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

Local authorities covered	Basingstoke and Deane Borough Council

Further information on the content of each section is set out in the guidance.

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.***

Basingstoke and Deane Borough Council, like many areas across the UK, continues to experience areas of poor air quality. The Council has been highlighted by Defra as one of a number of Local Authorities where the UK's national air quality assessment has identified road links that are currently exceeding the annual mean nitrogen dioxide (NO_2) limit value, with exceedances predicted to continue in 2019 and in some cases beyond.

The Council, along with 32 other Local Authorities, received a Ministerial Direction on the 23rd March 2018 to undertake a feasibility study into nitrogen dioxide compliance. This is the 'third wave' of Local Authorities charged with undertaking such a study. Previously 5 Local Authorities (the so called 'first wave') were directed to undertake a feasibility study, these were followed by a second wave of 23 Local Authorities directed to undertake a local study in 2017.

The UK's national air quality plan has identified a length of road, the A339 (Ringway East) between the A339/A33 Roundabout and the A339/A30 Black Dam Roundabout, as in exceedance of the annual mean NO_2 Air Quality Directive Limit value. This road link is a key part of the ring road around the centre of Basingstoke town centre that also links onto the M3 motorway at junction 6. A map of the road link highlighted as in exceedance within the UK's national air quality assessment is shown in Figure 1.

This road link is predicted to demonstrate compliance in 2020 (Table 1 below). In order to achieve compliance in 2019 the concentrations on the link needs to reduce by at least 1 µg/m^3. To demonstrate compliance this year, in 2018, the concentrations on the links need to reduce by between 2 and 3 µg/m^3 depending on the census ID.

Table 1: Compliance status between 2017 and 2021 for the two census IDs on A339

Roads in exceedance	Census ID	2017	2018	2019	2020	2021
A339	56997	45	43	41	39	36
A339	6941	45	42	41	39	36

Basingstoke and Deane Borough Council currently has no declared Air Quality Management Areas (AQMAs) within its Borough.

Figure 1: Location of the exceedance road link on the A339 in the context of the Borough

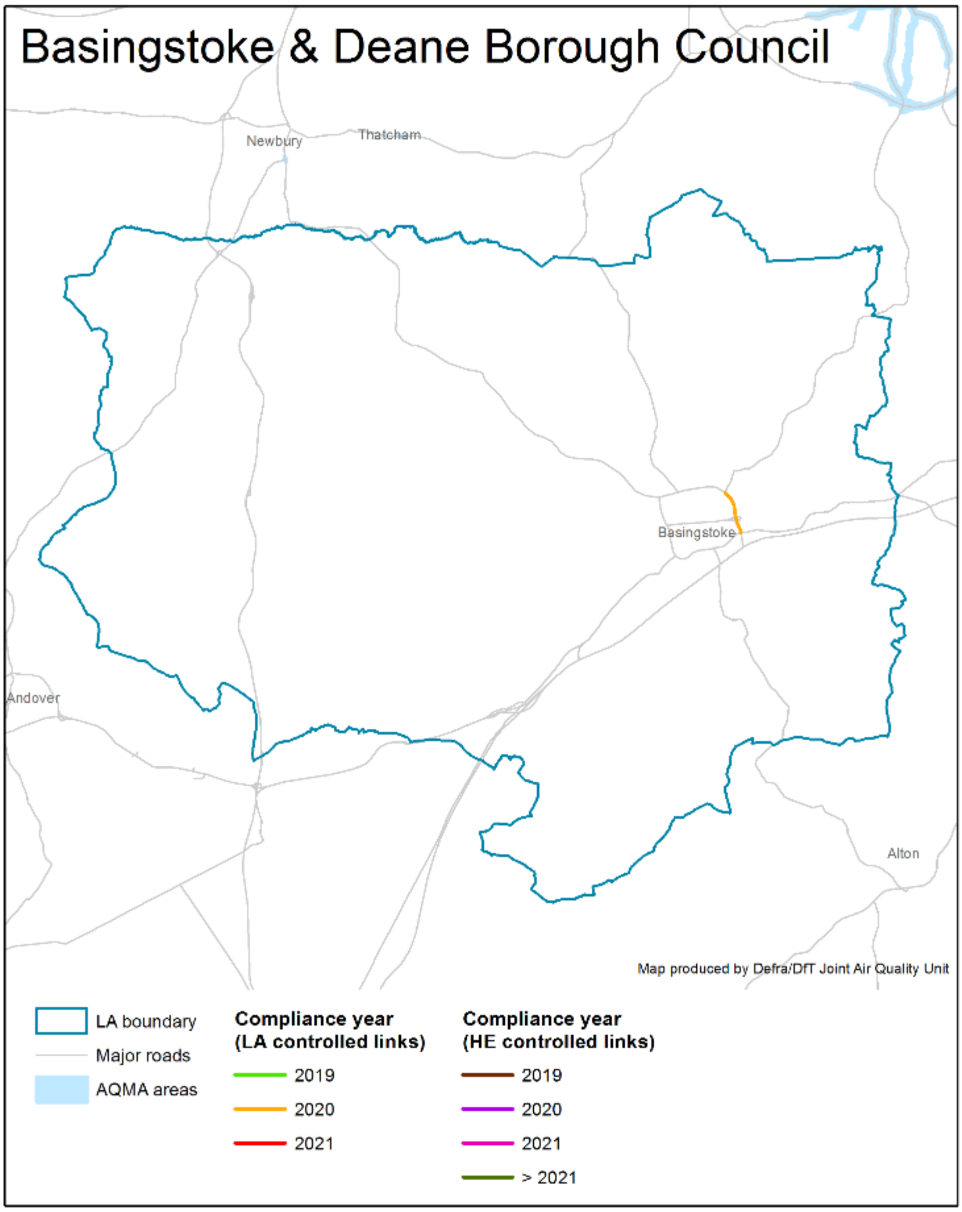
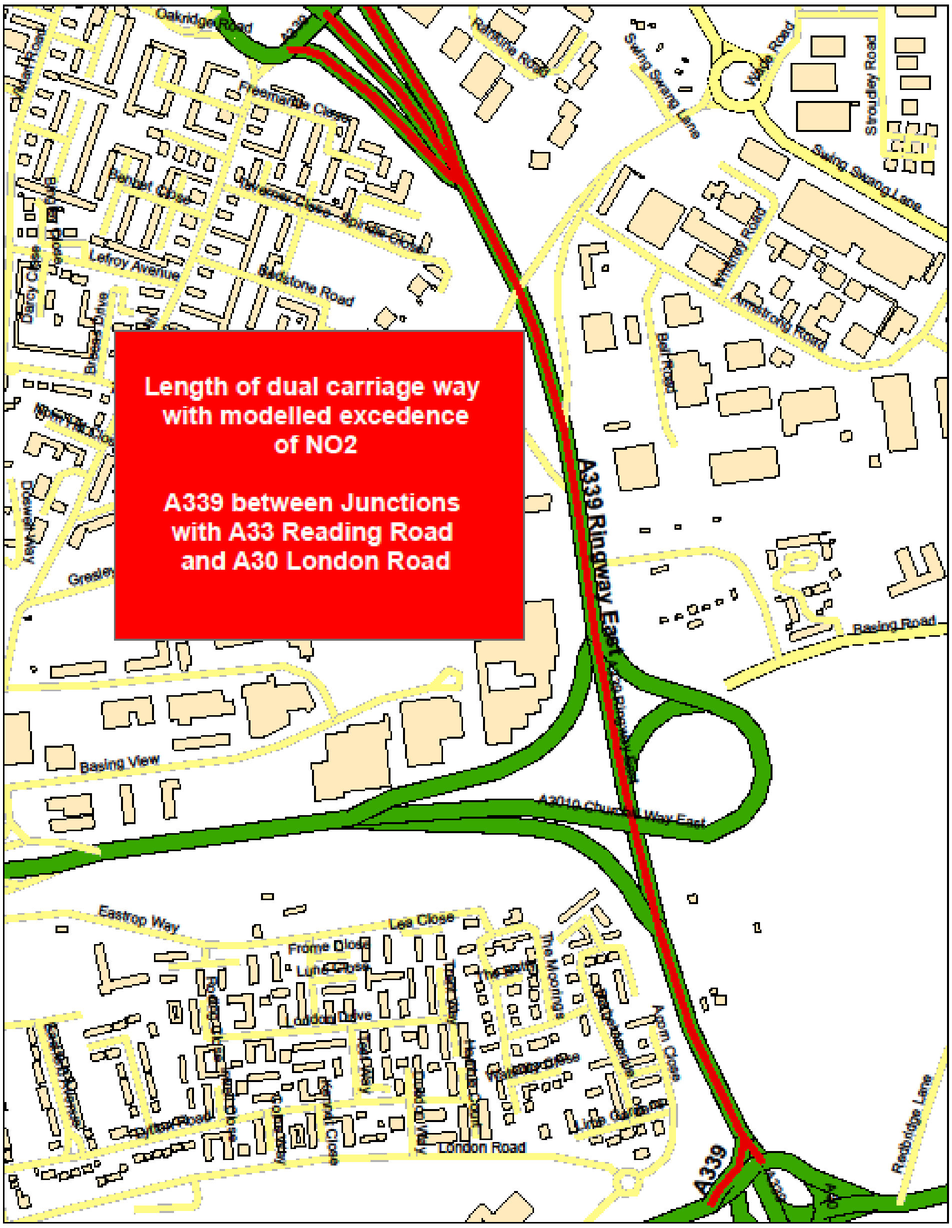

Basingstoke & Deane Borough Council
Newbury
Thatcham
Basingstoke
Andover
Alton
Map produced by Defra/DfT Joint Air Quality Unit
LA boundary
Major roads
AQMA areas
Compliance year (LA controlled links)
2019
2020
2021
Compliance year (HE controlled links)
2019
2020
2021
> 2021

Figure 2: A339 showing Ringway East and the length of the exceeding road link



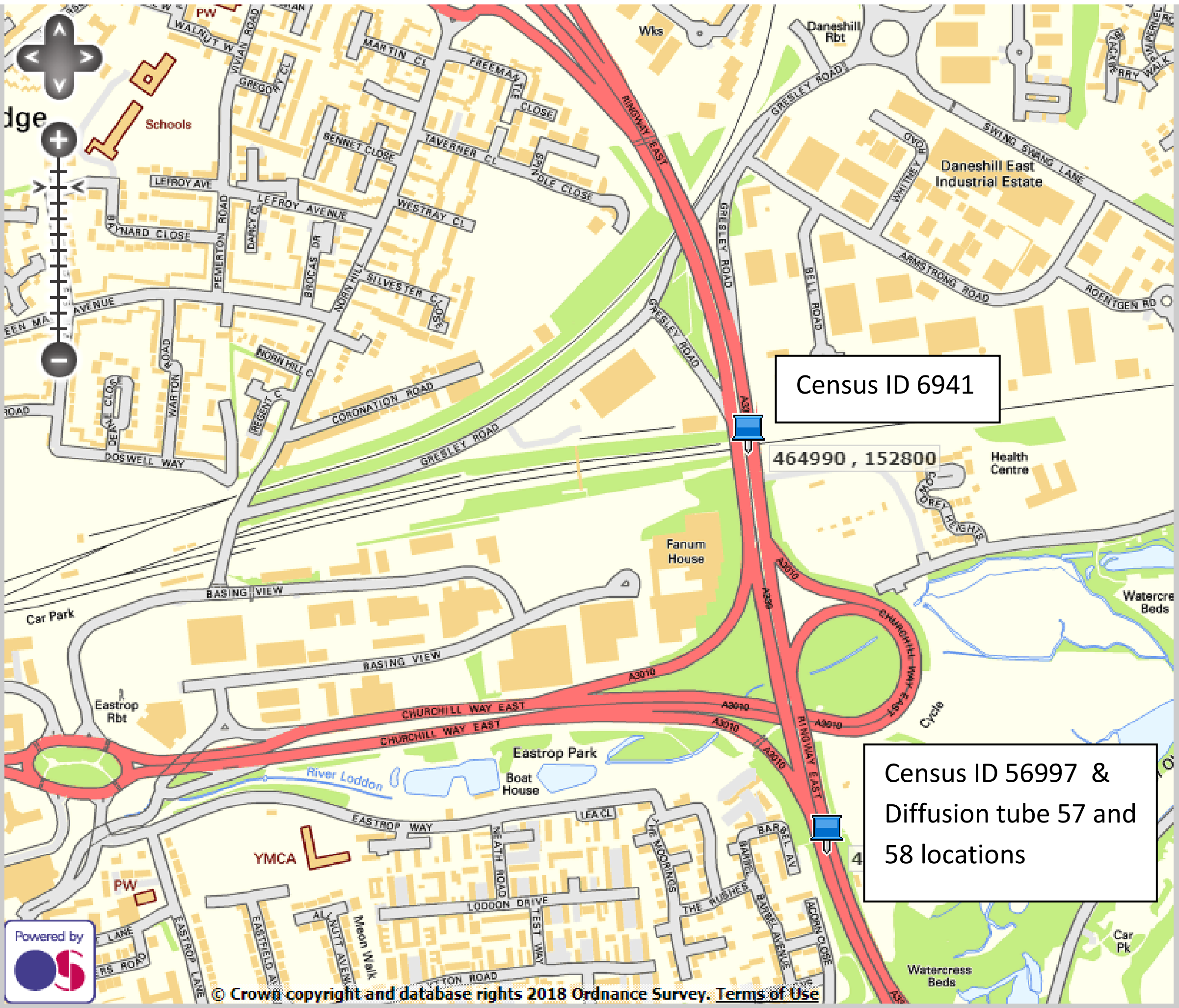
A339 Plan of Exceedence
Basingstoke & Dean Borough Council

Contains OS data (c) Crown copyright and database right 2018.
Date: 18/04/2018

Traffic Data

The Department for Transport (DfT) have two locations along the A339 at which the national air quality model (PCM) indicates an exceedance of the annual average NO_2 limit value (Figure 3). Census ID 6941 is on the Ringway East (A339) link between A3010 and A33 junctions with a road length of 1.1 kms. Census ID 56997 is on Ringway East (A339) between the A30 and A3010 junctions with a road length of 0.6 kms. The A339 joins the M3 at junction 6 and, as it is a strategic route connecting the motorway to regional centres including Newbury, Wokingham and Reading, it is expected that a high proportion of traffic on the A339 involves through traffic. From the M3 through the Black Dam roundabout up to the A339 junction with the A3010 Churchill Way East, there are bands of trees and hedgerow screening (approximately 40-80 m wide between M3 and Black Dam, and 30 m wide between Black Dam and the A3010 junction). From the A3010 junction to the northly section of the exceedance link lies a number of industrial and commercial businesses.

Figure 3: Location of the exceeding A339 road link and location of two Department for Transport traffic count points



Traffic counts between 2012 and 2016 are provided in Table 2 for both count census ID locations (Table 3). It should be noted that the Defra national modelling used 2015 as the baseline. Projections into future years are based on national traffic growth factors and from 2015 to 2016 this was in the region of 2%. Traffic counts for census id 56997 indicate a growth of 16% from 2015 to 2016. This increase in traffic follows a Highways England road improvement scheme at the Black Dam roundabout which connects the A339 Ringway East with the A30. This connects to the spur at Junction 6 of the M3 (Figure 4). Prior to the road scheme, the Black Dam roundabout was operating above capacity, resulting in long queues during weekday peak periods along all approach roads and even onto the M3 Junction 6 exit slip roads. As part of the Government's Pinch Point Programme it was decided to increase the capacity of the junction to improve safety and traffic flows at this location. This resulted in construction of a four lane northbound carriageway through the roundabout, widening on the eastern side of the gyratory to provide four lanes and widening on the north-eastern section of the gyratory to provide five lanes. Specifically, the A339 southbound was widened to provide four lanes approaching the roundabout and the A339 northbound was widened into the central reserve to provide four lanes to the A3010 Churchill Way diverge.

The Black Dam junction is a 4-arm roundabout under full traffic signal control and subject to the national speed limit. Currently there is an at-grade pedestrian route adjacent to the A339 Ringway East immediately north of the junction, and this is connected via a footway located on a bridge over the road to Redbridge Lane to the east and to Barbel Avenue to the west. There are no other pedestrian or cyclist facilities at the junction or on the approaches to the Roundabout.

As part of the road scheme Highways England, undertook six months of air diffusion tube monitoring and a detailed level assessment was produced prior to construction to determine the long-term impacts of the scheme on air quality[1]. The report concluded that no receptors in the study area were predicted to exceed the annual mean or 1-hour mean NO_2. The scheme effects are likely to be insignificant due to the fact that there are no relevant receptors (residential properties, schools, hospitals or hotels) predicted to be in exceedance of annual mean NO_2 or PM_{10} concentrations in the study area.

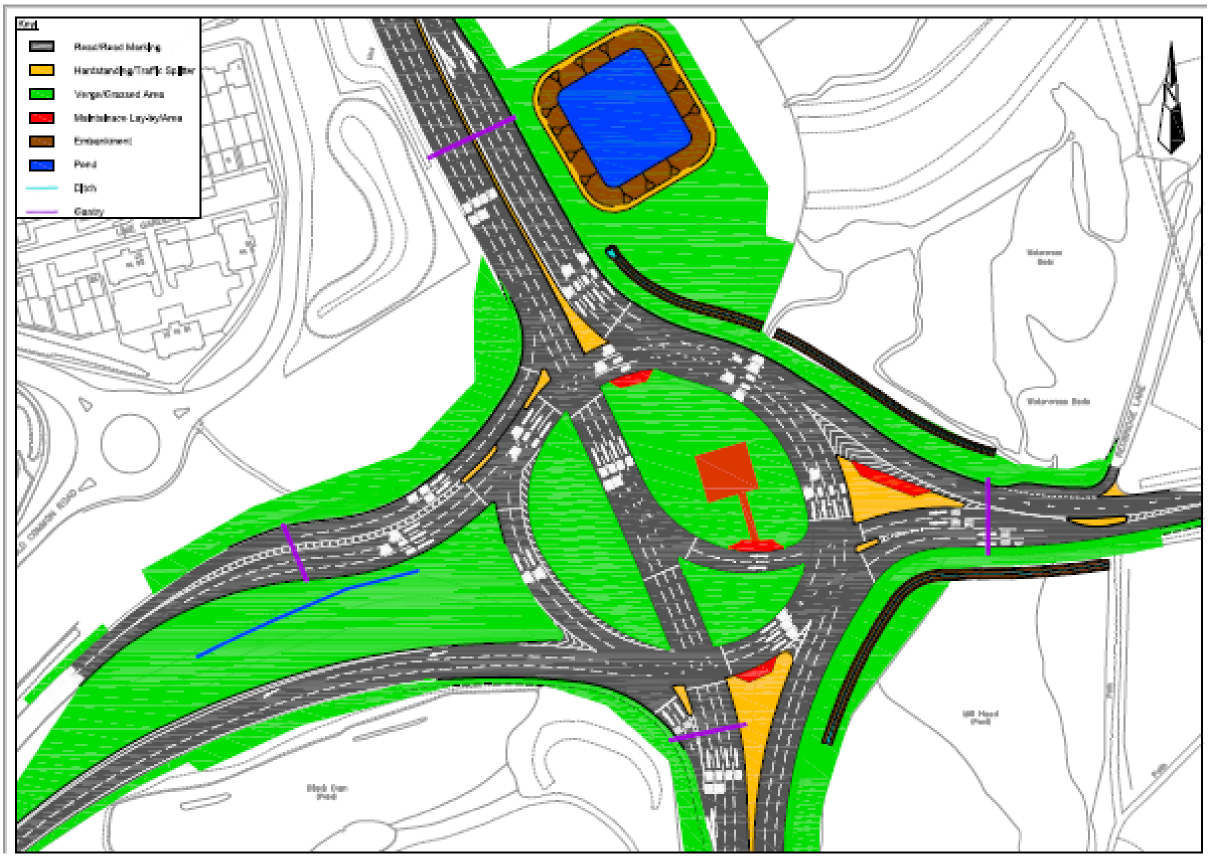
The improvement scheme commenced construction in October 2014 and was complete in March 2016 and cost £11.3m.

Table 2: Traffic counts at two census count points on the A339 (from Department for Transport).

Census id	Year		AADT	Cars	LGV	HGV_{a+r}	Buses
6941	2012	Counted	50915	42744	5751	2075	130
	2013	Estimated	50711	42502	5817	2055	122
	2014	Counted	51738	42138	6700	2376	157
	2015	Estimated	51326	41365	7048	2385	156
	2016	Counted	58388	48232	7079	2475	217
56997	2012	Counted	55432	45662	6982	2377	131
	2013	Estimated	54738	45943	5898	2505	163
	2014	Counted	54144	44722	6664	2433	117
	2015	Estimated	53668	43901	7010	2430	116
	2016	Counted	62060	51667	7387	2481	196

[1] http://webarchive.nationalarchives.gov.uk/20160607113318/http://assets.highways.gov.uk/roads/road-projects/m3-junction-6-black-dam-roundabout-improvements/M3%20J6%20-%20Summary%20of%20Env%20Results.pdf

Figure 4. The Black Dam roundabout following the scheme improvement.



<u>Source apportionment</u>

Source apportionment analysis has been supplied by JAQU for the A339 which indicates the largest contribution of NOx is from diesel passenger cars (up to 31%) followed by diesel LGV (19%). The proportion of NOx from goods vehicles highlights the route for freight from the M3 to the regional areas to the north and south. There is a negligible contribution from buses again indicating the strategic nature of the route.

Table 3: Source apportionment for total NO_x (%) from Defra PCM model for non-compliant links on the A339

Census ID	Regional BG	Urban BG (non-traffic)	Urban BG (traffic)	Diesel Cars	Petrol Cars	Diesel LGV	Petrol LGV	rHGV	aHGV	Bus
56997	5	5	9	31	7	19	0	14	9	2
6941	5	8	9	29	7	19	0	12	10	2

Table 4: Monthly average diffusion tube data NO_2 ($\mu g\ m^{-3}$) from two new monitoring locations on the footbridge over the A339. See Figure 3 for locations on map.

Tube ID	February 2018	March 2018	April 2018	May 2018
57	38	46	24	*Tube missing*

58	36	45	*Tube missing*	*Tube missing*

Relevant Exposure

Basingstoke and Deane Council monitors NO_2 concentrations at 37 sites across the borough using diffusion tubes. There are no recorded exceedances of the annual average objective at locations of relevant personal exposure, and accordingly the Council have not been required to declare an Air Quality Management Area. A decrease in the annual average concentrations has been observed at many of the diffusion tube locations since 2012.

The Council notes that as there is a footpath near to parts of the A339, and even though there is no fixed habitation, JAQU requires the Council to undertake this feasibility study. The Air Quality Directive 2008/50/EC Annex III B 1(a) states that:

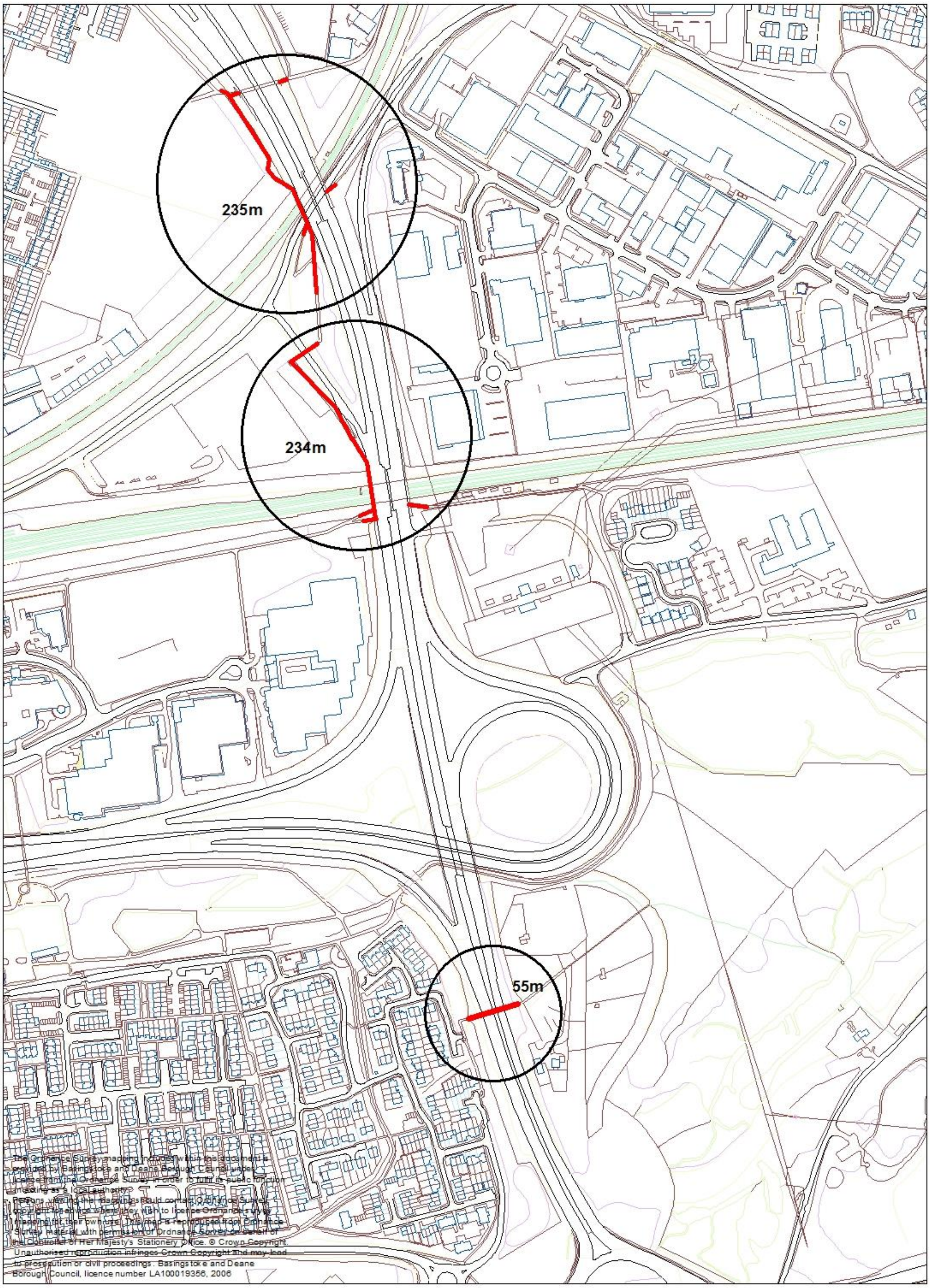
B. ***Macroscale siting of sampling points***
1. Protection of human health
(a) Sampling points directed at the protection of human health shall be sited in such a way as to provide data on the following:
— the areas within zones and agglomerations where the highest concentrations occur to which the population is likely to be directly or indirectly exposed for a period which is significant in relation to the averaging period of the limit value(s)

Figure 5 below shows the location of the footpath adjacent to the A339 with sections within 15 m of the roadside marked in red which are less than 500 m in length. Given the clarity in the Directive on the requirement for exposure over the averaging period as above, and lack of nearby fixed habitation, we conclude that this location on the A339 is not a relevant receptor for compliance assessment for the annual average limit value. Instead, we conclude that it could be a relevant location for the hourly limit value. However, given that the predicted annual average concentration in 2017 is 45 $\mu g\ m^{-3}$, it is not likely there is an exceedance of the hourly limit value, given Defra Guidance LAQM Technical Guidance 2016 paragraph 7.91. It is suggested that the road link **is** in compliance with the NO_2 Limit values at relevant receptor siting locations.

This feasibility study has targeted footpaths located adjacent to non-compliant roads in Basingstoke and Deane. The Council acknowledge that there are other footpaths located nearby e.g. path near Eastrop Park running under the the slip road the Churchhill Way East. This path runs beneath the road and is therefore not at grade with the road and does not need to be included in the study. Additionally, this path runs adjacent to compliant road links and therefore the concentrations on the path is anticipated to be lower than those paths adjacent to non-compliant A339 road link.

Following on from discussions with JAQU, it was agreed that census ID 56997 could be excluded from this targeted feasibility study. The only access to census ID 56997 is via a footbridge (see the highlighted 55m long footbridge in Figure 5) which is not at grade with the main road and instead runs perpendicular to the road on a bridge over the road. There is no other access to census ID 56997 therefore the link can be excluded from the compliance assessment.

Figure 5: Location of the public accessible footpath (in red) along the A339 with distances in metres. The 55 m path is located on a footbridge running perpendicular to the road and following JAQU guidance is not deemed to be relevant public access resulting in link 56997 being excluded from the study.



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.

We have used the information gathered in Part 1 to identify a list of measures that have the potential to bring forward the year of compliance for the road links targeted in this work. The source apportionment data highlighted that cars, specifically diesels, are the main contributor to the non-compliance on Ringway East, followed by diesel LGVs. Therefore, we have included measures that will reduce emissions from these sources.

<u>Existing Measures:</u>

Basingstoke and Deane Council works closely with Hampshire County Council on the implementation of the Local Transport Plan. Since the national modelling based on 2015, there has been a major road infrastructure scheme completed which has improved traffic flow and management along the A339. As explained above, this scheme resulted in a road widening scheme to 4 lanes approaching the Black Dam roundabout, which has significantly reduced congestion and increased average speeds along the A339. In addition to the successful completion of the Black Dam Roundabout improvement scheme, there are 5 other schemes in construction to improve traffic management around the town. These are:

- A33 Strategic Corridor Improvements, Basingstoke – Phases 1 & 2 – this corridor links onto the A339
- A30 Winchester Road Roundabout improvements, Basingstoke
- Dualling of section of A340 in North Basingstoke
- A340 Thornycroft Roundabout, Basingstoke improvements proposed
- A30 Brighton Hill Roundabout, Basingstoke improvements proposed.

The schemes above will help improve traffic flows on the target links, and thus are anticipated to improve air quality in the local area. However, their distances to the target road link mean they are unlikely to help reduce emissions on the target link.

Currently the Borough Council is working with the County Council in the development of a new Transport Strategy which aims to promote sustainable transport and mobility across the Borough. This strategy follows on from the 2014-2017 Strategy which brought substantial benefits to Basingstoke. For example, the County Council was awarded £4.1m of Tranche 1 small projects LSTF grant to deliver the Hampshire Sustainable Transport Towns Project. The final year of delivery was 2017, and the project has delivered a package of 31 complementary schemes and initiatives to improve the attractiveness of walking, cycling and public transport within the six towns including Basingstoke. Alongside 18 capital schemes, the package also contains a number of travel planning initiatives, the promotion of cycling and the' My Journey' travel awareness marketing campaign. The Borough also has a number of electric vehicle charging points and the new Transport Strategy will set out opportunities for expansion. The Council have recently introduced a new Taxi Licensing scheme which includes a maximum age limit for vehicles.

<u>New Measures – specific to the A339 road link</u>

- *Closure of the footpath* until the end of 2019.

- *Relocation of the footpath* to run through the neighbouring business park to remove the relevant exposure at Census ID 6941 and closure of the footbridge at Census ID 55997, though this will need to be considered in relation to the wider pedestrian network in this area.
- Additional *traffic/speed management schemes* to improve flow of traffic along the feeder roads and associated junctions.
- *Reduction in the traffic speed limit* on this link of the A339
- Further work on *travel plans and delivery service plans* with businesses within the borough that are serviced by this link to the M3.

New Measures – general measures with a low emission strategic approach

As the primary source of NOx emissions are related to diesel cars and vans more generic measures are included as below:

- Low emission vehicle lease/salary sacrifice scheme to target the worst polluting vehicles (such as privately-owned diesel cars).

- Parking incentives such as reduced fares for low emission vehicles.

- Installation of more electric vehicle charging points within the town to promote use of these low emission vehicles.

- Creation and promotion of electric vehicle car clubs to improve the accessibility of electric vehicle to the public

- Retrofit scheme for LGV, HGV or buses to convert to low emission vehicles.

- Public engagement promoting sustainable transport including taking public transport, walking / cycling, and encouraging car-sharing via HantsCarshare - https://liftshare.com/uk/community/hants

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.

Development of a short-list of measures

To assess the feasibility and deliverability of the new measures identified in Part 2, a severity-weighted assessment tool was used to score each of the long-list of measures. For each measure, a score between 1 and 3 (1 being the lowest impact/least feasible, and 3 being highest benefit/most feasible) was assigned to each of the following categories: bring forward compliance; effective (at reducing emissions); timescale (reduce emissions in time); deliverable (are systems in place to implement e.g. legislation); achievable (acceptable to the community); co-benefits (e.g. noise benefits); likely uptake; positive benefits (e.g. road safety/journey times); and negative benefits (e.g. social inequality or economic impacts). The scores from each category were totalled, with a higher total representing a more favourable measure. The result of this tool is provided in Table 5, and further discussion of the reasoning of the scoring for each measure is described below.

- Closure of the footpath until the end of 2019 – this is not a preferable option as Basingstoke and Deane Borough Council are actively encouraging the community to adopt sustainable, active travel like walking, and closing the path sends conflicting a message. It is unlikely to be acceptable with the elected members of the council or local environmental groups.
- Relocation of the footpath – the relocation of both of the footpaths running alongside the A339 would be particularly challenging and would lead to large increases in the distance and time individuals would have to walk. If the diverted route was better provisioned e.g. better path and lighting, maybe this would not cause the number of people travelling on the route to decrease. The impacts of this would be difficult to ascertain.
- Traffic management scheme at feeder junctions – work is in the planning stage on the realignment of Gresley Road and will include the introduction of improved traffic signalling to minimise congestion. In its current form, there is often cars queuing back from the junction onto the A339 at peak times. However, the measure is not going to be completed in time to bring forward compliance as this contract has not yet been finalised.
- Reduction of speed on the A339 target link (e.g. 12-month temporary reduction) – on census ID 56997 the speed limit is 50 mph, while on the 6941 the speed limit increases to 70 mph. A reduction of the speed limit on the 6941 could lead to reduced emissions and could help bring forward compliance. However, it should be ensured that any reduction of the speed limit on this link does not lead to any tail backs onto the M3.
- Support businesses creating / implementing travel plans – local knowledge of the vehicle movements in the area indicates vehicles from the Sainsbury's Distribution Centre, located in the Houndsmill Industrial Estate, frequently travel on the non-complaint A339 links. These LGVs and HGVs could be targeted in an updated travel plan to minimise their travel on the target road links. Data on the movement of Sainsbury's-owned vehicles would be required in order to quantify any changes associated with this measure.
- Low emission vehicle lease / salary sacrifice scheme – this would be difficult to implement in the timescales available as a large number of businesses would need to be targeted in order to become an effective measure to reduce emissions.
- Parking incentives for low emissions vehicles / installation of electric vehicle charging points and creation of electric vehicle car clubs – while this would potentially help combat pollution in the town centre, it is anticipated that the impact of these schemes on the target road link

would be relatively small and difficult to quantify.

- Retrofit scheme for LGV, HGV or buses – this could target vehicles that use the non-complaint road links, e.g. businesses such as Sainsbury's, or the council waste fleet (who use the links to access the incinerator to the north-east of the city).
- Public engagement – while this in an important measure to reduce air pollution within Basingstoke, the impacts of any public engagement scheme will be challenging to determine on the target road links and would not be anticipated to give the required reduction in NOx emissions required to bring forward compliance.

Table 5: Scoring of the long-list of possible new measures against primary success factors

Measure	Bring forward compliance	Effective	Timescale	Deliverable	Total score
Closure of footpath	3	1	2	1	7
Relocation of footpath	3	1	1	1	6
Traffic management scheme on feeder roads / junctions	2	2	1	2	7
Reduction of speed on the A339 target link (e.g. 12 month temporary reduction)	**3**	**2**	**2**	**2**	**9**
Travel Plans with businesses	**3**	**2**	**2**	**2**	**9**
Change in waste contract, with vehicle upgrade to Euro 6	**3**	**2**	**3**	**2**	**10**
Public engagement	1	1	2	1	5

Based on the scoring, discussion and quantifiability of the long-list of measures, the following short list of measures have been identified to take forward into Part 4:

- **Reduction of speed limits on the link 6941 from 70 mph to 50 mph**
- **Upgrade of council waste fleet to Euro 6**
- **Potential travel plan upgrade / retrofit of LGV/HGV from Sainsbury's Distribution Centre**

2017 Baseline modelling

Table 6 demonstrates how Ricardo have met the requirements set by JAQU for the dispersion modelling.

Table 6: JAQU's modelling reporting requirements

Ref	Requirement	LA Model Description (please provide details for each Requirement)	Please highlight where the approach differs from the Requirements
A		**Air quality model specification**	
A.1	**Model selection**	ADMS-Roads	
A.1.1	Details of emissions model based on COPERT 5 emission factors.	Ricardo's PyCOPERT model was used which includes COPERT 5 emissions.	
A.1.2	Gradient effects included?	Gradients above 2.5 % corrected following guidance in LAQM.TG(16)	
A.1.3	Details of air quality dispersion model.	Please see section 'Dispersion model details'	
A.1.4	Canyon effects included?	No canyons located in the study area	
A.1.5	Tunnels and flyovers included?	Tunnels and flyovers were not explicitly modelled	

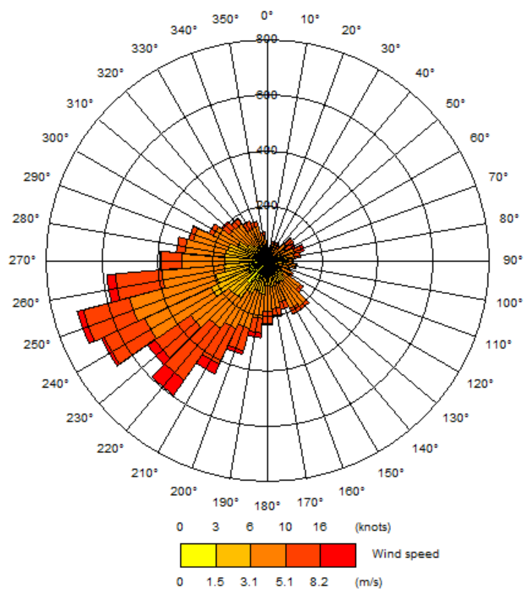
A.2	**Air quality model domain**		
A.2.1	Please provide a map showing model domain in relation to exceedance locations identified in PCM model.	Modelled Roads, in Figure 7.	
A.2.2	Locally identified exceedance locations included?	No local sites with monitoring exceedances	
A.2.3	Domain includes displacement routes?	No. Detailed traffic modelling was unavailable for this study therefore information on displacement routes (and quantification of any displacement) could not be modelled. In addition, the key measure is a reduction in the speed limit from 70 to 50 mph which is unlikely to cause any significant displacement.	
A.3	**Air quality model receptor locations**		
A.3.1	Details of receptor grid size and other receptor locations.	Please see the "model description" section for grid size, and "model validation" for receptor locations	
A.3.2	Methods to be used to assign subset of receptors for AQD assessment requirements.	Receptors were located 4 m from the kerb, 10 m spaced and at 2 m height. Additional receptors were located at 2 m height every 10 m along the footpaths adjacent to the target road links	
B	**Air quality base year modelling**		
B.1	**General**		
B.1.1	Base year modelled.	2017	
B.1.2	Details of Meteorological data.	Please refer to 'Dispersion model details', and Figure 6.	
B.2	**Traffic input data**		
B.2.1	Source of traffic activity data and vehicle types.	Please refer to the 'Traffic data' section of this report.	
B.2.2	Details of representation of road locations (achieved through use of a georeferenced transport model or another approach?).	Georeferenced roads can be seen in Figure 7	
B.2.3	Source of vehicle fleet composition information (local/EFT).	From local traffic model, see 'traffic data' section of this report.	
B.2.4	Source of vehicle speed information.	Annual average vehicle speed was calculated from DfT 15-minute MasterMap data.	
B.3	**NOx/NO_2 emissions assumptions**		
B.3.1	Source of primary NO_2 emission fractions (f-NO_2).	NO_x to NO_2 defaults for all other urban traffic .	
B.3.2	Details of method used to calculate projections for f-NO_2 and to calculate NO_2 concentrations from NO_x concentrations.	Defra NO_x to NO_2 calculator (v6.1) used to calculate NO_2 from NOx. This calculator uses default fNO2 for Basingstoke & Deane for the year being modelled (2017, 2020 or 2021)	
B.4	**Non-road transport modelling**		
B.4.1	Details of modelling for non-road transport sources.	No non-road traffic emission sources were modelled. Defra LAQM background maps were used for non-road sources	
B.5	**Measurement data for model calibration**		
B.5.1	Details used for the model calibration e.g. dates, locations.	2017 diffusion tube data maintained by Basingstoke and Deane Borough Council, see Figure 7 for locations. Additional information is in the	

		'model verification' section of the report.	
B.5.2	Type of monitoring data (automatic and/or diffusion tubes) used for the model calibration.	Only diffusion tube data located within modelling domain	
B.5.3	All available automatic (and/or diffusion tube) monitoring data included in the model calibration?	All monitoring data in close proximity to the modelled roads were included	
B.5.4	Quality assurance of measurement data.	Annualisation and bias adjusted diffusion tubes, as per LAQM.TG(16). Discussed in more detail in 'Monitoring data' below.	
C	**Projections modelling**	N/A	
C.1	**Baseline projections modelling**	N/A	
C.1.1	Years modelled.	2017, 2021 and 2022	
C.1.2	Details of method for projected vehicle fleet composition.	Scaled to 2021 and 2022 using the respective projections for each year from NAEI	
C.1.3	Details of method for projected vehicle activity.	2017 traffic data scaled to 2022 and 2021 using the local factors from TEMPro for the respective year.	
C.1.4	Impact of Real Driving Emissions legislation (RDE) included?	Included within COPERT 5.	

Dispersion model details:

ADMS-Roads version 4.0.1 was used, with meteorological data collected during 2017 at Farnborough, to model the target roads (Figure 6: Wind rose from met data). Further information on meteorological parameters is available on request.

Figure 6: Wind rose of met data used in local dispersion modelling



Defra's modelled 2017 NO_x background concentrations with a 2015 base year were used. The primary road contribution was removed to prevent double counting main roads included in the dispersion model.

Gridded outputs from ADMS were created using the source-orientated gridding system, meaning a greater density of points were located close to the road sources. Due to the size of the study area, the minimum grid spacing possible to be modelled using ADMS was: 10 m (x) and 25 m (y). A subset of receptors was modelled at a higher resolution following siting guidelines issued by JAQU (4 m from kerbside, 10 m spaced and 2 m in height).

In addition, to model concentrations at the footpath locations adjacent to the roads that are accessible to the public, receptors were modelled every 10 m along the path at 2 m height.

Traffic data:

Annual average daily traffic by direction data was available for the target roads in Basingstoke from DfT traffic counts. The latest counts from 2016 were scaled to 2017 (and 2022) using the respective local factors obtained from TemPRO. This traffic data provided a basic fleet breakdown, from which the proportion of cars, LDV, rigid HGV, artic HGV and buses were calculated. The split between petrol and diesel cars was assumed to be equal to the national breakdown value. The proportion of vehicles in each Euro class in the fleet was taken directly from COPERT 5. Figure 7 shows the location of the roads included in the local model, and the location of the diffusion tube monitoring receptor located on the study links.

Figure 7: Location of roads included in dispersion model. The monitoring location on the target road links is also highlighted. The inset map highlights the location of the sensitive receptors included along the public footpaths.

Model validation:

A single pair of co-located diffusion tube were located on the footpath over link 56997, which were deployed at the announcement of the Ministerial Directive naming the exceedance links. The measurements from these tubes (Feb – April 2017) were annualised following LAQM.TG(16) guidance and using bias adjustment factors from 2017 to provide a 'best estimate' of the concentrations at the monitoring site during 2017. The 2017 concentration from tube 57 (28 $\mu g/m^3$ NO_2 in 2017) was used for model validation, as this tube had the greatest data capture.

The NO_2 concentration predicted at tube 57 from the local model was 18 $\mu g/m^3$, highlighting an underestimation in the modelled concentrations. A correction factor of 2.35 was applied to the modelled concentrations to account for this underestimation. The modelled NO_2 concentrations for the study area are shown in Figure 8 below:

Figure 8: Map of modelled 2017 NO_2 concentrations from local modelling

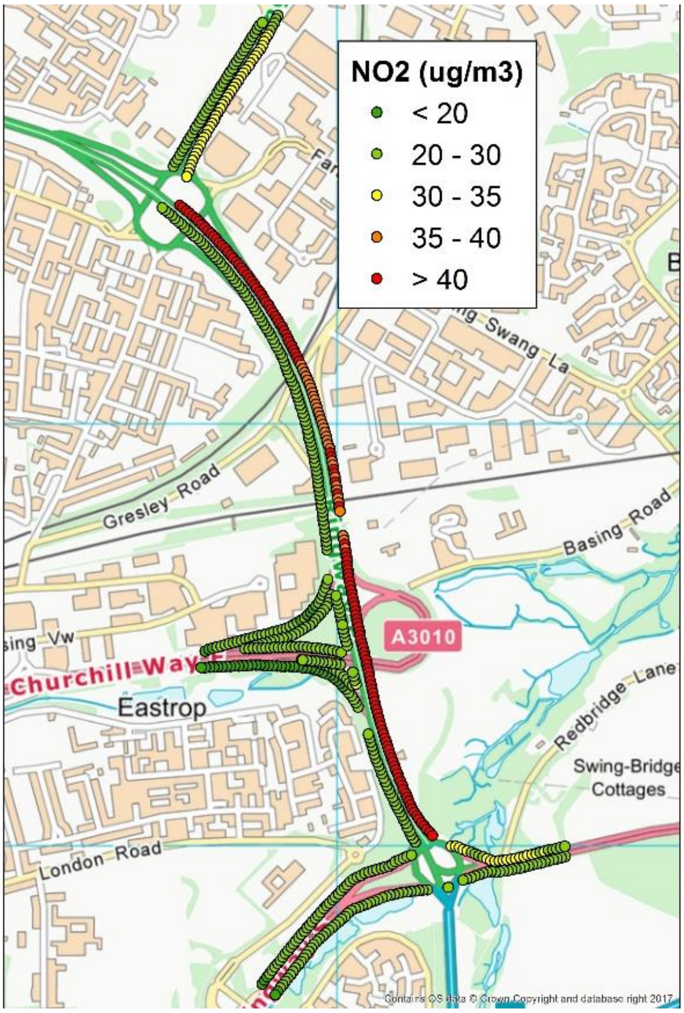
Receptors were located 4 m from the kerbside, at 10 m spacing and 2 m height along the target road links to provide an estimate of concentrations on the target road links at similar locations to those from the national model. Receptors within 25 m of a major junction were removed following guidance issued by JAQU. For the links in the national model, the maximum concentration predicted by the local model was extracted. Table 7 compares the national and local modelled concentrations on two road links initially identified in the Targeted Feasibility study:

Table 7: Comparison of national and local modelled 2017 NO_2 concentrations on study roads

Link ID	National model 2017 NO_2 ($\mu g/m^3$)	Local model 2017 NO_2 ($\mu g/m^3$)
6941	45	50
56997	45	48

A map of the modelled NO_2 concentrations at the PCM receptors is shown in Figure 9. The south westerly prevailing wind results in higher concentrations on the eastern side of the road link.

Figure 9: Concentrations modelled at PCM receptors adjacent to Basingstoke target road



As discussed in a previous section, public access to the non-compliant link is via footpaths running adjacent to the roads (Figure 7). The location of the footpaths was obtained from a shapefile of Hampshire County Council Rights of Way. Sensitive receptors were located at 10 m spacing and 2 m height along these footpaths to provide an estimate of concentrations along the footpaths. Receptors located on path locations which were not at grade with the road (e.g. running through an underpass) and running perpendicular to the road were excluded (e.g. the footpath at the east of the target road in Figure 10 below).

Figure 10: Location of footpath not at grade with the road and therefore has not been included in the paths where sensitive receptors were located. (Footpath goes under the road shown in the photograph)

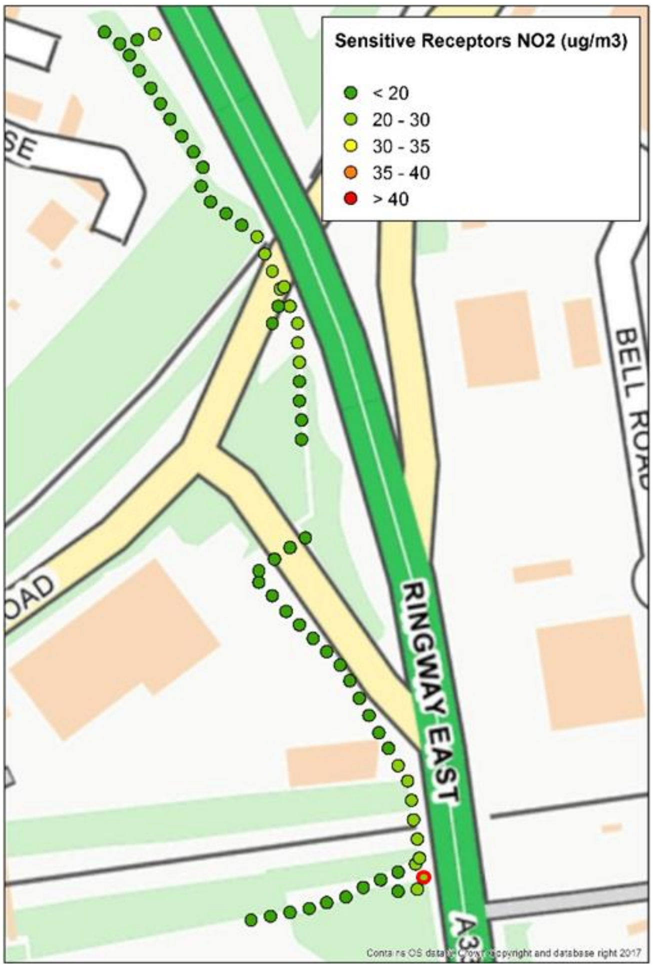
The closest sensitive receptor (footpath centre point) to the road was located 2.6 m from the kerbside (marked on Figure12). The location reflects the 234 m section of path highlighted in Figure 10 above. At these locations the footpath is separated from the edge of the carriageway by a metal Armco barrier and metal railings approximately 1 m wide (Figure 11).

The footpath running close to the road over the railway at Gresley Road was modelled at 4.5 m from the edge of the road. A similar barrier is in place at this location between the road and footpath. The 4.5 m distance from the kerb is similar to the distance between the further point on the footpath and the kerb. The maximum concentration modelled on this stretch is 23 µg/m^3 - the width of the footpath is approximately 3 m wide and the increase in concentrations by moving to the edge of the path closest to the road (approx. 1-2 m closer) will not increase NO_2 concentrations above the national annual limit value.

Figure 11: Images of the footpath located closest to the road (left to right: footpath crossing railway south of Gresley Road; footpath crossing railway north of Gresley Road; barrier separating the footpath and road in these locations)

Figure 12 shows the location and modelled NO_2 concentrations of the sensitive receptors located on the footpaths. The maximum concentration modelled on the footpath was 24.1 µg/m^3.

Figure 12: Concentrations of NO_2 modelled along the footpaths adjacent to the non-compliant road links. The sensitive receptor circled in red is the receptor located closest to the kerb (2.6 m)



The maximum modelled concentration in locations which the public can access is 24 µg/m^3, which is below the national annual limit value for NO_2. However, on the eastern side of the roadlink concentrations are higher with a maximum concentration of 50 µg/m^3 NO_2 in 2017, owing to the prevailing winds dispersing emissions from the road. Although there is no public access at this side, the Council have considered measures to lower the concentrations.

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.

Following discussions with JAQU, Basingstoke and Deane were instructed to carry out the modelling of the short-list of measures identified in Part 3. To summarise the modelling carried out during this feasibility study were as follows:

- 2017 Baseline
- 2021 Baseline
- 2022 Baseline
- 2017 + measure (Speed reduction)
- 2017 + measure (waste and Sainsburys fleet upgrade)
- 2020 + measure (Speed reduction)
- 2020 + measure (waste and Sainsburys fleet upgrade)

The local baseline modelling in Part 3 identified a maximum concentration of 50 µg/m^3 NO_2 in 2017 for the road link census ID 6941 at PCM equivalent receptors 4m from the kerbside. Using the Defra Roadside NO_2 Projection Factors (accessed 10th Sept 2018), future concentrations on this link were estimated. These projections identified the year of compliance on these road links to be 2022 (Table 8).

The concentrations in 2022 were modelled using ADMS to confirm agreement of the year of compliance with the projection factors. Scaling factors from TEMPro were used to predict the growth in traffic volume between 2017 and 2022, while the projection estimates for fleet composition from the NAEI was used to predict the changes in the fleet breakdown in 2022. The local model concentrations for 2022 also demonstrate compliance in this year (Table 8). Therefore, to establish if the links were compliant in 2021, modelling was also carried out for 2021. The results of the 2021 modelling demonstrated that both links 6941 and 56997 were compliant in 2021. Linear interpolation between the 2017 and 2021 baseline concentrations indicate that both the PCM links compliance will not be achieved in 2020.

The local modelling predicts both 6941 and 56997 will be in compliance in 2021. The results of the local model will be used in preference to the concentrations projected from 2017 using national projection factors.

Table 8: NO_2 concentrations on target road links from local model in 2017, 2021 and 2022. Concentrations of intermediary years 2018 – 2020 have been estimated using linear interpolation between 2017 and 2021 local model concentrations. Projected concentrations from 2017 to 2022 from the national roadside projection factors are also provided.

PCM Link	**Local Model 2017**	**Interpolation NO_2 ($\mu g/m^3$)**			**Local Model 2021**	**Local Model 2022**		**Projection of 2017 local model concentrations using national projection factors**				
		2018	2019	2020				**2018**	**2019**	**2020**	**2021**	**2022**
6941	50	47	44	42	39	36		47	45	43	41	39
56997	48	46	43	40	37	34		46	44	42	40	38

Three measures were identified in the short-list of measures which were taken forward to modelling (for years 2017 and 2020): reduction of speed limits, upgrading the Council waste fleet contract and upgrading the Sainsburys distribution fleet. Funding for the upgrade of the waste fleet has been confirmed and the Sainsburys fleet upgrade is underway, therefore these measures have been modelled in combination.

Reducing the speed limit on the links from 70 to 50 mph

This measure has modelled the impact of changing the speed limit on the non-compliant links (6941 and 56997) from 70 mph to 50 mph. To account for actual speeds on the road link, the model was set up so that if the speeds on these road links were greater than 50 mph then the speeds were manually set to 50 mph. If the speeds were already less than 50 mph these were left unchanged.

The modelling of these measures demonstrates that compliance on the target road link can be brought forward from 2021 as predicted by the baseline scenario (Table 9). Reducing the speeds on the target links is able to bring forward compliance on link 6941 from 2021 to 2019. However, this measure is unable to change the year of compliance on link 56997.

Table 9: Modelled concentrations after the implementation of speed limit reductions. Modelling was carried out for 2017 and 2020. Linear interpolation between the two model years has been used to estimate concentrations in intermediary years.

PCM Link	Local Model	Linear interpolation		Local Model
	2017	2018	2019	2020
6941	46	43	40	38
56997	48	45	42	40

Upgrade of council waste fleet and upgrade of Sainsburys vehicles

The Council waste collection fleet is contracted to Veolia UK. Information on the typical daily traffic movements of the waste fleet on the A339 have been estimated by Veolia to be: 20 to 21 loads of non-recyclables; 17 to 18 loads of recyclables and 9 to 10 loads of glass. Taking the lowest number of movements in each case this leads to an estimated 46 movements of waste vehicles along the route each day. The composition of the Basingstoke waste fleet is provided in Table 10 – all these vehicles are classed as rigid HGV. The measure tested is the upgrade of the waste fleet to be all Euro VI, which is condition of the new waste contract.

Table 10: Euro standards of Veolia waste fleet vehicles in Basingstoke

Euro Class	% of waste vehicles in each Euro class
3	4 %
4	4 %
5	88 %
6	4 %

Sainsburys have a depot in Basingstoke which is a distribution centre with HGV's accessing the facility using the surrounding roads. In 2015 the fleet composition of these vehicles was 98 % Euro 5, 2 % Euro 6; following upgrade works to the fleet the 2018 composition is 100 % Euro 6. The number of rigid HGV vehicles traveling to/from the depot are estimated to be 461 vehicles a week. For the modelling it has been assumed that all these vehicles travel along the target road links on the A339.

As both the waste vehicle and Sainsbury vehicle upgrades impact the same class of vehicles (HGV) and have secured funding with completion dates in 2018, the modelling of these two measures has been carried out in combination. Therefore, this measure has been modelled as no change to the number of rigid HGV's compared to the 2017 baseline, but with a change in the Euro breakdown of these vehicles to reflect the upgrade.

Table 11: Modelled concentrations after the implementation of an upgrade of the waste and Sainsburys fleet. Modelling was carried out for 2017 and 2020. Linear interpolation between the two model years has been used to estimate concentrations in intermediary years.

PCM Link	Local Model	Linear interpolation		Local Model
	2017	2018	2019	2020
6941	49	47	44	42
56997	48	45	42	40

The upgrade of the waste and Sainsburys vehicles to Euro 6 has little impact on the overall concentrations on the target road links (Table 11). The modelled concentrations for 2017 on link 6941 are reduced by 1 $\mu g/m^3$ while on link 56997 the concentrations are unchanged. This upgrade measure does not change the year of compliance for 56997 (compliance is achieved in 2020 for both baseline and after implementation of the fleet upgrade); and for 6941 compliance is not brought forward from 2021 to 2020 as a result of this measure.

To conclude, of the three measures (speed reductions, upgrade of waste fleet and upgrade of Sainsbury's distribution fleet) only **the reduction of the speed limit from 70 mph to 50 mph on the target links can bring forward compliance on the target road links.**

The Council have consulted Hampshire County Council (HCC) Transport team regarding the reduction in the speed limit. HCC have confirmed that at this stage they cannot commit to any reduction in the speed limit along the road link. HCC would need to undertake further detailed investigations (including legal and financial implications) and a safety audit before any decision can be reached.

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.

This section includes a summary information in response to the Primary Critical Success factor:

The primary Critical Success Factor is to deliver a scheme that leads to compliance with NO_2 concentration limits in the shortest possible time. Only options that are estimated to lead to compliance as quickly as possible will pass the Critical Success Factor.

This will be followed by a position statement on measures to bring forward compliance and the assessment against the Secondary Critical Success Factors of:

***Value for money**: It is important for local authorities to think about options that deliver good value for money, considering all of the economic costs and benefits.*

***Affordability**: Local authorities should provide information on estimated financial costs for each options.*

***Distributional impacts**: Consideration should be given to the relative impacts on key groups, in order to determine whether there could be a disproportionate impact on one or a number of particular groups.*

***Strategic and wider air quality fit**: Local authorities should consider how each option interacts with other local policies already in place and what additional strategic aims it could help to achieve.*

***Supply side capacity and capability**: The success of the chosen option will depend on a number of external constraints, so local authorities should assess commercial capacity or capability limitations.*

***Achievability:** Local authorities should consider whether the option can be delivered given the potential resources available (for example staffing levels) and management structures in place.*

***Displacement**: Local authorities should consider the potential for displacement on other roads and in particular whether this displacement might cause other exceedances.*

A summary table for each road link is included in Table 14.

Introduction and summary results

Two road links were identified by the PCM national model as being non-compliant with the annual average NO_2 limit value in 2018. Compliance was predicted in 2020 from the PCM model. These road links are on the A339.

Local modelling identified greater concentrations than the PCM model in 2017, and predicted later years of compliance for the road link (either 2020 or 2021). In summary, the local modelling performed has produced different results to the PCM modelling undertaken nationally, and critically this is suggesting compliance is achieved later (and post 2020) relative to the national modelling.

Table 12: Annual average NO_2 concentrations modelled for 2017 in non-compliance ($\mu g\ m^{-3}$) and expected year of compliance.

Road link ID	PCM NO_2 (2017)	Local NO_2 (2017)	Expected year of compliance
6941	45	50	2021
56997	45	48	2020

Measures were reviewed during a Council stakeholder workshop and 7 options were identified as having the potential to improve air quality in Basingstoke along the specified road links. The three measures with the highest scores in a severity-weighted assessment tool were assessed, which include the reduction of the speed limit on the target road from 70 to 50 mph, the upgrade of the waste vehicle fleet in Basingstoke to Euro VI, and the upgrade of distribution vehicles from the nearby Sainsburys depot to Euro VI.

The two upgrade measures have funding secured or are already underway and have therefore been modelled as a single measure package. The concentrations in 2017 assuming the implementation of these two short-listed measures were modelled. Estimates of future year concentrations were made using the Roadside NO_2 projection factors produced by Defra. The expected year of compliance with each measure is given in Table 13. Only the reduction of speeds on the target links is able to bring forward the year of compliance from 2021 to 2019.

Table 13: Estimated year of compliance in the baseline and after the implementation of the measures

Road link ID	Baseline	Speed Reduction	Vehicle upgrade
6941	2021	2019	2021
56997	2020	2020	2020

<u>Feasibility of Measures and Wider Impacts</u>

The air quality analysis above adopts a simplifying assumption that the measures are implemented immediately. In practice, applying a speed reduction will take time to develop and implement. For example, the precise method of implementation and governance structures need to be defined, any funding requirements need to be identified and filled, and stakeholders will need to be engaged and brought on board. This will impact on the date at which compliance is achieved, and whether this is brought forward from the baseline.

The reduction of the speed limit on the target road links from 70 to 50 mph brings forward the year of compliance on the road link. However, this measure requires further consideration to ensure there are no detrimental impacts of such a speed change elsewhere in the road network. For example, during the stakeholder meeting concerns were raised that slower speeds at this location could lead to queuing on further south on the A339 towards the M3 which could have safety implications if traffic queues onto the motorway. Further consideration should be given to these concerns e.g. carrying out traffic modelling to establish any likely queuing as the result of the speed change.

The reduction of the speed limits on the target link is the only measure with the ability to bring forward the year of compliance on the link relative to the baseline, and is therefore the preferred option.

Table 14: Summary of compliance status and measures for each road link

Road link	PCM identified link?	Summary of exceedance	Measures identified that could bring forward compliance	For any new measures, please set out costs and timeframe
6941	Yes – this link was identified as having an exceedance in the national PCM modelling	We have updated the baseline data using our local modelled data which shows that the link will be compliant in 2021. Summary of NO_2 concentration (from linear interpolation between 2017 and 2021 local model concentrations): 2017: 50 $\mu g/m^3$ 2018: 47 $\mu g/m^3$ 2019: 44 $\mu g/m^3$ 2020: 42 $\mu g/m^3$ 2021: 39 $\mu g/m^3$ 2022: 36 $\mu g/m^3$	We have identified a measure that brings forward compliance on this road link to 2019.	Our recommended measure that brings forward compliance is a reduction of the speed limit on the link from 70 to 50 mph.
56997	Yes – this link was identified as having an exceedance in the national PCM modelling	We have updated the baseline data using our local modelled data which shows that the link is compliant in 2021. Summary of NO_2 concentration (from linear	NA	NA

		interpolation between 2017 and 2021 local model concentrations):: 2017: 48 µg/m^3 2018: 46 µg/m^3 2019: 43 µg/m^3 2020: 40 µg/m^3 2021: 37 µg/m^3 2022: 34 µg/m^3		