



High Wycombe Highway Assignment Model

Buckinghamshire County Council

Local Model Validation Report

HWTCMSQ/HWHAM/LMVR | C

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1. Introduction

1.1 Overview

Jacobs are framework consultants to the Transport for Buckinghamshire Alliance (TfB) between Ringway Jacobs and Buckinghamshire County Council (BCC). Under the terms of this contract, Jacobs are commissioned to undertake transport planning, modelling and assessment studies on behalf of the County Council, working in partnership with District Councils.

Jacobs was commissioned by BCC and Wycombe District Council (WDC) to update the High Wycombe Highway Assignment Model (HWHAM) for the purposes of the continued assessment of the High Wycombe Town Centre Masterplan / Southern Quadrant (HWTM/SQ) devolved major scheme.

Jacobs manages a suite of transport models and assessment tools on behalf of the Councils. These models have been developed to inform the assessment of new schemes and land use proposals. HWHAM has been developed for the continued assessment of the HWTM/SQ proposals and as part of separate commissions emerging land use proposals including those associated with the adopted WDC Core Strategy (Reserve Sites).

1.2 Background

The HWHAM has developed iteratively over a period of decades and in 2011 an existing strategic highway assignment model was built using the PTV VISUM modelling suite which covered the urban area of High Wycombe. The previous version of the model had a 2010 base for the morning (AM) and evening (PM) peak hours and was developed by Jacobs using matrices from a 2006 CONTRAM model.

These matrices were developed using roadside interview (RSI) data from May 2006. The existing model was developed according to the guidelines in DMRB and WebTAG for highway assignment modelling then applicable. However, in August 2012 new guidance in the form of WebTAG unit 3.19 was released with a specific focus on highway assignment modelling. It was deemed prudent to review the existing model against this guidance and to create updated models to improve fit with new guidance where appropriate. The previous model development work was undertaken for the purposes of informing the testing of the emerging New Wycombe Local Plan and the model was reviewed and approved for use by Highways England.

1.3 Purpose of report

The first stage in the model development process is to produce updated 2013 AM and PM peak hour models consistent with the scope set out in the Appraisal Specification Report (Jacobs, June 2014). This Local Model Validation Report (LMVR) outlines the steps taken to build on previous modelling work to produce suitable base models of the High Wycombe urban area.

1.4 Structure of report

The content of the remaining sections of this report are as follows:

- Section 2 - an outline of the existing models and description of the steps taken to update the models to a 2013 base year
- Section 3 - data used for model development, matrix building and validation
- Section 4 - the development of the highway network
- Section 5 - the development of the assignment matrices
- Section 6 - the traffic assignments and model convergence
- Section 7 - network and route choice calibration
- Section 8 - calibration and validation of trip matrices

- Section 9 - summary of results

A glossary of the terms used in this report is provided in Appendix A.

2. Model Overview

2.1 History of the High Wycombe Transport Model

In 1992 Halcrow was appointed by BCC to develop a transport model of High Wycombe to assist in the development of a transport strategy as part of the Wycombe Transport Study (WTS). This model, known as WTS1, was developed using data collected in 1991 and 1992. In 2006, a new programme of data collection enabled a renewal of the model, referred to as WTS2. The WTS2 model was used by Jacobs as the foundation for the development of the 2010 model and in turn subsequent versions of the model.

2.2 Model update methodology

The specification for the recent updates of HWHAM comprised a methodology which can be summarised as follows:

- Review of available traffic data and collection of new data
- Coding of junction details to reflect latest layouts and signal settings
- Review of land use changes between 2006 and 2013
- Analysis of data to confirm no significant changes in traffic flows
- Update of 2006 matrices to 2013 using matrix estimation
- Validation of 2013 model using traffic counts and journey time data
- Stress testing to confirm that the model is fit for purpose

This version of the model addresses comments raised by Highways England consultants during a review associated with work undertaken as part of the emerging New Wycombe Local Plan. This included the presentation of additional flow and journey time validation information for the M40 between Junctions 5 and 3.

2.3 Model description

The key characteristics of the base model are summarised in Table 2-A.

Key Characteristics	High Wycombe 2013 Base
Model Structure	Highway assignment model
Base Model Year	2013
Zoning System	225 zones (120 within the study area)
Time Periods	AM Peak hour (08:00-09:00); PM Peak hour (17:00-18:00)
Model Area	High Wycombe urban area (see Figure 4-A), plus buffer network
Trip Matrices (Private Modes)	Car, LGV, HGV
Trip Matrices (Public Modes)	None
Modelling Package	PTV VISUM 12.52-13
Calibration/Validation	WebTAG unit 3.19

Table 2-A Characteristics of the High Wycombe Model

3. Review of Data

3.1 Data sources

An examination of recent data available from TfB and DfT yielded a wide range of suitable data:

- 2006 RSI surveys and counts from WS2 modelling¹
- Automatic traffic counts (ATCs) for 2011 to 2013
- Manual classified counts (MCCs) for 2010 to 2013
- TRADS data for the M40
- Highways England journey time database (JTDB) data for M40 in June 2013
- Trafficmaster journey time data for June 2013
- 2011/2 School Census Data

3.2 RSI Surveys

RSI's were undertaken at twelve sites around the town in May and June 2006. The locations are shown in Appendix B. The surveys were conducted for 12 consecutive hours on a weekday in one direction at each site, between 07:00 and 19:00. Bi-directional ATCs and MCCs were undertaken at each location.

Data from classified ATCs was collected at the same twelve locations in March 2013. A comparison of 2006 and 2013 flows is shown in Figure 3-A and Figure 3-B² for the three day average (Tuesday-Thursday) total traffic in the AM and PM peak hours.

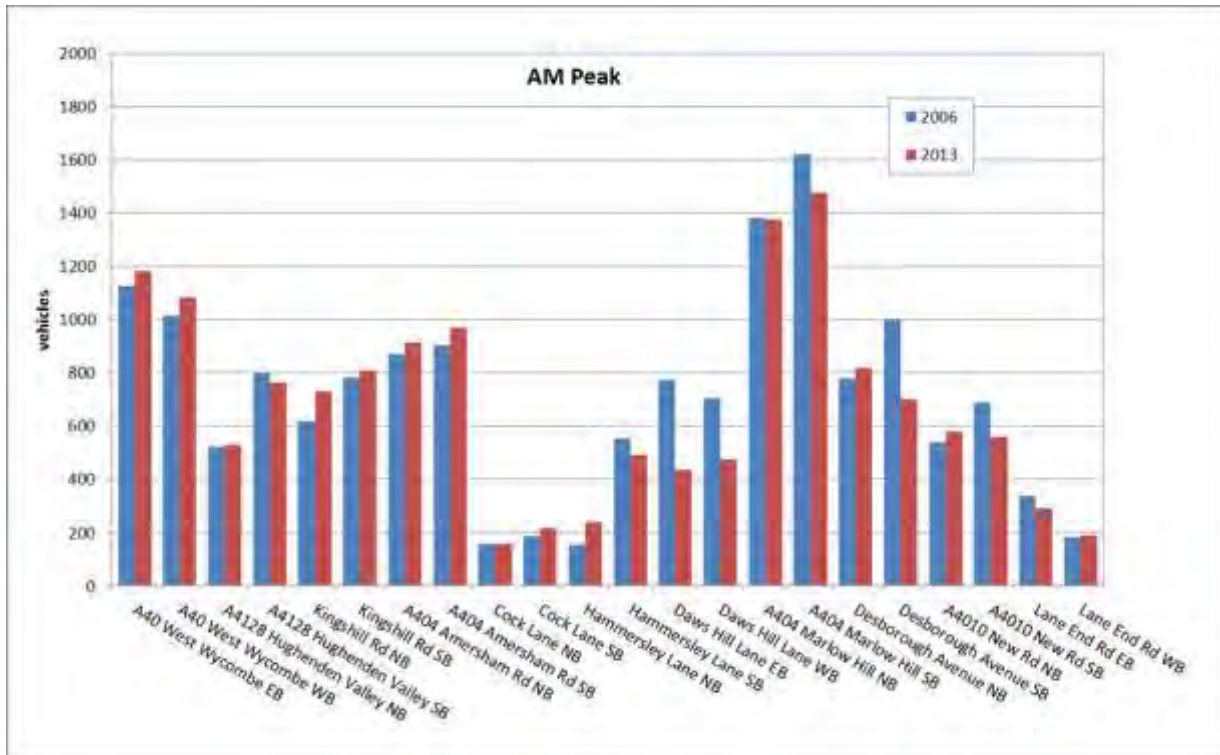


Figure 3-A Comparison of 2006 and 2013 AM peak flows at RSI sites

¹ Wycombe Transport Model Highway Model Development Report (Halcrow, October 2007)

² A404 Marlow Hill counts represented by 2012 data in Figures 3-A and 3-B (2013 data faulty)

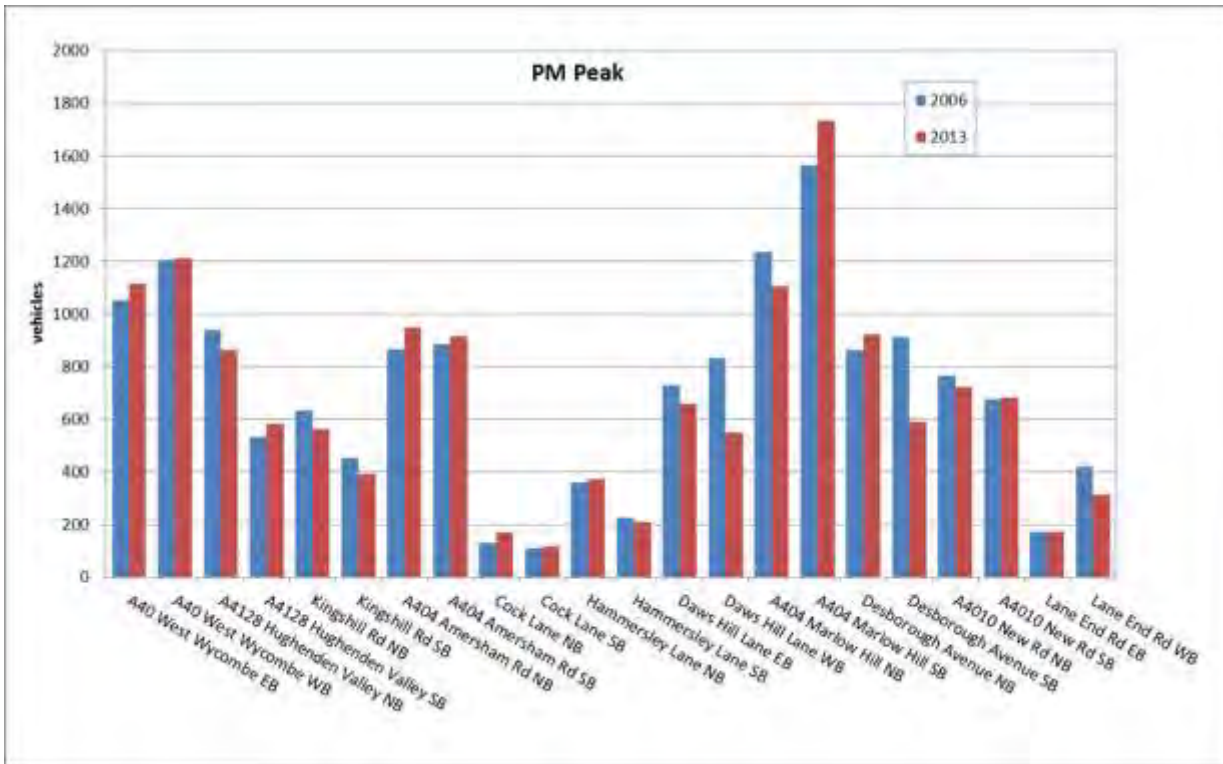


Figure 3-B Comparison of 2006 and 2013 PM peak flows at RSI sites

The change in flow varies between sites, however the overall change is a 4.5% reduction in the AM and a 4.2% reduction in the PM peak based on RSI site locations. While this is within the level of typical daily variation at traffic count sites, an overall negative change in traffic volume levels could be explained by local changes in land use and the impact of national economic conditions.

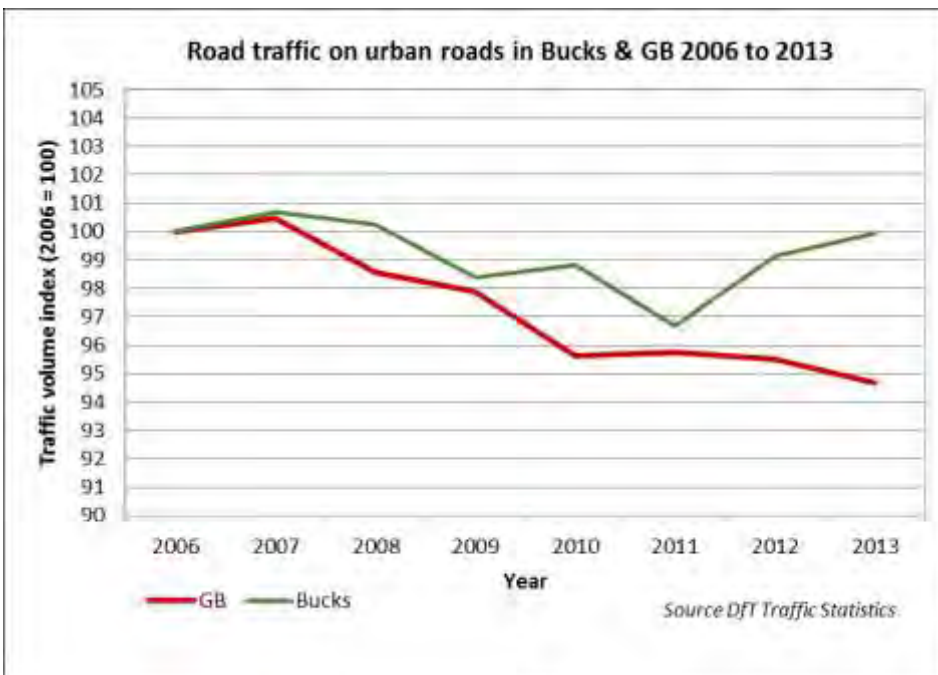


Figure 3-C Annual road traffic volumes indexed to 2006

Figure 3-C presents the historic trend for urban traffic (2006 to 2013) from DfT traffic statistics. Over this period, urban road traffic (vehicle miles) in Great Britain dropped by 5.4%, while in Buckinghamshire it has returned to 2006 levels. Overall, the information shows that the traffic volumes within High Wycombe have not been subject to significant change (>10%) in the last 8 years and this supports the continued use of RSI data for the purposes the model is intended for use.

3.3 Traffic counts

TfB has carried out or commissioned a programme of traffic counts in High Wycombe. A review of these identified a number of counts which are suitable for use in this study. Where multiple counts were available, the most recent was selected, subject to quality. The majority of counts used are less than two years old, but it was decided to include manual classified turning counts carried out in the town centre in 2010. Data from sites around junctions 3 and 4 of the M40 were extracted from the TRADS database.

Where significant geographical gaps in the data set were found, new counts were commissioned. These included a manual classified turning count at Handy Cross (M40 Junction 4) and further count sites in the town centre. A full list of the count data used in this study, with details of location, type of count and survey date is given in Appendix C, together with a location plan. All ATC data was processed to calculate three day midweek averages using data for Tuesday to Thursday.

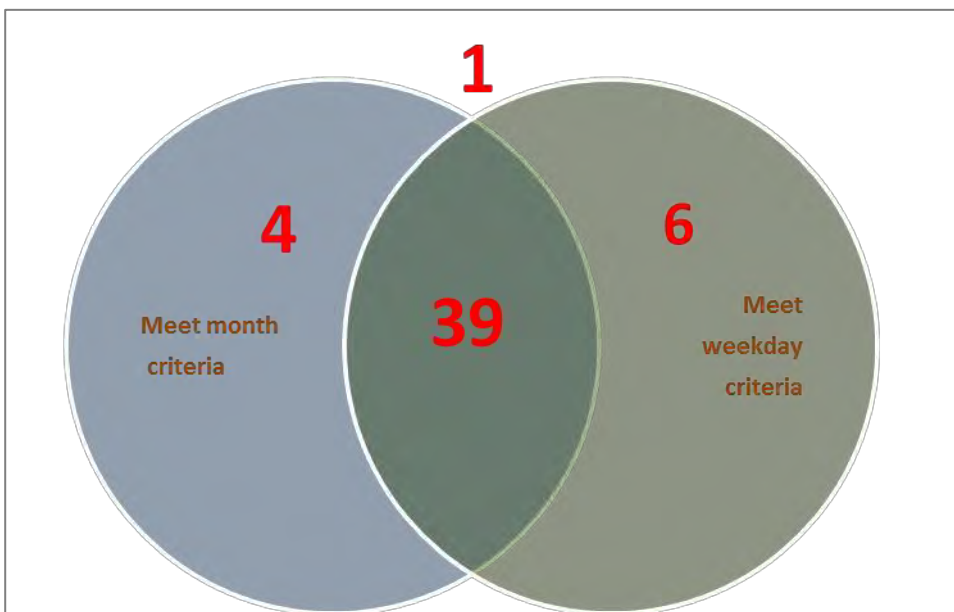


Figure 3-D Count data compliance with neutral month criteria

The traffic counts utilised in the model development are from a number of different years and months. WebTAG³ advises that surveys should be carried out during a 'neutral' (representative) month, excluding holiday periods, local school holidays and half terms. The following Tuesdays to Thursdays can be considered neutral:

- late March and April – excluding the weeks before and after Easter
- May - excluding the Thursday before and all of the week of each Bank Holiday
- June, September, October and November (adequate light permitting)

Analysis of the traffic counts (illustrated in Figure 3-D) used in this study shows that nearly 80% (39 counts) meet the above criteria fully. A further 10 counts meet either the weekday or month criteria. Only one site does not meet any of the requirements.

³ TAG Unit M1.2 Data Sources and Surveys

3.4 Trafficmaster journey time data

Trafficmaster data is provided to Local Authorities by DfT for use in transportation studies. The Trafficmaster data contains average journey times for each Integrated Transport Network (ITN) link at 15 minute intervals for each day. The anonymised data also includes the type of vehicle generating the journey time and whether the data was collected on a school day.

Data for June 2013 was used to calculate the mean AM and PM peak journey times. In order to have a reasonable sized sample for each link (an average of 50 per link), data for all schooldays in the month was used.

The data was aggregated to reflect the routes shown in Figure 3-E. These were chosen to cover the main radial routes in and out of the town.

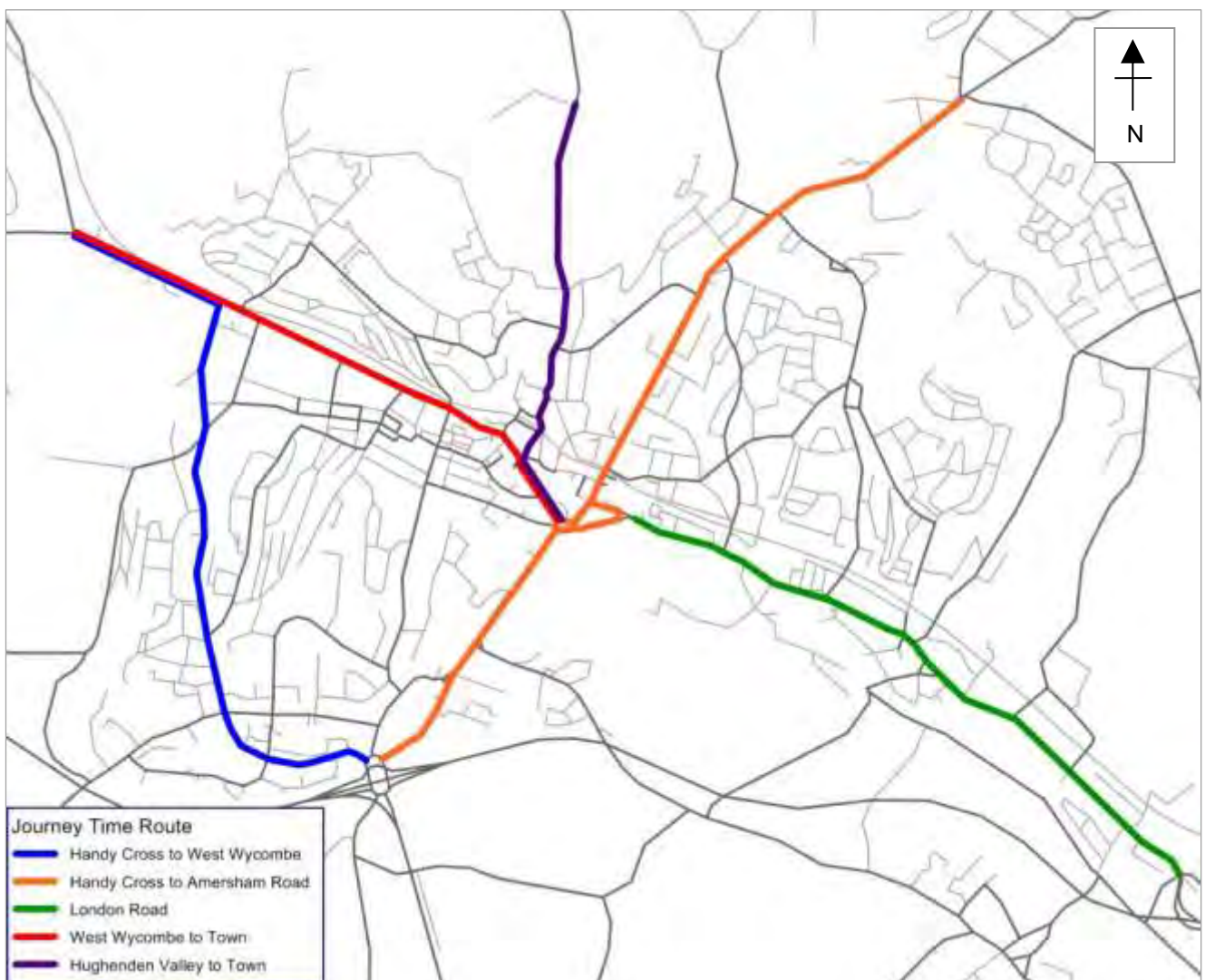


Figure 3-E Journey Time Routes

4. Network Development

4.1 Background

High Wycombe is located in the Wycombe District of Buckinghamshire, with a current population of around 100,000. The town is situated north of the M40 motorway, at the hub of five radial highway corridors which include the A40 (east and west), A404 (north and south) and the A4128 Hughenden Road. The A4010, situated in the west of the town, provides a route for north-south movements between Aylesbury and the M40/Thames Valley.

4.2 Study Area

The 2013 transport model detailed study area includes the urban area of High Wycombe as shown in Figure 4-A. A wider buffer area with less detail is included which allows for route choice of traffic towards and away from the town.

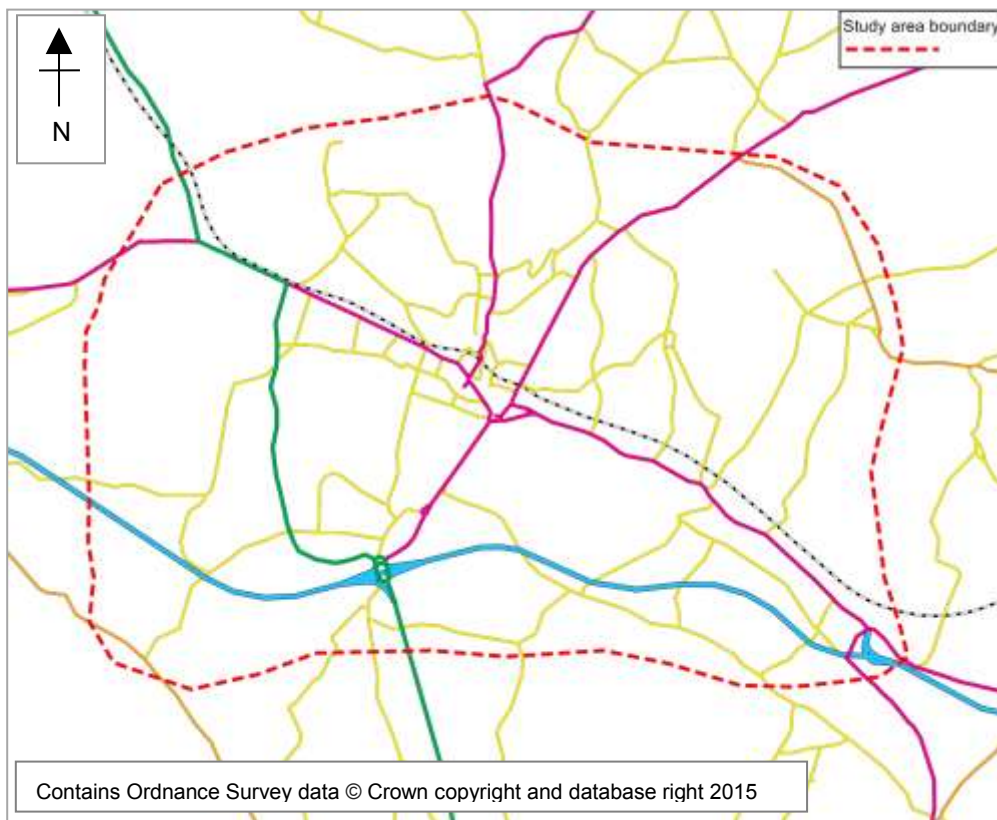


Figure 4-A Highway assignment model detailed study area boundary

4.3 Network update

The 2013 network is based on the network from the 2010 model, which was built using the Ordnance Survey (OS) MeridianTM2 mid-scale vector dataset. MeridianTM2 is a suitable product due to the ease of availability, geographic accuracy and high compatibility with VISUM. The most recent OS data available was used to update the network. In addition aerial photography and observations made during site visits were used to refine sections of the network and to code junction details.

The resulting VISUM network is considered to be an accurate geographic representation of the road network, classified by link type into Motorways, A-roads, B-roads and local roads. The model highway network, with link type indicated by the colour, is presented in Figure 4-B.



Figure 4-B Network link types

A thorough update of the 2010 network was carried out to ensure that the 2013 network correctly reflects the current situation.

4.4 Link characteristics

Detailed characteristics were coded for each link using aerial images, street level photographs and on-site observations. In VISUM links are coded by direction and the following characteristics are included:

- Number of lanes
- Link capacity (vehicles per hour)
- Maximum free-flow speed in kilometres per hour
- Class(es) of vehicles permitted to traverse the link (e.g. car, HGV, pedestrian, bus only)
- Traffic count(s) (for comparison with modelled flows).

Link capacities are based on a number of factors including link type, number of lanes, single or dual carriageway, street characteristics and amount of on-street parking. These factors and the speed limit pertaining to each link were used to determine the appropriate maximum free-flow speed. The resulting modelled speed on a link is a function of maximum speed and capacity. The parameters of this function (known as a speed-flow relationship) are set to reproduce the reduction in speed as traffic increases for each link type.

4.5 Junction characteristics

Junction coding is an important part of the model development, as it is the delay encountered at roundabouts, signalised junctions and at side roads of give-way junctions which has a major effect on the journey time along

2011 Census data has been used to inform the loading of demand on the network. A small number of zones have been added for non-residential land uses such as schools and shopping centres.

There are 225 zones in the model covering the whole of Great Britain. Of these, 120 are within the study area (see Figure 4-A). Zones in the centre of the study area typically contain less than 300 households, while those towards the edge have up to 1400 households. Outside this area, zones cover progressively larger areas, for example Oxford is a single zone, and Scotland and the North-west of England comprise one zone.

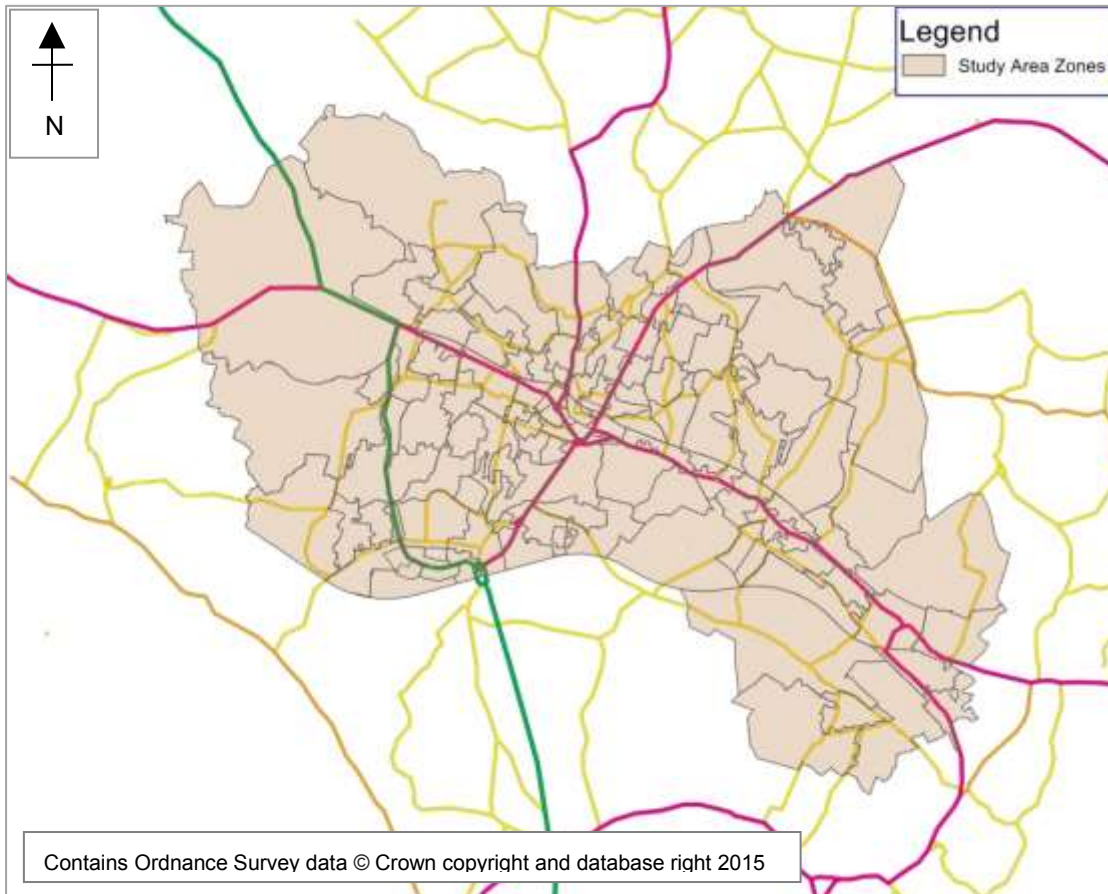


Figure 4-D Study area zones

5. Matrix Development

5.1 Introduction

This section describes the preparation and procedures that were undertaken to build the Car, LGV and HGV matrices of the highway model. The data sources used for matrix building were as follows:

- *2006 Wycombe Transport Study (WTS2) Model matrices*
- *2011 / 2012 South High Wycombe School Census Data*
- *2006 to 2013 Development Land Use Data*
- *M40 Through-Traffic Matrices*

The matrices built from these sources were combined to produce the 2013 AM and PM matrices for Cars, LGVs and HGVs.

5.2 2006 Wycombe Transport Study (WTS2) Model matrices

The WTS Model matrices comprised several data sources collected in 2006. The matrices were used as the main source for origin – destination (OD) data in the 2013 model. The following were the WTS2 model datasets:

- *Roadside interview survey (RSI) data*
- *London area transport survey (LATS) data*
- *Household surveys*
- *Planning data*
- *Synthetic matrices*

2006 RSI matrices

The 2006 observed matrices were built from the RSI data for the following purpose and vehicle groups:

- *Car Home to Work*
- *Car Work to Home*
- *Car Home to Employers Business*
- *Car Employers Business to Home*
- *Car Home to Education*
- *Car Education to Home*
- *Car Home to Shopping*
- *Car Shopping to Home*
- *Car Home to Other*
- *Car Other to Home*
- *Car Non Home Based Employers Business to Other*
- *Car Non Home Based Other*
- *LGV*
- *HGV*

The following information is based on the report 'Wycombe Transport Model – Highway Model Development Report – October 2007 – Halcrow Group Ltd' which explains the sources and processes previously applied in matrix development for the WTS2 model.

WTS2 LATS survey matrices

Traffic surveys on the approaches to Handy Cross in 2006 were ruled out because of roadworks. Therefore use was made of LATS surveys conducted in 2001. The LATS surveys are undertaken across London and the South East of England on behalf of the Highways England (previously Highways Agency) and Transport for London. A number of cordons and screenlines are defined to allow the identification of regional movements. These surveys included roadside interviews on the slip roads onto the major motorways in the region. This includes surveys on the on-slips at junctions 3 and 4 for which data was obtained from the Highways England. The LATS records were typically used for those movements to/from the M40 to areas not covered by the High Wycombe RSIs, such as M40 to Marlow, Flackwell Heath or Cressex Industrial Area.

WTS2 household surveys

Household surveys were undertaken on various days in June, July and September 2006 on a 5% sample of households in the study area. They provided supplementary information that was not available from other sources. The 2001 census provided information on household characteristics and travel to work data. The roadside interviews undertaken in and around High Wycombe gave an insight into vehicle movements to/from the town. However, the key role of the household survey was to provide information on local journeys, by all modes and purposes within the study area. In particular, the household survey provided information on the trip length distributions, by purpose, of the trips made by internal residents. These were used in the derivation of synthetic trip matrices for internal study area movements.

WTS2 Planning data

Population and employment data were obtained from the 2001 Census at ward and output area level. WDC provided data on the changes in dwellings between 2001 and 2006 and provided estimates of 2006 population and number of jobs by WTS2 traffic zones.

WTS2 synthetic matrices

Synthetic matrices were created to represent the short-distance movements that were not observed in the RSI surveys. They were built by determining trip end data (population, employment, for example) from planning data for each WTS zone to derive an estimate of how many trips are being made to/from each zone. These trips were then distributed between the matrix zones based on known trip length distributions (TLD) and travel distances.

Gravity models were used to distribute trips for respective trip purposes matrices. The gravity model was calibrated to the observed trip length distributions from the household survey for each purpose. The zonal trip ends were generated from the planning, population and employment data supplied by WDC and BCC.

5.3 2011/2012 school census matrices

These 2011/2012 school matrices comprised of OD movements to and from the schools in South High Wycombe shown in Figure 5-A. The matrices were built from the School Census Data Survey that consists of the school name, origin postcode and mode of travel. The schools were allocated to the following 'school' zones:

- *Zone 7000 - Cressex Community School*
- *Zone 7001 - Chepping View Primary Academy*
- *Zone 7002 - St Augustine's / St Bernard's Catholic Schools*
- *Zone 7003 - John Hampden Grammar School*
- *Zone 7004 - Wycombe High School*

School matrix development focused on this specific area in High Wycombe due to the scale and clustered nature of schools in this area which have a significant influence on the pattern of movements in South High Wycombe, and for reasons related to data availability.

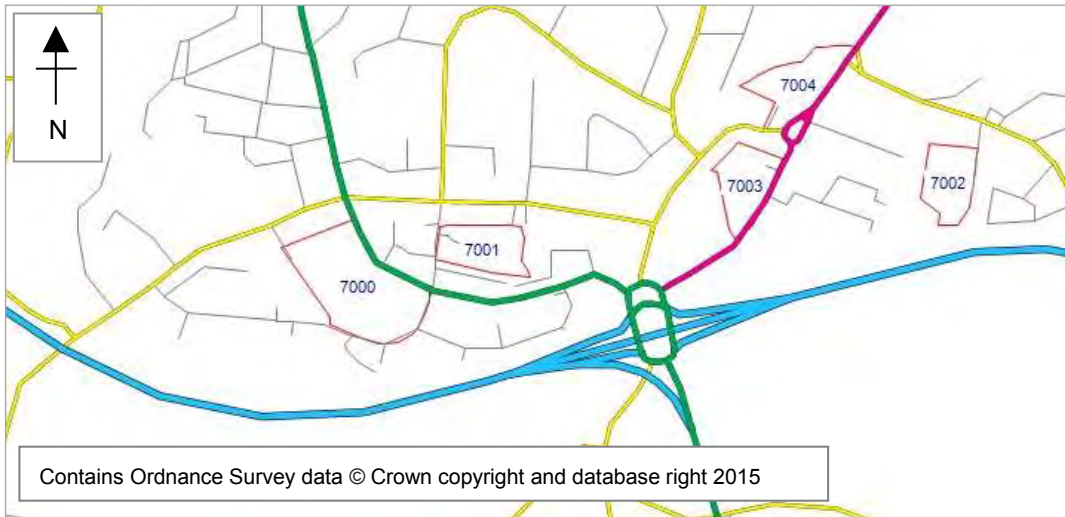


Figure 5-A South High Wycombe school zones

Records which featured the mode of travel to school as “car” were utilised for the matrix building of the school matrices. The postcodes of the origins and the schools were plotted in a GIS package and allocated to the model zones as shown in Figure 5-A. Only AM peak matrices were built as the school day ends in the inter peak period. It was assumed that the car trips travel to the schools then return to their origins after the pupils have been dropped off to school.

5.4 2006-2013 developments matrices

WDC provided housing and employment application data from 2006 to 2013. The data was filtered to include sites of more than 20 dwellings for housing sites or 200m² gross floor area (GFA) of employment land use class B. The trip generation rates were taken from assumptions derived as part of study work on Major Development Areas in Buckinghamshire. These trip rates were applied to create the production and attraction of trips to and from the sites shown in Figure 5-B and Figure 5-C.

Type of Development	Trip Generation Rates			
	AM (08:00 to 09:00)		PM (17:00 to 18:00)	
	Arrival	Departure	Arrival	Departure
Privately Owned Housing	0.143	0.419	0.418	0.249
Affordable Housing (Houses for Rent)	0.098	0.167	0.212	0.150
Flats Privately Owned	0.086	0.266	0.276	0.124
Flats For Rent	0.073	0.103	0.108	0.095
Industrial Estate / Business Park	0.816	0.398	0.248	0.657
Parcel Distribution Centre	0.556	1.148	0.852	0.796
Warehousing	0.345	0.228	0.096	0.242
B8 Business Use	0.429	0.596	0.398	0.464

Table 5-A Trip generation rate assumptions

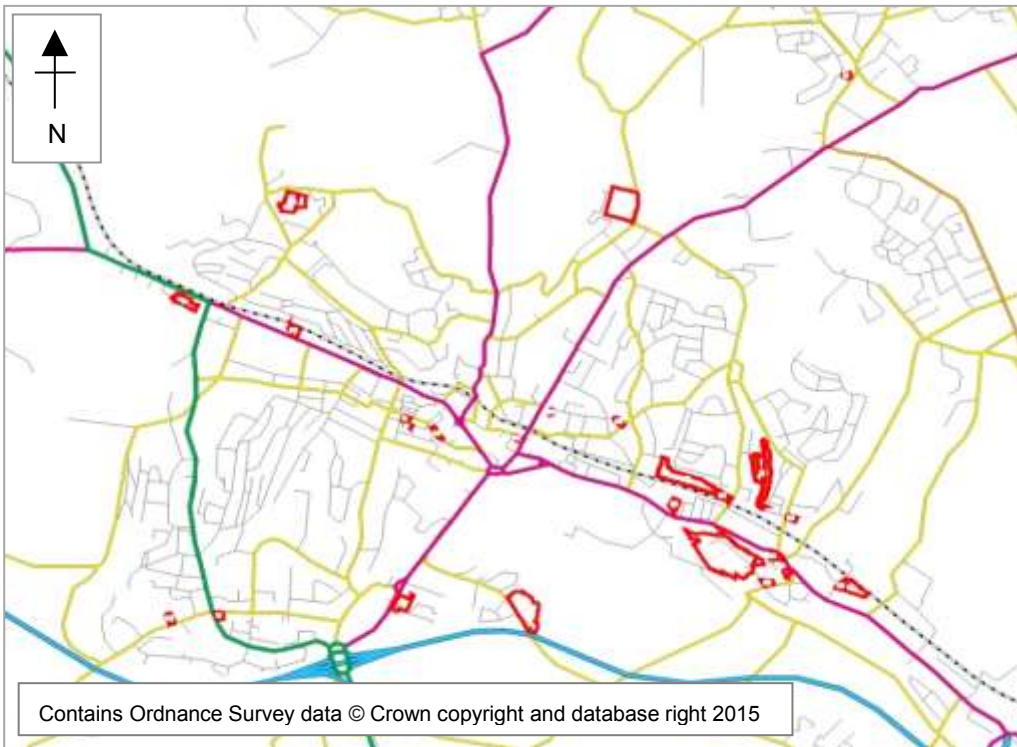


Figure 5-B Location of residential sites

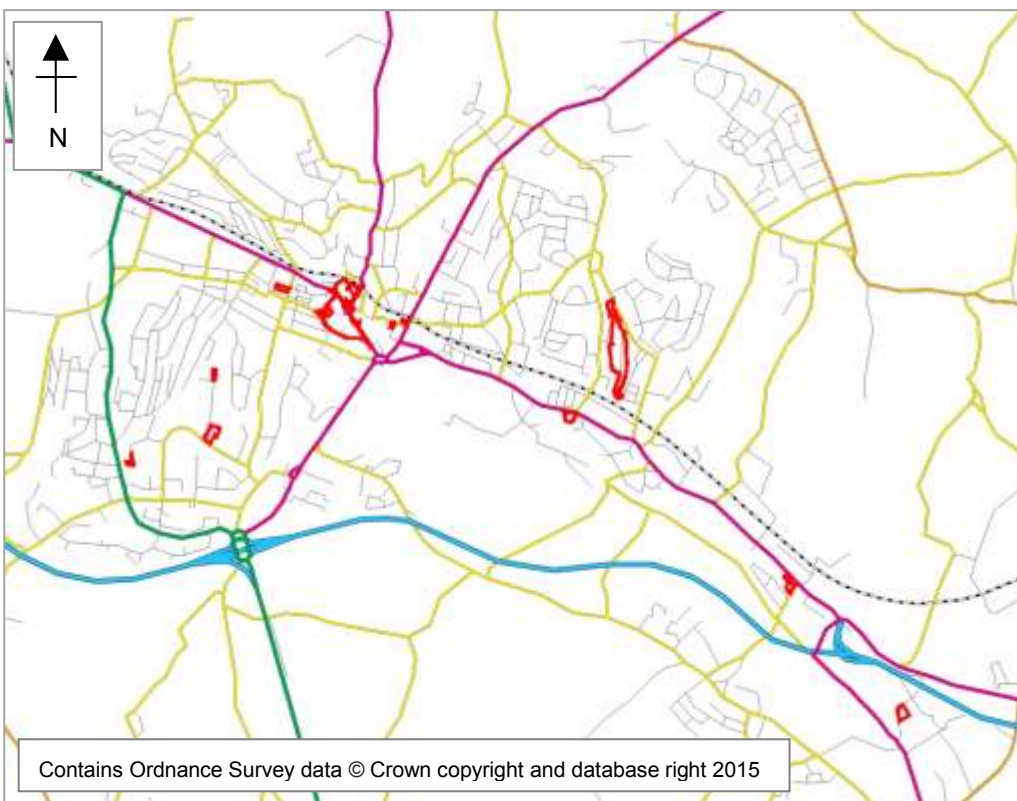


Figure 5-C Location of employment sites

5.5 M40 through traffic matrices

The M40 through traffic matrices consist of the through motorway traffic movements between M40 J6 (Zone 5901) and M40 J1a (Zone 5902) as shown in Figure 5-E. These matrices were built to represent an approximate level of through-movements on the M40 by reviewing the level of local trips that utilise the M40 motorway and adding through-traffic to ensure the level of overall traffic on the M40 compares well with the TRADS count data.

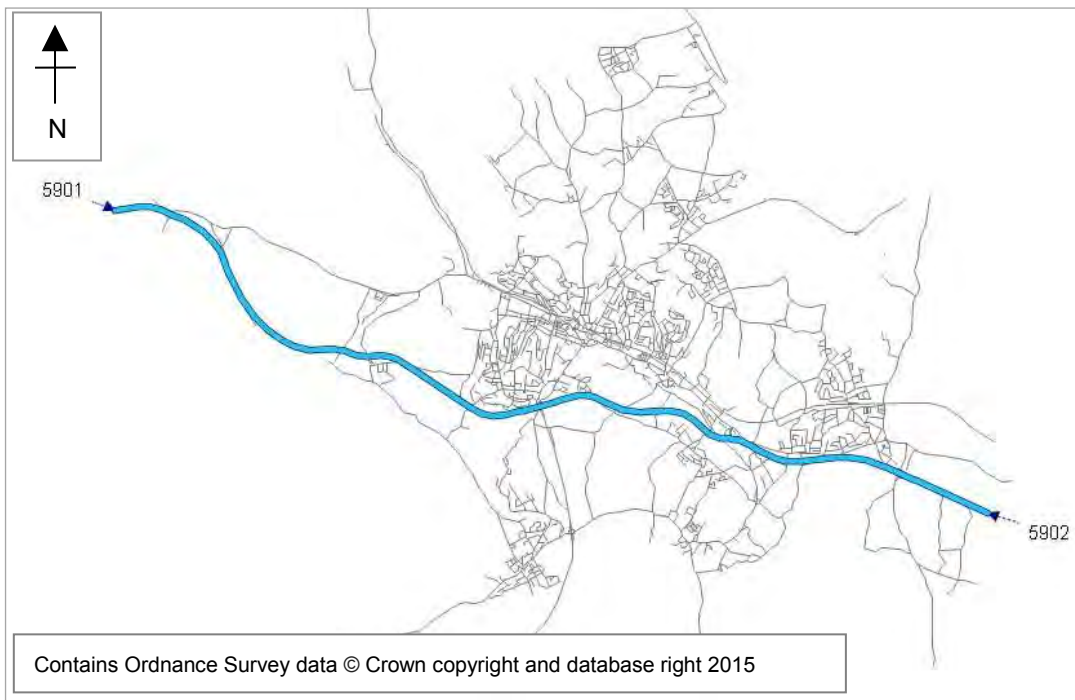


Figure 5-D M40 through-traffic zones

5.6 Merging of matrices

5.6.1 Car matrices

A methodology was developed to combine the matrices from all the different data sources together. The main objective was to infill the unobserved cells from the RSI matrices and also to maintain the trip length distribution of the short distance movements from the synthetic matrices and long distance movements from the RSI and LATS matrices.

Prior to merging, the 2006 RSI car matrices were factored to 2013 levels. The 2006 to 2013 conversion factors were average factors obtained from a comparison of the 2006 and 2013 ATC counts at the RSI locations (see section 3.2). Table 5-B presents the conversion factors for AM and PM peaks.

Time Period	2006 to 2013 factors
AM	0.93
PM	0.95

Table 5-B 2006 to 2013 car matrix factors

The RSI car purposes matrices, except for the education matrices (Car Home to Education and Education to Home), were combined as a car RSI matrix. The RSI education matrices were combined with the school matrices separately and later added to the final merged car matrices. Only trips that were not observed in the RSI education matrices were infilled from the School Census matrices. This was to avoid double counting and also to retain the observed RSI trips.

A 10 by 10 sector matrix was created where sectors 1 to 4 are internal sectors in the detailed study area and Sectors 5 to 10 are the external sectors as shown in Figure 5-F. Sector 1 represents the zones within the RSI screenline and sectors 2 to 4 are within the High Wycombe town area.

The RSI (except education), synthetic and LATS matrices were merged utilising an average weighted method at the sector level through the following formula:

$$\text{Merged cell trip value, } T_m = \frac{T_1 I_2 + T_1 I_3 + T_2 I_1 + T_2 I_3 + T_3 I_1 + T_3 I_2}{I_1 + I_2 + I_3}$$

where

- 1 = RSI matrix
- 2 = Synthetic matrix
- 3 = LATS matrix

T_1 , T_2 and T_3 = trip value from cell ij of matrix 1, 2 and 3

I_1 , I_2 and I_3 = weighting of cell ij from matrix 1, 2 and 3 (where higher weighting given to RSI followed by synthetic and LATS matrices).

The basic concept of merging is as follows:

1. Intra Sector Movements

- a) Internal sector comprised of
 - i. Synthetic matrices
- b) External sector comprised of
 - i. Synthetic matrices
 - ii. RSI matrices
 - iii. LATS matrices

2. Inter Sector Movements

- a) Internal to internal sector comprised of
 - i. Synthetic matrices
 - ii. RSI matrices
- b) Internal to external sector comprised of
 - i. Synthetic matrices
 - ii. RSI matrices
 - iii. LATS matrices
- c) External to External sector comprised of
 - i. Synthetic matrices
 - ii. RSI matrix matrices
 - iii. LATS matrices

The Education and M40 through trip matrices were added to the merged matrices to produce the prior car matrices. Figure 5-G and Figure 5-H present the trip length distribution of the respective AM and PM dataset and the combined prior matrices.

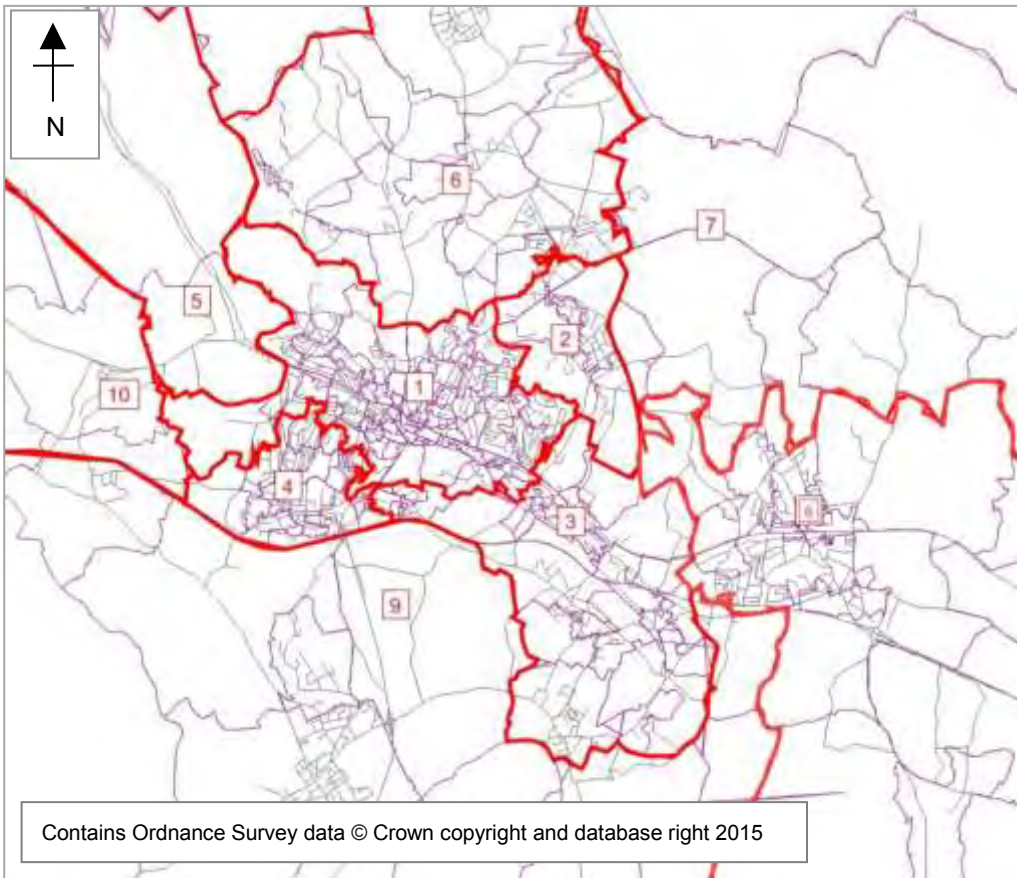


Figure 5-E High Wycombe Model sectors

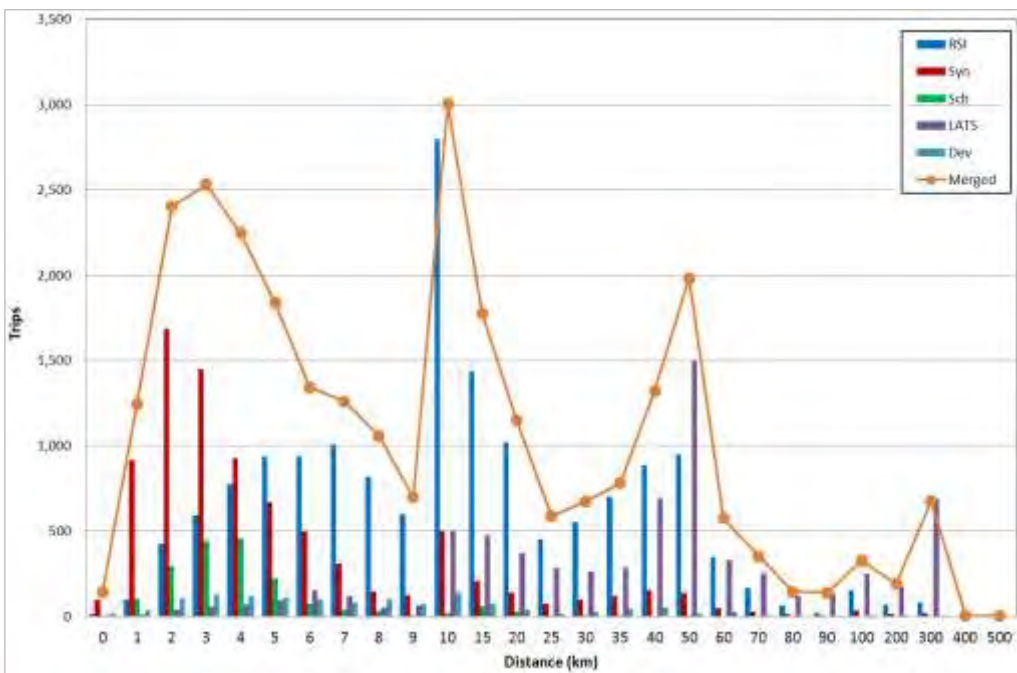


Figure 5-F Trip length distribution AM - individual / merged car matrices

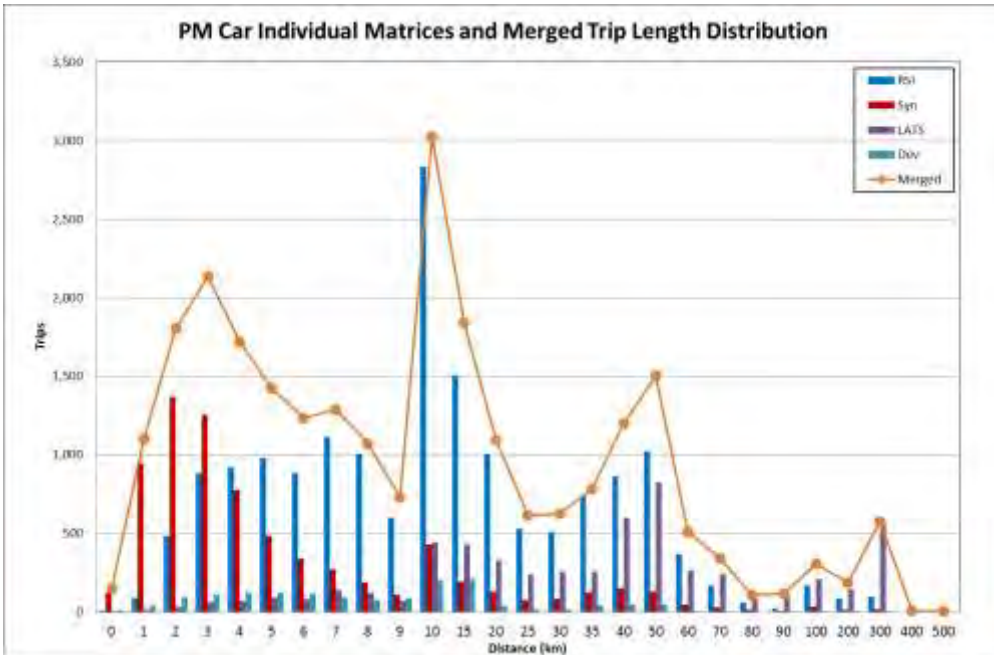


Figure 5-G Trip length distribution PM - individual / merged car matrices

5.6.2 LGV and HGV matrices

The RSI data was the only source of data for goods vehicles. These matrices were used as the prior goods vehicles matrices.

5.7 Assessment of the prior matrices

The flows resulting from the assignment of prior matrices were compared with observed counts for the screenlines and cordons shown in Figure 5-H in both the inbound and outbound directions. In total there are four cordons. The Inner and Outer cordons are subdivided into seven screenlines.

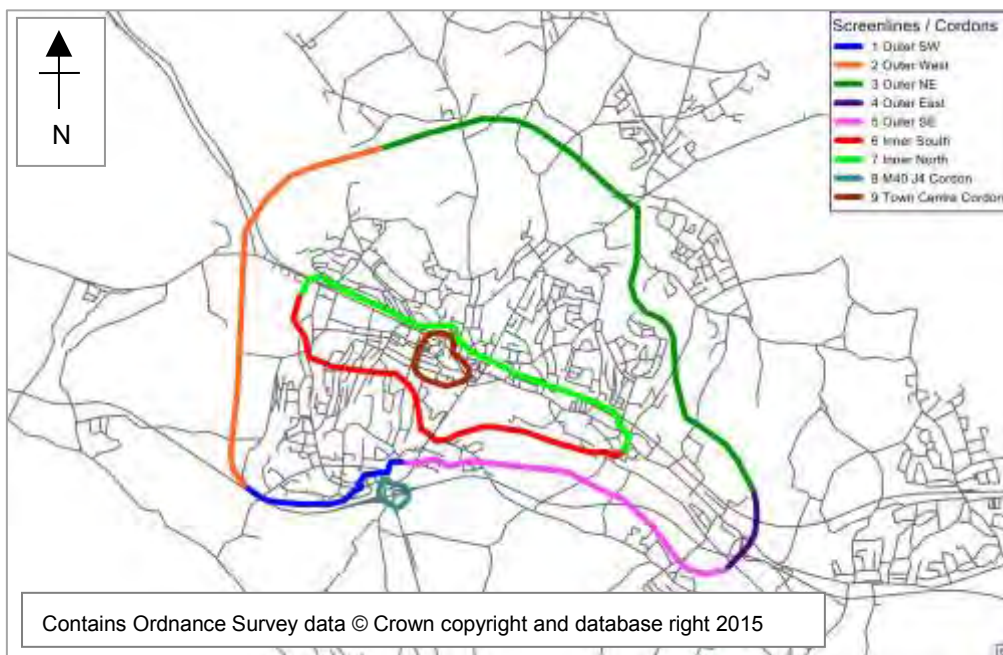


Figure 5-H Screenlines and cordons

Table 5-C to Table 5-D present the prior matrices comparison results. In the AM peak, the modelled Outer and M40 J4 cordons compare well with observed, however the other cordons show differences in the order of 25% to 30%. The PM peak cordons vary from the observed by between 8% and 20% with a mix of positive and negative differences.

From the prior matrices comparison results, it can be concluded the prior matrices compare well around the Outer Cordon level. The percentage difference between the observed and modelled cordon flows ranged between -1.5% and 1.4% in the AM peak and in the PM peak ranged between -8.2% and -9.5%. The remaining cordons compare less well in both peaks.

This is probably due to the merging of the 2006 synthetic and LATS matrices. The trip patterns have changed over the seven years due to local changes in land use and the impact of national economic conditions.

The guidance in Webtag 3.19 Section 8.1.1 explains that trip matrices should not be taken from existing models unless several conditions are met. One of the conditions is that the dataset should be based on survey data which are less than six years old.

Although the 2006 WTS matrices are more than six years old, they are the only source of data for the matrix building of the prior matrices. Matrix estimation was, therefore, required to refine estimates of trips from the 2006 synthesised data which are mainly in the Inner Cordon and Town Centre Cordons and 2006 LATS in the M40 J4 Handy Cross Cordon as shown in the tables below.

Cordon	Dir.	Observed (no. of vehicles)	Modelled (no. of vehicles)	GEH	% Difference
Inner Cordon	In	12,485	16,331	32.0	30.8%
	Out	10,949	13,617	24.1	24.4%
Outer Cordon	In	12,540	12,719	1.6	1.4%
	Out	12,033	11,854	1.6	-1.5%
Town Centre	In	5,493	6,878	17.6	25.2%
	Out	3,773	4,849	16.4	28.5%
M40 J4 Handy Cross	In	6,631	7,101	5.7	7.1%
	Out	6,631	7,101	5.7	7.1%

Table 5-C AM Peak prior matrices detailed comparison of cordon results

Cordon	Dir.	Observed (no. of vehicles)	Modelled (no. of vehicles)	GEH	% Difference
Inner Cordon	In	11,066	12,476	13.0	12.7%
	Out	12,534	14,415	16.2	15.0%
Outer Cordon	In	11,840	10,715	10.6	-9.5%
	Out	13,497	12,389	9.7	-8.2%
Town Centre	In	4,291	4,824	7.9	12.4%
	Out	4,812	5,674	11.9	17.9%
M40 J4 Handy Cross	In	7,195	5,751	17.9	-20.1%
	Out	7,195	5,751	17.9	-20.1%

Table 5-D PM Peak prior matrices detailed comparison of cordon results

5.8 Matrix estimation

From the assessment of the prior matrices in Section 5.7, it can be concluded that matrix estimation is required to adjust the matrices to 2013 traffic volumes and patterns. The process is part of the calibration process to adjust the prior OD matrix so that the assignment flows in the model on the road network match as closely as possible to observed count data.

ATC and MCC counts along the screenlines shown in Figure 5-I were used for the matrix estimation process. The TRADS counts were included as part of the M40 Junction 4 cordon counts. The remaining traffic counts were used as validation counts. These independent validation counts are spread across the modelled area. Detailed information regarding the calibration and validation counts and results are shown in Appendix E and Appendix F.

The adjustment of the demand matrix was undertaken using VISUM's TFlowFuzzy matrix estimation module. This is performed by entropy maximisation. The optimisation function is defined as follows:

$$\begin{aligned} & \text{maximize } q(\underline{t}) + q(\overline{s}) + q(\underline{s}) \\ & \text{such that } \mathbf{A} \cdot \mathbf{t} + \overline{\mathbf{s}} = \overline{\mathbf{v}} \\ & \quad \mathbf{A} \cdot \mathbf{t} - \underline{\mathbf{s}} = \underline{\mathbf{v}} \\ & \quad \overline{\mathbf{s}} \geq \underline{\mathbf{0}} \\ & \quad \underline{\mathbf{s}} \geq \underline{\mathbf{0}} \end{aligned}$$

with:

$$q(\overline{s}) = - \sum_{l=1}^m \overline{s}_l \cdot \ln \frac{\overline{s}_l}{\underline{s}_l} - \overline{s}_l$$

$$q(\underline{s}) = - \sum_{l=1}^m \underline{s}_l \cdot \ln \frac{\underline{s}_l}{\overline{s}_l} - \underline{s}_l$$

$\overline{\mathbf{v}}, \underline{\mathbf{v}} \dots$	maximum/minimum of Fuzzy Set
$\overline{\mathbf{s}}, \underline{\mathbf{s}} \dots$	slack variables
$\overline{\mathbf{s}} = \overline{\mathbf{v}} - \mathbf{v} \dots$	upper bandwidth for traffic count
$\underline{\mathbf{s}} = \mathbf{v} - \underline{\mathbf{v}} \dots$	lower bandwidth for traffic count

Where:-

m ... number of counts

t ... demand variable

q(t) ... objective function

A ... shared matrix in which each element (A_{lk}) expresses the share of trips of one OD (k) using link (l).

The above equation is a non-linear optimisation problem with equality constraints which is then solved by the Lagrange multiplier method and provides the zeros of the first partial derivatives of the objective function. A tolerance bandwidth of +/- 5% on the ATC counts and +/- 10% on the MCC counts were applied for the matrix estimation process. Figure 5-J presents the matrix estimation procedure workflow.

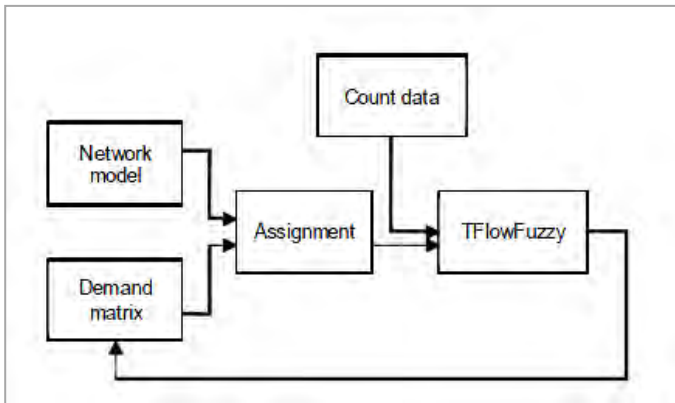


Figure 5-I Matrix estimation procedure

Table 5-E presents the total pre- and post-matrix estimation of the respective user classes. From the table it can be concluded that there is a small variation in the car matrices after matrix estimation with only a difference of 0.8% in the AM peak and 8.4% in the PM peak. The LGV trips reduced by 176 vehicles in the AM peak and increased by 243 vehicles in the PM peak.

Time Period	User Class	Prior Matrix Estimation	Post Matrix Estimation	% Difference
AM	Car	33,327	33,594	0.8%
	LGV	1,903	1,727	-9.2%
	HGV	503	531	5.5%
PM	Car	30,362	32,925	8.4%
	LGV	1,328	1,571	18.3%
	HGV	255	284	11.4%

Table 5-E Prior and post matrix estimation matrix totals

5.9 Pre and post matrix estimation analysis

The guidance in Webtag 3.19 Section 8.3.13 explains that the changes that result from matrix estimation should be carefully monitored based on benchmark criteria shown in Table 5-F. Failure to meet these benchmarks does not necessarily mean that the model is not fit for purpose. Further tests should be undertaken if this occurs.

These benchmark criteria are for guidance only and also based on the assumption that prior matrices were built from datasets that are less than six year old. As the prior matrices were built from mainly 2006 datasets which are seven years old, this criteria could be slightly relaxed with further explanation and tests.

Measure	Benchmark Criteria
Matrix zonal cell values	Slope within 0.98 and 1.02 Intercept near zero R ² in excess of 0.95
Matrix zonal trip ends	Slope within 0.99 and 1.01 Intercept near zero R ² in excess of 0.98
Trip length distribution	Means within 5% Standard deviations within 5%
Sector to sector level matrices	Differences within 5%

Table 5-F Benchmark Criteria for Matrix Estimation Changes

5.9.1 Scatter plots of matrix zonal cell values

Figures 5-J and 5-K present the scatter plots of matrix zonal cell the values for AM and PM peaks respectively. Only the AM peak satisfies the slope within the 0.98 to 1.02 benchmark criteria. The PM failed with a slope of 1.0942. The R2 criteria passed for both time periods. The differences may be caused by commercial land use changes in the town centre.

Time Period	Slope	Slope Criteria (between 0.99 and 1.01)	R ²	R ² Criteria (in excess of 0.98)
AM	0.999	Pass	0.962	Pass
PM	1.0946	Fail	0.957	Pass

Table 5-G Slope and R² summary of AM and PM zonal cell values

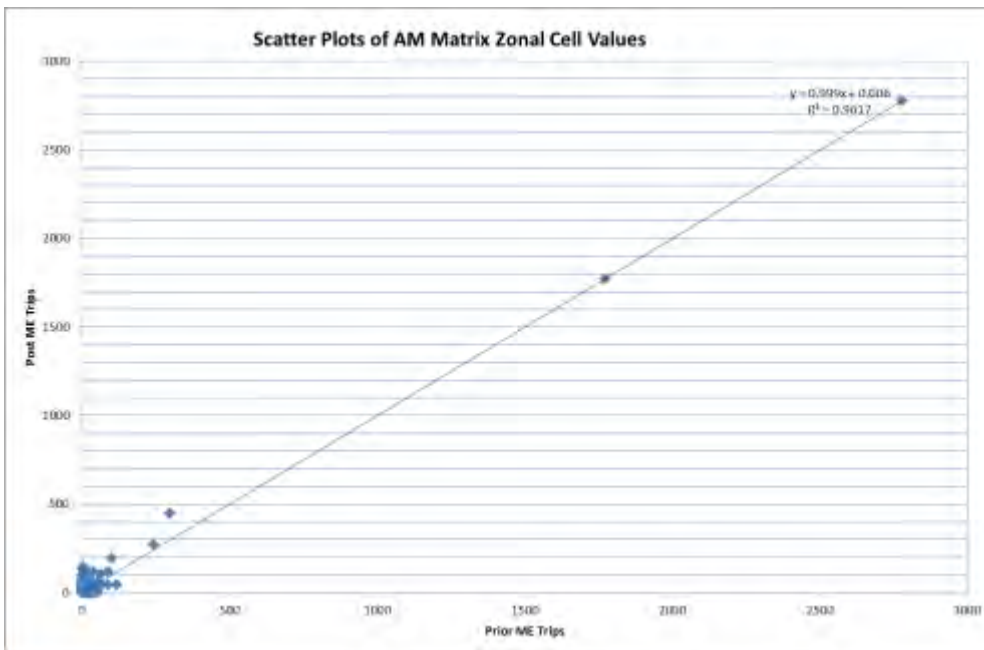


Figure 5-J Scatter plot of AM matrix zonal cell values

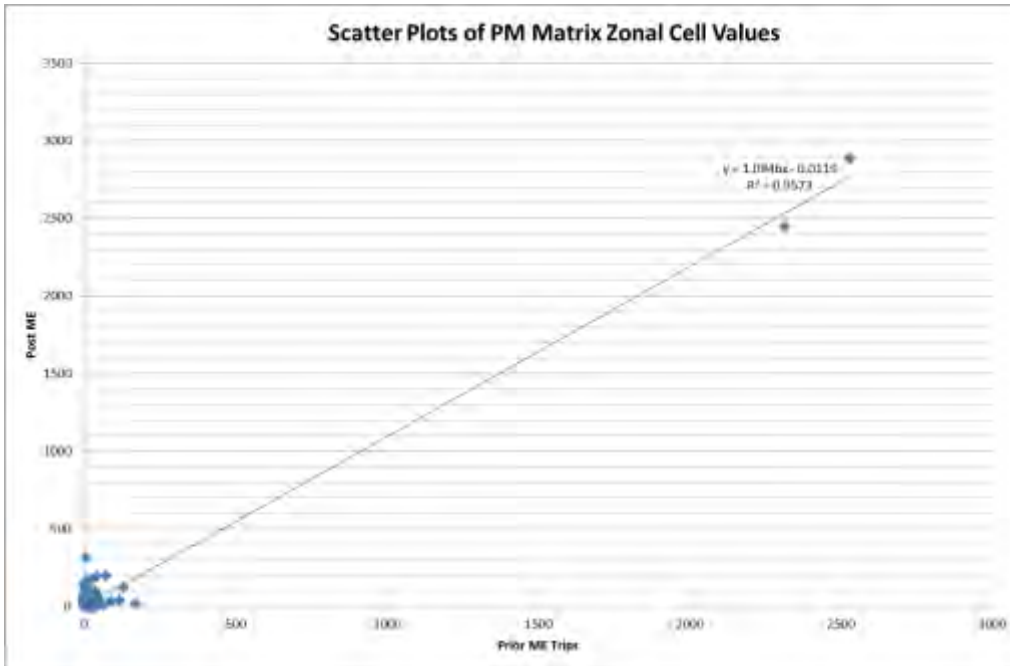


Figure 5-K Scatter plot of PM matrix zonal cell values

5.9.2 Scatter plots of matrix trip ends

The scatter plot analyses of pre and post matrix estimation trip ends are presented in Figure 5-L to Figure 5-O. The slope and R² of the scatter plots of both AM and PM peaks did not meet the benchmark criteria as summarised in Table 5-H.

From the analysis it can be concluded that the matrix estimation has changed the trip ends significantly in both AM and PM peaks. This is because the prior matrices are built from 2006 data sources and there have been land use and traffic volume changes between 2006 and 2013.

Time Period	Trip Ends	Slope	Slope Criteria (between 0.99 and 1.01)	R ²	R ² Criteria (in excess of 0.98)
AM	Origin	0.907	Fail	0.873	Fail
	Destination	0.953	Fail	0.874	Fail
PM	Origin	1.02	Fail	0.867	Fail
	Destination	1.084	Fail	0.896	Fail

Table 5-H Slope and R² summary of AM and PM trip ends

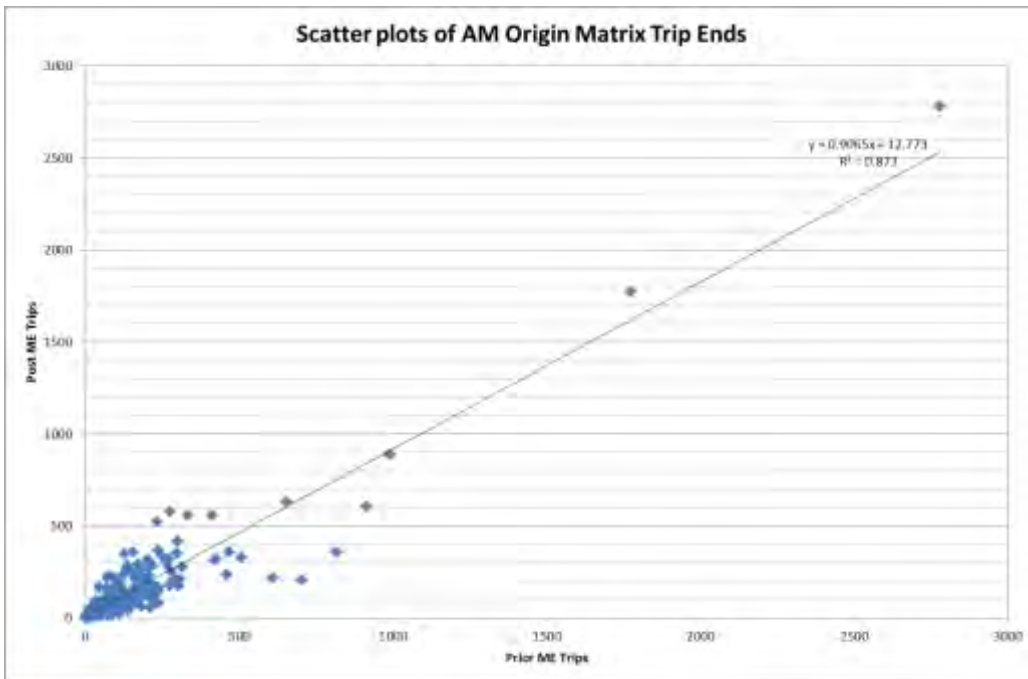


Figure 5-L Scatter plot of AM origin matrix trip ends

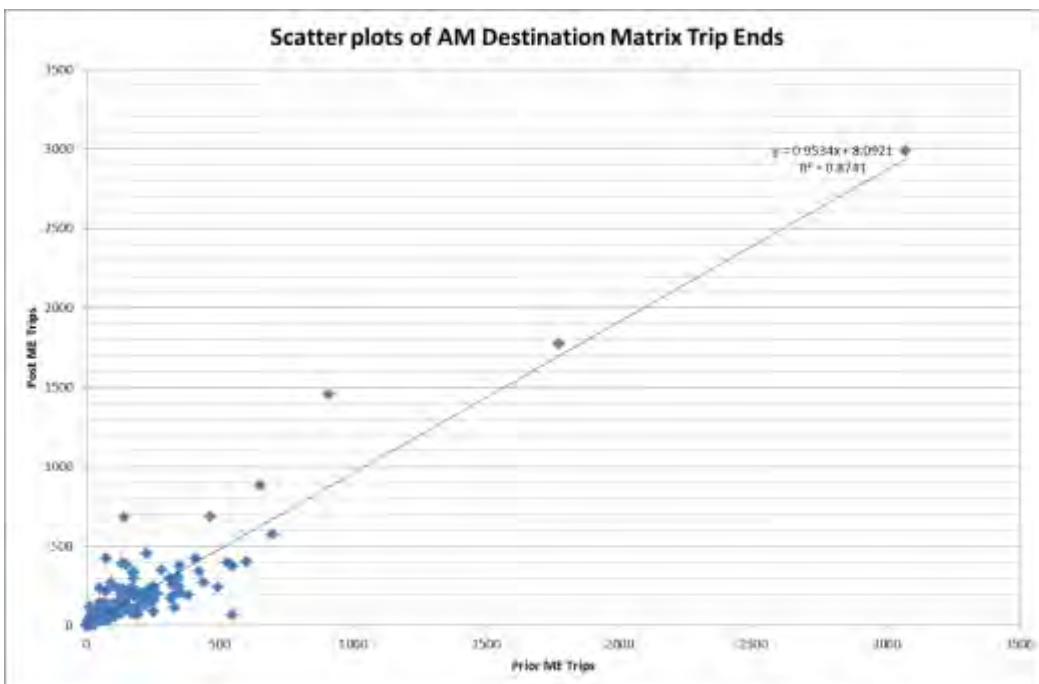


Figure 5-M Scatter plot of AM destination matrix trip ends

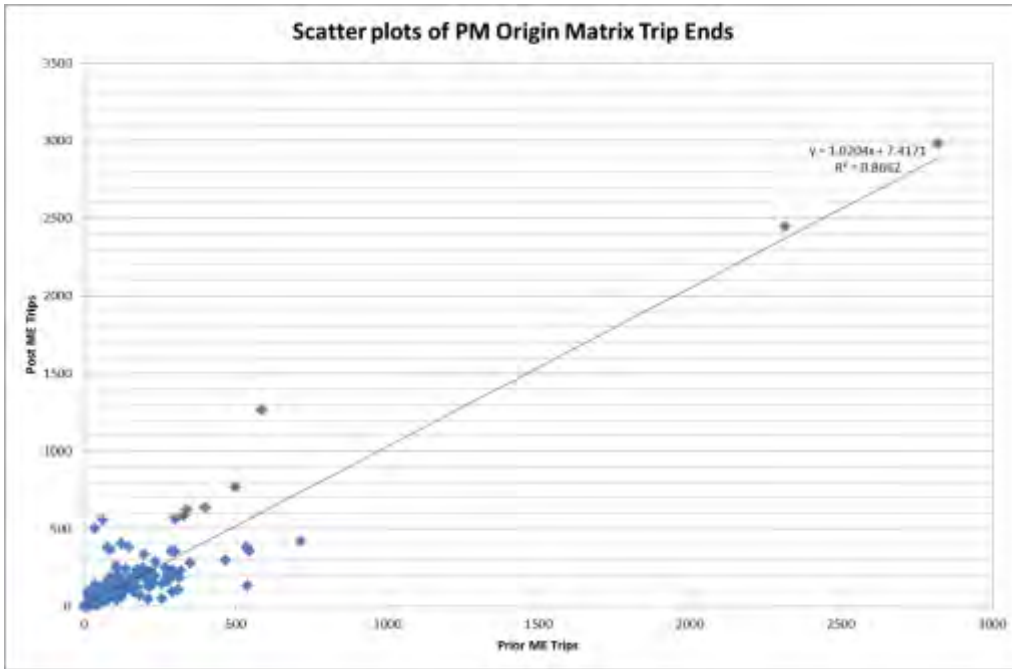


Figure 5-N Scatter plot of PM origin matrix trip ends

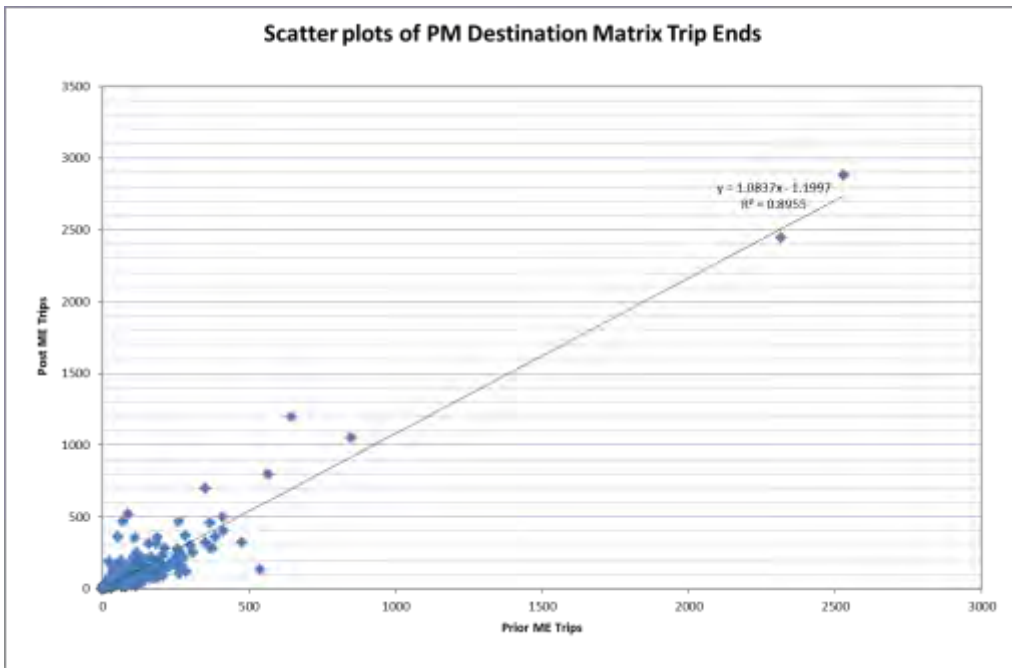


Figure 5-O Scatter plot of PM destination Matrix trip ends

5.9.3 Trip length distribution

Figure 5-P and Figure 5-Q present the trip length distribution of the car matrices for prior and post matrix estimation. In the AM peak, the percentage difference in each distance category ranged between -2% and 4% while in the PM peak it ranged between -2% and 2%. Both peaks satisfied the within 5% benchmark criteria.

In the AM peak, matrix estimation has refined the OD trips in the 1 to 3 km category from the short distance synthesised matrices and trips between 10 and 15 km from the LATS data, with a 4% increase. There is a

similar pattern in the PM peak with a 1% reduction in the 3 to 4 km category and reduction of 2% in the 10 to 15 km and an increase of 2% in the 50 to 60 km category.

From the results it can be concluded that matrix estimation has not changed the trip distribution of the AM and PM matrices significantly. The percentage differences were within the acceptable benchmark criteria. The changes occurred mainly for the short distance trips (1 to 3 km category) and long distances trips in the 10 km and above categories.

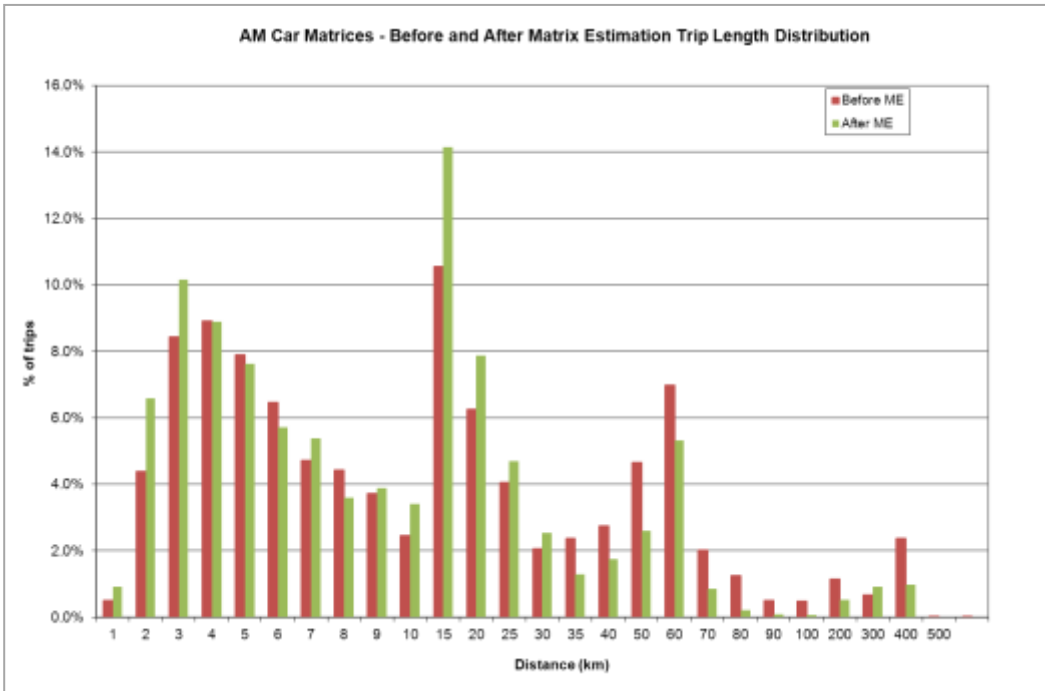


Figure 5-P AM car matrices prior / post matrix estimation trip length distribution

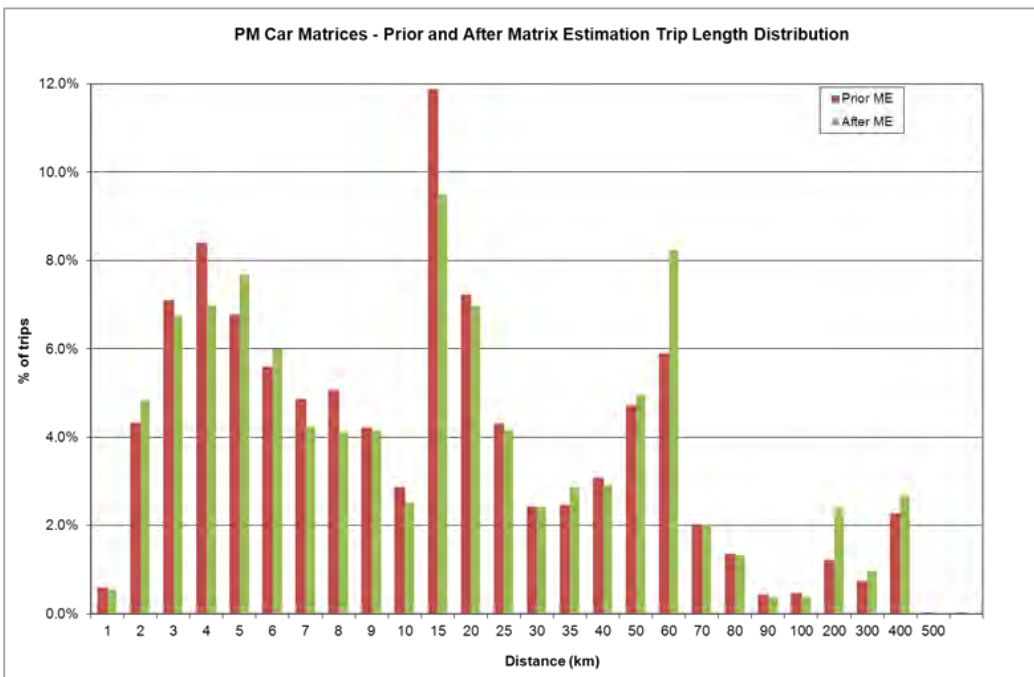


Figure 5-Q PM car matrices prior / post matrix estimation trip length distribution

5.9.4 Sector to sector level

The sector to sector level comparison analysis was carried out for the following sectors:

- Sector 1 - where the zones are within the RSI screenlines
- Sector 2 - remaining zones in the model

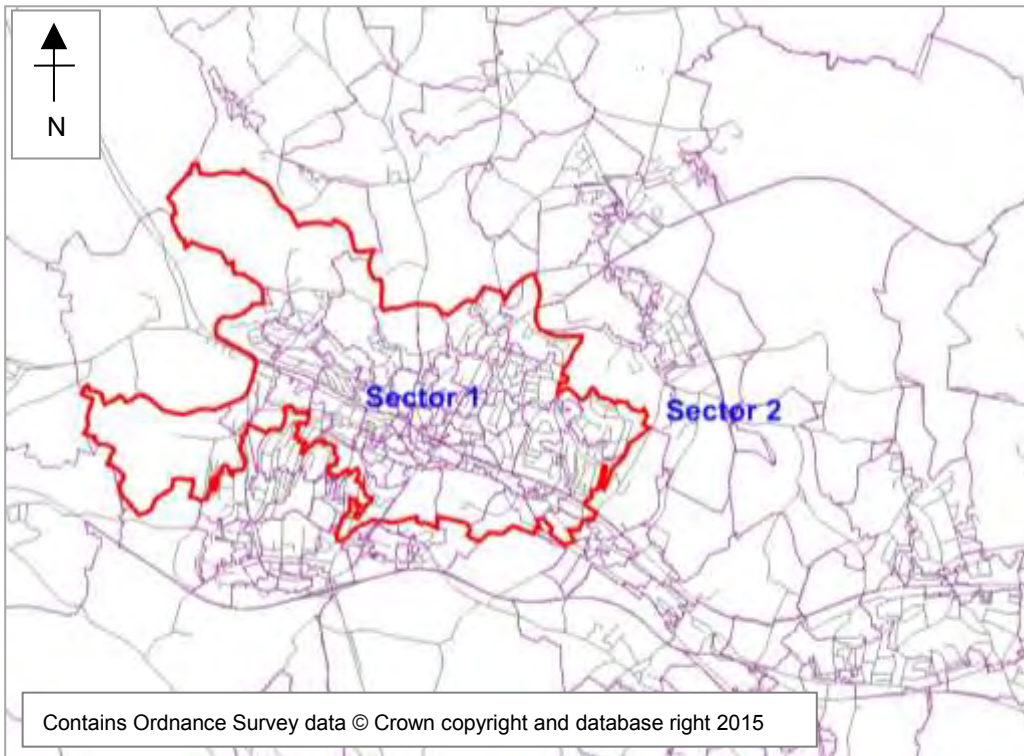


Figure 5-R Sectors applied for sector to sector analysis

Table 5-I and Table 5-J summarise the sector to sector results for both AM and PM peaks. In the AM peak, matrix estimation has changed the OD trips mainly from sector 2 where there was a reduction of 22% of trips crossing the RSI screenlines and an increase of 11% within sector 2. The differences from sector 1 satisfy the benchmark criteria of within 5%.

Similar results were obtained in the PM peak where there were significant differences at the inter sector level after matrix estimation (-11% to -22%). Possible reasons for this significant difference are:

- The 2006 synthesised and LATS matrices were not factored to 2013 level when merged with the RSI matrices.
- Matrix estimation is required to adjust the 2006 OD trip patterns from the synthesised and LATS matrices to 2013 and hence the significant differences.

Sectors	1	2	Total
1	-2%	-6%	-4%
2	-22%	11%	3%
Total	-14%	7%	1%

Table 5-I Percentage difference AM sector to sector level

Sectors	1	2	Total
1	4%	-22%	-13%
2	-11%	23%	15%
Total	-5%	11%	7%

Table 5-J Percentage difference PM sector to sector level

Further investigation established that the 2006 synthesised and LATS matrices were the main cause of the significant differences. Factoring the datasets to 2013 level in the merging of matrices stage reduced the percentage difference crossing the sector boundary.

Table 5-K and Table 5-L present the results of the sector to sector factoring test. It can be concluded that the synthesised and LATS datasets were the main reason for the significant differences crossing the RSI screenlines. By factoring the datasets to a 2013 level, the inter sector trip percentage differences have reduced close to the 5% benchmark criteria for both AM and PM peaks.

Sectors	1	2	Total
1	24%	7%	14%
2	3%	26%	21%
Total	12%	22%	19%

Table 5-K Percentage difference AM by factoring 2006 synthesised and LATS matrices

Sectors	1	2	Total
1	26%	-5%	6%
2	3%	33%	26%
Total	13%	23%	20%

Table 5-L Percentage difference PM by factoring 2006 synthesised and LATS matrices

5.9.5 Conclusion

From the pre and post matrix analysis, the following conclusions can be made:

- The prior matrices were built from 2006 datasets which are older than the recommendation of less than six years old as per Webtag 3.19. As the 2006 datasets are the only available source of data, a matrix estimation process has refined the OD trips to a 2013 level. The scatter plots analysis demonstrated significant changes to the matrix and the results of this process have not satisfied the benchmark criteria.
- Matrix estimation has not changed the trip length distribution of the matrices and satisfies the benchmark criteria in both AM and PM peaks.
- The sector to sector analysis did not meet the benchmark criteria. A further test was carried out to investigate the main cause of the differences. The findings from the test were the 2006 synthesised and LATS datasets were the main reason for the differences. Factoring the datasets to a 2013 level during merging minimised the differences at the inter sector level.
- If the matrix building process is to be revisited, it would be recommended to apply this factoring process and also merge with the latest available data such as the 2011 journey to work census data.
- As with all strategic models, failure or success in meeting the benchmarks does not necessarily demonstrate that a model is fit for purpose or otherwise. A series of sensitivity tests (described in Section 6.4) were carried out to review the junction operation and route selection under changes in traffic demand in a set of theoretical forecast scenarios.

A primary focus of the modelling methodology has been to achieve a good level of calibration and validation with observed data and to test the model to ensure that the responses in the model to changes in land use and infrastructure are reasonable and intuitive. The information in the remainder of this report demonstrates this has been achieved.

6. Assignment Assessment

6.1 Introduction

The assignment procedure adopted for the highway model is based on an equilibrium assignment using Intersection Capacity Analysis (ICA) with multiple demand segments (Car, LGV and HGV). The assignment process ends when a satisfactory level of convergence is achieved.

The traffic volume results of the highway assignment are presented in Appendix H.

6.2 Generalised costs

For the purposes of the highway assignments, the generalised cost is calculated by combining time and distance, using weightings derived from Values of Time and Operating Costs (TAG Unit 3.5.6) based on 2010 prices. The details, as given in the AM and PM VISUM model network 0.0395 files, are presented in Table 6-A and Table 6-B.

User Class	Time (Gsec/sec)	Distance (Gsec /metre)
Car	1.00	0.0395
LGV	1.00	0.0511
HGV	1.00	0.1380

Table 6-A Generalised cost weightings AM Peak

User Class	Time (Gsec/sec)	Distance (Gsec /metre)
Car	1.00	0.0391
LGV	1.00	0.0484
HGV	1.00	0.1380

Table 6-B Generalised cost weightings PM Peak

6.3 Assignment convergence

The assignments were run for a maximum of 200 outer iterations. The WebTAG guidance recommends checking the percentage change in link flows over successive iterations; however, VISUM calculates the GEH statistic (see paragraph 8.1.1) of the change in turning flows over successive iterations, which provides a similar indication of convergence. The guidance also states that the assignment should be stable and achieve a %GAP of less than 0.1%.

Details of the highway assignment convergence for the first 25 outer iterations are given for the AM peak in Table 6-C, and for the PM in Table 6-D.

Outer iteration	Proportion of turns with GEH <= 0.5 between current and previous iteration	Proportion of turns with GEH <= 0.5 between current iteration and smoothed ICA assignment	Proportion of turns with relative gap between ICA wait time and VDF wait time < 0.05	Final %GAP value for inner iteration	Number of inner iterations
1	0.364	1.000	0.166	0.00004228	8
2	0.471	0.498	0.784	0.00004696	8
3	0.822	0.539	0.844	0.00006118	4
4	0.861	0.588	0.886	0.00007186	3
5	0.880	0.649	0.916	0.00003648	4
6	0.934	0.711	0.936	0.00005769	3
7	0.961	0.794	0.948	0.0000811	2
8	0.959	0.844	0.958	0.00005587	2
9	0.962	0.869	0.965	0.00002059	3
10	0.979	0.898	0.973	0.00005593	2
11	0.980	0.925	0.980	0.00005578	2
12	0.981	0.949	0.981	0.00004976	2
13	0.989	0.959	0.983	0.00006451	2
14	0.994	0.966	0.984	0.00001341	2
15	0.996	0.968	0.986	0.0000347	2
16	0.996	0.974	0.988	0.00002154	2
17	0.995	0.975	0.988	0.0000258	2
18	0.999	0.983	0.990	0.00001219	2
19	0.997	0.986	0.990	0.00000796	2
20	0.999	0.987	0.991	0.00001021	2
21	0.999	0.990	0.991	0.00001672	2
22	0.998	0.994	0.991	0.00000626	3
23	0.999	0.996	0.991	0.00000396	2
24	1.000	0.997	0.991	0.00000321	2
25	0.999	0.997	0.991	0.00000735	2

Table 6-C AM Peak convergence of ICA Assignment

Outer iteration	Proportion of turns with GEH <= 0.5 between current and previous iteration	Proportion of turns with GEH <= 0.5 between current iteration and smoothed ICA assignment	Proportion of turns with relative gap between ICA wait time and VDF wait time < 0.05	Final %GAP value for inner iteration	Number of inner iterations
1	0.362	1.000	0.178	0.00008268	8
2	0.479	0.509	0.768	0.00003808	8
3	0.855	0.547	0.830	0.00007173	3
4	0.837	0.590	0.878	0.0000332	4
5	0.928	0.645	0.905	0.00003332	3
6	0.945	0.704	0.924	0.00008591	2
7	0.948	0.759	0.948	0.00008891	2
8	0.978	0.806	0.963	0.00004882	2
9	0.973	0.860	0.970	0.00005459	2
10	0.959	0.877	0.974	0.00008172	2
11	0.977	0.906	0.979	0.00003511	2
12	0.967	0.917	0.983	0.00004706	2
13	0.964	0.931	0.985	0.00006922	2
14	0.986	0.941	0.985	0.0000561	2
15	0.992	0.955	0.988	0.00001859	2
16	0.993	0.967	0.989	0.00004874	2
17	0.993	0.974	0.990	0.00002389	2
18	0.993	0.978	0.991	0.00003651	2
19	0.993	0.985	0.992	0.00002181	2

20	0.998	0.992	0.993	0.0000225	2
21	0.999	0.996	0.994	0.00001573	2
22	0.999	0.997	0.994	0.00000723	2
23	0.999	0.999	0.994	0.00000843	2
24	0.996	0.996	0.994	0.00001532	2
25	0.999	0.997	0.994	0.00000563	2

Table 6-D PM Peak Convergence of ICA Assignment

These tables above show that the AM and PM models achieve a high level of convergence and stability.

6.4 Stress tests

A series of stress tests were carried out to the base model to review the junction operation and route selection under changes in traffic demand in theoretical forecast scenarios. Three scenarios were developed as follows:

- Scenario A (2031 Do Minimum) - Apply an overall level of growth based on TEMPRO from 2013 base to 2031.
- Scenario B (2031 Do Minimum + Development Sites) -Test a series of theoretical development sites based on WDC Core Strategy reserve sites at (1)Terriers Farm, (2) Gomm Valley and (3) Abbey Barn South. An assumption of 500 homes in each development with a trip generation of 100 arrivals and 300 departures was assumed in the AM with the arrivals and departures transposed in the PM peak.
- Scenario C (2031 Do Minimum + M40 J3a) - A theoretical piece of strategic transport infrastructure was coded in South High Wycombe to assess whether the re-assignment response is logical.

Difference plots were reviewed and these demonstrated the model responded logically to the additional traffic demand and theoretical strategic transport infrastructure schemes.

Figure 6-A shows the effect of development on traffic patterns by means of a difference plot between Scenarios A and B for the AM peak. The additional traffic redistributes through the main road network in a logical pattern without unrealistic diversion into residential areas.

In Figure 6-B the addition of a new motorway junction has logical and intuitive impacts including the increase of traffic on the M40 while relieving local routes in the south of the town, especially Daws Hill Lane.

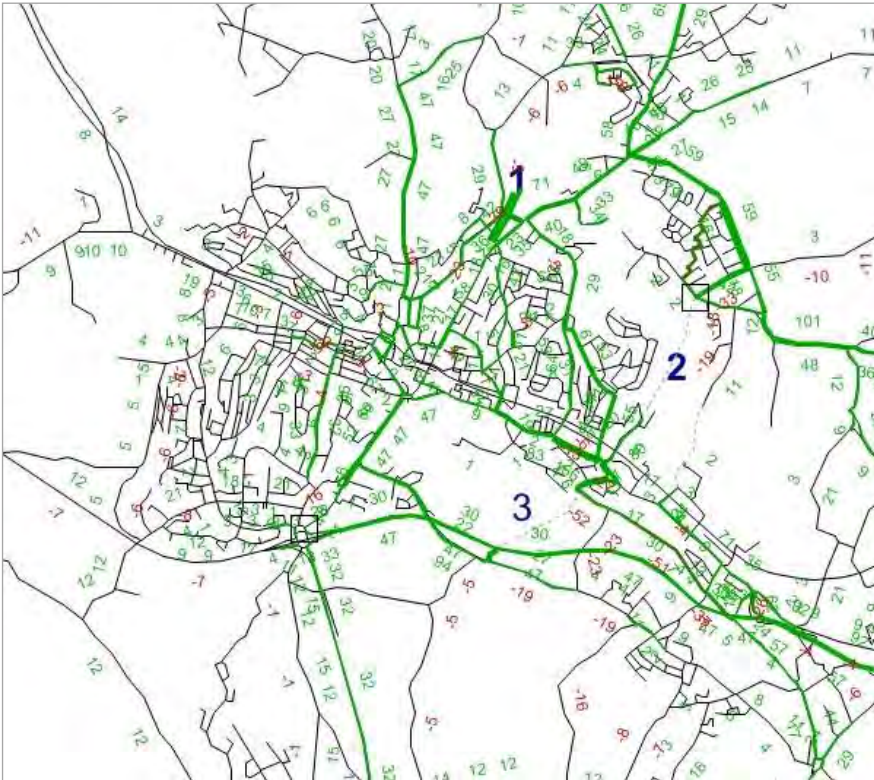


Figure 6-A AM peak difference plot for Scenario B-Scenario A



Figure 6-B AM peak difference plot for Scenario C-Scenario A

7. Network and Route Choice Assessment

7.1 Network

An initial trip matrix was assigned to the coded network. Link speeds and junction delays were checked and adjusted where necessary. As part of the calibration process link lengths were compared to the VISUM link parameter polygon length to show any coding errors. The lengths of the observed (Trafficmaster) and modelled journey time routes were also compared. The maximum difference in length was 50 metres on the Handy Cross to Amersham Road route. This is likely due to minor limitations of the mapping in how it represents the actual road layout.

7.2 Route choice

Trip distribution analysis was undertaken for key locations on major routes within the model study area to assess route choice logic within the model. An illustration of this exercise for the A404 Marlow Hill and the A40 London Road is presented in Appendix D.

As an additional check on routing in the models, the turning movements at five major junctions have been analysed. Flow bundles (select links) were used to extract the turning volumes and check the logic of movements through each junction and adjustments made to the network and matrix where required. The tables presented in Appendix G compare the entry flow proportions at each junction after this process had been completed. These show a good comparative pattern of movement at each of these junctions.

8. Trip Matrix Assessment

8.1 Calibration and validation criteria

After the development of the highway network and matrices, the traffic assignment was assessed against observed traffic flow and journey time data.

WebTAG sets various criteria to be met before a transport model can be said to represent base year conditions to an acceptable standard:

- Good comparison between observed and modelled flow volumes on screenlines across the study area
- Good comparison between observed and modelled journey times through the study area.

Modelled flows were calibrated to observed data forming cordons and screenlines and validated against a set of independent count data. Journey times were extracted from June 2012 Trafficmaster data for five routes through the town.

8.1.1 Link flow criteria

Over 85% of flow volume comparisons are required to have a GEH value of less than 5.0 for individual flows and screenline totals should have a GEH of less than 4.0 for all or nearly all screenlines. The GEH value is a variant of the Chi-squared statistic and shows the goodness of fit between modelled and observed data. It is defined as:

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

Where M is the modelled flow and C is the observed flow.

At least 85% of modelled flows should also meet the following requirements.

Individual flows within 15% for flows of 700-2700 vehicles per hour (vph)

Individual flows within 100 vph for flows <700 vph

Individual flows within 400 vph for flows >2700 vph

Screenline totals should be within 5% of observed traffic volumes for all or nearly all screenlines.

8.1.2 Journey time criteria

The journey time validation criteria require the difference between the modelled and observed journey times to be within 15% (or 1 minute, if higher than 15% of the observed journey time) for at least 85% of routes tested.

8.2 Comparison of calibration flows

The results for the screenlines for both inbound and outbound directions are shown in Table 8-A and Table 8-B for the AM and PM peaks respectively. The GEH criterion is not applied to screenlines consisting of only one observation.

No.	Screenline Name	Dir.	Observed (no.of vehs)	Modelled (no.of vehs)	GEH	GEH<4
1	Outer SW	In	2,767	2,812	0.9	Pass
	Outer SW	Out	2,723	3,032	5.8	Fail
2	Outer West	In	1,559	1,495	1.6	Pass
	Outer West	Out	1,463	1,319	3.9	Pass
3	Outer NE	In	3,799	3,615	3.0	Pass
	Outer NE	Out	3,144	3,073	1.3	Pass
4	Outer East	In	1,940	1,778	3.8	Pass
	Outer East	Out	2,165	2,145	0.4	Pass
5	Outer SE	In	2,475	2,449	0.5	Pass
	Outer SE	Out	2,538	2,717	3.5	Pass
6	Inner South	In	4,609	4,542	1.0	Pass
	Inner South	Out	5,452	5,660	2.8	Pass
7	Inner North	In	7,876	7,637	2.7	Pass
	Inner North	Out	5,497	5,280	3.0	Pass

Table 8-A AM Peak screenline calibration

No.	Screenline Name	Dir.	Observed (no.of vehs)	Modelled (no.of vehs)	GEH	GEH<4
1	Outer SW	In	2,963	3,146	3.3	Pass
	Outer SW	Out	3,511	3,479	0.5	Pass
2	Outer West	In	1,397	1,274	3.4	Pass
	Outer West	Out	1,662	1,679	0.4	Pass
3	Outer NE	In	2,741	2,834	1.8	Pass
	Outer NE	Out	3,573	3,473	1.7	Pass
4	Outer East	In	2,230	2,136	2.0	Pass
	Outer East	Out	1,823	1,708	2.7	Pass
5	Outer SE	In	2,509	2,594	1.7	Pass
	Outer SE	Out	2,928	2,960	0.6	Pass
6	Inner South	In	5,164	5,107	0.8	Pass
	Inner South	Out	4,754	4,688	1.0	Pass
7	Inner North	In	5,902	5,753	2.0	Pass
	Inner North	Out	7,780	7,513	3.1	Pass

Table 8-B PM Peak screenline calibration

Table 8-C summarises the results for the cordon comparisons and shows that, although there are a small number of individual failures, both peaks satisfy the acceptability criteria for screenline totals.

	AM Peak	PM Peak
No. of cordon comparisons	14	14
% GEH < 4	94	100

Table 8-C Summary of screenline calibration

Table 8-D and Table 8-E present a comparison of the cordon totals with the total of observed counts for the AM and PM peak hours.

Cordon	Dir.	Observed (no. of vehicles)	Modelled (no. of vehicles)	GEH	% Difference	GEH<4	Within +/- 5%
Inner Cordon	In	12,485	12,179	2.8	-2.5%	Pass	Pass
	Out	10,949	10,940	0.1	-0.1%	Pass	Pass
Outer Cordon	In	12,540	12,149	3.5	-3.1%	Pass	Pass
	Out	12,033	12,286	2.3	2.1%	Pass	Pass
Town Centre	In	5,493	5,499	0.1	0.1%	Pass	Pass
	Out	3,907	3,978	1.1	1.8%	Pass	Pass
M40 J4 Handy Cross	In	6,631	6,788	1.9	2.4%	Pass	Pass
	Out	6,631	6,788	1.9	2.4%	Pass	Pass

Table 8-D AM Peak cordon calibration summary

Cordon	Dir.	Observed (no. of vehicles)	Modelled (no. of vehicles)	GEH	% Difference	GEH<4	Within +/- 5%
Inner Cordon	In	11,066	10,860	2.0	-1.9%	Pass	Pass
	Out	12,534	12,201	3.0	-2.7%	Pass	Pass
Outer Cordon	In	11,840	11,984	1.3	1.2%	Pass	Pass
	Out	13,497	13,299	1.7	-1.5%	Pass	Pass
Town Centre	In	4,291	4,294	0.0	0.1%	Pass	Pass
	Out	4,812	4,835	0.3	0.5%	Pass	Pass
M40 J4 Handy Cross	In	7,195	7,352	1.8	2.2%	Pass	Pass
	Out	7,195	7,352	1.8	2.2%	Pass	Pass

Table 8-E PM Peak cordon calibration summary

The above tables show that for all cordons in both directions for both peak hours the total observed flow and modelled flow differ by less than 5%.

Table 8-F summarises the link flow comparisons used in the screenline and cordon calibration. The detailed results are presented in Appendix E. These results meet the acceptability criteria

		AM Peak	PM Peak
	No. of link flow comparisons	119	119
A	% link flows GEH < 5	87%	83%
B	% meeting modelled flows criteria	86%	83%
C	% meeting at least one of A and B	90%	87%

Table 8-F Summary of Link Flow Calibration

All of the tests performed meet or exceed the criteria set in WebTAG and, therefore, the calibration of both the AM peak and PM peak models satisfies the requirements of the guidance. The cordon and screenline calibration results, together with the individual link flow results, provide confidence that the observed traffic volumes are well reflected in the model.

8.3 Link flow validation

The comparison of the link flows for validation is presented in Appendix F and is summarised below in Table 8-G.

		AM Peak	PM Peak
	No. of link flow comparisons	98	98
A	% link flows GEH < 5	81%	81%
B	% meeting modelled flows criteria	79%	74%
C	% meeting at least one of A and B	83%	83%

Table 8-G AM and PM Peak link flow validation

The results of the link flow validation indicate that the model demonstrates a good level of agreement with the observed flows. Furthermore, the model validation results represent an improvement in the level of fit with observed data in comparison to the previously approved 2006 and 2010 versions of the base model.

8.4 Journey time validation

Journey time validation was undertaken for five key routes (shown in **Error! Reference source not found.**) in, through and out of the town. The observed mean average times were derived from Trafficmaster data for June 2013. The journey time validation results are presented in Table 8-H and Table 8-I.

Route	Direction	Observed Mean (mm:ss)	Modelled (mm:ss)	Difference (seconds)	% Difference	Pass/Fail
1	Handy Cross to West Wycombe	08:02	08:36	34	7.2%	Pass
2	West Wycombe to Handy Cross	11:51	11:16	-35	-5.0%	Pass
3	Handy Cross to Amersham Road	14:40	13:05	-95	-10.8%	Pass
4	Amersham Road to Handy Cross	18:23	16:29	-114	-10.3%	Pass
5	London Road inbound	09:24	10:22	58	10.3%	Pass
6	London Road outbound	12:32	14:11	99	13.1%	Pass
7	West Wycombe to Town	09:11	08:37	-34	-6.2%	Pass
8	Town to West Wycombe	07:14	08:15	61	14.2%	Pass
9	Hughenden Valley Road to Town	09:48	10:42	54	9.1%	Pass
10	Town to Hughenden Valley Road	05:11	05:17	6	2.0%	Pass

Table 8-H AM Peak journey time validation

For both peak hour models, 90% of the journey time comparisons meet the criteria set out in paragraph 8.1.2 above (which specify over 85%).

Route	Direction	Observed Mean (mm:ss)	Modelled (mm:ss)	Difference (seconds)	% Difference	Pass/Fail
1	Handy Cross to West Wycombe	11:21	10:29	-52	-7.6%	Pass
2	West Wycombe to Handy Cross	09:04	08:58	-6	-1.2%	Pass
3	Handy Cross to Amersham Road	14:47	14:23	-24	-2.7%	Pass
4	Amersham Road to Handy Cross	12:06	13:21	75	10.4%	Pass
5	London Road inbound	09:28	10:29	61	10.7%	Pass
6	London Road outbound	10:59	11:52	53	8.0%	Pass
7	West Wycombe to Town	09:31	08:07	-84	-14.7%	Pass
8	Town to West Wycombe	10:04	08:44	-80	-13.3%	Pass
9	Hughenden Valley Road to Town	06:10	05:16	-54	-14.6%	Pass
10	Town to Hughenden Valley Road	05:44	07:01	77	22.3%	Fail

Table 8-I PM Peak journey time validation

8.5 M40 link flow and journey time validation

In Table 8-J modelled flows on the M40 on either side of junction 4 (Handy Cross) are compared to the observed flows from the TRADS database. This is to be expected, since through traffic was loaded at either end of the modelled M40 in order to give realistic flows.

08:00 09:00	Observed mean (vehicles)	Modelled (vehicles)	Difference	% Difference	Pass/Fail
Junction 3 - 4 WB	3619	3497	-122	-3%	Pass
Junction 4 - 3 EB	4506	4540	34	1%	Pass
Junction 4 - 5 WB	2822	2923	101	4%	Pass
Junction 5 - 4 EB	4247	4112	-135	-3%	Pass
17:00 18:00	Observed mean (vehicles)	Modelled (vehicles)	Difference	% Difference	Pass/Fail
Junction 3 - 4 WB	4544	4640	96	2%	Pass
Junction 4 - 3 EB	4220	4215	-5	0%	Pass
Junction 4 - 5 WB	4328	4113	-215	-5%	Pass
Junction 5 - 4 EB	3583	3531	-52	-1%	Pass

Table 8-J M40 Link Flow Validation

Table 8-K shows the comparison of modelled and observed journey times for the M40 Junctions 3-4 and Junctions 4-5 in both directions. The observed data is from the Highways England journey time database. There is close agreement for all movements except for junction 5 to 4 in the AM peak, where the exit lane queue is modelled separately from the through movement.

08:00 09:00	Observed Mean (mm:ss)	Modelled (mm:ss)	Difference (seconds)	% Difference	Pass/ Fail
Junction 3 - 4 WB	03:08	03:08	0	0%	Pass
Junction 4 - 3 EB	03:17	03:27	10	5%	Pass
Junction 4 - 5 WB	06:26	06:01	-25	-6%	Pass
Junction 5 - 4 EB	07:35	06:29	-56	-13%	Pass
17:00 18:00	Observed Mean (mm:ss)	Modelled (mm:ss)	Difference (seconds)	% Difference	Pass/ Fail
Junction 3 - 4 WB	03:17	03:30	13	7%	Pass
Junction 4 - 3 EB	03:03	03:19	16	9%	Pass
Junction 4 - 5 WB	06:38	06:27	-11	-3%	Pass
Junction 5 - 4 EB	06:34	06:12	-22	-6%	Pass

Table 8-K M40 Journey Time Validation

9. Summary

Jacobs was commissioned by BCC and Wycombe District Council (WDC) to update the High Wycombe Highway Assignment Model (HWHAM) for the purposes of the continued assessment of the High Wycombe Town Centre Masterplan / Southern Quadrant (HWTCM/SQ) devolved major scheme.

Jacobs manages a suite of transport models and assessment tools on behalf of the Councils. These models have been developed to inform the assessment of new schemes and land use proposals. HWHAM has been developed for the continued assessment of the HWTCM/SQ proposals and as part of separate commissions emerging land use proposals including those associated with the adopted WDC Core Strategy (Reserve Sites).

An existing strategic highway assignment model built using the PTV VISUM modelling suite includes the urban area of High Wycombe. This model has a 2010 base for the morning (AM) and afternoon (PM) peak hours and was developed by Jacobs using matrices from a 2006 CONTRAM model.

These matrices were developed using roadside interview (RSI) data from May 2006. The existing model was developed according to the guidelines in DMRB and WebTAG for highway assignment modelling then applicable. However, in August 2012 new guidance in the form of WebTAG unit 3.19 was released with a specific focus on highway assignment modelling. It was deemed prudent to review the existing model against this guidance and to create updated models to improve fit with new guidance where appropriate. The previous model development work was undertaken for the purposes of informing the testing of the emerging New Wycombe Local Plan and the model was reviewed and approved for use by Highways England.

This report describes the background to the model including network and matrix development and model calibration and validation processes. The screenline, cordon and link flow calibration and journey time validation meet the guidance criteria. The link flow validation is slightly below the level set out in the guidance.

This report demonstrates the suitability of the model for use as part of the Local Plan development process. The model is a tool which can be used to assess the strategic highway impact of new developments in and around High Wycombe, and the strategic impact of transport schemes and other changes in land-use upon the traffic in the town.

Appendix A. Glossary of terms

Acronym	Definition
ANPR	Automatic Number Plate Recognition
ATC	Automatic Traffic Count (using road-surface sensors)
BCC	Buckinghamshire County Council
CONTRAM	CONTinuous TRaffic Assignment Model (transport modelling software developed by TRL Ltd. & Mott MacDonald)
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
GEH	A statistic measuring how well model volumes compare with survey volumes
GFA	Gross floor area
GIS	Geographic Information System
Halcrow	Halcrow Group Limited
HCM	Highway Capacity Manual
HGV	Heavy Goods Vehicle
ICA	Intersection Capacity Analysis
Jacobs	Jacobs Engineering UK Limited
LATS	London Area Transportation Surveys
LGV	Light Goods Vehicle
LMVR	Local Model Validation Report
MCC	Manual Classified Traffic Count (often using video technology)
Meridian™2	GIS database of roads from Ordnance Survey
NRTS	DfT National Road Traffic Survey
OD	Origin to Destination
RSI	Roadside Interview survey
TfB	Transport for Buckinghamshire Alliance (between BCC and Ringway Jacobs)
Trafficmaster	Source of Journey Time Data
TRADS	TRAffic Database System that stores Highways Agency traffic count data
TRL	The UK Transport Research Laboratory
VISUM	Transport Modelling software developed by PTV AG
VPH	Vehicles per Hour
WebTAG	DfT guidance on the conduct of transport studies (http://www.dft.gov.uk/webtag/)
WTS	Wycombe Transport Study

Appendix B. Location of 2006 RSI sites



Appendix C. Traffic Count Data

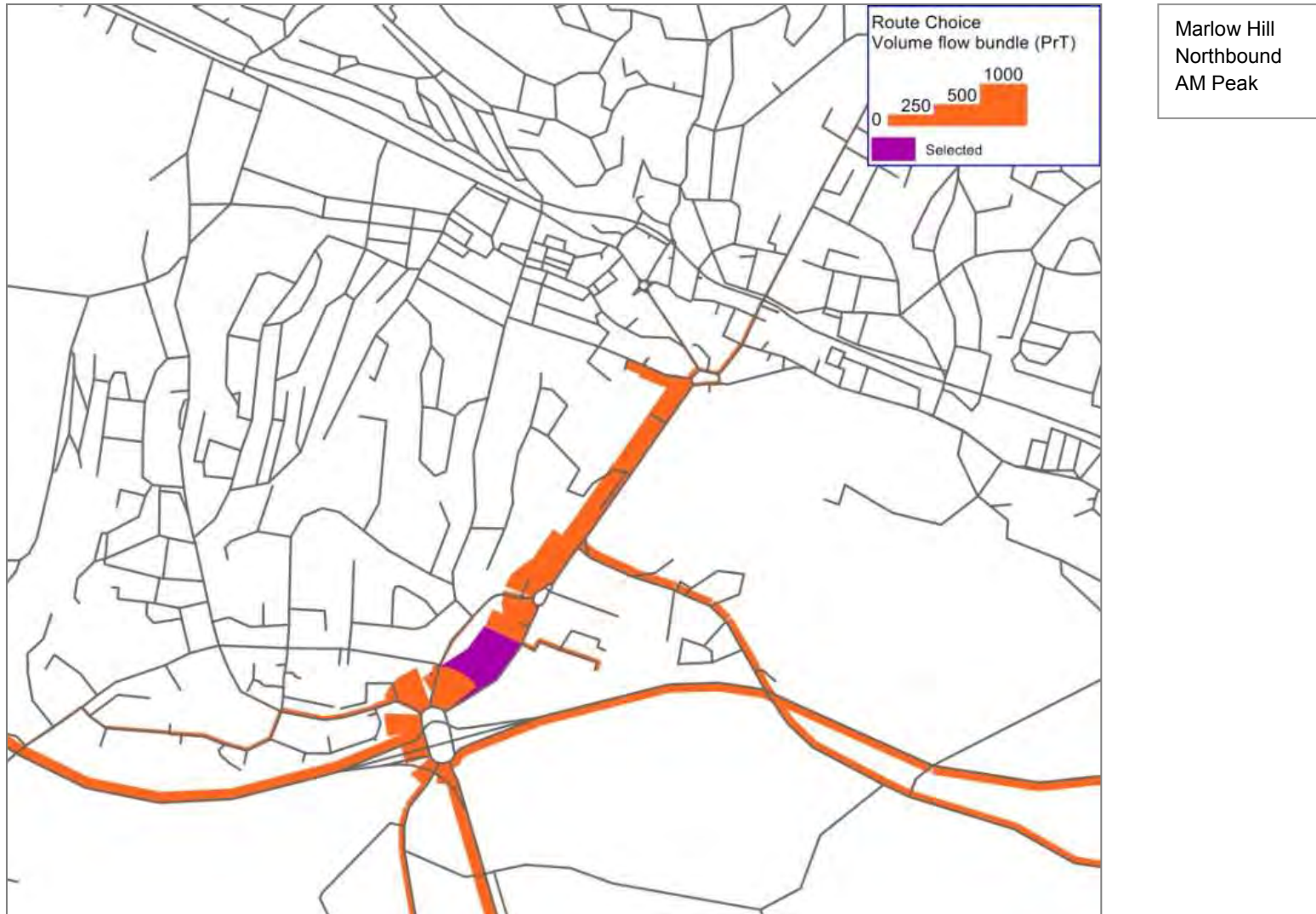
Map Ref	Location Details	Year	Day	Date of Survey	Survey Type
1	A40 Oxford Road/ Abbey Way/A4128 Arch Way roundabout	2010	Thursday	24/06/2010	MCC
2	Abbey Way gyratory	2010	Thursday	24/06/2010	MCC
3	Swains Lane/ Treadaway Hill j/w Treadaway Road	2011	Friday	17/06/2011	MCC
4	London Road /Micklefield Road/ access to Wycombe Retail Park	2011	Thursday	23/06/2011	MCC
5	Cressex Island	2011	Thursday	01/12/2011	MCC
6	A4010 Bradenham	2012	3 day ave	01/01/2012	ATC
7	A4128 Cryers Hill	2012	3 day ave	01/01/2012	ATC
8	Desborough Avenue j/w Deeds Grove	2012	Thursday	01/03/2012	MCC
9	A40 Knaves Beech roundabout	2012	Thursday	22/03/2012	MCC
10	A4094 Knaves Beech Way j/w Boundary Road	2012	Tuesday	22/05/2012	MCC
11	A40/A4010 West Wycombe: Pedestal Roundabout	2012	Tuesday	12/06/2012	MCC
12	Parker Knoll Way j/w access to Morrisons	2012	Wednesday	12/06/2012	MCC
13	B474 Penn Rd Hazlemere W of j/w Rose Avenue	2012	3 day ave	13/06/2012	ATC
14	Mill End Rd j/w Dashwood Avenue/Gallows Lane	2012	Wednesday	13/06/2012	MCC
15	Gordon Road near railway	2012	3 day ave	14/06/2012	ATC
16	A40/A404 Abbey Way/London Road j/w Easton Street	2012	Friday	15/06/2012	MCC
17	A4010 John Hall Way btwn Crest Road & Holmers Farm Way	2012	Friday	15/06/2012	ATC
18	A404 Amersham Road j/w Arnison Avenue	2012	Friday	15/06/2012	MCC
19	Desborough Rd btwn Desborough Ave & Short St	2012	3 day ave	15/06/2012	ATC
20	Suffield Rd btwn Desborough Ave & West End St	2012	3 day ave	15/06/2012	ATC
21	A4128/C77 Hughenden: Valley Road j/w Cryers Hill Road	2012	Tuesday	19/06/2012	MCC
22	Four Ashes Road j/w Kingshill Road/North Road	2012	Tuesday	19/06/2012	MCC
23	Sands, New Road j/w Lane End Road	2012	Wednesday	20/06/2012	MCC
24	Amersham Hill j/w Totteridge Road	2012	Thursday	21/06/2012	MCC
25	A40/U131 High Wycombe: London Road j/w Cock Lane	2012	Friday	22/06/2012	MCC
26	A4010/Unc High Wycombe: John Hall Way j/w Crest Road	2012	Tuesday	26/06/2012	MCC
27	A404 Marlow Hill j/w Handy Cross Sports Centre Access	2012	Tuesday	26/06/2012	MCC
28	Lane End Road j/w Horns Lane	2012	Tuesday	26/06/2012	MCC
29	Cressex Road j/w Horns Lane	2012	Tuesday	26/06/2012	MCC
30	A40 West Wycombe Road j/w Desborough Avenue/The Pastures	2012	Thursday	28/06/2012	MCC
31	A40 West Wycombe Road j/w Plomer Hill	2012	Thursday	28/06/2012	MCC
32	High Wycombe: Priory Road, S of j/w Priory Avenue	2012	Thursday	28/06/2012	MCC
33	A404/B474 Hazlemere Crossroads	2012	Tuesday	03/07/2012	MCC
34	A404/C102 Marlow Hill j/w Daws Hill Lane	2012	Tuesday	03/07/2012	MCC
35	Marlow Road j/w Cressex Road	2012	Tuesday	03/07/2012	MCC
36	Abbey Barn Rd/Kingsmead Rd j/w Abbey Barn Ln	2012	Wednesday	03/10/2012	MCC

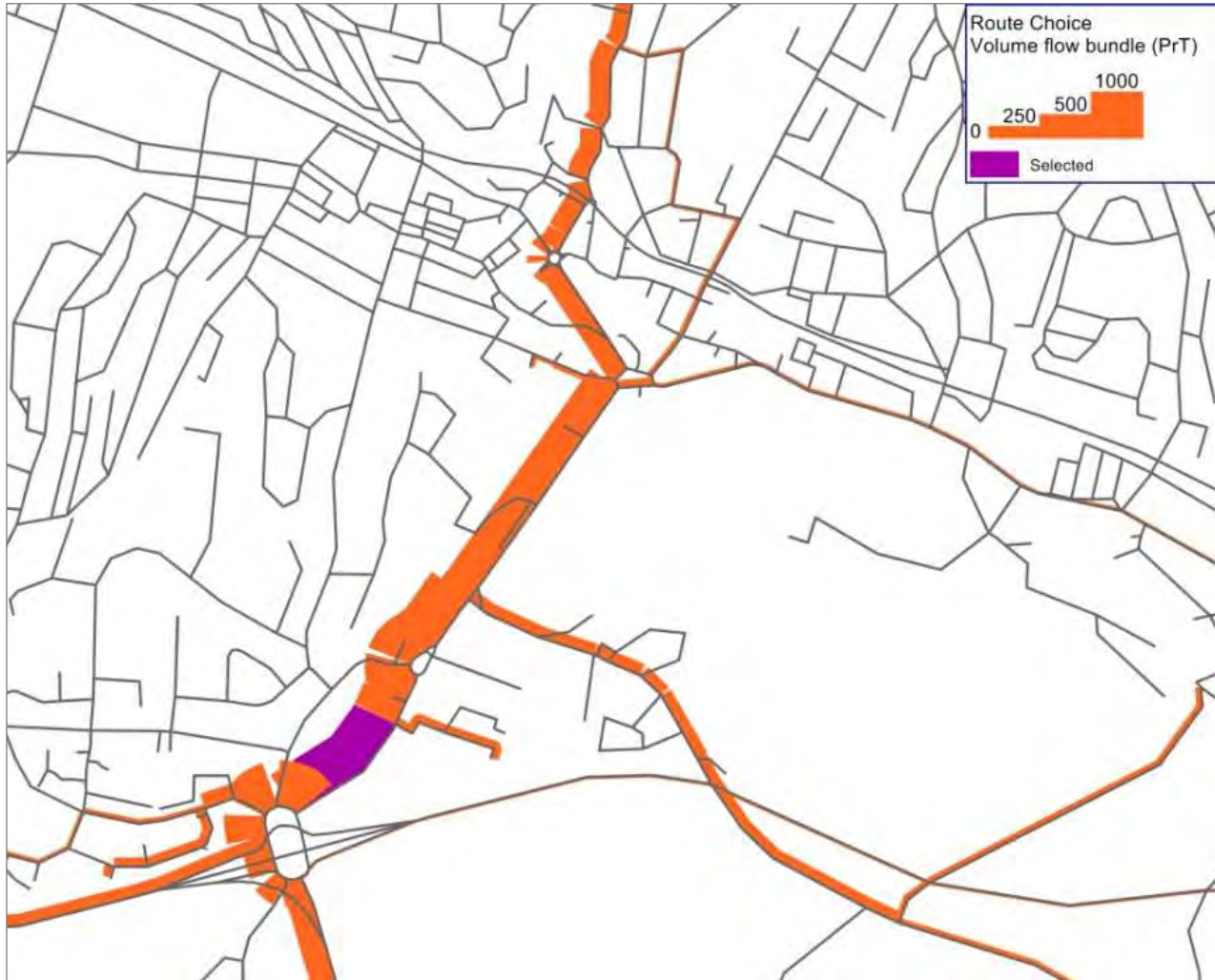
Map Ref	Location Details	Year	Day	Date of Survey	Survey Type
37	A40/A4010 West Wycombe Road j/w Chapel Lane	2012	Wednesday	30/01/2013	MCC
38	A4010 New Road, Booker	2013	3 day ave	19/03/2013	ATC
39	A404 Amersham Road, Hazlemere	2013	3 day ave	19/03/2013	ATC
40	A404 Marlow Hill, Cressex	2013	3 day ave	19/03/2013	ATC
41	A4128 Valley Road, Hughenden Valley	2013	3 day ave	19/03/2013	ATC
42	Cock Lane, Totteridge	2013	3 day ave	19/03/2013	ATC
43	Daws Hill Lane	2013	3 day ave	19/03/2013	ATC
44	Desborough Avenue	2013	3 day ave	19/03/2013	ATC
45	Hammersely Lane	2013	3 day ave	19/03/2013	ATC
46	Hatters Lane, N of j/w Guinions Road	2013	3 day ave	19/03/2013	ATC
47	Kingshill Road, Four Ashes	2013	3 day ave	19/03/2013	ATC
48	Lane End Road, Booker	2013	3 day ave	19/03/2013	ATC
49	M40 TRADS data	2013	3 day ave	April 2013	ATC
50	M40 Junction 4 Handy Cross	2013	Tuesday	23/04/2013	MCC

Locations of traffic count data referenced in above table



Appendix D. Illustration of Trip Distribution Checks

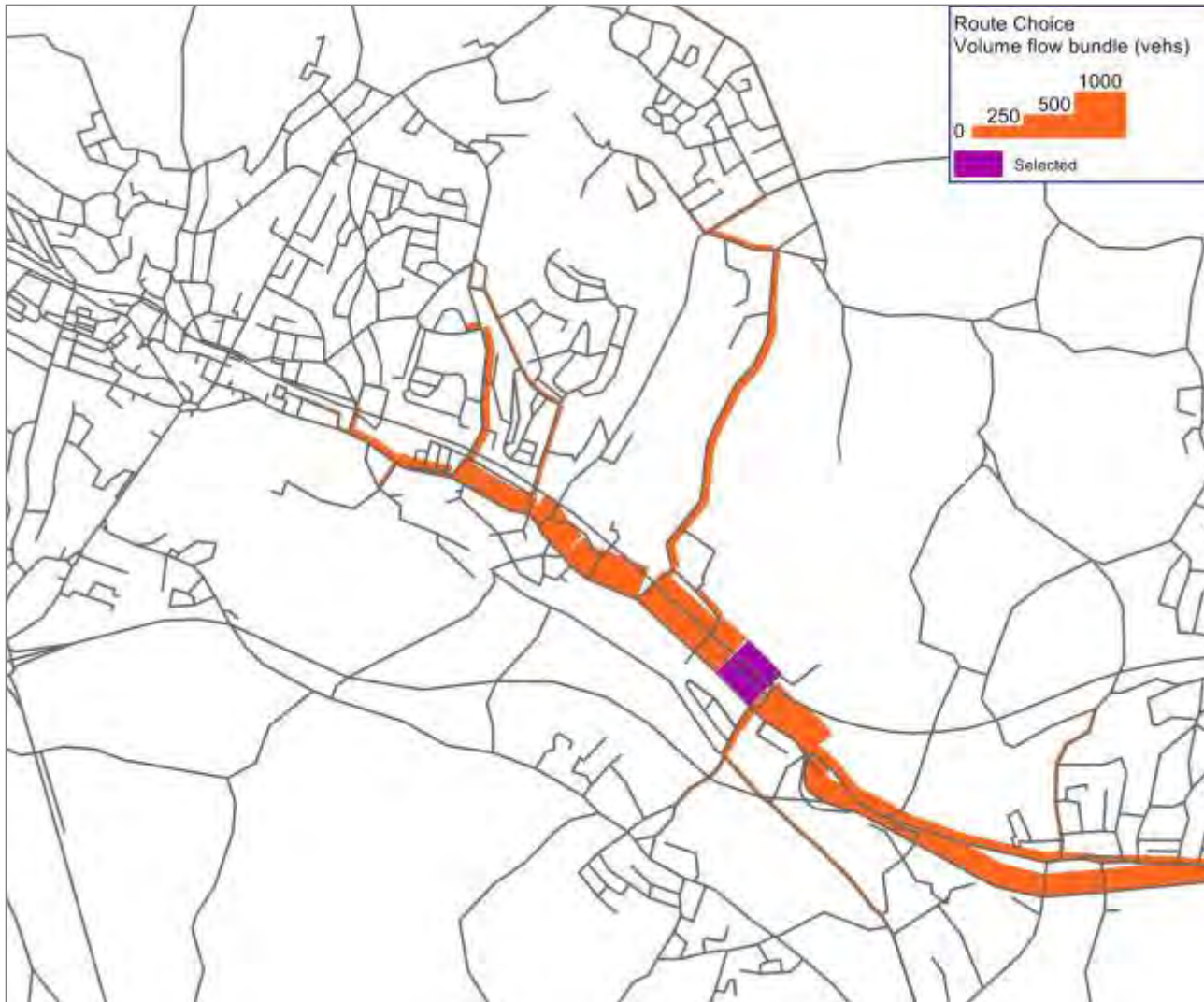




Marlow Hill
Northbound
PM Peak



London Road
Westbound
AM Peak



London Road
Eastbound
AM Peak

Appendix E. Link Volume Calibration Data (AM and PM)

AM Calibration

Screenline No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
1	Cressex Road (over M40) NB	342	486	144	42.1%	7.1	Fail	Fail
	Crest Road WB	227	150	-77	-33.9%	5.6	Fail	Pass
	A4010 John Hall Way E of Crest Rd WB	1029	993	-36	-3.5%	1.1	Pass	Pass
	Cressex Road WB Away from Junction with Marlow Road	383	443	60	15.7%	3.0	Pass	Pass
	Marlow Road NB Away from Junction with Cressex Rd	786	740	-46	-5.9%	1.7	Pass	Pass
	Cressex Road (over M40) SB	401	487	86	21.4%	4.1	Pass	Pass
	Crest Road EB	286	348	62	21.7%	3.5	Pass	Pass
	A4010 John Hall Way E of Crest Rd EB	618	745	127	20.6%	4.9	Pass	Fail
	Cressex Road EB Towards Junction with Marlow Road	543	506	-37	-6.8%	1.6	Pass	Pass
	Marlow Road SB Towards Junction with Cressex Rd	875	946	71	8.1%	2.4	Pass	Pass
2	A4010 Bradenham Road SB	673	662	-11	-1.6%	0.4	Pass	Pass
	A40 West Wycombe EB	595	627	32	5.4%	1.3	Pass	Pass
	Lane End Road EB	291	206	-85	-29.2%	5.4	Fail	Pass
	A4010 Bradenham Road NB	698	583	-115	-16.5%	4.5	Pass	Fail
	A40 West Wycombe WB	575	487	-88	-15.3%	3.8	Pass	Pass
	Lane End Road WB	190	249	59	31.1%	4.0	Pass	Pass
3	Valley Road SB	694	613	-81	-11.7%	3.2	Pass	Pass
	A4128 Cryers Hill Road SB	609	595	-14	-2.3%	0.6	Pass	Pass
	North Road SB	576	549	-27	-4.7%	1.1	Pass	Pass

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Screenine No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
3	Four Ashes Road SB	241	230	-11	-4.6%	0.7	Pass	Pass
	A404 Amersham Road S of Holmer Green Road SB	972	945	-27	-2.8%	0.9	Pass	Pass
	Hammersley Lane SB	491	420	-71	-14.5%	3.3	Pass	Pass
	Cock Lane SB	216	263	47	21.8%	3.0	Pass	Pass
	Valley Road NB	575	515	-60	-10.4%	2.6	Pass	Pass
	A4128 Cryers Hill Road NB	594	478	-116	-19.5%	5.0	Fail	Fail
	North Road NB	430	501	71	16.5%	3.3	Pass	Pass
	Four Ashes Road NB	235	290	55	23.4%	3.4	Pass	Pass
	A404 Amersham Road S of Holmer Green Road NB	914	883	-31	-3.4%	1.0	Pass	Pass
	Hammersley Lane NB	238	269	31	13.0%	1.9	Pass	Pass
	Cock Lane NB	158	137	-21	-13.3%	1.7	Pass	Pass
4	A40 Knaves Beech WB	610	545	-65	-10.7%	2.7	Pass	Pass
	M40 J3 off slip	866	812	-54	-6.2%	1.9	Pass	Pass
	A4094 Boundary Road WB	464	421	-43	-9.3%	2.0	Pass	Pass
	A40 Knaves Beech EB	615	506	-109	-17.7%	4.6	Pass	Fail
	M40 J3 on slip	956	940	-16	-1.7%	0.5	Pass	Pass
	A4094 Boundary Road EB	594	699	105	17.7%	4.1	Pass	Fail
5	A404 Marlow Hill South NB Towards Junction with Marlow Rd	1044	1090	46	4.4%	1.4	Pass	Pass
	Daws Hill Lane WB	475	520	45	9.5%	2.0	Pass	Pass
	Abbey Barn Lane NB	202	173	-29	-14.4%	2.1	Pass	Pass
	Swains Lane NB Towards Junction with Treadaway Road	655	607	-48	-7.3%	1.9	Pass	Pass
	Treadaway Road NB Towards Junction with Swains Lane	99	59	-40	-40.4%	4.5	Pass	Pass
	A404 Marlow Hill SB Away from Junction with Marlow Rd	958	1203	245	25.6%	7.5	Fail	Fail

**High Wycombe Highway Assignment Model
Local Model Validation Report**



Screenline No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow	
	Daws Hill Lane EB	437	457	20	4.6%	0.9	Pass	Pass	
	Abbey Barn Lane SB	465	348	-117	-25.2%	5.8	Fail	Fail	
	Swains Lane SB Away from Junction with Treadaway Road	512	550	38	7.4%	1.6	Pass	Pass	
	Treadaway Road SB Away from Junction with Swains Lane	166	159	-7	-4.2%	0.5	Pass	Pass	
6	Lane End Rd EB Towards Junction with New Road	414	419	5	1.2%	0.2	Pass	Pass	
	A4010 New Road NB Towards Junction with Land End Rd	659	569	-90	-13.7%	3.6	Pass	Pass	
	Desborough Ave NB Towards Junction with Plumer Rd	821	799	-22	-2.7%	0.8	Pass	Pass	
	A404 Marlow Hill North Away from Junction	1776	1703	-73	-4.1%	1.8	Pass	Pass	
	Daws Hill Lane nr Marlow Hill WB	589	651	62	10.5%	2.5	Pass	Pass	
	Abbey Barn Road EB Away from Junction with Kingsmead Rd	350	401	51	14.6%	2.6	Pass	Pass	
	Lane End Rd WB Away from Junction with New Road	739	779	40	5.4%	1.5	Pass	Pass	
	A4010 New Road SB Away from with Lands End Rd	677	706	29	4.3%	1.1	Pass	Pass	
	Desborough Ave SB Away from Junction with Plumer Rd	703	700	-3	-0.4%	0.1	Pass	Pass	
	A404 Marlow Hill North Towards Junction	1886	2048	162	8.6%	3.7	Pass	Pass	
	Daws Hill Lane nr Marlow Hill EB	579	631	52	9.0%	2.1	Pass	Pass	
	Abbey Barn Road WB Towards Junction with Kingsmead Rd	868	796	-72	-8.3%	2.5	Pass	Pass	
	7	A40 West Wycombe Road EB	1138	1237	99	8.7%	2.9	Pass	Pass
		Plomer Hill SB	579	522	-57	-9.8%	2.4	Pass	Pass
The Pastures SB		668	671	3	0.4%	0.1	Pass	Pass	
Parker Knoll Way WB Away from Junction with A4128		657	635	-22	-3.3%	0.9	Pass	Pass	
Arch Way (under bridge) SB		1354	1150	-204	-15.1%	5.8	Fail	Fail	
Priory Road SB		208	305	97	46.6%	6.1	Fail	Pass	
A404 Crendon Street SB		650	625	-25	-3.8%	1.0	Pass	Pass	

**High Wycombe Highway Assignment Model
Local Model Validation Report**



Screenine No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
	Gordon Road SB	563	503	-60	-10.7%	2.6	Pass	Pass
	Hatters Lane SB	512	542	30	5.9%	1.3	Pass	Pass
	Micklefiled Road SB	466	422	-44	-9.4%	2.1	Pass	Pass
	Cock Lane S of railway SB	259	289	30	11.6%	1.8	Pass	Pass
	A40 London Road S of Cock Lane WB	822	736	-86	-10.5%	3.1	Pass	Pass
	A40 West Wycombe Road WB	1081	1020	-61	-5.6%	1.9	Pass	Pass
	Plomer Hill NB	373	352	-21	-5.6%	1.1	Pass	Pass
	The Pastures NB	237	274	37	15.6%	2.3	Pass	Pass
	Parker Knoll Way EB Towards Junction with A4128	481	436	-45	-9.4%	2.1	Pass	Pass
	Arch Way (under bridge) NB	387	368	-19	-4.9%	1.0	Pass	Pass
	Priory Road NB	33	20	-13	-39.4%	2.5	Pass	Pass
	A404 Crendon Street NB	523	488	-35	-6.7%	1.6	Pass	Pass
	Gordon Road NB	329	333	4	1.2%	0.2	Pass	Pass
	Hatters Lane NB	391	406	15	3.8%	0.8	Pass	Pass
	Micklefiled Road NB	268	181	-87	-32.5%	5.8	Fail	Pass
	Cock Lane S of railway NB	244	244	0	0.0%	0.0	Pass	Pass
	A40 London Road S of Cock Lane EB	1150	1158	8	0.7%	0.2	Pass	Pass
8	Marlow Road SB	670	647	-23	-3.4%	0.9	Pass	Pass
	A404 Marlow Hill SB	843	1109	266	31.6%	8.5	Fail	Fail
	Handy Cross WB Off slip	1415	1510	95	6.7%	2.5	Pass	Pass
	A404(T) NB	963	826	-137	-14.2%	4.6	Pass	Fail
	Wycombe Road NB	785	751	-34	-4.3%	1.2	Pass	Pass
	Handy Cross EB Off slip	1255	1161	-94	-7.5%	2.7	Pass	Pass

High Wycombe Highway Assignment Model Local Model Validation Report



Screenine No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
	A4010 John Hall Way EB	700	784	84	12.0%	3.1	Pass	Pass
	Marlow Road NB	450	377	-73	-16.2%	3.6	Pass	Pass
	A404 Marlow Hill NB	906	1018	112	12.4%	3.6	Pass	Pass
	Handy Cross EB on slip	1451	1588	137	9.4%	3.5	Pass	Pass
	A404(T) SB	1983	2003	20	1.0%	0.4	Pass	Pass
	Wycombe Road SB	465	333	-132	-28.4%	6.6	Fail	Fail
	Handy Cross WB on slip	216	270	54	25.0%	3.5	Pass	Pass
	A4010 John Hall Way WB	1160	1199	39	3.4%	1.1	Pass	Pass
9	A40 Abbey Way West Away from Abbey Way Gyratory	935	1011	76	8.1%	2.4	Pass	Pass
	Oxford Street WB	45	38	-7	-15.6%	1.1	Pass	Pass
	Arch Way SB	1354	1150	-204	-15.1%	5.8	Fail	Fail
	Bellfield Road SB	585	600	15	2.6%	0.6	Pass	Pass
	West Wycombe Way E EB Away from Desborough Ave	858	926	68	7.9%	2.3	Pass	Pass
	Desborough Road EB	525	463	-62	-11.8%	2.8	Pass	Pass
	Suffield Road EB	446	512	66	14.8%	3.0	Pass	Pass
	Queen Alexandra Road WB	745	799	54	7.2%	1.9	Pass	Pass
	A40 Abbey Way West towards Abbey Way Gyratory	1242	1259	17	1.4%	0.5	Pass	Pass
	Arch Way NB	387	381	-6	-1.6%	0.3	Pass	Pass
	Bellfield Road NB	488	503	15	3.1%	0.7	Pass	Pass
	West Wycombe Way E WB Towards Desborough Ave	691	801	110	15.9%	4.0	Pass	Pass
	Desborough Road WB	374	405	31	8.3%	1.6	Pass	Pass
	Suffield Road WB	239	249	10	4.2%	0.6	Pass	Pass
	Queen Alexandra Road EB	486	380	-106	-21.8%	5.1	Fail	Fail

**High Wycombe Highway Assignment Model
Local Model Validation Report**



AM	Criteria GEH <5	Criteria Flow	GEH and/or Flow
Pass	103	102	107
Fail	16	17	12
Total	119	119	119

PM Calibration

Screenine No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
1	Cressex Road (over M40) NB	495	430	-65	-13.1%	3.0	Pass	Pass
	Crest Road WB	426	462	36	8.5%	1.7	Pass	Pass
	A4010 John Hall Way E of Crest Rd WB	712	817	105	14.7%	3.8	Pass	Pass
	Cressex Road WB Away from Junction with Marlow Road	492	520	28	5.7%	1.2	Pass	Pass
	Marlow Road NB Away from Junction with Cressex Rd	838	917	79	9.4%	2.7	Pass	Pass
	Cressex Road (over M40) SB	523	593	70	13.4%	3.0	Pass	Pass
	Crest Road EB	484	466	-18	-3.7%	0.8	Pass	Pass
	A4010 John Hall Way E of Crest Rd EB	990	803	-187	-18.9%	6.2	Fail	Fail
	Cressex Road EB Towards Junction with Marlow Road	555	598	43	7.7%	1.8	Pass	Pass
	Marlow Road SB Towards Junction with Cressex Rd	959	1019	60	6.3%	1.9	Pass	Pass
2	A4010 Bradenham Road SB	683	604	-79	-11.6%	3.1	Pass	Pass
	A40 West Wycombe EB	540	548	8	1.5%	0.3	Pass	Pass
	Lane End Road WB	174	122	-52	-29.9%	4.3	Pass	Pass
	A4010 Bradenham Road NB	822	873	51	6.2%	1.8	Pass	Pass
	A40 West Wycombe WB	525	560	35	6.7%	1.5	Pass	Pass
	Lane End Road WB	315	246	-69	-21.9%	4.1	Pass	Pass
3	Valley Road SB	540	636	96	17.8%	4.0	Pass	Pass
	A4128 Cryers Hill Road SB	542	553	11	2.0%	0.5	Pass	Pass
	North Road SB	193	222	29	15.0%	2.0	Pass	Pass
	Four Ashes Road SB	223	262	39	17.5%	2.5	Pass	Pass
	A404 Amersham Road S of Holmer Green Road SB	915	789	-126	-13.8%	4.3	Pass	Fail

High Wycombe Highway Assignment Model Local Model Validation Report



Screenline No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
3	Hammersley Lane SB	211	284	73	34.6%	4.6	Pass	Pass
	Cock Lane SB	117	88	-29	-24.8%	2.9	Pass	Pass
	Valley Road NB	773	718	-55	-7.1%	2.0	Pass	Pass
	A4128 Cryers Hill Road NB	708	683	-25	-3.5%	0.9	Pass	Pass
	North Road NB	375	297	-78	-20.8%	4.3	Pass	Pass
	Four Ashes Road NB	224	404	180	80.4%	10.2	Fail	Fail
	A404 Amersham Road S of Holmer Green Road NB	948	844	-104	-11.0%	3.5	Pass	Pass
	Hammersley Lane NB	375	373	-2	-0.5%	0.1	Pass	Pass
	Cock Lane NB	170	154	-16	-9.4%	1.3	Pass	Pass
4	A40 Knaves Beech WB	678	620	-58	-8.6%	2.3	Pass	Pass
	M40 J3 off slip	1007	1005	-2	-0.2%	0.1	Pass	Pass
	A4094 Boundary Road EB	545	511	-34	-6.2%	1.5	Pass	Pass
	A40 Knaves Beech EB	510	483	-27	-5.3%	1.2	Pass	Pass
	M40 J3 on slip	747	696	-51	-6.8%	1.9	Pass	Pass
	A4094 Boundary Road EB	566	529	-37	-6.5%	1.6	Pass	Pass
5	A404 Marlow Hill South NB Towards Junction with Marlow Rd	1002	1017	15	1.5%	0.5	Pass	Pass
	Daws Hill Lane WB	549	558	9	1.6%	0.4	Pass	Pass
	Abbey Barn Lane NB	371	354	-17	-4.6%	0.9	Pass	Pass
	Swains Lane NB Towards Junction with Treadaway Road	496	590	94	19.0%	4.0	Pass	Pass
	Treadaway Road NB Towards Junction with Swains Lane	91	75	-16	-17.6%	1.8	Pass	Pass
	A404 Marlow Hill SB Away from Junction with Marlow Rd	1336	1335	-1	-0.1%	0.0	Pass	Pass
	Daws Hill Lane EB	659	809	150	22.8%	5.5	Fail	Fail
	Abbey Barn Lane SB	232	113	-119	-51.3%	9.1	Fail	Fail

High Wycombe Highway Assignment Model Local Model Validation Report



Screenine No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
	Swains Lane SB Away from Junction with Treadaway Road	558	593	35	6.3%	1.5	Pass	Pass
	Treadaway Road SB Away from Junction with Swains Lane	143	110	-33	-23.1%	2.9	Pass	Pass
6	Lane End Rd EB Towards Junction with New Road	588	622	34	5.8%	1.4	Pass	Pass
	A4010 New Road NB Towards Junction with Land End Rd	619	695	76	12.3%	3.0	Pass	Pass
	Desborough Ave NB Towards Junction with Plumer Rd	924	827	-97	-10.5%	3.3	Pass	Pass
	A404 Marlow Hill North Away from Junction	1689	1736	47	2.8%	1.1	Pass	Pass
	Daws Hill Lane nr Marlow Hill WB	576	525	-51	-8.9%	2.2	Pass	Pass
	Abbey Barn Road EB Away from Junction with Kingsmead Rd	768	702	-66	-8.6%	2.4	Pass	Pass
	Lane End Rd WB Away from Junction with New Road	332	263	-69	-20.8%	4.0	Pass	Pass
	A4010 New Road SB Away from with Lands End Rd	697	679	-18	-2.6%	0.7	Pass	Pass
	Desborough Ave SB Away from Junction with Plumer Rd	590	653	63	10.7%	2.5	Pass	Pass
	A404 Marlow Hill North Towards Junction	1971	2058	87	4.4%	1.9	Pass	Pass
	Daws Hill Lane nr Marlow Hill EB	794	762	-32	-4.0%	1.1	Pass	Pass
	Abbey Barn Road WB Towards Junction with Kingsmead Rd	370	273	-97	-26.2%	5.4	Fail	Pass
	7	A40 West Wycombe Road EB	1049	1033	-16	-1.5%	0.5	Pass
Plomer Hill SB		386	247	-139	-36.0%	7.8	Fail	Fail
The Pastures SB		285	331	46	16.1%	2.6	Pass	Pass
Parker Knoll Way WB Away from Junction with A4128		464	434	-30	-6.5%	1.4	Pass	Pass
Arch Way (under bridge) SB		494	616	122	24.7%	5.2	Fail	Fail
Priory Road SB		157	172	15	9.6%	1.2	Pass	Pass
A404 Crendon Street SB		541	503	-38	-7.0%	1.7	Pass	Pass
Gordon Road SB		390	291	-99	-25.4%	5.4	Fail	Pass
Hatters Lane SB	307	337	30	9.8%	1.7	Pass	Pass	

High Wycombe Highway Assignment Model Local Model Validation Report



Screenine No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
8	Micklefiled Road SB	330	249	-81	-24.5%	4.8	Pass	Pass
	Cock Lane S of railway SB	199	172	-27	-13.6%	2.0	Pass	Pass
	A40 London Road S of Cock Lane WB	1300	1368	68	5.2%	1.9	Pass	Pass
	A40 West Wycombe Road WB	1213	1315	102	8.4%	2.9	Pass	Pass
	Plomer Hill NB	622	609	-13	-2.1%	0.5	Pass	Pass
	The Pastures NB	602	609	7	1.2%	0.3	Pass	Pass
	Parker Knoll Way EB Towards Junction with A4128	901	737	-164	-18.2%	5.7	Fail	Fail
	Arch Way (under bridge) NB	958	968	10	1.0%	0.3	Pass	Pass
	Priory Road NB	149	144	-5	-3.4%	0.4	Pass	Pass
	A404 Crendon Street NB	720	604	-116	-16.1%	4.5	Pass	Fail
	Gordon Road NB	478	369	-109	-22.8%	5.3	Fail	Fail
	Hatters Lane NB	527	504	-23	-4.4%	1.0	Pass	Pass
	Micklefiled Road NB	542	533	-9	-1.7%	0.4	Pass	Pass
	Cock Lane S of railway NB	246	198	-48	-19.5%	3.2	Pass	Pass
	A40 London Road S of Cock Lane EB	822	923	101	12.3%	3.4	Pass	Pass
8	Marlow Road SB	664	758	94	14.2%	3.5	Pass	Pass
	A404 Marlow Hill SB	1172	1237	65	5.5%	1.9	Pass	Pass
	Handy Cross WB Off slip	1467	1617	150	10.2%	3.8	Pass	Pass
	A404(T) NB	1020	1119	99	9.7%	3.0	Pass	Pass
	Wycombe Road NB	766	716	-50	-6.5%	1.8	Pass	Pass
	Handy Cross EB Off slip	924	943	19	2.1%	0.6	Pass	Pass
	A4010 John Hall Way EB	1182	962	-220	-18.6%	6.7	Fail	Fail
	Marlow Road NB	672	577	-95	-14.1%	3.8	Pass	Pass

High Wycombe Highway Assignment Model Local Model Validation Report



Screenine No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
	A404 Marlow Hill NB	1043	1064	21	2.0%	0.6	Pass	Pass
	Handy Cross EB on slip	1502	1627	125	8.3%	3.2	Pass	Pass
	A404(T) SB	2143	2154	11	0.5%	0.2	Pass	Pass
	Wycombe Road SB	500	576	76	15.2%	3.3	Pass	Pass
	Handy Cross WB on slip	419	416	-3	-0.7%	0.1	Pass	Pass
	A4010 John Hall Way WB	916	938	22	2.4%	0.7	Pass	Pass
9	A40 Abbey Way West Away from Abbey Way Gyratory	1327	1262	-65	-4.9%	1.8	Pass	Pass
	Oxford Street WB	127	98	-29	-22.8%	2.7	Pass	Pass
	Arch Way SB	494	616	122	24.7%	5.2	Fail	Fail
	Bellfield Road SB	394	385	-9	-2.3%	0.5	Pass	Pass
	West Wycombe Way E EB Away from Desborough Ave	641	653	12	1.9%	0.5	Pass	Pass
	Desborough Road EB	507	426	-81	-16.0%	3.8	Pass	Pass
	Suffield Road EB	368	479	111	30.2%	5.4	Fail	Fail
	Queen Alexandra Road WB	433	375	-58	-13.4%	2.9	Pass	Pass
	A40 Abbey Way West towards Abbey Way Gyratory	1065	1205	140	13.1%	4.2	Pass	Pass
	Arch Way NB	958	1067	109	11.4%	3.4	Pass	Pass
	Bellfield Road NB	739	607	-132	-17.9%	5.1	Fail	Fail
	West Wycombe Way E WB Towards Desborough Ave	873	766	-107	-12.3%	3.7	Pass	Pass
	Desborough Road WB	501	342	-159	-31.7%	7.7	Fail	Fail
	Suffield Road WB	301	391	90	29.9%	4.8	Pass	Pass
Queen Alexandra Road EB	375	457	82	21.9%	4.0	Pass	Pass	

**High Wycombe Highway Assignment Model
Local Model Validation Report**



PM	Criteria GEH <5	Criteria Flow	GEH and/or Flow
Pass	99	99	103
Fail	20	20	16
Total	119	119	119

Appendix F. Link Volume Validation Data

Links Used in Validation



AM Validation

Link No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
1	Chapel Lane SB	639	699	60	9.4%	2.3	Pass	Pass
2	Chapel Lane NB	416	392	-24	-5.8%	1.2	Pass	Pass
3	A40 West Wycombe Rd WB Away from Junction with Plomer Hill	822	675	-147	-17.9%	5.4	Fail	Fail
4	A40 West Wycombe Rd EB Towards Junction with Plomer Hill	633	585	-48	-7.6%	1.9	Pass	Pass
5	A40 West Wycombe Way West WB Away from Junction with Desborough Ave	744	763	19	2.6%	0.7	Pass	Pass
6	A40 West Wycombe Way West EB Towards Junction with Desborough Ave	674	667	-7	-1.0%	0.3	Pass	Pass
7	A404 Crendon Street SB Toward Junction with Totteridge Rd	454	559	105	23.1%	4.7	Pass	Fail
8	A404 Crendon Street NB Away from Junction with Totteridge Rd	426	394	-32	-7.5%	1.6	Pass	Pass
9	A404 Amersham Road SB Towards Junction with Green St	967	945	-22	-2.3%	0.7	Pass	Pass
10	A404 Amersham Road NB Away from Junction with Green St	875	883	8	0.9%	0.3	Pass	Pass
11	A404 Amersham Road SB Towards Junction with Hamilton Rd	695	645	-50	-7.2%	1.9	Pass	Pass
12	A404 Amersham Road NB Away from Junction with Hamilton Rd	490	588	98	20.0%	4.2	Pass	Pass
13	Cryers Hill Road S of Pipers Lane SB	682	407	-275	-40.3%	11.8	Fail	Fail
14	Cryers Hill Road S of Pipers Lane NB	476	347	-129	-27.1%	6.4	Fail	Fail
15	A4010 New Rd SB Towards Junction with Lane End Rd	1264	1398	134	10.6%	3.7	Pass	Pass
16	A4010 New Rd NB Away from Junction with Lane End Rd	921	901	-20	-2.2%	0.7	Pass	Pass
17	A4010 John Hall Way NB Towards Junction with Cressex Rd	577	543	-34	-5.9%	1.4	Pass	Pass
18	A4010 John Hall Way SB Away from Junction with Cressex Rd	563	583	20	3.6%	0.8	Pass	Pass
19	A40 Abbey Way WB Towards Roundabout	1913	2032	119	6.2%	2.7	Pass	Pass
20	A40 Abbey Way EB Away from Roundabout	712	744	32	4.5%	1.2	Pass	Pass
21	A40 Abbey Way Away from Junction	1164	1164	0	0.0%	0.0	Pass	Pass
22	A40 Abbey Way Towards Junction	717	744	27	3.8%	1.0	Pass	Pass
23	A404 Amersham Rd SB Towards Junction with Amison Ave	710	729	19	2.7%	0.7	Pass	Pass
24	A404 Amersham Rd NB Away from Junction with Amison Ave	613	753	140	22.8%	5.4	Fail	Fail
25	A40 London side Towards Abbey Way East	1164	1164	0	0.0%	0.0	Pass	Pass
26	A40 London side Away from Abbey Way East	1139	973	-166	-14.6%	5.1	Fail	Fail
27	A40 London Road Westbound between Micklefield Rd and Cock Ln	916	897	-19	-2.1%	0.6	Pass	Pass

High Wycombe Highway Assignment Model Local Model Validation Report



Link No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
28	A40 London Road Eastbound between Micklefield Rd and Cock Ln	1229	1273	44	3.6%	1.2	Pass	Pass
29	A4094 Knaves Beech Way N of Boundary Rd SB	542	736	194	35.8%	7.7	Fail	Fail
30	A4094 Knaves Beech Way N of Boundary Rd NB	761	584	-177	-23.3%	6.8	Fail	Fail
31	A4094 Knaves Beech Way SB Away from Tesco roundabout	749	736	-13	-1.7%	0.5	Pass	Pass
32	A4094 Knaves Beech Way NB Towards Tesco roundabout	670	584	-86	-12.8%	3.4	Pass	Pass
33	A40 London Road WB Away from Tesco roundabout	786	743	-43	-5.5%	1.6	Pass	Pass
34	A40 London Road EB Towards Tesco roundabout	1038	984	-54	-5.2%	1.7	Pass	Pass
35	B474 Penn Road WB	605	642	37	6.1%	1.5	Pass	Pass
36	B474 Penn Road EB	901	865	-36	-4.0%	1.2	Pass	Pass
37	Lands End Rd SB Towards Junction with Horns Ln	441	487	46	10.4%	2.1	Pass	Pass
38	Lands End Rd NB Away from Junction with Horns Ln	375	390	15	4.0%	0.8	Pass	Pass
39	Horns Lane NB	219	253	34	15.5%	2.2	Pass	Pass
40	Horns Lane SB	365	307	-58	-15.9%	3.2	Pass	Pass
41	Cressex Road WB Towards Junction with Horns Lane	362	418	56	15.5%	2.8	Pass	Pass
42	Cressex Road EB Away from Junction with Horns Lane	463	472	9	1.9%	0.4	Pass	Pass
43	Totteridge Road WB	334	212	-122	-36.5%	7.4	Fail	Fail
44	Totteridge Road WB	235	240	5	2.1%	0.3	Pass	Pass
45	Kingsmead Road WB	189	252	63	33.3%	4.2	Pass	Pass
46	Kingsmead Road EB	444	527	83	18.7%	3.8	Pass	Pass
47	Desborough Avenue S of Deeds Grove SB	805	793	-12	-1.5%	0.4	Pass	Pass
48	Desborough Avenue S of Deeds Grove NB	720	751	31	4.3%	1.1	Pass	Pass
49	Treadaway Hill NB	726	666	-60	-8.3%	2.3	Pass	Pass
50	Treadaway Hill SB	650	709	59	9.1%	2.3	Pass	Pass
51	Desborough Ave SB Away from Junction with A40 West Wycombe Rd	519	412	-107	-20.6%	5.0	Pass	Fail
52	Desborough Ave NB Towards Junction with A40 West Wycombe Rd	329	237	-92	-28.0%	5.5	Fail	Pass
53	Dashwood Ave WB Towards Junction with Mill End Rd	225	274	49	21.8%	3.1	Pass	Pass
54	Dashwood Ave EB Away from Junction with Mill End Rd	301	425	124	41.2%	6.5	Fail	Fail
55	Arnison Avenue NB	306	292	-14	-4.6%	0.8	Pass	Pass

High Wycombe Highway Assignment Model Local Model Validation Report



Link No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
56	Amison Avenue SB	198	211	13	6.6%	0.9	Pass	Pass
57	Deeds Grove WB Away from Junction with Desborough Rd	65	76	11	16.9%	1.3	Pass	Pass
58	Deeds Grove EB Towards Junction with Desborough Rd	191	217	26	13.6%	1.8	Pass	Pass
59	Mill End Road South SB Towards Junction With Chapel Lane	688	698	10	1.5%	0.4	Pass	Pass
60	Mill End Road South NB Away from Junction With Chapel Lane	504	462	-42	-8.3%	1.9	Pass	Pass
61	Chalfont Way SB Towards Junction with A4010 John Hall Way	205	410	205	100.0%	11.7	Fail	Fail
62	Chalfont Way NB Away from Junction with A4010 John Hall Way	483	455	-28	-5.8%	1.3	Pass	Pass
63	Holmer Green Road NB	369	398	29	7.9%	1.5	Pass	Pass
64	Holmer Green Road SB	409	620	211	51.6%	9.3	Fail	Fail
65	Sports Centre Out	239	213	-26	-10.9%	1.7	Pass	Pass
66	Sports Centre In	169	235	66	39.1%	4.6	Pass	Pass
67	Boundary Road W of Knaves Beech Way WB	472	573	101	21.4%	4.4	Pass	Fail
68	Boundary Road W of Knaves Beech Way EB	821	698	-123	-15.0%	4.5	Pass	Fail
69	Queen Victoria Rd NB Away from Junction with A40 Abbey Way	981	913	-68	-6.9%	2.2	Pass	Pass
70	A404 Easton Street West EB Towards Junction with A404 Easton Street	1134	1096	-38	-3.4%	1.1	Pass	Pass
71	Morrisons In	262	256	-6	-2.3%	0.4	Pass	Pass
72	Morrisons Out	183	153	-30	-16.4%	2.3	Pass	Pass
73	Crest Road SB	230	208	-22	-9.6%	1.5	Pass	Pass
74	Crest Road NB	202	41	-161	-79.7%	14.6	Fail	Fail
75	A4010 New Road S of Bookerhill Road SB	560	573	13	2.3%	0.5	Pass	Pass
76	A4010 New Road S of Bookerhill Road NB	579	455	-124	-21.4%	5.5	Fail	Fail
77	A40 West Wycombe Road E of Bradenham Road EB	1183	1237	54	4.6%	1.6	Pass	Pass
78	A40 West Wycombe Road E of Bradenham Road WB	1084	1020	-64	-5.9%	2.0	Pass	Pass
79	A404 Marlow Hill towards DHL junction	1478	1520	42	2.8%	1.1	Pass	Pass
80	A404 Marlow Hill away from DHL junction	1378	1195	-183	-13.3%	5.1	Fail	Fail
81	A404 Marlow Hill Away from Abbey Way Gyratory	1455	1520	65	4.5%	1.7	Pass	Pass
82	A404 Marlow Hill Towards Abbey Way Gyratory	1264	1407	143	11.3%	3.9	Pass	Pass
83	A4128 Valley Road SB	765	771	6	0.8%	0.2	Pass	Pass

High Wycombe Highway Assignment Model Local Model Validation Report



Link No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
84	A4128 Valley Road NB	533	555	22	4.1%	0.9	Pass	Pass
85	Mill End Road North NB Away from Junction with Dashwood Ave	295	175	-120	-40.7%	7.8	Fail	Fail
86	Mill End Road North SB Towards Junction with Dashwood Ave	539	563	24	4.5%	1.0	Pass	Pass
87	Eden Car Park Out	16	76	60	375.0%	8.8	Fail	Pass
88	Eden Car Park In	643	297	-346	-53.8%	16.0	Fail	Fail
89	Oxford Road NB	512	759	247	48.2%	9.8	Fail	Fail
90	Oxford Road SB	685	741	56	8.2%	2.1	Pass	Pass
91	Abbey Way SB	1277	1259	-18	-1.4%	0.5	Pass	Pass
92	Abbey Way NB	724	692	-32	-4.4%	1.2	Pass	Pass
93	A404 Marlow Hill S of Sports Centre SB	949	1109	160	16.9%	5.0	Pass	Pass
94	A404 Marlow Hill S of Sports Centre NB	965	1018	53	5.5%	1.7	Pass	Pass
95	Kingshill Road SB	810	780	-30	-3.7%	1.1	Pass	Pass
96	Kingshill Road NB	730	791	61	8.4%	2.2	Pass	Pass
97	A40 London Road EB Away from Junction with Hatters Ln	1081	1042	-39	-3.6%	1.2	Pass	Pass
98	A40 London Road WB Towards Junction with Hatters Ln	831	845	14	1.7%	0.5	Pass	Pass

AM	Criteria GEH <5	Criteria Flow	GEH and/or Flow
Pass	79	77	81
Fail	19	21	17
Total	98	98	98

PM Validation

High Wycombe Highway Assignment Model Local Model Validation Report



Link No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
1	Chapel Lane SB	497	515	18	3.6%	0.8	Pass	Pass
2	Chapel Lane NB	379	607	228	60.2%	10.3	Fail	Fail
3	A40 West Wycombe Rd WB Away from Junction with Plomer Hill	872	761	-111	-12.7%	3.9	Pass	Pass
4	A40 West Wycombe Rd EB Towards Junction with Plomer Hill	644	571	-73	-11.3%	3.0	Pass	Pass
5	A40 West Wycombe Way West WB Away from Junction with Desborough	648	599	-49	-7.6%	2.0	Pass	Pass
6	A40 West Wycombe Way West EB Towards Junction with Desborough Ave	656	694	38	5.8%	1.5	Pass	Pass
7	A404 Crendon Street SB Toward Junction with Totteridge Rd	434	482	48	11.1%	2.2	Pass	Pass
8	A404 Crendon Street NB Away from Junction with Totteridge Rd	626	591	-35	-5.6%	1.4	Pass	Pass
9	A404 Amersham Road SB Towards Junction with Green St	864	789	-75	-8.7%	2.6	Pass	Pass
10	A404 Amersham Road NB Away from Junction with Green St	687	844	157	22.9%	5.7	Fail	Fail
11	A404 Amersham Road SB Towards Junction with Hamilton Rd	563	456	-107	-19.0%	4.7	Pass	Fail
12	A404 Amersham Road NB Away from Junction with Hamilton Rd	887	829	-58	-6.5%	2.0	Pass	Pass
13	Cryers Hill Road S of Pipers Lane SB	493	368	-125	-25.4%	6.0	Fail	Fail
14	Cryers Hill Road S of Pipers Lane NB	619	601	-18	-2.9%	0.7	Pass	Pass
15	A4010 New Rd SB Towards Junction with Lane End Rd	907	837	-70	-7.7%	2.4	Pass	Pass
16	A4010 New Rd NB Away from Junction with Lane End Rd	1085	1213	128	11.8%	3.8	Pass	Pass
17	A4010 John Hall Way NB Towards Junction with Cressex Rd	659	737	78	11.8%	3.0	Pass	Pass
18	A4010 John Hall Way SB Away from Junction with Cressex Rd	584	552	-32	-5.5%	1.3	Pass	Pass
19	A40 Abbey Way WB Towards Roundabout	2101	1748	-353	-16.8%	8.0	Fail	Fail
20	A40 Abbey Way EB Away from Roundabout	734	761	27	3.7%	1.0	Pass	Pass
21	A40 Abbey Way Away from Junction	962	780	-182	-18.9%	6.2	Fail	Fail
22	A40 Abbey Way Towards Junction	824	761	-63	-7.6%	2.2	Pass	Pass
23	A404 Amersham Rd SB Towards Junction with Amison Ave	572	553	-19	-3.3%	0.8	Pass	Pass
24	A404 Amersham Rd NB Away from Junction with Amison Ave	839	926	87	10.4%	2.9	Pass	Pass
25	A40 London side Towards Abbey Way East	962	780	-182	-18.9%	6.2	Fail	Fail
26	A40 London side Away from Abbey Way East	1083	956	-127	-11.7%	4.0	Pass	Pass
27	A40 London Road Westbound between Micklefield Rd and Cock Ln	1388	1420	32	2.3%	0.9	Pass	Pass
28	A40 London Road Eastbound between Micklefield Rd and Cock Ln	957	1001	44	4.6%	1.4	Pass	Pass

**High Wycombe Highway Assignment Model
Local Model Validation Report**



Link No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
29	A4094 Knaves Beech Way N of Boundary Rd SB	951	631	-320	-33.6%	11.4	Fail	Fail
30	A4094 Knaves Beech Way N of Boundary Rd NB	432	435	3	0.7%	0.1	Pass	Pass
31	A4094 Knaves Beech Way SB Away from Tesco roundabout	764	631	-133	-17.4%	5.0	Pass	Pass
32	A4094 Knaves Beech Way NB Towards Tesco roundabout	529	435	-94	-17.8%	4.3	Pass	Pass
33	A40 London Road WB Away from Tesco roundabout	996	913	-83	-8.3%	2.7	Pass	Pass
34	A40 London Road EB Towards Tesco roundabout	798	663	-135	-16.9%	5.0	Pass	Fail
35	B474 Penn Road WB	776	760	-16	-2.1%	0.6	Pass	Pass
36	B474 Penn Road EB	680	622	-58	-8.5%	2.3	Pass	Pass
37	Lands End Rd SB Towards Junction with Horns Ln	358	244	-114	-31.8%	6.6	Fail	Fail
38	Lands End Rd NB Away from Junction with Horns Ln	321	350	29	9.0%	1.6	Pass	Pass
39	Horns Lane NB	372	349	-23	-6.2%	1.2	Pass	Pass
40	Horns Lane SB	253	118	-135	-53.4%	9.9	Fail	Fail
41	Cressex Road WB Towards Junction with Horns Lane	623	731	108	17.3%	4.2	Pass	Pass
42	Cressex Road EB Away from Junction with Horns Lane	522	337	-185	-35.4%	8.9	Fail	Fail
43	Totteridge Road WB	259	223	-36	-13.9%	2.3	Pass	Pass
44	Totteridge Road WB	246	214	-32	-13.0%	2.1	Pass	Pass
45	Kingsmead Road WB	426	526	100	23.5%	4.6	Pass	Fail
46	Kingsmead Road EB	164	215	51	31.1%	3.7	Pass	Pass
47	Desborough Avenue S of Deeds Grove SB	645	623	-22	-3.4%	0.9	Pass	Pass
48	Desborough Avenue S of Deeds Grove NB	760	783	23	3.0%	0.8	Pass	Pass
49	Treadaway Hill NB	558	665	107	19.2%	4.3	Pass	Fail
50	Treadaway Hill SB	672	703	31	4.6%	1.2	Pass	Pass
51	Desborough Ave SB Away from Junction with A40 West Wycombe Rd	339	338	-1	-0.3%	0.1	Pass	Pass
52	Desborough Ave NB Towards Junction with A40 West Wycombe Rd	416	407	-9	-2.2%	0.4	Pass	Pass
53	Dashwood Ave WB Towards Junction with Mill End Rd	205	205	0	0.0%	0.0	Pass	Pass
54	Dashwood Ave EB Away from Junction with Mill End Rd	313	382	69	22.0%	3.7	Pass	Pass
55	Arnison Avenue NB	243	238	-5	-2.1%	0.3	Pass	Pass
56	Arnison Avenue SB	300	238	-62	-20.7%	3.8	Pass	Pass

High Wycombe Highway Assignment Model Local Model Validation Report



Link No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
57	Deeds Grove WB Away from Junction with Desborough Rd	173	125	-48	-27.7%	3.9	Pass	Pass
58	Deeds Grove EB Towards Junction with Desborough Rd	68	139	71	104.4%	7.0	Fail	Pass
59	MIII End Road South SB Towards Junction With Chapel Lane	459	410	-49	-10.7%	2.4	Pass	Pass
60	MIII End Road South NB Away from Junction With Chapel Lane	731	685	-46	-6.3%	1.7	Pass	Pass
61	Chalfont Way SB Towards Junction with A4010 John Hall Way	638	631	-7	-1.1%	0.3	Pass	Pass
62	Chalfont Way NB Away from Junction with A4010 John Hall Way	199	400	201	101.0%	11.6	Fail	Fail
63	Holmer Green Road NB	500	514	14	2.8%	0.6	Pass	Pass
64	Holmer Green Road SB	451	421	-30	-6.7%	1.4	Pass	Pass
65	Sports Centre Out	220	192	-28	-12.7%	2.0	Pass	Pass
66	Sports Centre In	358	337	-21	-5.9%	1.1	Pass	Pass
67	Boundary Road W of Knaves Beech Way WB	939	797	-142	-15.1%	4.8	Pass	Fail
68	Boundary Road W of Knaves Beech Way EB	441	618	177	40.1%	7.7	Fail	Fail
69	Queen Victoria Rd NB Away from Junction with A40 Abbey Way	795	662	-133	-16.7%	4.9	Pass	Fail
70	A404 Easton Street West EB Towards Junction with A404 Easton Street	1375	1163	-212	-15.4%	6.0	Fail	Fail
71	Morrisons In	372	506	134	36.0%	6.4	Fail	Fail
72	Morrisons Out	464	586	122	26.3%	5.3	Fail	Fail
73	Crest Road SB	357	440	83	23.2%	4.2	Pass	Pass
74	Crest Road NB	491	479	-12	-2.4%	0.5	Pass	Pass
75	A4010 New Road S of Bookerhill Road SB	684	601	-83	-12.1%	3.3	Pass	Pass
76	A4010 New Road S of Bookerhill Road NB	724	617	-107	-14.8%	4.1	Pass	Fail
77	A40 West Wycombe Road E of Bradenham Road EB	1118	1033	-85	-7.6%	2.6	Pass	Pass
78	A40 West Wycombe Road E of Bradenham Road WB	1213	1315	102	8.4%	2.9	Pass	Pass
79	A404 Marlow Hill towards DHL junction	1605	1660	55	3.4%	1.4	Pass	Pass
80	A404 Marlow Hill away from DHL junction	1105	1101	-4	-0.4%	0.1	Pass	Pass
81	A404 Marlow Hill Away from Abbey Way Gyratory	1808	1660	-148	-8.2%	3.6	Pass	Pass
82	A404 Marlow Hill Towards Abbey Way Gyratory	1298	1195	-103	-7.9%	2.9	Pass	Pass
83	A4128 Valley Road SB	582	646	64	11.0%	2.6	Pass	Pass
84	A4128 Valley Road NB	863	858	-5	-0.6%	0.2	Pass	Pass

**High Wycombe Highway Assignment Model
Local Model Validation Report**



Link No.	Location	Observed (no. of vehicles)	Modelled (no. of vehicles)	Difference (Mod Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
85	Mill End Road North NB Away from Junction with Dashwood Ave	549	393	-156	-28.4%	7.2	Fail	Fail
86	Mill End Road North SB Towards Junction with Dashwood Ave	333	296	-37	-11.1%	2.1	Pass	Pass
87	Eden Car Park Out	125	134	9	7.2%	0.8	Pass	Pass
88	Eden Car Park In	113	57	-56	-49.6%	6.1	Fail	Pass
89	Oxford Road NB	517	409	-108	-20.9%	5.0	Pass	Pass
90	Oxford Road SB	720	780	60	8.3%	2.2	Pass	Pass
91	Abbey Way SB	1069	1205	136	12.7%	4.0	Pass	Pass
92	Abbey Way NB	1234	1109	-125	-10.1%	3.7	Pass	Pass
93	A404 Marlow Hill S of Sports Centre SB	1206	1237	31	2.6%	0.9	Pass	Pass
94	A404 Marlow Hill S of Sports Centre NB	1010	1064	54	5.3%	1.7	Pass	Pass
95	Kingshill Road SB	393	484	91	23.2%	4.3	Pass	Pass
96	Kingshill Road NB	564	701	137	24.3%	5.4	Fail	Fail
97	A40 London Road EB Away from Junction with Hatters Ln	909	919	10	1.1%	0.3	Pass	Pass
98	A40 London Road WB Towards Junction with Hatters Ln	1186	1039	-147	-12.4%	4.4	Pass	Pass

PM	Criteria GEH <5	Criteria Flow	GEH and/or Flow
Pass	79	73	81
Fail	19	25	17
Total	98	98	98

Appendix G. Junction Turning Movement Checks



Observed								
From / To	A	B	C	D	E	F	G	Total
A	1%	79%	39%	71%	9%	13%	12%	25%
B	0%	0%	0%	1%	0%	1%	0%	1%
C	0%	0%	0%	2%	1%	0%	0%	0%
D	41%	0%	11%	1%	71%	80%	26%	38%
E	0%	0%	0%	0%	1%	1%	0%	0%
F	49%	9%	26%	12%	1%	0%	61%	25%
G	8%	13%	24%	12%	16%	5%	0%	10%
Total	100%	100%	100%	100%	100%	100%	100%	100%
Modelled								
From / To	A	B	C	D	E	F	G	Total
A	0%	93%	29%	44%	31%	30%	16%	25%
B	2%	0%	0%	1%	0%	0%	0%	1%
C	0%	0%	0%	0%	0%	0%	0%	0%
D	70%	0%	8%	0%	10%	68%	27%	40%
E	1%	0%	0%	0%	0%	0%	0%	0%
F	27%	5%	38%	38%	57%	1%	56%	27%
G	1%	1%	25%	17%	1%	1%	0%	7%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Abbey Way Gyratory AM turning proportions

Observed								
From / To	A	B	C	D	E	F	G	Total
A	1%	74%	27%	42%	0%	24%	13%	20%
B	1%	0%	5%	9%	0%	0%	1%	3%
C	1%	4%	0%	1%	0%	0%	0%	1%
D	29%	0%	10%	18%	78%	69%	56%	40%
E	2%	0%	0%	1%	0%	1%	1%	1%
F	58%	6%	33%	14%	19%	1%	30%	25%
G	8%	16%	26%	15%	4%	5%	0%	10%
Total	100%	100%	100%	100%	100%	100%	100%	100%
Modelled								
From / To	A	B	C	D	E	F	G	Total
A	0%	17%	31%	47%	4%	36%	10%	25%
B	7%	0%	2%	2%	0%	2%	2%	3%
C	0%	0%	0%	0%	0%	0%	0%	0%
D	40%	22%	11%	0%	24%	58%	50%	36%
E	3%	0%	0%	0%	0%	1%	0%	1%
F	41%	57%	22%	43%	72%	0%	38%	25%
G	9%	3%	34%	7%	0%	4%	0%	10%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Abbey Way Gyrotary PM turning proportions

Observed						
From / To	H	I	J	K	L	Total
H	1%	16%	40%	47%	3%	24%
I	22%	1%	0%	51%	92%	48%
J	4%	2%	0%	1%	0%	2%
K	71%	81%	60%	1%	5%	26%
L	2%	1%	0%	0%	0%	1%
Total	100%	100%	100%	100%	100%	100%
Modelled						
From / To	H	I	J	K	L	Total
H	0%	29%	-	45%	20%	27%
I	41%	0%	-	48%	79%	43%
J	3%	0%	-	1%	0%	1%
K	55%	71%	-	0%	1%	26%
L	0%	0%	-	6%	0%	3%
Total	100%	100%	-	100%	100%	100%

A40 Oxford Road/A4128 roundabout AM turning proportions

Observed						
From / To	H	I	J	K	L	Total
H	1%	15%	43%	50%	29%	27%
I	16%	1%	0%	32%	45%	18%
J	10%	2%	0%	5%	3%	5%
K	67%	77%	57%	9%	23%	46%
L	7%	5%	0%	4%	0%	5%
Total	100%	100%	100%	100%	100%	100%
Modelled						
From / To	H	I	J	K	L	Total
H	0%	19%	-	47%	14%	28%
I	29%	0%	-	40%	42%	23%
J	1%	1%	-	6%	4%	3%
K	67%	77%	-	0%	40%	41%
L	3%	3%	-	8%	0%	5%
Total	100%	100%	-	100%	100%	100%

A40 Oxford Road/A4128 roundabout PM turning proportions

Observed				
From / To	M	N	O	Total
M	-	37%	38%	38%
N	-	0%	62%	39%
O	-	63%	0%	24%
Total	-	100%	100%	100%
Modelled				
From / To	M	N	O	Total
M	-	23%	43%	36%
N	-	0%	57%	39%
O	-	77%	0%	25%
Total	-	100%	100%	100%

Easton Street AM turning proportions

Observed				
From / To	M	N	O	Total
M	-	26%	54%	44%
N	-	0%	46%	30%
O	-	74%	0%	26%
Total	-	100%	100%	100%
Modelled				
From / To	M	N	O	Total
M	-	20%	55%	43%
N	-	0%	45%	29%
O	-	80%	0%	28%
Total	-	100%	100%	100%

Easton Street PM turning proportions

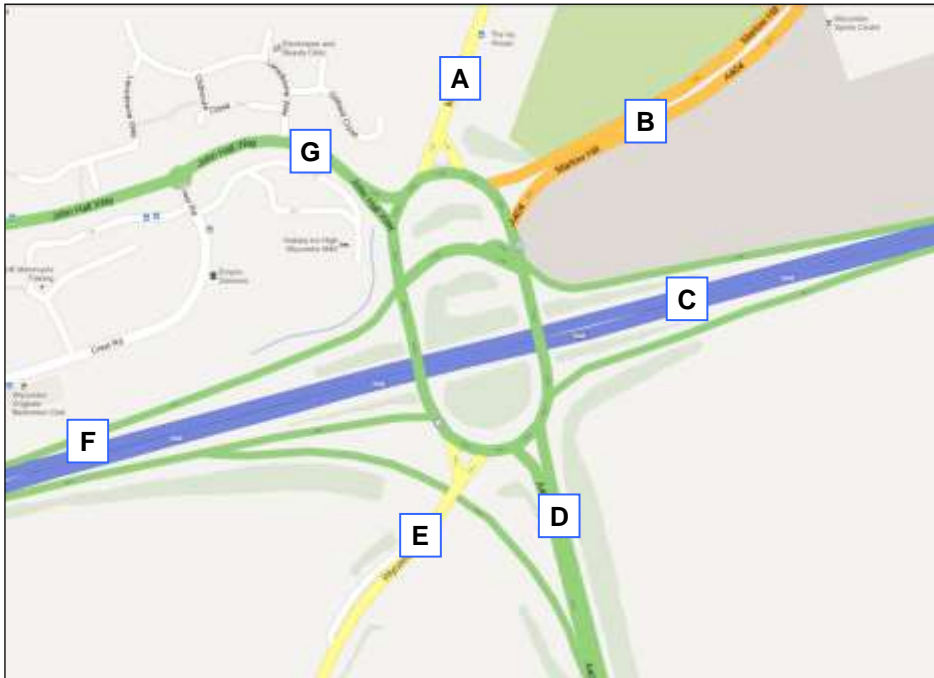


Observed				
From / To	A	B	C	Total
A	0%	100%	74%	48%
B	62%	0%	26%	35%
C	38%	0%	0%	17%
Total	100%	100%	100%	100%
Modelled				
From / To	A	B	C	Total
A	0%	100%	93%	54%
B	62%	0%	7%	29%
C	38%	0%	0%	17%
Total	100%	100%	100%	100%

A40/Chapel Lane junction AM turning proportions

Observed				
From / To	A	B	C	Total
A	0%	100%	85%	45%
B	69%	0%	15%	39%
C	31%	0%	0%	16%
Total	100%	100%	100%	100%
Modelled				
From / To	A	B	C	Total
A	0%	100%	90%	43%
B	54%	0%	10%	32%
C	46%	0%	0%	25%
Total	100%	100%	100%	100%

A40/Chapel Lane junction PM turning proportions



Observed								
From / To	A	B	C	D	E	F	G	Total
A	0%	6%	21%	8%	21%	13%	2%	10%
B	5%	0%	18%	19%	21%	30%	2%	13%
C	37%	27%	0%	26%	32%	1%	29%	21%
D	16%	36%	13%	0%	1%	1%	32%	15%
E	13%	7%	27%	1%	0%	28%	17%	12%
F	24%	20%	0%	37%	5%	0%	17%	19%
G	6%	5%	21%	9%	20%	28%	0%	11%
Total	100%	100%	100%	100%	100%	100%	100%	100%
Modelled								
From / To	A	B	C	D	E	F	G	Total
A	0%	6%	21%	10%	4%	17%	0%	10%
B	0%	0%	16%	25%	23%	61%	9%	16%
C	45%	24%	0%	29%	23%	0%	37%	22%
D	12%	27%	12%	0%	0%	0%	27%	12%
E	14%	12%	30%	0%	0%	11%	6%	11%
F	27%	23%	0%	23%	30%	0%	22%	17%
G	1%	8%	21%	13%	20%	10%	0%	12%
Total	100%	100%	100%	100%	100%	100%	100%	100%

M40 J4 Handy Cross roundabout AM turning proportions

Observed								
From / To	A	B	C	D	E	F	G	Total
A	0%	5%	22%	7%	15%	7%	1%	9%
B	10%	0%	20%	20%	23%	44%	10%	16%
C	35%	22%	0%	29%	28%	0%	26%	20%
D	16%	35%	13%	0%	0%	3%	38%	14%
E	21%	9%	22%	0%	0%	16%	14%	11%
F	8%	17%	0%	26%	7%	0%	11%	13%
G	10%	13%	24%	17%	27%	30%	0%	16%
Total	100%	100%	100%	100%	100%	100%	100%	100%
Modelled								
From / To	A	B	C	D	E	F	G	Total
A	0%	0%	24%	11%	5%	18%	1%	10%
B	0%	0%	12%	29%	38%	34%	6%	17%
C	43%	17%	0%	29%	37%	0%	38%	22%
D	19%	41%	14%	0%	0%	0%	37%	15%
E	5%	10%	25%	0%	0%	25%	9%	10%
F	29%	10%	0%	22%	19%	0%	10%	13%
G	4%	22%	25%	10%	0%	23%	0%	13%
Total	100%	100%	100%	100%	100%	100%	100%	100%

M40 J4 Handy Cross roundabout PM turning proportions



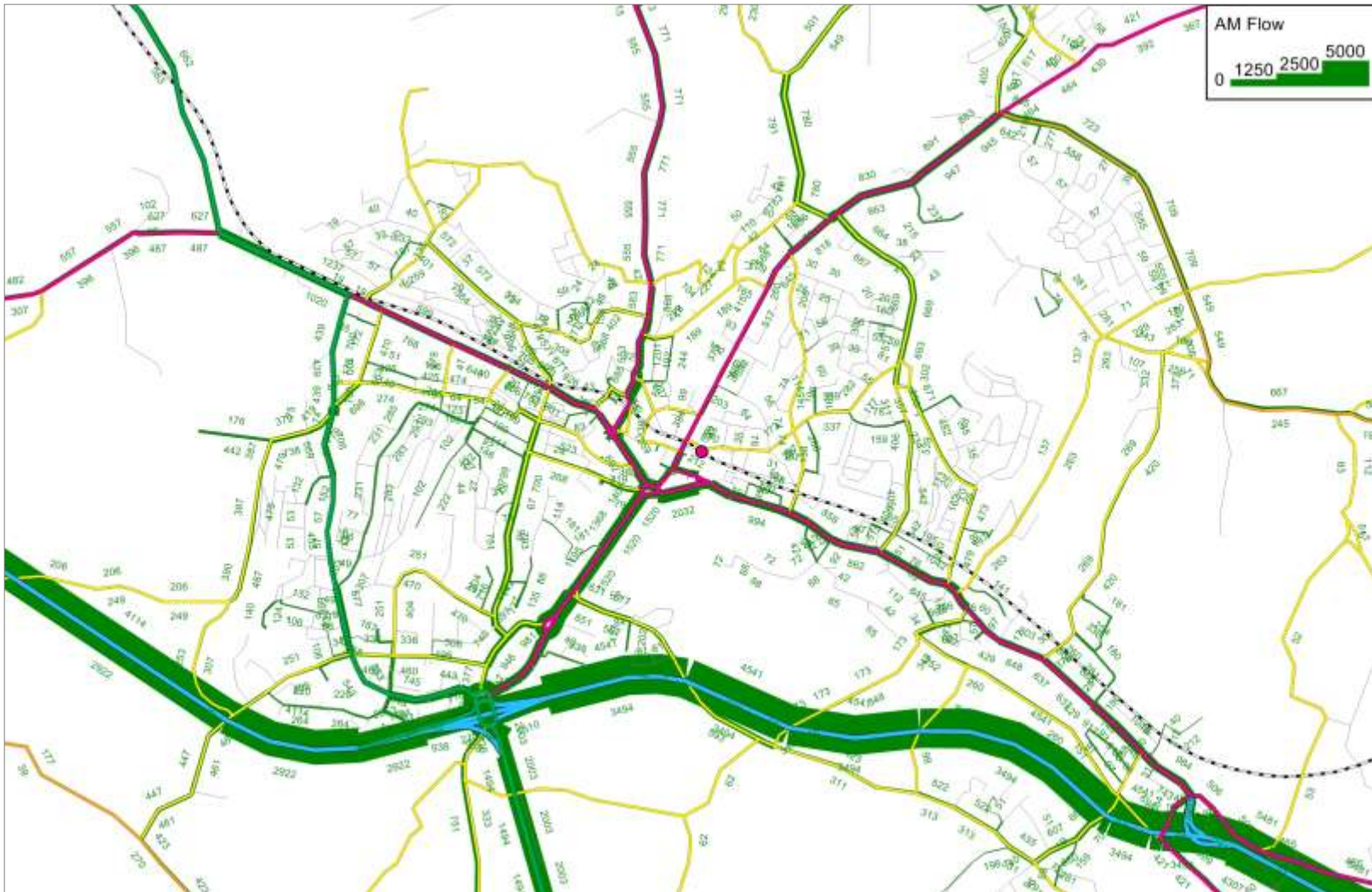
Observed						
From / To	A	B	C	D	E	Total
A	0%	15%	53%	-	62%	33%
B	10%	0%	37%	-	27%	20%
C	51%	57%	0%	-	11%	28%
D	0%	0%	0%	-	0%	0%
E	39%	28%	9%	-	0%	19%
Total	100%	100%	100%	-	100%	100%
Modelled						
From / To	A	B	C	D	E	Total
A	0%	16%	57%	-	60%	33%
B	17%	0%	39%	-	31%	22%
C	43%	55%	0%	-	8%	26%
D	0%	0%	0%	-	0%	0%
E	40%	29%	4%	-	0%	19%
Total	100%	100%	100%	-	100%	100%

M40 J3 Knaves Beech roundabout AM turning proportions

Observed						
From / To	A	B	C	D	E	Total
A	0%	8%	52%	-	61%	27%
B	14%	0%	33%	-	21%	17%
C	55%	59%	0%	-	16%	34%
D	0%	0%	0%	-	0%	0%
E	30%	33%	15%	-	2%	22%
Total	100%	100%	100%	-	100%	100%
Modelled						
From / To	A	B	C	D	E	Total
A	0%	12%	57%	-	38%	24%
B	20%	0%	31%	-	29%	20%
C	48%	62%	0%	-	33%	36%
D	0%	0%	0%	-	0%	0%
E	32%	26%	13%	-	0%	20%
Total	100%	100%	100%	-	100%	100%

M40 J3 Knaves Beech roundabout PM turning proportions

Appendix H. Base Model Link Volumes



High Wycombe Highway Assignment Model Local Model Validation Report

