THIRD WAVE LOCAL AUTHORITIES – TARGETED FEASIBILITY STUDY TO DELIVER NITROGEN DIOXIDE CONCENTRATION COMPLIANCE IN THE SHORTEST POSSIBLE TIME

Local authorities covered	Solihull Metropolitan Borough Council

<u>Further information on the content of each section is set out in the guidance.</u>

Part 1: Understanding the problem

This section should set out background on the information about the road links projected to have exceedances in the PCM national model, in combination with source apportionment data, to provide a description of the severity of the NO2 exceedance and its possible sources and causes. It should set out the scale of the problem and the case for change. Maps and local data should be included. ***Each road link should be addressed in turn.***

Background and Location

Two sections of the A45 in Solihull, West Midlands, have been identified as being projected to be in exceedance of the annual mean NO_2 EU limit value in the PCM national model. These links are Census ID 86030 and 99175. JAQU has stated that the stretch of the A45 relating to Census ID 99175 has been re-routed to allow for the extension of the runway of Birmingham Airport, and that the geometry of the road link has therefore now changed. It was noted that the PCM modelled concentration may therefore not be representative of this stretch of road.

The two links are described on Huddle as follows:

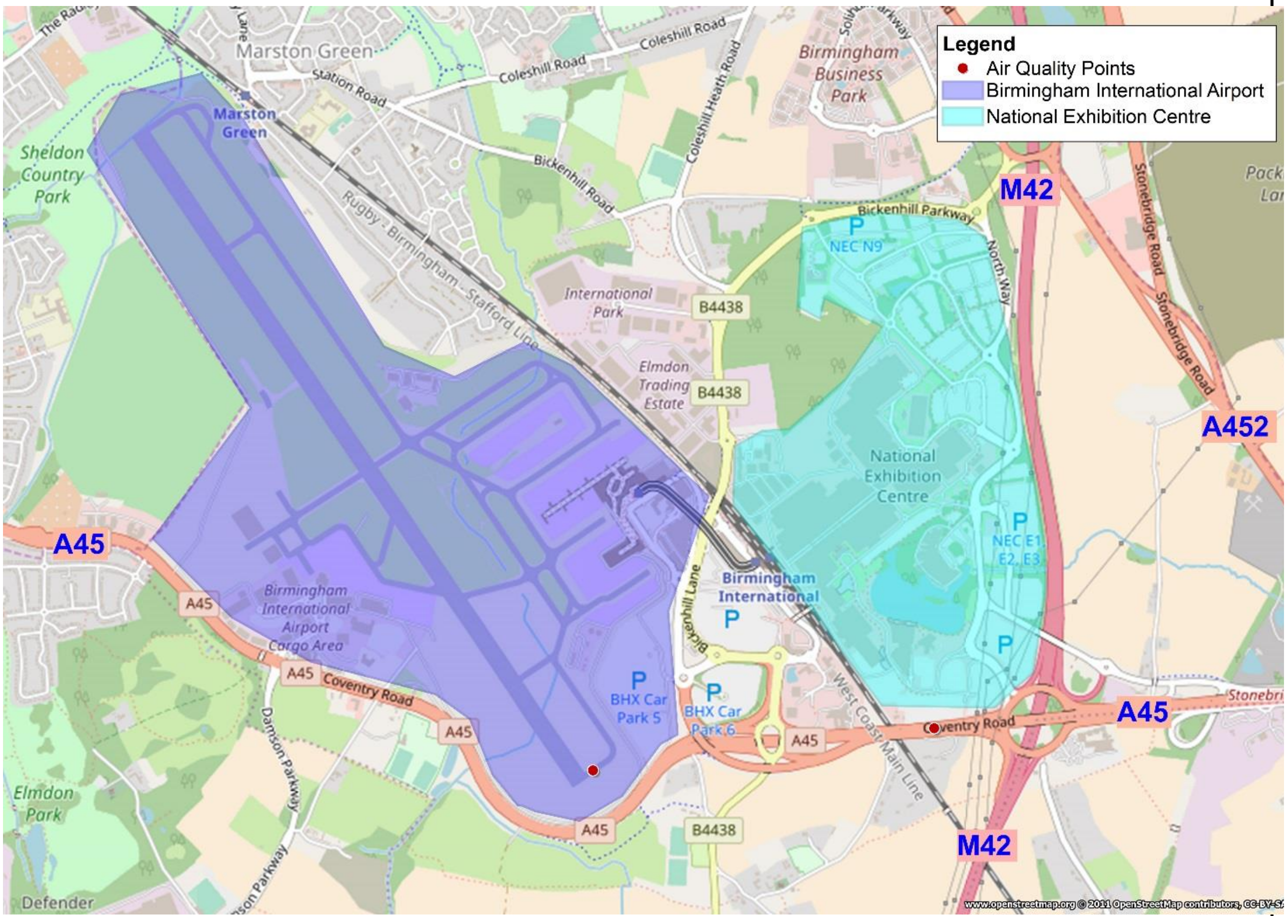
- Census ID 86030: runs from the B4438 to Junction 6 of the M42.
- Census ID 99175: runs from the B4438 to the junction with the local authority boundary.

It was noted that the local authority boundary is further west than shown on the map provided (which shows the end of the link as being at Damson Parkway). Therefore, we will consider a slightly longer link for Census ID 99175, instead running from the B4438 to Goodway Road.

As the two links are directly next to each other, the measures outlined in this document will apply to each section.

Figure 1 shows the points of exceedance, based on coordinates provided by Defra.

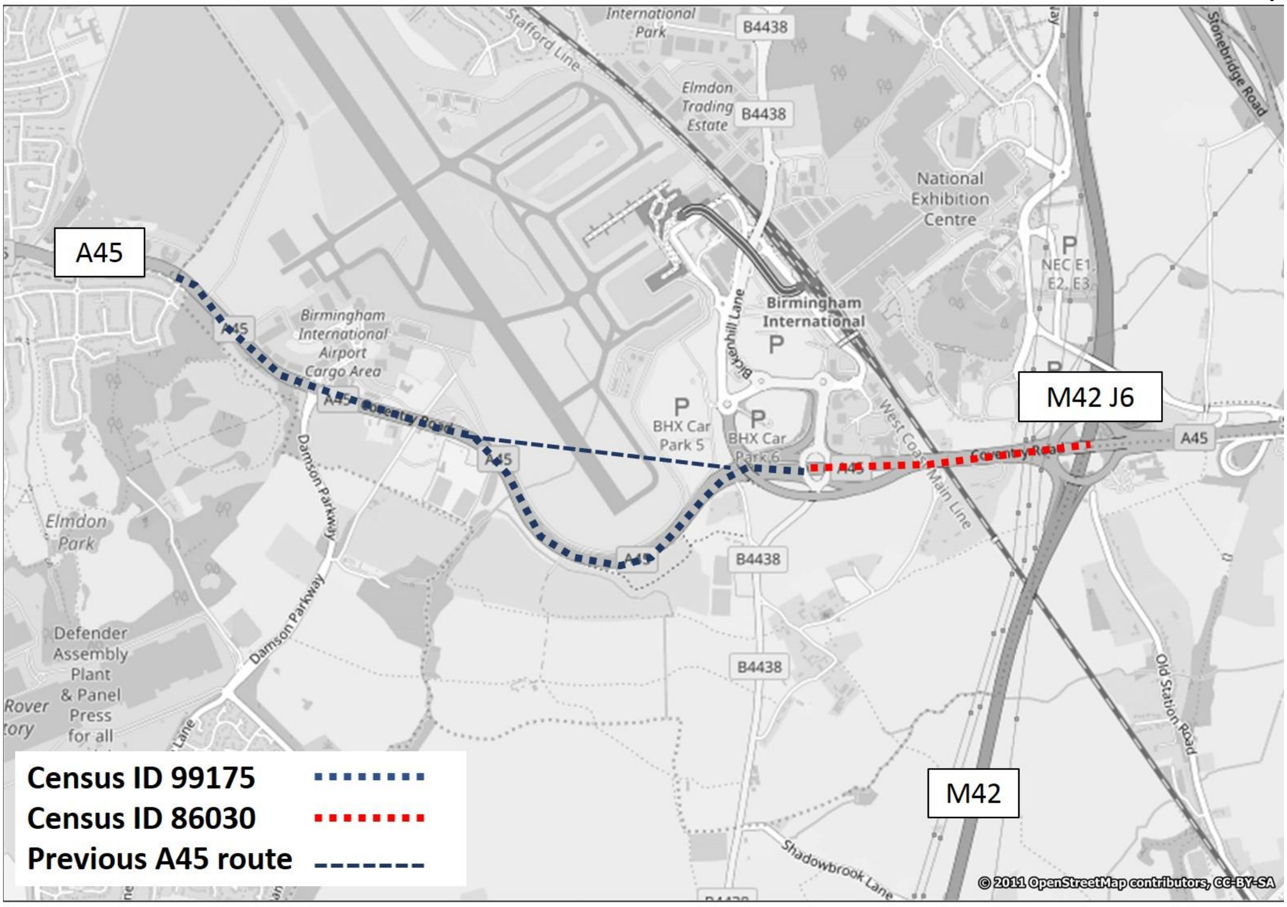
Figure 1 Location of Census ID Points



Updated geometries for the two links were not provided, and so the two links assumed and discussed in this document have been plotted on the map in

Figure 2, based on the descriptions provided by JAQU, and as noted above.

Figure 2 Census ID Links

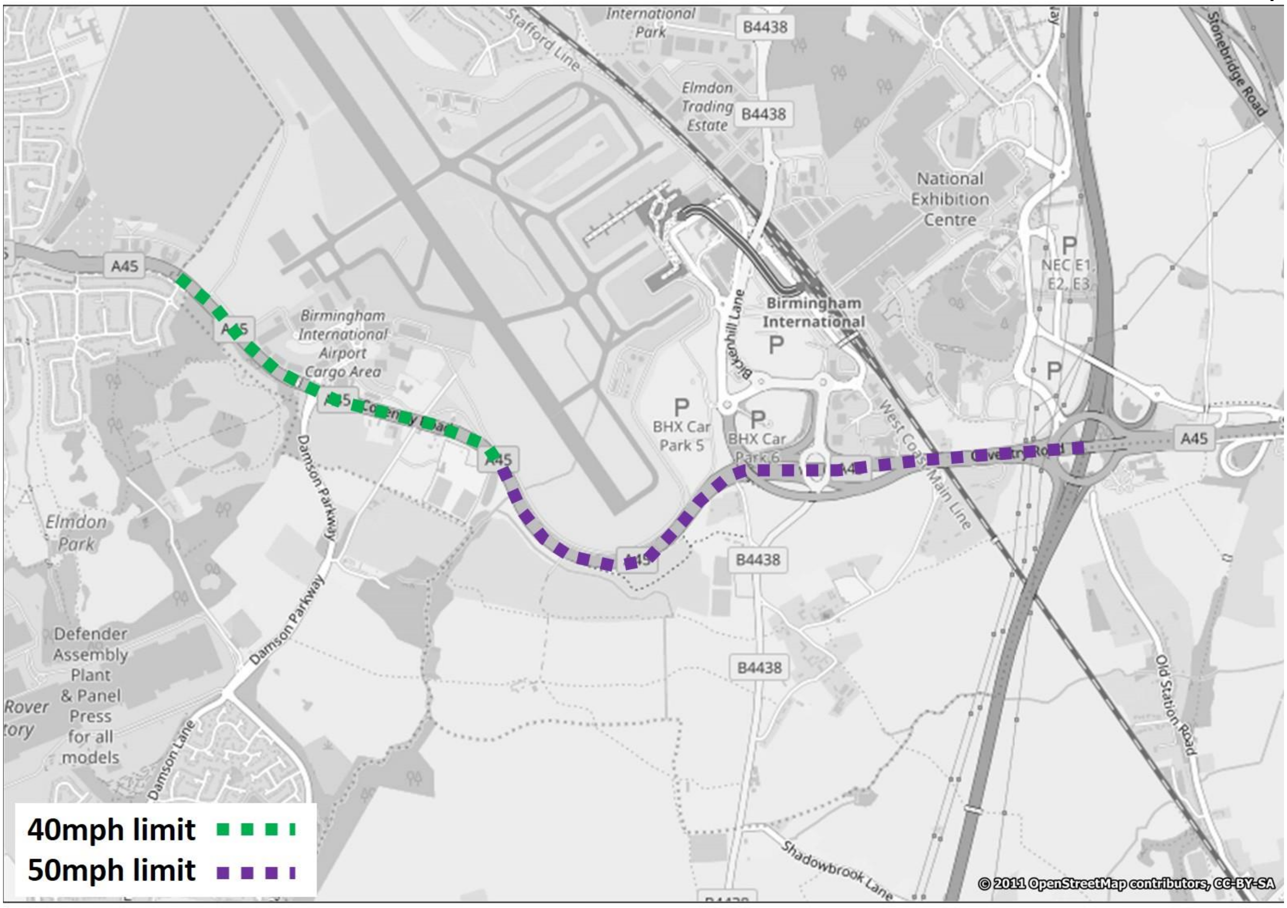


Census ID 86030, which runs from the M42 to the Clock Junction, which is the junction with the B4438 (Catherine De Barnes Lane) and Bickenhill Lane, is a stretch of dual carriageway with predominantly two lanes in each direction (D2) and approximately 1km in length.

Section 99175 is also D2 and is approximately 2.9km. To the east of links 99175 and 86030, the A45 connects to M42 Junction 6, approximately 1.5km from the airport, where there are accesses to the M42 northbound and southbound, as well as accesses to the National Exhibition Centre (NEC) and National Motorcycle Museum. The A45 continues east to connect to Coventry.

To the west of the links, the A45 provides access towards Birmingham City Centre, approximately 11km away from the airport. To the north of the A45 between the Damson Parkway junction and the Clock Junction (B4438) a bus only road runs parallel to the highway within the airport boundary. The entire stretch of the A45 at this location is a Red Route Clearway (no stopping permitted). The stretch of the A45 with the Census ID 86030 is subject to a 50mph speed restriction, whereas the route with the ID 99175 is subject to both 40mph and 50mph restrictions, as shown in Figure 3.

Figure 3 Speed Restrictions



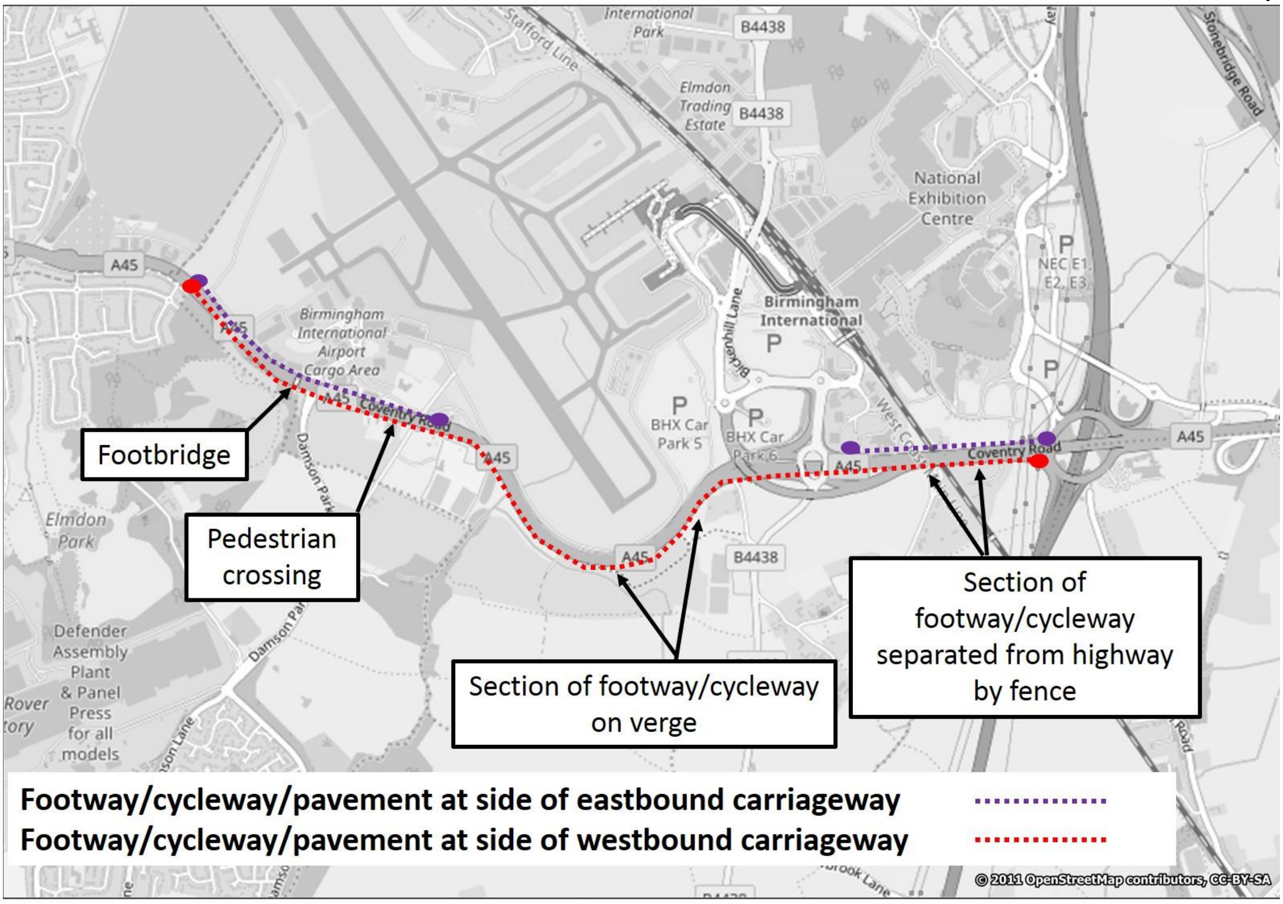
Non-Motorised User (NMU) Access

There are a number of footways/cycleways in the vicinity, with a footway/cycleway running alongside most of the distance of the two links. This is a footway for most of the route, with sections of shared foot and cycleway. There is an NMU route which runs parallel to the westbound carriageway, connecting to cycling and walking routes near to the interchange of the A45 and B4438 (Bickenhill Lane). At the section where the A45 has been diverted to accommodate the runway, this NMU route is not directly adjacent to the highway, and is situated on the grassed slope approximately 10m from the carriageway. This is shown in

Figure 4. However, the NMU route again becomes level with the A45 and the footway runs next to the westbound carriageway up to the end of link 99175. There is also a pedestrian bridge on link 99175, at the junction with Damson Parkway, although this is now closed. The NMU facilities are shown in Figure 5. Note that Public Rights of Way and cycle routes will be investigated in further detail.

Figure 4 Footway/Cycleway on Westbound Carriageway (© Google 2018)

Figure 5 NMU Facilities



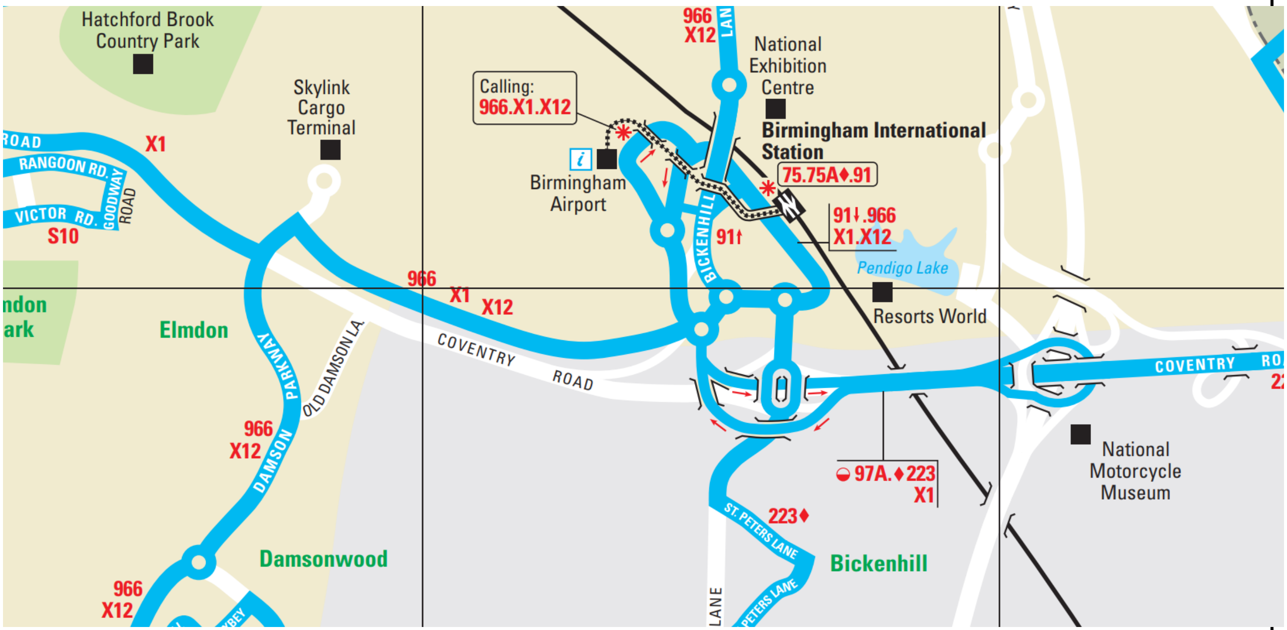
Public Transport

Bus routes for the two links are as follows:

- Link 99175: the X1 service runs from the west start point of the link along the A45 to Damson Parkway. At this point, services on the A45 and services from Damson Parkway enter the airport area and use the bus only road within the airport which runs parallel to the A45. This is an extension of Falcon Way to the airport terminal. This means that there are no bus services on the A45 at this point.
- Link 86030: the services operating in the airport and NEC area north of the A45 route onto the A45 from the junction with the B4430, with buses providing access to Coventry and Solihull. Service X1 (National Express West Midlands) operates along Link 86030, with approximately three buses per hour per direction during the peak and inter-peak periods. Therefore, there are approximately six buses per hour using this section of the A45.

The routes operating in the vicinity are shown in Figure 6, which is taken from the Network West Midlands website.

Figure 6 Local Bus Routes



The X1 service, operated by National Express, uses Euro VI standard vehicles.

The nearest railway station is Birmingham International, located off Bickenhill Lane. The railway line runs below Link 86030. Both electric and diesel trains run along this section. The trains are both passenger and freight.

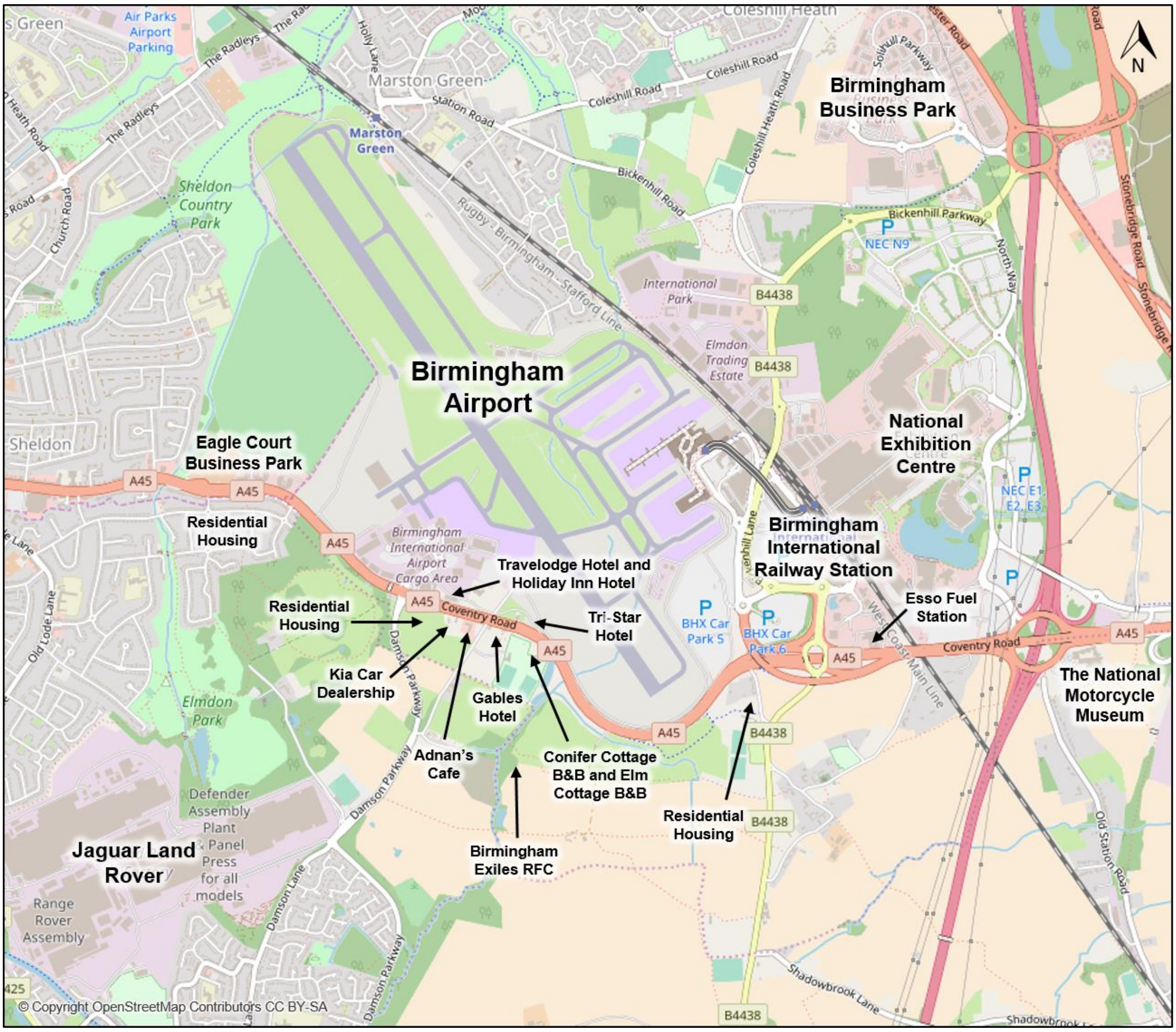
Local Trip Generators

In terms of local trip generators, the following are located in the vicinity of the areas of exceedance:

- Birmingham Airport: located to the west of Junction 6 of the M42. There were 12 million passengers reported to have travelled from the airport in the 12 months previous to April 2017. The site includes several hotels, as well as the main terminal building. There are approximately 150 companies at the site, with 7,000 people employed.
- Birmingham International Railway Station: located to the west of Junction 6 of the M42, the railway station provides links to Birmingham, Coventry and London amongst others.
- The NEC, Resorts World and Genting Arena: this complex is located next to the airport and railway station, with the NEC and Genting Arena hosting frequent large events.
- Birmingham Business Park: located to the north of the NEC site, near Junction 7 of the M42.
- Jaguar Land Rover: located off Damson Parkway, to the south of the A45 at the point of exceedance. There are 8,000 parking spaces available.
- Birmingham Business Park: located to the north of the NEC, with approximately 7,000 employees.
- The National Motorcycle Museum: located off Junction 6 of the M42.
- Eagle Court Business Park: located to the west of the airport.
- Other: there is a car dealership, several hotels/bed and breakfasts, a fuel station and a small number of houses along the section of the A45.

The exact locations of these local trip generators have been plotted on the map in Figure 7.

Figure 7 Local Trip Generators



Planned Future Developments

There are a number of developments planned in the vicinity of the areas of exceedance. These include the following:

- Sprint: a Sprint bus route is planned in the area, running between Birmingham and UKC in time for the Commonwealth Games in 2022. This would use Link 99175 up to Damson Parkway before using the bus-only link to the airport. The buses are likely to be Euro 6 diesel engines. Another Sprint route, that would interact with this section of the A45 and would link UKC and Solihull, is also a possibility.
- High Speed 2 (HS2): the Birmingham Interchange station will be located in the "triangle" between the M42, A452 and A45. This is within 500m of Link 86030. This will be in place by 2026. A considerable amount of construction work is envisaged in the vicinity between 2019 and 2026.
- Damson Parkway/A45 junction: a feasibility study is underway at present, which could result in infrastructure works to increase capacity at the junction.
- M42 Junction 6: a major scheme is planned for Junction 6 of the M42, with the target to begin construction by 2020. The scheme aims to increase capacity at the junction to

the airport and HS2. The scheme involves providing a link for traffic from the M42 between Junction 5 and Junction 6 in the northbound direction to the Clock Junction. Therefore, it is anticipated that fewer vehicles would use the section of the A45 between the M42 Junction 6 and the Clock Junction (i.e. Link 86030).

support economic growth in the local area and to improve access to locations such as

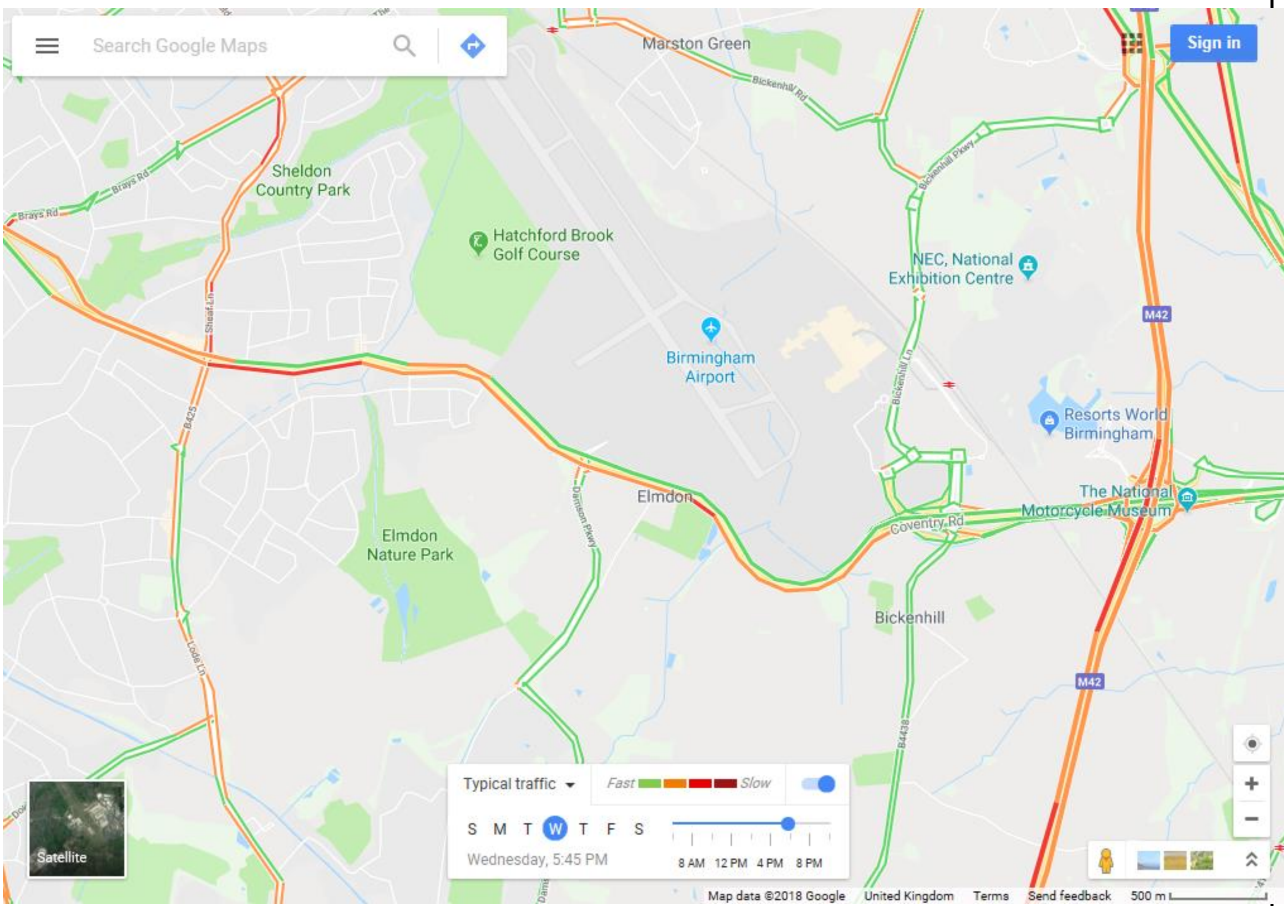
- UKC: the UK Central hub area, including the NEC, airport and planned HS2 station, aims to boost the economy by attracting investors. There will be a new mixed-use development between the NEC and airport and the HS2 interchange.

As a result of the planned improvements in the local area, it is expected that there will be a significant amount of heavy construction work in and around this section of the A45. In addition, construction traffic may be routed through the two links in question, which are likely to have an impact on NO_2 in the vicinity. The timescales of many of the improvements is not yet clear. However, it is expected that some of the work is completed ahead of the Commonwealth Games in 2022 and before Phase 1 of HS2 in 2026.

Traffic Profiles and Congestion

Understanding traffic profiles and congestion in the local area is crucial to assessing the impact of traffic on NO_2 levels. Traffic count information has been obtained from the DfT and is analysed later in this section. In terms of congestion, Google Maps has been used to obtain a broad understanding of congestion on the A45 at this location, as shown in Figure 8.

Figure 8 Congestion Shown on Google Maps



Generally, there does not appear to be congestion during the AM peak. However, there are delays during the PM peak, as shown on the map (which presents a typical PM peak on a Wednesday). Generally, the A45 eastbound towards the M42 appears to be relatively free of congestion, with most delays occurring on the westbound carriageway towards Birmingham from the B4438 junction all the way to the Solihull/Birmingham boundary. The traffic speeds seem to be particularly slow on the approaches to the Damson Parkway/A45 junction (Census ID 99175). The M42 appears to be heavily congested in the PM peak period. This is highly likely to be a major contributor to the NO_2 exceedances on the nearby A45, particularly Link 86030, although the effect of such is unlikely to be fully reflected in the PCM model.

Air Quality: Understanding the Problem

Spatial Extent of the Exceedance

This section of the study uses information about the road links projected to have exceedances, in combination with source apportionment data, to provide a description of the severity of the NO_2 exceedance and its possible sources and causes. It then sets out the scale of the problem and the case for change.

Data has been extracted from the PCM model[1] for the exceeding road links identified (Census IDs 86030 and 99175). Table 1 provides baseline PCM concentration projections assuming no further action beyond the air quality measures that were committed by the reference year (2015). This indicates that PCM link 86030 is projected to be compliant by 2021, whereas PCM link 99175 is projected to comply by 2020.

Table 1 Baseline Roadside NO_2 concentration (μg/m³) from PCM (Do Nothing Scenario)

Census ID	Base Year (2015)	2017	2018	2019	2020	2021
86030	55	50	47	45	42	39
99175	51	46	43	41	38	36

The locations of these road links are shown in Figure 9**Error! Reference source not found.**, along with the year in which compliance with EU limit values is expected to occur on each link. Two PCM links located in the area administered by Birmingham City Council are also shown (Census ID 56416 and 56385) to provide context.

[1] Defra (2017) Projections for concentrations of NO_2 NO_X across the UK for the years 2017 - 2030 inclusive, calculated as part of a Pollution Climate Mapping (PCM) model assessment for the development of the UK plan for tackling roadside NO_2 concentrations. Baseline and with measures projections. Accessed Apr-18: https://uk-air.defra.gov.uk/library/no2ten/2017-no2-projections-from-2015-data

Figure 9 Modelled Exceedances of Annual Mean NO_2 EU Limit Values

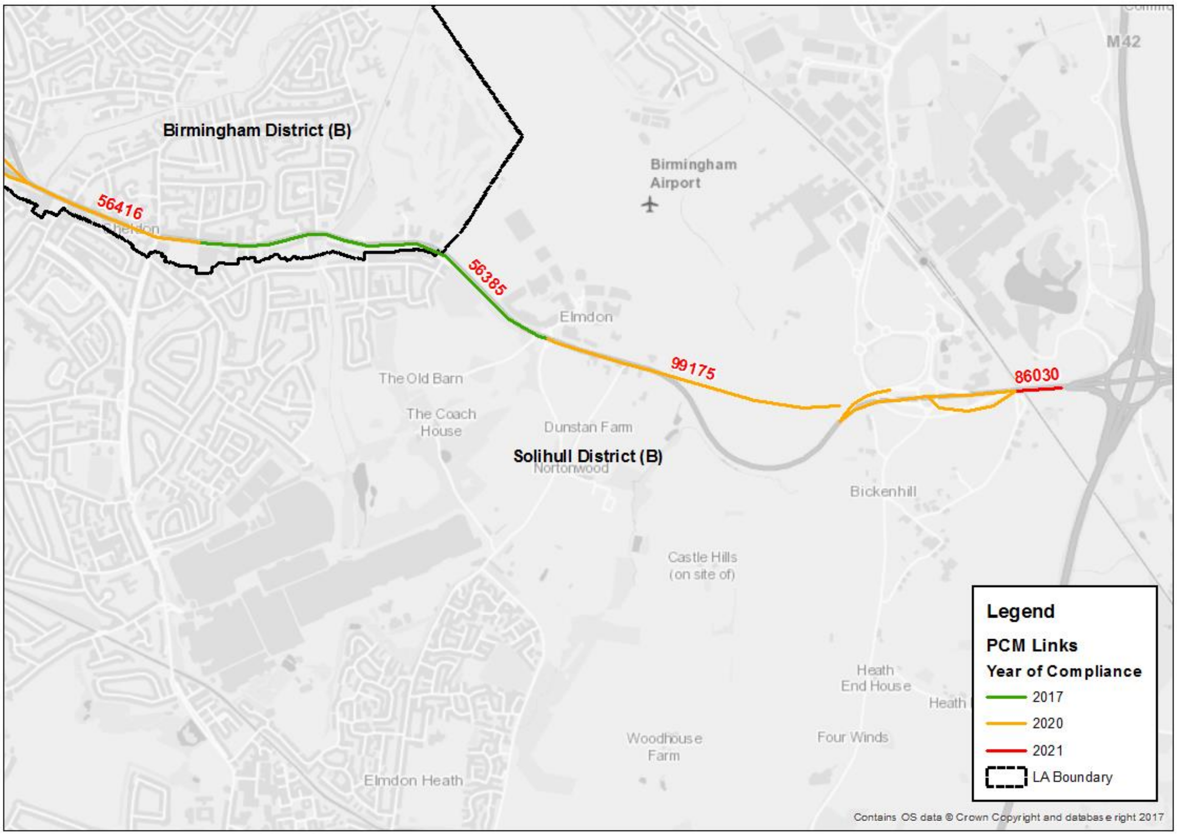


Table 1 indicates that higher annual mean NO_2 concentrations are modelled to occur adjacent to PCM link 86030 than PCM link 99175, resulting in a later projected year of compliance. Figure 9 indicates that PCM link 86030 is located between the M42 and the first junction on the A45, which is used to access Birmingham International Airport, the NEC and a number of large car parks. This difference in projected concentrations between adjacent links suggests traffic flows on PCM link 86030 (and therefore emissions) are greater than those on PCM link 99175, which is west of this junction.

The map also indicates higher annual mean NO_2 concentrations are modelled to occur adjacent to PCM link 99175 than PCM link 56385 (the Census ID of which is located in the area administered by Birmingham City Council). PCM link 56385 is located west of the second junction on the A45, which is used to access the Cargo Centre of Birmingham International Airport and a number of car parks and hotels (to the north of the A45) and Elmdon Heath and the Jaguar Land Rover Solihull Plant (to the south of the A45). This difference in projected concentrations between adjacent links suggests traffic flows on PCM link 99175 (and therefore emissions) are greater than those on PCM link 56385.

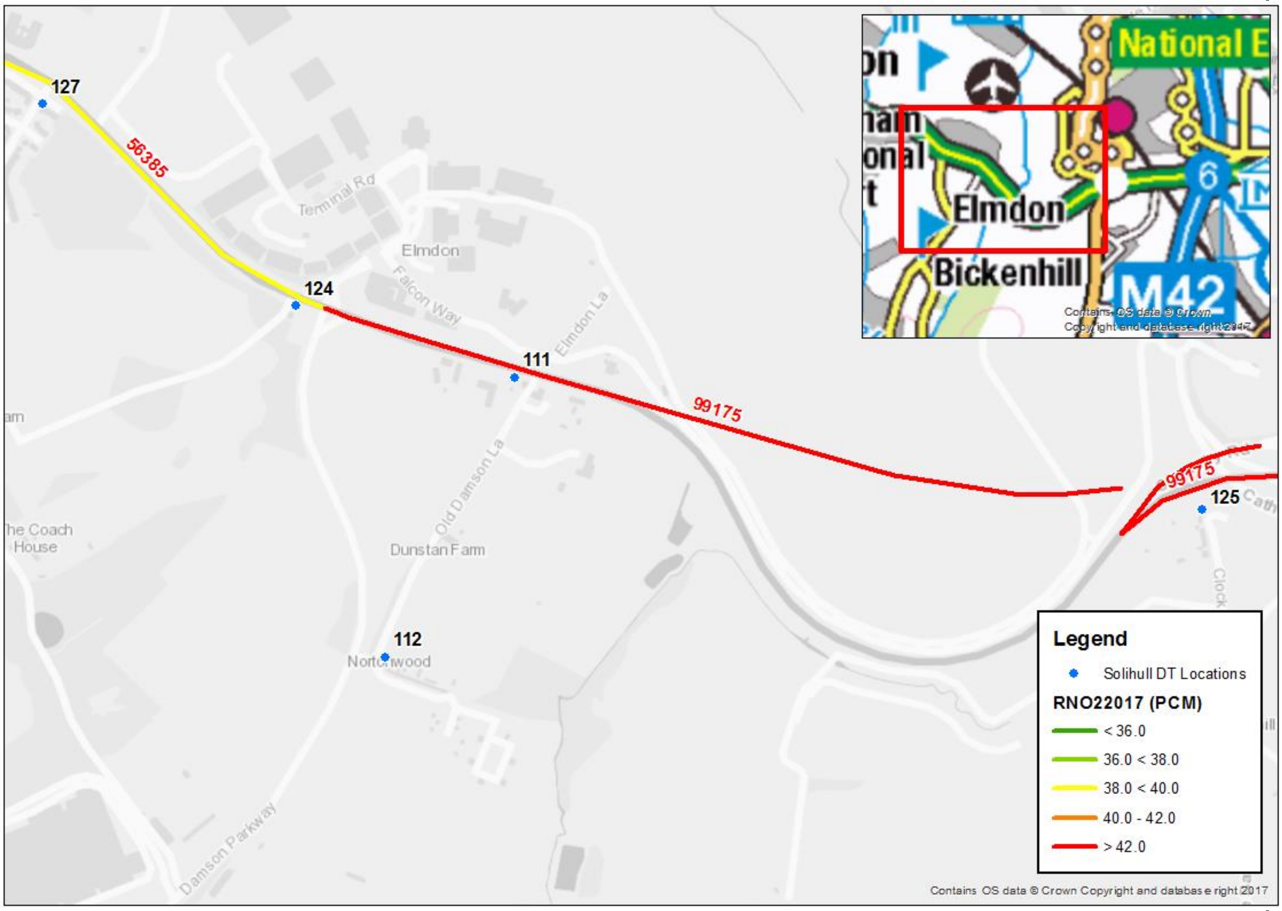
Comparison of PCM Model Outputs and Measured Concentrations

SMBC has installed NO_2 diffusion tubes at a number of locations within the study area (see Figure 10). Some of these tubes have been in place since July 2017, whilst others have only been installed relatively recently (February 2018). Where more than three months of data are available, the measurement results obtained at these sites have been annualised and bias adjusted so as to be representative of a 2017 annual mean concentration, in accordance with the methods described in LAQM.TG16. It should be noted that these data are currently provisional and will be updated as more measurement data become available.

The results indicate that the estimated 2017 annual mean NO_2 concentration at DT111 (40.1 µg/m³) is compliant with the level of the annual mean NO_2 EU limit value (40 µg/m³). This diffusion tube is located approximately 4m from the A45 and is therefore comparable to PCM model projections. As shown in Figure 10 however, this measured value is substantially lower than that projected by the PCM model for 2017 (45.9 µg/m³). It should be noted, however, that DT111 is located to the south of the A45 at a location representative of relevant exposure but that a prevailing south-westerly wind is likely to result in higher annual mean NO_2 concentrations to the north of the A45 at a similar distance.

The two months of data obtained at the three further diffusion tube sites in the study area (DT124, DT125 and DT127) suggest that concentrations at these locations are also approaching 40 µg/m³, however additional measurement data is required to undertake further meaningful analysis of measured concentrations at these sites.

Figure 10 Solihull Diffusion Tube Locations Adjacent to PCM Model Links



Source Apportionment of PCM Model Data

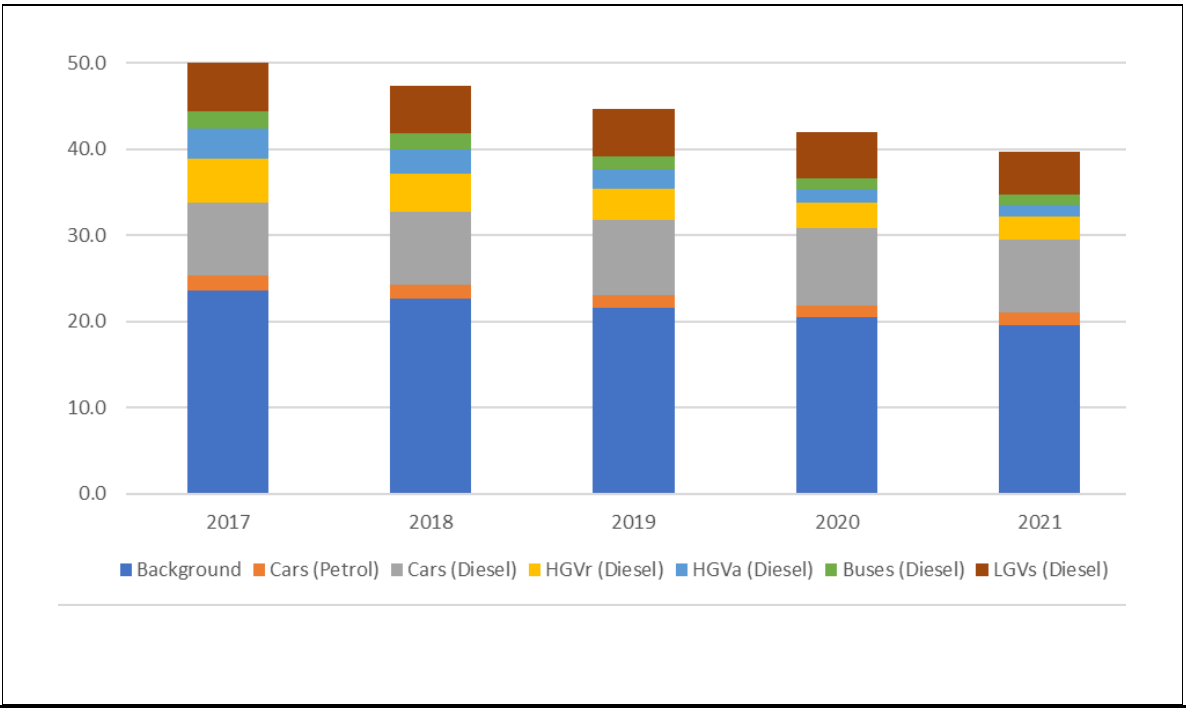
Source apportionment data have been obtained for road links 86030 and 99175 for the years 2015, 2020 and 2025 (the available years for which source apportionment data are available within the period of interest)[2]. These data were then interpolated to estimate values for intervening years.

[2] Defra (2017) Projections for concentrations of NO_2 NO_X across the UK for the years 2017 - 2030 inclusive, calculated as part of a Pollution Climate Mapping (PCM) model assessment for the development of the UK plan for tackling

The relative contribution of different emission sources to the modelled (PCM) NO_2 contribution from background sources and road sources respectively, has been estimated using the source apportionment data provided for NOx[3].

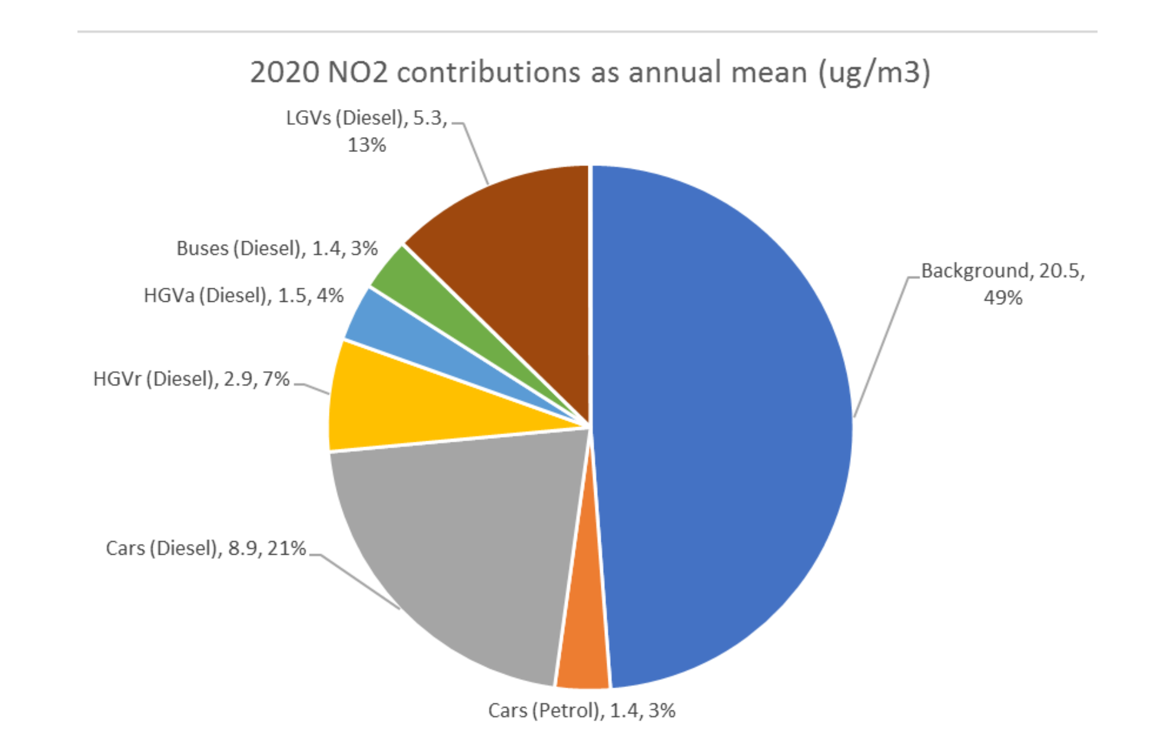
The highest PCM link concentrations in Solihull are projected for road link 86030, with total NO_2 estimated as 47 µg/m³ in 2018, 45 µg/m³ in 2019 and 42 µg/m³ in 2020. Figure 11 provides estimated source apportionment data for the total projected NO_2 concentration in each year. These data indicate that background NO_2 is relatively high, accounting for approximately 50% of the total (20 µg/m³). The remaining 50% is attributed to road transport on this specific road link. Attributing this by vehicle type shows that diesel cars contribute 20% (9 µg/m³ in 2020), diesel LGVs 13% (5 µg/m³ in 2020), HGVs (rigid and articulated) 11% (4 µg/m³ in 2020), with buses contributing 3% (1.4 µg/m³ in 2020). The contribution made by petrol LGVs and motorcycles is negligible.

Figure 11 Source Apportionment of NO_2 (µg/m³) by Year, with Proportionate Contributions for 2020 (Road Link 86030)



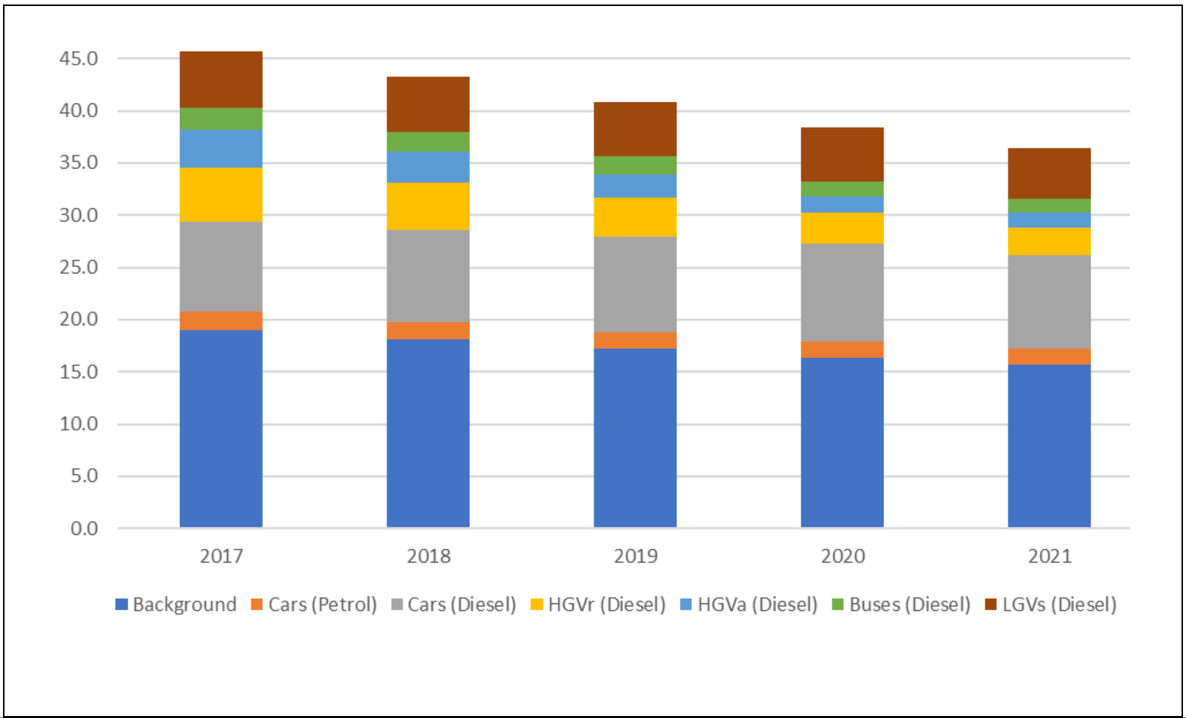
roadside NO_2 concentrations. Annual mean NOx source apportionment for 2015 and the projected baseline situation for 2015, 2020, and 2025. Accessed Apr-18: https://uk-air.defra.gov.uk/library/no2ten/2017-no2-projections-from-2015-data

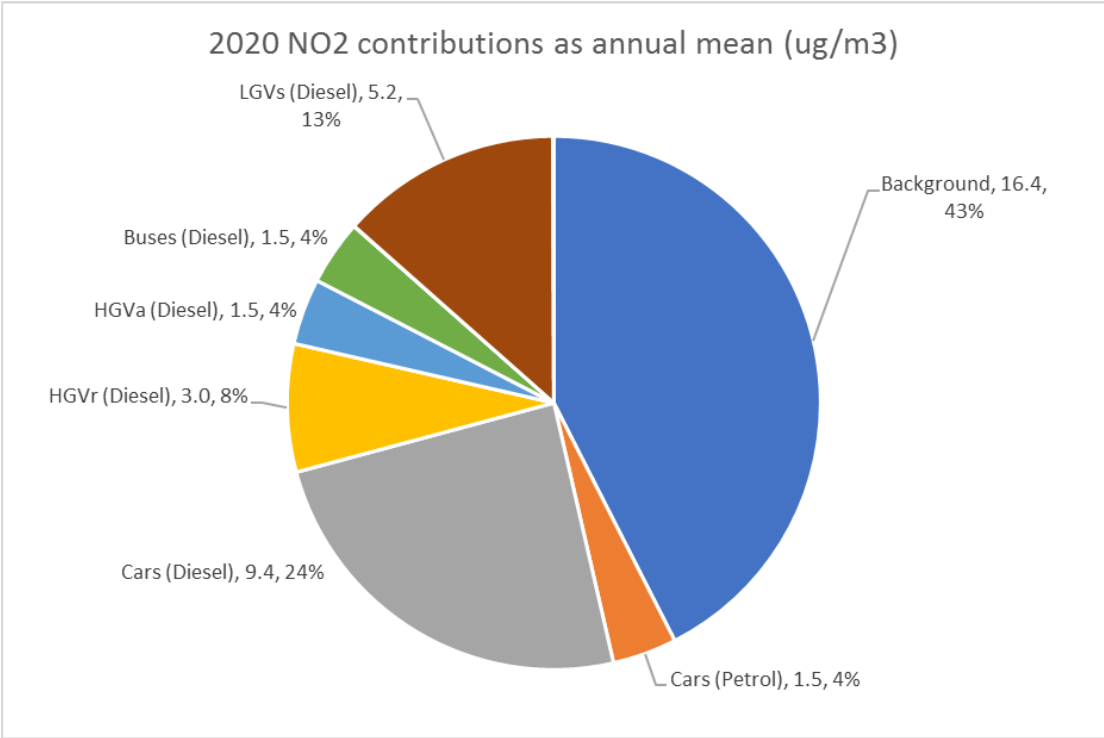
[3] For each road link the data shows the proportional contribution to annual mean NO_x concentrations from each source. Oxides of nitrogen (NO_x) is the term used to describe the sum of nitrogen dioxide (NO_2) and nitric oxide (NO) in the air. Emission regulations cover total NO_x, whereas ambient concentration limits focus on NO_2. Ambient NO_2 concentrations are made up of both directly emitted NO_2 (known as primary NO_2) and NO_2 formed in the atmosphere by the oxidation of NO (known as secondary NO_2). This means that it is not possible to calculate an unambiguous source apportionment specifically for NO_2 concentrations; therefore the source apportionment is provided for NO_x, rather than for NO_2.



Road link 99175 is projected to have lower concentrations, with total NO_2 estimated as 43 µg/m³ in 2018, 41 µg/m³ in 2019 and 38 µg/m³ in 2020. The following figure provides equivalent source apportionment data for this link. Background NO_2 has a slightly lower relative and absolute contribution (43%, 16 µg/m³). Contributions to the remaining NO_2 by vehicle type mirror those for link 86030: diesel cars contribute 24% (9 µg/m³ in 2020), diesel LGVs 13% (5 µg/m³ in 2020), HGVs (rigid and articulated) 12% (3 µg/m³ in 2020), with buses contributing 4% (1.5 µg/m³ in 2020).

Figure 12 Source Apportionment of NO_2 (µg/m³) by Year, with Proportionate Contributions for 2020 (Road Link 99175)





The location of the A45 in Solihull, adjacent to Birmingham International Airport, suggested that it would be prudent to further examine the background component, to identify the extent to which aircraft emissions contribute to projected annual mean NO_2 concentrations in this area.

The PCM model provides a further breakdown of background contributions to total NO_X concentrations. The following two figures provide source apportionment of background NO_X for the two links. Comparing the two road links, absolute values of NO_X contributions (µg/m³) from the different background sources are extremely similar, with the exception of Urban background: road transport, which in 2020 contributes 17 µg/m³ NO_X on link 86030, compared with 12 µg/m³ NO_X on link 99175. The same source (Urban background: road transport) shows significant reductions over time on both links, compared with the other source sectors whose absolute NO_X contributions remain relatively consistent.

The PCM background NO_X contribution for aircraft (urban other transport and mobile machinery: aircraft) is relatively minor on both links, 0.6 µg/m³ (2% of total NO_X background for link 86030 and 3% for link 99175).

Figure 13 Source Apportionment of Background NOX (µg/m³) by Year (Road Link 86030)

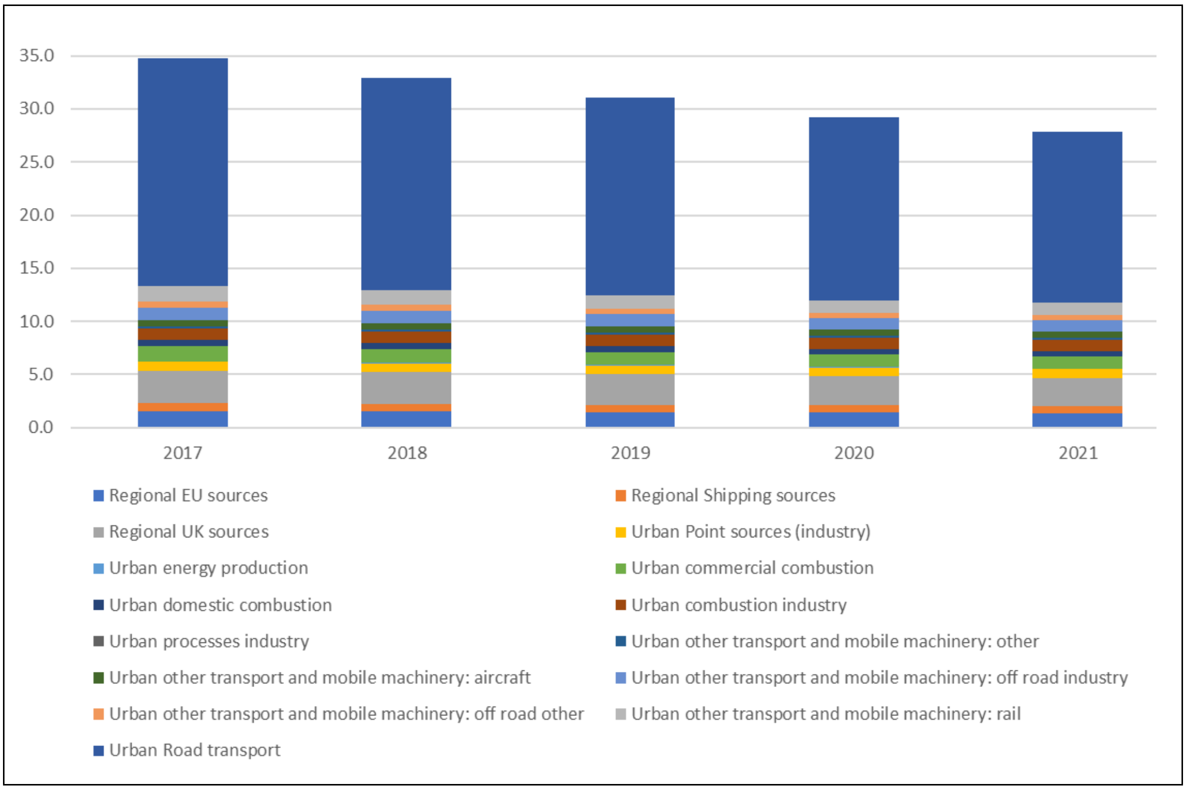


Figure 14 Source Apportionment of Background NOX (µg/m³) by Year (Road Link 99175)

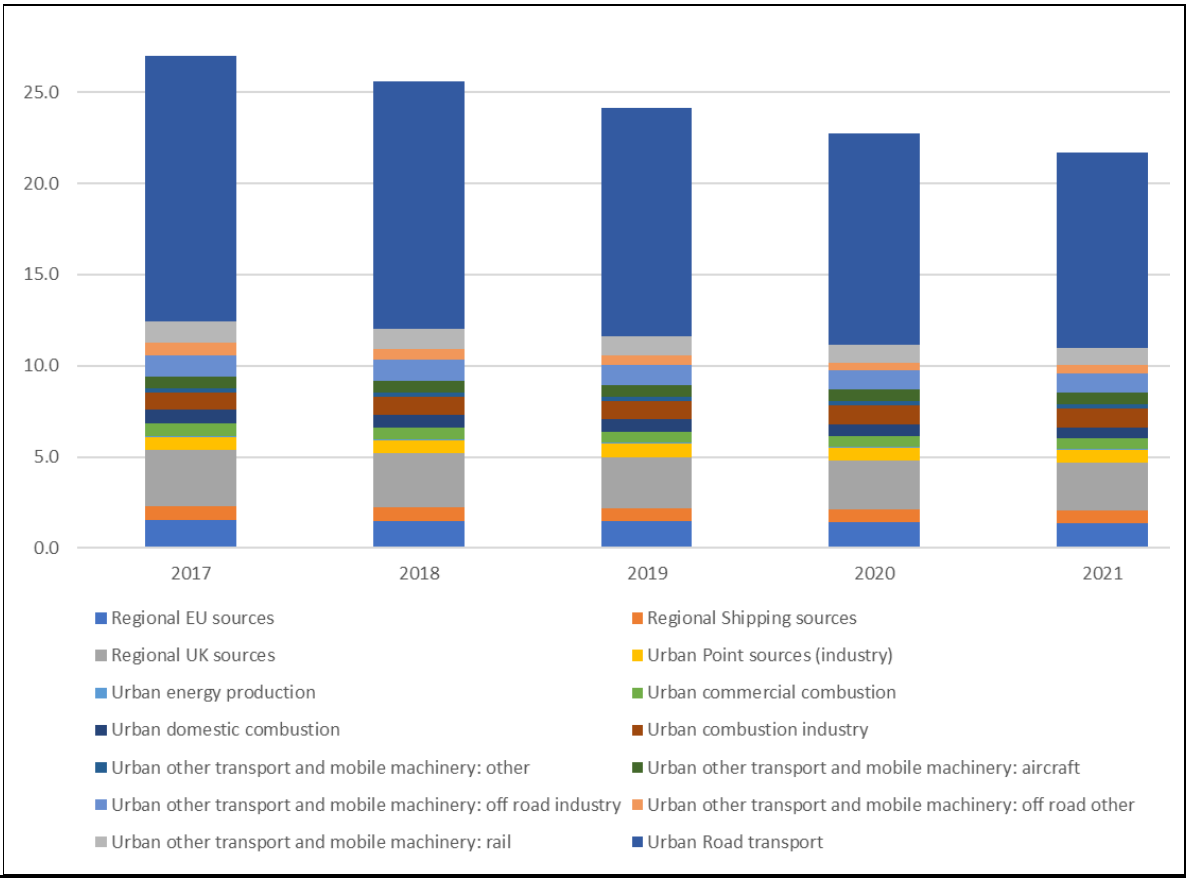
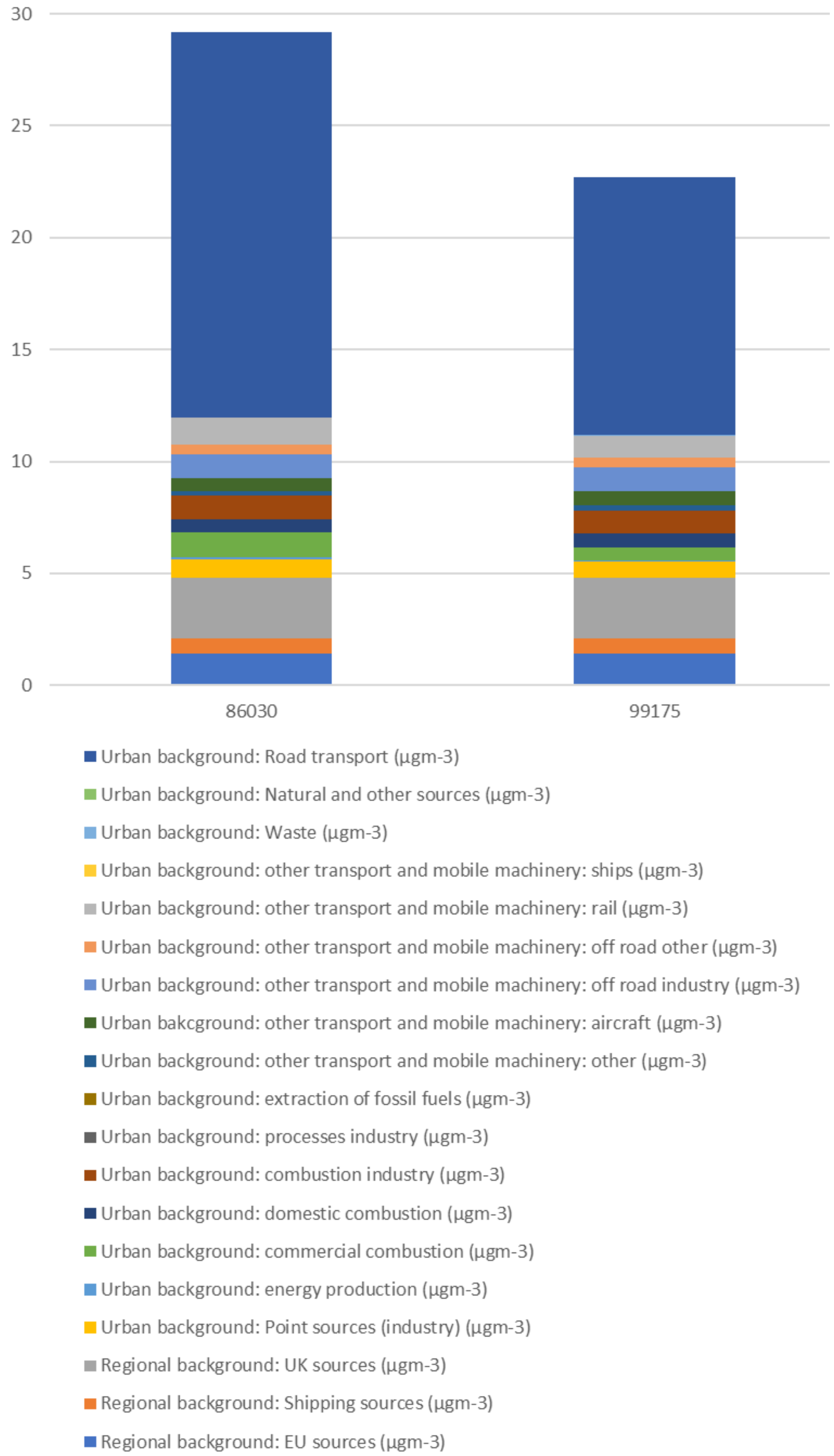


Figure 15 Source Apportionment of Background NOX (µg/m³) for 2020 by Road Link



The PCM model estimates background concentrations for the UK as a whole. These data are compiled by Defra for LAQM purposes[4], and provided at a 1km x 1km resolution, for total NO_2, and apportioned by source sector for NO_X. It is understood that these background contributions are assigned to PCM model links according to the corresponding X, Y grid reference of their Census ID. Mapped contributions from 'aircraft' and 'road transport' to background concentrations are presented in Figure 16 and

Figure 17 respectively, along with the location of the Census ID for each PCM model link. These figures illustrate how the background contributions from these source types are assumed to vary across the study area and at the location of each PCM model link Census ID. Estimated background NO_X concentrations can be used to estimate relative source sector contributions to NO_2 concentrations assuming a 1:1 ratio, although as noted previously**Error! Bookmark not defined.**, this approach is not entirely accurate, as the relationship between NO_X and NO_2 is non-linear. Despite this, estimated background contributions to NO_2 for aircraft and road transport concentrations are shown in brackets by grid square in Figure 16 and

[4] Defra (2017) Background mapping data for local authorities, including 2015-based background maps for years 2015 to 2030 for NOx and NO2. Available online at: https://uk-air.defra.gov.uk/data/laqm-background-home

Figure 17 respectively, to provide context.

Figure 16 indicates that whilst the contribution from aircraft sources associated with Birmingham Airport is clearly distinguishable within the background maps, the estimated contribution at the location of each PCM link Census ID is relatively small. Conversely,

Figure 17 indicates that background ‘road transport’ sources are estimated to make a sizeable contribution at the location of each PCM model link Census ID, in particular that for link 86030, presumably as a result of its proximity to the M42. Indeed, it appears that this difference in the estimated background contribution from ‘road transport’ sources for PCM link 99175 and 86030 respectively, is a significant contributor to the difference in projected NO_2 concentrations and associated year of compliance between these two links (see Table 1).

Figure 16 Contribution of aircraft to background NO_X concentrations (2017 with 2015 base year). Estimated contributions to NO_2 concentrations for each grid square are given in brackets.

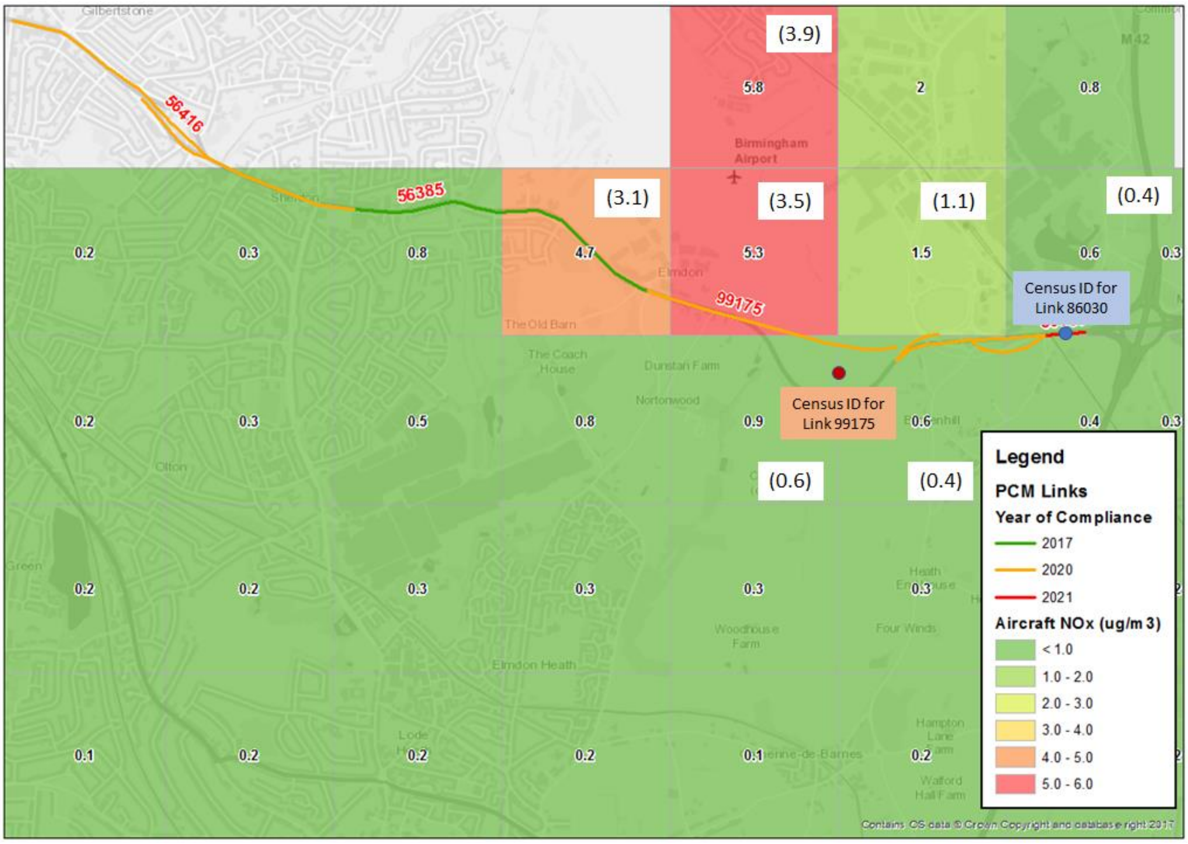
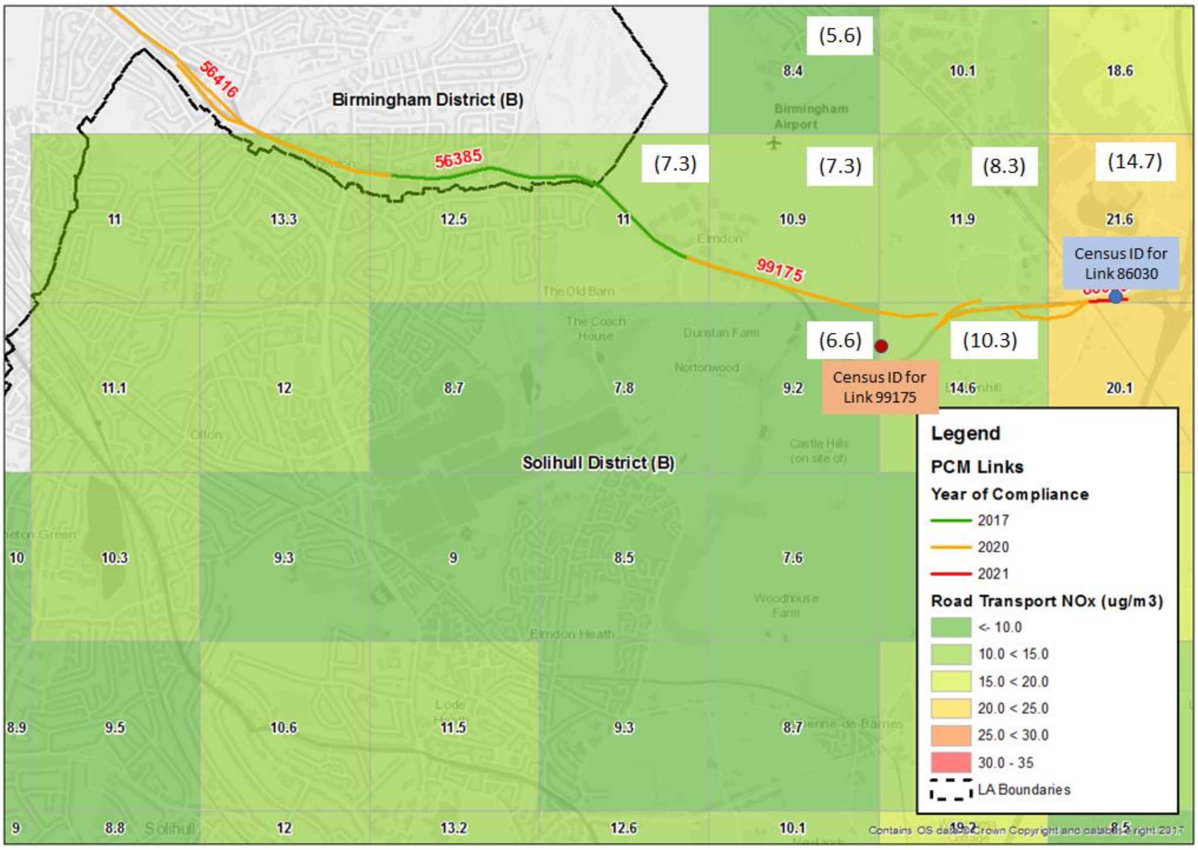


Figure 17 Contribution of road transport to background NO_X concentrations (2017 with 2015 base year) Estimated contributions to NO_2 concentrations for each grid square are given in brackets.



Local Source Apportionment

Limited recent traffic data are held by SMBC within the study area. As such, traffic data obtained from the DfT website have been used to provide a local estimate of the contribution of different vehicle types to NOx emissions for each PCM link in the study area.

The locations of these traffic count sites are shown Figure 18 and the traffic data obtained summarised in Table 2.

Figure 18 Locations of DfT Traffic Counts

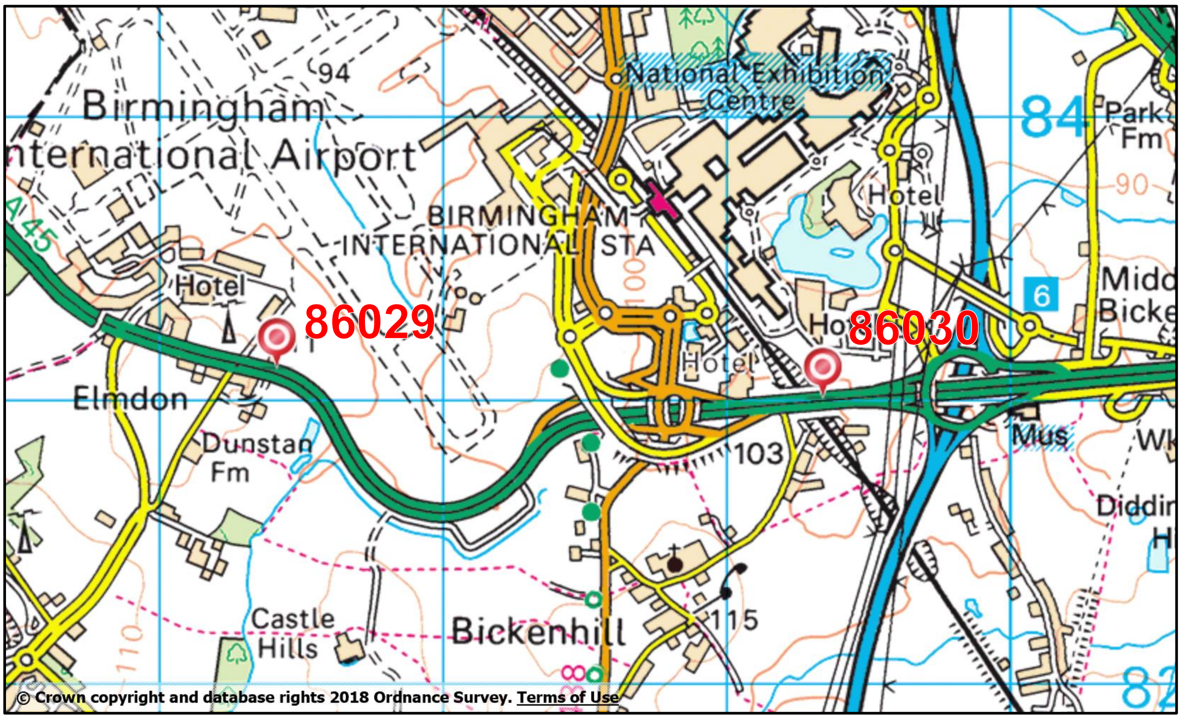


Table 2 DfT Traffic Count Data (2016)

Count Point ID	Cars and Taxis	LGVs	Rigid HGVs	Artic HGVs	Buses and Coaches
86029	38,222 (83%)	5,160 (11%)	1,164 (2%)	1,656 (4%)	90 (<1%)
86030	57,329 (85%)	6,011 (9%)	1,204 (1%)	2,167 (3%)	341 (1%)

The information presented in Table 2 indicates that total traffic volumes at site 86030 were substantially greater than at site 86029, presumably reflecting the significant number of vehicle movements associated with Birmingham Airport and the NEC. This difference is particularly marked for cars and taxis and buses and coaches.

These data have subsequently been used to estimate relative Road-NOx emissions, by vehicle type, for each road link in 2017 using Defra's Emissions Factors Toolkit (v8.0.1a) and an assumed average speed of 80 kph. These results of this analysis are shown in Table 3.

Table 3 Local Road NOx Source Apportionment

Count Point ID	Petrol Cars and Taxis	Diesel Cars and Taxis	LGVs	Rigid HGVs	Artic HGVs	Buses and Coaches
86029	7.1%	45.1%	29.9%	8.4%	8.1%	1.0%
86030	7.8%	49.5%	25.4%	6.3%	7.8%	2.8%

These results indicate that diesel cars and taxis make by far the largest contribution to NOx emissions on each link (45-50%), closely followed by LGVs (25-30%). Together, rigid and artic HGVs contribute 14-16%, whilst buses and coaches are estimated to make a relatively minor contribution (1-3%).

Part 2: Developing a long list of measures for addressing the exceedances

This section should provide a long list of possible measures to be considered for each road link. Local authorities should consider the source apportionment set out in part 1.

In order to develop a long list of potential measures, we have consulted with nearby organisations. We have also liaised with Atkins colleagues who have previously worked in the area. Meetings and/or discussions have been held with the following organisations:

- Birmingham Airport;
- Jaguar Land Rover;
- Birmingham Business Park;
- Resorts World;
- Solihull MBC (Sustainable Transport Lead);
- Transport for West Midlands; and
- Birmingham City Council.

In addition, due to Atkins' previous work with the local employer Interserve, information has been gathered for this organisation.

To ensure the relevant information has been recorded at each meeting, a pro forma was produced, which is completed for each business engaged with. This provides a record of travel planning initiatives implemented, fleet composition etc., with the aim to show where appropriate further measures could be introduced and also where measures have been introduced since 2015. These will be included as an appendix.

The long list of measures which could be implemented in the future is as follows:

- Enhanced workplace travel plans at organisations in the vicinity identified in Part 1;
- Workplace travel planning, including personalised travel planning sessions and changes to flexible working policies;
- Junction capacity enhancements where queuing occurs;
- The introduction of a Clean Air Zone (CAZ), including charging for vehicles that do not meet specified emissions standards;
- Marketing and communications campaigns;
- Enhanced public transport to large organisations and business parks in and around the corridor;
- Introduction of a workplace parking levy;
- Encouraging use of the local walking and cycling network, for example by offering cycle training, journey planning and cycle buddy schemes;
- Set up or promotion of car sharing schemes;
- Changes to the speed limit;
- The installation of speed control devices;
- Changes to signing to highlight alternative routes; and
- Optimising traffic signals.
- Converting taxis to Euro 6 engines or electric vehicles;
- Using vegetation to help absorb NO_2 by appropriate planting, roadside hedges, "green" advertising hoardings;
- Car clubs for large organisations in the vicinity;
- Screens along the M42 to push NO_2 upwards, to aid dispersion; and
- The introduction of Sprint Park and Ride.

Since 2015, the model base year, there have been some changes which could constitute measures working towards reducing NO_2. For example, alongside the re-routing of the A45, improved non-motorised user facilities were implemented. Furthermore, Interserve is an example of one organisation which has re-located to the Birmingham International area. As part of their re-location in February 2018, a host of measures have been introduced, including needs-based on-site car parking management, provision of a shuttle bus to a “remote” car park one mile from the office, as well as pool cycles at this car park, provision of on-site cycle and moped-motorcycle storage and maintenance workstation, set-up of a private car sharing group and free public transport tickets for one year.

The further measures which have been implemented since 2015 are as follows:

- Enhanced walking and cycling facilities.

Note that although there are two points of exceedance, due to their location and position next to each other, the measures discussed in this document will apply to both sections.

Assessment of these measures will take place as part of Parts 3 and 4. It is noted that some of the measures listed may be viewed as unsuitable for this area. This will be taken into account during appraisal and sifting.

Part 3: Assessing deliverability/feasibility and delivering a short list

For each of the measures identified in part 2, local authorities should set out an assessment of deliverability including how long it would take to deliver each measure and whether it is practicably feasible to deliver. Based on this assessment of deliverability and feasibility, the local authority should develop a short list of measures to take forward to part 4 of the report.

This section will assess the deliverability of each of the measures outlined in Part 2, to produce a short list of measures which will be taken forward to Part 4. Firstly, this section will provide more detail on what each measure might entail, and a high-level indication of an implementation timetable. Each measure is then assessed based on these assumptions.

Enhanced workplace travel plans at organisations in the vicinity identified in Part 1

This measure would involve implementing or enhancing travel plans at organisations in the vicinity, such as Jaguar Land Rover and Birmingham Airport. Travel plans provide a structure for employers to encourage sustainable travel within their organisation. This includes both staff travel and business travel. Travel plan specialists would work with sustainability leads at such employers to either implement a new travel plan or to enhance an existing travel plan, for example by adding new measures or by creating an action plan.

Workplace travel planning, including personalised travel planning sessions and changes to flexible working policies

This measure would require travel demand management specialists to work with employers in the vicinity to offer a bespoke package of workplace travel planning measures. This might include undertaking travel events with staff with personalised travel planning sessions and providing advice on implementing flexible working or parking policies and other schemes, such as a cycle buddy scheme. It also may entail car parking management strategies, reviewing and optimising fleet vehicles by changes to engine types and negotiating with Transport for West Midlands or directly with operators to incentivise and/or to provide reduced cost public transport. It may also include a review of freight movements and timings with regards to HGVs.

Likely implementation timetable:

- Within 6 weeks: create list of local employers and associated numbers of employees; make contact with local employers and establish relationships; hold meetings and telephone calls with these employers to understand where their travel planning measures could be improved; investigate and secure funding for this work.
- Within 10 weeks: hold travel events and personalised travel planning sessions at these employers; work with employers on a one-to-one basis to offer a bespoke range of measures.

Junction capacity enhancements where queueing occurs

Although there is limited data available to understand where congestion and queuing occurs, there is some evidence to suggest that queueing occurs at the Damson Parkway junction, and on the approach to Junction 6 of the M42. Junction capacity enhancements would involve measures such as widening and re-allocation of lanes in order to maximise the efficiency of the junctions. It is noted that there is a feasibility study currently being undertaken for the junction at Damson Parkway.

Likely implementation timetable:

- Within three months: have undertaken some traffic and feasibility studies of local junctions which may experience congestion.
- Within six months: have taken forward the best measures which are likely to alleviate congestion issues; investigate and secure funding.
- Within 12 months: have started work, if appropriate and subject to funding being available.

The introduction of a Clean Air Zone (CAZ), including charging for vehicles that do not meet specified emissions standards

Clean Air Zones can be separated into two categories: charging and non-charging. Whilst charging CAZs require owners of vehicles that do not meet a certain standard to pay a charge to use the route, non-charging CAZs may restrict access for certain vehicles, without charging. In this instance, a CAZ could be implemented on the A45 for the length of the two links.

Likely implementation timetable:

- Within three months: have had discussions with JAQU and identified funding; have undertaken consultations.
- Within nine months: have produced final business case and achieved scheme approval.
- Within 24 months: have implemented infrastructure for CAZ and have begun charging.

Note that this is based on ambitious implementation timescales identified in a plan of implementation of a CAZ by Leeds City Council[5].

Marketing and communications campaigns

Marketing and communications campaigns could be introduced to encourage sustainable travel, for example, use of public transport and encouraging cycling and walking.

[5] https://www.leeds.gov.uk/docs/Air%20Quality%20Consultation%20FAQS.pdf

Likely implementation timetable:

- Within three months: have outlined where marketing and communications would be best targeted; to discuss with HE to identify where there could be collaboration; to have begun designing of marketing and communications strategy.
- Within six months: have rolled out marketing and communications campaigns, to be ongoing.

Enhanced public transport to large organisations and business parks in and around the corridor

This measure would involve investigating where staff are travelling from (from a number of neighbouring organisations), producing potential routing options and liaising with public transport providers to understand whether public transport in the area could be enhanced. This may involve buses being diverted to call into business parks or major employers, for example.

Likely implementation timetable:

- Within three months: have held discussions and negotiations with local public transport operators to understand where improvements could be made; to have identified which organisations would benefit from improved public transport; to have held conversations with these; to have decided whether any improvements could feasibly be made.
- Within 12 months: have registered the change to the timetable and implemented changes.

Introduction of a workplace parking levy

A workplace parking levy would involve charging employers in the vicinity who provide workplace parking.

Likely implementation timetable:

- Within six months: have held discussions internally and with local organisations; have held consultation and gained opinion; have plan for implementation.
- Within 24 months: have begun to roll out workplace parking levy.

Encouraging use of the local walking and cycling network, for example by offering cycle training, journey planning and cycle buddy schemes

As well as offering workplace travel planning support, as mentioned previously, similar measures could be offered within the wider community to those who may travel on the A45, for example, visitors to the airport or the NEC. This measure would involve considering where staff from multiple organisations are travelling from and combining this data, before identifying appropriate cycle and walking routes.

Likely implementation timetable:

- Within three months: have created list of local organisations and homes where marketing and communications could be targeted; plan of strategy to implement; secure funding for work.
- Within six months: have implemented all elements of this measure taken forward.

Set up or promotion of car sharing schemes

This measure involves setting up car sharing schemes for employees in the area, or encouraging use of existing schemes. This would involve working with nearby businesses to plan how best to promote car sharing schemes. This could be achieved through staff bulletins, posters/leaflets, intranet notices and travel events.

Likely implementation timetable:

- Within two months: have created list of local organisations where car sharing would be targeted; have secured funding for this work; have strategy for promotion of car sharing; where businesses do not have a car share scheme, look to implement a scheme.
- Within six months: roll out new car share scheme or roll out promotion of existing schemes.

Changes to the speed limit

There are currently both 40mph and 50mph speed limits on the A45 in the study area. This measure would involve reviewing whether altering these speed limits could improve air quality.

Likely implementation timetable:

- Within three months: have reviewed traffic speed and congestion data, for example by analysing satellite navigation data platforms; have reviewed where changes should take place; have undertaken relevant statutory consultations (e.g. with police).
- Within six months: have implemented changes, with associated signage etc.

The installation of speed control devices

This could involve installing speed cameras or average speed cameras along the section of the A45 which is part of the study area, in order to ensure that drivers are travelling at speeds which have less of a negative impact on air quality.

Likely implementation timetable:

- Within three months: have identified what type of speed cameras to introduce and where these should be located; have undertaken the relevant statutory consultations; have discussed similar schemes implemented in Solihull with relevant teams to roll-out this measure in a similar way.
- Within six months: have made the relevant arrangements to install cameras; have planned back office set-up if necessary; have identified staff to work in back office if necessary; have purchased relevant equipment.
- Within one year: have implemented speed control devices.

Changes to signing to highlight alternative routes

This measure would involve understanding where alternative routes could be used for the main trip attractors in the vicinity. This may include routing vehicles to Birmingham City Centre from Junction 5 of the M42, or by signing access to Birmingham Business Park from Junction 7, for example. This could also include a VMS system, or similar, that encourages use of the M6 and A38 Expressway to access Birmingham City Centre from the M42 northbound on the approach to Junction 6. The signs could highlight estimated journey times to the City Centre via the M6.

Likely implementation timetable:

- Within three months: have made contact with Highways England and Birmingham City Council to agree strategy and which alternative routes will be signed, and where from.
- Within six months: have implemented changes to signage.

Optimising traffic signals

Traffic signals along the A45 (for example, at Damson Parkway) could be optimised to improve the flow of traffic. This might involve using systems such as SCOOT (Split Cycle Offset Optimisation

Technique).

Likely implementation timetable:

- Within six months: have identified which junctions could be optimised; have run modelling tests on these junctions to identify if changes would optimise junction operation; have consulted with internal signals team.
- Within one year: have implemented changes, if appropriate.

Converting taxis to Euro 6 engines or electric vehicles

Due to the nature of the trip attractors in the vicinity, it is likely that there is a high proportion of taxis in the area (although there is no data available to show this). Taxis could be converted to cleaner engines or to electric vehicles.

Likely implementation timetable:

- Within six months: have identified vehicles to be converted and have consulted with relevant parties.
- Within two years: have implemented changes.

Using vegetation to help absorb NO_2

Vegetation could be used along the A45 to help absorb NO_2, by appropriate planting, roadside hedges, and “green” advertising hoardings.

Likely implementation timetable:

- Within six months: have identified safe and appropriate locations for planting.
- Within one year: have implemented changes.

The introduction of car clubs

Car clubs could be introduced for large organisations in the vicinity, for example, Jaguar Land Rover. This would enable staff to have access to shared vehicles. This would involve joint working with several organisations.

Likely implementation timetable:

- Within six months: have made contact with employers in the area to gauge interest and likely take-up.
- Within one year: have agreed which organisations will take part and researched car clubs which could be signed up to, with a few to rolling out the scheme within 18 months.

The installation of screens along the M42

This measure would involve the installation of screens along the M42 in order to push NO_2 upwards and thus improving air quality.

Likely implementation timetable:

- Within six months: have identified the most effective locations for the screens to be installed and have discussed and agreed this with Highways England.
- Within one year: have installed the screens along the M42.

The introduction of Sprint Park and Ride

A Park and Ride for Birmingham could be set up along the corridor, making use of the Sprint service to be introduced. This would involve converting a parcel of land into a Park and Ride facility.

Likely implementation timetable:

- Within six months: have identified a potential parcel of land for a Park and Ride facility and have discussed the possibility of the Sprint services calling into the Park and Ride.
- Within one year: have undertaken the relevant consultations, secured the land for the Park and Ride facility and made amendments to the Sprint route and timetable.
- Within two years: have secured planning permissions and begun progress on converting land.
- Within three years: have implemented changes.

Each of these measures has been assessed on the following criteria:

- **Deliverability:** this relates to how likely it is that a measure can be delivered with relative ease. This also includes the likelihood of political objection and likely timescales (i.e. whether measures can be introduced in time to bring forward compliance). Each measure has been scored based on a five-point scale, where 1 is that there are significant concerns relating to deliverability, and 5 is awarded where a measure is likely to be very deliverable.
- **Potential impact:** this seeks to understand how much of an impact on air quality the measure may have, ahead of full assessment (for those in the short list) in Part 4.
- **Fit with Solihull's wider transport policies and objectives:** some measures may have an excellent fit with Solihull's wider transport policies (a score of 5), whereas some may not fit with any of these policies (a score of 1). The policies include the West Midlands Local Transport Plan and the Solihull Connected Transport Strategy.

For each of the criteria, the measures were scored on a scale of 1 – 5. This ensures that each measure has been considered on the same basis. Based on the guidance to understand which measures perform best in terms of deliverability, this criteria was weighted more heavily. Deliverability was weighted as 60%, potential impact as 35% and fit with Solihull's policies as 5%. Potential impact and fit with Solihull's policies had a lower weighting. The outcome from this is that each measure has a score out of 15 based on the weighting. The results of this are shown in the following table. Note that due to rounding, the sum of each row may not total the number in the "Score" column.

Table 4: Short List of Options Scoring

Measure	Deliverability	Fit with Solihull's Policies	Potential Impact	Score
Enhanced workplace TPs	9	1	2	**12**
Workplace travel planning	9	1	2	**12**
Junction capacity enhancements	5	0	3	9
CAZ	5	1	4	10
Marketing and comms	9	1	2	**12**

Enhanced public transport	7	1	2	10
Workplace parking levy	5	0	4	10
Use of walking and cycling network	9	1	2	**12**
Car sharing schemes	9	1	2	**12**
Changes to speed limit	7	0	2	10
Speed control devices	5	0	3	9
Changes to signing	7	0	4	**12**
Optimising traffic signals	7	0	2	10
Converting taxis	7	1	2	10
Using vegetation	7	1	2	10
Car clubs	7	1	2	10
Screens on M42	7	1	3	11
Sprint P&R	4	1	3	8

As shown in the table, the highest scoring measures, to form a short list, are as follows:

- Enhanced workplace travel plans;
- Workplace travel planning;
- Marketing and communications;
- Use of cycling and walking network;
- Car sharing schemes; and
- Changes to signing.

The measure implemented since 2015 (to enhance walking and cycling facilities) will also be taken forward.

Part 4: Evidencing the short listed measures to identify options that could bring forward compliance

In this section, local authorities should set out the likely effectiveness of the shortlisted measures in bringing forward compliance. Local authorities should assess each option against the Primary Critical Success Factor.

Assumed impacts of shortlisted measures

Information on traffic volume and composition for DfT count sites 86029 and 86030 (see Table 2) were used to estimate baseline emissions, and subsequently, the emissions impacts of packages of measures, for PCM links 99175 and 86030 respectively.

The scenarios modelled are described under the following headings. The package of measures allows for the combination of similar types of measures, for example, travel planning related initiatives. The changes in trips assumed in the packages of measures are based on a combination of research evidence, traffic counts showing the modal split of vehicle types, and local knowledge

<u>Base Scenario</u>

Description

The base package assumes that no interventions are introduced and therefore a business as usual approach is adopted.

Assumption

2016 DfT traffic counts were used as the baseline (see Part 3). Future baseline traffic volumes were projected for years 2017-2021 inclusive by interpolating DfT traffic projections for the West Midlands (Principal Roads)[6].

<u>S0 Scenario</u>

Description

In S0, the measures which have been implemented since 2015 (enhancements to the NMU network) will continue to be delivered.

Assumption

It is assumed that the measures in S0 will result in a 1% reduction in car trips. It is assumed that full benefits will be realised by 2018.

<u>S1 Scenario</u>

Description

[6] DfT (2015) English regional plus Welsh traffic growth and speeds forecasts, Scenario 1. Accessed June 2018: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/411455/english-regional-plus-welsh-traffic-growth-and-speeds-forecasts-scenario-1.xlsx

In S1, a package of travel planning measures (including workplace TPs, workplace PTP, car sharing schemes, marketing and communications etc.) will be delivered at selected sites within the study area.

Assumption

It is assumed that the travel planning measures in this scenario will result in a 3% reduction in trips in addition to the benefits realised by S0. It is assumed that this measure affects all fuel types and vehicle ages (Euro standards) to the same extent. It is assumed that full benefits will be realised by 2020.

Evidence

A reduction is 3% of trips is considered to be ambitious but reasonable for high intensity workplace travel planning. Table 5 provides locally validated evidence of mode share reduction due to travel planning against national best practice. The examples in Table 5 show mode shift from travel planning to vary between 2.5% and 5.1%, therefore a reduction of 3% for this study is considered reasonable.

Table 5: Employee Travel Planning Mode Shift Evidence

Source	Link	Mode Shift Evidence (Employee Commuting)
Transport for Quality of Life & TRL, February 2016, Meta-analysis of outcomes in investment in the 12 LSTF large projects	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/500220/meta-analysis_of-interim-report.pdf	Overall SOV reduction of 2.5% for high intensity travel planning delivered through the large LSTF programmes Centro's (now TfWM) Smarter Choices Smarter Network LSTF project
Department for Transport, Impact of the Local Sustainable Transport Fund, October 2017	https://www.gov.uk/government/publications/impact-of-the-local-sustainable-transport-fund-summary-report	Overall a reduction of 2.7% for high intensity travel planning delivered through all LSTF programmes (across the 93 business sites monitored)
Sloman et al, 2010. The effects of Smarter Choice Programmes in the Sustainable Travel Towns	https://www.gov.uk/government/publications/the-effects-of-smarter-choice-programmes-in-the-sustainable-travel-towns-full-report	Overall SOV reduction of 2.7% for high intensity travel planning delivered through DfT's Sustainable Travel Towns Programme
Birmingham Airport Employee Travel Plan	Not published	Reduction in SOV by 5.1% between 2010 and 2016 Target for a further reduction in 4% between 2016 and 2022
Birmingham Business Park Employee Travel Plan	Not published	Reduction in SOV by 3% between 2016 and 2018

<u>S2 Scenario</u>

Description

In S2, the travel planning measures in S1 will be delivered in addition to more focused travel planning measures focusing on HGVs at workplaces. These measures could include out-of-hours deliveries and maximising the capacity of freight vehicles.

Assumption

It is assumed that the HGV focused travelling planning measures will result in a 1% reduction in HGV trips in addition to the benefits realised by S1. It is assumed that this measure affects all HGV types and ages (Euro standards) to the same extent. It is assumed that full benefits will be realised by 2020.

Evidence

The DfT's Freight Carbon Review (2017)[7] seeks to help the road freight sector reduce its emissions. One of the measures recommended in the review is 'reducing road miles' which seeks to ensure that use of the road network for freight movements is optimised. Analysis undertaken by the Centre for Sustainable Road Freight (SRF) suggests that making freight movements outside of peak periods to avoid congestion could reduce travel times by up to 16%, which could in turn result in a 3% reduction in km travelled. The 1% reduction in HGV trips due to workplace travel planning in this study can therefore be considered achievable and conservative.

S3 Scenario

Description

In S3, the travelling planning measures in S1 and S2 will be delivered in addition to improved signage to encourage vehicles to take the most efficient route to their destination.

Assumption

It is assumed that the improved signage will result in a 2% reduction in vehicle trips in addition to the benefits realised in S2. It is assumed that this measure affects all vehicle types, fuel types and vehicle ages (Euro standards) to the same extent. It is assumed that full benefits will be realised by 2020.

Evidence

Research undertaken by The EVIDENCE project (funded by the EACI) has found that improved information for travellers has the potential to change modal choice. Research was undertaken into travel information in Aalborg, Denmark which consisted of further development of two existing traffic information websites[8]. The research found that for one corridor in the study area, car use was expected to reduce by 2-4% due to the improved information provision.

Although the improved signage proposed as part of this study is different to the provision of traffic information websites, they both sit under the umbrella of improved information for travellers. It can therefore be assumed that improved signage as part of this study could result in around a 2% reduction in vehicle trips.

S4 Scenario

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[7] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/590922/freight-carbon-review-2017.pdf

[8] http://www.civitas.eu/sites/default/files/evaluation_modernising_travel_information.pdf

Description

In S4, an intensive programme of initiatives will be undertaken with the many large employers and business parks adjacent to the corridor including:

- Enhanced workplace travel plans;
- Workplace travel planning;
- Marketing and communications;
- Use of cycling and walking network;
- Car sharing schemes;
- Changes to signing; and
- Fleet Efficiency Advice.

Assumption

It is assumed that the initiatives in S4 will result in a 3% switch for LDVs (cars and LGVs) from pre-Euro 4 petrol and pre-Euro 6 diesel to most recent Euro 6 petrol / diesel vehicles. It is assumed that full benefits will be realised by 2020.

Evidence

Monitoring of the impact of transport and traffic initiatives is in its infancy and there is very little evidence available. However, there is a raft of evidence available via the Energy Savings Trust, the Carbon Trust and similar bodies that focus on reducing CO_2 emissions. The case studies evaluated demonstrate that these programmes work and significant reductions in the emission of harmful gasses can be achieved in relatively short timescales.

S5 Scenario

Description

In S5, the Birmingham Ring Road Clean Air Zone (CAZ) is expected to be introduced and some of the benefits of this scheme realised along the A45.

Assumption

It is assumed that Birmingham CAZ will result in a 1% switch of all vehicles (except motorcycles) from pre-Euro 4 petrol and pre-Euro 6/VI diesel to most recent Euro 6 petrol / diesel vehicles. It is assumed that full benefits will be realised by 2020.

Evidence

The future year traffic modelling for the Birmingham CAZ[9] identifies the current and future level of compliance for vehicles (see Table 8). Compliant petrol vehicles are those of Euro Class 4 and above whilst compliant diesel vehicles are those of Euro Class 6 and above.

Table 6 shows that the forecast switch to compliant vehicles by 2020 varies from 12% for taxis and 36% for LGVs. These forecasts are considered ambitious but achievable considering the measures that will be delivered.

The A45 is one of the arms of the Birmingham Ring Road, serving east Birmingham, Solihull, and Coventry. Air quality benefits for the A45 are therefore expected due the introduction of the

9 https://www.birminghambeheard.org.uk/economy/caz_individual/supporting_documents/Transport%20Modelling%20Forecasting%20Report%202020%20OBC%20with%20Addtional%20Measures.pdf

CAZ on the ring road. The future year traffic modelling for the Birmingham CAZ[10] forecasts a reduction of 1.1% in NO_2 concentrations by 2020 at a point on the A45 in Sheldon (approximately two miles from the two NO_2 emission exceedance points on the A45). It is therefore reasonable to assume that a 1% reduction in NO_x emissions could be achieved in the study area.

Table 6: Birmingham CAZ 2016 and 2020 Do Minimum Compliance Rates

Vehicle	Compliance Status	2016	2020	Difference (2016-2020)
Car/ PHV	Compliant	55%	77%	+22%
LGV	Compliant	23%	59%	+36%
HGV	Compliant	34%	61%	+27%
Bus	Compliant	38%	60%	+22%
Taxi	Compliant	17%	29%	+12%

Source: steer davies gleave (2018) 'Birmingham Clean Air Zone Feasibility Study - Future Year Traffic Modelling'

Impacts of shortlisted measures on NOx Emissions

Defra's Emission Factor Toolkit (v8.0.1a) has been used to calculate road-NO_X emissions, by vehicle type, for each road link in each year between 2016 and 2021 using an assumed average speed of 80 kph for both road links. Link lengths were taken from PCM model outputs: 0.24 km for 86030 and 3.25 km for 99175 (combined length of two links listed for 99175). The results of this analysis are shown in Table 7 to Table 10. Note that the impacts on NO_X emissions are directly proportional to the % reductions in trips by vehicle type.

Table 7 and Table 8 report absolute emissions, i.e. the total NO_X emitted from vehicles (in tonnes per year) along the link lengths identified as exceeding the annual mean NO_2 EU Limit Value within the PCM model. These figures were provided to JAQU for input to the Streamlined PCM model, which was used to calculate resulting NO_2 concentrations under the various scenarios. Table 7 and Table 8 also provide the percentage reduction in emissions achieved by the different scenarios, compared to the Base scenario, displayed in brackets.

Emissions are highest for road link 99175, because it is 3.25 km long, compared to 86030, which is only 0.24 km in length. The overall percentage reductions differ slightly by road link (e.g. comparing percentage reductions for 2020 in Table 7 and Table 8), owing to slight differences in the composition of the vehicle fleet on these two-road links. 86030 has proportionally more cars and taxis, so packages that affect car trip reductions (S0 and S1), have a (slightly) proportionally greater impact on total emissions.

Table 9 and Table 10 present the emissions impacts by vehicle type for both road links in 2020. These tables show the direct impact of the packages of measures on different components of the local vehicle fleet. In 2020, for all vehicles, the relative emission reductions for total Road NO_X range between 0.6% reduction for S0 (measures already implemented) to 4.4% / 4.6% reduction for S3 (implementation of all shortlisted trip reduction measures), and 7.6% / 7.7% reduction for S5 (implementation of all shortlisted trip reduction and cleaner vehicle measures).

10 https://www.birminghambeheard.org.uk/economy/caz_individual/supporting_documents/Air%20Quality%20Modelling%20Report.pdf

Table 7 Absolute and relative impacts of packages of measures on Road NOx (Link 99175, 3.25 km): All vehicles

	Total Road NO_X for all vehicles, tonnes/annum (brackets denote % change in emissions for packages (S0-S3) compared with Base)					
Scenario	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Base	21.4	20.2	18.8	17.7	16.4	15
S0	21.4 (0%)	20.2 (0%)	18.7 (-0.6%)	17.6 (-0.6%)	16.3 (-0.6%)	14.9 (-0.6%)
S1	21.4 (0%)	20.2 (0%)	18.7 (-0.6%)	17.6 (-0.6%)	16.0 (-2.3%)	14.6 (-2.4%)
S2	21.4 (0%)	20.2 (0%)	18.7 (-0.6%)	17.6 (-0.6%)	16.0 (-2.4%)	14.6 (-2.5%)
S3	21.4 (0%)	20.2 (0%)	18.7 (-0.6%)	17.6 (-0.6%)	15.7 (-4.4%)	14.3 (-4.4%)
S4	21.4 (0%)	20.2 (0%)	18.7 (-0.6%)	17.6 (-0.6%)	15.3 (-6.5%)	14.0 (-6.9%)
S5	21.4 (0%)	20.2 (0%)	18.7 (-0.6%)	17.6 (-0.6%)	15.2 (-7.6%)	13.8 (-8.2%)

Table 8 Absolute and relative impacts of packages of measures on Road NOx (Link 86030, 0.24 km): All vehicles

	Total Road NO_X for all vehicles, tonnes/annum (brackets denote % change in emissions for packages (S0-S3) compared with Base)					
Scenario	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Base	2.1	2	1.9	1.8	1.6	1.5
S0	2.1 (0%)	2.0 (0%)	1.9 (-0.6%)	1.8 (-0.6%)	1.6 (-0.6%)	1.5 (-0.7%)
S1	2.1 (0%)	2.0 (0%)	1.9 (-0.6%)	1.8 (-0.6%)	1.6 (-2.5%)	1.5 (-2.6%)
S2	2.1 (0%)	2.0 (0%)	1.9 (-0.6%)	1.8 (-0.6%)	1.6 (-2.6%)	1.5 (-2.7%)
S3	2.1 (0%)	2.0 (0%)	1.9 (-0.6%)	1.8 (-0.6%)	1.6 (-4.6%)	1.4 (-4.6%)
S4	2.1 (0%)	2.0 (0%)	1.9 (-0.6%)	1.8 (-0.6%)	1.5 (-6.7%)	1.4 (-7.1%)
S5	2.1 (0%)	2.0 (0%)	1.9 (-0.6%)	1.8 (-0.6%)	1.5 (-7.7%)	1.4 (-8.3%)

Table 9 Absolute and relative impacts of packages of measures on Road NOx (Link 99175, 3.25 km): 2020 emissions by vehicle type

	Total Road NO_X in 2020 by vehicle type, tonnes/annum (brackets denote % change in emissions for packages (S0-S3) compared with BAU)							
Scenario	**All vehicles**	**Petrol Cars and Taxis**	**Diesel Cars and Taxis**	**LGVs**	**Rigid HGVs**	**Artic HGVs**	**Buses and Coaches**	**Motor-cycles**
Base	16.4	1.2	8.3	5.2	0.8	0.7	0.1	0.05
S0	16.3 (-0.6%)	1.2 (-1%)	8.3 (-1%)	5.2 (0%)	0.8 (0%)	0.7 (0%)	0.1 (0%)	0.05 (-1%)
S1	16 (-2.3%)	1.2 (-4%)	8 (-4%)	5.2 (0%)	0.8 (0%)	0.7 (0%)	0.1 (0%)	0.05 (-4%)
S2	16 (-2.4%)	1.2 (-4%)	8 (-4%)	5.2 (0%)	0.8 (-1%)	0.7 (-1%)	0.1 (0%)	0.05 (-4%)
S3	15.7 (-4.4%)	1.2 (-5.9%)	7.8 (-5.9%)	5.1 (-2%)	0.8 (-3%)	0.7 (-3%)	0.1 (-2%)	0.04 (-5.9%)
S4	15.3 (-6.5%)	1.1 (-9%)	7.6 (-8.4%)	5.0 (-4%)	0.8 (-3%)	0.7 (-3%)	0.1 (-2%)	0.04 (-5.9%)
S5	15.2 (-7.6%)	1.1 (-9%)	7.6 (-9.1%)	4.9 (-4.6%)	0.8 (-6.5%)	0.6 (-9.3%)	0.1 (-4.6%)	0.04 (-5.9%)

Table 10 Absolute and relative impacts of packages of measures on Road NOx (Link 86030, 0.24 km): 2020 emissions by vehicle type

	Total Road NO_X in 2020 by vehicle type, tonnes/annum (brackets denote % change in emissions for packages (S0-S3) compared with BAU)							
Scenario	**All vehicles**	**Petrol Cars and Taxis**	**Diesel Cars and Taxis**	**LGVs**	**Rigid HGVs**	**Artic HGVs**	**Buses and Coaches**	**Motor-cycles**
Base	1.6	0.1	0.9	0.4	0.1	0.1	0.03	0.003
S0	1.6 (-0.6%)	0.1 (-1%)	0.9 (-1%)	0.4 (0%)	0.1 (0%)	0.1 (0%)	0.03 (0%)	0.003 (-1%)
S1	1.6 (-2.5%)	0.1 (-4%)	0.9 (-4%)	0.4 (0%)	0.1 (0%)	0.1 (0%)	0.03 (0%)	0.003 (-4%)
S2	1.6 (-2.6%)	0.1 (-4%)	0.9 (-4%)	0.4 (0%)	0.1 (-1%)	0.1 (-1%)	0.03 (0%)	0.003 (-4%)
S3	1.6 (-4.6%)	0.1 (-5.9%)	0.9 (-5.9%)	0.4 (-2%)	0.1 (-3%)	0.1 (-3%)	0.03 (-2%)	0.003 (-5.9%)
S4	1.5 (-6.7%)	0.1 (-9%)	0.8 (-8.4%)	0.4 (-4%)	0.1 (-3%)	0.1 (-3%)	0.03 (-2%)	0.003 (-5.9%)
S5	1.5 (-7.7%)	0.1 (-9%)	0.8 (-9.1%)	0.4 (-4.6%)	0.1 (-6.5%)	0.1 (-9.3%)	0.03 (-4.6%)	0.003 (-5.9%)

Impacts of shortlisted measures on NO_2 concentrations

The impacts on roadside annual mean NO_2 concentrations of the NO_X emissions reductions shown above were modelled by JAQU using the Streamlined PCM Model. The results are presented in Table 11 and Table 29 for Links 99175 and 86030 respectively. They show the impact of the estimated emission reduction scenarios between 2018 and 2021. Reductions in annual mean NO_2 concentrations of 0.2 µg/m³ are predicted for both links in 2018, as a result of the assumed effect of measures already implemented (S0). Scenarios 1-5 are assumed to be implemented in 2020 and result in reductions of annual mean NO_2 of between 0.6 and 1.9 µg/m³ for link 99175 and between 0.7 and 2.2 µg/m³ for link 86030.

The Institute of Air Quality Management provides a framework for describing the impact of changes in NO_2 concentrations[11], as percentage changes relative to air quality standards. With percentage concentration changes of between 1% and 3%, the impacts of scenarios S1-3 can be described as slight to moderate beneficial.

For Link 99175, the reductions in NO_2 concentrations resulting from the implementation of existing (S0) and additional measures (S1-5) does not affect the year in which the Link is projected to comply with the annual mean NO_2 EU limit value, which remains as 2020.

For Link 86030, the reductions in NO_2 concentrations resulting from the implementation of existing (S0) and additional measures (S1-4), is projected to result in an annual mean concentration of 40.0 µg/m³ in 2020. On the same link, implementation of S5 is projected to result in an annual mean concentration of 39.8 µg/m³ in 2020. Both scenarios S4 and S5 would therefore bring forward compliance on Link 86030 by one year, from 2021 to 2020.

[11] Institute of Air Quality Management and Assessment (IAQM) (2017) Land-Use Planning and Development Control: Planning for Air Quality. Accessed June 2018: http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf

Table 11 Estimated Roadside NO_2 concentration ($\mu g/m^3$) as modelled by JAQU using the Streamlined PCM Model, following the emission reduction scenarios set out above – Link 99175

Scenario	2018	2019	2020	2021
Base	43.3	40.9	38.5	35.9
S0	43.1	40.8	38.3	35.8
S1	43.1	40.8	37.9	35.4
S2	43.1	40.8	37.9	35.3
S3	43.1	40.8	37.4	34.9
S4	43.1	40.8	36.8	34.3
S5	43.1	40.8	36.6	34.0

Table 12 Estimated Roadside NO_2 concentration ($\mu g/m^3$) as modelled by JAQU using the Streamlined PCM Model, following the emission reduction scenarios set out above – Link 86030

Scenario	2018	2019	2020	2021
Base	47.3	44.6	41.9	39.1
S0	47.1	44.4	41.7	38.9
S1	47.1	44.4	41.2	38.4
S2	47.1	44.4	41.2	38.4
S3	47.1	44.4	40.7	37.9
S4	47.1	44.4	40.0	37.3
S5	47.1	44.4	39.8	37.0

The preferred option is Scenario 4, as Scenario 5 models the assumed impact of proposed measures within Birmingham over which Solihull have no influence.

Sensitivity Test for Preferred Measure

As the UK Government is required to achieve compliance with the annual mean NO_2 limit value in the shortest possible time, additional sensitivity testing has been undertaken to estimate the potential effect of earlier delivery timescales for the preferred option (S4), with a view to potentially achieving compliance adjacent to PCM link 99175 in 2019, as opposed to 2020.

The results of this sensitivity test are shown in Table 13, which indicates that compliance could be achieved adjacent to PCM link 99175 in 2019, should the preferred measure be implemented by September 2019. Whilst this delivery timescale is considered ambitious, should funding be provided by the end of December 2018, it is achievable. It should also be noted that the earlier the preferred measure is implemented, the greater the impacts are likely to be in 2019 and the greater the confidence that the assumed effects of the preferred measure will be achieved by this point.

Table 13 Estimated 2019 Roadside NO_2 concentration (µg/m³) as modelled by JAQU using the Streamlined PCM Model, with varying date of implementation of preferred measure – Link 99175

Scenario 4	Implementation Date										
	Jan 19	Feb 19	Mar 19	Apr 19	May 19	Jun 19	Jul 19	Aug 19	Sep 19	Oct 19	Nov 19
2019 Annual Mean NO2	39.4	39.6	39.7	39.8	39.9	40.1	40.2	40.3	40.4	40.6	40.7

Part 5: Setting out a preferred option

In this section, local authorities should set out a summary of their preferred option to bringing forward compliance (where such measures exist). Where new measures have been identified that could bring forward compliance, local authorities should also assess a range of Secondary Critical Success Factors in order to identify the preferred option.

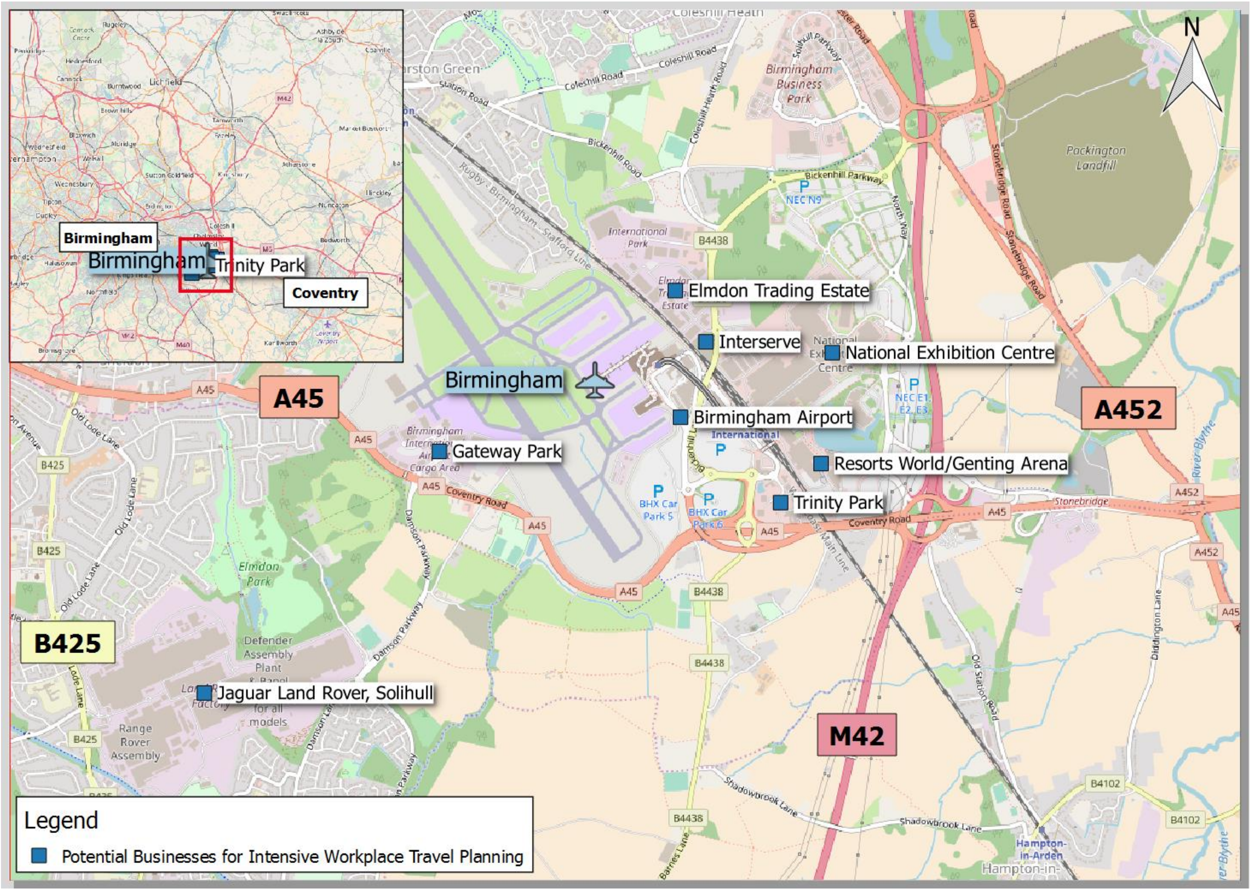
The preferred option (Scenario 4) that has been chosen to bring forward compliance is intensive workplace travel planning which includes a mix of 'soft' and 'hard' measures as outlined below:

- Enhanced workplace travel plans;
- Workplace travel planning;
- Marketing and communications;
- Use of cycling and walking network;
- Car sharing schemes;
- Changes to signing; and
- Fleet Efficiency Advice.

It is recommended that the intensive workplace travel planning is undertaken with eight of the following nine business located in close proximity of the A45:

- Jaguar Land Rover site in Solihull
- National Exhibition Centre
- Birmingham Airport
- Resorts World/Genting Arena
- Birmingham Business Park
- Interserve
- Gateway Park
- Interserve
- Elmdon Trading Estate
- Trinity Park close to Birmingham International Station

Figure 19 Potential Businesses for Intensive Workplace Travel Planning



The following diagram outlines the process in which the intensive workplace travel planning is recommended to be delivered. Please note that this process will be repeated for each of the eight identified businesses.

TEMPLATE

Initial Meeting
- Discuss travel plan measures
- Discuss key success factors
- Discuss key issues

Workshop
- Workshop with key stakeholders within the business including HR, finance, environment, estates, PR, staff representatives, management, and fleet management.

Travel Survey
- Undertake a baseline travel survey with all staff.

Travel Plan
- Develop a site specific travel plan including measurable targets to allow assessment of the success of the travel plan.

Present
- Present the travel plan back to all of the key stakeholders and request feedback.

Iteration
- Finalise the travel plan with the feedback from key stakeholders.

Implement
- Implement the travel plan within the business.

Monitor
- Undertake a travel survey one year after the travel plan has been implemented to understand the impacts.

Update
- Update the travel plan with the new survey data and any additional measures or targets.

Compliance with the secondary critical success factors for the preferred option is described under the following headings.

Value for money

The preferred option of intensive workplace travel planning is a mixture of revenue and capital interventions which are expected to deliver high value for money. The cost-benefits of travel planning peak in the first two-years of delivery and then reduce by around 25% per year[12]. Table 14 provides a summary of evidence for the Benefits-to-Cost (BCR) ration for workplace travel planning. According to DfT guidance[13], BCRs represent the following Value for Money (VfM):

- Poor VfM if BCR is below 1.0
- Low VfM if the BCR is between 1.0 and 1.5
- Medium VfM if the BCR is between 1.5 and 2.0
- High VfM if the BCR is between 2.0 and 4.0
- Very High VfM if the BCR is greater than 4.0

Please note, the majority of BCR calculations for smarter choices interventions do not take into account the full range of activities (e.g. carbon reduction due to the paucity of evidence data). Therefore, the BCRs presented in the following table are likely to be a conservative estimate.

Table 14: Employee Travel Plans Value for Money Evidence

Evidence Source	Weblink	Costs	Indicative BCR	Comments
DfH, Highways Agency, TravelWise, NHS South West et al, Soft Measures, Hard Facts - The Value for Money of transport measures which change travel behaviour	http://www.sthc.co.uk/ Documents/ DoH_Soft_ Measures Hard_Facts.pdf	£9 per employee for the ongoing delivery of travel plans (excludes major incentives or capital costs e.g. cycle hub)	BCRs of between 3.5:1 and 13:1 for area workplace intensive travel planning (mainly attributed to congestion reduction on the Strategic Road Network)	
Department for Transport, Impact of the Local Sustainable Transport Fund, October 2017	https://www.gov.uk/ government/publications/ impact-of-the-local- sustainable -transport-fund-summary- report		BCRs of between 5.2 and 6.1 for LSTF workplace travel planning programmes	Based on an estimated cost for each car kilometre removed (decongestion, journey ambience and health benefits)
Transport for Quality of Life – report to the	https://assets.publishing. service.gov.uk/government/		BCRs of:	

12 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/416797/finding-the-balance-sustainable-travel.pdf

13 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/267296/vfm-advice-local-decision-makers.pdf

Department for Transport, Finding the Optimum: Revenue/ Capital Investment Balance for Sustainable Travel, December 2014	uploads/system/uploads/ attachment_data/file/ 416797/finding-the-balance-sustainable-travel.pdf		4.8 – high range 3.7 – mid range 2.7 – low range	

Despite the BCR estimates in the above table being conservative, all of the indicative BCRs present high value for money or higher. This suggests that the preferred option for this study is also likely to provide high or very-high value for money.

Affordability

The total cost over a two-year period for the preferred option (Scenario 4) is £832,000.

The forecast cost for each of the measures in the preferred option (S4) are presented in Table 15.

Table 15: Preferred Option Cost Breakdown

Measure	Description	Forecast Cost	Notes
Area/ site-wide Travel Plan Coordination/ Management - Staff Costs (full time equivalent role)	Staff resource to coordinate the delivery of area-wide travel planning and lead engagement with individual organisations	£100,000	Salary costs, plus other employment costs for two years
Travel Plan monitoring	Costs of commissioning TRICS multi-modal surveys	£16,000	Two surveys
Area wide Car Share Scheme – licence for database and promotions/ campaigns	Costs of annual area-wide travel plan scheme (Birmingham Green Hub Liftshare) https://liftshare.com/uk/community/ birminghamgreenhub	£20,000	For two years
Employee personalised travel planning	Delivery of personalised travel plans for eight businesses and their employees Includes Workplace Challenge competition	£240,000	Intensive in Year 1
Travel marketing campaign	Additional staff time to the Travel Plan Coordinator's time and the costs of developing and printing/ acquiring promotional materials to support specific travel campaigns	£16,000	For two years
Employee travel incentives	Incentives for employees for travel behavioural change E.g. public transport Swift taster cards. Assumption of £20 per employee and 30% take up rate for 25,000 employees	£150,000	Intensive in Year 1
Travel support grants	A grant scheme to support businesses in providing on-site capital facilities to support sustainable travel. Assumed a match based grant scheme (50% contribution from an individual business). Assumption of £5,000 from SMBC to each of the eight businesses.	£40,000	Year 1

On site Electric Vehicle charging points	A combination of rapid charging points and standard charging points dependent upon the specific needs of the eight businesses	£110,000	4 EV rapid charging points at £20,000 each = £80,000 4 EV standard charging points at £5,000 each = £20,000 In addition, £10,000 included to cover maintenance and servicing of charging points
On site cycling 'hub'	High quality 'one stop shop' cycle facility for shared use by businesses – storage, maintenance facilities, changing and showering, bike share	£100,000	Figure includes maintenance and servicing of the facility
Fleet Efficiency Advice programme	Support for employers in getting advice and/or subsidies to improve the efficiency, fuel consumption, and emissions from their fleet. One option is to support employers' in gaining membership to the ECO Stars Fleet Recognition Scheme which is a free scheme that can provide employers with access to expert advice and support. The programme would involve a fleet expert (possibly through the existing Energy Savings Trust programme) engaging with each business, gathering fleet data, analysing, reporting and then presenting back to Board members with recommendations taking into account timescales.	£40,000	
TOTAL		**£832,000**	

It is anticipated that once the funding for this project finishes, the cost of delivering and updating the travel plans can be absorbed by the businesses and therefore future funding will not be required.

Distributional impacts

The preferred package is not expected to impact disproportionately on any particular group. The intensive travel planning will be undertaken with a range of businesses who will have employees from many different societal groups with the exception of children, the elderly, and some disability groups. In addition, the travel plan contents will be specific to each organisation and therefore there will be ample opportunity to ensure that groups are not disproportionately impacted.

In addition, the preferred package will not displace air quality issues elsewhere but will seek to reduce emissions in the study area and beyond. This will be possible as employees will be travelling to their place of work from a wider catchment and therefore benefits could be felt in wider Solihull and neighbouring Birmingham.

Strategic and wider air quality fit

SMBC understands the importance of good air quality for its residents and is proactive in trying to achieve it. One of actions in the borough's 2013 local plan related specifically to air quality, as follows:

Encourage better air quality in and around the Borough through the adoption of low emission zone initiatives such as those involving the use of electric vehicles for freight and public transport.

To achieve this action, SMBC instigated a new air quality monitoring regime in June 2017 to provide robust data on air quality. This data is collected through NO_2 diffusion tubes at key locations across the borough which will be pivotal to actions regarding air quality in the future.

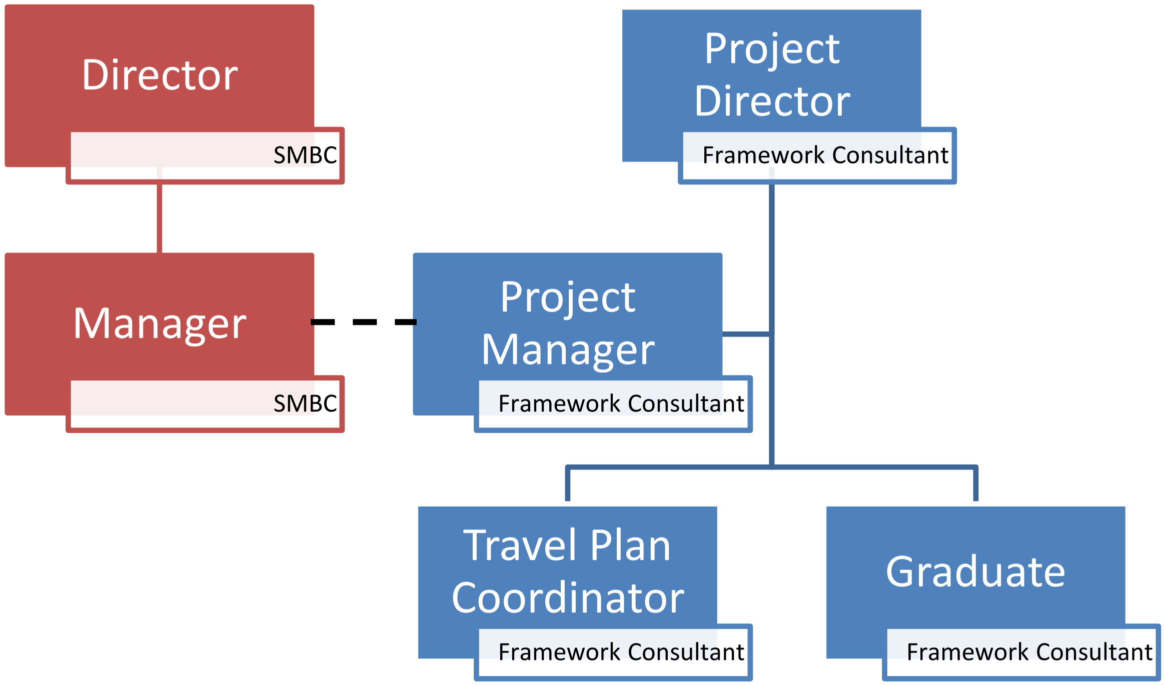
A Solihull Clean Air Strategy is being developed and proposed actions within this will be evidence based, dependent on the results of the annual monitoring data. An effective Clean Air Strategy and associated action plan will be reliant on an integrated approach which encompasses behavioural, strategic and infrastructure changes. These will be considered within the wider context of the West Midlands Combined Authority and the Birmingham & Solihull Sustainability and Transformation Partnership, to improve air quality across Birmingham & Solihull.

SMBC recognise that a cleaner, healthier environment benefits people and the economy and are therefore actively seeking to improve air quality in the borough. The delivery of this intensive workplace travel planning will help to support the borough's aim of improving air quality by focusing on an area of the borough that has high employment activity and therefore high potential for change.

Supply side capacity and capability

SMBC can confirm that with appropriate funding, they can externally resource a consultant with the capacity and capability to deliver the preferred option. SMBC have access to a number of professional services frameworks which have agreements with industry leading technical consultants. The technical consultants on their framework have extensive experience of delivering workplace travel planning with many of them previously supporting local authorities with their delivery of the DfT's Local Sustainable Transport Fund. SMBC are therefore very confident that they can fully resource the delivery of the preferred package through their current frameworks in the time period between now and end 2019.

In addition, SMBC have sufficient internal resources to manage the delivery of the preferred option through its preferred consultant. It is expected that the resources required on both the SMBC and consultant side will be small and concise to ensure consistency in the delivery of the intensive travel planning. The following diagram illustrates the team structure that is envisaged.



Recent conversations with a number of the technical consultants on SMBC's frameworks have confirmed that they have the capacity and technical skills to deliver the intensive travel planning through their West Midlands' offices. In addition, they have confirmed that due to their extensive experience of undertaking travel planning; they have a tried and tested methodology which can be adapted for this study. Market testing with Fleet Efficiency specialists has also identified that there is adequate capacity in the wider Region to undertake and implement the Fleet Advisory initiatives as part of the Intensive Travel Plan programme.

Achievability

As previously stated, SMBC are confident that they can deliver the workplace travel planning through an external technical consultant with internal staff managing the consultant. In addition, SMBC will work with Transport for West Midlands (TfWM) to align travel plan delivery with other workplaces in the West Midlands. One of key benefits of the preferred package of measures is that they can start immediately after funding has been confirmed and can be delivered simultaneously across the selected employers. This will ensure that these measures will be effective in the shortest possible time. Table 16 outlines the proposed timeline for delivering the preferred option.

Regarding fleet initiatives, an organisation's grey fleet typically has a three-year lifecycle, while the LGV fleet typically has a five-year lifecycle. So up to 33% of the grey fleet and up to 20% of the LGV fleet can be replaced by compliant vehicles in early 2019 with similar proportions applicable to early 2020. The Advice programme will target the worst polluting vehicles so positive change can happen in the short term.

Table 16: Preferred Option Indicative Programme

Year	**2018**				**2019**				
Month	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**
Initial meeting	■								
Workshop	■								
Travel survey		■							
Travel plan		■	■	■					

Presentation									
Iteration									
Implementation									

<u>Displacement</u>

The preferred option has been selected to reduce overall NO_x emissions rather than displace emissions to other areas. This will be achieved by delivering intensive workplace travel planning which will encourage people to travel to work in a more environmentally friendly way, and encourage businesses to manage their vehicle fleet more effectively. The only measure which could result in displacement is the change to signage. However, this measure will result in the displacement of traffic onto more appropriate routes such as the M6 and A38 (M). The preferred package of measures is expected to reduce NO_x emissions on the section of the A45 which currently exceed the annual mean NO_2 limit value. In addition, as the preferred package will target journeys to and from workplaces; it is likely that there will be air quality benefits over a wider area including Solihull and Birmingham.