A63 Castle Street Improvements, Hull
Environmental Statement

Appendix 15.1

EFFECTS ON ALL TRAVELLERS - DRIVER STRESS DURING OPERATION

TR010016/APP/6.3
HE514508-MMSJV-EGN-S0-RP-LE-000011
6 September 2018

A63 Castle Street Improvements, Hull

Environmental Statement

Appendix 15.1 Driver stress during operation

Revision Record						
Rev No	**Date**	**Originator**	**Checker**	**Approver**	**Status**	**Suitability**
P01.1	01.02.18	J Higgins	J Barrett	J McKenna	WIP	S0
P01	31.07.18	J Higgins	J Barrett	J McKenna	Shared	S4
P02	06.09.18	J Higgins	J Barrett	J McKenna	Shared	S4

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1. Driver stress during operation

1.1.1 The assessment of driver stress during the operation of the scheme considers average vehicle flows and speeds during the AM and PM peak periods only, where light vehicles are considered as one flow unit and heavy duty vehicles are considered as 3 flow units. This methodology is in accordance with DMRB Volume 11, Section 3, Part 9, Tables 2 and 3.

1.1.2 Flow units are calculated as follows:

- A car or light van equals one flow unit.
- A commercial vehicle over 1½ tons unladen weight or a public service vehicle equals 3 flow units.

Table 1.1: Assessment of operational driver stress in the design year (2040)

Traffic flow link	Location	Road type	Average vehicle flow during peak times DM 2040	Average speed (km/hr) DM	Average vehicle flow during peak times DS 2040	Average speed (km/hr) DS	Driver stress DM	Driver stress DS
1230_4010	A63_Castle_St_(Myton_St_to_Princes_Dock_St)	Dual_c	2,718.255	32.85687	N/A	N/A	High	N/A
1230_1215	A63_Castle_St_(Myton_St_to_Princes_Dock_St)	Dual_c	N/A	N/A	929.0027	43.92	N/A	Moderate
1196_1164	A63_Castle_St_(Princes_Dock_St_to_Dagger_Lane)	Dual_c	2,691.634	33.31299	N/A	N/A	High	N/A
1215_1196	A63_Castle_St_(Princes_Dock_St_to_Dagger_Lane)	Dual_c	2,691.634	33.54292	N/A	N/A	High	N/A
1215_5103	A63_Castle_St_(Princes_Dock_St_to_Dagger_Lane)	Dual_c	N/A	N/A	883.9864	16.54	N/A	Moderate
5108_5104	A63_Castle_St_(Waterhouse_Ln_to_Fish_St)	Dual_c	N/A	N/A	3,125.324	38.64	N/A	High
1164_1165	A63_Castle_Street_(Dagger_Lane_to_Fish_St)	Dual_c	2,691.614	40.68785	N/A	N/A	High	N/A
1165_1166	A63_Castle_Street_(Fish_St_to_Vicar_Lane)	Dual_c	2,691.618	39.30725	N/A	N/A	High	N/A
1142_8542	A63_Castle_Street_(Mytongate_to_Humber_Dock_Marina)	Dual_c	2,508.31	24.10557	N/A	N/A	High	N/A
1166_8864	A63_Castle_Street_(Vicar_Lane_to_Market_Place)	Dual_c	2,691.623	34.16897	N/A	N/A	High	N/A
4010_1215	A63_Castle_Street_(Waterhouse_Ln_to_Princes_Dock_St)	Dual_c	2,718.255	32.95051	N/A	N/A	High	N/A
8895_8896	A63_Castle_St_(Humber_Dock_St)	Dual_c	2,397.6	18.06291	N/A	N/A	High	N/A
8896_8897	A63_Castle_St_(Waterhouse_Ln_to_Humber_Dock_St)	Dual_c	2,486.232	20.78667	N/A	N/A	High	N/A
1864_8532	A63_Clive_Sullivan_Way	Dual_c	428.8845	23.6181	655.5569	15.31731	Moderate	Moderate
4327_1369	A63_Clive_Sullivan_Way	Dual_c	578.0064	24.30018	943.6272	20.09752	Moderate	Moderate
1863_1369	A63_Clive_Sullivan_Way	Dual_c	2,100.784	18.11445	2,285.795	15.52122	High	High

Traffic flow link	Location	Road type	Average vehicle flow during peak times DM 2040	Average speed (km/hr) DM	Average vehicle flow during peak times DS 2040	Average speed (km/hr) DS	Driver stress DM	Driver stress DS
1864_1371	A63_Clive_Sullivan_Way	Dual_c	2,288.963	53.04081	2,819.056	49.12142	High	High
4326_8529	Daltry_St	Dual_c	55.53098	32	145.2443	32	Moderate	Moderate
1566_8895	A63_Garrison_Road_(Dagger_Ln_to_Market_Place)	Dual_c	2,397.6	18.87635	N/A	N/A	High	N/A
5110_5124	A63_Garrison_Road_(Fish_St_to_Vicar_Ln)	Dual_c	N/A	N/A	3,782.528	13.41	N/A	High
5126_5108	A63_Garrison_Road_(Fish_St_to_Vicar_Ln)	Dual_c	N/A	N/A	3,124.986	28.905	N/A	High
5109_6001	A63_Garrison_Road_(High_St_to_Citadel_Way)	Dual_c	N/A	N/A	3,132.692	32.845	N/A	High
6016_4360	A63_Garrison_Road_(Market_Place_to_Citadel_Way)	Dual_c	2,211.545	24.585	N/A	N/A	High	N/A
8865_6001	A63_Garrison_Road_(Market_Place_to_Citadel_Way)	Dual_c	2,559.933	37.85	N/A	N/A	High	N/A
6016_5127	A63_Garrison_Road_(Market_Place_to_Citadel_Way)	Dual_c	N/A	N/A	2,637.938	44.385	N/A	High
5125_5109	A63_Garrison_Road_(Market_Place_to_High_St)	Dual_c	N/A	N/A	3,132.727	30.93	N/A	High
8864_1214	A63_Garrison_Road_(Market_Place)	Dual_c	2,355.179	31.32615	N/A	N/A	High	N/A
5124_5125	A63_Garrison_Road_(Market_Place)	Dual_c	N/A	N/A	3,052.577	37.195	N/A	High
5127_5126	A63_Garrison_Road_(Market_Place)	Dual_c	N/A	N/A	2,558.207	39.985	N/A	High
1146_1566	A63_Garrison_Road_(opposite_Market_Place)	Dual_c	2,132.632	8.208702	N/A	N/A	High	N/A
4360_1146	A63_Garrison_Road_(opposite_Market_Place)	Dual_c	2,132.801	10.23219	N/A	N/A	High	N/A
1214_8865	A63_Garrison_Road_(opposite_Market_Place)	Dual_c	2,355.163	33.27948	N/A	N/A	High	N/A
5103_5110	A63_Hessle_Rd_(Dagger_Ln_to_Vicar_Ln)	Dual_c	N/A	N/A	3,782.519	46.54	N/A	High
4255_1864	A63_Hessle_Rd_(Redfern_Close_to_Porter_St)	Dual_c	2,717.858	53.64367	N/A	N/A	High	N/A
5101_5112	A63_Hessle_Rd_Slip_road_(Waverley_St_to_Mytongate)	Dual_c	N/A	N/A	330.49	23.91	N/A	Moderate

Traffic flow link	Location	Road type	Average vehicle flow during peak times DM 2040	Average speed (km/hr) DM	Average vehicle flow during peak times DS 2040	Average speed (km/hr) DS	Driver stress DM	Driver stress DS
8535_4327	A63_Hessle_Road	Single_l	578.0064	25.36862	943.6312	22.96035	Moderate	High
1369_1603	A63_Hessle_Road_(between_Redfern_Close_and_Commercial_Ln)	Dual_c	2,678.641	16.86591	3,229.317	15.43426	High	High
1603_1865	A63_Hessle_Road_(Commercial_Ln_to_Porter_St)	Dual_c	2,678.641	18.5787	N/A	N/A	High	N/A
1603_5101	A63_Hessle_Road_(Commercial_Ln_to_Waverley_St)	Dual_c	N/A	N/A	3,229.317	37.64	N/A	High
5102_5100	A63_Hessle_Road_(Porter_St_to_Waverley_St)	Dual_c	N/A	N/A	3,474.615	15.415	N/A	High
1140_4328	A63_Hessle_Road_(porter_Street_-_spruce_road)	Dual_c	2,693.877	50.72778	N/A	N/A	High	N/A
5100_1864	A63_Hessle_Road_(Redfern_Close_to_Porter_St)	Dual_c	N/A	N/A	3,474.615	33.19	N/A	High
5122_5123	A63_Hessle_Road_(slip_road)	Dual_c	N/A	N/A	534.7534	46.345	N/A	Moderate
5123_5102	A63_Hessle_Road_(slip_road)	Dual_c	N/A	N/A	536.6605	21.565	N/A	Moderate
8539_1140	A63_Hessle_Road_(Spruce_Road_to_Mytongate)	Dual_c	2,667.519	50.84919	N/A	N/A	High	N/A
4328_4255	A63_Hessle_Road_(St_James_St_to_Waverley_St)	Dual_c	2,695.249	46.39319	N/A	N/A	High	N/A
5101_5103	A63_Hessle_Road_(Waverley_St_to_Dagger_Ln)	Dual_c	N/A	N/A	2,898.818	35.76	N/A	High
5104_5102	A63_Hessle_Road_(Waverley_St_to_Waterhouse_Ln	Dual_c	N/A	N/A	2,937.435	40.32	N/A	High
1865_8540	A63_Hessle_St	Dual_c	2,678.641	19.51213	N/A	N/A	High	N/A
8542_1365	A63_Mytongate	Dual_c	1,996.453	15.98747	N/A	N/A	High	N/A
8868_8541	A63_Mytongate	Dual_c	2,127.161	35.78359	N/A	N/A	High	N/A
8872_8868	A63_Mytongate	Dual_c	2,127.161	27.56454	N/A	N/A	High	N/A
8540_8872	A63_Mytongate	Dual_c	2,295.013	3.6205	N/A	N/A	High	N/A
8541_1230	A63_Mytongate	Dual_c	2,750.347	33.61921	N/A	N/A	High	N/A

Traffic flow link	Location	Road type	Average vehicle flow during peak times DM 2040	Average speed (km/hr) DM	Average vehicle flow during peak times DS 2040	Average speed (km/hr) DS	Driver stress DM	Driver stress DS
5104_5116	A63_Mytongate	Dual_c	N/A	N/A	187.899	42.655	N/A	Moderate
1003_1004	Anlaby_Road	Single_l	19.50424	N/A	29.58039	N/A	N/A	N/A
1233_1419	Anlaby_Road	Single_l	146.075	25.46728	124.4689	26.14282	Moderate	Moderate
1412_1419	Anlaby_Road	Single_l	168.7969	18.50209	168.7969	18.5	Moderate	Moderate
4329_1003	Anlaby_Road	Single_l	214.3797	25.01902	211.6622	25.02365	Moderate	Moderate
1247_4329	Anlaby_Road	Single_l	214.3797	25.02148	211.6622	25.02587	Moderate	Moderate
1004_1003	Anlaby_Road	Single_l	262.5388	N/A	248.3761	N/A	N/A	N/A
1419_1233	Anlaby_Road	Single_l	293.6849	4.125482	250.0173	5.08837	Moderate	Moderate
1003_4264	Anlaby_Road	Single_l	476.5925	20.97917	450.1867	20.98593	Moderate	Moderate
4264_1233	Anlaby_Road	Single_l	476.7073	6.932502	450.2509	5.034043	Moderate	Moderate
4329_1247	Anlaby_Road	Single_l	801.1767	31.97402	615.2838	34.57126	High	High
1003_4329	Anlaby_Road	Single_l	801.1767	31.34996	615.298	33.97479	High	High
4264_1003	Anlaby_Road	Single_l	820.6754	32.84726	635.2112	33.34663	High	High
1233_4264	Anlaby_Road	Single_l	820.6849	28.62297	635.2201	30.54507	High	High
1419_1420	Anne_St	Single_l	105.8321	10.53719	84.31994	11.00747	Moderate	Moderate
1420_1419	Anne_St	Single_l	159.7654	14.15416	115.3469	14.29177	Moderate	Moderate
4360_1149	Blackfriargate	Single_l	75.43546	29.80004	N/A	N/A	Moderate	N/A
5127_1149	Blackfriargate	Single_l	N/A	N/A	79.71999	28.445	N/A	Moderate
1109_1231	Blanket_Row	Single_l	1.505044	14.52983	N/A	18.60728	Moderate	N/A

Traffic flow link	Location	Road type	Average vehicle flow during peak times DM 2040	Average speed (km/hr) DM	Average vehicle flow during peak times DS 2040	Average speed (km/hr) DS	Driver stress DM	Driver stress DS
1231_1109	Blanket_Row	Single_l	3.278691	14.71288	N/A	14.00043	Moderate	N/A
1419_1412	Carr_Ln	Single_l	73.84467	19.5	73.84467	19.5	Moderate	Moderate
8992_8993	Commercial_Rd	Single_l	63.17304	N/A	70.89789	N/A	N/A	N/A
8993_8992	Commercial_Rd	Single_l	185.4239	N/A	213.9012	N/A	N/A	N/A
8992_1505	Commercial_Rd	Single_l	293.8237	34.45313	311.1807	34.41423	Moderate	Moderate
1505_8992	Commercial_Rd	Single_l	347.942	23.45903	409.0636	23.39385	Moderate	Moderate
4007_8992	Commercial_Rd	Single_l	356.6657	40.18058	N/A	N/A	Moderate	N/A
8992_4007	Commercial_Rd	Single_l	533.0214	13	N/A	N/A	Moderate	N/A
5118_5119	Commercial_Rd	Single_l	N/A	N/A	381.973	48	N/A	Moderate
5119_5120	Commercial_Rd	Single_l	N/A	N/A	622.8193	16.315	N/A	High
5119_8992	Commercial_Rd	Single_l	N/A	N/A	381.973	29.77	N/A	Moderate
8992_5119	Commercial_Rd	Single_l	N/A	N/A	622.8193	48	N/A	High
1152_1164	Dagger_Lane	Single_l	0.004635	7.102903	N/A	N/A	Moderate	N/A
1151_1152	Dagger_Lane	Single_l	0.009269	23.91022	N/A	26.51934	Moderate	N/A
1152_1151	Dagger_Lane	Single_l	N/A	13.72081	N/A	13.46216	N/A	N/A
8529_8531	Daltry_St	Single_l	55.53098	16.52912	145.2443	14.81682	Moderate	Moderate
8529_4326	Daltry_St	Single_l	1024.61	32.9509	761.1813	38.62076	High	High
8873_8529	Daltry_St	Single_l	1024.61	32.5	761.1863	32.5	High	High
8873_8531	Daltry_Street/_Rawling_Way_Rbt.	Single_l	663.8036	32.86358	789.8014	32.5053	High	High

Traffic flow link	Location	Road type	Average vehicle flow during peak times DM 2040	Average speed (km/hr) DM	Average vehicle flow during peak times DS 2040	Average speed (km/hr) DS	Driver stress DM	Driver stress DS
8531_8530	Daltry_Street/_Rawling_Way_Rbt.	Single_l	719.3518	30.85115	935.0311	30.32407	High	High
8533_8534	Daltry_Street/_Rawling_Way_Rbt.	Single_l	908.0139	28.48421	1,155.082	27.78844	High	High
8535_8532	Daltry_Street/_Rawling_Way_Rbt.	Single_l	1,259.113	29.56619	899.7975	30.18246	High	High
8532_8873	Daltry_Street/_Rawling_Way_Rbt.	Single_l	1,688.427	28.66427	1,550.988	35.30598	High	High
8534_8535	Daltry_Street/_Rawling_Way_Rbt.	Single_l	1,837.12	28.25836	1,843.429	23.19606	High	High
8875_8533	Daltry_Street/_Rawling_Way_Rbt.	Single_l	1,860.772	26.93528	1,979.986	28.74819	High	High
1545_4259	English_St	Single_l	2.013638	36.5246	N/A	36.5246	Moderate	N/A
4259_1422	English_St	Single_l	2.013638	35.97494	N/A	35.95601	Moderate	N/A
4259_1545	English_St	Single_l	48.00054	14.77251	17.02743	14.84399	Moderate	Moderate
1422_4259	English_St	Single_l	48.15286	24.53083	17.02743	24.5528	Moderate	Moderate
1545_8692	English_St	Single_l	309.6504	N/A	283.6289	N/A	N/A	N/A
4249_1235	Ferensway	Dual_c	415.2353	12.21819	309.635	12.96855	Moderate	Moderate
8536_1232	Ferensway	Dual_c	494.9329	27.87827	N/A	N/A	Moderate	N/A
1233_1232	Ferensway	Dual_c	571.044	16.51691	737.5819	14.46238	Moderate	Moderate
1232_1233	Ferensway	Dual_c	684.2327	4.173357	639.864	5.494226	Moderate	Moderate
1232_4003	Ferensway	Dual_c	788.6394	10.19921	N/A	N/A	Moderate	N/A
1233_4249	Ferensway	Dual_c	799.9391	17.45967	675.3279	17.85978	Moderate	Moderate
1235_4249	Ferensway	Dual_c	874.1662	12.95677	797.5768	14.24985	Moderate	Moderate
4249_1233	Ferensway	Dual_c	888.0305	6.185366	841.2356	8.969721	Moderate	Moderate

Traffic flow link	Location	Road type	Average vehicle flow during peak times DM 2040	Average speed (km/hr) DM	Average vehicle flow during peak times DS 2040	Average speed (km/hr) DS	Driver stress DM	Driver stress DS
1232_5113	Ferensway	Dual_c	N/A	N/A	1,158.099	43.045	N/A	Moderate
5112_1232	Ferensway	Single_l	N/A	N/A	334.0503	15.405	N/A	Moderate
1165_1167	Fish_St	Single_l	N/A	34.5	N/A	N/A	N/A	N/A
1167_1165	Fish_St	Single_l	N/A	22.31483	N/A	N/A	N/A	N/A
1148_5126	Garrison_Road_Queen_Street_junction	Single_l	N/A	N/A	566.3266	23.505	N/A	Moderate
1201_1853	High_St	Single_l	185.2545	15.4506	127.7906	15.47595	Moderate	Moderate
1446_1201	High_St	Single_l	202.269	29.95293	182.3648	29.96147	Moderate	Moderate
1201_1446	High_St	Single_l	341.5231	26.14816	523.9852	12.32917	Moderate	Moderate
1142_1143	Holiday_Inn	Single_l	6.380929	N/A	N/A	N/A	N/A	N/A
1143_1142	Holiday_Inn	Single_l	28.47065	N/A	N/A	N/A	N/A	N/A
1231_8896	Humber_Dock_Street	Single_l	93.58213	5.387738	N/A	N/A	Moderate	N/A
1110_1231	Humber_Dock_Street	Single_l	95.36046	N/A	N/A	N/A	N/A	N/A
1231_1110	Humber_Dock_Street	Single_l	N/A	N/A	N/A	N/A	N/A	N/A
1545_1372	Jackson_St	Single_l	226.7299	24.67327	213.109	46.6519	Moderate	Moderate
1372_1545	Jackson_St	Single_l	276.771	15.8778	268.7482	16.29164	Moderate	Moderate
8960_2560	Kingston_Retail_Park	Single_l	28.85335	N/A	28.85335	N/A	N/A	N/A
1422_8991	Kingston_Retail_Park	Single_l	261.1247	N/A	296.3168	N/A	N/A	N/A
8991_1422	Kingston_Retail_Park	Single_l	383.6417	N/A	411.1738	N/A	N/A	N/A
1505_1422	Kingston_St	Single_l	293.9589	32.90995	311.1807	32.54861	Moderate	Moderate

Traffic flow link	Location	Road type	Average vehicle flow during peak times DM 2040	Average speed (km/hr) DM	Average vehicle flow during peak times DS 2040	Average speed (km/hr) DS	Driver stress DM	Driver stress DS
1422_1505	Kingston_St	Single_l	347.942	27.45155	409.0636	27.33357	Moderate	Moderate
1201_1001	Liberty_Lane	Single_l	85.06008	18.00621	75.41716	17.93588	Moderate	Moderate
1001_1002	Liberty_Lane	Single_l	164.5725	N/A	261.7833	N/A	N/A	N/A
1001_4143	Liberty_Lane	Single_l	191.1411	17.32395	90.00313	16.87502	Moderate	Moderate
4143_1001	Liberty_Lane	Single_l	243.5259	19.49024	439.7958	16.76616	Moderate	Moderate
1001_1201	Liberty_Lane	Single_l	409.5627	21.40114	544.8389	11.21252	Moderate	Moderate
1002_1001	Liberty_Lane	Single_l	436.8201	N/A	381.7122	N/A	N/A	N/A
2560_8960	Linnaeus_St	Single_l	46.35353	N/A	46.56575	N/A	N/A	N/A
8897_1142	Linnaeus_St	Single_l	2,486.171	21.50506	N/A	N/A	High	N/A
1422_4258	Lister_St	Single_l	22.40288	27.43979	N/A	27.58171	Moderate	N/A
1135_1212	Lowgate	Single_l	187.4226	28.19193	544.1938	25.10996	Moderate	Moderate
1212_1135	Lowgate	Single_l	598.4155	19.72922	581.4452	24.19553	Moderate	Moderate
4271_4143	Market_Place	Single_l	139.3829	21.44243	229.6131	20.73899	Moderate	Moderate
1135_4271	Market_Place	Single_l	139.3829	21.44946	229.6131	20.36215	Moderate	Moderate
4143_1418	Market_Place	Single_l	171.9256	27.89802	73.35356	28.15631	Moderate	Moderate
1145_8865	Market_Place	Single_l	203.4439	8.473177	N/A	N/A	Moderate	N/A
1586_1145	Market_Place	Single_l	203.4681	11.40567	80.10894	12.38811	Moderate	Moderate
1150_1586	Market_Place	Single_l	203.4681	35.5	80.10894	35.5	Moderate	Moderate
1418_1150	Market_Place	Single_l	203.4681	27.70647	80.10894	28.20395	Moderate	Moderate

Traffic flow link	Location	Road type	Average vehicle flow during peak times DM 2040	Average speed (km/hr) DM	Average vehicle flow during peak times DS 2040	Average speed (km/hr) DS	Driver stress DM	Driver stress DS
4143_4271	Market_Place	Single_l	313.7482	24.71244	691.8666	20.36463	Moderate	High
4271_1135	Market_Place	Single_l	313.7482	24.1639	691.8666	22.49099	Moderate	High
1586_1150	Market_Place	Single_l	336.4343	37.51319	729.9378	33.89833	Moderate	High
1144_1586	Market_Place	Single_l	336.4343	33	729.9314	33	Moderate	High
1150_1418	Market_Place	Single_l	336.4343	33.85459	729.9378	31.27996	Moderate	High
8864_1144	Market_Place	Single_l	336.4343	33.90075	N/A	N/A	Moderate	N/A
1418_4143	Market_Place	Single_l	398.4829	29.8041	885.5439	21.01621	Moderate	High
1145_5125	Market_Place	Single_l	N/A	N/A	80.10894	21.035	N/A	Moderate
5124_1144	Market_Place	Single_l	N/A	N/A	729.9314	30.68	N/A	High
1230_4441	Myton_St	Single_l	32.09363	28.70077	119.4549	28.67336	Moderate	Moderate
4441_1420	Myton_St	Single_l	32.10753	11.95782	119.4549	10.86851	Moderate	Moderate
8870_4007	A63_Mytongate	Dual_c	356.6657	38.5	N/A	N/A	Moderate	N/A
8536_4003	A63_Mytongate	Dual_c	370.2452	13.64781	N/A	N/A	Moderate	N/A
1162_8867	A63_Mytongate	Dual_c	383.6279	13.6394	N/A	N/A	Moderate	N/A
8540_1162	A63_Mytongate	Dual_c	383.6279	14.51453	N/A	N/A	Moderate	N/A
1365_8869	A63_Mytongate	Dual_c	477.2668	28.80293	N/A	N/A	Moderate	N/A
4003_8868	A63_Mytongate	Dual_c	477.2668	2.862495	N/A	N/A	Moderate	N/A
8868_1365	A63_Mytongate	Dual_c	477.2668	23.14115	N/A	N/A	Moderate	N/A
8538_4005	A63_Mytongate	Dual_c	481.4995	2.2188	N/A	N/A	Moderate	N/A

Traffic flow link	Location	Road type	Average vehicle flow during peak times DM 2040	Average speed (km/hr) DM	Average vehicle flow during peak times DS 2040	Average speed (km/hr) DS	Driver stress DM	Driver stress DS
4005_8872	A63_Mytongate	Dual_c	481.5368	14.45629	N/A	N/A	Moderate	N/A
8872_8867	A63_Mytongate	Dual_c	481.5368	28.03909	N/A	N/A	Moderate	N/A
1161_8869	A63_Mytongate	Dual_c	510.6892	15.29988	N/A	N/A	Moderate	N/A
8542_1161	A63_Mytongate	Dual_c	510.6892	17.22121	N/A	N/A	Moderate	N/A
4007_8538	A63_Mytongate	Dual_c	533.0214	4.842855	N/A	N/A	Moderate	N/A
8870_8538	A63_Mytongate	Dual_c	631.4491	17.51785	N/A	N/A	Moderate	N/A
1160_8541	A63_Mytongate	Dual_c	664.65	1.306626	N/A	N/A	Moderate	N/A
4003_1160	A63_Mytongate	Dual_c	664.65	16.01977	N/A	N/A	Moderate	N/A
8538_1163	A63_Mytongate	Dual_c	679.3909	13.42135	N/A	N/A	Moderate	N/A
1163_8539	A63_Mytongate	Dual_c	679.5866	3.202893	N/A	N/A	Moderate	N/A
8867_8536	A63_Mytongate	Dual_c	865.1652	33.87759	N/A	N/A	Moderate	N/A
8869_8870	A63_Mytongate	Dual_c	988.1193	33.43834	N/A	N/A	Moderate	N/A
1365_4005	A63_Mytongate	Dual_c	1,993.353	29.52885	N/A	N/A	High	N/A
4005_8539	A63_Mytongate	Dual_c	1,993.353	48.94161	N/A	N/A	High	N/A
5105_5106	A63_Mytongate	Dual_c	N/A	N/A	489.3737	30.955	N/A	Moderate
5105_5115	A63_Mytongate	Dual_c	N/A	N/A	327.6062	38.59	N/A	Moderate
5106_5107	A63_Mytongate	Dual_c	N/A	N/A	295.1793	6.86	N/A	Moderate
5106_5118	A63_Mytongate	Dual_c	N/A	N/A	314.6088	30.21	N/A	Moderate
5107_5112	A63_Mytongate	Dual_c	N/A	N/A	383.287	19.2	N/A	Moderate

Traffic flow link	Location	Road type	Average vehicle flow during peak times DM 2040	Average speed (km/hr) DM	Average vehicle flow during peak times DS 2040	Average speed (km/hr) DS	Driver stress DM	Driver stress DS
5107_5122	A63_Mytongate	Dual_c	N/A	N/A	172.407	35.5	N/A	Moderate
5112_5105	A63_Mytongate	Dual_c	N/A	N/A	379.7401	6.2	N/A	Moderate
5113_5105	A63_Mytongate	Dual_c	N/A	N/A	437.2336	10.315	N/A	Moderate
5113_5114	A63_Mytongate	Dual_c	N/A	N/A	720.8611	14.805	N/A	Moderate
5114_5115	A63_Mytongate	Dual_c	N/A	N/A	720.8521	13.77	N/A	Moderate
5115_1230	A63_Mytongate	Dual_c	N/A	N/A	1,048.453	37.87	N/A	Moderate
5116_5106	A63_Mytongate	Dual_c	N/A	N/A	120.5622	2.175	N/A	Moderate
5116_5117	A63_Mytongate	Dual_c	N/A	N/A	67.34133	16.335	N/A	Moderate
5117_5118	A63_Mytongate	Dual_c	N/A	N/A	67.34133	27.845	N/A	Moderate
5120_5107	A63_Mytongate	Dual_c	N/A	N/A	260.588	6.285	N/A	Moderate
5120_5121	A63_Mytongate	Dual_c	N/A	N/A	362.2307	10.51	N/A	Moderate
5121_5122	A63_Mytongate	Dual_c	N/A	N/A	362.2307	9.295	N/A	Moderate
8692_1545	Neptune_St	Single_l	219.2053	N/A	216.2304	N/A	N/A	N/A
1232_4427	Osborne_St	Single_l	111.9604	29.36495	31.9301	29.6306	Moderate	Moderate
1232_1420	Osborne_St	Single_l	124.2388	17.30305	66.97136	19.94674	Moderate	Moderate
1420_9382	Osborne_St	Single_l	224.3001	26.76091	233.9487	26.5794	Moderate	Moderate
4427_1232	Osborne_St	Single_l	257.6492	10.82392	398.569	6.509113	Moderate	Moderate
2566_4427	Osborne_St	Single_l	293.8353	N/A	293.8353	N/A	N/A	N/A
1420_1232	Osborne_St	Single_l	385.7106	5.297778	429.0891	4.628535	Moderate	Moderate

Traffic flow link	Location	Road type	Average vehicle flow during peak times DM 2040	Average speed (km/hr) DM	Average vehicle flow during peak times DS 2040	Average speed (km/hr) DS	Driver stress DM	Driver stress DS
9382_1420	Osborne_St	Single_l	507.9376	11.51072	507.9511	10.83259	Moderate	Moderate
1537_4249	Paragon_Interchange	Single_l	220.0337	N/A	230.6208	N/A	N/A	N/A
4249_1537	Paragon_Interchange	Single_l	590.8106	N/A	552.6201	N/A	N/A	N/A
4428_4427	Porter_St	Single_l	228.4621	16.52022	350.25	16.31631	Moderate	Moderate
4427_4428	Porter_St	Single_l	304.582	16.62121	205.3664	17.95606	Moderate	Moderate
1151_1418	Posterngate	Single_l	93.22842	16.06442	162.2691	14.70795	Moderate	Moderate
1197_1151	Posterngate	Single_l	93.23308	16.58256	162.2691	16.48577	Moderate	Moderate
1197_4432	Princes_Dock_St	Single_l	26.61746	N/A	45.01131	N/A	N/A	N/A
1215_1197	Princes_Dock_St	Single_l	26.62862	15.5	45.01131	15.54784	Moderate	Moderate
4432_1197	Princes_Dock_St	Single_l	93.23308	N/A	162.2691	N/A	N/A	N/A
1197_1215	Princes_Dock_St	Single_l	N/A	15.75474	N/A	N/A	N/A	N/A
1109_1446	Queen_Street	Single_l	75.43546	23.49741	79.75144	23.4577	Moderate	Moderate
1149_1109	Queen_Street	Single_l	75.43546	29.92265	79.71999	29.91327	Moderate	Moderate
1446_1456	Queen_Street	Single_l	100.0422	N/A	101.0755	N/A	N/A	N/A
1456_1446	Queen_Street	Single_l	162.7221	N/A	258.0869	N/A	N/A	N/A
1446_1109	Queen_Street	Single_l	277.3109	17.16503	566.3266	16.69109	Moderate	Moderate
1109_1148	Queen_Street	Single_l	279.0868	6.887737	566.3266	3.517736	Moderate	Moderate
8527_8534	Rawling_Way	Single_l	929.1237	8.784974	688.276	8.51632	High	High
2557_8527	Rawling_Way	Single_l	929.1237	19.5	688.276	19.5	High	High

Traffic flow link	Location	Road type	Average vehicle flow during peak times DM 2040	Average speed (km/hr) DM	Average vehicle flow during peak times DS 2040	Average speed (km/hr) DS	Driver stress DM	Driver stress DS
8533_8527	Rawling_Way	Single_l	952.7619	28.5	824.8985	28.5	High	High
8527_2557	Rawling_Way	Single_l	952.7707	40.6456	824.9029	43.24398	High	High
1152_1167	Robinson_Row	Single_l	N/A	16.5	N/A	28.2504	N/A	N/A
1167_1152	Robinson_Row	Single_l	N/A	16.5	N/A	28.71126	N/A	N/A
4440_4441	Roper_St	Single_l	0.009269	16.48252	N/A	16.17212	Moderate	N/A
1135_1138	Silver_Street	Single_l	573.6389	N/A	498.9263	N/A	N/A	N/A
1150_1168	South_Church_Side	Single_l	0.004635	21	N/A	23.99143	Moderate	N/A
1168_1150	South_Church_Side	Single_l	N/A	N/A	N/A	14.16	N/A	N/A
1168_1167	South_Church_Side	Single_l	N/A	16.5	N/A	17.69437	N/A	N/A
1141_1140	Spruce_Road	Single_l	26.45317	N/A	N/A	N/A	N/A	N/A
1140_1141	Spruce_Road	Single_l	N/A	N/A	N/A	N/A	N/A	N/A
1141_5123	Spruce_Road	Single_l	N/A	N/A	N/A	N/A	N/A	N/A
5123_1141	Spruce_Road	Single_l	N/A	N/A	N/A	N/A	N/A	N/A
4258_1422	St_James_St	Single_l	N/A	26.49547	N/A	26.4553	N/A	N/A
4259_4258	St_James_St	Single_l	0.143666	21	N/A	19.81631	Moderate	N/A
4258_4255	St_James_St	Single_l	22.54656	4.403451	N/A	N/A	N/A	N/A
4255_4258	St_James_St	Single_l	N/A	20	N/A	N/A	N/A	N/A
4258_4259	St_James_St	Single_l	N/A	22.18214	N/A	22.24789	N/A	N/A
4258_5111	St_James_St	Single_l	N/A	N/A	N/A	30	N/A	N/A

Traffic flow link	Location	Road type	Average vehicle flow during peak times DM 2040	Average speed (km/hr) DM	Average vehicle flow during peak times DS 2040	Average speed (km/hr) DS	Driver stress DM	Driver stress DS
5111_4258	St_James_St	Single_l	N/A	N/A	N/A	29.59	N/A	N/A
4427_2566	St_Lukes_St	Single_l	71.92544	N/A	71.95495	N/A	N/A	N/A
1168_1166	Vicar_Lane	Single_l	0.004635	18.49273	N/A	N/A	Moderate	N/A
1166_1168	Vicar_Lane	Single_l	N/A	18.5	N/A	N/A	N/A	N/A
2560_4428	Walker_St	Single_l	135.9001	13.20475	91.10006	13.4511	Moderate	Moderate
2557_2560	Walker_St	Single_l	164.2505	14.55215	128.9198	14.55495	Moderate	Moderate
4428_4122	Walker_St	Single_l	183.8551	14.54809	117.3613	14.5675	Moderate	Moderate
4122_4428	Walker_St	Single_l	472.0937	15.6443	465.9161	15.58759	Moderate	Moderate
4428_2560	Walker_St	Single_l	500.3854	13.6973	294.8376	13.75684	Moderate	Moderate
2560_2557	Walker_St	Single_l	511.2305	6.082046	314.9492	10.38688	Moderate	Moderate
4440_4442	Waterhouse_Ln	Single_l	106.689	N/A	110.4886	N/A	N/A	N/A
9382_4440	Waterhouse_Ln	Single_l	106.6979	25	110.4886	25	Moderate	Moderate
9382_5440	Waterhouse_Ln	Single_l	117.6898	N/A	123.5455	N/A	N/A	N/A
4440_9382	Waterhouse_Ln	Single_l	196.4128	20.4097	196.4174	20.4097	Moderate	Moderate
4442_4440	Waterhouse_Ln	Single_l	196.4174	N/A	196.4174	N/A	N/A	N/A
5440_9382	Waterhouse_Ln	Single_l	311.6149	N/A	311.6149	N/A	N/A	N/A

A63 Castle Street Improvements, Hull
Environmental Statement

Volume 3 Appendix 15.2
EFFECTS ON ALL TRAVELLERS – TEMPORARY TRAFFIC MANAGEMENT PLAN, VIRTUS

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Virtus

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A63 Castle Street Improvements Temporary Traffic Management Plan

Overview of TM Proposal

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A63 Castle Street Improvements Temporary Traffic Management Plan

Overview of TM Proposal

Balfour Beatty

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Contents

Introduction

Virtus Traffic Management Solutions ltd were tasked by Balfour Beatty in 2015 to collate information on the constraints relating to the A63 Castle Street Improvement scheme, review existing plans that had been previously produced at ECI stage, and develop a Temporary Traffic Management Plan (TTMP) for the project.

The information already held was supplemented by a number of visual surveys of the function of Mytongate roundabout, and it was identified that maintaining the operation of Mytongate roundabout as a gyratory during construction, was in all probability not going to be the most effective way to minimise the effect of the project on the network. Based on the information we held, it was our professional opinion that the most effective way of minimising road user impact would be for an alternative set of phasing plans to those prepared in line with the early stage tender document. From this, an “alternative” TTMP was then developed

The basis of this alternative plan being that the right turn movements and associated signals around Mytongate gyratory would be removed to assist with the free flow of traffic. It was accepted that any road works scheme on the A63, along the Castle Street length, would inevitably cause additional disruption to the existing network function, but it was our belief that any additional journey length associated with removing the right turn facilities would be mitigated by the improved through-put.

Discussions were undertaken with representatives from Hull City Council (HCC), and it was noted that their principle concern was the migration of traffic, including HGV’s, from the A63 onto their local road system during the works as a result of a break down in flow caused by the Temporary Traffic Management. It was explained that this alternative TTMP would be tailored to maximise traffic flow on the A63 so that traffic should have less reason to migrate onto HCC roads, and therefore reduce the impact on their network and negate the need to implement localised measures to alleviate migration. Measures which are difficult to police and generally of limited effect.

During the meeting with HCC, the possible need to close the A1079 Ferensway, between the A1106 Anlaby Road and Mytongate roundabout, in order to allow adequate construction space during some later phases was discussed. Those at the meeting agreed in principal that the most suitable route for a diversion would be along the A1106 Anlaby Road and down Rawling Way to Rawling way roundabout, as it was the current approved Tactical Diversion Route that is brought into effect during closures of Mytongate Roundabout or Castle Street.

To prove or disprove our theory, in September 2016 Halcrow-Hyder were commissioned to produce a series of traffic models which would allow an accurate and direct comparison between the ‘Tender phasing’ and the ‘Alternative phasing’ plans, assess the impact each would have to inform discussions with HCC regarding their network, and to produce technical notes to document their findings.

<u>Technical notes produced to date</u>

- TN066 TM Phasing Technical Note Draft V4
- TN068 Additional Tasks Technical Note Draft V4
- TN072 Construction Routing SATURN Analysis Technical Note Draft V1
- TN074 TM Scenario Testing Technical Note Draft V3

Virtus Traffic Management Solutions believe that the TTMP laid out in the following pages not only conforms to all current legislation and guidance, but also takes into account the unique and challenging nature of the scheme, and ensures as far as is reasonably practicable that it is safe for all users of the A63 at Castle Street.

1. Tender Vs Alternative

Within this document 'Tender' and 'Alternative' will be referenced to indicate a specific Traffic Management phasing plan. The main differences between these two options are;

TENDER – The initial tender phase Temporary Traffic Management Plan was a document first produced by Morgan Sindall for Balfour Beatty in September 2013. This high level early involvement document set out a phasing plan based on information available at the time. However, there are a number of issues with this plan that have become clear when compared with the information that we now hold. In the main these are;

- The retention of the right turn movements at Mytongate. Even though retaining these movements may appear the obvious thing to do, a consequence of this is vastly reduced stacking space allowed for vehicles waiting at the traffic signals to turn right. This is dictated by the space required for construction, along with the size of vehicles making those movements. It was evident to us that retaining the right turns would result in severe queuing on both carriageways.
- The reduced lane widths on the main A63 are shown in the tender document as being 3.25m in both lanes, and both lanes around the Gyratory being 3.5m wide. The reason for the offside lane being the same as the nearside is to allow for HGV traffic to enter lane 2, as would be required if the right turns were retained. The Issue here is that even though there are no specific guidance documents for narrowing lane widths on circulatory roads in a temporary situation, the guidance for permanent design within **TD16/07 – Geometric Design of Roundabouts** states that "*The width of the circulatory carriageway must be between 1 and 1.2 times the maximum entry width".* It is our belief therefore, that due to the fact that the approaching lane widths will have already been reduced from approx. 3.65m to 3.25m on the approach, that we should be offering at least the maximum of 1.2 times entry width. Had this logic been applied during the tender proposal, there would have been a requirement for two lanes of 3.9m's or 7.8m's in total, which would see a loss of 800mm of the working space that has in fact been proposed. Further to this, reducing the road widths to 3.25m in both lanes wouldn't offer the required width for construction whilst still offering adequate protection from a Temporary Vehicle Crash Barrier (TVCB) that would require a minimum N2W2 containment level. In order to maintain the quoted lane widths there would be need for additional phases in order to carry out carriageway widening along the schemes length in advance of the main work. See figures 1, 2, and 3 below.

- As part of our proposal we have had to take into account the location of the Earl de Grey Public house, Castle building and William Booth House. Their close proximity to the live traffic and construction activities have created severe design challenges which don't appear to have been taken fully into account during the early stage tender design. Evidence of this is shown from phase 4B onwards when the eastbound traffic appears to be running directly along the façade of both Castle Building, Earl de Grey and to a lesser extent William Booth House's boundary. Whilst there is an indicative barrier system illustrated on the drawings, there are no specifications as to what containment level that system was ever planned to be, let alone the H4a Very High Containment level that we have since found to be necessary, or any accurate cross section drawings with details of their option.

- On all tender phase drawings there is an indicative Pedestrian route showing a north/south and east/west movement. However, once again there are no plans outlining how that pedestrian passage would have been safely created or managed, whether sight lines and safe stopping distances had been considered, and with several areas being left open to interpretation.

- The proposed use of Contra-flows. In recent years Highways England have moved away from their use on major projects, as they are seen to be confusing for road users and hazardous to maintain. On this scheme these issues would be further exacerbated by such a small, wide site. Traffic would be directed across 20m+ of lateral width, across varying temporary surfaces and along a very short linear length. This would give insufficent opportunity to have adequate warning signs in place to warn, instruct and direct.

ALTERNATIVE – The alternative phasing plan was born from a desire to mitigate as much as possible any further congestion on what is already one of the most heavily congested sections of road in the east Ridings of Yorkshire, as Castle Street currently has an Annual Average Daily Flow figure (AADF) of approximately 54,000 vehicles.

The route for traffic during the alternative phasing has been comprehensively assessed. Many options have been explored & discounted before we reached what we believe to be the optimum solution. Items considered have been, barrier containment level requirements, available or required construction widths, pinch points in crucial areas and Non-motorised users (NMUs).

Lane widths along the main A63 for the alternative option are proposed as 3.25m on the nearside and 2.75m on the offside, this in effect will ban HGV's from lane two. Along with these, and following the guidance mentioned above from **TD16/07 – Geometric Design of Roundabouts,** there would be reduced lane widths of 3.3m and 3.9m around the gyratory. These reduced lane widths are only possible alongside the removal of the right turn facilities at Mytongate roundabout, along with all associated signals.

The removal of right turn facilities at Mytongate, and the permissible narrow lanes, are all crucial factors in allowing us to construct the scheme so close to the existing structures. These 'Pinch points' have created serious design challenges and have meant that working space requirements have been the key driver for the TTMP.

Figure 1 Generic cross section of A63 carriageway

Figure 1 illustrates a typical cross section of the A63 on the Castle street section

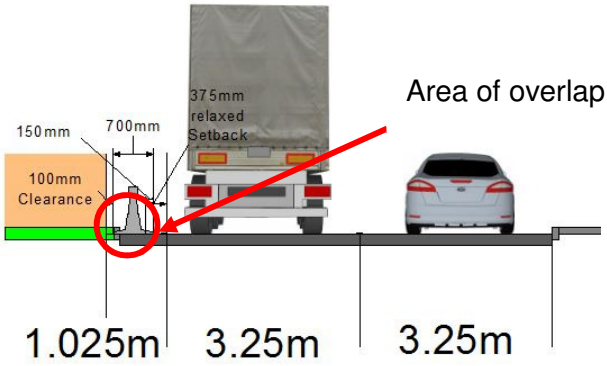


Figure 2 Generic cross section of tender phasing proposal

Figure 2 illustrates the narrow lane widths as indicated in the initial Tender document.

The working width of the TVCB is beyond the carriageway limits at this point and would require prior carriageway widening works to allow these to be installed.

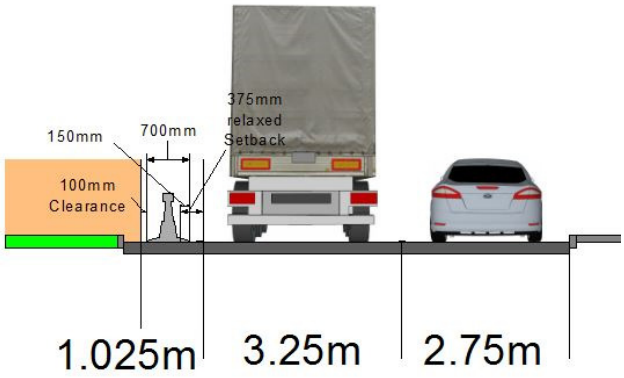


Figure 3 Cross section illustrating proposed lane widths

Figure 3 illustrates the narrow lane widths proposed for the alternative phasing plan. These allow construction behind TVCB without any additional widening being required.

2. Network Impact – VISSIM Models

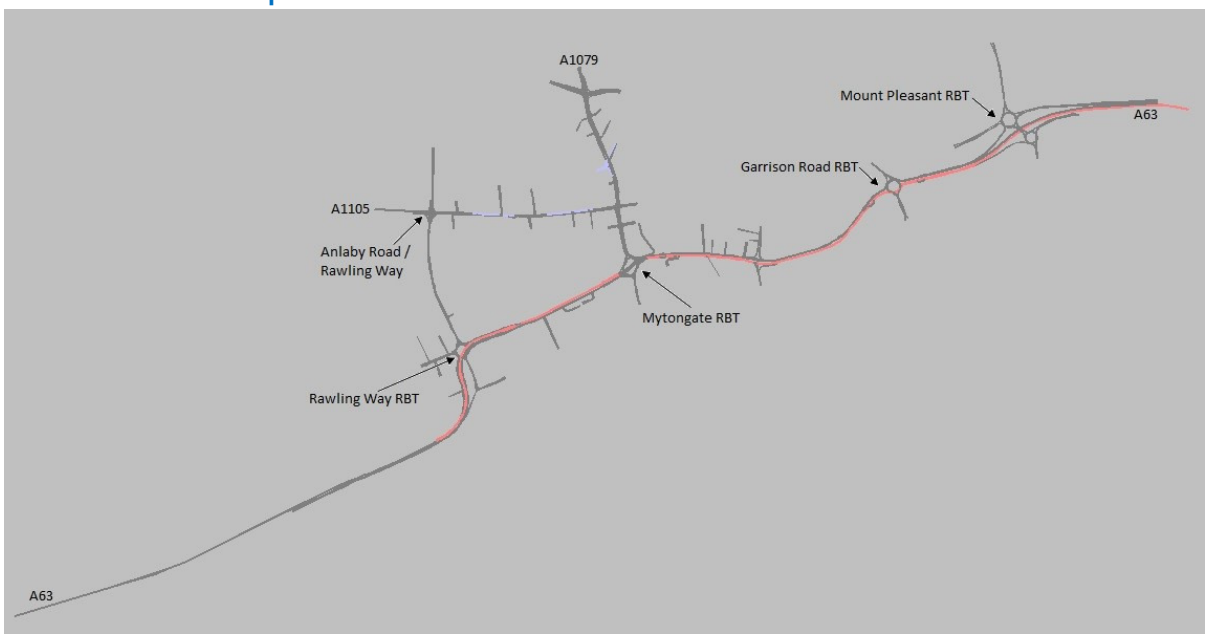


Figure 4 Illustration of the area covered by the term 'Network' in the technical notes

The four technical notes that have been produced all focus on separate tasks, in the main these are;

- TN066 TM Phasing Technical Note Draft V4

TN066 documents the results of modelling all 6 construction phases for the proposed tender and alternative phasing plans to give a clear comparison between the effects of each. The AM, Inter and PM hourly Peaks were used on each of the three tests carried out. These tests measured 1, Network Performance, 2, Journey Time and 3, Peak queue lengths. The summary of these tests is;

  - With the alternative strategy the A63 generally runs much more quickly through the Mytongate junction than with the tender strategy.
  - With the Tender strategy right turning traffic off the A63 onto Ferensway or Commercial Road blocks the A63 ahead movements and therefore causes delay on the A63 mainline.
  - When the Mytongate junction is reconfigured from Phase 4 onwards of the Tender strategy significant delays are caused at this junction. Modifying signal timings could reduce the delay to Ferensway but at the expense of the A63. This layout will therefore result in significant delay.
  - With the alternative phasing the AM peak generally operates better than with the tender layout with overall less delay in the network. However, some increases in queuing are predicted at the Rawling Way roundabout and Anlaby Road / Rawling Way junction due to additional traffic being routed this way as a result of right turn closures at Mytongate.

- TN068 TM Additional Tasks Technical Note Draft V4

TN068 was requested after TN066 had been reviewed and the extent of queue lengths was realised. It became clear that to give an accurate of illustration of what the effects would be once Traffic Management (TM) had been installed, we should understand what

current level of queueing was, and this is referred to as 'Do Minimum' within the note. In addition to this we asked for a scenario to be modelled that assumed we had managed to retain some form of at-grade north/south pedestrian crossing, and what effects the required signalisation would have on flow. The summary of these tests is;

- The addition of a pedestrian crossing results in increased journey times and delay
- The pedestrian crossing also results in increases to queue lengths, with the exception of Garrison Road roundabout where the crossing reduces queuing on the A63 EB approach arm as it is held up at the crossing instead
- The A63 WB pedestrian crossing has the greatest impact on traffic movements at Rawling Way roundabout due to pulses of traffic released by the crossing affecting other arms of the roundabout, resulting in increased journey times and queue lengths
- There is no evidence of traffic building up at the A63 EB pedestrian crossing to a level where it impacts back to Rawling Way roundabout

- TN072 Construction Routing SATURN Analysis Technical Note Draft V1

TN072 was produced to examine the effects on HCC's network of removing the right turn facilities at Mytongate, and to better understand the probable alternative routes traffic would take as a result of the right turn bans (assuming no signed diversions were in place). The main areas highlighted were;

- Increased flows on most arms of the Rawling Way roundabout due to a number of vehicles from the banned turns at Mytongate using this junction as an alternative route
- The reduction in opposing flow across the Great Union Street arm of the Garrison Road roundabout leads to an increase in right turning traffic from Great Union Street onto the A63. This traffic previously took other routes such as Queen Street to avoid congestion at the roundabout
- There are reductions in flows along Ferensway due to the closure of access onto the A63 from this arm
- The absolute flow increases along key diversion routes such as Rawling Way and Freetown Way are not as large as the number of vehicles diverted onto these routes from banned turns at Mytongate. This is due to traffic currently on these routes reassigning elsewhere to avoid the additional flows on their original routes.
- Most roads in the network experience increases in traffic apart from certain sections of Ferensway and one or two locations where localised rerouting occurs.

- TN074 TM Scenario Testing Technical Note Draft V3

TN074 was produced in order to give a comparison of network effects across various scenarios that have been looked at, these are;

Base – The existing network conditions based on 2016 data.

2023 Do Minimum (DM) – Includes expected traffic growth and includes the planned Garrison Road improvement scheme.

2023 with Traffic management (NLT) – To assume Ferensway left turn on to the A63 is closed.

2023 with Traffic management (LT) – To assume Ferensway left turn on to the A63 is open.

2023 with Traffic management (LT WC1) – To assume left turn retained at Ferensway but to assume worst case scenario for traffic on main line A63, assuming that traffic wouldn't re-route as suggested in TN072 and would remain entirely on the A63 and along the signed diversions.

As with TN066 the AM, Inter and PM hourly Peaks were used on each of the three tests carried out. These tests again measured 1, Network Performance, 2, Journey Time and 3, Peak queue lengths. The main conclusion of that modelling work was;

- Comparing the Do Minimum forecast with the base indicates that even without traffic management measures in place there will be significant congestion, delay and queuing increases on the modelled road network by 2023 compared with those experienced today. This is especially the case on the A63 where queuing traffic is predicted to extend off the edges of the modelled network to the east and west in peak periods with hundreds of vehicles unable to enter the network in the modelled time period due to these queues.
- The removal of the Mytongate signals as part of the TM is forecast to result in a number of improvements to traffic flows, queues and delays on the A63 mainline in each direction compared with the Do Minimum situation.
- However, due to traffic being reassigned in the network due to the TM including closure of various turning movements at Mytongate the benefits to the A63 are offset by loss of benefits elsewhere in the network.
- Particular junctions that are predicted to be problematic are the Rawling Way / Madeley Street roundabout and the Argyle Street / Anlaby Road junction. Queues from these junctions are forecast to affect other parts of the road network in certain peaks with vehicles unable to enter to model network on a variety of approach arms.
- In the PM peak the large volume of traffic wishing to turn onto Anlaby Road due to the right turn onto the A63 at Mytongate being closed results in delays on Ferensway itself as well as on Anlaby Road.
- In the worst-case scenario where no one changes their routing or travel patterns as a result of the Mytongate turn closures, extensive queuing is forecast to develop from the Garrison Road roundabout as all traffic originally turning right or ahead at Mytongate U-turns in this location. This in turn has a knock-on effect on Ferensway and other parts of the network.

What the modelling has proven, is that keeping traffic flowing as freely as possible on the A63 is going to be of paramount importance to reducing the impact on HCC's surrounding network. However, this alone won't be enough and there are a number of areas highlighted by TN074 that would benefit from some early mitigating measures being put in place. And these are;

- Rawling Way / Madeley Street roundabout;
- Anlaby Road / Argyle Street signalised junction; and
- Ferensway / Anlaby Road signalised junction.

3. Mitigating measures

There are a number of measures that can be introduced to mitigate additional delays, both in advance of and during construction. Key areas to consider are;

- Garrison Road/Great Union Street roundabout –
  Although there are already plans for future junction improvement works to be carried out, this junction would benefit from some signal timing readjustment.
- Rawling Way/Madeley Street roundabout –
  As one of the main areas of concern raised within the modelling, this area would benefit from some junction improvement works in advance of the main construction. Precisely what they may be is yet unknown, but adding an extra lane to the gyratory, the addition of box junctions and signalisation are just three options to consider.
- Anlaby Road/Rawling Way junction –
  Already a major junction on Anlaby road with signal controls and dedicated lanes, signal timing readjustment to reflect the new traffic demand should offer a benefit here.
- Ferens Way/ Anlaby Road junction –
  As above, this junction would also benefit from signal timing readjustment.
- Ferensway/Castle Street -
  During later phases when it may be necessary to close Ferensway between Anlaby Road and Castle Street to allow construction of the new eastbound slip road, there may be an opportunity to only fully close this access during off-peak hours.
- Daltry Street/Jackson Street –
  A box junction on Daltry Street, across the mouth of Jackson Street, should mitigate against traffic queuing for Rawling way roundabout from stopping traffic wishing to join the A63 West.
- Ferensway & Commercial Road left turns –
  The heavily trafficked nature of the A63 will undoubtedly make it difficult to exit from Ferensway or commercial Road onto the A63, so some form of signalisation may be required to allow traffic out of the junction and ease congestion. This is being considered alongside the same issue that site traffic will have when wanting to exit site, as both will have heavy traffic and difficult sight lines to contend with. This may lead us to install traffic signals, that control a site exit and joining junction simultaneously, in order to create a safe opportunity for these movements. The results in technical note TN068 suggested that a single pedestrian crossing wouldn't have too detrimental an effect on the mainline through-put, so we should expect similar effects from a controlled junction.

4. South Area Severance

The area to the south of Mytongate, leading from Commercial Road is the area that we might reasonably expect most objections from stakeholders, as this is the main access route for a number of residential properties, the main entrance to the Cinema, Kingston Retail Park and other smaller businesses.

We are aware that by removing the ability to turn right into and out of this area, there is likely to be the perception that we will be causing additional delay. However, through extensive modelling we have sought to prove that in reality, by improving through-put at Mytongate, (by the removal of the right turn facility and associated traffic signals) ultimately even though their journey length may increase, the journey time may not be greatly affected, and in a

number of cases there will even be a marked improvement on travel times over those with the right turns retained.

5. Non-Motorised Users

CDM 2015 guidance (L153) states *'A construction site must be organised in such a way that, so far as is reasonably practicable, pedestrians and vehicles can move without risks to health or safety.'*

Chapter 8, Part 1 – Design (D3.32) states *'Where pedestrians, cyclists, equestrians and other vulnerable road users are affected by road works, the designer should give detailed consideration to minimising the impact on them and ensuring suitable alternatives exist.*

This consideration should include the following: (but not limited to)

- *Safety implications of temporary surfaces, obstructions, ramps, diversions etc.;*
- *Standard of surface/gradients/lighting;*
- *Adequacy of crossing facilities for pedestrians;*
- *The needs of children, particularly if schools or play areas etc. are nearby;*
- *Closing off of unsafe access across works; and*
- *Arrangements for those with restricted mobility and other special needs.*

It is our belief that to maintain safe passage for Non-motorised Users (NMU's) from either side of the A63, whilst still upholding the ethos of such safety initiatives as Highways England's Raising the Bar and Aiming for Zero, would require us to divert all NMU's away from the area around Mytongate completely. The main users we are focussing on are Pedestrians, Cyclists and those with restricted mobility.

5.1 Pedestrians

Attempting to Maintain any form of North/South 'at-grade' pedestrian route across the A63 during construction would be a major challenge, not only due to the difficult physical layout of the site, but also due to the severe impact that the consequential loss in works area would have on the construction program. Pedestrians would be required to negotiate temporary surfaces, ramps, and level differences whilst having to cross narrowed lanes within the traffic management, and a carriageway in contra-flow during some phases.

To maintain a safe crossing close to Mytongate, the use of some form of temporary structure across the site would need to be explored. However, this option has Its own design challenges due to the tight nature of the scheme, and availability of land for suitable landing points

Therefore, the proposal is for a pedestrian diversion, either to the west of Mytongate to a temporary at-grade road crossing close to Porter Street, or to the east of Mytongate to the at-grade crossing at Market Place. The temporary crossing at Porter street will be installed close the existing crossing which will be closed during construction of the new Porter Street footbridge. Once the new Porter street footbridge is constructed it will be open to the public. The foot traffic to the East of Mytongate will also have the option to use the improved facilities beneath the A63 at Humber Street until such time as the newly constructed Princes Quay footbridge is open.

See figure 5 below for example of what an at-grade crossing might look like, and the resultant loss of working area due to barrier lead-in/departure specifications. (Loss indicated by the red zones)

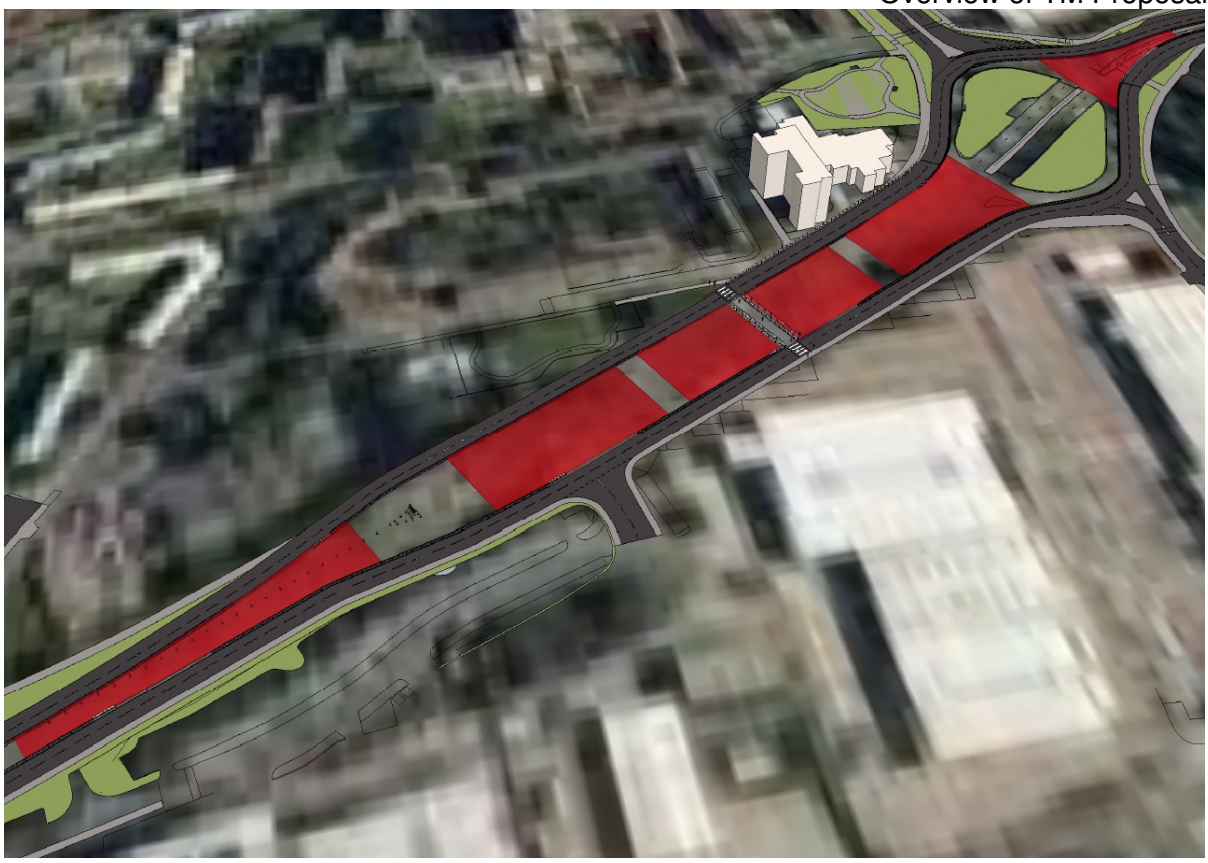


Figure 5 Example of loss of works area due to TVCB specification at an at-grade pedestrian crossing

There remains a major challenge however when it comes to East/West movements between Myton Street and Princes Dock Street on the North side of Castle Street, and between Mytongate and the Holiday Inn access on the South side. The completed Castle Street layout extends beyond the current footways, and as such they are denied to pedestrians for a large part of the project due to construction, and with no straightforward natural diversion to follow there appears to be just two options available as to where to route pedestrians.

- Option 1
  With no natural route adjacent to the closed footway, and in the absence of any other solution, a lengthy diversion would need to be put in place that would see pedestrians routed into the city on the North side of Castle Street and routed around the Marina on the South side. See figure 6 below.
- Option 2
  It was hoped at an early stage that there may be a route for pedestrians to travel East & West behind the Earl de Grey building from Princes Dock Street and out onto Waterhouse Lane. However, with the proposed construction of a new hotel on the grounds this isn't going to be possible, so another option would be to utilise a corner of Princes Quay's ground floor car park. Utilising this space would mean that we could join up the existing footway that runs along the front of the building from the Marina, to the Waterhouse lane exit. See figures 7 & 8 below.

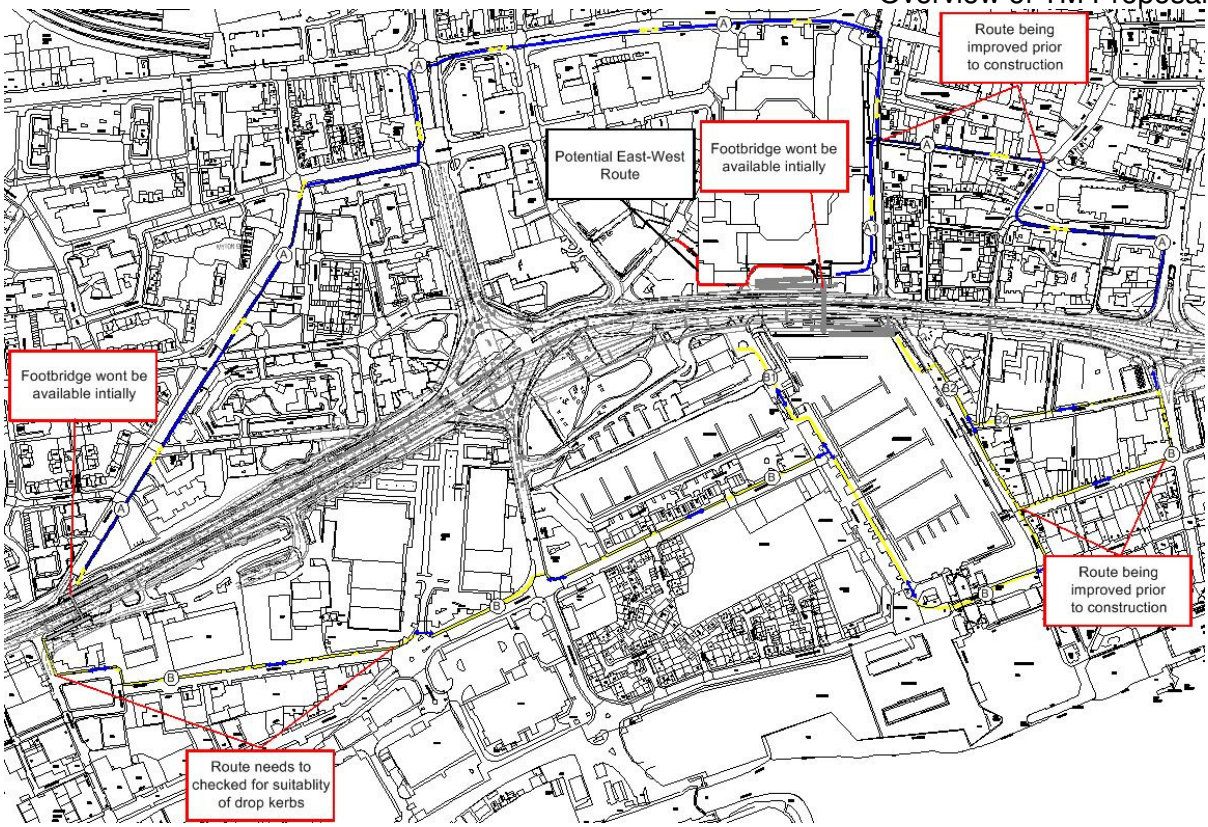


Figure 6 Pedestrian diversion route, assuming no East/West solution is found

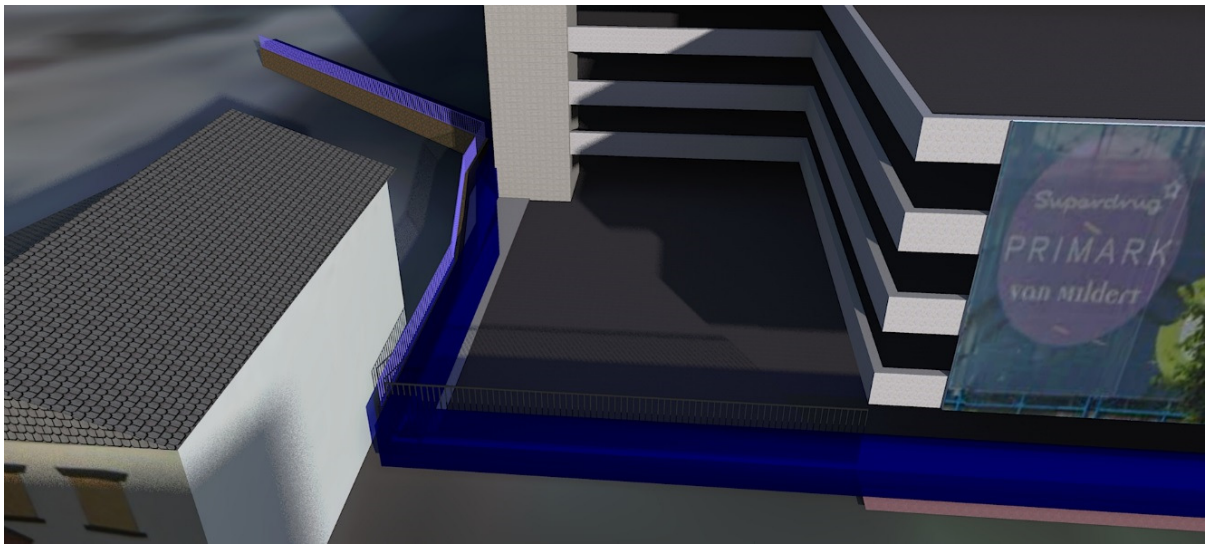


Figure 7 Illustration of area of car park to be utilised

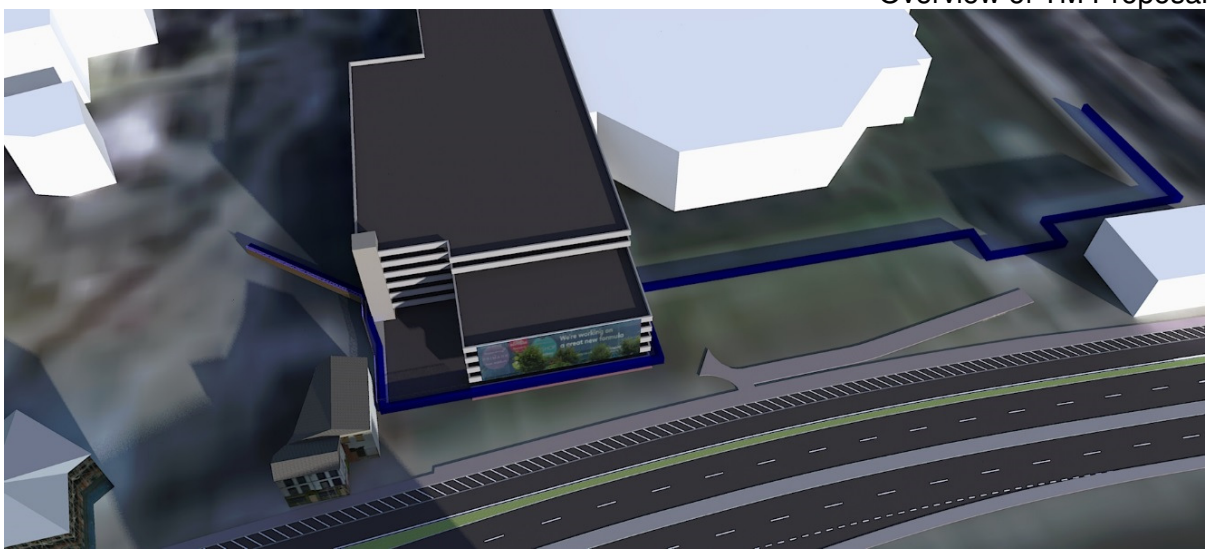
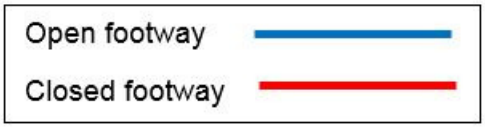


Figure 8 Illustration of indicative East/West route

In order to remove doubt as much as possible, the routes available to pedestrians will largely remain the same throughout construction. Nevertheless, there will need to be some small changes to coincide with differing construction phasing. Below are the proposed diversion routes, phase by phase, assuming that we can secure a route through Princes Quay car park as outlined above.

Key:



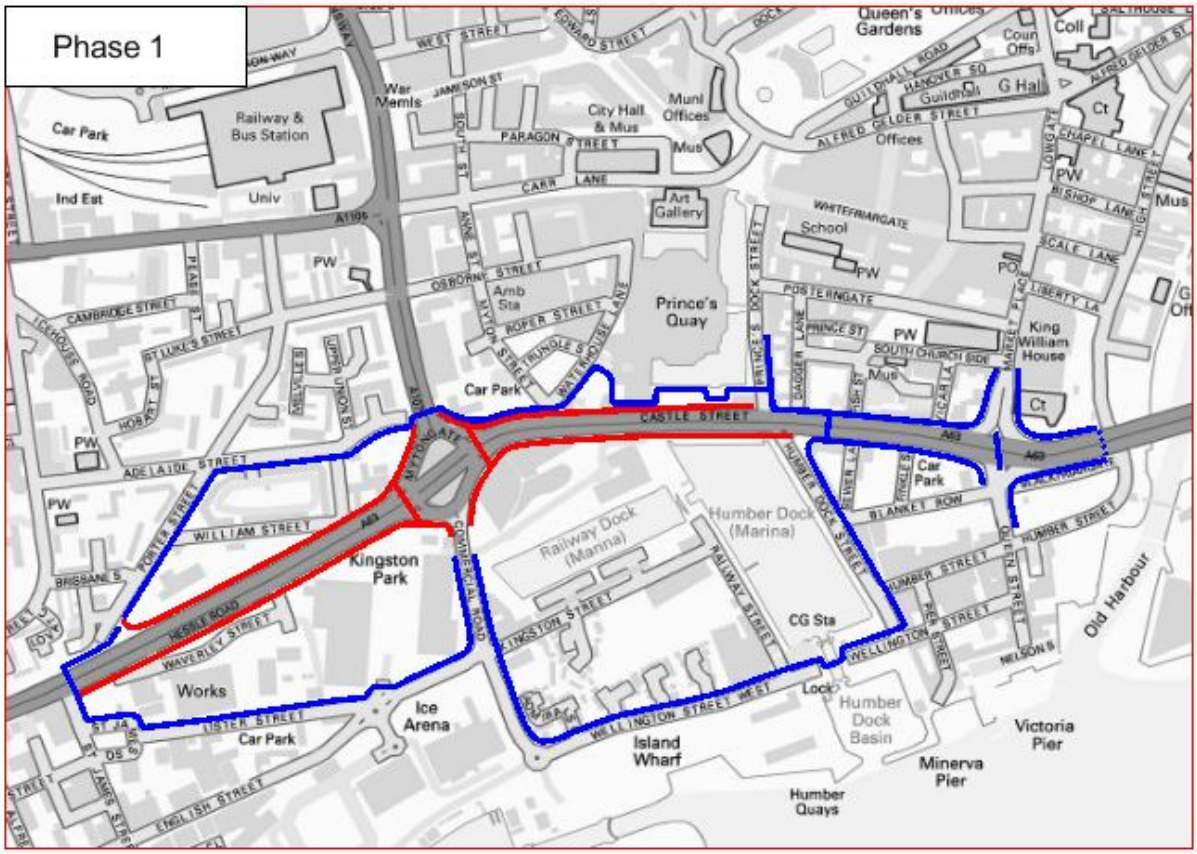


Figure 9 Phase 1 pedestrian diversion route

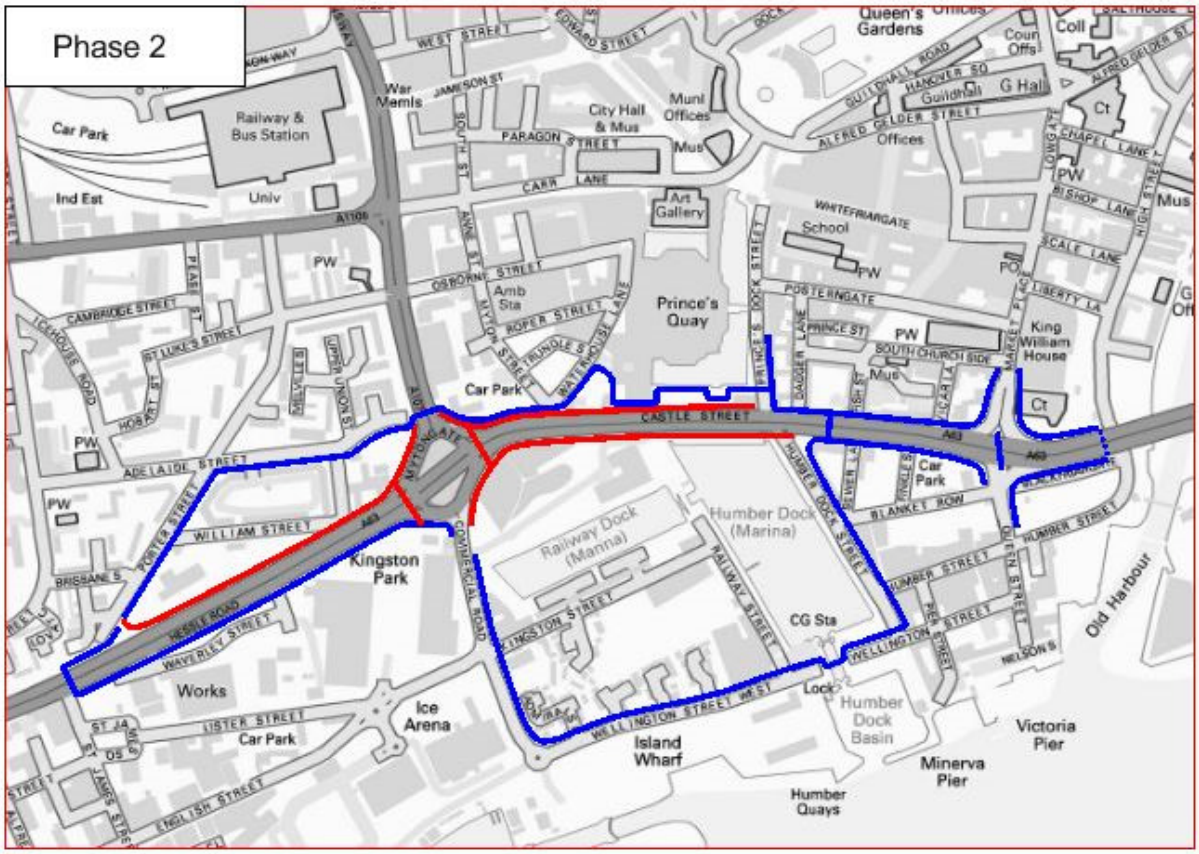


Figure 10 Phase 2 pedestrian diversion route

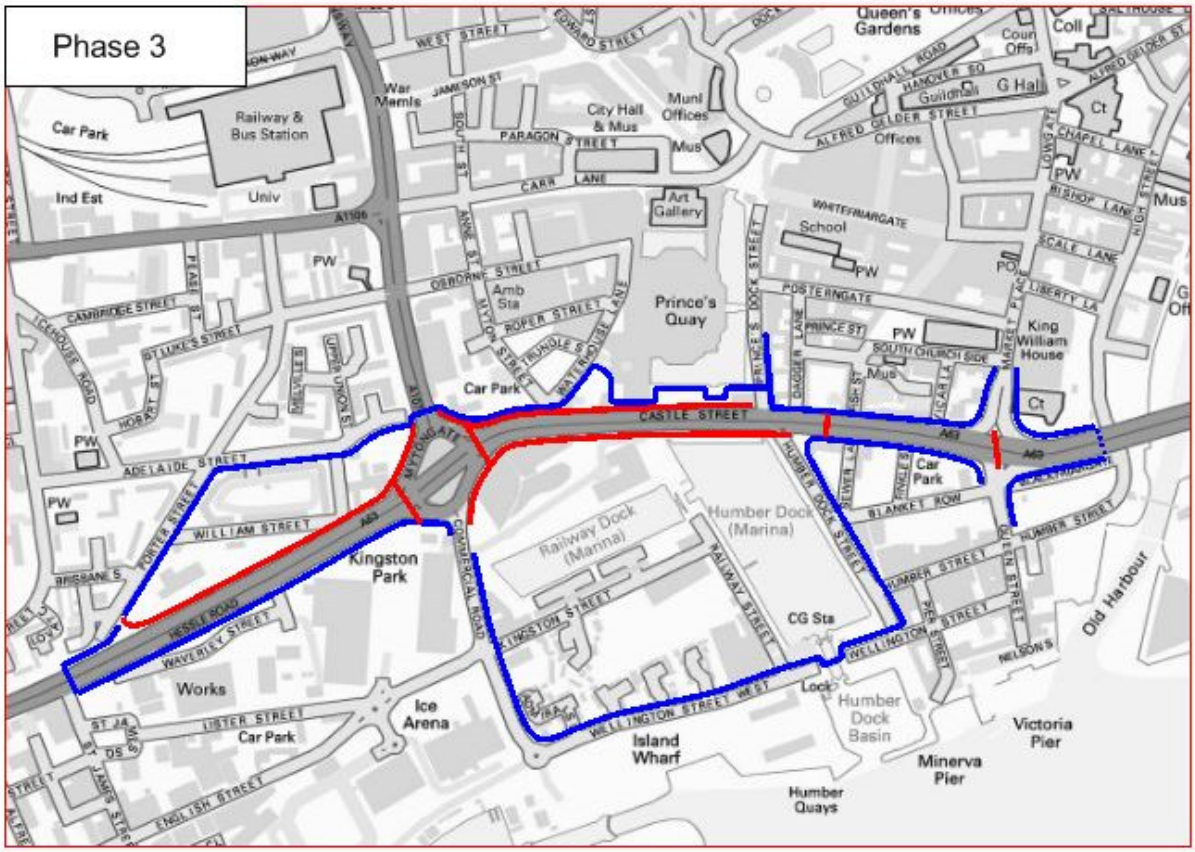


Figure 11 Phase 3 pedestrian diversion route

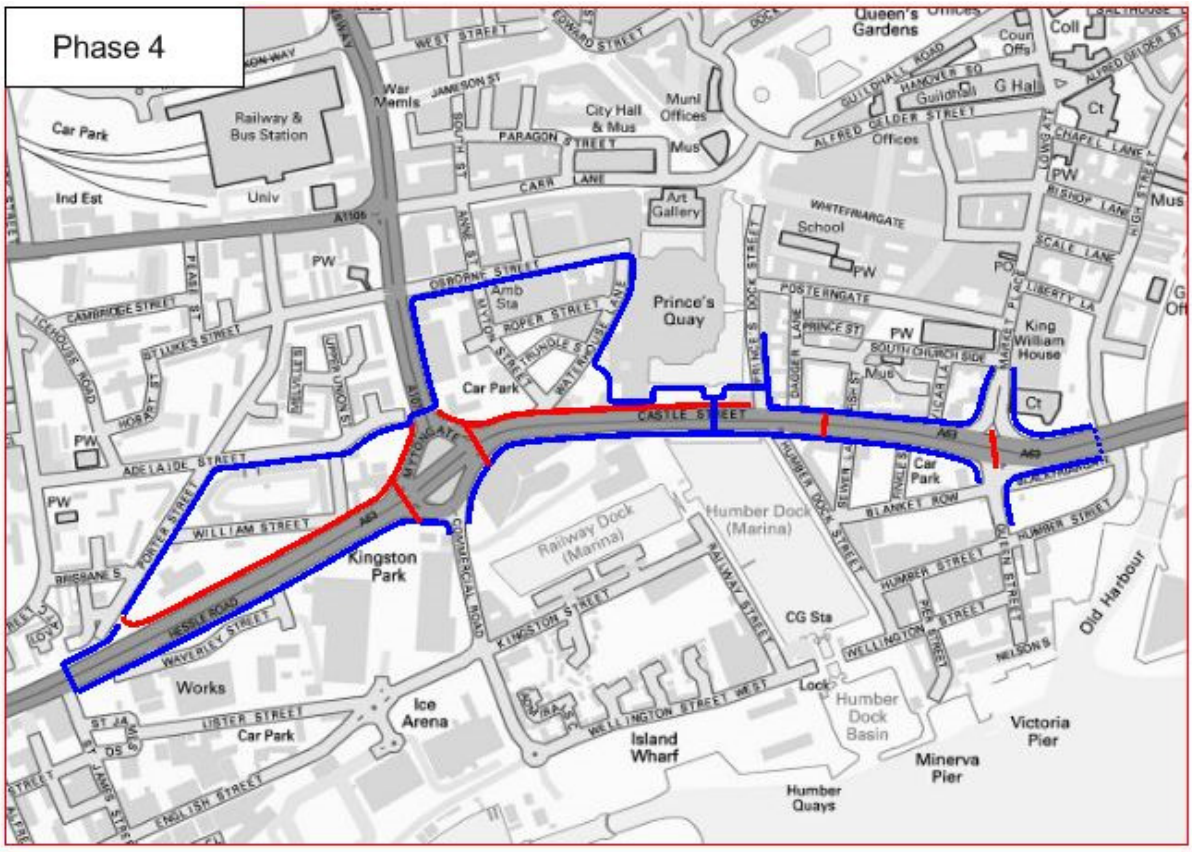


Figure 12 Phase 4 pedestrian diversion route

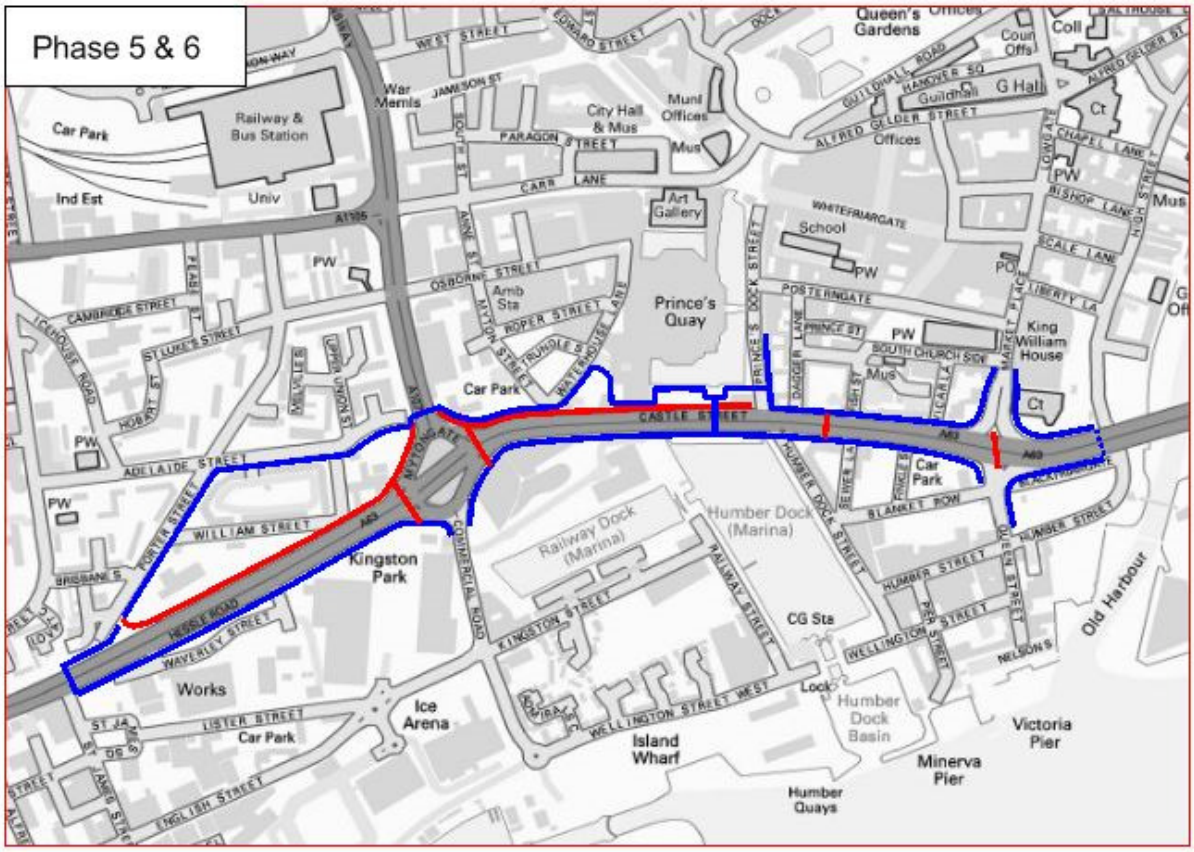


Figure 13 Phase 5 & 6 pedestrian diversion route

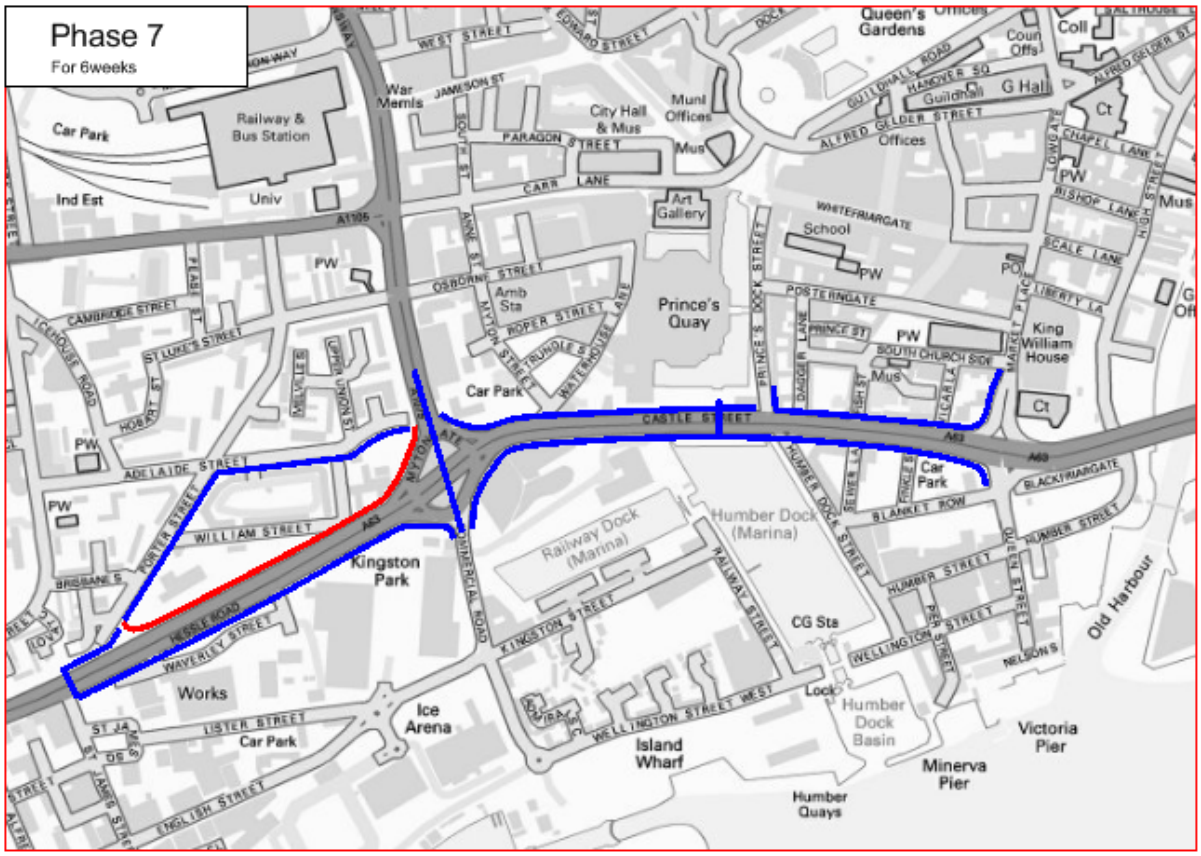


Figure 14 Phase 7 pedestrian diversion route – FOR 6 weeks

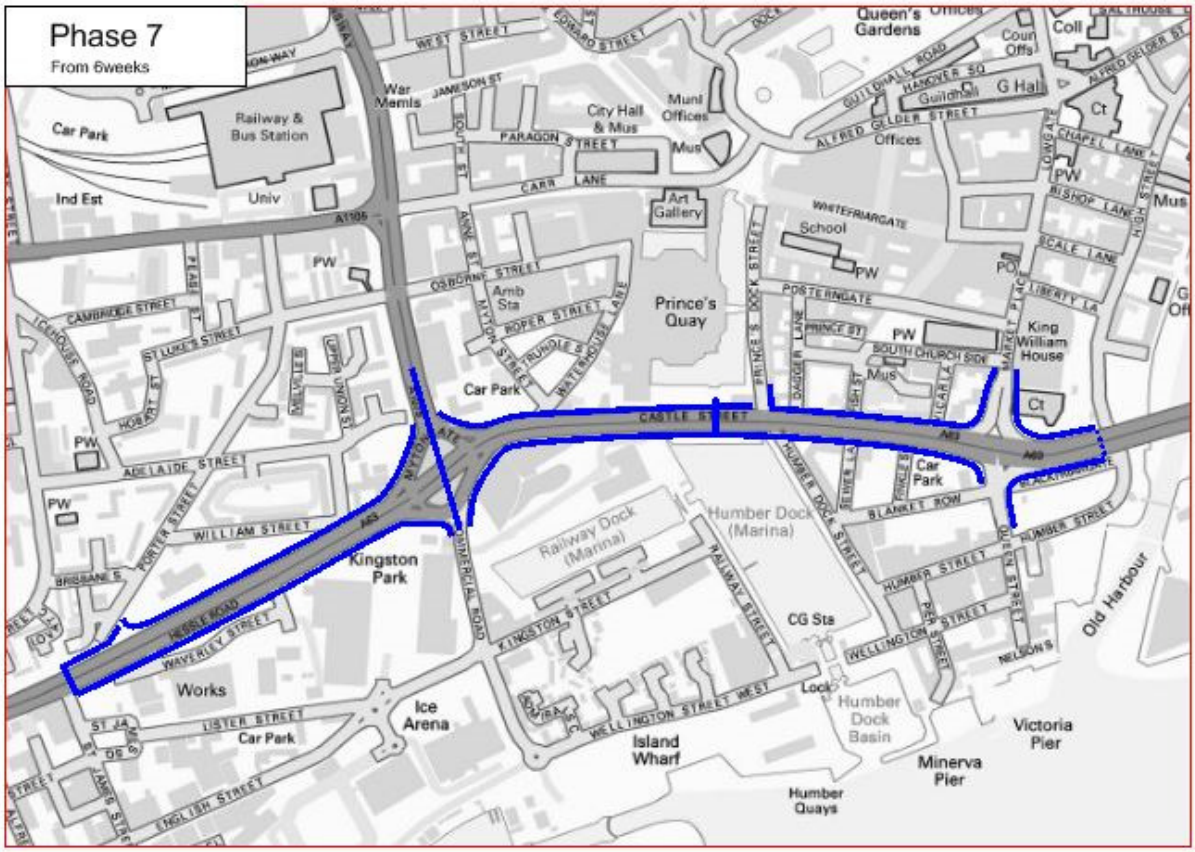


Figure 15 Phase 7 pedestrian diversion route – FROM 6 weeks

5.2 Cyclists

Chapter 8 of the Traffic Signs Manual (Chapter 8) states on cyclists *'Widths of between 2.75m and 3.25m for nearside lanes should be avoided. Guidance on lane widths is given in D3.3'* However section D3.3 only states *'TAL 15/99 advises that cyclists need a width of at least 1.25m to travel safely'* & *'Where there are HGV's and buses, additional lane width will be required, refer to Traffic Advisory Leaflet 15/99 - Cyclist at Roadworks* (TAL 15/99)*, for Further guidance'.*

TABLE 1
LANE WIDTHS AND OVERTAKING SAFETY

EFFECTIVE LANE WIDTH (METRES)	OVERTAKING A CYCLIST
<2.75	Cars: very few can overtake HGVs: cannot overtake
2.75-3.25	Cars: most can overtake but without adequate safety HGVs: cannot overtake
3.25-3.50	Cars: most can overtake with adequate safety HGVs: cannot overtake
3.50-3.75	Cars: can overtake with adequate safety HGVs: overtaking possible but without adequate safety
>4.00	Cars: can overtake with adequate safety HGVs: can overtake with adequate safety

All guidance within TAL 15/99 on lane widths refers to Table 1 within the document (below) which sets out lane widths at which certain types of vehicle are able to overtake cyclists with or without adequate safety. This states clearly that it believes it is not possible for HGV's to safely overtake a cycle whilst running in a narrowed lane of 3.25m.

Figure 16

Whilst it is understood that cycle diversions are rarely well received and should only be considered as the last option, the above information along with the other hazards which present themselves lead us to believe that a cycle diversion away from the works is the only safe course of action open to us. Additional hazards to be considered are

- The difficult road alignment caused by routeing 2 lanes of traffic around Mytongate gyratory in narrowed lanes.
- The greatly reduced sight lines available once site hoarding has been added.
- Temporary road surfaces.
- Unusually high HGV content.

- As a secondary measure we would seek to install signage as seen in figure 17. As stated in TAL 15/99 their use is not encouraged. However, we do believe that the hazards to cyclists present throughout our roadworks do justify their use.
- TAL 15/99 states '*Where access is permitted for motor vehicles, "Cyclist Dismount" signs should not be used. The hazards to cyclists at roadworks are rarely great enough to justify this measure. In any case, cyclists are likely to ignore such instructions. The only situation where cyclists should be advised to dismount is where the carriageway is closed off but the footway remains open. In such cases a white-on-red temporary sign "CYCLISTS DISMOUNT AND USE FOOTWAY" may be used.*
-

Figure 17 Additional cyclist signage

5.3 NMUs with restricted mobility

Additional consideration has been given to those with restricted mobility as these road users could be severely affected by any lengthy pedestrian diversion. A Shuttle bus option has been considered which would travel at regular intervals along a circular route around the city with stops at predetermined locations, this bus would have wheelchair facilities on board and be from a licensed operator. Along with this we would discuss the option of procuring the services of a local Taxi provider to help those deemed to be most at need.

An indicative map has been produced of what such a route may look like for the shuttle bus, this has taken into account key locations around the city, either side of Castle Street. These are only our interpretation at present and we would seek to hold further discussions with all relevant parties regarding pick up & set down locations and operating hours. See figure 18 below.

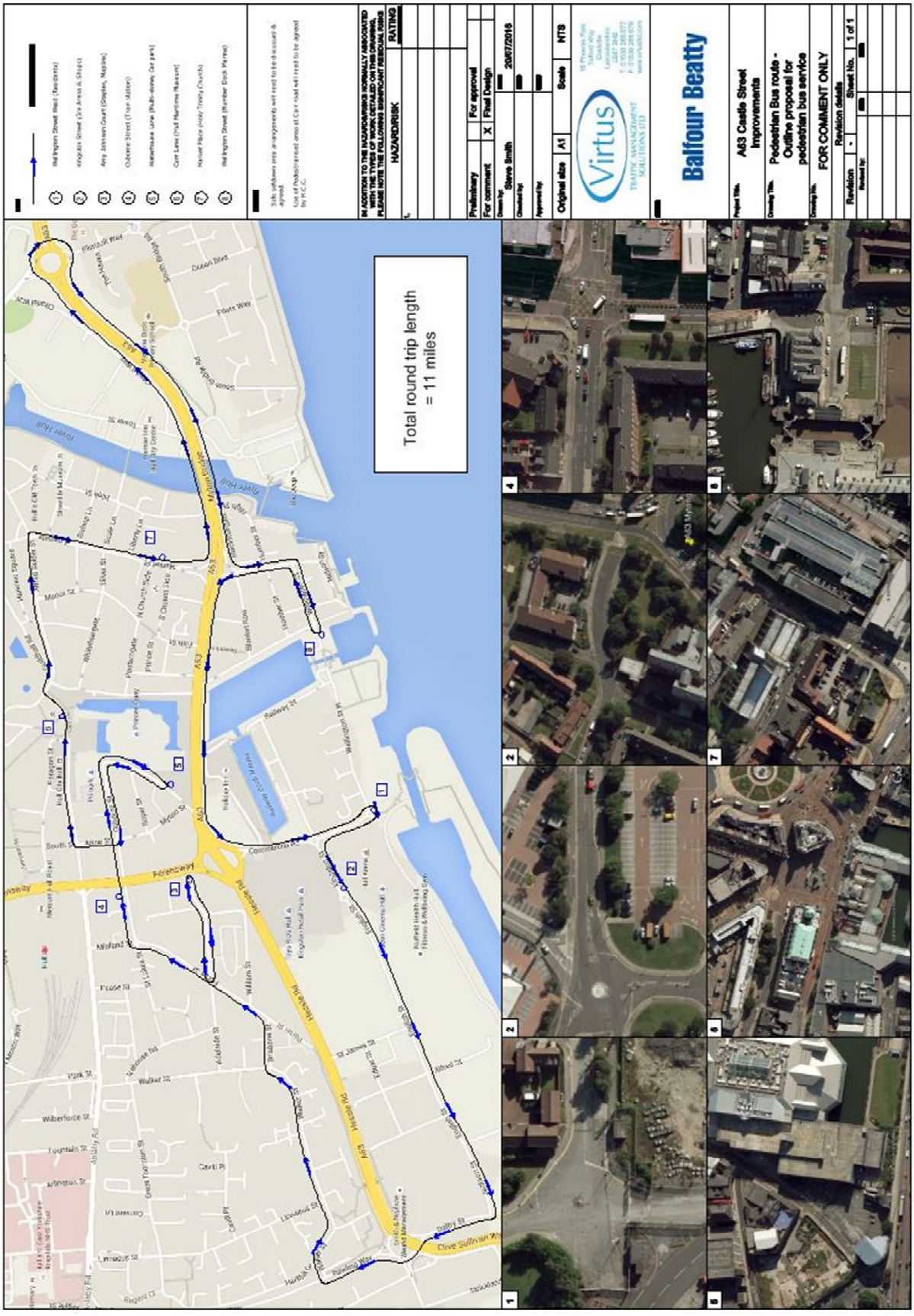


Figure 17 Indicative route and set down locations for shuttle bus

Figure 18 Recovery extents and base locations

6. Free Vehicle Recovery

Chapter 8 Part 1 - D3.35.1 states *"When works are likely to cause congestion, accidents or breakdowns can result in stationary traffic which may create a hazardous situation. It may therefore be appropriate to have recovery vehicles permanently on site or available on immediate call out."* And D3.35.21 states *"The likelihood of congestion and/or accidents will influence the level of response time required."*

We intend to increase flow along the A63 by the introduction of the free-flow arrangements. Yet, the nature of the road and the number of vehicles that use it are such, that without an efficient recovery service being provided, a simple vehicle breakdown could result in stationary traffic almost immediately. The effects of this are likely to be severely detrimental to the A63, Hull City's network, and could very quickly cause major disruption to the wider network.

Expected recovery response times on most major road works schemes are between 20 and 30 minutes, from receiving notification to having a recovery vehicle on scene. To this end we have sought to keep the locations of each base as close to the recovery extents as possible. However, we have to accept that the journeys indicated below currently take upwards of 20 minutes at peak periods with no restrictions in place. We therefore would look to explore the possibility of placing a 'satellite' or 'roving' recovery crew in a central location in order to meet those times at peak periods, should it be deemed necessary.

Our proposal is to have 2 recovery bases to service the scheme as illustrated below.

- Recovery base 1, Eastbound - Will be situated in a layby prior to the A116 St Andrews Quay junction, approx. 1.5km from the start of our narrow lane restrictions. This will have an Impact Protection Vehicle (IPV), a 'Heavy' recovery vehicle and a 'Light' recovery vehicle, along with welfare and accommodation.

- Recovery base 2, Westbound - Will be situated in a secure portion of Tower Street car park, approximately 550m from Garrison Road roundabout and this will be the main drop-off point for both bases. This will have the same vehicle provision as base 1, with an IPV, Heavy and Light vehicles, along with the recovery provider's welfare and accommodation.

There will also be a welfare provision for the occupants of recovered vehicles in line with IAN 65/05 Design of Vehicle Recovery Operations at Road Works, these will include access to:

- Telephone
- Toilet facilities
- Drinking water
- Shelter with heat, light and seating

The set down location for large and/or heavy goods vehicles is yet to be finalised.

7. CCTV

Chapter 8 states that "*In order to achieve rapid removal of broken-down vehicles, it is essential that an efficient system is set up to monitor the affected network for broken-down vehicles throughout the duration of the works. This can be achieved using one of the following.*

- Closed Circuit television – Such systems are relatively expensive to install and maintain but are reliable and allow for 24hr monitoring and recording of the affected network.
- Dedicated roving patrols – These patrols offer a cheaper alternative in terms of set up cost but they require additional recovery or contractors staff to drive through the works area looking for broken down vehicles.
- Watchmen – Providing watchmen relies on contractor's staff within the site area acting as lookouts for broken down vehicles.

On larger sites the use of dedicated roving patrols can slow the recovery operation when compared with CCTV and hence this system is not recommended for road works where congestion is currently or likely to become a major problem. Therefore, it is our intention to install a CCTV system to cover the site from the "Free recovery starts here" sign to the "End" sign in each direction.

Early discussions suggested that we may have been able to utilise the CCTV viewing facilities housed at HCC's Festival House building. However, should this option no longer be open to us, we would seek to locate it in one of our compounds.