Broxbourne Borough Council Local NO_2 Plan – Outline Business Case Status Review & Next Steps

Broxbourne Borough Council

Project number: 60563501

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Quality information

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V3.0	2020-11-27	Final incorporating analysis of softer measures	Yes	Siamak Khorgami	Regional Director
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1. Introduction

The A10 PCM Exceedance Stretch

1.1 The Pollution Climate Mapping (PCM) national model identified that Broxbourne Borough Council (BBC) has one road link (Census ID 78365) projected to have an exceedance of the annual mean EU Limit Value of 40µg/m^3 for nitrogen dioxide (NO_2). The road link under consideration is a section of the A10, between its junction with B198 and the slip road leading towards the A1170/ B156 roundabout. The road link is located within the district of Broxbourne but managed by Hertfordshire County Council (HCC).

1.2 Figure 1.1 shows the location of the A10 PCM exceedance stretch. It broadly extends from Turnford Interchange through the junction with Church Lane to the junction with College Road.

Figure 1.1: A10 Exceedance Location in Broxbourne

COVID-19 Caveat

1.3 This document was drafted in November 2020 and the authors note the medium and longer-term impacts of the COVID-19 pandemic are largely unknown. Travel volumes, patterns and behaviours could alter as a result of the pandemic; however this report has been drafted assuming that all previous growth, economic, transport and air quality assumptions remain unchanged as per guidance received.

1.4 Guidance on considering the impacts of COVID-19 was received from the Joint Air Quality Unit (JAQU) on 04 May 2020[1]. It stated: "*Modelling of your future year "with measures" scenarios may be impacted by COVID-19 if there is a change to natural fleet turnover (how the population upgrades their vehicles naturally), traffic patterns or how the population responds to Clean Air Zones. You may have seen reports on the observed reduction in NO2 due to a decrease in road transport usage. Due to the nature of the impact of (and response to) COVID-19 any short-term reduction in measured NO_2 concentrations during 2020 does not necessarily mean future years will see a reduction. To investigate these impacts JAQU are conducting Emissions Factor Toolkit (EFT) analysis[2] and intend to send a further communication on this in mid-May.*

1.5 We are also aware that some LAs have asked about the implications of COVID19 in relation to the economic assessments you are carrying out as part of your plan; we recognise that businesses are already being impacted, and these impacts could be prolonged. As such, we understand that there may be a desire to proactively reflect this in your analysis. However, we would like to caution against work being done on this prematurely. The enduring economic impacts of COVID-19 are not fully understood at present and we do not expect LAs to redo any economic analysis in the light of these uncertainties, and to continue analysis as planned. JAQU will continue to develop our understanding to inform LA plans. Where an authority is seeking to consider economic impacts, again please discuss and agree this with JAQU before proceeding."

Work Undertaken to Date

1.6 Following the PCM modelling, a Targeted Feasibility Study (TFS)[3] was undertaken to:

- Characterise the air quality issue along the A10 PCM exceedance stretch, as identified in the national modelling; and
- Identify measures which could reduce the concentration of NO_2 along the A10 PCM exceedance stretch as quickly as possible, with the principal objective of bringing forward compliance with the statutory annual mean EU Limit Value.

1.7 The TFS report was prepared by BBC with consultancy support provided by Bureau Veritas UK Ltd. The local dispersion modelling results, as identified by the TFS, suggested that NO_2 concentrations were far greater along the PCM exceedance stretch than what was originally predicted by the PCM model. Natural compliance was predicted to be achieved by 2028, in comparison to a natural compliance year of 2019 as predicted by the PCM model. Furthermore, the 2017 and 2018 diffusion tube results (for BB09 and BB28, which are situated along the A10 road link) reported concentrations significantly above those predicted by the PCM model.

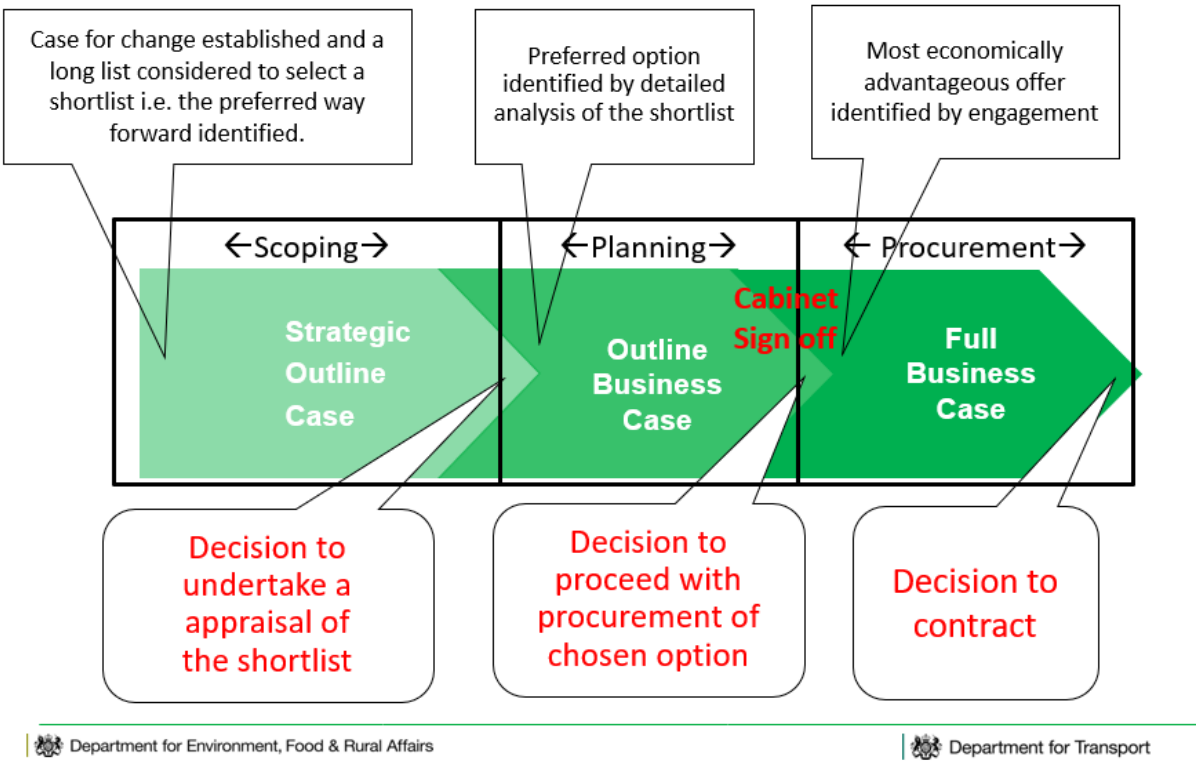
1.8 It was deemed necessary that substantial intervention was necessary to bring forward compliance on the A10 road link. As instructed by the Joint Air Quality Unit (JAQU) a Local NO_2 Plan to identify measures that could bring forward compliance within the shortest possible time was required. Consequently, the Council was identified as one of eight 'third wave' Local Authorities that have more persistent long term exceedances, therefore being required under Ministerial Direction to develop a Local NO_2 Plan to identify specific measures that could bring forwards compliance within the shortest possible time.

1.9 In late 2018 the project team broadened to include AECOM and Eunomia. AECOM have provided the transport scheme optioneering and modelling, whilst Eunomia have led the

[1] Email from Olawale Ladapo at JAQU
[2] Not available yet
[3] Targeted Feasibility Study to deliver Nitrogen Dioxide concentration compliance in the shortest possible time. Prepared by the Council with consultancy support provided by Bureau Veritas UK Ltd.

economic assessment of the schemes proposed. Following completion of the TFS, the project started to progress through the phases of Business Case submission as outlined in Figure 1.2. A Strategic Outline Case was submitted in early 2019 with the Outline Business Case submitted in October 2019 and extended and re-submitted in June 2020.

Figure 1.2: Department for Environment, Food & Rural Affairs / Department for Transport Business Case Guidance Flow Chart[4]



Scheme Identification Background

1.10 During the preparation of the Strategic Outline Case, HCC and BBC advised that non-charging schemes were preferred. These were deemed to be more acceptable publicly, politically and implementation-wise by the Council. However, when reviewed by JAQU, they advised that a more significant measure would be required to bring forward compliance and creating a Clean Air Zone (CAZ) with charges for non-compliant vehicles should be prioritised.

1.11 The Outline Business Case focussed on a non-charging option which included a speed reduction along the A10 with enhanced bus services serving neighbouring areas and five CAZ options (see Section 4.4 for outline details). Full details and results can be found in the transport modelling, air quality and economic impact reports in Huddle. As expected, the results of any type of scheme on the A10 (a dual A-road approaching the M25) resulted in re-routeing and the displacement of some traffic onto adjacent or parallel routes.

Ministerial Direction – May 2020

1.12 Revised Ministerial Direction[5] was received in May 2020 which confirmed that "*There is often a risk that a scheme to reduce NO_2 levels on a targeted area will have wider implications for surrounding areas, and this is something we have collectively recognised from the outset of our work with you considering the nature of the A10. However, it is a key criteria for local plan development that any scheme does not result in an unacceptable level of increase in NO_2 elsewhere, particularly where there is the possibility this could result in the creation of new*

[4] Presentation slide provided by JAQU on a Webinar held on 10 December 2018
[5] Letter sent by Ms Rebecca Row MP Parliamentary Under Secretary of State on 6 May 2020 to Broxbourne Borough Council

exceedances. The evidence you have provided is sufficient to now conclude that there is an unacceptable risk of this occurring as a result of your proposals."

1.13 Wider clarification from JAQU was sought which confirmed that any scheme proposed could not result in a deterioration of air quality (to any degree) on any road. As such, any scheme which would result in traffic diverting on to other roads should not be considered.

1.14 A number of the non-charging and CAZ schemes that were originally proposed and assessed found that these schemes would improve air quality along the corridor, however these schemes have been discounted as they induce traffic re-routeing on to other roads and do not comply with the Ministerial Direction received.

1.15 JAQU have therefore confirmed that the project team should stop work on these measures and instead begin to consider alternative non-charging measures that can bring forward compliance in the shortest possible time (without the type of unintended traffic diversion consequences discussed above). The project team were requested to deliver a revised Outline Business Case by 31 October 2020. These timescales severely limit the scope of work which can be undertaken.

1.16 In order to comply with the Ministerial Direction the project team started to focus on schemes which will reduce NO_2 levels on the A10 but won't divert vehicular traffic on to other roads.

Purpose of This Document

1.17 Stakeholders including HCC, BBC, AECOM, Eunomia and Bureau Veritas UK have been working collaboratively to examine options to address the air quality on the A10 in Broxbourne since October 2018. A significant amount of work has been performed and knowledge gathered about the A10 corridor and its users including those with high emission vehicles who should be targeted in order to improve air quality and bring forward NO_2 compliancy.

1.18 This document reiterates and presents the current challenges of reducing NO_2 on the A10 exceedance stretch including fleet composition and level of traffic demand. Data from the automatic number plate recognition (ANPR) surveys undertaken and transport modelling confirms who the users of the A10 corridor are that need to be targeted for an optimum reduction in NO_2 levels.

1.19 Interdependencies with other schemes are outlined and constraints highlighted. The new Critical Success Factors (CSFs) for the scheme are confirmed considering the Ministerial Direction.

1.20 Finally, measures which would meet the Ministerial Direction are assessed considering the previous sections in order to focus decision-makers on how the project should proceed.

2. The Existing & Future Situation

2.1 This section highlights the A10 PCM study area and the characteristics of vehicles movements on the A10. The current issues and movements are highlighted which helps focus the narrative on the types of movements which must be targeted by any scheme looking to address air quality.

The A10 Study Area

2.2 The A10 is a strategic corridor for north south movements and connects the City of London to the M11 motorway at Junction 11 south of Cambridge. The road travels through Inner and Outer London Boroughs, Hertfordshire and Cambridgeshire.

2.3 The road is a relatively free flowing dual carriageway interjected by roundabout junctions with key arterial A roads north of Broxbourne. Entering Broxbourne and travelling southbound towards London the traffic signalised junction with Church Lane is the first junction where vehicles may expect to experience congestion. There are further traffic signal and roundabout junctions approaching the A10/M25 junction 25 junction. Congestion and delays are expected in this area due to the nature of the road and at-grade junctions along it.

2.4 Whilst the A10 is a strategic route, it should be noted that the A1(M) and M11 running parallel to the A10 offer a quicker route for strategic journeys. Due to grade-separated junctions and higher speed limits (under normal traffic conditions) these routes would be preferred for journeys without origins or destinations along the A10 corridor.

Current Traffic Conditions

2.5 Figure 2.1 and Figure 2.2 highlight typical traffic conditions (pre COVID-19) on the exceedance stretch and further north on the A10. These highlight that the PCM exceedance stretch experiences congestion and delays as the junctions reduce traffic speeds along the A10.

Figure 2.1: Typical Traffic Conditions on the A10 – AM Peak (Source: Google Maps, copyright Google 2019)

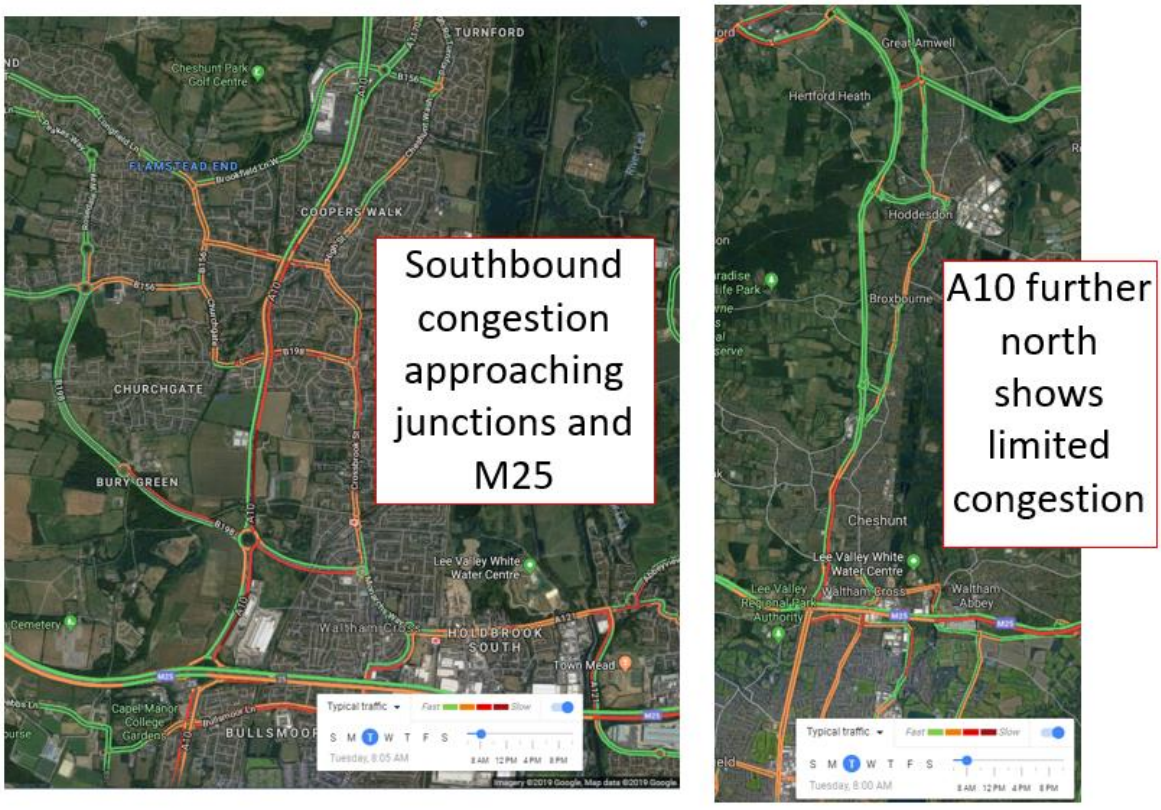
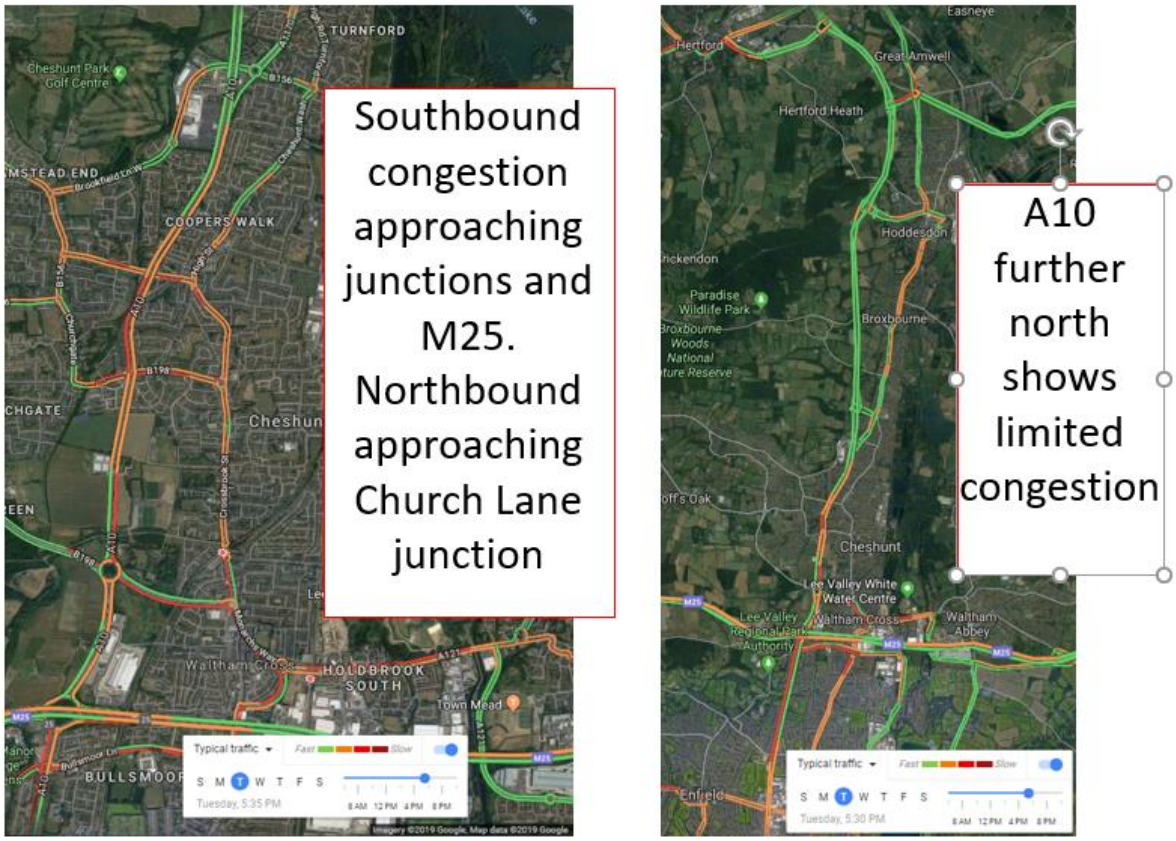


Figure 2.2: Typical Traffic Conditions on the A10 – PM Peak (Source: Google Maps, copyright Google 2019))



2.6 Journey time reliability along the A10 corridor is poor particularly in AM and PM Peak hours. Sample analysis using Google Maps identified 20 – 30 minute variations in north-south journey times. Examples include:

- Broxbourne to Enfield in the AM peak ranged between 20 and 40 minutes and identified 3 different route options;
- Great Amwell to Enfield in the AM peak ranged between 30 and 55 minutes and identified 2 different route options; and
- Great Amwell to South Mimms in the AM peak ranged between 30 and 50 minutes and identified 3 route options.

2.7 These journey time variations and the congestion plots highlight there is a high demand for movements in this corridor and delays/congestion are common-place. This helps explain the poor air quality results recorded.

ANPR Data Summary

2.8 Automatic Number Plate Recognition (ANPR) surveys[6] were undertaken in BBC for a week in May 2019 to help support the project. The ANPR survey served 3 main purposes:

- To understand the current vehicle fleet on the A10 exceedance stretch to determine how many vehicles may be impacted by an environmental charge (linked to vehicle pollution euro-classification);
- To understand if assumptions regarding the number of compliant vehicles in the current vehicle fleet were correct. Due to the natural upgrade of the vehicle fleet, new cars are more environmentally friendly than older vehicles; and

[6] Full details in the *Broxbourne Borough Council Local NO_2 Plan ANPR Survey Technical Note – Technical Annex to T3* issued by AECOM on 12 August 2019

- To understand vehicle movements in the local area of the A10 exceedance stretch and determine the number of local and strategic movements. This would form an important input to the Strategic Case for any scheme proposed.

2.9 The ANPR survey revealed that the fleet of vehicles on the A10 passing through and around the exceedance stretch was older than the national average. Table 2.1 highlights the fleet composition compared to 2019 national figures sourced from the Emissions Factor Toolkit v9.1a (consistent with the National Atmospheric Emissions Inventory (NAEI)).

Table 2.1: Vehicle Fleet Composition on/around the A10 Exceedance Stretch – all ANPR Sites (national figures in brackets)

Category	Vehicle Type	Percentage of total vehicles recorded
Compliant	Car – Petrol	37.9% (43.1%)
Compliant	Car – Diesel	12.2% (16.2%)
Compliant	LGV	5.3% (8.6%)
Compliant	HGV	2.2% (1.1%)
Compliant	Total	57.6% (69%)
Non - Compliant	Car – Petrol	6.6% (2.1%)
Non - Compliant	Car – Diesel	19.9% (17%)
Non - Compliant	LGV	10.6% (7%)
Non - Compliant	HGV	1.1% (0.3%)
Non - Compliant	Total	38.2% (26.4%)
Unknown / Other	Total	4.2% (2.8%)

2.10 Table 2.1 highlights that compared to national figures, the data in Broxbourne identified:

- The percentage of compliant petrol cars is lower than national estimations, whilst the percentage of non-compliant diesel and petrol cars are higher than national estimations;
- There are fewer compliant diesel cars and LGVs;
- There is a greater proportion of compliant HGVs; and
- There are a greater proportion of non-compliant LGVs, HGVs and unknown/other vehicles.

2.11 Postcode data of vehicles recorded by the ANPR cameras was analysed. For the purposes of this report, the postcode has been assumed to be the home or business address of the vehicles recorded by the cameras, i.e. the origin.

2.12 The data for car users highlighted in Figure 2.3 illustrated that most cars were registered to addresses along the A10 corridor and were bounded by the parallel A1(M) and M11 motorways. The data also highlighted that there are a lot of local users of the A10 with the greatest concentration of postcodes recorded in Broxbourne, East Herts and Welwyn & Hatfield Districts which is to be expected. There are also origins in neighbouring West Essex, Harlow, Epping and Enfield. North of Hertfordshire, origins near Milton Keynes, Bedford and Cambridge were also observed. It is clear the issue of poor air quality is recorded in Broxbourne but generated by vehicles registered in all the surrounding counties/boroughs.

2.13 The data also highlighted there was limited interaction with locations in west Hertfordshire such as Hemel Hempstead, Watford and St Albans. Most origins outside of Hertfordshire were from North London, Enfield, Epping and Harlow.

Figure 2.3: Postcodes of cars recorded by the ANPR survey

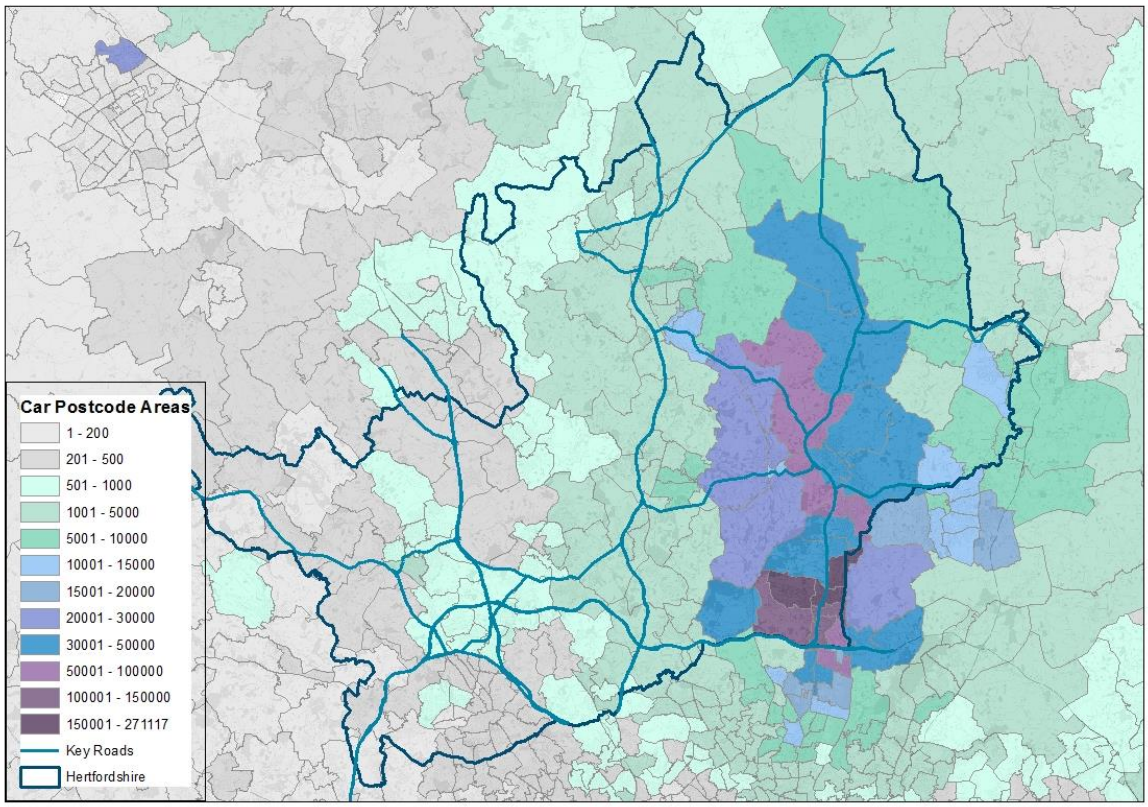
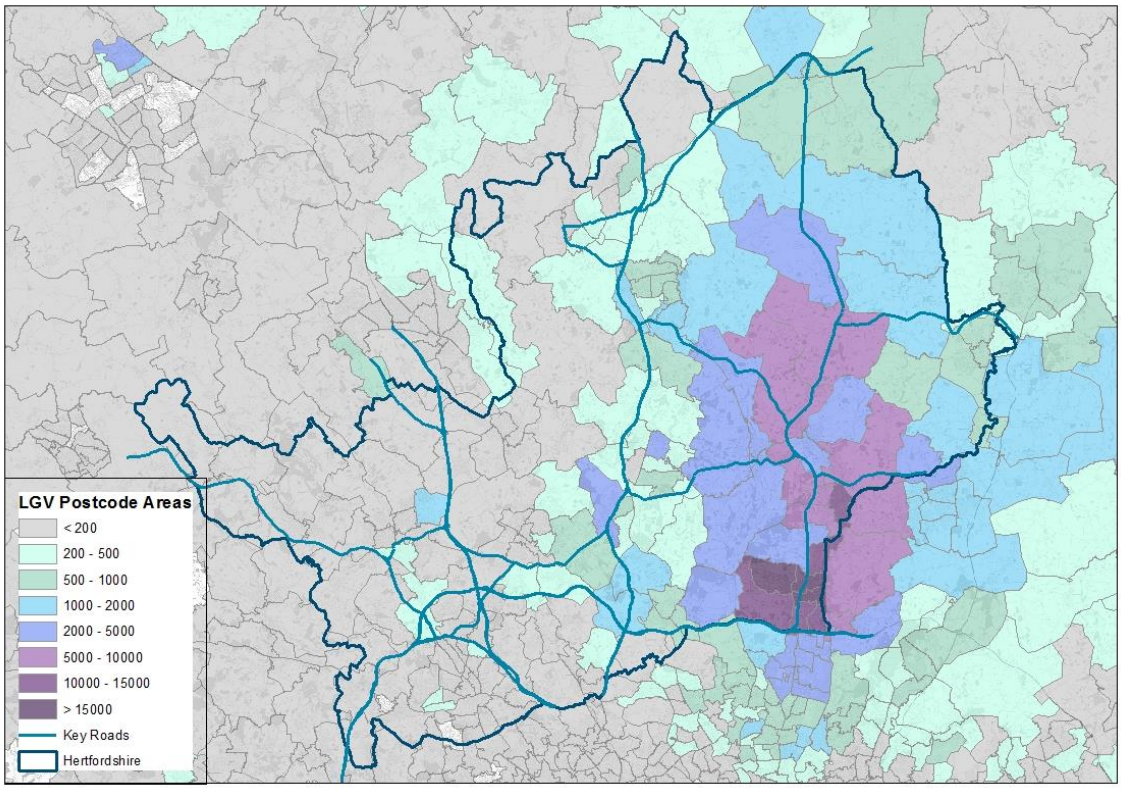


Figure 2.4: Postcodes of LGVs recorded by the ANPR survey



2.14 Figure 2.4 highlights that similar to cars, there were a lot of LGVs registered in Broxbourne, East Herts and Welwyn & Hatfield Districts. There were also origins in neighbouring west Essex, Harlow, Epping and Enfield. North of Hertfordshire, near Milton Keynes, Bedford and Cambridge.

2.15 Generally, car trips are more strategic with approximately two-thirds of traffic passing through the A10 corridor, and all show an interaction with the A10 and M25 north/south of the PCM exceedance stretch These results help confirm that for most users, the A10 is the most direct route between origins and destinations. A10 demand management schemes would very likely result in displacement of traffic on to other routes (unless attractive alternatives by other modes were provided) and this would be unacceptable as degreed in the Ministerial Direction.

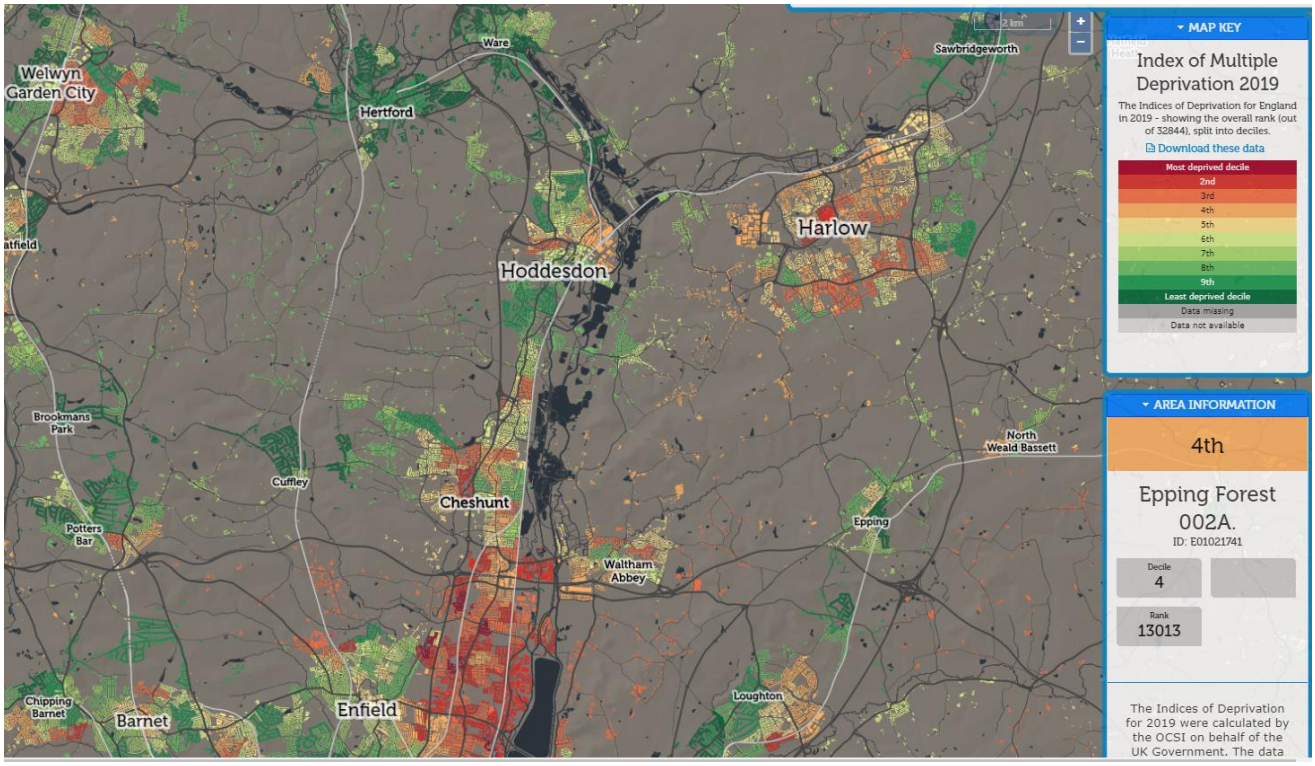
2.16 Similarly, the ANPR results indicate the greatest impacts of demand management schemes would be incurred by residents/business owners of Broxbourne and the surrounding area, however impacts extend into north London boroughs and Essex. The air quality issues in Broxbourne are not just a Hertfordshire issue.

2.17 Origins of HGVs in the study area are more dispersed but follow a similar pattern to LGVs.

2.18 Routeing/trip pattern information gathered by the ANPR surveys confirmed that the A10 through the exceedance stretch is primarily used for north-south movements. Junctions around the exceedance stretch (Church Road/College Lane) are used to access Cheshunt town centre, retail areas or the stations; however the large majority is through traffic. Traffic originating or travelling to the intermediate or outer areas does not tend to use the A10 and utilises local roads to travel around the exceedance stretch and join at junctions north and south of the study area. This is to be expected given the A10 experiences congestion at junctions along its length which aren't grade separated.

2.19 The fleet composition results from the ANPR surveys are supported by the Index of Multiple Deprivation data for BBC and surrounding. As levels of deprivation are partly informed by income, this will link to the cost, age and therefore environmental standards of vehicles households in the study area will run. It is an assumption that poorer households will have less disposable income to spend on their vehicle therefore will own cheaper, older, more polluting vehicles.

Figure 2.5: A10 Study Area Index of Multiple Deprivation 2019 (Source: Consumer Data Research Centre Maps[7])



[7] https://maps.cdrc.ac.uk/#/geodemographics/imde2019/default/BTTTFFT/12/-0.0449/51.7296/ accessed on 17 June 2020

2.20 Comparing Figure 2.3, Figure 2.4 and Figure 2.5 and Table 2.1 it can be recognised that many of the users of the A10 originate from areas with low levels of Multiple Deprivation. This helps inform the fleet results observed in Table 2.1.

COMET Transport Modelling and Natural Compliance

2.21 To forecast the influence of different transport policy measures, assess their impact on the transport network, and consequently on emissions and air quality, the Hertfordshire Countywide Model of Transport (COMET) has been used. This model suite has been enhanced to improve the representation of traffic flows at and in the vicinity of the identified exceedance section, to produce the necessary inputs required by emission and air quality modelling, and to better represent the packages of measures that will be assessed to meet the study aims. Full details of the modelling work undertaken are contained in the T2, T3 and T4 reports available on Huddle.

2.22 Outputs from the COMET transport modelling informed the air quality modelling (all reports also available on Huddle). A series of “Baseline” (i.e. do-nothing) scenarios were created to assess the impact. Committed schemes not linked to this project were included, however the major impact on the A10 corridor would be the rate at which the fleet is renewed as owners upgrade their vehicles to newer, more environmentally-friendly vehicles.

2.23 Results from the Baseline scenarios confirmed that an expected compliance would be achieved in 2025. It is worth re-iterating the impact of COVID-19 on these assumptions is currently unknown.

Defining the Scale of Change Required

2.24 JAQU guidance states that measures should only be implemented if they can bring forward compliance by 12 months or more. A high level investigation into the scale of change required was carried out using the air quality modelling outputs. The vehicle flow and composition was adjusted on the road links modelled within the PCM exceedance stretch to ascertain the level of change that was required to bring forward compliance. The assessment estimated the minimum reduction in Annual Average Daily Traffic (AADT) required to bring forwards compliance at the worst case receptor (BB28), and whether this would be realistically achievable.

A fixed reduction has been applied to each vehicle type (Car, LGV, HGV) as well as a fixed percentage reduction in the total AADT flow on the A10 PCM exceedance stretch, covering all vehicle types. The vehicle emissions were recalculated using the Emissions Factor Toolkit (V9.1.a) and the dispersion model reran with the updated flows for the years 2022, 2023 and 2024. A comparison of the predicted annual mean NO_2 concentrations for each year as well as the reduction when compared to the baseline concentrations are shown in Table 2.2. The NO_x emissions near to BB28, the worst case receptor, as a result of these reductions are presented in **Table 2.2**
Notes:

Reductions carried out are not step-wise, and therefore the results shown are for a direct reduction of the raw AADT for that year.

2.25 Table 2.3.

Table 2.2 – High Level Investigation to Quantify the Reduction of Vehicles Required to Bring Forwards Compliance

Year	Baseline NO_2 Concentration ($\mu g/m^3$) at BB28	Vehicle Type	Reduction Amount per Road Link (AADT)	Annual Mean NO_2 Concentration ($\mu g/m^3$)	Annual Mean NO_2 Difference to Baseline ($\mu g/m^3$)
2022	48.4	Car (Petrol & Diesel)	-10000 (55%)	41.8	-6.6
2022	48.4	LGV	-2000 (62%)	44.2	-4.2
2022	48.4	HGV	-2000 (75%)	41.7	-6.7

Year	Baseline NO_2 Concentration ($\mu g/m^3$) at BB28	Vehicle Type	Reduction Amount per Road Link (AADT)	Annual Mean NO_2 Concentration ($\mu g/m^3$)	Annual Mean NO_2 Difference to Baseline ($\mu g/m^3$)
2022	48.4	Total Flow	-7696 (30%)	39.8	-8.6
2023	45.6	Car (Petrol & Diesel)	-8000 (45%)	40.6	-5.0
2023	45.6	LGV	-2500 (77%)	40.6	-5.0
2023	45.6	HGV	-2000 (76%)	39.5	-6.1
2023	45.6	Total Flow	-5125 (20%)	40.3	-5.3
2024	42.6	Car (Petrol & Diesel)	-4000 (23%)	40.3	-2.3
2024	42.6	LGV	-2000 (61%)	39.0	-3.6
2024	42.6	HGV	-850 (33%)	40.3	-2.3
2024	42.6	Total Flow	-2587 (10%)	40.2	-2.4

Table 2.2 Notes:

Reductions carried out are not step-wise, and therefore the results shown are for a direct reduction of the raw AADT for that year.

Table 2.3 – NO_x Emissions at BB28 Following Reduction in AADT

Year	Vehicle Type AADT Reduction	Bassline NO_x Emissions at BB28 (g/km/s)	NO_x Emissions Post Reduction at BB28 (g/km/s)	Reduction in NO_x Emissions (g/km/s)	Percentage Difference in NO_x Emissions
2022	Car (Petrol & Diesel)	0.11	0.06	-0.06	-51%
2022	LGV	0.06	0.02	-0.04	-64%
2022	HGV	0.09	0.02	-0.07	-76%
2022	Total Flow	0.26	0.18	-0.08	-30%
2023	Car (Petrol & Diesel)	0.11	0.06	-0.04	-41%
2023	LGV	0.05	0.01	-0.04	-79%
2023	HGV	0.08	0.02	-0.06	-77%
2023	Total Flow	0.24	0.19	-0.05	-20%
2024	Car (Petrol & Diesel)	0.10	0.08	-0.02	-21%
2024	LGV	0.05	0.02	-0.03	-63%
2024	HGV	0.07	0.05	-0.02	-33%
2024	Total Flow	0.22	0.20	-0.02	-10%

Table 2.3 Notes:

Emissions are the sum of the calculated NO_x from northbound road links (source ID 4606), and the southbound road link (source ID 4595) nearest to BB28. BB28 is located between two southbound road links (source IDs 4738 and 4595), which have differing speeds. Source ID 4738 has a speed of 45.2kph, whereas 4595 has a speed of 20kph. Source ID 4595 was selected as a worst case scenario.

2.26 The assessment identified that a significant reduction in AADT would be required in order to bring forwards compliance by 12 months. At minimum, a measure that would focus on an individual vehicle category would require approximately 23% of Cars, 61% of LGVs or 33% of HGVs to be removed in 2024 to achieve compliance. If a measure was implemented to reduce overall traffic flow, a 30% reduction (approximately 7600 vehicles) in 2022 would be required, a 20% reduction (approximately 5100 vehicles) in 2023 would be required, and a 10% reduction (approximately 2500 vehicles) in 2024 would be required. Due to the scale of reductions required in total vehicle flow, it is unlikely to be achievable in the time frames given to implement a successful measure.

Section Summary

2.27 The key elements highlighted in this section are:

1. The A10 is a key strategic route through Broxbourne. It connects wider towns in Hertfordshire to the M25 and beyond. The issue is not just generated by Hertfordshire residents; however they would be impacted greatest by any scheme;
2. Delays and congestion exist along the PCM exceedance stretch as it is the first incidence of at-grade junctions approaching/leaving London/the M25. Rat-running and re-routeing currently exist due to these delays, varying journey times and limited parallel routes;
3. The vehicle fleet composition on and around the exceedance stretch is lower than national expectations – this is expected when viewing economic considerations around the study area and confirms the scale of intervention would have to be significant; and
4. A significant amount of traffic would have to be removed from the A10 just to bring compliance forward by one year.

3. Wider Scheme Constraints/Issues

3.1 Having defined the characteristics of the A10 corridor and users of the road, this section outlines the key scheme constraints and conflicts in the local/wider area which need to be considered when examining scheme options.

M25 Junction 25

3.2 South of the exceedance stretch the A10 intersects with the M25 at junction 25. Highways England have been working to implement an upgrade scheme at junction 25 since 2017. This will involve the signalisation of all arms and providing additional capacity. In addition they propose to install a free flowing left turn filter from the eastbound M25 onto the A10 northbound towards the exceedance stretch. Localised widening will also enhance capacity leading to and from the junction.

3.3 This scheme is a committed scheme with funding of up to £50M confirmed. The implementation date of this scheme has the potential to slip further into the future and it is currently scheduled to be complete by Sept 2022, however, these programme delivery dates are yet to be agreed with HCC Network Management, so currently remain in draft. Guidance from JAQU has stipulated that any air quality scheme requiring works on street cannot be started until the junction 25 works are complete. As works should only be considered if they bring forward compliance by a minimum of at least a year (i.e. to 2024 or earlier) the timeframe for implementing any scheme on street is minimal.

3.4 Any scheme to address air quality on the exceedance stretch would require the reduction of flows on the A10. This requirement conflicts with the Junction 25 upgrade scheme which provides additional capacity at the junction and to and from the A10. This could attract additional traffic along the A10 corridor.

HCC Major Road Network (MRN) Bid

3.5 Separately to this JAQU project, The A10 /Church Lane, A10 / College Road and A10 /Lieutenant Ellis Way junctions in Broxbourne/Cheshunt have been identified as key congestion hotspots and a constraint to future planned growth in the Broxbourne area. The A10 / Church Lane and A10 / College Road junctions are within the exceedance stretch.

3.6 Design reviews and modelling work have been undertaken and a preferred design option has been investigated for each of the locations with indicative costs and land take requirements. Each preferred scheme option looks to enhance capacity leading to or through the exceedance stretch. The junction schemes and supporting measures were submitted to England Economic Heartland (EEH) as an application for the Major Road Network (MRN) fund. The application was assessed using a Multi Criteria Assessment Framework against EEH priorities and the MRN objectives and was subsequently shortlisted by the EEH for submission to the DfT.

3.7 HCC are now progressing with a Strategic Outline Business Case (SOBC) to support their MRN bid proposals at the 3 junctions. The SOBC is still being drafted and an agreed submission date with DfT is soon to be agreed. It is likely to not be until February/March 2021. A decision as to funding or progression to next stage of the bid process will be made by the department once the SOBC has been submitted.

3.8 It can be recognised that these schemes in conjunction with the M25 junction 25 scheme conflict with the short-term requirements to improve air quality along the A10 by removing traffic. These schemes (if implemented) would attract more traffic to the corridor as delays and congestion would be reduced.

3.9 The combined schemes would also impact the public perception of what the A10 corridor should be used for. The highways schemes not linked to the JAQU project are seeking to address the current issues by improving capacity. However, providing more capacity would adversely impact air quality as more vehicles would be attracted to the corridor. Similarly,

implementing road works on the same stretch of road over many years would generate local frustration and negative publicity.

London Ultra Low Emission Zone (ULEZ)

3.10 The London ULEZ is due to expand to an area bounded by the north and south circular (A205/A406) corridors in October 2021[8]. The A10 connects to the A406 North Circular Road approximately 10 kilometres south of the exceedance stretch. Some vehicular traffic on the A10 in the study area will route to/from south of the A406 North Circular Road (i.e. into the area the ULEZ will expand into).

3.11 The project team believes that the expansion of the ULEZ in 2021 will lead to improvements in air quality as vehicles travelling on arterial routes towards/from the North Circular (i.e. A10) and beyond would consider upgrading their vehicle rather than paying a daily ULEZ charge. This is also evident from the information shared by TfL on their highway modelling for LEZ/ULEZ (September 2020) which considers that by 2021 all the HGV demand on the A10 is LEZ compliant. It also shows an increase in the proportion of compliant LGVs on the A10 in all the modelled years.

3.12 Due to time constraints, an in-depth analysis of the impact of the ULEZ expansion on traffic travelling along the A10 could not be undertaken. However, the transport model has shown that in 2018 8.6% of the total vehicle flows travelling southbound towards London along the A10 from Junction 25 (the edge of the model domain) were HGVs. We expect that a large proportion of these will become compliant in response to the ULEZ expansion. This will not bring forward compliance on its own, however when combined with a speed limit reduction it could reduce concentrations along the A10. Nonetheless, it is difficult to quantify this without further modelling and a speed limit reduction has already been discounted due to the impact of rerouting on neighbouring roads.

Timescales

3.13 As detailed in the previous section, JAQU guidance states that measures should only be implemented if they can bring forward compliance from 2025. As natural compliance is assumed to occur in 2025, measures would have to, as a minimum, bring compliance forward to 2024. This is due to compliance of NO_2 concentrations being reported as an annual average, therefore in order to bring forwards compliance the latest possible would be by 2024. Mid-year concentrations cannot be accurately estimated due to constraints associated with temporal resolution of the required modelling inputs.

3.14 As mentioned in Section 3.3, guidance from JAQU has stipulated that any air quality scheme requiring works on street cannot be started until the Junction 25 works are complete. The programme for this scheme has slipped to 2023 and it is feasible it could slip further, constraining any opportunity to implement civil/physical scheme(s) on street to address air quality.

3.15 Should the MRN funding be approved there is a very large risk that two schemes with conflicting objectives could be scheduled on the exceedance stretch during the same timescale.

Conflicting Project Guidance

3.16 Following submission of the Strategic Outline Case, BBC were encouraged by JAQU to progress a charging scheme as their preferred option. This conflicted with the Council's preferred option of non-charging and softer measures as it was felt these would be more politically acceptable.

[8] https://tfl.gov.uk/modes/driving/ultra-low-emission-zone/ulez-where-and-when#:~:text=ULEZ%20expansion%20%2D%20October%202021,or%20pay%20a%20daily%20charge. Accessed on 15 June 2020

3.17 The Ministerial Direction received in May 2020 conflicts with the advice provided by JAQU after the Strategic Outline Case submission. This becomes even more restrictive when the conflicting schemes and their timescales as detailed in this section are considered.

3.18 The project team have liaised with other JAQU (first and second wave) authorities in order to gain insight and knowledge from previous schemes looking to address air quality exceedances. A similar exceedance stretch was recorded on the A127 in Essex. It was noted from Essex's previous Strategic Outline Case submission to JAQU that:

"Whereas Charging CAZs can be effectively implemented in urban areas as these represent a 'destination' to which all traffic movements can be managed; a Charging CAZ cannot be effectively implemented on areas of linear non-likely compliance, such as the Basildon and Rochford links (A127), which provides a through-route for traffic, as traffic will simply switch to alternative parallel routes and potentially move non-likely compliance to other locations."

3.19 The project team feel the same limitations apply to the A10 exceedance stretch and the lessons learnt from previous JAQU studies should be carefully considered for the A10 in Broxbourne.

Section Summary

3.20 The key elements highlighted in this section are:

1. The M25 junction 25 scheme will attract more traffic to the corridor and severely limits the timeframe for any physical/civil schemes on street;
2. The MRN bid proposals will attract more traffic to the corridor and timeframes will probably conflict with any scheme to improve air quality;
3. The project team believes that the expansion of the ULEZ in 2021 will lead to improvements in air quality along the A10. This is supported by information shared by TfL; and
4. Traffic re-routeing due to CAZ proposals is an anticipated affect and it is disappointing a lot of work was undertaken before the Ministerial Direction was received.

4. Previous Scheme Options

4.1 Having defined the users on the exceedance stretch, their requirements and wider conflicting scheme interdependencies, this section summarises the schemes assessed to date and the results. (All modelling and results were undertaken prior to the Ministerial Direction received in May 2020).

4.2 Wider, more ambitious schemes which would help improve air quality but could not be progressed are detailed. The reasons why they could not progress are outlined to provide reassurances to JAQU that all possible options have been considered.

Major Schemes Discounted

4.3 Several major schemes were discounted at the Strategic Outline Case stage. It was acknowledged these schemes could contribute to improving air quality in the exceedance stretch, however all were discounted due to the following reasons:

- Closing the at-grade junctions at the Church Lane / College Road junctions with the A10. These were discounted as traffic would still need to cross the A10 which would place increased pressure on other routes, generate significant re-routeing and significantly increase severance generated by the A10;
- Provide grade separated junctions at the Church Lane / College Road junctions with the A10. These were discounted due to the considerable cost involved, possible land take and increased severance which would be generated; and
- Increase the frequency of parallel rail services or lobby for new rail routes. These were discounted due to the considerable timeframes and cost involved in negotiating changes to rail patterns. There are also very limited options to change rail services once franchises are agreed.

Summary of Modelling Undertaken to Date

4.4 Scheme options modelled to date[9] include:

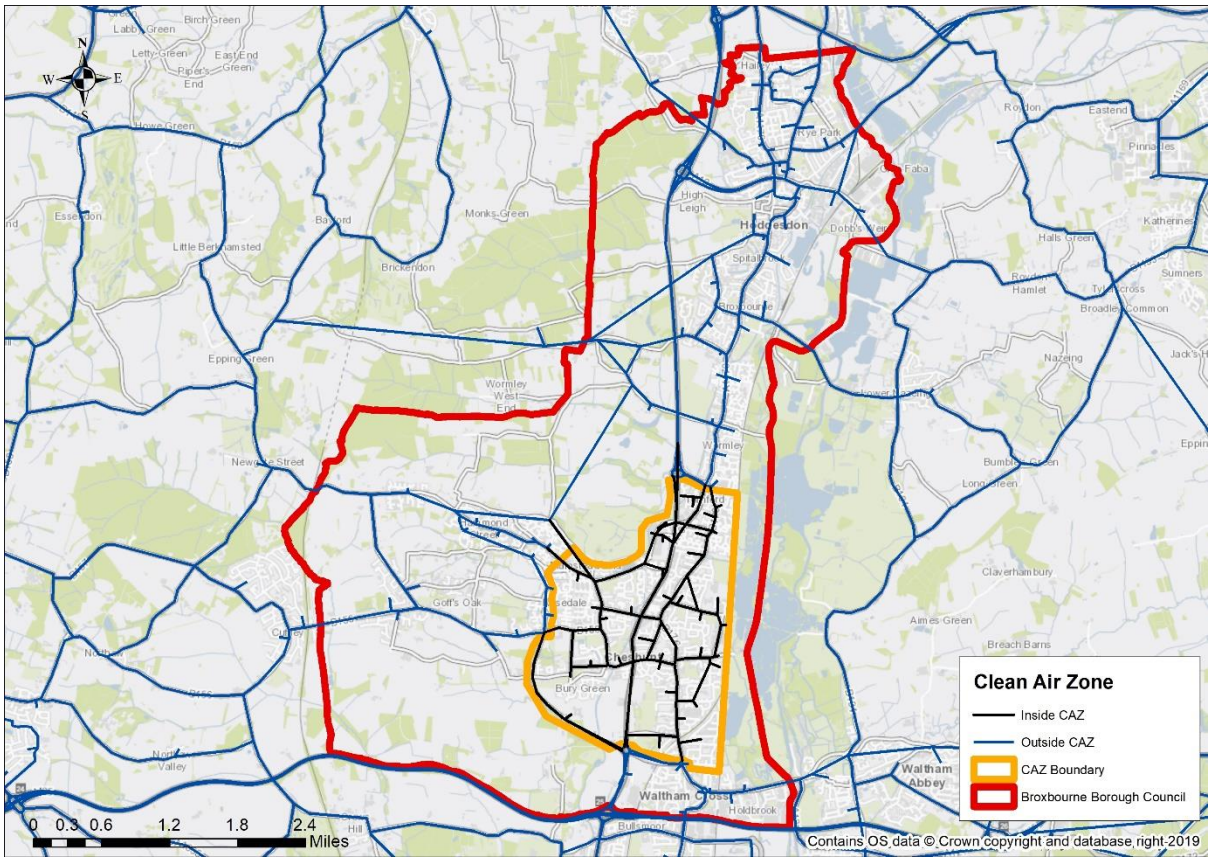
- **Non-charging:** The Non-charging Option is a package of measures represented in a single option designed to reduce private vehicular traffic using the A10. The measures represented in the model include the following interventions: speed reduction to 40 MPH on the A10 between the A414 and the M25, use of signals to 'gate' traffic away from the A10, new public transport services and re-design of signalised junction at Church Lane.
- **CAZ-D(1) (larger exemption area):** This charging option is a Class D CAZ and any non-compliant vehicles crossing a defined cordon (see Figure 4.1) is subject to a charge unless it is subject to either the vehicle exemption or area exemption. The area exemption covers the BBC area and applies to residents and business registered in BBC.
- **Combined:** The Combined Option is an option that combined the Non-charging measures in combination with CAZ-D(1).
- **CAZ-D(2) (smaller exemption area):** This charging option is a Class D CAZ and any non-compliant vehicles crossing a defined cordon is subject to a charge unless it is subject to either the vehicle exemption or area exemption. The exemption area covers the CAZ charging boundary and applies to residents and business registered inside the CAZ.
- **CAZ-C(1) (larger exemption area):** This charging Option is a Class C CAZ and any non-compliant LGVs or HGVs crossing the CAZ boundary is subject to a charge unless the area exemption applies. The area exemption covers BBC and applies to residents and business registered in BBC.

[9] Full details contained in the *Broxbourne Borough Council Local NO2 Plan- COMET-A10 Application, T4 - Transport Model Forecasting Report* issued by AECOM in February 2020

- **CAZ-C(2) (smaller exemption area):** This charging Option is a Class C CAZ and any non-compliant LGVs or HGVs crossing the CAZ boundary is subject to a charge unless the area exemption applies. The area exemption includes the CAZ charging boundary and applies to residents and business registered in BBC.

4.5 Figure 4.1 details the boundaries of the modelling scenarios assessed.

Figure 4.1: Scheme Options CAZ Boundaries



4.6 The following figures illustrate the results observed across the model scenarios. Whilst each scenario generated marginally different results, the results could be grouped into 2 categories:

1. The scenarios generate significant re-routeing which conflicts with the Ministerial Direction; or
2. Impacts were not significant enough to meaningfully improve air quality along the exceedance stretch and bring compliance forward.

4.7 Figure 4.2 details the flow differences in the non-charge option compared to the Baseline. Blue represents flow decrease and green a flow increase. It can be recognised there is a significant flow reduction on the exceedance stretch, however traffic reroutes onto parallel routes. Similarly Figure 4.3 details the flow differences from the CAZ D(2) option compared to the Baseline. The impacts are much less, however re-routeing still occurs.

Figure 4.2: 2026 Non-charge option compared with 2026 Baseline (AM peak)

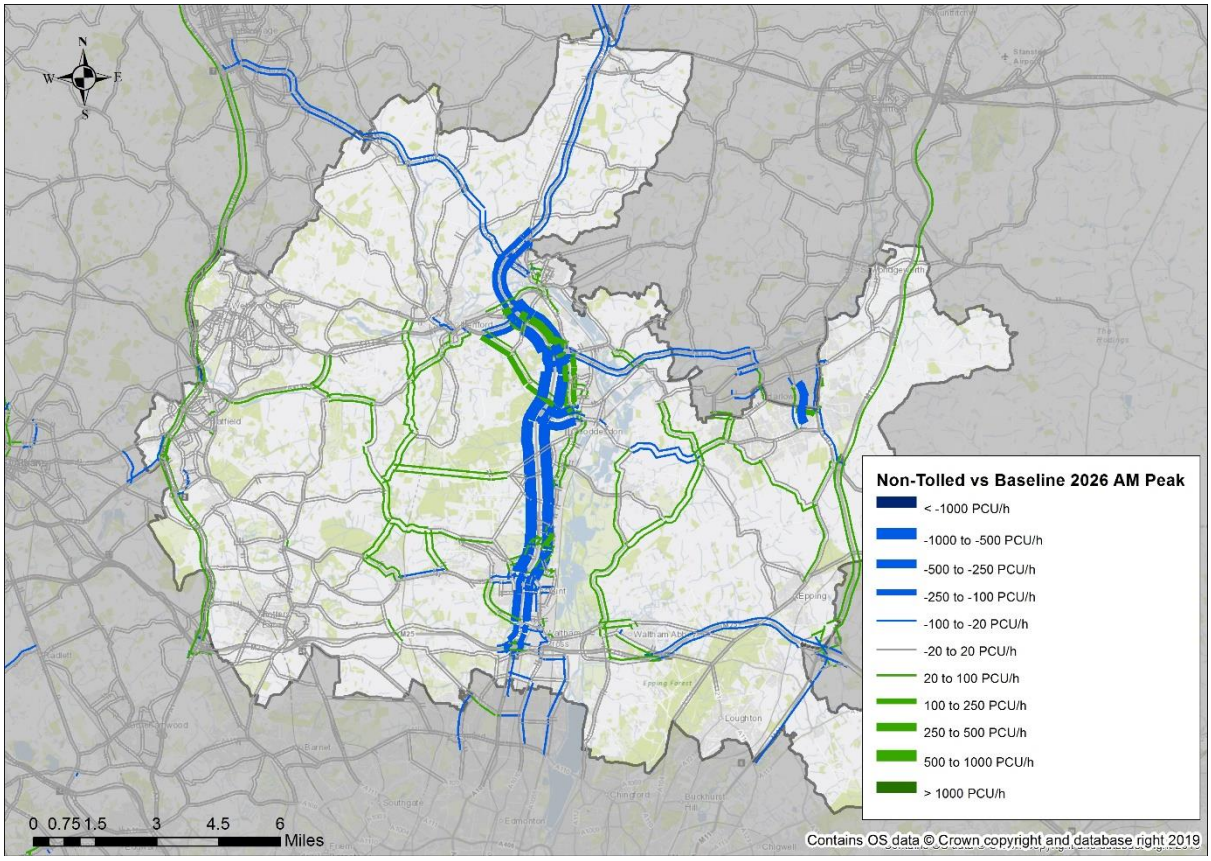
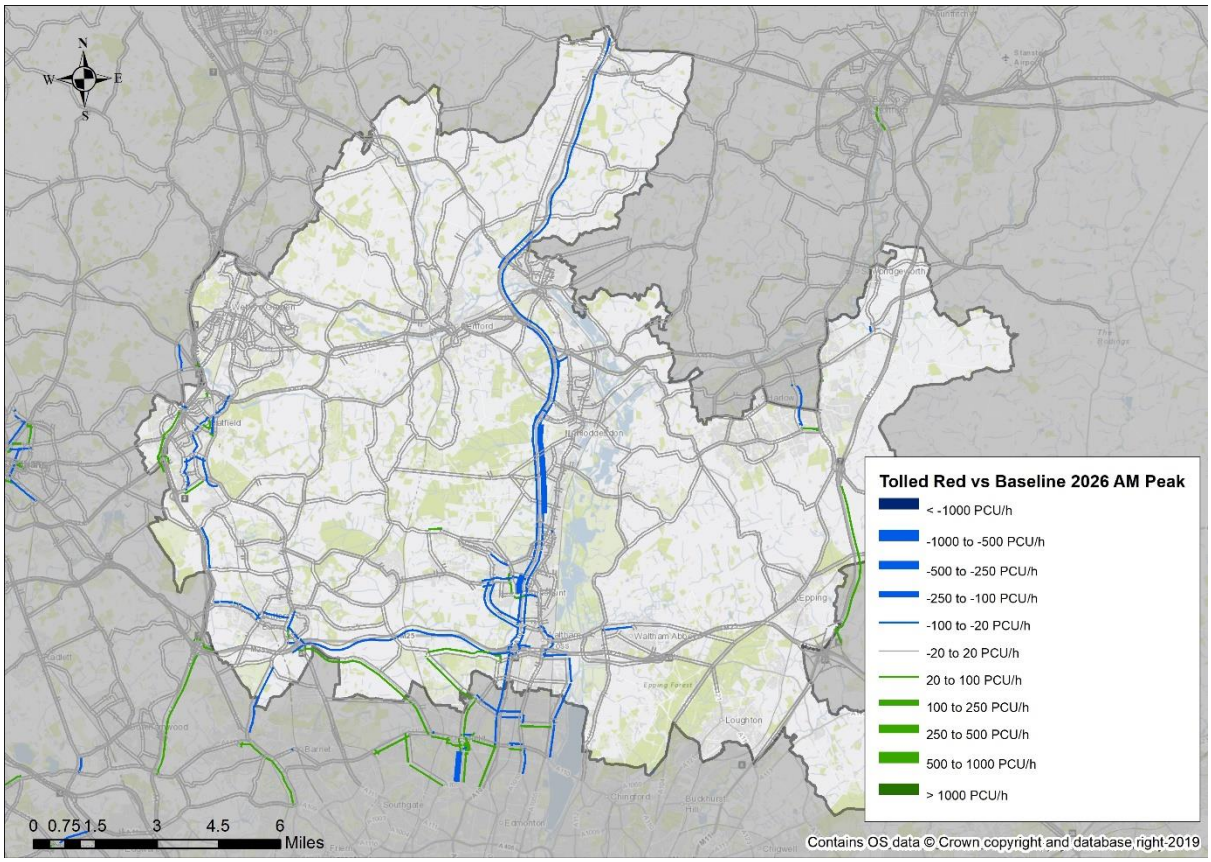


Figure 4.3: 2026 CAZ-D(2) option compared with 2026 Baseline (AM Peak)



4.8 The headline flow impacts from the transport modelling are summarised in Table 4.1.

Table 4.1: Range of One-Way Hourly Flow Difference Compared to the Baseline Scenarios of each Scenario Assessed

Option	Forecast Highway Flow (PCUs) Diverted off the A10: 2022	Forecast Highway Flow (PCUs) Diverted off the A10: 2026	Rail Flow (passengers, average hour): 2022	Rail Flow (passengers, average hour): 2026	Bus Flow (passengers, average hour): 2022	Bus Flow (passengers, average hour): 2026
Non-charging	-600 to -700	-600 to -700	Less than -10	Less than -10	Less than 40	Less than 40
CAZ-D(1)	-100 to -200	Less than -50	Less than -50	Less than -50	Less than 80	Less than 80
Combined	-650 to -850	-600 to -700	Less than -50	Less than -60	Less than 90	Less than 100
CAZ-D(2)	-150 to -200	-50 to -100	Less than -50	Less than -50	Less than 75	Less than 80
CAZ-C(2)	- 50 to -100	Less than -50	No material difference	No material difference	No material difference	No material difference
CAZ-C(1)	Less than -50	Less than -50	No material difference	No material difference	No material difference	No material difference

4.9 Table 4.1 illustrates that scenarios have differing impacts on the transport network however one message is key; vehicle drivers impacted do not choose to switch to rail or bus for their journey. Therefore, all results reported to date induce some re-routeing.

4.10 Results from the transport modelling informed the air quality modelling, which found that on average, 2022 NO_2 annual mean concentrations within Broxbourne for all the measure scenarios listed above resulted in an overall improvement in air quality compared to the baseline. The Combined measure option, followed by the CAZ-D(2) measure option, led to the greatest reduction in NO_2 concentrations predicted at the worst case receptor (BB28) located on the A10 PCM exceedance stretch. In comparison, the CAZ-C(1) measure option resulted in the lowest level of improvements in annual NO_2 concentrations at BB28.

4.11 All measure options were shown to bring forwards compliance from 2025, as displayed in Table 4.2. However, assumed compliance when taking into consideration the M25 J25 works, would likely result in the CAZ-C(1) measure option not bringing forward compliance from 2025. For all other measure options, compliance would be brought forwards to at least 2024.

Table 4.2: Predicted Compliance Year for Each Measure Option

Measure Option	2022 Annual Mean NO_2 Concentration at BB28 ($\mu g/m^3$)	2023 Annual Mean NO_2 Concentration at BB28 ($\mu g/m^3$)	Compliance Year	Assumed Compliance Year with Junction M25 Works
CAZ-D(1)	42.0	40.2	2023	2024
CAZ-C(1)	44.9	42.6	2024*	2025
Non-Charging	40.8	38.6	2023	2024
Combined	36.2	34.9	2022	2023
CAZ-D(2)	38.2	37.0	2022	2023
CAZ-C(2)	42.2	40.4	2023	2024

Table 4.2 Notes:

Predicted compliance year as no modelling has been undertaken for 2024.

4.12 All measure options were however shown to also cause an increase in annual mean NO_2 concentrations, as a result of displacement, in the surrounding local authorities (Welwyn

Hatfield, Hertsmere, East Hertfordshire, Epping Forest and Harlow). This can be seen in Table 4.3 which displays the maximum NO_2 concentration increases in the aforementioned local authorities. The Non-charging and Combined measure options showed the greatest increase in annual mean NO_2 concentrations outside of BBC, with CAZ-D(1) and CAZ-C(1) showing the lowest increase. As a consequence, due to the displacement created by the measures proposed, a worsening of air quality elsewhere has been predicted (albeit mostly to a relatively minor extent relative to the potential air quality benefits in Broxbourne).

Table 4.3: Maximum NO_2 Concentration Increase in Local Authorities Surrounding Broxbourne Relative to 2022 Base Year, Categorised by Measure Option (µg/m^3)

Local Authority	2022 Non-Charging	2022 CAZ-C(1)	2022 CAZ C(2)	2022 Combined	2022 CAZ-D(1)	2022 CAZ-D(2)
Hertsmere	0.7	0.2	0.9	0.8	0.3	0.9
Welwyn Hatfield	0.6	0.1	0.4	0.7	0.2	0.7
Epping Forest	1.0	0.3	0.5	1.1	0.6	0.9
Harlow	1.1	0.3	0.3	1.1	0.4	0.4
East Hertfordshire	4.3	0.3	0.3	4.2	0.6	0.8
Enfield	0.1	0.2	0.4	0.5	0.3	0.7

Section Summary

4.13 This section has highlighted that all significant infrastructure schemes which could contribute to improving the air quality on the exceedance stretch cannot be implemented as:

- They would induce traffic diversion on to other routes and therefore increase NO_2 levels;
- They would not have a significant enough impact;
- They are not feasible (politically/financially/stakeholder acceptability) to implement;
- They would increase severance; or
- They cannot be implemented in the timeframes.

5. New Scheme Parameters (CSFs)

5.1 Following the Ministerial Review in March 2020 and in liaison with JAQU, a revised set of Critical Success Factors (CSFs) have been agreed for the project. This section details the CSFs and what they are trying to achieve. Remaining scheme options are then assessed against the CSFs, Tertiary and Secondary Success Factors and options which remain are discussed further in the following chapter.

New Critical Success Factors

5.2 CSFs are classified into two categories – primary and secondary. CSF's include a Tertiary evaluation, if the measure passes all the Tertiary stages, only at that stage will it be assessed against the Secondary Success Factors, Tertiary evaluation was introduced to ensure focus on measures which meet with the unique project characteristics.

Primary Critical Success Factors

5.3 The Primary CSF is a fixed assessment criterion agreed with JAQU and is crucial to the overall success of the project. Measures that do not meet this criterion are rejected without further evaluation.

5.4 The overall spending objective of the Broxbourne local plan is to deliver a scheme that does not result in an unacceptable level of increase in NO_2 concentration elsewhere (particularly where there is the possibility this could result in the creation of new exceedances), while leads to compliance with NO_2 concentration limits in the shortest possible time.

5.5 Only measures or packages of measures that are likely to lead to compliance as quickly as possible without causing an unacceptable increase in NO_2 concentration elsewhere will pass the Primary CSF. All standalone measures and measures that will only be implemented as part of a package are assessed against the Primary CSF. Individual measures within a package are not required to be assessed against the Primary CSF.

Secondary Critical Success Factors

5.6 Measures which pass the primary CSF were then assessed against the secondary CSFs as detailed in Table 5.1. The secondary CSFs have been defined based on the JAQU guidance and HM Treasury's Green Book.

Table 5.1: Secondary Critical Success Factors

Secondary CSF	Description	Justification
Potential Value for Money	Does the implementation of the measure deliver good value of money? This includes both the direct financial impacts of implanting the measure but also the wider cost to society e.g. cost implications as a result of improving public health or the cost to businesses who are impacted by the measure	It is important to think about how best to spend the money available to ensure public funding is used effectively to maximise benefits and minimise cost.
Distributional Impacts	Is there a disproportionate impact on one or a number of particular groups? This includes consideration of the measures impact on a range of groups including income/deprivation, children, elderly, sex, disability, ethnicity and businesses.	Thinking about the greater impact of a measure on the various potential groups of people impacted will help to avoid a significant disparity in how the benefits are realised.
Strategic Fit and Meets Business Need	Does the implementation of the measure compliment the wider local strategic aims?	Understanding how well the measure will fit within existing policies will help with successful implementation.

Secondary CSF	Description	Justification
	This includes consideration of the measures against the Broxbourne Local Plan and Transport Strategy to ensure it fits the on-going aims for growth in the Borough.	
Supplier Capacity and Capability	Will the measure be able to be realistically implemented? This includes consideration of the availability of contractors to provide services and whether there is an established market to support effective delivery e.g. of additional public transport routes.	It is important to understand the level of available resources required at an early stage to allow for appropriate organisation to enable smooth implementation of the selected measures in a timely manner.
Potential Affordability	Is the measure affordable both in the short term and as an ongoing implemented measure? At this stage affordability should be scored on a relative scale. For example, cheaper options score higher.	Understanding the overall cost of the measure and how it will be funded is crucial to assess the financial feasibility of implementing the measure.
Achievability	Can the measure be delivered on a local scale given the resources available? This includes consideration of availability of technology to support measures and any market limitations to delivering the measure.	It is important to understand whether the measure can be realistically delivered within the set timescales. Otherwise the total benefits will not be achieved.

Tertiary Evaluation of Soft Measures

5.7 Given the restrictive nature of the measures which are available for consideration (see 5.3) it is important that for any measures progressed only feature characteristics which fully align with the Project deliverable/constraints. These will be applied before evaluation against secondary CSF's and link to the project constraints detailed in Chapter 3. If any scheme fails on a single point they are discounted as a potential measure. Parameters include:

- NO_2 reduction – If we are unable to demonstrate /evidence a tangible reduction of NO_2;
- M25 junction 25 – If implementation would have to wait until after the M25 junction 25 scheme is complete due to the unknown completion date;
- Time – If the implementation and benefits realisation cannot make a material impact prior to 2024 and therefore will not bring forward the year of natural compliance (based on present baseline modelling);
- Analysis/modelling – If the process to assess potential benefits cannot be modelled or requires detailed modelling and this cannot be completed by the end of September 2020 these are discounted; and
- Traffic Displacement – Where measures would result in displacement of traffic elsewhere.

5.8 The Primary CSF determines whether an option achieves the minimum requirements of the project, however other Secondary CSFs should be used to determine those measures or packages of measures that would be best relative to other, wider considerations.

Revised OBC Timescale

5.9 In addition to the CSFs identified, JAQU advised that a revised Outline Business Case should be submitted by 31st October 2020 detailing new measures proposed. As any new schemes would need to be accurately defined and assessed in the transport, air quality and economic models by 3 different consultants, this timescale severely limits what evidence-base for any scheme can be provided.

6. Remaining Scheme Options

6.1 This chapter summarises the review of over 70 scheme options by the project team in light of the revised CSFs and revised OBC timescales outlined in the previous chapter. To provide an auditable trial for JAQU, the schemes which are discounted and reasons for their omission are detailed. Many of the reasons for discounting link to the constraints outlined in this report.

6.2 In response to the revised OBC timeframe, the project team believe there are schemes which could still contribute to improving air quality, however it is not feasible to provide a quantitative evidence base in the timescales provided by JAQU. These are also highlighted. If JAQU considered revising the OBC timescales, they could be investigated further.

Caveat

6.3 It is important to note that the project team ***do not believe*** that any combination of measures discussed in this section would result in the ~10% reduction in total flow (see Section 2.2) on the A10 required to bring forward compliance to 2024. This should be considered by JAQU.

6.4 Table 6.1, in part from the TFS, provides some high-level indications of how softer measures may impact the traffic flow on the A10 and the estimated reduction of NO_x emissions at BB28, noting that the assumptions made therein were based on general observations of the estimated impacts. Whilst this table is subjective and open to debate, it can be recognised that a combination of all measures in one package may still not be enough to bring forward compliance. In case of double counting, it is worth noting that travel plans (measure number 9) typically encompass some of the other measures listed.

Table 6.1: Possible Traffic Volume Impacts of Softer Measures

Measure No.	Description	Estimated Traffic Reduction	Estimated NO_x Reduction at BB28 in 2024 (g/km/s)	Percentage NO_x Reduction at BB28 in 2024
9	Travel Plans	3% reduction in cars	-0.0029	-1.3%
10	Review of Taxi/Private hire vehicle license fees	0.5% increase in Euro 6	N/A	N/A
13	Car Clubs	50 cars removed from the road	-0.0001	-0.1%
15	Journey planning initiatives	1% reduction in cars	-0.0010	-0.4%
18	Improvements to public transport infrastructure	1% reduction in cars	-0.0010	-0.4%
20	Travel website	1% reduction in cars	-0.0010	-0.4%
23	Behavioural change travel campaign	1% reduction in cars	-0.0010	-0.4%
24	Transition level choice campaign	1% reduction in cars	-0.0010	-0.4%

Measure No.	Description	Estimated Traffic Reduction	Estimated NO_x Reduction at BB28 in 2024 (g/km/s)	Percentage NO_x Reduction at BB28 in 2024
26	Job seeker travel scheme	1% reduction in cars	-0.0010	-0.4%

Table 6.1 Notes:
Emissions are the sum of the calculated NOx from northbound road links (source ID 4606), and the southbound road link (source ID 4595) nearest to BB28. BB28 is located between two southbound road links (source IDs 4738 and 4595), which have differing speeds. Source ID has a speed of 45.2kph, whereas 4595 has a speed of 20kph. Source ID 4595 was selected as a worst case scenario. No emissions were calculated for measure number 10 due to the breakdown of number taxis and private hire vehicles not being available within the traffic data.

Discounted Scheme Options

6.5 Table 6.2 details the discounted scheme options and the reasons for their omission (even if the OBC timeframe was extended, these issues would still not be considered for the reasons outlined).

Table 6.2: Discounted Scheme Options

ID	Measure Category	Measure	Comments
2	CAZ Option	Charging CAZ - Band A A10 specific	Would result in traffic displacement and impacts on air quality elsewhere
3	CAZ Option	Charging CAZ - Band B A10 specific	Would result in traffic displacement and impacts on air quality elsewhere
4	CAZ Option	Charging CAZ - Band C A10 specific	Would result in traffic displacement and impacts on air quality elsewhere
5	CAZ Option	Charging CAZ - Band D A10 specific	Would result in traffic displacement and impacts on air quality elsewhere
6	CAZ Option	Charging CAZ - Band A borough-wide	Would result in traffic displacement and impacts on air quality elsewhere
7	CAZ Option	Charging CAZ - Band B borough-wide	Would result in traffic displacement and impacts on air quality elsewhere
8	CAZ Option	Charging CAZ - Band C borough-wide	Would result in traffic displacement and impacts on air quality elsewhere
9	CAZ Option	Charging CAZ - Band D borough-wide	Would result in traffic displacement and impacts on air quality elsewhere
10	CAZ Option	Non-Charging CAZ - Band A A10 specific	Do not believe a non-charging scheme would have a material impact. If vehicles were impacted it would result in traffic displacement and impacts on air quality elsewhere
11	CAZ Option	Non-Charging CAZ - Band B A10 specific	Do not believe a non-charging scheme would have a material impact. If vehicles were impacted it would result in traffic displacement and impacts on air quality elsewhere
12	CAZ Option	Non-Charging CAZ - Band C A10 specific	Do not believe a non-charging scheme would have a material impact. If vehicles were impacted it would result in traffic displacement and impacts on air quality elsewhere
13	CAZ Option	Non-Charging CAZ - Band D A10 specific	Do not believe a non-charging scheme would have a material impact. If vehicles were impacted it would result in traffic displacement and impacts on air quality elsewhere

ID	Measure Category	Measure	Comments
14	CAZ Option	Non-Charging CAZ - Band A borough-wide	Do not believe a non-charging scheme would have a material impact. If vehicles were impacted it would result in traffic displacement and impacts on air quality elsewhere
15	CAZ Option	Non-Charging CAZ - Band B borough-wide	Do not believe a non-charging scheme would have a material impact. If vehicles were impacted it would result in traffic displacement and impacts on air quality elsewhere
16	CAZ Option	Non-Charging CAZ - Band C borough-wide	Do not believe a non-charging scheme would have a material impact. If vehicles were impacted it would result in traffic displacement and impacts on air quality elsewhere
17	CAZ Option	Non-Charging CAZ - Band D borough-wide	Do not believe a non-charging scheme would have a material impact. If vehicles were impacted it would result in traffic displacement and impacts on air quality elsewhere
20	Low Emission Vehicle Option	HGV/LGV recognition schemes, ECO Stars	Struggle to provide evidence
22	Low Emission Vehicle Measure	Collaborating with bus operators to introduce ultra-low emission vehicles into the bus fleet (new or retrofit). Target use of ULEV into the problem areas	Won't help bring forward compliance, provides limited benefits
24	Low Emission Vehicle Measure	Procuring low emission vehicles for council-owned fleets	Majority of council fleet is Euro 6, don't believe council fleet size will be big enough
25	Low Emission Vehicle Measure	Alternative fuel (EV) infrastructure development	Requires EV infrastructure to be put at start and end of journeys to be fully effective, struggle to provide evidence for improvement of air quality
26	Low Emission Vehicle Measure	Install rapid EV charging points within all Council owned Car Parks	Requires EV infrastructure to be put at start and end of journeys to be fully effective, struggle to provide evidence for improvement of air quality
27	Low Emission Vehicle Measure	Diesel scrappage schemes	Hard to implement on a local scale (as seen in Leeds), should be done on a national scale, there are already existing manufacturing scrappage schemes
28	Public Transport Routes and Services	Bike Rental Schemes	Not able to provide evidence for investment
29	Public Transport Routes and Services	Cycle-to-work schemes	Not able to provide evidence for investment
34	Public Transport Routes and Services	Implementation of bus lanes on the A10	Results in the displacement of traffic
38	Public Transport Routes and Services	Park and Ride Schemes	Results in the displacement of traffic
41	Traffic Measures	VMS signs on A10 warning of congestion - promotion of parallel corridors if required	Would result in traffic displacement and impacts on air quality elsewhere

ID	Measure Category	Measure	Comments
44	Traffic Measures	Speed limit reduction on A10 from Hertford to M25 (permanent or smart/dynamic)	Would result in traffic displacement and impacts on air quality elsewhere
46	Traffic Measures	Pollution dynamic traffic management for signage and re-routing	Would result in traffic displacement and impacts on air quality elsewhere
47	Traffic Measures	Pollution dynamic traffic management for speed limit changes	Would result in traffic displacement and impacts on air quality elsewhere
48	Traffic Measures	College Road: At grade improvement at College Road / A10 junction, providing additional northbound and southbound lanes at the junction and increased length of northbound left filter into College Road, and banning all right turns	Dependency of M25 completion and would attract additional traffic to the corridor and displacement of traffic if turns banned
49	Traffic Measures	Church Lane: At grade highway capacity improvement at Church Lane / A10 junction, providing an additional north-south lane through the junction and banning all right turns and left turns onto the A10	Dependency of M25 completion and would attract additional traffic to the corridor and displacement of traffic if turns banned
50	Traffic Measures	A10 widened to 3 lanes in both directions between College Road and Church Lane junctions	Dependency of M25 completion and would attract additional traffic to the corridor and displacement of traffic if turns banned
51	Traffic Measures	Strategic Routing of HGVs / Freight	Would result in traffic displacement and impacts on air quality elsewhere
52	Traffic Measures	Use of signals to gate traffic away from the critical section of the A10	Would result in traffic displacement and impacts on air quality elsewhere
53	Traffic Measures	High occupancy vehicle (HOV) lanes	Would result in traffic displacement and impacts on air quality elsewhere
54	Traffic Measures	Low emission vehicle lanes	Would result in traffic displacement and impacts on air quality elsewhere
55	Traffic Measures	Flounders/overs at key junctions, e.g. construct a flyover the A10 to connect east and west Cheshunt	Dependency of M25 completion and would attract additional traffic to the corridor
56	Traffic Measures	A10 congestion charge	Would result in traffic displacement and impacts on air quality elsewhere
57	Travel Planning Interventions	Reducing vehicle idling at taxi ranks, stations, bus stops and outside schools	No relevance to A10
59	Travel Planning Interventions	On and off-street parking charges linked to vehicle emission standards - including any resident's permits.	Creates displacement of traffic
60	Travel Planning Interventions	Parking restrictions	Creates displacement of traffic, difficult to implement
61	Travel Planning Interventions	Waiting and loading restrictions / Keep clear zones	No relevance to A10
66	Travel Planning Interventions	Disincentives use of car travel on council business	Not going to impact on NO2

ID	Measure Category	Measure	Comments
74	Other Measures	"Green" infrastructure screen or similar on side of A10/cladding with pollution absorbing material	Based on Highways England trial, viewed as not being practical, expensive
75	Other Measures	Reduce road traffic demand through sustainable development planning policy, e.g. Obligate new developments to include EV charging points, subsidised EV car rental or car-pooling clubs	Delivery of new development won't be in sufficient time to bring forward year of compliance
76	Other Measures	Air pollution early warning and/or monitoring information via text, email, website and/or app	Doesn't bring forward year of compliance
77	Other Measures	Class C or Class D CAZ covering the entire AQ modelling domain which will include East Herts, Epping Forest, Harlow, Welwyn, Hatfield, Hertsmere	May not bring forward year of compliance, creates traffic displacement
79	Other Measures	Voluntary speed reduction	Results in traffic displacement, not applicable
80	Other Measures	Freight Restrictions (LGV and HGV) - parking and delivery restrictions and levy, subsidies or exceptions for sustainable drop offs (no time restrictions)	No relevance to A10
81	Other Measures	Other Multi occupancy, public transport lane or incentives and benefits	Creates traffic displacement
82	Other Measures	DRT - demand responsive travel, fluid public transport network	Needs a wider geographical implementation

Possible Scheme Options (if OBC deadline extended)

6.6 Table 6.3 details the scheme options which cannot be assessed quantitatively by the end of October in line with the revised OBC timeframe prescribed by JAQU. The project team believe all could contribute to improving air quality if additional time to investigate them were provided.

Table 6.3: Possible Scheme Options (if OBC deadline extended)

ID	Measure Category	Measure	Comments
18	Low Emission Vehicle Measure	Taxi/Private Hire Vehicle Policy license fees, e.g. new taxi licence for zero emission taxis	Can't do modelling within timescale. Can't identify taxis within the ANPR data set which will prohibit analysis (as many are standard "car" vehicles). Unknown impacts on air quality
19	Low Emission Vehicle Measure	Retrofitting or upgrade of private hire vehicles / taxis to LPG/retrofitting subsidies for local cab owners	Can't do modelling within timescale. Can't identify taxis within the ANPR data set which will prohibit analysis (as many are standard "car" vehicles). Unknown impacts on air quality

ID	Measure Category	Measure	Comments
23	Low Emission Vehicle Measure	Collaborating with local freight operators to introduce low emission vehicles into the LGV and HGV fleet	TfL scheme possible synergy, if any funding for measure then it would be substantial, would need to do an initial analysis of proportion of current LGV fleet
30	Public Transport Routes and Services	Signage and cycle parking	Part of wider cycle package
31	Public Transport Routes and Services	New cycle routes (away from traffic) or pedestrianised areas, e.g. long distance cycle path connecting Enfield with New River and providing an alternative sustainable route	Proposal to include cycle path along new river, investment £3m+, may not be able to demonstrate air quality benefits
33	Public Transport Routes and Services	Council funding to provide free buses for all schools	Part of a wider public transport package
36	Public Transport Routes and Services	"Public transport infrastructure improvements, e.g. - Enhanced bus shelters - Accurate electronic timetables - m-tickets / contactless payment options"	Limited ability to provide direct link between behavioural change and reduction in NO_2
37	Public Transport Routes and Services	"Incentivise public transport usage, e.g. - Provision of information about existing services - Campaigns - Season ticket loan/discounts - Subsidised tickets"	Limited ability to provide direct link between behavioural change and reduction in NO_2
39	Public Transport Routes and Services	Rail travel requirements between local towns should be served at all times of day	Will require liaison with rail providers
42	Traffic Measures	Traffic signal control for smoother traffic movement, e.g. install Smart Traffic Lights at the main bottle-necks at the Church Lane and College Road Junctions	Microsimulation modelling required to gauge impacts
58	Travel Planning Interventions	Employer-based / school / personal travel plans to encourage active travel. Promote shift patterns and staggered employee office hours	Requires detailed study on who to target, also conditional on other measures; bus and cycle schemes
63	Travel Planning Interventions	Car Club / Car Sharing Schemes/ Car Pooling	Part of package of measures
65	Travel Planning Interventions	School start time variations	Some change in variation - need to revisit
68	Travel Planning Interventions	Freight delivery and service plans, e.g. work with local distribution centres to change delivery routes/reduce emissions	Requires detailed study on who to target
69	Behavioural Campaigns	Education and eco-driving courses to train fleet drivers to drive in a way that minimises emissions	Viewing time to be determined longer than 1 year, any programme would need to be considered on a wider geographical level than just Broxbourne/Hertfordshire

ID	Measure Category	Measure	Comments
70	Behavioural Campaigns	Provision of high quality, bespoke and accessible information on sustainable travel, e.g. on a dedicated travel website with route/mode options	Viewing time to be determined longer than 1 year, any programme would need to be considered on a wider geographical level than just Broxbourne/Hertfordshire
71	Behavioural Campaigns	Behaviour change campaigns to reduce single occupancy car trips	Viewing time to be determined longer than 1 year, any programme would need to be considered on a wider geographical level than just Broxbourne/Hertfordshire
72	Behavioural Campaigns	Transition Travel Choices Campaign	Viewing time to be determined longer than 1 year, any programme would need to be considered on a wider geographical level than just Broxbourne/Hertfordshire
73	Behavioural Campaigns	Job Seeker Travel Scheme / Apprentice Travel Scheme	Viewing time to be determined longer than 1 year, any programme would need to be considered on a wider geographical level than just Broxbourne/Hertfordshire
78	Other Measures	Anti-idling campaign in traffic signals using VMS signs	Signage can also be used but VMS would allow peak time operation

Remaining Scheme Options

6.7 Table 6.4 details the remaining scheme options which could be investigated and quantified before the revised OBC deadline of 31st October 2020. It should be re-iterated that these two schemes in isolation will not bring forward the year of compliance by one year and impacts may be marginal.

Table 6.4: Remaining Scheme Options

ID	Measure Category	Measure	Comments
32	Public Transport Routes and Services	City link shuttle service to key towns, e.g. various proposals from the Broxbourne Transport Strategy (High Leigh, Brookfield/Cheshunt Lakeside, Park Plaza enhancements), Broxbourne borough – Enfield cross-boundary services; extending one or more TfL services to Park Plaza; extending the Brookfield service down into Enfield.	Would require a new model scenario but have been tested as part of the non-tolled packages. Could be investigated in isolation as an individual scheme, or combined into one new scenario
35	Public Transport Routes and Services	Introduce a low emissions bus route, connecting Enfield Town and Hoddesdon, via the A10	Would require a new model scenario but have been tested as part of the non-tolled packages. Could be investigated in isolation as an individual scheme, or combined into one new scenario

Non-Transport Scheme Options

6.8 A key unknown is also the impact of COVID-19 on any underlying forecasting assumptions. The pandemic has significantly altered people's travel patterns and the economic stability of the United Kingdom. Impacts in the short to medium term are largely unknown. The full impact may not be known for several years, however all the transport, air quality and economic

assumptions modelled to date will be subject to significant review in the coming months and years. This could significantly alter the requirements of any scheme to address air quality on the A10.

7. Initial Conclusions

7.1 This report has summarised the work undertaken to date investigating schemes to address the air quality exceedance stretch on the A10 in Broxbourne. Whilst schemes have been identified to improve air quality along the exceedance stretch, the knock-on impacts are unacceptable based on the agreed criteria.

7.2 The challenges presented by the constraints and options available significantly limit the types of interventions which can be progressed. In many cases, identified measures cannot be modelled (due to time limitations and/or data constraints) to provide robust outcome-based measures which are those typically funded by JAQU.

7.3 The project has been unable to identify a single or package of measures which are likely to bring forward the year of compliance by 12 months or more and does not create unacceptable levels of traffic displacement elsewhere on the Network.

Recommendations/Next Steps

7.4 In view of the fact we are unable to develop a proposal(s) which can bring forward the year of compliance, the Project was paused to enable JAQU to review and consider the next steps.

7.5 The suggested next steps were:

1. JAQU indicate if they agree the core principle that the year of compliance cannot be brought forward based on the constraints and schemes considered.
2. JAQU indicate how they would like to proceed and advise of potential next steps. This could include (but not be limited to):
    a. **31/10/2020** - OBC is progressed with the two measures identified within the limited timescale. Outputs will include an approved OBC.
    b. **Revised Timescale -** Agreement to enable the modelling (where feasible) of the other 20 identified measures and delivery of an approved OBC. This could be expanded to include non-transport based measures.
    c. **Project Closure** -Acceptance of the proposed technical note and suspension of the OBC and acceptance by JAQU that the year of compliance cannot be brought forward.
    d. **Hybrid** - Acceptance of this Technical note and suspension of the OBC and acceptance by JAQU that the year of compliance cannot be brought forward. Funding to develop an action plan which supports the AQMA and directly links County and District council transport plans which highlight the areas which will directly impact on Air Quality. This may involve joint funding or access to funding of some of the identified projects as yet unfunded within the Council plans.

JAQU Response

7.6 Following review of this document in Autumn 2020, JAQU have identified a series of softer transport measures which they would consider supporting as detailed in Table 8.1: . The following chapter presents the qualitative analysis requested by JAQU. Additionally, further EFT analysis has been carried out to assess the likely impact of Measure 42 – Traffic Signal Control.

8. Softer Measures Analysis

8.1 The measures presented in Table 8.1 are a shortlist of measures that JAQU would consider supporting from the initial list of softer measures presented in Table 6.3 and Table 6.4.

Table 8.1: Softer Transport Measures Requiring Further Assessment

ID	Measure Category	Measure
32	Public Transport Routes and Services	New and enhanced bus services identified by the Broxbourne Transport Strategy, extended to incorporate improved cross-boundary links into Enfield.
35	Public Transport Routes and Services	Upgrade the fleet of local bus services operating through the Clean Air Zone to low emissions and ultra-low emissions technology (minimum Euro VI).
18	Public Transport Routes and Services	Taxi/Private Hire Vehicle Policy license fees, e.g. new taxi licence for zero emission taxis
19	Public Transport Routes and Services	Retrofitting or upgrade of private hire vehicles / taxis to LPG/retrofitting subsidies for local cab owners
23	Public Transport Routes and Services	Collaborating with local freight operators to introduce low emission vehicles into the LGV and HGV fleet
36	Public Transport Routes and Services	"Public transport infrastructure improvements, e.g. - Enhanced bus shelters - Accurate electronic timetables - m-tickets / contactless payment options"
37	Public Transport Routes and Services	"Incentivise public transport usage, e.g. - Provision of information about existing services - Campaigns - Season ticket loan/discounts - Subsidised tickets"
42	Traffic Measures	Traffic signal control for smoother traffic movement, e.g. install Smart Traffic Lights at the main bottle-necks at the Church Lane and College Road Junctions
70	Behavioural Campaigns	Provision of high quality, bespoke and accessible information on sustainable travel, e.g. on a dedicated travel website with route/mode options
78	Other Measures	Anti-idling campaign in traffic signals using VMS signs

8.2 A literature review has been undertaken to assess the quantitative impacts of the measures shown in Table 8.1 (with the exception of Measure 42), however it should be noted that the impacts of softer transport measures are difficult to accurately quantify. Determining why changes in travel behaviour take place and linking them to specific measures is very subjective. Collecting such data can only be accurately undertaken by interviewing travellers to ask why they are travelling by a certain transport mode. This is time consuming, costly and therefore outside the remit of many softer measures schemes.

8.3 At a national scale, the Department for Transport (DfT) has previously allocated funding to softer transport measures through two funding mechanisms. The first was the “Sustainable Travel Towns (STT)” project: “*In 2004, three towns - Darlington, Peterborough and Worcester – jointly received £10 million funding from the Department for Transport for the implementation of large-scale ‘smarter choice’ programmes over a five year period, as part of the ‘Sustainable Travel Towns’ (STT) demonstration project. All three programmes put in place a range of initiatives aiming to encourage more use of non-car options – in particular, bus use, cycling and walking – and to discourage single-occupancy car use. The strategies adopted by the three towns included the development of a strong brand identity; travel awareness campaigns; public transport promotion; cycling and walking promotion; school and workplace travel planning; and large-scale personal travel planning work. An evaluation conducted on behalf of the Department for Transport of the impacts of the STT project concluded that it was successful in reducing travel by car and increasing the use of other modes, from a comparison with trends in other medium-sized urban areas. Overall, in the three towns, there was a reduction in total*

traffic levels in the order of 2%, together with a reduction of 7-10% in the number of car driver trips per resident". (page 1[10]).

8.4 The longer term impacts of the STT project are reported to be more difficult to quantify, "*although, this study suggests that the outcomes from sustainable travel behaviour programmes do not decay rapidly, not least because involvement in such activities seems to lead to further related activities, and because they often involve associated improvements to local infrastructure and services. Instead, the benefits of such initiatives may be long-lived, particularly where there are ongoing inputs to such work; where underpinning infrastructure and service quality is maintained or enhanced, as part of an integrated approach; and where there are broadly supportive underlying national trends.*" (page 51[13]).

8.5 The second DfT application of funding to softer transport measures was through the Local Sustainable Transport Fund (LSTF) which operated between 2011 and 2015. "*The Local Sustainable Transport Fund (LSTF) was the biggest-ever competitive funding programme for sustainable transport initiatives in England. Between 2011 and 2015 the Department for Transport (DfT) distributed £540 million in grants to 12 'Large Projects' (receiving 46% of the total) and 84 'Small Projects' (receiving up to £5 million each). The overall expenditure was approximately £1 billion, including contributions from local authorities and DfT grants for non-local schemes such as Bikeability.*

8.6 The Fund's core objectives were to support the local economy and to reduce carbon emissions. In addition, the Fund aimed to deliver wider social and economic benefits (e.g. accessibility and inclusion); improve safety; improve air quality; and increase physical activity and the resulting health benefits.

8.7 Local authorities invested the funding in infrastructure schemes to increase bus and rail patronage and active travel (cycling and walking), and complementary initiatives such as new bus services, cycle training and travel support for job-seekers.

8.8 Each funded project undertook monitoring in line with an overarching monitoring and evaluation framework. A meta-evaluation pulled together data and evidence to assess overall impact.

8.9 *The programme was successful in achieving its objectives, particularly in relation to the local economy, carbon emissions, wider social and economic benefits, and physical activity. There was less direct evidence of its impacts on air quality or road safety, although both may have benefited to some degree*" (page 6[11])

8.10 Summarising the impacts of the LSTF a detailed report was produced titled "*What Works? Learning from the Local Sustainable Transport Fund 2011 – 2015*[12]". This report contains a lot of relevant information which can be applied to the softer measures in Table 8.1: , however two themes are clear in the analysis:

3. The measures assessed were considerable and over large areas (e.g. towns, sections of boroughs or entire boroughs/districts); and
4. The impact of measures are only quantifiably felt when combined with other harder/softer schemes – e.g. a new bus service will only make a difference if it is heavily promoted, incentivised or combined with physical bus-priority measures.

8.11 A key issue which should be considered by JAQU is the scale of any of the softer transport measures proposed. The exceedance stretch is located in a defined area on the A10 corridor, however many softer transport measures would need to be introduced across not only Broxbourne, but other districts in Hertfordshire, Essex and into north London to target the users on the A10 corridor. This is reflected in the ANPR survey data collected and reinforced in the

[10] "*Sustainable Travel Towns: An evaluation of the longer term impacts*", S Cairns and M Jones, July 2016 downloaded from https://www.gov.uk/government/publications/sustainable-travel-towns-evaluation-of-the-longer-term-impacts
[11] "*Impact of the Local Sustainable Transport Fund Summary Report*", DfT, 2017 downloaded from https://www.gov.uk/government/publications/impact-of-the-local-sustainable-transport-fund-summary-report
[12] Produced by the T-TEAR Framework by the ARUP supply group for DfT in July 2016. Downloaded from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/584463/lstf-what-works-report.pdf

STT/LSTF reports. The project team acknowledge this could be a barrier to any softer measure implementation.

8.12 A further consideration is that many softer transport measures prove to be more successful when they link to wider growth and planning activities. For example, linking new developments to well-connected bus, cycle and walking routes from their inception is more likely to encourage use than retro-fitting facilities to areas where people have already developed travel patterns. It is often quite significant interventions which are required to change travel behaviour e.g. limiting car parking spaces at developments. It is acknowledged any softer measure scheme will be retro-fitted onto the local area which will be more difficult for users to accept.

8.13 In May 2016 DEFRA published an article entitled "*Evidence review on effectiveness of transport measures in reducing nitrogen dioxide (Appendix 1 to project summary report for contract AQ0959 'Exploring and appraising proposed measures to tackle air quality'*)[13]. The review confirmed that "*the areas that appear to offer the most potential to reduce NO2 concentrations in the more highly polluted areas of the UK, based on literature and expert opinion, focus on reducing the demand for use of diesel vehicles in those areas, particularly passenger cars in the fleet, and promoting alternative fuels/technologies:*

- *Accelerating the uptake of Euro 6 for light duty (cars and vans) and Euro VI for heavy-duty (lorries, coaches and buses) vehicles, in areas most affected by air pollution;*
- *Increasing the uptake of hybrid powertrains. For buses in particular, hybrid powertrains should be NOX and CO2 optimised for urban duty cycles. For cars, petrol hybrids but not diesel hybrids should be encouraged (there is no evidence that diesel car hybrid powertrains have lower NOx than conventional diesel cars); and*
- *Greening taxi fleets, particularly for operation in pollution hot-spots" (page ii[14]).*

8.14 It can be recognised that these findings are applicable to Broxbourne as the ANPR data highlights there are greater numbers of non-compliant diesel and petrol cars travelling through the exceedance stretch compared to national projections. However the report concluded that "… *travelling attitudes and habits are often very deep rooted and can be hard to change; comprehensive packages of measures which include a focus on travel option information e.g. personalised travel planning or eco-driving can help to address this. However, the emissions benefit of such information campaigns may tail off over time. Also, although significant impacts in terms of travel behaviour changes have been seen, directly related improvements in air quality have not always been observed. In some cases NO2 concentration benefits may have been too small to perceive."* (page iii[14])

8.15 Sustrans, the sustainable transport charity undertook a study entitled "*Reducing car use – what do people who live and drive in cities and towns think*?" in 2019 which examined attitudes to car use in Scottish urban areas[14]. The study highlighted two important considerations which are relevant to this analysis:

5. The large majority of drivers in urban areas are multi-modal and walk, use public transport and cycle already; and
6. *"The most important factors, when assessing attractiveness, were arriving on time, feeling safe from harm, journey time, having flexibility (ability to change mind during a journey), comfort, and journey cost. The ability to carry other people, including children, and cargo, such as shopping, during a journey is also seen as important. Talking a journey that has less impact on the environment and society is also of importance to people but less so than the factors above." (page 4[15])*

8.16 It can be recognised that these conclusions would be applicable to traffic on the A10 corridor and convenience will be the key reason why many users use their private vehicle to travel. The softer measures proposed should feed into a wider Broxbourne/Hertfordshire strategy for the

[13] Produced by Ricardo Energy & Environment for DEFRA in May 2016. Downloaded from https://uk-air.defra.gov.uk/assets/documents/reports/cat05/1605120947_AQ0959_appendix_1-evidence_review_on_air_quality_effects_of_transport_measures.pdf
[14] Produced by Sustrans in November 2019. Downloaded from https://www.sustrans.org.uk/media/5501/final-reducing-car-use-report.pdf

area to reduce reliance on private vehicles. This may be very difficult to implement in a staged manner and the project team believe that all softer transport measures should link together to both a Transport Strategy in Broxbourne, but also the wider Hertfordshire, North London and Essex area surrounding Broxbourne.

8.17 Table 8.2 provides further qualitative analysis of the softer transport measures. The evaluation has confirmed that softer transport measures may contribute to mode shift and changing traveller's mode choice, however the linkage to improved air quality is often difficult to quantify or not recorded. The scale and size of any softer transport measures proposed to address the air quality exceedance on the A10 should be carefully considered. All available evidence confirms that the impact of the softer measures proposed will be very marginal and extremely difficult to quantify.

8.18 For Measure 42 – Traffic Signal Control, EFT analysis was carried out using EFT version 9.1a to quantify the NO_x emissions change at adjusted speeds along the A10 PCM Exceedance Stretch. Speeds were adjusted by ±20% at intervals of 5% on each of the road links associated to Church Lane and College Road Junctions, for the years 2022 to 2025. Changes in emissions were compared against the baseline for each year where the speed was not adjusted. Details of the relative and actual speed changes on each road link, the percentage change in NO_x emissions, and maps of the road links assessed are provided in Appendix A. In summary, it is predicted that by increasing the speed on each link by 20% (between 4.0kph to 9.6kph) a reduction of NO_x emissions compared to the baseline of between 5.7% and 12.3% would be observed on the respective link. The maximum NO_x reduction predicted across all years assessed is 0.019µg/m^3, with the minimum being 0.004µg/m^3.

8.19 Table 8.3 presents the estimated costs to implement and operate the list of softer measures. At this stage the costing is largely indicative, and the costing associated with a number of measures are still unknown at the time of preparing this report.

Table 8.2: Softer Transport Measures Detailed Commentary following Literature Review

ID	Measure Category	Measure	Comments	Possible Impact
32	Public Transport Routes and Services	New and enhanced bus services identified by the Broxbourne Transport Strategy, extended to incorporate improved cross-boundary links into Enfield.	This is likely to have some impact as the ANPR data collected for this project has confirmed that the A10 is used for medium distance trips between Hertfordshire and North London/Enfield. However the modelling of this service in COMET did not indicate a significant impact on the A10 itself. This is to be expected as there are no bus services which use the north/south A10 in the exceedance stretch, therefore any scheme would need to target surrounding car drivers who would transfer to a bus service and not travel on the section of the A10. The provision of bus services on their own would also only have a minimal impact as the corridor suffers from delays and congestion and without bus lanes or priority at traffic signals for buses, any impacts would be negligible. Any improvements would need to be in line with the Hertfordshire Enhanced Partnership Bus Strategy. This strategy builds on the Intalink Partnership in Hertfordshire[15] which is an existing collaborative working group of bus operators, train operating companies and local councils which has been in operation for over 20 years. Discussions should also be held with the London Borough of Enfield to ascertain their willingness to work with Broxbourne to develop services which target users of the A10 corridor. Members of the Hertfordshire Enhanced Partnership Bus Strategy confirmed that they are currently in discussions with developers to promote the linking of large new developments to urban areas via bus services, however there is not an existing example of where a bus route has been implemented to address cross-boundary links. Any new services are predominantly linked to new demand created by new developments and there is no evidence of introducing a new service linked to existing housing areas. Lessons could also be learnt from the partnership between TfL and Hertfordshire which led to the introduction of services from north London to/from Potters Bar. It should also be considered that there is an option to travel by rail between Broxbourne and Enfield however the journey can involve up to two changes of trains and takes up to 50 minutes. Travelling by car for this journey will be the current favoured option.	Negligible
35	Public Transport Routes and Services	Upgrade the fleet of local bus services operating through the Clean Air Zone to low	The Ultra-low emission bus scheme was announced in 2019. Prior to this, the Low Emission Bus Scheme ran during 2014-16. There does not appear to be a current round of funding available. The Low Carbon Vehicle Partnership provides some additional information on the previous schemes, what makes/models of buses are classed as ultra low emission buses.	Negligible

[15] https://www.hertfordshire.gov.uk/media-library/documents/about-the-council/consultations/hcc-intalink-bus-strategy-easy-read.pdf

ID	Measure Category	Measure	Comments	Possible Impact
		emissions and ultra-low emissions technology (minimum Euro VI).	It is important to note that under the arrangements of the Hertfordshire Enhanced Bus Partnership, there are measures to raise and enforce quality standards including emissions from vehicles which are agreed with bus operators. The Ultra Low Carbon Vehicle Partnership[16] estimates that "*An Ultra-Low Emission Bus saves 30% well-to-wheel greenhouse gas emissions over the UK Bus Cycle compared to a Euro VI diesel bus of equivalent passenger capacity and has a Euro VI certified engine or equivalent emissions capability."* It should also be noted that low emission buses could not be stipulated in Hertfordshire through the Enhanced Bus Partnership as only one operator in the county had the ability to supply such vehicles. They were also found to be prohibitively expensive to introduce. Bus operators are aiming to ensure their fleets use Euro VI diesel engines as a minimum requirement, however some upgrades to newer vehicles have been delayed by COVID-19. Linked to the point above, this may only have a negligible impact on the A10 exceedance stretch as there are currently no bus routes which use the north/south A10 corridor. Members of the Hertfordshire Enhanced Partnership Bus Strategy confirmed that there are no existing examples of buses being upgraded (beyond planned renewals) in response to air quality concerns.	
18	Public Transport Routes and Services	Taxi/Private Hire Vehicle Policy license fees, e.g. new taxi licence for zero emission taxis	There are nationwide incentives for taxi drivers and companies to buy zero-emission capable vehicles, with exemptions from the premium rate of vehicle excise duty, which came into effect in 2019. More information is available through the Low Carbon Vehicle Partnership "*The Low Emission Taxi Guide"*[17]. Taxi licences are administered by the planning authority (Broxbourne) in Hertfordshire. There does not appear to be any specific requirements or additional measures in Broxbourne to require the use of low emission vehicles. Other Hertfordshire authorities such as East Hertfordshire and Watford have introduced new policies which require that vehicles meet Euro 6 emission standards as a minimum requirement[18]. Introducing such measures on taxis would require a policy change within Broxbourne and this may be difficult to implement politically given the impact of COVID-19 on taxi operators.	Low
19	Public Transport Routes and Services	Retrofitting or upgrade of private hire vehicles / taxis to	Detailed examples of how greener taxi fleets have been promoted throughout the UK are available online, with one good example from Nottingham[19]. The analysis highlights how a significant amount of physical charging infrastructure had to accompany the policy and an Ultra Low Emission Vehicle support package which included building an evidence base to support the scheme, a "try before you buy" scheme and	Low

[16] https://www.lowcvp.org.uk/Hubs/leb/ultra-low-emission-bus.htm
[17] https://www.lowcvp.org.uk/assets/reports/LowCVP_Low_Emission_Taxi_Guide-March_2019_Update.pdf
[18] https://www.eastherts.gov.uk/licences-registration/taxi-licensing/vehicle-requirements-taxis and https://www.watford.gov.uk/info/20011/business_and_licensing/1105/herts_2025_-_electric_taxi_vehicles
[19] https://www.transportnottingham.com/driving/electric-taxis/

ID	Measure Category	Measure	Comments	Possible Impact
		LPG/retrofitting subsidies for local cab owners	financial support involving licencing incentives and home charge grants. This example highlights how any policy may take a considerable amount of time and effort to bring into operation.	
23	Public Transport Routes and Services	Collaborating with local freight operators to introduce low emission vehicles into the LGV and HGV fleet	Unclear how this could be facilitated however Broxbourne could partner with organisations like the Low Carbon Vehicle Partnership, TfL, Road Haulage Association and Freight Transport Association to develop a bespoke campaign for the local area. This could in effect be an extension of the TfL Low Emission Zone, however the M25 would be excluded. Any new policy would also risk generating re-routeing if older more polluting vehicles were dissuaded from travelling through the exceedance stretch.	Negligible
36	Public Transport Routes and Services	"Public transport infrastructure improvements, e.g. - Enhanced bus shelters - Accurate electronic timetables - m-tickets / contactless payment options"	Any improvements need to be in line with the Hertfordshire Enhanced Partnership Bus Strategy. Incentives would need to be secured and agreed between operators and third parties, e.g. through planned new developments as part of Travel Plans. The existing Hertfordshire Intalink working group arrangement has already resulted in improvements to the provision of information and publicity and mobile and multi-operator ticketing.	Negligible
37	Public Transport Routes and Services	"Incentivise public transport usage, e.g. - Provision of information about existing services - Campaigns - Season ticket loan/discounts - Subsidised tickets"	Members of the Hertfordshire Enhanced Partnership Bus Strategy confirmed that there are no existing examples of incentivising public transport, however they partner with developers of new developments to enhance knowledge of services to new residents. They are working with one developer in Bishops Stortford North to promote bus travel. Via the Travel Plan the developer will be funding £100 per house/£50 per flat in Intalink bus vouchers. By creating the Intalink vouchers it allows them to be used on multiple operators. Usage data is currently unavailable as the vouchers are yet to be distributed, however a similar system could be employed around Broxbourne if funding was secured.	Negligible

ID	Measure Category	Measure	Comments	Possible Impact
70	Behavioural Campaigns	Provision of high quality, bespoke and accessible information on sustainable travel, e.g. on a dedicated travel website with route/mode options	Unlike some other authorities, Hertfordshire County Council's Intalink website provides a wealth of information on bus routes and a journey planning facility. The website is also accessible via an app and average approximately 100,000 users per year. The website includes some information on bus services which extend into Enfield although it then doesn't appear to be able to track journeys a long way into Enfield and wider Greater London (therefore users would need to switch to other journey planning platforms, e.g. TfL's). Hence high quality, bespoke and accessible information on sustainable travel is already available for Hertfordshire travellers, however linking it to surrounding services into London or Essex is not readily available. Intalink have confirmed that a promotional campaign highlighting the website/app is currently being planned.	Negligible
78	Other Measures	Anti-idling campaign in traffic signals using VMS signs	Local authorities across the country have run anti-idling campaigns, for example East Suffolk[20] and Oxford[21]. Living Streets has also run campaigns in London[22]. A clear message is that providing literature and evidence to drivers that they will save money by using less fuel helps improve the effectiveness of the campaigns. It is also clear that representatives on street communicating with drivers helps to convey the message. The impact of using VMS asking drivers to turn their engine off when idling was conducted at Tower Bridge in 2017 and is detailed in the "*Tower Bridge Anti Idling*" report issued by AECOM in July 2017[23]. The report concluded that "*Over half of those who tend not to switch off their engines when queuing say this is because they expect the queue to start moving quickly. Many drivers are reluctant to switch off their engines when queuing, unless traffic has not moved for some considerable time. This could increase in very cold or very hot weather to maintain air conditions in the vehicle. VMS providing information on the likely delay would encourage only 13% of drivers to switch off, although this was thought to be one of the most effective measures that could be taken*" (page 45[24]). The report concludes that the anti idling campaign had very small impacts on air quality recordings around Tower Bridge. This is only one example and caution should be exercised when viewing results from London given the Congestion Charge and frequent queues/delays traffic experiences in central London. However, given the exceedance stretch is located at a defined location on the A10 the project team believes that an anti-idling campaign could be one of the simplest and most effective to implement and monitor on the A10.	Low

[20] https://www.eastsuffolk.gov.uk/environment/environmental-protection/air-quality/anti-idling-campaign/
[21] https://www.oxford.gov.uk/info/20299/air_quality_projects/1258/anti-idling_air_quality_campaign
[22] https://www.livingstreets.org.uk/about-us/our-work-in-action/tackling-idling-in-london
[23] Downloaded from https://www.southwark.gov.uk/assets/attach/8584/Tower-Bridge-Anti-Idling-Final-Report.pdf

Table 8.3: Estimated Costs Associated with the Softer Measures

ID	Measure Category	Measure	Capital Cost	Operating Costs	Maintenance Costs	Notes
32	Public Transport Routes and Services	New and enhanced bus services identified by the Broxbourne Transport Strategy, extended to incorporate improved cross-boundary links into Enfield.	-	Typically 1 PVR (Peak Vehicle Requirement) = total gross operating cost of £170k per annum for 12 hours per day 6 days per week, though TfL prices up to £200k. Total cost per annum = (9 PVR * 170k) + (2 PVR * 200k) = £1.93m Across 5 years of support = £9.65m Therefore total scheme requirement = **£6.45m (revenue operating costs).**	-	Revenue generated would generally be expected to rise annually, but without detailed forecasts it has been assumed very approximately to be one-third of the gross operating cost for the period of support.
35	Public Transport Routes and Services	Upgrade the fleet of local bus services operating through the Clean Air Zone to low emissions and ultra-low emissions technology (minimum Euro VI).	£1.8m (capital vehicle purchase costs).	-	-	Purchase cost of single-decker Enviro 200 Euro VI vehicle circa £135k, with electric/hydrogen/hybrid technology upwards of this figure and would require additional infrastructure investment.
18	Public Transport Routes and Services	Taxi/Private Hire Vehicle Policy license fees, e.g. new taxi licence for zero emission taxis	-	-	-	Further analysis required to determine overall costs
19	Public Transport Routes and Services	Retrofitting or upgrade of private hire vehicles / taxis to LPG/retrofitting subsidies for local cab owners	-	-	-	Further analysis required to determine overall costs
23	Public Transport Routes and Services	Collaborating with local freight operators to introduce low emission vehicles into the LGV and HGV fleet	-	-	-	Difficult to estimate a cost associated with collaboration

ID	Measure Category	Measure	Capital Cost	Operating Costs	Maintenance Costs	Notes
36	Public Transport Routes and Services	"Public transport infrastructure improvements, e.g. - Enhanced bus shelters - Accurate electronic timetables - m-tickets / contactless payment options"	£955k	-	-	
37	Public Transport Routes and Services	"Incentivise public transport usage, e.g. - Provision of information about existing services - Campaigns - Season ticket loan/discounts - Subsidised tickets"	£1,000k	-	-	
42	Traffic Measures	Traffic signal control for smoother traffic movement, e.g. install Smart Traffic Lights at the main bottle-necks at the Church Lane and College Road Junctions	£100k	£1k	£2k	
70	Behavioural Campaigns	Provision of high quality, bespoke and accessible information on sustainable travel, e.g. on a dedicated travel website with route/mode options	£250k	£25 k	£5k	Capital costs cover: Setting up website, brand identity, communications plan, etc.
78	Other Measures	Anti-idling campaign in traffic signals using VMS signs	£100k	£1k	£2k	Capital costs of individual VMS signs = £25k per unit, assumed 4 units.

9. Final Conclusions and Next Steps

9.1 This report details the scoping out of the measures in line with the updated primary, secondary and newly added tertiary critical success factors. The project team has been unable to identify a single or package of measures which are likely to bring forward the year of compliance by 12 months or more and does not create unacceptable levels of traffic displacement elsewhere on the Network, therefore failing to meet the primary and secondary critical success factors. During the development of this report and ultimate conclusion, JAQU have been updated at each stage and have been kept informed of this potential outcome. The review has on every occasion taken the opportunity to appraise all stakeholders of the likely outcome.

9.2 Further analysis was carried out on a list of softer measures agreed by JAQU which they would be willing to consider supporting. As part of this analysis, it was identified that a significant reduction in traffic on the A10 (up to 10%) is required to improve air quality on the A10. Given the local and strategic nature of traffic on the A10 as shown by the ANPR data, it will not be possible for any softer measure to target all users or movements, therefore achieving a 10% reduction of all traffic is unlikely.

9.3 It is the project team's conclusion that this study could however lead to a step change in promoting alternative softer transport measures across Broxbourne and south Hertfordshire/Essex/north London and can usefully link to wider borough/county strategies. However, linking any of the softer measures discussed (with the exception of an anti-idling campaign) to quantifiable improvements in air quality on one section of the A10 will be almost impossible to measure. Consequently, the economic benefits from implementing these softer measures are likely to also be marginal, and the associated cost of implementing such measures will outweigh the benefits significantly.

9.4 Despite no measure being capable of quantifiably improving air quality along the A10 within the time scales provided, it has been agreed with JAQU that softer measures focusing on behavioural change should still be pursued. The final measures which are therefore to be progressed are as follows:

- Public transport infrastructure improvements, e.g. – Enhanced bus shelters – Accurate electronic timetables – m-tickets, contactless payment options;
- Incentivise public transport usage, e.g. – Provision of information about existing services – Campaigns – Season ticket loan/discounts – Subsidised tickets;
- Provision of high quality, bespoke and accessible information on sustainable travel, e.g. on a dedicated travel website with route/mode options; and
- Anti-idling campaign in traffic signals using VMS signs.

9.5 Table B.1 and Table B.2 in Appendix B summarise the emerging scope and preliminary costings for each of these four measures. It should be noted that these are still currently a work in progress and the final details are yet to be confirmed.

9.6 It is proposed that this document provides the main basis of briefing Members of both Broxbourne and Hertfordshire County Council. Approval of the main conclusions will be required prior to moving on to the next steps.

9.7 Once member approval has been agreed, it is proposed that a Hybrid FBC is to be submitted which is based on the general structure of an FBC, but with specific exemptions recognised in line with the identified limitations and constraints. As any analysis of soft measures cannot be carried out quantitatively, this will therefore not comply with the Green Book guidance and inhibits the ability to provide any Analytical Assurance Statements.

9.8 A formal document will be submitted as a supporting Appendix to the Hybrid FBC which outlines these measures, with detailed scope of what they will entail, inclusive of risks, obstacles and delivery timescales, alongside supporting indicative costs. These shall be reviewed by JAQU and agreed to in principle prior to the submission of the Hybrid FBC.

9.9 Timescales for submission of the Hybrid FBC are still being negotiated, with an anticipated deadline of no later than June 2021.

Appendix A – EFT Traffic Signal Control Analysis

Table A.1 below shows both the relative and actual speed changes applied to each of the northbound and southbound road links associated to the College Road and Church Lane junctions which were used in the EFT analysis. Maps of the road links assessed are provided in Figure A.1. Relative speeds were adjusted to ±20% at 5% intervals. The percentage change in NO_x emissions on each road link following changes in speed, for years 2022-2025, are provided in Table A.2 to Table A.5.

Table A.1 – Relative Speed Changes (%) and Actual Speed (kph) Applied to Each Road Link

Road Section	Source ID	Speed Change:--20%	Speed Change:--15%	Speed Change:--10%	Speed Change:--5%	No Speed Change	Speed Change:-5%	Speed Change:-10%	Speed Change:-15%	Speed Change:-20%
Northbound, South of College Road	4586	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
Northbound, South of College Road	4702	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
Northbound, South of College Road	4585	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
Northbound, South of College Road	4435	20.9	22.2	23.5	24.8	26.1	27.4	28.7	30.0	31.3
Southbound, South of College Road	4457	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
Southbound, South of College Road	4734	37.0	39.4	41.7	44.0	46.3	48.6	50.9	53.2	55.6
Northbound, North of College Road	4456	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
Northbound, North of College Road	5173	38.2	40.6	43.0	45.4	47.8	50.2	52.6	55.0	57.4
Northbound, North of College Road	4437	35.8	38.1	40.3	42.5	44.8	47.0	49.3	51.5	53.7
Southbound, North of College Road	4587	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0

Road Section	Source ID	Speed Change:--20%	Speed Change:--15%	Speed Change:--10%	Speed Change:--5%	No Speed Change	Speed Change:-5%	Speed Change:-10%	Speed Change:-15%	Speed Change:-20%
Southbound, North of College Road	4735	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
Southbound, North of College Road	4588	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
Southbound, North of College Road	4589	37.5	39.9	42.2	44.6	46.9	49.3	51.6	53.9	56.3
Northbound, South of Church Lane	4594	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
Northbound, South of Church Lane	5139	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
Northbound, South of Church Lane	5140	27.8	29.6	31.3	33.0	34.8	36.5	38.3	40.0	41.7
Southbound, South of Church Lane	4455	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
Southbound, South of Church Lane	4593	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
Southbound, South of Church Lane	5172	37.5	39.9	42.2	44.6	46.9	49.3	51.6	53.9	56.3
Northbound, North of Church Lane	4461	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
Northbound, North of Church Lane	4605	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
Northbound, North of Church Lane	4454	36.0	38.2	40.5	42.7	45.0	47.2	49.5	51.7	54.0
Southbound, North of Church Lane	4436	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
Southbound, North of Church Lane	4595	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0
Southbound, North of Church Lane	4738	36.2	38.4	40.7	42.9	45.2	47.4	49.7	52.0	54.2

Table A.2 – Percentage Change of NO_x Emissions Following Percentage Change of Speed, 2022

Road Section	Source ID	Speed Change:--20%	Speed Change:--15%	Speed Change:--10%	Speed Change:--5%	No Speed Change	Speed Change:-5%	Speed Change:-10%	Speed Change:-15%	Speed Change:-20%
Northbound, South of College Road	4586	14.3	10.2	6.5	3.1	0.0	-2.9	-5.5	-8.0	-10.3
Northbound, South of College Road	4702	12.1	8.6	5.5	2.6	0.0	-2.4	-4.7	-6.8	-8.8
Northbound, South of College Road	4585	12.8	9.2	5.9	2.8	0.0	-2.6	-5.0	-7.3	-9.4
Northbound, South of College Road	4435	13.7	9.8	6.2	3.0	0.0	-2.8	-5.3	-7.7	-9.9
Southbound, South of College Road	4457	11.8	8.4	5.3	2.5	0.0	-2.3	-4.5	-6.5	-8.3
Southbound, South of College Road	4734	14.0	9.9	6.3	3.0	0.0	-2.7	-5.1	-7.4	-9.4
Northbound, North of College Road	4456	12.5	8.9	5.7	2.7	0.0	-2.5	-4.9	-7.1	-9.2
Northbound, North of College Road	5173	11.7	8.3	5.2	2.5	0.0	-2.1	-4.1	-5.9	-7.4
Northbound, North of College Road	4437	10.8	7.7	4.8	2.3	0.0	-2.1	-3.9	-5.5	-7.0
Southbound, North of College Road	4587	13.3	9.5	6.1	2.9	0.0	-2.7	-5.2	-7.5	-9.7
Southbound, North of College Road	4735	13.4	9.6	6.1	2.9	0.0	-2.7	-5.2	-7.6	-9.8
Southbound, North of College Road	4588	13.4	9.6	6.1	2.9	0.0	-2.7	-5.2	-7.6	-9.8
Southbound, North of College Road	4589	14.0	10.0	6.3	3.0	0.0	-2.7	-5.1	-7.4	-9.4
Northbound, South of Church Lane	4594	12.9	9.2	5.9	2.8	0.0	-2.6	-5.1	-7.4	-9.5

Road Section	Source ID	Speed Change:--20%	Speed Change:--15%	Speed Change:--10%	Speed Change:--5%	No Speed Change	Speed Change:-5%	Speed Change:-10%	Speed Change:-15%	Speed Change:-20%
Northbound, South of Church Lane	5139	12.3	8.8	5.6	2.7	0.0	-2.5	-4.8	-7.0	-9.0
Northbound, South of Church Lane	5140	13.0	9.3	5.9	2.8	0.0	-2.6	-5.0	-7.3	-9.4
Southbound, South of Church Lane	4455	8.6	6.1	3.9	1.8	0.0	-1.7	-3.2	-4.6	-6.0
Southbound, South of Church Lane	4593	13.3	9.5	6.1	2.9	0.0	-2.7	-5.2	-7.5	-9.7
Southbound, South of Church Lane	5172	14.1	10.1	6.4	3.0	0.0	-2.8	-5.2	-7.4	-9.5
Northbound, North of Church Lane	4461	12.8	9.2	5.9	2.8	0.0	-2.6	-5.1	-7.4	-9.5
Northbound, North of Church Lane	4605	16.8	11.9	7.6	3.6	0.0	-3.3	-6.3	-9.2	-11.8
Northbound, North of Church Lane	4454	11.4	8.1	5.1	2.4	0.0	-2.2	-4.2	-5.9	-7.5
Southbound, North of Church Lane	4436	12.3	8.8	5.6	2.7	0.0	-2.5	-4.7	-6.9	-8.8
Southbound, North of Church Lane	4595	12.9	9.3	5.9	2.8	0.0	-2.6	-5.1	-7.4	-9.5
Southbound, North of Church Lane	4738	13.1	9.3	5.9	2.8	0.0	-2.6	-4.9	-6.9	-8.8

Table A.3 – Percentage Change of NO_x Emissions Following Percentage Change of Speed, 2023

Road Section	Source ID	Speed Change:--20%	Speed Change:--15%	Speed Change:--10%	Speed Change:--5%	No Speed Change	Speed Change:-5%	Speed Change:-10%	Speed Change:-15%	Speed Change:-20%
Northbound, South of College Road	4586	14.4	10.3	6.5	3.1	0.0	-2.9	-5.5	-8.0	-10.3
Northbound, South of College Road	4702	12.0	8.6	5.5	2.6	0.0	-2.4	-4.7	-6.8	-8.7
Northbound, South of College Road	4585	12.8	9.2	5.8	2.8	0.0	-2.6	-5.0	-7.3	-9.4
Northbound, South of College Road	4435	13.7	9.8	6.2	3.0	0.0	-2.8	-5.3	-7.7	-9.9
Southbound, South of College Road	4457	11.6	8.3	5.3	2.5	0.0	-2.3	-4.4	-6.4	-8.2
Southbound, South of College Road	4734	13.8	9.8	6.2	3.0	0.0	-2.7	-5.1	-7.3	-9.3
Northbound, North of College Road	4456	12.4	8.9	5.7	2.7	0.0	-2.5	-4.9	-7.1	-9.2
Northbound, North of College Road	5173	11.5	8.2	5.2	2.4	0.0	-2.1	-4.0	-5.8	-7.3
Northbound, North of College Road	4437	10.7	7.6	4.8	2.3	0.0	-2.0	-3.9	-5.4	-6.9
Southbound, North of College Road	4587	13.2	9.4	6.0	2.9	0.0	-2.7	-5.2	-7.5	-9.6
Southbound, North of College Road	4735	13.3	9.5	6.1	2.9	0.0	-2.7	-5.2	-7.5	-9.7
Southbound, North of College Road	4588	13.3	9.5	6.1	2.9	0.0	-2.7	-5.2	-7.5	-9.7
Southbound, North of College Road	4589	13.8	9.9	6.2	3.0	0.0	-2.7	-5.1	-7.3	-9.3
Northbound, South of Church Lane	4594	12.8	9.2	5.9	2.8	0.0	-2.6	-5.1	-7.3	-9.5

Road Section	Source ID	Speed Change:--20%	Speed Change:--15%	Speed Change:--10%	Speed Change:--5%	No Speed Change	Speed Change:-5%	Speed Change:-10%	Speed Change:-15%	Speed Change:-20%
Northbound, South of Church Lane	5139	12.2	8.7	5.6	2.7	0.0	-2.5	-4.8	-6.9	-8.9
Northbound, South of Church Lane	5140	12.9	9.2	5.9	2.8	0.0	-2.6	-5.0	-7.2	-9.3
Southbound, South of Church Lane	4455	8.5	6.0	3.8	1.8	0.0	-1.7	-3.2	-4.6	-5.9
Southbound, South of Church Lane	4593	13.2	9.4	6.0	2.9	0.0	-2.7	-5.1	-7.5	-9.6
Southbound, South of Church Lane	5172	13.9	9.9	6.3	3.0	0.0	-2.7	-5.1	-7.3	-9.4
Northbound, North of Church Lane	4461	12.8	9.2	5.9	2.8	0.0	-2.6	-5.1	-7.4	-9.5
Northbound, North of Church Lane	4605	17.0	12.1	7.7	3.7	0.0	-3.3	-6.4	-9.3	-11.9
Northbound, North of Church Lane	4454	11.3	8.0	5.1	2.4	0.0	-2.2	-4.1	-5.8	-7.4
Southbound, North of Church Lane	4436	12.1	8.6	5.5	2.6	0.0	-2.4	-4.7	-6.8	-8.7
Southbound, North of Church Lane	4595	12.9	9.2	5.9	2.8	0.0	-2.6	-5.1	-7.4	-9.5
Southbound, North of Church Lane	4738	12.9	9.2	5.8	2.8	0.0	-2.5	-4.8	-6.8	-8.7

Table A.4 – Percentage Change of NO_x Emissions Following Percentage Change of Speed, 2024

Road Section	Source ID	Speed Change:--20%	Speed Change:--15%	Speed Change:--10%	Speed Change:--5%	No Speed Change	Speed Change:-5%	Speed Change:-10%	Speed Change:-15%	Speed Change:-20%
Northbound, South of College Road	4586	14.6	10.4	6.6	3.1	0.0	-2.9	-5.6	-8.0	-10.3
Northbound, South of College Road	4702	11.9	8.5	5.4	2.6	0.0	-2.4	-4.6	-6.7	-8.6
Northbound, South of College Road	4585	12.8	9.2	5.8	2.8	0.0	-2.6	-5.0	-7.3	-9.4
Northbound, South of College Road	4435	13.7	9.8	6.2	3.0	0.0	-2.8	-5.3	-7.7	-9.9
Southbound, South of College Road	4457	11.4	8.1	5.2	2.5	0.0	-2.3	-4.4	-6.3	-8.1
Southbound, South of College Road	4734	13.7	9.7	6.2	2.9	0.0	-2.7	-5.0	-7.2	-9.2
Northbound, North of College Road	4456	12.4	8.9	5.7	2.7	0.0	-2.5	-4.9	-7.1	-9.1
Northbound, North of College Road	5173	11.4	8.1	5.1	2.4	0.0	-2.0	-4.0	-5.7	-7.2
Northbound, North of College Road	4437	10.6	7.5	4.7	2.3	0.0	-2.0	-3.9	-5.4	-6.8
Southbound, North of College Road	4587	13.1	9.4	6.0	2.9	0.0	-2.6	-5.1	-7.4	-9.5
Southbound, North of College Road	4735	13.2	9.5	6.0	2.9	0.0	-2.7	-5.2	-7.5	-9.6
Southbound, North of College Road	4588	13.2	9.5	6.0	2.9	0.0	-2.7	-5.2	-7.5	-9.6
Southbound, North of College Road	4589	13.7	9.7	6.2	2.9	0.0	-2.7	-5.0	-7.2	-9.2
Northbound, South of Church Lane	4594	12.8	9.2	5.9	2.8	0.0	-2.6	-5.0	-7.3	-9.4

Road Section	Source ID	Speed Change:--20%	Speed Change:--15%	Speed Change:--10%	Speed Change:--5%	No Speed Change	Speed Change:-5%	Speed Change:-10%	Speed Change:-15%	Speed Change:-20%
Northbound, South of Church Lane	5139	12.1	8.7	5.5	2.6	0.0	-2.5	-4.7	-6.8	-8.8
Northbound, South of Church Lane	5140	12.8	9.1	5.8	2.8	0.0	-2.6	-4.9	-7.1	-9.2
Southbound, South of Church Lane	4455	8.3	5.9	3.7	1.8	0.0	-1.6	-3.1	-4.5	-5.8
Southbound, South of Church Lane	4593	13.1	9.4	6.0	2.9	0.0	-2.6	-5.1	-7.4	-9.5
Southbound, South of Church Lane	5172	13.8	9.8	6.2	3.0	0.0	-2.7	-5.0	-7.3	-9.3
Northbound, North of Church Lane	4461	12.8	9.2	5.9	2.8	0.0	-2.6	-5.1	-7.3	-9.5
Southbound, South of Church Lane	4605	17.4	12.3	7.8	3.7	0.0	-3.4	-6.5	-9.4	-12.1
Southbound, South of Church Lane	4454	11.1	7.9	5.0	2.4	0.0	-2.2	-4.1	-5.7	-7.3
Southbound, North of Church Lane	4436	11.9	8.5	5.4	2.6	0.0	-2.4	-4.6	-6.7	-8.6
Southbound, North of Church Lane	4595	12.9	9.2	5.9	2.8	0.0	-2.6	-5.0	-7.3	-9.4
Southbound, North of Church Lane	4738	12.8	9.1	5.8	2.7	0.0	-2.5	-4.8	-6.7	-8.6

Table A.5 – Percentage Change of NO_x Emissions Following Percentage Change of Speed, 2025

Road Section	Source ID	Speed Change:--20%	Speed Change:--15%	Speed Change:--10%	Speed Change:--5%	No Speed Change	Speed Change:-5%	Speed Change:-10%	Speed Change:-15%	Speed Change:-20%
Northbound, South of College Road	4586	14.7	10.5	6.6	3.2	0.0	-2.9	-5.6	-8.1	-10.4
Northbound, South of College Road	4702	11.7	8.3	5.3	2.5	0.0	-2.4	-4.5	-6.6	-8.5
Northbound, South of College Road	4585	12.8	9.1	5.8	2.8	0.0	-2.6	-5.0	-7.2	-9.3
Northbound, South of College Road	4435	13.7	9.8	6.2	3.0	0.0	-2.8	-5.3	-7.7	-9.9
Southbound, South of College Road	4457	11.0	7.8	5.0	2.4	0.0	-2.2	-4.2	-6.1	-7.9
Southbound, South of College Road	4734	13.5	9.6	6.1	2.9	0.0	-2.6	-4.9	-7.1	-9.1
Northbound, North of College Road	4456	12.4	8.8	5.6	2.7	0.0	-2.5	-4.8	-7.0	-9.0
Northbound, North of College Road	5173	11.1	7.9	5.0	2.4	0.0	-2.0	-3.8	-5.5	-7.0
Northbound, North of College Road	4437	10.4	7.4	4.7	2.2	0.0	-2.0	-3.8	-5.3	-6.7
Southbound, North of College Road	4587	13.0	9.3	5.9	2.8	0.0	-2.6	-5.0	-7.3	-9.4
Southbound, North of College Road	4735	13.1	9.4	6.0	2.9	0.0	-2.6	-5.1	-7.4	-9.5
Southbound, North of College Road	4588	13.1	9.4	6.0	2.9	0.0	-2.6	-5.1	-7.4	-9.5
Southbound, North of College Road	4589	13.5	9.6	6.1	2.9	0.0	-2.6	-4.9	-7.1	-9.1
Northbound, South of Church Lane	4594	12.8	9.2	5.9	2.8	0.0	-2.6	-5.0	-7.3	-9.4

Road Section	Source ID	Speed Change:--20%	Speed Change:--15%	Speed Change:--10%	Speed Change:--5%	No Speed Change	Speed Change:-5%	Speed Change:-10%	Speed Change:-15%	Speed Change:-20%
Northbound, South of Church Lane	5139	12.0	8.5	5.4	2.6	0.0	-2.4	-4.7	-6.8	-8.7
Northbound, South of Church Lane	5140	12.6	9.0	5.7	2.8	0.0	-2.5	-4.9	-7.1	-9.1
Southbound, South of Church Lane	4455	8.0	5.7	3.6	1.7	0.0	-1.6	-3.0	-4.4	-5.7
Southbound, South of Church Lane	4593	12.9	9.2	5.9	2.8	0.0	-2.6	-5.0	-7.3	-9.4
Southbound, South of Church Lane	5172	13.6	9.7	6.1	2.9	0.0	-2.7	-5.0	-7.2	-9.2
Northbound, North of Church Lane	4461	12.8	9.2	5.9	2.8	0.0	-2.6	-5.1	-7.3	-9.5
Northbound, North of Church Lane	4605	17.7	12.6	8.0	3.8	0.0	-3.5	-6.7	-9.6	-12.3
Northbound, North of Church Lane	4454	11.0	7.8	4.9	2.3	0.0	-2.1	-4.0	-5.6	-7.1
Southbound, North of Church Lane	4436	11.5	8.2	5.2	2.5	0.0	-2.3	-4.5	-6.5	-8.3
Southbound, North of Church Lane	4595	12.8	9.2	5.9	2.8	0.0	-2.6	-5.0	-7.3	-9.4
Southbound, North of Church Lane	4738	12.6	9.0	5.7	2.7	0.0	-2.5	-4.7	-6.6	-8.4

Figure A.1 – Maps of Road Links. Left to Right: College Road Junction, Church Lane Junction, Larger Scale A10 Exceedance Stretch

Appendix B – Details of Softer Measures to be Pursued

Table B.1 – Funding and Scheme Comments for Pursued Measures

ID	Measure Category	Measure	Comments	Cost information	Totals
36	Public Transport Routes and Services	Public transport infrastructure improvements, e.g. – Enhanced bus shelters – Accurate electronic timetables – m-tickets / contactless payment options	Upgrade up to 20 stop/shelter locations across Broxbourne. This upgrade will include DDA kerbing improvements, new and refurbed shelters programme, real time passenger information (RTPI) screens, solar panels for energy generation and green roofs/ living shelter. Green/living shelters absorb roadside pollution particles and provide cooling structures/places to wait in warm weather as well as encouraging biodiversity in built up areas. Solar run screens are a carbon neutral energy generation to power light and screens on the shelters.	Kerbing and groundworks = £166k Shelter upgrades (new or refurbed shelter, solar panels RTPI screens, green roof/living shelters) = £660k (£33k * 20)	Kerbing = £166,660 Shelter = £660,000 **Total = £826,660**
37	Public Transport Routes and Services	Incentivise public transport usage, e.g. – Provision of information about existing services – Campaigns – Season tickets loan/discounts – subsidised tickets	• Development within the existing Intalink (https://www.intalink.org.uk/) m-ticketing app for multi operator ticketing • Smart ticketing initiative • Awareness campaign and ongoing marketing Route branding	m-ticketing app = £40k Smart ticketing = £40k Campaign/Marketing = £80k Route/Bus branding = £30k	m-tick = £40,000 Smart tick = £40,000 Campaign = £80,000 Bus branding = £30,000 **Total = £190,000**
70	Behavioural Campaigns	Provision of high quality, bespoke and accessible information on sustainable travel, e.g. on a dedicated travel website with route/mode options	Create a 'travel area' on the Intalink website specifically for the Broxbourne area. This section of the site would contain all the relevant maps, service timetables, real time information, journey planning and ticket information for the area. There would also be the potential to advertise area specific campaigns (e.g. active travel), encourage multi-mode travelling, news and events on this section of the web as well for the Broxbourne area	Development and maintenance costs of the pages = £10k	Web = £10,000 **Total = £10,000**
78	Behavioural Campaigns	Anti-idling campaign on traffic signals using VMS signs	Installation of 7 VMS signs on the A10 corridor linking to 10 roadside air quality monitoring units/ stations. The AQ monitoring units will provide data to automatically update VMS signs with messaging around anti-idling and air quality. **They are not intended to provide compliance or monitoring effectiveness, rather reinforce messaging.**	7 VMS signs (install, maintenance, data feeds) = £45k 10 AQ sensors (install, maintenance, data feeds) = £10k	VMS = £45,000 AQ Sensors = £10,000 **Total = £55,000**

Table B.2 – Total Cost Summary for Pursued Measures

Item	Total Cost
Infrastructure	£826,660
Incentivise	£190,000
Information	£10,000
VMS/ AQ Sensors	£55,000
Total	£1,081,660