Sheffield & Rotherham Clean Air Plan Full Business Case

AQ3 – The Local Plan Air Quality Modelling Report

April 2022

Rotherham Metropolitan Borough Council

Sheffield City Council

Document control					
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Acronyms and Abbreviations

ANPR	Automatic Number Plate Recognition
AQD	Air Quality Directive
AQMA	Air Quality Management Area
BaU	Business as Usual
CAP	Clean Air Plan
CAZ	Clean Air Zone
COPERT	Computer Programme to calculate Emissions from Transport
Defra	Department for Environment Food & Rural Affairs
DfT	Department for Transport
EDB	Emissions Database
EFT	Emission Factor Toolkit
f-NO_2	Primary NO_2
FBC	Full Business Case
HGV	Heavy Goods Vehicle
JAQU	Joint Air Quality Unit (Defra and DfT)
LAQM	Local Air Quality Management
LGV	Light Goods Vehicle
LV	Limit Value
µg/m^3	micrograms per cubic metre
Met	Meteorology
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
PCM	Pollution Climate Mapping
PM_{10}	Airborne particles less than 10 microns in diameter
PO	Preferred Option
SRN	Strategic Road Network
SCRTM1	Sheffield City Region Transport Model
TCF	Transforming Cities Fund

Content Page

1. Introduction

Poor air quality is acknowledged as being a risk to public health in the UK. Sheffield and Rotherham Councils are committed to improving air quality for their residents and visitors.

This report is part of the Evidence Submission pack for the Full Business Case for the Clean Air Plan for Sheffield City Council and Rotherham MBC. The current version of this report has been written after the baseline and scenario modelling for the FBC has been carried out. It is submitted as part of the Full Business Case Submissions. It presents the results of the forecast baseline and the preferred option for the Clean Air Plan (CAP).

2. Methodology

The methodology used for the air quality dispersion modelling is described in Evidence Submission Document AQ2 so limited detail is provided here. The model was adjusted and verified using 2017 baseline data. Results for receptors located next to road links relevant for compliance with the EU Limit Value are reported. The traffic data was derived from the Sheffield City Region (SCRTM1) SATURN model (see Documents T2 and T3). All modelling follows guidance from JAQU and has been subject to discussion with JAQU throughout the process.

3. The Preferred Option

The Preferred Option is a CAZ C charging clean air zone in Sheffield City Centre including the inner ring road, Park Square and the A61/Parkway junction, with associated fleet upgrades, and transport schemes on key routes in Rotherham. The scheme was mandated by the Secretary of State in February 2020.

The class C Clean Air Zone means the most polluting buses, taxis, vans, coaches and lorries will pay a charge to enter the city centre if they do not meet minimum compliance standards. Private cars will be exempt.

The Rotherham transport schemes include the introduction of a Traffic Regulation Order (TRO) to impose a weight limit on Wortley Road (A629) northbound, with all HGVs to access the M1 via the A6109; and a highways scheme to allow a new parallel route to be used by some of the bus services currently operating on Rawmarsh Hill (A633).

4. Baseline Situation

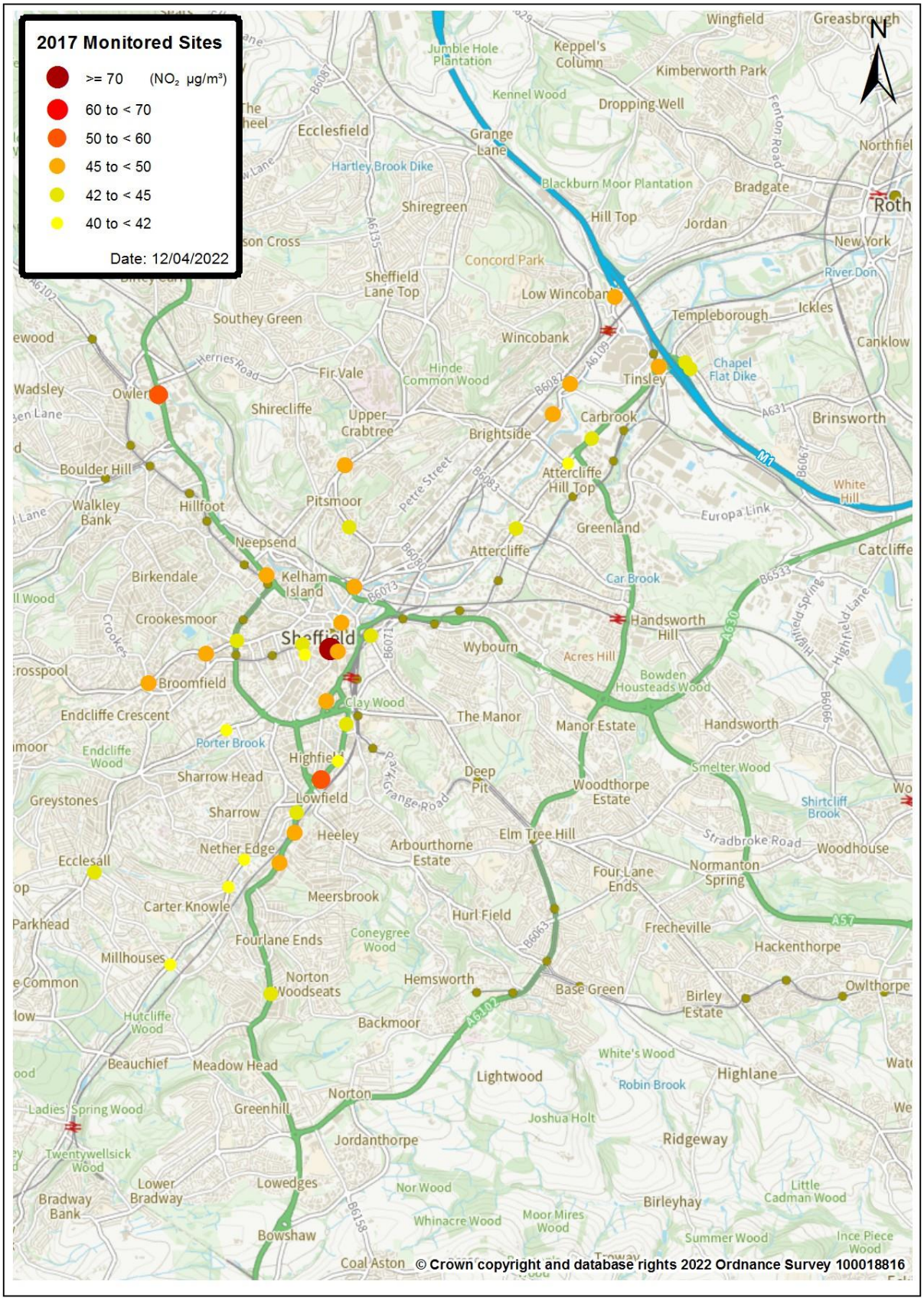
In 2017, annual mean concentrations of nitrogen dioxide showed exceedences of the national air quality objective and EU Limit Value.

A summary of observed data is presented which has been collected from monitoring locations in Sheffield and Rotherham. This data was used to validate the 2017 Base Year Air Quality modelling data.

The figures below show the annual average concentrations of NO_2 at the non-compliant Air Quality Monitoring Sites in Sheffield and Rotherham in 2017. It shows those sites which exceed the EU Limit Value of 40µg/m^3, with the graduated colour scheme highlighting the scale of the current exceedance.

Figure 1 – AQ Monitoring Sites which exceeded 40µg/m^3 annual mean NO_2 in Sheffield and Rotherham in 2017

Sheffield Area:



Rotherham Area:

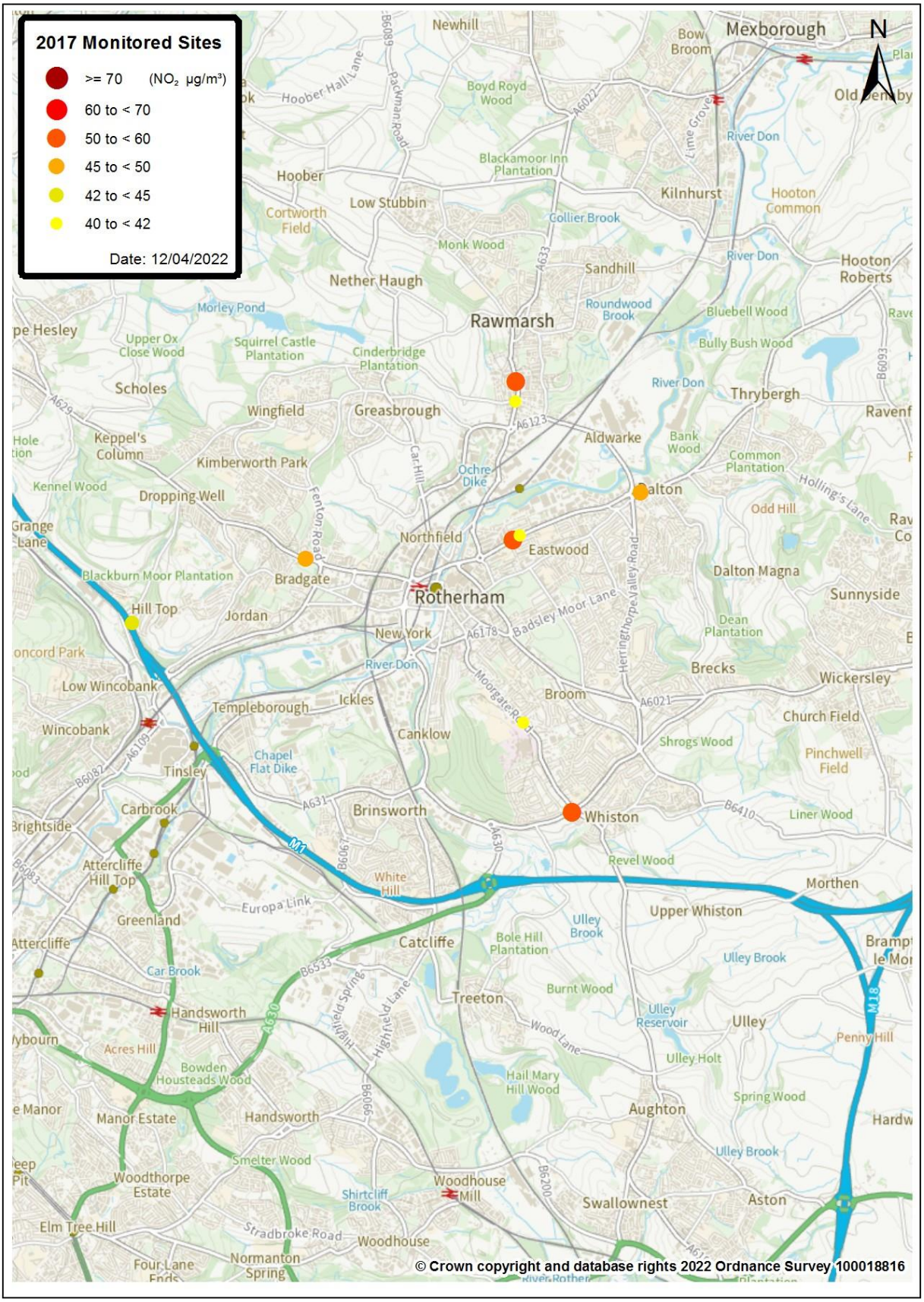


Figure 2 – Sheffield Air Quality Problem Sites – Recent Trend

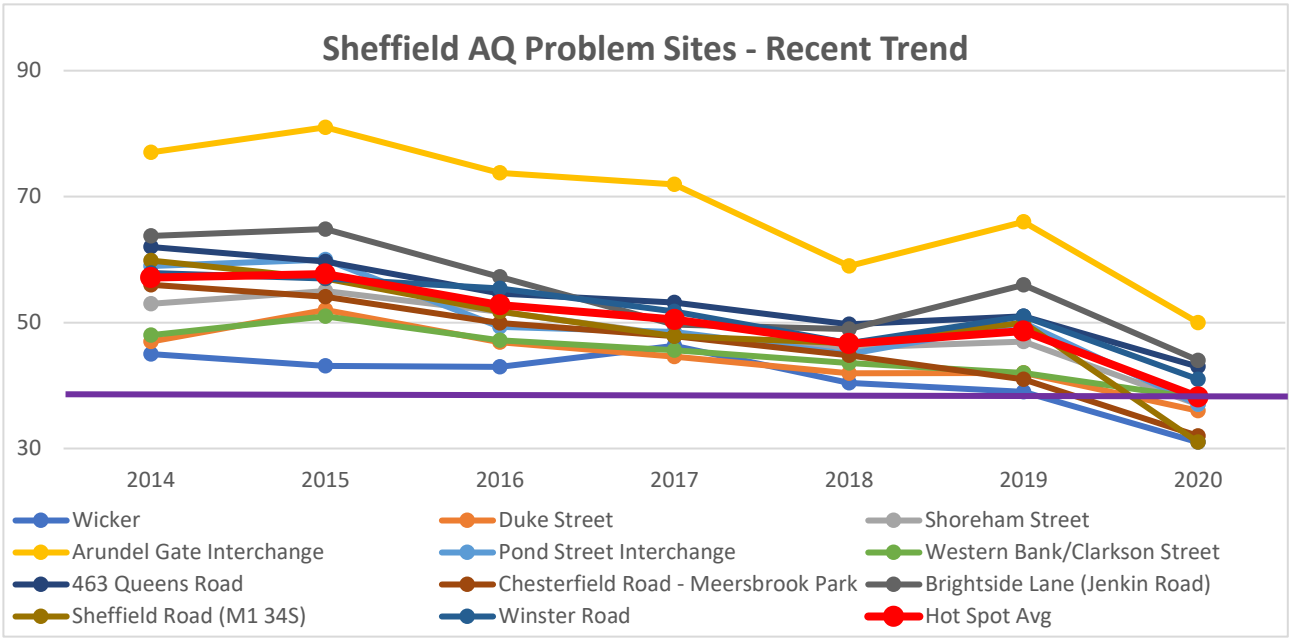
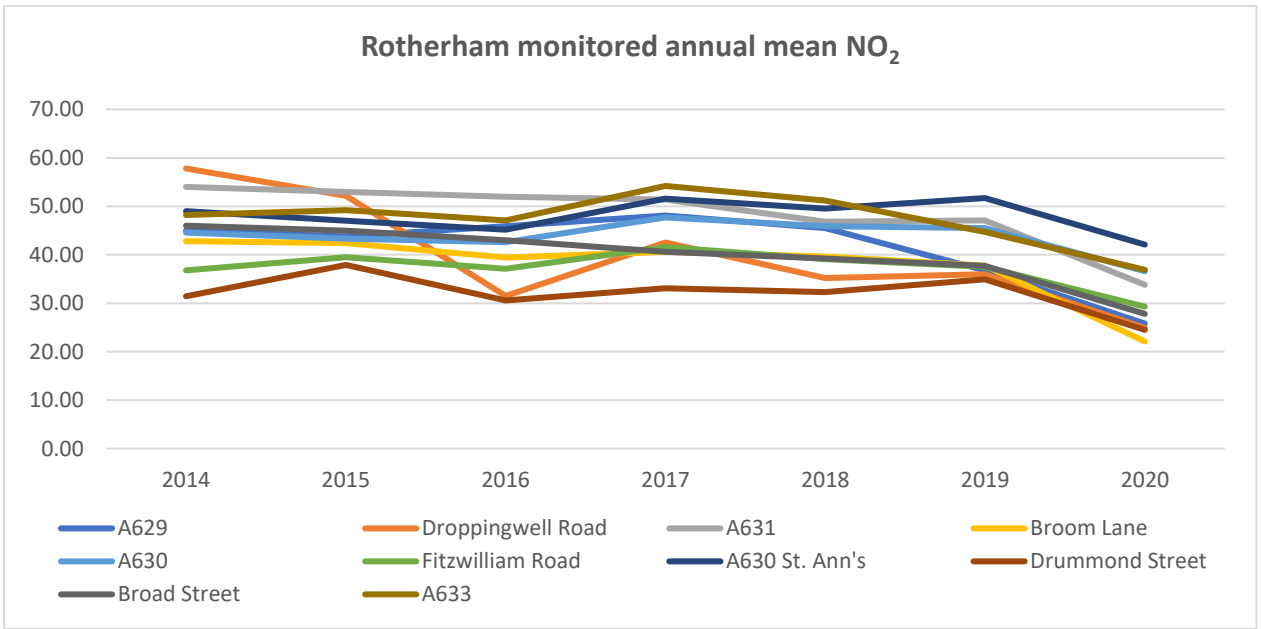


Figure 3



The data above suggest that the NO_2-based air quality is generally improving at most of the hot-spot sites in the region, as would be expected. However, air quality is not predicted to improve sufficiently at all locations to meet the AQD and action is required to achieve this in the shortest possible time.

During 2020, the Covid response resulted in around 19% lower annual mean nitrogen dioxide compared with 2019. JAQU stressed that our predictions should not take this into consideration in our predictions. Figures 4 and 5 below show the trends

in mean monthly borough-wide nitrogen dioxide (roadside and background sites) in Sheffield and Rotherham respectively, and clearly show the impacts of the reduction in traffic flows as a result of Covid restrictions at various times. They also show that levels in September 2021 are only slightly higher in Sheffield but slightly lower in Rotherham than those observed in 2019.

Figure 4

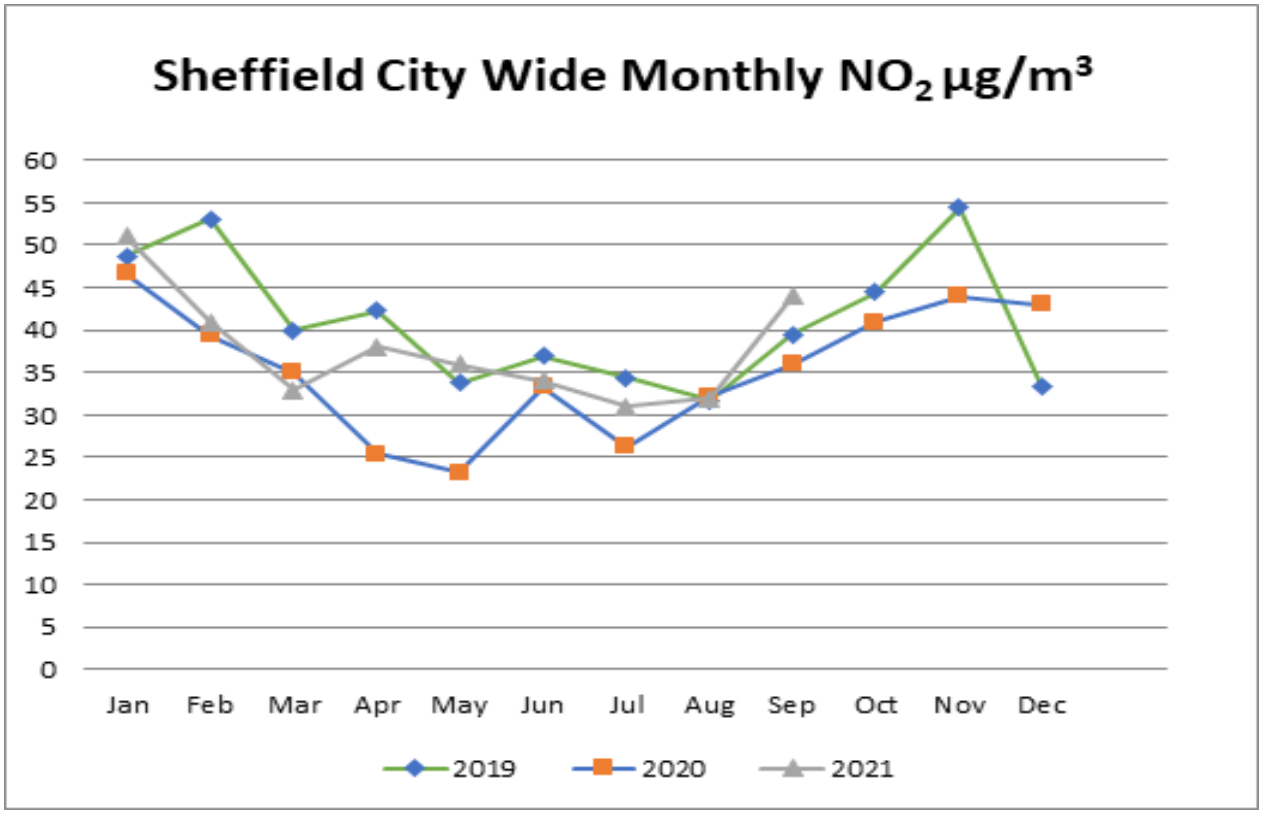
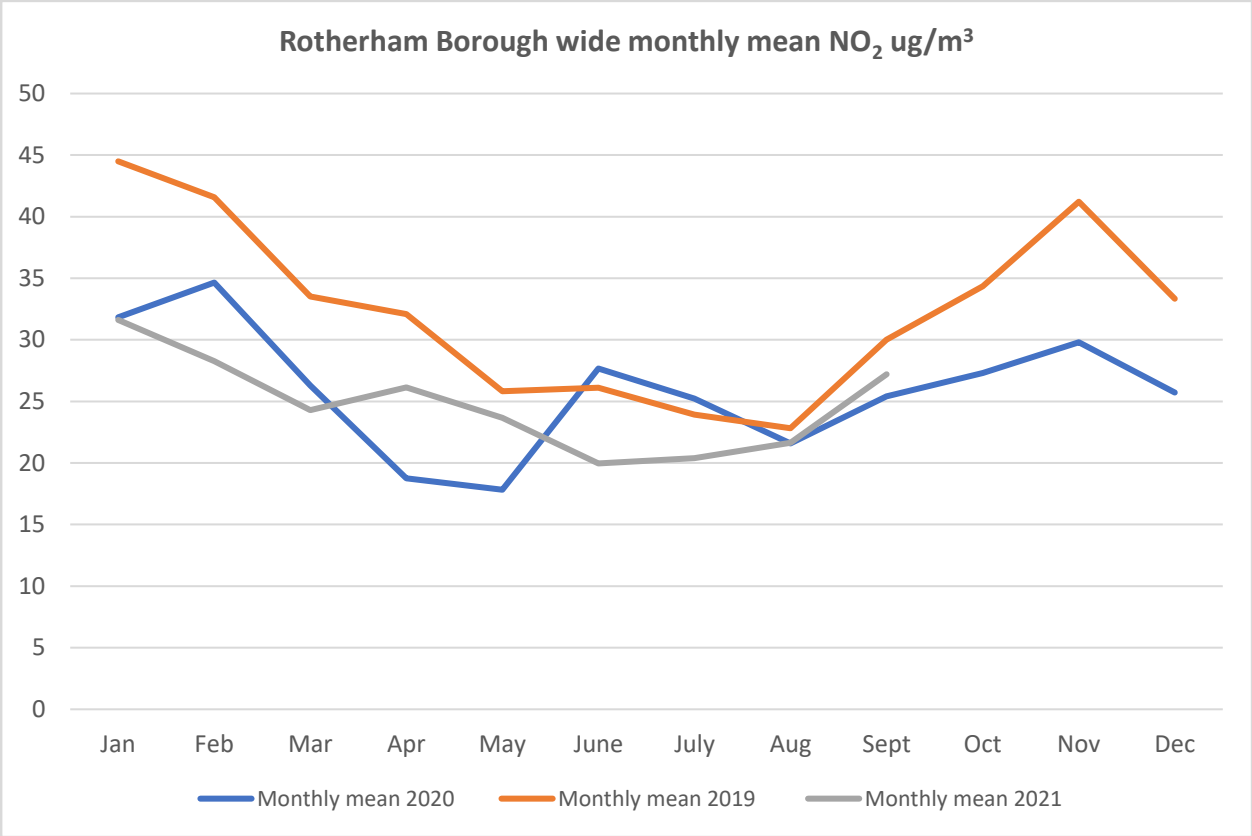


Figure 5



5. Assessment of PCM Road Links in the modelled domain

An assessment of all PCM road links was undertaken in the modelled domain. Context:

- Road locations situated within areas where members of the public do not have access and there is no fixed habitation or where there is no public access within 15 m (Annex III of AQD – 10 m), these roads have been excluded from the compliance assessment (JAQU guidance) – See Appendix 3 – AQ2–SD03 in AQ2 Report).
- Where there is access (houses, gardens, or footpaths) within 15 m at grade with the road, these road links are included (JAQU guidance).
- Where there is access via a footpath or similar that is not at grade with the road, because the road is elevated or in a cutting, these roads are included if the access is parallel to (runs alongside) the road (JAQU guidance) (Annex III of AQD – 10 m).
- If the only access (the footpath or another road with pavements) is not at grade with the main road but is perpendicular (goes under or over the main road with a bridge), then if there is no other access these roads may be excluded from the compliance assessment (JAQU guidance).
- Locations where the air sampled is representative of air quality for a street segment no less than 100 m length at traffic-orientated sites.

- Traffic-orientated sampling probes shall be at least 25 m from the edge of major junctions and within 10 m from the kerbside.

This assessment showed that the PCM links on the Sheffield section of the Parkway (A630 between Sheffield City Centre and the M1, Census IDs: 36588, 47855, 76045, 99303) are not considered to be a valid location for reporting compliance with the EU LV as they fall within the EU direction at section **A** sub-section **2(a)** (locations where members of the public have no access and there is no fixed habitation) of AQD Annex III and JAQU guidance (see Appendix 3 (Technical Note) below – AQ2–SD03). The Census IDs specifically affected are: 36588, 47855, 76045, 99303. Pedestrians and cyclists are prohibited on these road links.

On the Rotherham stretch of the Parkway, there is one PCM road link, Census ID 73910, with four receptor point reporting locations referred to in this report. Three of these receptor point reporting locations grid references, (X-442410, Y-388731) (X-442398, Y-388723) and (X-442804, Y-388927) are not considered to be valid for reporting compliance with the EU LV, the fourth receptor point reporting location, (440725, Y-387859), may be considered to be a valid location. However, notwithstanding the above, we also note that the combined effect of the charging scheme in Sheffield, and the proposed 50mph speed limit, will bring all links on the Parkway in Rotherham within the limit value of $40\mu g \cdot m^{-3}$. It is therefore proposed to introduce the revised speed limit, with costs included in this full business case, to remove risk of challenge regarding public access, and to put compliance on this link beyond challenge or doubt. – see sections 1.1 of Document AQ2.

The non-valid PCM road link locations will therefore no longer be reported.

Furthermore, results for the M1 (which come under Highways England, now National Highways, jurisdiction), for example, for Census IDs 16007, 28052, 37913 and 73909 are also excluded, as reported in the Target Determination documents, our modelling suggests that the $40\mu g/m^3$ annual average limit value for NO_2 will continue to be exceeded in 2021 and beyond at a number of locations close to the M1, unless appropriate action is taken by National Highways.

Annual mean nitrogen dioxide is predicted for locations which meet the EU's and JAQU's requirements, i.e., >25m from a junction, be representative of air quality for a street segment no less than 100 m length and 4m from the kerb.

6. Total Road NOx Emissions

This table shows the road NOx **emissions** from the SCRTM1 model output, mean % change in roadside NOx at PCM receptors; % average decrease in total NO_2 annual mean.

Model year	Road NOx emissions - model domain g/s	% decrease in modelled road NOx $\mu g/m^3$ (2017=100) PCM roads	% decrease in modelled roadside mean total NO_2 (2017 =100) PCM roads
2017	97.14	100	100
2022 BaU	65.05	62.5	72
2022 PO CAZ C	61.97	59.4	70

This shows that there is a significant decrease in NOx emissions from the vehicle fleet between 2017 and 2022. The reason there is such a reduction in road emissions of NOx between 2017 and 2022 is the proportion of Euro 6/VI vehicles in the vehicle fleet. For an HGV, Euro VI standards were introduced in 2012, so a vehicle would need to be 10 years old not to be Euro VI in 2022 and obviously this means there will be very few non-Euro VI HGVs (the bus fleet is an exception here). For light vehicles the standard came into force in 2015, so all vehicles younger than 7 years old will be E6 in 2022. Significant improvements in the vehicle fleet are forecast to have taken place between 2017 and 2022. This provides added assurance that it is likely that the preferred option will achieve compliance with the EU LV.

7. Dispersion Modelling Results

7.1 Sheffield Predicted Nitrogen Dioxide concentrations for 2017 Baseline, 2022 BaU and 2022 PO

Reporting locations are at 4m from the kerb and are distance corrected.

Key routes for compliance in **bold.** Please refer also to the Supporting Technical Document (see Appendix 1 – AQ2–SD01 in AQ2 Report)

Site Location at 4m	Census_ ID	Road ID	X co-ordinate	Y co-ordinate	NO_2 annual mean 2017 BaU Base Year	NO_2 annual mean 2022 BaU Predicted Baseline	NO_2 annual mean 2022 Sheffield City Centre PO CAZ C and other compliance measures
PCM Link A6135	7355	A6135	438506	384878	26.0	20.2	19.9
PCM Link A6178	7380	A6178	437929	388796	40.4	30.9	29.9
PCM Link A6102	7817	A6102	437701	390085	32.0	25.7	25.9
PCM Link A6102	7818	A6102	436002	381660	23.4	18.9	18.7
PCM Link A57	8144	A57	433585	387106	33.0	24.6	23.2
PCM Link A621	8710	A621	431992	380867	27.0	20.9	20.2
PCM Link A61	8744	A61	435361	386381	34.0 Note 1	28.4	25.9
PCM Link A61	**8758**	**A61**	**435742**	**386706**	**43.3**	32.8	29.2
PCM Link A61	16580	A61	433531	390152	36.0	26.4	25.6
PCM Link A61	16581	A61	435141	384991	39.1	30.4	28.5
PCM Link A631	17332	A631	440115	390799	37.9	28.3	28.1
PCM Link A6109	**17718**	**A6109**	**438610**	**390615**	**45.6**	35.1	34.2
PCM Link A6315	17728	A6315	435840	388817	38.7	29.1	28.9
PCM Link A61	17809	A61	434807	388215	38.7	28.1	25.6
PCM Link A61	**18546**	**A61**	**433439**	**390517**	**41.3**	30.6	29.9
PCM Link A6102	18721	A6102	439354	388403	29.0	22.6	23.0
PCM Link A6135	27373	A6135	438015	385151	27.7	21.0	20.7
PCM Link A621	27381	A621	434748	385003	34.5	26.8	25.4

PCM Link A6178	**27393**	**A6178**	**437104**	**388329**	**44.6**	34.5	33.8
PCM Link A6101	27821	A6101	433358	389729	29.0	23.2	23.0
PCM Link A6102	27822	A6102	438730	386000	24.0	19.0	19.0
PCM Link A61	27857	A61	435696	385891	38.4	30.0	28.2
PCM Link A6102	28172	A6102	433306	390469	34.0	26.6	25.6
PCM Link A631	28868	A631	439676	389987	34.0	26.4	26.6
PCM Link A6178	**37441**	**A6178**	**439719**	**390828**	**46.3**	36.0	36.1
PCM Link A61	37898	A61	435811	386349	35.1	27.1	24.7
PCM Link A6102	37902	A6102	438287	389813	37.0	28.0	28.1
PCM Link A6178	38549	A6178	438549	389658	39.1	30.0	30.2
PCM Link A61	46619	A61	433942	389499	31.7	24.2	23.0
PCM Link A61	46620	A61	434996	381727	29.8	23.6	22.9
PCM Link A621	47393	A621	435233	385955	38.0	29.0	27.2
PCM Link A625	47396	A625	434318	386284	34.8	27.2	25.4
PCM Link A629	47405	A629	435534	396240	31.0	25.7	24.6
PCM Link A6109	47826	A6109	439171	391727	40.3	31.7	31.4
PCM Link A61	47856	A61	433383	390693	33.9	26.2	25.6
PCM Link A61	47860	A61	434401	386985	35.3	27.7	25.7
PCM Link A61	48531	A61	435182	380648	29.4	22.7	22.2
PCM Link A6102	48804	A6102	439066	389235	37.0	28.3	28.2
PCM Link A61	**48805**	**A61**	**435531**	**386560**	**48.0**	36.8	33.4
PCM Link A61	56608	A61	435045	387996	37.0	28.8	26.1
PCM Link A629	56862	A629	436006	395739	23.0	18.6	18.4
PCM Link A6109	56863	A6109	436322	388232	35.2	27.7	25.5
PCM Link A6178	57330	A6178	440015	391185	30.4	23.0	22.8
PCM Link A61	57861	A61	435005	386383	34.0	27.2	24.9
PCM Link A6135	57875	A6135	436491	390150	35.7	27.2	26.2
PCM Link A6102	58427	A6102	439148	386937	33.0	26.1	25.7

PCM Link A61	**60030**	**A61**	**435769**	**386951**	**49.0**	36.4	32.4
PCM Link A61	**75194**	**A61**	**435549**	**386631**	**43.7**	33.4	30.0
PCM Link A61	**75195**	**A61**	**435810**	**386626**	**41.0**	30.1	27.3
PCM Link A61	75196	A61	435753	386520	34.0 Note 1	26.1	23.8
PCM Link A61	75197	A61	435313	386367	34.0	28.1	25.6
PCM Link A61	75198	A61	435737	386648	39.0	32.8	29.8
PCM Link A61	75199	A61	435574	386556	38.0	29.3	26.6
PCM Link A6135	**76044**	**A6135**	**435923**	**388023**	**41.1**	31.7	27.7
PCM Link A61	76046	A61	436217	387889	36.0	28.8	26.0
PCM Link A57	77544	A57	432052	387069	19.1	15.4	15.1
PCM Link A6101	77547	A6101	433005	389489	29.0	23.9	23.4
PCM Link A6102	77551	A6102	432723	391009	34.0	26.9	25.9
PCM Link A61	77553	A61	433793	392251	23.0	18.9	18.7
PCM Link A6135	77557	A6135	435631	396500	25.0	22.3	21.7
PCM Link A6135	81155	A6135	436829	386425	30.8	23.4	22.2
PCM Link A61	81162	A61	435402	388018	36.0 Note 1	30.2	27.6
PCM Link A6102	81227	A6102	435013	390701	27.0	21.8	21.8
PCM Link A6102	81228	A6102	433571	390669	30.0	23.3	23.1
PCM Link A6102	81229	A6102	433482	390875	27.0	21.4	21.0
PCM Link A6102	81230	A6102	433152	390852	35.0	28.6	27.9
PCM Link A61	**81236**	**A61**	**435658**	**388179**	43.0 Note 1	36.3	32.4
PCM Link A61	81237	A61	435810	388040	34.0 Note 1	27.0	24.4
PCM Link A6109	**81238**	**A6109**	**435861**	**388168**	**42.0**	34.8	31.3
Glossop Road B6547	n/a	Glossop Rd B6547	433413	386744	30.6	24.3	23.7
Barkers Pool Taxi Rank	n/a	Barkers Pool Taxi Rank	435290	387225	33.6	30.7	27.2
C710 Arundel Gate	**n/a**	**C710**	**435600**	**387293**	**61.1**	**47.8**	38.3 Note 2
Beeley Wood Rd, S6	n/a	Beeley Wood Rd	433248	391121	30.1	21.4	21.1

Arundel Gate, Gallery	**n/a**	**C710**	**435546**	**387052**	**45.0**	35.0	28.2
Arundel Gate, Stoddart Bldg	**n/a**	**C710**	**435463**	**386972**	**48.0**	**42.0**	32.2
Arundel Gate/Surrey Str	n/a	C710	435608	387100	39.0	28.3	23.2
Orphanage Rd / Barnsley Rd	n/a	A6135	435789	389592	**49.0** Note 1	37.2	35.7

Notes

Note 1 These are adjusted results (see Appendix 2 (Technical Note) – AQ2–SD02): Note on Adjustment of Modelled Road NOx for Assessment Locations)

Note 2 Compliance is with anti-idling bus measures in place (see Technical Note, T4-SD01, – Modelling Bus Idling on Arundel Gate)

7.2 Assessment of PO Scheme Impacts - Sheffield

Results in the above Table show that the predicted annual mean concentrations of nitrogen dioxide exceed the annual mean Limit Value at 2 roadside locations in 2022 for business as usual. The locations are Arundel Gate C710 and Stoddart Building. In the preferred option scenario, all locations are compliant with the EU LV for annual mean nitrogen dioxide (<40.4ug/m^3) with the anti-idling bus measures in place at C710 Arundel Gate. This shows that the CAZ Charging scheme, in Sheffield city centre including the inner ring road, will be successful in achieving compliance once implemented in 2022.

7.3 Rotherham Predicted Nitrogen Dioxide concentrations for 2017 baseline, 2022 BaU and 2022 PO

Key routes for compliance in **bold**

Please refer also to the Supporting Technical Document (see Appendix 1 – AQ2–SD01 in AQ2 Report)

Site Location	Census id	Road ID	x-co-ordinate	y co-ordinate	NO_2 annual mean 2017 BaU Base Year	NO_2 annual mean 2022 BaU Predicted Baseline	NO_2 annual mean 2022 Sheffield City Centre PO CAZ C and other compliance measures
Parkway Footpath crossing 440725, 387859[note 1]	**73910**	**A630**	**440725**	**387859**	**36.4**	**30**	**29.7**
Parkway AQM site from 2023: 442398, 388723[note 2]	**73910**	**A630**	**442398**	**388723**	**50.3**	**41.1**	**39.9**
Parkway AQM site up to 2021[note 3]	**73910**	**A630**	**442804**	**388927**	**51.7**	**41**	**39.9**
Parkway (4m)[note 4]	**73910**	**A630**	**442410**	**388731**	**48.4**	**43.1**	**40.4**
Rawmarsh Hill (4m)	**17339**	**A633**	**443695**	**395454**	**50.2**	**41.3**	**39.2**
Wortley Road (4m)	**77552**	**A629**	**441075**	**393332**	**46.7**	**41.9**	**40.1**
Fitzwilliam Road (4m)	**58395**	**A630**	**443317**	**393399**	**51.6**	**41.2**	**39.4**
PCM link -A6022 (4m)	27858	A6022	444926	399292	32.2	23.9	23.7
PCM Link -M1, (4m) Blackburn, Rotherham National Highways	36007	M1	438607	392848	51.7	39.0	38.9
PCM link -A633 (4m)	73410	A633	443241	401486	29.1	23.5	22.9
PCM link -A633 (4m)	7388	A633	443849	400674	31.8	24.5	23.5
PCM link -A631 (4m)	47409	A631	444315	390127	40.9	37.3	36.7
PCM link -A618 (4m)	77548	A618	444604	390048	35.0	22.8	22.4
PCM link A634 (4m)	77549	A634	453402	391141	21.8	17.7	16.9
PCM link -A630 (4m)	77554	A630	446010	394518	36.3	28.2	27.2
PCM link -A633 (4m)	77563	A633	443972	400994	31.1	24.8	24.1
PCM link A57 (4m)	77759	A57	451754	383960	30.1	22.6	22.6
PCM link -A633 (4m)	99965	A633	444029	401284	31.1	24.5	24.2

PCM link -A630 (4m)	17805	A630	442271	392395	39.7	35.3	34.7
PCM link -A631 (4m)	17807	A631	445708	391334	38.6	30.8	29.1
PCM link -A6123 (4m)	17808	A6123	445231	391301	38.7	29.5	28.5
PCM link -A6109 (4m)	18689	A6109	439518	391958	32.3	30.5	29.6
PCM link -A6021 (4m)	27799	A6021	445004	391582	39.6	30.6	29.8
PCM link -A631 (4m)	27396	A631	444990	390817	44.4	32.1	31.6
PCM link -A6123 (4m)	37868	A6123	445026	392002	38.8	29.0	28.4
PCM link -A629 (4m)	38673	A629	441997	393118	42.3	31.6	30.4
PCM link -A631 (4m)	56055	A631	443009	390122	39.6	30.5	29.8
PCM link -A630 (4m)	57857	A630	442268	392799	38.7	31.1	31.1
PCM link -A6021 (4m)	60031	A6021	443354	392480	31.3	28.3	27.0
PCM link -A6021 (4m)	60032	A6021	443201	392992	33.9	25.7	24.5
PCM link -A6123 (4m)	60033	A6123	444952	394587	37.4	27.6	27.3
PCM link - A633 (4m)	60034	A633	443521	394689	38.5	31.5	29.9
PCM link -A618 (4m)	7360	A618	444009	390804	32.4	24.8	24.1
PCM link - A631 (4m)	7382	A631	447994	391929	40.2	32.0	31.5
PCM link -A6178 (4m)	73907	A6178	442004	391870	36.1	27.8	27.9
PCM link -A631 (4m)	73908	A631	441885	390419	43.5	33.6	32.9
PCM link -A57 (4m)	73911	A57	444666	384363	30.1	26.7	23.4
PCM link -A618 (4m)	77384	A618	445591	385008	33.1	25.3	24.0
PCM link - A630 (4m)	7750	A630	442592	393155	43.4	33.0	31.4
PCM link - A618 (4m)	77542	A618	445268	385995	32.9	24.5	24.2
PCM link - A6021 (4m)	7973	A6021	445495	391527	38.8	29.5	28.8
PCM link - A6023 (4m)	80807	A6023	442713	394219	40.2	32.5	31.8
PCM link - A6021 (4m)	8345	A6021	442594	392182	32.5	29.8	29.2
PCM link - A6109 (4m)	8590	A6109	441152	393010	35.5	28.3	27.7
PCM link - A633 (4m)	27401	A633	442509	401861	20.2	23.7	22.3
PCM link - A630 (4m)	28002	A630	442517	391650	38.9	29.9	29.1

With reference to monitored data in Rotherham, there have been significant reductions of NO_2 in certain locations between 2017 and 2021, especially if influenced by the M1. The M1 influenced change is explained by the fact that some Rotherham roads are effectively

an alternative route to the M1 when the M1 is either congested or has roadworks (which were in place for many years up to the opening of the Smart motorway). The vehicle fleet upgrades faster on the strategic network, so there is an improved fleet and reduced emissions at M1 influenced locations. The Smart motorway has resulted in better flows between J35A and J31 and there has also been an impact of the 60mph speed limit which is in place as part of National Highways commitment to meeting the EU LV close to the SRN.

7.4 Assessment of PO Scheme Impacts - Rotherham

Predicted annual mean concentrations of nitrogen dioxide show exceedances of the annual mean Limit Value at roadside locations on 3 key routes in 2022 for business as usual. These are Fitzwilliam Road, Rawmarsh Hill and Wortley Road. In the preferred option scenario, all locations are compliant with the EU LV for annual mean nitrogen dioxide (40µg/m^3). This shows the location specific traffic management schemes proposed in Rotherham, will be successful in achieving compliance once implemented in 2022.

7.5 COVID scenario tests undertaken

Background

The Covid-19 pandemic, commencing primarily in 2020 with Europe, brought new challenges and uncertainties that impacted the programme; see the Strategic Case, Section 2.

In February 2020 the implications of the national pandemic were emerging and national lockdown in the UK was announced on the 16th of March 2020. Different periods of lockdown restrictions continued at a national and local level through 2020 and at the start of 2021.
JAQU announced that the go-live dates of all charging CAZs that were due to go live in 2020 were to be postponed to early 2021.

The implications on travel were significant and this brought about associated improvements in local air quality.

Along with a number of other Local Authorities, Sheffield and Rotherham reviewed their Clean Air Plan and CAZ proposals during 2020. In April 2020 the SCC and RMBC project team began to consider whether the medium and long-term impacts of the Covid19 pandemic would result in long-lasting travel behaviour changes (i.e., beyond the easing of the main 'lock-down' measures) which would affect compliance with the NO_2 target limit in the earliest possible compliance year (which at that time was forecast to be 2021).

JAQU continued to advise Sheffield and Rotherham to develop our measure packages to tackle the exceedances predicted from modelling 'as planned and agreed' until late May 2020, when they requested local authorities to undertake additional (limited) sensitivity testing, focussing on the impact of reduced fleet turnover on our Preferred Option.

In July 2020 JAQU wrote to Local Authorities acknowledging the uncertainty around the local economic impact of Covid-19 and encouraging local authorities to draw on emerging evidence from a range of sources (including any available local evidence), while continuing to implement their Directed schemes.

SCC/RMBC/JAQU then agreed a program of evidence gathering and travel demand, and emissions modelling which would help determine the likelihood and scale of any long-term impacts of the Covid19 pandemic, in order to assess:

- whether the assumptions underpinning the OBC Preferred Option modelling and appraisal remained valid and robust;

- whether the combined COVID assumption impacts would increase or decrease the likelihood Sheffield and Rotherham's local air quality will remain in exceedance of legal NO_2 limits in any given future year;

- whether the economic impacts of the pandemic on the local vehicle owners' ability/willingness to upgrade their non-compliant vehicles and the corresponding impacts on the need for financial support to encourage the required fleet improvements.

On the 17th of July 2020 JAQU agreed to Sheffield and Rotherham modelling a combined COVID scenario which included assumptions that predicted increased traffic or some fleets / use and decreased travel in other scenarios. The combined COVID scenario assumptions were referred to as 'coping best we can'.

In February 2021, shortly after the completion of our analytical work, we were advised in a letter from Ministers that due to the degree of uncertainty associated with Covid-19 it had been decided COVID impact assumptions should not be considered within the core modelling to be used to inform the Preferred Option or the Full Business Case. The post-Covid-related scenario assumption tests described here were therefore not taken forward into the design and testing of the final Preferred Option.
Note a number of changes were made to the modelled data beyond February 2021. Our baseline data was updated to take account of new, actual AQ data now available, updated BaU fleet standards and to incorporated changed transport network schemes into the modelling. Quality Assurance checks were undertaken of monitoring locations and calibration factors applied, and relevant adjustments made. The CAZ C options were then remodelled to test the Preferred Option for implementation.

Combined COVID assumption scenario tests undertaken:

The combined scenario agreed with JAQU combined the most likely impact factors resulting economic downturn, referred to as a 'slump' scenario with the most likely impact factors predicted as a result of increased economic activity, e.g., online sales and deliveries. The combined scenario test was referred to as 'Coping best we can'.

See Appendix 1: 'Covid 'coping' scenario assumption note' of this document for impact factors and assumptions included.

Given the extent of uncertainty associated with COVID it was decided to test a range of scenarios including a non-charging test which included road scheme within Sheffield and Rotherham. A CAZ D was not tested as this was discounted at the OBC stage having evidenced that a CAZ C with additional '+' measures Preferred Option was predicted to reach compliance within the shortest time.

The following combined COVID assumption scenario tests were undertaken:

- **Business as Usual (BaU) 2022 without COVID assumptions, BaU fleet upgrade**

- **Business as Usual (BaU) 2022 with COVID assumptions, BaU fleet upgrade**

- **Test 1b: CAZ B with 'coping' COVID assumptions, road schemes in Sheffield and Rotherham, fleet upgrades:**

    - Car - As per OBC PO (i.e., BAU + small % H&M)
    - LGV - As BAU
    - HGV - As per OBC PO (upgrade over BAU)
    - Black Cab - As per OBC PO (90+% ULEV)
    - PHV - As per OBC PO (90+% ULEV)
    - Bus - As per OBC PO (Euro 6, Retrofit or better)

- **Test 2a: Non-charging test with 'coping' COVID assumptions, road schemes in Sheffield and Rotherham, fleet upgrades:**
    - Car - As BAU
    - LGV - As BaU
    - HGV - As BAU
    - Black Cab - As per OBC PO (90+% ULEV)
    - PHV - As per OBC PO (90+% ULEV)
    - Bus - As per OBC PO (Euro 6, Retrofit or better) – Test 2a.

- **Test 2b: Non-charging test with 'coping' COVID assumptions, road schemes in Sheffield and** Rotherham, fleet upgrades:
    - Car - As BAU
    - LGV - As PO
    - HGV - As BAU
    - Black Cab - As per OBC PO (90+% ULEV)
    - PHV - As per OBC PO (90+% ULEV)
    - Bus - As per OBC PO (Euro 6, Retrofit or better) - Test 2b.

- **Test 3: CAZ C+ with road schemes in Rotherham, OBC preferred option - with road schemes in Rotherham, fleet upgrades:**
    - Car - As per OBC PO (ie BAU + small % H&M)
    - LGV - As per OBC PO (upgrade over BAU)
    - HGV - As per OBC PO (upgrade over BAU)
    - Black Cab - As per OBC PO (90+% ULEV)
    - PHV - As per OBC PO (90+% ULEV)
    - Bus - As per OBC PO (Euro 6, Retrofit or better)

See Appendix 2 for the modelled results,

8. Conclusion

The preferred option is for the introduction of a charging Class C Clean Air Zone in the centre of Sheffield, including the inner ring road, Park Square and the A61/Parkway junction. Rotherham MBC is developing targeted schemes on the Parkway (A630), Fitzwilliam Road, Wortley Road and Rawmarsh Hill. Bus fleet upgrades of any vehicles in Sheffield and Rotherham which are not currently Euro VI compliant is a key aspect of the proposed scheme in both Sheffield and in Rotherham, along with improvements to the private hire and Hackney Carriage fleet.

The preferred option is predicted to achieve compliance with the limit values for nitrogen dioxide at all locations in Sheffield and Rotherham during 2022, which is the shortest possible time in which a scheme can be delivered. If an alternative scheme was adopted, there would a lengthy delay in implementation as a further statutory consultation process would need to take place.

APPENDIX

Appendix 1 - Covid 'coping' scenario assumption note

Sheffield & Rotherham Clean Air Plan – Evidence Base

TECHNICAL NOTE FOR THE 'COPING AS BEST WE CAN' COVID SCENARIO: Implementing the 'Coping as best we can' post-covid scenario in the Transport & Emissions Modelling

TD1 - Travel demand to/from existing premises – commute (reduced employment)

Assumption: 7.7% decrease in employment – (implemented as a 7.5% reduction)
To apply the decrease in commute trips due to reduced employment to the person trip ends we moved 7.5% of part time and full time employed population into the unemployed category. This drives the relevant changes in the trip-end model, including decreasing commuting and increasing the trips made by unemployed adults.

TD2 - Travel demand to/from existing premises – commute (more home working)

Assumption: 25% decrease in commuting
The SRTM1 trip-end model does not include a specific Working from Home category of employed adult. Instead, the base-year proportion of those working from home is incorporated within the commuting trip rate. The NTEM trip end data suggests that a 25% decrease in 'commute' trips approximately corresponds to a 10% reduction to total trips. We therefore apply a 10% reduction to all population groups to get the required change to the from-home person trip ends.

TD3a - Travel demand to/from existing premises – business travel (economic downturn)

Assumption: 7.7% decrease in business travel (modelled as a 7.5% decrease)
The approach used to model TD1 (increased unemployment) will also generate a corresponding 7.5% reduction in Business Travel. To avoid double-counting, we have not applied any further reduction to Business Travel trip-ends when modelling this impact. NB If this impact was to be modelled in isolation, we would need to apply the required change to the zone attributes which generate and attract business travel.

TD3b - Travel demand to/from existing premises – business travel (more virtual meetings)

Assumption: 25% decrease in business travel
There is no separate Work from Home category to represent this impact directly in the SRTM. The NTEM suggests that a 25% decrease in 'business' trips correspond to 3% reduction to total trips; thus, we apply a 3% reduction to all population groups to achieve the required change to person trip ends. No other trip purposes are affected by this change.

TD4a - Travel demand to/from existing city-centre premises - shopping (economic downturn)

Assumption: 11% decrease in retail trips
An 11% decrease is applied to the retail employment category, which adjusts the pattern of trip attractions and reduces retail-related goods vehicle trips. However, the total number of

retail trips is controlled by the trip productions, which is a product of the trip-rates and the population, sub-divided into a large number of different person/household/car ownership types. It was not possible apply the required reduction to these trip-rates within the SRTM1 model's complex trip-end forecasting process, which makes use of the NTEM/ CTRIPEND processes from the DfT, within the time available for this piece of work.
Instead, the required 11% reduction in retail trips (equivalent to 1.5% reduction in total trips as calculated via NTEM) was achieved by reducing the number of full-time and part-time employed adults by the amount needed to deliver this 1.5% in total trips. However, this 'artificial' reduction in the employed population was then offset to an extent by these adults being added to the unemployed category (as per the modelling of TD1). As a result, the total trip-making was only reduced by the difference in trip rates between employed and unemployed adults, rather than by the full trip rate of employed adults. As a result, the impact of TD4a will have been slightly under-estimated. This under-estimation could be corrected when the 'best guess' estimate of the %reduction in city centre retail trip-making has been agreed.

TD4b - Car travel demand to/from existing premises - shopping (more on-line and local shopping)

Assumption: 10% decrease
Based on the NTEM trip ends data, a 10% decrease in retail trips corresponds to 1% reduction to total trips; thus, we apply a 1% reduction to all population groups to get the required change to person trip ends. A 10% reduction is also applied to the retail employment category, to achieve the required changes in the trip distribution and a reduction in goods vehicle trip to the retail areas.

TD4c - Increase in Retail - LGV kms as a result of the increase in on-line shopping

Assumption: 10% increase to LGV retail trips, which are assumed to be 25% of all LGV trips, resulting in a 2.5% increase in LGV trips.
As a result of increased online shopping, we assume there to be an increase in the number of LGV trips delivering goods direct to people's homes. Thus, to model this impact we apply a 2.5% increase in total LGV trips directly to the freight trip ends process output. The growth in the amount of retail-related LGVs is assumed to be the same as the decrease in the number of car-based retail trips. The additional retail deliveries to non-car-using former-shoppers are assumed to cancel out the efficiencies of the home delivery logistics, relative to the individual home-to-shop car trips – see Tech Note 07 for further details.

TD5 - Travel demand to/from existing premises - other leisure (economic down-turn and reduced city centre businesses)

Assumption: 10% decrease
A 10% decrease is applied to the employment in the relevant economic sectors (restaurants and bars, recreation and sport, etc) to achieve the required change to the trip-attraction distribution (and any goods vehicle activity generated by these jobs).
A 10% decrease in leisure trips is equivalent to a 0.5% drop in total trips. As for TD4a, it was not possible to adjust the trip production rates for the various population types to remove these 'other leisure trips from the trip-end model. Instead, the number of employed adults was reduced to achieve this target 0.5% reduction in total trip production. However, as per TD4a, the process which was used to implement TD1 (reduced employment) was re-used here, resulting in the reduction in employed adults being added back onto the unemployed adult total. As a result, the impact of TD5 will have been slightly under-estimated here. This under-estimation could be corrected when the 'best guess' estimate of the %reduction in 'other/leisure' trip-making has been agreed.

PT1 - Reduction in bus service frequency

Assumption: 20% decrease

SYSTRA have developed a process for identifying lightly-used bus services and reducing their frequency (and the associated Peak Vehicle Requirement) to achieve a user-defined reduction in total bus kms – See Tech Note 01 for further details. This process was applied separately to each of the time periods modelled in the SRTM1 public transport model network, to achieve the required 20% reduction in bus kms in each of these time periods.

The full mode-choice model and PT assignment models were then re-run, to predict the corresponding impacts on car traffic (from the mode-shift responses of PT users from car-available households). Note that the SRTM1 mode-choice model does not include taxis as a mode and therefore its forecasts exclude any increased taxi mileage resulting from the assumed reductions in bus frequencies (particularly from non-car-available households).

F_1 - Business as Usual fleet upgrades reduced – 6 months of fleet upgrades lost

Assumption: 6 months BaU fleet upgrades 'lost'

Modelled by calculating a 50/50 combination of ENEVAL Business as Usual fleet emissions for 2021 and 2022 and using this to represent the relevant 2022 'post-covid' scenarios.

Combining the Impacts

The impacts relating to each purpose are run separately and the resulting freight and person trips ends outputs from the tripend process for each amended purpose are merged, to create the required SRTM1 input file.

Appendix 2 – see separate spreadsheet