Shropshire Council

SHREWSBURY NORTH WEST RELIEF ROAD

Traffic Data Collection Report

TR001
DECEMBER 2017

DRAFT

Shropshire Council

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1 INTRODUCTION

1.1 BACKGROUND

1.1.1. WSP has been commissioned by Shropshire Council to prepare a business case for the proposed North West Relief Road (NWRR) scheme in Shrewsbury. To support the development of an Outline Business Case (OBC) for the scheme, a traffic model was required to provide forecasts for the operational and economic appraisal.

1.1.2. The proposed NWRR scheme would provide a new single carriageway road in the north-west quadrant of Shrewsbury. It would connect to existing roads with new roundabouts at Holyhead Road and on Berwick Road. The NWRR would cross both the River Severn and its flood plain and the Shrewsbury to Chester railway line on new bridges.

1.1.3. A map showing the location of the scheme is provided in Figure 1.

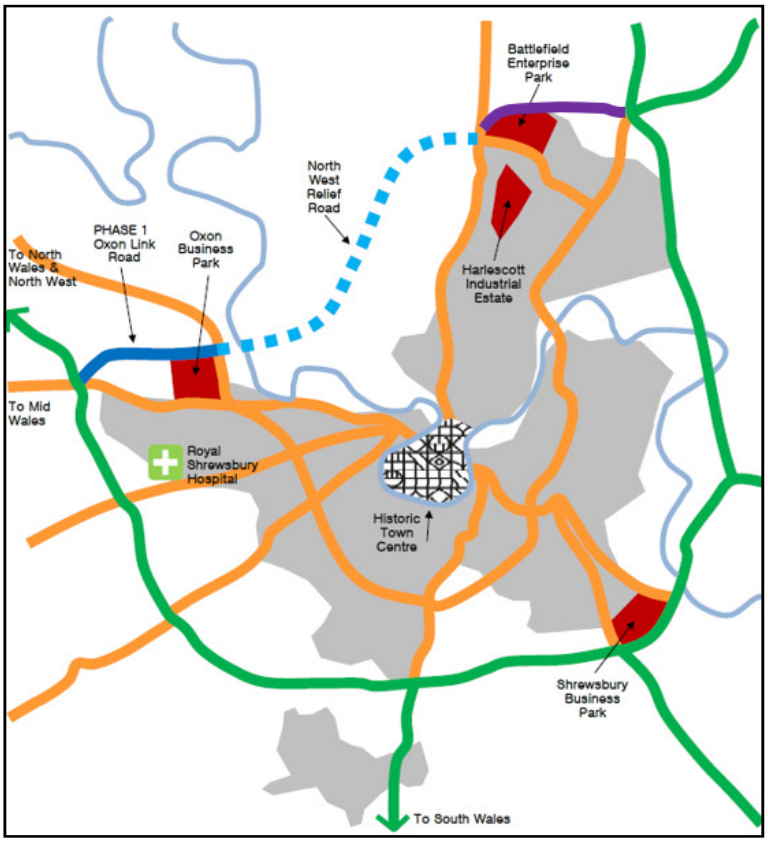


Figure 1 - Proposed Shrewsbury North West Relief Road

1.2 OBJECTIVE AND SCOPE

1.2.1. As part of the NWRR study, a programme of traffic surveys was carried out in spring 2017 to provide data to develop and validate a traffic model for a 2017 Base Year.

1.2.2. This report describes the various data collection activities undertaken, including the survey type, the date and time data was collected and the methodology employed, including the analysis and outputs.

1.2.3. All the traffic surveys were carried out in 'neutral' months during March, April and May 2017, with school and public holidays avoided. The weeks before and after Easter 2017 were also avoided, in compliance with WebTAG unit M1.2.

1.3 STUDY AREA

1.3.1. The project study area is presented in Figure 2. The study area primarily includes all of Shrewsbury with the A5 Felton Roundabout in the North West, Ellesmere Roundabout and the Battlefield Roundabout in the North, A5/ A49 Preston Island Roundabout in the East and A5 corridor in the South.

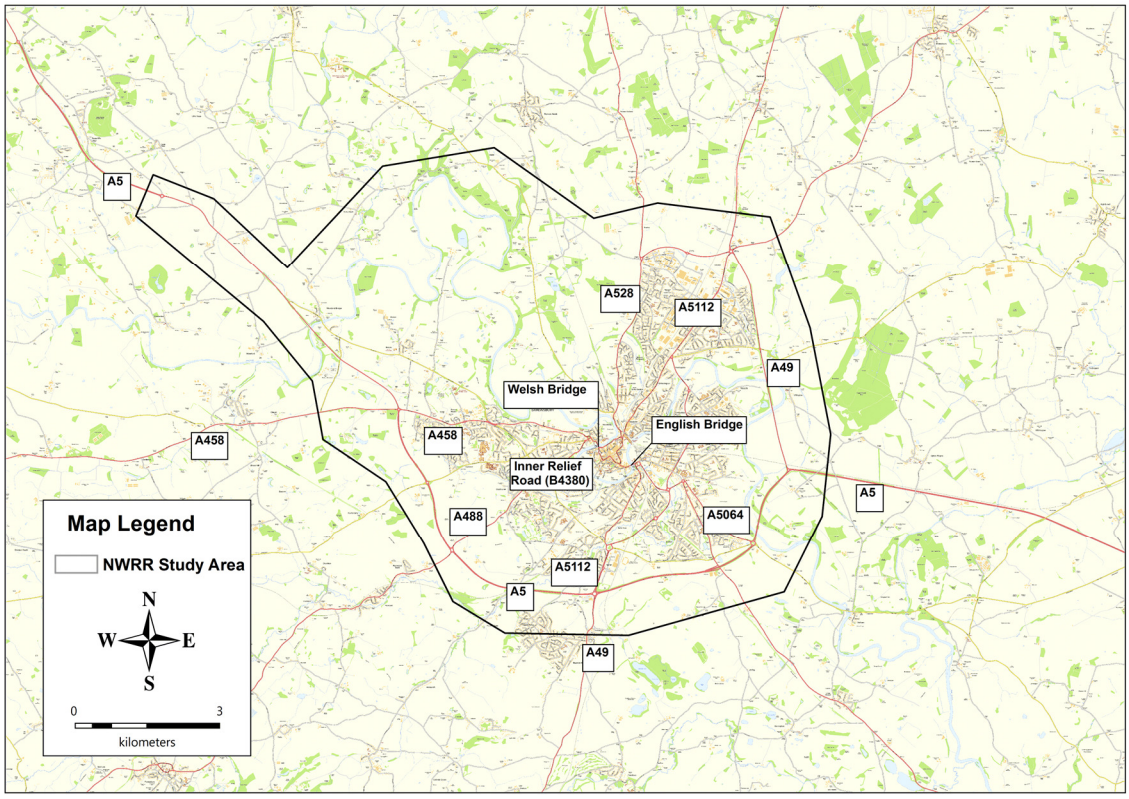


Figure 2 – NWRR Model Study Area

2 TRAFFIC DATA

2.1 OVERVIEW

2.1.1. A range of data was required for the development and validation of the Shrewsbury model. Data for the model was collected from a programme of traffic surveys carried out in spring 2017, and obtained from other sources, including Traffic Master data from the Department for Transport (DfT) and mobile phone network data, directly commissioned from Citi Logik.

2.1.2. This section describes each data set and its utilisation in the model development process.

2.2 SURVEY ELEMENTS

2.2.1. The survey data comprised the following elements and was used for various parts of the model building process.

- **Automatic Traffic Counts (ATC)**. A total of 81 sites were surveyed with (approximately) 3weeks data in each case. The information was used for :-
  - model calibration and validation,
  - expansion of Roadside Interview Surveys
  - identifying the peak periods of travel demand and
  - 16-hour, 18-hour, AADT and AAWT conversion factors.
- **Manual Classified Counts (MCC)**. These comprised counts at 64 location, carried out on links and at junctions to derive turning movements, and used in model calibration and validation including checking for route choice.
- **Car park Interviews**. Interviews were carried out at 19 locations in car parks surrounding Shrewsbury Town Centre, together with supporting MCC counts. This data provided trip origins for trips to town centre car parks and Park and Ride (P&R) sites and was used as a source of data for developing the trip matrices.
- **Automated Number Plate Recognition (ANPR)**. This comprised 5 sites on key radial routes into Shrewsbury and was used to identify strategic through traffic movements for the (existing) alternative routes to the proposed NWRR scheme.
- **Roadside Interview Surveys (RSI)**. These comprised 3 sites designed to capture Origins and Destinations of trips passing through key locations which will be directly impacted by the proposed NWRR scheme. Used as a source of data for developing the trip matrices.

2.3 OTHER DATA SOURCES

2.3.1. In addition to the traffic surveys, additional traffic data was either obtained or commissioned from a number of other sources. This data and its application for the model development is described below.

- **Mobile Phone/Network Data (MND**) - Mobile phone data was obtained from Citi Logik who supplied information from Vodafone Users. This data covered the period from 24th February 2017 to 4th April 2017, covering all trips to and from the Shrewsbury model study area. The MND provided Origin and Destination data by mode and purpose for trips to, from and within the study area which was used as a key source for the development of the trip matrices.
- **Traffic Master (OD)** – Traffic Master data was provided by the DfT. This included OD data for all trips associated with Traffic master's fleet of vehicles that either started or ended within the Shropshire boundary based upon data from journeys from 1st September 2014 to 31st August 2015.The Traffic Master Origin and Destination data was used for the development of the HGV trip matrices.
- **Traffic Master (Journey Times)** – This provided journey time information on key routes within the study area for deriving cruise speeds, identifying junction delays and for model validation.
- **WebTRIS** – This data was obtained from Highways England and comprised some 20 ATC link counts on dual carriageways and motorways and was used for model calibration and validation.
- **Accident Data** - used to identify accident locations and for use in economic appraisal (the potential for scheme accident savings).
- **Signal Data** - obtained for all traffic signals within the model area to accurately code the highway network.

2.4 SURVEY PROGRAMME

2.4.1. A programme of traffic surveys was carried out in Shrewsbury during spring 2017. The survey programme is summarised in Table 1.

2.4.2. Although all surveys were initially planned for completion during March 2017, some surveys had to be repeated or postponed for various reasons, details of which are described in appropriate sections of this report.

Table 1 – Survey Data Collection Programme

Survey\Date	March 2017	April 2017	May 2017
ATC	X	X	X
MCC	X		
Car Park	X		X
ANPR	X		
RSI			X

2.4.3. Table 2 provides a schedule of the other data sources accessed for model development. These are further described in Section 8.12. WebTRIS data is described in Section 3.4

Table 2 - Other Traffic Data

Sources	Dates
WebTRIS	March 2017, or March 2015/2016
Journey Time	March 2016
OD - Traffic Master	September 2014 to August 2015
OD – Mobile Phone Data	5 weeks(22/02/17 – 04/04/17)
Accident Data	5 years (01/06/2012 – 31/06/2017)
Signal Data	2017 (various)

2.4.4. Where WebTRIS data is unavailable for March 2017, data has been used for March 2016 or March 2015 applying appropriate annual growth factors. These factors are presented in Table 14 in section 12.5.

2.5 SITE VISITS, TRAFFIC INCIDENTS AND ROADWORKS

2.5.1. WSP staff were in attendance during the survey data collection programme to ensure that survey data collection methods were adhered to and to be able to react to incidents and challenges.

2.5.2. In addition, site attendance allowed staff to monitor and record the traffic conditions, disruptions, roadworks and accidents; to undertake quality checks; to check and ensure compliance of the surveys with the survey specification/ requirements; and to apply any corrective action where required.

2.5.3. WSP interrogated the www.roadworks.org website for information on the programme of roadworks during the survey programme window to avoid where possible major works which could impact the model build. Avoiding

all works was however impossible as during the survey programme, Shrewsbury was subject to roadworks primarily related to the on-going implementation of the Shrewsbury Integrated Transport Package schemes.

3 ATC SURVEYS AND WEBTRIS DATA

3.1 OBJECTIVE AND SCOPE

3.1.1. The ATC surveys were primarily undertaken to obtain traffic flows for the peak hour on an average weekday for model calibration and validation. The ATC data were also used for expansion of the RSI interview data; identifying the peak period; and deriving 16 hour, 18 hour, AADT and AAWT conversion factors.

3.1.2. WSP commissioned Nationwide Data Collection (NDC) to collect ATC data at 80 sites as illustrated on Figure 3 and detailed in Table 15 of Appendix A.

3.1.3. ATC surveys were undertaken between 13th March 2017 and 9th April 2017 to provide continuous data over a 3 week period. This provided traffic flow data for 3 vehicle categories, Cars, LGVs and HGVs.

3.1.4. The locations of the ATC sites were chosen in order to form a number of screenlines across Shrewsbury. This facilitated analysis and interpretation of traffic patterns, particularly with respect to key sectors of the model.

3.1.5. It should be noted that the ATC surveys were not undertaken on major roads where WebTRIS data was already available (see Section 3.4)

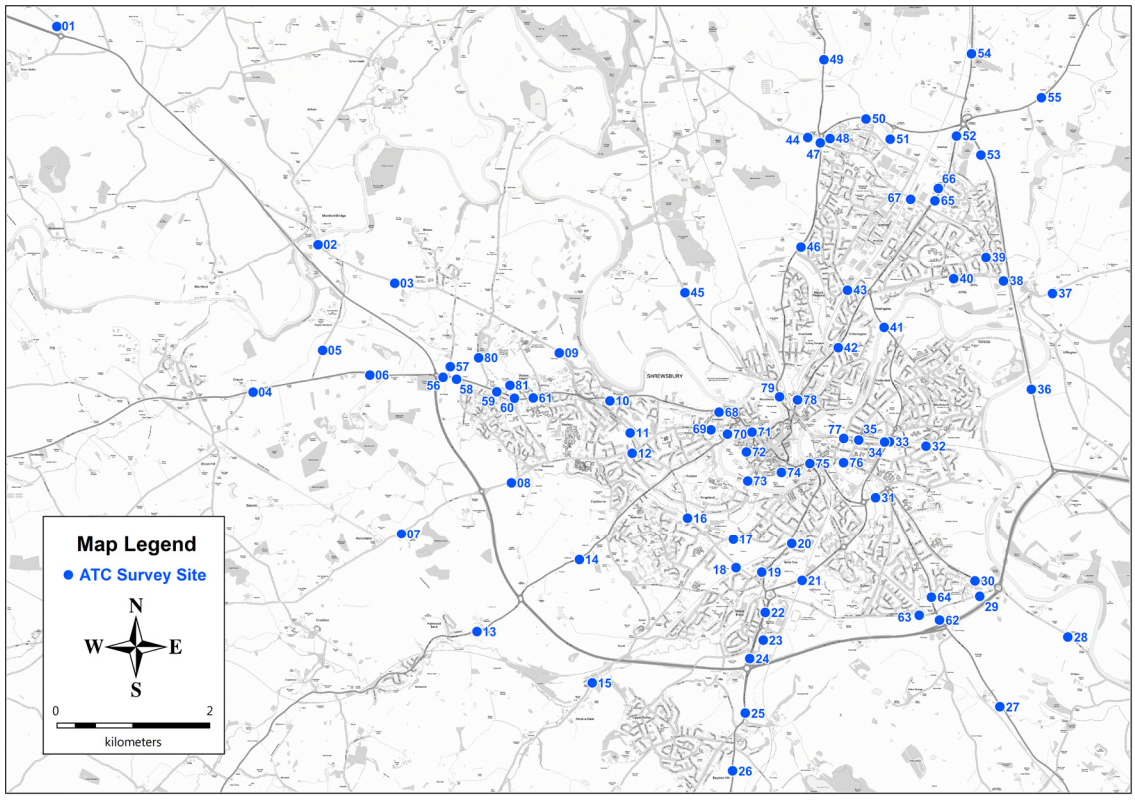


Figure 3 – ATC Survey Locations

3.2 OPERATIONAL ISSUES

3.2.1. Regular site visits were undertaken during the entire survey programme to check that the surveys were being carried out in accordance with the survey specification and to identify any specific problems or issues.

3.2.2. Initial checks were undertaken during data processing by both NDC and WSP to identify any shortcomings in data quality and deviances from required standards.

3.2.3. Table 3 shows the list of events and incidents recorded during the survey and the actions taken.

Table 3 - ATC Events, Incidents and Actions

ID/ LOCATION	EVENTS/ INCIDENTS AND ACTIONS
ATC 7	Tube damaged on 20/03/17 around 4PM and repaired on 27/03/17 1:25 PM.
ATC 9	Tube damaged on 20/03/17 around 4PM and repaired on 27/03/17 12:15 PM
ATC 20, ATC 22, ATC 61	Loss of data observed for more than 3 days and resurveyed in May 2017
ATC 71 & 75	Event (Road Race) between 15/03/17 to 19/03/17. Survey started from 21/03/17
ATC 61, 69 & 70	Planned ATC sites delayed due to roadworks.

3.3 ANALYSIS

3.3.1. The ATC data was analysed to derive daily flow profiles and variations in weekday flows. This analysis is described in 12.2 and 12.3.

3.3.2. Further analysis carried out using ATC data is explained in Section Traffic Flow Analysis below.

3.4 WEBTRIS DATA

3.4.1. WebTRIS count data was obtained from Highways England for sites on the A5, A458 and A49 roads. This was collected from http://webtris.highwaysengland.co.uk/ database for the month of March 2017 for the locations shown in Figure 4.

3.4.2. Historic ATC data from March 2015 and March 2016 was obtained to supplement the 2017 ATC data. The 2015/2016 ATC data was factored to 2017 through the application of factors to adjust for annual growth. Details of the factors are presented in Table 14 of section 12.5.

3.4.3. The WebTRIS count site locations are presented in Table 16 of Appendix B and the counts are presented in Table 17 of Appendix B.

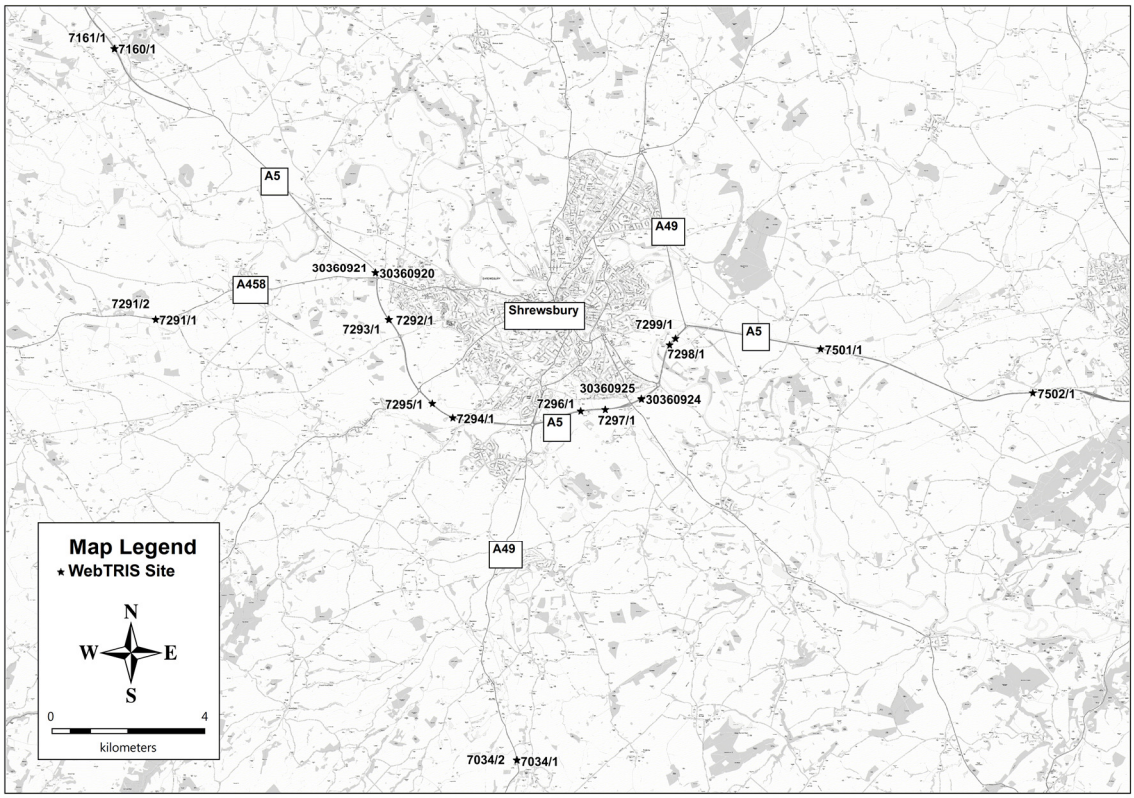


Figure 4 – WebTRIS Site Locations

4 MCC SURVEYS

4.1 LOCATION AND METHODOLOGY

4.1.1. WSP commissioned Intelligent Data Collection (IDC) to collect MCC data on 64 different locations that are shown in Figure 5.

4.1.2. Further details of the sites are presented in Table 18 of Appendix C.

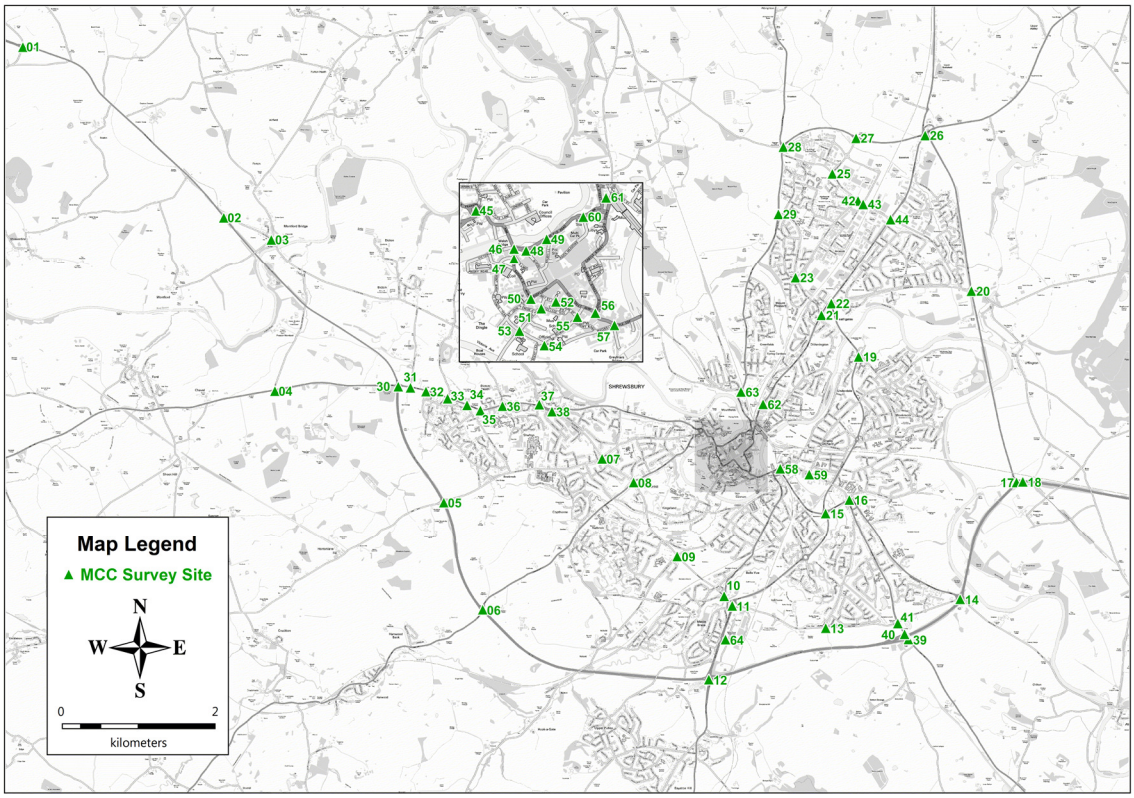


Figure 5 - MCC Survey Locations

4.2 OPERATIONAL ISSUES

4.2.1. Regular and frequent site visits were carried out during the survey periods.

4.2.2. Additional checks of the data collected were carried out by both IDC and WSP to identify any shortcomings in data quality and deviation from required standards or the survey specification.

4.2.3. Problems were identified with 2 sites as shown in the Table 4, which also indicates what mitigation actions were taken.

Table 4 - MCC vents, Incidents and Actions

Site ID	Events/ Incidents and Mitigations
MCC 58	Insufficient video coverage of the junction. Resurveyed on 26th and 27th April 2017 post Easter.
MCC 47	Partial Data was corrupted on Wednesday 29th March 2017. Data for Thursday 30th March 2017 has been used as an alternative for this site.

5 CAR PARK INTERVIEW SURVEYS

5.1 OBJECTIVE AND SCOPE

5.1.1. The Car Park Interview (CP) surveys were undertaken at the principal commuter/ shopper's car parks within the town centre and wider area of Shrewsbury, as shown in Figure 6

5.1.2. The CP surveys were carried out through face to face interviews with car park users at the point of vehicle entry. The interviews sought to identify trip origin and purpose and time of travel of car park users.

5.1.3. MCC surveys were undertaken at entry and exit at all CP survey locations classified by vehicle types.

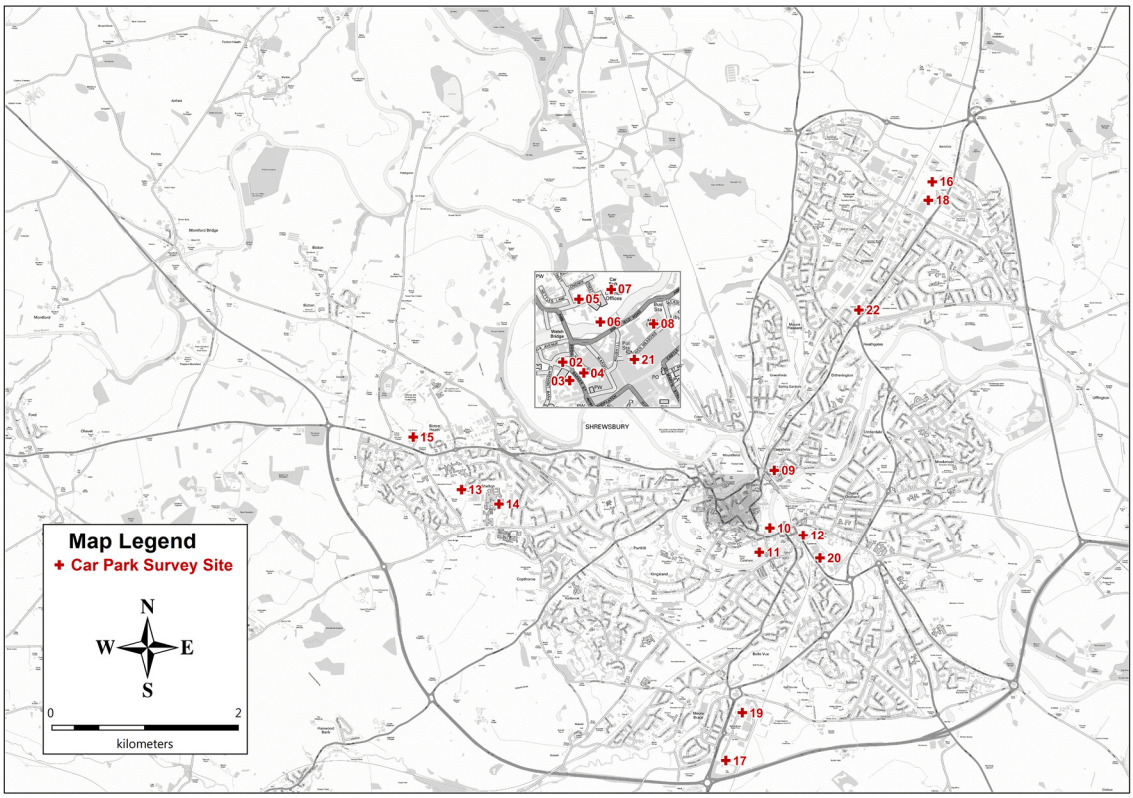


Figure 6 - Car Park Survey Locations

5.2 LOCATION AND METHODOLOGY

5.2.1. Car Park (CP) interview surveys were initially proposed at 22 locations in and around Shrewsbury town centre. These include the principal car parks for commuter, shopping and leisure and the three Park & Ride sites. The number of survey locations were reduced from 22 to 19, as permissions for surveys were denied at 3 sites. However, MCC surveys were carried out at these 3 sites in order to derive entry and exit totals.

5.2.2. The Car Park Interview surveys were undertaken on Wednesday 29th March 2017 between 07:00 AM and 19:00 PM. Interviewers collected information to determine the purpose of their trip, where they've travelled from, their ultimate destination and the likely duration of their stay.

5.2.3. MCC surveys were undertaken at the entry and exits of the car parks between 07:00 AM to 19:00 PM using video cameras and tabulated in 15 minutes intervals.

5.3 RE-SURVEY

5.3.1. The results of the survey revealed that sample rates were low at some sites either for certain peak period or for all peak periods. It was therefore decided to re-survey a number of sites in May 2017.

5.3.2. Table 5 identifies the car parks that were re-surveyed as a result of various issues including low sample rates. Details of the re-surveys that were carried out in May 2017, are provided in Table 6.

Table 5 - Car Park Survey – Operational Issues

Site	Car park name	No. Of Spaces	Issues	Re-Surveyed?
CP02	St Austins	48	High refusal rate	
CP03	The Tannery	44	OK	
CP04	Bridge St	54	OK	
CP05	Frankwell Quay	12	Negligible usage. Abandoned at about 11am to focus on CP07.	
CP06	Frankwell Riverside	75		Yes
CP07	Frankwell Main	720	OK	Yes
CP08	Raven Meadows	856	High refusal rate	Yes
CP09	Shrewsbury Rail Station	189	OK	
CP10	Wyle Cop	240	Permission not granted. Surveyors "rejected" to interview on adjoining public road in AM. Staff interviewed outside the car park in PM.	Yes
CP11	St Julian's Friars	272	High refusal rate	Yes
CP12	Abbey Foregate	342		Yes
CP13	Redwoods Centre	198	OK	Yes
CP14	Royal Shrewsbury Hospital	1787	High refusal rate in AM Switched to interview on departure in PM. Potential double counting.	Yes
CP15	Oxon Park & Ride	560	Park & Ride sites abandoned after morning peak with occasional revisits.	?
CP16	Harlescott Park & Ride	860	Park & Ride sites abandoned after morning peak with occasional revisits.	?
CP17	Meole Brace Park & Ride	780	Park & Ride sites abandoned after morning peak with occasional revisits.	?

CP19	Meole Brace Retail Park	760		Yes
CP21	The Gap	70	OK	
CP23	Barker Street	54	Exit flow not counted as part of the agreed scope.	

5.3.3. The car park interviews at the 9 sites with low sample rates were re-surveyed (with new MCCs) on 24th May 2017, as indicated in Table 6 below.

Table 6 - Car Park Re-survey

SITE	CAR PARK NAME	NO. OF SPACES	DETAILS OF RE-SURVEY
CP06	Frankwell Riverside Car Park	75	Interview at the pay machines and at the bridge stairs
CP07	Frankwell Main Car Park	720	Interview at the pay machines and at the bridge stairs
CP08	Raven Meadows Car Park	856	Interview at pay stations
CP10	Wyle Cop Car Park	<200?	Permissions not possible/Interview on public footway at both exits
CP11	St Julians Friars Car Park	272	Interview at the entrance
CP12	Abbey Foregate Car Park	342	Interview at the entrance
CP13	Redwoods Centre Car Park	<200?	Interview at the entrance
CP14	Royal Shrewbury Hospital Car Park	>200	Interview on departure
CP19	Meole Brace Retail Park Car Park	>200	Interview at the store entrances

5.3.4. It was noted the video footage from MCC cameras were unable to record the entry/ exit counts correctly at Car Park 14 and Car Park 23. MCC surveys were therefore re-scheduled at these locations.

5.4 DATA PROCESSING

5.4.1. All individual car park data survey sheets were imported into one table with a unique reference assigned to each record. Records with missing key information were deleted.

5.4.2. MapInfo was used to match reported postcodes/addresses with model zones. An index was manually created to match the remaining ambiguous addresses with model zones where possible.

5.4.3. Every reported address was put into table where the origin and destination zones were assigned using the 'ZoneLookup'. A matrix table was created to establish the count of each O-D pair, per hour.

5.4.4. Details of the data processing undertaken for the car park survey that includes summary of the hourly sample rates for each of the sites is provided in Table 7.

Table 7 - Sample Rates from Car Park Interview Survey

Site	Hours Survey	7am to 8am	8am to 9am	9am to 10am	10am to 11am	11am to 12pm	12pm to 1pm	1pm to 2pm	2pm to 3pm	3pm to 4pm	4pm to 5pm	5pm to 6pm	6pm to 7pm
CP02	12hrs	100%	113%	56%	40%	35%	0%	22%	0%	12%	29%	7%	3%
CP03	12hrs	0%	86%	50%	0%	0%	0%	0%	0%	0%	10%	0%	0%
CP04	12hrs	0%	7%	13%	34%	24%	0%	0%	30%	83%	27%	13%	3%
CP05	4hrs	100%	0%	0%	20%	-	-	-	-	-	-	-	-
CP06	12hrs	60%	80%	60%	23%	55%	5%	15%	13%	10%	8%	15%	7%
CP07	12hrs	25%	16%	30%	12%	35%	22%	16%	14%	13%	14%	13%	7%
CP08	12hrs	0%	400%	35%	0%	6%	2%	5%	5%	2%	4%	2%	17%
CP09	12hrs	11%	30%	12%	50%	50%	0%	33%	0%	40%	0%	33%	0%
CP10	12hrs	58%	32%	38%	35%	20%	21%	44%	27%	27%	13%	27%	0%
CP11	12hrs	83%	25%	28%	25%	32%	39%	9%	58%	60%	70%	50%	18%
CP12	12hrs	45%	14%	5%	18%	24%	18%	11%	19%	17%	19%	18%	32%
CP13	12hrs	15%	34%	22%	0%	14%	42%	15%	5%	18%	6%	5%	67%
CP14	12hrs	1%	2%	1%	8%	6%	4%	6%	5%	3%	2%	1%	6%
CP15	4hrs	41%	53%	35%	18%	-	-	-	-	-	-	-	-
CP16	3hrs	6%	14%	22%	-	-	-	-	-	-	-	-	-
CP17	3hrs	17%	11%	10%	-	-	-	-	-	-	-	-	-
CP19	12hrs	5%	2%	4%	3%	3%	2%	1%	4%	1%	1%	4%	2%
CP21*	12hrs	0%	31%	10%	0%	30%	28%	35%	10%	0%	0%	33%	0%
CP23	7hrs	-	-	-	-	-	17%	27%	6%	8%	13%	4%	0%

6 ANPR SURVEYS

6.1 OBJECTIVE AND SCOPE

6.1.1. ANPR surveys were undertaken to supplement and to verify other survey data as well as the mobile network data. ANPR sites were located in order to capture the through/ strategic traffic movements and journey times across routes likely to be affected by the proposed NWRR scheme.

6.2 LOCATION AND METHODOLOGY

6.2.1. WSP commissioned Intelligent Data Collection (IDC) to collect ANPR data at 5 sites at the locations shown in Figure 7 below.

6.2.2. ANPR surveys were undertaken using ANPR cameras between 07:00 AM to 19:00 PM on Wednesday 29th and Thursday 30th March 2017. Similar to the MCC surveys, ANPR data was enumerated only for 29/03/17.

6.2.3. ATC and MCC surveys were undertaken at the ANPR sites for count validation.

6.2.4. ANPR data was classified into two categories;

- Light Vehicles (Cars and LGV)
- Heavy vehicles (OGV1, OGV2 and PSV).

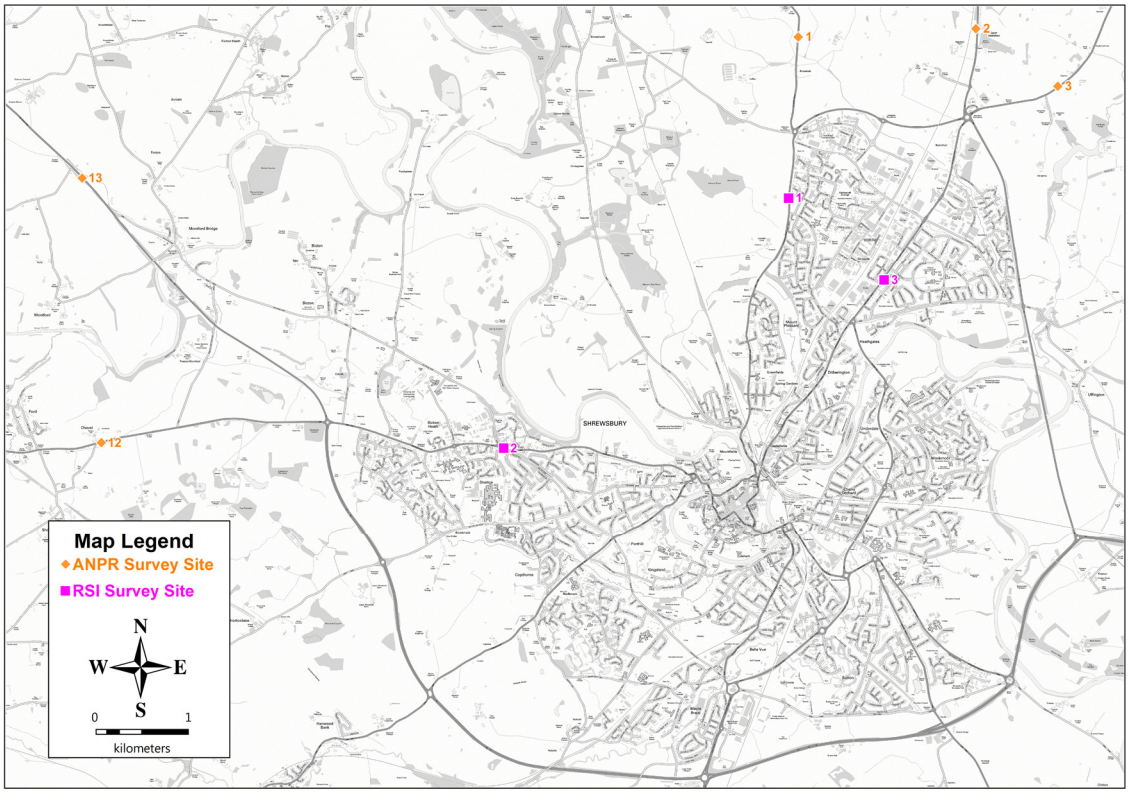


Figure 7 - RSI and ANPR Survey Location

6.2.5. Site visits were undertaken both by WSP and IDC during the survey, as part of quality check. ANPR was equipped with remote monitoring, fault identification and live web portal access, which made it easier to monitor the data collection process. The survey conditions were generally overcast during the entire duration of survey.

6.3 DATA PROCESSING

6.3.1. Sample rate and match rate for all ANPR sites were calculated based on MCC survey results for the same survey day i.e., 29/03/17, except for MCC site 47, where the ANPR data was compared to 30/03/17 due to partial data loss on 29/03/17.

6.3.2. Table 8 compares the no of vehicles 'captured' by the ANPR and percentage of 'matched' number plates compared to the captured totals.

6.3.3. The 'capture rate' is the percentage of vehicle registrations recognised by the system compared with an independent vehicle count. The 'match' rate is the percentage of 'captured ' registrations' that are also picked up at other sites, including the original site in the opposite direction, eg return trips.

Table 8 - ANPR Capture and Match Rates

Site ID	Overall Sample Rates			Inbound Sample Rates			Outbound Sample Rates			Inbound Match Rates		
	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Sample Rate	MCC	Captured Plates	Match Rate
Site 01	7709	7269	94.3%	3984	3838	96.3%	3725	3431	92.1%	3984	2319	58.2%
Site 02	8897	8122	91.3%	4413	3872	87.7%	4484	4250	94.8%	4413	2109	47.8%
Site 03	10038	9121	90.9%	5012	4648	92.7%	5026	4473	89.0%	5012	2484	49.6%
Site 12	12024	10540	87.7%	6077	5520	90.8%	5947	5020	84.4%	6077	2677	44.1%
Site 13	18442	17577	95.3%	9472	8961	94.6%	8970	8616	96.1%	9472	3896	41.1%

6.3.4. Table 8 shows that the ANPR capture rate is around 90% of the MCC count, while match rates range between 44 to 60%.

6.3.5. Table 9 shows a summary of the OD matrix for all trips/movements of less than 60 minutes duration. It can be seen that there are high proportion of 'return' trips i.e., those vehicles that are captured inbound and outbound at the same site within 60 minutes.

Table 9 - ANPR OD Summary

ANPR Site O\D	01	02	03	12	13	Total	% Return Trips
1	266	74	98	22	17	477	56%
2	68	289	60	44	13	474	61%
3	88	70	402	124	70	754	53%
12	32	59	122	236	176	625	38%
13	27	21	63	173	306	590	52%
Total	481	513	745	599	582	2920	

7 RSI SURVEYS

7.1 OBJECTIVE AND SCOPE

7.1.1. The Roadside Interview (RSI) surveys were carried out by the survey contractor Tracsis, at 3 locations to the north west of Shrewsbury covering the routes considered most likely to be affected by the proposed NWRR scheme as illustrated in Figure 7 in section 6.2 above.

7.1.2. The RSI surveys were intended to both verify the Mobile Network Data and/or be used as a direct input to the development of the trip matrices.

7.1.3. The RSI's were carried out in a single direction from 07:00am until 19:00pm. Interviews recorded the time in 30 minute segments. ATC and MCC surveys were carried out at RSI sites and used to calculate sample rates and for RSI data expansion.

7.1.4. These ATC and MCC surveys are additional to those scheduled in previous sections relating to the main ATC and MCC surveys.

7.2 LOCATION AND METHODOLOGY

7.2.1. RSI surveys were carried out in an outbound (from Shrewsbury Town Centre) direction only. The locations of RSI stations are presented in Figure 7 in section 6.2 above and described in Table 10.

7.2.2. RSI surveys were planned for end of March 2017 in line with the other traffic surveys. However due to the non-availability of the police on the proposed date, the RSIs were re-scheduled and carried out on 4th May 2017.

Table 10 – RSI Survey Locations

SITE REF	ROAD	LOCATION	DIRECTION	GRID REFERENCE
RSI 1	A528 Ellesmere Road	Layby to the North of Mount Pleasant Road	NB	315930N 349720E
RSI 2	A458 Welshpool Road	Near B4380 Holyhead Road/ The Mount Junction	WB	313280N 346340E
RSI 3	B4380 Roman Road	South of Upper Road/ Roman Road Junction	NB	310820N 348930E

7.2.3. The surveys were undertaken both as face to face interviews with the drivers and using post cards. The RSI's were manned by Surveyors from Tracsis, Supervisors from WSP and Tracsis, Police and Traffic Management personnel at all three sites.

7.2.4. A classified ATC was conducted at the RSI site for a continuous period of three weeks that included the survey day. MCC video surveys were also conducted in conjunction with the RSI surveys covering the period 06:30am to 19:00pm.

7.3 DATA PROCESSING

7.3.1. The first stage in the processing involved a series of logic and range checks in order to verify the accuracy and consistency of the data to ensure the data was suitable for the matrix building.

7.3.2. The routeing for all RSI records were logic checked by plotting in GIS and checking for directionality and whether travel through the RSI location was plausible.

7.3.3. The next stage of the process involved creating a data set for the non-interview i.e. inbound direction. This was achieved by switching the origins and destinations and assigning a reverse trip time. This was carried out by utilising the ANPR surveys conducted near the RSI sites to create a reverse trip time probability distribution for each time interval for both light and heavy vehicles.

7.3.4. Expansion factors were calculated for each site, for each vehicle type and time interval in order to expand the RSI records to total observed flows. After expansion, an additional adjustment factor was applied to reverse trips only, to ensure that the distribution of trip purposes by model period matches the forward direction.

7.3.5. In cases where there were too few or no survey records of a vehicle type in a certain time interval relative to the MCC, patching was undertaken.

7.3.6. Finally, the trip records were factored from the survey day to represent average flows over the three week using the ATC data. Adjustment factors were prepared for each site, direction, and model period, for both light and heavy vehicles in order to adjust for the discrepancy between vehicle classifications in MCC and ATC methods.

7.4 RESULTS (SAMPLE RATES, EXPANSION AND TRANSPOSE MATRIX)

7.4.1. Table 11 shows the summary of the samples and count data for each RSI sites.

Table 11 – RSI Sample Rates

RSI Site	Time Period	Number of Samples			Peak Period Count			Sample Rate		
		CAR	LGV	HGV	CAR	LGV	HGV	CAR	LGV	HGV
1	AM	238	28	10	1654	116	16	14%	24%	63%
	IP	242	27	9	2242	214	32	11%	13%	28%
	PM	186	18	0	1301	68	3	14%	26%	0%
2	AM	160	16	0	1496	131	25	11%	12%	0%
	IP	209	16	0	2656	224	37	8%	7%	0%
	PM	168	13	0	1774	84	19	9%	15%	0%
3	AM	225	38	2	1518	102	32	15%	37%	6%
	IP	264	16	2	3712	216	36	7%	7%	6%
	PM	144	10	0	1705	76	10	8%	13%	0%

Table 11 shows that the sample rate for cars and LGV are reasonably high when compare to HGVs.

8 JOURNEY TIME – TRAFFIC MASTER

8.1 OBJECTIVE AND SCOPE

8.1.1. Journey Time (JT) data were required for defining network cruise speeds, identifying junction delays and for model validation.

8.1.2. JT data for the NWRR model was primarily obtained from two sources, the DfT Traffic master database and the ANPR surveys. This section reports on the JT data derived from the Traffic master data. The ANPR surveys were described in Section ANPR Surveys above.

8.2 LOCATION AND METHODOLOGY

8.2.1. JT data was collected for the entire model study area from the Department for Transport (DfT) Congestion Statistics team for the model study area as defined in section 1.3.

8.2.2. The Traffic master JT data contain average journey times by vehicle type for March 2017 for each link at 15 minute intervals for a full 24 hours duration, although there were some gaps identified in the data.

8.2.3. Data is available for Cars, LGV, OGV1, OGV2, PSV and other. However for analysis purpose it was aggregated as Light vehicles and Heavy vehicles only.

8.2.4. JT data was analysed for AM peak 08:00 to 09:00 hours, Inter peak – average of 10:00 to 16:00 hours and PM peak 17:00 to 18:00 hours and disaggregated into following three road classifications:

- MajorHA: Contains journey time information for all 'A' Trunk and Motorway road links.
- MajorLA: Contains journey time information for all principal 'A' road links
- MinorLA: Contains journey time information for all B, C and U road links

8.2.5. In accordance with WebTAG unit 1.2, the JT routes should cover as wider a range of route types and routes of interest for the scheme appraisal, between 3 km to 15 km in length and no longer than 40 minutes. Based on these criteria, the JT routes were defined so as to capture all the key A and B roads within the study area.

8.2.6. The key journey times included are listed below:

- Churncote Roundabout to Ellesmere Road Roundabout;
- Holyhead Junction to Bayston Hill Roundabout;
- Bayston Hill Roundabout to Preston Island Roundabout;
- Preston Island Roundabout to Ellesmere Road Roundabout;
- A488 Hanwood Road;
- A5191 and A5112;
- B4386;
- B4380 Inner Relief Road; and
- A5112 Inner Relief Road with exclusion of Hazledine way and Pritchard Way.

8.2.7. These routes are show in Figure 8.

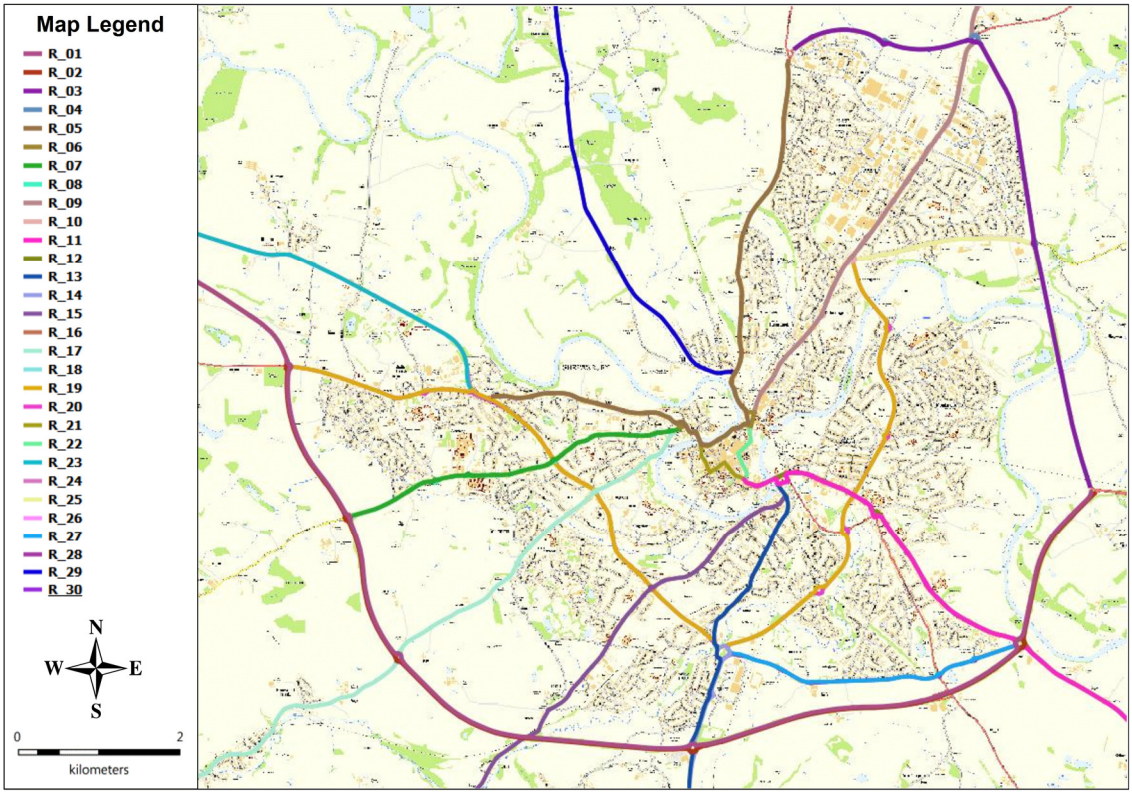


Figure 8 – Journey Time Routes

8.3 DATA CHECKS AND RESULTS

8.3.1. The initial checks on the data revealed that the Heavy vehicles were faster than the Light Vehicles. This was considered atypical since HGV would tend to travel at a much lower speed compared to cars and LGVs.

Following further discussions with the DfT, use of the 2016 data was advised pending further revisions to the 2017 JT data.

9 MOBILE NETWORK DATA

9.1 OBJECTIVE AND SCOPE

9.1.1. WSP commissioned Citi Logik to provide Mobile Network Data for the NWRR study. MND comprises the movements of Vodafone customers (traced through their devices) which relating to the Study Area, i.e. trips that traverse through the Study Area or originate/end their journeys within the Study Area.

9.1.2. Citi Logik have therefore provided trip matrices which include the following segmentation:

- Mode (road, rail, slow);
- Trip purpose;
- Direction for home-based trips;
- Time of the day; and
- Day of the week.

9.1.3. The 'road' mode includes all motorised travel, including HGV, LGV, bus and car. The data is unable to distinguish between bus and car travel. Similarly the 'slow' mode included pedestrians and cyclists. Rail includes all types of travel in this category, but air travel is excluded. Mixed mode usage (eg car / walk, is allocated to the dominant mode

9.1.4. The data is also able to include a basic indication of purpose, comprising home based or non home based, to/from work or Other. Travel data is associated with individual users and by studying their travel patterns on a long term basis, it has been possible to establish their home location (where the device is stationary for a long period overnight) and regular work where the device is stationary for a long period during the working day). Up to 2 work locations can be defined for each user.

9.1.5. Based on this information the travel data can determine whether a trip is 'home to work' (commuting), or home to elsewhere (HBO), non-home to work (NHBW) or Other to Other (NHBO).

9.1.6. The trip data was extracted for a 5 week period (for the NWRR) and then merged to give an average day. Expansion factors were then calculated from the ratio of Vodofone users to the total population (16-74).

9.1.7. A trip is identified when the communication between device and base station changed masts. For trips passing through the study area these are traced back (and forward) to their ultimate origin /destinations and not just their entry / departure point into the local area.

9.1.8. The start time of a trip is defined as the first recorded movement from mast to mast (after a 'dwell' or more than 30 minutes) and the end of a trip similarly. A dwell of less than 30 minutes is considered as a pause within a longer journey.

9.1.9. The data can therefore distinguish between time of day (any travel between particular times) and day of week.

9.2 LOCATION AND METHODOLOGY

9.2.1. The MPD was collected based on three major zone classifications i.e., 1. External Zones; 2. Geofence and 3. Study Area, as shown in Figure 9.

9.2.2. The Geofence lies slightly outside the Study Area and includes a buffer area to ensure than all trips travelling within the study area are identified. The internal and geofence areas are compatible with the study zone systems as shown in Figure 10.

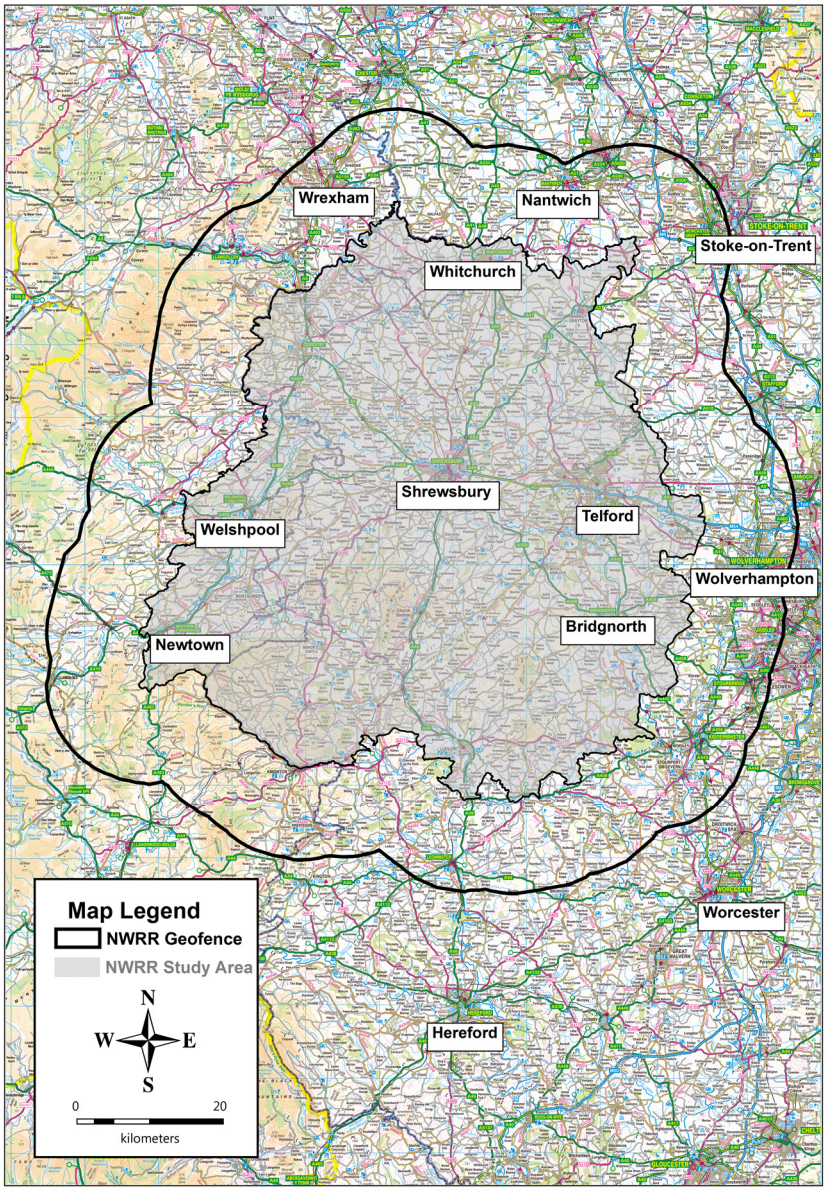


Figure 9 – Mobile Phone Data Study Area & Geofence

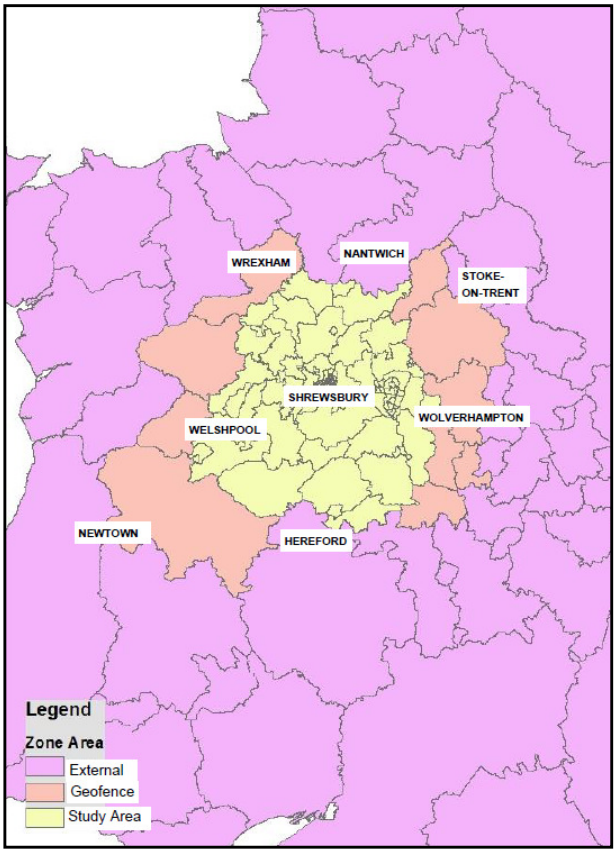


Figure 10 – Mobile Phone Data Zones

9.2.3. The data collection period for the Shrewsbury project ran for five weeks, from 22nd February 2017 to 4th April 2017, excluding: 22nd February, 23rd February, 10th March, and 29the March owing to outages on the Vodafone network. This period consisted of five weeks, resulting in 27 weekdays (Monday – Friday) and 10 weekend days (Saturday-Sunday).

9.2.4. The MPD collected was expanded to the population data for the age group between 16 to 74 years based on the latest UK Census data.

9.3 ANALYSIS AND OUTPUTS

9.3.1. Data was aggregated into the following categories.

- Monday to Thursday, Friday, Saturday and Sunday; and
- Monday to Friday and Saturday to Sunday.
- Trips were also provided for the following time period bands.
- AM Peak (0700-1000)
- Inter-peak (1000 – 1600)
- PM Peak (1600-1900)
- Off-peak 1 (1900-0000), and
- Off-peak 2 (0000-0700).

9.3.2. The time definition corresponds to the trip start time if it originated inside the study area or the time it entered the study area if it started outside.

9.3.3. The data collection period for Shrewsbury ran for 5 weeks from 22/02/2017 to 04/04/2017, excluding 22/02, 23/02 10-13/03 and 23/03 due to outages on the Vodofone network.

9.3.4. As part of quality assurance processes, number of verifications on the data has been undertaken by Citi Logik to ensure that the data is fit for purpose.

9.3.5. The following additional data checks and validations were carried out by Citi Logik:

- Average 24hr Unexpanded Working Day Travel Flow;
- Device Trip Rates;
- Average 24hr Working Day Total Travel Flow;
- Trip Length Distributions;
- 'All Purpose' Symmetry;
- Symmetry Test for All Home Based 'from home' and 'to home' trips;
- Symmetry Test for Home-Base Work (HBW) Trips;
- Trip rates;
- Correlation between All-Purpose Trips and Population;
- Correlation between Home-Based Trips and Population;
- Symmetry Test for Non Home-Based Trips;
- Home Based Work Outbound Versus Inbound by Time of Day;
- Comparison between Home Based Work Trips and Census Journey to Work data; and
- All Purpose Trips by Time of Day.

9.3.6. A technical note on the verification process was prepared by Citi Logik and is reported in 'TN02 Mobile Phone Data Verification' (Citi Logik June, 2017).

9.3.7. Further checks and analysis of the MND was carried out by WSP and reported in 'Shrewsbury north West Relief Road: Review of Mobile Phone Data' (WSP, October 2017).

9.3.8. In addition to this, WSP undertook their own assessment of the data to understand how it compares with other sources. This was reported in 'Shrewsbury North West Relief Road: Review of Mobile Phone Data' (WSP, October 2017).

9.3.9. The review indicated that the MND is a valuable resource, given the difficulties in obtaining survey data from more conventional survey methods. But is has its own characteristics and in some cases shortcomings particularly in relation to the definition of journey purposes, which have to be implied rather than directly surveyed. These are different from the various shortcomings associated with RSI surveys which are well understood and compensated for, or not.

9.3.10. MND is a new resource and it will take a while for the profession to learn how to best make use of its information.

9.3.11. The main detailed conclusions were that:-

- In percentage terms, Commuting and Other trips were similar to NTS, but Business trips (NHBWork) were much higher.
- Trips rates for commuting were much higher than NTS and overall rates were slightly higher.
- Trip length histograms show a lack of short distance trips, possibly due to problems defining these with respect to phone masts.
- Rail trips from NTS constitute 3% of the total trips, whereas the MPD rail trips has only 0.5% of the total trips. This is not impossible give the sparseness of the local rail network compared with the national average which includes London commuting.

10 ACCIDENT DATA

10.1 OBJECTIVE AND SCOPE

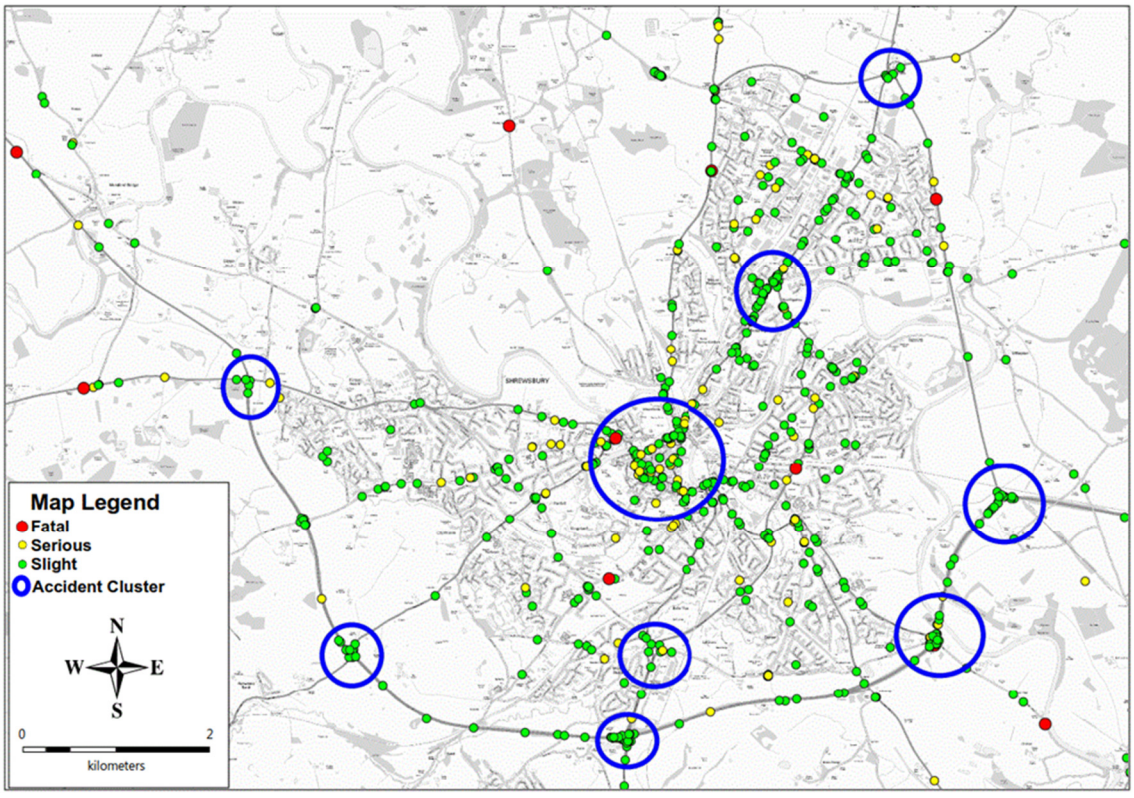
10.1.1. Accident data was required to undertake an analysis on the impact of accidents for the proposed scheme. This data will be used as an input to COBALT (Cost and Benefit to Accidents – Light Touch) which will be used to assess the predicted accident savings and associated economic benefits.

10.1.2. Accident data covering a period of five years from 01/06/2012 to 31/06/2017 was collected from Shropshire Council.

10.1.3. Accident rates will be calculated for all links within the study area COBALT network using the accident data collected.

10.2 ANALYSIS AND OUTPUTS

10.2.1. Figure 11 shows the number of junctions where multiple accidents took place during this period. Accident hot spots are mainly observed along the outer relief road i.e., A5/ A49 corridor junctions, those along inner relief road and also within the town centre. While accidents outside the town centre are mostly rear shunt type accidents, those within the town centre largely involve vulnerable road users.



Source: Contains OS data © Crown copyright and database right (2017)

Figure 11 - Accident Analysis by Severity

10.2.2. Table 12 shows a breakdown of accident severity and the year in which it occurred. Table 13 shows the accidents by time period.

10.2.3. The analysis in Table 12 shows that in the last five years accidents peaked in 2016 at 165 which was 27 more accidents than in 2013. The number of slight and severe accidents occurring have risen from 2013 to 2016. Fatal accidents were highest in 2014 at 4, with 3 fatal accidents in 2016.

Table 12 - Accidents by Severity (2012 – 2017)

Severity	2012	2013	2014	2015	2016	2017
Slight	74	121	123	123	129	35
Serious	14	15	24	25	33	11
Fatal	1	2	4	1	3	0
All	89	138	151	149	165	46

Table 13 - Accidents by Time Period

TIME PERIOD	Weekday		Weekend		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
12:00 AM - 07:00 AM	25	4%	17	10%	42	6%
07:00 AM -10:00 AM	128	23%	19	11%	147	20%
10:00 AM - 04:00 PM	195	35%	78	44%	273	37%
04:00 PM -07:00 PM	151	27%	39	22%	190	26%
07:00 PM - 12:00 AM	62	11%	24	14%	86	12%
24 hours Total	561	100%	177	100%	738	100%

10.2.4. Figure 12 shows the locations of accidents involving vulnerable road users i.e., pedestrians and cyclists.

10.2.5. Accidents involving cycles totalled 140 (19% of all accidents) and 121 (16%) accidents involved pedestrians. As noted above, Shrewsbury town centre and Heathgates roundabout have significant amount of accidents involving these road users. This is to be expected as footfall and cycle usage are higher in these locations compared to the rest of the study area.

11 SIGNAL DATA

11.1 SCOPE, LOCATION AND OUTPUTS

11.1.1. Traffic signal data is a key input for the base year model network build.

11.1.2. Signal data was collected for all UTC and non-UTC sites within the model study area.

11.1.3. The requested signal data are covered the period from 28th to 30th March 2017, in order to align with the traffic surveys. However signal data for these dates was not available for 5 sites and for these sites, historic data (2013 to 2015) has been used.

11.1.4. Traffic Signal data was collected for AM peak (07:00 to 10:00 hours), IP (10:00 to 16:00 hours) and PM (16:00 to 19:00 hours).

11.1.5. The following information from the signal data were used for model build:

- Signal Location/ Intersection name
- Controller specifications
- Phasing plans
- Signal timing: Total cycle length, green time and inter-green time
- Offset
- Stages
- Filters

11.1.6. The signal data was collected from Shropshire Council and from Systra Limited through Highways England.

Source: Contains OS data © Crown copyright and database right (2017)

Figure 12 - Accident involving Pedestrians and Cyclists

12 TRAFFIC FLOW ANALYSIS

12.1 OVERVIEW

12.1.1. Traffic flow data was required to provide a baseline for current traffic conditions and for calibration and validation of the traffic model, including the factoring and expansion of the roadside interview data. Data was analysed to determine hourly, daily, weekly, monthly and annual factors.

12.1.2. Traffic flow dataset was drawn from the ATCs carried out as part of the 2017 survey programme and 2017 WebTRIS data. The counts were selected in order to provide a spread across the model study area.

12.1.3. The locations of the traffic counts used for the traffic flow analysis are illustrates in Figure 13.

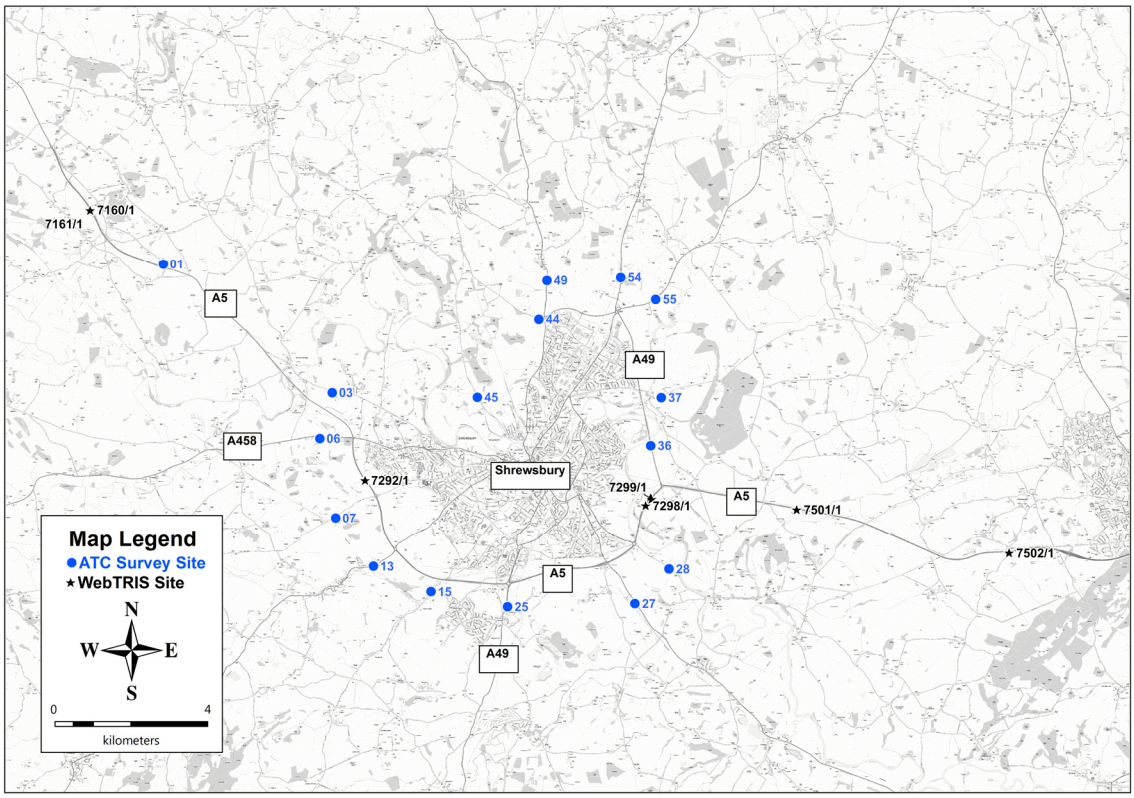


Figure 13 - Traffic Flow Data Count Sites

12.2 DAILY TRAFFIC FLOW PROFILE

12.2.1. Figure 14 presents the daily traffic profile comparison between Monday to Thursday, Weekday (Monday to Friday) and Weekly (Monday to Sunday). This shows that there is only marginal difference between Monday to Thursday and Monday to Friday daily profile. However from the comparison of Weekday and Weekly profile, it is noted that the weekend peak hour traffic is lower for AM and PM.

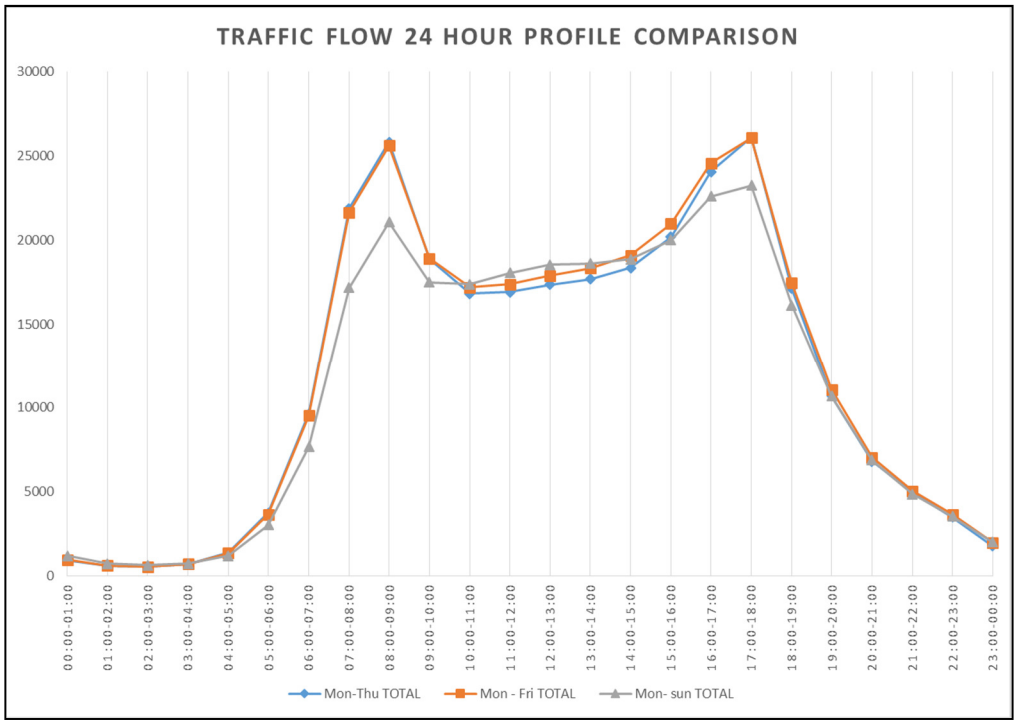


Figure 14 - 24 hour Profile Comparison

12.2.2. From the 12 hour and 24 hour profile, it can be clearly seen that there is a spike in traffic flow between 07:00 to 10:00 hours and 16:00 to 19:00 hours. This is considered as the AM and PM peak period and the period between these two peak periods is defined as inter-peak period.

12.3 PEAK HOUR FLOW PROFILES

12.3.1. Figure 15 and Figure 16shows the actual peak hour within AM peak period and PM peak period respectively.

12.3.2. It can be seen that 08:00 to 09:00 hours for AM peak and 17:00 to 18:00 hours for PM peak are consistently higher within the respective peak periods across all sites. Thus the model time periods are defined as AM Peak: 08:00 to 09:00 hours; Inter Peak: 10:00 to 16:00 hours; and PM Peak: 17:00 to 18:00 hours.

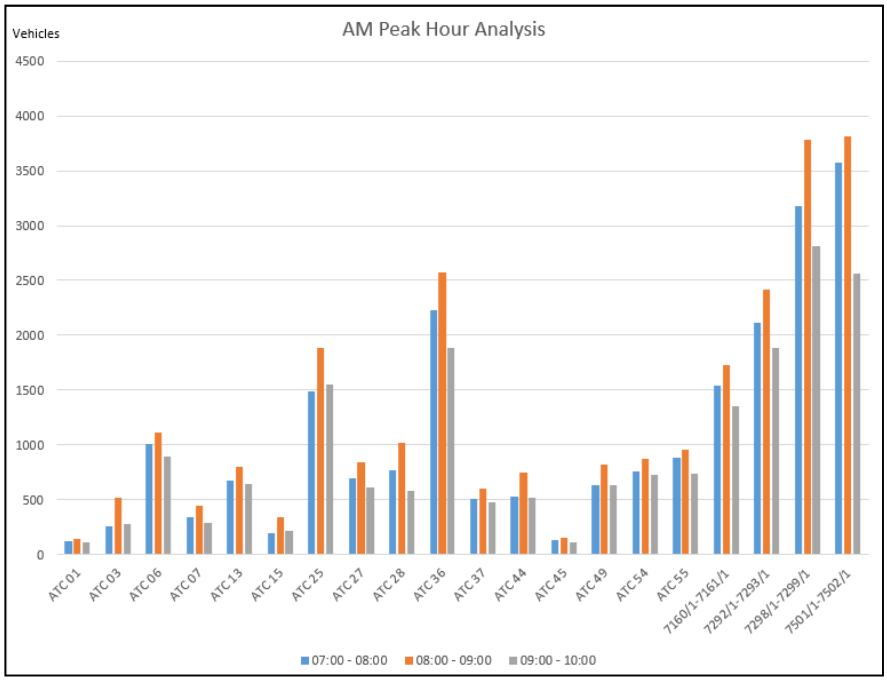


Figure 15 - AM peak flow profile

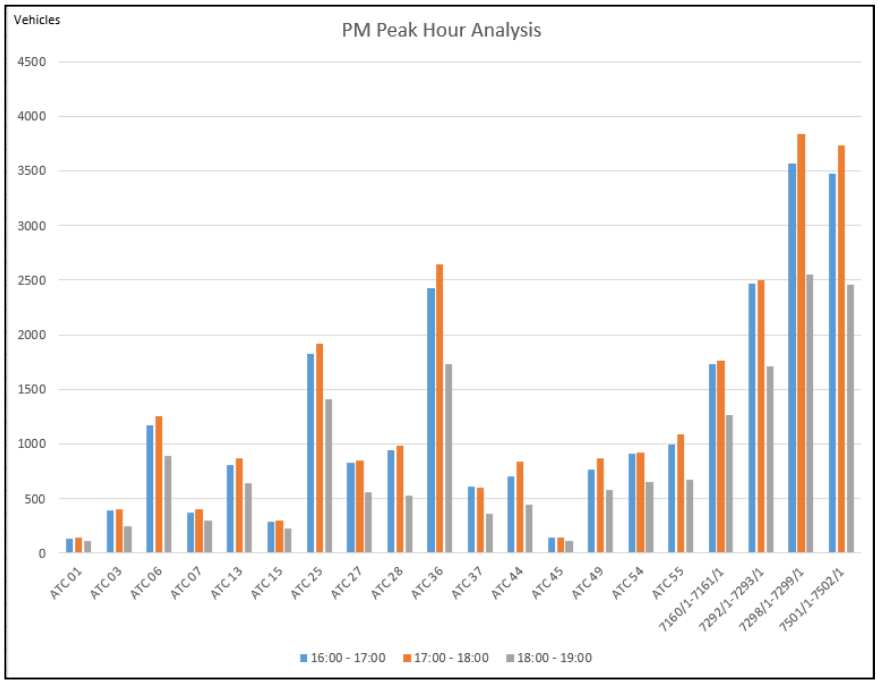


Figure 16 - PM peak flow profile

12.4 CHOICE OF MODELLED DAYS

12.4.1. The comparison of the 4 day (Mon to Thu) weekly flow profiles and 5 day (Mon to Fri) weekday profiles showed there was very little variation in flows. A 5 day (Mon to Fri) average was chosen for the base model.

12.5 ANNUAL GROWTH FACTOR

12.5.1. Factors were derived from the WebTRIS and ATC data collected as part of the 2017 survey programme. These factors were applied to the 2015 and 2016 WebTRIS data to derive equivalent 2017 flows. These are presented in Table 14 below.

Table 14 - Annual Growth Factors

SITE ID	DESCRIPTION	2015	2016	2017	2015 TO 2016	2016 TO 2017
7292/1	A5 between A458 & B4386 WB	13,027	14,386	14,489	10%	1%
7294/1	A5 between A488 & A49 WB	17,355	22,129	20,126	28%	-9%
7296/1	A5 between A49 & A458 EB	17,653	19,105	20,701	8%	8%
7297/1	A5 between A49 & A458 WB	17,434	19,703	20,916	13%	6%
7299/1	A5 between A49 & B4380 WB	17,184	20,045	20,863	17%	4%
7501/1	A5 at Upton Magna EB	18,478	19,647	20,277	6%	3%
7502/1	A5 at Burcot WB	17,408	19,542	20,199	12%	3%
7161/1	A5 at Nesscliffe NB	9,275	9,973	10,270	8%	3%
7160/1	A5 at Nesscliffe SB	9,474	9,941	10,263	5%	3%
7291/2	A458 at Cardeston WB	4,786	4,702	4,956	-2%	5%
7291/1	A458 at Cardeston EB	4,632	4,570	4,762	-1%	4%
7034/1	A49 at Longnor NB	6,120	6,223	6,363	2%	2%
7034/2	A49 at Longnor SB	5,958	6,198	6,244	4%	1%
	Total	158,784	176,163	180,430	11%	2%
	Total excluding A5 WB Traffic	76,376	80,359	83,838	5.22%	4.33%

March - Tuesday to Thursday excluding Easter holidays and the weeks before/ after Easter holidays.

Appendix A

ATC SITE LOCATIONS AND DATES

ID	START DATE	END DATE	LOCATION	X-Coordinate	Y-Coordinate
ATC 1	28/03/2017	09/04/2017	A5 between the A5 junction and the settlement of Nessclife	339828	318065
ATC 2	13/03/2017	09/04/2017	B4380 Holyhead Road	343230	315230
ATC 3	13/03/2017	09/04/2017	B4380 Holyhead Rd	344228	314715
ATC 4	20/03/2017	09/04/2017	A458	342384	313301
ATC 5	13/03/2017	09/04/2017	B4473 Preston Montford Lane	343289	313844
ATC 6	13/05/2017	09/04/2017	A458	343905	313522
ATC 7	14/03/2017	09/04/2017	B4386	344316	311452
ATC 8	14/03/2017	09/04/2017	B4386 Oak Rd	345748	312123
ATC 9	13/03/2017	09/04/2017	B4380 Holyhead Road	346371	313809
ATC 10	13/03/2017	09/04/2017	A458 The Mount	347030	313187
ATC 11	13/03/2017	09/04/2017	B4380 Shelton Road	347294	312771
ATC 12	14/03/2017	09/04/2017	B4386 Mytton Oak Road	347320	312506
ATC 13	14/03/2017	03/04/2017	A488	345300	310183
ATC 14	14/03/2017	09/04/2017	A488 Hanwood Road	346632	311116
ATC 15	14/03/2017	09/04/2017	Longden Road	346800	309521
ATC 16	15/03/2017	09/04/2017	B4380 Roman Road	348042	311662
ATC 17	15/03/2017	09/04/2017	Longden Road	348638	311380

ATC 18	15/03/2017	09/04/2017	B4380 Roman Road	348672	311011
ATC 19	14/03/2017	09/04/2017	Upper Road	349007	310953
ATC 20	15/03/2017	09/04/2017	A5191 Belle Vue Road	349398	311323
ATC 21	15/03/2017	09/04/2017	A5112 Hazeldine Way	349533	310844
ATC 22	14/03/2017	28/03/2017	A5112 Hereford Road	349053	310430
ATC 23	14/03/2017	09/04/2017	Meole Brace Park & Ride and Retail Park	349026	310072
ATC 24	14/03/2017	09/04/2017	A5112 Hereford Road	348851	309833
ATC 25	14/03/2017	09/04/2017	A49 Hereford Road	348793	309129
ATC 26	14/03/2017	28/03/2017	A49 Hereford Road	348628	308382
ATC 27	14/03/2017	09/04/2017	A458	352108	309210
ATC 28	15/03/2017	09/04/2017	B4380 Emstrey Bank	352993	310112
ATC 29	15/03/2017	09/04/2017	Thieves Lane	351847	310638
ATC 30	15/03/2017	09/04/2017	A5064 London Road	351784	310839
ATC 31	15/03/2017	09/04/2017	Haycock Way	350489	311930
ATC 32	15/03/2017	09/04/2017	Belvidere Road	351147	312599
ATC 33	14/03/2017	09/04/2017	A5112 Bage Way	350671	312657
ATC 34	15/03/2017	09/04/2017	Bell Lane	350607	312653
ATC 35	14/03/2017	09/04/2017	Monkmoor Road	350271	312678
ATC 36	15/03/2017	09/04/2017	A49	352518	313338

ATC 37	14/03/2017	09/04/2017	B5062 Newport Road	352792	314584
ATC 38	14/03/2017	09/04/2017	B5062 Sundorne Road	352156	314747
ATC 39	14/03/2017	09/04/2017	Featherbed Lane	351927	315064
ATC 40	14/03/2017	09/04/2017	B5062 Sundorne Road	351506	314776
ATC 41	14/03/2017	09/04/2017	A5112 Telford Way	350601	314142
ATC 42	15/03/2017	09/04/2017	A5191 Spring Gardens	350004	313878
ATC 43	14/03/2017	09/04/2017	Mount Pleasant Road	350124	314626
ATC 44	15/03/2017	09/04/2017	B5067 Berwick Road	349607	316623
ATC 45	14/03/2017	09/04/2017	B5067 Berwick Road	348007	314594
ATC 46	15/03/2017	09/04/2017	A528 Ellesmere Road	349518	315200
ATC 47	15/03/2017	09/04/2017	A528 Ellesmere Road	349770	316554
ATC 48	14/03/2017	09/04/2017	Knights Way	349897	316609
ATC 49	21/03/2017	09/04/2017	A428 Shrewsbury Road	349816	317634
ATC 50	14/03/2017	09/04/2017	A5124	350365	316864
ATC 51	14/03/2017	09/04/2017	Battlefield Way	350680	316601
ATC 52	14/03/2017	09/04/2017	A5112 Battlefield Road	351543	316641
ATC 53	14/03/2017	09/04/2017	A49	351861	316396
ATC 54	21/03/2017	09/04/2017	A49 Shrewsbury Road	351738	317712

ATC 55	21/03/2017	09/04/2017	A53	352649	317140
ATC 56	13/03/2017	09/04/2017	A458 Welshpool Road	344858	313494
ATC 57	13/03/2017	09/04/2017	Calcott Lane	344951	313632
ATC 58	13/03/2017	09/04/2017	A458 Welshpool Road	345033	313468
ATC 59	13/03/2017	09/04/2017	A458 Welshpool Road	345558	313306
ATC 60	13/03/2017	09/04/2017	A458 Welshpool Road	345786	313221
ATC 61	13/03/2017	08/04/2017	A458 Welshpool Road	346031	313225
ATC 62	15/03/2017	09/04/2017	A458	351322	310332
ATC 63	15/03/2017	09/04/2017	B4380 Oteley Road	351059	310393
ATC 64	15/03/2017	09/04/2017	A458 Wenlock Road	351217	310629
ATC 65	14/03/2017	09/04/2017	A5112	351262	315800
ATC 66	14/03/2017	09/04/2017	Access to Harlescott Park & Ride	351307	315961
ATC 67	14/03/2017	09/04/2017	Harlescott Lane	350947	315820
ATC 68	20/03/2017	09/04/2017	A458 The Mount	348452	313041
ATC 69	3/05/2017	23/05/2017	B4386 Copthorne Rd	348346	312811
ATC 70	3/05/2017	23/05/2017	A488 New Street	348561	312755
ATC 71	14/03/2017	09/04/2017	A458 Frankwell	348881	312782
ATC 72	14/03/2017	09/04/2017	Claremont Bank	348808	312524

ATC 73	14/03/2017	09/04/2017	Kingsland Bridge	348824	312147
ATC 74	14/03/2017	09/04/2017	Town Walls	349264	312258
ATC 75	14/03/2017	09/04/2017	A5191 English Bridge	349634	312373
ATC 76	14/03/2017	09/04/2017	Abbey Foregate	350073	312385
ATC 77	14/03/2017	09/04/2017	Underdale Road	350074	312700
ATC 78	14/03/2017	09/04/2017	Castle Foregate	349474	313200
ATC 79	14/03/2017	09/04/2017	A528 Chester Street	349240	313242
ATC 80	13/03/2017	09/04/2017	Shepherds Lane	345321	313747
ATC 81	13/03/2017	09/04/2017	Little Oxon Road	345728	313389

Appendix B

WEBTRIS SITE LOCATION

SITE ID	LOCATION	DIRECTION	X	Y
7160/1	A5 at Nesscliffe	SB	337936	319481
7161/1	A5 at Nesscliffe	NB	337921	319473
7291/1	A458 at Cardeston	EB	339001	312438
7291/2	A458 at Cardeston	WB	339001	312433
7292/1	A5 between A458 and B4386	NB	345067	312434
7294/1	A5 between A488 and A49	WB	346739	309876
7034/1	A49 at Longnor	NB	348404	300961
7034/2	A49 at Longnor	SB	348414	300963
7296/1	A5 between A49 and A458	EB	350071	310053
7297/1	A5 between A49 and A458	WB	350710	310094
7298/1	A5 between A49 and B4380	NB	352386	311772
7299/1	A5 between A49 and B4380	SB	352539	311939
7501/1	A5 at Upton Magna	EB	356318	311667
7502/1	A5 at Burcot	WB	361847	310525
7295/1	A5 between A488 and A49/A5112	SB	346206	310250
7293/1	A5 between A458 and B4386	SB	345082	312432
30360920	A5 between B4396 and A458	SB	344727	313651
30360921	A5 between A458 and B4396	NB	344718	313652
30360924	A5 between A458 and A5064	SB	351652	310377
30360925	A5 between A5064 and A458	NB	351651	310363

Appendix B.1

WEBTRIS COUNTS

SITE ID	PROPORTIONS									ADJUSTED WEBTRIS DATA								
	AM PEAK			IP AVERAGE			PM PEAK			AM PEAK			IP AVERAGE			PM PEAK		
	CAR	LGV	HGV	CAR	LGV	HGV	CAR	LGV	HGV	CAR	LGV	HGV	CAR	LGV	HGV	CAR	LGV	HGV
7160/1	100%	68%	32%	100%	60%	40%	100%	71%	29%	845	62	29	571	61	42	730	43	17
7161/1	100%	66%	34%	100%	59%	41%	100%	77%	23%	696	61	32	584	59	41	913	43	13
7291/1	100%	68%	32%	100%	60%	40%	100%	71%	29%	376	25	12	286	28	19	346	22	9
7291/2	100%	66%	34%	100%	59%	41%	100%	77%	23%	294	33	17	293	26	18	494	18	5
7292/1	100%	66%	34%	100%	59%	41%	100%	77%	23%	982	101	52	834	86	60	1325	63	19
7294/1	100%	66%	34%	100%	59%	41%	100%	77%	23%	1565	113	59	1162	96	67	1971	71	21
7034/111	100%	59%	41%	100%	54%	46%	100%	81%	19%	473	37	26	368	32	27	527	28	7
7034/21	100%	61%	39%	100%	58%	42%	100%	76%	24%	505	37	24	364	40	29	506	33	11
7296/1	100%	68%	32%	100%	60%	40%	100%	71%	29%	1887	105	50	1161	116	79	1460	75	30
7297/1	100%	66%	34%	100%	59%	41%	100%	77%	23%	1507	136	70	1188	107	74	2120	69	21
7298/1	100%	68%	32%	100%	60%	40%	100%	71%	29%	1809	84	40	1202	96	65	1651	60	24
7299/1	100%	66%	34%	100%	59%	41%	100%	77%	23%	1652	130	68	1169	102	71	2022	65	19
7501/1	100%	68%	32%	100%	60%	40%	100%	71%	29%	1818	77	36	1104	85	58	1567	49	20
7502/1	100%	66%	34%	100%	59%	41%	100%	77%	23%	1708	112	58	1080	83	58	2032	51	15
7295/122	80%	13%	6%	71%	17%	12%	82%	13%	5%	1521	253	119	886	218	148	1203	183	73
7293/1	100%	68%	32%	100%	60%	40%	100%	71%	29%	1160	83	39	805	89	61	1005	65	26
30360920	100%	68%	32%	100%	60%	40%	100%	71%	29%	855	74	35	573	67	45	684	51	20

[1] MCC proportions were applied on vehicles >6.6m to get LGV and HGV split.

[2] *MCC proportions were applied on vehicles >6.6m to get LGV and HGV split.*

30360921	100%	66%	34%	100%	59%	41%	100%	77%	23%	682	70	36	606	65	45	962	49	15
30360924	100%	68%	32%	100%	60%	40%	100%	71%	29%	1314	101	48	949	108	74	1127	71	29

Appendix C

MCC COUNT LOCATIONS

ID	JUNCTION NAME	TYPE	NO. OF ARMS 3	X	Y
MCC 01	Felton Butler Roundabout	Roundabout	2	340722	317122
MCC 02	A5 / B4380 Holyhead Road	Priority	3	342455	315757
MCC 03	Montford Bridge/ B4380	Priority	2	342897	315236
MCC 04	A458 / B4473	Priority	3	343159	313444
MCC 05	Woodcote Roundabout	Roundabout	4	345346	311986
MCC 06	A5 / A488 Hanwood Road	Roundabout	4	345857	310595
MCC 07	B4380 Shelton Road / B4386 Mytton Oak Road	Roundabout	4	347382	312548
MCC 08	B4380 Shelton Road / A488 Radbrook Road	Roundabout	4	347835	312263
MCC 09	B4380 Roman Road / Longden Road	Roundabout	4	348388	311257
MCC 10	A5191 Hereford Road / B4380 Roman Road	Signal	3	349033	310780
MCC 11	Meole Brace Roundabout	Roundabout	5	349109	310646
MCC 12	Bayston Hill Roundabout	Roundabout	5	348799	309690
MCC 13	B4380 Oteley Road / Sutton Road	Priority	3	350332	310344
MCC 14	Emstrey Island	Roundabout	5	352083	310729
MCC 15	A5112 Bage Way / A458 Old Potts Way	Roundabout	4	350324	311869
MCC 16	A458 Wenlock Road / A5064 London Road / Haycock Way	Roundabout	5	350642	312028
MCC 17	Preston Island	Roundabout	3	352821	312246
MCC 18	A5 (East of A49 Junction)	N/A	2	353392	312174
MCC 19	A5112 Telford Way / Woodcote Way / Oswell Road	Roundabout	5	350751	313897
MCC 20	A49 / B5062 Sundorne Road	Roundabout	4	352234	314743
MCC 21	A5191 Ditherington Road / Mount Pleasant Road	Signal	3	350273	314416
MCC 22	Heathgates Roundabout	Roundabout	4	350407	314575

[3] Total number of arms surveyed for this study

MCC 23	Mount Pleasant Road / Lancaster Road	Roundabout	4	349934	314930
MCC 25	Harlescott Lane / Battlefield Way	Priority	3	350422	316293
MCC 26	Battlefield Roundabout	Roundabout	5	351631	316779
MCC 27	Enterprise Roundabout	Roundabout	4	350726	316749
MCC 28	A528 Ellesmere Road / A5124	Roundabout	5	349779	316645
MCC 29	A528 Ellesmere Road / Mount Pleasant Road	Priority	3	349712	315757
MCC 30	Churncote Roundabout	Roundabout	4	344768	313503
MCC 31	A458 Welshpool Road / Calcott Lane	Priority	3	344937	313482
MCC 32	A458 Welshpool Road / Gains Park Way	Priority	3	345128	313442
MCC 33	A458 Welshpool Road / Shepherd's Lane	Priority	3	345412	313348
MCC 34	A458 Welshpool Road / Little Oxon Lane	Priority	3	345664	313263
MCC 35	A458 Welshpool Road Racecourse Lane	Priority	3	345840	313186
MCC 36	A458 Welshpool Road / Clayton Way	Roundabout	4	346120	313259
MCC 37	A458 Welshpool Road / B380 Holyhead Road	Signal	4	346570	313252
MCC 38	B4380 Shelton Road / A458 The Mount	Signal	3	346779	313176
MCC 39	A458 / A5 Westbound On-slip	On slip	2	351430	310193
MCC 40	A458 / A5 Eastbound Off-slip	Off slip	2	351354	310294
MCC 41	A458 Wenlock Road / B4380 Oteley Road	Roundabout	4	351270	310419
MCC 42	Harlescott Lane / Lancaster Road	Priority	3	350745	315937
MCC 43	Harlescott Lane / Brixton Way	Mini Roundabout	4	350828	315870
MCC 44	A5112 Whitchurch Road / Harlescott Lane	Signal	4	351178	315665
MCC 45	Frankwell	Roundabout	4	348690	312925
MCC 46	A458 Mardol Quay / A5191 Bridge Street	Signal	3	348899	312724
MCC 47	A5191 Bridge Street / Lower Claremont Bank	Signal	4	348899	312673

MCC 48	A458 Mardol Quay / Mardol	Priority	2	348966	312724
MCC 49	A458 Smithfield Road / Roushill	Yellow Box Priority	3	349075	312774
MCC 50	A5191 Bellstone / St John's Hill	Priority	3	348983	312447
MCC 51	Swan Hill / College Hill	Uncontrolled	3	349045	312401
MCC 52	Princess St / Market Street	Uncontrolled	2	349122	312442
MCC 53	Town Walls / Swan Hill / Murivance	Priority	4	348924	312280
MCC 54	Town Walls / Belmont / Crescent Lane	Priority	2	349062	312217
MCC 55	Milk St / Princess St	Priority	3	349228	312355
MCC 56	A5191 Wyle Cop / A5191 Dogpole	Signals	3	349335	312372
MCC 57	A5191 Wyle Cop / Beeches Lane	Uncontrolled	2	349435	312305
MCC 58	A458 Old Potts Way Gyratory	Gyratory		349704	312372
MCC 59	Abbey Foregate / Monkmoor Road	Signal	3	350114	312363
MCC 60	A458 Smithfield Road / Raven Meadows	Signal	3	349259	312891
MCC 61	A528 Chester Street / A5191 Castle Foregate	Gyratory		349385	313000
MCC 62	A5191 Castle Foregate / Newpark Road	Priority	3	349519	313277
MCC 63	A528 Ellesmere Road / B5067 Berwick Road	Signal	3	349226	313428
MCC 64	A5112 Hereford Way / Meole Brace Retail Park	Roundabout	3	348958	310210

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