M11 Junction 7a

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1. Introduction

1.1 Project Background

1.1.1 Essex County Council (ECC) has commissioned Jacobs to deliver the Economic Assessment Report (EAR) for the proposed M11 Junction 7a scheme. The scheme is located between Junctions 7 and 8 of the M11 motorway and includes a grade separated junction and a link road joining the M11 with the B183 Gilden Way east of Harlow, Essex. This document is an update of the previous EAR produced in August 2017.

1.1.2 Harlow is part of the M11 corridor, one of the four key growth areas set out in the Government's 2003 Sustainable Communities Plan. The A414 connects Harlow to the M11 via the existing Junction 7 which is the only connection to the Strategic Road Network (SRN).

1.1.3 Harlow currently suffers from severe congestion in peak periods, as the A414 is both the prime distributor for the town, as well as the through route between Chelmsford, Hertford and beyond. The situation is exacerbated by the location of key industrial sites on the northern and western sides of the town, which are the furthest points from the A414 and the M11 Junction 7 to the south-east of the town. Further pressure comes from the development of the Enterprise Zone situated immediately adjacent to the A414 which is likely to provide around 5,000 jobs in the area. In addition, further development to support economic growth through the Local Plan process will place additional pressure on the local and strategic road network.

1.1.4 The purpose of the current scheme is to provide additional access to the wider road network and alleviate the existing congestion across the town, making it a more attractive place to invest, retain existing business and to allow the town to grow. Without additional highway access to the town, economic vitality and growth will not happen and the potential of the town to support sub-regional growth and prosperity will be lost. The scheme will improve across the whole of Harlow and improve network resilience to open up key development sites, provide additional access to the strategic road network, reduce congestion on the A414 and reduce congestion at M11 J7.

1.1.5 Constraints have already been placed on the development of the Local Enterprise Zone, which can only be relieved by additional road improvements, primarily improving access to the M11. This scheme has been identified as a priority in the Essex Growth Strategy (EGS) and is also supported by the South East LEP.

1.2 Scheme History

1.2.1 The transport infrastructure of Harlow has been recognised as a major issue for both businesses and residents. The 2005 Harlow Transportation Study was undertaken to test the feasibility of major population and employment growth in the area against the existing transport infrastructure. The study considered two main planning scenarios based around the construction of 19,000 new housing units over and above the then existing Local Plan commitments by the year 2021.

- **Scenario 1** placed the additional development on a north-south axis, including significant residential development to the north of the A414 in the vicinity of Eastwick and Gilston Park.

- **Scenario 2** placed the additional development on an east-west axis, with a smaller cluster of residential development along the B183 to the north east of the town.

1.2.2 The 2005 report had highlighted the shortcomings of the existing J7. Work was therefore undertaken in 2005/06 to investigate the possibility of establishing a direct link between the A414 (Harlow) and the M11 southbound.

1.2.3 In 2007 a Feasibility Study was undertaken to assess the feasibility of constructing a link road from the A414 dual carriageway north of Harlow to the M11, with the objective to open up development potential around Harlow.

1.2.4 Two options were considered:

- Providing a link from the existing A414 north of Harlow to the M11 (A414-M11 link)
- Providing a link from the M11 to the East of Harlow (link into East Harlow)

1.2.5 The Harlow Junction 7a Feasibility Study, 2011, was undertaken to assess the feasibility of a new junction on the M11 between junctions 7 and 8 together with a new link road connecting into the existing Harlow road network.

1.2.6 A crucial difference between this study and previous schemes was the extent of the associated link road. All the previous schemes had envisaged a new link road form the M11 at least as far as A1184 at Harlow Mill, and generally without an interchange on the B183. In contrast, this study envisaged that the connection to the new junction would be provided by an extension and possible upgrading of Gilden Way – the newer southern section of the B183.

1.3 Scheme Objectives

1.3.1 ECC and local districts have identified the scheme objectives shown in Table 1-1.

Table 1-1 : Scheme objectives

Scheme Objectives
• To improve accessibility to and from Harlow; • To ensure the proposed infrastructure is the appropriate scale for future traffic demands; • To facilitate future housing developments around Harlow and employment growth to the east of Harlow; and • To reduce congestion primarily for the A414 corridor.

1.4 Scenario Assessment

1.4.1 The economic appraisal of the scheme was undertaken across the following growth scenarios:

- Core – based on the NTEM growth, including all completed, permitted, near certain and more than likely developments;
- ECC Medium growth *(i.e. ECC most likely)*;
- ECC High growth *(i.e. ECC Emerging Local Plan)*;
- WebTAG Low *(i.e. low growth)* – based on the proportional low growth of the core scenario; and

- WebTAG High *(i.e. high growth)* – based on the proportional high growth of the core scenario.

1.4.2 The main economic appraisal will present the headline results of the core scenario, and the ECC Medium, ECC High, WebTAG Low and WebTAG High growth scenarios will be presented as a sensitivity test.

1.5 Model Development and Traffic Forecasting Overview

1.5.1 The Harlow Transport Model is used to forecast the future traffic levels for the area around Harlow and Bishop's Stortford covering the M11 corridor.

1.5.2 The Harlow Transport Model uses the PTV VISUM strategic transport modelling software package and has a base year of 2014. The 'Harlow Transport Model LMVR', which was last updated in March 2017, describes how the model was developed, tested and verified, demonstrating that the model is fit for purpose.

1.5.3 Following construction of the validated base model, Jacobs was commissioned in June 2014 by Essex County Council to construct forecast year models to assess proposed highway improvements. The primary objective of the model development was to assess the effect on traffic of the highway options for improved access to Harlow from the Strategic Road Network and to inform scheme appraisal documents.

1.5.4 For the purposes of the forecasting exercise there are three growth scenarios modelled: NTEM, medium and high. The NTEM growth scenario is the core scenario for the economic analysis, while the medium and high growth scenarios are considered as sensitivity tests.

1.5.5 The forecast models have been prepared for three years; 2021 which is the anticipated opening year the scheme (new access to the M11 near Harlow), and two forecast years 2036 and 2051, in order to complete a full economic appraisal of the scheme. Forecast models were developed for three alternative growth scenarios for each of the above three years for the "Do Minimum" and "Do Something" scenarios.

1.6 Economic Assessment

1.6.1 As explained in TAG Unit A1.1, an economic assessment is undertaken to facilitate the quantification and monetisation of scheme costs and benefits. Overall, schemes are assessed against relevant government objectives, which include:

- provide good value for money in relation to impacts on public accounts;
- improve transport economic efficiency for business users and transport providers;
- improve transport economic efficiency for consumer users; and
- improve reliability.

1.6.2 An economic assessment is undertaken over a 60-year period in accordance with the requirement of TAG Unit A1.1[1]. Economic assessment results are presented in the form of Transport Economic Efficiency (TEE), Public Accounts (PA), and Analysis of Monetised Costs and Benefits (AMCB) tables. The results will also inform the Appraisal Summary Table (AST) of this scheme presented as part of the Interim Full Business Case.

[1] Department for Transport, May 2018, TAG UNIT A1.1 Cost-Benefit Analysis

1.7 Purpose of this report

1.7.1 The EAR describes the methodology used to undertake the economic assessment. It includes a description of the derivation of scheme costs, user benefits for travel time, vehicle operating costs, accidents and journey time reliability. Delays associated with the scheme construction and maintenance have also been assessed as well as the impact on environmental variables such as air quality, emissions and noise. The value for money expressed as a Benefit to Cost Ratio (BCR) is a key output and is determined in accordance with the requirements of TAG Unit A1.1.

1.7.2 The content of the report is based upon the requirements set out in 'Interim Advice Note 106/08 – Guidance Note for Traffic Consultants Employed on HE Schemes'.

1.8 Structure of this report

1.8.1 The remainder of this report describes the stages involved in the development of the economic assessment and contains appropriate reporting of the outputs from the process. The structure of the remainder of this report is as follows:

- **Chapter 2 Economic Assessment Methodology**– explains the economic assessment approach adopted and the derivation of shortlisted scheme options' benefits.
- **Chapter 3 Estimation of Costs** – describes the derivation of the scheme costs.
- **Chapter 4 Estimation of Benefits**– provides a summary of the economic assessment results.
- **Chapter 5 Core Scenario Appraisal Summary**– provides a summary and conclusion to the above for the NTEM growth scenario.
- **Chapter 6 Wider Impacts** – provides an overview of the impacts of the scheme outside the transport market.
- **Chapter 7 Sensitivity Tests Appraisal Results** – provides a summary and conclusion to a number of sensitivity tests, including the ECC medium and high growth.
- **Chapter 8 Summary and Conclusions** - discusses overall summary and conclusions.

2. Economic Assessment Methodology

2.1 Introduction

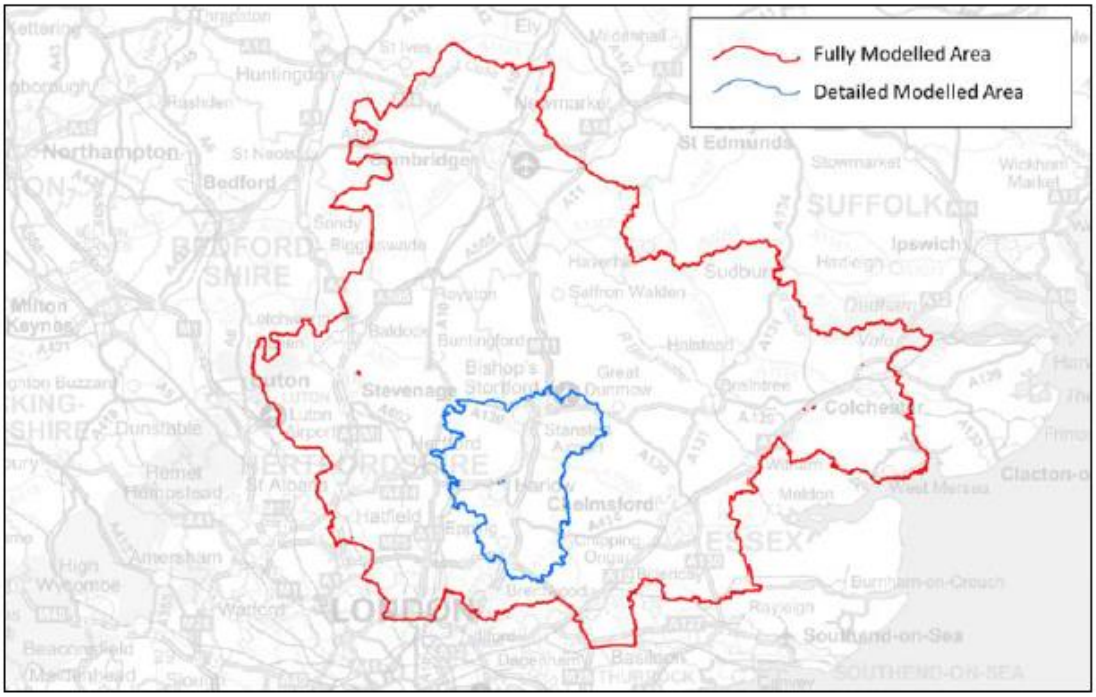
2.1.1 The economic assessment is based on the outputs of transport models which predict the movement of people and vehicles in the Do Minimum and Do Something scenarios based on a range of standard parameters. It involves the determination of the costs and benefits of the scheme using traffic flows and speeds obtained from the traffic model to derive travel time savings, vehicle operating costs, accident, environmental and indirect taxation impacts.

2.2 Study Area

2.2.1 The model covers the urban areas along the M11 from Epping in the south to Bishop's Stortford and Stansted Airport in the north of the modelled area. The model is centred on the town of Harlow which is the focal point of the area of interest. Harlow, Epping Forest, Uttlesford and east Hertfordshire District Councils are the four key districts within the model area.

2.2.2 Figure 2-1 below shows the coverage of the Harlow Transport Model, showing both the fully modelled area and the detailed modelled area within it.

Figure 2-1 : Extent of Harlow Transport Model Coverage



2.3 Transport Model Used

2.3.1 As mentioned in Chapter 1, the Harlow Transport Model is used to forecast the future traffic levels for the area around Harlow and Bishop's Stortford covering the M11 corridor. This model uses the PTV VISUM strategic transport modelling software package and has a base year of 2014.

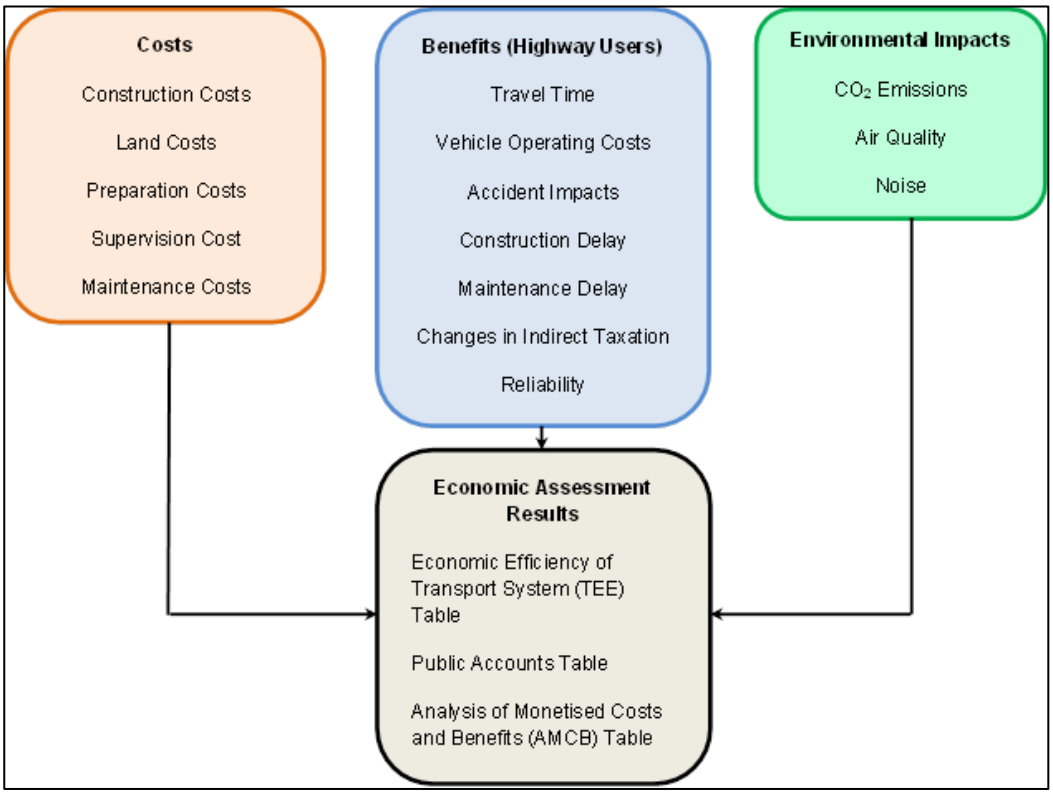
2.4 Appraisal Period and Future Years

2.4.1 In accordance with TAG Unit A1.1, the economic appraisal period extends 60 years after the scheme opening year. For this report there are three model forecast years: 2021 (assumed as the Scheme opening year), 2036 and 2051. The economic appraisal will therefore be carried out up to 2080 with a first appraisal year of 2021.

2.5 Economic Appraisal Methodology

2.5.1 The Economic Assessment has been carried out using standard procedures and economic parameters as defined by TAG Unit A1. The components that make up the assessment are shown in Figure 2-2.

Figure 2-2 : Economic Assessment Components



2.5.2 The following elements of the economic assessment have been considered:

- Road user journey time impacts due to changes in travel time and vehicle operating costs;
- Road user safety impacts due to changes in the future number and/ or severity of accidents;
- Reliability impacts due to changes in journey time variability;
- Construction and future maintenance impacts on road user travel time and vehicle operating costs;

- Indirect tax revenue due to changes in the amount of fuel and other direct vehicle operating costs purchased and changes in expenditure on transport offsetting changes in expenditure elsewhere in the economy; and
- Greenhouse gas, noise and air quality impacts.

2.5.3 The results of the assessment are presented in the following tables:

- Transport Economic Efficiency (TEE) Table;
- Public Accounts (PA) Table; and
- Analysis of Monetised Costs and Benefits (AMCB) Table.

3. Estimation of Costs

3.1 Overview

3.1.1 As outlined previously, part of the economic analysis process is to derive the costs associated with the scheme. TAG Unit A1.2[2] defines two categories of costs:

- Investment costs: predominantly construction, land, preparation and supervision costs.
- Operating and maintenance costs: routine non- traffic related maintenance costs.

3.2 Construction costs

3.2.1 The construction costs are based on cost estimates as of December 2016. The costs have been estimated under the assumption that the works will be procured using a “design & construct” form of procurement with by single stage competitive tender utilising a standard form of contract.

3.2.2 The rates used reflect construction projects of similar size and nature and were initially estimated based on prices as at the 1st Quarter of 2016 and converted into outturn costs using Highways England’s project construction related inflation. Please note, the costs were provided by Highways England (HE) as factors costs and excludes VAT. The land and part claims costs were estimated by Lambert Smith Hampton (LSH), and no inflation or optimism bias were applied, as recommended by LSH[3]. These estimates have been converted to 2010 prices using the GDP-deflator series as published in the July 2016 TAG Data book. The prices have not been converted to market prices, in agreement with ECC and HE, as the former are not liable to pay VAT.

3.3 Operating and Maintenance Costs

3.3.1 The operating and maintenance (O&M) costs per annum have been calculated by Highways England over the 60-year appraisal period, comparing the Do Something O&M maintenance profile against the Do Minimum scenario.

3.3.2 The O&M cost estimates were based on the Cyclical and Reactive Maintenance Delivery Plan (CRMDP). The O&M cost estimates were prepared based on prices as at the 1st Quarter 2016, converted into outturn costs using HE’s projected construction relation inflation. The outturn O&M costs were converted to 2010 prices using the GDP-deflator series and discounted accordingly as recommended by DfT’s WebTAG guidance.

3.4 Risk and optimism bias

3.4.1 Risk allowances have been included in this estimate for design development risks, construction risks, employer change risks and employer risks. The quantified risk was calculated based on the latest risk register using a straight-line extrapolation methodology.

3.4.2 TAG Unit A1.2 requires optimism bias to be included in the estimation of cost calculations. Optimism bias is the demonstrated systematic tendency for appraisers to be overly optimistic about key parameters. However, optimism bias has been excluded for both capital and operating costs, as HE has already accounted for unscheduled items, project risk, uncertainty and portfolio risk, each being assessed on a project specific basis. Additional optimism bias allowances are not deemed to be required at this stage.

3.5 Spending profile

3.5.1 The costs have been discounted following TAG Unit A1.1 using 3.5% discount rate starting at 2010. The costs have been broken down in three phases with the following schedule:

- **Development phase:** Starting in the FY 2018/19 and ending in FY 2019/20.
- **Construction phase**: Starting in the FY 2019/20 and ending in the FY 2021/22.
- **Other costs (e.g. third-party costs):** Starting in FY 2019/20 and ending in FY 2021/22.
- **Land acquisition and part claims 1 costs** have been assumed to take place in the FY 2019/20.

3.6 Funding and developer's contribution

3.6.1 Source of funding has yet to be finalised. For the purposes of this economic analysis it has been assumed that £41.7m would be provided by Highways England and £51.4m would be provided by ECC and other sources, including £10.5m provided by South Essex Local Enterprise Partnership (SELEP). Any budget deficit of the scheme would assume to be funded by ECC. Note that costs in Table 3-1 have been converted to 2010 prices and discounted to the same year. O&M costs are assumed to be fully covered by ECC.

3.7 Summary of Discounted Costs

3.7.1 Table 3-1 shows the summary of the discounted prices.

Table 3-1 : Summary of discounted Scheme Costs - £m, 2010 market prices

	Discounted Costs, £m
Operating Costs	£5.33m
Construction Costs	£52.97m
Land acquisitions and claims	£4.19m
Total, PVC (Broad Transport Budget)	**£62.49m**

3.7.2 For more details of the capital costs and O&M costs by HE, please refer to Appendix I.

3.7.3 Alternatively, ECC has developed their own capital cost estimation. The methodology to derive the cost estimation adopted by ECC differs to HE, with such differences as:

- **Optimism bias** – the ECC cost estimates include an optimism bias of 3%, whereas the HE costs excludes optimism bias completely.
- **Risk allowances** – the risk allowances calculated by ECC based on a quantified risk analysis and a Monte Carlo simulation, whereas the risk allowances calculated by HE was based on a straight-line extrapolation method.
- **Inflation** – to calculate the scheme outturn costs, ECC adjusted the inflation, using the Building Cost Information Service (BCIS) General Civil Engineering Cost indices. Alternatively, HE converted their base cost estimates into outturn costs using the HE projected construction related inflation indices.

[2] Department for Transport, July 2017, TAG UNIT A1.2 Scheme Costs
[3] Lambert Smith Hampton, 11th October 2017, *Transaction Report Valuation Short Report Part 2*

3.7.4 Although this report presents the estimated costs (presented in this section) and the economic appraisal results using the HE costs, the Interim Full Business Case will present both HE and ECC cost estimates at this stage. The final cost estimations will be further refined in the Full Business Case.

3.7.5 More details of the cost estimates by ECC, as well as the economic analysis using the ECC costs (as opposed to the cost estimates developed by HE), can be found in Appendix B.

4. Estimation of Benefits

4.1 Overview

4.1.1 As discussed previously a key part of economic appraisal is to determine the benefits of the Scheme. The costs experienced by road users in the situation without the scheme (known as the Do Minimum) are compared to costs in the situation with the Scheme (known as the Do Something).

4.1.2 Different types of benefit which are being assessed as part of the economic analysis are shown in Figure 4-1.

4.2 Transport User Appraisal

4.2.1 The calculation of main economic benefits to road users incorporates use of the DfT's Transport Users Benefit Appraisal (TUBA) program. TUBA compares the economic costs for the Do Something (DS) situation with the costs for the Do Minimum (DM) situation to establish the value of forecast savings in travel time and vehicle operating costs. A BCR is calculated by comparing these values, together with those of other relevant costs and benefits, with the construction and operation costs, over a 60-year appraisal period.

4.3 Economic Parameters

4.3.1 TUBA provides a complete set of default economic parameters in its 'Standard Economics File'. This contains values of time, vehicle operating cost data, tax rates and economic growth rates. TUBA version 1.9.10 reports economic values in 2010 prices, discounted to a present value of 2010.

4.3.2 As discussed in Section 2.4, traffic forecasts were prepared for the following years:

- Opening year 2021; and
- 2036 and 2051 forecast years.

4.4 Appraisal Period

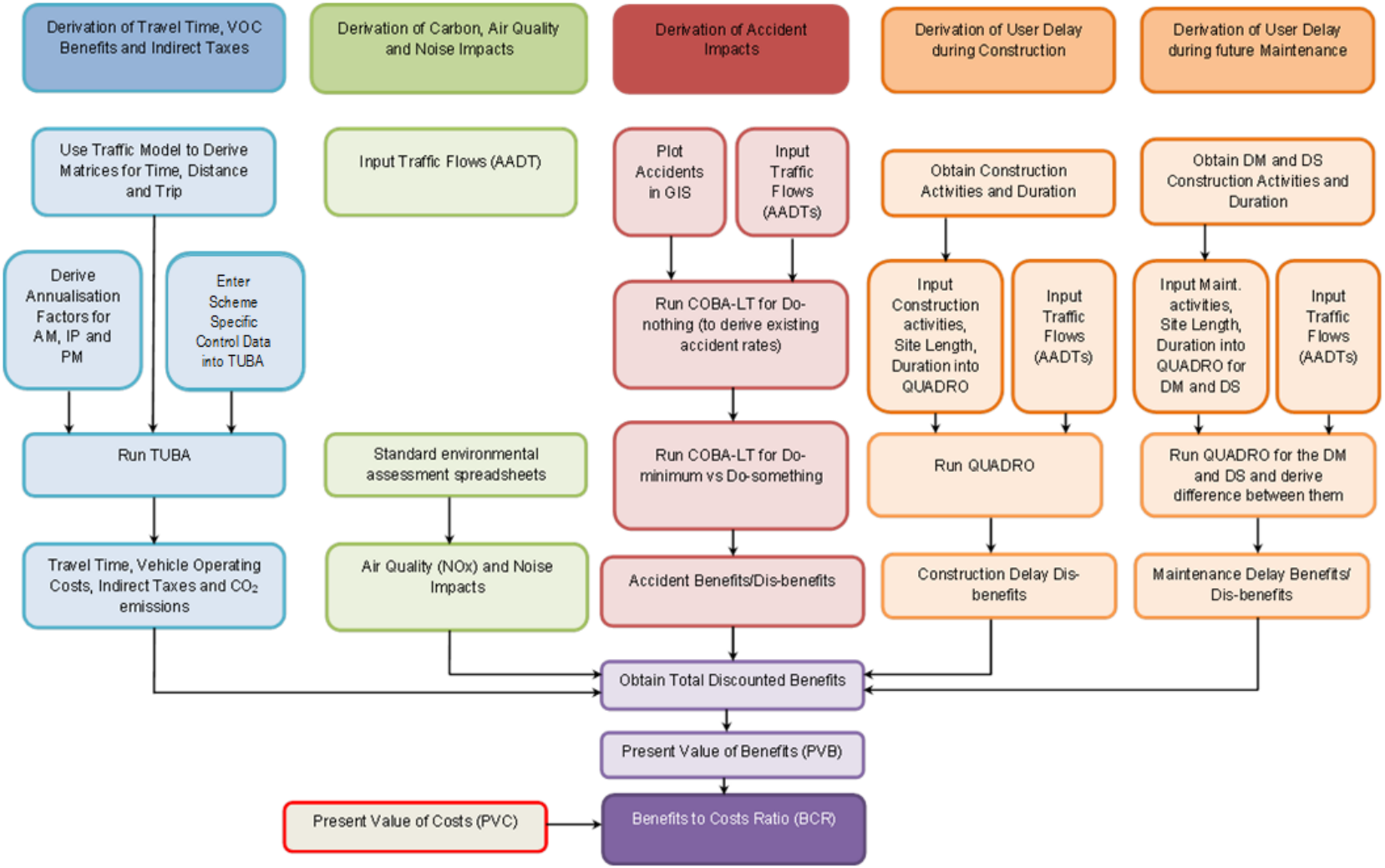
4.4.1 As specified in DfT guidance a 60-year appraisal period was used from Scheme opening year of 2021 therefore providing a final appraisal year of 2080. Traffic levels are assumed to remain constant after the horizon year of 2051 for the purpose of the economic appraisal.

4.5 Time Slices and Annualisation Factors

4.5.1 TUBA works on the basis of five standard-definition time periods as follows:

- AM peak (weekday 07:00 to 10:00);
- PM peak (weekday 16:00 to 19:00);
- Inter-peak (weekday 10:00 to 16:00);
- Off-peak (weekday 19:00 to 07:00); and
- Weekend.

Figure 4-1: Flow diagram showing the process for the derivation of benefits



4.5.2 The Highway Assignment Model (HAM) comprises three weekday time periods; an AM peak hour (08:00-09:00), an inter-peak hour (11:00-12:00) and a PM peak hour (17:00-18:00).

4.5.3 The off-peak and weekend time periods are not included within the appraisal.

4.5.4 The modelled period benefits calculated by TUBA were converted into an estimate of annual benefits using the following peak hour to peak period factors:

- Weekday AM peak period (7am to 10am, 3 hours) – 2.82 * AM peak hour
- Weekday IP period (10am to 4pm, 6 hours) – 6.45 * IP peak hour; and
- Weekday PM period (4pm to 7pm, 3 hours) – 2.77 * PM peak hour

4.5.5 The annualisation factor for each TUBA time period also has to incorporate the number of times the period occurs per year, with the year divided up as follows:

- 253 normal weekdays

4.5.6 The two sets of factors above were combined to create annualisation factors applicable to the standard TUBA time periods. Table 4-1 summarises the TUBA periods and relevant annualisation factors.

Table 4-1 : Time slices and annualisation factors

No	Time Slice	Time Period	Duration (mins)	Formula	Annualisation Factor
1	07:00-10:00	AM Period	60	2.82 * 253	715
2	10:00-16:00	IP Period	60	6.45 * 253	1631
3	16:00-19:00	PM Period	60	2.77 * 253	701

4.5.7 The traffic model user classes split into seven user classes within TUBA to take account of varying values of time for different purposes and vehicle operating costs by vehicle type. The TUBA user classes are shown in Table 4-2 along with proportion of trips for each purpose by time period.

4.5.8 Car trips are already split within the traffic model into these user classes. To split LGV flows into those used for personal and freight purposes, WebTAG guidelines were used. These provide a split of 12% for LGV personal and 88% for LGV freight. For the OGV1 and OGV2, splits were derived from long terms Automatic Traffic Counts (ATC). Table 4-2 summarises the TUBA purpose split.

Table 4-2 : Purpose splits by time period

No	Purpose	AM	IP	PM
1	Car Commute	1	1	1
2	Car Business	1	1	1
3	Car Other	1	1	1
4	LGV	0.12	0.12	0.12
5	LGV	0.88	0.88	0.88

No	Purpose	AM	IP	PM
6	OGV1	0.53	0.52	0.63
7	OGV2	0.47	0.48	0.37

4.6 Input Matrices, Representative Distance and Time Skims

4.6.1 Data input to TUBA comprised trip, flow weighted average travel time and travel distance skim matrices. These matrices were prepared for each Scheme option scenario separately for combinations of three time periods (AM, IP, PM), five user classes (Car Business, Car Commute, Car Other, LGV and HGV) and three forecast years (2021, 2036 and 2051) for both Do Minimum (Without Scheme) and Do Something (With Scheme) for each scenario (Medium, NTEM and High).

4.6.2 The VISUM software, which was used for the HAM model, uses kilometres and seconds as units. However, TAG unit A1.1 and the TAG Databook (and therefore TUBA) use kilometres and hours as units. Hence a factor of 0.0167 was used in the TUBA input file where relevant to convert travel time between zones into hours.

4.7 TUBA Warnings and Logic Checking

4.7.1 TUBA undertakes a check on the inputs provided and identifies any large cost or matrix changes between the Do Minimum and Do Something situation. The warnings of each TUBA type were output and reviewed for each scenario. For more details on the TUBA warnings, please refer to Appendix E.

4.8 Accident Appraisal

4.8.1 COBA-LT (COst and Benefit to Accidents – Light Touch) is used as the industry standard modelling software when undertaking accident appraisal for road schemes throughout the UK. The aim of COBA-LT is to carry out economic appraisal in accordance with the DfT's Transport Analysis Guidance; WebTAG. COBA-LT assesses the safety aspects of road schemes using detailed inputs of either:

a) separate road links and road junctions that would be impacted by the scheme; or

b) combined links and junctions.

4.8.2 The assessment is based on a comparison of accidents by severity and associated costs across an identified network in 'Without-Scheme' and 'With-Scheme' forecasts, using details of:

- Local link and junction characteristics;
- Speed limits;
- Modernity and lane width;
- Local accident rates;
- DfT costs for accidents; and
- Forecast traffic volumes by link and junction.

Accident rate analysis

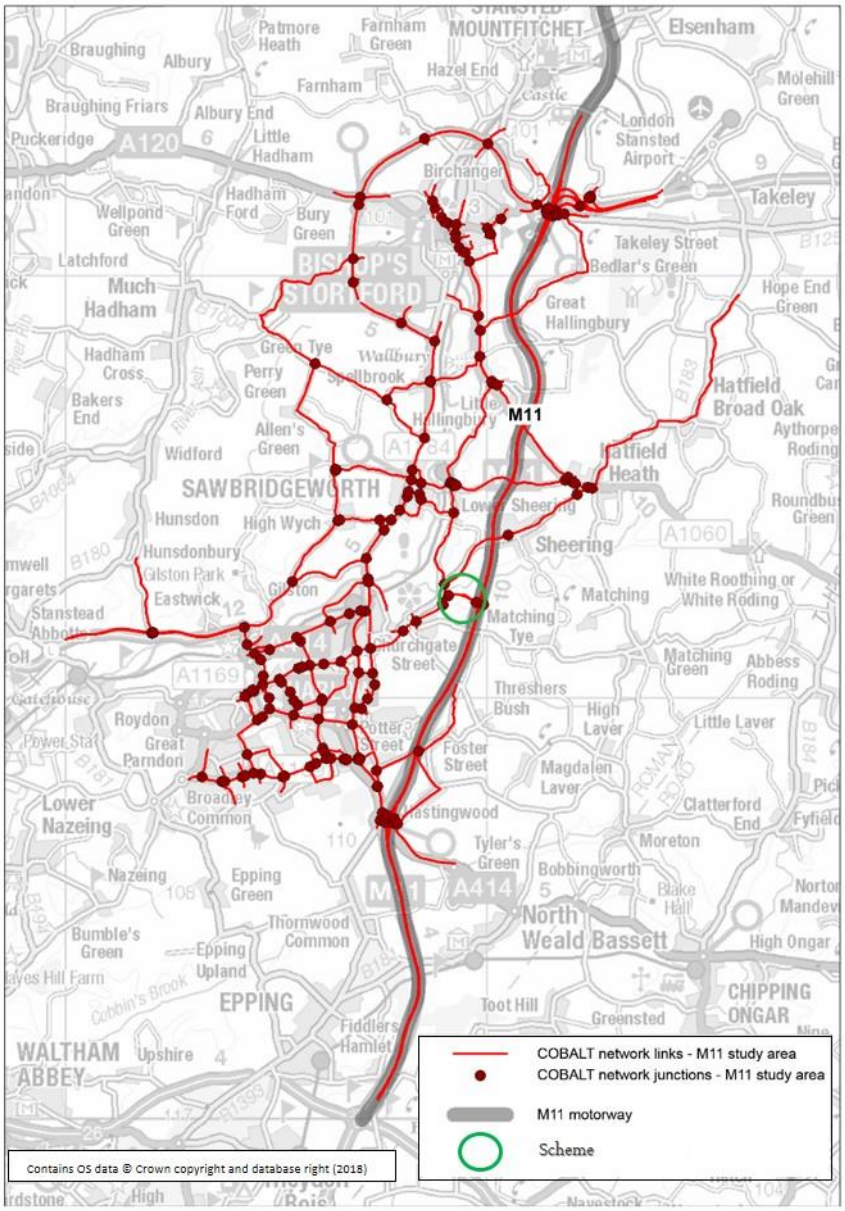
4.8.3 COBA-LT accident rate calculations are based on predicted Personal-Injury Accident (PIA) numbers. Accidents are rated Slight, Serious or Fatal based on the worst level of severity experienced by any casualty.

4.8.4 COBA-LT is set up to be used anywhere in the UK with the accident rate assumptions reflecting this. However, as a result, if a local area experiences extreme high or low flows the local accident rates may not be in line with DfT parameter rates. Where this occurs, bespoke calculations may be required to analyse road safety implications in the area.

COBA-LT Study Area

4.8.5 Figure 4-2 shows the study area, which starts south of Harlow and extends to Stansted Airport. It includes the M11 and all A, B and inner-city roads that are forecast to experience notable changes in flow or accidents. The area comprises some 23km from north to south and some 10km from east to west.

Figure 4-2: COBA-LT Study Area



COBA-LT Methodology

4.8.6 The analysis of the economic impact of accidents was undertaken using COBA-LT (version 2013.2) with the COBA-LT 2018.1 WebTAG parameters file. Further programmes included MapInfo, Microsoft Excel and a VISUM map as reference. This allows for an improved accuracy in the visualisation of the study area, as road bends can be accounted for when mapping links.

Link and Junction Classification

4.8.7 For this analysis the links and junctions were analysed separately.

4.8.8 In total three runs were undertaken:

- Links only including flows for Base, Do Minimum and Do Something;
- Junction only including base year flows to calculate future year accident rates; and
- Junction only including flows for Do Minimum and Do Something using the previously calculated accident rates

4.8.9 A desk based analysis using Google maps, map GIS and option drawings was undertaken to define the link and junction types.

Accidents

4.8.10 STATS19 collision data from 2012 to 2016 were used for the accident analysis. Local accident rates were estimated based on the accidents data by road types and were applied to a separate link and junction in COBA-LT analysis; as accidents could only be assigned to roads and could not be specified to the direction of flows, two way flows were added together and the COBA-LT link analysis was undertaken by road section.

4.8.11 Accidents at junctions were defined as all those accidents that took place within 20 metres of a junction. For both the junction and link analysis the observed numbers of accidents were entered as a comma-delimited series for each consecutive year.

4.8.12 Where no accidents were recorded at a junction during the 5-year period, 0.5 accidents were assigned to one of the years to introduce the probability of an accident occurring at some point in the future and avoid an optimistic estimation of zero accidents over the appraisal 60-year period.

4.8.13 Finally, the accident severity split was set to default values.

Speed limits

4.8.14 Speed limits for all the links and junctions were sourced using Google maps, scheme drawings, and mapped speed limits available in the ITO website[4].

Flows

[4] (http://product.itoworld.com/map/124?lon=1.36778&lat=51.94987&zoom=11)

4.8.15 Peak hour vehicle flows for the core scenario were converted to Annual Average Daily Traffic (AADT) using the expansion factors shown in Table 4-3.

Table 4-3: Expansion Factors

Road Type	AM Hr to AM Period	IP Hr to IP Period	PM Hr to PM Period	AAWT24 to AADT24
Motorway	3.05	6.48	2.88	0.96
A Road	2.76	6.39	2.72	0.94
Other	2.58	6.45	2.67	0.84

4.9 Delays during Construction and Future Maintenance

4.9.1 Part of the cost of the construction, and ongoing maintenance, of the scheme is borne by road users, in terms of traffic delays. The DfT programme Queues And Delays at ROadwork's (QUADRO) version 4 revision 15.0 has been used for assessing and quantifying these delays during the construction of the scheme, and the maintenance of the scheme, expected to take place over the 60 year appraisal period.

4.9.2 QUADRO calculates the total works and user costs of construction and maintenance tasks. For each task the timing of the works was specified based on the provided construction schedules, along with information on traffic flows, the temporary traffic management arrangements at the site, and a representative diversion route around the site. The program contains an iterative assignment model for allocating traffic to the diversion route if the site becomes overloaded. The effect of the works was evaluated by calculating the time and vehicle operating costs incurred by all traffic on the network, both with and without the works. Output available from the model included information on the speed, queuing and diversionary behaviour of traffic on an hourly basis, plus cost summaries by type and vehicle category.

4.9.3 The total user delay costs, for a particular task or profile of tasks over the appraisal period, were then discounted to a base year (2010). This enabled construction and maintenance tasks which occur in different years to be compared on a common basis.

4.9.4 User delays during construction

4.9.5 The scheme involves the construction of a new junction on the M11 between Junctions 7 and 8, as well as a new link road to connect the new junction to B183 Gilden Way in Harlow. To accommodate the increased traffic, Gilden Way is to be widened into 2 lanes in the Westbound direction. While the construction of the new link road and junction will be mostly off-line, traffic management will be required during some works, such as tie-ins, the M11 overbridge and the widening of Gilden Way.

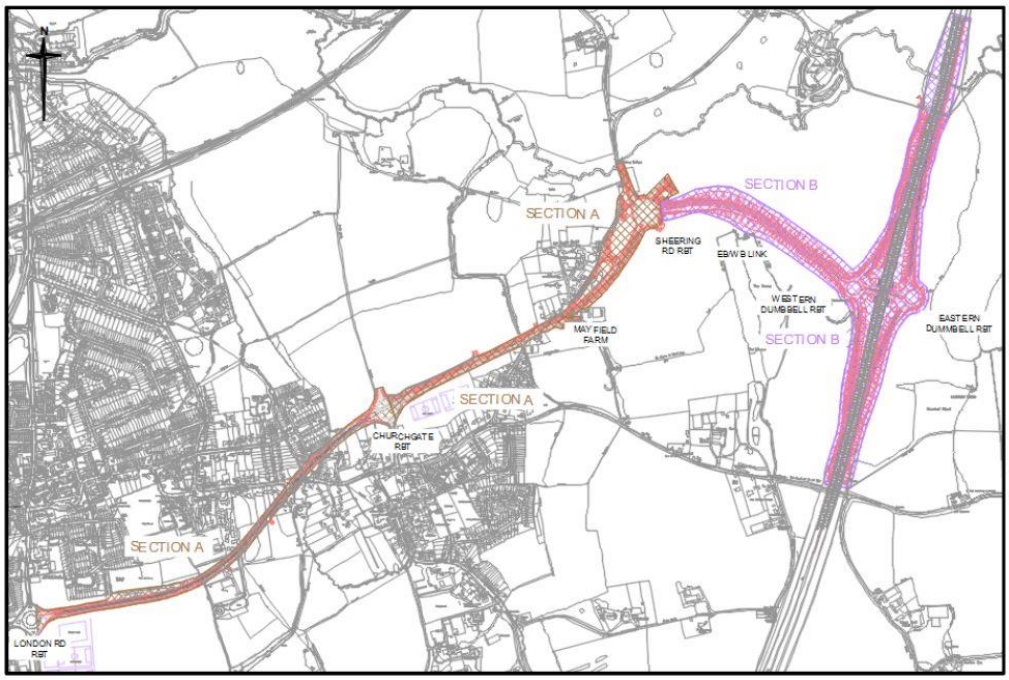
4.9.6 Construction of the scheme is forecasted to commence in mid-2019, with up to two years of pre-construction activities taking place; such as environmental/ecological mitigations and utility diversions. The construction of the scheme is forecasted to finish mid-2021.

4.9.7 For the purpose of the QUADRO assessment, user delays due to construction were calculated based upon two distinct construction phases (see Figure 4-3) based predominantly around geographic constraints and earthworks movements, detailed in Table 4-4.

Table 4-4 : M11 junction 7a construction phases

Phase	Area	Description
Section A	London Roundabout [Ch0] – New Campions Roundabout [Ch2250]	Phases A - F are due to start in 2019, where construction will take place on B183 Gilden Way and due to finish early 2021. Construction work will include lane widening and conversion of the existing single carriageway from two lanes to three lanes by adding additional lane to the westbound direction between the London Roundabout and Mayfield Farm. Phases G - I are due to start in 2019, where construction will take place on the new offline section between Mayfield Farm and the new Sheering Road Roundabout, which is due to finish mid-2021.
Section B	From East of the new Sheering Road Roundabout up to the M11 Dumbbell roundabout junction including N/B & S/B On & Off slips on the existing M11	Works on Section B are due to start in mid-2019, where construction will take place on the M11 between junction 7 and 8 and due to finish in mid-2021. Construction work will include constructing the two-lane link between M11J7A Westbound Roundabout and the new Sheering Road Roundabout.

Figure 4-3: Construction phases of the scheme



4.9.8 It should be noted that for the purpose of this assessment, the construction of the link road between east of the new Sheering Roundabout and the M11 dumbbell roundabouts is not assessed the majority of the work would be carried out off-line and is unlikely to have a material impact on the existing traffic on the M11.

4.9.9 User delays due to construction were calculated based on the following key characteristics shown in Table 4-5.

Table 4-5 : M11J7a Construction Profile

Assumptions	Section A	Section B
Traffic Management[5]	24 hours, seven days a week	
Road Description	Non built-up trunk road	Motorway, dual 3 lanes
Lane Width[6]	2.75-3.00 metres	3.0-3.30 metres
Maximum Delay[7]	20 minutes	
Speed Limit	30mph	50mph
Diversion Route[8]	None	A414N and A1184/A120 around Bishop's Stortford between M11 J7 and J8 for both directions.

4.9.10 Max-Q-Delay function within QUADRO was used for all jobs which did not require traffic to be diverted.

4.9.11 QUADRO was run using the 2021 Do-Minimum Model AADT flows. The 24-hour flow profile (Monday-Friday) and vehicle class split were derived from the appropriate long term traffic counts. The vehicle class split was derived from the QUADRO 4 Manual (July 2017) and differs, depending on the class of road. The following presents the vehicle class splits for the M11.

Table 4-6: Vehicle class split by road[9]

Road	Classification of Road	Cars	LGVs	OVG1	OVG2	PSV
M11	Motorway	0.825	0.112	0.030	0.024	0.009
Gilden Way	Non Built-up trunk	0.787	0.110	0.038	0.059	0.006

[5] Although the timing of the construction work will vary (day time, night time working), the traffic management will be in place 24/7 until the end of the construction phase due to safety reasons except for Section B, Phase B.
[6] Sections where the speed limit is reduced but the lane width remains as before are modelled separately.
[7] Maximum delay experienced by road users before QUADRO assumes road users would divert to alternative routes
[8] Diversion route for Section B Phase B only.
[9] Source: Mott MacDonald, 2017, QUADRO4 Part 5

4.9.12 QUADRO default information relevant to specific road class was used where local data was not available.

4.9.13 User delays during maintenance

4.9.14 For the purpose of the QUADRO assessment, user delays due to future maintenance were calculated for the Do-Minimum scenario and the Do-Something scenario. Due to the unavailability of a detailed maintenance profile of the scheme, assumptions were made on the type and frequency of maintenance jobs expected to be carried out, based on two documents:

- The “Maintenance and Repair Strategy Statement” (March 2016) produced by Jacobs.
- QUADRO manual (May 2016).

4.9.15 Maintenance QUADRO was run on the same basis as those for construction delays described above i.e. using the local hourly profile, using diversion routes where there is complete carriageway closure and using 2021, 2036 and 2051 AADT flows as appropriate.

4.9.16 Maintenance profile was modelled over the 60-year appraisal period from the opening year of 2021. Please note, an assumption was made, in which maintenance tasks would not occur until 5 years after the opening year for the Do-Something scenario.

4.9.17 Two main maintenance tasks were modelled: road surface maintenance and gantry maintenance. It should be noted that maintenance delays associated with white lining and grass cutting are assumed to be minimal and have therefore been excluded from the above assessments. It has also been assumed that maintenance associated with street lighting, drainage, kerbs and safety barriers would be undertaken at the same time as road surfacing and gantry maintenance.

4.9.18 The results of the two separate QUADRO assessments for the maintenance of road surfacing and gantry maintenance were obtained by subtracting the Do-Minimum total maintenance value from the Do-Something total maintenance value.

4.9.19 Table 4-7 and Table 4-8 presents the maintenance profile of the Do-Minimum and Do-Something scenarios respectively, which includes the frequency and traffic management of the maintenance tasks.

Table 4-7: Do Minimum Maintenance Task Profile

Maintenance Tasks	Direction	Year	Traffic Management Requirement	Traffic Management Duration	Duration
Thin Road Surfacing (30mm)	EB & WB	20 years	Shuttle working	24 hours	4 days
Overlay (50mm/100mm)	EB & WB	20 years	Shuttle working	24 hours	12 days

Table 4-8: Do Something Maintenance Task Profile

Maintenance Tasks	Direction	Year	Traffic Management Requirement	Traffic Management Duration	Duration
Gilden Way					
Thin Road Surfacing (30mm)	EB & WB	20 years	Contraflow	24 hours	6 days
Overlay (50mm/100mm)	EB & WB	20 years	Contraflow	24 hours	15 days
M11 on-slips and off-slips					
Resurfacing (Inlay, 100mm)	NB & SB	20 years	Lane closure	24 hours	5 days
Resurfacing	NB & SB	20 years	Lane closure	24 hours	12 days
Gantry maintenance - major	SB	20 years	Lane closure	Night Time only	1 days
Gantry maintenance - minor	SB	12 years	Lane closure	Night Time only	1 days
Link Road					
Resurfacing (Inlay, 100mm)	EB & WB	20 years	Reduced Lane Width	24 hours	6 days
Resurfacing	EB & WB	20 years	Reduced Lane Width	24 hours	15 days

4.10 Greenhouse Gases

4.10.1 The Climate Change Act 2008 created a new approach to managing and responding to climate change in the UK. At the heart of the Act is a legally binding target to reduce the UK's greenhouse gas emissions. It is therefore important that the impacts of proposed transport interventions on greenhouse gas emissions - whether they are increased or decreased - are incorporated within the cost benefit analysis in a consistent and transparent way.

4.10.2 The emissions are calculated under a 'without scheme' scenario and a 'with scheme' scenario using the same methodology as the approach for assessing local air quality (below) to provide the difference and impact of the scheme. These values are then converted into a monetary value, calculating a net present value (NPV) over the appraisal period. The Highway England IAN185/15 has been used to calculate the greenhouse gas emissions for the Opening Year and Design Year for both the Do Minimum and Do Something scenarios and projected for 60 appraisal years. The output from the calculation is inputted into the TAG Greenhouse Gases Workbook to calculate the monetary value.

4.11 Local Air Quality

4.11.1 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (DEFRA 2007) set air quality objectives to further improve air quality in the UK from today into the long term. Road transport is a significant source of PM_{10} and NOx and hence air pollution in the locality near to the road.

4.11.2 The approach to assessing local air quality for a scheme is set out in TAG Unit A3[10] (Environmental Impact Appraisal) and is based on a quantification of the change in exposure at properties in the opening year and design year for PM_{10}) as well as the change in emissions for NOx. The next stage in air quality assessment is monetary valuation of the changes in air quality. The TAG Local Air Quality Workbook has been used to calculate the change in Air Quality; and the TAG Air Quality Valuation workbook has been used for monetary value

4.12 Noise Assessment

4.12.1 The approach for the assessment of traffic-related noise is set out in TAG Unit A3. Noise levels have been predicted at all residential properties within the study area. The study area has been defined in accordance with HD213/11 - Revision 1 (DMRB). Predicted noise level changes at all receptors are then subsequently assessed in terms of a monetary evaluation in to determine the Net Present Value (NPV). The total NPV in terms of noise takes account of the value of impact from noise on sleep disturbance, amenity, heart disease, stroke and dementia.

4.12.2 The monetary values are national average values per household per year at 2010 prices. These are increased in line with forecasts of GDP per household and discounted over the appraisal period to give a present value of noise.

4.13 Journey Time Reliability

4.13.1 Journey time reliability is defined as the measure of dispersion in journey time distribution that users are unable to predict. The variability may be due to effects such delays caused by accidents, incidents, weather, speed restricted vehicles or animals on the road. Journey time reliability excludes predictable delays such as varying levels of demand by time of day, day of week and seasonal effects that users are aware of.

4.13.2 For private road users, journey time reliability uses standard deviation as a measure of the variation in travel times. A Value of Reliability is then applied to the sum of the standard deviations.

[10] Department for Transport, 2015, TAG UNIT A3 Environmental Impact Appraisal

4.13.3 Guidance on assessing the reliability is given in TAG Unit A1.3[11]. The guidance states that a model can be used to forecast journey time reliability from journey times and distance. It also gives the equation used to estimate the change in journey time reliability and to derive the monetary benefit of journey time reliability.

4.13.4 The formulae have been used to derive the monetary value of the change in journey time reliability for the M11 Junction 7A study. Journey time skims and trip matrices for each modelled year, period, user class and scenario (i.e. NTEM, medium and high) for Do Minimum and Do Something scenarios have been extracted from VISUM. Distances used are those from the Do Minimum for each Origin/Destination pair.

4.13.5 Annualisation factors have been applied to estimate the journey time reliability benefits in the opening year (2021) and the forecast years (2036 and 2051) using the same annualisation factors as used for TUBA.

4.13.6 In order to estimate the benefits in non-modelled years, it is assumed that for years between the first modelled year and the last modelled year, the benefits can be estimated by linear interpolation between the two years. Secondly, for those years beyond the last modelled year, it has been assumed that benefits will be the same as those for the last modelled year. This means there will be no growth in benefits beyond the last modelled year.

4.13.7 Reliability benefits are not included as part of the TEE or the AMCB, therefore do not form part of the BCR, but are included as part of the AST.

[11] Department for Transport, 2017, TAG UNIT A1.3 User and Provider Impacts

5. Core Scenario Appraisal Summary

5.1 Overview

5.1.1 The different types of benefits and costs, as well as the methodology for deriving them, have been discussed in chapters 2, 3 and 4.

5.1.2 This chapter presents the results of these appraisals and how they have been used to derive the overall Benefit-Cost Ratio (BCR) for the core NTEM growth scenario.

5.1.3 The appraisal results of the ECC Medium, ECC High, WebTAG Low and WebTAG High growth scenarios can be found in section 7.

5.2 Headline Economic Appraisal Results

5.2.1 Table 5-1 below presents a summary of the BCR which is between 2.00 and 4.00 which means that the scheme is rated as “High” Value for Money (VfM) according to the DfT Value for Money Assessment Guidance.

Table 5-1: Core (NTEM growth) scenario cost and benefits summary, £m

Growth Scenario	Present Value of Benefits (PVB)	Present Value of Costs (PVC)	BCR	VfM rating
NTEM	£163.3m	£62.5m	2.6	High

5.2.2 The total benefits, as shown in the PVB column above, including the following items:

- Travel time, assessed using TUBA;
- Vehicle operating Costs (VoC), assessed using TUBA;
- Accident, assessed using COBA-LT;
- Indirect tax, assessed using TUBA;
- Carbon (greenhouse gases);
- Noise and air quality assessed using relevant WebTAG worksheets; and
- Delays during construction and future maintenance assessed using QUADRO.

5.2.3 The Scheme benefits are a combination of different elements listed above and they are dependent on network capacity, average speeds, number of trips, cost of travel, tax, etc.

5.2.4 Detailed outputs from the economic assessments in terms of TEE, PA and AMCB tables are presented in section 5.8.

5.3 Travel Time Savings and Vehicle Operating Results

5.3.1 Table 5-2 below shows the monetised benefits in terms of journey time improvement and vehicle operating costs. The magnitude of the latter is dependent on speed. As expected the introduction of M11 J7a and associated improvements along Gilden Way result in a positive impact for all purposes.

5.3.2 Without the scheme it is expected that the pressure of new housing and employment will increase traffic flows, congestion and delays, particularly in Harlow and the A414. With the proposed scheme although some areas will experience increase in traffic and delays, there will be a large decrease in flows approaching the M11 J7 from Harlow along the A414 London Road, relieving this heavily congested road. The scheme also appears to improve most of the junctions that would experience congestion in a Do Minimum situation. For more detail refer to the Traffic Model Forecasting Report M11 J7a.

Table 5-2 : NTEM growth TUBA benefits (Time + VOC) by purpose, £m

Purpose	NTEM	%
Business	£ 54m	30%
Commuting	£ 74m	41%
Other	£ 52m	29%
Total	**£ 180m**	**100%**

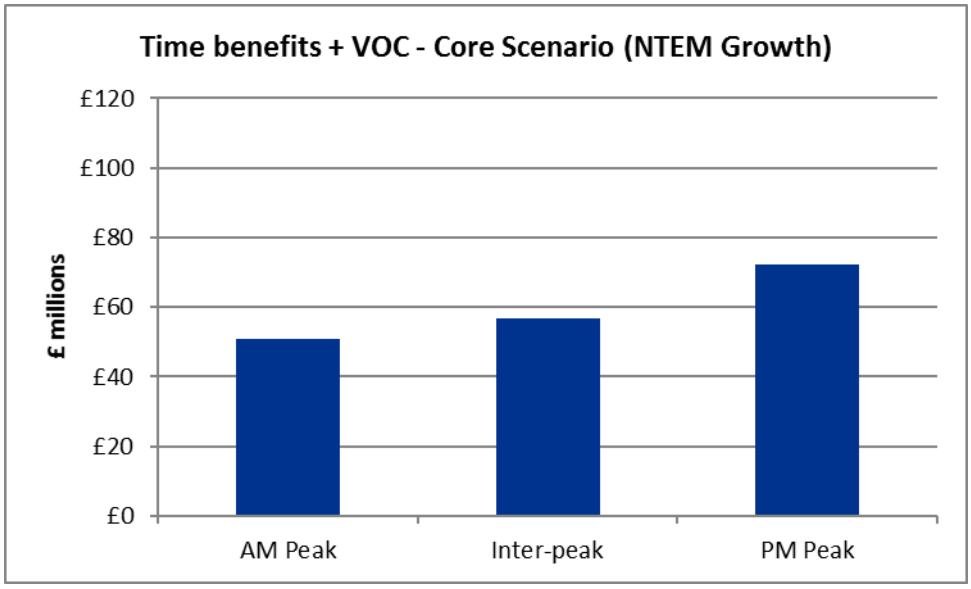
5.3.3 Analysis of time benefits grouped by the size of the time saving is shown in Table 5-3 below by purpose. The results show that a higher proportion of the scheme's benefits come from savings more than 5 minutes, closely followed by savings of between 2 to 5 minutes.

Table 5-3 : NTEM growth time benefits by time savings by purpose, £m

NTEM growth	< 2min	2 to 5min	> 5min	Total by purpose
Business	£8.8m	£20.2m	£17.9m	£46.9m
Commute	£19.9m	£24.6m	£29.9m	£74.4m
Other	£17.3m	£19.6m	£18.5m	£55.4m
Total by time band	**£46.0m**	**£64.4m**	**£66.3m**	**£176.7m**

5.3.4 When breaking down the benefits (Time + VoC) by time period, AM appears to be the least significant. The detail of this analysis is shown in Table 5-4.

Figure 5-1: NTEM growth TUBA Benefits Analysis (Time + VoC) by Time Period, £m



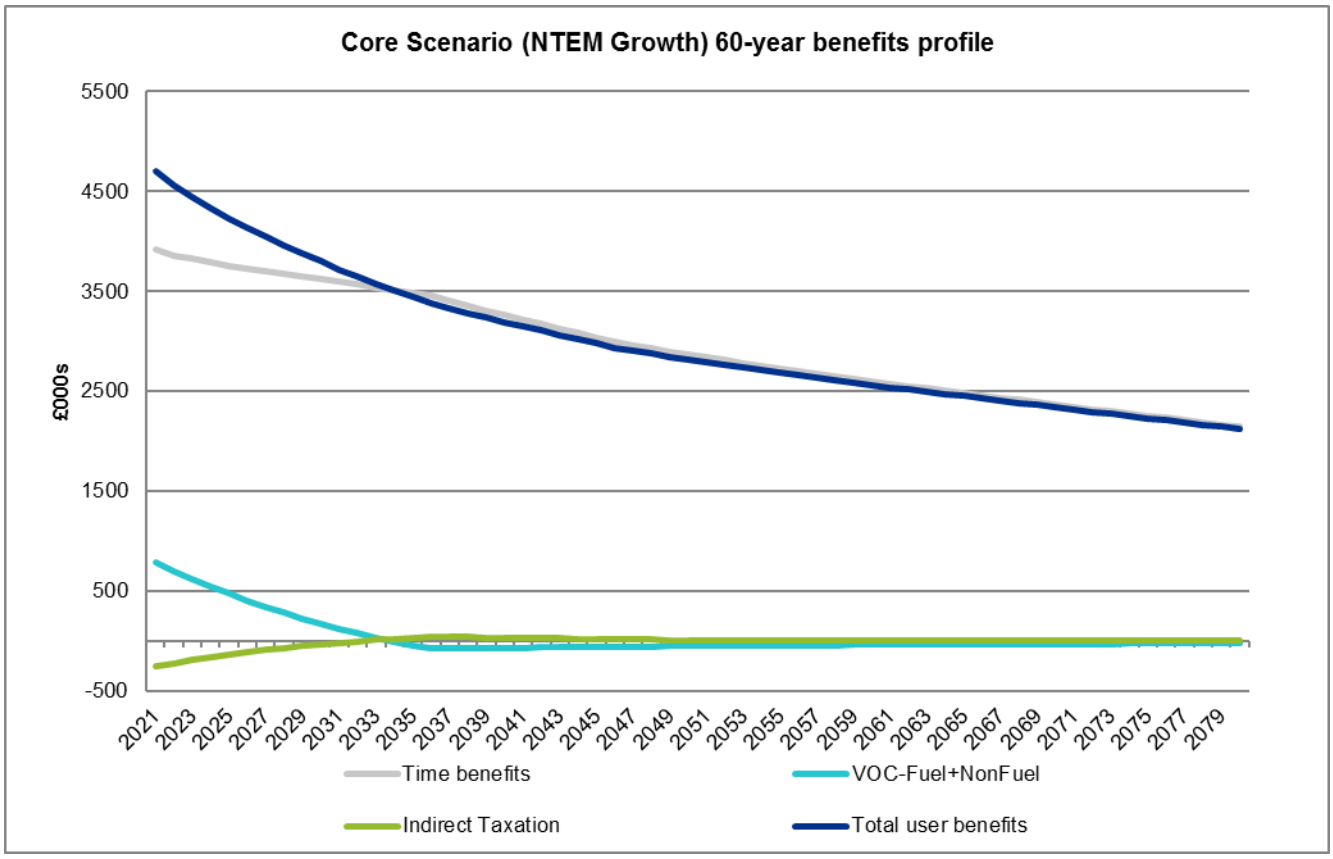
5.3.5 Table 5-4 shows that the main beneficiaries of this scheme are Car-Commuting users, followed by Car-Others, with the latter accruing more benefits during IP and the former accruing more benefits during AM and PM.

Table 5-4 : NTEM growth TUBA Benefits (Time + VoC) by Vehicle Class/ Purpose, £m

Purpose	NTEM		
	AM	IP	PM
Car - Business	£2m	£6m	£5m
Car - Commuting	£21m	£15m	£38m
Car - Other	£16m	£20m	£13m
LGV - Personal	£1m	£1m	£1m
LGV Freight	£11m	£14m	£16m
OGV1	£0	-£0	- £1m
OGV2	£0	£0	- £1m
Total	£51m	£57m	£72m
Total (AM+IP+PM)	**£180m**		

5.3.6 The benefit profile over the scheme's 60-year appraisal shows when the benefits are going to take place. Total user benefits tend to decline after the opening year due to increase in congestion. Figure 5-2 shows more detail.

Figure 5-2 : Core Scenario 60-year benefits profile



5.3.7 An indicative analysis has been carried out of benefits on a geographical basis - TUBA was run with a sectors file, which enables user benefits between each model zone origin-destination pair to be aggregated into larger geographical areas. In TUBA terminology, the larger geographical areas are known as sectors and the relationship between model zones and sectors is defined in the TUBA sector file. There were 21 sectors defined for the appraisal of M11 J7a Scheme, as presented in Table 5-5. The sectors are shown in Figure 5-3.

Figure 5-3 : TUBA sectors

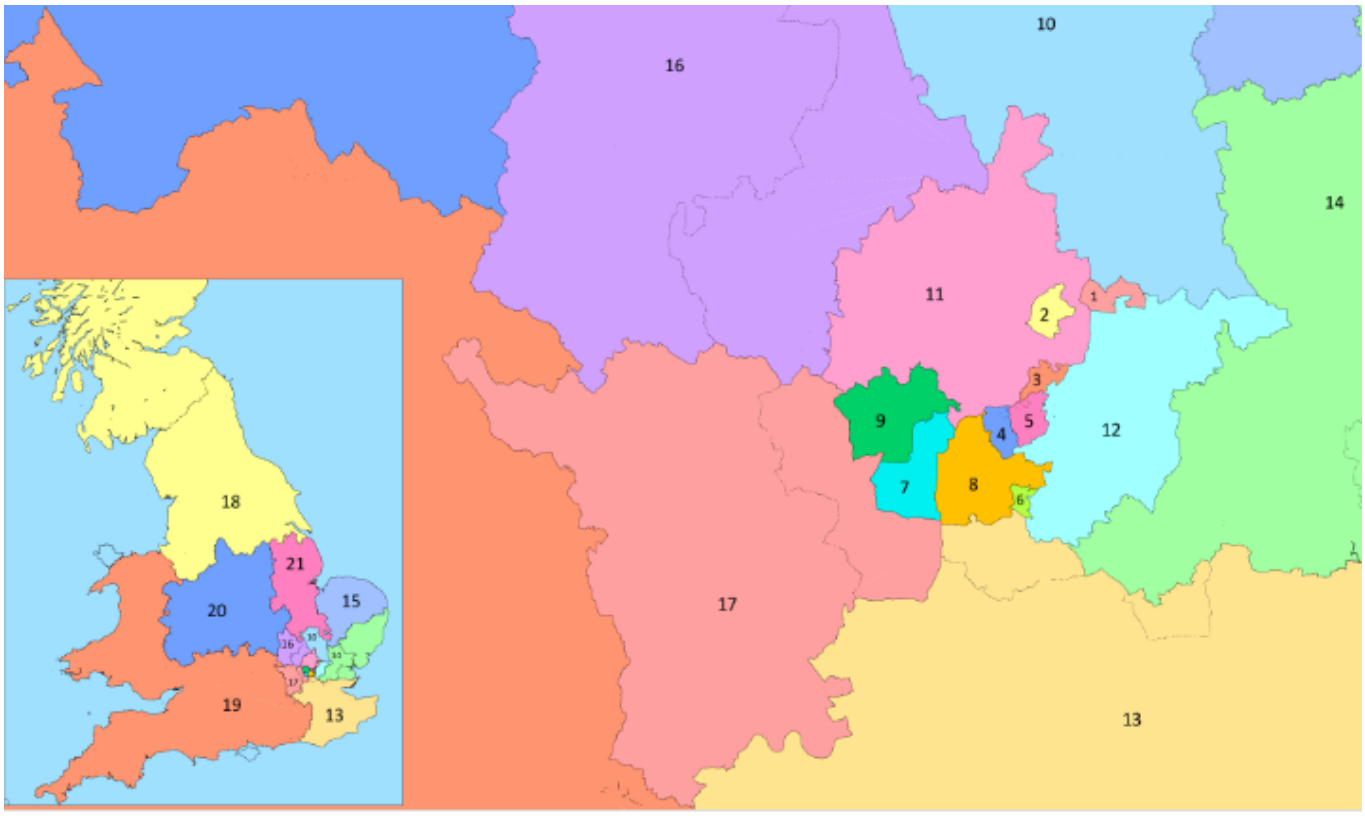


Table 5-5: Sector areas of the M11J7a scheme

No.	Area	No.	Area	No.	Area
1	Stansted	2	Bishop's Stortford	3	Sawbridgeworth
4	Harlow West	5	Harlow East	6	Epping
7	Hoddesdon & Cheshunt	8	Nazeing & Waltham Abbey	9	Hertford & Ware
10	Cambridge & Uttlesford	11	Much Hadham and rural	12	Hatfield Heath and rural
13	London & the South East	14	Rest of Essex & Suffolk	15	Norfolk
16	Luton & Stevenage	17	NW London & Herts	18	The North & Scotland
19	Wales & South West	20	The Midlands	21	Lincolnshire & Northamptonshire

5.3.8 The distribution of total user benefits resulting from the NTEM growth scenario is presented on a sector to sector basis in Table 5-6. The benefits are largely spread across all the sectors. However, there are some noticeable origin-destinations, e.g. Harlow (sector 5) as a destination largely benefits from journey time improvements coming from Stansted Airport, Bishop Stortford and in general from areas to the north and south of Harlow (sectors 1,5,13 and 14). Some other sectors are experiencing disbenefits for all the scenarios. Journey benefits are affected when traveling from Harlow heading to the southwest (sector 5 to 4) and vice versa. Some slight disbenefits can also be observed when moving within Harlow.

Table 5-6 : Benefits analysis by sectors for NTEM growth scenario

Origin/ Destination	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	**Total**
1	0.0%	1.3%	0.5%	2.8%	5.9%	0.0%	0.0%	0.0%	0.1%	0.0%	0.6%	1.3%	-0.4%	-0.1%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%	**12%**
2	0.0%	0.8%	0.5%	1.0%	2.6%	0.0%	0.1%	0.0%	0.2%	0.1%	0.8%	0.6%	0.1%	0.1%	0.0%	0.1%	0.5%	0.0%	0.1%	0.0%	0.0%	**8%**
3	0.6%	0.4%	0.0%	-0.3%	-0.9%	0.0%	0.0%	0.0%	0.0%	0.2%	0.3%	0.0%	0.1%	0.1%	0.0%	0.1%	0.2%	0.0%	0.1%	0.1%	0.0%	**1%**
4	2.1%	0.6%	-0.1%	-0.1%	-3.6%	0.0%	0.0%	0.0%	0.0%	0.8%	0.8%	-0.6%	0.8%	1.0%	0.1%	0.0%	0.2%	0.0%	0.0%	0.0%	0.2%	**2%**
5	4.7%	2.4%	-0.3%	-4.1%	-2.0%	0.3%	0.0%	0.0%	0.0%	2.2%	2.2%	-1.3%	1.2%	2.0%	0.3%	0.1%	0.6%	0.0%	0.3%	0.0%	0.4%	**9%**
6	0.0%	0.0%	0.1%	0.1%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.6%	0.3%	0.1%	0.0%	0.0%	0.2%	0.0%	0.0%	0.1%	0.0%	**2%**
7	0.1%	0.2%	0.0%	0.2%	0.0%	0.0%	0.3%	-0.2%	0.3%	0.2%	0.0%	0.1%	0.6%	0.0%	0.4%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	**3%**
8	0.2%	0.0%	0.0%	0.0%	0.1%	0.0%	-0.1%	0.0%	0.0%	0.2%	0.0%	0.1%	0.3%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	**1%**
9	0.1%	0.1%	0.0%	-0.1%	-0.1%	0.0%	0.1%	0.0%	0.2%	0.1%	0.1%	0.0%	0.8%	0.0%	0.1%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	**2%**
10	0.0%	0.1%	0.2%	1.4%	3.4%	0.1%	0.3%	0.1%	0.4%	0.1%	0.1%	0.7%	-0.2%	0.2%	0.0%	0.0%	-0.2%	0.0%	0.0%	0.0%	0.0%	**7%**
11	0.6%	0.6%	0.3%	0.7%	2.6%	0.1%	0.1%	0.1%	0.3%	0.0%	0.3%	0.4%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	**6%**
12	1.2%	0.7%	0.0%	-0.3%	-1.0%	0.3%	0.0%	0.0%	0.0%	0.9%	0.6%	0.7%	1.4%	1.2%	0.1%	0.1%	0.3%	0.4%	0.1%	0.0%	0.2%	**7%**
13	-0.2%	0.2%	0.2%	2.2%	3.6%	0.2%	1.8%	1.8%	1.1%	-0.2%	0.3%	5.1%	0.0%	0.8%	0.0%	0.1%	0.7%	0.2%	0.0%	0.4%	-0.3%	**18%**
14	0.4%	0.5%	0.1%	1.1%	2.4%	0.3%	0.1%	0.2%	0.0%	1.3%	0.4%	1.7%	-0.1%	2.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	0.4%	**11%**
15	0.0%	0.0%	0.0%	0.2%	0.5%	0.0%	0.4%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%	**1%**
16	0.0%	0.1%	0.1%	0.0%	-0.1%	0.1%	0.1%	0.1%	0.2%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**1%**
17	-0.2%	0.8%	0.4%	0.1%	2.1%	0.2%	0.5%	-0.3%	0.6%	0.0%	0.2%	1.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**6%**
18	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0%**
19	-0.1%	0.3%	0.4%	0.1%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**2%**
20	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0%**
21	0.0%	0.0%	0.0%	0.1%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	-0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0%**
Total	**10%**	**9%**	**2%**	**5%**	**17%**	**2%**	**4%**	**2%**	**4%**	**6%**	**7%**	**11%**	**5%**	**8%**	**1%**	**1%**	**3%**	**1%**	**0%**	**1%**	**1%**	**100%**

5.4 Accidents Appraisal Results

5.4.1 The model forecasts an increase of 24 accidents or 0.2% over the 60-year assessment period, which can be regarded as a very minor impact. Although the model predicts an increase in accidents, these are expected to occur mostly on links with low speed limits and are therefore less serious.

5.4.2 Please note, the assessment has been undertaken for the core (NTEM) scenario, and the results are assumed to be consistent for all scenarios considered in this document.

5.4.3 Table 5-7 presents a summary of the findings of the accident analysis.

5.4.4 The benefits are estimated at approximately £208,000 over the 60-year appraisal period (discounted 2010 prices), considered between slightly beneficial and neutral. Although the junction analysis present disbenefits of £5.8m; this is offset by the £6.0m benefits observed for the link analysis.

5.4.5 The model forecasts an increase of 24 accidents or 0.2% over the 60-year assessment period, which can be regarded as a very minor impact. Although the model predicts an increase in accidents, these are expected to occur mostly on links with low speed limits and are therefore less serious. It is important to note that overall, both links and junction fatalities decrease by 0.7 and 10.2 respectively. This suggests that the scheme tends to reduce the severity of accidents.

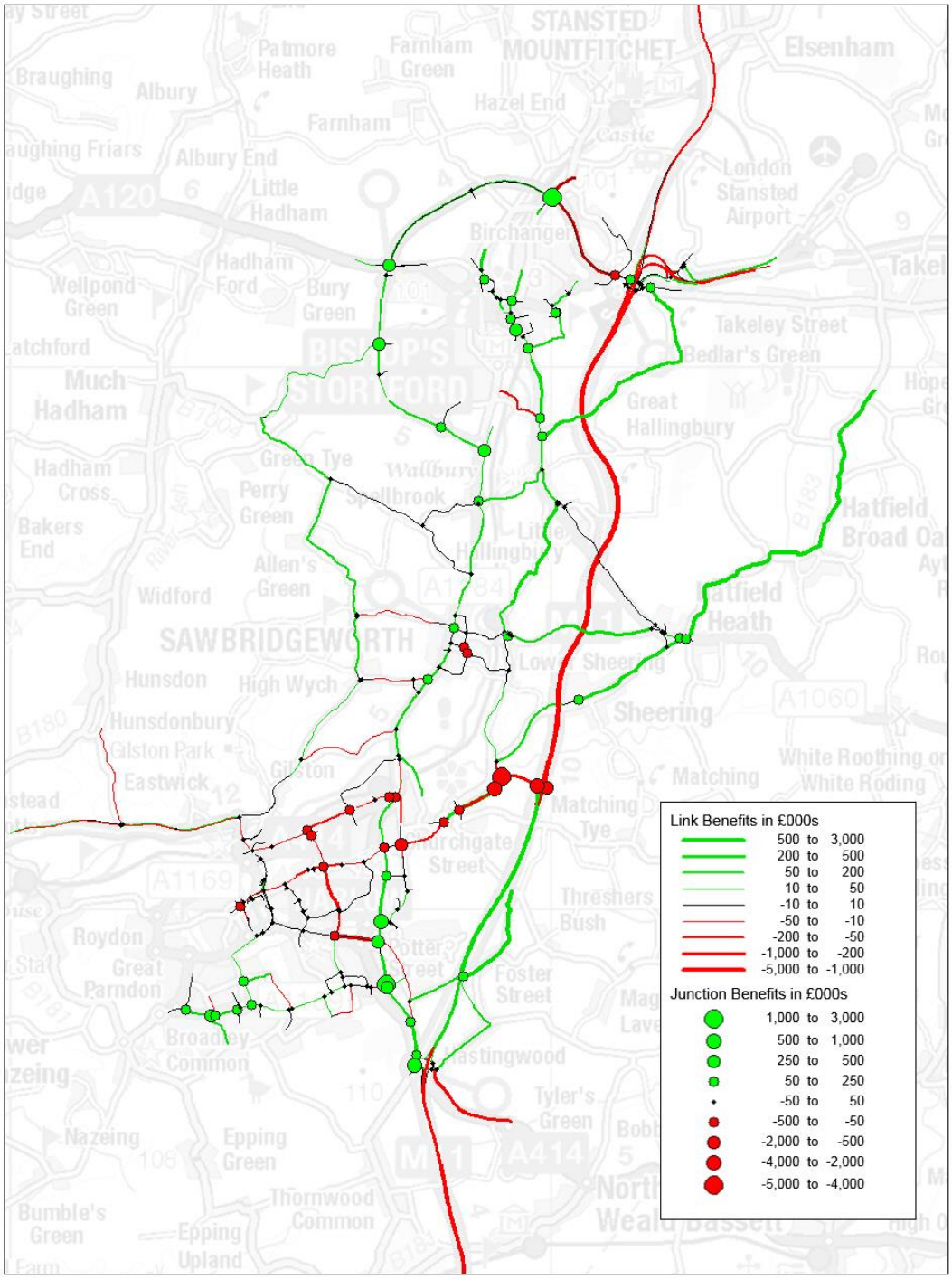
5.4.6 Please note, the assessment has been undertaken for the core (NTEM) scenario, and the results are assumed to be consistent for all scenarios considered in this document.

Table 5-7 : Predicted accident savings and benefits for NTEM growth scenario

	COBA-LT Output			
		Links	**Junctions**	**Total**
Economic Summary	Total (Without-Scheme Accident Costs), £000s	£ 325,094	£ 193,404	£ 517,498
	Total With-Scheme Accident Costs, £000s	£ 319,105	£ 198,185	£ 517,290
	Total Accident Benefits Saved by Scheme, £000s	**£ 5,990**	**£ -5,782**	**£ 208**
Accident Summary	Total Casualties Saved by Scheme (Fatal)	1.7	-1	0.7
	Total Casualties Saved by Scheme (Serious)	23.8	-13.6	10.2
	Total Casualties Saved by Scheme (Slight)	82.6	-169.3	-86.7
	Total Accidents Saved by Scheme	**104**	**-128**	**-23.8**
	Total Accidents Saved by Scheme %	**1.6**	**-2.3**	**-0.2**

5.4.7 Figure 5-4 shows the places where the intervention leads to a reduction in accidents. The areas marked with red present an increase in expected accidents, but this can be mainly explained by the expected increase in flows.

Figure 5-4: Link and Junction Benefits



5.4.8 The new junction allows travellers to access the M11 at a further point increasing the flows from the new junction to Stansted airport significantly. This in effect leads to an increase in accident costs on the M11 to the north of the proposed junction.

5.4.9 The predicted increase in vehicles using the new junction to access the M11 from the South West via Harlow results in an increase in accidents costs in those sections of the study area. However, the speed limit on Sheering road is reduced from 60mph to 40mph as part of the scheme, which mitigates the increase in accident costs from the significantly higher flows. Likewise, the upgrade of some of the junctions also reduces accident costs.

5.4.10 Although higher accident costs are generated on the northern section of the M11 and junction 7a and 8, these are counterbalanced by the reduction in demand and the reduction in accident costs on a number of parallel roads resulting from lower traffic flows. In particular, the reduction in demand can be seen on the links to the east of the M11. Furthermore, a reduction in traffic flows using the existing junction 7 to the south of the new junction, results in benefits on this section of the M11 and the links from Harlow leading to that junction.

5.5 Delays during Construction and Future Maintenance Appraisal Results

5.5.1 When schemes are constructed it is inevitable that there are some delays to traffic as it is being built. Table 5-8 below shows the costs associated with user delays during construction for the core (NTEM) scenario. The total construction delay impact is assumed to be consistent across all scenarios assessed in this document.

Table 5-8 : Total construction delay impact for core (NTEM growth) scenario (discounted, 2010 prices)

	NTEM growth scenario (£)
Work	£2,745,524
Commute	£1,601,855
Other	£2,667,851
Total	**£7,015,230**

5.5.2 User delay costs of £7m are expected from the construction of the scheme due to reduced speed limit, lane closures and lane widths as part of the traffic management plan.

5.5.3 A comparison was made of the future maintenance requirements both with and without the scheme over 60-year appraisal period.

5.5.4 Table 5-9 below shows the costs associated with user delays during maintenance as produced by QUADRO following the methodology described in Chapter 4.

Table 5-9: Maintenance Delays Costs – NTEM Growth scenario (2010 prices)

Journey Purpose	Maintenance Cost, £
Work	-1,237,601
Commute	-476,673
Other	-718,359
Total	**-2,432,633**

5.5.5 Total user delay savings of £ 2.4m are expected as a result of the scheme, despite only modelling B183 Gilden Way in the Do-Minimum scenario. Without the scheme, it is likely that significant maintenance would be required at the start of the appraisal period, which would cause delay to traffic. However, with the scheme in place, no significant maintenance would be required for a number of years after the scheme opens. As a result, fewer number of maintenance jobs are carried out over the 60-year appraisal period in the Do-Something Scenario. Additionally, in the Do-Minimum scenario, road-surfacing maintenance on the single-carriageway B183 Gilden Way would require shuttle-working, causing longer delays. Whereas in the Do-Something scenario, all road surfacing maintenance within the scheme area only requires contraflow, causing minimal delays.

5.5.6 The combined user delay impact as a result of both construction and maintenance of the scheme leads to an overall net user delay cost of £4.58 million is estimated as a result of necessary traffic management during construction and future maintenance.

Table 5-10: Construction + Maintenance Delay Cost Impact, £ (discounted, 2010 prices)

Journey Purpose	Total Cost, £
Work	1,507,923
Commute	1,125,182
Other	1,949,492
Total	**4,582,597**

5.6 Carbon Emission, Air Quality and Noise Results

5.6.1 As discussed above, Greenhouse Gases, Air Quality and Noise's NPV are derived using standard environmental spreadsheets following relevant TAG guidelines.

5.6.2 Table 5-11 shows the carbon (greenhouse gases) benefits, air quality (NOx and PM_{10}) and Noise as calculated using the TAG spreadsheet, for NTEM growth scenario.

Table 5-11 : Greenhouses gases, air quality and noise NPVs, £m for NTEM growth scenario

Environmental benefit	Value of benefit, £m
Greenhouse Gases	- £ 15.7
Air Quality	- £ 0.3
Noise	£ 4.9

5.6.3 In terms of Greenhouse Gases, it is predicted that there will be an increase in greenhouse gases emissions in the opening and design years of the scheme, with a total increase over the 60-year appraisal period predicted, due to changes in traffic over the entire modelled area. The negative NPVs indicate a net worsening (increase) of CO2 emissions for all growth scenarios.

5.6.4 In terms of Air Quality, it is predicted that there will be an overall net disbenefit (deterioration) to air quality for all growth scenarios, as the assessment predicts an increase in both PM10 concentration and NOx around the scheme area.

5.6.5 And in terms of noise, it is predicted that there will be a noise related benefit; more households are expected to experience decreased daytime noise during the daytime, as well as a significant number of households will experience reduced night-time noise in comparison to the households expected to experience increased night-time noise.

5.7 Journey Time Reliability Results

5.7.1 Journey time appraisal methodology has been described in chapter 4. Total benefits attributed to reductions in journey times due to improvements in reliability (journey time variability) are presented in Table 5-12. It should be noted that these values are not included in the calculation of the PVB or BCR but will be included in the Appraisal Summary Table (AST).

Table 5-12 : Reliability Benefits by Purpose, £, 2010 prices for NTEM growth scenario

Purpose of travel	Reliability Benefits, £
Business	749,161
Commute	1,784,943
Other	1,204,896
Total	**3,738,999**

5.8 Transport Economic Efficiency (TEE), Public Accounts (PA) and Analysis of Monetised Costs and Benefits (AMCB)

5.8.1 Table 5-13 shows a summary of the economic assessment for the Core Scenario. The economic appraisal presents a benefit cost ratio of 2.6. The BCR of the scheme is above the threshold 2:1, indicating a High Value for Money.

5.8.2 Table 5-14, Table 5-15 and Table 5-16 presents the Transport Economic Efficiency (TEE) table, Public Accounts table (PA) and the Analysis of the Monetised Costs and Benefits (AMCB) table for the core scenario respectively.

Table 5-13 : Core Scenario (NTEM growth) benefits and costs of each scenario, £m

			Costs/Benefits
			£ millions
Benefits	Consumer Commuting User Benefits	Travel Time	74.4
		VOC	-0.8
		Construction Delays	-1.6
		Maintenance Delays	0.5
		Net Benefits	**72.5**
	Consumer Other User Benefits	Travel Time	55.4
		VOC	-3.3
		Construction Delays	-2.7
		Maintenance Delays	0.7
		Net Benefits	**50.1**
	Consumer Business User Benefits	Travel Time	46.9
		VOC	7.0
		Construction Delays	-2.7
		Maintenance Delays	1.2
		Developer Contributions	-
		Net Benefits	**52.4**
	Accidents Benefits		0.2
	Indirect Tax Revenues		-0.6
	Noise		4.9
	Air Quality		-0.3
	Greenhouse Gases (Carbon)		-15.7
	Total PVB (£m)		**163.3**
Costs	Operating Costs		5.3
	Investment Costs		57.2
	Developer Contributions		-
	Total PVC (£m)		**62.5**
		Net Present Value (NPV)	**100.9**
		Benefits to Cost Ratio (BCR)	**2.6**

5.8.3 Please note: All monetary values are discounted to 2010 year value.

Table 5-14: Transport Economic Efficiency (TEE) table, Core Scenario, £000s, discounted

TEE Table (£000's) for Core Scenario (NTEM Growth)				
	Type	**All Modes**	**Road, Private Cars and LGVs**	
Commuting User Benefits	Travel Time	£74,390	£74,390	
	Vehicle Operating Costs	-£800	-£800	
	User Charges	-	-	
	During Construction & Maintenance	-£1,125	-£1,125	
	Net Benefits (1a)	**£72,465**	**£72,465**	
Other User Benefits	Travel Time	£55,392	£55,392	
	Vehicle Operating Costs	-£3,295	-£3,295	
	User Charges	-	-	
	During Construction & Maintenance	-£1,949	-£1,949	
	Net Benefits (1b)	**£50,148**	**£50,148**	
Business	**Type**	**All Modes**	**Goods Vehicles**	**Business Cars & LGVs**
	Travel Time	£46,921	£35,842	£11,079
	Vehicle Operating Costs	£6,960	£4,428	£2,532
	User Charges	-	-	-
	During Construction & Maintenance	-£1,508	-£1,508	
	Net Benefits (2)	**£52,373**	**£38,762**	**£13,611**
	Type	**All Modes**	**Road**	
	Developers contributions (4)	-	-	
	Net Benefits (5)	**£52,373**	**£52,373**	
Total	**Present Value of Transport Economic Efficiency Benefits (TEE)**	**£ 174,985**		

Table 5-15: Public Accounts (PA) table, Core Scenario, £000s, discounted

Public Accounts (£000's) for NTEM Growth		
Local Government Funding	**All modes**	**Road**
Revenue	-	-
Operating Costs	£ 5,328	£ 5,328
Investment Costs	£ 31,559	£ 31,559
Developer Contributions		
Grant/Subsidy Payments	-	-
NET IMPACT (7)	**£36,888**	**£36,888**
Central Government Funding – Transport	**All modes**	**Road**
Revenue	-	-
Operating costs	-	-
Investment costs	£ 25,600	£ 25,600
Developer Contributions	-	-
Grant/Subsidy Payments	-	-
NET IMPACT (8)	**£25,600**	**£25,600**
Central Government Funding- Non Transport		
Indirect Tax Revenues (9)	£647	£647
TOTALS		
Broad Transport Budget (10)	£ 62,488	£ 62,488
Wider Public Finances (11)	£647	£647

Table 5-16: Analysis of Monetised Costs and Benefits (AMCB) table, Core scenario, £000s, discounted

Analysis of Monetised Costs and Benefits (£000's) for NTEM Growth	
Noise (12)	£ 4,863
Local Air Quality (13)	- £336
Greenhouse Gases (14)	-£ 15,732
Accidents (17)	£ 208
Economic Efficiency: Consumer Users (Commuting)	£ 72,465
Economic Efficiency: Consumer Users (Other)	£ 50,148
Economic Efficiency: Business Users and Providers	£ 52,373
Wider Public Finances (Indirect Taxation Revenues)	-£ 647
Present Value of Benefits (PVB)	**£ 163,341**
Broad Transport Budget	£ 62,488
Present Value of Costs (PVC)	**£ 62,488**
OVERALL IMPACTS	
Net Present Value (NPV)	**£ 100,853**
Benefit to Cost Ratio (BCR)	**2.6**

5.9 Adjusted BCR

5.9.1 As explained in section 6.3, the wider economic impacts were not included in the BCR of the core scenario analysis. Although the agglomeration impact and tax revenues arising from labour market impacts have not been calculated for this assessment, the output change in imperfectly competitive markets were easily quantified using the guidance set out in WebTAG Unit A2.1. The quantified benefit of £2m has been included to calculate the adjusted BCR, as presented in Table 5-17.

Table 5-17: NTEM growth scenario (including wider impact) benefits and costs summary, £m

Adjusted BCR	Benefits	£m
Standard Benefits	**Total PVB**	**163.3**
Additional Wider Benefits	Agglomeration	-
	Output change in imperfectly competitive markets (with freight)	1.4
	Taxes arising from labour supply impacts	-
	Adjusted Total PVB	164.7
Standard Costs	Total PVC	62.5
	Adjusted BCR	**2.6**
	Adjusted NPV	**102.2**

5.9.2 The dependent development assessment results were not included in the adjusted BCR. For more details, please refer to section 6.2.

6. Wider Impacts

6.1 Purpose of Wider Impact Assessment

6.1.1 Wider economic impacts refer to the additional benefits (or disbenefits) that can arise as the impact of transport improvements is transferred into the wider economy; beyond those business' and passengers that are directly affected by the transport change. Transport schemes may impact the wider economy in terms of productivity, investment and employment. These benefits (or disbenefits) are mostly realised in the medium and long run.

6.1.2 Wider Economic Impacts arise from distortions in other markets. These distortions lead to several market failures in other parts of the economy that need to be accounted for. These market failures could have positive or adverse welfare affects.

6.1.3 Whilst direct benefits from transport schemes, such as time benefits, may be more intuitive, the impacts on the wider economy is often less obvious. This provides the challenge of assessing the wider impact appraisal. A full quantification of the wider impacts can be an onerous exercise and it is not always proportionate or necessary to undertake the analysis.

6.1.4 WebTAG Unit A2.1 Wider Economic Impacts[12] (May 2018) identifies three types of wider impacts: induced investment, employment effects and productivity. Under the three main types of wider impacts, the following impacts were assessed (quantitatively or qualitatively):

- Induced Investment
  - Dependent Development
  - Output Change in Imperfectly Competitive Markets
- Employment Effects
  - Labour Supply Impacts
- Productivity
  - Agglomeration Impacts

6.1.5 For the purposes of the M11 J7a scheme we have included a simplified methodology in which we provide an economic context narrative, quantify the increase in output in competitive markets impacts and dependent development, and undertake a qualitative analysis for agglomeration and labour market

6.2 Induced Investment: Dependent Development

Background

[12] Department for Transport, 2018, TAG UNIT A2.1 Wider Economic Impacts

6.2.1 A dependent development is a very particular case of induced investment. Dependent development refers to new development that is dependent on the provision of a transport scheme and for which, with the new development but in the absence of the transport scheme, the existing transport network would not provide a reasonable level of service to existing and/or new users. This has the implication that the development would not be delivered in the absence of the transport scheme.

6.2.2 The purpose of the dependent development assessment is to look at the extent of the 'economic benefit' that can be derived from unlocking of land for residential development. Although the benefits of dependent housing unlocked by a transport scheme should not be included in the NPV and BCR calculations, they should be included within the Economic Assessment Report as recommended by DfT's TAG Guidance.

6.2.3 The dependent development assessment was undertaken in accordance to DfT's Transport Appraisal in the Context of Dependent Development (July 2015).

6.2.4 The Dependent Development assessment estimates the Land Value Uplift, which measures the difference between the price of land in its new and former uses and represents the private gain to land owners. It provides a convenient way of estimating the economic value of a development which is dependent on the M11J7a scheme.

6.2.5 In addition to Land Value Uplift, the Transport External Costs (TEC) is calculated, which refers to the additional costs imposed on the existing road users by the development road users, such as increased levels of congestion or over-crowding. These costs arise as a result of those trips which are dependent on the M11J7a scheme.

6.2.6 This section will summarise the Land Value Uplift and Transport External Costs arising from the dependent development. For more details of the Dependent Development Assessment, please refer to Appendix H.

Land Value Uplift

6.2.7 The benefits of the dependent development are calculated to capture the value uplift of the change in land use, from agricultural/industrial use to residential/employment use. The Department for Transport WebTAG Unit A2.3 provides guidance on a methodology to capture the economic benefits generated by new housing and office developments.

6.2.8 The total land uplift value of the developments identified in each growth scenario represents the net social value of the land:

Net Social Value = *Value of Land in Residential/Employment use - Value of Land in Existing Use (Agriculture or Industrial) + Externality Value (Perpetuity Value)*

6.2.9 Residential, industrial and agricultural land values are taken from the Valuation Office Agency Property Market Report for the East region of the UK. The land value for employment was sourced from the Department for Communities and Local Government's Appraisal Guidance (2016), whereby the type of land "Business Park Greenfield Uplift" was used as this type of non-residential development best aligned with the office development 372.2. All land value per hectare were converted to 2010 prices using the GDP deflator series. The existing value of the land is assumed to be based on industrial or agricultural land prices depending on whether the land has been previously developed or not.

6.2.10 The perpetuity value is the externality cost of developing on different land types. The developments identified as dependent on the M11J7a scheme encroach near the greenbelt boundary, designed to protect an area of agriculture, forestry and outdoor leisure from urban growth. The perpetuity value (per hectare) of £237,000 was obtained from *"Valuing the External Benefits of Undeveloped Land: a review of the economic literature*, ODPM (2002), using the value for urban fringe to estimate the total negative externality of the identified developments encroaching the greenbelt boundary.

6.2.11 The Land Value Uplift (net social value) is presented in Table 6-1 for the core (NTEM), ECC Medium and ECC High growth scenarios.

Table 6-1: Land Value Uplift, £m (2010 prices)

	Value of Land for Residential/Office use (1)	Existing Value of Land (2)	Perpetuity Value (3)	Total Land Value Uplift (1) – (2) + (3)	Value for Money Score
Core (NTEM)	£ 136m	£1m	-£15m	£121m	Largely Beneficial
ECC Medium	£ 399m	£3m	-£43m	£352m	Largely Beneficial
ECC High	£ 593m	£5m	-£64m	£523m	Largely Beneficial

6.2.12 For the Core scenario, three residential developments were identified as dependent on the M11J7a scheme, at a Land Value Uplift (net social gain) of approximately £121m. The net social gain includes the existing value of the land (£1m), as well as the perpetuity cost of £15m.

6.2.13 In accordance to DfT's TAG A2.3, the estimated value of dependent development benefits unlocked by the M11J7a scheme are considered in the Value for Money assessment. The estimated benefits for the Core (NTEM), ECC Medium and ECC high growth scenarios are assessed against the suggested qualitative assessment scores:

Table 6-2: Qualitative Assessment Scores

Benefits	Score
Greater than £100m	Large beneficial
Between £100m and £25m	Moderate beneficial
Between £25m and zero	Slight beneficial
Zero	Neutral
Between zero and -£25m	Slight adverse
Between -£25m and -£100m	Moderate adverse
Less than -£100m	Large adverse

6.2.14 For all growth scenarios, the total land value uplift surpasses the maximum benchmark of £100m, suggesting the maximum value of the dependent development potentially unlocked by the M11J7a is considered **largely beneficial**.

6.2.15 However, the total value of the land uplift may not entirely be attributable to the transport scheme. Although the new Junction 7a will play a crucial role in the facilitation of housing and office development, other infrastructure items are needed, such as schools, supply of electricity and water etc. The benefits arising from the land uplift therefore depends on a package of infrastructure scheme, rather than just the transport scheme alone. Attributing all the benefits of the dependent development to the transport scheme alone would not be considered appropriate. Additionally, forecasting land use change is particularly uncertain (as recognised by DfT), and no further assessment is planned to validate the forecasts. As a consequent, the **total value of land uplift is not included in the calculation of the adjusted BCR**, as recommended by DfT's TAG unit A2.1.

Transport External Cost

6.2.16 The transport external costs were calculated in line with WebTAG Unit A2.3 Transport Appraisal in the Context of Dependent Development (July 2015). These consider the additional costs imposed on the existing road users by the development road users.

6.2.17 The transport external costs were calculated using TUBA (version 1.9.10), assuming Scenario D was assigned as the Do Minimum network and Scenario C was assigned as the Do Something network:

- **Do Minimum (Scenario D)** – without dependent new housing but with the transport scheme
- **Do Something (Scenario C)** –with dependent new housing and with the transport scheme

6.2.18

6.2.19 Table 6-3 6-3 presents transport external costs (discounted, 2010 prices) for the Core (NTEM), ECC Medium and ECC High growth scenarios for the year 2036.

Table 6-3: Transport External Cost of the land use development (with transport scheme), £m

Scenario	Transport External Cost, £m
Core (NTEM)	£ 1.1m
ECC Medium	£ 5.6m
ECC High	£ 10.9m

6.2.20 The transport external cost estimated for the core scenario, £1.1m, is the monetised transport cost imposed as a result of the additional development road users using the road network.

6.2.21 However, the transport external cost is lower in the event the transport scheme is implemented, compared to the transport external cost without the transport scheme.

6.2.22 The core scenario shows the transport scheme helps mitigate the transport external cost imposed on the existing road users by nearly £1m, as presented in Table 6-4 for the year 2036. The M11J7a scheme is critical to help accommodate increased traffic caused by the potential future development.

Table 6-4: Transport External Costs (without the scheme vs with the scheme), £000s

Scenario	Without the scheme (1)	With the scheme (2)	Change to TEC as a result of the transport scheme (1) – (2)
Core (NTEM)	£ 2.0m	£ 1.1m	**£1.0m** ↓
ECC Medium	£ 6.2m	£ 5.6m	**£0.6m** ↓
ECC High	£ 11.4m	£ 10.9m	**£0.5m** ↓

6.2.23 For full details of the dependent development assessment, please refer to Appendix H.

6.3 Induced Investment: Output Change in Imperfectly Competitive Markets

6.3.1 Output changes in imperfectly competitive markets are derived from a reduction in transport costs (to business and/or freight). This effect will increase firms' profits due to a cheaper production of goods or services that require the use of transport in their production process. Lower production costs will incentivise companies to expand their outputs, even in imperfectly competitive markets as they can increase production and still maintain their margins.

6.3.2 As discussed in the agglomeration impact section, the manufacturing industry is particularly likely to profit from the decreased transport costs as the improved connectivity will improve their productivity. This will lead to lower input prices and thus increases in outputs. The output increase is likely to lead to welfare gains as it implies that the higher outputs will be valued more by the consumers than the extra costs incurred for producers.

6.3.3 A further industry that is likely to profit from a decrease in transport costs is the retail sector. Retail stores are exposed to frequent transport of goods to their stores; the scheme will thus lead to an increase in productivity, resulting in higher outputs. Furthermore, the demand for their goods is likely to increase due to the fact that consumers have easier access to their stores.

6.3.4 This impact can be easily quantified using the guidance set out in Web TAG Unit A2.1, which suggests that the estimated increase in output is 10% of the business user benefits reported in the TEE. The guidance also recommends calculating a core test without Freight and a sensitivity test with Freight. Table 6-5 contains the results.

Table 6-5: Output increase in imperfectly competitive markets - £m, 2010 prices, discounted to 2010

	Without Freight (Core analysis)	With Freight (Sensitivity test)
Net Business User Benefits	£ 14m	£ 54m
Output increase	£ 1.4m	£ 5.4m

6.3.5 These impacts are not included in the BCR but can be included in an adjusted BCR and reported as part of the AST.

6.4 Employment Effects: Tax Revenues arising from Labour Market Impacts

6.4.1 The main mean of tax income stems from increases in labour income. In accordance to WebTAG, two forms of labour market impacts will be assessed. The two streams that may affect the labour market as a result from transport schemes are “labour supply” impacts, and “moves to more or less productive jobs” impacts

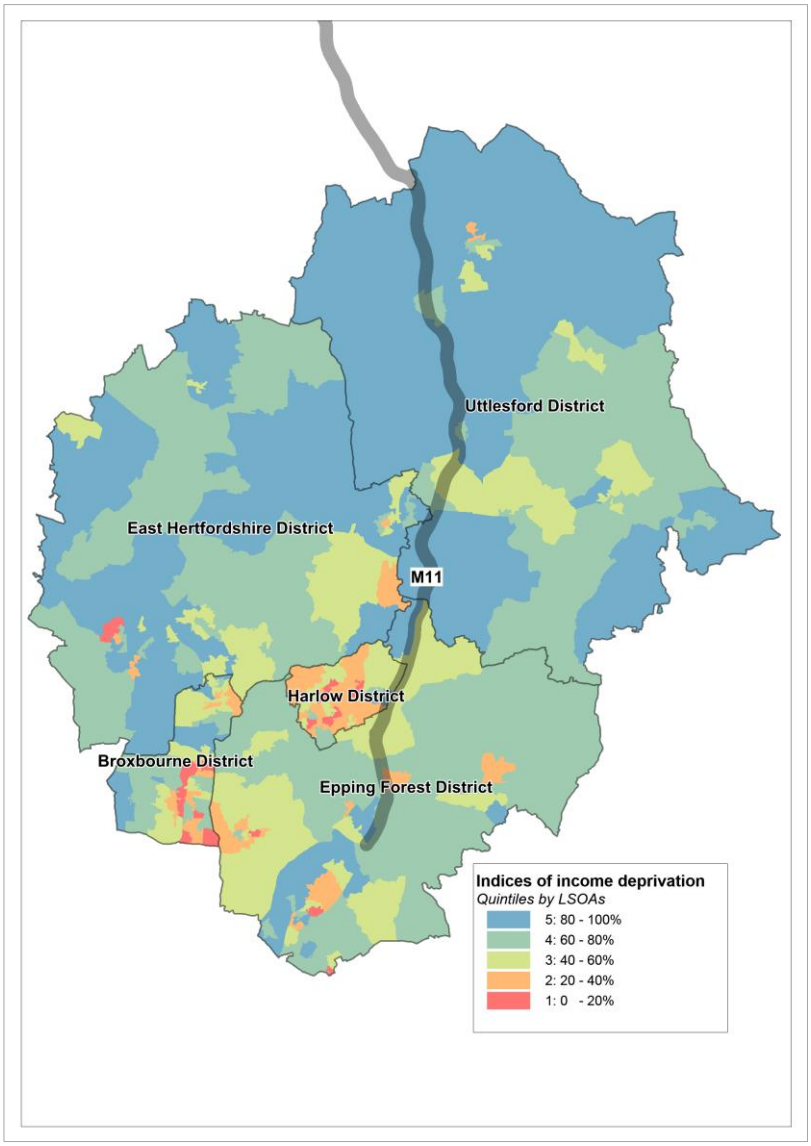
6.4.2 Apart from the availability of jobs, labour supply is influenced by workers considering the trade-off between working and not-working by maximising their utility between the costs and benefits of work. The main costs to be considered for this wider impact appraisal are changes to commuting user benefits. Noting that 41% of the PVB of the scheme come from commuting purposes and that unemployment in Harlow is frequently around 10% (higher than the UK average) it is reasonable to expect that some new workers might be encouraged to get into the labour market and therefore increase the exchequer’s income.

6.4.3 However, this impact is likely to depend on what sectors grow in the area and on the ability of the unemployed and local authorities to retrain workers as part of the unemployment is due to a decrease in the manufacturing activity.

6.4.4 If the new enterprise zone in Harlow attracts companies from highly productive sectors, it is possible to think that some workers may switch to more productive and better paid jobs; this is in turn likely to increase the accrual of income tax by the government.

6.4.5 Figure 6-1 shows that income deprivation is unusually high in Harlow, this may be deterring people from working. With an expected increase in the productivity of incumbent companies on top of a rise in new firms assembling in and around Harlow, the income landscape in and around Harlow is likely to improve. This would translate to higher incentives to work.

Figure 6-1: Income deprivation in Harlow



6.4.6 Evidence shows that this impact is usually less significant than the increase in output in competitive markets, therefore given that the estimation of the latter for a 60-year appraisal period is just £1.4m this impact can be regarded as positive, but just slightly beneficial.

6.5 Productivity: Agglomeration Impact

6.5.1 Agglomeration impacts account for changes in the geographical concentration of economic activity that might arise from a scheme. An increased agglomeration leads to higher clustering of firms to a certain location that is likely to be located in proximity to a large labour market. Improved access to larger product, input and labour markets will increase the productivity of firms. Agglomeration benefits are also likely to enhance the spillover of technology and knowledge.

6.5.2 Agglomeration impacts of a transport scheme are estimated based on impacts to effective densities, i.e. accessibility to employment clusters. In simple terms, journey time improvements can be seen as having an effect equivalent to shrinking the area and therefore increasing effective densities. Section Table 5-6 shows that most of the TUBA sectors experience benefits, especially sectors to the North East of Harlow, aligned with the strategy of improving the London-Harlow-Stansted-Cambridge-Peterborough Corridor.

6.5.3 Manufacturing, once a core sector in the economic structure of Harlow, has gradually decreased over the last couple of years. Whilst a decrease in manufacturing is a pattern seen in the whole UK, in this particular area it could have been affected by congestion and deterioration in accessibility to Harlow.

6.5.4 Manufacturing is particularly sensitive to congestion and requires very good accessibility levels as they depend on frequent transport to and from their factories. The new scheme is likely to improve the accessibility into Harlow which could induce increased productivity in the Manufacturing sector in the area leading to positive agglomeration effects.

6.5.5 The economic landscape in Harlow is characterised by a relatively high proportion of large employers. These might see the improved connectivity to Harlow as an opportunity to expand their business further, thus increasing the concentration of large companies in the area. Large companies benefit from economies of scale, an expansion of their activity in Harlow may therefore have relatively high efficiency benefits.

6.5.6 The Banking, Finance and Insurance sector is the biggest sector in Harlow, comprising of about 30% of all businesses. These companies, similarly to the main retail businesses, are mainly situated in the city centre and will profit from an improved connectivity. This sector is under the Producer Services category which according to WebTAG Unit A2.1 has the highest elasticity of productivity with respect to effective density. This sector may experience agglomeration benefits in this and other areas, subject to space constraints in city centres.

6.5.7 The M11 J7a may unlock the development of focal points of employment for example the Harlow Enterprise Zone, which in itself is good evidence of how a transport scheme can increase productivity.

6.5.8 Considering the analysis above it is reasonable to conclude that the scheme would be beneficial in terms of agglomeration. These impacts are not meant to be included in the BCR but can be included in an adjusted BCR when quantified. For the purposes of the M11 J7a scheme assessment, a summary of this qualitative analysis will be included in the AST.

7. Sensitivity Tests Appraisal Results

7.1 Overview

7.1.1 This chapter presents the results of four different sensitivity tests:

1. ECC Medium growth (i.e. ECC Most Likely)
2. ECC High growth (i.e. High Emerging)
3. WebTAG's Low Growth (of the core scenario)
4. WebTAG's High Growth (of the core scenario)

7.2 Headline economic appraisal results for ECC Medium and ECC High Growth Scenarios

7.2.1 These sensitivity tests intend to show the value for money analysis based on the Medium Growth of traffic forecast, i.e. the most likely scenario considered by ECC, and the High Growth of traffic forecast, i.e. the scenario in which there is high emerging growth within the Harlow area. Table 7-1 below presents a summary of the BCRs, whereby:

- the ECC Medium Growth scenario presents a BCR between 2.0 and 4.0, indicating the scheme as "High" Value for Money (VfM)
- The ECC High Growth scenario presents a BCR greater than 4.0, indicating the scheme as "Very High" VfM, the highest category according to the DfT.

7.2.2 It is important to note that under all the different growth scenarios, the BCR presents a good rating.

Table 7-1 : ECC Medium and ECC High Growth benefits and costs summary, £m

Growth Scenario	Present Value of Benefits (PVB)	Present Value of Costs (PVC)	BCR	VfM rating
ECC Medium	£213.94	£62.49	3.4	High
ECC High	£263.73	£62.49	4.2	Very High

7.2.3 The benefits shown in the PVB column above, include the same elements assessed for the Core Scenario. Most of the variables have been estimated using the latest VDM outputs for ECC Medium and ECC High.

7.2.4 Detailed outputs from the economic assessments in terms of TEE, PA and AMCB tables for the ECC Medium and High growth scenarios are presented in Appendix C and in Appendix D for High.

7.3 WebTAG's Low and High Growth (of the Core Scenario)

7.3.1 These sensitivity tests intend to show the VfM analysis based on the low and high growth of the core scenario (NTEM growth), as per DfT guidance. Table 7-2 presents the BCRs of the sensitivity analysis, whereby:

- the Low growth of the core scenario presents a BCR between 1.5 and 2.0, indicating a medium VfM
- the High growth of the core scenario presents a BCR between 2.0 and 4.0 indicating a high VfM.

Table 7-2: WebTAG Low and High growth of the Core scenario benefits and costs summary, £m

Scenario	Present Value of Benefits (PVB)	Present Value of Costs (PVC)	BCR	VfM Rating
WebTAG Low Growth	£109.12	£62.49	1.7	Medium
WebTAG High Growth	£204.72	£62.49	3.3	High

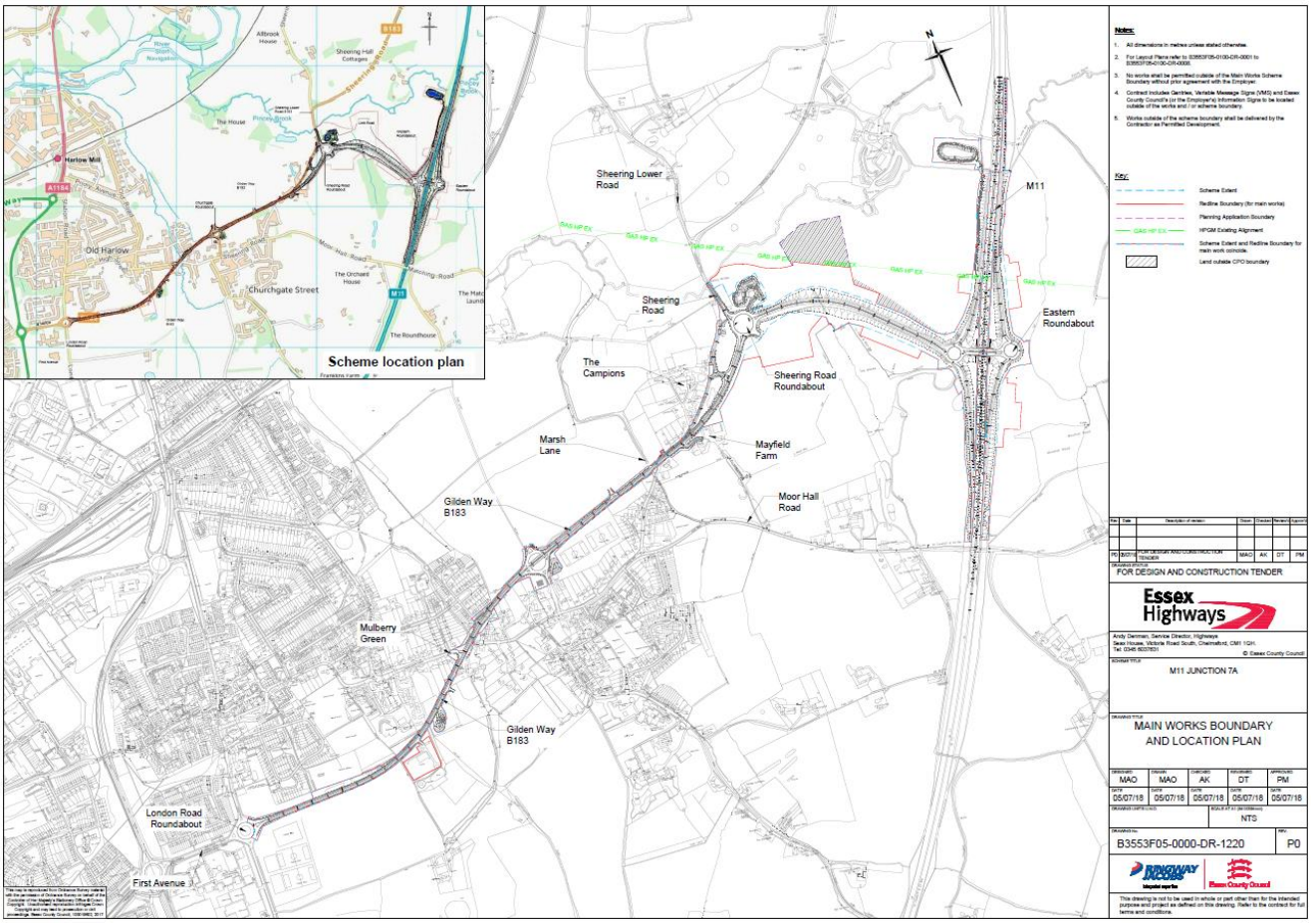
7.3.2 Detailed outputs from the economic assessments presented in TEE, PA and AMCB tables for the WebTAG's Low growth of the NTEM scenario and WebTAG's High growth of the NTEM scenario can be found in Appendix E and Appendix F.

8. Summary and Conclusion

8.1.1 This document has presented the analysis of how the introduction of M11 J7a and associated improvements along Gilden Way will impact the economy and environment. The calculations were undertaken for an appraisal period of 60 years, from 2021 and ending in 2080. While there are some expected disbenefits the core scenario presents a robust BCR of 2.6 and sensitivity tests return a high to very high value for money rating. The main effects of the scheme are outlined below:

- Travel time savings represent the majority of the benefits associated with the Scheme for all the scenarios. For all scenarios most of the benefits are accrued under the purposes categorised as “other” (e.g. leisure, education, etc).
- VOC are positive for all the purposes for all the scenarios.
- As expected, there are some disbenefits experienced by road users as a result of delay due to constructions works. None of these costs are higher than 4% of the travel time benefits resulting from the Scheme.
- Future maintenance delay savings are expected as a result of the scheme.
- The scheme has a slightly beneficial to neutral effect on accidents over 60 years. Although the assessment predicts an increase in accidents, these are expected to occur mostly on links with low speed limits and are therefore less serious. The increase in slight accidents is offset by the reduction in serious and fatal casualties, leading to an overall positive effect.
- In terms of Greenhouse Gases, it is predicted that there will be an increase in greenhouse gas emissions in the opening and design years of the scheme, with a total increase over the 60-year appraisal period predicted, due to changes in traffic over the entire modelled area. The negative NPVs indicate a net worsening (increase) of CO2 emissions for all growth scenarios.
- In terms of Air Quality, it is predicted that there will be an overall net disbenefit (deterioration) to air quality for all growth scenarios, due to an increase in both PM10 concentration and NOx.
- In terms of noise, it is predicted that there will be an overall noise related benefit, more households are expected to experience decreased daytime noise during the daytime, as well as a significant number of households will experience reduced night-time noise in comparison to the households expected to experience increased night-time noise.
- The costs are based on cost estimates as at December 2016. To allow for uncertainty, investment costs have been uplifted by 3% including risk allowance and optimism bias.
- To the date the sources of funding have not been finalised. Any potential developer contribution is seen as a cost to the business element of Present Value of Benefits and as a relief to the local government costs, therefore reducing the Present Value of Costs.

Appendix A. Scheme Drawing



Appendix B. Economic Appraisal Results using Essex County Council Capital and Operating Costs

This appendix details the economic appraisal results of the core (NTEM) scenario, based on the construction costs estimated by Essex County Council, rather than the construction costs estimated by Highways England used in the main economic appraisal (see Section 3). The costs presented in this appendix will be referred to as ECC costs. The future maintenance costs are assumed to be the same, as outlined in Section 3.2.1. Similarly, the estimated benefits of the scheme (see Section 5) do not change as a result of the alternate construction costs.

B.1 Construction costs

The construction cost estimates are based on the design information developed to Stage 4 for tendering purposes. The costs have been estimated under the assumption that the works will be procured using a “design and construct” form of procurement with by single stage competitive tender utilising the NEC 3 Engineering and Construction Contract.

The rates used reflect construction projects of similar size and nature and were initially estimated based on prices as at the 4th Quarter of 2016 and construction inflation has been added to be able to estimate real changes in costs where compared to general inflation. The Building Cost Information Service (BCIS) General Civil Engineering Cost Index has been used to calculate inflation. Please note, the costs are given as resource costs and excludes VAT. The land and compensation estimates are as at the fourth quarter of 2016. These estimates have been converted to 2010 prices using the GDP-deflator series as published in the July 2016 TAG Data book. The prices have not been converted to market prices, as recommended by TAG Unit A1.2, as ECC are not expected to incur VAT costs. This deviation from guidance has been agreed with ECC and HE.

For full details of the construction cost estimates produced by ECC, please refer to the document “Pre-Tender Estimate Rev 9” (dated 25th July 2018).

B.2 Operating and Maintenance Costs

The Operating and Maintenance costs (O&M) have not been estimated by ECC. At this stage, we have assumed the O&M cost estimates calculated by HE (see section 3.3), with the inclusion of an optimism bias allowance of 3%.

B.3 Risk and Optimism Bias

Allowances have been included in this estimate for design development risks, construction risks, employer change risks and employer risks. A quantified risk analysis and Monte Carlo simulation has been undertaken following the last risk workshop (See document B3353F05-0000-RA-0018 Rev P00 dated 26 June 2018).

TAG Unit A1.2 requires optimism bias to be included in the estimation of cost calculations. Optimism bias is the demonstrated systematic tendency for appraisers to be overly optimistic about key parameters. DfT Treasury Analysis Guidance (See TAG Unit A1.2 Scheme Costs, section 3.5.6) recommends that estimates, at Stage 4, are uplifted by 3% for Optimism Bias. Allowance of 3% has therefore been included in line with DfT guidelines.

Summary of the costs

Table 8-3 presents the summary of the construction, land acquisition and part claims, and O&M costs, discounted using 3.5% discount rate starting at 2010, in accordance to TAG Unit A1.1.

Table 8-1: Summary of capital and O&M costs, £m, discounted 2010 prices

2010 prices	Discounted costs, £m
Operating Costs	£5.49m
Construction Costs	£39.70m
Land acquisitions and claims	£4.19m
Total, PVC (Broad Transport Budget)	**£49.38m**

B.4 Core Scenario Appraisal Results

B.4.1 Value for Money

Table 8-2 below presents a summary of the BCR which is between 2.00 and 4.00 which means that the scheme is rated as “High” Value for Money (VfM) according to the DfT Value for Money Assessment Guidance.

Table 8-2: Core Scenario (NTEM growth) benefits and costs (ECC costs) summary, £m

Growth Scenario	Present Value of Benefits (PVB)	Present Value of Costs (PVC)	BCR	VfM rating
NTEM	£163.3	£ 49.4	3.3	High

B.4.2 Transport Economic Efficiency (TEE), Public Accounts (PA) and Analysis of Monetised Costs and Benefits (AMCB) Tables

As no change is anticipated for the scheme benefits as a result of a variance in cost estimates, the Transport Economic Efficiency (TEE) tables remains equivalent to Table 5-14 in section 5.8.

Table 8-3 and Table 8-4 presents the Public Accounts (PA) and Analysis of Monetised Costs and Benefits AMCB) tables respectively, updated with the ECC costs.

Table 8-3: Public Accounts (PA) with ECC costs

Public Accounts (£000's) for Core (NTEM growth) scenario with ECC costs		
Local Government Funding	**All modes**	**Road**
Revenue	-	-
Operating Costs	£5,488	£5,488
Investment Costs	£18,484	£18,484
Developer Contributions		
Grant/Subsidy Payments		
NET IMPACT (7)	**£23,973**	**£23,973**
Central Government Funding – Transport	**All modes**	**Road**
Revenue	-	-
Operating costs		
Investment costs	£25,410	£25,410
Developer Contributions		
Grant/Subsidy Payments		
NET IMPACT (8)	**£25,410**	**£25,410**
Central Government Funding- Non Transport		
Indirect Tax Revenues (9)	£647	£647
TOTALS		
Broad Transport Budget (10)	£49,383	£49,383
Wider Public Finances (11)	£647	£647

Table 8-4: Analysis of Monetised Costs and Benefits (AMCB) with ECC costs, £000s

Analysis of Monetised Benefits (£000's) for Core (NTEM growth) scenario with ECC costs	
Noise (12)	£4,863
Local Air Quality (13)	-£336
Greenhouse Gases (14)	-£15,732
Accidents (17)	£208
Economic Efficiency: Consumer Users (Commuting)	£72,465
Economic Efficiency: Consumer Users (Other)	£50,148
Economic Efficiency: Business Users and Providers	£52,373
Wider Public Finances (Indirect Taxation Revenues)	-£647
Present Value of Benefits (PVB)	**£163,341**
Broad Transport Budget	£49,383
Present Value of Costs (PVC)	**£49,383**
OVERALL IMPACTS	
Net Present Value (NPV)	**£113,958**
Benefit to Cost Ratio (BCR)	**3.3**

Appendix C. ECC Medium Growth Reporting Tables

TEE Table (£000's) for ECC Medium Growth				
	Type	**All Modes**	**Road, Private Cars and LGVs**	
Commuting User Benefits	Travel Time	£103,088	£103,088	
	Vehicle Operating Costs	£3,408	£3,408	
	User Charges	-	-	
	During Construction & Maintenance	-£1,125	-£1,125	
	Net Benefits (1a)	**£105,371**	**£105,371**	
Other User Benefits	Travel Time	£65,385	£65,385	
	Vehicle Operating Costs	£259	£259	
	User Charges		£0	
	During Construction & Maintenance	-£1,949	-£1,949	
	Net Benefits (1b)	**£63,695**	**£63,695**	
Business	**Type**	**All Modes**	**Goods Vehicles**	**Business Cars & LGVs**
	Travel Time	£55,190	£43,388	£11,802
	Vehicle Operating Costs	£3,762	£2,664	£1,098
	User Charges	-	-	-
	During Construction & Maintenance	-£1,508	-£1,508	-
	Net Benefits (2)	**£57,444**	**£44,544**	**£12,900**
	Type	**All Modes**	**Road**	
	Developers contributions (4)	-	-	-
	Net Benefits (5)	**£57,444**	**£57,444**	
Total	**Present Value of Transport Economic Efficiency Benefits (TEE)**	**£226,509**		

Public Accounts (£000's) for ECC Medium Growth		
Local Government Funding	**All modes**	**Road**
Revenue	-	-
Operating Costs	£5,328	£5,328
Investment Costs	£31,559	£31,559
Developer Contributions	-	-
Grant/Subsidy Payments	-	-
NET IMPACT (7)	**£36,888**	**£36,888**
Central Government Funding – Transport	**All modes**	**Road**
Revenue	-	-
Operating costs		
Investment costs	£25,600	£25,600
Developer Contributions		
Grant/Subsidy Payments		
NET IMPACT (8)	**£25,600**	**£25,600**
Central Government Funding- Non Transport		
Indirect Tax Revenues (9)	£1,573	£1,573
TOTALS		
Broad Transport Budget (10)	£62,488	£62,488
Wider Public Finances (11)	£1,573	£1,573

Analysis of Monetised Benefits (£000's) for ECC Medium Growth	
Noise (12)	£4,863
Local Air Quality (13)	-£336
Greenhouse Gases (14)	-£15,732
Accidents (17)	£208
Economic Efficiency: Consumer Users (Commuting)	£105,371
Economic Efficiency: Consumer Users (Other)	£63,695
Economic Efficiency: Business Users and Providers	£57,444
Wider Public Finances (Indirect Taxation Revenues)	-£1,573
Present Value of Benefits (PVB)	**£213,939**
Broad Transport Budget	£62,488
Present Value of Costs (PVC)	**£62,488**
OVERALL IMPACTS	
Net Present Value (NPV)	**£151,451**
Benefit to Cost Ratio (BCR)	**3.4**

Appendix D. ECC High Growth Reporting Tables

TEE Table (£000's) for ECC High Growth				
	Type	**All Modes**	**Road, Private Cars and LGVs**	
Commuting User Benefits	Travel Time	£135,163	£135,163	
	Vehicle Operating Costs	£3,836	£3,836	
	User Charges	-	-	
	During Construction & Maintenance	-£1,125	-£1,125	
	Net Benefits (1a)	**£137,874**	**£137,874**	
Other User Benefits	Travel Time	£83,830	£83,830	
	Vehicle Operating Costs	£3,225	£3,225	
	User Charges	-	-	
	During Construction & Maintenance	-£1,949	-£1,949	
	Net Benefits (1b)	**£85,106**	**£85,106**	
Business	**Type**	**All Modes**	**Goods Vehicles**	**Business Cars & LGVs**
	Travel Time	£53,498	£39,697	£13,801
	Vehicle Operating Costs	£2,794	£4,560	-£1,766
	User Charges	-	-	-
	During Construction & Maintenance	-£1,508	-£1,508	
	Net Benefits (2)	**£54,784**	**£42,749**	**£12,035**
	Type	**All Modes**	**Road**	
	Developers contributions (4)	-	-	
	Net Benefits (5)	**£54,784**	**£54,784**	
Total	**Present Value of Transport Economic Efficiency Benefits (TEE)**	**£277,784**		

Public Accounts (£000's) for ECC High Growth		
Local Government Funding	**All modes**	**Road**
Revenue	-	-
Operating Costs	£5,328	£5,328
Investment Costs	£31,559	£31,559
Developer Contributions	-	-
Grant/Subsidy Payments	-	-
NET IMPACT (7)	**£36,888**	**£36,888**
Central Government Funding – Transport	**All modes**	**Road**
Revenue	-	-
Operating costs	-	-
Investment costs	£25,600	£25,600
Developer Contributions	-	-
Grant/Subsidy Payments	-	-
NET IMPACT (8)	**£25,600**	**£25,600**
Central Government Funding- Non Transport		
Indirect Tax Revenues (9)	£3,040	£3,040
TOTALS		
Broad Transport Budget (10)	£62,488	£62,488
Wider Public Finances (11)	£3,040	£3,040

Analysis of Monetised Benefits (£000's) for ECC High Growth	
Noise (12)	£4,863
Local Air Quality (13)	-£336
Greenhouse Gases (14)	-£15,732
Accidents (17)	£208
Economic Efficiency: Consumer Users (Commuting)	£137,874
Economic Efficiency: Consumer Users (Other)	£85,106
Economic Efficiency: Business Users and Providers	£54,784
Wider Public Finances (Indirect Taxation Revenues)	-£3,040
Present Value of Benefits (PVB)	**£263,726**
Broad Transport Budget	£62,488
Present Value of Costs (PVC)	**£62,488**
OVERALL IMPACTS	
Net Present Value (NPV)	**£201,238**
Benefit to Cost Ratio (BCR)	**4.2**

Appendix E. WebTAG Low NTEM Growth Reporting Tables

TEE Table (£000's) for WebTAG Low NTEM Growth				
	Type	**All Modes**	**Road, Private Cars and LGVs**	
Commuting User Benefits	Travel Time	£46,985	£46,985	
	Vehicle Operating Costs	£3,150	£3,150	
	User Charges	-	-	
	During Construction & Maintenance	-£1,125	-£1,125	
	Net Benefits (1a)	**£49,010**	**£49,010**	
Other User Benefits	Travel Time	£35,175	£35,175	
	Vehicle Operating Costs	-£299	-£299	
	User Charges	-	-	
	During Construction & Maintenance	-£1,949	-£1,949	
	Net Benefits (1b)	**£32,927**	**£32,927**	
Business	**Type**	**All Modes**	**Goods Vehicles**	**Business Cars & LGVs**
	Travel Time	£35,223	£8,000	£27,223
	Vehicle Operating Costs	£7,911	£1,134	£6,777
	User Charges	-	-	-
	During Construction & Maintenance	-£1,508	-£1,508	
	Net Benefits (2)	**£41,626**	**£7,626**	**£34,000**
	Type	**All Modes**	**Road**	
	Developers contributions (4)			
	Net Benefits (5)	**£41,626**	**£41,626**	
Total	**Present Value of Transport Economic Efficiency Benefits (TEE)**	**£123,562**		

Public Accounts (£000's) for WebTAG's Low NTEM growth		
Local Government Funding	**All modes**	**Road**
Revenue		
Operating Costs	£5,328	£5,328
Investment Costs	£31,559	£31,559
Developer Contributions	£0	£0
Grant/Subsidy Payments		
NET IMPACT (7)	**£36,888**	**£36,888**
Central Government Funding – Transport	**All modes**	**Road**
Revenue	-	-
Operating costs	-	-
Investment costs	£25,600	£25,600
Developer Contributions	-	-
Grant/Subsidy Payments	-	-
NET IMPACT (8)	**£25,600**	**£25,600**
Central Government Funding- Non Transport		
Indirect Tax Revenues (9)	£3,445	£3,445
TOTALS		
Broad Transport Budget (10)	£62,488	£62,488
Wider Public Finances (11)	£3,445	£3,445

Analysis of Monetised Benefits (£000's) for WebTAG's Low NTEM growth	
Noise (12)	£4,863
Local Air Quality (13)	-£336
Greenhouse Gases (14)	-£15,732
Accidents (17)	£208
Economic Efficiency: Consumer Users (Commuting)	£49,010
Economic Efficiency: Consumer Users (Other)	£32,927
Economic Efficiency: Business Users and Providers	£41,626
Wider Public Finances (Indirect Taxation Revenues)	-£3,445
Present Value of Benefits (PVB)	**£109,120**
Broad Transport Budget	£62,488
Present Value of Costs (PVC)	**£62,488**
OVERALL IMPACTS	
Net Present Value (NPV)	**£46,632**
Benefit to Cost Ratio (BCR)	**1.7**

Appendix F. WebTAG's High NTEM Growth Reporting Tables

TEE Table (£000's) for WebTAG High NTEM Growth				
	Type	**All Modes**	**Road, Private Cars and LGVs**	
Commuting User Benefits	Travel Time	£97,904	£97,904	
	Vehicle Operating Costs	£2,403	£2,403	
	User Charges	-	-	
	During Construction & Maintenance	-£1,125	-£1,125	
	Net Benefits (1a)	**£99,182**	**£99,182**	
Other User Benefits	Travel Time	£74,192	£74,192	
	Vehicle Operating Costs	£3,009	£3,009	
	User Charges	-	-	
	During Construction & Maintenance	-£1,949	-£1,949	
	Net Benefits (1b)	**£75,252**	**£75,252**	
Business	**Type**	**All Modes**	**Goods Vehicles**	**Business Cars & LGVs**
	Travel Time	£54,928	£12,398	£42,530
	Vehicle Operating Costs	£7,421	£2,958	£4,463
	User Charges	-	-	-
	During Construction & Maintenance	-£1,508	-£1,508	
	Net Benefits (2)	**£60,841**	**£13,848**	**£46,993**
	Type	**All Modes**	**Road**	
	Developers contributions (4)	-	-	
	Net Benefits (5)	**£60,841**	**£60,841**	
Total	**Present Value of Transport Economic Efficiency Benefits (TEE)**	**£235,274**		

Public Accounts (£000's) for WebTAG's High NTEM growth		
Local Government Funding	**All modes**	**Road**
Revenue		
Operating Costs	£5,328	£5,328
Investment Costs	£31,559	£31,559
Developer Contributions	£0	£0
Grant/Subsidy Payments		
NET IMPACT (7)	**£36,888**	**£36,888**
Central Government Funding – Transport	**All modes**	**Road**
Revenue	-	-
Operating costs	-	-
Investment costs	£25,600	£25,600
Developer Contributions	-	-
Grant/Subsidy Payments	-	-
NET IMPACT (8)	**£25,600**	**£25,600**
Central Government Funding- Non Transport		
Indirect Tax Revenues (9)	£4,196	£4,196
TOTALS		
Broad Transport Budget (10)	£62,488	£62,488
Wider Public Finances (11)	£4,196	£4,196

Analysis of Monetised Benefits (£000's) for WebTAG's High NTEM growth	
Noise (12)	£4,863
Local Air Quality (13)	-£336
Greenhouse Gases (14)	-£15,732
Accidents (17)	£208
Economic Efficiency: Consumer Users (Commuting)	£99,182
Economic Efficiency: Consumer Users (Other)	£75,252
Economic Efficiency: Business Users and Providers	£60,841
Wider Public Finances (Indirect Taxation Revenues)	-£4,196
Present Value of Benefits (PVB)	**£220,081**
Broad Transport Budget	£62,488
Present Value of Costs (PVC)	**£62,488**
OVERALL IMPACTS	
Net Present Value (NPV)	**£157,593**
Benefit to Cost Ratio (BCR)	**3.5**

Appendix G. TUBA Warnings Report

G.1 Introduction

TUBA performs a series of checks on the input data and issues a warning if there are any anomalies. The warnings can be due to input errors, genuine network enhancements, substantial impacts of the scheme or new modes or sub-modes. These warnings are classified per O-D pair, model year, vehicle type and trip purpose.

The output files from TUBA contain 2,333 warnings for the Harlow M11 J7a scheme. The purpose of this document is to present analysis of these warnings for the Core Scenario (NTEM) by type and to assess their impact on the benefit-cost ratio. The following table summarises the numbers of warnings, by type.

Warning Type		Total
Travel Time	Ratio of DM to DS lower than limit	221
	Ratio of DM to DS higher than limit	1201
Travel Distance	Ratio of DM to DS lower than limit	599
	Ratio of DM to DS higher than limit	305
DM Speeds	Less than limit	0
DS Speeds	Less than limit	7
Total		**2,333**

Table 8-5: Summary of TUBA Warnings by type

G.2 Network Updates

Before discussing the impact of the TUBA warnings, it is important to understand the differences between the Do Minimum (DM) and Do Something (DS) scenarios. The following network updates (related to changes in travel time, distance and speed) have been included in the Do Something scenario:

a. M11 J7a improvements – provides additional access to M11, including a southern link road between Sheering Road roundabout and Junction 7a roundabouts, approach from Sheering Road roundabout to the East Harlow northern access road and signals to improve access to East Harlow development.

Figure 8-1: M11 J7a improvements - Do Something scenario location of network updates.

b. Lower Sheering Road – local access restriction by reducing links capacity.

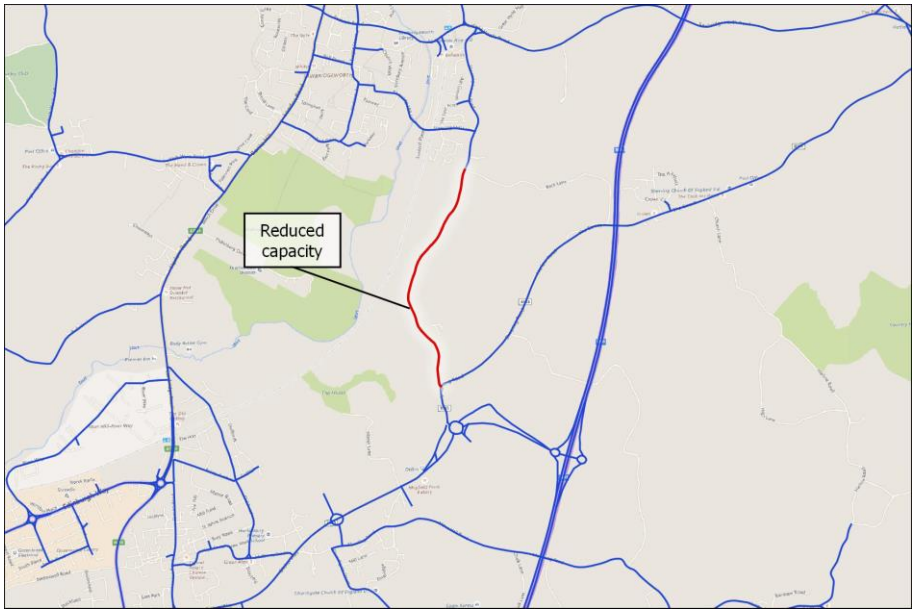


Figure 8-2: Lower Sheering Road - Do Something scenario location of network updates.

c. Gilden Way improvements – there has been an improvement at Gilden way in terms of the number of lanes, speed limits and road layout (Hamburguer junction with signals). An additional connector for zone 24 has also been added to provide access to Sheering Way.

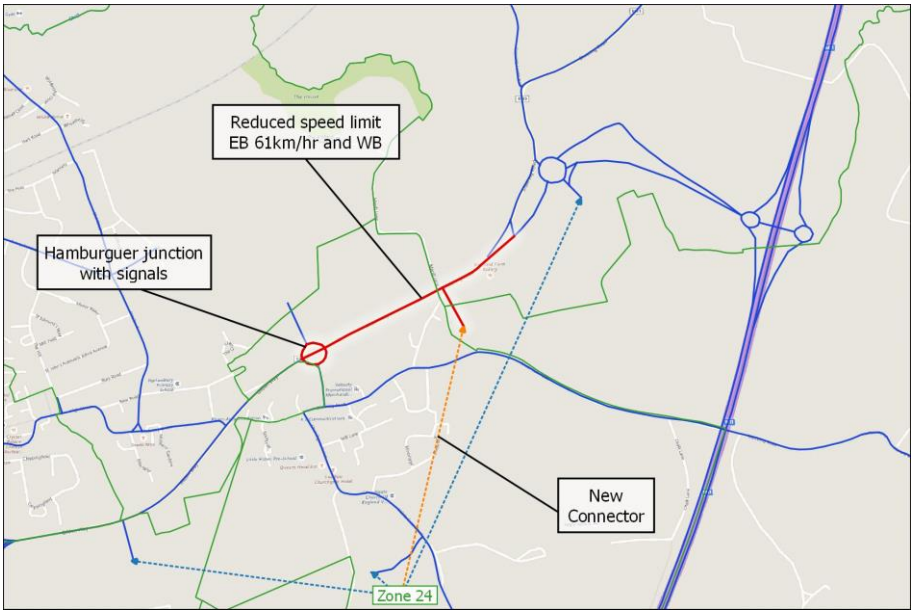


Figure 8-3: Gilden Way improvements - Do Something scenario location of network updates.

d. Heavy Good Vehicles ban at Old Harlow.

Figure 8-4: HGV ban - Do Something scenario location of network updates.

e. Old Road (North) closed for through access.

Figure 8-5: Old Road closing - Do Something scenario location of network updates.

f. A414 / London Road Enterprise Zone New Access and New Hall Link Road.

G.3 Ratio of Do Minimum to Do Something travel time lower than limit

There are 211 warnings highlighting that the ratio of Do Minimum to Do Something travel time are lower than the limit. Based on the analysis of the Visum models, the differences in travel time between these two scenarios for this category are attributed to the following reasons:

a. **Higher impedance in DS – Gilden Way Queue– 73% (161 warnings)**. This is a case where exactly the same route is observed but with higher impedance in the DS, which is a result of slower speeds and a longer travel time. The differences in the impedance could be attributed to the re-routing in the DS scenario because of the M11 J7a and Gilden Way improvements, the additional connector in zone 24 and differences on the trip distribution in some connectors, causing an increase in delays on some sections of the network. Investigation shows that these warnings only appear for all 2036 and 2051 scenarios, where there is a long queue along Gilden Way which might cause blocking back in the network, however changes in modelled delay are deemed reasonable.

b. **Heavy Good Vehicles ban at Old Harlow – 12% (26 warnings).** As mentioned in section 1.2, an HGV ban along Mulberry Green, High Street, Station Road, and Old Road has been introduced. This reduces the number of route options to access Old Harlow for HGVs. This warning category only affects HGV trips between Zone 18 (Old Harlow) and Zone 213 (Templefields).

c. **Higher impedance in DS – Queue at London Road Enterprise Zone Access in DS – 6% (14 warnings).** This warning is only affecting trips between Zone 21 and Zones 15, 18, 20 and 193. Investigation shows that these warnings only appear for 2036 AM peak scenario, where there is a long queue along the new London Road Enterprise Zone Access towards A414/London Road due to the existence of traffic signs at this junction. This could cause blocking back, however changes in modelled delay are deemed reasonable.

d. **Heavy Good Vehicles ban at Churchgate Street – 5% (12 warnings).** There is an HGV ban along Matching Road. As explained above, this reduces the number of route options for HGVs, therefore the route travelled between certain zones in the DS scenario is longer. This warning category is only affecting HGV trips between Zone 152 and Zones 61 and 88.

e. **Higher impedance in DS - Queue at High Wych Lane – 2% (5 warnings).** This warning only impacts trips between Zone 114 and Zone 51 for model year period 2051. Investigation shows that these warnings only appear for 2051 AM peak scenario, where there is a queue along the High Wych Lane from the junction with High Wych Road where only a left turn is allowed, which might cause blocking back in the network. It indicates that the speed between these two zones is lower for DS scenario, therefore the travel time is higher.

f. **Higher impedance in DS - Queue at Brook Road – 1% (3 warnings).** This warning is only observed for trips between Zone 50 and Zone 51 for 2051 AM peak model. Investigation shows that there is a bigger queue in DS along Brook Road from London Road junction which might cause blocking back in the network, resulting in lower speeds between these two zones in the DS scenario and an increased travel time.

The above observations affect the model routes in the Do Something scenario in a manner which is considered acceptable. Any changes in travel time will have an impact on the generalised cost of the associated movements. However, the traffic volumes affected by these warnings are very small and so are the differences in time. Thus, it is reasonable to assume that these warnings do not materially affect the TUBA results, and so can be ignored.

G.4 Ratio of Do Minimum to Do Something travel time higher than limit

There are 1201 warnings of ratios of Do Minimum to Do Something travel time higher than the limit. However, the majority of these (99% - 1191 warnings) are attributed to the M11 J7a improvements and the additional connector for zone 24. Given the model updates made, changes to routing patterns and journey times are to be expected here.

The route via the M11 in the Do Something scenario allows for travel at a faster speed and hence a faster travel time. As mentioned in Section 1.2, there is an additional connector for Zone 24 in the Do Something scenario which affect route choice. These changes to the connectors affect the available routes and hence the travel time in the Do Something scenario.

These changes in travel time impact on the generalised cost. However, as before, all these routes are considered acceptable. Thus, it is reasonable to ignore these warnings.

G.5 Ratio of Do Minimum to Do Something travel distance lower than limit

There are 599 warnings of ratios of Do Minimum to Do Something travel distances that are lower than the limit. 67% (402 warnings) are related to the M11 J7a improvements; 28% (167 warnings) are related to the differences in the number of routes between the two scenarios; 4% (22 warnings) are related to the HGV ban through Old Harlow and Churchgate Street at DS, and the remaining 1% (8 warnings) are related to the London Road Enterprise Zone Access.

Routing via M11 J7a results in a longer distance trip, however vehicles can travel at a faster speed, and hence have a faster travel time. In most cases in this assessment, the number of route options per zone pair are different especially if you are comparing two different networks. This affects VISUM model computation of distance (weighted average of the distance and volumes).

These differences in model routes affect the travel distance in the Do Something scenario. These changes in travel distance impact on the generalised cost. However, all route options are considered acceptable. Thus, it is reasonable to ignore these warnings.

G.6 Ratio of Do Minimum to Do Something travel distance higher than limit

There are 305 warnings of ratios of Do Minimum to Do Something travel distances higher than the limit. 62% (188 warnings) are related to the M11 J7a improvements and the additional connectors to/from zone 24 and its access to M11 J7a. 37% (114 warnings) are due to the differences in the number of routes between the two scenarios. 3% (9 warnings) are due to London Road Enterprise Zone Access.

G.7 Do Minimum speeds less than limit

There are no warnings related with Do Minimum Speeds.

G.8 Do Something speeds less than limit

This warning is only observed for zone pair 193 to 96 for model year period 2021. It indicates that the speed between the two zones is too slow. Investigation shows that there is a bigger queue along Edinburgh Way for the DS scenario which might cause blocking back in the network. The figure below shows the location of these zones and the queue.

G.9 Conclusion

All types of TUBA warning have been investigated. The majority of the warnings are related to the network updates in the Do Something scenario. The analysis presented above shows that it is reasonable to assume that these warnings are not contributing positively to the benefit-cost ratio. The results of this checks will be taken into account in future model updates to be undertaken as part of the business

Appendix H. Dependent Development Technical Report

H.1 Introduction

This note summarises the purpose, methodology and results of the dependent development assessment undertaken for the M11 Junction 7a scheme.

A dependent development is defined as a new development that is dependent on the provision of a transport scheme. It is dependent insofar as that without transport scheme, the existing transport network would not provide a reasonable level of service and, in consequence, the development would not be delivered in absence of the transport scheme.

For many transport schemes, land use developments can be assumed to be independent of the transport scheme. However, it is possible that some transport schemes could 'unlock' housing development and its associated benefits. In this situation, WebTAG states that benefits flowing from additional development can be considered alongside the benefits of the transport scheme itself.

The methodology to assess the impacts of dependent developments is adopted from WebTAG Unit A2.3: Transport Appraisal in the Context of Dependent Development[13] and the DMRB Vol 5 Section 1 Part 2 TA/XX/YY Traffic Forecasting for Major Schemes Draft Advice Note.

Assessing the dependent development benefits of a transport scheme requires the following three steps:

- **Step 1**: Determine the quantity of new housing that should be regarded as dependent on a transport scheme.
- **Step 2**: Assess the transport user benefits of the transport scheme in isolation (that is, in the absence of the dependent housing development) [14].
- **Step 3**: Assess the benefits of the dependent housing development assuming the transport scheme is provided.

The dependent development assessment requires four scenarios to be developed:

- Scenario A: without the housing development and without any form of transport scheme.
- Scenario B: with the housing development but without any form of transport scheme.
- Scenario C: with the housing development and with a transport scheme.
- Scenario D: without the housing development but with a transport scheme.

The road network in Harlow is suffering from congestion and some parts are likely to operate at or above capacity in the future as expected growth in road traffic will further increase the pressure on the network.

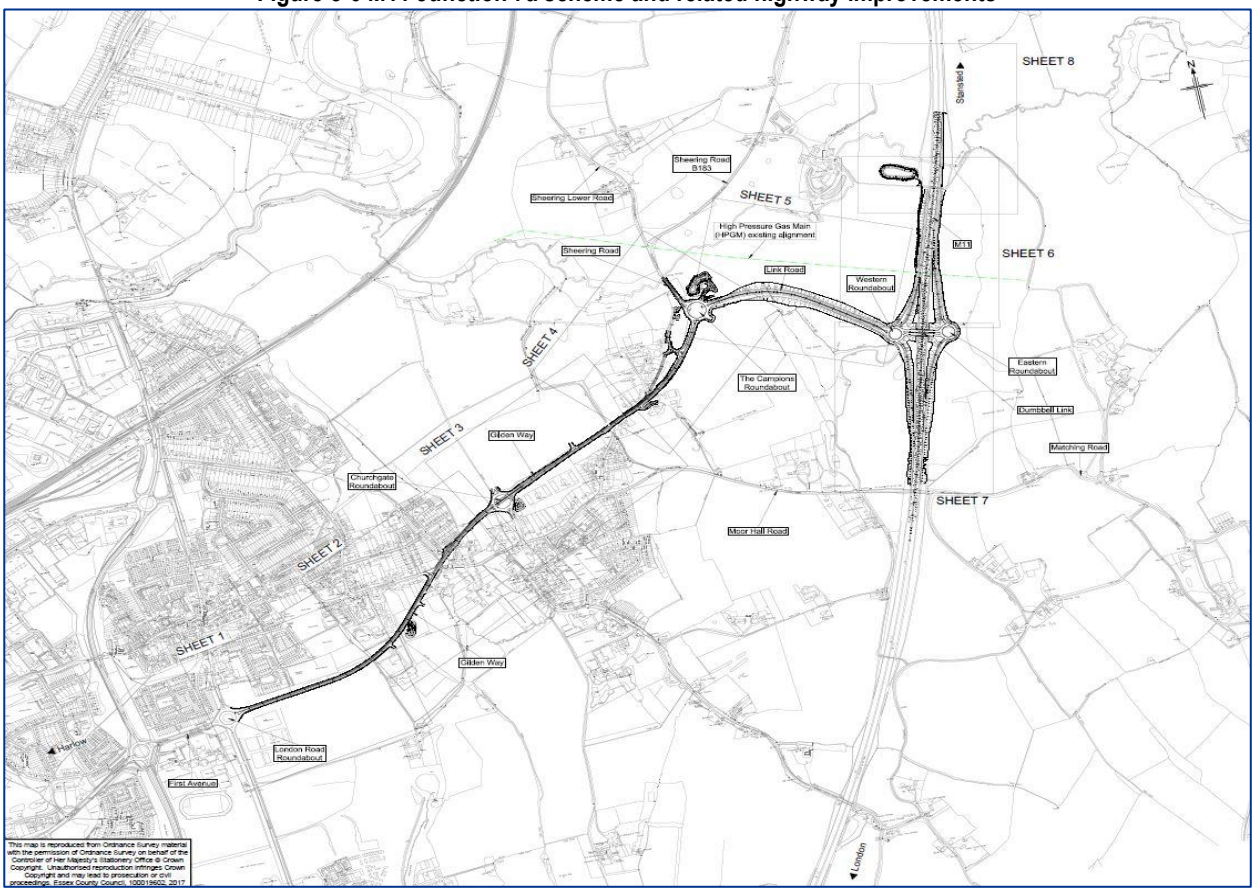
The emerging Harlow Local Development Plan[15] highlights that the inability of the existing transport system is the biggest single barrier to accommodating the level of growth needed in Harlow. M11 J7 is operating close to its planned capacity. In recognition of this constraint, HE has currently imposed a cap on the number of new jobs permitted within the Harlow Enterprise Zone until network capacity issues are addressed.

The M11 Junction 7a scheme will provide a second access to the strategic road network and the associated highway improvements on Gilden Way will increase the capacity of key links within Harlow. It is therefore likely

[13] WebTAG Unit A2.3 Transport Appraisal in the Context of Dependent Development July 2016
[14] Step 2 is usually preceded by the identification of a suitable minimum transport scheme required to restore a reasonable level of service. However, in the case of the M11 J7a, the scheme has already been identified and therefore this step can be omitted.
[15] Harlow Local Development Plan Emerging Strategy and Further Options April 2014

that the scheme will allow to accommodate traffic from new developments, thereby effectively ‘unlocking’ these developments.

Figure 8-6 M11 Junction 7a scheme and related highway improvements



Chapter 2 will outline the methodology used to identify and test potentially dependent developments in and around Harlow, the results of which are summarized in subsequent sections. Chapter 3 and 4 then presents the approach and results of the economic assessment of the identified dependent developments.

H.2 Step 1: Identification of Dependent Development on the Transport Scheme

H.2.1 Dependency Testing Methodology and Results

Determining whether new housing is dependent on a transport scheme is the first step in the assessment process of dependent development benefits. If housing is not dependent on the scheme, then the need for the transport scheme should be considered solely on transport grounds.

WebTAG requires that dependency testing is undertaken to identify future development dependent on the scheme. The dependency testing methodology is outlined in WebTAG Unit A2.3. Further detail on how to undertake a dependency test is provided in the Draft IAN TA/XX/YY on Traffic Forecasting for Major Schemes produced by Highways England (further referred to as DMRB guidance)

As stated within WebTAG new housing is dependent on the provision of the scheme if, with the new housing, but in the absence of the scheme, the transport network would not provide a “reasonable level of service” to existing and/or new users.

WebTAG does not give a precise definition of reasonable level of service. However, if additional traffic can be accommodated by the network without significant increases in the costs of travel for existing users, then the network can be assumed to be providing a reasonable level of service.

An increase in travel cost is commonly a result of additional delays on the network and the associated re-routing or waiting time. Given that the delays are the result of links and junctions operating close to or over capacity, it has been agreed in the ASR that Volume/Capacity ratios will be used as an indicator of whether the highway network provides a reasonable level of service.

An appropriate threshold in determining dependency as recommended by Highways England guidance is when the Volume/Capacity ratio exceeds 0.95. As recommended by the DMRB guidance, links have only been considered if the tested development contributes more than 5% of the total traffic demand.

Where development traffic results in links or turning movements exceeding these thresholds, or where the thresholds are already exceeded, then those developments which add traffic to such locations could be deemed as dependent upon network improvements.

To determine where development traffic is impacting the operational performance of the network a select link analysis has been undertaken to identify junctions serving a significant proportion of traffic generated by the potentially dependent development.

H.2.2 Identification of Potentially Dependent Developments

A longlist of potentially dependent developments has been created based on the following criteria:

1. The development features in the Uncertainty Log[16]; and
2. Is located within Greater Harlow; and
3. Exceeds the traffic demand equivalent to an average urban residential development of 100 dwellings; and
4. Does not dispose of planning permission or the permission is conditional on completion of the scheme; and/or
5. Relies on the scheme for physical access; and/or
6. Dependency on the scheme is established in a local policy document or in the scheme's strategic case.

Criteria 1, 2 and 3 have been agreed with Essex County Council whereas criteria 4, 5 and 6 are set out in WebTAG. Table 2-1 presents the developments which were identified as potentially dependent following application of the above criteria and it was subsequently agreed with Essex County Council to test these developments for dependency on the M11 J7a scheme.

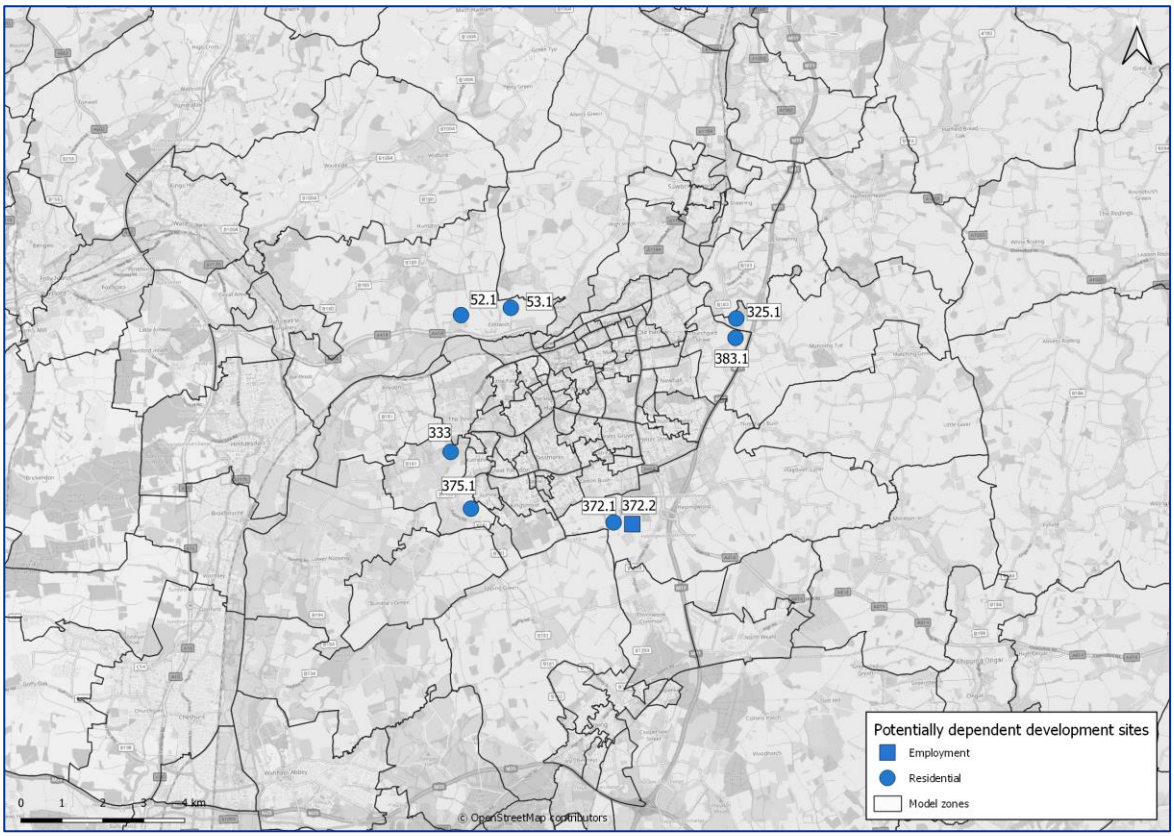
Table 8-6 - Shortlist of potentially dependent developments

District	Uncertainty Log Unique Ref	Model Zone	MSOA Zone	Scheme Description
East Herts	52.1	117	E02004886	Western Section (Gilston Park Estate) developed by CPP
East Herts	53.1	117	E02004886	Land North of Harlow: The Gilston Park Estate (Northern Section) developed by Places for People
Epping Forest	325.1	151	E02004527	East Harlow
Epping Forest	333	140	E02004528	West Katherines

[16] 2017-11-10 Assumptions Database from 10/11/2017

District	Uncertainty Log Unique Ref	Model Zone	MSOA Zone	Scheme Description
Epping Forest	372.1	149	E02004527	SR-0046 Latton Priory Farm, London Road, Harlow; Residential led urban extension to Harlow
Epping Forest	372.2	149	E02004527	SR-0046 Latton Priory Farm, London Road, Harlow; Residential led urban extension to Harlow
Epping Forest	375.1	140	E02004528	SR-0068 Land to the west of Sumners (bounded in part by Water Lane and Epping Road, Tylers Cross
Harlow	383.1	24	E02004544	SR-0146 Land East of Harlow, North of Church Langley and South of Sheering Road

Figure 8-7 Location and type of potentially dependent development sites



H.2.3 Estimating Link Capacities

In order to conduct a select link analysis to identify links in which development traffic contributes significantly to an exceedance of 95% V/C, it is necessary to obtain capacities for each link. Due to the nature of the modelling approach chosen for the scheme – assignment based on intersection capacity analysis - capacities have not been provided. However, capacities are necessary to estimate the volume over capacity ratio, which serves as proxy for transport user costs and level of service on a link.

It was therefore necessary to estimate link capacities within the area of interest. For rural roads, DMRB Volume 5 Section 1 Part 3 TA 46/97 *Traffic flow ranges for use in the assessment of new rural roads*[17] recommends the following formula:

[17] DMRB Vol 5 Section 1 Part 3 TA 46/97 http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol5/section1/ta4697.pdf

$$CAPACITY = [A - B * Pk\%H]$$

Where A and B are parameters dependant on road standard and Pk%HGV is the share of HGV in the peak hour.

For urban roads, DMRB Volume 4 Section1 Part 3 TA 79/99 Amendment No1 *Traffic capacity of urban roads*[18] provides estimated capacities based on number of lanes, carriageway width and road type. Classification of urban roads by road type depends on several criteria such as road purpose, speed limit, side roads, access to developments, parking and loading, pedestrian crossings and bus stops, which are summarised in Table 2-2.

Table 8-7 Urban road classification as per DMRB TA79/99[19]

Feature	ROAD TYPE				
	Urban Motorway	Urban All-purpose			
	UM	UAP1	UAP2	UAP3	UAP4
General Description	Through route with grade separated junctions, hardshoulders or hardstrips, and motorway restrictions.	High standard single/dual carriageway road carrying predominantly through traffic with limited access.	Good standard single/dual carriageway road with frontage access and more than two side roads per km.	Variable standard road carrying mixed traffic with frontage access, side roads, bus stops and at-grade pedestrian crossings.	Busy high street carrying predominantly local traffic with frontage activity including loading and unloading.
Speed Limit	60mph or less	40 to 60 mph for dual, & generally 40mph for single carriageway	Generally 40 mph	30 mph to 40 mph	30mph
Side Roads	None	0 to 2 per km	more than 2 per km	more than 2 per km	more than 2 per km
Access to roadside development	None. Grade separated for major only.	limited access	access to residential properties	frontage access	unlimited access to houses, shops & businesses
Parking and loading	none	restricted	restricted	unrestricted	unrestricted
Pedestrian crossings	grade separated	mostly grade separated	some at-grade	some at-grade	frequent at-grade
Bus stops	none	in lay-bys	at kerbside	at kerbside	at kerbside

For this assessment, a standard lane width of 3.65m was assumed for UAP1 and UAP2 type roads, whereas the width of UAP3 and UAP4 roads was assumed to be 3.375m.

TA79/99 then provides estimated hourly capacities based on road type, carriageway width and number of lanes as per Table 2-3.

[18] DMRB Vol 5 Section 1 Part 3 TA79/99 Amendment No 1 http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol5/section1/ta7999.pdf
[19] DMRB Vol 5 Section 1 Part 3TA79/99 Amendment No 1

Table 8-8 Urban road capacity estimations as per DMRB TA79/99[20]

		Two-way Single Carriageway- Busiest direction flow (Assumes a 60/40 directional split)									Dual Carriageway			
		Total number of Lanes									Number of Lanes in each direction			
		2				2-3	3	3-4	4	4+	2		3	4
Carriageway width		6.1m	6.75m	7.3m	9.0m	10.0m	12.3m	13.5m	14.6m	18.0m	6.75m	7.3m	11.0m	14.6m
Road type	UM	Not applicable										4000	5600	7200
	UAP1	1020	1320	1590	1860	2010	2550	2800	3050	3300	3350	3600	5200	*
	UAP2	1020	1260	1470	1550	1650	1700	1900	2100	2700	2950	3200	4800	*
	UAP3	900	1110	1300	1530	1620	*	*	*	*	2300	2600	3300	*
	UAP4	750	900	1140	1320	1410	*	*	*	*	*	*	*	*

For urban roads where the HGV share exceeds 15%, a reduction of between 100 and 225 vehicles per hour, depending on the HGV share, is applied to account for the capacity reduction caused by HGV as suggested by the DMRB TA79/99.[21]

Using these formulas and estimates and drawing on the rural/urban and dual/single carriageway classification, number of lanes and free flow speeds of the links provided by the Harlow Transport Model, capacities were estimated for each link.

Key links were visually inspected using the Street View function of Google Maps to ensure that the speed and road type classification are correct. If found to be wrong, road type and capacity were adjusted. These estimated capacities were then used as basis for the select link analysis and V/C calculations.

H.2.4 Select link analysis and V/C assessment

For each potentially dependent development, a select link analysis (flow bundle analysis in PTV VISUM 14) for the zones containing a potentially dependent development was conducted on the Do Minimum (DM) 2036 scenario. 2036 was chosen as it is the first modelled year in which all the potentially dependent developments are estimated to be complete, in line with WebTAG guidance.

The share of development traffic on each link was calculated by subtracting the select link flows from Scenario A (without potentially dependent developments) from the flows from Scenario B (with potentially dependent developments), as the difference is then equal the development traffic. This allows the identification of links in which development traffic contributes significantly (i.e. > 5%) to traffic demand. In addition, V/C ratios for all links were calculated for the DM 2036 scenario without any potentially dependent development (Scenario A) based on the modelled traffic flow and the capacity estimated previously.

The combined threshold of a >5% of contribution of the development and V/C > 95% was applied on the DM 2036 AM and PM scenarios without any of the potentially dependent developments (Scenario A). If the combined threshold is exceeded on any relevant link in the scenario without potentially dependent developments (Scenario A), this implies that the development is dependent, as key links for the development are already at or above capacity.

This analysis was repeated for the three main scenarios NTEM (Core), Medium and High, which differ in implemented road schemes and forecast housing and employment figures, with NTEM being the most

[20] DMRB Vol 5 Section 1 Part 3TA79/99 Amendment No 1
[21] DMRB Vol 5 Section 1 Part 3TA79/99 Amendment No 1

conservative estimate. The select link analysis resulted in the identification of the following dependent developments:

Table 8-9 Developments dependent due to V/C exceedance in Scenario A

Scenario	Development	Zone
NTEM (Core)	52.1, 53.1	117
Medium	383.1	24
	333, 375.1	140
	372.1, 372.2	149
High	52.1, 53.1	117
	383.1	24
	333, 375.1	140
	372.1, 372.2	149

Development 325.1 in zone 151 (East Harlow) does not cause any exceedance in the NTEM, Medium or High scenarios, neither in Scenario A (no potentially dependent developments) nor Scenario B (with potentially dependent developments). With no significant impact on level of service, it should therefore be considered as independent.

Table 8-10 Identified Independent Developments (no V/C exceedance in Scenario A and B)

Scenario	Development	Zone
NTEM	325.1	151
Medium	325.1	151
High	325.1	151

For three developments, key links were found to be below 95% V/C in Scenario A but exceeding this ratio in Scenario B:

- 383.1 (zone 24) in NTEM
- 52.1 and 53.1 (zone 117) in Medium

As advised by WebTAG, Scenario A was rerun but this time including development 383.1 (zone 24) in NTEM and 53.1 (zone 117) in Medium. In agreement with ECC, development 52.1 was excluded as 53.1 is more likely to be developed first and therefore should be tested first, with 52.1 to be added in the next run if required.

The respective increments of Scenario A (NTEM & Medium) confirmed that 383.1 (NTEM) and 53.1 (Medium) are causing V/C exceedances and can therefore be considered to be dependent. By definition, development 52.1, which will have to be accommodated in addition to 53.1, is then dependent as well. The second iteration of dependency tests confirms that the following developments are dependent, too:

Table 8-11 Additional identified developments (V/C exceedance in second iteration of Scenario A)

Scenario	Development (Uncertainty Log ID)	Model Zone
NTEM	383.1	24
Medium	52.1, 53.1	117
High	n/a	n/a

In conclusion the dependency tests conducted provided the following results:

Table 8-12 Results of dependency testing

Scenario	Development (Uncertainty Log ID)	Model Zone	Result
NTEM	52.1, 53.1	117	Dependent (in Scenario A & B)
	325.1	151	Independent (in Scenario A & B)
	383.1	24	Dependent (in Scenario A + 383.1 and Scenario B)
	333, 375.1	*140*	*n/a*
	372.1, 372.2	*149*	*n/a*
Medium	52.1, 53.1	117	Dependent (in Scenario A + 53.1 and Scenario B)
	325.1	151	Independent (in Scenario A & B)
	383.1	24	Dependent (in Scenario A & B)
	333, 375.1	140	Dependent (in Scenario A & B)
	372.1, 372.2	149	Dependent (in Scenario A & B)
High	52.1, 53.1	117	Dependent (in Scenario A & B)
	325.1	151	Independent (in Scenario A & B)
	383.1	24	Dependent (in Scenario A & B)
	333, 375.1	140	Dependent (in Scenario A & B)
	372.1, 372.2	149	Dependent (in Scenario A & B)

In agreement with ECC, it was decided to not identify the quantum of development 383.1 (in NTEM) respectively 52.1 and 53.1 (in Medium) that could potentially be accommodated without deteriorating the level of service significantly.

The table below lists the links that, as result of this analysis, have been identified as links exceeding a V/C ratio of 95% and with one or more developments constituting more than 5% of the total flow:

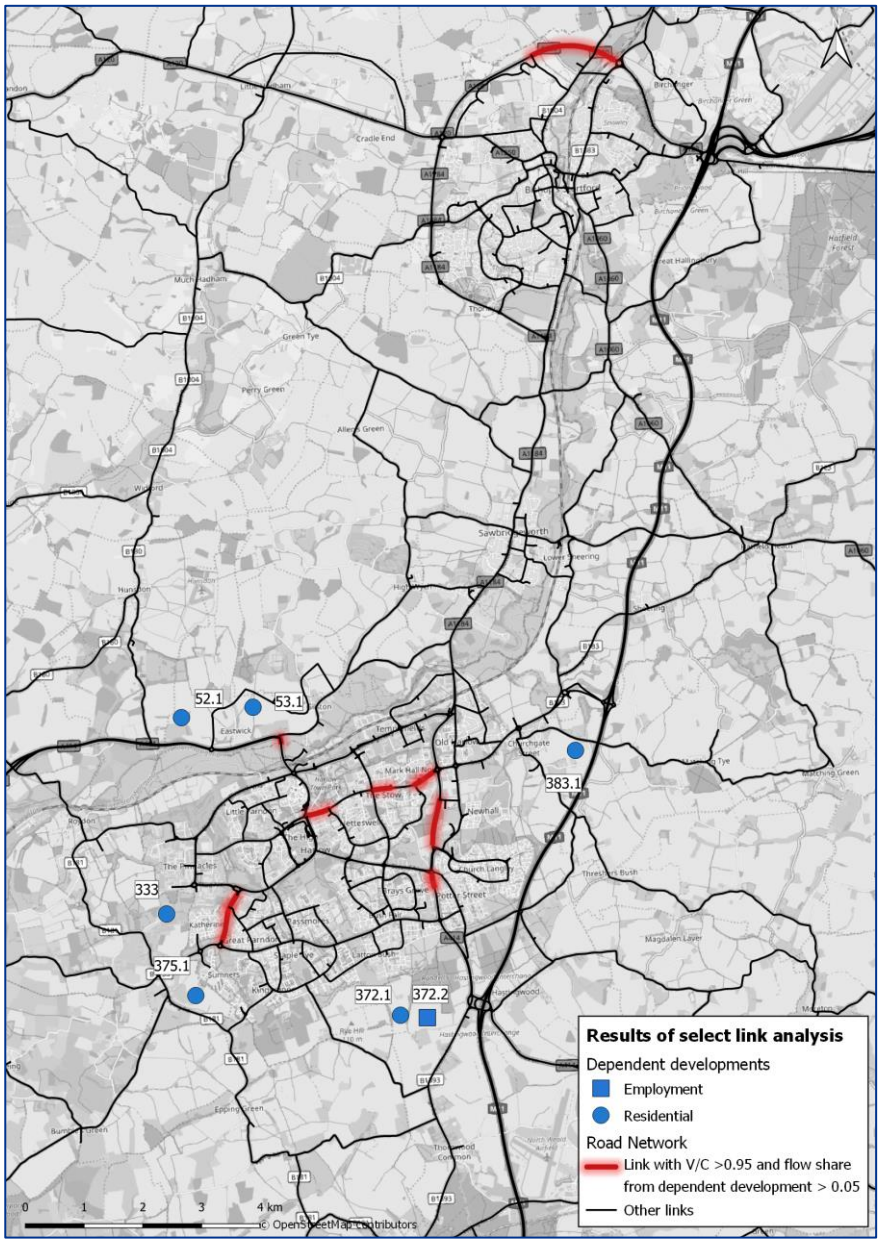
Table 8-13 Links exceeding V/C > 95% and development traffic flow share > 5%

Link	Scenario	Time Period	V/C %	Percentage of development traffic	Development (Uncertainty Log ID)
570413004	NTEM	AM	99%	30%	52.1, 53.1
153562736	NTEM	AM	97%	6%	383.1
178594	NTEM	AM	99%	6%	383.1

Link	Scenario	Time Period	V/C %	Percentage of development traffic	Development (Uncertainty Log ID)
570413004	Medium	AM	100%	14%	52.1, 53.1
185206585	Medium	PM	104%	8%	383.1
153562736	Medium	AM	98%	12%	383.1
153205463	Medium	PM	97%	9%	383.1
152795900	Medium	PM	96%	6%	383.1
313510	Medium	AM	99%	14%	333, 375.1
313510	Medium	AM	99%	14%	372.1, 372.2
178594	Medium	AM	100%	12%	383.1
133940	Medium	AM	97%	15%	333, 375.1
133940	Medium	AM	97%	15%	372.1, 372.2
570413051	High	AM	120%	5%	383.1
570413050	High	AM	120%	5%	383.1
570412882	High	AM	117%	7%	52.1, 53.1
185206585	High	AM	95%	8%	383.1
185206585	High	PM	103%	11%	383.1
185206585	High	PM	131%	6%	383.1
153562736	High	AM	99%	18%	383.1
153205463	High	PM	96%	12%	383.1
152795900	High	PM	100%	6%	383.1
313510	High	AM	100%	20%	333, 375.1
313510	High	AM	100%	18%	372.1, 372.2
178594	High	AM	101%	18%	383.1
133940	High	AM	97%	20%	333, 375.1
133940	High	AM	97%	18%	372.1, 372.2

The links exceeding both thresholds and the developments therefore dependent upon the M11 J7a are presented in Figure 2-2.

Figure 8-8 Results of select link analysis



H.2.5 Results

The traffic forecasts without M11 Junction 7a and without potentially dependent developments indicate that the highway network in Greater Harlow already shows signs of stress, with several key links operating at or above capacity.

With the additional trips generated by the potentially dependent developments, the network stress increases further. Two (NTEM), five (Medium) and seven (High) developments are dependent on the transport scheme as the network already fails to provide a reasonable level of service in the without dependent development scenario.

One development (in NTEM, Medium and High) was confirmed to be dependent of the scheme as no relevant link exceeded a V/C ratio of 0.95, neither in the without development nor in the with development scenario. Further incremental testing has revealed that two developments (NTEM) and one development (Medium) are

dependent as V/C ratios of 0.95 are not exceeded in the without but are being exceeded in the with development scenario.

Due to the reverse order applied in the appraisal process, in which a scheme has been developed and the standard transport appraisal has been conducted before dependent developments have been identified, the dependent developments identified in this process have been included in the standard transport user benefits appraisal. As this is not in line with the WebTAG and HE guidance on dependent developments and is not consistent with the principle of avoiding double counting, the dependent development assessment is to be considered as a sensitivity test rather than constituting part of the transport appraisal for the M11J7a.

The benefits of dependent development will be assessed and monetised separately and will be reported in the Economic Assessment Report. Details of how this will be undertaken are detailed in the following two chapters of this technical note.

H.3 Step 2: Assessment of the Transport Scheme in Isolation

This step assesses the benefits of the transport scheme, excluding the dependent development across all growth scenarios. The analysis for the transport intervention in isolation has been calculated using the software TUBA. This assessment will **only include time benefits**, excluding Vehicle Operating Costs, Indirect Taxation, COBAL-T, QUADRO and Environmental Impacts. The Net Value Benefit (NVB) and BCR will be estimated using Scenarios A and D.

The monetised time benefits were calculated using TUBA (version 1.9.10) using the following transport model runs:

- **Do Minimum** – *Scenario A* – without dependent new housing and without any form of transport scheme
- **Do Something** – *Scenario D* – without dependent new housing but with the transport scheme

Table 8-14 presents the monetised time benefits (discounted, 2010 prices) for the Core (NTEM), ECC Medium and ECC High Growth scenarios for the year 2036.

Table 8-14: Monetised Time Benefits of the Transport Scheme in Isolation, £000s, discounted 2010 prices

Scenario	Time Savings, £000s
Core (NTEM)	£2,410
ECC Medium	£2,473
ECC High	£3,490

In accordance to TAG Unit A2.3, the monetised benefits of the scheme in isolation are presented in the Transport Economic Efficiency (TEE) table (Table 8-15).

Table 8-15: Core scenario (NTEM) TEE, £000s (year 2036)

Transport Economic Efficiency (TEE), £000s – NTEM GROWTH			
Consumer - Commuting user benefits	All Modes		Road
Travel Time	1006		1006
Vehicle operating costs	14		14
User charges	0		0
During Construction & Maintenance	0		0
NET CONSUMER - COMMUTING BENEFITS	**1020**		**1020**
Consumer - Other user benefits	All Modes		Road
Travel Time	590		590
Vehicle operating costs	88		88
User charges	0		0
During Construction & Maintenance	0		0
NET CONSUMER - OTHER BENEFITS	**678**		**678**
Business	All Modes	Road Personal	Road Freight
Travel Time	813	189	624
Vehicle operating costs	135	26	109
User charges	0	0	0
During Construction & Maintenance	0	0	0
Subtotal	**948**	**215**	**733**
Private Sector Provider Impacts			
Revenue	0		0
Operating costs	0		0
Investment costs	0		0
Grant/subsidy	0		0
Subtotal	**0**		**0**
Other business Impacts			
Developer contributions	0		0
NET BUSINESS IMPACT	**948**		
TOTAL			
Present Value of Transport Economic Efficiency Benefits (TEE)	**2646**		

Table 8-16: ECC Medium growth scenario TEE, £000s (year 2036)

Transport Economic Efficiency (TEE), £000s – ECC MEDIUM GROWTH			
Consumer - Commuting user benefits	All Modes		Road
Travel Time	1035		1035
Vehicle operating costs	-56		-56
User charges	0		0
During Construction & Maintenance	0		0
NET CONSUMER - COMMUTING BENEFITS	**979**		**979**
Consumer - Other user benefits	All Modes		Road
Travel Time	639		639
Vehicle operating costs	201		201
User charges	0		0
During Construction & Maintenance	0		0
NET CONSUMER - OTHER BENEFITS	**840**		**840**
Business	All Modes	Road Personal	Road Freight
Travel Time	799	186	612
Vehicle operating costs	-9	67	-76
User charges	0	0	0
During Construction & Maintenance	0	0	0
Subtotal	**790**	**253**	**536**
Private Sector Provider Impacts			
Revenue	0		0
Operating costs	0		0
Investment costs	0		0
Grant/subsidy	0		0
Subtotal	**0**		**0**
Other business Impacts			
Developer contributions	0		0
NET BUSINESS IMPACT	**790**		
TOTAL			
Present Value of Transport Economic Efficiency Benefits (TEE)	**2609**		

Table 8-17: ECC High growth scenario TEE, £000s (year 2036)

Transport Economic Efficiency (TEE), £000s – ECC HIGH GROWTH			
Consumer - Commuting user benefits	All Modes		Road
Travel Time	1,370		1,370
Vehicle operating costs	-101		-101
User charges			
During Construction & Maintenance			
NET CONSUMER - COMMUTING BENEFITS	**1,269**		**1,269**
Consumer - Other user benefits	All Modes		Road
Travel Time	1,029		1,029
Vehicle operating costs	269		269
User charges			
During Construction & Maintenance			
NET CONSUMER - OTHER BENEFITS	**1,298**		**1,298**
Business	All Modes	Goods Vehicles	Business Cars & LGVs
Travel Time	1,089	849	240
Vehicle operating costs	-184	-113	-71
User charges			
During Construction & Maintenance			
Subtotal	**905**	**736**	**169**
Private Sector Provider Impacts			
Revenue	0		0
Operating costs	0		0
Investment costs	0		0
Grant/subsidy	0		0
Subtotal	**0**		**0**
Other business Impacts			
Developer contributions			
NET BUSINESS IMPACT	**905**		
TOTAL			
Present Value of Transport Economic Efficiency Benefits (TEE)	**3,472**		

H.4 Step 3: Assessment of the benefits of the dependent development

This step is a two-part process: evaluating and reporting the planning gain associated with the dependent developments, and the transport external costs arising from the dependent development.

The planning gain associated with the change in land use is represented by the uplift in land value arising from the decision to grant planning permission for that development. This uplift is defined as the value of the land in its new residential use minus the value of the land in its existing (e.g. agricultural) use. The non-transport external impact of the 'dependent development' reflects the loss in amenity value of the land in its existing use. This can be calculated based on values within the WebTAG 'Valuing Housing Impacts' workbook.

The net external transport costs caused by the dependent new homes were estimated using TUBA v1.9.10. The time benefits will be estimated using Scenarios C and D. Additionally, the transport external costs estimated in this step (Step 3) is compared to the transport external costs calculated in Step 1.

Land Value Uplift

The benefits of the dependent development are calculated to capture the value uplift of the change in land use, from agricultural/industrial use to residential/employment use. The Department for Transport WebTAG Unit A2.3 provides guidance on a methodology to capture the economic benefits generated by new housing and office developments.

To estimate the approximate area (hectares) of each dependent development identified under the NTEM, Medium and High Growth scenarios, the average dwellings per hectare was used, calculated from the indicative values provided by the AECOM Strategic Site Assessment (2016) for the selected areas in Essex:

Table 8-18: Area and residential density (dwellings per ha)

Site	Total area (ha)	Residential density (dwellings per ha)
Gilston (A)	1015	30
Katherines (R)	72.5	33
Sumners (U)	56.5	29.5-35.4
Latton Priory (M)	260	35
East Harlow (J)	267.5	35
Average Density		**33.09**

The average density of 33.09 dwellings per hectare was used to estimate the approximate size of the dependent development identified across all three growth scenarios based on the number of dwellings for each development, as presented in Table 8-19:

Table 8-19: Number of Dwellings and Size of the dependent developments (ha)

	Number of Dwellings			Size (hectares)		
Uncertainty Log ID	**NTEM**	**Medium**	**High**	**NTEM**	**Medium**	**High**
52.1	693	929	1,386	20.94	28.06	41.89
53.1	832	1,115	1,664	25.14	33.69	50.29
325.1	150	250	750	4.53	7.56	22.67
333	0	737	1,100	0.00	22.27	33.24
372.1	0	704	1,050	0.00	21.26	31.73

375.1	0	670	1,000	0.00	20.25	30.22
383.1	520	1,742	2,600	15.71	52.64	78.57

Residential, industrial and agricultural land values are taken from the Valuation Office Agency Property Market Report for the East region of the UK. The land value for employment was sourced from the Department for Communities and Local Government's Appraisal Guidance (2016), whereby the type of land "Business Park Greenfield Uplift" was used as this type of non-residential development best aligned with the office development 372.2. All land value per hectare were converted to 2010 prices using the GDP deflator series. The existing value of the land is assumed to be based on industrial or agricultural land prices depending on whether the land has been previously developed or not.

Table 8-20: Land Value Assumptions (2010 prices)

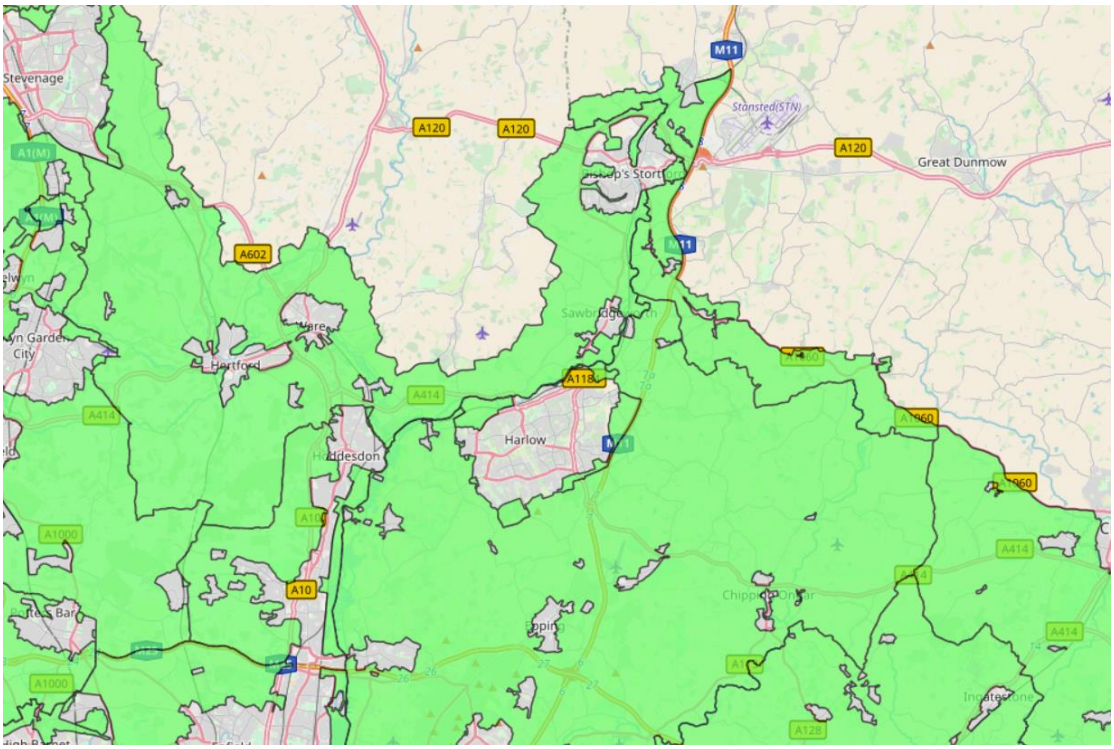
Land Type	Value of land per hectare (£000s)	Source
Residential	£ 2,206	*VOA Property Market Report 2011*
Industrial	£ 571	*VOA Property Market Report 2011*
Agricultural	£ 19	*VOA Property Market Report 2011*
Employment (Business Park)	£ 1,328	*Department for Communities and Local Government Appraisal Guidance (2016)*

The total land uplift value of each development represents the net social value of the land:

> **Net Social Value =** *Value of Land in Residential/Employment use - Value of Land in Existing Use (Agriculture or Industrial) + Externality Value (Perpetuity Value)*

The perpetuity value is the externality cost of developing on different land types. The developments identified as dependent on the M11J7a scheme encroach near the greenbelt boundary, designed to protect an area of agriculture, forestry and outdoor leisure from urban growth. The perpetuity value (per hectare) of £237,000 was obtained from *"Valuing the External Benefits of Undeveloped Land: a review of the economic literature*, ODPM (2002), using the value for urban fringe to estimate the total negative externality of the identified developments encroaching the greenbelt boundary.

Figure 9: Greenbelt land near Harlow (as of 2017)



Source: Troy Planning, 2018

Table 8-21 presents the total land value uplift (benefits) of each development identified under the core (NTEM), ECC Medium and ECC High Growth scenarios in 2010 prices.

Table 8-21: Land valuation uplift calculation

Scenario	Development ID	Type	Size (hectares)	Land value (£m)	Existing value of land (£m)	Perpetuity Value (£m)	Total Land Uplift (£m)
NTEM	52.1	Residential	21	46.19	0.39	- 4.95	40.84
	53.1	Residential	25	55.45	0.47	- 5.95	49.03
	383.1	Residential	16	34.65	0.29	- 3.72	30.64
	Total		**62**	**136.29**	**1.16**	**- 14.62**	**121**
Medium	52.1	Residential	28	61.89	0.53	- 6.64	55
	53.1	Residential	34	74.31	0.63	- 7.97	66
	383.1	Residential	53	116.10	0.99	- 12.46	103
	333	Residential	22	49.12	0.42	- 5.27	43
	375.1	Residential	20	44.66	0.38	- 4.79	39
	372.1	Residential	21	46.89	0.40	- 5.03	41
	372.2	Employment	5	5.98	0.08	- 1.06	5
	Total		**183**	**398.95**	**3.43**	**- 43.22**	**352**
High	52.1	Residential	42	92.39	0.79	- 9.91	82
	53.1	Residential	50	110.92	0.94	- 11.90	98
	383.1	Residential	79	173.30	1.47	- 18.59	153
	333	Residential	33	73.32	0.62	- 7.87	65
	375.1	Residential	30	66.65	0.57	- 7.15	59
	372.1	Residential	32	69.98	0.60	- 7.51	62
	372.2	Employment	5	5.98	0.08	- 1.06	5
	Total		**270**	**592.54**	**5.07**	**- 63.99**	**523**

In accordance to DfT's TAG A2.3, the estimated value of dependent development benefits unlocked by the M11J7a scheme are considered in the Value for Money assessment. The estimated benefits for the Core (NTEM), ECC Medium and ECC High Growth scenarios are assessed against the suggested qualitative assessment scores:

Table 8-22: Qualitative Assessment Scores

Benefits	Score
Greater than £100m	Large beneficial
Between £100m and £25m	Moderate beneficial
Between £25m and zero	Slight beneficial
Zero	Neutral
Between zero and -£25m	Slight adverse
Between -£25m and -£100m	Moderate adverse
Less than -£100m	Large adverse

For all growth scenarios, the total land value uplift surpasses the maximum benchmark of £100m, suggesting the value of the dependent development potentially unlocked by the M11J7a is considered **largely beneficial**.

However, the total value of the land uplift may not entirely be attributable to the transport scheme. Although the new Junction 7a will play a crucial role in the facilitation of housing and office development, other infrastructure items are needed, such as schools, supply of electricity and water etc. The benefits arising from the land uplift therefore depends on a package of infrastructure scheme, rather than just the transport scheme alone. Attributing all of the benefits of the dependent development to the transport scheme alone would not be considered appropriate and consequently the total value of land uplift is not included in the calculation of the adjusted BCR.

Transport External Costs

The transport external costs were calculated in line with WebTAG Unit A2.3 Transport Appraisal in the Context of Dependent Development (July 2015). These consider the additional costs imposed on the existing road users by the development road users. The transport external costs were calculated using TUBA (version 1.9.10), assuming Scenario D was assigned as the Do Minimum network and Scenario C was assigned as the Do Something network:

- **Do Minimum** – *Scenario D* – without dependent new housing but with the transport scheme
- **Do Something** – *Scenario C* – with dependent new housing and with the transport scheme

Table 8-23 presents transport external costs (discounted, 2010 prices) for the Core (NTEM), ECC Medium and ECC High Growth scenarios for the year 2036.

Table 8-23: Transport External Cost of the land use development (with transport scheme), £000s

Scenario	Transport External Cost, £000s
Core (NTEM)	£ 1,057
ECC Medium	£ 5,575
ECC High	£ 10,895

The transport external cost estimated for the core scenario, £1.1m, is the monetised transport cost imposed as a result of the additional development road users using the road network.

However, the transport external cost is lower in the event the transport scheme is implemented, compared to the transport external cost without the transport scheme.

The core scenario shows the transport scheme helps mitigate the transport external cost imposed on the existing road users by nearly £1m, as presented in Table 6-4 for the year 2036. The M11J7a scheme is critical to help accommodate increased traffic caused by the potential future development.

Table 8-24: Transport External Costs (without the scheme vs with the scheme), £000s

Scenario	Without the scheme (1)	With the scheme (2)	Change to TEC as a result of the transport scheme (1) – (2)
Core (NTEM)	£ 2,047	£ 1,057	**£990** ↓
ECC Medium	£ 6,194	£ 5,575	**£619** ↓
ECC High	£ 11,360	£ 10,895	**£465** ↓

Appendix I. Capital and O&M costs – provided by Highways England

Table 8-25 presents the scheme outturn costs by financial year, provided by Highways England. Table 8-26 presents the Operating and Maintenance cost profile over the 60-year appraisal period, starting from the opening year 2021 in 2010 prices (undiscounted). For more details of the capital and operating costs, please contact Highways England.

Table 8-25: Scheme outturn costs by Financial Year

	FY 18/19	FY 19/20	FY 20/21	FY 21/22	Total
Development Phase	3,421,307	833,882			4,255,189
Construction		22,008,396	45,339,878	2,123,123	69,471,397
Other Costs		1,968,624	3,920,953	113,053	6,002,630
Land Provision		6,586,000			6,586,000
Portfolio Risk	253,881	2,716,875	3,649,604	171,720	6,792,080
Total (without VAT)	**3,675,188**	**34,113,777**	**52,910,435**	**2,407,896**	**93,107,296**
VAT		2,968,879	4,368,290	352,823	7,689,992
Total (with VAT)	**3,675,188**	**37,082,656**	**57,278,725**	**2,760,720**	**100,797,289**

Source: Highways England

Table 8-26: O&M cost profile, 60-year appraisal period, undiscounted 2010 prices (£)

Year	Total Incremental O&M Cost, £	Year	Total Incremental O&M Cost, £	Year	Total Incremental O&M Cost, £	Year	Total Incremental O&M Cost, £
2021	77,654	**2036**	323,722	**2051**	847,392	**2066**	389,430
2022	79,407	**2037**	100,947	**2052**	138,775	**2067**	111,685
2023	75,685	**2038**	118,288	**2053**	97,835	**2068**	197,634
2024	63,007	**2039**	346,659	**2054**	96,532	**2069**	438,151
2025	38,472	**2040**	578,693	**2055**	90,045	**2070**	681,647
2026	22,412	**2041**	341,284	**2056**	96,604	**2071**	575,360
2027	- 46,042	**2042**	5,834	**2057**	13,196	**2072**	333,907
2028	- 75,983	**2043**	- 88,695	**2058**	69,298	**2073**	14,784
2029	173,897	**2044**	13,701	**2059**	755,666	**2074**	- 20,830
2030	404,216	**2045**	196,007	**2060**	1,161,028	**2075**	98,390
2031	245,126	**2046**	319,185	**2061**	561,525	**2076**	127,482
2032	195,668	**2047**	243,638	**2062**	147,801	**2077**	190,987
2033	296,106	**2048**	150,475	**2063**	141,628	**2078**	180,695
2034	429,623	**2049**	844,349	**2064**	484,579	**2079**	1,284,926
2035	561,503	**2050**	1,553,167	**2065**	783,992	**2080**	3,282,520
						Total	**20,960,668**

Source: Highways England