Essex Highways

Epping Forest District Council

Submission Local Plan

Highway Assessment Report

December 2017

RINGWAY JACOBS integrated expertise

Essex County Council

Essex Highways

Document Control Sheet

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Essex Highways

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1 Introduction

1.1 Overview

1.1.1 Epping Forest District Council (EFDC) has prepared a proposed Submission Local Plan as part of their Regulation 19 requirement. A transport modelling assessment has been undertaken by Essex Highways, on behalf of EFDC and Essex County Council (ECC), to assess the potential transport related effects of the district's emerging Local Plan and some of the initial mitigation measures potentially required to support the delivery of planned development.

1.1.2 The work that has been undertaken accords with the approaches to developing a robust assessment of the transport impacts of both existing development as well as that proposed as set out in the National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG). The work has been used to inform the development of the Submission Local Plan, particularly in relation to understanding the opportunities to improve the sustainability of transport provision, improving accessibility and understanding the transport implications of development. This report, and the work undertaken to support it, forms one part of the 'toolkit' of evidence that the Council has used to inform the development of the Submission Local Plan.

1.1.3 As is made clear in the PPG this is an iterative process which becomes more refined and detailed as the process draws to a conclusion. Further work is therefore being undertaken to refine the outputs and provide a more detailed package of mitigation measures and interventions to support the Local Plan when it is formally submitted to the Secretary of State for examination. Consequently, it is important to recognise that this is not the final stage in the Transport Assessment process.

1.1.4 The transport work that has, and will continue to be developed, also supports other evidence, and in particular the Council's and its partners understanding of any likely significant effects of air quality on the Epping Forest arising from traffic growth. The transport work has therefore taken into account, for example, potential growth in traffic arising from development outside of the Epping Forest District administrative boundary. It has also modelled all proposed housing and employment land, including factoring in development on windfall sites. In doing so it is important to recognise, based on experience, that there are occasions when a site allocated for development does not come forward as anticipated. As such the outputs contained in this report represent a 'worst-case' scenario with regard to traffic growth and therefore provide a robust assessment of the traffic related effects of the Submission Local Plan.

1.1.5 The EFDC Submission Local Plan Highway Assessment is a strategic modelling based study to inform the decision making surrounding the suitability of potential development sites, initial highway mitigation proposals and the proposed submission development scenario.

1.1.6 The modelling assessment has made use of a VISUM assisted spreadsheet model covering the key highway network and settlements within the district. A number of development scenarios have been tested previously to evolve and support the Local Plan through the pre-submission and consultation processes up to this point. The

scenarios tested include: development available for future residential, commercial and educational land uses; infrastructure requirements; and opportunities to encourage sustainable travel choices.

1.1.7 This report sets out details of the transport model, the forecasting methodology, as well as the results and analysis of the traffic impacts of the future development scenarios tested to date as well as potential highway mitigation proposals.

1.1.8 At this stage the study does not consider aspects including: ambitious increases in sustainable travel (rail, bus and active modes); the identification of further highway mitigation over and above an initial package of measures; and impacts on public transport services such as overcrowding. These will potentially need to be considered separately to support submission to the Secretary of State for Examination in Public (EiP). This report provides a useful foundation to undertake any such additional study work.

1.2 Objectives

1.2.1 The purpose of this report is to evaluate the likely traffic impacts of a range of different development scenarios, up to and including the proposed Submission Local Plan offer, and potential highway mitigation proposals contained within the forecast scenarios.

1.2.2 The objectives of the study are to:

- assess the existing transport situation on the principal highway network within Epping Forest District (EFD);
- identify and calculate the volume and distribution of vehicle trips based on the quantum and locations of potential developments, including residential, commercial and educational developments, from the planning data provided by EFDC;
- forecast the traffic impacts of various development scenarios and report the main traffic issues;
- forecast the traffic impacts, including the benefits or otherwise, of an initial package of future highway mitigation projects proposed in the Infrastructure Delivery Plan of the Submission Local Plan;
- provide the starting point to: test the proposed Submission Local Plan development scenario; refine the package of mitigation required; and identify locations that may require further investigation regarding traffic impacts.

1.3 Interdependencies

1.3.1 Further consideration should also be given to ‘cross boundary’ impacts with the neighbouring Harlow District to the north. The EFDC Submission Local Plan is inherently linked to Harlow growth and includes a number of large scale EFDC strategic sites located on the boundary of the two districts. Separate ongoing modelling work may need to be reviewed to update any future studies and ensure the impacts of both Local Plans are considered holistically.

1.3.2 The 'cross boundary' impacts with neighbouring Broxbourne District, particularly between Waltham Abbey and Waltham Cross, will also need to be considered as part of any future work to support the final Local Plan submission.

1.3.3 The assessments included in this report account for external traffic growth from outside the district through the use of the Department for Transport's (DfT) TEMPRO planning tool, in addition to EFDC growth, to ensure increases in cross boundary and through traffic are captured.

1.4 Report Structure

1.4.1 This report provides details of the transport modelling approach used to test and support the Submission Local Plan. The following sections set out the modelling methodology, development assumptions, results and recommended next steps:

Section 2 Transport Base Model – describes the methodology used to construct the Highway Assessment base model including traffic data, software and overall study area.

Section 3 Model Forecasting, Trip Generation, Distribution and Assignment – provides an overview of the Local Plan scenarios and Technical Assessments tested with details of how the associated forecast travel demand has been derived and added to the model.

Section 4 Model Results and Analysis – summarises the modelling results and associated highway impact from each of the scenarios and Technical Assessments tested.

Section 5 Wider Impacts – summarises the status of separate transport modelling being undertaken in parallel to assess interdependent, as well as wider, impacts including Harlow District.

Section 6 Summary – discusses the transport modelling outcomes to date and sets out the recommended next steps to support the Local Plan through to formal submission to the Secretary of State for examination.

2 Transport Base Model

2.1 Model Extent

2.1.1 The Epping Forest District (EFD) VISUM (v14) assisted spreadsheet Highway Assessment model has been used to assess various forecast traffic scenarios as a precursor to testing the proposed Submission Local Plan.

2.1.2 The model includes the key road networks within EFD with a particular focus on the Waltham Abbey, Loughton and Epping settlements. In addition to the principal model there is a degree of overlap with the adjacent Harlow VISUM transport model and a VISSIM microsimulation model, which has also been developed to specifically assess air quality within the Epping Forest Special Area of Conservation (SAC). While the outcomes of this report focus on the outputs of the principal EFD Highway Assessment Model, reference is made to these associated models throughout and any further work required will seek to draw on all relevant and available data and modelling tools.

2.1.3 Figure 2-1 below illustrates the extent of the principal Highway Assessment model area as well as the extents of the associated Harlow VISUM and Epping Forest SAC VISSIM models for reference.

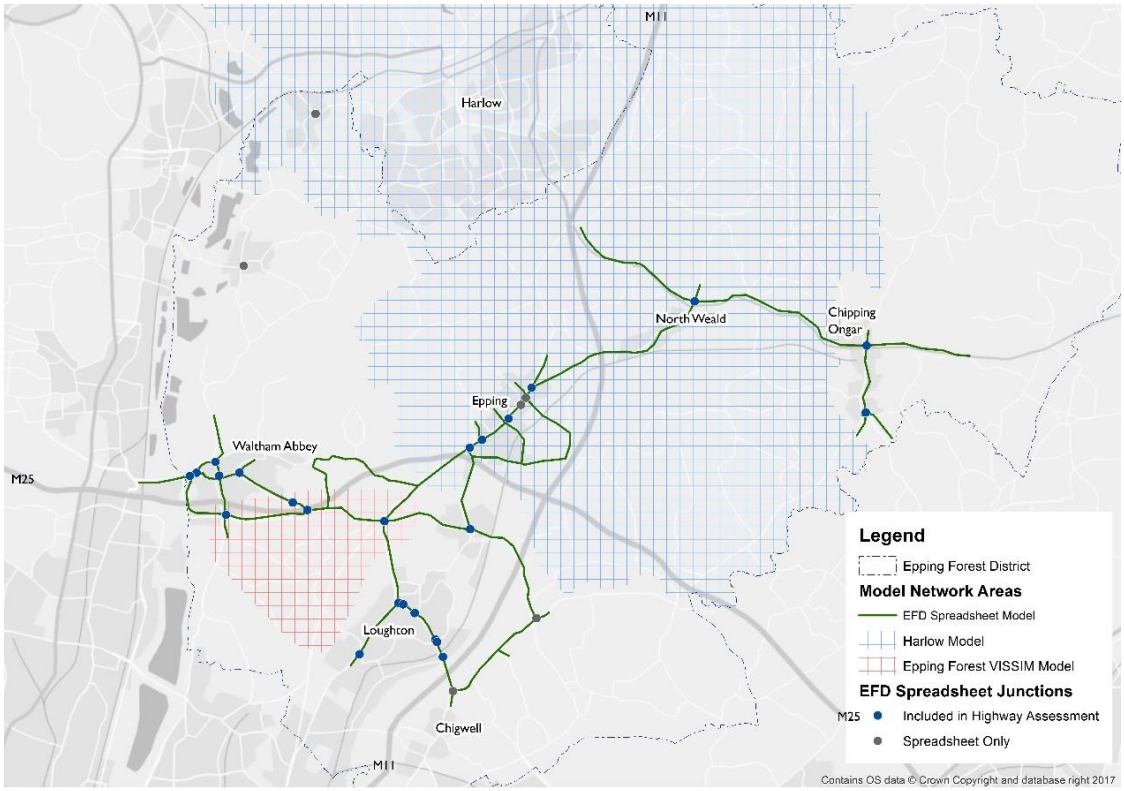

Figure 2-1 Model Extents

2.1.4 Figure 2-2 references the specific junctions tested in the Highway Assessment model as well as peripheral junctions included in the model for information purposes only.

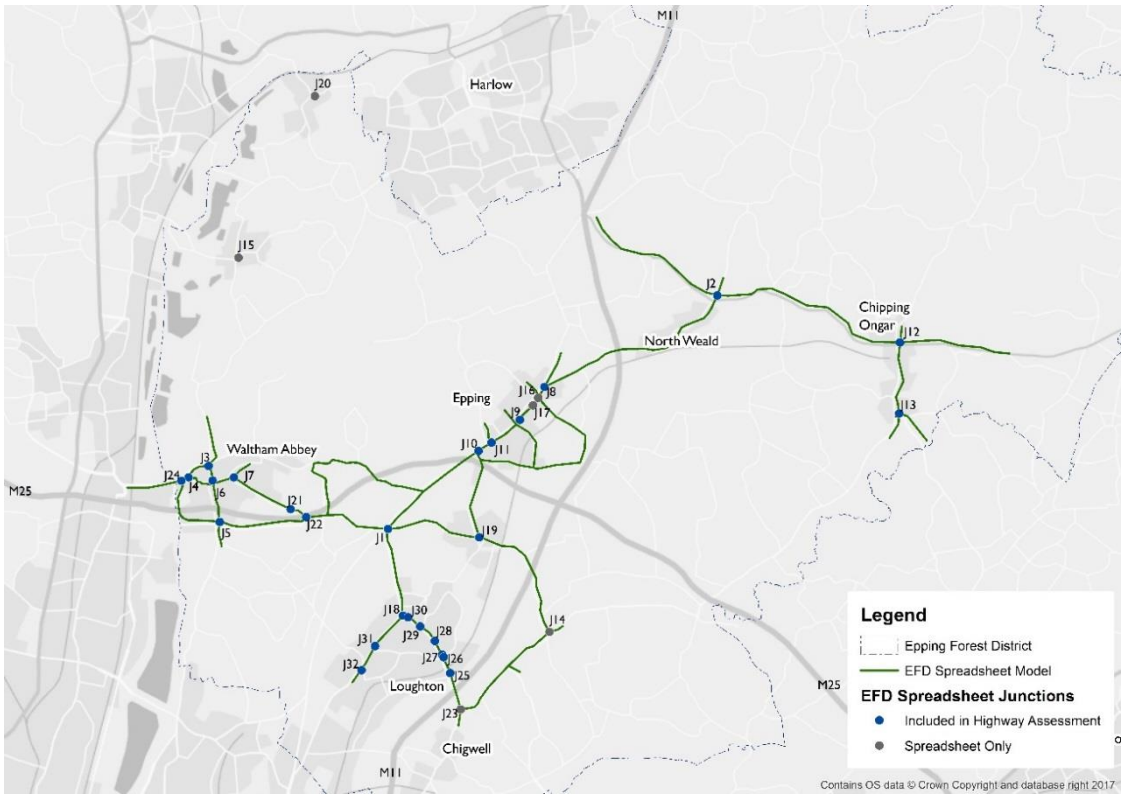

Figure 2-2 Highway Assessment (HA) Model Network and Junctions

2.1.5 The EFD Highway Assessment Model generates the forecast vehicle trip generation, distribution and assignment for the different future development and network scenarios. Model outputs are subsequently assessed in industry standard junction modelling software including:

- TRL's Junctions 9 to assess network performance of priority (T-Junctions and non-signalised cross roads) and roundabout junctions; and
- JCT's LINSIG v3.0 to assess network performance of traffic signals.

2.1.6 It is important to note that the model outputs do not account for detailed considerations including traffic interactions, dynamic reassignment and individual driver behaviour. The model can however, provide an appraisal of traffic problems across the core EFD geographical area including vehicle demand, junction performance and stretches of road likely to be operating above their theoretical capacity. These outputs will highlight areas where some form of mitigation is likely to be required to reduce the traffic impact of forecast development.

2.1.7 The modelling approach has been prepared in line with DfT/WebTAG modelling principles and was deemed reasonable in scale and fit for purpose, by Essex Highways in consultation with ECC and EFDC, to assess the highway network within the district under the given scenarios. This section discusses the overall methodology in more detail.

2.2 Spreadsheet Model Development Structure

2.2.1 The EFD Highway Assessment model combines a spreadsheet interface with observed traffic data, estimated development trip data, TEMPRO growth and a VISUM assignment module to derive different traffic scenarios across the modelled network.

2.3 Base Year

2.3.1 The model base year is 2017 and has been derived from a combination of 2013 and 2017 traffic data as well as TEMPRO growth for 2013-2017.

2.4 Transport Modes

2.4.1 The model is not multi-modal and only includes the following vehicle classes:

- Car/light goods vehicles (LGV);
- and heavy goods vehicles (HGV).

2.4.2 Traffic flows are ultimately converted into Passenger Car Units (PCUs) for Junctions 9 and LINSIG junction modelling purposes.

2.5 Model Time Periods

2.5.1 The model includes the weekday AM and PM peak hours for the following periods:

- AM Weekday 0800-0900
- PM Weekday 1700-1800

2.5.2 These time periods have been identified as the typical network peak periods across the week and also generally represent the typical peak traffic generation periods of future development proposed in the Submission Local Plan. The model time periods are therefore considered a robust worst-case for assessment purposes.

2.6 Model Area Zones

2.6.1 The model area has been divided into a series of zones to represent a geographical area where vehicle trips are generated by existing settlements and proposed development land uses. Zone sizes are determined by the concentration of highway network and routing options, using larger zone allocations in more rural and peripheral areas with fewer roads, and smaller zones in more complex networks within urban areas.

2.6.2 The zone shapes and sizes were reviewed throughout the process to ensure they were suitable for the assessment of the potential pattern of development and to ensure that the vehicle trips generated would access the highway network at a relevant point. This ensured that the impact on the highway network could be captured more accurately. Figure 2-3 illustrates the zoning structure used within the model.

Figure 2-3 Map of Model Zones

2.7 Base Year Traffic Assignment

2.7.1 The 2017 base year traffic assignment is based solely on observed turning counts at the key junctions included in the model (see Figure 2-2). The data was sense checked against available automated traffic counts (ATCs) to ensure a typical day was captured at each junction.

3 Model Forecasting, Trip Generation, Distribution and Assignment

3.1 Overview

3.1.1 The base year transport spreadsheet model was adapted to assign future development related traffic growth across the district and forecast traffic flows at the identified key junctions. The forecast model was created with a degree of flexibility and included a range of different development proposals, which could be toggled 'ON' or 'OFF' for scenario testing.

3.1.2 This section outlines the methodologies used to derive forecast year traffic scenarios for modelling and assessment.

3.2 Forecast Year

3.2.1 The model forecast year is 2033 and is consistent with the Local Plan period. The forecast scenarios assume that all development proposed is fully built-out, occupied and operational by 2033.

3.3 Forecast Scenario Testing

3.3.1 The Local Plan process has been refined over the past four years through a series of scenario tests to assess the impact of different development allocation patterns and define an initial package of complementary transport mitigation interventions. The initial scenario testing culminated in the Draft Local Plan (DLP) published under Regulation 18 for public consultation in October 2016.

3.3.2 A subsequent round of option testing was undertaken through three 'Technical Assessments' in 2017 to further refine the current DLP into the Submission Local Plan. The 'Technical Assessments' did not constitute actual proposed development scenarios and were undertaken specifically to test the impact of different distributions of development across the district. The Technical Assessments were based on the outcomes of the following information:

- an updated Employment Review;
- detailed analysis of the public consultation outcomes and key issues identified;
- and the submission of additional or amended sites for consideration.

3.3.3 This Highway Assessment provides an overview of the highway related traffic impacts of:

- a Do-Minimum scenario, where no Local Plan growth is delivered;
- the Do-Something 2016 DLP scenario;
- the impact of sustainable modal shift through 'Low' and 'Medium Sustainability' traffic demand (described below and in Section 3.4 in more detail);
- the Do Something Technical Assessments of variants of the current DLP;

- and the proposed Submission Local Plan.

3.3.4 While the Submission Local Plan is included in this initial assessment, it should be noted that a subsequent full transport modelling assessment will be undertaken to further refine any mitigation required and fully address the potential traffic impacts.

3.3.5 Notwithstanding the above, the Submission Local Plan has been tested for the 'total projected housing supply available', including factoring in development on windfall sites, rather than the actual calculated 'future housing requirement' for the district. It is important to recognise, based on experience, that there are occasions when a site allocated for development does not come forward as anticipated. As such the outputs contained in this report represent a 'worst-case' scenario with regard to traffic growth and therefore provide a robust assessment of the traffic related effects of the Submission Local Plan.

3.3.6 A summary of each of the Do-Minimum and Do-Something scenarios assessed in this report are provided below:

Scenario 1 '2017 Base Year' - an assessment of network performance for the current situation;

Scenario 2 '2033 Do-Minimum' - includes all development sites that have received planning permission within EFDC to October 2016, other planning assumptions across the Plan period along with full background traffic growth. Assumes no new highway schemes or sustainable modal shift to rail, bus or active modes;

Scenario 3 '2033 Do-Something' – continuation of Scenario 2 with the addition of 2016 Draft Local Plan (DLP) development with adjusted TEMPRO background traffic growth. Assumes no new highway schemes or sustainable modal shift ('Low Sustainability');

Scenario 4 '2033 Do-Something' – continuation of Scenario 3 with the inclusion of reasonable sustainable transport improvements and associated modal shift ('Medium Sustainability');

Scenario 5 '2033 Do-Something' – continuation of Scenario 4 with the inclusion of an initial package of highway improvement schemes;

Technical Assessments (TA) 6a/b/c *–variants of Scenario 4 to test different development distributions and support the definition of the final Submission Local Plan (assumes 2033 forecast year, reasonable sustainable transport improvements and associated modal shift, but no new highway schemes)**:***

> ***TA-6a*** *– variant of Scenario 4 with lower employment assumptions and inclusion of new school provision;*

TA-6b *– variant of TA-6a with higher growth + new school at Waltham Abbey; higher employment at North Weald Airfield and Wider Harlow sites; and reduced residential in Epping;*

TA-6c *– variant of TA-6a with higher employment at Wider Harlow sites; and new School in Epping.*

Scenarios 7a/b '2033 Do-Something Final Submission' – representing the proposed Submission Local Plan development growth and tested with 'Medium Sustainability' demand assumptions with both the existing highway network (Scenario 7a) and an initial package of highway improvements schemes (Scenario 7b)

3.3.7 Scenario 1 provides an overview of the existing situation for information purposes. Scenario 2 acts as the forecast reference case i.e. the 'Do-Minimum' for comparison with the forecast 2033 Do-Something scenarios. Scenario 2 contains all development permitted by planning permission plus TEMPRO background traffic growth up to 2033.

3.3.8 The Do-Minimum, therefore, does not contain any Local Plan growth other than committed developments identified from the base year of 2017 to the forecast year of 2033 within the district. This is comprised of developments which have already been built, are in the process of construction or have planning permission. Additional planning assumptions within TEMPRO have also been included.

3.3.9 The Do-Something scenario forecasts contain Local Plan allocation options for growth across EFD within the proposed Plan period, as well as local and strategic mitigation measures.

3.3.10 The following Table 3-1 summarises the scale of development and land uses assessed in each of the 2033 assessments including the Draft Local Plan (DLP), Technical Assessments and Submission Local Plan.

Scenario / Technical Assessment	Houses (units)	Employment (sqm)	Schools (pupils)	Summary
1-Current Situation	-	-	-	- Existing traffic conditions
2-Do-Minimum	1,194*	-	-	- No Local Plan - Background traffic growth - Committed development traffic growth - No mode shift
3-DLP ('Low Sustainability')	11,961*	578,387	-***	- Do-Minimum plus Local Plan - High Employment - No new schools - No mode shift
4-DLP ('Medium Sustainability')	11,961*	578,387	-***	- Scenario 3 plus medium mode shift
5-DLP ('Medium Sustainability')	11,961*	578,387	-***	- Scenario 4 plus highway improvements

Scenario / Technical Assessment	Houses (units)	Employment (sqm)	Schools (pupils)	Summary
6a- Variant DLP Test A ('Medium Sustainability')	11,992*	78,000	6,210	- Scenario 4 plus: - district wide lower employment - 2 new secondary schools at Harlow - District wide new school provision
6b- Variant DLP Test B ('Medium Sustainability')	12,465*	152,000	6,210	- Scenario 6a plus: - Higher residential Waltham Abbey - New secondary school at Harlow - New secondary school at Waltham Abbey - Higher employment North Weald & Harlow - Lower residential Epping - District wide new school provision
6c- Variant DLP Test C ('Medium Sustainability')	11,940*	122,000	6,210	- Scenario 6a plus: - New secondary school at Harlow - New secondary school at Epping - Higher employment Harlow - District wide new school provision
7b-Submission Scenario ('Medium Sustainability')	11,822**	94,760	6,210	- Do-Minimum plus Submission Local Plan - Mode shift
7a-Submission Scenario ('Medium Sustainability')	11,822**	94,760	6,210	- Do-Minimum plus Submission Local Plan - Mode shift - plus Highway Improvements

Table 3-1 Development Scenario Assumptions

Notes:

All Do-Something housing numbers are based on the 'total projected housing supply available' and the assessments are therefore considered robust and as worst-case.

*Future housing scenarios and DLP Variant Tests (2-6) include committed housing planning permissions (1,194 units) up to 2016 as per Appendix 5 of the current Draft Local Plan (2016).

**Scenarios 7a/b – Submission Local Plan include committed housing planning permissions (1,801 units) up to 2017 and Windfall sites (385 units).

***Please note additional school provision was not tested in Scenarios 2-5 and only included with subsequent testing to inform the Submission Local Plan. Furthermore, separate assessments are currently ongoing to test a new replacement site for the Princess Alexandra Hospital (PAH), in or around the wider Harlow area, to identify the optimal location. The analysis in this report does not include the outcomes of these assessments at this stage and any further work would need to consider the impacts of a replacement to the PAH.

3.3.11 An overview of the various scenarios and the relevant transport demand and supply assumptions assessed is illustrated in Figure 3-1.

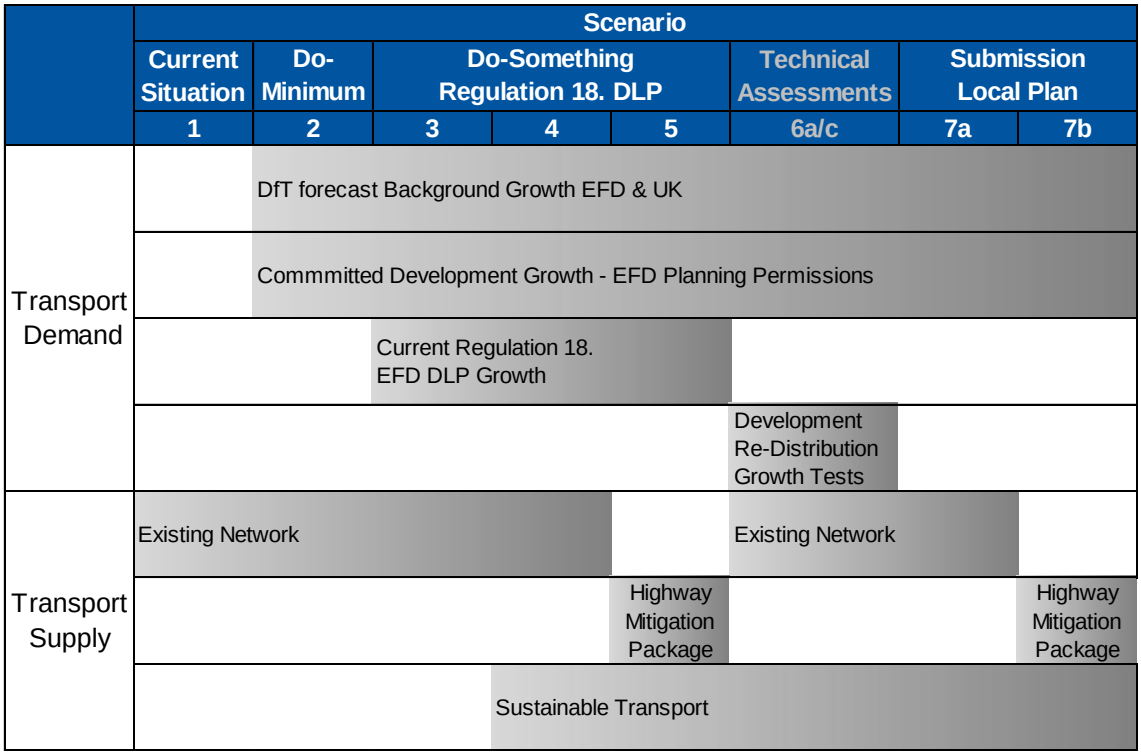

Figure 3-1 Scenario Overview

3.4 Vehicle Trip Generation Method

3.4.1 The EFD Highway Assessment Model includes information on car, LGV and HGV traffic converted in to Passenger Car Units (PCUs) for assessment purposes. In the first instance, all vehicle trips generated by each committed and potential development site were calculated using the development information provided by EFDC and Trip Rate Information Computer System (TRICS) version 7.4.2 (2017). All trips were then converted using PCU weighting factors.

3.4.2 TRICS is the national industry standard database system of multi-modal trip generation and analysis used in the planning process. The database holds an extensive catalogue of trip rate surveys generated by different land uses and location type. The TRICS Good Practice Guide informed the methodology used to derive appropriate site selections for inclusion in the model.

3.4.3 The TRICS methodology was refined into the following two tier approach to account for the beneficial impact of the reasonable sustainable transport improvements assumed in some of the scenarios assessed, including:

- 'Low Sustainability' (Scenarios 2 and 3) – No sustainable transport improvements with high vehicle trip rates applied to new development as a worst-case

- 'Medium Sustainability' (Scenarios 4-7) – Reasonable sustainable transport improvements with lower (15%-22% reduction) vehicle trip rates applied to new development as a likely case
- *'High Sustainability' – not included in this assessment and to be assessed in next phase of work to explore more ambitious sustainable travel improvements and the impact of Garden Community objectives at Wider Harlow strategic sites as well as other Smarter Travel Choices*

3.4.4 The 'Medium Sustainability' approach is based on the Essex Public Transport Accessibility Level (EPTAL). The EPTAL methodology is an evidence based approach that combines TRICS trip rates for different location classifications (i.e. town centre, edge of town centre, suburban and edge of town) with weightings for Essex specific Car Ownership and Usage Levels (COUL), from the 2011 Census data, and existing levels of public transport accessibility i.e. distances to interchanges and frequency of services.

3.4.5 The EPTAL approach provides an Essex focus to development trip forecasting and sustainable accessibility, to better understand the level of access to public transport in different areas and their relationship with TRICS location classifications for wards in Essex. EPTAL has therefore been used to provide a more appropriate TRICS trip rate for new development to target, based on the likely sustainable access characteristics brought about by reasonable improvements in particular locations.

3.4.6 It should be noted that the use of EPTAL in Scenarios 4-7 resulted in reductions for most land use classification trip rates. However, there were some instances of trip rates increasing, particularly employment land uses, potentially due to low sample sizes held on TRICS for some land uses. Notwithstanding these minor anomalies, the EPTAL method has been applied across all land uses in the 'Medium Sustainability' scenarios for consistency.

3.4.7 Furthermore, existing traffic and background traffic growth have not been adjusted to account for any realistic sustainable transport improvements, i.e. modal shift opportunities for existing residents/workers arising from new transport infrastructure. The assessments are therefore considered very much a robust worst-case. Additionally, no provision has been made for evolving travel to work patterns, including a greater propensity for home or flexible working, nor the impact of advances in information and communication technology. Further consideration will be given to these trips as part of any 'High Sustainability' scenario test.

3.5 Development Vehicle Trips

3.5.1 Trip generation was calculated separately for vehicles arriving and departing at each development site. At this stage, all development related trips have been assumed to be new trips. No allowance has been made for linked, pass-by, diverted, transferred or internalised trips and present a worst-case. Further consideration will be given to these trips as part of any subsequent assessment.

3.5.2 Unless otherwise stated, all trip rates are provided as per:

- 100m² gross floor area (GFA) for employment uses
- unit for residential uses
- pupil for schools

3.5.3 The PCU/Vehicle trip rates used for the respective scenarios are summarised in the following tables. Table 3-2 provides the trip rates applied to developments in Scenarios 2 and 3 regardless of location and with little or no provision for sustainable modal shift i.e. 'Low Sustainability' assumptions.

	Private house	Affordable house	Private flat	Affordable Flat	Emp. - Office	Emp. - Warehouse	Emp. - Industrial Units	Emp. - Businesss Park
AM ARRIVALS								
Default	0.232	0.154	0.101	0.125	1.323	0.120	0.744	1.343
AM Departures								
Default	0.453	0.305	0.286	0.198	0.210	0.058	0.115	0.210
PM ARRIVALS								
Default	0.614	0.283	0.317	0.216	0.160	0.053	0.070	0.161
PM Departures								
Default	0.132	0.218	0.174	0.072	1.189	0.141	0.595	1.166

Table 3-2 'Low Sustainability'/Default Land Use Trip Rates (PCU/Vehicles)

3.5.4 Table 3-3 summarises the EPTAL trip rates, as discussed in the previous section and applied to Scenarios 4-7, with a more detailed assessment of the impact of development location and the potential for reasonable improvements to sustainable transport choices and modal shift i.e. 'Medium Sustainability' assumptions.

	Private house	Affordable house	Private flat	Affordable Flat	Emp. - Office	Emp. - Warehouse	Emp. - Industrial Units	Emp. - Businesss Park
AM ARRIVALS								
Town Centre	0.162	0.186	0.010	0.038	0.551	0.171	0.420	1.407
Edge of Town Centre	0.162	0.186	0.076	0.118	1.622	0.171	0.420	1.407
Suburban	0.137	0.186	0.075	0.118	1.474	0.098	0.461	1.361
Edge of Town	0.130	0.161	0.089	0.098	1.365	0.081	0.781	1.588
AM Departures								
Town Centre	0.278	0.252	0.036	0.065	0.058	0.069	0.104	0.144
Edge of Town Centre	0.278	0.252	0.203	0.156	0.205	0.069	0.104	0.144
Suburban	0.351	0.252	0.262	0.156	0.468	0.118	0.089	0.165
Edge of Town	0.396	0.288	0.262	0.156	0.119	0.056	0.143	0.252
PM ARRIVALS								
Town Centre	0.158	0.264	0.057	0.066	0.039	0.064	0.180	0.116
Edge of Town Centre	0.158	0.264	0.195	0.114	0.163	0.064	0.180	0.116
Suburban	0.327	0.264	0.274	0.114	0.347	0.085	0.030	0.112
Edge of Town	0.330	0.264	0.317	0.144	0.061	0.035	0.065	0.197
PM Departures								
Town Centre	0.203	0.192	0.042	0.075	0.533	0.242	0.442	1.159
Edge of Town Centre	0.203	0.192	0.114	0.105	1.479	0.242	0.442	1.159
Suburban	0.195	0.192	0.129	0.105	1.306	0.125	0.386	1.031
Edge of Town	0.180	0.192	0.174	0.105	1.167	0.090	0.573	1.368

Table 3-3 'Medium Sustainability' Land Use Trip Rates (PCU/Vehicles.)

3.5.5 The following primary and secondary school trip rates have been used to assess Technical Assessments 6a-c and Scenarios 7a-b proposed Submission Local Plan. Initial assumptions have been applied to account for likely catchment areas for primary

schools and their location relative to the modelled network. The methodology for the assessment of school traffic will be refined in any final modelling to support the Local Plan submission.

	Primary School	Secondary School
AM ARRIVALS	0.269	0.159
AM DEPARTURES	0.181	0.104
AM TOTAL	**0.450**	**0.263**
PM ARRIVALS	0.030	0.014
PM DEPARTURES	0.044	0.027
PM TOTAL	**0.074**	**0.041**

Table 3-4 School Trip Rates per Pupil (PCU/Vehicles.)

3.5.6 The distribution of different residential types was determined for each town in the district using 2011 Census data, to determine the mix of housing and flats, and the Submission Local Plan Housing Policy H2 target of 40% affordable housing. Developments not located in the main towns in the district were assigned a housing-type split derived from the average of all the towns. Table 3-5 summarises the distribution of different residential types in the principal district settlements.

	Epping	Wider Harlow	Ongar	North Weald	Waltham Abbey	Loughton	Epping Forest Av.
2011 Census Data – Residential Type by Settlement							
% Houses	79%	75%	86%	84%	68%	76%	78%
% Flats	21%	25%	14%	16%	32%	24%	22%
EFDC Draft Local Housing Policy (H1-H4) Target							
% Private	60%	60%	60%	60%	60%	60%	60%
% Affordable	40%	40%	40%	40%	40%	40%	40%

Table 3-5 Housing Mix and Accommodation Types in Epping Forest District

3.5.7 The distribution of 23 hectares of employment sites, based on likely floor space (94,760 sqm) created from the number of hectares to be allocated and their use class, has been assessed in line with the need identified in the Employment Review and as set out in Table 3-6.

Land Use	Floor Space (SQM)
B1a Office	7,640
B1c/B2 Industrial	19,280
B8 Warehousing	67,840
Total	**94,760**

Table 3-6 Employment Land Use Distribution

3.5.8 The resulting overall trip generation values applied to each of the development land uses assessed in the scenarios are summarised in Table 3-7 for both the weekday AM and PM peak hours. All trips represent the additional volume of new development only, committed and allocated, related PCU/Vehicle trips added to the network to generate the 2033 'Low Sustainability' and 'Medium Sustainability' scenarios.

Scenario / Technical Assessment		AM Peak Hour			PM Peak Hour		
		Arrivals	Departures	Total	Arrivals	Departures	Total
2	Do-Minimum	173	349	522	424	149	573
3	DLP Low Sust.	5,137	4,962	10,098	5,735	4,699	10,434
4/5	DLP Med Sust.	4,040	4,512	8,552	3,729	4,357	8,087
TA6a	DLP Test A	2,509	4,161	6,670	3,366	2,433	5,799
TA6b	DLP Test B	3,460	4,511	7,971	3,626	3,279	6,906
TA6c	DLP Test C	2,966	4,252	7,218	3,397	2,828	6,225
7a/b	Submission LP	2,546	4,123	6,670	3,256	2,480	5,736

Table 3-7 Development Scenarios – Total Peak Hour PCU/Vehicle Trips

3.5.9 The development trip generation totals for each scenario highlight the benefits of encouraging sustainable modal shift with a reduction of 15%-22% in development vehicle trips from the AM and PM peaks between Scenario 3 to Scenario 4. The analysis also illustrates that the lower development quantum included in more recent tests, undertaken to inform the Submission Local Plan scenario, would generate between 7%-22% less development trips in the AM peak and 15%-28% less traffic in the PM peak periods when compared to the DLP scenarios.

Essex Highways

3.6 External and Background Traffic Growth

3.6.1 The background traffic growth represents the traffic growth which will occur independently of any committed developments within EFD or as a result of allocations within the Local Plan. This generally represents economic growth in the region, other planning assumptions, growth outside the district including Harlow, and changes in car ownership.

3.6.2 The Department for Transport (DfT) TEMPRO v7.2 planning tool was interrogated to determine external and background traffic growth forecasts throughout the district. TEMPRO provides a forecast level of growth for an area, based on the predicted level of employment and housing specified in the regional development forecast for origins and destinations.

3.6.3 This forecast has been adjusted by an additional economic factor, taken from WebTAG Table M4.2.1, which accounts for economic based growth, using indicators of income and fuel. This forecast represents the maximum potential growth in demand within the study area.

3.6.4 The Do-Minimum applies committed development related traffic growth to the TEMPRO based forecast to account for economic growth, other development planning assumptions and wider UK growth to generate a forecast scenario without the intervention of an adopted Local Plan.

3.6.5 In the Do-Something scenarios only background growth, accounting for just economic and wider UK growth from TEMPRO, has been applied. Any other planning assumptions (additional housing or employment growth) included within TEMPRO for the district up to 2033 was removed. The EFDC Local Plan and committed development traffic was then added to the adjusted TEMPRO background growth as a more accurate development forecast to avoid double counting and presenting an overly pessimistic future traffic situation.

3.7 Trip Distribution

3.7.1 The origin and destinations of trips travelling to and from the development sites, known as trip distribution, were derived from the 2011 Census journey to work (JTW) dataset. As previously discussed, and in order to utilise this data, a model zone system was defined based on the Census JTW output areas and boundaries. It was then possible to aggregate the JTW data to fit within the zone definitions of the spreadsheet model. 116 internal and external zones were subsequently identified – see Figure 2-3 for reference.

3.7.2 A matrix of Census JTW trips was subsequently derived and used as a basis for the creation of sectored distribution matrices for each of the four main settlements in the model, including Epping, Loughton, Ongar and Waltham Abbey, as well as for the wider district and beyond.

3.7.3 Individual developments were assigned to a specific zone and associated distribution pattern for each scenario. The distributions applied to any further development sites included in the study area are therefore based on 2011 observed trip patterns for

specific areas in the district. Since the majority of travel from home to work occurs in the AM peak, it was assumed that the home end of the trip is the origin, and the work place the destination. This assumption was inverted to inform the PM peak.

3.7.4 For the purposes of the scenarios assessed to date, any school traffic has been distributed using the overarching JTW method discussed above. Further consideration will be given to the distribution of school traffic as part of any further work to support the final submission document. Similarly, the distribution of rail heading commuter car trips to station car parks will also need further consideration.

3.8 Trip Assignment & Route Identification

3.8.1 The principal functionality of the EFD Highway Assessment model is spreadsheet based. However, the model was enhanced to improve its efficiency while reducing bias and potential sources of errors. This included a simplified macro-strategic model application, using PTV VISUM v14, to assist trip assignment calculations within the area of interest with a particular emphasis on the following detailed and strategic modelling areas:

- Detailed Network – Epping, Waltham Abbey, Loughton
- Wider Strategic Network – Epping Forest District, North Weald, Ongar, Harlow, Nazeing & External

3.8.2 Figures 3-2a/b overleaf illustrate the ‘Detailed’ and ‘Wider Strategic’ Networks coded into the model.

3.8.3 The simplified route choice strategic model represents an attempt to simulate the current and potential future transport route choice to provide relevant forecasts to be used in the spreadsheet based outputs for further testing in standalone junction assessment software. It should be noted that this stage of the modelling process is not a dynamic VISUM assignment model and route choice assumptions are fixed for all future development traffic arriving or departing from the different zones.

3.8.4 VISUM was selected for this modelling exercise due to its flexibility to assist a spreadsheet interface and ability to efficiently undertake highway route choice and assignment calculations. The model is also broadly compatible with other VISUM models developed by ECC across the county.

3.8.5 The modelled network area was created using the Integrated Transport Network (ITN). ITN segregates links into motorways, A-roads, B-roads, minor roads, local streets, private roads, and alleys, in descending order of importance. Private roads, and alleys were excluded from the calculations since only the principal road network was the subject of the study.

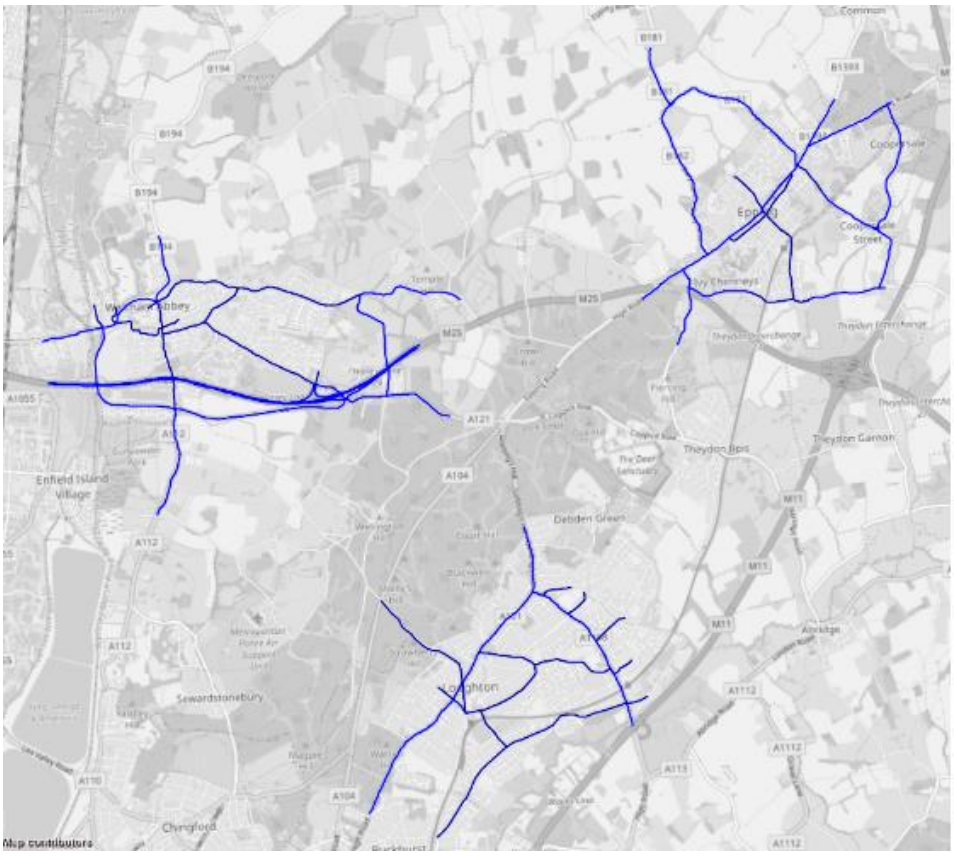

Figure 3-2 (a) VISUM Detailed Network

Figure 3-2 (b) VISUM Wider Strategic Model Area Network

3.8.6 The different highways classes or types were coded into the model, using guidance from COBA Volume 13 Section 1 part 5, to classify roads based on characteristics including: road class; number of lanes; and speeds. The following road classes were considered in the analysis:

- A Road out of town
- A Road in town
- Rest of town
- B Road out of town
- B Road in town
- Other rural/non-town links
- Motorways

3.8.7 In the external model area, only major highways (selected Motorways, A roads and B roads) were coded in order to guarantee good levels of accessibility. Due to the simplified nature of the model for basic assignment purposes, existing congestion and priorities on junctions were not considered as being critical regarding the final route choice. Therefore, no Volume Delay Functions or capacity restrictions were applied or coded into the model. Network delays were considered separately as part of the overall model outputs and network performance.

3.8.8 The model uses the zonal system (see Figure 2-3) with a series of appropriate connectors to ensure that travelling times were realistic and loaded into the principal areas of interest. In addition, connector length was updated to a constant value so that route choice was chosen only based on OD characteristics and not based on travelling time.

3.8.9 The assignment methodology used within the VISUM model was 'Equilibrium' based, utilising unitary demand matrices without incremental loading. This is an 'all demand' based approach, and therefore route choice was distributed based on final flows to evaluate the use of alternative routes, with only the most likely chosen under an all or nothing scenario.

3.8.10 The model has a limitation on performing micro-simulation specific tasks or taking into consideration existing or future high levels of congestion. Forecast matrices have therefore been fixed when assigned to the network. This represents a worst-case scenario and allows the impact of the potential development sites to be assessed more transparently to simplify the scenario testing and decision making processes.

3.8.11 The modelling approach follows recognised and accepted DfT/WebTAG principles and is therefore considered robust, fit for purpose and appropriate in scale for the type of highway network included in the Highway Assessment study area.

3.9 Future Transport Supply & Mitigation

Overview

3.9.1 The proposed package of mitigation targets a balance of implementing reasonable sustainable transport initiatives, including rail, bus and active modes, prior to the

delivery of actual physical highway improvements. This methodology adopts a more sustainable approach and avoids the need for overproviding highway capacity, potentially leading to unconstrained car traffic growth. Details of the initial mitigation proposals are discussed below in this section. It is important to recognise that it will be the responsibility of any development coming forward through a planning application to thoroughly test the related and cumulative transport impacts, as well as reasonable mitigation measures, as part of any Transport Assessment /Statement.

3.9.2 As previously stated, and prior to submission of the Local Plan to the Secretary of State, the overall package of mitigation will be subject to further refinement and testing to take account of the final Submission Local Plan development scenario impacts as well as more ambitious sustainable travel objectives evolving through the ongoing parallel assessment work associated with the neighbouring Harlow Local Plan and the Garden Communities.

Sustainable Transport Choices

3.9.3 The Do-Something Scenarios 4-7 all make provision for reasonable improvements to sustainable transport choices across the district and to neighbouring destinations e.g. Harlow and London. The analysis considers the sustainable access assumptions, taken from the EPTAL vehicle trip generation assessment, to provide a balance of what can be reasonably delivered by developers and public transport operators to encourage modal shift. Further more ambitious improvements could be delivered, e.g. such as through the Garden Community objectives, but at this stage it is important to present a case, which is not overly pessimistic or overly optimistic.

3.9.4 The cycling and bus teams at ECC and Essex Highways have been consulted to identify potential for improvements based on the likely pattern of development and historic studies including the Epping Forest Cycle Action Plan. Consideration has also been given to anticipated capacity improvements planned by TfL for the Central Line and Greater Anglia rail network. Improvements include:

- Improved bus connectivity, service extensions and increased frequency between principal settlements and London Underground stations including Epping, Loughton, Chigwell, Harlow, North Weald, Waltham Abbey and Ongar
- Network of on and off-road cycle routes serving Epping, Loughton, Waltham Abbey and Harlow
- Planned TfL Central Line improvements to introduce single train design, improved signalling and automation to increase capacity by 25% over the next decade
- Planned Greater Anglia improvements to introduce increased frequency and capacity over the next decade with longer single train design, improved stations, superfast Wi-Fi and flexible fare tariffs

3.9.5 Figure 3-3 provides an overview of potential improvements to bus services, cycling infrastructure and proposed sustainable corridors at sites in and around the Garden Communities. Again these are initial proposals for sustainable mitigation, which will be refined in line with the further testing of the proposed Submission Local Plan.

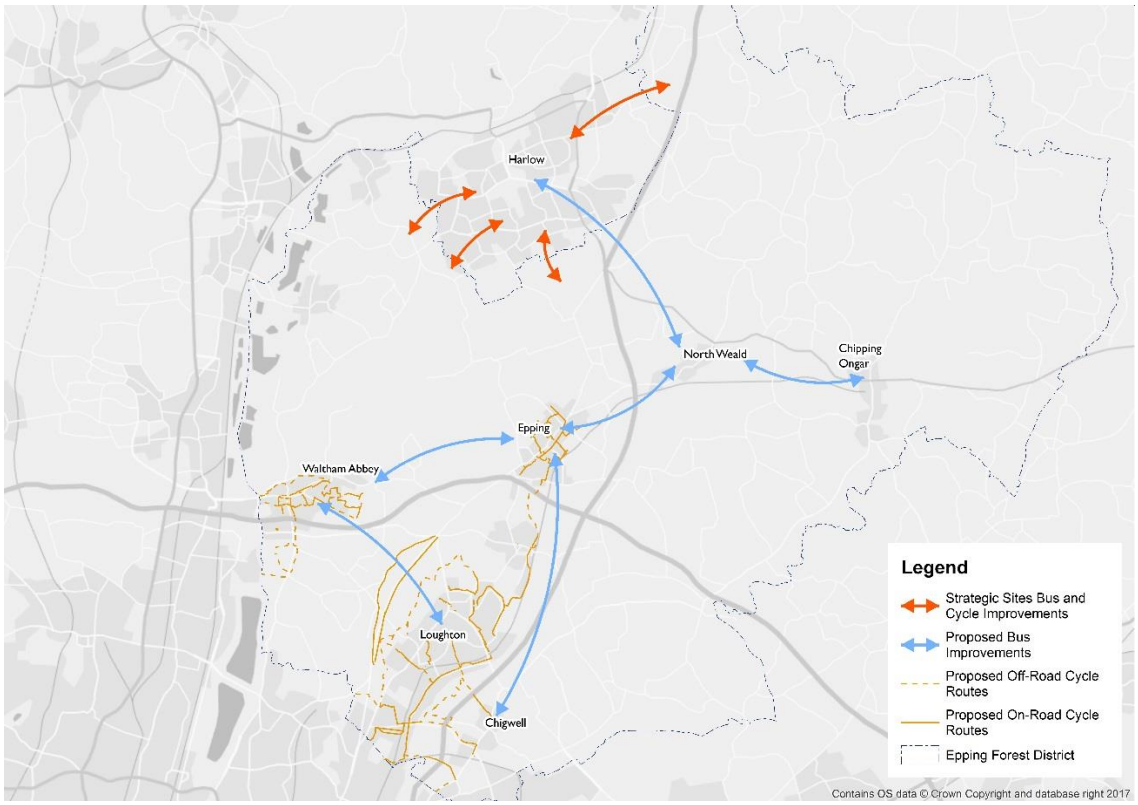

Figure 3-3 Overview of Potential Bus and Cycle Improvements

Local Highway Schemes

3.9.6 An initial package of highway improvements has been tested in Scenarios 5 & 7b to either improve on the Do-Minimum or generate a nil-detriment impact at a number of key junctions and links across the network. It is important to note that this initial highway mitigation package will be subject to further testing against the final Submission Local Plan scenario as well as higher sustainability assumptions to develop and refine the final package of measures and address any residual issues.

3.9.7 Table 3-8 provides a summary of interventions considered at different junctions (please refer to Figure 2-2 for their location). Areas of the highway network requiring potential further consideration or scheme identification have been highlighted.

JUNCTION		Current Type	Summary
1	Wake Arms PH - Epping Forest	Roundabout	Enhanced roundabout with local widening to increase approach lane and circulatory capacity
2	Talbot PH - North Weald	Roundabout	Enhanced roundabout with local widening to increase approach lane and circulatory capacity
4	Highbridge St - Waltham Abbey	Roundabout	Minor adjustments to lane markings and lane provision
6	Sewardstone Road - Waltham Abbey	Traffic Signals	Traffic management and bus only routing

JUNCTION		Current Type	Summary
7	Honey Lane - Waltham Abbey	Roundabout	Local widening to increase lane capacity
8	B1393 Thornwood Road	Traffic Signals	Potential for introduction of MOVA plus further investigation required
9	Station Rd & St John's Rd - Epping	Roundabout	Potential scheme required
10	Theydon Road - Epping	Traffic Signals	Enhanced signal with local widening and increased lane capacity
11	Bury Ln - Epping	Roundabout	Potential scheme required
12	Four Wantz Service Stn - Ongar	Roundabout	Enhanced roundabout with local widening to increase approach lane and circulatory capacity
13	Coopers Hill - Marden Ash, Ongar	Roundabout	Enhanced roundabout with local widening to increase approach lane and circulatory capacity
14	A113 Ongar Rd/B172 Abridge Road - Abridge	Cross Roads /T-Junction	Potential scheme required
18	A121 Church Hill - A1168 Rectory Lane - Loughton	Roundabout	Local widening and PUFFIN crossings to increase approach lane and circulatory capacity
19	Piercing Hill - Theydon Bois	Cross Roads /T-Junction	Local widening and roundabout options tested
22	M25 J26 Southern Rbt - Waltham Abbey	Roundabout	Enhanced roundabout to increase approach lane and circulatory capacity
23	A113 High Road/A1168 Chigwell Ln - Chigwell	Roundabout	Potential scheme required
24	A121/B194 Meridian Way Signals - Waltham Abbey	Traffic Signals	Enhanced signals with local widening and traffic management
25	A1168 Chigwell Lane/Langston Road/ Oakwood Hill - Loughton	Traffic Signals	Introduction of MOVA and local lane widening
26	A1168 Chigwell Lane/The Broadway - Loughton	Roundabout	Potential scheme required
27	A1168 Chigwell Lane/Borders Lane - Loughton	Roundabout	Potential scheme required
28	A1168 Rectory Lane/Westall Road Rectory Lane - Loughton	Cross Roads /T-Junction	Potential scheme required
29	A1168 Rectory Lane Pyrles Lane - Loughton	Cross Roads /T-Junction	Potential scheme required
30	A1168 Rectory Lane Hillyfields Priority - Loughton	Cross Roads /T-Junction	Potential scheme required

Table 3-8 Initial Highway Improvement Package

Strategic Highway Schemes

3.9.8 The following strategic highway schemes, while not explicitly modelled in the EFD Highway Assessment Model, are being assessed as part of the separate ongoing wider Harlow modelling. These are detailed further in the Infrastructure Delivery Plan published alongside the Submission Local Plan.

3.9.9 A combination of the following schemes would potentially be required to deliver growth in and around Harlow as part of the emerging Local Plans:

- Improvements to Junction 7 on the M11
- Provision of a through route at the interchange roundabout from Harlow A414 southbound to the B1393 to Epping Southbound, and minor widening works on the western side of the roundabout
- Provision of new Junction 7a and associated improvements to include:
  - widening of Gilden Way from the London Road roundabout to Marsh Lane
  - new road to link the improved Gilden Way to the M11 via a new Sheering Road roundabout.
  - new road link to reconnect to Sheering Road just south of Pincey Brook
  - new roundabouts on either side of the M11 and connected by a new bridge over the M11
  - slip roads on and off the M11 for both north-bound and south-bound traffic
- New second Stort Crossing to the east of the existing crossing: Additional road crossing of the River Stort in Harlow, comprising a dual carriageway linking the A414 at Eastwick with a new 3-arm roundabout north of the River Stort, and a further single carriageway link to River Way towards the eastern end of A414 Edinburgh Way
- A414 improvements - including Edinburgh Way, Howard Way and Harlow Retail Park, East Road and River Way, First Avenue
- Highways improvements to A1025 Third Avenue, First Avenue and Second Avenue
- Possible enhancements to Water Lane/A1169 roundabout; A1025/ Abercrombie Way signals; and, traffic calming along the A1169

4 Model Results and Analysis

4.1 Overview

4.1.1 The results presented in this report summarise modelled forecast traffic impacts on the highway in Epping Forest District. In this section the results are presented for all modelled forecast scenarios, comprising the Do-Minimum (Scenario 2) and the Do-Something scenarios (Scenarios 3-7). Reference is also made to the current situation (Scenario 1) for information.

4.1.2 The Do-Minimum (Scenario 2) represents a future situation that excludes proposed Local Plan growth up to 2033, but accounts for full background traffic growth from DfT forecasts, as well as all committed and other planning assumptions in the district across the Plan period. The Do-Minimum is therefore a likely representation of the future transport situation if the proposed Local Plan was not adopted and therefore an appropriate benchmark for comparison with the Do-Something scenarios.

4.1.3 The Do-Something scenarios (Scenarios 3-7) then add a combination of proposed Local Plan development and initial transport interventions for the district up to 2033, including:

- Published Reg.18 DLP development (Scenarios 3-5)
- Reasonable sustainable modal-shift (Scenarios 4-7)
- Initial package of highway improvements (Scenario 5)
- DLP variations with amended and redistributed development (TAs 6a/b/c)
- Submission Local Plan with and without initial package of highway improvements (Scenarios 7a/7b)

4.1.4 The Highway Assessment therefore accounts for and tests the transport demand from a range of development scenarios to inform the Submission Local Plan in the period to 2033, including new homes, employment space and schools. It also accounts for all transport demand from the rest of the United Kingdom up to 2033 using the modelled network as either through trips or background growth.

4.2 Assessments

4.2.1 The model forecast year is 2033 to remain consistent with the plan period and accounts for all planned development, and windfall sites based on historic trends, across the district. The Highway Assessment makes best use of the outputs from the available modelling tools. While the transport modelling methodology has been deemed appropriate in scale and fit for purpose, it should be reiterated that the EFD Highway Assessment model is essentially a spreadsheet interface, coupled to a fixed assignment model, with traffic outputs tested in separate standalone junction specific modelling software. The model does not therefore account for the likely reassignment of traffic to less congested alternative routes and presents a worst-case. Furthermore, the model does not include the range of network performance statistics and outputs usually associated with more complex modelling platforms e.g. journey time analysis, speeds, vehicle distances and time travelled across network.

4.2.2 As a worst-case, the Highway Assessment also makes no allowance for the impact of sustainable transport choices on background and existing traffic or for any internalisation of trips within the larger sites. This would be expected at the strategic sites in and around the wider Harlow area including East Harlow, Latton Priory, Water Lane area (including West Katherine's and West Sumners) e.g. school trips between pupils' homes and schools on these sites.

4.2.3 The analysis uses the following model outputs as indicators of overall network performance to assess the different scenarios. Results for the weekday AM and PM peak hours are summarised in Tables 4-1 to 4-13 and discussed throughout the remainder of this section:

- Changes in traffic flow
- Ratio of Flow to Capacity (RFC) / Degree of Saturation (DOS)

4.2.4 The following sequential approach to the analysis has been adopted to articulate the Highway Assessment work to date:

Assessment 1: Existing (Scenario 1) v Do Minimum (Scenario 2) – The existing situation has been appraised against the Do-Minimum to provide information of current network performance and likely future performance if the EFDC Local Plan was not implemented. The Do-Minimum has been taken forward as the benchmark for analysing the Do-Something scenarios.

Assessment 2: Do Minimum (Scenario 2) v Current DLP (Scenarios 3 & 4) – The Regulation 18 published DLP 'Low' and 'Medium' sustainable modal shift scenarios have been assessed against the Do-Minimum as a starting point for the proposed Local Plan submission and identify key pressures on the transport network.

Assessment 3: Existing (Scenario 1) & Do Minimum (Scenario 2) v Current DLP (Scenario 5) – An initial package of highway improvements has been tested with sustainable modal shift assumptions to identify whether traffic growth associated with the Local Plan could at least be reasonably mitigated to a similar level of network performance as the Do-Minimum situation, or preferably, back to the current situation i.e. 'Nil-Detriment'. This initial package of interventions does not represent the final package, which will need to be refined as part of future work, but provides an initial strategy to deliver physical improvements to accommodate Local Plan growth.

Assessment 4: Current DLP (Scenario 4) v DLP Variants (Technical Assessments 6a/b/c) –Technical Assessments 6a/b/c have been assessed as variations against the DLP to illustrate the changes in transport impacts of different development patterns to refine the Submission version. Please note Scenarios 4-5 and Technical Assessments 6a/b/c all model 'Medium Sustainability' assumptions with reasonable mode shift as a more realistic expected situation than the worst-case.

Assessment 5: Submission Local Plan (Scenarios 7a/b) – The proposed Submission Local Plan scenario has been assessed against the existing highway network (7a) as well as the initial package of highway mitigation measures (7b) tested in Scenario 5. The assessment repeats Assessment 3 and results are presented alongside the current network performance (Scenario 1) and the Do-Minimum

(Scenario 2). Again, this initial package of interventions does not represent the final package.

4.2.5 Figure 4-1 below provides a summary of the Scenarios and Technical Assessments tested for reference purposes.

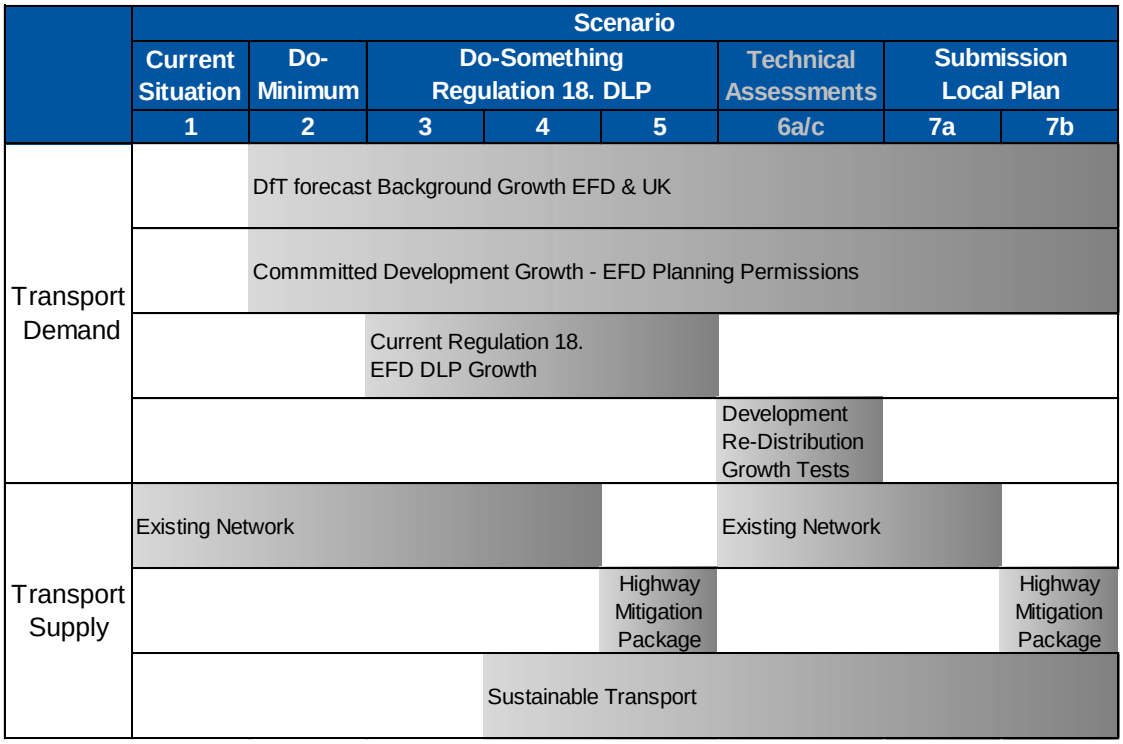

Figure 4-1 Overview of Scenarios

4.3 Ratio of Flow to Capacity (RFC) / Degree of Saturation (DOS)

4.3.1 The RFC/DOS measures the performance of a road link or turning movement at a junction. An RFC/DOS value greater than 1.00 generally means that the stretch of road or turning movement has a higher level of traffic flow than its theoretical, or operational, capacity, with resulting flow breakdown, increased queuing and congestion expected.

4.3.2 With the exception of signalised junctions, an RFC below 0.85 is typically considered acceptable as there is still scope to accommodate future growth and daily fluctuations in traffic flows. For signalled junctions the DOS threshold is higher at 0.90 given the added traffic management capabilities. A value between 0.85 and 1.00, or 0.90 and 1.00 for signalled junctions, suggests the stretch of road or junction is starting to approach theoretical capacity with little or no spare capacity to accommodate additional growth or daily fluctuations, which can lead to periodic increases in delay, queues and driver stress.

4.3.3 The maximum modelled RFC/DOS across all approaches for each junction in the Highway Assessment have been applied to Tables 4-2 to 4-13 later in this section, to aid the interpretation of the model results. For ease of reference, and to avoid the over

provision of expensive highway infrastructure, all RFC/DOS values between 0.90, rather than 0.85, and 1.00 have been highlighted in amber as approaching capacity for all junction types. RFC/DOS values greater than 1.0 have been highlighted in graded shades of red (lighter red highlights marginal increases over capacity leading to darker red for more severe increases).

4.4 Changes in Traffic Flows

4.4.1 The EFD Highway Assessment Model is constructed from a series of demand matrices from observed and forecast flows at the key junctions modelled in the Highway Assessment area, as shown in Figure 4-2, for different scenarios.

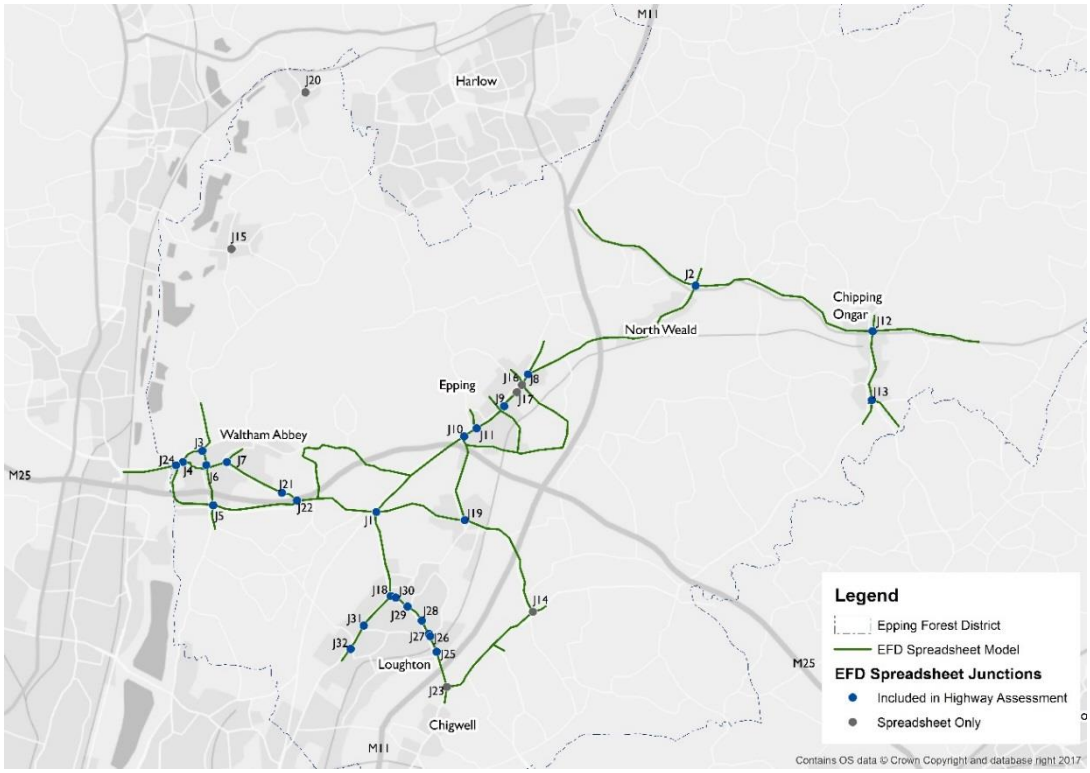

Figure 4-2 Highway Assessment (HA) Network and Junctions

4.4.2 Table 4-1 provides a summary of the percentage change in traffic flows across the modelled network as an indication of average traffic growth for each of the scenarios.

Scenario/ Technical Assessment	% Change from Existing (Scenario 1)	% Change from Do-Min (Scenario 2)	% Change from Scenario 3	% Change from Scenario 4
	Av.	Av.	Av.	Av.
Scenario 1				
Scenario 2	17%			
Scenario 3	62%	39%		
Scenario 4/5	49%	27%	-8%	
TA 6a	37%	17%	-16%	-8%
TA 6b	42%	21%	-13%	-5%
TA 6c	39%	18%	-15%	-7%
Scenario 7	36%	16%	-16%	-9%

Table 4-1 Average Model Network Flow Changes by Scenario

4.4.3 The model outputs show that:

- Traffic levels would increase from current levels in the 2033 Do-Minimum (Scenario 2) by 17%, even without the introduction of any Local Plan growth
- The introduction of DLP growth would increase network flows significantly (62%) if delivered without sufficient sustainable transport improvements (Scenario 3)
- The introduction of improved sustainable transport choices reduces the impact of DLP traffic growth to 49% from current levels
- The proposed Submission Local Plan (Scenario 7) generates the lowest growth (36%) from the current situation of all the Do-Something scenarios.

4.4.4 The proposed Submission Local Plan (Scenario 7) increases traffic by 16% over the Do-Minimum scenario (2). When compared to the development proposed in the DLP, the Submission Local Plan generates 16% less traffic than the 'Low Sustainability' scenario (3) and 9% less traffic than the 'Medium Sustainability' scenario (4).

4.4.5 Tables 4-2 to 4-13 summarise the changes in traffic flows at each of the junctions in more detail for each of the scenarios.

4.5 Assessment 1: Existing (Scenario 1) v Do Minimum (Scenario 2)

4.5.1 The Do-Minimum traffic growth from the existing situation is generally uniform across the modelled network given the majority of growth can be attributed to the addition of TEMPRO to all base traffic data. There are minor increases over and above the average due to the delivery of 1,194 committed houses (Draft Local Plan 2016 - Appendix 5).

4.5.2 The analysis (see Tables 4-2 & 4-3) shows that a number of junctions are currently approaching or exceeding their theoretical capacity. The most notable of these include Junction 1 Wake Arms roundabout in the heart of the Epping Forest SAC. A maximum recorded RFC of 1.33 in the AM and 1.21 in the PM peaks indicate there are already significant levels of congestion and delay occurring across a number of approaches. The junction is at the intersection of a number of key routes (A121, B1393 and A104) linking the principal settlements of Epping, Waltham Abbey and Loughton, as well as providing access to Epping Forest and the nearby M25 Junction 26.

4.5.3 Junction 6 Sewardstone Road / Sun Street / Farm Hill Road signals is on a key north-south route serving Waltham Abbey town and marginally exceeds capacity in the AM and approaches capacity in the PM existing situation.

4.5.4 Junction 24 Meridian Way signals, also in Waltham Abbey, forms a key east-west route leading to the neighbouring Waltham Cross and district of Broxbourne. The signals are exceeding capacity in both peak periods.

4.5.5 Junction 8 The Plain / Thornwood Road signals is the principal gateway to the north of Epping town leading north towards North Weald and M11 Junction 7. The junction exceeds capacity in the existing PM situation.

4.5.6 Junction 18 A121 Goldings Hill / Church Hill double roundabout, forming a key intersection to the north of Loughton and Debden, is also currently exceeding capacity in both peak periods.

4.5.7 The addition of Do-Minimum growth will worsen these congested junctions and increase queues, delays and driver stress. As shown in Tables 4-2 & 4-3, up to nine of the junctions modelled in the HA currently exceed or are approaching capacity in either peak. The addition of Do-Minimum traffic increases the number of junctions exceeding capacity on at least one or more approach to seventeen in either peak. A total of twenty junctions are either exceeding or approaching capacity on at least one arm.

4.5.8 A number of key links and corridors are likely to be experiencing high levels of congestion, queuing and delay in the Do-Minimum scenario either due to the constrained junction nodes discussed or overall link capacity, including:

- B1393 corridor between M11 Junction 7, Epping, Bell Common and Epping Forest SAC
- A1168/A121 corridor between M11 Junction 5, Loughton and Epping Forest SAC
- A112/A121 links in Waltham Abbey
- A121/A104 in Epping Forest SAC
- A121 at M25 Junction 26
- A1168 at M11 Junction 5

4.5.9 The analysis indicates that the Do-Minimum scenario would have a significant impact across the network and at key junctions.

REF	Junction Name	Type	Flow		Change in Flow (PCU/H)	% Change Total Flow	RFC/DOS	
			Scen. 1	Scen. 2			Scen. 1	Scen. 2
1	Wake Arms PH - Epping Forest	RBT	3888	4525	637	16%	1.33	1.72
2	Talbot PH - North Weald	RBT	2246	2607	362	16%	0.81	1.02
3	Crooked Mile - Waltham Abbey	RBT	2542	2939	397	16%	0.52	0.66
4	Highbridge St - Waltham Abbey	RBT	1575	1830	256	16%	0.46	0.65
5	Sewardstone Rd - Waltham Abbey	RBT	2976	3445	469	16%	0.52	0.67
6	Sewardstone Road - Waltham Abbey	SIG	2364	2733	369	16%	1.007	1.083
7	Honey Lane - Waltham Abbey	RBT	1234	1430	196	16%	0.81	1.01
8	B1393 Thornwood Road	SIG	2400	2785	385	16%	0.897	1.066
9	Station Rd & St John's Rd - Epping	RBT	2224	2587	363	16%	0.85	1.15
10	Theydon Road - Epping	SIG	2265	2633	369	16%	0.907	1.176
11	Bury Ln - Epping	RBT	2237	2603	365	16%	1.02	1.34
12	Wantz Service Stn - Ongar	RBT	3126	3663	537	17%	0.86	1.15
13	Coopers Hill - Marden Ash, Ongar	RBT	1617	1909	292	18%	0.88	1.11
14	A113 Ongar Rd/B172 Abridge Road - Abridge	G/WAY	1880	2231	352	19%	1.15	2.78
18	A121 Church Hill - A1168 Rectory Lane - Loughton	RBT	2286	2678	393	17%	1.15	1.37
19	Piercing Hill - Theydon Bois	G/WAY	1630	1893	264	16%	0.89	1.33
21	M25 J26 Northern Rbt - Waltham Abbey	RBT	1816	2106	290	16%	0.38	0.47
22	M25 J26 Southern Rbt - Waltham Abbey	RBT	2960	3456	496	17%	0.97	1.27
24	A121/B194 Meridian Way Signals - Waltham Abbey	SIG	2517	2923	406	16%	1.023	1.33
25	A1168 Chigwell Lane/Langston Road/Oakwood Hill - Loughton	SIG	2626	3074	448	17%	0.945	1.076
26	A1168 Chigwell Lane/The Broadway - Loughton	RBT	1515	1801	287	19%	0.63	0.72
27	A1168 Chigwell Lane/Borders Lane - Loughton	RBT	1081	1310	229	21%	0.62	0.63
28	A1168 Rectory Lane/Westall Road Rectory Lane - Loughton	G/WAY	960	1140	180	19%	0.6	0.78
29	A1168 Rectory Lane Pyrles Lane - Loughton	G/WAY	1898	2205	307	16%	0.76	1.09
30	A1168 Rectory Lane Hillyfields Priority - Loughton	G/WAY	1532	1805	273	18%	0.63	0.83
31	A121 High Road Traps Hill	G/WAY	1276	1486	210	16%	0.3	0.37
32	A121 High Road - Old Station Road - Ollards Grove	RBT	1557	1802	245	16%	0.65	0.77

Table 4-2 AM Peak Current Situation V Do-Minimum Network Performance (PCU Flows per hour & RFC/DOS)

Essex Highways

REF	Junction Name	Type	Flow		Change in Flow (PCU/H)	% Change Total Flow	RFC/DOS	
			Scen. 1	Scen. 2			Scen. 1	Scen. 2
1	Wake Arms PH - Epping Forest	RBT	4113	4826	713	17%	1.21	1.55
2	Talbot PH - North Weald	RBT	2161	2527	366	17%	0.70	0.91
3	Crooked Mile - Waltham Abbey	RBT	2991	3475	484	16%	0.53	0.70
4	Highbridge St - Waltham Abbey	RBT	1871	2184	313	17%	0.85	1.26
5	Sewardstone Rd - Waltham Abbey	RBT	3280	3821	540	16%	0.65	0.83
6	Sewardstone Road - Waltham Abbey	SIG	2657	3095	438	16%	0.96	1.13
7	Honey Lane - Waltham Abbey	RBT	1408	1644	236	17%	0.74	0.93
8	B1393 Thornwood Road	SIG	2567	3002	434	17%	1.16	1.41
9	Station Rd & St John's Rd - Epping	RBT	2186	2568	383	18%	0.93	1.27
10	Theydon Road - Epping	SIG	2101	2469	368	17%	0.77	1.10
11	Bury Ln - Epping	RBT	2181	2561	380	17%	1.00	1.27
12	Wantz Service Stn - Ongar	RBT	2985	3529	544	18%	0.76	1.04
13	Coopers Hill - Marden Ash, Ongar	RBT	1650	1960	310	19%	0.73	0.99
14	A113 Ongar Rd/B172 Abridge Road - Abridge	G/WAY	1823	2188	365	20%	1.00	3.00+
18	A121 Church Hill - A1168 Rectory Lane - Loughton	RBT	2087	2473	386	19%	1.04	1.27
19	Piercing Hill - Theydon Bois	G/WAY	1485	1743	258	17%	0.80	1.19
21	M25 J26 Northern Rbt - Waltham Abbey	RBT	2158	2535	377	17%	0.52	0.64
22	M25 J26 Southern Rbt - Waltham Abbey	RBT	2805	3302	498	18%	0.75	0.96
24	A121/B194 Meridian Way Signals - Waltham Abbey	SIG	2674	3125	451	17%	1.12	1.44
25	A1168 Chigwell Lane/Langston Road/Oakwood Hill - Loughton	SIG	2415	2862	447	18%	0.94	1.09
26	A1168 Chigwell Lane/The Broadway - Loughton	RBT	1845	2200	355	19%	0.77	0.94
27	A1168 Chigwell Lane/Borders Lane - Loughton	RBT	1606	1930	324	20%	0.78	0.95
28	A1168 Rectory Lane/Westall Road Rectory Lane - Loughton	G/WAY	1401	1657	257	18%	0.38	0.53
29	A1168 Rectory Lane Pyrles Lane - Loughton	G/WAY	1780	2086	306	17%	0.67	0.76
30	A1168 Rectory Lane Hillyfields Priority - Loughton	G/WAY	1425	1698	274	19%	0.25	0.39
31	A121 High Road Traps Hill	G/WAY	1254	1474	219	17%	0.43	0.55
32	A121 High Road - Old Station Road - Ollards Grove	RBT	1783	2055	272	15%	0.70	0.98

Table 4-3 PM Peak Current Situation V Do-Minimum Network Performance (PCU Flows per hour & RFC/DOS)

Essex Highways

4.6 Assessment 2: Do Minimum (Scenario 2) v DLP 'Low Sustainability' & 'Medium Sustainability' (Scenarios 3 & 4)

4.6.1 The published DLP has been assessed as an initial Do-Something scenario against the Do-Minimum to compare the likely future transport situation with and without the implementation of the initial Regulation 18 Local Plan development. The Do-Minimum and Do Something Scenario 3 have been assessed as a worst-case with 'Low Sustainability' traffic growth, i.e. little or no modal-shift, and the Do-Something Scenario 4 has been assessed with 'Medium Sustainability' to reflect reasonable improvements to bus, rail and active modes.

4.6.2 The high increase in development associated with the DLP will increase traffic growth on average by a further 39% and 27% (refer to Table 4-1) from the Do-Minimum in the respective 'Low' and 'Medium Sustainability' scenarios. The constrained transport situation outlined in Assessment 1 is therefore expected to worsen with the introduction of Local Plan growth even with the introduction of reasonable sustainable modal shift.

4.6.3 The analysis (see Tables 4-4 & 4-5) reflect this increase in development traffic with the majority of junctions (up to 24) exceeding theoretical operational capacity in either peak period. A number of these junctions are expected to be exceeding, or at least approaching, RFCs of 2.0 during the peak hours and shows that demand generally exceeds capacity across the network leading to increased journey times, little or no network resilience and driver stress. The key links and corridors, shown as constrained in Assessment 1, will worsen with the addition of Do-Something Scenario 4 traffic growth reinforcing the case for further mitigation and improvements to support Local Plan growth.

4.6.4 In the first instance, the beneficial impacts of improved sustainable transport choices should always be considered before any physical highway intervention to encourage modal shift away from the car and prevent any oversupply of highway capacity, which would offset traveller propensity to consider alternative modes.

4.6.5 The Do-Something Scenario 4 assesses a reasonable package of sustainable travel improvements, either planned by Public Transport Operators (PTOs), e.g. TfL, bus/rail companies, or delivered by development, e.g. bus and active modes. This assessment is considered a 'Medium Sustainability' scenario and any further more ambitious improvements are being considered as part of ongoing work to explore a 'High Sustainability' scenario, considering the impact of Garden Community objectives at the strategic sites, high frequency public transport and localised site specific initiatives e.g. low car dependency developments and car clubs. Where appropriate, developments of a certain scale would require a Transport Assessment/Transport Statement and Travel Plan to maximise uptake of sustainable transport choices and demonstrate how car travel can be reduced.

Essex Highways

REF	Junction Name	Type	Flow			Change in Flow (PCU/H) Scenario 3	% Change in Flow Scenario 3	Change in Flow (PCU/H) Scenario 4	% Change in Flow Scenario 4	RFC/DOS		
			Scen. 2	Scen. 3	Scen. 4					Scen. 2	Scen. 3	Scen. 4
1	Wake Arms PH - Epping Forest	RBT	4525	6249	5880	1723	38%	1355	30%	1.72	2.1	2.07
2	Talbot PH - North Weald	RBT	2607	4114	3710	1506	58%	1103	42%	1.02	1.7	1.53
3	Crooked Mile - Waltham Abbey	RBT	2939	4314	3895	1375	47%	956	33%	0.66	1.07	1.03
4	Highbridge St - Waltham Abbey	RBT	1830	2954	2591	1124	61%	761	42%	0.65	1.12	0.87
5	Sewardstone Rd - Waltham Abbey	RBT	3445	3771	3612	326	9%	167	5%	0.67	0.73	0.7
6	Sewardstone Road - Waltham Abbey	SIG	2733	2981	2893	248	9%	160	6%	1.083	1.269	1.141
7	Honey Lane - Waltham Abbey	RBT	1430	1479	1442	49	3%	13	1%	1.01	1.03	1.01
8	B1393 Thornwood Road	SIG	2785	3992	3664	1207	43%	879	32%	1.066	1.849	1.367
9	Station Rd & St John's Rd - Epping	RBT	2587	3803	3478	1216	47%	891	34%	1.15	2.14	2.02
10	Theydon Road - Epping	SIG	2633	3895	3568	1261	48%	935	35%	1.176	1.962	1.639
11	Bury Ln - Epping	RBT	2603	3741	3444	1139	44%	841	32%	1.34	2.26	2.14
12	Wantz Service Stn - Ongar	RBT	3663	4634	4306	971	27%	643	18%	1.15	1.49	1.37
13	Coopers Hill - Marden Ash, Ongar	RBT	1909	2554	2384	645	34%	475	25%	1.11	1.56	1.47
14	A113 Ongar Rd/B172 Abridge Road - Abridge	G/WAY	2231	2914	2785	683	31%	554	25%	2.78	3.00+	3.00+
18	A121 Church Hill - A1168 Rectory Lane - Loughton	RBT	2678	3599	3326	920	34%	647	24%	1.37	1.66	1.43
19	Piercing Hill - Theydon Bois	G/WAY	1893	2055	2035	162	9%	142	7%	1.33	1.91	1.76
21	M25 J26 Northern Rbt - Waltham Abbey	RBT	2106	2569	2449	463	22%	343	16%	0.47	0.56	0.53
22	M25 J26 Southern Rbt - Waltham Abbey	RBT	3456	4511	4275	1055	31%	818	24%	1.27	1.61	1.52
23	A113 High Road/A1168 Chigwell Ln - Chigwell	RBT	105	1885	2000	1779	1688%	1895	1798%	0	1.16	1.13
24	A121/B194 Meridian Way Signals - Waltham Abbey	SIG	2923	4141	3703	1218	42%	780	27%	1.33	1.822	1.696
25	A1168 Chigwell Lane/Langston Road/Oakwood Hill - Loughton	SIG	3074	4874	4140	1800	59%	1066	35%	1.076	1.975	1.598
26	A1168 Chigwell Lane/The Broadway - Loughton	RBT	1801	2905	2571	1103	61%	770	43%	0.72	1.83	1.38
27	A1168 Chigwell Lane/Borders Lane - Loughton	RBT	1310	2464	2123	1154	88%	813	62%	0.63	1.7	1.14
28	A1168 Rectory Lane/Westall Road Rectory Lane - Loughton	G/WAY	1140	2087	1825	947	83%	685	60%	0.78	2.22	1.45
29	A1168 Rectory Lane Pyrles Lane - Loughton	G/WAY	2205	2990	2766	785	36%	560	25%	1.09	3.00+	3.79
30	A1168 Rectory Lane Hillyfields Priority - Loughton	G/WAY	1805	2677	2430	872	48%	625	35%	0.83	3.00+	3.45
31	A121 High Road Traps Hill	G/WAY	1486	1698	1617	212	14%	130	9%	0.37	0.6	0.52
32	A121 High Road - Old Station Road - Ollards Grove	RBT	1802	1852	1803	50	3%	1	0%	0.77	0.93	0.86

Table 4-4 AM Peak Do-Minimum v DLP 'Low & Medium Sustainability' Scenarios Network Performance (PCU Flows per hour & RFC/DOS)

Essex Highways

REF	Junction Name	Type	Flow			Change in Flow (PCU/H) Scenario 3	% Change in Flow Scenario 3	Change in Flow (PCU/H) Scenario 4	% Change in Flow Scenario 4	RFC/DOS		
			Scen. 2	Scen. 3	Scen. 4					Scen. 2	Scen. 3	Scen. 4
1	Wake Arms PH - Epping Forest	RBT	4826	6814	6178	1988	41%	1352	28%	1.55	2.61	2.17
2	Talbot PH - North Weald	RBT	2527	4122	3636	1595	63%	1109	44%	0.91	2.14	1.66
3	Crooked Mile - Waltham Abbey	RBT	3475	4741	4371	1266	36%	896	26%	0.70	1.21	1.00
4	Highbridge St - Waltham Abbey	RBT	2184	3225	2920	1041	48%	736	34%	1.26	1.70	1.71
5	Sewardstone Rd - Waltham Abbey	RBT	3821	4116	3929	295	8%	108	3%	0.83	0.94	0.87
6	Sewardstone Road - Waltham Abbey	SIG	3095	3321	3208	225	7%	113	4%	1.13	1.24	1.12
7	Honey Lane - Waltham Abbey	RBT	1644	1702	1661	58	4%	17	1%	0.93	0.96	0.93
8	B1393 Thornwood Road	SIG	3002	4398	3922	1396	47%	920	31%	1.41	2.48	1.80
9	Station Rd & St John's Rd - Epping	RBT	2568	4021	3507	1453	57%	939	37%	1.27	2.07	1.70
10	Theydon Road - Epping	SIG	2469	3958	3444	1489	60%	975	39%	1.10	2.04	1.68
11	Bury Ln - Epping	RBT	2561	3895	3431	1334	52%	870	34%	1.27	2.04	1.69
12	Wantz Service Stn - Ongar	RBT	3529	4536	4198	1007	29%	670	19%	1.04	1.44	1.30
13	Coopers Hill - Marden Ash, Ongar	RBT	1960	2575	2401	615	31%	442	23%	0.99	1.58	1.41
14	A113 Ongar Rd/B172 Abridge Road - Abridge	G/WAY	2188	2856	2697	668	31%	509	23%	3.00+	3.00+	3.00+
18	A121 Church Hill - A1168 Rectory Lane - Loughton	RBT	2473	3449	3118	975	39%	645	26%	1.27	2.39	2.00
19	Piercing Hill - Theydon Bois	G/WAY	1743	1921	1881	178	10%	138	8%	1.19	1.93	1.82
21	M25 J26 Northern Rbt - Waltham Abbey	RBT	2535	3261	3007	726	29%	472	19%	0.64	0.81	0.71
22	M25 J26 Southern Rbt - Waltham Abbey	RBT	3302	4471	4122	1168	35%	819	25%	0.96	1.37	1.31
23	A113 High Road/A1168 Chigwell Ln - Chigwell	RBT	116	1760	1768	1644	1416%	1651	1422%	0.00	0.86	0.42
24	A121/B194 Meridian Way Signals - Waltham Abbey	SIG	3125	4266	3881	1141	37%	756	24%	1.44	1.97	1.68
25	A1168 Chigwell Lane/Langston Road/Oakwood Hill - Loughton	SIG	2862	4503	3797	1641	57%	935	33%	1.09	1.51	1.29
26	A1168 Chigwell Lane/The Broadway - Loughton	RBT	2200	3205	2837	1005	46%	638	29%	0.94	1.84	1.47
27	A1168 Chigwell Lane/Borders Lane - Loughton	RBT	1930	2973	2605	1043	54%	675	35%	0.95	1.84	1.47
28	A1168 Rectory Lane/Westall Road Rectory Lane - Loughton	G/WAY	1657	2528	2258	871	53%	601	36%	0.53	3.00+	1.81
29	A1168 Rectory Lane Pyrles Lane - Loughton	G/WAY	2086	2850	2618	764	37%	531	25%	0.76	1.82	0.81
30	A1168 Rectory Lane Hillyfields Priority - Loughton	G/WAY	1698	2570	2298	871	51%	599	35%	0.39	2.47	1.12
31	A121 High Road Traps Hill	G/WAY	1474	1757	1608	284	19%	134	9%	0.55	1.01	0.75
32	A121 High Road - Old Station Road - Ollards Grove	RBT	2055	1987	1993	-68	-3%	-62	-3%	0.98	0.97	0.98

Table 4-5 PM Peak Do-Minimum v DLP 'Low & Medium Sustainability' Scenarios Network Performance (PCU Flows per hour & RFC/DOS)

4.6.7 The introduction of improved sustainable transport choices in the Do-Something Scenario 4 could reduce the traffic impact of Scenario 3 by approximately 8% on average, which is consistent with the wider evidence associated with EPTAL analysis discussed previously.

4.6.8 However, while the analysis generally shows Scenario 4 improves on Scenario 3 (see Tables 4-4 & 4-5), there is a residual 27% increase in traffic over the Do-Minimum and 49% increase over the current situation. The network constraints highlighted in Assessment 1 are therefore still expected to worsen, albeit to a lesser degree. In the absence of higher sustainability, the potential need remains for a package of highway improvements to support future development.

Essex Highways

4.7 Assessment 3: Existing (Scenario 1) & Do Minimum (Scenario 2) v DLP (Scenario 5)

4.7.1 The Do-Something Scenario 5 assesses the same traffic growth scenario as Scenario 4 'Medium Sustainability' against an initial package of physical highway mitigation measures. At this stage, infrastructure 'concepts' have been formulated through the use of the junction modelling packages (Junctions 9 and LINSIG) and desktop observations to appraise the extent of potential capacity upgrades required to fully, or at least better, accommodate the worst-case weekday peak period future traffic flows.

4.7.2 The potential to improve the network within the EFD Highway Assessment model area is generally constrained by a number of factors including Epping Forest SAC land ownership/SAC boundaries, building lines and other infrastructure. The concepts tested illustrate the scale of possible capacity requirements under the given traffic growth scenario and will need to be refined against practical design, constraints (land/engineering) and costs and in line with further ongoing assessments of the Submission Local Plan. It should also be noted that mitigation for some areas of the network require further consideration.

4.7.3 The Do-Something Scenario 5 has been assessed against the Do-Minimum (see Tables 4-6 & 4-7), in the first instance, to benchmark the likely transport situation with and without Local Plan development. The analysis shows that the initial mitigation package could deliver improved network performance, or at least nil-detriment, at a number of the key junctions and link corridors identified in Assessment 1, including:

- Junction 1 Wake Arms roundabout
- Junction 6 Sewardstone Road / Sun Street / Farm Hill Road
- Junction 18 A121 Goldings Hill / Church Hill double roundabout
- A112/A121 links in Waltham Abbey
- A121/A104 in Epping Forest SAC
- A121 at M25 Junction 26

4.7.4 While there are a number of isolated residual impacts to address, the key exceptions where further consideration of mitigation options are needed, include:

- B1393 corridor between M11 Junction 7, Epping, and Bell Common
- A1168/A121 corridor between M11 Junction5 and Loughton

Essex Highways

REF	Junction Name	Type	Flow		Change in Flow (PCU/H)	% Change in Flow	RFC/DOS	
			Scen. 2	Scen. 5			Scen. 2	Scen. 5
1	Wake Arms PH - Epping Forest	RBT	4525	5880	1355	30%	1.72	0.996
2	Talbot PH - North Weald	RBT	2607	3710	1103	42%	1.02	0.975
3	Crooked Mile - Waltham Abbey	RBT	2939	3895	956	33%	0.66	1.03
4	Highbridge St - Waltham Abbey	RBT	1830	2591	761	42%	0.65	0.68
5	Sewardstone Rd - Waltham Abbey	RBT	3445	3612	167	5%	0.67	0.7
6	Sewardstone Road - Waltham Abbey	SIG	2733	2893	160	6%	1.083	0.94
7	Honey Lane - Waltham Abbey	RBT	1430	1442	13	1%	1.01	0.736
8	B1393 Thornwood Road	SIG	2785	3664	879	32%	1.066	1.367
9	Station Rd & St John's Rd - Epping	RBT	2587	3478	891	34%	1.15	2.02
10	Theydon Road - Epping	SIG	2633	3568	935	35%	1.176	0.951
11	Bury Ln - Epping	RBT	2603	3444	841	32%	1.34	2.14
12	Wantz Service Stn - Ongar	RBT	3663	4306	643	18%	1.15	0.976
13	Coopers Hill - Marden Ash, Ongar	RBT	1909	2384	475	25%	1.11	0.917
14	A113 Ongar Rd/B172 Abridge Road - Abridge	G/WAY	2231	2785	554	25%	2.78	3.00+
18	A121 Church Hill - A1168 Rectory Lane - Loughton	RBT	2678	3326	647	24%	1.37	1.14
19	Piercing Hill - Theydon Bois	G/WAY	1893	2035	142	7%	1.33	0.85
21	M25 J26 Northern Rbt - Waltham Abbey	RBT	2106	2449	343	16%	0.47	0.53
22	M25 J26 Southern Rbt - Waltham Abbey	RBT	3456	4275	818	24%	1.27	0.989
24	A121/B194 Meridian Way Signals - Waltham Abbey	SIG	2923	3703	780	27%	1.33	0.848
25	A1168 Chigwell Lane/Langston Road/Oakwood Hill - Loughton	SIG	3074	4140	1066	35%	1.076	1.26
26	A1168 Chigwell Lane/The Broadway - Loughton	RBT	1801	2571	770	43%	0.72	1.38
27	A1168 Chigwell Lane/Borders Lane - Loughton	RBT	1310	2123	813	62%	0.63	1.14
28	A1168 Rectory Lane/Westall Road Rectory Lane - Loughton	G/WAY	1140	1825	685	60%	0.78	1.45
29	A1168 Rectory Lane Pyrles Lane - Loughton	G/WAY	2205	2766	560	25%	1.09	3.79
30	A1168 Rectory Lane Hillyfields Priority - Loughton	G/WAY	1805	2430	625	35%	0.83	3.45
31	A121 High Road Traps Hill	G/WAY	1486	1617	130	9%	0.37	0.52
32	A121 High Road - Old Station Road - Ollards Grove	RBT	1802	1803	1	0%	0.77	0.86

Table 4-6 AM Peak Do-Minimum v DLP 'Medium Sustainability' + Highway Mitigation Network Performance (PCU Flows per hour & RFC/DOS)

Essex Highways

REF	Junction Name	Type	Flow		Change in Flow (PCU/H)	% Change in Flow	RFC/DOS	
			Scen. 2	Scen. 5			Scen. 2	Scen. 5
1	Wake Arms PH - Epping Forest	RBT	4826	6178	1352	28%	1.55	1.01
2	Talbot PH - North Weald	RBT	2527	3636	1109	44%	0.91	1.06
3	Crooked Mile - Waltham Abbey	RBT	3475	4371	896	26%	0.7	1.00
4	Highbridge St - Waltham Abbey	RBT	2184	2920	736	34%	1.26	0.94
5	Sewardstone Rd - Waltham Abbey	RBT	3821	3929	108	3%	0.83	0.87
6	Sewardstone Road - Waltham Abbey	SIG	3095	3208	113	4%	1.125	1.02
7	Honey Lane - Waltham Abbey	RBT	1644	1661	17	1%	0.93	0.73
8	B1393 Thornwood Road	SIG	3002	3922	920	31%	1.412	1.80
9	Station Rd & St John's Rd - Epping	RBT	2568	3507	939	37%	1.27	1.70
10	Theydon Road - Epping	SIG	2469	3444	975	39%	1.099	0.88
11	Bury Ln - Epping	RBT	2561	3431	870	34%	1.27	1.69
12	Wantz Service Stn - Ongar	RBT	3529	4198	670	19%	1.04	0.98
13	Coopers Hill - Marden Ash, Ongar	RBT	1960	2401	442	23%	0.99	0.95
14	A113 Ongar Rd/B172 Abridge Road - Abridge	G/WAY	2188	2697	509	23%	3.00+	3.00+
18	A121 Church Hill - A1168 Rectory Lane - Loughton	RBT	2473	3118	645	26%	1.27	1.09
19	Piercing Hill - Theydon Bois	G/WAY	1743	1881	138	8%	1.19	0.72
21	M25 J26 Northern Rbt - Waltham Abbey	RBT	2535	3007	472	19%	0.64	0.71
22	M25 J26 Southern Rbt - Waltham Abbey	RBT	3302	4122	819	25%	0.96	0.95
24	A121/B194 Meridian Way Signals - Waltham Abbey	SIG	3125	3881	756	24%	1.442	1.09
25	A1168 Chigwell Lane/Langston Road/Oakwood Hill - Loughton	SIG	2862	3797	935	33%	1.093	1.01
26	A1168 Chigwell Lane/The Broadway - Loughton	RBT	2200	2837	638	29%	0.94	1.47
27	A1168 Chigwell Lane/Borders Lane - Loughton	RBT	1930	2605	675	35%	0.95	1.47
28	A1168 Rectory Lane/Westall Road Rectory Lane - Loughton	G/WAY	1657	2258	601	36%	0.53	1.81
29	A1168 Rectory Lane Pyrles Lane - Loughton	G/WAY	2086	2618	531	25%	0.76	0.81
30	A1168 Rectory Lane Hillyfields Priority - Loughton	G/WAY	1698	2298	599	35%	0.39	1.12
31	A121 High Road Traps Hill	G/WAY	1474	1608	134	9%	0.55	0.75
32	A121 High Road - Old Station Road - Ollards Grove	RBT	2055	1993	-62	-3%	0.98	0.98

Table 4-7 PM Peak Do-Minimum v DLP 'Medium Sustainability' + Highway Mitigation Network Performance (PCU Flows per hour & RFC/DOS)

4.7.7 As a point of reference, the Do-Something Scenario 5 has also been assessed against the current situation (Scenario 1) to appraise how well the mitigation package performs against existing network performance. The analysis (see Tables 4-8 & 4-9) needs to be considered within the context of the level of traffic growth tested and what is practicably achievable in terms of highway improvements.

4.7.8 The Do-Something Scenario 5 could potentially deliver either improvement, nil-detriment or at least only moderate increases, over the existing situation at key junctions including:

- Junction 1 Wake Arms roundabout
- Junction 6 Sewardstone Road / Sun Street / Farm Hill Road
- Junction 18 A121 Goldings Hill / Church Hill double roundabout
- A121 at M25 Junction 26

4.7.9 As with the Do-Minimum comparison, there are a number of isolated residual impacts to address. Further consideration of mitigation options is needed on key corridors, including:

- B1393 corridor between M11 Junction 7, Epping, and Bell Common
- A1168/A121 corridor between M11 Junction5 and Loughton

4.7.10 The initial mitigation package will need to be refined and updated in line with further testing of the Submission Local Plan, stakeholder consultation and design considerations. The analysis also highlights a number of residual impacts that may require additional or new mitigation measures to address specific issues across the network. Furthermore, evidence emerging from initial outputs from the associated Epping Forest VISSIM micro-simulation model indicates that the introduction of mitigation at some of the key junctions could release additional demand and capacity issues at downstream junctions. A coordinated approach is required to understand the interdependencies of the network and ensure mitigation is provided in a sequential and balanced manner.

4.7.11 The eventual mitigation package would also need to be appraised against a ‘High Sustainability’ scenario to explore the impact of more ambitious sustainable modal shift. This analysis would serve to ensure that any package is both reasonable in scale and provides for an appropriate level of highway capacity to avoid undermining opportunities for sustainable modal shift.

Essex Highways

REF	Junction Name	Type	Total Flow (PCU)		Change in Total Flow (PCU/H)	% Change Total Flow	RFC/DOS	
			Scen. 1	Scen. 5			Scen. 1	Scen. 5
1	Wake Arms PH - Epping Forest	RBT	3888	5880	1992	51%	1.33	0.996
2	Talbot PH - North Weald	RBT	2246	3710	1465	65%	0.81	0.975
3	Crooked Mile - Waltham Abbey	RBT	2542	3895	1353	53%	0.52	1.03
4	Highbridge St - Waltham Abbey	RBT	1575	2591	1017	65%	0.46	0.68
5	Sewardstone Rd - Waltham Abbey	RBT	2976	3612	636	21%	0.52	0.7
6	Sewardstone Road - Waltham Abbey	SIG	2364	2893	529	22%	1.007	0.94
7	Honey Lane - Waltham Abbey	RBT	1234	1442	209	17%	0.81	0.736
8	B1393 Thornwood Road	SIG	2400	3664	1264	53%	0.897	1.367
9	Station Rd & St John's Rd - Epping	RBT	2224	3478	1254	56%	0.85	2.02
10	Theydon Road - Epping	SIG	2265	3568	1303	58%	0.907	0.951
11	Bury Ln - Epping	RBT	2237	3444	1206	54%	1.02	2.14
12	Wantz Service Stn - Ongar	RBT	3126	4306	1180	38%	0.86	0.976
13	Coopers Hill - Marden Ash, Ongar	RBT	1617	2384	767	47%	0.88	0.917
14	A113 Ongar Rd/B172 Abridge Road - Abridge	G/WAY	1880	2785	906	48%	1.15	3.00+
18	A121 Church Hill - A1168 Rectory Lane - Loughton	RBT	2286	3326	1040	46%	1.15	1.14
19	Piercing Hill - Theydon Bois	G/WAY	1630	2035	405	25%	0.89	0.85
21	M25 J26 Northern Rbt - Waltham Abbey	RBT	1816	2449	633	35%	0.38	0.53
22	M25 J26 Southern Rbt - Waltham Abbey	RBT	2960	4275	1315	44%	0.97	0.989
24	A121/B194 Meridian Way Signals - Waltham Abbey	SIG	2517	3703	1187	47%	1.023	0.848
25	A1168 Chigwell Lane/Langston Road/Oakwood Hill - Loughton	SIG	2626	4140	1514	58%	0.945	1.26
26	A1168 Chigwell Lane/The Broadway - Loughton	RBT	1515	2571	1056	70%	0.63	1.38
27	A1168 Chigwell Lane/Borders Lane - Loughton	RBT	1081	2123	1042	96%	0.62	1.14
28	A1168 Rectory Lane/Westall Road Rectory Lane - Loughton	G/WAY	960	1825	865	90%	0.6	1.45
29	A1168 Rectory Lane Pyrles Lane - Loughton	G/WAY	1898	2766	868	46%	0.76	3.79
30	A1168 Rectory Lane Hillyfields Priority - Loughton	G/WAY	1532	2430	898	59%	0.63	3.45
31	A121 High Road Traps Hill	G/WAY	1276	1617	341	27%	0.3	0.52
32	A121 High Road - Old Station Road - Ollards Grove	RBT	1557	1803	246	16%	0.65	0.86

Table 4-8 AM Peak Current v DLP 'Medium Sustainability' + Highway Mitigation Network Performance (PCU Flows per hour & RFC/DOS)

Essex Highways

REF	Junction Name	Type	Total Flow (PCU)		Change in Total Flow (PCU/H)	% Change in Total Flow	RFC/DOS	
			Scen.1	Scen. 5			Scen.1	Scen. 5
1	Wake Arms PH - Epping Forest	RBT	4113	6178	2065	50%	1.21	1.01
2	Talbot PH - North Weald	RBT	2161	3636	1475	68%	0.70	1.06
3	Crooked Mile - Waltham Abbey	RBT	2991	4371	1380	46%	0.53	1.00
4	Highbridge St - Waltham Abbey	RBT	1871	2920	1049	56%	0.85	0.94
5	Sewardstone Rd - Waltham Abbey	RBT	3280	3929	649	20%	0.65	0.87
6	Sewardstone Road - Waltham Abbey	SIG	2657	3208	551	21%	0.96	1.02
7	Honey Lane - Waltham Abbey	RBT	1408	1661	253	18%	0.74	0.73
8	B1393 Thornwood Road	SIG	2567	3922	1354	53%	1.16	1.80
9	Station Rd & St John's Rd - Epping	RBT	2186	3507	1322	60%	0.93	1.70
10	Theydon Road - Epping	SIG	2101	3444	1343	64%	0.77	0.88
11	Bury Ln - Epping	RBT	2181	3431	1249	57%	1.00	1.69
12	Wantz Service Stn - Ongar	RBT	2985	4198	1213	41%	0.76	0.98
13	Coopers Hill - Marden Ash, Ongar	RBT	1650	2401	752	46%	0.73	0.95
14	A113 Ongar Rd/B172 Abridge Road - Abridge	G/WAY	1823	2697	874	48%	1.00	3.00+
18	A121 Church Hill - A1168 Rectory Lane - Loughton	RBT	2087	3118	1031	49%	1.04	1.09
19	Piercing Hill - Theydon Bois	G/WAY	1485	1881	396	27%	0.80	0.72
21	M25 J26 Northern Rbt - Waltham Abbey	RBT	2158	3007	849	39%	0.52	0.71
22	M25 J26 Southern Rbt - Waltham Abbey	RBT	2805	4122	1317	47%	0.75	0.95
24	A121/B194 Meridian Way Signals - Waltham Abbey	SIG	2674	3881	1207	45%	1.12	1.09
25	A1168 Chigwell Lane/Langston Road/Oakwood Hill - Loughton	SIG	2415	3797	1382	57%	0.94	1.01
26	A1168 Chigwell Lane/The Broadway - Loughton	RBT	1845	2837	993	54%	0.77	1.47
27	A1168 Chigwell Lane/Borders Lane - Loughton	RBT	1606	2605	999	62%	0.78	1.47
28	A1168 Rectory Lane/Westall Road Rectory Lane - Loughton	G/WAY	1401	2258	857	61%	0.38	1.81
29	A1168 Rectory Lane Pyrles Lane - Loughton	G/WAY	1780	2618	838	47%	0.67	0.81
30	A1168 Rectory Lane Hillyfields Priority - Loughton	G/WAY	1425	2298	873	61%	0.25	1.12
31	A121 High Road Traps Hill	G/WAY	1254	1608	353	28%	0.43	0.75
32	A121 High Road - Old Station Road - Ollards Grove	RBT	1783	1993	210	12%	0.70	0.98

Table 4-9 PM Peak Current v DLP 'Medium Sustainability' + Highway Mitigation Network Performance (PCU Flows per hour & RFC/DOS)

Essex Highways

4.8 Assessment 4: Current DLP (Scenario 4) v DLP Variants (Technical Assessments 6a/b/c)

4.8.1 The more recent Do-Something scenarios appraise three Technical Assessment (TA) variants of the Regulation 18 DLP. The TAs all assume 'Medium Sustainability' traffic growth and a lower level of employment following the outcomes of the EFDC Employment Review. However, new and expanded school provision has been added in, which was absent from any previous scenarios.

4.8.2 Assessments 1-3 have tested the Regulation 18 DLP against a number of transport conditions including modal shift and possible highway improvements. The outcomes of these assessments provide an appropriate benchmark to these latest tests to help inform the final Submission Local Plan. Expected traffic growth in TAs 6a-c is likely to be 5%-8% lower (refer to Table 4-1) than Scenario 4 and have a reduced impact on the current and Do-Minimum scenarios. Scenario 4 has therefore been used as a 'like for like' assessment to benchmark and ensure that the latest scenarios either improve on or have a nil-detriment impact over the Regulation 18 DLP results.

4.8.3 The analysis presents (see Tables 4-10 & 4-11) marginal changes generally between Scenario 4 and TAs 6a-c. There are some minor increases in impact, potentially brought about by the introduction of school traffic. This impact is generally isolated to the AM peak and most notably in Waltham Abbey in TA 6b and Epping in TA 6c, where two new secondary schools were tested respectively. Any further work to test the Submission Local Plan scenario will refine the methodology used to assess school impacts e.g. trip internalisation. The absence of significant school traffic in the PM peak results in more notable improvements across the network for TAs 6a-c against Scenario 4.

4.8.4 The outcomes of Assessment 4 indicate that, even with an allowance for increased school traffic, the proposed lower level of employment and redistributed housing growth will generally improve on the Regulation 18 DLP forecast highway impact. TA 6a presents the lowest likely traffic growth scenario while TAs 6b & 6c could also reduce the impact on some parts of the network. The inclusion of secondary schools at Waltham Abbey and Epping would have some minor localised impacts not previously identified.

4.8.5 The final Submission Local Plan scenario generally adopts the pattern of growth tested in TA 6a with some minor increases in the employment offer, to reflect the outcomes of the Employment Review and additional secondary school expansion in Epping.

Essex Highways

REF	Junction Name	Type	Flow (PCU/H)				Change in Flow (PCU/H) Scen. 6A	% Change in Flow Scen. 6A	Change in Flow (PCU/H) Scen. 6B	% Change in Flow Scen. 6B	Change in Flow (PCU/H) Scen. 6C	% Change in Flow Scen. 6C	RFC/DOS			
			Scen. 4	Scen. 6A	Scen. 6B	Scen. 6C							Scen. 4	TA 6A	TA 6B	TA 6C
1	Wake Arms PH - Epping Forest	RBT	5880	5623	5786	5833	-258	-4%	-94	-2%	-47	-1%	2.07	2.07	2.11	2.13
2	Talbot PH - North Weald	RBT	3710	3807	4081	3943	97	3%	371	10%	232	6%	1.53	1.55	1.77	1.64
3	Crooked Mile - Waltham Abbey	RBT	3895	3777	4376	3866	-118	-3%	481	12%	-29	-1%	1.03	1	1.18	0.99
4	Highbridge St - Waltham Abbey	RBT	2591	2516	2682	2603	-75	-3%	91	4%	12	0%	0.87	0.93	1.05	1.02
5	Sewardstone Rd - Waltham Abbey	RBT	3612	3611	3981	3614	0	0%	369	10%	2	0%	0.7	0.71	0.82	0.71
6	Sewardstone Road - Waltham Abbey	SIG	2893	2947	3366	2948	54	2%	473	16%	55	2%	1.141	1.255	1.373	1.196
7	Honey Lane - Waltham Abbey	RBT	1442	1467	1545	1466	25	2%	103	7%	24	2%	1.01	1.03	1.08	1.03
8	B1393 Thornwood Road	SIG	3664	3696	3907	3716	32	1%	243	7%	52	1%	1.367	1.352	1.393	1.354
9	Station Rd & St John's Rd - Epping	RBT	3478	3454	3643	3462	-24	-1%	165	5%	-16	0%	2.02	1.88	1.91	1.87
10	Theydon Road - Epping	SIG	3568	3531	3696	3733	-37	-1%	128	4%	165	5%	1.639	1.642	1.607	1.684
11	Bury Ln - Epping	RBT	3444	3353	3574	3556	-91	-3%	130	4%	112	3%	2.14	1.95	2.00	2.00
12	Wantz Service Stn - Ongar	RBT	4306	4285	4610	4458	-21	0%	304	7%	152	4%	1.37	1.31	1.44	1.37
13	Coopers Hill - Marden Ash, Ongar	RBT	2384	2200	2362	2306	-183	-8%	-22	-1%	-78	-3%	1.47	1.33	1.39	1.38
14	A113 Ongar Rd/B172 Abridge Road - Abridge	G/WAY	2785	2450	2465	2435	-335	-12%	-320	-11%	-350	-13%	3.00+	3.51	3.52	3.41
18	A121 Church Hill - A1168 Rectory Lane - Loughton	RBT	3326	2884	2901	2889	-441	-13%	-424	-13%	-437	-13%	1.43	1.54	1.57	1.55
19	Piercing Hill - Theydon Bois	G/WAY	2035	1961	1969	1939	-74	-4%	-66	-3%	-96	-5%	1.76	1.69	1.71	1.57
21	M25 J26 Northern Rbt - Waltham Abbey	RBT	2449	2394	2439	2480	-54	-2%	-10	0%	32	1%	0.53	0.52	0.55	0.55
22	M25 J26 Southern Rbt - Waltham Abbey	RBT	4275	4053	4278	4204	-221	-5%	3	0%	-71	-2%	1.52	1.53	1.54	1.58
24	A121/B194 Meridian Way Signals - Waltham Abbey	SIG	3703	3612	3778	3699	-92	-2%	74	2%	-4	0%	1.70	1.70	1.72	1.70
25	A1168 Chigwell Lane/Langston Road/Oakwood Hill - Loughton	SIG	4140	3174	3173	3171	-967	-23%	-967	-23%	-969	-23%	1.60	1.12	1.13	1.12
26	A1168 Chigwell Lane/The Broadway - Loughton	RBT	2571	1935	1940	1935	-636	-25%	-630	-25%	-636	-25%	1.38	0.79	0.80	0.79
27	A1168 Chigwell Lane/Borders Lane - Loughton	RBT	2123	1488	1513	1489	-635	-30%	-611	-29%	-634	-30%	1.14	0.69	0.70	0.70
28	A1168 Rectory Lane/Westall Road Rectory Lane - Loughton	G/WAY	1825	1229	1246	1231	-596	-33%	-579	-32%	-594	-33%	1.45	0.80	0.81	0.81
29	A1168 Rectory Lane Pyrles Lane - Loughton	G/WAY	2766	2201	2216	2203	-564	-20%	-550	-20%	-562	-20%	3.79	1.03	1.04	1.03
30	A1168 Rectory Lane Hillyfields Priority - Loughton	G/WAY	2430	1933	1949	1936	-497	-20%	-481	-20%	-494	-20%	3.45	1.30	1.32	1.30
31	A121 High Road Traps Hill	G/WAY	1617	1670	1701	1672	54	3%	84	5%	55	3%	0.52	0.49	0.54	0.49
32	A121 High Road - Old Station Road - Ollards Grove	RBT	1803	1843	1852	1843	40	2%	49	3%	40	2%	0.86	0.88	0.90	0.88

Table 4-10 AM Peak DLP 'Medium Sustainability' v Updated Local Plan Test Scenarios 6A-C (PCU Flows per hour & RFC/DOS)

Essex Highways

REF	Junction Name	Type	Flow (PCU/H)				Change in Flow (PCU/H) Scen. 6A	% Change in Flow Scen. 6A	Change in Flow (PCU/H) Scen. 6B	% Change in Flow Scen. 6B	Change in Flow (PCU/H) Scen. 6C	% Change in Flow Scen. 6C	RFC/DOS			
			Scen. 4	Scen. 6A	Scen. 6B	Scen. 6C							Scen. 4	TA 6A	TA 6B	TA 6C
1	Wake Arms PH - Epping Forest	RBT	6178	5859	5880	5891	-319	-5%	-298	-5%	-286	-5%	2.17	2.23	2.20	2.20
2	Talbot PH - North Weald	RBT	3636	3627	3865	3740	-9	0%	229	6%	104	3%	1.66	1.68	2.00	1.81
3	Crooked Mile - Waltham Abbey	RBT	4371	4197	4514	4232	-174	-4%	143	3%	-139	-3%	1.00	0.98	1.06	0.99
4	Highbridge St - Waltham Abbey	RBT	2920	2789	2857	2821	-131	-4%	-63	-2%	-99	-3%	1.71	1.69	1.72	1.70
5	Sewardstone Rd - Waltham Abbey	RBT	3929	3870	4072	3869	-59	-2%	143	4%	-60	-2%	0.87	0.84	0.90	0.84
6	Sewardstone Road - Waltham Abbey	SIG	3208	3186	3415	3187	-22	-1%	207	6%	-22	-1%	1.12	1.12	1.16	1.11
7	Honey Lane - Waltham Abbey	RBT	1661	1660	1743	1658	-1	0%	82	5%	-3	0%	0.93	0.95	1.00	0.95
8	B1393 Thornwood Road	SIG	3922	3851	3944	3869	-70	-2%	22	1%	-53	-1%	1.80	1.79	1.84	1.80
9	Station Rd & St John's Rd - Epping	RBT	3507	3388	3461	3396	-119	-3%	-46	-1%	-112	-3%	1.70	1.60	1.63	1.60
10	Theydon Road - Epping	SIG	3444	3338	3394	3370	-105	-3%	-50	-1%	-74	-2%	1.68	1.67	1.60	1.70
11	Bury Ln - Epping	RBT	3431	3290	3397	3321	-141	-4%	-33	-1%	-110	-3%	1.69	1.60	1.63	1.60
12	Wantz Service Stn - Ongar	RBT	4198	4056	4360	4229	-142	-3%	162	4%	30	1%	1.30	1.26	1.47	1.36
13	Coopers Hill - Marden Ash, Ongar	RBT	2401	2173	2323	2278	-229	-10%	-79	-3%	-124	-5%	1.41	1.13	1.19	1.18
14	A113 Ongar Rd/B172 Abridge Road - Abridge	G/WAY	2697	2337	2342	2322	-359	-13%	-355	-13%	-375	-14%	3.00+	3.00+	3.00+	3.00+
18	A121 Church Hill - A1168 Rectory Lane - Loughton	RBT	3118	2647	2647	2648	-471	-15%	-471	-15%	-470	-15%	2.00	1.45	1.46	1.45
19	Piercing Hill - Theydon Bois	G/WAY	1881	1790	1788	1768	-91	-5%	-93	-5%	-113	-6%	1.82	1.36	1.33	1.30
21	M25 J26 Northern Rbt - Waltham Abbey	RBT	3007	2909	2916	2912	-98	-3%	-91	-3%	-96	-3%	0.71	0.68	0.69	0.69
22	M25 J26 Southern Rbt - Waltham Abbey	RBT	4122	3843	3881	3852	-278	-7%	-241	-6%	-270	-7%	1.31	1.10	1.09	1.10
24	A121/B194 Meridian Way Signals - Waltham Abbey	SIG	3881	3720	3787	3752	-161	-4%	-93	-2%	-129	-3%	1.68	1.66	1.69	1.67
25	A1168 Chigwell Lane/Langston Road/Oakwood Hill - Loughton	SIG	3797	2955	2947	2949	-842	-22%	-850	-22%	-848	-22%	1.29	1.10	1.09	1.09
26	A1168 Chigwell Lane/The Broadway - Loughton	RBT	2837	2290	2289	2288	-547	-19%	-548	-19%	-549	-19%	1.47	1.00	1.00	1.00
27	A1168 Chigwell Lane/Borders Lane - Loughton	RBT	2605	2048	2066	2047	-556	-21%	-539	-21%	-558	-21%	1.47	1.01	1.01	1.01
28	A1168 Rectory Lane/Westall Road Rectory Lane - Loughton	G/WAY	2258	1730	1740	1730	-528	-23%	-518	-23%	-528	-23%	1.81	0.58	0.59	0.58
29	A1168 Rectory Lane Pyrles Lane - Loughton	G/WAY	2618	2112	2121	2113	-505	-19%	-496	-19%	-505	-19%	0.81	0.77	0.77	0.77
30	A1168 Rectory Lane Hillyfields Priority - Loughton	G/WAY	2298	1809	1817	1809	-489	-21%	-481	-21%	-488	-21%	1.12	0.57	0.57	0.57
31	A121 High Road Traps Hill	G/WAY	1608	1601	1618	1601	-6	0%	11	1%	-6	0%	0.75	0.70	0.75	0.70
32	A121 High Road - Old Station Road - Ollards Grove	RBT	1993	1998	2005	1998	5	0%	12	1%	5	0%	0.98	0.95	0.96	0.95

Table 4-11 PM Peak DLP 'Medium Sustainability' v Updated Local Plan Test TAs 6A-C (PCU Flows per hour & RFC/DOS)

Essex Highways

4.9 Assessment 5: Existing (Scenario 1) & Do Minimum (Scenario 2) v Submission Local Plan (Scenarios 7a & 7b)

4.9.1 The Submission Local Plan (Scenario 7a/b) builds on the overall site selection process, and not just transport modelling, as a balanced approach to delivering high quality sustainable growth while minimising the impacts on the highway network. The scenario assumes a reasonable level of smarter travel choices are delivered and assume 'Medium Sustainability' traffic growth for assessment purposes.

4.9.2 Assessment 5 compares the Submission Local Plan growth scenario with the existing situation (Scenario 1) and Do-Minimum growth scenario to demonstrate the anticipated impact of the Local Plan on the highway network. Results are summarised in Tables 4-12 - 4-13.

4.9.3 The impact of Scenario 7a on the existing highway network generally reflects the findings of Assessment 4, given the level of growth is relatively similar, with only marginal changes across the network when compared to the Draft Local Plan and Technical Assessments. While the Submission Local Plan represents the lowest level of traffic growth across all scenarios tested, there is a residual need for a comprehensive package of highway mitigation measures to reasonably accommodate likely traffic growth.

4.9.4 The impact of the Submission Local Plan growth with the initial package of highway mitigation (Scenario 7b) generally reflects the findings of Assessment 3, with a number of improvements at key junctions including:

- Junction 1 Wake Arms roundabout
- Junction 6 Sewardstone Road / Sun Street / Farm Hill Road
- Junction 18 A121 Goldings Hill / Church Hill double roundabout
- A121 at M25 Junction 26

4.9.5 However, as with previous assessments, there are a number of isolated residual impacts to address. Further consideration of mitigation options is needed on key corridors, including:

- B1393 corridor between M11 Junction 7, Epping, and Bell Common
- A1168/A121 corridor between M11 Junction 5 and Loughton

4.9.6 While the Submission Local Plan would generate lower traffic growth, than previously assessed scenarios, the need remains for the initial mitigation package to be refined and updated in line with further testing of the Submission Local Plan scenario, stakeholder consultation and design considerations. The analysis also highlights a number of residual impacts that may require additional or new mitigation measures to address specific issues across the network as well as downstream impacts.

4.9.7 The eventual mitigation package would also need to be appraised against a 'High Sustainability' scenario to explore the impact of more ambitious sustainable modal shift. A coordinated approach is required to understand the interdependencies of the network and ensure mitigation is provided in a sequential and balanced manner.

Essex Highways

REF	Junction Name	Type	RFC/DOS			
			Scen.1	Scen.2	Scen.7a	Scen.7b
1	Wake Arms PH - Epping Forest	RBT	1.33	1.72	2.08	0.98
2	Talbot PH - North Weald	RBT	0.81	1.02	1.45	0.93
3	Crooked Mile - Waltham Abbey	RBT	0.52	0.66	1.11	1.11
4	Highbridge St - Waltham Abbey	RBT	0.46	0.65	0.99	0.76
5	Sewardstone Rd - Waltham Abbey	RBT	0.52	0.67	0.71	0.71
6	Sewardstone Road - Waltham Abbey	SIG	1.007	1.083	1.22	0.94
7	Honey Lane - Waltham Abbey	RBT	0.81	1.01	1.06	0.79
8	B1393 Thornwood Road	SIG	0.897	1.066	1.3	1.3
9	Station Rd & St John's Rd - Epping	RBT	0.85	1.15	1.73	1.73
10	Theydon Road - Epping	SIG	0.907	1.176	1.59	0.94
11	Bury Ln - Epping	RBT	1.02	1.34	1.84	1.84
12	Wantz Service Stn - Ongar	RBT	0.86	1.15	1.30	0.96
13	Coopers Hill - Marden Ash, Ongar	RBT	0.88	1.11	1.30	0.85
14	A113 Ongar Rd/B172 Abridge Road - Abridge	G/WAY	1.15	2.78	3.18	3.18
18	A121 Church Hill - A1168 Rectory Lane - Loughton	RBT	1.15	1.37	1.50	1.50
19	Piercing Hill - Theydon Bois	G/WAY	0.89	1.33	1.43	0.77
21	M25 J26 Northern Rbt - Waltham Abbey	RBT	0.38	0.47	0.55	0.55
22	M25 J26 Southern Rbt - Waltham Abbey	RBT	0.97	1.27	1.54	0.99
24	A121/B194 Meridian Way Signals - Waltham Abbey	SIG	1.02	1.33	1.82	0.90
25	A1168 Chigwell Lane/Langston Road/Oakwood Hill - Loughton	SIG	0.95	1.08	1.13	1.13
26	A1168 Chigwell Lane/The Broadway - Loughton	RBT	0.63	0.72	0.80	0.80
27	A1168 Chigwell Lane/Borders Lane - Loughton	RBT	0.62	0.63	0.71	0.71
28	A1168 Rectory Lane/Westall Road Rectory Lane - Loughton	G/WAY	0.60	0.78	0.84	0.84
29	A1168 Rectory Lane Pyrles Lane - Loughton	G/WAY	0.76	1.09	1.05	1.05
30	A1168 Rectory Lane Hillyfields Priority - Loughton	G/WAY	0.63	0.83	1.30	1.30
31	A121 High Road Traps Hill	G/WAY	0.30	0.37	0.51	0.51
32	A121 High Road - Old Station Road - Ollards Grove	RBT	0.65	0.77	0.88	0.88

Table 4-12 AM Submission Local Plan Scenarios 7a/7b v Existing Scenario 1 and Do Minimum Scenario 2 (RFC/DOS)

Essex Highways

REF	Junction Name	Type	RFC/DOS			
			Scen.1	Scen.2	Scen.7a	Scen.7b
1	Wake Arms PH - Epping Forest	RBT	1.21	1.55	1.98	1.02
2	Talbot PH - North Weald	RBT	0.7	0.91	1.45	0.89
3	Crooked Mile - Waltham Abbey	RBT	0.53	0.7	1.05	1.05
4	Highbridge St - Waltham Abbey	RBT	0.85	1.26	1.82	1.00
5	Sewardstone Rd - Waltham Abbey	RBT	0.65	0.83	0.85	0.85
6	Sewardstone Road - Waltham Abbey	SIG	0.963	1.125	1.14	1.11
7	Honey Lane - Waltham Abbey	RBT	0.74	0.93	0.96	0.73
8	B1393 Thornwood Road	SIG	1.162	1.412	1.67	1.67
9	Station Rd & St John's Rd - Epping	RBT	0.93	1.27	1.48	1.48
10	Theydon Road - Epping	SIG	0.77	1.099	1.58	0.89
11	Bury Ln - Epping	RBT	1.00	1.27	1.48	1.49
12	Wantz Service Stn - Ongar	RBT	0.76	1.04	1.22	0.92
13	Coopers Hill - Marden Ash, Ongar	RBT	0.73	0.99	1.11	0.76
14	A113 Ongar Rd/B172 Abridge Road - Abridge	G/WAY	1.00	3.00+	3.00+	3.00+
18	A121 Church Hill - A1168 Rectory Lane - Loughton	RBT	1.04	1.27	1.43	1.43
19	Piercing Hill - Theydon Bois	G/WAY	0.80	1.19	1.24	0.62
21	M25 J26 Northern Rbt - Waltham Abbey	RBT	0.52	0.64	0.66	0.66
22	M25 J26 Southern Rbt - Waltham Abbey	RBT	0.75	0.96	1.10	0.95
24	A121/B194 Meridian Way Signals - Waltham Abbey	SIG	1.12	1.44	1.77	1.08
25	A1168 Chigwell Lane/Langston Road/Oakwood Hill - Loughton	SIG	0.94	1.09	1.11	1.11
26	A1168 Chigwell Lane/The Broadway - Loughton	RBT	0.77	0.94	1.01	1.01
27	A1168 Chigwell Lane/Borders Lane - Loughton	RBT	0.78	0.95	1.00	1.00
28	A1168 Rectory Lane/Westall Road Rectory Lane - Loughton	G/WAY	0.38	0.53	0.58	0.58
29	A1168 Rectory Lane Pyrles Lane - Loughton	G/WAY	0.67	0.76	0.78	0.78
30	A1168 Rectory Lane Hillyfields Priority - Loughton	G/WAY	0.25	0.39	0.56	0.56
31	A121 High Road Traps Hill	G/WAY	0.43	0.55	0.72	0.72
32	A121 High Road - Old Station Road - Ollards Grove	RBT	0.70	0.98	0.95	0.95

Table 4-13 PM Submission Local Plan Scenarios 7a/7b v Existing Scenario 1 and Do Minimum Scenario 2 (RFC/DOS)

5 Wider Impacts

5.1 Overview

5.1.1 The assessment of the emerging EFDC Local Plan is also subject to a number of interdependencies including the proximity and potential impacts on the Epping Forest Special Area of Conservation and also the strategic sites located in the Wider Harlow area.

5.1.2 Over and above the EFDC Submission Local Plan Highway Assessment there are a number of parallel transport modelling assessments being undertaken to understand the wider impacts. While these assessments are not complete, and still need to test the Submission Local Plan scenario, this section provides a summary of the modelling undertaken to date for information purposes only. All results are subject to further testing and potential change.

5.2 Epping Forest Special Area of Conservation (SAC) VISSIM

5.2.1 A VISSIM Microsimulation model has been developed in line with the TfL VISSIM Model Audit Process (VMAP) and in consultation with the Conservators of Epping Forest to assess Air Quality impacts on the Epping Forest SAC.

5.2.2 The primary purpose of the model is to provide traffic modelling outputs, such as predicted traffic flows, expected queue lengths, duration of queue, average vehicle speed, and percentage of heavy goods vehicles to EFDC's air quality consultants Aecom.

5.2.3 The VISSIM model extents are shown in Figure 5-1 and include the following junctions:

- Junction 1: Wake Arms Roundabout – B1393 Epping Road/ B172/ A121 Golding's Hill/ A104 Epping New Road/ A121 Woodridden Hill
- Junction 33: Woodgreen Road/ A121 Woodridden Hill/ Forest Side/ A121 Honey Lane
- Junction 34: A112 Sewardstone Road/ Avey Lane
- Junction 35: High Beech/ Cross Roads/ High Beech Loughton
- Junction 36: A104 Epping New Road/ Earle's Path/ Cross Roads (Robin Hood Roundabout)

5.2.4 The model has been validated and calibrated against observed Journey Times, Automated Traffic Counts (ATCs) and Automatic Number Plate Recognition (ANPR) surveys to determine the origin and destination of traffic on the network and ensure results were representative of typical traffic patterns in the study area.

5.2.5 The model, to date, has only been used to test the existing situation, Do-Minimum and current Draft Local Plan (Scenarios 1-5) and further testing of the Submission Local Plan will be undertaken prior to submission of the Local Plan to the Secretary of State.

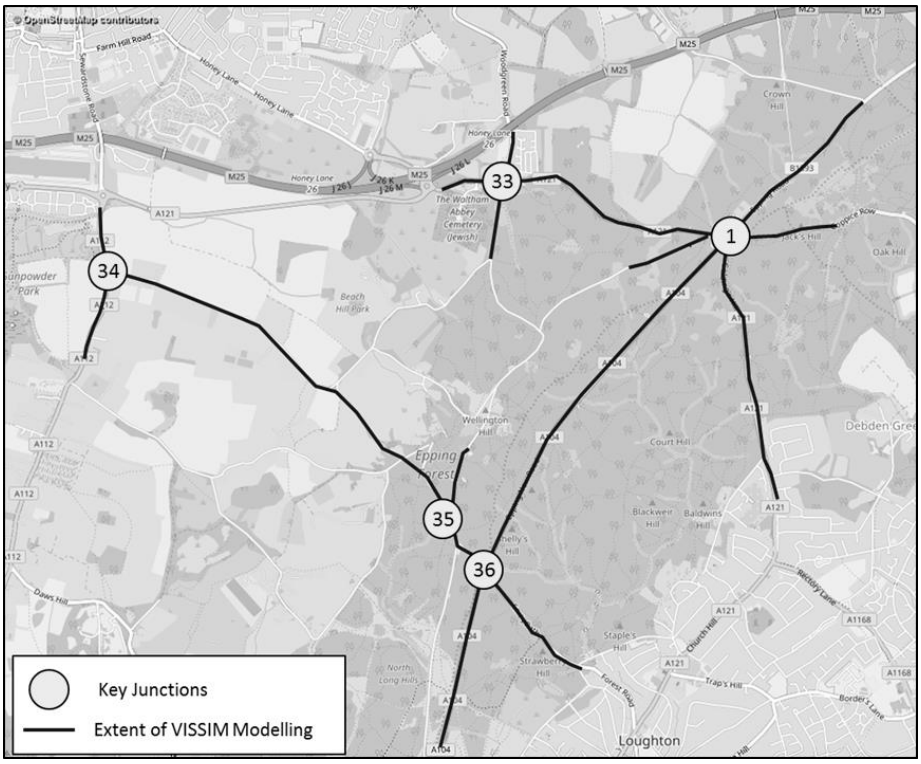

Figure 5-1 VISSIM Model Area

5.2.6 The initial results show that Scenario 3, with DLP 'Low Sustainability' growth, has the most detrimental impact in terms of increasing travel times through the modelled area. The impact of reasonable sustainable modal shift and the initial package of highway improvements, particularly at Junction 1 Wake Arms Roundabout, (Scenario 4) generally improve journey times over and above the Do-Minimum growth (Scenario 2).

5.2.7 An advantage of using the VISSIM model is the dynamic representation of the network performance including the interaction of adjacent junctions within the modelled area. A key finding of the tests to date highlight that capacity improvements at Wake Arms Roundabout will release significant additional downstream demand to adjacent junctions including Junction 36 Robin Hood Roundabout and Junction 33 Woodgreen Road/ A121 Woodridden Hill/ Forest Side/ A121 Honey Lane. The additional demand added to these junctions in the peak hours generates additional congestion issues potentially requiring further mitigation.

5.2.8 The VISSIM modelling will be updated with the Submission Local Plan growth scenario for further testing and refinement of the proposed highway mitigation package. The model outputs will also be used to inform the associated supporting Air Quality assessment being prepared by Aecom.

5.3 Wider Harlow Modelling

5.3.1 A separate combined VISUM modelling exercise is being undertaken to assess the impact of development proposed in the West Essex/East Hertfordshire (WEEH) districts in and around Harlow, including Epping Forest, Harlow, Uttlesford and East

Herts. In particular, the model has been used to identify and test major infrastructure requirements around and within the town of Harlow leading to the M11.

5.3.2 The Submission Local Plan scenario for EFDC will be run in this model as part of ongoing work and results will be reported in the final submission for examination. In the interim this section provides an overview of the key implications for the district of Epping Forest arising from the modelling of Local Plan scenarios in the wider Harlow area.

5.3.3 The VISUM strategic transport model was updated to model the impact of the emerging Local Plan developments on the highway network using a forecast year of 2033. While the model extends beyond the WEEH districts, its main usefulness is to forecast strategic impacts in the wider Harlow area and to compare between development scenarios.

5.3.4 A series of modelling Technical Notes (TNs 1-6) have reported on model development and identified the highway impact of emerging Local Plan growth. These notes identified locations where the network would be under particular stress in wider Harlow. The notes also explored the impacts of options to improve capacity around larger development sites including Gilston, East Harlow, Latton Priory and Water Lane area (including West Katherine's and West Sumners).

5.3.5 Further work is currently being finalised to explore the likely effects of attaining lower levels of car use ('Intermediate Mode Split') by the end of the 2011-2033 Plan period, with correspondingly higher levels of sustainable travel, than is currently achieved in Harlow. In addition, the aim of reducing the need to out-commute is represented by an estimated increase in more local, shorter trips by a range of modes.

5.3.6 An additional assessment will build on these sustainability assessments to explore the likely highway impact of a larger Gilston development, to the north of Harlow, at a range of residential delivery of between 3,000 to 10,000 homes. Although, it should be noted that approximately 7,000 of these homes will be delivered beyond the Plan period of 2033.

5.3.7 The model used the latest development scenarios as provided across the districts of Epping Forest, Harlow, Uttlesford and East Hertfordshire in September 2016. This scenario included the Draft Local Plan (Scenarios 3 & 4) as modelled in the EFD Highway Assessment Model. However, given the nature of separate modelling platforms and ongoing assessment work, it should be noted that some traffic growth assumptions may differ, including background traffic and development trip rates. Any future assessment of the Submission scenario will ensure a consistent approach to growth assumptions is adopted where possible.

5.3.8 The key development sites assessed are:

- Latton Priory
- East Harlow
- New Hall
- Gilston
- Water Lane area (including West Katherine's and West Sumners)

5.3.9 The following strategic schemes have been considered in different combinations as part of the assessments:

- M11 J7a is constructed
- another Stort Crossing
- options for greater levels of sustainable travel corridors in Harlow

5.3.10 The table below gives and interim summary of the latest network statistics from the scenario tests of the above schemes.

Scenarios	Total Number of Arrivals and Departures in Wider Harlow	Total Number of Trips on the Wider Harlow Network	Average Network Speed (mph)
Current modal split	26,889	31,650	26
Current with Crossing	26,889	31,897	28
Current with Crossing & Sustainable Corridor	26,889	31,808	25
Intermediate modal split	25,684	30,997	28
Intermediate with Crossing	25,684	30,852	29
Intermediate Current with Crossing & Sustainable Corridor	25,684	30,863	29

Table 4-12 Wider Harlow Modelling Interim Results

5.3.11 Implementation of a north-south bus infrastructure corridor with a widened central Stort crossing, without any mode share change, would likely result in marginally lower overall network speeds than without the additional crossing. However, it can be seen that with intermediate sustainable travel levels, overall network speeds would likely to be faster in all scenarios.

5.3.12 It should be noted that the number of vehicle trips on the wider Harlow road network area may only reduce by 2-3% as a result of the mode switch whilst the number of trips commencing or ending in Harlow decreases by approximately 4.5% when intermediate assumptions are applied. This indicates that other traffic might re-route via wider Harlow to use any freed-up highway capacity.

5.3.13 The analysis to date indicates that a significant package of highway improvements would be needed in and around Harlow and M11 to help deliver the level of growth proposed in the proposed WEEH Local Plans. In addition to physical interventions, significant sustainable mode shift will be required to ensure the improved network operates at an efficient level and within theoretical capacity.

6 Summary

6.1.1 The traffic impacts of the Epping Forest District Council Submission Local Plan have been assessed using the EFD VISUM assisted Spreadsheet Highway Assessment model for the forecast year of 2033. The weekday AM and PM worst-case peak hours have been modelled for a number of scenarios to analyse the evolution of the Plan up to this point.

6.1.2 The Highway Assessment was undertaken at a strategic scale for a number of scenarios in advance of the Submission Local Plan and consequently not all impacts of developments have been identified at this stage. It is acknowledged that further modelling is required to test the Submission Local Plan scenario in full with more ambitious sustainable transport choices aligned to Garden Communities objectives in particular and a refined package of highway mitigation measures to address likely growth across the Plan period.

6.1.3 Scenario 1 provides the existing traffic situation and Scenario 2 Do-Minimum (Reference Case) represents a future year in which the Local Plan is not adopted, but accounts for all planned or committed development within the district and full development in the rest of the United Kingdom to 2033.

6.1.4 Scenario 3 adds all development planned in the 2016 published Regulation 18 DLP to 2033, but with no provision for sustainable mode shift and new highway schemes. In Scenarios 4 & 5, improved sustainable transport choices and an initial package of highway schemes have been tested respectively.

6.1.5 Following the outcomes of an Employment Review, stakeholder feedback and new sites, Technical Assessments 6a-c test variants of the published Regulation 18 DLP to inform the proposed Submission Local Plan. In summary, the scenarios are as follows:

- Scenario 1: Base Year/Existing Situation – representation of current highway network.
- Scenario 2: Do-Minimum: Only background traffic growth and committed development in EFDC, with no Local Plan development, low sustainable modal shift and no new highway schemes;
- Scenario 3: Background traffic growth and current DLP development in EFDC, with low sustainable modal shift and no new highway schemes;
- Scenario 4: Scenario 3 plus reasonable sustainable transport improvements but no new highway schemes;
- Scenario 5: Scenario 4 plus initial package of highway schemes;
- Technical Assessments 6a-c: Scenario 4 plus variant development scenarios;
- Scenario 7a: Submission Local Plan with existing highway network;
- Scenario 7b: Submission Local Plan with initial package of highway mitigation.

6.1.6 The analysis shows that currently a number of junctions and links are either approaching or exceeding capacity. The Do-Minimum growth increases traffic levels by 17% from current levels leading to additional capacity issues across the network.

Essex Highways

6.1.7 In Scenario 3, with no mitigation, the current DLP traffic could increase traffic levels by 62%, which could have significant impacts at a number of key junctions and corridors across the network.

6.1.8 The introduction of reasonable improvements to sustainable transport choices (Scenario 4) reduces the traffic impact of Scenario 3 by approximately 8%. However, while this improves the Do-Something future traffic situation, the analysis highlights a number of residual impacts on key junctions and corridors, with the need for more substantial physical highway interventions.

6.1.9 An initial package of highway improvements has been tested in Scenario 5 and shown to either improve on the Do-Minimum or generate nil-detriment on a number of key junctions and links. This initial highway mitigation package will be subject to further testing against the Submission Local Plan scenario as well as higher sustainability assumptions to develop and refine the eventual package and address any residual issues.

6.1.10 The outcomes of testing Scenarios 1-5 have formed the basis to benchmark further testing of the Local Plan in the build up to the Submission version. Technical Assessments 6a-c take account of the outcomes of an Employment Review, stakeholder consultation and the availability of new sites, to test lower and redistributed development as a closer representation of the quantum and distribution of development proposed for the district.

6.1.11 The revised development scenarios include reasonable improvements to sustainable transport choices and have been tested against the corresponding DLP Scenario 4 to ensure likely traffic impacts are either lower or no worse than those previously identified. The analysis indicates that the revised development scenarios generally improve on the forecast traffic situation previously tested with only marginal localised increases potentially associated with the addition of school traffic, which was previously excluded from Scenarios 2-5.

6.1.12 The Highway Assessment therefore provides a robust basis to take further testing of the Submission Local Plan forward. This further testing will need to model the Submission Plan scenario on the following basis:

- with ‘High Sustainability’ assumptions to explore the impact of more ambitious sustainable modal shift and ensure that any package of physical highway intervention is reasonable in scale and does not overprovide capacity;
- to refine the initial highway mitigation package in line with constraints, stakeholder consultation and design considerations, as well as address any residual gaps on the network needing improvement;
- and address any new capacity issues at downstream junctions, understand the interdependencies of the network and ensure mitigation is provided in a sequential and balanced manner.

6.1.13 The results of the assessment work to date indicate that the forecast development traffic would increase traffic levels significantly across the network. This would be expected given the quantum of employment land and housing proposed. The analysis

demonstrates that the delivery of a combination of more ambitious sustainable transport and physical highway improvements could potentially mitigate the most significant impacts of the Local Plan, particularly when considered against the 2033 Do Minimum Scenario where no Local Plan growth is delivered. Further work is needed and the scale of mitigation required will be refined as part of ongoing assessments of the Submission Local Plan scenario.

6.1.14 The ongoing assessment work for the WEEH districts growth, including EFDC sites at in the wider Harlow area, also identify that significant infrastructure improvements and ambitious sustainable modal shift is required to address significant impact in and around Harlow and the M11.

6.1.15 It should be noted that the Highway Assessment represents a robust worst-case in terms of traffic demand and supply assumptions as it does not yet account for the full benefits of all proposed mitigation. It also tests the total projected housing supply available rather than the lower future housing requirement for the district.