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M5 Junction 11 and Junction 12 – Paramics model

Local Model Development Report

Document No. | 01

October 2018

679475CH.ST.17.15.32

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Project Name

Project No:	679475CH.ST.17.15.32
Document Title:	M5 Junction 11 and Junction 12 – Paramics model - Local Model Development Report
Document No.:	01
Revision:	00
Date:	October 08, 2018
Client Name:	Highways England
Client No:	SW 99 CH2M
Project Manager:	Andrew Ball
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File Name:	3 – Comms/Reports/M5_A40 Paramics Model Validation Report_V1.docx

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Document history and status

Revision	Date	Description	By	Review	Approved
Final	08/10/2018	Local Model Validation Report	IA / MS	AB	MH

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Executive Summary

Highways England commissioned Jacobs (legacy CH2M) to propose a methodology to update the 2012 M5 Junction 9 to Junction 14 S-Paramics Model. It was agreed that the corridor model would be split into a series of sub-models and each one would include a greater hinterland to the SRN to provide an improved capability to assess the impact of new development located on the M5 corridor. One of the new models covers M5 Junction 10 and Junction 11 and the A40 corridor from the west of Cheltenham and to the north of Gloucester.

Therefore, the new M5 models cover the Strategic Road Network (SRN) junctions and adjacent local networks in order to reflect route choice and hence model more realistic impacts of changes in traffic demand. It is intended that these models would be capable of testing the impact of development close to the SRN as well as the performance of junctions within the model area.

The new M5 Junction 10 and Junction 11 model covers M5 J10, M5 J11, and sections of A40, A38 and A4019. It comprises of around 3300 links, 1800 nodes, including 47 signalised junctions, and 100 zones.

The basis of the prior demand matrix was a comprehensive ANPR data collection survey. In addition, the 2011 Census housing and population data was used to inform internal trip generation. Matrix estimation within the Paramics Discovery 19.0 was undertaken utilising junction turning counts and link counts that were collected as part of the data collection exercise.

It should be noted that on the APNR survey day there was an incident on the M5 in the early hours of the AM peak in the northbound direction which disrupted the motorway main line flows. A full assessment has been undertaken to understand the impact of this incident on the local road network. The analysis has shown very little impact.

It is noted that most of the signalised junctions included in the model are controlled by MOVA. A PCMOVA component is not integrated yet with the Paramics Discovery v19.0, used for the model development. Hence, the signal junction concerned were replaced either by demand actuated signals or fixed signals based on observed signal timings. The model could be updated later when the PCMOVA component is available.

The model has been demonstrated to achieve the WebTAG flow calibration criteria. Also, the model has been validated using journey times along 9 journey time routes and met the WebTAG recommended criteria. The model satisfactorily reflects observed flows, queues and delays of the modelled area.

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1. Introduction

1.1 Background Information

Jacobs Ltd. was commissioned by Highways England to develop a Paramics model of the M5 between J10 and J11, as well as the A40 routes into Cheltenham and Gloucester and the A38 corridor from A40 to A4019.

1.2 Modelling Software

The original model was developed using S-Paramics. Both VISSIM and Paramics Discovery microsimulation modelling software were considered for the current study. Due to the complex nature of network and considering the extent of the model area, it was decided to use the Paramics Discovery for the current update. "Paramics Discovery" is a Windows based new version of S-Paramics. S-Paramics developer SYSTRA (previously SIAS) has released the new version and discontinued any support for the previous S-Paramics. The new Paramics Discovery is more user-friendly and has some enhanced functionality compared to previous S-Paramics. Also, the new version of Paramics will continue to improve further which implies updating the model in near future will be more convenient and less costly. Hence, it was decided to use Paramics Discovery version 19.0 for updating the model.

1.3 Scope of the Study

The modelled area covers motorway sections including M5 Junction 10 and Junction 11, the A40 from Gloucester to Cheltenham, a section of the A38 (between the A40 and A4019) and the west of Cheltenham town centre (west of the rail line). The geographical coverage of the study area has been shown in Figure 1.
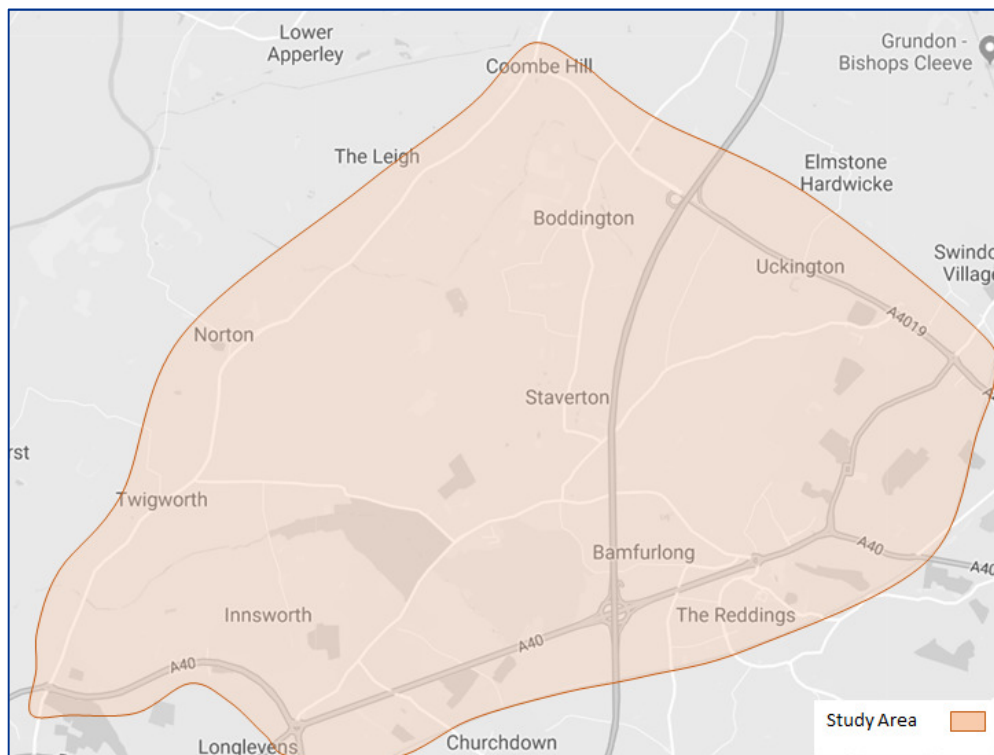
Figure 1: Model Study Area

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2. Key Features of the Model

The M5 Junction 10 and Junction 11 Paramics model has been developed according to the specification described in this section of the report. The Model has been developed in version 19 of the Paramics Discovery software. The model represents 2017 as Base Year.

2.1   Modelling Period

The modelled periods cover the peaks in traffic flows observed on site. The following time periods were modelled:

- AM Weekday Peak Period: 07:00-10:00

- PM Weekday Peak Period: 16:00-19:00

The sum of flows was compared at the following major ANPR sites for both ANPR survey date (28th November) and an average day obtained from the ATC data. Average day data was taken for Tuesday, Wednesday and Thursday between 29th November to 07th of December 2017:

- ANPR Site 1
- ANPR Site 2
- ANPR Site 6
- ANPR Site 15
- ANPR Site 16

- ANPR Site 17
- ANPR Site 18
- ANPR Site 27
- ANPR Site 28
- ANPR Site 41

The analysis of data shows that the modelled period covers the peak period shown by the traffic data for both the AM and PM peak periods (Figure 2). The average profile and the ANPR survey date profile matches with average profile well. It is noted that the data shows that on the 28th November (APNR survey day) the start of the peak hour AM traffic volume has moved by 1 hour from 0730 to 0830 hours. This is the impact of the incident on the M5 northbound. As the model has been calibrated based on turning count data collected on 28th November, in order to best reflect the operation of the highway network in the AM peak hour, the 0800 to 0900 hours turning data was used as main calibration and validation hour. For clarity, flow calibration has been reported for 0700 to 0800 hours and 0900-1000 hours. Also, it should be noted that 0700-0730 hours has worked as the warm up period to create delays on an empty network and it is expected to have low flows in 0700-0800 hours during calibration.
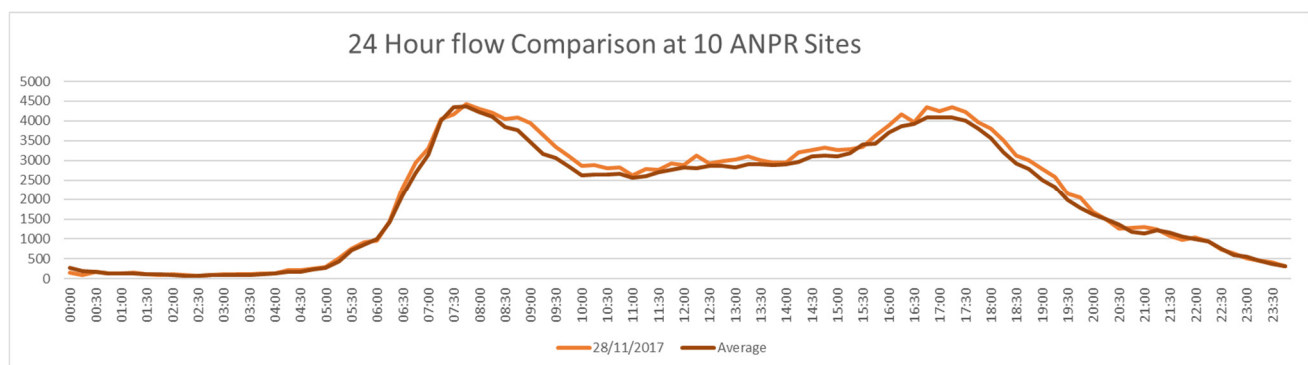
Figure 2: Average Traffic flows over 24-Hour period

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2.2   Key Parameters

The following matrix levels are included within the model:

- Matrix Level 1 = Car (100%)

- Matrix Level 2 = LGV (100%)

- Matrix Level 3 = OGV1 (50%) and OGV2 (50%)

Public transport service buses have been added to the model on a fixed route basis according to published timetables.

The following routeing parameters were applied to the model:

- Generalised Cost (Where t = time and d = distance)

    o   Car = 1*t + 0.4*d

    o   LGV = 1*t + 0.7*d

    o   OGV1 = 1*t + 2.1*d

    o   OGV2 = 1*t + 2.1*d

    o   Coach = 1*t + 2.1*d

- Feedback Interval = 2 minutes

- Feedback Co-efficient = 0.5

- Perturbation = 5

- Familiarity:

    o   Car and LGV = 50%

    o   OGV 1 and OGV 2 = 10%

    o   Coach = 0%

2.3   Zoning System

The zoning system has been developed mainly based LSOA census boundary. The 24 External ANPR sites have been designated as the external zones (naming series starts with 201). In addition, the Business Park adjacent to Elmbridge Court roundabout also included as external zone. Zone 226 external zone is currently empty. The LSOA boundaries were first split into fine zones based on land use and then further split based on their access or loading point to the network. As such, 73 internal zones have been derived. Two zones named as 301 and 302 have been reserved as future development zones. Thus, the model has a total of 100 zones as shown in Figure 3.
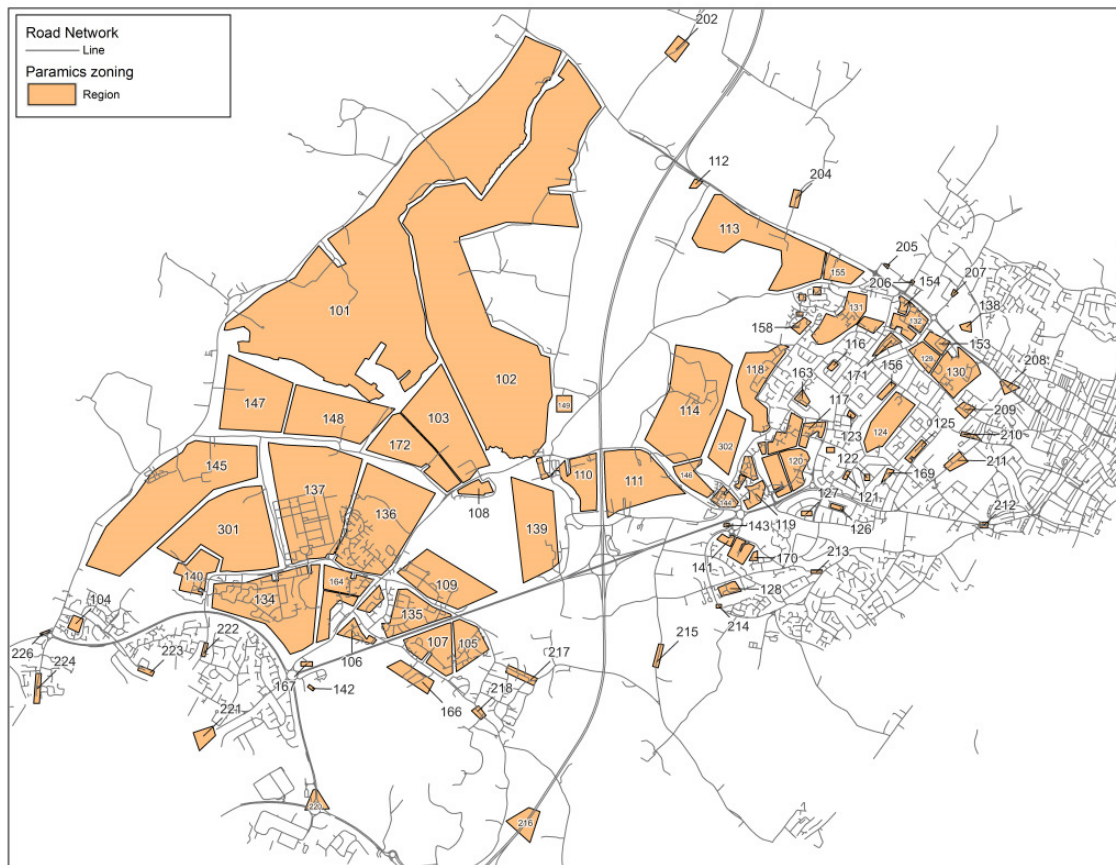
Figure 3: Average Traffic flows over 24-Hour period

2.4 Link hierarchy

2.4.1 Major/Minor Links

Within Paramics, links can be classified as major or minor. Major links are assumed to be 'signposted', so the true cost of travelling on them is known to both familiar and unfamiliar vehicles.

The familiar vehicles perceive the cost of travelling on them to be equal to the true cost, as they are, by definition, familiar with the network. Unfamiliar vehicles have a lower awareness of minor links, so perceive the cost of using these links to be twice the true cost.

The distribution of major and minor links in the model is indicated by Figure 6. Major links are shown in red, with the minor links in blue. The strategic road network and the main routes to and from Cheltenham and Gloucester have been coded as major routes.

Some of the rural road network and the residential streets in Cheltenham have been coded as minor routes. This will reduce the probability of traffic using these links as through routes.

Figure 4 shows the distribution of Major and Minor Link Types
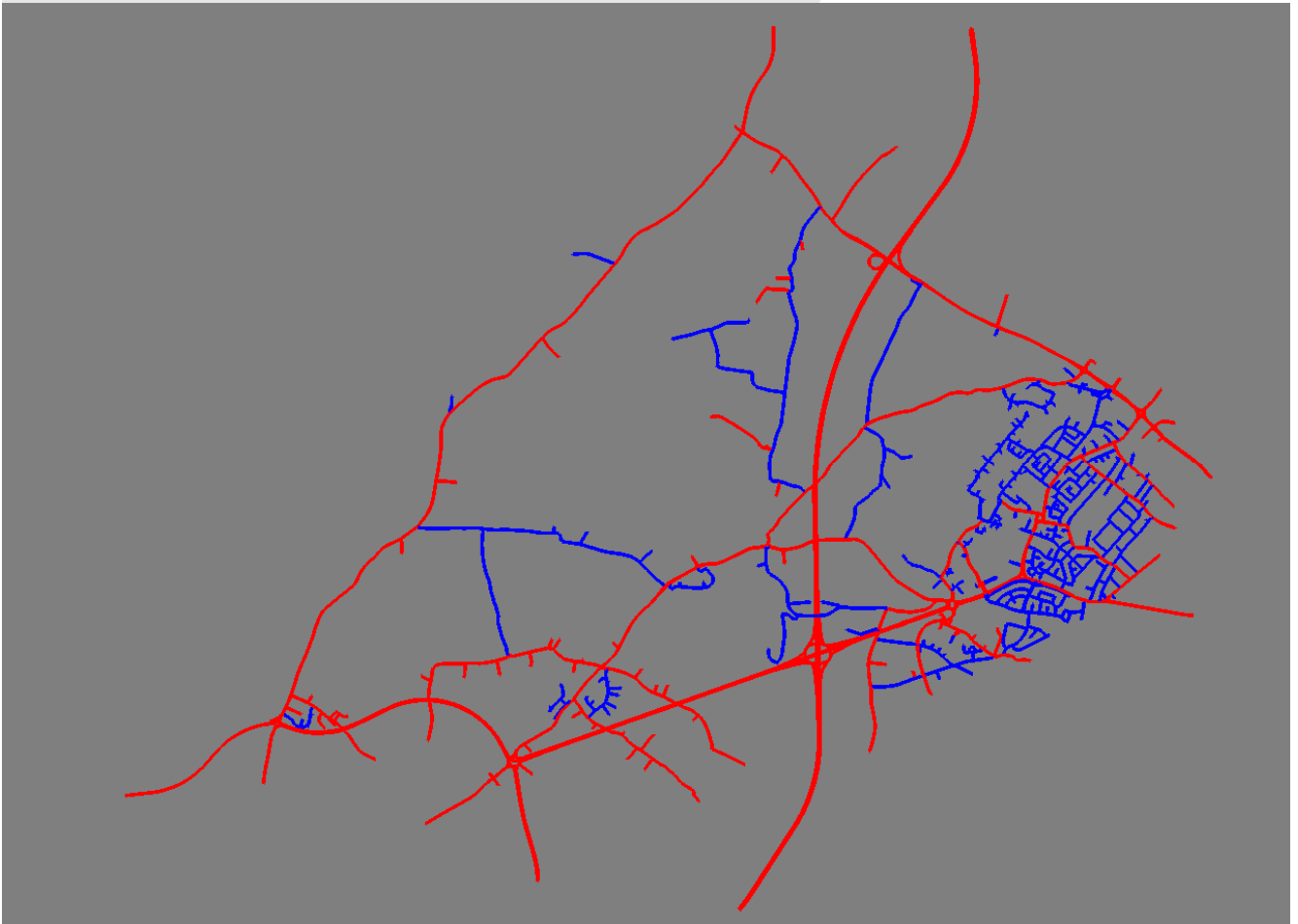
Figure 4: Distribution of Major and Minor Link Types

2.4.2 'Highway' and 'Urban' link types

'Highway' and 'Urban' link types provide the capability to model different types of driver behaviour, with respect to lane usage and speed. The use of 'Highway' links also enables the coding of the ramp feature to simulate merging behaviour. The distribution of 'Highway' and 'Urban' links in the model is shown in Figure 5.
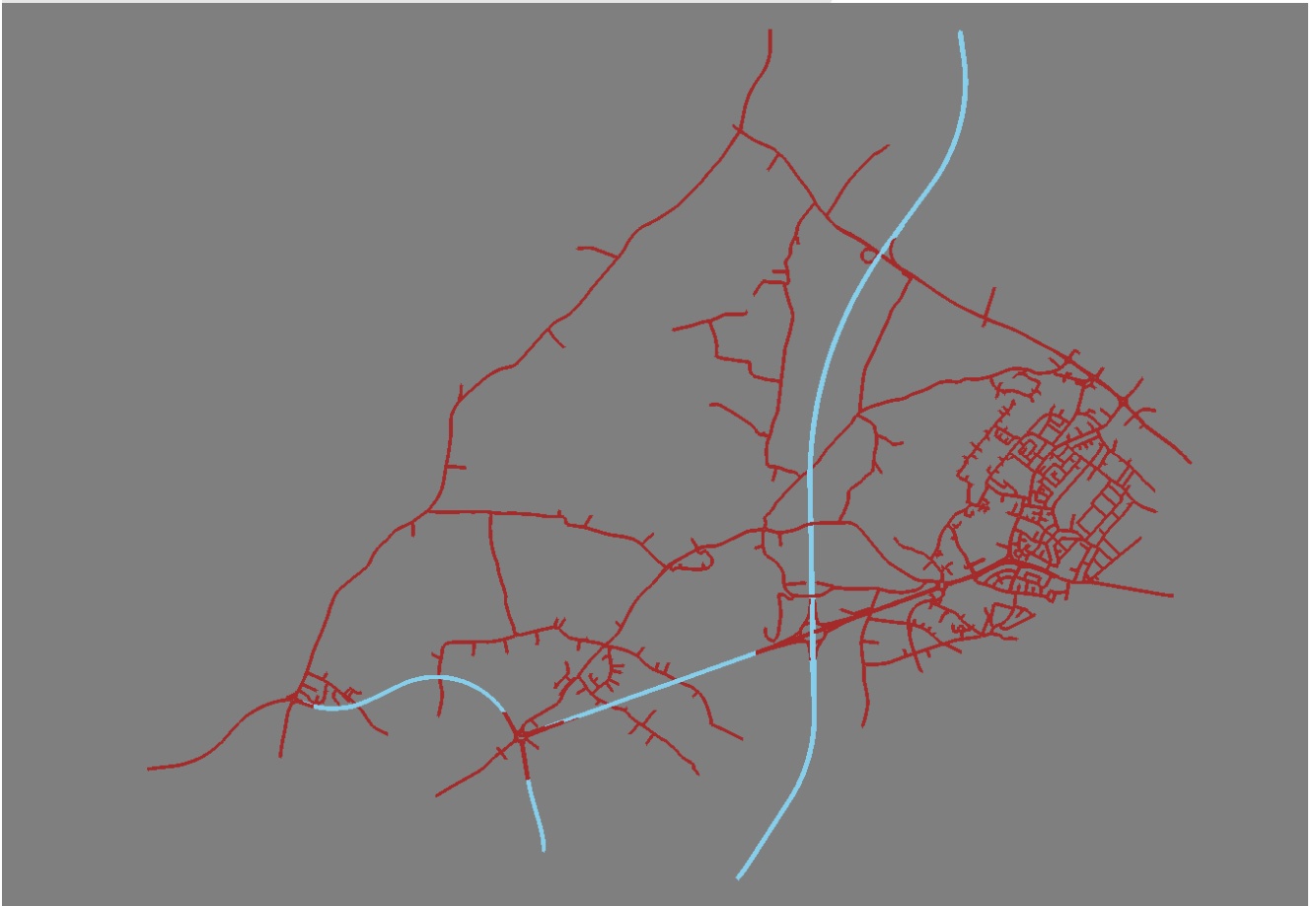
Figure 5: Distribution of 'Highway' and 'Urban' Link Types

2.4.3   Link Categories

A range of 'Link Categories' have been used to enable the range of road types in the network to be simulated. The categories enable variations in factors such as speed limits, cost factors and urban/highway link types to be specified. The 'Link Categories' are shown on Figure 6.
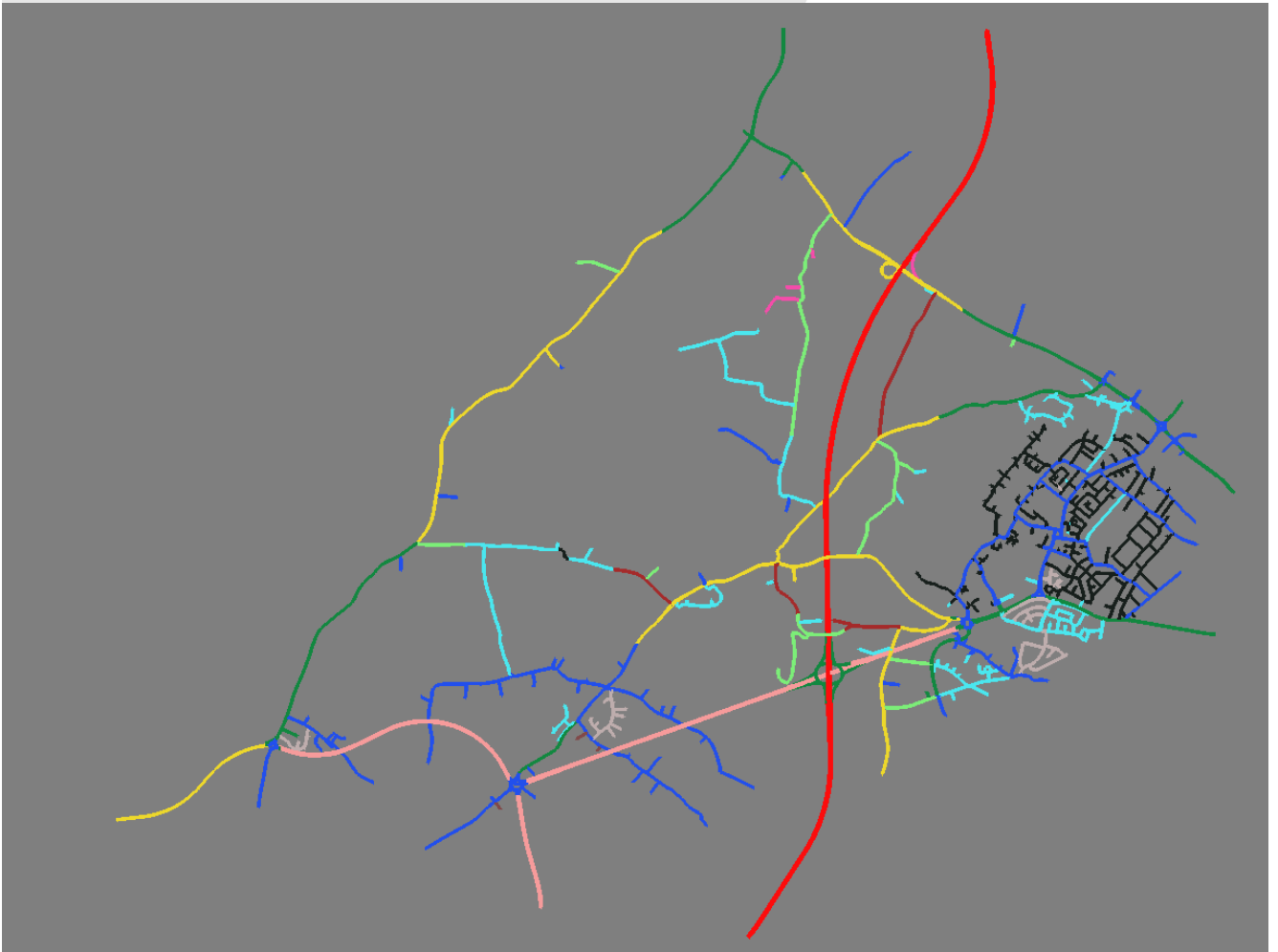
Figure 6: Link Categories

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3. Data Collection and Analysis

3.1   Current Traffic Condition

Site observations were carried out to understand the characteristics and performance of the network covered by the Model. Key locations of note are described in this section.

It was observed that there is congestion on all approaches to the A4019 Tewkesbury Road/A4013 Princess Elizabeth Way/Kingsditch Lane roundabout in the AM peak. Along the A4019 eastbound approach, this congestion blocks back to M5 Junction 10. Also, this traffic sometimes blocked back from the M5 Junction 10 southbound off-slip onto the mainline of the motorway. On the A4013, this traffic blocks back to the A40/A4013 roundabout to the south.

There is also congestion on all approaches to the A40 Gloucester Road/A4013 Princess Elizabeth Way roundabout in the AM peak. Along the A4013 approach, this blocks back to the A4019/A4013 roundabout to the north. On the A40 eastbound approach, this congestion blocks all the way back to the Elmbridge Court roundabout to the west, leading to extremely heavy queues on the A40 eastbound on-slip at M5 Junction 11.

Overall, the network is very heavily congested in the AM peak, with a lot of interaction between the various junctions on the network due to blocking back in several locations.
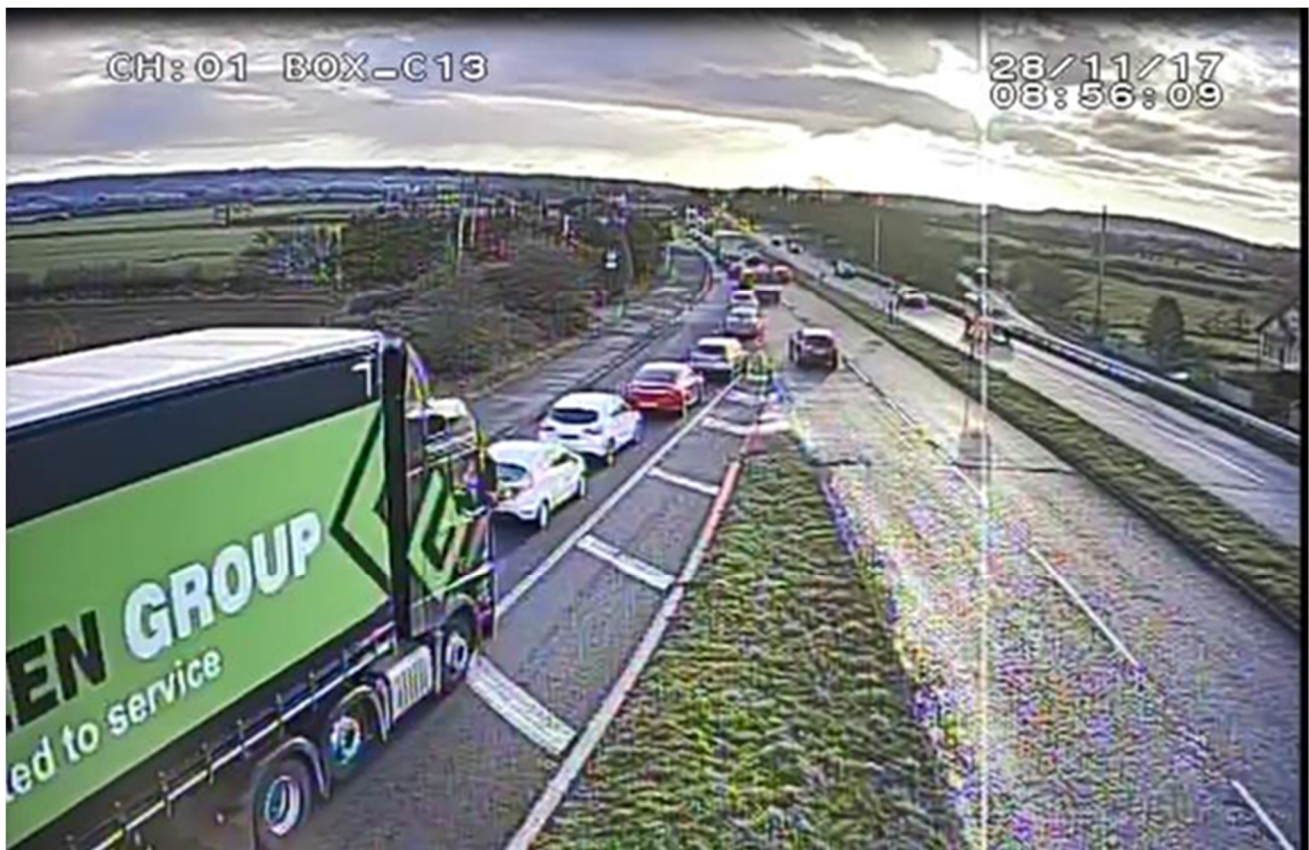
Figure 7: Typical traffic conditions at M5 J10 offslip in the AM peak

In the PM peak, there is congestion on all approaches to the A4019/A4013 roundabout and all approaches to the A40/A4013 roundabout. In particular there is congestion in both directions along the A40 and A4013 Princess Elizabeth Way between the A40/B4063 roundabout in the south to the A4019/A4013 roundabout in the north.

In the PM peak, there is little congestion around M5 Junctions 10 and 11, unlike in the AM peak when congestion is severe at these junctions.

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3.2 Traffic Data Collection

A review of all existing models and available traffic data within the study area was undertaken. The following models were reviewed:

- Central Severn Vale SATURN Model – Base Year 2013, owned by Gloucestershire County Council and Highways England;

- South West Regional Traffic Model – Base year 2015, owned by Highways England;

- A40 Innsworth Paramics Model – Base Year 2016. The model covers M5 J11, A40 (T) and the surrounding local roads. This model has been developed by PFA and is owned by Robert Hitchins Ltd;

- Ashchurch model – 2013 Base Year. This model covers M5 J9, A46(T), A438 and the surrounding local roads. This model has also been developed by PFA Consulting and is owned by Robert Hitchins Ltd

- M5 J13 and A419 corridor S-Paramics model (Eco Park planning application); and

- M5 J14 S-Paramics model developed by CH2M on behalf of Highways England and November 2016 traffic count in this location.

Following the review, it was established that most of the existing data used to inform models was collected around 2013. Hence, new surveys in and around the study area were commissioned and undertaken in 2017 to inform this model. Traffic data that was collected in 2016 was retained and used to supplement the 2017 data. The following traffic surveys were undertaken:

- Automatic Number Plate Recognition (ANPR) – directional ANPR video surveys to record time and classification (Cars, Lights, Heavies, Coaches/PSV) of vehicles passing each camera;

- Automatic Traffic Count (ATC) – automatic count to record classified traffic volumes (over a 2 week period);

- Manual Classified Counts (MCC) – manual counts recording turning movements by vehicle classification (Cars, Lights, OGV1, OGV2, Coaches/PSV, cycle); and

- Queue Surveys to record queues at junction approaches.

Journey Time data was obtained from the Traffic Master database. This data was provided by Gloucestershire County Council.

3.3 Automatic Number Plate Recognition (ANPR)

ANPR data was collected at 42 locations as shown in Figure 8. The locations of the sites form an outer cordon and internal screen lines. The ANPR data was collected for a 12 hour period (0700-1900). ATC data was also collected at all ANPR sites.

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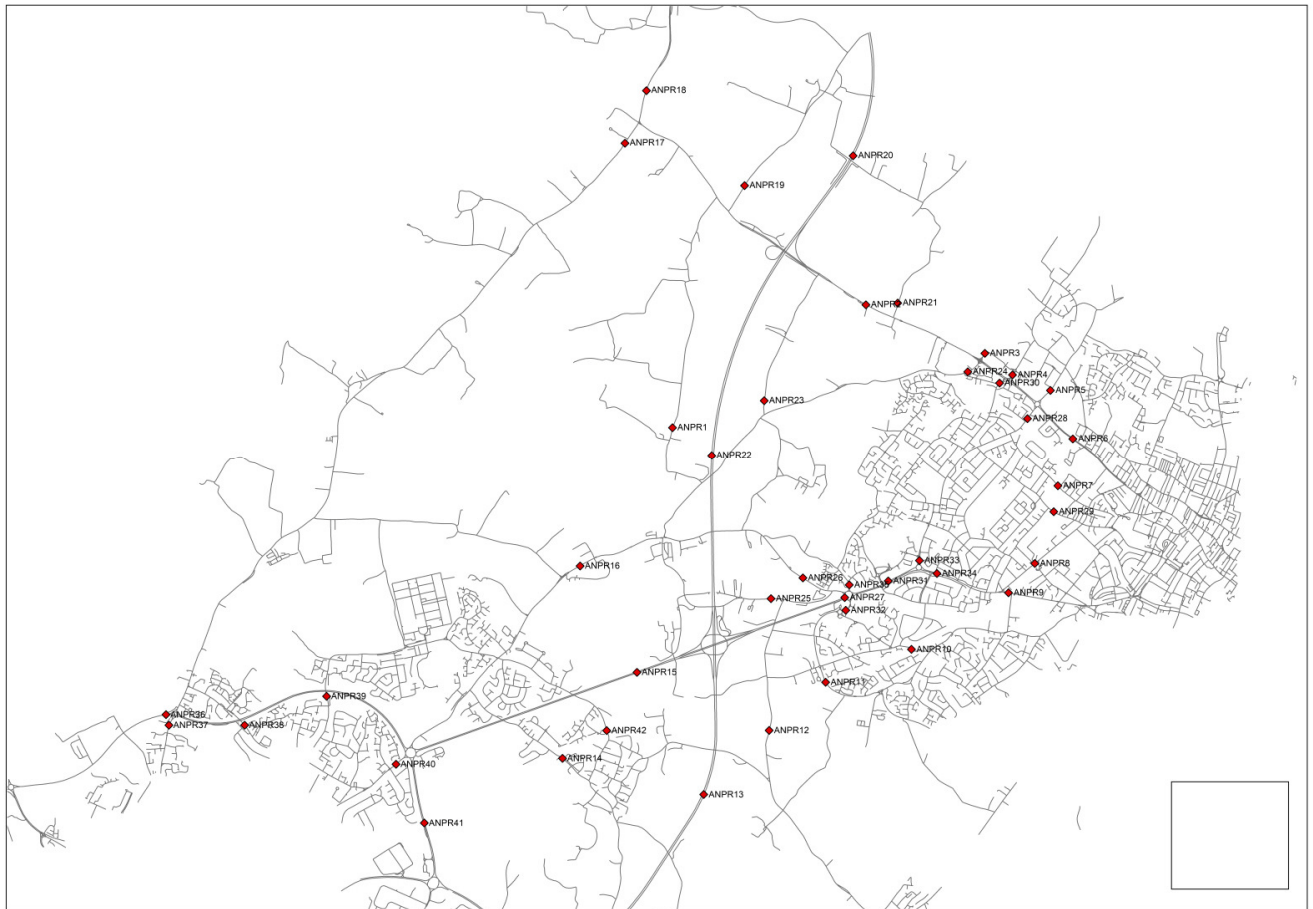
Figure 8: ANPR Camera Locations

Data were obtained for AM (0700-1000) and PM (1600-1900) peak period matrices. Also, 'rip chain' data reports for 12 hour and 3 hour (i.e. 0700-1000) peak periods for a maximum time of 30 minutes were provided, along with separate sample rate reports. The data was provided for Car, LGV and HGV vehicles.

The sample rate reports show that an average of 84% sample rate was achieved for inbound traffic and 88% was achieved for outbound traffic.

Table 1: ANPR Sample Rates

Site	Inbound Sample Rates			Outbound Sample Rates			Inbound Match Rates		
	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Matched Plates	Match Rate
01	516	458	89%	558	478	86%	-	-	-
02	9041	8330	92%	8847	8001	90%	-	-	-
03	3303	2895	88%	3821	3191	84%	3303	2552	77%
04	6963	6475	93%	6148	5671	92%	6963	5729	82%
05	9919	7871	79%	10485	8914	85%	9919	7202	73%
06	11631	10059	86%	10410	9762	94%	11631	8643	74%
07	2289	1949	85%	3361	3132	93%	2289	877	38%
08	5167	4439	86%	4959	4389	89%	5167	2336	45%
09	10215	8770	86%	8395	7147	85%	10215	7366	72%
10	5437	4910	90%	5575	5175	93%	5437	3203	59%
11	3970	3059	77%	4004	3024	76%	3970	2396	60%
12	3289	2422	74%	2561	2121	83%	3289	1757	53%
13	31889	26628	84%	32491	27657	85%	31889	25831	81%
14	2755	2515	91%	2906	2473	85%	2755	1155	42%
15	15888	12567	79%	16174	13938	86%	-	-	-
16	5537	4802	87%	5619	4266	76%	-	-	-
17	5350	4485	84%	5177	4711	91%	-	-	-
18	6766	6068	90%	6924	6317	91%	6766	5679	84%
19	2191	1340	61%	2285	2122	93%	2191	1227	56%
20	35390	29540	83%	36069	30252	84%	35390	28580	81%
21	459	340	74%	210	166	79%	459	290	63%
22	31809	27072	85%	29575	25482	86%	-	-	-
23	1832	1747	95%	1982	1577	80%	-	-	-
24	4124	3255	79%	3709	2758	74%	-	-	-
25	2323	2058	89%	2423	2205	91%	-	-	-
26	3660	3044	83%	4073	3388	83%	-	-	-
27	19735	16712	85%	21551	19574	91%	-	-	-
28	10983	10064	92%	12351	11555	94%	-	-	-
29	2053	1895	92%	2104	1847	88%	2053	726	35%
30	3332	2428	73%	3883	3759	97%	-	-	-
31	15412	14229	92%	17335	15885	92%	-	-	-
32	9884	8283	84%	9815	8698	89%	-	-	-
33	7932	6581	83%	9239	8505	92%	-	-	-
34	10651	9797	92%	10830	9945	92%	-	-	-
35	2379	2147	90%	1577	1455	92%	-	-	-
36	12648	10806	85%	11153	9497	85%	12648	9369	74%
37	7389	5937	80%	9631	9277	96%	7389	4161	56%
38	3347	2331	70%	2867	2707	94%	3347	1630	49%
39	3091	2200	71%	3796	2483	65%	3091	804	26%
40	7219	6428	89%	7670	6770	88%	7219	5437	75%
41	16954	9856	58%	15760	14538	92%	16954	7953	47%
42	2599	2298	88%	2872	2501	87%	2599	764	29%
Total	357321	299090	84%	361175	317313	88%	196933	135667	69%

3.4 Automatic Traffic Count (ATC)

ATC data was collected at 72 sites in total, including the ANPR locations. Out of the 72, 30 were ATC only locations and remaining 42 were ATC and APNR. The data was collected during a 2-week period time in both directions and straddling the ANPR. The time range of data collection was 24 hours every day. The data was collected by the end of November and beginning of December 2017. The location of the ATC data collection sites is shown in Figure 9.
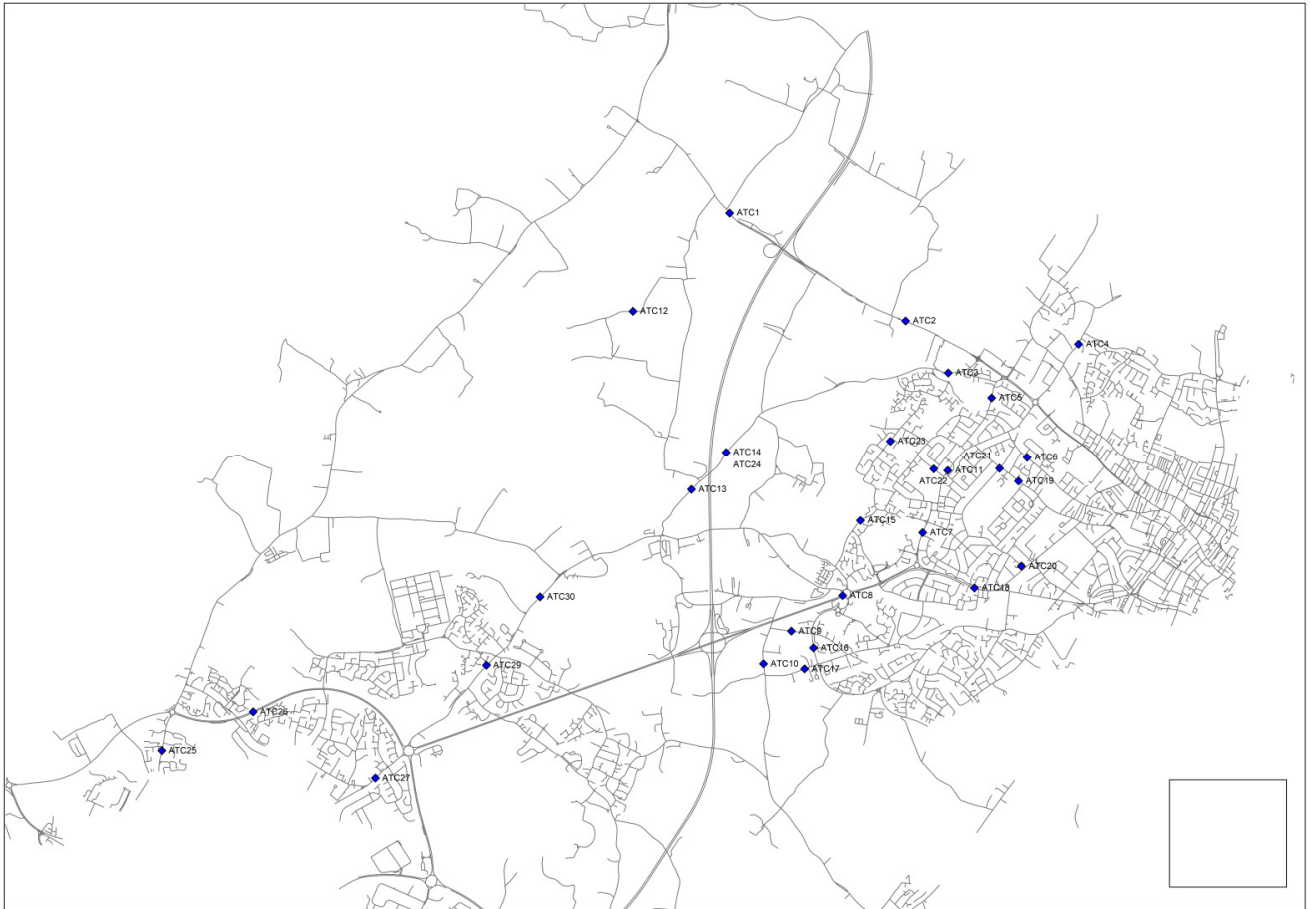
Figure 9: ATC Locations

Flows have been averaged to represent weekday flows by each direction during the peak hours (0700 - 1000 and 1600 - 1900) for cars, LGVs and HGVs. Flows from the 28th November 2017 were considered and 'normalised' to make consistent against MCC data collected on other days.

3.5   Manually Classified Turning Count (MCC)

MCC surveys have been undertaken at 42 junctions. Turning counts have been collected during one weekday for 12 hours (0700 - 1900). The date of the survey was 28th November 2017. MCC turn counts have been classified by vehicle type (Cars, LGV, OGV1, OGV2, buses and cycle). The location of the MCC data collections sites is shown on Figure 10.
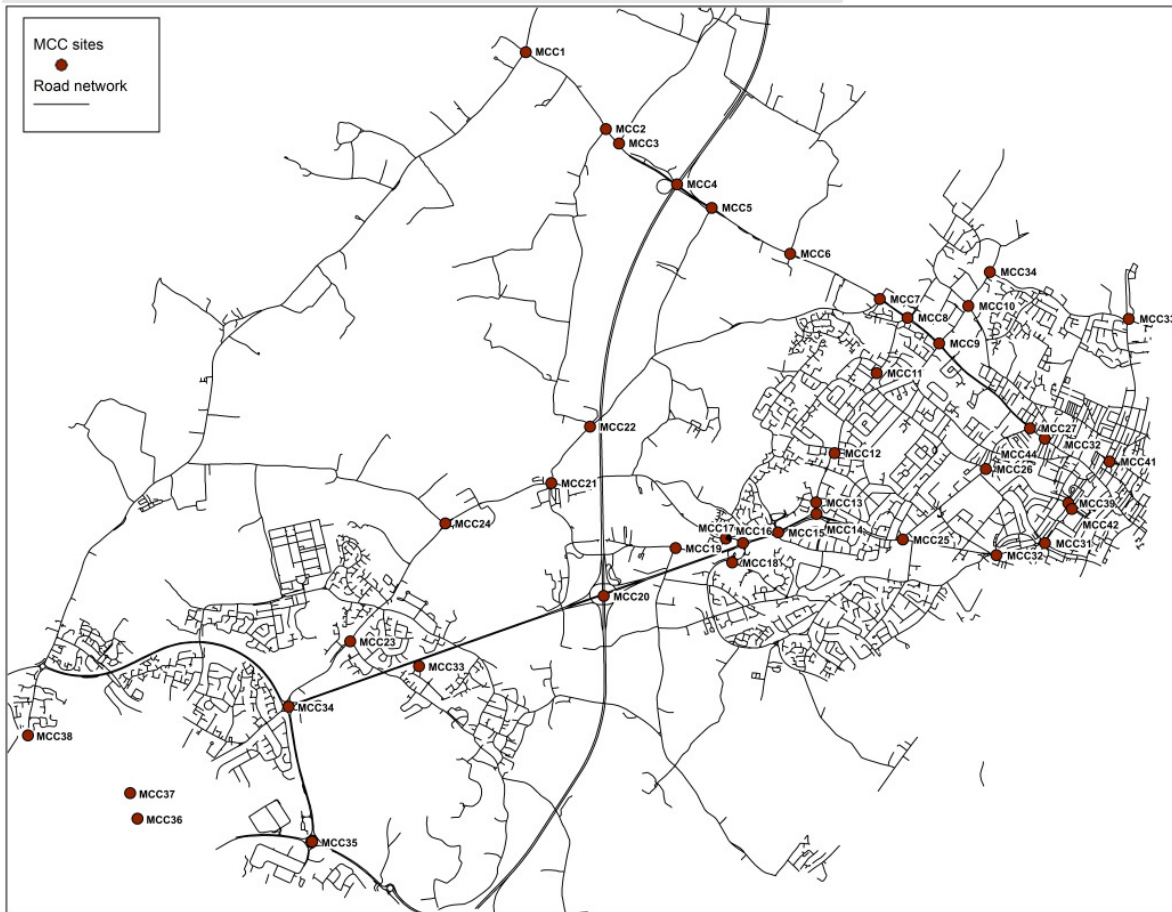
Figure 10: MCC Locations

3.6   Queue Survey

Queue surveys have been undertaken at 31 locations. The data was collected on 28th November 2017 and it is presented as the maximum number of cars forming a queue in each lane of the section, during periods of 15 minutes from 0700 to 1900. The data are segregated into 'light' and 'heavy' vehicles, and are then presented as a maximum queue length using the assumption that a light vehicle contributes 6 m to a queue and a heavy vehicle contributes 15 m.

3.7   Journey Time Data

Traffic Master Journey Time Data was provided by Gloucestershire County Council for the 8 (Eight) routes as shown in Figure 11. The data covers weekdays and was obtained for AM peak (0800 to 0900 hours) and PM Peak (1700 to 1800 hours). The data was extracted for October 2015 to November 2015. To supplement this data, JACOBS undertook a journey time survey for a route covering M5 J10 SB off slip on 29th and 30th November, 2017 considering the importance of the current queuing condition at the off-slip.

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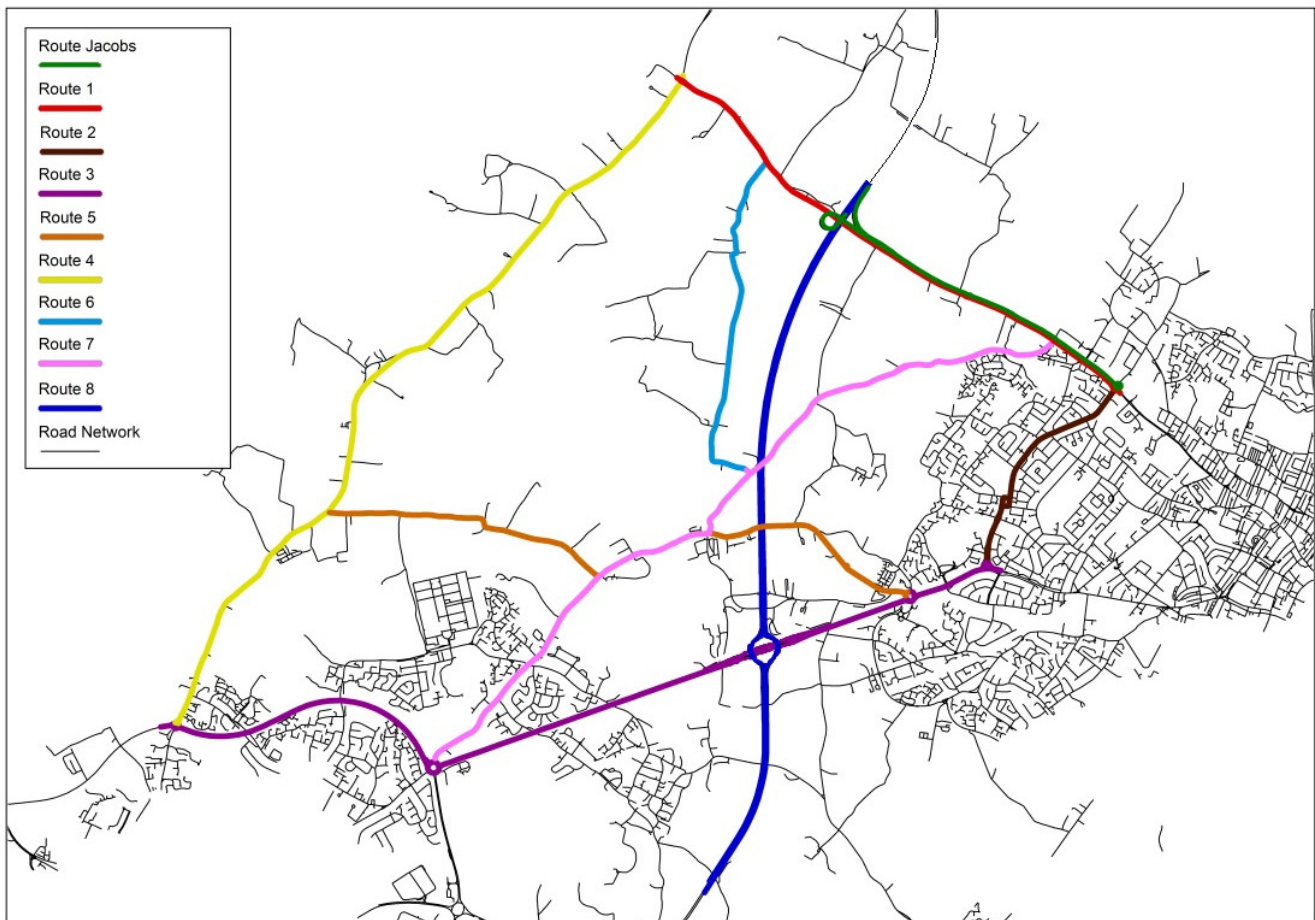
Figure 11: Journey Time Routes

3.8   Traffic incident on M5

On the day of the ANPR survey, 28th November 2017, a traffic incident happened on the M5 during the early hours of the morning peak (between 6:30 am to 7:30 am). It is understood that the incident happened in between M5 J10 and J11. To understand the potential impact of this incident, a detailed analysis was undertaken. During the analysis, flows and journey times were compared along the M5 as well as along the A38 Tewkesbury Road considering that the A38 could be an alternative for M5 traffic in both directions. In addition, flows along the A4019 were also compared.

The traffic on the M5 at this time would comprise longer distance movements and local commuter movements. For longer distance through traffic, the options to reroute are limited unless they use the A38 which is a long detour as M5 J10 is a limited access junction. Notwithstanding the unattractive nature of alternative routes, to understand the impact on the M5, traffic flow and average speed was compared.

Figure 12 shows the 24-hour flow comparison for sites along the SRN M5 and A40 located close to ANPR sites 13, 15, 20, 22 and 27. The data was collected for 6 days (28/11/2017 to 30/11/2017 and 05/12/2017 to 07/12/2017). Average data was collected excluding the 28th November data and compared against the 28th November data.

The traffic flow analysis clearly shows that there was a flow disruption on the M5 in both NB and SB directions. Initially, flow was lower between 0700 hrs and 0830 hrs but later flows became higher between 0830 hrs to 0915 hrs. After 0915 hours the flow became normal. The analysis did not indicate any major re-routeing issues. The following figure also shows that there were no major changes in flow along the A40 which implies that impact of the incident on the A40 was insignificant. Overall the PM did not show any abnormality.

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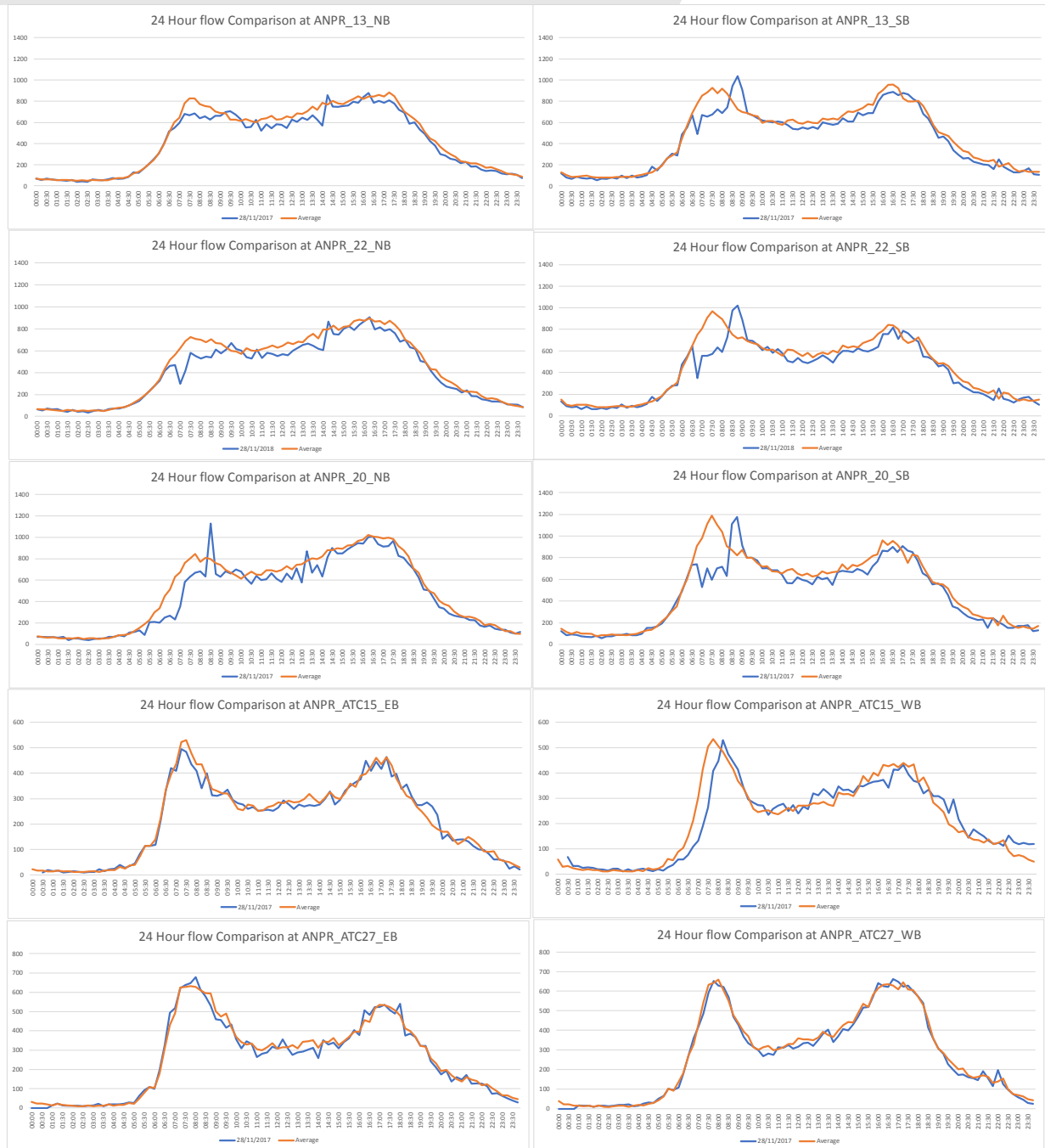
Figure 12: ANPR Flow Comparison

For further understanding, the average speed was calculated for journeys between J9 and J11A from WebTRIS data and compared against the ANPR surveyed travel time between ANPR sites 13 and 20. The analysis shows clearly that the incident happened at early hours of the AM peak in the northbound direction and caused a substantial reduction in speed. The PM period shows no abnormality. A comparison of average speeds on the M5 are shown in Figure 13.
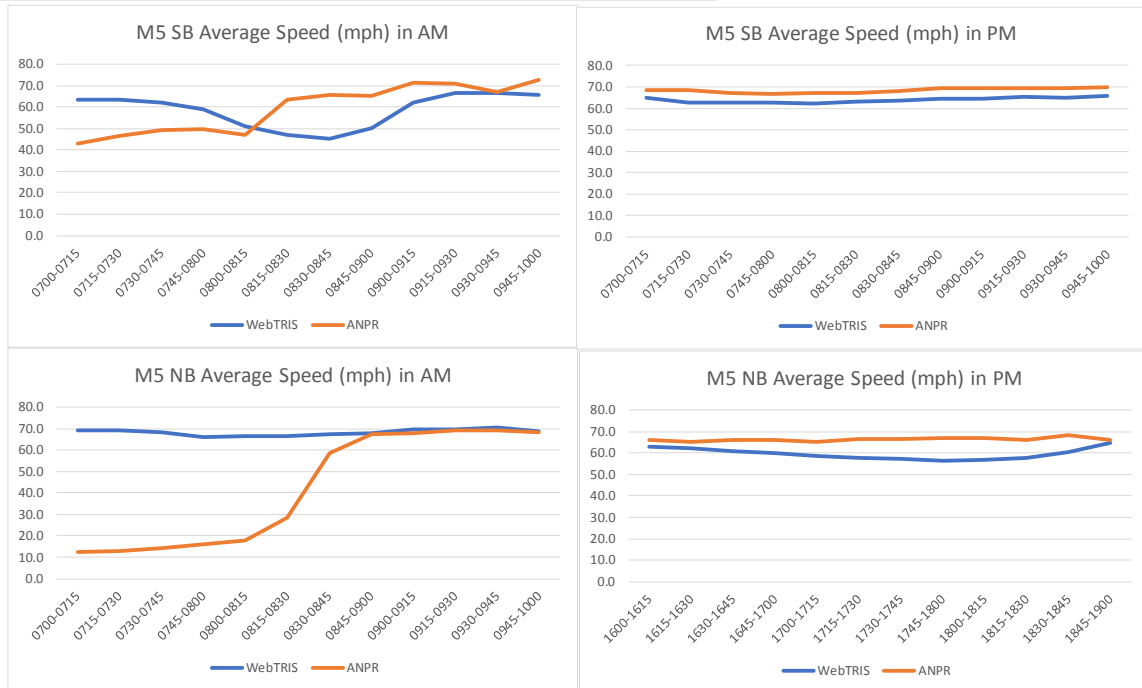
Figure 13: M5 Average Speed Comparison

Following the above analysis on the SRN, further checks were undertaken on local roads to understand the flow variation between an average day and the ANPR survey day. The 24-hour flow was compared at ANPR sites 1, 2, 17, 18 and 41 as shown in Figure 14. The analysis shows that ANPR 1 SB, ANPR 2 EB and ANPR 18 SB has some variation in the flow profile in the AM peak. The traffic flow was slightly higher at ANPR 1 SB and ANPR 18 SB, but a low flow was observed at ANPR 2. This triggered further investigation for trip re-routeing. Accordingly, individual traffic routes from 12 hour trip chain data was analysed for SB traffic entering the study area in the AM peak through ANPR 18, 19, 20 and 21 and compared their return route in the PM peak. Following this analysis around 165 trips were reassigned to ANPR site 20 (M5 SB) from other local roads (ANPR Site 5, 18, 19 and 21).

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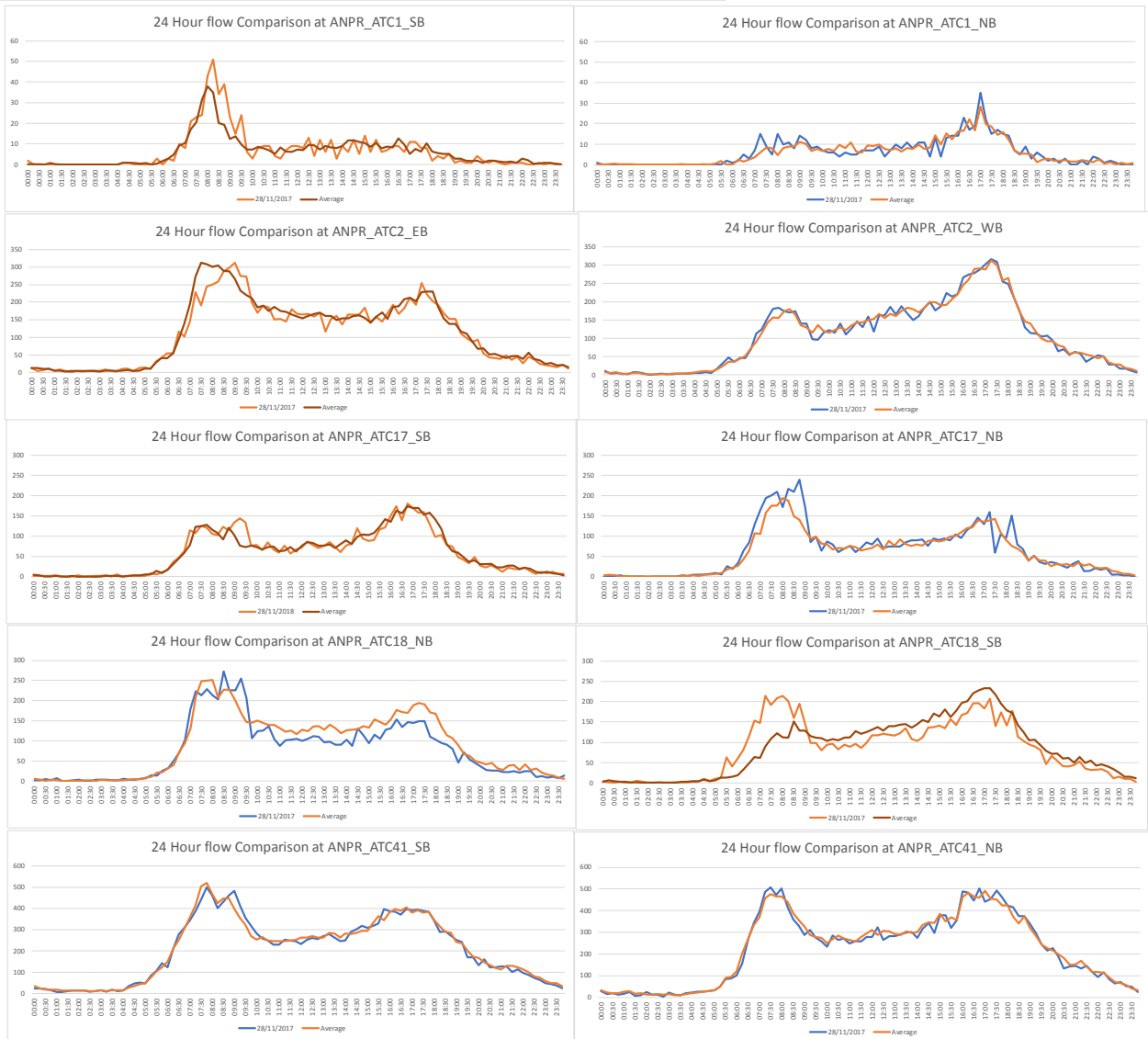
Figure 14: Local Road Network Flow Comparison

In addition, further travel time data was used to compare journey times along the A38 (between ANPR site 37 and ANPR site 18) for any major variation between the survey date and another normal day. On local roads, observed journey time data was obtained from traffic master for 0800-0900 hours. Hence, average journey time data was compared as shown in Table 2 for this period.

Table 2: Journey Time Comparison (minutes)

Direction	ANPR	Traffic Master
Northbound	23	9
Southbound	26	11

The above analysis shows that the A38, the alternative route for M5 traffic, was also congested on the day of the incident. Hence the A38 was not an attractive option for M5 through traffic.

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4. Matrix Development

4.1   Introduction

Deriving trip matrices from ANPR data requires a detailed analysis of available data. External to external trip movements are readily available from the ANPR matrix. However, derivation of external to internal, internal to external or internal to internal trip movements requires more analysis. The demand matrices were developed for a 3-hour peak period for both the AM and PM peaks. Vehicle release profiling was used in assigning the peak period matrices in each individual hour. This chapter describes the development of Prior Trip matrices from the ANPR data.

4.2   ANPR Survey Data

ANPR Survey data provided us with following information:

- Peak period (3-hours) OD matrix;

- Sample Rate Report for all ANPR site; and

- Trip Chain file (30 minutes interval) for 12 hour and individual peak periods.

The ANPR sites were categorised into two groups; external sites and internal sites. The 24 external ANPR sites form the outer cordon and the entry points to the model network. The 18 internal ANPR sites form screen lines. Based on those screen lines the modelled network was divided into 4 internal sectors as shown in Figure 15
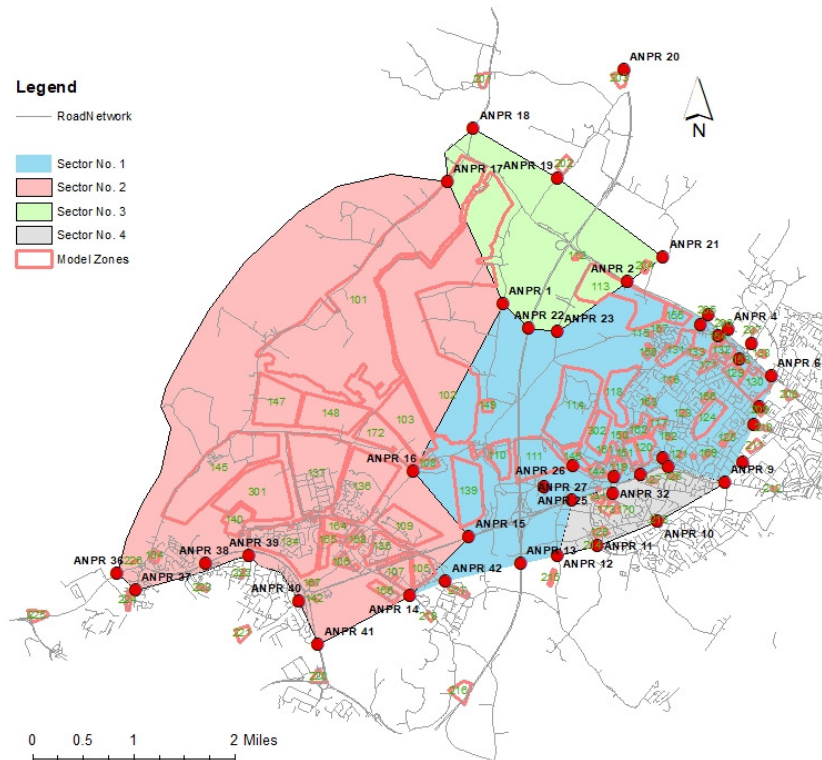
Figure 15: Internal Model Sectors for ANPR trip Assignment

External ANPR site to external ANPR site movement from the OD matrix provides through movements directly. The average sample rate for the external site was 84%. The minimum sample rate was 68% and the maximum up to 93%.

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4.3 Development of Sector Matrix

External ANPR site to external ANPR site movement from the OD matrix provides through movements directly.

Any trip originating from an external ANPR site and destining to an ANPR internal site (given in the ANPR OD matrix) was assigned to a sector, based on the direction of travel traced in the trip chain file. Using this process, all of the external ANPR site trips to ANPR internal sites were assigned to 4 sectors. In the same way, internal site to internal site trips were also included in sector to sector internal movements. Thus, all trips within the supplied ANPR matrix were transferred to a OD matrix which comprised of 24 external zones and 4 internal sectors.

It should be noted that surveyed ANPR OD matrices included only those trips which passes through at least two ANPR sites and matched. There are a significant number of trips which were captured as singly observed and they were destining to an adjacent sector. These singly observed trips were identified from the sample rate report which informs to total MCC counts, total captured vehicle and total matched vehicle. The following simple equation was followed:

Singly Observed trip = Total Captured – Matched

Singly observed trips from each site were then assigned to sectors. For internal sites these provided information regarding internal to internal movement within the 4 sectors.

Adjustment for traffic incident

The traffic incident identified in the AM peak period may have an impact on traffic re-routeing at ANPR sites 13, 18 and 20. Hence, the trip chain file over the full 12 hour period was carefully considered to identify rerouted trips as described in Table 3. Also, average profile was used in the model for vehicle release rather than the ANPR release profile. The following table shows where the replacement took placed:

Table 3: ANPR trip adjustment

		Internal Sectors			
		100	200	300	400
External Site	ANPR Site 5	-17	0	-3	-6
	ANPR Site 18	-48	-23	-1	-33
	ANPR Site 19	-14	-4	0	-7
	ANPR Site 20	81	27	7	50
	ANPR Site 21	-2	0	0	-3

4.4 Expansion of Sector Matrix

The sector matrix was then expanded based on the observed ANPR MCC counts. For external sites a simple extrapolation was assumed. However, for internal sectors, the internal ANPR sites were grouped along the sectoral screen lines and the total outbound and inbound flow to each sector was compared against the total capture. As such, an average sample rate for each sample was derived. The factor was applied to production end only as a singly constrained. The ANPR matrix expansion factors are shown in Table 4.

Table 4: ANPR Matrix Expansion Factors

Description	ANPR Site	AM			PM		
		Car	LGV	HGV	Car	LGV	HGV
External	3	1.20	1.23	1.40	1.18	1.19	1.31
External	4	1.09	1.10	1.18	1.13	1.14	1.24

Description	ANPR Site	AM			PM		
		Car	LGV	HGV	Car	LGV	HGV
External	5	1.29	1.31	1.38	1.28	1.29	1.37
External	6	1.16	1.19	1.33	1.21	1.23	1.35
External	7	1.25	1.45	2.21	1.19	1.29	2.58
External	8	1.18	1.26	2.12	1.19	1.25	2.31
External	9	1.26	1.29	1.44	1.23	1.27	1.54
External	10	1.10	1.13	1.45	1.14	1.19	1.74
External	11	1.28	1.30	1.53	1.40	1.45	1.81
External	12	1.14	1.19	1.55	0.87	1.20	1.32
External	13	1.08	1.12	1.26	1.36	1.39	1.45
External	14	1.13	1.21	2.00	1.11	1.22	2.54
External	18	0.68	0.69	0.72	1.15	1.16	1.23
External	19	1.76	1.78	1.91	1.67	1.69	0.00
External	20	1.32	1.34	1.38	1.23	1.20	1.26
External	21	1.34	1.36	1.50	1.53	1.62	1.92
External	29	1.15	1.45	2.29	1.12	1.24	2.90
External	36	1.12	1.20	1.29	1.08	1.17	1.35
External	37	1.33	1.41	1.74	1.28	1.33	1.84
External	38	1.47	1.52	1.83	1.59	1.65	2.66
External	39	1.41	1.60	2.49	1.43	1.59	3.44
External	40	1.21	1.22	1.39	1.16	1.19	1.35
External	41	2.06	2.17	2.41	1.80	1.84	2.16
External	42	1.22	1.40	0.00	1.13	1.27	0.00
Internal Sector	100	1.14	1.14	1.14	1.19	1.19	1.19
Internal Sector	200	1.18	1.18	1.18	1.18	1.18	1.18
Internal Sector	300	1.15	1.15	1.15	1.17	1.17	1.17
Internal Sector	400	1.13	1.13	1.13	1.16	1.16	1.16

The ANPR site 18 and ANPR site 20 factors were modified based on the average day traffic instead of the 28th November ANPR MCC data. This adjustment was undertaken to represent accurate traffic flow entering the network in an average weekday. The 3-Hour sector matrix totals for the AM and PM peak period are shown in Table 5.

Table 5: 3-Hour Sector Matrix Totals for AM and PM Peak Period

	AM Period (0700-1000 Hours)				PM Period (1600-1900 Hours)			
	Car	LGV	HGV	Total	Car	LGV	HGV	Total
Internal to Internal	4244	503	62	4809	4586	467	23	5076
Internal to External	14781	2345	279	17405	18947	1775	74	20796
External to Internal	15636	2085	428	18149	15453	1715	156	17324
External to External	28350	5720	1697	35767	32174	4265	962	37401
Total	63010	10653	2466	76129	71160	8222	1215	80597

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4.5   Sector movement to Model Zone Distribution

The intra-sectoral trips were distributed using synthetic trip distribution. Employment and housing information for Lower Super Output Area (LSOA) was obtained from 2011 Census data. Generic TRICS trip rates were applied to obtain the LSOA trip ends for both employment and dwellings separately. An area-based correlation was derived between the LSOA area and the model zonal area using GIS. Manual checks were undertaken ensuring the logical relationship between the LSOA and the model zone. For example, an LSOA may cover a model zone which is mostly empty or generates insignificant trips. In those cases, judgment was applied to shift those trips to other zones which belong to the LSOA. Also, if there is an employment zone within the LSOA zone then employment trip ends were allocated to the employment zone(s). At the end of the process trip ends were obtained against each model zone. Then all zones were assigned to a sector. Few zones were shared by two sectors. In those cases, the zonal proportions were calculated based on their land use.

Then sectoral trips were expanded to Paramics zone trips based on the Paramics zone trip end weightage derived as above. Thus, AM and PM observed matrices for car, LGV and HGV were obtained from ANPR survey data.

The above process has been shown in Figure 16
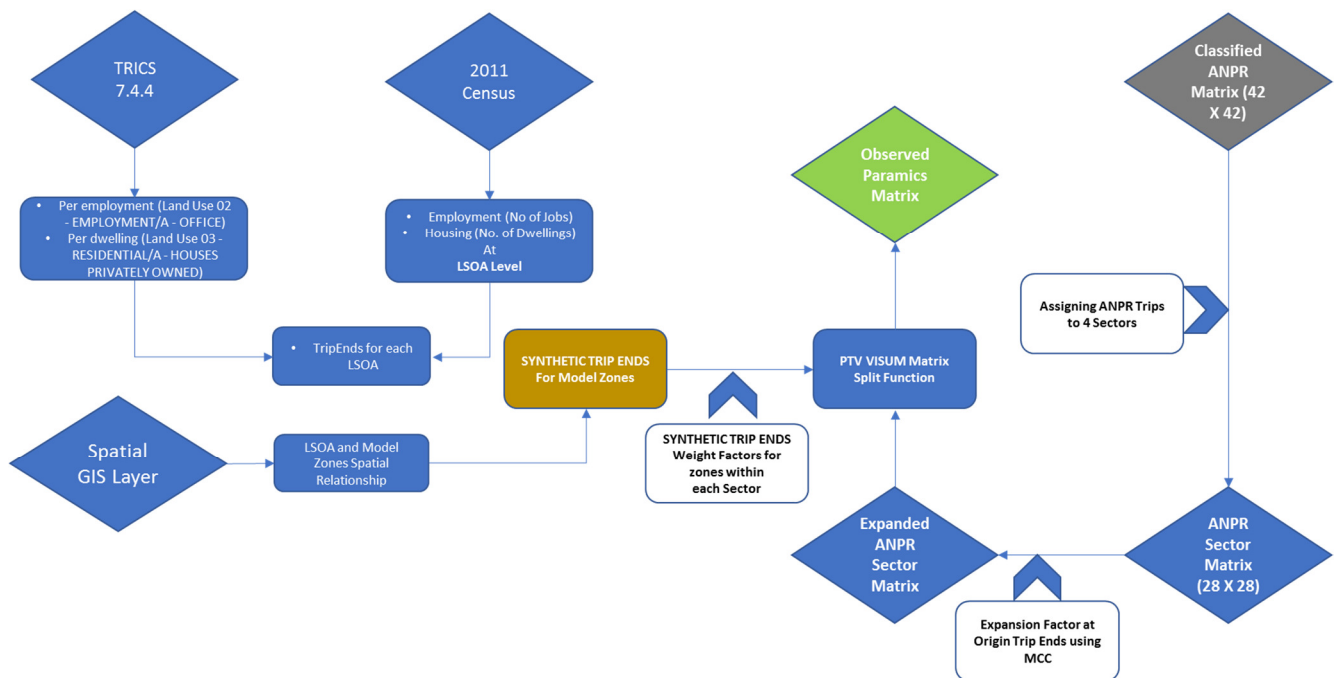
Figure 16: ANPR Matrix to Model Zone Matrix Development Process

4.6   Development of Synthetic Matrix

The partial matrices, described above, provide a good estimate of demand for trips crossing model screen lines and sector boundaries. However, the nature of this process means that all intra-zonal and inter-zonal movements within a sector are not sampled. In addition, internal to internal trip matrices were largely unobserved. Hence, the demand matrix developed from ANPR data therefore required synthetic data to infill unobserved cells. It should be noted that all external to external trips were excluded from the observed matrix for synthetic distribution as it is intended to apply only for internal zones.

Unfortunately, Paramics Discovery does not have any functionality to derive gravity models. However, PTV Vision's software VISUM has such functionality known as 'KALIBRI'.

Estimating gravitation parameters (KALIBRI)

The Estimate gravitation parameters function (short KALIBRI) allows you to calibrate two different utility functions (determine parameters a, b and c) for the gravity model used for trip distribution.

$$f(U_{ij}) = a \cdot U_{ij}^{b} \cdot e^{c \cdot U_{ij}}$$

Where,   Uij = Value of the utility (for example distance or travel time) between zone i and zone j

        a,b,c = Parameters to be estimated

The key input for developing the gravity model was as follows:

- Synthetic Trip Ends derived from Census Data;

- Partial Matrix observed through ANPR Survey Data; and

- Distance Skims.

Synthetic Trip Ends were derived from the Census 2011 population data and Office for National Statistics (ONS) Business and Employment Register Survey 2015 data (latest available at the time of matrix development, at LSOA level) as mentioned in the previous section. As the zones correspond to Census boundaries, the total number of dwellings and total number of jobs within each census spatial area has been converted to model zone totals and trip rates derived from TRICS applied to obtain total trip ends.

The gravity model was only developed for the car matrix considering that the proportion of LGV and HGV is very small in internal zones.

Gravity Model Calibration

Gravity models for both the AM and PM peak periods were developed for each of the trip purposes by inputting the various parameters described above. The models were run in VISUM to determine the calibration parameters (a, b and c). Figure 17 also shows the gravity distribution curve.

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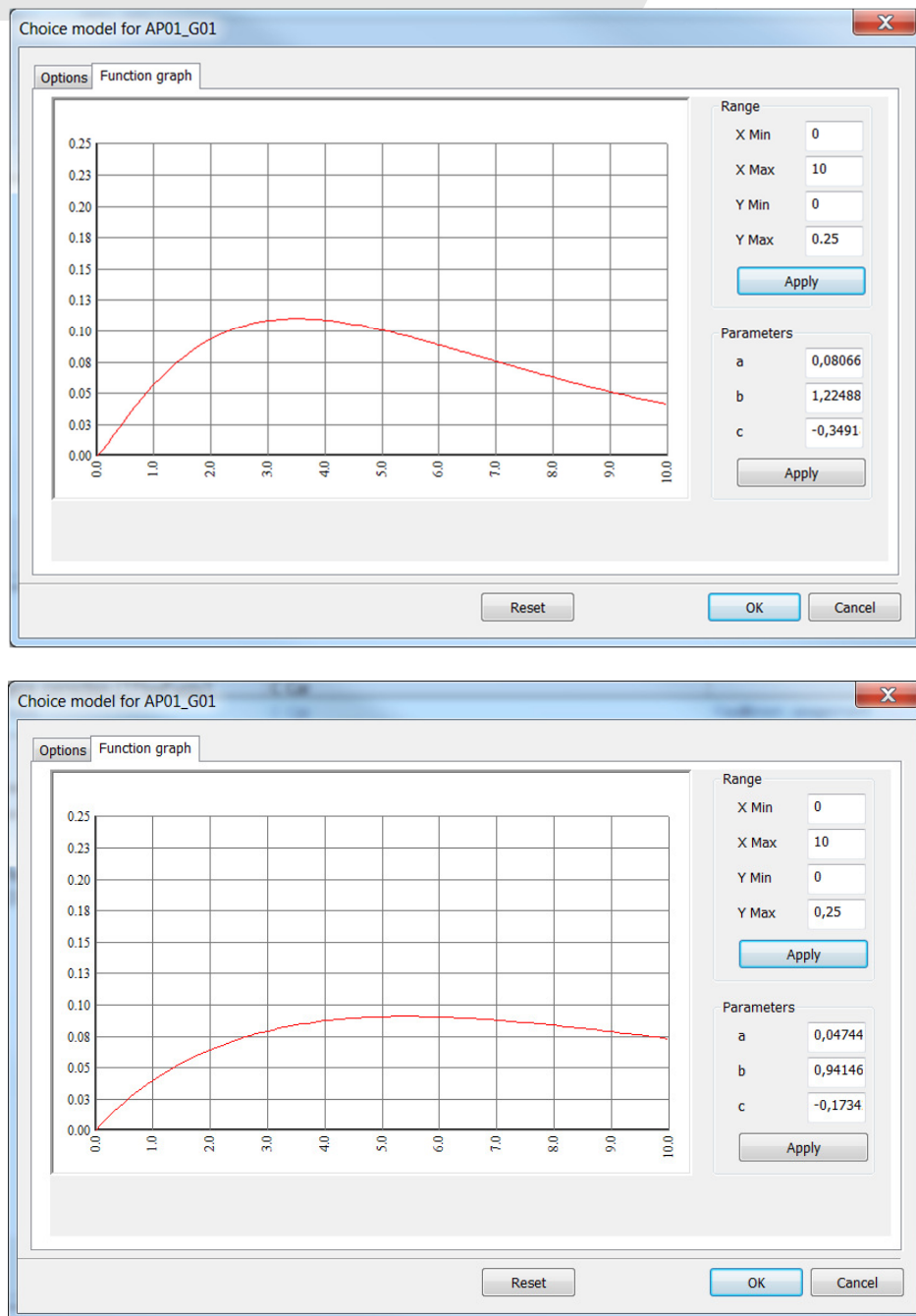
Figure 17: Gravity Distribution Curves

The TLD from the partially observed matrices shows a smooth distribution of trips. Overall, comparison of the distributions reveals that the level of calibration shows a very good fit for all car trips. To understand the goodness of fit, mean trip lengths were compared between the observed and Synthetic matrix. The result has been shown in Table 6.

Table 6: Mean Trip Length Comparison (km)

AM		PM	
Observed	Synthetic	Observed	Synthetic
5.0	5.0	4.8	4.9

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Following the VISUM user manual, a further test to assess the goodness of fit is to express (in %) the overlap area between the observed and modelled distributions to the total area under the observed distribution as given in Table 7.

The table also shows that car trips in both AM and PM has over 95% overlap. A 100% overlap shows a very good fit. Therefore, the quality of the gravity model distribution is very robust. The comparison of the observed and modelled TLDs for the full matrices are shown in Figure 18 and Figure 19 for the AM and PM peaks respectively.

Table 7: Comparison of area under TLD

Trip purpose	Area under curve		Overlapped area	% of overalp to Total Observed
	Observed	Modelled		
AM	0.99	0.99	0.94	95%
PM	0.99	0.99	0.94	95%
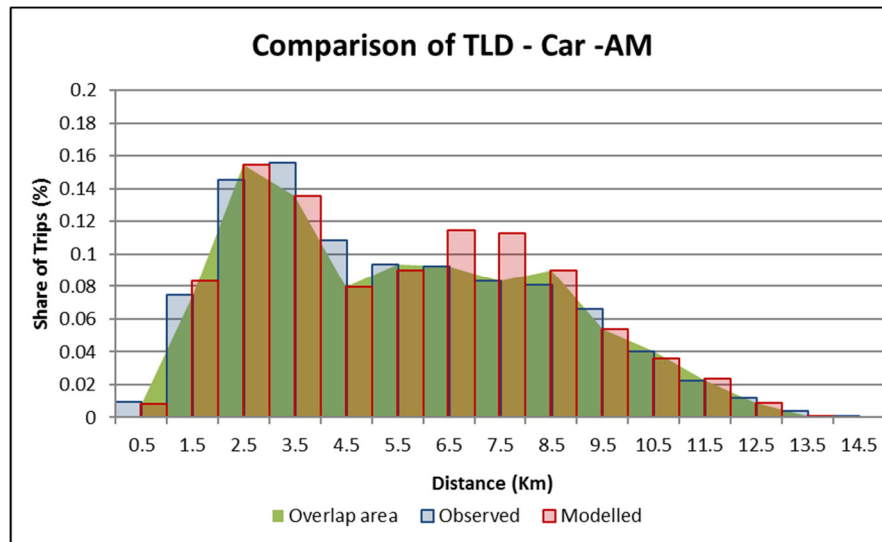
Figure 18: Comparison of TLD (observed vs. modelled) – Car AM
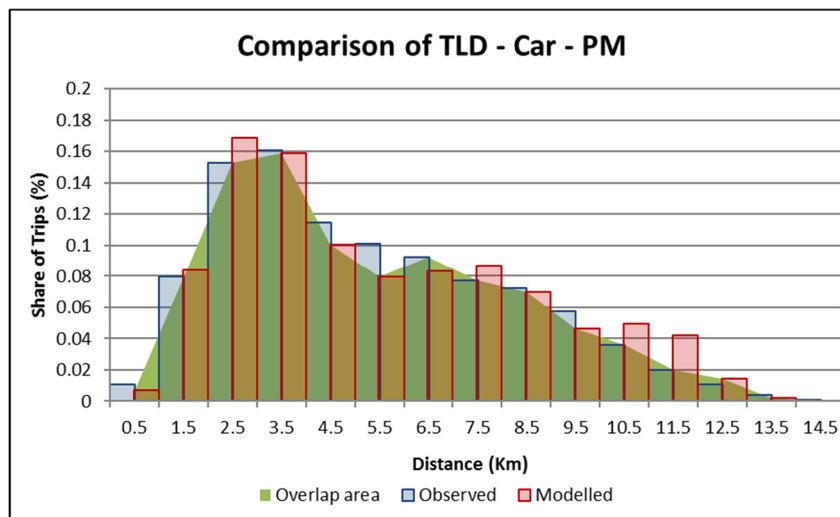
Figure 19: Comparison of TLD (observed vs. modelled) – Car PM

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4.7   Development of Prior Matrix

The observed matrices from ANPR surveys and synthetic matrices needed to be merged to infill unobserved movements. It is recognized that a large part of internal to internal movement is largely unobserved. As a result, a relative weight of 75% was given to the observed cell movements. Therefore, 75% of the observed movements were retained and the remaining 25% distributed across all internal to internal cells.

In case of LGV and HGV the observed ANPR matrix was directly used as Prior matrix. Table 8 shows the 3-Hour prior demand matrices for the AM and PM peaks.

Table 8: 3-Hour Prior Demand Matrices for the AM and PM Peaks

	AM Period (0700-1000 Hours)				PM Period (1600-1900 Hours)			
	Car	LGV	HGV	Total	Car	LGV	HGV	Total
Internal to Internal	4463	371	103	4937	4711	570	26	5307
Internal to External	15170	2297	197	17664	19433	1705	69	21207
External to Internal	16013	1988	335	18183	15336	1803	162	17301
External to External	27654	5461	1706	35499	32176	4149	950	37276
Total	63301	10117	2341	76283	71655	8228	1207	81091

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5. Matrix Calibration

The matrix estimation module of Paramics Discovery was used to adjust the prior matrix in order to calibrate to observed volumetric count data.

In order to proceed with the matrix estimation process, Paramics requires four sets of information as follows:

- Prior matrix;

- Routeing information;

- Survey Template, providing a set of target count data; and

- Constraints on how the matrix estimation can alter the prior matrix.

Routeing information was obtained by recording Pija data from the model. The routeing information was updated during matrix estimation and calibration when any significant change was made to the modelled network.

5.1   Review of Matrix Estimation

Throughout the matrix estimation process, the change in trips between each O-D pair (calibrated trip matrix – prior trip matrix) was reviewed to check for unrealistic changes in the number of trips. Any large changes were monitored, and adjustments were made to the trip constraints, the seeded prior matrix or the network coding, as required.

The trip matrix and main O-D totals were reviewed in order to provide an understanding of the overall impact of the matrix estimation process. The prior and post matrix totals are presented in Table 9 and Table 10.

Table 9: 3-Hour Prior and Post Matrix Comparison for the AM Peak

	Prior		Post		% Difference	
	Car	Total	Car	Total	Car	Total
Internal to Internal	4463	4937	4801	5083	8	3
Internal to External	15170	17664	12443	14782	-18	-16
External to Internal	16013	18336	13807	15987	-14	-13
External to External	27654	34821	28432	35766	3	3
Total	63300	75758	59484	71619	-6	-5

Table 10: 3-Hour Prior and Post Matrix Comparison for the PM Peak

	Prior		Post		% Difference	
	Car	Total	Car	Total	Car	Total
Internal to Internal	4711	5307	5105	5738	8	8
Internal to External	19433	21207	15883	17356	-18	-18
External to Internal	15336	17301	13026	14598	-15	-16
External to External	32176	37275	33244	38420	3	3
Total	71656	81090	67258	76112	-6	-6

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5.1.1 Zonal Trip End Comparison

Regression statistics were generated between the trip ends values of the prior and post car matrices and shown in Figure 20 to Figure 23. The Figure shows that the post matrix shows a very good fit to the prior-matrix for both AM and PM peak statistics (i.e. slope, intercept and R2).
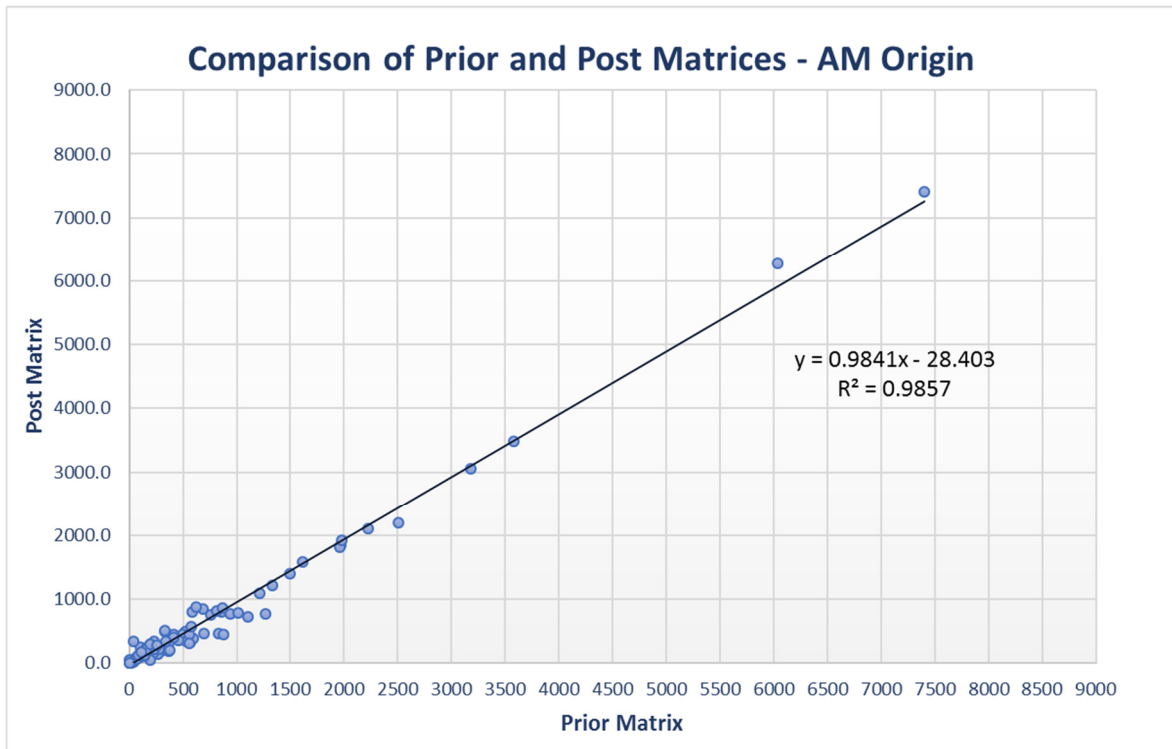
Figure 20: Prior vs Post Origin Trip End Regression Analysis – Car AM

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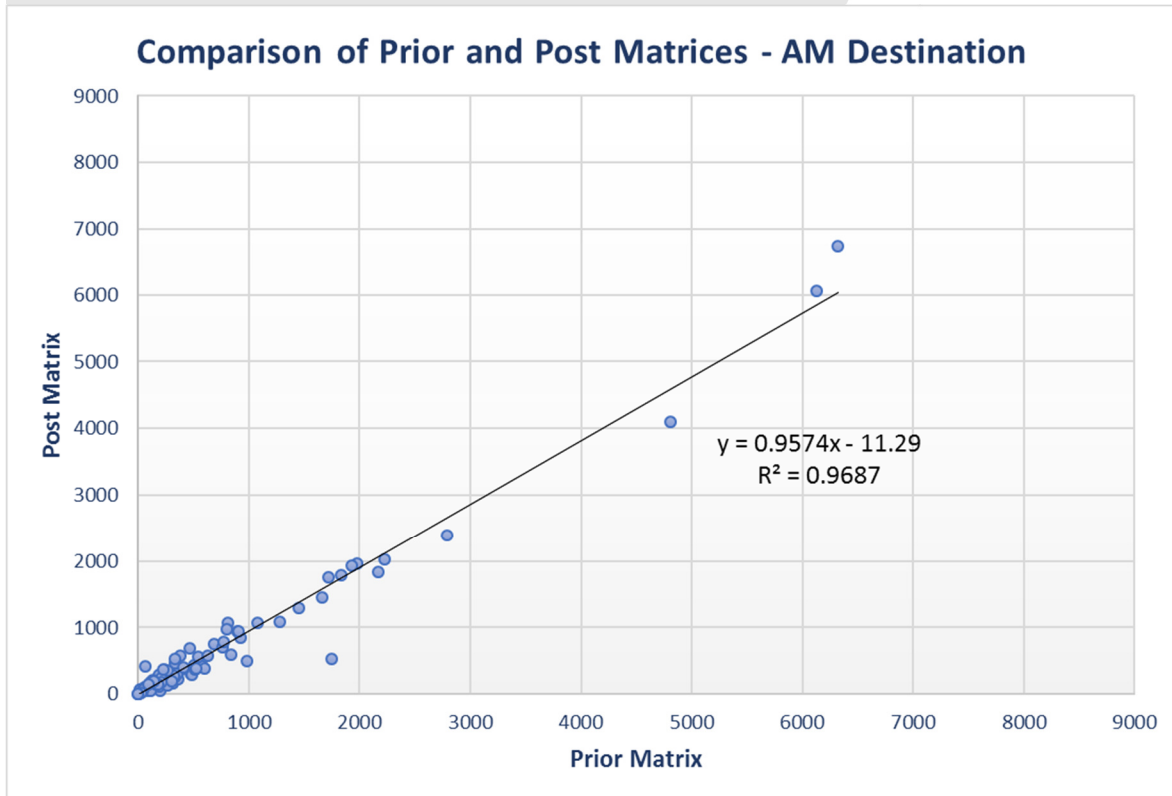
Figure 21: Prior vs Post Destination Trip End Regression Analysis – Car AM
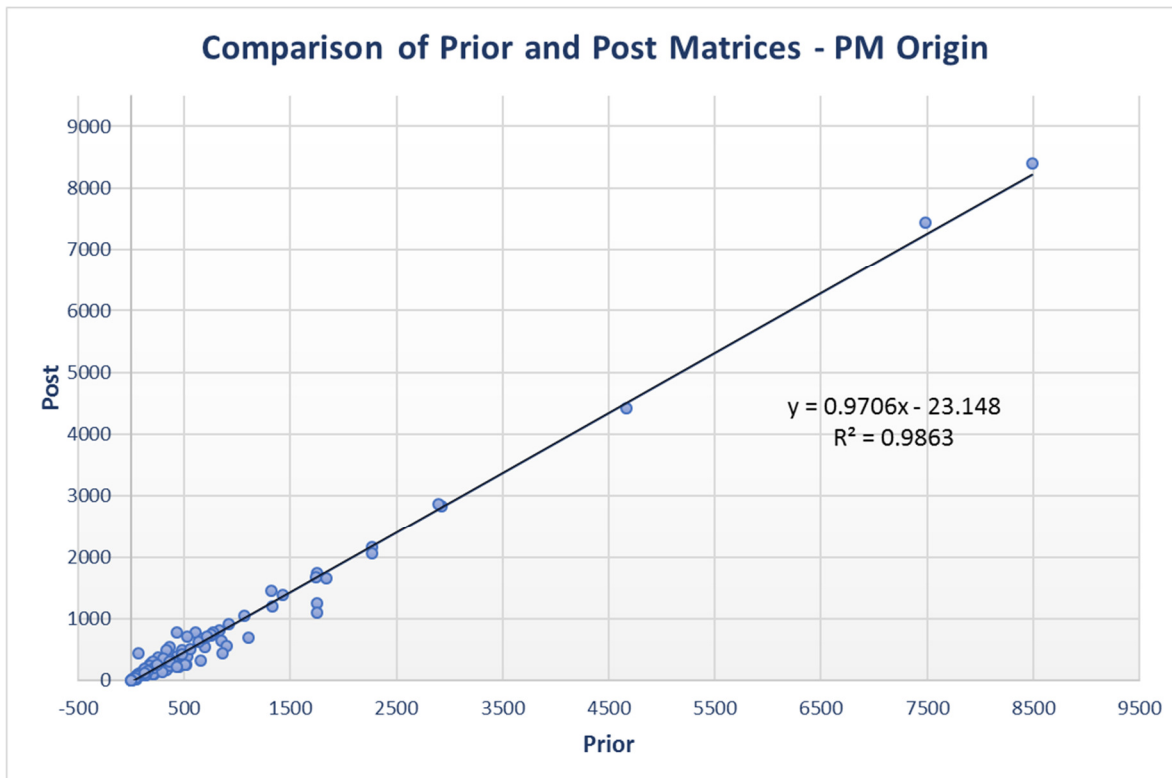
Figure 22: Prior vs Post Origin Trip End Regression Analysis – Car PM

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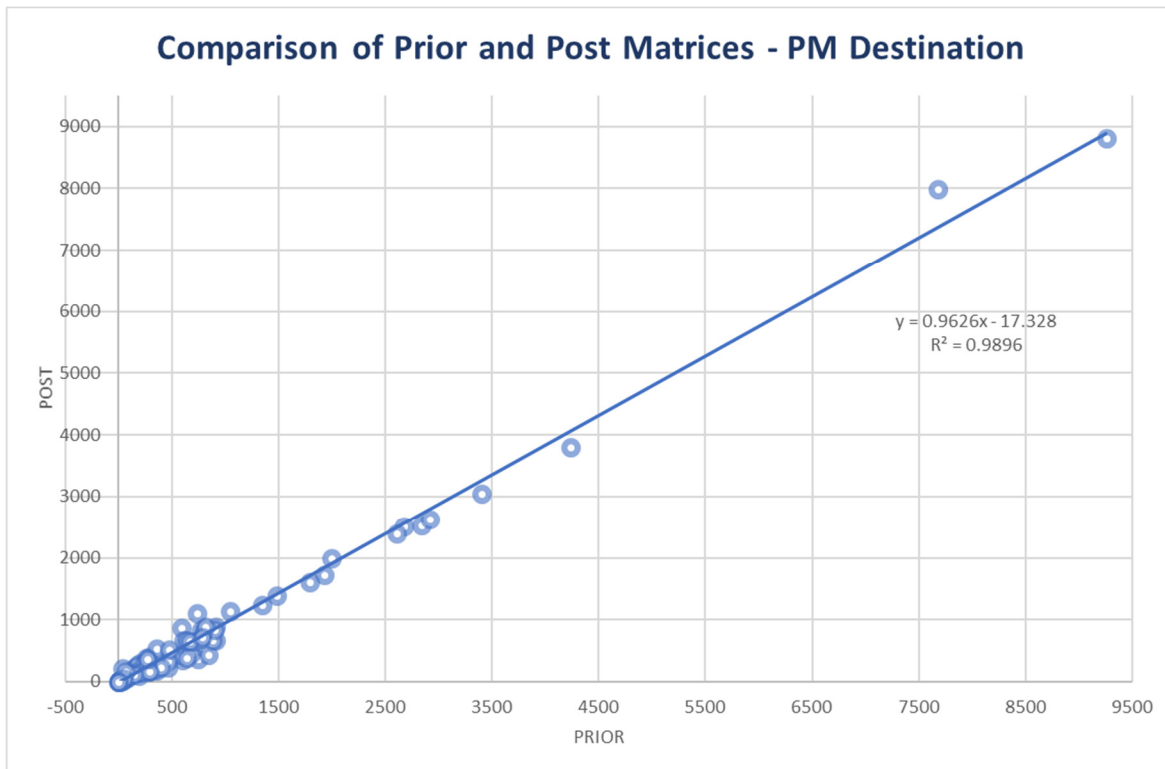
Figure 23: Prior vs Post Destination Trip End Regression Analysis – Car PM

5.1.2   Trip Length Distribution (TLD)

Trip length distributions (TLD) were compared between the prior and post matrices for both AM and PM peak periods as shown in Figure 24. The TLD plots shows that there is no major changes in trip length pattern. However, there is a slight change in TLD for short trips which are mainly internal to internal trips which was mostly unobserved. Comparisons were made between their means trip lengths are also shown in Table 11. These show that the mean is very close.

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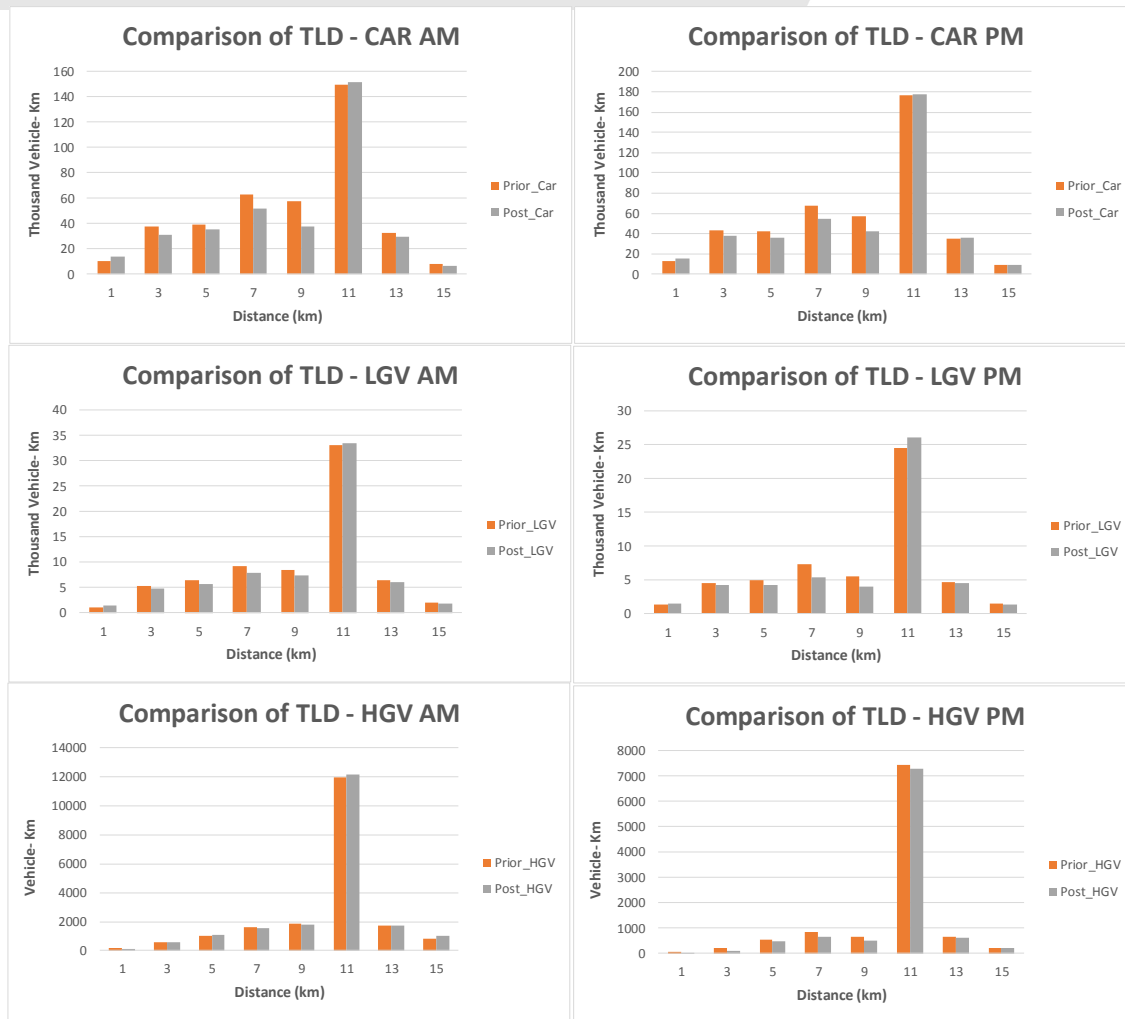
Figure 24: Trip Length Distribution

Table 11: 3-Mean Trip Length Comparison

	Prior Matrix	Post Matrix
	AM Peak	
Car	6.3	6.0
LGV	7.1	7.0
HGV	8.5	8.8
	PM Peak	
Car	6.2	6.1
LGV	6.6	6.6
HGV	8.9	9.6

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6. Network Calibration

6.1 Demand Profiles

Traffic release profiles have been developed for 15 minute intervals based on the surveyed volumetric count data. Where significant queuing was observed on the network at a survey location, the traffic profile has been adjusted in order to account for the number of queued vehicles. This ensures that the release profiles in the model reflect the full traffic demand observed on the network. Release profiles were developed based on average of two weeks (Tuesday to Thursday) data except M5 where traffic profile was derived from two weeks data but excluding the ANPR day.

6.2 Network Calibration

6.2.1 Visibility

The default driver behaviour in Paramics is for all vehicles to come to a complete halt when they reach a stop-line or give way line at a junction. In practice, at junctions such as roundabouts, vehicles will be able to see if there is a gap to pull into and do not necessarily need to come to a complete halt. To reflect this and in order to adequately represent junction capacity, the visibility parameter has been added on the approach to some junctions in the model. The default visibility in Paramics is 0m, this leads to unrealistic behaviour and is not considered to be standard. Typically, good practice is to set it between 0m and 30m depending on local conditions. In general, visibility has been set to 20m or 30m at roundabouts and 10m or 20m at priority junctions.

6.2.2 Look Through

The Look Through parameter has been enabled at priority junctions and at roundabout splitter islands in order to increase the length of road that vehicles consider when giving way. The use of Look Through has improved give way behaviour in the model by helping to ensure that drivers are aware of vehicles when giving way.

6.2.3 Gap Acceptance Times

Lane merge, lane cross and path cross gap acceptance buffer times have been reduced at a number of junctions in the model in order to simulate observed operation of junctions. The gap acceptance parameters have been altered at the following locations:

- A40/Tewkesbury Road roundabout:

- Northern Arm: Lane cross and Lane merge set to 1.5 seconds

- Eastern, Southern and Western arms: Lane cross and Lane merge set to 2 seconds

- A40/Granley Road priority junction: Lane cross and Lane merge set to 2 seconds

- Princess Elizabeth Way/Kingsmead Road priority junction: Lane cross and Lane merge set to 2 seconds

- Princess Elizabeth Way/Hesters Way Road priority junction: Lane cross and Lane merge set to 2 seconds

- Princess Elizabeth Way/Oldbury Road priority junction: Lane cross and Lane merge set to 2 seconds

- Princess Elizabeth Way/Marsland Road/Edinburgh Place: Lane cross and Lane merge set to 2 seconds

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6.2.4 Signal Timings

The signal controller information was obtained from the GCC. Most of the signals are either MOVA operated or demand actuated. In absence of PCMOVA linkage in Paramics Discovery. Those signals were coded as either fixed signal or demand actuated. Phases and stages were retained from the controller specification. Based on the video data the average signal time was calculated.

6.2.5 Pedestrian Crossings

Pedestrian crossings were incorporated in the model based on network surveys and google map. Timings were calibrated. Based on their probable usage the cycle time was calculated.

6.2.6 Speed Limits

Speed limits on approaches to at grade roundabouts have been reduced within the model to reflect driver caution observed in practice. This involved coding graded reductions in speed limits on links approaching the junctions from 40mph to 20mph. Coding the links with the 60mph speed limit led to unrealistic behaviour on approach to the roundabouts including vehicles colliding with each other and therefore to facilitate the accurate representation of capacity, the reductions in speed limits were typically applied over short distances of up to 100m on links.

6.3 Route Calibration

Paramics route viewer has been used to check the shortest path routes between origin and destinations during network calibration as illustrated in Figure 25.
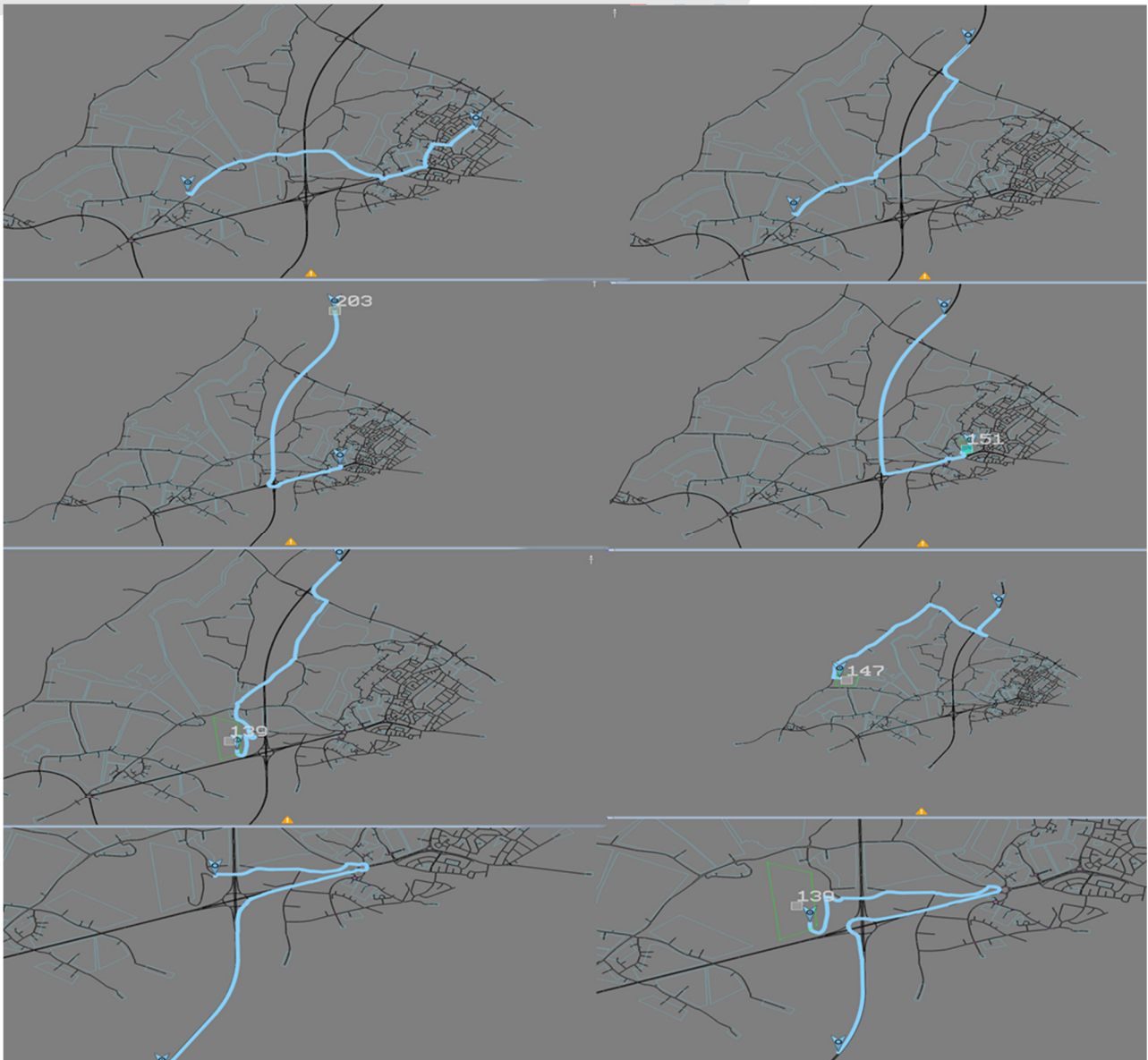
Figure 25: Route Calibration

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7. Assignment Calibration and Validation

The model calibration process is designed to ensure that the parameters which control the model's calculation of route choices and the resulting delays can help to replicate the traffic patterns in the network. Model calibration also indicates the process of adjusting and confirming values of the OD flows in the matrices in order to improve model performance.

The assignment validation requires the modelled flows replicate independent data which has not been used for the construction of the model. The following calibration and validation checks were undertaken:

• Flow calibration and validation
• model journey time validation

It should be noted that the assignment calibration and the validation statistics were compared mainly for following peak hours:

• AM Peak : 0800 to 0900 hours
• PM Peak : 1700 to 1800 hours

This peak hour was selected to maintain consistency with The Central Severn Vale (CSV) model which is to be source of forecast flows for the Paramics model. Although 3 hour demand matrices were assigned using 3 hour average demand profile but it the first half hour and the last half an hour acted as the warm up period and cooling off period respectively. Hence, the result of first hour and last hour is not accurate. All results from the model are based on an average of 10 randomly seeded runs.

7.1.1   Assignment Calibration

The model outputs were compared with the observed and plotted to assess the goodness of fit. Scatter plots were developed for the both AM and PM period and R2 values compared between observed flows and model flows. The comparisons are illustrated. Figure 26 and Figure 27.
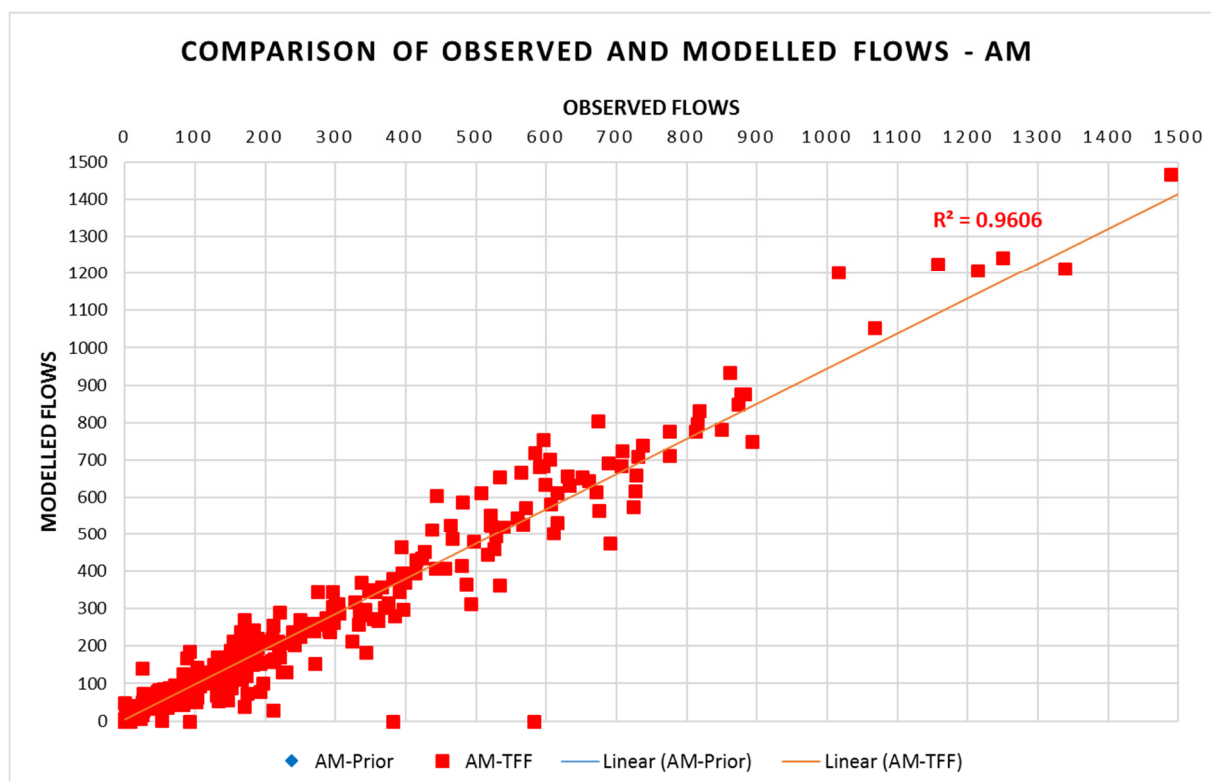
Figure 26: Observed vs Modelled Flows in AM Peak Period

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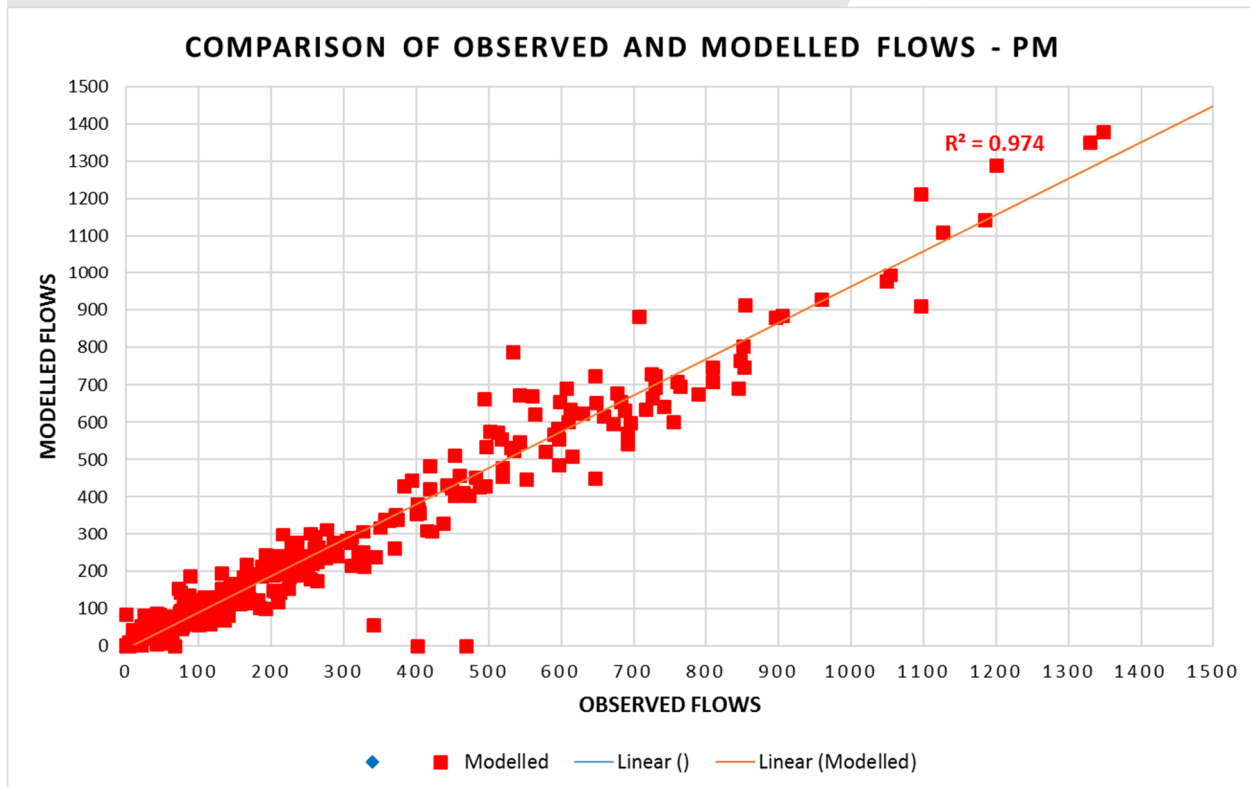
Figure 27: Observed vs Modelled Flows in PM Peak Period

The Observed vs Modelled Flows comparison shows that the observed counts and the modelled are close fit.

7.1.2   Traffic Flow Calibration

The M5 Junction 10 and Junction 11 model has been calibrated against the following counts:

- 72 ATC sites (42 of these were located at the ANPR sites); and
- 253 Manually classified turn counts.

The above calibration data taken from the count sites shown in Figure 28
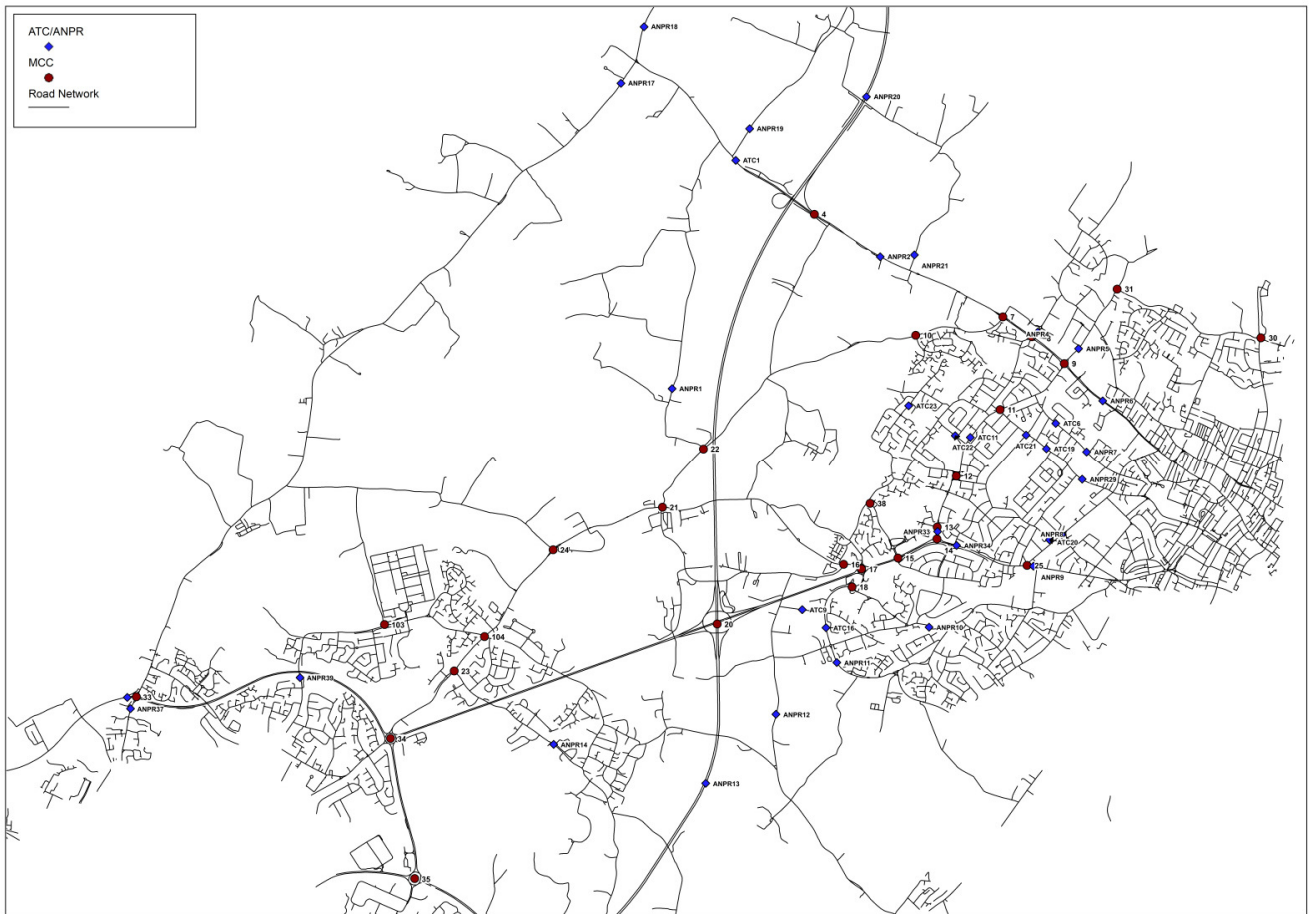
Figure 28: Calibration Count Locations

The modelled flow and the observed flows from ANPR MCC were compared along outer cordon and 2 screenlines as shown in the following Figure 29. The comparison results have been illustrated in Table 12 Table 13, Table 14 and Table 15. The result shows that 67% of the screenlines has met WebTAG +/-5% flow in AM peak and the 83% has met the criteria in PM. It should be noted that observed flows were collected on 28th November 2017 when the incident occurred on the M5. Thus, unlike other flows, the flows for motorway trips were adjusted to average day during matrix calibration process. As a result, AM flow achieved lower screenline calibration.

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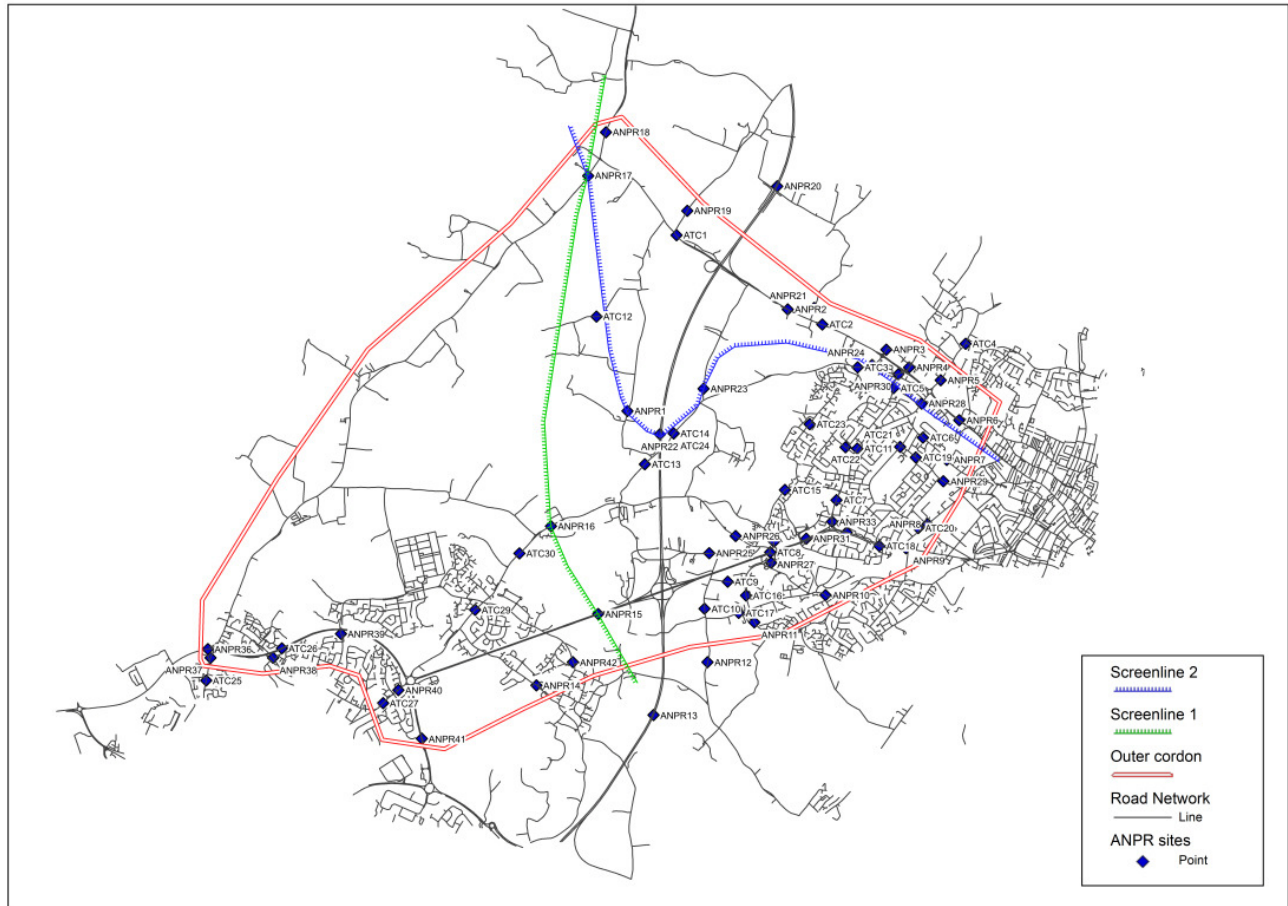
Figure 29: Calibration Screenlines

Table 12: 3-Screenline Calibration Summary – AM Peak

	Direction	Number of Sites	Observed Flow	Modelled Flow	Difference	% Difference	Flow Diff <5%
	CAR						
Outer Cordon	IN	24	16258	15539	-719	4	Y
Outer Cordon	OUT	24	16247	15019	-1228	8	N
Screenline 1	NB/EB	3	2488	2468	-20	1	Y
Screenline 1	SB/WB	3	2305	2322	16	1	Y
Screenline 2	SB	7	4699	4310	-388	8	N
Screenline 2	NB	7	4229	4370	140	3	Y
				% of Screenline Passing the WebTAG Criteria			67%
	ALL VEHICLE						
Outer Cordon	IN	24	19795	19076	-719	4	Y
Outer Cordon	OUT	24	20068	18517	-1551	8	N
Screenline 1	NB/EB	3	2974	2990	16	1	Y
Screenline 1	SB/WB	3	2675	2691	16	1	Y
Screenline 2	SB	7	5937	5509	-428	7	N
Screenline 2	NB	7	5291	5468	177	3	Y
				% of Screenline Passing the WebTAG Criteria			67%

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Table 13: Screenline Calibration Summary – PM Peak

	Direction	Number of Sites	Observed Flow	Modelled Flow	Difference	% Difference	Flow Diff <5%
				CAR			
Outer Cordon	IN	24	17297	16440	-857	5	Y
Outer Cordon	OUT	24	17741	17168	-573	3	Y
Screenline 1	NB/EB	3	2215	2177	-38	2	Y
Screenline 1	SB/WB	3	2744	2676	-69	2	Y
Screenline 2	SB	7	4938	4869	-69	1	Y
Screenline 2	NB	7	4729	5056	327	7	N
					% of Screenline Passing the WebTAG Criteria		83%
				ALL VEHICLE			
Outer Cordon	IN	24	19855	18886	-969	5	Y
Outer Cordon	OUT	24	20218	19517	-701	3	Y
Screenline 1	NB/EB	3	2439	2428	-11	0	Y
Screenline 1	SB/WB	3	3074	3021	-53	2	Y
Screenline 2	SB	7	5727	5602	-126	2	Y
Screenline 2	NB	7	5506	5891	385	7	N
					% of Screenline Passing the WebTAG Criteria		83%

Table 14: Assignment Summary across Screenlines Sites– AM Peak

Description	Direction	No of sites	Flow Criteria	GEH<5	Overall Pass	% Overall Pass
			Car			
Outer Cordon	All	48	41	43	44	92%
Screenline 1	All	6	6	5	6	100%
Screenline 2	All	14	9	11	12	86%
			All vehicle			
Outer Cordon	All	48	39	42	42	88%
Screenline 1	All	6	6	3	6	100%
Screenline 2	All	14	10	10	11	79%

Table 15: Assignment Summary across Screenlines Sites– PM Peak

Description	Direction	No of sites	Flow Criteria	GEH<5	Overall Pass	% Overall Pass
			Car			
Outer Cordon	All	48	43	43	44	92%
Screenline 1	All	6	6	6	6	100%
Screenline 2	All	14	12	13	13	93%
			All vehicle			
Outer Cordon	All	48	42	42	43	90%
Screenline 1	All	6	5	6	6	100%
Screenline 2	All	14	12	12	13	93%

Individual counts were compared at 72 link count sites and 253 Turn Counts sites. Table 16 and Table 17 shows individual link counts and turning count calibration summary respectively.

Table 16: Link Flow Calibration

	Total Link Counts	Counts Passed Flow Criteria	% of Counts Passed Flow Criteria	Counts Passed GEH Criteria	% of Counts Passed GEH Criteria	Counts Passed Flow OR GEH Criteria	% of Counts Passed Flow OR GEH Criteria
CAR							
AM (0800-0900)	72	62	86%	59	82%	65	90%
PM (1700-1800)	72	65	89%	62	86%	65	90%
ALL VEHICLE							
AM (0800-0900)	72	60	83%	56	78%	61	85%
PM (1700-1800)	72	63	88%	60	82%	65	90%

Table 17: Turn Flow Calibration

	Total Link Counts	Counts Passed Flow Criteria	% of Counts Passed Flow Criteria	Counts Passed GEH Criteria	% of Counts Passed GEH Criteria	Counts Passed Flow OR GEH Criteria	% of Counts Passed Flow OR GEH Criteria
CAR							
AM (0800-0900)	253	234	92%	223	86%	240	93%
PM (1700-1800)	253	240	94%	219	86%	243	95%
ALL VEHICLE							
AM (0800-0900)	253	229	90%	212	83%	229	90%
PM (1700-1800)	253	236	91%	213	82%	237	92%

The detailed flow calibration results for both links and turning movements has been attached in **Appendix A.**

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8. Validation

Model validation is the process by which results from the calibrated model are compared to independent data that has not been used in the calibration of the network or development of the matrix. The validation process involves a comparison of observed and modelled journey times. WebTAG criteria for model validation to journey times states that >85% of routes should have a modelled journey time within 15% or 1 minute of the surveyed time.

8.1   Journey Time Comparison

The M5 Junction 10 and Junction 11 model, has been validated against a set of journey time routes that cover the majority of the main routes in the modelled area. The location of the journey time validation routes is shown in Figure 11 of this report.

A comparison between observed and modelled journey times for both the AM peak hour and PM peak hour is shown in Table 18 and Table 19. All results from the model are based on an average of 10 randomly seeded runs.

Table 18: **Comparison of Observed and Modelled Journey Times (AM Peak Hour: 08:00-09:00)**

Journey Time Route	Journey Time (Seconds)		Absolute Difference	% Difference	Meets WebTAG Criteria?
	Observed	Modelled			
Route1_WB	412	442	30	7.3	Yes
Route1_EB	596	513	83	13.9	Yes
Route2_SB	342	322	20	5.8	Yes
Route2_NB	368	320	48	12.9	Yes
Route3_WB	647	649	2	0.3	Yes
Route3_EB	755	830	75	9.9	Yes
Route4_NB	513	476	37	7.3	Yes
Route4_SB	686	578	108	15.8	No
Route5_WB	533	606	73	13.7	Yes
Route5_EB	696	731	35	5.1	Yes
Route6_NB	239	245	6	2.5	Yes
Route6_SB	274	241	33	12.0	Yes
Route7_NB	1049	855	194	18.5	No
Route7_SB	934	955	21	2.2	Yes
Route8_SB	246	284	37	15.0	Yes
Route8_NB	321	310	11	3.5	Yes
JACOBS_1_SB	557	506	51	9.1	Yes
Jacobs_1_NB	275	302	27	9.8	Yes
	Percentage of Journey Times that Meet WebTAG criteria				89%

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Table 19: **Comparison of Observed and Modelled Journey Times (PM Peak Hour: 17:00-18:00)**

Journey Time Route	Journey Time (Seconds)		Absolute Difference	% Difference	Meets WebTAG Criteria?
	Observed	Modelled			
Route1_WB	533	482	51	10	Yes
Route1_EB	472	441	31	7	Yes
Route2_SB	401	383	19	5	Yes
Route2_NB	347	318	29	8	Yes
Route3_WB	814	651	164	20	No
Route3_EB	624	571	54	9	Yes
Route4_NB	511	459	52	10	Yes
Route4_SB	532	601	69	13	Yes
Route5_WB	502	566	64	13	Yes
Route5_EB	544	521	23	4	Yes
Route6_NB	238	242	4	2	Yes
Route6_SB	265	239	26	10	Yes
Route7_NB	773	681	91	12	Yes
Route7_SB	919	965	46	5	Yes
Route8_SB	247	285	37	15	Yes
Route8_NB	248	288	40	16	Yes
JACOBS_1_SB	368	260	108	29	No
Jacobs_1_NB	330	306	24	7	Yes
	Percentage of Journey Times that Meet WebTAG criteria				89%

The journey time analysis shows that the model is validated by journey time in both the AM peak and the PM peak. The graphical analysis of each journey time routes has been attached in **Appendix B.**

8.2   Queue Lengths Comparison

The queue comparison does not form part of validation. Mainly because of the definition of a queue is not clearly defined and its definition varies software to software. Queue data is usually collected only for a day. Also, surveyors may not accurately measure the correct queue length if it is longer. However, consideration of 'queue' length, however subject to interpretation, gives a good indication of congestion hotspots and can be qualitative validation parameters rather than quantitative. Hence, queue length has been reported as illustrated in Table 20 to Table 23.

Table 20: **Comparison of Maximum Observed Queue Length (AM Peak Hour: 08:00-08:00)**

Survey Location	Junction Arm	Maximum Queue Length (m)		
		Observed	Modelled	Difference
MCC 14	A40 (West)	120	127	-7
	Princess Elizabeth Way (North)	54	177	-123
	A40 (East)	54	159	-105
MCC 9	A4019 (West)	123	201	-78
	Kingsditch Lane (North)	177	187	-10
	A4019 (East)	135	210	-75

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	Princess Elizabeth Way	126	194	-68
MCC 4	M5 J10 Southbound offslip	39	478	-439
MCC20	M5 J11 Northbound offslip	45	123	-78
	M5 J11 Southbound offslip	87	149	-62
MCC 34	B4063 (North)	108	487	-379
	A40 (West)	69	237	-168
	A40 (East)	90	106	-16
	B4063 (South)	90	732	-642
	A417	156	717	-561
MCC 17	Fiddlers Green	102	90	12
	A40 (West)	102	1033	-931
	A40 (East)	147	334	-187
	B4063 (North)	114	81	33
	Hatherley Lane	147	146	1

Table 21: **Comparison of Average Observed Queue Length (AM Peak Hour: 08:00-08:00)**

Survey Location	Junction Arm	Average Queue Length (m)		
		Observed	Modelled	Difference
MCC 14	A40 (West)	59	9	49
	Princess Elizabeth Way (North)	25	10	15
	A40 (East)	32	22	10
MCC 9	A4019 (West)	59	31	28
	Kingsditch Lane (North)	60	45	15
	A4019 (East)	46	28	18
	Princess Elizabeth Way	46	25	22
MCC 4	M5 J10 Southbound offslip	10	138	-128
MCC20	M5 J11 Northbound offslip	25	10	15
	M5 J11 Southbound offslip	32	17	14
MCC 34	B4063 (North)	71	59	12
	A40 (West)	46	57	-11
	A40 (East)	42	1	41
	B4063 (South)	38	77	-40
	A417	77	101	-24
MCC 17	Fiddlers Green	64	14	50
	A40 (West)	61	129	-68
	A40 (East)	90	38	52

| | B4063 (North) | 49 | 7 | 43 |
| | Hatherley Lane | 79 | 18 | 61 |

Table 22: **Comparison of Maximum Observed Queue Length (PM Peak Hour: 1700-1800)**

Survey Location	Junction Arm	Maximum Queue Length (m)		
		Observed	Modelled	Difference
MCC 14	A40 (West)	111	266	-155
	Princess Elizabeth Way (North)	84	302	-218
	A40 (East)	99	129	-30
MCC 9	A4019 (West)	114	126	-12
	Kingsditch Lane (North)	87	116	-29
	A4019 (East)	102	285	-183
	Princess Elizabeth Way	162	164	-2
MCC 4	M5 J10 Southbound offslip	12	69	-57
MCC20	M5 J11 Northbound offslip	42	115	-73
	M5 J11 Southbound offslip	90	121	-31
MCC 34	B4063 (North)	99	549	-450
	A40 (West)	57	120	-63
	A40 (East)	81	106	-25
	B4063 (South)	72	60	12
	A417	111	483	-372
MCC 17	Fiddlers Green	30	66	-36
	A40 (West)	78	113	-35
	A40 (East)	141	327	-186
	B4063 (North)	12	63	-51
	Hatherley Lane	150	191	-41

Table 23: **Comparison of Average Observed Queue Length (PM Peak Hour: 1700-1800)**

Survey Location	Junction Arm	Average Queue Length (m)		
		Observed	Modelled	Difference
MCC 14	A40 (West)	67	13	54
	Princess Elizabeth Way (North)	49	45	4
	A40 (East)	73	10	62
MCC 9	A4019 (West)	64	24	40
	Kingsditch Lane (North)	37	19	18
	A4019 (East)	42	41	1

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	Princess Elizabeth Way	61	23	38
MCC 4	M5 J10 Southbound offslip	2	4	-2
MCC20	M5 J11 Northbound offslip	26	9	17
	M5 J11 Southbound offslip	39	13	26
MCC 34	B4063 (North)	54	64	-10
	A40 (West)	31	36	-5
	A40 (East)	39	3	36
	B4063 (South)	24	13	10
	A417	84	66	18
MCC 17	Fiddlers Green	10	10	1
	A40 (West)	34	15	19
	A40 (East)	46	32	13
	B4063 (North)	9	3	6
	Hatherley Lane	52	37	16

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9. Summary

Jacobs has prepared a Paramics Discovery model covering M5 Junction 10 and Junction 11 and the surrounding local road network.

The model has been developed for a base year of 2017 using traffic data collected in November and December 2017. Journey time data, used for validation, was extracted from Traffic Master data provided by Gloucestershire County Council and collected in October 2015 to November 2015. In addition, site visits, OS mapping, bus timetables and aerial mapping have been used to aid in the construction of the model.

The model has been developed to cover the 3-hour (0700-1000 hours) and 3-hour (1600-1900 hours) evening peak. However, considering the warm up period and the cooling off period, the following 'peak' hour has been the focus of the calibration and validation process:

- AM Weekday Peak – 08:00-09:00; and

- PM Weekday Peak – 17:00-18:00.

Automatic Number Plate Registration (ANPR) survey, ATC data and the Turning count (MCC) data was collected for the model development purpose. ATC data was collected for continuous 2 weeks. ANPR data and Turning count (MCC) data was collected on 28th November 2017. Few MCC data was collected at a different date.

An incident happened on M5 Mainline between J10 and J11 in early hours of AM peak (0630-0700) during the ANPR survey day. This was spotted during the data analysis and prompted further investigation to understand the impact of the incident in modelled period. It was found from 12-hour trip chain analysis that there was no major traffic rerouting in NB direction, but a few traffic movements rerouted in SB direction. Those trips were reassigned at the early stage of matrix development process. Moreover, vehicle release profiles were developed based on average of two weeks (Tuesday to Thursday) data except M5 where traffic profile was derived from two weeks data but excluding the ANPR day.

The total trip demand within the model has been estimated using surveyed traffic count data. The model was calibrated to surveyed turn counts and link counts. The validation was undertaken against the observed journey time data along 18 routes.

The matrix calibration was undertaken in the form of trip end regression analysis and the trip length analysis. It shows an estimated post matrix is a good fit of prior matrix.

Network calibration was undertaken in the form of OD shortest path. It also shows that routes represented in the model is logical and robust.

Assignment calibration and validation was undertaken using Link Counts, Turn Counts and Journey Time data. This LMVR demonstrates that the base model has been calibrated and validated to WebTAG criteria and is suitable for use in testing the performance of proposed interventions in the study area road network.

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Appendix A. Flow Calibration Detailed Results

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Appendix A.1: Link Count Calibration AM (Cars)

		Direction	From Node	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
				8 to 9 AM - CARS						
ATC6	Arle Road, between Brooklyn Gardens and Nether Gardens	SB	1274:1276	290	243	2.86	-47	-16.09%	P	P
		NB	1276:1274	139	153	1.11	13	9.60%	P	P
ATC9	North Road West, between Badgeworth Road and Grovefield Way	EB	235:577	101	52	5.61	-49	-48.46%	P	P
		WB	577:235	102	64	4.25	-39	-37.85%	P	P
ATC16	Grovefield Way, between North Road West and The Reddings	SB	577:1928	188	196	0.55	8	4.01%	P	P
		NB	1928:577	427	453	1.25	26	6.15%	P	P
ATC19	Alstone Road front of Rowanfield Infant School	WB	1292:1291	384	281	5.66	-103	-26.85%	O	O
		EB	1291:1292	212	166	3.34	-46	-21.66%	P	P
ATC20	Libertus Road approaching B4633 Gloucester Rd	SB (EB)	1377:1378	269	240	1.82	-29	-10.80%	P	P
		NB (WB)	1378:1377	99	120	2.01	21	21.23%	P	P
ATC21	Brooklyn Road North of Edinburgh Place	SB	1335:1330	134	130	0.33	-4	-2.80%	P	P
		NB	1330:1335	224	132	6.90	-92	-41.14%	P	P
ATC22	Location Changed Oldbury Road front of Pates Grammer School	EB	1018:1017	170	38	13.00	-133	-77.86%	O	O
		WB	1017:1018	52	19	5.68	-34	-64.54%	P	P
ATC23	Springbank Road close to Helens Close	SB	1190:1193	130	67	6.29	-62	-48.10%	P	P
		NB	1193:1190	166	111	4.66	-55	-33.06%	P	P
ANPR 1	Main Street, between Boddington Lane and Brock Farm Lane	SB	1583:1582	137	95	3.88	-42	-30.54%	P	P
		NB	1582:1583	37	40	0.46	3	7.67%	P	P
ANPR 2	A4019, between Withybridge Lane and The Green	SB (EB)	843:846	877	876	0.03	-1	-0.09%	P	P
		NB (WB)	846:843	566	528	1.67	-39	-6.88%	P	P
ANPR 4	Manor Road, between A4019 and Rutherford Way	SB (WB)	877:885	360	268	5.18	-92	-25.47%	P	P
		NB (EB)	885:881	415	430	0.74	15	3.67%	P	P
ANPR 5	Kingsditch Lane, between A4019 and Upper Field Road	SB	891:898	591	681	3.57	90	15.22%	P	P
		NB	898:891	813	776	1.32	-37	-4.57%	P	P
ANPR 6	A4019, at railway line	SB (EB)	1256:1259	775	778	0.08	2	0.29%	P	P
		NB (WB)	1486:1680	707	685	0.83	-22	-3.11%	P	P
ANPR 7	Arle Road, at railway line	SB	1351:1968	391	345	2.44	-47	-11.98%	P	P
		NB	1968:1351	138	132	0.54	-6	-4.57%	P	P
ANPR 8	B4633, at railway line	SB (WB)	1496:1383	334	284	2.83	-50	-14.91%	P	P
		NB (EB)	1383:1496	274	346	4.09	72	26.30%	P	P
ANPR 9	A40, at railway line	EB	1546:1482	728	660	2.56	-68	-9.28%	P	P
		WB	1482:1546	893	749	5.03	-144	-16.13%	O	O
ANPR 10	Hatherly Lane, at railway line	SB (EB)	2028:2045	610	502	4.59	-108	-17.76%	O	P
		NB (WB)	2045:2028	775	711	2.33	-64	-8.19%	P	P
ANPR 11	Grovefield Way, at railway line	SB	1926:1681	236	209	1.88	-28	-11.83%	P	P
		NB	1681:1926	442	409	1.61	-33	-7.52%	P	P
ANPR 12	Badgeworth Road, at railway line	SB	239:1948	182	152	2.33	-30	-16.54%	P	P
		NB	1948:239	558	544	0.61	-14	-2.56%	P	P
ANPR 13	M5, at railway line, between Junction 11 and 11A	SB	327:580	2554	2334	4.45	-220	-8.62%	P	P
		NB	581:326	1957	2135	3.94	178	9.10%	P	P
ANPR 14	Pirton Lane, at railway line	SB	1936:1748	533	363	8.04	-170	-31.93%	O	O
		NB	1748:1936	414	396	0.91	-18	-4.41%	P	P
ANPR 17	A38, between A4019 and Pancake Lane	SB	751:749	437	511	3.41	74	16.99%	P	P
		NB	749:751	674	564	4.44	-110	-16.38%	O	P
ANPR 18	A4019, North of A38 / A4019 junction	SB	770:769	815	797	0.63	-18	-2.21%	P	P
		NB	769:770	651	654	0.13	3	0.52%	P	P
ANPR 19	Unnamed Road, between A4019 and Cursey Lane	SB	1656:1655	374	316	3.16	-59	-15.66%	P	P
		NB	1655:1656	297	263	2.02	-34	-11.40%	P	P
ANPR 20	M5, between Junction 9 and Junction 10	NB	822:611	2880	2424	8.85	-456	-15.83%	O	O
		SB	815:823	2425	2155	5.66	-271	-11.17%	P	P
ANPR 21	The Green, between A4019 and Lowdilow Lane	SB	850:848	184	175	0.73	-10	-5.29%	P	P
		NB	848:850	12	11	0.46	-2	-12.81%	P	P
ANPR 29	Alstone Lane, at railway line	SB (EB)	1359:1358	138	155	1.38	17	12.12%	P	P
		NB (WB)	1358:1359	238	238	0.03	-1	-0.22%	P	P
ANPR 33	A4013, between A40 and Cowper Road	SB	1030:1032	674	804	4.78	130	19.27%	O	P
		NB	1032:1030	630	657	1.03	26	4.13%	P	P
ANPR 34	A40, between A4013 and Benhall Avenue	EB	533:529	596	755	6.11	159	26.65%	O	O
		WB	529:533	861	933	2.42	73	8.44%	P	P
ANPR 36	A40, between A417 and A38	SB (WB)	1994:1995	651	653	0.06	2	0.25%	P	P
		NB (EB)	1995:1994	1067	1053	0.42	-14	-1.30%	P	P
ANPR 37	A38, between A40 and A417	NB	1991:1990	539	521	0.78	-18	-3.34%	P	P
		SB	1990:1991	873	848	0.85	-25	-2.84%	P	P
ANPR 38	A40, between A38 and B4063	SB	1840:1839	242	203	2.59	-39	-15.98%	P	P
		NB	1839:1840	336	370	1.81	34	10.13%	P	P
ANPR 39	Innsworth Lane, between Brionne Way and Rookery Road	SB	1802:1803	487	365	5.88	-121	-24.92%	O	O
		NB	1803:1802	349	350	0.05	1	0.24%	P	P
ANPR 40	B4063, between A40 and Nine Elms Road	SB (WB)	1974:2066	616	534	3.42	-82	-13.34%	P	P
		NB (EB)	2066:1974	708	723	0.58	16	2.19%	P	P
ANPR 41	A417, at railway line	SB	1977:1979	1489	1469	0.52	-20	-1.35%	P	P
		NB	1978:1976	1250	1243	0.20	-7	-0.56%	P	P
ANPR 42	Station Road at Rail Bridge	SB	1649:1651	370	303	3.64	-67	-18.05%	P	P
		NB	1651:1649	284	259	1.51	-25	-8.75%	P	P

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Appendix A.2: Link Count Calibration AM (Total)

				8 to 9 AM - TOTAL						
		Direction	From Node	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
ATC6	Arle Road, between Brooklyn Gardens and Nether Gardens	SB	1274:1276	346	315	1.73	-31	-9.08%	P	P
		NB	1276:1274	167	202	2.56	35	20.78%	P	P
ATC9	North Road West, between Badgeworth Road and Grovefield Way	EB	235:577	121	63	6.07	-58	-48.10%	P	P
		WB	577:235	120	74	4.65	-46	-38.17%	P	P
ATC16	Grovefield Way, between North Road West and The Reddings	SB	577:1928	228	233	0.32	5	2.15%	P	P
		NB	1928:577	508	520	0.53	12	2.38%	P	P
ATC19	Alstone Road front of Rowanfield Infant School	WB	1292:1291	452	338	5.75	-114	-25.27%	O	O
		EB	1291:1292	252	214	2.48	-38	-15.00%	P	P
ATC20	Libertus Road approaching B4633 Gloucester Rd	SB (EB)	1377:1378	322	279	2.47	-43	-13.32%	P	P
		NB (WB)	1378:1377	119	144	2.21	25	21.26%	P	P
ATC21	Brooklyn Road North of Edinburgh Place	SB	1335:1330	167	149	1.44	-18	-10.84%	P	P
		NB	1330:1335	262	154	7.51	-108	-41.34%	O	O
ATC22	Location Changed Oldbury Road front of Pates Grammer School	EB	1018:1017	205	47	14.12	-158	-77.27%	O	O
		WB	1017:1018	63	23	6.12	-40	-63.65%	P	P
ATC23	Springbank Road close to Helens Close	SB	1190:1193	155	76	7.39	-79	-51.23%	P	P
		NB	1193:1190	196	126	5.50	-70	-35.61%	P	P
ANPR 1	Main Street, between Boddington Lane and Brock Farm Lane	SB	1583:1582	151	103	4.22	-48	-31.52%	P	P
		NB	1582:1583	45	45	0.06	0	0.89%	P	P
ANPR 2	A4019, between Withybridge Lane and The Green	SB (EB)	843:846	1064	1069	0.16	5	0.48%	P	P
		NB (WB)	846:843	691	668	0.90	-24	-3.40%	P	P
ANPR 4	Manor Road, between A4019 and Rutherford Way	SB (WB)	877:885	425	322	5.35	-103	-24.31%	O	O
		NB (EB)	885:881	487	503	0.70	16	3.20%	P	P
ANPR 5	Kingsditch Lane, between A4019 and Upper Field Road	SB	891:898	739	845	3.77	106	14.34%	P	P
		NB	898:891	1013	942	2.26	-71	-6.99%	P	P
ANPR 6	A4019, at railway line	SB (EB)	1256:1259	965	959	0.20	-6	-0.65%	P	P
		NB (WB)	1486:1680	844	817	0.94	-27	-3.20%	P	P
ANPR 7	Arle Road, at railway line	SB	1351:1968	523	451	3.27	-72	-13.80%	P	P
		NB	1968:1351	184	174	0.72	-10	-5.22%	P	P
ANPR 8	B4633, at railway line	SB (WB)	1496:1383	374	324	2.69	-50	-13.42%	P	P
		NB (EB)	1383:1496	328	404	3.96	76	23.11%	P	P
ANPR 9	A40, at railway line	EB	1546:1482	866	774	3.21	-92	-10.62%	P	P
		WB	1482:1546	992	836	5.15	-156	-15.69%	O	O
ANPR 10	Hatherly Lane, at railway line	SB (EB)	2028:2045	707	576	5.17	-131	-18.51%	O	O
		NB (WB)	2045:2028	843	770	2.58	-73	-8.68%	P	P
ANPR 11	Grovefield Way, at railway line	SB	1926:1681	293	254	2.37	-39	-13.38%	P	P
		NB	1681:1926	495	468	1.23	-27	-5.43%	P	P
ANPR 12	Badgeworth Road, at railway line	SB	239:1948	228	186	2.92	-42	-18.42%	P	P
		NB	1948:239	644	630	0.55	-14	-2.17%	P	P
ANPR 13	M5, at railway line, between Junction 11 and 11A	SB	327:580	3362	3097	4.66	-265	-7.89%	P	P
		NB	581:326	2496	2715	4.29	219	8.77%	P	P
ANPR 14	Pirton Lane, at railway line	SB	1936:1748	601	405	8.72	-196	-32.55%	O	O
		NB	1748:1936	464	442	1.03	-22	-4.72%	P	P
ANPR 17	A38, between A4019 and Pancake Lane	SB	751:749	511	566	2.38	55	10.82%	P	P
		NB	749:751	838	701	4.93	-137	-16.32%	O	P
ANPR 18	A4019, North of A38 / A4019 junction	SB	770:769	941	883	1.94	-59	-6.22%	P	P
		NB	769:770	829	824	0.18	-5	-0.63%	P	P
ANPR 19	Unnamed Road, between A4019 and Cursey Lane	SB	1656:1655	421	362	2.98	-59	-14.01%	P	P
		NB	1655:1656	378	330	2.55	-48	-12.70%	P	P
ANPR 20	M5, between Junction 9 and Junction 10	NB	822:611	3816	3313	8.42	-503	-13.18%	O	O
		SB	815:823	3083	2756	6.05	-327	-10.61%	P	P
ANPR 21	The Green, between A4019 and Lowdilow Lane	SB	850:848	213	271	3.72	58	27.14%	P	P
		NB	848:850	18	37	3.65	19	106.67%	P	P
ANPR 29	Alstone Lane, at railway line	SB (EB)	1359:1358	202	213	0.73	11	5.20%	P	P
		NB (WB)	1358:1359	315	309	0.37	-6	-2.06%	P	P
ANPR 33	A4013, between A40 and Cowper Road	SB	1030:1032	798	979	6.06	181	22.62%	O	O
		NB	1032:1030	756	814	2.07	58	7.67%	P	P
ANPR 34	A40, between A4013 and Benhall Avenue	EB	533:529	727	903	6.17	176	24.21%	O	O
		WB	529:533	966	1056	2.83	90	9.33%	P	P
ANPR 36	A40, between A417 and A38	SB (WB)	1994:1995	847	873	0.90	26	3.12%	P	P
		NB (EB)	1995:1994	1315	1298	0.47	-17	-1.29%	P	P
ANPR 37	A38, between A40 and A417	NB	1991:1990	658	635	0.89	-23	-3.45%	P	P
		SB	1990:1991	997	972	0.78	-25	-2.47%	P	P
ANPR 38	A40, between A38 and B4063	SB	1840:1839	313	257	3.34	-56	-17.99%	P	P
		NB	1839:1840	385	421	1.79	36	9.32%	P	P
ANPR 39	Innsworth Lane, between Brionne Way and Rookery Road	SB	1802:1803	568	414	6.97	-155	-27.20%	O	O
		NB	1803:1802	425	423	0.12	-2	-0.56%	P	P
ANPR 40	B4063, between A40 and Nine Elms Road	SB (WB)	1974:2066	712	625	3.36	-87	-12.22%	P	P
		NB (EB)	2066:1974	808	820	0.43	12	1.53%	P	P
ANPR 41	A417, at railway line	SB	1977:1979	1743	1721	0.53	-22	-1.26%	P	P
		NB	1978:1976	1600	1579	0.53	-21	-1.31%	P	P
ANPR 42	Station Road at Rail Bridge	SB	1649:1651	464	369	4.63	-95	-20.39%	P	P
		NB	1651:1649	319	333	0.79	14	4.45%	P	P

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Appendix A.3: Turn Count Calibration AM (Car)

ID	Direction	From Node	To Node	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
			8 to 9 AM - CARS							
4a	(A) M5 SB Offslip (N)	(B) A4019 Withy Bridge (E)	817:841	841:824	399	370.8	1.44	-28	-7.07%	P	P
	(D)A4019 Withy Bridge (W)	(B) A4019 Withy Bridge (E)	798:841	841:824	737	740.4	0.13	3	0.46%	P	P
4b	(B) A4019 Withy Bridge (E)	(D)A4019 Withy Bridge (W)	800:799	799:796	497	479.7	0.78	-17	-3.48%	P	P
		(C)M5 NB Onslip (S)	800:799	799:801	249	226.6	1.45	-22	-9.00%	P	P
7	(A) B634 Hayden Road (N)	(B) A4019 Tewkesbury Road (E)	857:1483	1483:1686	3	12.3	3.36	9	310.00%	P	P
		(C)B634 Hayden Road (S)	1483:943	943:919	67	76.7	1.14	10	14.48%	P	P
		(D) A4019 Tewkesbury Road (W)	1483:943	943:941	88	68	2.26	-20	-22.73%	P	P
	(B) A4019 Tewkesbury Road (E)	(A) B634 Hayden Road (N)	913:943	943:1483	1	18.1	5.53	17	1710.00%	P	P
		(C)B634 Hayden Road (S)	912:913	913:919	89	118.6	2.91	30	33.26%	P	P
		(D) A4019 Tewkesbury Road (W)	913:943	943:941	382	379.4	0.13	-3	-0.68%	P	P
	(C)B634 Hayden Road (S)	(A) B634 Hayden Road (N)	919:943	943:1483	169	198.3	2.16	29	17.34%	P	P
		(B) A4019 Tewkesbury Road (E)	919:943	943:1686	24	142.1	12.96	118	492.08%	O	O
		(D) A4019 Tewkesbury Road (W)	945:919	919:941	91	101.4	1.06	10	11.43%	P	P
	(D) A4019 Tewkesbury Road (W)	(A) B634 Hayden Road (N)	930:914	914:1483	218	214	0.27	-4	-1.83%	P	P
		(B) A4019 Tewkesbury Road (E)	914:943	943:1686	850	781	2.42	-69	-8.12%	P	P
		(C)B634 Hayden Road (S)	914:943	943:919	54	54.7	0.09	1	1.30%	P	P
8A	(B) A4019 Tewkesbury Road (E)	(C)Hayden Road (S)	885:867	867:871	271	154.4	7.99	-117	-43.03%	O	O
		(D) A4019 Tewkesbury Road (W)	885:861	861:863	466	487.3	0.98	21	4.57%	P	P
	(C)Hayden Road (S)	(B) A4019 Tewkesbury Road (E)	871:861	861:885	207	213	0.41	6	2.90%	P	P
		(D) A4019 Tewkesbury Road (W)	871:861	861:863	19	37.6	3.50	19	97.89%	P	P
	(D) A4019 Tewkesbury Road (W)	(B) A4019 Tewkesbury Road (E)	922:861	861:885	883	877.6	0.18	-5	-0.61%	P	P
8B	(A) Manor Road (N)	(B) A4019 Tewkesbury Road (E)	877:885	885:876	104	130.6	2.46	27	25.58%	P	P
		(D) A4019 Tewkesbury Road (W)	877:885	885:861	211	29.1	16.60	-182	-86.21%	O	O
	(B) A4019 Tewkesbury Road (E)	(A) Manor Road (N)	911:885	885:881	88	169.4	7.18	81	92.50%	P	P
		(D) A4019 Tewkesbury Road (W)	911:885	885:861	526	459.5	3.00	-67	-12.64%	P	P
	(D) A4019 Tewkesbury Road (W)	(A) Manor Road (N)	861:885	885:881	273	260	0.80	-13	-4.76%	P	P
		(B) A4019 Tewkesbury Road (E)	861:885	885:876	817	831.9	0.52	15	1.82%	P	P
9	(A) Kingsditch Lane (N)	(B) A4019 Tewkesbury Road (E)	898:1613	1693:1653	52	82.5	3.72	31	58.65%	P	P
		(C)A4013 Princess Elizabeth Way (S)	898:1613	1620:893	520	524.5	0.20	5	0.87%	P	P
		(D)A4019 Tewkesbury Road (W)	898:1613	1602:1517	63	72.5	1.15	10	15.08%	P	P
	(B) A4019 Tewkesbury Road (E)	(A) Kingsditch Lane (N)	1593:1635	1499:898	46	49.1	0.45	3	6.74%	P	P
		(C)A4013 Princess Elizabeth Way (S)	1593:1635	1620:893	187	195.1	0.59	8	4.33%	P	P
		(D)A4019 Tewkesbury Road (W)	1593:1635	1602:1517	479	416	2.98	-63	-13.15%	P	P
	(C)A4013 Princess Elizabeth Way (S)	(A) Kingsditch Lane (N)	893:1692	1499:898	520	551.7	1.37	32	6.10%	P	P
		(B) A4019 Tewkesbury Road (E)	893:1692	1693:1653	151	147	0.33	-4	-2.65%	P	P
		(D)A4019 Tewkesbury Road (W)	893:1692	1602:1517	92	186.2	7.99	94	102.39%	P	P
	(D)A4019 Tewkesbury Road (W)	(A) Kingsditch Lane (N)	1650:1691	1499:898	219	176.1	3.05	-43	-19.59%	P	P
		(B) A4019 Tewkesbury Road (E)	1650:1691	1693:1653	724	575	5.85	-149	-20.58%	O	O
		(C)A4013 Princess Elizabeth Way (S)	1650:1691	1620:893	169	212.4	3.14	43	25.68%	P	P
10	(A) Old Gloucester Road (E)	(B) Pilgrove Way (S)	958:957	957:960	26	27.7	0.33	2	6.54%	P	P
		(C)Old Gloucester Road (W)	958:957	957:961	192	154.2	2.87	-38	-19.69%	P	P
	(B) Pilgrove Way (S)	(A) Old Gloucester Road (E)	960:957	957:958	106	92.8	1.32	-13	-12.45%	P	P
		(C)Old Gloucester Road (W)	960:957	957:961	49	59.7	1.45	11	21.84%	P	P
	(C)Old Gloucester Road (W)	(A) Old Gloucester Road (E)	961:957	957:958	323	214	6.65	-109	-33.75%	O	O
		(B) Pilgrove Way (S)	961:957	957:960	23	30.5	1.45	8	32.61%	P	P
11	(A) A4013 Princess Elizabeth Way (E)	(B) Orchard Way (S)	1002:1003	1003:1009	48	47	0.15	-1	-2.08%	P	P
		(C)A4013 Princess Elizabeth Way (W)	1002:1003	1003:2259	633	632.7	0.01	0	-0.05%	P	P
	(B) Orchard Way (S)	(A) A4013 Princess Elizabeth Way (E)	1009:1003	1003:1002	73	71.9	0.13	-1	-1.51%	P	P
		(C)A4013 Princess Elizabeth Way (W)	1009:1003	1003:2259	126	107.7	1.69	-18	-14.52%	P	P
	(C)A4013 Princess Elizabeth Way (W)	(A) A4013 Princess Elizabeth Way (E)	2259:1003	1003:1002	481	586.1	4.55	105	21.85%	O	P
		(B) Orchard Way (S)	2259:1003	1003:1009	147	96.3	4.60	-51	-34.49%	P	P
12	(A) A4013 Princess Elizabeth Way (N)	(A) A4013 Princess Elizabeth Way (N)	1019:1020	1020:1019	1	0.1	1.21	-1	-90.00%	P	P
		(B) Edinburgh Place (E)	1019:1020	1022:1026	49	81.5	4.02	33	66.33%	P	P
		(C)A4013 Princess Elizabeth Way (S)	1019:1020	1025:1668	534	654.7	4.95	121	22.60%	O	P
		(D) Marsland Road (W)	1019:1020	1023:1024	41	52	1.61	11	26.83%	P	P
	(B) Edinburgh Place (E)	(A) A4013 Princess Elizabeth Way (N)	1026:1022	1020:1019	103	75.6	2.90	-27	-26.60%	P	P
		(C)A4013 Princess Elizabeth Way (S)	1026:1022	1025:1668	46	78.1	4.08	32	69.78%	P	P
		(D) Marsland Road (W)	1026:1022	1023:1024	64	61.7	0.29	-2	-3.59%	P	P
	(C)A4013 Princess Elizabeth Way (S)	(A) A4013 Princess Elizabeth Way (N)	1668:1025	1020:1019	463	524.6	2.77	62	13.30%	P	P
		(B) Edinburgh Place (E)	1668:1025	1022:1026	24	27.8	0.75	4	15.83%	P	P
		(D) Marsland Road (W)	1668:1025	1023:1024	11	21.6	2.63	11	96.36%	P	P
	(D) Marsland Road (W)	(A) A4013 Princess Elizabeth Way (N)	1024:1023	1020:1019	65	80.5	1.82	16	23.85%	P	P
		(B) Edinburgh Place (E)	1024:1023	1022:1026	166	128.8	3.06	-37	-22.41%	P	P
		(C)A4013 Princess Elizabeth Way (S)	1024:1023	1025:1668	38	40.8	0.45	3	7.37%	P	P
13	(A) A4013 Princess Elizabeth Way (N)	(B) A4013 Princess Elizabeth Way (S)	1542:1679	1679:538	584	718.4	5.27	134	23.01%	O	O
		(C)Hubble Road (W)	1542:1679	1679:1035	126	116.6	0.85	-9	-7.46%	P	P
	(B) A4013 Princess Elizabeth Way (S)	(A) A4013 Princess Elizabeth Way (N)	1678:1679	1679:1036	606	582.8	0.95	-23	-3.83%	P	P
		(C)Hubble Road (W)	1678:1679	1679:1035	86	84.5	0.16	-2	-1.74%	P	P
	(C)Hubble Road (W)	(A) A4013 Princess Elizabeth Way (N)	1045:1035	1035:1036	76	67.4	1.02	-9	-11.32%	P	P
		(B) A4013 Princess Elizabeth Way (S)	1035:1679	1679:538	42	39.2	0.44	-3	-6.67%	P	P
14	(A) A4013 Princess Elizabeth Way (N)	(B) A40 Gloucester Road (E)	538:552	544:543	24	51.9	4.53	28	116.25%	P	P
		(C.) A40 Gloucester Road (W)	538:552	549:548	605	701.6	3.78	97	15.97%	P	P
	(B) A40 Gloucester Road (E)	(A) A4013 Princess Elizabeth Way (N)	547:545	551:550	167	147.7	1.54	-19	-11.56%	P	P
		(C.) A40 Gloucester Road (W)	547:545	549:548	731	709.2	0.81	-22	-2.98%	P	P
	(C.) A40 Gloucester Road (W)	(A) A4013 Princess Elizabeth Way (N)	539:542	551:550	522	522.5	0.02	1	0.10%	P	P
		(B) A40 Gloucester Road (E)	539:542	544:543	564	666.5	4.13	103	18.17%	O	P
15	(A) Telstar Way (N)	(B) A40 Gloucester Road (E)	441:512	512:446	21	25	0.83	4	19.05%	P	P
		(C)A40 Gloucester Road (W)	441:512	512:453	396	298.7	5.22	-97	-24.57%	P	P
	(B) A40 Gloucester Road (E)	(A) Telstar Way (N)	1729:512	512:443	172	119.7	4.33	-52	-30.41%	P	P
		(C)A40 Gloucester Road (W)	1729:512	512:453	1157	1225.8	1.99	69	5.95%	P	P
	(C)A40 Gloucester Road (W)	(A) Telstar Way (N)	445:512	512:443	691	475.9	8.91	-215	-31.13%	O	O
		(B) A40 Gloucester Road (E)	445:512	512:446	1016	1202.4	5.60	186	18.35%	O	O
16	(A) B4063 (E)	(B) Bamfurlong Lane (S)	1908:206	206:215	98	92.6	0.55	-5	-5.51%	P	P
		(C)B4063 (W)	1908:206	206:207	267	251.1	0.99	-16	-5.96%	P	P
	(B) Bamfurlong Lane (S)	(A) B4063 (E)	215:206	206:1908	159	182.9	1.83	24	15.03%	P	P
		(C)B4063 (W)	215:206	206:207	64	71.4	0.90	7	11.56%	P	P
	(C)B4063 (W)	(A) B4063 (E)	207:206	206:1908	305	287.8	1.00	-17	-5.64%	P	P
		(B) Bamfurlong Lane (S)	207:206	206:215	50	38.9	1.66	-11	-22.20%	P	P
17	(A) Fiddler's Green Lane (N)	(B) A40 Gloucester Road (E)	368:439	1700:437	35	33	0.34	-2	-5.71%	P	P
		(C)Hatherley Lana (S)	368:439	455:570	38	41.9	0.62	4	10.26%	P	P
		(D) A40 Gloucester Road (W)	368:439	562:211	29	33.9	0.87	5	16.90%	P	P
		(E)B4063 (W)	368:439	354:209	24	15.6	1.89	-8	-35.00%	P	P
	(B) A40 Gloucester Road (E)	(A) Fiddler's Green Lane (N)	456:1710	563:368	20	18.8	0.27	-1	-6.00%	P	P
		(C)Hatherley Lana (S)	456:1710	455:570	354	273.1	4.57	-81	-22.85%	P	P
		(D) A40 Gloucester Road (W)	456:1710	562:211	1214	1207.4	0.19	-7	-0.54%	P	P
		(E)B4063 (W)	456:1710	354:209	83	126.1	4.23	43	51.93%	P	P
	(C)Hatherley Lana (S)	(A) Fiddler's Green Lane (N)	570:351	563:368	75	50.6	3.08	-24	-32.53%	P	P
		(B) A40 Gloucester Road (E)	570:351	1700:437	150	188	2.92	38	25.33%	P	P
		(D) A40 Gloucester Road (W)	570:351	562:211	727	616.9	4.25	-110	-15.14%	O	P
		(E)B4063 (W)	570:351	354:209	113	112.5	0.05	-1	-0.44%	P	P
	(D) A40 Gloucester Road (W)	(A) Fiddler's Green Lane (N)	357:1708	563:368	197	99.8	7.98	-97	-49.34%	P	P
		(B) A40 Gloucester Road (E)	357:1708	1700:437	1339	1212.2	3.55	-127	-9.47%	P	P
		(C)Hatherley Lana (S)	357:1708	455:570	493	314	8.91	-179	-36.31%	O	O
		(E)B4063 (W)	357:1708	354:209	152	88.6	5.78	-63	-41.71%	P	P
	(E)B4063 (W)	(A) Fiddler's Green Lane (N)	209:564	563:368	70	47.2	2.98	-23	-32.57%	P	P
		(B) A40 Gloucester Road (E)	209:564	1700:437	255	259.7	0.29	5	1.84%	P	P
		(C)Hatherley Lana (S)	209:564	455:570	36	62.7	3.80	27	74.17%	P	P
		(D) A40 Gloucester Road (W)	209:564	562:211	115	102.2	1.23	-13	-11.13%	P	P
18	(A) Car Park (N)	(B) Hatherley Lane (NE)	1912:573	1922:571	4	2.3	0.96	-2	-42.50%	P	P
		(C)Hatherley Lane (SE)	1912:573	1923:1847	0	0.9	1.34	1	#DIV/0!	P	P
	(B) Hatherley Lane (NE)	(A) Car Park (N)	571:1916	1921:1912	146	57.3	8.80	-89	-60.75%	P	P
		(C)Hatherley Lane (SE)	571:1916	1923:1847	516	444.6	3.26	-71	-13.84%	P	P
		(D) Unnamed Road (S)	571:1916	1924:1909	25	22.5	0.51	-3	-10.00%	P	P
		(E)Grovefield Way (W)	571:1916	1920:1925	181	161	1.53	-20	-11.05%	P	P
	(C)Hatherley Lane (SE)	(A) Car Park (N)	1847:1917	1921:1912	13	6	2.27	-7	-53.85%	P	P
		(B) Hatherley Lane (NE)	1847:1917	1922:571	615	611.8	0.13	-3	-0.52%	P	P
		(D) Unnamed Road (S)	1847:1917	1924:1909	19	16.3	0.64	-3	-14.21%	P	P
		(E)Grovefield Way (W)	1847:1917	1920:1925	60	35.5	3.55	-25	-40.83%	P	P
	(D) Unnamed Road (S)	(B) Hatherley Lane (NE)	1909:1918	1922:571	17	5.1	3.58	-12	-70.00%	P	P
		(C)Hatherley Lane (SE)	1909:1918	1923:1847	5	4.2	0.37	-1	-16.00%	P	P
		(E)Grovefield Way (W)	1909:1918	1920:1925	5	1.7	1.80	-3	-66.00%	P	P
	(E)Grovefield Way (W)	(A) Car Park (N)	1925:1919	1921:1912	57	36.4	3.01	-21	-36.14%	P	P
		(B) Hatherley Lane (NE)	1925:1919	1922:571	347	348.8	0.10	2	0.52%	P	P
		(C)Hatherley Lane (SE)	1925:1919	1923:1847	80	50.5	3.65	-30	-36.88%	P	P
		(D) Unnamed Road (S)	1925:1919	1924:1909	5	7.8	1.11	3	56.00%	P	P

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	From	To	Code 1	Code 2	Obs	Mod	GEH	Diff	%		
20	(A) M5 (N)	(B) A40 (E)	1813:266	267:1816	212	158	3.97	-54	-25.47%	P	P
		(D)A40 (W)	1813:266	263:1819	342	298.1	2.45	-44	-12.84%	P	P
	(B) A40 (E)	(A) M5 (N)	1809:268	265:1821	158	171.9	1.08	14	8.80%	P	P
		(C)M5 (S)	1809:268	269:1817	660	643.3	0.65	-17	-2.53%	P	P
	(C)M5 (S)	(A) M5 (N)	1481:264	263:1819	19	30.4	2.29	11	60.00%	P	P
		(B) A40 (E)	1481:264	267:1816	671	614.4	2.23	-57	-8.44%	P	P
	(D)A40 (W)	(A) M5 (N)	1484:262	265:1821	211	255	2.88	44	20.85%	P	P
		(C)M5 (S)	1484:262	269:1817	36	37.9	0.31	2	5.28%	P	P
		(D)A40 (W)	1484:262	265:1821	211	255	2.88	44	20.85%	P	P
21	(A) B4634 Old Gloucester Road (N)	(B) B4063 Cheltenham Road (E)	170:161	161:1904	71	96.7	2.81	26	36.20%	P	P
		(C)Bamfurlong Lane (S)	170:161	161:167	123	130.2	0.64	7	5.85%	P	P
		(D) B4063 Cheltenham Road (W)	170:161	161:1712	187	169.4	1.32	-18	-9.41%	P	P
	(B) B4063 Cheltenham Road (E)	(A) B4634 Old Gloucester Road (N)	1904:161	161:170	72	78.9	0.79	7	9.58%	P	P
		(C)Bamfurlong Lane (S)	1904:161	161:167	10	40.7	6.10	31	307.00%	P	P
		(D) B4063 Cheltenham Road (W)	1904:161	161:1712	134	117	1.52	-17	-12.69%	P	P
	(C)Bamfurlong Lane (S)	(A) B4634 Old Gloucester Road (N)	167:161	161:170	174	73.4	9.05	-101	-57.82%	O	O
		(B) B4063 Cheltenham Road (E)	167:161	161:1904	7	3.2	1.68	-4	-54.29%	P	P
		(D) B4063 Cheltenham Road (W)	167:161	161:1712	65	44.4	2.79	-21	-31.69%	P	P
	(D) B4063 Cheltenham Road (W)	(A) B4634 Old Gloucester Road (N)	1712:161	161:170	220	290.1	4.39	70	31.86%	P	P
		(B) B4063 Cheltenham Road (E)	1712:161	161:1904	151	137.5	1.12	-14	-8.94%	P	P
		(C)Bamfurlong Lane (S)	1712:161	161:167	54	78.9	3.05	25	46.11%	P	P
22	(A) B4634 Old Gloucester Road (N)	(B) B4634 Old Gloucester Road (S)	989:177	177:990	299	311.4	0.71	12	4.15%	P	P
		(C)Unnamed Road (W)	989:177	177:178	22	5.7	4.38	-16	-74.09%	P	P
	(B) B4634 Old Gloucester Road (S)	(A) B4634 Old Gloucester Road (N)	990:177	177:989	395	396	0.05	1	0.25%	P	P
		(C)Unnamed Road (W)	990:177	177:178	83	42.9	5.05	-40	-48.31%	P	P
	(C)Unnamed Road (W)	(A) B4634 Old Gloucester Road (N)	178:177	177:989	22	27.8	1.16	6	26.36%	P	P
		(B) B4634 Old Gloucester Road (S)	178:177	177:990	93	100.9	0.80	8	8.49%	P	P
23	(A) B4063 Cheltenham Road East (E)	(B) Pirton Lane (S)	1999:142	142:2000	95	77.7	1.86	-17	-18.21%	P	P
		(C)B4063 Cheltenham Road East (W)	1999:142	142:1980	183	241.9	4.14	59	32.19%	P	P
	(B) Pirton Lane (S)	(A) B4063 Cheltenham Road East (E)	2000:142	142:1999	208	160.3	3.52	-48	-22.93%	P	P
		(C)B4063 Cheltenham Road East (W)	2000:142	142:1980	189	219.8	2.15	31	16.30%	P	P
	(C)B4063 Cheltenham Road East (W)	(A) B4063 Cheltenham Road East (E)	1980:142	142:1999	295	304.9	0.57	10	3.36%	P	P
		(B) Pirton Lane (S)	1980:142	142:2000	220	170.9	3.51	-49	-22.32%	P	P
24	(A) B4063 (N)	(B) B4063 (S)	1720:156	156:1717	170	271.6	6.84	102	59.76%	O	O
		(C)Down Hatherley Lane (W)	1720:156	156:1722	76	64	1.43	-12	-15.79%	P	P
	(B) B4063 (S)	(A) B4063 (N)	1717:156	156:1720	393	465.1	3.48	72	18.35%	P	P
		(C)Down Hatherley Lane (W)	1717:156	156:1722	64	68.9	0.60	5	7.66%	P	P
	(C)Down Hatherley Lane (W)	(A) B4063 (N)	1722:156	156:1720	229	131.7	7.25	-97	-42.49%	P	P
		(B) B4063 (S)	1722:156	156:1717	48	48.3	0.60	0	0.62%	P	P
33	(A) A38 Tewkesbury Road (N)	(B) A40 (E)	659:656	664:665	117	108.6	0.79	-8	-7.18%	P	P
		(C.) A38 Tewkesbury Road (S)	659:656	666:658	398	390.3	0.39	-8	-1.93%	P	P
		(D.) A40 (W)	659:656	668:660	173	175.8	0.21	3	1.62%	P	P
	(B) A40 (E)	(A) A38 Tewkesbury Road (N)	657:661	669:659	126	150.1	2.05	24	19.13%	P	P
		(C.) A38 Tewkesbury Road (S)	657:661	666:658	455	408.4	2.24	-47	-10.24%	P	P
		(D.) A40 (W)	657:661	668:660	423	435.8	0.62	13	3.03%	P	P
	(C.) A38 Tewkesbury Road (S)	(A) A38 Tewkesbury Road (N)	658:662	669:659	286	274.3	0.70	-12	-4.09%	P	P
		(B) A40 (E)	658:662	664:665	239	208.8	2.02	-30	-12.64%	P	P
		(D.) A40 (W)	658:662	668:660	34	42.5	1.37	9	25.00%	P	P
	(D.) A40 (W)	(A) A38 Tewkesbury Road (N)	660:663	669:659	327	318.3	0.48	-9	-2.66%	P	P
		(B) A40 (E)	660:663	664:665	688	691.1	0.12	3	0.45%	P	P
		(C.) A38 Tewkesbury Road (S)	660:663	666:658	30	49.8	3.13	20	66.00%	P	P
34	(A) B4063 Cheltenham Road (N)	(B) A40 (E)	75:J6	614:95	28	63.6	5.26	36	127.14%	P	P
		(C.) Unnamed (SE)	75:J6	1727:77	17	17.2	0.05	0	1.18%	P	P
		(D.) A417 (S)	75:J6	1823:115	154	212.5	4.32	59	37.99%	P	P
		(E.) B4063 Cheltenham Road (SW)	75:J6	107:J3	75	96.3	2.30	21	28.40%	P	P
		(F.) A40 (NW)	75:J6	86:87	71	92.7	2.40	22	30.56%	P	P
	(B) A40 (E)	(A) B4063 Cheltenham Road (N)	1949:92	88:75	8	0	4.00	-8	-100.00%	P	P
		(C.) Unnamed (SE)	1949:92	1727:77	92	0	13.56	-92	-100.00%	P	P
		(D) A417 (S)	1949:92	1823:115	583	0	34.15	-583	-100.00%	O	O
		(E.) B4063 Cheltenham Road (SW)	1949:92	107:J3	381	0	27.60	-381	-100.00%	O	O
		(F.) A40 (NW)	91:1530	1530:1731	530	520.8	0.40	-9	-1.74%	P	P
	(C.) Unnamed (SE)	(B) A40 (E)	77:82	614:95	0	0.3	0.77	0	#DIV/0!	P	P
		(D) A417 (S)	77:82	1823:115	2	1.5	0.38	-1	-25.00%	P	P
		(E.) B4063 Cheltenham Road (SW)	77:82	107:J3	1	0.3	0.87	-1	-70.00%	P	P
		(F.) A40 (NW)	77:82	86:87	0	0	0.00	0	0.00%	P	P
	(D) A417 (S)	(A) B4063 Cheltenham Road (N)	108:83	88:75	205	208	0.21	3	1.46%	P	P
		(B) A40 (E)	108:83	614:95	571	571.4	0.02	0	0.07%	P	P
		(C.) Unnamed (SE)	108:83	1727:77	0	5	3.16	5	#DIV/0!	P	P
		(E.) B4063 Cheltenham Road (SW)	108:83	107:J3	148	121.3	2.30	-27	-18.04%	P	P
		(F.) A40 (NW)	108:83	86:87	356	344.5	0.61	-12	-3.23%	P	P
	(E.) B4063 Cheltenham Road (SW)	(A) B4063 Cheltenham Road (N)	J3:1973	88:75	192	156.7	2.67	-35	-18.39%	P	P
		(B) A40 (E)	J3:1973	614:95	304	313	0.51	9	2.96%	P	P
		(D) A417 (S)	J3:1973	1823:115	209	213.3	0.30	4	2.06%	P	P
		(F) A40 (NW)	J3:1973	86:87	21	30.5	1.87	10	45.24%	P	P
	(F) A40 (NW)	(A) B4063 Cheltenham Road (N)	80:85	88:75	99	105.7	0.66	7	6.77%	P	P
		(B) A40 (E)	80:85	614:95	366	357.5	0.45	-9	-2.32%	P	P
		(C.) Unnamed (SE)	80:85	1727:77	24	29	0.97	5	20.83%	P	P
		(D) A417 (S)	80:85	1823:115	528	495.7	1.43	-32	-6.12%	P	P
		(E.) B4063 Cheltenham Road (SW)	80:85	107:J3	3	2.7	0.18	0	-10.00%	P	P
38	(A) Fiddlers Green Lane (N)	(B) Telstar Way (E)	390:389	2068:393	333	257.5	4.39	-76	-22.67%	P	P
		(C.) Fiddlers Green Lane (S)	390:389	2069:2041	80	48.3	3.96	-32	-39.63%	P	P
	(B) Telstar Way (E)	(A) Fiddlers Green Lane (N)	393:2068	389:390	132	99.5	3.02	-33	-24.62%	P	P
		(C.) Fiddlers Green Lane (S)	393:2068	2069:2041	19	10.7	2.15	-8	-43.68%	P	P
	(C.) Fiddlers Green Lane (S)	(A) Fiddlers Green Lane (N)	2041:2069	389:390	343	183	9.87	-160	-46.65%	O	O
103	(A) Innsworth Ln (W)	(B) Frogfurlong Ln (N)	1789:1683	1855:1790	67.12377492	51.3	2.06	-16	-23.57%	P	P
		(C.) Innsworth Ln (E)	1789:1683	1788:1787	249.1765498	270.2	1.30	21	8.44%	P	P
	(B) Frogfurlong Ln (N)	(A) Innsworth Ln (W)	1790:1855	1683:1789	49.11495726	39.7	1.41	-9	-19.17%	P	P
	(C.) Innsworth Ln (E)	(A) Innsworth Ln (W)	1787:1788	1683:1789	295.9583967	344.1	2.69	48	16.27%	P	P
		(B) Frogfurlong Ln (N)	1787:1788	1855:1790	58.57187157	53.1	0.73	-5	-9.34%	P	P
104	(A) Innsworth Ln (W.)	(B) B4063 Cheltnham Rd (N)	991:145	145:993	149.458729	142	0.62	-7	-4.99%	P	P
		(C.) Parton Rd (E.)	991:145	145:146	175.7634653	180.8	0.38	5	2.87%	P	P
		(D) B4063 Cheltnham Rd (S)	991:145	145:992	110.8983769	125.3	1.33	14	12.99%	P	P
	(B) B4063 Cheltnham Rd (N)	(A) Innsworth Ln (W.)	993:145	145:991	54.40297734	85.5	3.72	31	57.16%	P	P
		(C.) Parton Rd (E.)	993:145	145:146	69.94668515	75.1	0.61	5	7.37%	P	P
		(D) B4063 Cheltnham Rd (S)	993:145	145:992	126.4420847	121.9	0.41	-5	-3.59%	P	P
	(C.) Parton Rd (E.)	(A) Innsworth Ln (W.)	146:145	145:991	158.1694121	194	2.70	36	22.65%	P	P
		(B) B4063 Cheltnham Rd (N)	146:145	145:993	140.936947	122.7	1.59	-18	-12.94%	P	P
		(B) B4063 Cheltnham Rd (D)	146:145	145:992	64.62174426	75.6	1.31	11	16.99%	P	P
	(D) B4063 Cheltnham Rd (S)	(A) Innsworth Ln (W.)	992:145	145:991	132.0129918	171.9	3.24	40	30.21%	P	P
		(B) B4063 Cheltnham Rd (N)	992:145	145:993	292.0287395	237.1	3.38	-55	-18.81%	P	P
		(C.) Parton Rd (E.)	992:145	145:146	46.15838876	54.6	1.19	8	18.29%	P	P
31	(A) A4013 Princess Elizabeth Way (NE)	(B) A4013 Princess Elizabeth Way (SW)	1694:1010	1010:1011	596	685	3.52	89	14.93%	P	P
		(C)Hesters Way Road (NW)	1694:1010	1010:2261	133	53.7	8.21	-79	-59.62%	P	P
	(B) A4013 Princess Elizabeth Way (SW)	(A) A4013 Princess Elizabeth Way (NE)	1011:1010	1010:1694	444	605.8	7.06	162	36.44%	O	O
		(C)Hesters Way Road (NW)	1011:1010	1010:2261	63	87.6	2.85	25	39.05%	P	P
	(C)Hesters Way Road (NW)	(A) A4013 Princess Elizabeth Way (NE)	2261:1010	1010:1694	192	78.4	9.77	-114	-59.17%	O	O
		(B) A4013 Princess Elizabeth Way (SW)	2261:1010	1010:1011	26	73.1	6.69	47	181.15%	P	P
30	(A) Hayden Road (N)	(B) B4063 (E)	1521:182	182:197	149	92.8	5.11	-56	-37.72%	P	P
		(C)B4063 (W)	1521:182	182:184	52	1.3	9.82	-51	-97.50%	P	P
	(B) B4063 (E)	(A) Hayden Road (N)	197:182	182:1521	49	83.3	4.22	34	70.00%	P	P
		(C)B4063 (W)	197:182	182:184	255	244.9	0.64	-10	-3.96%	P	P
	(C)B4063 (W)	(A) Hayden Road (N)	184:182	182:1521	1	0.9	0.10	0	-10.00%	P	P
		(B) B4063 (E)	184:182	182:197	165	238.1	5.15	73	44.30%	P	P
35	(A) A4013 Princess Elizabeth Way (E)	(B) Grevil Road (S)	2057:1005	1005:1268	210	219.9	0.68	10	4.71%	P	P
		(C)A4013 Princess Elizabeth Way (W)	2057:1005	1005:1705	598	633.7	1.44	36	5.97%	P	P
	(B) Grevil Road (S)	(A) A4013 Princess Elizabeth Way (E)	1268:1005	1005:2057	103	144.3	3.71	41	40.10%	P	P
		(C)A4013 Princess Elizabeth Way (W)	1268:1005	1005:1705	95	71.6	2.56	-23	-24.63%	P	P
	(C)A4013 Princess Elizabeth Way (W)	(A) A4013 Princess Elizabeth Way (E)	1705:1005	1005:2057	507	612.8	4.47	106	20.87%	O	P
		(B) Grevil Road (S)	1705:1005	1005:1268	79	90.5	1.25	12	14.56%	P	P
25	(A) B4633 Gloucester Road (N)	(B) A40 Lansdown Road (E)	1472:1479	1479:1477	95	71.4	2.59	-24	-24.84%	P	P
		(D) A40 Gloucester Road (W)	1472:1479	1479:1682	200	263.2	4.15	63	31.60%	P	P
	(B) A40 Lansdown Road (E)	(A) B4633 Gloucester Road (N)	1546:1682	1682:1487	187	117	5.68	-70	-37.43%	P	P
		(D) A40 Gloucester Road (W)	1546:1682	1682:1478	657	633.5	0.93	-24	-3.58%	P	P
	(D) A40 Gloucester Road (W)	(A) B4633 Gloucester Road (N)	2061:1682	1682:1487	146	170.2	1.92	24	16.58%	P	P
		(B) A40 Lansdown Road (E)	2061:1682	1682:1477	633	585.7	1.92	-47	-7.47%	P	P
15b	(B)A40 Gloucester Road (E)	(C)Whittington Road (S)	1729:1730	1730:475	37	80.6	5.69	44	117.84%	P	P
		(D)A40 Gloucester Road (W)	1729:512	512:453	1157	1225.8	1.99	69	5.95%	P	P
		(D)A40 Gloucester Road (W)	474:453	453:458	132	118.8	1.18	-13	-10.00%	P	P

Appendix A.4: Turn Count Calibration AM (Total)

ID	Direction		From Node	To Node	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
					8 to 9 AM - TOTAL						
4a	(A) M5 SB Offslip (N)	(B) A4019 Withy Bridge (E)	817:841	841:824	484	502.9	0.85	19	3.90%	P	P
	(D)A4019 Withy Bridge (W)	(B) A4019 Withy Bridge (E)	798:841	841:824	859	871.6	0.43	13	1.47%	P	P
4b	(B) A4019 Withy Bridge (E)	(D)A4019 Withy Bridge (W)	800:799	799:796	598	626.7	1.16	29	4.80%	P	P
		(C)M6 NB Onslip (S)	800:799	799:801	308	280.7	1.59	-27	-8.86%	P	P
7	(A) B634 Hayden Road (N)	(B) A4019 Tewkesbury Road (E)	857:1483	1483:1686	7	17.7	3.04	11	152.86%	P	P
		(C)B634 Hayden Road (S)	1483:943	943:919	78	83.7	0.63	6	7.31%	P	P
		(D) A4019 Tewkesbury Road (W)	1483:943	943:941	104	78.9	2.62	-25	-24.13%	P	P
	(B) B634 Hayden Road (E)	(A) B634 Hayden Road (N)	913:943	943:1483	2	22.8	5.91	21	1040.00%	P	P
		(C)B634 Hayden Road (S)	912:913	913:919	106	147	3.65	41	38.68%	P	P
		(D) A4019 Tewkesbury Road (W)	913:943	943:941	477	489.7	0.58	13	2.66%	P	P
	(C)B634 Hayden Road (S)	(A) B634 Hayden Road (N)	919:943	943:1483	193	216.1	1.62	23	11.97%	P	P
		(B) A4019 Tewkesbury Road (E)	919:943	943:1686	31	181.1	14.58	150	484.19%	O	O
		(D) A4019 Tewkesbury Road (W)	945:919	919:941	108	119.3	1.06	11	10.46%	P	P
	(D) A4019 Tewkesbury Road (W)	(A) B634 Hayden Road (N)	930:914	914:1483	248	240	0.51	-8	-3.23%	P	P
		(B) A4019 Tewkesbury Road (E)	914:943	943:1686	990	951.4	1.24	-39	-3.90%	P	P
		(C)B634 Hayden Road (S)	914:943	943:919	63	66.6	0.45	4	5.71%	P	P
8A	(B) A4019 Tewkesbury Road (E)	(C)Hayden Road (S)	885:867	867:871	309	181.7	8.13	-127	-41.20%	O	O
		(D) A4019 Tewkesbury Road (W)	885:861	861:863	551	621	2.89	70	12.70%	P	P
	(C)Hayden Road (S)	(B) A4019 Tewkesbury Road (E)	871:861	861:885	236	244	0.52	8	3.39%	P	P
		(D) A4019 Tewkesbury Road (W)	871:861	861:863	24	48.9	4.12	25	103.75%	P	P
	(D) A4019 Tewkesbury Road (W)	(B) A4019 Tewkesbury Road (E)	922:861	861:885	1049	1073.4	0.75	24	2.33%	P	P
8B	(A) Manor Road (N)	(B) A4019 Tewkesbury Road (E)	877:885	885:876	138	157.4	1.60	19	14.06%	P	P
		(D) A4019 Tewkesbury Road (W)	877:885	885:861	254	41.4	17.49	-213	-83.70%	O	O
	(B) A4019 Tewkesbury Road (E)	(A) Manor Road (N)	911:885	885:881	111	195.4	6.82	84	76.04%	P	P
		(D) A4019 Tewkesbury Road (W)	911:885	885:861	606	581.4	1.01	-25	-4.06%	P	P
	(D) A4019 Tewkesbury Road (W)	(A) Manor Road (N)	861:885	885:881	330	306.7	1.31	-23	-7.06%	P	P
		(B) A4019 Tewkesbury Road (E)	861:885	885:876	955	1012.5	1.83	58	6.02%	P	P
9	(A) Kingsditch Lane (N)	(B) A4019 Tewkesbury Road (E)	898:1613	1693:1653	77	122.4	4.55	45	58.96%	P	P
		(C)A4013 Princess Elizabeth Way (S)	898:1613	1620:893	600	617.5	0.71	18	2.92%	P	P
		(D)A4019 Tewkesbury Road (W)	898:1613	1602:1517	86	103.1	1.76	17	19.88%	P	P
	(B) A4019 Tewkesbury Road (E)	(A) Kingsditch Lane (N)	1593:1635	1499:898	66	69.9	0.47	4	5.91%	P	P
		(C)A4013 Princess Elizabeth Way (S)	1593:1635	1620:893	232	241.7	0.63	10	4.18%	P	P
		(D)A4019 Tewkesbury Road (W)	1593:1635	1602:1517	539	482.5	2.50	-57	-10.48%	P	P
	(C)A4013 Princess Elizabeth Way (S)	(A) Kingsditch Lane (N)	893:1692	1499:898	606	660	2.15	54	8.91%	P	P
		(B) A4019 Tewkesbury Road (E)	893:1692	1693:1653	177	190.6	1.00	14	7.68%	P	P
		(D)A4019 Tewkesbury Road (W)	893:1692	1602:1517	112	250.3	10.28	138	123.48%	O	O
	(D)A4019 Tewkesbury Road (W)	(A) Kingsditch Lane (N)	1650:1691	1499:898	271	214.6	3.62	-56	-20.81%	O	O
		(B) A4019 Tewkesbury Road (E)	1650:1691	1693:1653	834	676.8	5.72	-157	-18.85%	O	O
		(C)A4013 Princess Elizabeth Way (S)	1650:1691	1620:893	197	279.8	5.36	83	42.03%	P	P
10	(A) Old Gloucester Road (E)	(B) Pilgrove Way (S)	958:957	957:960	31	33.3	0.41	2	7.42%	P	P
		(C)Old Gloucester Road (W)	958:957	957:961	233	191.6	2.84	-41	-17.77%	P	P
	(B) Pilgrove Way (S)	(A) Old Gloucester Road (E)	960:957	957:958	112	100.9	1.08	-11	-9.91%	P	P
		(C)Old Gloucester Road (W)	960:957	957:961	53	71.8	2.38	19	35.47%	P	P
	(C)Old Gloucester Road (W)	(A) Old Gloucester Road (E)	961:957	957:958	387	249.8	7.69	-137	-35.45%	O	O
		(B) Pilgrove Way (S)	961:957	957:960	26	36.8	1.93	11	41.54%	P	P
11	(A) A4013 Princess Elizabeth Way (E)	(B) Orchard Way (S)	1002:1003	1003:1009	61	61.1	0.01	0	0.16%	P	P
		(C)A4013 Princess Elizabeth Way (W)	1002:1003	1003:2259	733	786.8	1.95	54	7.34%	P	P
	(B) Orchard Way (S)	(A) A4013 Princess Elizabeth Way (E)	1009:1003	1003:1002	84	94.6	1.12	11	12.62%	P	P
		(C)A4013 Princess Elizabeth Way (W)	1009:1003	1003:2259	140	131.6	0.72	-8	-6.00%	P	P
	(C)A4013 Princess Elizabeth Way (W)	(A) A4013 Princess Elizabeth Way (E)	2259:1003	1003:1002	570	759.4	7.35	189	33.23%	O	O
		(B) Orchard Way (S)	2259:1003	1003:1009	165	124	3.41	-41	-24.85%	P	P
12	(A) A4013 Princess Elizabeth Way (N)	(A) A4013 Princess Elizabeth Way (N)	1019:1020	1020:1019	1	0.1	1.21	-1	-90.00%	P	P
		(B) Edinburgh Place (E)	1019:1020	1022:1026	64	97.4	3.72	33	52.19%	P	P
		(C)A4013 Princess Elizabeth Way (S)	1019:1020	1025:1668	618	809.2	7.16	191	30.94%	O	O
		(D) Marsland Road (W)	1019:1020	1023:1024	45	65.8	2.79	21	46.22%	P	P
	(B) Edinburgh Place (E)	(A) A4013 Princess Elizabeth Way (N)	1026:1022	1020:1019	120	89.1	3.02	-31	-25.75%	P	P
		(C)A4013 Princess Elizabeth Way (S)	1026:1022	1025:1668	53	87.5	4.12	35	65.09%	P	P
		(D) Marsland Road (W)	1026:1022	1023:1024	70	66.1	0.47	-4	-5.57%	P	P
	(C)A4013 Princess Elizabeth Way (S)	(A) A4013 Princess Elizabeth Way (N)	1668:1025	1020:1019	541	670.6	5.27	130	23.96%	O	O
		(B) Edinburgh Place (E)	1668:1025	1022:1026	31	32.3	0.23	1	4.19%	P	P
		(D) Marsland Road (W)	1668:1025	1023:1024	15	23.9	2.02	9	59.33%	P	P
	(D) Marsland Road (W)	(A) A4013 Princess Elizabeth Way (N)	1024:1023	1020:1019	77	104.2	2.86	27	35.32%	P	P
		(B) Edinburgh Place (E)	1024:1023	1022:1026	179	138.7	3.20	-40	-22.51%	P	P
		(C)A4013 Princess Elizabeth Way (S)	1024:1023	1025:1668	39	48.4	1.42	9	24.10%	P	P
13	(A) A4013 Princess Elizabeth Way (N)	(B) A4013 Princess Elizabeth Way (S)	1542:1679	1679:538	683	873.9	6.84	191	27.95%	O	O
		(C)Hubble Road (W)	1542:1679	1679:1035	128	139.6	1.00	12	9.06%	P	P
	(B) A4013 Princess Elizabeth Way (S)	(A) A4013 Princess Elizabeth Way (N)	1678:1679	1679:1036	709	731.1	0.82	22	3.12%	P	P
		(C)Hubble Road (W)	1678:1679	1679:1035	89	122.3	3.24	33	37.42%	P	P
	(C)Hubble Road (W)	(A) A4013 Princess Elizabeth Way (N)	1045:1035	1035:1036	79	74.9	0.47	-4	-5.19%	P	P
		(B) A4013 Princess Elizabeth Way (S)	1035:1679	1679:538	44	44.2	0.03	0	0.45%	P	P
14	(A) A4013 Princess Elizabeth Way (N)	(B) A40 Gloucester Road (E)	538:552	544:543	25	61.2	5.51	36	144.80%	P	P
		(C.) A40 Gloucester Road (W)	538:552	549:548	700	852.3	5.47	152	21.76%	O	O
	(B) A40 Gloucester Road (E)	(A) A4013 Princess Elizabeth Way (N)	547:545	551:550	173	165.3	0.59	-8	-4.45%	P	P
		(C.) A40 Gloucester Road (W)	547:545	549:548	798	809.1	0.39	11	1.39%	P	P
	(C.) A40 Gloucester Road (W)	(A) A4013 Princess Elizabeth Way (N)	539:542	551:550	616	691.8	2.96	76	12.31%	P	P
		(B) A40 Gloucester Road (E)	539:542	544:543	673	803	4.79	130	19.32%	O	P
15	(A) Telstar Way (N)	(B) A40 Gloucester Road (E)	441:512	512:446	22	35.2	2.47	13	60.00%	P	P
		(C)A40 Gloucester Road (W)	441:512	512:453	420	331.4	4.57	-89	-21.10%	P	P
	(B) A40 Gloucester Road (E)	(A) Telstar Way (N)	1729:512	512:443	175	142.6	2.57	-32	-18.51%	P	P
		(C)A40 Gloucester Road (W)	1729:512	512:453	1322	1439.5	3.16	118	8.89%	P	P
	(C)A40 Gloucester Road (W)	(A) Telstar Way (N)	445:512	512:443	709	511.2	8.01	-198	-27.90%	O	O
		(B) A40 Gloucester Road (E)	445:512	512:446	1234	1511.2	7.48	277	22.46%	O	O
16	(A) B4063 (E)	(B) Bamfurlong Lane (S)	1908:206	206:215	103	115.9	1.23	13	12.52%	P	P
		(C)B4063 (W)	1908:206	206:207	315	303.1	0.68	-12	-3.78%	P	P
	(B) Bamfurlong Lane (S)	(A) B4063 (E)	215:206	206:1908	186	222.4	2.55	36	19.57%	P	P
		(C)B4063 (W)	215:206	206:207	73	87.6	1.63	15	20.00%	P	P
	(C)B4063 (W)	(A) B4063 (E)	207:206	206:1908	370	354.2	0.83	-16	-4.27%	P	P
		(B) Bamfurlong Lane (S)	207:206	206:215	57	50.9	0.83	-6	-10.70%	P	P
17	(A) Fiddler's Green Lane (N)	(B) A40 Gloucester Road (E)	368:439	1700:437	35	39.3	0.71	4	12.29%	P	P
		(C)Hatherley Lana (S)	368:439	455:570	44	50.8	0.99	7	15.45%	P	P
		(D) A40 Gloucester Road (W)	368:439	562:211	35	45.2	1.61	10	29.14%	P	P
		(E)B4063 (W)	368:439	354:209	24	19.1	1.06	-5	-20.42%	P	P
	(B) A40 Gloucester Road (E)	(A) Fiddler's Green Lane (N)	456:1710	563:368	21	19.3	0.38	-2	-8.10%	P	P
		(C)Hatherley Lana (S)	456:1710	455:570	381	305.6	4.07	-75	-19.79%	P	P
		(D) A40 Gloucester Road (W)	456:1710	562:211	1393	1401.7	0.23	9	0.62%	P	P
		(E)B4063 (W)	456:1710	354:209	109	156.8	4.15	48	43.85%	P	P
	(C)Hatherley Lana (S)	(A) Fiddler's Green Lane (N)	570:351	563:368	81	56.1	3.01	-25	-30.74%	P	P
		(B) A40 Gloucester Road (E)	570:351	1700:437	168	216.5	3.50	49	28.87%	P	P
		(D) A40 Gloucester Road (W)	570:351	562:211	756	666.1	3.37	-90	-11.89%	P	P
		(E)B4063 (W)	570:351	354:209	120	129.7	0.87	10	8.08%	P	P
	(D) A40 Gloucester Road (W)	(A) Fiddler's Green Lane (N)	357:1708	563:368	214	117.3	7.51	-97	-45.19%	P	P
		(B) A40 Gloucester Road (E)	357:1708	1700:437	1527	1461.2	1.70	-66	-4.31%	P	P
		(C)Hatherley Lana (S)	357:1708	455:570	540	351.1	8.95	-189	-34.98%	O	O
		(E)B4063 (W)	357:1708	354:209	189	111.8	6.29	-77	-40.85%	P	P
	(E)B4063 (W)	(A) Fiddler's Green Lane (N)	209:564	563:368	82	57.1	3.01	-25	-30.37%	P	P
		(B) A40 Gloucester Road (E)	209:564	1700:437	281	323.7	2.46	43	15.20%	P	P
		(C)Hatherley Lana (S)	209:564	455:570	49	75.7	3.38	27	54.49%	P	P
		(D) A40 Gloucester Road (W)	209:564	562:211	147	121.1	2.24	-26	-17.62%	P	P
18	(A) Car Park (N)	(B) Hatherley Lane (NE)	1912:573	1922:571	4	2.3	0.96	-2	-42.50%	P	P
		(C)Hatherley Lane (SE)	1912:573	1923:1847	0	0.9	1.34	1	#DIV/0!	P	P
	(B) Hatherley Lane (NE)	(A) Car Park (N)	571:1916	1921:1912	149	59.8	8.73	-89	-59.87%	P	P
		(C)Hatherley Lane (SE)	571:1916	1923:1847	548	495.4	2.30	-53	-9.60%	P	P
		(D) Unnamed Road (S)	571:1916	1924:1909	34	25.7	1.52	-8	-24.41%	P	P
		(E)Grovefield Way (W)	571:1916	1920:1925	217	195	1.53	-22	-10.14%	P	P
	(C)Hatherley Lane (SE)	(A) Car Park (N)	1847:1917	1921:1912	13	6	2.27	-7	-53.85%	P	P
		(B) Hatherley Lane (NE)	1847:1917	1922:571	646	655.6	0.38	10	1.49%	P	P
		(D) Unnamed Road (S)	1847:1917	1924:1909	27	18.8	1.71	-8	-30.37%	P	P
		(E)Grovefield Way (W)	1847:1917	1920:1925	64	36.4	3.90	-28	-43.13%	P	P
	(D) Unnamed Road (S)	(B) Hatherley Lane (NE)	1909:1918	1922:571	20	5.5	4.06	-15	-72.50%	P	P
		(C)Hatherley Lane (SE)	1909:1918	1923:1847	7	4.2	1.18	-3	-40.00%	P	P
		(E)Grovefield Way (W)	1909:1918	1920:1925	12	2.4	3.58	-10	-80.00%	P	P
	(E)Grovefield Way (W)	(A) Car Park (N)	1925:1919	1921:1912	57	46	1.53	-11	-19.30%	P	P
		(B) Hatherley Lane (NE)	1925:1919	1922:571	383	404.9	1.10	22	5.72%	P	P
		(C)Hatherley Lane (SE)	1925:1919	1923:1847	86	53.2	3.93	-33	-38.14%	P	P
		(D) Unnamed Road (S)	1925:1919	1924:1909	6	8.3	0.86	2	38.33%	P	P

JACOBS

ID	From	To	Ref1	Ref2	Obs	Mod	GEH	Diff	%	F1	F2
20	(A) M5 (N)	(B) A40 (E)	1813:266	267:1816	244	214.2	1.97	-30	-12.21%	P	P
		(D)A40 (W)	1813:266	263:1819	436	383.8	2.58	-52	-11.97%	P	P
	(B) A40 (E)	(A) M5 (N)	1809:268	265:1821	183	196.7	0.99	14	7.49%	P	P
		(C)M5 (S)	1809:268	269:1817	775	753.1	0.79	-22	-2.83%	P	P
	(C)M5 (S)	(A) M5 (N)	1481:264	263:1819	20	43.6	4.19	24	118.00%	P	P
		(B) A40 (E)	1481:264	267:1816	781	737.6	1.58	-43	-5.56%	P	P
	(D)A40 (W)	(A) M5 (N)	1484:262	265:1821	276	330.9	3.15	55	19.89%	P	P
		(C)M5 (S)	1484:262	269:1817	43	54.2	1.61	11	26.05%	P	P
		(D)A40 (W)	1484:262	265:1821	276	330.9	3.15	55	19.89%	P	P
21	(A) B4634 Old Gloucester Road (N)	(B) B4063 Cheltenham Road (E)	170:161	161:1904	86	117.1	3.09	31	36.16%	P	P
		(C)Bamfurlong Lane (S)	170:161	161:167	148	154.3	0.51	6	4.26%	P	P
		(D) B4063 Cheltenham Road (W)	170:161	161:1712	221	220.1	0.06	-1	-0.41%	P	P
	(B) B4063 Cheltenham Road (E)	(A) B4634 Old Gloucester Road (N)	1904:161	161:170	94	93.6	0.04	0	-0.43%	P	P
		(C)Bamfurlong Lane (S)	1904:161	161:167	19	59.2	6.43	40	211.58%	P	P
		(D) B4063 Cheltenham Road (W)	1904:161	161:1712	160	132	2.32	-28	-17.50%	P	P
	(C)Bamfurlong Lane (S)	(A) B4634 Old Gloucester Road (N)	167:161	161:170	207	81.7	10.43	-125	-60.53%	O	O
		(B) B4063 Cheltenham Road (E)	167:161	161:1904	11	6.1	1.68	-5	-44.55%	P	P
		(D) B4063 Cheltenham Road (W)	167:161	161:1712	83	54.7	3.41	-28	-34.10%	P	P
	(D) B4063 Cheltenham Road (W)	(A) B4634 Old Gloucester Road (N)	1712:161	161:170	278	365.6	4.88	88	31.51%	P	P
		(B) B4063 Cheltenham Road (E)	1712:161	161:1904	200	172.8	1.99	-27	-13.60%	P	P
		(C)Bamfurlong Lane (S)	1712:161	161:167	84	97.4	1.41	13	15.95%	P	P
22	(A) B4634 Old Gloucester Road (N)	(B) B4634 Old Gloucester Road (S)	989:177	177:990	367	400	1.69	33	8.99%	P	P
		(C)Unnamed Road (W)	989:177	177:178	23	6.7	4.23	-16	-70.87%	P	P
	(B) B4634 Old Gloucester Road (S)	(A) B4634 Old Gloucester Road (N)	990:177	177:989	480	489	0.41	9	1.88%	P	P
		(C)Unnamed Road (W)	990:177	177:178	94	48.1	5.45	-46	-48.83%	P	P
	(C)Unnamed Road (W)	(A) B4634 Old Gloucester Road (N)	178:177	177:989	26	32.7	1.24	7	25.77%	P	P
		(B) B4634 Old Gloucester Road (S)	178:177	177:990	103	112.8	0.94	10	9.51%	P	P
23	(A) B4063 Cheltenham Road East (E)	(B) Pirton Lane (S)	1999:142	142:2000	102	94.3	0.78	-8	-7.55%	P	P
		(C)B4063 Cheltenham Road East (W)	1999:142	142:1980	244	314.2	4.20	70	28.77%	P	P
	(B) Pirton Lane (S)	(A) B4063 Cheltenham Road East (E)	2000:142	142:1999	222	182.2	2.80	-40	-17.93%	P	P
		(C)B4063 Cheltenham Road East (W)	2000:142	142:1980	220	264.6	2.87	45	20.27%	P	P
	(C)B4063 Cheltenham Road East (W)	(A) B4063 Cheltenham Road East (E)	1980:142	142:1999	366	399.7	1.72	34	9.21%	P	P
		(B) Pirton Lane (S)	1980:142	142:2000	247	201.5	3.04	-46	-18.42%	P	P
24	(A) B4063 (N)	(B) B4063 (S)	1720:156	156:1717	244	346.6	5.97	103	42.05%	O	O
		(C)Down Hatherley Lane (W)	1720:156	156:1722	94	64.4	3.33	-30	-31.49%	P	P
	(B) B4063 (S)	(A) B4063 (N)	1717:156	156:1720	471	594.1	5.33	123	26.14%	O	O
		(C)Down Hatherley Lane (W)	1717:156	156:1722	71	77.6	0.77	7	9.30%	P	P
	(C)Down Hatherley Lane (W)	(A) B4063 (N)	1722:156	156:1720	274	139.7	9.34	-134	-49.01%	O	O
		(B) B4063 (S)	1722:156	156:1717	59	48.8	1.39	-10	-17.29%	P	P
33	(A) A38 Tewkesbury Road (N)	(B) A40 (E)	659:656	664:665	135	129	0.52	-6	-4.44%	P	P
		(C.) A38 Tewkesbury Road (S)	659:656	666:658	432	433.1	0.05	1	0.25%	P	P
		(D.) A40 (W)	659:656	668:660	221	215.1	0.40	-6	-2.67%	P	P
	(B) A40 (E)	(A) A38 Tewkesbury Road (N)	657:661	669:659	154	186.8	2.51	33	21.30%	P	P
		(C.) A38 Tewkesbury Road (S)	657:661	666:658	509	478.5	1.37	-31	-5.99%	P	P
		(D.) A40 (W)	657:661	668:660	583	611.4	1.16	28	4.87%	P	P
	(C.) A38 Tewkesbury Road (S)	(A) A38 Tewkesbury Road (N)	658:662	669:659	334	336.6	0.14	3	0.78%	P	P
		(B) A40 (E)	658:662	664:665	270	255.6	0.89	-14	-5.33%	P	P
		(D.) A40 (W)	658:662	668:660	41	48	1.05	7	17.07%	P	P
	(D.) A40 (W)	(A) A38 Tewkesbury Road (N)	660:663	669:659	427	397.4	1.46	-30	-6.93%	P	P
		(B) A40 (E)	660:663	664:665	841	846.4	0.19	5	0.64%	P	P
		(C.) A38 Tewkesbury Road (S)	660:663	666:658	43	61.5	2.56	19	43.02%	P	P
34	(A) B4063 Cheltenham Road (N)	(B) A40 (E)	75:J6	614:95	35	78.3	5.75	43	123.71%	P	P
		(C.) Unnamed (SE)	75:J6	1727:77	18	19	0.23	1	5.56%	P	P
		(D.) A417 (S)	75:J6	1823:115	180	256.9	5.20	77	42.72%	P	P
		(E.) B4063 Cheltenham Road (SW)	75:J6	107:J3	85	111.7	2.69	27	31.41%	P	P
		(F.) A40 (NW)	75:J6	86:87	94	132.8	3.64	39	41.28%	P	P
	(B) A40 (E)	(A) B4063 Cheltenham Road (N)	1949:92	88:75	12	0	4.90	-12	-100.00%	P	P
		(C.) Unnamed (SE)	1949:92	1727:77	94	0	13.71	-94	-100.00%	P	P
		(D.) A417 (S)	1949:92	1823:115	667	0	36.52	-667	-100.00%	O	O
		(E.) B4063 Cheltenham Road (SW)	1949:92	107:J3	428	0	29.26	-428	-100.00%	O	O
		(F.) A40 (NW)	91:1530	1530:1731	619	627.8	0.35	9	1.42%	P	P
	(C.) Unnamed (SE)	(B) A40 (E)	77:82	614:95	0	0.5	1.00	1	#DIV/0!	P	P
		(D.) A417 (S)	77:82	1823:115	2	2.3	0.20	0	15.00%	P	P
		(E.) B4063 Cheltenham Road (SW)	77:82	107:J3	1	0.5	0.58	0	-50.00%	P	P
		(F.) A40 (NW)	77:82	86:87	0	0	#DIV/0!	0	#DIV/0!	P	#DIV/0!
	(D) A417 (S)	(A) B4063 Cheltenham Road (N)	108:83	88:75	259	269.4	0.64	10	4.02%	P	P
		(B) A40 (E)	108:83	614:95	659	682.7	0.92	24	3.60%	P	P
		(C.) Unnamed (SE)	108:83	1727:77	1	7.1	3.03	6	610.00%	P	P
		(E.) B4063 Cheltenham Road (SW)	108:83	107:J3	168	153.2	1.17	-15	-8.81%	P	P
		(F.) A40 (NW)	108:83	86:87	481	474.2	0.31	-7	-1.41%	P	P
	(E.) B4063 Cheltenham Road (SW)	(A) B4063 Cheltenham Road (N)	J3:1973	88:75	210	180.8	2.09	-29	-13.90%	P	P
		(B) A40 (E)	J3:1973	614:95	328	349.4	1.16	21	6.52%	P	P
		(D.) A417 (S)	J3:1973	1823:115	227	246.4	1.26	19	8.55%	P	P
		(F.) A40 (NW)	J3:1973	86:87	26	34.3	1.51	8	31.92%	P	P
	(F.) A40 (NW)	(A) B4063 Cheltenham Road (N)	80:85	88:75	125	140.4	1.34	15	12.32%	P	P
		(B) A40 (E)	80:85	614:95	432	443.8	0.56	12	2.73%	P	P
		(C.) Unnamed (SE)	80:85	1727:77	25	30.3	1.01	5	21.20%	P	P
		(D.) A417 (S)	80:85	1823:115	631	588.8	1.71	-42	-6.69%	P	P
		(E.) B4063 Cheltenham Road (SW)	80:85	107:J3	6	6	0.00	0	0.00%	P	P
38	(A) Fiddlers Green Lane (N)	(B) Telstar Way (E)	390:389	2068:393	345	280.3	3.66	-65	-18.75%	P	P
		(C.) Fiddlers Green Lane (S)	390:389	2069:2041	95	62.2	3.70	-33	-34.53%	P	P
	(B) Telstar Way (E)	(A) Fiddlers Green Lane (N)	393:2068	389:390	141	102.4	3.50	-39	-27.38%	P	P
		(C.) Fiddlers Green Lane (S)	393:2068	2069:2041	21	11.1	2.47	-10	-47.14%	P	P
	(C.) Fiddlers Green Lane (S)	(A) Fiddlers Green Lane (N)	2041:2069	389:390	381	208.7	10.03	-172	-45.22%	O	O
103	(A) Innsworth Ln (W)	(B) Frogfurlong Ln (N)	1789:1683	1855:1790	77.72794711	62.4	1.83	-15	-19.72%	P	P
		(C.) Innsworth Ln (E)	1789:1683	1788:1787	300.3869824	326.6	1.48	26	8.73%	P	P
	(B) Frogfurlong Ln (N)	(A) Innsworth Ln (W)	1790:1855	1683:1789	59.25104777	45.5	1.90	-14	-23.21%	P	P
	(C.) Innsworth Ln (E)	(A) Innsworth Ln (W)	1787:1788	1683:1789	373.5926207	413.5	2.01	40	10.68%	P	P
		(B) Frogfurlong Ln (N)	1787:1788	1855:1790	72.87568382	62.1	1.31	-11	-14.79%	P	P
104	(A) Innsworth Ln (W.)	(B) B4063 Cheltnham Rd (N)	991:145	145:993	191.7296643	179.4	0.91	-12	-6.43%	P	P
		(C.) Parton Rd (E.)	991:145	145:146	225.1977216	221.9	0.22	-3	-1.46%	P	P
		(D) B4063 Cheltnham Rd (S)	991:145	145:992	145.0197745	158.3	1.08	13	9.16%	P	P
	(B) B4063 Cheltnham Rd (N)	(A) Innsworth Ln (W.)	993:145	145:991	74.28414325	106.6	3.40	32	43.50%	P	P
		(C.) Parton Rd (E.)	993:145	145:146	90.20948288	90.1	0.01	0	-0.12%	P	P
		(D) B4063 Cheltnham Rd (S)	993:145	145:992	186.763296	160	2.03	-27	-14.33%	P	P
	(C.) Parton Rd (E.)	(A) Innsworth Ln (W.)	146:145	145:991	199.4506996	232.7	2.26	33	16.67%	P	P
		(B) B4063 Cheltnham Rd (N)	146:145	145:993	173.6668951	150.6	1.81	-23	-13.28%	P	P
		(B) B4063 Cheltnham Rd (D)	146:145	145:992	82.23472164	94.3	1.29	12	14.67%	P	P
	(D) B4063 Cheltnham Rd (S)	(A) Innsworth Ln (W.)	992:145	145:991	165.6711706	211.6	3.34	46	27.72%	P	P
		(B) B4063 Cheltnham Rd (N)	992:145	145:993	382.6511945	302.1	4.35	-81	-21.05%	P	P
		(C.) Parton Rd (E.)	992:145	145:146	59.67415182	65.5	0.74	6	9.76%	P	P
31	(A) A4013 Princess Elizabeth Way (NE)	(B) A4013 Princess Elizabeth Way (SW)	1694:1010	1010:1011	706	843.6	4.94	138	19.49%	O	P
		(C)Hesters Way Road (NW)	1694:1010	1010:2261	146	72.5	7.03	-74	-50.34%	P	P
	(B) A4013 Princess Elizabeth Way (SW)	(A) A4013 Princess Elizabeth Way (NE)	1011:1010	1010:1694	560	777	8.39	217	38.75%	O	O
		(C)Hesters Way Road (NW)	1011:1010	1010:2261	72	105	3.51	33	45.83%	P	P
	(C)Hesters Way Road (NW)	(A) A4013 Princess Elizabeth Way (NE)	2261:1010	1010:1694	218	108.3	8.59	-110	-50.32%	O	O
		(B) A4013 Princess Elizabeth Way (SW)	2261:1010	1010:1011	33	94.5	7.70	62	186.36%	P	P
30	(A) Hayden Road (N)	(B) B4063 (E)	1521:182	182:197	167	113.5	4.52	-54	-32.04%	P	P
		(C)B4063 (W)	1521:182	182:184	57	1.3	10.32	-56	-97.72%	P	P
	(B) B4063 (E)	(A) Hayden Road (N)	197:182	182:1521	60	102.2	4.49	42	70.33%	P	P
		(C)B4063 (W)	197:182	182:184	319	295.2	1.36	-24	-7.46%	P	P
	(C)B4063 (W)	(A) Hayden Road (N)	184:182	182:1521	6	1.4	2.39	-5	-76.67%	P	P
		(B) B4063 (E)	184:182	182:197	218	296.8	4.91	79	36.15%	P	P
35	(A) A4013 Princess Elizabeth Way (E)	(B) Grevil Road (S)	2057:1005	1005:1268	274	279.9	0.35	6	2.15%	P	P
		(C.)A4013 Princess Elizabeth Way (W)	2057:1005	1005:1705	708	787	2.89	79	11.16%	P	P
	(B) Grevil Road (S)	(A) A4013 Princess Elizabeth Way (E)	1268:1005	1005:2057	125	190.2	5.19	65	52.16%	P	P
		(C.)A4013 Princess Elizabeth Way (W)	1268:1005	1005:1705	107	86.5	2.08	-21	-19.16%	P	P
	(C)A4013 Princess Elizabeth Way (W)	(A) A4013 Princess Elizabeth Way (E)	1705:1005	1005:2057	631	781.1	5.65	150	23.79%	O	P
		(B) Grevil Road (S)	1705:1005	1005:1268	92	114.6	2.22	23	24.57%	P	P
25	(A) B4633 Gloucester Road (N)	(B) A40 Lansdown Road (E)	1472:1479	1479:1477	109	82.6	2.70	-26	-24.22%	P	P
		(D) A40 Gloucester Road (W)	1472:1479	1479:1682	222	301.4	4.91	79	35.77%	P	P
	(B) A40 Lansdown Road (E)	(A) B4633 Gloucester Road (N)	1546:1682	1682:1487	210	135.1	5.70	-75	-35.67%	P	P
		(D) A40 Gloucester Road (W)	1546:1682	1682:1478	729	703	0.97	-26	-3.57%	P	P
	(D) A40 Gloucester Road (W)	(A) B4633 Gloucester Road (N)	2061:1682	1682:1487	169	206.1	2.71	37	21.95%	P	P
		(B) A40 Lansdown Road (E)	2061:1682	1682:1477	740	688	1.95	-52	-7.03%	P	P
15b	(B)A40 Gloucester Road (E)	(C)Whittington Road (S)	1729:1730	1730:475	49	103.5	6.24	-55	111.22%	P	P
		(D)A40 Gloucester Road (W)	1729:512	512:453	1322	1439.5	3.16	118	8.89%	P	P
		(D)A40 Gloucester Road (W)	474:453	453:458	143	132	0.94	-11	-7.69%	P	P

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Appendix A.5: Outer Cordon Calibration AM (Car)

| | | | | | | | | | | | | In | | | |
SI	ANPR	Description	Direction	Link ID	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
1	ANPR 3	Gallagher Retail Park, between A4019 and Manor Road	SB (EB)	857:1483	164	159	0.40	-5	-3.07%	P	P
2	ANPR 4	Manor Road, between A4019 and Rutherford Way	SB (WB)	877:885	360	268	5.18	-92	-25.47%	P	P
3	ANPR 5	Kingsditch Lane, between A4019 and Upper Field Road	SB	891:898	591	681	3.57	90	15.22%	P	P
4	ANPR 6	A4019, at railway line	NB (WB)	1486:1680	707	685	0.83	-22	-3.11%	P	P
5	ANPR 7	Arle Road, at railway line	NB	1968:1351	138	132	0.54	-6	-4.57%	P	P
6	ANPR 8	B4633, at railway line	SB (WB)	1496:1383	334	284	2.83	-50	-14.91%	P	P
7	ANPR 9	A40, at railway line	WB	1482:1546	893	749	5.03	-144	-16.13%	O	O
8	ANPR 10	Hatherly Lane, at railway line	NB (WB)	2045:2028	775	711	2.33	-64	-8.19%	P	P
9	ANPR 11	Grovefield Way, at railway line	NB	1681:1926	442	409	1.61	-33	-7.52%	P	P
10	ANPR 12	Badgeworth Road, at railway line	NB	1948:239	558	544	0.61	-14	-2.56%	P	P
11	ANPR 13	M5, at railway line, between Junction 11 and 11A	NB	581:326	1957	2135	3.94	178	9.10%	P	P
12	ANPR 14	Pirton Lane, at railway line	NB	1748:1936	414	396	0.91	-18	-4.41%	P	P
13	ANPR 18	A4019, North of A38 / A4019 junction	SB	770:769	815	797	0.63	-18	-2.21%	P	P
14	ANPR 19	Unnamed Road, between A4019 and Cursey Lane	SB	1656:1655	374	316	3.16	-59	-15.66%	P	P
15	ANPR 20	M5, between Junction 9 and Junction 10	SB	822:611	2880	2424	8.85	-456	-15.83%	O	O
16	ANPR 21	The Green, between A4019 and Lowdilow Lane	SB	850:848	184	175	0.73	-10	-5.29%	P	P
18	ANPR 29	Alstone Lane, at railway line	SB (EB)	1359:1358	138	155	1.38	17	12.12%	P	P
19	ANPR 36	A40, between A417 and A38	NB (EB)	1995:1994	1067	1053	0.42	-14	-1.30%	P	P
20	ANPR 37	A38, between A40 and A417	NB	1991:1990	539	521	0.78	-18	-3.34%	P	P
21	ANPR 38	A40, between A38 and B4063	NB	1839:1840	336	370	1.81	34	10.13%	P	P
22	ANPR 39	Innsworth Lane, between Brionne Way and Rookery Road	NB	1803:1802	349	350	0.05	1	0.24%	P	P
23	ANPR 40	B4063, between A40 and Nine Elms Road	NB (EB)	2066:1974	708	723	0.58	16	2.19%	P	P
24	ANPR 41	A417, at railway line	NB	1978:1976	1250	1243	0.20	-7	-0.56%	P	P
25	ANPR 42	Station Road at Rail Bridge	NB	1651:1649	284	259	1.51	-25	-8.75%	P	P
		Total			**16258**	**15539**		**-719**	**-4.42%**		P

| | | | | | | | | | | | | Out | | | |
SI	ANPR	Description	Direction	Link ID	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
1	ANPR 3	Gallagher Retail Park, between A4019 and Manor Road	NB (WB)	1483:857	384	431	2.31	47	12.16%	P	P
2	ANPR 4	Manor Road, between A4019 and Rutherford Way	NB (EB)	885:881	415	430	0.74	15	3.67%	P	P
3	ANPR 5	Kingsditch Lane, between A4019 and Upper Field Road	SB	898:891	813	776	1.32	-37	-4.57%	P	P
4	ANPR 6	A4019, at railway line	SB (EB)	1256:1259	775	778	0.08	2	0.29%	P	P
5	ANPR 7	Arle Road, at railway line	SB	1351:1968	391	345	2.44	-47	-11.98%	P	P
6	ANPR 8	B4633, at railway line	NB (EB)	1383:1496	274	346	4.09	72	26.30%	P	P
7	ANPR 9	A40, at railway line	EB	1546:1482	728	660	2.56	-68	-9.28%	P	P
8	ANPR 10	Hatherly Lane, at railway line	SB (EB)	2028:2045	610	502	4.59	-108	-17.76%	O	P
9	ANPR 11	Grovefield Way, at railway line	SB	1926:1681	236	209	1.88	-28	-11.83%	P	P
10	ANPR 12	Badgeworth Road, at railway line	SB	239:1948	182	152	2.33	-30	-16.54%	P	P
11	ANPR 13	M5, at railway line, between Junction 11 and 11A	SB	327:580	2554	2334	4.45	-220	-8.62%	P	P
12	ANPR 14	Pirton Lane, at railway line	SB	1936:1748	533	363	8.04	-170	-31.93%	O	O
13	ANPR 18	A4019, North of A38 / A4019 junction	NB	769:770	651	654	0.13	3	0.52%	P	P
14	ANPR 19	Unnamed Road, between A4019 and Cursey Lane	NB	1655:1656	297	263	2.02	-34	-11.40%	P	P
15	ANPR 20	M5, between Junction 9 and Junction 10	NB	815:823	2425	2155	5.66	-271	-11.17%	P	P
16	ANPR 21	The Green, between A4019 and Lowdilow Lane	NB	848:850	12	11	0.46	-2	-12.81%	P	P
18	ANPR 29	Alstone Lane, at railway line	NB (WB)	1358:1359	238	238	0.03	-1	-0.22%	P	P
19	ANPR 36	A40, between A417 and A38	SB (WB)	1994:1995	651	653	0.06	2	0.25%	P	P
20	ANPR 37	A38, between A40 and A417	SB	1990:1991	873	848	0.85	-25	-2.84%	P	P
21	ANPR 38	A40, between A38 and B4063	SB	1840:1839	242	203	2.59	-39	-15.98%	P	P
22	ANPR 39	Innsworth Lane, between Brionne Way and Rookery Road	SB	1802:1803	487	365	5.88	-121	-24.92%	O	O
23	ANPR 40	B4063, between A40 and Nine Elms Road	SB (WB)	1974:2066	616	534	3.42	-82	-13.34%	P	P
24	ANPR 41	A417, at railway line	SB	1977:1979	1489	1469	0.52	-20	-1.35%	P	P
25	ANPR 42	Station Road at Rail Bridge	SB	1649:1651	370	303	3.64	-67	-18.05%	P	P
		Total			**16247**	**15019**		**-1228**	**-7.56%**		O

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Appendix A.6: Outer Cordon Calibration AM (Total)

SI	ANPR	Description	Direction	Link ID	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
1	ANPR 3	Gallagher Retail Park, between A4019 and Manor Road	SB (EB)	857:1483	192	182	0.70	-10	-5.00%	P	P
2	ANPR 4	Manor Road, between A4019 and Rutherford Way	SB (WB)	877:885	425	322	5.35	-103	-24.31%	O	O
3	ANPR 5	Kingsditch Lane, between A4019 and Upper Field Road	SB	891:898	739	845	3.77	106	14.34%	P	P
4	ANPR 6	A4019, at railway line	NB (WB)	1486:1680	844	817	0.94	-27	-3.20%	P	P
5	ANPR 7	Arle Road, at railway line	NB	1968:1351	184	174	0.72	-10	-5.22%	P	P
6	ANPR 8	B4633, at railway line	SB (WB)	1496:1383	374	324	2.69	-50	-13.42%	P	P
7	ANPR 9	A40, at railway line	WB	1482:1546	992	836	5.15	-156	-15.69%	O	O
8	ANPR 10	Hatherly Lane, at railway line	NB (WB)	2045:2028	843	770	2.58	-73	-8.68%	P	P
9	ANPR 11	Grovefield Way, at railway line	NB	1681:1926	495	468	1.23	-27	-5.43%	P	P
10	ANPR 12	Badgeworth Road, at railway line	NB	1948:239	644	630	0.55	-14	-2.17%	P	P
11	ANPR 13	M5, at railway line, between Junction 11 and 11A	NB	581:326	2496	2715	4.29	219	8.77%	P	P
12	ANPR 14	Pirton Lane, at railway line	NB	1748:1936	464	442	1.03	-22	-4.72%	P	P
13	ANPR 18	A4019, North of A38 / A4019 junction	SB	770:769	941	883	1.94	-59	-6.22%	P	P
14	ANPR 19	Unnamed Road, between A4019 and Cursey Lane	SB	1656:1655	421	362	2.98	-59	-14.01%	P	P
15	ANPR 20	M5, between Junction 9 and Junction 10	SB	822:611	3816	3313	8.42	-503	-13.18%	O	O
16	ANPR 21	The Green, between A4019 and Lowdilow Lane	SB	850:848	213	271	3.72	58	27.14%	P	P
18	ANPR 29	Alstone Lane, at railway line	SB (EB)	1359:1358	202	213	0.73	11	5.20%	P	P
19	ANPR 36	A40, between A417 and A38	NB (EB)	1995:1994	1315	1298	0.47	-17	-1.29%	P	P
20	ANPR 37	A38, between A40 and A417	NB	1991:1990	658	635	0.89	-23	-3.45%	P	P
21	ANPR 38	A40, between A38 and B4063	NB	1839:1840	385	421	1.79	36	9.32%	P	P
22	ANPR 39	Innsworth Lane, between Brionne Way and Rookery Road	NB	1803:1802	425	423	0.12	-2	-0.56%	P	P
23	ANPR 40	B4063, between A40 and Nine Elms Road	NB (EB)	2066:1974	808	820	0.43	12	1.53%	P	P
24	ANPR 41	A417, at railway line	NB	1978:1976	1600	1579	0.53	-21	-1.31%	P	P
25	ANPR 42	Station Road at Rail Bridge	NB	1651:1649	319	333	0.79	14	4.45%	P	P
		Total			**19795**	**19076**		**-719**	**-3.63%**		**P**

Out											
SI	ANPR	Description	Direction	Link ID	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
1	ANPR 3	Gallagher Retail Park, between A4019 and Manor Road	NB (WB)	1483:857	428	480	2.42	52	12.06%	P	P
2	ANPR 4	Manor Road, between A4019 and Rutherford Way	NB (EB)	885:881	487	503	0.70	16	3.20%	P	P
3	ANPR 5	Kingsditch Lane, between A4019 and Upper Field Road	NB	898:891	1013	942	2.26	-71	-6.99%	P	P
4	ANPR 6	A4019, at railway line	SB (EB)	1256:1259	965	959	0.20	-6	-0.65%	P	P
5	ANPR 7	Arle Road, at railway line	SB	1351:1968	523	451	3.27	-72	-13.80%	P	P
6	ANPR 8	B4633, at railway line	NB (EB)	1383:1496	328	404	3.96	76	23.11%	P	P
7	ANPR 9	A40, at railway line	EB	1546:1482	866	774	3.21	-92	-10.62%	P	P
8	ANPR 10	Hatherly Lane, at railway line	SB (EB)	2028:2045	707	576	5.17	-131	-18.51%	O	O
9	ANPR 11	Grovefield Way, at railway line	SB	1926:1681	293	254	2.37	-39	-13.38%	P	P
10	ANPR 12	Badgeworth Road, at railway line	SB	239:1948	228	186	2.92	-42	-18.42%	P	P
11	ANPR 13	M5, at railway line, between Junction 11 and 11A	SB	327:580	3362	3097	4.66	-265	-7.89%	P	P
12	ANPR 14	Pirton Lane, at railway line	SB	1936:1748	601	405	8.72	-196	-32.55%	O	O
13	ANPR 18	A4019, North of A38 / A4019 junction	NB	769:770	829	824	0.18	-5	-0.63%	P	P
14	ANPR 19	Unnamed Road, between A4019 and Cursey Lane	NB	1655:1656	378	330	2.55	-48	-12.70%	P	P
15	ANPR 20	M5, between Junction 9 and Junction 10	NB	815:823	3083	2756	6.05	-327	-10.61%	P	P
16	ANPR 21	The Green, between A4019 and Lowdilow Lane	NB	848:850	18	37	3.65	19	106.67%	P	P
18	ANPR 29	Alstone Lane, at railway line	NB (WB)	1358:1359	315	309	0.37	-7	-2.06%	P	P
19	ANPR 36	A40, between A417 and A38	SB (WB)	1994:1995	847	873	0.90	26	3.12%	P	P
20	ANPR 37	A38, between A40 and A417	SB	1990:1991	997	972	0.78	-25	-2.47%	P	P
21	ANPR 38	A40, between A38 and B4063	SB	1840:1839	313	257	3.34	-56	-17.99%	P	P
22	ANPR 39	Innsworth Lane, between Brionne Way and Rookery Road	SB	1802:1803	568	414	6.97	-155	-27.20%	O	O
23	ANPR 40	B4063, between A40 and Nine Elms Road	SB (WB)	1974:2066	712	625	3.36	-87	-12.22%	P	P
24	ANPR 41	A417, at railway line	SB	1977:1979	1743	1721	0.53	-22	-1.26%	P	P
25	ANPR 42	Station Road at Rail Bridge	SB	1649:1651	464	369	4.63	-95	-20.39%	P	P
		Total			**20068**	**18517**		**-1551**	**-7.73%**		**O**

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Appendix A.7: Screenline Calibration AM

ATC Site	Description	Link ID	CARS							All Vehicle						
			Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
									Screenline 1 Northbound / Eastbound							
ANPR 15	A40, between A417 and M5 Junction 11	321:286	1245	1308	1.74	62	5.00%	P	P	1440	1555	2.96	115	7.95%	P	P
ANPR 16	B4063, between Down Hatherley Lane and Commerce Road	156:1720	568	597	1.18	29	5.02%	P	P	696	734	1.42	38	5.46%	P	P
ANPR 17	A38, between A4019 and Pancake Lane	749:751	674	564	4.44	-110	-16.38%	O	P	838	701	4.93	-137	-16.32%	O	P
Total			**2488**	**2468**	**0.39**	**-20**	**-0.79%**		**P**	**2974**	**2990**	**0.29**	**16**	**0.53%**		**P**
									Screenline 1 Southbound / Westbound							
ANPR 15	A40, between A417 and M5 Junction 11	287:322	1566	1475	2.35	-92	-5.86%	P	P	1796	1714	1.96	-82	-4.58%	P	P
ANPR 16	B4063, between Down Hatherley Lane and Commerce Road	1720:156	302	336	1.88	34	11.13%	P	P	368	411	2.18	43	11.68%	P	P
ANPR 17	A38, between A4019 and Pancake Lane	751:749	437	511	3.41	74	16.99%	P	P	511	566	2.38	55	10.82%	P	P
Total			**2305**	**2322**	**0.33**	**16**	**0.70%**		**P**	**2675**	**2691**	**0.31**	**16**	**0.60%**		**P**

ATC Site	Description	Link ID	CARS							All Vehicle						
			Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
									Screenline 2 Southbound							
ANPR 17	A38, between A4019 and Pancake Lane	751:749	437	511	3.41	74	16.99%	P	P	511	566	2.38	55	10.82%	P	P
ANPR 1	Main Street, between Boddington Lane and Brock Farm Lane	1583:1582	137	95	3.88	-42	-30.54%	P	P	151	103	4.22	-48	-31.52%	P	P
ANPR 23	Withybridge Lane, between B4634 and A4019	1055:1056	273	212	3.91	-61	-22.31%	P	P	336	274	3.54	-62	-18.39%	P	P
ANPR 24	B4634, between A4019 and Hayden Road	919:945	244	251	0.43	7	2.80%	P	P	289	298	0.53	9	3.15%	P	P
ANPR 28	A4013, between A4019 and George Readings Way	1853:1852	861	931	2.32	70	8.07%	P	P	1038	1138	3.04	100	9.66%	P	P
ANPR 30	Hayden Road, between A4019 and Village Road	871:870	306	220	5.27	-85	-27.94%	P	P	352	267	4.81	-85	-24.03%	P	P
ANPR 22	M5, between Junction 10 and Junction 11	605:603	2441	2090	7.37	-351	-14.38%	P	P	3260	2861	7.21	-399	-12.23%	P	P
Total			**4699**	**4310**	**5.79**	**-388**	**-8.27%**		**O**	**5937**	**5509**	**5.66**	**-428**	**-7.21%**		**O**
									Screenline 2 Northbound							
ANPR 17	A38, between A4019 and Pancake Lane	749:751	674	564	4.44	-110	-16.38%	O	P	838	701	4.93	-137	-16.32%	O	P
ANPR 1	Main Street, between Boddington Lane and Brock Farm Lane	1582:1583	37	40	0.46	3	7.67%	P	P	45	45	0.06	0	0.89%	P	P
ANPR 23	Withybridge Lane, between B4634 and A4019	1056:1055	169	267	6.66	98	58.30%	P	P	232	343	6.54	111	47.80%	O	O
ANPR 24	B4634, between A4019 and Hayden Road	945:919	449	436	0.59	-13	-2.79%	P	P	533	510	1.01	-23	-4.32%	P	P
ANPR 28	A4013, between A4019 and George Readings Way	1853:997	728	891	5.70	162	22.27%	P	O	909	1108	6.28	199	21.94%	O	O
ANPR 30	Hayden Road, between A4019 and Village Road	870:871	416	253	8.92	-163	-39.23%	O	O	470	295	8.94	-175	-37.19%	O	O
ANPR 22	M5, between Junction 10 and Junction 11	604:606	1757	1920	3.80	163	9.28%	P	P	2264	2465	4.14	201	8.89%	P	P
Total			**4229**	**4370**	**2.14**	**140**	**3.32%**		**P**	**5291**	**5468**	**2.42**	**177**	**3.35%**		**P**

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Appendix A.8: Link Count Calibration PM (Car)

		Direction	From Node	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
				5 to 6 PM - CARS						
ATC6	Arle Road, between Brooklyn Gardens and Nether Gardens	SB	1274:1276	231	242	0.66	10	4.39%	P	P
		NB	1276:1274	199	194	0.30	-4	-2.14%	P	P
ATC9	North Road West, between Badgeworth Road and Grovefield Way	EB	235:577	67	60	0.90	-7	-10.70%	P	P
		WB	577:235	100	56	4.91	-43	-43.46%	P	P
ATC16	Grovefield Way, between North Road West and The Reddings	SB	577:1928	384	429	2.26	46	11.87%	P	P
		NB	1928:577	261	294	2.02	34	12.90%	P	P
ATC19	Alstone Road front of Rowanfield Infant School	WB	1292:1291	226	216	0.72	-11	-4.72%	P	P
		EB	1291:1292	263	225	2.44	-38	-14.46%	P	P
ATC20	Libertus Road approaching B4633 Gloucester Rd	SB (EB)	1377:1378	245	205	2.69	-40	-16.48%	P	P
		NB (WB)	1378:1377	132	193	4.83	62	46.75%	P	P
ATC21	Brooklyn Road North of Edinburgh Place	SB	1335:1330	138	137	0.05	-1	-0.44%	P	P
		NB	1330:1335	212	142	5.26	-70	-33.02%	P	P
ATC22	Location Changed Oldbury Road front of Pates Grammer School	EB	1018:1017	24	28	0.81	4	17.11%	P	P
		WB	1017:1018	70	46	3.10	-24	-33.82%	P	P
ATC23	Springbank Road close to Helens Close	SB	1190:1193	141	92	4.57	-49	-34.98%	P	P
		NB	1193:1190	141	81	5.75	-61	-42.92%	P	P
ANPR 1	Main Street, between Boddington Lane and Brock Farm Lane	SB	1583:1582	30	27	0.69	-4	-12.23%	P	P
		NB	1582:1583	76	45	3.95	-31	-40.57%	P	P
ANPR 2	A4019, between Withybridge Lane and The Green	SB (EB)	843:846	789	674	4.25	-115	-14.57%	P	P
		NB (WB)	846:843	1096	911	5.82	-184	-16.84%	O	O
ANPR 4	Manor Road, between A4019 and Rutherford Way	SB (WB)	877:885	647	451	8.36	-196	-30.29%	O	O
		NB (EB)	885:881	453	510	2.62	57	12.67%	P	P
ANPR 5	Kingsditch Lane, between A4019 and Upper Field Road	SB	891:898	808	748	2.18	-61	-7.52%	P	P
		NB	898:891	854	912	1.96	58	6.82%	P	P
ANPR 6	A4019, at railway line	SB (EB)	1256:1259	850	804	1.61	-46	-5.45%	P	P
		NB (WB)	1486:1680	1049	979	2.22	-71	-6.73%	P	P
ANPR 7	Arle Road, at railway line	SB	1351:1968	232	242	0.68	11	4.54%	P	P
		NB	1968:1351	264	262	0.14	-2	-0.84%	P	P
ANPR 8	B4633, at railway line	SB (WB)	1496:1383	496	430	3.05	-66	-13.25%	P	P
		NB (EB)	1383:1496	442	432	0.49	-10	-2.29%	P	P
ANPR 9	A40, at railway line	EB	1546:1482	682	654	1.06	-27	-4.01%	P	P
		WB	1482:1546	763	696	2.49	-67	-8.80%	P	P
ANPR 10	Hatherly Lane, at railway line	SB (EB)	2028:2045	590	567	0.97	-23	-3.94%	P	P
		NB (WB)	2045:2028	579	523	2.39	-56	-9.69%	P	P
ANPR 11	Grovefield Way, at railway line	SB	1926:1681	464	411	2.52	-53	-11.37%	P	P
		NB	1681:1926	304	280	1.42	-24	-7.98%	P	P
ANPR 12	Badgeworth Road, at railway line	SB	239:1948	415	310	5.51	-105	-25.31%	O	O
		NB	1948:239	187	186	0.04	-1	-0.29%	P	P
ANPR 13	M5, at railway line, between Junction 11 and 11A	SB	327:580	2865	2788	1.45	-77	-2.69%	P	P
		NB	581:326	2727	2680	0.91	-47	-1.73%	P	P
ANPR 14	Pirton Lane, at railway line	SB	1936:1748	209	239	2.02	30	14.44%	P	P
		NB	1748:1936	223	213	0.69	-10	-4.56%	P	P
ANPR 17	A38, between A4019 and Pancake Lane	SB	751:749	535	523	0.51	-12	-2.18%	P	P
		NB	749:751	402	371	1.60	-31	-7.83%	P	P
ANPR 18	A4019, North of A38 / A4019 junction	SB	770:769	518	554	1.56	36	6.99%	P	P
		NB	769:770	610	600	0.41	-10	-1.66%	P	P
ANPR 19	Unnamed Road, between A4019 and Cursey Lane	SB	1656:1655	167	184	1.27	17	10.06%	P	P
		NB	1655:1656	256	219	2.44	-38	-14.69%	P	P
ANPR 20	M5, between Junction 9 and Junction 10	NB	822:611	3219	2889	5.97	-330	-10.25%	P	P
		SB	815:823	2963	3158	3.52	195	6.57%	P	P
ANPR 21	The Green, between A4019 and Lowdilow Lane	SB	850:848	13	13	0.11	0	3.02%	P	P
		NB	848:850	11	15	1.30	5	43.95%	P	P
ANPR 29	Alstone Lane, at railway line	SB (EB)	1359:1358	215	191	1.69	-24	-11.19%	P	P
		NB (WB)	1358:1359	161	184	1.69	22	13.77%	P	P
ANPR 33	A4013, between A40 and Cowper Road	SB	1030:1032	845	690	5.58	-155	-18.30%	O	O
		NB	1032:1030	534	789	9.91	255	47.73%	O	O
ANPR 34	A40, between A4013 and Benhall Avenue	EB	533:529	959	929	0.98	-30	-3.13%	P	P
		WB	529:533	708	883	6.20	175	24.68%	O	O
ANPR 36	A40, between A417 and A38	SB (WB)	1994:1995	1055	994	1.88	-60	-5.70%	P	P
		NB (EB)	1995:1994	1127	1112	0.45	-15	-1.35%	P	P
ANPR 37	A38, between A40 and A417	NB	1991:1990	615	509	4.49	-106	-17.29%	O	P
		SB	1990:1991	905	885	0.67	-20	-2.22%	P	P
ANPR 38	A40, between A38 and B4063	SB	1840:1839	288	249	2.35	-38	-13.36%	P	P
		NB	1839:1840	371	352	0.99	-19	-5.08%	P	P
ANPR 39	Innsworth Lane, between Brionne Way and Rookery Road	SB	1802:1803	437	331	5.40	-106	-24.25%	O	O
		NB	1803:1802	259	262	0.18	3	1.11%	P	P
ANPR 40	B4063, between A40 and Nine Elms Road	SB (WB)	1974:2066	896	881	0.48	-14	-1.61%	P	P
		NB (EB)	2066:1974	612	635	0.93	23	3.81%	P	P
ANPR 41	A417, at railway line	SB	1977:1979	1348	1379	0.85	31	2.32%	P	P
		NB	1978:1976	1614	1541	1.83	-73	-4.52%	P	P
ANPR 42	Station Road at Rail Bridge	SB	1649:1651	233	242	0.60	9	3.97%	P	P
		NB	1651:1649	326	306	1.16	-21	-6.33%	P	P

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Appendix A.9: Link Count Calibration PM (Total)

		Direction	From Node	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
				5 to 6 PM - TOTAL						
ATC6	Arle Road, between Brooklyn Gardens and Nether Gardens	SB	1274:1276	271	274	0.17	3	1.03%	P	P
		NB	1276:1274	239	232	0.45	-7	-2.89%	P	P
ATC9	North Road West, between Badgeworth Road and Grovefield Way	EB	235:577	79	72	0.76	-7	-8.35%	P	P
		WB	577:235	119	63	5.83	-56	-46.81%	P	P
ATC16	Grovefield Way, between North Road West and The Reddings	SB	577:1928	449	480	1.42	31	6.79%	P	P
		NB	1928:577	307	336	1.62	29	9.48%	P	P
ATC19	Alstone Road front of Rowanfield Infant School	WB	1292:1291	264	241	1.43	-23	-8.64%	P	P
		EB	1291:1292	313	241	4.32	-72	-22.97%	P	P
ATC20	Libertus Road approaching B4633 Gloucester Rd	SB (EB)	1377:1378	293	234	3.61	-59	-20.00%	P	P
		NB (WB)	1378:1377	153	222	5.01	69	44.77%	P	P
ATC21	Brooklyn Road North of Edinburgh Place	SB	1335:1330	171	154	1.36	-17	-10.12%	P	P
		NB	1330:1335	247	158	6.25	-89	-36.03%	P	P
ATC22	Location Changed Oldbury Road front of Pates Grammer School	EB	1018:1017	28	43	2.50	15	53.21%	P	P
		WB	1017:1018	83	62	2.50	-21	-25.66%	P	P
ATC23	Springbank Road close to Helens Close	SB	1190:1193	169	102	5.75	-67	-39.59%	P	P
		NB	1193:1190	168	84	7.44	-84	-49.76%	P	P
ANPR 1	Main Street, between Boddington Lane and Brock Farm Lane	SB	1583:1582	38	32	1.08	-6	-16.84%	P	P
		NB	1582:1583	90	53	4.36	-37	-41.00%	P	P
ANPR 2	A4019, between Withybridge Lane and The Green	SB (EB)	843:846	886	749	4.80	-137	-15.50%	O	P
		NB (WB)	846:843	1234	1001	6.96	-233	-18.87%	O	O
ANPR 4	Manor Road, between A4019 and Rutherford Way	SB (WB)	877:885	708	492	8.82	-216	-30.51%	O	O
		NB (EB)	885:881	487	547	2.65	60	12.36%	P	P
ANPR 5	Kingsditch Lane, between A4019 and Upper Field Road	SB	891:898	914	841	2.47	-73	-8.02%	P	P
		NB	898:891	953	1010	1.82	57	5.98%	P	P
ANPR 6	A4019, at railway line	SB (EB)	1256:1259	937	887	1.65	-50	-5.31%	P	P
		NB (WB)	1486:1680	1177	1091	2.57	-87	-7.35%	P	P
ANPR 7	Arle Road, at railway line	SB	1351:1968	269	278	0.56	9	3.42%	P	P
		NB	1968:1351	299	296	0.17	-3	-0.97%	P	P
ANPR 8	B4633, at railway line	SB (WB)	1496:1383	537	465	3.22	-72	-13.43%	P	P
		NB (EB)	1383:1496	477	470	0.34	-8	-1.57%	P	P
ANPR 9	A40, at railway line	EB	1546:1482	718	693	0.95	-25	-3.52%	P	P
		WB	1482:1546	846	778	2.38	-68	-8.01%	P	P
ANPR 10	Hatherly Lane, at railway line	SB (EB)	2028:2045	646	618	1.10	-28	-4.27%	P	P
		NB (WB)	2045:2028	646	588	2.33	-58	-8.98%	P	P
ANPR 11	Grovefield Way, at railway line	SB	1926:1681	497	440	2.64	-57	-11.49%	P	P
		NB	1681:1926	354	322	1.72	-32	-8.93%	P	P
ANPR 12	Badgeworth Road, at railway line	SB	239:1948	464	344	5.99	-120	-25.95%	O	O
		NB	1948:239	235	232	0.21	-3	-1.36%	P	P
ANPR 13	M5, at railway line, between Junction 11 and 11A	SB	327:580	3358	3224	2.34	-134	-3.99%	P	P
		NB	581:326	3316	3260	0.98	-56	-1.69%	P	P
ANPR 14	Pirton Lane, at railway line	SB	1936:1748	227	261	2.16	34	14.89%	P	P
		NB	1748:1936	258	247	0.70	-11	-4.30%	P	P
ANPR 17	A38, between A4019 and Pancake Lane	SB	751:749	632	603	1.17	-29	-4.60%	P	P
		NB	749:751	446	411	1.70	-35	-7.87%	P	P
ANPR 18	A4019, North of A38 / A4019 junction	SB	770:769	574	638	2.61	64	11.18%	P	P
		NB	769:770	713	662	1.96	-51	-7.21%	P	P
ANPR 19	Unnamed Road, between A4019 and Cursey Lane	SB	1656:1655	190	210	1.39	20	10.32%	P	P
		NB	1655:1656	292	246	2.82	-46	-15.86%	P	P
ANPR 20	M5, between Junction 9 and Junction 10	NB	822:611	3783	3353	7.20	-430	-11.37%	O	O
		SB	815:823	3542	3783	3.99	241	6.81%	P	P
ANPR 21	The Green, between A4019 and Lowdilow Lane	SB	850:848	16	50	5.89	34	211.25%	P	P
		NB	848:850	12	29	3.75	17	141.67%	P	P
ANPR 29	Alstone Lane, at railway line	SB (EB)	1359:1358	245	208	2.44	-37	-15.02%	P	P
		NB (WB)	1358:1359	180	208	1.98	28	15.33%	P	P
ANPR 33	A4013, between A40 and Cowper Road	SB	1030:1032	919	807	3.80	-112	-12.15%	P	P
		NB	1032:1030	587	900	11.47	313	53.25%	O	O
ANPR 34	A40, between A4013 and Benhall Avenue	EB	533:529	1017	1034	0.52	17	1.62%	P	P
		WB	529:533	790	1002	7.08	212	26.82%	O	O
ANPR 36	A40, between A417 and A38	SB (WB)	1994:1995	1216	1144	2.09	-72	-5.91%	P	P
		NB (EB)	1995:1994	1290	1279	0.30	-11	-0.84%	P	P
ANPR 37	A38, between A40 and A417	NB	1991:1990	672	559	4.56	-113	-16.83%	O	P
		SB	1990:1991	1016	991	0.80	-25	-2.49%	P	P
ANPR 38	A40, between A38 and B4063	SB	1840:1839	331	285	2.62	-46	-13.90%	P	P
		NB	1839:1840	402	381	1.06	-21	-5.20%	P	P
ANPR 39	Innsworth Lane, between Brionne Way and Rookery Road	SB	1802:1803	488	368	5.82	-120	-24.65%	O	O
		NB	1803:1802	300	300	0.01	0	-0.03%	P	P
ANPR 40	B4063, between A40 and Nine Elms Road	SB (WB)	1974:2066	984	976	0.26	-8	-0.83%	P	P
		NB (EB)	2066:1974	673	695	0.85	22	3.31%	P	P
ANPR 41	A417, at railway line	SB	1977:1979	1546	1577	0.78	31	2.01%	P	P
		NB	1978:1976	1843	1765	1.83	-78	-4.23%	P	P
ANPR 42	Station Road at Rail Bridge	SB	1649:1651	283	291	0.46	8	2.76%	P	P
		NB	1651:1649	379	367	0.62	-12	-3.17%	P	P

Appendix A.10: Turn Count Calibration PM (Car)

ID	Direction	Direction	From Node	To Node	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
					5 to 6 PM - CARS						
4a	(A) M5 SB Offslip (N)	(B) A4019 Withy Bridge (E)	817:841	841:824	473	404	3.28	-69	-14.52%	P	P
	(D) A4019 Withy Bridge (W)	(B) A4019 Withy Bridge (E)	798:841	841:824	453	405	2.34	-48	-10.68%	P	P
4b	(B) A4019 Withy Bridge (E)	(D) A4019 Withy Bridge (W)	800:799	799:796	687	631	2.17	-56	-8.12%	P	P
		(C) M5 NB Onslip (S)	800:799	799:801	597	485	4.80	-112	-18.71%	O	P
7	(A) B634 Hayden Road (N)	(B) A4019 Tewkesbury Road (E)	857:1483	1483:1686	21	46	4.31	25	118.57%	P	P
		(C) B634 Hayden Road (S)	1483:943	943:919	172	186	1.02	14	7.97%	P	P
		(D) A4019 Tewkesbury Road (W)	1483:943	943:941	223	154	5.05	-69	-31.08%	P	P
	(B) A4019 Tewkesbury Road (E)	(A) B634 Hayden Road (N)	913:943	943:1483	4	9	1.83	5	115.00%	P	P
		(C) B634 Hayden Road (S)	912:913	913:919	159	167	0.60	8	4.84%	P	P
		(D) A4019 Tewkesbury Road (W)	913:943	943:941	726	664	2.34	-62	-8.51%	P	P
	(C) B634 Hayden Road (S)	(A) B634 Hayden Road (N)	919:943	943:1483	156	112	3.81	-44	-28.27%	P	P
		(B) A4019 Tewkesbury Road (E)	919:943	943:1686	192	243	3.43	51	26.30%	P	P
		(D) A4019 Tewkesbury Road (W)	945:919	919:941	171	123	3.99	-48	-28.30%	P	P
	(D) A4019 Tewkesbury Road (W)	(A) B634 Hayden Road (N)	930:914	914:1483	192	98	7.79	-94	-48.85%	P	P
		(B) A4019 Tewkesbury Road (E)	914:943	943:1686	530	531	0.03	1	0.15%	P	P
		(C) B634 Hayden Road (S)	914:943	943:919	97	90	0.77	-7	-7.63%	P	P
8A	(B) A4019 Tewkesbury Road (E)	(C) Hayden Road (S)	885:867	867:871	254	179	5.11	-75	-29.61%	P	P
		(D) A4019 Tewkesbury Road (W)	885:861	861:863	847	765	2.89	-82	-9.68%	P	P
	(C) Hayden Road (S)	(B) A4019 Tewkesbury Road (E)	871:861	861:885	311	215	5.93	-96	-30.90%	P	P
		(D) A4019 Tewkesbury Road (W)	871:861	861:863	39	60	2.92	21	52.56%	P	P
	(D) A4019 Tewkesbury Road (W)	(B) A4019 Tewkesbury Road (E)	922:861	861:885	724	728	0.16	4	0.61%	P	P
8B	(A) Manor Road (N)	(B) A4019 Tewkesbury Road (E)	877:885	885:876	280	249	1.89	-31	-11.00%	P	P
		(D) A4019 Tewkesbury Road (W)	877:885	885:861	341	56	20.20	-285	-83.49%	O	O
	(B) A4019 Tewkesbury Road (E)	(A) Manor Road (N)	911:885	885:881	235	275	2.53	40	17.19%	P	P
		(D) A4019 Tewkesbury Road (W)	911:885	885:861	760	709	1.90	-52	-6.78%	P	P
	(D) A4019 Tewkesbury Road (W)	(A) Manor Road (N)	861:885	885:881	226	235	0.59	9	3.98%	P	P
		(B) A4019 Tewkesbury Road (E)	861:885	885:876	809	708	3.66	-101	-12.45%	P	P
9	(A) Kingsditch Lane (N)	(B) A4019 Tewkesbury Road (E)	898:1613	1693:1653	109	121	1.12	12	11.01%	P	P
		(C) A4013 Princess Elizabeth Way (S)	898:1613	1620:893	519	478	1.82	-41	-7.82%	P	P
		(D) A4019 Tewkesbury Road (W)	898:1613	1602:1517	202	148	4.07	-54	-26.68%	P	P
	(B) A4019 Tewkesbury Road (E)	(A) Kingsditch Lane (N)	1593:1635	1499:898	168	153	1.22	-16	-9.23%	P	P
		(C) A4013 Princess Elizabeth Way (S)	1593:1635	1620:893	261	275	0.84	14	5.25%	P	P
		(D) A4019 Tewkesbury Road (W)	1593:1635	1602:1517	755	602	5.87	-153	-20.25%	O	O
	(C) A4013 Princess Elizabeth Way (S)	(A) Kingsditch Lane (N)	893:1692	1499:898	597	555	1.77	-43	-7.12%	P	P
		(B) A4019 Tewkesbury Road (E)	893:1692	1693:1653	165	151	1.15	-14	-8.73%	P	P
		(D) A4019 Tewkesbury Road (W)	893:1692	1602:1517	228	271	2.73	43	18.90%	P	P
	(D) A4019 Tewkesbury Road (W)	(A) Kingsditch Lane (N)	1650:1691	1499:898	237	205	2.15	-32	-13.50%	P	P
		(B) A4019 Tewkesbury Road (E)	1650:1691	1693:1653	691	542	5.99	-149	-21.53%	O	O
		(C) A4013 Princess Elizabeth Way (S)	1650:1691	1620:893	166	217	3.69	51	30.72%	P	P
10	(A) Old Gloucester Road (E)	(B) Pilgrove Way (S)	958:957	957:960	119	89	2.98	-30	-25.55%	P	P
		(C) Old Gloucester Road (W)	958:957	957:961	328	212	7.08	-116	-35.46%	O	O
	(B) Pilgrove Way (S)	(A) Old Gloucester Road (E)	960:957	957:958	43	47	0.64	4	10.00%	P	P
		(C) Old Gloucester Road (W)	960:957	957:961	14	36	4.37	22	155.71%	P	P
	(C) Old Gloucester Road (W)	(A) Old Gloucester Road (E)	961:957	957:958	344	239	6.18	-106	-30.67%	O	O
		(B) Pilgrove Way (S)	961:957	957:960	38	52	2.07	14	36.58%	P	P
11	(A) A4013 Princess Elizabeth Way (E)	(B) Orchard Way (S)	1002:1003	1003:1009	65	70	0.56	5	7.08%	P	P
		(C) A4013 Princess Elizabeth Way (W)	1002:1003	1003:2259	741	643	3.75	-99	-13.29%	P	P
	(B) Orchard Way (S)	(A) A4013 Princess Elizabeth Way (E)	1009:1003	1003:1002	63	78	1.83	15	24.44%	P	P
		(C) A4013 Princess Elizabeth Way (W)	1009:1003	1003:2259	116	129	1.17	13	11.21%	P	P
	(C) A4013 Princess Elizabeth Way (W)	(A) A4013 Princess Elizabeth Way (E)	2259:1003	1003:1002	648	651	0.13	3	0.49%	P	P
		(B) Orchard Way (S)	2259:1003	1003:1009	85	80	0.52	-5	-5.53%	P	P
12	(A) A4013 Princess Elizabeth Way (N)	(A) A4013 Princess Elizabeth Way (N)	1019:1020	1020:1019	0	0	0.45	0	#DIV/0!	P	P
		(B) Edinburgh Place (E)	1019:1020	1022:1026	91	104	1.32	13	14.29%	P	P
		(C) A4013 Princess Elizabeth Way (S)	1019:1020	1025:1668	501	576	3.21	75	14.87%	P	P
		(D) Marsland Road (W)	1019:1020	1023:1024	36	63	3.85	27	75.28%	P	P
	(B) Edinburgh Place (E)	(A) A4013 Princess Elizabeth Way (N)	1026:1022	1020:1019	120	108	1.16	-12	-10.33%	P	P
		(C) A4013 Princess Elizabeth Way (S)	1026:1022	1025:1668	20	53	5.42	33	163.50%	P	P
		(D) Marsland Road (W)	1026:1022	1023:1024	161	125	2.98	-36	-22.17%	P	P
	(C) A4013 Princess Elizabeth Way (S)	(A) A4013 Princess Elizabeth Way (N)	1668:1025	1020:1019	564	620	2.31	56	9.96%	P	P
		(B) Edinburgh Place (E)	1668:1025	1022:1026	50	35	2.38	-16	-31.00%	P	P
		(D) Marsland Road (W)	1668:1025	1023:1024	47	42	0.83	-6	-11.70%	P	P
	(D) Marsland Road (W)	(A) A4013 Princess Elizabeth Way (N)	1024:1023	1020:1019	75	78	0.39	3	4.53%	P	P
		(B) Edinburgh Place (E)	1024:1023	1022:1026	113	98	1.45	-15	-13.19%	P	P
		(C) A4013 Princess Elizabeth Way (S)	1024:1023	1025:1668	28	33	0.82	5	16.07%	P	P
13	(A) A4013 Princess Elizabeth Way (N)	(B) A4013 Princess Elizabeth Way (S)	1542:1679	1679:538	543	674	5.30	131	24.09%	O	O
		(C) Hubble Road (W)	1542:1679	1679:1035	39	39	0.00	0	0.00%	P	P
	(B) A4013 Princess Elizabeth Way (S)	(A) A4013 Princess Elizabeth Way (N)	1678:1679	1679:1036	512	573	2.61	61	11.89%	P	P
		(C) Hubble Road (W)	1678:1679	1679:1035	23	26	0.68	3	14.78%	P	P
	(C) Hubble Road (W)	(A) A4013 Princess Elizabeth Way (N)	1045:1035	1035:1036	220	215	0.33	-5	-2.23%	P	P
		(B) A4013 Princess Elizabeth Way (S)	1035:1679	1679:538	291	241	3.08	-50	-17.25%	P	P
14	(A) A4013 Princess Elizabeth Way (N)	(B) A40 Gloucester Road (E)	538:552	544:543	173	192	1.41	19	10.98%	P	P
		(C.) A40 Gloucester Road (W)	538:552	549:548	647	724	2.93	77	11.84%	P	P
	(B) A40 Gloucester Road (E)	(A) A4013 Princess Elizabeth Way (N)	547:545	551:550	89	115	2.60	26	29.55%	P	P
		(C.) A40 Gloucester Road (W)	547:545	549:548	730	692	1.41	-38	-5.16%	P	P
	(C.) A40 Gloucester Road (W)	(A) A4013 Princess Elizabeth Way (N)	539:542	551:550	419	482	2.99	63	15.13%	P	P
		(B) A40 Gloucester Road (E)	539:542	544:543	729	724	0.20	-5	-0.73%	P	P
15	(A) Telstar Way (N)	(B) A40 Gloucester Road (E)	441:512	512:446	41	45	0.67	4	10.73%	P	P
		(C) A40 Gloucester Road (W)	441:512	512:453	482	452	1.91	-30	-6.29%	P	P
	(B) A40 Gloucester Road (E)	(A) Telstar Way (N)	1729:512	512:443	37	71	4.66	34	92.70%	P	P
		(C) A40 Gloucester Road (W)	1729:512	512:453	1200	1290	2.56	90	7.53%	P	P
	(C) A40 Gloucester Road (W)	(A) Telstar Way (N)	445:512	512:443	243	189	3.66	-54	-22.14%	P	P
		(B) A40 Gloucester Road (E)	445:512	512:446	1096	1214	3.46	118	10.74%	P	P
16	(A) B4063 (E)	(B) Bamfurlong Lane (S)	1908:206	206:215	74	88	1.50	14	18.24%	P	P
		(C) B4063 (W)	1908:206	206:207	241	241	0.01	0	-0.04%	P	P
	(B) Bamfurlong Lane (S)	(A) B4063 (E)	215:206	206:1908	72	152	7.59	80	111.67%	P	P
		(C) B4063 (W)	215:206	206:207	32	48	2.47	16	48.75%	P	P
	(C) B4063 (W)	(A) B4063 (E)	207:206	206:1908	203	212	0.60	9	4.29%	P	P
		(B) Bamfurlong Lane (S)	207:206	206:215	52	48	0.55	-4	-7.50%	P	P
17	(A) Fiddler's Green Lane (N)	(B) A40 Gloucester Road (E)	368:439	1700:437	12	18	1.53	6	49.17%	P	P
		(C) Hatherley Lana (S)	368:439	455:570	43	35	1.21	-8	-17.67%	P	P
		(D) A40 Gloucester Road (W)	368:439	562:211	121	98	2.16	-23	-18.68%	P	P
		(E) B4063 (W)	368:439	354:209	3	9	2.29	6	183.33%	P	P
	(B) A40 Gloucester Road (E)	(A) Fiddler's Green Lane (N)	456:1710	563:368	60	61	0.08	1	1.00%	P	P
		(C) Hatherley Lana (S)	456:1710	455:570	350	316	1.85	-34	-9.63%	P	P
		(D) A40 Gloucester Road (W)	456:1710	562:211	1329	1352	0.62	23	1.71%	P	P
		(E) B4063 (W)	456:1710	354:209	86	135	4.64	49	56.63%	P	P
	(C) Hatherley Lana (S)	(A) Fiddler's Green Lane (N)	570:351	563:368	89	67	2.48	-22	-24.61%	P	P
		(B) A40 Gloucester Road (E)	570:351	1700:437	99	121	2.12	22	22.42%	P	P
		(D) A40 Gloucester Road (W)	570:351	562:211	695	599	3.79	-96	-13.86%	P	P
		(E) B4063 (W)	570:351	354:209	114	107	0.65	-7	-5.96%	P	P
	(D) A40 Gloucester Road (W)	(A) Fiddler's Green Lane (N)	357:1708	563:368	104	82	2.33	-22	-21.54%	P	P
		(B) A40 Gloucester Road (E)	357:1708	1700:437	1185	1144	1.22	-42	-3.50%	P	P
		(C) Hatherley Lana (S)	357:1708	455:570	552	447	4.66	-105	-19.06%	O	P
		(E) B4063 (W)	357:1708	354:209	123	77	4.66	-47	-37.80%	P	P
	(E) B4063 (W)	(A) Fiddler's Green Lane (N)	209:564	563:368	41	54	1.86	13	31.22%	P	P
		(B) A40 Gloucester Road (E)	209:564	1700:437	74	144	6.67	70	94.05%	P	P
		(C) Hatherley Lana (S)	209:564	455:570	10	35	5.27	25	250.00%	P	P
		(D) A40 Gloucester Road (W)	209:564	562:211	148	130	1.52	-18	-12.09%	P	P
18	(A) Car Park (N)	(B) Hatherley Lane (NE)	1912:573	1922:571	138	97	3.77	-41	-29.64%	P	P
		(C) Hatherley Lane (SE)	1912:573	1923:1847	19	17	0.47	-2	-10.53%	P	P
	(B) Hatherley Lane (NE)	(A) Car Park (N)	571:1916	1921:1912	3	0	2.45	-3	-100.00%	P	P
		(C) Hatherley Lane (SE)	571:1916	1923:1847	542	547	0.23	5	1.00%	P	P
		(D) Unnamed Road (S)	571:1916	1924:1909	51	6	8.53	-45	-89.02%	P	P
		(E) Grovefield Way (W)	571:1916	1920:1925	260	279	1.13	19	7.12%	P	P
	(C) Hatherley Lane (SE)	(A) Car Park (N)	1847:1917	1921:1912	0	0	#DIV/0!	0	#DIV/0!	P	#DIV/0!
		(B) Hatherley Lane (NE)	1847:1917	1922:571	497	533	1.60	36	7.28%	P	P
		(D) Unnamed Road (S)	1847:1917	1924:1909	42	19	4.23	-23	-55.48%	P	P
		(E) Grovefield Way (W)	1847:1917	1920:1925	133	106	2.44	-27	-20.08%	P	P
	(D) Unnamed Road (S)	(B) Hatherley Lane (NE)	1909:1918	1922:571	39	29	1.70	-10	-25.38%	P	P
		(C) Hatherley Lane (SE)	1909:1918	1923:1847	42	30	2.04	-12	-29.05%	P	P
		(E) Grovefield Way (W)	1909:1918	1920:1925	43	28	2.59	-15	-35.81%	P	P
	(E) Grovefield Way (W)	(A) Car Park (N)	1925:1919	1921:1912	0	1	1.55	1	#DIV/0!	P	P
		(B) Hatherley Lane (NE)	1925:1919	1922:571	263	236	1.70	-27	-10.19%	P	P
		(C) Hatherley Lane (SE)	1925:1919	1923:1847	61	45	2.23	-16	-26.56%	P	P
		(D) Unnamed Road (S)	1925:1919	1924:1909	20	3	5.14	-17	-86.50%	P	P

Jct	From	To									
20	(A) M5 (N)	(B) A40 (E)	1813:266	267:1816	250	210	2.64	-40	-16.00%	P	P
		(D)A40 (W)	1813:266	263:1819	400	356	2.27	-44	-11.03%	P	P
	(B) A40 (E)	(A) M5 (N)	1809:268	265:1821	275	234	2.56	-41	-14.87%	P	P
		(C)M5 (S)	1809:268	269:1817	852	747	3.73	-105	-12.37%	P	P
	(C)M5 (S)	(A) M5 (N)	1481:264	263:1819	50	42	1.23	-8	-16.60%	P	P
		(B) A40 (E)	1481:264	267:1816	672	596	3.01	-76	-11.28%	P	P
	(D)A40 (W)	(A) M5 (N)	1484:262	265:1821	401	381	1.02	-20	-5.01%	P	P
		(C)M5 (S)	1484:262	269:1817	90	95	0.47	5	5.00%	P	P
		(D)A40 (W)	1484:262	265:1821	401	381	1.02	-20	-5.01%	P	P
21	(A) B4063 Old Gloucester Road (N)	(B) B4063 Cheltenham Road (E)	170:161	161:1904	35	42	1.07	7	18.86%	P	P
		(C)Bamfurlong Lane (S)	170:161	161:167	116	58	6.22	-58	-50.00%	P	P
		(D) B4063 Cheltenham Road (W)	170:161	161:1712	261	276	0.89	15	5.59%	P	P
	(B) B4063 Cheltenham Road (E)	(A) B4634 Old Gloucester Road (N)	1904:161	161:170	101	79	2.32	-22	-21.78%	P	P
		(C)Bamfurlong Lane (S)	1904:161	161:167	6	5	0.25	-1	-10.00%	P	P
		(D) B4063 Cheltenham Road (W)	1904:161	161:1712	158	124	2.89	-34	-21.71%	P	P
	(C)Bamfurlong Lane (S)	(A) B4634 Old Gloucester Road (N)	167:161	161:170	143	166	1.84	23	16.01%	P	P
		(B) B4063 Cheltenham Road (E)	167:161	161:1904	8	44	7.03	36	447.50%	P	P
		(D) B4063 Cheltenham Road (W)	167:161	161:1712	79	103	2.56	24	30.89%	P	P
	(D) B4063 Cheltenham Road (W)	(A) B4634 Old Gloucester Road (N)	1712:161	161:170	230	238	0.49	8	3.26%	P	P
		(B) B4063 Cheltenham Road (E)	1712:161	161:1904	107	131	2.20	24	22.43%	P	P
		(C)Bamfurlong Lane (S)	1712:161	161:167	59	42	2.39	-17	-28.81%	P	P
22	(A) B4634 Old Gloucester Road (N)	(B) B4634 Old Gloucester Road (S)	989:177	177:990	357	340	0.91	-17	-4.76%	P	P
		(C)Unnamed Road (W)	989:177	177:178	12	11	0.33	-1	-9.17%	P	P
	(B) B4634 Old Gloucester Road (S)	(A) B4634 Old Gloucester Road (N)	990:177	177:989	418	421	0.14	3	0.67%	P	P
		(C)Unnamed Road (W)	990:177	177:178	64	58	0.74	-6	-9.06%	P	P
	(C)Unnamed Road (W)	(A) B4634 Old Gloucester Road (N)	178:177	177:989	45	17	4.96	-28	-61.56%	P	P
		(B) B4634 Old Gloucester Road (S)	178:177	177:990	63	28	5.14	-35	-55.08%	P	P
23	(A) B4063 Cheltenham Road East (E)	(B) Pirton Lane (S)	1999:142	142:2000	122	117	0.48	-5	-4.26%	P	P
		(C)B4063 Cheltenham Road East (W)	1999:142	142:1980	487	427	2.81	-60	-12.32%	P	P
	(B) Pirton Lane (S)	(A) B4063 Cheltenham Road East (E)	2000:142	142:1999	93	116	2.27	23	24.95%	P	P
		(C)B4063 Cheltenham Road East (W)	2000:142	142:1980	131	152	1.79	21	16.26%	P	P
	(C)B4063 Cheltenham Road East (W)	(A) B4063 Cheltenham Road East (E)	1980:142	142:1999	362	338	1.26	-24	-6.52%	P	P
		(B) Pirton Lane (S)	1980:142	142:2000	202	189	0.92	-13	-6.34%	P	P
24	(A) B4063 (N)	(B) B4063 (S)	1720:156	156:1717	519	454	2.94	-65	-12.49%	P	P
		(C)Down Hatherley Lane (W)	1720:156	156:1722	184	101	6.96	-83	-45.16%	P	P
	(B) B4063 (S)	(A) B4063 (N)	1717:156	156:1720	215	299	5.26	84	39.21%	P	P
		(C)Down Hatherley Lane (W)	1717:156	156:1722	12	16	1.14	4	35.83%	P	P
	(C)Down Hatherley Lane (W)	(A) B4063 (N)	1722:156	156:1720	73	88	1.66	15	20.41%	P	P
		(B) B4063 (S)	1722:156	156:1717	46	84	4.72	38	82.83%	P	P
33	(A) A38 Tewkesbury Road (N)	(B) A40 (E)	659:656	664:665	78	56	2.71	-22	-28.46%	P	P
		(C.) A38 Tewkesbury Road (S)	659:656	666:658	403	369	1.74	-34	-8.49%	P	P
		(D.) A40 (W)	659:656	668:660	326	250	4.45	-76	-23.19%	P	P
	(B) A40 (E)	(A) A38 Tewkesbury Road (N)	657:661	669:659	76	91	1.67	15	20.13%	P	P
		(C.) A38 Tewkesbury Road (S)	657:661	666:658	449	425	1.13	-24	-5.26%	P	P
		(D.) A40 (W)	657:661	668:660	607	690	3.26	83	13.67%	P	P
	(C.) A38 Tewkesbury Road (S)	(A) A38 Tewkesbury Road (N)	658:662	669:659	272	249	1.41	-23	-8.35%	P	P
		(B) A40 (E)	658:662	664:665	242	202	2.67	-40	-16.45%	P	P
		(D.) A40 (W)	658:662	668:660	88	57	3.61	-31	-35.00%	P	P
	(D.) A40 (W)	(A) A38 Tewkesbury Road (N)	660:663	669:659	374	339	1.84	-35	-9.30%	P	P
		(B) A40 (E)	660:663	664:665	677	678	0.02	1	0.07%	P	P
		(C.) A38 Tewkesbury Road (S)	660:663	666:658	75	95	2.15	20	26.40%	P	P
34	(A) B4063 Cheltenham Road (N)	(B) A40 (E)	75:J6	614:95	71	73	0.26	2	3.10%	P	P
		(C.) Unnamed (SE)	75:J6	1727:77	0	2	2.05	2	#DIV/0!	P	P
		(D.) A417 (S)	75:J6	1823:115	286	276	0.61	-10	-3.57%	P	P
		(E.) B4063 Cheltenham Road (SW)	75:J6	107:J3	135	147	1.04	12	9.19%	P	P
		(F.) A40 (NW)	75:J6	86:87	41	87	5.72	46	111.46%	P	P
	(B) A40 (E)	(A) B4063 Cheltenham Road (N)	1949:92	88:75	66	0	11.49	-66	-100.00%	P	P
		(C.) Unnamed (SE)	1949:92	1727:77	1	0	1.41	-1	-100.00%	P	P
		(D) A417 (S)	1949:92	1823:115	469	0	30.63	-469	-100.00%	O	O
		(E.) B4063 Cheltenham Road (SW)	1949:92	107:J3	401	0	28.32	-401	-100.00%	O	O
		(F) A40 (NW)	91:1530	1530:1731	658	617	1.64	-41	-6.28%	P	P
	(C.) Unnamed (SE)	(B) A40 (E)	77:82	614:95	22	21	0.26	-1	-5.45%	P	P
		(D) A417 (S)	77:82	1823:115	59	56	0.37	-3	-4.75%	P	P
		(E.) B4063 Cheltenham Road (SW)	77:82	107:J3	15	14	0.73	-1	-4.67%	P	P
		(F) A40 (NW)	77:82	86:87	26	22	0.73	-4	-13.85%	P	P
	(D) A417 (S)	(A) B4063 Cheltenham Road (N)	108:83	88:75	193	232	2.70	39	20.36%	P	P
		(B) A40 (E)	108:83	614:95	691	570	4.81	-121	-17.47%	O	P
		(C.) Unnamed (SE)	108:83	1727:77	1	2	0.68	1	80.00%	P	P
		(E.) B4063 Cheltenham Road (SW)	108:83	107:J3	311	291	1.16	-20	-6.46%	P	P
		(F.) A40 (NW)	108:83	86:87	394	446	2.53	52	13.15%	P	P
	(E.) B4063 Cheltenham Road (SW)	(A) B4063 Cheltenham Road (N)	J3:1973	88:75	167	135	2.61	-32	-19.22%	P	P
		(B) A40 (E)	J3:1973	614:95	254	301	2.82	47	18.50%	P	P
		(D) A417 (S)	J3:1973	1823:115	164	166	0.17	2	1.34%	P	P
		(F) A40 (NW)	J3:1973	86:87	28	33	0.91	5	17.86%	P	P
	(F) A40 (NW)	(A) B4063 Cheltenham Road (N)	80:85	88:75	122	111	1.01	-11	-8.93%	P	P
		(B) A40 (E)	80:85	614:95	459	457	0.12	-3	-0.54%	P	P
		(C.) Unnamed (SE)	80:85	1727:77	1	1	0.45	0	-40.00%	P	P
		(D) A417 (S)	80:85	1823:115	404	357	2.40	-47	-11.58%	P	P
		(E.) B4063 Cheltenham Road (SW)	80:85	107:J3	8	11	1.03	3	40.00%	P	P
38	(A) Fiddlers Green Lane (N)	(B) Telstar Way (E)	390:389	2068:393	225	183	2.96	-42	-18.80%	P	P
		(C.) Fiddlers Green Lane (S)	390:389	2069:2041	97	80	1.84	-17	-17.84%	P	P
	(B) Telstar Way (E)	(A) Fiddlers Green Lane (N)	393:2068	389:390	169	124	3.69	-45	-26.45%	P	P
		(C.) Fiddlers Green Lane (S)	393:2068	2069:2041	7	6	0.47	-1	-17.14%	P	P
	(C.) Fiddlers Green Lane (S)	(A) Fiddlers Green Lane (N)	2041:2069	389:390	263	174	6.00	-89	-33.73%	P	P
103	(A) Innsworth Road (W)	(B) Frogfurlong Ln (N)	1789:1683	1855:1790	40	32	1.33	-8	-19.82%	P	P
		(C.) Innsworth Ln (E)	1789:1683	1788:1787	309	275	1.98	-34	-10.97%	P	P
	(B) Frogfurlong Ln (N)	(A) Innsworth Ln (W)	1790:1855	1683:1789	77	49	3.55	-28	-36.49%	P	P
	(C.) Innsworth Ln (E)	(A) Innsworth Ln (W)	1787:1788	1683:1789	370	261	6.18	-110	-29.65%	O	O
		(B) Frogfurlong Ln (N)	1787:1788	1855:1790	66	55	1.43	-11	-16.81%	P	P
104	(A) Innsworth Ln (W.)	(B) B4063 Cheltnham Rd (N)	991:145	145:993	100	89	1.21	-12	-11.76%	P	P
		(C.) Parton Rd (E.)	991:145	145:146	238	197	2.77	-41	-17.20%	P	P
		(B) B4063 Cheltnham Rd (S)	991:145	145:992	157	151	0.52	-6	-4.10%	P	P
	(B) B4063 Cheltnham Rd (N)	(A) Innsworth Ln (W.)	993:145	145:991	171	115	4.75	-57	-33.11%	P	P
		(C.) Parton Rd (E.)	993:145	145:146	207	145	4.63	-61	-29.72%	P	P
		(B) B4063 Cheltnham Rd (S)	993:145	145:992	422	306	6.07	-116	-27.47%	O	O
	(C.) Parton Rd (E.)	(B) B4063 Cheltnham Rd (N)	146:145	145:991	225	205	1.35	-20	-8.83%	P	P
		(B) B4063 Cheltnham Rd (S)	146:145	145:993	72	66	0.70	-6	-8.12%	P	P
		(B) B4063 Cheltnham Rd (S)	146:145	145:992	92	91	0.20	-2	-2.03%	P	P
	(B) B4063 Cheltnham Rd (S)	(A) Innsworth Ln (W.)	992:145	145:991	241	211	2.00	-30	-12.46%	P	P
		(B) B4063 Cheltnham Rd (N)	992:145	145:993	203	147	4.30	-57	-27.94%	P	P
		(C.) Parton Rd (E.)	992:145	145:146	111	97	1.38	-14	-12.71%	P	P
31	(A) A4013 Princess Elizabeth Way (NE)	(B) A4013 Princess Elizabeth Way (SW)	1694:1010	1010:1011	598	654	2.25	56	9.43%	P	P
		(C)Hesters Way Road (NW)	1694:1010	1010:2261	209	118	7.14	-91	-43.68%	P	P
	(B) A4013 Princess Elizabeth Way (SW)	(A) A4013 Princess Elizabeth Way (NE)	1011:1010	1010:1694	494	664	7.05	170	34.31%	O	O
		(C)Hesters Way Road (NW)	1011:1010	1010:2261	99	107	0.81	8	8.28%	P	P
	(C)Hesters Way Road (NW)	(A) A4013 Princess Elizabeth Way (NE)	2261:1010	1010:1694	135	68	6.70	-67	-49.93%	P	P
		(B) A4013 Princess Elizabeth Way (SW)	2261:1010	1010:1011	24	81	7.84	57	236.25%	P	P
30	(A) Hayden Road (N)	(B) B4063 (E)	1521:182	182:197	72	49	3.03	-24	-32.64%	P	P
		(C)B4063 (W)	1521:182	182:184	42	3	8.16	-39	-92.38%	P	P
	(B) B4063 (E)	(A) Hayden Road (N)	197:182	182:1521	98	85	1.33	-13	-12.96%	P	P
		(C)B4063 (W)	197:182	182:184	250	205	2.96	-45	-17.88%	P	P
	(C)B4063 (W)	(A) Hayden Road (N)	184:182	182:1521	9	2	3.16	-7	-81.11%	P	P
		(B) B4063 (E)	184:182	182:197	186	212	1.86	26	14.09%	P	P
35	(A) A4013 Princess Elizabeth Way (E)	(B) Grevil Road (S)	2057:1005	1005:1268	320	244	4.54	-76	-23.84%	P	P
		(C.)A4013 Princess Elizabeth Way (W)	2057:1005	1005:1705	717	635	3.17	-83	-11.51%	P	P
	(B) Grevil Road (S)	(A) A4013 Princess Elizabeth Way (E)	1268:1005	1005:2057	88	186	8.38	98	111.48%	P	P
		(C.)A4013 Princess Elizabeth Way (W)	1268:1005	1005:1705	139	94	4.17	-45	-32.37%	P	P
	(C)A4013 Princess Elizabeth Way (W)	(A) A4013 Princess Elizabeth Way (E)	1705:1005	1005:2057	560	670	4.42	110	19.57%	O	P
		(B) Grevil Road (S)	1705:1005	1005:1268	53	80	3.29	27	50.57%	P	P
25	(A) B4633 Gloucester Road (N)	(B) A40 Lansdown Road (E)	1472:1479	1479:1477	26	30	0.72	4	14.62%	P	P
		(D) A40 Gloucester Road (W)	1472:1479	1479:1682	276	312	2.12	36	13.15%	P	P
	(B) A40 Lansdown Road (E)	(A) B4633 Gloucester Road (N)	1546:1682	1682:1487	146	112	3.00	-34	-23.36%	P	P
		(D) A40 Gloucester Road (W)	1546:1682	1682:1478	595	583	0.51	-12	-2.08%	P	P
	(D) A40 Gloucester Road (W)	(A) B4633 Gloucester Road (N)	2061:1682	1682:1487	236	237	0.05	1	0.34%	P	P
		(B) A40 Lansdown Road (E)	2061:1682	1682:1477	629	623	0.24	-6	-0.94%	P	P
15b	(B)A40 Gloucester Road (E)	(C)Whittington Road (S)	1729:1730	1730:475	0	83	12.91	83	#DIV/0!	P	P
		(D)A40 Gloucester Road (W)	1729:512	512:453	1200	1290	2.56	90	7.53%	P	P
		(D)A40 Gloucester Road (W)	474:453	453:458	181	123	4.74	-58	-32.27%	P	P

Appendix A.11: Turn Count Calibration PM (Total)

ID	Direction	Direction	From Node	To Node	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
				5 to 6 PM - TOTAL							
4a	(A) M5 SB Offslip (N)	(B) A4019 Withy Bridge (E)	817:841	841:824	511	450.3	2.77	-61	-11.88%	P	P
	(D)A4019 Withy Bridge (W)	(B) A4019 Withy Bridge (E)	798:841	841:824	488	443.2	2.08	-45	-9.18%	P	P
4b	(B) A4019 Withy Bridge (E)	(D)A4019 Withy Bridge (W)	800:799	799:796	737	689.1	1.79	-48	-6.50%	P	P
		(C)M5 NB Onslip (S)	800:799	799:801	639	531.2	4.46	-108	-16.87%	O	P
7	(A) B634 Hayden Road (N)	(B) A4019 Tewkesbury Road (E)	857:1483	1483:1686	22	50.4	4.72	28	129.09%	P	P
		(C)B634 Hayden Road (S)	1483:943	943:919	180	196	1.17	16	8.89%	P	P
		(D) A4019 Tewkesbury Road (W)	1483:943	943:941	243	167.6	5.26	-75	-31.03%	P	P
	(B) B634 Hayden Road (E)	(A) B634 Hayden Road (N)	913:943	943:1483	4	12.2	2.88	8	205.00%	P	P
		(C)B634 Hayden Road (S)	912:913	913:919	169	182	0.98	13	7.69%	P	P
		(D) A4019 Tewkesbury Road (W)	913:943	943:941	798	737.7	2.18	-60	-7.56%	P	P
	(C)B634 Hayden Road (S)	(A) B634 Hayden Road (N)	919:943	943:1483	164	121.5	3.56	-43	-25.91%	P	P
		(B) A4019 Tewkesbury Road (E)	919:943	943:1686	199	265.3	4.35	66	33.32%	P	P
		(D) A4019 Tewkesbury Road (W)	945:919	919:941	179	129.6	3.98	-49	-27.60%	P	P
	(D) A4019 Tewkesbury Road (W)	(A) B634 Hayden Road (N)	930:914	914:1483	208	108.2	7.94	-100	-47.98%	P	P
		(B) A4019 Tewkesbury Road (E)	914:943	943:1686	574	592.3	0.76	18	3.19%	P	P
		(C)B634 Hayden Road (S)	914:943	943:919	106	99.1	0.68	-7	-6.51%	P	P
8A	(B) A4019 Tewkesbury Road (E)	(C)Hayden Road (S)	885:867	867:871	283	206.8	4.87	-76	-26.93%	P	P
		(D) A4019 Tewkesbury Road (W)	885:861	861:863	942	847.9	3.15	-94	-9.99%	P	P
	(C)Hayden Road (S)	(B) A4019 Tewkesbury Road (E)	871:861	861:885	334	230.2	6.18	-104	-31.08%	O	O
		(D) A4019 Tewkesbury Road (W)	871:861	861:863	39	68.5	4.02	30	75.64%	P	P
	(D) A4019 Tewkesbury Road (W)	(B) A4019 Tewkesbury Road (E)	922:861	861:885	793	809.2	0.57	16	2.04%	P	P
8B	(A) Manor Road (N)	(B) A4019 Tewkesbury Road (E)	877:885	885:876	294	271.8	1.32	-22	-7.55%	P	P
		(D) A4019 Tewkesbury Road (W)	877:885	885:861	387	64.2	21.49	-323	-83.41%	O	O
	(B) A4019 Tewkesbury Road (E)	(A) Manor Road (N)	911:885	885:881	241	295.3	3.32	54	22.53%	P	P
		(D) A4019 Tewkesbury Road (W)	911:885	885:861	838	783.6	1.91	-54	-6.49%	P	P
	(D) A4019 Tewkesbury Road (W)	(A) Manor Road (N)	861:885	885:881	243	251.9	0.57	9	3.66%	P	P
		(B) A4019 Tewkesbury Road (E)	861:885	885:876	884	787.5	3.34	-97	-10.92%	P	P
9	(A) Kingsditch Lane (N)	(B) A4019 Tewkesbury Road (E)	898:1613	1693:1653	117	129.6	1.13	13	10.77%	P	P
		(C)A4013 Princess Elizabeth Way (S)	898:1613	1620:893	572	538.7	1.41	-33	-5.82%	P	P
		(D) A4019 Tewkesbury Road (W)	898:1613	1602:1517	236	172.9	4.41	-63	-26.74%	P	P
	(B) A4019 Tewkesbury Road (E)	(A) Kingsditch Lane (N)	1593:1635	1499:898	179	178.3	0.05	-1	-0.39%	P	P
		(C)A4013 Princess Elizabeth Way (S)	1593:1635	1620:893	287	311.3	1.40	24	8.47%	P	P
		(D)A4019 Tewkesbury Road (W)	1593:1635	1602:1517	820	655.5	6.06	-165	-20.06%	O	O
	(C)A4013 Princess Elizabeth Way (S)	(A) Kingsditch Lane (N)	893:1692	1499:898	633	606.4	1.07	-27	-4.20%	P	P
		(A) A4019 Tewkesbury Road (N)	893:1692	1693:1653	189	178.3	0.79	-11	-5.66%	P	P
		(D)A4019 Tewkesbury Road (W)	893:1692	1602:1517	239	306.3	4.08	67	28.16%	P	P
	(D)A4019 Tewkesbury Road (W)	(A) Kingsditch Lane (N)	1650:1691	1499:898	256	224.9	2.01	-31	-12.15%	P	P
		(B) A4019 Tewkesbury Road (E)	1650:1691	1693:1653	740	589.5	5.84	-151	-20.34%	O	O
		(C)A4013 Princess Elizabeth Way (S)	1650:1691	1620:893	183	253.4	4.77	70	38.47%	P	P
10	(A) Old Gloucester Road (E)	(B) Pilgrove Way (S)	958:957	957:960	128	96.3	2.99	-32	-24.77%	P	P
		(C)Old Gloucester Road (W)	958:957	957:961	367	233.9	7.68	-133	-36.27%	O	O
	(B) Pilgrove Way (S)	(A) Old Gloucester Road (E)	960:957	957:958	60	54.4	0.74	-6	-9.33%	P	P
		(C)Old Gloucester Road (W)	960:957	957:961	19	40.4	3.93	21	112.63%	P	P
	(C)Old Gloucester Road (W)	(A) Old Gloucester Road (E)	961:957	957:958	359	259.9	5.63	-99	-27.60%	P	P
		(B) Pilgrove Way (S)	961:957	957:960	43	57.1	1.99	14	32.79%	P	P
11	(A) A4013 Princess Elizabeth Way (E)	(B) Orchard Way (S)	1002:1003	1003:1009	72	76.9	0.57	5	6.81%	P	P
		(C)A4013 Princess Elizabeth Way (S)	1002:1003	1003:2259	807	747.3	2.14	-60	-7.40%	P	P
	(B) Orchard Way (S)	(A) A4013 Princess Elizabeth Way (E)	1009:1003	1003:1002	70	84.9	1.69	15	21.29%	P	P
		(C)A4013 Princess Elizabeth Way (S)	1009:1003	1003:2259	135	149.4	1.21	14	10.67%	P	P
	(C)A4013 Princess Elizabeth Way (S)	(A) A4013 Princess Elizabeth Way (E)	2259:1003	1003:1002	690	734.9	1.68	45	6.51%	P	P
		(B) Orchard Way (S)	2259:1003	1003:1009	95	89.1	0.61	-6	-6.21%	P	P
12	(A) A4013 Princess Elizabeth Way (N)	(A) A4013 Princess Elizabeth Way (N)	1019:1020	1020:1019	0	0.1	0.45	0	#DIV/0!	P	P
		(B) Edinburgh Place (E)	1019:1020	1022:1026	103	118.2	1.45	15	14.76%	P	P
		(C)A4013 Princess Elizabeth Way (S)	1019:1020	1025:1668	531	675.1	5.87	144	27.14%	O	O
		(D) Marsland Road (W)	1019:1020	1023:1024	43	72.2	3.85	29	67.91%	P	P
	(B) Edinburgh Place (E)	(A) A4013 Princess Elizabeth Way (N)	1026:1022	1020:1019	125	119.3	0.52	-6	-4.56%	P	P
		(C)A4013 Princess Elizabeth Way (S)	1026:1022	1025:1668	21	59.4	6.06	38	182.86%	P	P
		(D) Marsland Road (W)	1026:1022	1023:1024	168	130.2	3.10	-38	-22.50%	P	P
	(C)A4013 Princess Elizabeth Way (S)	(A) A4013 Princess Elizabeth Way (N)	1668:1025	1020:1019	613	710.2	3.78	97	15.86%	P	P
		(B) Edinburgh Place (E)	1668:1025	1022:1026	56	38.8	2.50	-17	-30.71%	P	P
		(D) Marsland Road (W)	1668:1025	1023:1024	52	47.9	0.58	-4	-7.88%	P	P
	(D) Marsland Road (W)	(A) A4013 Princess Elizabeth Way (N)	1024:1023	1020:1019	80	84	0.44	4	5.00%	P	P
		(B) Edinburgh Place (E)	1024:1023	1022:1026	122	104.9	1.61	-17	-14.02%	P	P
		(C)A4013 Princess Elizabeth Way (S)	1024:1023	1025:1668	31	39.7	1.46	9	28.06%	P	P
13	(A) A4013 Princess Elizabeth Way (N)	(B) A4013 Princess Elizabeth Way (S)	1542:1679	1679:538	589	792.1	7.73	203	34.48%	O	O
		(C)Hubble Road (W)	1542:1679	1679:1035	39	42.1	0.49	3	7.95%	P	P
	(B) A4013 Princess Elizabeth Way (S)	(A) A4013 Princess Elizabeth Way (N)	1678:1679	1679:1036	566	675.7	4.40	110	19.38%	O	P
		(C)Hubble Road (W)	1678:1679	1679:1035	24	33	1.69	9	37.50%	P	P
	(C)Hubble Road (W)	(A) A4013 Princess Elizabeth Way (N)	1045:1035	1035:1036	225	223.3	0.11	-2	-0.76%	P	P
		(B) A4013 Princess Elizabeth Way (S)	1035:1679	1679:538	296	266.8	1.74	-29	-9.86%	P	P
14	(A) A4013 Princess Elizabeth Way (N)	(B) A40 Gloucester Road (E)	538:552	544:543	179	206	1.95	27	15.08%	P	P
		(C.) A40 Gloucester Road (W)	538:552	549:548	686	851.4	5.97	165	24.11%	O	O
	(B) A40 Gloucester Road (E)	(A) A4013 Princess Elizabeth Way (N)	547:545	551:550	100	135.3	3.25	35	35.30%	P	P
		(C.) A40 Gloucester Road (W)	547:545	549:548	788	795	0.25	7	0.89%	P	P
	(C.) A40 Gloucester Road (W)	(A) A4013 Princess Elizabeth Way (N)	539:542	551:550	464	571.6	4.73	108	23.19%	O	O
		(B) A40 Gloucester Road (E)	539:542	544:543	781	815.6	1.22	35	4.43%	P	P
15	(A) Telstar Way (N)	(B) A40 Gloucester Road (E)	441:512	512:446	44	57.4	1.88	13	30.45%	P	P
		(C)A40 Gloucester Road (W)	441:512	512:453	503	477.8	1.14	-25	-5.01%	P	P
	(B) A40 Gloucester Road (E)	(A) Telstar Way (N)	1729:512	512:443	39	80.8	5.40	42	107.18%	P	P
		(C)A40 Gloucester Road (W)	1729:512	512:453	1303	1499.3	5.24	196	15.07%	O	O
	(C)A40 Gloucester Road (W)	(A) Telstar Way (N)	445:512	512:443	258	201.2	3.75	-57	-22.02%	P	P
		(B) A40 Gloucester Road (E)	445:512	512:446	1186	1390.9	5.71	205	17.28%	O	O
16	(A) B4063 (E)	(B) Bamfurlong Lane (S)	1908:206	206:215	88	102.9	1.53	15	16.93%	P	P
		(C)B4063 (W)	1908:206	206:1908	280	279.7	0.02	0	-0.11%	P	P
	(B) Bamfurlong Lane (S)	(A) B4063 (E)	215:206	206:1908	85	183.5	8.50	99	115.88%	P	P
		(C)B4063 (W)	215:206	206:207	36	55.4	2.87	19	53.89%	P	P
	(C)B4063 (W)	(A) B4063 (E)	207:206	206:1908	231	240.2	0.60	9	3.98%	P	P
		(B) Bamfurlong Lane (S)	207:206	206:215	56	54.3	0.23	-2	-3.04%	P	P
17	(A) Fiddler's Green Lane (N)	(B) A40 Gloucester Road (E)	368:439	1700:437	13	18	1.27	5	38.46%	P	P
		(C)Hatherley Lana (S)	368:439	455:570	47	36.1	1.69	-11	-23.19%	P	P
		(D) A40 Gloucester Road (W)	368:439	562:211	137	99.9	3.41	-37	-27.08%	P	P
		(E)B4063 (W)	368:439	354:209	3	8.7	2.36	6	190.00%	P	P
	(B) A40 Gloucester Road (E)	(A) Fiddler's Green Lane (N)	456:1710	563:368	68	71	0.36	3	4.41%	P	P
		(C)Hatherley Lana (S)	456:1710	455:570	386	353.1	1.71	-33	-8.52%	P	P
		(D) A40 Gloucester Road (W)	456:1710	562:211	1408	1521.1	2.96	113	8.03%	P	P
		(E)B4063 (W)	456:1710	354:209	105	168.1	5.40	63	60.10%	P	P
	(C)Hatherley Lana (S)	(A) Fiddler's Green Lane (N)	570:351	563:368	102	73.2	3.08	-29	-28.24%	P	P
		(B) A40 Gloucester Road (E)	570:351	1700:437	120	152.2	2.76	32	26.83%	P	P
		(D) A40 Gloucester Road (W)	570:351	562:211	742	641	3.84	-101	-13.61%	P	P
		(E)B4063 (W)	570:351	354:209	121	116.2	0.44	-5	-3.97%	P	P
	(D) A40 Gloucester Road (W)	(A) Fiddler's Green Lane (N)	357:1708	563:368	108	92.5	1.55	-16	-14.35%	P	P
		(B) A40 Gloucester Road (E)	357:1708	1700:437	1267	1275.7	0.24	9	0.69%	P	P
		(C)Hatherley Lana (S)	357:1708	455:570	578	480.2	4.25	-98	-16.92%	P	P
		(E)B4063 (W)	357:1708	354:209	142	88.1	5.03	-54	-37.96%	P	P
	(E)B4063 (W)	(A) Fiddler's Green Lane (N)	209:564	563:368	44	63.7	2.68	20	44.77%	P	P
		(B) A40 Gloucester Road (E)	209:564	1700:437	87	174.7	7.67	88	100.80%	P	P
		(C)Hatherley Lana (S)	209:564	455:570	11	41.3	5.93	30	275.45%	P	P
		(D) A40 Gloucester Road (W)	209:564	562:211	160	141.6	1.50	-18	-11.50%	P	P
18	(A) Car Park (N)	(B) Hatherley Lane (NE)	1912:573	1922:571	141	100	3.73	-41	-29.08%	P	P
		(C)Hatherley Lane (SE)	1912:573	1923:1847	19	17.5	0.35	-2	-7.89%	P	P
	(B) Hatherley Lane (NE)	(A) Car Park (N)	571:1916	1921:1912	4	0	2.83	-4	-100.00%	P	P
		(C)Hatherley Lane (SE)	571:1916	1923:1847	573	588.4	0.64	15	2.69%	P	P
		(D) Unnamed Road (S)	571:1916	1924:1909	58	7.7	8.78	-50	-86.72%	P	P
		(E)Grovefield Way (W)	571:1916	1920:1925	282	311.7	1.72	30	10.53%	P	P
	(C)Hatherley Lane (SE)	(A) Car Park (N)	1847:1917	1921:1912	0	0	#DIV/0!	0	#DIV/0!	P	#DIV/0!
		(B) Hatherley Lane (NE)	1847:1917	1922:571	525	579	2.30	54	10.29%	P	P
		(D) Unnamed Road (S)	1847:1917	1924:1909	44	18.9	4.48	-25	-57.05%	P	P
		(E)Grovefield Way (W)	1847:1917	1920:1925	143	108.4	3.09	-35	-24.20%	P	P
	(D) Unnamed Road (S)	(B) Hatherley Lane (NE)	1909:1918	1922:571	45	30.5	2.36	-15	-32.22%	P	P
		(C)Hatherley Lane (SE)	1909:1918	1923:1847	44	31.3	2.07	-13	-28.86%	P	P
		(E)Grovefield Way (W)	1909:1918	1920:1925	50	29.7	3.22	-20	-40.60%	P	P
	(E)Grovefield Way (W)	(A) Car Park (N)	1925:1919	1921:1912	0	1.2	1.55	1	#DIV/0!	P	P
		(B) Hatherley Lane (NE)	1925:1919	1922:571	289	274.4	0.87	-15	-5.05%	P	P
		(C)Hatherley Lane (SE)	1925:1919	1923:1847	63	46.5	2.23	-17	-26.19%	P	P
		(D) Unnamed Road (S)	1925:1919	1924:1909	22	2.7	5.49	-19	-87.73%	P	P

JACOBS®

Node	From	To	ID1	ID2	Obs	Mod	GEH	Diff	%	F1	F2
20	(A) M5 (N)	(B) A40 (E)	1813:266	267:1816	273	232.2	2.57	-41	-14.95%	P	P
		(D)A40 (W)	1813:266	263:1819	459	418	1.96	-41	-8.93%	P	P
	(B) A40 (E)	(A) M5 (N)	1809:268	265:1821	297	263.8	1.98	-33	-11.18%	P	P
		(C)M5 (S)	1809:268	269:1817	926	823.9	3.45	-102	-11.03%	P	P
	(C)M5 (S)	(A) M5 (N)	1481:264	263:1819	54	53.7	0.04	0	-0.56%	P	P
		(B) A40 (E)	1481:264	267:1816	743	669.7	2.76	-73	-9.87%	P	P
	(D)A40 (W)	(A) M5 (N)	1484:262	265:1821	445	435.3	0.46	-10	-2.18%	P	P
		(C)M5 (S)	1484:262	269:1817	108	114.5	0.62	7	6.02%	P	P
		(D)A40 (W)	1484:262	265:1821	445	435.3	0.46	-10	-2.18%	P	P
21	(A) B4634 Old Gloucester Road (N)	(B) B4063 Cheltenham Lane (E)	170:161	161:1904	39	46.9	1.21	8	20.26%	P	P
		(C)Bamfurlong Lane (S)	170:161	161:167	129	65	6.50	-64	-49.61%	P	P
		(D) B4063 Cheltenham Road (W)	170:161	161:1712	293	310.5	1.01	18	5.97%	P	P
	(B) B4063 Cheltenham Road (E)	(A) B4634 Old Gloucester Road (N)	1904:161	161:170	106	89.1	1.71	-17	-15.94%	P	P
		(C)Bamfurlong Lane (S)	1904:161	161:167	7	6.7	0.11	0	-4.29%	P	P
		(D) B4063 Cheltenham Road (W)	1904:161	161:1712	174	146.9	2.14	-27	-15.57%	P	P
	(C)Bamfurlong Lane (S)	(A) B4634 Old Gloucester Road (N)	167:161	161:170	162	181.6	1.50	20	12.10%	P	P
		(B) B4063 Cheltenham Road (E)	167:161	161:1904	10	49.6	7.25	40	396.00%	P	P
		(D) B4063 Cheltenham Road (W)	167:161	161:1712	90	118.3	2.77	28	31.44%	P	P
	(D) B4063 Cheltenham Road (W)	(A) B4634 Old Gloucester Road (N)	1712:161	161:170	251	263.1	0.75	12	4.82%	P	P
		(B) B4063 Cheltenham Road (E)	1712:161	161:1904	121	147.1	2.25	26	21.57%	P	P
		(C)Bamfurlong Lane (S)	1712:161	161:167	64	46.3	2.38	-18	-27.66%	P	P
22	(A) B4634 Old Gloucester Road (N)	(B) B4634 Old Gloucester Road (S)	989:177	177:990	400	383.2	0.85	-17	-4.20%	P	P
		(C)Unnamed Road (W)	989:177	177:178	14	11.9	0.58	-2	-15.00%	P	P
	(B) B4634 Old Gloucester Road (S)	(A) B4634 Old Gloucester Road (N)	990:177	177:989	448	462	0.66	14	3.13%	P	P
		(C)Unnamed Road (W)	990:177	177:178	80	67.5	1.46	-13	-15.63%	P	P
	(C)Unnamed Road (W)	(A) B4634 Old Gloucester Road (N)	178:177	177:989	46	17.8	4.99	-28	-61.30%	P	P
		(B) B4634 Old Gloucester Road (S)	178:177	177:990	70	32.1	5.30	-38	-54.14%	P	P
23	(A) B4063 Cheltenham Road East (E)	(B) Pirton Lane (S)	1999:142	142:2000	133	129.5	0.31	-4	-2.63%	P	P
		(C)B4063 Cheltenham Road East (W)	1999:142	142:1980	533	472.9	2.68	-60	-11.28%	P	P
	(B) Pirton Lane (S)	(A) B4063 Cheltenham Road East (E)	2000:142	142:1999	97	130.4	3.13	33	34.43%	P	P
		(C)B4063 Cheltenham Road East (W)	2000:142	142:1980	141	172.3	2.50	31	22.20%	P	P
	(C)B4063 Cheltenham Road East (W)	(A) B4063 Cheltenham Road East (E)	1980:142	142:1999	402	377.1	1.26	-25	-6.19%	P	P
		(B) Pirton Lane (S)	1980:142	142:2000	221	205.7	1.05	-15	-6.92%	P	P
24	(A) B4063 (N)	(B) B4063 (S)	1720:156	156:1717	571	511.6	2.55	-59	-10.40%	P	P
		(C)Down Hatherley Lane (W)	1720:156	156:1722	199	117.3	6.50	-82	-41.06%	P	P
	(B) B4063 (S)	(A) B4063 (N)	1717:156	156:1720	243	337.1	5.53	94	38.72%	P	P
		(C)Down Hatherley Lane (W)	1717:156	156:1722	13	17.4	1.13	4	33.85%	P	P
	(C)Down Hatherley Lane (W)	(A) B4063 (N)	1722:156	156:1720	77	93.2	1.76	16	21.04%	P	P
		(B) B4063 (S)	1722:156	156:1717	47	88.3	5.02	41	87.87%	P	P
33	(A) A38 Tewkesbury Road (N)	(B) A40 (E)	659:656	664:665	87	64.4	2.60	-23	-25.98%	P	P
		(C.) A38 Tewkesbury Road (S)	659:656	666:658	445	412.7	1.56	-32	-7.26%	P	P
		(D.) A40 (W)	659:656	668:660	378	286.1	5.04	-92	-24.31%	P	P
	(B) A40 (E)	(A) A38 Tewkesbury Road (N)	657:661	669:659	91	108.6	1.76	18	19.34%	P	P
		(C.) A38 Tewkesbury Road (S)	657:661	666:658	503	475.7	1.23	-27	-5.43%	P	P
		(D.) A40 (W)	657:661	668:660	734	799.9	2.38	66	8.98%	P	P
	(C.) A38 Tewkesbury Road (S)	(A) A38 Tewkesbury Road (N)	658:662	669:659	298	272.4	1.52	-26	-8.59%	P	P
		(B) A40 (E)	658:662	664:665	269	224.2	2.85	-45	-16.65%	P	P
		(D.) A40 (W)	658:662	668:660	103	61.7	4.55	-41	-40.10%	P	P
	(D.) A40 (W)	(A) A38 Tewkesbury Road (N)	660:663	669:659	423	381.7	2.06	-41	-9.76%	P	P
		(B) A40 (E)	660:663	664:665	781	790.3	0.33	9	1.19%	P	P
		(C.) A38 Tewkesbury Road (S)	660:663	666:658	84	106.2	2.28	22	26.43%	P	P
34	(A) B4063 Cheltenham Road (N)	(B) A40 (E)	75:J6	614:95	78	83.6	0.62	6	7.18%	P	P
		(C.) Unnamed (SE)	75:J6	1727:77	0	2.4	2.19	2	#DIV/0!	P	P
		(D.) A417 (S)	75:J6	1823:115	308	305.1	0.17	-3	-0.94%	P	P
		(E.) B4063 Cheltenham Road (SW)	75:J6	107:J3	150	159.7	0.78	10	6.47%	P	P
		(F.) A40 (NW)	75:J6	86:87	46	101.2	6.43	55	120.00%	P	P
	(B) A40 (E)	(A) B4063 Cheltenham Road (N)	1949:92	88:75	75	0	12.25	-75	-100.00%	P	P
		(C.) Unnamed (SE)	1949:92	1727:77	1	0	1.41	-1	-100.00%	P	P
		(D) A417 (S)	1949:92	1823:115	534	0	32.68	-534	-100.00%	O	O
		(E.) B4063 Cheltenham Road (SW)	1949:92	107:J3	431	0	29.36	-431	-100.00%	O	O
		(F.) A40 (NW)	91:1530	1530:1731	705	686.4	0.71	-19	-2.64%	P	P
	(C.) Unnamed (SE)	(B) A40 (E)	77:82	614:95	22	25.3	0.68	3	15.00%	P	P
		(D) A417 (S)	77:82	1823:115	59	58.1	0.12	-1	-1.53%	P	P
		(E.) B4063 Cheltenham Road (SW)	77:82	107:J3	15	15.7	0.18	1	4.67%	P	P
		(F.) A40 (NW)	77:82	86:87	27	24.6	0.47	-2	-8.89%	P	P
	(D) A417 (S)	(A) B4063 Cheltenham Road (N)	108:83	88:75	219	260.3	2.67	41	18.86%	P	P
		(B) A40 (E)	108:83	614:95	730	632.1	3.75	-98	-13.41%	P	P
		(C.) Unnamed (SE)	108:83	1727:77	1	2.2	0.95	1	120.00%	P	P
		(E.) B4063 Cheltenham Road (SW)	108:83	107:J3	363	335.3	1.48	-28	-7.63%	P	P
		(F.) A40 (NW)	108:83	86:87	502	535.1	1.45	33	6.59%	P	P
	(E.) B4063 Cheltenham Road (SW)	(A) B4063 Cheltenham Road (N)	J3:1973	88:75	176	146.3	2.34	-30	-16.88%	P	P
		(B) A40 (E)	J3:1973	614:95	276	331	3.16	55	19.93%	P	P
		(D) A417 (S)	J3:1973	1823:115	176	182.2	0.46	6	3.52%	P	P
		(F) A40 (NW)	J3:1973	86:87	31	35	0.70	4	12.90%	P	P
	(F) A40 (NW)	(A) B4063 Cheltenham Road (N)	80:85	88:75	137	125.1	1.04	-12	-8.69%	P	P
		(B) A40 (E)	80:85	614:95	525	518.1	0.30	-7	-1.31%	P	P
		(C.) Unnamed (SE)	80:85	1727:77	1	0.7	0.33	0	-30.00%	P	P
		(D) A417 (S)	80:85	1823:115	463	421.9	1.95	-41	-8.88%	P	P
		(E.) B4063 Cheltenham Road (SW)	80:85	107:J3	8	13.2	1.60	5	65.00%	P	P
38	(A) Fiddlers Green Lane (N)	(B) Telstar Way (E)	390:389	2068:393	238	209.9	1.88	-28	-11.81%	P	P
		(C.) Fiddlers Green Lane (S)	390:389	2069:2041	112	93.8	1.79	-18	-16.25%	P	P
	(B) Telstar Way (E)	(A) Fiddlers Green Lane (N)	393:2068	389:390	178	132.5	3.65	-46	-25.56%	P	P
		(C.) Fiddlers Green Lane (S)	393:2068	2069:2041	8	6.2	0.68	-2	-22.50%	P	P
	(C.) Fiddlers Green Lane (S)	(A) Fiddlers Green Lane (N)	2041:2069	389:390	299	207.7	5.74	-91	-30.54%	P	P
103	(A) Innsworth Ln (W)	(B) Frogfurlong Ln (N)	1789:1683	1855:1790	42.98588368	35.6	1.18	-7	-17.18%	P	P
		(C.) Innsworth Ln (E)	1789:1683	1788:1787	329.8339921	309.3	1.15	-21	-6.23%	P	P
	(B) Frogfurlong Ln (N)	(A) Innsworth Ln (W)	1790:1855	1683:1789	82.66516093	54.8	3.36	-28	-33.71%	P	P
	(C.) Innsworth Ln (E)	(A) Innsworth Ln (W)	1787:1788	1683:1789	393.4171434	285.7	5.85	-108	-27.38%	O	O
		(B) Frogfurlong Ln (N)	1787:1788	1855:1790	69.9868392	59.3	1.33	-11	-15.27%	P	P
104	(A) Innsworth Ln (W.)	(B) B4063 Cheltnham Rd (N)	991:145	145:993	105.8996227	99.9	0.59	-6	-5.67%	P	P
		(C.) Parton Rd (E.)	991:145	145:146	250.8367533	217.9	2.15	-33	-13.13%	P	P
		(B) B4063 Cheltnham Rd (S)	991:145	145:992	165.7017625	164.8	0.07	-1	-0.54%	P	P
	(B) B4063 Cheltnham Rd (N)	(A) Innsworth Ln (W.)	993:145	145:991	181.0675901	128.9	4.14	-52	-28.81%	P	P
		(C.) Parton Rd (E.)	993:145	145:146	218.4439275	160.9	4.18	-58	-26.34%	P	P
		(B) B4063 Cheltnham Rd (S)	993:145	145:992	445.1937078	338.8	5.37	-106	-23.90%	O	O
	(C.) Parton Rd (E.)	(B) B4063 Cheltnham Rd (N)	146:145	145:991	240.3963796	227.1	0.87	-13	-5.53%	P	P
		(B) B4063 Cheltnham Rd (N)	146:145	145:993	76.41465673	73.1	0.38	-3	-4.34%	P	P
		(B) B4063 Cheltnham Rd (S)	146:145	145:992	98.71947545	101.8	0.31	3	3.12%	P	P
	(B) B4063 Cheltnham Rd (S)	(A) Innsworth Ln (W.)	992:145	145:991	257.3315197	233.7	1.51	-24	-9.18%	P	P
		(B) B4063 Cheltnham Rd (N)	992:145	145:993	217.2654564	165.6	3.73	-52	-23.78%	P	P
		(C.) Parton Rd (E.)	992:145	145:146	118.1329288	107.5	1.00	-11	-9.00%	P	P
31	(A) A4013 Princess Elizabeth Way (NE)	(B) A4013 Princess Elizabeth Way (SW)	1694:1010	1010:1011	667	763.2	3.60	96	14.42%	P	P
		(C)Hesters Way Road (NW)	1694:1010	1010:2261	233	134.4	7.24	-99	-42.32%	P	P
	(B) A4013 Princess Elizabeth Way (SW)	(A) A4013 Princess Elizabeth Way (NE)	1011:1010	1010:1694	541	750.3	8.24	209	38.69%	O	O
		(C)Hesters Way Road (NW)	1011:1010	1010:2261	112	119.7	0.72	8	6.88%	P	P
	(C)Hesters Way Road (NW)	(A) A4013 Princess Elizabeth Way (NE)	2261:1010	1010:1694	151	73.2	7.35	-78	-51.52%	P	P
		(B) A4013 Princess Elizabeth Way (SW)	2261:1010	1010:1011	28	92.1	8.27	64	228.93%	P	P
30	(A) Hayden Road (N)	(B) B4063 (E)	1521:182	182:197	89	56.6	3.80	-32	-36.40%	P	P
		(C)B4063 (W)	1521:182	182:184	48	3.6	8.74	-44	-92.50%	P	P
	(B) B4063 (E)	(A) Hayden Road (N)	197:182	182:1521	110	98.6	1.12	-11	-10.36%	P	P
		(C)B4063 (W)	197:182	182:184	290	239.4	3.11	-51	-17.45%	P	P
	(C)B4063 (W)	(A) Hayden Road (N)	184:182	182:1521	10	1.9	3.32	-8	-81.00%	P	P
		(B) B4063 (E)	184:182	182:197	213	239.1	1.74	26	12.25%	P	P
35	(A) A4013 Princess Elizabeth Way (E)	(B) Grevil Road (S)	2057:1005	1005:1268	348	275.7	4.09	-72	-20.78%	P	P
		(C)A4013 Princess Elizabeth Way (W)	2057:1005	1005:1705	790	733.9	2.03	-56	-7.10%	P	P
	(B) Grevil Road (S)	(A) A4013 Princess Elizabeth Way (E)	1268:1005	1005:2057	107	220.2	8.85	113	105.79%	O	O
		(C)A4013 Princess Elizabeth Way (W)	1268:1005	1005:1705	153	109.1	3.83	-44	-28.69%	P	P
	(C)A4013 Princess Elizabeth Way (W)	(A) A4013 Princess Elizabeth Way (E)	1705:1005	1005:2057	610	749.1	5.34	139	22.80%	O	O
		(B) Grevil Road (S)	1705:1005	1005:1268	59	90.4	3.63	31	53.22%	P	P
25	(A) B4633 Gloucester Road (N)	(B) A40 Lansdown Road (E)	1472:1479	1479:1477	29	32	0.53	3	10.34%	P	P
		(D) A40 Gloucester Road (W)	1472:1479	1479:1682	293	347.6	3.05	55	18.63%	P	P
	(B) A40 Lansdown Road (E)	(A) B4633 Gloucester Road (N)	1546:1682	1682:1487	162	122.1	3.33	-40	-24.63%	P	P
		(D) A40 Gloucester Road (W)	1546:1682	1682:1478	634	653.8	0.78	20	3.12%	P	P
	(D) A40 Gloucester Road (W)	(A) B4633 Gloucester Road (N)	2061:1682	1682:1487	256	266.9	0.67	11	4.26%	P	P
		(B) A40 Lansdown Road (E)	2061:1682	1682:1477	673	659.1	0.54	-14	-2.07%	P	P
15b	(B)A40 Gloucester Road (E)	(C)Whittington Road (S)	1729:1730	1730:475	0	102.5	14.32	103	#DIV/0!	#DIV/0!	#DIV/0!
		(D)A40 Gloucester Road (W)	1729:512	512:453	1303	1499.3	5.24	196	15.07%	O	O
		(D)A40 Gloucester Road (W)	474:453	453:458	190	135.7	4.26	-54	-28.58%	P	P

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Appendix A.12: Outer Cordon Calibration PM (Car)

SI	**ANPR**	**Description**	**Direction**	**Link ID**	**Observed**	**Modelled**	**GEH**	**Mod-Obs**	**% Diff**	**Flow Criteria**	**DMRB Pass**

In

SI	ANPR	Description	Direction	Link ID	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
1	ANPR 3	Gallagher Retail Park, between A4019 and Manor Road	SB (EB)	857:1483	388	386	0.07	-1	-0.37%	P	P
2	ANPR 4	Manor Road, between A4019 and Rutherford Way	SB (WB)	877:885	453	510	2.62	57	12.67%	P	P
3	ANPR 5	Kingsditch Lane, between A4019 and Upper Field Road	SB	891:898	808	748	2.18	-61	-7.52%	P	P
4	ANPR 6	A4019, at railway line	NB (WB)	1486:1680	1049	979	2.22	-71	-6.73%	P	P
5	ANPR 7	Arle Road, at railway line	NB	1968:1351	264	262	0.14	-2	-0.84%	P	P
6	ANPR 8	B4633, at railway line	SB (WB)	1496:1383	496	430	3.05	-66	-13.25%	P	P
7	ANPR 9	A40, at railway line	WB	1482:1546	763	696	2.49	-67	-8.80%	P	P
8	ANPR 10	Hatherly Lane, at railway line	NB (WB)	2045:2028	579	523	2.39	-56	-9.69%	P	P
9	ANPR 11	Grovefield Way, at railway line	NB	1681:1926	304	280	1.42	-24	-7.98%	P	P
10	ANPR 12	Badgeworth Road, at railway line	NB	1948:239	187	186	0.04	-1	-0.29%	P	P
11	ANPR 13	M5, at railway line, between Junction 11 and 11A	NB	581:326	2727	2680	0.91	-47	-1.73%	P	P
12	ANPR 14	Pirton Lane, at railway line	NB	1748:1936	223	213	0.69	-10	-4.56%	P	P
13	ANPR 18	A4019, North of A38 / A4019 junction	SB	770:769	518	554	1.56	36	6.99%	P	P
14	ANPR 19	Unnamed Road, between A4019 and Cursey Lane	SB	1656:1655	167	184	1.27	17	10.06%	P	P
15	ANPR 20	M5, between Junction 9 and Junction 10	SB	822:611	3219	2889	5.97	-330	-10.25%	P	P
16	ANPR 21	The Green, between A4019 and Lowdilow Lane	SB	850:848	13	13	0.11	0	3.02%	P	P
18	ANPR 29	Alstone Lane, at railway line	SB (EB)	1359:1358	215	191	1.69	-24	-11.19%	P	P
19	ANPR 36	A40, between A417 and A38	NB (EB)	1995:1994	1127	1112	0.45	-15	-1.35%	P	P
20	ANPR 37	A38, between A40 and A417	NB	1991:1990	615	509	4.49	-106	-17.29%	O	P
21	ANPR 38	A40, between A38 and B4063	NB	1839:1840	371	352	0.99	-19	-5.08%	P	P
22	ANPR 39	Innsworth Lane, between Brionne Way and Rookery Road	NB	1803:1802	259	262	0.18	3	1.11%	P	P
23	ANPR 40	B4063, between A40 and Nine Elms Road	NB (EB)	2066:1974	612	635	0.93	23	3.81%	P	P
24	ANPR 41	A417, at railway line	NB	1978:1976	1614	1541	1.83	-73	-4.52%	P	P
25	ANPR 42	Station Road at Rail Bridge	NB	1651:1649	326	306	1.16	-21	-6.33%	P	P
		Total			**17297**	**16440**		**-857**	**-4.95%**		**P**

Out

SI	ANPR	Description	Direction	Link ID	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
1	ANPR 3	Gallagher Retail Park, between A4019 and Manor Road	NB (WB)	1483:857	329	219	6.63	-110	-33.37%	O	O
2	ANPR 4	Manor Road, between A4019 and Rutherford Way	NB (EB)	885:881	647	451	8.36	-196	-30.29%	O	O
3	ANPR 5	Kingsditch Lane, between A4019 and Upper Field Road	NB	898:891	854	912	1.96	58	6.82%	P	P
4	ANPR 6	A4019, at railway line	SB (EB)	1256:1259	850	804	1.61	-46	-5.45%	P	P
5	ANPR 7	Arle Road, at railway line	SB	1351:1968	232	242	0.68	11	4.54%	P	P
6	ANPR 8	B4633, at railway line	NB (EB)	1383:1496	442	432	0.49	-10	-2.29%	P	P
7	ANPR 9	A40, at railway line	EB	1546:1482	682	654	1.06	-27	-4.01%	P	P
8	ANPR 10	Hatherly Lane, at railway line	SB (EB)	2028:2045	590	567	0.97	-23	-3.94%	P	P
9	ANPR 11	Grovefield Way, at railway line	SB	1681:1681	464	411	2.52	-53	-11.37%	P	P
10	ANPR 12	Badgeworth Road, at railway line	SB	239:1948	415	310	5.51	-105	-25.31%	O	O
11	ANPR 13	M5, at railway line, between Junction 11 and 11A	SB	327:580	2865	2788	1.45	-77	-2.69%	P	P
12	ANPR 14	Pirton Lane, at railway line	SB	1936:1748	209	239	2.02	30	14.44%	P	P
13	ANPR 18	A4019, North of A38 / A4019 junction	NB	769:770	610	600	0.41	-10	-1.66%	P	P
14	ANPR 19	Unnamed Road, between A4019 and Cursey Lane	NB	1655:1656	256	219	2.44	-38	-14.69%	P	P
15	ANPR 20	M5, between Junction 9 and Junction 10	NB	815:823	2963	3158	3.52	195	6.57%	P	P
16	ANPR 21	The Green, between A4019 and Lowdilow Lane	NB	848:850	11	15	1.30	5	43.95%	P	P
18	ANPR 29	Alstone Lane, at railway line	NB (WB)	1358:1359	161	184	1.69	22	13.77%	P	P
19	ANPR 36	A40, between A417 and A38	SB (WB)	1994:1995	1055	994	1.88	-60	-5.70%	P	P
20	ANPR 37	A38, between A40 and A417	SB	1990:1991	905	885	0.67	-20	-2.22%	P	P
21	ANPR 38	A40, between A38 and B4063	SB	1840:1839	288	249	2.35	-38	-13.36%	P	P
22	ANPR 39	Innsworth Lane, between Brionne Way and Rookery Road	SB	1802:1803	437	331	5.40	-106	-24.25%	O	O
23	ANPR 40	B4063, between A40 and Nine Elms Road	SB (WB)	1974:2066	896	881	0.48	-14	-1.61%	P	P
24	ANPR 41	A417, at railway line	SB	1977:1979	1348	1379	0.85	31	2.32%	P	P
25	ANPR 42	Station Road at Rail Bridge	SB	1649:1651	233	242	0.60	9	3.97%	P	P
		Total			**17741**	**17168**		**-573**	**-3.23%**		**P**

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Appendix A.13: Outer Cordon Calibration PM (Total)

Sl	ANPR	Description	Direction	Link ID	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
					In						
1	ANPR 3	Gallagher Retail Park, between A4019 and Manor Road	SB (EB)	857:1483	419	415	0.22	-5	-1.07%	P	P
2	ANPR 4	Manor Road, between A4019 and Rutherford Way	SB (WB)	877:885	487	547	2.65	60	12.36%	P	P
3	ANPR 5	Kingsditch Lane, between A4019 and Upper Field Road	SB	891:898	914	841	2.47	-73	-8.02%	P	P
4	ANPR 6	A4019, at railway line	NB (WB)	1486:1680	1177	1091	2.57	-87	-7.35%	P	P
5	ANPR 7	Arle Road, at railway line	NB	1968:1351	299	296	0.17	-3	-0.97%	P	P
6	ANPR 8	B4633, at railway line	SB (WB)	1496:1383	537	465	3.22	-72	-13.43%	P	P
7	ANPR 9	A40, at railway line	WB	1482:1546	846	778	2.38	-68	-8.01%	P	P
8	ANPR 10	Hatherly Lane, at railway line	NB (WB)	2045:2028	646	588	2.33	-58	-8.98%	P	P
9	ANPR 11	Grovefield Way, at railway line	NB	1681:1926	354	322	1.72	-32	-8.93%	P	P
10	ANPR 12	Badgeworth Road, at railway line	NB	1948:239	235	232	0.21	-3	-1.36%	P	P
11	ANPR 13	M5, at railway line, between Junction 11 and 11A	NB	581:326	3316	3260	0.98	-56	-1.69%	P	P
12	ANPR 14	Pirton Lane, at railway line	NB	1748:1936	258	247	0.70	-11	-4.30%	P	P
13	ANPR 18	A4019, North of A38 / A4019 junction	SB	770:769	574	638	2.61	64	11.18%	P	P
14	ANPR 19	Unnamed Road, between A4019 and Cursey Lane	SB	1656:1655	190	210	1.39	20	10.32%	P	P
15	ANPR 20	M5, between Junction 9 and Junction 10	SB	822:611	3783	3353	7.20	-430	-11.37%	O	O
16	ANPR 21	The Green, between A4019 and Lowdilow Lane	SB	850:848	16	50	5.89	34	211.25%	P	P
18	ANPR 29	Alstone Lane, at railway line	SB (EB)	1359:1358	245	208	2.44	-37	-15.02%	P	P
19	ANPR 36	A40, between A417 and A38	NB (EB)	1995:1994	1290	1279	0.30	-11	-0.84%	P	P
20	ANPR 37	A38, between A40 and A417	NB	1991:1990	672	559	4.56	-113	-16.83%	O	P
21	ANPR 38	A40, between A38 and B4063	NB	1839:1840	402	381	1.06	-21	-5.20%	P	P
22	ANPR 39	Innsworth Lane, between Brionne Way and Rookery Road	NB	1803:1802	300	300	0.01	0	-0.03%	P	P
23	ANPR 40	B4063, between A40 and Nine Elms Road	NB (EB)	2066:1974	673	695	0.85	22	3.31%	P	P
24	ANPR 41	A417, at railway line	NB	1978:1976	1843	1765	1.83	-78	-4.23%	P	P
25	ANPR 42	Station Road at Rail Bridge	NB	1651:1649	379	367	0.62	-12	-3.17%	P	P
		Total			**19855**	**18886**		**-969**	**-4.88%**		**P**
					Out						
1	ANPR 3	Gallagher Retail Park, between A4019 and Manor Road	NB (WB)	1483:857	361	242	6.85	-119	-32.94%	O	O
2	ANPR 4	Manor Road, between A4019 and Rutherford Way	NB (EB)	885:881	708	492	8.82	-216	-30.51%	O	O
3	ANPR 5	Kingsditch Lane, between A4019 and Upper Field Road	NB	898:891	953	1010	1.82	57	5.98%	P	P
4	ANPR 6	A4019, at railway line	SB (EB)	1256:1259	937	887	1.65	-50	-5.31%	P	P
5	ANPR 7	Arle Road, at railway line	SB	1351:1968	269	278	0.56	9	3.42%	P	P
6	ANPR 8	B4633, at railway line	NB (EB)	1383:1496	477	470	0.34	-8	-1.57%	P	P
7	ANPR 9	A40, at railway line	EB	1546:1482	718	693	0.95	-25	-3.52%	P	P
8	ANPR 10	Hatherly Lane, at railway line	SB (EB)	2028:2045	646	618	1.10	-28	-4.27%	P	P
9	ANPR 11	Grovefield Way, at railway line	SB	1926:1681	497	440	2.64	-57	-11.49%	P	P
10	ANPR 12	Badgeworth Road, at railway line	SB	239:1948	464	344	5.99	-120	-25.95%	O	O
11	ANPR 13	M5, at railway line, between Junction 11 and 11A	SB	327:580	3358	3224	2.34	-134	-3.99%	P	P
12	ANPR 14	Pirton Lane, at railway line	SB	1936:1748	227	261	2.16	34	14.89%	P	P
13	ANPR 18	A4019, North of A38 / A4019 junction	NB	769:770	713	662	1.96	-51	-7.21%	P	P
14	ANPR 19	Unnamed Road, between A4019 and Cursey Lane	NB	1655:1656	292	246	2.82	-46	-15.86%	P	P
15	ANPR 20	M5, between Junction 9 and Junction 10	NB	815:823	3542	3783	3.99	241	6.81%	P	P
16	ANPR 21	The Green, between A4019 and Lowdilow Lane	NB	848:850	12	29	3.75	17	141.67%	P	P
18	ANPR 29	Alstone Lane, at railway line	NB (WB)	1358:1359	180	208	1.98	28	15.33%	P	P
19	ANPR 36	A40, between A417 and A38	SB (WB)	1994:1995	1216	1144	2.09	-72	-5.91%	P	P
20	ANPR 37	A38, between A40 and A417	SB	1990:1991	1016	991	0.80	-25	-2.49%	P	P
21	ANPR 38	A40, between A38 and B4063	SB	1840:1839	331	285	2.62	-46	-13.90%	P	P
22	ANPR 39	Innsworth Lane, between Brionne Way and Rookery Road	SB	1802:1803	488	368	5.82	-120	-24.65%	O	O
23	ANPR 40	B4063, between A40 and Nine Elms Road	SB (WB)	1974:2066	984	976	0.26	-8	-0.83%	P	P
24	ANPR 41	A417, at railway line	SB	1977:1979	1546	1577	0.78	31	2.01%	P	P
25	ANPR 42	Station Road at Rail Bridge	SB	1649:1651	283	291	0.46	8	2.76%	P	P
		Total			**20218**	**19517**		**-701**	**-3.47%**		**P**

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Appendix A.14: Screenline Calibration PM

ATC Site	Description	Link ID	CARS							All Vehicle						
			Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
Screenline 1 Northbound / Eastbound																
ANPR 15	A40, between A417 and M5 Junction 11	321:286	1517	1419	2.57	-98	-6.48%	P	P	1662	1586	1.89	-76	-4.57%	P	P
ANPR 16	B4063, between Down Hatherley Lane and Commerce Road	156:1720	296	388	4.97	92	31.08%	P	P	331	431	5.11	100	30.15%	P	P
ANPR 17	A38, between A4019 and Pancake Lane	749:751	402	371	1.60	-31	-7.83%	P	P	446	411	1.70	-35	-7.87%	P	P
Total			2215	2177	0.81	-38	-1.71%		P	2439	2428	0.23	-11	-0.46%		P
Screenline 1 Southbound / Westbound																
ANPR 15	A40, between A417 and M5 Junction 11	287:322	1570	1597	0.68	27	1.73%	P	P	1728	1789	1.46	61	3.55%	P	P
ANPR 16	B4063, between Down Hatherley Lane and Commerce Road	1720:156	639	555	3.44	-84	-13.15%	P	P	714	629	3.28	-85	-11.92%	P	P
ANPR 17	A38, between A4019 and Pancake Lane	751:749	535	523	0.51	-12	-2.18%	P	P	632	603	1.17	-29	-4.60%	P	P
Total			2744	2676	1.32	-69	-2.50%		P	3074	3021	0.96	-53	-1.72%		P

| ATC Site	Description	Link ID	CARS							All Vehicle						
			Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass	Observed	Modelled	GEH	Mod-Obs	% Diff	Flow Criteria	DMRB Pass
Screenline 2 Southbound																
ANPR 17	A38, between A4019 and Pancake Lane	751:749	535	523	0.51	-12	-2.18%	P	P	632	603	1.17	-29	-4.60%	P	P
ANPR 1	Main Street, between Boddington Lane and Brock Farm Lane	1583:1582	30	27	0.69	-4	-12.23%	P	P	38	32	1.08	-6	-16.84%	P	P
ANPR 23	Withybridge Lane, between B4634 and A4019	1055:1056	99	154	4.95	56	56.36%	P	P	121	180	4.81	59	48.76%	P	P
ANPR 24	B4634, between A4019 and Hayden Road	919:945	387	441	2.65	54	13.91%	P	P	424	476	2.44	52	12.19%	P	P
ANPR 28	A4013, between A4019 and George Readings Way	1853:1852	1027	971	1.77	-56	-5.46%	P	P	1149	1103	1.38	-46	-4.03%	P	P
ANPR 30	Hayden Road, between A4019 and Village Road	871:870	453	261	10.17	-192	-42.43%	O	O	509	296	10.61	-213	-41.83%	O	O
ANPR 22	M5, between Junction 10 and Junction 11	605:603	2407	2492	1.73	85	3.55%	P	P	2854	2913	1.09	59	2.05%	P	P
Total			4938	4869	0.98	-69	-1.39%		P	5727	5602	1.67	-126	-2.19%		P
Screenline 2 Northbound																
ANPR 17	A38, between A4019 and Pancake Lane	749:751	402	371	1.60	-31	-7.83%	P	P	446	411	1.70	-35	-7.87%	P	P
ANPR 1	Main Street, between Boddington Lane and Brock Farm Lane	1582:1583	76	45	3.95	-31	-40.57%	P	P	90	53	4.36	-37	-41.00%	P	P
ANPR 23	Withybridge Lane, between B4634 and A4019	1056:1055	159	243	5.92	84	52.72%	P	P	189	272	5.47	83	43.97%	P	P
ANPR 24	B4634, between A4019 and Hayden Road	945:919	408	482	3.53	74	18.24%	P	P	451	522	3.20	70	15.63%	P	P
ANPR 28	A4013, between A4019 and George Readings Way	1853:997	851	968	3.87	117	13.72%	P	P	940	1082	4.46	142	15.07%	O	P
ANPR 30	Hayden Road, between A4019 and Village Road	870:871	343	276	3.84	-67	-19.66%	P	P	369	300	3.79	-69	-18.78%	P	P
ANPR 22	M5, between Junction 10 and Junction 11	604:606	2491	2672	3.57	181	7.29%	P	P	3021	3252	4.12	231	7.64%	P	P
Total			4729	5056	4.67	327	6.91%		O	5506	5891	5.10	385	6.99%		O

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Appendix B. Route Journey Time Graph Analysis

Appendix B.1: Journey Time Graph for Different Routes – AM Peak
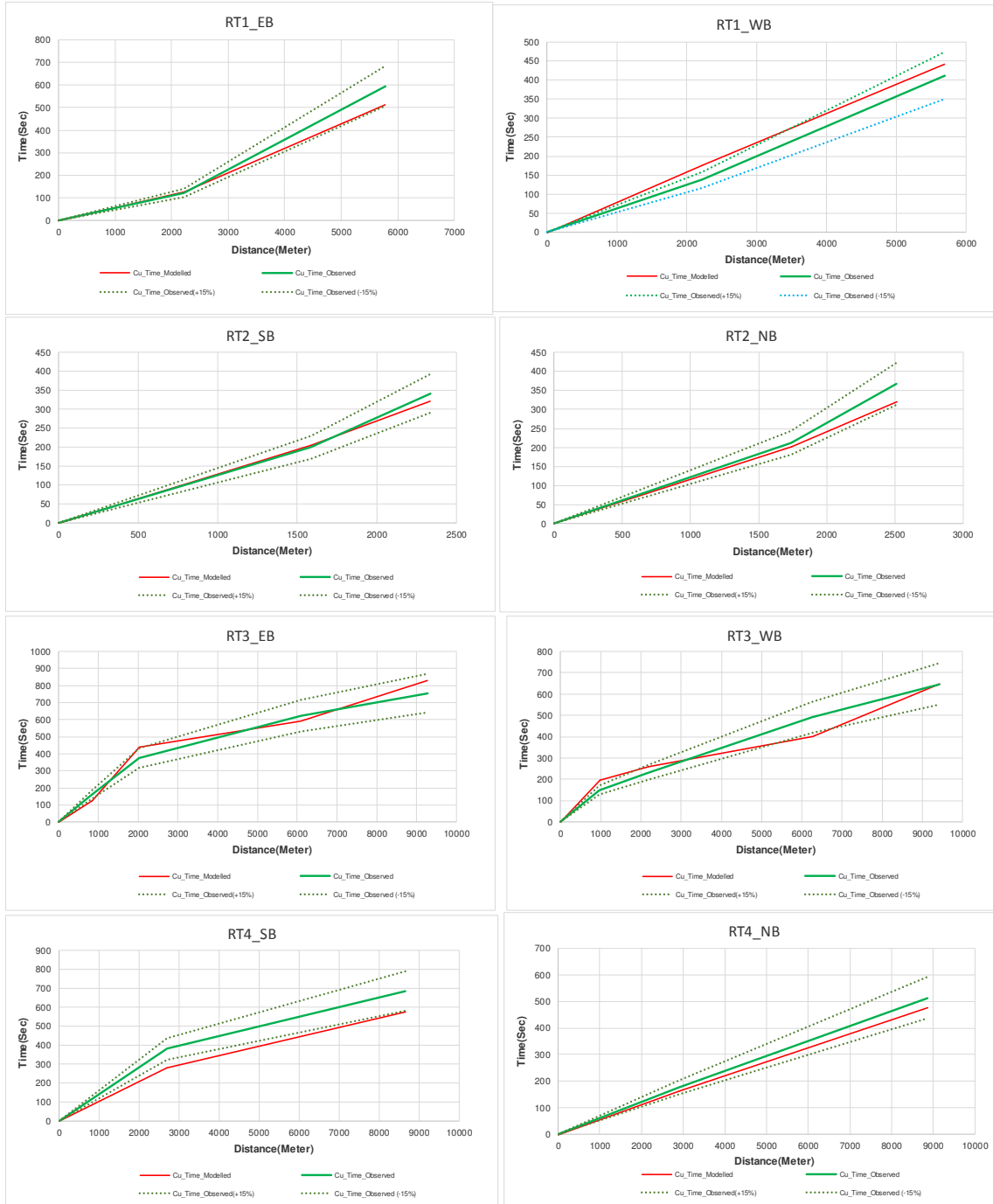
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RT5_EB

RT5_WB

Route6_NB

Route6_SB

Route7_NB

Route7_SB

Route8_NB

Route8_SB

JACOBS®
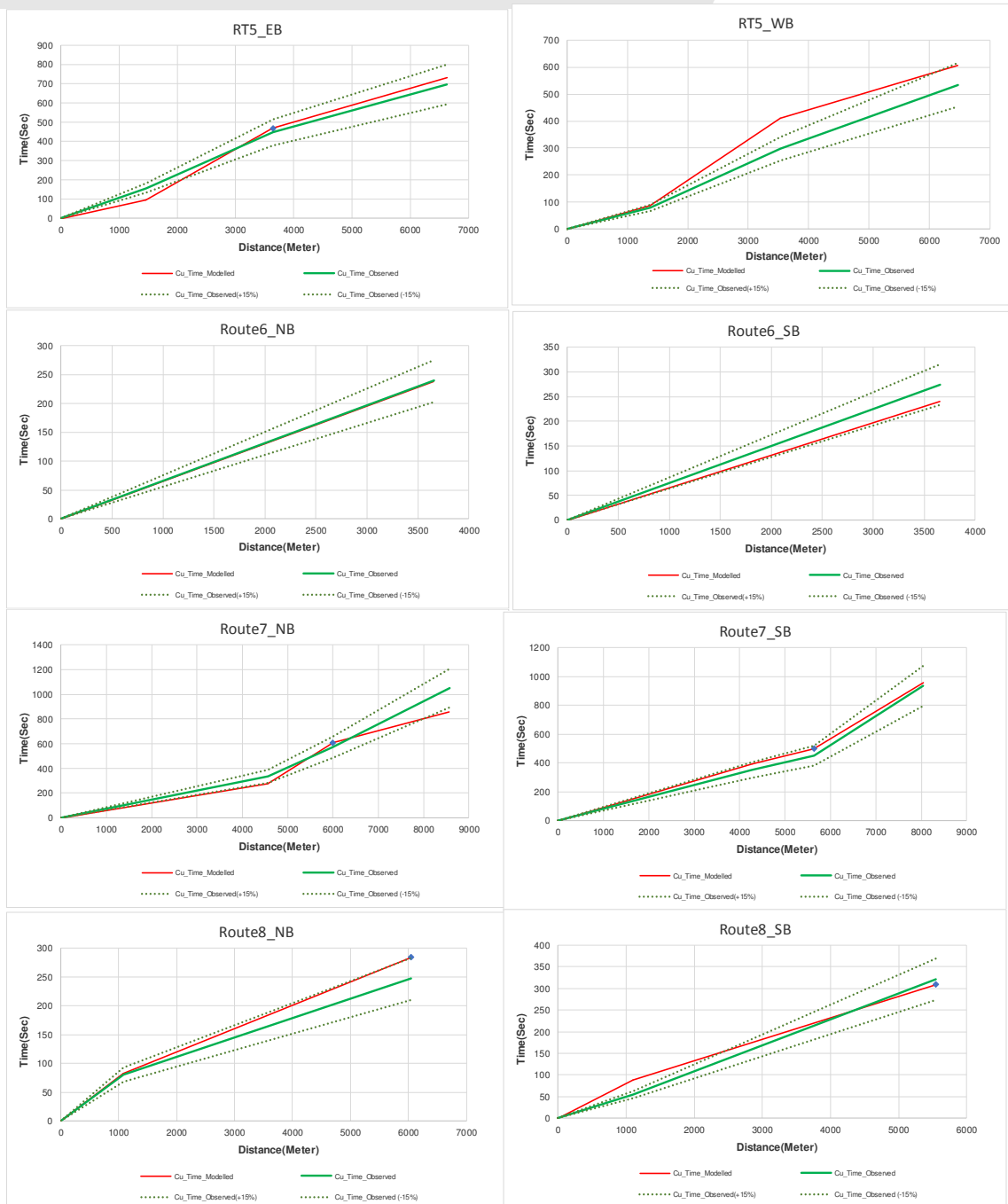
Appendix B.2: Journey Time Graph for Different Routes – PM Peak

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