Appendix G Summary of Traffic Changes Arising from ORR CAZ D in 2020 (v2 13/12/17)

1. This note provides a summary of the modelled forecast changes in all day (weekday 0700-1900 and estimated AADT[1]) traffic flows arising with the implementation of a Clean Air Zone covering Leeds within the Outer Ring Road and applying to HGVs, LGVs and cars (buses are modelled as a fixed demand based on existing routes).

2. This is based on the following assumptions:

- Cars, LGV and HGV included
- Daily charges of £12.50 (cars, LGV) and £100 (HGV) for non-compliant vehicles
- No suppression of non-compliant LGV/HGV trips. Full demand response for cars
- Assumed compliance levels (%):

Table 1

2020	Car	LGV	HGV
Within CAZ	91.7	88.2	97.4
Outside CAZ	76.4	60.7	80.3

1. For the purpose of this test, the ORR has been defined as (clockwise from Colton): M1, M62, M621, A6110, A647 and A6120. These roads are deemed the most appropriate diversion route for non-compliant vehicles and are therefore excluded from the CAZ. The M621 between Junction 1 (A6110) and Junction 8 (M1) has been included within the CAZ.

2. Throughout this report the analysis is presented in various ways. Tables and graphs either contain direct outputs from the transport model or adjusted outputs that reflect existing traffic levels and how well the model reproduces them. The former are all labelled as Modelled the latter as Forecast. When it comes to understanding the percentage changes in traffic levels the Forecast data is regarded as being more robust. Both the Modelled and Forecast data are based on AADT estimates, with local factors applied to both traffic counts and model outputs to generate these. In addition, network plots of changes in modelled flows are also included – these are based on modelled 12 hour weekday flows.

3. Analysis of the model results indicates that there have been a few perverse outcomes, caused by the way the charges are applied in the Saturn highway model. In some locations non-compliant flows have increased within the CAZ. It is thought that these are trips that start and finish within the CAZ area, but in the DM test utilised the ORR for part of their journey. The way the charges are applied means that these trips effectively pay double to follow these routes and therefore divert to make their full journey within the CAZ. There is no apparent way to rectify this within the options available in the Saturn software.

[1] Annual Average Daily Traffic

Review of roads with increased traffic

4. The following plots show the modelled changes in flows from a 2020 Do Minimum situation. All changes in cars, LGV and HGV are in vehicles.

5. The impact of the ORR CAZ D has a relatively small effect upon total traffic levels. Figure 1 shows the roads where an increase of 250 or more vehicles is forecast in either direction of travel over the 12 hour weekday.

6. Roads outside the CAZ that are attracting diverted traffic include the M62; the A62/Town St/Gildersome La/Back La/Tong Rd route between the M62 at Gildersome and the A6110; the A6120 N of Dawson's Corner; Wide La, Morley; Elland Rd N of the A6110; and the M1 to the east of Leeds.

7. Only the M62, part of the A58 and Elland Rd are affected by a greater increase than 500 vehicles - see Figure 2. The M62, is acting as a diversion route for the M621, and Elland Rd between the A6110 and M621 Jn 2 has been affected most by the para 4 issues.

Figure 1 – Total traffic – increase of 250 or more vehicles (12 hour)

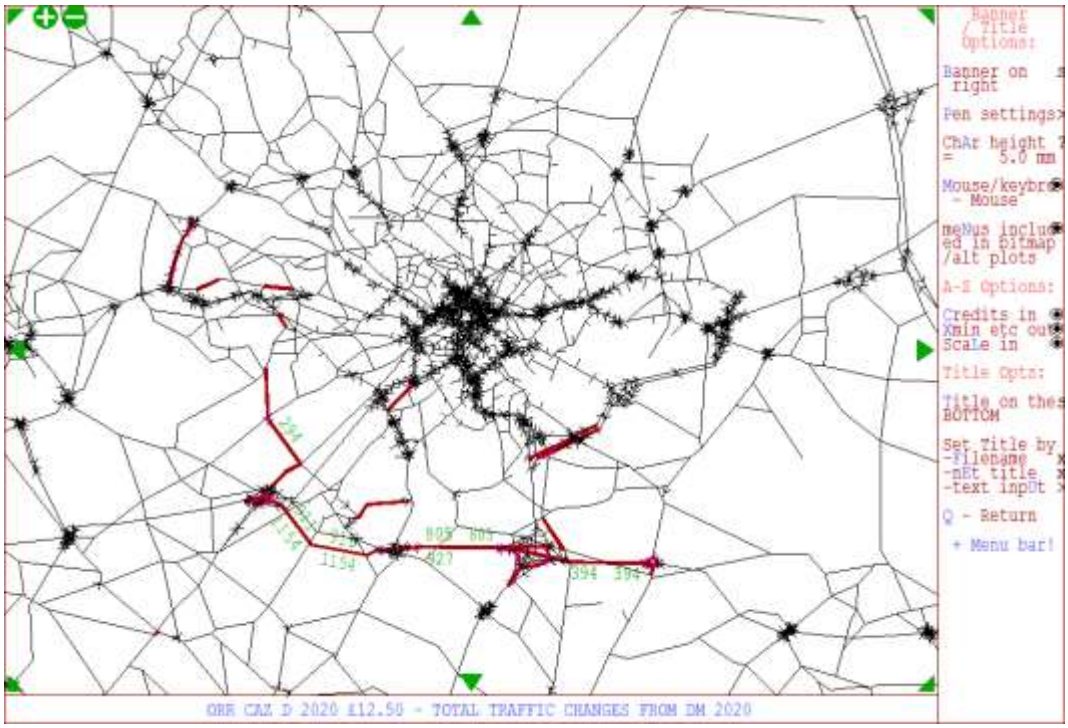
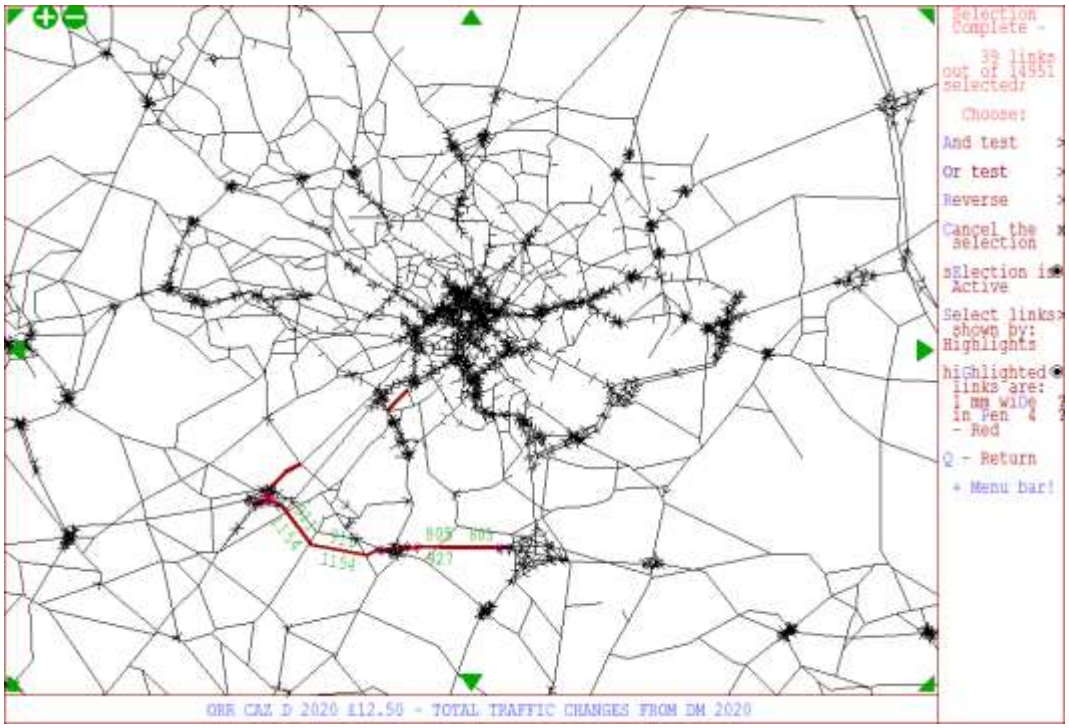


Figure 2 – Total traffic – increase of 500 or more vehicles (12 hour)



8. The increases on these routes tend to comprise non-compliant vehicles – Figures 3-5 shows the changes in non-compliant cars, LGVs and HGVs.

Figure 3 – Non-compliant Car – increase of 500 or more vehicles (12 hour)

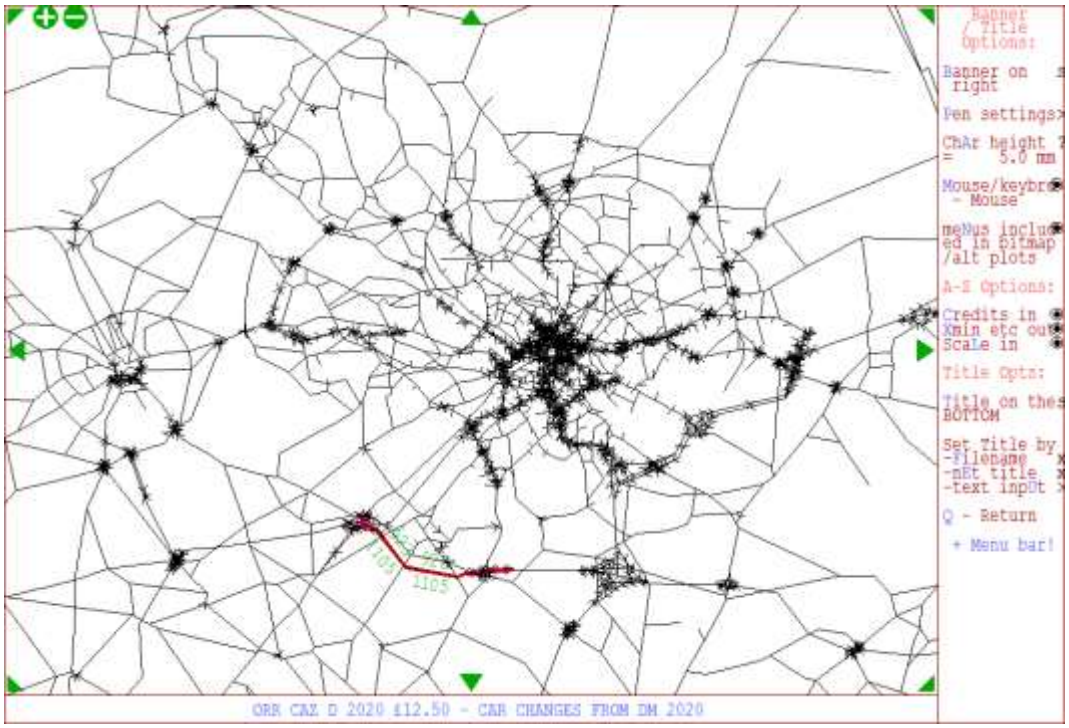


Figure 4 – Non-compliant LGV – increase of 250 or more vehicles (12 hour)

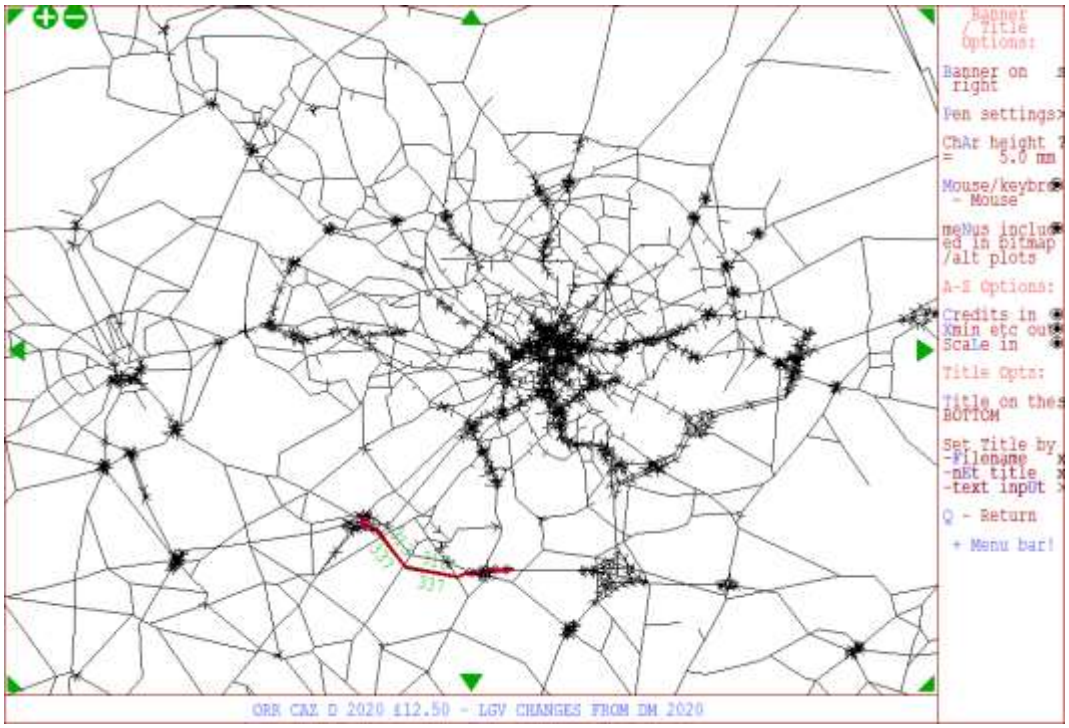
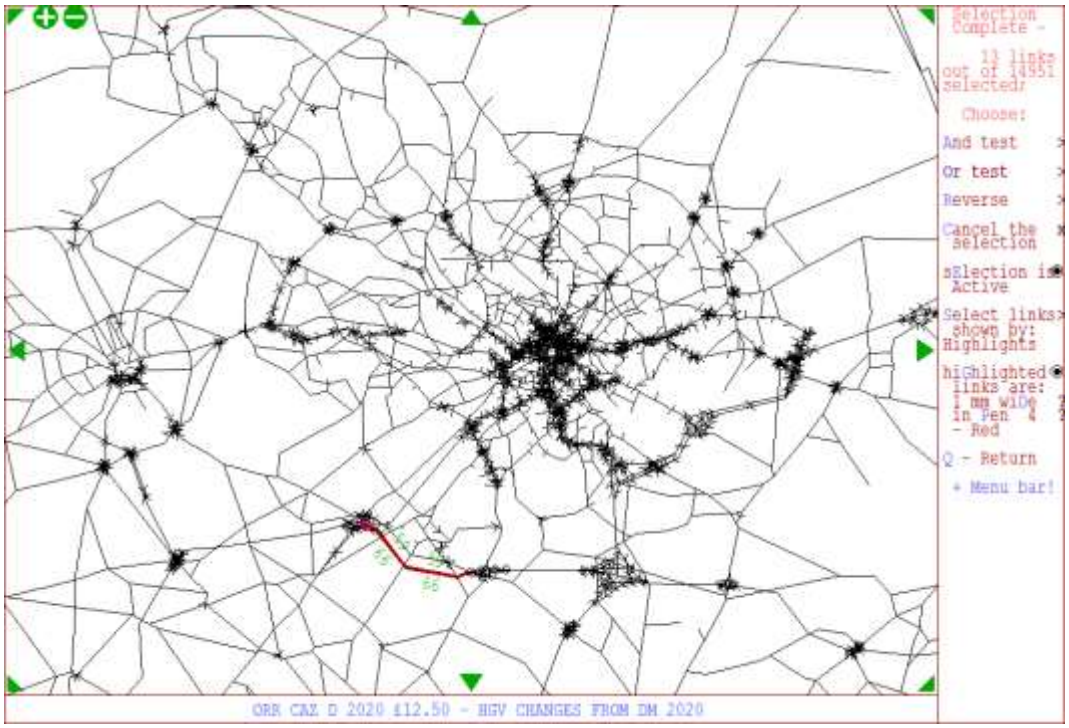
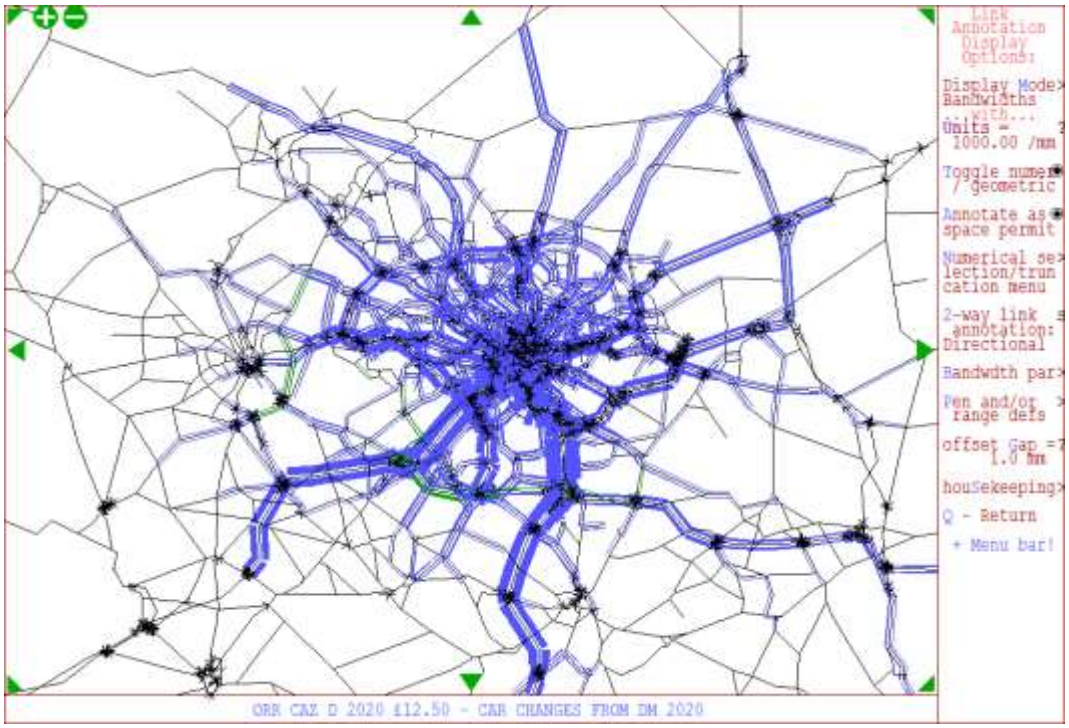


Figure 5 – Non-compliant HGV – increase of 50 or more vehicles (12 hour)



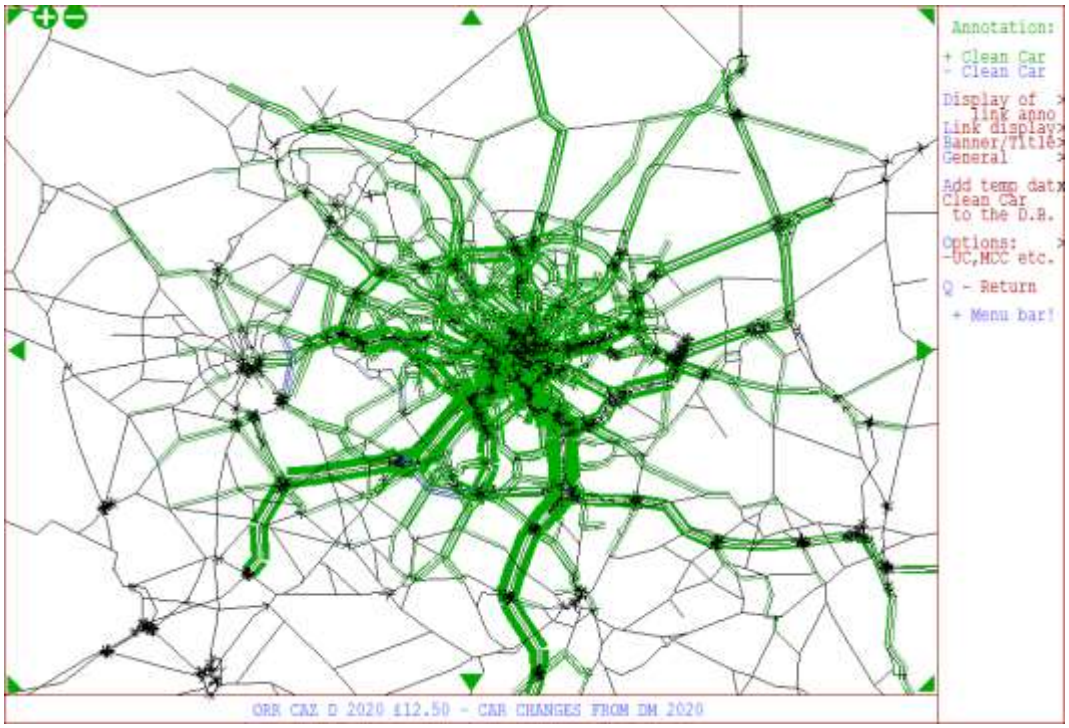
9. The scale of coverage of the ORR CAZ is such that this has a widespread impact on reducing non-compliant traffic levels over a much wider area than that covered by the scheme. As Figures 6 and 7 demonstrate all radial routes, the motorway network and the outer ring road itself all benefit from a switch to compliant cars. A similar situation applies to LGVs and HGVs.

Figure 6 – Non-compliant Cars – changes from DM 2020 (12 hour)



Note: Green = increase, blue = decrease

Figure 7 – Compliant Cars – changes from DM 2020 (12 hour)



Note: Green = increase, blue = decrease

10. The scale of increase on most of the roads outside the CAZ is modest, with the greatest numerical change occurring on the M62. Here, the two way 12 hr weekday traffic flow is modelled as rising by just over 2,000 pcus between Jn 27 (Gildersome) and 28 (Tingley) and

by over 1,800 between Jn 28 and 29 (Lofthouse). This compares with DfT counts showing an AADT of around 120,000 vehicles between Jn 27 and Jn 29[2].

11. The Gildersome La route between Jn 27 and the A6110 attracts around 1,100 additional pcus to the A62 (12 hr weekday), around 400-560 to Gildersome La, Back La, Tong Rd, Gamble La and Wood La. In contrast, surveys in 2015 recorded 7,600 vehicles (12 hr 2 way) on Gildersome La[3] and 11,000 on Tong Rd[4].

12. Given that the ORR CAZ does not affect the A6110 west of the M621 it is not fully clear why the model is re-routing traffic onto this section of the network, though this may be associated with through trips that in the DM continue along the M621 (east) or the A6110/A653 for example that are switching onto the M62.

13. With regards to the routes outside Leeds District, the flow changes cannot be taken as necessarily representative as the model is not validated in this area. However, the modelled level of change is 300 or fewer additional pcus (12 hr weekday) on the M606, A6177 Rooley La and the A658 at Apperley Bridge. DfT survey data indicates that the AADT flow on the A658 here is around 20,000[5].

14. Within Kirklees the flow increases are 100-300 pcus. As with the Gildersome La route, it is not fully clear why these roads should attract diverted traffic and it may be the net result of some wider reassignment.

15. It is clear, therefore, that the significant issues with displaced traffic that apply with an IRR CAZ do not apply when the boundary is extended out to the outer ring road.

16. As a comparator with an IRR CAZ, Table 2 shows the impact of the ORR CAZ D on the minor roads affected by the former. This has utilised observed traffic levels together with the forecasts changes in the model to arrive at an estimated change in overall traffic arising from the ORR CAZ. The changes are without exception very marginal and also apply to LGV and HGV levels – see Appendix A.

Table 2 – Forecast Change in Traffic Levels on Routes affected by an IRR CAZ

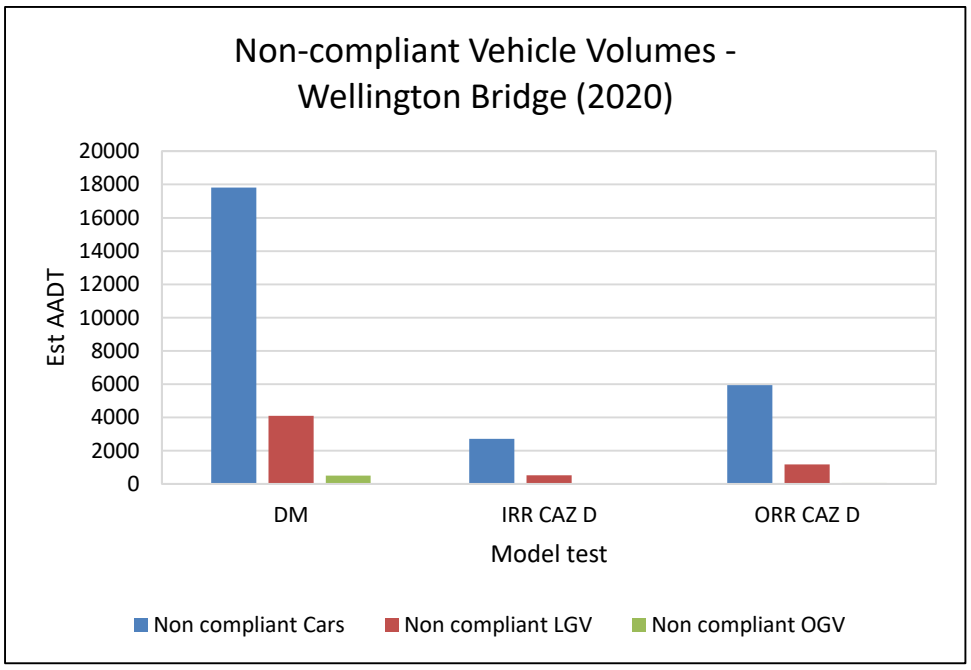
Road	Observed	Modelled AADT			Estimated 2020 AADT			
	Est AADT 2015	Base 2015	DM 2020	CAZ 2020	DM 2020	CAZ 2020	Change	%age change
Torre Rd	7000	3392	3537	3537	7145	7145	0	0%
Lincoln Green Rd	9900	5752	6288	6269	10436	10417	-19	0%
Woodhouse St	8400	8552	9104	9064	8952	8912	-40	0%
Hyde Park Rd	5800	8447	8847	8866	6200	6219	19	0%
Woodsley Rd	5800	6505	6571	6555	5866	5850	-16	0%
Canal Rd	13100	16068	16865	16782	13897	13814	-83	-1%
Town St	10300	13012	13197	13273	10485	10561	76	1%
Upper Wortley Rd	10700	11321	11681	11748	11060	11127	67	1%

[2] Jn 27-28: CP 6055; Jn28-29: CP 36055 (2015)
[3] TAD 1634 site 60
[4] TAD 1634 site 72
[5] A658: CP 81393 (2015)

17. In contrast, the fact that traffic is not being diverted off the inner ring road onto these minor roads means that the reduction in non-compliant vehicles is significantly less and therefore the effect upon air quality is also likely to be much more limited.

18. Figure 7 shows the modelled changes in non-compliant vehicles on the inner ring road at Wellington Bridge. With the ability of vehicles to divert, the IRR CAZ delivers an 85-92% reduction in non-compliant vehicles compared with the ORR CAZ where the reduction is only around 67% (cars), 71% (LGV) and 88% (HGV).

Figure 7 – Modelled Levels of Non-compliant Vehicles – Leeds IRR



19. Table 4 shows the modelled changes in traffic on the routes affected by diverted traffic under the ORR CAZ.

20. Comprehensive up to date classified counts are not available to assess the current levels of LGVs and HGVs on these routes, however, the use of a number of historic counts has enabled a broad brush assessment of the forecast changes. The overall flow changes are modest.

21. Overall traffic levels are forecast to rise by 9% on Gildersome La and 5% on Tong Rd. Higher LGV (18%) and HGV (10%) increases are forecast for Gildersome La, though on Tong Rd they are more in one with the overall increase.

22. The changes in the levels of compliant and non-compliant vehicles is mixed, with the former increasing on Tong Rd and the latter on Gildersome La. This indicates that these modelled changes are likely to be as much about the effects of small changes in journey times causing a reassignment rather than a genuine impact of the CAZ.

Table 4 – Forecast Change in Traffic Levels on Routes with Diverted Traffic under ORR CAZ D

Road	Observed	Modelled AADT			Estimated 2020 AADT			
	Est AADT 2015	Base 2015	DM 2020	CAZ 2020	DM 2020	CAZ 2020	Change	%age change
A6120 Ring Rd Farsley	23013	22186	24216	24656	25043	25483	440	2%
Gildersome La	6800	6438	6798	7439	7160	7801	641	9%
Tong Rd	11000	11348	11812	12329	11464	11981	517	5%
M62 Jn 27-28	120237	118458	136070	138424	137849	140203	2354	2%
M62 Jn 28-29	122710	134005	154704	156679	143409	145384	1975	1%

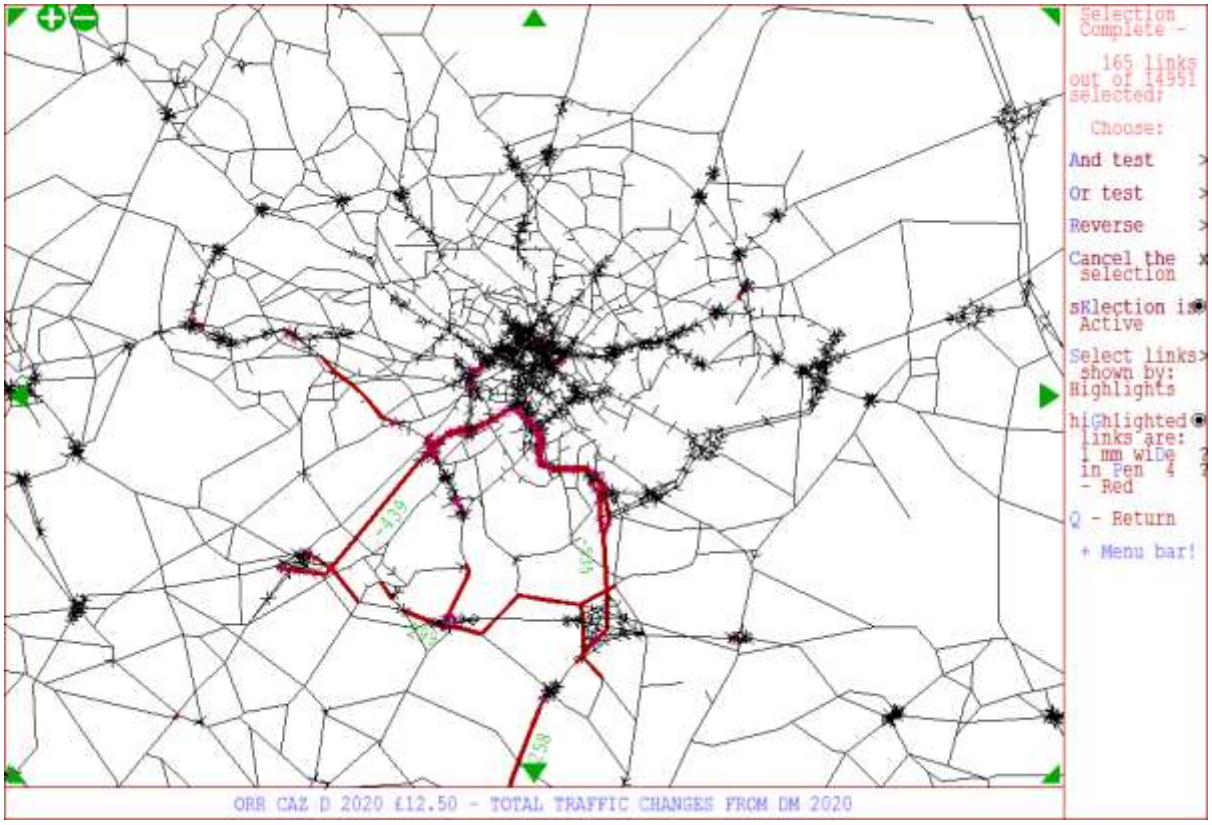
Review of roads with reduced traffic

23. Figure 8 shows the parts of the highway network where the overall volume of traffic is forecast to fall by 250 or more vehicles per 12 hour weekday with an ORR CAZ D. The effect is concentrated upon the A647/A6110, the M621, the A650, parts of the IRR and the A64.

24. An element of these changes (the A647/A6110 and the fall on the A650 and A653 around Jn 28 (Tingley)) is associated with the issue raised in paragraph 4. However, the effect of through trips previously using the A6110/M621 or A6110/A653 re-assigning out of the CAZ is clear to see.

25. The scale of change here is greatest on the M621/M1 between Jn 1 and the M62 at Lofthouse, with flows down by around 1000-1200 vehicles (12 hr 2 way), which is a very minor change compared with the total volume of daily traffic on this route.

Figure 8 – Total traffic – decrease of 250 or more vehicles (12 hour)



Conclusions

26. In summary, an ORR CAZ D would avoid the significant level of traffic re-assignment associated with an IRR CAZ, in particular there would be no diversion of non-compliant vehicles from the IRR onto unsuitable minor roads to the north and west of the city centre.

27. Outside the ORR, the model tests indicate that there would be some diversion of both compliant and non-compliant vehicles, although the volumes concerned are significantly less than with an IRR CAZ.

28. Routes affected by this reassignment include the M606/A6177/A658 route across Bradford; the M62; the A62/Town St/Gildersome La/Back La/Tong Rd route between the M62 at Gildersome and the A6110; the A651/B6122/A638 route between Birkenshaw and Dewsbury and the M1 to the east of Leeds.

29. Of these, Gildersome La is forecast to attract an additional 9% vehicles, 18% more LGVs and 10% more HGVs, with the other routes in Leeds having a much smaller increase. Given that the A6110 remains available for non-compliant vehicles it is considered that this re-assignment is unlikely to occur in practise and is attributable to small changes in journey times in the model causing trips to divert.

APPENDIX A

Table A1 – Forecast Changes in LGV volumes – minor roads to north and west of city centre

Road	Observed	Modelled AADT			Estimated 2020 AADT			
	Est AADT 2015	Base 2015	DM 2020	CAZ 2020	DM 2020	CAZ 2020	Change	%age change
Torre Rd	590	235	264	264	619	619	0	0%
Lincoln Green Rd	770	387	448	448	831	831	0	0%
Woodhouse St	820	736	800	799	884	883	-1	0%
Hyde Park Rd	500	588	625	624	537	536	-1	0%
Woodsley Rd	370	481	525	524	414	413	-1	0%
Canal Rd	980	1210	1330	1321	1100	1091	-9	-1%
Town St	890	1072	1142	1160	960	978	18	2%
Upper Wortley Rd	1030	1208	1350	1328	1172	1150	-22	-2%

Note: 2015 observed AADT estimated from 2017 MCC

Table A2 – Forecast Changes in HGV volumes – minor roads to north and west of city centre

Road	Observed	Modelled AADT			Estimated 2020 AADT			
	Est AADT 2015	Base 2015	DM 2020	CAZ 2020	DM 2020	CAZ 2020	Change	%age change
Torre Rd	170	28	32	33	174	175	1	1%
Lincoln Green Rd	170	66	63	64	167	168	1	1%
Woodhouse St	140	101	104	104	143	143	0	0%
Hyde Park Rd	100	89	91	91	102	102	0	0%
Woodsley Rd	80	83	83	83	80	80	0	0%
Canal Rd	310	291	287	287	306	306	0	0%
Town St	220	261	268	269	227	228	1	0%
Upper Wortley Rd	290	292	308	305	306	303	-3	-1%

Note: 2015 observed AADT estimated from 2017 MCC

Table A3 – Forecast Changes in LGV volumes – routes attracting more traffic

Road	Observed	Modelled AADT			Estimated 2020 AADT			
	Est AADT 2015	Base 2015	DM 2020	CAZ 2020	DM 2020	CAZ 2020	Change	%age change
A6120 Ring Rd Farsley	3738	1890	2184	2261	4032	4109	77	2%
Gildersome La	970	644	740	929	1066	1255	189	18%
Tong Rd	1200	1052	1168	1241	1316	1389	73	6%
M62 Jn 27-28	19786	11324	13521	14221	21983	22683	700	3%
M62 Jn 28-29	17596	12984	15982	16429	20594	21041	447	2%

Note: 2015 observed AADT estimated from 2015 MCC

Table A4 – Forecast Changes in HGV volumes – routes attracting more traffic

Road	Observed	Modelled AADT			Estimated 2020 AADT			
	Est AADT 2015	Base 2015	DM 2020	CAZ 2020	DM 2020	CAZ 2020	Change	%age change
A6120 Ring Rd Farsley	579	270	251	278	560	587	27	5%
Gildersome La	250	262	278	305	266	293	27	10%
Tong Rd	340	342	349	366	347	364	17	5%
M62 Jn 27-28	20818	9069	9436	9511	21185	21260	75	0%
M62 Jn 28-29	19690	10595	11010	11086	20105	20181	76	0%

Note: 2015 observed AADT estimated from 2015 MCC

Table A5 – Modelled changes in traffic volumes – routes attracting more traffic

2020 estimated AADT with ORR CAZ D												
Road			Compliant			Non compliant				Total		
	Anode Bnode	AADT	Cars	LGV	OGV	Cars	LGV	OGV	PSV	Cars	LGV	OGV
A6120 Ring Rd Farsley		24656	18017	1657	226	4100	604	52	0	22117	2261	278
Gildersome La		7439	4352	574	253	1751	355	52	102	6103	929	305
Tong Rd		12329	8812	924	331	1756	317	35	154	10568	1241	366
M62 Jn 27-28		138424	85526	8317	7537	29166	5904	1974	0	114692	14221	9511
M62 Jn 28-29		156679	99081	10326	8996	30083	6103	2090	0	129164	16429	11086
Change from 2020 DM												
Road			Compliant			Non compliant				Total		
	Anode Bnode	AADT	Cars	LGV	OGV	Cars	LGV	OGV	PSV	Cars	LGV	OGV
A6120 Ring Rd Farsley		440	1373	331	24	-1037	-254	3	0	336	77	27
Gildersome La		641	14	125	30	411	64	-3	0	425	189	27
Tong Rd		517	1065	215	51	-638	-142	-34	0	427	73	17
M62 Jn 27-28		2354	-887	110	-40	2466	590	115	0	1579	700	75
M62 Jn 28-29		1975	1510	625	155	-58	-178	-79	0	1452	447	76
Percentage change from 2020 DM												
Road			Compliant			Non compliant				Total		
	Anode Bnode	AADT	Cars	LGV	OGV	Cars	LGV	OGV	PSV	Cars	LGV	OGV
A6120 Ring Rd Farsley		2%	8%	25%	12%	-20%	-30%	6%	0%	2%	4%	11%
Gildersome La		9%	0%	28%	13%	31%	22%	-5%	0%	7%	26%	10%
Tong Rd		4%	14%	30%	18%	-27%	-31%	-49%	0%	4%	6%	5%
M62 Jn 27-28		2%	-1%	1%	-1%	9%	11%	6%	0%	1%	5%	1%
M62 Jn 28-29		1%	2%	6%	2%	0%	-3%	-4%	0%	1%	3%	1%

Note: Model flow validation is variable across these routes and the results must be taken as indicative only.

Table A6 – Modelled changes in traffic volumes – city centre cordons

Two way flow changes from DM 2020												
			Compliant			Non compliant				Total		
Summary		AADT	Cars	LGV	OGV	Cars	LGV	OGV	PSV	Cars	LGV	OGV
Cordon on approaches to IRR												
DM 2020		661,310	428,269	42,539	16,272	132,323	27,544	3,992	10,371	560,592	70,083	20,264
ORR CAZ D 2020		657,907	512,235	60,944	19,509	45,864	8,457	525	10,373	558,099	69,401	20,034
IRR Cordon Changes		-3,403	83,966	18,405	3,237	-86,459	-19,087	-3,467	2	-2,493	-682	-230
Percentage change		-0.5%	19.6%	43.3%	19.9%	-65.3%	-69.3%	-86.8%	0.0%	-0.4%	-1.0%	-1.1%
Cordon within IRR												
DM 2020		337,221	220,496	19,243	5,891	68,117	12,462	1,450	9,562	288,613	31,705	7,341
ORR CAZ D 2020		336,885	264,137	27,711	6,833	24,497	3,940	202	9,565	288,634	31,651	7,035
Within IRR Changes		-336	43,640	8,468	942	-43,619	-8,522	-1,248	3	21	-54	-306
Percentage change		-0.1%	19.8%	44.0%	16.0%	-64.0%	-68.4%	-86.1%	0.0%	0.0%	-0.2%	-4.2%

Table A7 – Modelled changes in traffic volumes – IRR

2020 estimated AADT with ORR CAZ D												
Road			Compliant			Non compliant				Total		
	Anode Bnode	AADT	Cars	LGV	OGV	Cars	LGV	OGV	PSV	Cars	LGV	OGV
IRR Lovell Park Br		60208	48956	4887	1421	4265	641	38	0	53221	5528	1459
IRR Woodhouse tunnel		76711	61449	7454	1465	5330	975	38	0	66779	8429	1503
IRR Wellington Br		89075	69200	9077	2500	5936	1175	63	1124	75136	10252	2563
A643 Ingram		57828	43050	6889	1952	4677	1192	68	0	47727	8081	2020
M621 Jn 2 - 2a		72474	56156	7796	3591	3779	849	74	229	59935	8645	3665
M621 Jn 2a - 3		88695	67564	9979	4452	5132	1230	109	229	72696	11209	4561
M621 Jn 3 - 4		71151	53331	8714	3839	4069	1103	95	0	57400	9817	3934
John Smeaton Viaduct		33903	26577	3053	1544	2284	406	39	0	28861	3459	1583
IRR East Street		31152	25520	2299	719	2188	304	20	102	27708	2603	739
B6154 Wellington Rd		17728	13513	1625	230	1350	237	6	767	14863	1862	236
Change from 2020 DM												
Road			Compliant			Non compliant				Total		
	Anode Bnode	AADT	Cars	LGV	OGV	Cars	LGV	OGV	PSV	Cars	LGV	OGV
IRR Lovell Park Br		-433	8059	1460	247	-8371	-1578	-250	0	-312	-118	-3
IRR Woodhouse tunnel		-455	10190	2252	258	-10504	-2393	-258	0	-314	-141	0
IRR Wellington Br		-576	11531	2741	409	-11880	-2927	-450	0	-349	-186	-41
A643 Ingram		-177	6467	2018	274	-6630	-1962	-344	0	-163	56	-70
M621 Jn 2 - 2a		-1323	9576	2372	656	-10618	-2663	-646	0	-1042	-291	10
M621 Jn 2a - 3		-1302	11276	3023	739	-12265	-3274	-801	0	-989	-251	-62
M621 Jn 3 - 4		-1367	8736	2569	614	-9713	-2876	-697	0	-977	-307	-83
John Smeaton Viaduct		-337	4255	956	290	-4617	-952	-269	0	-362	4	21
IRR East Street		-370	4119	687	118	-4427	-740	-127	0	-308	-53	-9
B6154 Wellington Rd		-13	2146	497	40	-2161	-494	-41	0	-15	3	-1
Percentage change from 2020 DM												
Road			Compliant			Non compliant				Total		
	Anode Bnode	AADT	Cars	LGV	OGV	Cars	LGV	OGV	PSV	Cars	LGV	OGV
IRR Lovell Park Br		-1%	20%	43%	21%	-66%	-71%	-87%	0%	-1%	-2%	0%
IRR Woodhouse tunnel		-1%	20%	43%	21%	-66%	-71%	-87%	0%	0%	-2%	0%
IRR Wellington Br		-1%	20%	43%	20%	-67%	-71%	-88%	0%	0%	-2%	-2%
A643 Ingram		0%	18%	41%	16%	-59%	-62%	-83%	0%	0%	1%	-3%
M621 Jn 2 - 2a		-2%	21%	44%	22%	-74%	-76%	-90%	0%	-2%	-3%	0%
M621 Jn 2a - 3		-1%	20%	43%	20%	-71%	-73%	-88%	0%	-1%	-2%	-1%
M621 Jn 3 - 4		-2%	20%	42%	19%	-70%	-72%	-88%	0%	-2%	-3%	-2%
John Smeaton Viaduct		-1%	19%	46%	23%	-67%	-70%	-87%	0%	-1%	0%	1%
IRR East Street		-1%	19%	43%	20%	-67%	-71%	-86%	0%	-1%	-2%	-1%
B6154 Wellington Rd		0%	19%	44%	21%	-62%	-68%	-87%	0%	0%	0%	0%

Note: Model flow validation is variable across these routes and the results must be taken as indicative only.