Woodside Connection and Houghton Regis Development
Modelling Report

Prepared by: .... Andrew Bustin, Consultant

Checked by: .... Mark Chadwick, Principal Consultant

Approved by: .... Ian Burrows, Regional Director

Woodside Connection and Houghton Regis Development

Rev No	Comments	Checked by	Approved by	Date
1	Internal draft	MPC	IOB	14/02/13
2	Draft for Client Review	MPC	IOB	15/02/13

AECOM House, 63-77 Victoria Street, St Albans, Hertfordshire, AL1 3ER
Telephone: 01727 535000 Website: http://www.aecom.com

Job No 60247699 Reference 500 Date Created February 2013

p:\uksta1-tp-planning\projects\transport planning - c beds model management and maintenance contract\00 - applications\woodside connection - pinch point app\reporting\woodside connection - traffic modelling report (draft) v2.doc

Table of Contents

1 Introduction

1 Introduction

Background

1.1 The Central Bedfordshire and Luton Transport Model (CBLTM) has been used to produce outputs to assist with the assessment of both the Woodside Connection (WSC) highway scheme and the Houghton Regis Development (HRD) in the Dunstable and Houghton Regis area.

Purpose of the Report

1.2 This Modelling Report documents the base year model development and forecasting assumptions and the results of the model runs undertaken to assess the potential future impacts of WSC and HRD. This Modelling Report documents the base year model development and forecasting assumptions and the results of the model runs undertaken to assess the potential future impacts of WSC and HRD. The purpose of the report is to provide supporting documentation for the application for Pinch Point funding for the Woodside Connection. Due to time limitations the assessment for the application has had to be based on available existing 2031 model scenarios. Although there is an appropriate 'Do Something' model scenario that includes the Woodside Connection scheme there is not currently an appropriate 'Do Minimum' scenario that has the appropriate level of development. This situation is not ideal in that it does not allow for the true benefits of the scheme to be clearly identified and hence adequately quantified. It is expected that an appropriate 'Do Minimum' model will be developed at a future date.

Report Structure

1.3 Following this introduction, the report is structured as follows:

- Section 2 – Model Overview;
- Section 3 – Calibration and Validation Data
- Section 4 – Network Development
- Section 5 – Trip Matrix Development
- Section 6 – Model Calibration
- Section 7 – Model Validation
- Section 8 – Summary of Model Development, Standards Achieved and Fitness for Purpose
- Section 9 – Forecast Year Modelling Specification;
- Section 10 – Forecast Year Trip Matrix Development;
- Section 11 – Without Scheme Modelling Results;
- Section 12 – With Houghton Regis Development Modelling Results
- Section 13 – Conclusions;

- .

2 Model Overview

2 Model Overview

Model Development

2.1 CBLTM was developed on behalf of Central Bedfordshire Council (CBC) and Luton Borough Council as a 2009 base year model. AECOM were appointed to manage and maintain the model in early 2012 and produced a high level model verification report. This concluded that the model was suitable for the purpose of assessing the various overall development options being put forward by Central Bedfordshire Council. However, the model would need to be reviewed in further detail before being considered suitable for specific scheme or development appraisal.

2.2 As the model was required for assessing the impacts of the proposed Houghton Regis Development and the Woodside Connection it was determined that re-calibration and re-validation of the model was required in the local area. The main impacts of the proposals will be on the Dunstable and Houghton Regis area, and routes to and from M1 Junctions 11 and 12, and the new M1 J11A. Link and junction traffic flows would be expected to increase due to additional development leading to further stress on the highway network. In order to model these impacts effectively, additional detail was required to be added to the transport model network and zoning system. The intention was to produce an enhanced transport model in the area of interest, suitable for assessing the proposed development and network changes, without causing unnecessary detriment to the performance of the model outside of this area.

2.3 AECOM undertook a model review of the area surrounding the proposed interventions which looked at the following aspects:

- Highway Network – suitability for assessing scheme impacts, network coverage and correct coding of key junctions
- Zone System – check level of detail with relation to detail in highway network and also number of trip represented by each zone
- Roadside Interviews – check coverage and location
- Calibration and Validation – check performance of link and turning flows, validation of journey times, and general data coverage

Model Structure

2.4 The CBLTM forecasting process is made up of a number of components. The Trip End Model is run in advance of the other components; these being the Public Transport Model, the Demand Model and the Highway Assignment Model; which are all integrated into a single iterative process.

Trip End Model

2.5 The Trip End Model requires input of employment, household and population planning data at an NTEM zone level. A correspondence has been set up to allow growth to be defined at a CBLTM zone level before being aggregated for input into the model. The Trip End Model process involves the running of NatCop and CTripEnd in order to produce the base and forecast year highway trip ends and also Public Transport Model inputs.

Public Transport Model

2.6 A number of weaknesses in the Public Transport Model were highlighted in the Model Verification report produced when the model was handed over to AECOM. As a result, the use of the Public Transport Model within the forecasting process has been limited to that which is essential for feeding into the demand model.

Demand Model

2.7 The Demand Model generates a forecast year reference matrix based on the calibrated and validated base year matrices and growth calculated from the highway trip ends produced by the Trip End Model. This is then passed to the Highway Assignment Model to generate initial costs which are fed back into the Demand

Model and the forecast year matrix is reproduced. An iterative process then takes place between the Demand Model and Highway Assignment Model until convergence is reached and the final forecast assignment matrices are produced.

Highway Assignment Model

2.8 The CBLTM Highway Assignment Model is based in SATURN. Information regarding changes to networks and demand between the base year and forecast year are discussed in subsequent chapters.

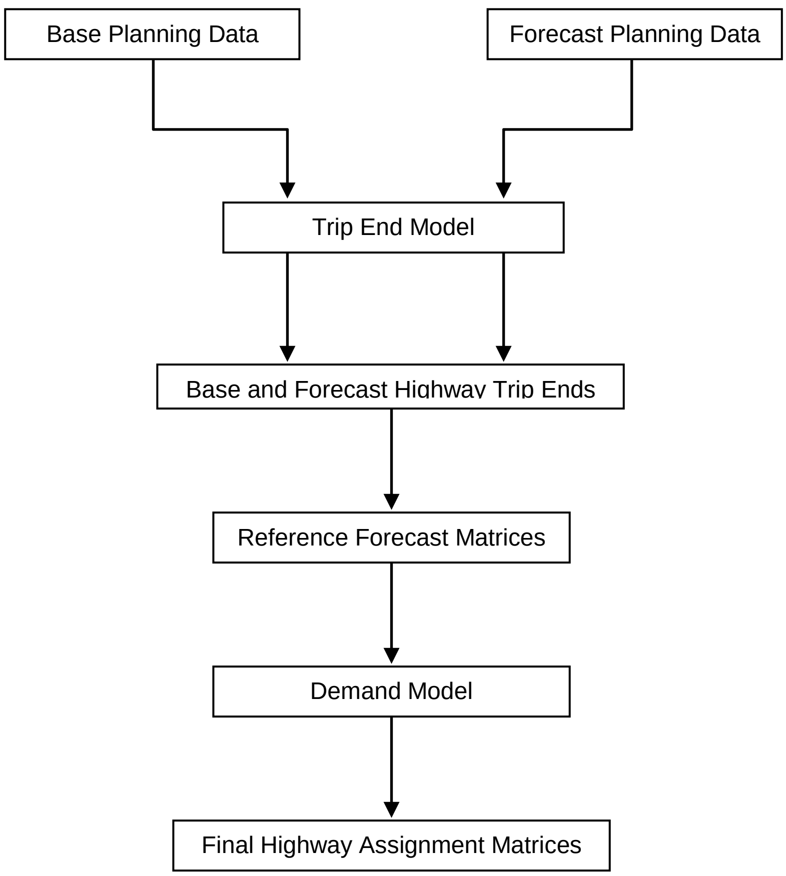
Model Forecasting Process

2.9 The forecasting process is driven by growth in employment, households and population and is based on the calibrated and validated base year highway assignment matrices. Planning data for the base year and forecast year are prepared at an NTEM zoning level and input into the Trip End Model in order to produce base and forecast year highway trip ends. These are disaggregated from an NTEM zone level to a CBLTM zone level using planning data provided at a CBLTM zone level.

2.10 The absolute growth between base and forecast year trip ends is applied to the base year matrices which is followed by a furness process resulting in the reference forecast year matrices. The demand model is then run to convergence when the final highway assignment matrices are output and assigned to the forecast year highway networks.

2.11 The model forecasting process is illustrated in Figure 2.1.

Figure 2.1: CBLTM Standard Forecasting Process



Model Parameters

Base Year

2.12 The Highway Assignment Model has been calibrated and validated to an October 2009 base year.

Time Periods

2.13 The modelled time periods are as follows:

- AM Peak (0800-0900)
- Inter-peak (1000-1600 average hour)
- PM Peak (1700-1800)

User Classes

2.14 The assignment demand is segmented into five separate user classes as follows:

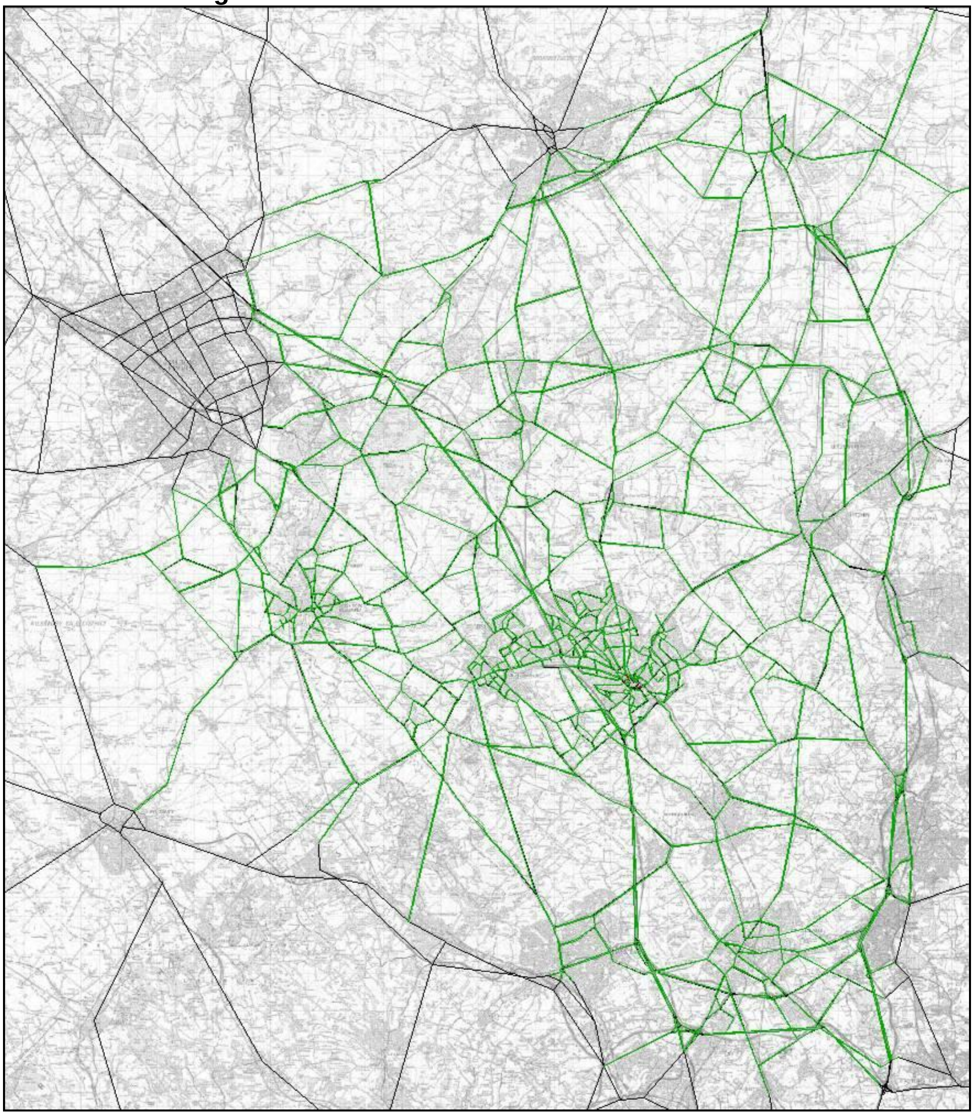
- Car (Commuting trips)
- Car (Business trips)
- Car (Other trips)
- LGV
- HGV

Model Coverage

Simulation and Buffer Network

2.15 The CBLTM modelled network is represented by two distinct areas; the simulation and buffer networks. Junction interactions and link behaviour are modelled in detail within the simulation area whereas the buffer network represents an area surrounding the simulation network which has little detail in terms of junctions and link capacity and is used to carry traffic between the external zones and the simulation area. Figure 2.2 below shows the extent of the base year simulation area in green.

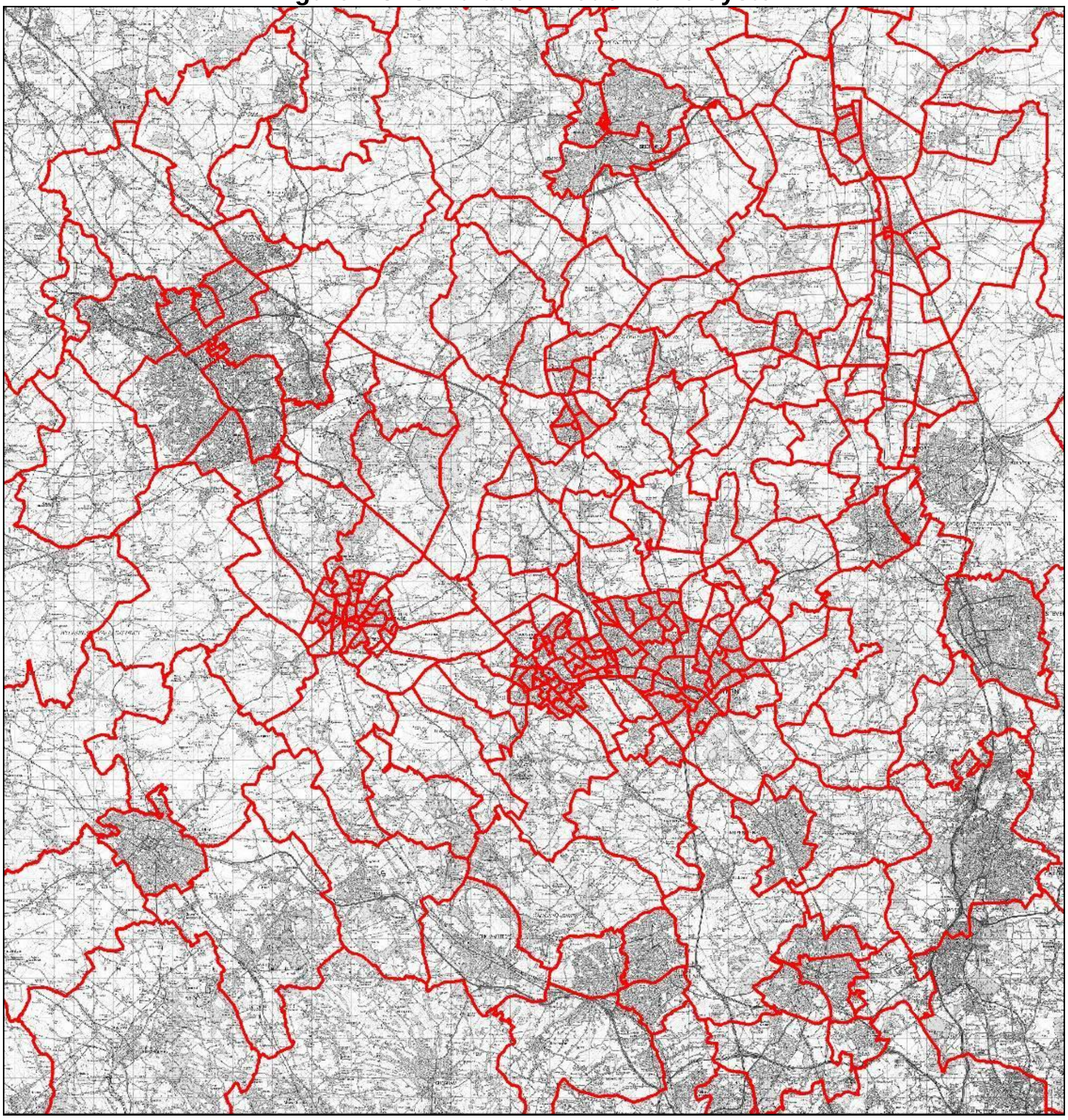
Figure 2.2: Base Year Simulation Network Area



Zone System

2.16 Following the base model updates, the zone system now comprises of 358 geographical zones along with a further 50 zones for use as development zones. The zones are generally based on 2001 census output areas. The zone system for the simulation model area is shown in Figure 2.3.

Figure 2.3: Simulation Model Zone System



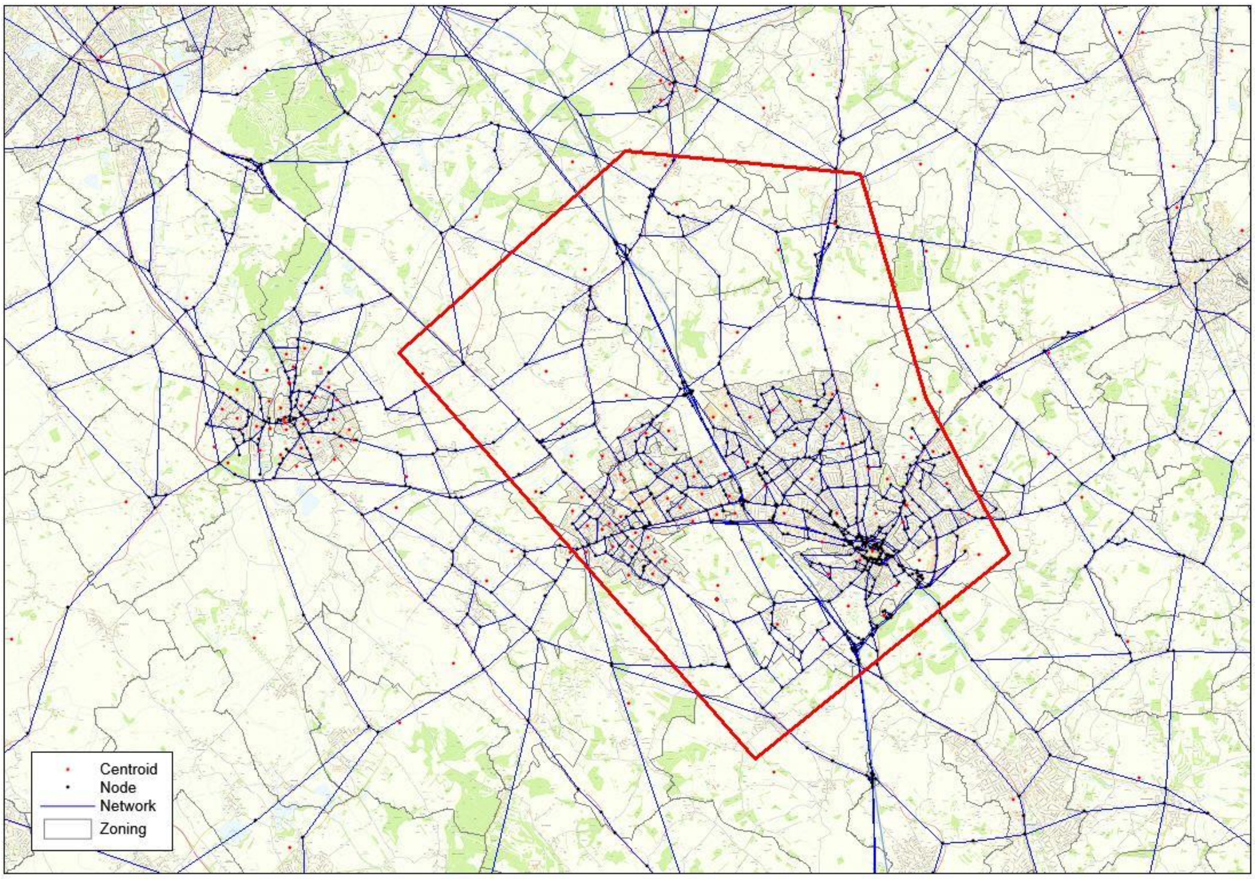
Capabilities on project:
Transportation

Study Area

Area of Influence

2.17 For the purposes of assessing the impacts of the Woodside Connection an 'Area of Influence' was determined by comparison of 'with' and 'without' the scheme models. From this comparison a cordon was defined as shown in Figure 2.4. This area is broadly bounded by the A5 to the west, A6 to the east, M1 Junction 12 to the north and Junction 10 to the south.

Figure 2.4: Core Study Area



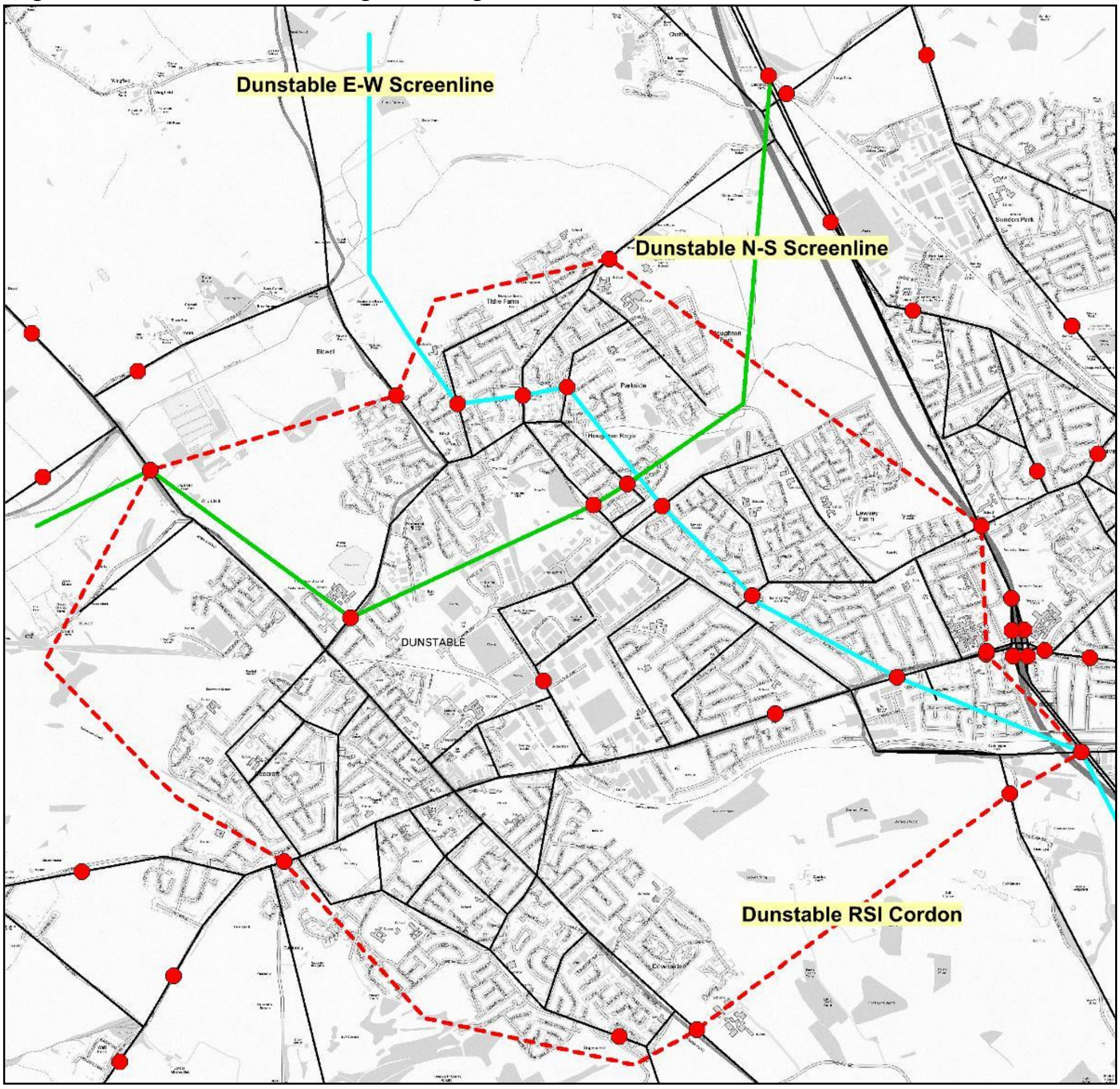
3 Calibration and Validation Data

3 Calibration and Validation Data

Screenlines in the Area of Interest

3.1 Most of the calibration and validation screenlines used in the original development of the model have been used again in the model enhancements. Some refinement of the screenlines in the Dunstable and Houghton Regis areas has been undertaken to provide north-south and east-west screenlines which divide the RSI (Roadside Interview) cordon into four sectors. Figure 1 shows the calibration screenlines used in the Dunstable and Houghton Regis areas.

Figure 1: Dunstable and Houghton Regis Area Calibration Screenlines



3.2 The RSI cordon counts have been derived from ATC (Automatic Traffic Count) and MCC (Manual Classified Count) surveys undertaken in October 2009. The total numbers of vehicles were taken from the ATC counts which were then disaggregated into vehicle types using the MCC data.

3.3 The counts on the two Dunstable screenlines have been collected from a range of survey types undertaken at different times. All but one of the count totals have been taken from ATC data – this was not available for the A5120 site just east of the A5 and so a turning count from November 2008 has been used here. The ATC data for the other sites has been taken from July, September and October 2009, and November and December 2010. In most cases the ATC totals have been disaggregated into vehicle types using MCC or turning count data from the same month and year, although in some cases counts from other months have had to be used. The TRADS data used for the M1 count has been relied on for both totals vehicles and vehicle classification.

3.4 Where data from months other than October 2009 have been used, factoring has taken place based on month, year and road type in order to normalise the data to this month and year. These factors were inherited from the work undertaken by Halcrow.

Screenlines Across the Whole Model

3.5 Figure 2 and Figure 3 show the calibration and validation screenlines across the whole model area.

Figure 2: Calibration Screenlines

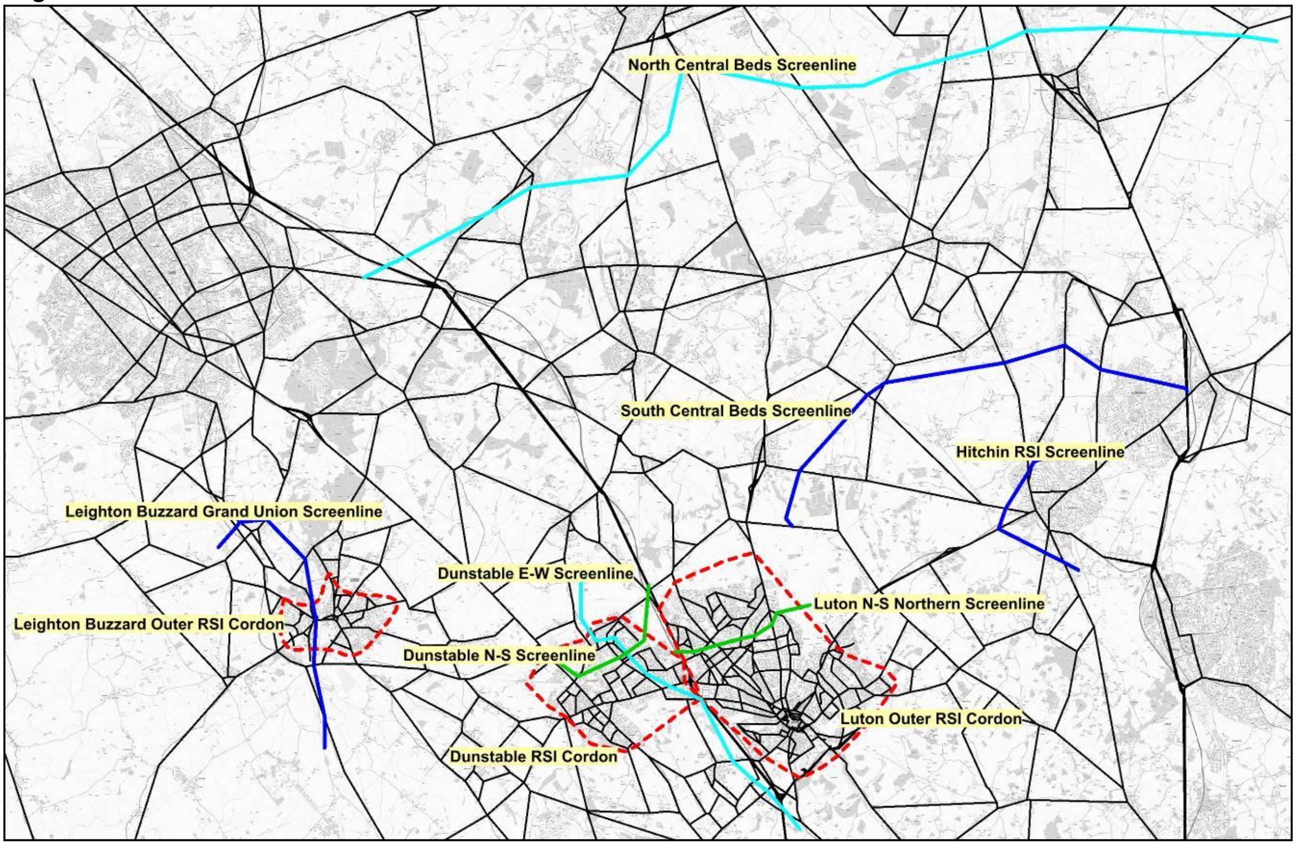
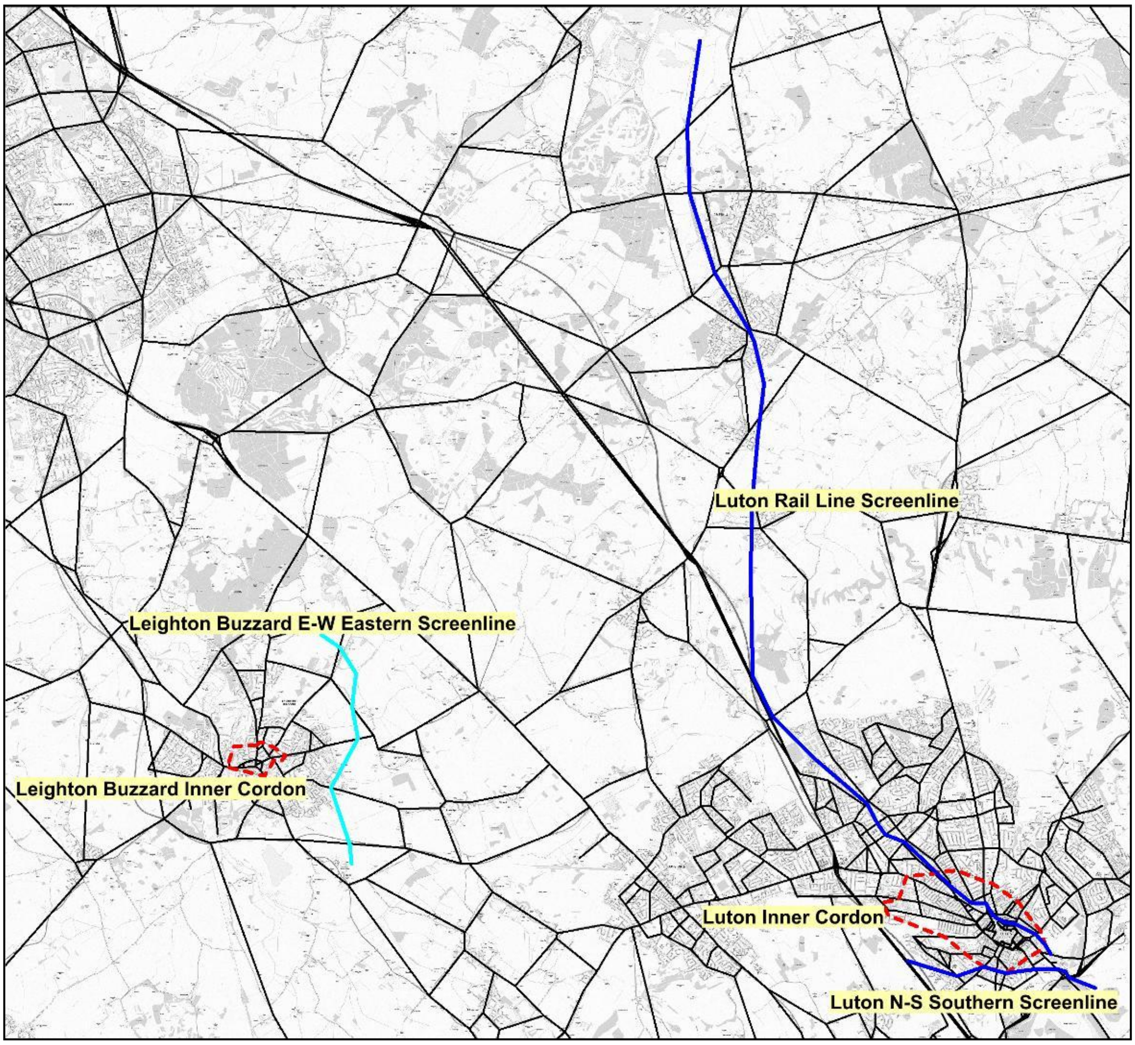


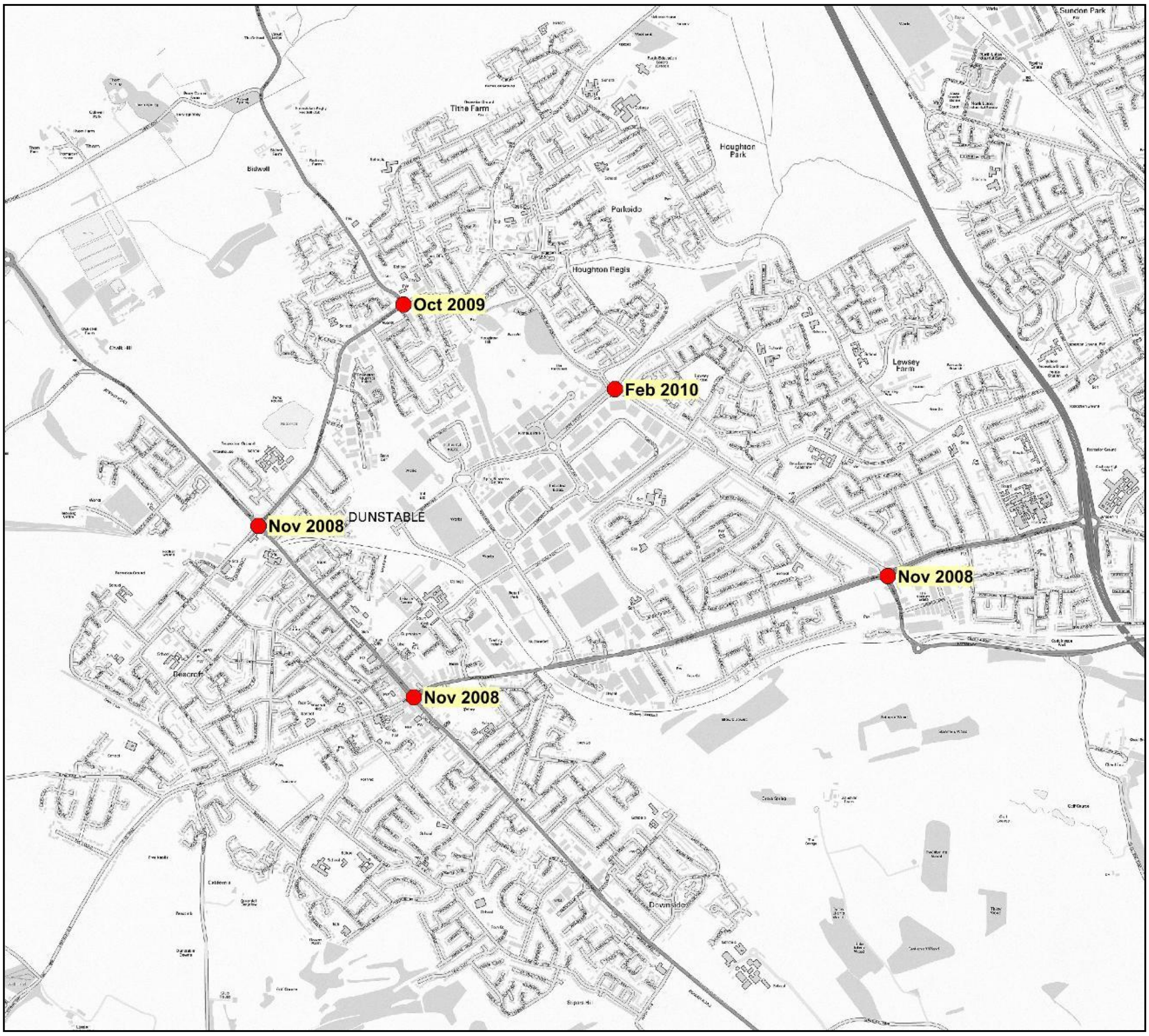
Figure 3: Validation Screenlines



Turning Count Data

3.6 Turning count data has been used to validate the model at key junctions in the Dunstable and Houghton Regis area. The locations of the turning counts with the dates at which they were undertaken are shown in Figure 4.

Figure 4: Turning Count Locations



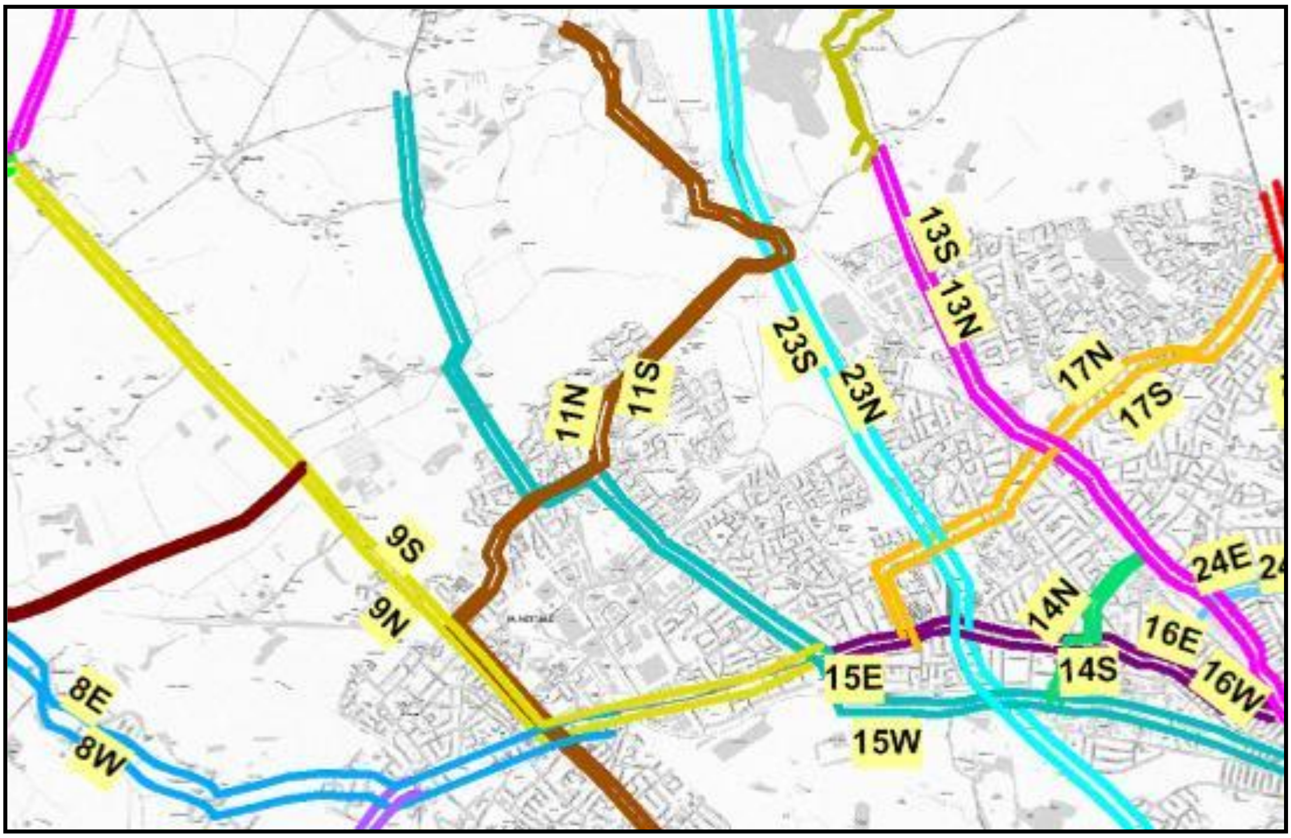
Additional Data

3.7 The existing count data used for validation has been supplemented with a number of new counts. ATC data has been obtained for the M1 Junction 11 and 12 slip roads as these are the key junctions serving the Dunstable and Houghton Regis areas. ATC and turning count data has also been obtained from the area surrounding the Poynters Road/Porz Avenue/Park Road North junction which will be where the south-western end of the Woodside Connection links in to the existing road network.

Journey Time Data

3.8 The original data used for the validation of journey times in the model has been retained. More detailed analysis has been carried out of the journey time performance on routes which pass through the Dunstable and Houghton Regis areas by producing graphs which include the validation at intermediate timing points as well as for the whole route. Figure 5 shows the journey time routes which pass through the area of interest.

Figure 5: Journey Time Routes



3.9 The averages used for the observed journey times were derived from ITIS speed data. It should be noted that this source tends to be biased towards HGV and LGV speeds although we have not had access to the raw data in order to assess reliability.

4 Network Development

4 Network Development

4.1 The original model networks have been used as a basis for the model enhancement. The initial specification set out a number of network updates which would be included before calibration commenced. These were as follows:

- The removal of a vehicle link on the eastern side of Dunstable which is currently only accessible by pedestrians and cycles.
- Changes to the use of speed flow curves and fixed speeds for certain links to improve consistency.
- The inclusion of HGV restrictions based on information received from Central Bedfordshire Council.
- The improvement of junction coding at some 20 junctions in and around the Dunstable and Houghton Regis area.

4.2 Further updates to the networks were included in order to incorporate the disaggregation of zones and to ensure the level of detail in the network was consistent with that of the revised zoning system. This meant the addition of Wilbury Drive, Ridgeway Avenue, Katherine Drive and Woodford Road in east Dunstable, and Icknield Road, Bull Pond Lane, First Avenue and Friars Walk in south Dunstable. Some other minor changes such as the splitting of links and moving of existing centroid connectors was also required to accommodate the new zone connectors.

4.3 While these updates were being undertaken, and throughout the calibration process, further network improvements were identified and incorporated as follows:

- A review of saturation flow coding across the Dunstable and Houghton Regis area revealed that left and right turns at priority junctions had not been coded with sufficient capacity. Corrections have been applied to all priority junctions in the area where necessary.
- Errors in centroid connector coding were identified in the north Luton area. Although outside the area of interest, it was thought best to address these immediately.
- The journey time validation process indicated that the A5/A505 central Dunstable and A5/A5120 junctions were understating delay. The original coding of these junctions used multiple lanes at the stop line to represent flares. To better represent reality, flare coding was introduced which reduced the capacity on the approaches and increased the modelled delay.
- The journey time validation process highlighted some large delays in the model at the signalised Poynters Road/Leagrave High Street and Toddington Road/Grange Avenue junctions which were not represented in the observed data. We obtained signal specifications for these two junctions and adjusted the signal timings appropriately in order to provide a better representation of base year conditions.
- A structured review of coded link lengths highlighted a number of locations where lengths had been coded incorrectly. The coded length of these links has been corrected.
- The journey time validation process indicated that a number of links had been coded with ‘free flow speeds’ which were too slow. Google aerial mapping and ‘Streetview’ were used to assess the links in question and revisions were made where appropriate.

5 Trip Matrix Development

5 Trip Matrix Development

Prior Matrix Checks

5.1 In order to have confidence in the original prior matrix as a basis for recalibration, some checks have been carried out to assess the reliability of the original assignment matrix. These checks focussed on the zones within the Dunstable and Houghton Regis urban areas.

5.2 The first check carried out was on vehicle trip length distributions across the Dunstable RSI cordon. A comparison of matrix trip lengths from zones external to the cordon to those inside the cordon against RSI trip lengths has been undertaken. As an indicator of the significance of any differences, Table 1 shows the RSI sample rates for these surveys. This shows that 13% of vehicles were surveyed in the AM peak and 11% of vehicles were surveyed in the PM peak.

Table 1: RSI Sample Rates

	Total Vehicles Across Cordon Inbound	Total Vehicles Surveyed	% Surveyed
AM Peak	6061	795	13%
PM Peak	6104	656	11%

5.3 The results of the analysis from the AM and PM peaks are shown in Figure 6 and Figure 7. They show that the matrix is reasonable in its representation of trip lengths for inbound trips crossing the Dunstable RSI cordon. The matrix slightly underestimates trips which are less than 5km in length and slightly overestimates trips which are between 5km and 10km in length. However, the degree of difference seen is not significant considering the sample rates shown in Table 1.

Figure 6: AM Peak Trip Length Distribution Comparison of Matrix Against RSI Data

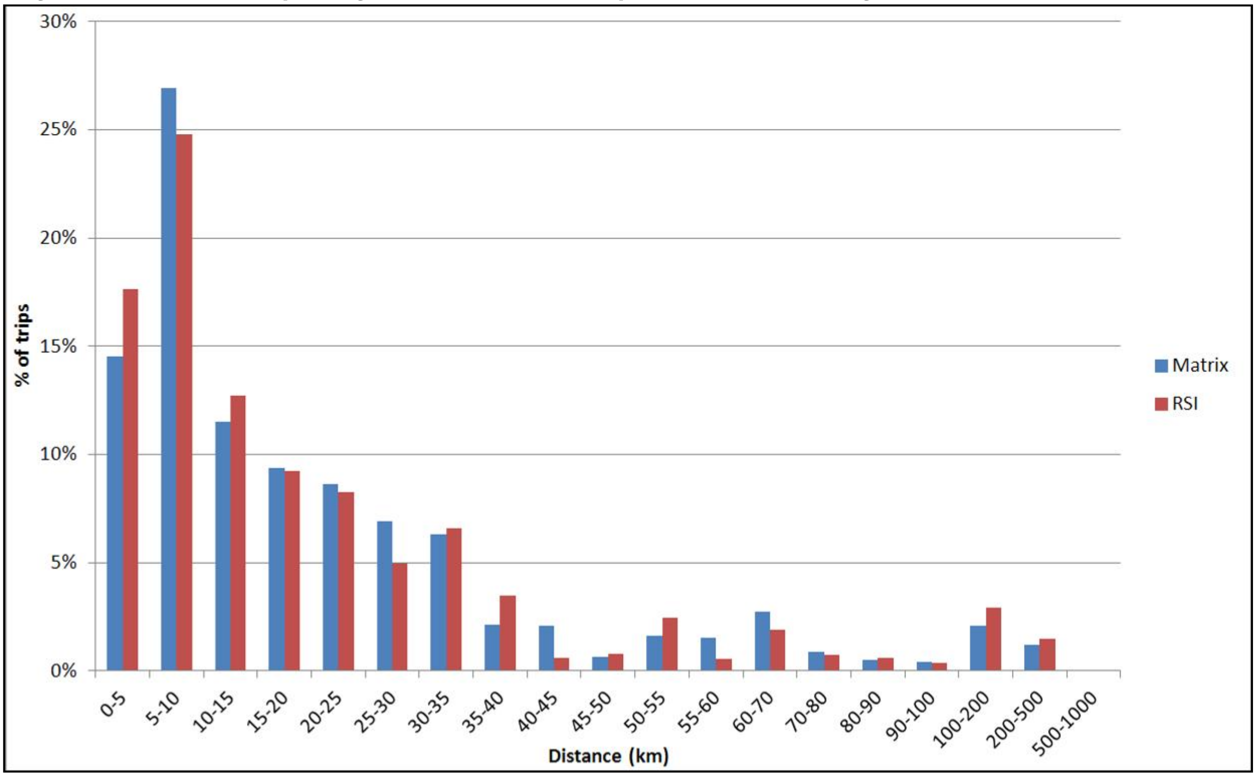
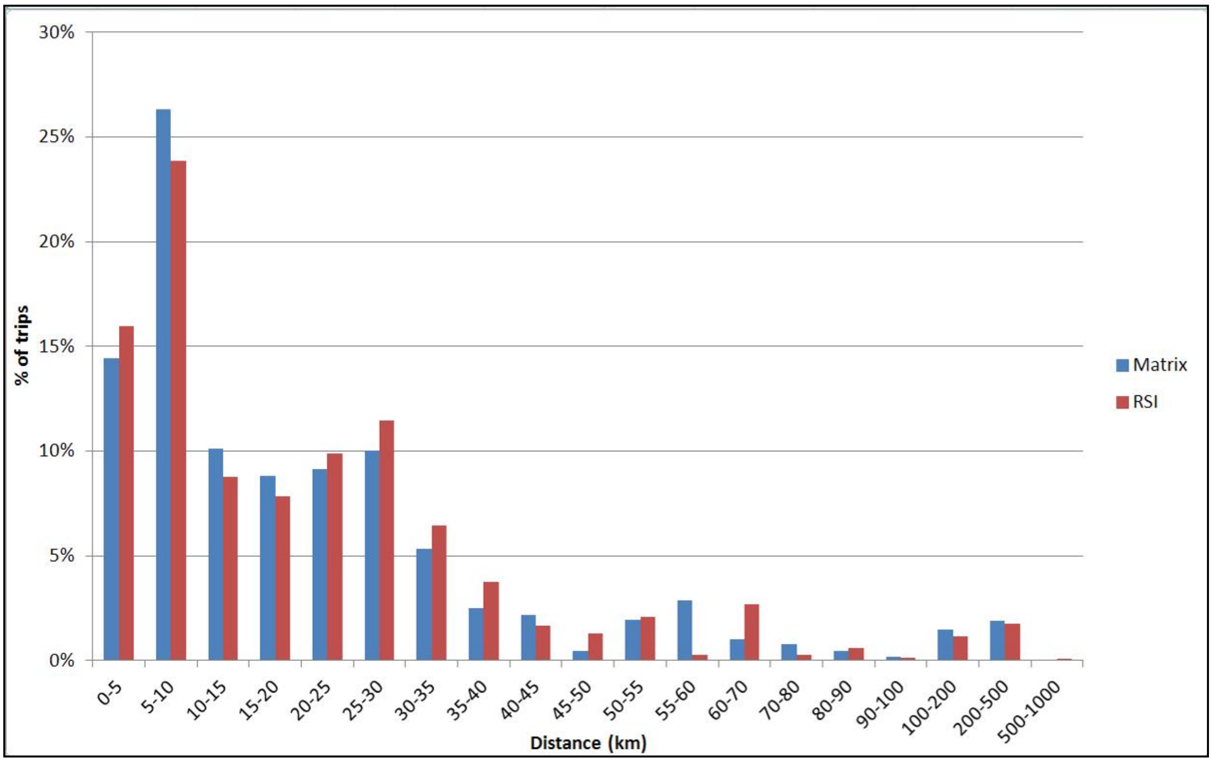


Figure 7: PM Peak Trip Length Distribution Comparison of Matrix Against RSI Data



5.4 To aid understanding of the synthetic trip production for movements inside of the RSI cordon, an analysis of trip lengths between zones internal to the Dunstable RSI cordon was undertaken. Figure 8 and Figure 9 give the trip length distributions produced by this analysis. The graphs show that there is a reasonable distribution of trips of length 1-4 kilometres with a small percentage of trips within the 4-5km category and very few trips of length less than 1km. This is as would be expected given that the cordon is around 5km in diameter.

Capabilities on project:
Transportation

Figure 8: AM Peak Trip Length Distribution of Trips Internal to RSI Cordon

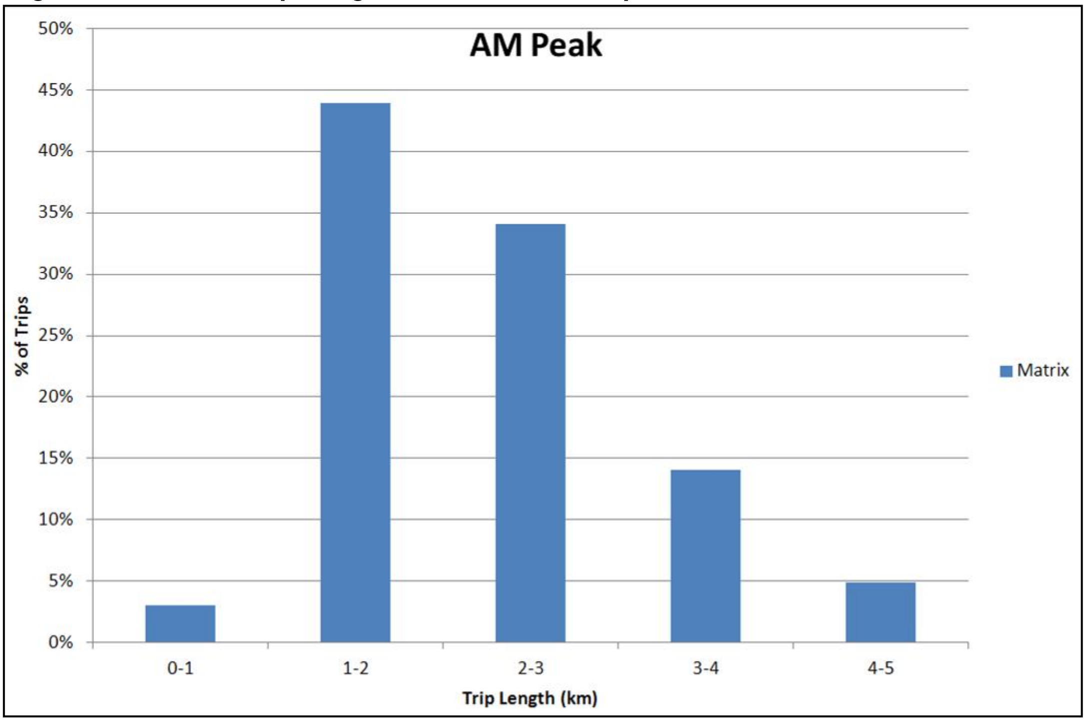
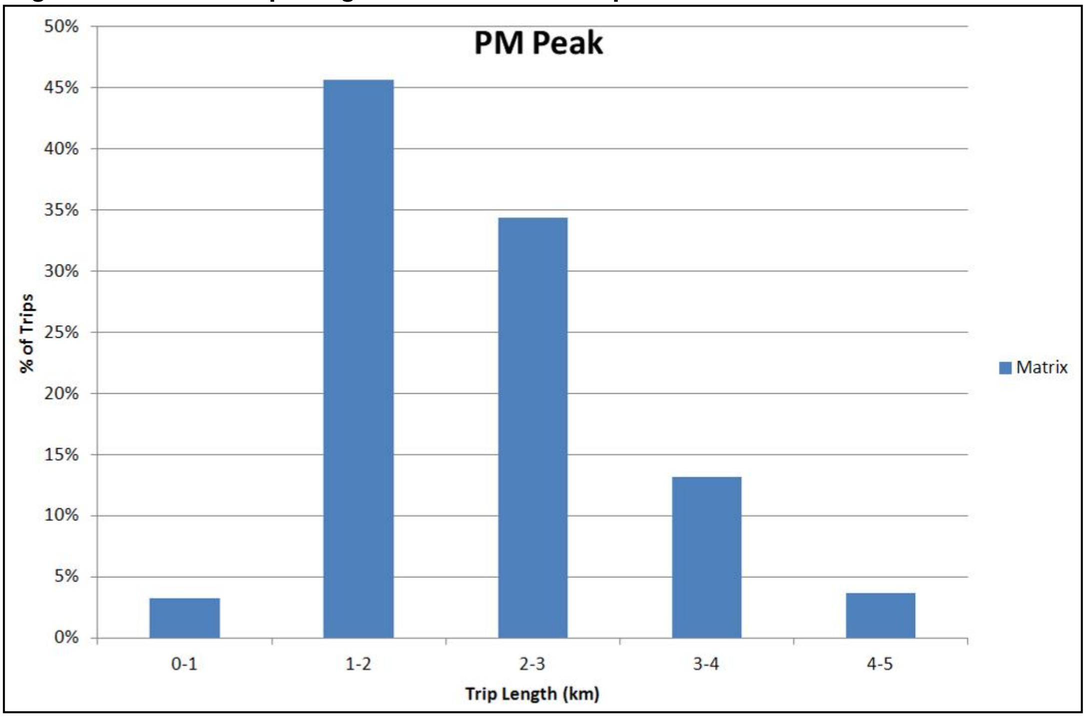


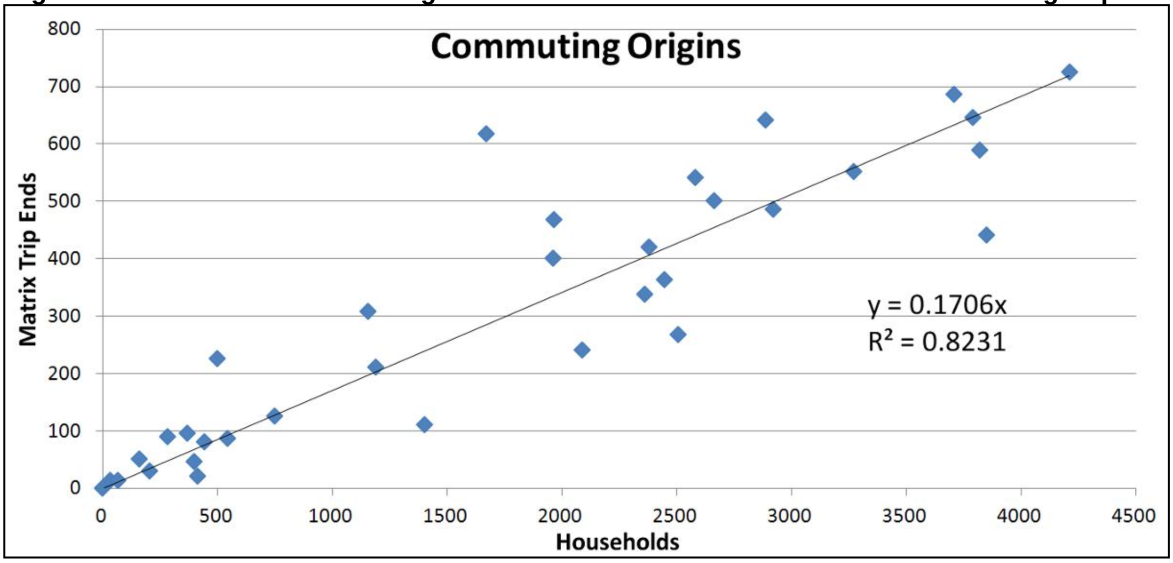
Figure 9 PM Peak Trip Length Distribution of Trips Internal to RSI Cordon

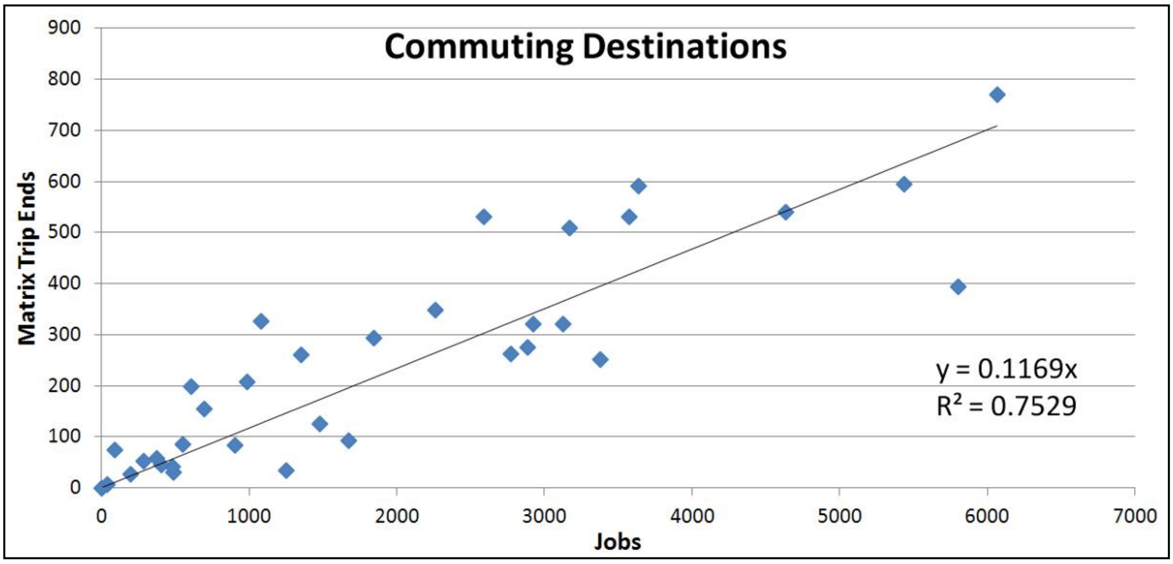


5.5 Checks were also undertaken on the matrix to measure the correlation between planning data and the base year highway matrix trip ends. AM peak car commuting origins were compared against households with destinations compared against jobs. This comparison is important in terms of using the model for forecasting purposes to ensure that sensible outturn forecast year trips are produced when growth is applied. This analysis was undertaken on the zones within the model review area.

5.6 Figure 10 shows the scatter graphs. For origins the correlation is good with trip ends generally increasing proportionately with households. A certain amount of variation is to be expected due to differing trip rates. There is one clear outlier in the origins graph which represents zone 13952. This zone contains four schools and therefore this may account for the larger than expected commuting origins seen here. The correlation of destinations trip ends with jobs is also satisfactory.

Figure 10: Correlation of Planning Data with AM Peak Base Year Matrix Commuting Trip Ends





6 Model Calibration

6 Model Calibration

Calibration Screenlines Performance

6.1 The tables below summarise the performance of the screenlines against WebTAG guidelines The performance in the AM peak is good with all screenlines passing the model standards at a total vehicle and individual vehicle class level.

6.2 The performance in the inter-peak is generally good with only the Dunstable East-West screenline failing at a total flow level with a difference between count and modelled flow of 7%.

Table 2: AM Peak Calibration Screenline Performance

	Total Vehicle Results				Car and LGV Results				HGV Results			
	Count (veh)	**Model (veh)**	**% Diff**	**Pass /Fail**	**Count (veh)**	**Model (veh)**	**% Diff**	**Pass /Fail**	**Count (veh)**	**Model (veh)**	**GEH**	**Pass /Fail**
Dunstable RSI Cordon Inbound	6,405	6,390	0%	PASS	6,049	6,049	0%	PASS	316	300	0.9	PASS
Dunstable RSI Cordon Outbound	7,066	7,069	0%	PASS	6,785	6,783	0%	PASS	235	245	0.7	PASS
Dunstable N-S Screenline Northbound	6,059	6,016	-1%	PASS	5,325	5,329	0%	PASS	678	667	0.4	PASS
Dunstable N-S Screenline Southbound	6,839	6,765	-1%	PASS	6,121	6,093	0%	PASS	670	652	0.7	PASS
Dunstable E-W Screenline Eastbound	5,288	5,207	-2%	PASS	5,026	5,019	0%	PASS	211	152	4.3	PASS
Dunstable E-W Screenline Westbound	4,971	5,053	2%	PASS	4,715	4,830	2%	PASS	200	186	1.0	PASS

Table 3: Inter-peak Calibration Screenline Performance

	Total Vehicle Results				Car and LGV Results				HGV Results			
	Count (veh)	Model (veh)	% Diff	Pass /Fail	Count (veh)	Model (veh)	% Diff	Pass /Fail	Count (veh)	Model (veh)	GEH	Pass /Fail
Dunstable RSI Cordon Inbound	5,320	5,314	0%	PASS	4,992	4,990	0%	PASS	289	288	0.1	PASS
Dunstable RSI Cordon Outbound	5,091	5,084	0%	PASS	4,784	4,783	0%	PASS	267	265	0.1	PASS
Dunstable N-S Screenline Northbound	6,013	5,920	-2%	PASS	4,967	4,937	-1%	PASS	978	963	0.5	PASS
Dunstable N-S Screenline Southbound	5,422	5,416	0%	PASS	4,712	4,738	1%	PASS	669	659	0.4	PASS
Dunstable E-W Screenline Eastbound	3,885	4,023	4%	PASS	3,625	3,847	6%	FAIL	192	140	4.0	PASS
Dunstable E-W Screenline Westbound	3,600	3,854	7%	FAIL	3,377	3,649	8%	FAIL	168	169	0.1	PASS

Table 4: PM Peak Calibration Screenline Performance

	Total Vehicle Results				Car and LGV Results				HGV Results			
	Count (veh)	Model (veh)	% Diff	Pass /Fail	Count (veh)	Model (veh)	% Diff	Pass /Fail	Count (veh)	Model (veh)	GEH	Pass /Fail
Dunstable RSI Cordon Inbound	7,705	7,676	0%	PASS	7,504	7,496	0%	PASS	147	142	0.4	PASS
Dunstable RSI Cordon Outbound	6,173	6,163	0%	PASS	6,019	6,012	0%	PASS	116	115	0.2	PASS
Dunstable N-S Screenline Northbound	7,636	7,481	-2%	PASS	6,977	6,904	-1%	PASS	594	560	1.4	PASS
Dunstable N-S Screenline Southbound	6,407	6,406	0%	PASS	5,948	5,963	0%	PASS	423	425	0.1	PASS
Dunstable E-W Screenline Eastbound	4,913	4,971	1%	PASS	4,780	4,868	2%	PASS	95	69	2.8	PASS
Dunstable E-W Screenline Westbound	5,506	5,505	0%	PASS	5,304	5,370	1%	PASS	149	101	4.3	PASS

7 Model Validation

7 Model Vaidation

7.1 Model validation is illustrated by means of screenlines, individual link counts, turning counts and journey time routes in the Dunstable and Houghton Regis areas.

M1 Slip Road Flow Validation

7.2 The tables below show the flow validation on the M1 Junction 11 and 12 slip roads. Five out of eight slip roads in the AM Peak and inter-peak pass the WebTAG flow criteria with a number of these close to passing. Four out of eight slip roads pass in the PM peak with two of those that fail within 20 vehicles of passing.

Table 5: AM Peak M1 Slip Road Validation

	All Traffic				Car and LGV			
	Count (veh)	Model (veh)	Diff	Pass /Fail	Count (veh)	Model (veh)	Diff	Pass /Fail
J11 South Slip NB	804	702	-102	PASS	743	632	-111	PASS
J11 South Slip SB	1,130	1,162	32	PASS	1,045	1,116	70	PASS
J11 North Slip NB	598	641	43	PASS	550	577	26	PASS
J11 North Slip SB	594	872	278	FAIL	540	836	296	FAIL
J12 South Slip NB	347	301	-47	PASS	322	265	-57	PASS
J12 South Slip SB	694	1,001	306	FAIL	666	945	279	FAIL
J12 North Slip NB	430	477	48	PASS	409	455	46	PASS
J12 North Slip SB	258	401	143	FAIL	222	387	165	FAIL

Table 6: Inter-peak M1 Slip Road Validation

	All Traffic				Car and LGV			
	Count (veh)	Model (veh)	Diff	Pass /Fail	Count (veh)	Model (veh)	Diff	Pass /Fail
J11 South Slip NB	665	620	-44	PASS	586	540	-46	PASS
J11 South Slip SB	629	778	149	FAIL	567	706	140	FAIL
J11 North Slip NB	395	584	189	FAIL	390	522	133	FAIL
J11 North Slip SB	367	410	43	PASS	321	382	61	PASS
J12 South Slip NB	290	383	94	PASS	259	340	80	PASS
J12 South Slip SB	323	467	144	FAIL	295	440	145	FAIL

	All Traffic				Car and LGV			
	Count (veh)	**Model (veh)**	**Diff**	**Pass /Fail**	**Count (veh)**	**Model (veh)**	**Diff**	**Pass /Fail**
J12 North Slip NB	211	288	77	PASS	182	262	80	PASS
J12 North Slip SB	187	195	8	PASS	164	167	3	PASS

Table 7: PM Peak M1 Slip Road Validation

	All Traffic				Car and LGV			
	Count (veh)	**Model (veh)**	**Diff**	**Pass /Fail**	**Count (veh)**	**Model (veh)**	**Diff**	**Pass /Fail**
J11 South Slip NB	1,207	1,142	-65	PASS	1,165	1,106	-58	PASS
J11 South Slip SB	771	740	-31	PASS	744	719	-26	PASS
J11 North Slip NB	706	780	75	PASS	688	764	75	PASS
J11 North Slip SB	503	687	184	FAIL	476	668	192	FAIL
J12 South Slip NB	843	783	-60	PASS	825	779	-46	PASS
J12 South Slip SB	328	494	166	FAIL	319	482	162	FAIL
J12 North Slip NB	264	384	120	FAIL	252	379	127	FAIL
J12 North Slip SB	390	491	102	FAIL	373	466	92	PASS

Turning Flow Validation

7.3 Turning flows have been validated at five key junctions across the Dunstable and Houghton Regis area:

- Park Road North/Poynters Road/Porz Avenue (AM peak data only)
- A505/Poynters Road/Hatters Way
- A5/A505/B489
- A5/A5120
- A5120/Houghton Regis High Street

7.4 The standards used for link flow validation are also applied to turning flow validation. However, it should be noted that WebTAG Unit 3.19d §3.2.9 concedes that these standards are difficult to achieve for turning flows. The reasons for this include the fact that the data collected is representative of just one survey day and therefore is susceptible to volume and proportional variation, and also the tendency for turning movement traffic flows to be low.

7.5 Overall, therefore, the modelled turning movements perform reasonably and within the tolerance which would be expected with at least half of turns passing the criteria at most junctions. Turning movements in this model can only be used to provide an indication of highway network stress with a requirement for further operational junction modelling and assessment at the individual junctions, to determine in more detail, the performance of the junction/s. Any future year assessment of junction behaviour using this model should reflect on the quality of the base model and level of turning flow validation before determining the relative confidence.

Journey Time Validation

7.6 The tables below show the journey time validation performance of the routes which pass through the Dunstable and Houghton Regis areas. The performance in the AM peak is very good with only one route, 15E, failing the WebTAG criteria. The modelled journey time is only slightly outside the 15% guideline and the failure is partly due to model performance in central Luton which is not relevant for the task currently being undertaken.

7.7 The inter-peak model performs well with the majority of the key routes passing the WebTAG standards. The failure in both directions on route 16 is again due to problems in central Luton. On route 9, the failures are due to a lack of delay at two signalised junctions in central Dunstable which are susceptible to congestion. However, the journey time performances at other locations on the route are in line with the observed times.

7.8 The PM peak model performs well with only route 16 performing poorly. In the westbound direction this is due to problems in central Luton. In the eastbound direction there is a lack of delay on the approach to M1 J11 which is likely to be due to variation in delay experienced at traffic signals. However, as explained in Paragraph 3.9, there is uncertainty over this because we have not had access to the raw journey time data.

Table 8: AM Peak Journey Time Validation

Route	Observed Time (sec)	Modelled Time (sec)	Diff	% Diff	Pass/Fail
8E	847	854	8	0.9%	Pass
8W	825	751	-73	-8.9%	Pass
9S	1071	955	-117	-10.9%	Pass
9N	954	876	-78	-8.2%	Pass
11N	1688	1646	-41	-2.5%	Pass
11S	1732	1647	-85	-4.9%	Pass
15E	994	1148	155	15.6%	Fail
15W	877	998	121	13.8%	Pass
16E	599	531	-68	-11.3%	Pass
16W	550	491	-59	-10.7%	Pass
17N	607	684	77	12.7%	Pass
17S	628	676	48	7.6%	Pass
23S	1011	1036	25	2.5%	Pass
23N	927	1038	112	12.1%	Pass

Table 9: Inter-peak Journey Time Validation

Route	Observed Time (sec)	Modelled Time (sec)	Diff	% Diff	Pass/Fail
8E	839	779	-60	-7.2%	Pass
8W	817	744	-73	-8.9%	Pass
9S	1021	811	-211	-20.6%	Fail
9N	1072	872	-200	-18.7%	Fail
11N	1769	1542	-227	-12.8%	Pass
11S	1679	1500	-179	-10.7%	Pass
15E	937	966	29	3.1%	Pass
15W	964	1010	47	4.8%	Pass
16E	662	508	-155	-23.4%	Fail
16W	565	480	-85	-15.1%	Fail
17N	657	683	26	4.0%	Pass
17S	668	656	-12	-1.8%	Pass
23S	945	997	52	5.5%	Pass
23N	961	1051	90	9.3%	Pass

Table 10: PM Peak Journey Time Validation

Route	Observed Time (sec)	Modelled Time (sec)	Diff	% Diff	Pass/Fail
8E	791	828	37	4.7%	Pass
8W	782	782	0	0.0%	Pass
9S	952	910	-41	-4.3%	Pass
9N	979	903	-77	-7.8%	Pass
11N	1809	1722	-88	-4.8%	Pass
11S	1652	1597	-55	-3.3%	Pass
15E	994	965	-29	-2.9%	Pass
15W	1176	1224	49	4.1%	Pass
16E	689	524	-165	-24.0%	Fail
16W	581	489	-92	-15.9%	Fail
17N	750	722	-28	-3.8%	Pass
17S	774	756	-18	-2.3%	Pass
23S	962	1044	83	8.6%	Pass
23N	1120	1175	55	4.9%	Pass

Assignment Convergence

7.9 Table 11 displays the convergence statistics for the base model assignments. The model converges following four consecutive iterations where at least 99% of links have a flow change of less than 1%. This exceeds the standards set out in WebTAG. Values of Delta, %GAP and percentage of links with change in delay less than 1% have also been reported giving further evidence that the model is well converged in each time period.

Table 11: Assignment Convergence Statistics

Time Period	Number of Iterations	Delta	%GAP	% of Links with Flow Change <1%	% of Links with Delay Change <1%
AM	23	0.0036%	0.0034	99.2	99.4
IP	15	0.0010%	0.0015	99.1	99.8
PM	28	0.0009%	0.0011	99.3	99.3

8 Summary of Model Development, Standards Achieved and Fitness for Purpose

8 Summary of Model Development, Standards Achieved and Fitness for Purpose

8.1 The aim of the base highway model improvements was to enhance model performance in the Dunstable and Houghton Regis areas in order to provide a robust starting point for forecasting and the assessment of the Houghton Regis development and Woodside Connection.

8.2 Recalibration of the model has resulted in good model performance for traffic crossing the Dunstable RSI cordon and also for traffic crossing the screenlines internal to this. This generates confidence in the model's ability to correctly model traffic in and out of the Dunstable and Houghton Regis areas, and especially to and from M1 Junctions 11 and 12. The calibration standards have been met both at a total traffic level and when looking at light and heavy vehicles separately.

8.3 The standards achieved in model calibration are supported by the level of model validation. Link flow validation on the M1 slip roads, turning flows validation at key junctions in the Dunstable and Houghton Regis area and the validation of journey times on the routes passing through the area all indicate that the model replicates base year conditions well.

8.4 The primary impact of the two schemes is expected to be on traffic in and out of the Dunstable and Houghton Regis areas, and between the M1 and this area. As a result of the work undertaken to recalibrate and revalidate the model, the model is considered suitable to use in assessing the proposed development and network change in Dunstable and Houghton Regis.

9 Modelling Specification

9 Modelling Specification

Overview

9.1 The Central Bedfordshire and Luton Transport Model (CBLTM) has been used to produce outputs to assist with the assessment of the Woodside Connection (WSC) and the Houghton Regis Development (HRD). Further information about the proposals for WSC and HRD are provided below and along with details of the agreed forecast years and tine periods and the test definitions.

Woodside Connection (WSC)

Scheme Description

9.2 The Woodside Connection provides a more direct route for traffic between the primary road network (the M1 motorway and the A5) and the Woodside area of Dunstable / Houghton Regis, which is a major employment area. The scheme is being promoted by Central Bedfordshire Council, in conjunction with Luton Borough Council.

9.3 The scheme would provide a new highway link between the proposed M1 Junction 11A and Poynters Road/Porz Avenue/Park Road North roundabout, which would reduce the need for Heavy Goods Vehicles to use the congested A5 and A505 routes through Dunstable town centre. In conjunction with the Woodside Connection scheme, it is proposed to introduce an HGV ban and impose a 20mph speed limit on Poynters Road.

9.4 The proposed route of the Woodside Connection is shown in Figure 3.1 below.

Model Application

9.5 The forecast year model runs are being used to input to the application for the Woodside Connection. Specifically, the model outputs are expected to be used to inform the following technical studies:

- Transport Assessment
- Environmental Impact Assessments (Noise and Air Quality)
- WSC scheme design

Houghton Regis Development (HRD)

Development Description

9.6 The Houghton Regis Development is a major urban extension on land to the north of Houghton Regis, between the A5120 and M1. A consortium of developers is working together to promote their combined land interest of some 391 hectares for a new residential and employment uses, local centres, community infrastructure and facilities.

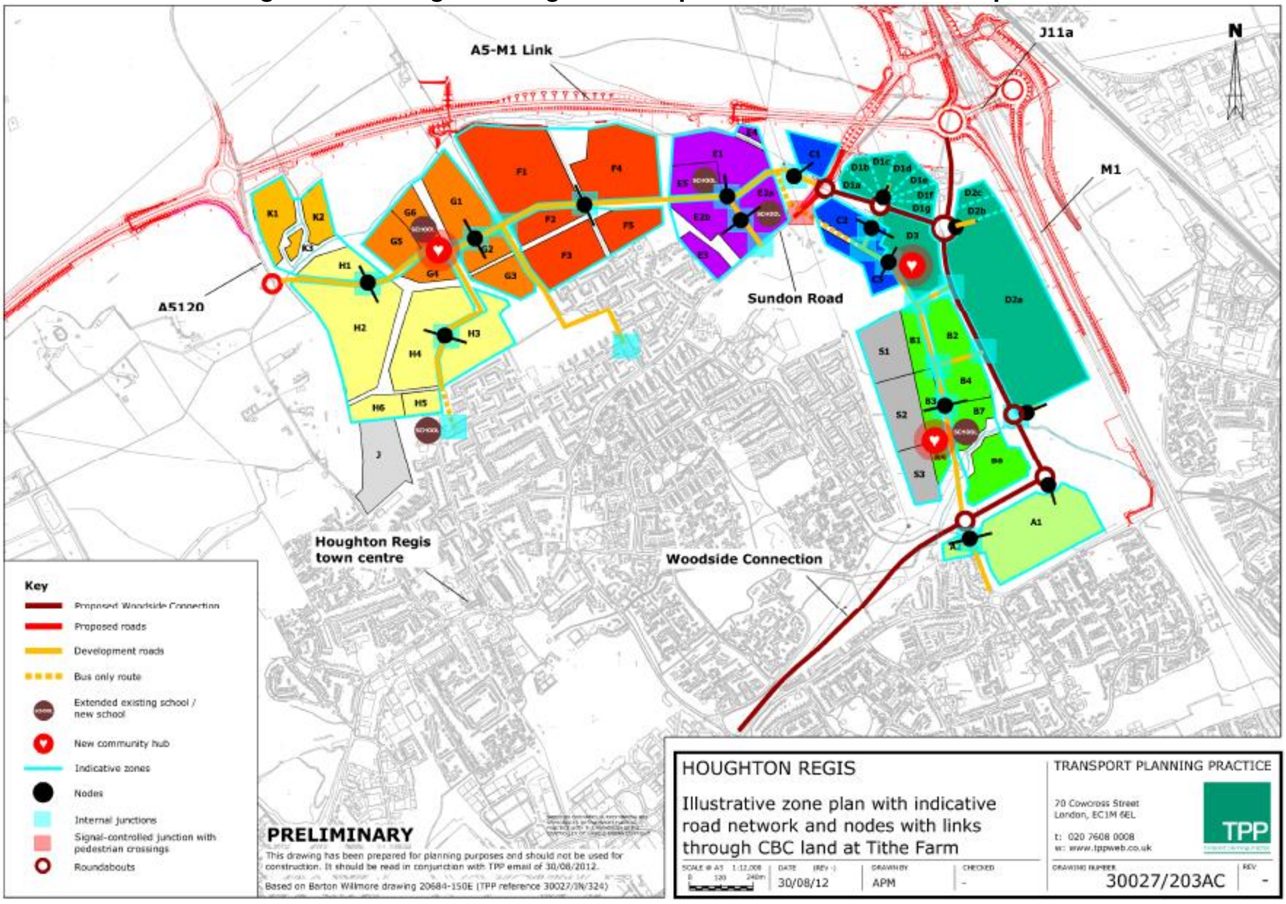
9.7 The land has been highlighted within the area of search for growth under the Milton Keynes Sub Regional Strategy for the Luton/Dunstable/Houghton Regis – Leighton Linslade Growth Area and has achieved a site specific allocation in the draft Core Strategy for around 5000 new houses and major employment development.

9.8 The consortium is working in conjunction with the local and central government to provide supporting technical information for a planning application, which is expected to be submitted in late 2012.

9.9 The illustrative masterplan for the Houghton Regis Development is shown in Figure 3.1.

Capabilities on project:
Transportation

Figure 3.1: Houghton Regis Development Illustrative Masterplan



Model Application

9.10 The forecast year model runs are being used to input to a planning application for the Houghton Regis Development. Specifically, the model outputs are expected to be used to inform the following technical studies:

- Transport Assessment
- Environmental Impact Assessments (Noise and Air Quality)
- HRD scheme design

Forecast Years and Time Periods

9.11 The designated forecast year for both the HRD and WSC schemes is 2031. For all tests, model runs have been completed for the AM peak, interpeak and PM peak hours.

10 2031 Trip Matrix Development

10 2031 Trip Matrix Development

Background Traffic Growth

Committed and Proposed Development

10.1 There are a number of potential urban extension developments in Central Bedfordshire and Luton that may come forward by 2031. However, given the uncertainty regarding these developments, it has been agreed with CBC that the growth associated with these developments would not be included in the current set of model runs.

Growth in Central Bedfordshire and Luton

10.2 The planning data totals used to calculate growth in Central Bedfordshire and Luton between 2009 and the forecast year of 2031 have been constrained to TEMPRO v6.2 at a National Trip End Model (NTEM) zoning level. It is assumed that the Houghton Regis Development growth is included within TEMPRO forecasts, therefore the 2031 without HRD tests have been constrained to TEMPRO minus the business case HRD development.

10.3 This planning data has been disaggregated to CBLTM zoning using planning data assumptions which are consistent with those made for the CBC Development Plan Consultation work undertaken by AECOM in May 2012. Consequently, as agreed with CBC, there are a number of potential urban extension developments in Central Bedfordshire and Luton that may come forward by 2031 but are not represented when disaggregating growth within the model.

10.4 LGV and OGV growth within CBLTM is forecast in-line with outputs from the DfT's National Transport Model (NTM) Regional Traffic Forecasts 2011 (RTF11).

10.5 Table 5.1 shows TEMPRO growth in Employment, Households and Population from 2009 to 2031 for the districts in the Central Bedfordshire and Luton area.

Table 5.1: TEMPRO v6.2 Growth in Central Bedfordshire and Luton

District	Employment Growth	Household Growth	Population Growth
	2009 to 2031	2009 to 2031	2009 to 2031
Luton	11535	10210	23164
Mid Bedfordshire	3114	10673	23380
Bedford	4721	24595	42407
South Bedfordshire	1254	24269	41291

Growth outside Central Bedfordshire and Luton

10.6 Growth outside Central Bedfordshire and Luton has been included in all tests in line with latest TEMPRO forecasts.

10.7 LGV and OGV growth within Central Bedfordshire and Luton is matched to RTF11 forecasts for the East of England Region. Intermediate year growth not specified within RTF11 outputs has been calculated through interpolation.

Treatment of Houghton Regis Development Growth

10.8 As described above, it is assumed that the HRD growth is included in the TEMPRO planning data and therefore has been removed from the planning data in tests without HRD. For tests with HRD, the development growth is applied to the Trip End Model. This ensures that the demand model takes into account the redistribution effects and other impacts that the additional development growth is likely to have.

10.9 Detailed trip generation and distribution information has been provided by TPP for use in modelling HRD. As a result, the trips represented by the HRD zones in the final highway assignment model matrices have been replaced with bespoke trip ends and distributions with the revised trip matrices re-run though the highway assignment model. The derivation of the bespoke HRD demand is described in detail below.

Houghton Regis Development Trip Generation and Distribution

Trip Generation

10.10 Vehicle trip generation forecasts have been provided for the Houghton Regis Development for application in the forecasting model. Forecasts have been provided for the following development scenarios:

- Business Case (2031 Test 4)

10.11 Table 5.2 summarises the proposed quantum of residential and commercial development in Test 4. along with the number of primary and secondary school places proposed to support the development. Table 5.3 summarises the associated estimates of households, population and employment that have been applied in the planning data.

Table 5.2: HRD Development Scenarios: Proposed Quantum of Development[1]

Scenario	Description	Residential Units (no.)	Commercial Floorspace (sqm)	School Places (pupils)
Test 4	Business Case	5,150	133,500	3,360

Table 5.3: HRD Development Scenarios: Planning Data Assumptions

Scenario	Description	Households	Population	Employment
Test 4	Business Case	5,150	12,959	2,648

10.12 The estimate of the number of car, LGV and OGV trips have been provided by development zone in the AM peak, inter-peak and PM peak hours.

Table 5.5: Comparison of HRD Traffic Generation Scenarios (Vehicles)[2]

Scenario	Description	AM Peak Hour		Interpeak Hour		PM Peak Hour	
		In	Out	In	Out	In	Out
Test 4	Business Case	2,672	3,443	2,410	2,436	2,618	2,549

10.13 The traffic forecasts have been converted into passenger car units (PCUs) for application in the model with cars and LGVs equivalent to 1 PCU and HGVs equivalent to 2 PCUs.

[1] Source: TPP
[2] Source: TPP

Trip Distribution

10.14 A range of information has been provided regarding the assumed distribution of trips generated by HRD, with different trip distributions applied to the following land uses within the development:

- Retail
- Primary Schools
- Secondary School
- Employment
- Leisure
- Residential

10.15 For transparency, a simple approach to trip distribution has been adopted. While this approach is expected to give a reasonably representative trip length distributions for HRD as a whole, there is a risk that trip lengths may be under or overstated for specific land uses and/or trip purposes. The process used to determine trip distribution for each land use is explained in more detail below.

10.16 The distribution of employment and leisure trips is based on trip length distributions extracted from the 2001 Census for Houghton Regis. Journey to Work origin/destination data has been analysed to determine the distribution of car trips attracted to and produced by Houghton Regis[3] by trip length. The resultant trip length distribution profiles are summarised in Table 5.7 below.

Table 5.7: Trip Length Distribution, Houghton Regis[4]

Distance	Attraction	Production	Average
0-2km	23%	22%	22%
2-4km	14%	24%	21%
4-6km	9%	3%	4%
6-8km	5%	1%	2%
8-10km	8%	12%	11%
10-15km	8%	13%	12%
15-20km	4%	8%	7%
20-25km	6%	4%	4%
25-30km	3%	5%	4%
30-35km	3%	4%	3%
35-40km	1%	0%	1%
40-45km	1%	0%	1%
45-50km	1%	2%	2%
50-60km	1%	1%	1%
60+ km	14%	2%	5%

[3] The trip length distributions for Houghton Regis are derived by aggregating Journey to Work data for the Houghton Hall, Tithe Farm and Parkside wards (Population: 16,970)
[4] Source: 2001 Census Journey to Work data

10.17 The ‘attraction’ trip length distribution has been applied to the AM inbound and PM outbound movements, while the ‘production’ trip length distribution has been applied to the AM outbound and PM inbound movements. The ‘average’ trip length distribution is applied to all movements in the inter-peak hour.

10.18 In order to determine the final distribution of trips, each model zone has been mapped to a distance band according to the coordinates of the zone centroid. The distribution of car trips between the CBLTM zones within each band is weighted according to the zone population divided by the crow fly distance from the relevant development zone. The distribution of LGV and HGV trips between the model zones in each distance band is weighted according to the number of jobs in that zone divided by the crow fly distance.[5]

[5] The use of commuting trip length distribution to estimate LGV and HGV trip distributions is likely to understate the average trip length of LGV and HGV trips and therefore overstate the impact of these vehicles on the local road network. For this reason the assessment on the local road network may be considered robust.

10.19 The distribution of vehicle trips from residential land uses is also based on trip length distributions extracted from the 2001 Census for Houghton Regis.[6] However, an adjustment has been made to reflect that a proportion of short distance trips generated by other land uses within HRD (retail, schools, employment, leisure) will be internal trips produced by the residential land uses with the development.[7]

10.20 These short distance trips must be removed from the residential trip generation to avoid double counting. The trip length distribution for residential trips has therefore been adjusted to reduce the proportion of short distance trips. The revised trip length distributions are summarised in Table 5.8.

Table 5.8: Residential Trip Length Distributions

Distance	Attraction	Production	Average
0-2km	10%	14%	13%
2-4km	6%	15%	12%
4-6km	12%	3%	6%
6-8km	7%	2%	3%
8-10km	10%	16%	14%
10-15km	10%	17%	15%
15-20km	5%	10%	9%
20-25km	8%	5%	6%
25-30km	3%	7%	6%
30-35km	3%	5%	5%
35-40km	2%	1%	1%
40-45km	2%	1%	1%
45-50km	2%	3%	2%
50-60km	2%	1%	1%
60+ km	18%	2%	6%

10.21 As for employment and leisure trips, the 'attraction' trip length distribution has been applied to the AM inbound and PM outbound movements, while the 'production' trip length distribution has been applied to the AM outbound and PM inbound movements. The 'average' trip length distribution is applied to all movements in the inter-peak hour.

10.22 In order to determine the final distribution of trips, each CBLTM zone has been mapped to a distance band according to the coordinates of the zone centroid. The distribution of car, LGV and HGV trips between the CBLTM zones in each distance band is weighted according to the number of jobs in that zone divided by the crow fly distance from the relevant development zone.

[6] The majority of car trips generated by residential land uses in the morning and evening peak hours are commuting related therefore it is reasonable to apply trip length distributions derived from 2001 Census JTW data to determine the distribution residential trips in these time periods. The use of commuting trip length distributions in the interpeak period will tend to overstate car trip lengths and therefore represents a robust assessment of likely development impacts.

[7] Analysis of the trip ends generated by the other land uses suggests that approximately one quarter of all vehicle trips from the residential land uses will be internal to HRD.

Trip Purpose

10.23 Car trips have been disaggregated in to trip purposes (car commuting, car business, car other) using TEMPRO data for the Dunstable NTEM zone. Table 5.9 summarises the assumed split by direction.

Table 5.9: Car Trip Purpose

Trip Purpose	AM Peak		Interpeak		PM Peak	
	Origin	Dest.	Origin	Dest.	Origin	Dest.
Car (Commuting)	65%	62%	23%	25%	50%	54%
Car (Business)	6%	7%	5%	5%	7%	7%
Car (Other)	28%	31%	71%	70%	43%	39%

11 Without Scheme Modelling Results

Capabilities on project:
Transportation

11 Without Scheme Modelling Results

11.1 Without Scheme modelling refers to model runs that do not include WSC or HRD. 2031 Without scheme model analysis has been carried out for the 'reference' scenario that excludes the A5-M1 Link road and for the proxy 2031 'Do Minimum' scenario that includes the A5-M1 Link road. In practice the Do Minimum scenario would also include the Houghton Regis Development but this scenario was not available.

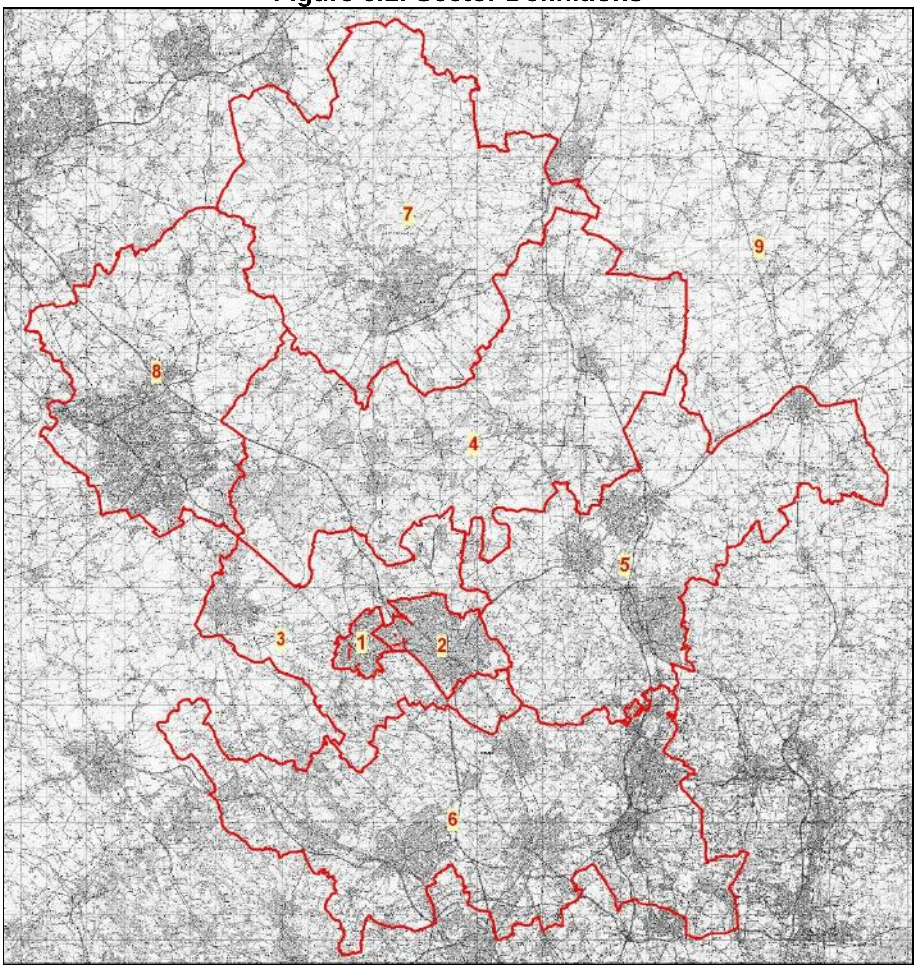
11.2 For each test a comparable test has been identified in order to illustrate the impact of various demand and/or network interventions. The model analysis for each test comprises

- Matrix change at a sector level
- Flow difference plots

11.3 Overall network statistics for the model simulation area and a comparison of forecast traffic flows on key links are presented at the end of the section.

11.4 Figure 6.1 shows the sector definitions that have been used.

Figure 6.1: Sector Definitions



2031 Reference Case

11.5 The 2009 base year model has been selected as the most suitable comparable test for the 2031 Reference Case. Table 6.6 summarises the changes in demand and infrastructure between the two tests.

Table 6.6: Comparison of 2009 Base and 2031 Reference Case Test Definitions

Test	Traffic Demand						Highway Infrastructure						
	Base 2009	Background growth (NTEM/TEMPRO)	Committed and proposed development	Early release sites at Kestrel Way (A1) and East Bidwell (H2)	Distribution centre adjacent to M1	Full HRDC development	Committed and proposed infrastructure	A5 - M1 link	Woodside Connection (WSC)	Poynters Road Scheme	Connection to WSC from Parkside Drive	Connection to WSC from Pastures Way	HRDC development access over CBC land
2009 Base	✓												
2031 Ref Case	✓	✓	✓				✓						

Matrix Change

11.6 The highway assignment matrix change from 2009 Base to 2031 Reference Case is shown in Table 6.7 below for AM Peak, Inter-peak and PM Peak. The slight reduction in demand internal to Dunstable and Houghton Regis is related to the fact that the Houghton Regis Development growth has been removed from the TEMPRO planning data forecasts in the 2031 Reference Case.

Table 6.7: Highway Assignment Matrix Change from 2009 Base to 2031 Reference Case (AM, IP, PM)

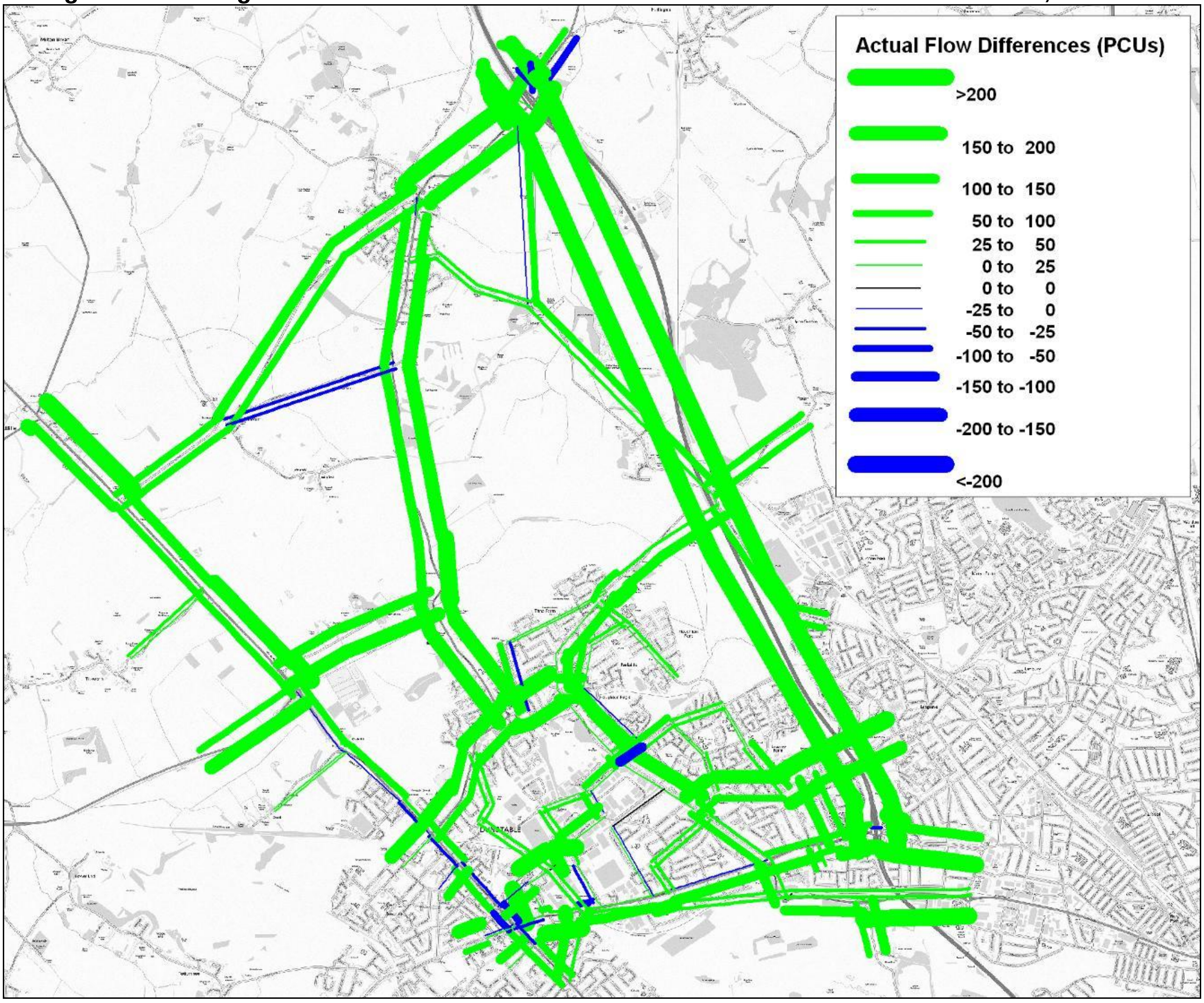
Sector			1	2	3	4	5	6	7	8	9	Tot
1	**Dunstable & Houghton Regis**	AM	-2%	9%	6%	-3%	15%	13%	3%	15%	19%	**6%**
		IP	6%	24%	24%	21%	18%	34%	41%	30%	33%	**20%**
		PM	-2%	15%	27%	27%	24%	32%	63%	46%	25%	**17%**
2	**Luton**	AM	14%	20%	27%	14%	14%	26%	30%	26%	26%	**20%**
		IP	24%	32%	43%	27%	44%	40%	36%	39%	33%	**33%**
		PM	15%	22%	42%	40%	32%	21%	45%	38%	32%	**25%**
3	**South Beds**	AM	34%	50%	19%	33%	39%	47%	43%	45%	42%	**33%**
		IP	38%	57%	27%	38%	50%	60%	55%	53%	42%	**38%**
		PM	11%	33%	20%	22%	39%	35%	57%	30%	27%	**24%**
4	**Mid Beds**	AM	6%	30%	27%	7%	17%	23%	28%	22%	33%	**17%**
		IP	29%	45%	36%	19%	41%	40%	41%	36%	37%	**28%**
		PM	13%	34%	36%	9%	25%	28%	37%	31%	28%	**18%**
5	**North Herts**	AM	19%	30%	45%	25%	20%	24%	18%	31%	37%	**23%**
		IP	23%	53%	47%	36%	30%	34%	31%	46%	40%	**33%**
		PM	24%	14%	35%	15%	19%	15%	23%	32%	20%	**19%**
6	**South Herts**	AM	14%	24%	25%	21%	19%	11%	26%	17%	28%	**16%**
		IP	29%	33%	46%	44%	30%	23%	50%	39%	40%	**28%**
		PM	23%	23%	59%	33%	24%	12%	72%	45%	33%	**19%**
7	**Bedford**	AM	51%	56%	50%	43%	31%	50%	19%	51%	44%	**25%**
		IP	60%	70%	60%	47%	44%	56%	25%	54%	45%	**32%**
		PM	11%	29%	55%	34%	19%	34%	19%	46%	21%	**21%**
8	**Milton Keynes**	AM	47%	56%	31%	33%	46%	45%	50%	24%	48%	**28%**
		IP	53%	64%	54%	43%	49%	43%	58%	34%	48%	**38%**
		PM	26%	36%	58%	30%	27%	17%	51%	26%	31%	**29%**
9	**External**	AM	26%	31%	28%	29%	24%	31%	22%	29%	18%	**19%**
		IP	38%	36%	42%	36%	37%	40%	41%	44%	25%	**28%**
		PM	22%	26%	43%	34%	32%	29%	48%	46%	18%	**21%**
Total		AM	**14%**	**23%**	**22%**	**16%**	**20%**	**17%**	**21%**	**26%**	**20%**	**21%**
		IP	**23%**	**35%**	**34%**	**28%**	**33%**	**29%**	**30%**	**37%**	**28%**	**30%**
		PM	**12%**	**23%**	**35%**	**19%**	**23%**	**17%**	**26%**	**30%**	**20%**	**21%**

Capabilities on project:
Transportation

Flow Changes

11.7 Figure 6.4 shows changes in forecast traffic flows from 2009 Base to 2031 Reference Case in the AM Peak.

Figure 6.4: Change in Forecast Traffic Flows from 2009 Base to 2031 Reference Case, AM Peak



11.8 The difference plot indicates general growth across the model area as would be expected.

2031 Test 1

11.9 The 2031 Reference Case is considered the most suitable test to use as a comparison for 2031 Test 1. The change between these two tests is the introduction of the A5-M1 Link.

Table 6.8: Comparison of 2031 Reference Case and 2031 Test 1 Test Definitions

Test	Traffic Demand						Highway Infrastructure						
	Base 2009	Background growth (NTEM/TEMPRO)	Committed and proposed development	Early release sites at Kestrel Way (A1) and East Bidwell (H2)	Distribution centre adjacent to M1	Full HRDC development	Committed and proposed infrastructure	A5 - M1 link	Woodside Connection (WSC)	Poynters Road Scheme	Connection to WSC from Parkside Drive	Connection to WSC from Pastures Way	HRDC development access over CBC land
2031 Ref Case	✓	✓	✓				✓						
2031 Test 1	✓	✓	✓				✓	✓					

Matrix Change

11.10 The highway assignment matrix change from 2031 Reference Case to 2031 Test 1 is shown in Table 6.9 below for AM Peak, Inter-peak and PM Peak.

Table 6.9: Highway Assignment Matrix Change from 2031 Reference Case to 2031 Test 1 (AM, IP, PM)

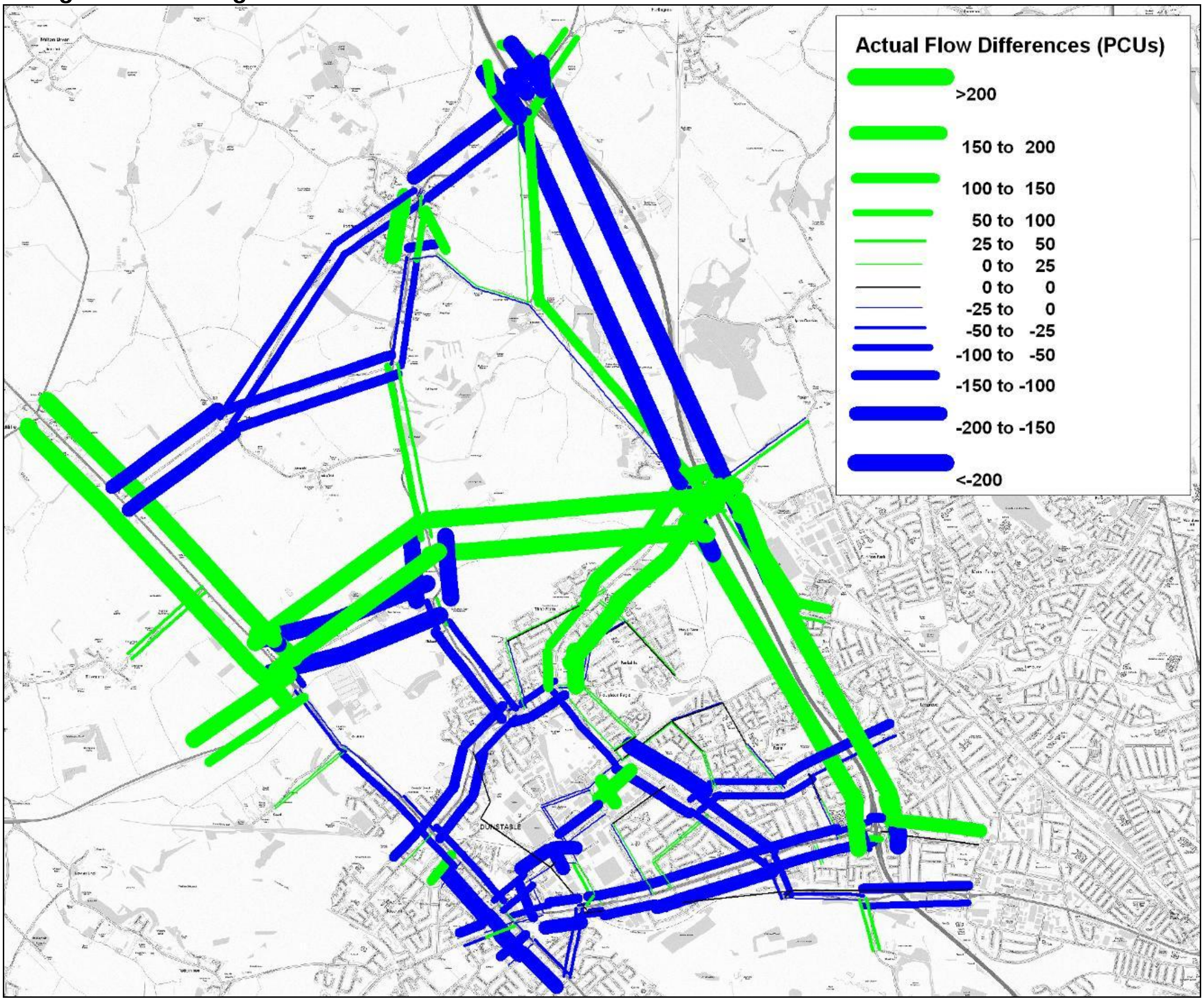
Sector			1	2	3	4	5	6	7	8	9	Tot
1	**Dunstable & Houghton Regis**	AM	-1%	1%	0%	3%	2%	1%	4%	-3%	0%	**0%**
		IP	-1%	2%	2%	3%	2%	2%	0%	-2%	1%	**1%**
		PM	-2%	3%	1%	4%	6%	2%	1%	-3%	1%	**1%**
2	**Luton**	AM	2%	0%	2%	0%	0%	-1%	0%	3%	-1%	**0%**
		IP	3%	-1%	5%	0%	0%	-1%	0%	5%	0%	**0%**
		PM	3%	0%	6%	-1%	0%	0%	0%	4%	2%	**0%**
3	**South Beds**	AM	2%	5%	-1%	-1%	1%	1%	0%	-2%	0%	**0%**
		IP	1%	5%	-1%	-1%	1%	1%	-1%	-2%	0%	**0%**
		PM	2%	3%	-1%	0%	1%	1%	1%	-2%	1%	**0%**
4	**Mid Beds**	AM	4%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
		IP	3%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
		PM	6%	1%	0%	0%	0%	0%	0%	1%	0%	**0%**
5	**North Herts**	AM	6%	0%	0%	0%	0%	0%	0%	1%	0%	**0%**
		IP	3%	0%	1%	0%	0%	0%	0%	0%	0%	**0%**
		PM	1%	0%	0%	0%	0%	0%	0%	1%	0%	**0%**
6	**South Herts**	AM	4%	0%	0%	0%	0%	0%	0%	2%	0%	**0%**
		IP	3%	-1%	1%	0%	0%	0%	0%	2%	0%	**0%**
		PM	1%	0%	1%	0%	0%	0%	-1%	1%	0%	**0%**
7	**Bedford**	AM	4%	0%	0%	0%	0%	0%	0%	1%	0%	**0%**
		IP	1%	0%	-1%	0%	0%	0%	0%	0%	0%	**0%**
		PM	4%	0%	0%	0%	0%	0%	0%	2%	0%	**0%**
8	**Milton Keynes**	AM	1%	6%	-1%	0%	0%	1%	1%	0%	0%	**0%**
		IP	-2%	7%	-2%	0%	1%	2%	1%	0%	0%	**0%**
		PM	-2%	5%	-2%	0%	1%	4%	1%	0%	0%	**0%**
9	**External**	AM	2%	1%	0%	0%	0%	0%	0%	0%	0%	**0%**
		IP	1%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
		PM	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Total		AM	**1%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	0%
		IP	**1%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	0%
		PM	**1%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	0%

Capabilities on project:
Transportation

Flow Changes

11.11 Figure 6.5 shows the change in forecast traffic flows from 2031 Reference Case to 2031 Test 1 in the AM Peak.

Figure 6.5: Change in Forecast Traffic Flows from 2031 Reference Case to 2031 Test 1 AM Peak



11.12 The difference plot indicates that the introduction of the A5-M1 Link has a number of impacts. Traffic flow increases on the M1 south of J11A due to the increased capacity provided by the new link. Traffic is reduced north of J11A and increased on the A5 north of Dunstable due to traffic between Milton Keynes and the south choosing to use the A5 rather than the M1 for access to and from Milton Keynes. There is also a reduction in traffic through the centre of Dunstable and Houghton Regis brought about by the new link.

Network Statistics

11.13 Table 6.10 shows assignment model network statistics from the 2009 Base and without scheme tests. The average speed is indicative of the impact of demand and network changes in each test, but should not be used directly when assessing forecast year traffic conditions.

11.14 The average speeds show that the traffic growth in 2016 and 2031 reduces the average speed but this improves with the introduction of the A5-M1 link.

Table 6.10: Without Scheme Network Statistics[8]

		2009 Base	**2031 Ref Case**	**2031 Test 1**
AM	Total pcu kms	*1,534,500*	2,000,400	2,012,700
	Total pcu hrs	*20,750*	29,650	29,700
	Avg speed (km/h)	*74.0*	67.5	67.8
IP	Total pcu kms	*1,177,700*	1,621,600	1,632,700
	Total pcu hrs	*14,000*	20,600	20,700
	Avg speed (km/h)	*84.1*	78.7	78.9
PM	Total pcu kms	*1,580,900*	2,030,200	2,043,000
	Total pcu hrs	*21,450*	30,000	30,100
	Avg speed (km/h)	*73.7*	67.7	67.9

[8] Network statistics are based on the simulation network only. Total pcu kilometres is rounded to the nearest 100; Total pcu hours is rounded to the nearest 50; Average speed is rounded to 1d.p.

12 With Woodside Connection and HRD Modelling Results

12 With Woodside Connection and HRD Modelling Results

12.1 This section of the report summarises the results of the model runs that have been undertaken to assess the impact of the Houghton Regis Development, or the 'Do Something' scenario. This is referred to as Test 4 and is as 2031 Test 1 but also includes the Woodside Connection and the Houghton Regis Developments. As previously discussed the fact that the 'Do Minimum' scenario does not include the Houghton Regis Developments does mean that a comparison of the two scenarios will result in an understatement of the benefits of Woodside Connection. To assist in understanding the impacts of the trips relating to HRD a comparison has been undertaken against Test 8 which has the Woodside Connection but excludes HRD.

12.2 For each test a comparable test has been identified in order to illustrate the impact of various demand and/or network interventions. The model analysis for each test comprises

- Matrix change at a sector level
- Flow difference plots

12.3 Overall network statistics for the model simulation area and a comparison of forecast traffic flows on key links are presented at the end of the section.

Matrix Change

12.4 The highway assignment matrix change from 2031 Test 8 to 2031 Test 4 is shown in Table 8.7 below for the AM Peak, Inter-peak and PM Peak.

Flow Changes

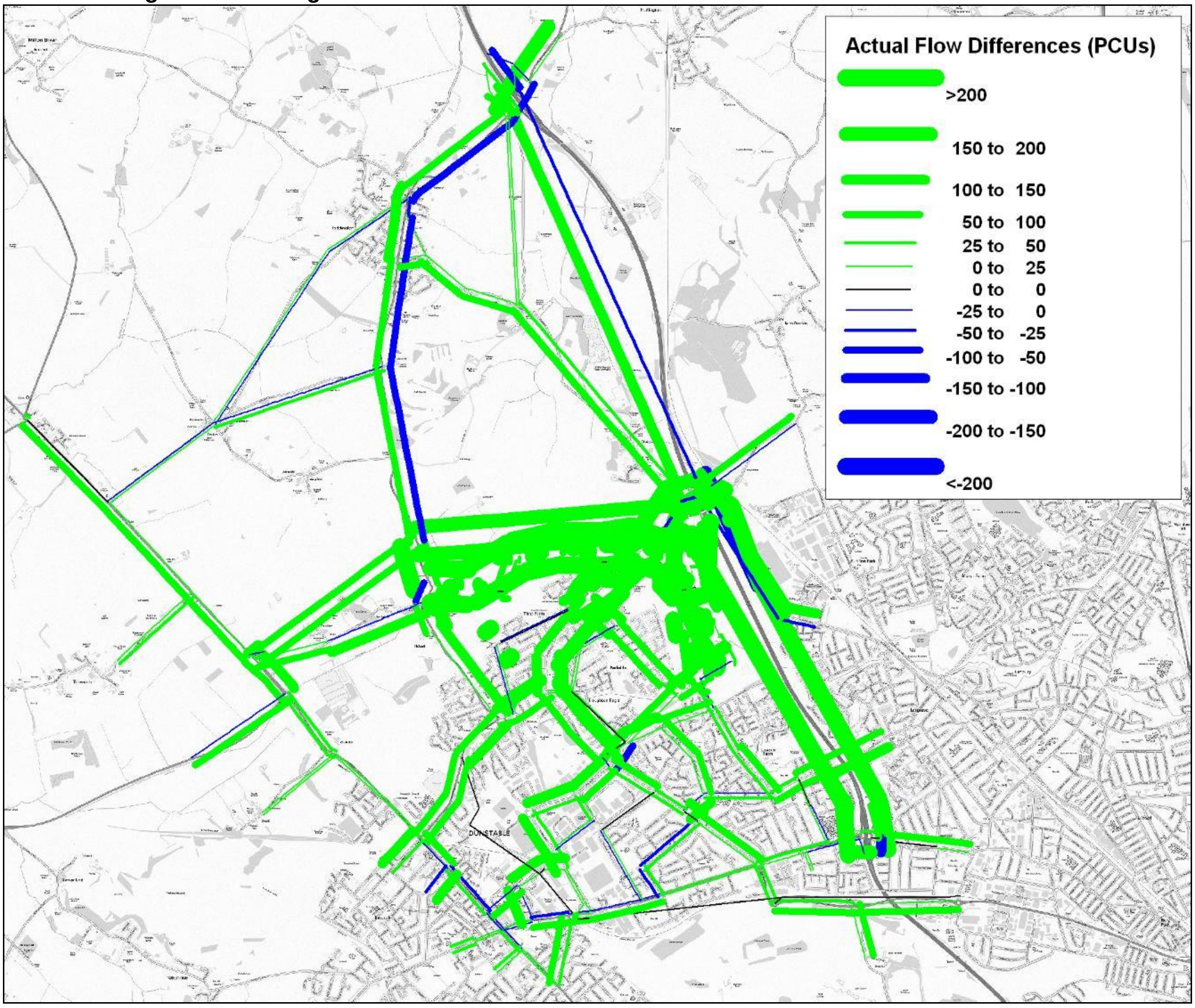
12.5 Figure 8.3 shows the change in forecast traffic flows from 2031 Test 8 to 2031 Test 4 in the AM Peak.

12.6 The difference plot indicates how the introduction of the Houghton Regis Development increases traffic on local roads as well as on strategic routes such as the M1 and A5-M1 link.

Table 8.7: Highway Assignment Matrix Change from 2031 Test 8 to 2031 Test 4 (AM, IP, PM)

Sector			1	2	3	4	5	6	7	8	9	Tot
1	Dunstable & Houghton Regis	AM	104%	23%	23%	122%	114%	34%	43%	30%	39%	**51%**
		IP	72%	23%	25%	96%	65%	20%	27%	17%	26%	**39%**
		PM	81%	25%	21%	62%	48%	11%	13%	9%	36%	**39%**
2	Luton	AM	17%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
		IP	21%	0%	0%	0%,	0%	0%	0%	0%	0%	**2%**
		PM	17%	0%	0%	0%	0%	0%	0%	0%	0%	**2%**
3	South Beds	AM	17%	0%	0%	1%	0%	1%	1%	0%	0%	**1%**
		IP	24%	0%	0%	0%,	0%,	1%	0%,	0%	0%,	**2%**
		PM	22%	0%	0%	-1%	-1%	0%	-2%	0%	-1%	**2%**
4	Mid Beds	AM	24%	0%	-1%	0%	0%	0%	0%	0%	0%	**1%**
		IP	77%	0%,	0%	0%,	0%	0%	0%	0%	0%	**1%**
		PM	58%	-1%	0%	0%	0%	0%	0%	0%	0%	**1%**
5	North Herts	AM	34%	0%	-1%	0%	0%	0%	0%	0%	0%	**0%**
		IP	47%	0%	0%	0%,	0%	0%	0%	0%,	0%	**0%**
		PM	73%	0%	0%	0%	0%	0%	0%	-1%	0%	**0%**
6	South Herts	AM	16%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
		IP	25%	0%	0%	0%,	0%	0%	0%,	0%,	0%	**0%**
		PM	16%	0%	0%	0%	0%	0%	-1%	-1%	0%	**0%**
7	Bedford	AM	8%	0%	-1%	0%	0%	-1%	0%	0%	0%	**0%**
		IP	30%	0%	0%	0%,	0%	0%	0%	0%	0%	**0%**
		PM	27%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
8	Milton Keynes	AM	7%	0%,	0%	0%	0%	0%	0%	0%	0%	**0%**
		IP	15%	-1%	0%	0%,	0%	0%	0%	0%	0%	**0%**
		PM	15%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
9	External	AM	27%	0%	-1%	0%	0%	0%	0%	0%	0%	**0%**
		IP	30%	0%	0%	0%,	0%	0%	0%	0%	0%	**0%**
		PM	23%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Total		AM	**42%**	**2%**	**2%**	**1%**	**0%**	**0%**	**0%**	**0%**	**0%**	**1%**
		IP	**39%**	**2%**	**2%**	**1%,**	**0%**	**0%**	**0%**	**0%**	**0%**	**1%**
		PM	**34%**	**2%**	**2%**	**1%**	**0%**	**0%**	**0%**	**0%**	**0%**	**1%**

Figure 8.3: Change in Forecast Traffic Flows from 2031 Test 8 to 2031 Test 4 AM Peak



Network Statistics

12.7 Table 8.8 shows assignment model network statistics from the with Houghton Regis Development tests. The average speed is indicative of the impact of demand and network changes in each test, but should not be used in isolation when assessing forecast year traffic conditions.

Table 8.8: With HRD Network Statistics[9]

		2031 Test 8	**2031 Test 4**
AM	Total pcu kms	*2,015,900*	2,041,600
	Total pcu hrs	*29,750*	30,500
	Avg speed (km/h)	*67.8*	66.9
IP	Total pcu kms	*1,635,900*	1,665,400
	Total pcu hrs	*20,700*	21,300
	Avg speed (km/h)	*79.0*	78.2
PM	Total pcu kms	*2,045,300*	2,077,000
	Total pcu hrs	*30,150*	31,000
	Avg speed (km/h)	*67.8*	67.0

[9] Network statistics are based on the simulation network only. Total pcu kilometres is rounded to the nearest 100; Total pcu hours is rounded to the nearest 50; Average speed is rounded to 1d.p.

13 Conclusions

13 Conclusions

13.1 This report has detailed the work undertaken in developing the CBLTM for the purposes of assessing development and associated infrastructure in the Houghton Regis area. There are supported proposals for a considerable amount of development in the Houghton Regis area. As part of these proposals new highway infrastructure is also proposed, including the A5-M1 Link road and local access roads.

13.2 A key link within these infrastructure proposals is the Woodside Connection. This will provide access to new employment, housing areas, and retail and educational facilities. It will help drive economic growth by providing good direct access to the Strategic Road Network. It will also provide improved access for commercial vehicles to existing employment within Dunstable and relieve existing residential routes.

13.3 The traffic modelling has demonstrated that the Woodside Connection will be an attractive route carrying substantial volumes of traffic of up to 1870 vehicles in the peak hour in one direction and between 3200 and 3400 two-way.

13.4 As has been noted within the report the assessment of Woodside Connection and particularly its benefits has been constrained due to the non-availability of an appropriate ‘Do Minimum’ scenario and hence the outcomes reported in the Pinch Point Funding application pro-forma are provisional data. The benefits of the scheme are masked in the output data due to HRD trips being in the DS but not DM scenarios. This is further exacerbated as although demand is constrained to TEMPRO the HRD has been specifically calculated externally to the demand model and this generally results in higher trip making than the demand model produces for the equivalent quantum of housing and jobs.

13.5 It is recommended that an appropriate Do Minimum scenario is modelled that includes the Houghton Regis development but excluding the Woodside Connection.