Modelling Bus Idling On Arundel Gate

Issues and Methodology (1)

- Arundel Gate is the only location under the CAZ C scenario which does not achieve compliance (~41.0), one possibility to achieve the small additional reduction required to get below the target concentrations is to tackle this idling

- The transport model includes the bus interchange at Arundel Gate. All timetabled bus services which operate on this road are included in the model and congestion affects at the signals along this stretch of road are included. However, the strategic transport model cannot not take into consideration the idling at stops and acceleration away from stops.

- This has the impact that the modelled (post-dispersion model) NO_2 concentrations are notably lower than the observed resulting in a large (>2.0) calibration factor at this location which is taken forward into forecasting (ie assumes that same levels and impact of idling in the future.

- The current average idling time per bus on Arundel Gate is 98.6 seconds (this is taken from survey data undertaken by Sheffield City Council in 2019). Buses are only meant to stop for 120 seconds, but underpinning this average there are lots of observed occasions when buses idle for over this time.

- The plan to tackle idling would be therefore to more stringently enforce this maximum time.

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Issues and Methodology (2)

- Using the data from the survey undertaken by Sheffield Council, there are big variations in dwell time on Arundel Gate but the average idling time was calculated to be 98.6 seconds. Manipulating that data to cap all those services which idled more than 120 seconds would bring the average idle time down to 71.0 seconds.

- Based on a study undertaken by PTEG in 2010, "Bus Idling and Emissions", PTEG, September 2010 (1) which included analysis of some services in Sheffield (Service 52 – Hillsborough to Woodhouse) it can be calculated that the average idling emissions , in NOX, for that service were ~0.033g/m^3 *(For the purpose of this analysis we have assumed all Sheffield buses behave as per the 52)*

- In order to then 'model' the impact of the idling enforcement we propose to reduce the forecast calibration factor, by calculating the emissions with average idling at 98.6 seconds and at 71.0 seconds and reducing the calibration factor by the ratio of these two levels of emission

- We will then apply the revised factor to the outputs from the dispersion modelling for the CAZ C option. This method will also allow us to determine either what level of anti-compliance we need and/or what the maximum average idling time per bus can and still reach (Air Quality) compliance.

(1) https://www.urbantransportgroup.org/system/files/PTEGBusIdling_ResultsReportfinalv10.pdf

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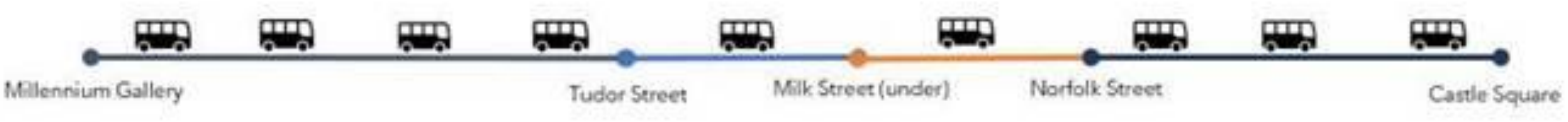
Section of Road in consideration



- The section of Arundel Gate which constitutes the 'bus interchange' consists of 9 stops in the northbound direction (that is the side of the road where the monitoring is located). It is represented in the strategic transport model by 4 links as above (Each bus representing the location of a stop)

- All buses which travel along Arundel Gate stop at one, and only one, of the northbound stops. So for the purpose of these calculations / method we have assumed that each stop has 1/9 of the idling.

- The monitoring point which yields the value of 2.06 is between Milk Street and Norfolk Street so there is one bus stop on that modelled section.

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Calculations

- Total bus flow on Arundel Gate from strategic model is ~**1,120** per day. As there are 9 stops we can assume **124** (=1120/9) buses per stop per day
- A rough calculation of current annual idling emissions at each stop gives us = (124 x 365 x 0.033 x 98.6) ≈ **147,267g** NOX per annum
- When we impose a limit of 71 seconds that decreases to **106,044g** per annum
- The strategic model NOX emissions on that section of road are ~ **77,000g** per annum (in the with CAZ + Bus Gate scenarios – of which around 96% are attributable to bus)
- With current idling total NOX is therefore (≈147,267+77,000) = **224,267g** and with the 2 min idling limit it would be **183,044g**
- If we then amend the calibration factor (2.06) on that link to account for that we get = 2.06 / (224267/183044) ≈ **1.68** ie a new calibration factor value to use in the CAZ option tests

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Impact on Results of anti-idling measures as part of the scheme

- All results include bus gate on Arundel Gate
- Results show capping idling at 2 mins (based on this method) would achieve compliance with some wiggle room

	Without 2 Min Cap	With 2 Min Cap
Base Year	60.69	60.69
Baseline	48.66	48.66
CAZ C	41.18	37.13 (-10%)

- To achieve a value of 40μg an average dwell time of 92.6 would be the breaking point.

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Caveats

1. The values of g/sec of NOX emitted idling is based on 2010 values. It is likely that this has improved since then but there is no evidence to suggest a different figure should be used. This is therefore likely to mean we are over-estimating the idling emissions *(based on very rough analysis of EFT bus NOX emissions at 5kph between 2010 and 2017 – this could be ~40%)*

2. The analysis is based on one road link with one stop – it is likely there will be interactions with neighbouring links and other stops. However, this is meant to be a ready reckoner as to what a 2 min idling cap could do and it is also the case that the distance based drop off will be sufficient that they will only have a small impact at the monitoring location *(when considering proportional impacts with and without 2min cap should even itself out)*

3. The idling time data provided by Sheffield Council notes that it is likely to include some time which is really waiting at signals rather than idling at a stop. This means that the average idling time is overestimated which will further create an overestimate of the emissions *(assume 10%)*

- *Assuming 40%, 0% and 10% impact for these three options we end up with a revised adjusted calibration factor of 1.77 which gives a concentration of 38.13 in CAZ C*