Environment and Transport – Commissioning Framework

Enderby Village Microsim

Modelling Report

15 December 2017
3899.005

Leicestershire County Council

Leicestershire County Council

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1. Document Sign-off

1.1. Control Details

Document Location:	K:\TMODELLING\07. 3899 Market Town Microsimulation\3899.005 Enderby Village - August 2017\06. Deliverables
Production Software:	Microsoft Word 2010
Owner:	Alex Gray, Network Data and Intelligence Team

1.2. Document history and status

Ver	Date	Description	Author	Review	Approved
0.1	24/11/17	Draft for internal review	CH	RB	
0.2	28/11/17	Draft version for release to the client	CH	RB	TB
1.0	15/12/17	Final Version	CH	RB	TB

1.2.1. This document has been prepared by Leicestershire County Council for the sole use of our client (the "Client") and in accordance with the terms and conditions of service provision under the Transport Modelling & Planning Framework, the budget for fees and the terms of reference agreed between Leicestershire County Council and the Client. Any information provided by third parties and referred to herein has not been checked or verified by Leicestershire County Council, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of Leicestershire County Council.

1.2.2.

1.2.3. Whilst the modelling work outlined in this report has been carried out using the Leicester and Leicestershire Integrated Transport Model (LLITM), its findings and any conclusions do not necessarily represent the views of Leicestershire County Council as the Highway Authority.

2. Overview

2.1. Introduction

2.1.1. Network Data and Intelligence (NDI) has been commissioned to produce a microsimulation model of Enderby village.

2.1.2. The Enderby village microsimulation model will be used to test a proposed traffic management scheme within the village.

2.1.3. The Enderby microsimulation model has been created from a number of Manual Classified Turning Counts which have been collected in July 2017; therefore giving a 2017 base model. As such the 2017 highway network has been used to code the existing roads into the model.

2.1.4. The model has been developed for the 2017 base year weekday morning and evening peak periods (0800 to 0900 and 1700 to 1800). Quarter hour “warm-up” and “cool-down” periods have also been included to add some traffic onto the network prior to the peak period and also to allow journeys to complete after the simulation period.

2.1.5. The study area of the model is shown in Figure 2.1 below.

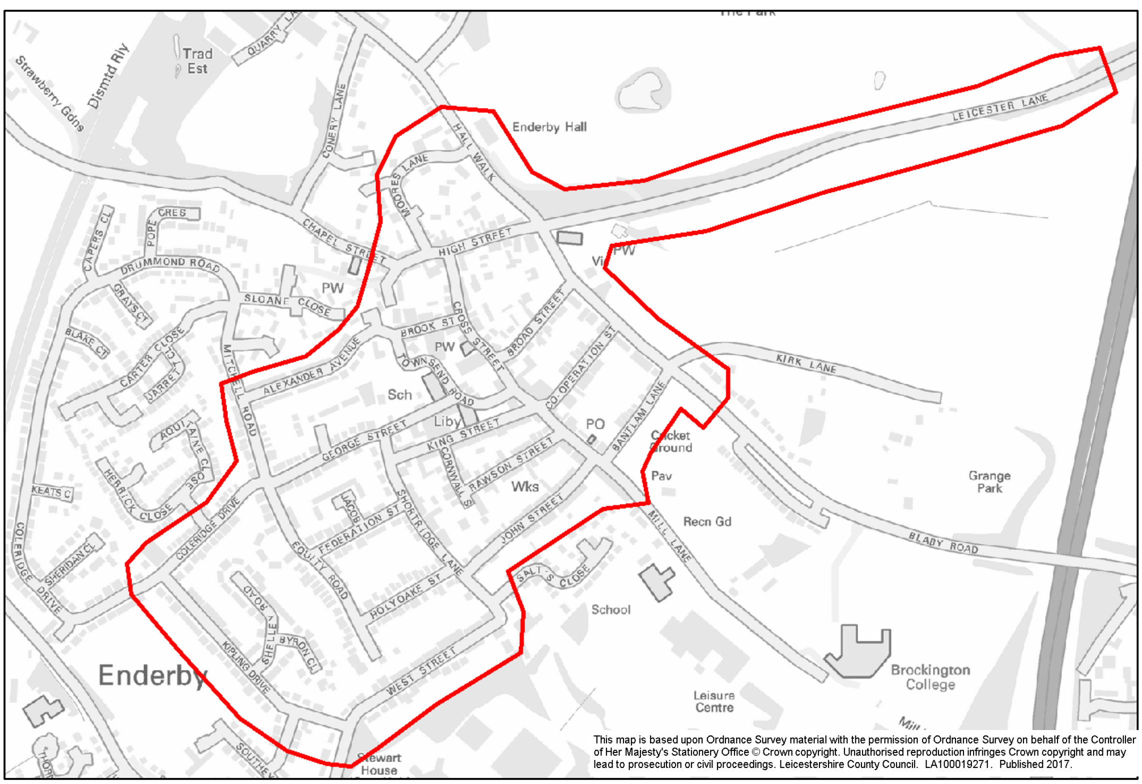

Figure 2.1 Study area of the Enderby village Microsimulation Model.

3. Data Collection

3.1. Methodology

3.1.1. In order to create the microsimulation model, an extensive data collection exercise was undertaken in which Manual Classified Turning Counts were observed at all key and many minor junctions within the study area. A total of 29 sites were surveyed in July 2017, predominantly on one common day with the data being classified into the following vehicle classes:

- Car
- Motorcycle
- Passenger Service Vehicle
- Light Goods Vehicle
- Other Goods Vehicle 1
- Other Goods Vehicle 2
- Pedal Cycle

3.1.2. Figure 3.1 shows the locations of the surveyed sites whilst Table 3.1 contains a comprehensive listing of each.

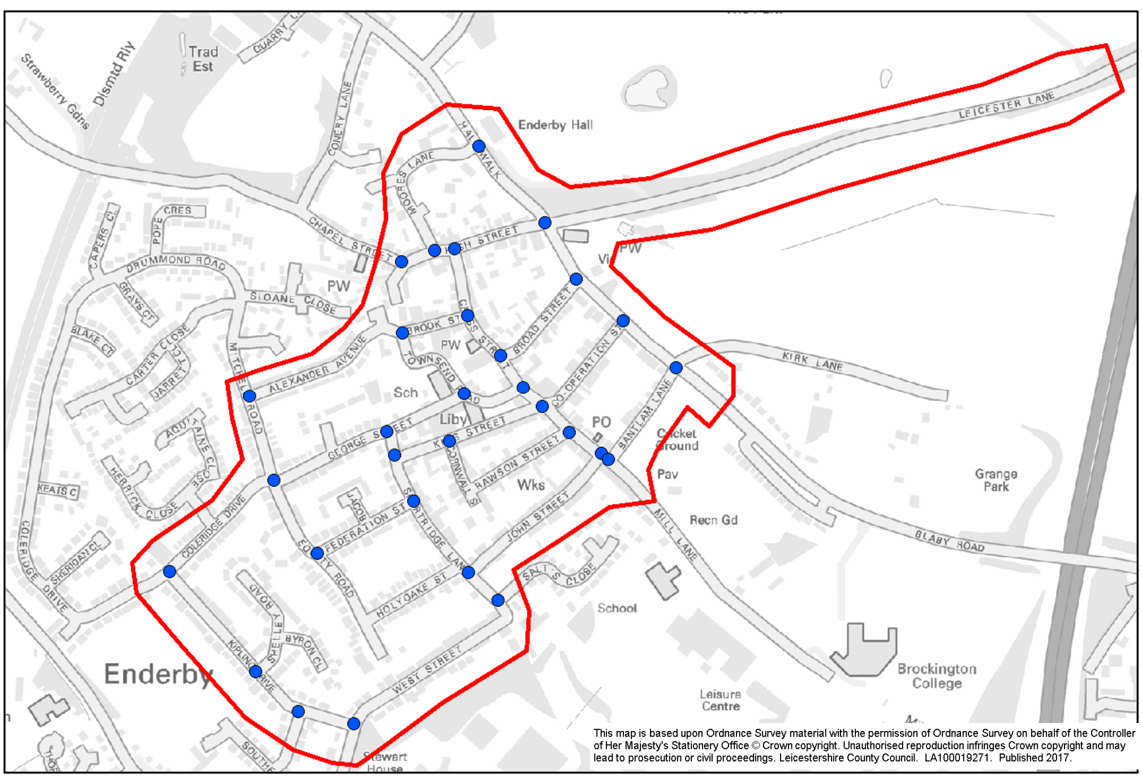

Figure 3.1.1 Spatial location of Manual Classified Turning Count sites in Enderby.

No	Location Description	Type
107048	Hall Walk/Moores Lane	MCC
107051	Leicester Lane/B582/High Street	MCC
107054	High Street/The Cross	MCC
107059	High Street/Moores Lane	MCC
107062	High Street/Chapel Street	MCC
107065	B582/Broad Street	MCC
107068	B582/Co-Operation Street	MCC
107071	Kirk Lane/B582/Bantlam Lane	MCC
107074	Mill Lane/Bantlam Lane/John Street	MCC
107080	Mill Lane/Rawston Street	MCC
107083	Co-Operation St/Mill Ln/King St/Cross St	MCC
107086	Cross Street/ Townsend Road	MCC
107089	Cross Street/Broad Street	MCC
107092	Cross Street/Brook Street	MCC
107095	Shortridge Lane/Salts Close	MCC
107098	Shortridge Lane/John Street	MCC
107101	Shortridge Lane/Holyoake Street	MCC
107104	Shortridge Ln/Federation Street	MCC
107107	King Street/Cornwall Street	MCC
107110	Shortridge Lane/King Street/George Street	MCC
107113	George Street/Townsend Road	MCC
107116	Alexandra Ave/Townsend Rd/Brook Street	MCC
107119	Mitchell Road/Colbridge Drive/ Alexandra Avenue	MCC
107247	Kipling Drive/West Street/Stewart Avenue	MCC
107250	Kipling Drive/Shelley Road	MCC
107253	Coldridge Drive/Kipling Drive	MCC
107256	Kipling Drive/Masefield Road	MCC
107471	Federation Street/Equity Road	MCC
107474	Alexander Ave/Mitchell Road	MCC

Table 3.1.1 Counts Collected in the development of the Enderby Village Microsimulation model.

4. Model Development

4.1. Highway Network

4.1.1. Loading points have been added to the model. In the majority of cases these loading points coincide with a real life junction (such as cul-de-sac or car park entrance). Where there is no appropriate real life junction, an artificial loading point has been added.

4.1.2. As part of the highway network, lane markings, conflict areas and priority rules have been included as per satellite imagery. Speed limits and reduced speed zones have been added to match real life traffic conditions. The construction of the physical highway network is identical between the AM and PM peak period models. Costs and surcharges have been added to certain routes, often rat-runs or routes with high street parking, to make these routes less favourable and therefore attract fewer trips. Signal timings also differ between the AM and PM peak periods.

4.1.3. A plan showing the extent of the Enderby Village Microsimulation Models highway network can be found in figure 4.1.1.

Figure 4.1.1 Enderby Village Microsimulation Model's highway network.

4.2. Signal Timings

4.2.1. In the Enderby Village Microsimulation Model there is one signalised junction, at Hall Walk, Blaby Road and Leicester Lane. The signal timings have been supplied from the Leicester and Leicestershire Transport Model, with additional time given to account for pedestrian movements. The signal timing sheets for the AM and PM peak periods can be found in figures 4.2.1. and 4.2.2. respectively.

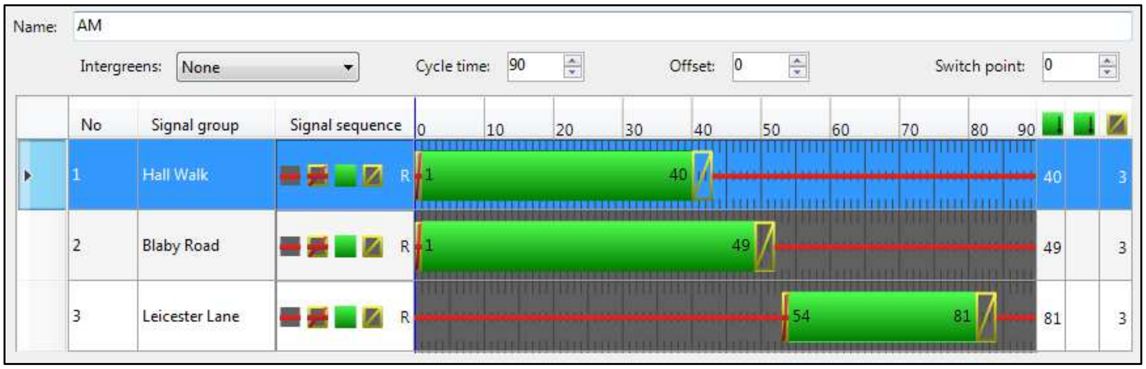

Figure 4.2.1 AM peak period signal timings

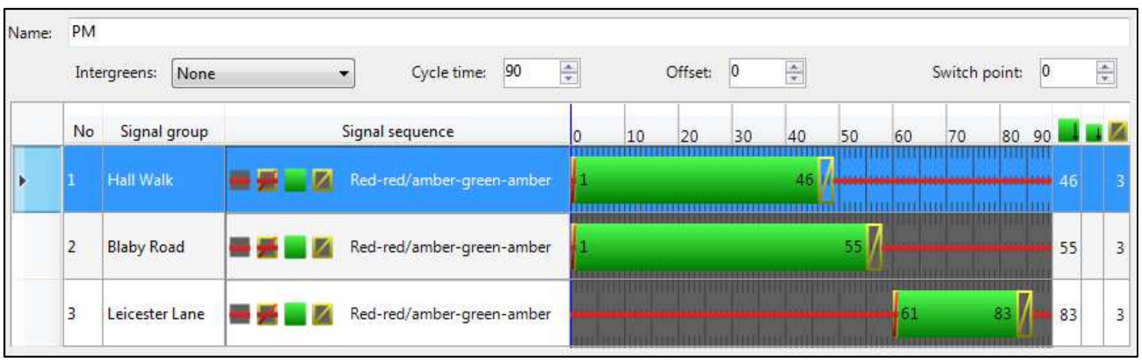

Figure 4.2.2 PM peak period signal timings.

4.3. Passenger Transport

4.3.1. Bus route 50 serves Enderby with Narborough to the south and Leicester to the north. During peak periods there is one bus every 20 minutes in each direction. The bus route and timetable has been coded into the model to represent reality. Bus stops have also been situated in the appropriate location. A map of the bus routes can be found in figure 4.3.1. A list of stops in the model can be found in table 4.3.1 (note- in the model the bus service will stop for a period of 9 seconds at every stop – this is a default value which has been assumed as the average stop and dwell time at all stops, no matter if passengers are alighting/boarding the bus at the particular point).

Figure 4.3.1 Current existing and modelled bus route through Enderby village. Top left: Southbound (towards Narborough). Top Right: Northbound (towards Leicester). Bottom left: Southbound (towards Narborough). Bottom Right: Northbound (towards Leicester).

Number	Stop	Direction
1	Opp Co-op Street	Northbound
2	Adj Co-op Street	Southbound
3	Opp Cross Street	Southbound
4	Adj Cross Street	Northbound
5	Adj Federation Street	Northbound
6	Opp Herrick Close	Northbound
7	Adj Herrick Close	Southbound
8	Adj Shelley Road	Southbound
9	o/s West Street	Southbound
10	Adj Shortridge Lane	Southbound
11	Opp Shelley Road	Northbound

Table 4.3.1 List of bus stops in the Enderby Village Microsimulation Model.

Figure 4.3.2 Location of bus stops in the network

4.4. Matrix Estimation

4.5. Zoning System

4.5.1. In order to model the desired level of detail, the area of interest has been split into 37 zones which are the source and destination of trips in the model. Each zone has a zone connector which is where physical trips either enter or exit the network.

4.5.2. Zones in and out of the modelled area are given the name A-E. Zones which involve trips with an origin and/or a destination within Enderby are given a name between F1 and F31. Generally speaking there is a higher density of zones in the village centre; however the exact extent of each zone has been determined through examination of the data collection results along with manual judgement.

4.5.3. The spatial distribution of zones can be found in figure 4.5.1.

4.5.4. The zones are used to form a trip matrix, the method of how the matrices are produced is outlined in section 4.6.

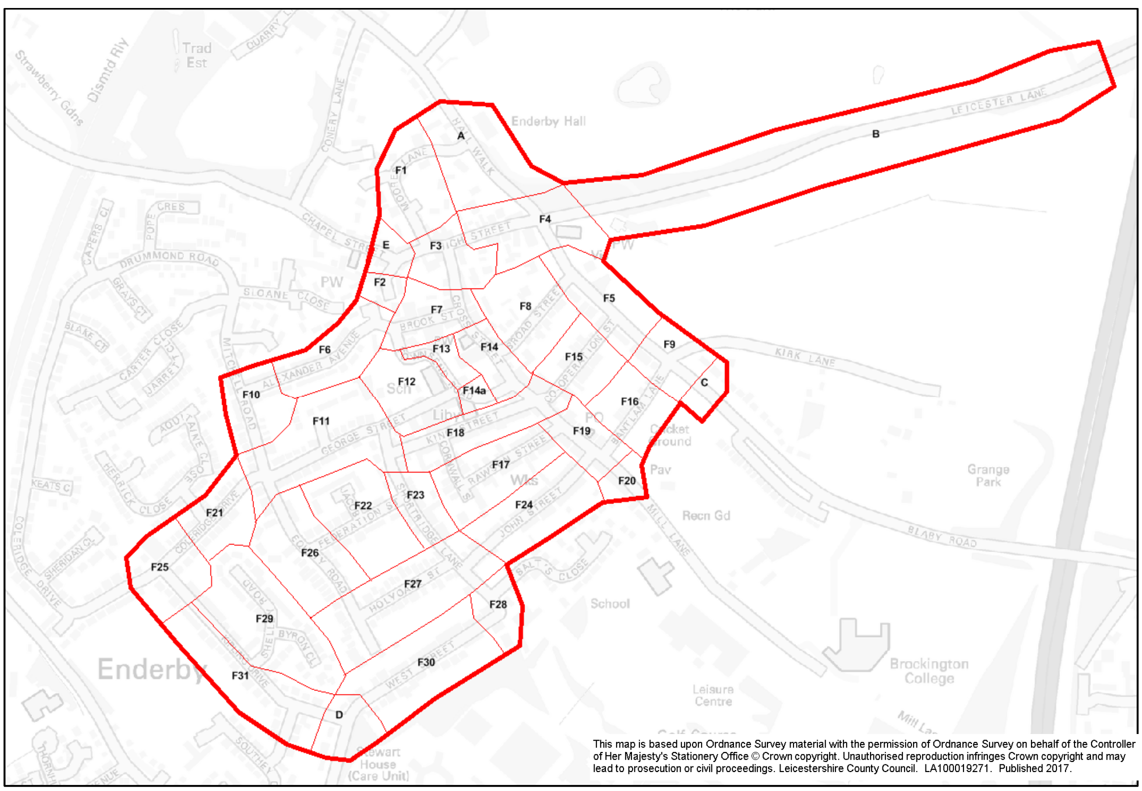

Figure 4.5.1 Spatial distribution of zones within the Enderby Village Microsimulation Model.

4.6. Matrix Estimation Algorithm

4.6.1. The Matrix Estimation (ME) process uses a bespoke script developed by AECOM to run Matrix Estimation in VISSIM. This enables assignments within VISSIM to be used within the process, rather than conducting ME in another software package and then assigning in VISSIM, which would not work as effectively.

4.6.2. The script was developed in Python and implements the “gradient method”. An accepted algorithm for adjusting matrices to reflect counts is the “gradient method”, documented in “A Gradient Approach for the O-D Matrix Adjustment Problem”, Spiess, 1990. It is not the only well-used matrix estimation algorithm – however, algorithms generally share two basic principles:

- the revised matrix should reproduce the observed flows as well as possible; and
- the revised matrix should resemble the original matrix as well as possible.

4.6.3. Algorithms differ in the relative weights they place on the two points, as well as in how, “as well as possible”, is defined for each and whether some counts and/or origin-destination pairs are weighted more highly than others. Matrices are produced for three user classes: Cars, LGVs and HGVs.

4.6.4. The gradient method aims at each step to make minimal adjustments to the matrix to achieve a given improvement in flow comparison by seeking the path of steepest descent.

4.6.5. Before starting the ME process, the prior matrix is assigned to the meso model and the model run to convergence to discover all possible paths between OD pairs. Once the meso model has converged, cost and path files are used to run a prior matrix assignment in the micro model with an imposed restriction of up to 3 paths per OD pair. Using these paths the micro model is run to convergence to reveal the best 3 paths between each OD pair and it is these cost and path files that form part of the necessary input to the ME process.

4.6.6. The final required input to the ME process is a starter, or prior, trip matrix. Unfortunately, there is not an ‘off the shelf’ prior matrix available and so one has been derived using the 2016 forecast year matrix from the Leicester and Leicestershire Integrated Transport Model (LLITM) to inform the movements of the external zones - A-E (via a series of select link analysis) and internally a flat matrix of 0.1 has been used for zones F1-F31. The matrix assumes a “flat release distribution” across the peak hour and warm up/cool down periods.

4.6.7. Count data from strategically important links within the model has then been input into the AECOM algorithm, which then attempts to match the observed counts with modelled flows.

4.6.8. A description of the full algorithm is as follows:

i. A single standard assignment is performed to generate flows. All following network calculations are performed only on links/nodes/segments that actually have counts; other links are ignored.

ii. The "gradient" is calculated for each link, segment or node with a count, using the following function:

$$G = \lambda(ObservedCount - ModelFlow)$$

where λ is a chosen small number; 0.01 is used in LLITM-PT.

iii. The "objective function" Z is calculated for the network as a whole, as

$$Z = \sum \lambda(ModelFlow - ObservedCount)^2$$

where λ is the same number as before. This is not used in the rest of the process but is a measure of convergence.

iv. A "gradient matrix" is computed. This matrix gradient is called g.

v. The gradient matrix is multiplied by demand to get a demand adjustment. A new assignment of this demand adjustment is performed to produce new flows. This assignment uses the same routes as i, with only the demand by zone-pair changed. It does not recalculate congestion and re-evaluate routes. Note that this step will require the assignment of negative demand, since the adjustments will sometimes be negative.

vi. The maximum absolute ratio of adjusted to new demand is calculated by matrix cell, that is to say, the maximum matrix-level gradient is calculated. Negatives become positive.

vii. The "optimal step length" is calculated as a network calculation as follows, using the maximum G calculated in step 6. The flows used here are those derived from step 5, not the current "real" assignment flows.

$$StepLength = \sum \left(\frac{G}{\lambda} \frac{Flow}{\sum Flow^2}\right) Max(|g|)$$

viii. If the step length is greater than 1, it is set to 1.

ix. A new demand matrix is calculated as follows:

$$NewDemand = PreviousDemand\left(1 + StepLength\left(\frac{g}{Max(|g|)}\right)\right)$$

x. A decision is made on whether to stop or not (based on number of iterations, value of objective function, or some other convergence measure). If the process is not halted, it goes back to step 1, using the new demand matrix calculated in step 9 in place of the original matrix.

The ME process follows the following procedure;

- Mesoscopic: Run the model from 50% to 100% in mesoscopic simulation (2.5 increment);
- Mesoscopic: Run the model until reaches convergence (criteria shown in Table 4-2);
- Microscopic: Run the model with the same volumes on paths to extract volumes; and
- Run matrix estimation python script to generate new matrix; and
- Check modelled flows against observed flows to see if GEHs <5 are falling further.

The ME process produces up to 300 matrices; of which 3 are used for further modelling (one for each mode). Due to the lack of a reliable prior matrix it is often useful to manually “massage” the matrices in order to gather more accurate results – this may involve redistributing trips between zones or adding additional zones. When massaging the matrix, observed count evidence can be used to inform decisions. Once manually changed, the matrices can then go through the ME process again in order to create an enhanced matrix.

The matrices have been produced assuming the demand on the network is solely loaded as “dynamic assignment” trips. Dynamic assignment allows for individual vehicles having route choice in order to complete their journey. For Car trips between zones A, B and C, dynamic assignment has been withdrawn and trips between these zones are manually assigned (and therefore do not have route choice). This is because when running the model, trips from these zones were observed making illogical movements through the network to avoid the Hall Walk, Leicester Lane, Blaby Road, High Street Crossroads. This often resulted in the model becoming oversaturated which has severe consequences for the network. The majority of paths on the network remain coded in Dynamic assignment, meaning that each vehicle on the network makes its own route choice. A summary of the final Car matrix can be found in figure 4.6.1.

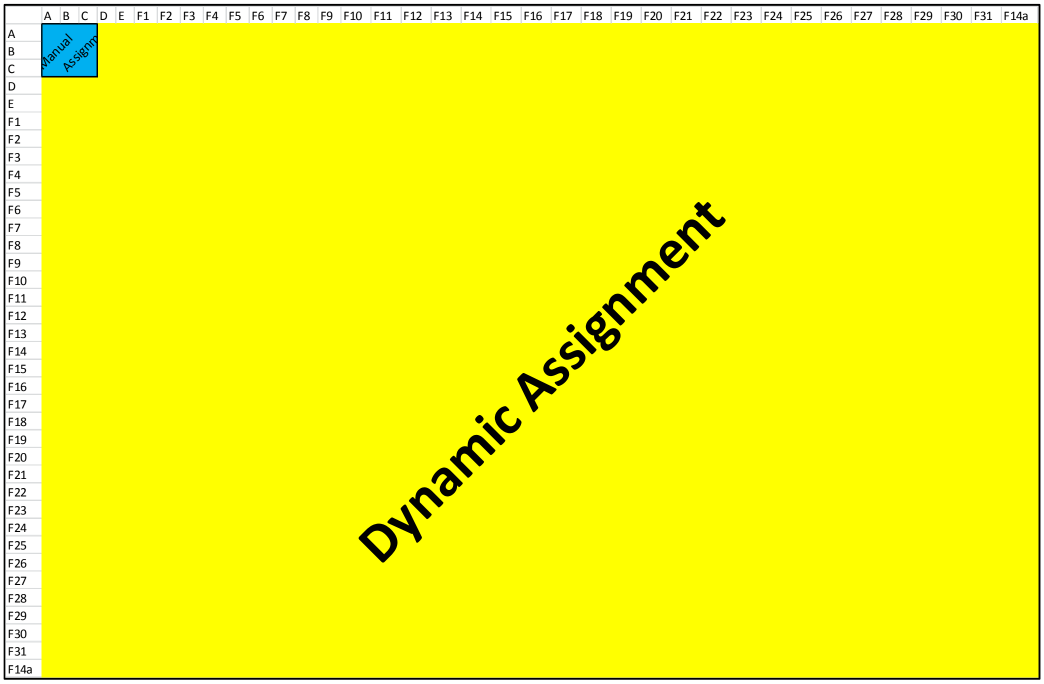

Figure 4.6.1 Summary of the Car matrices produced for the Enderby Village Microsimulation.

5. Model Calibration and Validation

5.1. Calibration

5.1.1. The models were calibrated in an iterative manner, whereby priority rules, reduced speed areas, vehicle behaviour and signal timings were adjusted based on the prevailing flow data and observations of traffic conditions, before running additional iterations of Matrix Estimation to calibrate the demand matrices. This process is summarised in figure 5.1.1.

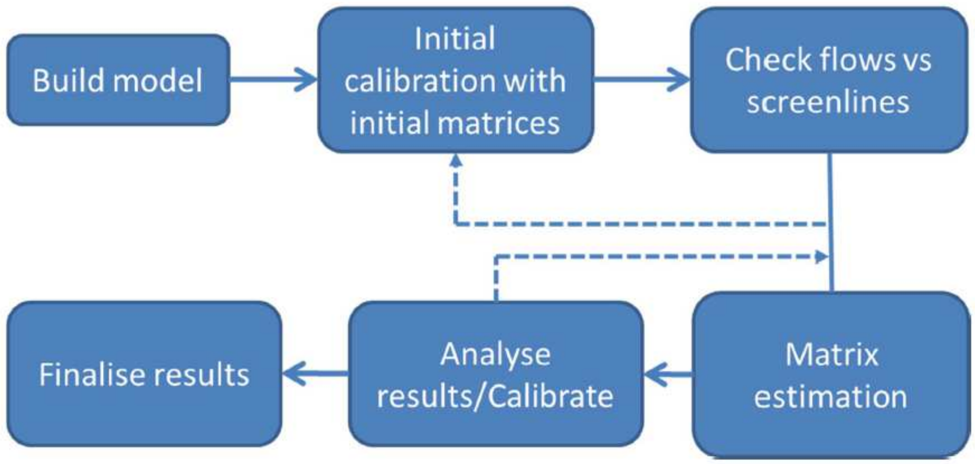

Figure 5.1.1 Overview of calibration process

5.1.2. Flow calibration is a process whereby modelled flow output are compared and calibrated to match observed traffic flows within a network. In the development of the Enderby Village Microsimulation Model, flow calibration has been undertaken on links at 10 key sites around the village. The sites chosen for calibration can be viewed in figure 5.1.2. For each of these sites the modelled flow was compared to the observed flow on each link and turning movement as part of the ME process.

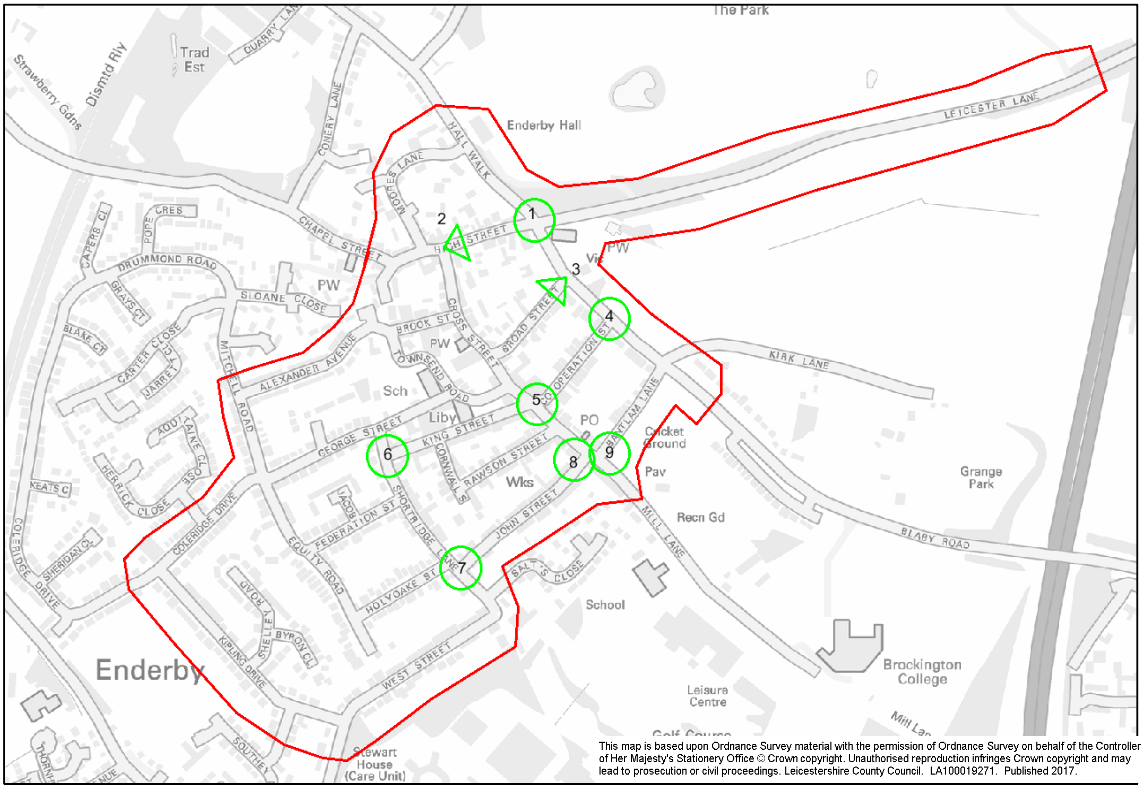

Figure 5.1.2 Locations used to calibrate the model.

5.1.3. In addition to flow calibration, delays and journey times have also been monitored as part of the model calibration process. The results from this analysis can be found on section 6.2.

5.2. Validation

5.2.1. Screenline validation has been undertaken to validate the Enderby Village Microsimulation Model. Four screenlines have been created and the number of vehicles crossing each screenline is monitored in each core scenario. A plan showing the screenlines can be found in figure 5.2.1.

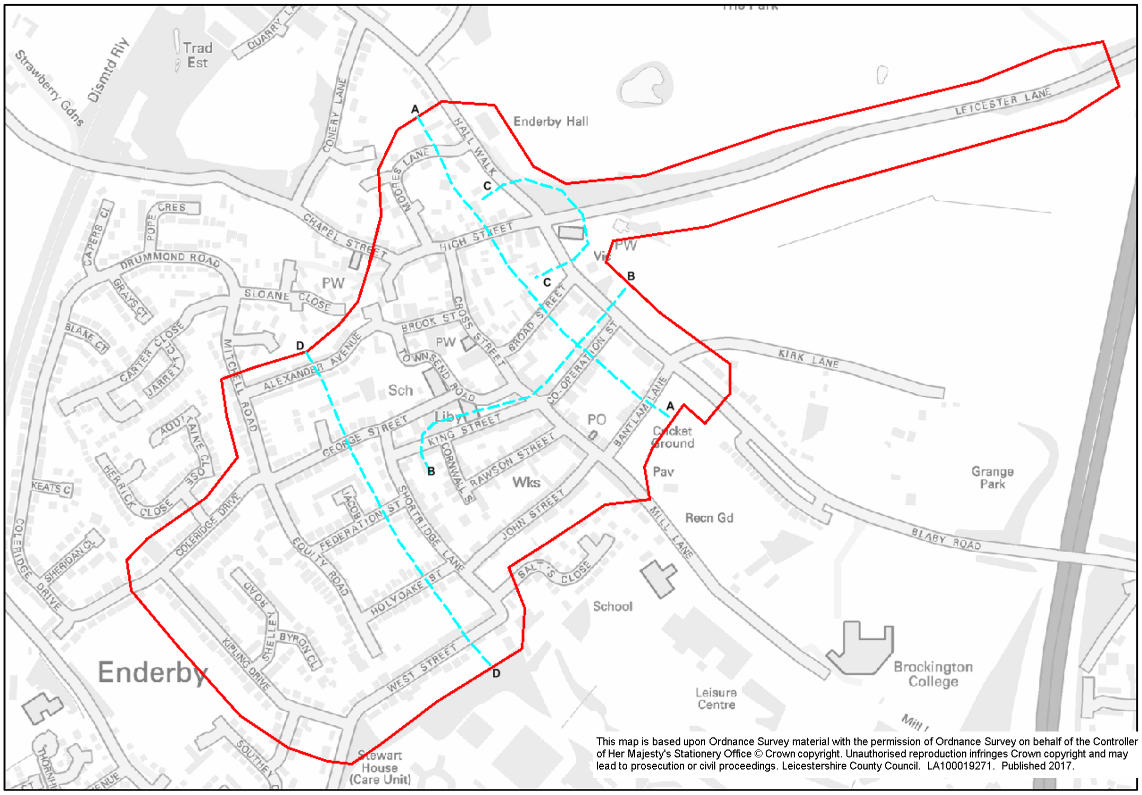

Figure 5.2.1 Validation Screenlines used in the development of the Enderby Village Microsimulation Model.

5.3. WebTAG Calibration and Validation guidelines

5.3.1. The WEBTAG calibration and validation guideline criteria have been applied to the Enderby Village Microsimulation Model and can be seen in this section.

5.3.2. WebTAG dictates the margin of error acceptable within a model. However, it should be noted that the guidance in WebTAG is produced for macroscopic models, typically covering larger areas, containing many more trips, with a sparser coverage of count data.

5.3.3. The relevant WebTAG guidance which applies to this model can be found in figures 5.3.1. and 5.3.2.

Link Flow and Turning Movement Validation

3.2.7 For link flow validation, the measures which should be used are:

- the absolute and percentage differences between modelled flows and counts; **and**
- the GEH statistic, which is a form of the Chi-squared statistic that incorporates both relative and absolute errors, and is defined as follows:

$$GEH = \sqrt{\frac{(M-C)^2}{(M+C)/2}}$$

where: GEH is the GEH statistic;

M is the modelled flow; and

C is the observed flow.

These two measures are broadly consistent and link flows that meet either criterion should be regarded as satisfactory.

3.2.8 The validation **criteria** and **acceptability guidelines** for link flows and turning movements are defined in Table 2.

Table 2 Link Flow and Turning Movement Validation Criteria and Acceptability Guidelines

Criteria	Description of Criteria	Acceptability Guideline
1	Individual flows within 100 veh/h of counts for flows less than 700 veh/h	> 85% of cases
	Individual flows within 15% of counts for flows from 700 to 2,700 veh/h	> 85% of cases
	Individual flows within 400 veh/h of counts for flows more than 2,700 veh/h	> 85% of cases
2	GEH < 5 for individual flows	> 85% of cases

WebTAG Unit M3.1

Figure 5.3.1 WebTAG link flow and turning movements guidelines

Table 1 Screenline Flow Validation Criterion and Acceptability Guideline

Criteria	Acceptability Guideline
Differences between modelled flows and counts should be less than 5% of the counts	All or nearly all screenlines

WebTAG Unit M3.1

Figure 5.3.2 WebTAG flow screenline guideline

5.4. WebTAG Calibration and Validation Results

5.4.1. Full calibration and validation results can be found in Appendix 1. This section presents a summary of the results.

Calibration Summary	AM	PM
Link Compliance	19/24 (79%)	22/24 (92%)
Turning Compliance	50/55 (91%)	52/55 (95%)

Table 5.4.1 Summary of the calibration results

Time	Screenline	Direction	Observed Count	Model Flow	% Difference
AM	A	Eastbound	569	448	-21
		Westbound	312	386	+24
		Overall	**881**	**834**	**-5**
	B	Northbound	1140	1235	+8
		Southbound	388	383	-1
		Overall	**1528**	**1618**	**+6**
	C	To Junction	1876	1927	+3
		From Junction	1821	1805	-1
		Overall	**3697**	**3692**	**+0**
	D	Eastbound	475	361	-24
		Westbound	165	134	-19
		Overall	**640**	**495**	**-23**
PM	A	Eastbound	400	375	-6
		Westbound	549	547	0
		Overall	**949**	**922**	**-3**
	B	Northbound	791	849	+7
		Southbound	685	727	+6
		Overall	**1476**	**1576**	**+7**
	C	To Junction	1806	1995	+10
		From Junction	1655	1827	+10
		Overall	**3461**	**3822**	**+10**
	D	Eastbound	284	342	+20
		Westbound	405	530	+31
		Overall	**689**	**872**	**+27**

Table 5.4.2 Summary of the screenline validation results

5.4.2. Although not all base models meet the full WebTAG guidelines, however the models have still achieved an acceptable level of calibration and validation. In general the calibration sites comply very well to the guidelines. The screenlines generally perform better in the Enderby village centre area.

5.4.3. Despite not complying to all of the WebTAG guidelines, it is considered that the level of calibration and validation is such that the model provides a robust starting point for testing schemes in the Do Something Scenario.

6. Model Outcomes

6.1. Observed traffic conditions

6.1.1. The contents of this section are designed to describe how the model behaves during the relevant peak period.

6.1.2. The AM peak sees high demand through the Hall Walk, Leicester Lane and Blaby Road junction, with large queues developing in all directions throughout the peak period. This can be seen in figure 6.1.1. The observation in the model matches what is experienced on the ground.

6.1.3. In the AM peak there also periodic queues observed on North-East bound movements within Enderby Village, with traffic attempting to get onto Blaby Road. Generally the largest queues can be found on Co-Operation Street, however there are also queues observed along Broad Street and Bantlam Lane. This situation is captured in figure 6.1.2.

6.1.4. Figures 6.1.3. and 6.1.4. show the most trafficked links and the average speed on links respectively. Perhaps unsurprisingly links along Hall Walk, Leicester Lane and Blaby Road carry the highest volume of trips. Many links within Enderby Village are lightly trafficked; there is a noticeable movement through the village to/from south west to the east. The average speed along links can provide insight as to where congestion is occurring, and with this in mind the key junction at Hall Walk, Leicester Lane and Blaby Road flags up as having a low average speed. Much of the village area is speed restricted to around 20mph to take into account for observed traffic conditions. However it is still clear that there are delays along Co-Operation Street and other parallel links approaching Blaby Road.

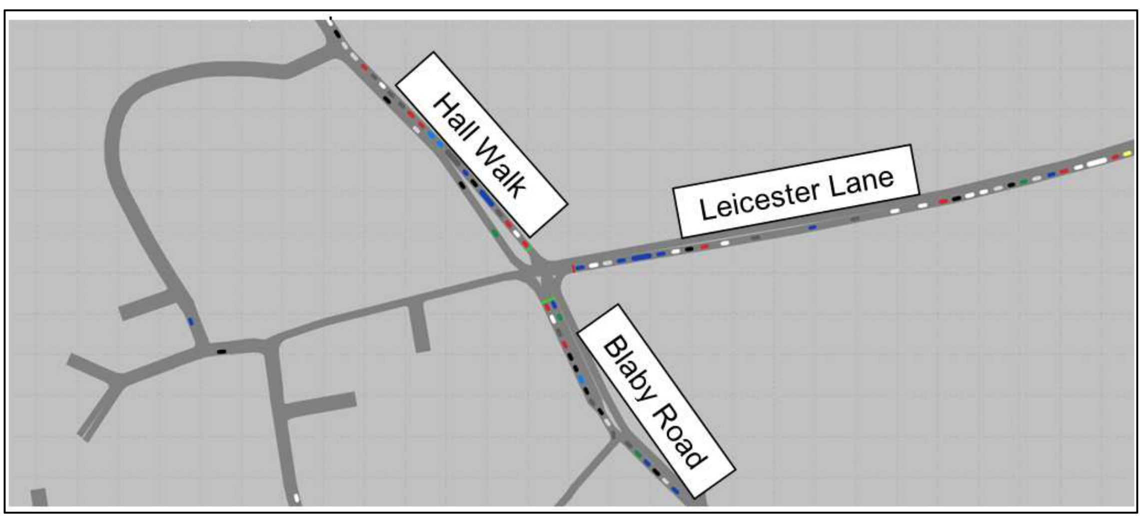

Figure 6.1.1 AM peak period queuing observed at the Hall Walk, Leicester Lane and Blaby Road junction

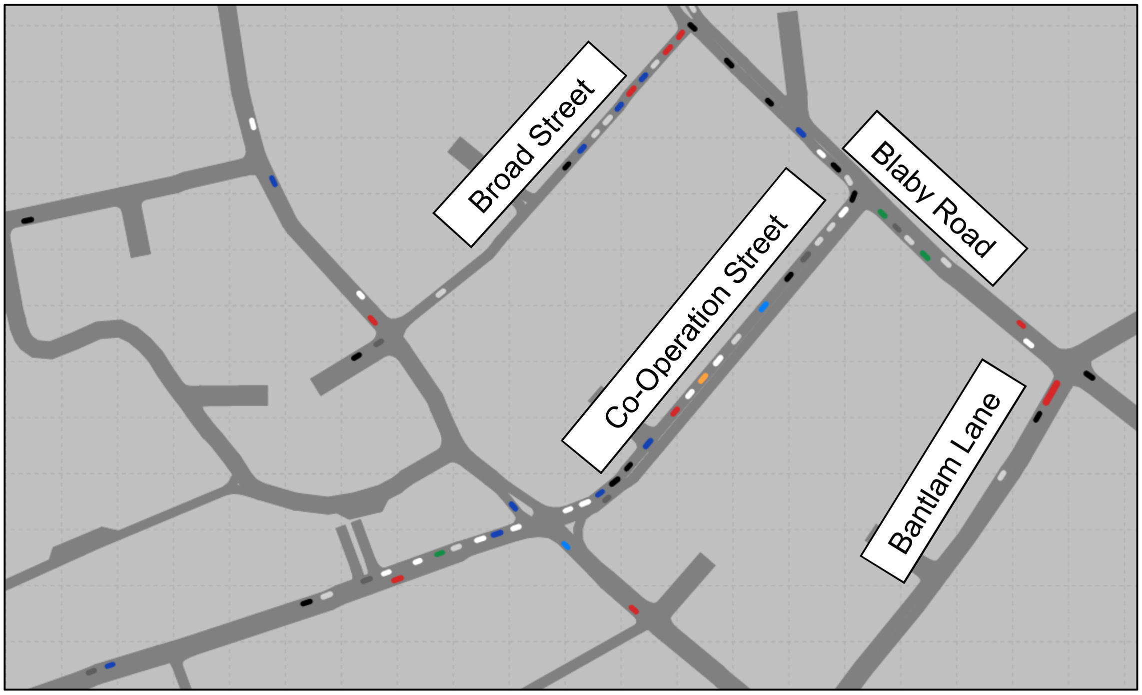

Figure 6.1.2 Queuing traffic observed on village roads during the AM peak.

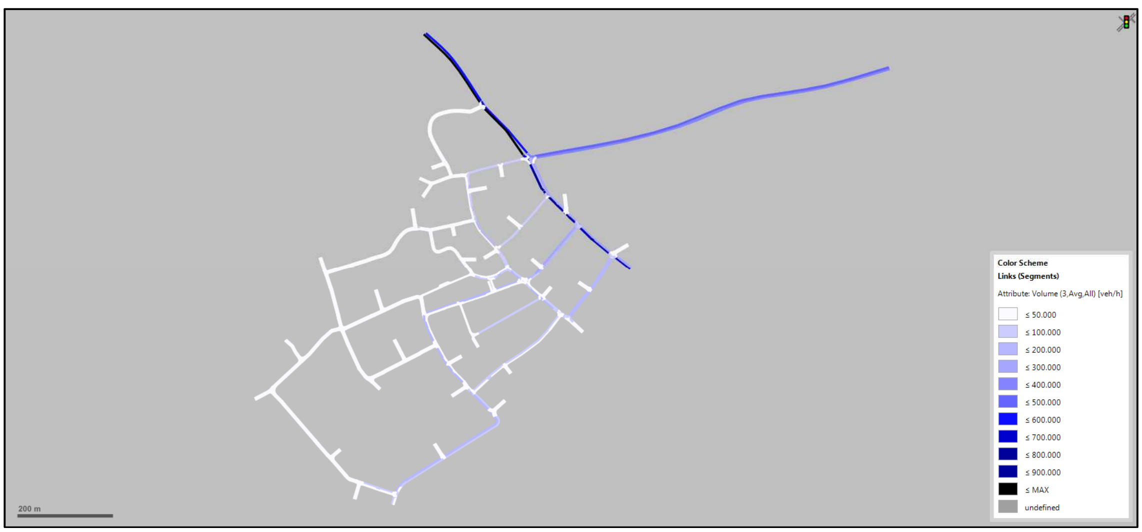

Figure 6.1.3 AM peak hour traffic flow distribution (vehicles/hour)

Figure 6.1.4 AM peak hour average speed (KM/H)

6.1.5. In the PM peak there are also queues present at the Hall Walk, Leicester Lane and Blaby Road junction; the largest of which appear on Leicester Lane approaching the junction. Inside the village there is very little queueing, and where there is it is usually confined to Co-Operation Street and parallel links. A summary of the traffic situation around the congested Hall Walk, Leicester Lane and Blaby Road junction is found in figure 6.1.5.

6.1.6. The PM peak model has a similar flow distribution to the AM model, with the highest flows confined to Hall Walk, Leicester Lane and Blaby Road. There is also a noticeable flow to/from south west Enderby up to routes onto Blaby Road. The flow distribution plan can be seen in Figure 6.1.6.

6.1.7. Figure 6.1.7.shows the average speed of vehicles travelling on the Enderby Village network. The PM network generally appears to have a higher average speed on most links than the AM equivalent. However there are still low speeds prevalent on links approaching the Hall Walk, Leicester Lane and Blaby Road junction. Much of the village area is speed restricted to around 20mph to take into account for observed traffic conditions. However it is still clear that there are delays along Co-Operation Street and other parallel links approaching Blaby Road.

Figure 6.1.5 Typical PM peak hour traffic conditions at the Hall Walk, Leicester Lane and Blaby Road junction.

Figure 6.1.6 PM peak hour traffic flow distribution (vehicle/hour)

Figure 6.1.7 PM peak hour average speed (KM/H)

6.2. Journey Time Analysis

6.2.1. An additional assessment of journey times has been undertaken to provide a numerical comparison between this, the core scenario, and the do something scenario. Measurements from the model have been undertaken for the routes outlined in Table 6.2.1. and Figure 6.2.1.

6.2.2. Journey times have been derived by running the model five times and averaging the length of time it takes vehicles to travel from one point to another. Trips between A, B and C are subject to little or no route choice; therefore there is confidence that the trips will follow the routes drawn in figure 6.2.1. For trips between D and E there is route choice, and therefore the overall journey time will consist of trips undertaking a range of routes.

To/From	A *Hall Walk*	B *Leicester Lane*	C *Blaby Road*	D *Co-Operation Street*	E *Stewart Avenue*
A	-			-	-
B		-		-	-
C			-	-	-
D	-	-	-	-	
E	-	-	-		-

Table 6.2.1 Journey time route matrix

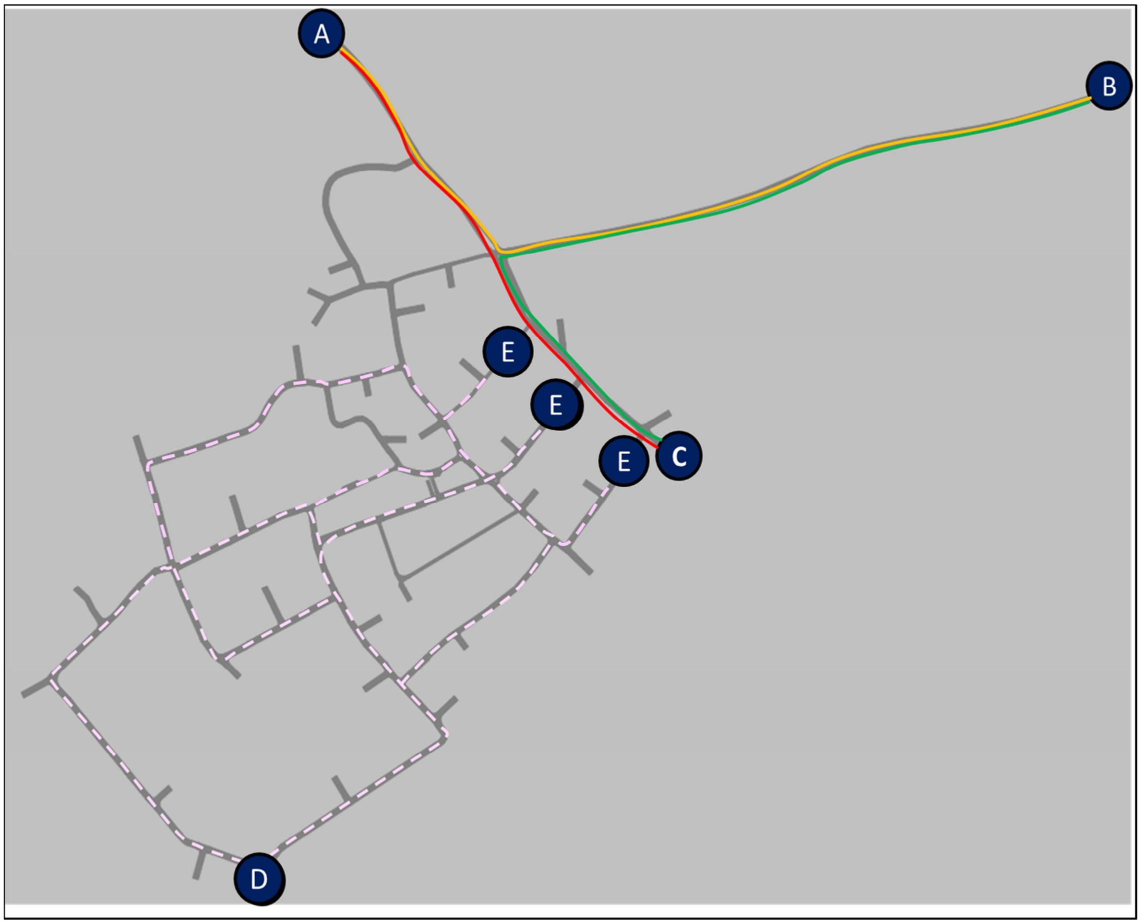

Figure 6.2.1 Journey Time Routes

6.2.3. The results of journey time from the model runs can be found in Table 6.2.2. In general these results back up what was observed in the traffic flows and average speeds analysis section. Trips from point B (Leicester Lane) experience the highest journey times. Trips in Enderby Village, between points D and E, take longer in the AM period in comparison to the PM period. Overall however across all routes, the PM peak period generally performs better than the AM peak period.

AM-Core	Iteration										Average	
	1		2		3		4		5			
	Vehicles	Time	Vehicles	Time	Vehicles	Time	Vehicles	Time	Vehicles	Time	Vehicles	Time
A -> B	292	204	293	216	306	195	292	215	328	198	302	206
B -> A	352	429	364	332	362	335	360	362	349	248	357	341
A -> C	141	185	129	222	173	181	133	190	154	182	146	192
C -> A	550	111	535	115	572	115	599	107	567	111	565	112
B -> C	1	598	1	173	1	412	1	409	2	343	1	387*
C -> B	18	195	11	145	21	195	15	159	16	169	16	173
D -> E	98	327	102	331	93	313	98	247	94	219	97	288
E -> D	5	213	8	193	6	204	5	266	8	207	6	217

PM-Core	Iteration										Average	
	1		2		3		4		5			
	Vehicles	Time	Vehicles	Time	Vehicles	Time	Vehicles	Time	Vehicles	Time	Vehicles	Time
A>B	410	99	388	118	422	114	430	134	427	137	415	120
B>A	257	504	241	505	253	307	267	394	250	531	254	448
A>C	311	83	339	102	329	99	335	118	331	123	329	105
C>A	293	112	289	119	340	77	294	113	292	122	302	109
B>A	50	509	75	508	61	329	55	396	65	554	61	459
B>C	116	252	115	245	111	185	100	264	100	292	108	248
D>E	106	313	103	382	108	343	106	361	108	337	106	347
E>D	39	207	43	199	42	193	39	203	40	206	41	202

Table 6.2.2 Journey time route results

* Results between points B -> C in the AM have been omitted from averages due to a low number of trips observed in the model.

7. Do Something Scenario

7.1. Do Something Schemes

7.1.1. The Do Something scenario has required the following changes to be implemented within the Enderby Village road network:

- Cross Street (between High Street and Broad Street) southbound only
- Cross Street (between Broad Street and Co-Operation Street) northbound only
- Townsend Road (between Cross Street and George Street) westbound only
- King Street (entire length) westbound only
- John Street (entire length) eastbound only

7.1.2. In addition to the one way schemes, the Leicester bound bus route has been rerouted to avoid King Street (which is now one way), instead using John Street and Mill Lane before re-joining the original route along Co-Operation Street.

7.1.3. Figure 7.1. shows the extent of the proposed one way schemes which are coded into the Do Something scenario.

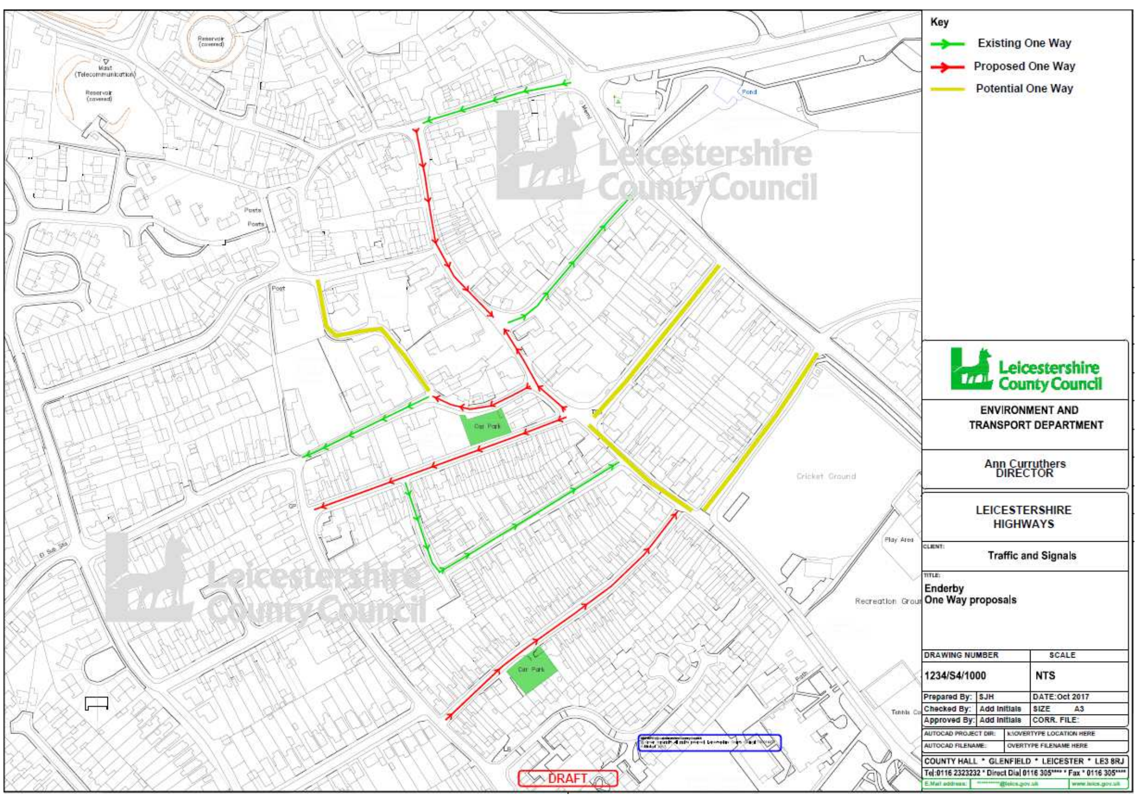

Figure 7.1.1 One way schemes to be coded into the Do Something scenario

7.2. Do Something Traffic Conditions

7.2.1. The model has been re-run with the Do Something network and comparable observations have been made to show the differences between the core and Do Something models.

7.2.2. In the AM Do Something peak hour scenario, the highest flows are observed on the Hall Walk, Leicester Lane and Blaby Road links. Within the village there is a high flow on John Street which results in queues. There is congestion observed on links approaching Blaby Road (Co-Operation Street and parallel routes). The model also predicts that there will be an increase in congestion along Bantam Lane towards Blaby Road. This is because from John Street a higher proportion of trips use Bantam Lane to access Blaby Road. This can be seen in Figure 7.2.1. Queuing is also observed on Mill Road on a less frequent basis. Average speed in the village is broadly comparable to the Core scenario. Notable exception to this however is John Street which is slower; the same is true for the northern section of Cross Street. Figures 7.2.2. and 7.2.3. show both the flow profiles and average speed along links.

Figure 7.2.1 Observed queueing on John Street and links approaching Blaby Road.

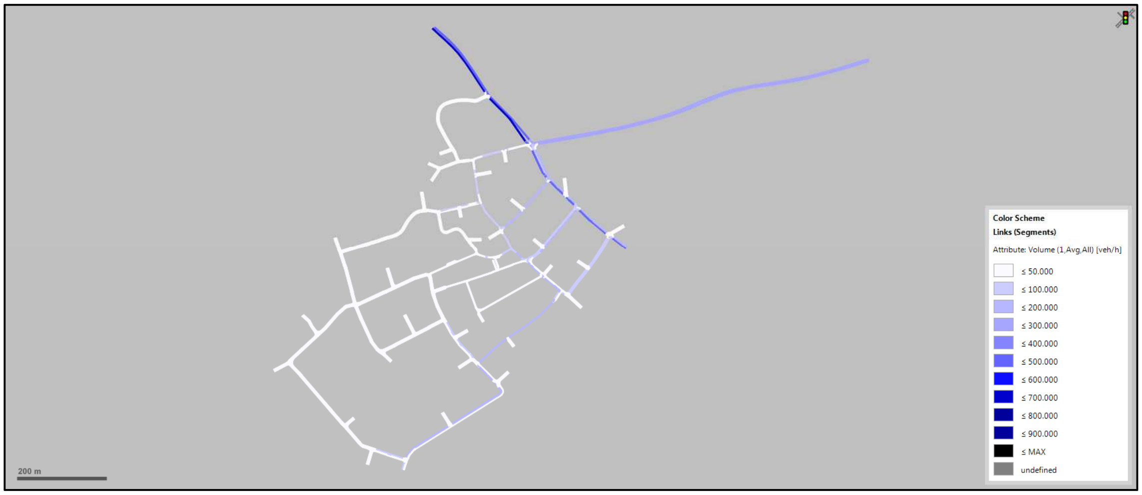

Figure 7.2.2 AM Do Something peak hour flow profile (Vehicle/Hour)

Figure 7.2.3 AM Do Something peak hour average speed (KM/H)

7.2.3. In the PM Do Something scenario again there is an increase in traffic using the John Street/Bantlam Lane corridor, however this does not routinely result in congestion within the village area. Queues are observed at the Hall Walk, Leicester Lane and Blaby Road junction, these queues are large, due to the amount of traffic using these links. Model observations can be seen in figure 7.2.4. Plans showing traffic flows and average speeds can be found in figures 7.2.5. and 7.2.6.

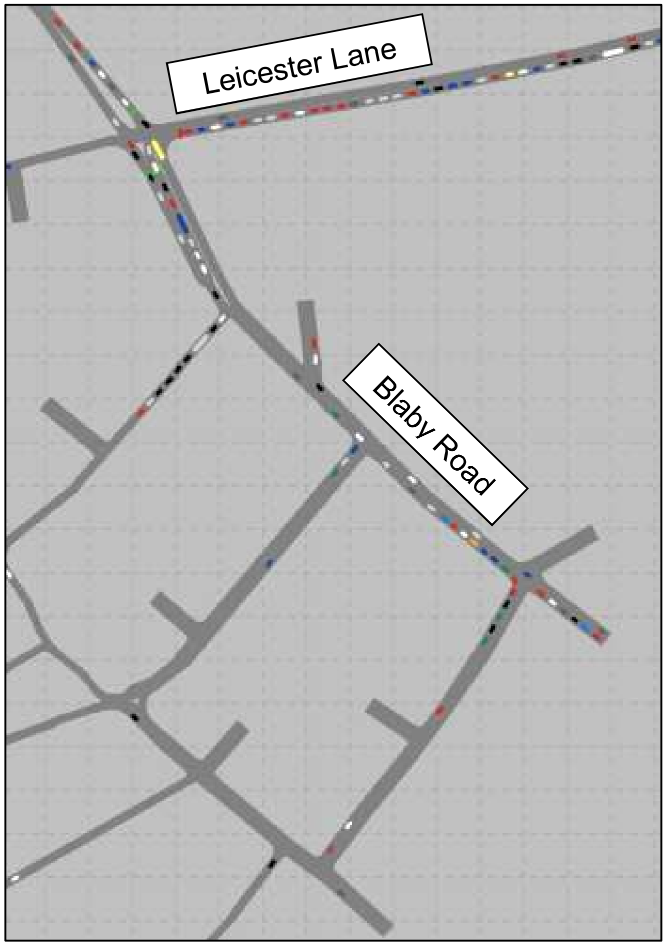

Figure 7.2.4 Standard traffic conditions observed in the PM Do Something Scenario

Figure 7.2.5 PM Do Something peak hour flow profile (Vehicles/Hour)

Figure 7.2.6 PM Do Something peak hour average speed (KM/H)

7.3. Journey Time Comparison

7.3.1. Identical routes have been used to test journey times within the Do Something scenario as in the Core scenario. This therefore gives a true comparison as to the two scenarios.

7.3.2. In isolation the DS journey time results reaffirm that trips approaching Enderby along Leicester Lane (point B) experience the highest journey times, especially in the PM peak. Within Enderby Village trips between points D and E take longer in the AM peak, trips North-East bound taking just under 6 minutes on average. Full results can be found in Table 7.3.1.

7.3.3. Table 7.3.2 and 7.3.3 presents the comparison between the Core and Do Something scenarios.

7.3.4. In the AM peak, generally there is an increase in Journey Time for trips entering the model from points A and C. Trips originating from point B see a slight decrease in journey times. Within Enderby village there are predicted to be increases in journey time for trips both to and from points D and E. The increases in journey time is greatest in the eastbound direction. On the whole, across all journey time routes and weighted depending on the traffic volume there is an increase of 1% in journey times with the implementation of the Do Something Scenario.

7.3.5. The PM peak differences suggest a slight decrease in journey times from point A. Trips originating from points B and C see an increase in journey times. Within the village again there is an increase in time for trips travelling to and from point D to E; this is greatest for eastbound trips. On the whole, across all journey time routes there is an increase of 4.3% in journey times with the implementation of the Do Something Scenario.

AM-DS	Iteration										Average	
	1		2		3		4		5			
	Vehicles	Time	Vehicles	Time	Vehicles	Time	Vehicles	Time	Vehicles	Time	Vehicles	Time
A -> B	284	226	290	215	316	206	303	183	297	218	298	210
B -> A	365	271	375	359	366	400	374	214	361	225	368	294
A -> C	123	224	147	205	162	199	150	161	138	232	144	204
C -> A	535	110	594	113	504	124	578	111	560	109	554	113
B -> C	0	0	1	491	1	489	0	0	2	367	1	269*
C -> B	22	182	18	183	12	259	15	170	16	151	17	189
D -> E	92	643	98	512	92	174	101	237	99	481	96	409
E -> D	4	346	5	209	8	213	6	249	10	239	7	251

PM-DS	Iteration										Average	
	1		2		3		4		5			
	Vehicles	Time	Vehicles	Time	Vehicles	Time	Vehicles	Time	Vehicles	Time	Vehicles	Time
A>B	410	100	399	116	431	122	431	127	441	130	422	119
B>A	256	506	242	501	253	309	260	432	243	553	251	460
A>C	311	85	348	95	334	102	339	107	346	116	336	101
C>A	264	133	246	134	299	104	290	115	282	118	276	121
B>A	50	511	75	506	62	335	52	432	63	570	60	471
B>C	108	327	95	245	95	254	100	265	98	262	99	271
D>E	123	391	121	544	128	448	125	397	129	425	125	441
E>D	40	246	45	238	40	224	37	228	39	224	40	232

Table 7.3.1 Journey time analysis for the Do Something Scenarios.

* Results between points B -> C in the AM have been omitted from averages due to a low number of trips observed in the model.

AM Diff	Core Average (S)	DS Average (S)	Core-DS (S)	PM Diff	Core Average (S)	DS Average (S)	Core-DS (S)
A -> B	206	210	4	A -> B	120	119	-2
B -> A	341	294	-47	B -> A	448	460	12
A -> C	192	204	12	A -> C	105	101	-4
C -> A	112	113	1	C -> A	109	121	12
B -> C	n/a	n/a	n/a	B -> C	459	471	12
C -> B	173	189	16	C -> B	248	271	23
D -> E	288	409	122	D -> E	347	441	94
E -> D	217	251	35	E -> D	202	232	30
TOTAL	1527	1671	143	TOTAL	1578	1744	177

Table 7.3.2 Difference in journey time between the Core and Do Something models. *

* Results between points B -> C in the AM have been omitted due to a low number of trips observed in both the Core and Do Something models.

Difference	Average (S)	Average (%)
AM	20	1.0%
PM	22	4.3%

Table 7.3.3 Vehicle weighted journey time difference for all routes

8. Conclusions

8.1.1. The Enderby Village Microsimulation Model has been produced to show the impact of a proposed traffic management scheme within the village, using a 2017 base year and count data. Through comparing the Core with the Do Something model, the impacts of the scheme has been assessed both through observation and by analysing journey times.

8.1.2. The results of the modelling suggest that the network will be between 1% and 4% slower as a result of the implementation of the Do Something schemes. On the higher trafficked routes (Hall Walk, Leicester Lane and Blaby Road) there is generally little change in observed queuing and traffic behaviour. The scheme is predicted to cause an increase in journey time in all directions within Enderby Village, primarily as a result of reduction of capacity and route choice.

9. Contact Details

We trust that this report meets your requirements and we look forward to having the opportunity to work with you again in the future.

If you have any questions please do not hesitate to contact:

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Appendix 1

Calibration and Validation results

Project Reference: 3899.005

Leicestershire County Council

AM – Turning Movement

Count Site		COUNT	AVERAGE MODELFLOW	# Diff
1A1	Leicester Lane/ B582/ High Street	390	303	-87.0
1A2		241	239.4	-1.6
1A3		12	38	26.0
1B1		384	362.4	-21.6
1B2		30	4.8	-25.2
1B3		13	31.2	18.2
1C1		13	37.2	24.2
1C2		479	705	226.0
1C3		303	154.2	-148.8
2A1	High Street	8	11.4	3.4
2A2		54	70.6	16.6
3A1	Broad Street	174	58.2	-115.8
3A2		20	14.8	-5.2
4A1	B582/ Co-Operation Street	249	204.4	-44.6
4A2		41	81	40.0
4B1		75	55.6	-19.4
4B2		435	681.2	246.2
4C1		186	165.6	-20.4
4C2		38	58.4	20.4
5A1	Co-Operation St/ Mill Ln/ King St/ Cross St	15	62.2	47.2
5A2		50	13.4	-36.6
5A3		3	1.8	-1.2
5B1		42	31.6	-10.4
5B2		33	13.6	-19.4
5B3		4	66.2	62.2
5C1		11	1.8	-9.2
5C2		78	82.8	4.8
5C3		19	35.8	16.8
5D1		77	18.2	-58.8
5D2		191	124	-67.0
5D3		56	1.4	-54.6
6A1	Shortridge Lane/ King Street	134	58.8	-75.2
6A2		26	5	-21.0
6B1		5	6	1.0
6B2		28	4.8	-23.2
6C1		7	2.4	-4.6
6C2		182	158.6	-23.4
7A1	Shortridge Lane/ John Street	5	5	0.0
7A2		52	28.4	-23.6
7B1		34	43.8	9.8
7B2		6	25.8	19.8
7C1		173	139	-34.0
7C2		99	92.8	-6.2
8A1	Bantlam Lane/ John Street	101	103.6	2.6
8A2		5	17.4	12.4
8B1		33	47.8	14.8
8B2		88	75.8	-12.2
8C1		12	44.4	32.4
8C2		103	56.8	-46.2
9A1	Mill Lane/ Bantlam Lane	109	76.2	-32.8
9A2		20	82.4	62.4
9B1		101	41.2	-59.8
9B2		75	32.6	-42.4
9C1		48	121.8	73.8
9C2		156	38.6	-117.4
				91% Compliance

PM – Turning Movement

Count Site		COUNT	AVERAGE MODELFLOW	# Diff
1A1	Leicester Lane/ B582/ High Street	418	412.6	-5.4
1A2		319	407	88.0
1A3		30	22.4	-7.6
1B1		296	254.4	-41.6
1B2		94	68	-26.0
1B3		68	106.8	38.8
1C1		27	75.8	48.8
1C2		392	472.4	80.4
1C3		162	173.6	11.6
2A1	High Street	32	3	-29.0
2A2		98	91.2	-6.8
3A1	Broad Street	98	63.4	-34.6
3A2		34	1	-33.0
4A1	B582/ Co-Operation Street	368	389.8	21.8
4A2		73	124	51.0
4B1		141	41.4	-99.6
4B2		384	490.2	106.2
4C1		107	106.2	-0.8
4C2		47	73.2	26.2
5A1	Co-Operation St/ Mill Ln/ King St/ Cross St	20	70.2	50.2
5A2		31	9.2	-21.8
5A3		11	14.2	3.2
5B1		143	8.4	-134.6
5B2		95	100.4	5.4
5B3		21	49.8	28.8
5C1		21	7.2	-13.8
5C2		68	29.8	-38.2
5C3		20	32.6	12.6
5D1		39	48.4	9.4
5D2		115	70.4	-44.6
5D3		24	2.4	-21.6
6A1	Shortridge Lane/ King Street	90	28.6	-61.4
6A2		71	166.2	95.2
6B1		20	56.8	36.8
6B2		81	64	-17.0
6C1		13	1.2	-11.8
6C2		92	96	4.0
7A1	Shortridge Lane/ John Street	9	2	-7.0
7A2		121	225.2	104.2
7B1		59	145	86.0
7B2		11	1.6	-9.4
7C1		93	108.8	15.8
7C2		70	75	5.0
8A1	Bantlam Lane/ John Street	20	16	-4.0
8A2		66	17.8	-48.2
8B1		60	126.8	66.8
8B2		72	20	-52.0
8C1		11	43.8	32.8
8C2		63	32.4	-30.6
9A1	Mill Lane/ Bantlam Lane	128	175.8	47.8
9A2		43	32.8	-10.2
9B1		91	113.8	22.8
9B2		75	84	9.0
9C1		39	43.2	4.2
9C2		90	5.2	-84.8
				95% Compliance

AM – Link Flow

Count Site		COUNT	AVERAGE MODELFLOW	# Diff
1A	Hall Walk	637	639.8	2.8
1B	Leicester Lar	56	73.2	17.2
1C	Blaby Road	790	870.6	80.6
2A	High Street	228	128.8	-99.2
3A	Broad Street	269	219.2	-49.8
4A	Blaby Road	116	136.6	20.6
4B	Blaby Road	621	846.8	225.8
4C	Co-Operatio	53	120.6	67.6
5A	Cross Street	95	46.8	-48.2
5B	Co-Operatio	48	81.6	33.6
5C	Mill Lane	174	136.8	-37.2
5D	King Street	381	184.2	-196.8
6A	Shortridge La	31	11	-20.0
6B	King Street	35	7.2	-27.8
6C	Shortridge La	187	163.6	-23.4
7A	Shortridge La	86	72.2	-13.8
7B	John Street	179	164.8	-14.2
7C	Shortridge La	200	196.4	-3.6
8A	Mill Lane	38	65.2	27.2
8B	Mill Lane	100	120.2	20.2
8C	John Street	212	133	-79.0
9A	Mill Lane	121	123.6	2.6
9B	Bantlam Roa	123	154.4	31.4
9C	Mill Lane	156	38.6	-117.4
				79% Compliance

PM – Link Flow

Count Site		COUNT	AVERAGE MODELFLOW	# Diff
1A	Hall Walk	645	683.8	38.8
1B	Leicester Lar	189	250.6	61.6
1C	Blaby Road	586	649	63.0
2A	High Street	196	154.6	-41.4
3A	Broad Street	402	390.8	-11.2
4A	Blaby Road	214	165.4	-48.6
4B	Blaby Road	491	596.4	105.4
4C	Co-Operatio	67	143.4	76.4
5A	Cross Street	185	31.8	-153.2
5B	Co-Operatio	137	157.4	20.4
5C	Mill Lane	127	110.8	-16.2
5D	King Street	229	101.4	-127.6
6A	Shortridge La	91	223	132.0
6B	King Street	94	65.2	-28.8
6C	Shortridge La	101	98	-3.0
7A	Shortridge La	180	370.2	190.2
7B	John Street	104	110.4	6.4
7C	Shortridge La	90	91	1.0
8A	Mill Lane	126	144.6	18.6
8B	Mill Lane	83	63.8	-19.2
8C	John Street	191	208.2	17.2
9A	Mill Lane	134	146.6	12.6
9B	Bantlam Roa	114	127.2	13.2
9C	Mill Lane	90	5.2	-84.8
				92% Compliance

Link Calibration Results

Leicestershire County Council

AM	Count Site	COUNT	MODEL FLOW 1	2	3	4	5	AVERAGE	% Diff	# Diff	COUNT	MODEL FLOW	% Diff
A1	Moores Lane (Eb)	18	0	3	4	4	2	2.6		-15.4	881	833	0.95
A2	Moores Lane (Wb)	4	9	8	2	7	5	6.2		2.2			
A3	High Street (Wb)	55	78	79	84	72	75	77.6		22.6			
A4	Broad Street (Eb)	196	63	74	79	77	86	75.8		-120.2			
A5	Co-Operation Street (Eb)	227	216	232	239	227	216	226		-1.0			
A6	Co-Operation Street (Wb)	120	131	148	149	148	142	143.6		23.6			
A7	Bantlam Lane (Eb)	128	149	142	143	140	143	143.4		15.4			
A8	Bantlam Lane (Wb)	133	158	155	151	162	165	158.2		25.2			
B1	King Street (Wb)	35	12	11	11	14	10	11.6		-23.4	1528	1617	1.06
B2	King Street (Eb)	326	228	216	210	216	208	215.6		-110.4			
B3	Cross Street (Nb)	193	162	185	183	193	168	178.2		-14.8			
B4	Cross Street (Sb)	63	88	81	75	77	77	79.6		16.6			
B5	Blaby Road (Nb)	621	842	873	805	840	844	840.8		219.8			
B6	Blaby Road (Sb)	290	270	288	268	307	324	291.4		1.4			
C1	Hall Walk (Nb)	863	1060	1105	1039	1069	1072	1069	1.24		3697	3692	1.00
C2	Hall Walk (Sb)	643	556	603	559	604	614	587.2		-55.8			
C3	Leicester Lane (Eb)	693	442	467	446	474	474	460.6		-232.4			
C4	Leicester Lane (Wb)	438	394	405	404	407	409	403.8		-34.2			
C5	Blaby Road (Sb)	265	262	279	251	284	304	276		11.0			
C6	Blaby Road (Nb)	795	895	928	860	888	904	895	1.13				
D1	Alexander Avenue (Eb)	44	66	53	62	39	62	56.4		12.4	640	495	0.77
D2	Alexander Avenue (Wb)	13	25	16	17	10	21	17.8		4.8			
D3	George Street (Eb)	134	34	20	28	29	33	28.8		-105.2			
D4	George Street (Wb)	53	17	9	11	12	15	12.8		-40.2			
D5	Federation Street (Eb)	20	41	42	43	41	49	43.2		23.2			
D6	Federation Street (Wb)	8	36	30	33	19	31	29.8		21.8			
D7	West Street (Eb)	277	225	249	227	233	229	232.6		-44.4			
D8	West Street (Wb)	91	67	78	74	72	77	73.6		-17.4			
		6746	6526	6779	6457	6665	6759						

PM	Count Site	COUNT	MODEL FLOW 1	2	3	4	5	AVERAGE	% Diff	# Diff	COUNT	MODEL FLOW	% Diff
A1	Moores Lane (Eb)	2	0	0	0	0	1	0.2		-1.8	949	922	0.97
A2	Moores Lane (Wb)	2	13	11	8	8	0	8		6.0			
A3	High Street (Wb)	151	158	160	173	173	167	166.2		15.2			
A4	Broad Street (Eb)	132	63	70	67	75	63	67.6		-64.4			
A5	Co-Operation Street (Eb)	154	188	174	184	174	174	178.8		24.8			
A6	Co-Operation Street (Wb)	214	168	168	165	168	157	165.2		-48.8			
A7	Bantlam Lane (Eb)	112	130	129	124	126	132	128.2		16.2			
A8	Bantlam Lane (Wb)	182	205	199	222	217	194	207.4		25.4			
B1	King Street (Wb)	182	117	121	122	123	120	120.6		-61.4	1476	1576	1.07
B2	King Street (Eb)	101	116	125	129	117	136	124.6		23.6			
B3	Cross Street (Nb)	245	127	125	128	131	129	128		-117.0			
B4	Cross Street (Sb)	62	101	91	93	90	92	93.4		31.4			
B5	Blaby Road (Nb)	445	601	589	640	578	572	596		151.0			
B6	Blaby Road (Sb)	441	481	543	508	512	522	513.2		72.2			
C1	Hall Walk (Nb)	688	731	690	772	746	695	726.8		38.8	3461	3822	1.10
C2	Hall Walk (Sb)	767	810	820	850	866	865	842.2	1.10				
C3	Leicester Lane (Eb)	580	586	572	590	590	593	586.2		6.2			
C4	Leicester Lane (Wb)	458	419	430	427	439	432	429.4		-28.6			
C5	Blaby Road (Sb)	387	482	542	510	514	522	514		127.0			
C6	Blaby Road (Nb)	581	734	717	768	714	685	723.6		142.6			
D1	Alexander Avenue (Eb)	30	49	63	60	56	52	56		26.0	689	872	1.27
D2	Alexander Avenue (Wb)	37	25	25	36	35	33	30.8		-6.2			
D3	George Street (Eb)	89	51	41	45	48	50	47		-42.0			
D4	George Street (Wb)	191	109	123	112	109	112	113		-78.0			
D5	Federation Street (Eb)	11	4	7	3	5	9	5.6		-5.4			
D6	Federation Street (Wb)	12	16	12	15	9	10	12.4		0.4			
D7	West Street (Eb)	154	237	228	238	225	238	233.2		79.2			
D8	West Street (Wb)	165	379	366	370	381	374	374		209.0			
		6575	7100	7141	7359	7229	7129						

Link Validation Results

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