3.5 Dolday/Bridge Street AQMA - Worcester City Council

Date of Detailed Assessment: October 2008
Date of Declaration: 23rd April 2009
Date of Further Assessment: July 2010

Figure 3-12 Plan of AQMA:

Please note the above plan is out of date. There is a recent development of 84 residential apartments that is situated the length of the south side of All Saints Road from the corner of Newport Street to the corner of Dolday and part of the area immediately south of that corner denoted as car park in the above plan.

The Dolday AQMA comprises a one way system on the A44 on the eastern side of Worcester Bridge and the River Severn at the heart of Worcester City. The bridge is the only crossing in the city for vehicles journeying across the river. All traffic heading into or across the city from the west side of the river and towns such as Malvern, Hereford, Leominster on the A44 and A449 turn left immediately after crossing the bridge and enter the AQMA.

The one way system comprising three lanes around the four sides of the roughly diamond shaped AQMA. From the bridge traffic travels north west along North Parade past residential properties in John Gwyn House on the corner and The Old Rectifying PH on the right. After 100m Newport Street turning on the right provides access to Newport Street car park which makes up 25 – 30% of the current AQMA area. The western side is bounded by the River Severn. After Newport Street the carriageway becomes North Quay. The left hand lane continues forward onto Croft Road A449 which then passes under the railway arches before turning right towards The Tything and then continues north for a few miles eventually out of the city towards destinations such as Kidderminster and Bromsgrove.

The two right lanes of traffic from North Quay turn right in an easterly direction after traffic lights adjacent to the Severn View PH onto Dolday. Two lanes of traffic also join the one way

system from the opposite direction on Croft Road after traffic lights. Dolday is bounded by commercial properties on its northern side and Newport Street car park in between the Severn View PH, which may have limited residential accommodation, and the recently developed Newport House residential block at the corner with All Saints Road. The left hand lane turns left onto The Butts out of Dolday opposite the enclosed city bus station beneath the Crowngate shopping centre. The two right hand lanes of traffic turn right in a south easterly onto All Saints Road after a set of traffic lights and pedestrian crossing.

The two right hand lanes continue on a slight incline along All Saints Road to a set of traffic lights and pedestrian crossing after 100m before turning right in south westerly direction onto Bridge Street. A one way turning on the right immediately before the lights provides access to a few commercial properties and the car park on Newport Street. The southern side of All Saints Road is bounded by a four or five storey block of residential apartments, Newport House, with residential parking on ground floor.

On the northern side All Saints Road is bounded by the Crowngate Shopping Centre and car park block accessed from a turning on the left, Moreton Place, 30 to 40m from the junction. Beyond Moreton Place is a five storey residential apartment block of 28 properties and then mixed 1st and 2nd floor residential and ground floor commercial properties on the corner with Deansway A44. The left hand lane turns out of All Saints Road onto Deansway which bypasses the town centre to the north and passes the Cathedral before heading south east out of the city towards J7 of the M5 or south along the A38 to suburban residential areas such as St Peter The Great.

Bridge Street is a narrow 60 – 70m stretch of road bounded by four storey residential properties on both sides. Traffic is joined by vehicles heading south westwards from Deansway after two sets traffic lights and pedestrian crossings. The right hand lane turns back onto the one way system on North Parade at the junction with Worcester Bridge. The two left hand lanes head across the bridge into another one way system pass the Cricket ground and then onto the west side of the City and other destinations.

The current boundary of the AQMA follows the 40 µg/m^3 contours of predicted pollution levels produced in the Detailed Assessment (AQC, 2008b). However the predicted pollution contours in the DA included the properties on the east of Bridge Street which have not been included in the AQMA order 2009. It also includes large areas of non-residential land (i.e. no relevant exposure) including three car parks. Therefore the AQMA boundary requires amendment unless more recent monitoring or modelling implies otherwise. This is confirmed within the Further Assessment by AQC, 2010 – see below.

3.5.1 Prevailing Conditions

AM and PM peak traffic time site observations of the Dolday/Bridge Street AQMA were undertaken in 2012 to characterise existing conditions and identify issues in order to inform the focus of potential measures within the action plan. Photos from the site walkover are included at the end of this section.

A large volume of traffic uses the one way system within the AQMA, particularly at peak times, due to the major routes and destinations accessible from this central location.

The speed limit in the area is 30mph although traffic is generally observed to move much more slowly at peak times. Traffic flow moving around the inner two lanes of the one way system is paused at a set of traffic lights on each side of the AQMA with the exception of Bridge Street onto North Parade and the bridge. This clearly causes queuing traffic to build up whilst waiting for lights to change but it also controls an even spread of traffic on the inner

ring. Significant volumes of traffic particularly during peak hours queue back along Bridge Street from the exit onto North Parade. Here there are no traffic signals controlling spread of traffic and drivers have to await a break in oncoming traffic traversing the bridge eastwards for an opportunity to exit Bridge Street. This can be exacerbated by traffic queues caused by activation of the pedestrian crossing in North Parade.

Additionally significant congestion in the AQMA is noted due to traffic exiting the AQMA onto Croft Road, The Butts and Deansway which is observed to be very slow stop start at peak times. Traffic continuing on Croft Road is observed to queue and be slow moving all the way back from much further along The Tything particularly at PM peak times. In fact this peak time queue starts at the junction where the A38 and A449 fork on the exit out of the city 1.5km to the north. Similarly traffic queues along the length of The Butts from the junction with Foregate Street during AM and PM peak times. The congestion caused by exiting traffic has an adverse effect on queues at the traffic lights on the inner lanes of the AQMAs due to vehicles changing and blocking lanes etc.

Traffic is a made up of a mixture of vehicle types, cars and commuters, delivery vehicles and also high proportion of buses due to the proximity of Worcestershire Bus Station on the boundary of the AQMA.

The high residential buildings on Bridge Street and All Saints Road in conjunction with the Crowngate Centre create street canyons in those roads. Contrastingly there is the opposite effect along North Quay and North Parade as they are bounded by the open space across the river on the south west and the car park for large part on the eastern side. Similarly Dolday is open for two thirds of its length on the southern side because of the car park.

There are parking restrictions in place, with double yellow lines along the whole route. Loading and unloading was not observed to be an issue within the AQMA as all properties, commercial and residential, bounding the AQMA are accessible from the rear for deliveries. In addition to yellow lines there are no waiting box markings at each set of traffic lights; however these are often ignored during busy peak times caused by congestion.

The Newport Street Car Park is not the busiest car park within the city. Generally parking spaces are available during AM peak traffic and car park gradually fills up during the working day. There are also a few other car parks in the nearby vicinity: Croft Road located underneath the railway arches and the Cattle Market accessible via The Butts or Croft Road, in addition to the Crowngate multi-storey car park accessed via Moreton Place off the AQMA. All are significant destinations for traffic seeking to access the town centre and surrounding businesses.

There are no bus stops or taxi ranks within the AQMA but Worcester Bus Station is located adjacent to the Dolday/The Butts conjunction and all buses turning left out of the bus station exit the local area via the AQMA. Similarly buses travelling from the west of the city, cross the bridge and traverse the AQMA to enter the bus station via North Parade and Dolday before turning onto The Butts and entering the bus station from the east. Buses therefore make up a relatively higher proportion of traffic in Dolday/Bridge Street compared to other AQMAs.

There are no schools or nurseries within the AQMA although the Worcester College of Technology is close by in Deansway.

There are pedestrian crossings at each of the three sets of traffic lights and additionally there is a separate crossing on North Parade adjacent to the Old Rectifying PH. However pedestrian traffic was not observed to be particularly significant within the AQMA. The whole AQMA can be walked comfortably within a 10 minute period and there are very few retail

outlets within the AQMA. The AQMA does not therefore meet the criterion of the Technical Guidance LAQM.TG(09) requiring consideration of the 1 hour objective.

Photo 1: North Quay looking NW to Dolday and Croft Road

Photo 2: North Quay looking SE along North Parade

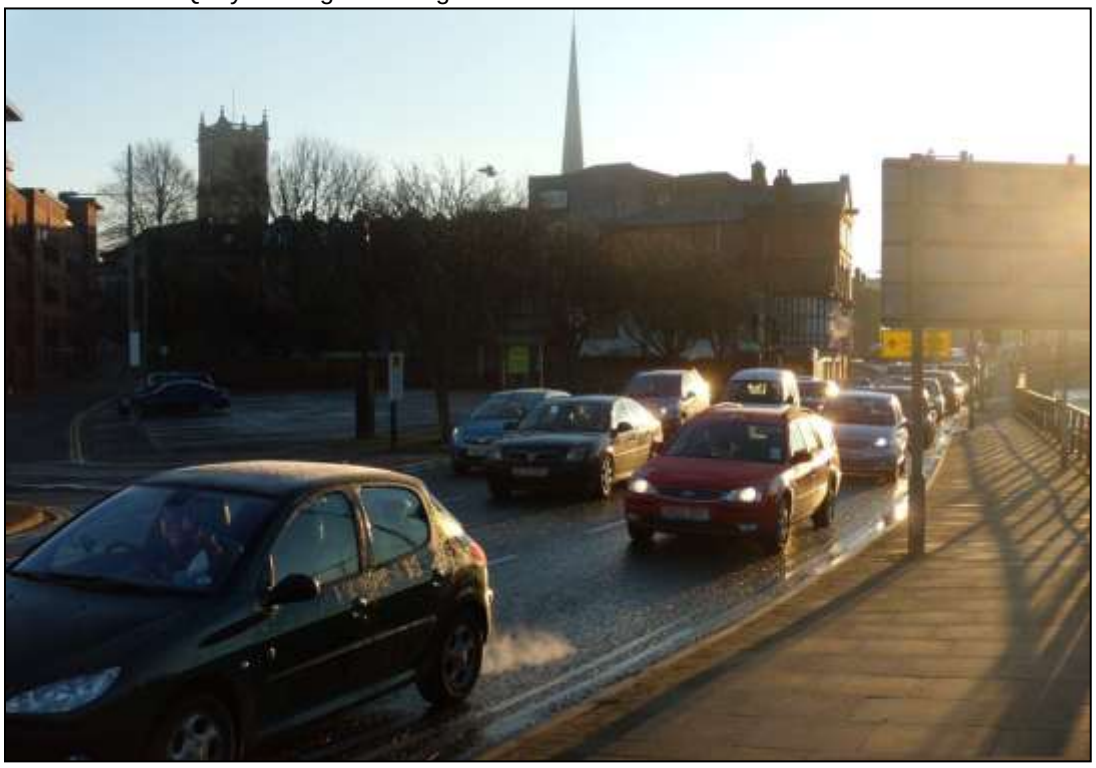


Photo 3: Looking NW along Dolday to congestion on far lane exiting AQMA onto The Butts

Photo 4: Looking SE along All Saints Road from Dolday

Photo 5: Looking N from corner of Bridge Street/All Saints Road to Deansway

Photo 6: Looking N on Bridge Street at traffic queuing to turn right onto North Parade

Photo 7: Looking SW along Bridge Street and traffic on bridge centre of picture

3.5.2 Summary of any Further Assessment report

A Further Assessment to confirm the requirement for an AQMA in Dolday/Bridge Street, Worcester and undertake modelling to inform potential solutions was completed by independent consultants AQC (Air Quality Consultants) on behalf of WC in July 2010. A summary of the findings of the Further Assessment are outlined below.

- The model results indicate that the annual mean nitrogen dioxide objective is being exceeded at a number of properties along Bridge Street and All Saints Road.
- Concentrations are predicted at both ground floor and first floor levels; however ground-floor concentrations are discussed as these are worst case.
- The highest predicted concentration in 2009 is 57.5 µg/m^3, at dwellings at corner of Bridge Street and North Parade (D1). Concentrations are also predicted to exceed the annual mean objective at 5 other receptors.
- There are no predicted annual mean concentrations greater than 60 µg/m^3 and therefore it is unlikely that the 1-hour nitrogen dioxide objective is being exceeded at these locations.
- The results demonstrate there are no predicted exceedences of the annual mean objective outside of the current AQMA boundary and therefore the AQMA should be retained.
- Measured results at the Bridge Street diffusion tube monitoring site in 2009 (39.9 µg/m^3) are lower than those modelled at nearby receptors. This can be accounted for by the canyon effect along Bridge Street. The diffusion tube monitoring site is located outside of the canyon, and therefore results are lower than those modelled within the canyon.

- The measured concentration at the Dolday (Ambirak) diffusion tube monitoring site in 2009 (39.3 µg/m^3) is lower than nearby receptors as it is located on The Butts, away from the busier Dolday and All Saints.
- AQC recommend that the AQMA should therefore be retained and for precautionary reasons, the boundary should be extended to include properties to the east along Deansway, where concentrations are just below the objective. Additionally considering the redeployment of the diffusion tubes in this area to sites along Deansway and All Saints Road, with tubes located at the building façade.

3.5.3 Source Apportionment Data

Sources contributing to the objective exceedences within the AQMA have been identified within the Further Assessment. The data presented below have been calculated in line with guidance provided in LAQM.TG(09) (Defra, 2009).

Table 3-16 and Figure 3-14 (AQC, 2010) set out the relative contributions of traffic emissions to the total predicted nitrogen dioxide concentration at ten worst case scenario receptor locations shown in Figure 3-13 below.

Figure 3-13 shows location of worst case scenario receptors, monitoring positions and boundary

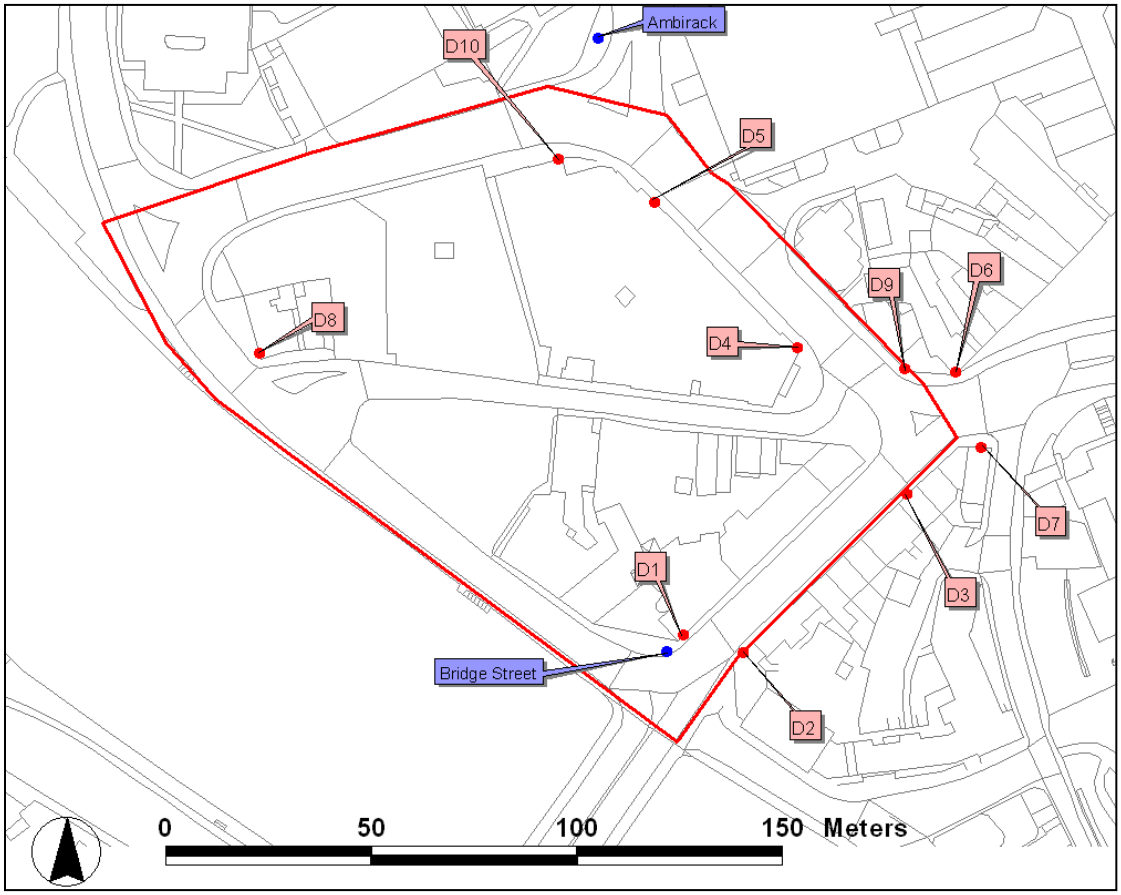
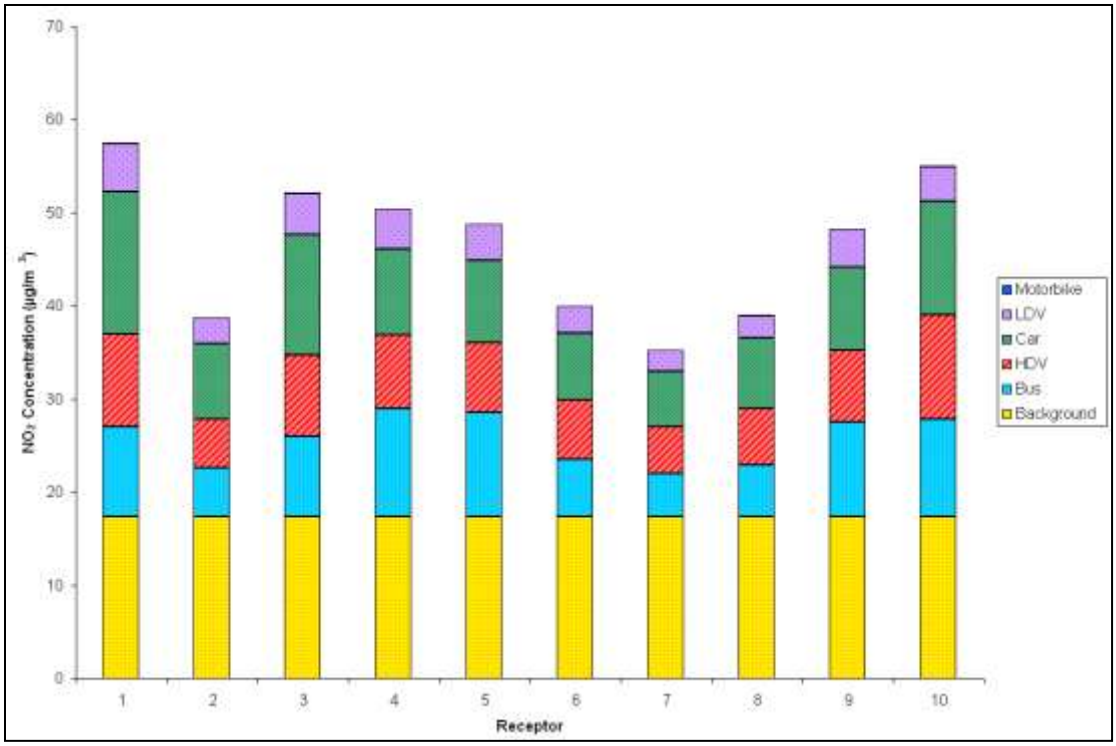


Table 3-16 Predicted Annual Mean (2010) Nitrogen Dioxide Concentrations and the Contribution of Each Source Type to the Total within the Bridge Street/Dolday AQMA

	Annual Mean Concentration (µg/m^3)						
	Background	Motor Cycles	Cars	LGV	Buses	HGV	Total
D1	17.3	0.1	15.3	5.1	9.7	9.9	57.5
D2	17.3	0.1	8.1	2.7	5.2	5.3	38.7
D3	17.3	0.1	12.9	4.4	8.7	8.7	52.1
D4	17.3	0.0	9.2	4.3	11.6	7.9	50.4
D5	17.3	0.0	8.9	3.9	11.2	7.5	48.8
D6	17.3	0.1	7.2	2.9	6.2	6.3	40.0
D7	17.3	0.1	6.0	2.3	4.6	5.1	35.2
D8	17.3	0.0	7.5	2.4	5.6	6.0	39.0
D9	17.3	0.0	8.9	4.0	10.2	7.6	48.2
D10	17.3	0.1	12.2	3.7	10.5	11.2	55.0
	% Contribution to Total						
D1	30.2	0.2	26.7	8.9	16.9	17.2	100
D2	44.8	0.2	21.0	7.0	13.4	13.6	100
D3	33.3	0.2	24.8	8.5	16.6	16.6	100
D4	34.4	0.1	18.2	8.6	22.9	15.8	100
D5	35.5	0.1	18.1	8.0	22.9	15.3	100
D6	43.4	0.1	18.0	7.2	15.5	15.8	100
D7	49.2	0.1	16.9	6.4	13.0	14.3	100
D8	44.5	0.1	19.4	6.3	14.3	15.5	100
D9	35.9	0.1	18.5	8.4	21.2	15.9	100
D10	31.5	0.1	22.2	6.7	19.1	20.3	100

Ten worst case scenario receptor locations identified in above figure 3-13 have been used to provide an overview of source contributions. Table 3-16 above and Figure 3-14 below show that the most significant component for each receptor is the background concentrations. In most cases, emissions from Heavy Goods Vehicles and buses, despite making up a relatively small proportion of the total traffic volume, contribute significantly to the overall concentration (over 30% when considered together). Emissions from cars contribute the next largest proportion to the overall concentration.

Figure 3-14 Relative Contribution of Each Source Type to the Total Annual Mean Nitrogen Dioxide Concentration (µg/m^3) at Receptor Locations where exceedences of the Annual Mean Objective are predicted (AQC, 2010)



3.5.4 Air Quality Improvement Required.

The degree of improvement, identified in the Further Assessment, required in order for the mean objective for nitrogen dioxide to be achieved is defined by the difference between the highest measured or predicted concentration and the objective level (40 µg/m^3). The highest NO_2 concentration at a relevant location is 57.5 µg/m^3 modelled at D1 on corner of Bridge Street and North Parade requiring a reduction of 17.5 µg/m^3 in order for the objective to be achieved.

However the Further Assessment explains that in terms of describing reductions in emissions required it is more useful to consider nitrogen oxides (NO_x) which has been calculated in line with guidance presented in LAQM.TG(09) (Defra, 2009). Table 3-15 below sets out the required reduction in local emissions of NOx in Dolday/Bridge Street AQMA at each receptor where an exceedence has been predicted in order for the annual mean objective to have been achieved in 2009. At Receptor D1, local emissions would need to have been 54% lower.

Figure 3-15 Predicted distribution of nitrogen concentrations at receptors in AQMA

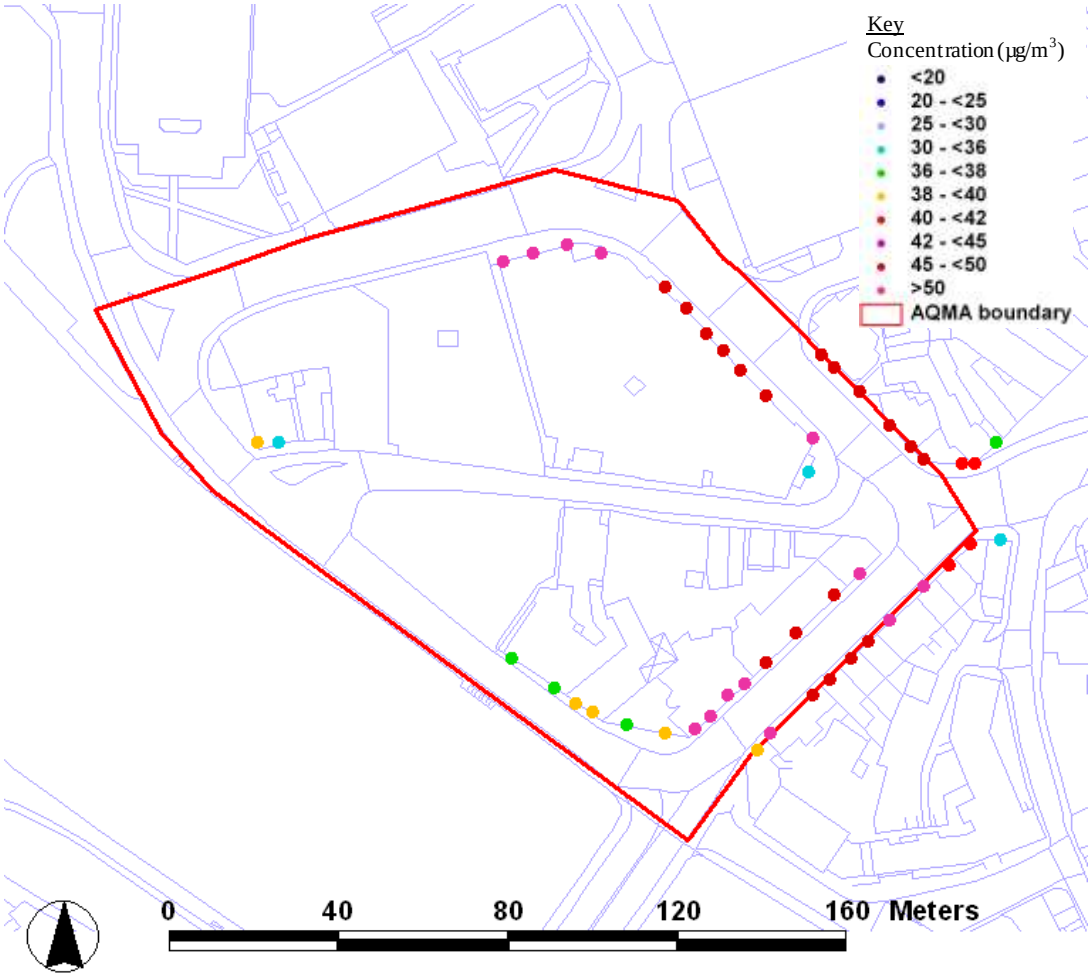


Table 3-17 Required reduction in Annual Mean Nitrogen Dioxide Concentrations and in Emissions of Nitrogen Oxides at Receptors in the Dolday/Bridge Street AQMA in 2009

Receptor	Required reduction in annual mean nitrogen dioxide concentration (µg/m^3)	Required reduction in emissions of oxides of nitrogen from local roads (%)
D1	17.5	54.0
D3	12.1	43.5
D4	10.4	39.4
D5	8.8	35.0
D9	8.2	33.3
D10	15.0	49.6

The results highlight that targeting individual types of vehicle on these local roads in isolation would not lead to the annual mean objective being achieved unless the reductions are very large. This is primarily because the background concentration, which is not influenced significantly by very local emissions, contributes a large proportion of total nitrogen dioxide concentrations. However reducing total vehicle emissions by around 50% would be a potentially effective measure for achieving the objectives at most receptor locations.

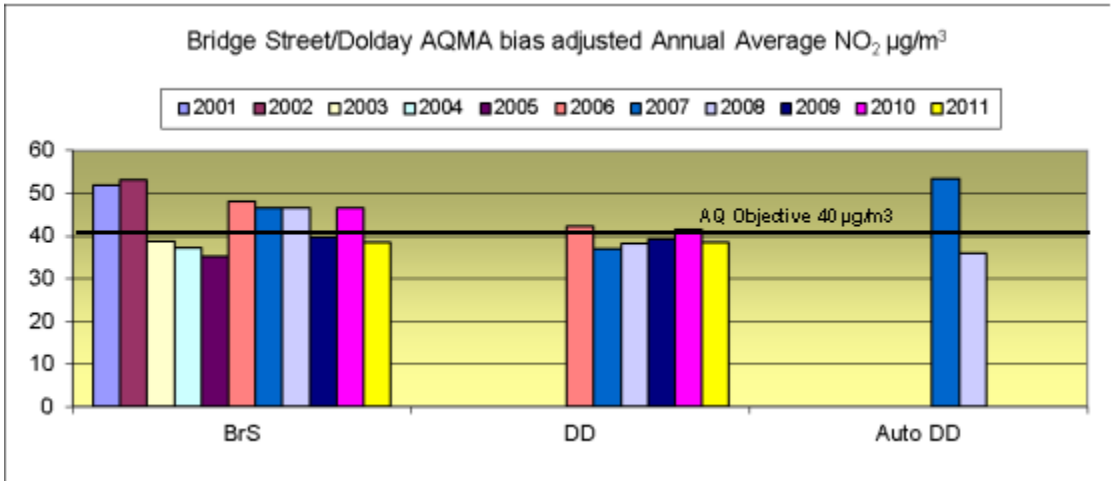
Measures within the Action Plan need to be proportionate to the scale of the exceedence of the objective and the number of people affected. In this case, 50 to 200 people may be subject to exceedences of the annual mean objective and the magnitude of the exceedence ranges from relatively medium to large 8.2 to 17.5 µg/m^3 above the objective).

3.5.5 Long term local trends in NO_2

As part of the AQAP process data has been collated from previous WC yearly progress reports and screening assessments to produce meaningful picture of long term trends in monitoring results of nitrogen dioxide in Dolday/Bridge Street.

The graph below depicts these long term trends from bias adjusted annual average results of NO_2.

Figure 3-16 Bias adjusted annual average NO2 monitoring results 2001 - 2011 Dolday AQMA



Loc Brs – Lamp post near John Gwen House; Loc DD and Auto DD – Opposite Crown Gate bus station;

It should be noted both monitoring positions do not represent relevant receptor locations. The data requires further adjustment to provide relevant exposure at the façade of the nearest residential dwellings; Bridge street – John Gwen House (2m distance) and Dolday – Newport House (approx. 28m from away from the monitoring location).

Accordingly the measured data from all the positions should be adjusted back from the roadside position to relevant exposure receptor locations using the calculator tool provided by Defra. The calculation requires an appropriate background level be used within the calculation. As an appropriate local urban background monitoring position is not available for the majority of the years it has not been possible to undertake the necessary calculations satisfactorily prior to the completion of this AQAP. Calculations will be undertaken for future versions of the AQAP utilising available background map data from Defra.

3.5.6 Summary of progress of actions identified or implemented to date

No previous action plans have been completed for the Dolday/Bridge Street AQMA.

3.5.7 Actions identified from Local Transport Programme 3 (LTP3):

A number of actions have been identified within the County Councils transport strategy as having a potential impact on Dolday/Bridge Street AQMA. The LTP3 scheme code, brief description and current status as provided by WCC in February and update in June 2013 is shown in Table 3-18.

LTP3: Network Management Plan (WCC, 2011o) states: 'Worcester's congestion problems are primarily due to the limited River Severn road crossing capacity. The Worcester Transport Strategy is being developed by building on the success of Worcester as a national demonstration project for the Sustainable Travel Towns Initiative. The strategy aims to reduce congestion and accommodate future economic growth through the more efficient use of the existing highway network through increased use of sustainable travel. Thus, a number of congestion related performance indicators are being regularly monitored for Worcester including:

- Percentage of journeys made by bus, bicycle and on foot in Worcester
- Change in annual traffic flow
- In bound am peak journey times on key routes into the city'

Table 3-18 LTP3 actions impacting Dolday/Bridge Street AQMA.

LTP3 Scheme	Description of Improvements	Current Status
W1 - Worcester Foregate Street Enhancement.	Indirect: Significant improvement to passenger facilities including quality of interchange with other transport modes	This scheme is now under construction and will be completed in 2013.
W2 - Worcester Shrub Hill Station Enhancement	Indirect: Improvements to infrastructure and facilities	Proposals exist within future phases of the Worcester Transport Strategy
W9 - Worcester City Walls Rd/ Cathedral Sq./ Deansway corridor maintenance & improvement	Adjacent: A comprehensive programme of junction and traffic signals enhancements, street furniture decluttering, replacement and enhancement, and improved walk and cycle infrastructure, and passenger transport infrastructure and information	Proposals exist within future phases of the Worcester Transport Strategy
W11 - Worcester City Secure Cycle parking.	Indirect: Provision of indoor cycle parking facilities in City Centre to make cycling more attractive	This scheme is now under construction and will be completed in late 2013
W14 - Worcester Crown East (West of Worcester) Park & Ride.	Indirect: Provide a Park and ride alternative to access for residents of the rural areas to the west of Worcester as well as residents of any new developments approved in the area.	Proposals exist within future phases of the Worcester Transport Strategy
W17 - Worcester – Rail capacity Improvement	Indirect: Upgrading rail signalling and junctions, removal of single track operations, enhance capacity and improve reliability	Not in current Network Rail work scheme. Likely to be 2021-2025.

3.5.8 Summary of key issues identified from review for consideration within actions

Issue DD1 - The A44 Dolday one way system is a major link at the heart of Worcester City connecting west and east across the River Severn. All traffic traversing the only highway bridge within the Worcester City boundary will travel through at least one side of the AQMA.

Issue DD2 - The current boundary of the AQMA requires amendment to include residential buildings on eastern side of Bridge Street as outlined in the Detailed and Further Assessments. Additionally the western boundary could be altered to exclude large open areas of car park and commercial buildings as these are not representative of relevant exposure.

Issue DD3 – There are three sets of traffic lights within the AQMA which can cause temporary pauses in traffic.

Issue DD4 – Much congestion within the AQMA is caused by problem flows much further afield particularly at PM peak time e.g. The Butts and Croft Road – Castle Street – Tything – Barborne Road congestion.

Issue DD5 – Relatively high proportion of buses in AQMA due to adjacent bus station.

Issue DD6 – Two street canyons exist within the AQMA due to the high storey buildings within Bridge Street and All Saints Road. A slight rise in topography is also a minor contributing factor to emissions in the latter.

Issue DD7 – Box markings can be ignored during period of congestion.

Issue DD8 – There are a number of car parks in the vicinity including two within or adjacent to the AQMA.

Issue DD9 – Worcester College of Technology is nearby.

Issue DD10 – Existing diffusion tube monitoring positions outside the street canyons and so not representative of worst case scenarios identified within the Further Assessment. Redeploying or providing additional monitoring positions will improve data quality and definition of AQMA boundary.

Issue DD11 - Source apportionment in FA demonstrated HDVs (HGVs and PSVs), emissions from Heavy Goods Vehicles and buses, despite making up a relatively small proportion of the total traffic volume, contribute significantly to the overall concentration, generally over 30% when considered together (38.7% at Receptor D4). However, the ambient background concentration contributes a significant proportion (30 to 49.2%) to the overall concentration.

Issue DD12 - The results of modelling in the Further Assessment indicate 10 to 100 people are subject to exceedences of the annual mean and the magnitude of the exceedence ranges from 8.8 to 17.5 $\mu g/m^3$ above the objective. Reducing total vehicle emissions by around 50% would be a potentially effective measure for achieving the objectives at most receptor locations.

Issue DD13 – Recorded data requires working back to facades of residential properties from roadside monitoring locations using available calculator tools and background maps.

Issue DD14 - Significant traffic queues back along the street canyon in Bridge Street from the exit onto North Parade due to a lack of traffic signals controlling spread of oncoming traffic crossing the bridge. Congestion is also exacerbated by traffic queues caused by activation of the pedestrian crossing in North Parade.