

# East Hertfordshire Local Plan Support – Do Minimum Model Run Report

<b>Client name</b> East Hertfordshire Council	<b>Date</b> January 2017	<b>Project number</b> 60522529	<b>Project name</b> East Hertfordshire Local Plan Support
<b>Prepared by:</b> JL	<b>Checked by:</b> SK	<b>Approved by:</b> IB	

Revision	Revision date	Prepared by	Checked by
1: Draft for client comment (v1)	8 <sup>th</sup> December 2016	JL	SK
2: Final (v1.a)	10 <sup>th</sup> January 2017	JL	SK
3: Final (v1.b)	16 <sup>th</sup> January 2017	JL	SK

## 1. Introduction

### 1.1 Task Objective

- 1.1.1 In October 2016, AECOM was commissioned by East Hertfordshire Council (EHC) to provide support for its upcoming Local Plan submission in March 2017. The support is in relation to the district's highway network performance and covers an analysis of conditions in the present day<sup>1</sup> and 2031, estimated using a strategic transport model.
- 1.1.2 Hertfordshire County Council's (HCC) existing 2014 Base Year and 2031 Forecast Year COMET models (version 2, October 2016) have been used to inform this work. The 2031 Forecast includes Local Plan growth from all 10 Hertfordshire districts as well as the most significant committed/very likely planned transport infrastructure changes (see section 4.1.2 for a list of schemes). Although COMET is a multi-modal model, the focus of this work is on the interpretation of highway assignment results.

### 1.2 Caveats

- 1.2.1 COMET is a strategic countywide model and has not been developed specifically to represent traffic conditions in urban areas. The model has not been validated in urban areas located in East Hertfordshire. The model's main purpose is to simulate inter-urban movements in Hertfordshire, and the calibration/validation process has been conducted accordingly. This has an implication on the level of confidence that can be placed on results in urban areas of East Hertfordshire.
- 1.2.2 The highway assignment component of the COMET model suite is in SATURN. SATURN is a tool that suits the strategic geographical scale of COMET, however, does not enable investigation of detailed sections of the highway network (e.g. detailed junction or corridor assessment). At this stage, therefore, the results presented here should be interpreted as high level indications of likely traffic conditions.

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<sup>1</sup> 2014 Base Year Model

### **1.3 Structure of this note**

1.3.1 This note is presented in the following sections:

- Review of Base Year (2014) Model Performance
- Review of Base Year (2014) Traffic Conditions
- Review of Forecast Year (2031) Traffic Conditions
- Proposed Major East Hertfordshire Developments
- Potential Mitigation Options
- Air Quality Management Areas
- Summary and Next Steps
- Appendices
  - Appendix A – Journey Time Validation Results
  - Appendix B – GEH Results
  - Appendix C – Town Based Trip Distribution Plots
  - Appendix D – A414 Hertford Corridor Analysis
  - Appendix E – Glossary of Terms

## **2. Review of Base Year (2014) Model Performance**

2.1.1 This section of the document summarises the performance (i.e. representativeness) of the COMET highway assignment model in East Hertfordshire according to Department for Transport WebTAG (Transport Analysis Guidance) criteria. The performance indicators provided are those that were defined during the model development process, and are categorised as follows:

- Journey Time Validation Routes
- Screenlines and Cordons Validation
- Link flow Validation
- Town Based Trip Distribution Plots (not strictly an indication of model performance, however illustrates the strategic travel patterns)

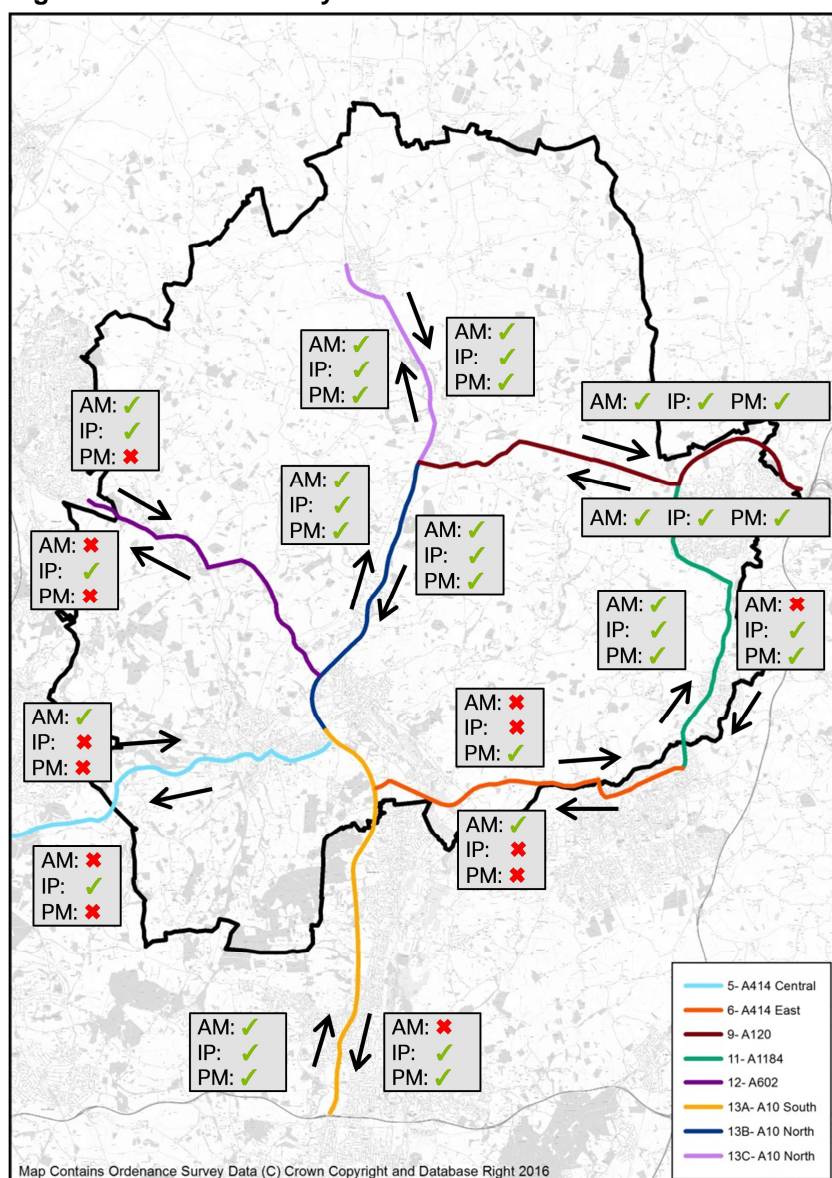
### **2.2 Journey Time Validation Routes**

2.2.1 During the development of COMET, eight journey time routes in East Hertfordshire were defined for the purpose of model validation, as shown in Figure 1. Journey times along these routes are compared between the model and observed data (TrafficMaster journey time data).

2.2.2 WebTAG recommends that modelled and observed journey times should be within 15% (or within 1 minute, if higher than 15%)<sup>2</sup>. The diagram below has been annotated according to whether the journey time route meets this criterion. Full results for the journey time validation routes are provided in Table 5 (see appendix).

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<sup>2</sup> TAG Unit M3.1 Highway Assignment Modelling. Table 3.

**Figure 1. COMET Journey Time Validation Routes in East Hertfordshire<sup>3</sup>**

2.2.3 In both the AM Peak (8am-9am) and PM Peak (5pm-6pm), the model represents journey times on approximately 70% of the defined routes in East Hertfordshire according to WebTAG criteria. The strongest validation results across all time periods are on the A120 between the M11 and A10, all sections of the A10, and A1184 south of Bishop's Stortford.

2.2.4 The model's performance on the A414 (both sides of the A10) and on the A602 generally does not meet WebTAG criteria:

- A414 west of the A10 – the model over-represents delay in both directions in the PM Peak, and under-represents delay in the westbound direction in the AM Peak. The representation of the eastbound movement in the AM Peak is WebTAG compliant.
- A414 east of the A10 – the model under-represents delay in the eastbound direction in the AM Peak, and in the westbound direction in the PM Peak. The AM Peak and PM Peak results for the opposite directions, respectively, are WebTAG compliant.
- A602 – the model under-represents westbound delay in both peak hours, and over-represents eastbound delay in the PM Peak. The AM Peak eastbound movement is WebTAG compliant.

<sup>3</sup> IP (inter-peak) results are given for information only.

2.2.5 These results should be considered alongside any analysis regarding the likely scale of change in corridor level delay.

## 2.3 Screenlines and Cordons Validation

2.3.1 A further measure of model performance is the extent to which it represents the volume of traffic into/out of towns (cordons), and the volume of traffic across imaginary screenlines. WebTAG recommends that the difference between modelled and observed flow across screenlines and cordons should be less than 5%<sup>4</sup>.

2.3.2 Figure 2 and Figure 3 show the locations of the screenlines and cordons in East Hertfordshire, and also indicate (by colour coding) the difference between modelled and observed flow. In both time periods, the Bishop's Stortford cordon represents outbound flow (inner circle in diagram) and inbound flow (outer circle in diagram) within WebTAG guidelines. The model performance in Hertford is also generally in accordance with the guidelines, however, the outbound flow in the AM Peak is underrepresented in the model by 10%-15%.

2.3.3 Although outside East Hertfordshire district, the cordon covering Hoddesdon/Broxbourne/Cheshunt also shows good results, suggesting that the interaction into/out of this section of the A10 corridor is well represented.

2.3.4 The east/west screenline in the northern part of the district (running broadly parallel to the A120) indicates that the north/south movements it covers (including those on the A10) are well represented by COMET.

2.3.5 The following screenlines do not consistently meet WebTAG guidelines:

- North/south screenline at the western edge of the district
- East/west screenline at the southern edge of the district

2.3.6 It should be noted, however, that both of these screenlines are among the longest in the whole modelled area. The more local performance of these screenlines (within East Hertfordshire) is provided in Table 1, and shows that the performance in East Hertfordshire is generally further from WebTAG guidelines than the screenline as a whole. This represents a potential weakness in the representation of trips crossing these screenlines into and out of the East Herts district.

**Table 1. Local Screenline Performance**

Screenline	Direction	Peak Hour	Performance across entire screenline	Performance within East Hertfordshire
North/south screenline at the western edge of the district	Eastbound	AM	+16% (over-representation)	+11% (over-representation)
		PM	+17% (over-representation)	+23% (over-representation)
	Westbound	AM	WebTAG compliant (<5% difference)	+7% (over-representation)
		PM	WebTAG compliant (<5% difference)	+9% (over-representation)
East/west screenline at the southern edge of the district	Northbound	AM	-12% (under-representation)	-12% (under-representation)
		PM	-10% (under-representation)	-10% (under-representation)
	Southbound	AM	WebTAG compliant (<5% difference)	-6% (under-representation)
		PM	-7% (under-representation)	WebTAG compliant (<5% difference)

<sup>4</sup> TAG Unit M3.1 Highway Assignment Modelling. Table 1.



Figure 2. AM Peak Cordon & Screenline Results

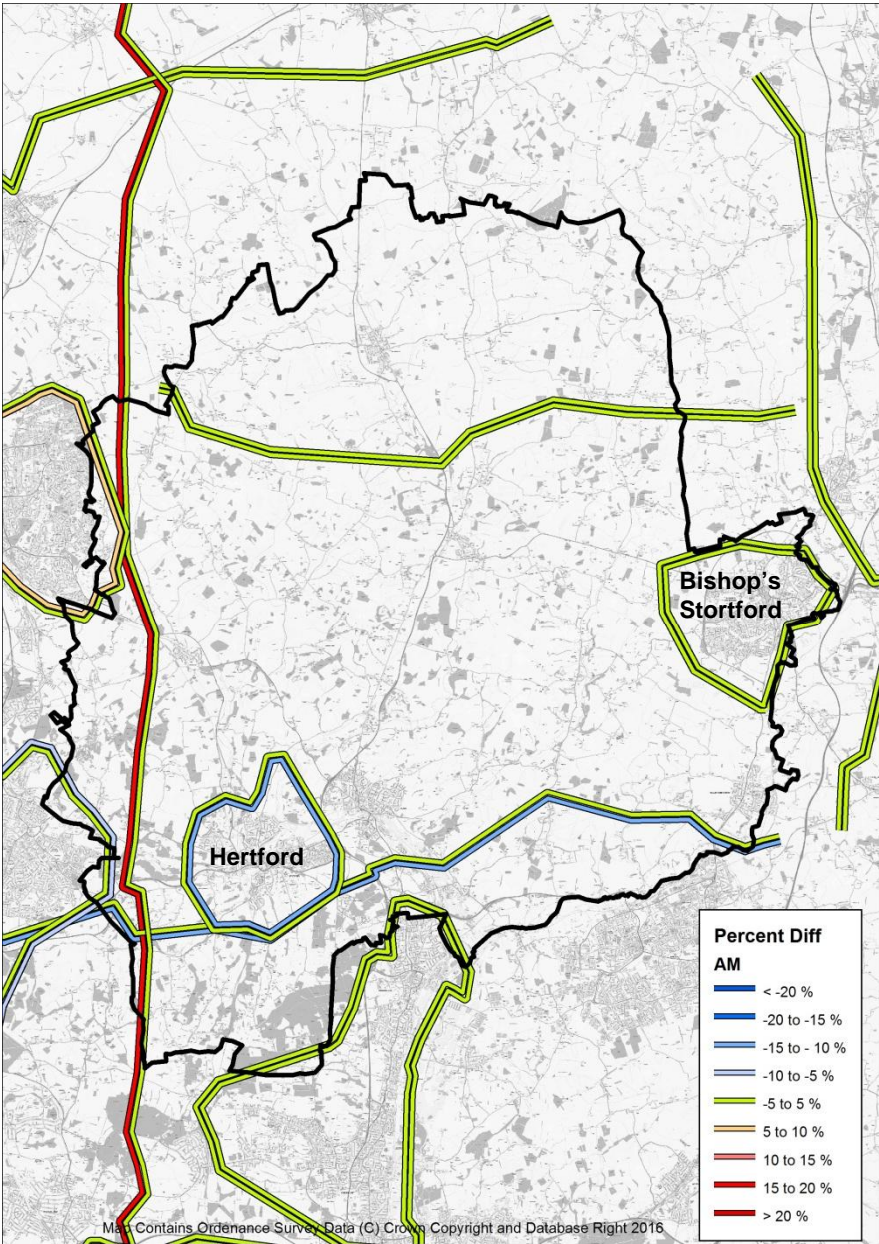
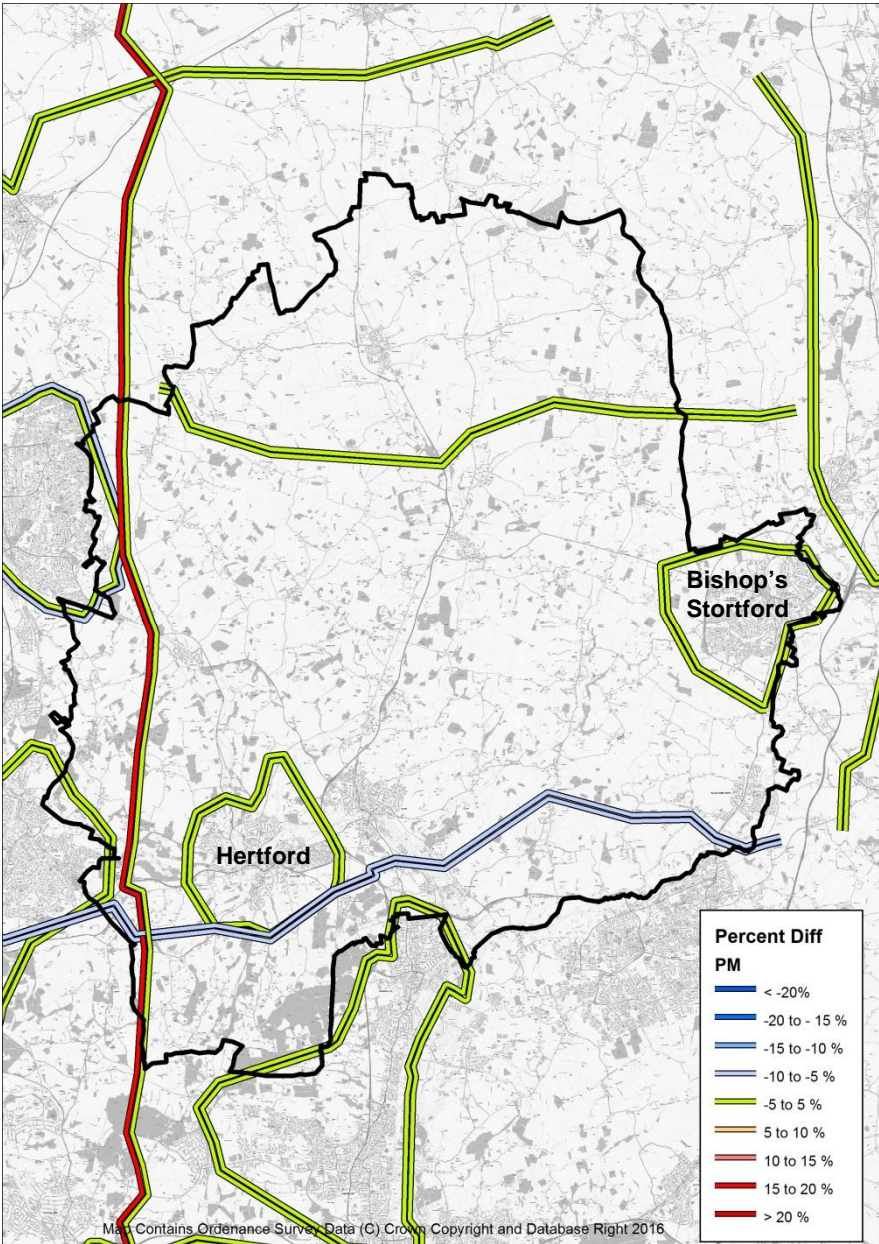


Figure 3. PM Peak Cordon & Screenline Results



## **2.4 Link Flow Validation**

- 2.4.1 This section presents the validation results of the COMET highway assignment model according to the GEH statistic<sup>5</sup>. According to WebTAG criteria, the GEH value for individual model links should be less than 5.
- 2.4.2 Figure 4 and Figure 5 show the results of each link for which observed vehicle flow data is available. Links coloured green are those where traffic volumes are accurately represented by the model, whereas red links are furthest from meeting the criteria. See appendix (Table 6) for full GEH results.
- 2.4.3 At a district level, the GEH performance of the model in East Hertfordshire is mixed. The performance on the following radial routes around Bishop's Stortford generally meets or is close to meeting GEH values of 5 in both time periods:
- A120 to the west, north and east of the town
  - Rye St (B1004) and Stansted Rd (B1383) north of the town
  - Great Hadham Rd (B1004) to the southwest of the town
  - Hallingbury Rd (A1060) south of the town
- 2.4.4 Weaknesses in model performance around Bishop's Stortford exist on the A1184 south of the town (particularly in the PM Peak), and on Pig Ln.
- 2.4.5 The performance of the model around Hertford is generally further from WebTAG guidelines, however, does represent vehicle volumes according to WebTAG criteria on the following key links:
- A414 east and west of the town
  - A10 east of the town
  - North Rd (A119) north of the town
  - Bramfield Rd northwest of the town

## **2.5 Model Suitability**

- 2.5.1 COMET has been developed in line with latest WebTAG guidance, however, (as raised in the preceding sections) there are performance limitations which have an implication on the level of confidence that can be placed in the model results.
- 2.5.2 Notwithstanding these limitations, COMET is deemed an appropriate tool for representing broad strategic movements, and is therefore considered suitable for assessing the Local Plan at a very high level.

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<sup>5</sup> GEH compares the modelled flow versus observed flow, and is defined in section 3.2.7 of WebTAG Unit M3.1 – Highway Assignment Modelling.



Figure 4. AM Peak GEH Results

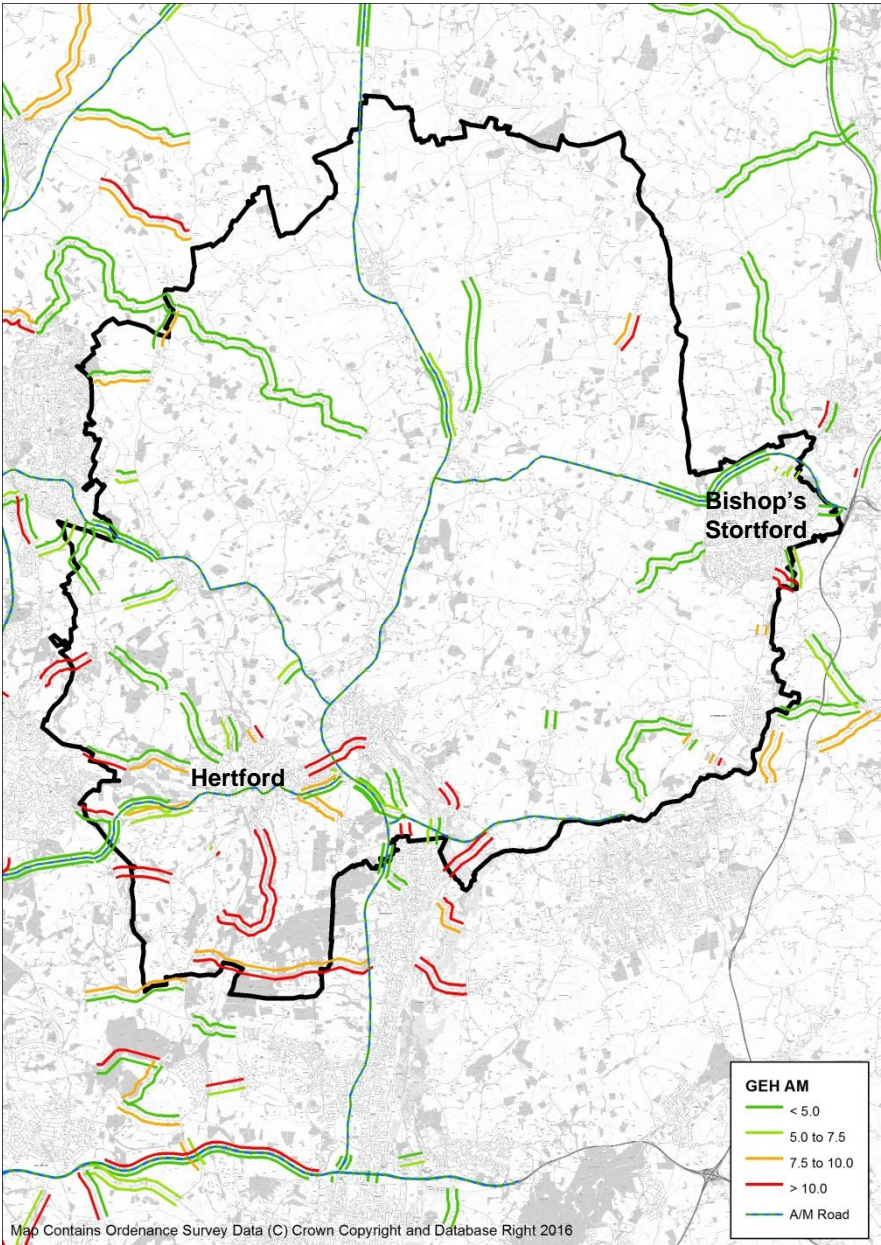
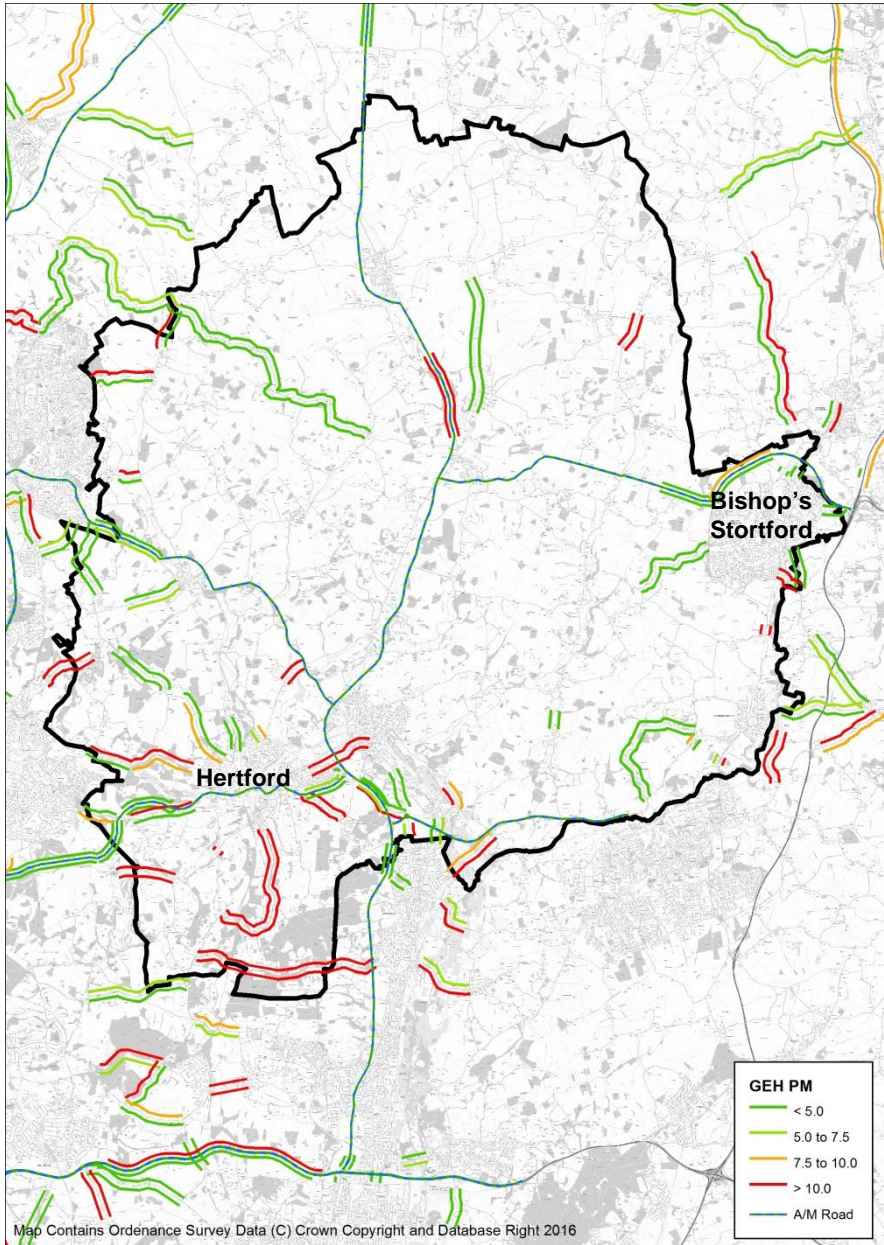


Figure 5. PM Peak GEH Results



## **2.6 Town Based Trip Distribution Plots: Base Year (2014)**

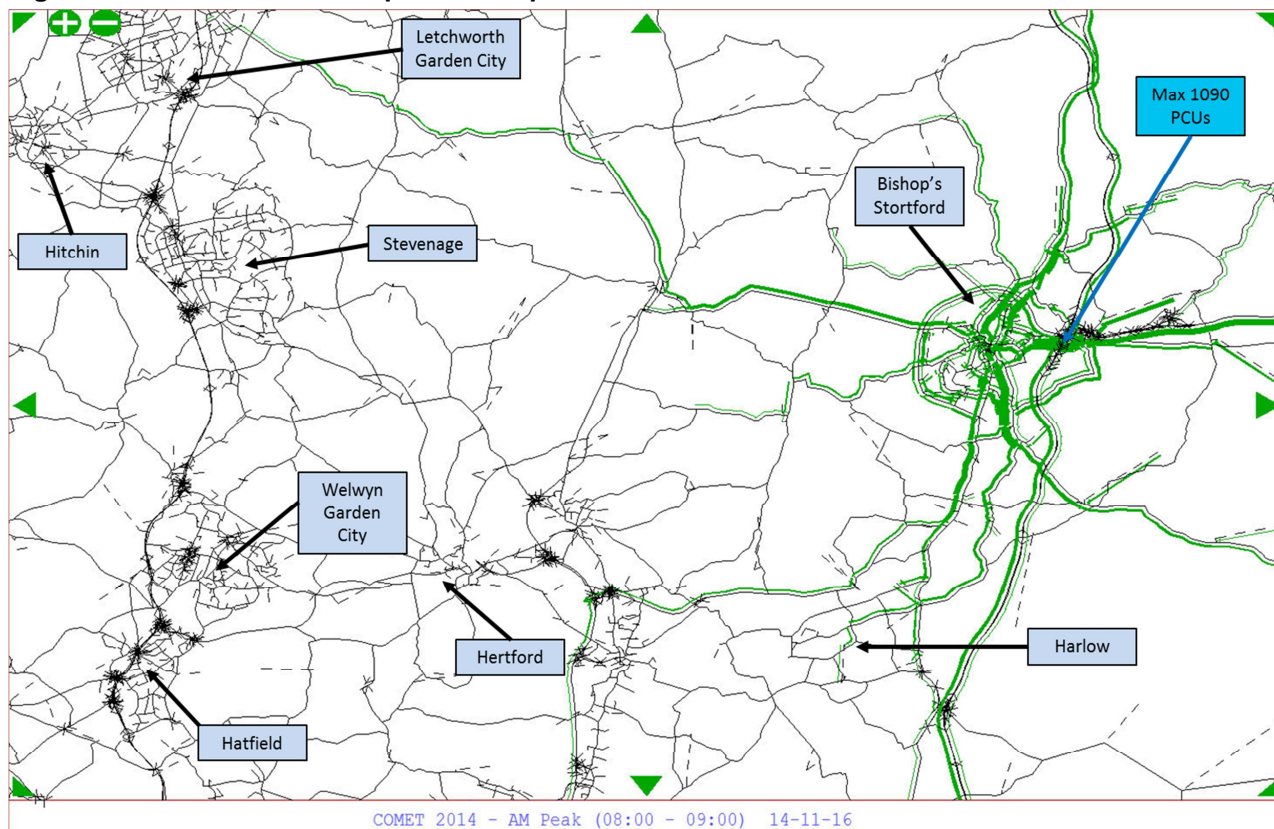
- 2.6.1 Trip distribution plots are provided in this section to illustrate the origins, destinations and route choices of trips in the model to/from Bishop's Stortford and Hertford. Plots showing AM trips *to towns* and PM trips *from towns* have been provided in this section as they provide an indication of to work/from work travel patterns for Hertford and Bishop's Stortford<sup>6</sup>.
- 2.6.2 Figure 6 and Figure 7 show the AM Peak inbound trips and PM Peak outbound trips for Bishop's Stortford, respectively. These plots indicate that town has a close interaction with the A120 (towards Essex) and M11 corridors, and that the interaction with the rest of the district is relatively limited. There are a comparatively low number of trips between Bishop's Stortford and the rest of Hertfordshire. Where this interaction exists, it is primarily via the A120 and A414 towards the A10 and A1(M) corridors.
- 2.6.3 Figure 8 and Figure 9 show the equivalent diagrams for Hertford. The high levels of through-traffic through Hertford clearly constitute a significant proportion of the illustrated flow. Unlike Bishop's Stortford, a close interaction is visible between other towns in Hertfordshire including Welwyn Garden City, Ware, Hatfield, Stevenage and St Albans. These trips rely principally on the strategic A414, A602, A10 and A1(M).

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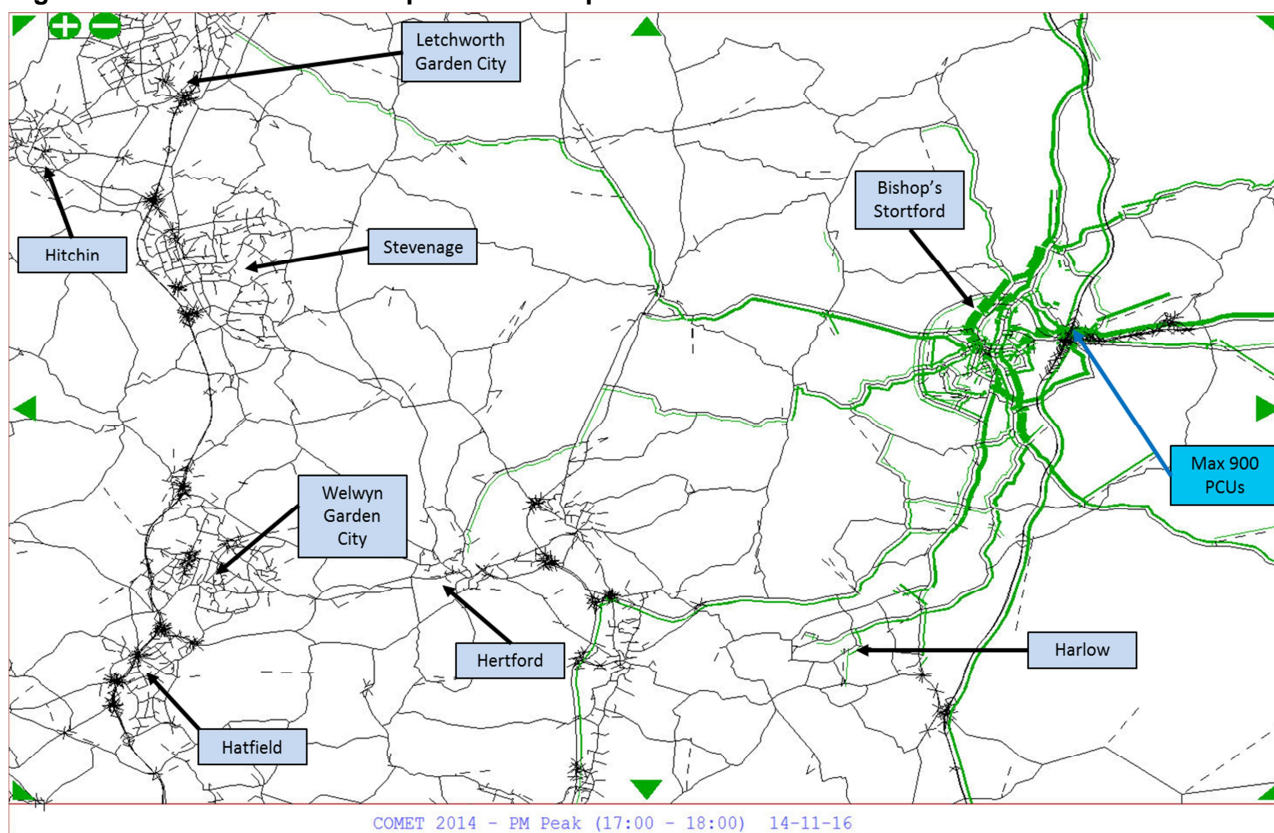
<sup>6</sup> Figure 32, Figure 33, Figure 34 and Figure 35 (see appendix) contain the remaining town based trip distribution plots.



**Figure 6. AM Peak Inbound trips to Bishop's Stortford<sup>7</sup>**

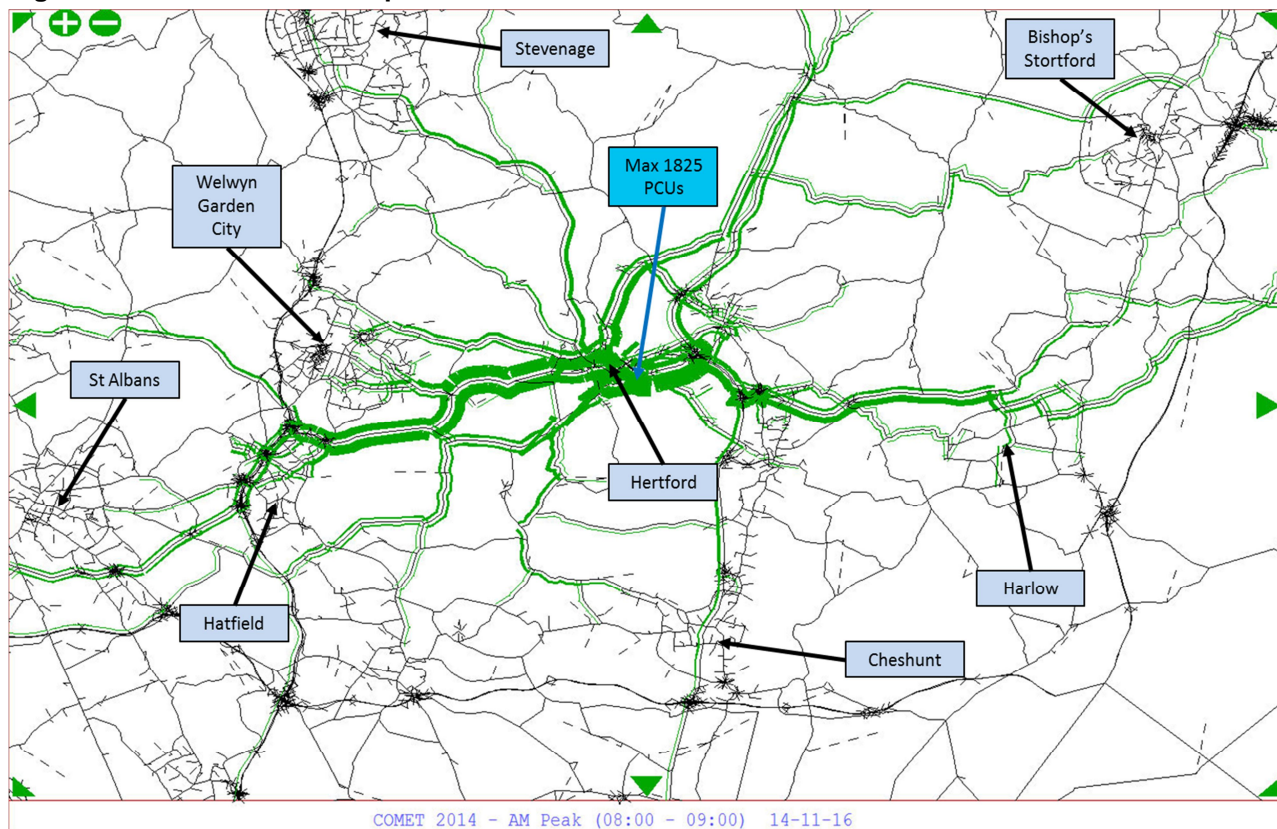


**Figure 7. PM Peak Outbound trips from Bishop's Stortford<sup>7</sup>**

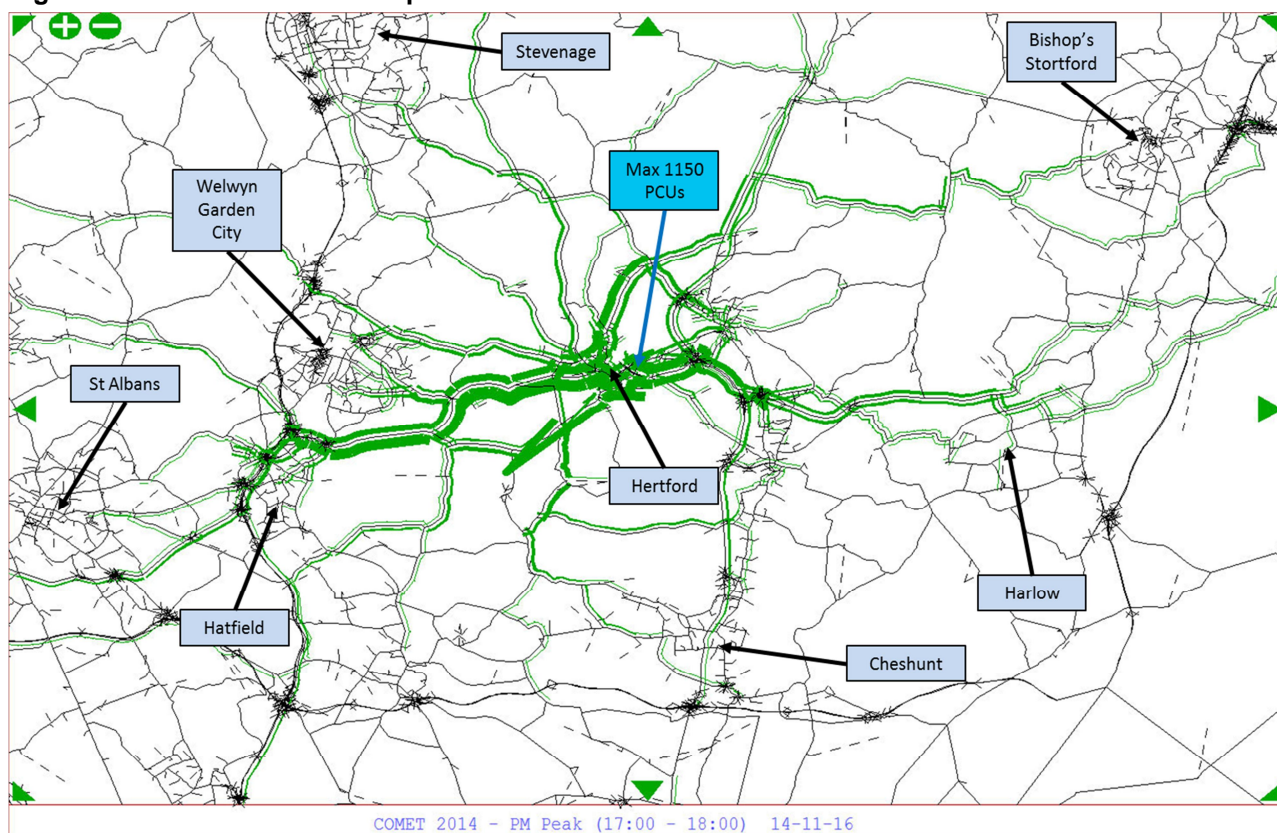


<sup>7</sup> Units are PCUs (Passenger Car Units). Cars and LGVs equal 1 PCU, whilst HGVs equal 2.2 PCUs.

**Figure 8. AM Peak Inbound trips to Hertford<sup>7</sup>**



**Figure 9. PM Peak Outbound trips from Hertford<sup>7</sup>**





### 3. Review of Base Year (2014) Traffic Conditions

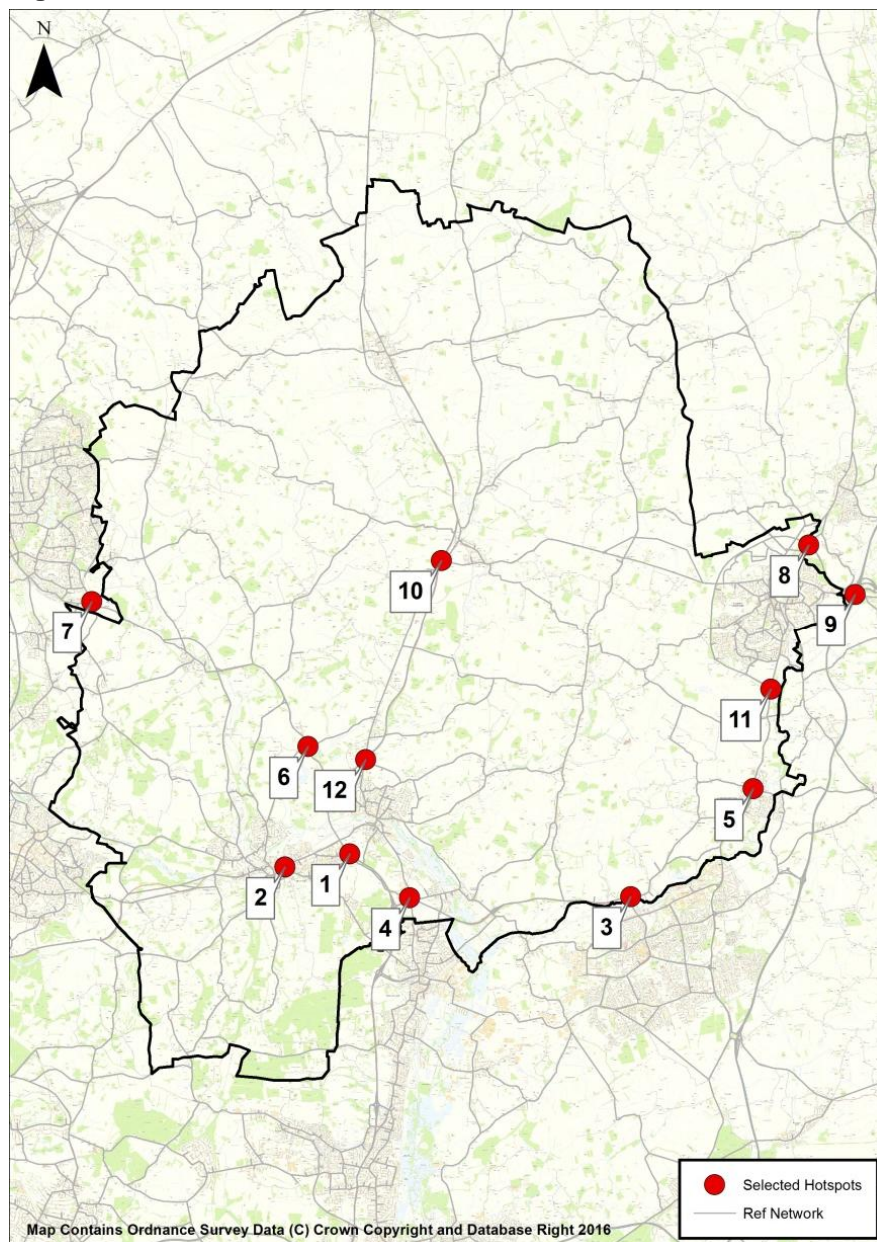
3.1.1 This section presents the modelled condition of the highway network (principally in relation to congestion) in East Hertfordshire in 2014 (the Base Year of COMET). The Base Year model (2014) results are provided as a benchmark against which to view the Forecast year (2031) results covered later in this document.

#### 3.2 Selected Junctions

3.2.1 The focus of the highway network analysis for both 2014 and 2031 is on twelve selected junctions in East Hertfordshire, as shown in Figure 10 (with Selected Junction ID). These junctions (which are/may become congestion hotspots) have been selected by the following means:

- Previous HCC studies
- TrafficMaster Data
- Liaison with EHC

**Figure 10. Selected Junctions in East Hertfordshire**





### 3.3 Base Year (2014) Network Congestion

- 3.3.1 Figure 11 and Figure 12 show the congestion in the COMET Base Year (2014) model in East Hertfordshire for the AM and PM Peaks, respectively<sup>8</sup>. The selected junction ID is also shown.
- 3.3.2 It should be noted that due to the strategic nature of COMET, the impact of on street parking is not represented, nor is detailed junction operation. This may locally reduce the capacity of some sections of the highway network (e.g. village and town centres).
- 3.3.3 There are strong consistencies between the AM and PM peak in terms of the spatial distribution of congestion:
- A414 through Hertford (particularly around Bluecoats Roundabout)
  - Eastwick Roundabout (north of Harlow)
  - Signalised junction in Little Hadham
  - B1383 – A120 (Bishop's Stortford)
  - A602 – Anchor Ln – Wadesmill Rd (north of Hertford)
  - A1184 – Station Rd – West Rd (Sawbridgeworth)
  - M11 Junction 8
  - Various junctions within Bishop's Stortford town centre (COMET is not currently suitable to assess junction delays within the town centre)
- 3.3.4 Further commentary on the delays (including 2031 Forecast results) can be found in Table 2.

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<sup>8</sup> Congestion is shown in terms of both junction delay and link stress:

Junction delay is defined by the average delay for all possible turns at the given model node, weighted by the vehicular flow making each turn. Note that the delay for a specific turn at a junction may therefore be significantly higher or lower than this value indicates, but the defined measure gives an overall impression of junction operation.

Link stress is calculated by SATURN as a ratio of volume over capacity (V/C) for a given link. Links are generally considered to be approaching capacity at 80% V/C, beyond which there is a material deterioration in operation. Note that the length of the modelled queue on amber/red links is not related to the length of the link in the plot. The V/C value calculated by SATURN relates to the link as a whole, however, the queue may not extend along the whole link (particularly if the link is long). The extent of the queueing should therefore also be interpreted using the junction delay circles.

Figure 11. AM Peak 2014 Congestion Plot

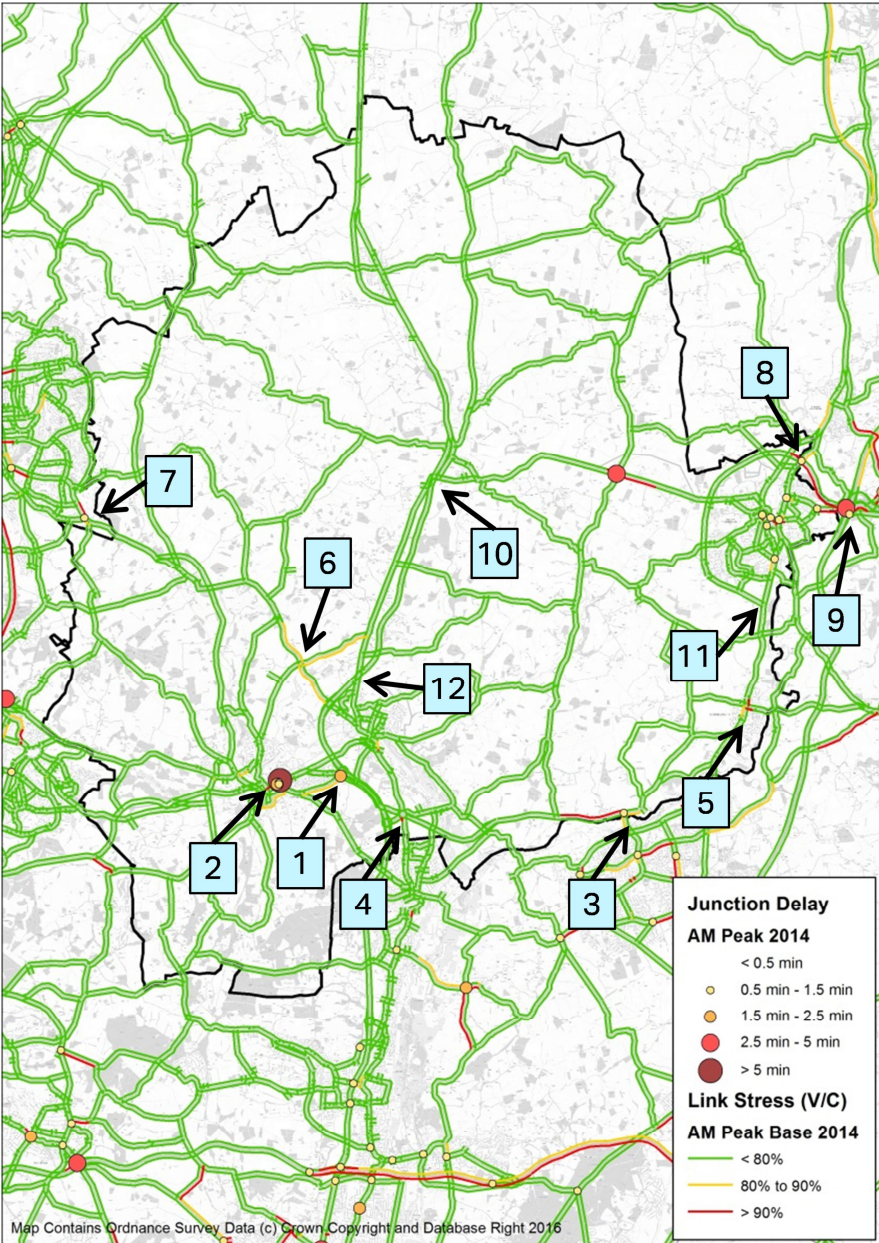
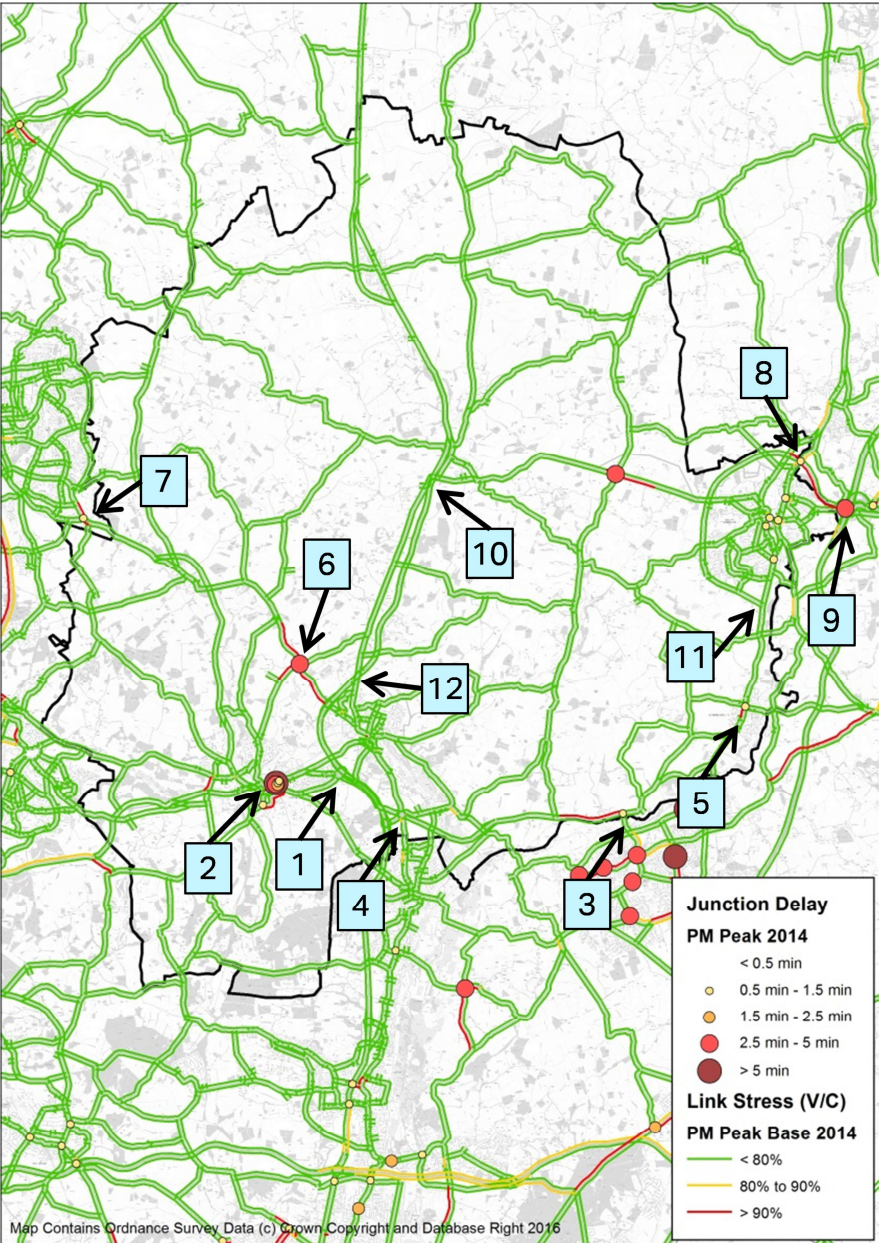


Figure 12. PM Peak 2014 Congestion Plot



## **4. Review of Forecast Year (2031) Traffic Conditions**

### **4.1 Forecast Year (2031) Network Congestion**

- 4.1.1 As was shown for the Base Year model in section 3.3, Figure 13 and Figure 14 present the congestion plots for 2031.
- 4.1.2 As stated in the Introduction, the 2031 Forecast includes Local Plan growth from all 10 Hertfordshire districts. Outside Hertfordshire, growth projections are taken from central government (Department for Transport) forecasts (NTEM 7) which are likely to under-represent the proposed magnitude of growth in Local Plans of neighbouring authorities (e.g. Essex). This allows for an assessment of the impacts of East Hertfordshire's (and other Hertfordshire districts') growth, however, may not capture the full impact of development around the Harlow and Bishop's Stortford areas.
- 4.1.3 The Forecast Year scenario also includes the most significant committed/very likely planned transport infrastructure changes. The highway schemes that have been introduced into the model network between the 2014 Base Year and 2031 Forecast year in East Hertfordshire are:
- A120 Little Hadham Bypass
  - A602 Ware to Stevenage Corridor Strategy Stage 1
  - A10 Amwell Roundabout – Removal of Bus Lane on southern A1170 arm
  - Bishop's Stortford North Development
    - Access onto Hadham Road
    - New access onto A120 and Spine Road connecting with Rye Street
    - Addition of flared approaches on both A120 arms of A120 / B1383 roundabout
  - Bishops Stortford North (ASR 5) access to Rye Street
  - Gilston development access
  - Land North and East of Ware Spine Road (development access road)
- 4.1.4 In addition to these schemes, the following highway schemes (of significance to East Hertfordshire) have been included in Essex:
- M11 Junction 8 short term capacity improvements
  - New M11 Junction 7a with associated link to & roundabout on B183 Gilden Way (plus localised widening of Gilden Way)
  - A414 Junction upgrades through Harlow
  - Cambridge Rd, Harlow – new access into River Way

- 4.1.5 As expected, congestion generally increases across the district due to growth in traffic volumes. The most significant delay increase is at the Bluecoats Roundabout in Hertford in the PM Peak (> 5 mins additional delay compared to the Base Year), and to a lesser extent in the AM Peak. There are also several other junctions in the district where delays increase by between 30 secs and 1 min:
- Rush Green Roundabout
  - A602 – Anchor Ln – Wadesmill Rd (north of Hertford)
  - Eastwick Roundabout (north of Harlow)
  - A1184 – Station Rd – West Rd (Sawbridgeworth)
- 4.1.6 The signalised junction in Little Hadham is expected to experience a delay reduction of 1-1.5 mins between 2014 and 2031 due to the introduction of the Little Hadham Bypass. It should be noted that traffic signals in this location have not been optimised for the Forecast Year (which may reduce delay further here).
- 4.1.7 Table 2 provides a summary of the Base Year and Forecast Year conditions at the selected junctions. For reference, the abbreviation “V/C” in the table stands for the ratio of “volume over capacity” for the specified road. Links are generally considered to be approaching capacity at 80% V/C, beyond which there is a material deterioration in operation. The symbol “~” in the table denotes “approximately”.



Figure 13. AM Peak 2031 Congestion Plot

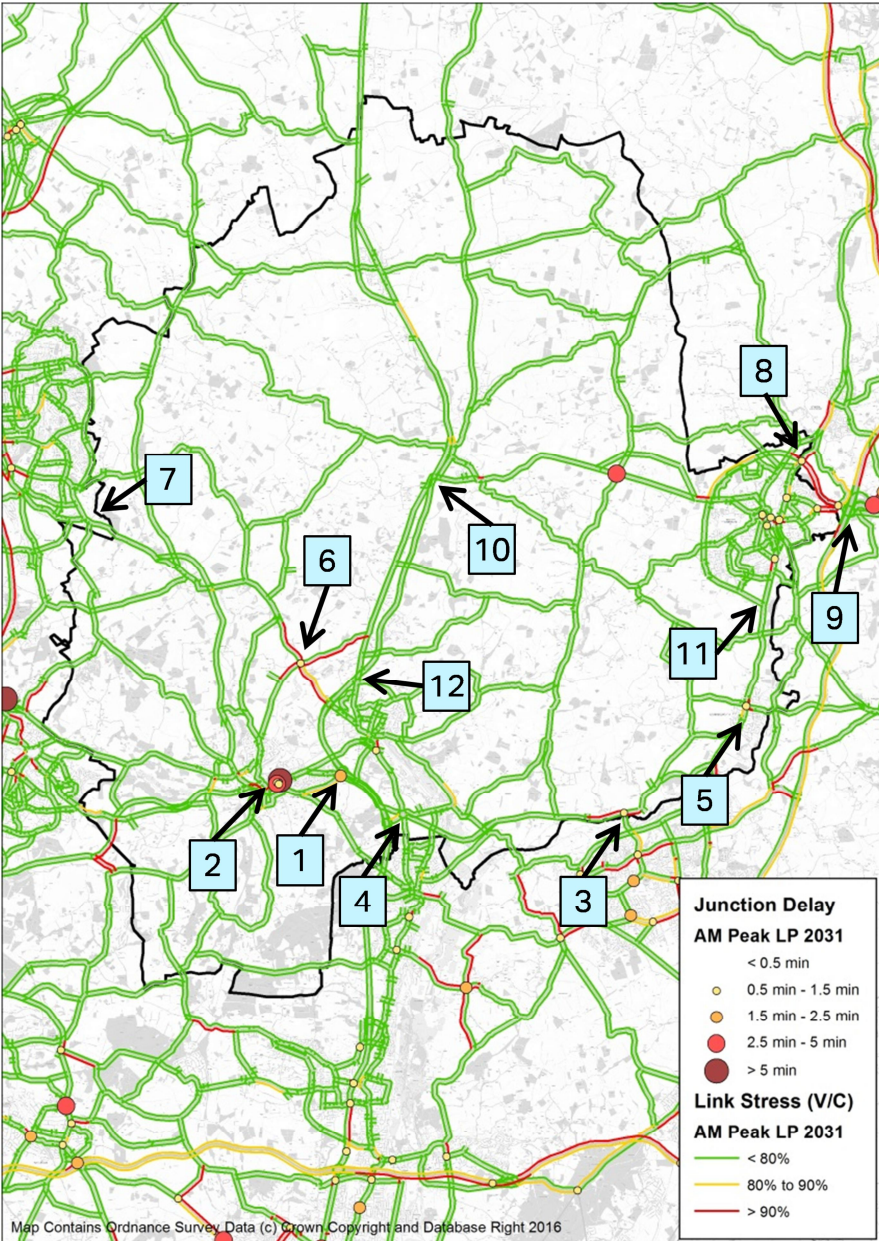
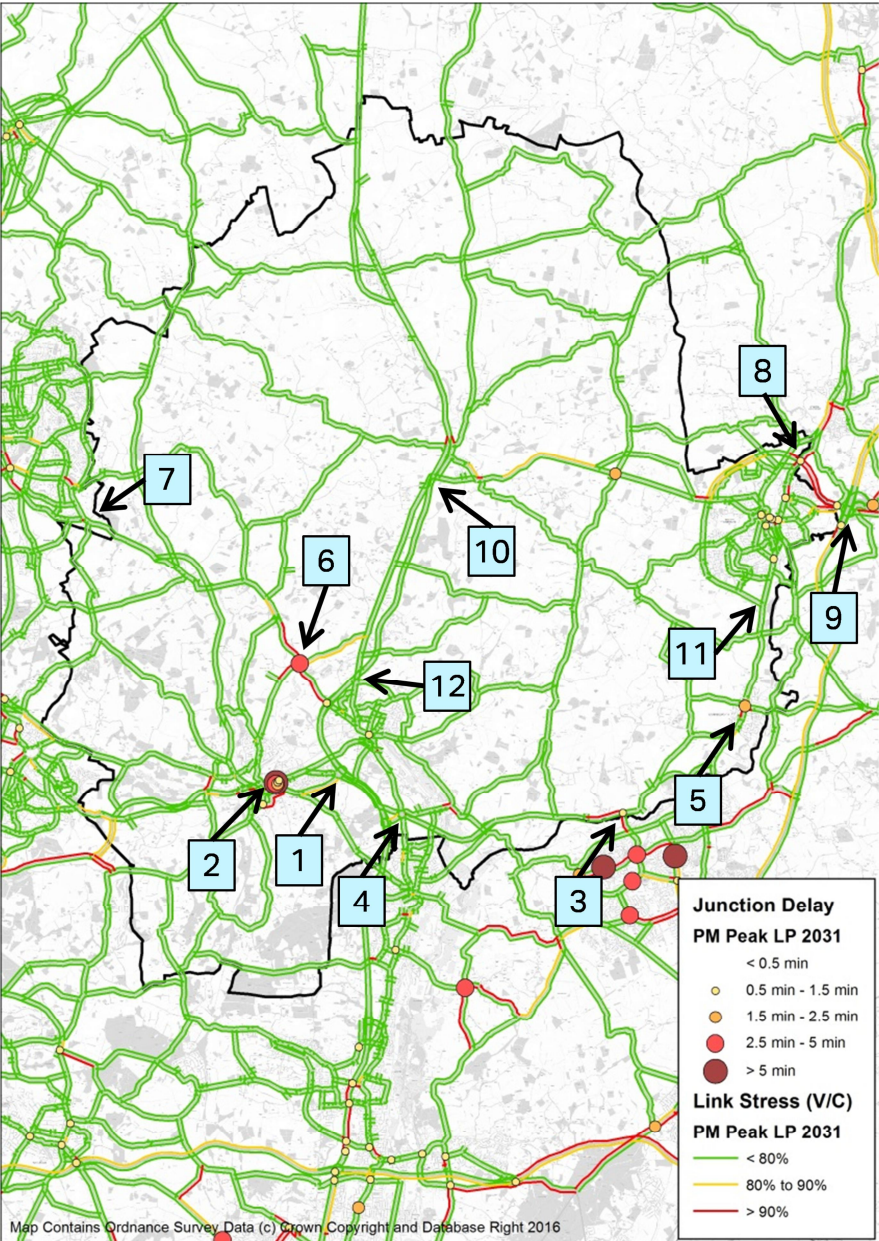


Figure 14. PM Peak 2031 Congestion Plot



**Table 2. Selected Junctions Delay (Base Year/Forecast Year Comparison)**

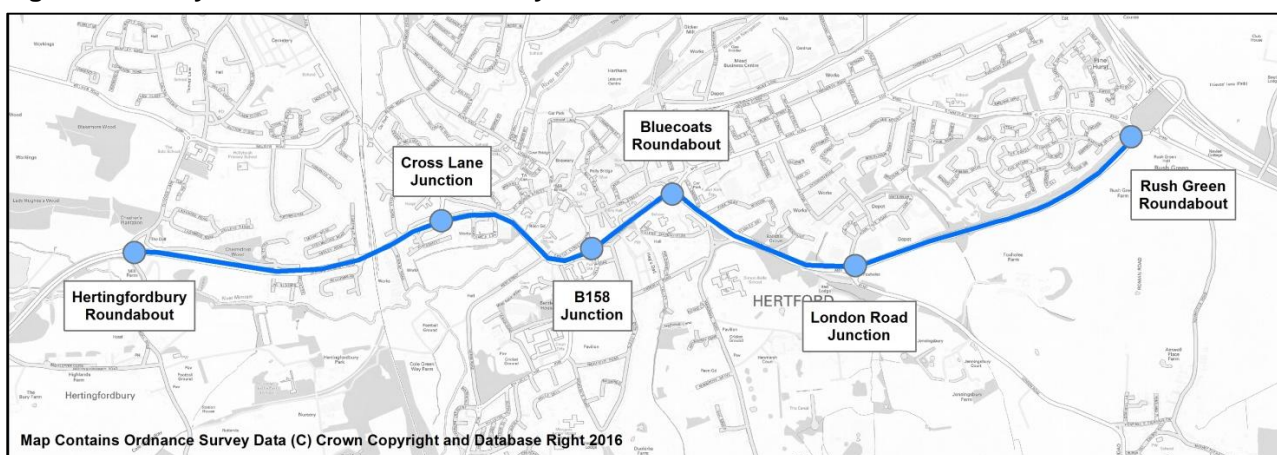
ID	Junction Name	Town	COMET Base Year Congestion (most congested time period shown)	COMET 2031 Congestion (time period consistent with Base Year column)
1	Rush Green Roundabout	nr Hertford	<b>AM Peak</b> V/C >90% on B1502 NB approach Delay ~2 mins	V/C >90% on B1502 NB approach Delay ~2.5 mins
2	Bluecoats Roundabout A414 – A119	Hertford	<b>AM Peak</b> V/C >90% on both A414 approaches Some sections of roundabout itself have V/C >90%.	V/C >90% on both A414 approaches Some sections of roundabout itself have V/C >90%. Delay increases relative to Base Year on some approaches of up to ~1 min.
	A119/Mill Rd junction (adjacent to Blue Coats roundabout)	Hertford	<b>AM Peak</b> V/C >90% on both A119 approaches Delay ~5 mins	V/C >90% on westbound A119 approach Delay ~6 mins
3	Eastwick Roundabout A414 – Eastwick Rd	nr Harlow	<b>AM Peak</b> V/C >90% A414 EB V/C >80% on other approaches Delay ~1 min	V/C >90% A414 EB and WB approaches Delay from ~1.5 mins
4	Amwell Roundabout A414 – A1170 – B1502 – B181	nr Hoddesdon	<b>PM Peak</b> V/C 80%-90% on A1170 and B181 approaches	V/C >90% on B181 approach V/C 80-90% on A414 EB approach  The scheme in the Forecast Year to remove the bus lane on the southern A1170 approach arm does reduce link stress on this arm.
5	A1184 – Station Rd – West Rd	Sawbridgeworth	<b>PM Peak</b> V/C >90% London Rd & Cambridge Rd Delay ~1 min	V/C >90% on all approaches Delay ~1.5 mins
6	A602 – Anchor Ln – Wadesmill Rd	nr Ware	<b>PM Peak</b> V/C >100% B158 EB Delay 2 mins	V/C >100% on A602 approaches and Wadesmill Rd V/C >80% Anchor Lane Delay ~3.5 mins
7	A602 – Hertford Rd	nr Stevenage	<b>PM Peak</b> V/C >90% on A602 approaches Delay ~1 min	V/C >90% on A602 NB Delay <30 secs (due to signalisation scheme)
8	B1383 – A120	Bishop's Stortford	<b>PM Peak</b> V/C >90% on A120 approaches V/C 80%-90% on B1383 approaches Delay ~1.5 mins	V/C >90% on all approaches Delay ~1.5 mins  Delay increases slightly between Base Year and Forecast Year (despite scheme here to add flared approaches on A120 arms).
9	M11 Junction 8	Bishop's Stortford	<b>AM Peak</b> V/C >90% on A120 approaches	V/C <80% on all approaches. However, delay ~1 min and V/C >90% at Birchanger Roundabout is likely to be having a restraining effect.
10	A120 – A10 – ALL	Puckeridge	No significant delay indicated in model.	No significant delay indicated in model.
11	A1184 – Thorley St	Bishop's Stortford	No significant delay indicated in model.	No significant delay indicated in model.
12	A10 – A1170	nr Ware	No significant delay indicated in model.	No significant delay indicated in model.



## 4.2 A414 Hertford Corridor Analysis

- 4.2.1 Analysis is provided in this section that illustrates the locations of highway network delay along the A414 in Hertford<sup>9</sup>.
- 4.2.2 As is shown in Figure 1, it should be noted that the COMET Base Year model over-represents delay through Hertford in both directions in the PM Peak, and under-represents delay in the westbound direction in the AM Peak. The representation of the eastbound movement in the AM Peak is WebTAG compliant.
- 4.2.3 Any misrepresentation of delay in the Base Year is likely to be propagated into the Forecast Year, however, a high level indication of change in delay between the two years can nevertheless be shown.
- 4.2.4 All journey time analysis presented here relates to the section of the A414 between the Hertingfordbury Roundabout (St Mary's Ln/Thieves Ln) and the Rush Green Roundabout (A10) – see Figure 15 for an illustration of the route.

**Figure 15. Analysed A414 Hertford Journey Time Route**



- 4.2.5 Figure 16 shows the A414 eastbound journey time for the route, and shows the variation between the Base Year (BY) and Forecast Year (FY). As expected (due to rising traffic volumes on the A414), the journey time increases by approximately 7% to 10.5 mins.
- 4.2.6 In both modelled years, a consistent pattern exists whereby the largest delays are encountered at the Bluecoats Roundabout (see Table 2 for details of congestion at this roundabout).
- 4.2.7 Figure 17 shows similar journey time results, however, for the westbound direction. Unlike for the eastbound movement, there is a small reduction in journey time between the Base Year and Forecast Year (despite flow increases). This result is due to signal optimisation in the Forecast Year that increases the capacity of the A414 westbound movement through the Bluecoats Roundabout. This prioritisation of the A414 westbound movement causes a knock-on increase in delay for trips from the A119 (Ware Rd) to the A414 of approximately 1 minute<sup>10</sup>.
- 4.2.8 The journey time results for the PM Peak are shown in Figure 36 and Figure 37 (see appendix), and indicate Forecast Year journey times that are either slightly longer or broadly equal to the Base Year values.

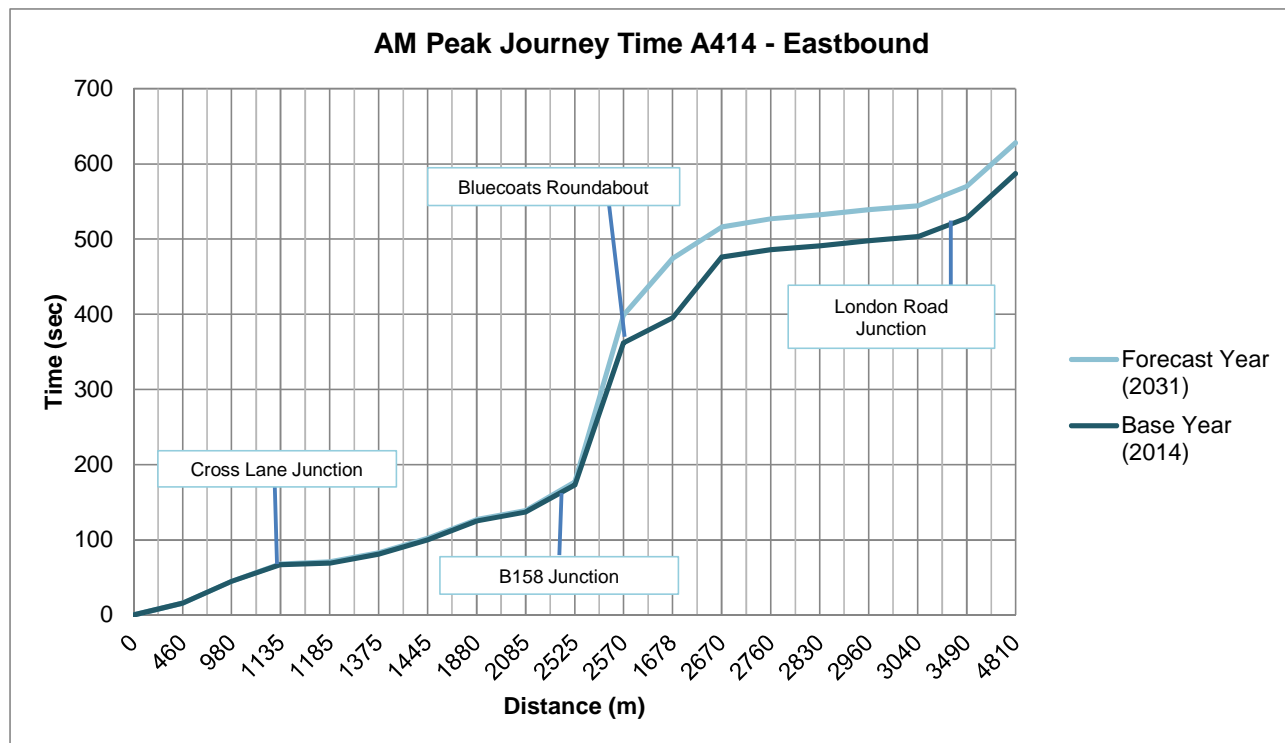
<sup>9</sup> AECOM has previously undertaken work along the A414 Corridor in Hertford as part of the A414 Transport Strategy (2013-2015). Any comments made as part of this work may vary from the analysis presented here for the following reasons: i. the S-Paramics model used for the previous work is a micro-simulation package, whereas COMET is a strategic tool, ii. the local growth assumptions have very likely evolved since 2014, and iii. the S-Paramics model was locally calibrated, whereas COMET has not been calibrated in Hertford (or any other urban area).

<sup>10</sup> Increase of 1 minute along a route starting from the A119 (Ware Rd) approach arm to the A414/B158 roundabout.

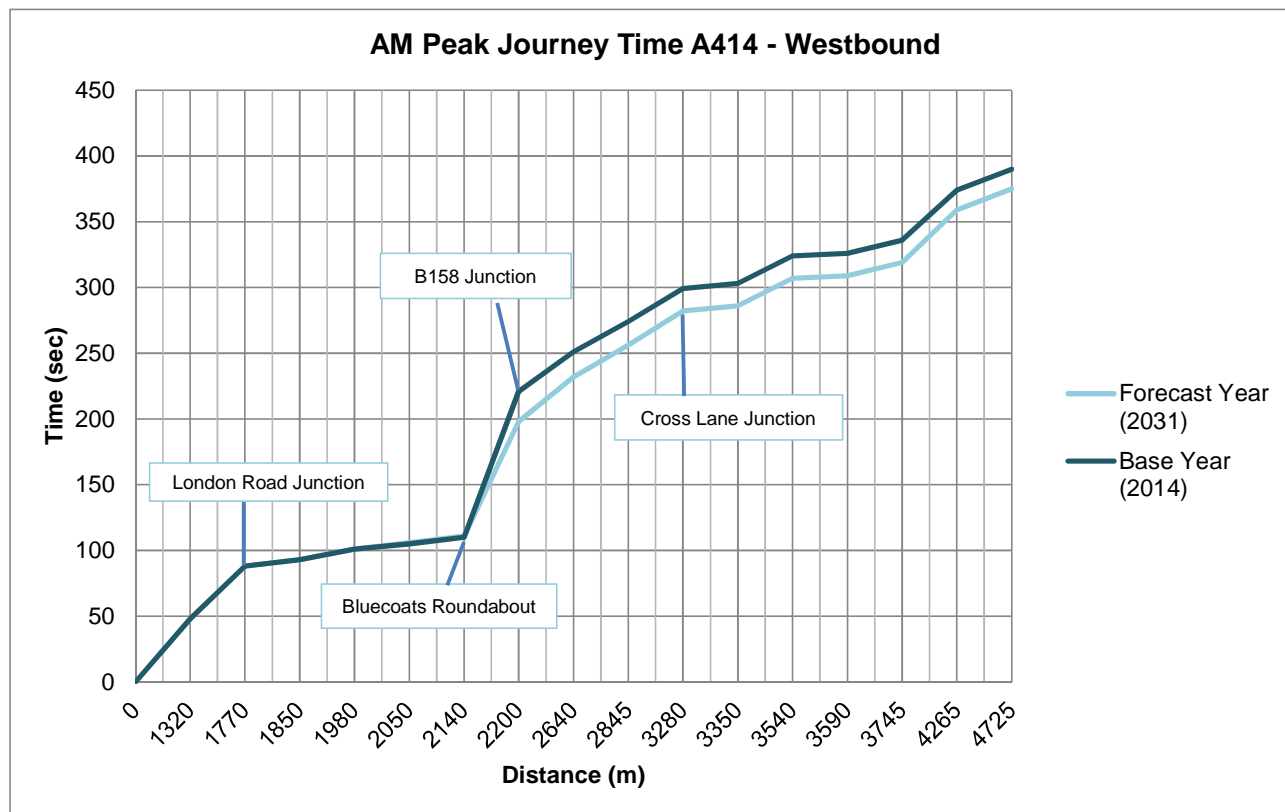


4.2.9 A414 delays through Hertford are largely a consequence of congestion at constrained junctions in this urban area. Therefore, there is a potential need for a strategic (i.e. non-junction based) mitigation solution for this issue.

**Figure 16. AM Peak Journey Time A414 – Eastbound**



**Figure 17. AM Peak Journey Time A414 – Westbound**



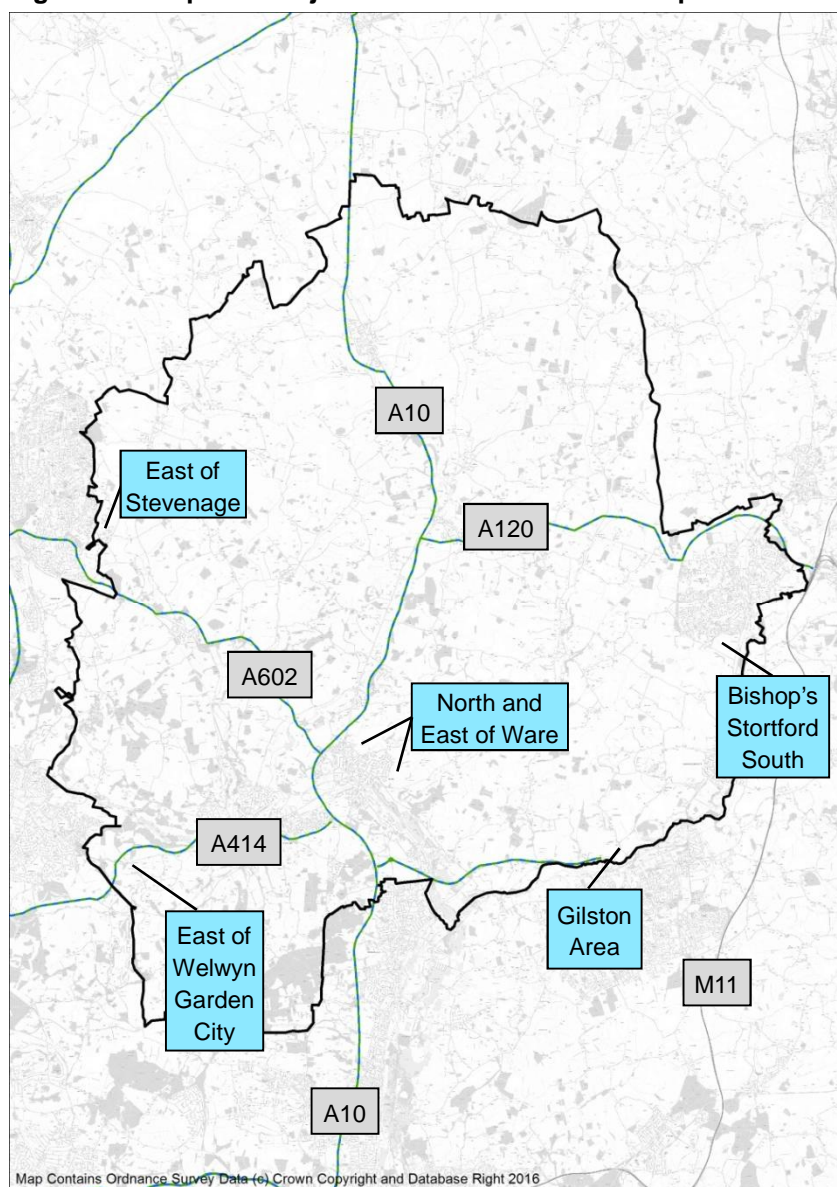
## 5. Proposed Major East Hertfordshire Developments

5.1.1 This section of the document considers five major proposed developments in East Hertfordshire, and provides initial analysis on the likely spatial distribution of their impacts on the highway network. The developments covered are as follows (including the magnitude of growth as agreed with EHC in October 2016):

- Gilston Area (3,050 dwellings)
- Bishop's Stortford South (750 dwellings & 500 jobs)
- North and East of Ware (1,000 dwellings & 300 jobs)
- East of Stevenage (600 dwellings)
- East of Welwyn Garden City (1,350 dwellings)

5.1.2 It is understood from EHC that the above sites will be delivered in line with the trajectory in the District Plan, which details differing delivery dates for these sites across the plan period, but provides for the total quantum of development being delivered by 2033. While the COMET model extends only as far as 2031, this report is intended to take into account the impact of strategic development over the whole plan period. Therefore, the full quantum of development that would be achieved for the five sites by 2033 has been included for modelling purposes.

**Figure 18. Proposed Major East Hertfordshire Developments**



- 5.1.3 At this stage, this analysis (i.e. the assessment of likely impacts) is in its initial stage as no comparison has been made with a scenario that does not contain these developments.
- 5.1.4 The analysis below shows the modelled volume and distribution of trips associated with the development, as well as a local congestion plot in the development's vicinity. It should be noted that the delay/congestion indicated on these plots (Figure 20, Figure 22, Figure 24, and Figure 26) is not wholly attributable to the development trips, however, illustrates where development trips would contribute to congestion in the network.
- 5.1.5 The diagrams provided in this section are for the AM Peak only. The equivalent analysis has also been undertaken for the PM Peak, and reveals a broadly inverted trip distribution compared to the AM Peak, so is therefore not shown. The extent/locations of network congestion, however, do vary slightly between the two peak hours – PM Peak congestion can be seen in Figure 14.

## 5.2 Gilston Area

- 5.2.1 As stated in section 4.1.2, the assumed growth outside Hertfordshire in the model is derived from central government (Department for Transport) forecasts (NTEM 7) which are likely to under-represent the proposed magnitude of growth in Local Plans of neighbouring authorities. This is particularly relevant for the Gilston Area given its proximity to Harlow.
- 5.2.2 It is understood that the Essex County Council VISUM model does include Essex authorities' Local Plan growth. This VISUM model has not been reviewed as part of this work, however, its growth assumptions may mean it is a more appropriate tool in this location.
- 5.2.3 Figure 19 and Figure 20 show the AM Peak trip distribution and congestion plot for the Gilston Area development. This site accesses the modelled network on Eastwick Rd and the A414 (see dashed lines in diagram).
- 5.2.4 A significant proportion of development trips use the A414 between this site and the A10 via Eastwick Roundabout and Amwell Roundabout. Beyond the A10/A414 junction, the strongest interaction is with the urban areas in Broxbourne District between the A414 and M25. A smaller proportion of the developments trips are to/from Hertford and Ware via the A414.
- 5.2.5 In addition to the A414/A10 corridors, developments trips are also modelled on the M11 via the A1184 and M11 Junction 7a (a Forecast Year scheme).
- 5.2.6 The following selected junctions (see Table 2 for full list) are likely to receive trips associated with this development:
- Eastwick Roundabout (selected junction 3)
  - Amwell Roundabout (selected junction 4)
  - Rush Green Roundabout (selected junction 1)
  - A1184 – Station Rd – West Rd (Sawbridgeworth) (selected junction 5)
  - Bluecoats Roundabout (selection junction 2)

## 5.3 Bishop's Stortford South

- 5.3.1 Figure 21 and Figure 22 show the AM Peak trip distribution and congestion plot for the Bishop's Stortford South development. This site accesses the modelled network on Obrey Way (see dashed line in diagram).
- 5.3.2 Some of the development trips to/from this site are internal to Bishop's Stortford, and access the town centre via Whittington Way and London Rd. Of the development trips that are not internal to Bishop's Stortford, however, the relevant corridors are the A1184 (towards Sawbridgeworth and selected junction 5 in Figure 10) and the A120.

5.3.3 The shortest route between this development and M11 Junction 8 is through the town centre. Congestion within Bishop's Stortford, however, encourages modelled trips to route via Pig Ln and Church Rd, instead.

5.3.4 The following selected junctions (see Table 2 for full list) are likely to receive trips associated with this development:

- A1184 – Station Rd – West Rd (Sawbridgeworth) (selected junction 5)
- A1184 – Thorley St (Bishop's Stortford) (selected junction 11)
- M11 Junction 8 (selected junction 9)
- Eastwick Roundabout (selected junction 3)

## 5.4 North and East of Ware

5.4.1 Figure 23 and Figure 24 show the AM Peak trip distribution and congestion plot for the North and East of Ware development. This site accesses the modelled network via a new spine road connecting the A1170, Fanhams Hall Rd and the B1004 (see dashed lines in diagram).

5.4.2 There is a strong linkage between this development and the A10 (primarily south of Ware) via the A1170. Elsewhere, development trips are likely to use Hollycross Rd (towards B181 into Harlow), Anchor Ln, and the A602 (towards Stevenage). Trips via Wadesmill Rd and the A414 to Hertford are also indicated by the model.

5.4.3 The following selected junctions (see Table 2 for full list) are likely to receive trips associated with this development:

- A602 – Anchor Ln – Wadesmill Rd (selected junction 6)
- Rush Green Roundabout (selected junction 1)
- A10 – A1170 (selected junction 12)

## 5.5 East of Stevenage

5.5.1 Figure 25 and Figure 26 show the AM Peak trip distribution and congestion plot for the East of Stevenage development. This site accesses the modelled network via Broadwater Ln/Benington Rd (see dashed line in diagram)<sup>11</sup>. Trips to/from the A602 are therefore fed via the Broadwater Ln/Gresley Way junction.

5.5.2 The origins/destinations of trips associated with this development are primarily in Stevenage, and modelling indicates a relatively minor interaction with the East Hertfordshire network. Where this interaction exists, it is via the A602 towards the A10.

5.5.3 The following selected junctions (see Table 2 for full list) are likely to receive trips associated with this development:

- A602 – Anchor Ln – Wadesmill Rd (selected junction 6)
- A602 – Hertford Rd (Stevenage) (selected junction 7)
- Junctions on A602 between district boundary and A1(M), including A602/Monkswood Way roundabout (Stevenage).

<sup>11</sup> It is recognised in reality the access point will be further north on Gresley Way (opposite the White Way and Uplands). The model zone in which this development falls, however, accesses the network via Broadwater Ln/Benington Rd. This is due to the strategic nature of COMET. Nevertheless, development trips to/from the A602 do route via the Broadwater Ln/Gresley Way junction (as will happen in reality). Therefore, at a strategic level, this is not considered to be a material limitation.

## **5.6 East of Welwyn Garden City**

- 5.6.1 Figure 27 and Figure 28 show the AM Peak trip distribution and congestion plot for the East of Welwyn Garden City development. This site accesses the modelled network via the A414/Birchall Ln roundabout<sup>12</sup>.
- 5.6.2 The origins/destinations of trips associated with this development are primarily in Welwyn Garden City, and modelling indicates a relatively minor interaction with the East Hertfordshire network beyond Hertford. Trips from this site into East Hertfordshire predominantly use the A414 in the direction of Hertford, A602 and A10. The number of westbound A414 trips towards A1(M) is relatively low (up to 20) when compared to the eastbound A414 trips towards Hertford (up to 50).
- 5.6.3 The following selected junctions (see Table 2 for full list) are likely to receive trips associated with this development:
- A602 – Anchor Ln – Wadesmill Rd (selected junction 6)
  - Rush Green Roundabout (selected junction 1)
  - Bluecoats Roundabout (selection junction 2)

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<sup>12</sup> It is recognised in reality the access point will be on Birchall Ln (north/west of the A414). The model zone in which this development falls, however, means that development trips need to use the A414/Birchall Ln roundabout. In reality, this will not be the case, however, is due to the strategic nature of COMET. The overestimation of development trips through this roundabout is acknowledged, however, no significant congestion is modelled here. Therefore, at a strategic level, this is not considered to be a material limitation.



Figure 19. Gilston Area AM Peak 2031 Trip Distribution

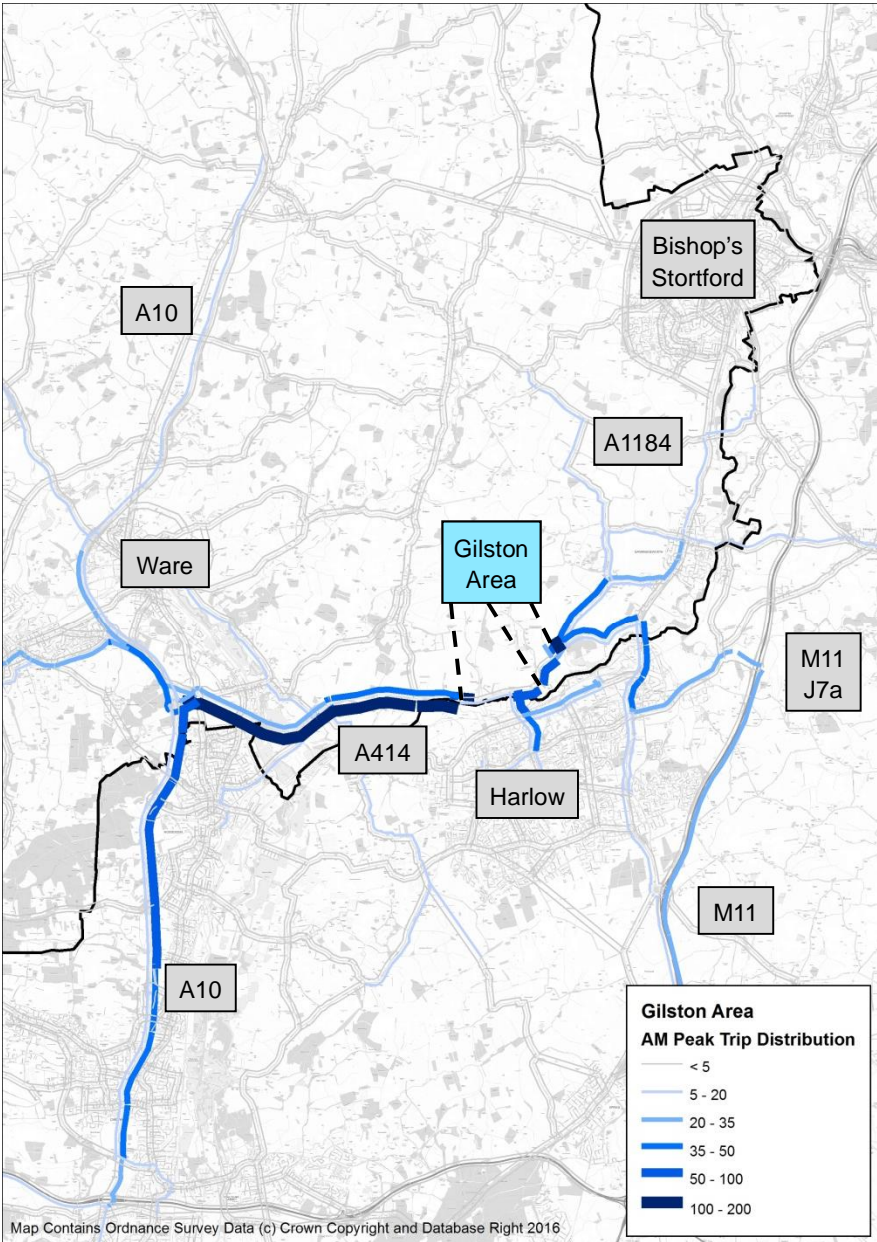


Figure 20. Gilston Area AM Peak 2031 Congestion Plot

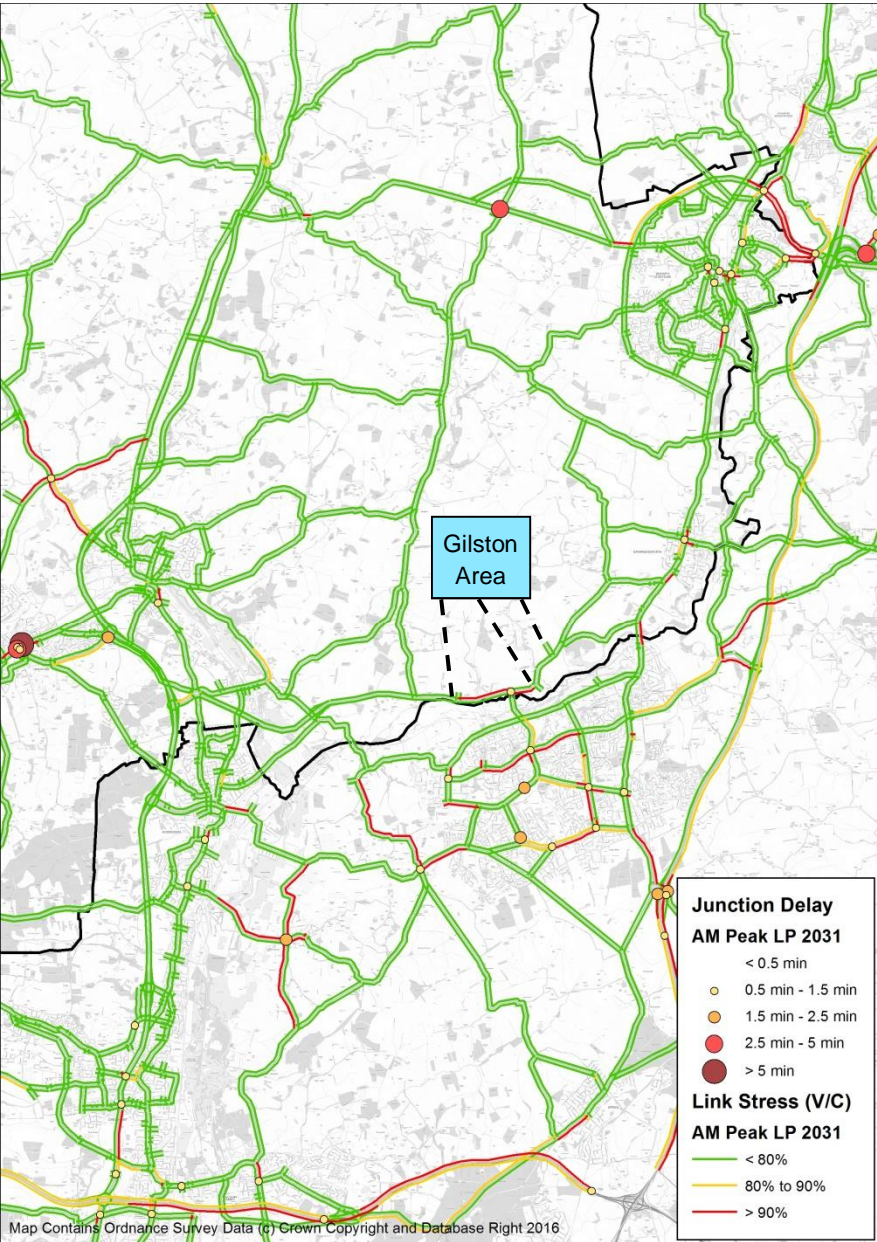




Figure 21. Bishop's Stortford South AM Peak 2031 Trip Distribution

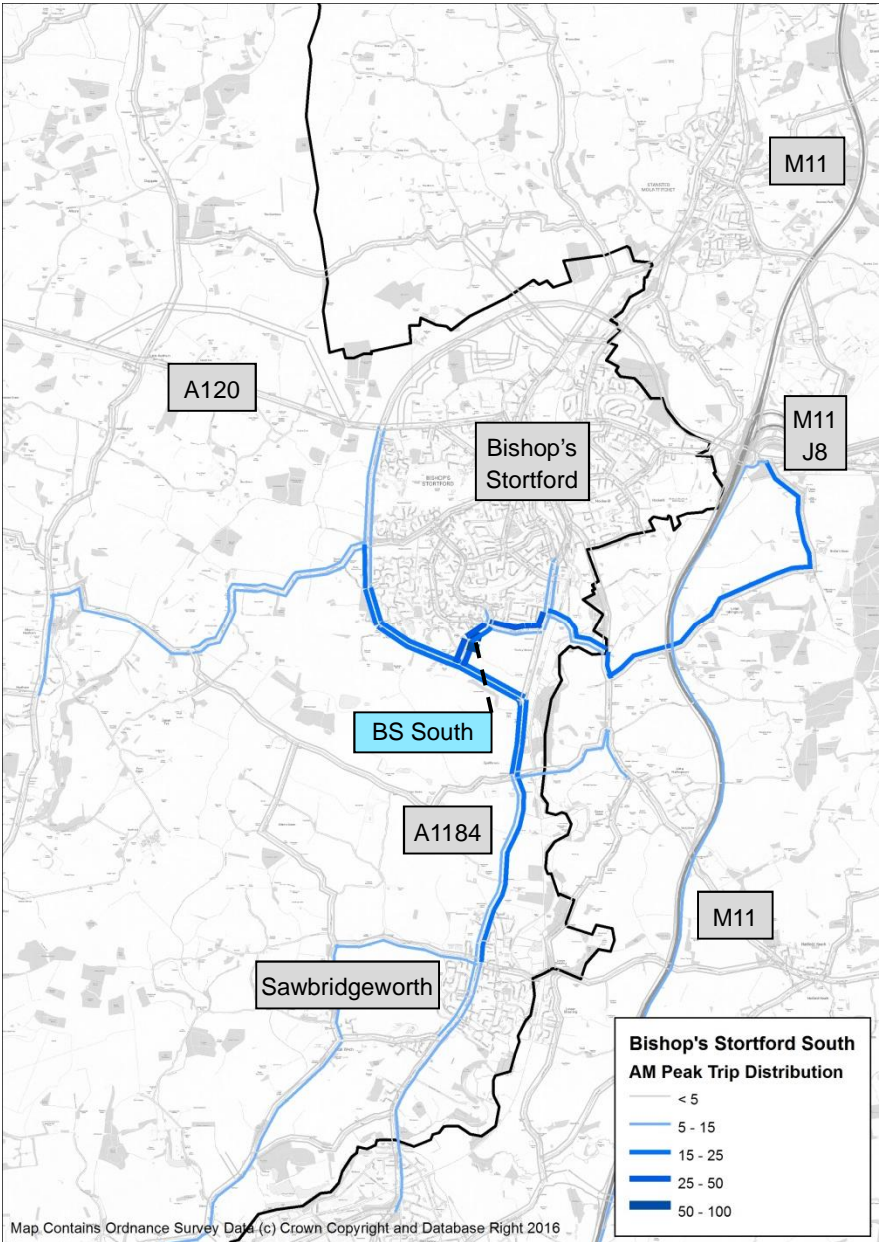


Figure 22. Bishop's Stortford South AM Peak 2031 Congestion Plot

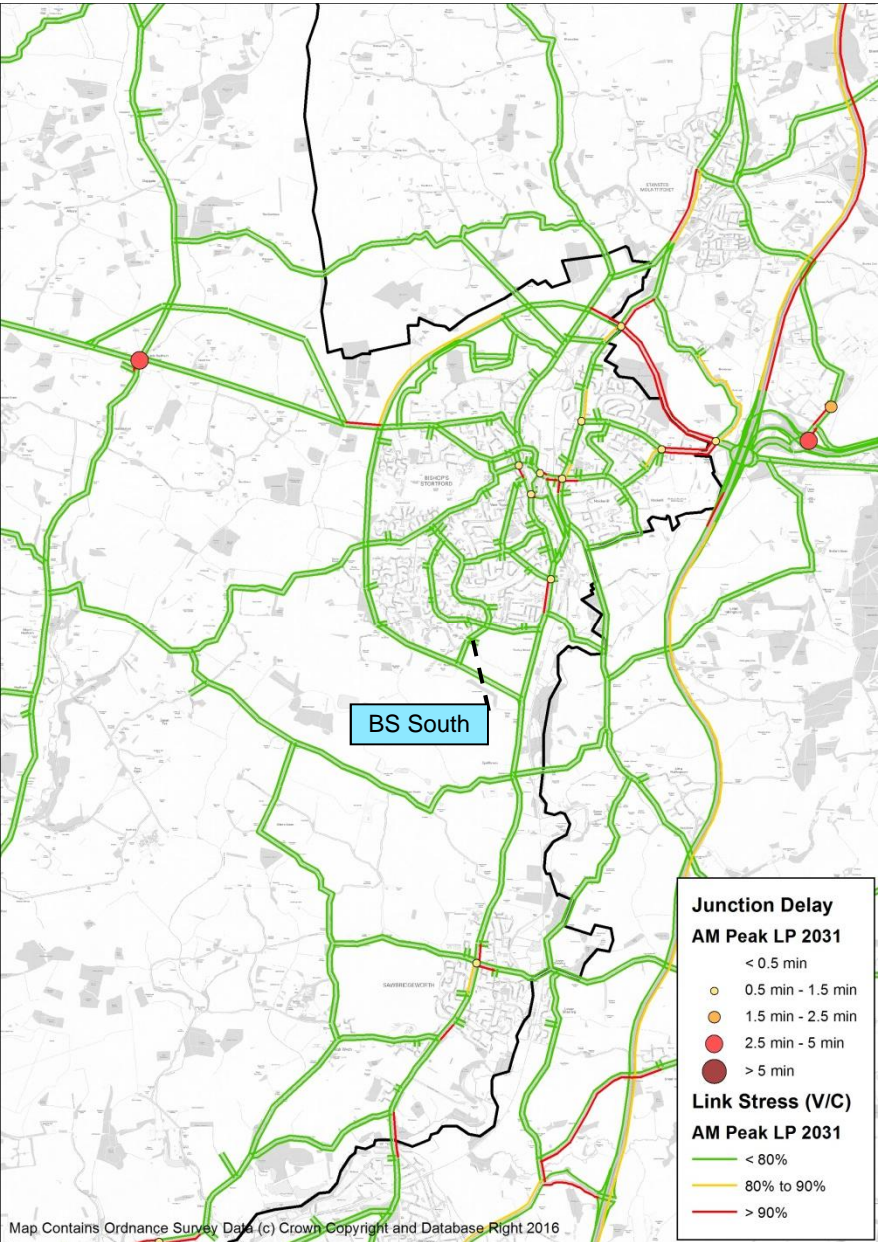




Figure 23. North and East of Ware AM Peak 2031 Trip Distribution

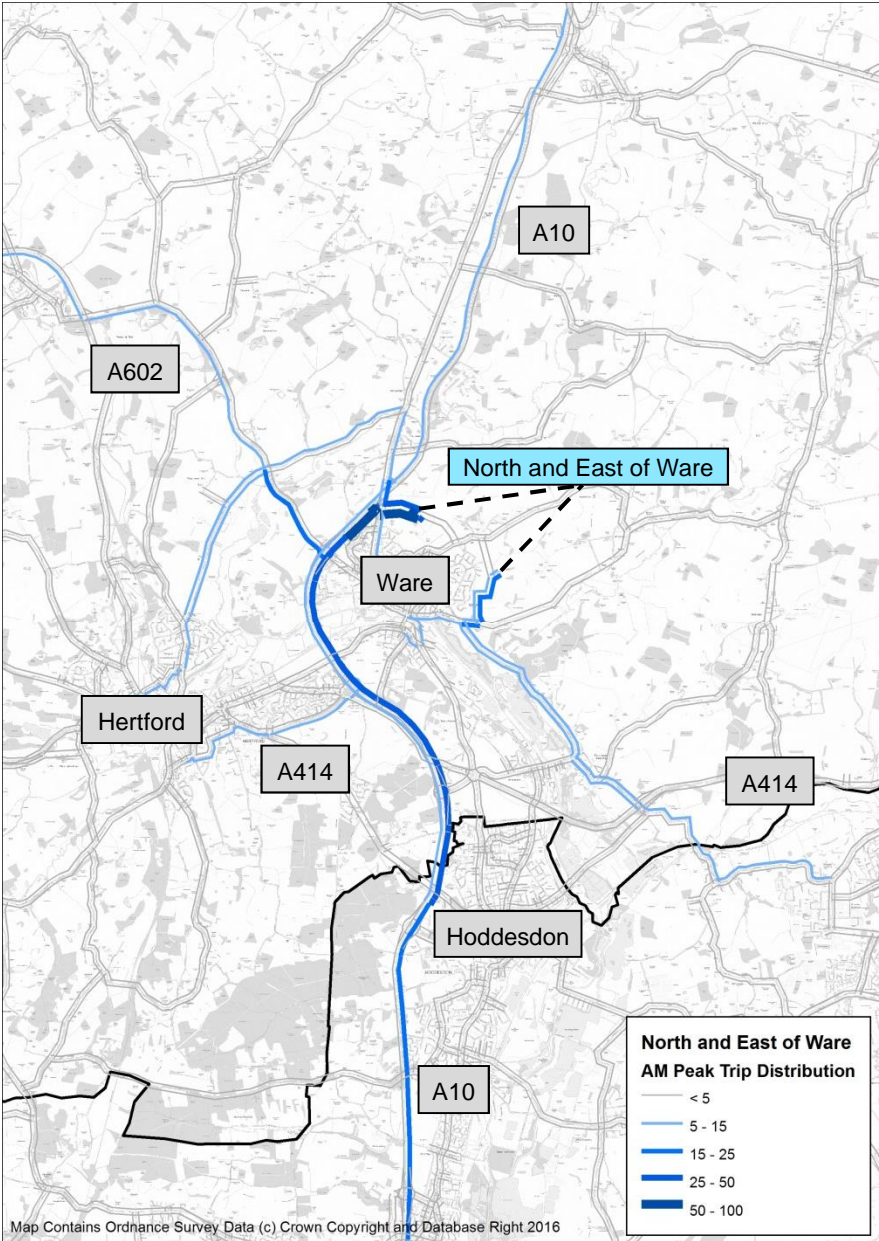
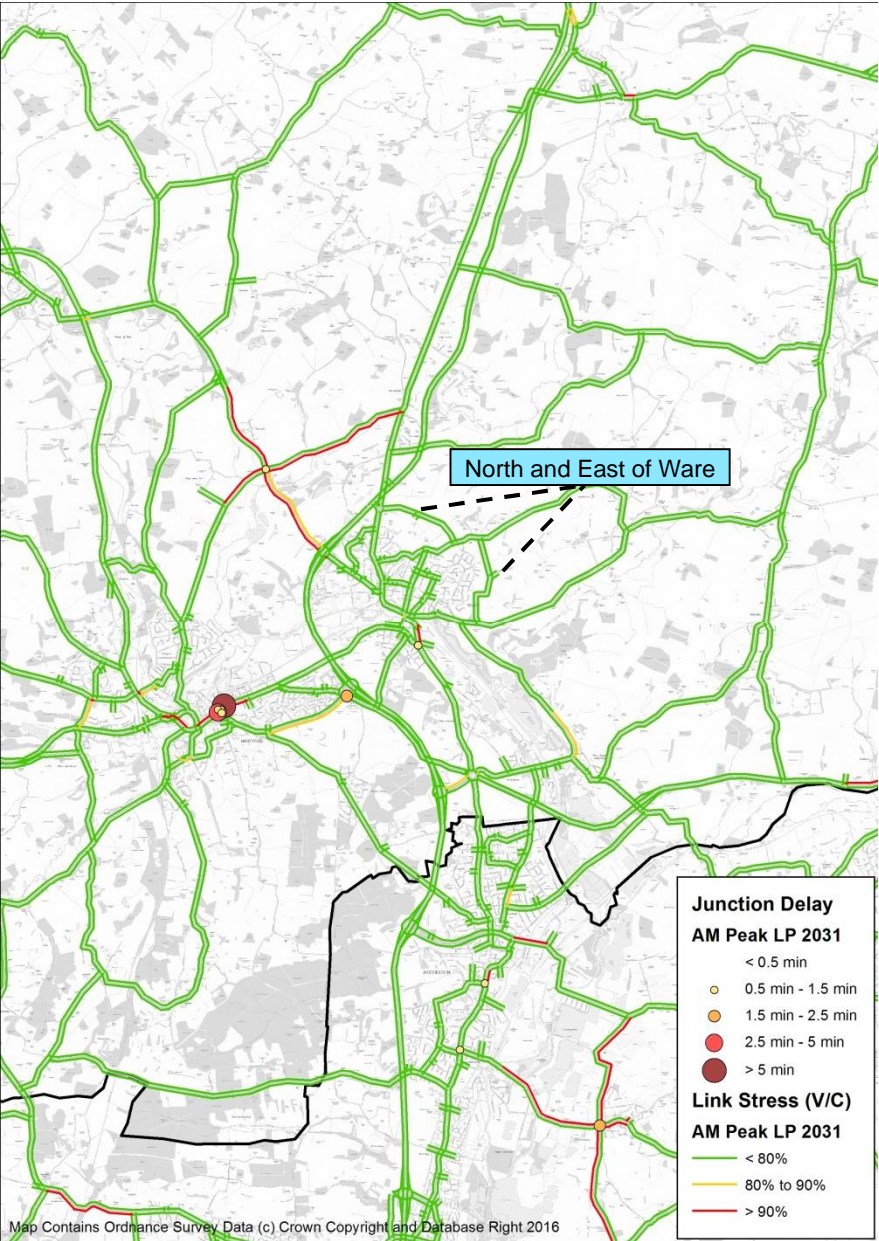
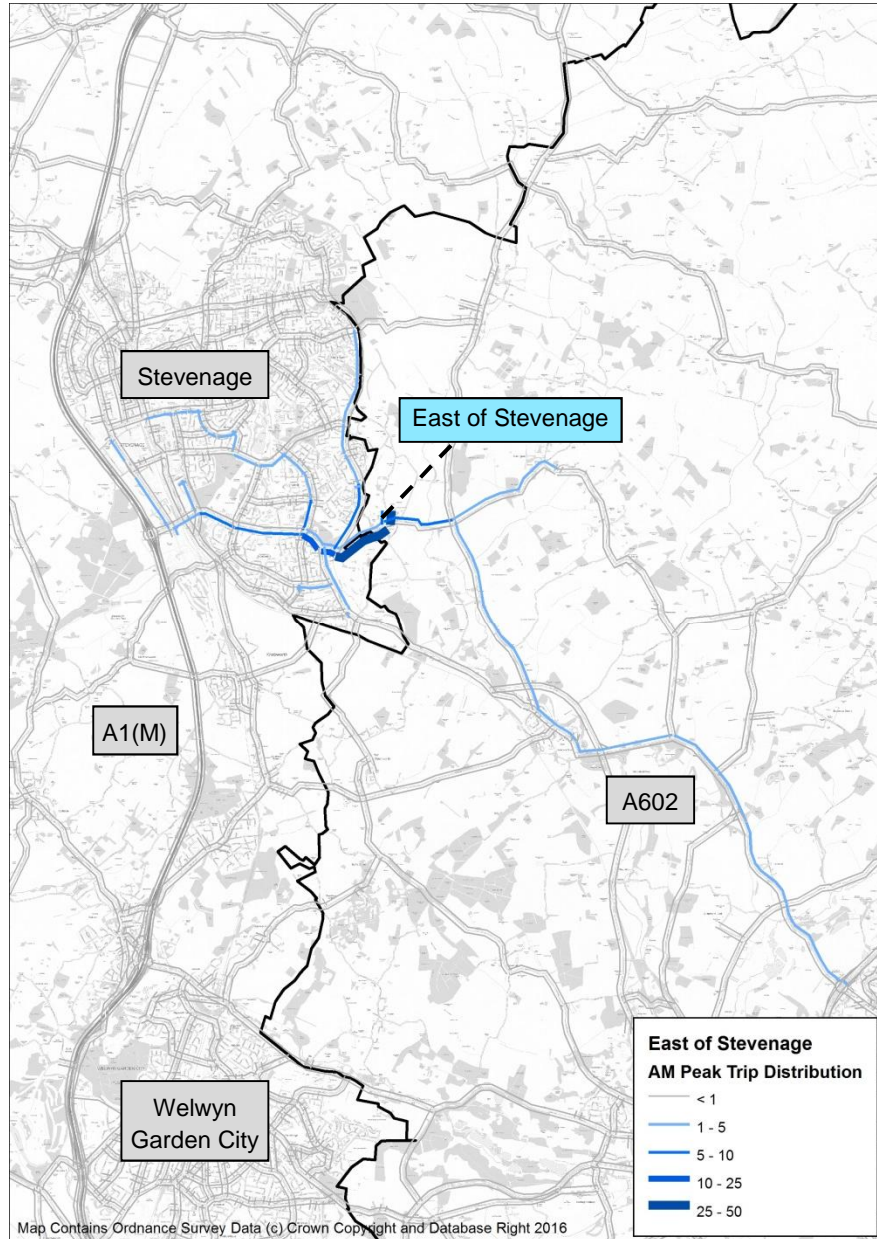


Figure 24. North and East of Ware AM Peak 2031 Congestion Plot





**Figure 25. East of Stevenage AM Peak 2031 Trip Distribution**



**Figure 26. East of Stevenage AM Peak 2031 Congestion Plot**

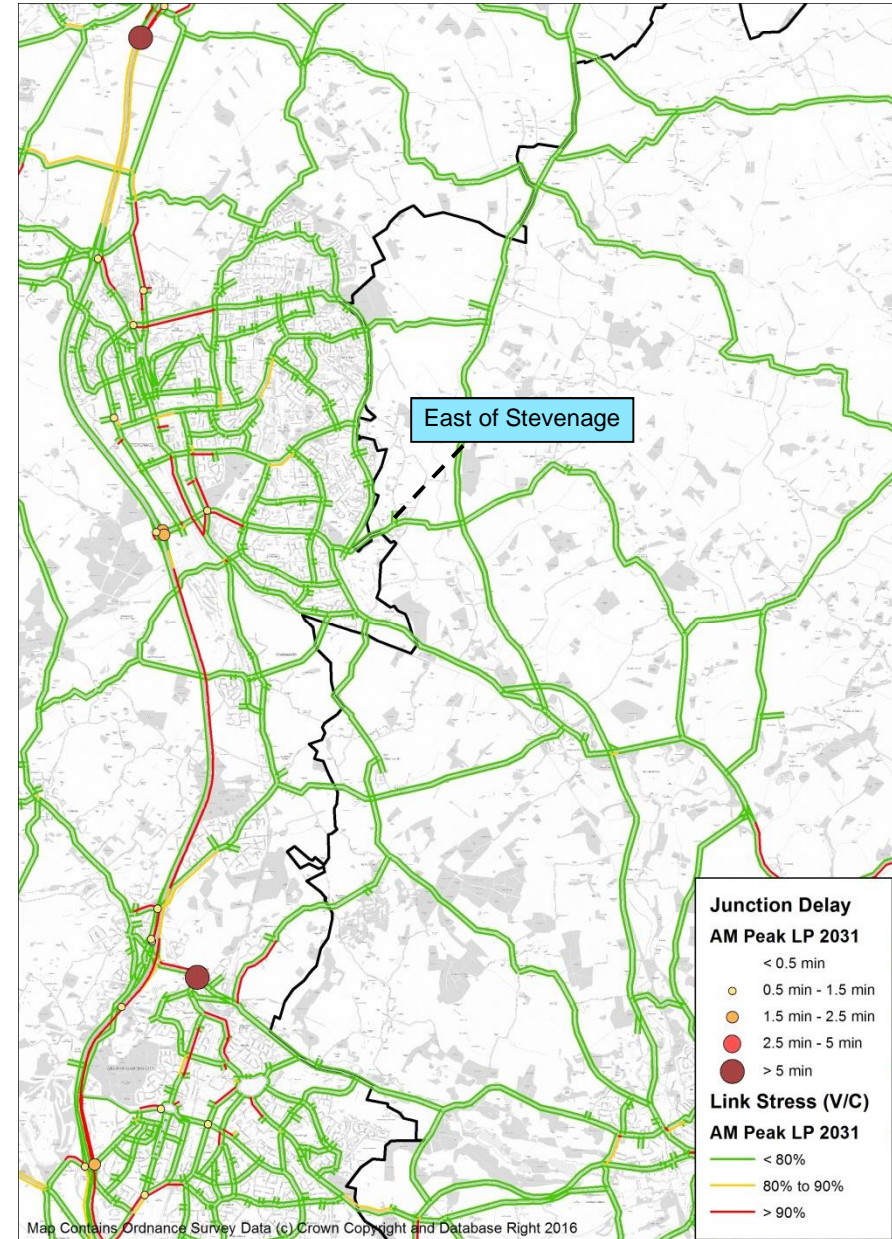




Figure 27. East of Welwyn Garden City AM Peak 2031 Trip Distribution

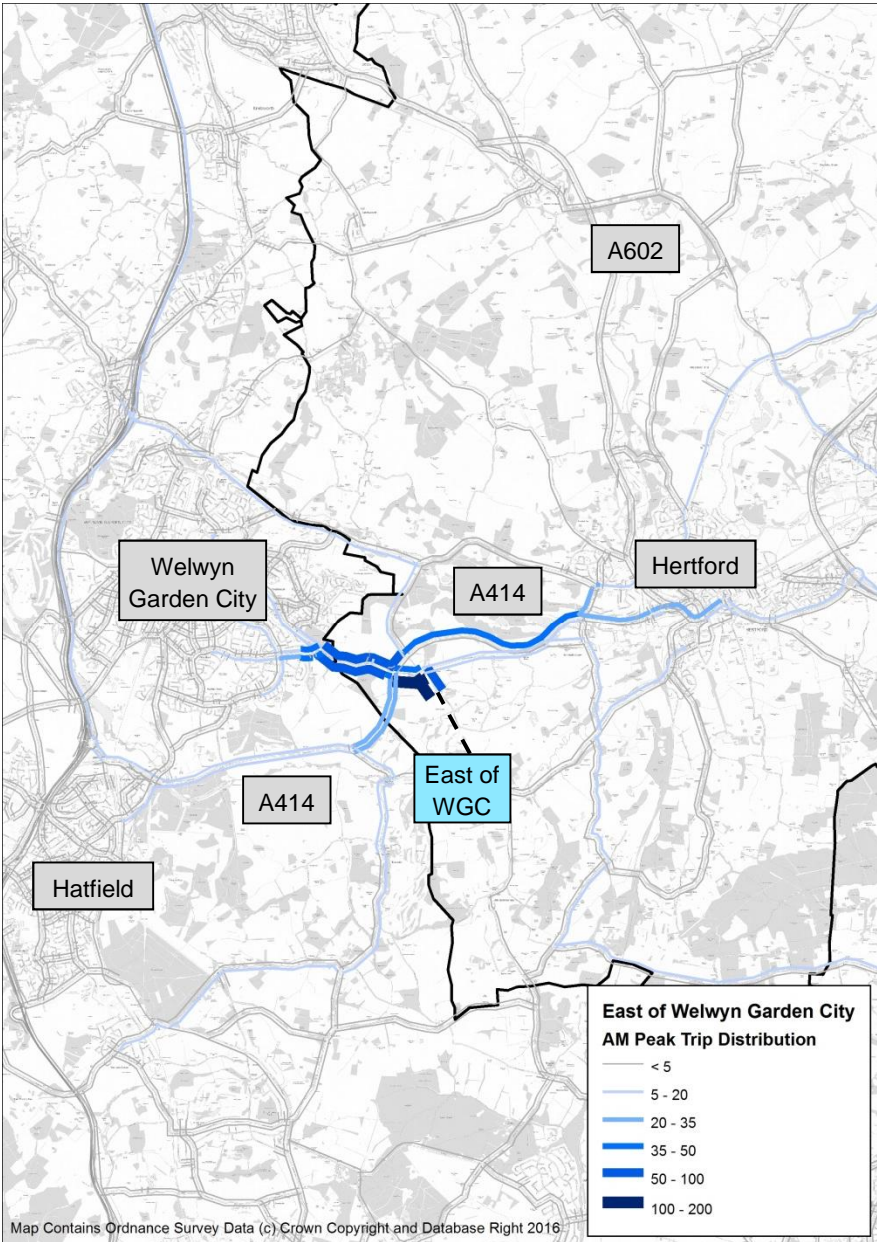
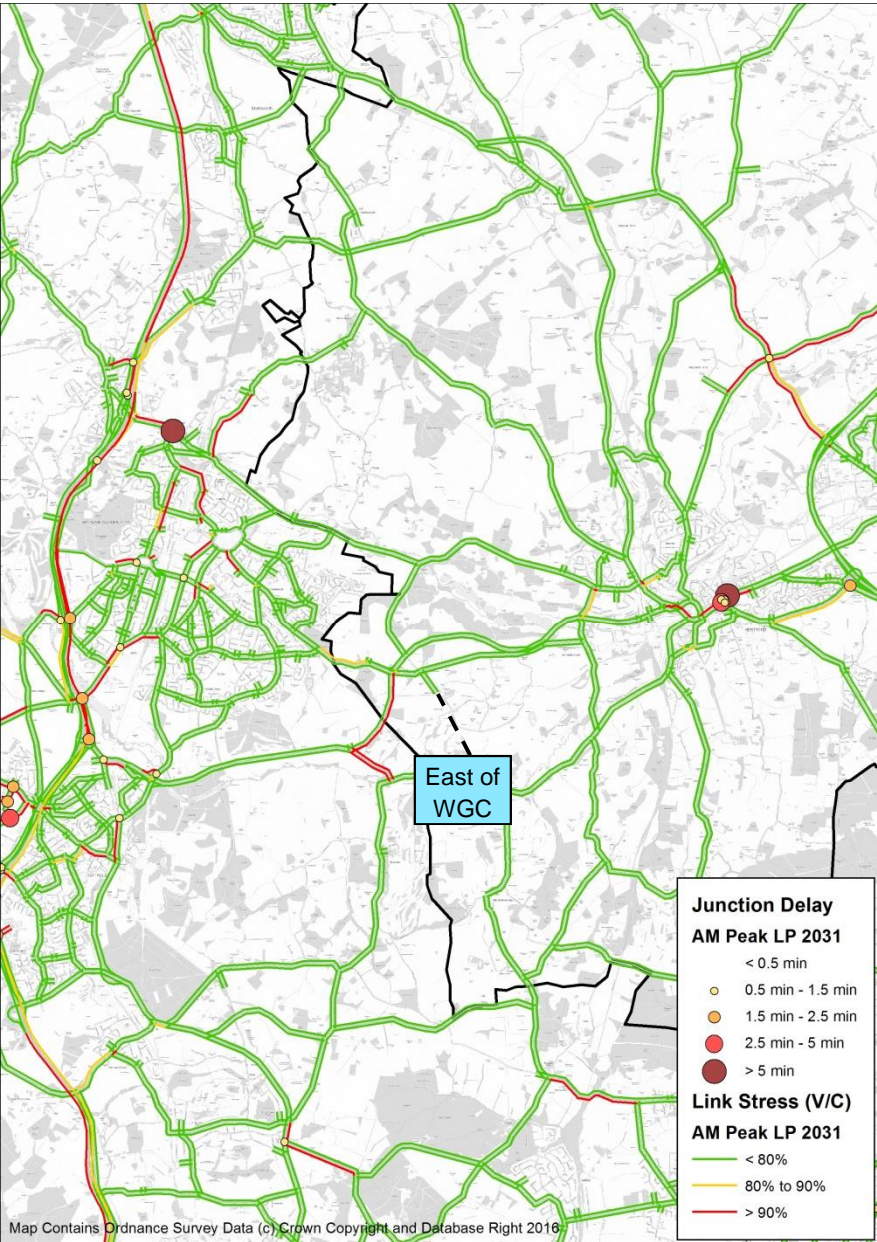


Figure 28. East of Welwyn Garden City AM Peak 2031 Congestion Plot



## 6. Potential Mitigation Options

- 6.1.1 Table 3 presents the type of potential mitigation options that may be appropriate at the selected locations shown in Figure 10 and Table 2.
- 6.1.2 At this stage, these mitigation measures should be interpreted at a very high level, and would require further testing. In addition, it should be noted that potential assessments of any mitigation option (at a later stage, out of the present scope) should rely on a range of indicators which are not limited to congestion.

**Table 3. Potential Mitigation Options**

ID	Junction Name	Potential mitigation
1	Rush Green Roundabout	Signalisation of B1502 NB approach, or addition of segregated left turn lane from this arm to A414.
2	Bluecoats Roundabout A414 – A119	This junction is physically constrained, and may therefore necessitate a more strategic “non-junction based” mitigation solution to address A414 through-traffic.
3	Eastwick Roundabout A414 – Eastwick Rd	Potential addition of segregated left turn lanes to remove some movements through the roundabout. In the longer term, it is likely that a more sustainable solution will be required for this junction, particularly given local growth aspirations.  As part of the proposals for growth in the Gilston Area, the section of Fifth Avenue between the Eastwick Roundabout and the Burnt Mill roundabout will be widened to increase capacity. A second Stort crossing will also be provided.
4	Amwell Roundabout A414 – A1170 – B1502 – B181	Potential conversion to signalised “hamburger-style” to prioritize A414 through-traffic.
5	A1184 – Station Rd – West Rd	Remove roundabouts and replace by signalized junction. Potential to ban right turns, although this may cause problematic re-routeing
6	A602 – Anchor Ln – Wadesmill Rd	Signalisation or addition of further flares on all/some approach arms.
7	A602 – Hertford Rd	Signalisation tested in 2031 forecast indicates significant reduction in delay.
8	B1383 – A120	This junction falls outside the East Hertfordshire boundary, and a potential mitigation scheme is being investigated by Essex County Council. Modelling results do not suggest that the Bishop’s Stortford North mitigation scheme sufficiently deals with congestion here.
9	M11 Junction 8	This junction may require a combination of short and long term interventions. A potential mitigation scheme is being investigated by Essex County Council.
10	A120 – A10 – ALL	Strategic modelling does not suggest that a mitigation scheme is required at this junction. Further assessment might be needed to understand the impact of developments and likely mitigation required.
11	A1184 – Thorley St	Strategic modelling does not suggest that a mitigation scheme is required at this junction. Further assessment might be needed to understand the impact of developments and likely mitigation required.
12	A10 – A1170	Strategic modelling does not suggest that a mitigation scheme is required at this junction. Further assessment might be needed to understand the impact of developments and likely mitigation required.

### 6.2 Sustainable Strategies and Modal Shift

- 6.2.1 The mitigation options presented in Table 3 are predominantly highway-based capacity upgrade measures at certain junctions in the district where future congestion is expected. Whilst such highway-based capacity upgrades may be necessary and effective in some cases, there is an inherent risk that such measures simply transfer the problem elsewhere in the network.

- 6.2.2 As an alternative approach, it is suggested that longer term and more sustainable mitigation should be achieved through transport strategies / schemes that promote modal shift (i.e. encouraging trips to be made by walking, cycling or public transport). Encouraging modal shift is of particular importance in new developments before car-dominant travel patterns are established. Potential modal shift strategies are not within the current scope, but may be investigated in further work.

## 7. Air Quality Management Areas

- 7.1.1 The locations of Air Quality Management Areas (AQMA) in East Hertfordshire are shown in Figure 29, Figure 30 and Figure 31. The COMET highway traffic assignment model is not designed to forecast air quality, however, results are provided in the following section on the likely increase in traffic flow (as a proxy for vehicle emissions) between the Base Year and Forecast Year at these locations.

- 7.1.2 The roads considered in the calculation of traffic increase in the three AQMAs are as follows:

- Hertford
  - A414 southeast of Bluecoats Roundabout
  - A414 southwest of Bluecoats Roundabout
  - A414 adjacent to Castle Gardens
  - A119 Ware Rd
- Sawbridgeworth
  - London Rd
  - Cambridge Rd
  - Station Rd
- Bishop's Stortford
  - Hockerill St
  - Dunmow Rd
  - London Rd
  - Stansted Rd

- 7.1.3 The AQMA with the largest increase in traffic is Hertford (+26%), and this significant trend should be investigated further as part of other relevant transport studies in this area.

- 7.1.4 The increases in Sawbridgeworth and Bishop's Stortford are more modest (+8% and +2%, respectively). This trend is a result of existing congestion in the Base Year model in these locations, meaning that future traffic growth is effectively limited by the capacity of the junction. In these congested areas, any additional vehicles added to the queues are likely to exacerbate air quality issues.

**Table 4. Flow increases at East Hertfordshire AQMAs (2014 – 2031)**

AQMA	AM Peak	Inter-peak	PM Peak	Total
Hertford	1946 (+26%)	2155 (+28%)	1527 (+23%)	5628 (+26%)
Sawbridgeworth	209 (+5%)	292 (+7%)	547 (+12%)	1048 (+8%)
Bishop's Stortford	145 (+3%)	110 (+3%)	34 (+1%)	289 (+2%)

\* percentages are rounded to nearest percent



Figure 29. Hertford AQMA

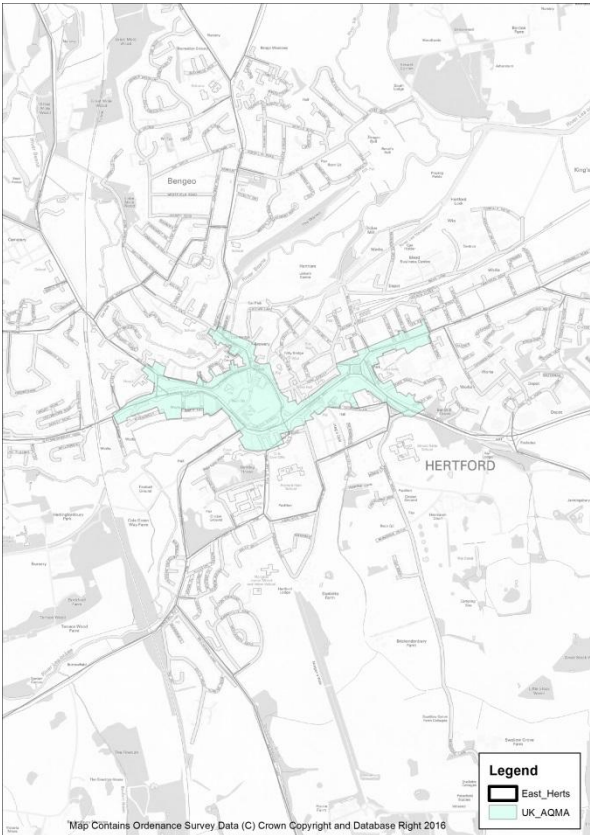


Figure 30. Sawbridgeworth AQMA

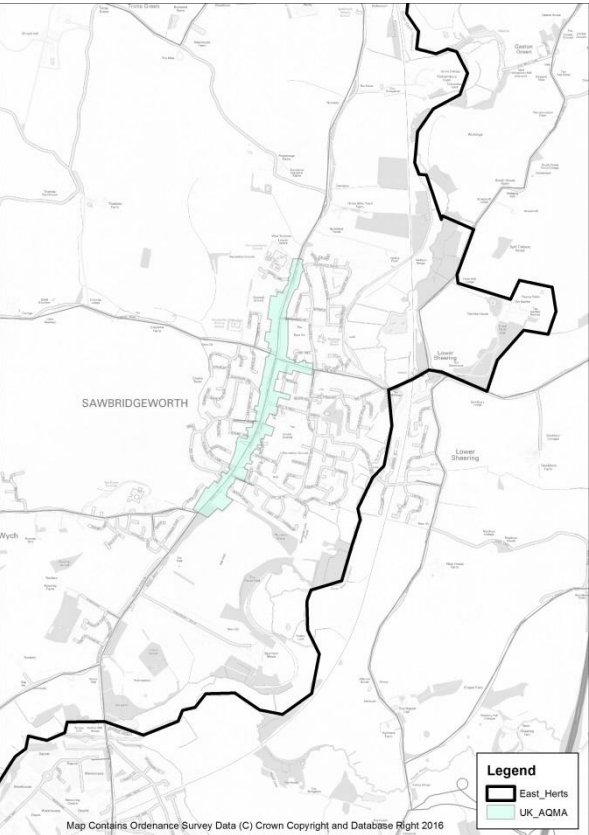
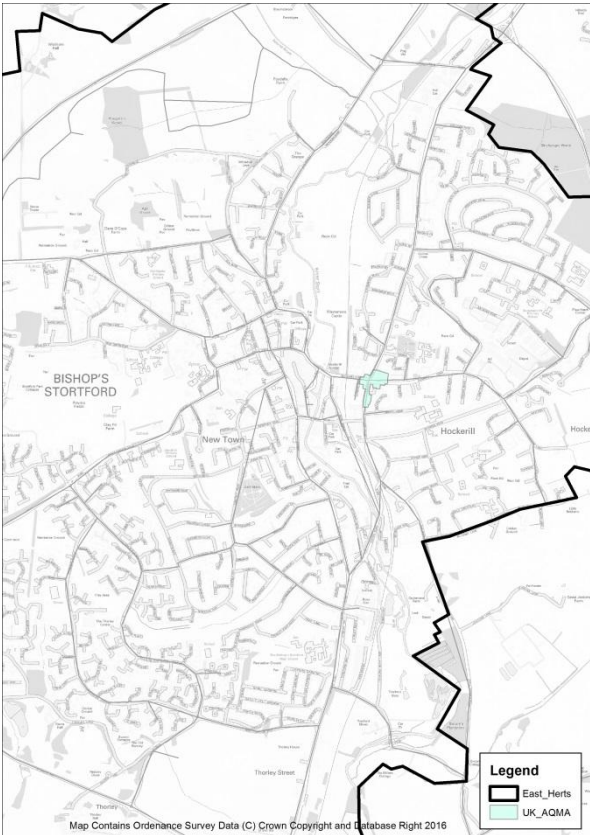


Figure 31. Bishop's Stortford AQMA



## **8. Summary and Next Steps**

### **8.1 Summary**

- 8.1.1 This document provides strategic level analysis of the highway network performance in East Hertfordshire in support of the District Plan submission in March 2017. The analysis presented here makes use of HCC's COMET models (2014 Base Year and 2031 Forecast Year).
- 8.1.2 The analysis covers:
- Key selected junctions in East Hertfordshire
  - A414 corridor delay through Hertford
  - Five proposed major developments in East Hertfordshire
  - Air Quality Management Areas
- 8.1.3 The available model scenarios indicate that highway network congestion in East Hertfordshire is likely to rise between the present day and 2031, particularly at key junctions where delay is already evident. The mitigation of this delay may be achieved through the introduction of new transport infrastructure schemes, some potential options for which are shown in Table 3.

### **8.2 Next Steps**

- 8.2.1 To test the potential highway mitigation options outlined in this document (Table 3), further modelling work is required, initially at a strategic level. This work will help to develop an evidence base for the appropriateness of any mitigation option.
- 8.2.2 Notwithstanding the pursuit of highway-based mitigation schemes, scope also exists to explore the development of sustainable transport and modal shift. These schemes should encourage transport through modes such as walking, cycling and public transport.
- 8.2.3 As stated in section 1, the 2031 COMET Forecast Year includes Local Plan growth in all 10 Hertfordshire districts. Outside Hertfordshire, growth projections are taken from central government (Department for Transport) forecasts (NTEM 7). Given the proximity of East Hertfordshire to neighbouring authorities (which may have Local Plan assumptions that are significantly higher than those envisaged by central government), it may be necessary to produce a 2031 Forecast Year that reflects the Local Plan growth of these neighbouring authorities. In this way, a higher level of cumulative growth (and therefore potential highway impact) can be assessed.



## Appendix A – Journey Time Validation Results

**Table 5. Journey Time Validation Results**

Route	Direction	Observed			Modelled			Difference			% Difference			WebTAG Compliant?		
		AM	IP	PM	AM	IP	PM	AM	IP	PM	AM	IP	PM	AM	IP	PM
Route 5: A414 Central	EB	924	840	1,144	1,007	1,006	1,503	83	166	359	9%	20%	31%	YES	NO	NO
Route 5: A414 Central	WB	1,086	797	871	902	800	1,027	-184	3	156	-17%	0%	18%	NO	YES	NO
Route 6: A414 East	EB	793	756	774	658	568	733	-135	-188	-41	-17%	-25%	-5%	NO	NO	YES
Route 6: A414 East	WB	724	751	762	618	586	593	-106	-166	-168	-15%	-22%	-22%	YES	NO	NO
Route 9: A120	EB	1,108	974	1,226	1,053	909	1,184	-55	-64	-42	-5%	-7%	-3%	YES	YES	YES
Route 9: A120	WB	1,168	949	1,094	1,038	891	1,139	-130	-57	45	-11%	-6%	4%	YES	YES	YES
Route 11: A1184	NB	922	883	983	782	780	870	-141	-103	-112	-15%	-12%	-11%	YES	YES	YES
Route 11: A1184	SB	1,041	849	900	850	788	818	-191	-61	-83	-18%	-7%	-9%	NO	YES	YES
Route 12: A602	EB	769	644	672	653	588	814	-115	-57	142	-15%	-9%	21%	YES	YES	NO
Route 12: A602	WB	768	671	895	618	581	661	-151	-90	-233	-20%	-13%	-26%	NO	YES	NO
Route 13A: A10 (Rush Green - M25)	NB	711	720	817	692	691	757	-19	-30	-60	-3%	-4%	-7%	YES	YES	YES
Route 13A: A10 (Rush Green - M25)	SB	1,032	725	833	716	671	724	-317	-55	-108	-31%	-8%	-13%	NO	YES	YES
Route 13B: A10 (A120 - Rush Green)	NB	361	352	351	356	356	362	-5	4	12	-1%	1%	3%	YES	YES	YES
Route 13B: A10 (A120 - Rush Green)	SB	362	356	340	364	357	358	2	1	18	1%	0%	5%	YES	YES	YES
Route 13C: A10 (A507 - A120)	NB	375	369	370	328	325	339	-47	-44	-31	-12%	-12%	-8%	YES	YES	YES
Route 13C: A10 (A507 - A120)	SB	418	392	385	354	332	333	-64	-60	-51	-15%	-15%	-13%	YES	YES	YES

## Appendix B – GEH Results

**Table 6. GEH Results**

Link ID	Location	Observed AM	Model AM	GEH AM	Observed PM	Model PM	GEH PM
3301-1132	White Stubbs Ln	199	355	9.38	347	729	16.47
3482-1195	A10	1817	1879	1.44	1798	1796	0.04
3373-1212	Hoddesdon Rd	213	209	0.29	214	147	5.01
3561-1241	Rye Rd	61	337	19.58	47	342	21.15
3430-3035	A1184	633	427	8.93	817	514	11.73
10012-3042	Harmer Green Ln/Burnham Green Rd	286	37	19.57	47	313	19.85
3449-3043	B1004	655	516	5.73	507	501	0.27
3128-3053	B1197	236	133	7.59	437	223	11.77
3550-3063	A1170	544	533	0.49	539	572	1.41
3518-3066	B180	177	147	2.40	131	125	0.57
3417-3080	A1184	521	729	8.33	741	923	6.31
3472-3122	B1502	276	345	3.91	493	433	2.78
3471-3128	Watford_A414	1466	1568	2.61	1190	1232	1.20
3053-3128	B1197	426	277	7.92	347	172	10.87
3309-3139	Brickendon Ln	158	0	17.78	73	0	12.08
3584-3160	Colsfoot Lane	87	121	3.32	36	48	1.88
3558-3162	A119	216	148	5.07	467	388	3.85
3338-3165	B158	499	602	4.37	318	557	11.41
3457-3189	B1383	451	617	7.19	512	524	0.52
11292-3203	A1250	1023	941	2.61	747	725	0.83
3605-3251	The Old Coach Rd/Hertingfordbury Rd	80	34	6.16	67	43	3.30
3589-3274	Bragbury Ln	166	135	2.50	32	53	3.17
10400-3288	Watford_A414	823	765	2.04	1432	1376	1.49
3604-3289	Watford_A414	1522	1251	7.28	1190	1228	1.08
10397-3290	B1000	277	259	1.11	610	333	12.74
3581-3290	B1000	95	208	9.15	156	283	8.56
3578-3291	Benington Rd	69	76	0.81	51	277	17.65
7294-3292	B1037	305	342	2.03	229	465	12.67
10403-3294	B158	282	509	11.40	575	931	12.99
3576-3295	B1037	198	218	1.38	173	425	14.58
5291-3295	Unnamed Road	26	9	4.08	20	3	5.09
3589-3296	A602	905	913	0.28	941	931	0.34
3461-3297	Unnamed Rd	17	9	2.23	11	7	1.18
1132-3301	White Stubbs Ln	318	587	12.65	117	305	12.93
3307-3305	B158	260	641	17.95	293	893	24.63
3305-3307	B158	434	599	7.24	468	733	10.82
3139-3309	Brickendon Lane	79	0	12.57	131	0	16.19
3583-3310	Tattle Hill/Bramfield Rd	116	155	3.38	39	62	3.27
3559-3323	Sacombe Rd	160	47	11.12	135	55	8.20

Link ID	Location	Observed AM	Model AM	GEH AM	Observed PM	Model PM	GEH PM
3165-3338	B158	343	492	7.28	412	690	11.84
3544-3340	A119	400	206	11.17	340	54	20.36
3490-3344	B1502	459	534	3.37	444	746	12.37
3364-3347	A10	1532	1656	3.10	2186	1887	6.63
3347-3364	A10	1990	1958	0.72	1996	1832	3.74
1212-3373	Hoddesdon Rd	204	314	6.81	193	242	3.34
3568-3376	A10	1189	985	6.17	711	460	10.36
3551-3378	Cappell Ln	208	398	10.90	198	350	9.16
3385-3383	B1368	76	88	1.27	147	117	2.63
3383-3385	B1368	157	146	0.91	97	111	1.39
3565-3402	Unnamed Rd	38	135	10.44	26	133	11.99
3415-3407	B1004	447	451	0.17	233	263	1.89
3412-3408	Unnamed Rd	4	0	2.83	2	0	2.00
3408-3412	Unnamed Rd	4	0	2.83	2	0	2.00
3513-3414	High Wych Rd	405	242	9.04	781	528	9.88
3407-3415	B1004	187	199	0.86	360	412	2.64
3530-3416	A120	720	665	2.10	766	679	3.22
3437-3416	A120	786	787	0.05	921	891	1.00
3080-3417	A1184	630	1039	14.17	647	954	10.86
3035-3430	A1184	699	505	7.93	762	428	13.70
3416-3437	A120	820	759	2.17	834	621	7.90
3456-3445	Pig Lane	188	367	10.75	202	424	12.54
3043-3449	B1004	476	622	6.25	690	795	3.87
3456-3453	A1060	568	595	1.11	404	496	4.33
3453-3456	A1060	452	335	5.90	457	473	0.73
3445-3456	Pig Lane	249	570	15.85	158	447	16.63
3189-3457	B1383	523	390	6.21	548	461	3.90
3297-3461	Unnamed Rd	10	8	0.49	13	1	4.67
3128-3471	Watford_A414	878	643	8.51	1520	1281	6.37
3122-3472	B1502	495	381	5.44	546	464	3.63
1195-3482	A10	1436	1446	0.25	2079	2107	0.61
3344-3490	B1502	282	198	5.42	397	480	3.98
3591-3494	A1170	693	434	10.90	677	526	6.14
3414-3513	High Wych Rd	676	650	0.99	388	432	2.16
3066-3518	B180	116	115	0.10	172	188	1.19
3416-3530	A120	583	579	0.15	711	647	2.45
3340-3544	A119	390	162	13.74	546	284	12.88
3063-3550	A1170	501	480	0.93	575	539	1.51
3378-3551	Cappell Ln	60	265	16.08	71	466	24.10
10395-3556	B195	554	824	10.30	624	621	0.11
3162-3558	A119	451	376	3.67	152	205	3.99



Link ID	Location	Observed AM	Model AM	GEH AM	Observed PM	Model PM	GEH PM
3323-3559	Sacombe Rd	159	75	7.73	51	117	7.24
1241-3561	Rye Rd	40	186	13.73	61	160	9.44
3402-3565	Unnamed Rd	25	99	9.40	35	178	13.87
3376-3568	A10	696	577	4.73	1262	900	11.00
3295-3576	B1037	210	337	7.66	161	175	1.08
3291-3578	Benington Rd	35	89	6.85	90	85	0.49
3290-3581	B1000	177	227	3.54	86	339	17.38
3310-3583	Tattle Hill/Bramfield Rd	46	65	2.60	81	180	8.70
3160-3584	Colsfoot Lane	40	43	0.52	87	129	4.08
3587-3585	Watton Rd	157	131	2.19	182	254	4.88
3585-3587	Watton Rd	223	139	6.25	159	100	5.14
3296-3589	A602	810	805	0.17	1033	842	6.24
3274-3589	Bragbury Ln	27	34	1.33	169	173	0.29
3494-3591	A1170	578	305	12.99	682	438	10.29
3289-3604	Watford_A414	977	941	1.16	1336	1258	2.17
3251-3605	The olde coach road	63	10	8.69	82	11	10.42
3295-5291	Unnamed Road	23	5	4.71	22	37	2.69
7286-5544	Watton Rd	239	137	7.47	109	130	1.94
5544-7286	Watton Rd	86	137	4.84	342	235	6.29
3292-7294	B1037	231	374	8.23	278	358	4.48
3042-10012	Harmer Green Ln/Burnham Green Rd	65	516	26.46	301	48	19.13
3556-10395	B195	391	466	3.61	594	794	7.60
3290-10397	B1000	683	218	21.88	306	336	1.67
10408-10398	Tylers Causeway	303	392	4.76	76	107	3.19
3288-10400	Watford_A414	1373	1449	2.01	1024	1115	2.78
3294-10403	B158	496	782	11.31	343	612	12.30
10398-10408	Tylers Causeway	63	139	7.58	343	219	7.39
3203-11292	A1250	752	715	1.37	840	826	0.47

## Appendix C – Town Based Trip Distribution Plots

Figure 32. AM Peak Outbound trips from Bishop's Stortford<sup>7</sup>

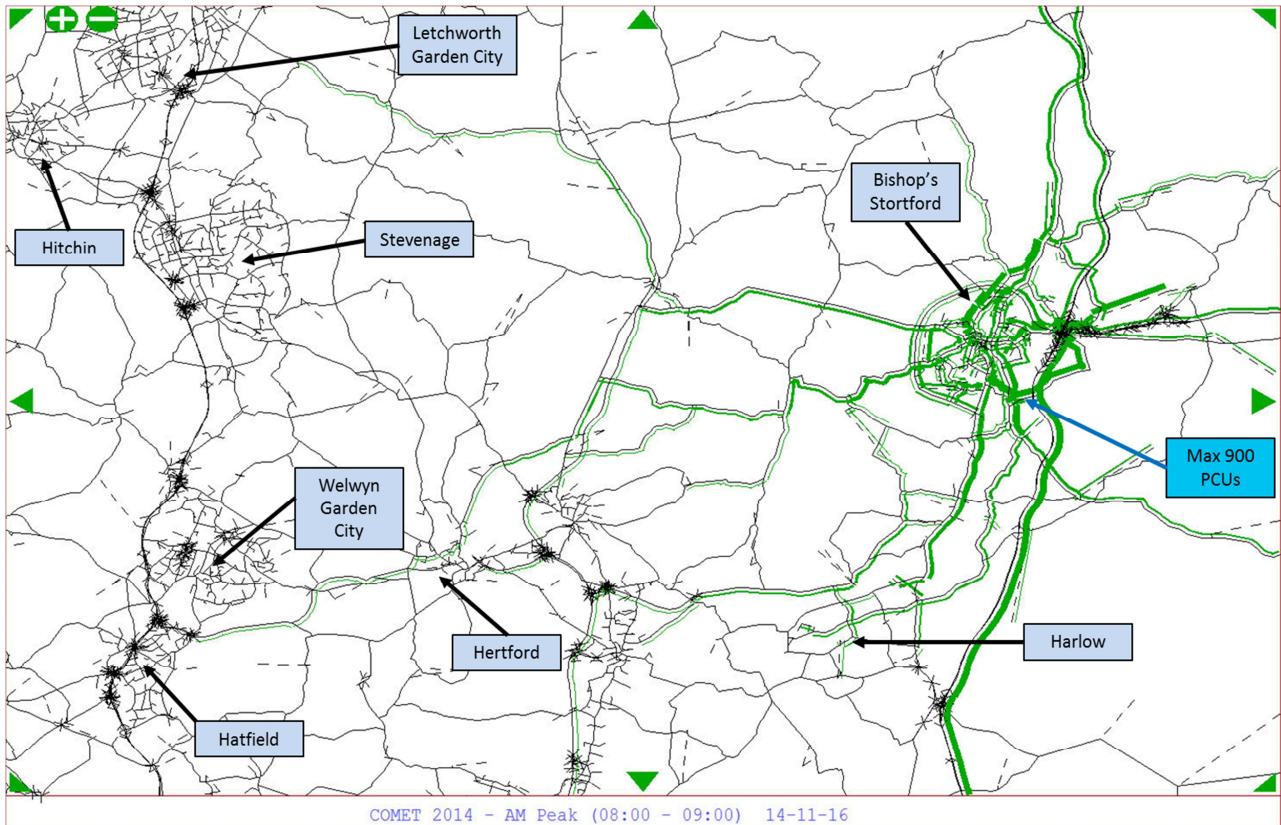
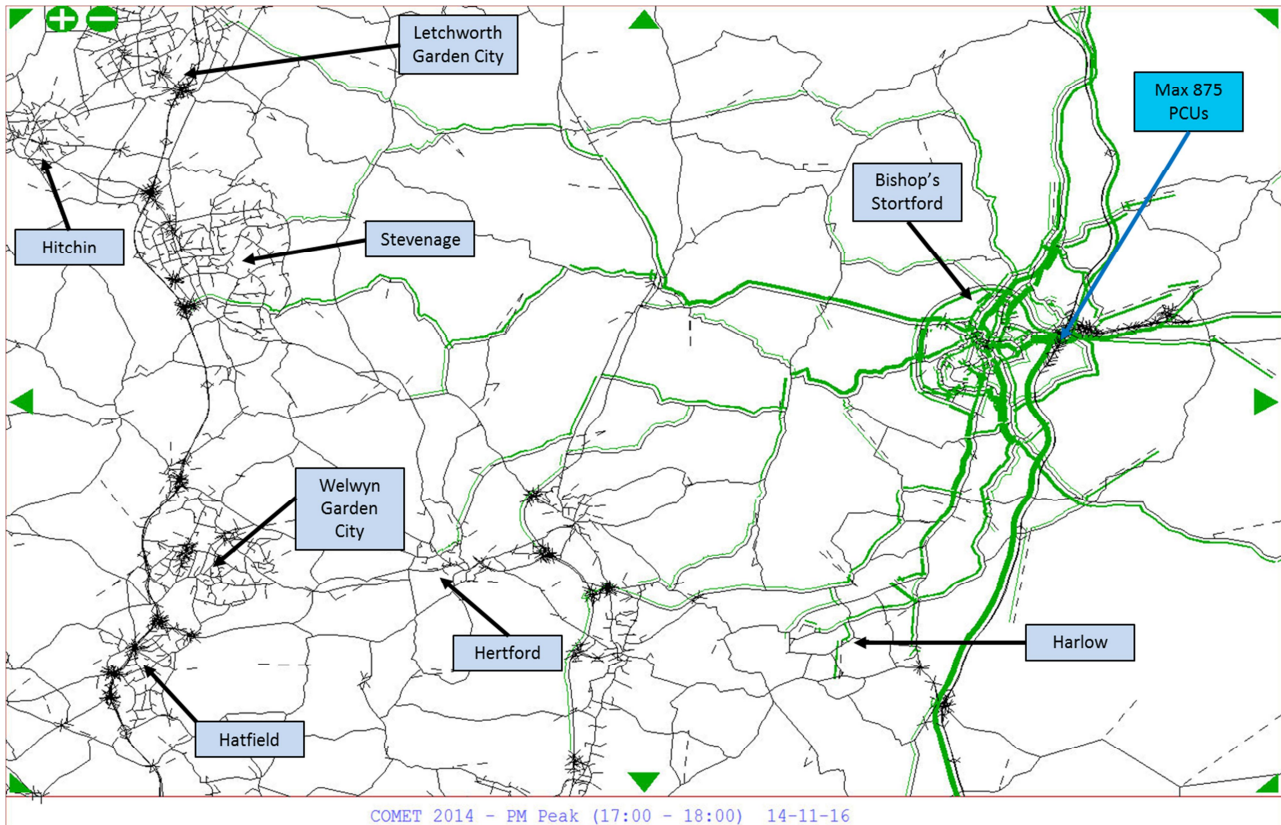
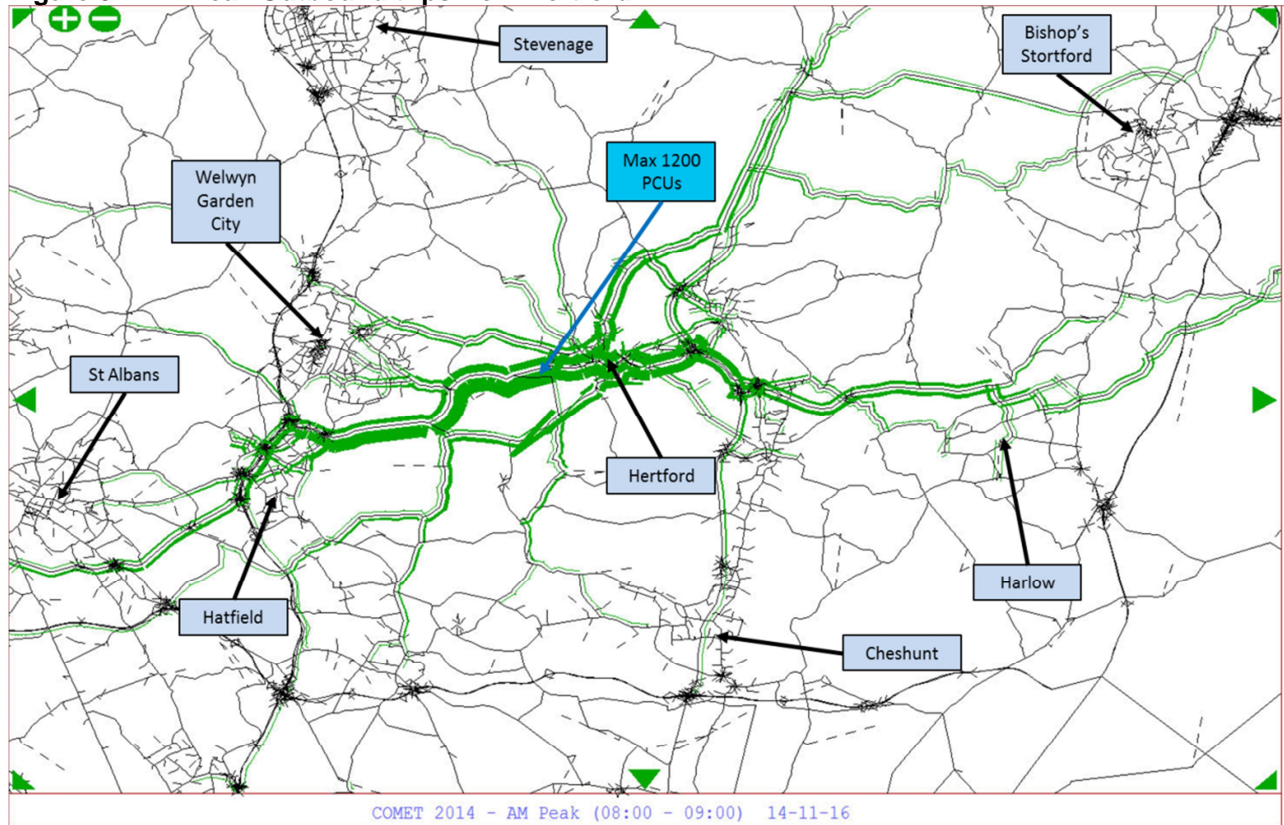


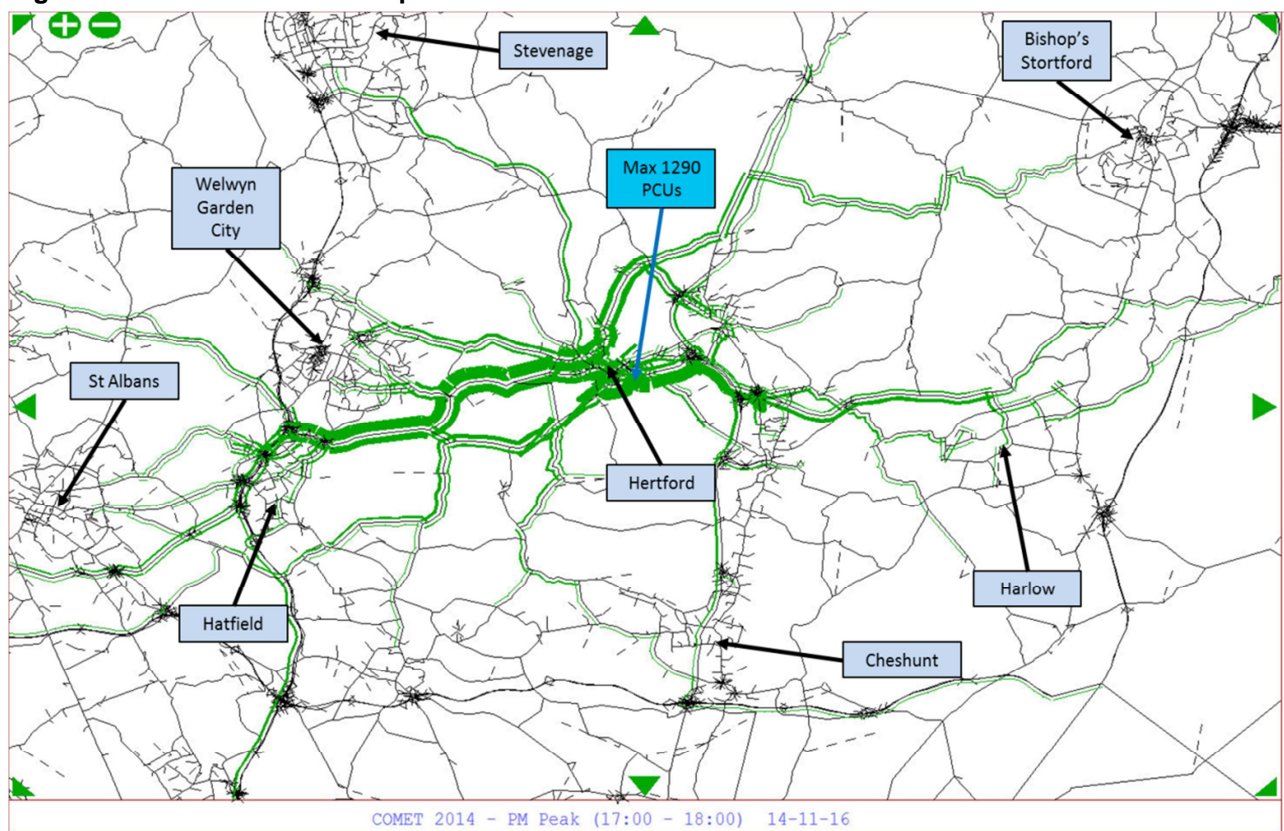
Figure 33. PM Peak Inbound trips to Bishop's Stortford<sup>7</sup>



**Figure 34. AM Peak Outbound trips from Hertford<sup>7</sup>**



**Figure 35. PM Peak Inbound trips to Hertford<sup>7</sup>**





## Appendix D – A414 Hertford Corridor Analysis

Figure 36. PM Peak Journey Time A414 – Westbound

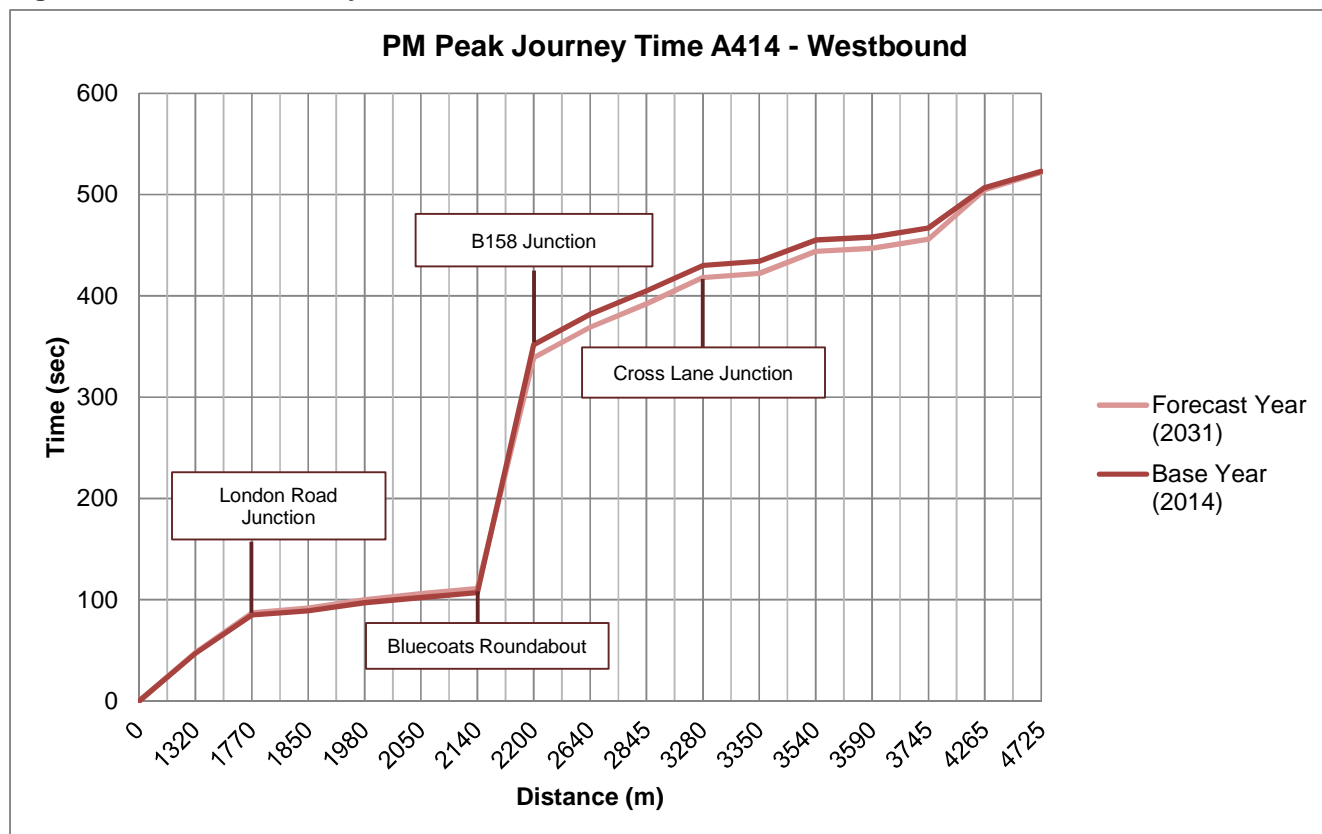
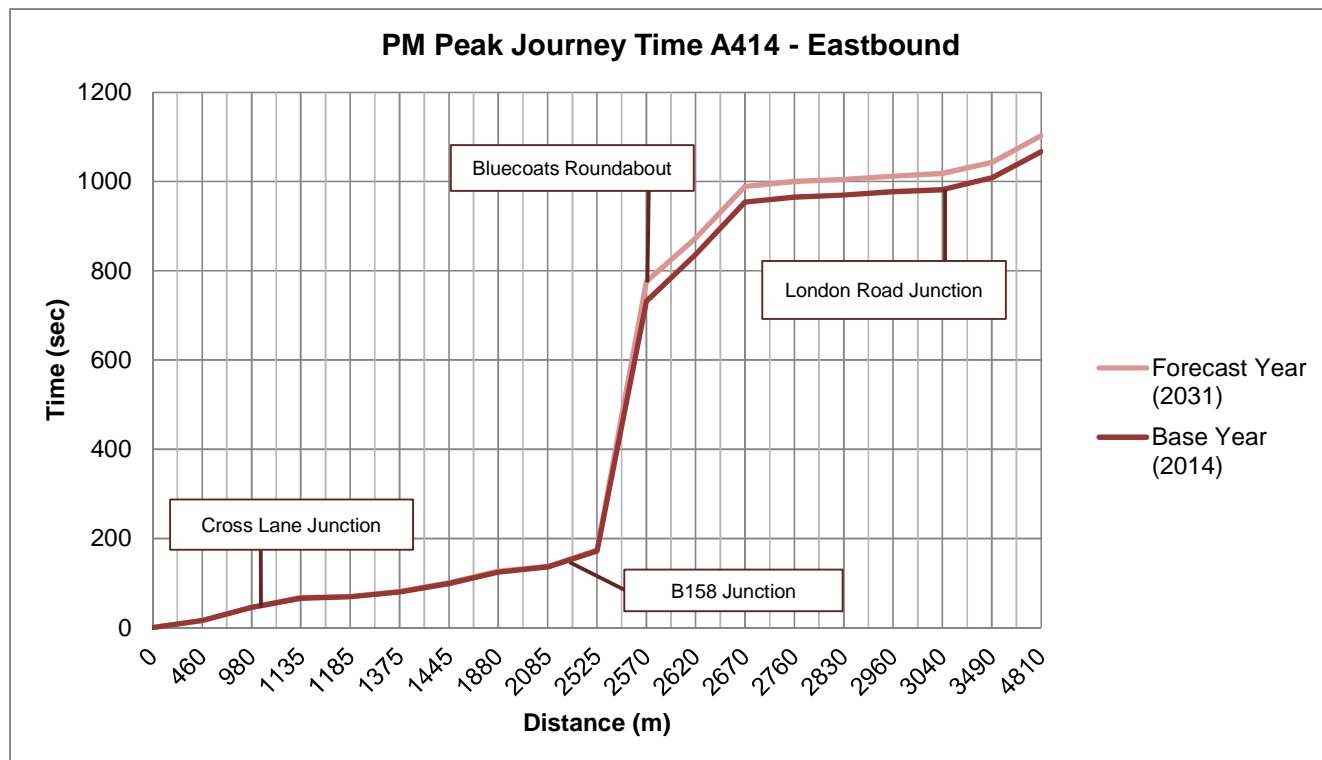


Figure 37. PM Peak Journey Time A414 – Eastbound



## Appendix E – Glossary of Terms

### **WebTAG**

WebTAG stands for *Web* (i.e. online) *Transport Analysis Guidance*, and is set out by The Department for Transport (<https://www.gov.uk/guidance/transport-analysis-guidance-webtag>). WebTAG contains guidance on the conduct of transport studies, and is considered the standard against which transport planning work in the UK is assessed. In transport modelling, the term “WebTAG compliant” means that WebTAG guidance is met in relation to that particular performance criterion.

### **Volume over Capacity (V/C)**

This is the ratio of volume over capacity (V/C) for a given link. Links are generally considered to be approaching capacity at 80% V/C, beyond which there is a material deterioration in operation. Note that the length of the modelled queue on amber/red links in congestion plots is not related to the length of the link in the diagram. The V/C value calculated by SATURN relates to the link as a whole, however, the queue may not extend along the whole link (particularly if the link is long). The extent of the queueing should therefore also be interpreted using the junction delay circles.

### **GEH**

GEH is a statistic that compares the modelled flow versus observed flow, and is defined in section 3.2.7 of WebTAG Unit M3.1 – Highway Assignment Modelling.

### **PCU**

Passenger Car Unit (used in Transport Modelling). Cars and LGVs equal 1 PCU, whilst HGVs equal 2.2 PCUs