Hemel Hempstead Urban Transport Model

LDF Option: Western Hemel

Report

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TABLES

1 Introduction

1.1 This study was commissioned to investigate the potential impact on the road network of the Western Hemel spatial option from the Local Development Framework.

1.2 The Western Hemel spatial option comprises two sites:

- Site A: Marchmont Farm. 380 dwellings built by 2021.
- Site B: Western Hemel. 450 dwellings by 2021, 900 dwellings by 2031.

1.3 No detailed design work exists for either site, and access arrangements are not confirmed. However it is likely that access to Site B will be from The Avenue and Long Chaulden.

1.4 This note details the 2021 and 2031 future year scheme models and test procedures used to test the impact of the Western Hemel spatial option. The 2021 and 2031 Do Minimum PARAMICS models are used as the basis for the modelling work, and also as the baseline against which the impact of the scheme models are tested, in terms of overall network behaviour and journey times.

1.5 The remainder of the note is structured as follows:

- Chapter 2: Scheme Model;
- Chapter 3: Assessment of Traffic Impacts;
- Chapter 4: Development Sensitivity Test;
- Chapter 5: Summary and Conclusions.

2 Scheme Model

Network Changes

Zoning

2.1 Two zones were added for the development sites:

- Zone 66 – Marchmont Farm;
- Zone 67 – West Hemel.

Links

2.2 Zone 66 has been assumed to feed on and off the network from Piccotts End.

2.3 Two access roads were coded for Zone 67:

- The Avenues, connecting to the network at Boxted Road;
- Development road connecting to Long Chaulden, between Newlands and Middle Hill.

2.4 Priority junctions at the connections with the existing network were coded in each case, with the development access as the minor arm.

Demand Changes

Trip Generation

2.5 Trip rates from a similar study investigating the potential traffic impact of a large residential development site in Hemel Hempstead were transferred and used for this study (see Table 2.1). These trip rates are those agreed for use in comparing LDF site options in Hemel Hempstead.

TABLE 2.1 RESIDENTIAL TRIP RATES

Time Period	Peak Hour Trips per Dwelling	Peak Period Trips per Dwelling
AM departures	0.259	0.641
AM arrivals	0.106	0.623
PM departures	0.137	0.354
PM arrivals	0.255	0.658

2.6 The number of dwellings at each site in the two modelling years is shown in Table 2.2.

TABLE 2.2 NUMBER OF DWELLINGS PER SITE

Site	2021	2031
A: Marchmont Farm	380	380
B: Western Hemel	450	900
Total	930	1280

2.7 The number of peak period trips generated in each modelled year by each site is shown in Table 2.3.

TABLE 2.3 PEAK PERIOD TRIP GENERATION

Trip Segment	A: Marchmont Farm	B: Western Hemel
2021		
AM out	243	288
AM in	100	118
PM out	134	159
PM in	250	296
2031		
AM out	243	576
AM in	100	236
PM out	134	318
PM in	250	592

2.8 The modelled Saturday period was not considered in this exercise.

2.9 The total number of peak period trips added to the matrix represented 1.3% of the total do-minimum trips in 2021 and 1.9% in 2031.

Trip Distribution

2.10 Existing model zones with similar characteristics (ie residential, suburban) were selected to provide trip distribution patterns for the development zones.

- Zone 18 distribution used for Zone 66 (Marchmont Farm);
- Zone 16 distribution used for Zone 67 (Western Hemel).

3 Assessment of Traffic Impacts

Model Runs

3.1 Five random seeds were run for each modelled time period and the results averaged to produce mean statistics.

3.2 Model output was produced in such a way as to make it possible to directly compare the results of the Western Hemel models with the Do-Minimum models for both 2021 and 2031.

Network Behaviour

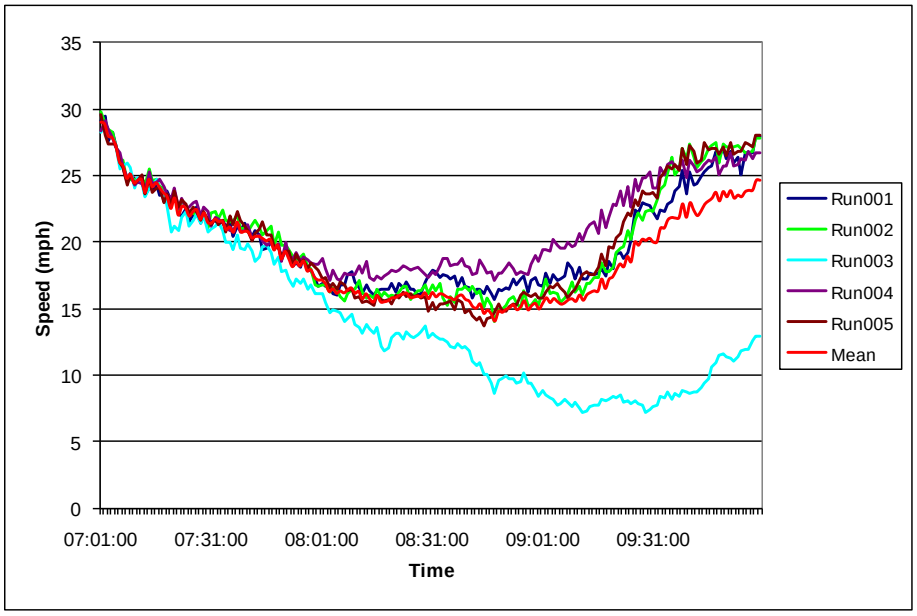
Visual Inspection of Models

3.3 Overall network behaviour was first observed by visual inspection of the scheme and do-minimum model runs for each modelled year. In summary:

- 2021 AM: general network behaviour similar to Do-Minimum. Minor localised queueing nearby development accesses – particularly at the Boxted Road, Warners End and Northridge Way junction.
- 2021 PM: general network behaviour similar to Do-Minimum (few problems in network).
- 2031 AM: general network behaviour similar to Do-Minimum with additional minor queuing occurring on junctions along Boxted Road as in 2021, and also along the A4147. In one model seed run, queuing on Leighton Buzzard Road propagated throughout the network and resulted in much lower average network speeds. It is possible in that if significant development goes ahead in Western Hemel, that junctions along Leighton Buzzard Road will need upgrading.
- 2031 PM: general network behaviour similar to Do-Minimum (few problems in network).

3.4 The difference in average network speeds between model runs throughout the morning peak period is illustrated in Figure 3.1. This shows the relative infrequency of the breakdown in flow across the network.

FIGURE 3.1 COMPARISON OF AVERAGE SPEEDS BETWEEN MODEL RUNS IN THE MORNING PEAK IN 2031



Network Statistics

3.5 In Table 3.1 and 3.2 a comparison of overall network statistics between the Western Hemel models and the Do-Minimum is presented for 2021 and 2031 respectively.

TABLE 3.1 OVERALL NETWORK STATISTICS 2021

Network Statistic	Morning Peak			Evening Peak		
	Do-Minimum	Western Hemel	Diff. %	Do-Minimum	Western Hemel	Diff. %
Mean vehicle speed (mph)	23.0	22.1	-1.6%	22.0	21.6	-1.2%
Average time on network (s)	328	338	+1.8%	329	338	+1.4%
Average queuing delay (s)	58	67	+7.1%	45	51	+6.0%
Total time on network (hr)	5573	5789	+1.8%	5907	6102	+1.3%
Total queuing delay (hr)	977	1153	+7.1%	809	918	+6.0%

TABLE 3.2 OVERALL NETWORK STATISTICS 2031

Network Statistic	Morning Peak			Evening Peak		
	Do-Minimum	Western Hemel	Diff. %	Do-Minimum	Western Hemel	Diff. %
Mean vehicle speed (mph)	18.4	17.9	-5.0%	20.1	19.2	-4.4%
Average time on network (s)	413	440	+8.2%	363	382	+5.2%
Average queuing delay (s)	115	140	+20.7%	56	69	+23.5%
Total time on network (hr)	7221	7776	+7.9%	6731	7215	+7.2%
Total queuing delay (hr)	2011	2481	+20.4%	1032	1298	+25.8%

3.6 The statistics for 2021 show that morning and evening peak traffic impacts are similar across the network. With the Western Hemel developments, network speeds drop by 1.2 - 1.6% and delays increase by around 6.0 - 7.1%.

3.7 The statistics for 2031 show a more marked drop in network speeds of 4.4 – 5.0% and an increase in delays of over than 20% in both the morning and evening peaks.

3.8 It is worth noting at this stage that visual inspection of model behaviour shows that it is the morning peak that is most affected by the increased traffic associated with the Western Hemel developments. However, the percentage changes indicated in Table 3.2 above suggest that the impacts are of a similar scale in the evening peak. This is largely a result of the Do-Minimum results for the evening peak being lower, and therefore a relatively smaller increase in impact shows a disproportionate increase in percentage terms.

Journey Times

3.9 In Table 3.3 and 3.4 a comparison of journey times over 20 routes between the Western Hemel models and the Do-Minimum is presented for 2021 and 2031 respectively.

TABLE 3.3 JOURNEY TIME STATISTICS 2021

Journey Time Route	Morning Peak (s)			Evening Peak (s)		
	Do-Minimum	Western Hemel	Diff. %	Do-Minimum	Western Hemel	Diff. %
A414 (Plough to M1)	799	806	1%	298	295	-1%
A414 (M1 to Plough)	330	312	-6%	388	407	5%
A4146 (A4147 to London Road)	347	340	-2%	276	275	-1%
A4146 (London Road to A4147)	281	280	0%	289	301	4%
A4147 (Leighton Buzzard Rd to St Agnells)	145	154	6%	159	146	-8%
A4147 (St Agnells to Leighton Buzzard Rd)	149	155	4%	178	172	-4%
NERR (Signals to A414 RouteN)	194	167	-14%	163	164	1%
NERR (A414 to Signals RouteN)	194	194	0%	306	294	-4%
A4251 (Box Lane to Rucklers Lane)	656	672	2%	535	597	12%
A4251 (Rucklers Lane to Box Lane)	444	481	8%	405	416	3%
A4147 (St Agnells to A414)	373	385	3%	307	335	9%
A4147 (A414 to St Agnells)	207	206	-1%	320	329	3%
Two Waters (A41 to Plough)	143	141	-1%	124	127	2%
Two Waters (Plough to A41)	106	116	9%	106	107	1%
NERR (Maylands to Signals)	196	192	-2%	196	200	2%
NERR (Signals to Maylands)	79	79	0%	76	76	1%
NERR (Signals to A414 RouteMid)	191	175	-8%	170	172	1%

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Journey Time Route	Morning Peak (s)			Evening Peak (s)		
	Do-Minimum	Western Hemel	Diff. %	Do-Minimum	Western Hemel	Diff. %
NERR (A414 to Signals RouteMid)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
NERR (Signals to A414 RouteS)	188	175	-7%	157	157	0%
NERR (A414 to Signals RouteS)	152	152	0%	161	160	0%

TABLE 3.4 JOURNEY TIME STATISTICS 2031

Journey Time Route	Morning Peak (s)			Evening Peak (s)		
	Do-Minimum	Western Hemel	Diff. %	Do-Minimum	Western Hemel	Diff. %
A414 (Plough to M1)	1281	1108	-14%	330	332	0%
A414 (M1 to Plough)	392	413	5%	523	525	0%
A4146 (A4147 to London Road)	532	607	14%	265	300	13%
A4146 (London Road to A4147)	314	332	6%	301	318	6%
A4147 (Leighton Buzzard Rd to St Agnells)	175	186	6%	143	154	7%
A4147 (St Agnells to Leighton Buzzard Rd)	162	208	28%	186	207	11%
NERR (Signals to A414 RouteN)	241	173	-28%	163	170	4%
NERR (A414 to Signals RouteN)	200	194	-3%	301	314	4%
A4251 (Box Lane to Rucklers Lane)	591	656	11%	579	587	1%
A4251 (Rucklers Lane to Box Lane)	432	424	-2%	420	429	2%

Journey Time Route	Morning Peak (s)			Evening Peak (s)		
	Do-Minimum	Western Hemel	Diff. %	Do-Minimum	Western Hemel	Diff. %
A4147 (St Agnells to A414)	450	428	-5%	465	490	5%
A4147 (A414 to St Agnells)	228	215	-5%	332	379	14%
Two Waters (A41 to Plough)	137	149	9%	122	124	1%
Two Waters (Plough to A41)	99	102	3%	107	110	3%
NERR (Maylands to Signals)	242	234	-3%	252	254	1%
NERR (Signals to Maylands)	115	118	2%	76	79	3%
NERR (Signals to A414 RouteMid)	232	185	-20%	172	175	2%
NERR (A414 to Signals RouteMid)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
NERR (Signals to A414 RouteS)	239	169	-29%	163	164	1%
NERR (A414 to Signals RouteS)	154	154	0%	165	167	1%

3.10 In 2021 there is little significant impact on journey times across the network in either the morning or evening peak.

3.11 In 2031 journey times on key routes that would be expected to carry development traffic from Western Hemel are higher than in the Do-Minimum, with the A4147 and A4146 particularly affected in the morning peak.

3.12 In both 2021 and 2031 some journey times actually decrease in the Western Hemel model – indicating a change in the distribution of route costs because of the extra development traffic on certain key routes.

4 Development Sensitivity Test

Rationale

4.1 In 2031, additional development at Western Hemel, together with the generally more congested 2031 network, caused significant flow breakdown in one of the five modelled morning peak runs.

4.2 A new 2031 scenario was therefore tested with only half the proposed increase in residences between 2021 and 2031 at Western Hemel (Site B). The number of dwellings at each site in this sensitivity test is shown in Table 4.1.

TABLE 4.1 NUMBER OF DWELLINGS PER SITE (PARTIAL DEVELOPMENT SCENARIO)

Site	2031
A: Marchmont Farm	380
B: Western Hemel	675
Total	1055

4.3 The number of peak period trips generated by each site is shown in Table 4.2.

TABLE 4.2 PEAK PERIOD TRIP GENERATION (PARTIAL DEVELOPMENT SCENARIO)

Trip Segment	A: Marchmont Farm	B: Western Hemel
2031		
AM out	243	432
AM in	100	177
PM out	134	239
PM in	250	444

Network Statistics

4.4 Five model seeds were run and average statistics compiled. A comparison with the Do-Minimum statistics is presented in Table 4.3.

TABLE 4.3 OVERALL NETWORK STATISTICS 2031 (PARTIAL DEVELOPMENT SCENARIO)

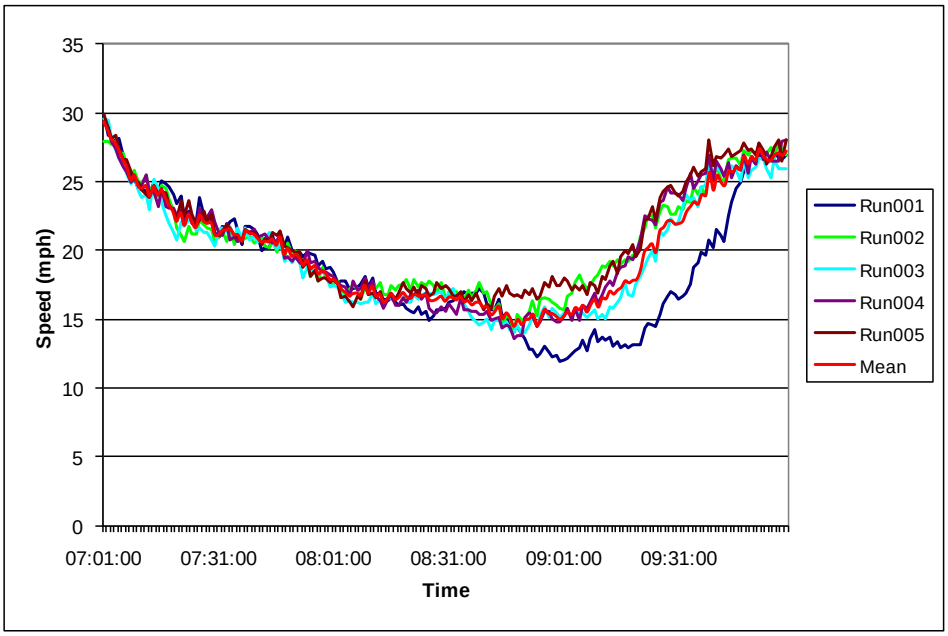
Network Statistic	Morning Peak			Evening Peak		
	Do-Minimum	Western Hemel	Diff. %	Do-Minimum	Western Hemel	Diff. %
Mean vehicle speed (mph)	18.4	18.8	+2.1%	20.1	19.2	-4.3%
Average time on network (s)	413	404	-2.3%	363	381	+4.9%
Average queuing delay (s)	115	110	-4.7%	56	67	+21.3%
Total time on network (hr)	7221	7131	-1.3%	6731	7170	+6.5%
Total queuing delay (hr)	2011	1936	-3.7%	1032	1271	+23.2%

4.5 The statistics show that in the morning peak, the partial development scenario performs similarly to the Do-Minimum in 2031. For some statistics (such as average speed) the scenario actually appears to perform slightly better. However, the difference is not significant, and merely a result of random variation in traffic behaviour between runs.

4.6 In the evening peak, the scenario performs slightly worse than the Do-Minimum; the differences are very similar to the difference between the Do-Minimum and the full 2031 development scenario reported in Table 3.2.

4.7 No runs in this scenario produced the flow breakdown across the network and the associated drop in network speeds and performance that was seen in one run of the full development scenario in the morning peak. This is illustrated in Figure 4.1.

FIGURE 4.1 COMPARISON OF AVERAGE NETWORK SPEEDS BETWEEN MODEL RUNS IN 2031 (PARTIAL DEVELOPMENT SCENARIO)



5 Summary and Conclusions

5.1 Generally, the traffic impacts of Western Hemel on the wider road network were minimal in 2021 in both the morning and evening peak. There was some indication that development traffic flow in the area around Boxted Road, particularly the junction with Warner's End/Northridge, could cause minor localised queueing issues. However, these would be relatively easy to mitigate and not unusual for the size of development tested.

5.2 In 2031 there were still no significant problems in the evening peak.

5.3 In 2031 the Western Hemel development traffic had a more significant effect on the wider network, causing lower network speeds, with associated higher journey times and delays.

5.4 The localised queuing problems around Boxted Road observed in 2021 were magnified, but still not a serious issue.

5.5 However, in one model run (out of five) in the morning peak, traffic flow breakdown did occur across the road network because of serious queuing occurring on Leighton Buzzard Road. Two junctions in particular did not appear to have sufficient capacity:

- Queensway/Warners End/Leighton Buzzard Road;
  - Development traffic using Warner's End Road to access the rest of Hemel blocks south-north traffic. Signalisation, or minor junction re-design may mitigate this issue.
- Leighton Buzzard Road/Coombe Street;
  - Increased traffic levels on Leighton Buzzard Road cause queueing back from the signals. Minor junction re-design may mitigate this issue.

5.6 A sensitivity test was run, with only half the increase in housing at the Western Hemel site between 2021 and 2031. In this test, flow breakdown did not occur.

5.7 The results of this analysis are summarised in Table 5.1:

TABLE 5.1 SUMMARY OF ANALYSIS

Scenario / Site	2021	2031 (Partial)	2031 (Full)
A: Marchmont Farm	380	380	380
B: Western Hemel	450	675	900
Total	930	1280	1280
Network Performance (AM)	Similar to Do-Minimum;	Similar to Do-Minimum	Slightly worse than Do-Minimum. Flow Breakdown in one run.
Network Performance (PM)	Similar to Do-Minimum;	Slightly worse than Do-Minimum.	Slightly worse than Do-Minimum.

5.8 Finally, it should be noted that these results provide an indication only of potential traffic problems that could occur with the Western Hemel development. A more detailed analysis may be advisable when the full development profile and access arrangements are known.

CONTROL SHEET

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