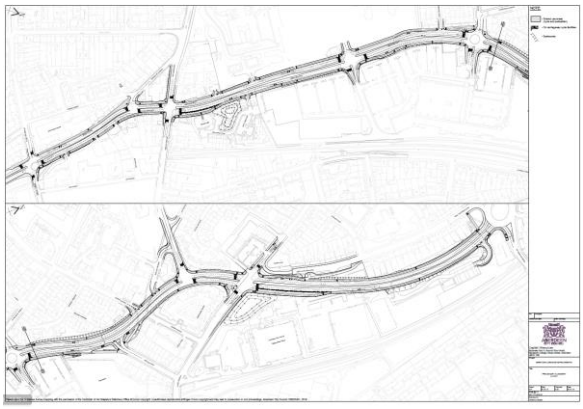
ABERDEEN CITY COUNCIL

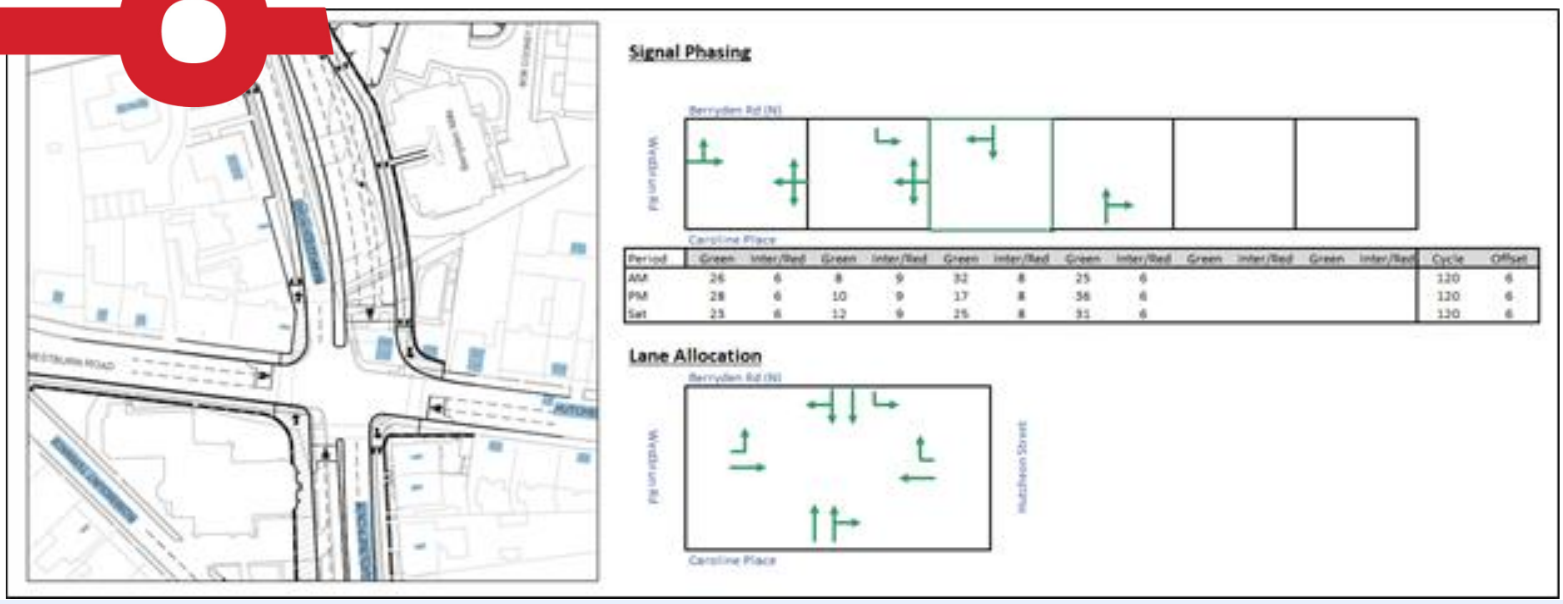
SYSTRA

Aberdeen – Berryden Corridor Improvements **23/10/19**

Reference number GBO1T19G34/3



BERRYDEN CORRIDOR IMPROVEMENTS - TRAFFIC MODELLING APPRAISAL OF FINAL SCHEME



SYSTRA

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ABERDEEN – BERRYDEN CORRIDOR IMPROVEMENTS

TRAFFIC MODELLING APPRAISAL

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1. INTRODUCTION

1.1 Study Brief

1.1.1 This modelling study is required to provide model outputs to quantify the predicted key benefits of the Berryden Corridor Improvement proposals for general traffic and public transport, using the Aberdeen City Centre Paramics Model.

1.1.2 Following a Linsig led signal optimisation study undertaken by consultants Jacobs and using traffic model data previously provided by SYSTRA, ACC have requested that SYSTRA also revise the traffic model signal timings and junction configuration within the modelling to reflect the optimised outputs from the Linsig assessment.

1.1.3 This report provides detail on the updated Berryden corridor improvement scheme, and provides key outputs from the model networks to assess the operational benefits of the scheme on the future Aberdeen traffic network.

1.2 Background

1.2.1 The existing Berryden corridor, running from Skene Square to Belmont Road, facilitates journeys between the city centre, the north of Aberdeen and beyond. The corridor represents a pinch point in the city road network and has been identified as a route operating beyond its capacity leading to significant congestion and journey time delays, particularly at peak times. There is also limited dedicated infrastructure for cyclists and a lack of consistent infrastructure for pedestrians.

1.2.2 The Berryden Corridor Improvement Project (the "Project") involves widening the existing road and junction improvements between Skene Square and Ashgrove Road, and constructing a new section of road between Ashgrove Road and Kittybrewster roundabout. The Project is intended to improve the efficiency of the public network through improving journey time reliability, relieving congestion and improving infrastructure for walking and cycling.

1.2.3 Model testing of the Berryden Corridor Improvements has been ongoing since 2009. The scheme has been continually assessed as the traffic model is upgraded to new baseline and new future year model scenarios. In addition, some minor design changes to the scheme itself have all been assessed within the traffic model.

1.2.4 Chapter 2 of this report provides the updated junction detail of the proposed scheme as modelled. Chapter 3 details the impact of the City Centre Masterplan on the key area of the Berryden Road corridor. Chapter 4 summarises the model testing and results, and the report summary and conclusions are provided in Chapter 5.

1.2.5 An executive summary of this report has also been produced. (GBO1T19G34/4).

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2. BERRYDEN CORRIDOR IMPROVEMENT SCHEME

2.1 Overview

2.1.1 For this study, optimised signal timings through the Berryden corridor have been derived via a Linsig assessment carried out by Jacobs. The Linsig output decks have been provided to SYSTRA by ACC.

2.1.2 In addition to updated signal timings and offsets, the Linsig assessment also provided revised lane arrangements at the junctions through the Berryden corridor. Nine signalised junctions were optimised (using outputs from the City Centre Paramics Model) through the Linsig assessment, seven through the Berryden corridor, and two on Powis Terrace (See Figure 2.1).

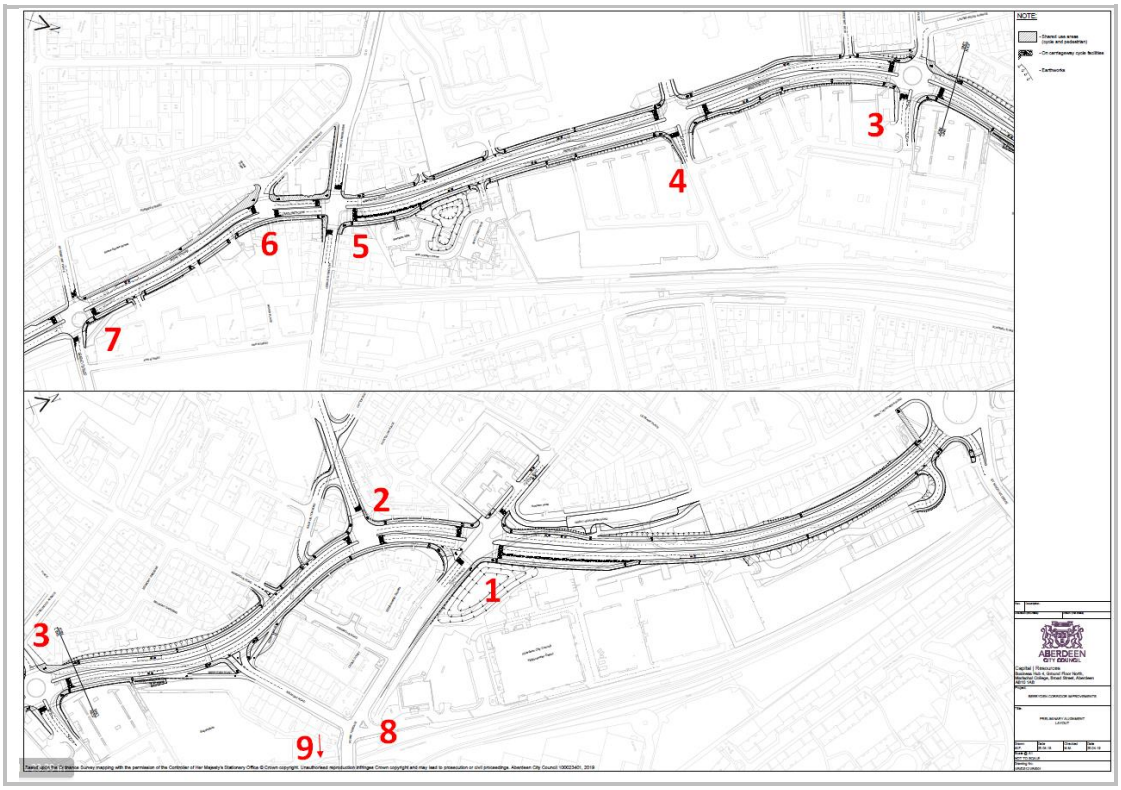

Figure 2.1 :Berryden Corridor Improvements – Linsig Assessment Junctions

2.1.3 Appendix A details the Berryden Rd and Powis Terrace signalised junction lane arrangements, signal timings and offsets applied in the traffic models.

2.1.4 For each junction, the signal timings and offsets were amended in each period to match the Linsig outputs.

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3. MODEL TESTING RESULTS

3.1 Overview

3.1.1 The Berryden Corridor Improvement Scheme is proposed to provide substantial benefits across the north of the city and beyond including:

- Improved journey times and connections
- Reduced congestion
- Improved pedestrian and cycle provision.

3.1.2 To quantify the potential traffic improvements of the Berryden Corridor Improvement scheme, the following model outputs have been collated:

- Traffic flows through Berryden Road and parallel corridors
- Traffic queue levels around Berryden Road
- Average journey times through study area
- Public transport journey times through study area
- Network wide model statistics – average speeds etc.

3.1.3 It should be noted that this report does not qualify or quantify the potential improvements to provisions for pedestrians and cyclists. Whilst the traffic models include all the proposed pedestrian crossing facilitates associated with the Berryden corridor improvement scheme, the Paramics model outputs cannot quantify these improvements from a pedestrian perspective.

3.2 Model Test Scenarios

3.2.1 The Berryden scheme was assessed in a 2023 future year scenario ('Do Min') and compared against a 'Do-nothing 'scenario (without Berryden corridor improvements). In addition, the scheme was assessed in a 2023 network which also includes the full currently defined City Centre Masterplan infrastructure.

3.2.2 The model scenarios required for assessment are therefore:

- Scenario 1: 2023 Do-Nothing (no Berryden improvements, no CC Masterplan)
- Scenario 2: 2023 Do-Min (with Berryden improvements, no CC Masterplan)
- Scenario 3: 2023 CC Masterplan (no Berryden improvements, with CC Masterplan)
- Scenario 4: 2023 Do-Max (with Berryden improvements, with CC Masterplan)

3.2.3 For this study, optimised signal timings and traffic lane allocations through the Berryden corridor have been derived through a Linsig optimisation carried out by Jacobs. The Linsig output decks have been provided to SYSTRA by ACC.

3.2.4 SYSTRA have applied the signal timings, offsets and lane allocations to the model test scenarios. The detail of which is also provided in this report.

3.2.5 The traffic model periods in which the analysis has been carried out are:

AM Peak Period Model	06:00-10:00	Peak Hour: 08:00-09:00
PM Peak Period Model	15:00-19:00	Peak Hour: 16:30-17:30
Saturday Peak Period Model	12:00-16:00	Peak Hour: 12:30-13:30

3.3 Consideration of City Centre Masterplan Proposals

3.3.1 The need for the Berryden corridor improvement has been acknowledged for some time, the Project as it currently stands has also been identified as being required to facilitate the delivery of the Union Street Pedestrianisation project (the "USP").

3.3.2 More recently the scope of the USP has evolved to transform the wider transportation network in the city centre as part of the Aberdeen City Centre Masterplan (the "ACCMP").

3.3.3 A separate modelling study was undertaken in 2016 to develop an implementation programme for the ACCMP. The ACCMP supersedes the previous Union Street Pedestrianisation scheme (USP), but includes similar road closures and restrictions through the city centre area which will have an impact on traffic demands through the Berryden corridor and associated junctions. The ACCMP has a 25-year programme of implementation which requires a gradual reduction in traffic within the City Centre to 80% of the predicted traffic demand.

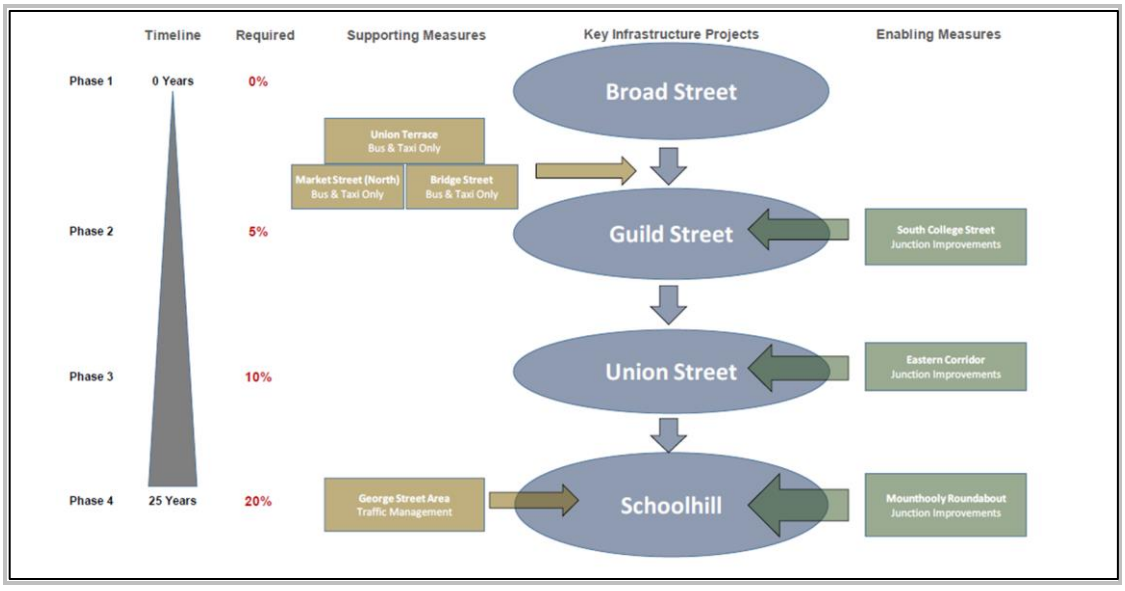


Figure 3.1 :City Centre Masterplan – Implementation Programme

3.3.4 Traffic modelling of the City Centre Masterplan has shown that the transport measures proposed through the city centre area forces general traffic out from the city centre into the wider network.

3.3.5 In particular, the east-west corridor of Hutcheon St /Westburn Road becomes a critical route across the outer City Centre area. Hence, the Berryden Road / Hutcheon Street junction becomes a critical junction in the City Centre network to allow the City Centre Masterplan to operate. In general, modelling has shown that, whilst the City Centre Masterplan requires a global 20% traffic reduction to operate, the traffic demand through the Berryden Road /

Hutcheon Street junction was significantly increased, particularly through the Westburn Rd / Hutcheon St corridor.

The Berryden corridor improvements provide a significant benefit to the successful operation of City Centre Masterplan, as the scheme provides additional traffic capacity at the critical junction of Berryden Road / Hutcheon Street.

3.4 Additional Junction Mitigation – Scenario 3

3.4.1 Through the testing of the four scenarios (detailed in Section 1.3.2), it was found that the model network was gridlocking (congested to the point of failure) in Scenario 3, PM Peak. Inspection of the model identified that the source of the gridlocking was at the Berryden Road / Hutcheon Street junction.

3.4.2 Analysis of the traffic demand showed that the City Centre Masterplan will result in a significant increase in both the east-west traffic demand through Hutcheon Street-Westburn Road, and also in the northbound right turn, from Caroline Place to Hutcheon Street.

3.4.3 The traffic signal phasing and timings for Scenario 3 were therefore amended to allow an early cut off to the Berryden southbound phase to allow the northbound right turn traffic to clear. This simple signal phasing change allowed the model to run at the required 80% demand in all peaks.

3.5 Traffic Flow Analysis

3.5.1 Traffic flow data was extracted for Berryden Road and associated parallel corridors in each test scenario. Figure 4.1 shows the location of the flow screenline where traffic flows were collated.

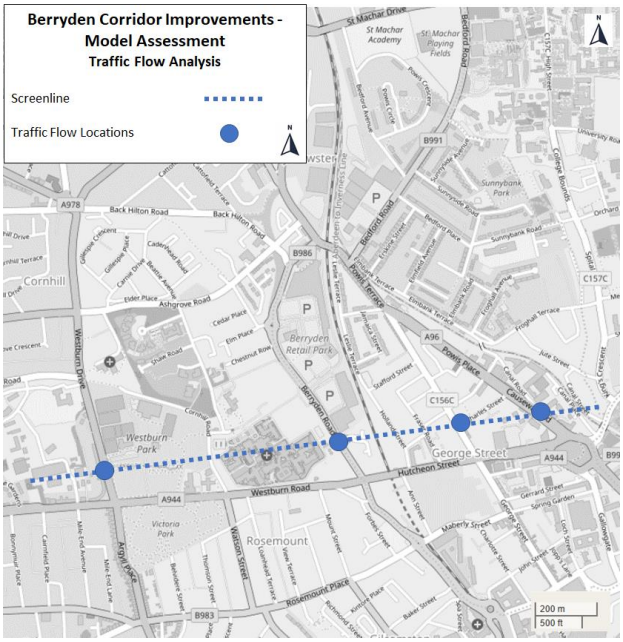


Figure 3.2 :Traffic Flow Screenline

3.5.2 Table 4.1 provides the peak hour traffic flows for each model scenario in the AM, PM, and Saturday Peak periods.

Table 3.1 : Peak Hour Traffic Flows

AM Peak Hour (08:00-09:00)	Vehicle Flows							
	Berryden Road		Westburn Drive		Powis Place		George Street	
Scenario	NB	SB	NB	SB	NB	SB	NB	SB
1 - 2023 Ref Case - No Improvements	326	651	477	708	296	554	141	254
2 - 2023 Ref Case - With Improvements	363	777	512	719	250	475	118	208
% Diff	11.5%	19.4%	7.4%	1.6%	-15.4%	-14.4%	-16.3%	-18.4%
3 - 2023 Masterplan - No Improvements	235	549	382	672	232	456	132	212
4 - 2023 Masterplan - With Improvements	231	673	406	635	202	420	151	184
% Diff	-1.62%	22.75%	6.50%	-5.51%	-12.92%	-7.90%	14.24%	-13.22%

PM Peak Hour (16:30-17:30)	Vehicle Flows							
	Berryden Road		Westburn Drive		Powis Place		George Street	
Scenario	NB	SB	NB	SB	NB	SB	NB	SB
1 - 2023 Ref Case - No Improvements	648	514	733	656	568	453	285	195
2 - 2023 Ref Case - With Improvements	986	638	698	625	418	403	171	211
% Diff	52.2%	24.2%	-4.7%	-4.7%	-26.5%	-11.0%	-40.1%	8.5%
3 - 2023 Masterplan - No Improvements	399	471	636	589	472	378	282	102
4 - 2023 Masterplan - With Improvements	642	567	615	524	394	306	191	163
% Diff	61.0%	20.5%	-3.4%	-11.0%	-16.6%	-19.0%	-32.3%	59.3%

SAT Peak Hour (12:30-13:30)	Vehicle Flows							
	Berryden Road		Westburn Drive		Powis Place		George Street	
Scenario	NB	SB	NB	SB	NB	SB	NB	SB
1 - 2023 Ref Case - No Improvements	631	640	805	653	494	363	256	246
2 - 2023 Ref Case - With Improvements	1053	857	589	606	330	442	212	302
% Diff	67.0%	34.0%	-26.9%	-7.3%	-33.3%	21.9%	-17.2%	22.8%
3 - 2023 Masterplan - No Improvements	390	521	568	623	373	433	273	52
4 - 2023 Masterplan - With Improvements	565	762	571	470	358	477	256	146
% Diff	45.0%	46.1%	0.4%	-24.5%	-4.0%	10.4%	-6.0%	181.1%

3.5.3 Table 4.2 provides the equivalent traffic flows over the 4-hour model periods

Table 3.2 : Peak Period Traffic Flows

AM Period (06:00-10:00)	Vehicle Flows							
	Berryden Road		Westburn Drive		Powis Place		George Street	
Scenario	NB	SB	NB	SB	NB	SB	NB	SB
1 - 2023 Ref Case - No Improvements	1138	2404	1620	2721	1007	2022	442	945
2 - 2023 Ref Case - With Improvements	1260	2806	1750	2719	872	1729	400	781
% Diff	10.7%	16.7%	8.0%	-0.1%	-13.4%	-14.5%	-9.7%	-17.3%
3 - 2023 Masterplan - No Improvements	939	2036	1329	2426	774	1566	449	828
4 - 2023 Masterplan - With Improvements	859	2486	1421	2342	690	1436	509	692
% Diff	-8.46%	22.10%	6.95%	-3.48%	-10.88%	-8.30%	13.55%	-16.38%

PM Period (15:00-19:00)	Vehicle Flows							
	Berryden Road		Westburn Drive		Powis Place		George Street	
Scenario	NB	SB	NB	SB	NB	SB	NB	SB
1 - 2023 Ref Case - No Improvements	2683	2037	2947	2507	2213	1849	1092	809
2 - 2023 Ref Case - With Improvements	3721	2421	2868	2474	1685	1563	690	876
% Diff	38.7%	18.8%	-2.7%	-1.3%	-23.9%	-15.4%	-36.8%	8.4%
3 - 2023 Masterplan - No Improvements	1495	1888	2568	2269	1864	1452	1085	504
4 - 2023 Masterplan - With Improvements	2277	2122	2495	2084	1511	1202	777	640
% Diff	52.3%	12.4%	-2.8%	-8.1%	-18.9%	-17.2%	-28.4%	26.9%

SAT Period (12:00-16:00)	Vehicle Flows							
	Berryden Road		Westburn Drive		Powis Place		George Street	
Scenario	NB	SB	NB	SB	NB	SB	NB	SB
1 - 2023 Ref Case - No Improvements	2433	2438	2904	2519	1974	1468	1019	997
2 - 2023 Ref Case - With Improvements	3891	3189	2102	2221	1331	1830	798	1143
% Diff	59.9%	30.8%	-27.6%	-11.8%	-32.6%	24.7%	-21.7%	14.6%
3 - 2023 Masterplan - No Improvements	1761	2090	2092	2252	1460	1707	1020	556
4 - 2023 Masterplan - With Improvements	2298	2746	1919	1798	1401	1702	928	702
% Diff	30.5%	31.4%	-8.3%	-20.1%	-4.0%	-0.3%	-9.0%	26.4%

3.5.4 The following comments are drawn from the traffic flow model outputs:

- Peak hour traffic flows through Berryden Road in both directions are significantly higher when the corridor improvements are in place
- Traffic flows through the parallel corridors of Westburn Drive, Powis Place, and George Street are reduced when Berryden Road improvements are in place. This shows that the Berryden Corridor Improvements encourages more appropriate traffic routing from parallel corridors
- The traffic flow increases on Berryden Road are more significant in the PM and Saturday Peak (particularly northbound) compared to the AM peak.
- The Peak period analysis shows that the traffic flow increases on Berryden Road – with improvements, are also significantly higher across the full 4 hour periods.
- For the 2023 scenarios that include the City Centre Masterplan, the traffic flows through Berryden Road are again higher when the improvements are in place

Model traffic flow analysis through Berryden Road and associated parallel routes shows that the Berryden Road corridor improvements allow significantly more traffic to route through the corridor and also reduces traffic flow on Westburn Drive, Powis Place, and George Street. This is the case whether the City Centre Masterplan is included or not.

3.6 Queue Analysis

3.6.1 Traffic queuing in a model can be collated over a predefined area as well as for individual junction arms. Traffic queue areas are a good comparator to use when there are multiple areas of queueing and congestion in a model network. Figure 4.1 shows the queue cordon applied for this queue assessment.

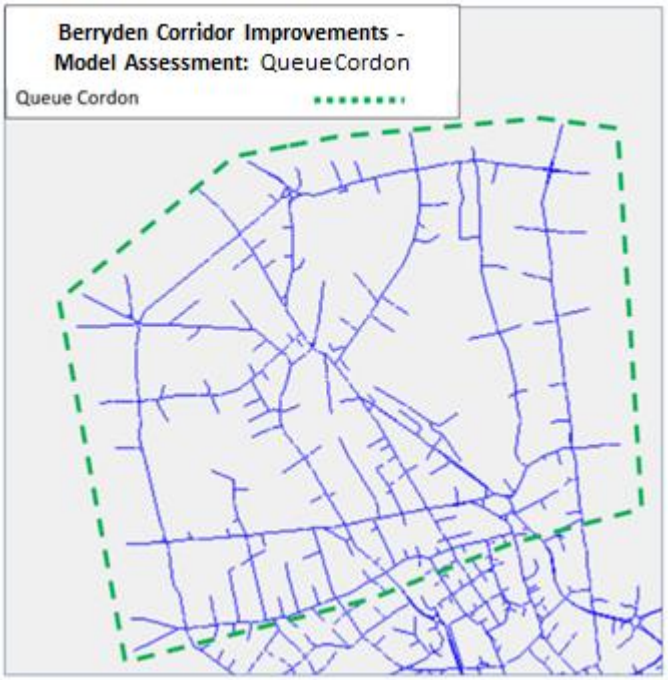


Figure 3.3 :Queue Cordon

3.6.2 Table 4.3 provides the summary queue results for each test scenario. The results are provided for the peak hour and peak period for each model period.

Table 3.3 : Cordon Queue Analysis

AM Peak	Total Queuing Within Cordon (Veh)	
Scenario	AM Pk Hour (08:00-09:00)	AM Period (06:00-10:00)
1 - 2023 Ref Case - No Improvements	7668	5715
2 - 2023 Ref Case - With Improvements	7131	5297
% Diff	-7.0%	-7.3%
3 - 2023 Masterplan - No Improvements	5861	4474
4 - 2023 Masterplan - With Improvemnts	5489	4203
% Diff	-6.4%	-6.1%
PM Peak	Total Queuing Within Cordon (Veh)	
Scenario	PM Pk Hour (16:30-17:30)	PM Period (15:00-19:00)
1 - 2023 Ref Case - No Improvements	10527	10458
2 - 2023 Ref Case - With Improvements	8691	8317
% Diff	-17.4%	-20.5%
3 - 2023 Masterplan - No Improvements	9601	9081
4 - 2023 Masterplan - With Improvemnts	7283	6610
% Diff	-24.1%	-27.2%
Saturday Peak	Total Queuing Within Cordon (Veh)	
Scenario	Sat Pk Hour (12:30-13:30)	Sat Period (12:00-16:00)
1 - 2023 Ref Case - No Improvements	13097	10747
2 - 2023 Ref Case - With Improvements	10105	8552
% Diff	-22.8%	-20.4%
3 - 2023 Masterplan - No Improvements	11746	10278
4 - 2023 Masterplan - With Improvemnts	9189	7451
% Diff	-21.8%	-27.5%

3.6.3 The following comments are drawn from the model queue outputs:

- Peak hour queue levels through the cordon area vary between 7% and 25% lower when Berryden Road improvements are in place. In the PM Peak and Saturday Peak, the queueing is approximately 20% lower.
- Over the 4-hour peak period, the reduction in queueing through the cordon area is similar to that observed in the peak hour. In some instances, there is a higher percentage queue reduction over the model period, compared to the peak hour. This is understandable given that traffic queueing can build up throughout the model period.
- For the 2023 scenarios which include the City Centre Masterplan, the reduction in queueing due to the Berryden improvements is equal to or better than the results for the Reference Case comparisons. This suggest that the Berryden corridor improvements have an even greater reduction in network queueing, after the City Centre Masterplan is implemented.

Traffic queue analysis collated over the Berryden Road, Powis Terrace and Westburn Drive area shows that the levels of traffic queueing is consistently lower when the Berryden corridor improvements are in place. In the PM Peak and Saturday Peak particularly, the queue levels are approximately 20% lower or better. The benefits to traffic queueing also apply when the City Centre Masterplan is in place.

3.7 Journey Time Analysis

3.7.1 Traffic journey times were collated in each scenario for key north/south routes into the City Centre from the North – see Figure 4.3

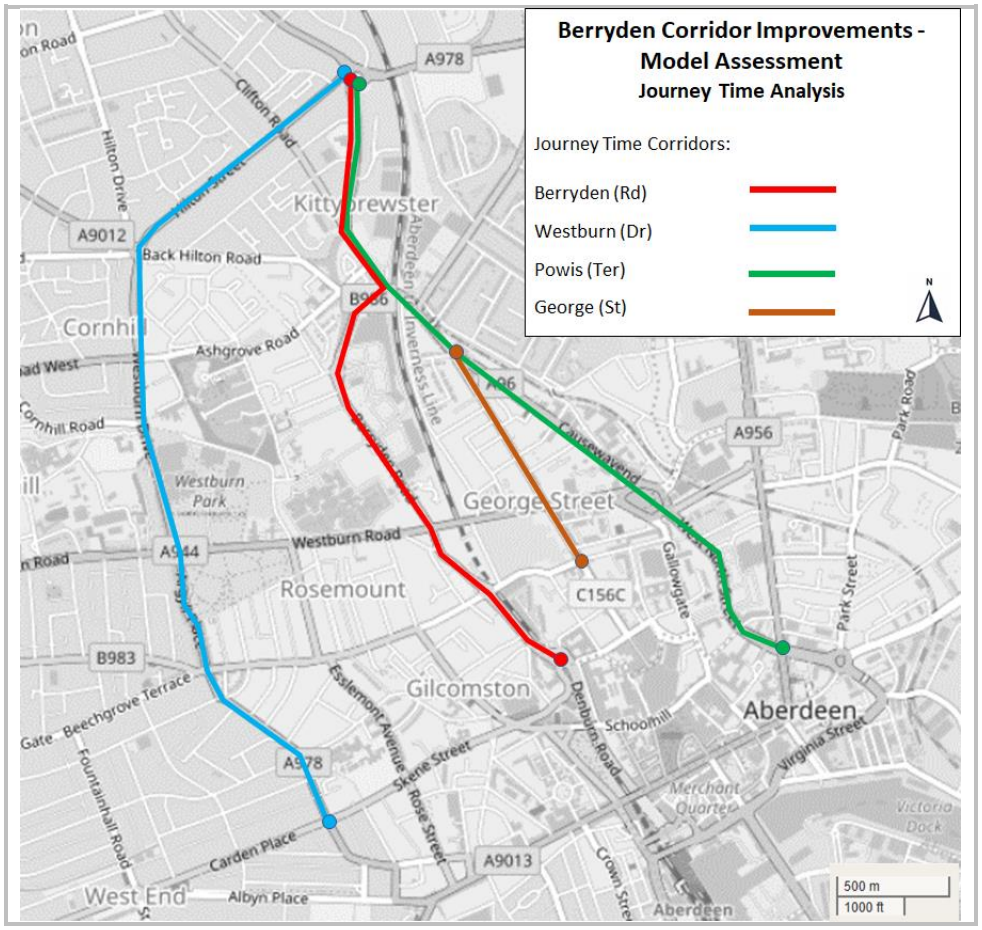


Figure 3.4 :Journey Time Routes

3.7.2 Table 4.4 summarises the average peak hour journey times for each test scenario through the four routes identified above. Table 4.5 provides the results for each 4-hour peak period.

Table 3.4 : Peak Hour Average Journey Times

AM Peak Hour (08:00-09:00)	Journey Time (mm:ss) by Path							
	Berryden Road		Westburn Drive		Powis Place		George Street	
Scenario	NB	SB	NB	SB	NB	SB	NB	SB
1 - 2023 Ref Case - No Improvements	04:56	05:35	05:54	06:48	05:01	02:24	01:51	05:22
2 - 2023 Ref Case - With Improvements	04:32	05:17	05:48	06:52	05:16	02:31	01:47	05:17
% Diff	-7.9%	-5.2%	-1.8%	0.9%	5.1%	4.9%	-3.2%	-1.7%
3 - 2023 Masterplan - No Improvements	05:49	05:42	07:27	06:47	04:41	02:34	02:35	04:57
4 - 2023 Masterplan - With Improvements	04:45	05:11	06:30	06:29	05:23	02:33	02:46	05:30
% Diff	-18.4%	-9.1%	-12.7%	-4.5%	15.0%	-1.0%	7.0%	11.1%

PM Peak Hour (16:30-17:30)	Journey Time (mm:ss) by Path							
	Berryden Road		Westburn Drive		Powis Place		George Street	
Scenario	NB	SB	NB	SB	NB	SB	NB	SB
1 - 2023 Ref Case - No Improvements	08:01	09:32	07:52	07:27	08:08	03:44	03:12	05:59
2 - 2023 Ref Case - With Improvements	05:15	05:44	06:31	07:33	07:02	02:39	02:08	05:40
% Diff	-34.6%	-40.0%	-17.3%	1.3%	-13.6%	-28.9%	-33.1%	-5.4%
3 - 2023 Masterplan - No Improvements	16:32	07:00	08:50	07:07	06:25	03:45	33:26	04:46
4 - 2023 Masterplan - With Improvements	05:12	05:22	06:06	06:21	07:09	02:46	02:47	05:44
% Diff	-68.5%	-23.5%	-31.0%	-10.9%	11.3%	-26.5%	-91.7%	20.3%

SAT Peak Hour (12:30-13:30)	Journey Time (mm:ss) by Path							
	Berryden Road		Westburn Drive		Powis Place		George Street	
Scenario	NB	SB	NB	SB	NB	SB	NB	SB
1 - 2023 Ref Case - No Improvements	08:42	11:37	06:40	07:40	12:06	05:46	02:48	13:22
2 - 2023 Ref Case - With Improvements	05:03	05:57	05:51	06:29	11:22	03:51	02:10	06:47
% Diff	-41.9%	-48.8%	-12.2%	-15.3%	-6.0%	-33.3%	-22.6%	-49.3%
3 - 2023 Masterplan - No Improvements	09:34	07:56	08:06	07:03	13:08	04:01	35:18	05:49
4 - 2023 Masterplan - With Improvements	06:37	05:31	06:38	06:08	11:08	03:34	08:39	05:39
% Diff	-30.9%	-30.3%	-18.1%	-12.9%	-15.3%	-11.4%	-90.9%	-2.7%

Table 3.5 : Peak Period Average Journey Times

AM Period (06:00-10:00)	Journey Time (mm:ss) by Path							
	Berryden Road		Westburn Drive		Powis Place		George Street	
Scenario	NB	SB	NB	SB	NB	SB	NB	SB
1 - 2023 Ref Case - No Improvements	04:44	05:20	05:34	06:30	04:39	02:24	01:50	05:12
2 - 2023 Ref Case - With Improvements	04:27	05:04	05:32	06:21	04:53	02:31	01:50	05:05
% Diff	-5.9%	-5.2%	-0.5%	-2.1%	5.0%	4.8%	-0.1%	-2.2%
3 - 2023 Masterplan - No Improvements	05:13	05:13	06:25	06:23	04:43	02:31	02:33	04:45
4 - 2023 Masterplan - With Improvements	04:34	04:57	05:49	06:15	05:17	02:30	02:38	05:18
% Diff	-12.5%	-5.0%	-9.3%	-2.2%	12.2%	-0.2%	3.1%	11.5%
PM Period (15:00-19:00)	Journey Time (mm:ss) by Path							
	Berryden Road		Westburn Drive		Powis Place		George Street	
Scenario	NB	SB	NB	SB	NB	SB	NB	SB
1 - 2023 Ref Case - No Improvements	07:45	08:45	07:44	08:55	08:54	04:07	03:28	06:19
2 - 2023 Ref Case - With Improvements	05:30	06:07	06:23	07:20	07:10	02:59	02:11	05:49
% Diff	-29.0%	-30.2%	-17.4%	-17.8%	-19.5%	-27.6%	-36.9%	-8.0%
3 - 2023 Masterplan - No Improvements	16:25	06:42	08:02	07:00	06:42	03:45	22:05	04:45
4 - 2023 Masterplan - With Improvements	05:27	05:37	05:59	06:28	06:46	02:44	02:39	05:37
% Diff	-66.8%	-16.2%	-25.6%	-7.7%	1.0%	-27.3%	-88.0%	18.2%
SAT Period (1200-16:00)	Journey Time (mm:ss) by Path							
	Berryden Road		Westburn Drive		Powis Place		George Street	
Scenario	NB	SB	NB	SB	NB	SB	NB	SB
1 - 2023 Ref Case - No Improvements	07:52	09:36	06:06	06:51	09:51	04:23	02:15	11:11
2 - 2023 Ref Case - With Improvements	04:50	05:44	05:35	06:01	10:11	03:05	02:06	06:19
% Diff	-38.6%	-40.2%	-8.6%	-12.3%	3.3%	-29.6%	-6.4%	-43.5%
3 - 2023 Masterplan - No Improvements	08:22	07:41	07:26	06:48	11:26	03:26	46:02	05:23
4 - 2023 Masterplan - With Improvements	05:45	05:27	05:54	05:53	09:44	03:06	05:02	05:33
% Diff	-31.2%	-29.1%	-20.7%	-13.5%	-14.8%	-9.7%	-89.1%	3.1%

3.7.3 The following comments are drawn from the journey time model outputs:

- On Berryden Road, whilst the AM peak hour average journey times are 5-10% quicker when the Berryden corridor improvements are in place, in the PM Peak hour, the journey times are 35-40% quicker and in the Saturday Peak hour they are 40-50% quicker
- Average journey times through Westburn Drive, Powis Place and George Street are also reduced in the PM and Saturday peak when the Berryden corridor improvements are in place
- For the 2023 scenarios which include the City Centre Masterplan, the journey time savings due to the Berryden corridor improvements, are generally equal to the results for the Reference Case comparisons. This is important to note, particularly considering the Test 3 and Test 4 scenarios are run at only 80% demand.
- Over the peak period, the journey time savings are very similar to the peak hour statistics, therefore suggesting the journey time savings are sustained out-with the core peaks of the day.
- It should be noted that journey times through the George Street corridor in Test 3 are very high (over 30 minutes in PM& Saturday peaks) due to localised congestion in the model network. Note that this does not occur when the Berryden improvements are in Place (Test 4).

Model journey time analysis, collated through the Berryden corridor and other parallel routes, suggests that there are some time savings through each of these routes when Berryden Road improvements are in place. Even when the City Centre Masterplan is in place, and the model network is run at 80% of the full demand, there are still significant time savings, particularly through the Berryden Road corridor itself.

3.8 Public Transport Journey Time Analysis

3.8.1 Public Transport journey times were collated for key high frequency services which utilise either the Berryden Road or George St / Powis Terrace corridor – See Table 4.6.

Table 3.6 : PT Routes for Assessment

Service	Local Route	Frequency
First Bus 11	Back Hilton Road - Berryden Road - Hutcheon Street	15 minute
First Bus 12	Back Hilton Road - Berryden Road - Woolmanhill	12 minute
First Bus 17	Great Northern Road - Powis Terrace - George Street	15 minute
First Bus 18	Great Northern Road - Powis Terrace - George Street	15 minute

3.8.2 Table 4.7 summarises the average peak period journey times for each bus route detailed above. The journey times given are the average time for the buses to traverse the full route within the model network.

Table 3.7 : PT Journey Times

AM Period (06:00-10:00)	Journey Time (mm:ss) by PT Route							
Test Scenario	No. 11 SB	No .11 NB	No. 12 SB	No .12 NB	No. 17 SB	No .17 NB	No. 18 SB	No .18 NB
1 - 2023 Ref Case - No Improvements	21:18	20:49	20:01	18:40	20:29	19:55	21:11	21:25
2 - 2023 Ref Case - With Improvements	20:38	21:47	20:21	18:26	20:36	20:01	20:52	21:51
% Diff	-3.12%	4.61%	1.74%	-1.21%	0.61%	0.51%	-1.46%	2.03%
3 - 2023 Masterplan - No Improvements	20:53	19:58	17:31	19:26	18:23	20:11	20:36	19:33
4 - 2023 Masterplan - With Improvements	19:45	19:13	18:14	18:53	19:47	20:52	20:02	19:50
% Diff	-5.45%	-3.72%	4.06%	-2.84%	7.67%	3.34%	-2.79%	1.49%

PM Period (15:00-19:00)	Journey Time (mm:ss) by PT Route							
Test Scenario	No. 11 SB	No .11 NB	No. 12 SB	No .12 NB	No. 17 SB	No .17 NB	No. 18 SB	No .18 NB
1 - 2023 Ref Case - No Improvements	24:42	26:45	24:14	25:34	25:13	25:24	25:55	26:20
2 - 2023 Ref Case - With Improvements	24:16	24:04	21:23	22:49	23:25	24:54	25:36	23:38
% Diff	-1.70%	-10.06%	-11.75%	-10.75%	-7.15%	-1.95%	-1.24%	-10.28%
3 - 2023 Masterplan - No Improvements	24:20	29:18	20:49	27:32	24:37	22:29	27:11	24:35
4 - 2023 Masterplan - With Improvements	24:29	23:47	20:38	22:02	23:20	21:55	23:58	24:15
% Diff	0.61%	-18.88%	-0.94%	-19.96%	-5.22%	-2.52%	-11.87%	-1.39%

SAT Period (1200-16:00)	Journey Time (mm:ss) by PT Route							
Test Scenario	No. 11 SB	No .11 NB	No. 12 SB	No .12 NB	No. 17 SB	No .17 NB	No. 18 SB	No .18 NB
1 - 2023 Ref Case - No Improvements	23:48	23:50	24:00	23:07	24:14	23:20	24:20	23:52
2 - 2023 Ref Case - With Improvements	24:46	23:47	22:43	23:05	24:37	22:24	25:36	24:02
% Diff	4.11%	-0.24%	-5.35%	-0.14%	1.57%	-3.97%	5.22%	0.64%
3 - 2023 Masterplan - No Improvements	27:17	24:46	19:13	23:15	32:18	25:13	37:51	22:37
4 - 2023 Masterplan - With Improvements	22:16	21:48	19:29	20:23	20:06	21:43	21:25	21:54
% Diff	-18.35%	-12.01%	1.37%	-12.31%	-37.75%	-13.89%	-43.41%	-3.19%

3.8.3 The following comments are drawn from analysis of the model PT journey time results:

- There are mixed results for the comparison of bus journey times through the Berryden Road and Powis Terrace corridors. In general, there are some significant reductions in bus journey times, particularly in the PM peak and Saturday peak, when Berryden Road improvements are in place. There is little benefit observed in the AM peak. This ties in with the queue and journey time results reported.
- There is no clear indication that the bus priority measures on Powis Terrace are providing additional benefit to the PT network. Journey time savings are generally similar for buses routing on Powis Terrace to those on Berryden Road.
- The model scenarios which include the City Centre Masterplan show the highest improvement to the PT journey times when Berryden Road improvements are in place.

Model bus journey time analysis, collated for services through Berryden Road and Powis Terrace, show some time savings through both corridors in the PM and Saturday Peaks.

The results do not clearly show any specific benefits from the proposed bus priority measures on Powis Terrace. The modelled traffic flow reductions through this corridor are a key factor in journey time savings.

3.9 Network Summary Statistics

3.9.1 The network summary statistics report on the overall network performance of a model.

3.9.2 The average time taken statistic is based upon the average time for all trips in the network to make their journey. A decrease in this statistic represents an improvement in the operation of the network.

3.9.3 The mean speed statistic represents the average speed for all vehicles in the model network. An increase in average speed represents an improvement in the operation of the network.

3.9.4 Table 3.8 provides a summary of the average time taken and average speed for each of the model scenarios.

Table 3.8 : Global Network Statistics

AM Period (06:00-10:00)	Average Time Taken (hh:mm:ss)	Mean Speed (mph)
1 - 2023 Ref Case - No Improvements	05:18	14.55
2 - 2023 Ref Case - With Improements	05:21	14.40
% Diff	1.0%	-1.0%
3 - 2023 Masterplan - No Improvements	05:45	14.74
4 - 2023 Masterplan - With Improvements	05:34	15.18
% Diff	-3.1%	2.9%
PM Period (15:00-19:00)	**Average Time Taken (hh:mm:ss)**	**Mean Speed (mph)**
1 - 2023 Ref Case - No Improvements	07:12	10.68
2 - 2023 Ref Case - With Improements	06:35	11.64
% Diff	-8.5%	9.0%
3 - 2023 Masterplan - No Improvements	06:53	12.05
4 - 2023 Masterplan - With Improvements	06:03	13.64
% Diff	-12.1%	13.2%
SAT Period (12:00-16:00)	**Average Time Taken (hh:mm:ss)**	**Mean Speed (mph)**
1 - 2023 Ref Case - No Improvements	06:47	10.70
2 - 2023 Ref Case - With Improements	05:44	12.54
% Diff	-15.4%	17.2%
3 - 2023 Masterplan - No Improvements	09:22	8.57
4 - 2023 Masterplan - With Improvements	06:32	12.23
% Diff	-30.4%	42.7%

3.9.5 The following comments can be drawn from the Global Network Statistics:

- The inclusion of the Berryden corridor improvements in the traffic model has shown to improve the overall network average time taken and mean speed, particularly in the PM and Saturday Peak periods.
- The benefits accrued to the network from the Berryden corridor improvements are more significant under the 2023 with City Centre Masterplan scenario.

The global model statistics suggest that the overall average time taken and mean speed of vehicles in the network are improved when the Berryden Corridor Improvements are implemented. The benefits accrued are even higher when the City Centre Masterplan is in place.

4. SUMMARY & CONCLUSIONS

4.1 Report Summary

4.1.1 This modelling study is required to provide model outputs to quantify the predicted key benefits of the Berryden Corridor Improvement proposals for general traffic and public transport, using the Aberdeen City Centre Paramics Model.

4.1.2 Following a Linsig led signal optimisation study undertaken by consultants Jacobs and using traffic model data previously provided by SYSTRA, ACC have requested that SYSTRA also revise the traffic model signal timings and junction configuration within the modelling to reflect the optimised outputs from the Linsig assessment.

4.1.3 The model scenarios assessed were:

- Scenario 1: 2023 Do-Nothing (no Berryden Improvements, no CC Masterplan)
- Scenario 2: 2023 Do-Min (with Berryden Improvements, no CC Masterplan)
- Scenario 3: 2023 CC Masterplan (no Berryden Improvements, with CC Masterplan)
- Scenario 4: 2023 Do-Max (with Berryden Improvements, with CC Masterplan)

4.1.4 The Test 3 and 4 model scenarios were run at 80% of the predicted 2023 traffic demand. This figure has been derived from previous modelling of the City Centre Masterplan, which identified that a 20% traffic reduction through the City Centre area was required to allow the network to operate with the full proposed City Centre Masterplan infrastructure measures.

4.1.5 Model traffic flow analysis suggests that the proposed City Centre Masterplan Infrastructure results in additional traffic demand at the critical junction of Hutcheon St / Berryden Road. This is the case, even with a 20% reduction in network wide traffic demand (to accommodate the proposed masterplan infrastructure).

Modelling Results

- **Traffic flow** analysis through Berryden Road and associated parallel routes shows that the Berryden corridor improvements allow significantly more traffic to route through this corridor (approx. 10%-60%) The scheme also reduces traffic flow on Westburn Drive, Powis Place, and George Street. This is the case whether the City Centre Masterplan is in place or not.
- Traffic **queue** analysis collated over the Berryden Road, Powis Terrace and Westburn Drive area shows that the levels of traffic queueing are consistently lower when the Berryden corridor improvements are in place (approx. 5%-25%). In the PM Peak and Saturday Peak particularly, the queue levels are approximately 20% lower or better. The benefits to traffic queueing also apply when the City Centre Masterplan is in place.
- **Journey time** analysis, collated through the Berryden corridor and other parallel routes, suggests that there are some significant time savings through each of these routes when the Berryden corridor improvements are in place (up to 50%). Even when the City Centre Masterplan is in place, and the model network is run at 80% of the full demand, there are still significant time savings, particularly through the Berryden Road corridor itself.

- **Bus journey time** analysis, collated for services through Berryden Road and Powis Terrace, show some time savings through both corridors in the PM and Saturday Peaks (up to 20%). The results are slightly mixed as each bus routing through the model will arrive at the signalised junctions at different points in the signal phasing which can skew a comparative assessment.
- The **global model statistics** suggest that the overall average time taken and mean speed of vehicles in the network are improved when the Berryden corridor improvements are implemented (up to 40%). The benefits accrued are even higher when the City Centre Masterplan is in place.

4.1.6 It should be noted that this report does not qualify or quantify the potential improvements to provisions for pedestrians and cyclists. Whilst the traffic models include all the proposed pedestrian crossing facilitates associated with the Berryden corridor improvements, the Paramics model outputs cannot quantify these improvements.

4.2 Conclusions

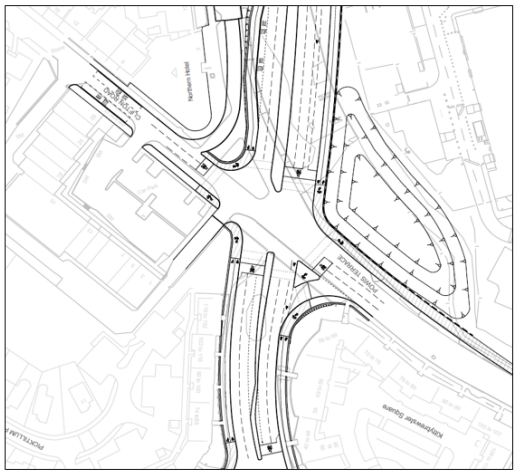
4.2.1 The model testing of the Berryden corridor improvements have shown universal improvements to local queue levels, journey times (delay), public transport delays, and also to the wider network operation.

4.2.2 The outputs from the Linsig assessment are likely to have optimised the model operation of the scheme and allowed for a clear and consistent set of model statistics which highlight the scheme benefits to Public Transport and general traffic.

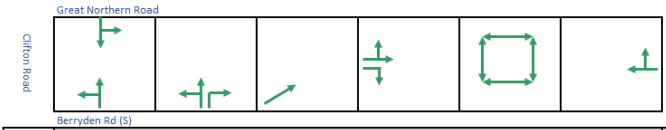
4.2.3 Following the implementation of the City Centre Masterplan together with wider measures to reduce traffic through the City Centre (including modal shift, network hierarchy changes and the proposed Low Emission Zone), the modelling results suggest that the proposed Berryden scheme will continue to provide a significant improvement to the operation of the network. The critical pinch points in the City Centre area will include the Berryden Road / Hutcheon Street junction, which has a significantly improved traffic capacity as part of the Berryden corridor improvement proposals.

APPENDIX A: BERRYDEN ROAD SIGNAL PHASING & TIMINGS

1. Berryden Road / Clifton Road / Great Northern Road / Powis Terrace

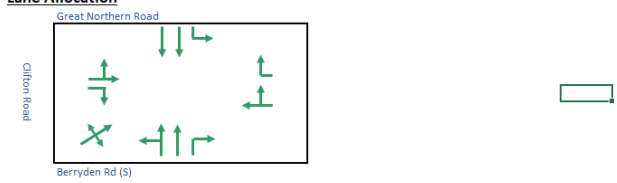


Signal Phasing

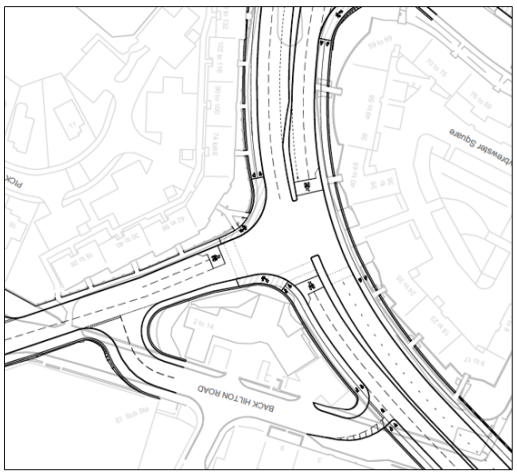


Period	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Cycle	Offset
AM	22	9	8	7	7	5	10	11	6	5	25	5	120	5
PM	13	9	9	7	7	5	7	11	6	5	36	5	120	5
Sat	16	9	15	7	7	5	7	11	6	5	27	5	120	5

Lane Allocation



2. Berryden Road / Back Hilton Road



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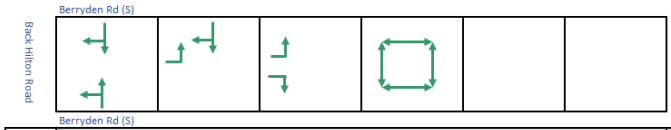
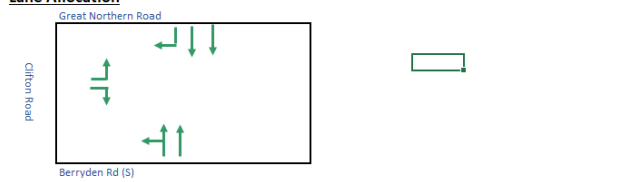


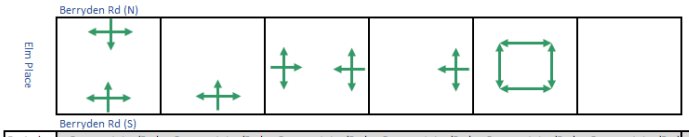
Period	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Cycle	Offset
AM	41	5	10	5	38	10	6	5	120	105
PM	71	5	4	5	14	10	6	5	120	68
Sat	68	5	4	5	17	10	6	5	120	78

Lane Allocation



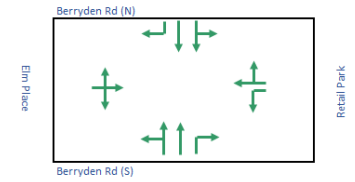
3. Berryden Road / Elm Place / Retail Park

Signal Phasing

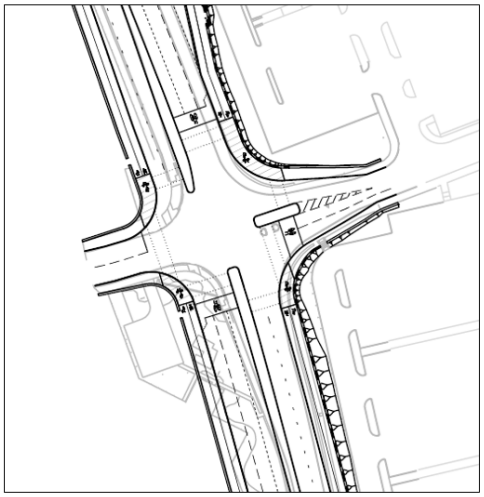


Period	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Cycle	Offset
AM	46	11	6	6	18	9	2	11	6	5			120	13
PM	36	11	6	6	28	9	2	11	6	5			120	114
Sat	36	11	6	6	28	9	2	11	6	5			120	115

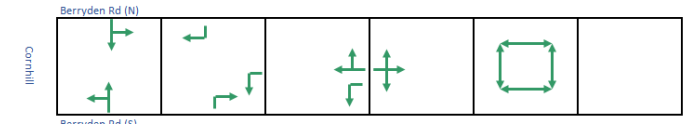
Lane Allocation



4. Berryden Road / Cornhill Development / Retail Park

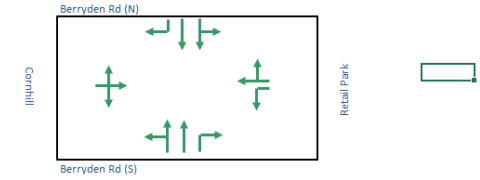


Signal Phasing

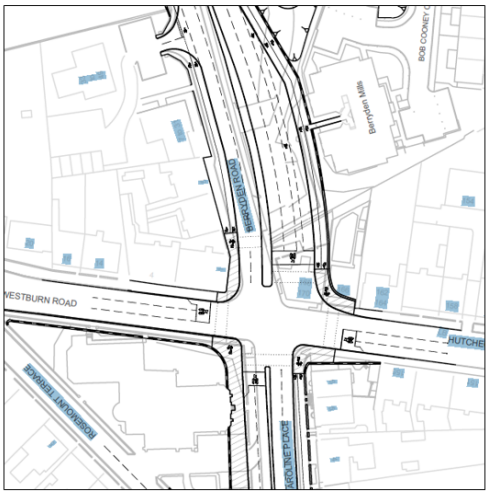


Period	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Cycle	Offset
AM	52	10	6	9	6	7	10	9	6	5			120	6
PM	53	10	6	9	6	7	9	9	6	5			120	104
Sat	43	10	15	9	9	7	7	9	6	5			120	114

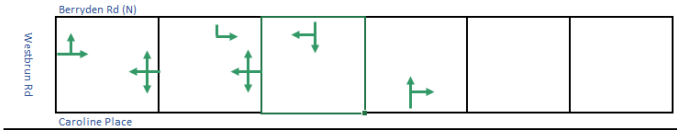
Lane Allocation



5. Berryden Road / Hutcheon Street / Westburn Road / Caroline Place

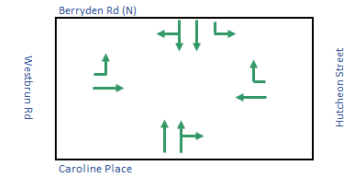


Signal Phasing

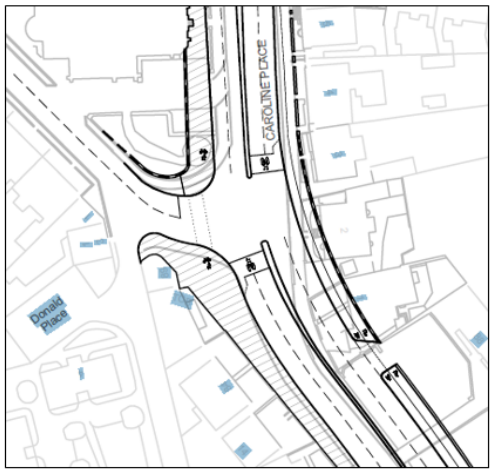


Period	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Cycle	Offset
AM	26	6	8	9	32	8	25	6					120	6
PM	28	6	10	9	17	8	36	6					120	6
Sat	23	6	12	9	25	8	31	6					120	6

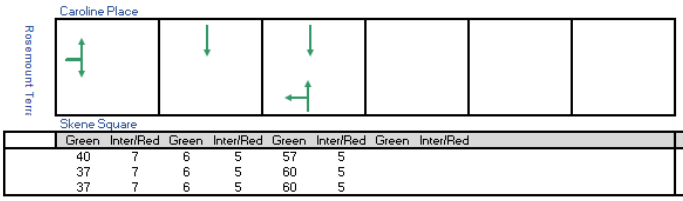
Lane Allocation



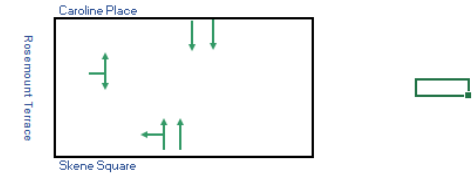
6. Caroline Place / Rosemount Terrace / Skene Square



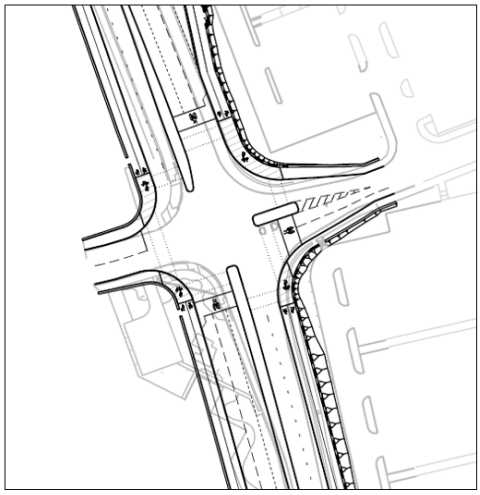
Signal Phasing



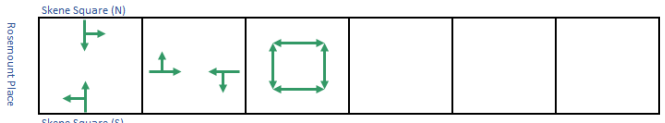
Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Cycle	Offset
40	7	6	5	57	5			120	12
37	7	6	5	60	5			120	3
37	7	6	5	60	5			120	16



7. Skene Square / Rosemount Place / Maberly Street

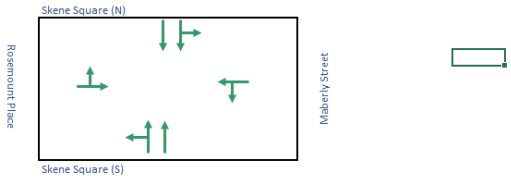


Signal Phasing

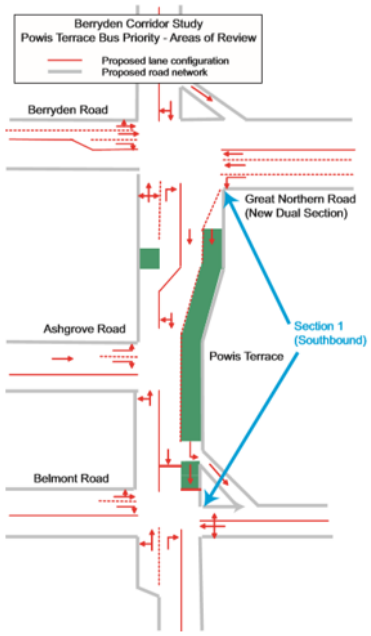


Period	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Cycle	Offset
AM	74	9	17	9	6	5							120	37
PM	57	9	34	9	6	5							120	52
Sat	54	9	37	9	6	5							120	60

Lane Allocation



8. Belmont Road / Powis Terrace



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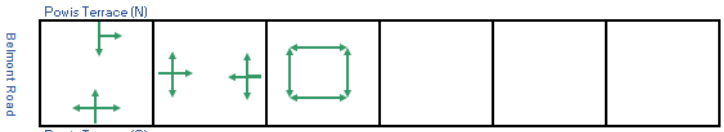
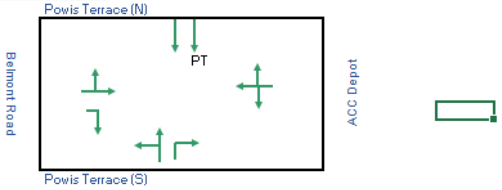
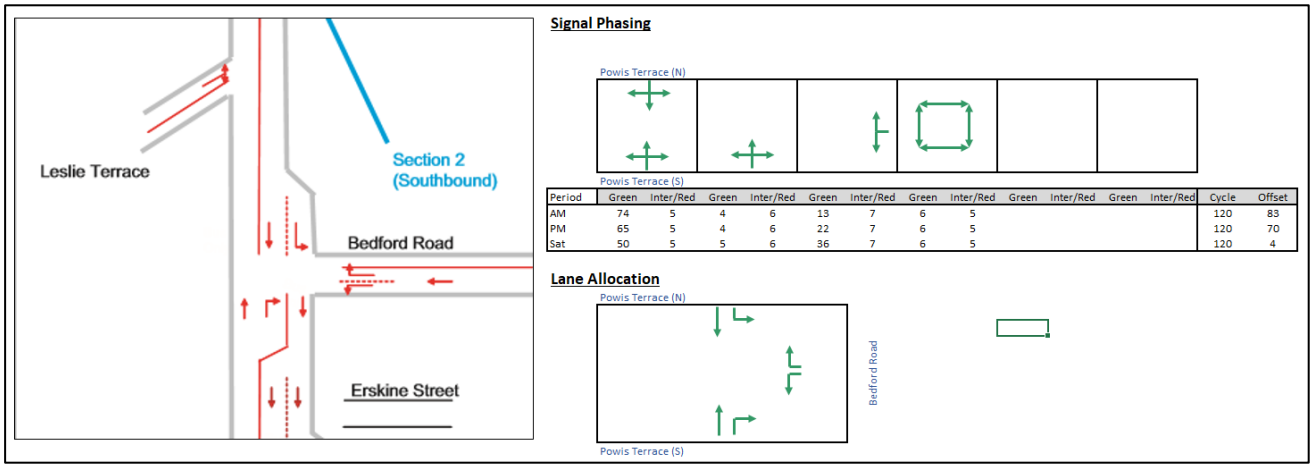


Period	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Cycle	Offset
AM	82	6	13	8	6	5							120	81
PM	84	6	11	8	6	5							120	63
Sat	88	6	7	8	6	5							120	16

Lane Allocation



9. Bedford Road / Powis Terrace



Period	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Green	Inter/Red	Cycle	Offset
AM	74	5	4	6	13	7	6	5					120	83
PM	65	5	4	6	22	7	6	5					120	70
Sat	50	5	5	6	36	7	6	5					120	4

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