



**To:** Executive Management Team

**Date:** 19 January 2016

**Subject:** Air Quality Modelling in the City Centre

---

## **1. Background**

- 1.1. In late summer Government commenced a consultation entitled *Draft plans to improve air quality in the UK*, aimed at demonstrating compliance with the Air Quality Directive in the shortest possible time.
- 1.2. This consultation identified Birmingham as a non-compliant local authority. The consultation identified two stretches of the A38 as being in exceedence of the objective annual limit value for nitrogen dioxide (NO<sub>2</sub>) of 40µgm<sup>-3</sup> and suggested a means by which compliance could be achieved by 2020, namely the introduction of a clean air zone (CAZ) and the types of vehicles that should be covered.

## **2. Briefing Aims**

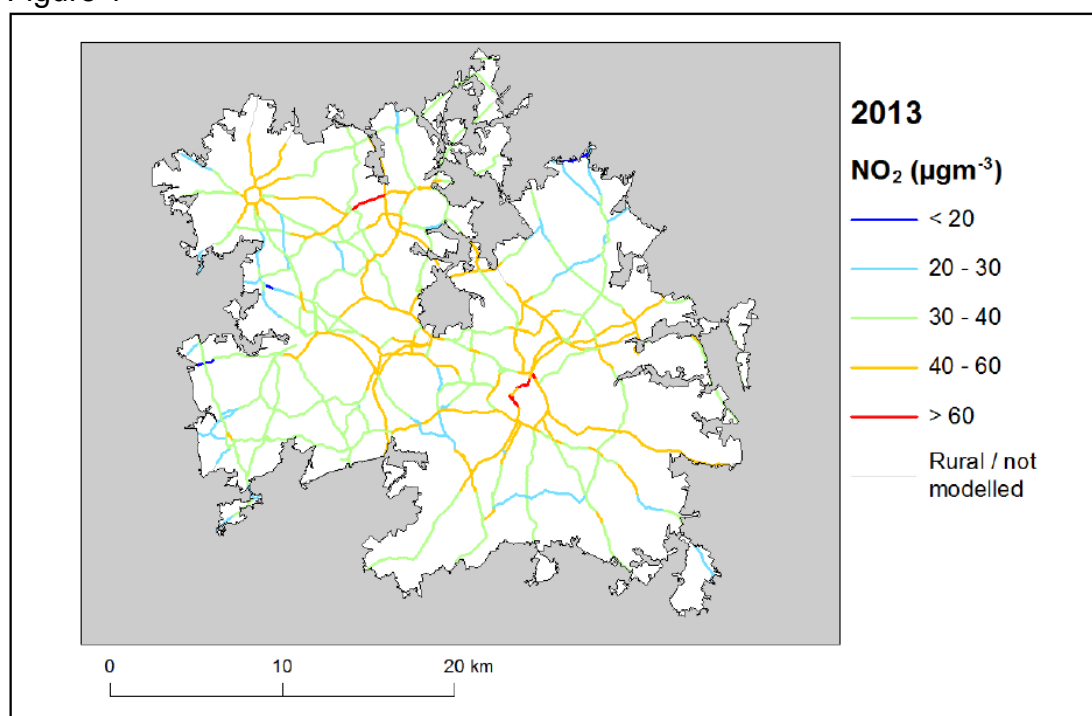
- 2.1. This briefing note does not seek to provide any insight into the consultation, these having been provided by briefing to relevant Cabinet Members.
- 2.2. This briefing seeks to explain in layman terms the limitations around the modelling of the city centre as undertaken by Defra's consultants and also limitations that exist with Birmingham City Council's own model.
- 2.3. An understanding of this briefing is critical to understanding the scale of the air quality problem in Birmingham city centre.

## **3. Defra Modelling**

- 3.1. The consultation undertaken by Defra is underpinned by modelling by consultants working on Defra's behalf. An explanation of the model, to a lesser degree, is provided in the consultation document *Draft Air Quality Plan for the achievement of EU air quality limit value for nitrogen dioxide (NO<sub>2</sub>) in West Midlands Urban Area (UK0002)*.
- 3.2. An important point to note is that the Defra models only consider roads with a traffic flow (AADT) of 5000 vehicles or more per day. It is understood that the concentrations on roads with smaller flows are not presented.
- 3.3. The modelling work then identifies those roads for which there is believed to be an exceedence of the legislative limit in 2013 (baseline), and also for future scenarios in 2020, 2025 and 2030.

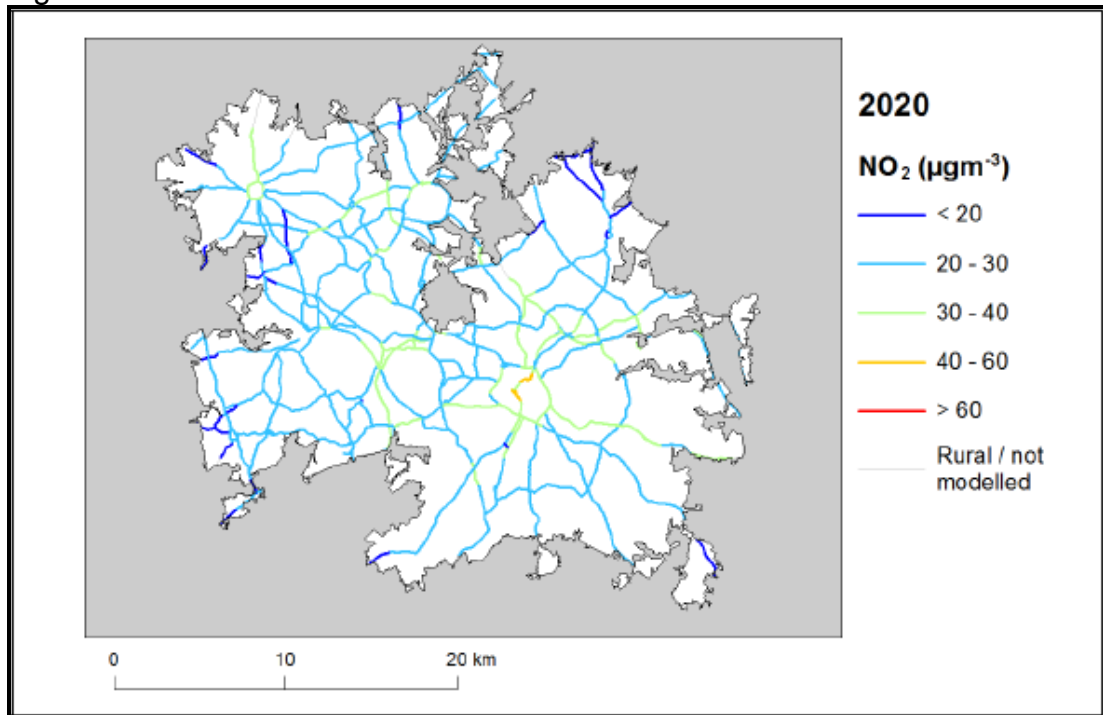
- 3.4. The future scenarios are based on expected natural improvements to the fleet, demonstrated by shifting the % of lower mark Euro classes to more higher mark Euro classes and also by updating the emission factors i.e. how much pollution is actually emitted by each Euro class of vehicle.
- 3.5. The models show Birmingham being compliant in 2025, but not in 2020, and this non-compliance will persist for some-time between 2020 and 2025. As part of their strategy Defra are seeking to bring forward compliance in Birmingham to 2020.
- 3.6. The model for 2013 is shown below.

Figure 1



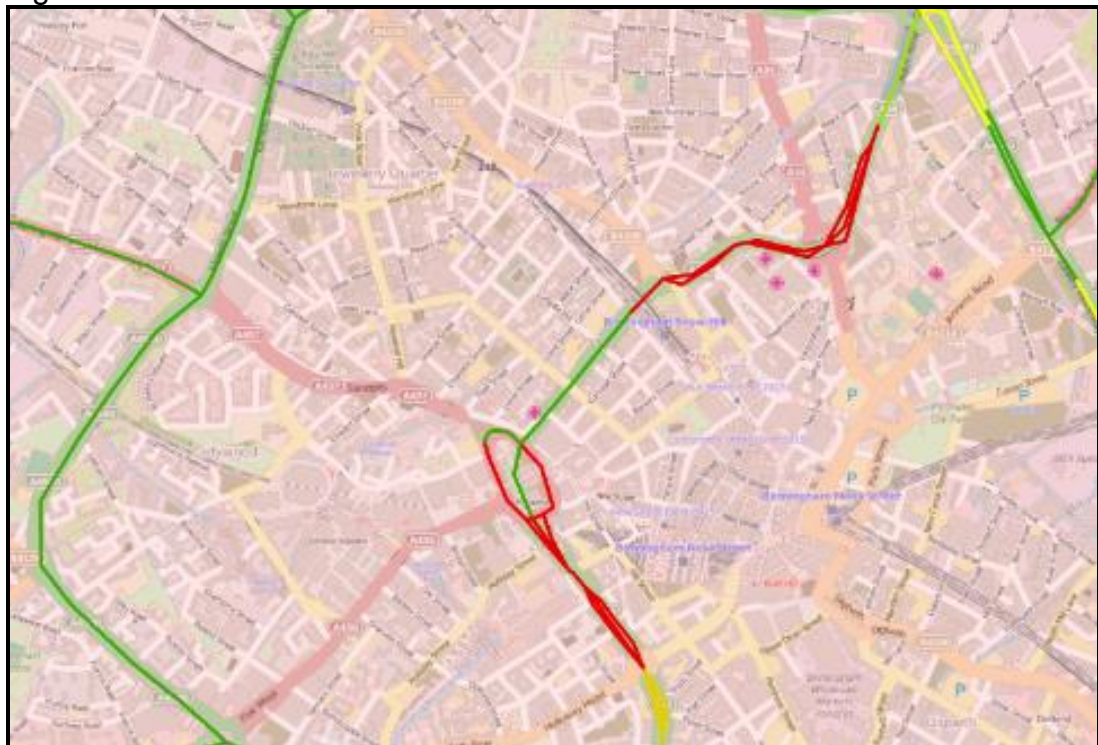
- 3.7. This model identifies stretches of the A38 as being problematic along with areas of the ring road, but nothing else within the city centre. The model for 2020, which factors in a % change to cleaner vehicles (shift in Euro classes and updating of the emission factors), is shown in Figure 2.

Figure 2



3.8. Two stretches of the A38 are identified in 2020 as being non-compliant. These are better show in the following diagram.

Figure 3

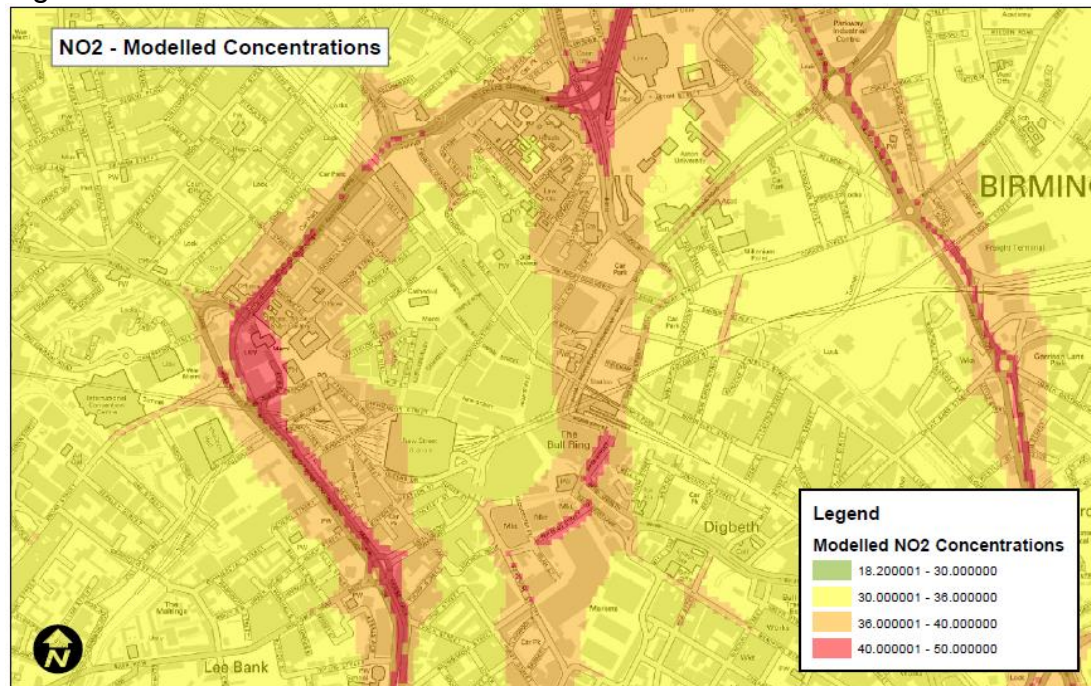


3.9. On the basis of this it would be reasonable to assume that Birmingham's problem is very localised but this would be an incorrect conclusion to draw.

#### 4. Environmental Health Modelling

- 4.1. Birmingham City Council's Environmental Health service have also monitored the city centre using a different modelling software package. Our model is based on 2015 emission factors, thereby sitting between the 2013 and 2020 Defra models.
- 4.2. The results are presented in Figure 4 below.

Figure 4



- 4.3. It is interesting to note both the similarities and the differences between the Defra and BCC models.
- 4.4. Both the Defra 2013 and BCC 2015 model show stretches of the A38 as a problem. This is a factor of the amount of traffic on this road with the direct emission from the road traffic combining with the general pollution levels within the city centre to create these stretches of non-compliant roads. This persists into the 2020 Defra model.
- 4.5. Both the Defra 2013 and BCC 2015 model show stretches of the ring road as a problem. By 2020 the Defra model suggests this is no longer a problem. BCC do not have an updated 2020 model and cannot therefore comment.
- 4.6. What is more interesting is what the Defra models do not show, such as the areas within the city centre area around Moor Street, the Bullring and Digbeth, which the BCC model identifies as being a problem in 2015. The BCC model identifies roads where the levels are approaching  $40\mu\text{g}\text{m}^{-3}$ . At this level there is no in-built confidence i.e. where the model predicts levels up to  $36\mu\text{g}\text{m}^{-3}$  we have a 10% confidence that the legal limit of  $40\mu\text{g}\text{m}^{-3}$  will

not be breached, but where the model predicts over  $36\mu\text{gm}^{-3}$  there is no such confidence.

- 4.7. The BCC model also predicts hotspots of exceedence within Digbeth i.e. roads over the  $40\mu\text{gm}^{-3}$  legal limit.

## **5. Environmental Health Monitoring**

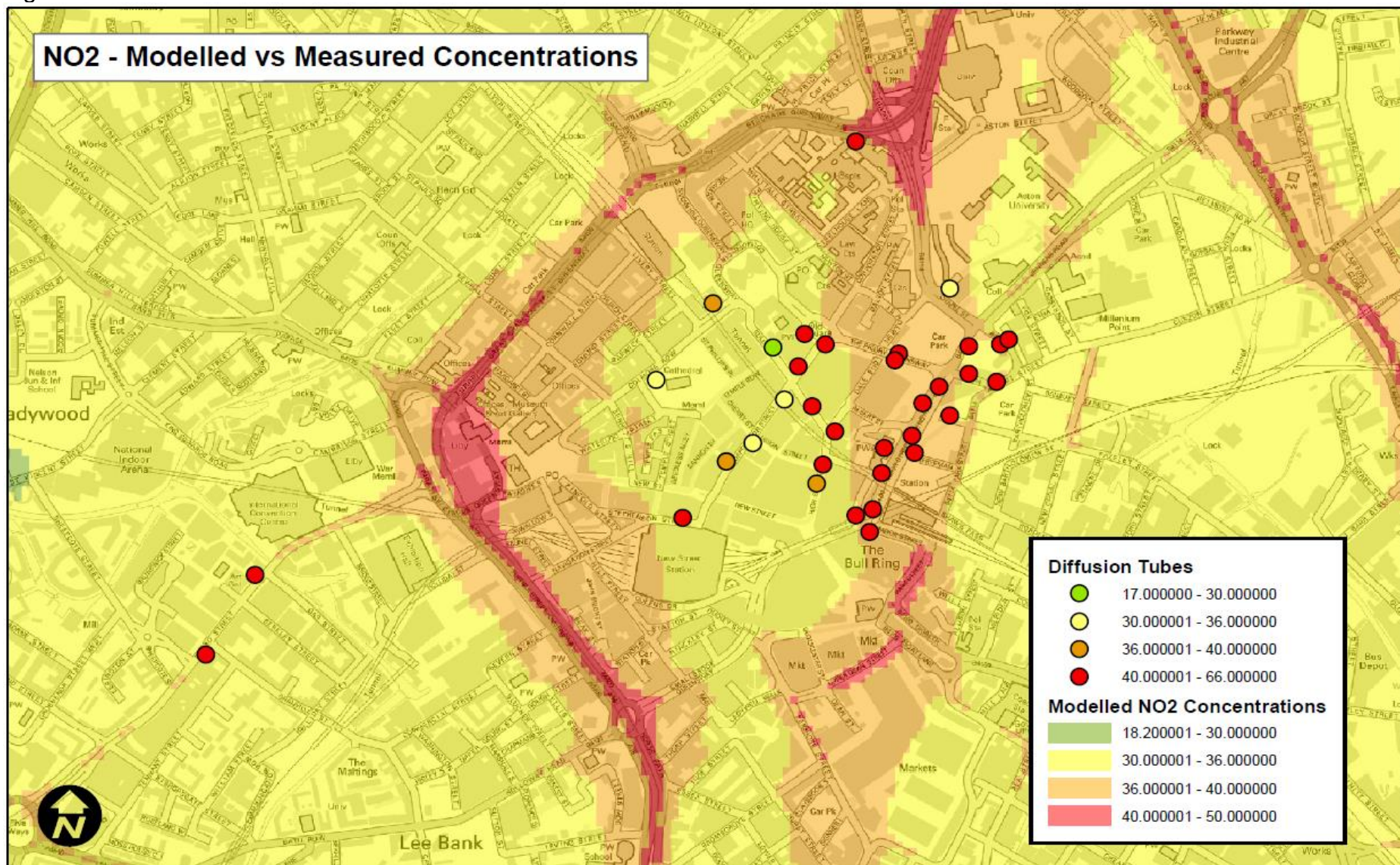
- 5.1. Environmental Health have undertaken lots of monitoring within the city centre over the years. More recently this monitoring has focussed on those areas where there have been changes to the traffic network or rerouting of traffic e.g. buses. The monitoring technology utilises passive diffusion tubes which means they can be widely deployed as needed.
- 5.2. Figure 5 on the following page overlays the latest round of monitoring with the BCC 2015 model.
- 5.3. The comparison is interesting as it is immediately apparent that the model does not correlate with the actual monitored levels. There are far more hotspots of elevated concentrations above the legal limit than are shown by the BCC model.
- 5.4. Note, that the Defra models do not show these areas of exceedence also.
- 5.5. Accordingly, it is a reasonable assumption to state that the modelling undertaken for 2013 (Defra) and 2015 (BCC) does not accurately represent the concentrations of  $\text{NO}_2$  within the city centre at all the points monitored.
- 5.6. Based on the above, there may also be other hotspots within the city centre that have not been identified.
- 5.7. Furthermore, as the Defra 2020 model does not consider all roads within an area it would not be correct to consider the Defra models as the sole representation of air quality within an area; to do so would be poor science and would open the Council to challenge from interested parties.

## **6. Using the models**

- 6.1. The models do have a use as a strategic tool to show overall reductions in pollutants within an area. To use them to drive reductions at hotspots without associated monitoring is however fraught with risk.
- 6.2. Birmingham city centre is a large built up area which does not lend itself well to modelling unless significant resources are diverted to refine existing models to factor in the urban environment e.g. run bespoke models which include building heights so as to incorporate pollutant dispersion (or not as the case may be).



Figure 5



- 6.3. The models may however be used strategically. They could be used to demonstrate the overall benefit that may arise from interventions. Where those interventions relate to removing a significant pollution source, whether through redirection of traffic or through 'greening of the fleet' then the model has value.
- 6.4. The point above holds true for the Defra model in that although it does not capture all roads within the centre and as evidenced may miss some areas of exceedence, it can nevertheless be used as an area based tool.
- 6.5. If area based interventions can be put in place which reduce the pollution concentrations on those roads identified within the Defra model then this may have a knock on effect on other roads within the city centre, that is to say the overall pollution concentrations may reduce as a benefit of that intervention, which will drive down concentrations on most roads, as well as those directly modelled.
- 6.6. The approach considered above is valuable in that it allows some confidence that future changes to the network or rerouting of traffic may not significantly adversely affect compliance with the legal limit.
- 6.7. A practical example would be a Clean Air Zone which improves the emissions standards of vehicles entering the area. Everything else being equal the overall concentrations will reduce and the modelled roads may be used as a proxy for those roads that are not modelled.
- 6.8. With regards to the above it would be advantageous to back up any intervention with monitoring to demonstrably prove the effect.

Mark Wolstencroft  
Operations Manager Environmental Protection  
0121 303 9950  
[mark\\_wolstencroft@birmingham.gov.uk](mailto:mark_wolstencroft@birmingham.gov.uk)

### Acknowledgements

All maps courtesy:

© Crown Copyright and database right 2015. Ordnance Survey 100021326.

You are not permitted to copy, sub-licence, distribute or sell any of this data to third parties in any form.