

**Appendix F Summary of Traffic Changes Arising from ORR CAZ C 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<sup>1</sup>) traffic flows arising with the implementation of a Clean Air Zone covering Leeds within the Outer Ring Road and applying to HGVs and LGVs (taxis are not modelled separately within the Leeds Transport Model and buses are modelled as a fixed demand based on existing routes).
2. This is based on the following assumptions:
  - LGV and HGV included but not cars
  - Daily charges of £12.50 (LGV) and £100 (HGV) for non-compliant vehicles
  - No suppression of non-compliant trips
  - Assumed compliance levels (%):

**Table 1**

2020	Car	LGV	HGV
Within CAZ	76.4	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.

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<sup>1</sup> 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 LGV and HGV are in vehicles.
5. The impact of the ORR CAZ C has a lesser effect upon LGV traffic across Leeds than the IRR CAZ C and much of the impact is associated with the issues raised in para 4. Figure 1 shows the roads where an increase of 50 or more LGV's is forecast in either direction of travel over the 12 hour weekday.
6. Aside from increased usage of the A6120, roads outside the CAZ that are attracting diverted traffic include the M606/A6177/A658 route across Bradford; the M62; the A58 from Drighlington to Back La; 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.
7. Only the M62 is affected by a greater increase than 300 LGVs - see Figure 2 – due to its use as a diversion route for vehicles previously using the M621.

**Figure 1 - LGV – increase of 50 or more vehicles (12 hour)**

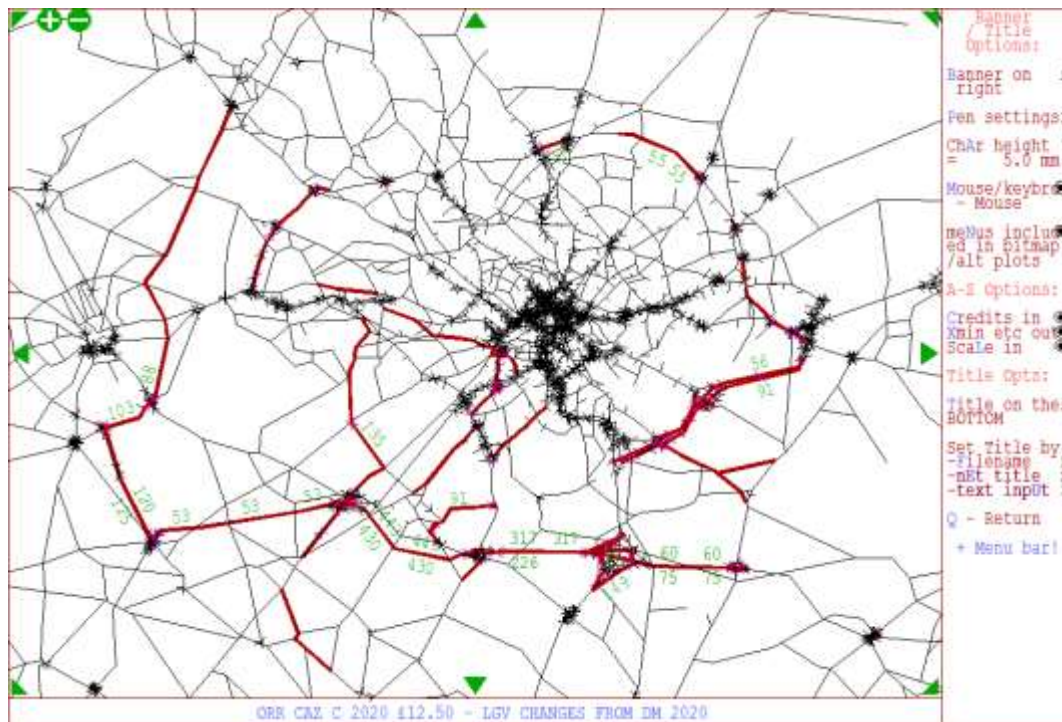
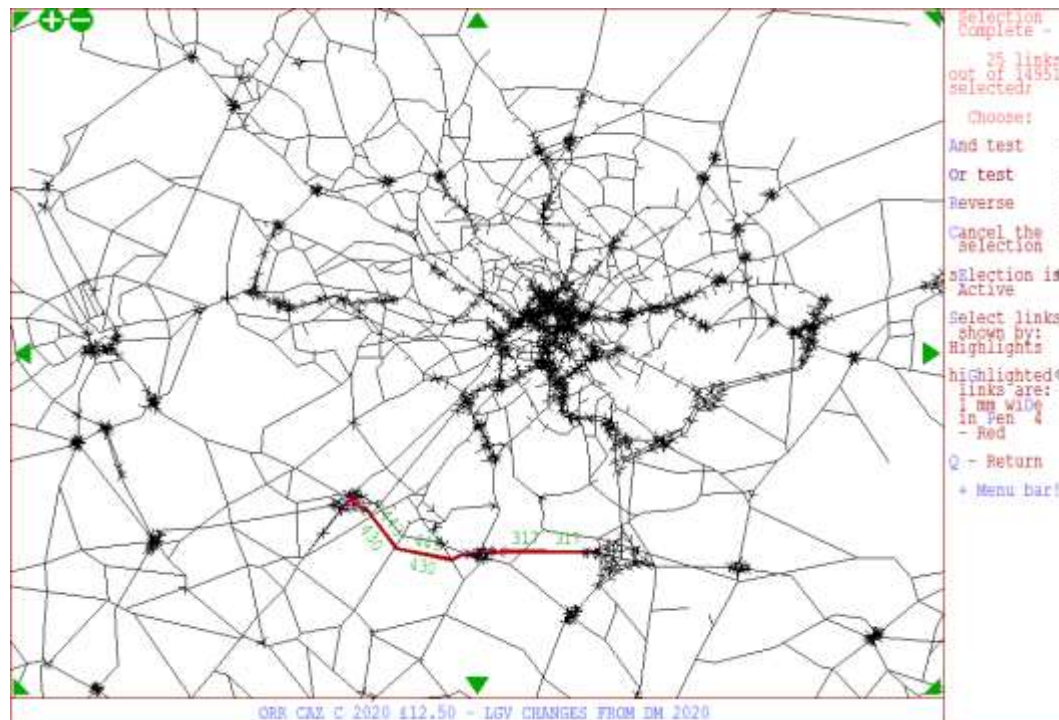


Figure 2 - LGV – increase of 300 or more vehicles (12 hour)



8. Figures 3-5 provide more detail of these forecasts. On the basis of the assignment effect noted in paragraph 4, it is considered that the forecast changes within the CAZ itself are unlikely to materialise on the grounds that any charging regime would have a single daily charge for travel within the CAZ, allowing vehicles to pass in and out of the zone without incurring additional costs. Reassignment is therefore very unlikely to occur.
9. 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 LGV flow is modelled as rising by almost 900 vehicles between Jn 27 (Gildersome) and 28 (Tingley) and by over 500 between Jn 28 and 29 (Lofthouse). This compares with DfT counts showing an LGV AADT of around 19,000 between Jn 27 and Jn 29<sup>2</sup>.
10. The Gildersome La route between Jn 27 and the A6110 attracts around 340 additional LGVs to the A62 (12 hr weekday), around 200 to Gildersome La and Back La and around 100 to Tong Rd/Gamble La/Wood La. In contrast, surveys in 2015 recorded 1,070 LGV (12 hr 2 way) on Gildersome La<sup>3</sup> and 1,320 on Tong Rd<sup>4</sup>.
11. 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.

<sup>2</sup> Jn 27-28: CP 6055 – average of 18,800 (2014-16 flows); Jn28-29: CP36055 – average of 19,400

<sup>3</sup> TAD 1634 site 60

<sup>4</sup> TAD 1634 site 61

Figure 3 - LGV – increase of 50 or more vehicles (12 hour) – west of city centre

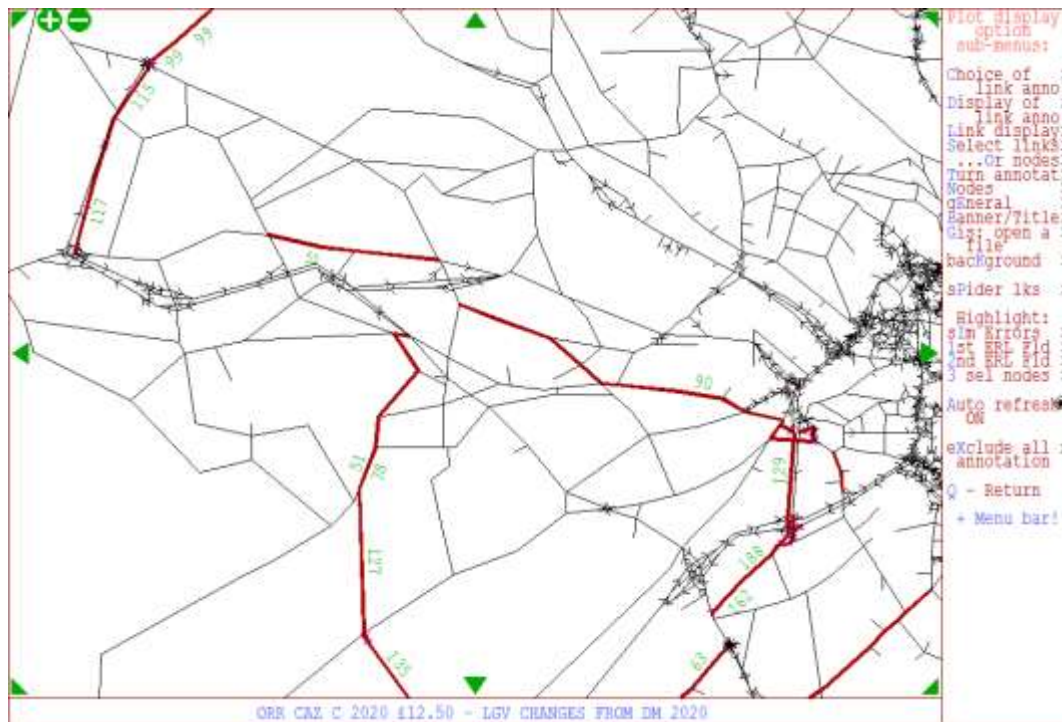
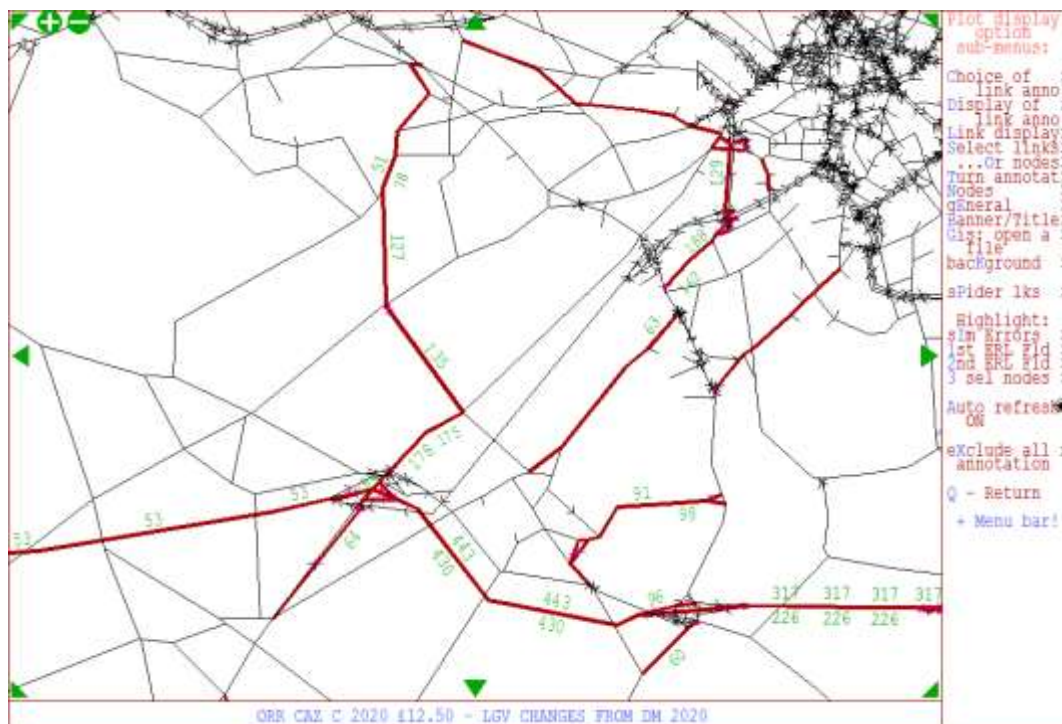


Figure 4 - LGV – increase of 50 or more vehicles (12 hour) – southwest of city centre

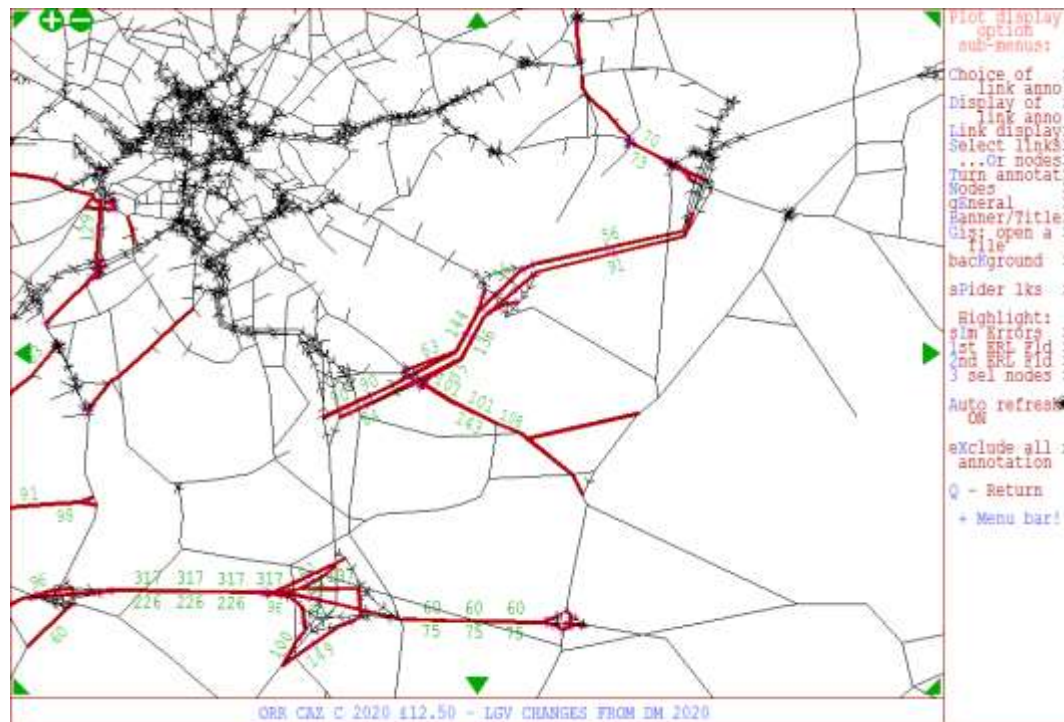


12. The modelled increase in LGV on the M1 east of Leeds is around 280 LGV, substantially below the observed current usage of this motorway (14,000 LGV AADT<sup>5</sup>).

<sup>5</sup> M1 jn 44-45: CP 99547 - average 13,800 LGV AADT (2014-16)



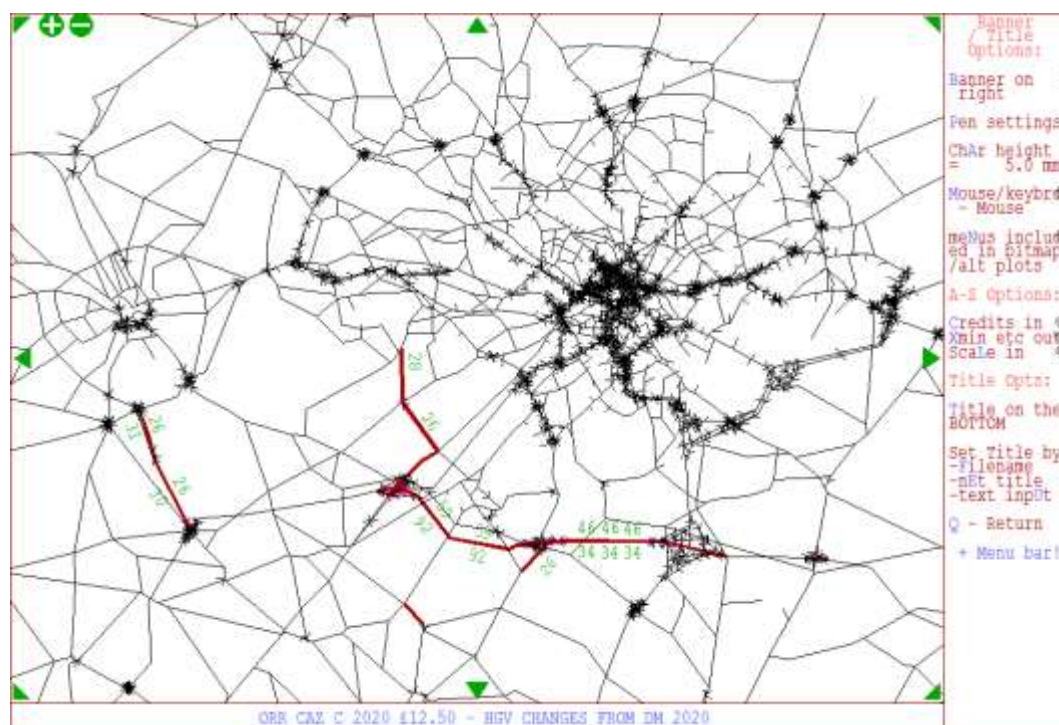
Figure 5 - LGV – increase of 50 or more vehicles (12 hour) – southeast of city centre



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 level of change is under 300 additional LGV (12 hr weekday) on the M606, under 200 on A6177 Rooley La and around 100 on the A658 at Apperley Bridge. DfT survey data indicates that the AADT LGV flow on the A658 here is around 2,400<sup>6</sup>.
14. Within Kirklees the flow increases are 60-80 LGVs. 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. When it comes to HGVs, the proportion of these vehicles in the overall traffic mix is markedly lower than LGVs, and the forecast level of compliance by 2020 higher (Table 1). Consequently, the flow changes arising from the ORR CAZ C test are lower. Figure 6 shows the parts of the Leeds network where a forecast increase of 25 or more vehicles in either direction of travel is forecast.

<sup>6</sup> A658: CP 81393 – 2,400 LGV (2014-16 average)

Figure 6 - HGV – increase of 25 or more vehicles (12 hour)



16. Again, the routes attracting the bulk of displaced traffic are the same roads affected by the additional LGVs. The additional flow on the M62 is between 80 HGV east of Jn 28 (Tingley) and 150 to the west (12 hr 2 way vehs). A smaller volume is modelled as being displaced onto the M606 (55) and Town St/Gildersome La (35). The traffic count on Gildersome La referred to earlier recorded a 12 hr 2 way HGV flow of 266 vehicles.
17. It is clear, therefore, that the significant issues with displaced traffic that apply with an IRR CAZ C do not apply when the boundary is extended out to the outer ring road.
18. As a comparator with the IRR CAZ C, Table 2 shows the impact of the ORR CAZ C on the minor roads adversely affected by an IRR CAZ. 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. Table 3 shows the impact on LGV levels. The changes are without exception very marginal.

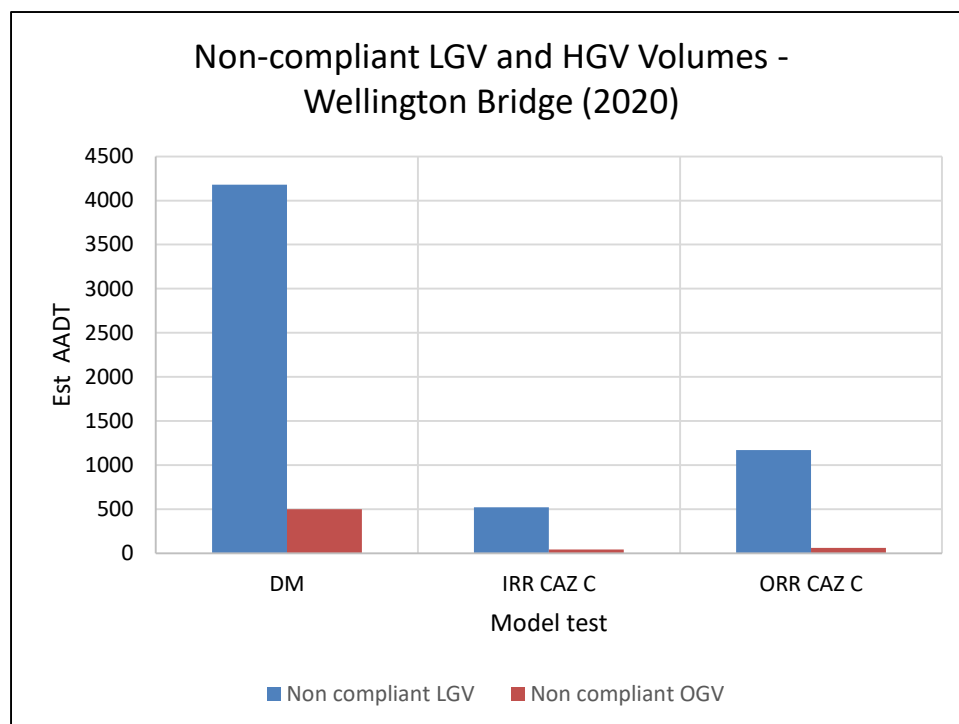
Table 2 – Forecast Change in Traffic Levels on Routes adversely affected by an IRR CAZ C

Road	Observed	Modelled AADT			Estimated 2020 AADT		Change	%age change
	Est AADT 2015	Base 2015	DM 2020	CAZ 2020	DM 2020	CAZ 2020		
Torre Rd	7000	3370	3570	3568	7200	7198	-2	0%
Lincoln Green Rd	9900	6909	7551	7547	10542	10538	-4	0%
Woodhouse St	8400	8872	9119	9113	8647	8641	-6	0%
Hyde Park Rd	5800	9240	9349	9343	5909	5903	-6	0%
Woodsley Rd	5800	6713	6785	6802	5872	5889	17	0%
Canal Rd	13100	16831	17533	17509	13802	13778	-24	0%
Town St	10300	12641	13015	13021	10674	10680	6	0%
Upper Wortley Rd	10700	11310	11859	11865	11249	11255	6	0%

**Table 3 – Forecast Change in LGV Levels on Routes adversely affected by an IRR CAZ C**

Road	Observed	Modelled AADT			Estimated 2020 AADT		Change	%age change
	Est AADT 2015	Base 2015	DM 2020	CAZ 2020	DM 2020	CAZ 2020		
Torre Rd	590	233	265	262	622	619	-3	0%
Lincoln Green Rd	770	393	470	470	847	847	0	0%
Woodhouse St	820	731	797	797	886	886	0	0%
Hyde Park Rd	500	571	623	629	552	558	6	1%
Woodsley Rd	370	471	512	514	411	413	2	0%
Canal Rd	980	1134	1297	1295	1143	1141	-2	0%
Town St	890	978	1098	1107	1010	1019	9	1%
Upper Wortley Rd	1030	1216	1357	1318	1171	1132	-39	-3%

19. 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.
20. Figure 7 shows the modelled changes in non-compliant LGV and HGV on the inner ring road at Wellington Bridge. With the ability of vehicles to divert, the IRR CAZ C delivers a substantial reduction in non-compliant vehicles (88% LGV, 91% HGV) compared with the ORR CAZ where the reduction is only 72% (LGV) although for HGV it is higher at 88%.

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

21. Table 4 shows the modelled changes in traffic on the routes affected by diverted traffic under the ORR CAZ C.
22. 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 very modest.

23. Overall LGV levels are forecast to rise by 20% on Gildersome La and HGV levels by 13% - see Appendix A. For LGVs this represents an increase in both compliant and non-compliant vehicles, while for HGVs the increase is entirely associated with more compliant vehicles. This again suggests that these changes are more to do with fluctuations in the model assignment as the A6110 remains an options for all vehicles.
24. Changes on the A6120 and Tong Rd are also predominantly attributable to a switch in compliant vehicles rather than non-compliant.

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

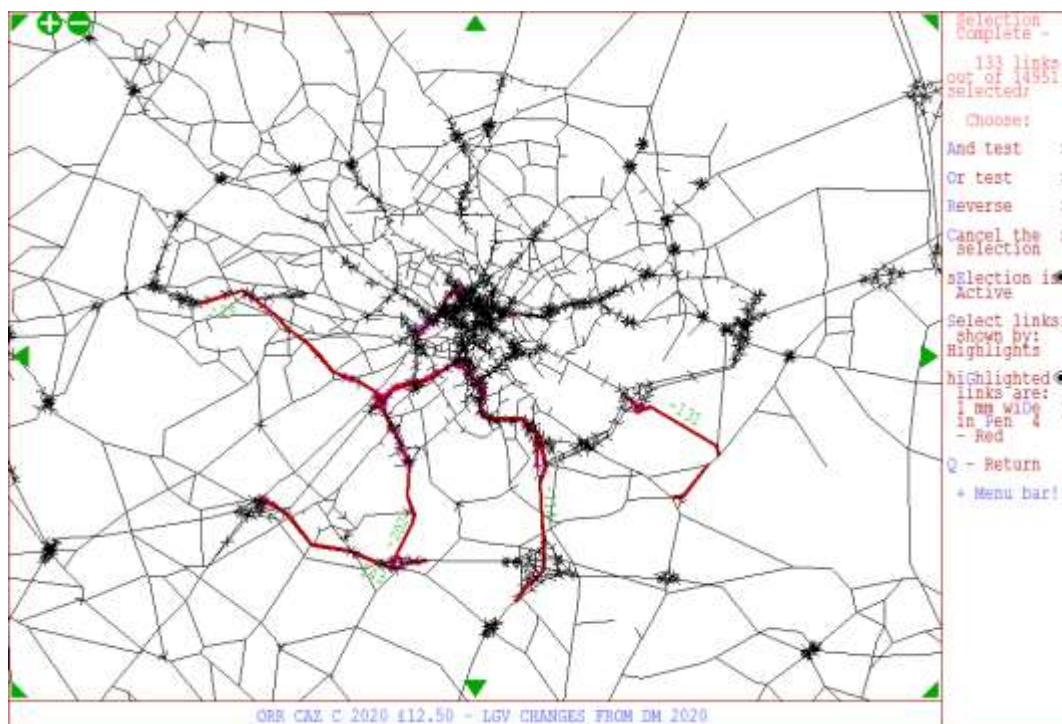
Road	Observed	Modelled AADT			Estimated 2020 AADT			
	Est AADT 2015	Base 2015	DM 2020	CAZ 2020	DM 2020	CAZ 2020	Change	
A6120 Ring Rd Farsley	23013	22241	24288	24366	25060	25138	78	0%
Gildersome La	6800	6419	6743	6919	7124	7300	176	2%
Tong Rd	11000	11319	11822	11914	11503	11595	92	1%
M62 Jn 27-28	120237	118444	136245	136888	138038	138681	643	0%
M62 Jn 28-29	122710	133929	154782	155195	143563	143976	413	0%



### Review of roads with reduced traffic

25. Figure 8 shows the parts of the highway network where the overall volume of LGVs is forecast to fall by 100 or more vehicles per 12 hour weekday with an ORR CAZ C. The effect is concentrated upon the A647/A6110, the M621, the A650, parts of the IRR and the A64.
26. An element of these changes is associated with the issue raised in paragraph 4. However, the effect of through trips previously using the A650, A6110/M621 or A6110/A653 re-assigning out of the CAZ is clear to see. (The change on Newsam Green Rd east of M1 Jn 45 can be disregarded as this link is not available for general traffic.)
27. The scale of change here is greatest in the area around M621 Jn 1, with flows down by approaching 600 vehicles (12 hr 2 way) on both the A6110 to the west and M621 to the north.

Figure 8 - LGV – decrease of 100 or more vehicles (12 hour)



28. A similar situation occurs with HGV flows – see Figures 9 and 10 – although here the scale of the changes is markedly less. It should be noted that the reduction on the A65 also occurs with LGVs, the fall being below the 100 vehicle threshold in Figure 8.

Figure 9 - HGV – decrease of 25 or more vehicles (12 hour)

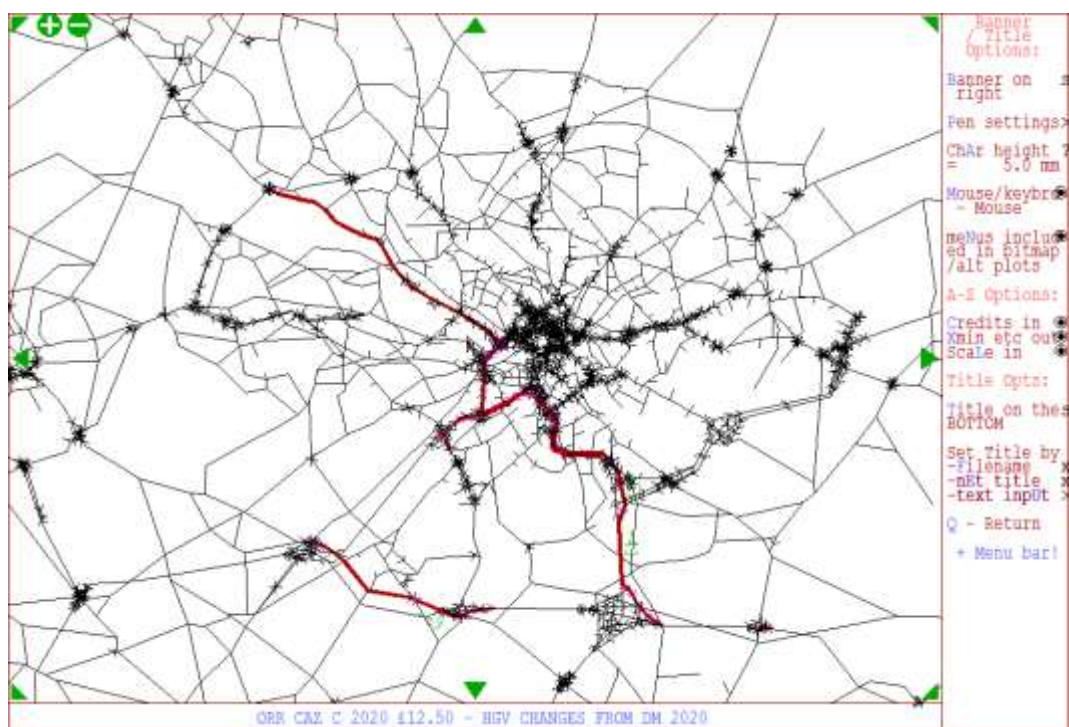
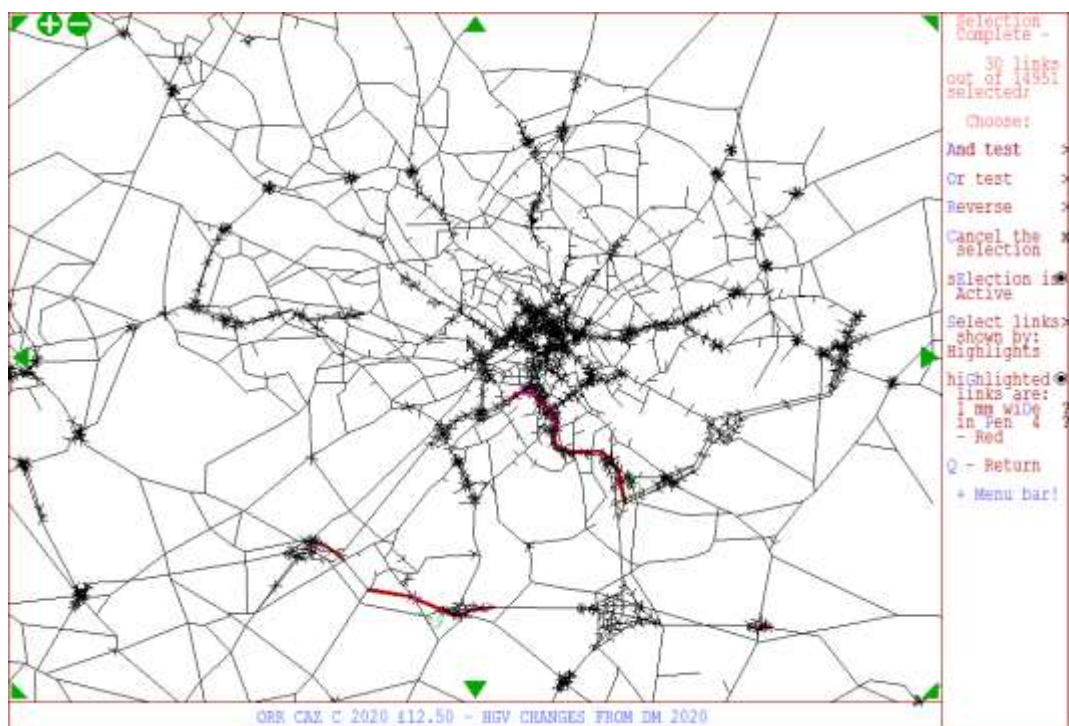


Figure 10 - HGV – decrease of 50 or more vehicles (12 hour)



## **Conclusions**

29. In summary, an ORR CAZ C 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.
30. 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.
31. It is considered that some of these diverted trips are unlikely to occur in practise as the A6110 remains available for general traffic with the ORR CAZ.
32. Routes affected by this reassignment include the M606/A6177/A658 route across Bradford; the M62; the A58 from Drighlington to Back La; 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.
33. Of these, Gildersome La is forecast to attract an additional 20% HGV and 13% LGV, with the other routes in Leeds having a much smaller increase.

**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	
Torre Rd	590	233	265	262	622	619	-3	0%
Lincoln Green Rd	770	393	470	470	847	847	0	0%
Woodhouse St	820	731	797	797	886	886	0	0%
Hyde Park Rd	500	571	623	629	552	558	6	1%
Woodsley Rd	370	471	512	514	411	413	2	0%
Canal Rd	980	1134	1297	1295	1143	1141	-2	0%
Town St	890	978	1098	1107	1010	1019	9	1%
Upper Wortley Rd	1030	1216	1357	1318	1171	1132	-39	-3%

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	
Torre Rd	170	29	35	35	176	176	0	0%
Lincoln Green Rd	170	56	64	65	178	179	1	1%
Woodhouse St	140	99	103	102	144	143	-1	-1%
Hyde Park Rd	100	90	93	93	103	103	0	0%
Woodsley Rd	80	78	79	79	81	81	0	0%
Canal Rd	310	312	323	321	321	319	-2	-1%
Town St	220	263	276	275	233	232	-1	0%
Upper Wortley Rd	290	301	314	311	303	300	-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	
A6120 Ring Rd Farsley	3738	1904	2157	2250	3991	4084	93	2%
Gildersome La	970	638	747	963	1079	1295	216	20%
Tong Rd	1200	1042	1150	1268	1308	1426	118	9%
M62 Jn 27-28	19786	11317	13546	14338	22015	22807	792	4%
M62 Jn 28-29	17596	13001	15970	16462	20565	21057	492	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	
A6120 Ring Rd Farsley	579	270	251	280	560	589	29	5%
Gildersome La	250	262	278	312	266	300	34	13%
Tong Rd	340	338	349	367	351	369	18	5%
M62 Jn 27-28	20818	9067	9411	9551	21162	21302	140	1%
M62 Jn 28-29	19690	10609	10996	11070	20077	20151	74	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 C										
Road				Compliant		Non compliant			Total	
	Anode Bnode	AADT	Cars	LGV	OGV	LGV	OGV	PSV	LGV	OGV
A6120 Ring Rd Farsley		24366	21836	1640	226	610	54	0	2250	280
Gildersome La		6919	5542	594	257	369	55	102	963	312
Tong Rd		11914	10125	942	331	326	36	154	1268	367
M62 Jn 27-28		136888	112999	8419	7574	5919	1977	0	14338	9551
M62 Jn 28-29		155195	127663	10348	8977	6114	2093	0	16462	11070
Change from 2020 DM										
Road				Compliant		Non compliant			Total	
	Anode Bnode	AADT	Cars	LGV	OGV	LGV	OGV	PSV	LGV	OGV
A6120 Ring Rd Farsley		78	-44	346	25	-253	4	0	93	29
Gildersome La		176	-74	146	35	70	-1	0	216	34
Tong Rd		92	-44	252	52	-134	-34	0	118	18
M62 Jn 27-28		643	-289	291	45	501	95	0	792	140
M62 Jn 28-29		413	-153	766	180	-274	-106	0	492	74
Percentage change from 2020 DM										
Road				Compliant		Non compliant			Total	
	Anode Bnode	AADT	Cars	LGV	OGV	LGV	OGV	PSV	LGV	OGV
A6120 Ring Rd Farsley		0%	0%	27%	12%	-29%	8%	0%	4%	12%
Gildersome La		3%	-1%	33%	16%	23%	-2%	0%	29%	12%
Tong Rd		1%	0%	37%	19%	-29%	-49%	0%	10%	5%
M62 Jn 27-28		0%	0%	4%	1%	9%	5%	0%	6%	1%
M62 Jn 28-29		0%	0%	8%	2%	-4%	-5%	0%	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	LGV	OGV	PSV	LGV	OGV
<b>Cordon on approaches to IRR</b>										
DM 2020		663808	563136	42011	16230	28000	4058	10373	70011	20288
ORR CAZ C 2020		663325	563579	60879	19540	8428	529	10370	69307	20069
IRR Cordon Changes		-483	443	18868	3310	-19572	-3529	-3	-704	-219
Percentage change		-0.1%	0.1%	44.9%	20.4%	-69.9%	-87.0%	0.0%	-1.0%	-1.1%
<b>Cordon within IRR</b>										
DM 2020		336622	288318	18790	5945	12519	1487	9563	31309	7432
ORR CAZ C 2020		336830	288658	27412	7112	3884	204	9560	31296	7316
Within IRR Changes		208	340	8622	1167	-8635	-1283	-3	-13	-116
Percentage change		0.1%	0.1%	45.9%	19.6%	-69.0%	-86.3%	0.0%	0.0%	-1.6%

**Table A7 – Modelled changes in traffic volumes – IRR**

2022 estimated AADT with ORR CAZ C										
Road				Compliant		Non compliant			Total	
	Anode Bnode	AADT	Cars	LGV	OGV	LGV	OGV	PSV	LGV	OGV
IRR Lovell Park Br		59432	52535	4851	1357	653	36	0	5504	1393
IRR Woodhouse tunnel		76819	67066	7367	1375	975	36	0	8342	1411
IRR Wellington Br		88954	75186	9022	2391	1170	61	1124	10192	2452
A643 Ingram		58604	48505	6915	1943	1175	66	0	8090	2009
M621 Jn 2-2a		73333	60821	7763	3607	837	76	229	8600	3683
M621 Jn 2a-3		89588	73603	9915	4524	1208	109	229	11123	4633
M621 Jn 3-4		72592	58767	8792	3851	1088	94	0	9880	3945
John Smeaton Viaduct		34056	29001	3095	1512	410	38	0	3505	1550
IRR East Street		31332	27763	2375	749	322	21	102	2697	770
<b>Change from 2020 DM</b>										
Road				Compliant		Non compliant			Total	
	Anode Bnode	AADT	Cars	LGV	OGV	LGV	OGV	PSV	LGV	OGV
IRR Lovell Park Br		-92	63	1498	234	-1643	-244	0	-145	-10
IRR Woodhouse tunnel		-137	72	2275	233	-2467	-250	0	-192	-17
IRR Wellington Br		-164	119	2770	395	-3010	-438	0	-240	-43
A643 Ingram		20	-61	2108	311	-1996	-342	0	112	-31
M621 Jn 2-2a		-244	195	2354	608	-2727	-674	0	-373	-66
M621 Jn 2a-3		-213	182	3028	752	-3340	-835	0	-312	-83
M621 Jn 3-4		-186	180	2648	629	-2932	-711	0	-284	-82
John Smeaton Viaduct		-32	22	964	266	-1010	-274	0	-46	-8
IRR East Street		-46	21	740	128	-801	-134	0	-61	-6
<b>Percentage change from 2020 DM</b>										
Road				Compliant		Non compliant			Total	
	Anode Bnode	AADT	Cars	LGV	OGV	LGV	OGV	PSV	LGV	OGV
IRR Lovell Park Br		0%	0%	45%	21%	-72%	-87%	0%	-3%	-1%
IRR Woodhouse tunnel		0%	0%	45%	20%	-72%	-87%	0%	-2%	-1%
IRR Wellington Br		0%	0%	44%	20%	-72%	-88%	0%	-2%	-2%
A643 Ingram		0%	0%	44%	19%	-63%	-84%	0%	1%	-2%
M621 Jn 2-2a		0%	0%	44%	20%	-77%	-90%	0%	-4%	-2%
M621 Jn 2a-3		0%	0%	44%	20%	-73%	-88%	0%	-3%	-2%
M621 Jn 3-4		0%	0%	43%	20%	-73%	-88%	0%	-3%	-2%
John Smeaton Viaduct		0%	0%	45%	21%	-71%	-88%	0%	-1%	-1%
IRR East Street		0%	0%	45%	21%	-71%	-86%	0%	-2%	-1%

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