A720 Sheriffhall Roundabout

DMRB Stage 2

Traffic and Economic Assessment Report

Transport Scotland

Project Number: 60470009

March 2017

Issue	Date	Details	Prepared by	Checked by	Approved by
1	21 March 2017	Final Report 47067662/Doc/D/002	Andrew Simpson Senior Consultant Dan Tuck Consultant	Russell Bissland Technical Director	Russell Bissland Technical Director

AECOM
Aurora
120 Bothwell Street
Glasgow
G2 7JS
UK

LIMITATIONS

AECOM Infrastructure & Environment UK Limited ("AECOM") has prepared this Report for the sole use of Transport Scotland ("Client") in accordance with the Agreement under which our services were performed (TS/MTRIPS/SER/2008/14/01. 01 April 2014). No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by AECOM. This Report is confidential and may not be disclosed by the Client nor relied upon by any other party without the prior and express written agreement of AECOM.

The conclusions and recommendations contained in this Report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by AECOM has not been independently verified by AECOM, unless otherwise stated in the Report.

The methodology adopted and the sources of information used by AECOM in providing its services are outlined in this Report. The work described in this Report was undertaken between October 2013 and March 2017 and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

Where assessments of works or costs identified in this Report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

AECOM disclaim any undertaking or obligation to advise any person of any change in any matter affecting the Report, which may come or be brought to AECOM's attention after the date of the Report.

Certain statements made in the Report that are not historical facts may constitute estimates, projections or other forward-looking statements and even though they are based on reasonable assumptions as of the date of the Report, such forward-looking statements by their nature involve risks and uncertainties that could cause actual results to differ materially from the results predicted. AECOM specifically does not guarantee or warrant any estimate or projections contained in this Report.

AECOM officially combined with URS Corporation on 20 October 2014 and all URS legacy companies including URS Infrastructure & Environment UK Limited became wholly owned subsidiaries of AECOM.

On 16 March 2015 the name of URS Infrastructure & Environment UK Limited changed to AECOM Infrastructure & Environment UK Limited to reflect the company's status as a wholly owned subsidiary through which AECOM operates in the UK.

COPYRIGHT

TABLE OF CONTENTS

1 INTRODUCTION

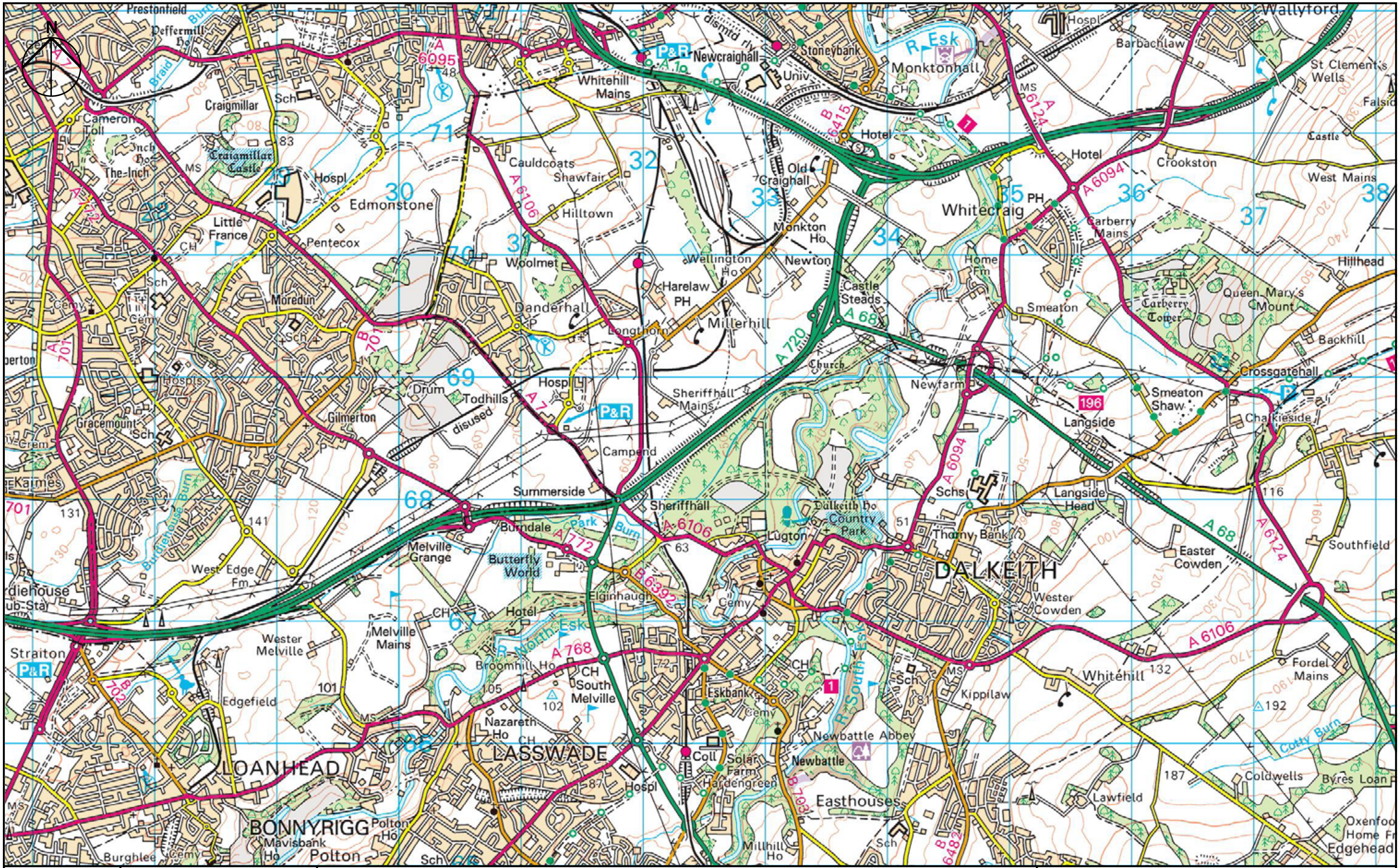
This report has been prepared by AECOM on behalf of Transport Scotland as part of the Design Manual for Roads and Bridges (DMRB) Stage 2 Assessment of the A720 Sheriffhall Roundabout.

The operational and economic assessment of proposed road improvement schemes requires the development and application of various computer models. In the case of the A720 Sheriffhall Roundabout, this has involved the development of a Paramics micro-simulation model due to interaction between adjacent junctions and the likely effects of high traffic demand in a congested network.

In addition, the Sestran Regional Model (SRM) and the Traffic Model for Scotland (TMfS) have been used to assist in forecasting future traffic levels, and industry-standard software packages Program for the Economic Assessment of Road Schemes (PEARS) and Network Evaluation from Surveys and Assignments (NESA) have been used for the purposes of the Economic Assessment.

The purpose of the DMRB Stage 2 Traffic and Economic Assessment Report is to describe existing traffic conditions in the A720 Sheriffhall Roundabout study area, to outline the indicative costs, risks and optimism bias associated with the proposed Improvement Options and to describe the work undertaken to develop the various computer models. The report also considers future traffic conditions over the economic life of the scheme and presents the results of an operational and economic assessment of the proposed Improvement Options.

A general location plan of the study area is shown in **Figure 1.1**. A more detailed key location plan is shown in **Figure 1.2**.

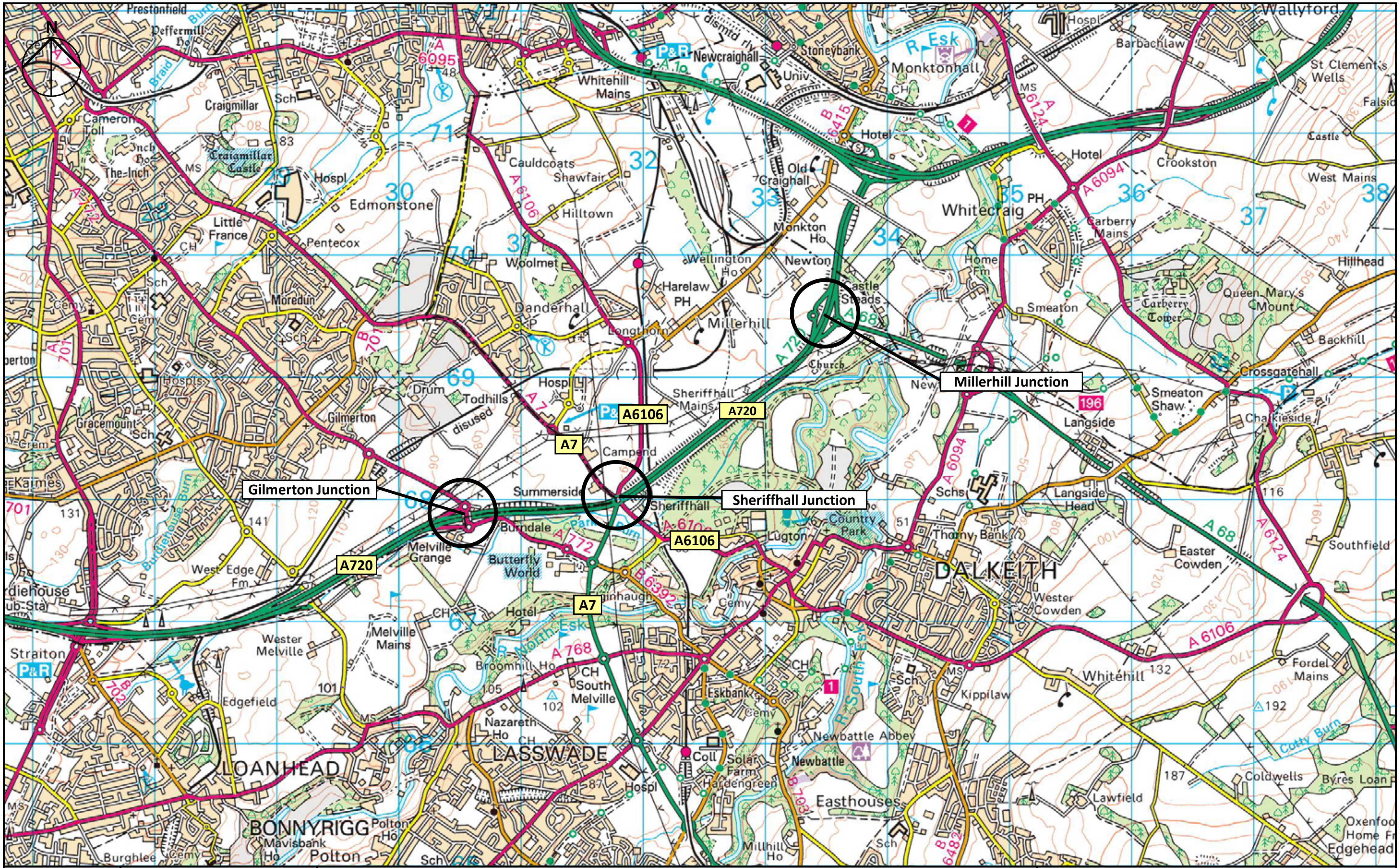


AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 1.1
General Location Plan



AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 1.2
Key Location Plan

2 TRAFFIC SURVEYS

2.1 Manual Classified Counts

Methodology

Manual Classified Counts (MCCs) were undertaken at 3 locations along the A720 on Thursday 2 October 2014 to define current traffic volumes and turning movements. The Manual Classified Counts were undertaken at the following locations:

- M1 – Gilmerton Junction;
- M2 – Sheriffhall Roundabout; and
- M3 – Millerhill Junction.

An additional 9 locations were also surveyed on Wednesday 1 October 2014 at the following locations to provide information on the traffic flows in the surrounding area:

- M4 – Melville Gate Road / A6106 Old Dalkeith Road Priority Junction;
- M5 – Melville Gate Road / Gilmerton Road Roundabout;
- M6 – Gilmerton Road Roundabout;
- M7 – Melville Dykes Road Roundabout;
- M8 – Drum Street / Ferniehill Drive Traffic Signals;
- M9 – Ferniehill Road / Old Dalkeith Road Priority Junction;
- M10 – The Wisp / Old Dalkeith Road Priority Junction;
- M11 – The Wisp / Millerhill Road Priority Junction; and
- M12 – Millerhill Road / A6106 to A7 Link Road Roundabout.

The locations of the MCCs are shown in **Figure 2.1**.

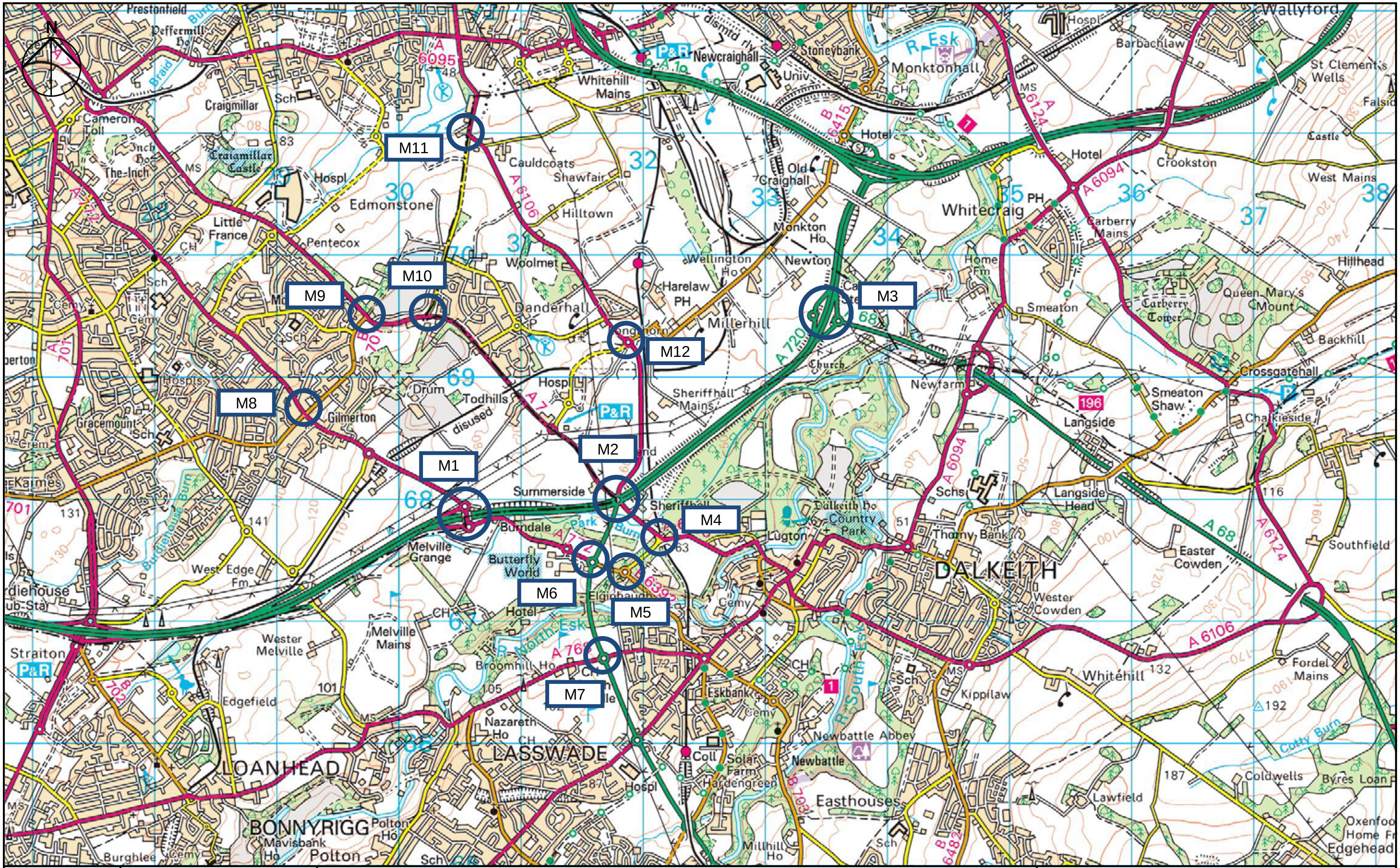
The MCC data for each site were collected in 15-minute intervals between 07:00 hours and 19:00 hours over the survey period to provide a 12-hour record of turning movements.

The standard DMRB 5-vehicle classification was adopted for the surveys, which includes the following vehicle types:

- Cars;
- Light Goods Vehicles (LGV);
- Other Goods Vehicles 1 (OGV1);
- Other Goods Vehicles 2 (OGV2); and
- Buses and Coaches (PSV).

Full turning counts of all movements were undertaken at each MCC Site, excluding the mainline only movements at MCC Site 1 and MCC Site 3.

It should also be noted that the A6106 Millerhill Road was temporarily closed at MCC Site 2 Sheriffhall Roundabout on the day of survey due to roadworks in the area.



Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 2.1
MCC Locations

MCC Survey Results

A summary of the MCC data and the overall vehicle classification percentages is shown in **Table 2.1.**

Table 2.1 – Summary of 12-Hour MCC Total Junction Flows and Vehicle Proportions

MCC Site	Units	Car	LGV	OGV1	OGV2	PSV	Total	HGV Total
MCC 1A	**Flow**	8,810	1,324	349	292	233	11,008	874
	%	80.0%	12.0%	3.2%	2.7%	2.1%	100.0%	7.9%
MCC 1B	**Flow**	11,671	1,854	508	454	243	14,730	1,205
	%	79.2%	12.6%	3.4%	3.1%	1.6%	100.0%	8.2%
MCC 2	**Flow**	45,566	8,212	2,290	2,560	416	59,044	5,266
	%	77.2%	13.9%	3.9%	4.3%	0.7%	100.0%	8.9%
MCC 3A	**Flow**	5,188	762	193	353	11	6,507	557
	%	79.7%	11.7%	3.0%	5.4%	0.2%	100.0%	8.6%
MCC 3B	**Flow**	9,796	1,476	402	739	24	12,437	1,165
	%	78.8%	11.9%	3.2%	5.9%	0.2%	100.0%	9.4%
MCC 4	**Flow**	8,764	1,429	255	92	318	10,858	665
	%	80.7%	13.2%	2.3%	0.8%	2.9%	100.0%	6.1%
MCC 5	**Flow**	7,001	1,035	146	59	224	8,465	429
	%	82.7%	12.2%	1.7%	0.7%	2.6%	100.0%	5.1%
MCC 6	**Flow**	20,213	3,305	874	622	269	25,283	1,765
	%	79.9%	13.1%	3.5%	2.5%	1.1%	100.0%	7.0%
MCC 7	**Flow**	19,623	3,183	866	591	139	24,402	1,596
	%	80.4%	13.0%	3.5%	2.4%	0.6%	100.0%	6.5%
MCC 8	**Flow**	15,864	2,114	446	53	453	18,930	952
	%	83.8%	11.2%	2.4%	0.3%	2.4%	100.0%	5.0%
MCC 9	**Flow**	18,107	2,122	495	115	451	21,290	1,061
	%	85.0%	10.0%	2.3%	0.5%	2.1%	100.0%	5.0%
MCC 10	**Flow**	15,517	2,038	479	126	329	18,489	934
	%	83.9%	11.0%	2.6%	0.7%	1.8%	100.0%	5.1%
MCC 11	**Flow**	8,726	1,415	333	84	37	10,595	454
	%	82.4%	13.4%	3.1%	0.8%	0.3%	100.0%	4.3%
MCC 12	**Flow**	4,883	1,061	312	86	18	6,360	416
	%	76.8%	16.7%	4.9%	1.4%	0.3%	100.0%	6.5%
Total	**Flow**	**199,729**	**31,330**	**7,948**	**6,226**	**3,165**	**248,398**	**17,339**
	%	**80.4%**	**12.6%**	**3.2%**	**2.5%**	**1.3%**	**100.0%**	**7.0%**

Note 1: MCC Site 1A refers to the northern roundabout at Gilmerton Junction.
Note 2: MCC Site 1B refers to the southern roundabout at Gilmerton Junction.
Note 3: MCC Site 3A refers to the northern roundabout at Millerhill Junction.
Note 4: MCC Site 3B refers to the southern roundabout at Millerhill Junction.

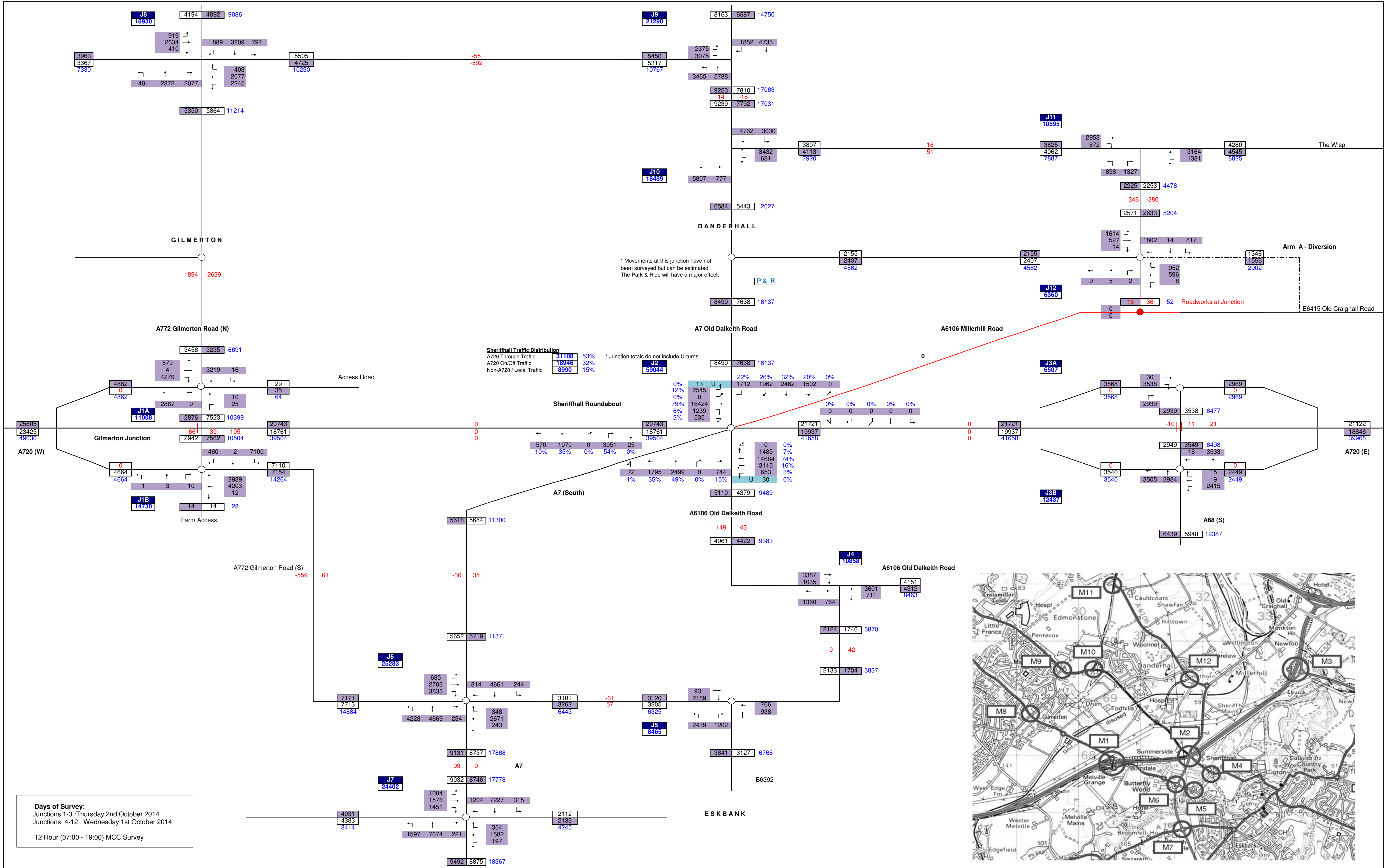
The observed 12-hour, AM and PM peak traffic flows for all vehicles and the 12-hour traffic flows for light vehicles and HGVs, for all sites, are shown in **Figures 2.2 to 2.6**.

The observed 2-way 12-hour mainline and side road flows recorded for all vehicles are shown in **Figure 2.7.** The results of the October 2014 surveys indicate that 59,040 vehicles passed through the at-grade Sheriffhall Roundabout during the 12-hour survey period. In comparison, 57,670 vehicles were recorded passing through the junction in October 2013.

The percentage change with respect to the Stage 1 October 2013 surveys are shown in **Figure 2.8**. For all entry flows into Sheriffhall Roundabout, there has been an increase of approximately 2.4%.

Examination of this information indicates that traffic flows on the A7 north of Sheriffhall Roundabout and the A720 east of Sheriffhall Roundabout have increased significantly relative to the October 2013 surveys and that these changes in local trip patterns are likely to be influenced by the temporary closure of the A6106 north of Sheriffhall Roundabout during the October 2014 surveys.

The traffic flow profile at Sheriffhall Roundabout in 15-minute intervals between 07:00 and 19:00 hours for each of the six approach arms are shown in **Figure 2.9**. Examination of this information indicates that traffic flows on the A720 at Sheriffhall Roundabout are generally higher in the eastbound direction during the AM peak and higher in the westbound direction during the PM peak.



Days of Survey:
Junctions 1-3 :Thursday 2nd October 2014
Junctions 4-12 : Wednesday 1st October 2014

12 Hour (07:00 - 19:00) MCC Survey

	Total	Cx	CxTotal	A	B	C	D	E	F	U Turns
J1A	11008	TRUE	**11073**	3241	36	2934	4862			65
J1B	14730	TRUE	**14764**	7571	7179	14				34
J2	59044	TRUE	**59087**	0	19967	5110	5616	20756	7638	43
J3A	6507	TRUE	**6513**	0	2945	3568				6
J3B	12437	TRUE	**12440**	2449	6440	0	3551			3
J4	10858	TRUE	**10885**	4317	2127	4441	0			27
J5	8465	TRUE	**8498**	1709	3646	3143				33

	Total	Cx	CxTotal	A	B	C	D	E	F	U Turns
J6	25283	TRUE	**25305**	5733	3262	9137	7173			22
J7	24402	TRUE	**24421**	8747	2139	9496	4039			19
J8	18930	TRUE	**18930**	4892	4725	5350	3963			0
J9	21290	TRUE	**21296**	6587	9254	5455				6
J10	18489	TRUE	**18489**	4113	6584	7792				0
J11	10595	TRUE	**10597**	4546	2225	3826				2
J12	6360	TRUE	**6380**	1562	16	2164	2638			20

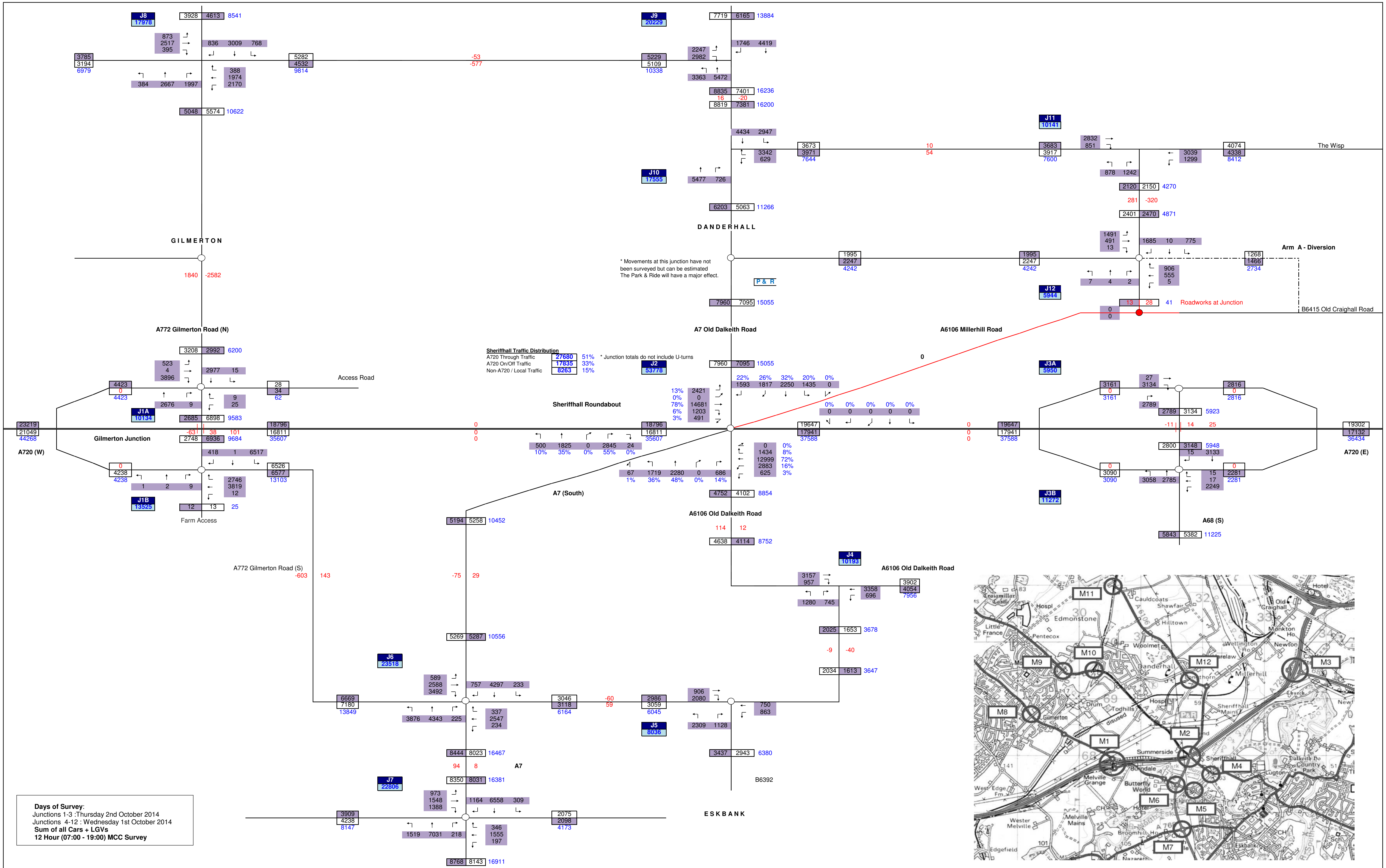
A	B	C	D	E	F	A	B	C	D	E	F
6	1	58	0			14	0	6	2		
9	25	0	0			1	6	4	8		
0	30	0	0	13	0	0	0	0	0		
0	6	0				0	1	5			
0	1	0	2			0	0	0			
5	3	19	0			1	0	1			
5	5	23				6	0	9	5		

<< Breakdown of U-Turns

AECOM

A720 Sheriffhall Roundabout
DMRB Stage 2 Traffic and Economic Assessment Report

Figure 2.2
Manual Classified Counts - 1st / 2nd October 2014
Observed Weekday 12-hour All Vehicle Traffic Flows



Days of Survey:
Junctions 1-3 :Thursday 2nd October 2014
Junctions 4-12 : Wednesday 1st October 2014
Sum of all Cars + LGVs
12 Hour (07:00 - 19:00) MCC Survey

	Total	Cx	CxTotal	A	B	C	D	E	F	U Turns	A	B	C	D	E	F
J1A	10134	TRUE	**10197**	2998	35	2741	4423			63	6	1	56	0		
J1B	13525	TRUE	**13557**	6944	6601	12				32	8	24	0			
J2	53778	TRUE	**53817**	0	17969	4752	5194	18807	7095	39	0	28	0	0	11	0
J3A	5950	TRUE	**5956**	0	2795	3161				6	0	6	0			
J3B	11272	TRUE	**11274**	2281	5844	0	3149			2	0	1	0	1		
J4	10193	TRUE	**10214**	4058	2028	4128	0			21	4	3	14	0		
J5	8036	TRUE	**8066**	1617	3441	3008				30	4	4	22			

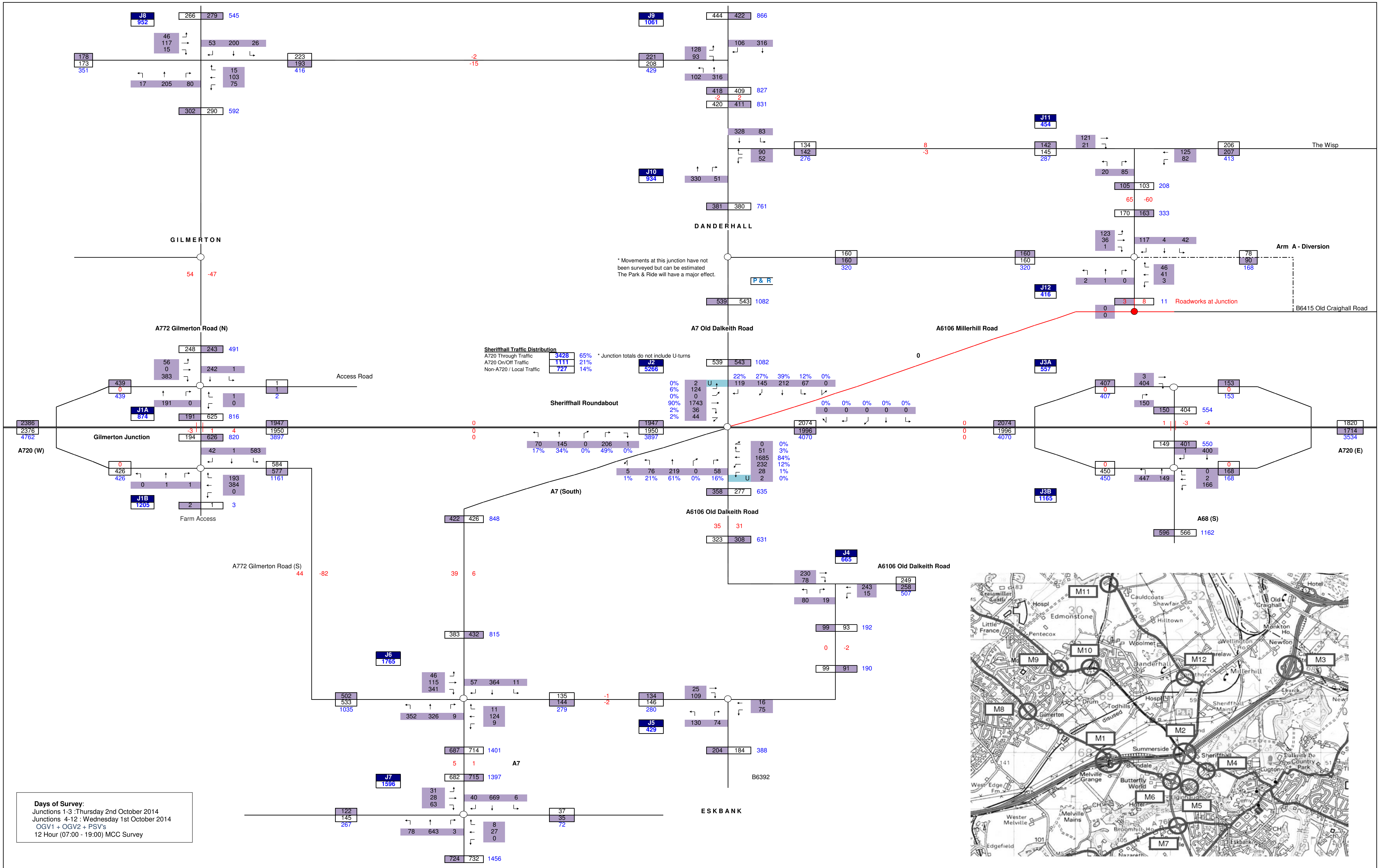
	Total	Cx	CxTotal	A	B	C	D	E	F	U Turns	A	B	C	D	E	F
J6	23518	TRUE	**23537**	5300	3118	8450	6669			19	13	0	6	0		
J7	22806	TRUE	**22824**	8032	2104	8772	3916			18	1	6	4	7		
J8	17978	TRUE	**17978**	4613	4532	5048	3785			0	0	0	0	0		
J9	20229	TRUE	**20235**	6165	8836	5234				6	0	1	5			
J10	17555	TRUE	**17555**	3971	6203	7381				0	0	0	0			
J11	10141	TRUE	**10143**	4339	2120	3684				2	1	0	1			
J12	5944	TRUE	**5963**	1472	13	2004	2474			19	6	0	9	4		

<Breakdown of U-Turns

AECOM

A720 Sheriffhall Roundabout
DMRB Stage 2 Traffic and Economic Assessment Report

Figure 2.3
Manual Classified Counts - 1st / 2nd October 2014
Observed Weekday 12-hour - Cars + LGV Flows



Days of Survey:
Junctions 1-3 :Thursday 2nd October 2014
Junctions 4-12 : Wednesday 1st October 2014
OGV1 + OGV2 + PSV's
12 Hour (07:00 - 19:00) MCC Survey

AECOM

	Total	Cx	CxTotal	A	B	C	D	E	F	U Turns
J1A	874	TRUE	**876**	243	1	193	439			2
J1B	1205	TRUE	**1207**	627	578	2				2
J2	5266	TRUE	**5270**	0	1998	358	422	1949	543	4
J3A	557	TRUE	**557**	0	150	407				0
J3B	1165	TRUE	**1166**	168	596	0	402			1
J4	665	TRUE	**671**	259	99	313	0			6
J5	429	TRUE	**432**	92	205	135				3

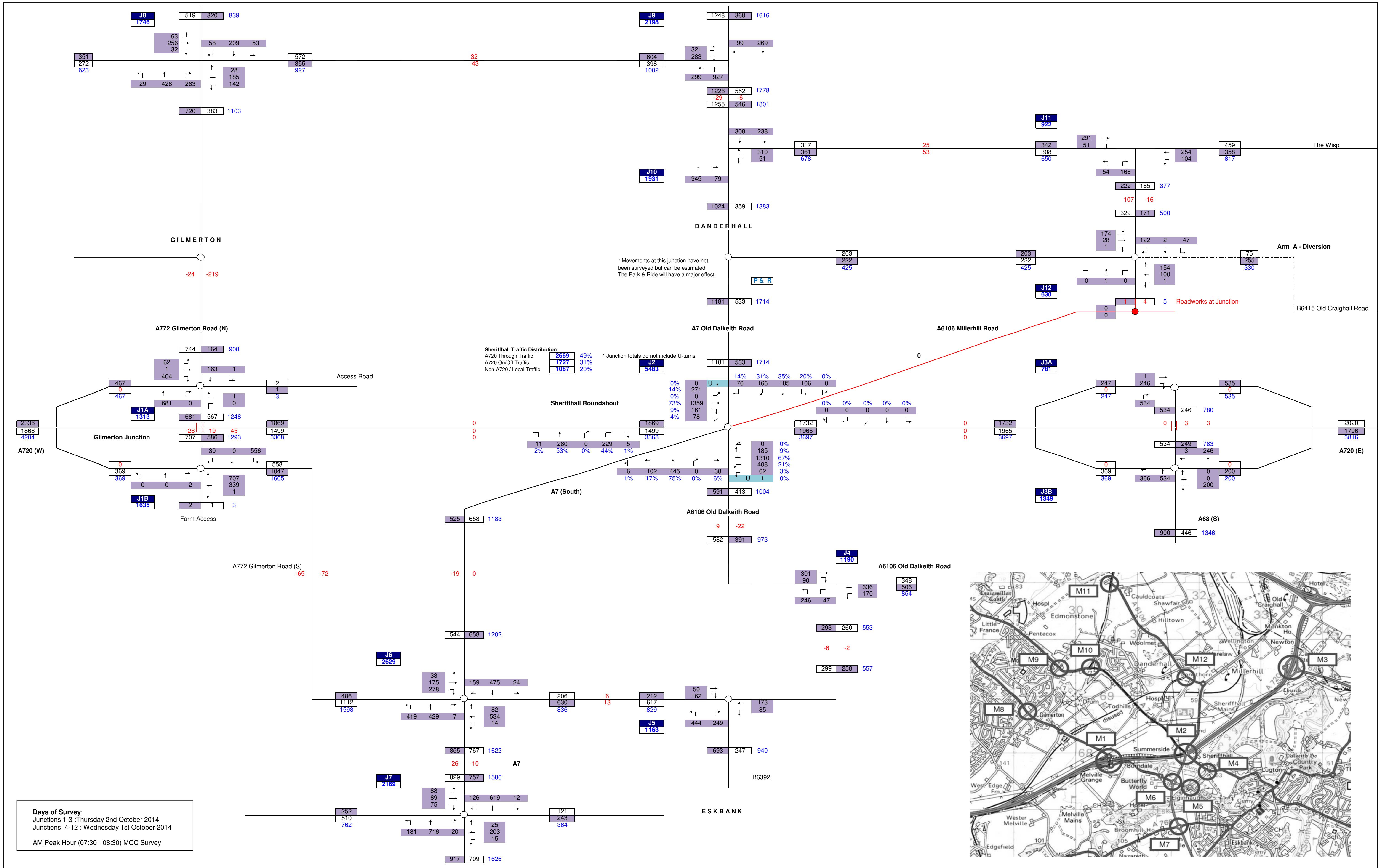
	Total	Cx	CxTotal	A	B	C	D	E	F	U Turns
J6	1765	TRUE	**1768**	433	144	687	504			3
J7	1596	TRUE	**1597**	715	35	724	123			1
J8	952	TRUE	**952**	279	193	302	178			0
J9	1061	TRUE	**1061**	422	418	221				0
J10	934	TRUE	**934**	142	381	411				0
J11	454	TRUE	**454**	207	105	142				0
J12	416	TRUE	**417**	90	3	160	164			1

A	B	C	D	E	F	A	B	C	D	E	F
0	0	2	0			1	0	0	2		
1	1	0				0	0	0	1		
0	2	0	0	2	0	0	0	0	0		
0	0	0				0	0	0			
0	0	0	1			0	0	0			
1	0	5	0			0	0	0			
1	1	1				0	0	0	1		

<Breakdown of U-Turns

A720 Sheriffhall Roundabout
DMRB Stage 2 Traffic and Economic Assessment Report

Figure 2.4
Manual Classified Counts - 1st / 2nd October 2014
Observed Weekday 12-hour - OGV1 + OGV2 + PSV Flows



Days of Survey:
Junctions 1-3 :Thursday 2nd October 2014
Junctions 4-12 : Wednesday 1st October 2014

AM Peak Hour (07:30 - 08:30) MCC Survey

AECOM

	Total	Cx	CxTotal	A	B	C	D	E	F	U Turns
J1A	1313	TRUE	**1336**	164	1	704	467			23
J1B	1635	TRUE	**1637**	588	1047	2				2
J2	5483	TRUE	**5484**	0	1966	591	525	1869	533	1
J3A	781	TRUE	**781**	0	534	247				0
J3B	1349	TRUE	**1349**	200	900	0	249			0
J4	1190	TRUE	**1193**	509	293	391	0			3
J5	1163	TRUE	**1164**	258	693	213				1

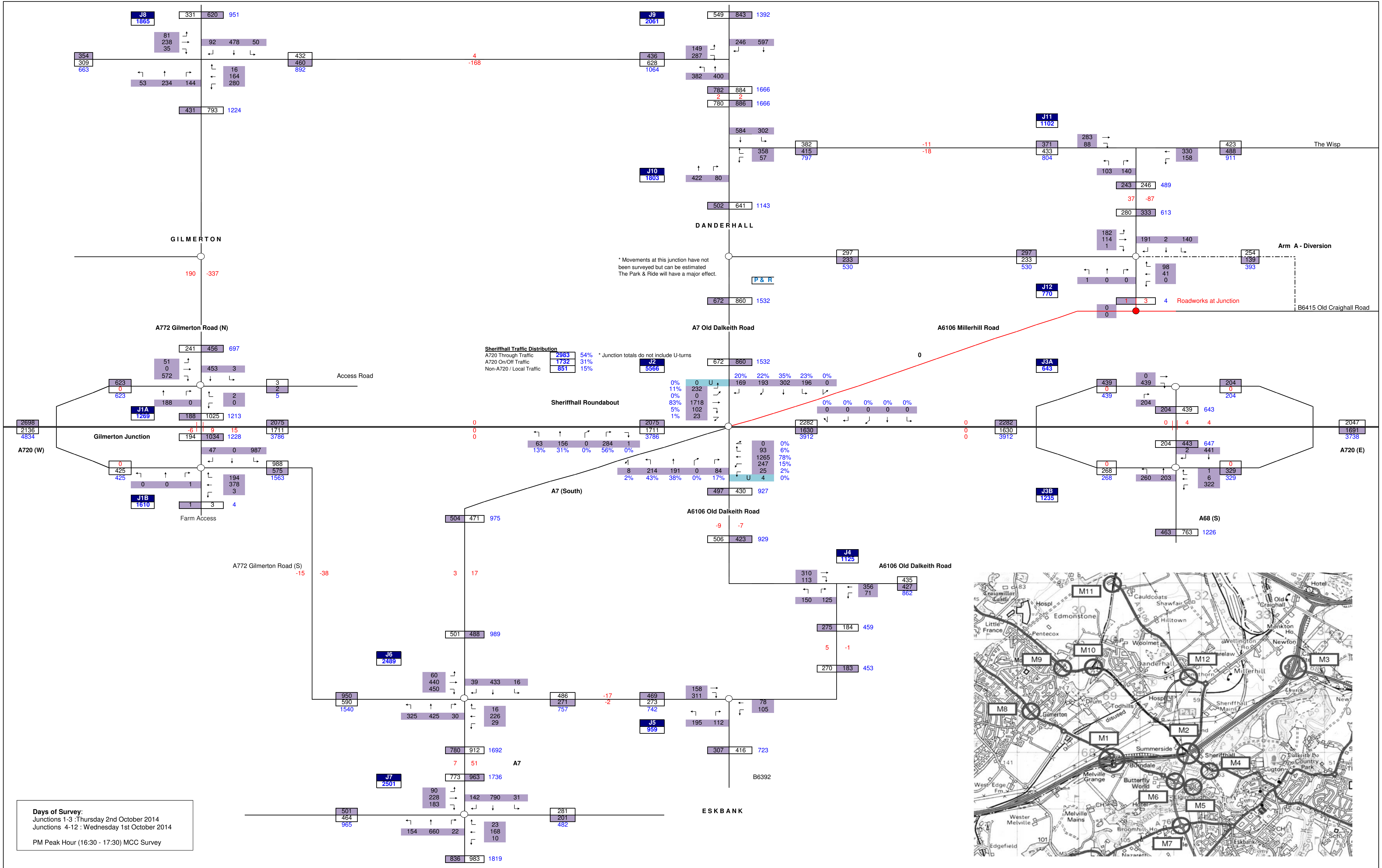
	Total	Cx	CxTotal	A	B	C	D	E	F	U Turns
J6	2629	TRUE	**2629**	658	630	855	486			0
J7	2169	TRUE	**2176**	757	247	918	254			7
J8	1746	TRUE	**1746**	320	355	720	351			0
J9	2198	TRUE	**2198**	368	1226	604				0
J10	1931	TRUE	**1931**	361	1024	546				0
J11	922	TRUE	**922**	358	222	342				0
J12	630	TRUE	**630**	255	1	203	171			0

A	B	C	D	E	F	A	B	C	D	E	F
0	0	23	0			0	0	0	0		
2	0	0				0	4	1	2		
0	1	0	0	0	0	0	0	0	0		
0	0	0				0	0	0			
0	0	0	0			0	0	0			
3	0	0	0			0	0	0			
0	0	1				0	0	0	0		

Breakdown of U-Turns

A720 Sheriffhall Roundabout
DMRB Stage 2 Traffic and Economic Assessment Report

Figure 2.5
Manual Classified Counts - 1st / 2nd October 2014
Observed Weekday AM Peak Hour All Vehicle Traffic Flows



Days of Survey:
Junctions 1-3 :Thursday 2nd October 2014
Junctions 4-12 : Wednesday 1st October 2014

PM Peak Hour (16:30 - 17:30) MCC Survey

AECOM

	Total	Cx	CxTotal	A	B	C	D	E	F	U Turns
J1A	1269	TRUE	**1274**	456	2	193	623			5
J1B	1610	TRUE	**1614**	1035	578	1				4
J2	5566	TRUE	**5570**	0	1634	497	504	2075	860	4
J3A	643	TRUE	**645**	0	206	439				2
J3B	1235	TRUE	**1235**	329	463	0	443			0
J4	1125	TRUE	**1125**	427	275	423	0			0
J5	959	TRUE	**963**	184	308	471				4

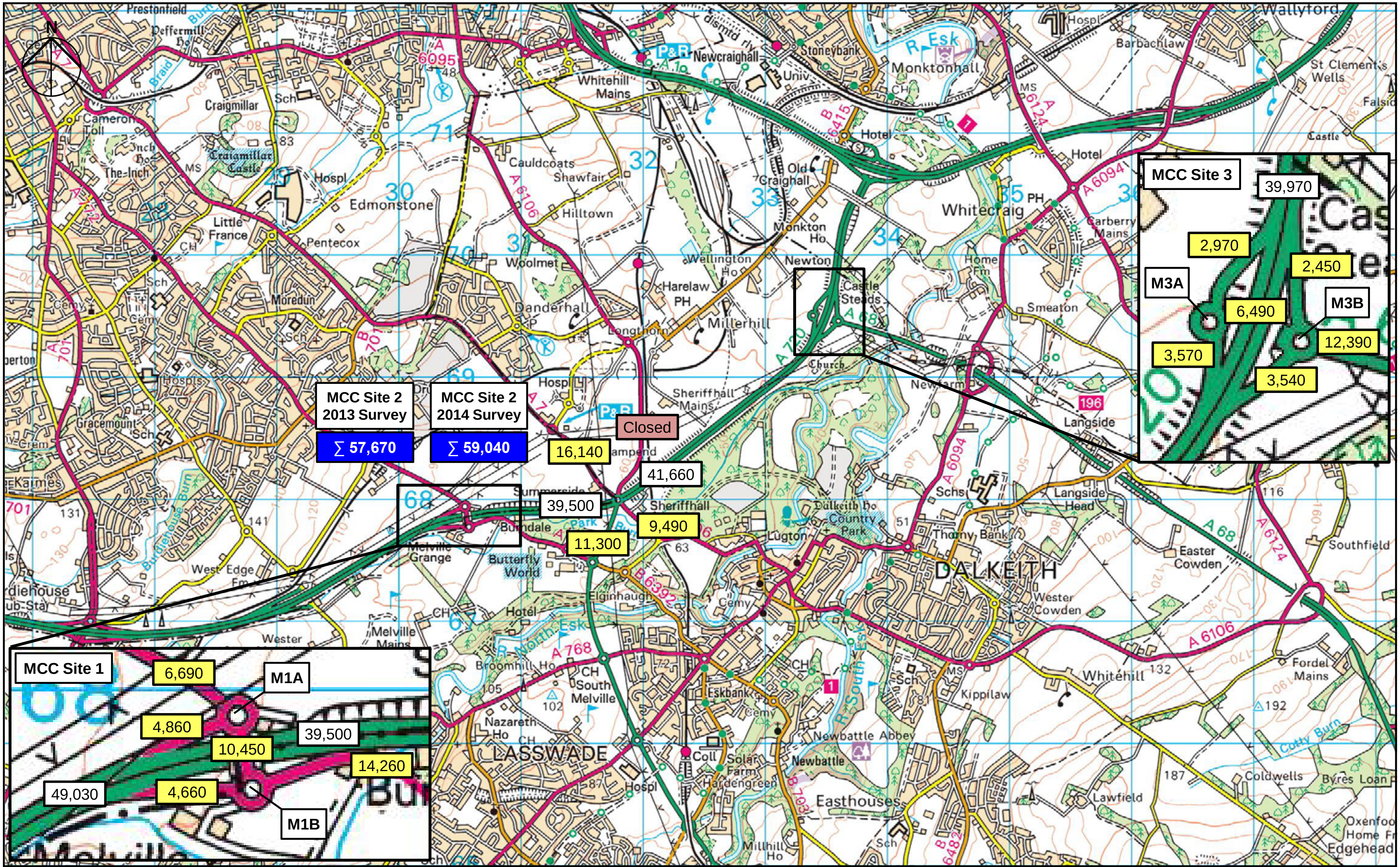
	Total	Cx	CxTotal	A	B	C	D	E	F	U Turns
J6	2489	TRUE	**2489**	488	271	780	950			0
J7	2501	TRUE	**2502**	963	201	836	502			1
J8	1865	TRUE	**1865**	620	460	431	354			0
J9	2061	TRUE	**2061**	843	782	436				0
J10	1803	TRUE	**1803**	415	502	886				0
J11	1102	TRUE	**1102**	488	243	371				0
J12	770	TRUE	**771**	139	1	298	333			1

A	B	C	D	E	F	A	B	C	D	E	F
0	0	5	0			0	0	0	0		
1	3	0				0	0	0	1		
0	4	0	0	0	0	0	0	0	0		
0	2	0				0	0	0			
0	0	0	0			0	0	0			
0	0	0	0			0	0	0			
1	1	2				0	0	1	0		

<Breakdown of U-Turns

A720 Sheriffhall Roundabout
DMRB Stage 2 Traffic and Economic Assessment Report

Figure 2.6
Manual Classified Counts - 1st / 2nd October 2014
Observed Weekday PM Peak Hour All Vehicle Traffic Flows



AECOM

Source:

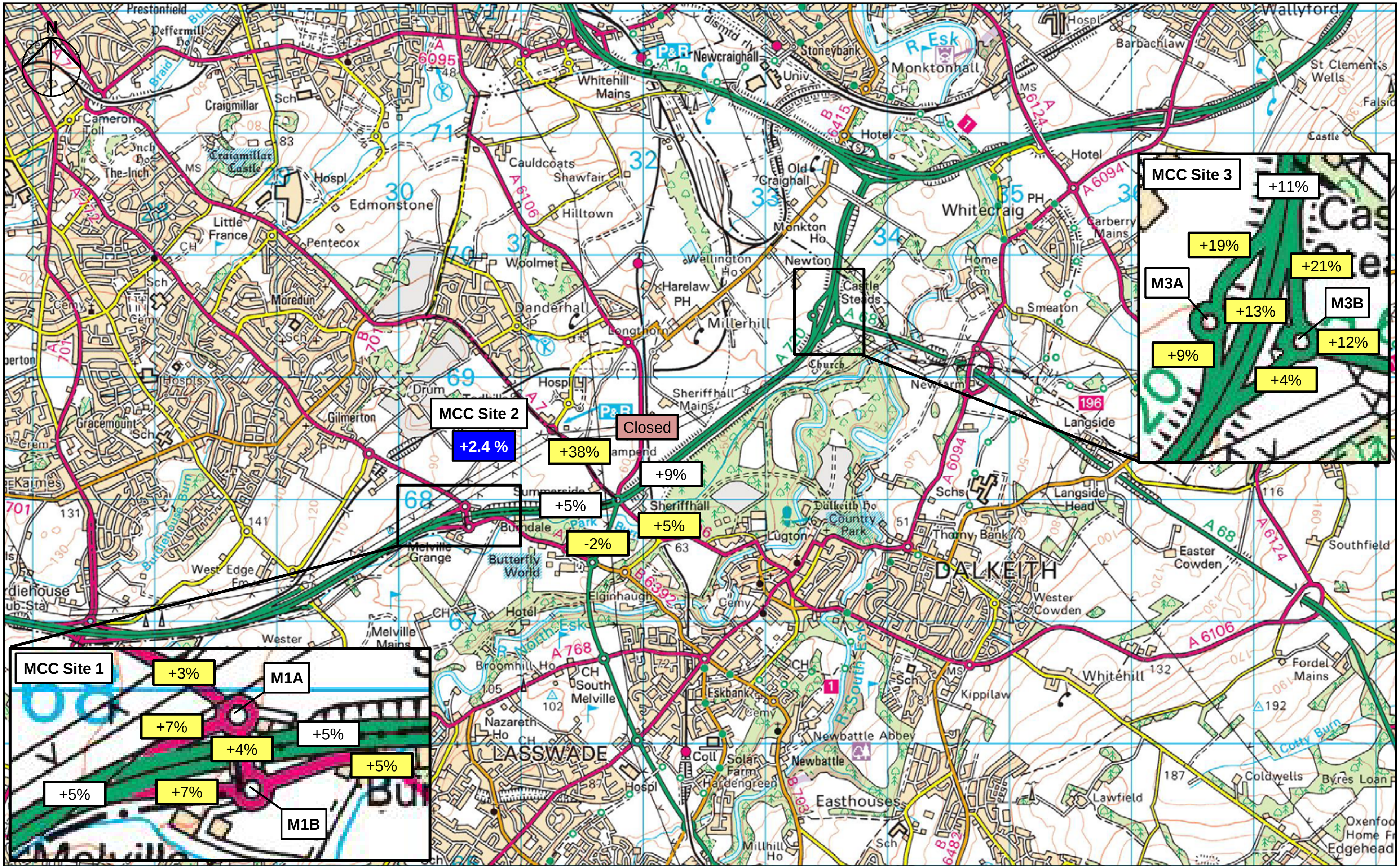
Notes:

1,000	Side Road Flow
10,000	Main Road Flow
Closed	A6106 Millerhill Road Closed
∑	Sheriffhall Junction Total (Sum of all Entries)

Day of 2013 Survey: Tuesday 8 October 2013 Day of 2014 Survey: Thursday 2 October 2014

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 2.7
Observed Weekday 2-Way 12-Hour Link Flows



Source:

Ordnance Survey License number 100046668.

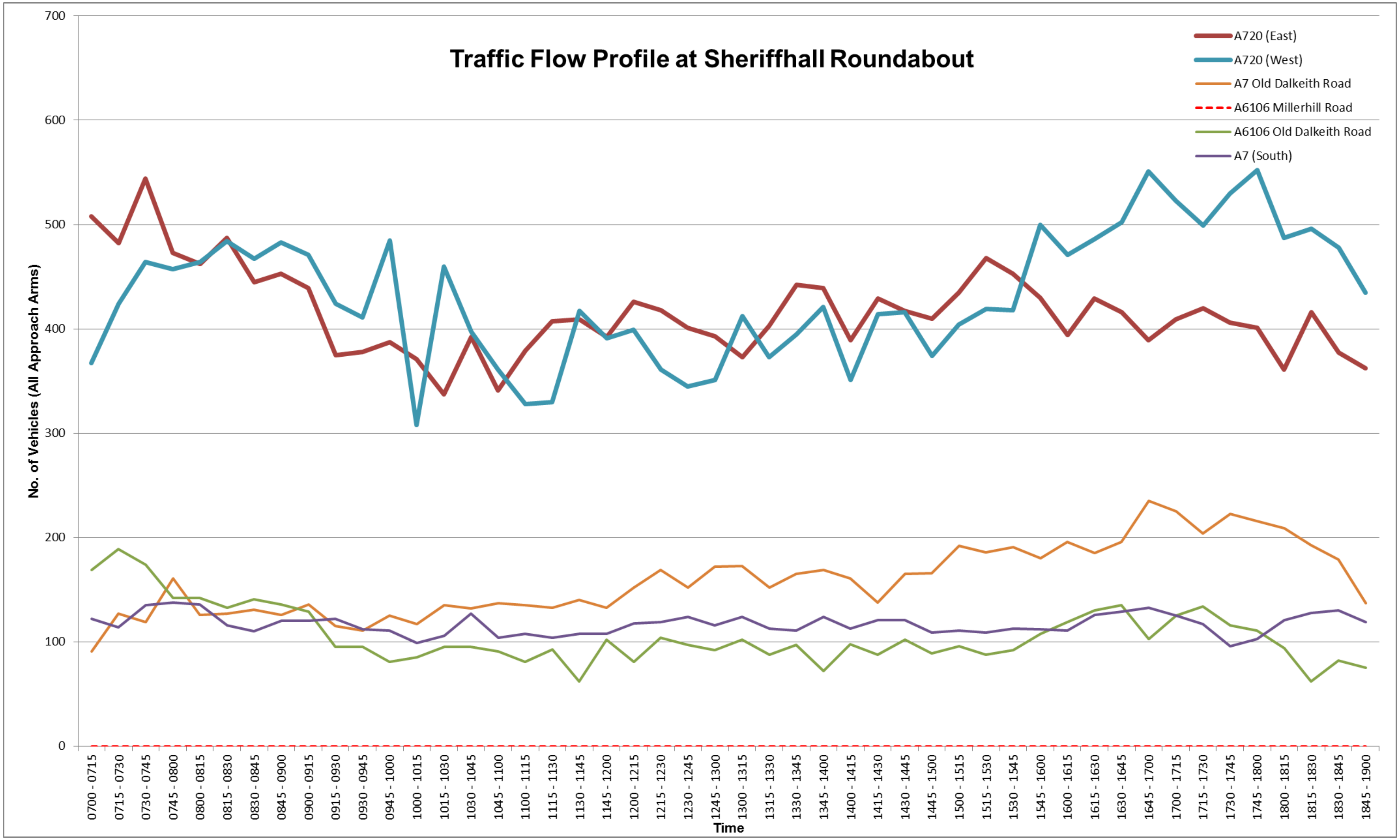
Notes:

x%	Side Road Flow
x%	Main Road Flow
Closed	A6106 Millerhill Road Closed
x%	Sheriffhall Junction Total (Sum of all Entries)

Day of 2013 Survey: Tuesday 8 October 2013 Day of 2014 Survey: Thursday 2 October 2014

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 2.8
Comparison of October 2013 and October 2014 Observed Weekday 12-Hour Traffic Flows



AECOM	Source:	Notes: Manual Classified Counts (Thursday 2 October 2014) A6106 Millerhill Road closed due to Roadworks	**A720 Sheriffhall Roundabout – DMRB Stage 2** **Traffic & Economic Assessment Report** Figure 2.9 Sheriffhall Roundabout Traffic Flow Profile

2.2 Queue Surveys

Methodology

Queue length surveys were undertaken at Sheriffhall Roundabout within the study area on Thursday 2 October 2014 to assist in establishing operating conditions on the approach roads to the roundabout. The queue length surveys were undertaken at the following locations:

- Q1 – A720 (East) in the westbound direction;
- Q2 – A6106 Old Dalkeith Road (South) in the northbound direction;
- Q3 – A7 (South) in the northbound direction;
- Q4 – A720 (West) in the eastbound direction; and
- Q5 – A7 Old Dalkeith Road (North) in the southbound direction.

The locations of the queue surveys are shown in **Figure 2.10**.

Queue Survey Results

The maximum queue lengths and corresponding times for each queue survey site are shown in **Table 2.2**.

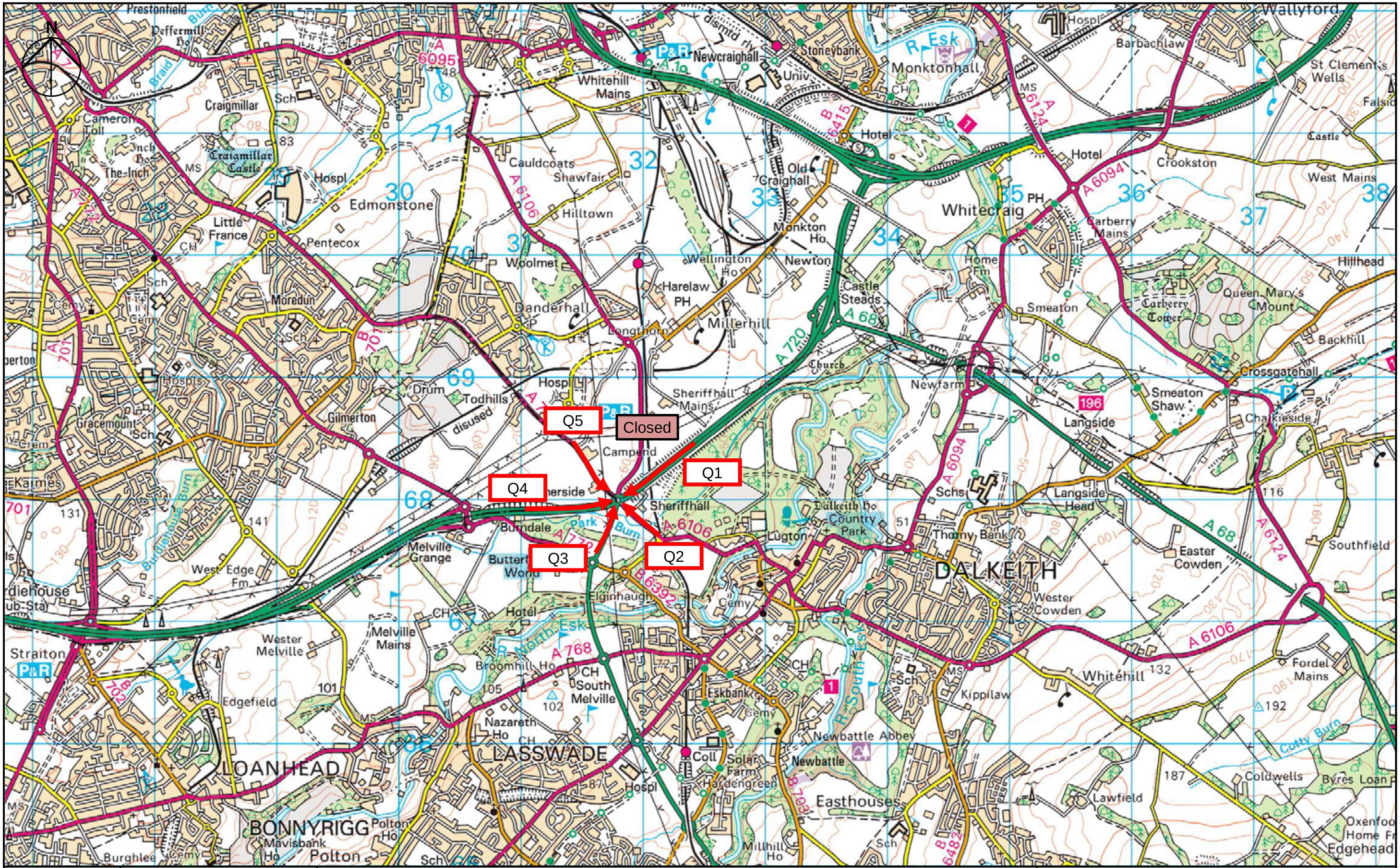
Table 2.2 – 12-Hour Maximum Queue Lengths (Total PCUs for All Lanes)

Queue Site	Approach Road	AM Peak Queue		PM Peak Queue	
		Time	Length (PCUs)	Time	Length (PCUs)
Q1	**A720 (East)**	07:15 + 07:20	72	15:25	51
Q2	**A6106 Old Dalkeith Road (South)**	07:50	50	16:35	16
Q3	**A7 (South)**	09:20	30	16:25	31
Q4	**A720 (West)**	09:45	32	17:30	195
Q5	**A7 Old Dalkeith Road (North)**	07:50	18	17:10	90

Examination of the survey results indicates that significant localised queuing, especially during the AM and PM Peak periods, occurs at the Sheriffhall signalised roundabout. In the AM Peak, the longest queuing was observed on the A720 (East) approach to Sheriffhall Roundabout with an observed queue length of 72 PCUs recorded at 07:15 and 07:20. In the opposite direction on the A720 (West), a maximum queue length of 32 PCUs in the AM Peak was observed at 09:45 hours.

In the PM Peak, the maximum queue length was observed on the A720 (West) approach to Sheriffhall Roundabout with a queue length of 195 PCUs recorded at 17:30 hours. In the opposite direction on the A720 (East), a maximum queue length of 51 PCUs was observed at 15:25 hours on the approach to Sheriffhall Roundabout.

Given the difficulty in recording accurate queue lengths it should be noted that although the queue lengths on the A7 are comparable to queue lengths on the A720, as a result of slow moving traffic which is not recorded as a queue, the delay to road users is likely to be more significant on the A720.



AECOM

Source:

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 2.10
Queue Survey Locations

2.3 Journey Time Surveys

Methodology

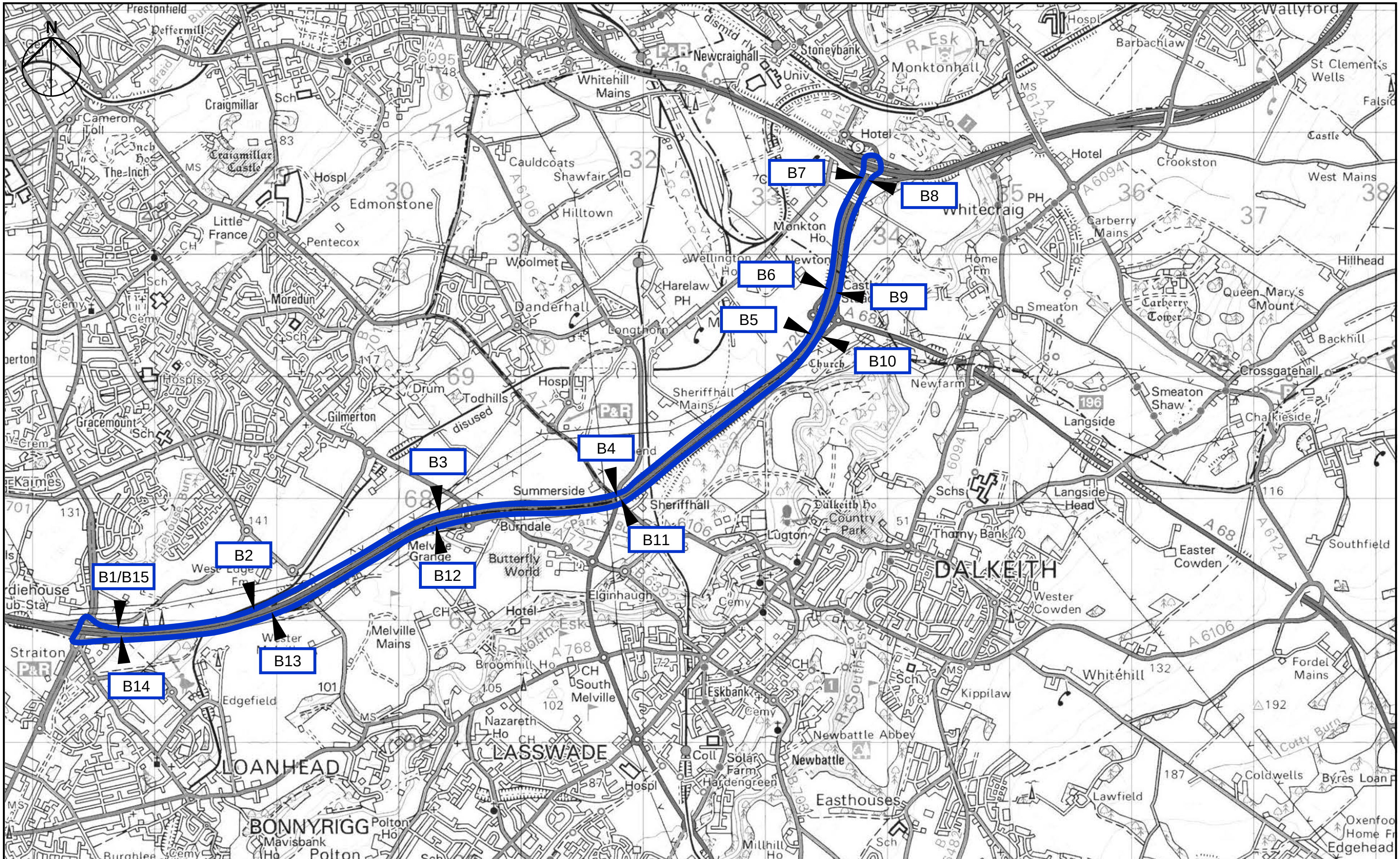
A survey of journey times was undertaken along the A720 to assist in defining current operating conditions within the area. Three routes were defined to include the A720 mainline (Blue Route) and the surrounding area (Red and Green Routes).

The limits of the journey time survey and the locations of the measurement points along the routes are shown in **Figures 2.11 to 2.13**.

The surveys were carried out on Thursday 2 October 2014 using three survey vehicles. Various runs were carried out for the Blue survey route in eastbound and westbound directions between 07:00 hours and 19:00 hours to record variations in journey times throughout the day. The survey periods were 07:00 – 10:00 hours (AM Peak Period), 11:00 – 15:00 hours (Inter-Peak Period) and 16:00 – 19:00 hours (PM Peak Period). The Red and Green survey routes were surveyed in both clockwise and anti-clockwise directions.

The survey was based on the standard moving observer technique to record journey times at each of the predefined measurement points along the route.

Weather conditions during the surveys were generally good. Delays were recorded at various times on each route during the days of survey. A national speed limit of 70mph applies on the A720.

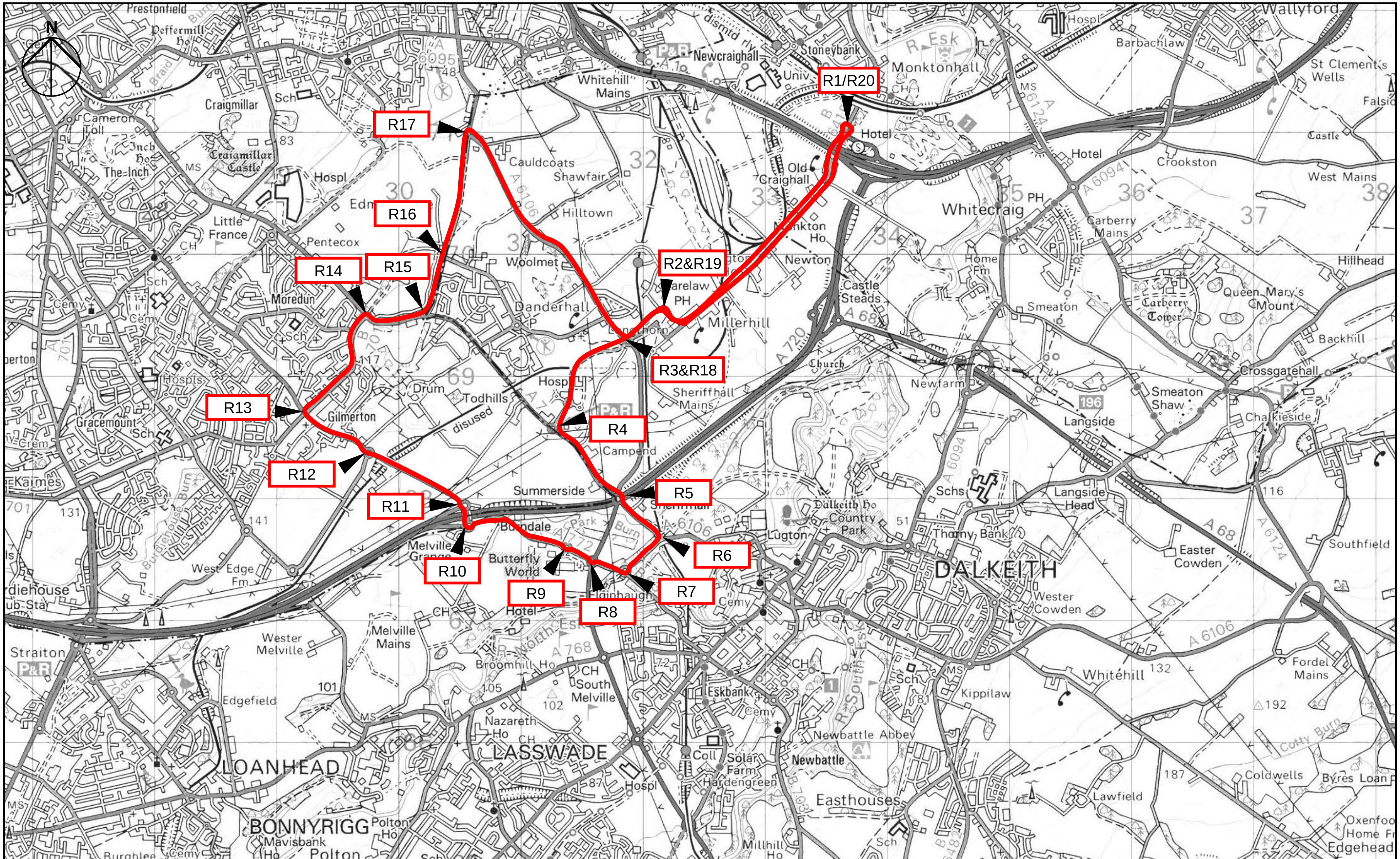


Notes:

JTS Measurement Point

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 2.11
Journey Time Surveys – Blue Route



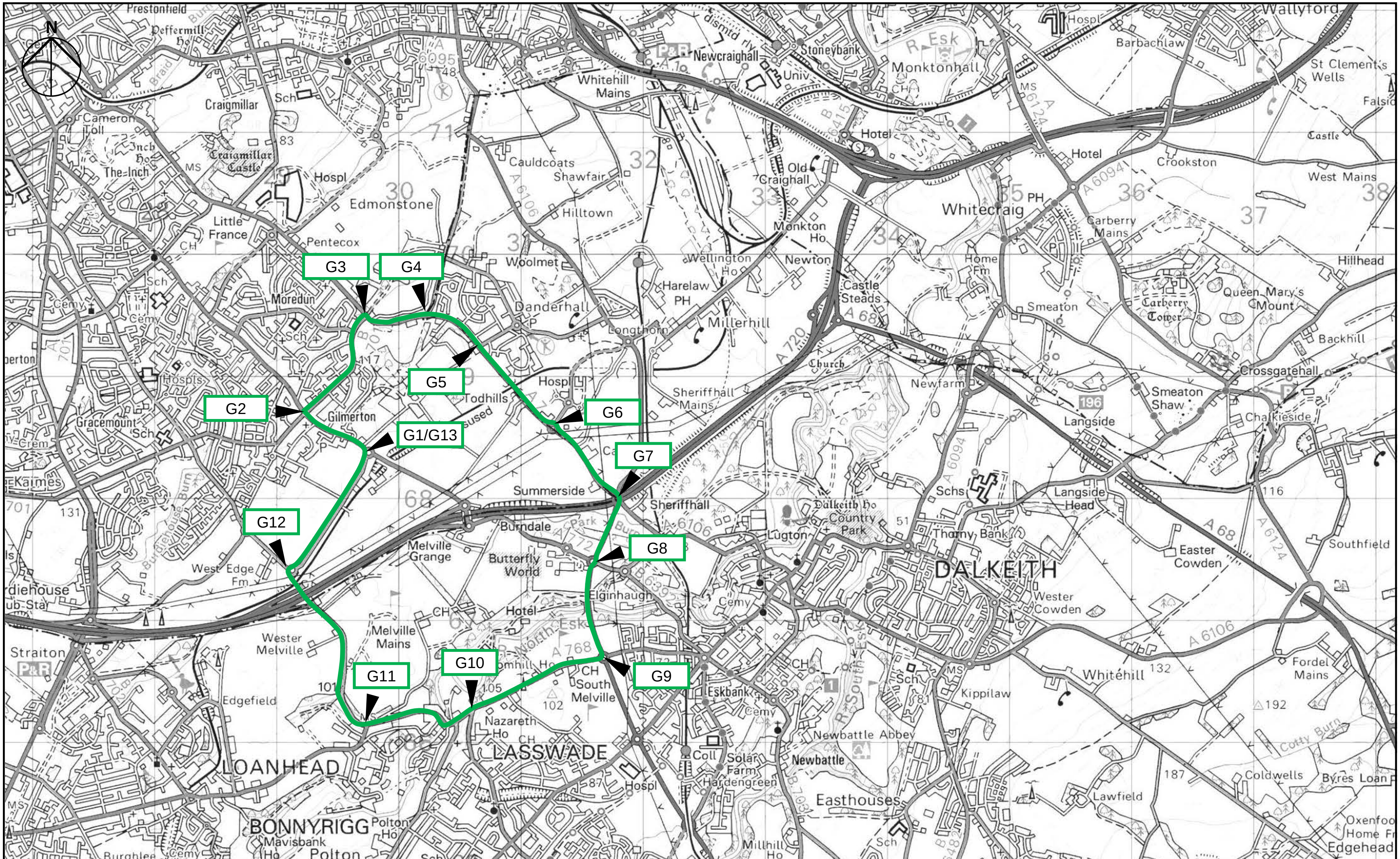
AECOM

Notes:

▲ JTS Measurement Point

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 2.12
Journey Time Surveys – Red Route



	Source: © Crown copyright and database right (2017). All rights reserved. Ordnance Survey License number 100046668.	Notes: ▲ JTS Measurement Point	**A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report** Figure 2.13 Journey Time Surveys – Green Route

Journey Time Survey Results – Blue Route

The results of the Blue Route Journey Time Surveys are shown in **Tables 2.3 and 2.4**.

Table 2.3 – Summary of Journey Time Survey Results: Blue Route – Eastbound

Measurement Point	JTS Survey Length (km)	Speed Limit (mph)	Avg. AM Peak Time	Avg. AM Peak Speed (mph)	Avg. Inter-Peak Time	Avg. Inter-Peak Speed (mph)	Avg. PM Peak Time	Avg. PM Peak Speed (mph)
B1 – B2	0.892	70	00:00:34	58.4	00:00:34	59.2	00:00:36	56.0
B2 – B3	1.562	70	00:00:54	65.1	00:00:55	64.0	00:00:57	61.4
B3 – B4	1.645	70	00:01:50	33.5	00:01:28	41.9	00:03:13	19.0
B4 – B5	1.967	70	00:01:19	55.9	00:01:19	55.4	00:01:19	55.9
B5 – B6	0.690	70	00:00:23	66.0	00:00:24	63.9	00:00:24	65.2
B6 – B7	0.846	70	00:00:42	45.2	00:00:37	51.5	00:00:41	46.1
Overall	**7.602**		**00:05:42**	**49.8**	**00:05:16**	**53.8**	**00:07:09**	**39.6**

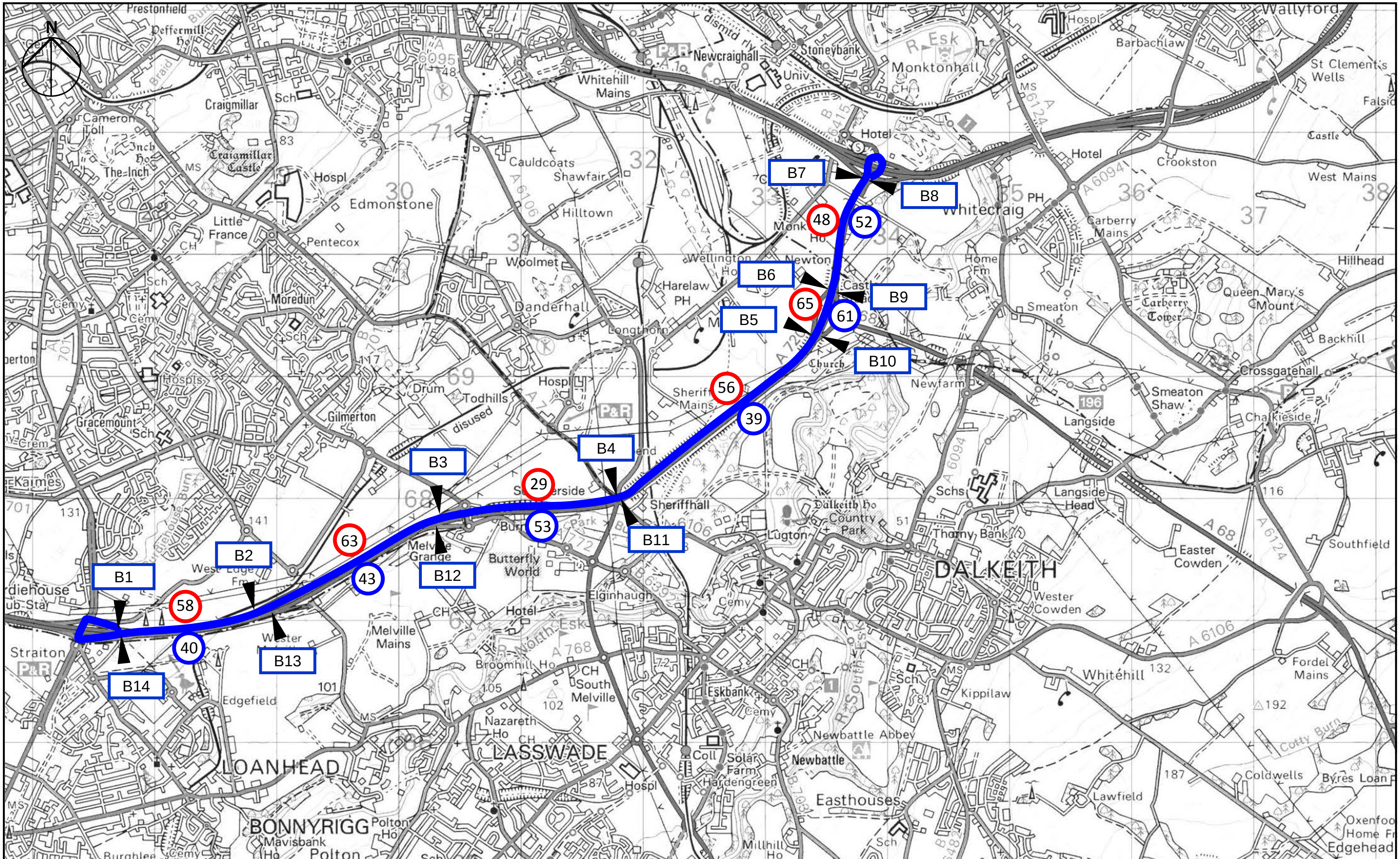
Table 2.4 – Summary of Journey Time Survey Results: Blue Route – Westbound

Measurement Point	JTS Survey Length (km)	Speed Limit (mph)	Avg. AM Peak Time	Avg. AM Peak Speed (mph)	Avg. Inter-Peak Time	Avg. Inter-Peak Speed (mph)	Avg. PM Peak Time	Avg. PM Peak Speed (mph)
B8 – B9	0.849	70	00:00:37	51.7	00:00:37	51.9	00:00:35	54.1
B9 – B10	0.741	70	00:00:27	61.9	00:00:28	60.0	00:00:27	62.0
B10 – B11	1.931	70	00:02:03	35.1	00:01:45	41.3	00:01:53	38.4
B11 – B12	1.645	70	00:01:09	53.1	00:01:10	52.6	00:01:09	53.0
B12 – B13	1.621	70	00:02:25	25.1	00:01:01	59.2	00:01:01	59.8
B13 – B14	1.026	70	00:01:40	23.0	00:00:42	55.2	00:00:43	53.9
Overall	**7.813**		**00:08:20**	**34.9**	**00:05:42**	**51.1**	**00:05:47**	**50.4**

Note: The difference in length between the Eastbound and Westbound routes is due to different entry and exit slip-roads onto the A720.

The average daily directional speeds observed during the Journey Time Surveys for the Blue Journey Time Survey route are also shown in **Figure 2.14**.

The eastbound and westbound journey time speeds observed for each run carried out are shown in **Figures 2.15 and 2.16** respectively. The eastbound and westbound variation in journey speeds is shown in **Figures 2.17 and 2.18** respectively.



Notes:

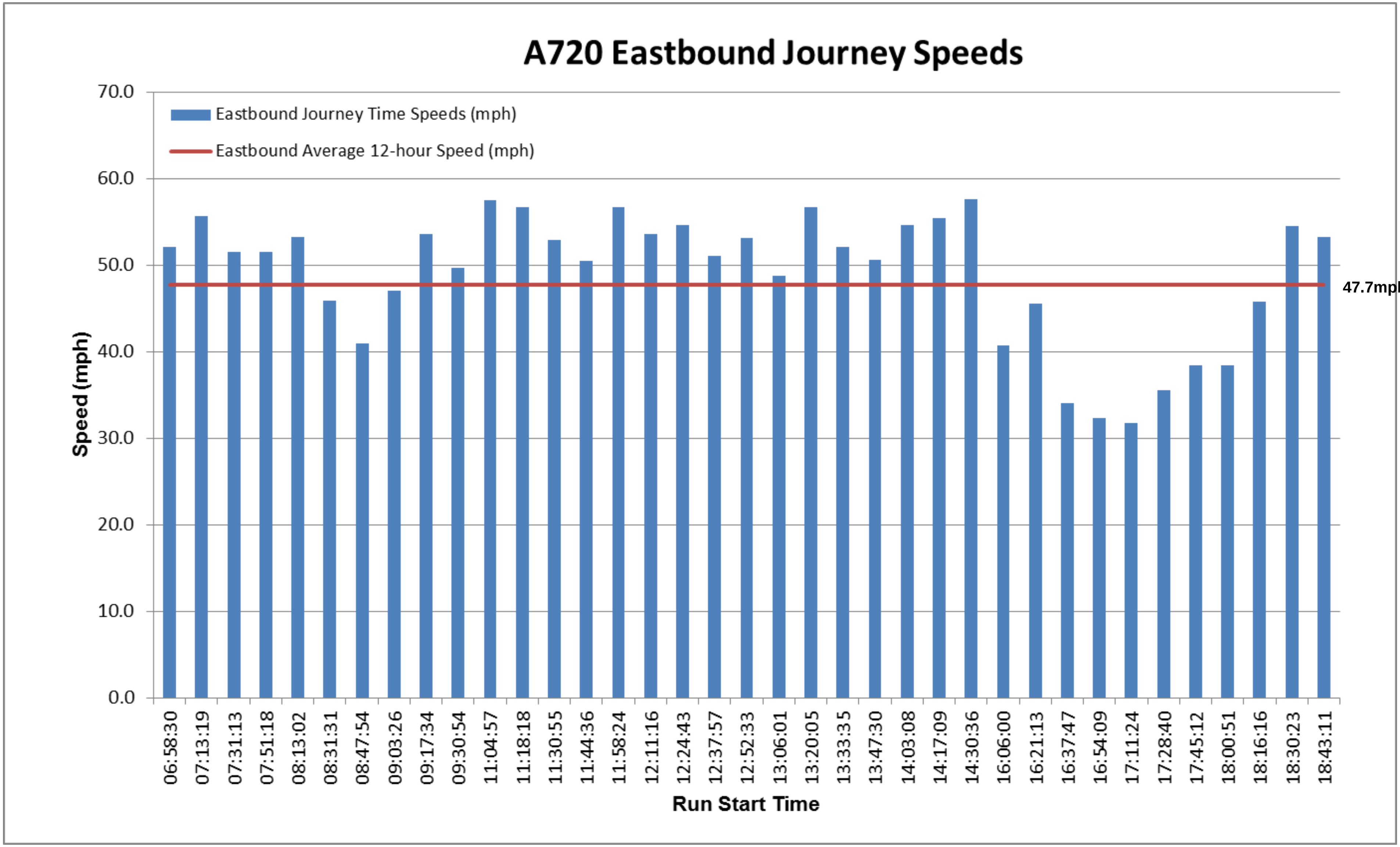
JTS Measurement Point

40 Eastbound Speed (mph)

40 Westbound Speed (mph)

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 2.14
Average Directional Speeds – Blue Route
(07:00 – 19:00 hours)



AECOM

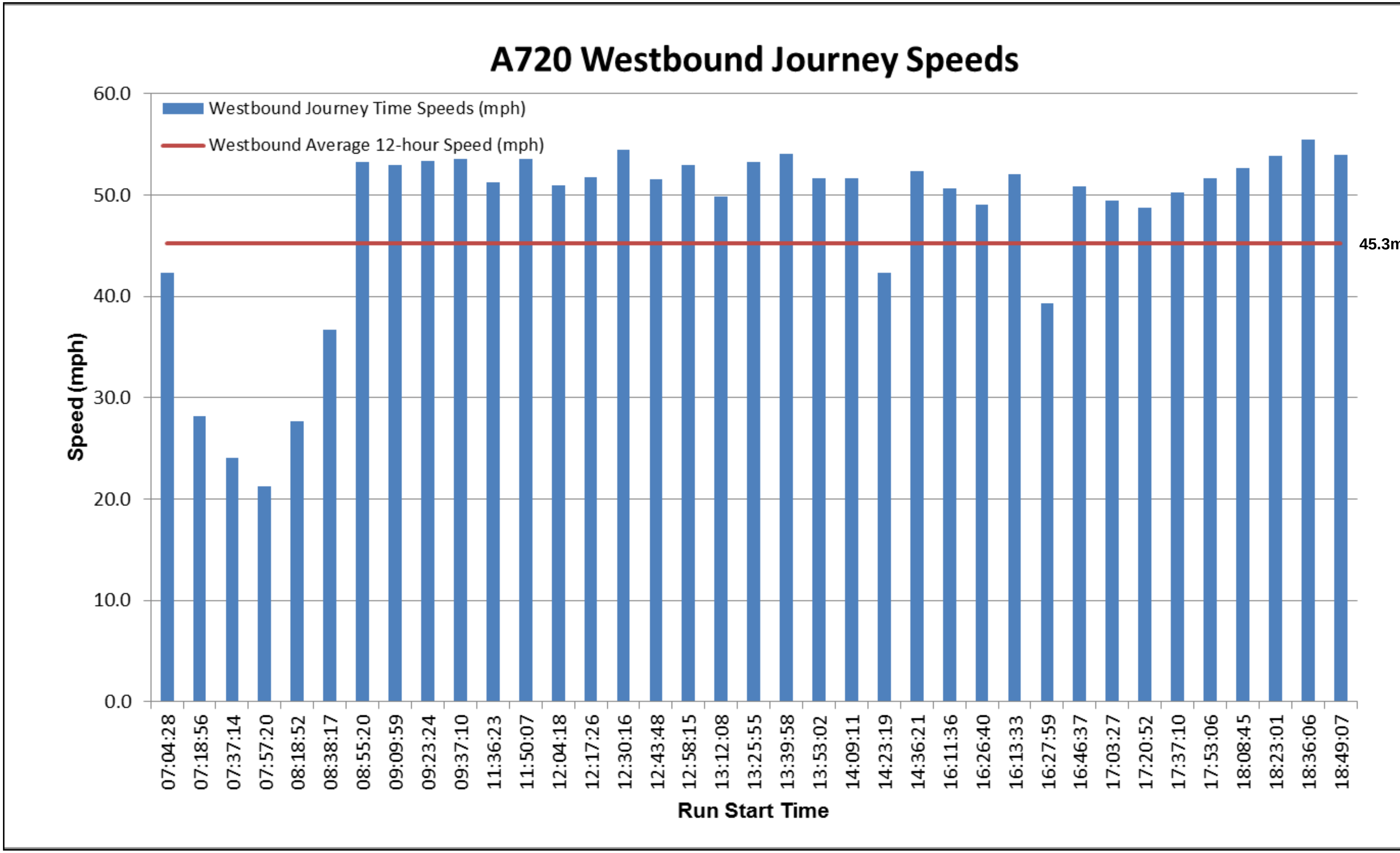
Source:

Notes:

Journey Speeds relates to travel between B1 and B7

A720 Sheriffhall Roundabout – DMRB Stage 2
Traffic & Economic Assessment Report

Figure 2.15
Eastbound Journey Time Speeds (mph)
07:00 – 19:00 hours



AECOM

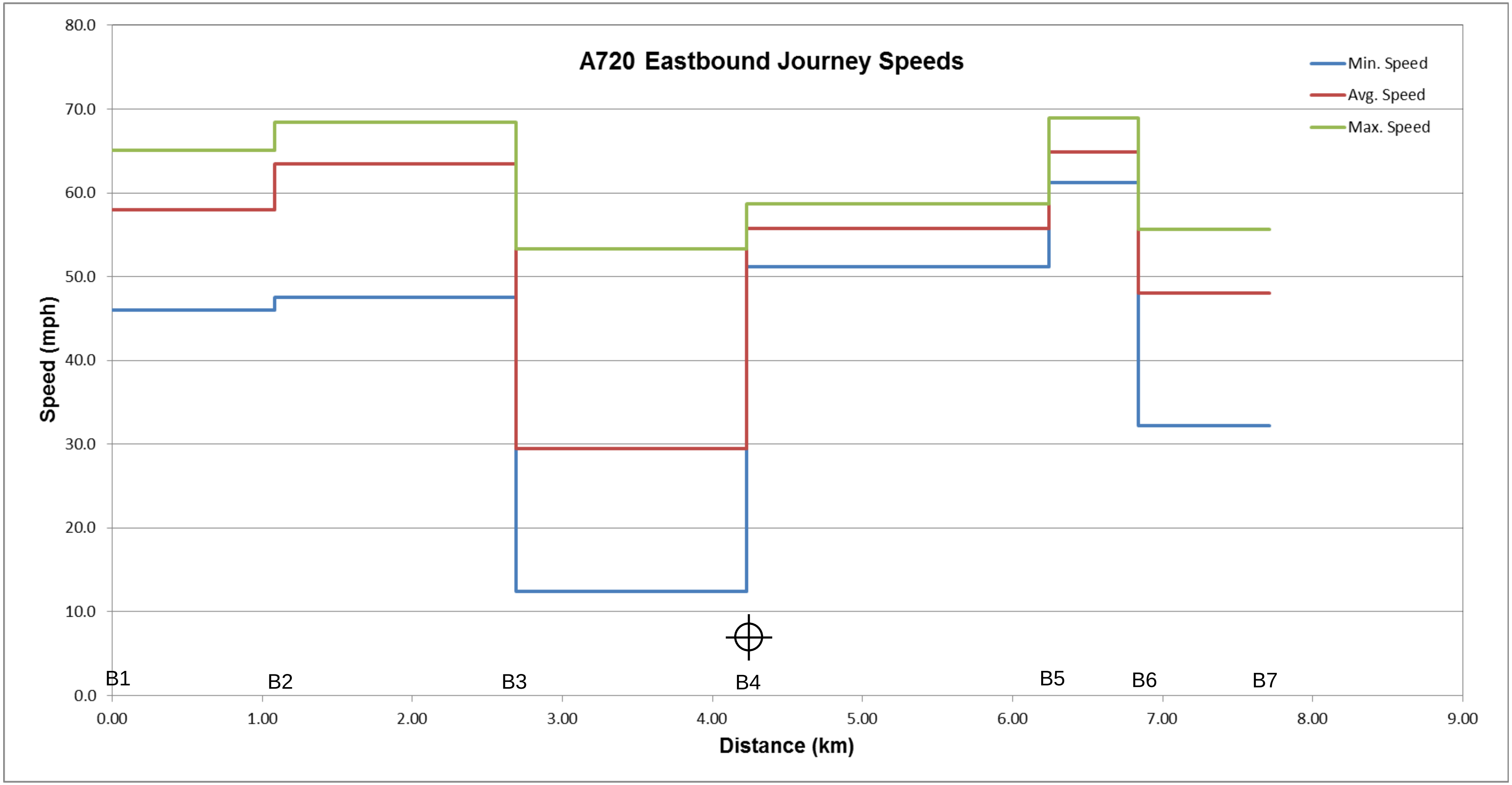
Source:

Notes:

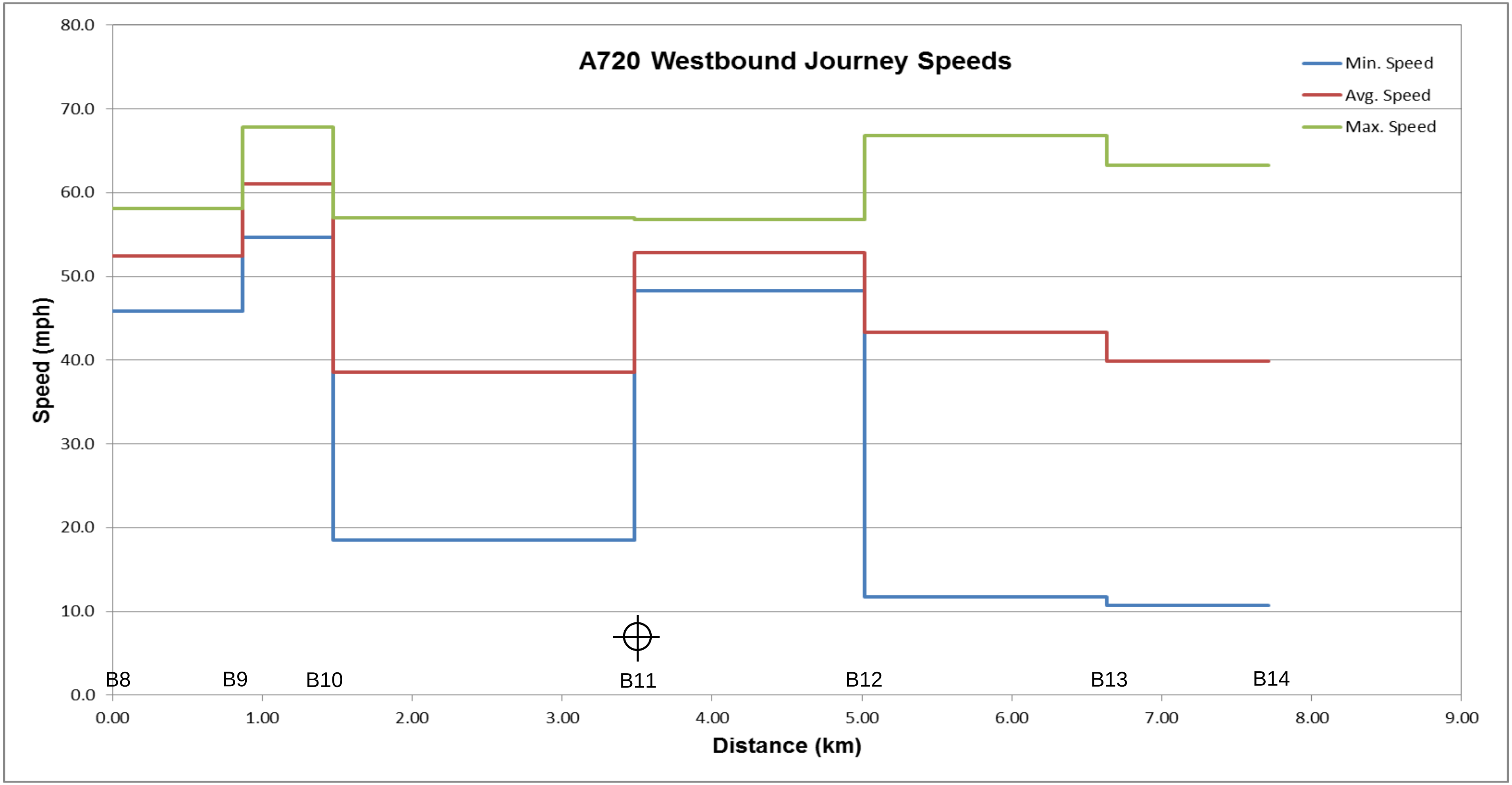
Journey Speeds relates to travel between B8 and B14

A720 Sheriffhall Roundabout – DMRB Stage 2
Traffic & Economic Assessment Report

Figure 2.16
Westbound Journey Time Speeds (mph)
07:00 – 19:00 hours



AECOM	Source:	Notes:	**A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report** Figure 2.17 Variations in Eastbound Journey Speeds (mph) 07:00 – 19:00 hours



AECOM	Source:	Notes:	**A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report** Figure 2.18 Variations in Westbound Journey Speeds (mph) 07:00 – 19:00 hours

In the eastbound direction, the average recorded speed during the PM period was 39.6mph which is significantly lower than the speed recorded during the AM and Inter-Peak periods. In contrast, in the westbound direction, the average recorded speed during the AM period was 34.9mph which is significantly lower than the speeds recorded during the PM and Inter-Peak periods.

Examination of the average daily directional speeds indicates that eastbound speeds between Straiton and Gilmerton are around 60mph but reduce to 29mph on the approach to Sheriffhall Roundabout and increase thereafter to around 60mph towards Millerhill.

Examination of the average daily directional speeds also indicates that westbound speeds are around 60mph at Millerhill, but reduce to 39mph on the approach to Sheriffhall Roundabout. Thereafter, although westbound speeds increase to 53mph, average daily speeds reduce again to 40mph on the approach to Straiton.

The variation between the minimum and maximum speeds recorded on the A720 provide a clear indication of the effects of delays and congestion on the approach to Sheriffhall Roundabout compared to the other sections of the A720. It should be noted that the slow westbound speeds recorded on the approach to Straiton are due to the survey vehicles leaving the A720 and are therefore not representative of average speeds on the A720 mainline at this location.

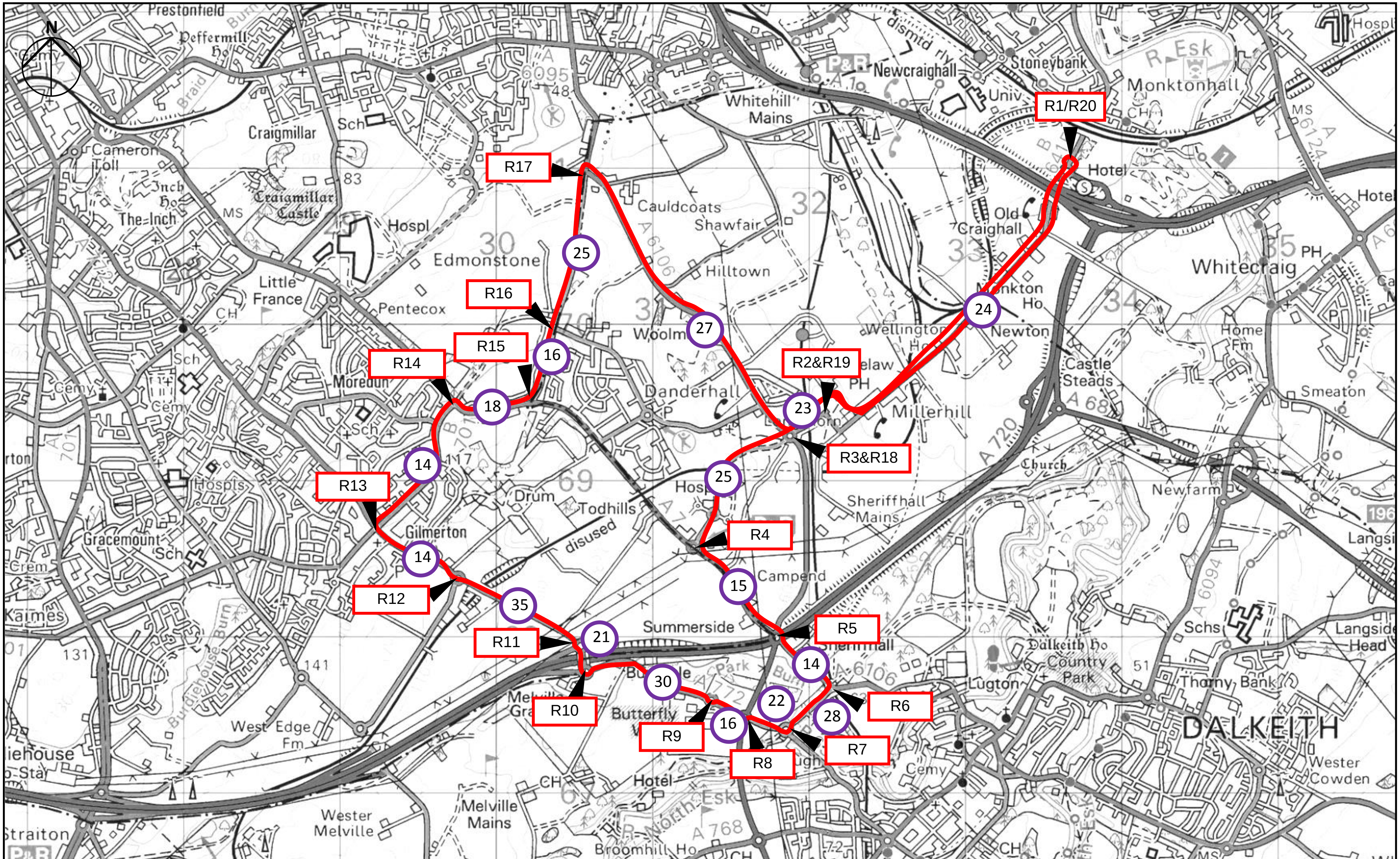
Journey Time Survey Results – Red Route

The results of the Red Route Journey Time Surveys are shown below in **Table 2.5**.

Table 2.5 – Summary of Journey Time Survey Results: Red Route

Measurement Point	JTS Survey Length (km)	Speed Limit (mph)	Avg. AM Peak Time	Avg. AM Peak Speed (mph)	Avg. Inter-Peak Time	Avg. Inter-Peak Speed (mph)	Avg. PM Peak Time	Avg. PM Peak Speed (mph)
R1 – R2	2.385	30/60	00:03:30	25.4	00:03:44	23.8	00:03:52	22.9
R2 – R3	0.261	30	00:00:25	23.5	00:00:27	21.9	00:00:25	23.4
R3 – R4	1.018	30	00:01:26	26.5	00:01:21	28.1	00:01:53	20.1
R4 – R5	0.800	50	00:01:18	22.9	00:01:34	19.1	00:03:44	8.0
R5 – R6	0.559	40	00:02:03	10.1	00:01:23	15.0	00:01:00	20.7
R6 – R7	0.399	30	00:00:34	26.4	00:00:31	29.2	00:00:30	29.6
R7 – R8	0.272	60	00:00:30	20.0	00:00:25	24.4	00:00:28	21.8
R8 – R9	0.244	60	00:00:32	17.3	00:00:37	14.7	00:00:34	16.2
R9 – R10	0.906	60	00:01:07	30.0	00:01:10	29.1	00:01:06	30.6
R10 – R11	0.233	60	00:00:24	21.7	00:00:24	21.6	00:00:25	20.9
R11 – R12	0.843	60	00:00:58	32.3	00:00:53	35.5	00:00:50	37.4
R12 – R13	0.636	30	00:01:26	16.6	00:01:25	16.7	00:02:22	10.0
R13 – R14	1.022	30	00:02:20	16.3	00:02:22	16.1	00:03:50	10.0
R14 – R15	0.501	40	00:00:55	20.3	00:00:54	20.8	00:01:30	12.5
R15 – R16	0.511	30	00:01:00	19.1	00:00:59	19.5	00:01:55	9.9
R16 – R17	1.022	30	00:01:15	30.7	00:01:46	21.5	00:01:33	24.6
R17 – R18	2.170	30	00:02:23	34.0	00:03:06	26.1	00:03:31	23.0
R18 – R19	0.287	30	00:00:26	24.2	00:00:29	21.9	00:00:28	22.4
R19 – R20	2.392	30/60	00:03:39	24.5	00:03:19	26.9	00:03:56	22.7
Overall	**16.460**		**00:26:11**	**23.4**	**00:26:49**	**22.9**	**00:33:54**	**18.1**

The average daily combined two-way speeds observed for the Red Journey Time Survey route are shown in **Figure 2.19**.



AECOM

Source:
© Crown copyright and database right (2017). All rights reserved. Ordnance Survey License number 100046668.

Notes:

▲ JTS Measurement Point

(40) Average Speed (mph) - Clockwise and Anti-Clockwise combined

A720 Sheriffhall Roundabout – DMRB Stage 2
Traffic & Economic Assessment Report

Figure 2.19
Average Two-Way Speeds – Red Route
(07:00 – 19:00 hours)

Journey Time Survey Results – Green Route

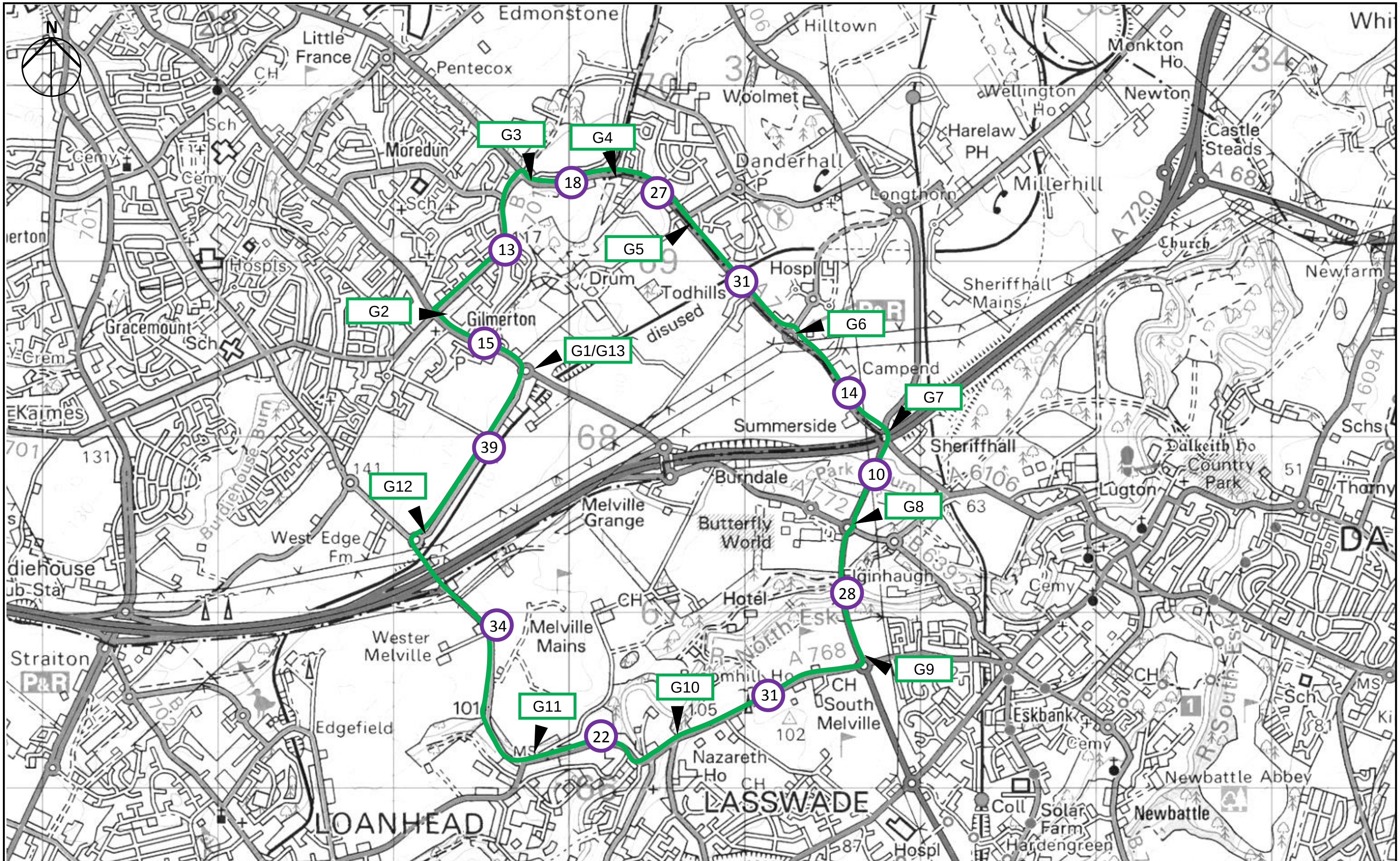
The results of the Green Route Journey Time Surveys are shown below in **Table 2.6**.

Table 2.6 – Summary of Journey Time Survey Results: Green Route

Measurement Point	JTS Survey Length (km)	Speed Limit (mph)	Avg. AM Peak Time	Avg. AM Peak Speed (mph)	Avg. Inter-Peak Time	Avg. Inter-Peak Speed (mph)	Avg. PM Peak Time	Avg. PM Peak Speed (mph)
G1 – G2	0.604	30	00:01:23	16.3	00:01:22	16.6	00:01:47	12.6
G2 – G3	1.017	30	00:02:24	15.8	00:02:28	15.4	00:04:37	8.2
G3 – G4	0.499	40	00:00:53	20.9	00:00:53	21.2	00:01:23	13.5
G4 – G5	0.521	40	00:00:40	29.1	00:00:41	28.1	00:00:48	24.3
G5 – G6	0.898	50	00:01:04	31.2	00:00:59	34.2	00:01:18	25.7
G6 – G7	0.785	50	00:01:17	22.8	00:01:49	16.1	00:03:30	8.4
G7 – G8	0.605	60	00:02:23	9.4	00:02:14	10.1	00:02:07	10.7
G8 – G9	0.836	60	00:01:30	20.8	00:00:57	32.9	00:00:55	34.1
G9 – G10	1.208	60	00:01:31	29.6	00:01:27	31.0	00:01:23	32.6
G10 – G11	0.976	30/40	00:01:47	20.4	00:01:28	24.8	00:01:41	21.5
G11 – G12	1.484	40/60	00:01:36	34.5	00:01:39	33.5	00:01:40	33.1
G12 – G13	1.192	60	00:01:08	39.2	00:01:05	41.2	00:01:12	37.1
Overall	**10.624**		**00:17:37**	**22.5**	**00:17:01**	**23.3**	**00:22:22**	**17.7**

The average daily combined two-way speeds observed for the Green Journey Time Survey route are shown in **Figure 2.20**.

As expected, the average speeds recorded along the Red and Green Routes on the non-trunk road network are lower than the speeds on the A720. In addition, the average speeds on the approaches to Sheriffhall Roundabout are significantly lower than the surrounding road network due to the delays and congestion at the roundabout.



AECOM	Source: © Crown copyright and database right (2017). All rights reserved. Ordnance Survey License number 100046668.	Notes: ▲ JTS Measurement Point (40) Average Speed (mph) - Clockwise and Anti-Clockwise combined	**A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report** Figure 2.20 Average Two-Way Speeds – Green Route (07:00 – 19:00 hours)

2.4 Accident Data

An analysis of recent trends in road traffic accidents was undertaken as part of this study to identify road sections and specific locations which have locally higher than average personal injury accident rates and/or severity ratios. To assist in assessing conditions in the A720 study area, information on all road traffic accidents on the A1, A68, A7 and A720 involving personal injury accidents for the ten-year period between 2004 and 2013 were obtained from Transport Scotland. Data for 2014 was also available from January 2014 to October 2014.

A720 Long-Term Accident Trends

Analysis of road traffic accidents on the A720 study area (between approximately 1 kilometre to the west of Gilmerton Junction to Old Craighall Junction on the A1 and in addition a 3-kilometre section of the A68 Dalkeith Bypass) indicates that the total number of personal injury accidents between 2004 and 2013 has fluctuated between 10 accidents in 2005 and 25 accidents in 2012 and 2013 with an annual average of 20 accidents. This information is shown below in **Table 2.7**.

Table 2.7 –Number of Accidents per Year by Severity

Year	Fatal	Serious	Slight	Total
2004	1	0	19	20
2005	0	2	8	10
2006	0	1	23	24
2007	0	2	15	17
2008	0	0	15	15
2009	0	3	17	20
2010	0	3	18	21
2011	1	1	20	22
2012	1	1	23	25
2013	0	1	24	25
2014*	0	0	17	17
Total	**3**	**14**	**199**	**216**
Percentage	**1.4%**	**6.5%**	**92.1%**	**100%**

Analysis of road traffic accidents between 2004 and 2014 (partial) within the entire study area indicates that there have been a total of 216 personal injury accidents with 1.4% recorded as fatal, 6.5% as serious and just over 92% recorded as slight.

The study area can be further sub-divided into 5 major sections. These are the A1 at Old Craighall, the A68 Old Dalkeith Bypass, Sheriffhall Roundabout on the A720 (including a 500m buffer on the A720 approach roads either side), the A720 west of Sheriffhall extending to approximately 800m west of Gilmerton junction and the A720 east of Sheriffhall up to the A1 at Old Craighall Junction.

A breakdown of accidents by route and by each 5 year period is shown in **Tables 2.8a and 2.8b**.

Table 2.8a –Number of Accidents by Section by Severity (2004-2008)

Section	Fatal	Serious	Slight	Total
A720 – West	1	0	10	11
A720 – Sheriffhall Roundabout	0	2	37	39
A720 – East	0	1	8	9
A720 Total	**1**	**3**	**55**	**59**
A68*	-	-	-	-
A1 – Old Craighall Jcn	0	2	25	27
Overall Total	**1**	**5**	**80**	**86**
Percentage	**1.2%**	**5.8%**	**93.0%**	**100%**

Note: The A68 Dalkeith Northern Bypass was opened in September 2008 so no data is included in the 2004-2008 analysis.

Table 2.8b –Number of Accidents by Section by Severity (2009-2013)

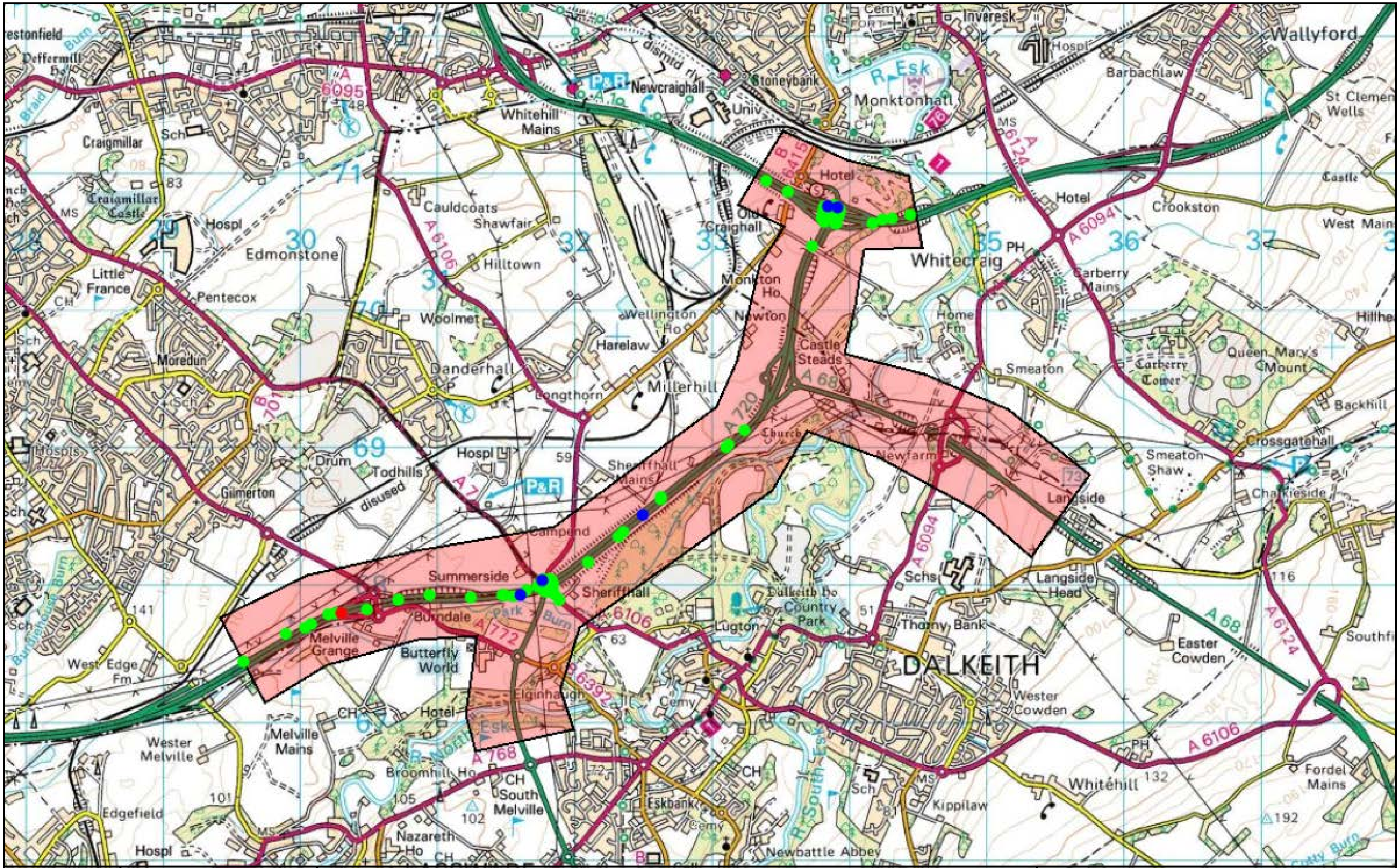
Section	Fatal	Serious	Slight	Total
A720 – West	1	1	7	9
A720 – Sheriffhall Roundabout	0	0	46	46
A720 – East	1	0	16	17
A720 Total	**2**	**1**	**69**	**72**
A68*	0	3	2	5
A1 – Old Craighall Jcn	0	5	31	36
Overall Total	**2**	**9**	**102**	**113**
Percentage	**1.8%**	**8.0%**	**90.3%**	**100%**

Accident Locations

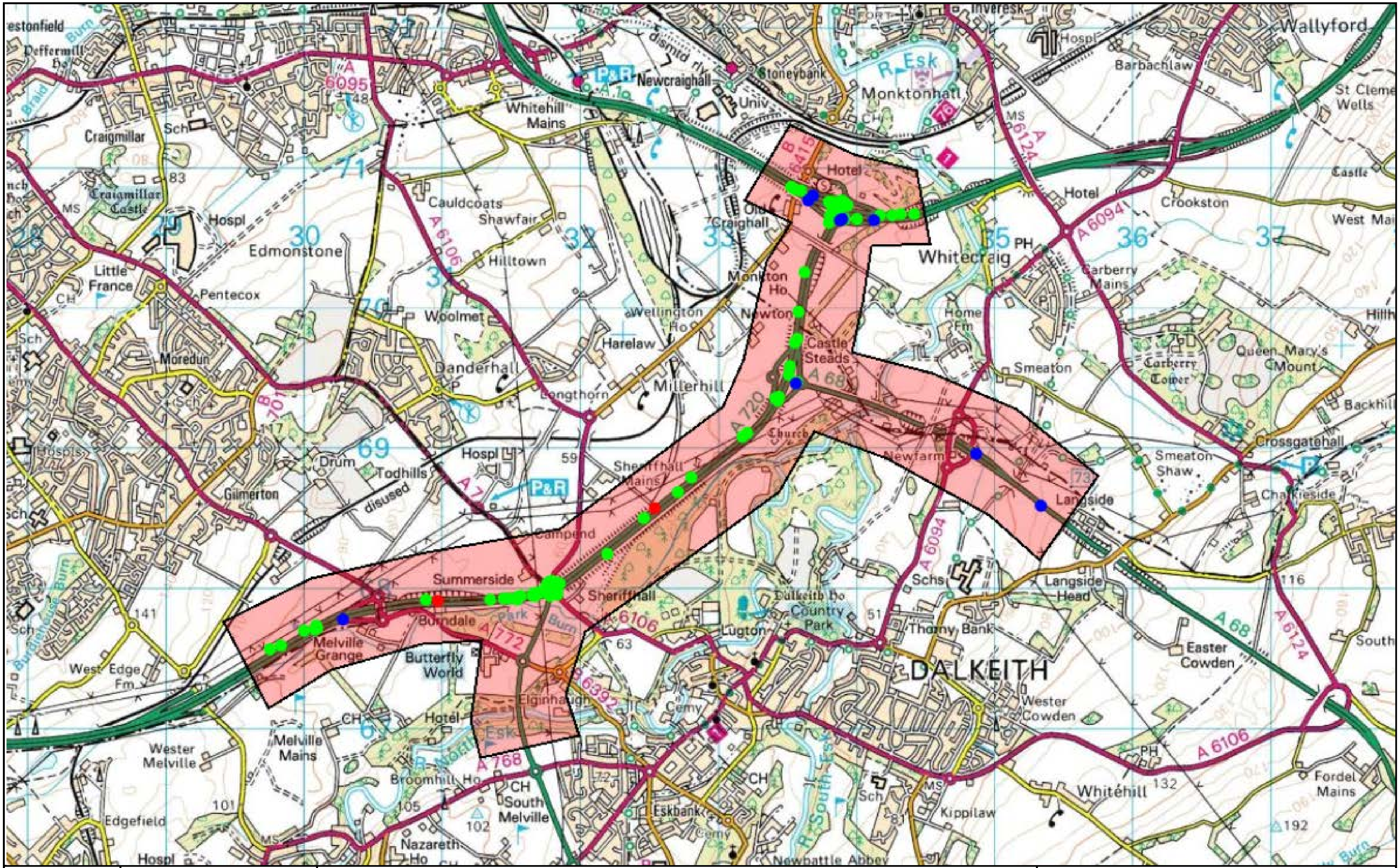
Although the analysis of variations in the number of accidents provides an indication of general trends, it is important to consider accident locations to identify road sections which experience higher than average numbers of accidents and/or severity. The locations of all personal injury accidents recorded during the 5-year period between 2004 and 2008 are shown in **Figure 2.21** and personal injury accidents recorded during the following 5-year period from 2009 to 2013 are shown in **Figure 2.22**.

From the analysis, it can be seen that there have been 3 fatal accidents recorded on this section of the A720 between 2004 and 2013. The first fatal accident was recorded on 28 April 2004, in the eastbound carriageway on the merge of or just before the entry slip-road at Gilmerton. The second fatal accident was recorded on 19 June 2011, located approximately 1 kilometre to the west of Sheriffhall Roundabout in the eastbound carriageway. The third fatal accident was recorded on 29 June 2012, located approximately 1 kilometre to the east of Sheriffhall Roundabout in the eastbound carriageway. On average, there have been approximately 0.3 fatal accidents per year, less than 1.5 serious accidents per year and approximately 18 slight accidents per year.

At Sheriffhall Roundabout there have been a total of 83 slight personal injury accidents and 2 serious personal injury accident recorded between 2004 and 2013, an average of 8.5 personal injury accidents per year. The 85 accidents recorded at Sheriffhall Roundabout represent 43% of all accidents recorded in the study area over the ten-year period.



AECOM	Source: © Crown copyright and database right (2017). All rights reserved. Ordnance Survey License number 100046668.	Notes: Slight Personal Injury Accident Serious Personal Injury Accident Fatal Personal Injury Accident	**A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report** Figure 2.21 Accident Locations (2004 – 2008)



	Source:	Notes:	A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report
AECOM		Slight Personal Injury Accident Serious Personal Injury Accident Fatal Personal Injury Accident	Figure 2.22 Accident Locations (2009 – 2013)

2.5 Summary of Existing Conditions

A programme of data collection surveys was undertaken in October 2014 within the study area to assist in establishing current traffic conditions. The surveys included manual classified counts (MCCs), queue surveys and the measurement of typical journey times. The 12-hour 2-way traffic flows on the A720 were found to be 39,500 west of Sheriffhall Roundabout and 41,660 east of Sheriffhall Roundabout. The 12-hour 2-way traffic flows on the roads surrounding Sheriffhall were found to be 6,690 on the A772 Gilmerton Road North; 14,260 on the A772 Gilmerton Road South; 16,140 on the A7 Old Dalkeith Road (North); 11,300 on the A7 South and 9,490 on the A6106 Old Dalkeith Road. It should be noted that the A6106 Millerhill Road was closed during the period of survey.

The results of the October 2014 surveys indicate that 59,040 vehicles passed through the at-grade Sheriffhall Roundabout during the 12-hour survey period. In comparison, 57,670 vehicles were recorded passing through the junction in October 2013.

Sheriffhall signalised roundabout can lead to significant localised queuing, especially during the AM and PM Peak periods. In the AM Peak, the heaviest queuing was observed on the A720 (East) approach to Sheriffhall Roundabout with an observed queue length of 72 PCUs. In the opposite direction on the A720 (West), a maximum queue length of 32 PCUs was observed in the AM Peak. In the PM Peak, the maximum queue length was observed on the A720 (West) approach to Sheriffhall Roundabout with a queue length of 195 PCUs. In the opposite direction on the A720 (East), a maximum queue length of 51 PCUs was observed on the approach to Sheriffhall Roundabout.

In the eastbound direction on the A720, the average recorded speed during the PM period was 40mph which is significantly lower than the speed recorded during the AM and Inter-Peak periods. In contrast, in the westbound direction on the A720, the average recorded speed during the AM period was 35mph which is significantly lower than the speeds recorded during the PM and Inter-Peak periods. Examination of the average daily directional speeds indicates that eastbound speeds between Straiton and Gilmerton are around 60mph but reduce to 29mph on the approach to Sheriffhall Roundabout and increase thereafter to around 60mph towards Millerhill. Examination of the average daily directional speeds also indicates that westbound speeds are around 60mph at Millerhill, but reduce to 39mph on the approach to Sheriffhall Roundabout and thereafter increase to 53mph. The variation between the minimum and maximum speeds recorded on the A720 provides a clear indication of the effects of delays and congestion on the approach to Sheriffhall Roundabout compared to the other sections of the A720.

To assist in assessing conditions in the A720 study area, information on all road traffic accidents on the A1, A68, A7 and A720 involving personal injury accidents for the ten-year period between 2004 and 2013 were obtained from Transport Scotland. Data for 2014 was also available from January 2014 to October 2014. An analysis of recent trends in road traffic collisions was undertaken as part of this assessment to identify road sections and specific locations which have higher than average road traffic collisions involving personal injury. Analysis of road traffic accidents on the A720 study area (between approximately 1 kilometre to the west of Gilmerton Junction to Old Craighall Junction on the A1 and in addition a 3-kilometre section of the A68 Dalkeith Bypass) indicates that the total number of personal injury accidents between 2004 and 2013 has fluctuated between 10 accidents in 2005 and 25 accidents in 2012 and 2013 with an annual average of 20 accidents.

3 DESCRIPTION OF IMPROVEMENT OPTIONS

3.1 Introduction

Three proposed Improvement Options have been identified for assessment and comparison.

Descriptions of these proposed Improvement Options are shown below.

3.2 Improvement Option A

Option A is a grade separated dumbbell arrangement at Sheriffhall with the A720 elevated and passing over the A7 carried by a new overbridge with a span of approximately 35m. The 80m diameter dumbbell roundabouts and local roads would remain approximately at-grade. The north roundabout is a 5-arm roundabout which connects the A720 eastbound diverge slip, the A7 North, the A6106 Millerhill Road, the A720 eastbound merge slip and the A7 Link. The south roundabout is a 5-arm roundabout which connects the A720 westbound merge slip, the A7 Link, the A720 westbound diverge slip, the A6106 Old Dalkeith Road, and the A7 South.

The A720 mainline would be raised up on embankments up to 9.5m high on approach to the A7 crossing. Vertical and horizontal realignment of the A720 would be required over an approximate length of 1600m.

The A720 eastbound merge slip and A720 westbound diverge slip cross the Borders Railway and would therefore require the existing railway underbridge structure to be extended by approximately 19m. The A720 would also be raised in level at this point, compared to the existing layout. The existing railway underbridge has been designed such that it can accommodate an additional 5m depth of fill material. Therefore the A720 mainline level increase at this location is understood to be achievable without strengthening work to the existing structure.

NMU facilities would be incorporated in the form of a shared footway/cycleway which utilises the existing carriageway as far as possible. NMU routes would generally be offline from live carriageway. NMU routes would be provided on the existing A7 North, A7 South, A6106 Old Dalkeith Road and A6106 Millerhill Road. Where NMU routes run adjacent to the carriageway, shared facilities would be provided within the road verge and offset a minimum of 1.5m from the carriageway. At-grade crossings of A7 Link Road, A720 eastbound diverge slip, A720 eastbound merge slip, A720 westbound diverge slip and A720 westbound merge slip would be provided.

3.3 Improvement Option B

Option B provides a grade separated roundabout at Sheriffhall, and has the least land-take of all emerging options. Vertical and horizontal realignment of the A720 would be required over an approximate length of 1600m and the A720 would be carried across the Sheriffhall Roundabout by two new bridges each with a span of approximately 40m. The A720 mainline would be raised up on embankments up to 9.9m high on approach to the Sheriffhall Roundabout crossings. The Sheriffhall Roundabout layout would be retained, but would be enlarged and become an 8-arm roundabout, connecting the A7 North, the A6106 Millerhill Road, the A6106 Old Dalkeith Road, A7 South and all A720 east and west facing slips.

The A720 eastbound merge slip and A720 westbound diverge slip cross the Borders Railway and would therefore require the existing railway underbridge structure to be extended by approximately 47m. The roundabout at Sheriffhall would be enlarged to 150m dimeter but is retained at its existing location, and would be reduced to three lanes in width. Minimal realignment of the roundabout arms would be required, with the exception of the A6106 Millerhill Road to the north which would be realigned over an approximate length of 550m.

NMU facilities would be incorporated in the form of a shared footway/cycleway and generally provided in the road verge and offset a minimum of 1.5m from the carriageway. NMU routes would be provided within the verge of A7 North, A7 South and A6106 Old Dalkeith Road. An NMU route, offline from the carriageway, would be provided on the existing A6106 Millerhill Road. At-grade crossings would be located on all roundabout arms and make use of splitter islands where available.

3.4 Improvement Option C

Option C provides a dumbbell grade separated junction west of Sheriffhall, with the A7 carried over the A720. The A7 would be realigned and carried over the A720 by a new overbridge located approximately 250m west of the existing Sheriffhall Roundabout and with an approximate span of 40m. The 80m diameter dumbbell roundabouts, located north and south of the A720, would be raised on embankments up to 9.8m in height.

The dumbbell roundabout to the north of the A720 would be a 4-arm roundabout, connecting the A720 eastbound diverge slip, the A7 North, the A720 eastbound merge slip and the A7 Link. The A7 North would be realigned for an approximate length of 585m tying in to the existing Shawfair Park roundabout. The A7 North would have embankments up to 5m in height on its approach to the north dumbbell roundabout.

The roundabout to the south of the A720 would be a 5-arm roundabout, connecting the A720 westbound merge slip, the A7 Link, the A720 westbound diverge slip, the realigned A6106 Old Dalkeith Road, and the realigned A7 South. The A7 South would be realigned over an approximate length of 250m tying into the existing Gilmerton Road roundabout. The realigned A6106 Old Dalkeith Road would be realigned for approximately 530m, and would have embankments up to 9.7m in height.

The A6106 Millerhill Road would be realigned for a length of approximately 760m. A 3-arm roundabout would be provided at the junction of the A6106 Millerhill Road and the realigned A7 North. The A6106 Millerhill Road would be largely at-grade with minimal embankments.

The A720 would be at-grade through Sheriffhall. The east facing slips would tie into the existing A720 mainline to the west of Borders Railway therefore no works would be required at the Borders Railway underbridge.

NMU facilities would be incorporated in the form of a shared footway/cycleway which utilises the abandoned sections of carriageway as far as possible. NMU routes would generally be offline from the live carriageway. NMU routes would be provided on the existing A7 North, A7 South, A6106 Millerhill Road and A6106 Old Dalkeith Road. Where NMU routes run adjacent to the carriageway, shared facilities would be provided within the road verge and offset a minimum of 1.5m from the carriageway. Grade separated crossing facilities would be provided with a dedicated NMU overbridge over the A720 and an NMU underpass below the new A6106 Old Dalkeith Road. An at-grade crossing on the A6106 Millerhill Road would be provided close to the new A7 North roundabout.

The general layouts of Improvement Options A, B and C are shown in **Figures 3.1 to 3.3**.

AECOM

Source:

Notes:

A720 Sheriffhall Roundabout
DMRB Stage 2 Scheme Assessment Report

Figure 3.1
Improvement Option A

AECOM

Source:

Notes:

A720 Sheriffhall Roundabout
DMRB Stage 2 Scheme Assessment Report

Figure 3.2
Improvement Option B

AECOM	Source: © Crown copyright and database right (2017). All rights reserved. Ordnance Survey License number 100046668.	Notes:	**A720 Sheriffhall Roundabout** **DMRB Stage 2 Scheme Assessment Report** Figure 3.3 Improvement Option C

4 INDICATIVE COSTS, RISKS AND OPTIMISM BIAS

4.1 Basis of Cost Estimates

Detailed cost estimates were prepared for each of the proposed Improvement Options. These costs, which are based on current rates, were used to define both the total construction cost and total land cost of the proposed Improvement Options.

Full details of the derivation of the cost estimates are set out in the Stage 2 Engineering Assessment Report.

A summary of the estimated costs of the proposed Improvement Options in Quarter 4 2016 prices is shown in **Table 4.1**.

Table 4.1 – Estimated Scheme Cost Summary

	Improvement Option A	Improvement Option B	Improvement Option C
Total Construction Cost (£m)	£60,105,850	£58,677,739	£59,975,355
Total Land Cost (£m)	£9,696,678	£5,685,081	£6,969,181
Preparation (9% of Total Construction and Land Costs)	£6,282,227	£5,792,654	£6,025,008
Supervision (5% of Total Construction and Land Costs)	£3,490,126	£3,218,141	£3,347,227
Total Scheme Cost (£m)	£79,574,881	£73,373,615	£76,316,771

Note: All costs are in Quarter 4, 2016 prices and exclude VAT.

4.2 Assessment of Risk

An investigation of prevailing rates was undertaken to establish reasonable costs for the Improvement Options, including an assessment of risk. The work undertaken to date is therefore considered to be sufficient to establish reasonable rates for cost estimating purposes.

4.3 Optimism Bias

As there is a tendency for project appraisers to be overly optimistic when assessing total scheme costs, optimism bias has been included in the appraisal to increase the capital expenditure estimate of the improvement options and the potential for delays during construction, in accordance with the operational advice concerning H.M. Treasury's New Green Book on Appraisal and Evaluation in Central Government.

As schemes progress through the various stages from the identification of a general corridor to the development of various route options and finally the selection of the Proposed Scheme, the level of optimism bias is likely to reduce accordingly.

Current DMRB guidance recommends that at DMRB Stage 2 Route Option Assessment, an allowance of 25% for optimism bias is used for Roads and an allowance of 44% for optimism bias is used for Fixed Links (ie bridges and tunnels).

A breakdown of the estimated costs of the proposed Improvement Options, including an allowance of 25% and 44% for optimism bias, is shown in **Table 4.2**. All costs are in Quarter 4, 2016 prices.

Table 4.2 – Estimated Scheme Cost Summary, Including Optimism Bias

	Improvement Option A	Improvement Option B	Improvement Option C
Total Construction Cost (£m)	£70,478,242	£69,494,636	£70,514,999
Total Land Cost (£m)	£12,120,847	£7,106,351	£8,711,476
Preparation (9% of Total Construction and Land Costs)	£7,433,918	£6,894,089	£7,130,383
Supervision (5% of Total Construction and Land Costs)	£4,129,954	£3,830,049	£3,961,324
Total Scheme Cost (£m)	£94,162,961	£87,325,125	£90,318,182

Note: All costs are in Quarter 4, 2016 prices and exclude VAT.

4.4 Cost Profile

For the purpose of the economic appraisal, the overall cost profiles which have been adopted are shown in **Table 4.3**.

Table 4.3 –Scheme Cost Profiles

	2020	2021	2022	2023	2024
Improvement Option A	6.0%	15.0%	23.0%	54.0%	2.0%
Improvement Option B	6.0%	10.0%	24.0%	57.0%	3.0%
Improvement Option C	6.0%	11.0%	24.0%	56.0%	3.0%

A 2 year construction programme has been programmed commencing in 2022 with the scheme opening in 2024.

5 DEVELOPMENT OF COMPUTER MODELS

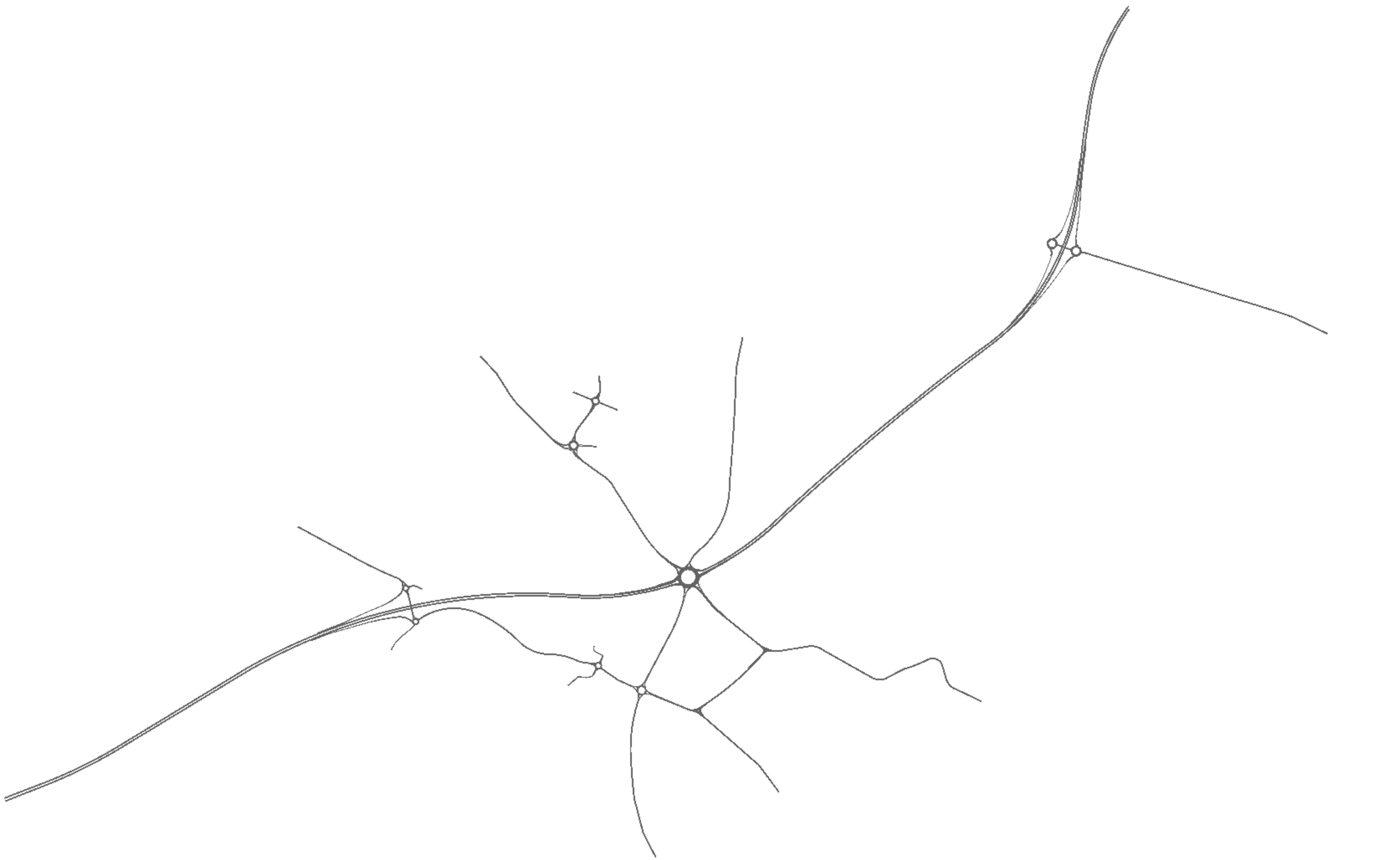
5.1 Introduction

The operational and economic assessment of proposed road improvement schemes requires the development and application of various computer models. In the case of the A720 Sheriffhall Roundabout, this has involved the development of a Paramics Micro-Simulation Model.

5.2 Paramics Base Network

The Paramics Base network has been developed to represent existing conditions observed during the programme of traffic surveys undertaken in October 2013 and October 2014. The limits of the modelled base network were defined to include road sections that are likely to experience a change in operating conditions as a result of the proposed Improvement Options.

A network plot indicating the extent of the modelled network is shown in **Figure 5.1**.



Source:

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2
Traffic & Economic Assessment Report

Figure 5.1
Paramics Base Network

5.3 Zoning System

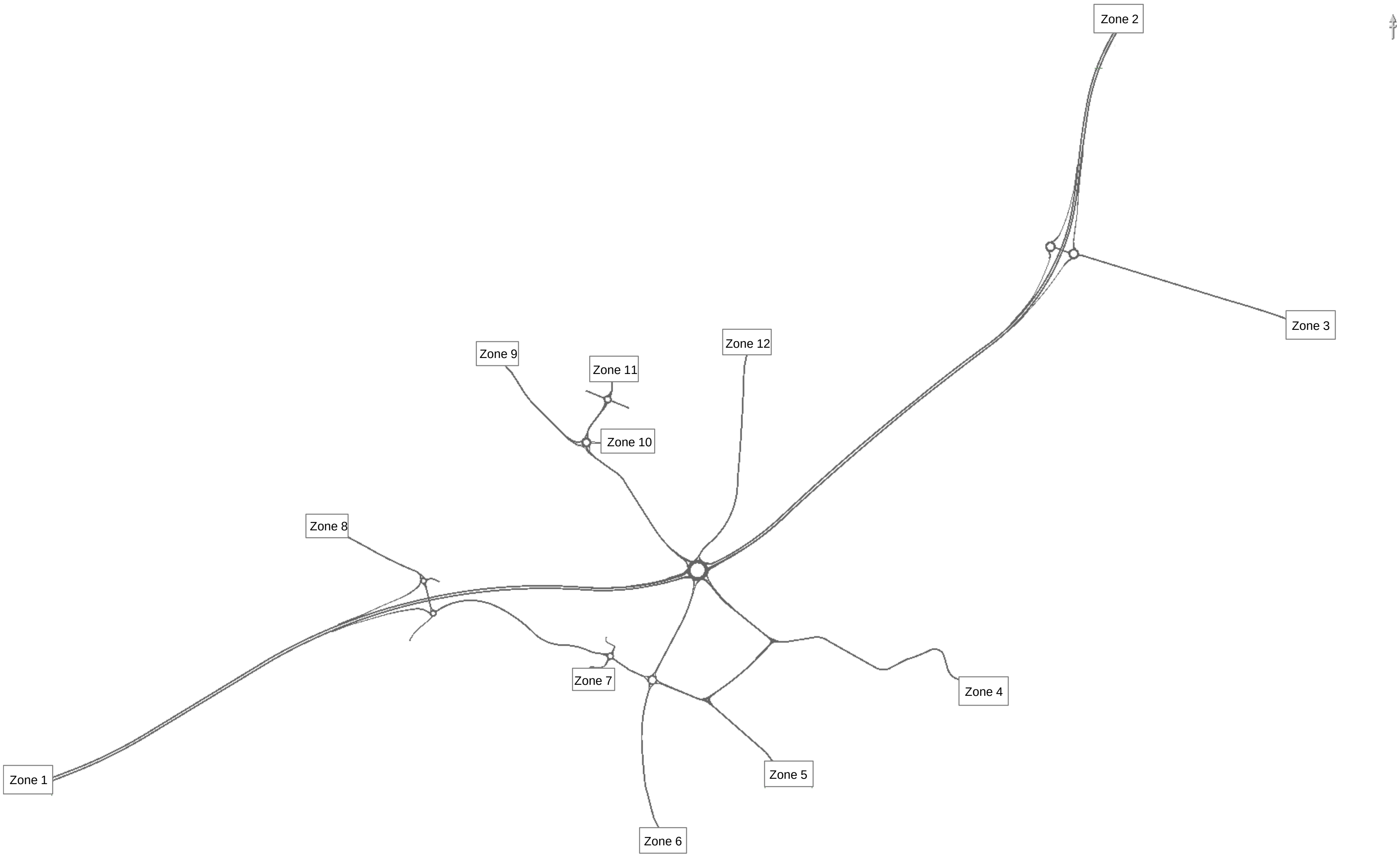
A zoning system was developed to represent the main origins and destinations of trips in the modelled area. A total of 12 zones were defined to model trip patterns in the area.

The zones used to define traffic movements in the modelled network are as follows:

- Zone 1 – A720 West of Sheriffhall Roundabout;
- Zone 2 – A720 East of Sheriffhall Roundabout;
- Zone 3 – A68 Dalkieth Northern Bypass;
- Zone 4 – A6106 Old Dalkieth Road South of Sheriffhall Roundabout;
- Zone 5 – B6392;
- Zone 6 – A7 South of Sheriffhall Roundabout;
- Zone 7 – Dobbies Garden Centre South of the A772 Gilmerton Road;
- Zone 8 – A772 Gilmerton Road North of Gilmerton Junction;
- Zone 9 – A7 North of Sheriffhall Roundabout;
- Zone 10 – Sheriffhall Park and Ride;
- Zone 11 – A7 to A6106 Link Road; and
- Zone 12 – A6106 Millerhill Road North of Sheriffhall Roundabout.

It should be noted that Zone 10 and Zone 11 were defined to allow modelling of conditions when more detailed information is available on trip patterns.

A network plot indicating the locations of these zones is shown in **Figure 5.2**.



Source:

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2
Traffic & Economic Assessment Report

Figure 5.2
Paramics Base Network Zoning System

5.4 Link Categories

The Paramics network is constructed using node points at key locations such as junctions, speed limit change points, road narrowing / widening and any changes in the alignment of the road. These nodes are connected by a series of links to represent the road network.

The key parameters are defined for each link including speed limit, lane width and number of lanes. Each link is also specified as either Major or Minor, and Urban or Highway, to influence driver behaviour on the modelled road network.

The perceived cost of driving on a Minor link is double the cost of an equivalent Major link for non-familiar drivers, which encourages the majority of vehicles to travel using the major signposted routes, while allowing for familiar drivers who have local knowledge to use alternative routes. The default ratio of 80% familiar drivers to 20% unfamiliar drivers has been adopted in the Paramics Base model.

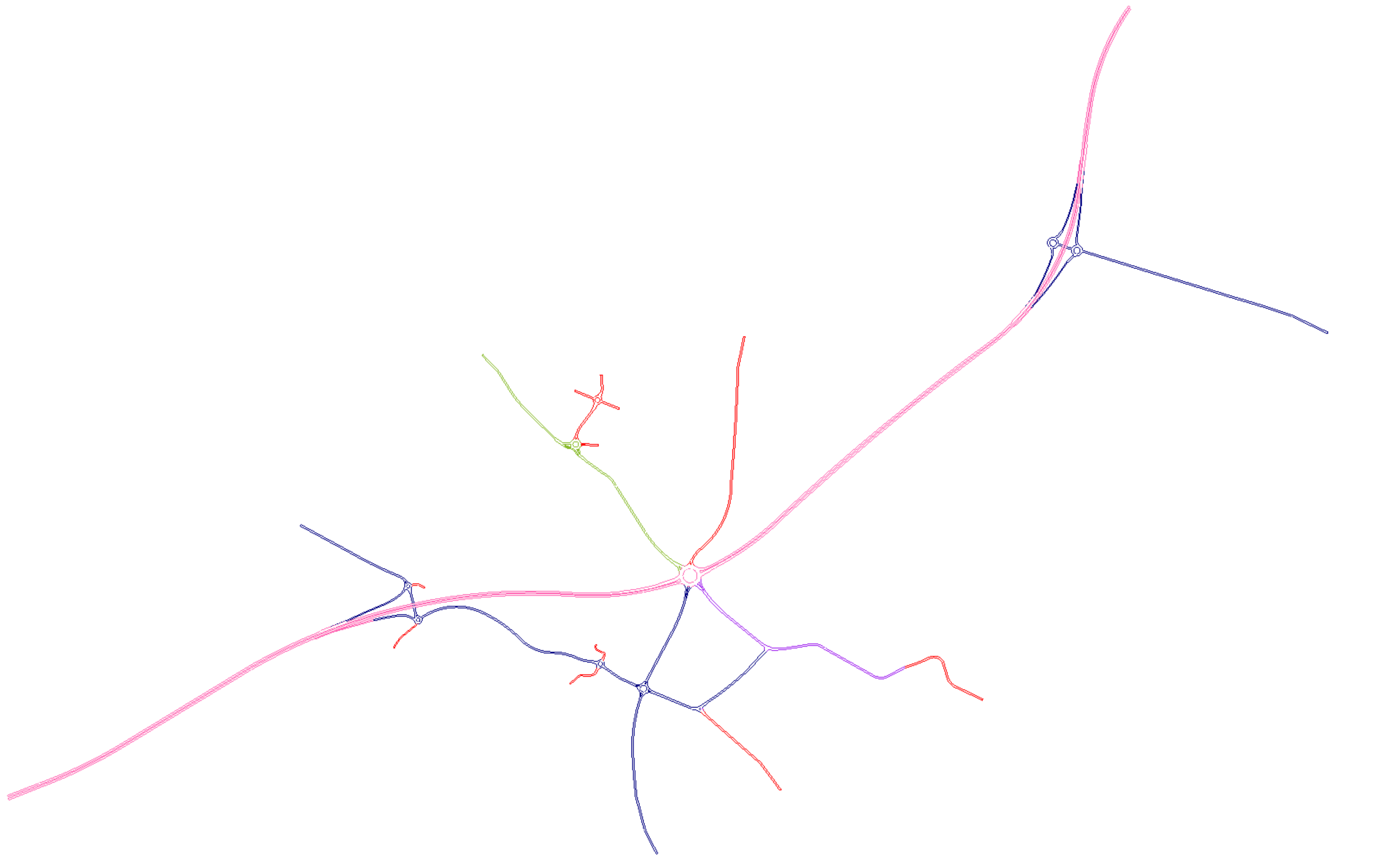
On an Urban link drivers are more likely to consider which lane they should be using for any approaching turning decisions, whereas on a Highway link drivers are more likely to use the faster lane to make use of overtaking opportunities.

Details of the link characteristics on different sections of the modelled network are shown in **Table 5.1**.

Table 5.1 – Link Characteristics

Road Section	Speed Limit (mph)	Single / Dual Carriageway	Link Category	Urban / Highway
A720 Mainline	70 mph	Dual 2-Lane Carriageway	Major	Highway
A7 North of Sheriffhall Rb	40 mph	Single Carriageway	Major	Urban
A7 South of Sheriffhall Rb	60 mph	Single Carriageway	Major	Urban
A6106 North of Sheriffhall Rb	30 mph	Single Carriageway	Major	Urban
A6106 South of Sheriffhall Rb	50 mph	Single Carriageway	Major	Urban
Gilmerton Road	60 mph	Single Carriageway	Minor	Urban

The speed limits of each link in the Paramics Base model are shown in **Figure 5.3**.



Source:

Notes:

70 mph
40 mph
60 mph
30 mph
50 mph

A720 Sheriffhall Roundabout – DMRB Stage 2
Traffic & Economic Assessment Report

Figure 5.3
Paramics Base Network
Speed Limits

5.5 Vehicle Composition

Based on the MCC information collected within the study area, the 2014 12-hour weekday vehicle proportions defined in the Paramics Base model are as follows:

- 80.4% Cars;
- 12.6% Light Goods Vehicles (LGV);
- 3.2% Other Goods Vehicles 1 (OGV1);
- 2.5% Other Goods Vehicles 2 (OGV2); and
- 1.3% Buses and Coaches (PSV).

Trip patterns around the Paramics Base model network have been based on two matrices, namely:

- Demand Matrix 1 – Light Vehicles (Cars and LGVs); and
- Demand Matrix 2 – Heavy Vehicles (OGV1s, OGV2s and PSVs).

Of the 93% of Cars and LGVs in Demand Matrix 1, 86.4% are Cars and 13.6% are LGVs.

Of the 7% of OGV1s, OGV2s and PSVs in Demand Matrix 2, 46% are OGV1, 35.6% are OGV2 and 18.4% are PSVs.

5.6 Demand Profile

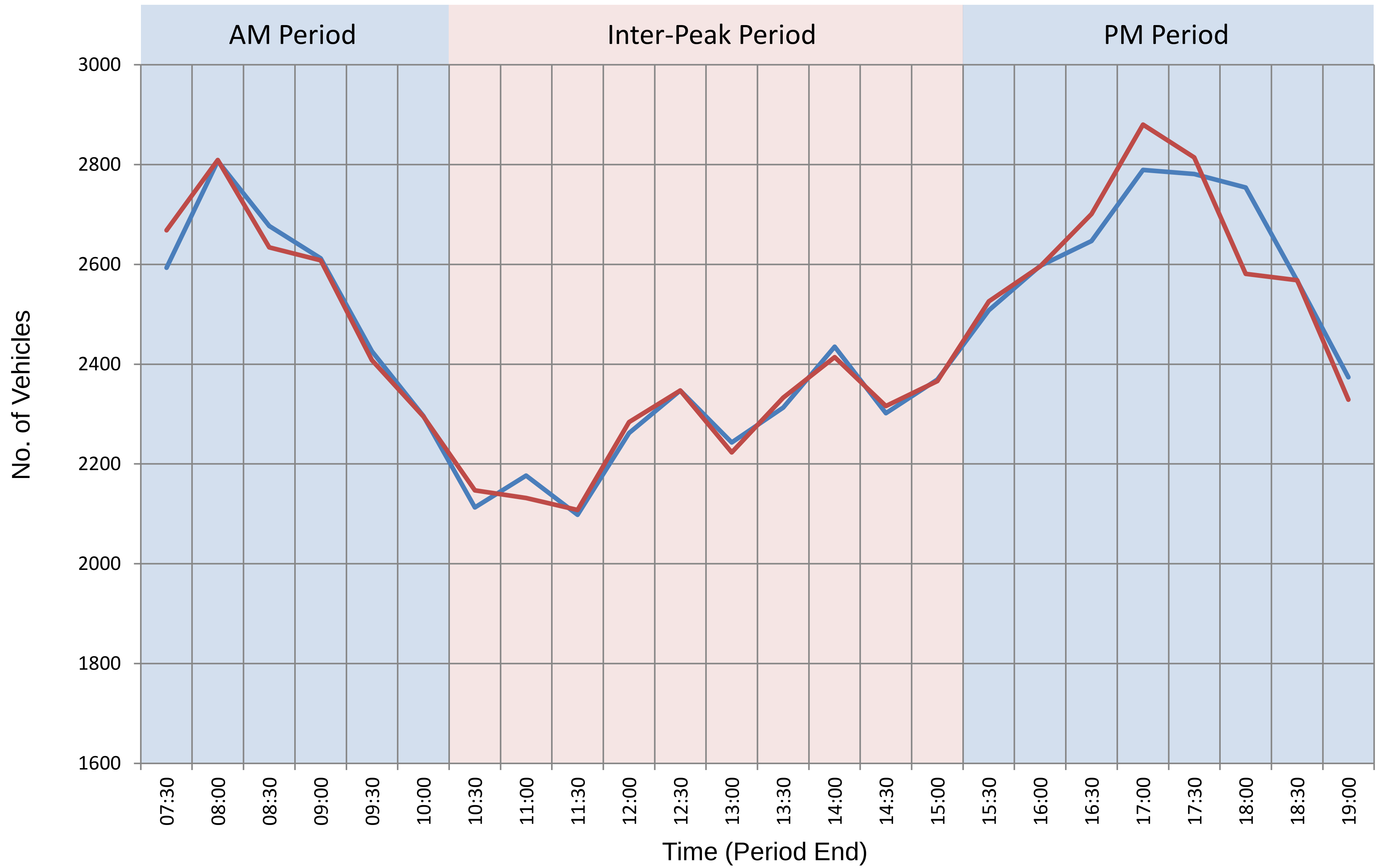
The total traffic flow observed passing through Sheriffhall Roundabout during each 30-minute period throughout the 12-hour MCC survey was used to derive a representative Demand Profile for the release of traffic onto the Paramics Base model network.

The MCC traffic survey undertaken at each junction entry records the volume of traffic which actually passes through each junction during any given time period. However, in congested operating conditions, the actual volume may not necessarily be the total traffic demands that wishes to pass through the junction during the same time period.

To provide a more reasonable representation of the volume of traffic demand, the total number of vehicles recorded in a queue at the end of each 30 minute period was added to the vehicle count passing through the junction during the corresponding 30 minute period, and subtracted from the subsequent 30 minute period.

The observed traffic demand profile derived from the October 2014 MCC and queue surveys is shown in **Figure 5.4**.

Examination of the demand flow profile indicates that the AM Peak demand occurs between 07:30 and 08:00 hours and the PM Peak demand occurs between 16:30 and 17:00 hours.



AECOM

Source:

Notes:

Observed Traffic Volume (October 2014)

Observed Traffic Volume + Queue Count Adjustment

A720 Sheriffhall Roundabout – DMRB Stage 2
Traffic & Economic Assessment Report

Figure 5.4
Observed Traffic Demand Profile
Sheriffhall Roundabout

Modelled Time Periods

The Paramics Base model is split into three distinct time periods, namely the AM Peak Period, Inter-Peak Period and PM Peak Period. A separate demand flow profile matrix has been developed for each of the modelled time periods. The start and end times of the modelled time periods are shown in **Table 5.2**.

Table 5.2 – Paramics Base Model Time Periods

Time Period	Start Time (hh:mm:ss)	End Time (hh:mm:ss)	Duration (hh:mm:ss)
AM Peak Period	07:00:00	09:59:59	03:00:00
Inter-Peak Period	10:00:00	14:59:59	05:00:00
PM Peak Period	15:00:00	18:59:59	04:00:00

5.7 Trip Matrix Building

The locations of the MCC surveys used to build the modelled traffic flows are shown in **Figure 5.5**.

The relevant trip patterns in the study area have been estimated from the 12-hour traffic counts observed during the October 2013 and October 2014 surveys.

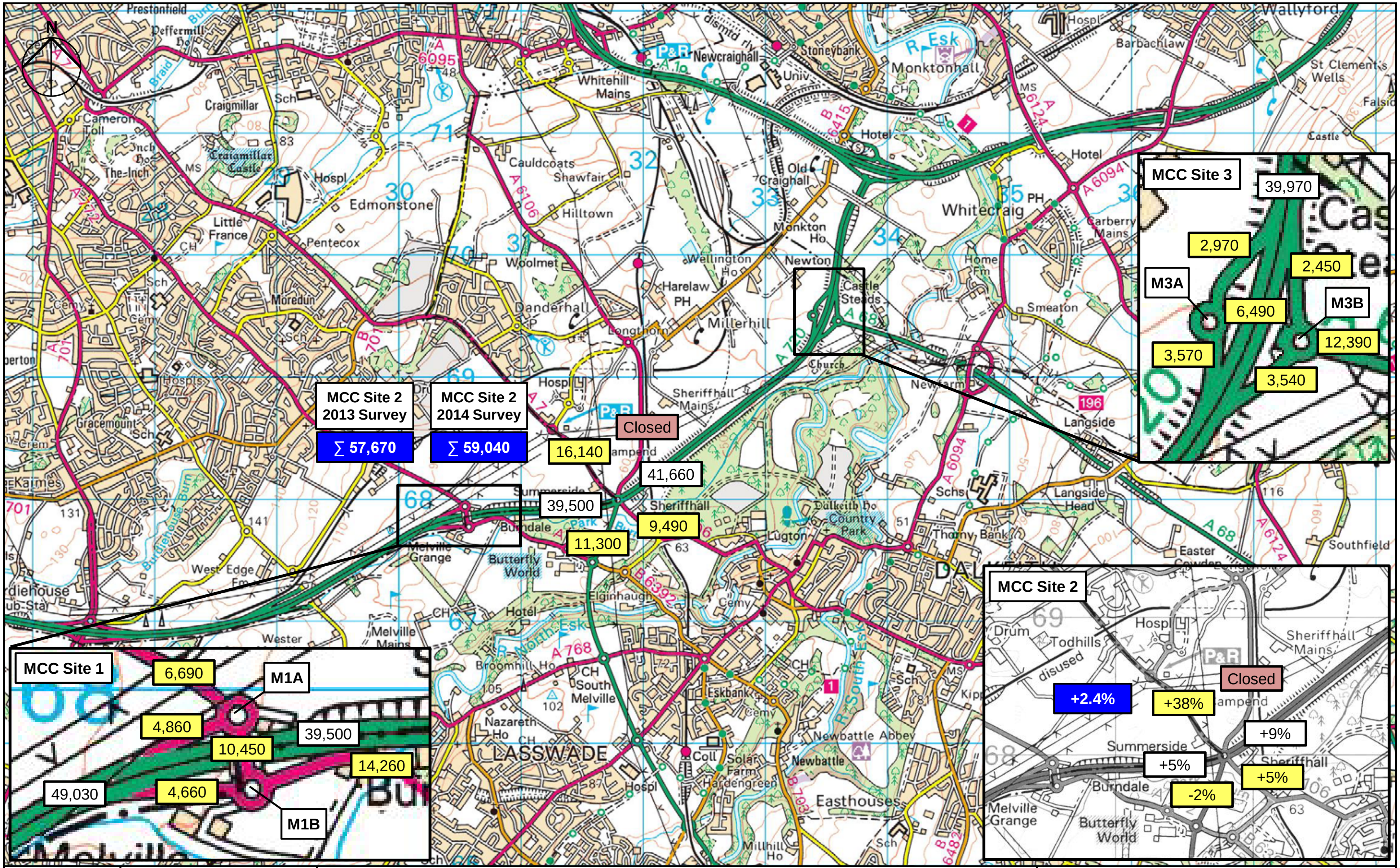
The results of the October 2013 surveys indicate that approximately 57,670 vehicles passed through the at-grade Sheriffhall Roundabout during the 12-hour survey period.

The results of the October 2014 surveys indicate that approximately 59,040 vehicles passed through the at-grade Sheriffhall Roundabout during the 12-hour survey period, indicating an increase of approximately 2% between 2013 and 2014. The 2014 observed traffic flows are shown in **Figure 5.6**.

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 5.5
Locations of Traffic Flows



AECOM

Notes:

1,000	Side Road Flow
10,000	Main Road Flow
Closed	A6106 Millerhill Road Closed
∑	Sheriffhall Junction Total (Sum of all Entries)

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 5.6
2014 Observed 12-Hour Traffic Flows

Further examination of trip patterns indicates that traffic on the A7 North of Sheriffhall Roundabout increased by approximately 4,440 (38%) vehicles from a two-way flow of 11,700 vehicles in 2013 to 16,140 vehicles in 2014. On the A720 East of Sheriffhall Roundabout, traffic flows increased by approximately 3,490 (9%) vehicles from a two-way flow of 38,170 vehicles in 2013 to 41,660 vehicles in 2014.

These changes in local trip patterns are likely to have been influenced by the temporary closure of the A6106 North of Sheriffhall Roundabout in 2014, with traffic reassigning on to alternative routes.

To provide a reasonable representation of typical traffic conditions at Sheriffhall Roundabout, the trip patterns observed on the A7 (North), A6106 (North) and A720 (East) approaches to Sheriffhall Roundabout in 2013 have been used to adjust the turning movements observed during the 2014 surveys to compensate for the effects on the A6106 (North) closure. The overall effect of these adjustments has been to increase the total flow through the junction marginally to 59,120 vehicles.

The turning movements observed at Sheriffhall Roundabout during the October 2014 surveys are shown in **Table 5.3**. The adjusted turning movements derived at Sheriffhall Roundabout using the traffic information from the October 2013 surveys as described above is shown in **Table 5.4**.

Table 5.3 – Sheriffhall Roundabout: Observed 2014 Traffic Flows (12-Hour)

	A6106 (North)	A720 (East)	A6106 (South)	A7 (South)	A720 (West)	A7 (North)	Total
A6106 (North)	0	0	0	0	0	0	**0**
A720 (East)	0	0	653	3,115	14,684	1,485	**19,937**
A6106 (South)	0	744	0	72	1,795	2,499	**5,110**
A7 (South)	0	3,051	25	0	570	1,970	**5,616**
A720 (West)	0	16,424	1,239	535	0	2,545	**20,743**
A7 (North)	0	1,502	2,462	1,962	1,712	0	**7,638**
Total	**0**	**21,721**	**4,379**	**5,684**	**18,761**	**8,499**	**59,044**

Note: The A6106 (N) was temporarily closed at the Sheriffhall Roundabout on the day of survey due to roadworks in the area.

Table 5.4 – Sheriffhall Roundabout: Observed (Adjusted) 2014 Traffic Flows (12-Hour)

	A6106 (North)	A720 (East)	A6106 (South)	A7 (South)	A720 (West)	A7 (North)	Total
A6106 (North)	0	64	828	1,125	1,490	36	**3,543**
A720 (East)	30	0	545	2,501	14,010	1,485	**18,571**
A6106 (South)	769	524	0	72	1,795	1,950	**5,110**
A7 (South)	1,237	2,302	25	0	570	1,482	**5,616**
A720 (West)	1,651	15,652	1,239	535	0	1,666	**20,743**
A7 (North)	84	1,502	1,742	1,313	896	0	**5,537**
Total	**3,771**	**20,044**	**4,379**	**5,546**	**18,761**	**6,619**	**59,120**

To provide a reasonable representation of trip patterns in the area, separate trip matrices have been developed for the AM Peak Period, Inter-Peak Period, PM Peak Period and 12-Hour Period considering both Light Vehicles and Heavy Vehicles. The total trips defined within each of these matrices are summarised in **Table 5.5**.

Table 5.5 – 2014 Trip Matrix Summary

Time Period	Light Vehicles	Heavy Vehicles	All Vehicles
AM Peak Period	19,930	1,759	**21,689**
Inter-Peak Period	27,504	2,749	**30,253**
PM Peak Period	28,254	2,166	**30,420**
12-Hour Period	75,688	6,674	**82,362**

The resultant all-vehicle trip matrices developed for the Paramics Base model for the AM Peak Period, Inter-Peak Period, PM Peak Period and 12-Hour Period are shown in **Tables 5.6 to 5.9**.

Table 5.6 – 2014 Trip All-Vehicle Matrix (AM Peak Period)

Zone	1	2	3	4	5	6	7	8	9	10	11	12	Total
1	0	3,220	682	387	0	900	299	187	441	0	0	488	**6,604**
2	2,606	0	451	167	0	541	0	310	436	0	0	6	**4,517**
3	1,042	1,209	0	0	0	0	0	0	0	0	0	0	**2,251**
4	395	122	0	0	0	15	0	295	286	0	0	282	**1,395**
5	0	0	0	0	0	58	361	489	660	0	0	0	**1,568**
6	1,374	524	0	9	45	0	0	219	325	0	0	320	**2,816**
7	111	0	0	0	176	31	0	0	0	0	0	0	**318**
8	87	88	0	123	189	0	13	0	0	0	0	0	**500**
9	127	257	0	107	335	21	0	0	0	0	0	24	**871**
10	0	0	0	0	0	0	0	0	0	0	0	0	**0**
11	0	0	0	0	0	0	0	0	0	0	0	0	**0**
12	432	12	0	161	0	242	0	0	2	0	0	0	**849**
Total	**6,174**	**5,432**	**1,133**	**954**	**745**	**1,808**	**673**	**1,500**	**2,150**	**0**	**0**	**1,120**	**21,689**

Table 5.7 – 2014 Trip All-Vehicle Matrix (Inter-Peak Period)

Zone	1	2	3	4	5	6	7	8	9	10	11	12	Total
1	0	4,407	1,290	434	0	1,100	524	239	726	0	0	518	**9,238**
2	4,234	0	843	211	0	586	0	353	640	0	0	11	**6,878**
3	1,341	931	0	0	0	0	0	0	0	0	0	0	**2,272**
4	712	238	0	0	0	36	0	244	184	0	0	253	**1,667**
5	0	0	0	0	0	108	494	50	528	0	0	0	**1,180**
6	1,728	705	0	12	94	0	0	223	318	0	0	506	**3,586**
7	24	0	0	0	548	36	0	7	0	0	0	0	**615**
8	195	321	0	237	45	351	0	0	0	0	0	0	**1,149**
9	471	589	0	247	491	466	0	0	0	0	0	38	**2,302**
10	0	0	0	0	0	0	0	0	0	0	0	0	**0**
11	0	0	0	0	0	0	0	0	0	0	0	0	**0**
12	503	27	0	344	0	471	0	0	21	0	0	0	**1,366**
Total	**9,208**	**7,218**	**2,133**	**1,485**	**1,178**	**3,154**	**1,018**	**1,116**	**2,417**	**0**	**0**	**1,326**	**30,253**

Table 5.8 – 2014 Trip All-Vehicle Matrix (PM Peak Period)

Zone	1	2	3	4	5	6	7	8	9	10	11	12	Total
1	0	4,487	1,566	418	0	675	1,316	153	499	0	0	645	**9,759**
2	3,665	0	1,121	167	0	560	0	151	409	0	0	13	**6,086**
3	1,122	799	0	0	0	0	0	0	0	0	0	0	**1,921**
4	688	164	0	0	0	21	0	227	120	0	0	234	**1,454**
5	0	0	0	0	0	77	212	299	520	0	0	0	**1,108**
6	1,542	438	0	4	95	0	0	72	491	0	0	411	**3,053**
7	283	0	0	0	654	840	0	0	0	0	0	0	**1,777**
8	178	226	0	404	327	435	0	0	0	0	0	0	**1,570**
9	298	656	0	353	453	582	0	0	0	0	0	22	**2,364**
10	0	0	0	0	0	0	0	0	0	0	0	0	**0**
11	0	0	0	0	0	0	0	0	0	0	0	0	**0**
12	555	25	0	323	0	412	0	0	13	0	0	0	**1,328**
Total	**8,331**	**6,795**	**2,687**	**1,669**	**1,529**	**3,602**	**1,528**	**902**	**2,052**	**0**	**0**	**1,325**	**30,420**

Table 5.9 – 2014 Trip All-Vehicle Matrix (12-Hour Period)

Zone	1	2	3	4	5	6	7	8	9	10	11	12	Total
1	0	12,114	3,538	1,239	0	2,675	2,139	579	1,666	0	0	1,651	**25,601**
2	10,505	0	2,415	545	0	1,687	0	814	1,485	0	0	30	**17,481**
3	3,505	2,939	0	0	0	0	0	0	0	0	0	0	**6,444**
4	1,795	524	0	0	0	72	0	766	590	0	0	769	**4,516**
5	0	0	0	0	0	243	1,067	838	1,708	0	0	0	**3,856**
6	4,644	1,667	0	25	234	0	0	514	1,134	0	0	1,237	**9,455**
7	418	0	0	0	1,378	907	0	7	0	0	0	0	**2,710**
8	460	635	0	764	561	786	13	0	0	0	0	0	**3,219**
9	896	1,502	0	707	1,279	1,069	0	0	0	0	0	84	**5,537**
10	0	0	0	0	0	0	0	0	0	0	0	0	**0**
11	0	0	0	0	0	0	0	0	0	0	0	0	**0**
12	1,490	64	0	828	0	1,125	0	0	36	0	0	0	**3,543**
Total	**23,713**	**19,445**	**5,953**	**4,108**	**3,452**	**8,564**	**3,219**	**3,518**	**6,619**	**0**	**0**	**3,771**	**82,362**

6 MODEL CALIBRATION AND VALIDATION

6.1 Introduction

As the principal benefits associated with the proposed improvement options at Sheriffhall Roundabout are likely to result from savings in transit time, it is necessary to calibrate and validate the Paramics Base model to provide a reasonable representation of trip patterns and journey times within the modelled area.

6.2 Paramics Base Model Runs

Paramics includes the function to simulate the effects of the random variations that occur naturally on the road network throughout the day, which can result in variability in the modelled results. The average of 30 separate model runs has therefore been examined to compare the modelled traffic flows and speeds with the observed MCC and journey time surveys as part of the model validation process.

6.3 Trip Assignment and Validation

The GEH statistic is used to assess the extent to which modelled flows reflect observed conditions. The GEH statistic calculates a value for the difference between modelled and observed flows taking into account that when traffic flows are low the percentage difference between modelled and observed flows may be high, but the significance of this difference is small.

In accordance with DMRB Guidelines, a model should return a GEH statistic of <5 for 85% of individual flows.

The GEH statistics calculated for the link flows and turning movements for all junctions counted within the modelled area in each of the three time periods are summarised in **Table 6.1.**

Table 6.1 – GEH Statistics: All Junctions

	AM Peak Period		Inter-Peak Period		PM Peak Period	
	GEH < 1 (%)	GEH < 5 (%)	GEH < 1 (%)	GEH < 5 (%)	GEH < 1 (%)	GEH < 5 (%)
Link Flows	57%	**96%**	66%	**96%**	61%	**96%**
Turning Flows	59%	**96%**	52%	**95%**	62%	**95%**
Junctions	63%	**100%**	63%	**100%**	38%	**100%**

The above results indicate a strong level of correlation between the modelled and observed traffic flows throughout the network and are summarised below:

- 96% of junction entry and exit link flows return a GEH of <5 in all three modelled time periods and exceed the 85% target;
- 95% of turning flows return a GEH statistic of <5 in the Inter-Peak and PM periods, and 96% of turning flows return a GEH of <5 in the AM period and exceed the 85% target; and
- 100% of total flows through each junction return a GEH of <5 in all three modelled time periods and exceed the 85% target.

Given the significance of developing a representative model of operating conditions at Sheriffhall Roundabout, the GEH statistics calculated for the link flows and turning movements at Sheriffhall Roundabout are summarised in **Table 6.2**.

Table 6.2 – GEH Statistics: Sheriffhall Roundabout

	AM Peak Period		Inter-Peak Period		PM Peak Period	
	GEH < 1 (%)	GEH < 5 (%)	GEH < 1 (%)	GEH < 5 (%)	GEH < 1 (%)	GEH < 5 (%)
Link Flows	75%	**100%**	83%	**100%**	83%	**100%**
Turning Flows	73%	**93%**	77%	**97%**	87%	**93%**
Junctions	100%	**100%**	100%	**100%**	100%	**100%**

The above results indicate a good level of correlation between modelled and observed traffic flows at Sheriffhall Roundabout and are summarised below:

- 100% of junction entry and exit link flows return a GEH statistic of <5 in all three modelled time periods and exceed the 85% target;
- 93% of turning flows return a GEH statistic of <5 in the AM and PM periods, and 97% of turning flows return a GEH of <5 in the Inter-Peak period and exceed the 85% target; and
- 100% of total flows through the junction return a GEH statistic of <5 in all three modelled time periods and exceed the 85% target.

A summary of the 12-hour observed and modelled link flows and turning movements at each junction modelled in the Paramics Base model network is shown in **Table 6.3**.

Table 6.3 – Summary of 12-Hour Observed and Modelled Link Flows at each Junction Modelled in Paramics Base Model Network

Junction	Observed Traffic Flows	Modelled Traffic Flows	Difference in Traffic Flows	% Difference in Traffic Flows
M1A Gilmerton Junction (North)	11,008	10,844	-165	-1.5%
M1B Gilmerton Junction (South)	14,730	14,661	-69	-0.5%
M2 Sheriffhall Roundabout	59,120	59,004	-116	-0.2%
M3A Millerhill Junction (North)	6,507	6,440	-67	-1.0%
M3B Millerhill Junction (South)	12,437	12,352	-85	-0.7%
M4 Melville Gate/Old Dalkeith Road Junction	10,858	11,141	283	2.6%
M5 Melville Gate Roundabout	8,465	8,908	443	5.2%
M6 Gilmerton Road Roundabout	25,283	25,476	193	0.8%

Examination of the above information indicates that the differences between the observed traffic flows through the key junctions along the A720 (M1, M2 and M3) and the modelled traffic flows are within 1.5%.

On the surrounding network, the differences between the observed and modelled traffic flows through the junctions (M4, M5 and M6) increase to between 0.8% and 5.2%.

A summary of the observed and modelled link flows and turning movements at Sheriffhall Roundabout during the AM Peak Period, Inter-Peak Period and PM Peak Period is shown in **Table 6.4**.

Table 6.4 – Summary of Observed (Adjusted) and Modelled Link Flows at Sheriffhall Roundabout by Time Period

Time Period	Observed Traffic Flows	Modelled Traffic Flows	Difference in Traffic Flows	% Difference in Traffic Flows
AM Peak Period	15,308	15,229	-79	-0.5%
Inter-Peak Period	22,730	22,668	-62	-0.3%
PM Peak Period	21,082	21,075	-7	0.0%
12-Hour	59,120	59,004	-116	-0.2%

Examination of the above information indicates that the differences between the observed and modelled traffic flows at Sheriffhall Roundabout during the AM Peak Period, Inter-Peak Period, PM Peak Period and 12-Hour Period are within 0.5%.

6.4 Journey Time Calibration

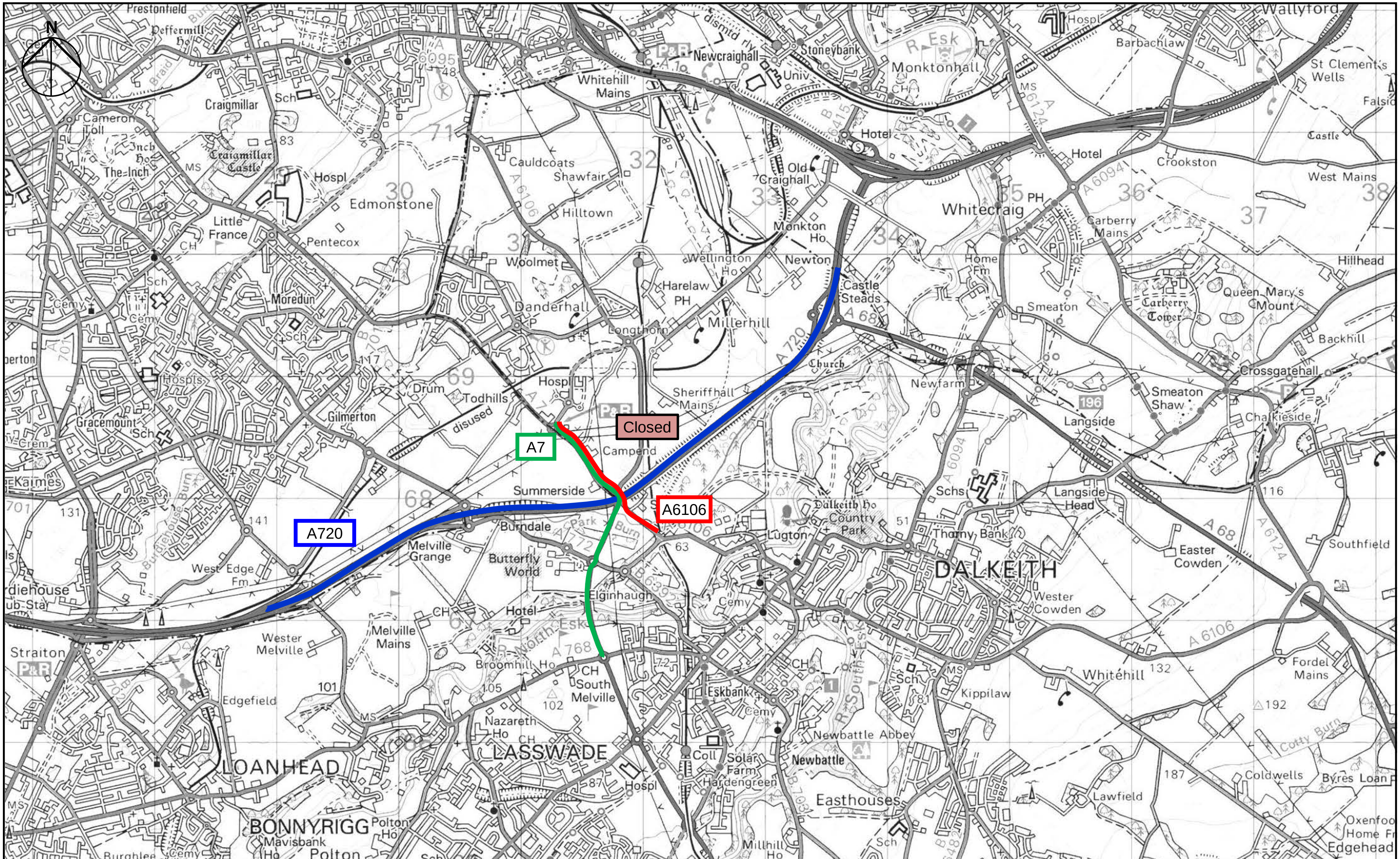
As the principal benefits associated with the proposed improvement options at Sheriffhall Roundabout are likely to result from savings in transit time, it is necessary to calibrate the Paramics Base model to provide a reasonable representation of journey times within the modelled area.

The Paramics Base model has been calibrated to take account of the journey time information collected as part of the October 2014 surveys.

Due to the temporary closure of the A6106 to the north of Sheriffhall Roundabout when the Journey Time Surveys were carried out, the Red Route consists of the A6106 to the south of the roundabout and the A7 to the north.

The sections of the journey time survey routes travelling through Sheriffhall Roundabout used to calibrate the journey times of vehicles in the Paramics model are shown in **Figure 6.1**.

Due to the temporary change in traffic patterns at Sheriffhall Roundabout as a result of the temporary closure of the A6106, including the reassignment of traffic onto the A7 (North) and A720 (East) approaches to the roundabout, it has been considered that the 2013 Journey Time Survey data (observed with the A6106 open) provides a more reasonable representation of operating conditions on the A720 westbound, and as such has been used as the basis of comparison with modelled journey times and speeds in this direction of the A720.



AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 6.1
2014 Journey Time Routes

A comparison of the modelled output journey times along each route through Sheriffhall Roundabout and the corresponding observed journey times are shown in **Tables 6.5a to 6.5d**.

Table 6.5a – Observed Journey Times

Route	AM Peak Period	Inter-Peak Period	PM Peak Period	12-Hour Period
A720 EB (B2 – B6)	04:26	04:06	05:52	04:43
A720 WB (B9 – B13)	05:59	04:51	06:14	05:32
A7 NB (G9 – G6)	06:21	05:05	04:54	05:26
A7 SB (G6 – G9)	03:41	04:54	08:11	05:27
A6106 NB (R6 – R5)	04:48	03:00	02:21	03:27
A6106 SB (R5 – R6)	02:16	02:54	06:20	03:36
Gilmerton Road NB (R8 – R11)	01:56	02:07	01:43	01:56
Gilmerton Road SB (R11 – R8)	02:12	02:15	02:38	02:19

Table 6.5b – Modelled Journey Times

Route	AM Peak Period	Inter-Peak Period	PM Peak Period	12-Hour Period
A720 EB (B2 – B6)	04:09	03:52	06:43	05:00
A720 WB (B9 – B13)	04:47	03:50	07:13	05:15
A7 NB (G9 – G6)	07:51	02:31	04:54	05:05
A7 SB (G6 – G9)	03:02	02:59	06:36	04:57
A6106 NB (R6 – R5)	05:34	01:57	02:54	03:42
A6106 SB (R5 – R6)	02:14	02:11	05:41	03:38
Gilmerton Road NB (R8 – R11)	01:32	01:27	01:30	01:30
Gilmerton Road SB (R11 – R8)	02:02	01:28	01:57	01:47

Table 6.5c – Modelled and Observed Journey Times: Differences

Route	AM Peak Period	Inter-Peak Period	PM Peak Period	12-Hour Period
A720 EB (B2 – B6)	-00:17	-00:14	00:51	00:17
A720 WB (B9 – B13)	-01:12	-01:00	01:00	-00:17
A7 NB (G9 – G6)	01:31	-02:35	00:01	-00:21
A7 SB (G6 – G9)	-00:39	-01:55	-01:35	-00:30
A6106 NB (R6 – R5)	00:46	-01:04	00:33	00:14
A6106 SB (R5 – R6)	-00:02	-00:43	-00:39	00:01
Gilmerton Road NB (R8 – R11)	-00:24	-00:40	-00:13	-00:26
Gilmerton Road SB (R11 – R8)	-00:10	-00:48	-00:41	-00:32

Table 6.5d – Modelled and Observed Journey Times: % Differences

Route	AM Peak Period	Inter-Peak Period	PM Peak Period	12-Hour Period
A720 EB (B2 – B6)	-6.4%	-5.6%	14.5%	6.1%
A720 WB (B9 – B13)	-20.0%	-20.8%	16.0%	-5.1%
A7 NB (G9 – G6)	23.8%	-50.7%	0.2%	-6.5%
A7 SB (G6 – G9)	-17.6%	-39.1%	-19.3%	-9.1%
A6106 NB (R6 – R5)	15.8%	-35.3%	23.5%	6.9%
A6106 SB (R5 – R6)	-1.3%	-24.8%	-10.4%	0.7%
Gilmerton Road NB (R8 – R11)	-20.5%	-31.3%	-12.4%	-22.5%
Gilmerton Road SB (R11 – R8)	-7.9%	-35.3%	-25.8%	-22.9%

The DMRB Acceptability Guidelines for the comparison of modelled and observed journey times indicates that times should be within 15% or 1 minute, in 85% of cases.

The results of this comparison indicate that on the A720, modelled eastbound journey times have been calibrated to within 1 minute or 15% of observed journey times in all three time periods (AM, Inter-Peak and PM), and modelled westbound journey times have been calibrated to within 1 minute or 15% during the Inter-Peak and PM periods. During the AM period, modelled westbound journey times are approximate 1 minute 12 seconds lower than journey times observed in October 2013.

In addition, comparison of the average journey times throughout the total 12-hour modelled period show that both directions of all four routes (A720, A7, A6106 and Gilmerton Road) are within 1 minute or 15% of the observed average 12-hour journey times.

The modelled average 12-hour journey times on the A720 show a difference of approximately +6% in the eastbound direction and approximately -5% in the westbound direction relative to observed journey times. This results in an average 2-way difference of approximately 1% along the A720.

Overall this comparison indicates that the model provides a reasonable representation of typical journey times and speeds and is a suitable basis for the economic assessment of the proposed improvement options.

7 FORECASTING

7.1 Introduction

The Paramics model was developed to provide a reasonable representation of traffic conditions observed during the 12-hour traffic surveys undertaken in October 2014, as described previously in the report.

For the purposes of the traffic and economic assessment, it is necessary to further develop the model to represent the 24-hour annual average daily traffic flows and to incorporate the forecasted growth in traffic volumes from the day of survey to the proposed Scheme Opening Year and beyond.

Details of the adopted annualisation and forecasting procedures are described below.

7.2 Traffic Annualisation

Transport Scotland maintains a database of traffic flow information for the Scottish trunk road network through a series of permanent Automatic Traffic Counters (ATCs). Permanent ATCs NTC00604 (EB) and NTC00605 (WB) are located on the A720 west of Sheriffhall Roundabout, as shown in **Figure 7.1**.

Traffic volumes recorded by these counters are less likely to have been affected by temporary traffic reassignment due to the closure of the A6106 than the counters to the east of Sheriffhall Roundabout, and have therefore been used as a basis for the derivation of Annualisation factors for the observed day of survey traffic flows.

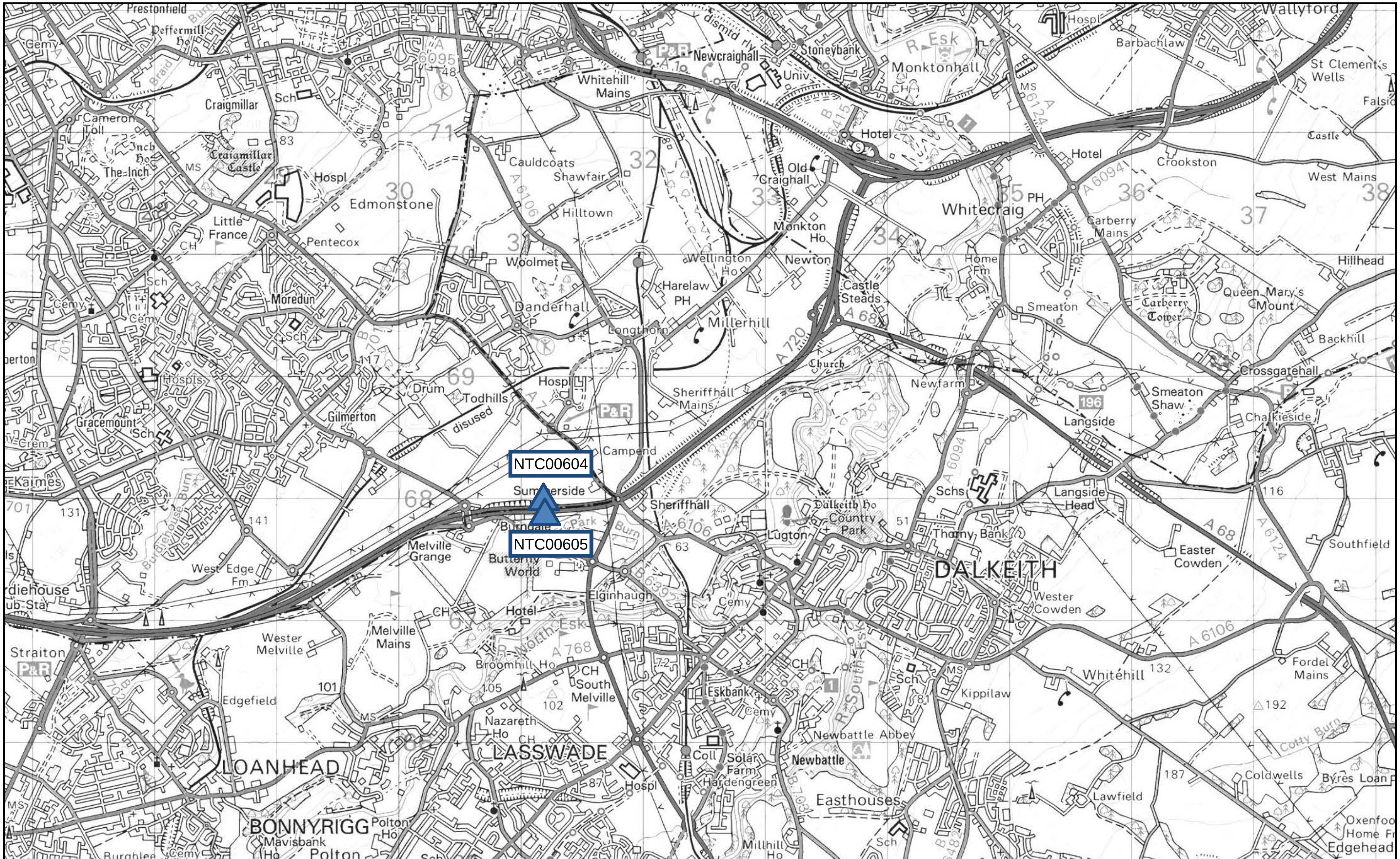
The traffic flows for the more lightly trafficked overnight 12-hour period were derived by comparing the 12-hour and 24-hour ATC flows.

The 2-way 24-hour traffic flow recorded by permanent ATCs NTC00604 and NTC00605 on Thursday 2nd October 2014 (day of survey) was 49,005 vehicles.

The 2-way 24-hour Average Annual Weekday Traffic (AAWDT) flow recorded by permanent ATCs NTC00604 and NTC00605 during 2014 was 46,289 vehicles. This indicates an annualisation factor of **0.94** which has been used to convert the day of survey flows to AAWDT flows.

The 2-way 24-hour Average Annual Weekend Traffic flow recorded by permanent ATCs NTC00604 and NTC00605 during 2014 was 38,118 vehicles. This indicates an annualisation factor of **0.78** which has been used to convert the day of survey flows to Annual Average Weekend Traffic flows.

The factors described above have been used to estimate the volumes of traffic on the road network by factoring the 12-hour day of survey information to derive both the annual average weekday and weekend traffic flows.



AECOM	Source: © Crown copyright and database right (2017). All rights reserved. Ordnance Survey License number 100046668.	Notes	**A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report** Figure 7.1 Permanent ATC Locations

7.3 Traffic Growth

October 2014 Baseline Traffic Surveys

A detailed programme of traffic surveys was carried out in October 2014 around the Sheriffhall area which established local traffic volumes, turning movements and vehicle speeds throughout the 12-hour day.

A Paramics Base model was developed to provide a reasonable representation of observed conditions including an adjustment for the effects of reopening the A6106 which was closed at the time of the surveys.

2014 Base Traffic from SRM12

Although the 2014 traffic surveys provide detailed information to assist in building the Paramics model, further information is required to define future traffic demand up to the 2024 Scheme Opening Year and beyond.

The SEStran Regional Model (SRM12), which has been developed separately by Transport Scotland and covers the South East Scotland area, has been used to derive an estimate of future growth based on the traffic related effects of proposed changes in land use over both the local and the wider regional area.

The traffic data received from SRM12 consisted of AM-Peak hour, Inter-Peak hour and PM-Peak hour traffic turning flows at Sheriffhall Roundabout, expressed in Passenger Car Units (PCUs), and split by Cars, LGVs, HGVs and PSVs.

The traffic data was then converted to a 3-hour AM-Peak Period, 5-hour Inter-Peak Period and 4-hour PM-Peak Period using pre-defined factors and from PCUs to vehicles to match the format of data required in the Paramics model.

Prior to combining information from the SRM12 model with the Sheriffhall Roundabout Paramics model the traffic flows through Sheriffhall Roundabout defined in the two models were compared.

The total 12-hour flow through Sheriffhall Roundabout obtained from the SRM12 Base model is 59,218 vehicles.

The total 12-hour flow through Sheriffhall Roundabout from the 2014 Paramics Base model is 59,004 vehicles.

This consistency check indicates that the 12-hour flow through Sheriffhall Roundabout in the 2014 Paramics Base model and SRM12 Base model are within 214 vehicles (0.36%).

2024 Future Base Traffic from SRM12 Reference Case

As an integral part of the development of the SRM12 model, the effects of the proposed changes in land use up to 2024 were used to define the SRM12 Reference Case.

To provide an estimate of future traffic conditions in the area and to maintain consistency with other Transport Scotland models, the predicted changes in traffic flows between the 2014 Base Year and the proposed 2024 Scheme Opening Year were derived from the SRM12 model.

SRM12 indicates that traffic flows through Sheriffhall Roundabout could increase by approximately 12% between 2012 and 2024, i.e. approximately 1% pa. This is based on the SRM12 ‘actual’ traffic flows. The SRM12 ‘demand’ traffic flows indicate an increase of 16%, which exceeds the ‘actual’ flows and the capacity of the junction.

Due to wider area network characteristics in SRM12 constraining some of the ‘demand’ traffic from reaching Sheriffhall Roundabout within the modelled time period, it is considered that the ‘actual’ traffic flows from SRM12 are more appropriate to use for the comparative assessment of improvement options.

To develop trip matrices for the Paramics model which represent traffic flows in the 2024 Scheme Opening year, the change in traffic movements between the SRM12 2012 base and the SRM12 2024 Reference Case models were added to the existing 2014 traffic matrix defined in the Paramics Base model.

2024 Future Design Traffic from SRM12 Reference Case with Grade-Separation at Sheriffhall

The Design models have been developed to incorporate the SRM12 2024 predicted traffic including the effects of releasing suppressed demand/induced traffic following grade-separation.

In addition to the 12% increase in traffic flows described above, the SRM12 model indicates that traffic flows through Sheriffhall could increase by a further 18% approximately in 2024 as a result of the proposed grade-separated junction at Sheriffhall. This is based on the SRM12 'actual' traffic flows and is an indication on the potential for suppressed demand/induced traffic in the area.

Traffic Growth Beyond 2024 from TMfS12

Although traffic volumes are expected to increase beyond 2024, this information is not available from the SRM12 model.

For the purpose of the assessment of the Improvement Options, and in discussion with Transport Scotland Technical Analysis Branch, the Transport Model for Scotland (TMfS12) forecasts of traffic growth for the SESplan area have been applied to define the increase in traffic beyond 2024.

The TMfS12 traffic growth factors applied to future years are as follows:

- 2024 to 2027 - 1.34% p.a.
- 2027 to 2032 - 1.05% p.a.
- 2032 to 2037 - 0.83% p.a.

Traffic Growth Limits

Examination of the Base model, taking into account the effects of annualisation in traffic flows, indicates that the base network can accommodate the full SRM12 demand in 2024, but beyond 2024 significant congestion occurs which extends to the limits of the model, indicating that the network is unable to accommodate any further growth beyond 2024.

The Base model is therefore based on zero growth beyond 2024 to establish the level of demand that could be accommodated on the base network to provide a reasonable basis for the 60-year assessment of the Improvement Options.

Examination of the Design models indicates that beyond 2030, significant congestion occurs on Improvement Option C which extends to the limits of the model, indicating that the network is unable to accommodate any further growth beyond 2030.

The Design models for Improvement Options A, B and C are therefore based on zero growth beyond 2030 to establish the level of demand that could be accommodated on the design networks to provide a reasonable basis for the comparative 60-year assessment of all Improvement Options. However it should be noted that Improvement Options A and B can accommodate growth beyond 2030.

Forecasting Summary

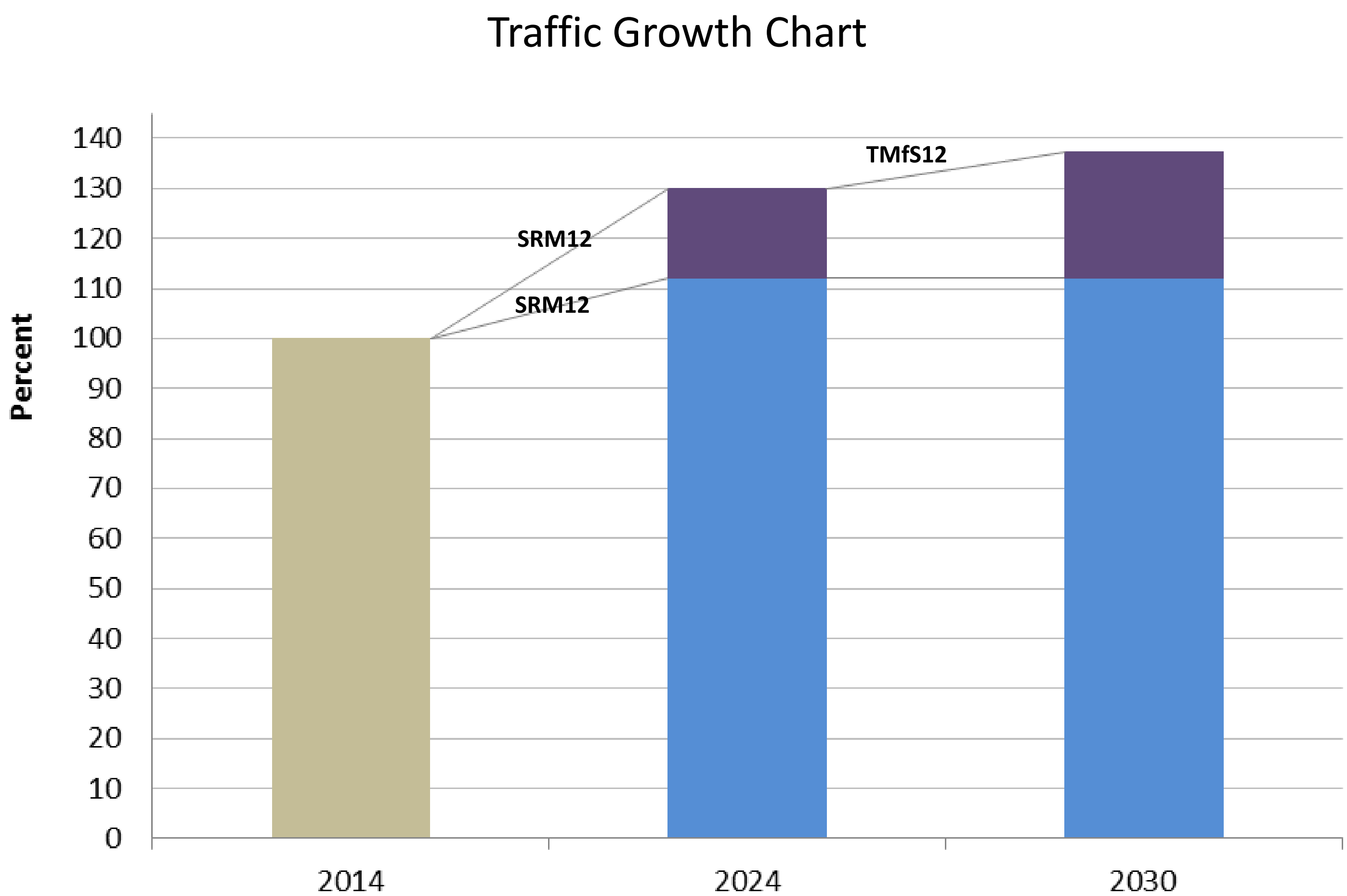
A chart illustrating the future traffic growth forecasts used for the assessment is shown in **Figure 7.2**.

A summary of the 12-hour 2-way traffic flows at the entry/exit links on each of the 6 key routes in the Paramics model and for each scenario described above is shown in **Table 7.1**.

Table 7.1 – 2-way Entry/Exit Traffic Flows (07:00 – 19:00)

Scenario	A720 West	A720 East	A7 North	A7 South	A6106 North	A6106 South
2014 Day of Survey	49,314	36,926	12,156	18,019	7,314	8,624
2014 Average Annual Weekday	46,360	34,713	11,427	16,947	6,878	8,110
2024 Existing Junction	53,745	40,238	11,333	17,327	7,608	8,853
2024 Grade-Separated Junction	58,612	44,740	12,166	21,846	12,439	9,064
2030 Existing Junction	*53,745	*40,238	*11,333	*17,327	*7,608	*8,853
2030 Grade-Separated Junction	62,940	48,041	13,066	23,456	13,354	9,732

*Zero traffic growth has been applied in the Base model beyond the 2024 Opening Year



AECOM

Source:

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2
Traffic & Economic Assessment Report

Figure 7.2
Future Traffic Growth Summary

8 OPERATIONAL ASSESSMENT

The principal operational effects of the proposed A720 Sheriffhall Junction Improvement would be to improve the movement of traffic on the A720 between Gilmerton and Old Craighall by providing grade-separation of the A720 at the existing Sheriffhall Roundabout, and reducing the conflict between strategic and local traffic.

For the purpose of the assessment of the proposed improvements it has been assumed that the scheme would open in 2024.

The operational assessment is based on the examination of the results from the various 2024 and 2030 Paramics models.

Paramics includes the function to simulate the effects of the random variations in vehicle behaviour that occur naturally on the road network throughout the day, which can result in variability in the modelled results. To minimise the effects of any abnormal results, the economic assessment is based on the aggregation of multiple runs. The average of 20 separate model runs has therefore been examined to provide a reasonable basis to compare the operational effects of each modelled Improvement Option relative to the Base network model.

8.1 Traffic Flows

To assist in interpreting the results of the Paramics model, the key traffic flow data included in the model are presented in this report.

Figure 8.1 indicates the two-way 12-hour AAWDT flows for the Base network in the proposed 2024 opening year based on the SRM12 Reference Case traffic growth projection.

Figures 8.2 to 8.4 indicate the two-way 12-hour AAWDT flows for the three Design networks in the proposed 2024 opening year based on the SRM12 Reference Case traffic growth projection and including the effects of releasing suppressed demand due to the provision of grade-separation at Sheriffhall Roundabout.

Figures 8.5 to 8.7 indicate the two-way 12-hour AAWDT flows for the three Design networks in the 2030 future year based on the SRM12 Reference Case traffic growth projection to 2024 including the effects of releasing suppressed demand due to the provision of grade-separation at Sheriffhall Roundabout, and TMfS12 growth between 2024 and 2030.

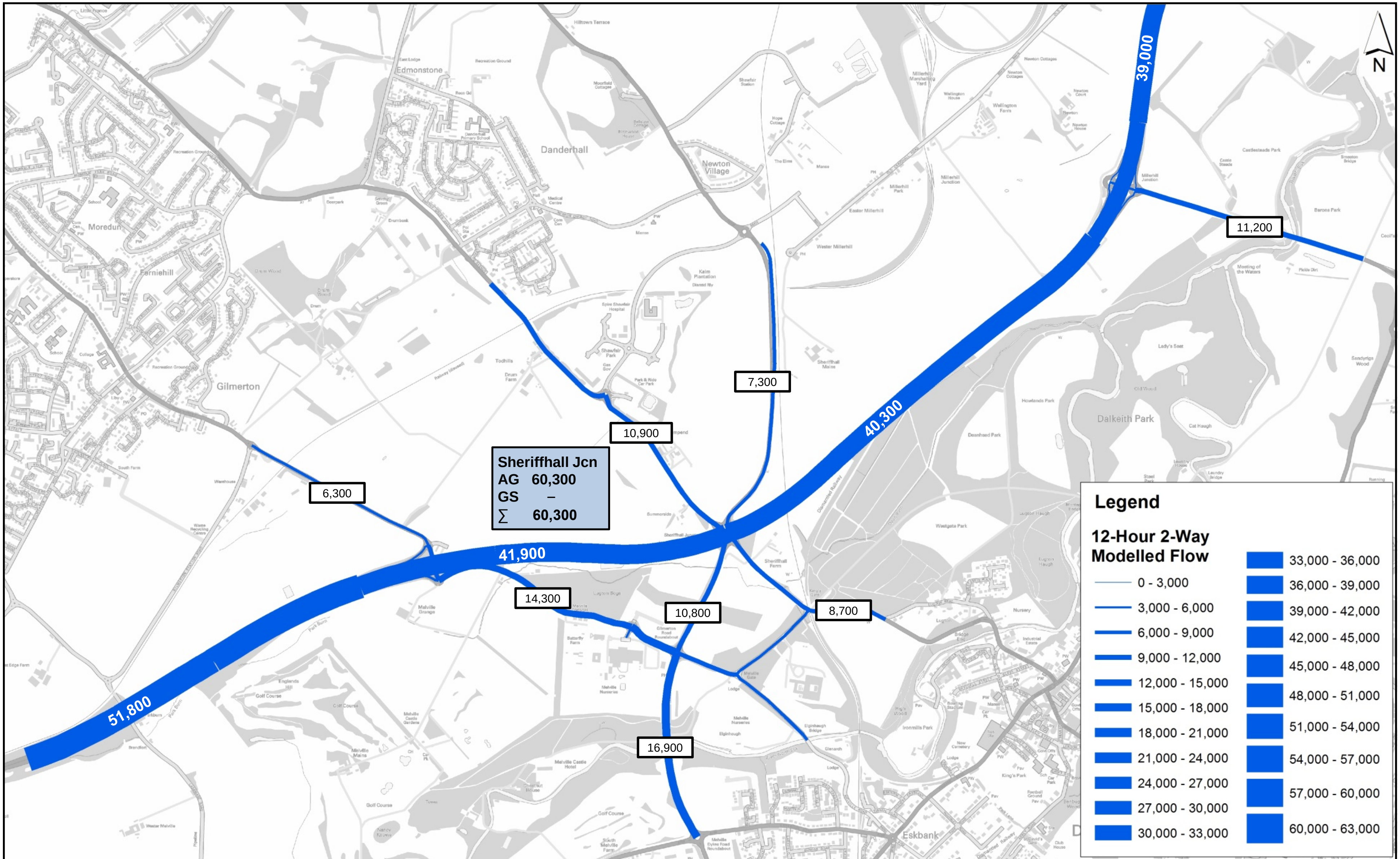
The changes in traffic flows through Sheriffhall junction are summarised in **Table 8.1**.

Table 8.1 – Total Sheriffhall Junction Traffic Flow (12-hour AAWDT Flows)

Location	Base	Option A	Option A Diff	Option B	Option B Diff	Option C	Option C Diff
2024 Junction Flow	60,299	35,732	-40.7%	35,895	-40.5%	35,940	-40.4%
2024 A720 Through Traffic	-	35,689	-	35,682	-	35,680	-
2024 Total Sheriffhall Flow	60,299	71,421	+18.4%	71,577	+18.7%	71,620	+18.8%
2030 Junction Flow	*60,299	38,373	-36.4%	38,500	-36.2%	37,905	-37.1%
2030 A720 Through Traffic	-	38,321	-	38,315	-	37,777	-
2030 Total Sheriffhall Flow	*60,299	76,694	+27.2%	76,815	+27.4%	75,682	+25.5%

*Zero traffic growth has been applied in the Base model beyond the 2024 Opening Year

Examination of these results indicates that total traffic flows through the junction will increase by between 18% and 19% in 2024 due to the release of suppressed demand. However, the provision of the grade-separated junction would also reduce traffic flow through the junction by between 40% and 41% in 2024 due to the removal of A720 through traffic.

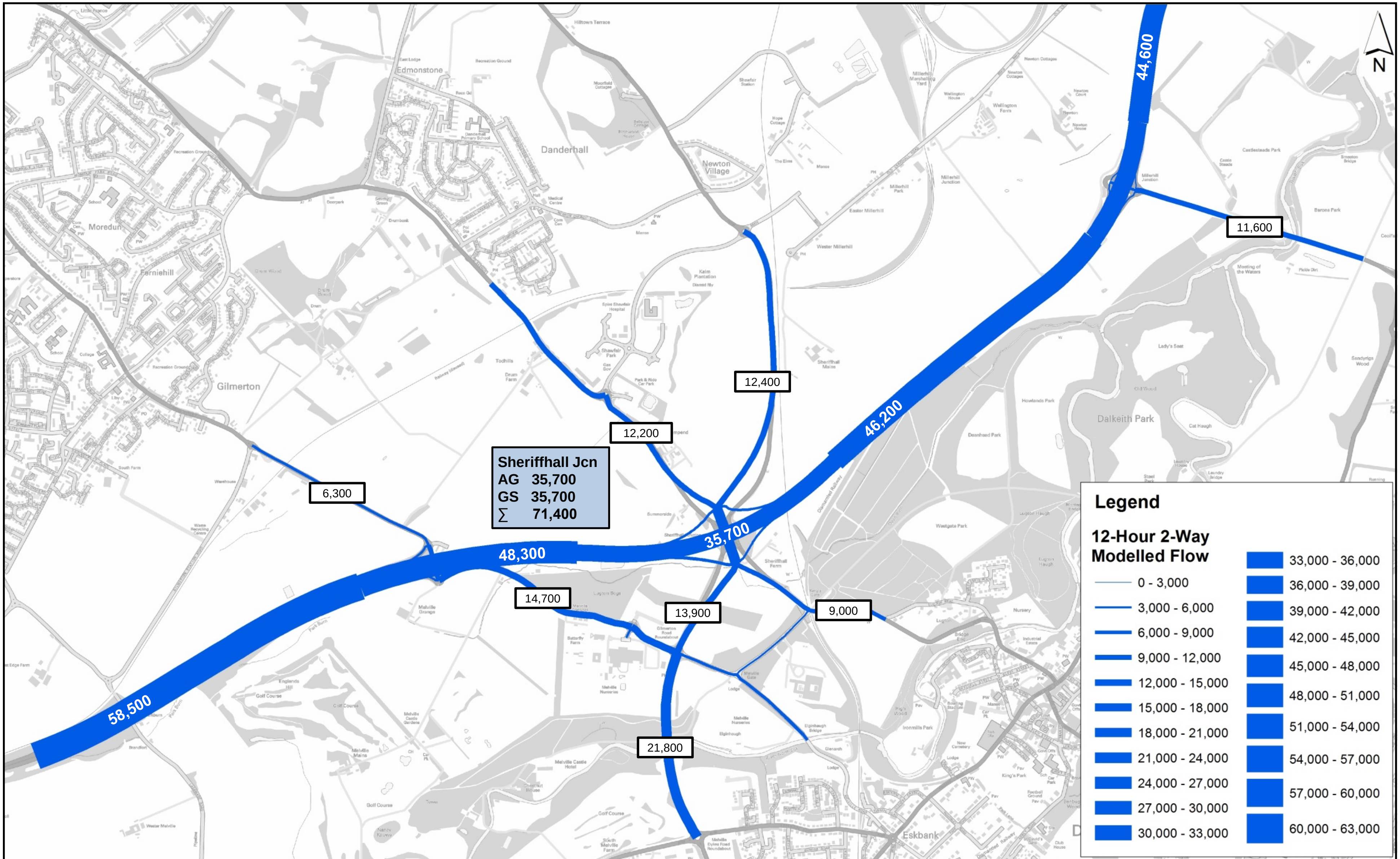


Notes: Modelled Flows rounded to nearest 100 vehicles. AG=At Grade, GS=Grade Separated, ∑=Total Junction Flow

1,000	A720 Mainline Flow
1,000	Side Road Flow

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.1
12-Hr Traffic Flow Bandwidth – Base Network
2024 Opening Year



AECOM

Source:

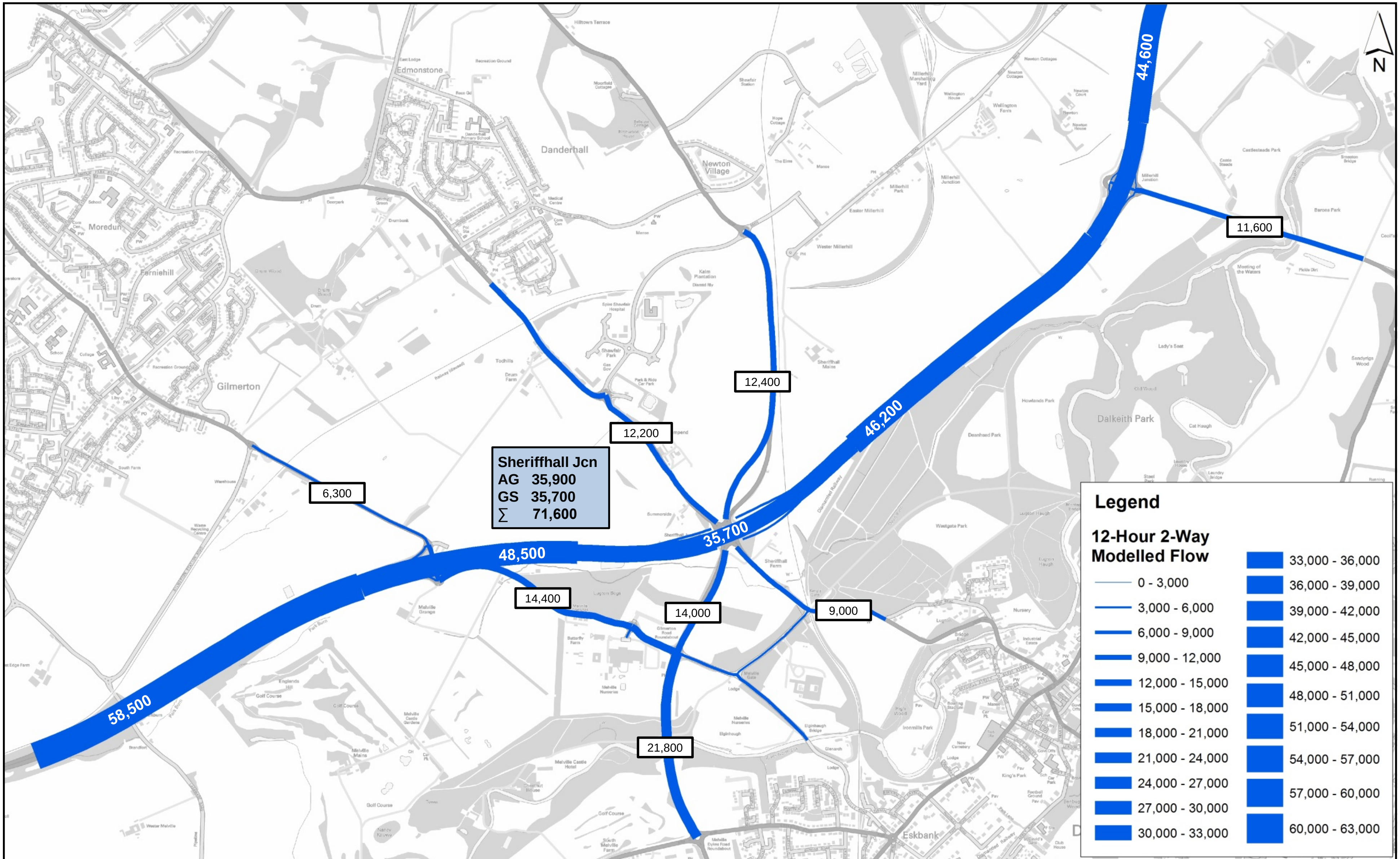
Notes: Modelled Flows rounded to nearest 100 vehicles. AG=At Grade, GS=Grade Separated, ∑=Total Junction Flow

1,000 A720 Mainline Flow

1,000 Side Road Flow

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.2
12-Hr Traffic Flow Bandwidth – Design Option A Network
2024 Opening Year



Source:

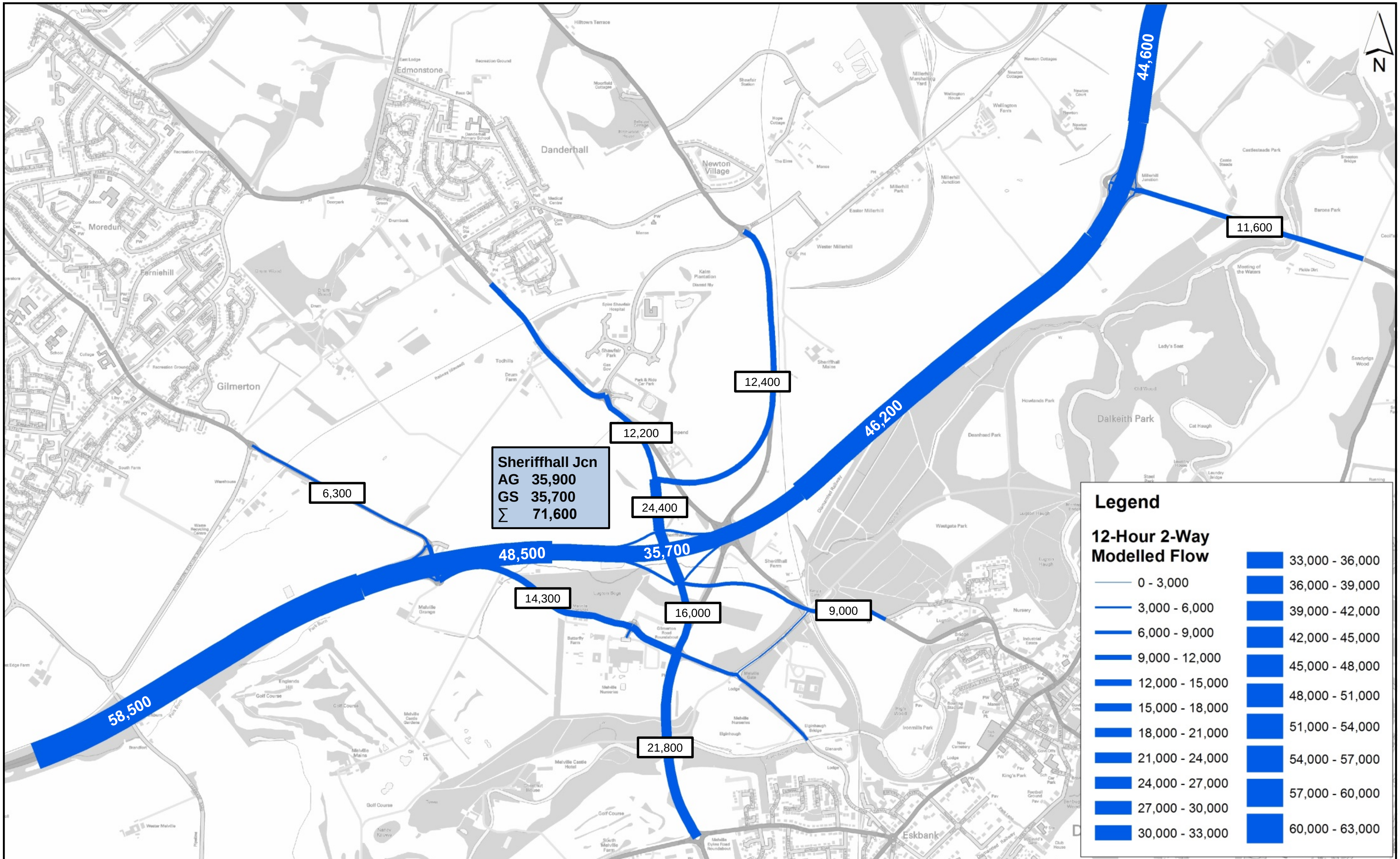
Notes: Modelled Flows rounded to nearest 100 vehicles. AG=At Grade, GS=Grade Separated, ∑=Total Junction Flow

1,000 A720 Mainline Flow

1,000 Side Road Flow

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.3
12-Hr Traffic Flow Bandwidth – Design Option B Network
2024 Opening Year



AECOM

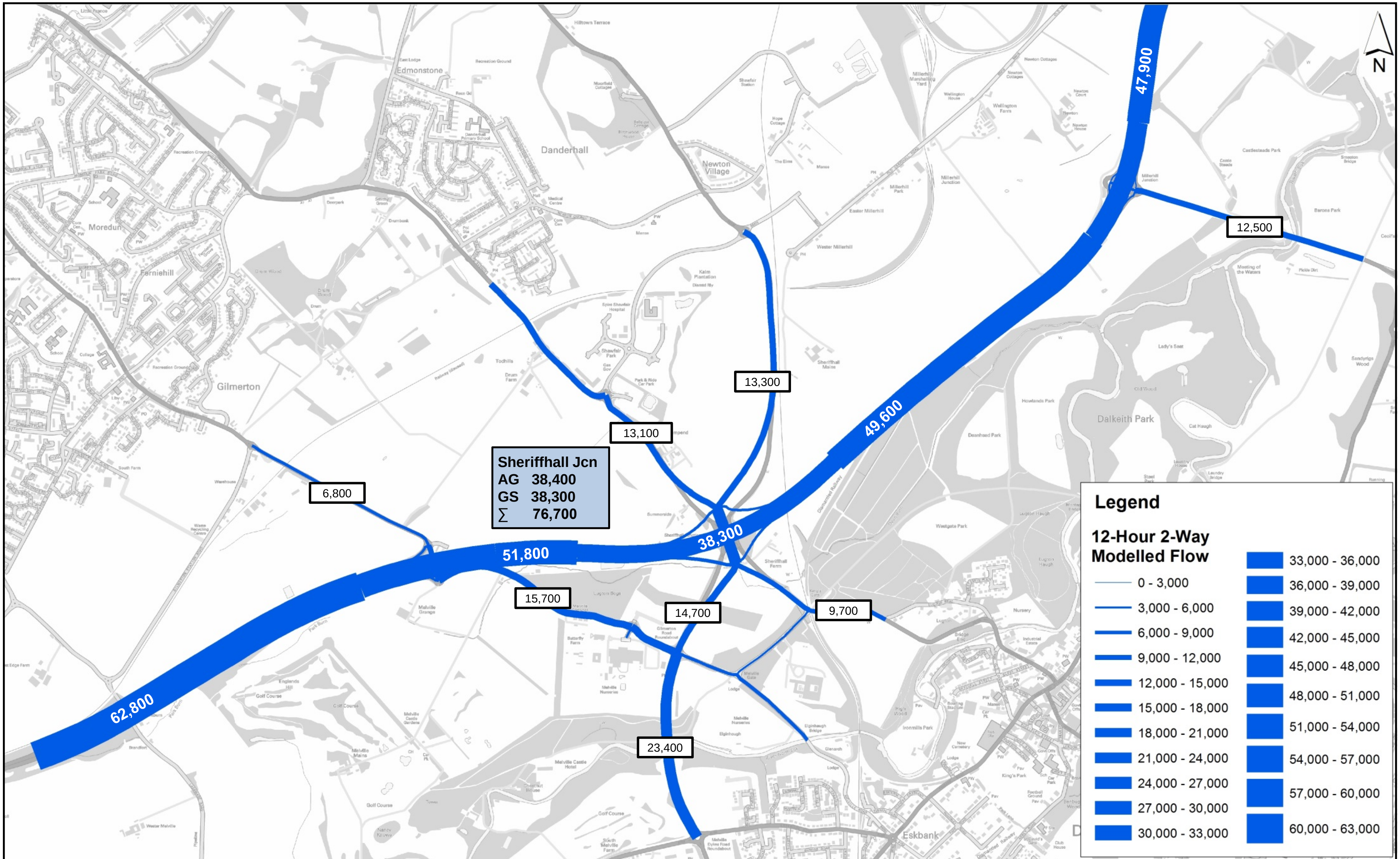
Source:

Notes: Modelled Flows rounded to nearest 100 vehicles. AG=At Grade, GS=Grade Separated, ∑=Total Junction Flow

1,000	A720 Mainline Flow
1,000	Side Road Flow

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.4
12-Hr Traffic Flow Bandwidth – Design Option C Network
2024 Opening Year

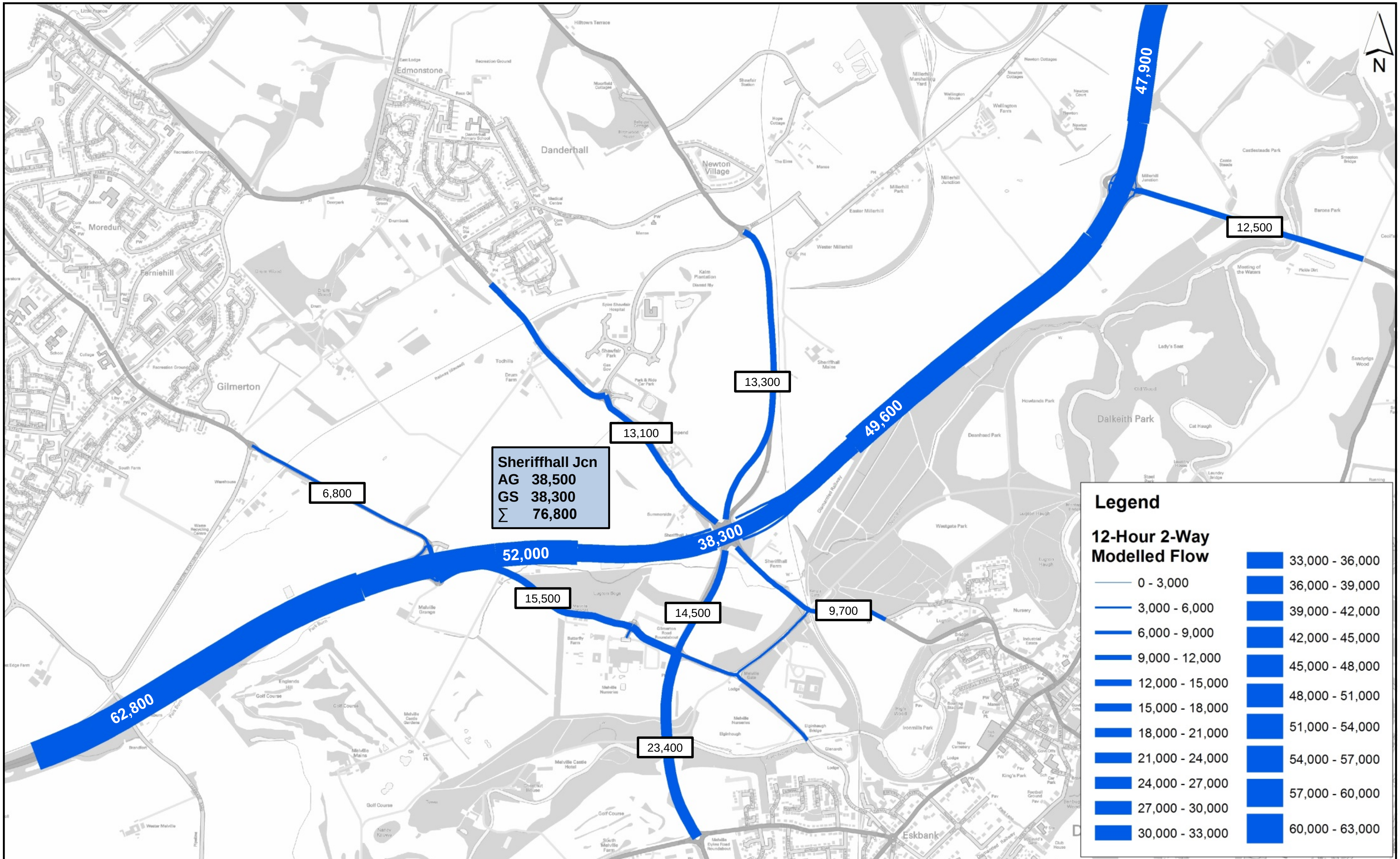


Notes: Modelled Flows rounded to nearest 100 vehicles. AG=At Grade, GS=Grade Separated, ∑=Total Junction Flow

1,000	A720 Mainline Flow
1,000	Side Road Flow

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.5
12-Hr Traffic Flow Bandwidth – Design Option A Network
2030 Future Year



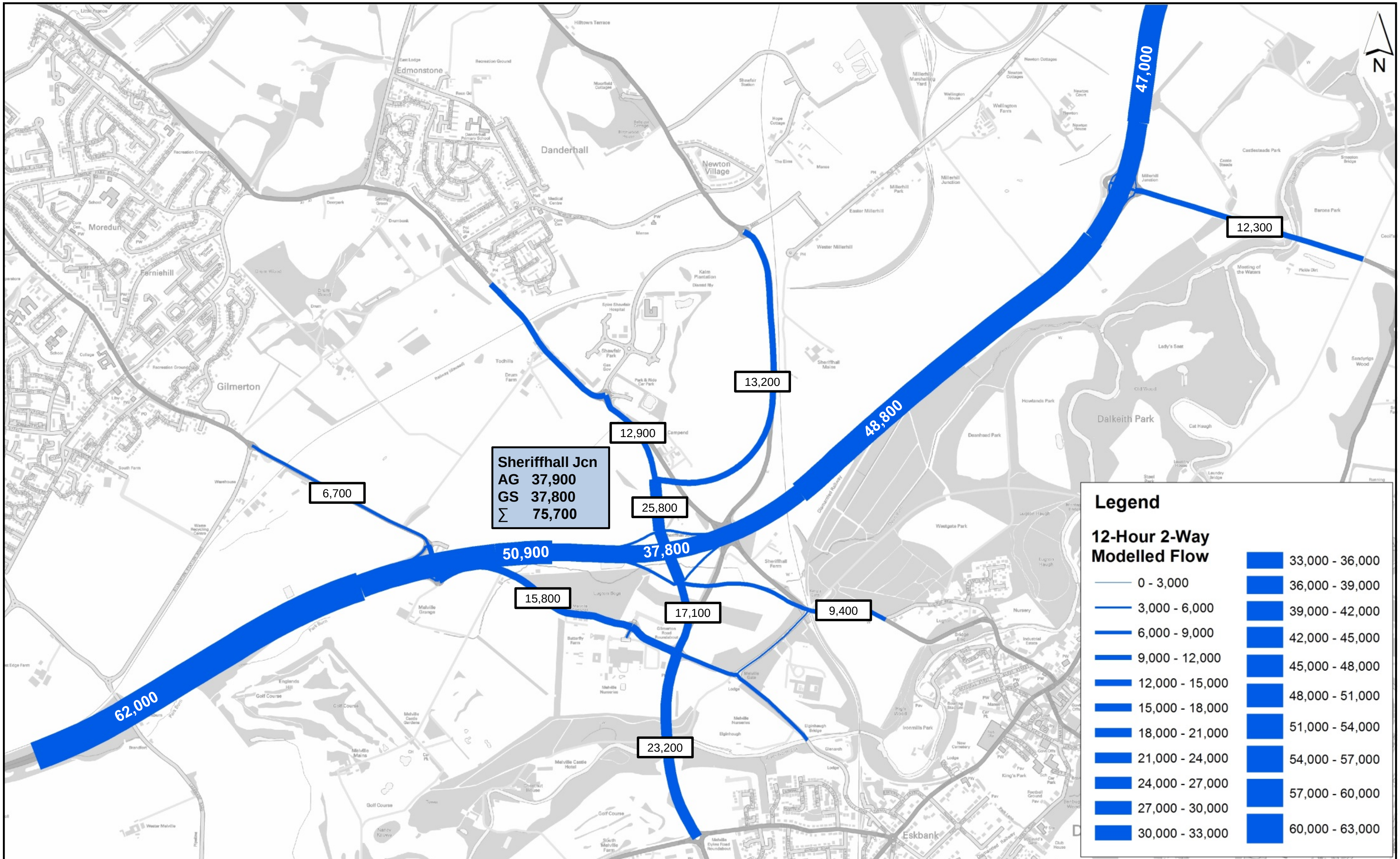
AECOM

Notes: Modelled Flows rounded to nearest 100 vehicles. AG=At Grade, GS=Grade Separated, ∑=Total Junction Flow

1,000	A720 Mainline Flow
1,000	Side Road Flow

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.6
12-Hr Traffic Flow Bandwidth – Design Option B Network
2030 Future Year



AECOM

Source:

Notes: Modelled Flows rounded to nearest 100 vehicles. AG=At Grade, GS=Grade Separated, ∑=Total Junction Flow

1,000	A720 Mainline Flow
1,000	Side Road Flow

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.7
12-Hr Traffic Flow Bandwidth – Design Option C Network
2030 Future Year

8.2 Journey Times

Savings in journey times are generally one of the most significant benefits resulting from the provision of a new transport improvement scheme.

Paramics reports average speeds across all links in the modelled network, which includes any junction delays associated with queueing vehicles.

The modelled average AM (0700-1000), Inter-Peak (1000-1500), PM (1500-1900) and 12-hour link speeds on the Base Network in 2014, 2024 and 2030 are shown in **Figures 8.8 to 8.19**. The modelled average AM, Inter-Peak, PM and 12-hour link speeds on the Improvement Options A, B and C Networks in 2024 and 2030 are shown in **Figures 8.20 to 8.43.**

In addition, Paramics also reports average journey speeds and times along predefined routes in the modelled network. Three specific routes have been defined to provide an indication of changes in conditions on the local network. The key journey time routes which have been defined in the Paramics model are the A720 mainline, the A7 and the A6106. These routes are shown in **Figure 8.44**.

AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.8
Base Network – Average Link Speeds
2014 AM Period

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2
Traffic & Economic Assessment Report

Figure 8.9
Base Network – Average Link Speeds
2014 Inter-Peak Period

AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.10
Base Network – Average Link Speeds
2014 PM Period

AECOM

Source:

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2
Traffic & Economic Assessment Report

Figure 8.11
Base Network – Average Link Speeds
2014 12-Hour Period

AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.12
Base Network – Average Link Speeds
2024 AM Period

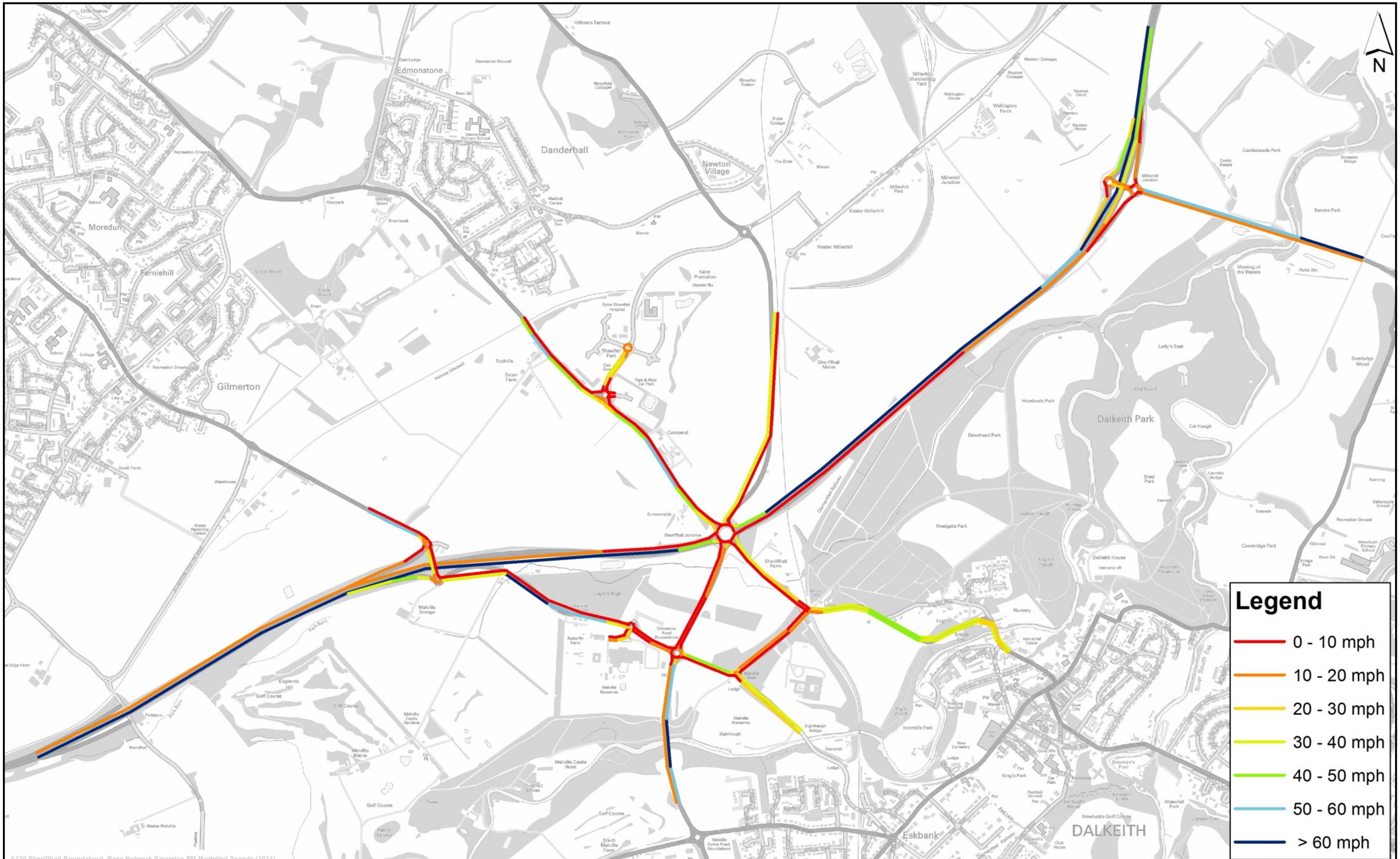
AECOM

Source:

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.13
Base Network – Average Link Speeds
2024 Inter-Peak Period



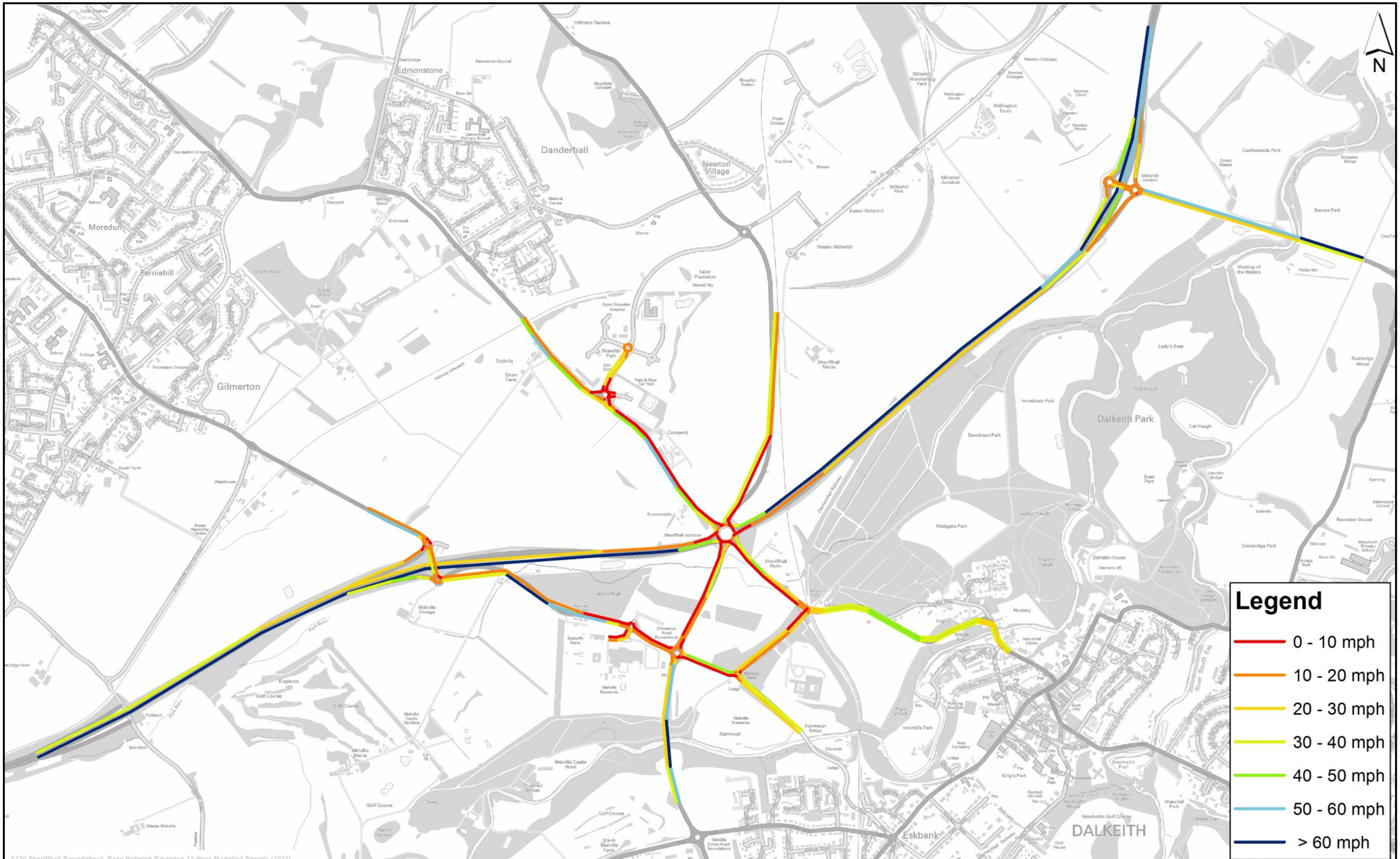
AECOM

Source:

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.14
Base Network – Average Link Speeds
2024 PM Period



AECOM

Source:

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.15
Base Network – Average Link Speeds
2024 12-Hour Period

AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.16
Base Network – Average Link Speeds
2030 AM Period

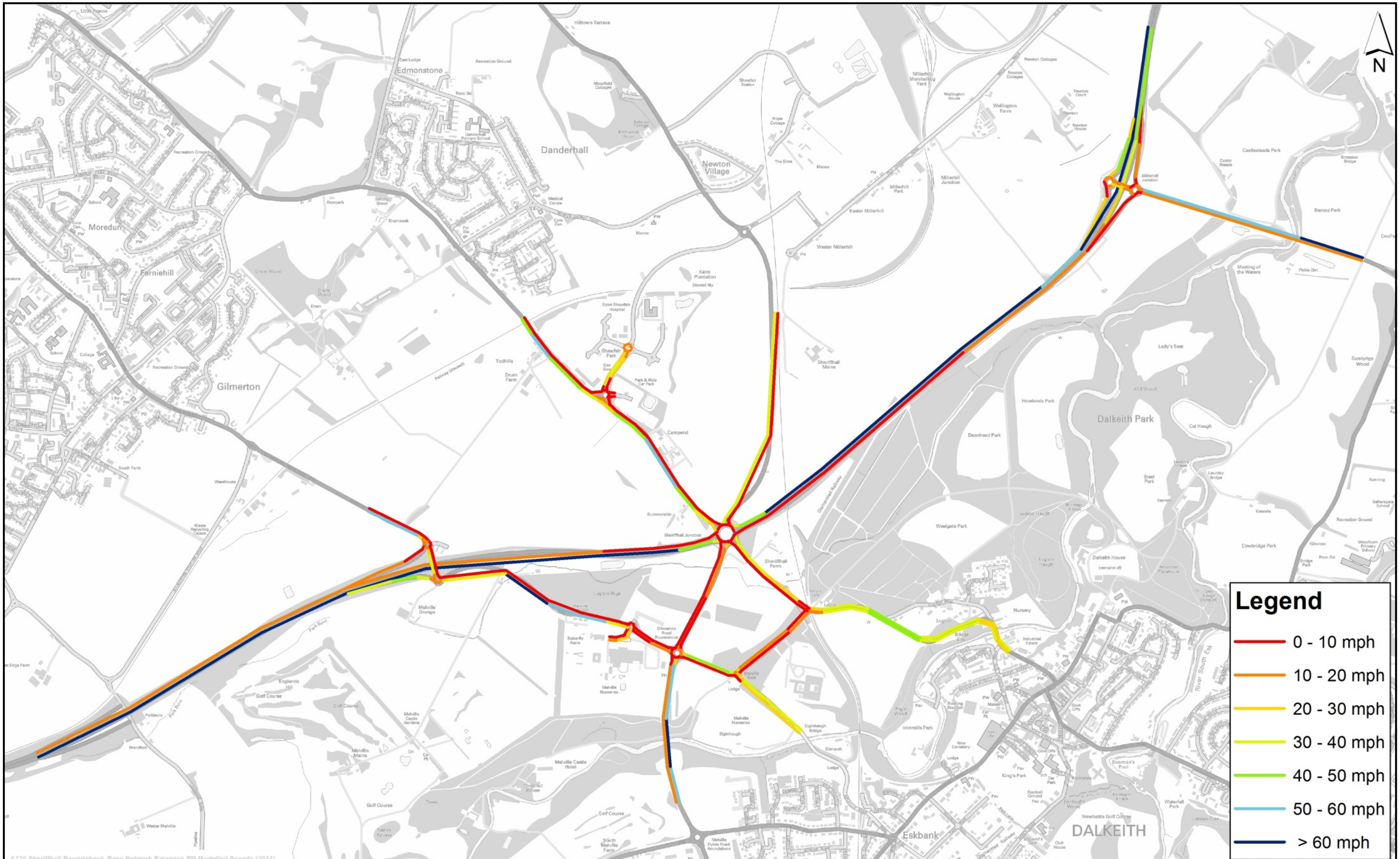
AECOM

Source:

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.17
Base Network – Average Link Speeds
2030 Inter-Peak Period



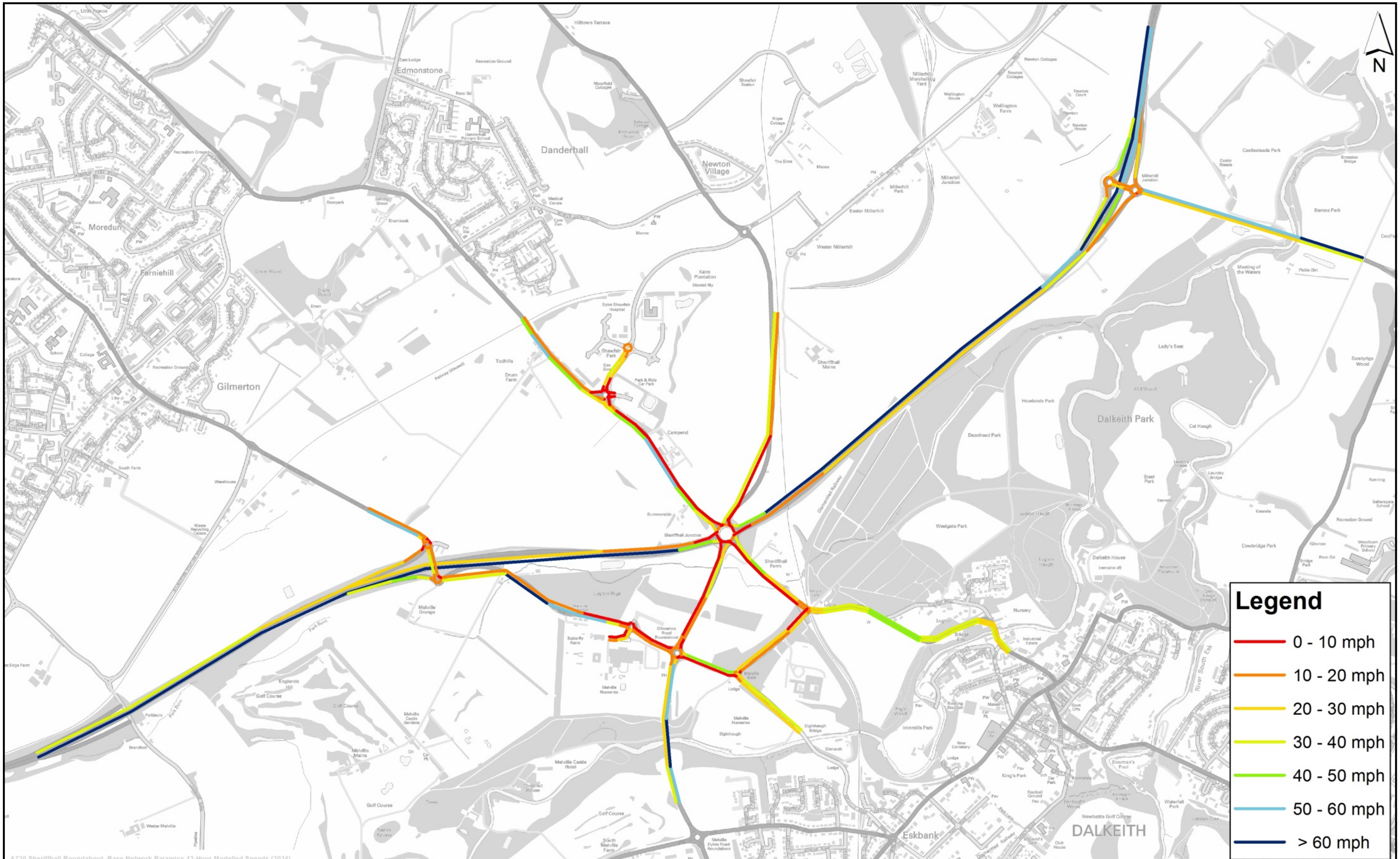
AECOM

Source:

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.18
Base Network – Average Link Speeds
2030 PM Period



AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.19
Base Network – Average Link Speeds
2030 12-Hour Period

AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.20
Design Option A – Average Link Speeds
2024 AM Period

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.21
Design Option A – Average Link Speeds
2024 Inter-Peak Period

AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.22
Design Option A – Average Link Speeds
2024 PM Period

AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.23
Design Option A – Average Link Speeds
2024 12-Hour Period

AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.24
Design Option B – Average Link Speeds
2024 AM Period

AECOM

Source:

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.25
Design Option B – Average Link Speeds
2024 Inter-Peak Period

AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.26
Design Option B – Average Link Speeds
2024 PM Period

AECOM	Source: © Crown copyright and database right (2017). All rights reserved. Ordnance Survey License number 100046668.	Notes:	**A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report** Figure 8.27 Design Option B – Average Link Speeds 2024 12-Hour Period

AECOM	Source: © Crown copyright and database right (2017). All rights reserved. Ordnance Survey License number 100046668.	Notes:	**A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report** Figure 8.28 Design Option C – Average Link Speeds 2024 AM Period

Source:

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.29
Design Option C – Average Link Speeds
2024 Inter-Peak Period

AECOM

Source:

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

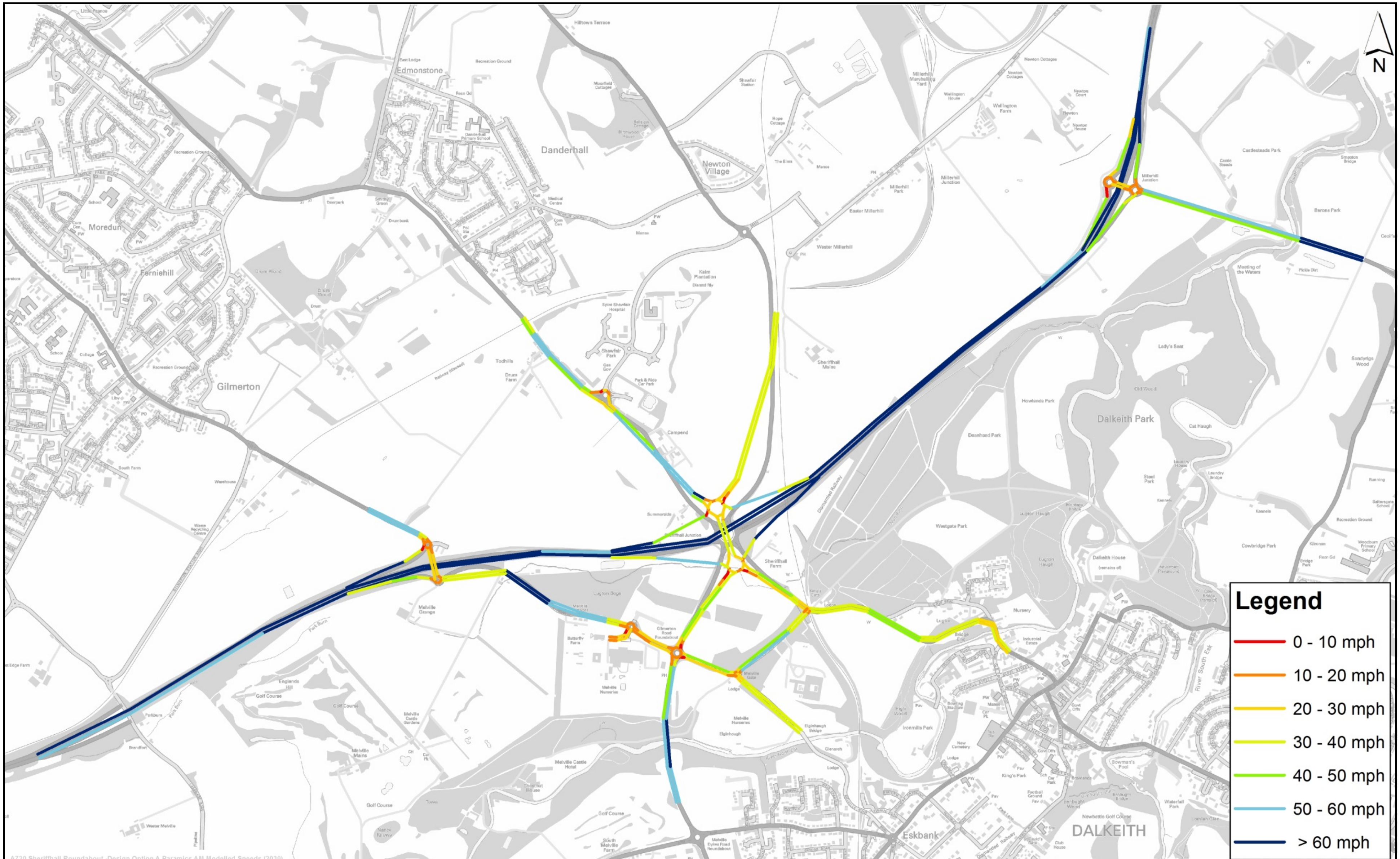
Figure 8.30
Design Option C – Average Link Speeds
2024 PM Period

AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.31
Design Option C – Average Link Speeds
2024 12-Hour Period



AECOM	Source: © Crown copyright and database right (2017). All rights reserved. Ordnance Survey License number 100046668.	Notes:	**A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report** Figure 8.32 Design Option A – Average Link Speeds 2030 AM Period

AECOM

Source:

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.33
Design Option A – Average Link Speeds
2030 Inter-Peak Period

AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.34
Design Option A – Average Link Speeds
2030 PM Period

AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.35
Design Option A – Average Link Speeds
2030 12-Hour Period

AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.36
Design Option B – Average Link Speeds
2030 AM Period

AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.37
Design Option B – Average Link Speeds
2030 Inter-Peak Period

AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.38
Design Option B – Average Link Speeds
2030 PM Period

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.39
Design Option B – Average Link Speeds
2030 12-Hour Period

AECOM	Source: © Crown copyright and database right (2017). All rights reserved. Ordnance Survey License number 100046668.	Notes:	**A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report** Figure 8.40 Design Option C – Average Link Speeds 2030 AM Period

AECOM

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.41
Design Option C – Average Link Speeds
2030 Inter-Peak Period

AECOM

Source:

Ordnance Survey License number 100046668.

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.42
Design Option C – Average Link Speeds
2030 PM Period

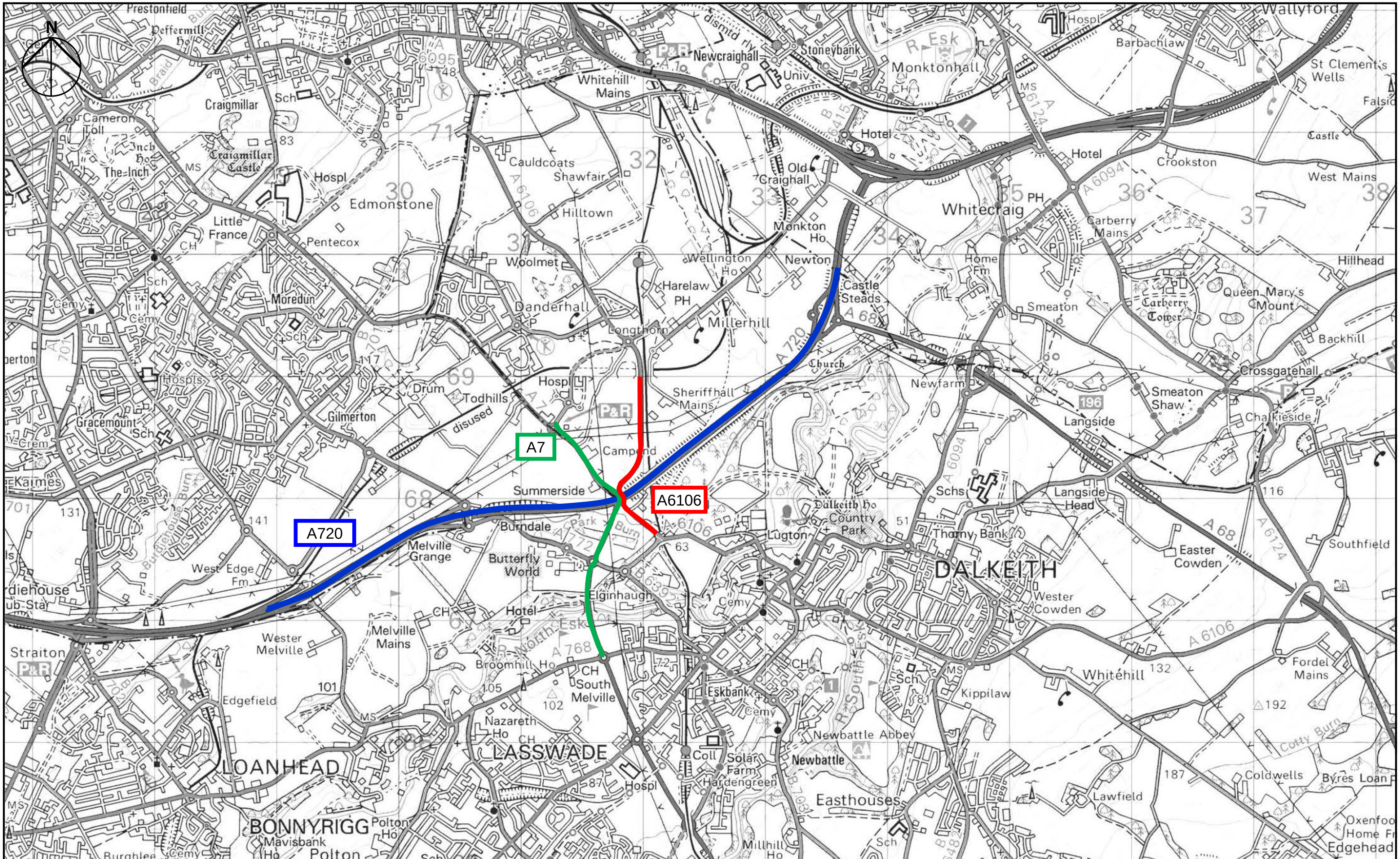
AECOM

Source:

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.43
Design Option C – Average Link Speeds
2030 12-Hour Period



Source:

Notes:

A720 Sheriffhall Roundabout – DMRB Stage 2 Traffic & Economic Assessment Report

Figure 8.44
Modelled Journey Time Routes

Average Journey Speeds – 2024

The average AM, Inter-Peak, PM and 12-hour journey speeds for each route by direction in the Base Network and each of the three Improvement Option Networks in 2024 are shown in **Tables 8.2 to 8.5**.

Table 8.2 – Average Journey Speeds (mph), Base 2024

	A720 E/b	A720 W/b	A7 N/b	A7 S/b	A6106 N/b	A6106 S/b
AM Period	54.2	55.0	15.8	29.1	11.5	22.0
IP Period	45.2	54.6	30.1	28.1	16.7	22.5
PM Period	18.0	17.5	8.7	6.9	6.5	4.1
12-Hour	30.8	32.3	13.9	12.3	9.6	7.7

Table 8.3 – Average Journey Speeds (mph), Option A 2024

	A720 E/b	A720 W/b	A7 N/b	A7 S/b	A6106 N/b	A6106 S/b
AM Period	63.9	64.6	36.1	36.2	28.9	30.9
IP Period	64.1	65.0	42.8	36.5	31.6	31.3
PM Period	62.5	64.5	39.6	32.5	30.8	29.8
12-Hour	63.4	64.7	39.1	35.2	30.4	30.5

Examination of the above journey speed information indicates that for predicted 2024 traffic conditions, Improvement Option A operates more efficiently than the Base Network, even including additional traffic growth due to the release of suppressed demand.

During the 12-hour period, the strategic A720 traffic experiences an increase in average journey speed from approximately 31mph to 63mph in an eastbound direction, and approximately 32mph to 65mph in a westbound direction.

During the 12-hour period, the local A7 traffic experiences an increase in average journey speed from approximately 14mph to 39mph in a northbound direction, and approximately 12mph to 35mph in a southbound direction.

During the 12-hour period, the local A6106 traffic experiences an increase in average journey speed from approximately 10mph to 30mph in a northbound direction, and approximately 8mph to 31mph in a southbound direction.

Table 8.4 – Average Journey Speeds (mph), Option B 2024

	A720 E/b	A720 W/b	A7 N/b	A7 S/b	A6106 N/b	A6106 S/b
AM Period	63.9	64.7	40.7	38.2	32.4	33.0
IP Period	64.1	65.1	47.8	38.8	34.0	33.6
PM Period	62.5	64.6	45.5	32.5	33.7	31.2
12-Hour	63.5	64.8	44.4	36.7	33.3	32.3

Examination of the above journey speed information indicates that for predicted 2024 traffic conditions, Improvement Option B operates more efficiently than the Base Network, even including additional traffic growth due to the release of suppressed demand.

During the 12-hour period, the strategic A720 traffic experiences an increase in average journey speed from approximately 31mph to 64mph in an eastbound direction, and approximately 32mph to 65mph in a westbound direction.

During the 12-hour period, the local A7 traffic experiences an increase in average journey speed from approximately 14mph to 44mph in a northbound direction, and approximately 12mph to 37mph in a southbound direction.

During the 12-hour period, the local A6106 traffic experiences an increase in average journey speed from approximately 10mph to 33mph in a northbound direction, and approximately 8mph to 32mph in a southbound direction.

Table 8.5 – Average Journey Speeds (mph), Option C 2024

	A720 E/b	A720 W/b	A7 N/b	A7 S/b	A6106 N/b	A6106 S/b
AM Period	63.9	64.6	34.7	30.6	29.9	31.2
IP Period	64.0	65.0	39.8	32.1	31.5	31.8
PM Period	62.4	64.4	38.4	25.5	31.0	29.6
12-Hour	63.4	64.7	37.4	29.7	30.7	30.6

Examination of the above journey speed information indicates that for predicted 2024 traffic conditions, Improvement Option C operates more efficiently than the Base Network, even including additional traffic growth due to the release of suppressed demand.

During the 12-hour period, the strategic A720 traffic experiences an increase in average journey speed from approximately 31mph to 63mph in an eastbound direction, and approximately 32mph to 65mph in a westbound direction.

During the 12-hour period, the local A7 traffic experiences an increase in average journey speed from approximately 14mph to 37mph in a northbound direction, and approximately 12mph to 30mph in a southbound direction.

During the 12-hour period, the local A6106 traffic experiences an increase in average journey speed from approximately 10mph to 31mph in a northbound direction, and approximately 8mph to 31mph in a southbound direction.

Average Journey Speeds – 2030

The average AM, Inter-Peak, PM and 12-hour journey speeds for each route by direction in each of the three Improvement Option Networks in 2030 are shown in **Tables 8.6 to 8.8**

Table 8.6 – Average Journey Speeds (mph), Option A 2030

	A720 E/b	A720 W/b	A7 N/b	A7 S/b	A6106 N/b	A6106 S/b
AM Period	63.3	64.1	31.8	34.9	26.0	30.1
IP Period	63.6	64.5	41.6	35.8	31.2	31.0
PM Period	61.9	63.9	37.3	29.3	30.2	27.4
12-Hour	62.9	64.2	36.3	33.6	28.8	28.9

Examination of the above journey speed information indicates that for predicted 2030 traffic conditions, Improvement Option A operates more efficiently than the Base Network, even including additional traffic growth due to the release of suppressed demand and further growth between 2024 and 2030 based on TMfS12 forecasts.

During the 12-hour period, the strategic A720 traffic experiences an increase in average journey speed from approximately 31mph to 63mph in an eastbound direction, and approximately 32mph to 64mph in a westbound direction.

During the 12-hour period, the local A7 traffic experiences an increase in average journey speed from approximately 14mph to 36mph in a northbound direction, and approximately 12mph to 34mph in a southbound direction.

During the 12-hour period, the local A6106 traffic experiences an increase in average journey speed from approximately 10mph to 29mph in a northbound direction, and approximately 8mph to 29mph in a southbound direction.

Table 8.7 – Average Journey Speeds (mph), Option B 2030

	A720 E/b	A720 W/b	A7 N/b	A7 S/b	A6106 N/b	A6106 S/b
AM Period	63.3	64.1	31.2	34.4	26.0	31.5
IP Period	63.6	64.6	47.9	38.9	34.2	33.6
PM Period	62.0	63.0	42.9	29.4	33.9	27.9
12-Hour	62.9	63.9	39.7	35.5	30.3	29.9

Examination of the above journey speed information indicates that for predicted 2030 traffic conditions, Improvement Option B operates more efficiently than the Base Network, even including additional traffic growth due to the release of suppressed demand and further growth between 2024 and 2030 based on TMfS12 forecasts.

During the 12-hour period, the strategic A720 traffic experiences an increase in average journey speed from approximately 31mph to 63mph in an eastbound direction, and approximately 32mph to 64mph in a westbound direction.

During the 12-hour period, the local A7 traffic experiences an increase in average journey speed from approximately 14mph to 40mph in a northbound direction, and approximately 12mph to 36mph in a southbound direction.

During the 12-hour period, the local A6106 traffic experiences an increase in average journey speed from approximately 10mph to 30mph in a northbound direction, and approximately 8mph to 30mph in a southbound direction.

Table 8.8 – Average Journey Speeds (mph), Option C 2030

	A720 E/b	A720 W/b	A7 N/b	A7 S/b	A6106 N/b	A6106 S/b
AM Period	61.6	63.8	29.2	27.9	27.8	30.3
IP Period	63.5	64.2	39.3	31.0	31.2	31.3
PM Period	54.3	34.7	34.0	15.3	13.1	19.0
12-Hour	59.5	50.4	33.4	24.2	22.0	23.1

Examination of the above journey speed information indicates that for predicted 2030 traffic conditions, Improvement Option C operates more efficiently than the Base Network, even including additional traffic growth due to the release of suppressed demand and further growth between 2024 and 2030 based on TMfS12 forecasts.

During the 12-hour period, the strategic A720 traffic experiences an increase in average journey speed from approximately 31mph to 60mph in an eastbound direction, and approximately 32mph to 50mph in a westbound direction.

During the 12-hour period, the local A7 traffic experiences an increase in average journey speed from approximately 14mph to 33mph in a northbound direction, and approximately 12mph to 24mph in a southbound direction.

During the 12-hour period, the local A6106 traffic experiences an increase in average journey speed from approximately 10mph to 22mph in a northbound direction, and approximately 8mph to 23mph in a southbound direction.

Average Journey Times – 2024

The average AM, Inter-Peak, PM and 12-hour journey times for each route by direction in the Base Network and each of the 3 Improvement Option Networks in 2024, and the corresponding journey time savings are shown in **Tables 8.9 to 8.12**.

Table 8.9 – Average Journey Times, Base 2024

	A720 E/b	A720 W/b	A7 N/b	A7 S/b	A6106 N/b	A6106 S/b
AM Period	04:04	03:58	05:06	03:00	05:05	02:32
IP Period	04:52	04:00	02:41	03:06	03:30	02:29
PM Period	12:16	12:28	09:18	12:40	09:00	13:36
12-Hour	07:08	06:46	05:48	07:04	06:04	07:12

Table 8.10 – Average Journey Times, Option A 2024

	A720 E/b	A720 W/b	A7 N/b	A7 S/b	A6106 N/b	A6106 S/b
AM Period	03:25	03:22	02:19	02:30	02:07	01:51
IP Period	03:25	03:21	01:57	02:28	01:57	01:49
PM Period	03:30	03:22	02:06	02:47	02:00	01:55
12-Hour	03:27	03:21	02:08	02:34	02:02	01:53
AM Period Time Saving	00:38	00:37	02:48	00:30	02:57	00:41
IP Period Time Saving	01:27	00:39	00:44	00:38	01:33	00:39
PM Period Time Saving	08:46	09:06	07:12	09:53	07:00	11:41
12-Hour Time Saving	03:42	03:25	03:40	04:30	04:03	05:20

Examination of the above journey time information indicates that for predicted 2024 traffic conditions, Improvement Option A operates more efficiently than the Base Network, even including additional traffic growth due to the release of suppressed demand.

During the 12-hour period, the strategic A720 traffic experiences a journey time saving of approximately 3 minutes 42 seconds in an eastbound direction, and approximately 3 minutes 25 seconds in a westbound direction.

During the 12-hour period, the local A7 traffic experiences a journey time saving of approximately 3 minutes 40 seconds in a northbound direction, and approximately 4 minutes 30 seconds in a southbound direction.

During the 12-hour period, the local A6106 traffic experiences a journey time saving of approximately 4 minutes 03 seconds in a northbound direction, and approximately 5 minutes 20 seconds in a southbound direction.

Table 8.11 – Average Journey Times, Option B 2024

	A720 E/b	A720 W/b	A7 N/b	A7 S/b	A6106 N/b	A6106 S/b
AM Period	03:25	03:21	02:00	02:18	01:54	01:46
IP Period	03:25	03:20	01:42	02:16	01:49	01:44
PM Period	03:30	03:22	01:47	02:43	01:50	01:52
12-Hour	03:27	03:21	01:50	02:24	01:51	01:48
AM Period Time Saving	00:38	00:37	03:07	00:41	03:10	00:46
IP Period Time Saving	01:27	00:40	00:59	00:50	01:41	00:45
PM Period Time Saving	08:46	09:06	07:31	09:57	07:10	11:44
12-Hour Time Saving	03:42	03:25	03:58	04:40	04:13	05:24

Examination of the above journey time information indicates that for predicted 2024 traffic conditions, Improvement Option B operates more efficiently than the Base Network, even including additional traffic growth due to the release of suppressed demand.

During the 12-hour period, the strategic A720 traffic experiences a journey time saving of approximately 3 minutes 42 seconds in an eastbound direction, and approximately 3 minutes 25 seconds in a westbound direction.

During the 12-hour period, the local A7 traffic experiences a journey time saving of approximately 3 minutes 58 seconds in a northbound direction, and approximately 4 minutes 40 seconds in a southbound direction.

During the 12-hour period, the local A6106 traffic experiences a journey time saving of approximately 4 minutes 13 seconds in a northbound direction, and approximately 5 minutes 24 seconds in a southbound direction.

Table 8.12 – Average Journey Times, Option C 2024

	A720 E/b	A720 W/b	A7 N/b	A7 S/b	A6106 N/b	A6106 S/b
AM Period	03:25	03:22	02:16	02:40	02:51	02:32
IP Period	03:25	03:21	01:58	02:32	02:42	02:29
PM Period	03:30	03:22	02:03	03:12	02:44	02:41
12-Hour	03:27	03:22	02:06	02:45	02:46	02:35
AM Period Time Saving	00:38	00:37	02:50	00:20	02:14	00:00
IP Period Time Saving	01:27	00:39	00:43	00:34	00:48	-00:01
PM Period Time Saving	08:45	09:06	07:15	09:28	06:16	10:55
12-Hour Time Saving	03:41	03:25	03:42	04:19	03:18	04:37

Examination of the above journey time information indicates that for predicted 2024 traffic conditions, Improvement Option C operates more efficiently than the Base Network, even including additional traffic growth due to the release of suppressed demand.

During the 12-hour period, the strategic A720 traffic experiences a journey time saving of approximately 3 minutes 41 seconds in an eastbound direction, and approximately 3 minutes 25 seconds in a westbound direction.

During the 12-hour period, the local A7 traffic experiences a journey time saving of approximately 3 minutes 42 seconds in a northbound direction, and approximately 4 minutes 19 seconds in a southbound direction.

During the 12-hour period, the local A6106 traffic experiences a journey time saving of approximately 3 minutes 18 seconds in a northbound direction, and approximately 4 minutes 37 seconds in a southbound direction.

Average Journey Times – 2030

The average AM, Inter-Peak, PM and 12-hour journey times for each route by direction in each of the 3 Improvement Option Networks and 2030, and the corresponding journey time savings relative to the Base Network are shown in **Tables 8.13 to 8.15**.

Table 8.13 – Average Journey Times, Option A 2030

	A720 E/b	A720 W/b	A7 N/b	A7 S/b	A6106 N/b	A6106 S/b
AM Period	03:27	03:23	02:37	02:35	02:22	01:54
IP Period	03:26	03:22	02:00	02:31	01:58	01:51
PM Period	03:32	03:24	02:14	03:05	02:02	02:05
12-Hour	03:29	03:23	02:18	02:41	02:08	01:59
AM Period Time Saving	00:36	00:35	02:29	00:24	02:43	00:38
IP Period Time Saving	01:26	00:38	00:41	00:35	01:32	00:38
PM Period Time Saving	08:43	09:04	07:04	09:35	06:58	11:31
12-Hour	03:40	03:23	03:30	04:23	03:56	05:13

Examination of the above journey time information indicates that for predicted 2030 traffic conditions, Improvement Option A operates more efficiently than the Base Network, even including additional traffic growth due to the release of suppressed demand and further growth between 2024 and 2030 based on TMfS12 forecasts.

During the 12-hour period, the strategic A720 traffic experiences a journey time saving of approximately 3 minutes 40 seconds in an eastbound direction, and approximately 3 minutes 23 seconds in a westbound direction.

During the 12-hour period, the local A7 traffic experiences a journey time saving of approximately 3 minutes 30 seconds in a northbound direction, and approximately 4 minutes 23 seconds in a southbound direction.

During the 12-hour period, the local A6106 traffic experiences a journey time saving of approximately 3 minutes 56 seconds in a northbound direction, and approximately 5 minutes 13 seconds in a southbound direction.

Table 8.14 – Average Journey Times, Option B 2030

	A720 E/b	A720 W/b	A7 N/b	A7 S/b	A6106 N/b	A6106 S/b
AM Period	03:27	03:23	02:37	02:35	02:17	01:47
IP Period	03:26	03:22	01:42	02:17	01:45	01:40
PM Period	03:32	03:27	01:54	03:02	01:45	02:00
12-Hour	03:28	03:24	02:03	02:30	01:58	01:52
AM Period Time Saving	00:36	00:35	02:30	00:24	02:48	00:45
IP Period Time Saving	01:26	00:38	00:59	00:49	01:45	00:49
PM Period Time Saving	08:44	09:01	07:24	09:38	07:15	11:36
12-Hour Time Saving	03:40	03:22	03:45	04:34	04:07	05:20

Examination of the above journey time information indicates that for predicted 2030 traffic conditions, Improvement Option B operates more efficiently than the Base Network, even including additional traffic growth due to the release of suppressed demand and further growth between 2024 and 2030 based on TMfS12 forecasts.

During the 12-hour period, the strategic A720 traffic experiences a journey time saving of approximately 3 minutes 40 seconds in an eastbound direction, and approximately 3 minutes 22 seconds in a westbound direction.

During the 12-hour period, the local A7 traffic experiences a journey time saving of approximately 3 minutes 45 seconds in a northbound direction, and approximately 4 minutes 34 seconds in a southbound direction.

During the 12-hour period, the local A6106 traffic experiences a journey time saving of approximately 4 minutes 07 seconds in a northbound direction, and approximately 5 minutes 20 seconds in a southbound direction.

Table 8.15 – Average Journey Times, Option C 2030

	A720 E/b	A720 W/b	A7 N/b	A7 S/b	A6106 N/b	A6106 S/b
AM Period	03:33	03:24	02:42	02:55	03:03	02:37
IP Period	03:27	03:23	02:00	02:38	02:43	02:32
PM Period	04:02	06:16	02:19	05:20	06:28	04:10
12-Hour	03:41	04:19	02:21	03:22	03:52	03:25
AM Period Time Saving	00:31	00:34	02:25	00:04	02:01	-00:05
IP Period Time Saving	01:26	00:37	00:41	00:29	00:47	-00:03
PM Period Time Saving	08:14	06:12	06:59	07:19	02:32	09:26
12-Hour Time Saving	03:28	02:28	03:27	03:42	02:13	03:47

Examination of the above journey time information indicates that for predicted 2030 traffic conditions, Improvement Option C operates more efficiently than the Base Network, even including additional traffic growth due to the release of suppressed demand and further growth between 2024 and 2030 based on TMfS12 forecasts.

During the 12-hour period, the strategic A720 traffic experiences a journey time saving of approximately 3 minutes 28 seconds in an eastbound direction, and approximately 2 minutes 28 seconds in a westbound direction.

During the 12-hour period, the local A7 traffic experiences a journey time saving of approximately 3 minutes 27 seconds in a northbound direction, and approximately 3 minutes 42 seconds in a southbound direction.

During the 12-hour period, the local A6106 traffic experiences a journey time saving of approximately 2 minutes 13 seconds in a northbound direction, and approximately 3 minutes 47 seconds in a southbound direction.

Comparison of Improvement Options

The 12-hour Journey Speeds and Times for the Base network and each of the three Design networks in 2030, along with corresponding savings in Journey Times, are summarised in **Table 8.16**.

Table 8.16 –12-hour Journey Speeds and Times Summary – 2030

		A720 E/b	A720 W/b	A7 N/b	A7 S/b	A6106 N/b	A6106 S/b
Journey Speeds (mph)	Base*	30.8	32.3	13.9	12.3	9.6	7.7
	Option A	62.9	64.2	36.3	33.6	28.8	28.9
	Option B	62.9	63.9	39.7	35.5	30.3	29.9
	Option C	59.5	50.4	33.4	24.2	22.0	23.1
Journey Times (mm:ss)	Base*	07:08	06:46	05:48	07:04	06:04	07:12
	Option A	03:29	03:23	02:18	02:41	02:08	01:59
	Option B	03:28	03:24	02:03	02:30	01:58	01:52
	Option C	03:41	04:19	02:21	03:22	03:52	03:25
Journey Time Savings (mm:ss)	Base*	-	-	-	-	-	-
	Option A	03:40	03:23	03:30	04:23	03:56	05:13
	Option B	03:40	03:22	03:45	04:34	04:07	05:20
	Option C	03:28	02:28	03:27	03:42	02:13	03:47
Journey Time Savings (%)	Base*	-	-	-	-	-	-
	Option A	51%	50%	60%	62%	65%	72%
	Option B	51%	50%	65%	65%	68%	74%
	Option C	49%	36%	59%	52%	37%	53%

*Journey Speeds and Times from the Base model are the same in 2024 and 2030 due to the application of zero traffic growth beyond 2024

Examination of the above journey speed and time information indicates that Improvement Option C is operating less efficiently than Improvement Option A and Improvement Option B.

Improvement Option C is located to the west of the existing Sheriffhall Roundabout, and as such is closer in proximity to Gilmerton Roundabout on the A7.

This has the effect that there is a shorter distance on the A7 to accommodate vehicles queueing on the southbound approach to Gilmerton Roundabout, before queues extend back onto the southern dumb-bell of the Improvement Option C grade-separated junction layout. This causes blocked access to traffic trying to use this roundabout from the A720 westbound off-slip, which then causes queuing down the off-slip and back onto the A720 itself.

9 ECONOMIC ASSESSMENT

9.1 Introduction

PEARS (Program for the Economic Assessment of Road Schemes) is an economic assessment package that has been specifically designed for use with the output from traffic microsimulation models and has therefore been used to quantify the operational benefits of the Improvement Options relative to the Base network in monetary terms.

Paramics includes the function to simulate the effects of the random variations in vehicle behaviour that occur naturally on the road network throughout the day, which can result in variability in the modelled results. To minimise the effects of any abnormal results, the economic assessment is based on the aggregation of multiple runs. The results from 20 separate model runs have therefore been extracted from the Paramics models and input into PEARS to provide a reasonable basis to compare the economic impact of each modelled Improvement Option relative to the Base network model over the 60 year assessment period.

9.2 PEARS Appraisal

A detailed breakdown of the PEARS results is contained in **Table 9.1** and indicates the transport economic efficiency, public accounts and monetised costs and benefits as defined in PEARS Tables 15A to 15C.

In accordance with current government guidelines on the reporting of transport economic efficiency, the results of the economic assessment are presented in the market prices unit of account.

Table 9.1 – PEARS Assessment Summary

	Option A	Option B	Option C
Non-Business User Benefits			
Travel Time	347.09	335.20	186.00
Vehicle Operating Costs	-27.45	-27.41	-34.99
Travel Time and VOC during Construction (QUADRO)	-	-	-
Travel Time and VOC during Maintenance (QUADRO)	-	-	-
Net Non-Business User Benefits	**319.64**	**307.79**	**151.01**
Business User Benefits			
Travel Time	287.47	277.73	160.21
Vehicle Operating Costs	-2.34	-2.53	-12.94
Travel Time and VOC during Construction (QUADRO)	-	-	-
Travel Time and VOC during Maintenance (QUADRO)	-	-	-
Subtotal	285.13	275.20	147.27
Private Sector Provider Impacts (Operating Costs)	2.86	2.86	0.58
Net Business Impact	**287.99**	**278.06**	**147.85**
Total Present Value of TEE Benefits	**607.63**	**585.85**	**298.86**
Government Funding			
Investment Costs	64.75	59.85	61.94
Operating Costs	0.00	0.00	0.00
Present Value of Costs	**64.75**	**59.85**	**61.94**
TEE Benefits			
Emissions	-3.79	-3.87	-6.74
Accident Benefits	-	-	-
Non Business User Benefits	319.64	307.79	151.01
Business User Benefits	287.99	278.06	147.85
Indirect Tax Revenues	9.17	9.37	16.18
Present Value of Benefits (PVB)	**613.01**	**591.35**	**308.30**
Present Value of Costs (PVC)	**64.75**	**59.85**	**61.94**
OVERALL IMPACT			
Net Present Value (NPV)	**548.26**	**531.49**	**246.36**
Benefit to Cost Ratio (BCR)	**9.47**	**9.88**	**4.98**

Based on the estimated scheme costs and the application of the SRM12 and TMfS12 traffic growth projections, as described previously in the report, the economic assessment (excluding Accident Benefits) of the Improvement Options defined using PEARS is summarised in **Table 9.2**.

Table 9.2 – PEARS Assessment Summary (Excluding Accident Benefits)

	Option A	Option B	Option C
Present Value of Benefits (£m)	613.01	591.35	308.30
Present Value of Costs (£m)	64.75	59.85	61.94
Net Present Value (£m)	548.26	531.49	246.36
Benefit to Cost Ratio	9.47	9.88	4.98

9.3 Road Safety

The PEARS assessment software does not consider any aspect of changes in road traffic accidents as part of the scheme assessment. To provide a standard assessment of the effects of the proposed improvement options, separate accident models have been created using industry standard software.

NESA (Network Evaluation from Surveys and Assignments) is the standard computer program introduced in the 1970s to examine proposed investments in the trunk road network in Scotland by comparing the costs of the road scheme with the associated road user benefits. The procedures for developing and applying the NESA model are set out in DMRB Volume 15.

A series of simplified “accident only” NESA models has therefore been developed to quantify the changes in accident numbers and costs due to the provision of the Proposed Improvement Options.

The number of total personal injury accidents over the 60-year assessment period and corresponding Present Values of Benefit associated with each of the three Design Schemes, based on the application of national accident values, are shown in **Tables 9.3 to 9.5**.

It should be noted that the NESA accident only model indicates that the proposed improvement options would increase the number of accidents on the road network. This is due primarily to the additional traffic on the network following the release of suppressed demand associated with the proposed grade-separated junction.

Table 9.3 – Road Safety Benefits – Option A

	No. of Acc. In 2024	No. of Acc. In 2030	No. of Acc. 60-year Total	Acc. Total Cost (£m)
Base Network	36.2	35.2	2119.7	114.538
Option A Network	39.2	41.3	2470.3	135.44
Benefits	-3.0	-6.1	-350.6	-20.902

The results from the NESA model, based on the application of default accident rates for a link and junction analysis, indicates that the provision of Improvement Option A would generate 351 accidents over the 60-year economic life of the scheme which equates to an accident cost disbenefit of £20.9m.

Table 9.4 – Road Safety Benefits – Option B

	No. of Acc. In 2024	No. of Acc. In 2030	No. of Acc. 60-year Total	Acc. Total Cost (£m)
Base Network	36.2	35.2	2119.7	114.538
Option B Network	39.6	41.9	2505.1	137.746
Benefits	-3.4	-6.7	-385.4	-23.208

The results from the NESA model, based on the application of default accident rates for a link and junction analysis, indicates that the provision of the Improvement Option B would generate 385 accidents over the 60-year economic life of the scheme which equates to an accident cost disbenefit of £23.2m.

Table 9.5 – Road Safety Benefits – Option C

	No. of Acc. In 2024	No. of Acc. In 2030	No. of Acc. 60-year Total	Acc. Total Cost (£m)
Base Network	36.2	35.2	2119.7	114.538
Option C Network	39.8	42	2512.1	136.762
Benefits	-3.6	-6.8	-392.4	-22.224

The results from the NESA model, based on the application of default accident rates for a link and junction analysis, indicates that the provision of the Improvement Option C would generate 392 accidents over the 60-year economic life of the scheme which equates to an accident cost disbenefit of £22.2m.

Common Base and Design Traffic Demand

In addition to the main “accident only” assessment, a further assessment has been undertaken to examine the effects of adopting the same level of traffic demand in both the Base and Design Networks. This assessment removes the effects of releasing suppressed demand in 2024 and the predicted TMfS12 growth in traffic between 2024 and 2030. Separate models have been created where both the Base and Design models are based on the same 2024 traffic flows derived from SRM12 Reference Case, with zero growth beyond 2024.

The results from this assessment are shown in **Tables 9.6 to 9.8**.

Table 9.6 – Road Safety Benefits – Option A (Common Traffic Demand)

	No. of Acc. In 2024	No. of Acc. In 2030	No. of Acc. 60-year Total	Acc. Total Cost (£m)
Base Network	36.9	35.8	2155.1	115.703
Option A Network	35.9	34.9	2099.8	115.093
Benefits	1.0	0.9	55.3	0.610

The results of the NESA analysis, based on the application of default accident rates for a link and junction analysis, indicates that the provision of Option A would save 55 accidents over the 60-year economic life of the scheme which equates to an accident cost benefit of £0.61m.

Table 9.7 – Road Safety Benefits – Option B (Common Traffic Demand)

	No. of Acc. In 2024	No. of Acc. In 2030	No. of Acc. 60-year Total	Acc. Total Cost (£m)
Base Network	36.9	35.8	2155.1	115.703
Option B Network	35.6	34.6	2080.5	114.426
Benefits	1.3	1.2	74.6	1.277

The results of the NESA analysis, based on the application of default accident rates for a link and junction analysis, indicates that the provision of Option B would save 75 accidents over the 60-year economic life of the scheme which equates to an accident cost benefit of £1.28m.

Table 9.8 – Road Safety Benefits – Option C (Common Traffic Demand)

	No. of Acc. In 2024	No. of Acc. In 2030	No. of Acc. 60-year Total	Acc. Total Cost (£m)
Base Network	36.9	35.8	2155.1	115.703
Option C Network	36.4	35.4	2127.9	115.641
Benefits	0.5	0.4	27.2	0.062

The results of the NESA analysis, based on the application of default accident rates for a link and junction analysis, indicates that the provision of Option C would save 27 accidents over the 60-year economic life of the scheme which equates to an accident cost benefit of £0.06m.

9.4 Overall Economic Appraisal

Based on the estimated scheme costs and the application of the SRM12 and TMfS12 traffic growth projections, as described previously in the report, the economic assessment (including Accident Benefits) of the Improvement Options defined using PEARS is summarised in **Table 9.6**.

Table 9.6 – Overall Economic Appraisal Summary

	Option A	Option B	Option C
PVB – PEARS only (£m)	613.01	591.35	308.30
PVB – Accidents only (£m)	-20.90	-23.21	-22.22
Present Value of Benefits (£m)	592.11	568.14	286.08
Present Value of Costs (£m)	64.75	59.85	61.94
Net Present Value (£m)	527.36	508.29	224.14
Benefit to Cost Ratio	9.14	9.49	4.62

10 CONCLUSIONS & RECOMMENDATIONS

10.1 Conclusion

Modelling of the traffic operation of the three options has shown that Options A and B perform significantly better than Option C. Whilst Options A and B perform relatively similar, Option C shows traffic congestion on the A720, with queues on slip roads impacting on the A720 from 2030 onwards. Similarly, as a result of its off-line location and the inclusion of an additional roundabout junction to accommodate the A6106 north of the Sheriffhall Roundabout, Option C shows much heavier congestion on the adjacent local road network with greater delays along the A7 / A6106 compared to Options A and B.

Cost estimates range from £87.3M to £94.2M, with Option B having the lowest overall cost and Option A the highest. Options A and B demonstrate similar NPV benefits of £527.4M And £508.3M, however relative to the estimated cost, Option B returns a stronger BCR of 9.49 compared to 9.14 for Option A. In contrast, Option C returns much lower NPV of £224.1M, resulting in a significantly lower BCR of 4.62.

Whilst Options A and B offer similar benefits, the lower capital cost of Option B represents better value for money than Option A.

It should be noted that whilst Options A and B perform much more strongly than Option C in relation to future traffic provision, it is clear that with the high levels of traffic growth predicted for the area, all options will face capacity challenges in future years.

From this perspective, further operational enhancements may be required to maintain capacity and minimise congestion and it would be sensible to take this scope for enhancement into account in scheme development and assessment.

The obvious measure to improve capacity would be to signalise the junction and the need and timing for potential signalisation will require detailed consideration at Stage 3, both from an operational perspective and with respect to NMU provision.

Whilst Options A and B could both be developed to allow future signalisation, Option B has a more propitious layout, offering better opportunities for future capacity enhancement.

Therefore, taking into account overall benefits, value for money and the future scope for enhancement, it is considered that Option B should be taken forward as the preferred option.

aecom.com