of road links which form connections to the A500 Queensway, most notably the A5006/A500 roundabout junction which severs a nearby industrial and business park.

However, the net difference of significant AADT change (AADT change by 10% or more) demonstrates that the Preferred Option is likely to reduce the risk of accident on more road links than the number where risk is increased. Roads where risk of accident will be reduced include:

- the A53 (west of the A500), a road serving a large residential area centred in Basford;
- Sandy Lane;

- Victoria Road; and
- sections of City Road.

Traffic management measures will be implemented on the roads to the east and west of Victoria Road in order to ensure that the adjacent local communities are not adversely impacted by traffic re-routeing through these areas when the bus gate is in operation. This scheme aims to alter the nature of the areas to signal to drivers to proceed with greater care. It will enhance existing traffic calming measures and therefore is difficult to reflect in a strategic traffic model as traffic calming is currently in place. Engagement with the local community is proposed before the scheme is implemented.

### 7.4.3. Distributional Analysis for the Benchmark CAZ D

#### 7.4.3.1. Relationship between changes in AADT and IMD-Income

Table 7-2 and Figure 7-3 show the relationship between the change in AADT flow with the implementation of the Benchmark CAZ D and IMD-Income quintile.

The majority of the domain comprises LSOAs amongst the most deprived areas of England (quintile 1) and consequently the largest number of road links fall within this quintile. The analysis shows that quintile 1 LSOAs, which represent the quintile class with the lowest income in England, contains both the greatest amount of links with an absolute significant reduction in AADT flows: 77% of the "winning" road links are expected to be found in the most deprived areas. Therefore, the Benchmark CAZ D is likely to reduce the risk of accident not only across the domain but especially for residents who are most likely to be at risk from an increase in AADT flows.

**Figure 7-3: Road links where AADT changes by 10% with the Benchmark CAZ D overlaid with IMD-income quintile class**

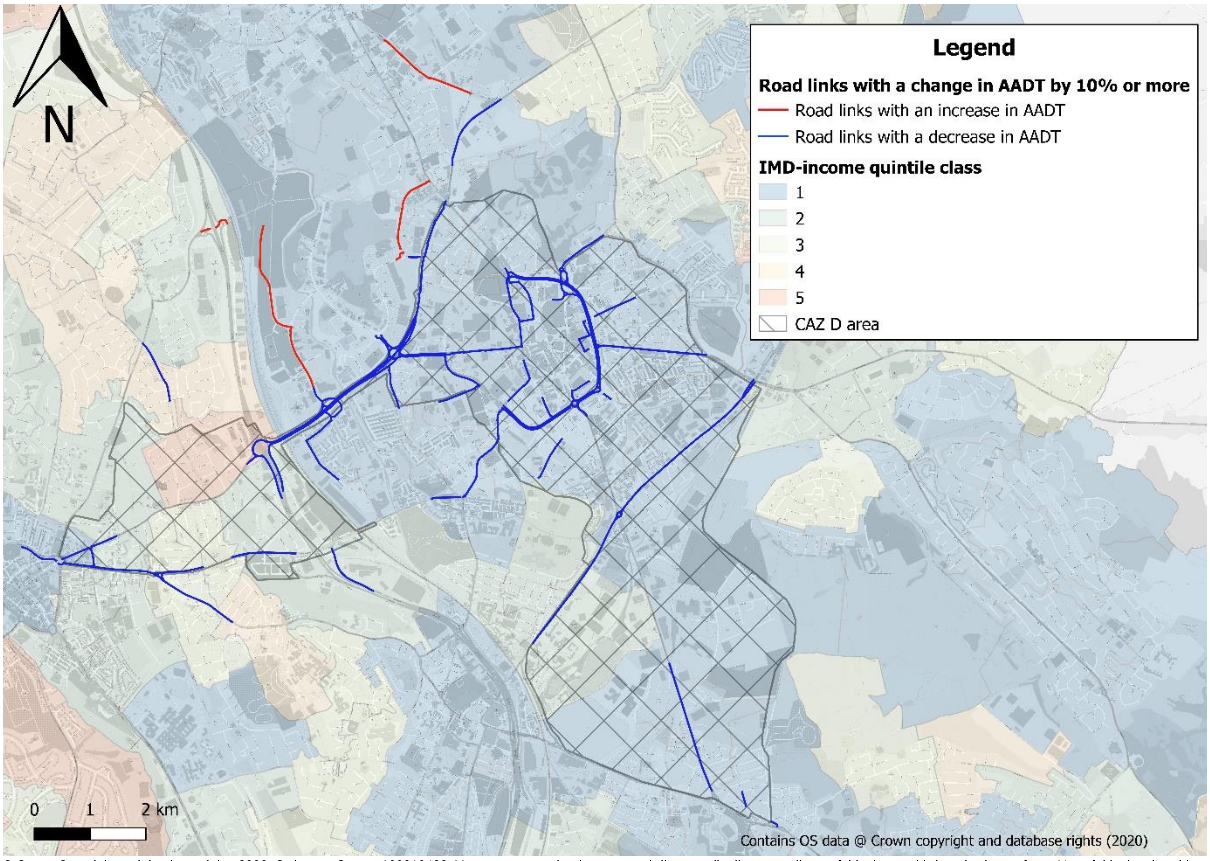


**Table 7-2: Relationship between changes in AADT and IMD-income quintiles**

| Impact / Quintiles | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Total number of links in quintile* | 2,505 | 1,170 | 694 | 612 | 462 |
| Number of links with an increase in traffic more than 10% ("losers") | 37 | 6 | 0 | 0 | 0 |
| Number of links with a decrease in traffic more than 10% ("winners") | 373 | 51 | 25 | 21 | 19 |
| Net change (10%) (decrease – increase) | 336 | 45 | 25 | 11 | 19 |
| Net change (10%) domain share | 77.06 | 10.32 | 5.73 | 2.52 | 4.36 |
| Share or road links in each quintile | 46.02 | 21.50 | 12.75 | 11.24 | 8.49 |
| Net impact by road length (km) | -19.84 | -3.82 | -1.19 | -0.54 | -1.46 |
| TAG assessment | ✓✓✓ | ✓ | ✓ | ✓ | ✓ |
| *The total number of links in this Table differ from Table 7-1 because links crossing several LSOAs were split | | | | | |

## 7.4.3.2. Benchmark CAZ D impacts on residents under the age of 16 (U16)

Figure 7-4 illustrates the spatial relationship between the proportion of residents under 16 (U16) (quintiles 1 – 5) and the location of road links with a significant change in AADT flow, defined as a change of 10% or more. A number of LSOAs with a higher proportion of U16 reside in areas within and just outside the Benchmark CAZ D boundary. The figure shows that significant increases in AADT flow are predicted to occur along Shelton Boulevard, Forge Lane, Greyhound Way and North Road, all of which are in areas with a high proportion of U16 residents.

**Figure 7-4: Road links with an AADT change of 10% or more overlaid by U16 quintile class**

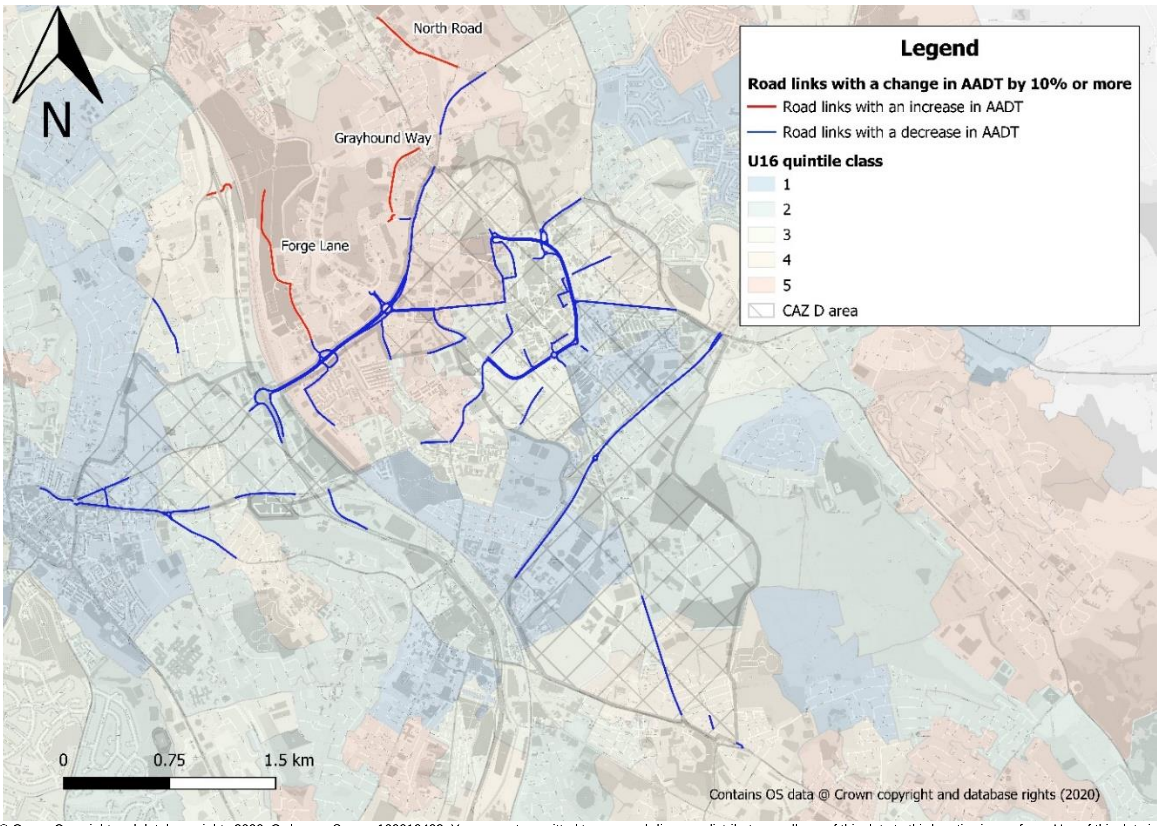


Table 7-3 shows that the implementation of the Benchmark CAZ D is unlikely to result in a significant distributional effect, with areas in the middle U16 quintile class benefiting slightly more than areas in quintiles 1 and 4. There is no clear relationship between quintile class and reduction in AADT flows on individual road links where high proportions of U16 reside.

**Table 7-3: Relationship between changes in AADT and U16 quintile class, Benchmark CAZ D**

| Impact / Quintiles | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Total number of links in quintile* | 1,360 | 1,100 | 897 | 943 | 1,143 |
| Number of links with an increase in traffic more than 10% (“losers”) | 0 | 4 | 0 | 8 | 31 |
| Number of links with a decrease in traffic more than 10% (“winners”) | 68 | 93 | 168 | 34 | 116 |
| Net change (10%) (decrease – increase) | 68 | 89 | 168 | 26 | 85 |
| Net change (10%) domain share | 15.60 | 20.41 | 38.53 | 5.96 | 19.50 |
| Share or road links in each quintile | 24.99 | 20.21 | 16.48 | 17.33 | 21.00 |
| Net impact by road length (km) | -3.56 | -6.31 | -10.01 | -1.08 | -5.90 |
| Tag assessment | ✓ | ✓✓ | ✓✓✓ | ✓ | ✓✓ |
| *The total number of links in this Table differ from Table 7-1 because links crossing several LSOAs were split | | | | | |

## 7.4.3.3. Benchmark CAZ D impacts on residents over the age of 65 (O65)

Figure 7-5 presents quintiles for the proportion of residents over the age of 65 (O65) overlaid on the location of road links with significant changes in AADT flow (10% or greater).

**Figure 7-5: Road links with an AADT change of 10% or more overlaid by O65 quintile class**

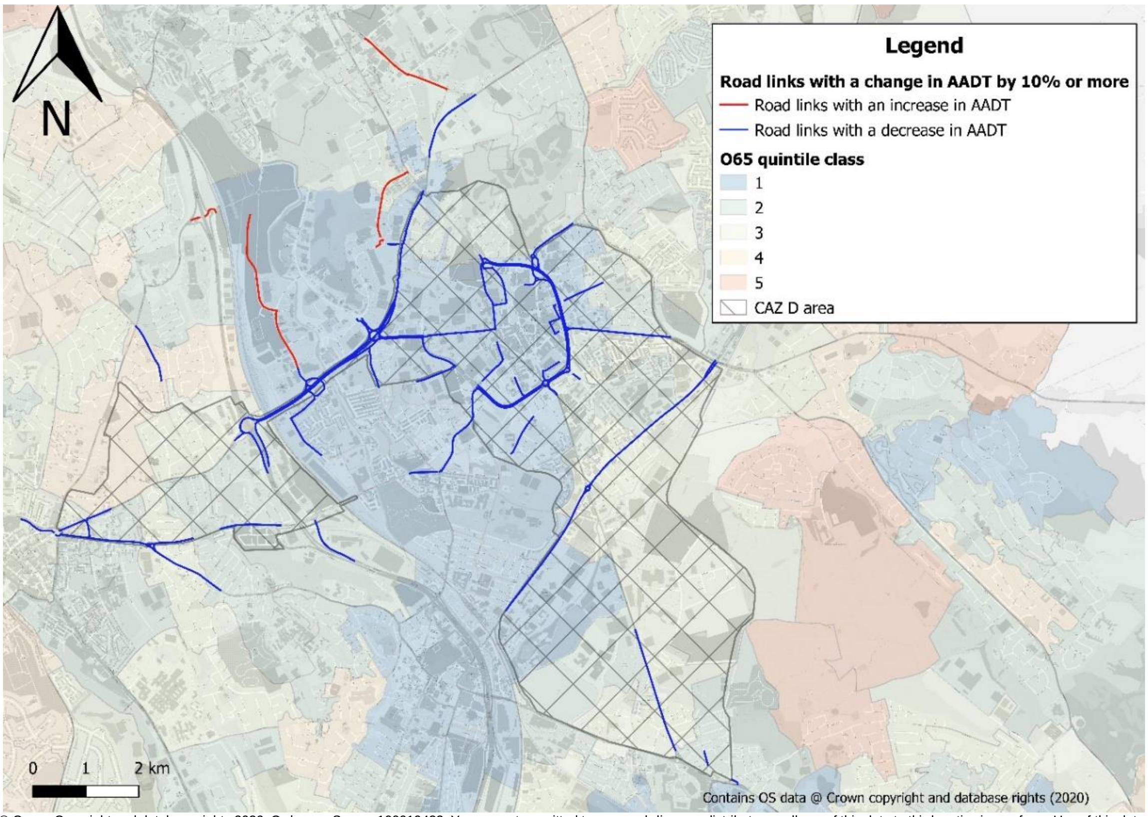


**Table 7-4: Relationship between changes in AADT and O16 quintile class, Benchmark CAZ D**

| Impact / Quintiles | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Total number of links in quintile* | 1,292 | 1,367 | 1,195 | 836 | 753 |
| Number of links with an increase in traffic more than 10% ("losers") | 23 | 20 | 0 | 0 | 0 |
| Number of links with a decrease in traffic more than 10% ("winners") | 272 | 94 | 107 | 6 | 0 |
| Net change (10%) (decrease – increase) | 249 | 74 | 107 | 6 | 0 |
| Net change (10%) domain share | 57.11 | 16.97 | 24.54 | 1.38 | 0.00 |
| Share or road links in each quintile | 23.74 | 25.11 | 21.95 | 15.36 | 13.83 |
| Net impact by road length (km) | -15.67 | -4.66 | -6.11 | -0.42 | 0.00 |
| Tag assessment | ✓✓✓ | ✓ | ✓✓ | ✓ | - |
| *The total number of links in this Table differ from Table 7-1 because links crossing several LSOAs were split | | | | | |

Table 7-4 presents the impacts of the Benchmark CAZ D option on the O65 group. The table suggests that the schemes is likely to lead to a net reduction in AADT flows in all quintile classes, with a greater proportion of reductions occurring in LSOAs with a low proportion of O65 citizens.

#### 7.4.3.4. Benchmark CAZ D impacts on residents with a registered disability

Figure 7-6 shows how the road links with a significant change in AADT flow relate to areas with a low or high proportion of residents with a registered disability. Table 7-5 shows that the majority of the road links examined within this study lie in LSOAs with a higher proportion of residents with a registered disability. The table shows that the introduction of a Benchmark CAZ D will be most beneficial to areas with greater numbers of resident population with a registered disability suggesting a disproportionate benefit for these groups who are more vulnerable to the risk of accidents.[71]

[71] TRL (2002), "*Review of the road safety of disabled children and adults*", available online at https://trl.co.uk/sites/default/files/TRL559.pdf {accessed 05/05/20]

**Figure 7-6: Road links with an AADT change of 10% or more overlaid by disability quintile class**

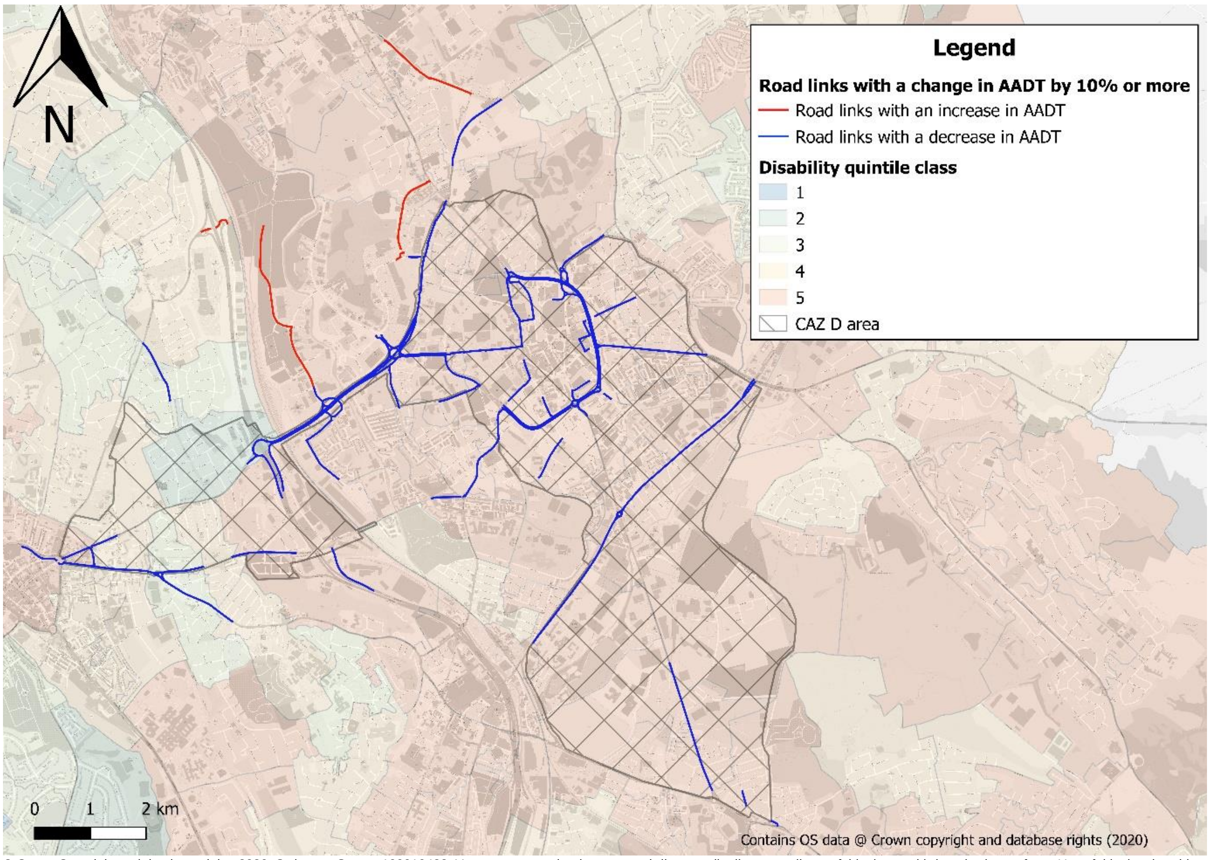





**Table 7-5: Relationship between changes in AADT and disability quintile class, Benchmark CAZ D**

| Impact / Quintiles | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Total number of links in quintile* | 88 | 275 | 802 | 1,313 | 2,965 |
| Number of links with an increase in traffic more than 10% ("losers") | 0 | 0 | 0 | 6 | 37 |
| Number of links with a decrease in traffic more than 10% ("winners") | 0 | 19 | 27 | 35 | 398 |
| Net change (10%) (decrease – increase) | 0 | 19 | 27 | 29 | 361 |
| Net change (10%) domain share | 0.00% | 4.36% | 6.19% | 6.65% | 82.80% |
| Share or road links in each quintile | 1.62% | 5.05% | 14.73% | 24.12% | 54.47% |
| Net impact by road length (km) | 1.62 | 5.05 | 14.73 | 24.12 | 54.47 |
| Tag assessment** | - | ✓✓ | ✓ | ✓ | ✓✓✓ |
| *The total number of links in this Table differ from Table 7-1 because links crossing several LSOAs were split | | | | | |

## 7.4.4. Distributional analysis of the Preferred Option

### 7.4.4.1. Preferred Option relationship impact on IMD-Income

Figure 7-7 shows that a high proportion of the road links where AADT flows change by more than 10% lie in within the quintile 1 of IMD-Income LSOAs. The data shown in Table 7-6 further supports this observation and also highlights that the number of "winners" road links is proportionally greater for quintile 1 of IMD-Income compared with the share of road links within this quintile. As with the Benchmark CAZ D, the Preferred Option is likely to deliver a disproportionate benefit to more deprived areas, with a population vulnerable to the risk of accidents. Quintile 4 of IMD-Income, representing a higher-income population, is predicted to experience a "light adverse" impact with a greater number of road links predicted to experience a significant increase than a decrease in traffic flows, and, therefore, likely to increase the risk of road traffic accidents for this quintile.

**Figure 7-7: Road links with a significant change in AADT (>10%) overlaid with IMD-Income quintiles for the Preferred Option**

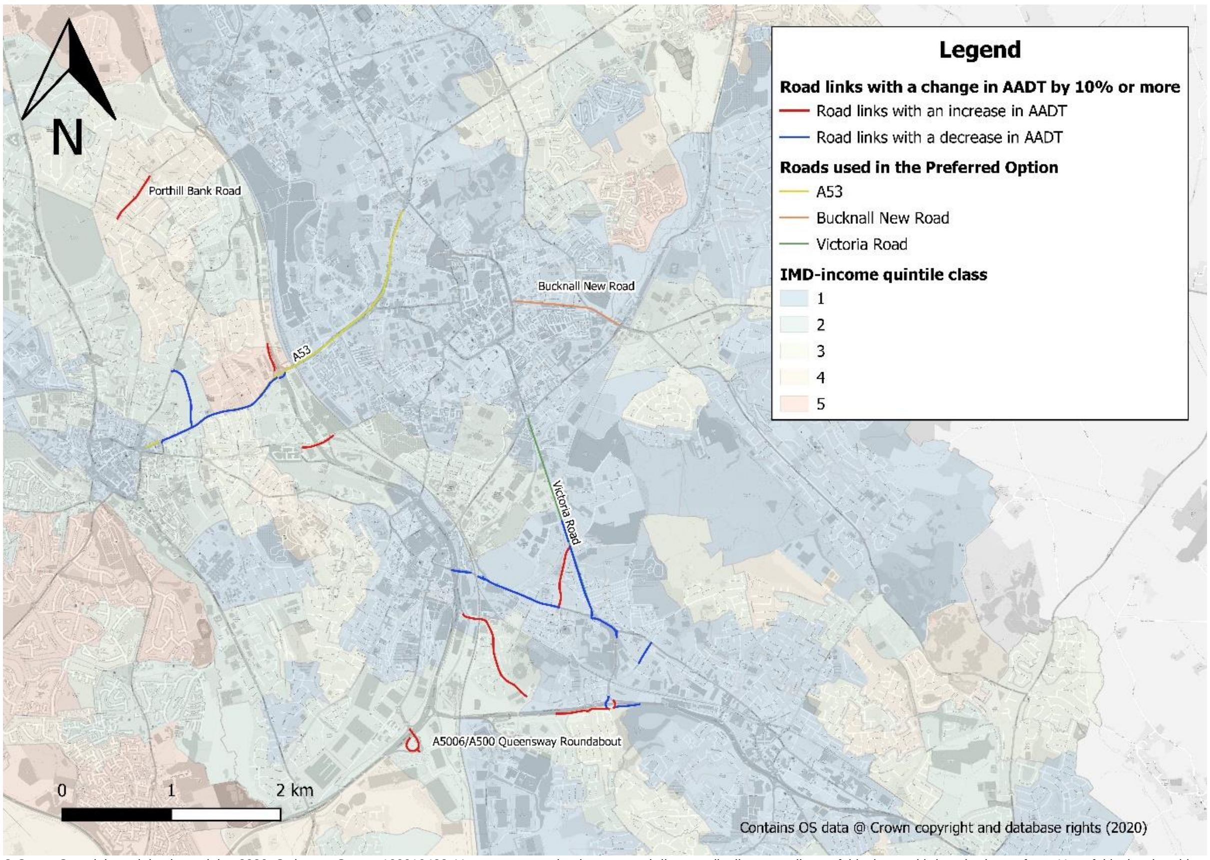





**Table 7-6: Relationship between changes in AADT from the Preferred Option and IMD-Income classes**

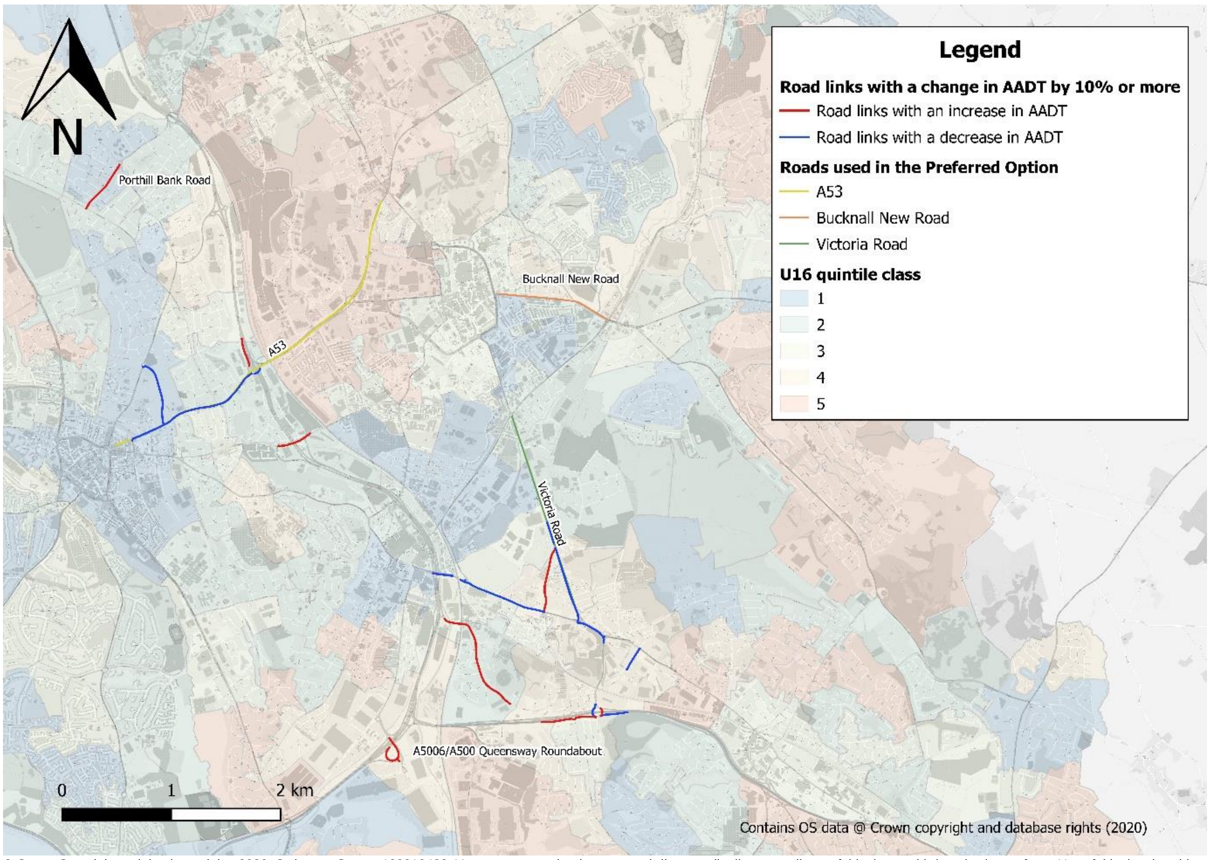
| Impact / Quintiles | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Total number of links in quintile* | 2505 | 1170 | 694 | 612 | 462 |
| Number of links with an increase in traffic more than 10% ("losers") | 17 | 27 | 5 | 17 | 2 |
| Number of links with a decrease in traffic more than 10% ("winners") | 67 | 28 | 10 | 0 | 12 |
| Net change (10%) (decrease – increase) | 50 | 1 | 5 | -17 | 10 |
| Net change (10%) domain share | 102.0% | 2.04% | 10.2% | -34.7% | 20.4% |
| Share of road links in each quintile | 46.0% | 21.5% | 12.8% | 11.2% | 8.5% |
| Net impact by road length (km) | -1.97 | 0.46 | -0.28 | 0.79 | -0.29 |
| Tag assessment** | ✓ | - | - | - | - |
| *The total number of links in this Table differ from Table 7-1 because links crossing several LSOAs were split | | | | | |

### 7.4.4.2. Preferred Option impacts on residents under the age of 16 (U16)

Figure 7-8 illustrates the location of all five quintiles of residents under the age of 16 and shows a mixed impact across the quintile classes.

Table 7-7 shows that the net change in significant impacts (>10%) for the Preferred Option is predicted to result in an absolute net reduction in AADT flows (i.e. a positive impact) on individual links across all quintiles with the exception of quintiles 2 and 5 which are predicted to experience a very small net increase. Furthermore, quintiles 3 and 4 would benefit disproportionately more from the Preferred Option.

**Figure 7-8: Changes in AADT (>10%) with the Preferred Option overlaid with U16 quintile class**






It should be noted that the distributional analysis in relation to young people is focussed on their involvement in accidents as a pedestrian or cyclist as they may not make the same considered decisions as adults. Young people as passengers in vehicles are likely to experience the same level of risk as the general population. As can be seen from Table 7-8, there are a noticeable number of road links forecast to experience an increase of AADT in the Preferred Option which are operated by Highways England and as such do not provide access for pedestrians and cyclists. They include the southernmost red links on the plan and represent A500/A5006 slip road, A50(T) adjacent to Heron Cross and Heron Cross roundabout. Due to the high level nature of the distributional analysis, the increase in traffic on these links will have inherently been concluded in the assessment. Therefore, the inclusion of these impacts should be borne in mind in the interpretation of the results with regards to overestimating any detrimental impact on young people.

**Table 7-7: Relationship between changes in AADT from the Preferred Option and U16 quintile classes**

| Impact / Quintiles | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Total number of links in quintile* | 1,360 | 1,100 | 897 | 943 | 1,143 |
| Number of links with an increase in traffic more than 10% (“losers”) | 14 | 26 | 10 | 16 | 2 |
| Number of links with a decrease in traffic more than 10% (“winners”) | 26 | 22 | 29 | 40 | 0 |

| | | | | | |
|---|---|---|---|---|---|
| Net change (10%) (decrease – increase) | 12 | -4 | 19 | 24 | -2 |
| Net change (10%) domain share | 24.5% | -8.2% | 38.8% | 49.0% | -4.1% |
| Share or road links in each quintile | 25.0% | 20.2% | 16.5% | 17.3% | 21.0% |
| Net impact by road length (km) | -1.01 | 0.46 | -0.28 | 0.79 | -0.29 |
| Tag assessment | ✓ | x | ✓ | ✓ | x |
| *The total number of links in this Table differ from Table 7-1 because links crossing several LSOAs were split | | | | | |

### 7.4.4.3. Preferred Option impact on residents over the age of 65 (O65)

Figure 7-9 shows how the location of road links with a significant change corresponds with the over 65 (O65) quintile class. The figure illustrates that most of the significant changes in AADT flows occur in areas with a mid-proportion of O65 demographic (quintiles 2 -4), especially in the area of Victoria Road.

**Figure 7-9: Changes in AADT (>=10%) associated with the Preferred Option overlaid with O65 quintile class**

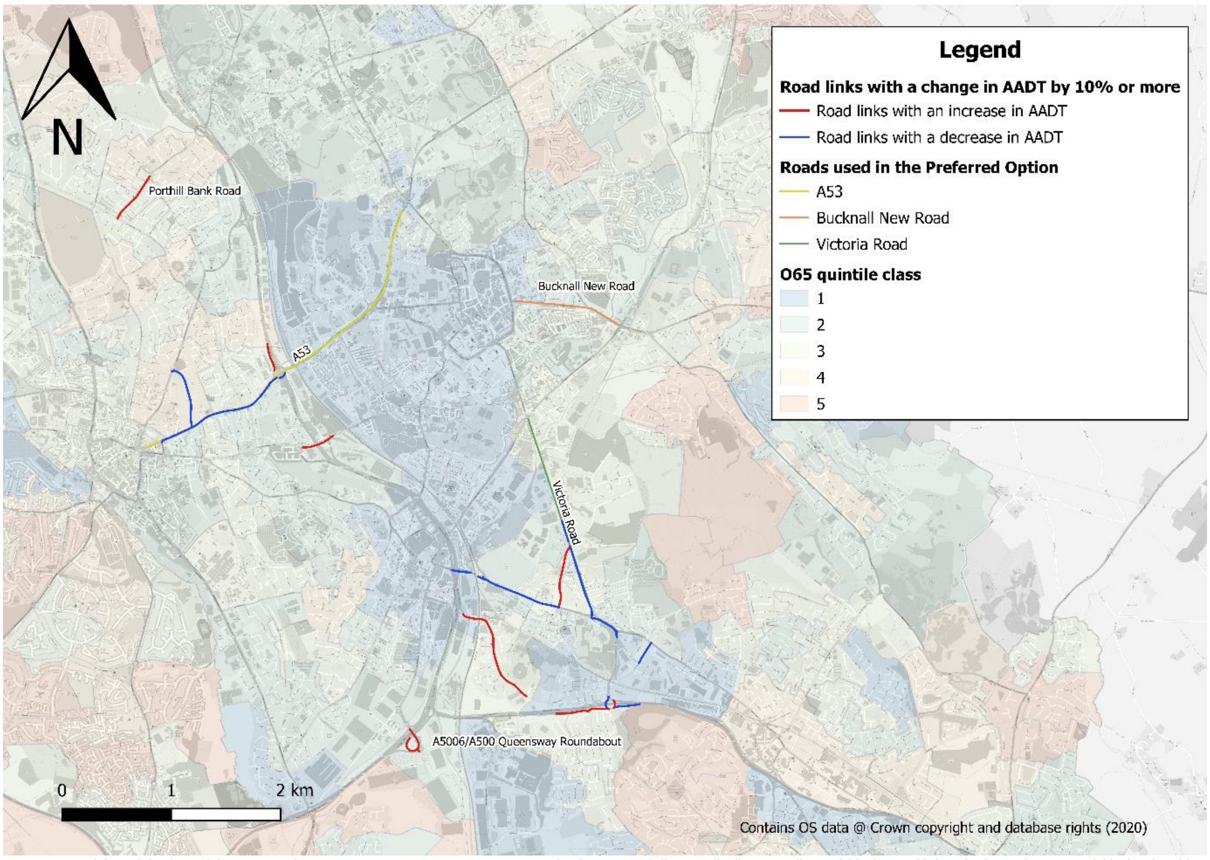





Table 7-8 shows a low impact of the Preferred Option on the O65 population in terms of risk on road traffic accident, with no distributional effects. Quintiles 2 and 4 show a slight disproportionate beneficial impact as there more road links predicted to have a significant decrease in AADT flow than an increase, while quintiles 3 and 5 are evaluated to experience a slight disbenefit due to the Preferred Option. However, the magnitude of these changes is small, and as a result these impacts are unlikely to be meaningful.

**Table 7-8: Relationship between changes in AADT from the Preferred Option and O65 quintile classes**

| Impact / Quintiles | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Total number of links in quintile* | 1,292 | 1,367 | 1,195 | 836 | 753 |
| Number of links with an increase in traffic more than 10% ("losers") | 6 | 18 | 40 | 1 | 3 |
| Number of links with a decrease in traffic more than 10% ("winners") | 15 | 49 | 39 | 13 | 1 |
| Net change (10%) (decrease – increase) | 9 | 31 | -1 | 12 | -2 |
| Net change (10%) domain share | 18.4% | 63.3% | -2.0% | 24.5% | -4.1% |
| Share of road links in each quintile | 23.7% | 25.1% | 22.0% | 15.4% | 13.8% |
| Net impact by road length (km) | -0.28 | -1.33 | 1.10 | -0.62 | -0.17 |
| Tag assessment | - | ✓ | X | ✓ | - |
| *The total number of links in this Table differ from Table 7-1 because links crossing several LSOAs were split | | | | | |

### 7.4.4.4. Preferred Option impact on residents with a registered disability

Figure 7-10 shows the location of road links with changes in AADT flow of 10% or more overlaid with quintiles of residents with a registered disability. The figure clearly illustrates that many of the road links with a significant change in traffic flows are located in areas with a high proportion of residents with a registered disability.

**Figure 7-10: Road links with a change in AADT of 10% or more, with disability quintiles overlaid**

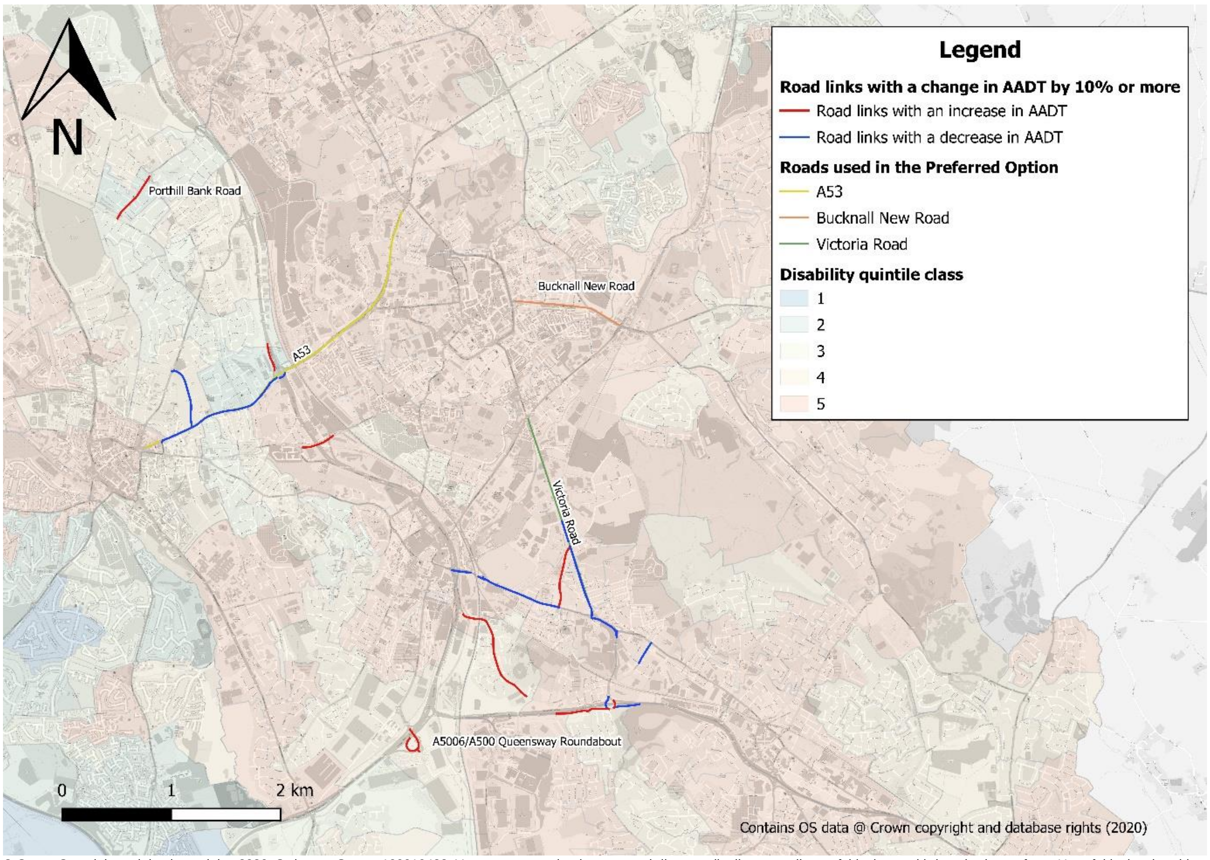


**Table 7-9: Impacts of the Preferred Option impact on AADT in the disability quintile classes**

| Impact / Quintiles | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Total number of links in quintile* | 88 | 275 | 802 | 1,313 | 2,965 |
| Number of links with an increase in traffic more than 10% ("losers") | 0 | 16 | 3 | 24 | 25 |
| Number of links with a decrease in traffic more than 10% ("winners") | 0 | 12 | 2 | 33 | 70 |
| Net change (10%) (decrease – increase) | 0 | -4 | -1 | 9 | 45 |
| Net change (10%) domain share | 0.00% | -0.92% | -0.23% | 2.06% | 10.32% |
| Share of road links in each quintile | 1.62% | 5.05% | 14.73% | 24.12% | 54.47% |
| Net impact by road length (km) | 0.00 | 0.17 | 0.14 | -0.16 | -1.45 |
| Tag assessment | - | - | - | - | ✓ |

Table 7-9 presents the change in AADT flow categorised by disability quintiles. By far the largest change (a benefit) is experienced by the fifth quintile, representing areas with the highest proportion of residents with a registered disability. Impacts on the other four quintiles are negligible. As such, this analysis shows that the preferred option will have a substantial distributional impact disproportionately benefitting the most vulnerable residents with regards to disability in the North Staffordshire area.

## 7.5. Summary

In summary this analysis has shown how the Benchmark CAZ D and the Preferred Option are likely to impact traffic flows and by extension road safety in the general population and vulnerable groups.

As for other impacts analysed in this document, the impacts on traffic flow for both the Preferred Option and the Benchmark CAZ D are concentrated within the Central Impact Area, with some rerouting within the wider AQ Domain. The CIA covers an area incorporating Hanley town centre and the main campus of Staffordshire University, together with the Fenton Industrial estate and the Basford area. The Central Impact Area contains a disproportionately high percentage of households in IMD-Income quintile 1 relative to North Staffordshire as a whole, reflecting regional trends in urban centres. The CIA contains a relatively low proportion of O65 residents, but follows regional trends for U16 residents. The CIA also has a very high proportion of residents with a registered disability compared with the North Staffordshire area as a whole, reflecting the importance of access to amenities for this group.

In the Preferred Option, potential accident risk impacts are concentrated in areas around two main traffic management schemes on Victoria Road and the A53. The option results in a combination of benefits and disbenefits, as traffic is primarily rerouted rather than being removed through modal shift. However, there is an overall small net benefit. 2.2% of road links are predicted to experience a reduction in traffic flows greater than 10%, while 1.3 % of road links are predicted to experience an increase. Roads where significant increases are predicted include Manor Street, Porthill Bank Road, and some road links which form connections to the A500.

Distributional analysis of these impacts demonstrates that low IMD-income households will benefit disproportionately, as will households with a registered disability, as both these areas are located in LSOAs with a high proportion of these groups. No distributional effects are predicted to occur for the O65 and U16 groups.

The Benchmark CAZ D is substantially more aggressive, and as a result delivers small reductions in traffic flows across a wider area as the result of modal shift, together with decreases in traffic flows inside the boundary, and increases outside as non-compliant vehicles reroute to avoid the charge. 9.3 % of all road links in the AQ domain are predicted to experience significant reductions in traffic flows under this option.

As the CAZ boundary encompasses an area with a high proportion of low IMD-income households, and a high proportion of residents with a registered disability, these groups will benefit disproportionately from the scheme. However, it should be noted that these groups are also particularly vulnerable to the effects on personal affordability and user benefits which are described in Sections 5 and 6. The O65 group will not benefit as much as other groups; no distributional effects were seen for the U16 group.

**Table 7-10: Summary of road safety distributional impacts**

| Scenario | Summary assessment |
|---|---|
| Preferred Option | ✓<br><br>Overall, 2.2% of road links are predicted to experience a significant decrease (at least 10%) in traffic flow (AADT). Conversely, 1.3% of road links are predicted to experience a significant increase. The lower number of road links where risk of traffic accidents will decrease, and the larger number where risk will increase, reflects the targeted nature of the traffic management measures in this option. However, as for the Benchmark CAZ D, the net road safety impact of the option is beneficial.<br><br>Analysis suggests LSOAs with greater levels of deprivation and a high proportion of residents with a registered disability are likely to benefit disproportionately more from the implementation of the Preferred Option, as for the Benchmark CAZ D. As a result, both options can be stated to have a disproportionate benefit with respect to these two groups vulnerable to accident risk.<br><br>No significant distributional effects were found with respect to children and older people who are also at higher risk of accidents. |
| Benchmark CAZ D | ✓✓<br><br>Overall, 9.3% of road links are predicted to experience a significant decrease (at least 10%) in traffic flow (AADT). Conversely, 0.8% of road links are predicted to experience a significant increase.<br><br>LSOAs with greater levels of deprivation and a high proportion of residents registered with a disability are likely to benefit disproportionately from these changes.<br><br>No disproportionate impacts were found with respect to children and older people who are also at higher risk from traffic accidents. |

# 8. Noise

## 8.1. Context

The World Health Organisation identifies environmental noise and vibration caused by road traffic as a significant cause of stress, anxiety and aggression.[72] Environmental noise is the second largest environmental risk to public health in Western Europe, with clear evidence of links to health outcomes including cardiovascular disease, cognitive impairment in children and sleep disturbance.

## 8.2. Methodology

Implementation of either the Preferred Option or Benchmark CAZ D will lead to changes in traffic flows through rerouting of vehicles, potentially leading to changes in noise levels.

Specific modelling of changes in noise has not been undertaken for either option. Instead, the change in Annual Average Daily Traffic (AADT) flow between the 2022 Reference Case and each option has been used as a proxy for changes in accidents and noise. The TAG A3 approach defines a significant change in noise levels to be 3dB, corresponding to either:

- A 50% change in traffic volume.

  While 18hr AAWT (Annual Average Weekday Traffic) flows are typically used in noise assessments. In this assessment, for simplicity AADT flow has been used, directly matching outputs from the traffic model. This allows for some consideration of the potential for changes in night-time noise levels as it is likely this would differ between the Preferred Option and Benchmark CAZ D.

- A change in speed greater than 10 km.h$^{-1}$.
  Road links were removed when one carriageway in a dual carriageway experienced a change of this magnitude, but the link as a whole did not. Road links on roundabouts were also screened out when only a small section of the roundabout was affected.

## 8.3. Assessment

In the Preferred Option, no road link is predicted to experience a change in traffic volumes greater than 50% or changes in speed greater than 10 km.h$^{-1}$; as such, this option is considered to have negligible impacts on noise.

Similarly, in the Benchmark CAZ D, no road link is predicted to experience a change in traffic volumes greater than 50%; as such, this option is considered to have negligible impacts on noise. With the introduction of a Clean Air Zones, vehicle upgrades may lead to older (generally louder) vehicles being replaced with newer vehicles that are subject to tighter noise limits in accordance with Regulation (EU) No 540/2014. However, these changes are small and as such are not expected to result in a perceivable reduction in noise levels.

## 8.4. Summary

Table 10-3 presents a summary of the noise impacts of the two scenarios.

[72] http://www.who.int/quantifying_ehimpacts/publications/e94888/en

**Table 8-1: Summary of noise impacts**

| Scenario | Summary assessment |
|---|---|
| Benchmark CAZ D | -<br>This option is not expected to produce significant noise impacts. |
| Preferred Option | -<br>This option is not expected to produce significant noise impacts. |

# 9. Accessibility

## 9.1. Context

The approach for the appraisal of distributional impacts on accessibility involved a qualitative assessment of how implementation of the CAZ and Preferred Option may affect access to community facilities for those groups whose mobility limits the range of transport options available to them.

Accessibility forms one strand of the evidence base regarding the distributional impacts of the Preferred Option and the Benchmark CAZ D; for a full overview of the overall distributional impacts of the two options, this analysis should be considered in the context of the E3 report as a whole.

## 9.1. Methodology

The assessment method set out in section 8 of TAG unit 4.2 focusses on the following accessibility impacts:

1. Changes in routings of timings of current public transport services
2. Any changes to public transport provision, including routing, frequencies, waiting facilities and rolling stock
3. Any indirect impacts on accessibility to services

While there may be some indirect effects on public transport travel time or timetables due to changes in traffic volumes, there are no planned changes to train or scheduled bus timetables, routes or fares included in the proposals for the Preferred Option or the Benchmark CAZ D.

However, the Preferred Option includes a series of measures to improve waiting facilities at bus stops across a number of corridors centred in and around the Central Impact Area. These measures include new accessible kerbs, new bus shelters, real-time public information (RTPI) and upgrades to existing bus shelters.

Following the default distance given in TAG, the impact area for each measure was calculated assuming a 400m walking distance from each measure area.

The full Distributional Analysis domain (comprising 1264 LSOAs) was used for this assessment. Population and number of households are available at LSOA level. The percentage of households in each LSOA falling within the 400m buffer for each accessibility measure was calculated assuming that households are distributed evenly throughout each LSOA. The results for the number of households have been presented in this section.

This assessment is similar to that carried out for air quality in Section 3. The analysis explores the distribution of households experiencing positive changes in accessibility for each of the socio-economic impact groups, with a focus on low income groups (IMD-Income), children under 16, elderly (over 65) and the disabled. These are the impact groups for which accessibility by public transport is the most important. Each quintile is assigned a scoring to rank the distributional impacts based on the system shown in Table 9-1.

**Table 9-1 Strategic accessibility assessment appraisal criteria**

| Proportionate changes | Assessment |
|---|---|
| > +16% | Large Beneficial ✓✓✓ |

| Proportionate changes | Assessment |
|---|---|
| +6% to +15% | Moderate Beneficial ✓✓ |
| +2% to +5% | Slight Beneficial ✓ |
| -1& to +1% | Neutral **-** |
| -2% to -5% | Slight Adverse × |
| -6% to -15% | Moderate Adverse ×× |
| < -16% | Large Adverse ××× |

For a description of the quintile distribution of each impact group living within each of the assessment domains (namely, the Distributional Analysis domain and the Central Impact Area), refer to Section 2 and Figure 2-4.

## 9.2. TAG table analysis

This assessment is similar to that carried out for air quality. The overlay of the impact and demographic variables following the TAG guidance for IMD-Income, Children Under 16, Elderly (Over 65) and the disabled, are presented in Table 9-3 to Table 9-10. Each quintile is assigned a scoring to rank the distributional impacts based on the system shown in Table 9-2.

**Table 9-2 General system for grading of distributional impacts for each of the identified groups**

| Impact | Assessment |
|---|---|
| Beneficial and the population impacted is significantly greater than the proportion of the group in the total population. | Large Beneficial ✓✓✓ |
| Beneficial and the population impacted is broadly in line with the proportion of the group in the total population. | Moderate Beneficial ✓✓ |
| Beneficial and the population impacted is smaller than the proportion of the group in the total population. | Slight Beneficial ✓ |
| There are no significant benefits or disbenefits experienced by the group for the specified impact. | Neutral |
| Adverse and the population impacted is smaller than the proportion of the group in the total population. | Slight Adverse × |
| Adverse and the population impacted is broadly in line with the proportion of the group in the total population. | Moderate Adverse ×× |
| Adverse and the population impacted is significantly greater than the proportion of the group in the total population. | Large Adverse ××× |

### 9.2.1. TAG table analysis: Income disparity

**Table 9-3 TAG 'quintile' analysis for Preferred Option – IMD-Income overlay with Preferred Option bus infrastructure improvements**

| Income IMD | Most deprived | | | | Least deprived | |
|---|---|---|---|---|---|---|
| Preferred Option Bus Infrastructure Improvements | **0%-20%** | **20%-40%** | **40%-60%** | **60%-80%** | **80%-100%** | |
| | **1** | **2** | **3** | **4** | **5** | **Total** |
| No. households affected by bus infrastructure improvements | 16,176 | 4,290 | 2,813 | 1,051 | 671 | |
| No. households not affected by bus infrastructure improvements | 109,584 | 143,604 | 167,313 | 198,118 | 210,626 | |
| Winners | 16,176 | 4,290 | 2,813 | 1,051 | 671 | |
| Total number of winners across all groups | | | | | | 25,003 |
| Winners in each area | 64.70% | 17.16% | 11.25% | 4.20% | 2.69% | |
| Share of the total population in the impact area | 14.72% | 17.31% | 19.92% | 23.32% | 24.73% | |
| Assessment | ✓✓✓ | ✓✓ | ✓ | ✓ | ✓ | |

The Preferred Option bus infrastructure improvements will deliver a distributional impact across IMD: the measure will deliver a disproportionate benefit to the more deprived households.

**Table 9-4 TAG 'quintile' analysis for Preferred Option – IMD-Income overlay with Preferred Option bus measures**

| Income IMD | Most deprived | | | | Least deprived | |
|---|---|---|---|---|---|---|
| Preferred Option Bus Measures | 0%-20% | 20%-40% | 40%-60% | 60%-80% | 80%-100% | |
| | 1 | 2 | 3 | 4 | 5 | Total |
| No. households affected by bus measures | 19,612 | 6,235 | 3,396 | 1,960 | 2,324 | |
| No. households not affected by bus measures | 106,148 | 141,659 | 166,730 | 197,209 | 208,973 | |
| Winners | 19,612 | 6,235 | 3,396 | 1,960 | 2,324 | |
| Total number of winners across all groups | | | | | | 33,527 |
| Winners in each area | 58.50% | 18.60% | 10.13% | 5.84% | 6.93% | |
| Share of the total population in the impact area | 14.72% | 17.31% | 19.92% | 23.32% | 24.73% | |
| Assessment | ✓✓✓ | ✓✓ | ✓ | ✓ | ✓ | |

The Preferred Option bus measures will deliver a distributional impact across IMD: the measure will deliver a disproportionate benefit to the more deprived households.

### 9.2.2. TAG table analysis: Distribution of children

**Table 9-5 TAG 'quintile' analysis for Preferred Option – Children Under 16 overlay with Preferred Option bus infrastructure improvements**

| Children (Under 16) | Lower proportion | | | | Higher proportion | |
|---|---|---|---|---|---|---|
| Preferred Option Bus Infrastructure Improvements | 0%-20% | 20%-40% | 40%-60% | 60%-80% | 80%-100% | |
| | 1 | 2 | 3 | 4 | 5 | Total |
| No. households affected by bus infrastructure improvements | 4,687 | 5,102 | 4,550 | 3,695 | 6,969 | |
| No. households not affected by bus infrastructure improvements | 205,444 | 216,830 | 156,637 | 138,824 | 111,508 | |
| Winners | 4,687 | 5,102 | 4,550 | 3,695 | 6,969 | |
| Total number of winners across all groups | | | | | | 25,003 |
| Winners in each area | 18.74% | 20.41% | 18.20% | 14.78% | 27.87% | |
| Share of the total population in the impact area | 24.60% | 25.98% | 18.87% | 16.68% | 13.87% | |
| Assessment | ✓ | ✓ | ✓✓ | ✓ | ✓✓✓ | |

The Preferred Option bus infrastructure improvements will deliver a distributional impact across under-16s: the measure will deliver a disproportionate benefit to the households with a greater proportion of children.

**Table 9-6 TAG 'quintile' analysis for Preferred Option – Children Under 16 overlay with Preferred Option bus measures**

| Children (Under 16) | Lower proportion | | | | Higher proportion | |
|---|---|---|---|---|---|---|
| Preferred Option Bus Measures | 0%-20% | 20%-40% | 40%-60% | 60%-80% | 80%-100% | |
| | 1 | 2 | 3 | 4 | 5 | Total |
| No. households affected by bus measures | 7,722 | 7,384 | 5,626 | 4,636 | 8,158 | |

| Children (Under 16) | Lower proportion | | | Higher proportion | | |
|---|---|---|---|---|---|---|
| No. households not affected by bus measures | 202,409 | 214,548 | 155,561 | 137,883 | 110,319 | |
| Winners | 7,722 | 7,384 | 5,626 | 4,636 | 8,158 | |
| Total number of winners across all groups | | | | | | 33,527 |
| Winners in each area | 23.03% | 22.02% | 16.78% | 13.83% | 24.33% | |
| Share of the total population in the impact area | 24.60% | 25.98% | 18.87% | 16.68% | 13.87% | |
| Assessment | ✓ | ✓ | ✓ | ✓ | ✓✓✓ | |

The Preferred Option bus measures will deliver a distributional impact across under-16s: the measure will deliver a disproportionate benefit to the households with a greater proportion of children.

### 9.2.3. TAG table analysis: Distribution of elderly

**Table 9-7 TAG 'quintile' analysis for Preferred Option – Elderly Over 65 overlay with Preferred Option bus infrastructure improvements**

| Elderly (Over 65) | Lower proportion | | | Higher proportion | | |
|---|---|---|---|---|---|---|
| Preferred Option Bus Infrastructure Improvements | **0%-20%** | **20%-40%** | **40%-60%** | **60%-80%** | **80%-100%** | |
| | **1** | **2** | **3** | **4** | **5** | **Total** |
| No. households affected by bus infrastructure improvements | 7,095 | 7,610 | 6,613 | 2,485 | 1,200 | |
| No. households not affected by bus infrastructure improvements | 80,344 | 137,238 | 176,238 | 214,099 | 221,324 | |
| Winners | 7,095 | 7,610 | 6,613 | 2,485 | 1,200 | |
| Total number of winners across all groups | | | | | | 25,003 |
| Winners in each area | 28.38% | 30.44% | 26.45% | 9.94% | 4.80% | |
| Share of the total population in the impact area | 10.24% | 16.96% | 21.40% | 25.35% | 26.05% | |
| Assessment | ✓✓✓ | ✓✓✓ | ✓✓ | ✓ | ✓ | |

The Preferred Option bus infrastructure improvements will deliver a distributional impact across over-65s: the measure will deliver a disproportionate benefit to the households with a lower proportion of elderly.

**Table 9-8 TAG 'quintile' analysis for Preferred Option – Elderly Over 65 overlay with Preferred Option bus measures**

| Elderly (Over 65) | Lower proportion | | | Higher proportion | | |
|---|---|---|---|---|---|---|
| Preferred Option Bus Measures | **0%-20%** | **20%-40%** | **40%-60%** | **60%-80%** | **80%-100%** | |
| | **1** | **2** | **3** | **4** | **5** | **Total** |
| No. households affected by bus measures | 8,831 | 10,173 | 8,024 | 4,240 | 2,259 | |
| No. households not affected by bus measures | 78,608 | 134,675 | 174,827 | 212,344 | 220,265 | |
| Winners | 8,831 | 10,173 | 8,024 | 4,240 | 2,259 | |
| Total number of winners across all groups | | | | | | 33,527 |
| Winners in each area | 26.34% | 30.34% | 23.93% | 12.65% | 6.74% | |
| Share of the total population in the impact area | 10.24% | 16.96% | 21.40% | 25.35% | 26.05% | |
| Assessment | ✓✓✓ | ✓✓✓ | ✓✓ | ✓ | ✓ | |

The Preferred Option bus measures will deliver a distributional impact across over-65s: the measure will deliver a disproportionate benefit to the households with a lower proportion of elderly.

### 9.2.4. TAG table analysis: Distribution of residents with a registered disability

**Table 9-9 TAG 'quintile' analysis for Preferred Option – Disabled overlay with Preferred Option bus infrastructure improvements**

| Disabled | Lower proportion | | | Higher proportion | | |
|---|---|---|---|---|---|---|
| Preferred Option Bus Infrastructure Improvements | **0%-20%** | **20%-40%** | **40%-60%** | **60%-80%** | **80%-100%** | |
| | **1** | **2** | **3** | **4** | **5** | **Total** |
| No. households affected by bus infrastructure improvements | 0 | 400 | 1,327 | 4,981 | 18,295 | |
| No. households not affected by bus infrastructure improvements | 135,662 | 211,848 | 173,364 | 179,350 | 129,019 | |
| Winners | 0 | 400 | 1,327 | 4,981 | 18,295 | |
| Total number of winners across all groups | | | | | | 25,003 |
| Winners in each area | 0.00% | 1.60% | 5.31% | 19.92% | 73.17% | |
| Share of the total population in the impact area | 15.88% | 24.85% | 20.45% | 21.58% | 17.24% | |
| Assessment | - | ✓ | ✓ | ✓✓ | ✓✓✓ | |

The Preferred Option bus infrastructure improvements will deliver a distributional impact across the disabled; the measure will deliver a disproportionate benefit to the households with a greater proportion of elderly.

**Table 9-10 TAG 'quintile' analysis for Preferred Option – Disabled overlay with Preferred Option bus measures**

| Disabled | Lower proportion | | | Higher proportion | | |
|---|---|---|---|---|---|---|
| Preferred Option Bus Measures | **0%-20%** | **20%-40%** | **40%-60%** | **60%-80%** | **80%-100%** | |
| | **1** | **2** | **3** | **4** | **5** | **Total** |
| No. households affected by bus measures | 0 | 1,289 | 2,992 | 6,955 | 22,290 | |
| No. households not affected by bus measures | 135,662 | 210,959 | 171,699 | 177,376 | 125,024 | |
| Winners | 0 | 1,289 | 2,992 | 6,955 | 22,290 | |
| Total number of winners across all groups | | | | | | 33,527 |
| Winners in each area | 0.00% | 3.85% | 8.92% | 20.74% | 66.49% | |
| Share of the total population in the impact area | 15.88% | 24.85% | 20.45% | 21.58% | 17.24% | |
| Assessment | - | ✓ | ✓ | ✓✓ | ✓✓✓ | |

The Preferred Option bus measures will deliver a distributional impact across the disabled; the measure will deliver a disproportionate benefit to the households with a greater proportion of elderly.

In summary, both of the Preferred Option accessibility measures deliver the same distributional patterns for each of the socio-economic impact groups: a disproportionate benefit to more deprived households, households with a higher proportion of children (under 16) and disabled, and a lower proportion of elderly.

## 9.3. Overall strategic accessibility assessment appraisal

The table below presents the total number of households affected by each of the Preferred Option accessibility measures. The assessment has been carried out by assigning a scoring to rank the impacts based on the system shown in Table 9-10.

Both of the accessibility measures fall within the 'slight beneficial' impact based on the proportion of change as a result of the intervention.

**Table 9-11 Strategic accessibility assessment appraisal results – Preferred option bus infrastructure improvements and bus measures**

| Measure | No. of households affected | Percentage of households affected | Assessment |
|---|---|---|---|
| Preferred Option bus infrastructure improvements | 25,003 | 2.93% | ✓ |
| Preferred Option bus measures | 33,527 | 3.92% | ✓ |
| Total number of households in DA domain | **854,246** | | |

## 9.4. Summary of accessibility assessment

The Preferred Option accessibility measures deliver the same distributional patterns for each of the socio-economic impact groups: a disproportionate benefit to more deprived households, households with a higher proportion of children (under 16) and residents with a registered disability, and a lower proportion of elderly residents. Table 9-12 presents a summary of the key impacts for Accessibility.

**Table 9-12: Summary of impacts for Accessibility**

| Scenario | Summary assessment |
|---|---|
| Preferred Option | ✓<br>The Preferred Option accessibility measures deliver the same distributional patterns for each of the socio-economic impact groups: a disproportionate benefit to more deprived households, households with a higher proportion of children (under 16) and disabled, and a lower proportion of elderly residents. |
| Benchmark CAZ D | -<br>Negligible impacts. |

# 10. Severance

## 10.1. Context

Severance is defined here as the separation of residents from facilities and services they use within their community caused by new or improved roads or by changes in traffic flows. Changes in traffic flows can lead to a significant impact on community severance when AADT flows exceed 8000 vehicles per day.[73] For example, significant changes in journey lengths or travel patterns within a community may occur if a new road acts as a barrier which deters people from using particular facilities. Conversely, if a scheme diverts traffic and makes an existing road easier to cross, community severance may be reduced.

Community severance effects are not evenly spread amongst the people in an affected area; aged people, the disabled and children are particularly vulnerable to disruption of their travel patterns, for example as a result of having fewer travel options available.[73]

Severance is a single aspect of the distributional impacts of the Preferred Option and the Benchmark CAZ D; for a full overview of the overall distributional impacts of the two options, this analysis should be considered in the context of the E3 report as a whole.

## 10.2. Methodology

Following the TAG screening approach, for each option, roads were identified meeting the following criteria:

- The change in total traffic flow or HDV traffic resulting from the option is greater than 10% for the AADT flow. Road links were removed when one carriageway in a dual carriageway experienced a change of this magnitude, but the link as a whole did not. Road links on roundabouts were also screened out as not representing potential severance.
- The total AADT flow is greater than 8,000. [73]

For affected road links, a qualitative approach has been followed to identify the characteristics of the population and facilities surrounding the affected road links, based on the following factors:

- Degree of change in traffic flows (and thereby the change in the level of severance).
- Nature and number of nearby amenities, particularly considering those serving groups that are potentially vulnerable to the effects of severance such as people without access to a car, older people, people with disabilities, parents with pushchairs, and children.
- Availability of alternative routes.
- Local knowledge on the impact areas provided by the Councils.

As the changes in severance associated with the options are generally small, a full distributional analysis was not considered proportionate.

[73] Design Manual for Roads and Bridges Volume 11 Section 3 Part 8: Pedestrians, Cyclists, Equestrians And Community Effects

## 10.3. Assessment

### 10.3.1. Preferred Option

Figure 10-1 shows routes screened in for severance impacts. A description of the potential impacts on each route is provided in Table 10-1.

**Figure 10-1: Severance impacts of the Preferred Option, 2022**

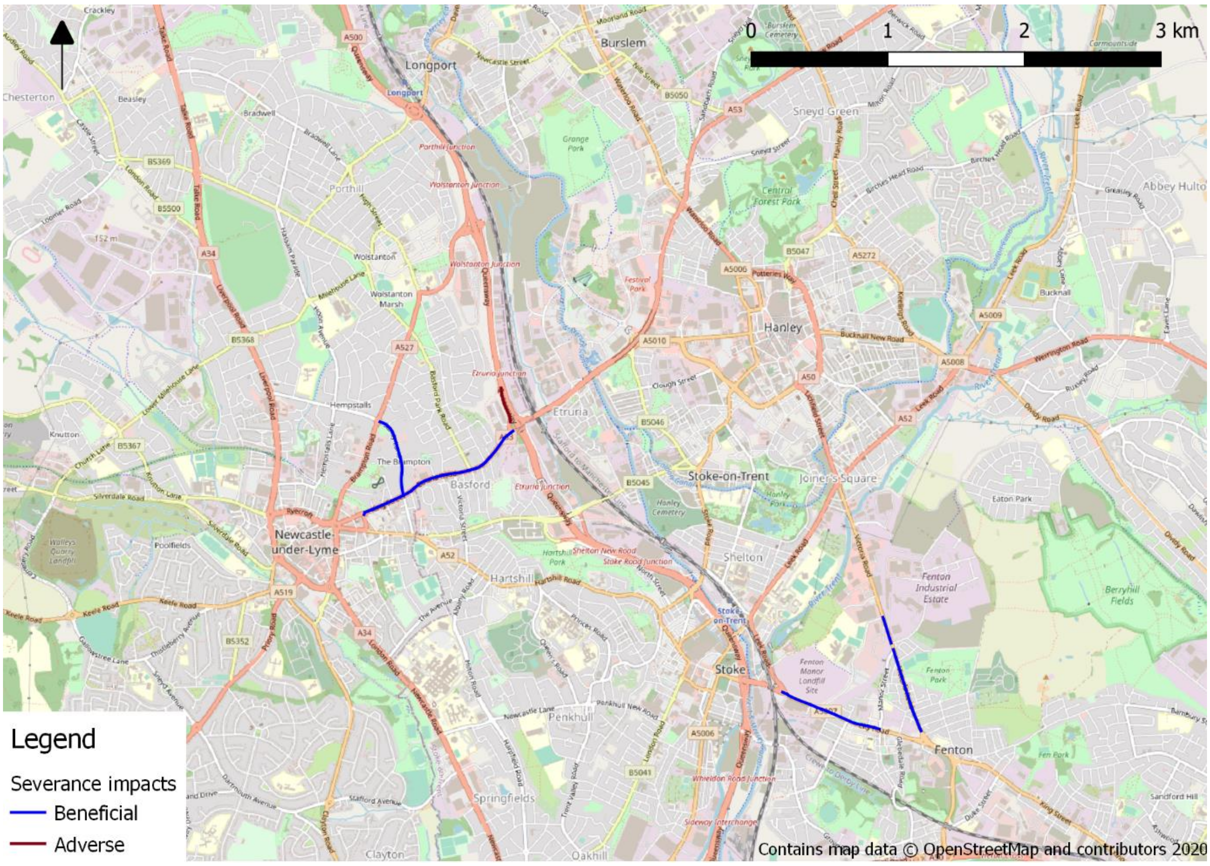





**Table 10-1: Severance impacts with the implementation of the Preferred Option**

| Road Link | Assessment* | Affected amenities |
|---|---|---|
| City Road - between Leek Road and Manor Street | Slight Beneficial | Our Lady's Catholic Primary School, Shopping. |
| Victoria Road | Slight Beneficial | Shopping. |
| A53 - Etruria Road | Moderate Beneficial | New Vic Theatre, Basford Private Pre-School Nursery, Shops including Basford Post Office, Little Oaks Day Nursery, Alison House Care Home. |
| A53 - King Street | Slight Beneficial | Congregational Church, Borough Arms, Well Pharmacy. |
| Sandy Lane | Slight Beneficial | St. Quentin residential homes. |
| Manor Street* | Slight Adverse | Christ Church C Of E Primary School. |

* While Manor Street is now shown on Figure 10-1 as it does not meet the 8000 AADT flow screening criteria, it has been included in this table due to the sensitive nature of the road link.

The Preferred Option leads to a small number of moderately-sized localised changes in traffic flows which may affect severance. However, as the measures in this option are closely targeted on local areas of exceedance, overall impacts on severance are small compared with the impacts of the Benchmark CAZ D, which affects traffic flows across a far larger area.

The majority of severance impacts from the Preferred Option are improvements resulting from the diversion of traffic from congested road links, potentially improving the ability of pedestrians to take their preferred line to nearby amenities. As the bus gates will operate at peak times, benefits to severance will be felt particularly strongly at these times. The amenities affected cover a wide range of groups. In particular, residents using amenities on the A53 will benefit from the additional signalised pedestrian crossings along this road.

The single road where the Preferred Option has been assessed to have an adverse impact is Manor Street, which acts as a minor displacement route resulting from the bus gate on Victoria Road. While this road link is screened out following the DMRB (Design Manual for Roads and Bridges) guidelines as the maximum predicted AADT flow is below 8000, the road is the entrance to Christ Church C Of E Primary School, which is relevant to vulnerable parents with pushchairs and children. As the majority of trips to and from the school will occur in peak hours, the increase along this link has been classified as “Slight Adverse” in spite of the low AADT flow. Manor Street will be subject to additional traffic management measures included in the Preferred Option, including speed restrictions (to 20mph), the provision of new road humps and carriageway re-surfacing, and enhanced signage to improve the enforcement of the existing environmental weight restriction in Manor Street. These actions would help to ameliorate these impacts on the most vulnerable pedestrians travelling from and to the school.

## 10.3.2. Benchmark CAZ D

Figure 10-2 shows routes screened in for severance impacts. A description of the potential impacts on each route is provided in Table 10-2.

**Figure 10-2: Severance impacts of the Benchmark CAZ D, 2022**

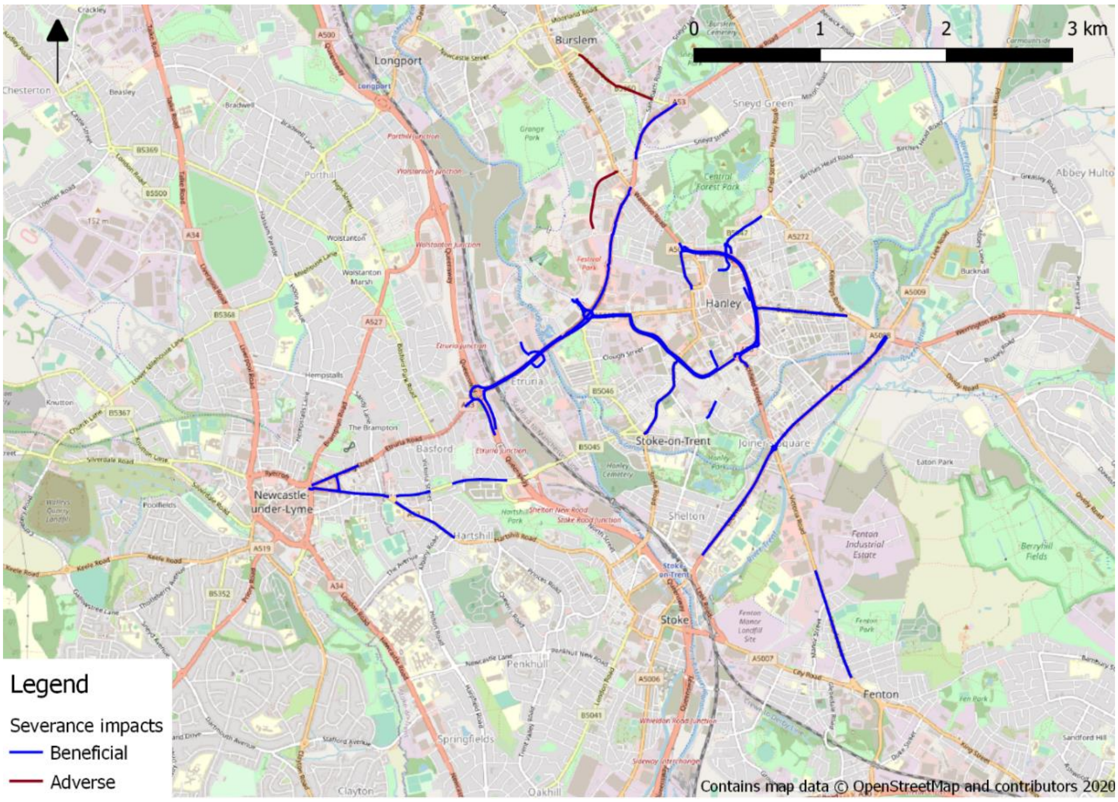


**Table 10-2: Severance impacts with the implementation of the Benchmark CAZ D**

| Road Link | Assessment | Affected amenities |
|---|---|---|
| Potteries Way | Moderate Beneficial | City Centre amenities |
| A52 - Hartshill Road | Slight Beneficial | Harpfield Primary Academy |
| A52 - Brunswick Street | Slight Beneficial | Restaurants, Jubilee 2 Gym |
| A53 - Colbridge Road | Slight Beneficial | Festival Park and Festival Heights Retail Park |
| A53 - King Street | Slight Beneficial | Congregational Church, Borough Arms, Well Pharmacy |
| B5045 | Slight Beneficial | Basford community play area, Hartshill Nature Reserve |
| A5006 - Broad Street | Slight Beneficial | St. Marks C Of E Primary School, Peak Education Stoke |
| Regent Road | Slight Beneficial | City Central Mosque |
| Bucknall New Road | Slight Beneficial | Hanley St. Luke's C Of E Primary School, Kiddies Kingdom Day Nursey, Shopping |
| Leek Road | Slight Beneficial | Shopping, All Saints Church Hanley, Staffordshire University, Stoke-on-Trent Rail Station |
| Town Road | Slight Beneficial | Central Forest Park, limited shopping |
| Victoria Road | Slight Beneficial | Shopping |
| York Street | Slight Beneficial | The Dudson Museum, Islamic Cultural Centre, City Centre Amenities |
| Greyhound Way | Slight Adverse | Festival Heights Retail Park |
| Nile Street | Slight Adverse | Shopping |
| North Road | Slight Adverse | North Road Academy, Honey Bears Day Nursery, shopping |

The Benchmark CAZ D leads to moderate changes in traffic flows across a wide area in the model domain, particularly around the City Centre. In particular, the reduction in AADT flows around the portion of Potteries Way which partly encircles the City Centre will improve accessibility to the wide range of amenities located in the centre, affecting all groups. Due to the wide range of amenities covered, and the lack of alternative routes for entering the City Centre, this impact has been assessed as "Moderate Beneficial". The Benchmark CAZ D also leads to smaller improvements in severance along a number of routes around the model domain.

However, displacement of traffic around the CAZ boundary leads to some areas of adverse impact. Of particular relevance are impacts on North Road, which will impact access to North Road Academy and Honey Bears Day Nursery, which are relevant to vulnerable parents with pushchairs and children.

## 10.4. Summary

Table 10-3 presents a summary of the severance impacts of the two scenarios.

**Table 10-3: Summary of severance impacts**

| Scenario | Summary assessment |
|---|---|
| Preferred Option | ✓<br>This option is expected to produce a small number of low-magnitude locally constrained positive impacts, and a single negative impact. |
| Benchmark CAZ D | ✓<br>This option is expected to produce low-magnitude positive impacts over a relatively wide area, with a small number of locally focussed negative impacts. |

# 11. Security

## 11.1. Context

Public transport plays a vital role in connectivity for residents of the North Staffordshire, linking residents to amenities and employment across the region. Research evidence citied in the TAG guidance demonstrates that there are several groups with particular concerns about their personal security. Women, younger people, older people, people with disabilities and Black and Minority Ethnic communities all tend to perceive risk more acutely when using public transport. Furthermore, public transport users tend to be from lower income groups, and as such may be disproportionately affected. Security concerns around public transport can act as a barrier to use, causing community severance and increasing congestion if residents instead use cars for transport.

## 11.2. Methodology

This section presents an assessment of improvements in security for public transport users, based on the measures included in the Preferred Option. The Benchmark CAZ D does not include any measures which will affect security when using public transport, so impacts from this option were scoped out.

The analysis considers both actual and perceived security impacts of the scheme. Following the approach outlined in TAG guidance, the following measures should be included in the security assessment:

- any change in public transport waiting facilities/interchange facilities;
- changes to pedestrian access;
- changes to provision of lighting and visibility;
- changes to landscaping; and
- changes to formal or informal surveillance.

The Preferred Option includes a substantial investment in CCTV cameras at bus stops; the security impacts of the option have been assessed by mapping the locations of these cameras, and by carrying out a quintile analysis with affected groups. Each quintile is assigned a scoring to rank the distributional impacts based on the system shown in Table 11-1.

**Table 11-1: General system for grading of distributional impacts for each of the identified groups**

| Impact | Assessment |
|---|---|
| Beneficial and the population impacted is significantly greater than the proportion of the group in the total population. | Large Beneficial ✓✓✓ |
| Beneficial and the population impacted is broadly in line with the proportion of the group in the total population. | Moderate Beneficial ✓✓ |
| Beneficial and the population impacted is smaller than the proportion of the group in the total population. | Slight Beneficial ✓ |
| There are no significant benefits or disbenefits experience by the group for the specified impact. | Neutral |
| Adverse and the population impacted is smaller than the proportion of the group in the total population. | Slight Adverse × |
| Adverse and the population impacted is broadly in line with the proportion of the group in the total population. | Moderate Adverse ×× |
| Adverse and the population impacted is significantly greater than the proportion of the group in the total population. | Large Adverse ××× |

This analysis forms one evidence strand in the overall appraisal of the distributional impacts of the Preferred Option and the Benchmark CAZ D; the decision to proceed with the Preferred Option was based on a full overview of all available evidence, including health impacts, economic impacts, and air quality impacts, and is described in the relevant Case documents.

## 11.3. Assessment

Stoke-on-Trent City Council and Staffordshire County Council have proposed CCTV cameras at 71 locations throughout Stoke-on-Trent. This will have a positive impact on both the actual and perceived security of existing customers of bus services, and to the extent that security concerns prevent people from using buses, could help encourage greater use of the bus network.

The CCTV cameras are placed at bus stops located in 32 LSOAs in Stoke-on-Trent. Table 11-2 presents the distribution of CCTV cameras by quintile for groups identified as relevant for security impacts. The CCTV locations are mapped in Figure 11-1 to Figure 11-6, overlaid with the quintiles of demographic groups.

**Table 11-2: Number of LSOAs with CCTV cameras disaggregated by quintiles of demographic group**

| Impact / Quintiles | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| IMD-Income | 23 | 6 | 1 | 2 | 0 |
| Under 16 | 5 | 7 | 5 | 6 | 9 |
| Over 65 | 10 | 8 | 7 | 4 | 3 |
| Disability | 0 | 0 | 1 | 3 | 28 |
| Women | 15 | 3 | 3 | 4 | 7 |
| Ethnicity | 0 | 6 | 14 | 5 | 7 |

The proposed CCTV camera locations are predominantly in areas with a relatively low-income population, with a high ratio of persons with disabilities and a high proportion of Black and Minority Ethnic. As previously described, these demographic groups are likely to travel by public transport and therefore will benefit disproportionately from these security improvements.

Furthermore, bus users from the wider North Staffordshire area will also benefit from the improvements. There is no existing formal surveillance at the majority of bus stops within North Staffordshire and therefore the baseline level for formal surveillance can be considered to be poor. Installation of effective CCTV cameras at 71 locations across the study area will result in a high level of formal surveillance. Following the assessment approach outlined  this results in a moderate beneficial impact for the area overall.

**Figure 11-1: Proposed location of the CCTV cameras at bus shelters, overlaid with IMD-Income quintiles**

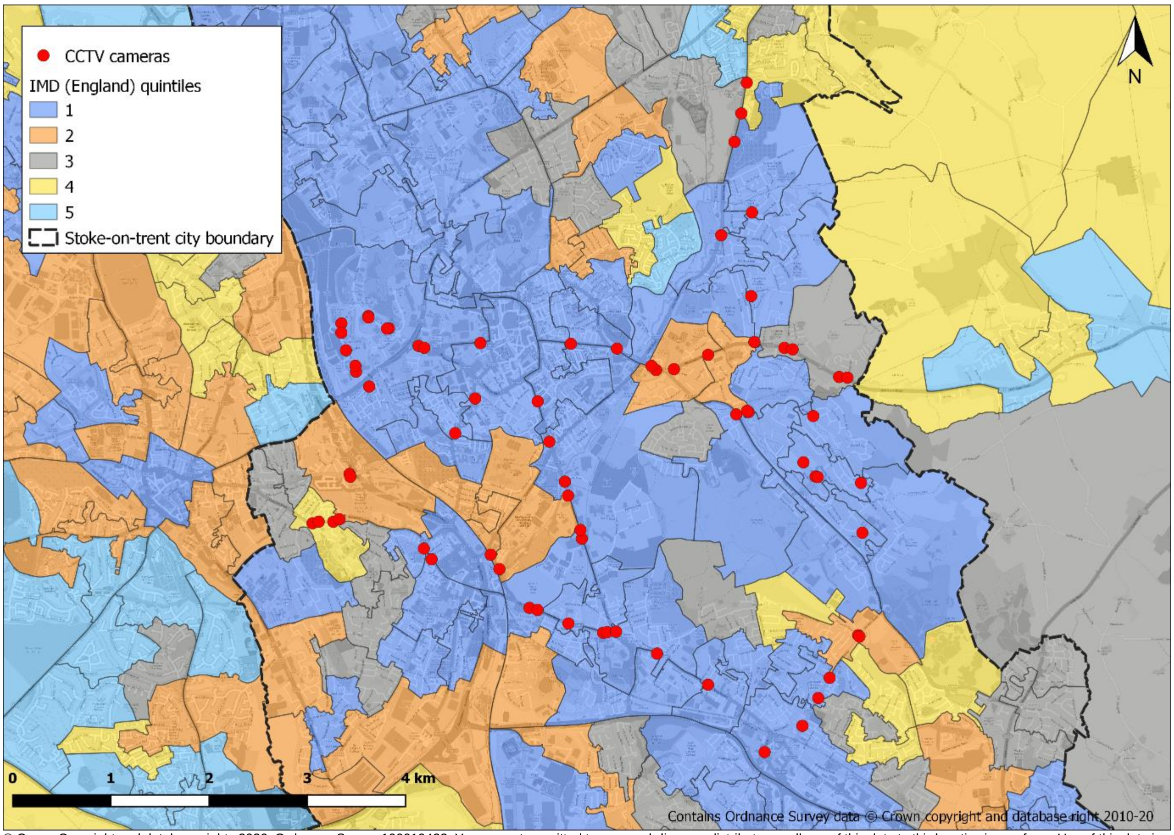





**Figure 11-2: Proposed location of the CCTV cameras at bus shelters, overlaid with Under 16 quintiles**

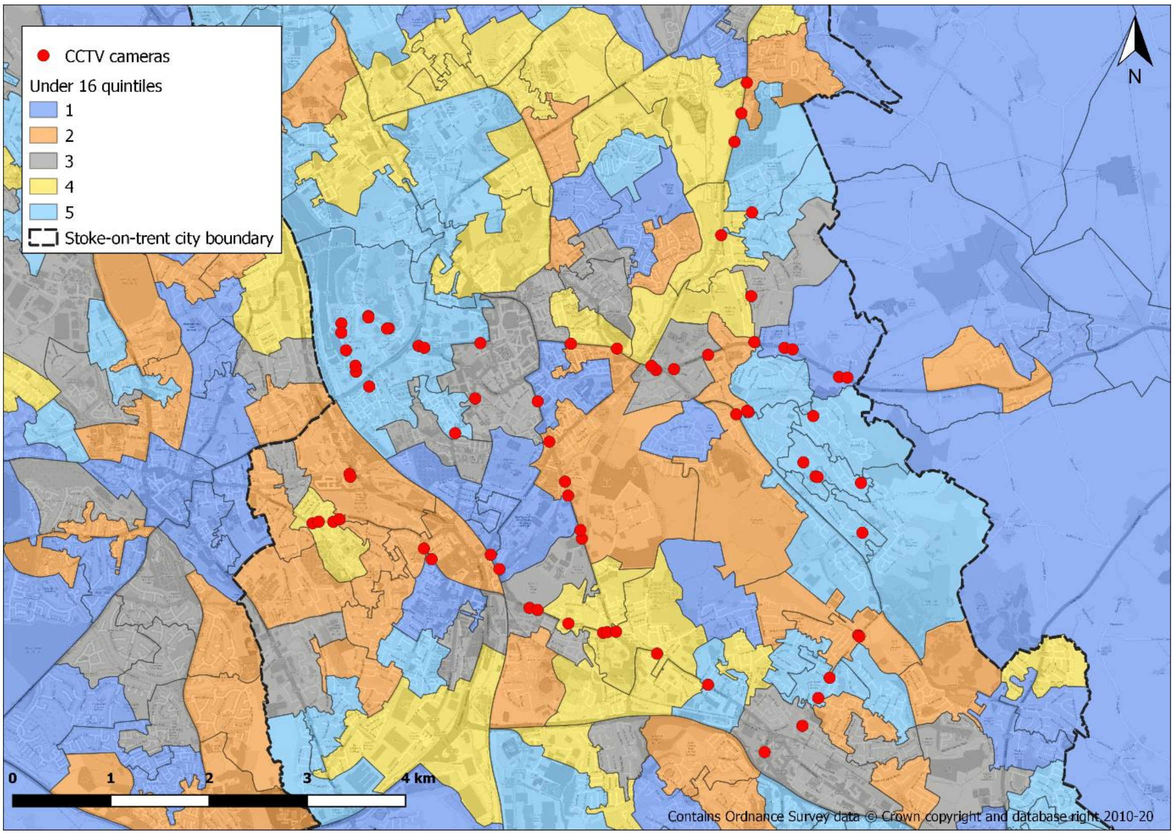


**Figure 11-3: Proposed location of the CCTV cameras at bus shelters, overlaid with Over 65 quintiles**

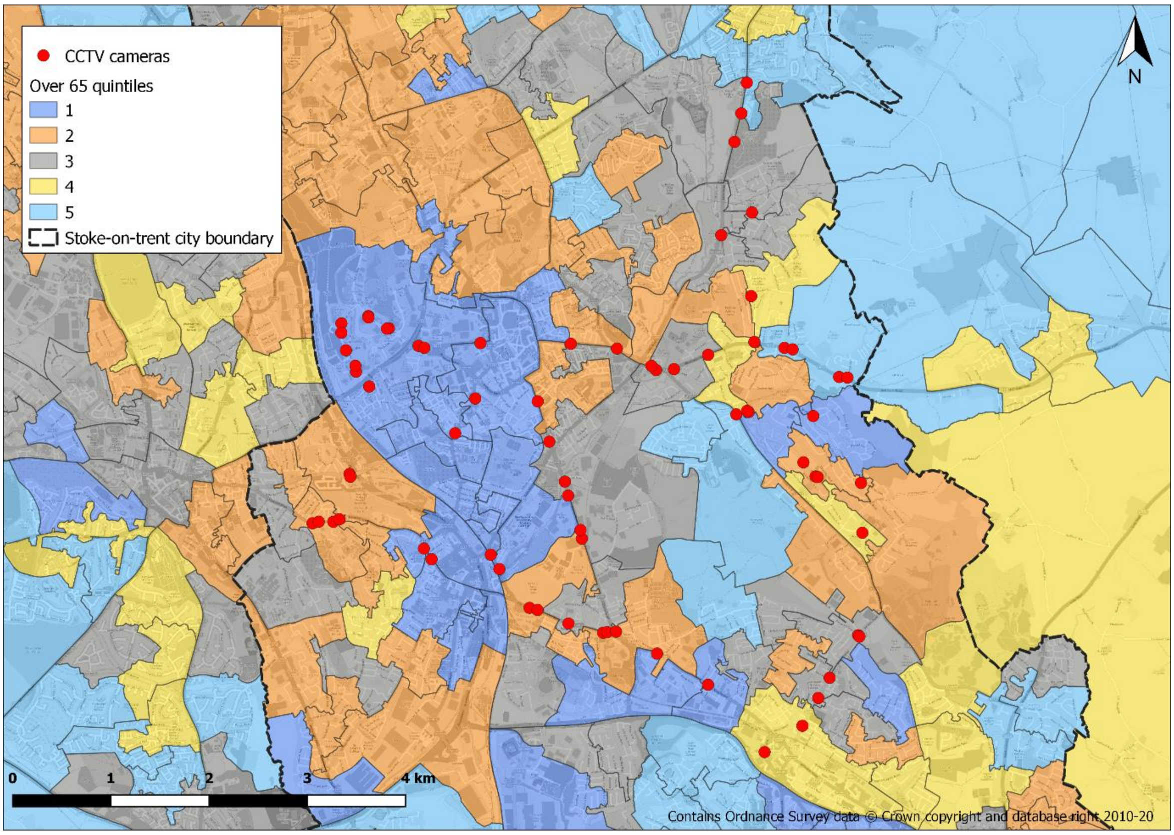





**Figure 11-4: Proposed location of the CCTV cameras at bus shelters, overlaid with Disability quintiles**

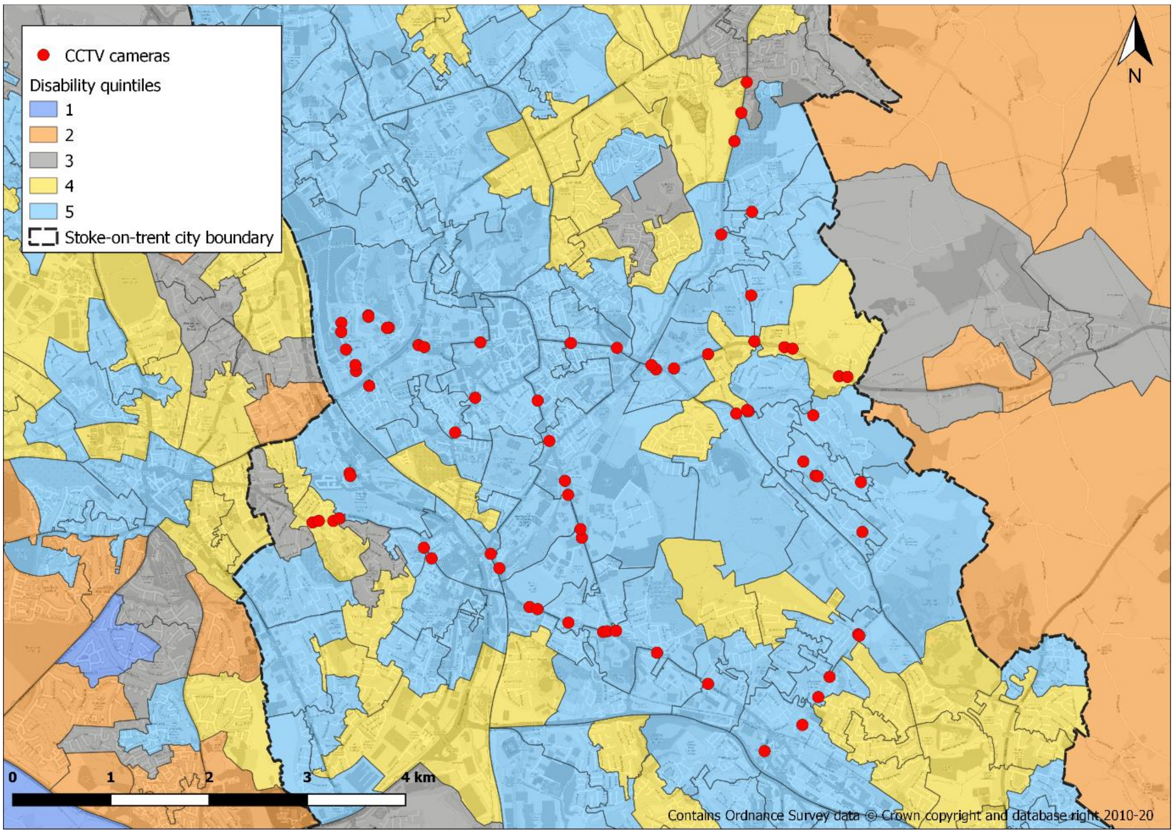


**Figure 11-5: Proposed location of the CCTV cameras at bus shelters, overlaid with Women quintiles**

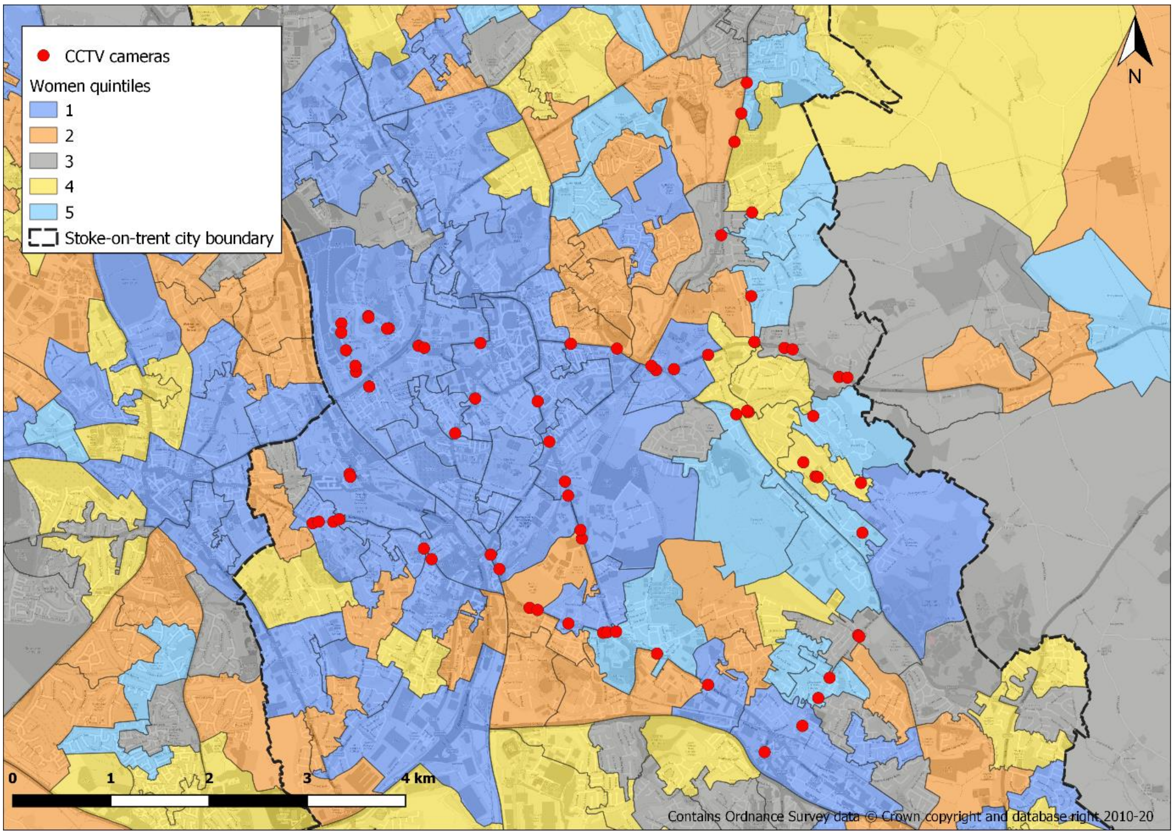
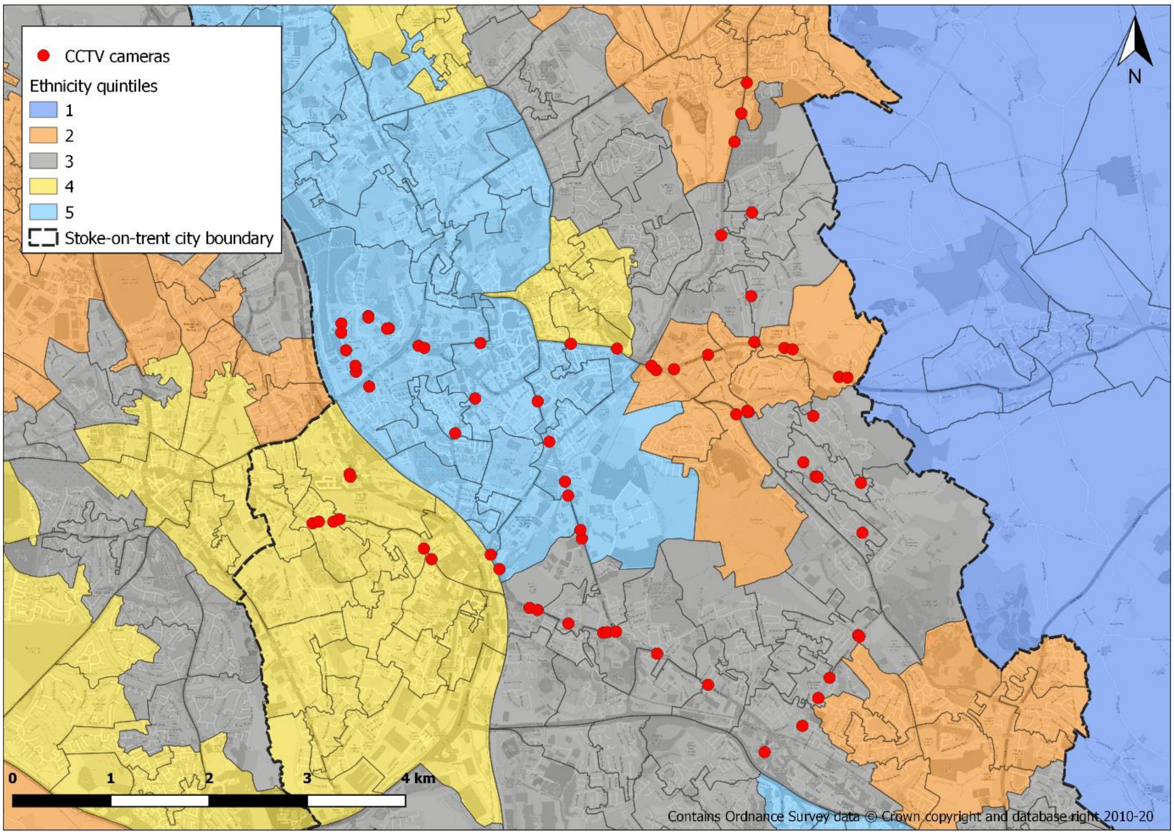





**Figure 11-6: Proposed location of the CCTV cameras at bus shelters, overlaid with Ethnicity quintiles**



## 11.4. Summary

The summary of assessment for both options is described in Table 11-3.

**Table 11-3: Summary of impacts for Security**

| Scenario | Summary assessment |
|---|---|
| Benchmark CAZ D | -<br>The Benchmark CAZ D will not significantly affect security. |
| Preferred Option | ✓✓<br>Implementation of CCTV cameras at bus stops will deliver benefit to bus users who tend to be more so from vulnerable groups. The location of these 71 cameras are located on bus stops in Stoke-on-Trent and would benefit of a population composed of rather low income residents, with a high proportion of persons with disabilities and a rather high ratio of ethnicity. In addition, these cameras should benefit to all public transport users in North Staffordshire |

# 12. Summary and conclusions

Our analysis has explored how the impacts are distributed for the two options under consideration in Stoke-on-Trent and Newcastle-under-Lyme: the Benchmark CAZ and the Preferred Option.

The key findings against each of these categories are set out below and summarised in Table 12-1:

**Air Quality**

The Benchmark CAZ D option will effect changes in concentrations which are as high as a 2.1 µg/m$^3$ improvement in certain LSOAs within the Central Impact Area. Only one LSOA, corresponding to 1,588 inhabitants, experiences a deterioration of air quality under the Benchmark CAZ D scenario (of less than 0.01 µg/m$^3$). Under the Preferred Option, improvements in air quality are smaller and less than 0.5 µg/m$^3$ in all LSOAs. A slight deterioration of air quality is experienced by 58 LSOAs; however, this is of a magnitude no greater than 0.15 µg/m$^3$. All LSOAs are outside the Central Impact Area and only 12 of the 58 represent the most deprived residents. However, this analysis is more concerned with the distribution of impacts under each option, rather than the absolute size.

Both options will deliver greatest benefit (i.e. reduction in air pollution) to the most deprived population and areas with greater levels of children, with again a greater positive impact with the Benchmark CAZ – suggesting both options could be considered to have a disproportionate positive effect. As the most deprived population is also living in the most polluted area of the city (highest $NO_2$ concentrations), the implementation of either scenario would be beneficial for the population already suffering the most from air pollution.

Any distributional effect depends on the size of impact but also the population numbers that experience the change from different groups. In the TAG analysis, the population in each IMD and under 16 quintile benefit in proportion to their representation in the overall population – suggesting no disproportionate impact. However, for the Preferred Option, the most deprived quintiles and those with highest numbers of children are seen to capture a higher proportion of net winners relative to their share of the overall population. As such, the Preferred Option could provide a disproportionate benefit to these vulnerable groups not only in the size of air pollution reductions delivered, but also in the numbers of population that benefit.

When looking at sensitive receptors again the models show that implementing either of the options has a positive effect across all receptor types (with a stronger benefit for Benchmark CAZ). The least impacted receptors are communal residences and special needs establishments, of which there are none located within the CAZ area where both options are targeted. In general, receptor types with a higher proportion of receptors within the CAZ are have the strongest improvement in air pollution, namely educational residences, nurseries/crèches, and public parks and gardens.

**Business affordability**

70% of all businesses in the CIA area are classified as micro businesses (less than 10 people) and 92% are considered micro or small (<50 people). Micro and small businesses are likely to be at greater risk from the CAZ D as they are less likely to have the available capital to purchase a compliant vehicle, they do not have large fleets which can redistribute non-compliant vehicles to areas not impacted by the CAZ charge and they are also more likely to have locally focused operations and hence face the charge more often. Across the North Staffordshire area there are over 16,000 micro businesses registered. It is likely that the vast majority will conduct some business inside the proposed CAZ area and therefore be impacted by either paying the charge or upgrading their vehicle(s). Another vehicle class and business type are taxi drivers who are some of the poorest in the community, targeting them will place further strain on their businesses and families and many of them would cease operating in the area.

In conclusion, there is a clear divide between the impacts of the Benchmark CAZ D and the Preferred Option. The Benchmark CAZ D will impact a large number of businesses in North Staffordshire, in particular affecting smaller businesses which may not be able to afford a new vehicle and therefore face a greater risk to their business. The Preferred Option would be much better for businesses who would not face a charge, but would face costs associated with vehicle rerouting. Whilst these are not negligible, they are smaller than under the Benchmark CAZ D. The Preferred Option would also benefit public transport users and operators with new buses and RTPI which would make public transport a more appealing offer to the general public.

**User benefits and personal affordability**

Both options have the potential to impact on user benefits and personal affordability through direct charges and indirect costs associated with behavioural responses to the options.

In the section assessing user benefits, the TUBA model outputs were used to explore the spatial pattern of results. Both options will result in large negative user benefits in areas with the highest proportion of deprived households. However, these costs will be far greater under the Benchmark CAZ D. The impact on the most deprived relative to the least deprived quintile is much greater under the Benchmark CAZ D relative to the Preferred Option. It could therefore be concluded that although both options will have an adverse effect on the most deprived households, the Benchmark CAZ D will have a greater disproportionate effect. Although TUBA will capture the majority of the key impacts on households under the Preferred Option, it will not capture all key impacts of the Benchmark CAZ D. As such, additional analysis was undertaken using a proxy for all costs based on ownership of non-compliant vehicles.

Poorer households make significantly more trips into the CAZ area and are more likely to own non-compliant cars. Our analysis of the distribution of costs using vehicle ownership data therefore suggests under a Benchmark CAZ D, a higher proportion of the costs will fall greatest on areas with:

- Greater levels of deprivation;
- Greater numbers of elderly residents;
- Greater numbers of residents with disabilities.

Furthermore, it is important to note that the same cost placed on the most deprived quintile will represent a greater proportion of budget and therefore an even greater impact.

Alongside direct impacts, the options have the potential to have indirect impacts (which will somewhat be captured by the TUBA analysis). The Preferred Option may provide a slight benefit to users of public transport, which are more likely to be vulnerable households. However the Benchmark CAZ D is likely to have a much larger, negative indirect impact through placing a cost on:

- Buses, which are used more so by poorer households, the young (0-16) and the elderly (60+); and

- Taxis, which are often relied upon by disabled persons who are unable to drive, and so could also face a disproportionate share of any costs passed through.

**Accidents**

Looking only at links which are predicted to experience a significant change in traffic (classed as 10% change in AADT flow or greater), under a Benchmark CAZ D 9.3% of all road links will reduce in AADT flow by 10% or and more links observe a significant decrease than increase. Under the Preferred

Option, 2.2% of links observe a significant decrease and more links observe a significant decrease than increase in traffic.

Under both a Benchmark CAZ D and the Preferred Option, LSOAs with greater levels of deprivation and a high proportion of residents registered with a disability are likely to benefit disproportionately more. Hence, both options arguably have a disproportionate benefit with respect to these two groups vulnerable to accident risk. This predominantly reflects the greater presence of these groups around the proposed charging zone, where the greatest impacts under both options are likely to occur. No disproportionate impacts were found with respect to children and elderly group who are also at higher risk of accidents.

**Noise**

Neither option is expected to have a significant impact on noise in North Staffordshire.

**Accessibility**

The Preferred Option includes a range of bus infrastructure measures which will improve accessibility along heavily-used bus corridors. These measures include new accessible kerbs, new bus shelters, real-time public information (RTPI) and upgrades to existing bus shelters. The Preferred Option accessibility measures deliver a disproportionate benefit to more deprived households, households with a higher proportion of children (under 16) and disabled, and a lower proportion of elderly residents.

**Severance**

Both the Preferred Option and the Benchmark CAZ D are expected to a lead to a small net positive impact. Impacts are predicted to be locally-constrained.

**Security**

The Preferred Option includes a large-scale investment in CCTV cameras at bus stops which will represent a ‘step-change’ in formal surveillance and have a substantial positive impact on both the actual and perceived security of existing bus users. These improvements to security may also help to encourage greater use of the bus network.

The proposed CCTV camera locations are predominantly in areas with a relatively low-income population, with a high ratio of persons with disabilities and a high proportion of ethnicity. These demographic groups are likely to travel by public transport and therefore will benefit disproportionately from these security improvements.

**Table 12-1: Summary of all distributional impacts**

| Impact | Summary assessment | |
|---|---|---|
| | **Preferred Option** | **Benchmark CAZ D** |
| Air quality | ✓✓<br>This option provides a small overall improvement in air quality, and minor improvements in most other areas of North Staffordshire. Some LSOAs, mainly adjacent to the A500, experience a small deterioration in air quality compared to the Reference Case. This is of no more than 0.15 µg/m$^3$.<br>This option reduces impacts across all sensitive receptors, suggesting a positive impact for vulnerable groups.<br>TAG analysis suggests that this option will have a disproportionate benefit for more deprived areas and areas with higher numbers of children (i.e. the proportion of all those that benefit in the most deprived quintile is greater than the proportion of the most deprived quintile in the overall population).<br>Analysis of size of impacts also suggests benefits will be greater for more deprived areas and areas with higher number of children (and relative impact for more deprived relative to less deprived is greater than that for Benchmark CAZ). | ✓✓<br>This option provides an overall improvement in air quality and small improvements in all other areas of North Staffordshire. The absolute air quality benefits are greater than in the Preferred Option. One LSOA, outside of the CAZ boundary, experiences a slight deterioration in air quality compared to the Reference Case. However, this is less than 0.1 µg/m$^3$.<br>Like the Preferred Option, the Benchmark CAZ D reduces impacts across all sensitive receptors, suggesting a positive impact for vulnerable groups.<br>TAG analysis suggests this option will not have a disproportionate impact on any group, but analysis of the size of impacts suggests benefits will be greater for more deprived areas and areas with higher proportions of children. |
| Affordability for businesses | X<br>The Preferred Option is likely to have a much more limited impact on businesses in North Staffordshire om terms of affordability than the Benchmark CAZ D. It does not place a direct cost on vehicle owners unlike the Benchmark CAZ D. However, businesses will be affected to a lesser degree through indirect costs associated with rerouting to avoid the proposed bus gates.<br>The Preferred Option would also benefit public transport users and operators with new buses and improved bus infrastructure, which would make public transport a more appealing offer to the general public. | XX<br>The Benchmark CAZ D would significantly impact all businesses in the charging area, the immediate surrounding area, and North Staffordshire. Those that rely on vehicles to move goods and services would be most affected by the charging zone. In fact, almost all businesses are reliant to some extent on vehicles from either a supply or demand side.<br>In order to avoid paying the CAZ charge businesses will need to upgrade their vehicle to a compliant standard or adopt another approach, but all behavioural responses will carry some burden for the business. HGVs and LGVs are the two vehicle types that will be most significantly impacted either through the requirement to pay the CAZ charge or the financial strain that upgrading will have on local businesses. In the HGV sector, the benefits seen by operators across 10 years is less than 20% of the immediate financial outlay of purchasing a compliant vehicle. |
| User benefits | XX | XXX |

| Impact | Summary assessment<br>Preferred Option | <br>Benchmark CAZ D |
|---|---|---|
| | TAG analysis shows a moderate adverse impact across all quintiles, hence no distributional effect.<br>Looking at the size of impact, the reduction in user benefits will be greatest for most deprived households. In particular given for the same impact, this will represent a greater proportion of their disposable income.<br>However, the relative impact between the most and least deprived is smaller than under Benchmark CAZ D. | Disbenefits in terms of personal affordability will be directly felt through the payment of the CAZ charge.<br>Looking at the size of impact, the reduction in user benefits will be greatest for most deprived households. In particular given for the same impact, this will represent a greater proportion of their disposable income<br>Relative impact between the most and least deprived is greater than under Preferred Option (impact on quintile 1 is 14.8 times that on quintile 5). Hence Benchmark CAZ D will have a more disproportionate adverse effect on the most deprived households. |
| Personal affordability | X<br>This option is also predicted to disbenefit to the population, however with lower costs to the population in comparison with the Benchmark CAZ.<br>The population which would disbenefit the most reside in the Longton area, south eastern part of Stoke-on-Trent. This disbenefit is primarily to increase in travel times, in comparison with a CAZ where the greatest costs are due to the user charge.<br>TUBA analysis suggests greater negative user benefits are experienced by the most deprived areas, suggesting a disproportionate adverse effect.<br>Looking at the relative impacts across quintiles, it can be seen that the impact on the most deprived relative to the least deprived quintile is much greater under the Benchmark CAZ relative to the preferred option. Hence the Benchmark CAZ will have a greater disproportionate effect. | XXX<br>TAG analysis of User benefits suggests no disproportionate adverse effect. However, analysis of the relative size of impacts suggests that the Benchmark CAZ D will have a greater disproportionate adverse effect on more deprived households.<br>Once additional costs are added to user benefits, Benchmark CAZ D will have a significantly greater impact on personal affordability overall<br>Additional analysis using non-compliant vehicle ownership suggests overall impacts of Benchmark CAZ D could have a disproportionate adverse effect on more deprived households, the elderly, and residents with a registered disability. |
| Accidents | ✓<br>Overall, 2.2% of road links are predicted to experience a significant decrease (at least 10%) in AADT flow. Conversely, 1.3% of road links are predicted to experience a significant increase. The lower number of road links where risk of traffic accidents will decrease, and the larger number where risk will increase, relative to the Benchmark CAZ D, reflects the targeted nature of the traffic management measures in this option. However, as for the Benchmark CAZ D, the net road safety impact of the option is beneficial.<br>Analysis suggests that LSOAs with greater levels of deprivation and a high proportion of residents registered with a disability are likely to benefit | ✓✓<br>9.3% of road links are predicted to experience a significant decrease (at least 10%) in AADT flow. Conversely, 0.8% of road links are predicted to experience a significant increase.<br>LSOAs with greater levels of deprivation and a high proportion of residents registered with a disability are likely to benefit disproportionately from these changes. Hence both options could be suggested to have a disproportionate benefit with respect to these two groups vulnerable to accident risk.<br>No disproportionate impacts were found with respect to children and older people who are also at higher risk from traffic accidents. |

| Impact | Summary assessment | |
|---|---|---|
| | **Preferred Option** | **Benchmark CAZ D** |
| | disproportionately more from the implementation of the Preferred Option, as for the Benchmark CAZ D.<br><br>As for the Benchmark CAZ D, No significant distributional effects were found with respect to children and older people who are also at higher risk of accidents. | |
| Noise | -<br>Negligible impacts. | -<br>Negligible impacts. |
| Accessibility | ✓<br>The Preferred Option accessibility measures deliver the same distributional patterns for each of the socio-economic impact groups: a disproportionate benefit to more deprived households, households with a higher proportion of children (under 16) and disabled, and a lower proportion of elderly residents. | X<br>Negligible impacts. |
| Severance | ✓<br>This option is expected to produce a small number of low-magnitude locally constrained positive impacts, and a single negative impact. | ✓<br>This option is expected to produce low-magnitude positive impacts over a relatively wide area, with a small number of locally focussed negative impacts. |
| Security | ✓✓<br>Implementation of CCTV cameras at bus stops will deliver benefit to bus users who tend to represent a higher proportion of vulnerable groups than the general population. These 71 cameras will be located on bus stops in Stoke-on-Trent and would benefit a population with a high proportion of low-income residents, with a high proportion of persons with disabilities. | -<br>The Benchmark CAZ D does not include measures that will affect security or perception of security. |

# Appendices

# Appendix 1: Socioeconomic impact group quintile distribution maps

**Figure A.1: Map of IMD quintiles for DA domain, where quintiles reference DA Domain**

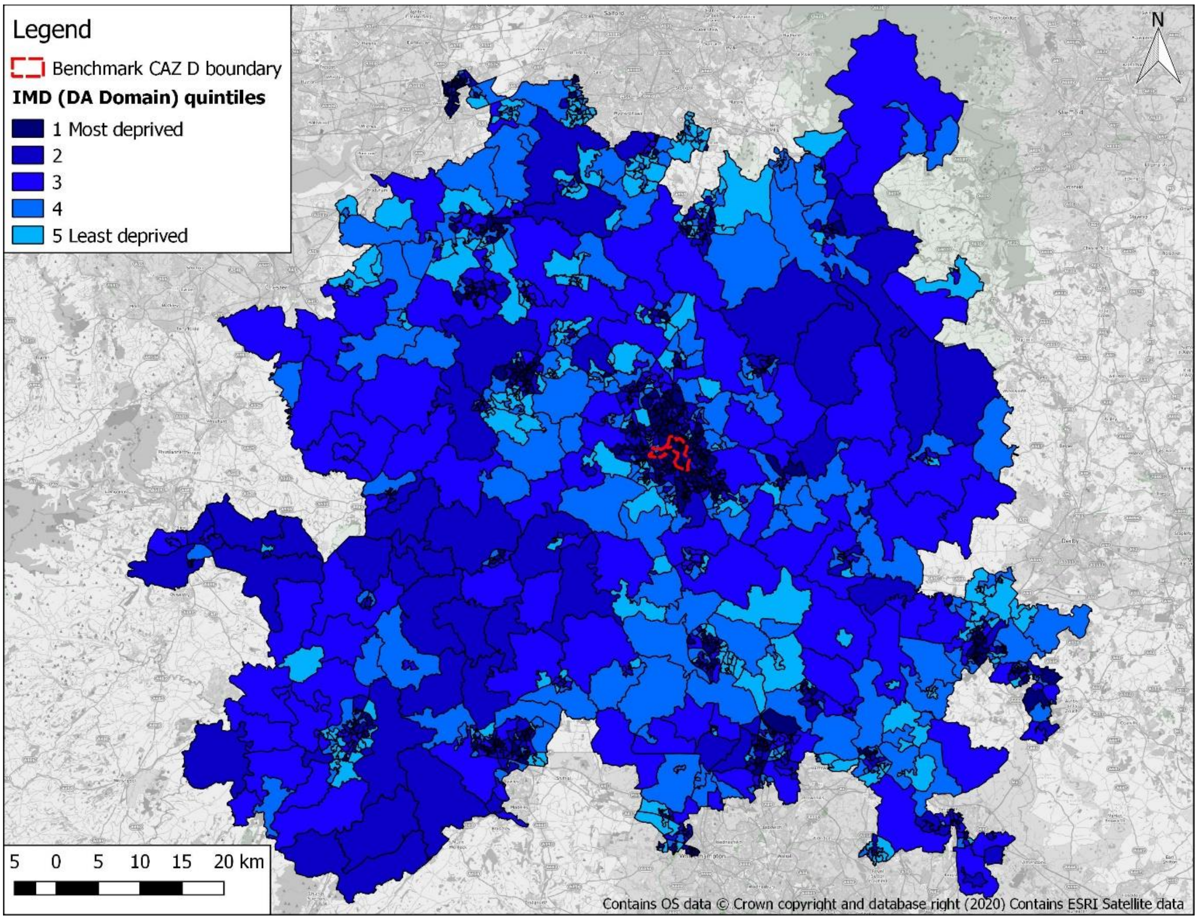


**Figure A.2: Map of IMD quintiles for DA domain, where quintiles reference England**

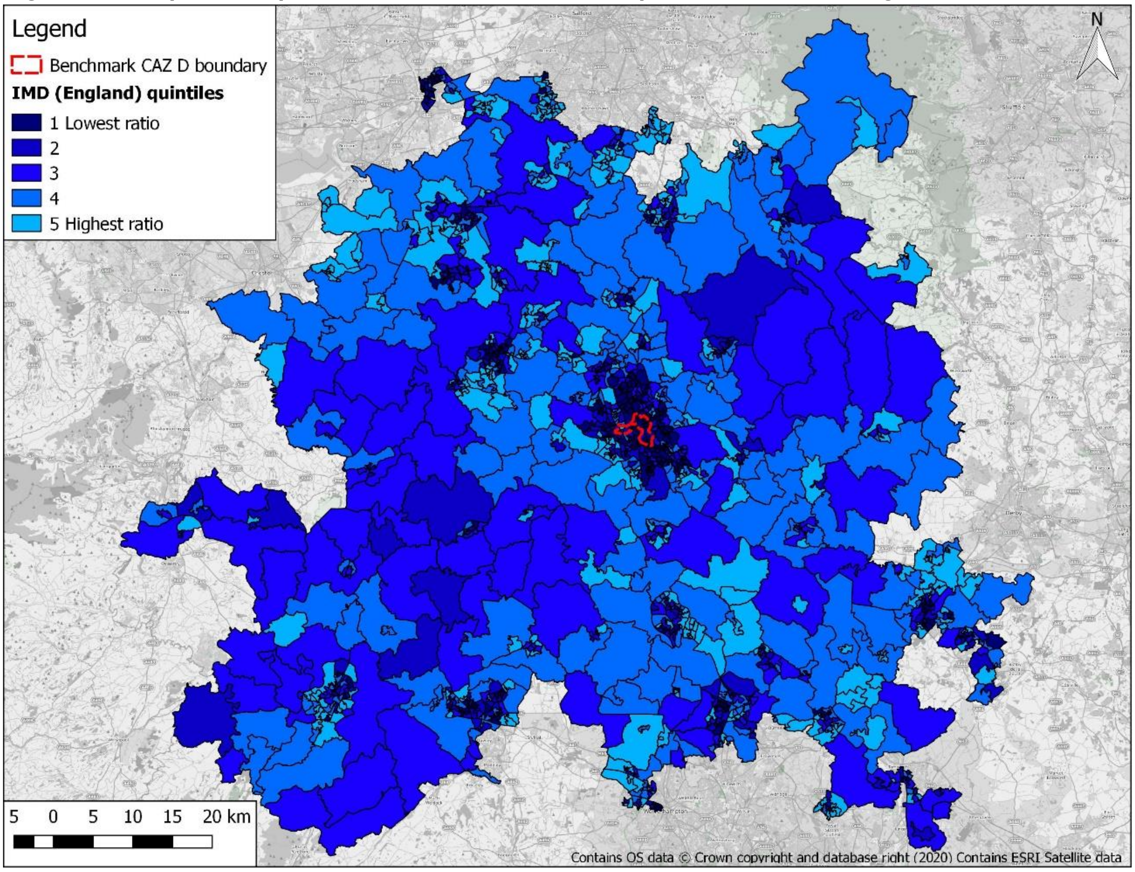


**Figure A.3: Map of IMD quintiles for DA domain, where quintiles reference England (zoom city centre)**

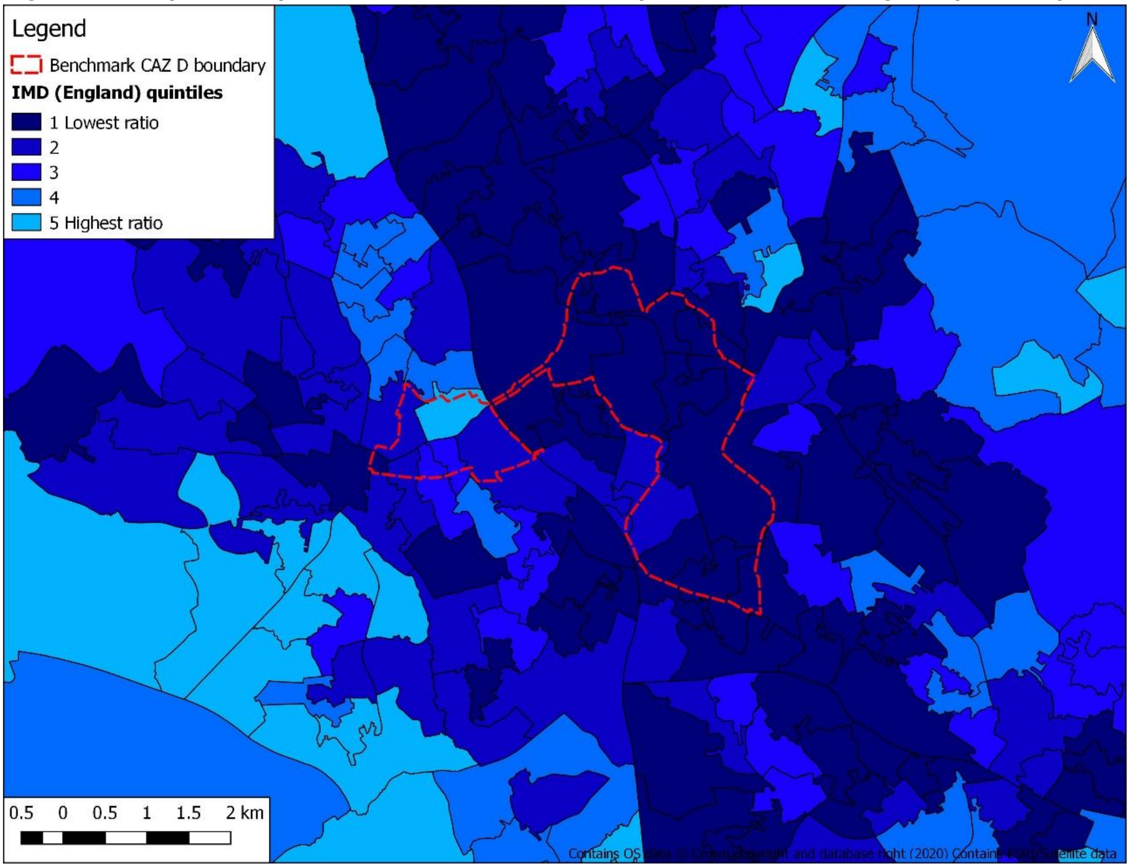


**Figure A.4: Map of Under 16 quintiles for DA domain, where quintiles reference England & Wales**

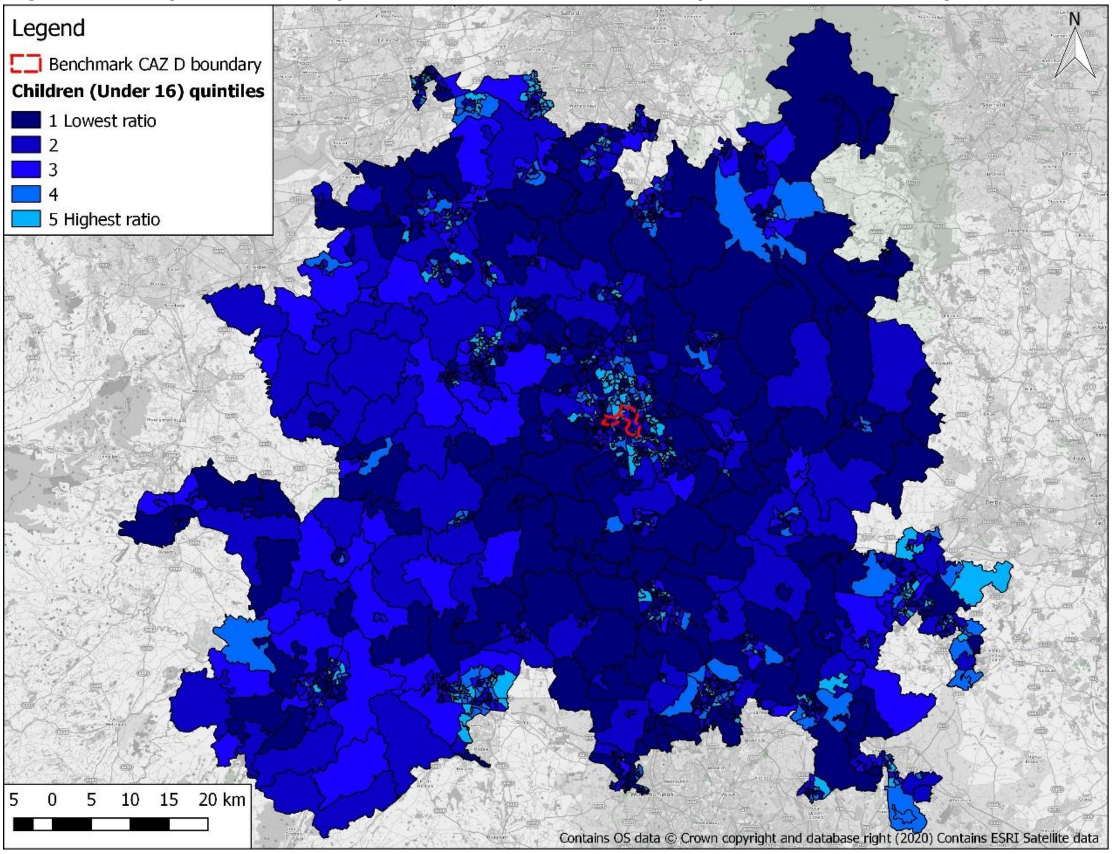


**Figure A.5: Map of Under 16 quintiles for DA domain, where quintiles reference England & Wales (city centre)**

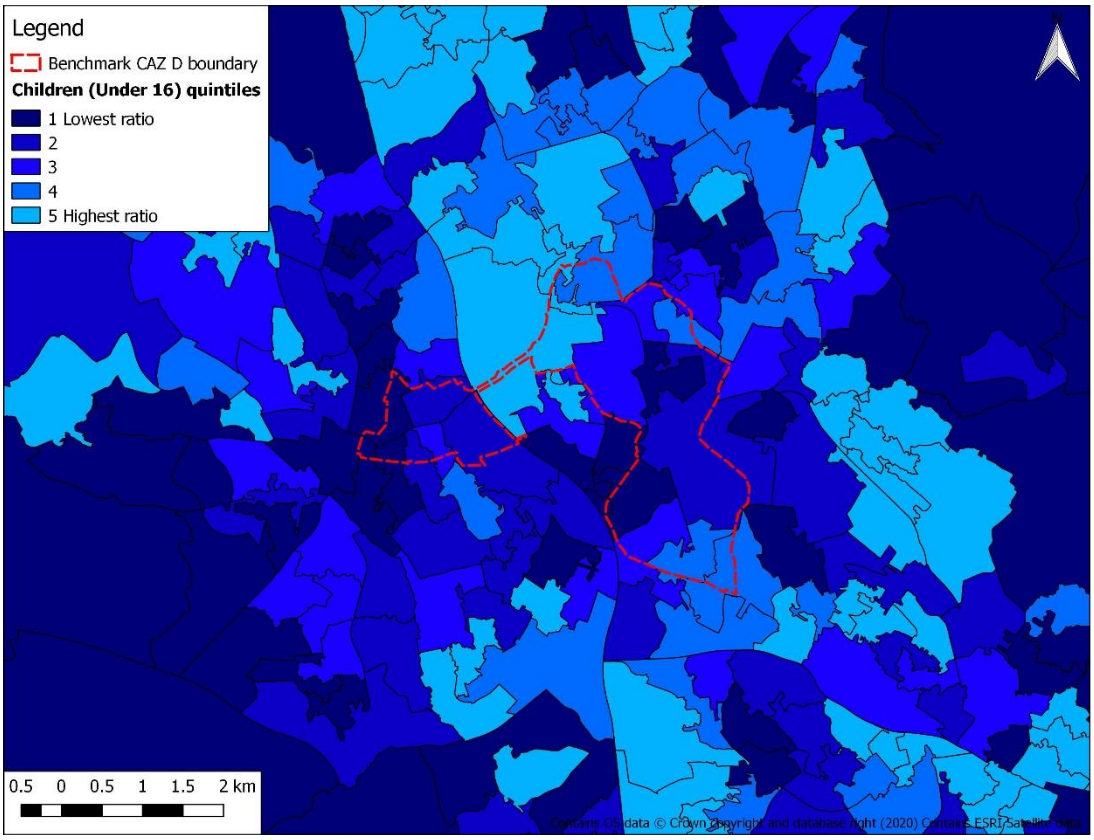


**Figure A.6: Map of Over 65 quintiles for DA domain, where quintiles reference England & Wales**

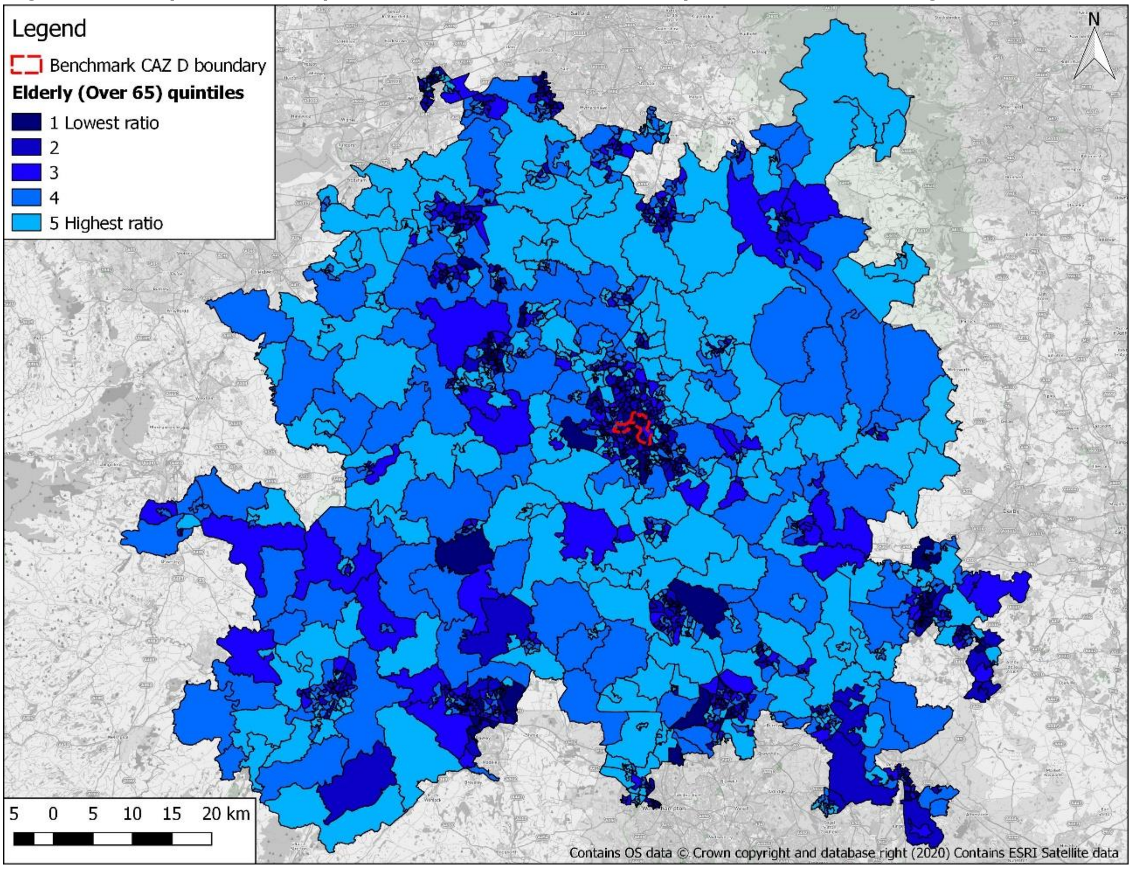


**Figure A.7: Map of IMD – Disability quintiles for DA domain, where quintiles reference England**

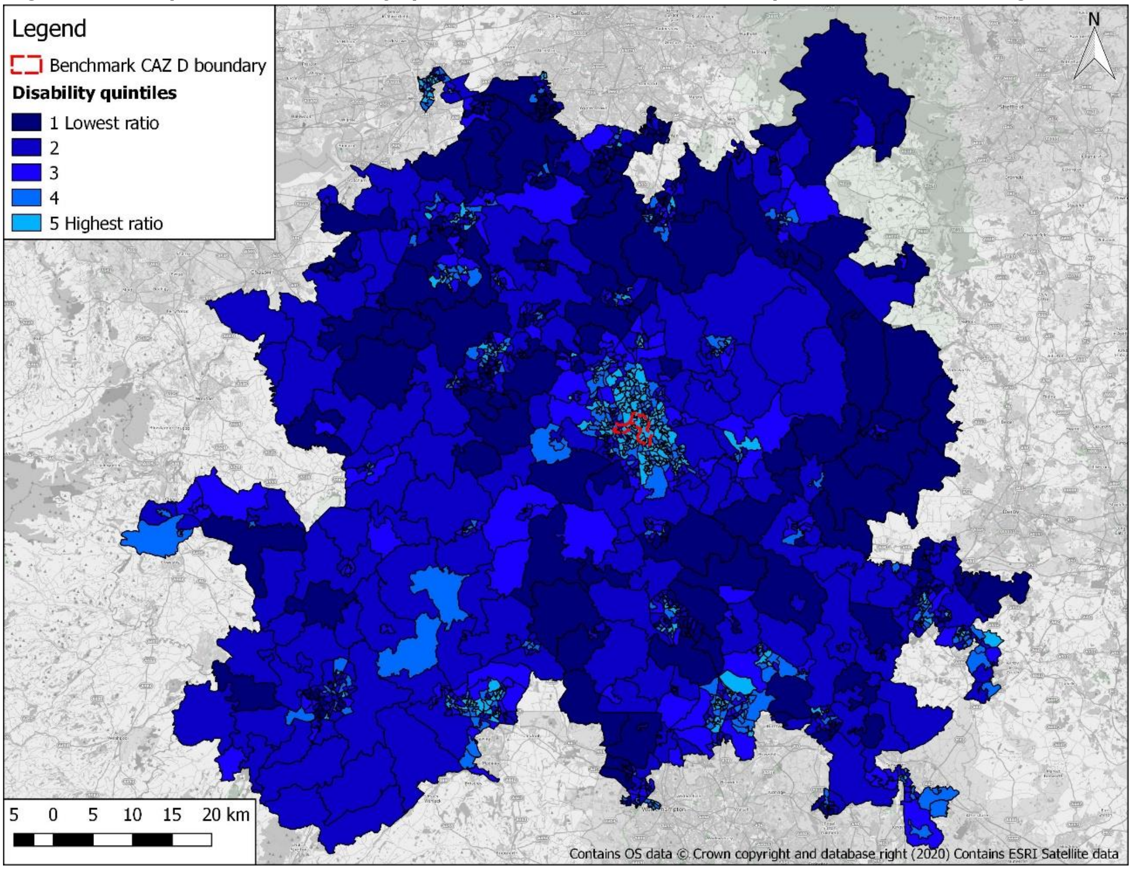


**Figure A.8: Map of Gender (proportion of women) quintiles for DA domain, where quintiles reference England & Wales**

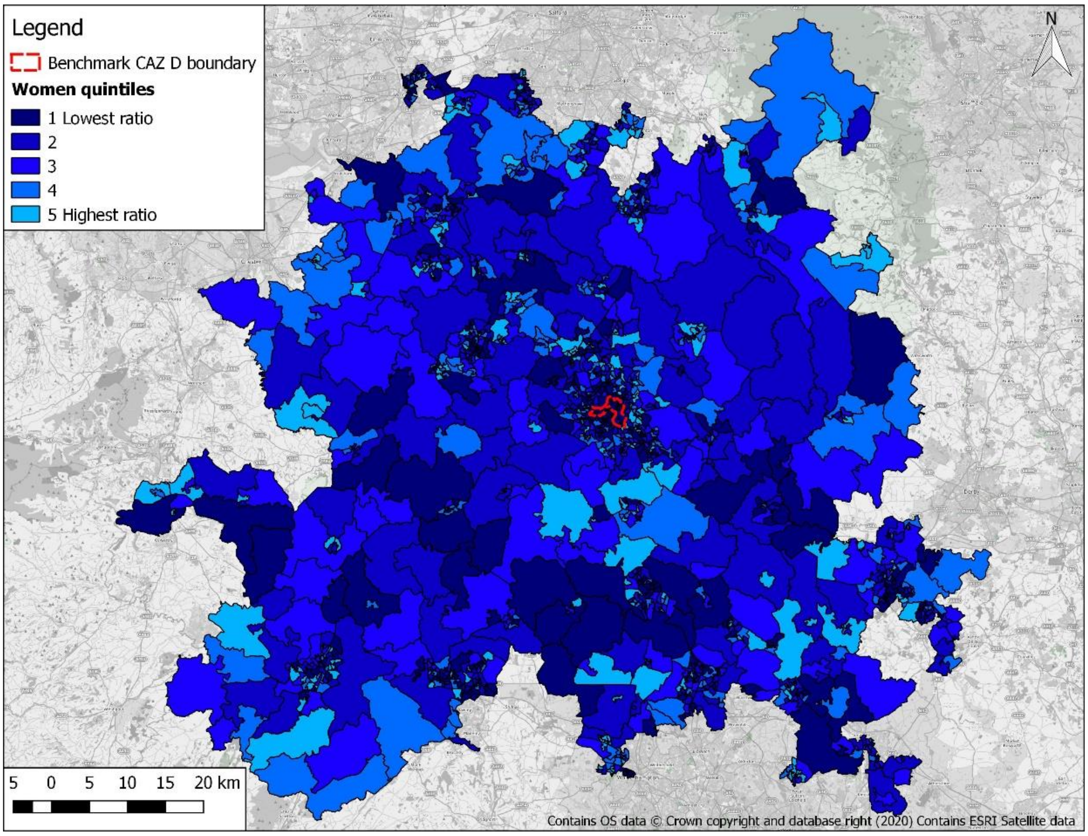


**Figure A.9: Map of proportion of "non-white" quintiles for DA domain, where quintiles reference England & Wales**

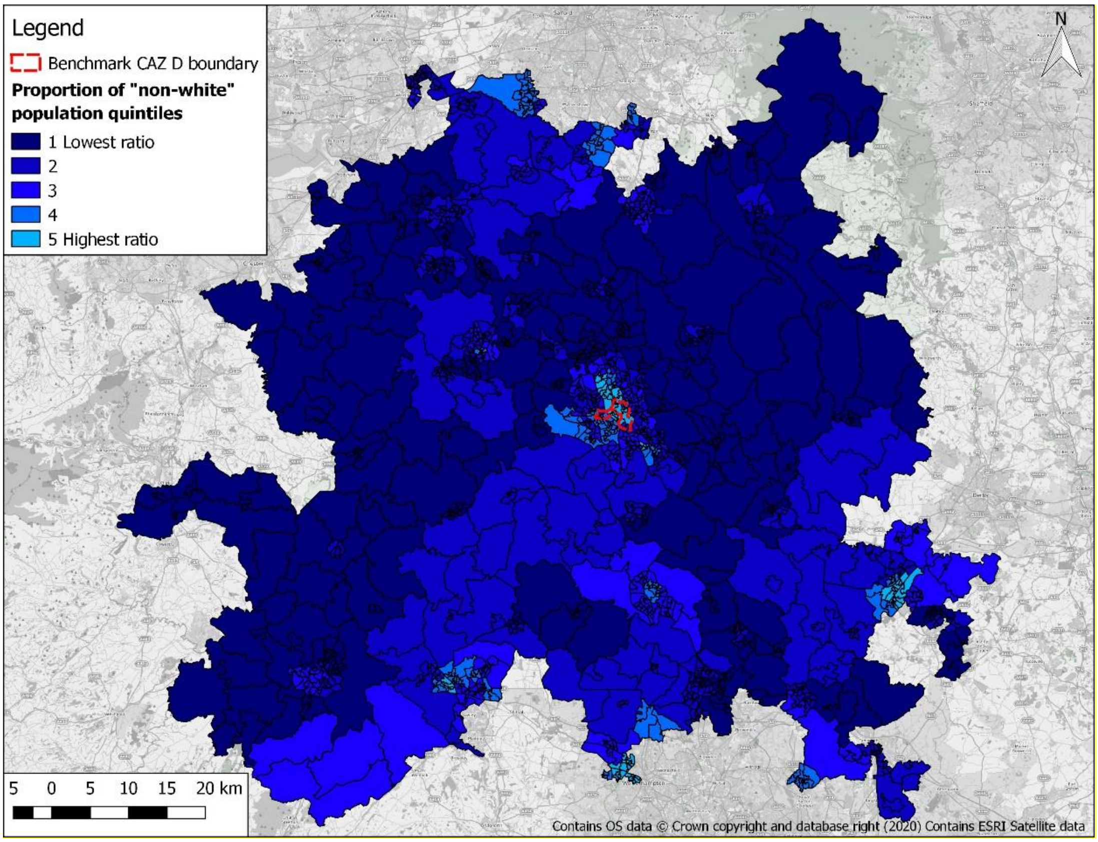


**Figure A. 10: Map of LGVs owned quintiles - where quintiles reference whole England and Wales (based on JAQU data)**

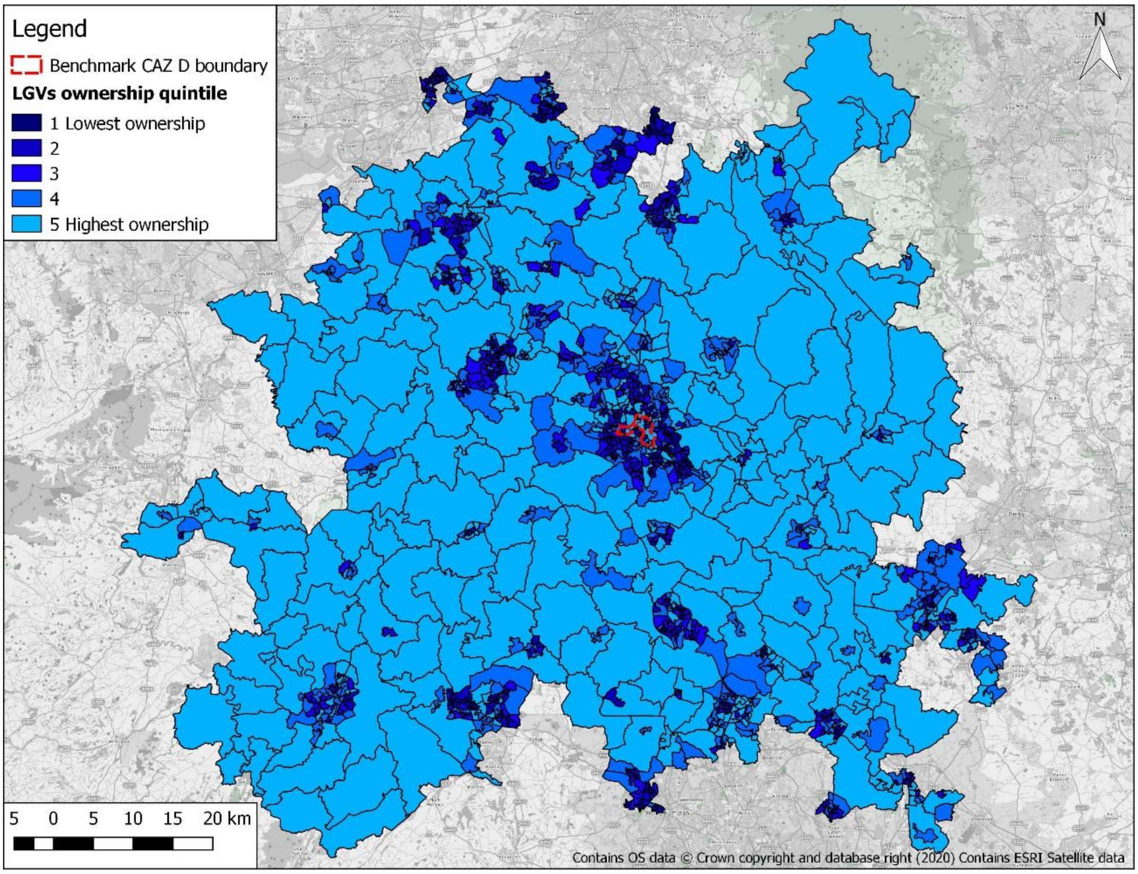


**Figure A. 11: Map of all business quintiles - where quintiles reference whole England and Wales**

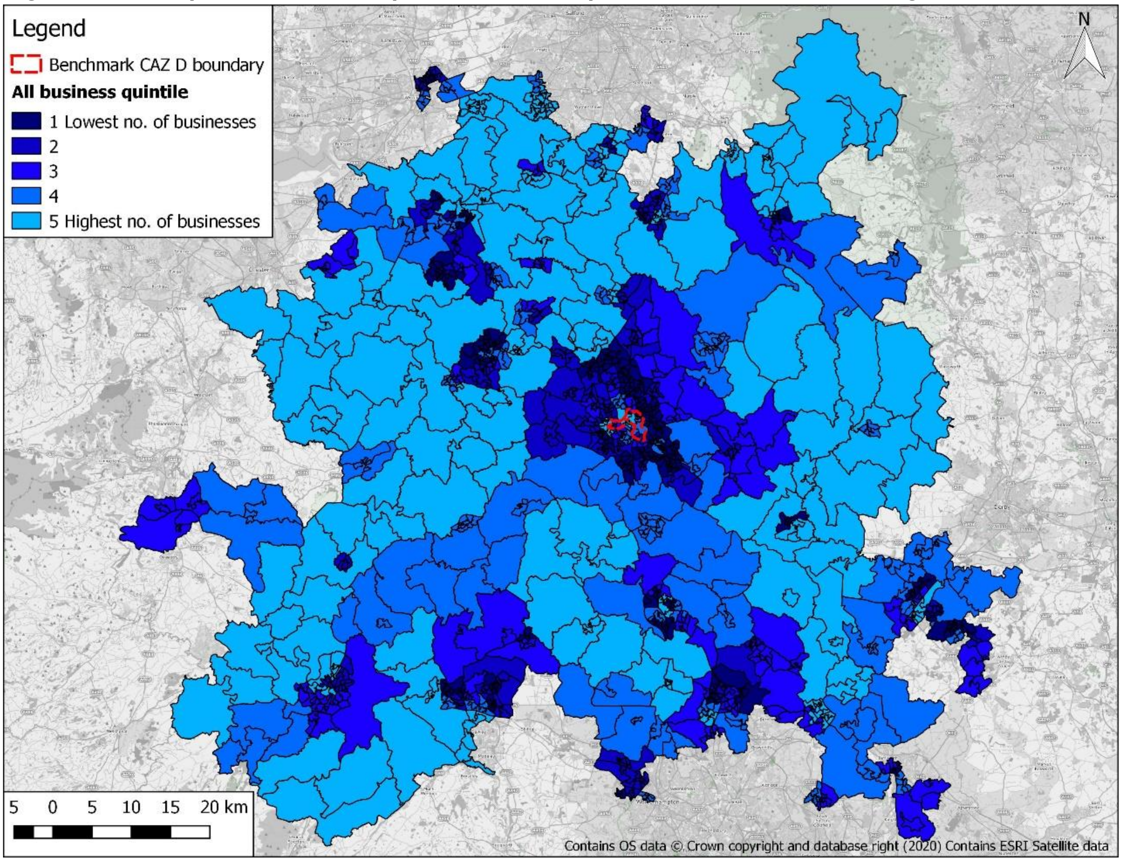


**Figure A. 12: Map of Small and Medium (SME) business quintiles - where quintiles reference whole England and Wales**

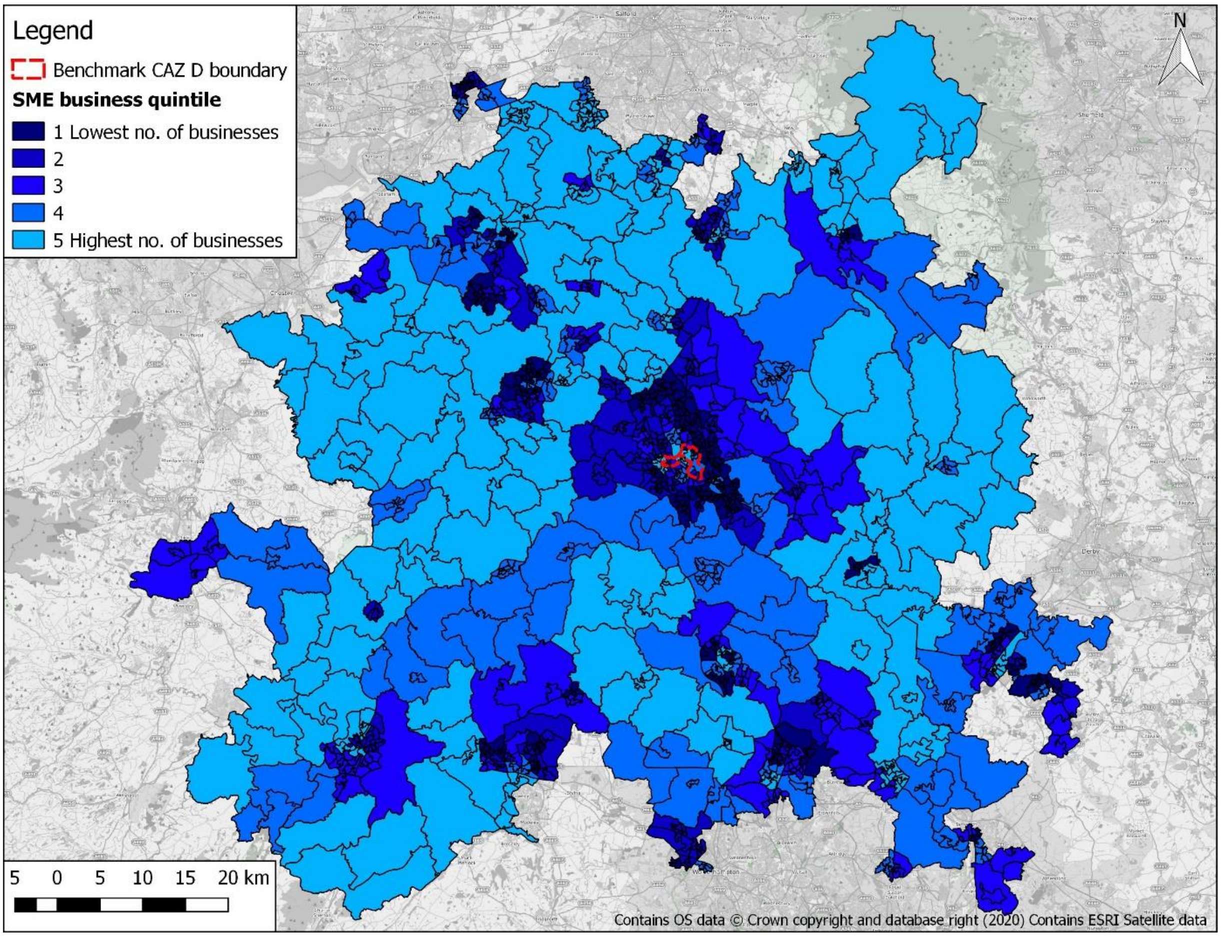


**Figure A. 13: Percentage of Non-Compliant LGVs per LSOA**

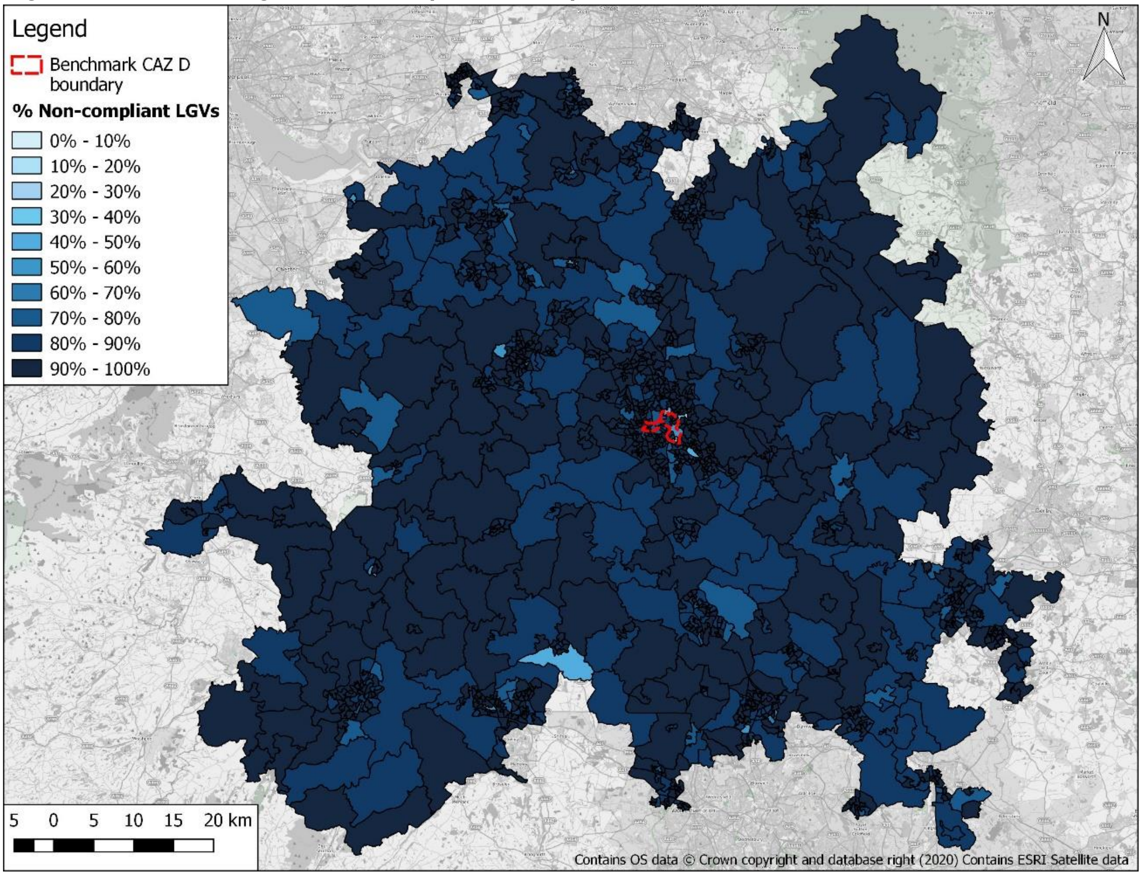


**Figure A. 14: Percentage of Non-Compliant LGVs per LSOA – Zoom to city centre**

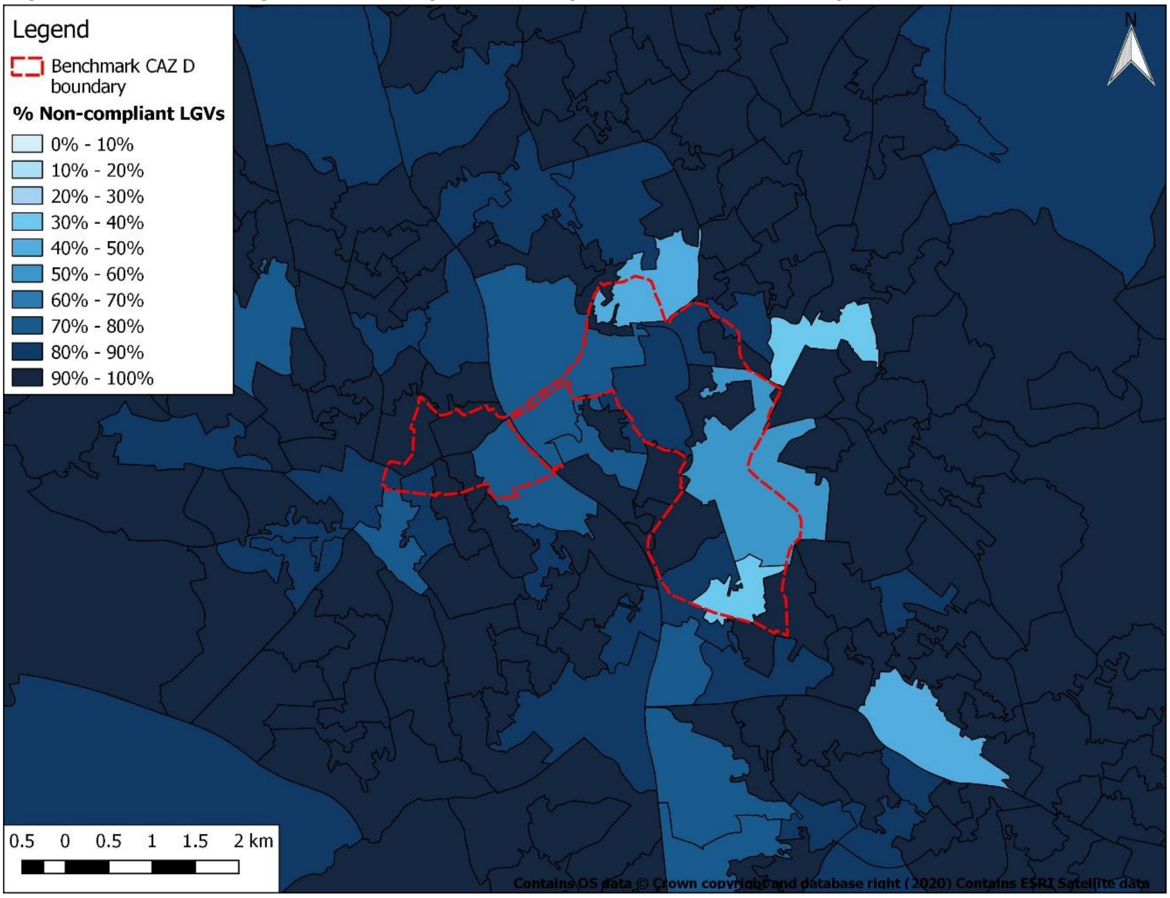


**Figure A. 15: Percentage of Non-Compliant cars per LSOA**

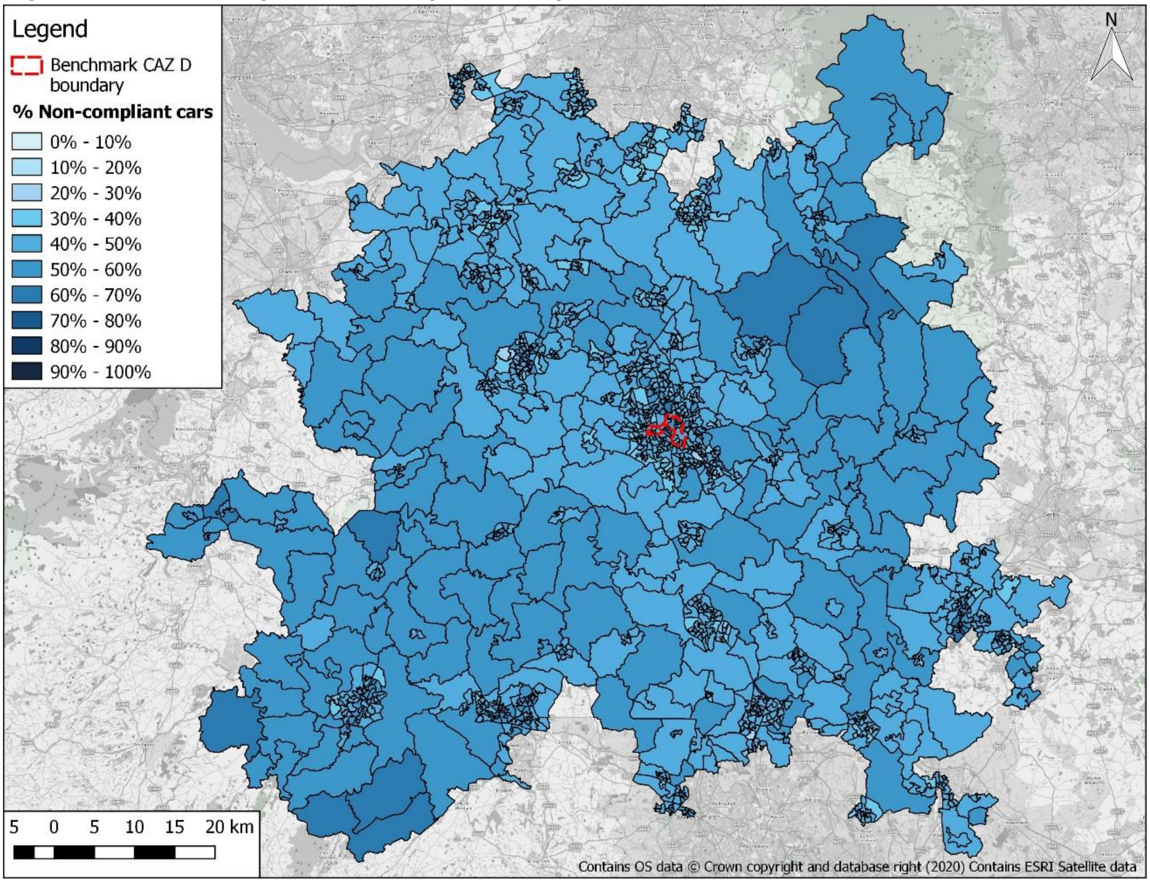
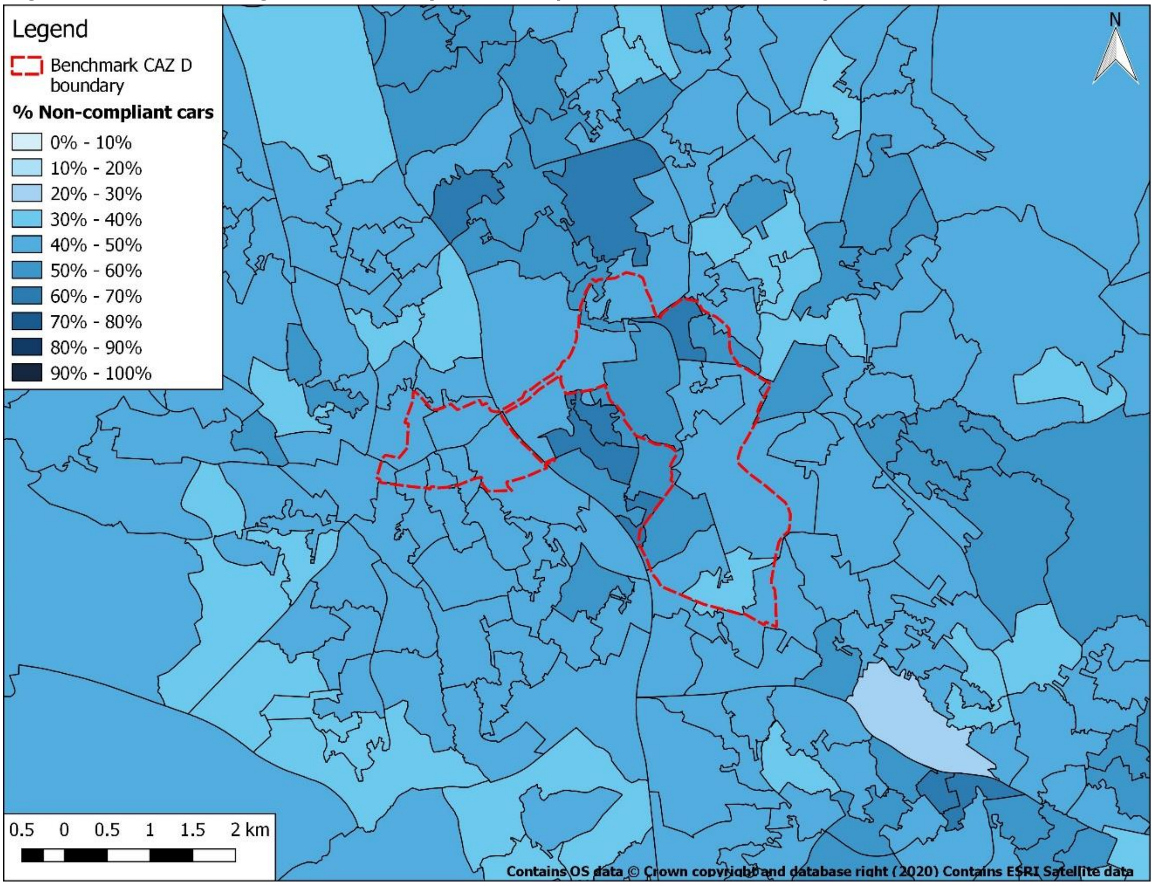


**Figure A. 16: Percentage of Non-Compliant cars per LSOA – Zoom to city centre**



# Appendix 2: Travel time origin zones with valid data for each destination zone

**Figure A. 17: Map of origin zones with compliant and non-compliant cars travel times data available to destination zone '68' (Royal Stoke University Hospital)**

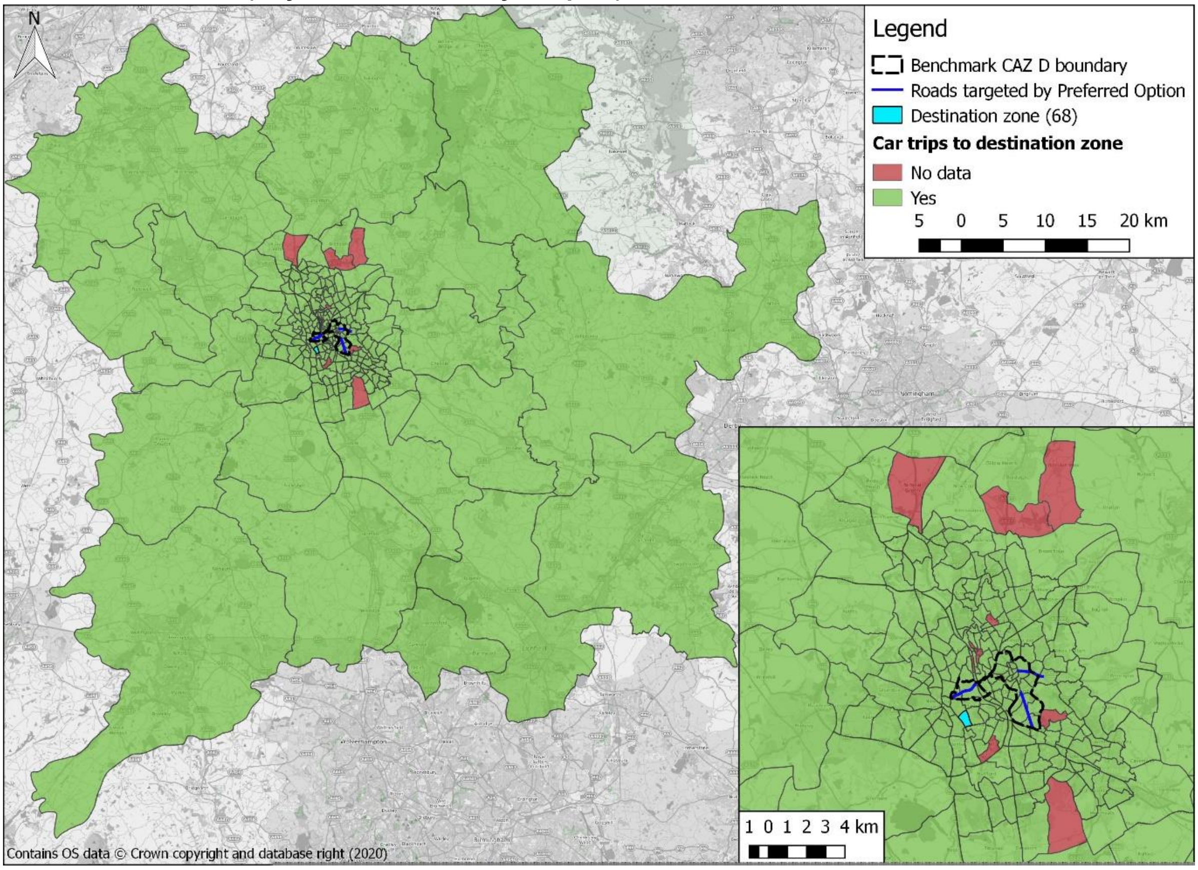


**Figure A. 18: Map of origin zones with compliant and non-compliant cars travel times data available to destination zone ‘75’ (Staffordshire University campus)**

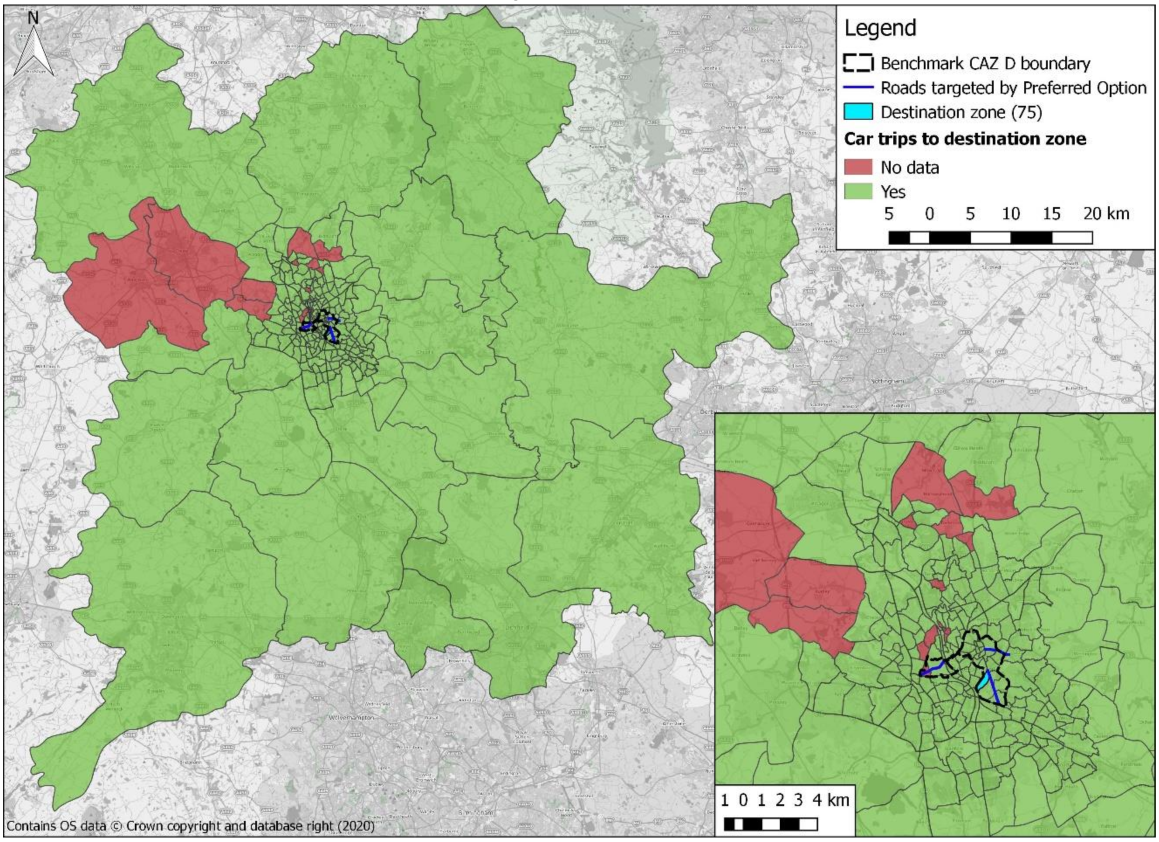


**Figure A. 19: Map of origin zones with compliant and non-compliant cars travel times data available to destination zone '101' (Hanley centre)**

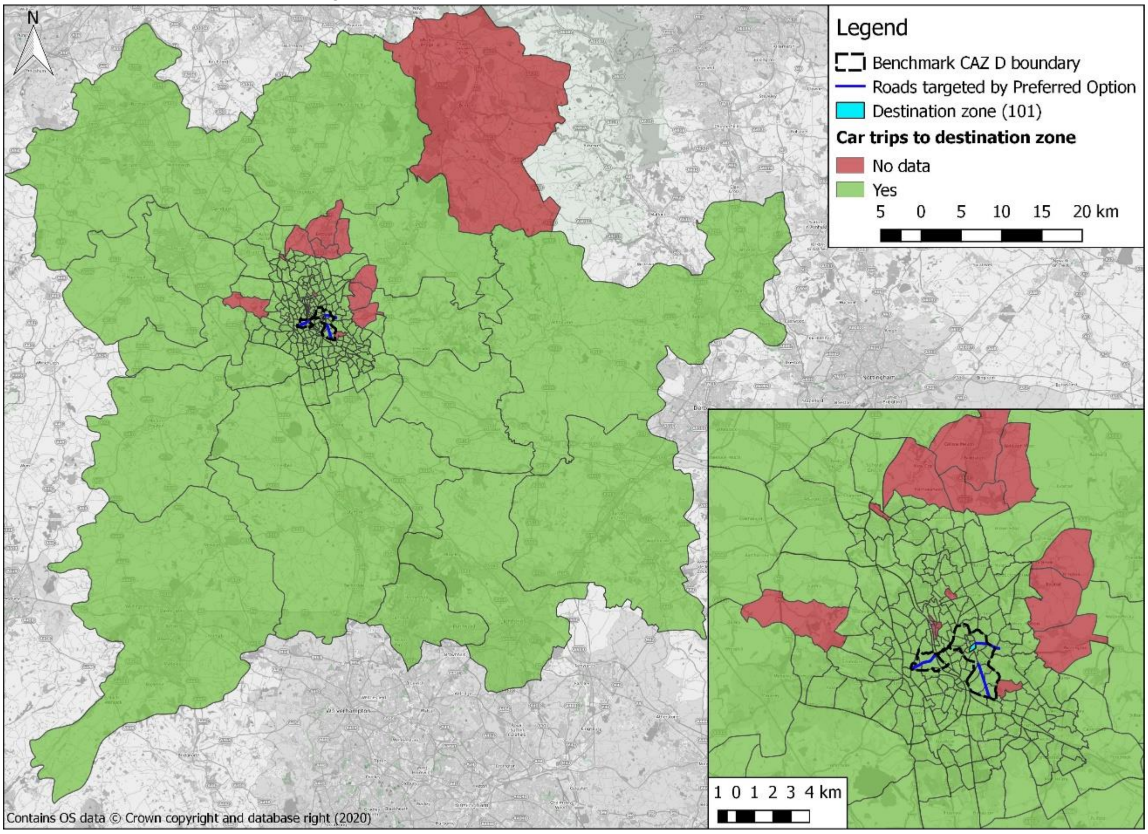


**Figure A. 20: Change in travel time from each origin zone to destination zone 68 under Preferred Option**

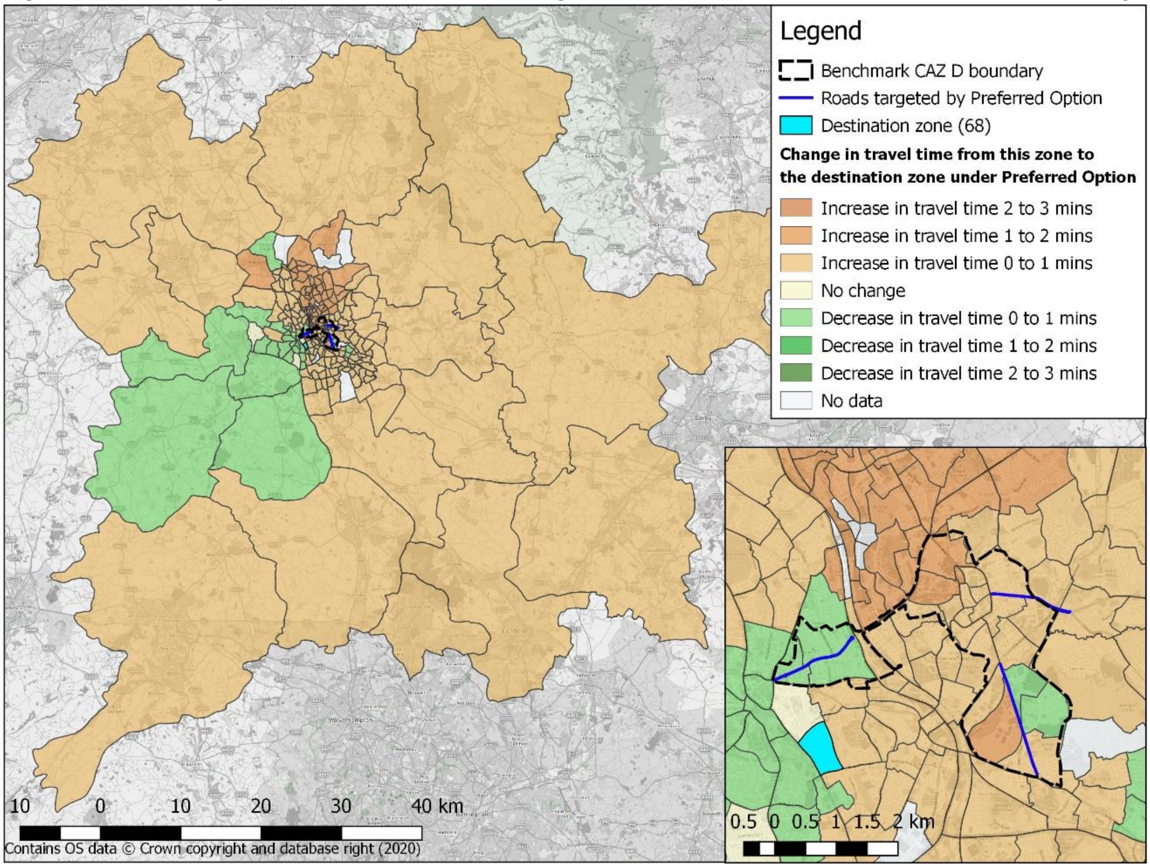


**Figure A. 21: Change in travel time from each origin zone to destination zone 68 under Benchmark CAZ D**

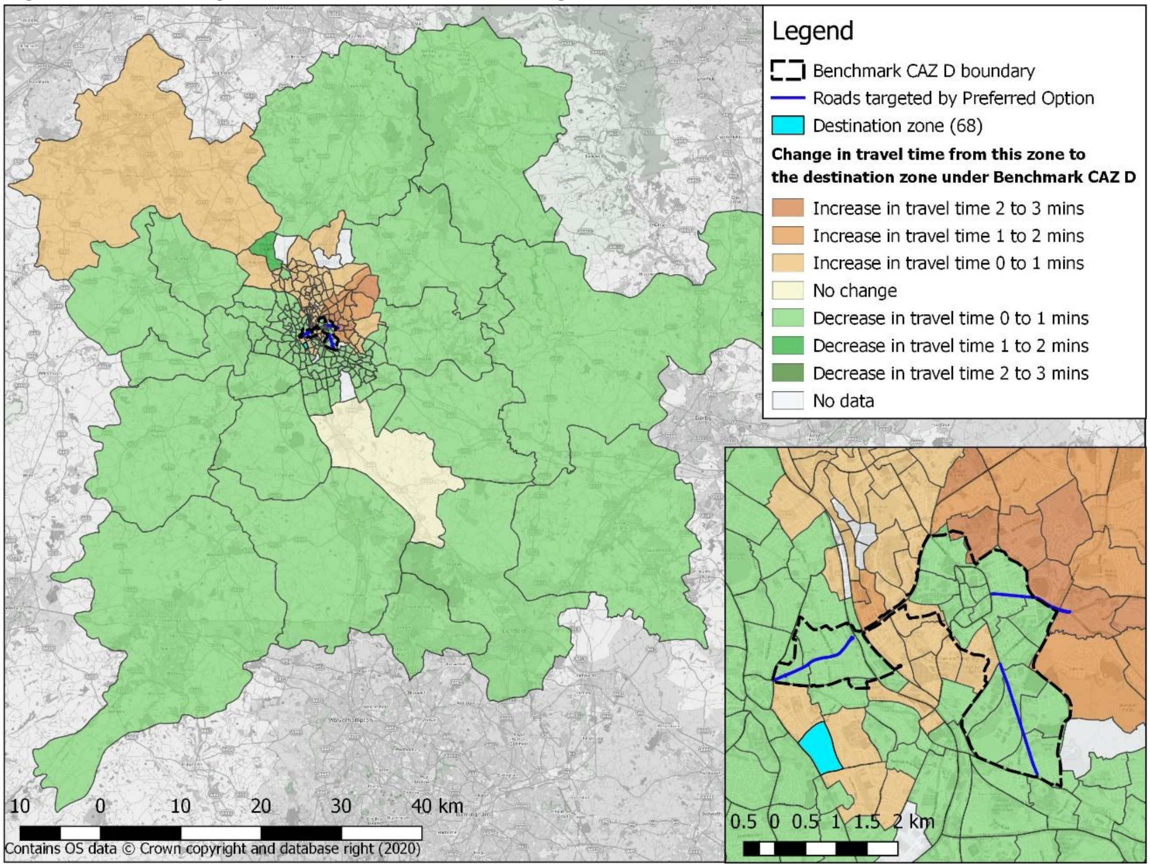


**Figure A. 22: Change in travel time from each origin zone to destination zone 75 under Preferred Option**

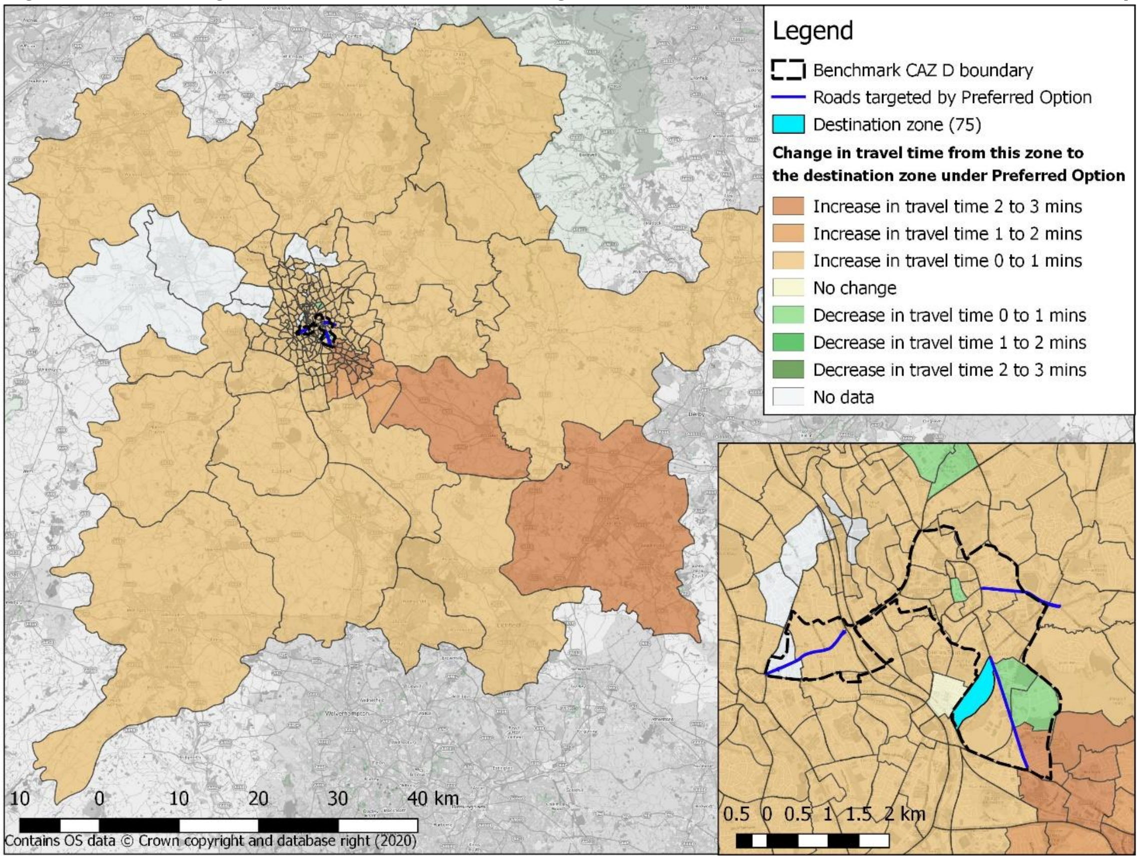


**Figure A. 23: Change in travel time from each origin zone to destination zone 75 under Benchmark CAZ D**

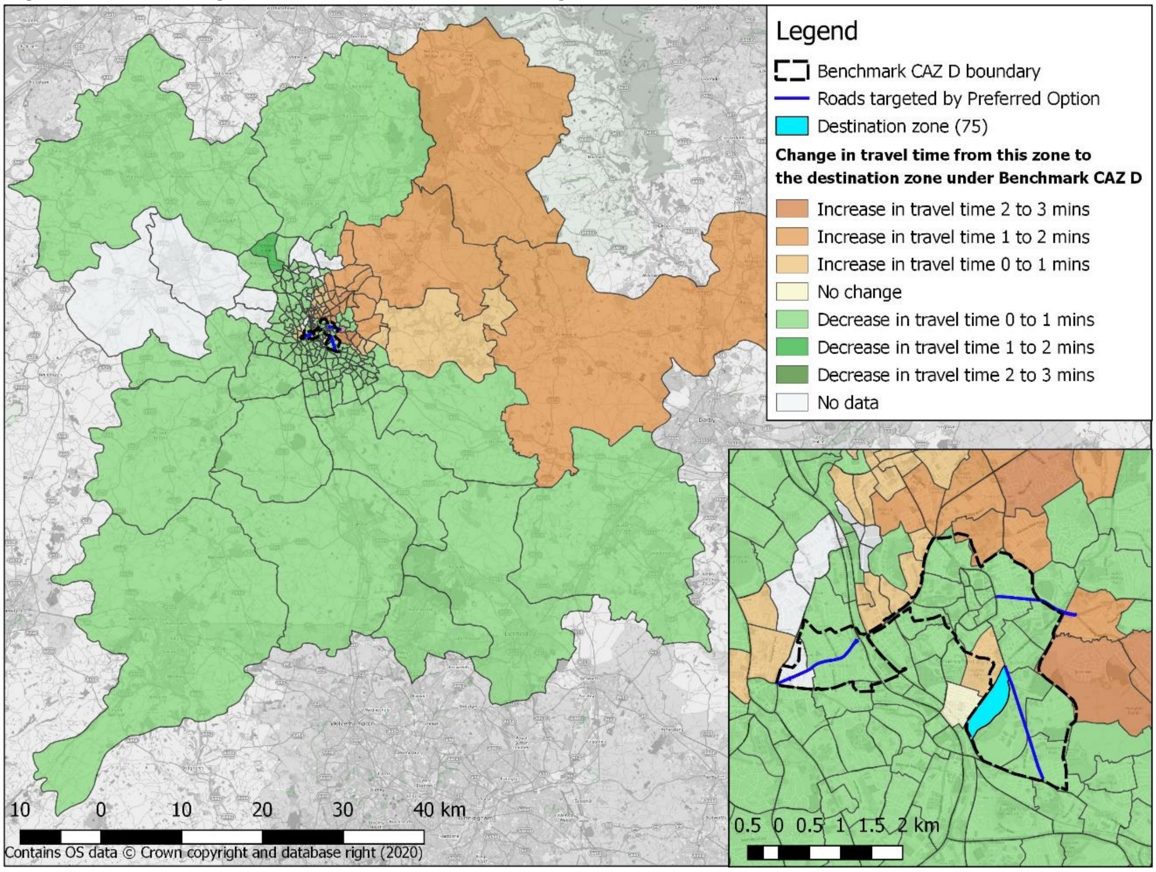


**Figure A. 24: Change in travel time from each origin zone to destination zone 101 under Preferred Option**

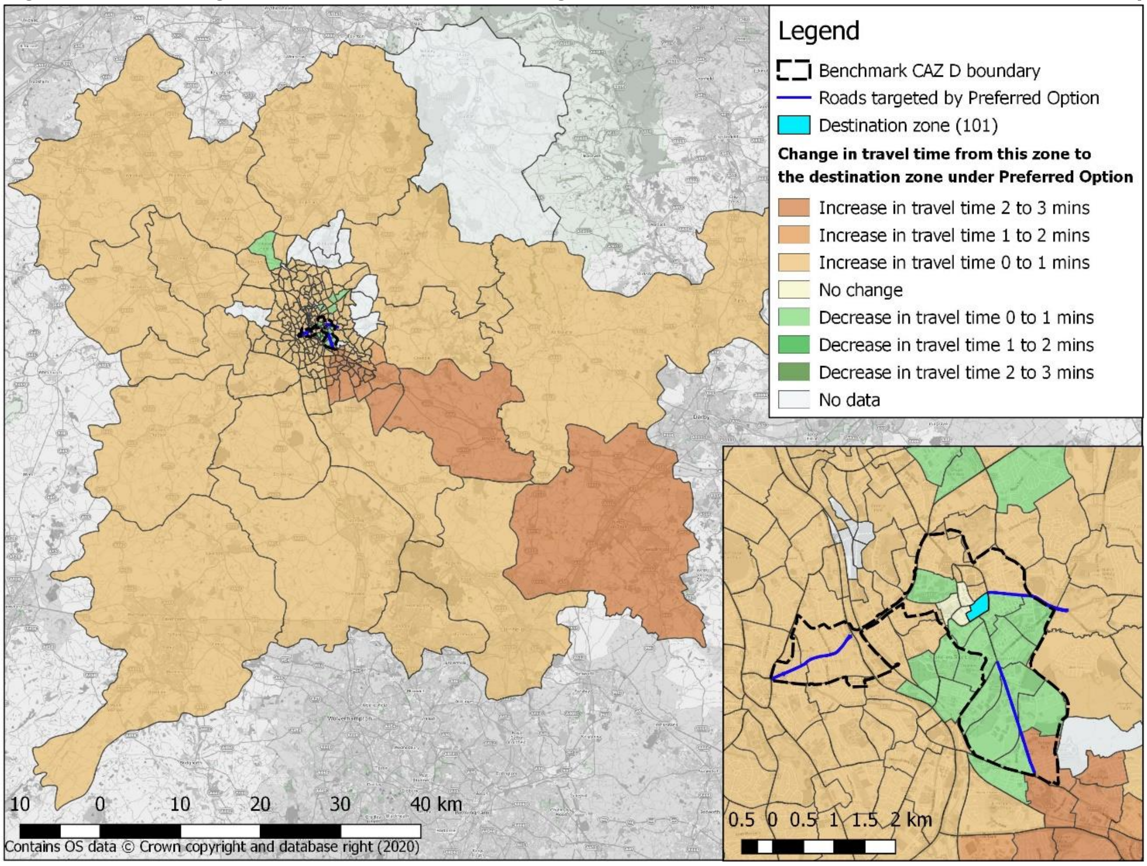
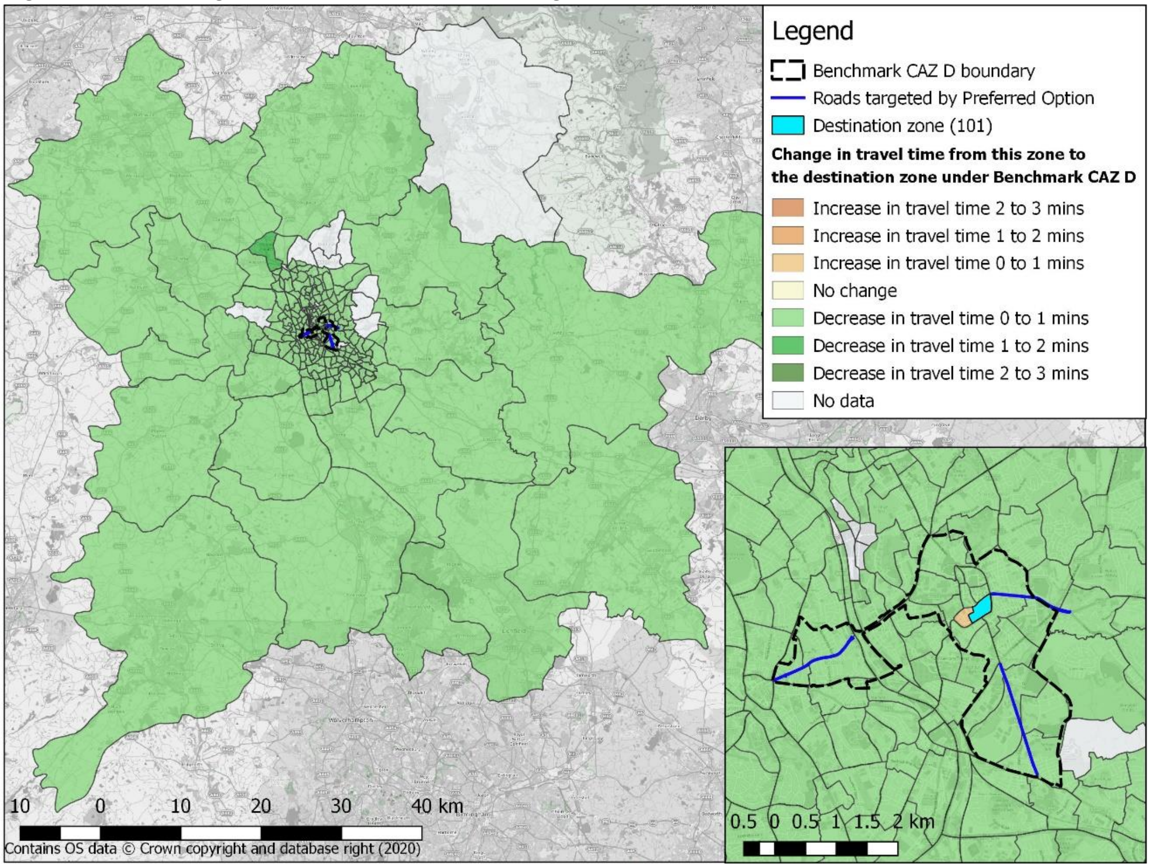


**Figure A. 25: Change in travel time from each origin zone to destination zone 101 under Benchmark CAZ D**



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Appendix D - NSLAQP COVID-19 sensitivity test results

# 1 Introduction

During 2019, several options were modelled to help identify a preferred option to resolve air quality issues within the North Staffordshire area. Throughout 2020, the COVID-19 pandemic has had a significant impact on travel patterns. These impacts have included changes to work patterns, economic factors and people's preferred mode of transport. The Government's Joint Air Quality Unit (JAQU) have requested sensitivity tests to investigate how predicted post-COVID-19 transport behaviour will impact upon levels of nitrogen dioxide ($NO_2$) air pollution. Sensitivity testing is a key step within the analytical process and aims to quantify the impact of uncertainty in the analysis.

The Air Quality Directive states that a road is compliant when annual average $NO_2$ concentrations are at or below 40 µg/m³. Three road links in North Staffordshire (namely; A50 Victoria Road, A53 Etruria Road and Bucknall New Road) were predicted to exceed permitted $NO_2$ levels in the 2022 compliance year if no interventions were made. The existing preferred option was designed to address concentrations along these links and the modelling work to date has shown it will reduce concentrations to legal levels in 2022 whilst minimising adverse impacts. The sensitivity tests are designed to indicate what changes might occur to the compliancy of the network for a reference case scenario and to determine if the preferred option still achieves compliance across the network when the impacts of COVID-19 are considered.

The additional sensitivity tests are outlined within Section 2 and relate to:

- A one-year delay in the implementation period from 2022 to 2023 as agreed with JAQU to take account of the impacts of COVID-19, both on the local economy and the local authorities' ability to complete the business case given conflicting service pressures.
- A one-year delay to fleet renewal as users put off upgrading their vehicles.
- A best estimate of COVID-19 related impacts on travel patterns.

# 2 Scenarios

The following sensitivity tests were undertaken.

### 2.1 Test 1 - 2022 Preferred Option with delayed fleet change

This test is like the previously conducted 2022 preferred option though with the inclusion of a one-year delay to the vehicle fleet change. The fleet change delay is considered because economic constraints or concerns created by COVID-19 may delay private individuals' decisions to upgrade their existing vehicles by a year, thus resulting in a more aged and polluting fleet at 2022 than previously modelled.

Concentrations of $NO_2$ are decreasing over time without any local action. People replace their older vehicles with newer vehicles meeting stricter emissions standards. National modelling by the Department for Environment, Food & Rural Affairs (Defra) predicts that concentrations along major roads in North Staffordshire will reduce by approximately 1 - 2 µg/m³ per year on average as the fleet is modernised. This test delays this fleet change by applying the same fleet mix as predicted in 2021 for 2022, whilst assuming 2022 levels of traffic flows with no reduction in traffic as a result of COVID-19 impacts. This test can be regarded as an unrealistic worst-case assumption of the impacts due to it not modelling COVID-19 related reductions in flow, or assuming a delay in the implementation of local measures. It is still a valuable test as it allows the uncertainty in the existing modelling to be better studied and to determine that if such an extreme set of assumptions were to occur, would the preferred option still achieve compliance in 2022. It should be noted that JAQU have requested all local authorities with clean air plans to undertake this test for comparative purposes.

### 2.2 Test 2 - 2023 Reference Case with delayed fleet change

This test applies a one-year fleet change delay whilst the modelled compliance year is delayed to 2023 to reflect the impact of a one-year delay in implementation. No other COVID-19 assumptions are made. This scenario only includes committed land use and transport schemes, that is, it does not include the preferred option.

### 2.3 Test 3 - 2023 Reference Case with delayed fleet change plus best estimate of COVID-19 impact

This test is similar to test 2 although additionally applies the predicted impact of COVID-19. As this test models the reference case, it confirms wherever mitigation is still required post-COVID-19 to achieve compliance with the Air Quality Directive.

### 2.4 Test 4 - 2023 Preferred Option with delayed fleet change

This test is similar to test 1 in that it models the preferred option with a delayed fleet change, though for this test the implementation date is delayed to 2023. The test allows the suitability of the proposed mitigation measures to be tested but doesn't allow for the air quality benefits resulting from a reduced number of trips due to the impacts of COVID-19.

### 2.5 Test 5 - 2023 Preferred Option with delayed fleet change and best estimate of COVID-19 Impact

The final test has the same assumptions as test 4 but in addition includes a best estimate of the effects of COVID-19. The COVID-19 assumptions will reduce travel demand which are expected to reduce the level of $NO_2$ emissions. This test will only be required if test 4 fails with levels of exceedance predicted.

## 3 Method

The approach to modelling the traffic flow impact of COVID-19 on both the 2023 reference case and preferred option has been informed by the JAQU guidance, "Accounting for local COVID-19 economic impacts". This guidance recommends local authorities consider the relevant effects of COVID-19 regarding:

- Higher prevalence of home working.
- Lower use of public transport.
- Higher use of active transport.
- Fewer business trips due to suppressed economic activity.
- Lower fleet turnover due to fewer new vehicle sales.

### 3.1 Higher prevalence of home working

COVID-19 has directly led to a large increase in home working. This has been the result of the requirement to keep social distancing, both in the work environment and also on public transport for the commute to work. This shift has been encouraged by government lockdown restrictions and guidance, greater acceptability of home working amongst employers and a trend towards home working by employees.

Not all jobs are suitable for transferring to home working and this shift is primarily in office related roles rather than service or manufacturing jobs which are typically not suited for home working.

A pre-COVID-19 survey for the Chartered Institute of Personnel and Development (CIPD) found that 7% of people could work from home but chose not to. The Department for Transport (DfT) has forecast a medium case whereby this 7% have begun working from home during the pandemic and will continue to work from home post-COVID-19. The same assumption is assumed for both commuting and business trips.

Home working is primarily an option for office-based jobs. The tests presented here have identified zones within the transport model which largely consist of office-based employment sites such as Park Hall Business Village, Stoke-on-Trent town centre, Etruria Valley, Festival Way, Smithfield and Keele University.

With the exception of the Keele University zone, a reduction of 7% for home-to-work and business trips starting and finishing in the identified zones has been applied for all modelled time periods. For Keele University, it is estimated that 40% of employed people could work from home. Therefore, the 7% reduction is applied to a 40% subset of commuting and business trips.

### 3.2 Lower use of public transport

The North Staffordshire bus passenger market contains many users who have no alternative private method of transportation due to economic or health factors. It is therefore assumed there would be no impact on bus passenger numbers. Given the impact of COVID-19 on bus operations, it is assumed there will be no investment or provision of additional bus services from that which existed pre-COVID-19 and therefore the future 2023 bus service provision should reflect what operated pre-COVID-19.

### 3.3 Higher use of active transport

There are no significant active transport schemes planned in addition to what is currently being promoted within the region and no schemes that could be regarded as a step change in active travel provision. Previous schemes such as Cycle Stoke have resulted in a greater number of trips made by bicycle, however these trips have not resulted in a significant mode shift from car usage. For this reason, a greater use of active transport is not expected to have any additional impact on the number of car trips in North Staffordshire.

### 3.4 Fewer business trips due to suppressed economic activity

As businesses are forced to temporally or permanently close as a result of COVID-19, business related trips will reduce.

The DfT have shared information entitled “Covid and Rail Demand Forecasting – Uncertainty and its Consequences – Rail Analysis”. This includes employment and Gross Domestic Product (GDP) forecasts taken from the Centre for Economics and Business Research (Cebr). This work predicts a medium case of employment being 99% and GDP being 97% of what it would be if COVID-19 had not occurred.

The tests presented here are based on traffic growth from the DfT National Trip End Model (NTEM). The employment forecast can be adjusted to show revised growth for car trips accounting for the impact of COVID-19 on economic activity. For goods vehicles, there is a well-established trend between goods vehicle trips and GDP growth whereby they tend to mirror each other. Therefore, a reduction of 3% in growth from the base year to 2023 has been applied for both Light goods vehicle trips (LGVs) and heavy goods vehicles (HGVs) to reflect the economic impact of COVID-19.

### 3.5 Lower fleet turnover due to fewer new vehicle sales

The real and perceived economic impacts of COVID-19 will affect private individual’s decision making for large purchases such as the purchase or upgrade of cars. Such decisions may also be influenced by a decline in car use associated by the rise in home working and home schooling.

Where a test assumes a one-year delay to fleet change, this is achieved by the use of the Defra Emissions Factor Toolkit (EFT). This tool has been used for the existing modelling undertaken and allows an estimate of the Euro emissions ratings for the fleet to be established for a given year and for all vehicle types. To establish the emissions profile for a one-year fleet upgrade delay, the previous years modelled profile was used. Therefore, for a 2023 delayed fleet change, the EFT Euro emissions for 2022 were used.

## *4* Results

### 4.1 Sensitivity Test 1: 2022 Preferred Option with delayed fleet change

The results for test 1 are shown in Table 4-1. For the original modelling of the preferred option for 2022, there were no roads showing $NO_2$ exceedances. When the same modelling is repeated though with the addition of a one-year fleet delay, several exceedance locations are forecast. These locations correspond to those identified for the original 2022 reference case scenario along with four new sites.

| Road | 2022 Preferred Option (no COVID-19 Impacts) (µg/m³) | 2022 Preferred Option with 1-year fleet delay (µg/m³) |
|---|---|---|
| A50 Victoria Road | 39 | **41** |
| A53 Etruria Road | 39 | **41** |
| Bucknall New Road | 39 | **41** |
| **New Exceedances** | | |
| A53 Etruria Road (east of A500) | 38 | **41** |
| A5272 Chell Street | 39 | **41** |
| Quadrant Road (near Intu Potteries car park) | 40 | **41** |
| A5271 Longport Road | 40 | **42** |

*Table 4-1: 2022 Preferred Option with delayed fleet change*

### 4.2 Sensitivity Test 2: 2023 Reference Case with delayed fleet change

This test saw an increase in non-compliant vehicle flows over almost the entire network when compared to the original 2022 reference case test. This is as expected as the new test contains an additional year of traffic growth. However, the overall traffic growth between 2022 and 2023 for North Staffordshire is only around 1%, so modest. The traffic modelling produced as part of this test was not required to be processed through the air quality model. This test was needed as a comparator with the other 2023 tests.

### 4.3 Sensitivity Tests 3: 2023 Reference Case with delayed fleet change plus best estimate of COVID-19 impacts

This test applies COVID-19 assumptions and also delays the implementation date to 2023. Whilst emissions are expected to increase due to the traffic growth, the COVID-19 assumptions change traffic levels and thus emissions. The net effect of the fleet change stays the same as the original 2022 reference case as the 2023 forecast year is cancelled out by the 1-year fleet delay assumption. These factors approximately balance each other out leading to very similar results compared to the original 2022 reference case results as shown in Table 4-2. This shows that post-COVID-19, mitigation will still be required in order to achieve compliance.

| Road | 2022 Reference Case (no COVID-19 Impacts) (µg/m³) | 2023 Reference Case with 1-year fleet delay and COVID-19 Impacts (µg/m³) |
|---|---|---|
| A50 Victoria Road | **46** | **45** |
| A53 Etruria Road | **43** | **43** |
| Bucknall New Road | **42** | **42** |

*Table 4-2: 2023 Reference Case with delayed fleet change plus best estimate of COVID-19 impacts*

### 4.4 Sensitivity Tests 4: 2023 Preferred Option with delayed fleet change

This test identifies whether the existing mitigations proposed as part of the preferred option are predicted to achieve compliance when a delayed fleet change is considered with a 2023 implementation year. The net effect is the additional year of traffic growth on the preferred option between 2022 and 2023. The results are shown in Table 4-3 for the three links that fail to achieve compliance in the original 2022 reference case scenario. The results show that these links still achieve compliance for the new test but with a slight increase notably on Victoria Road due to the one year of modest traffic growth. This indicates that the traffic growth only has a very marginal adverse impact on the exceedance locations and any increase in emissions incurred as a result of a delayed fleet change will be cancelled out by a delay in implementation resulting in the preferred option still achieving compliance. No other exceedances were reported.

| Road | 2022 Preferred Option (no COVID-19 Impacts) (μg/m³) | 2023 Preferred Option with 1-year fleet delay (μg/m³) |
|---|---|---|
| A50 Victoria Road | 39 | 40 (39.5) |
| A53 Etruria Road | 39 | 39 |
| Bucknall New Road | 39 | 39 |

*Table 4-3: 2023 Preferred Option with delayed fleet change*

### 4.5 Sensitivity Tests 5: 2023 Preferred Option with delayed fleet change and best estimate COVID-19 impact

Applying the COVID-19 assumptions has been shown in test 3 to marginally reduce traffic flows and so improve air quality. Test 5 was not required to be carried out as test 4 already showed compliance with the Air Quality Directive through the mitigation measures included with the preferred option. Compliance was achieved without requiring the marginal traffic flow reductions that the COVID-19 assumptions would have created within this test.

## *5* Conclusion

The additional sensitivity tests presented here demonstrate that COVID-19 can have a small impact on air quality. This impact may increase the proportion of emissions through a delayed fleet update to more modern vehicles. It may also reduce emissions through modified patterns of vehicle usage driven by economic factors and the decisions of individuals. The negative impact of COVID-19 on air quality due to fleet delay is compensated for by a reduction in traffic due to home working, a predicted slowing of economic growth and an additional year to achieve compliance. This results in an approximate net zero impact within the air quality model for the preferred option. The additional sensitivity tests show that whilst there is a slight increase in $NO_2$ levels from pre-COVID-19 modelling, the preferred option is still predicted to achieve compliance across the network for 2023. The results of the additional testing are shown to be compatible with the existing modelling and demonstrate that whilst mitigation measures are still required to achieve compliance with the Air Quality Directive, the preferred option is still an effective and proportionate solution.

**NEWCASTLE-UNDER-LYME BOROUGH COUNCIL**

**Report to Cabinet**

**9th December 2020**

**Report Title:** **Local Plan – Options**

**Submitted by:** **Chief Executive**

**Portfolios:** **Planning & Growth**

**Ward(s) affected:** **All**

**Purpose of the Report**

The report seeks to provide Cabinet with an update on the Local Plan options following the economic and social impact of the Covid 19 outbreak this year and emerging post Brexit landscape.

**Recommendation**

**That Cabinet consider the information provided and the option of commencing work on a Borough Local Plan for Newcastle under Lyme.**

**Reasons**

To ensure that the Council has in place the most suitable Local Plan to guide the development of the borough.

## 1. Background

1.1 The Government requires local authorities to have in place a Local Plan to ensure that communities are in control of development, and not subject to speculative development. The Government has set an expectation that all authorities will have adopted development plans in place by December 2023.

1.2 In March 2014 the then administration took a decision to prepare a Joint Local Plan (JLP) with Stoke on Trent City Council, and to establish a Joint Advisory Group which would oversee the production of the Plan. The timescale envisaged at that time anticipated a JLP being in place mid-2018, following examination in public earlier in 2018.

1.3 Joint work has been progressed by the two Councils, although due to various issues, the original and subsequent timetable have been continually missed and in January 2020 Cabinet received an update on the JLP. The report noted that the timetable had been amended again to allow time to respond to the new National Planning Policy Framework, and in particular that the plan period had been extended from 2033 to 2037 to comply with the requirement that the Plan covers a period of 15 years from submission to the Secretary of State. To accommodate this, the report recommended that the Plan be submitted for consultation in two parts – Part 1, covering strategy and policies, and Part 2 dealing with proposed site allocations later in the year – subsequently this didn't take place due to the impact of the Covid-19 outbreak.

1.4 Cabinet considered the Draft Joint Local Plan Part 1 – Strategy and Policies to be published for public consultation during Spring 2020. In approving the report, Cabinet expressed serious concerns about relevance & timeliness of a number of the polices and requested that further work be undertaken on Housing Numbers, Rural Settlement Hierarchy and Gypsy & Traveller Accommodation to inform the final plan.

1.5 The onset of the Covid pandemic led to further slippage of the agreed timeline, but work has continued with the aim of securing Cabinet and Committee resolutions to commence consultation at the beginning of 2021.

1.6 During 2020 particular attention was been paid to updating the evidence base of the plan, addressing both the additional work areas commissioned by Cabinet and also the overall projections required for housing and employment allocations. This updated evidence base has underpinned the allocations and policies in the plan.

1.7 Since the JLP was first envisaged, the UK is now closer to completing a separation from European Union in response to the Brexit debate in 2016. Combined with the Covid 19 outbreak this year the future economic and social climate has significant potential to be more dynamic that anticipated at the start of the plan review and even at the time Part 1 of the JLP was presented to committee in February. The challenges and opportunities these events could create will inevitably require businesses and organisations to become more dynamic and flexible in the way that they respond to future events, and the local plan will need to provide an appropriate framework to enable that and support economic stability.

1.8 The need for increased agility within the plan to respond to new circumstances has created new issues that the two Councils will need to consider carefully, in terms of what policies need to be pursued and the degree to which growth will need to be encouraged in each area, whilst taking into account the impact that new development may have on established communities and the environment.

1.9 Whilst the JLP recognises the need for growth, this has been set at a median point between high and low growth scenarios. Should either Council seek to amend the JLP to revise growth aspirations or react to external factors as they emerge or evolve e.g. Brexit, Covid, trade deals, or other future events, there would be a need to jointly agree new targets, policies and other enabling provisions within the plan and those would have to be shared by both Councils across their combined areas without either area losing investment or accepting excessive levels of development.

1.10 In light of the events that have transpired since February 2020, Cabinet has asked for an opportunity to review of the options available to the Council to ensure that the Borough will have a Local Plan which addresses the emerging needs of the borough and takes into account the changing circumstances due to Brexit, Covid-19 and the potential impact of the recently published government White Paper on planning and decide if a single plan for the borough presents a better possibility of addressing these issues and uncertainties.

## 2. Issues

### Current Position

2.1 The review of the current plan began with the creation of a Local Development Scheme (LDS) in 2013 which set out the route map the Councils would seek to follow to deliver an adopted Joint Local Plan.

2.2 The plan has now progressed through three stages of public consultation:

- Issues (February 2016) which presented issues affecting the area
- Strategic Options (July 2017) which presented options for employment and housing development based on different growth scenarios
- Preferred Options (February 2018) which presented a preferred growth scenario, options for employment and housing development (including preferred sites) and strategic options for retail and leisure

2.3 This year has seen work progressing to update the evidence base to support the plan notably the Housing and Employment Land study which is being undertaken by Turleys Associates alongside the other work commissioned to address the concerns raised by Cabinet in January.

2.4 From this point, the work remaining includes:

- Review of the work undertaken since January (when complete) and decide whether or not to approve of Draft Local Plan for Consultation;
- Consultation on the draft JLP (known as Regulation 19 Stage) followed by
- Amendments with a possible further consultation on amended version of the plan if extensive alterations are required.
- Once the consultation process is complete, the plan is submitted to the Planning Inspectorate for examination (the submission document) at which point the plan is locked in and the Councils can no longer make amendments.
- At the examination, the Inspector may suggest find the plan sufficiently robust for the purposes of decision making (known as being sound) – either with or without amendments (known as minor or major modifications) or, if it is deemed too deficient, unsound at which point the plan is taken back to an earlier stage for review and further consultation.

It is anticipated that, through this process, the Joint Local Plan could be in place towards the end of 2022, 4 years after originally planned. A critical consideration is taking a plan to inspection with underpinning data which is less than 2 years old. The focus of work undertaken by Turleys and other consultants in 2020 has been to ensure that the underpinning data is up to date and the current timeline will enable inspection to take place with data of sufficient currency. If it is considered that further work is needed at this stage before deciding whether or not to proceed to consultation on a draft joint local plan, there will be a need to undertake this work quickly to avoid delays which might trigger a need to update other aspects of the evidence base.

**Planning Risks Associated with the Joint Local Plan**

2.5 Over the seven years that the JLP has been in development much has changed in the economic landscape within which the plan exists, and in the Council's aspirations for the Borough. The two critical issues are:

- Covid 19 – The pandemic is not only likely to drive a significant reset of the local economy, with a high degree of turbulence in both the scale and nature of economic growth in the UK going forward into 2021 and the next two to three years at a minimum but it is likely to also bring about a number of social-economic changes too e.g. travel to work patterns, the role of the leisure economy and changing demands for housing types.

- Brexit – Like all other studies in the past few years, the work by Turleys to review the underpinning economic and housing data for the plan was commenced during the Brexit process. At the time this work began, it was felt reasoned considerations could be made around the future of the UK economy going into 2021 and beyond in the event of a deal or not being reached. Following the outbreak of Covid 19it is too soon to fully assess the impact the virus will have of this significant development on the economy of UK and the local the area. Depending on the speed with which trade deals are put in place, and the nature of those deals, the local economy and the associated demand for employment sites and housing sites may accelerate or decelerate.

2.6 These two issues alone present a very real need to consider whether a wider range of policy or land use options and economic catalysts can and should be incorporated into the local plan. The Council will need to be able to respond to uncertain and changing economic circumstances which gives rise to a need for it to be able to review its aspirations for the Borough and ensure the long term growth and development of the Borough.

2.7 In a time of economic turmoil and uncertainty the Council will wish to use its overall policy framework to provide certainty and focus for the borough – the framework includes the Local Plan as well as the Council Plan and the Medium Term Financial Plan, all of which need to be in alignment. Whilst the JLP has been prepared in compliance with the national planning framework (NPPF) and as such has some common ground between the two councils, the joint approach also necessitates both councils sharing a common growth target for jobs and housing delivery over the life of any JLP.

2.8 It is therefore essential that growth targets meet the future direction each Council wishes to take to deliver the growth needed to support their community's economic and social requirements whilst not causing unacceptable harm.

2.9 In the recovery from the Covid 19 outbreak and the opportunities that Brexit may offer, each authority will need to look closely at the needs of its area and consider how best these needs can be met. Whilst the effects of Covid and Brexit are likely to be similar for each council, the opportunity exists for each Council to address these opportunities in different ways to seek new investment, to secure new jobs, investment and housing to support the social and economic future for the people and businesses in their area. In some instances, higher rates of growth will open up opportunities to secure a part of any national growth whilst a more reserved approach may be necessary to ensure the worst excesses of development do not cause unacceptable harm. Responding in an agile way to these opportunities with a plan based on the borough geography is likely to be more straightforward than with a combined plan spanning different administrations. The opportunities anticipated from the Planning White Paper equally underline the need for agility and control.

**Preparation of a Standalone Borough Plan for Newcastle under Lyme**

2.10 Preparation of a standalone Borough plan would require the local plan process to be restarted, commencing with the creation of an updated Local Development Scheme (LDS) – in essence the 'Project Plan' that identifies the documents the Council will prepare as part of the Local Plan over the plan production period. The LDS explains:

- The purpose of the Local Plan documents;
- The resources the Council will require; and
- Timescales for producing Local Plan documents, including when public consultation will take place

2.11 After the LDS is in place, work can commence on preparing an updated and Newcastle specific evidence base to underpin the plan, focussing on any evidence which would be more than two years old by the time the plan reaches inspection. Following this, the next major step will be the production of the Issues and Options paper which will set the broad outline of development across the borough after which the various stages of public consultation can take place, leading to the production of a Draft Local Plan for consultation. With appropriate resources deployed, and depending on the outcome of the consultations required, this could see a stand-alone plan in place by 2023 or 2024. Securing delivery by 2023 would assume no delays, and no challenges to the timeline, and with much of the 2020 evidence base still being valid, with limited additional data being commissioned.

2.12 As has been experienced with the JLP, Local Plans have a poor record of keeping to the initial projected time line. This is in part due to internal pressures but there are a significant number of external factors than can also have an effect. The current White Paper, changes to permitted development rights, a revision to the NPPF or development in a neighbouring authority can affect the evidence base or key assumptions and put the plan back months. Equally, work on Strategic Planning Documents (SPDs) such as design guides, new guidance on traveller developments, telecoms infrastructure provision or flooding for example can delay plan preparation. Such issues need to be carefully managed within the overall programme management of plan preparation.

## 3 <u>Issues to Consider</u>

3.1 In reaching a decision on how best to progress with the preparation of the Local Plan, there are a wide range of issues to consider, which are set out below. Members will need to be alert to the fact that any decision to not progress with the Joint Local Plan process would impact not only on this Council but equally on Stoke on Trent City Council who would also need to reset their process, and progress their own local plan.

**The role of the Adopted Local Plan**

3.2 The government places significant weight on the role of an adopted development plan framework, incorporating the Local Plan as well as Neighbourhood Plans, Supplementary Planning Documents and County Plans. Whilst the other aspects of the planning framework are heavily linked to the Local Plan, they nevertheless carry material weight if the Local Plan expires. This weight diminishes over time as new appeal decisions are decided and new policies are delivered at the national level. The Council's current plan is the Newcastle under Lyme Local Plan 2011. This precedes the 2012 National Planning Policy Framework, and due to the passage of time, is considered to be of limited weight in supporting planning decisions at appeal.

3.3 Whilst still having some value, the age of the current local plan does mean that any delay in securing a fresh local plan represents a risk to the Council. The Five year Land Supply is a specific key area where the absence of a current Local Plan can create a risk for the Council. By not having an up-to-date housing target, and a strategy to meet it, it can become near impossible for a Council to evidence how recent development has contributed to meeting the target. To address this risk as effectively as possible, the recommended route is to have an up to date plan in place.

**Engagement with partners and stakeholders**

3.4 Outside of the planning process, pursing a Borough Local Plan and resetting the plan process would be of interest in a number of spheres, and consideration will need to be given to communication and engagement with key stakeholders including:

- Borough Residents
- The development industry
- Stoke on Trent City Council
- Staffordshire County Council
- Neighbouring authorities
- LEP
- MHCLG

**Financial Considerations**

3.5 Work has now been ongoing for a period of approximately 7 years to produce a plan, with a range of Council employees, agency and specialist commissions deployed on various aspects of the plan preparation to date. To cease the preparation of a Joint Plan at this stage will mean that that funds will have been deployed on a project which is not progressed to fruition. Newcastle under Lyme's expenditure to date on the preparation of the Joint Local Plan is estimated to be c.£316,000 plus staff time. A further £90,000 in external commissions would be required to progress to adoption.

3.6 It should be noted that this investment has primarily been targeted to the securing of evidence to support the policies in the plan. Many of these studies have been structured around separate sections for Newcastle or Stoke studies and it will be possible for much of the information contained within them to be rolled forward into any new development plan. Whilst not all of the documents can be simply separated and some of the work would need to be reviewed closer to the time any new plan approaches consultation to ensure the latest data is available, it is expected that 70% of the current material can be used again. This will dramatically minimise costs in securing evidence for a Borough Plan.

**Costs to Prepare Borough Plan**

3.7 There is a significant cost to producing a dedicated Borough plan from this point forward despite having commissioned most of the primary evidence. Additional budget provision would be required for a new Borough Local Plan, augmenting the current planning policy team and commissioning the necessary studies. This will be required to both cover work areas which might previously have been undertaken from within the wider Stoke on Trent Council team, and work in areas where specialist external support would be required.

3.8 Delivering at pace would require a team of:

| Role | Percentage of officer time dedicated to the development plan |
|---|---|
| Team Leader | 70% |
| Principal Planner | 80% |
| Senior Planner | 80% |
| Planner | 100% |
| Support worker | 80% |
| Programme Manager | 100% |

- Staff Total Costs p.a. £250,000
- External commissions £285,000 – £315,000
- Examination (minimum) £70,000

3.9 Given the existence of a National Planning Policy Framework, and the development work undertaken to date on the joint plan, a Borough Plan is likely to share a large number of policies with Stoke on Trent, for example around assessing flood risk or commercial development outside of local centres. In order to minimise the cost of preparing a Borough Plan, the Council could take the work undertaken to date as a baseline to build on, utilising which ever studies and policies remain sufficiently current and sufficiently aligned with the Council's ambitions for the Borough.

**Duty to Cooperate**

3.10 Within the current National Planning Policy Framework, all neighbouring Councils are bound by a "duty to co-operate". This obligation requires Councils preparing plans to take into account the housing and employment needs of adjacent authorities and to try to accommodate some of their development pressures to prevent encroachment into the Green Belt. For Newcastle this would include Stoke on Trent, Stafford Borough, Shropshire and Cheshire East.

3.11 Stoke on Trent and Newcastle under Lyme operate as one functional economic area and housing market area within a larger sub-region according to evidence (SHMA/ELR). If the two authorities each preparing stand-alone plans the authorities would still need to continue to reach joint agreements on how to accommodate the housing and economic needs of the two authority areas under the current Duty to Cooperate. Failures to meet the Duty to Co-operate is likely to cause the Local Plans to be found unsound. The Duty does not change if it is a joint or separate plans.

**The Planning White Paper**

3.12 When released, the White Paper brought with it proposals around a new approach to plan delivery with top down housing numbers from central government and the concept of zoning.

3.13 It now appears the aspirations of the Government to see a rapid roll out of the new system may be more ambitious than can be delivered and the potential of a new planning system overtaking work on the Joint Local is diminishing. A new standalone plan however is more exposed to the White Paper and the timelines projected above might be affected if significant changes are made to the system.

**Neighbourhood Planning**

3.14 As indicated earlier, Neighbourhood Plans have in the past decade become a more important part of the planning process providing an important layer of local information and design guidance which the more strategic local plan cannot readily deliver.

3.15 Whilst they are generally well supported by communities, their production and subsequent adoption as a material planning consideration which can be used as the main line of defence in a planning appeal depends on the technical underpinnings supporting the policies.

3.16 This technical work is in part provided by agencies working for the parish groups but in addition, Local Plan officers have a significant role. In appraising the draft plans and advising on how best they can be formulated not only to secure adoption but assist the Council in winning appeals against inappropriate development.

3.17 Historically, this advice has been provided to the planning team through a part time role but this position has proved difficult to fill as it is part time in nature and there are few individuals who are able to provide the technical and organisational expertise required. Future consideration to strengthening the Neighbourhood Planning resource may be necessary, depending on whether there is a growth in community aspirations for such plans.

## 4. Proposal

4.1 Cabinet is invited to consider the issues raised in this report and determine how to progress with the development of a Local Plan which addresses the needs and aspirations of the Borough. If minded to progress the option of a Borough Local Plan, Cabinet may wish to consider:

- Commissioning further advice on the impact of COVID and BREXIT on the local economy, and the local planning process;
- Engaging with the stakeholders identified in this report to better understand their position regarding a Borough Local Plan;

## 5. Reasons for Proposed Solution

5.1 To ensure the most appropriate local plan is delivered for the Council.

## 6. Legal and Statutory Implications

a. In reaching a decision in this matter, it is important that Cabinet are content that they have identified and evaluated the full range of likely impacts of each available course of action, associated cost implications and identified and carefully considered all of the relevant factors, and has taken into account representations from those who may be affected by each available option. Cabinet much then balance these issues in arriving at a decision it believes is in the best interests of the proper planning of the area.

b. A main consideration will be the potential impact on the outcome of planning applications during any period that the council’s development plan is considered to be out of date, and the extent to which the National Planning Policy Framework and/or Neighbourhood Plans will be sufficient to ensure plan-led development. That will need to be balanced against the longer-term advantages Cabinet feels can be achieved by taking one approach over any other.

## 7. Equality Impact Assessment

7.1 Both maintaining progress with the JLP and commencing work on a new Borough plan allow equal consideration to be given to equality matters. It is considered that the impact of each decision is comparable in this respect.

## 8. Financial and Resource Implications

a. Subject to replacing an agency member of staff with permanent staff which is scheduled to take place once the JLP is released for consultation, resourcing has been put in place for the delivery of the JLP.

b. If a move is made now to commencing work on a Borough plan, officers will need to revisit the Local Development Scheme and the issues and options papers before commencing work in the draft plan. Delivery at pace will require additional resourcing as set out in this report, amounting to an additional £550,000 over the period 2021-2023, and these costs will need to be reflected in the Medium Term Financial Plan, as well as an allowance for any residual risks associated with this decision.

9. **Major Risks**

a. Failure to have an adopted plan in place may expose the Council to the risk of negative appeal decisions on planning applications which result in harm to the borough.

b. To put this in context, such decisions may include small sites of under ten houses to very large schemes in excess of 200 properties. Permissions by appeal also have the potential to deliver obligations in a less than desirable form taking little account of local needs or being removed all together. It also leaves the Council of being seen by the community as unable to determine its own future regarding the shape that development takes in the Borough.

10. **Sustainability and Climate Change Implications**

10.1 Climate change and sustainability is a core element of any development plan. By establishing a Borough Local Plan the Council will be able to address the matter of the Climate Emergency target.

11. **Key Decision Information**

11.1 This is not a key decision

12. **Earlier Cabinet/Committee Resolutions**

12.1 None

13. **List of Appendices**

13.1 None

**14. Background Papers**

14.1 None

NEWCASTLE-UNDER-LYME BOROUGH COUNCIL

**EXECUTIVE MANAGEMENT TEAM'S REPORT TO**

**Cabinet**
**09 December 2020**

**Report Title:** **Sustainable Environment Strategy**

**Submitted by:** **Executive Director – Operational Services**

**Portfolios:** **Environment and Recycling**

**Ward(s) affected:** **ALL**

| |
|---|
| **Purpose of the Report**<br><br>To consider adopting a Sustainable Environment Strategy for the Council. |
| **Recommendation**<br><br>1. **That Cabinet approve the Sustainable Environment Strategy and Action Plan for the Council and Borough.**<br><br>2. **That Cabinet seek views on and support for the Strategy and Action Plan from key local partners and the Economy, Environment and Place Scrutiny Committee.** |
| **Reasons**<br><br>The Sustainable Environment Strategy sets out the Council's ambition to be an exemplar local authority in both caring for, and enhancing our local environment for the quality of life of residents now and in the future. |

1. **Background**

1.1 At its meeting on 4th November 2020, Cabinet received and endorsed the Councils reviewed Medium Term Financial Strategy including a mid-term review of the Council Plan. Under Priority 3 – a Healthy, Active and Safe Borough, Cabinet reaffirmed its commitment to establish a Sustainable Environment Strategy for the Council and the Borough linked to Government targets.

1.2 In order to translate the Councils ambitions in respect of the environment, a Sustainable Environment Strategy will be the vehicle for helping the Council achieve its aims of caring for and enhancing our natural environment and to adapt and mitigate the effects of climate change.

1.3 The focus of the strategy is on delivering those actions that we know will achieve a positive impact and importantly, where we know we have the greatest control and influence to turn our plans into actions for the benefit of the Borough.

2. **Issues**

2.1 Plans are being developed in two complimentary works streams. The first is to fundamentally and comprehensively review the Councils own activities and services and incorporate actions into the Action Plan that make a significant contribution to this Strategy and achieves a net carbon neutral position for the Councils activities and operations by 2030. The second is to work with partners across the Borough and Staffordshire to work together on Borough wide actions that will help achieve agreed targets.

2.2 Cabinet are asked to support an aspiration to become an exemplar authority, known for both preserving and protecting our local environment for the present and future and also for enhancing our environment and the quality of life of residents.

2.3 The Strategy identifies four priority outcomes and how we will deliver our aims. The four priority outcomes are:

- To reduce our reliance on fossil fuels
- To reduce carbon emissions
- To minimise waste and increase recycling;
- To offset carbon emissions

2.4 The Sustainable Environment Strategy outlines the first phase of our commitments and future direction of travel for the Council, but it is by no means the end of the work needed. The strategy acknowledges that this is only the beginning of the journey and further work is required to develop the optimum range of activities in the Action Plan in the future, on an ongoing and flexible basis.

2.5 To improve the local environment and mitigate the effects of climate change will require changing the way we do things, looking at our own services and ways of working and taking direct action wherever possible, as well as encouraging, supporting and enabling others to do the same.

2.6 It is fully recognised that the Council needs to work with its partners to be able to deliver some of our aims and to enable and support others in delivering their priorities for change. The Council is already working with partners and other Staffordshire Districts, Boroughs and the Staffordshire County Council through the Leaders and Chief Executives Group to identify areas of potential joint working that will benefit the Borough and County as a whole.

2.7 In addition the Council has worked with Keele University to secure funding to work with the Centre for Alternative Technology, and Carbon Literacy Project, to facilitate joint working between the Staffordshire councils. The programme of work plans to involve, a 2 day workshop with multiple representatives from all Staffordshire councils to explore learning, synergies, and potential future joint projects, and a number of days of consultancy support from the Centre for Alternative Technology to help drive the identified projects forwards.

2.8 It is also recognised that the pace of change related to climate change and policy direction is fast as well as the pace of development of technology and best available techniques to support these changes. This strategy will therefore be fully reviewed annually to ensure that our ambitions and actions are aligned to emerging local, national and global policy and to refresh the Action Plan as necessary to take advantage of opportunities as they arise.

2.9 A Sustainable Environment Strategy Steering Group has been established, led by the Portfolio Holder for Environment and Recycling. The Steering Group will report directly into Cabinet on progress with this Strategy.

2.10 The Government has very recently announced its 10 Point Plan which is aimed at eradicating the UK's contribution to climate change by 2050, which has been enshrined into law as part of the net-zero emissions target. A budget of £12bn. has been agreed to transition the UK into net carbon neutrality and the plan includes a wide range of actions that includes green energy production and use, energy efficient buildings, carbon capture and the natural environment.

2.11 On the issue of achieving carbon neutrality, Economy, Environment and Place Scrutiny Committee supported the target date of 2030 for the Borough Councils activities and functions. In relation to Borough wide carbon neutrality, the Committee considered the practicality of achieving Borough wide carbon neutrality at its meeting on 30th September 2020. This followed consideration of the issue at a cross party Working Group and resolved to recommend to Council that the target date for this aspect be adjusted to 2050 to align with the government target and that of neighbouring authorities and to reflect the importance of ensuring that it is achievable and credible.

## 3. Proposal

1. That Cabinet approve the Sustainable Environment Strategy and Action Plan for the Council and Borough.

2. That Cabinet seek views on and support for the Strategy and Action Plan from key local partners.

## 4. Reasons for Proposed Solution

4.1 The Sustainable Environment Strategy sets out the Council's ambition to be an exemplar local authority in both caring for, and enhancing our environment. Adapting to and mitigating the effects of climate change means changing the way we do things for the long term benefit of the Borough.

## 5. Options Considered

5.1 Agree the proposed Sustainable Environment Strategy and Action Plan designed to achieve protect the local environment and Carbon neutrality for the Councils operations by 2030.

5.2 Do not agree the proposed Strategy and Action Plan and seek an alternative method of achieving the above.

## 6. Legal and Statutory Implications

6.1 The Climate Change Act 2008 has the following provisions:

Carbon targets and carbon budgeting - The Act places the government under a legal duty to reduce greenhouse gas emissions by 80% below 1990 levels by 2050

The Committee on Climate Change - The Act also establishes the Committee on Climate Change, an independent, expert body to advise government on the appropriate level for the targets, budgets, and on matters relating to mitigation and adaptation. The

Committee will submit annual reports to parliament on progress towards the targets and the government must respond to this report.

6.2 Councils Duty to reduce carbon emissions - There are currently no statutory requirements for local authorities to set or negotiate targets to reduce their own or area wide emissions.

6.3 All Local Authorities also have a “biodiversity duty” under the Natural Environment and Rural Communities Act 2006

7. **Equality Impact Assessment**

7.1 There are no adverse equality impact identified as a consequence of this report. Specific actions contained within the proposed Action Plan will need to consider any equality impacts on a project by project basis.

8. **Financial and Resource Implications**

8.1 There are financial and resource implications associated with the implementation of the proposed actions contained within the Action Plan. There will be different implications action by action, which may require revenue and or capital expenditure and investment as well as in some cases savings resulting from an action.

8.2 Each action will be need to be considered on their balance of costs and benefits and approval for expenditure sought as appropriate in each case in the context of competing financial pressures, available funding, return on investment and potential external funding contributions.

8.3 Some of the possible interventions will require the completion of a detailed business case to be completed.

9. **Major Risks**

9.1 There are overarching risks of inaction in respect of the Councils response to the environmental threats caused by rising carbon emissions, habitat loss, plastic pollution and poor use of dwindling natural resources.

As a result, Councils around the UK and Governments around the world are responding to these threats and public calls for a robust and rapid reduction and mitigation measures and have declared Climate Emergencies as well as reigniting environmental strategies with the aim of accelerating action to achieve carbon neutrality, consider how to mitigate the effects of climate change and change how resources are used.

There are growing expectations that Councils take a leading and decisive role in this respect and there are reputational risks to the Council in not acting positively.

Any risks associated with specific projects contained within the proposed Action Plan will be assessed and considered on a project by project basis.

10. **Sustainability and Climate Change Implications**

10.1 This strategy seeks to help the Council achieve its aim of caring for and enhancing our natural environment and to adapt and mitigate the effects of climate change. The Strategy has a specific intention to adopt appropriate monitoring systems for tracking our reduction in emissions and increased capacity for offsetting and publish our progress.

11. **Key Decision Information**

11.1 The recommendations contained within this report affect all wards within the Borough, is therefore a Key Decision and as such has been included on the Councils published Forward Pan.

12. **Earlier Cabinet/Committee Resolutions**

12.1 Full Council – 3rd April 2019
12.2 Economy, Environment and Place Scrutiny Committee
12.3 Economy, Environment and Place Scrutiny Committee Task and Finish Group

13. **List of Appendices**

13.1 None

14. **Background Papers**

14.1 Draft Sustainable Environment Strategy

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# Newcastle-under-Lyme Sustainable Environment Strategy

## Our Commitment for Newcastle-under-Lyme

Newcastle under Lyme is dedicated to ensuring a sustainable future that leads to improvements within our communities and we will continue to strive to reduce our own impact on the environment in everything we do.

NEWCASTLE UNDER LYME BOROUGH COUNCIL

November 2020

# Context





## Foreword by Councillor Trevor Johnson
## Portfolio Holder for Environment and Recycling

Over the last two years the Country has been focussing on the sustainablility agenda and the environmental threats caused by rising carbon emissions, habitat loss, plastic pollution and poor use of dwindling natural resources. As a result, Councils around the UK and Governments around the world are responding to these threats and public calls for a robust and rapid reduction and mitigation measures and have declared Climate Emergencies as well as pursuing environmental strategies with the aim of accelerating action to achieve carbon neutrality, consider how to mitigate the effects of climate change and change how resources are used.

In April 2019, the Borough Council passed a climate emergency motion. A central element of this was the aim of becoming carbon neutral with respect to the Council's own estates and activities and those related to our residents and businesses.

The Cabinet have committed to establishing a Sustainable Environment Strategy. The Borough Council has historically had a strong commitment to biodiversity and energy efficiency. In 2007, the Council was a participant in Staffordshire Climate Change Partnership and climate change adaptation group. In 2008, we were a signatory to the Nottingham Declaration, making a public commitment to tackle climate change in concert with other councils. In 2013, the Council subscribed to the 'Climate Local' commitment, preparing and authorising an action plan to reduce carbon emissions and to promote action to tackle climate change with our partners and residents.

The Government has recently announced a ten point plan which is aimed at eradicating the UKs contribution to climate change by 2050.

We are now working in partnership across the Borough to tackle the environmental issues facing our communities and businesses and in particular with key partners such as Staffordshire County Council and Keele University.

Many of the issues can only be tackled together and to this end the Staffordshire County Council has very recently launched its own Climate Change Action Plan which will link into and support the Borough's Strategy.

## Why have an environmental strategy and a plan?

A strategy is needed to protect our local environment and achieve our wider sustainability goals for the Borough. The release of greenhouse gases into the atmosphere from human activity is changing the world's climate and the planet is warming up. Rising global temperatures in the long-term will create more extreme and unpredictable weather changes, rising sea levels, severe flooding and reduced water availability, all of which pose significant risk to human health, wildlife and ecosystems.

The Committee on Climate Change in its May 2019 report, recommended replacing the UK's previous target to reduce emissions by 80% by 2050 with a new statutory target for at least a 100% reduction of UK greenhouse gas emissions by 2050 (compared to 1990 levels), and called for a set of "clear, stable and well-designed policies" to be introduced "without delay."

By this reasoning, it is understood that for the Borough Council to achieve its aim of carbon neutrality, it has to have a strategy and an action plan, which sets clear, stable and well-designed policies, delineating  a 'roadmap' as to how it will arrive at this target. This is intended to be such a document, but at the same time, it is acknowledged that this is not a 'perfect strategy' and there will be information, plans and actions that may not have been included within it. This Strategy will not be static but one that will be regularly reviewed, added to, expanded on, specifically as more suitable and appropriate projects are identified.

All Local Authorities also have a "biodiversity duty" under the Natural Environment and Rural Communities Act 2006. The Government's 25 Year Environment Plan, A Green Future (2018), pledges that this will be the first generation to leave the environment in a better state than we found it,and pass on to the next generation a natural environment protected and enhanced for the future.

# Our current commitment

We are committed to keeping Newcastle under Lyme clean, green, attractive and sustainable. Our teams already undertake a huge amount of work to ensure that we honour this pledge and below we give examples of some of that work.

## Recycling, waste and resource management

• **Recycle More** - from July 2020, as part of the new recycling service, the types of items that can be collected at kerbside has been expanded to include plastic tubs, pots and trays.
• **Zero to Landfill** - none of the waste collected at kerbside in Newcastle under Lyme will go to landfill; instead it will be used to generate clean energy.
• **Over 90% of all recycling** in Newcastle under Lyme stays in the UK and provide transparent information about what happens to waste collected for recycling.
• **Recycling of household items** is used to help residents furnish homes.
• **Separate food waste** collection and recycling service is provided to residents in the Borough as well as food waste reduction awareness programmes.
• **We recycle machinery parts** and waste oil used at our Knutton depot.
• **The Cremators at Bradwell Crematorium** are designed such that the emissions from mercury fillings are captured by abatement plant, along with particulate and other emissions. 100% of our cremations are mercury abated and recoverable metals are recycled through a national scheme.
• **Keele Cemetery utilises sustainable building techniques** including ground source heating, recycled aluminium roofing, natural ventilation and a Sustainable Urban Drainage system.
• **We use only Forest Stewardship Council (FSC)-certified timber** wherever possible and recycle our tree surgery arisings into mulch for shrub beds.
• **Peat Free compost** is used in all of our remaining bedding plant public floral displays. We have replaced over 70% of our annual bedding with permanent herbaceous perennials, and drought tolerant plants, and we have also introduced self-watering hanging baskets to reduce water use.
• **We have reduced our water usage** in public buildings with initiatives such as waterless urinals at Jubilee 2 and flush controls in the town centre public toilets.
• **Across our offices we are 'Digital by Default'** and discourage unnecessary printing.

## Travel and Transport

• **We are currently accessing Highways England funding** to install rapid electric car chargers at strategic points which are easily accessible to the general public.
• **We operate a cycle to work scheme** and offer bike loans to employees.
• **We're working in partnership with the transport authority** (Staffordshire County Council) to develop cycling and walking infrastructure for the Borough.
• **We are trialling an electric scooter pilot** for Newcastle Town Centre and surrounding area.
• **We have procured fully electric vehicles** for our pest control and dog warden services and a Recycling and Waste fleet using the very latest Euro IV. engines.
• **We operate agile and home working**, allowing staff to work home where possible or from a location that is convenient to them, to minimise unnecessary travel.
• As part of the Kidsgrove Town Deal improvements to the canals will give **access to the town centre and wider countryside.**

Maer, Newcastle-under-Lyme

# Our current commitment

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## Built Environment

• **Our Emerging Local Plan** encourages sustainability and energy assessment for new planning applications/encourages new build to be low or zero carbon.
• **Our flagship Jubilee 2 sports centre** was built to BREAM 'Very Good' standards, has solar panels, and combined heat and power systems.
• We will deploy **sustainable building techniques** in or work to refurbish Kidsgrove Sports Centre.
• **We are currently exploring options to bring forward key housing sites** and associated infrastructure and consider how solutions might use energy sourced at point such as through air/ground heat source pumps, solar or other means.
• **We consider and secure green infrastructure** in all larger scale projects

School's Planting Scheme, Newcastle-under-Lyme

through contributions to public open space on- and off-site.
• **We are developing a North Staffordshire Air Quality Plan** with Staffordshire County Council and Stoke on Trent City Council in key areas of local concern.
• **We secure the planting of new trees and shrubs** where appropriate, whenever we grant a planning consent.

Castle House and Queens Gardens, Town Centre

## Energy and Renewables

• **We have installed photovoltaic panels** on the roof at Knutton Lane Depot.
• **We have reduced our energy use** across our built estate by 17% for electricity and 8% for gas over the last two years.
• **We use state of the art environmental building controls** at our Castle House headquarters building.
• As part of the Newcastle Town Deal we will **install solar panels** on the roofs of the shelters in the bus station.

# Our current commitment

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## Natural Environment

• We are proud of our heritage in creating award-winning open spaces – we have been awarded 6 Green Flag Awards for the Boroughs Parks, Gardens and Cemeteries and will continue to work to this standard
• We have an adopted Open Space Strategy and a Green Infrastructure Strategy which allows the Council to plan for the management of its open spaces for the long term benefit of residents and visitors, as well as improving resilience in relation to climate change.
• We engage the community to manage our local open spaces, parks, gardens, playing fields, woodlands and allotment sites and support community volunteering across a range of sites.
• We run and facilitate educational programmes and events under the banner of the long established Newcastle in Bloom initiative, including a high profile town centre and gateway public art programme, designed to raise awareness of our local natural environment.
• We manage 4 Local Nature Reserves with a diverse range of habitats, and encourage other recreational uses which can take place in harmony with nature, to maximise opportunities for people to interact with their natural environment.
• We encourage biodiversity and habitat creation across our open spaces through the use of wildflowers, native planting schemes and diverse floral planting displays which include pollinators to attract bees and other insects
• The Boroughs Urban Tree Strategy aims to protect, preserve and enhance the Boroughs tree and woodlands for current and future generations, and to adapt our tree stock over time to better respond to and mitigate climate change.
• We manage approximately 368 ha of native woodlands giving opportunities to get close up with nature and improve local air quality, as well as helping to address the national decline in native broadleaf woodland.

• We work with partners such as Staffordshire Wildlife Trust and the Environment Agency on sub-regional projects such as SUNRISE, to protect and enhance local wildlife assets and create a connected network of green infrastructure.
• We will work with the Environment Agency on issues such as air quality, odours and flooding.

Award-winning Brampton Park, Newcastle-under-Lyme

# Newcastle Borough Council's commitment for the future



Our plans are being developed in two complimentary works streams. The first is to fundamentally and comprehensively review the Councils own activities and services and incorporate actions into the Action Plan that make a significant contribution to this Strategy, the second is to work with partners across the Borough and Staffordshire to work together on Borough wide actions that will help achieve to targets set.

## Our Ambition

Newcastle Borough Councils aspiration is to become an exemplar authority, known for both preserving and protecting our local environment for the present and future and also for enhancing our environment and the quality of life of residents.

Being more sustainable and mitigating the effects of climate change will require changing the way we do things, looking at our own services and ways of working and taking direct action wherever possible, as well as encouraging, supporting and enabling others to do the same.

## We Recognise

The Council has formally recognised a climate emergency and in doing so it acknowledges that there is a real need to act now and plan ahead in how to tackle the environmental threats posed by climate change. This need to act will require a balance to be found between the prioritisation of funding for projects and the duty to be accountable for the way in which public funds are used. We will make bold decisions where there is a good business case to deliver the right outcomes for our residents and businesses that consider both financial and environmental returns for that investment.

## We Will Review

We recognise that the pace of change related to climate change and policy direction is fast as well as the development of technology and best techniques to support these changes and become more sustainable as a Borough.

This strategy will therefore be fully reviewed annually to ensure that our ambitions and actions are aligned to emerging local, national and global policy and to identify the refresh the Action Plan as necessary to take advantage of opportunities as they arise.

# A Biodiverse Borough



The recent international focus on the impacts of climate change and the requirement for a sustainable future has also highlighted the importance of nature and bio-diversity to the planet. Biodiversity is critically important to our health, to our safety and even to our livelihood.

Five ways in which biodiversity supports our economies and enhances our wellbeing according to the World Economic Forum are:

**1. Biodiversity Ensures Health and Food Security**

Biodiversity underpins global nutrition and food security. Millions of species work together to provide us with a large array of fruits, vegetables and animal products essential to a healthy, balanced diet – but they are increasingly under threat.

People once understood that the conservation of species was crucial for healthy societies and ecosystems. We must ensure this knowledge remains part of our modern agricultural and food systems to prevent diet-related diseases and reduce the environmental impact of feeding ourselves.

**2. Biodiversity Helps Fight Disease.**

Higher rates of biodiversity have been linked to an increase in human health.

First, plants are essential for medicines. For example, 25% of drugs used in modern medicine are derived from rainforest plants while 70% of cancer drugs are natural or synthetic products inspired by nature. This means that every time a species goes extinct, we miss out on a potential new medicine.

Second, biodiversity due to protected natural areas has been linked to lower instances of disease. As human activities encroach upon the natural world, through deforestation and urbanization, we reduce the size and number of ecosystems. As a result, animals live in closer quarters with one another and with humans, creating ideal conditions for spread of disease.

**3. Biodiversity Benefits Business**

According to the World Economic Forum's recent Nature Risk Rising Report, more than half of the world's GDP ($44 trillion) is highly or moderately dependent on nature and there is great potential for the economy to grow and become more resilient by ensuring biodiversity.

# A Biodiverse Borough



**4. Biodiversity Provides Livelihoods**

Humans derive approximately $125 trillion of value from natural ecosystems each year. Globally, three out of four jobs are dependent on water while the agricultural sector employs over 60% of the world's working poor.

Ecosystems, therefore, must be protected and restored – not only for the good of nature but also for the communities that depend on them and nature-positive businesses can provide cost-effective, robot-proof, business-friendly jobs that stimulate the rural economy without harming the environment.

**5. Biodiversity Protects Us**

Biodiversity makes the earth habitable. Biodiverse ecosystems provide nature-based solutions that buffer us from natural disasters such as floods and storms, filter our water and regenerate our soils.

Protecting and restoring natural ecosystems is vital to fighting climate change. Nature-based solutions could provide 37% of the cost-effective CO2 mitigation needed by 2030 to maintain global warming within 2°C (35.6 F).

As ecosystems are increasingly threatened by human activity, acknowledging the benefits of biodiversity is the first step in ensuring that we look after it. We know biodiversity matters. Now, as a society, we should protect it – and in doing so, protect our own long-term interests.

We recognise the need for a considered and robust approach to Biodiversity and nature conservation across the Borough. Our teams manage 1800 acres of the Authority's own land, as natural greenspaces for people and nature. The Borough maintains and protects its Local Nature Reserves, Countryside Parks Woodlands and waterways. The Boroughs award winning parks and greenspaces retain conservation management principles at their core and include this in our strategies and management plans.

We recognise the importance of protecting the existing tree stock of the district; from street trees, woodlands, hedgerows and veteran specimen trees. We will prioritise and accelerate tree planting on our own land and we will also support and encourage local groups and communities to deliver and manage their own planting projects in their neighbourhoods and parishes through the provision of technical advice and signposting to funding opportunities.

The importance of creating green networks and corridors is a key feature of the Boroughs Open Spaces Strategy and we will strive to reduce fragmentation and isolation of species through the provision of new networks of green infrastructure where possible on our land. We also recognise the importance of accelerating the capture of carbon wherever the opportunities arise.

# The Scope of this Strategy



The focus of our strategy is on delivering those actions that we know will deliver a positive impact and importantly where we know we have the greatest control and influence to turn our plans into actions for the benefit of the Borough.

Earlier in this Strategy a number of themes have been followed in exploring what we already do, what we currently know and what we might do to protect and enhance our local environmental quality and reduce our carbon emissions. Under each theme we have given consideration to what we might do around our own estate to improve environmental performance and what we might do across the wider geography of Newcastle to achieve the outcomes and Vision that we committed to.

The themes identified include:

**Waste, Recycling & Resource Management**

**Natural Environment**

**Built Environment**

**Energy consumption & Renewables**

**Travel & Transport**

**Awareness, Engagement & Behaviour Change**

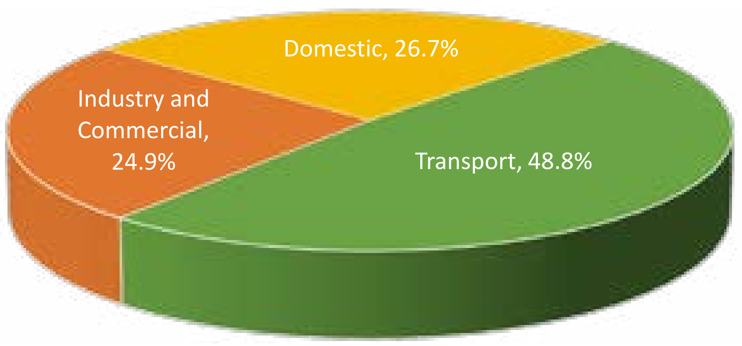
# What do we do know already?





National data available from BEIS Local Authority Emissions dataset on the level of carbon emissions within Newcastle-under-Lyme are split by domestic, industrial and transport emissions. It shows that for 2018 24.9% of total emission were from Industry and Commercial, 26.7% from Domestic and 48.8% from Transport.

Carbon emissions in Newcastle-under-Lyme, 2018

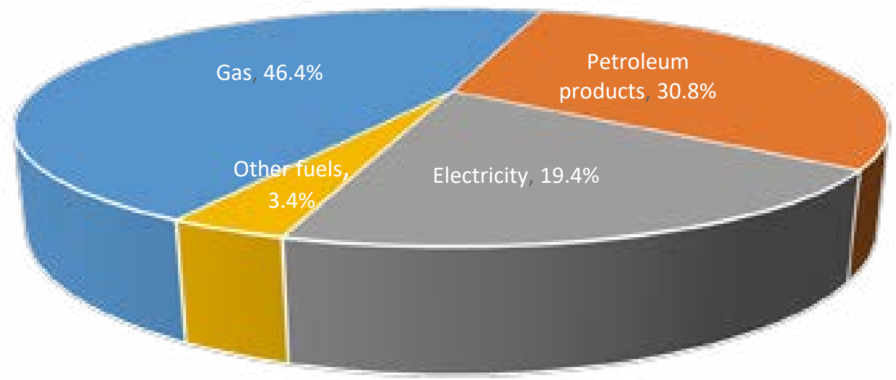



Source: www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2018

As part of developing its new Local Plan, the Borough Council in collaboration with neighbouring Staffordshire authorities commissioned AECOM to quantify the current energy and greenhouse gas emissions.

In 2017, total fuel consumption in Newcastle-under-Lyme was approximately 1,278 GWh (5% of all fuel consumption in Staffordshire). The largest proportion of fuel consumed was gas (46.4%), with

Fuel consumption in Newcastle-under-Lyme, 2017




Total Fuel Consumption

The domestic sector accounts for the highest proportion of fuel consumption in Newcastle-under-Lyme, followed by road transport and industrial & commercial sectors. Within the domestic sector, approximately 75.2% of fuel consumed is gas and 22.9% is electricity. In the industrial & commercial sector, approximately 49.3% of fuel consumed is electricity and 37.5% is gas.

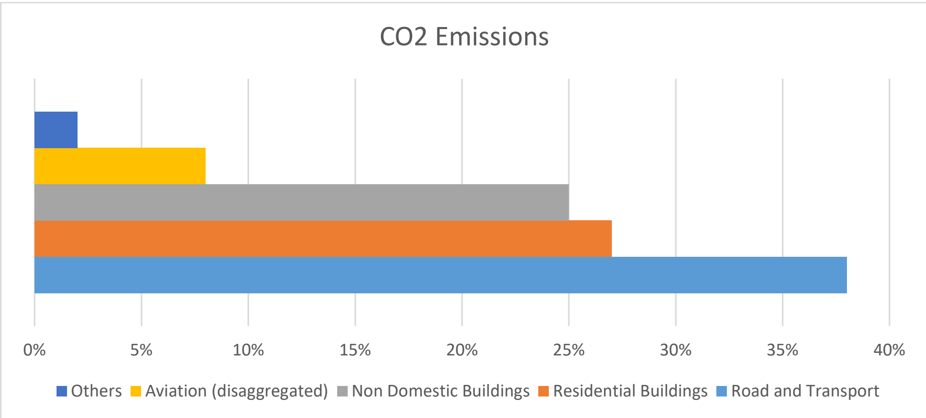
The baseline GHG emissions in Newcastle-under-Lyme are estimated to be 903.02 ktCO2e. Of this total, Scope 1 and 2 emissions (i.e. those associated with fuel consumption and electricity used within the area boundary) account for roughly 767.38 ktCO2e. the largest portion of emissions result from petrol and diesel used in road transport (38%), followed by residential buildings (27%). Within the residential sector, the use of natural gas (e.g. for heating, hot water and cooking) accounts for the majority of GHG emissions. Non-domestic buildings collectively account for around 25% of total emissions. Emissions from aviation make up around 8% of the overall total; these are based on UK-wide aviation emissions, allocated to Newcastle-under-Lyme based on its population. Other sectors, such as wastewater treatment, waste disposal, and livestock collectively account for less than 3% of total emissions.

# What do we do know already?



C02 Emissions

- Road and Transport 38%
- Residential Buildings 27%
- Non Domestic Buildings 25%
- Aviation (disaggregated) 8%
- Others 2%




The Tyndall Centre, a collaborative academic research project for Climate Change, has quantified carbon budgets at local authority levels. These carbon budgets are based on translating the “well below 2°C and pursuing 1.5°C” global temperature target and equity principles in the United Nations Paris Agreement to a national UK carbon budget. The UK budget is then split between sub-national areas using different allocation regimes.

The complete report for the Newcastle under Lyme is available at: https://carbon-budget.manchester.ac.uk/reports/E07000195/

According to Tyndall Centre, for Newcastle-under-Lyme to make its ‘fair’ contribution towards the Paris Climate Change Agreement, it must remain within its maximum cumulative carbon dioxide emissions budget of 4.6 million tonnes (MtCO2) for the period of 2020 to 2100.

**Table 1:** *Periodic Carbon Budgets for 2018 for Newcastle-under-Lyme.*

| Carbon Budget Period | Recommended Carbon Budget (Mt $CO_2$) |
|---|---|
| 2018 - 2022 | 3.2 |
| 2023 - 2027 | 1.5 |
| 2028 - 2032 | 0.7 |
| 2033 - 2037 | 0.3 |
| 2038 - 2042 | 0.2 |
| 2043 - 2047 | 0.1 |
| 2048 - 2100 | 0.1 |

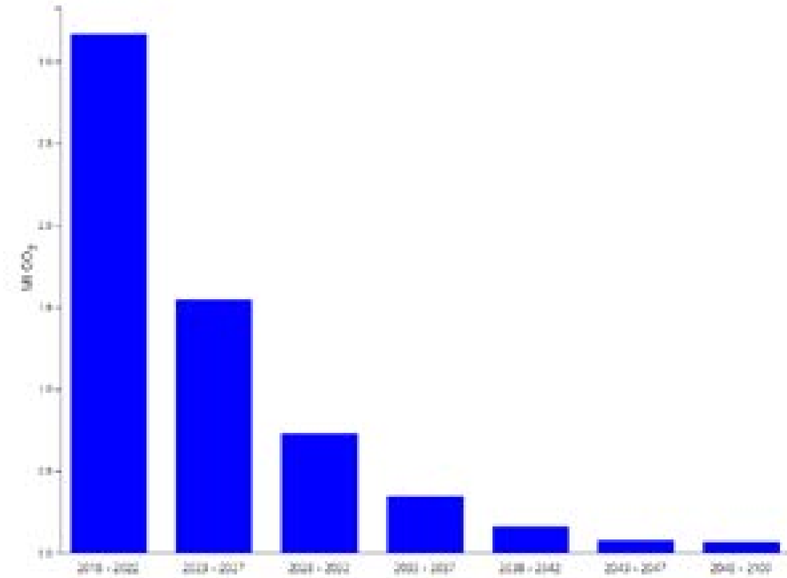


***Figure 2:*** *Cumulative $CO_2$ emissions for budget period (based on Table 1) from 2018 to 2100 for Newcastle-under-Lyme*

The allocated Carbon budget of 4,600 kt Co2 from 2020 to 2100 (6,100 kt C02 for the period of 2018-2100, as the current estimates for emissions for 2018 and 2019 have been included).

However, at the current 2017 CO2 emissions levels, Newcastle under Lyme would use this entire budget, (which has been allocated a period of 80 years) within 6 years from 2020.

# Priority Outcomes



Although there has been good progress already made in a number of areas that support and enhance our natural environment, it is acknowledged that we could do and have to do more to achieve the aims of this Strategy and our goal of carbon neutrality.

We commit to achieving 100% carbon neutrality across our own operations and assets by 2030 at the latest through a combination of reducing carbon production and offsetting of any residual carbon emissions.

We will also work in partnership to achieve a significant reduction in emissions and improve carbon offset rates across the wider Borough and support Staffordshire as a County to meet its ambitions through the way we do things; ensuring that working towards carbon neutrality is a thread which runs through all of our decision-making.

### We will reduce our reliance on fossil fuels by

- Reducing our overall energy consumption from our operations and assets.
- Harnessing natural resources, for example by harvesting rain and grey water.
- Switching to green and renewable sources of energy.
- Raising expectations of developers, through our Local Plan policies.
- Making sustainable procurement choices.
- investigating green energy investment.

### We will minimise waste and increase recycling

- Producing less waste, and encouraging the use of sustainable alternatives to single-use plastics and other single use items
- We will reduce our use of natural resources and encourage their reuse and recycling.
- We will continue to provide a wide range of recycling opportunities including a wide range of plastics.
- We will provide separate household and business food waste recycling services and promote reduction in food waste.

### We will reduce emissions by

- Reducing our business mileage by more agile and home working
- Decreasing reliance on the car journeys
- Facilitating the growth of electric vehicles for both personal and operational use through provision of charging infrastructure
- Reducing the level of particulates in the district through the North Staffs Clean Air Project
- Facilitating alternatives to motor vehicle modes of transport including cycling and walking

### We will offset carbon emissions by

- Increasing our tree canopy and sequestration of carbon through the combined efforts of the Borough Council, town and parish councils, volunteers and residents.
- Establish carbon capture parks and community orchards on greenspace and encourage community ownership.
- Protecting existing hedgerows and tree canopy from the effects of development and maintaining our policy on tree preservation.
- Protecting existing habitats wetlands, marsh and encouraging additional vegetation planting in rivers and ponds
- increasing biodiversity, habitat protection, replacement and enhancement across our green open spaces.
- Working with local food producers to accelerate the production and availability of local environmentally friendly food stuff.
- Consider investing in offset as a last resort where we are not able to deliver it ourselves.

# How we will deliver our priority outcomes



The following section identifies a range of actions which covers the next five years. The main focus are actions which relate to the Council's own activities and estate. In addition, there are a number of actions which benefit the wider Newcastle-under-Lyme borough.

| Themes | Action | By when? |
|---|---|---|
| Overarching | 1. The Staffordshire Climate Change Adaptation & Mitigation Report has been finalised and key policy recommendations will inform policies in the Local Plan to ensure that new development will seek to mitigate the impact on climate change. | At the adoption of the Local Plan |
| | 2. The following policy principles are likely to be taken forward in the emerging Local Plan:-<br>• Presumption in favour of renewable energy development on unconstrained areas (which will be identified on the Policies Map), subject to specific criteria on design, siting, amenity impact etc.<br>• Electric vehicle charging points should be included in all developments' parking proposals. Where use of existing parking facilities are being utilised, contributions towards electric vehicle infrastructure is likely to be required;<br>• Requirement that all development should be adaptable to climate change and help reduce carbon emissions by including, wherever appropriate, decentralised and renewable and low carbon sources.<br>• Requirement on proposals for major developments to submit a sustainability statement demonstrating consideration of energy efficiency measures and low carbon technologies;<br>• Requirement for all development and energy proposals that would generate significant surplus or waste heat should take all practicable measures to utilise that heat to meet local energy needs;<br>• Requirement to connect into the heat network or be designed to do so where this is planned or exists, unless it can be demonstrated that there are more effective alternatives for minimising carbon emissions or such connection is impracticable;<br>• The Report also recommends consideration of a carbon offset fund. Should the Council choose to adopt this, the level of charge set would need to be tested in a Viability Report and additional resources may be required to manage this fund. | |
| | 3. To engage with Keele University (possible Staffordshire University) to explore what they are doing in relation to reducing carbon / becoming carbon neutral and to examine if the Council can learn anything from the work being undertaken. | 2021/2022 |
| | 4. To explore if there is any national best practice examples and/or guidance to support the delivery of such work. | 2021/2022 |

# How we will deliver our priority outcomes



| | | |
|---|---|---|
| | 5. The Council has modified its Invitation to Tender (Open Procedure) Part 2 Questionnaire to include the questions linked to provider's carbon reduction plan and officers will monitor and report on responses received as part of any future procurements. | 2020 |
| **Reduce our reliance on Fossil Fuels** | 6. An Outline Business Case is to be submitted to DEFRA, which will include a package of measures to be implemented with respect to Air Quality. | 2020 |
| | 7. DEFRA funding will be required to implement and monitor required measures. Measures likely to be implemented are anticipated to be taken forward by Staffordshire County Council and Stoke on Trent City Council as the Highways Authorities with input from Borough Council. | End of 2022 |
| | 8. A 'pilot' of a Government funded E-Scooters scheme in collaboration with Staffordshire County Council has commenced for a period of 12 months within the Town Centre. | 2020 – 2021 |
| | 9. To explore the option of expanding the use of E-scooters for local employees to use on distribution centres. | 2021 |
| | 10. Staffordshire County Council's Local Cycling and Walking Infrastructure Plan (LCWIP) 2020-2030 establishes a programme of improvements for pedestrians and cyclists to include better access and improved cycle routes for the residents of the Borough. | 2020-2030 |
| | 11. Newcastle under Lyme Borough Council, as an employer, has for a number of years, implemented agile working, to reduce Co2 from employee commuting. It has adopted a Green Travel Plan, encouraging Car Sharing, Cycle Loans, and Annual Bus Travel Card for its employees. | Ongoing |
| | 12. The Borough Council has installed four electrical vehicle charging outlets for its fleet vehicles at its Central Depot. | 2020 |
| | 13. A consortium bid, funded by Low Emission Taxi Infrastructure Scheme, has approved eight rapid electric vehicle charging points to be installed within the Borough. | 2021 |
| | 14. Staffordshire County Council have developed an EV strategy for the County. The Council will use this as a basis for its borough wide strategy. | 2021 |
| | 15. To investigate the installation of electrical vehicle charging points in car parks managed by the Borough for customer usage. | 2022 |

# How we will deliver our priority outcomes



| | | |
|---|---|---|
| | 16. The requirements for taxi vehicles to be electric or of a maximum age were rejected by Committee, as part of the last Taxi / Private Hire Vehicle policy update. Therefore older vehicles continue to be utilised and will continue to be licensed for as long roadworthy and meet license standards in force at time. | 2019 |
| | 17. To consider future amendments of policy and further consultation and adoption to the Taxi / PHV policy | 2025 |
| | 18. To assess the suitability and applicability of financial support schemes from the Office of Low Emissions Vehicles grants for new vehicles / grant for second hand (loan schemes to support purchase of New and Used vehicles) | 2025 |
| | 19. To assess schemes established by Local Authorities such as Birmingham / Coventry / Nottingham with respect to electrical vehicles and its associated infrastructure improvement and to incorporate learning for the Council. | 2025 |
| | 20. To assess whether the Taxi and PHV is to be affected by the current / future clean air work. Will be subject to Ministerial Approval of measures to improve Air Quality. | 2021/2022 |
| **Reduce Emissions** | 21. As part of the new recycling service, the Council has invested in Routesmart, allowing route optimisation with the new waste service. It is envisaged that once the new service has been embedded and routes optimised; fuel and emissions reduction will materialise. | Ongoing |
| | 22. To continue to provide driver CPC training and offer ECO driving aimed at Driver behaviour and well-being. | Ongoing |
| | 23. The current lease vehicles, which use diesel fuel, used by the Council Dog Warden & Pest Control Services will be replaced with 3 x Nissan E-NV200 Acenta Vans (electric vehicles). | 2020 |
| | 24. The Council has installed Wi Beees Data Loggers in six of its buildings. | 2020 |
| | 25. Based on the data captured by Wi Beees Data Loggers, the Council will seek to effect behaviour changes and optimise energy usage. | 2023 |
| | 26. To begin the installation of a new Building Energy Management System at our Main Leisure Centre Jubilee 2 | 2021 |
| | 27. To utilise data of energy usage in Council Buildings to procure new "e-telligent" packages of building management systems. | 2020/2021 |
| | 28. To appoint an energy specialist in- house or to engage an external specialist Consultant with the remit of reducing carbon emissions across the Council's portfolio. | 2021 |

# How we will deliver our priority outcomes



| | | |
|---|---|---|
| | 29. To Council has appointed external consultants to assess the feasibility of deploying low carbon technologies, across the Councils landholdings and buildings. | 2021 |
| | 30. The Council has begun working collaboratively with Keele University to explore new energy efficient schemes, district network heating. | 2020 |
| | 31. To Council has made preliminary assessment of the type of street lighting for which the Council is responsible for, 382 lights of which only 4 are currently LED. | 2020 |
| | 32. To develop a Capital Assets Strategy, which establishes the building maintenance and capital spend for Council Assets, which is consistent with the Carbon Reduction Agenda. | 2021 |
| | 33. To develop a proposal / business case to install LED to Council's owned street lighting. | 2021/2022 |
| **Minimise Waste, Recycle More** | 34. To review what neighbouring authorities are delivering as part of their carbon reduction/carbon neutrality programme, examine if there might be benefits from a combined public sector L.A. approach; | 2021/2022 |
| | 35. To engage with the Staffordshire Chamber of Commerce to understand the messages/guidance they are providing to the business sector on CO2 neutral energy tariffs; | 2021/2022 |
| | 36. To explore what local medium to large size private sector organisations are doing in relation to reducing carbon / becoming carbon neutral (examine any learning from the work being undertaken). | 2021/2022 |
| **Offset** | 37. The Borough Council will undertake a feasibility study for a tree planting programme on sites around the borough, to facilitate carbon capture and greening. Consultation, detailed design and cost estimates are to be prepared in 2021 and implementation to commence in 2021. | 2021 |
| | 38. The Borough Council is exploring the option of purchasing electricity and gas that is green tariff and assessing the financial implication of doing so and its likely carbon saving. | 2020 |
| | 39. To explore the feasibility of installing a 50kw array of solar thermal-PV hybrid at south facing roofs of NULBC central Depot. | 2021 |

# Working with our Partners to Enable Change

We need to work with our partners to be able to deliver some of our aims and to enable and support others in delivering their priorities for change. We commit to:

**Awareness, Engagement and Behavioural Change**

• Work with groups and individuals across the district to develop a tree planting network, invite the Woodland Trust and Forestry Commission to share funding opportunities and build a volunteer group to help with planting and maintenance.

• Producing information on how businesses can help themselves to be greener and reduce their carbon footprint.

• List funding opportunities on the Economic Development webpage as and when they become available.

• Signposting business community to Government/ Local Enterprise Partnership and other environmental initiatives.

• Clarify the government offer/regional/Local / Enterprise Partnership.

• Seeking best practice and information sharing with local businesses.

**Natural Environment**

• Work with our Parish and Town Councils and Staffordshire County Council to protect and increase tree canopy.
• Work with environmental bodies such as the Environment Agency to improve and protect local air quality, odours and flooding.
• Support local food producers markets and local food production.
• Support the development of a county-wide Air Quality Strategy.
• Work with Staffordshire Wildlife Trust to protect and restore wildlife habitats.

**Minimise waste and recycle more**

• Take an active role within the Staffordshire Joint Waste Management Board to support and progress projects to reduce waste, increase recycling and enhance re-use of recycled materials.
• Design and implement communications programmes to encourage waste minimisation.
• Work to implement the forthcoming Government Waste and Recycling Strategy for the local area including deposit return schemes if implemented by Government

**Built Environment**

• Encourage developers to use sustainable materials and techniques through the Councils emerging Local Plan.
• Exploring with local partners opportunities to develop geothermal recovery projects that make use of residual minewater from the areas previous industrial heritage.
• Work closely with local registered social landlords such as Aspire Housing to implement energy saving projects, efficient building maintenance techniques.

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**NEWCASTLE-UNDER-LYME BOROUGH COUNCIL**

**EXECUTIVE MANAGEMENT TEAM'S REPORT TO**

**Cabinet**
**09 December 2020**

**Report Title:** **Brampton Museum Redevelopment Project**

**Submitted by:** **Executive Director Commercial Development and Economic Growth**

**Portfolios:** **Leisure, Culture & Heritage**

**Ward(s) affected:** **All**

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| **Purpose of the Report**<br><br>To approve the award of a contract for the alterations and extensions to Brampton Museum |
| **Recommendation**<br><br>**That**<br>**1. The Executive Director for Commercial Development and Economic Growth in consultation with the Executive Director for Resources and Support Services and the Portfolio Holder for Leisure, Culture and Heritage is authorised to enter into a contract following a compliant procurement process with the successful contractor to undertake the alterations and extensions to Brampton Museum.** |
| **Reasons**<br><br>To ensure that funding opportunities are maximised for the Borough, in achieving Council Plan objectives. |

## 1. Background

1.1 In March The National Heritage Lottery Fund awarded the Brampton Museum £248,700 in support and as a contribution to the refurbishment and proposed changes (the award was the full amount applied for as part of the application). This funding is split £45,000 capital and £203,700 for programme funding. These funds have not yet been received by the Council, however are expected on presentation of invoices up to £248,700.

1.2 In April The Landfill Communities Fund awarded Brampton Museum £39,000 in support and as a contribution to the refurbishment and proposed changes. The award made was less than the amount applied for, but consists of £39,000 of capital. This funding has also not yet been received by the Council but will be paid in arrears on submission of invoices before May 2021.
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1.3 Newcastle-under-Lyme Civic Society have already contributed £100,000 towards the new temporary exhibition gallery.

1.4 £30,000 has been secured from the Arts Council Creative People and Places Fund through the Appetite programme administered by the New Vic. This will fund 3 years of Heritage Weeks celebrations including the 2023 850$^{th}$ Newcastle-under-Lyme Charter celebrations.

The funding received from the Arts Council is entirely in relation to programme funding and is expected to be received £10,000 per year in 2021, 2022 and 2023.

1.5 Additional funding of £30,000 has been earmarked from Section 106 monies towards the capital costs of the activity space.

1.6 The Friends of Brampton Museum are funding up to £4,000 for research room and talks equipment. This funding is due to be received in May-June2021, and is in relation to programme funding.

1.7 The Council's capital programme has an allocation of **£355,000** for the build over the next 3 years, between 2020/21 and 2022/23.

1.8 **£45,290.51** of the 2019/20 capital allocation of £45,000 has already been spent on preliminary work.

1.9 The funding will support the following:

- Creation of an extension for a new, dedicated temporary exhibitions space;
- Three year funding for a new member of staff and materials to deliver an activity plan to help more visitors and a wider range of visitors learn about the Borough of Newcastle's heritage and culture;
- Promotion and audience development to widen the demographic of visitors and volunteers
- Increase and diversify income to enable the museum to deliver its activities with less direct financial support from the council;
- Reconfiguring internal rooms to extend the capacity of the archive and create a dedicated research area with appropriate storage to manage the newly acquired library and council archive collections and keep them in good condition and promote wider access;
- Recruiting and training more and a wider range of volunteers to catalogue and digitise the new collections;
- Reinterpreting the ground floor galleries to use the collections to tell new stories to better engage visitors.

## 2. <u>Issues</u>

2.1 The specification for this contract has been developed by a specialist consultant with input from the Council's Facilities Management section and the Leisure & Culture team.

2.2 Given the indicative value of this contract estimated to be in the region of £626,000 the Council advertised this opportunity nationally via My Tenders (and Contract Finder).

2.3 Given the significance of this appointment the procurement procedure has followed best practice guidelines. The selection criteria for the appointment of an appropriate supplier was based upon best practice and the Most Economically Advantageous Tender (M.E.A.T.) with the evaluation criteria being based on 60% Quality and 40% price.

2.4 A detailed breakdown of the shortlisted companies and recommended provider can be provided to the Cabinet Member for Leisure, Culture and Heritage in October 2020 (in confidence) for approval. As part of the procurement process, the award of contract will be subject to a voluntary ten day standstill period, and should no challenge concerning the Councils award decision be received the contract will commence in December 2020.

2.5 Three compliant submissions were received And the contractor's submissions have been evaluated by the Council's Quantity Surveyor, with price submissions summarised as follows

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|---|---|
| Sandycroft Building Construction Limited | £570,439.12 |
| Bidder 'B' | £595,152.99 |
| Bidder 'C' | £630,860.08 |

2.6 Sandycroft Building Contractors Limited provided the most competitively priced compliant tender. They also returned the highest score on the Quality Assessment and submitted a compliant construction programme of approximately 20 weeks.

## 3. **<u>Proposal</u>**

3.1 That the Executive Director for Commercial Development and Economic Growth in consultation with the Executive Director for Resources and Support Services and the Portfolio Holder for Leisure, Culture and Heritage is authorised to enter into a contract following a compliant procurement process with Sandycroft Building Construction Ltd to undertake the alterations and extensions to Brampton Museum.

## 4. **<u>Reasons for Proposed Solution</u>**

4.1 To ensure that funding opportunities are maximised by the Museum on behalf of the Borough, contributing to achieving the Council's planned objectives.

## 5. **<u>Options Considered</u>**

5.1 There are no alternate options to be considered.

## 6. **<u>Legal and Statutory Implications</u>**

6.1 On receiving a grant from NLHF the Borough Council will be subject to terms and conditions as specified in their 'Standard Terms of Grant'. This ensures that the museum will remain open to the public for a period of 10 years and will be managed and maintained appropriately. The NLHF terms and conditions typically provide the ability for NLHF to clawback grant funding if the Council does not meet its obligations under the scheme. Officers will be required to submit regular progress reports to NLHF.

6.2 Landfill Communities Trust require that before placing an order, starting work or making any payments in respect of the project works before Derbyshire Environmental Trust have registered the project with ENTRUST, the Third Party Contribution has been paid and a Funding Agreement completed. Failure to adhere to this may well invalidate the grant offer. Officers will ensure compliance.

6.3 Should the project not go ahead for any reason all funders would expect the return of their funding commitment the awards by these organisations totalling £417,000.

6.4 All procurement, building control and planning has been undertaken in consultation with appropriate officers and following the Borough Council's policy guidance.

## 7. **<u>Equality Impact Assessment</u>**

7.1 An Equality Impact Assessment – has been completed and assessed as part of the application process and is available on request.

## 8. Financial and Resource Implications

8.1 Total construction costs are £570,400 (this includes contingency)

8.2 Professional fees and associated costs of moving will be an estimated £30,000

8.3 The total construction costs of the project are **£600,400**.

8.4 Of the external funding obtained (detailed in section 1 of this report), £184,000 is specifically for the construction costs. This consists of £45,000 from the National Lottery Heritage Fund, £39,000 from the Landfill Communities Fund, £100,000 from Newcastle-under-Lyme Civic Society.

8.5 The Council's capital programme has £355,000 committed over a 3 year period.

8.6 There is £40,000 of ear marked funding available in the Museum Purchases Fund for capital.

8.7 There is £30,000 earmarked from Section 106 monies for capital.

8.8 There is sufficient funds to cover the construction costs as the total funds are **£609,000**

8.9 Following the work the rateable value of the museum will rise by £7475.

## 9. Major Risks

9.1 Technical - Missed Completion Date;
9.2 Organisational - Programme Risks;
9.3 Economic - Controlling Costs;
9.4 Financial - Reduced level of funding available;
9.5 Social - project fails to meet community needs/ aspirations;
9.6 Management - Lack of capacity to deliver the project;
9.7 Delay in recruiting staff;
9.8 Coronavirus;
9.9 Unforeseen construction risk

A copy of the risk assessment is available on request.

## 10. Sustainability and Climate Change Implications

10.1 All requirements met in order to secure planning permission including Arboriculture Survey and Report, Conservation Area Consultation Report & Heritage statement.

10.2 There is no impact on:
a) Protected and priority species;
b) Designated sites, important habitats or other biodiversity features;
c) Features of geological conservation importance.

10.3 An Ecological Appraisal has been carried out and recommendations will be met.

10.4 The new extensions will include air source heat pumps for heating, LED lighting, natural vent (automatic windows) over cooling, photocell (external Lights) PV array. Use of high natural light levels; and low water use taps and toilets.

## 11. Key Decision Information

11.1 This is a key decision and appears on the Council Plan.

## 12. Earlier Cabinet/Committee Resolutions

12.1 Heritage Cabinet Working Group 12/09/19 Information received;
12.2 Planning Development permission granted 11/11/2019;
12.3 Heritage Cabinet Working Group 12/03/2020 Information received;
12.4 Capital Working Group;
12.5 Cabinet Report 22/04/2020.

## 13. List of Appendices

13.1 There are no appendices

## 14. Background Papers

14.1 There are no background papers.

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**NEWCASTLE-UNDER-LYME BOROUGH COUNCIL**

**EXECUTIVE MANAGEMENT TEAM'S REPORT TO CABINET**

**Cabinet**
**09 December 2020**

**Report Title:** **Proposed Residents Funeral Service**

**Submitted by:** **Head of Operations**

**Portfolio:** **Environment and Recycling**

**Ward(s) affected:** **All wards**

| |
|---|
| **Purpose of the Report**<br>To seek approval for the Council to offer a Residents Funeral Service and to invite tenders from suitable delivery partners and award the contract to the lowest suitable tender. |
| **Recommendation**<br><br>**That**<br>**1. The scheme to provide a residents funeral service, including a direct cremation option, is approved.**<br>**2. That authority is granted to invite tenders for the service and to accept the lowest suitable tender received.** |
| **Reasons**<br>To provide residents of the borough with an increased choice of funeral options, including more affordable options, in light of the national concern over funeral costs and the potential hardship this can cause some bereaved families. |

## 1. Background

1.1 The Borough Council is a Burial Authority with a statutory duty to ensure safe and proper disposal of the deceased. The Council currently fulfils this duty through the direct provision of cremation and burial services at Newcastle Crematorium and 8 cemeteries.

Concern has been raised in recent times about the rising cost of funerals and the associated hardship this can cause bereaved families at a very difficult time. The Competition and Markets Authority (CMA) have also instigated an investigation into the rising cost of funerals and cremations, with a view to determining whether current fees and charges across both local authority and private sector providers are fair and what options could be explored to address increasing costs. The outcome of this investigation is expected in March 2021. The Council publishes its Scale of Fees and Charges annually, and the fees for burial and cremation services are included to ensure transparency. In terms of the full cost of a funeral for a bereaved family, the Council's charges relate to only a part of the overall cost (purchase of graves, interment, cremation etc) whilst the majority of costs relate to the services provided by the private sector via Funeral Directors (collection and care of the deceased, provision of coffin, transport to the service etc).

1.2 Following a request from Cabinet members, the bereavement services team has been exploring the potential of delivering a residents funeral service, including a direct cremation option, with a view to increasing residents choice in relation to funerals and providing more affordable options to address the rising costs of funerals.

1.3 Several other local authorities throughout the country have started to provide a residents funeral as a service to their residents. In essence, this involves the council partnering with a local funeral director to provide a simple, dignified "end to end" funeral service at a fixed cost. Families can opt to add in extra services for pre-set additional costs should they so wish. The direct cremation option, also at a fixed cost, involves the deceased being brought directly to the crematorium and being cremated without a traditional funeral service or the family being present. The ashes are then returned to the family or interred in the crematorium grounds for a small additional charge. The direct cremation service is starting to be offered by other crematoria in the local area.

1.4 Research has been undertaken regarding existing lower cost funeral options in the borough, and whilst it is acknowledged that several funeral directors do provide lower cost options, they currently don't include any costs associated with the actual cremation or burial. From looking at examples of other local authorities who are currently providing a residents funeral service it is anticipated that an affordable service can be provided which includes both the funeral director's costs and the council's cremation / burial costs.

## 2. Issues

2.1 The key to the delivery of the proposed residents funeral service is the ability to be able to collect, store and then enable viewings of the deceased, as well as the formal transportation to the crematorium or cemetery and the staff needed to support this process. The council does not currently have the capacity nor the specialist capability to deliver these elements of the service in-house and it would be costly and time consuming to set this up, both in up front costs and ongoing annual running costs, which may not be fully recovered through any additional income generated. It is proposed therefore to deliver this service by partnering with a funeral director, who will already have access to the required facilities and staff. The requirements for this will be included in the tender documentation.

2.2 The direct cremation option is not currently provided at the Crematorium. As part of this project it is proposed to look to provide this option for families as an affordable alternative to a traditional cremation service and to include the option in the residents funeral service package. Direct cremations do not require the use of the chapel or music facilities for a service, and therefore would require a lower fee to that currently charged for a traditional cremation. This fee will be agreed and set as part of this project.

## 3. Proposal

3.1 The aim of the proposed residents funeral service is to provide a simple yet dignified funeral service, which would include all of the basics needed for a dignified funeral service at a fixed cost. The service would be able to be purchased at the point of need or as an advanced purchase plan.

3.2 The residents funeral service will be promoted through both the council and the successful tenderers websites, as well as through social media channels and on site at the crematorium and cemetery offices. It is proposed that the service at the point of delivery will not appear noticeably different to any other existing funeral service option.

3.3 The proposed service would be available for both cremation and burial options, although the burial option would require the additional cost of the purchase of the grave (unless one was already purchased). The package would include the collection and storage of the deceased, a coffin, a hearse and one limousine to transport family to the crematorium or selected cemetery. The use of the crematorium chapel or a graveside service would also be included.

3.4 There will be a small number of items not included in the fixed price, including the provision of a celebrant and any medical fees that may be required. There are also a small number of ancillary items which can be added to the basic package at an agreed additional cost.

3.5 The proposed package would only be made available to residents of the borough and this would be managed in line with the current rules on residents / non-residents eligibility for discounted fees.

3.6 The direct cremation option would be delivered in a similar manner to the resident funeral and would include the collection and storage of the deceased the provision of a coffin and transport to the crematorium. This option would also be open to non-residents of the Borough.

3.7 The proposed tender would be open to all funeral directors, but there will be a specific requirement that ensures that a chapel of rest is available within the borough to ensure that families can view loved ones without the requirement to travel outside of the borough.

3.8 A summary of the proposed Resident Funeral Service package is attached to this report at Appendix 1.

## 4. Reasons for Proposed Solution

4.1 To provide residents of the borough with an increased choice of funeral options, including more affordable options, in light of the national concern over funeral costs and the potential hardship this can cause some bereaved families.

## 5. Options Considered

5.1 To provide a residents funeral service and direct cremation option by partnering with a suitable funeral director – preferred option for reasons set out above.

5.2 To provide a residents funeral service and direct cremation option in-house – not feasible for reasons set out above

5.3 To continue with the current range of options available to bereaved families – this would not respond to Cabinet members aspirations nor the anticipated demand from bereaved families

## 6. Legal and Statutory Implications

6.1 The Council is a Burial Authority with a statutory duty to ensure the safe and proper disposal of the deceased. It has the power to enter into contractual arrangements to deliver services in relation to this duty.

## 7. Equality Impact Assessment

7.1 There is a positive equality impact resulting from these proposals, in that the proposed service would offer additional, affordable choice to bereaved families.

## 8. Financial and Resource Implications

8.1 The proposed residents funeral service is not anticipated to have any significant financial implications for the council. It is not expected to generate significant additional income as it is only available to residents, and the likelihood is that those residents who opt for the new service, would have used one of the current options available. However, the residents funeral service should still generate the current level of fee income as the council's elements of the cost remain as per the Scale of Fees and Charges. The purpose of this service is to provide an affordable funeral offer to residents and mitigate against the likelihood of financial hardship for families at a difficult time.

8.2 The direct cremation option may generate a very modest additional income if it proves to be a popular choice, as it is open to non-residents of the Borough and would therefore potentially attract custom which would not have otherwise chosen Borough facilities.

9. **Major Risks**

9.1 Poor take up of the service resulting in concerns remaining over the cost of funerals – this will be mitigated by promotion of the service via appropriate channels and marketing by the successful partner provider

9.2 Limited interest from potential partner providers – this has been mitigated by soft market testing to establish that there are interested potential partner providers in the locality

9.3 Unattractive pricing structure – this has been mitigated by market comparisons and target cost setting in the tender document package

10. **Sustainability and Climate Change Implications**

10.1 None

11. **Key Decision Information**

11.1 This decision will affect all wards of the Borough but is not anticipated to have any significant impact on income or expenditure.

12. **Earlier Cabinet/Committee Resolutions**

12.1 None

13. **List of Appendices**

13.1 Appendix 1 – Proposed Resident Funeral Package

14. **Background Papers**

14.1 None

**Residents Funeral Service and Direct Cremation (Appendix 2)**

**SPECIFICATION**

The Newcastle under Lyme Borough Resident Funeral (the 'Service') will be available to residents' of the Borough. It will be available to any resident who wanted to purchase it regardless of means. For a fixed price an individual purchasing a Residents' Funeral the following will be included:

- Collection of the deceased from any location in the Borough or outside of the borough if applicable or from Royal Stoke hospital or Mortuary.
- Dressing of the deceased. Viewing of deceased at Chapel of Rest (restrictions apply to latter – Based upon funeral directors operation).
- Provision of a suitable oak or environmentally friendly alternative (or similar) finished coffin with handles and an engraved nameplate.
- The funeral directors professional fees for making all necessary arrangements for the funeral service including provision of all appropriate staff and facilities to ensure that the funeral service proceeds with dignity.
- Transportation of the deceased in a hearse from the funeral home to the funeral service and one following limousine.
- A funeral service of 40 minutes in Newcastle Crematorium chapel or a graveside ceremony at one of the borough's eight Cemeteries.
- Cremation at Newcastle Crematorium or burial at Keele, Newcastle, Silverdale, Chesterton, Knutton, Attwood Street, Audley or Madeley cemeteries. Cremated remains would be interred in the monthly gardens at Newcastle Crematorium (families would be free to make alternative arrangements with regards to ashes should they wish. If such arrangements involved burial in a cremated remains grave, or other memorialisation within the Crematorium or a borough cemetery then that would be at the published scale of charges).
- An office and a chapel of rest would have to be provided within the borough.
- For the avoidance of doubt the Newcastle under Lyme Residents' Funeral Service does not apply where either burials or cremations take place outside of the Borough.

**<u>Permissible additional services at an extra cost that would not take the funeral outside of the service</u>**

In general should a resident request additional elements of service this would take the funeral outside of the Services and the proposed contract would not apply. However certain elements of service are so closely related to the Service that they would not take a funeral outside of the contract.

These additional elements of service are set out in the pricing schedule and must be priced by the Funeral Director.

**Disbursements**

A number of disbursement items shall not be included within the fixed price. These disbursement elements are covered in section 3 below.

The Newcastle under Lyme Borough Direct Cremation Option ('Direct Cremation') will be available to anyone who wishes to utilise this option. It will be available to any person who wanted to purchase it regardless of means. For a fixed price an individual purchasing a direct cremation the following will be included:

- Collection of the deceased from any location in the Borough or outside of the borough if applicable or from Royal Stoke hospital or Mortuary.
- Dressing of the deceased.
- Provision of a suitable oak or environmentally friendly alternative (or similar) finished coffin with handles and an engraved nameplate.
- The funeral directors professional fees for making all necessary arrangements for the direct cremation service including provision of all appropriate staff and facilities to ensure that the direct cremation service proceeds with dignity.
- Transportation of the deceased from the funeral home to the crematorium.

**Pre-payment Plan**

The Funeral Director shall provide and quote for the option of providing a Funeral Planning Authority registered pre-payment plan in respect of the Service.

**SERVICE DELIVERY**

The Service shall be provided as and when required by Newcastle under Lyme Borough residents. The Service shall be provided fully in accordance with the Contract Conditions/Specification.

**SPECIAL CONDITIONS**

1) GENERAL
   a) The Council shall:-
      i) Have the power to carry out inspections of Funeral Director's premises and materials used at any time to ensure compliance with the Specification.
   b) The Funeral Director shall:-
      i) Agree to follow and abide by the National Association of Funeral Directors' Code of Practice.
      ii) Display leaflets and any posters promoting the Service in a conspicuous place in public view, as well as promoting the service via social media / website.
      iii) Offer a 24 hour service and must have adequate office accommodation available within the Borough of Newcastle under Lyme.
      iv) Issue all accounts directly to the Client on invoices showing the Service in addition to the Funeral Director's particulars and send a duplicate copy of each invoice to the Council at the end of each month.
      v) Keep a complete record of all funerals executed under the arrangements with details of the names of staff employed thereon and a description of the vehicle(s) used.
      vi) Ensure that a Registrar's certificate of death is produced before removal of the body for interment.
      vii) Make all necessary arrangements with Newcastle Borough Council Bereavement Services Team and comply with all their requirements.
      viii) Burials and cremations must be conducted strictly in accordance with statutory requirements and regulations made by the Secretary of State for the Home Office (The Local Authorities' Cemeteries Order 1977) & (Cremation Regulations 2008) and all necessary forms, certificates and assistance to the Council's authorised officer must be provided.
      ix) Make all necessary arrangements for the funeral including arrangements at the cemetery or crematorium.
      x) Strictly observe the confidence of every client at all times.
      xi) Ensure that burial/cremations take place within 2 weeks from the date of death or if this is not possible for reasons outside of the Funeral Directors control, the burial/cremation will take place as soon as is reasonably practical.

2) THE FUNERAL
   a) Collection and Removal of Body and Accommodation prior to Burial or Cremation

i) The Funeral Director will collect the body of the deceased when required in a suitable vehicle from the place of death, hospital or mortuary, locally within a distance not exceeding a 25 mile radius (measured from Keele Cemetery).
ii) Each body must be dressed in a suitable robe.
iii) The body must be kept in a dignified manner either in a recognised mortuary or on the Funeral Director's premises until the day of the funeral or direct cremation.

b) Coffin Construction

i) The coffin shall consist of a good quality polished oak veneer or environmentally friendly option of suitable size to accommodate the deceased, with white lining throughout and be appropriate for the chosen means of disposal.
ii) All adult coffins must have six securely fitted handles and an engraved plate on the lid showing name, age and date of death of the deceased. Children's coffins should have the appropriate number of securely fixed handles depending upon the age and size of the deceased.
iii) In the case of cremation, the coffin must be finished in accordance with Newcastle Borough Council's regulations and the requirements of the Environmental Protection Act 1992.

c) Funeral Procedure

i) The funeral time and appropriate Borough cemetery will be chosen to suit the client (all cremations will be at Newcastle Crematorium), next of kin or other person who has assumed responsibility for the funeral.
ii) A separate hearse with the appropriate prescribed number of staff is to be provided for each funeral and shall be in attendance at the place required in good time to ensure that the cemetery/crematorium is reached by the time specified.
iii) The use of vans or of convertible hearses is prohibited for the funeral.
iv) The Funeral Director shall provide one limousine for conveyance of mourners for up to 25 running miles and 2 hours duration to facilitate transport to and from the mourner's house, agreed resting place and funeral reception, if necessary.
v) All drivers, undertakers and bearers shall be dressed uniformly.

N.B. Only items A and B apply to the direct cremation option, alongside suitable transportation of the coffin to the crematorium.

3) PRICE (Disbursements)

a) The Funeral Director shall exclude in his price the payment of all Fees charged for Doctors, Ministers and Religious services as these fees vary depending upon whether a burial or cremation or direct cremation is to take place. Also the Funeral Director shall exclude burial/cremation Fees charged by Newcastle Borough Council.

b) The Funeral Director shall include within his price the cost of making all necessary arrangements for the provision of the Service, excluding any element outlined in 3 a).

4) FORMS

a) For all Newcastle Residents' Funerals the Newcastle Resident Funeral 'Notice of Interment' or 'Preliminary Application Form for Cremation' must be completed even if the Client has requested additional services.

5) CUSTOMER CARE

a) A selection of the users of the service will be requested to complete a short questionnaire on the service provided. Copies of the results will be made available to the Funeral Director on request.

6) PROMOTION OF THE SERVICE

a) Newcastle Borough Council may promote the Service within available resources (E.G. Online, Social Media, Libraries, Community Centres, GP Practices and Council Buildings).

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## Cabinet Forward Plan: Newcastle under Lyme Borough Council

**Notice of Key Decisions to be taken under the Local Authorities (Executive Arrangements) (Meetings & Access to Information) (England) Regulations 2012**

This Plan gives 28 days' notice of Key Decisions which we are expecting to take over the next few months. Councils cannot take Key Decisions without first giving 28 days' notice, unless an urgent decision is required. Urgent Key Decisions may be taken under the urgency procedures set out in the Council's Constitution. A decision notice for each Key Decision made is published within 6 days of it having been made.

"Key decisions" are defined as those Executive (Cabinet) decisions which are likely:

a. to result in the Council incurring expenditure or making savings of £100,000 of more (in the case of Revenue) and £250,000 or more (in the case of Capital); and/or

b. to be significant in terms of the effects on communities living or working in an area comprising two or more wards of the Borough.

This Forward Plan also contains details of other important Cabinet decisions that we are expecting to take even if they do not meet this definition.

Whilst the majority of these decisions taken at meetings held in public, some decisions may be taken in private meetings because they deal with confidential information as defined in Schedule 12A of the Local Government Act 1972, and the public interest in withholding the information outweighs the public interest in disclosing it. If we intend to take a decision in private, that will be noted below with reasons.

If you object to a decision being taken in private, you can tell us why by emailing DemocraticServices@newcastle-staffs.gov.uk or contacting the address below. Any representations received at least 8 working days before the meeting will be published with the agenda together with a statement of the Council's response. Any representations received after this time will be reported verbally to the meeting.

Agenda Item 11

**The Cabinet is made up of the Leader, Deputy Leader and Cabinet Members with the following portfolios:**

| | |
|---|---|
| Leader of the Council (Corporate & Service Improvement, People & Partnerships) | Councillor Simon Tagg |
| Deputy Leader & Cabinet Portfolio Holder (Finance & Efficiency) | Councillor Stephen Sweeney |
| Cabinet Portfolio Holder (Community Safety & Well Being) | Councillor Helena Maxfield |
| Cabinet Portfolio Holder (Environment & Recycling) | Councillor Trevor Johnson |
| Cabinet Portfolio Holder (Leisure, Culture & Heritage) | Councillor Jill Waring |
| Cabinet Portfolio Holder (Planning & Growth) | Councillor Paul Northcott |

**Exempt Information Categories under Schedule 12A of the Local Government Act 1972**

1. Information relating to any individual
2. Information which is likely to reveal the identity of an individual
3. Information relating to the financial or business affairs of any particular person (including the authority holding that information).
4. Information relating to any consultations or negotiations, or contemplated consultations or negotiations, in connection with any labour relations matter arising between the authority or a Minister of the Crown and employees of, or office holders under the authority
5. Information in respect of which a claim to legal professional privilege could be maintained in legal proceedings.
6. Information which reveals an authority proposes;
   a. to give under any enactment a notice under or by virtue of which requirements are imposed on a person; or
   b. to make an order or direction under any enactment
7. Information relating to any action taken or to be taken in connection with the prevention, investigation or prosecution of a crime

Copies of the Council's Constitution, agendas and reports relevant to any key decision may be accessed on the Council's website www.newcastle-staffs.gov.uk or may be viewed during normal office hours. Copies or extracts can be obtained on payment of a fee (unless the publication contains exempt information).

For all enquiries, please contact:-

**The Chief Executive's Directorate, Castle House, Barracks Road**
**Newcastle-under-Lyme, Staffordshire ST5 1BL**
**Telephone 01782 742222** **Email:** DemocraticServices@newcastle-staffs.gov.uk

| Title of Report | Brief Description of Report | Cabinet Portfolio | Intended Decision Date | Relevant Overview & Scrutiny Committee | Wards Affected | Reason for Determining in Private Session (if applicable) |
|---|---|---|---|---|---|---|
| | | | | | | |
| Air Quality Implementation Plan | To approve the Air Quality Outline Business Case | Environment and Recycling | Cabinet 9 December 2020 | Economy, Environment and Place | All Wards | N\A |
| Affordable Funerals | To approve an affordable funerals offer | Planning & Growth | Cabinet 9 December 2020 | Finance, Assets & Performance | All Wards | N\A |
| Sustainable Environment Strategy | To approve a sustainable environment strategy for the Council and Borough | Environment & Recycling | Cabinet 9 December 2020 | Economy, Environment and Place | All Wards | N\A |
| Brampton Museum Work | To let a contract in respect of works to the Brampton Museum | Leisure, Culture & Heritage | Cabinet 9 December 2020 | Economy, Environment and Place | All Wards | N\A |
| 2020/21 Draft Savings Proposals | To consider savings proposals for inclusion in the 2020/21 Medium Term Financial Strategy | Finance & Efficiency | Cabinet 9 December 2020 | Finance, Assets & Performance | All Wards | N\A |
| Local Plan Update | To receive an update on the progress of the Local Plan | Planning & Growth | Cabinet 9 December 2020 | Economy, Environment and Place | All Wards | N\A |
| | | | | | | |
| Newcastle BID Ballot | To support a BID Ballot process | Planning & Growth | Cabinet 13 January 2020 | Economy, Environment and Place | All Wards | N\A |
| Draft Revenue & Capital Budget and Strategies 21/22 | To consider proposals for the 2021/22 Revenue & Capital Budget and Strategies | Finance & Efficiency | Cabinet 13 January 2020 | Finance, Assets & Performance | All Wards | N\A |

| | | | | | | |
|---|---|---|---|---|---|---|
| Temporary Accommodation Strategy | To consider adopting a temporary accommodation strategy | Community Safety & Wellbeing | Cabinet 13 January 2020 | Health, Wellbeing & Partnerships | All Wards | N/A |
| Schedule of Fees & Charges 2021/22 | To consider the proposed schedule of fees & charges for 2021/22 | Corporate & Service Improvement, People & Partnerships | Cabinet 13 January 2020 | Finance, Assets & Performance | All Wards | N/A |
| Local Plan Update | To receive an update on the progress of the Local Plan | Planning & Growth | Cabinet 13 January 2020 | Economy, Environment and Place | All Wards | N\A |
| Economic Development Strategy Action Plan | To approve the economic development strategy action plan | Planning & Growth | Cabinet 13 January 2020 | Economy, Environment and Place | All Wards | N\A |
| Newcastle Town Deal | To approve a Town Investment Plan for submission to Government | Corporate & Service Improvement, People & Partnerships | Cabinet 13 January 2020 | Economy, Environment and Place | All Wards | N\A |
| | | | | | | |
| CIL S106 Refresh | To assess the viability of implementing a charging structure on new development in accordance with the Community Infrastructure Levy Regulations and to identify how any funds raised may be utilised. The review will also consider the existing s106 charging system and the overlap between the two methods. | Planning & Growth | Cabinet 3 February 2020 | Economy, Environment and Place | All Wards | N\A |

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|---|---|---|---|---|---|---|
| Self-Build Register | To approve the introduction of a register of land suitable for self-builders | Planning & Growth | Cabinet 3 February 2020 | Economy, Environment and Place | All Wards | N\A |
| Revenue & Capital Budget and Strategies 21/22 | To approve proposals for the 2021/22 Revenue & Capital Budget and Strategies | Finance & Efficiency | Cabinet 3 February 2020 | Finance, Assets & Performance | All Wards | N\A |

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