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

| | |
|---|---|
| **Local authorities covered** | Reading Borough Council |

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

## Part 1: Understanding the problem

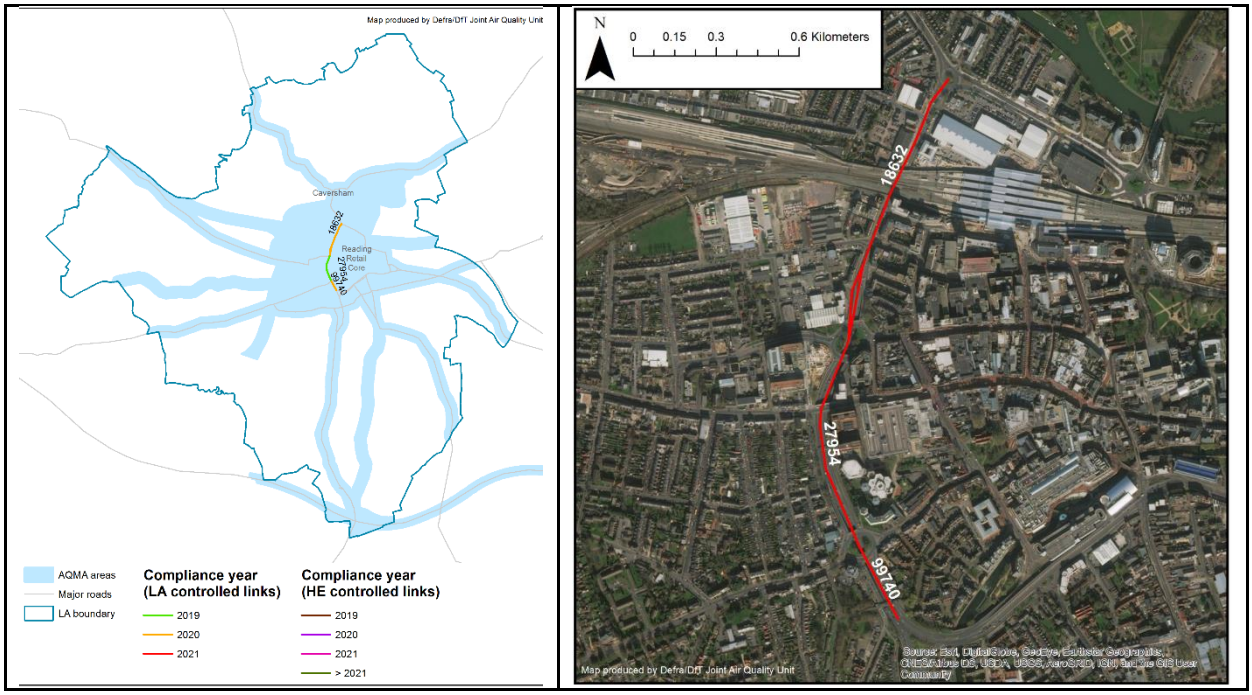
*This section should set out background on the information about the road links projected to have exceedances in the PCM national model, in combination with source apportionment data, to provide a description of the severity of the NO2 exceedance and its possible sources and causes. It should set out 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.***

Reading, 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 the A329 (Caversham Road) within Reading Borough Council as in exceedance of the annual mean $NO_2$ Air Quality Directive Limit value. This road is part of the Inner Distribution Road which is a dual-carriageway that circles the centre of Reading, and connects the city to the A33, which leads to the M4 (at junction 11). A map of the road links highlighted as in exceedance within the UK's national air quality assessment is shown in Figure 1. The three road non-compliant road links are located one after the other along the road and therefore will be discussed as a group below.

**Figure 1: Map of Reading Borough Council showing the non-compliant links for $NO_2$ that are the focus of this feasibility study.**



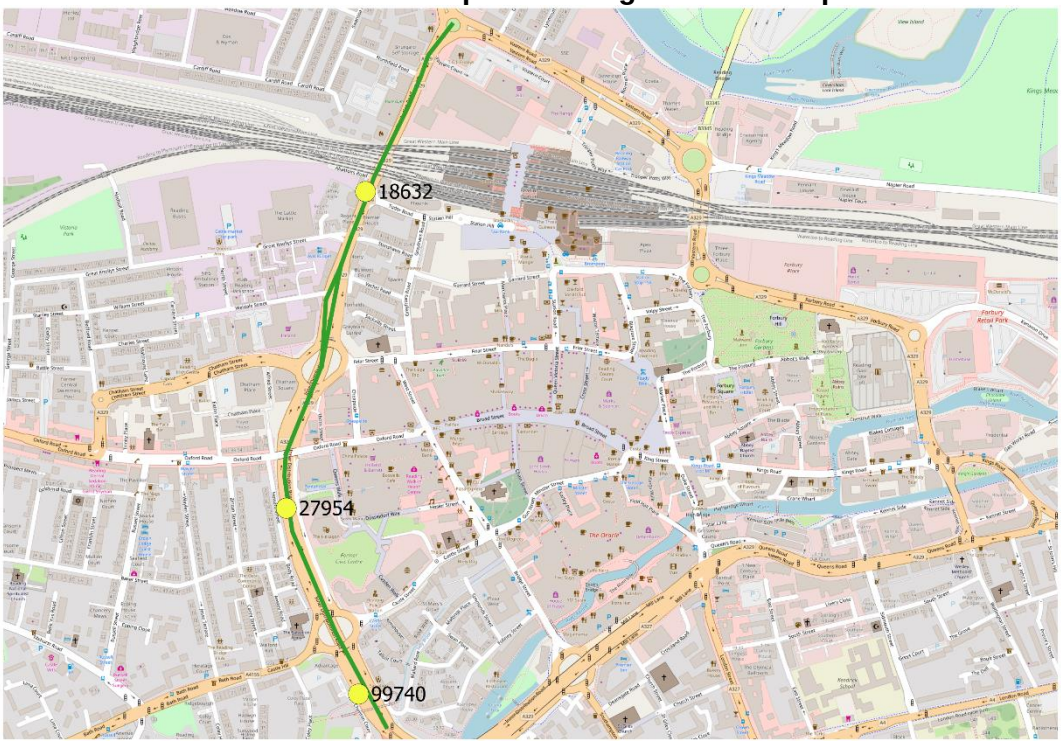

The exceedance on this road is identified at 3 link locations. The concentrations of $NO_2$ along these road links are predicted to demonstrate compliance in 2020 (Table 1). In order to achieve compliance in 2019 the concentrations on link 99740 need to reduce by at least 1 $\mu g/m^3$, while to achieve compliance in 2018 the concentrations on all the links need to reduce by at least 3, 1 and 2 $\mu g/m^3$ for links 99740, 18632 and 27954 respectively.

**Table 1: Predicted concentrations of $NO_2$ on A329 road link for 2017 – 2021. Cells highlighted in red exceed the $NO_2$ limit value, while green cells show the road links are compliant. The A329 demonstrates compliance in 2020.**

| Census ID of road link | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| 99740 | 44 | 43 | 41 | 39 | 37 |
| 18632 | 43 | 41 | 39 | 37 | 36 |
| 27954 | 44 | 42 | 40 | 39 | 37 |

The Department for Transport (DfT) have three traffic count locations along the A329 where the $NO_2$ exceedances occur. Census ID 99740 (road length 0.2 km) is located between the A4155 junction and the A33; Census ID 18632 (road length 0.7 km) is located between Chatham Street and the roundabout at Vastern Road; and Census ID 27954 (road length 0.5 km) is located between the A4155 and Chatham Street junctions (Figure 2).

**Figure 2: Location of DfT traffic count points along the non-compliant A329 road links.**

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The DfT made the following traffic counts over recent years at the count locations shown above (Table 2). 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 99740 show a reduction in traffic between 2015 and 2016 by ~1 %. Census ID 27954 showed slight increases in traffic between 2015 and 2016, however these levels were much lower than the projected growth factors (< 1%). This could lead to the local air quality modelling showing lower concentrations on links 99740 and 27954 compared to the Defra National Model. Traffic counts on Census ID 18632 increased by 5 % between 2015 and 2016, therefore it would be expected that local air quality modelling may show a higher than predicted annual average $NO_2$ concentration for 2016 than that suggested by Defra's national modelling.

**Table 2: Traffic counts at DfT sites along the A329 road links of interest for 2012 – 2016**

| **99740** | | | | | |
|---|---|---|---|---|---|
| **Year** | **Total traffic** | **Cars** | **LGV** | **HGV** | **Bus** |
| 2012 | 36913 | 30277 | 5122 | 987 | 273 |
| 2013 | 48166 | 40606 | 5732 | 1229 | 268 |
| 2014 | 48667 | 40185 | 6526 | 1319 | 284 |
| 2015 | 51150 | 42766 | 6196 | 1550 | 139 |
| 2016 | 50607 | 41790 | 6657 | 1527 | 140 |
| **18632** | | | | | |
| **Year** | **Total traffic** | **Cars** | **LGV** | **HGV** | **Bus** |
| 2012 | 34936 | 28927 | 4128 | 1428 | 202 |
| 2013 | 34818 | 28763 | 4175 | 1438 | 190 |
| 2014 | 35237 | 28464 | 4754 | 1549 | 202 |
| 2015 | 34951 | 27942 | 5001 | 1536 | 200 |
| 2016 | 37044 | 30906 | 4655 | 929 | 239 |
| **27954** | | | | | |

| Year | Total traffic | Cars | LGV | HGV | Bus |
|---|---|---|---|---|---|
| 2012 | 50276 | 43028 | 5527 | 1081 | 316 |
| 2013 | 48653 | 41019 | 5627 | 1281 | 339 |
| 2014 | 48940 | 40564 | 6499 | 1314 | 156 |
| 2015 | 48528 | 39820 | 6836 | 1304 | 154 |
| 2016 | 48955 | 40329 | 7003 | 1048 | 127 |

In the time available to complete the targeted feasibility study, local traffic counts could not be made and therefore source apportionment information for the non-complaint road links was used from the Defra PCM model (Table 3).

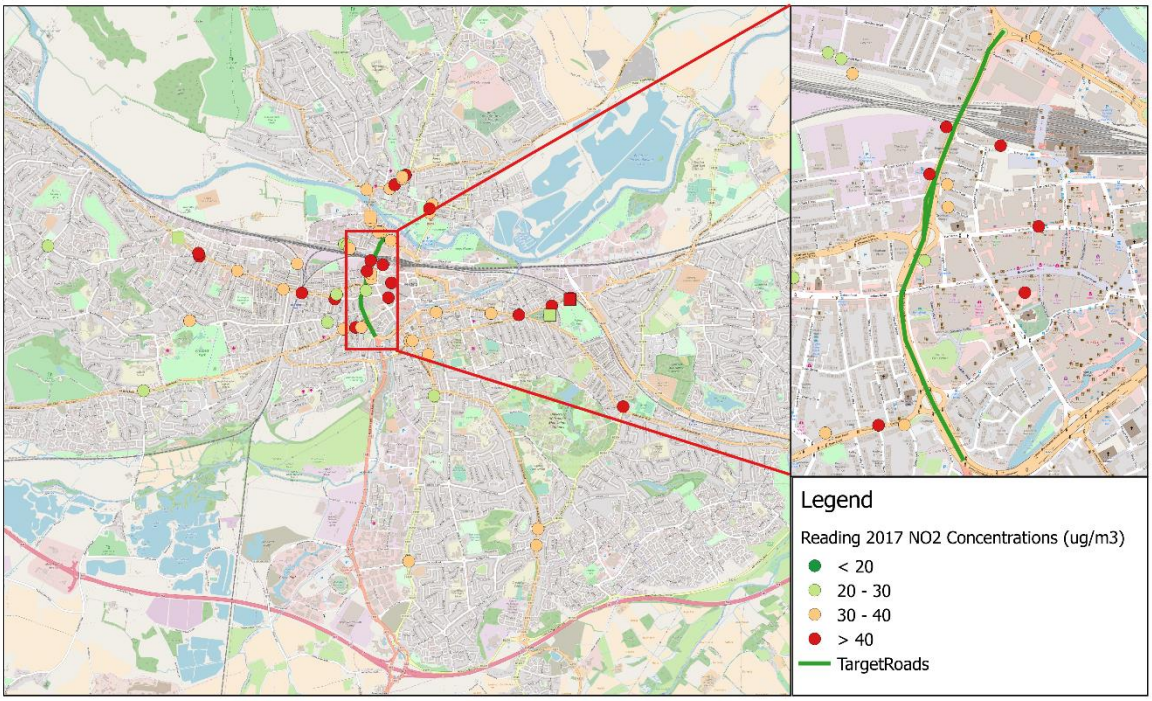
Diesel cars contribute the largest proportion of total $NO_x$ from road sources, followed by diesel LGV's. A significant (13 - 26 %) of the total $NO_x$ concentrations are from non-traffic urban background sources. The high background could be in part attributed to the railway station located in the immediate proximity of Census ID 18632. The A329 Caversham Road is located to the west of Reading town centre and is a key transport link to move vehicles through the town in a north-south orientation. The largest proportion of emissions are from cars (26 – 28 % of $NO_x$ concentrations) suggesting that these links are used for personal journeys including commuting to work places in the town-centre or leisure activities/shops located in the town centre. Many of the town-centre car parks (e.g. Oracle, NCP car parks at Garrard Street, Broad Street Mall and Reading Civic B) used to access the town centre businesses, the railway and bus stations are primarily accessed via the non-compliant road links on Caversham Road.

**Table 3: Source apportionment for total $NO_x$ (%) from Defra PCM model**

| Census ID | Regional BG | Urban BG (non-traffic) | Urban BG (traffic) | Diesel Cars | Petrol Cars | Diesel LGV | Petrol LGV | rHGV | aHGV | Bus |
|---|---|---|---|---|---|---|---|---|---|---|
| 99740 | 5 | 13 | 10 | 31 | 7 | 17 | 0 | 12 | 2 | 2 |
| 18632 | 5 | 26 | 12 | 21 | 5 | 14 | 0 | 12 | 3 | 3 |
| 27954 | 5 | 26 | 12 | 24 | 6 | 16 | 0 | 8 | 2 | 2 |

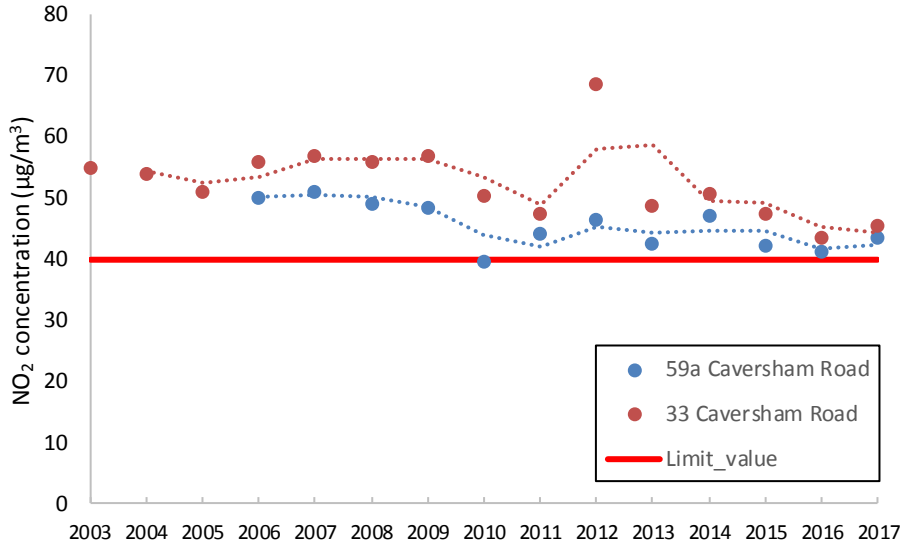
Reading Borough Council deploy 60 passive samplers and 4 automatic monitoring stations to measure $NO_2$ throughout the town (Figure 3). Two monitoring locations are located adjacent to the A329 links of interest – these sites measured an average concentration of 44 µg/m$^3$ $NO_2$ during 2017 [45 and 43 µg/m$^3$ respectively], which is similar to those concentrations predicted by Defra model for 2017 (Figure 4).

**Figure 3: Map showing Reading Borough Council $NO_2$ monitoring locations (squares denote automatic monitoring stations, while circles denote passive sampler locations). The inset map shows those measurement locations alongside the non-compliant A329 road links.**




Map data copyrighted OpenStreetMap contributors and available from https://www.openstreetmap.org

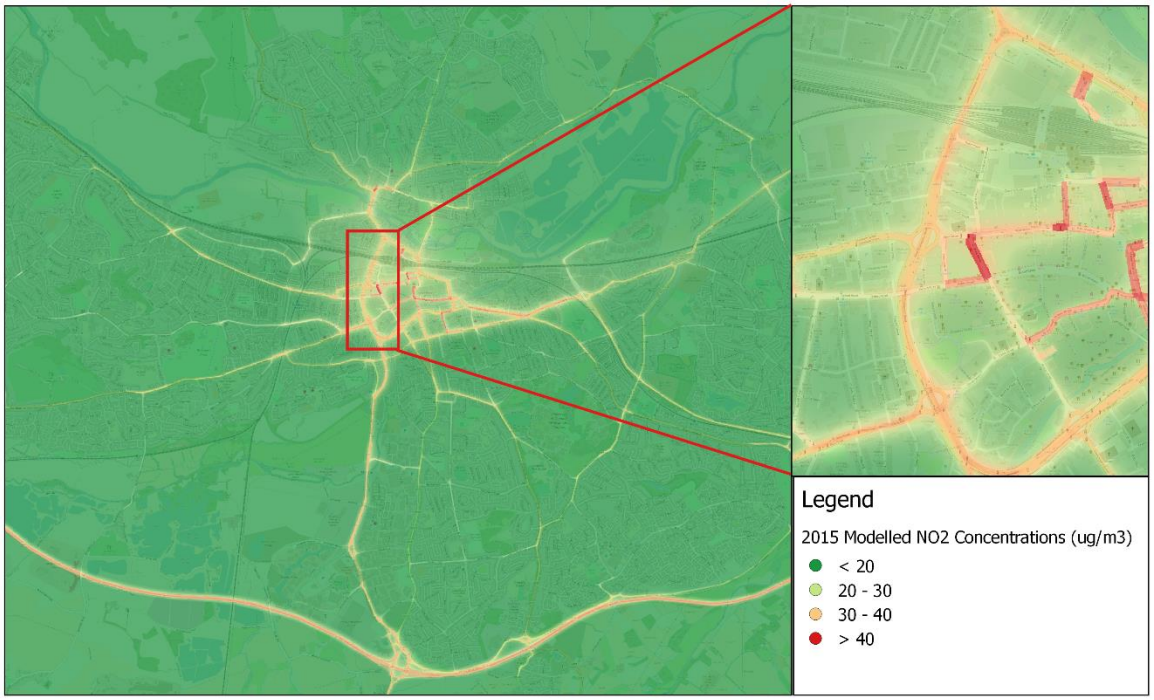
**Figure 4: Scatter plot showing change in $NO_2$ concentration at $NO_2$ monitoring sites located on A329 Caversham Road (59a and 30 Caversham Road) between 2003 and 2017.**

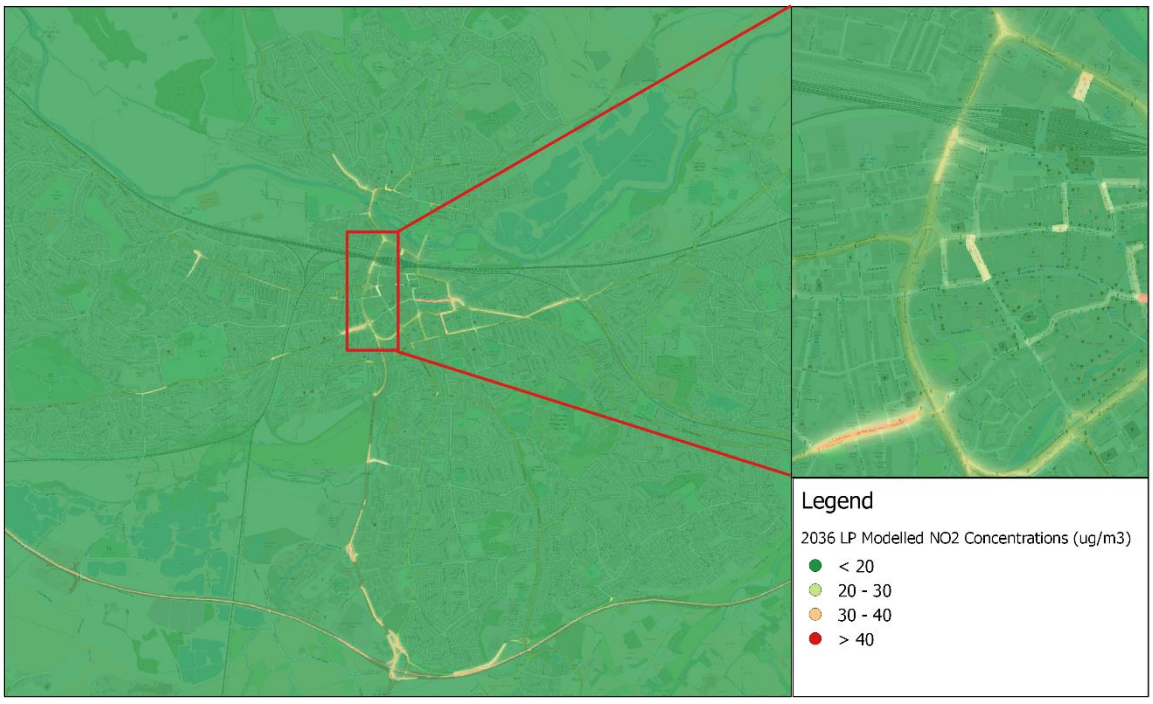



Reading Borough Council is currently developing a new (draft) Local Plan, which will replace the current development plans (the Core Strategy, Reading Central Area Action Plan and Sites and Detailed Policies Document) with a new plan setting out how Reading will develop up to 2036. The focus of the Local Plan will be the integration of new housing developments and commercial operations within the Borough of Reading. RBC have identified a housing need – 658 homes to be provided in the Borough each year, around 50% in Central Reading, 20% in South Reading and 30% in remaining areas of the Borough (from Draft Local Plan Consultation Leaflet). A town-scale air quality assessment was carried out to evaluate the likely impacts of Local Plan on

air quality in the Borough. Figure 5 shows the modelled concentrations of $NO_2$ in 2015 and in 2036 after implementation of the proposed Local Plan, for the whole city and additionally Caversham Road. The concentrations from the town-scale model at Caversham Road were estimated to be 35 and 45 µg/m$^3$ for 2015. The concentrations in 2036 after implementation of the Local Plan were lower than 2015, and no exceedance of the 40 µg/m$^3$ $NO_2$ limit value was modelled on the links.

**Figure 5: Modelled concentrations of $NO_2$ in 2015 (top) and 2036 after implementation of the Local Plan (bottom). The inset image shows the modelled concentration on the Caversham Road links.**



There have been a number of changes to the infrastructure in Reading since 2015 which are likely to have led to improvements in air quality on the road links in question:

- In 2015 the Council introduced a taxi emissions policy which set the maximum age of a licensed taxi to 15 years unless the vehicle was retrofitted to be a low emission vehicle.
- The bus fleet in the area has been improved – nearly 50 % of the Reading Buses fleet are now hybrid or compressed natural gas powered vehicles.
- Two park and ride stations were opened in 2015 – Winnersh Triangle Park and Southern Mereoak Park – located to the south and east of the town near junctions 10 and 11 of the M4. This could reduce the number of people travelling into Reading along the A329 in private vehicles thus reducing pollution.
- Package of sustainable transport measures implemented as part of the successful Local sustainable Transport Fund programme, including new pedestrian cycle bridge, 200 bike public hire scheme and improvements to walking, cycling and public transport infrastructure.
- The Southern Mass Rapid Transit development is underway, speeding up the movements of buses from the Mereoak park and ride to the town centre by installation of designated bus lanes. As above, the number of vehicles entering the city centre may be lower because of this scheme.
- The redevelopment of Reading station has led to improved interchanges to the north and south west and various traffic schemes were introduced alongside this.
- Funding secured and scheme development being progressed for new East Reading Mass Rapid Transit route and new railway station at Green Park.

**Local Dispersion modelling**

**Dispersion model details:**

ADMS-Roads version 4.0.1 was used, with meteorological data collected during 2017 at Farnborough, to model the target roads. Further information on meteorological parameters is available on request.

A number of diffusion tubes deployed by Reading Borough Council have identified local exceedances (Figure 7). The study area has been increased to include road links adjacent to the tubes monitoring exceedances.

Defra's modelled $NO_x$ background concentrations with a 2015 base year were used (for 2017 and 2019 respectively for base and future year modelling). The primary road contribution was removed to prevent double counting main roads included in the dispersion model, such as Caversham Road.

Gridded outputs from ADMS were created using 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: 50 m (x) and 22 m (y). A subset of receptors were modelled at a higher resolution following siting guidelines issued by JAQU (4 m from kerbside, 10 m spaced and 2 m height).

**Traffic data:**

The traffic data produced for the dispersion study evaluating Reading's Local Plan (discussed in Part 1) was scaled from 2015 to 2017 using local factors derived from TEMPro to obtain estimates of the fleet in Reading (a similar approach was used to scale 2017 to 2019 for future year modelling).

Telemetry data, including GPS indicating vehicle location, for a subset of 18 taxis in Reading was available for a week in June 2018. The movements of the subset taxi fleet in Reading was used to estimate the number of taxis travelling on the links in the study area for a standard day by

scaling the average number of journeys made by the subset of taxis on the links by the number of registered taxis in Reading. The number of taxis registered in Reading in 2018 was 655, which was assumed to be the same as the number of taxis in 2017 for the baseline model. The fleet composition of the taxis, including private/Hackney cab split and euro class, was available from the registration data, allowing taxi emissions to be explicitly modelled (Table 6).

**Table 6: Fleet composition of Reading taxi fleet from registration data (% of each engine Euro standard classification)**

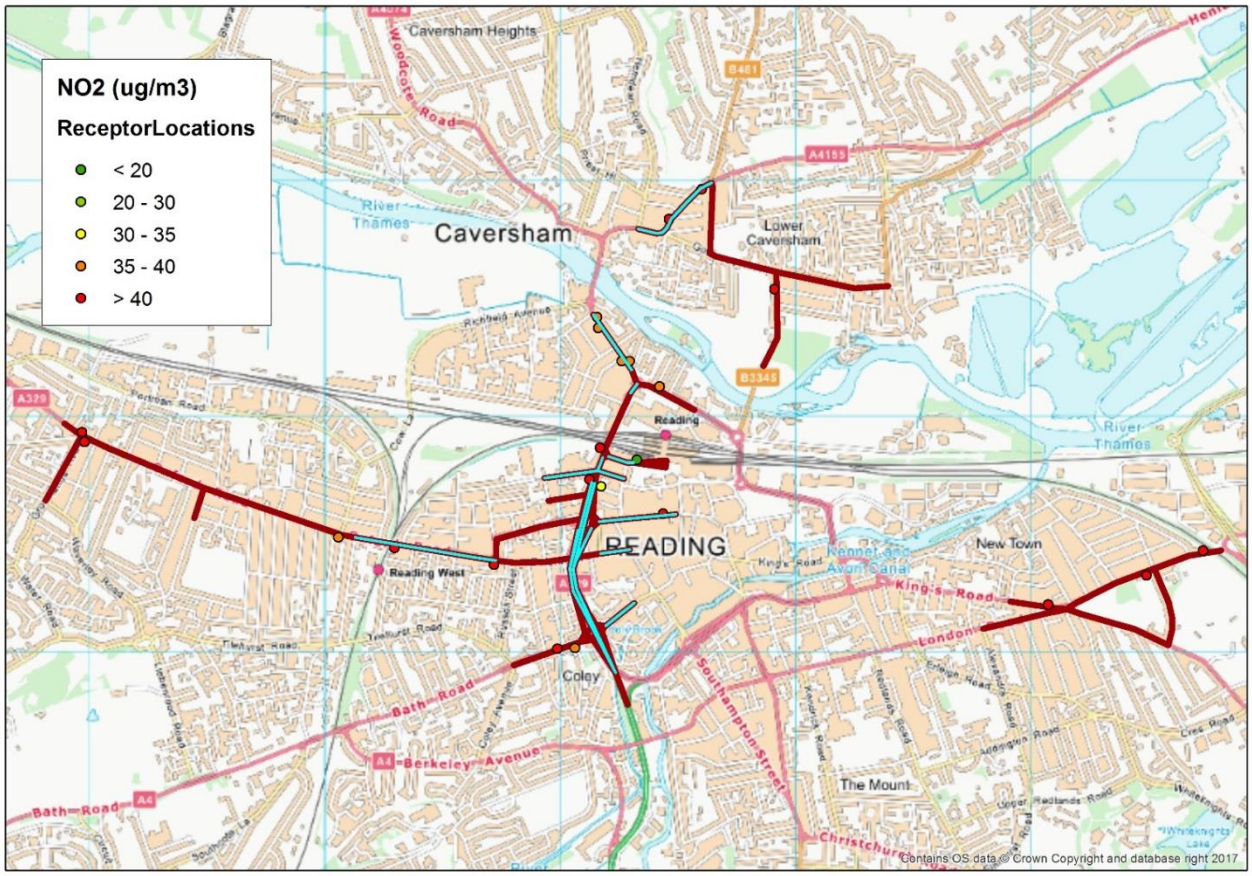
| | **Private Hire** | **Hackney Cab** |
|---|---|---|
| Euro 1 | 0.0 | 0.0 |
| Euro 2 | 0.0 | 3.2 |
| Euro 3 | 1.7 | 7.3 |
| Euro 4 | 23.5 | 22.7 |
| Euro 5 | 30.5 | 3.1 |
| Euro 6 | 6.6 | 1.4 |
| *Total Fleet (%)* | *62.3* | *37.7* |

$NO_x$ emissions were estimated on these links using Ricardo's PyCOPERT model which is based on COPERT V emission factors. The road links included in the dispersion model are shown in Figure 7.

**Canyon details:**

The target roads are located near the centre of Reading, and as a result a number of links were identified as being located within street canyons. The A329 Caversham Road is located below street level in the southern part of the road link and this has been modelled as a canyon to account for this. A map showing the location of the street canyons applied is shown in Figure 7.

**Figure 7: Location of roads included in dispersion model. The links highlighted in blue show locations where canyons were applied. Also shown are the monitoring receptor locations used for model verification.**



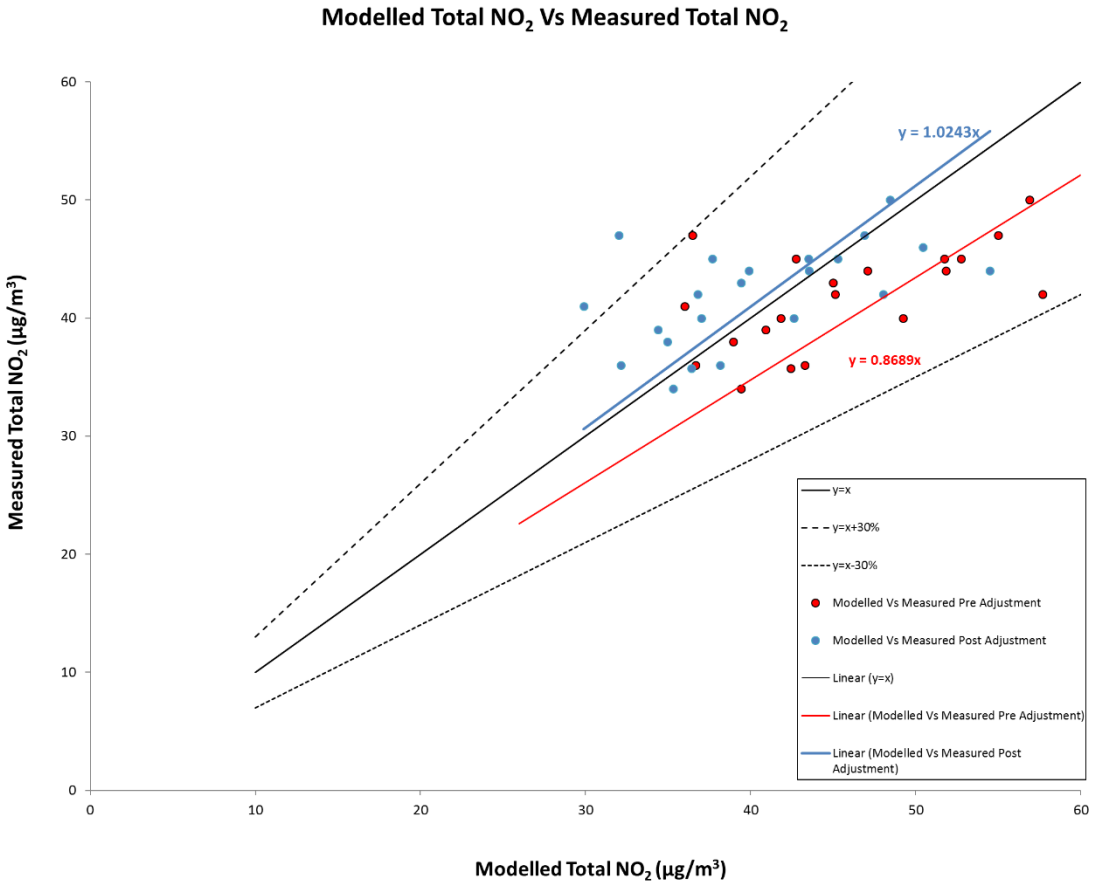

**Model validation:**

LAQM.TG (16) guidance was followed with a total of 22 monitoring locations being used for model verification and calibration. Table 7 provides evaluation of the statistics for the 2017 baseline model and Figure 8 shows the validation plot. The model predictions for the monitoring location at Station Road under predict the observed $NO_2$ concentrations, which could be a result of idling emissions from taxis at the nearby rank, which has not been accounted for within the local traffic model and therefore this site has been excluded from model validation.

**Table 7: Dispersion model calibration**

| Process in Verification | No Adjustment | With Primary Road $NO_x$ adjustment |
|---|---|---|
| No. sites | 22 | 22 |
| Modelled NOx Roads v Monitored NOx Rd Factor | *na* | 0.7057 |
| Root Mean Square Error | 11.1 | 7.1 |

**Figure 8: Modelled vs. Measured $NO_2$ concentration at validation receptors**




The gridded output from ADMS was used to generate contour plots for the 2017 and 2019 baseline models (Figures 9 and 10 respectively).

**Figure 9: Contour plots of 2017 baseline model concentrations**

**Figure 10: Contour plots of 2019 baseline model concentrations**


The subset of receptors generated at 4 m from the kerb, 10 m spacing and 2 m height were used to compare the local model to the national model concentrations. Any receptors falling within 25 m of a junction, or other feature where emissions were unlikely to reflect the road e.g. pedestrian crossings, were removed from the subset of receptors. The highest concentration receptor for each road link was reported.

On target link 99740 no PCM receptors were assigned to the link due to the presence of slip roads adjacent to the target link. To provide a direct comparison with link 99740 from the national model, a small subset of the area surrounding this link was modelled excluding the adjacent slip roads (Figure 12).

**Figure 12: Location of PCM receptors derived for link 99740. Left hand image shows PCM receptors following the slip roads adjacent to the target link. In right hand image, the slip roads were excluded from the PCM receptor generation (and in the subsequent ADMS model).**

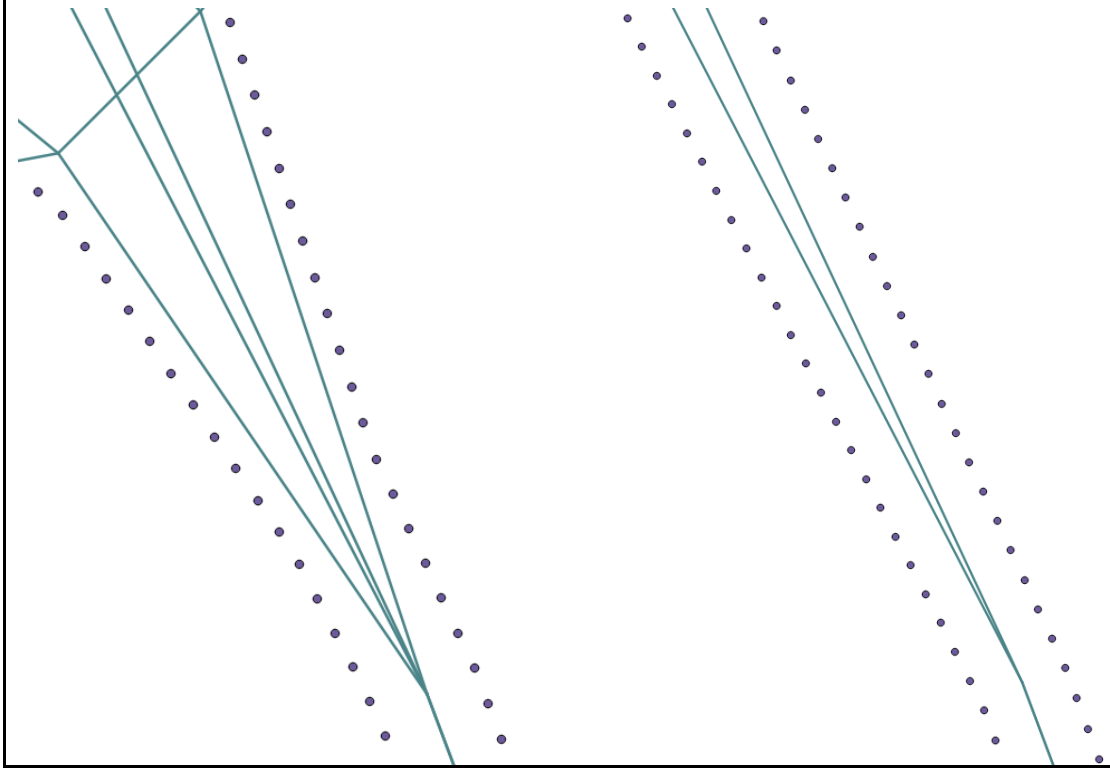


Table 8 compares the local and national model results for the roads included in this model. An estimate of concentrations in 2018 was made by extrapolation between the 2017 and 2019 concentrations as this year was not explicitly modelled in this study.

**Table 8: $NO_2$ concentrations on PCM links predicted by the local and national models. Census ID with (TL) show those links identified in Part 1 of this report to be non-compliant. Those modelled roads not on PCM links are identified by their road name instead of a census ID, and consequently have no national model concentrations reported.**

| Census ID | National model $NO_2$ ($\mu g/m^3$) | | | Local model $NO_2$ ($\mu g/m^3$) | | |
|---|---|---|---|---|---|---|
| | 2017 | 2018 | 2019 | 2017 | 2018 | 2019 |
| Westfield Road | - | - | - | 26 | 25 | 24 |
| Gosbrook Road | - | - | - | 32 | 30 | 29 |
| George Street | - | - | - | 36 | 35 | 34 |
| Tudor Road / Station Hill | - | - | - | 42 | 40 | 38 |
| Stanshawe Road | - | - | - | 41 | 39 | 37 |
| Great Knollys Street | - | - | - | 38 | 37 | 35 |
| Weldale Street | - | - | - | 32 | 31 | 29 |
| Friar Street | - | - | - | 51 | 48 | 44 |
| Oxford Road | - | - | - | 40 | 38 | 36 |
| Wantage Road | - | - | - | 18 | 17 | 16 |
| Grovelands Road | - | - | - | 24 | 22 | 21 |
| Castle Street | - | - | - | 34 | 32 | 31 |
| London Rd 6127 | 35 | 34 | 33 | 51 | 49 | 47 |
| 6924 | 32 | 31 | 30 | 43 | 41 | 39 |
| 18056 | 22 | 21 | 20 | 32 | 31 | 30 |
| **18632 (TL)** | **43** | **41** | **39** | **44** | **42** | **40** |
| **27954 (TL)** | **44** | **42** | **40** | **37** | **36** | **34** |
| 28100 | 36 | 34 | 33 | 39 | 38 | 36 |
| Kings Rd/Wokingham Rd 46955 | 33 | 32 | 31 | 51 | 49 | 47 |
| Chatham St 48360 | 33 | 32 | 30 | 51 | 49 | 47 |
| 58002 | 32 | 30 | 29 | 37 | 35 | 33 |
| 73897 | 37 | 36 | 34 | 43 | 41 | 39 |
| **99740 (TL)** | **44** | **43** | **41** | **27** | **29** | **30** |
| **99740 (TL) including slip roads** | **44** | **43** | **41** | **42** | **40** | **38** |

The local model predicts the target links of 27954 and 99740 to be in compliance in 2017 and into future years. The local and national modelled are in agreement that target link 18632 will be compliant in 2019.

## 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 Caversham Road, followed by diesel LGVs. Therefore, we have included measures that will reduce emissions from these sources.

Existing Measures:

- Implementation of a park and ride scheme at East Thames Valley Park (estimated completion is in 2019 therefore this measure will not bring forward compliance from 2020).
- East Mass Rapid Transit is under development which will provide fast track public transport, pedestrian and walking routes between the East Thames Valley park and ride and Reading city centre. The estimated completion date for this project is March 2022 therefore this in not going to reduce the year compliance is achieved on these links, however is anticipated to continue to improve air quality in the area in future.
- Funding has been secured to introduce charging points for electric vehicles in areas with no off street parking

Potential New Measures

- Low emission vehicle lease/salary sacrifice scheme to target the worst polluting vehicles (such as privately-owned diesel cars).
- Designated low emission parking areas to discourage more polluting vehicles entering the town-centre car parks, or alternatively parking incentives such as reduced fares for low emission vehicles.
- Allow electric vehicles or other low emissions vehicles to use bus lanes to promote the use of these cleaner vehicles.
- Installation of more electric vehicle charging points within the city 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.
- Development of park and ride facilities in the north and west of the Borough to further promote the use of public transport to access the city-centre.
- Intelligent transport systems to manage traffic to minimise congestion on the non-compliant links. Traffic management systems prioritising buses to encourage more public transport use through faster journey times.
- Restrict delivery times to the town centre to prevent LGV and HGV (all or more polluting goods vehicles) deliveries during peak traffic times.
- Retrofit scheme for LGV, HGV or buses to convert to low emission vehicle.
- Prioritise low emission vehicles at taxi ranks e.g. those at the station. Restrict access to Reading Station West drop off to private vehicles.
- Public engagement promoting sustainable transport including taking public transport, walking / cycling, and encouraging car-sharing.
- Improved junction layout along the roads, e.g. introduction of traffic signals on the roundabout at north of link 18632 to improve traffic flows.
- Reroute traffic to minimise the number of roads joining the entering the A329 via traffic-lighted junctions.
- Encourage / facilitate home-working to reduce journeys into the city centre.
- Congestion charging.
- Encourage fleet consolidation – e.g. use of electric LGVs for local deliveries into the town centre.

- Developing and implementing a new borough-wide car parking and air quality strategy, including possible demand management measures such as a Workplace Parking Levy, as part of updating the Local Transport Plan. It is envisaged that the new LTP will be complete in spring 2019 and subsequent demand management measures could be implemented by 2020/21. The Consultation on the LTP and complimentary measures will be undertaken in summer 2018 with scheme development following the outcome of the consultation.
- Incentivise electric fleet uptake across Hackney & Private Hire industry (vehicles and infrastructure)
- Work with the supermarket industry to incentivise customers to take up off peak delivery options and review their fleet – move towards ULEVs.

## 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 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 4, and further discussion of the reasoning of the scoring for each measure is described below.

- Low emission vehicle lease / salary sacrifice – In order for this measure to be effective it would require uptake by a number of businesses (e.g. not just the Council). It will not be achievable to implement this on the necessary scale within the timescales available to bring forward compliance, however Reading Borough Council will consider this measure in future air quality plans.
- Designated low emission parking – Reading Borough Council are reviewing their parking strategy currently, with the aim to reduce the number of vehicles entering the city centre in a bid to reduce congestion. Designated low emission parking counteracts the parking strategy and therefore is an unacceptable measure.
- Electric vehicles to use bus lanes – As described above Reading Borough Council are trying to minimise the number of all cars entering the city, which this measure could counteract. Additionally, Reading Borough Council are encouraging the use of public transport buses and as such, adding congestion to the bus lanes with electric vehicles could discourage public transport.
- Installation of electric vehicle charge points – This is included in current Council plans, specifically focusing on taxis. The council has funding to make telemetry measurements on approximately 50 taxis to allow planning for location of charge points. This data could be used to quantify the number of taxis travelling on Caversham Road which, in

combination with the taxi retrofit scheme, could be used to identify likely improvement in emissions as a result of this measure.

- Park and Ride in north and west of the city – This is part of the Reading Borough Councils long-term plan, however this cannot be completed in time to bring forward compliance (the time between the submission of the planning application and opening of the Mereoak Park and Ride, for example, was 2 years).
- Intelligent transport systems – These have been introduced in other roads in the city in a bid to ease congestion. This could be a suitable measure to apply on Caversham Road, however the impact of this will be difficult to quantify without the use of a transport model.
- Retrofit scheme for LGV, HGV, buses and taxis – a targeted retrofit scheme could be carried out focusing on businesses located on the A329 whose LGV and/or HGV vehicles use the links. Quantifying the impacts of this measure is likely to be challenging without the use of a transport model, and would rely on assumptions relating to the level of uptake.
- Prioritise low emission vehicles at taxi ranks – this is unlikely to be achievable in the timescales available as this would require some of the taxi fleet to be retrofitted. Reading Borough Council are in the process of looking into putting in electric vehicle charge points for taxis to promote electric vehicles. A transport model would be required to assess the impact of this measure.
- Public engagement promoting sustainable transport – This is an on-going measure by the Council, however the impacts will be hard to quantify. There are two schools in the area, however a substantial proportion of the journeys to school are already made by sustainable means so the effectiveness of a promotion campaign on emission reductions is anticipated to be low. A transport model would also be required to assess the impact of this measure.
- Improved junction layout – the current layouts on the junctions on Caversham Road are considered to be optimal, and no further improvements can be identified.
- Rerouting of traffic away from A329 – Cow Lane has been undergoing extensive upgrade work which is due for completion in early 2019. The completion of these upgrades is anticipated to reroute some traffic away from Caversham Road and onto Cow Lane, which is anticipated to result in reduced emissions on the non-compliant Caversham Road links. Traffic data forecasting the change in peak-time cars and HGVs on the roads surrounding Cow Lane (including Caversham Road) are available.
- Encourage home-working – This measure would be difficult to quantify and it is anticipated this will have a low impact on emission reduction on Caversham Road. A transport model would be required to assess the impact of this measure.
- Congestion charging scheme – This would be challenging to implement in the timeframe available, and would require a transport model to assess, and has therefore been excluded from the short-list of possible measures. However, Reading Borough Council would be willing to consider an investigation of a charging scheme in the future.
- Fleet consolidation – this is unlikely to be achievable in the timeframe available and it would be difficult to quantify the impacts of such a measure on the non-compliant Caversham Road links. A similar fleet consolidation scheme in Bristol was developed with the aid of EU funding via the CIVITAS project, which took 6 months to develop and launch the consolidation centre with continued development over time to increase the capacity of the centre (http://civitas.eu/measure/freight-consolidation-scheme).
- Borough-wide car park strategy including Workplace Parking Levy – The development of the Reading parking strategy is currently underway, however any measures derived from this will not bring forward compliance as this strategy is due for completion in 2020.
- Incentivise electric fleet Hackney taxis – The availability of electric Hackney cabs is restricted as demand is outstripping supply. As a result, this measure would be difficult to implement in time to bring forward compliance. Furthermore, the quantification of this measure would require the application of an assumption on the level of uptake of EV taxis, which would carry significant uncertainties.
- Encourage supermarkets to incentivise off-peak deliveries – this will be difficult to achieve on a Council-level as would likely require national support for incentivisation. The number of delivery vehicles using the non-compliant Caversham Road links would be difficult to quantify in the time available, without the use of a transport model.

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:

- **Retrofit scheme for taxis**
- **Retrofit scheme for buses**
- **Improved road infrastructure at Cow Lane leading to reduced traffic on Caversham Road**

| Measure | Bring forward compliance | Effective | Timescale | Deliverable | Achievable | Co-Benefits | Likely uptake | Positive benefits | Negative benefits | Total score |
|---|---|---|---|---|---|---|---|---|---|---|
| Low emission vehicle lease / salary sacrifice | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 10 |
| Designated low emission parking | 1 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 12 |
| EV to use bus lanes | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 11 |
| Installation of EV charge points | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 3 | 13 |
| Park & ride in North and west of Reading | 1 | 2 | 1 | 1 | 3 | 2 | 2 | 2 | 2 | 16 |
| **Intelligent transport systems** | **2** | **1** | **2** | **2** | **2** | **2** | **3** | **1** | **3** | **18** |
| **Retrofit of LGV and HGV** | **2** | **2** | **1** | **1** | **2** | **2** | **2** | **1** | **2** | **15** |
| **Prioritise low emissions taxis at ranks** | **2** | **2** | **1** | **2** | **3** | **2** | **2** | **1** | **3** | **18** |
| Public engagement promoting sustainable transport | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 3 | 15 |
| Improved junction layouts (e.g. roundabout at north of A329 target links) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| **Reroute traffic to reduce flow on A329** | **2** | **3** | **2** | **2** | **3** | **2** | **2** | **1** | **1** | **18** |
| Encourage home working | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 10 |
| Congestion charging | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 11 |
| Fleet consolidation | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 12 |
| Air Quality Strategy (workplace parking levy) | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 | 12 |
| Incentivise electric Hackney cabs | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 13 |
| Promote supermarkets to incentivise off-peak home deliveries | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 10 |

## 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.*

The shortlisted measures were modelled in ADMS – concentrations at PCM grids were extracted for evaluation of the effectiveness of the measures. The concentrations predicted on the PCM roads are provided in Table 9 for each of the measures.

**Table 9: $NO_2$ concentrations (µg/m$^3$) on PCM roads for the national model, local model and local model after implementation of measures: Cow Lane (*CL*); Euro 6 Bus (*E6B*); Euro 6 Taxi (*E6T*); Electric Taxi (*ET*); and Euro 6 bus & electric taxi (*E6BET*).**

| Census ID | National model | | | Local model | | | *CL* | *E6B* | | | *E6T* | | | *ET* | | | *E6BET* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2017 | 2018 | 2019 | 2017 | 2018 | 2019 | 2019 | 2017 | 2018 | 2019 | 2017 | 2018 | 2019 | 2017 | 2018 | 2019 | 2017 | 2018 | 2019 |
| Westfield Road | - | - | - | 26 | 25 | 24 | 24 | 26 | 25 | 24 | 26 | 25 | 24 | 26 | 24 | 23 | 26 | 24 | 23 |
| Gosbrook Road | - | - | - | 32 | 30 | 29 | 29 | 32 | 30 | 28 | 32 | 30 | 29 | 32 | 29 | 26 | 32 | 28 | 24 |
| George Street | - | - | - | 36 | 35 | 34 | 34 | 36 | 35 | 33 | 36 | 35 | 33 | 36 | 32 | 28 | 36 | 31 | 26 |
| Tudor Road / Station Hill | - | - | - | 42 | 40 | 38 | 38 | 42 | 39 | 37 | 42 | 40 | 37 | 42 | 38 | 35 | 42 | 38 | 34 |
| Stanshawe Road | - | - | - | 41 | 39 | 37 | 37 | 41 | 39 | 36 | 41 | 39 | 37 | 41 | 38 | 34 | 41 | 37 | 34 |
| Great Knollys Street | - | - | - | 38 | 37 | 35 | 35 | 38 | 36 | 34 | 38 | 36 | 34 | 38 | 35 | 32 | 38 | 35 | 32 |
| Weldale Street | - | - | - | 32 | 31 | 29 | 29 | 32 | 30 | 29 | 32 | 30 | 29 | 32 | 30 | 28 | 32 | 30 | 27 |
| Friar Street | - | - | - | 51 | 48 | 44 | 44 | 51 | 43 | 35 | 51 | 47 | 44 | 51 | 47 | 43 | 51 | 42 | 33 |
| Oxford Road | - | - | - | 40 | 38 | 36 | 36 | 40 | 37 | 34 | 40 | 38 | 36 | 40 | 37 | 33 | 40 | 36 | 31 |
| Wantage Road | - | - | - | 18 | 17 | 16 | 16 | 18 | 17 | 16 | 18 | 17 | 16 | 18 | 17 | 16 | 18 | 17 | 16 |
| Grovelands Road | - | - | - | 24 | 22 | 21 | 21 | 24 | 22 | 20 | 24 | 22 | 21 | 24 | 22 | 20 | 24 | 21 | 18 |
| Castle Street | - | - | - | 34 | 32 | 31 | 31 | 34 | 31 | 29 | 34 | 32 | 30 | 34 | 31 | 28 | 34 | 30 | 26 |
| London Rd 6127 | 35 | 34 | 33 | 51 | 49 | 47 | 47 | 51 | 47 | 43 | 51 | 49 | 47 | 51 | 48 | 45 | 51 | 46 | 41 |
| 6924 | 32 | 31 | 30 | 43 | 41 | 39 | 39 | 43 | 40 | 37 | 43 | 41 | 38 | 43 | 38 | 33 | 43 | 37 | 30 |
| 18056 | 22 | 21 | 20 | 32 | 31 | 30 | 30 | 32 | 31 | 29 | 32 | 31 | 29 | 32 | 30 | 28 | 32 | 30 | 27 |
| **18632 (TL)** | **43** | **41** | **39** | **44** | **42** | **40** | **40** | **44** | **42** | **40** | **44** | **42** | **40** | **44** | **40** | **37** | **44** | **40** | **36** |
| **27954 (TL)** | **44** | **42** | **40** | **37** | **36** | **34** | **34** | **37** | **36** | **34** | **37** | **36** | **34** | **37** | **35** | **32** | **37** | **34** | **31** |
| 28100 | 36 | 34 | 33 | 39 | 38 | 36 | 36 | 39 | 38 | 36 | 39 | 37 | 35 | 39 | 35 | 31 | 39 | 35 | 30 |
| Kings Rd/Wokingham Rd 46955 | 33 | 32 | 31 | 51 | 49 | 47 | 47 | 51 | 47 | 42 | 51 | 49 | 47 | 51 | 49 | 46 | 51 | 46 | 41 |
| Chatham St 48360 | 33 | 32 | 30 | 51 | 49 | 47 | 46 | 51 | 48 | 44 | 51 | 48 | 46 | 51 | 46 | 40 | 51 | 45 | 38 |
| 58002 | 32 | 30 | 29 | 37 | 35 | 33 | 33 | 37 | 34 | 31 | 37 | 35 | 33 | 37 | 34 | 32 | 37 | 33 | 29 |
| 73897 | 37 | 36 | 34 | 43 | 41 | 39 | 39 | 43 | 39 | 36 | 43 | 40 | 38 | 43 | 40 | 37 | 43 | 38 | 34 |
| **99740 (TL)** | **44** | **43** | **41** | **27** | **29** | **30** | **30** | **27** | **29** | **30** | **27** | **28** | **30** | **27** | **27** | **27** | **27** | **27** | **27** |

**Cow Lane improvements**

Cow Lane has been undergoing improvement works and is due to be reopened in early 2019. An estimate of the likely traffic on the target links was used to predict the impact of this road opening on 2019 concentrations (Figure 12). This measure will only impact a small number of the non-compliant roads in close proximity to Cow Lane.

The reopening of Cow Lane has little impact on the modelled concentrations on the non-compliant roads (Table 9). Only link 48360 (Chatham Street) shows a change in concentration as a result of this measure (concentration reduces by 1 $\mu g/m^3$).

**Figure 12: Traffic plans detailing the change in traffic in the areas surrounding Cow Lane after its reopening in early 2019**

**Bus Retrofit**

The modelling used the bus fleet composition as present in the NAEI. Since completion of the baseline modelling, the actual composition of the bus fleet has been made available. The actual composition of the 2018 Reading bus fleet (which is assumed to be similar to that in 2017) is slightly older than the national modelling assumptions (Table 10). This means that the emissions contributions from buses may be larger in reality than included in the baseline modelling. However, recent conversations with Reading Buses (who run > 95% of the bus fleet in Reading) highlighted that a proportion of their fleet are powered using alternative fuels e.g. 62 CNG and 15 hybrids. While the bus fleet in Reading is older and has a greater proportion of e.g. Euro 5 buses compared to the national model, a proportion of these are powered by alternative fuels and therefore produce lower emissions than a standard Euro 5 bus.

**Table 10: Comparison of fleet composition used in local model and data obtained from Reading bus companies**

| % of bus fleet | Local model (2017) | Bus registration data (2018) |
|---|---|---|
| Euro 1 | 0 | 0 |
| Euro 2 | 3 | 0 |
| Euro 3 | 13 | 8 |
| Euro 4 | 10 | 11 |
| Euro 5 | 32 | 48 |
| Euro 6 | 40 | 32 |

The bus retrofit measure investigated the impact of upgrading the bus fleet to all Euro 6. Upgrading the bus fleet has limited impact on the 18632, 27954 and 99740 target links which is not unexpected due to the small proportion of buses in the target determination on these links (Table 9). However, on the other links where local exceedances were measured in 2017, the bus upgrades bring forward compliance to 2018 (e.g. Friar Street).

**Taxi retrofit – all taxis Euro 6**

The proportion of taxis on the target links in Reading was on average 20% of the total AADT. Modelling the taxi fleet as all Euro 6 resulted in small improvements in concentrations on the target links (Table 9). However, these improvements are not large enough to bring forward compliance on target link 18632 to 2018.

**Taxi retrofit – all taxis electric**

The Reading taxi fleet was then modelled as all electric vehicles to establish if this could bring forward compliance. An all electric taxi fleet results in significant improvements to the concentrations on the modelled links with improvements of up to 6 $\mu g/m^3$ $NO_2$ observed (Table 9). On link 18632 the presence of all electric taxis brings forward compliance on the link to 2018.

**Electric taxis and Euro 6 buses**

The most effective measures (Euro 6 and electric taxis) were run in combination to determine if compliance on all the modelled links could be achieved. While this was the most effective measure, compliance is still not achieved on links 6127 (London Road) and 46955 (Wokingham Road) in 2019 (both links have modelled concentrations of 41 µg/m$^3$ (Table 9).

Intelligent signalling on traffic junctions on Caversham Road was identified in Part 3 as a potential short-listed measure to consider further. Improved signalling is being implemented throughout Reading but is not in place yet on Caversham Road. To consider this further evidence of changes in annual average speed as a result of the implementation to date was sought. This evidence is limited and with the high annual average flows and low peak hour speeds any changes to the annual average speeds are unlikely to bring much emission reduction. This measure was therefore not considered further in the modelling which quantified the air quality benefit of higher potential measures.

To conclude, t**he measures identified in this study with the ability to bring forward compliance on the target road links are all electric taxis, or a combination of all electric taxis and all Euro VI buses.**

## 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 13.

**Introduction and summary results**

Three 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 either in 2019 or 2020. These road links are on the A329, the Inner Distribution Road.

Following new advice from JAQU, 20 additional local road links were added to the model which were of local interest. 24 road links were modelled in total, as one of the PCM road links was modelled with and without the emissions from the adjoining slip roads. Of these additional 20 road links, 8 were in non-compliance in 2017 according to the local model. In total, of the 24 road links, 4 were in non-compliance in 2019. The earliest date of expected compliance for these 4 road links is 2020 and the latest is 2022.

The future year modelled in this study was 2019. In order to provide an estimate of the years of compliance for the road links with exceedances beyond 2019, the Defra Roadside $NO_2$ projection factors were used following guidance issued by JAQU, available on the LAQM website.

**Table 11: Annual average $NO_2$ concentrations modelled for 2019 in non-compliance (µg $m^{-3}$) and expected year of compliance.**

| Road link ID | PCM $NO_2$ (2019) | Local $NO_2$ (2019) | Expected year of compliance |
|---|---|---|---|
| Friar St | NA | 44 | 2021 |
| 6127 (London Rd) | 33 | 47 | 2022 |
| 46955 (Kings Rd/Wokingham Rd) | 31 | 47 | 2022 |
| 48360 (Chatham St) | 30 | 47 | 2022 |

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.

Measures were reviewed during a Council stakeholder workshop and 17 options were identified as having the potential to improve air quality in Reading along the specified road links. The three measures with the highest scores in a severity-weighted assessment tool were assessed, which

include the reopening of Cow Lane following extensive traffic management improvements, low emission buses and low emission taxis.

Four measures were modelled as these were identified as most feasible (A below) or most effective (B, C & D below) based on the emission reductions calculated using the Defra Emission Factor Toolkit. These measures were:

A. Traffic management scheme at Cow Lane Junction: This is an extensive re-routing scheme to remove traffic from the A329 and is due for completion in early 2019. This is expected to reduce emissions on the target links of the A329.
B. Low emission buses: 50% of the bus fleet in Reading is Euro VI. This measure would increase that to 100% Euro VI buses.
C. Low emission taxis: 8% of the taxi fleet are Euro 6 with the most vehicles being Euro 4 (46%). This measure includes 2 options:
    a. All taxi to be Euro 6
    b. All taxi to be Electric
D. Combined B & Cb above.

The expected year of compliance with the packages of measures above is given in Table 12. Package A does not bring forward compliance on Friar St, 6127 (London Road), 46955 (Kings Road, Wokingham Road) or 48630 (Chatham Street) which could be due to the very localised impacts of Cow Lane traffic management. Package B and D brings forward compliance on all links, while Package C is less effective at bringing forward compliance.

It is also worth noting that only Package D achieves compliance with legal limits on all links by 2020.

**Table 12: Estimated year of compliance in the baseline and with the packages of measures**

| Road link ID | Baseline | Package A | Package B | Package Ca | Package Cb | Package D |
|---|---|---|---|---|---|---|
| Friar St | 2021 | 2021 | 2019 | 2021 | 2021 | 2019 |
| 6127 (London Rd) | 2022 | 2022 | 2021 | 2022 | 2021 | 2020 |
| 46955 (Kings Rd/Wokingham Rd) | 2022 | 2022 | 2020 | 2022 | 2022 | 2020 |
| 48360 (Chatham St) | 2022 | 2022 | 2021 | 2022 | 2019 | 2019 |

**Feasibility of Measures and Wider Impacts**

The air quality analysis above adopts a simplifying assumption that the measures are implemented immediately. In practice, all options 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 traffic management measure, which is a committed development does not bring forward compliance.

Upgrading the bus fleet is modelled to bring forward compliance by up to 2 years. Engagement with the bus operators is underway with positive reception. However, until a scheme can be developed in detail (identifying the costs for upgrade of the fleet via retrofit and/or new vehicles and the funding mechanism to support this) it is not clear by how much this measure can bring forward compliance. The supply chain for implementation requires consideration i.e. how quickly could this bus fleet be procured or retrofitted in consultation with the operators.

The upgrade of the taxi fleet to either Euro 6 or electric does not on the whole bring forward compliance any further than the upgrade of the bus measure alone (with the exception of one link under Option Cb), but is anticipated to take longer to implement given the greater number of stakeholders, vehicles, requirement for infrastructure and limitations associated with supply chain involved.

The combined bus and taxi measure brings forward compliance in 2 of the 4 road links by 1 year compared to the bus only measure. However, this would need to be delivered this year (so compliance on links assessed can be achieved by 2019) which is unrealistic. The critical question is whether Package D would take a year or more longer than Package B to implement: it is anticipated it would take longer as both bus *and* taxi operators would need to be engaged, and a larger number of vehicles brought into compliance. However, the exact implementation times will depend critically on the detail of the measures.

In order to bring forward compliance on the road links the taxi fleet would need to be upgraded to either Euro VI or electric taxis. Upgrading to Euro VI does not bring forward compliance on the non-compliant links (Friar St, 6127, 46955 and 48360) (see Table 12 in report). Upgrading to all electric taxis has the ability to bring forward compliance on 6127 and 48360 but does not change the year of compliance on the remaining links. The upgrade of a full taxi fleet to electric vehicles is unlikely to be implemented in the available timescales due to a number of factors, including: long lead times of electric Hackney cabs; availability of funding; engagement with stakeholders to ensure uptake of the electric vehicles.

In conclusion, the most effective option to bring forward compliance is the upgrade of the bus fleet (Package B). This option brings forward compliance relative to the baseline. The relative time to implement between this and Package D is uncertain. However, Package B will be simpler (and likely shorter) to implement (given fewer stakeholders need to be engaged and vehicles updated), there is time available to implement this option by the end of 2019 which brings compliance forward by up to 2 years, and this option limits any costs and negative impacts on business to only one sector.

Preliminary conversations with Reading Buses have suggested that the retrofit of the buses would be achievable before the end of 2019. These timescales would only be likely to be achieved if funding is made available immediately for the full upgrade of Reading Buses fleet to Euro VI compliance and is also subject to sufficient supply being available from bus manufacturers. It should be noted this would only achieve compliance of Reading Buses fleet which operates approximately 95% of the bus network in Reading. Achieving 100% compliance would need to be through the introduction of a CAZ or LEZ and is likely to take significantly longer (anticipated to take longer than 2 years to implement) due to the requirement to undertake consultation with stakeholders and provide sufficient time for operators to make preparations for the new regulations to come in to effect.

The bus retrofit measure would upgrade the bus fleet to Euro VI. The current proportion of the Reading bus fleet that is Euro VI is 32 %, however there are a number of Euro 5 buses in the fleet that are powered by alternative fuels including CNG.

The modelling has been based on the assumption of upgrading all buses Euro V or below, therefore 68 % of the bus fleet would require retrofit. The total number of buses registered in Reading is 201, meaning 137 buses would require retrofit working to 32 % of fleet already being compliant.

The table below highlights the exceedance links, the year of compliance (assuming no interventions), the percentage of the AADT attributed to buses (maximum on the modelled road links making up the PCM census link) and the year of compliance after retrofit of the bus fleet to Euro VI.

| Road link with exceedances | Baseline compliance year | % of AADT from buses | Compliance year after retrofit |
|---|---|---|---|
| Friar St | 2021 | 78 | 2019 |
| 6127 | 2022 | 5 | 2021 |
| 46955 | 2022 | 100 | 2020 |
| 48360 | 2022 | 10 | 2021 |

**At this stage, the Council's preferred option to bring forward compliance from 2022 to 2021 is to implement a bus fleet upgrade.** Changes to the composition of the taxi fleet will also be considered, however, this will largely depend on the outcome of any OLEV/ULEV bid for the delivery of infrastructure and incentive schemes such as those that have been delivered by Nottingham City Council. In addition, the council is now undertaking impact assessments for a congestion charging zone and workplace parking levy in support of wider policy.

However, it is the Council's view that to progress the development of an option to bring forward compliance, a more detailed assessment and consultation exercise is required. This is particularly the case given the local baseline air quality modelling is suggesting different results to the national PCM modelling, critically that compliance will be achieved at a later date (and post 2020). Such a study will facilitate:

1. Exploration of the differences between the PCM and local modelling, the confidence in the local modelling and whether more detailed analysis is required
2. More complete consideration of the full range of options to bring forward compliance
3. More detailed exploration of the financial requirements and implementation steps and structures required for the preferred option (including when options can be delivered)
4. Further consultation with bus operators who can inform the feasibility and impact of such a measure
5. More in-depth analysis following JAQU guidance to inform a Business Case to support implementation of the preferred measures (in particular, value-for-money, distributional and displacement analysis).

Additionally, the modelling should be updated to account for the availability of the local bus fleet data, including the hybrid vehicles in the fleet. This will provide more accurate representation of the proportion of emissions attributed to the bus fleet. Although further detailed studies will extend the timetable to implementation and ultimately compliance, the Council believes that this is the most appropriate course of action in order to ensure any option taken forward is supported by a robust evidence base which also meets JAQU's requirements. Given JAQU has a key role to play in the timeline to implementation, the Council asks that JAQU does what it can to support the Council to bring compliance forward so $NO_2$ limits are achieved in the shortest possible time. If

funding is made available the Council has a good track record of delivering sustainable transport schemes. In addition, it should be noted the Council currently has a bid in for the Transforming Cities Fund which if successful would include measures to improve air quality within Reading and the wider urban region.

**Table 13: 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 |
|---|---|---|---|---|
| **Westfield Rd** | No – this link was identified as being close to exceedance using local modelling data. A modelling checklist has been approved by JAQU | We have updated the baseline data using our local modelled data which shows that the link is now compliant.<br><br>2017 data: 26 µg/m$^3$ | NA | NA |
| **Gosbrook Rd** | No – this link was identified as being close to exceedance using local modelling data. A modelling checklist has been approved by JAQU | We have updated the baseline data using our local modelled data which shows that the link is now compliant.<br><br>2017 data: 32 µg/m$^3$ | NA | NA |
| **George St** | No – this link was identified as being close to exceedance using local modelling data. A modelling checklist has been approved by JAQU | We have updated the baseline data using our local modelled data which shows that the link is now compliant.<br><br>2017 data: 36 µg/m$^3$ | NA | NA |
| **Tudor Rd /Station Hill** | No – this link was identified as | We have updated the baseline data | NA | NA |

| | | | | |
|---|---|---|---|---|
| | near to an AURN station to be used for model calibration. A modelling checklist has been approved by JAQU | using our local modelled data which shows that the link will be compliant in 2018.<br><br>Summary of NO2 concentration projections:<br><br>2017: 42 µg/m$^3$<br><br>2018: 40 µg/m$^3$ | | |
| **Stanshawe Rd** | No – this link was identified as near to an AURN station to be used for model calibration. data. A modelling checklist has been approved by JAQU | We have updated the baseline data using our local modelled data which shows that the link will be compliant in 2018.<br><br>Summary of NO2 concentration projections:<br><br>2017: 41 µg/m$^3$<br><br>2018: 39 µg/m$^3$ | NA | NA |
| **Great Knollys St** | No – this link was identified as being close to exceedance using local modelling data. A modelling checklist has been approved by JAQU | We have updated the baseline data using our local modelled data which shows that the link is now compliant.<br><br>2017 data: 38 µg/m$^3$ | NA | NA |
| **Weldale St** | No – this link was identified as being close to exceedance using local modelling data. A modelling checklist has | We have updated the baseline data using our local modelled data which shows that the link is now compliant. | NA | NA |

| | | | | |
|---|---|---|---|---|
| | been approved by JAQU | 2017 data: 32 µg/m$^3$ | | |
| **Friar St** | No – this link was identified as being close to exceedance using local modelling data. A modelling checklist has been approved by JAQU | We have updated the baseline data using our local modelled data which shows that the link will be compliant in 2021.<br><br>Summary of NO2 concentration projections:<br><br>2017: 51 µg/m$^3$<br><br>2018: 48 µg/m$^3$<br><br>2019: 44 µg/m$^3$<br><br>2020: 42 µg/m$^3$<br><br>2021: 39 µg/m$^3$ | Our recommended measure that bring forward compliance is a bus fleet upgrade. This brings forward compliance from 2021 to 2019. | Our recommended measure that bring forward compliance is a bus fleet upgrade.<br><br>A full impact assessment is required for the preferred option e.g. proportion of fleet that could be retrofitted/renewal, distributional impacts; displacement impacts and value for money. Further consultation with the bus operators to specify the options is required to underpin a full business case. This measure could be implemented in time to bring forward compliance from 2019. |
| **Oxford Rd** | No – this link was identified as being close to exceedance using local modelling data. A modelling checklist has been approved by JAQU | We have updated the baseline data using our local modelled data which shows that the link is now compliant.<br><br>2017 data: 40 µg/m$^3$ | NA | NA |

| | | | | |
|---|---|---|---|---|
| **Wantage Rd** | No – this link was identified as being close to exceedance using local modelling data. A modelling checklist has been approved by JAQU | We have updated the baseline data using our local modelled data which shows that the link is now compliant.<br><br>2017 data: 18 µg/m$^3$ | NA | NA |
| **Grovelands Rd** | No – this link was identified as being close to exceedance using local modelling data. A modelling checklist has been approved by JAQU | We have updated the baseline data using our local modelled data which shows that the link is now compliant.<br><br>2017 data: 24 µg/m$^3$ | NA | NA |
| **Castle St** | No – this link was identified as being close to exceedance using local modelling data. A modelling checklist has been approved by JAQU | We have updated the baseline data using our local modelled data which shows that the link is now compliant.<br><br>2017 data: 34 µg/m$^3$ | NA | NA |
| **6127** | No – this link was identified as having an exceedance using local modelling data. A modelling checklist has been approved by JAQU | We have updated the baseline data using our local modelled data which shows that the link will be compliant in 2022.<br><br>Summary of NO2 concentration projections:<br><br>2017: 51 µg/m$^3$<br><br>2018: 49 µg/m$^3$ | We have identified two measures that equally bring forward compliance on this road link. In part 5 of our study we have assessed these against the secondary success criteria and have recommended | Our recommended measure that bring forward compliance is a bus fleet upgrade.<br><br>A full impact assessment is required for the preferred option e.g. proportion of fleet that could be retrofitted/renewal, |

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| | | 2019: 47 µg/m$^3$<br>2020: 45 µg/m$^3$<br>2021: 43 µg/m$^3$<br>2022: 40 µg/m$^3$ | a bus fleet upgrade | distributional impacts; displacement impacts and value for money. Further consultation with the bus operators to specify the options is required to underpin a full business case. This measure could be implemented in time to bring forward compliance from 2022 to 2021.<br><br>The full impact assessment would follow JAQU guidance and include a summary of the proposed approach to designing and implementing the measure including roles and responsibilities, key project milestones, any key dependencies including assumptions made regarding involvement of/actions taken by other stakeholders in scheme delivery beyond the local authority. |
| **6924** | No – this link was identified as having an exceedance using local modelling data. A modelling checklist has | We have updated the baseline data using our local modelled data which shows that the link will be compliant in 2019. | There is not sufficient time to implement any measures to bring forward compliance further | NA |

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| | been approved by JAQU | Summary of NO2 concentration projections:<br>2017: 43 µg/m$^3$<br>2018: 41 µg/m$^3$<br>2019: 39 µg/m$^3$ | | |
| **18056** | No – this link was identified as being close to exceedance using local modelling data. A modelling checklist has been approved by JAQU | We have updated the baseline data using our local modelled data which shows that the link is now compliant.<br>2017 data: 32 µg/m$^3$ | NA | NA |
| **18632** | 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 2019.<br>Summary of NO2 concentration projections:<br>2017: 44 µg/m$^3$<br>2018: 42 µg/m$^3$<br>2019: 40 µg/m$^3$ | There is not sufficient time to implement any measures to bring forward compliance further | NA |
| **27954** | 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 now compliant. | NA | NA |

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| | | 2017 data: 37 µg/m$^3$ | | |
| **28100** | No – this link was identified as being close to exceedance using local modelling data. A modelling checklist has been approved by JAQU | We have updated the baseline data using our local modelled data which shows that the link is now compliant.<br><br>2017 data: 39 µg/m$^3$ | NA | NA |
| **46955** | No – this link was identified as having an exceedance using local modelling data. A modelling checklist has been approved by JAQU | We have updated the baseline data using our local modelled data which shows that the link will be compliant in 2022<br><br>Summary of NO2 concentration projections:<br><br>2017: 51 µg/m$^3$<br><br>2018: 49 µg/m$^3$<br><br>2019: 47 µg/m$^3$<br><br>2020: 45 µg/m$^3$<br><br>2021: 42 µg/m$^3$<br><br>2022: 40 µg/m$^3$ | We have identified two packages of measures that equally bring forward compliance on this road link. In part 5 of our study we have assessed these packages against the secondary success criteria and have recommended a bus fleet upgrade. | Our recommended measure that bring forward compliance is a bus fleet upgrade.<br><br>A full impact assessment is required for the preferred option e.g. proportion of fleet that could be retrofitted/renewal, distributional impacts; displacement impacts and value for money. Further consultation with the bus operators to specify the options is required to underpin a full business case. This measure could be implemented in time to bring forward compliance from 2022 to 2020. |

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| | | | | The full impact assessment would follow JAQU guidance and include a summary of the proposed approach to designing and implementing the measure including roles and responsibilities, key project milestones, any key dependencies including assumptions made regarding involvement of/actions taken by other stakeholders in scheme delivery beyond the local authority. |
| **48360** | No – this link was identified as having an exceedance using local modelling data. A modelling checklist has been approved by JAQU | We have updated the baseline data using our local modelled data which shows that the link will be compliant in 2022<br><br>Summary of NO2 concentration projections:<br><br>2017: 51 µg/$m^3$<br><br>2018: 49 µg/$m^3$<br><br>2019: 47 µg/$m^3$<br><br>2020: 45 µg/$m^3$<br><br>2021: 42 µg/$m^3$<br><br>2022: 40 µg/$m^3$ | We have identified two packages of measures that equally bring forward compliance on this road link. In part 5 of our study we have assessed these packages against the secondary success criteria and have recommended a bus fleet upgrade | Our recommended measure that bring forward compliance is a bus fleet upgrade.<br><br>A full impact assessment is required for the preferred option e.g. proportion of fleet that could be retrofitted/renewal, distributional impacts; displacement impacts and value for money. Further consultation with the bus operators to specify the options is required to underpin a full business case. This measure could be implemented in |

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| | | | | time to bring forward compliance from 2022 to 2021.<br><br>The full impact assessment would follow JAQU guidance and include a summary of the proposed approach to designing and implementing the measure including roles and responsibilities, key project milestones, any key dependencies including assumptions made regarding involvement of/actions taken by other stakeholders in scheme delivery beyond the local authority. |
| **58002** | No – this link was identified as being close to exceedance using local modelling data. A modelling checklist has been approved by JAQU | We have updated the baseline data using our local modelled data which shows that the link is now compliant.<br><br>2017 data: 37 µg/$m^3$ | NA | NA |
| **73897** | No – this link was identified as being close to exceedance using local modelling data. | We have updated the baseline data using our local modelled data which shows that | There is not sufficient time to implement any measures to bring forward | NA |

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| | A modelling checklist has been approved by JAQU | the link will be compliant in 2019<br><br>Summary of NO2 concentration projections:<br><br>2017: 43 µg/$m^3$<br><br>2018: 41 µg/$m^3$<br><br>2019: 39 µg/$m^3$ | compliance further | |
| **99740** | 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 now compliant.<br><br>2017 data: 27 µg/$m^3$ | NA | NA |