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Transport for Buckinghamshire

High Wycombe Town Centre Masterplan

Town Centre Micro-simulation Model
Local Model Validation Report

Transport for Buckinghamshire
Wycombe District Council

March 2011

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Document control sheet BPP 04 F8

Project:	High Wycombe Town Centre Masterplan		
Client:	Transport for Buckinghamshire Wycombe District Council	Project No:	B1279846
Document title:	Local Model Validation Report		
Ref. No:	B1279846/LMVR/Final		

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DATE: 10/03/2011	INITIALS: RS	INITIALS: PD	INITIALS: AB	INITIALS: RS
	Document status: Draft			

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DATE: 18/03/2011	INITIALS: RS	INITIALS: PD	INITIALS: AB	INITIALS: RS
	Document status: Final			

	Originated by	Checked by	Reviewed by	Approved by
REVISION	NAME:	NAME:	NAME:	NAME:
DATE:	INITIALS:	INITIALS:	INITIALS:	INITIALS:
	Document status:			

	Originated by	Checked by	Reviewed by	Approved by
REVISION	NAME:	NAME:	NAME:	NAME:
DATE:	INITIALS:	INITIALS:	INITIALS:	INITIALS:
	Document status:			

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Contents

1 Introduction

1.1 Purpose of Report

The Transport for Buckinghamshire (TfB) Alliance between Buckinghamshire County Council (BCC) and Ringway Jacobs was established for the delivery of all transportation services across the County. Jacobs was commissioned by The Alliance and Wycombe District Council (WDC) in November 2010 to undertake a transport assessment of the proposed High Wycombe Town Centre Masterplan. For the purposes of this report, the scheme is referred to simply as 'The Masterplan'.

This report is the first in a series of reports related to The Masterplan transport assessment as listed below:

- High Wycombe Town Centre Masterplan, Local Model Validation Report, March 2011
- High Wycombe Town Centre Masterplan, Traffic Forecasting and Assessment Report, July 2011

The purpose of this report is to describe the methodology for the development of a transport model of High Wycombe town centre and to present the results of the model calibration and validation process.

1.2 Study Background

In 2004 WDC, in partnership with BCC, undertook extensive consultation which informed stakeholders and the public on the future of High Wycombe town centre. The purpose of the exercise was to develop a vision and Masterplan for the town centre over the next thirty years. As part of the development of the Wycombe Development Framework further consultations were undertaken and the results of these have been brought together to develop The Masterplan proposals.

The resulting Masterplan sets out a vision for High Wycombe town centre over the next thirty years and was developed in accordance with BCC's Local Transport Plan (LTP). The Masterplan identified the negative and divisive impact of Abbey Way (elevated section) and to a lesser extent, Archway. The Masterplan vision focused upon reconnecting and enhancing the town centre, maintaining access whilst reducing road and traffic intrusion through the removal of the elevated Abbey Way, the de-dualling of Archway, and the provision of an alternative cross-town route.

TfB is working with WDC to assess the transportation performance of The Masterplan and the associated land use changes. Previous modelling work has been undertaken using TfB's town-wide strategic model and this has informed the development of The Masterplan proposals.

As part of this current phase of work, a micro-simulation transport model has been developed and a number of forecast scenarios are tested to compare the performance of the Masterplan with the existing town centre road network. As a precursor to the transport assessment, further concept design work was completed in February 2011 which provided a refined iteration of The Masterplan concept design. It is this latest Masterplan design that is the subject of the transport assessment.

1.3 Study Area

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 the Thames Valley and Aylesbury.

The study area for this assessment comprises of the core town centre area of High Wycombe, including the extent of the road network that would be physically changed as part of The Masterplan proposals. The study area is shown in Figure 1-A.

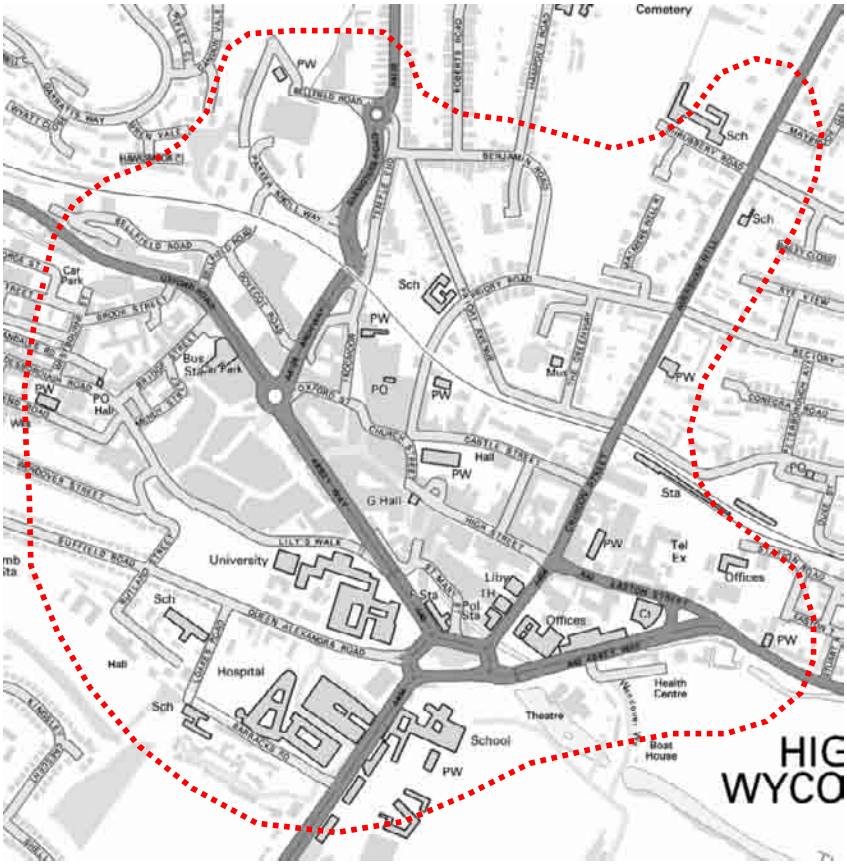


Figure 1-A Study Area

1.4 Structure of Report

This report outlines the data, methodology and validation procedures used to develop a transport model of High Wycombe town centre. The contents of the report are outlined below:

- ***Section 1 – overview of the report purpose and study background***
- ***Section 2 – description of the data that was collected by Jacobs and the traffic surveys that were commissioned***
- ***Section 3 – model development methodology***
- ***Section 4 – model calibration and validation results***

- ***Section 5 – summary of the report***

A glossary of terms is presented in Appendix A.

2 Data Collection

2.1 Introduction

This section describes the data that was collected to inform the development and calibration/validation of the High Wycombe town centre model. This includes a description of the location and type of traffic surveys that were commissioned in June 2010 as part of the study, and details of other data that was provided to Jacobs to assist with the development of the model.

2.2 Automatic Number Plate Recognition Surveys

Jacobs commissioned a programme of Automatic Number Plate Recognition (ANPR) surveys to inform the development of trip matrices for the model. The surveys were undertaken on 5th July 2010 at seven locations for the AM (07:00 – 10:00) and PM (16:00 – 19:00) weekday peak periods. The purpose of collecting the ANPR data is to provide up to date information on proportional journey patterns through the town centre road network.

To supplement the ANPR surveys, a number of manual number plate surveys were undertaken at key destinations within the town centre on the same date and time periods as the ANPRs. A summary of the locations where number plate surveys were undertaken is presented in Table 2-A, including information on the number of records counted in each peak period and any comments related to the data collection at specific sites. The locations of these surveys are presented in Figure 2-A.

Site ID	Location	Number of Records				Comments
		AM Peak Period		PM Peak Period		
		Inbound	Outbound	Inbound	Outbound	
1	Marlow Hill	3888	4209	4178	4143	
2	Suffield Road	1111	626	780	957	
3	Desborough Road	1016	611	1325	1002	
4	West Wycombe Road	2431	1999	2192	2833	Lane 1 60 seconds out
5	Hughenden Road	3583	1500	2116	3474	Faulty ATC data
6	Amersham Hill	2114	1196	1589	2038	
7	London Road	3120	1971	2574	2771	
8	Eden - Lilys Walk	225	19	325	621	
9	Eden - Oxford Street	239	39	188	322	
10	Dovecot	218	62	314	405	
11	Hospital	1135	430	413	898	
12	Railway Station	314	171	227	411	
13	Easton Street	351	15	51	290	
14	Swan	181	46	108	195	

Table 2-A Number Plate Surveys

An Automatic Traffic Count (ATC) survey was also undertaken at each of the ANPR survey locations to provide volumetric data where no existing traffic counts were

already available. The volumetric counts provide a useful comparative check against the volume of number plates recorded and provides a means to scale the ANPR records to an observed count as part of the matrix development process.

2.3 Link and Junction Turning Counts

TfB maintain a database of volumetric and classified traffic counts as part of a rolling annual programme of data collection. TfB supplied counts for four locations in High Wycombe town centre that were used in model calibration, including a junction turning count at Amersham Hill / Totteridge Road and three ATC's. Following a review of data availability, Jacobs commissioned a programme of classified turning counts to ensure any significant gaps in data collection were covered. Classified turning counts were undertaken at three key locations within the town centre on 24th June 2010 for the period from 07:00 – 19:00. This data set was used to inform the development of trip matrices and to support model calibration procedures. The locations of these surveys are presented in Table 2-B and Figure 2-A.

Site ID	Location	Type	Method	Collection Date
A	Abbey Way Ring Junction	Turning Count	Video	24/06/2010
B	Easton Street/London Rd/Abbey Way	Turning Count	Video	24/06/2010
C	Oxford Road Roundabout	Turning Count	Video	24/06/2010
D	Amersham Hill/Totteridge Rd	Turning Count	Manual	17/06/2010
E	A404 Crendon St at Railway Bridge	ATC	Tube	14-27/06/2010
F	Bellfield Rd North of Dovecot Rd	ATC	Tube	14-27/06/2010
G	Priory Rd near Railway Bridge	ATC	Tube	7-20/06/2010

Table 2-B Link and Junction Turning Counts

2.4 Queue Length Surveys

Jacobs commissioned and undertook queue length surveys on the approaches to the Abbey Way Ring Junction for the purposes of model validation. Queue lengths were recorded on 24th June 2010 during both the AM (07:00 – 10:00) and PM (16:00 – 19:00) peak periods for the four key approaches to the Ring Junction, namely:

- A404 Marlow Hill - Southbound
- A40 Abbey Way - Westbound
- Queen Alexandra Road - Eastbound
- A40 Abbey Way (elevated section) - Eastbound

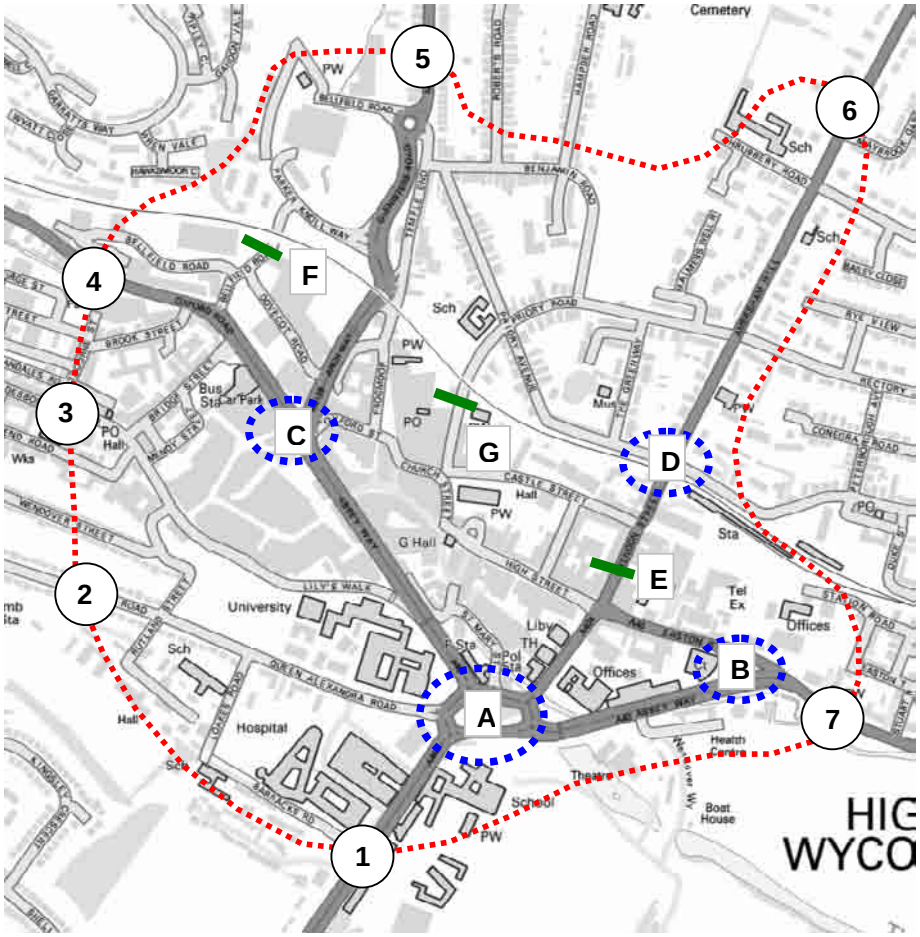


Figure 2-A Link and Junction Turning Counts

ANPR/ATC | Cordon Boundary | Turning Count | Link Count

2.5 Journey Time Data

GPS-based floating vehicle journey time surveys were not commissioned as part of this project. The ANPR data collection exercise included the recording of the time to the nearest second at which each vehicle record was observed at each recording point. A process of 'matching' and careful analysis of the results allows journey times to be derived from the ANPR data. The resulting set of journey time data was used for the purposes of model validation. More detail on the process of 'matching' is described in Section 3.3.1.

2.6 Saturation Flows

Saturation flows were measured on site at key signalised junctions within the study area during peak periods. Where possible, surveyors took a total of 10 recordings of at least 12 seconds in duration for each lane at the four key signalised junctions. The junctions surveyed are as follows:

- Easton Street/London Rd/Abbey Way

- Easton Street/Queen Victoria Road/High Street/Crendon Street
- Oxford Road roundabout
- Bellfield Road/Oxford Road

In some instances it was not possible to record sufficient reliable data to generate a saturation flow measure i.e. due to lack of traffic performing that manoeuvre or blocking back from an adjacent junction. For movements where it was not possible to record sufficient data, saturation flows were calculated using the RR67 formula. The observed and calculated saturation flows were then used to calibrate the signalised junction capacities in the model. The results of the saturation flow measurements are described further in Section 4.3.1 and in Appendix C.

2.7 Public Transport Data

Jacobs collected information on public transport routes and timetables from the Transport for Buckinghamshire website http://www.transportforbucks.net/Buses-and-trains.aspx. The public transport services including in the model are shown in Table 2-C.

Service No	Route
PR1	Park & Ride Service
1	Bourne End
2A	Stokenchurch and Lane End
2C	Stokenchurch and Piddington
4	Chesham
31	Green Route – Penn/Downley
32	Blue Route – Booker/Micklefield
33/34	Red Route – Totteridge/Castlefield
35/36	Purple Route – Flackwell Heath/Bourne End
37	Bourne End - Maidenhead
38	Orange Route – Deeds Grove
40	Thame
45/48	Great Missenden
52/62	Hemel Hempsted/Northchurch
106	T3 Princes Risborough
740	A40 Heathrow
74/X74	Slough
300	Aylesbury
336	Watford
737	Oxford – Stansted Airport
800/850	Marlow - Reading

Table 2-C Public Transport Services included in the Transport Model

2.8 Other Data

Site visits were made to obtain information on network and junction inventory including road markings; the presence, general usage and type of pedestrian crossings; and the effectiveness of lane use, exit blocking and queuing. This assisted in validating the network information provided to Jacobs in CAD diagrams and in aerial photography. Site visits were also useful for assessing driving behaviour, in particular, reactions to signal changes and gap acceptance.

Site visits also included checks on current signal cycle times and phasing for key signalised junctions.

3 Model Development Methodology

3.1 Introduction

This section describes the methodology adopted to develop the transport model of the study area. As part of this study, a dynamic micro-simulation model of High Wycombe town centre was developed using PTV's VISSIM software. The key purposes of the model can be summarised as follows:

- To provide a tool to assess the operational impact of physical changes to the town centre road network based on concept designs
- To provide evidence to stakeholders on the performance of The Masterplan and to provide sufficient information for the purposes of decision making.

The general approach to model development is based on guidelines set out by the Highways Agency including 'Interim Advice Note 36/01 – The use and application of micro-simulation traffic models, June 2001' and 'Guidelines for the use of micro-simulation software, July 2007'. The model calibration and validation criteria set out in DMRB have guided the model development methodology.

The modelled periods represent the AM (07:45 - 09:15) and PM (16:45 – 18:15) peak periods for a typical neutral weekday. The modelled periods include the peak hours and 15 minute warm-up and cool-down periods.

Table 3-A provides a summary of the model specifications.

Model Development	Specifications
Time Periods	Weekday AM (07:45 - 09:15), Weekday PM (16:45 – 18:15)
Warm Up/Cool Down	Includes 15 minutes warm up and cool down
Simulation Area	see Figure 1-A Extent of Study Area
Link Types	Urban roads, pedestrian footpaths
Public Transport	Buses included to advertised timetables
Assignment	Dynamic Assignment using VISSIM 5.20 – 12
Model Development	Based on DMRB / Highways Agency Model Development Guidelines
Model Calibration	Model calibrated to: - observed and calculated saturation flows - link and junction turning counts
Model Validation	Model validated to: - queue lengths - journey times
Multiple Runs	Average of 5 runs with incrementing random seed

Table 3-A Summary of Model Details

3.2 Network Development

3.2.1 Highway Network

A transport model in VISSIM consists of transport supply data and travel demand data. In terms of transport supply, transportation networks are defined in VISSIM

using the following main network objects, all of which can be adjusted and calibrated to reflect local conditions on the ground.

- Links and Connectors: A link represents a section of single or multi-lane carriageway with a specified direction of traffic flow. Connectors join links together, typically at junctions or at changes in road configuration providing continuous routes for traffic to use. Parameters include the number of lanes and gradient.
- Priority Rules/Conflict Areas: Defines right-of-way and merging behaviour at junctions and includes user-defined characteristics on gap acceptance i.e. for vehicles entering the circulating carriageway of a roundabout.
- Desired Speed/Reduced Speed Areas: A desired speed distribution defines the speed at which each vehicle type wishes to travel. Reduced speed areas are used to model short sections of links with low speed characteristics i.e. sharp bends or roundabouts.

The aerial photography and CAD highway layout data was used to replicate the existing highway network infrastructure in the model. This is achieved by accurately scaling the CAD data within VISSIM and refining the model highway network based on CAD.

The model highway network and characteristics where then checked against the latest aerial photography and on-site observations.

3.2.2 Signal Controllers

Jacobs modelled traffic signal controller settings for signalised junctions and pedestrian crossings present within the study area network, ensuring that the signal stages and cycle times are replicated within the VISSIM model.

The traffic signal junctions included in the model are as follows:

- Easton Street/London Rd/Abbey Way
- Easton Street/Queen Victoria Rd/High Street/Crendon Street
- Oxford Road roundabout
- Bellfield Road/Oxford Road
- Bridge Street/Oxford Road
- Desborough Road/Bridge Street
- Dovecot Road/Bellfield Road
- Parker Knoll Way/A4128 Glenisters Road
- A40 Abbey Way/Lilys Walk
- Bridge Street/Bus gate

3.3 Traffic Demand Data

3.3.1 Traffic Demand

The traffic demand in the High Wycombe town centre model is in the form of an Origin-Destination matrix developed using ANPR surveys and link and junction turning counts. Zones represent the origins and destinations of all trips in the study area. A list of zones and a diagram of the zoning system for the model is presented in Appendix B.

The link and junction turning counts were analysed to assess the peak period traffic profile in the town centre. The analysis showed a range of markedly different profiles at key locations across the town centre which on average did not show a significantly 'peaked' hourly profile. Therefore, and for consistency with forecast scenarios, a flat profile was adopted for each peak period.

Based on a review of existing classified count data at the locations presented in Figure 2-A, this model includes a simple but appropriate assumption on vehicle composition, with both AM and PM peak models being split by light (98%) and heavy (2%) vehicle classifications.

To develop the matrices, 'Micromatch' software was used to establish a set of observed partial matrices based on the ANPR 'matches'. The matching process establishes a matrix of movements based on the recording of vehicular number plates at one recording point which are then subsequently observed at a second recording point. The ANPR data is checked based on the timing of the recordings to ensure that any spurious matches are removed from the data set. This partial 'observed' matrix of movements is then populated with additional trips based on the following steps:

- Origin and destination matrix totals for external zones are established from observed traffic count information at the ANPR locations
- An initial estimate of trip generation is made for zones within the town centre and these are defined as initial origin and destination matrix totals for each internal zone
- Link volume and turning movement volumes are then reviewed and additional trips are added to the matrices proportionally, ensuring that the original trip distribution from the ANPR is reasonably maintained
- The process continues in an iterative manner until a satisfactory traffic volume calibration is achieved through the dynamic assignment process.

3.3.2 Dynamic Assignment

VISSIM uses dynamic assignment to determine the route choice for each vehicle between its origin and destination. The dynamic assignment procedure is an iterative process to model driver route choice behaviour.

Each route has a generalised cost based on its distance and travel time, where the travel time is determined by the traffic conditions in the simulation. For each iteration of the simulation the best route between each origin and destination is computed, that is the one with the lowest generalised cost. As traffic conditions vary for each iteration, this results in a set of routes from which the drivers choose. The percentage of drivers that choose each route is determined by its generalised cost. This iterative process is continued until convergence is reached, that is the traffic volumes on each route no longer significantly change between iterations.

Whilst route choice within the study area between most zones is limited, a number of genuine alternative routes exist, and therefore it was considered that dynamic assignment would be appropriate as part of the model specification.

3.3.3 Bus Services

Bus services are excluded from the dynamic assignment procedure as their routing is not dependent on traffic conditions. Instead, the path of each bus service is defined in the model network according to the advertised route (see Section 2.7).

3.4 Model Calibration and Validation

Having developed the model network and the trip matrices, a number of procedures and checks are undertaken to ensure the accuracy of the model. A full description of the model calibration and validation process and results is provided in Section 4.

4 Model Calibration/Validation

4.1 Introduction

This section presents the results of the model calibration and validation. The model is calibrated to the observed link and junction turning count volumes, and observed or calculated junction capacities. The model is validated to the observed journey times and queue lengths.

Model calibration ensures that the model development process can be shown to result in a model that accurately compares with observed data. Model validation serves as confirmation of the ability of the model to represent the current traffic conditions and journey patterns in the study area. Successful validation confirms the suitability of the model for use in scheme assessment.

For reporting purposes, traffic volume and journey times for the individual weekday AM (08:00 – 09:00) and PM (17:00 – 18:00) peak hours are analysed, rather than the full model period which includes 15-minute warm up and cool down periods. The model calibration and validation data presented in this section are derived from an average of five random seeds.

4.2 Model Convergence

While the number of genuine route choice options through the town centre is very limited, it is necessary to verify that the dynamic assignment has converged and produced appropriate paths by ensuring the model meets convergence criteria. For the purposes of this study, model convergence checks are based on the two sets of criteria specified in the TfL 'Traffic Modelling Guidelines, September 2010':

- 95% of all path traffic volumes between zones change by less than 5% for at least four consecutive iterations
- 95% of travel times on all paths between zones change by less than 20% for at least four consecutive iterations

The TfL convergence outputs can be derived directly from VISSIM evaluation files. Table 4-A presents a summary of the convergence data for the final four simulation runs for the weekday AM and PM peak models. Whilst the potential route choice within the model is limited, the convergence statistics confirm that both models have converged satisfactorily.

% of significant paths with changes in traffic volumes of less than 5%		% of paths with changes in travel times of less than 20%	
AM	PM	AM	PM
96.1%	96.2%	99.8%	99.8%
98.0%	95.2%	99.8%	100.0%
96.1%	95.6%	99.8%	100.0%
95.1%	95.6%	100.0%	100.0%

Table 4-A Model Convergence for Final Four Simulation Runs

4.3 Model Calibration

4.3.1 Junction Capacities

The capacities of all the major junctions within the study area have been calibrated. For signalised junctions the modelled saturation flow of each approach has been calibrated to observed saturation flows. Where it was not possible to collect observed data, RR67 values have been used. The results of the calibration are included in Appendix C, and indicate that an acceptable calibration of saturation flows at signalised junctions has been achieved in the model.

For roundabouts within the study area, the model capacities on the major entry arms have been calibrated using the roundabout capacity formula provided in TRRL Report 942 'The Traffic Capacity of Roundabouts'. This calibration process excludes the mini-roundabouts at the Abbey Way Ring junction which instead are calibrated against observed queue length data (see 4.4.2). The results of the capacity calibration are included in Appendix D, and indicate that an acceptable calibration of roundabout capacities has been achieved in the model.

4.3.2 Link Volumes and Junction Turning Movements

The average modelled link volumes and turning movements have been compared to the observed ATC and classified turning count data collected in 2010 to ensure that the level of traffic volume is accurately represented in the model. The DMRB guidelines for model acceptability states that at least 85% of link-based traffic volume comparisons should pass the GEH and flow criteria. Table 4-B presents a summary of the calibration results based on a total of 107 comparisons, and full results are presented in Appendices E and F. A correlation analysis has also been undertaken and is presented in Appendix G. The results indicate an acceptable calibration in accordance with DMRB criteria for traffic volume comparisons.

Time Period	No. of Comparisons	% Passing GEH criteria	% Passing Flow Criteria
AM (08:00 – 09:00)	107	96%	98%
PM (17:00 – 18:00)	107	94%	97%

Table 4-B Link and Turning Movement Calibration Results Summary

An additional site-specific check was made at the Eden Shopping Centre to assess how well the model car park barrier entry and exits compare to observed traffic volume data. The comparison with the Lilys Walk entrance and exit is made against the total count of number plate observations recorded for the peak hours during manual surveys. The Oxford Road entrance and exit is compared directly to turning count data recorded at Oxford Road roundabout. The results presented in Table 4-C indicate an acceptable calibration in accordance with DMRB criteria.

	Lilys Walk				Oxford Rd			
Time Period	Obs	Mod	GEH	Pass/ Fail	Obs	Mod	GEH	Pass/ Fail
AM - Entrance	28	37	1.58	Pass	197	170	1.99	Pass
AM - Exit	3	7	1.79	Pass	10	18	2.14	Pass
PM - Entrance	87	132	4.30	Pass	141	113	2.48	Pass
PM - Exit	246	283	2.28	Pass	135	126	0.79	Pass

Table 4-C Calibration of Eden Traffic Volumes

4.4 Model Validation

4.4.1 Journey Times

For the purpose of model validation, modelled journey times have been compared to the observed journey times based on ANPR data that were collected in July 2010. Figure 4-A provides a graphical representation of the routes that were selected for validation. Table 4-D presents a summary of the journey time calibration results, Table 4-E and Table 4-F present a comparison of the modelled and observed journey times for the AM Peak and the PM peak respectively.

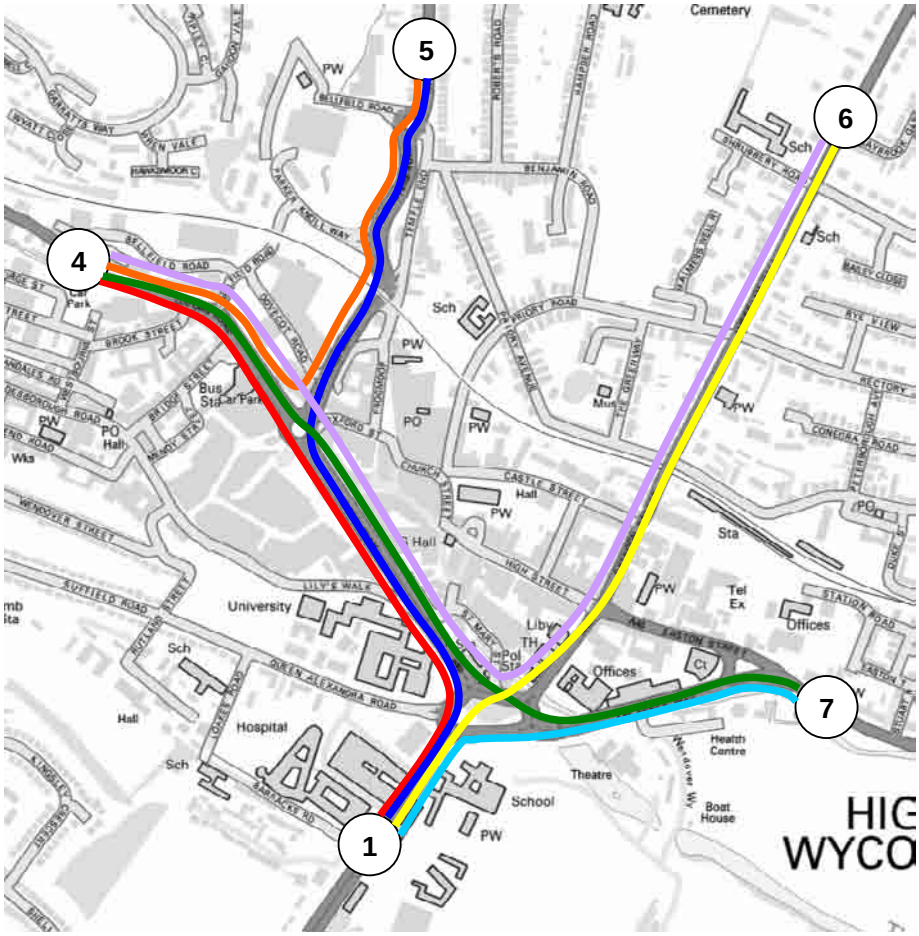


Figure 4-A Journey Time validation routes

Note 1: The routes shown are indicative of the main route between the zone pairs and are shown for presentational purposes only – multiple paths may be possible for each route

DMRB criteria for journey time validation states that 85% of modelled routes should achieve acceptable tolerance levels in comparison to observed data. The majority of journey times pass the DMRB model acceptability criteria by being within 15% or one minute of the observed journey times. This is with the exception of the Amersham Hill to West Wycombe Road in the AM peak hour and West Wycombe Road to Hughenden Road in the PM peak hour.

Time Period	No. of comparisons	Pass	Fail	% achieving criteria
AM (08:00 – 09:00)	14	13	1	92.9%
PM (17:00 – 18:00)	14	13	1	92.9%

Table 4-D Summary of Journey time calibration results

ID	Route	No. of records	Average Obs (s)	95% Conf Int. Lower – upper limit (s)	Average Mod (s)	Diff.	Pass/ Fail
1 - 6	Marlow Hill to Amersham Hill	126	317	(312 – 322)	271	-46	Pass
6 - 1	Amersham Hill to Marlow Hill	93	317	(301 – 333)	259	-58	Pass
4 - 7	West Wycombe Rd to London Rd	154	281	(275 – 287)	323	42	Pass
7 - 4	London Rd to West Wycombe Rd	59	243	(235 – 251)	251	8	Pass
1 - 5	Marlow Hill to Hughenden Rd	141	240	(234 – 246)	281	41	Pass
5 - 1	Hughenden Rd to Marlow Hill	136	189	(182 – 196)	222	33	Pass
4 - 5	West Wycombe Rd to Hughenden Rd	126	158	(154 – 162)	146	-12	Pass
5 - 4	Hughenden Rd to West Wycombe Rd	192	190	(186 – 195)	216	26	Pass
1 - 7	Marlow Hill to London Rd	173	223	(218 – 229)	206	-17	Pass
7 - 1	London Rd to Marlow Hill	147	98	(95 – 101)	92	-6	Pass
4 - 6	West Wycombe Rd to Amersham Hill	29	371	(356 – 387)	407	36	Pass
6 - 4	Amersham Hill to West Wycombe Rd	40	330	(314 – 347)	411	81	Fail
1 - 4	Marlow Hill to London Rd	33	254	(243 – 264)	290	36	Pass
4 - 1	London Rd to Marlow Hill	68	220	(207 – 233)	250	30	Pass

Table 4-E Journey Time Validation Results AM Peak

ID	Route	No. of records	Average Obs (s)	95% Conf Int. Lower – upper limit (s)	Average Mod (s)	Diff.	Pass/ Fail
1 - 6	Marlow Hill to Amersham Hill	161	336	(328 – 345)	280	-56	Pass
6 - 1	Amersham Hill to Marlow Hill	105	223	(212 – 234)	234	11	Pass
4 - 7	West Wycombe Rd to London Rd	77	368	(356 – 380)	318	-50	Pass
7 - 4	London Rd to West Wycombe Rd	107	278	(271 – 285)	273	-5	Pass
1 - 5	Marlow Hill to Hughenden Rd	189	353	(345 – 362)	297	-56	Pass
5 - 1	Hughenden Rd to Marlow Hill	67	269	(259 – 280)	237	-32	Pass
4 - 5	West Wycombe Rd to Hughenden Rd	123	253	(244 – 262)	150	-103	Fail
5 - 4	Hughenden Rd to West Wycombe Rd	117	224	(218 – 230)	240	16	Pass
1 - 7	Marlow Hill to London Rd	124	266	(258 – 274)	220	-46	Pass
7 - 1	London Rd to Marlow Hill	102	120	(114 – 126)	117	-3	Pass
4 - 6	West Wycombe Rd to Amersham Hill	45	386	(359 – 413)	367	-19	Pass
6 - 4	Amersham Hill to West Wycombe Rd	19	368	(362 – 379)	388	20	Pass
1 - 4	Marlow Hill to London Rd	30	304	(286 – 323)	270	-35	Pass
4 - 1	London Rd to Marlow Hill	27	294	(260 – 329)	245	-49	Pass

Table 4-F Journey Time Validation Results PM Peak

4.4.2 Queue Length Validation

For the purpose of model validation on the key approaches to the Abbey Way Ring Junction, modelled mean maximum queue lengths have been compared to the observed queue lengths collected in June 2010. While there are no formal criteria that should be met with regard to queue length validation, a model should be expected to reflect reasonably the observed and known patterns of queuing. Figures 4-B and 4-C present a comparison of the modelled and observed mean maximum queue lengths in metres for the AM and PM peak respectively.

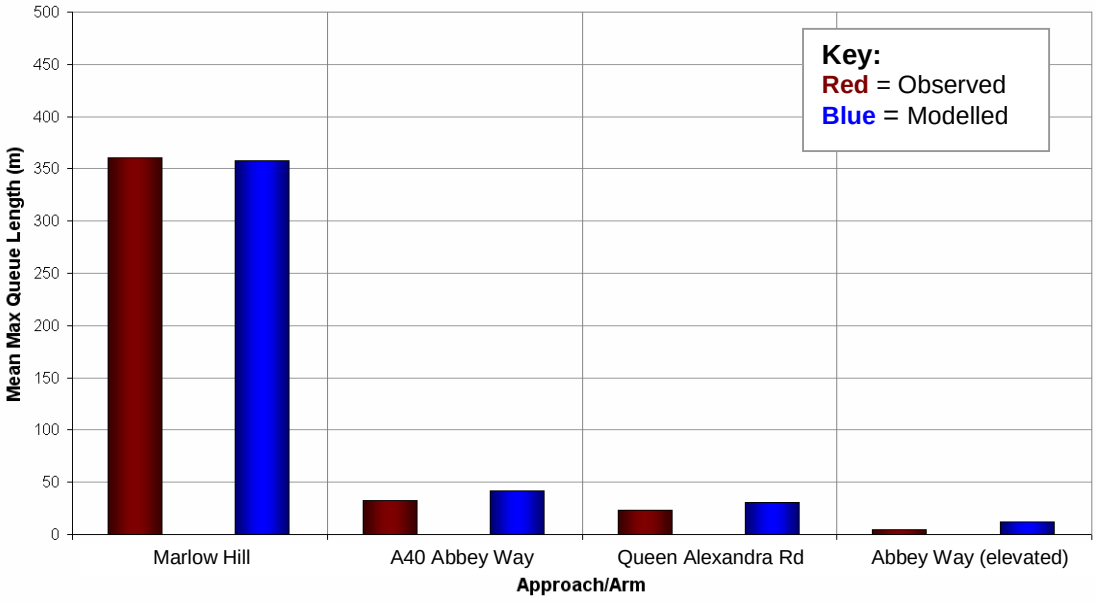


Figure 4-B Queue Length Validation AM Peak

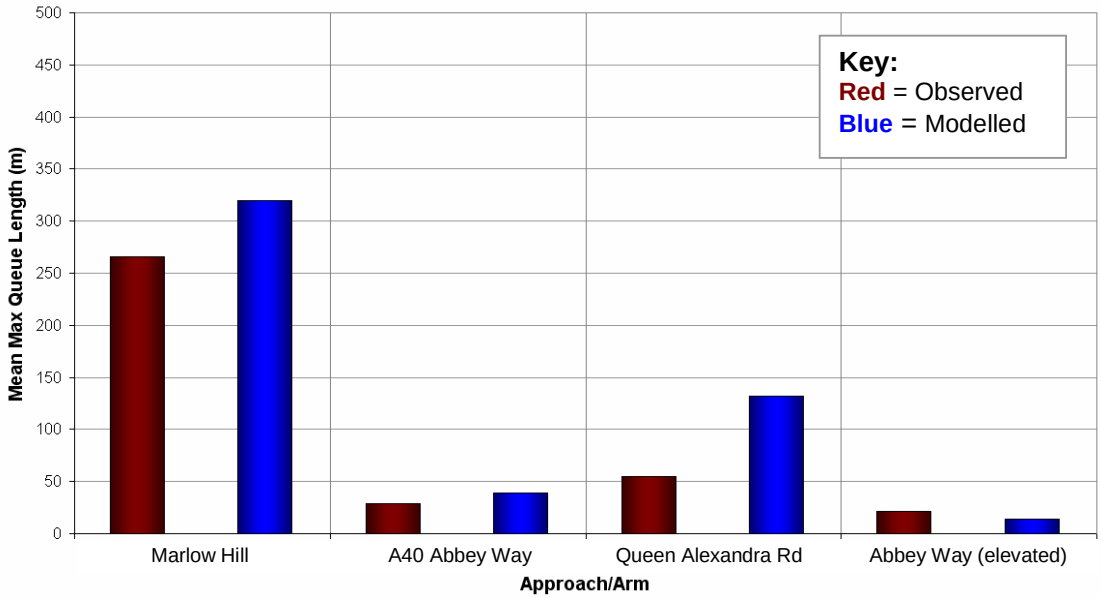


Figure 4-C Queue Length Validation PM Peak

The comparison demonstrates a good fit between observed and modelled queue lengths.

4.5 Summary of Model Calibration and Validation

The transport model has been calibrated successfully against junction capacities and traffic volumes, showing good correlation between observed and modelled values. The transport model has also been validated against journey time information and queue length data. In all cases, the models pass the level of accuracy required by DMRB. The models provide a sound base from which to apply forecast future traffic volumes and to test the impact of The Masterplan.

5 Summary

The Transport for Buckinghamshire (TfB) Alliance between Buckinghamshire County Council (BCC) and Ringway Jacobs was established for the delivery of all transportation services across the County. Jacobs was commissioned by The Alliance and Wycombe District Council (WDC) in November 2010 to undertake a transport assessment of the proposed High Wycombe Town Centre Masterplan.

As part of this study, a dynamic micro-simulation model of High Wycombe town centre was developed using VISSIM software. The key purposes of the model can be summarised as follows:

- To provide a tool to assess the operational impact of physical changes to the town centre road network based on concept designs
- To provide evidence to stakeholders on the performance of The Masterplan and to provide sufficient information for the purposes of decision making.

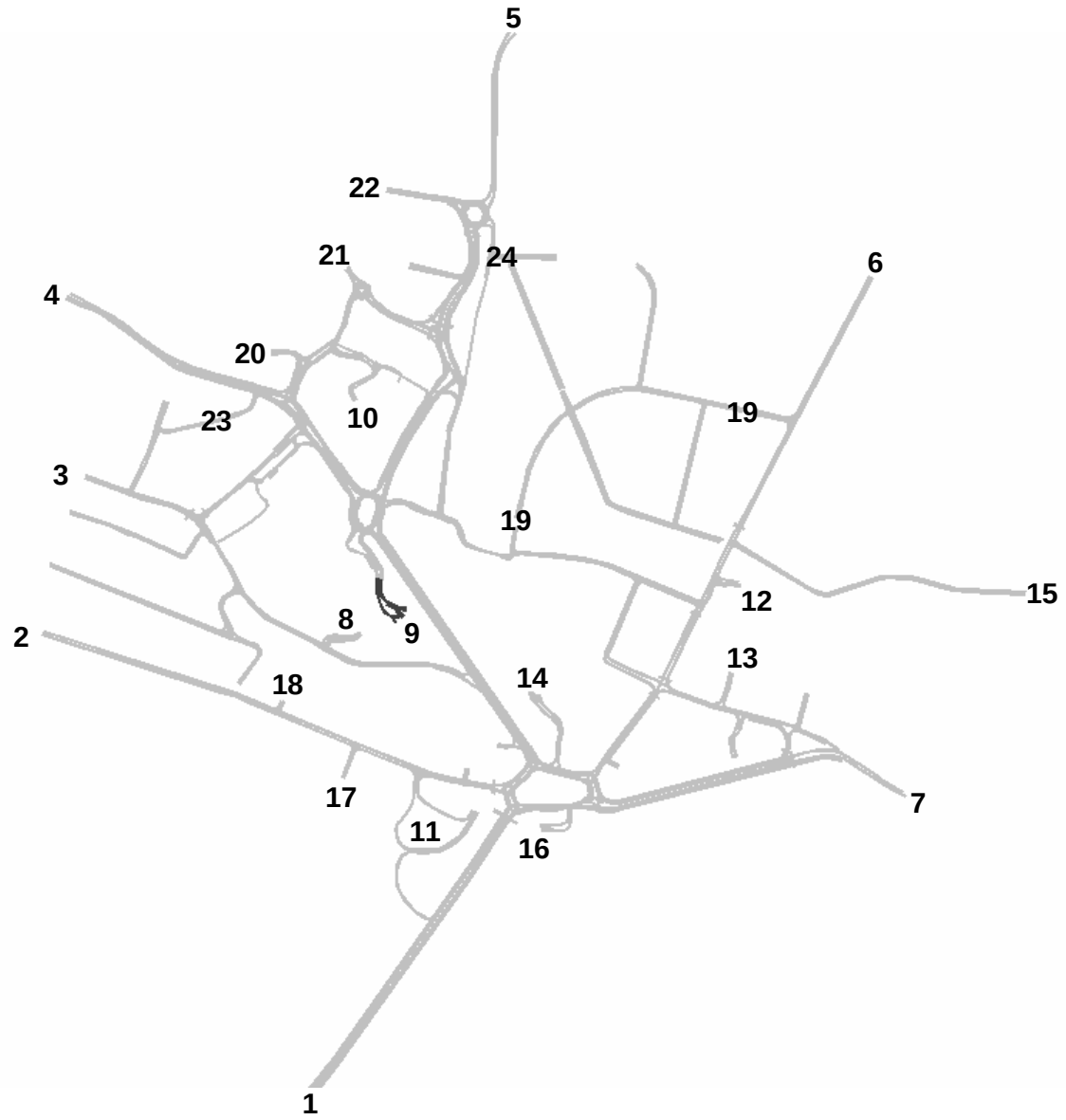
The transport model has been calibrated successfully against junction capacities and traffic volumes, showing good correlation between observed and modelled values. The transport model has been validated against journey time information and queue lengths. In all cases, the models pass the level of accuracy required by DMRB. The models provide a sound base from which to apply forecast future traffic volumes and to test the impact of The Masterplan.

Appendix A Glossary of Terms

Term	Description
ANPR	Automatic Number Plate Recognition
ATC	Automatic Traffic Count
BCC	Buckinghamshire County Council
CAD	Computer Aided Design. A computer software programme used for the process of design and design-documentation
DMRB	Design Manual for Roads and Bridges
GEH	A form of the CHI-squared statistic showing the goodness of fit between modelled and observed data, named after the initials of its founder Geoff E Havers
LTP	Local Transport Plan
PTV	Traffic engineering and software programming company who develop and maintain the VISSIM software package
RR67	A TRL research report entitled 'The prediction of saturation flows for road junctions controlled by traffic signals'
TfB	Transport for Buckinghamshire. The Alliance between Buckinghamshire County Council (BCC) and Ringway Jacobs was established for the delivery of all transportation services across the County
TfL	Transport for London
VISSIM	A Visual Simulation computer model
WDC	Wycombe District Council

Appendix B Zone List and Network Diagram

Zone Number	Loading Point
1	Marlow Hill
2	Suffield Road
3	Desborough Road
4	West Wycombe Road
5	Hughenden Road
6	Amersham Hill
7	London Road
8	Eden – Lilys Walk
9	Eden – Oxford Road
10	Dovecot - Sainsburys
11	Hospital
12	Railway Station
13	Easton Street Car Park
14	The Swan
15	Totteridge Road
16	Abbey School
17	Hospital (Queen Alexandra Road)
18	Hotel (Queen Alexandra Road)
19	Priory Area (East)
20	Bellfield Road West
21	Parker Knoll Way (Morrisons)
22	Bellfield Road
23	Brook Street
24	Temple End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Appendix C Signalisation Junction Capacity Calibration

This table presents the results of the saturation flow calibrations for the signalised junctions in the study area. As recommended in the TfL 'Traffic Modelling Guidelines, September 2010' the modelled saturation flows are calibrated to be within 10% of the observed values.

Calibration VISSIM Saturation Flow for Signalised Junctions									
Site No.	Location	Arm	Lanes	Movement	Mod. Flow	Ob. Flow	Diff.	GEH	Diff in %
1	Crendon Street	North	1	N-E	1703	**1645**	58	1.4	3.5%
		South	3	S-N	1869	**1857**	12	0.3	0.6%
				S-E	1680	**1740**	-60	1.5	3.4%
2	A404 / A40	North	2	N-S	1940	**1939**	1	0.0	0.1%
				N-S	1912	**1939**	-27	0.6	1.4%
		East	2	E-W	2053	**1918**	135	3.0	7.0%
				E-W	2071	**1918**	153	3.4	8.0%
		West	2	W-E	1953	**1881**	72	1.6	3.8%
				W-E	1822	**1881**	-59	1.4	3.1%
3	W Wycombe Way / Oxford Road	North	3	N-E	1689	1695	-6	0.1	0.4%
				N-S/W	1845	**1934**	-89	2.0	4.6%
					1896	**1934**	-38	0.9	2.0%
		East	3	E-W	2189	2025	164	3.6	8.1%
					1974	2025	-51	1.1	2.5%
				E-N	1732	1732	0	0.0	0.0%
		West	3	W-N	1842	**1765**	77	1.8	4.4%
				W-E	1825	**1953**	-128	2.9	6.6%
					1826	**1953**	-127	2.9	6.5%

Note 1: An observed flow value shown in bold represents recordings that were measured on site.

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Appendix D Roundabout Capacity Calibration

The roundabout entry arms have been calibrated for circulating flows of 1000veh/hr and 1500veh/hr per lane using the roundabout capacity formula provided in TRRL Report 942 'The Traffic Capacity of Roundabouts'. It is recommended in the TfL 'Traffic Modelling Guidelines, September 2010' that modelled saturation flows at signalised junctions should be within 10% of the observed values. However, there are no equivalent criteria stated in modelling guidance for roundabout entry capacities. For this assessment the modelled roundabout entry capacities have been calibrated to have a GEH of fewer than 5 or be within 10% of the calculated capacity or a flow difference of less than 50 vehicles. This is with the exception of where changing the priority on the approach to achieve the calibration criteria produces driver behaviour which contradicts that observed on site at the roundabout.

No	Location	Arm	Calculation Parameter						Final Equation			Circulating Flow	Entry Flow	Calibrated Model Flow	Diff	GEH	Diff %
			k	F	f_c	t_D	X_2	S	a	b	Formula	Q_c	Q_e				
R1	Hughenden Rd Rbt	Hughenden Rd	0.7	1243.2	0.5	1.4	4.1	48.0	0.41	926.06	Qe=926.06-0.41Qc	1000	516	436	80	3.7	15.5%
												1500	311	289	22	1.3	7.1%
		Temple End	1.0	1296.1	0.6	1.4	4.3	0.5	0.53	1232.68	Qe=1232.68-0.53Qc	1000	703	601	102	4.0	14.5%
												1500	438	389	49	2.4	11.1%
		Glenisters Rd	1.0	2027.8	0.7	1.4	6.7	1.6	0.7	2019.17	Qe=2019.17-0.7Qc	1500	969	1103	-134	4.2	13.8%
												2000	619	512	107	4.5	17.3%
		Bellfield Rd	0.9	1815.5	0.7	1.4	6.0	0.2	0.62	1717.91	Qe=1717.91-0.62Qc	1000	1098	961	137	4.3	12.5%
												1500	788	659	129	4.8	16.4%
R2	Bellfield Rd / Parker Knoll Way	Bellfield Rd	1.0	1339.6	0.6	1.5	4.4	1.4	0.57	1301.6	Qe=1301.6-0.57Qc	1000	732	612	120	4.6	16.3%
												1500	447	387	60	2.9	13.3%
		Parker Knoll Way	0.9	1134.9	0.5	1.5	3.7	3.4	0.5	1050.96	Qe=1050.96-0.5Qc	1000	551	587	-36	1.5	6.5%
												1500	301	365	-64	3.5	21.3%
		Parker Knoll Way (East)	1.0	1517.6	0.6	1.5	5.0	0.9	0.61	1474.6	Qe=1474.6-0.61Qc	1000	865	756	109	3.8	12.6%
												1500	560	475	85	3.7	15.1%
R3	Bellfield Rd / Bellfield Rd W	Bellfield Rd (N)	0.9	1232.5	0.6	1.5	4.1	2.6	0.51	1113.95	Qe=1113.95-0.51Qc	1000	604	589	15	0.6	2.5%
												1500	349	311	38	2.1	10.9%
		Bellfield Rd (W)	1.0	1287.1	0.6	1.5	4.2	1.9	0.56	1236.53	Qe=1236.53-0.56Qc	1000	677	603	74	2.9	10.9%
												1500	397	387	10	0.5	2.4%
		Bellfield Rd (S)	1.0	1386.8	0.6	1.5	4.6	1.7	0.6	1397.65	Qe=1397.65-0.6Qc	1000	798	703	95	3.5	11.9%
												1500	498	405	93	4.4	18.6%

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Appendix E Traffic Volume Calibration AM Peak

Link No.	Location/Movement	Observed Flow	Modelled Flow	Difference (Mod-Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
1	A40 Abbey Way (NW) to St Mary's Street	55	81	26	47%	**3.15**	Pass	Pass
2	A40 Abbey Way (NW) to Queen Victoria Road	391	419	28	7%	**1.40**	Pass	Pass
3	A40 Abbey Way (NW) to Abbey Way (E)	520	449	-71	-14%	**3.24**	Pass	Pass
4	A40 Abbey Way (NW) to Abbey School	6	4	-2	-27%	**0.70**	Pass	Pass
5	A40 Abbey Way (NW) to Marlow Hill	192	242	50	26%	**3.42**	Pass	Pass
6	A40 Abbey Way (NW) to Queen Alexandra Road	90	122	32	35%	**3.09**	Pass	Pass
7	A40 Abbey Way (NW) to A40 Abbey Way (NW)	14	1	-13	-94%	**4.85**	Pass	Pass
8	St Mary's Street to Queen Victoria Road	4	8	4	110%	**1.77**	Pass	Pass
9	St Mary's Street to Abbey Way (E)	10	7	-3	-32%	**1.10**	Pass	Pass
10	St Mary's Street to Abbey School	0	0	0	0%	**0.00**	Pass	Pass
11	St Mary's Street to Marlow Hill	9	8	-1	-13%	**0.41**	Pass	Pass
12	St Mary's Street to Queen Alexandra Road	2	4	2	100%	**1.15**	Pass	Pass
13	St Mary's Street to A40 Abbey Way (NW)	2	2	0	10%	**0.14**	Pass	Pass
14	St Mary's Street to St Mary's Street	0	0	0	0%	**0.00**	Pass	Pass
15	Queen Victoria Road to Abbey Way (E)	12	0	-12	-100%	**4.90**	Pass	Pass
16	Queen Victoria Road to Abbey School	1	0	-1	-100%	**1.41**	Pass	Pass
17	Queen Victoria Road to Marlow Hill	6	0	-6	-100%	**3.46**	Pass	Pass
18	Queen Victoria Road to Queen Alexandra Road	1	0	-1	-100%	**1.41**	Pass	Pass
19	Queen Victoria Road to A40 Abbey Way (NW)	1	0	-1	-100%	**1.41**	Pass	Pass
20	Queen Victoria Road to St Mary's Street	0	0	0	0%	**0.00**	Pass	Pass
21	Queen Victoria Road to Queen Victoria Road	0	0	0	0%	**0.00**	Pass	Pass
22	Abbey Way (E) to Abbey School	54	55	1	1%	**0.08**	Pass	Pass
23	Abbey Way (E) to Marlow Hill	1196	1212	16	1%	**0.45**	Pass	Pass

24	Abbey Way (E) to Queen Alexandra Road	204	201	-3	-1%	**0.20**	Pass	Pass
25	Abbey Way (E) to A40 Abbey Way (NW)	388	390	2	1%	**0.10**	Pass	Pass
26	Abbey Way (E) to St Mary's Street	0	0	0	0%	**0.00**	Pass	Pass
27	Abbey Way (E) to Queen Victoria Road	117	148	31	26%	**2.68**	Pass	Pass
28	Abbey Way (E) to Abbey Way (E)	9	0	-9	-100%	**4.24**	Pass	Pass
29	Abbey School to Marlow Hill	12	17	5	43%	**1.36**	Pass	Pass
30	Abbey School to Queen Alexandra Road	2	3	1	60%	**0.74**	Pass	Pass
31	Abbey School to A40 Abbey Way (NW)	4	4	0	5%	**0.10**	Pass	Pass
32	Abbey School to St Mary's Street	0	0	0	0%	**0.00**	Pass	Pass
33	Abbey School to Queen Victoria Road	0	1	1	100%	**1.55**	Pass	Pass
34	Abbey School to Abbey Way (E)	1	4	3	300%	**1.90**	Pass	Pass
35	Abbey School to Abbey School	0	0	0	0%	**0.00**	Pass	Pass
36	Marlow Hill to Queen Alexandra Road	456	399	-57	-13%	**2.77**	Pass	Pass
37	Marlow Hill to A40 Abbey Way (NW)	477	394	-83	-17%	**4.00**	Pass	Pass
38	Marlow Hill to St Mary's Street	8	7	-1	-15%	**0.44**	Pass	Pass
39	Marlow Hill to Queen Victoria Road	259	278	19	7%	**1.15**	Pass	Pass
40	Marlow Hill to Abbey Way (E)	85	103	18	22%	**1.90**	Pass	Pass
41	Marlow Hill to Abbey School	1	5	4	380%	**2.23**	Pass	Pass
42	Marlow Hill to Marlow Hill	7	13	6	80%	**1.79**	Pass	Pass
43	Queen Alexandra Road to A40 Abbey Way (NW)	73	63	-10	-13%	**1.16**	Pass	Pass
44	Queen Alexandra Road to St Mary's Street	9	9	0	4%	**0.13**	Pass	Pass
45	Queen Alexandra Road to Queen Victoria Road	237	202	-35	-15%	**2.35**	Pass	Pass
46	Queen Alexandra Road to Abbey Way (E)	88	60	-28	-32%	**3.31**	Pass	Pass
47	Queen Alexandra Road to Abbey School	11	0	-11	-100%	**4.69**	Pass	Pass
48	Queen Alexandra Road to Marlow Hill	72	82	10	14%	**1.14**	Pass	Pass
49	Queen Alexandra Road to Queen Alexandra Road	0	0	0	0%	**0.00**	Pass	Pass
50	Oxford Road to A4128 Archway	63	63	0	0%	**0.00**	Pass	Pass
51	Oxford Road to Oxford Street	35	25	-10	-29%	**1.83**	Pass	Pass
52	Oxford Road to Abbey Way	614	688	74	12%	**2.91**	Pass	Pass

53	Oxford Road to Temple Street	20	21	1	6%	**0.26**	Pass	Pass
54	Oxford Road to Oxford Road	4	0	-4	-100%	**2.83**	Pass	Pass
55	A4128 Archway to Oxford Street	0	0	0	0%	**0.00**	Pass	Pass
56	A4128 Archway to Abbey Way	661	618	-43	-6%	**1.68**	Pass	Pass
57	A4128 Archway to Temple Street	115	121	6	5%	**0.52**	Pass	Pass
58	A4128 Archway to Oxford Road	589	549	-40	-7%	**1.66**	Pass	Pass
59	A4128 Archway to A4128 Archway	4	0	-4	-100%	**2.83**	Pass	Pass
60	Oxford Street to Abbey Way	15	0	-15	-100%	**5.48**	Fail	Pass
61	Oxford Street to Temple Street	3	0	-3	-100%	**2.45**	Pass	Pass
62	Oxford Street to Oxford Road	60	26	-34	-57%	**5.18**	Fail	Pass
63	Oxford Street to A4128 Archway	6	0	-6	-100%	**3.46**	Pass	Pass
64	Oxford Street to Oxford Street	0	0	0	0%	**0.00**	Pass	Pass
65	Abbey Way to Temple Street	32	55	23	72%	**3.49**	Pass	Pass
66	Abbey Way to Oxford Road	373	408	35	9%	**1.76**	Pass	Pass
67	Abbey Way to A4128 Archway	319	309	-10	-3%	**0.54**	Pass	Pass
68	Abbey Way to Oxford Street	3	0	-3	-100%	**2.45**	Pass	Pass
69	Abbey Way to Abbey Way	12	0	-12	-97%	**4.66**	Pass	Pass
70	Temple Street to Oxford Road	9	0	-9	-100%	**4.24**	Pass	Pass
71	Temple Street to A4128 Archway	3	0	-3	-100%	**2.45**	Pass	Pass
72	Temple Street to Oxford Street	0	0	0	0%	**0.00**	Pass	Pass
73	Temple Street to Abbey Way	6	10	4	67%	**1.41**	Pass	Pass
74	Temple Street to Temple Street	0	0	0	0%	**0.00**	Pass	Pass
75	A404 Easton Street to A40 London Road	232	287	55	24%	**3.39**	Pass	Pass
76	A404 Easton Street to A40 Abbey Way	701	762	61	9%	**2.24**	Pass	Pass
77	A404 Easton Street to A404 Easton Street	0	0	0	0%	**0.00**	Pass	Pass
78	A40 London Road to A40 Abbey Way	1279	1243	-36	-3%	**1.01**	Pass	Pass
79	A40 London Road to A404 Easton Street	0	0	0	0%	**0.00**	Pass	Pass
80	A40 London Road to A40 London Road	0	0	0	0%	**0.00**	Pass	Pass
81	A40 Abbey Way to A404 Easton Street	0	0	0	0%	**0.00**	Pass	Pass

82	A40 Abbey Way to A40 London Road	722	620	-102	-14%	**3.92**	Pass	Pass
83	A40 Abbey Way to A40 Abbey Way	0	0	0	0%	**0.00**	Pass	Pass
84	A40 London Rd High Wyc btwn Easton St & Stuart Rd SEB	748	908	160	21%	**5.55**	Fail	Fail
85	A40 London Rd High Wyc btwn Easton St & Stuart Rd NWB	1138	1250	111	10%	**3.23**	Pass	Pass
86	A40 West Wycombe Rd 185m SE j/w The Pastures NWB	735	783	48	7%	**1.74**	Pass	Pass
87	A40 West Wycombe Rd 185m SE j/w The Pastures SEB	931	797	-133	-14%	**4.54**	Pass	Pass
88	A404 Crendon St High Wycombe at railway bridge SB	764	772	8	1%	**0.30**	Pass	Pass
89	A404 Crendon St High Wycombe at railway bridge NB	571	589	18	3%	**0.74**	Pass	Pass
90	Desborough Rd btwn Desborough Ave & Short St EB	301	293	-7	-2%	**0.41**	Pass	Pass
91	Desborough Rd btwn Desborough Ave & Short St WB	553	631	78	14%	**3.22**	Pass	Pass
92	Bellfield Rd High Wycombe N of Dovecot Rd NB	437	477	40	9%	**1.87**	Pass	Pass
93	Bellfield Rd High Wycombe N of Dovecot Rd SB	544	498	-47	-9%	**2.05**	Pass	Pass
94	Priory Rd High Wycombe near railway bridge NB	117	136	20	17%	**1.74**	Pass	Pass
95	Priory Rd High Wycombe near railway bridge SB	244	183	-61	-25%	**4.18**	Pass	Pass
96	Suffield Rd btwn Desborough Ave & West End St EB	407	423	16	4%	**0.77**	Pass	Pass
97	Suffield Rd btwn Desborough Ave & West End St WB	230	307	77	33%	**4.70**	Pass	Pass
98	A404 Marlow Hill NE of Daws Hill Lane NEB	1293	1186	-107	-8%	**3.05**	Pass	Pass
99	A404 Marlow Hill NE of Daws Hill Lane SWB	1550	1567	18	1%	**0.44**	Pass	Pass
100	A404 Amersham Hill to Totteridge Rd	60	72	12	19%	**1.43**	Pass	Pass
101	A404 Amersham Hill to A404 Wycombe Side	497	542	45	9%	**1.98**	Pass	Pass
102	Totteridge Road to A404 Wycombe Side	232	230	-2	-1%	**0.14**	Pass	Pass
103	Totteridge Road to A404 Amersham Road	56	72	16	29%	**2.05**	Pass	Pass
104	A404 Wycombe Side to A404 Amersham Road	368	397	29	8%	**1.50**	Pass	Pass
105	A404 Wycombe Side to Totteridge Road	189	191	2	1%	**0.15**	Pass	Pass
106	A4128 Hughenden Road Southbound*	1254	1059	-195	-16%	**5.74**	Fail	Fail
107	A4128 Hughenden Road Northbound*	603	527	-76	-13%	**3.21**	Pass	Pass

**** Observed total taken from count of ANPR records***

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Appendix F Traffic Volume Calibration PM Peak

.

Link No.	Location/Movement	Observed Flow	Modelled Flow	Difference (Mod-Obs)	% Difference	GEH	Criteria GEH <5	Criteria Flow
1	A40 Abbey Way (NW) to St Mary's Street	57	62	5	8%	**0.60**	Pass	Pass
2	A40 Abbey Way (NW) to Queen Victoria Road	212	222	10	5%	**0.71**	Pass	Pass
3	A40 Abbey Way (NW) to Abbey Way (E)	316	307	-9	-3%	**0.49**	Pass	Pass
4	A40 Abbey Way (NW) to Abbey School	0	6	6	100%	**3.52**	Pass	Pass
5	A40 Abbey Way (NW) to Marlow Hill	430	407	-23	-5%	**1.11**	Pass	Pass
6	A40 Abbey Way (NW) to Queen Alexandra Road	58	84	26	45%	**3.09**	Pass	Pass
7	A40 Abbey Way (NW) to A40 Abbey Way (NW)	8	0	-8	-95%	**3.71**	Pass	Pass
8	St Mary's Street to Queen Victoria Road	38	53	15	41%	**2.28**	Pass	Pass
9	St Mary's Street to Abbey Way (E)	67	80	13	19%	**1.47**	Pass	Pass
10	St Mary's Street to Abbey School	0	0	0	0%	**0.00**	Pass	Pass
11	St Mary's Street to Marlow Hill	7	8	1	14%	**0.37**	Pass	Pass
12	St Mary's Street to Queen Alexandra Road	4	3	-1	-30%	**0.65**	Pass	Pass
13	St Mary's Street to A40 Abbey Way (NW)	18	9	-9	-52%	**2.58**	Pass	Pass
14	St Mary's Street to St Mary's Street	0	0	0	0%	**0.00**	Pass	Pass
15	Queen Victoria Road to Abbey Way (E)	8	0	-8	-100%	**4.00**	Pass	Pass
16	Queen Victoria Road to Abbey School	0	0	0	0%	**0.00**	Pass	Pass
17	Queen Victoria Road to Marlow Hill	8	0	-8	-100%	**4.00**	Pass	Pass
18	Queen Victoria Road to Queen Alexandra Road	0	0	0	0%	**0.00**	Pass	Pass
19	Queen Victoria Road to A40 Abbey Way (NW)	12	0	-12	-100%	**4.90**	Pass	Pass
20	Queen Victoria Road to St Mary's Street	3	0	-3	-100%	**2.45**	Pass	Pass
21	Queen Victoria Road to Queen Victoria Road	0	0	0	0%	**0.00**	Pass	Pass
22	Abbey Way (E) to Abbey School	21	19	-2	-9%	**0.40**	Pass	Pass

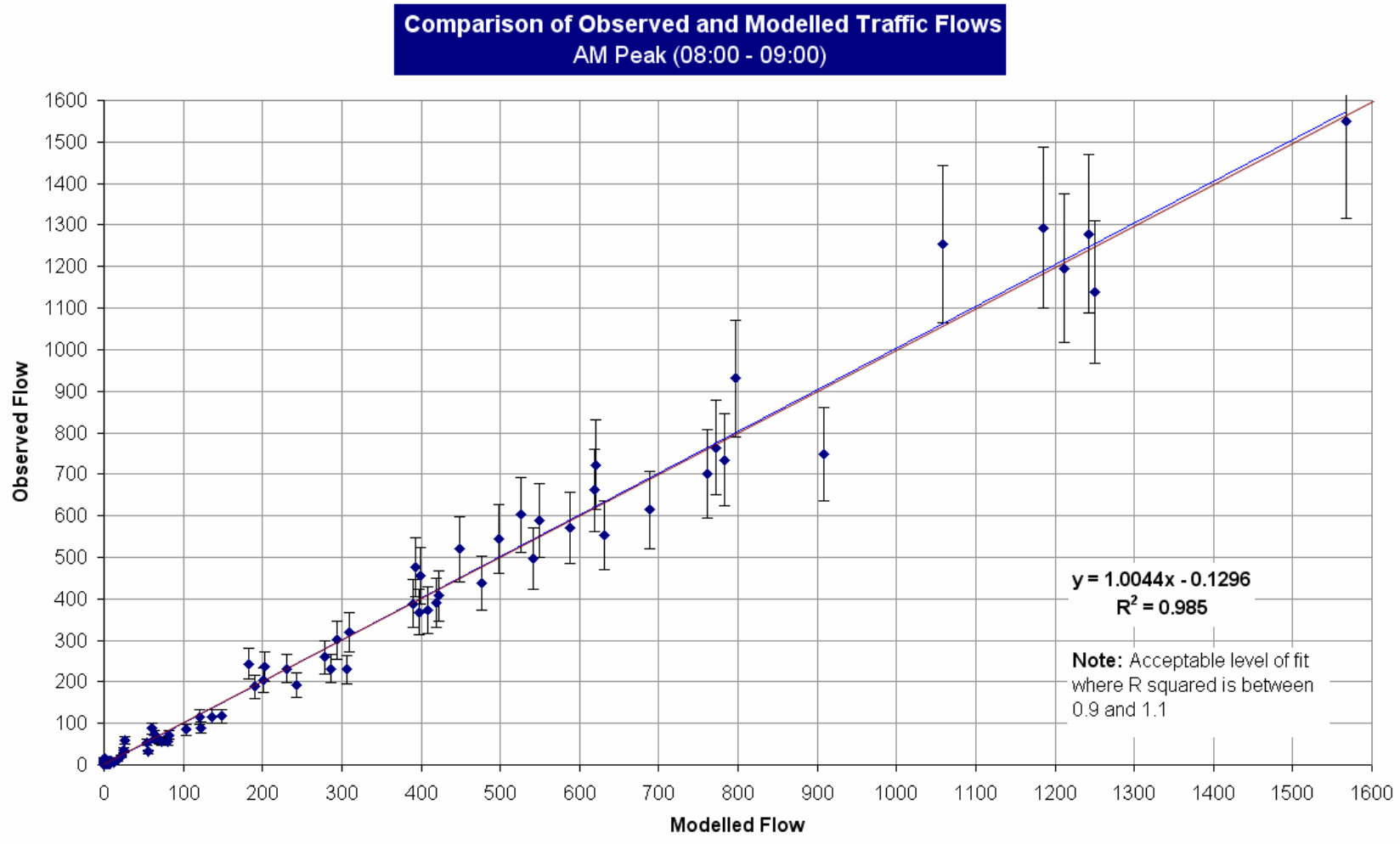
23	Abbey Way (E) to Marlow Hill	1256	1190	-66	-5%	**1.89**	Pass	Pass
24	Abbey Way (E) to Queen Alexandra Road	255	237	-18	-7%	**1.17**	Pass	Pass
25	Abbey Way (E) to A40 Abbey Way (NW)	392	417	25	6%	**1.26**	Pass	Pass
26	Abbey Way (E) to St Mary's Street	0	2	2	100%	**1.79**	Pass	Pass
27	Abbey Way (E) to Queen Victoria Road	94	139	45	48%	**4.19**	Pass	Pass
28	Abbey Way (E) to Abbey Way (E)	130	129	-1	-1%	**0.11**	Pass	Pass
29	Abbey School to Marlow Hill	17	17	0	0%	**0.00**	Pass	Pass
30	Abbey School to Queen Alexandra Road	3	3	0	-7%	**0.12**	Pass	Pass
31	Abbey School to A40 Abbey Way (NW)	26	26	0	-1%	**0.04**	Pass	Pass
32	Abbey School to St Mary's Street	0	0	0	0%	**0.00**	Pass	Pass
33	Abbey School to Queen Victoria Road	1	1	0	0%	**0.00**	Pass	Pass
34	Abbey School to Abbey Way (E)	5	4	-1	-12%	**0.28**	Pass	Pass
35	Abbey School to Abbey School	0	0	0	0%	**0.00**	Pass	Pass
36	Marlow Hill to Queen Alexandra Road	128	96	-32	-25%	**3.02**	Pass	Pass
37	Marlow Hill to A40 Abbey Way (NW)	779	711	-68	-9%	**2.49**	Pass	Pass
38	Marlow Hill to St Mary's Street	5	4	-1	-16%	**0.37**	Pass	Pass
39	Marlow Hill to Queen Victoria Road	270	357	87	32%	**4.92**	Pass	Pass
40	Marlow Hill to Abbey Way (E)	111	91	-20	-18%	**1.97**	Pass	Pass
41	Marlow Hill to Abbey School	5	5	0	4%	**0.09**	Pass	Pass
42	Marlow Hill to Marlow Hill	25	11	-14	-54%	**3.19**	Pass	Pass
43	Queen Alexandra Road to A40 Abbey Way (NW)	108	67	-41	-38%	**4.41**	Pass	Pass
44	Queen Alexandra Road to St Mary's Street	12	0	-12	-100%	**4.90**	Pass	Pass
45	Queen Alexandra Road to Queen Victoria Road	207	192	-15	-7%	**1.08**	Pass	Pass
46	Queen Alexandra Road to Abbey Way (E)	111	99	-12	-11%	**1.15**	Pass	Pass
47	Queen Alexandra Road to Abbey School	1	2	1	120%	**0.95**	Pass	Pass
48	Queen Alexandra Road to Marlow Hill	87	69	-18	-21%	**2.04**	Pass	Pass
49	Queen Alexandra Road to Queen Alexandra Road	1	1	0	-20%	**0.21**	Pass	Pass
50	Oxford Road to A4128 Archway	145	176	31	21%	**2.45**	Pass	Pass
51	Oxford Road to Oxford Street	31	25	-6	-19%	**1.13**	Pass	Pass

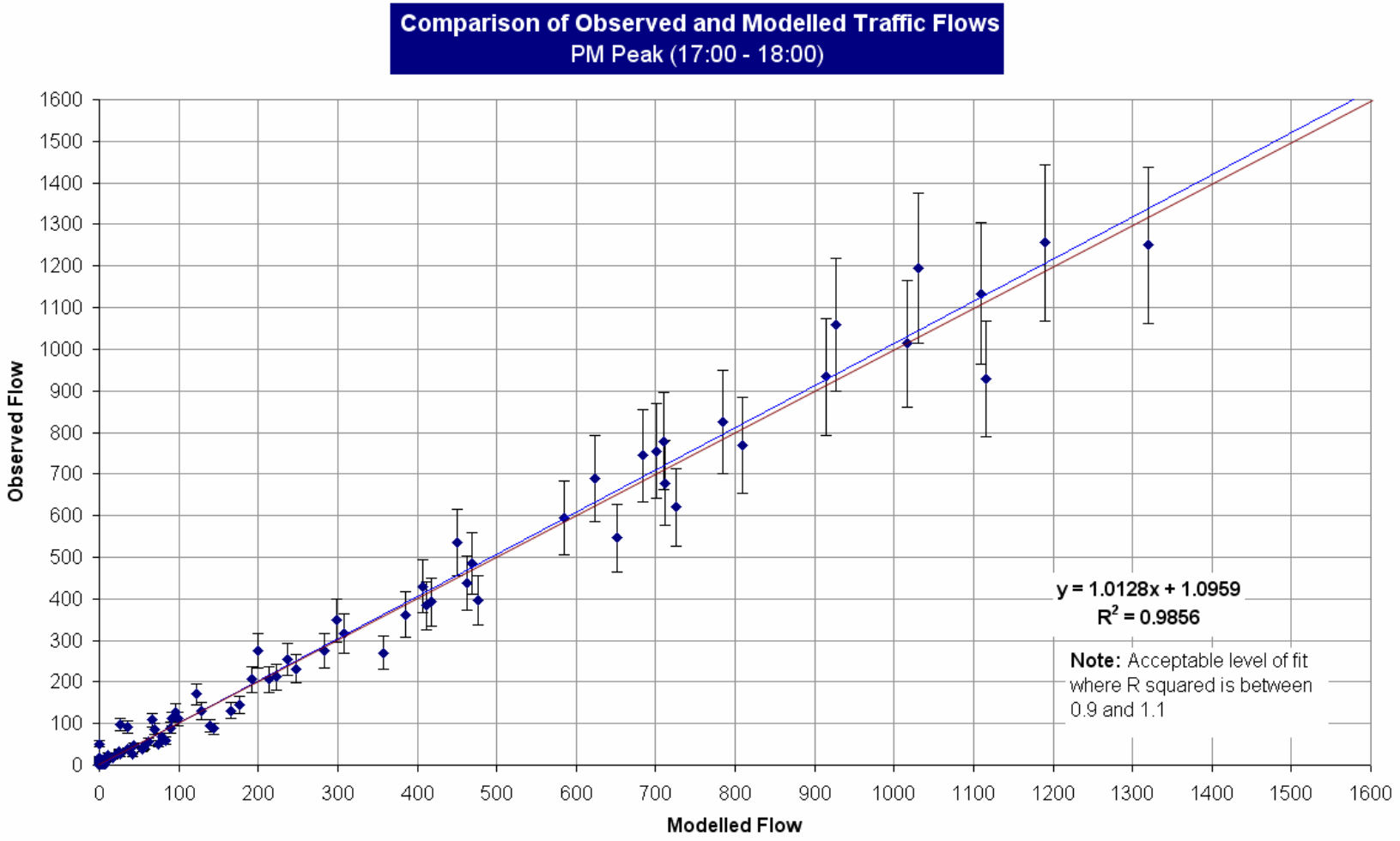
52	Oxford Road to Abbey Way	546	651	105	19%	**4.28**	Pass	Fail
53	Oxford Road to Temple Street	33	24	-9	-27%	**1.65**	Pass	Pass
54	Oxford Road to Oxford Road	4	0	-4	-100%	**2.83**	Pass	Pass
55	A4128 Archway to Oxford Street	0	0	0	0%	**0.00**	Pass	Pass
56	A4128 Archway to Abbey Way	362	385	23	6%	**1.21**	Pass	Pass
57	A4128 Archway to Temple Street	51	75	24	46%	**2.98**	Pass	Pass
58	A4128 Archway to Oxford Road	88	143	55	63%	**5.13**	Fail	Pass
59	A4128 Archway to A4128 Archway	9	0	-9	-100%	**4.24**	Pass	Pass
60	Oxford Street to Abbey Way	51	0	-51	-100%	**10.10**	Fail	Pass
61	Oxford Street to Temple Street	3	0	-3	-100%	**2.45**	Pass	Pass
62	Oxford Street to Oxford Road	97	26	-71	-73%	**8.99**	Fail	Pass
63	Oxford Street to A4128 Archway	19	0	-19	-100%	**6.16**	Fail	Pass
64	Oxford Street to Oxford Street	0	0	0	0%	**0.00**	Pass	Pass
65	Abbey Way to Temple Street	26	42	16	62%	**2.74**	Pass	Pass
66	Abbey Way to Oxford Road	383	412	29	8%	**1.46**	Pass	Pass
67	Abbey Way to A4128 Archway	744	684	-60	-8%	**2.23**	Pass	Pass
68	Abbey Way to Oxford Street	4	0	-4	-100%	**2.83**	Pass	Pass
69	Abbey Way to Abbey Way	92	36	-56	-61%	**7.00**	Fail	Pass
70	Temple Street to Oxford Road	37	36	-1	-3%	**0.17**	Pass	Pass
71	Temple Street to A4128 Archway	47	43	-4	-9%	**0.66**	Pass	Pass
72	Temple Street to Oxford Street	0	0	0	0%	**0.00**	Pass	Pass
73	Temple Street to Abbey Way	42	56	14	34%	**2.03**	Pass	Pass
74	Temple Street to Temple Street	0	0	0	0%	**0.00**	Pass	Pass
75	A404 Easton Street to A40 London Road	207	213	6	3%	**0.44**	Pass	Pass
76	A404 Easton Street to A40 Abbey Way	1013	1017	4	0%	**0.13**	Pass	Pass
77	A404 Easton Street to A404 Easton Street	0	0	0	0%	**0.00**	Pass	Pass
78	A40 London Road to A40 Abbey Way	1134	1110	-24	-2%	**0.73**	Pass	Pass
79	A40 London Road to A404 Easton Street	0	0	0	0%	**0.00**	Pass	Pass
80	A40 London Road to A40 London Road	0	0	0	0%	**0.00**	Pass	Pass

81	A40 Abbey Way to A404 Easton Street	0	0	0	0%	**0.00**	Pass	Pass
82	A40 Abbey Way to A40 London Road	755	701	-54	-7%	**1.99**	Pass	Pass
83	A40 Abbey Way to A40 Abbey Way	0	0	0	0%	**0.00**	Pass	Pass
84	A40 London Rd High Wyc btwn Easton St & Stuart Rd SEB	934	915	-19	-2%	**0.62**	Pass	Pass
85	A40 London Rd High Wyc btwn Easton St & Stuart Rd NWB	929	1115	186	20%	**5.81**	Fail	Fail
86	A40 West Wycombe Rd 185m SE j/w The Pastures NWB	1059	927	-132	-12%	**4.19**	Pass	Pass
87	A40 West Wycombe Rd 185m SE j/w The Pastures SEB	769	809	40	5%	**1.43**	Pass	Pass
88	A404 Crendon St High Wycombe at railway bridge SB	620	726	106	17%	**4.07**	Pass	Fail
89	A404 Crendon St High Wycombe at railway bridge NB	825	784	-41	-5%	**1.45**	Pass	Pass
90	Desborough Rd btwn Desborough Ave & Short St EB	485	468	-17	-4%	**0.78**	Pass	Pass
91	Desborough Rd btwn Desborough Ave & Short St WB	535	451	-84	-16%	**3.79**	Pass	Pass
92	Bellfield Rd High Wycombe N of Dovecot Rd NB	678	712	34	5%	**1.30**	Pass	Pass
93	Bellfield Rd High Wycombe N of Dovecot Rd SB	438	463	25	6%	**1.18**	Pass	Pass
94	Priory Rd High Wycombe near railway bridge NB	170	123	-48	-28%	**3.93**	Pass	Pass
95	Priory Rd High Wycombe near railway bridge SB	131	166	35	27%	**2.86**	Pass	Pass
96	Suffield Rd btwn Desborough Ave & West End St EB	348	299	-50	-14%	**2.76**	Pass	Pass
97	Suffield Rd btwn Desborough Ave & West End St WB	274	283	9	3%	**0.56**	Pass	Pass
98	A404 Marlow Hill NE of Daws Hill Lane NEB	1251	1320	70	6%	**1.94**	Pass	Pass
99	A404 Marlow Hill NE of Daws Hill Lane SWB	1822	1701	-121	-7%	**2.88**	Pass	Pass
100	A404 Amersham Hill to Totteridge Rd	90	90	0	0%	**0.04**	Pass	Pass
101	A404 Amersham Hill to A404 Wycombe Side	395	477	82	21%	**3.94**	Pass	Pass
102	Totteridge Road to A404 Wycombe Side	232	248	16	7%	**1.02**	Pass	Pass
103	Totteridge Road to A404 Amersham Road	46	58	12	25%	**1.61**	Pass	Pass
104	A404 Wycombe Side to A404 Amersham Road	594	585	-9	-2%	**0.39**	Pass	Pass
105	A404 Wycombe Side to Totteridge Road	275	200	-75	-27%	**4.89**	Pass	Pass
106	A4128 Hughenden Road Southbound*	690	623	-67	-10%	**2.61**	Pass	Pass
107	A4128 Hughenden Road Northbound*	1195	1030	-165	-14%	**4.95**	Pass	Pass

**** Observed total taken from count of ANPR***

Appendix G Correlation Analysis




Comparison of Observed and Modelled Traffic Flows
PM Peak (17:00 - 18:00)
Observed Flow
Modelled Flow
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
y = 1.0128x + 1.0959
R2 = 0.9856
Note: Acceptable level of fit where R squared is between 0.9 and 1.1