

FINAL

Evesham Transport Model – Report of Surveys

Prepared for

Worcestershire County Council

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Document History

Evesham Transport Model

Report of Surveys

Worcestershire County Council

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Introduction

1.1 Introduction

1.1.1 Study Overview

CH2M (now Jacobs) has been commissioned by Worcestershire County Council (WCC) to undertake traffic surveys to support the development of Evesham Transport Model. The purpose of the model development is to provide an up to date tool to test the ability of the future transport infrastructure proposals to support the demand for travel in a number of development scenarios.

Sub consultants, NDC and Tracsis, were chosen through a bidding process to cover both highways surveys and car park surveys required, respectively. The surveys were undertaken in June 2016.

This report provides details of the various surveys carried out and the data collected.

1.1.2 Highways Survey

A critical element of the highway model update is associated with the production of revised private vehicle matrices. In order to develop these matrices and provide data for model validation, a significant programme of traffic surveys was carried out in June 2016. The following types of highway surveys were undertaken;

- Roadside Interview Survey (RSI);
- Automatic Traffic Count (ATC);
- Manual Classified Count (MCC); and
- Car Park surveys.

No Journey Time Surveys were carried out as this information was extracted from Trafficmaster Data.

1.1.3 Report Structure

Chapter 2 to chapter 5 describe highway surveys and chapter 6 draws an overall conclusion.

Roadside Interview Survey (RSI)

2.1 Location and dates of survey

RSI surveys were undertaken for 12-hrs (07:00-19:00) at 9 sites in Evesham in June 2016. Table 1 and Figure 1 show the detailed location of RSI surveys. The model specification report identified 10 sites including one on the A46 Evesham Bypass between its junction with A44 Broadway Road and B4035 Badsey Road. This site was however cancelled due to absence of any suitable survey location following site visits.

RSI Survey Sites						
S. No	Road	Location	Interview Direction	Easting	Northing	Date
1	A44	A44 - Evesham Rd	WB	398962	247223	Wed 29 June
2	Lenchwick Road	South of Lenchwick Between Chadbury Rd & A44	SB	403732	246156	Tue 28 June
3	B4088	B4088 - Evesham Rd	SB	403924	246452	Tue 28 June
4	A46	A46 North of Evesham	SB	404134	246195	Tue 28 June
5	B4510 - Offenham Rd	B4510 - Offenham Rd junction	SB	405270	244108	Thurs 30 June
6	Badsey Rd	B4035 - Badsey Rd	WB	405512	243795	Thurs 30 June
8	A44 -Broadway Rd	Broadway Rd layby East of Broadway Rd/ A46 roundabout	EB	405583	242288	Thurs 30 June
9	A46 - Cheltenham Rd	Cheltenham Rd layby south of the A46/ Cheltenham Rd roundabout	NB	403223	241535	Wed 29 June
10	B4084	Crothorne, Between Brook Lane & Smokey Lane	EB	399819	244176	Wed 29 June

Note1: (SB – Southbound, NB – Northbound, WB –Westbound, EB – Eastbound)

Table 1: RSI sites and survey direction

To conduct the RSI surveys face to face interviews and where required traditional postcard survey methods were used. These responses were then collaborated by the sub consultant to include in the survey data analysis. RSI questionnaire is attached in Appendix A1.

RSI Interviews Obtained					
S. No	Road	Location	Interview Total	MCC	Sample
1	A44	A44 - Evesham Rd	1029	5736	17.9%
2	Lenchwick Road	South of Lenchwick Between Chadbury Rd & A44	586	754	77.7%
3	B4088	B4088 - Evesham Rd	878	2821	31.1%
4	A46	A46 North of Evesham	2099	8653	24.3%
5	B4510 - Offenham Rd	B4510 - Offenham Rd junction	1212	3383	35.8%
6	Badsey Rd	B4035 - Badsey Rd	1325	5364	24.7%
8	A44 -Broadway Rd	Broadway Rd layby East of Broadway Rd/ A46 roundabout	1322	5660	23.4%
9	A46 - Cheltenham Rd	Cheltenham Rd layby south of the A46/ Cheltenham Rd roundabout	1363	8329	16.4%
10	B4084	Crothorne, Between Brook Lane & Smokey Lane	828	3219	25.7%
TOTAL			10642	43919	24.2%

Table 2: RSI sample obtained

At sites 4 and 6, due to site conditions, only postcard surveys were conducted. The remaining sites were surveyed by road side interview method. The postcards sample return rate for these 2 sites was approximately 28%.

Postcards Issued & Returned					
S. No	Road	Day/ Date	Postcards		
			Issued	Returned	Sample
4	A46	Tue 28/06/16	7500	2099	28.0%
6	Badsey Rd	Thu 30/06/16	4623	1325	28.7%
TOTAL			12123	3424	28.2%

Table 3: Postcards sample return rate

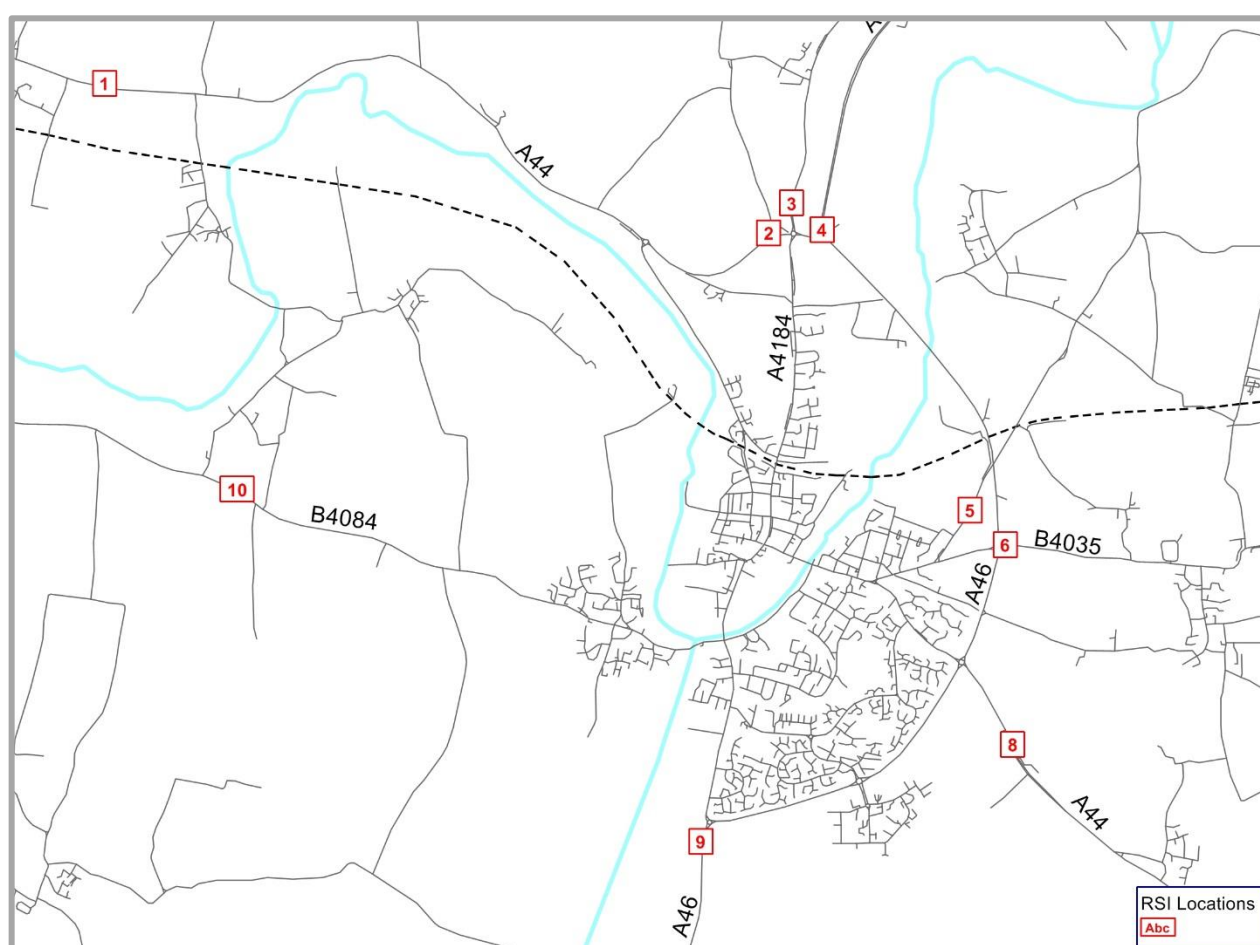


Figure 1: RSI survey location

2.2 Data Cleaning/Checking

The RSI data cleaning and checking process was carried out by CH2M to ensure that the data sets are suitable to use for developing trip matrices. The checks made are as follows:

- **Range checks** - these ensure that the answers to the questions lie within the ranges given for each response (e.g. vehicle types lie within the response range for this question, or that the times are coded between 0700 and 1900);

Characteristics

- **Postcode checks** - to ensure that the postcodes given on the survey forms are legitimate. Firstly the sub-contracted survey companies, who carried out the RSI, did a series of postcode validation checks before passing on the data to CH2M. Secondly, CH2M carried out another postcode check using a national database of postcodes in VISUM[®] and any that did not correspond were checked using an internet database. Any postcodes that could not be matched to either data set were deemed as invalid;
- **OS grid references** - having identified the postcodes, VISUM was used to allocate grid references to the origin and destination fields. This assisted in some of the later checks;
- **Logic checks** - these check that movements captured during the survey are logical, for example, the origin and destination for a journey cannot both be home and have the same postcode, HGV's cannot have Home as neither origin or destination, Education trips between 10am and 1pm were also verified for all RSI's. Those which didn't comply with these checks, were removed and considered illogical.
- **Movement checks**- this check is to ensure that journeys are plausible through a site.
- **Data completeness** - Each of the sites was examined to check that data was available for the three time periods required for the study.

Figure 2 and Figure 3 show the plots for all the origins and destinations of trips recorded during surveys, after all the data cleaning.

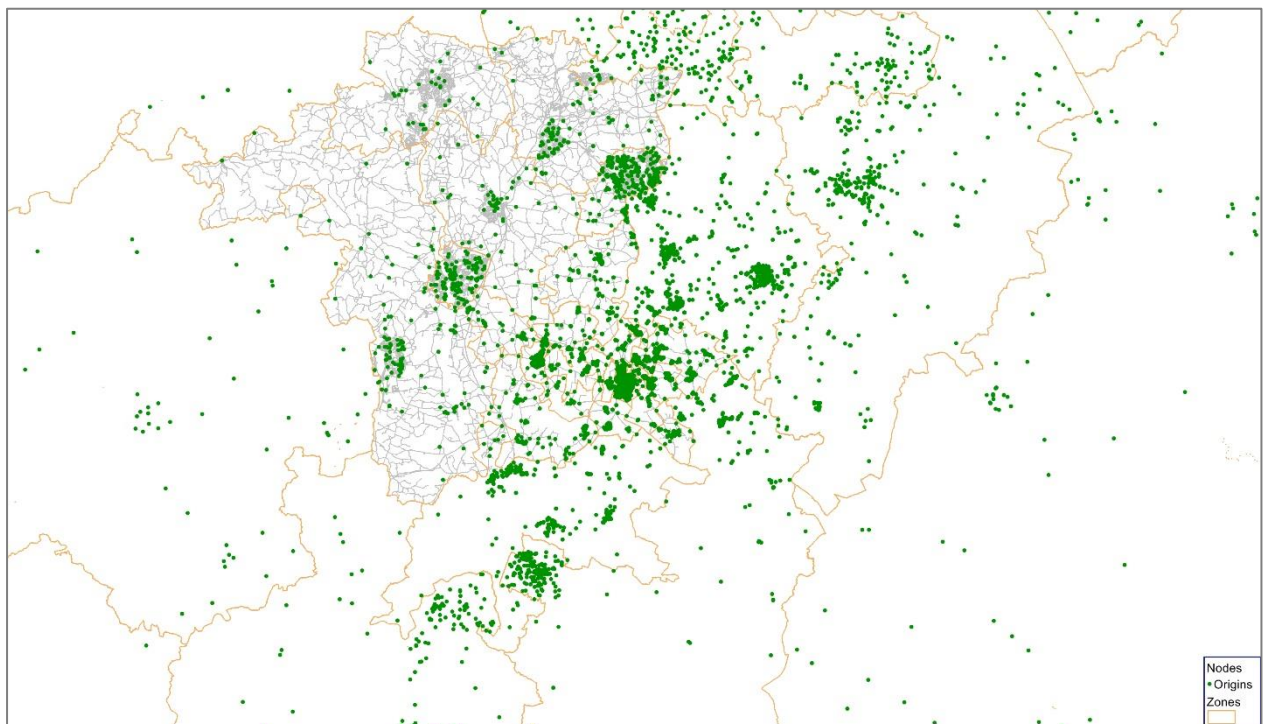


Figure 2: Origin plots for all sites.

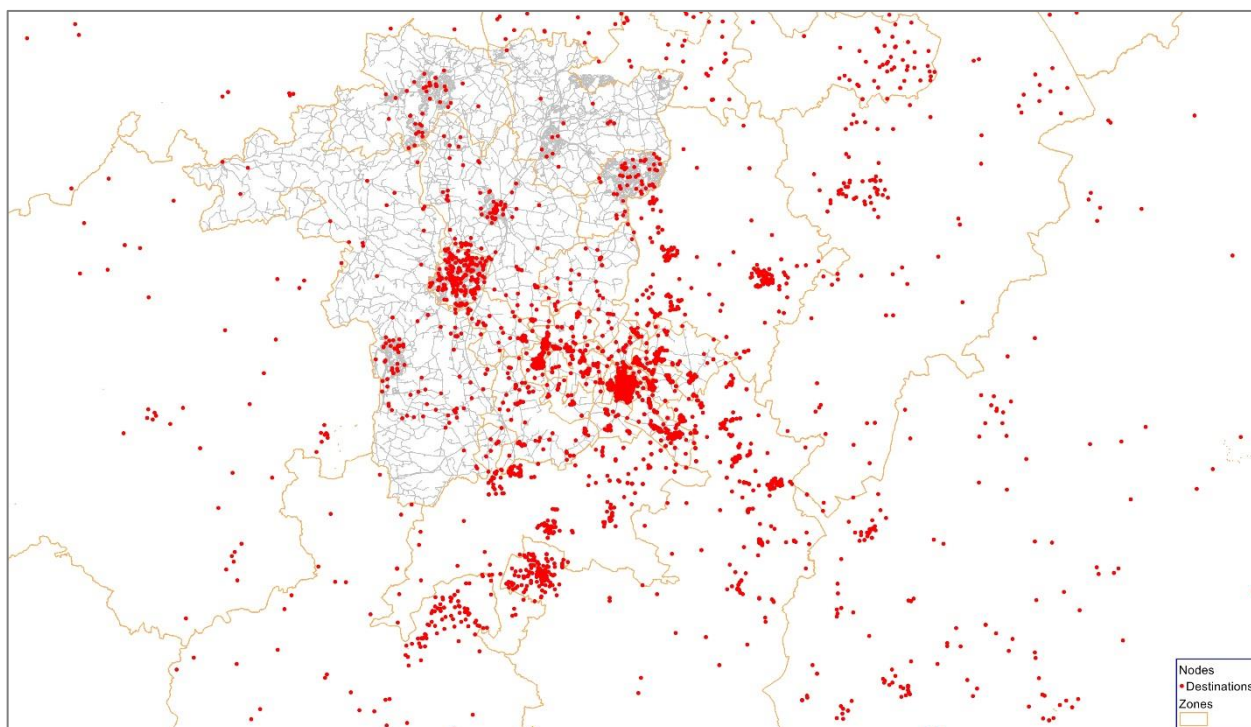


Figure 3: Destination plots for all sites.

Table 4 shows the logical, illogical and refused interviews including their percentages.

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 8	Site 9	Site 10
Logical Journeys	909	484	751	1940	1127	1143	1108	1130	725
Illogical Journeys	17	30	52	56	33	97	57	98	31
Incomplete/ Refused Interviews	103	72	75	103	52	85	157	134	72
	<i>Percentage (%)</i>								
Logical Journeys	88%	83%	86%	92%	93%	86%	84%	83%	88%
Illogical Journeys	2%	5%	6%	3%	3%	7%	4%	7%	4%
Incomplete/ Refused Interviews	10%	12%	9%	5%	4%	6%	12%	10%	9%

Table 4: Logical journeys from RSI sites

2.3 Sample Rate

The Highways Agency: “Design Manual for Roads and Bridges” (DMRB) Volume 5, Section 1, Part 4, ‘Traffic surveys by Roadside Interview’ Annex 8 contains advice on the sample size required to give results to the level of accuracy needed. The equation used to calculate the sample size required is as follows:

$$q = \frac{P(1-P)Q^3}{(E/1.96)^2(Q-1) + P(1-P)Q^2}$$

Where:

q = Sample size

P = Proportion of vehicles with a particular attribute

Q = Total traffic flow

E = Level of accuracy (expressed as a no. of vehicles)

This formula has been used to calculate the target sample rates for RSI sites.

Table 5 shows the comparison between the total traffic captured at each RSI site for 12 hour period and number of vehicles surveyed. The table also shows the required sample rate for each RSI sites with an accuracy level of +/- 2.5% and assumes 40% of trips have an origin or destination within Evesham.

RSI Surveys Sites			Sample Rate achieved					
Sl.No	Road	Traffic Count 0700 - 1900	MCC traffic count at accuracy level	Target No. of surveys	Target Sample rate (%)	Actual number of logical surveys	Actual sample rate	Diff
RSI 1	A44	5736	143	1174	20%	909	16%	5%
RSI 2	Lenchwick Road	754	19	499	66%	484	64%	2%
RSI 3	B4088	2821	71	969	34%	751	27%	8%
RSI 4	A46	8653	216	1260	15%	1940	22%	-8%
RSI 5	B4510 - Offenham Rd	3383	85	1027	30%	1127	33%	-3%
RSI 6	Badsey Rd	5364	134	1157	22%	1143	21%	0%
RSI 8	A44 -Broadway Rd	5660	142	1170	21%	1108	20%	1%
RSI 9	A46 - Cheltenham Rd	8329	208	1253	15%	1130	14%	1%
RSI 10	B4084	3219	80	1012	31%	725	23%	9%

Table 5: RSI sites with survey sample rate

Almost all RSI sites failed to achieve target number of surveys. RSI site 10 has the highest difference between actual and target survey (10%). RSI site 8 and 9 both have a difference of 1% to satisfy target number of survey whereas RSI site 1, 2 and 3 have differences of 5%, 2% and 8% respectively compared to actual number of surveys. RSI site 4 and 5 captured maximum number of traffic over 8% and 3% correspondingly whereas RSI site 6 was the only one achieving the target number of surveys.

As the actual sample achieved is mostly less than the target sample, the level of accuracy would reduce to 3% at 95% confidence interval. This indicates the strength of data as representative of the population would slight reduce compared to results had the target sample been achieved, but is considered a robust sample. Its implications on models developed on this data, such as matrices, will give more weightage to observed movements. Where synthetic matrices are developed and/or matrix estimation processes used, the impacts of the reduced sample rates are likely to be negligible.

Table 6 illustrates RSI site's traffic sample rate for AM, IP and PM peak hours for cars, LGVs and HGVs. The sample rate for cars range from 13% to 67% during the various peak hours. Due to the low volume of traffic at RSI site 2, the sample rate varies between 49% and 67% in the various peaks. The sample rate for car at the other sites vary between 13% and 36%; for LGVs between 8% and 40% and for HGVs between 0% and 33%. Sites 2,3 and 10 had very low HGVs (less than 5 vehicles) during the peak leading to no sample captured.

S.No	Site	Traffic Count			Actual number of logical surveys			Actual sample rate		
		Car	LGV	HGV	Car	LGV	HGV	Car	LGV	HGV
AM (08:00 - 09:00)										
RSI 1	A44	412	64	45	71	6	5	17%	9%	11%
RSI 2	Un-Named Road	61	3	19	41	2	16	67%	67%	84%
RSI 3	B4088	280	29	11	55	7	1	20%	24%	9%
RSI 4	A46	596	129	91	175	16	8	29%	12%	9%
RSI 5	B4510 - Offenham Rd	288	46	17	99	11	2	34%	24%	12%
RSI 6	Badsey Rd	411	60	44	139	7	3	34%	12%	7%
RSI 8	A44 -Broadway Rd	417	111	29	92	25	6	22%	23%	21%
RSI 9	A46 - Cheltenham Rd	784	140	66	102	13	9	13%	9%	14%
RSI 10	B4084	330	59	20	60	6	1	18%	10%	5%
Average hour IP (10:00 - 16:00)										
RSI 1	A44	320	73	46	54	10	3	17%	14%	7%
RSI 2	Un-Named Road	41	8	16	24	5	15	58%	65%	93%
RSI 3	B4088	179	27	9	50	7	1	28%	25%	11%
RSI 4	A46	437	97	79	115	10	7	26%	10%	9%
RSI 5	B4510 - Offenham Rd	223	28	18	81	11	3	36%	40%	17%
RSI 6	Badsey Rd	319	52	45	80	7	3	25%	13%	6%
RSI 8	A44 -Broadway Rd	361	60	21	88	11	3	24%	18%	12%
RSI 9	A46 - Cheltenham Rd	427	91	70	67	13	10	16%	14%	14%
RSI 10	B4084	187	39	14	46	7	1	25%	17%	10%
PM (17:00 - 18:00)										
RSI 1	A44	559	70	34	85	13	2	15%	19%	6%
RSI 2	Un-Named Road	43	3	1	21	0	0	49%	0%	0%
RSI 3	B4088	239	27	4	48	6	0	20%	22%	0%
RSI 4	A46	791	108	47	240	9	3	30%	8%	6%
RSI 5	B4510 - Offenham Rd	273	35	3	81	7	1	30%	20%	33%
RSI 6	Badsey Rd	372	49	16	72	7	1	19%	14%	6%
RSI 8	A44 -Broadway Rd	428	29	10	96	7	2	22%	24%	20%
RSI 9	A46 - Cheltenham Rd	739	111	50	120	11	0	16%	10%	0%
RSI 10	B4084	281	18	0	57	5	0	20%	28%	0%

Table 6: RSI sample rate for AM, IP and PM peak

2.4 RSI data analysis

The following section focuses on survey data captured at RSI sites. Table 7 **Error! Reference source not found.** show the occupancy level for Car, LGV and HGV separately, for each site and all sites combined. The average occupancy for each sites is also presented. For all sites, single occupancy vehicles have the maximum representation of all user classes available. Average occupancy, for all sites, for Car is 1.38, LGV is 1.12 and HGV is 1.07.

Avg Occupancy by Mode	Car	LGV	HGV	Average Occupancy
RSI Site 1	1.30	1.27	1.05	1.21
RSI Site 2	1.34	1.26	1.01	1.20
RSI Site 3	1.44	1.19	1.10	1.24
RSI Site 4	1.35	1.11	1.02	1.16
RSI Site 5	1.37	1.16	1.16	1.23
RSI Site 6	1.41	1.16	1.00	1.19
RSI Site 8	1.48	1.29	1.10	1.29
RSI Site 9	1.32	1.17	1.16	1.22
RSI Site 10	1.41	1.14	1.13	1.23
All Sites combined	1.38	1.19	1.07	1.21

Table 7: Average vehicle occupancy by mode, by site.

Table 8 shows the average trip length (miles) made for each purpose by mode for all RSI sites.

Purpose/ Mode (miles)	Car/Taxi	Light goods vehicle	OGV1 (Rigid, 2-3 axles)	OGV2 (Articulated, 3+ axles)	Motorcycles	Other (specify)
Business	31.86	23.20	31.30	35.70	28.32	11.41
Commute	16.02	18.81	8.81	0.00	9.07	0.00
Other	17.73	16.61	18.70	24.11	9.66	67.29

Table 8: Average trip length (miles) by purpose and mode – All Sites combined

Table 9 shows the average trip length in ‘miles’ and the percentages of trips of each purpose. They show that commute and other purpose trip lengths to be similar at around 17 miles whilst business trips have an average trip length of 30 miles. Over the survey duration, ‘other’ purpose trips have a 48% share of all purposes.

Purpose	Distance (miles)	Trips (%)
Business	30.00	23%
Commute	16.21	29%
Other	17.73	48%

Table 9: Average trip length by purpose - All Sites Combined

Figure 4 illustrates the trip length distribution of vehicles across all RSI sites. It shows the highest percentages (16%) of trips have trip lengths between 10 and 15 miles.

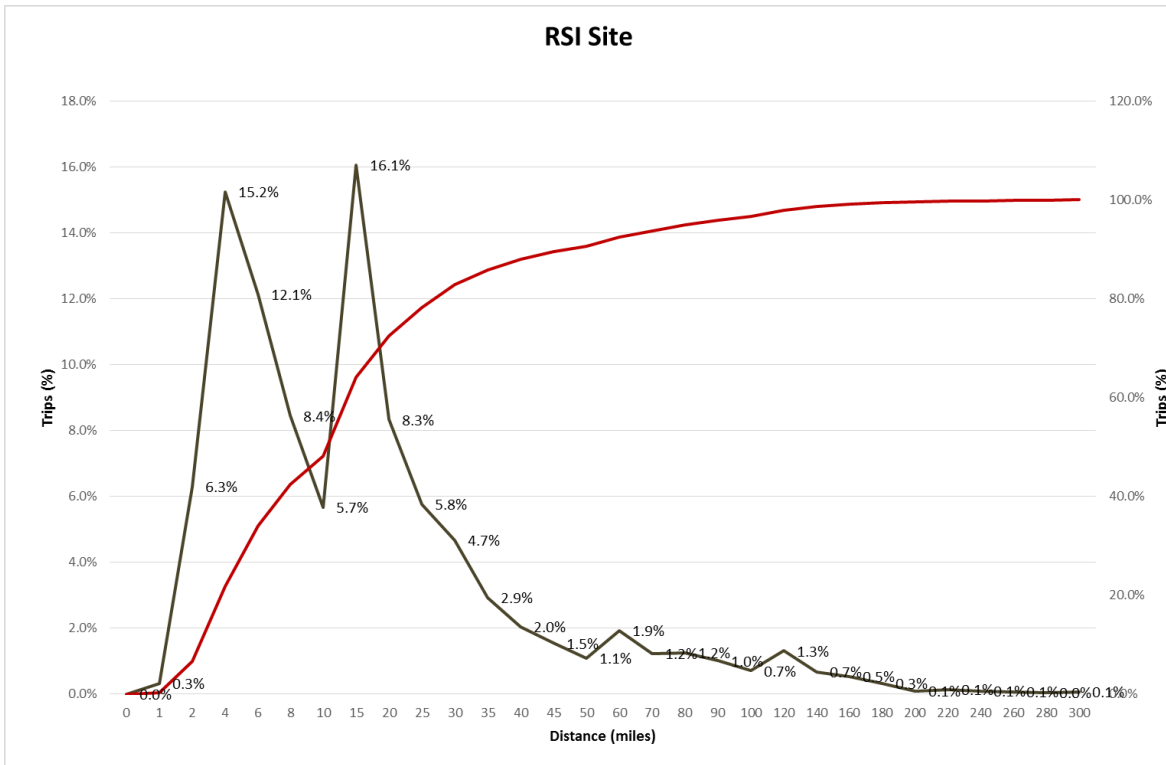


Figure 4: Average trip length and cumulative frequency distribution.

Due to dispersed settlement patterns around Evesham, the distribution shows two peaks, one peak representing the shorter distances from/to closer towns such as Pershore, Bidford-on-Avon, Sedgebarrow etc. This is followed by a trough in the distribution representing the countryside beyond these towns before another peak showing interactions with towns and cities slightly farther away such as Worcester, Stratford-upon-Avon, Cheltenham (10-15 miles).

2.5 Traffic condition and weather during survey

During the survey period traffic conditions in Evesham, in general, maintained a satisfactory level across all sites. Every care was taken to minimise the interruption to the regular traffic. There was heavy rain throughout the day on Tuesday 28th & Wednesday 29th June which caused some suspensions. Thursday 30th was dry throughout.

Due to heavy rain interviews at sites 1, 2, 3, 4 and 10 were suspended for short periods of time during the afternoon. Health and safety decisions were made by the Police along with the survey supervisor at each site as to whether surveys should continue or not. Despite interruptions due to heavy rain overall sample rate achieved was satisfactory.

On sites 5 and 6 there were several short suspensions in the AM period, to clear queuing traffic which was tailing back several hundred meters

Table 10 shows the sub consultant's comments on all incidences that occurred during RSI.

RSI Notes	
S. No	Sub consultant's comments
1	Interviewing commenced on time, rain was light at the start of the survey. Interviews were suspended from 13:15 to 13:30 due to heavy rain. There were no other disruptions at this site.
2	The start of interviewing was delayed until 07:30 due to the late arrival of the Police. There were a significant number of repeat OGV2 trips through this site from the adjacent Twyford Golf Club to and from the old BBC Wood Norton site. A large amount of landfill material is being delivered to the site over an eight-week period; and as a result the OGV trips through this site are skewed. In addition, none of the OGV's will be counted by the ATC north of the site as all trips were originating and terminating south of the counter. Interviews were suspended from 14:00 to 14:30 due to heavy rain.
3	Interviewing was suspended from 14:20 to 14:50 and 17:25 to 17:35 due to heavy rain. There were no other disruptions at this site.
4	There was a slight delay to the start of interviewing as the Police Officer did not arrive until 07:05. The site was suspended due to heavy rain between 14:20 and 14:45. Outside of these periods the site operated without incident.
5	There were significant queues through this site and it was agreed with the Police Officer that traffic would be allowed to flow freely any time the queue reached the A46 overbridge. This was predominantly a problem in the a.m. peak period southbound into Evesham. There was a short delay at 13:00 when an OGV1 tried to jump the queue by driving on the wrong side of the road.
6	There were several short suspensions between 09:35 and 10:20 to clear queuing traffic which was tailing back several hundred meters. The site ran freely for the remainder of the survey day.
8	This site operated without incident for the duration of the survey.
9	Despite almost continuous rain throughout the day the site managed to operate without any weather-related suspensions. There were no incidents or disruptions at this site and traffic ran freely.
10	Interviews were suspended from 12:40 to 13:00 due to heavy rain; there were no other survey suspensions. At 15:00 there was a near-miss for the Police Officer when a vehicle failed to stop. The vehicles information was radioed in to the Control Centre.

Table 10: Sub consultant's comments on the occurrences during RSI.

Automatic Traffic Count (ATC)

3.1 Location and date of counters

Automatic traffic counts (ATC) were undertaken by the sub-consultant collecting traffic flow data around Evesham at numerous sites that included all of the RSI sites (34 locations in total).

ATC data was collected over a three-week period during June and July 2016 (term time). At RSI sites too, ATC data was also collected for three weeks.

Table 11 shows ATC survey dates and locations for all of the ATC sites, including RSI. All ATC sites are shown in Figure 5 (excluding RSI).

Details of the ATC data for each site is available in Appendix B.

Sl. No	Location/Name	Easting	Northing	Week One		Week Two		Week Three		Week Four	
				Start Date	End Date	Start Date	End Date	Start Date	End Date	Start Date	End Date
11	Briars Close	402873	245850	06-Jun	-	-	-	-	26-Jun	-	-
12	Fladbury Bridge	402646	246227	04-Jun	10-Jun	16-Jun	-	-	29-Jun	-	-
13	A46	403967	243696	06-Jun	-	-	-	-	26-Jun	-	-
14	A46	403048	243013	06-Jun	12-Jun	16-Jun	-	-	29-Jun	-	-
15	A44	404627	243467	06-Jun	-	-	-	-	26-Jun	-	-
16	Station Road	403368	242289	06-Jun	-	-	-	-	26-Jun	-	-
17	A46	403529	244709	06-Jun	-	-	-	-	26-Jun	-	-
18	Evesham Road	403927	245019	06-Jun	-	-	-	-	26-Jun	-	-
19	Boston Lane	403786	244413	06-Jun	-	-	-	-	26-Jun	-	-
20	Pershore Road	403548	244517	06-Jun	-	-	-	-	26-Jun	-	-
21	Millenium Way	399978	245606	06-Jun	-	-	-	-	26-Jun	-	-
22	Falkland Road	403482	241734	06-Jun	-	-	-	-	26-Jun	-	-
23	Hawthorn Road	404772	242284	07-Jun	-	-	-	-	27-Jun	-	-
24	Abbey Road	404012	246132	04-Jun	11-Jun	17-Jun	-	-	29-Jun	-	-
25	High Street	399455	246721	06-Jun	-	-	-	-	26-Jun	-	-
26	Badsey Lane	405352	244718	03-Jun	07-Jun	12-Jun	-	-	27-Jun	-	-
27	A44 Evesham Road	405616	244741	06-Jun	-	-	-	-	26-Jun	-	-
28	Evesham Road - South of Lenchwick	401251	244747	06-Jun	-	-	-	-	26-Jun	-	-
29	B4088	401771	243492	06-Jun	-	-	-	-	26-Jun	-	-
30	A46 - South of Harvington	404459	241922	06-Jun	-	-	-	-	26-Jun	-	-
31	B4510	404744	242626	06-Jun	-	-	-	-	26-Jun	-	-
32	B4035	404778	242937	06-Jun	-	-	-	-	26-Jun	-	-
33	A44 Broadway Road	403501	243546	06-Jun	-	-	-	-	26-Jun	-	-
34	A46 Cheltenham Road	403748	244156	17-Jun	-	-	-	-	07-Jul	-	-
35	B4084	405470	243247	06-Jun	-	-	-	-	26-Jun	-	-
RSI 1	B4624 Worcester Road	398853	247232	04-Jun	10-Jun	11-Jun	17-Jun	18-Jun	24-Jun	25-Jun	28-Jun
RSI 2	A44	403748	246252	-	-	11-Jun	17-Jun	18-Jun	24-Jun	25-Jun	01-Jul
RSI 3	Bridge St	403902	246362	04-Jun	10-Jun	11-Jun	17-Jun	18-Jun	24-Jun	25-Jun	01-Jul
RSI 4	Pershore Road	408016	250988	07-Jun	13-Jun	14-Jun	20-Jun	21-Jun	27-Jun	28-Jun	04-Jul
RSI 5	Broadway Road	405509	242422	04-Jun	10-Jun	11-Jun	17-Jun	18-Jun	24-Jun	25-Jun	01-Jul
RSI 6	Cheltenham Road	403233	241558	03-Jun	09-Jun	10-Jun	16-Jun	17-Jun	23-Jun	24-Jun	30-Jun
RSI 8	B4624 Worcester Road	405266	244097	03-Jun	09-Jun	10-Jun	16-Jun	17-Jun	23-Jun	-	-
RSI 9	Greenhill	405539	243811	04-Jun	10-Jun	11-Jun	17-Jun	18-Jun	24-Jun	25-Jun	01-Jul
RSI 10	High Street	399703	244235	04-Jun	10-Jun	11-Jun	17-Jun	18-Jun	24-Jun	25-Jun	01-Jul

Table 11: ATC site locations and survey date – WCC ATC loops

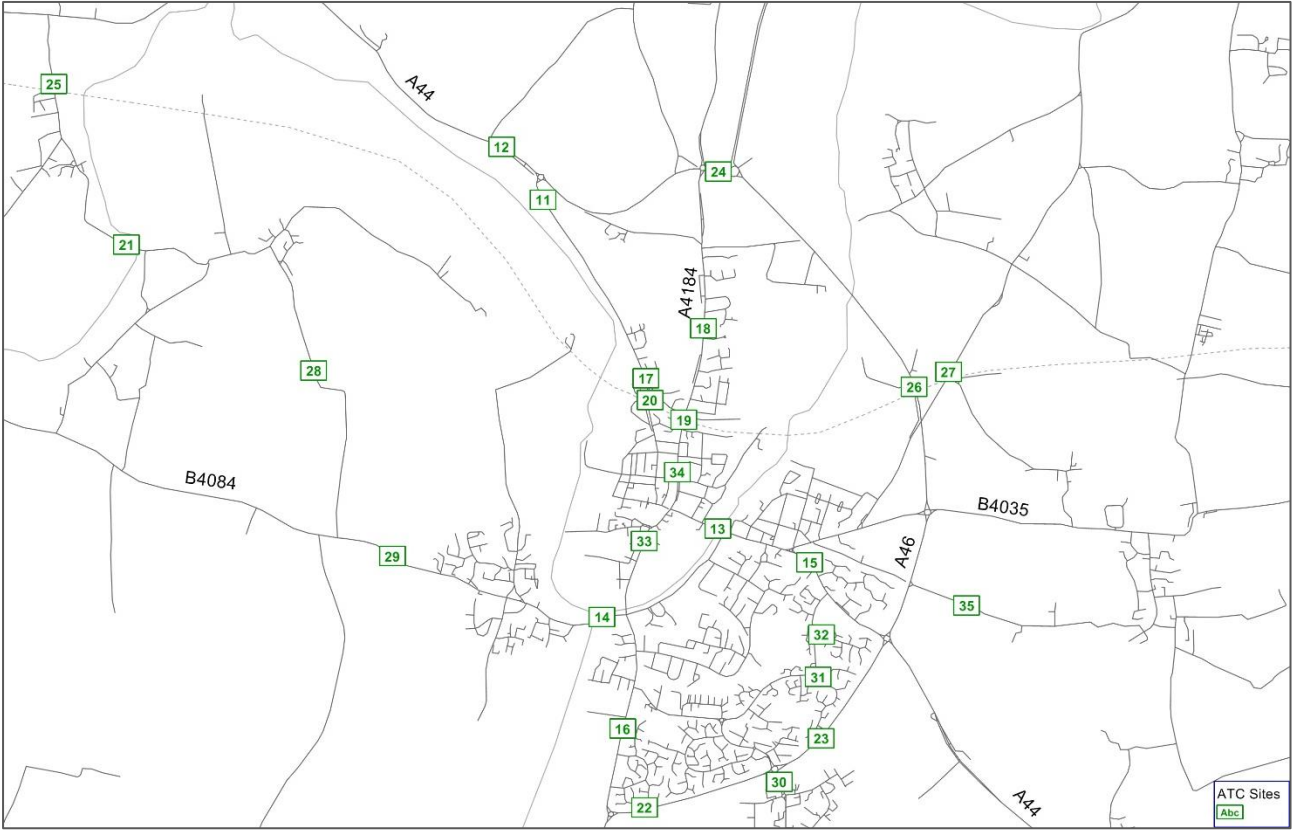


Figure 5: All ATC sites

3.2 Data checks

All ATC sites data were checked for the following criteria before data analysis;

- Location
- Days covered including valid days (i.e. excluding school holidays)
- Missing data (e.g. tube failure, storage full, poor data)
- Time period available
- Vehicle types
- Directional split
- Consistency in daily traffic profile
- Unusual incidents (e.g. any incidents)

3.3 Data Analysis and variability

Table 12 shows the peak hour two ways flows for LV (Car+LGV) and HGV at various ATC locations. ATC data cannot differentiate cars from LGVs and therefore data provided was based reported only for light vehicles and heavy vehicles.

This analysis will be used to determine the peak hour that the Evesham Transport Model will be developed for. Out of 34 sites 31 sites (91%) have peak flow between 08:00 and 09:00 during AM period. Only 2 sites (6%) shows peak flow between 09:00 and 10:00 whereas 1 site (3%) between 07:00 and 08:00. In the PM the peak flow is more spread than AM. 23 sites out of 34 (68%) have peak flow between 17:00 to 18:00 whereas 11 sites (32%) have peak flow between 16:00 and 17:00.

Following the analysis, for modelling purposes, the model will comprise an AM peak from 08:00 to 09:00, an average hour of 10:00 to 16:00 for inter peak model and from 17:00 to 18:00 for PM peak model.

Table 13 shows the directional flow for LV and HGV for AM peak hour, IP average and PM peak hour for the ATC sites.

Figure 6 illustrates hourly two-way traffic flow profile for all access points to the city. The graph establishes the peak hour identified for model development. Among these sites the highest traffic flows were at ATC 26 (A46) which is significantly higher in the PM peak hour compared to all other sites whereas the lowest traffic flows were at Evesham Rd – South of Lenchwick (RSI 2).

Sl.no.	ATC Site	Location/Name	AM PK Hr		IP (10:00-16:00)	PM PK Hr		HGV % to all veh	Motorcycle % to all veh
			All Vehicles	Hour Beginning	All Vehicles	All Vehicles	Hour Beginning	24 Hr	24 Hr
1	11	B4624 Worcester Road	629	0800	658	768	1700	1%	1%
2	12	A44	1279	0800	1066	1305	1700	4%	1%
3	13	Bridge St	499	0900	501	476	1700	0%	4%
4	14	Pershore Road	972	0800	894	1013	1700	1%	1%
5	15	Broadway Road	704	0800	748	945	1700	0%	1%
6	16	Cheltenham Road	654	0800	511	664	1700	1%	1%
7	17	B4624 Worcester Road	730	0900	865	940	1700	1%	1%
8	18	Greenhill	916	0800	749	938	1700	1%	1%
9	19	High Street	1119	0800	978	985	1600	1%	1%
10	20	Briars Close	308	0800	298	469	1700	0%	1%
21	21	Fladbury Bridge	247	0800	190	275	1700	1%	2%
12	22	A46	1445	0800	1210	1627	1700	6%	1%
13	23	A46	1784	0800	1697	1907	1600	5%	1%
14	24	A44	1556	0800	1529	1703	1600	2%	1%
15	25	Station Road	318	0800	249	342	1700	1%	1%
16	26	A46	2105	0800	2022	2287	1600	5%	1%
17	27	Evesham Road	593	0800	496	574	1600	2%	1%
18	28	Boston Lane	95	0800	87	123	1700	1%	2%
19	29	Pershore Road	743	0800	601	764	1700	1%	1%
20	30	Millenium Way	786	0800	474	579	1600	7%	1%
21	31	Falkland Road	169	0800	103	183	1700	0%	2%
22	32	Hawthorn Road	105	0800	75	128	1700	1%	1%
23	33	Abbey Road	1138	0800	1131	1001	1600	1%	1%
24	34	High Street	958	0800	925	881	1600	1%	1%
25	35	Badsey Lane	81	0800	59	57	1600	0%	4%
26	RSI 1	A44 Evesham Road	1241	0800	962	1274	1700	5%	1%
27	RSI2	Evesham Road - South of Lenchwick	113	0800	85	90	1600	2%	1%
28	RSI 3	B4088	539	0800	472	595	1700	4%	1%
29	RSI 4	A46 - South of Harvington	1704	0700	1353	1864	1700	9%	1%
30	RSI 5	B4510	457	0800	479	507	1600	4%	1%
31	RSI 6	B4035	1117	0800	955	1117	1700	5%	1%
32	RSI 8	A44 Broadway Road	931	0800	954	1106	1700	3%	1%
33	RSI 9	A46 Cheltenham Road	1862	0800	1405	1917	1700	7%	1%
34	RSI 10	B4084	799	0800	551	788	1700	4%	1%

Table 12: Peak hour two-way flows at ATC locations

ATC Site no.	Location/Name	Direction	AM Peak (08:00 - 09:00)		IP Average (10:00 - 16:00)		PM Peak (17:00 - 18:00)		12 Hr		24 Hr	
			LV	HGV	LV	HGV	LV	HGV	LV	HGV	LV	HGV
11	B4624 Worcester Road	North bound	217	4	353	5	436	2	3907	46	4524	55
		South bound	403	5	296	4	328	1	3608	47	4088	57
12	A44	North bound	516	34	521	32	726	14	6494	331	7639	378
		South bound	698	31	487	27	557	8	6320	285	7451	338
13	Bridge St	East bound	10	0	67	1	80	1	612	7	676	9
		West bound	486	2	432	2	394	1	4983	18	6091	22
14	Persnore Road	East bound	595	8	456	5	487	3	5679	59	6936	69
		West bound	364	5	427	6	519	4	5144	64	6458	76
15	Broadway Road	North bound	384	3	433	3	586	4	5257	33	6351	35
		South bound	316	1	311	2	354	1	3808	18	4758	20
16	Cheltenham Road	North bound	370	5	259	5	382	3	3497	55	4176	62
		South bound	275	4	241	5	277	1	3059	48	3902	55
17	B4624 Worcester Road	North bound	326	2	452	3	484	3	4988	33	5980	36
		South bound	396	5	406	4	449	4	4705	48	5654	56
18	Greenhill	North bound	395	2	430	2	538	2	5122	26	6132	32
		South bound	516	3	315	2	397	2	4082	27	4872	31
19	High Street	North bound	498	6	554	6	608	5	6446	70	7968	80
		South bound	607	8	414	4	369	3	5113	53	6436	64
20	Briars Close	North bound	134	1	160	1	199	1	1785	8	2036	9
		South bound	173	1	137	1	268	1	1770	7	1945	9
21	Fladbury Bridge	East bound	104	1	102	1	173	0	1327	7	1522	8
		West bound	142	1	87	1	102	0	1122	8	1315	8
22	A46	East	731	28	526	37	618	25	6793	390	8182	712
		West	661	26	617	30	959	26	8129	346	10539	632
23	A46	North	837	34	842	41	947	31	10045	436	12346	696
		South	877	36	776	38	901	28	9659	436	11778	854
24	A44	East bound	793	19	837	20	878	16	9723	230	11557	280
		West bound	724	20	655	17	796	12	7974	189	9489	238
25	Station Road	North bound	194	1	116	1	110	0	1472	10	1723	11
		South bound	121	1	132	1	232	0	1674	11	1930	13
26	A46	North bound	1066	41	921	45	985	26	11290	473	13501	764
		South bound	957	42	1012	44	1230	46	12193	532	14674	1007
27	Evesham Road	North bound	246	6	233	7	294	4	2917	76	3806	95
		South bound	333	9	247	9	274	3	3159	85	3848	99
28	Boston Lane	North bound	37	1	37	0	54	0	462	5	562	5
		South bound	57	0	48	1	68	0	620	6	718	6
29	Persnore Road	East bound	416	4	324	3	441	2	4218	34	5001	39
		West bound	319	4	268	5	320	1	3438	52	4213	57
30	Millenium Way	North bound	127	16	232	16	459	14	2756	182	3026	239
		South bound	626	17	210	15	94	12	2793	172	3261	217
31	Falkland Road	North bound	134	0	48	0	63	0	766	1	977	1
		South bound	34	0	55	0	120	0	746	1	971	1
32	Hawthorn Road	East bound	29	0	38	1	84	2	519	10	654	13
		West bound	76	0	36	0	42	0	533	1	660	1
33	Abbey Road	North bound	512	3	442	3	349	1	5114	28	6328	32
		South bound	619	4	679	6	643	8	7833	76	10159	84
34	High Street	North bound	510	4	510	3	529	2	5965	36	7472	43
		South bound	434	10	402	10	345	5	4737	107	6174	120
35	Badsey Lane	East bound	22	0	22	0	20	0	245	2	295	2
		West bound	59	0	37	0	36	0	484	2	562	2
RSI 1	A44 Evesham Road	East bound	547	28	456	36	637	26	5874	370	19515	1184
		Westbound	623	43	435	34	590	21	5799	396	19092	1307
RSI2	Evesham Road - South of Lenchwick	North bound	42	1	40	1	55	1	494	10	585	11
		South bound	69	2	42	1	33	0	518	11	606	13
RSI 3	B4088	North bound	198	10	228	10	301	7	2744	111	9171	359
		South bound	317	14	224	11	280	8	2863	131	9538	426
RSI 4	A46 - South of Harvington	North bound	910	68	622	83	812	51	8667	884	10671	1178
		South bound	659	67	581	68	951	50	7925	770	9948	1092
RSI 5	B4510	North bound	171	15	220	14	253	9	2574	154	3393	176
		South bound	255	17	230	15	237	8	2735	167	3336	195
RSI 6	B4035	East bound	466	25	446	25	488	14	5464	275	6840	339
		Westbound	598	28	455	29	598	16	5863	304	7018	372
RSI 8	A44 Broadway Road	North bound	398	15	467	18	672	15	5600	200	6481	226
		South bound	500	19	455	14	413	6	5325	165	6339	198
RSI 9	A46 Cheltenham Road	North bound	934	71	644	64	873	45	8590	715	10276	1018
		South bound	811	46	649	48	969	31	8800	536	10922	901
RSI 10	B4084	East bound	406	22	268	15	375	8	3625	176	4275	197
		Westbound	355	16	252	15	393	12	3470	173	4164	193

Table 13: Directional flows by time period.

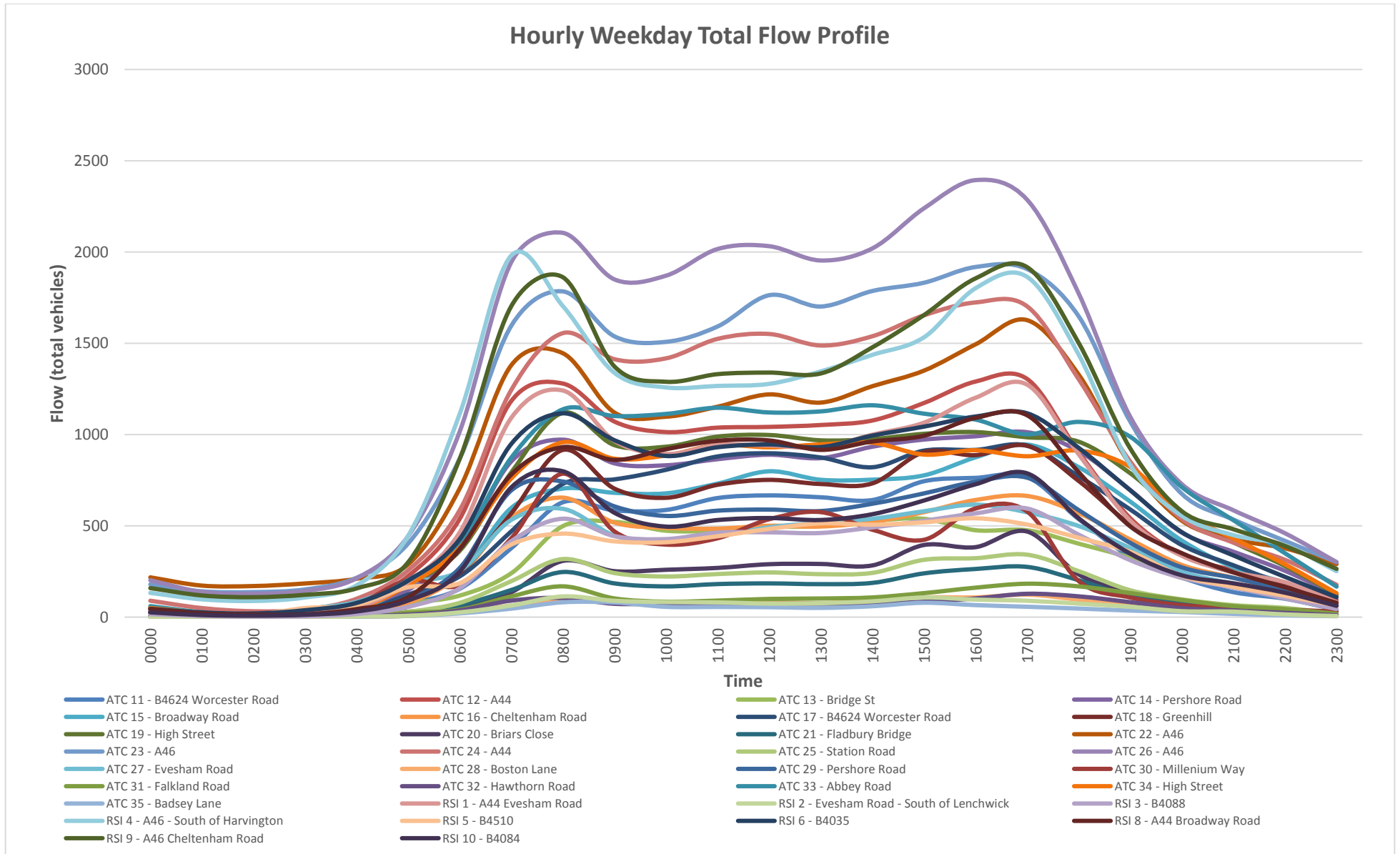


Figure 6: Hourly two ways traffic flow profile.

Manual Classified Counts

4.1 Location and date of counts

Manual classified counts (MCC) were undertaken on Tuesday 5th July 2016 from 0700 to 1900 with junction turning count undertaken at 27 sites around the city. The survey data was summarised into 15 minute intervals for the survey period. The vehicles movements were recorded under the following vehicle categories;

- Pedal Cycles
- Two-wheeled motor vehicles
- Cars/taxis
- Buses/coaches
- Light goods vehicles
- HGV rigid
- HGV articulated

The surveys were managed by the sub consultant, Tracsis. The locations of the 27 MCC sites are illustrated in In addition to these 27 sites, all RSI sites were covered with MCC link counts as well to assist in expanding the surveyed RSI sample. The MCC counts at RSI locations is shown in Appendix C3.

and the junction types are listed in Table 14. In addition to these 27 sites, all RSI sites were covered with MCC link counts as well to assist in expanding the surveyed RSI sample. The MCC counts at RSI locations is shown in Appendix C3.

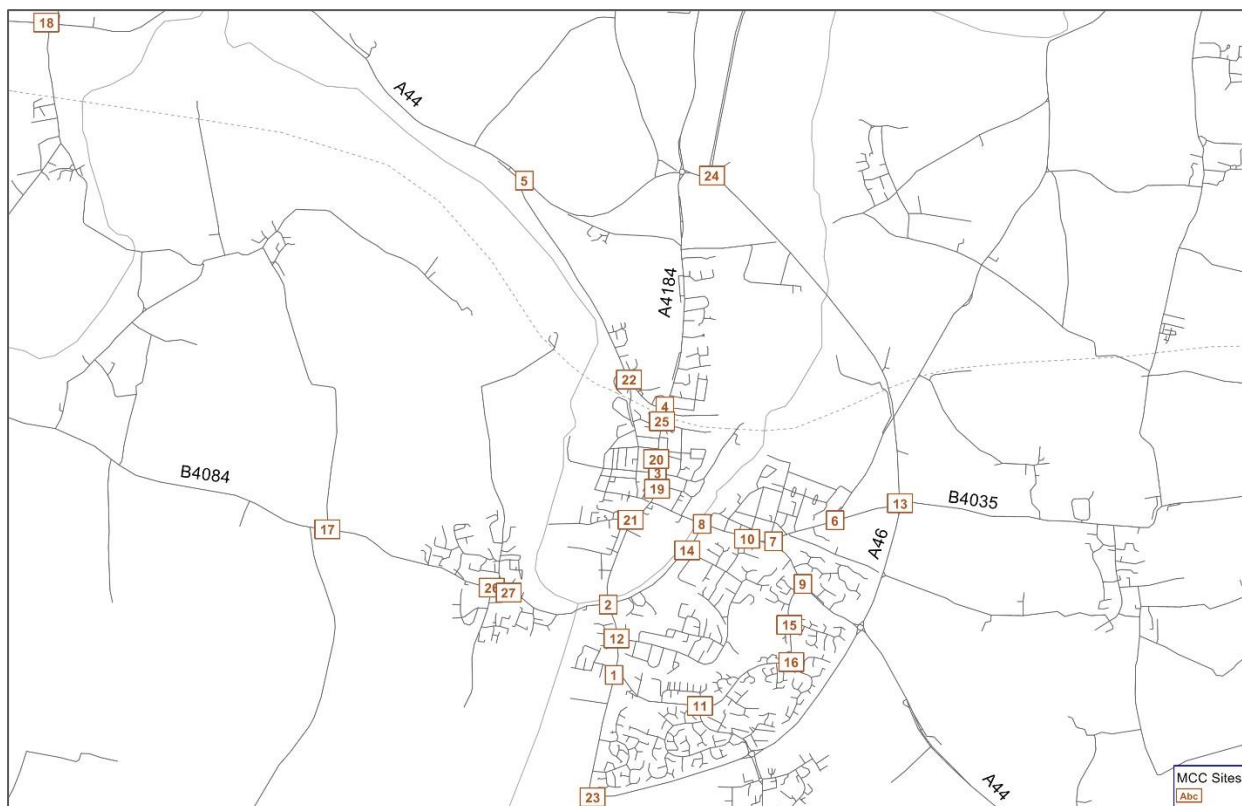


Figure 7: MCC sites location.

4.2 Data checks

Data received from the sub consultant was checked for their quality to the survey specification and it turned out to be acceptable. It was compared with corresponding ATC data where the surveys were undertaken on the same date. This graphical comparison is included in Appendix A2.

4.3 Data analysis

Appendix C1 shows an analysis of the junction turning counts (JCT) for each junction for AM (08:00 – 09:00), IP (Average of 10:00 to 16:00) and PM (17:00 to 1800) peak hours. These tables show turning count for LV and HGV between each arm and also the total of LV and HGV. Data is also extracted for junctions where U-turns were possible and recorded in the survey.

Junction number	Location	Easting	Northing	Junction Type
1	Cheltenham Rd/ Davies Rd	403445	242588	3 arms T- junction
2	B4084 Pershore Rd/ Cheltenham Rd/ B4035 Waterside/ Abbey Rd	403399	243083	4 arms cross junction
3	High St/ Avon St/ Swan Ln	403743	244015	4 arms cross junction
4	Greenhill/ B4624 Worcester Rd	403800	244463	3 arms T- junction
5	B4624 Worcester Rd/ A44/ A44 The Squires	402804	246089	4 arms roundabout
6	B4035 Elm Rd/ Offenham Rd	405011	243683	3 arms junction
7	B4035 Port St/ B4035 Elm Rd/ Broadway Rd	404526	243526	3 arms roundabout
8	B4035 Waterside/ Bridge St/ B4035 Port St	404059	243660	3 arms T- junction
9	Broadway Rd/ Davies Rd	404779	243233	4 arms T- junction
10	B4035 Port St/ Northwick Rd	404400	243557	3 arms T- junction
11	Davies Rd/ The Link	404053	242358	4 arms roundabout
12	Cheltenham Rd/ Fairfield Rd	403462	242837	4 arms T- junction
13	A46/ Elm Rd/ Badsey Rd	405464	243785	3 arms roundabout
14	B4035 Waterside/ Coopers Ln	403963	243464	4 arms T- junction
15	Davies Rd/ Hawthorn Rd	404682	242943	3 arms T- junction
16	Davies Rd/ Falkland Rd	404699	242674	3 arms junction
17	B4084 Pershore Rd/ Boston Ln	401413	243612	4 arms junction
18	Station Rd/ A44 Evesham Rd	399420	247204	3 arms T- junction
19	High St/ Oat St	403739	243932	3 arms junction
20	High St/ Swan Ln/ Avon St	403750	244179	4 arms junction
21	Abbey Rd/ Merstow Green/ Vine St	403559	243688	3 arms roundabout
22	Briar Cl/ B4624 Worcester Rd	403548	244663	3 arms junction
23	Evesham By-pass (A46/A4104 Cheltenham Rd)	403280	241714	3 arms roundabout
24	A46/ A44	404133	246129	3 arms roundabout
25	Evesham Station access	403779	244388	3 arms T- junction
26	B4084/ Peewit road	402573	243203	3 arms cross junction
27	B4084/ School Road	402679	243180	4 arms junction

Table 14: MCC sites with junction type

Figure 8 illustrates 15 minutes interval MCC profile for Light Vehicles, summed across all junctions surveyed. The graph shows the peak hour counts identified for model development. The MCC data is provided in Appendix C2

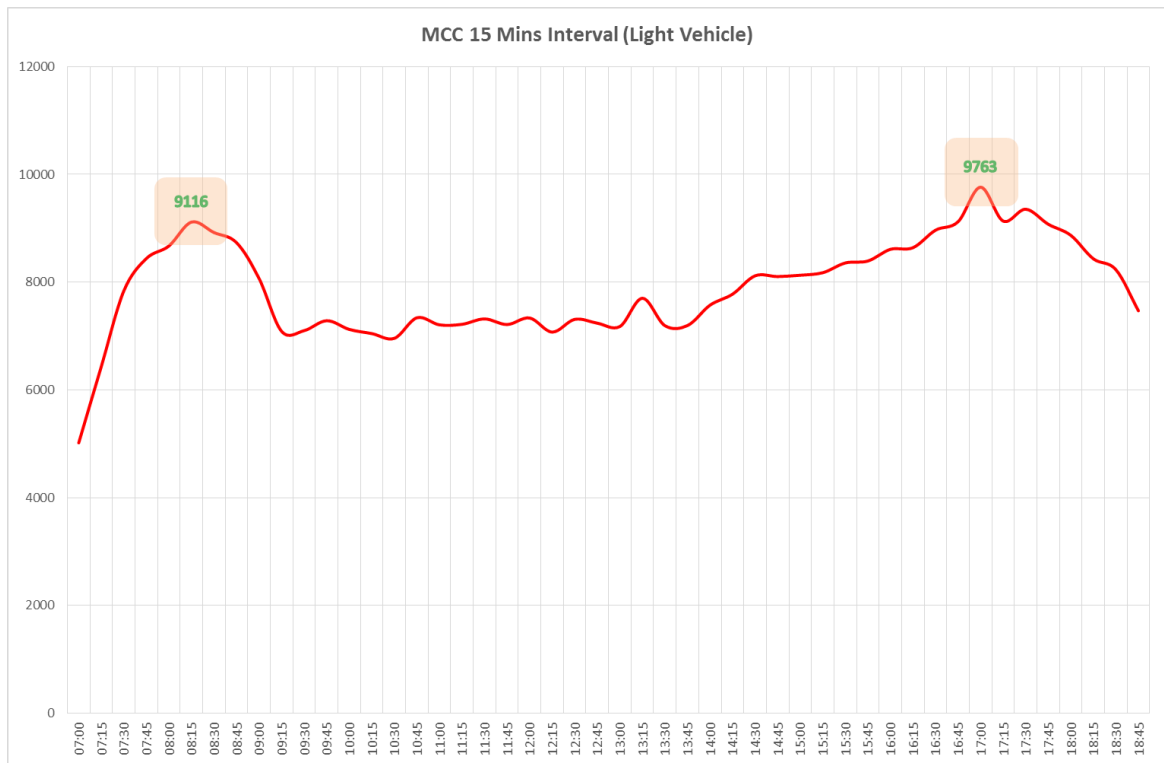


Figure 8: MCC 15 minutes interval - LV

Car Park Data

5.1 Location and dates of surveys

There are 20 car parks within Evesham Study area. 9 of the largest car parks were surveyed at various locations in this area. Figure 9 shows the detailed location of the Car Parks surveyed.

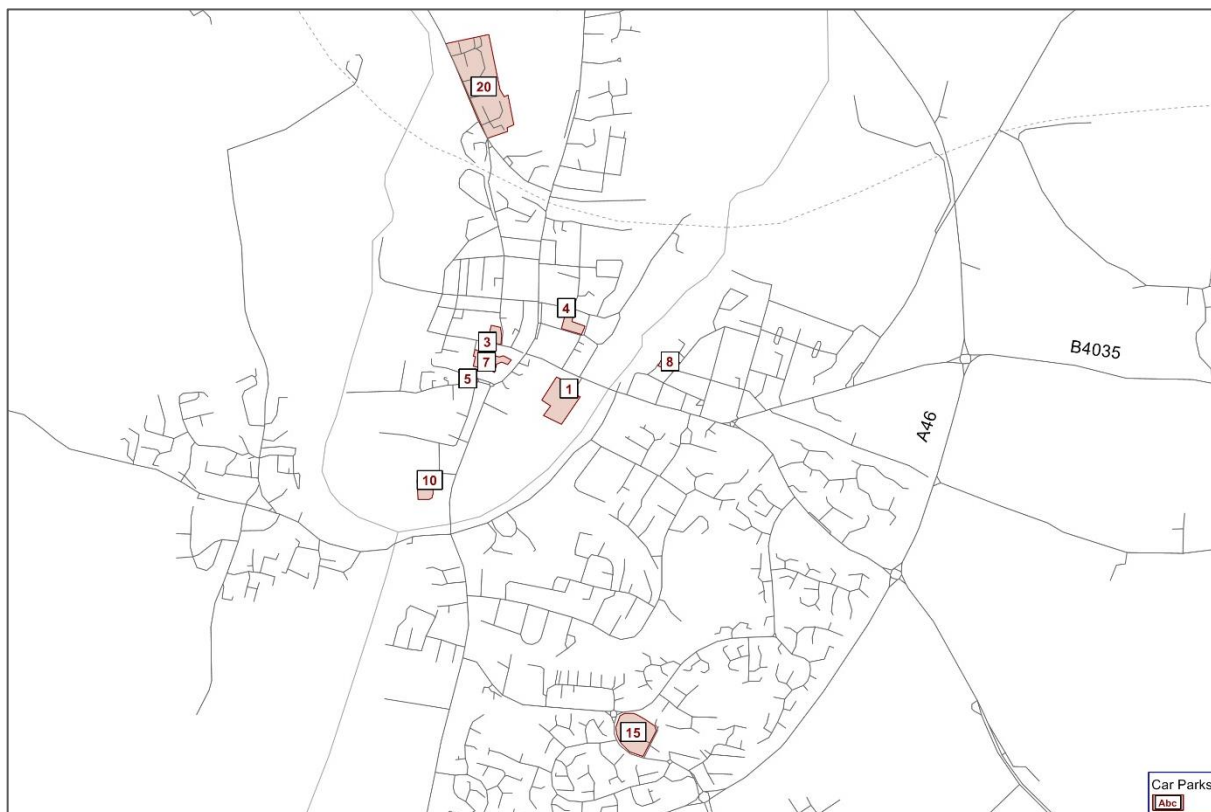


Figure 9: Car Park survey locations

Data was collected between Tuesday 28th – Thursday 30th June 2016 and the information collated was as follows:

- Car park occupancy count at the beginning of the day i.e. before 7:00am, on all sites;
- 12 hour (7:00am-7:00pm) entry and exit counts, on all sites;
- Full registration number plate data, from which the duration of stay was determined, on all sites;
- Origin/Destination surveys at 6 of the Car Parks, using traditional postcards along with electronic questionnaires using Tablets.

Table 15 shows the names/ locations of all the car parks surveyed, together with walking distance to town center; average price; type; capacity; average and maximum accumulation and its percentages; mean, mode and median duration in minutes.

Site No.	Car Park	Distance to Town Centre (mins)	Price (for 2h)	Long or Short*	Capacity	Average Accumulation	Max Accumulation	Arrivals	Mean duration (mins)	Mode duration (mins)	Median duration (mins)	Entry at AM Peak (No. veh)	Avg Duration AM Peak (8:00-9:00)	Exit at PM Peak (No. veh)	Avg Duration PM Peak (17:00-18:00)
1	Riverside Centre - Monks Walk	3	£1.00	Long	259	46%	80%	677	128	37	72	19%	06:48:02	25%	05:10:31
3	Bewdley Street	4	£2.00	Long	89	31%	43%	192	125	47	55	11%	07:47:36	18%	06:02:48
4	ALDI	4	£2.00	Short	151	54%	91%	1158	52	20	37	26%	00:48:42	41%	00:59:51
5	Merstow Green	4	£2.00	Short	91	46%	90%	586	65	39	43	47%	01:29:59	51%	00:54:04
7	Old Brewery - Bewdley Street	4	£2.00	Long	127	73%	95%	187	273	-	270	35%	04:51:05	13%	07:20:15
8	Burford Road	8	£2.00	Long	64	7%	17%	51	56	12	26	8%	01:15:24	0%	-
10	Evesham Leisure Centre - Abbey Road	9	£0.50	Long	184	37%	79%	643	81	5	68	11%	01:55:06	38%	00:52:15
15	Morrisons - Davies Road	24	Free	Long	-	-	-	3283	49	8	39	-	00:35:24	-	00:40:03
20	Evesham Shopping Park	16	0	Long	178	49%	77%	1873	30	11	17	19%	02:42:37	78%	00:17:41

* Short Stay - up to 3hrs/ Long Stay - All day

Table 15: Car Park Surveys (0700-1900)

ALDI (1158), Morrisons – Davies Rd (3283) and Evesham Shopping Park (1873) had the most arrivals throughout the day. ALDI (91%), Merstow Green (90%) and Old Brewery - Bewdley Street (95%) were the most occupied during the whole day.

Merstow Green (49%) and Evesham Shopping Park (78%) were the ones with the most entries and exits during AM and PM pk hours, respectively but accordingly to the table those are not the car parks most used to work related parking (average duration in those car parks were 1h and 30min for AM and almost 18min for PM peaks). On the other hand, Bewdley Street and Riverside Centre car parks, have higher stay durations during AM peak (between 6 and 8 hours. In addition to these two car parks, Old Brewery - Bewdley Street have higher durations during PM peak (between 5 and 8 hours).

Table 16 shows the number of vehicles that were registered entering and exiting each car park, and the average occupation based on the counts.

	Occupancy								
	Car Park 1	Car Park 3	Car Park 4	Car Park 5	Car Park 7	Car Park 8	Car Park 10	Car Park 15	Car Park 20
Entry	677	192	1158	586	187	51	643	3283	1873
Exit	676	185	1093	554	101	48	518	3209	1795
Avg Occupancy	677	189	1126	570	144	50	581	3246	1834

Table 16: Average occupancy of the Car Parks

Table 17 shows the total sample of OD surveys collected, based on the average occupancy (table 13) of each Car Park. The sample rate is low for Car Parks 1, 15 and 20 since many people refused to participate.

	Interviews					
	Car Park 1	Car Park 4	Car Park 7	Car Park 10	Car Park 15	Car Park 20
Proceed	58	254	84	170	159	139
Refused	76	149	4	33	639	64
Total	134	403	88	203	798	201
% Sample collected	20%	36%	61%	35%	25%	11%
% Valid Records	9%	23%	58%	29%	5%	8%

Table 17: Sample collected - OD Surveys

5.2 Data analysis

The following section will focus on survey data captured at the Car Parks. The car Park information will enhance understanding of trip making patterns of travellers that start and end their journey within the Evesham town. The Car park surveys will also be used to retrieve the average duration of stay by purpose to identify the RSI trips for non-survey direction. The car park information will also form part of the input to develop the gravity model for internal to internal synthetic matrices.

The expansion factors, to expand the O/D data, will be derived based on the samples by purpose, by time of the day and by total flows.

The sample used to analyse the data collected is presented in tables 18 and 19. The average occupancy for each site is also presented. For all sites single occupancy has the maximum representation. Average occupancy for Car/taxi and light goods vehicle for all sites is 1.47.

Interviews						
	<i>Car Park 1</i>	<i>Car Park 4</i>	<i>Car Park 7</i>	<i>Car Park 10</i>	<i>Car Park 15</i>	<i>Car Park 20</i>
Proceed	58	254	84	170	159	139
Refused	76	149	4	33	639	64
Total	<i>134</i>	<i>403</i>	<i>88</i>	<i>203</i>	<i>798</i>	<i>201</i>
% Sample collected	20%	36%	61%	35%	25%	11%
% Valid Records	9%	23%	58%	29%	5%	8%

Table 18: Car Parks data sample.

Mode and Occupancy	1	2	3	4	5	5+	Grand Total	Average Occupancy
Car Park 1	32	24	1	1	0	0	58	1.50
Car Park 4	123	100	24	4	3	0	254	1.68
Car Park 7	56	23	4	0	0	1	84	1.36
Car Park 10	121	35	10	3	1	0	170	1.40
Car Park 15	103	51	4	1	0	0	159	1.39
Car Park 20	96	41	1	0	0	1	139	1.30
All combined	531	274	44	9	4	2	864	1.47

Table 19: Occupancy distribution for Car/Taxi+LG

Table 20 shows the average trip length in miles, by vehicle type, made for each purpose to and from all Car Parks surveyed. Table 21 shows the average trip length in miles of each purpose.

Purpose/ Mode (miles)	Car/Taxi	Light goods vehicle	PSV (Coach)
Business	10.15	33.38	
Commute	11.98		
Other	6.29	7.91	53.12

Table 20: Average trip length (miles) by purpose and mode – All Sites combined

Purpose	Distance (miles)	No. of trips	Trips (%)
Business	13.06	16.00	2%
Commute	11.98	51.00	6%
Other	6.37	797.00	92%

Table 21: Average trip length by purpose - All Sites Combined

Conclusion

6.1 Conclusion

A comprehensive survey exercise was undertaken to support the Evesham Transport Model which involved collecting various traffic and travel characteristics of people using the Evesham Transport network. The surveys included various count information through ATC, MCC and travel information through RSIs, Origin-Destination and occupancy surveys at Car Parks.

Based on the above exercise, it can be concluded that sufficient data is available for the development of the Evesham Transport model to support the future development in Evesham.