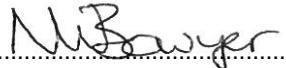


# Transport Scenario Testing

for the emerging East Herts District Plan  
using DIAMOND

Non Technical Report

Prepared by:   
.....  
Sam Thrower / Nik Bowyer  
Graduate Consultant / Senior Consultant

Checked by:   
.....  
Nik Bowyer  
Senior Consultant

Approved by:   
.....  
Ian Burrows  
Associate Director

Transport Scenario Testing for the emerging East Herts District Plan using DIAMOND: Non-Technical report

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3rd Floor, Portwall Place, Portwall Lane, Bristol, BS1 6NB  
Telephone: 0117 901 7000 Website: <http://www.aecom.com>

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# **1 Introduction**

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# 1 Introduction

## **Introduction**

- 1.1 East Hertfordshire District Council (EHDC) is in the process of working towards production of a draft District Plan and strategy that will first be presented to members prior to public consultation.
- 1.2 In order to support EHDC through this process, AECOM has provided transport modelling advice and support for the scenario development, testing and sifting stages of the Strategy Selection processes.
- 1.3 In order to provide an evidenced approach and analyses to the sifting procedure, AECOM has undertaken indicative transport modelling of each of EHDC's proposed development scenarios. Modelling of the scenarios and analysis of the outputs will allow for EHDC to quantitatively assess the options against each other, providing a sound basis for the sifting exercise.
- 1.4 This report provides a non-technical summary of the modelling exercise undertaken, the model results and their subsequent interpretation that may be used to inform further refinement of the development scenarios by EHDC.

## **Non-Technical Report Structure**

- 1.5 Following this introduction, the remainder of this report is structured as follows:
  - 2) Transport Modelling
  - 3) The Strategy Selection Process
  - 4) The DIAMOND Model
  - 5) Development Scenarios
  - 6) Methodology
  - 7) Modelling Results
  - 8) A1(M) and Welwyn-Hatfield Modelling
  - 9) Implications for the Strategy Selection process
  - 10) Next Steps

## **2 Transport Modelling**

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## 2 Transport Modelling

- 2.1 Transport models may be used across a large range of applications and can range from simple manual calculations to more complex land-use and demand-supply interaction models. The complexity of transport models reflects the specific needs of an assessment case.
- 2.2 Transport modelling can be used to provide an evidence base to help evaluate existing networks and to predict the likely effects of changes in traffic as a result of proposed developments or infrastructure alterations. Modelling is therefore an important part of most decision making processes.
- 2.3 A variety of transport models and modelling packages are available that can be sub-divided into the following categories:
- Spreadsheet models;
  - Highway traffic assignment models;
  - Public Transport traffic assignment models;
  - Micro-simulation models;
  - Junction design models.
- 2.4 Each of the types of model listed above has their own particular strengths and weaknesses with regards to their application to transport impact assessment studies. Micro-simulation and junction design models for instance can provide a good visual representation of the impacts of development across an urban area or at particular intersections, yet their use for a district-wide study would be impractical, expensive and time-consuming, requiring models for each separate urban area to be constructed. Likewise a traditional highway traffic assignment model would provide an impact assessment across the wider-network but have significant initial set-up costs and timescales that are not practical for a development options sifting exercise.
- 2.5 It is important therefore to select the correct modelling tool for the required assessment. Both the Strategy Selection process and DIAMOND model are explained in the course of the next two sections. The key requirement of this transport modelling for the Strategy Selection process is to sift development options in a consistent manner; DIAMOND is a spreadsheet model including a development traffic assignment element that can be run more cheaply and under shorter timescales than traditional traffic assignment models; whilst it has some limitations, it is appropriate for providing a high-level assessment of differing options and for providing some initial comparison and sifting of these.

### **3 The Strategy Selection Process**



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### 3 The Strategy Selection Process

- 3.1 EHDC's strategy selection process is a requirement of the development of a draft District Plan policy prior to consultation and subsequent adoption.
- 3.2 The strategy formulation process involves the selection of a number of broad development options and the subsequent refinement of these into a single option to be considered for the draft policy document for consultation.
- 3.3 The continually evolving nature of the options means that transport modelling is based on a 'snapshot' of the latest stage in the formulation of the strategy. The modelling therefore provides a perspective which can provide insight into various options, but cannot exactly map the specific impacts, due to the evolving nature of the strategy selection process.
- 3.4 In order to refine the proposed development options it is necessary to have an evidence based approach that allows for the sifting of developments against each other, allowing for poorer performing options to be eliminated prior to testing of the strategy.
- 3.5 To this end transport modelling advice and support has been undertaken to sift proposed development scenarios on the basis of their likely impacts on the transport network, in order to work towards a Preferred Option. It is possible that subsequent refinement and further testing of the Preferred Option may be required, although this will be dependent upon the outcome of the initial scenario testing.
- 3.6 The strategy selection process must take account of the requirements of the National Planning Policy Framework (NPPF). This requires local planning authorities to balance a wide range of considerations including transport and highways within the context of the 'presumption in favour of sustainable development'.
- 3.7 All the details of the strategy selection process are set out in a Supporting Document which will be subject to consultation and which will demonstrate how the final strategy was formulated.

## **4 The DIAMOND Model**

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## 4 The DIAMOND Model

- 4.1 Transport modelling has been undertaken using AECOM's modelling tool DIAMOND - the Development Impacts Assessment Model Of Network Demand. The model allows for multiple variants of development options to be input and tested, in order to analyse the broad impacts of the proposals on the local highway network.
- 4.2 DIAMOND's strengths include its flexibility to model a number of variants of proposed developments, both residential and employment, allowing for the variation of both development size and spatial distributions. The model allows for consistent assessment across a range of development proposals and applications, in a shorter timescale than traditional modelling techniques.
- 4.3 It should be noted that assessments made using DIAMOND are indicative and that the model's key strength is as a sifting tool to highlight the relative performance of the test scenarios. For this reason its main strength is in comparison of differences between the likely impacts of different district-wide scenarios at comparable overall development levels.
- 4.4 Given the large number of possible combinations of options which could be tested, DIAMOND is deployed most effectively by targeting key test variables rather than trying to sift all possible combinations of options.
- 4.5 DIAMOND is a link-based model, providing a high-level assessment of traffic impacts on roads across a given region. It has no junction modelling/interaction element and therefore does not consider junction delays during the model run process.
- 4.6 It should be noted DIAMOND is intended for initial sifting of development scenarios and as such is not an appraisal tool directly. The analysis and modelling work undertaken to date, allows a broad comparative assessment of development scenarios to be made. It is recommended further supporting assessment is subsequently carried out to determine the potential mitigation measures required to facilitate development as well as further detailed junction operational assessments which may be required to help support the evidence base in due course. Indeed it is recommended further work is carried out to support the District Plan process as it progresses from the District wide level to the site allocation stage, where individual developments will be required to be assessed.
- 4.7 A number of inputs into DIAMOND are considered as 'static', in that they are not altered between development scenarios. Static elements include both the modelled highway networks and background (non-development) traffic. Networks remain static over-time, meaning that the highway network remains fixed from the base year (2009) to all forecast years and scenarios; as such, the effects of new infrastructure are not taken into account, meaning that a pessimistic assessment of the highway networks is made. Likewise, non-development traffic remains fixed across all scenarios meaning that there are no effects due to reassignment included within the model.
- 4.8 DIAMOND has previously been used for a number of applications across Hertfordshire, including assessment of Local Development Framework (LDFs) across the county on behalf of the County Council and for providing a transport evidence base for the sifting of development options for the LDF process in the Borough of Welwyn-Hatfield. The model was initially developed on behalf of the Highways Agency (HA) in order to assess the likely impacts of proposed developments on the Strategic Road Network (SRN) and has been accepted for use by the HA for previous applications within Hertfordshire.
- 4.9 Hertfordshire County Council (HCC), as well as promoting development of the model, has endorsed the use of DIAMOND for the Local Planning Authorities (LPAs) within the county

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as part of their respective strategy development and sifting processes. Prior acceptance of the model for previous sifting exercises by the HA in conjunction with county endorsement means that DIAMOND represents a useful and accepted tool for the purposes of development sifting and strategy formation.

- 4.10 Further information pertaining to DIAMOND and its enhancement for use as an evidence base for sifting within East Hertfordshire is detailed in a separate Technical Note document.

## **5 Development Scenarios**

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## 5 Development Scenarios

- 5.1 EHDC has identified seven separate development scenarios for testing using DIAMOND. These are based on a short-list of options agreed by the Members of East Herts Council at the meeting of Full Council on 7th August 2012, following work on the first four chapters of the Supporting Document. The principles underlying test scenario formulation are as follows:
- **Comparability between scenarios:** the overall level of development tested must be broadly equal between scenarios in order to ensure area-wide comparability.
  - **Comparability between different growth levels:** two groups of scenarios were developed in order to provide an indication of the impacts at higher and lower levels of development. This reflects a need to get a sense of the different impacts at different levels of growth. In addition, the higher level enables testing of the largest development option (i.e north of Harlow)
  - **Selection of key test variables:** larger options were selected in order to focus attention on those which are likely to have the greatest highway impact. The exceptions to this are Terlings Park (270 dwellings) and East of Bishop's Stortford (150 dwellings), which were included as 'top-ups' to provide comparability of total quantum within each of the two assessment groups
  - **To provide an insightful assessment framework:** given the volume of options for sifting, and the ongoing process of refinement of options through the stepped approach to strategy selection, it is not possible to fully test all options. Therefore the scenarios have been developed with sufficient degree of differentiation to provide an indication of the likely impacts in a manner proportionate to strategic planning. This framework can continue to provide insight even as the options are refined as East Herts Council progresses towards finalisation of its strategy.
- 5.2 In addition to the seven development scenarios, two Reference Case options have also been identified, which allow for the development proposals to be assessed against a consistent base. This ensures that the impacts of each of the proposed development scenarios can be isolated and interrogated in- turn.
- 5.3 The Reference Case scenario does not include any of the key test variables, but includes 'other locations' i.e. shortlisted options which are considered to be below the threshold for separate testing as part of the DIAMOND transport modelling. It should be noted that these options do not reflect a 'committed' set of developments and are still subject to further scrutiny.
- 5.4 A separate Reference Case scenario has been identified that includes an additional allocation of north of Bishop's Stortford, to a quantum of 2,500 new dwellings. This option has been identified separately in order to allow for the impacts of this development to be isolated, given it is substantially larger in size than other identified Reference Case development sites, and also due to its designation with the East Herts Local Plan 2007 as safeguarded land ('Areas of Special Restraint').

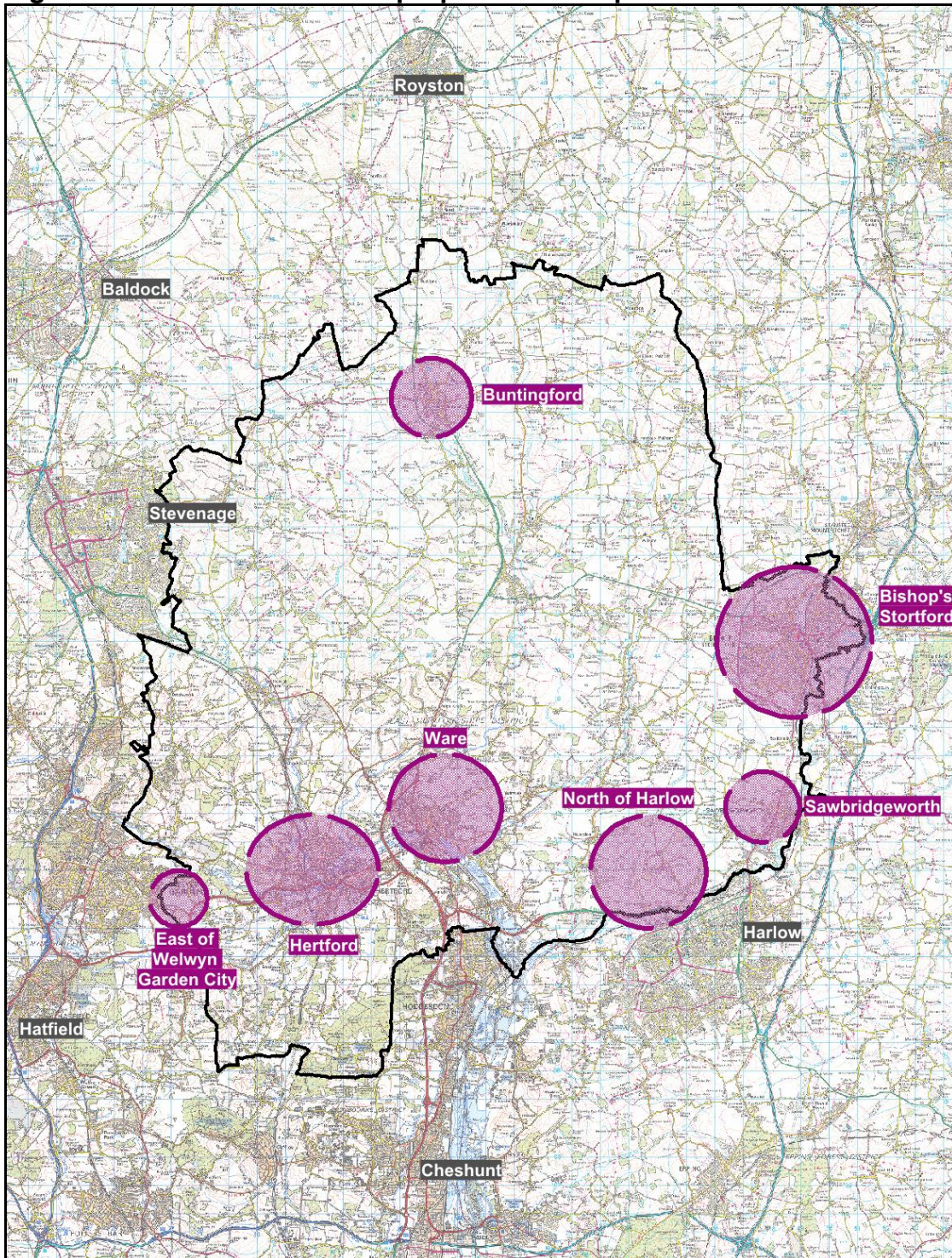
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- 5.5 The seven identified development options tested as part of the option sifting stage each comprise of either one or a combination of key test variables. These variables identify proposed developments of differing size and location, which are included over-and-above that of the Reference Case.
- 5.6 The proposed developments can be broadly split into two groupings: Options 1(a-c) and Options 2(a-d). Variants of Option 1 include 2,000 additional dwellings compared to those of Option 2, with the developments located to the south of the district, with a particular focus north of Harlow (1a, 1b) and in Ware (1b, 1c). Option 2 variants show lower levels of total residential development (11,813 dwellings), which are less-focused to the south and instead spread across other key urban areas throughout the district.
- 5.7 The specific development options included are listed below:
- **Option 1A** North of Harlow (8,000 dwellings)  
*[Note: 8,000 has been selected because an assumption has been made that the full 10,000 dwellings could not be delivered in practice by 2031)];*
  - **Option 1B** North of Harlow (5,000 dwellings), North & East of Ware (3,000 dwellings);
  - **Option 1C** West of Sawbridgeworth (3,000 dwellings), North and East of Ware (3,000 dwellings), East of Welwyn Garden City (2,000 dwellings);
  - **Option 2A** South of Bishop's Stortford (800 dwellings), West of Sawbridgeworth (2,000 dwellings), North of Ware (1,700 dwellings), Buntingford (1,500 dwellings);
  - **Option 2B** East of Bishop's Stortford (150 dwellings), West of Sawbridgeworth (3,000 dwellings), Buntingford (500 dwellings), East of Welwyn Garden City (2,000 dwellings), Terlings Park (270 dwellings);
  - **Option 2C** South of Bishop's Stortford (800 dwellings), East of Ware (1,300 dwellings), Buntingford (2,000 dwellings), East of Welwyn Garden City (2,000 dwellings);
  - **Option 2D** West of Sawbridgeworth (2,000 dwellings), East of Welwyn Garden City (2,000 dwellings), allocation in Welwyn-Hatfield District (2,000 dwellings).
- 5.8 Table 5.1 presents a list of each of the developments assumed by scenario, including the Reference Case assumptions. The broad spatial locations of the proposed development sites are shown in Figure 5.1, along with the district boundary.



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**Figure 5.1 – Broad location of proposed development sites**





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**Table 5.1 – Development scenarios and included sites**

DIAMOND Modelling Options for East Hertfordshire District Plan			Group 1 - North of Harlow (upto 15,000 by 2031)				Group 2 - No North of Harlow (upto 13,000 by 2031)				
	Location	Sieve 1 total dwellings capacity in East Herts	2031 Reference Case	2031 Ref Case + N Bishop's Stortford	Scenario 1A 10K North of Harlow	Scenario 1B 5K North of Harlow	Scenario 1C Nothing North of Harlow	Scenario 2A	Scenario 2B	Scenario 2C	Scenario 2D - inc. 2,000 in Wel-Hat
<b>KEY TEST VARIABLES</b>	North of Harlow A	10,000			8,000	0	0	0	0	0	0
	North of Harlow B	5,000			0	5,000	0	0	0	0	0
	South of Bishop's Stortford	800			0	0	0	800	0	800	0
	East of Bishop's Stortford	150			0	0	0	0	150	0	0
	Sawbridgeworth West	3,000			0	0	3,000	2,000	3,000	0	2,000
	Ware North (1700) Ware East (1300)	3,000			0	3,000	3,000	1,700	0	1,300	0
	Buntingford A (2000) and B (500)	2,000			0	0	0	1,500	500	2,000	0
	East of WGC (East Herts 2000, Welhat 2000)	2,000			0	0	2,000	0	2,000	2,000	4,000
	Terlings Park	270			0	0	0	0	270	0	0
	North of Bishop's Stortford	2,500	0	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
<b>OTHER LOCATIONS</b>	Bishop's Stortford Goods Yard	60	60	60	60	60	60	60	60	60	60
	Bishop's Stortford Old River Lane/Causeway	100	100	100	100	100	100	100	100	100	100
	BS SLAA sites	268	268	268	268	268	268	268	268	268	268
	BS other permissions	30	30	30	30	30	30	30	30	30	30
	Buntingford SLAA Sites	30	30	30	30	30	30	30	30	30	30
	Buntingford other permissions	37	37	37	37	37	37	37	37	37	37
	Hertford West	600	600	600	600	600	600	600	600	600	600
	Hertford North	100	100	100	100	100	100	100	100	100	100
	Hertford South	100	100	100	100	100	100	100	100	100	100
	Hertford South Mead Lane	100	100	100	100	100	100	100	100	100	100
	Hertford National Grid/Norbury Woodyard	200	200	200	200	200	200	200	200	200	200
	Hertford West of Marshgate Drive	182	182	182	182	182	182	182	182	182	182
	Hertford - former police station	126	126	126	126	126	126	126	126	126	126
	Hertford SLAA Sites	190	190	190	190	190	190	190	190	190	190
	Hertford other permissions	77	77	77	77	77	77	77	77	77	77
	Sawbridgeworth - N and S of West Road	200	200	200	200	200	200	200	200	200	200
	Sawbridgeworth - Crofters	80	80	80	80	80	80	80	80	80	80
	Sawbridgeworth SLAA sites	25	25	25	25	25	25	25	25	25	25
	Sawbridgeworth other permissions	6	6	6	6	6	6	6	6	6	6
	Ware Land East of Trinity Centre	81	81	81	81	81	81	81	81	81	81
	Ware (High Oak Road Area only)	200	200	200	200	200	200	200	200	200	200
	Ware SLAA Sites	34	34	34	34	34	34	34	34	34	34
	Ware Other permissions	32	32	32	32	32	32	32	32	32	32
Villages (total only - breakdown provided separately)	900	900	900	900	900	900	900	900	900	900	
<b>Sub-total - non-variable elements</b>			<b>3,758</b>	<b>6,258</b>	<b>6,258</b>	<b>6,258</b>	<b>6,258</b>	<b>6,258</b>	<b>6,528</b>	<b>6,258</b>	<b>6,258</b>
<b>Total - including variable elements</b>			<b>3,758</b>	<b>6,258</b>	<b>14,258</b>	<b>14,258</b>	<b>14,258</b>	<b>12,258</b>	<b>12,178</b>	<b>12,358</b>	<b>12,258</b>

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- 5.9 As Table 5.1 demonstrates, only the larger proposed development sites have been considered in individual groupings as 'key test variables', with the smaller development sites included in the Reference Case modelling grouping only and not being tested in isolation. These sites tend to be smaller in scale than those of the key test variables and will have smaller impacts on the highway network in the district. The tests commissioned by EHDC are for seven separate development variables of similar size, representing a large sifting sample, similar to the number of proposed development sifts undertaken for previous work in the Borough of Welwyn-Hatfield.
- 5.10 It should be noted that no employment growth has been included in the DIAMOND forecasts, with the assessments being based solely on the provision of residential growth. This is due to the fact that the technical work undertaken by EHDC to date suggests that the large majority of new development in the District to 2031 will be residential, and therefore the main traffic impacts are likely to be represented within the modelling.

## **6 Methodology**

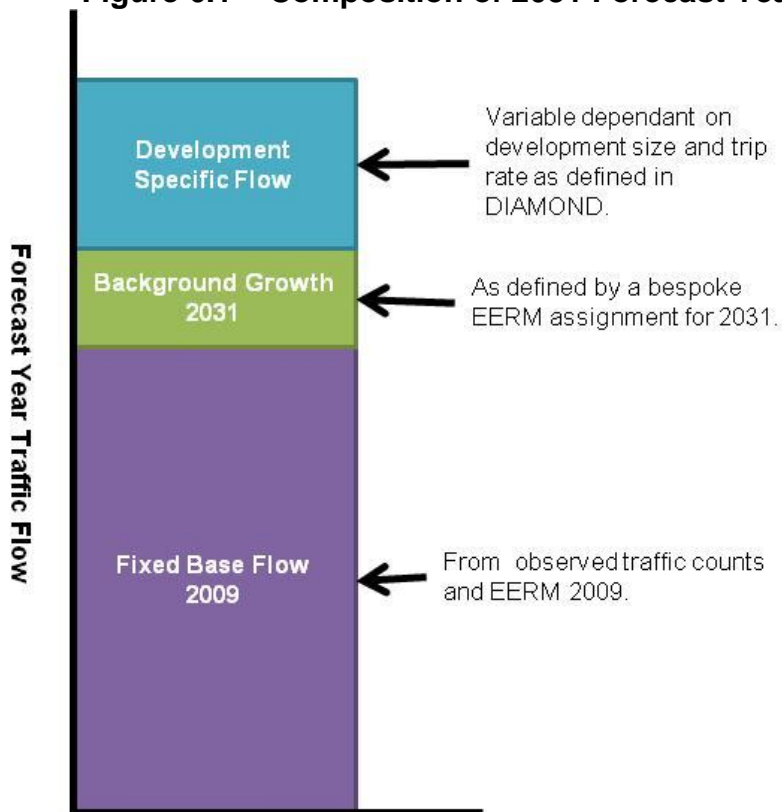
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## 6 Methodology

- 6.1 Traffic volumes on each link within DIAMOND are composed of three main constituent parts. The sum of each of these parts comprises the total volume of traffic on a link within the model. The three key elements making up the total traffic volumes are as follows:
- **Base-Year (2009) Volumes** - base traffic volumes are input to the model across all links to ensure it reflects present day traffic volumes; these volumes have been defined through the use of observed traffic counts. The traffic count data have been provided by HCC: the predominant source of data are Automatic Traffic Counts (ATCs) that have been collected over a period of 1-2 weeks; data from 2009 have been used where available, with data from other years used and adjusted if not. This is further explained in the separate Technical Note. These volumes remain fixed throughout the forecast year assessments – no reassignment of these trips occurs.
  - **Forecast Background Growth (2031)** – background traffic growth to 2031 was calculated through use of the East of England Regional Model (EERM). This was used in order to growth traffic from the 2009 volumes to 2031, excluding any trips due to the seven development proposals. These volumes remain fixed throughout the development scenarios and cannot re-route.
  - **Development scenario specific traffic** – the development traffic is calculated based on the trip rates defined in DIAMOND and, unlike the base-year and background growth, these volumes are variable as they are dependent on the size and spatial location of developments.
- 6.2 Figure 6.1 shows the composition of link traffic volumes in DIAMOND, as described above, in graphical format.

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**Figure 6.1 – Composition of 2031 Forecast Year Traffic Flow in DIAMOND**










- 6.3 With regards to growth in traffic outside East Hertfordshire, growth from the East of England Regional Model (EERM) has been used, based on Department for Transport (DfT) forecasts. These data are used in preference to emerging Local Plans, which are uncertain prior to examination and adoption and, in most cases, are lower than the previous regional growth forecasts. Use of these data is considered preferable because it enables a precautionary approach, which is unlikely to under-estimate impacts of traffic growth outside of the district.
- 6.4 It is noted that the close proximity of Stansted Airport, Essex has the potential for a significant impact on car trips within East Hertfordshire. Growth at Stansted Airport has been capped at 35 million passengers per annum (mppa) throughput in 2031, along with a corresponding growth in jobs at the airport. The 35 mppa cap in 2031 assumes the airport operating at total capacity assuming a single runway and a single terminal. This is considered to be in-line with the coalition government's 'Programme for Government', which did not support planning permission for an additional runway at Stansted.
- 6.5 Following model runs for each of the development scenarios, data have been output from DIAMOND in order to allow for comparative assessment of the scenarios to be

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undertaken. In extracting the data, both the traffic flows on key links within the district and their respective Volume/Capacity (V/C) ratios have been identified.

- 6.6 Appendices A and B presents the data that have been extracted for the morning peak hour (08:00-09:00), for key roads within urban areas and on inter-urban routes respectively. The appendices display the two-way traffic volume on each link in East Hertfordshire. It should be noted that these figures are indicative, having been rounded to the nearest 250 vehicles. These data have been rounded in order to improve confidence in the model outputs and aids comparative analysis between the different scenarios.
- 6.7 The links for each scenario have been banded into different colour categories; these bandings reflect the nature of stress or congestion that the road is experiencing. The congestion-levels shown are based on the ratio of traffic volumes on a link to the theoretical link capacity. It should be noted that the maximum V/C for a single direction on a two-way link has been chosen, this highlights issues related to tidality which, if the two-way V/C were shown, would not present as an issue. The levels of congestion corresponding to each colour are highlighted in the key in Table 6.1.

**Table 6.1 – Key: Congestion bandings**

Congestion banding	Volume-to-Capacity (V/C) ratio	Congestion banding description
	> 100%	Extremely congested (Over Capacity)
	95%-100%	Highly congested
	80% - 95%	Medium-to-highly congested
	70% - 80%	Moderately congested
	60% - 70%	Moderately congested
	50% - 60%	Becoming congested
	<50%	Uncongested

- 6.8 It should be noted that the flow displayed for each link is a sum of the flow for both directions while the maximum volume/capacity in either direction is applied to band the links into the differing stress categories.
- 6.9 The congestion bandings from the results may be used to draw some headline policy implications. There are two broad types of interventions which the District Council may choose to consider:
- **Highways interventions** may range from the provision of major new roads through to changes to traffic signals and road layout. In some cases highways interventions can be effective. However, caution should be exercised in assuming that highways interventions are feasible and deliverable
  - **Sustainable transport measures** include the provision of new bus services as well as encouraging more walking and cycling. In general terms such measures are cheaper than highways interventions, although their likely effectiveness in terms of reducing highways stress needs to be appraised realistically.

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- 6.10 Therefore, because a particular road is shown as 'highly stressed' does not necessarily mean that it should be discounted from consideration as part of the District Plan strategy. It is likely to mean however that highly stressed areas are likely to require greater investment in highways and sustainable transport schemes. This is investigated further in Chapter 9.

## **7 Modelling Results**



## 7 Modelling Results

### Introducing the results

- 7.1 This section of the Non-Technical Summary documents the changes to network performance (traffic volumes and stress) that are observed within DIAMOND as a result of the introduction of each of the development scenarios. This involves description of the model outputs shown in Appendices A and B as a result of the modelling process.
- 7.2 The impacts of each of the proposed development scenarios have been assessed against the 2031 Reference Case. As such, the effects of each of the key test variables can be isolated, helping to highlight the traffic impacts due solely to these variables.
- 7.3 It is worth noting that, as mentioned previously, both the network stress and traffic volumes have been calculated on the basis of a link-based assessment only, as a function of the DIAMOND model. No junction interaction element has been considered. As such, there may be some cases whereby current known network 'hotspots' are not fully represented in the analyses, as issues are the result of traffic interactions at the junctions as opposed to available link capacity; potential examples of this in East Hertfordshire are the signalised crossroads on the A120 at Little Hadham, and the A414 Gascoyne Way within Hertford. The results should therefore be considered in the light of the application of the DIAMOND model as a sifting tool for early-stage assessment of the development proposals.

### Description of the results

#### Reference Case

- 7.4 The 2031 Reference Case model demonstrates the impacts of traffic increases due to background growth (predicted income and car ownership changes) and options excluding the key test variables within East Hertfordshire. It is important to ascertain the impacts from this scenario in order to be able to subsequently isolate those of the proposed development scenarios, which will be benchmarked against the Reference Case.
- 7.5 Within East Hertfordshire, the key impacts on inter-urban routes are shown on the A10, A120 and A602.
- 7.6 For the A10, the sections between Ermine Street and Baldock Road (near Buntingford) and between the A414 and A1170 show an increase in two-way volumes of between 500 and 1,000 vehicles, with corresponding increases in stress to greater than 80% and 70% respectively. There are no key test variable development options for towns/villages located on this corridor, suggesting that the increases in volumes and stress are potentially due to trips passing through the district, as opposed to being due to growth within the district. It is noted however, that there is quite a high-level of growth assumed in the Reference Case for Hertford, from which some longer distance trips are likely to access the A10, particularly the section between the A414 and A1170.
- 7.7 Both the A120 Bishop's Stortford Northern Bypass and the A414 Fifth Avenue, Harlow show increases in two-way volumes of around 750 vehicles and corresponding increases in stress to greater than 95%, showing significant pressures on the road network. Growth assumed in the Reference Case for Bishop's Stortford is low (160 dwellings) and will not

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contribute fully to the increases shown on the A120; similarly included growth in Ware and surrounding villages is not the sole cause of the large increases shown on the A414 Fifth Avenue. Growth in surrounding districts has been included at the full RSS complement and an increase in 'through' trips is likely to be the main cause of the changes in traffic volumes and stress shown.

- 7.8 A number of changes in network stress and traffic volumes are observed in the urban areas across East Hertfordshire, with notable changes in Bishop's Stortford, Buntingford, Hertford, Sawbridgeworth and Ware. Little changes are observed in the South East parishes, although it is noted that some small increases (~250 vehicles) in traffic are expected on the B1004 in Much Hadham.
- 7.9 For strategic routes outside of the district, the most notable impacts of the Reference Case growth are seen on the M11. Two-way traffic volumes increase by between 1,000 and 1,500 vehicles across the sections between junctions 6 (M25) to 9 (A11), resulting in an increase in stress to greater than 70% between J6-7. For the A1(M) in Welwyn-Hatfield, two-way traffic volumes in the morning peak also increase by around 1,000 vehicles from 2009, although no changes in link stress are shown.

### **Reference Case plus North Bishop's Stortford [2,500 dwellings]**

- 7.10 This model includes all growth as per the Reference Case as well as an additional 2,500 dwellings to the north of Bishop's Stortford. This scenario has been modelled separately to assess the likely impacts of the site, given its greater size than other Reference Case developments.
- 7.11 The key impacts of the north Bishop's Stortford site are mostly limited to the urban area and the A120 bypass of the town. In the urban area, B1383 Stansted Road is the most affected, showing an increase of ~500 two-way vehicle trips and indicating stress at greater than 95% of capacity; given the location of the proposed development location, the route is likely to serve trips to/from the site. Both the B1004 Rye Road and the A1250 Hadham Road are also affected, showing an increase of ~250 vehicle trips and showing increases in stress to greater than 80% and 50% respectively. Rye Road is likely to serve trips to/from the site, providing access to the A120 in the north, whilst Hadham Road serves westbound trips for the A120 and southbound to the A1184.
- 7.12 The A120 shows some modest increases in traffic volumes, with around 250 additional two-way vehicle trips shown on the sections between the B1383 and the M11. These contribute to a slight increase in stress to greater than 70% between the B1383 and A1250, although still within operating capacity. The A1184 through Sawbridgeworth also shows increases in two-way traffic of around 250 vehicles, with both London Road and Cambridge Road showing an increase in stress to greater than 70%, but within operating capacity.

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### **Group 1 scenarios (around 14,200 dwellings)**

#### **Option 1A (Harlow North [8,000 dwellings])**

- 7.13 The inclusion of 8,000 dwellings North of Harlow leads to additional pressures on both urban and inter-urban roads within the district, with a number of roads showcasing additional stress and increases in traffic volumes. It should be noted that for the purposes of this assessment, no additional infrastructure has been assumed.
- 7.14 In urban areas within East Hertfordshire, some minor increases in traffic volumes are noted, with around 250 additional vehicles noted on London Road and Whittington Way in Bishop's Stortford, Thieves Lane in Hertford, Church Lane and the B180 Hunsdon Road in Hunsdon, representing the dispersal of development traffic across the network. No changes in stress across these roads are forecast. The only notable change in stress is shown on High Wych Road in Sawbridgeworth, where a similar increase in traffic volumes results in stress levels increasing to greater than 80% due to traffic routing between Harlow North and the A1184 via this route.
- 7.15 Within Harlow, significant increases in traffic are noted on Third Avenue where two-way traffic volumes double to around 5,500 vehicles and performance of the road changes from unstressed (<50%) to highly stressed (>80%). Similarly, the A414 Fifth Avenue between Eastwick Roundabout is shown to have significant increases in traffic volumes, with around an additional 3,000 vehicles on the route in the AM peak – this route is already significantly stressed (>95%) in the Reference Case.
- 7.16 With regards to inter-urban routes, sections of the M11, A10, A414 and the A1184 are impacted by the development. On the M11, an increase of around 250 vehicles is witnessed between junctions 6-7, although with no discernible impact on performance. The A10 shows an increase in volumes of between 250-500 vehicles between the A414 at Ware and the A1170 south of Hoddesdon, with all sections along this stretch showing an increase in stress, most notably the section between the A414 and Dinant Link Road increasing in stress to >80%. Increases in traffic volumes along the A414 within East Hertfordshire are noted, with between 250 and 750 additional trips forecast to the south of Ware.

#### **Option 1B (Harlow North [5,000 dwellings], Ware [3,000 dwellings])**

- 7.17 The inclusion of 5,000 dwellings North of Harlow combined with 3,000 dwellings in Ware leads to additional pressures on both urban and inter-urban roads within the district. As per Option 1A, it should be noted that for the purposes of this assessment, no additional infrastructure has been assumed.
- 7.18 In urban areas within East Hertfordshire, some minor increases in traffic volumes are noted, with around 250 additional vehicles noted on Whittington Way in Bishop's Stortford, the A119 Ware Road and Thieves Lane in Hertford and the B180 Hunsdon Road in Hunsdon. No changes in stress across these roads are forecast. The only notable changes in stress are shown on High Wych Road in Sawbridgeworth, where a similar increase in traffic volumes results in stress levels increasing to greater than 80% and the A1170 south of Ware, where the road becomes mildly stressed. The A1170 north of Ware shows a modest increase of around 250 vehicles.

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- 7.19 Within Harlow, significant increases in traffic are noted on Third Avenue where two-way traffic volumes increase to around 4,750 vehicles and performance of the road changes from unstressed (<50%) to moderately stressed (>60%). Similarly, the A414 Fifth Avenue between Eastwick Lodge Roundabout and Burnt Mill Roundabout is shown to have significant increases in traffic volumes, with around an additional 2,000 vehicles on the route in the AM peak – this route is already significantly stressed (>95%) in the Reference Case. These increases are less than forecast in option 1A, reflecting the reduction in development size at north Harlow.
- 7.20 Across inter-urban routes, as per option 1A, section of the M11, A10, and A414 are impacted by development, with impacts also noted on the A602 and A120 due to the proposed developments at Ware. For the M11, an increase of around 250 vehicles is witnessed between junctions 6-7, although no change in link performance is observed. A larger section of the A10 is impacted than in option 1A, with increases of around 500 vehicles forecast between the A602 and the M25, with the Ware development contributing to this – the sections of the A10 near Ware show an increase in stress, with the section between the A414 and the A1170 at Hoddesdon increasing to greater than 80%. Increases in traffic volumes along the A414 within East Hertfordshire are noted, with between 250 and 500 additional trips forecast to the south of Ware. Unlike Option 1A, the provision of dwellings at Ware leads to increases in two-way traffic volumes on the A120 at Standon and the A602 between Ware and Stevenage of around 250 vehicles; these appear to lead to little change in the performance of the roads, although the A602 Westmill Road does see a slight deterioration in stress to greater than 70%.

### **Option 1C (Sawbridgeworth West [3,000 dwellings], Ware [3,000 dwellings], East of Welwyn Garden City [2,000 dwellings])**

- 7.21 Scenario 1C maintains the same level of development as scenarios 1A-1B, yet does not include provision of housing North of Harlow, instead assuming development across the south of the district, at Ware, Sawbridgeworth and East of Welwyn Garden City. As a result, the traffic impacts from the developments are more widespread.
- 7.22 Little impact is noted within Bishop's Stortford, Buntingford or the south-east parishes, which are removed geographically from the proposed development locations. Traffic impacts within Ware are moderate, with around an additional 250 vehicles forecast on the A1170 south and north of Ware, with the road to the south becoming moderately stressed as a result. Within Hertford, increases of around 250 vehicles are forecast on the A119 Ware Road and Thieves Lane, although with no impact on the level of stress experienced on the road. It should be noted that the lack of a junction modelling element within DIAMOND may mean that the predicted congestion levels, whilst correct against the theoretical link capacities will not reflect any 'pinch-points' at junctions on the network, and the results will thus have to be interpreted against knowledge of the local conditions.
- 7.23 The largest impacts are noted within Sawbridgeworth, with High Wych Road, West Road and the A1184 all experiencing impacts from the 3,000 additional dwellings. The A1184 experiences increases of 500-750 vehicles on both the London Road and Harlow Rod sections, increasing to being highly stressed (>95%) from much lower levels of 70-80% and 60-70% respectively. High Wych Road shows an increase of around 250 vehicles

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due to development traffic using the route to travel between the A1184 and A414, although West Road has the highest increase in traffic, with an additional 750 vehicles forecast in the morning peak hour and performance deteriorating from slightly stressed (60-70%) to highly stressed (>95%) as it is a key access route to the A1184 from the development.

- 7.24 Roads to the east of Welwyn Garden City also show impacts as a result of the development, with an additional 500 vehicles forecast on the B195 Birchall Lane and additional 250 vehicles on Cole Green Lane as development traffic access the A414 and the town respectively. These routes are forecast to become more stressed as a result, with the B195 Birchall Lane becoming highly stressed.
- 7.25 Across inter-urban and strategic routes, impacts are similar to options 1A-1B, although with greater impacts on the A1184 as noted. The A10 is impacted similarly to option 1B, with increases of around 500 vehicles forecast between the A602 and the M25, with the Ware development contributing to this. Increases in traffic volumes along the A414 within East Hertfordshire are again noted, with between 250 and 500 additional trips forecast to the south of Ware. The provision of dwellings at Ware leads to increases in two-way traffic volumes on the A120 at Standon and the A602 between Ware and Stevenage of around 250 vehicles; with Westmill Road showing a slight deterioration in stress to greater than 70%.

### **Group 2 scenarios (around 12,200 dwellings)**

#### **Option 2A (South of Bishop's Stortford [800 dwellings], Sawbridgeworth West [2,000 dwellings], Ware North [1,700 dwellings], Buntingford [1,500 dwellings])**

- 7.26 Option 2A contains provision of 2,000 fewer dwellings than scenarios 1A-1C, with developments included further north at Buntingford and Bishop's Stortford. The traffic impact of these is discussed below.
- 7.27 The reduction of dwelling provision within Ware compared to scenarios 1B-1C results in a better performance of the highway network within the town, with no significant traffic increases forecast and with no impact on road performance demonstrated. As per previous scenarios, however, an additional 250 vehicles are forecast on the A602 compared to the Reference Case as a result of the development, with performance of the Westmill Road section slightly deteriorating.
- 7.28 Within Bishop's Stortford, the provision of a further 800 dwellings shows little impact over the Reference Case, although an additional 500 vehicles forecast on Whittington Way causes the road to become moderately stressed, operating at around 70-80% of capacity with a similar level of performance noted on the B1383 London Road, due to trips from the development accessing the network in this area. No significant change in performance on the A120 is noted. The A1184 performance does deteriorate, although the sections affected suggest that this is primarily due to development at Sawbridgeworth West as opposed to south of Bishop's Stortford.

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- 7.29 The largest impacts are noted within Sawbridgeworth, with High Wych Road, West Road and the A1184 all experiencing impacts. The A1184 experiences increases of between 250-500 vehicles on both the London Road and Harlow Rod sections. The reduction of dwelling provision from 3,000 dwellings in scenario 1C results in the West Road performance deteriorating to 80-95% stress, as opposed to the >95% stress previously forecast. The A1184 shows an increase of around 250 vehicles across the Cambridge Road, London Road and Harlow Road sections, with all of these being stressed to above 80% of capacity.
- 7.30 The provision of 1,500 dwellings at Buntingford leads to a forecast increase of trips on both the High Street and the B1038 Baldock Road. Whilst the performance of the High Street is not affected, the Baldock Road becomes highly stressed (>80%) as a result of traffic wishing to access both the A10 and A507 from the development. The development also results in an increase in trips on the A10 between Buntingford and Puckeridge of upto 500 vehicles, and contributes to the slight increase in trips shown on the A120 at Standon: no impact on road performance is noted for these sections of road.

**Option 2B (East of Bishop's Stortford [150 dwellings], Sawbridgeworth West [3,000 dwellings], Buntingford [500 dwellings], East of Welwyn Garden City [2,000 dwellings], Terlings Park [270 dwellings])**

- 7.31 Option 2B includes the lowest growth of all of the scenarios tested, with 12,178 dwellings in total. The scenario includes developments in similar spatial locations to that of option 2A, although with less development at Bishop's Stortford and Buntingford, more development at Sawbridgeworth and with development at Ware foregone in favour of East of Welwyn Garden City options. A small provision of growth is also included north of Harlow at Terlings Park.
- 7.32 As per previous scenarios, the Sawbridgeworth development shows the greatest impacts, both in Sawbridgeworth and on the A1184. The A1184 shows increases of between 250-500 vehicles (two-way) between Spellbrook and Harlow, with each of these sections becoming highly stressed, with the section between High Wych Road and Harlow in particular forecasting traffic volumes at above 95% of capacity. Within Sawbridgeworth, both the High Wych Road and West Road show increases in traffic volumes, with West Road experiencing an increase of 750 vehicles and becoming highly stressed.
- 7.33 The effects in Buntingford lead to a similar increase in traffic on the B1038, although the lower dwelling provision means that the level of stress experienced is slightly lower and also means that the vehicle flows on High Street do not witness much of an increase. The lower dwelling provision compared to scenario 2A also means that the effects on the A10 between Buntingford and Puckeridge are reduced, showing no significant change in traffic volumes compared to the Reference Case.
- 7.34 East of Welwyn Garden City, traffic impacts are similar to that of Option 1C with an additional 500 vehicles forecast on the B195 Birchall Lane and additional 250 vehicles on Cole Green Lane as development traffic access the A414 and the town respectively. The same level of development east of Welwyn has been assumed in the two scenarios.

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- 7.35 Within Bishop's Stortford, the provision of 150 dwellings has little impact on the highway network, with around 250 additional trips on the B1383 and Whittington Way, with a slight increase in performance to 'moderately stressed' noted on the latter. Some small increases in traffic volumes are noted in Hertford but with no impact on network performance, whilst Ware and the south-east parishes show almost no change in traffic volumes or performance.
- 7.36 Across strategic roads, whilst the A1184 shows the greatest impact other roads show less impact than in previous scenarios. The A10 shows some slight increases in traffic volumes of around 250 vehicles between Ware and the M25, although stress levels remain as per the Reference Case. The fact that changes on the A10 are much less under this scenario is due to a lack of development in Ware and North of Harlow, with developments at Welwyn Garden City and Buntingford resulting in less traffic that uses the road. Impacts on the A414 are also lower than other scenarios, with small increases shown between the A1(M) and the A10 due to development near Welwyn Garden City and a slight increase on London Road, Harlow, due to traffic from Sawbridgeworth West using the route to access eastern areas of the town and onto the M11.

**Option 2C (South of Bishop's Stortford [800 dwellings], Ware East [1,300 dwellings], Buntingford [2,000 dwellings], East of Welwyn Garden City [2,000 dwellings])**

- 7.37 The lack of development in Sawbridgeworth leads to increased performance of both the A1184 and High Wych and West Roads in the town. The A1184 demonstrates traffic volumes similar to the Reference Case, with only the stress on the Cambridge Road section slightly increasing, due to some traffic from Bishop's Stortford south using the route. High Wych and West Roads similarly show traffic volumes and stress as per the Reference Case.
- 7.38 The south Bishop's Stortford development leads to an additional 500 vehicles forecast on Whittington Way, causing the road to become moderately stressed, operating at around 70-80% of capacity with a similar level of performance noted on the B1383 London Road, due to trips from the development accessing the network in this area. No noticeable change in the performance of the A120 is noted.
- 7.39 Traffic impacts within Ware are moderate, with around an additional 250 vehicles forecast on the A1170 south and north of Ware, with the road to the south becoming moderately stressed as a result. Similarly, in Hertford, increases of around 250 vehicles are forecast on the A119 Ware Road and Thieves Lane, although with no impact on the level of stress experienced on the road. Impacts on the A10 around Ware show increases in stress between the A414 and Hoddesdon, caused by some additional 250 trips.
- 7.40 In Buntingford, an increase of around 500 trips is noted on the B1038 (Baldock Road) with route performance being demonstrated as highly stressed as a result. This is the largest increase of any scenario within Buntingford and is due to the fact that a further 500 dwellings have been assumed in the area when compared with scenario 2A. An increase of 250 trips is noted on the High street, which is a result of traffic travelling to/from the northern access of the A10. The development results in a slight increase in traffic on the A10 between Buntingford and Ware, although with no notable impact on stress across these sections of the road.

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- 7.41 There are little to no impacts shown within Harlow or the south-east Parishes, which are located geographically away from the proposed development sites.

**Option 2D (Sawbridgeworth West [2,000 dwellings], East of Welwyn Garden City [4,000 dwellings])**

- 7.42 The key development in scenario 2D is the provision of 4,000 dwellings east of Welwyn Garden City – 2,000 more than previous scenarios with the additional dwellings being provided outside of East Hertfordshire’s boundaries in Welwyn-Hatfield Borough. The west of Sawbridgeworth option is also retained, but reduced to 2,000 dwellings.
- 7.43 As per previous scenarios, development at Sawbridgeworth is forecast to lead to around 250 additional vehicles on the A1184 between the town and Harlow with stress increasing to greater than 80%, although not as high as in scenarios where 3,000 dwellings have been assumed. Similarly, High Wych Road and West Road show an additional 250-500 vehicles and corresponding stress increases, the latter due to its use by traffic accessing/exiting the proposed development.
- 7.44 The provision of 4,000 dwellings east of Welwyn Garden City has a noticeable impact on the B195 (both Birchall Lane and Blackfan Road) and Cole Green Lane. An additional 750 vehicles are forecast on Birchall Lane that provides access to/from the development to the A414 and to the town via Blackfan Road and Cole Green Lane. A corresponding increase of upto 500 vehicles is noted on the A414 west of the development providing access to Hatfield and the A1(M); scenario 2D is the only scenario for which an increase in traffic on the A1(M) between junctions 3-4 is forecast, although this does not lead to an decrease in performance of the A1(M), with a large amount of development traffic being either short-distance trips or making east-west movements.



## **8 A1(M) and Welwyn-Hatfield Modelling**

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## 8 A1(M) and Welwyn-Hatfield Modelling

- 8.1 DIAMOND has previously been used in order to undertake a similar exercise of assessing development proposals in the neighbouring district of the Borough of Welwyn-Hatfield (WHB). Where appropriate, these results have been incorporated into the most recent analysis for East Hertfordshire.
- 8.2 Scenario 2D as previously identified, includes a provision of 4,000 dwellings east of Welwyn Garden City; 2,000 of these dwellings are assumed to be constructed across the district boundary within WHB. Scenario 12B from the previous Welwyn-Hatfield Study identifies similar quantum of development to that included in Option 2D, with 1,600 dwellings within EHDC boundaries and 700 dwellings within Welwyn-Hatfield. These locations can be identified as sites Q and A respectively, shown in Figure A.1 of Appendix A. Whilst this level of development is some 1,700 dwellings short of the Scenario 2D forecasts, it will provide a useful and relevant comparison of the model outputs.
- 8.3 Scenario 12B from the WHB modelling shows an increase in traffic along the B158 towards the A1000 compared with a reference case; this routing of development trips is also observed in the EHDC Scenario 2D modelling, with development trips routing southbound along this route in the morning peak to avoid the congested A1(M).
- 8.4 Scenario 12B (WHB) also demonstrates increases in traffic volumes along the A414 between the A1(M) and Hertford, the B195 and Panshanger Lane between the B1000 and A414. Again, similar routing observations are noted in the EHDC Scenario 2D assessment. Additionally, both models show similar stress patterns on the B195 and Panshanger Lane, albeit with slightly increased stress observed in Scenario 2D, due to the larger amount of dwellings assumed in the vicinity, which impacts directly on these links.
- 8.5 The A1(M) shows high levels of stress in both model scenarios, operating close to capacity around Junction 4 at Hatfield and Junction 3 for St Albans. It is notable that the A1(M) is less congested in the PM peak compared to the AM peak in the WHB modelling, where as in the EHDC Scenario 2D modelling, it appears to be similarly congested in both peaks.
- 8.6 Overall, modelling for the PM peak shows much the same pattern as observed in the AM, demonstrating similarities between the WHB and EHDC modelling both in terms of traffic routing and predicted levels of stress.

## **9 Implications for the Strategy Selection process**

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## 9 Implications for the Strategy Selection process

- 9.1 Having reviewed the district-wide scenarios above and noting the results from the modelling exercise, it is necessary to understand the implications for East Herts Council's strategy selection process, leading up to the finalisation of the the spatial strategy for the District Plan.
- 9.2 From the model results it is possible to isolate the main likely traffic impacts attributable to each of the key test variables. The traffic impacts are link-based only, but provide a reasonable overview of the likely network impacts; some careful interpretations of known junction delay 'hotspots' may need to be considered. Care has been taken to separate the likely impacts from a development option from the impacts arising from development elsewhere, either within or outside of the District, by cross-checking the various scenario results.
- 9.3 Table 9.1 sets out the key impacts and identifies the likely policy implications that the modelling results give rise to noting the key findings at the urban level. As the analyses are only link-based, it is likely that further impacts from predicted development traffic will be noted downstream and that additional analyses and modelling may be required to identify these.
- 9.4 The implications of the findings depend on a range of factors, including the feasibility of highways and sustainable transport schemes to address the traffic impacts, neither of which it has been possible to test in the DIAMOND assessments. Possible infrastructure and sustainable transport mitigation measures will need to be pursued as part of individual planning applications coming forward in the period covered by the District Plan; however, some initial identification of possible schemes has been made in the analyses contained herein.

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**Table 9.1 – Impacts and policy implications of proposed developments**

Key Test Variable	A. Main findings	B. Policy Implications
<p><b>Bishop’s Stortford</b> (East 150 dwellings, South 800 dwellings)</p>	<p>Developments tested specifically within the vicinity of the town have been smaller than those at other locations. These developments themselves do not appear to have a significant impact upon congestion within the urban area, although it is noted that development in the south does result in moderate congestion on the B1383 London Road and Whittington Way, for which junction assessments may be required via the usual planning application procedure should development at this location be pursued.</p> <p>The majority of highly congested links within the town can be traced to the provision of 2,500 dwellings to the north of the town as part of the Reference Case. Isolating these impacts suggests that the A120 between the B1383 and the M11 as well as the B1383 (Stansted Road) and the B1004 (Rye Street) are all likely to become highly congested should development here go ahead. The A120 west of the B1383, the A1250 Dunmow Road and Parsonage Lane are all expected to be operating at capacity by the 2030 Reference Case, without any significant developments in the Bishop’s Stortford area.</p> <p>It is also noted that, across each of the modelled scenarios, between 50 and 200 additional trips are expected along the A120 and through Little Hadham. For the scenarios within which development at South Bishop’s Stortford of 800 dwellings is assumed, this value increases to between an additional 200 and 400 trips, although no significant change in congestion on the A120 is notable, noting that the route is relatively uncongested in these scenarios.</p>	<p>The A120 to the north of Bishop’s Stortford is already expected to be highly congested by 2030 without any additional developments being included. The inclusion of an additional 2,500 dwellings leads to the majority of the route between the A1184 and the M11 being highly congested across both the AM and PM peak hours. This is likely to be problematic for both local and through-trips. It is possible that the widening of certain sections of the route that are expected to be under-pressure could help to mitigate against the future pressures here; further modelling may inform whether widening is required throughout or whether solely junction improvements are required.</p> <p>Initial modelling suggests that the small development of 150 dwellings in East Bishop’s Stortford will not require any significant infrastructure enhancements.</p> <p>Development to the south of Bishop’s Stortford appears likely to lead to increased congestion on both the B1383 London Road and Whittington Way. As these routes are only expected to become moderately congested, it is possible that the provision of sustainable travel measures, such as the likes of frequent and reliable bus services into the town centre may help to mitigate against some of the increase in congestion. This would require some further investigation and scrutiny of junction performance along the route to ensure that no further significant highway issues would remain. With regards to Little Hadham, the crossroads within the centre of the village are already a significant congestion hotspot, with delays to traffic on both</p>

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Key Test Variable	A. Main findings	B. Policy Implications
		<p>arms of the A120 and the minor arms to the north and south. Whilst DIAMOND does not predict high levels of congestion here, it should be considered that DIAMOND is solely link-based and that the issues at Little Hadham are predominantly due to the low capacities for each arm at the junction. With development south of Bishop’s Stortford, an increase in congestion on the eastern arm of the A120 is noted at this location: this increase of upto 400 additional trips through the location could have significant operational impacts when coupled with the growth in background traffic to 2030. Assessment of the available headway at the junction should be made: it is possible that growth in background traffic alone may call for the need for infrastructure improvements at this location, although the development impacts should be determined.</p>
<p><b>Buntingford</b> (500 to 2,000 dwellings)</p>	<p>For scenarios 2A-2C which contain development at Buntingford, the key impact forecast is additional traffic (between 250 and 500 two-way vehicles) on the B1038 Baldock Road, between the A10 and the High Street. Whilst development of 500 dwellings (2B) shows an increase to moderate congestion on this link, both developments at 1,500 and 2,000 dwellings shows the route becoming highly congested. Some increase in congestion is also noted on the A507 to Stevenage, predominantly relating to the development at 2,000 dwellings, although with some additional congestion at 1,500 dwellings. The A507 increases from uncongested to between relatively uncongested and moderately congested for portions of this route.</p>	<p>It is likely that development of greater than 500 dwellings will cause increasing levels of congestion within the town, with both the High Street and the B1038 (Baldock Road) experiencing additional trip volumes. The B1038 is a key access route to both the A10 and A507 and is forecast by DIAMOND to become significantly congested and could lead to increased congestion throughout the town’s road network. Further consideration will need to be given to the access routes to the development sites – some direct access onto the A10 may be required in order to prevent the town centre from becoming too congested during the peak hours. With regards to the A507, increases in congestion as a result of development in Buntingford are likely to be within tolerable limits, although the likely</p>

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Key Test Variable	A. Main findings	B. Policy Implications
		<p>impacts on individual junctions are unknown. Promotion of smarter travel measures and promotion of bus services between Buntingford and Stevenage should be explored as these may be sufficient to mitigate against the increases in congestion that are forecast. From the DIAMOND work undertaken, no significant infrastructure upgrades are likely to be required along the route, although individual junction assessments should be undertaken as part of any development Transport Assessment documents.</p>
<p><b>North of Harlow</b></p>	<p>Development North of Harlow is forecast to have significant impacts on the highway network, predominantly within Harlow itself. The key impact forecast is on the A414 Fifth Avenue (River Stort crossing) which is forecast to operate at almost twice its design capacity with the introduction of the development – almost 50% of trips from North of Harlow are forecast to travel to destinations within Harlow itself. In accordance with this, significant volumes of development trips are also forecast on the A1025 Second and Third Avenue within Harlow, although it is not expected that these will have serious adverse effects on congestion on the links, although junction performance within the town may be an issue. Outside of Harlow, both the High Wych Road and the A1184 in Sawbridgeworth are expected to come under additional pressures; the A1184 Cambridge Road is particularly congested with development of 8,000 dwellings North of Harlow. Much of this traffic routes through Sawbridgeworth and travels north on the A1184 towards Bishop’s Stortford, leading to significant congestion on the A1184 which is likely to severely adversely affect road network performance in</p>	<p>The A414 Fifth Avenue is likely to completely breakdown with the introduction of a North of Harlow development if no infrastructure improvements are made; the link between Eastwick and Burnt Mill roundabouts is expected to operate at twice its link capacity, whilst the knock-on impacts on the A414 due to junction operational issues are likely to cause problems here too. Whilst some of this impact may be able to be mitigated by the provision of high quality public transport routes between North of Harlow and Harlow (e.g. Bus Rapid Transit), it is unlikely that this will solve the issue. Grade-separation of Eastwick is unlikely to mitigate this problem as the predominant movements will all be into Harlow. It may be that an alternative crossing of the river Stort, possibly to the west of Eastwick providing access to Pinnacles and the west of town, may provide some relief for this route, although this would need to be subject to further investigation. Significant pressures on the A1184 and High Wych Road are also noted as a result of northbound traffic from North of Harlow. The provision of a northern distributor road or similar between the A414 and</p>

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Key Test Variable	A. Main findings	B. Policy Implications
	<p>the town.</p>	<p>A1184 would likely provide relief to High Wych Road but would be unlikely to mitigate the predicted congestion on the A1184, as northbound traffic would still need to pass through the town. Such a route may also provide some relief to the A414 Fifth Avenue and Edinburgh Way, attracting traffic for the east of Harlow. It is possible that a further link between the A1184 and the M11 would help to further mitigate against the likely congestion through Sawbridgeworth, with northbound traffic attracted instead to the M11, accessing Harlow via Junction 8. Pursuance of such a scheme would need to be explored jointly with the Highways Agency and an in-depth assessment of the potential impacts and benefits assessed in accordance with the 5 stages recommended in WebTAG and HMT’s Green Book. Alternatively, a local bypass of Sawbridgeworth may mitigate against the increased traffic volumes through the town centre, although the predicted impacts on High Wych Road suggest that this would need to be delivered in conjunction with an alternative initial access route to the A1184.</p>
<p><b>Hertford</b> West 600, South 100, North 100, South Mead Lane (100) National Grid/Norbury Woodyard (200)</p>	<p>DIAMOND model outputs for Hertford typically show little variation in flows across the urban area across any of the scenarios. Some increases in traffic volumes over the 2031 Reference Case are noted for the A414, A119 and Thieves Lane are noted, although these don’t appear to impact upon the level of congestion forecast.</p>	<p>Analyses tend to indicate only small increases in the level of trips throughout the Hertford urban area. It is noted that dependent upon scenario there are between an additional 200 and 500 development trips on the A414 Gascoyne Way through Hertford. Whilst these do not appear to have any significant impact upon congestion within the DIAMOND model, it is worth noting that junction effects are not taken into account. The roundabouts within Hertford along this stretch of the A414 are known to have capacity issues at present and it is likely that this will be exacerbated by the additional trips forecast.</p>



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Key Test Variable	A. Main findings	B. Policy Implications
		<p>Individual junction modelling may be necessary to address issues at these particular locations and to determine any required mitigation. Given the additional traffic volumes across all scenarios and different development distributions, it is not expected that smarter sustainable travel measures on a development-basis will have a significant impact upon reducing traffic using the A414 Gascoyne Way.</p>
<p><b>Sawbridgeworth</b> North and South of West Road 200, Crofters 80, SLAA sites 25, other permissions 6.</p>	<p>Developments of both 2,000 (2A, 2D) and 3,000 dwellings have been tested at West Sawbridgeworth, all of which appear to lead to significant congestion within the urban area. The A1184 both within the town and north and south of the town (Cambridge Road / Harlow Road sections) is highly congested under all scenarios that include development to the west. Additionally, the High Wych Road and West Road, where development trips first access the road network, are expected to be highly congested with the site introduction. Of the links present within DIAMOND, only Station Road is not highly congested, as development trips make use of West Road instead to access the rest of the highway network.</p>	<p>Sawbridgeworth is likely to become significantly congested with development to the west of the town, more so than with development north of Harlow. Given the significant increase in the levels of congestion predicted and the likely deterioration in junction performance along the route of the A1184, it is unlikely that development to the west of the town could be delivered without investment in highways infrastructure to divert through-traffic out of the town centre; this could perhaps take the form of a local bypass of Sawbridgeworth, although a number of options would need to be thoroughly explored as would the feasibility of scheme delivery for a development of this size. The loading of development trips onto the local road network via West Road may also need to be explored, as it appears that development on this scale may adversely impact performance of the road.</p>
<p><b>Terlings Park</b> (270 dwellings)</p>	<p>No significant highway impacts are predicted from the Terlings Park development which, at around 270 dwellings, is only a small site. Up to an additional 250 trips are forecast on the A414 Fifth Avenue between Eastwick and Burnt Mill roundabouts, but these are not all solely due to the development at Terlings Park.</p>	<p>Some further traffic on the A414 between Eastwick and Burnt Mill is forecast and will add to the pressures on this already congested link. Traffic volumes are not forecast to be high to/from this development however and it is possible that existing infrastructure may be able to accommodate development trips, although further investigation will</p>

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Key Test Variable	A. Main findings	B. Policy Implications
<p><b>Ware</b> (North – 1,700 dwellings, East – 1,300 dwellings)</p>	<p>Developments of 1,300 and 1,700 dwellings as well as a combination of the two have been tested at Ware which show some moderate impacts on network performance. Increases of up to 250 additional trips are note on the A1170, which as a result becomes modertately congested. The A602 Westmill Road is also forecast to have a similar increase in flows and change in performance. The largest increases in traffic volumes are shown on Baldock Street / High Street when both developments are included, with a doubling of traffic flows over the Reference Case scenario, although the model shows that there is no increase in congestion across the link. The A414 south of Ware is largely unaffected across the scenarios where development has been included, showing only some small increases in traffic flows due to development within the town and no predicted change in congestion.</p>	<p>be required.</p> <p>The impacts shown by the modelling within Ware tend to be moderate, with the greatest impact appearing when both the north and east dwelling sites are included together. However, the increases in congestion tend only to show an increase to either relatively stressed or moderately stressed. This suggests that some small-scale infrastructure improvements or enhancements to public transport provision (e.g. in the form of smarter travel measures) may be able to mitigate against some of the traffic impacts. However, it should be noted that the model does not consider congestion due to junctions and it is recognised that there are currently some capacity constraint issues concerning junctions within the town. Further investigation and/or junction specific modelling will be required in order to fully understand the likely impacts of development on infrastructure performance in the urban area.</p>
<p><b>Welwyn Garden City</b> (Within EHDC boundaries – 2,000 dwellings, Within Wel-Hat boundaries – 2,000 dwellings)</p>	<p>Development scenarios tested have been located to the east of the town, as a result a number of trips are forecast between the site and the urban area. Most notably, increases in traffic are forecast on the B195 Birchall Lane and Blackfan Road which, with traffic from the developments making use of them, become highly congested. Similarly, Cole Green Lane – which also serves traffic into the urban area from the B195 – is forecast by DIAMOND to experience moderate congestion as a result of the development. When the full complement of 4,000 dwellings is included, the model forecasts that the B195 Birchall Lane is likely to become significantly congested, with flows exceeding the capacity of the link; under this level of</p>	<p>The B195 and Cole Green Lane to the east of Welwyn Garden City are likely to become highly congested with developoment to the east of the town, with Birchall Lane likely to experience flow breakdown if development of both the sites in East Hertfordshire and Welwn-Hatfield districts go ahead, as shown by the model predicting flows exceeding road capacity. It is likely that infrastructure improvements will be required in order to ensure that the B195 retain a reasonable level of performance. Development access onto other roads in the area, such as the A414, may also need to be investigated in order to reduce the levels of congestion forecast by DIAMOND.</p>

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Key Test Variable	A. Main findings	B. Policy Implications
	<p>development, the B1000 Hertford Road is also forecast to become moderately congested. None of the developments tested in this area of Welwyn Garden City appear to have a significant impact on traffic volumes or congestion on the A1(M).</p>	
<p><b>Villages</b> 10% growth</p>	<p>It has previously been noted that, due to the vast number of runs that would be required and the impracticality that this would entail, small localised village growth has not been tested within DIAMOND. However, the cumulative impact of 10% growth has been included in the model and therefore taken into account as part of the overall growth. In general, the overall increase of traffic on the inter-urban routes is much less than those of the key test variables and no significant impacts are expected.</p>	<p>It is not likely that there will be any significant traffic impacts resulting from the small-scale developments associated with existing villages. Some infrastructure improvements may be required to facilitate development, although these should be identified via separate transport assessments as part of the standard planning application process.</p>

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- 9.5 In addition to the policy implications noted above, some assessment of network-wide statistics has been undertaken. These statistics help to directly compare the modelled scenarios against a consistent set of criteria, helping to provide insight as to the traffic impacts as a whole across the district. Table 9.3 and Table 9.4 demonstrate this comparison for East Hertfordshire for the AM and PM peak respectively, whilst Table 9.5 and Table 9.6 demonstrates the comparison across the entire model.
- 9.6 The consistent set of criteria that have been picked are average network speeds, average Passenger Car Unit (PCU) hours and average PCU Kilometres. The PCU hours and PCU kilometres reflect the additional number of hours spent travelling and the additional distances travelled on the network as a result of developments being introduced. These statistics act as a proxy for the levels of congestion within the network: lower values mean that shorter travel times and distances are incurred by development traffic, suggesting that there is less congestion – less additional PCU hours spent on the network suggests less time is spent queuing, whilst less additional distance suggests that fewer trips have to re-route in order to avoid queues. The statistics are a useful diagnostic tool, although it should be noted that development trip distributions may have an influence on the results obtained from the model.
- 9.7 Across both the district and the whole of the model, very little change is noted with regards to average network speeds between development scenarios. As speeds have been averaged across the entire network to provide a consistent basis for analyses, there are a large number of links that experience no change in traffic volumes or congestion with the additional development trips added. As such, average network speeds will not be considered in the comparison of scenarios.
- 9.8 Table 9.2 sets out the development options ranked against the PCU hour and kilometre statistics. The best performing scenario (i.e. that with the least additional travelled hours and distance) is ranked 1, whilst the poorest performing is ranked 7. The rankings are provided for the impacts within East Hertfordshire district.

**Table 9.2 – Scenario ranking (based on network statistics, East Hertfordshire)**

Scenario	AM	PM	Overall
Scenario 1A	1	1	1
Scenario 1B	3	3	3
Scenario 1C	5	5	5
Scenario 2A	7	7	7
Scenario 2B	4	4	4
Scenario 2C	6	6	6
Scenario 2D	2	2	2

- 9.9 As the analyses demonstrate, the poorest performing scenarios are 2A, 2C and 1C, with 2A showing the largest increase in vehicle hours and kilometres across East Hertfordshire. It should be noted however, that – when considering the impacts across the entire network – scenario 1C is the poorest performing, with a much greater increase in vehicle hours and kilometres demonstrated. These greater adverse impacts outside of the district

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appear to be due to the additional development at Ware in scenario 1C (3,000 dwellings, compared with 1,700 in 2A): these additional dwellings lead to an increase in trips from Ware to the south and west, making use of the A10 and A414 / A1(M) outside of the East Herts district boundary due to attractors at Cheshunt, Welwyn Garden City, Hatfield and beyond. The inclusion of 2,000 dwellings east of Welwyn Garden City also increases trips outside of the district. Scenario 2A conversely, has higher levels of trips on the A10 (north of Ware) and A507 due to the included development at Buntingford; development South of Bishop's Stortford further compounds traffic issues on the A1184 and south of the town, contributing to the increase in congestion that is forecast.

- 9.10 The best performing scenarios highlighted by the analyses are scenarios 1A, 2D and 1B respectively. Scenario 1A (8,000 dwellings north of Harlow) exhibits the least increase in vehicle hours and kilometres both within East Hertfordshire and across the rest of the network. This is in part due to the trip distributions and geographical situation of the development – around 50% of all trips generated by the development travel only as far as Harlow, meaning that trip lengths (and hence additional kilometres) are kept low. As plots in the Technical Report demonstrate, the vast majority of trips that are not bound for Harlow from the development make use of the A414 and A10 and predominantly head south, outside of the district. As previously mentioned however, significant impacts from the development are expected within Harlow itself, with the A414 between Eastwick and Burnt Mill roundabouts being particularly severely affected and likely to come under significant pressures. It is likely that mitigation measures in the vicinity of Harlow will be required in order to mitigate the impacts of traffic from the development.
- 9.11 Scenario 2D is the next best performing scenario within East Hertfordshire, predominantly due to the fact that the development is sited, similarly to scenarios 1A and 1B, at the periphery of the district boundary. As a result, a large number of development trips from the east of Welwyn Garden City development (of which 2,000 are sited within the Welwyn-Hatfield district) travel west to those urban areas. This is noted when analysing the network-wide statistics, that show less of a clear distinction between the other scenarios when considering the impacts outside of East Hertfordshire, particularly when concerning the total number of hours travelled which, in part, increases due to the congestion forecast on the B195 (Birchall Lane and Blackfan Road), Cole Green Lane and the B1000 Hertford Road. It is still noted within this scenario however, that development in the vicinity of Sawbridgeworth does lead to significant congestion on the A1184, High Wych Road and West Road and mitigation in the form of highway infrastructure intervention would likely need to be considered for the town.

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**Table 9.3 – Network Statistics (East Hertfordshire District Area), AM Peak**

Network Statistic	Scenarios (2031)							
	Reference Case (& North Bishops Stortford)	Scenario 1A	Scenario 1B	Scenario 1C	Scenario 2A	Scenario 2B	Scenario 2C	Scenario 2D
Additional PCU Hours	5,192	114	220	329	371	230	322	172
Additional PCU Kilometres	364,655	7,827	14,405	18,478	21,758	12,568	20,942	10,140
Average speed (kph)	77	77	77	77	77	77	77	77

**Table 9.4 – Network Statistics (East Hertfordshire District Area), PM Peak**

Network Statistic	Scenarios (2031)							
	Reference Case (& North Bishops Stortford)	Scenario 1A	Scenario 1B	Scenario 1C	Scenario 2A	Scenario 2B	Scenario 2C	Scenario 2D
Additional PCU Hours	4,869	121	236	346	376	241	339	184
Additional PCU Kilometres	350,566	7,603	14,357	18,216	20,997	12,454	21,024	10,240
Average speed (kph)	78	78	77	77	77	77	77	78

**Table 9.5 – Network Statistics (Whole Model), AM Peak**

Network Statistic	Scenarios (2031)							
	Reference Case (& North Bishops Stortford)	Scenario 1A	Scenario 1B	Scenario 1C	Scenario 2A	Scenario 2B	Scenario 2C	Scenario 2D
Additional PCU Hours	488,009	662	727	1,034	766	821	713	759
Additional PCU Kilometres	39,943,387	40,329	45,533	54,829	43,513	41,518	43,463	40,431
Average speed (kph)	85	84	84	84	84	84	84	84

**Table 9.6 – Network Statistics (Whole Model), PM Peak**

Network Statistic	Scenarios (2031)							
	Reference Case (& North Bishops Stortford)	Scenario 1A	Scenario 1B	Scenario 1C	Scenario 2A	Scenario 2B	Scenario 2C	Scenario 2D
Additional PCU Hours	470,017	684	775	1,085	800	836	769	800
Additional PCU Kilometres	39,013,255	40,216	45,458	56,220	43,863	42,800	44,197	42,990
Average speed (kph)	86	86	86	85	86	86	86	86

## **10 Next Steps**

## 10 Next Steps

- 10.1 This Non-Technical Report has set out the scenarios devised for East Hertfordshire District Council's strategy selection process and the results of the DIAMOND model assignments which have incorporated them.
- 10.2 It should be recognised that the DIAMOND model is strictly a link-based assessment tool and should only be used to provide an early indication of the likely traffic impacts resulting from the development scenarios that have been tested. The tool does not model junction interactions and does not allow for the displacement of background traffic by traffic generated and attracted by the new development sites. It is recommended further supporting assessment is subsequently carried out to determine the potential mitigation measures required to facilitate development as well as further detailed junction operational assessments which may be required to help support the evidence base in due course. Indeed it is recommended further work is carried out to support the District Plan process as it progresses from the District wide level to the site allocation stage, where individual developments will be required to be assessed.
- 10.3 As such, the results described within this Non-Technical Report should only be used at the sifting stage of the strategy selection and formation process and should not be relied upon for anything further.
- 10.4 This report has set out the results of the modelling, with the initial analyses having drawn-out those scenarios which have the least impact on the highway networks. It is recommended that these analyses be reviewed by East Hertfordshire and used to focus the development scenarios to be taken forward to the next stage of the strategy selection process.
- 10.5 Further work to investigate the preferred scenarios will be required in order to have a fuller understanding and confidence in their likely traffic impacts. This will require the use of more sophisticated modelling tools at the strategic level, such as the Harlow Stansted Gateway Transport Model (HSGTM), and also for junction-focused assessments.
- 10.6 It is also recommended that further cooperation on planning matters and infrastructure is sought between EHDC, HCC and the Highways Agency. EHDC should aim to discuss production of a Statement of Common Ground (SoCG) with the HA prior to the public consultation on the draft District Plan. This will have the advantage of having all relevant parties 'signed-up' to a common set of models and results. Some thought may be given to this at this stage, but is likely to require the results of more detailed modelling prior to an agreement being reached.



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## Appendices