

LEEDS CLEAN AIR ZONE 2021 TRAFFIC MODELLING NOTE (19/10/20)

1. The Leeds Transport Model (LTM) has been run for the year 2021 to assess the impact of the Regent Street Bridge contraflow on traffic volumes on the A64M and adjacent roads, and subsequently to allow an assessment of air quality to be undertaken.
2. This note is an update on previous notes following a detailed check of the forecast matrices that revealed an error in the treatment of a number empty zones in the model where development is forecast to take place. This error resulted in an overall lower traffic forecast for 2021 which became apparent when the outputs were compared with other tests for the same year. This error has now been corrected and the results presented below therefore contain higher level of traffic than the tests presented in the previous notes. Across the Leeds model area trips are 2% higher, although the increase in veh-kms on the simulation network is just 0.6%.
3. These tests utilise the final version of the LTM with 5 user classes. The original LTM version utilised for the CAZ modelling used 10 user classes (representing compliant and non-compliant vehicles). Otherwise the two models are the same meaning that the validation and calibration information previously supplied still applies.
4. However, these tests utilise more recent information on planned developments across Leeds and include several transport schemes not included in the original tests (including Elland Rd P&R expansion, Headrow Gateway and Infirmary St Gateway in the city centre). Because of this there are likely to be some differences between the forecasts from these two models.
5. The Regent Street bridgeworks are being undertaken in two phases. Phase 1, which commenced in June 2020, has a complete closure of the westbound carriageway on the Leeds Inner Ring Road (A64/A64M) with a contraflow operating on the eastbound carriageway. Phase 2 is planned to commence in mid-April 2021 and run until completion of the works in spring 2022.
6. During the period of the contraflow the majority of slip roads are also closed as shown in Table 1, and this has resulted in a number of bus route diversions which were included in the model tests.

Table 1 – Contraflow closures

Slip road	Phase 1 contraflow (EB)	Phase 2 contraflow (WB)
EB off slip to Burmantofts St	Closed	Closed
WB on slip from Marsh La	Closed	Closed
WB off slip to Eastgate	Closed	Open
WB off slip to Vicar La	Closed	Open

7. Due to the change from phase 1 and phase 2 during 2021, two model tests were undertaken covering each scenario¹. In both cases the tests also included schemes currently under construction, but due to be effectively complete by 2021:
 - Elland Rd P&R expansion (completed July 2020 but not yet open)
 - Headrow Gateway

¹ HGRS_2021_v3 (phase 1) and HGRS2b_2021_v3 (phase 2)

- Infirmary St Gateway
- Although traffic levels across Leeds city centre remain below normal levels due to the impact of the Covid-19 pandemic no adjustments were made to the LTM, full NTEM 7.2 (Tempro) growth being applied from the model base year of 2015 to the 2021 forecast year.
 - This resulted in an increase in all day trips within the Leeds area of the model of 9.8% from the 2015 base model together with a 10.1% increase the veh-kms travelled across the model simulation network as shown in Table 2. The change from the previous 2020 CAZ model tests was just 1.9%. These changes apply equally to both the phase 1 and 2 contraflow tests and are very similar to the 2021 test without the contraflow (Table 3).

Table 2 – Changes in veh-kms within simulation model area (Contraflow Phases 1 & 2 2021)

	All Traffic	Cars	LGVs	OGVs	PSVs
From 2015 Base	10.1%	9.8%	15.8%	4.6%	-1.1%
From 2020 DM	1.9%	2.0%	2.2%	0.6%	-1.1%
From 2020 CAZ B	1.9%	2.0%	2.2%	0.5%	-1.1%

Table 3 – Changes in veh-kms within simulation model area (No contraflow 2021)

	All Traffic	Cars	LGVs	OGVs	PSVs
From 2015 Base	10.2%	10.0%	15.8%	4.6%	-1.0%
From 2020 DM	2.0%	2.1%	2.2%	0.6%	-1.0%
From 2020 CAZ B	2.0%	2.1%	2.2%	0.5%	-1.0%

- The fall in bus volumes is due to an update of bus services being undertaken in the model since the original tests, reflecting both changes in service provision on the ground and also changes due to the schemes outlined above.
- Pre-lockdown count data from permanent ATC sites located around Leeds city centre has been compared with the 2020 DM and 2021 full growth forecasts to provide an indication of the model performance.
- For the majority of locations, data for the first 11 weeks of the year (Jan 1 to 15 Mar 2020) has been utilised, including school holidays. Analysis of several of these sites for 2019 indicates that this is a good match for the AADT at these locations (within +/- 1%). For A61 East St the data is from the first two weeks at the start of March and is therefore less representative, however, the counter was only installed in Feb 2020 and so earlier data is not available.
- The comparison with the modelled flow indicates a very good match between the forecast and observed data, the biggest differences occurring on the M621 where both models are high – see Table 4. At the majority of the sites the modelled flows are within 10% of the observed values and the average difference is just 3-5%.

Table 4 – Comparison of Modelled AADT 2020 and 2021 with observed Pre-lockdown counts

Location	Modelled flows		Observed 2020	%age diff from observed	
	AADT 2021	AADT 2020 DM		AADT 2021	AADT 2020 DM
Leeds IRR and M621					
A64M Lovell Park Br	46,632	48,948	50,511	-8%	-3%
A58M Woodhouse tunnel	73,867	74,271	78,120	-5%	-5%
A643 Ingram	58,693	57,524	55,148	6%	4%
M621 Jn 2-2a	76,668	74,824	65,204	18%	15%
M621 Jn 2a-3	92,823	90,612	79,240	17%	14%
IRR East Street #	34,335	32,492	36,200	-5%	-10%
Key Radials Approaching Leeds City Centre					
A647 Canal St	28,762	28,651	31,406	-8%	-9%
A65 Kirkstall Rd	41,096	40,237	40,320	2%	0%
A58 Clay Pit La	44,593	44,624	45,423	-2%	-2%
A64 York Rd	43,918	43,975	42,829	3%	3%
A61 Low Rd	21,683	20,440	19,036	14%	7%
M621 Jn 4-5	93,916	91,510	82,509	14%	11%
A653 Dewsbury Rd	17,963	17,079	16,548	9%	3%
M621 Jn 1-2	86,346	84,187	71,060	22%	18%
Average deviation				5%	3%

Note: Observed data = average day Jan 1 to 15 Mar 2020 except IRR East Street = average day 2-15 Mar 2020

Forecast Contraflow Impacts 2021

14. The impacts of the contraflow on traffic levels using the A64/A64M Inner Ring Road are significant. When compared with the Do Minimum 2020 tests the Annual Average Daily Traffic (AADT) volumes at Regent St are forecast to fall by 29% (phase 1) and 38% (phase 2) – see Tables 5 and 6.
15. When compared with the model tests presented in previous notes, these forecast volumes on the A64M in 2021 are around 1% higher.

Table 5 – Leeds inner Ring Road Forecast AADT 2020 and 2021 (Phase 1 contraflow)

	AADT 2020 DM	AADT 2021	change	%age change
A64M Regent St	46,006	32,520	-13,486	-29%
A64M Lovell Park Br	48,948	38,413	-10,535	-22%

A58M Woodhouse tunnel	74,271	72,997	-1,274	-2%
A58 Wellington Br	88,249	90,353	2,104	2%
A643 Ingram	57,524	60,449	2,925	5%
M621 Jn 2-2a	74,824	79,055	4,231	6%
M621 Jn 2a-3	90,612	95,617	5,005	6%
M621 Jn 3-4	73,981	77,550	3,569	5%
John Smeaton Viaduct	35,059	33,718	-1,341	-4%
IRR East Street	32,492	27,797	-4,695	-14%

Table 6 – Leeds inner Ring Road Forecast AADT 2020 and 2021 (Phase 2 contraflow)

	AADT 2020 DM	AADT 2021	change	%age change
A64M Regent St	46,006	28,616	-17,390	-38%
A64M Lovell Park Br	48,948	34,449	-14,499	-30%
A58M Woodhouse tunnel	74,271	72,053	-2,218	-3%
A58 Wellington Br	88,249	90,044	1,795	2%
A643 Ingram	57,524	60,322	2,798	5%
M621 Jn 2-2a	74,824	79,101	4,277	6%
M621 Jn 2a-3	90,612	95,643	5,031	6%
M621 Jn 3-4	73,981	77,624	3,643	5%
John Smeaton Viaduct	35,059	33,876	-1,183	-3%
IRR East Street	32,492	27,478	-5,014	-15%

16. When compared with a model test for 2021 without the contraflow the usage of the northern inner ring road is similarly reduced. The AADT volumes at Regent St are forecast to fall by 31% (phase 1) and 39% (phase 2) – see Tables 7 and 8.
17. The reassignment of traffic due to the contraflow is illustrated in Figures 1 and 2. Blue represents a decrease, green an increase. The substantial reduction in traffic modelled using the northern section of Leeds IRR is very apparent, alongside the various diversion routes. This includes increased usage of the western sections of the IRR alongside the M621 for eastbound movements. A number of minor roads within the city centre and to the east and north of the city centre also pick up additional traffic.
18. Although the two plots appear very similar, Figure 3 reveals the differences between the phase 1 and phase 2 contraflows. This comprises a modelled increase in westbound traffic north of Quarry Hill, but a fall to the west of North St, where the opening up of the WB off slip allows traffic to route back onto North St.
19. Here, the increase in traffic using the slip road more than compensates for the loss of westbound traffic on the A64M itself. Nevertheless, when compared with the 2021 test without the contraflow, the volume of traffic modelled using the A64M, the WB slip road and the eastbound New York St, is 34% lower under phase 2 and 36% lower under phase 1.

Table 7 – Leeds inner Ring Road Forecast AADT 2021 and 2021 (Phase 1 contraflow)

	AADT 2021	AADT 2021 RS1	Change	%age
A64M Regent St	46,842	32,520	-14,322	-31%
A64M Lovell Park Br	46,632	38,413	-8,219	-18%
A58M Woodhouse tunnel	73,867	72,997	-870	-1%
A58 Wellington Br	89,299	90,353	1,054	1%
A643 Ingram	58,693	60,449	1,756	3%
M621 Jn 2-2a	76,668	79,055	2,387	3%
M621 Jn 2a-3	92,823	95,617	2,794	3%
M621 Jn 3-4	75,033	77,550	2,517	3%
John Smeaton Viaduct	37,125	33,718	-3,407	-9%
IRR East Street	34,335	27,797	-6,538	-19%

Table 8 – Leeds inner Ring Road Forecast AADT 2021 and 2021 (Phase 2 contraflow)

	AADT 2021	AADT 2021 RS2	Change	%age
A64M Regent St	46,842	28,616	-18,226	-39%
A64M Lovell Park Br	46,632	34,449	-12,183	-26%
A58M Woodhouse tunnel	73,867	72,053	-1,814	-2%
A58 Wellington Br	89,299	90,044	745	1%
A643 Ingram	58,693	60,322	1,629	3%
M621 Jn 2-2a	76,668	79,101	2,433	3%
M621 Jn 2a-3	92,823	95,643	2,820	3%
M621 Jn 3-4	75,033	77,624	2,591	3%
John Smeaton Viaduct	37,125	33,876	-3,249	-9%
IRR East Street	34,335	27,478	-6,857	-20%

Figure 1 – Phase 1 contraflow reassignment 2021 (AADT)

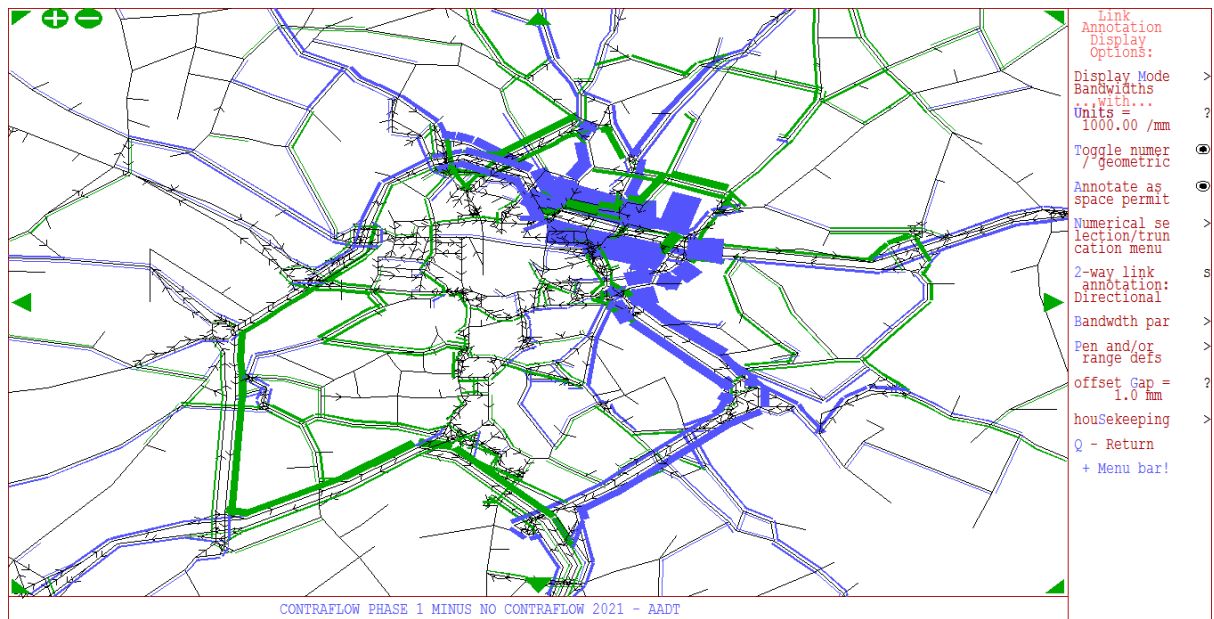


Figure 2 – Phase 2 contraflow reassignment 2021 (AADT)

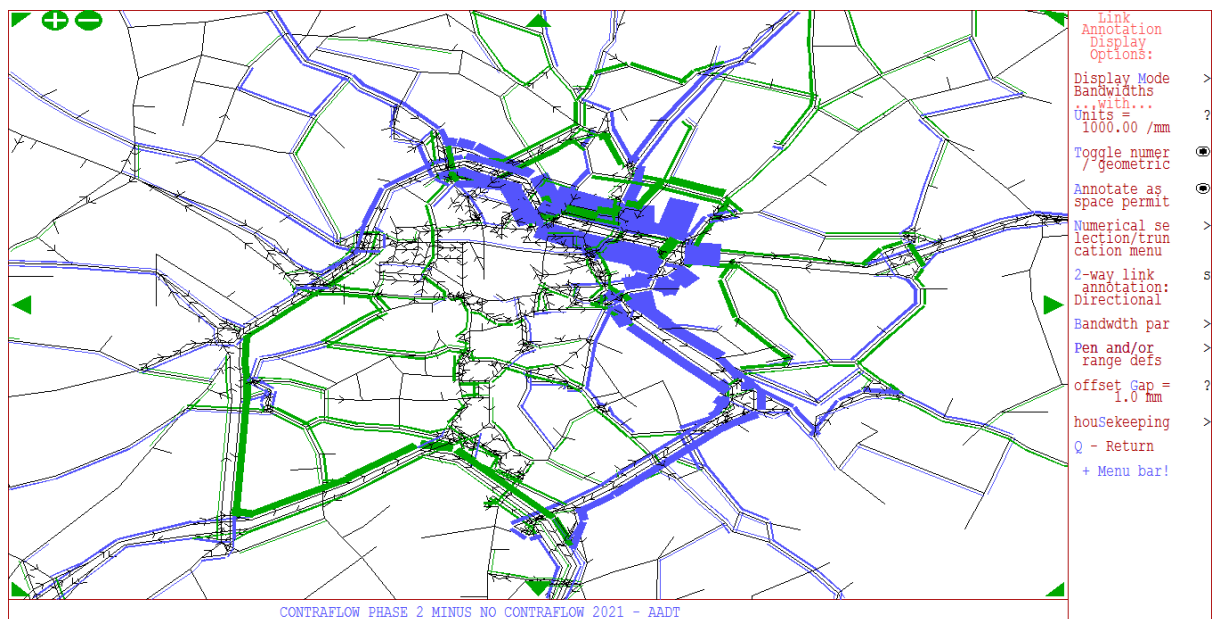
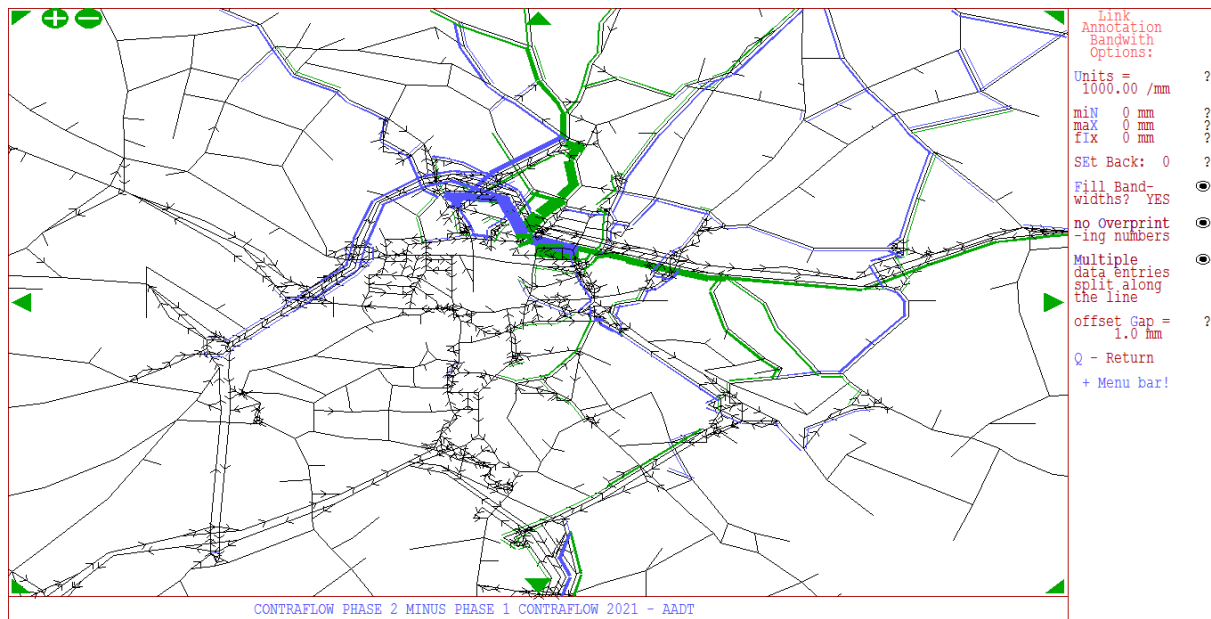


Figure 3 – Phase 2 contraflow minus Phase 1 contraflow 2021 (AADT)



Covid-19 Traffic Impacts

20. Currently, it is difficult to separate out the impact of the contraflow on traffic flows from the effects of the coronavirus pandemic. Data from a number of permanent ATCs located around the city centre has shown that there has been some reassignment of traffic due to lower levels of traffic congestion, meaning that in some locations observed levels during some peak hours are higher than normal. This applies to A643 Ingram Distributor and the M621 slip roads where it joins the motorway at Junction 2. In contrast traffic levels within the IRR remains well below normal levels.
21. Figure 4 shows the observed weekday 24 hour traffic levels on 4 sections of the IRR from the last week of February through to the middle of September. The substantial fall in the use of the A58M (at Woodhouse tunnel), alongside the other routes is very apparent as lockdown kicked in in late March.
22. Figure 5 shows the same data as an index (with week 2 as 100). It is notable that although all four routes fell by a similar amount initially, the growth in usage since then has been quite varied. A643 Ingram Distributor has grown to within 4% of pre-lockdown traffic, while the A64M (at Lovell Park) remains 39% below normal.
23. The Regent St contraflow commenced on the 1st of June 2020 – week 15 – and this can be seen in the graphs to limit growth after that date compared with the other sections of the IRR.
24. In fact, since week 14 (May half term week) weekday traffic levels have grown by just 11% on the A64M, compared with 31% on A58M, 38% on A61 East St and 45% on A643 Ingram Distributor. At the same time, usage of 5 key radials approaching the city centre has risen by 45%.
25. These observations support the scale of the modelled impact of the contraflow forecast for 2021, and give some indication that the modelled fall of 18% (phase 1) forecast at A64M Lovell Park Bridge (Table 7) may be conservative.

Figure 4 – Observed weekday 24 hr traffic: Leeds IRR Feb to Sep 2020

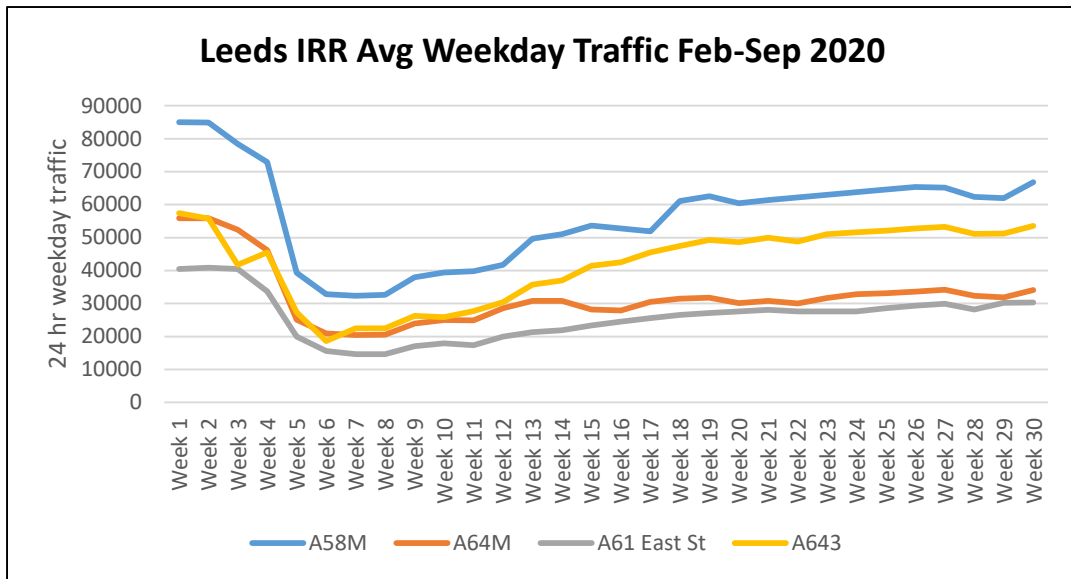
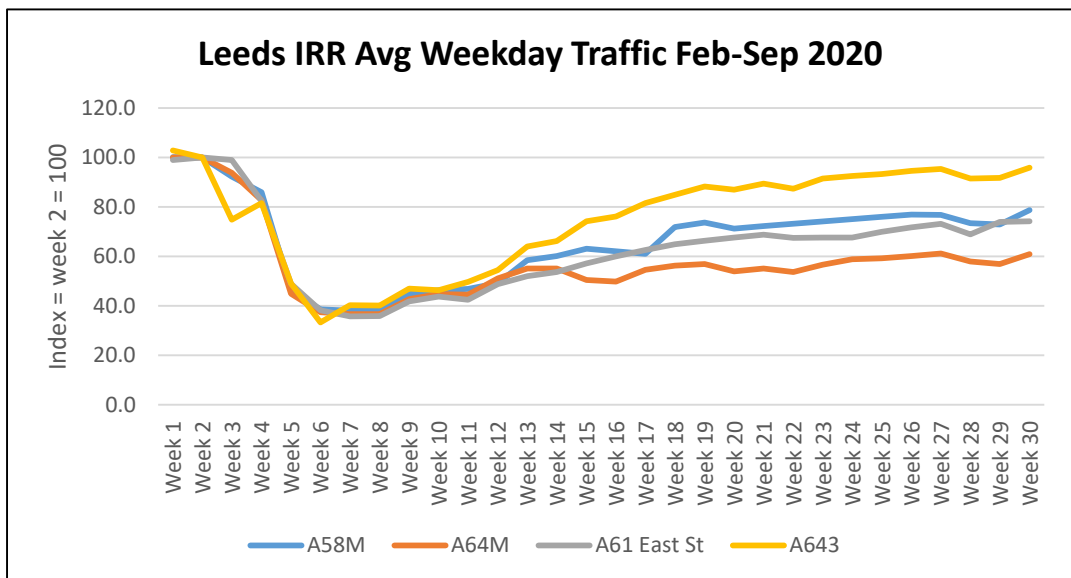


Figure 5 – Observed weekday 24 hr traffic: Leeds IRR Feb to Sep 2020 (Index)



26. Over the third week of September the average flow on the A64M was 32,000 vehs per day (34,100 per weekday). This compares with the forecast 2021 AADT level of 38,400 (Tables 5 and 7). Leeds children returned to school from Monday 7th September, but this has not brought about a material increase in daily traffic as the figures above illustrate. Moving forwards it remains unclear how much the management of the pandemic will have on traffic levels.
27. It is, however, worth noting that the observed level of traffic on the A64M prior to lockdown (Jan 1 to 15 Mar 2020, Table 4) was 50,500 vehs/day (54,900 per weekday), higher than forecast in the model for 2021 without the contraflow (46,600 AADT, Table 7) and higher than the original CAZ 2020 DM test (49,000, Table 5).
28. As noted earlier, the difference between the 2021 forecast and that for 2020 is likely to be linked to the impact of the various transport schemes being implemented in the city centre

as part of the LPTIP programme. These were not sufficiently developed to include in the original CAZ tests, but are either complete (Elland Rd P&R expansion) or under construction with completion in spring 2021 (Headrow Gateway and Infirmary St Gateway) and have been included in all the 2021 tests. These schemes are designed to increase public transport usage, but it is also worth noting that the Headrow Gateway scheme will also affect traffic routing around the north side of the city centre.

Sensitivity testing

- 29. Following the completion of the above tests at 100% of NTEM 7.2 (Tempro) growth, two further model tests have been undertaken². These utilised the GONZO command in Saturn to apply a constant growth factor to the model matrices of 5% in all time periods.
- 30. The effect of this was to increase veh-kms within the simulation network by 4.0% - see Table 9 and by 14.5% from the 2015 Base model. The changes were the same for both phases of the contraflow.

Table 9 – Changes in veh-kms within simulation model area (Tempro plus 5%)

	All Traffic	Cars	LGVs	OGVs	PSVs
From 2015 Base	14.5%	14.3%	20.4%	9.0%	-1.1%
From 2020 DM	6.0%	6.1%	6.3%	4.9%	-1.1%
From 2020 CAZ B	6.0%	6.1%	6.3%	4.8%	-1.1%
From 2021 RS	4.0%	4.0%	4.0%	4.3%	0.0%

- 31. The impact of this additional traffic on usage of the IRR is shown in Tables 10 and 11. Usage of these roads typically increases by less than the overall 4.0% increase across the model area so that volumes remains significantly below those modelled for 2020.
- 32. When usage of the WB off slip and New York St are included, overall traffic levels under Phase 1 are 30% and under Phase 2 28% below those modelled for 2020. (Compared with 36% and 34% under full Tempro growth – Para 19).
- 33. Figures 6 and 7 show the changes in forecast all day traffic (AADT) between these tests and the 100% Tempro tests. Across the majority of the network around the city centre there is a small increase in traffic levels.
- 34. Figures 8 and 9 show the changes from the 2021 forecast situation without the contraflow.

² HGRS_2021_V3_105PC (Phase 1) and HGRS2b_2021_V3_105 (Phase 2)

Table 10 – Leeds Inner Ring Road Forecast AADT 2020 and 2021 (Ph 1 contraflow)(Tempo + 5%)

	AADT 2020 DM	AADT 2021 RS1	change	%age change
A64M Regent St	46,006	33,629	-12,377	-27%
A64M Lovell Park Br	48,948	39,933	-9,015	-18%
A58M Woodhouse tunnel	74,271	74,996	725	1%
A58 Wellington Br	88,249	92,039	3,790	4%
A643 Ingram	57,524	61,616	4,092	7%
M621 Jn 2-2a	74,824	80,412	5,588	7%
M621 Jn 2a-3	90,612	97,272	6,660	7%
M621 Jn 3-4	73,981	78,957	4,976	7%
John Smeaton Viaduct	35,059	35,087	28	0%
IRR East Street	32,492	28,954	-3,538	-11%

Table 11 – Leeds inner Ring Road Forecast AADT 2020 and 2021 (Ph 2 contraflow)(Tempro + 5%)

	AADT 2020 DM	AADT 2021 RS2	change	%age change
A64M Regent St	46,006	29,128	-16,878	-37%
A64M Lovell Park Br	48,948	35,460	-13,488	-28%
A58M Woodhouse tunnel	74,271	73,982	-289	0%
A58 Wellington Br	88,249	91,644	3,395	4%
A643 Ingram	57,524	61,495	3,971	7%
M621 Jn 2-2a	74,824	80,694	5,870	8%
M621 Jn 2a-3	90,612	97,645	7,033	8%
M621 Jn 3-4	73,981	78,935	4,954	7%
John Smeaton Viaduct	35,059	35,255	196	1%
IRR East Street	32,492	28,847	-3,645	-11%

Figure 6 – Phase 1 contraflow reassignment 2021 (AADT) (105% cf 100% growth)

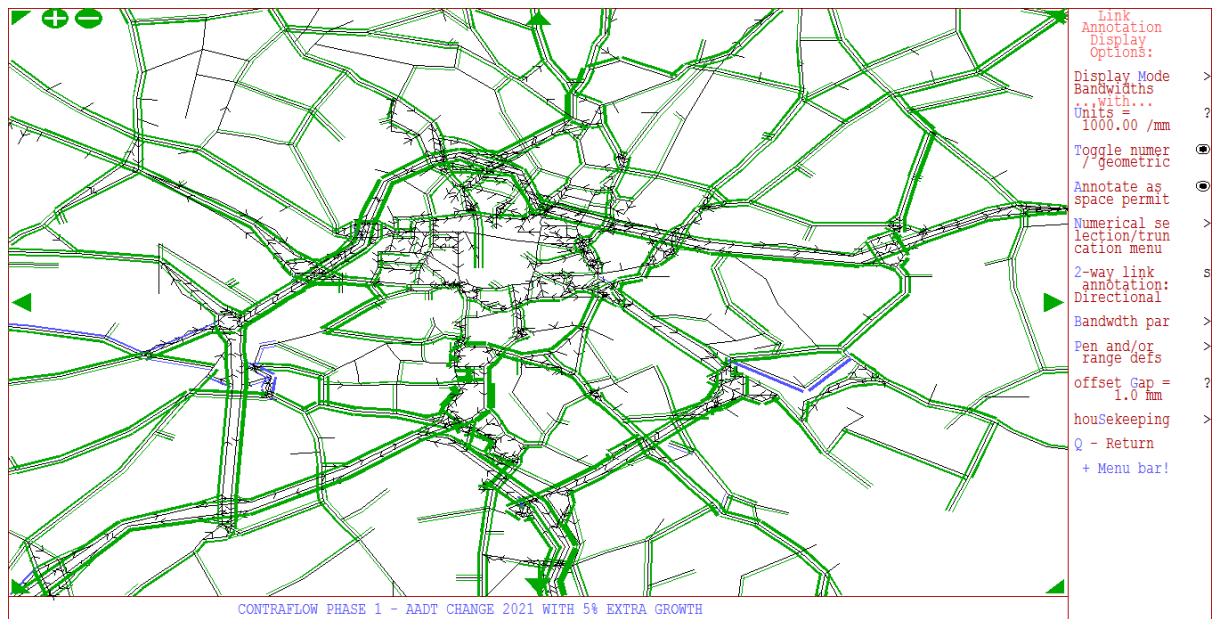


Figure 7 – Phase 2 contraflow reassignment 2021 (AADT) (105% cf 100% growth)

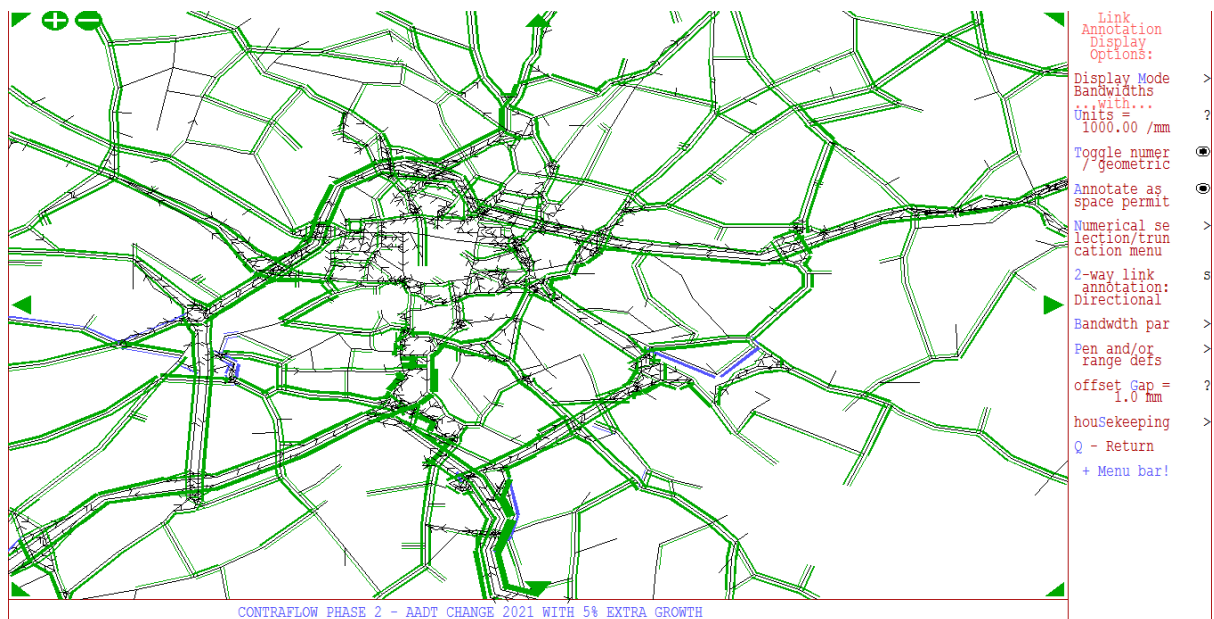


Figure 8 – Phase 1 contraflow reassignment 2021 (AADT) (105% cf 100% no contraflow)

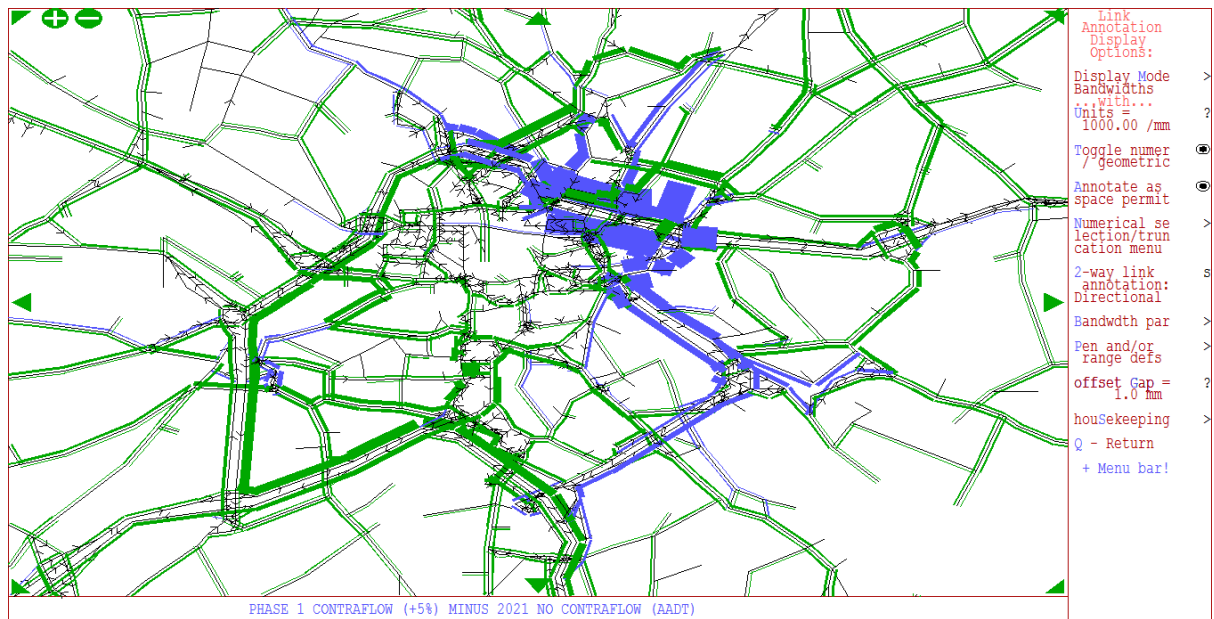


Figure 9 – Phase 2 contraflow reassignment 2021 (AADT) (105% cf 100% no contraflow)

