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West Essex and East Hertfordshire Local Plan Modelling

Essex County Council

Technical Note 1: WEEH Forecast Methodology Technical Report

22 March 2017

integrated expertise

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West Essex and East Hertfordshire Local Plan Modelling Technical Note 1: Forecast Methodology

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Limitation Statement

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This report is part of a suite of technical notes on the WEEH Local Plans modelling project and should be read in conjunction with these other technical notes. The analysis and forecasts contained in this report make use of information and input assumptions made available to Jacobs at a point in time. As conditions change the analysis and forecasts would be expected to change. Hence the findings set out in this report should be understood as relevant to that point in time when the information and assumption were made.

The WEEH transport model is focussed on the Harlow district but covers adjacent districts in West Essex and East Hertfordshire. The WEEH model contributes to the understanding of strategic impacts between the districts but does not intend to replace local transport models used in the districts surrounding Harlow.

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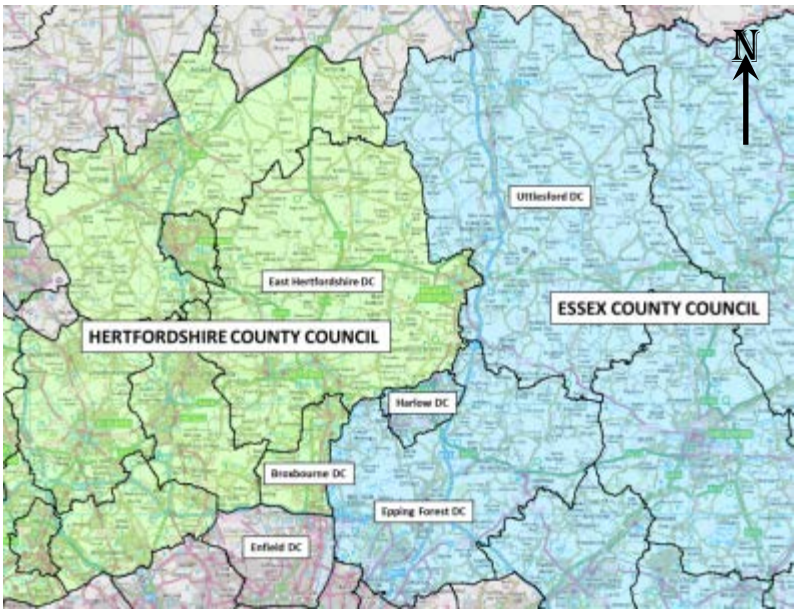
1. Introduction

1.1 Background

Essex County Council (ECC) have been providing ongoing traffic modelling support through Essex Highways and Jacobs in relation to the emerging Local Plan proposals for the four districts which comprise the West Essex and East Herts (WEEH) Strategic Housing Market Area (SHMA). This has been conducted through the Co-operation for Sustainable Development Board, which comprises officers and Members from East Hertfordshire, Epping Forest, Harlow and Uttlesford District Councils, Hertfordshire and Essex County Councils, and Highways England.

Figure 1.1 Local Authorities in the Vicinity of Harlow



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The Harlow Transport Model (created using VISUM version 14) is being used to assess the likely impact on the highway network of the SHMA emerging Local Plan strategic development sites around Harlow, their likely scale, and possible infrastructure requirements that may result. The Harlow Transport Model originally had a base year of 2014. After agreement with ECC the model was enhanced and recalibrated as described in the Harlow Base Model Enhancements Technical Report dated April 2016.

The Harlow Transport Model is now being used to assist with the evaluation of the development sites and scale of development that can be delivered as part of the Harlow, Epping Forest, Uttlesford and East Hertfordshire District Councils' emerging Local Plans. This testing will initially look at the broader strategic effects of the combined Local Plan proposals. Local impacts on the highway network should then be studied in combination with more detailed local junction or micro-simulation modelling.

1.2 Purpose of this Report

The WEEH modelling project has produced the following technical notes reflecting its scope of work:

- Technical Note 1: Forecasting methodology
- Technical Note 2: Spatial Options A-E Results
- Technical Note 3: Spatial Option A1 Stort Crossing/Northern Bypass
- Technical Note 4: Emerging Option

- Technical Note 5: East Harlow VISSIM model
- Technical Note 6: Latton Priory and Southern Way Impacts

This report documents the approach to forecasting future traffic levels in 2033 for the Local Plan scenarios provided by ECC on behalf of Harlow, Epping Forest, Uttlesford and East Hertfordshire District Councils. The assumptions made and methodologies followed are detailed, as well as the scenarios tested. The other technical notes listed above report on the detail of development magnitudes, spatial strategies and infrastructure assumptions, and present findings of the different scenarios tested to date.

2. Forecast Methodology

2.1 Overview of Approach

A number of changes were required to the two fundamental components of the base model – the network and the traffic demand – to produce 2033 Local Plan scenario forecast models. These changes are described in more detail throughout this chapter.

Step 1 – The base network required coding in order to add and modify links and nodes that represent agreed future year highway schemes.

Step 2 – The calibrated matrices of the base model were updated to reflect traffic growth for the forecast year. This took into account both background growth in traffic in areas outside of the SHMA area, and trip generation associated with specific spatial options for Local Plan housing and employment developments. In addition other factors which affect trip growth were taken into consideration, such as fuel and income adjustments and growth at Stansted airport.

Step 3 – The future year trip matrices were then assigned to the future year networks to produce forecast models.

It should be noted that a variable demand model was being developed for the M11 J7a project but it was not ready at the time the Local Plans modelling commenced. Since it was not desirable to duplicate work on model development, a simpler approach of using a fixed trip matrix was used. It was recognised by ECC that this would have limitations, including on model convergence when dealing with high growth scenarios, but that this was acceptable for the initial tests of planning scenarios in order to identify difference between options. In subsequent phases of the Local Plans modelling project, the intention is to then use the J7a variable demand model in order to test scenarios further, including any preferred option.

The following two core pieces of information are therefore considered inputs for the forecasting methodology:

- A list of prospective developments provided by ECC on behalf of Harlow, Epping Forest, Uttlesford and East Hertfordshire District Councils to identify the developments (and magnitude of each development) to be included in the different forecast scenarios. For each development, this log provided details of the location, the land use type, the land use class, the proposed number of dwellings for housing developments, and the gross floor area in square metres of the developable area for non-housing developments.
- An agreed list of the highway infrastructure schemes and modifications with their potential completion dates.

2.2 Forecast Years / Time Periods

The Local Plan models have been produced for a forecast year of 2033 to align with Districts' emerging Local Plan timescales, with adjustment to reflect the different overall planning periods, with the VISUM modelling being based from 2014 to 2033, and the districts being 2011 to 2033. Development planning scenarios were provided by each of the districts and compiled in an Uncertainty Log for each modelling scenario. ECC ensured that timeframes for the planning scenarios aligned to the model period.

There has been no change to the time periods of the forecasts from the base model: morning peak hour (AM) 0800-0900, inter-peak (IP) 1100-1200, and evening peak hour (PM) 1700-1800. The majority of tests/results analysis (as described in accompanying technical notes) have tended to concentrate on AM and PM peak hour assessments (to concentrate on "worst case scenarios") or solely on the AM peak.

2.3 Forecast Network

2.3.1 Future Year Highway Schemes

The forecast networks include future year highway schemes as informed by ECC. These are shown in Table 2.1:

Table 2.1 List of Highway Schemes

Scheme Description	Opening Year
A414 / Clocktower Junction Capacity Upgrade	2016
Harlowbury additional site access	2016
Mulberry Green left in left out	2016
A414 / London Road Enterprise Zone New Access and New Hall Link Road	2017
A414 First Avenue / Gilden Way Junction Upgrade	2017
A414 Cambridge Road (Gates) Upgrade - including widening Edinburgh Way to 4 lanes	2017
A414 Edinburgh Way / East Road Signal Junction Improvement	2017
London Road closure (except to buses)	2017
Mark Hall School Drop Off to London Road	2017
A120 Little Hadham By-pass (and associated signal timing changes)	2019
M11 J7	2020
M11 J8 short term capacity improvements	2021
A120 / B1383 Capacity Improvements	2021
A120 / A1250 Capacity Improvements	2021
Bishop's Stortford North Development, Access onto Hadham Road	2021
Cambridge Road - new access into River Way	2021
Second Avenue / Velizy Avenue Junction Capacity Upgrade	2021
B183 London Road to Harlowbury Upgrade	2021
Lower Sheering Road, local access restriction	2021
Reduced speed limit on Gilden Way	2021
HGV ban through Old Harlow and Churchgate Street	2021
M11 J7a	2021
A414 west of Eastwick, new development access roundabout	2022
A414 Eastwick to Burnt Mill dualling	2024
A414 / Eastwick Road Junction Capacity Upgrade	2024
A414 / Fifth Ave junction improvement	2024
Bishop's Stortford North Development, Access onto A120	2026
Bishop's Stortford North Development, Access onto Rye Street x2	2026
Signalisation of double mini-roundabout in Sawbridgeworth	Assumed to be 2021

The more notable schemes are illustrated in Figure 2.1, Figure 2.2, and Figure 2.3 below:

Figure 2.1 M11 Junction 7a

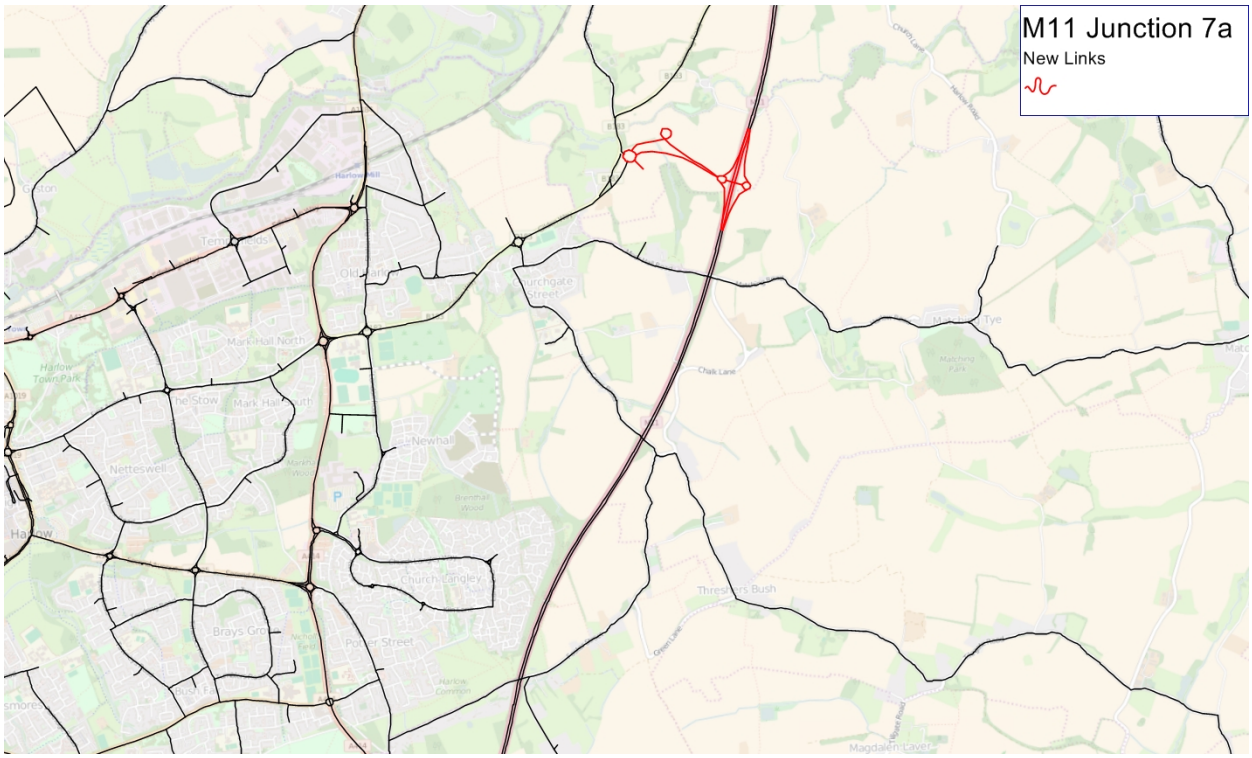

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Figure 2.2 Little Hadham Bypass

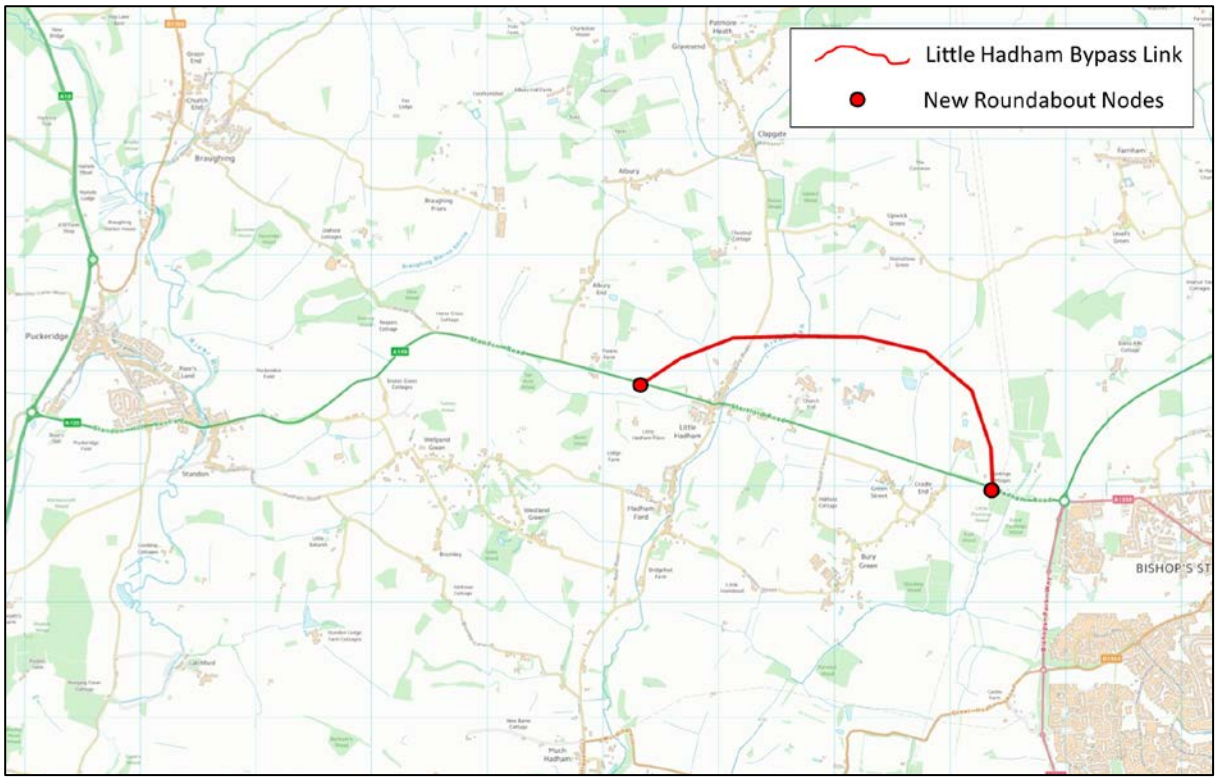

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Figure 2.3 M11 J7 Enhancements

2.3.2 Changes to Model Zone Structure and Centroid Connectors

The representation of Harlow and the surrounding area in the model is divided into zones. No changes were made to the number of zones in the model or to what is represented geographically by each of the zones present in the base year model.

The locations by which each zones traffic demand can enter and exit the network are known as centroid connectors. Where possible in the base model each zone was given a single connector. To reflect the new developments as part of the Local Plan in the future years, additional connectors were sometimes required for a number of zones.

In VISUM it is possible to specify the percentage share of traffic using each connector in a zone (in the case of a zone having multiple connectors). This can be defined separately for both the inbound and outbound directions. For new connectors dedicated to a new housing or employment development, all new generated traffic was assigned to the new connector. The connector share was calculated as the proportion of development traffic over all zone traffic. The remaining traffic was then assigned to the existing base year connector(s) relative to their previous percentage splits. The location of zones with additional connectors representing developing locations and modified connector shares are shown in Figure 2.4 and Figure 2.5:

Figure 2.4 Zones With Modified Zone Connector Shares in the Future Year Models - Harlow

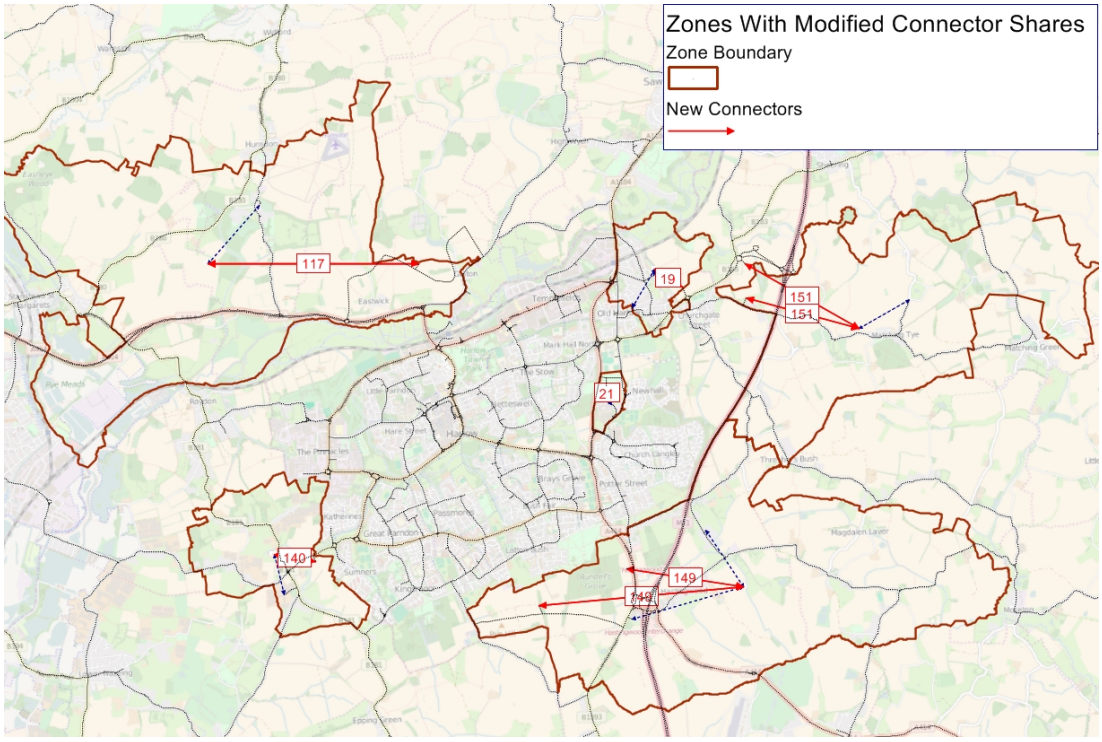
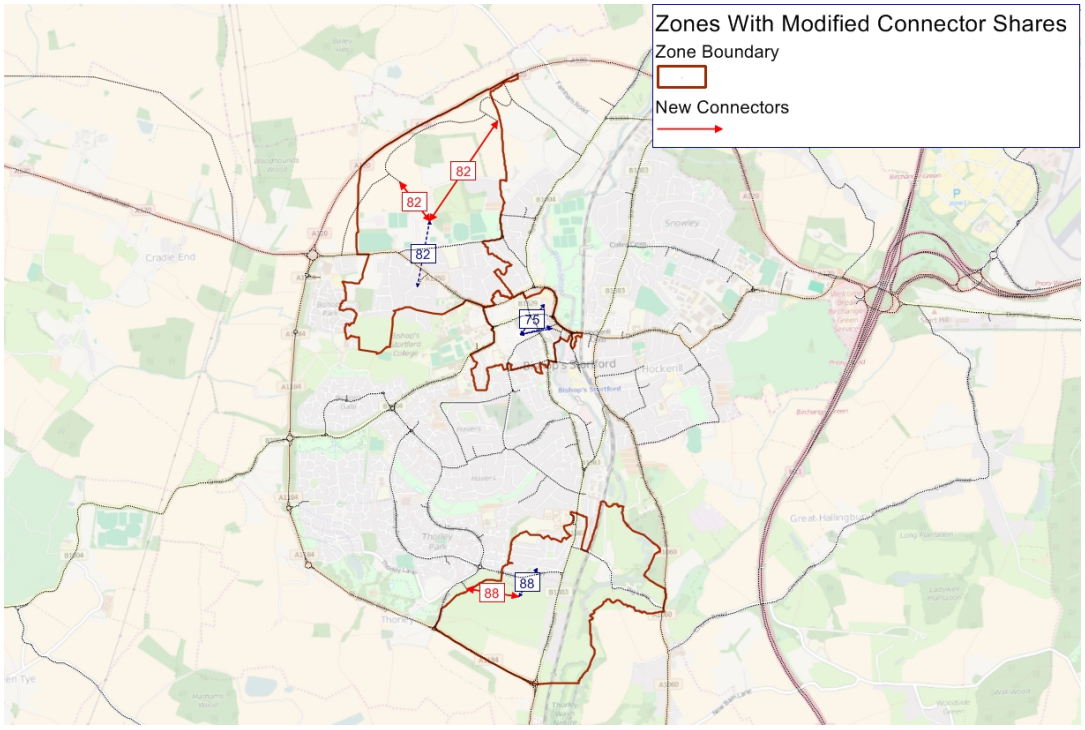


Figure 2.5 Zones With Modified Zone Connector Shares in the Future Year Models - Bishop's Stortford



3. Forecast Demand Matrix Building

3.1 Matrix Building Approach

The approach to forecasting trip demand within the study area starts with obtaining base year trip ends from the base model and factors them by National Trip End Model (NTEM) growth (using the Alternative Planning assumptions option in TEMPro). This produces background levels of growth, which are applied across the entire model (including external zones). Note that the Alternative Planning assumptions tool is used to subtract growth at those development sites from the Uncertainty Log in such a way as to avoid any double counting.

Then site-specific trip rates for those developments in the Uncertainty Log are calculated as the product of scale of development and trip rate information obtained from the Trip Rate Information Computer System (TRICS). The development site specific trip ends are added to the forecast year demand (already factored to adjusted NTEM growth) to obtain trip ends for use in forecasting.

In addition, matrix building incorporates other factors:

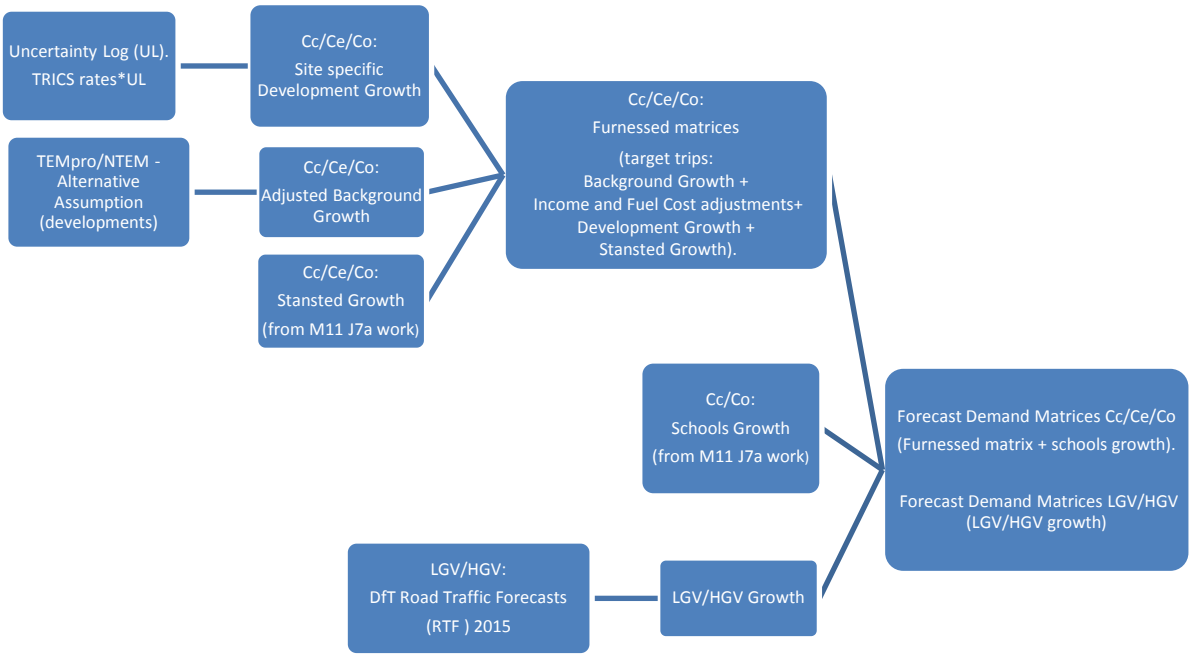
- Growth to and from Stansted airport (by using the same assumptions developed in the parallel Junction 7a M11 study);
- Goods vehicles growth applied to the LGV and HGV matrices using overall growth factors from the DfT Road Traffic Forecasts (RTF) for 2014 to 2033 (detailed later in 3.4.4);
- Schools growth – again using the same assumptions developed in the Junction 7a project; and
- Income and fuel adjustments applied to the background growth through TEMPro (detailed later in 3.4.3).

Figure 3.1 illustrates the matrix building process followed. The Furness method of generating future year matrices was used to combine NTEM background growth (including income and fuel adjustments), Uncertainty Log growth and Stansted airport growth for car user classes: Car commuting (Cc), Car employment (Ce), Car other (Co). A schools growth matrix is then added and global growth factors applied for goods vehicle growth.

The following sections provide a fuller explanation of the forecast demand methodology used. Specifically:

- Section 3.2 describes the approach to background growth using TEMPro/NTEM;
- Section 3.3 describes the approach to site-specific trip rates for those developments in the Uncertainty Log; and
- Section 3.4 describes how other factors were incorporated.

Figure 3.1 Forecast Demand Matrix Building Process



3.2 Background Growth using NTEM

The National Trip End Model (NTEM) model forecasts the growth in trip origin-destinations (or productions-attractions) for use in transport modelling. Data from NTEM is extracted using the Trip End Model Presentation Program (TEMPro v6.2). The forecasts take into account national projections of population, employment, housing, car ownership and trip rates. The level of growth in NTEM may include, partially or in full, local developments which are identified in an Uncertainty Log. This inclusion in both sources can lead to double counting of developments.

To overcome this double counting, the demand growth from future households and jobs expressed in each of the Uncertainty Logs was removed from TEMPro, using the ‘Alternative Planning Assumptions’ tool. In most cases this would involve subtracting the scenario household and jobs values from the TEMPro projected ones, resulting in background growth being derived from remaining TEMPro growth. However, in some cases removing the full scenario values from TEMPro would result in negative growth where the level of growth in the Uncertainty Log exceeded TEMPro levels of growth. In these cases the TEMPro growth was removed.

3.3 Site-specific Growth (Local Plan Development Sites)

Site-specific growth for cars was based on the ECC Uncertainty Log and translated into trip ends using the Trip Rate Information Computer System (TRICS) database and combined with the NTEM growth (subject to the comment in above where NTEM growth might have been removed).

Trip rates are required as trips originating and trips terminating in each of the AM, IP and PM periods. TRICS provides such rates for car, LGV, and HGV trips from 1st March 2013 onwards. Older data is also available and TRICS applies a default 8 year cut off on surveys included within the data. Data from March 2013 onwards was used to derive initial vehicle class specific trip rates, which were then used to determine factors which can be applied to the total overall trip rate derived from the larger 8 year data set. This method ensured that the sample sizes used to determine the trip rates are maximised (the TRICS Good Practice Guide provides no freely available specific information on what age of data remains valid to use and so, in the absence of this, the system default value of 8 years seemed most suitable).

The TRICS data was based on surveys from Monday to Friday only and was extracted for the following land use types:

- Housing;
- Employment;
- Leisure;
- Health;
- Retail;
- Hotel, Food and Drink

Further details are shown in Appendix A. However, final trip rates derived are shown in the table below.

Table 3.1 Housing AM-period vehicle trip rates per dwelling from TRICS for this study

Vehicle Type	AM			IP			PM		
	Arrivals	Departures	Total	Arrivals	Departures	Total	Arrivals	Departures	Total
	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate
CARS (inc. Taxis)	0.099	0.332	0.431	0.117	0.120	0.237	0.271	0.160	0.431
LGVS	0.048	0.062	0.110	0.034	0.037	0.071	0.083	0.040	0.123
HGVS	0.005	0.003	0.008	0.003	0.002	0.005	0.003	0.003	0.006
Total	0.152	0.397	0.549	0.154	0.159	0.313	0.357	0.203	0.56

Employment trip rates within TRICS include the following land use sub-classes:

- Employment Category A: Office (B1);
- Employment Category B: Business Park (B1);
- Employment Category C: Industrial Estate (B1);
- Employment Category C: Industrial Estate (B2); and
- Employment Category F: Warehousing (B8).

Trip rates for employment developments were extracted for same regions and areas as those for homes and included the trip surveys for all location types. The trip rates were calculated as trips per 100m^2 developable area.

The final employment trip rates calculated are shown in Appendix B. The car rates were then used within the model. LGV and HGV growth uses a global factor and no site specific growth was used.

Proposed developments in the four Districts also included a small number of other land use types in addition to housing and employment: Retail, Leisure, Education, Hotels, Shops and Health Centres.

Trip rates available within TRICS include the following land use sub-classes:

- Retail Category K: Retail Park (A1);
- Retail – Category I: Shopping Centre (A1);
- Retail – Category A: Food Superstore (A1);
- Health – Category G: GP Surgeries (D1);
- Leisure – Category O: Leisure Park (D2); and
- Hotel, Food and Drink Category A: Hotels (C1).

The trip rates were calculated for each of these main land use classes as:

- Retail – Trips per 100m^2;
- Health – Trips per doctor;
- Leisure – Trips per 100m^2 (converted from hectares to m^2); and
- Hotel, Food and Drink – Trips per bedroom.

The final trip rates calculated for the above land uses classes are shown in Table B.2, Table B.3, and Table B.4, in Appendix B.

3.4 Other Growth and Considerations

3.4.1 Stansted Airport Expansion Growth

Stansted Airport growth was applied separately to modelled zones 91 and 92 (which cover the airport in the model). This approach was consistent with the previous M11 forecast work being undertaken at the same time, as agreed with Essex County Council. There is assumed growth to 35 million passengers per annum (mppa) by 2025 onwards.

The Stansted growth was added to the relevant zones in the initial target forecast matrices for car user classes. These growth figures were the same for each scenario but differ by modelled time period.

The methodology for forecasting Stansted airport growth is described in the report of the Junction 7a study. The forecasts generated from the J7a project were used directly.

3.4.2 Schools Growth Forecasting

School-related trips were not included within the initial trip rates derivation. To remain consistent with the J7a M11 forecasts being undertaken at the same time as this methodology was developed, it was agreed with ECC to continue to consider school-related trips separately.

School-related growth was applied cumulatively to the forecast matrices for each user class to generate the final forecast matrices for use in the 2033 forecast assignments. Both car commuter and car other purpose trips were considered in this process. It is also noted that the values for PM trip growth from schools would appear high when it is considered that the peak period for school traffic falls before the overall modelled PM peak period.

The methodology for schools growth forecasting is described in further detail in the J7a study.

3.4.3 Income and Fuel Cost Adjustments

Income and fuel cost adjustments were made in accordance with WebTAG guidance M4, 'Forecasting and Uncertainty', paragraph 7.4.13. They are only applied to the background growth taken from NTEM.

Table 3.2 Income and Fuel Cost adjustment factors

Income and Fuel Cost Factors 2014 - 2033		
	Income adjustment factor	Fuel cost adjustment factor
2014	1.010	1.032
2033	1.057	1.102

3.4.4 HGV and LGV Global Factors

TEMPro/NTEM data is not available for goods vehicles so growth factors from the Department for Transport (DfT) Road Traffic Forecasts (RTF) 2015 were applied to the full LGV and HGV matrices using the figures below:

Table 3.3 LGV and HGV Growth Factors

Goods Vehicles Global Factors 2014 - 2033	
LGV	1.50
HGV	1.19

3.4.5 Assumed Sustainability Implicit Within the Trip Rates

Table 3.4 presents the AM and PM modal split of all people trips made by vehicle (multi or single occupancy), cyclists, pedestrians and public transport users obtained from TRICS and shows a level of sustainability implicitly assumed within the car model trip rates used:

Table 3.4 Survey Modal Splits of TRICS Housing Rates

Modal Choice	AM			PM		
	Arrivals	Departures	Totals	Arrivals	Departures	Totals
Vehicle Occupants	78.0%	75.1%	75.7%	81.8%	82.5%	82.0%
Pedestrians	19.6%	20.9%	20.6%	12.7%	13.4%	12.9%
Cyclists	1.6%	2.3%	2.1%	3.0%	2.8%	2.9%
Public Transport Users	0.8%	1.7%	1.6%	2.5%	1.4%	2.2%
Total	100%	100%	100%	100%	100.1%	100%

3.5 Components of Generalised Cost

As with the base model, five demand matrices were created for assignment onto the forecast model network. These represented three car purposes (for commuting, employer's business and other purposes), Light Goods Vehicles (LGVs) and Heavy Goods Vehicles (HGVs). The generalised cost formulations for each of the demand segments were updated for the forecast year to represent changes in the perceived values of time (VOT) and vehicle operating costs (VOC) anticipated for 2033. These projections were taken from the December 2014 version of the WebTAG Databook and the HGV VOT was doubled to maintain consistency with the base model. The updated forecast VOTs and VOCs are shown in Table 3.5 below:

Table 3.5 2033 Cost Parameters

	AM Period		IP Period		PM Period	
User Class	VOT (pence / min)	VOC (pence / km)	VOT (pence / min)	VOC (pence / km)	VOT (pence / min)	VOC (pence / km)
UC1 Commuting	19.16	6.08	19.04	6.08	18.84	6.08
UC2 Employer's Business	65.15	14.38	63.87	14.38	62.67	14.38
UC3 Other	23.65	6.08	24.56	6.08	25.45	6.08
UC4 LGV	29.70	14.60	29.70	14.60	29.70	14.60
UC5 HGV	60.15	62.93	60.15	62.93	60.15	62.93

4. New Local Plan Developments Trip Distribution

Some proposed developments are on (relatively) green field sites where there is little or no representative travel demand in the base situation. If the methodology were to rely on the distribution of the trips to or from these existing sparsely populated zones in the base matrix, then it would be unlikely to adequately reflect the likely trip distributions generated by the development. A more realistic trip distribution pattern was therefore needed to represent trips to and from these developments and the seeding approach adopted identifies one (or combines more than one) ‘parent zone’ with similar trip distribution patterns to those expected from the new development, and uses it to provide a revised underlying trip pattern for the zone containing the development.

The trip end totals and revised seeding distributions were calculated and imported into VISUM. Within VISUM a Furness Process was undertaken using the inbuilt Matrix Projection tool. This process aimed to meet the trip-end targets for both origins and destinations set by the defined targets to create a set of forecast matrices.

The location of each development was provided either by the X Y coordinates contained within the Uncertainty Log (as detailed in Technical Note 2) or by an additional GIS shape file both provided by the relevant District through ECC. The match of each development with the relevant zone number of the model was achieved and checked by displaying the sites on a joint GIS layer, according to their coordinates, overlaid with the model zoning system.

The list of correspondence between the base model zones and the parent zones is shown in Table 4.1:

Table 4.1 Base Model Zone and Parent Zone Correspondence

Development Type	Development Description	Uncertainty Log Ref	Base Model Zone No	Parent Zone(s)	Parent Zone Location
Housing	Land at Wych Elm – Little Parndon	326	5	194	Little Parndon
	Land North of Gilden Way – Old Harlow	298	19	99 + 25	Church Langley
	East Harlow (EFDC)	325	151	99 + 25	Church Langley
	East Harlow (HDC)	383	24	99 + 25	Church Langley
	New Hall Phase 2 & 3	305	23	99 + 25	Church Langley
	Latton Priory	372	149	99 + 25	Church Langley
	Gilston	52, 53	117	42 + 38 + 99 + 25	Combined Katherines, Sumners, Church Langley
	West Katherines and West Sumners	333, 375	140	42 + 38	Combined Katherines, Sumners
	Bishop's Stortford North	27,28	82	83 + 84 + 85	South West of Bishop's Stortford
	Land South of Bishop's Stortford	26	88	83 + 84 + 85	South West of Bishop's Stortford
Employment	Harlow Enterprise Zone - London Road North	336	21	41+43+44	Pinnacles
	Latton Priory	372,378	149	41+43+44	Pinnacles

5. Scenarios Tested and Accompanying Technical Notes

There are a number of additional accompanying technical notes which detail development magnitudes and characteristics, results, findings, and conclusions for the different scenarios tested and work carried out to date.

The scenarios initially tested were five core spatial development options (A-E), all with the M11 J7a "ECC option" in place. These Local Plan scenarios were prepared by the HMA District Officers Working Group based on work done by AECOM in March 2016. The scenarios consider both the number of homes to be provided in the vicinity of Harlow for the HMA and with varying levels of settlement in specific locations.

Subsequently, ECC provided a spatial option variant A1 and, at their request, this was used to test the effects of the three proposed phases of the Harlow Northern Bypass (M11 J7a only, Additional River Stort Crossing, full Northern Harlow Bypass).

ECC then provided another spatial option, named "the Emerging Option". This set of Local Plan developments were tested with specific investigation in to the effects of strategic sites to the west (Katherines/Sumners), east (East Harlow), and south (Latton Priory) of the edge of Harlow Town Centre.

The additional technical notes include:

- **Technical Note 2: Spatial Options A-E Results** – including inputs, outputs, findings and comparison between the different options, and identification of areas of the Harlow road network likely to perform unsatisfactorily under the 2033 scenarios;
- **Technical Note 3: Spatial Option A1 Stort Crossing/Northern Bypass**– a note explaining the impact and findings on strategic and Harlow traffic of the different phases of the potential Northern Bypass;
- **Technical Note 4: Emerging Option**– a selected Local Plan scenario including inputs, findings, comparison to base and Reference Case, and potential problems and solutions;
- **Technical Note 5: East Harlow VISSIM** – a specific note describing micro-simulation modelling undertaken to study the more localised impacts of the proposed East Harlow development; and
- **Technical Note 6: Latton Priory and Southern Way Impacts** – a specific note identifying the modelled impact on the local network of Latton Priory and Katherines/Sumners strategic sites to the south and west of Harlow to further inform the Local Plan process.

References

Jacobs, April 2016, “Harlow Base Model Enhancements Technical Report”

Appendix A. Housing Trip Rates

The following urban areas were considered to have very well-established Public Transport provision. Consequently private vehicle trip rates may not be representative and have been excluded from the selection:

- West Midlands;
- South Yorkshire;
- West Yorkshire;
- Greater Manchester;
- Merseyside;
- Tyne & Wear;
- Aberdeen City;
- City of Edinburgh;
- East Lothian; and
- Glasgow City.

The forecast model includes trip matrices for Cars, LGV and HGV. However TRICS only provides a vehicle type breakdown (Cars, LGV, HGV, PSV, Motorcycles, Taxis) for surveys from 2013 onwards.

To ensure as large a sample size as possible, the vehicle type breakdown from 2013 was applied to the 2007 total trip rates. The methodology (used for all types of developments (main and sub land use types)) was therefore based on the following:

- Step 1: Trip rates from TRICS from 2007 onwards were extracted to total person trip rates.
- Step 2: Trip rates from TRICS from 2013 and onwards were extracted to provide multi-modal breakdown by vehicle type (Cars, LGV, HGV, PSV, Motorcycles, and Taxis).
- Step 3: The vehicle type percentage breakdown obtained at Step 2 was applied to data obtained in Step 1 by applying the 2013 vehicle type breakdown from TRICS to the total vehicles from 2007 TRICS dataset.

Trip rates for housing developments were extracted for the regions and areas described above. Each main land use category in TRICS includes different land use sub-classes. The housing trip rates for this work were agreed to be based on the TRICS category “Houses Privately Owned” for all developments. The trip rates were calculated as trips per dwelling. The housing trip rates extracted for 2007 onwards are shown in Table A.1 in Appendix A.

The percentage vehicle type splits (derived from 2013-onwards data) are then shown in Table A.2. The trip rates for Cars/LGV/HGV/PSV/Taxis/Motorcycles were then projected to the 2007 trip rates as shown in Table A.3.

The resulting trip rates were amalgamated to match the required user classes within the model. The final housing trip rates are shown in Table A.4.

The car trip rates were then used within the VISUM model. It was decided that the LGV and HGV trip rates would not be used and would be derived from global growth factors (due to the inability to reconcile site-specific growth with TEMPro alternative assumptions for goods vehicles).

Table A.1 Housing Trip Rates for Total Vehicles (2007 onwards)

Vehicle Type	AM			IP			PM		
	Arrivals	Departures	Total	Arrivals	Departures	Total	Arrivals	Departures	Total
	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate
VEHICLES (2007 onwards)	0.152	0.403	0.55	0.156	0.161	0.32	0.364	0.206	0.57

Table A.2 Trip Rate Percentage by Vehicle Type (2013 onwards)

Vehicle Type	AM		IP		PM	
	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
	% Trip Rate	% Trip Rate	% Trip Rate	% Trip Rate	% Trip Rate	% Trip Rate
TAXIS	5.26%	2.21%	3.33%	2.86%	1.42%	1.49%
HGVS	3.51%	0.74%	1.67%	1.43%	0.71%	1.49%
CARS	59.65%	80.15%	71.67%	71.43%	73.05%	76.12%
LGVS	31.58%	15.44%	21.67%	22.86%	22.70%	19.40%
MOTOR CYCLES	0.00%	1.47%	0.00%	0.00%	2.13%	1.49%
PSV	0.00%	0.00%	1.67%	1.43%	0.00%	0.00%

Table A.3 Projected Housing Trip Rates by Vehicle Type (2007 onwards)

Vehicle Type	AM			IP			PM		
	Arrivals	Departures	Total	Arrivals	Departures	Total	Arrivals	Departures	Total
	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate
VEHICLES (2007 onwards)	0.152	0.403	0.555	0.156	0.161	0.317	0.364	0.206	0.57
TAXIS	0.008	0.009	0.017	0.005	0.005	0.010	0.005	0.003	0.008
HGVS	0.005	0.003	0.008	0.003	0.002	0.005	0.003	0.003	0.006
CARS	0.091	0.323	0.414	0.112	0.115	0.227	0.266	0.157	0.423
LGVS	0.048	0.062	0.110	0.034	0.037	0.071	0.083	0.040	0.123
MOTOR CYCLES	0.000	0.006	0.006	0.000	0.000	0.000	0.008	0.003	0.011
PSV	0.000	0.000	0.000	0.003	0.002	0.005	0.000	0.000	0.000
Sum of Trip Rates (All Vehicle Types)	0.152	0.403	0.555	0.156	0.161	0.317	0.364	0.206	0.570

Table A.4 Final Housing Trip Rates by Vehicle Type (Cars, LGVs, and HGVs)

Vehicle Type	AM			IP			PM		
	Arrivals	Departures	Total	Arrivals	Departures	Total	Arrivals	Departures	Total
	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate
CARS (inc. Taxis)	0.099	0.332	0.431	0.117	0.120	0.237	0.271	0.160	0.431
LGVS	0.048	0.062	0.110	0.034	0.037	0.071	0.083	0.040	0.123
HGVS	0.005	0.003	0.008	0.003	0.002	0.005	0.003	0.003	0.006
Total	0.152	0.397	0.549	0.154	0.159	0.313	0.357	0.203	0.56

The total overall AM vehicle trip rates generated from TRICS through the methodology described above were compared with other studies to check that they were reasonable. As shown in Figure A.1 and Figure A.2, the Harlow rates are in line with other Essex sources and are therefore considered to be robust. This means that we are unlikely to be understating the number of car trips generated by developments in the modelling

Figure A.1 Comparison of Harlow model AM Arrivals Housing Trip Rates with other Essex Sources

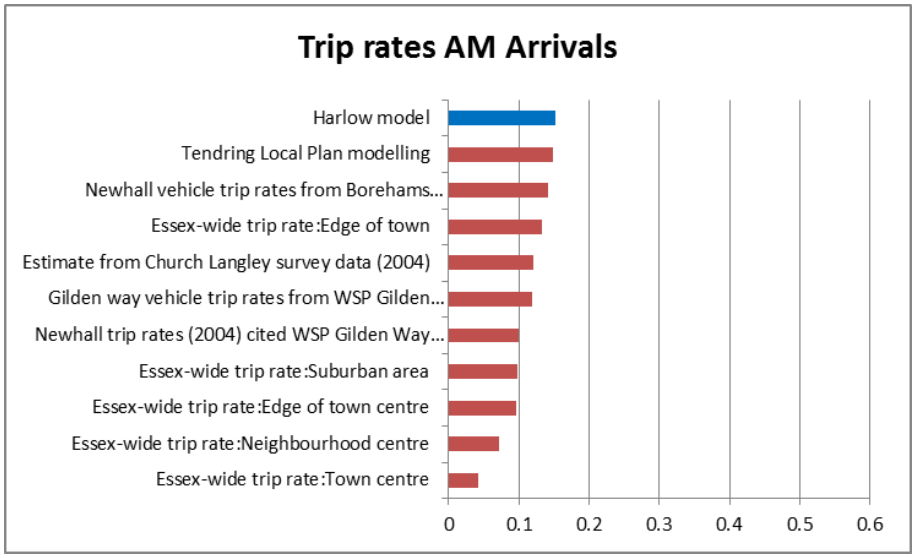
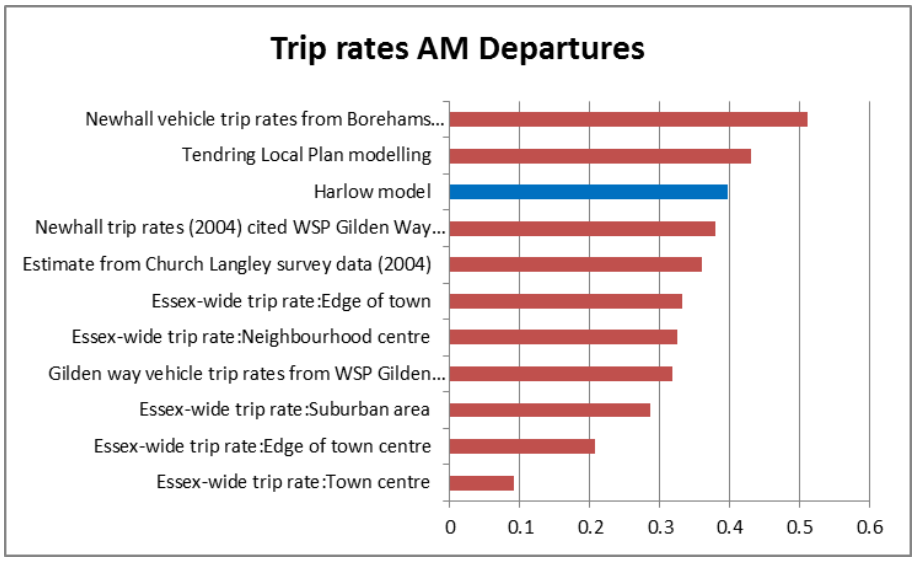


Figure A.2 Comparison of Harlow Model AM Departures Vehicular Housing Trip Rates with other Essex Sources



By comparison to the Tendring values (a more rural area with poorer public transport provision), for example, the Harlow model values for car trip rates are robust as they are slightly lower, but still large enough to give a realistic estimate of the number of trips produced by the Local Plan strategic sites.

In addition, these trip rates were compared to data made available by ECC from a recent survey carried out by WSP. This survey used traffic count data from the entry/exit of the Katherines estate from November 2016 and was combined with information regarding the number of homes within the Katherines estate to derive a “first

principles" alternative set of trip rates. Table A.6 and Table A.7 show the AM trip rates derived for our study and those derived from the WSP survey respectively so that they can be compared:

Table A.5 Housing AM-period trip rates from TRICS for this Study

Vehicle Type	AM		
	Arrivals	Departures	Total
	Trip Rate	Trip Rate	Trip Rate
CARS (inc. Taxis)	0.099	0.332	0.431

Table A.6 AM-period Trip Rates Derived from the WSP Survey Provided by ECC

Vehicle Type	AM		
	Arrivals	Departures	Total
	Trip Rate	Trip Rate	Trip Rate
CARS (inc. Taxis)	0.142	0.340	0.482

It is possible to see that there are only small differences in the rates used from the TRICS assumptions and those that would be derived from the survey. In the residential peak direction (AM departures) the TRICS assumptions used are -2% compared with the trips that would have been modelled using the survey assumptions (this equates to an underestimate of only -17 trips for AM departures for 2,100 proposed homes at Katherine/Sumners). The largest variation for the trips is an underestimate of the AM arrivals by 92 vehicles. This is likely due to the fact that there is Katherines Primary School that would act as an additional attractor in the AM peak which is not explicitly contained within the more generic TRICS assumptions.

Appendix B. Employment Trip Rates

Table B.1 Final Employment Trip Rates per 100m² by Vehicle Type (Cars, LGVs and HGVs)

Sub Land Use	Vehicle Type	AM			IP			PM		
		Arrivals	Departures	Total	Arrivals	Departures	Total	Arrivals	Departures	Total
		Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate	Trip Rate
Office (B1)	CARS	1.282	0.082	1.364	0.200	0.173	0.373	0.074	1.098	1.172
	LGVS	0.082	0.070	0.151	0.055	0.047	0.10	0.036	0.038	0.074
	HGVS	0.009	0.007	0.016	0.003	0.003	0.005	0.003	0.006	0.009
Business Park (B1)	CARS	0.924	0.071	0.994	0.072	0.093	0.164	0.079	0.711	0.790
	LGVS	0.533	0.079	0.612	0.171	0.177	0.348	0.022	0.323	0.345
	HGVS	0.043	0.011	0.055	0.011	0.008	0.019	0.004	0.039	0.043
Industrial Estate (B1)	CARS	0.355	0.077	0.432	0.126	0.180	0.306	0.078	0.265	0.342
	LGVS	0.280	0.229	0.509	0.170	0.169	0.340	0.079	0.217	0.296
	HGVS	0.087	0.077	0.164	0.028	0.025	0.053	0.039	0.057	0.096
Industrial Estate (B2)	CARS	0.008	0.004	0.012	0.006	0.000	0.006	0.013	0.016	0.029
	LGVS	0.329	0.196	0.525	0.235	0.257	0.492	0.089	0.289	0.377
	HGVS	0.055	0.015	0.069	0.028	0.030	0.058	0.000	0.027	0.027
Warehousing (B8)	CARS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	LGVS	0.000	0.013	0.013	0.000	0.000	0.000	0.000	0.000	0.000
	HGVS	0.038	0.007	0.045	0.019	0.026	0.045	0.016	0.043	0.059

Trip Rates – Other Land Use Developments

Table B.2 Retail and Leisure Trip Rates per 100m²

Main Land Use	Sub Land Use	Category	AM			IP			PM		
			Arrivals	Departures	Total	Arrivals	Departures	Total	Arrivals	Departures	Total
			Trip Rate per 100m²	Trip Rate per 100m²	Trip Rate per 100m²	Trip Rate per 100m²	Trip Rate per 100m²	Trip Rate per 100m²	Trip Rate per 100m²	Trip Rate per 100m²	Trip Rate per 100m²
Retail	Retail Park (A1)	HGVS	0.405	0.206	0.611	0.000	0.000	0.000	0.000	0.000	0.000
		CARS/Taxis	0.000	0.000	0.000	0.473	0.365	0.839	0.000	0.000	0.000
		LGVS	0.000	0.000	0.000	0.473	0.730	1.204	0.000	0.000	0.000
	Shopping Centre (A1)	HGVS	0.171	0.162	0.333	0.765	0.725	1.490	0.153	0.082	0.235
		CARS/Taxis	3.501	3.471	6.972	2.685	2.636	5.321	5.238	5.801	11.039
		LGVS	2.067	1.897	3.964	2.971	2.907	5.878	1.368	1.390	2.758
	Food Superstore (A1)	HGVS	0.075	0.055	0.130	0.056	0.022	0.078	0.014	0.012	0.027
		CARS/Taxis	2.104	1.531	3.635	4.202	3.959	8.161	4.495	4.744	9.239
		LGVS	0.360	0.286	0.646	0.313	0.324	0.637	0.378	0.338	0.716
Leisure	Leisure Park (D2)	HGVS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		CARS/Taxis	12.855	9.834	22.689	9.358	11.098	20.455	33.250	25.816	59.066
		LGVS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table B.3 Health Trip Rates per doctor

Main Land Use	Sub Land Use	Category	AM			IP			PM		
			Arrivals	Departures	Total	Arrivals	Departures	Total	Arrivals	Departures	Total
			Trip rate per doctor	Trip rate per doctor	Trip rate per doctor	Trip rate per doctor	Trip rate per doctor	Trip rate per doctor	Trip rate per doctor	Trip rate per doctor	Trip rate per doctor
Health	GP Surgeries (D1)	HGVS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		CARS/Taxis	4.701	2.050	6.750	3.856	4.419	8.275	2.343	3.672	6.015
		LGVS	0.262	0.293	0.555	0.592	0.491	1.083	0.000	0.000	0.000

Table B.4 Hotels, Food and Drink Trip Rates per bedroom

Main Land Use	Sub Land Use	Category	AM			IP			PM		
			Arrivals	Departures	Total	Arrivals	Departures	Total	Arrivals	Departures	Total
			Trip rate per bedroom	Trip rate per bedroom	Trip rate per bedroom	Trip rate per bedroom	Trip rate per bedroom	Trip rate per bedroom	Trip rate per bedroom	Trip rate per bedroom	Trip rate per bedroom
Hotels, Food and Drink	Hotels (C1)	HGVS	0.007	0.008	0.015	0.005	0.000	0.005	0.000	0.000	0.000
		CARS/Taxis	0.104	0.171	0.275	0.056	0.098	0.153	0.123	0.075	0.198
		LGVS	0.006	0.012	0.017	0.010	0.006	0.016	0.019	0.011	0.030