Department for Transport

AECOM

April 2013

Review of Lower Thames Crossing Options: Central Forecasts and Sensitivity Tests Report

Prepared by: ..... Checked by: .....

Andrew Currall
Senior Consultant

Mark Dazeley
Associate Director

Approved by: .....

Paul Hanson
Regional Director

Review of Lower Thames Crossing Options:

Rev No	Comments	Checked by	Approved by	Date
1	Initial draft for comment	MJD	PAH	2012-10-16
2	Final issue following DfT comment	MJD	PAH	2012-11-20
3	Revised final issue following DfT comment	MJD	PAH	2012-11-23
3.1	Minor edits to Tables 5.1, 5.2, §6.16 and Appendix A	MJD	PAH	2012-11-26

AECOM House, 63-77 Victoria Street, St Albans, Hertfordshire, AL1 3ER
Telephone: 01727 535000 Website: http://www.aecom.com

Job No 60249197 Reference 09 Reports Date Created November 2012

Table of Contents

1 Introduction

1.1 Purpose of this Report

1.1.1 This report is one of a series of technical documents produced as part of the 'Review of Lower Thames Crossing Capacity Options' study, commissioned by the Department for Transport in 2012. Initial stages of the study developed:

- transport models to test location options for a new Lower Thames Crossing, documented in 'Model Capability Report'; and
- conceptual designs for illustrative route alignments in a 'Design and Costing Report'.

1.1.2 This report documents the work undertaken using computer models to forecast traffic flows and traffic conditions in future scenarios for three location options for relieving capacity on the existing Dartford-Thurrock Crossing. These traffic forecasts will subsequently be used to calculate likely benefits, impacts and revenues in developing a strategic outline business case for each location option.

1.1.3 The models and forecasts are not intended as a detailed operational assessment of the new crossing options at this stage; the Lower Thames Crossing Model (LTCM) is a strategic model. Forecast data have been used to obtain likely estimates of the scale of costs and benefits of each option to inform consultation and decisions on the location of the new crossing. Further work will be required at the full business case stage to assess the options in more detail.

1.1.4 This report discusses the forecasting assumptions made, the resulting future year traffic forecasts, and forecast changes in traffic and travel conditions.

1.2 Definitions and Terminology

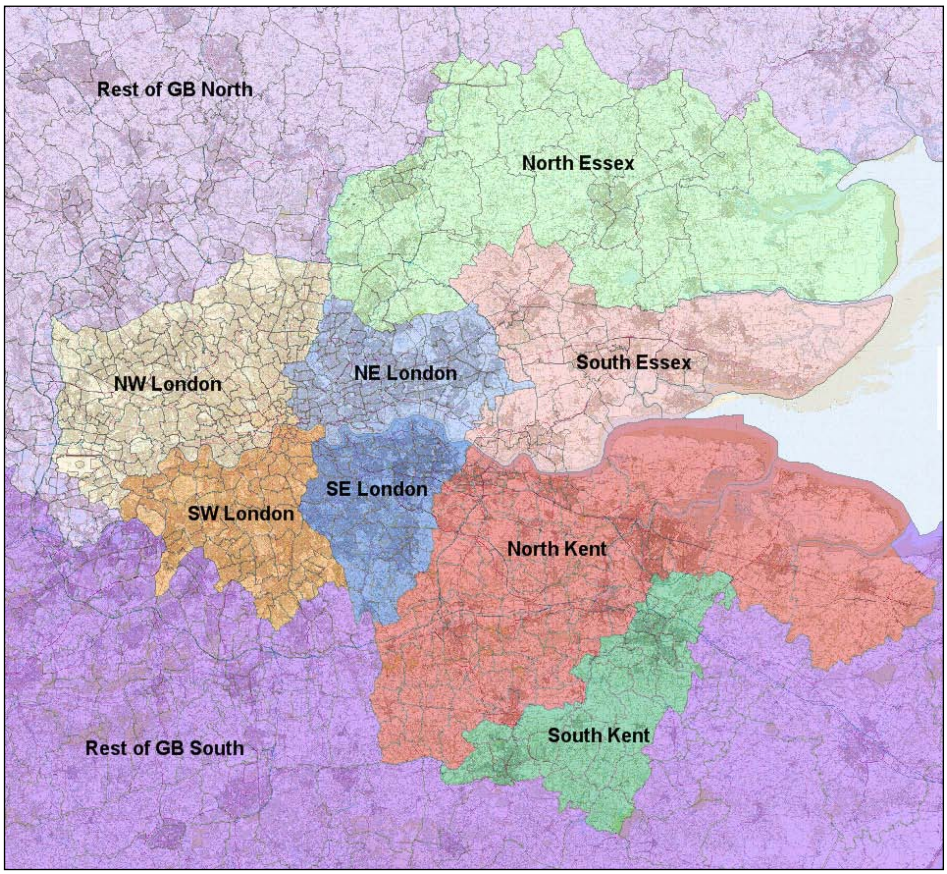
1.2.1 The Highways Agency's M25 Model was identified as the starting point for developing modelling capability for the purpose of this study.

1.2.2 The model development effort has resulted in the derivation of the LTCM, consisting of two sub-models:

- the Lower Thames Crossing Demand Model (LTC_{DM}), a travel demand forecasting model, developed using EMME software; and
- the Lower Thames Crossing Highway Assignment Model (LTC_{HAM}), a model of routes and congestion on the road network, developed using SATURN software.

1.2.3 A set of reporting areas has been defined, as shown in Figure 1.1. These are largely based on Local Authority district boundaries, with some consideration given, in the north-east and south-east of the reporting areas, as to how far the detailed area of LTC_{HAM} (the "simulation area") extends; beyond these limits modelling of traffic conditions is less precise. The South Kent area, for example, includes only the part of the Maidstone district within the LTC_{HAM} simulation area.

Figure 1.1: Reporting Areas



1.3 Report Structure

1.3.1 This report explains the forecasting assumptions adopted in the model, and then goes on to report results following the running of the model.

1.3.2 Following this introduction, this report is structured as follows:

- Chapter 2 explains the forecasting process and assumptions, including land-use planning data, economic conditions, and road network improvements.
- Chapter 3 discusses the forecasts "Without New Crossing"; these are the forecasts for the future transport conditions in the absence of any new Lower Thames Crossing capacity; this is used as a comparator, against which the benefits and impacts of providing a new crossing are judged.
- Chapter 4 discusses the core "With New Crossing" models, which forecast the effect of the options for providing additional capacity across the Lower Thames.
- Chapter 5 discusses the effect of various "sensitivity tests", which show how the forecasts change in response to various changes in the input assumptions.
- Finally, Chapter 6 summarises key findings.

2 Core Forecasting Assumptions

2.1 Introduction

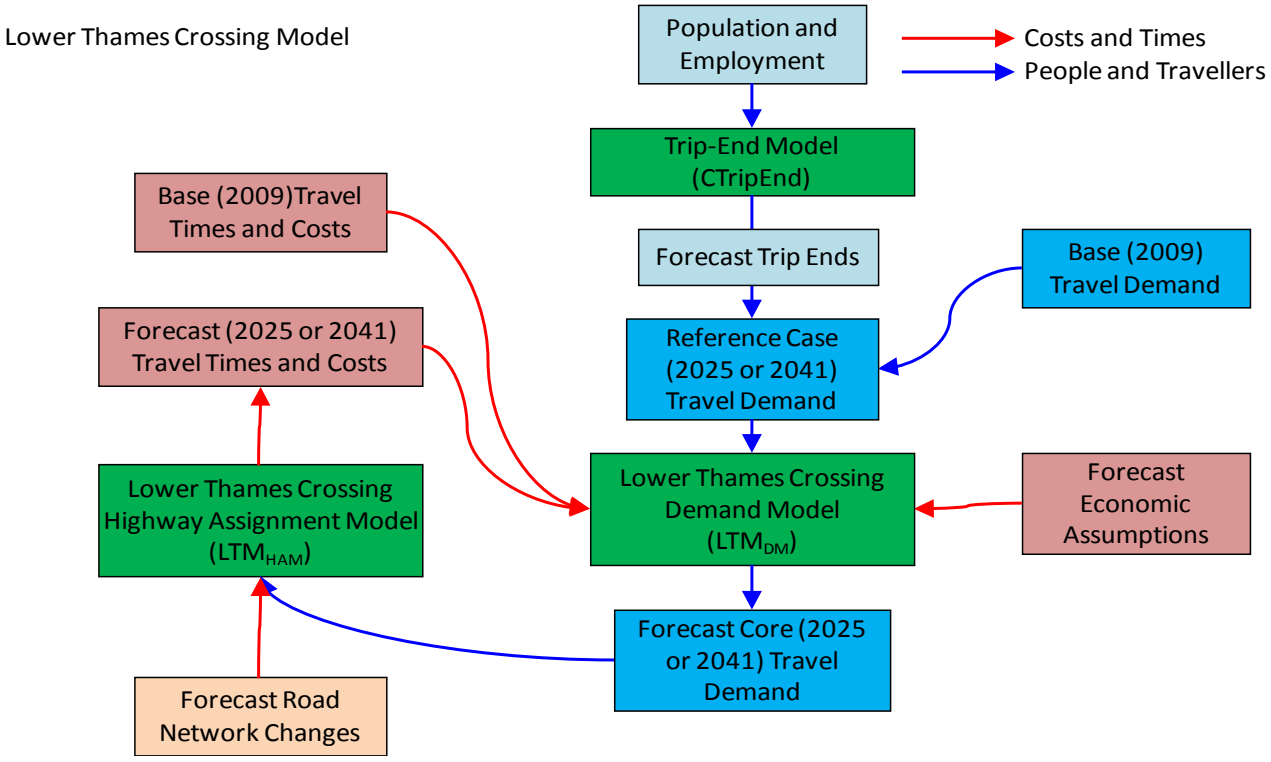
2.1.1 Before beginning to use the LTCM to produce forecasts of future year transport conditions, with and without a new Thames Crossing, it is necessary to prepare assumptions regarding the future transport context. Some of these assumptions will be revisited later, in Chapter 5, as we consider what might happen under different conditions, but those discussed in this chapter represent a starting point, or 'Core' forecast, which we consider to be a central or most likely scenario.

2.1.2 In preparing these assumptions we have referred to the DfT's Transport Analysis Guidance, WebTAG 3.15, which gives advice on the preparation of Core forecasts. As part of this process, an uncertainty log has been prepared, listing key areas of uncertainty about the forecasting assumptions; this is detailed in Appendix B.

2.2 Forecasting Process

2.2.1 The methodology used by the LTCM to forecast travel patterns and traffic conditions in the future is illustrated in Figure 2.1, and summarised below.

Figure 2.1: LTCM Forecasting Process



2.2.2 The validated base year (2009) highway and demand models (LTC_{HAM} and LTC_{DM}) are used as the basis for the model forecasts. Changes in traveller demand and journey times and costs are forecast from the base year representation.

2.2.3 Travel demand is derived from land use (population and employment) patterns. Forecast population and employment data are used to estimate changes in travel demand. We estimate traveller trip ends using the DfT's National Trip-End Model and National Car-Ownership Model (NTEM and NatCOP). These trip ends are then used to adjust (generally increasing) the base year traveller demand.

2.2.4 Freight growth assumptions are derived from the National Transport Model and applied to the base year freight matrices directly.

2.2.5 These adjustments to car and freight demand generate the 'Reference' demand, discussed later in this chapter. This is an interim stage in estimating the future year demand by considering changes in car ownership and land-use only.

2.2.6 Economic forecasting assumptions relate to the monetary cost of travel and to travellers' values of time. These are primarily derived from WebTAG 3.5.6, August 2012, but also include Thames crossing charging assumptions. These assumptions are input to the demand model.

2.2.7 The LTC_{DM} is used to derive a 'Core Without Scheme' scenario, which adjusts the Reference demand to take account of changes in transport infrastructure, congestion, travellers' valuation of time, and the changes in vehicle operating costs, public transport fares and charges. This involves iteration with the LTC_{HAM} which supplies travel times and costs. These are compared with the base 2009 costs to determine to what extent perceived travel conditions have changed, and the travel demand is forecast to respond accordingly.

2.3 Factors Affecting Transport Supply

2.3.1 One of the input assumptions in Figure 2.1 is 'Forecast Road Network Changes'. These must be determined prior to running any forecast models.

2.3.2 Currently the existing Dartford-Thurrock Crossing operates using toll booths situated south of the river, at which users pay the charge (or have DART-Tags read so that their accounts can be billed). In late 2014, a "free-flow charging" scheme is planned to be introduced, operating similarly to the existing London Congestion Charge, where vehicles are photographed using the crossing and identified as needing to pay the charge. This scheme should improve the existing crossing capacity by eliminating the need for toll collection booths and vehicles needing to slow down and stop to pass through them.

2.3.3 The potential effect of this scheme on crossing journey times, and on average charge paid, has been included in the LTC_{HAM} forecasts; it has been assumed that any new crossings will operate in the same way.

2.3.4 The remainder of this section summarises the process used to identify other potential and proposed road improvements and to determine whether they should be included in the future Core scenario. An initial list of road improvement schemes was derived through consultation with the following parties and sources:

- Hyder M25 'Dartford Free-Flow Charging' (DFFC) assessment Model;
- Highways Agency (HA);
- Department for Transport (DfT);
- Local Authorities outside London in the Lower Thames area[1]; and
- Transport for London (TfL).

2.3.5 After receiving the scheme lists from each of these sources, a process of collation and sifting was undertaken in order that only the schemes both relevant to our strategic forecasting objectives, and reasonably likely to happen, were to be included. Schemes included were those deemed either 'certain' or 'more than likely', in accordance with WebTAG 3.15.5.

2.3.6 170 schemes were considered in total, of which 65 were accepted and coded in $LTC_{HAM.}$ Those rejected were excluded for one of three reasons:

- they were considered relatively unlikely to proceed, often because no funding had been identified for the scheme;
- they were very minor, local schemes, of no strategic significance, or were outside the scope2 of the highway model; or
- they were a long way outside the area of interest of the model and considered too far away materially to affect the assessment of the Lower Thames Crossing options.

2.3.7 A complete list of all schemes considered and the justification for excluding those which were not used can be found in Appendix A.

[1] Kent County Council, Essex County Council, Thurrock Council, Medway Council and Southend-on-Sea Borough Council
[2] The model focuses on the strategic roads and does not, for example, include a detailed representation of individual town centres

2.4 Factors Affecting Underlying Demand

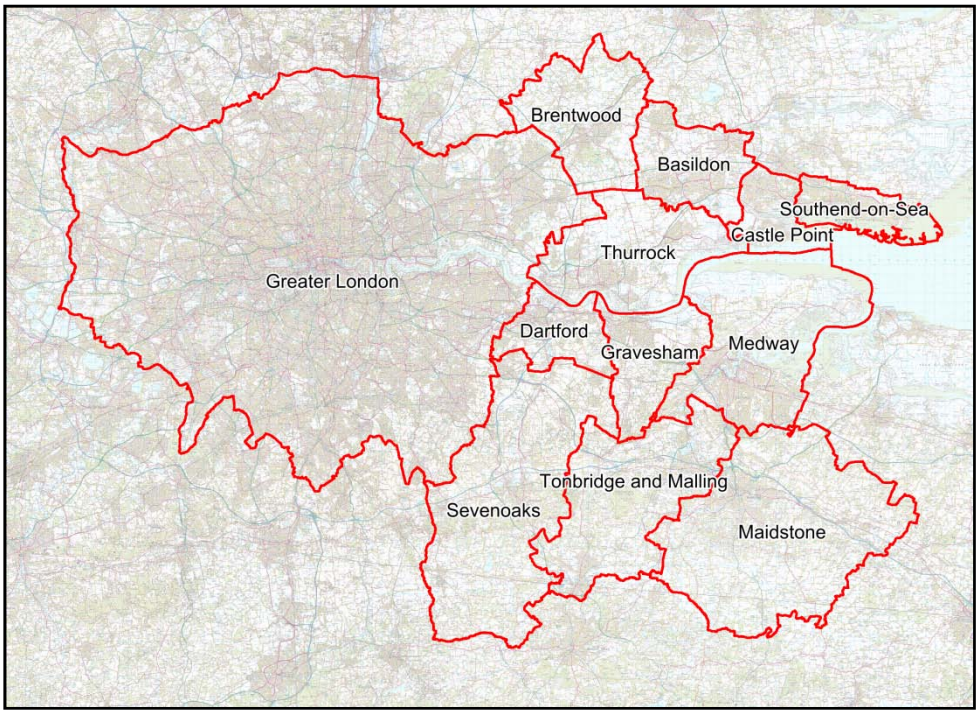
2.4.1 The key drivers of transport demand are population and employment. These have an effect on transport demand both related to their size (number of people and jobs), and to the location and type of population and employment; children have different travel patterns to adults in full-time employment, for example. The assumptions about the distribution and quantity of population and employment for the transport model are referred to as 'land-use' or 'planning data'.

2.4.2 The process used to put together employment, households and population estimates for the LTCM is described in this section.

2.4.3 The data have been compiled from three sources:

- the DfT's National Trip-End Model (NTEM) 6.2;
- TfL's London Transportation Studies (LTS) model, for the 33 boroughs of London; and
- consultation with the local authorities for the eleven districts around the model area as shown in Figure 2.2.

Figure 2.2: Location of 11 Districts (and Greater London) with Local Planning Data



London Planning Data

2.4.4 Population, employment and household forecasts, reflecting the Greater London Authority planning projections, between 2007 and 2031 were provided by TfL in the LTS[3] zoning system. Population was divided into children, working, not-working and retired adults. These data were converted into the LTCM and NTEM zone systems.

District Planning Data

2.4.5 Land-use data were obtained in LTCM zoning from the 11 local planning authorities shown above, initially with reference to published documents such as Local Development Plans. The relevant local authorities were given the opportunity to comment on the assumptions made, and their responses incorporated.

[3] Transport for London's strategic transport planning model of London

Planning Data Collation Process

2.4.6 Planning data were collated for the three modelled years: 2009, 2025 and 2041 (the base year of the model and two forecast years). In addition, it was necessary to collate the data from the three sources, and convert the data into a single consistent zoning system (set of geographical areas).

2.4.7 NTEM 6.2 data were obtained for 2006, 2011, 2021, 2026 and 2041. Linear interpolation was used to establish data for 2009 and 2025.

2.4.8 The local planning data were constrained by district to NTEM 6.2 in accordance with WebTAG 3.15.5 §1.3.2. A wider constraining area was considered, but the data from the 11 districts were considered to have differing levels of certainty, with moderation difficult, and hence the district-based constraint was adopted. Planning data for London were also constrained to the Greater London forecasts in NTEM, across the whole of Greater London (not by individual borough)[4].Table 2.1 shows the comparison between the NTEM and local data for 2009-2025 growth prior to the application of this constraint. Following the constraint, of course, the NTEM totals were adopted, with the more detailed trip patterns coming from the local data.

Table 2.1: Local Planning Data Growth Forecasts Compared with NTEM 6.2

	2009-2025 Growth					
	NTEM 6.2		Local Authorities		Difference (%)	
	Households	Jobs	Households	Jobs	Households	Jobs
Basildon	5,430	8,423	6,501	8,423	20%	0%*
Brentwood	2,734	5,445	2,090	4,000	-24%	-27%
Castle Point	3,925	1,472	1,865	2,117	-52%	44%
Dartford	15,849	14,652	14,395	22,610	-9%	54%
Gravesham	8,215	686	3,650	2,491	-56%	263%
Maidstone	9,497	4,429	10,051	7,666	6%	73%
Medway	18,168	2,491	15,494	15,634	-15%	528%
Sevenoaks	3,081	5,179	2,718	5,180	-12%	0%*
Southend-on-Sea	11,605	5,693	5,079	10,635	-56%	87%
Thurrock	18,241	5,620	18,781	17,344	3%	209%
Tonbridge and Malling	8,864	2,968	7,595	2,983	-14%	1%
Total (Districts)	105,609	57,059	88,219	99,083	-16%	74%
Greater London	557,793	506,919	541,838	510,365	-3%	1%

Note: * Basildon and Sevenoaks District Councils provided NTEM-derived employment forecasts

Running NatCOP & CTripEnd

2.4.9 For each of the model years, collated population and households, in the NTEM zoning system, have been input to the DfT's National Car Ownership Model (NatCOP) in order to obtain car ownership estimates for each modelled year.

2.4.10 After obtaining estimates for car ownership, these along with the collated population, household and employment tables (in NTEM zoning) were input to the DfT's trip-end modelling software CTripEnd, as shown in Figure 2.1 in order to generate trip ends (traveller demand, used in the transport model) for each of the three model years, in NTEM zoning.

2.4.11 These trip-ends were then disaggregated to LTCM zoning using proportions derived from the input planning data, population or employment, as appropriate.

2.5 Factors Affecting Cost of Travel

Economic Parameters

2.5.1 Economic parameters, used to estimate the cost of travel, have been derived from WebTAG 3.5.6, August 2012. The calculated values are presented in Table 2.2.

2.5.2 Values of time relate to the relative importance attached by travellers to time and money. They are presented by LTCM traveller segment, which is a combination of travel purpose (travel to work, travel for business, other

[4] Different assumptions for constraint to NTEM were considered in sensitivity testing, discussed in Chapter 5.

travel), traveller income level, home basis (home-based trips, HB, and non-home-based trips, NHB) and vehicle type (car, light goods vehicles, heavy goods vehicles).

Table 2.2: Change in Economic Parameters over Time

Parameter	2009	2025	2041	2025 Change	2041 Change	Units
Car Fuel Usage Petrol	1.014	0.619	0.536	-39%	-47%	litres/km, relative to 2010
Car Fuel Usage Diesel	1.016	0.718	0.615	-29%	-39%	litres/km, relative to 2010
LGV Fuel Usage Petrol	1.003	0.772	0.637	-23%	-37%	litres/km, relative to 2010
LGV Fuel Usage Diesel	1.018	0.716	0.652	-30%	-36%	litres/km, relative to 2010
Car Petrol Proportion	62%	44%	44%	-28%	-28%	proportion
Car Diesel Proportion	38%	53%	50%	38%	31%	proportion
Car Electric Proportion	0%	3%	5%	-	-	proportion
LGV Petrol Proportion	7%	1%	1%	-85%	-88%	proportion
LGV Diesel Proportion	93%	99%	99%	6%	6%	proportion
Business Petrol price	89	123	154	38%	72%	pence/litre (2010 prices)
Business Diesel price	93	130	162	39%	74%	pence/litre (2010 prices)
Business Electricity price	-	20	19	-	-	pence/kWh (2010 prices)
Consumer Petrol price	102	147	184	44%	80%	pence/litre (2010 prices)
Consumer Diesel price	107	155	195	45%	82%	pence/litre (2010 prices)
Consumer Electricity price	-	21	20	-	-	pence/kWh (2010 prices)
Value of Time, HBWork, Low	7.382	9.024	11.642	22%	58%	pence/minute (2010 prices)
Value of Time, HBWork, Med	10.185	12.45	16.06	22%	58%	pence/minute (2010 prices)
Value of Time, HBWork, High	12.929	15.805	20.389	22%	58%	pence/minute (2010 prices)
Value of Time, HBBusiness	44.548	57.421	79.085	29%	78%	pence/minute (2010 prices)
Value of Time, HBOther, Low	8.332	10.185	13.138	22%	58%	pence/minute (2010 prices)
Value of Time, HBOther, Med	9.59	11.722	15.122	22%	58%	pence/minute (2010 prices)
Value of Time, HBOther, High	10.644	13.011	16.784	22%	58%	pence/minute (2010 prices)
Value of Time, NHBBusiness	44.548	57.421	79.085	29%	78%	pence/minute (2010 prices)
Value of Time, NHBOther, Low	8.332	10.185	13.138	22%	58%	pence/minute (2010 prices)
Value of Time, NHBOther, Med	9.59	11.722	15.122	22%	58%	pence/minute (2010 prices)
Value of Time, NHBOther, High	10.644	13.011	16.784	22%	58%	pence/minute (2010 prices)
Value of Time, LGV	16.782	21.569	29.65	29%	77%	pence/minute (2010 prices)
Value of Time, HGV	41.366	53.166	73.085	29%	77%	pence/minute (2010 prices)

Crossing Charge Assumptions

2.5.3 The level of charges in place on the Dartford-Thurrock Crossing, and any proposed options, has been based on the current Government policy. A recent DfT statement[5] specified that the cash charge for car users would rise by 50p (to £2.00) in October 2012, and again by a further 50p (to £2.50) in October 2014. The costs for other vehicle types and for DART-Tag users is also assumed to increase proportionately.

2.5.4 Assuming that 2015 is the first full year of operation of these revised charges, the charges assumed in the model, in 2015 prices, are given in Table 2.3. The forecast charges for LGV and HGV, and the discounts for DART-Tag users, have been calculated by increasing the charges proportionately to car charges, and rounding to the nearest 10 pence.

[5] http://www.dft.gov.uk/news/statements/penning-20120522a

Table 2.3: 2015 Charge Assumptions (in 2015 Prices)

Vehicle Type	Cash Charge	DART-Tag
Car	£2.50	£1.70
LGV	£3.30	£2.90
HGV	£6.20	£5.30

2.5.5 After 2015, these charges have been assumed to increase in-line with the Consumer Price Index (CPI), and the 2015 forecast charges have been deflated to 2010 prices prior to being used in the model. We note that in the short term, Dartford-Thurrock Crossing charges are set to rise with the Retail Price Index (RPI). The approximation has been made because other monetary quantities in the model are assumed to increase with CPI, in accordance with WebTAG guidance.

2.5.6 In addition to the absolute charges in each of the forecast years, an estimate of the proportion of DART-Tag users is also required to calculate an average charge for a given vehicle type. The assumptions regarding the uptake of DART-Tag have been taken from Hyder and Halcrow's Traffic Forecasting Report for free-flow charging. Appendix N in that report gives assumed changes in the proportion of DART-Tag, and these changes have been applied to the proportions derived from the transaction data for the 2009 base year.

2.5.7 The assumed proportions of traffic using the existing Dartford-Thurrock Crossing with a DART-Tag are given in Table 2.4.

Table 2.4: Forecast DART-Tag Proportions

	Base Year			Forecast Years		
	AM	IP	PM	AM	IP	PM
Car	34.3%	12.8%	21.7%	70.3%	26.1%	44.3%
LGV	44.1%	41.3%	37.6%	46.2%	43.3%	39.5%
HGV	72.2%	71.3%	68.5%	72.2%	71.3%	68.5%

3 Core Scenario Without New Crossing

3.1 Introduction

3.1.1 Forecasts representing a "most likely" future scenario without a new crossing have been run for 2025 and 2041. These represent scenarios in the absence of options for an additional crossing, and therefore provide a comparator in the subsequent assessment of the impact of a new crossing.

3.1.2 The forecasts are discussed, as follows:

- the effect of changes in the distribution, type and quantity of population and employment is discussed in Section 3.2;
- the overall forecasts of future traffic conditions, including the impact of economic drivers on travel patterns, is discussed in Section 3.3;
- the effect of the changes in traffic on the performance of the highway network, in terms of speeds and delays, is discussed in 3.4.
- the effect of these changes upon the Dartford-Thurrock Crossing itself, in terms of vehicle flows and journey times, is discussed in Section 3.5.

3.2 Land-Use-Related ('Reference') Growth

3.2.1 A key driver of traffic growth over time is the change in population and employment. The first step in running the LTCM is to estimate the effect of these land-use changes (assumed as discussed in Section 2.4) upon traffic levels.

3.2.2 This trip-end model represents the effect of changes in total population, location of population and breakdown of population by person type (e.g. age of population), changes in total employment, location of employment and breakdown of employment by type, and of changes in household car ownership. It does *not* take account of other drivers of changes in travel patterns, including changes in the cost of travel, changes in provision of transport networks (roads and public transport services), or changes in level of traffic congestion.

3.2.3 Forecast planning data for the three modelled years are summarised in Table 3.1. The South-East is forecast to experience higher growth in population and employment than the rest of the country, with London forecast to have even higher levels of growth.

Table 3.1: Forecast Land-Use Data

Area	Population			Employment		
	2009	2009-2025	2009-2041	2009	2009-2025	2009-2041
South Essex	734,632	13%	24%	308,806	9%	16%
North Kent	813,223	14%	25%	383,193	7%	7%
North East London	1,562,471	22%	39%	659,277	17%	24%
South East London	1,005,631	15%	27%	356,580	2%	7%
North West London	3,048,256	13%	23%	2,690,375	12%	20%
South West London	1,861,655	13%	24%	956,441	5%	10%
North Essex	512,883	13%	24%	253,526	10%	16%
South Kent	216,434	12%	20%	121,746	5%	4%
Rest of Great Britain: North	39,427,690	10%	17%	19,135,445	6%	13%
Rest of Great Britain: South	9,732,061	12%	22%	4,976,401	8%	13%

3.2.4 The highway person trip changes implied by these land-use data are summarised in Table 3.2. The general pattern of trip increases is consistent with the land-use increases; for example, North East London has high forecast population and employment growth, and consequently high forecast growth in car trips. The trip

growth, however, is generally somewhat higher than land use growth; this is largely due to increases in car-ownership, which leads to increases in highway travel in excess of population and employment effects alone.

Table 3.2: Forecast Reference Car Person Trip Productions, including only land-use effects

Area	2009	2009-2025	2009-2041
South Essex	1,101,148	16%	29%
North Kent	1,647,421	22%	33%
North East London	2,631,519	37%	56%
South East London	1,759,609	18%	29%
North West London	6,522,661	18%	29%
South West London	3,140,200	17%	29%
North Essex	1,082,393	13%	24%
South Kent	456,511	11%	18%
Rest of Great Britain: North	76,139,734	12%	22%
Rest of Great Britain: South	20,432,945	12%	22%

3.2.5 The highway traffic (vehicle distance) changes generated by these trips are summarised in Table 3.3. Again, the general pattern is consistent, but with less variation between areas, as trips generated in one area result in traffic in other areas as well. North East London is forecast to have higher traffic growth than other areas, for example, but less so than in terms of trips or land-use. Overall traffic is forecast to increase by about 35% from 2009 to 2041.

Table 3.3: Forecast Reference Traffic (Vehicle km), including only land-use effects

		Vehicle km			% Change from 2009	
		2009	2025	2041	2025	2041
AM Peak	South Essex	798,000	978,000	1,081,000	23%	35%
	North Kent	1,505,000	1,799,000	1,966,000	20%	31%
	North East London	1,011,000	1,255,000	1,371,000	24%	36%
	South East London	598,000	702,000	776,000	17%	30%
	North West London	2,248,000	2,640,000	2,872,000	17%	28%
	South West London	929,000	1,065,000	1,139,000	15%	23%
	North Essex	1,437,000	1,720,000	1,907,000	20%	33%
	South Kent	492,000	575,000	623,000	17%	27%
Inter-peak	South Essex	671,000	878,000	1,021,000	31%	52%
	North Kent	1,115,000	1,436,000	1,620,000	29%	45%
	North East London	896,000	1,153,000	1,282,000	29%	43%
	South East London	529,000	636,000	717,000	20%	35%
	North West London	1,877,000	2,308,000	2,593,000	23%	38%
	South West London	785,000	939,000	1,036,000	20%	32%
	North Essex	1,083,000	1,376,000	1,593,000	27%	47%
	South Kent	343,000	425,000	485,000	24%	42%
PM Peak	South Essex	871,000	1,066,000	1,161,000	22%	33%
	North Kent	1,584,000	1,915,000	2,063,000	21%	30%
	North East London	1,067,000	1,321,000	1,430,000	24%	34%
	South East London	662,000	782,000	843,000	18%	27%
	North West London	2,237,000	2,688,000	2,920,000	20%	31%
	South West London	944,000	1,076,000	1,144,000	14%	21%
	North Essex	1,484,000	1,808,000	1,967,000	22%	33%
	South Kent	497,000	585,000	634,000	18%	28%

3.2.6 Figure 3.1 and Figure 3.2 show the forecast flow changes from the 2009 base year to the 2025 and 2041 Reference scenarios respectively. Both figures show the results of the AM peak hour (08:00–09:00) assignment with green showing forecast increases in flow from the base year to the given forecast year, and red indicating where flows are forecast to decrease.

3.2.7 These plots show the general increase in traffic across the network in the vicinity of the Dartford-Thurrock Crossing and the proposed location options. In absolute terms, the larger flow increases are forecast on the

strategic routes, including the M25, the A2 and the A13. Lower traffic growth is forecast on the rural and urban road network. A very small number of roads have forecast decreases in flow (red); this is due either to congestion on other parts of the routes taken by travellers on these roads, or to localised reductions in population and/or employment.

Figure 3.1: AM Peak Flow Changes between 2009 Base Year and 2025 Reference Growth

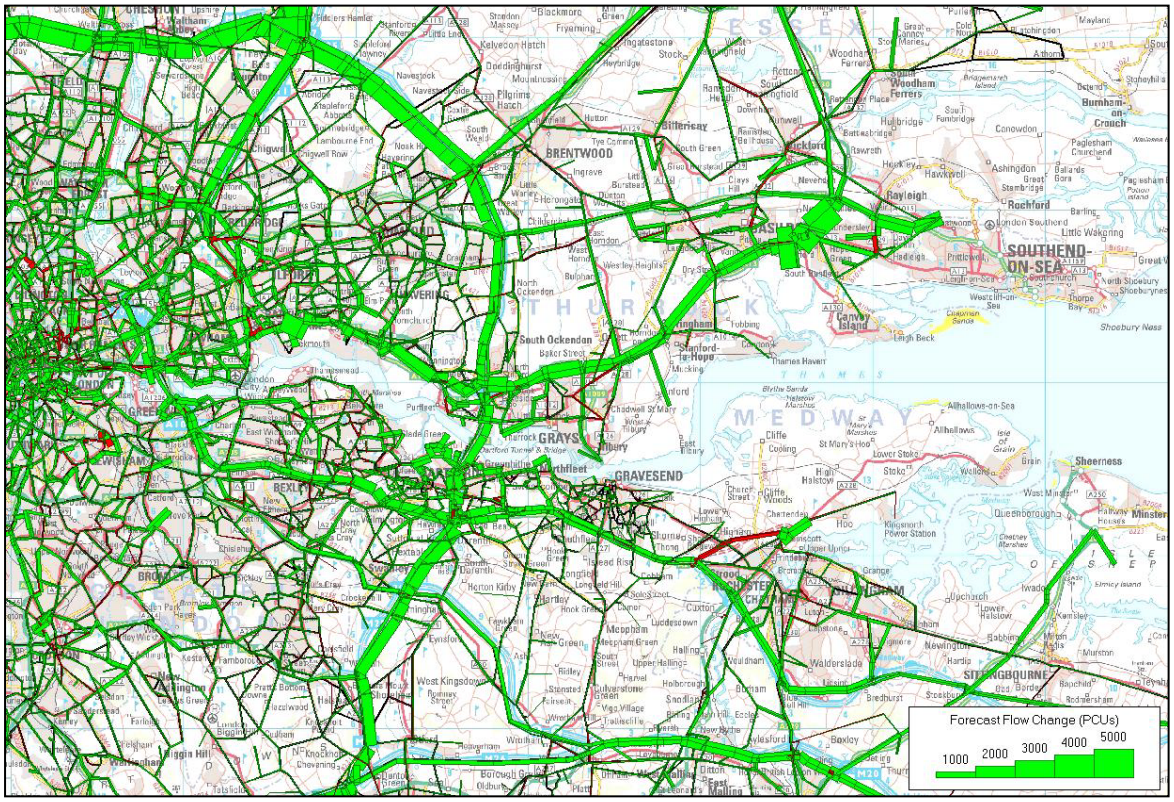


Figure 3.2: AM Peak Flow Changes between 2009 Base Year and 2041 Reference Growth

3.3 Cost and Supply Related ('Core') Growth

3.3.1 Following the generation of Reference demand as discussed above, the demand model (LTC_{DM}) is applied to forecast the effect of changes in transport cost upon demand. Relevant factors include:

- changes in the cost of fuel;
- improvements in vehicle engine efficiency;
- the effect of increases in GDP per capita upon perceived cost of travel;
- changes in the level of traffic congestion over time;
- new road infrastructure and changes to the road network;
- changes in average vehicle occupancy; the effect of this upon average cost of car travel per traveller; and
- changes in the cost of competing modes (i.e. rail and bus).

3.3.2 The LTCM takes account of all of these factors, the effect of which on total trips is illustrated in Table 3.4.

Table 3.4: Forecast Core Car Person Trips in Without Scheme Case

	2025			2041		
	Reference	**Core**	**Change**	**Reference**	**Core**	**Change**
South Essex	1,274,977	1,263,838	-0.9%	1,419,679	1,383,269	-2.6%
North Kent	2,003,550	1,996,408	-0.4%	2,193,155	2,168,250	-1.1%
North East London	3,608,656	3,534,671	-2.1%	4,108,681	3,941,599	-4.1%
South East London	2,067,557	2,037,040	-1.5%	2,270,465	2,189,787	-3.6%
North West London	7,667,590	7,567,186	-1.3%	8,435,936	8,179,510	-3.0%
South West London	3,668,027	3,600,754	-1.8%	4,035,950	3,866,364	-4.2%
North Essex	1,221,585	1,221,063	0.0%	1,342,817	1,333,406	-0.7%
South Kent	508,666	508,175	-0.1%	539,173	535,387	-0.7%
Rest of Great Britain: North	85,367,107	85,976,558	0.7%	93,150,521	93,796,240	0.7%
Rest of Great Britain: South	22,912,490	23,031,454	0.5%	24,921,519	25,017,448	0.4%
All	**130,300,205**	**130,737,147**	**0.3%**	**142,417,898**	**142,411,261**	**0.0%**

3.3.3 Compared with the effect of changes in population and employment, these factors have relatively little impact upon total forecast trip-making. They tend to reduce trips in the modelled local area, especially in London, due to increases in congestion, but outside the South East, they slightly increase trips, largely due to forecast improvements in fuel efficiency which are countered to a lesser extent by increases in congestion.

3.3.4 It should also be noted that the effect of changes in the cost of travel on vehicle distance (traffic) is greater than that on person trips, because trips tend to lengthen or shorten more easily than they are generated or suppressed (by way of illustration, most people must travel to work, but they have, in the long term, some choice about how long a journey they must make through choice of employment and residence location). This is illustrated in Table 3.5.

Table 3.5: Forecast Core Traffic (Vehicle km) in Without Scheme Case

		2025			2041		
		Reference	**Core**	**Change**	**Reference**	**Core**	**Change**
AM Peak	South Essex	978,048	974,850	-0.3%	1,080,514	1,046,033	-3.2%
	North Kent	1,799,132	1,819,385	1.1%	1,966,236	1,956,624	-0.5%
	North East London	1,255,475	1,201,873	-4.3%	1,370,507	1,278,308	-6.7%
	South East London	701,965	672,150	-4.2%	776,113	719,637	-7.3%
	North West London	2,639,770	2,522,267	-4.5%	2,871,639	2,657,579	-7.5%
	South West London	1,065,475	1,007,713	-5.4%	1,138,837	1,050,378	-7.8%
	North Essex	1,719,969	1,739,517	1.1%	1,906,653	1,878,457	-1.5%
	South Kent	574,985	592,767	3.1%	623,053	640,009	2.7%
Inter-peak	South Essex	877,568	873,779	-0.4%	1,020,929	972,886	-4.7%
	North Kent	1,435,638	1,469,059	2.3%	1,620,100	1,636,801	1.0%
	North East London	1,153,286	1,104,359	-4.2%	1,281,682	1,195,371	-6.7%
	South East London	636,423	614,003	-3.5%	716,943	669,362	-6.6%
	North West London	2,308,014	2,212,409	-4.1%	2,592,715	2,409,176	-7.1%
	South West London	938,934	893,402	-4.8%	1,036,095	955,366	-7.8%
	North Essex	1,375,551	1,410,266	2.5%	1,592,791	1,591,504	-0.1%
	South Kent	425,180	443,771	4.4%	485,324	501,749	3.4%
PM Peak	South Essex	1,066,145	1,038,946	-2.6%	1,160,654	1,103,448	-4.9%
	North Kent	1,915,229	1,910,778	-0.2%	2,062,597	2,036,986	-1.2%
	North East London	1,321,032	1,249,982	-5.4%	1,430,317	1,325,792	-7.3%
	South East London	782,335	730,651	-6.6%	842,505	770,409	-8.6%
	North West London	2,687,757	2,542,504	-5.4%	2,919,618	2,694,405	-7.7%
	South West London	1,075,702	1,022,953	-4.9%	1,143,666	1,064,313	-6.9%
	North Essex	1,807,922	1,788,471	-1.1%	1,967,207	1,929,898	-1.9%
	South Kent	584,695	597,742	2.2%	633,591	643,124	1.5%

3.3.5 The combined effect of land-use and transport-cost changes on traffic levels is illustrated in Table 3.6. This combines the effects shown in Table 3.3 and Table 3.5, and is the total forecast change in traffic from 2009 to 2025 and 2041.

3.3.6 Again, the general pattern is consistent, but with less variation between areas, as trips generated in one area result in traffic in other areas as well. North East London is forecast to have higher traffic growth than other areas, for example, but less so than in terms of trips or land-use. Overall traffic is forecast to increase by about 35% from 2009 to 2041.

Table 3.6: Forecast Increases in Traffic Over Time

		Vehicle km			% Change from 2009	
		2009	2025	2041	2025	2041
AM Peak	South Essex	798,173	974,850	1,046,033	22.1%	31.1%
	North Kent	1,505,219	1,819,385	1,956,624	20.9%	30.0%
	North East London	1,011,159	1,201,873	1,278,308	18.9%	26.4%
	South East London	598,252	672,150	719,637	12.4%	20.3%
	North West London	2,248,166	2,522,267	2,657,579	12.2%	18.2%
	South West London	928,970	1,007,713	1,050,378	8.5%	13.1%
	North Essex	1,436,609	1,739,517	1,878,457	21.1%	30.8%
	South Kent	492,398	592,767	640,009	20.4%	30.0%
Inter-peak	South Essex	670,691	873,779	972,886	30.3%	45.1%
	North Kent	1,115,056	1,469,059	1,636,801	31.7%	46.8%
	North East London	896,128	1,104,359	1,195,371	23.2%	33.4%
	South East London	529,414	614,003	669,362	16.0%	26.4%
	North West London	1,876,685	2,212,409	2,409,176	17.9%	28.4%
	South West London	785,099	893,402	955,366	13.8%	21.7%
	North Essex	1,082,662	1,410,266	1,591,504	30.3%	47.0%
	South Kent	342,855	443,771	501,749	29.4%	46.3%
PM Peak	South Essex	871,181	1,038,946	1,103,448	19.3%	26.7%
	North Kent	1,583,742	1,910,778	2,036,986	20.6%	28.6%
	North East London	1,067,201	1,249,982	1,325,792	17.1%	24.2%
	South East London	662,174	730,651	770,409	10.3%	16.3%
	North West London	2,236,995	2,542,504	2,694,405	13.7%	20.4%
	South West London	944,235	1,022,953	1,064,313	8.3%	12.7%
	North Essex	1,484,223	1,788,471	1,929,898	20.5%	30.0%
	South Kent	496,543	597,742	643,124	20.4%	29.5%

3.3.7 Overall the cost of travel (largely increasing congestion) is forecast to suppress traffic growth by 2% in 2025 and 4% in 2041. The effect is stronger in London, and weaker in Kent; in South Kent changes in the cost of travel actually increase vehicle distance. Figure 3.3 and Figure 3.4 show the forecast flow changes from the Reference to the Core scenarios; that is, they show the forecast effect of changes in the cost of travel upon traffic flows. Both figures show the results of the AM peak hour (08:00–09:00) with green showing forecast increases in flow and red indicating where flows are forecast to decrease.

3.3.8 The plots for 2025 and 2041 display a similar pattern of demand suppression and generation: traffic within London are reduced from the Reference scenario, whilst generation of traffic is observed on the clockwise M25 between Junctions 25 and 30, on the M20, A2 and M2, on the A228 between Rochester and the Isle of Grain, and on the A249 between Sittingbourne and the Isle of Sheppey.

3.3.9 Suppression in London occurs due to the significant levels of congestion; the resultant increases in the cost of travel lead to the suppression observed in the Core assignments. No significant infrastructure or capacity enhancement schemes have been assumed inside the M25 in the Core networks.

3.3.10 Forecast traffic growth is notable in North Kent. The majority of this growth is related to improvements in infrastructure that have been assumed in the Core networks; these schemes provide additional capacity on the highway network between the 2009 base year and 2025 forecasts. No further infrastructure schemes have been assumed between 2025 and 2041. The location of traffic growth demonstrated in the figures is consistent with these scheme locations.

3.3.11 Growth in traffic on the M25 shown between Junctions 25 and 30 corresponds to the ongoing widening schemes between Junctions 23-27 and Junctions 27-30. Full widening of the M25 to dual carriageway four lane motorway standard is assumed between Junctions 27-30, corresponding with the growth shown. Lower growth is shown east of Junction 27, which is consistent with the managed motorway scheme assumed between Junctions 23-27.

3.3.12 Traffic growth is also notable on the A228 to the Isle of Grain and on the A249 between Sittingbourne and Sheppey. In the case of the A228, the current at-grade roundabout at Four Elms is assumed to be replaced by a signalised roundabout designed to increase capacity, whilst the recent dualling scheme between Main Road and Roper's Lane, included in the Core network, provides additional link capacity. With regards to the A249,

the upgrade of the route between Iwade and Queenborough, completed in 2006, provides additional capacity to the Isle of Sheppey.

Figure 3.3: AM Peak Flow Changes between 2025 Reference and 2025 Core

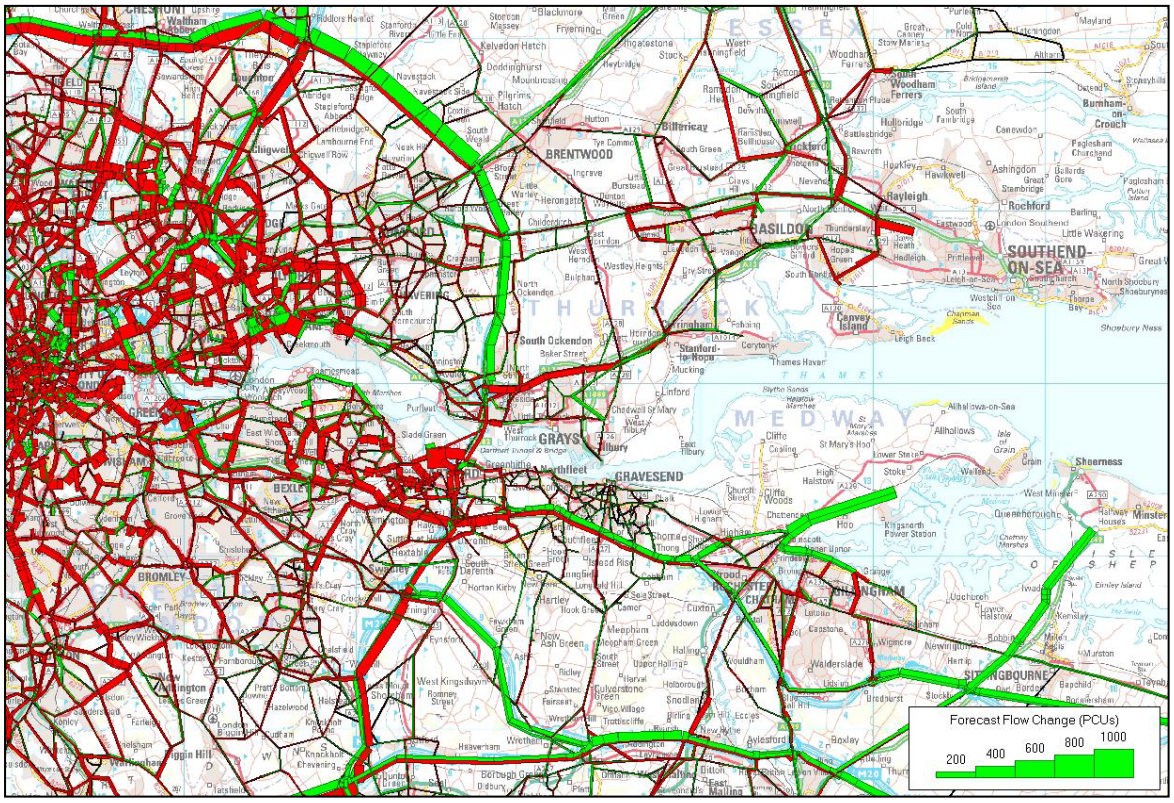
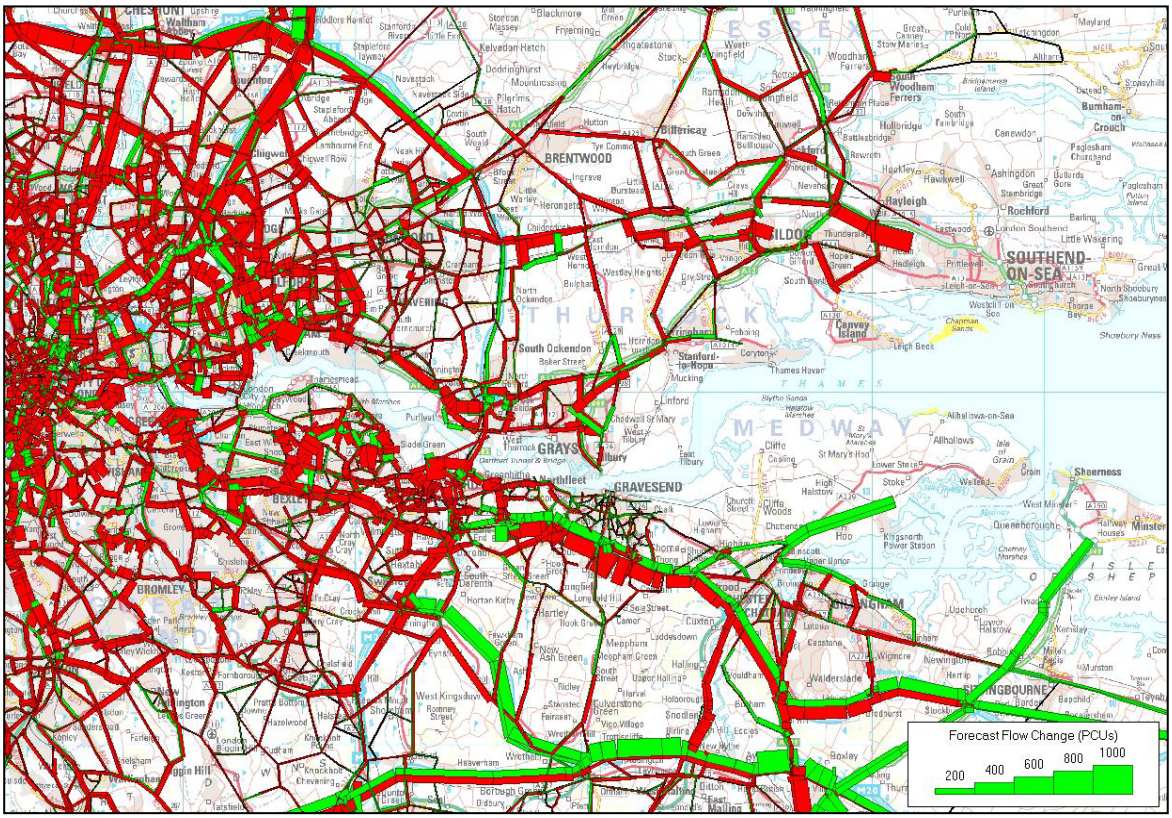


Figure 3.4: AM Peak Flow Changes between 2041 Reference and 2041 Core



3.4 Transport Network Performance

3.4.1 The general performance of the transport network, that is, the level of congestion experienced, is shown for the "Policy Area" in Table 3.7 and Table 3.8. This comprises North Kent, South Essex, North East London and South East London as shown in Figure 1.1.

3.4.2 A very large increase in congestion is observed in the Reference scenario, especially in 2041, but following suppression and redistribution of trips in the demand model, this is significantly reduced. Large delays in the Reference scenario will in general cause travellers to be redistributed elsewhere by the demand model, as their cost of travel will be significantly increased. This effect will tend to moderate increases in congestion.

3.4.3 It is clear that the area of study is heavily congested in 2009 (about 35% of journey time is delay in the peak periods) and is likely to become more so in the future, even after accounting for suppression of demand due to heavy congestion.

3.4.4 It should be noted, however, that forecast increases in traffic, vehicle hours and vehicle delay are partly due directly to increases in the number of travellers and the length of their journeys; they do not represent increases in the average journey time for a single traveller, which will be significantly smaller. These figures imply around 55-70% increase in in-vehicle time in 2041, and given vehicle kilometres are forecast to increase 32% overall in the scheme area, the increase in forecast average journey times is around 25-40%.

Table 3.7: Network Statistics in Without Scheme Case, 2025, Policy Area

		Base	Reference	Core	Base-Ref	Base-Core
AM Peak	Vehicle Time (Veh-hours)	85,420	132,670	113,120	55%	32%
	Vehicle Delay (Veh-hours)	29,854	65,318	47,306	119%	58%
	Queues End of Hour (Veh)	11,061	31,533	19,765	185%	79%
	Average Speed (kph)	46	36	41	-22%	-10%
Interpeak	Vehicle Time (Veh-hours)	66,020	103,151	91,627	56%	39%
	Vehicle Delay (Veh-hours)	19,996	44,771	34,235	124%	71%
	Queues End of Hour (Veh)	7,551	19,905	13,630	164%	80%
	Average Speed (kph)	49	40	44	-18%	-9%
PM Peak	Vehicle Time (Veh-hours)	91,305	143,223	119,697	57%	31%
	Vehicle Delay (Veh-hours)	32,522	71,503	50,807	120%	56%
	Queues End of Hour (Veh)	11,673	32,352	20,136	177%	72%
	Average Speed (kph)	46	36	41	-23%	-10%

Table 3.8: Network Statistics in Without Scheme Case, 2041, Policy Area

		Base	Reference	Core	Base-Ref	Base-Core
AM Peak	Vehicle Time (Veh-hours)	85,420	174,137	132,871	104%	56%
	Vehicle Delay (Veh-hours)	29,854	99,564	61,993	233%	108%
	Queues End of Hour (Veh)	11,061	52,846	28,428	378%	157%
	Speed (kph)	46	30	38	-35%	-18%
Interpeak	Vehicle Time (Veh-hours)	66,020	140,486	111,676	113%	69%
	Vehicle Delay (Veh-hours)	19,996	73,993	48,181	270%	141%
	Queues End of Hour (Veh)	7,551	37,430	21,027	396%	178%
	Speed (kph)	49	33	40	-32%	-18%
PM Peak	Vehicle Time (Veh-hours)	91,305	183,395	139,255	101%	53%
	Vehicle Delay (Veh-hours)	32,522	105,149	65,598	223%	102%
	Queues End of Hour (Veh)	11,673	53,361	28,578	357%	145%
	Speed (kph)	46	30	38	-35%	-18%

3.5 Forecast Crossing Flows and Journey Times

3.5.1 Vehicle flows on the Dartford-Thurrock Crossing and the main competing route, the Blackwall Tunnel, in the absence of new crossing capacity, are shown in Table 3.9.

3.5.2 As with the earlier statistics, flows in the future years are reported with only changes in land-use (Reference scenario) and with the effect of changes in transport cost added (Core scenario). The growth reported is the overall increase from base year to Core.

3.5.3 Forecast growth on the Dartford-Thurrock Crossing northbound in the peak hours is very low. This is because the safety considerations for traffic accessing the tunnels is assumed to constrain capacity following the introduction of the free-flow scheme. Southbound the growth is considerably larger, in part, reflecting the increase in capacity provided by the free-flow scheme in this direction, although some growth would have been likely even in the absence of the free-flow scheme, as the southbound route is not currently operating at capacity.

Table 3.9: Forecast Hourly Vehicle Flows on Thames Crossings

	2009	2025			2041		
	Base	Reference	Core	Growth	Reference	Core	Growth
AM Peak (8am-9am)							
Blackwell Tunnel (Northbound)	3,034	3,334	3,305	9%	3,297	3,240	7%
Blackwell Tunnel (Southbound)	3,394	3,395	3,349	-1%	3,253	3,270	-4%
Dartford-Thurrock Crossing (Northbound)	4,855	5,099	5,053	4%	5,051	4,909	1%
Dartford-Thurrock Crossing (Southbound)	4,112	5,167	5,097	24%	5,736	5,589	36%
Screenline (Northbound)	**7,970**	**8,433**	**8,359**	**5%**	**8,348**	**8,149**	**2%**
Screenline (Southbound)	**7,631**	**8,562**	**8,446**	**11%**	**8,989**	**8,859**	**16%**
Inter Peak (Average 10am-4pm)							
Blackwell Tunnel (Northbound)	2,772	3,229	3,173	14%	3,215	3,110	12%
Blackwell Tunnel (Southbound)	2,662	3,165	2,961	11%	3,091	2,910	9%
Dartford-Thurrock Crossing (Northbound)	4,193	4,942	4,897	17%	4,890	4,700	12%
Dartford-Thurrock Crossing (Southbound)	4,353	5,801	5,634	29%	6,377	5,687	31%
Screenline (Northbound)	**7,026**	**8,172**	**8,070**	**15%**	**8,105**	**7,810**	**11%**
Screenline (Southbound)	**7,063**	**8,966**	**8,595**	**22%**	**9,468**	**8,597**	**22%**
PM Peak (5pm to 6pm)							
Blackwell Tunnel (Northbound)	3,397	3,424	3,385	0%	3,406	3,367	-1%
Blackwell Tunnel (Southbound)	3,012	3,161	2,978	-1%	3,049	2,932	-3%
Dartford-Thurrock Crossing (Northbound)	5,050	5,343	5,291	5%	5,311	5,160	2%
Dartford-Thurrock Crossing (Southbound)	5,458	5,958	5,818	7%	6,263	5,907	8%
Screenline (Northbound)	**8,592**	**8,767**	**8,676**	**1%**	**8,717**	**8,526**	**-1%**
Screenline (Southbound)	**8,536**	**9,119**	**8,796**	**3%**	**9,311**	**8,839**	**4%**

3.5.4 Journey times along a route over the Dartford-Thurrock Crossing (shown on Figure 3.5), are presented in Table 3.10. Journey times are forecast to increase over time, especially northbound; significantly less so southbound. The sections of significant increase are the crossing itself (Junction 1a to Junction 31), and the just south of Junction 1a, from Junction 2 to Junction 1a, where queues are forecast to form approaching the northbound crossing.

Figure 3.5: Journey Time Route over the Dartford-Thurrock Crossing

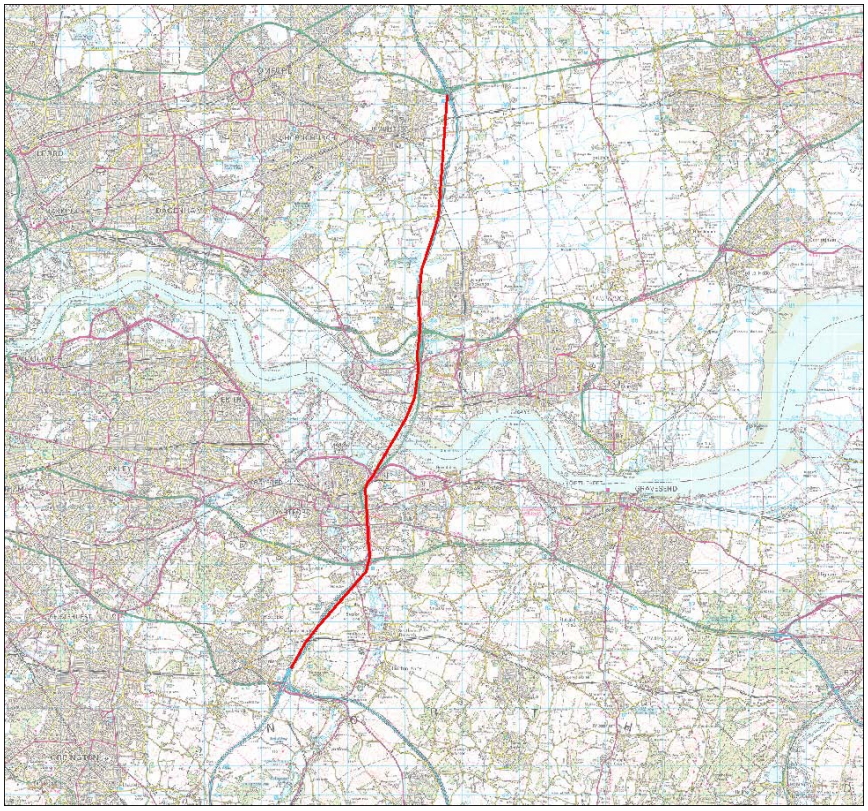


Table 3.10: Forecast Journey Times Across Dartford-Thurrock Crossing, Minutes

		AM Peak Hour			Avg. Interpeak Hour			PM Peak Hour		
		2009	2025	2041	2009	2025	2041	2009	2025	2041
Dartford-Thurrock Crossing - NB	M25 Jn3 to M25 Jn2	02:27	02:36	02:40	02:19	02:33	02:42	02:27	02:42	02:43
	M25 Jn2 to M25 Jn1a	02:26	02:53	06:36	02:23	02:48	04:52	02:25	03:12	05:04
	M25 Jn1a to M25 Jn31	05:47	08:40	08:42	04:52	07:06	08:40	05:39	07:44	08:41
	M25 Jn31 to M25 Jn30	00:30	00:32	00:32	00:30	00:31	00:32	00:30	00:31	00:32
	M25 Jn30 to M25 Jn29	05:36	05:43	05:53	05:35	05:35	05:47	05:50	05:29	05:40
	Total	***16:46***	***20:24***	***24:23***	***15:38***	***18:34***	***22:34***	***16:52***	***19:39***	***22:40***
Dartford-Thurrock Crossing - SB	M25 Jn29 to M25 Jn30	04:54	04:46	04:57	04:53	05:03	05:19	04:49	05:11	05:23
	M25 Jn30 to M25 Jn31	01:10	01:13	01:14	01:12	01:16	01:18	01:13	01:15	01:17
	M25 Jn31 to M25 Jn1a	03:45	03:35	04:37	04:01	04:00	06:00	05:00	03:43	04:13
	M25 Jn1a to M25 Jn2	01:32	01:37	01:56	01:33	01:47	01:57	01:35	01:39	01:52
	M25 Jn2 to M25 Jn3	03:04	03:24	03:39	02:59	03:16	03:24	03:04	03:11	03:18
	Total	***14:27***	***14:35***	***16:23***	***14:38***	***15:21***	***17:58***	***15:41***	***14:59***	***16:04***

3.6 Summary

3.6.1 Road traffic is forecast to increase over time. This is a consequence of a number of factors, but the main driver is the forecast increases in population, which are expected to be proportionately larger in the South-East than in the country as a whole. Overall population is expected to increase by around 20% from 2009 to 2041, and around 25% in the South-East.

3.6.2 This will drive increases in car trips, which are expected overall to be slightly larger than the population growth, due partly to increases in car ownership, and partly to falls in the perceived monetary cost of highway travel (driven by assumed improvements in fuel efficiency).

3.6.3 This in-turn will increase traffic flows. Traffic flow increases are expected to be larger still, since the main effect of reductions in the fuel cost of journeys is likely to be for travellers to make longer trips. Overall traffic flows are forecast to increase from 2009 to 2041 by around 30%, including the effect of road schemes considered likely to be implemented by 2041.

3.6.4 The forecast traffic flow increases will increase congestion in the local modelled area significantly between 2009 and 2041.

3.6.5 This increase in highway travel will have an effect upon the existing Dartford-Thurrock Crossing. Flows between 2009 and 2041 are forecast to increase 10-20% southbound, and 2-10% northbound; the latter heavily constrained due to lack of capacity. The closest significant competing route, the Blackwall Tunnel, is also operating close to capacity and is heavily constrained in terms of traffic growth.

3.6.6 These flows, and other increases in traffic between 2009 and 2041, are forecast to increase journey times over the crossing by 1-3 minutes southbound, and by 6-8 minutes northbound.

4 Core Scenario With New Crossing

4.1 Introduction

4.1.1 The three location options for a new crossing are:

- Option A, which comprises the provision of an additional crossing adjacent to the existing Dartford Crossing.
- Option B, which comprises a new crossing between Tilbury Docks and the Swanscombe peninsula, linking the A1089 to the A2 south of Northfleet.
- Option C, which comprises a new crossing east of Tilbury and Gravesend, with a route linking the M25, A13 and A2/M2. A variant extends this route along the A229 providing better access between the M2/M20.

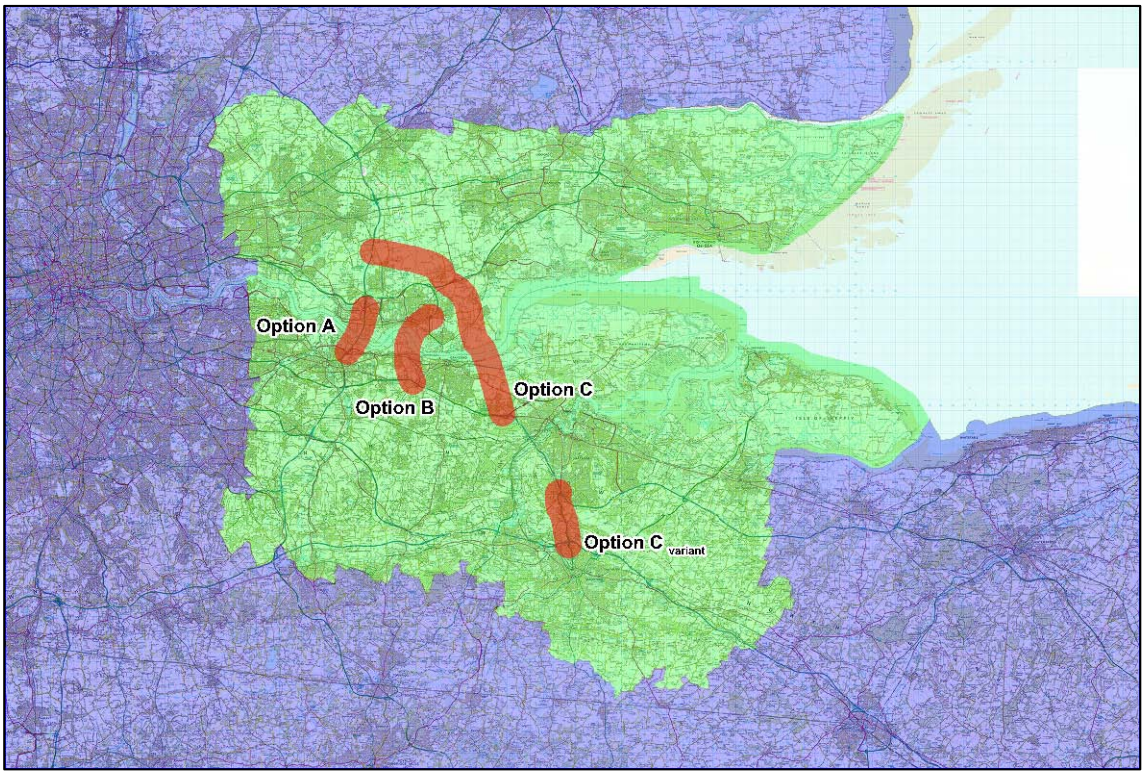
4.1.2 The location options are illustrated in Figure 4.1.

4.1.3 Eight forecasts representing the crossing options are described in this chapter; Options A, B, C and Option C plus a variant ($C_{variant}$); for each of the years 2025 and 2041. Apart from the inclusion of a new crossing (plus an additional improved stretch of the A229 in the case of $C_{variant}$) these "with new crossing" scenarios adopt identical input assumptions to the "without new crossing" scenarios discussed in the previous chapter.

4.1.4 This chapter discusses the forecast effect of the options, as obtained from the transport model, by comparing with the "without new crossing" scenarios, as follows:

- the effect of the new crossings on total trips and traffic flows in the Policy Area is discussed in Section 4.2;
- the effect of the traffic changes upon the highway network performance is discussed in Section 4.3.
- the effect on the crossing routes themselves, in terms of flows and total journey times, is discussed in Section 4.4; and
- flow plots, showing the forecast changes in traffic flows as a result of the new crossings, are shown and discussed in Section 4.5.

Figure 4.1: Proposed Location Options



4.2 Trips and Vehicle Kilometres

4.2.1 The total forecast trips from the transport model in the "Without New Crossing" scenario, and the change over this for each of the options, are illustrated in Table 4.1 and Table 4.2.

4.2.2 The demand model, $LTC_{DM,}$ forecasts changes in travel patterns in response to changes in costs and travel times. Consequently, adding new network or relieving capacity on existing network would usually be expected to increase traffic in total, since for many people journey times will improve.

4.2.3 However, there will also be disbenefits for *some* journeys. For example, travellers going from Grays to Epping will not benefit from a new crossing, but are likely to experience increased congestion due to the extra travellers generated by the new crossing. Consequently, some decreases in trips would also be expected.

Table 4.1: 2025 Forecast Change in Person Weekday Trips, With and Without New Crossings

	2025 Forecasts				
	No New Crossing	**Option A**	**Option B**	**Option C**	**Option $C_{variant}$**
South Essex	1,658,019	265	2,324	2,495	2,505
North Kent	2,140,928	-218	-555	1	999
North East London	4,002,664	16	731	919	926
South East London	2,270,347	-26	-55	214	480
North West London	8,587,782	29	95	279	263
South West London	4,042,057	17	37	182	244
North Essex	1,311,300	-94	-18	-1	1
South Kent	530,074	-12	-65	-99	177
Rest of Great Britain: North	86,889,146	811	-327	-1,040	-917
Rest of Great Britain: South	23,712,629	373	93	669	772
All	**135,144,947**	**1,162**	**2,260**	**3,619**	**5,450**

Table 4.2: 2041 Forecast Change in Person Weekday Trips, With and Without New Crossings

	2041 Forecasts				
	No New Crossing	**Option A**	**Option B**	**Option C**	**Option $C_{variant}$**
South Essex	1,925,955	399	1,972	1,605	1,746
North Kent	2,365,928	-856	-1,039	214	1,395
North East London	4,582,128	-344	545	730	745
South East London	2,510,199	-66	-108	247	405
North West London	9,579,322	-27	49	155	187
South West London	4,472,796	103	38	173	233
North Essex	1,456,594	-206	-53	-96	-95
South Kent	565,143	-56	-105	-118	87
Rest of Great Britain: North	95,037,619	-597	-498	1,520	760
Rest of Great Britain: South	25,949,075	-49	-168	624	718
All	**148,444,757**	**-1,699**	**634**	**5,053**	**6,181**

4.2.4 Options B and C are forecast to generate notably more trips than Option A; this is plausible since they add new routes to the network in addition to adding capacity. Option $C_{variant}$ is forecast to add more trips than Option C alone. South Essex and North Kent are forecast to experience significantly larger changes in trips relative to their size than other areas, as expected.

4.2.5 However, some of the forecast responses are less intuitive. Option A is forecast to suppress total trips in 2041. This has been carefully investigated. The addition of a new crossing is forecast to generate extra trips travelling from one side of the Thames to the other, as expected. These trips tend to be long-distance, in common with most trips using the Dartford-Thurrock Crossing today; on average, additional induced trips are around 15 km long. They thus generate extra congestion along much of their route, which in-turn suppresses shorter, more local trips (averaging around 4km).

4.2.6 Consequently, although total *trips* are forecast to decrease with the addition of Option A, as can be seen in Table 4.4, total *traffic* actually increases.

4.2.7 Both Options A and B are forecast to result in fewer car trips produced in North Kent; this is for similar reasons.

4.2.8 Forecast changes in traffic are shown in Table 4.3 and Table 4.4. All options are forecast to increase total traffic, as would be expected, with Option C resulting in larger increases than Option B, which results in larger increases than Option A.

4.2.9 Decreases in traffic are forecast in South London, but these are very small. They are likely related to small falls in traffic routeing from the M25 to the Blackwall Tunnel along the south bank of the river, as can be observed in the plots in Section 4.5.

Table 4.3: 2025 Forecast Vehicle Traffic (Vehicle km), With and Without New Crossings

		2025 Forecasts				
		No New Crossing	**Option A**	**Option B**	**Option C**	**Option $C_{variant}$**
AM Peak	South Essex	974,850	1.7%	2.3%	3.1%	3.2%
	North Kent	1,819,385	0.5%	1.9%	1.3%	1.5%
	North East London	1,201,873	0.4%	0.3%	1.0%	1.1%
	South East London	672,150	-0.1%	-0.1%	-0.2%	0.0%
	North West London	2,522,267	0.0%	0.0%	0.0%	0.0%
	South West London	1,007,713	0.0%	0.0%	0.0%	0.0%
	North Essex	1,739,517	0.4%	0.4%	0.7%	0.7%
	South Kent	592,767	0.1%	0.1%	0.0%	3.6%
Inter-peak	South Essex	873,779	1.7%	2.1%	3.7%	3.9%
	North Kent	1,469,059	0.6%	2.7%	1.6%	1.8%
	North East London	1,104,359	0.4%	0.3%	1.1%	1.1%
	South East London	614,003	-0.1%	0.0%	-0.1%	-0.1%
	North West London	2,212,409	0.0%	0.0%	0.0%	0.0%
	South West London	893,402	0.0%	0.0%	0.0%	0.0%
	North Essex	1,410,266	0.3%	0.3%	0.6%	0.7%
	South Kent	443,771	0.1%	0.6%	0.8%	3.1%
PM Peak	South Essex	1,038,946	1.4%	2.3%	2.5%	2.7%
	North Kent	1,910,778	0.3%	2.1%	1.9%	2.0%
	North East London	1,249,982	0.5%	0.5%	1.2%	1.2%
	South East London	730,651	-0.1%	0.0%	0.0%	-0.1%
	North West London	2,542,504	0.0%	0.0%	0.0%	0.0%
	South West London	1,022,953	0.0%	0.0%	0.0%	0.0%
	North Essex	1,788,471	0.3%	0.3%	0.6%	0.7%
	South Kent	597,742	0.0%	0.2%	0.3%	4.8%
All Day	**All Traffic**	**118,363,931**	**0.3%**	**0.7%**	**0.8%**	**1.1%**

Table 4.4: 2041 Forecast Vehicle Traffic (Vehicle km), With and Without New Crossings

		2041 Forecasts				
		No New Crossing	**Option A**	**Option B**	**Option C**	**Option $C_{variant}$**
AM Peak	South Essex	1,046,033	2.2%	2.2%	3.7%	3.8%
	North Kent	1,956,624	0.8%	2.3%	1.7%	2.0%
	North East London	1,278,308	0.7%	0.4%	1.4%	1.4%
	South East London	719,637	-0.1%	0.0%	0.0%	0.1%
	North West London	2,657,579	0.0%	0.0%	0.0%	0.0%
	South West London	1,050,378	0.0%	0.0%	0.0%	0.0%
	North Essex	1,878,457	0.4%	0.4%	0.6%	0.6%
	South Kent	640,009	0.0%	0.1%	-0.1%	3.3%
Inter-peak	South Essex	972,886	2.4%	2.6%	4.0%	4.2%
	North Kent	1,636,801	1.1%	3.2%	2.2%	2.6%
	North East London	1,195,371	0.7%	0.5%	1.4%	1.5%
	South East London	669,362	-0.1%	-0.1%	-0.2%	-0.1%
	North West London	2,409,176	0.0%	0.0%	0.0%	0.0%
	South West London	955,366	0.0%	0.0%	0.0%	0.0%
	North Essex	1,591,504	0.3%	0.3%	0.7%	0.7%
	South Kent	501,749	-0.1%	0.4%	0.1%	3.6%
PM Peak	South Essex	1,103,448	1.7%	1.8%	2.7%	2.8%
	North Kent	2,036,986	0.4%	2.2%	2.5%	2.6%
	North East London	1,325,792	0.6%	0.4%	1.2%	1.3%
	South East London	770,409	-0.2%	0.0%	0.1%	0.1%
	North West London	2,694,405	0.0%	0.0%	0.0%	0.0%
	South West London	1,064,313	0.0%	0.0%	0.0%	0.0%
	North Essex	1,929,898	0.3%	0.3%	0.6%	0.7%
	South Kent	643,124	0.0%	0.2%	0.4%	4.6%
All Day	**All Traffic**	**127,979,498**	**0.5%**	**0.8%**	**1.0%**	**1.2%**

4.3 Transport Network Performance

4.3.1 The general performance of the transport network, that is, the level of congestion experienced, is shown for the "Policy Area" in Table 4.5 and Table 4.6. This comprises North Kent, South Essex, North East London and South East London as shown in Figure 1.1.

4.3.2 All three options and the variant are forecast to increase, compared with the future year no new crossing scenario, average network speed in all time periods, and generally to reduce total vehicle queuing as well, though there are some exceptions in the PM peak.

4.3.3 Total vehicle time is forecast to increase as the extra induced traffic adds more total vehicle time than the congestion relief removes. Generally vehicle delay, however, is reduced. Option $C_{variant}$ increases vehicle time less than Option C alone, despite producing more traffic.

Table 4.5: 2025 Forecast Network Performance, With and Without New Crossings, Policy Area

		No New Crossing	Option A	Option B	Option C	Option $C_{variant}$
AM Peak	Vehicle Time (Veh-hours)	113,120	0.1%	0.5%	0.5%	0.4%
	Vehicle Delay (Veh-hours)	47,306	-0.4%	-0.1%	-0.3%	-0.7%
	Queues End of Hour (Veh)	19,765	-1.2%	-1.2%	-0.7%	-1.2%
	Average Speed (kph)	41.3	0.6%	0.7%	0.9%	1.1%
Interpeak	Vehicle Time (Veh-hours)	91,627	0.1%	0.6%	0.5%	0.5%
	Vehicle Delay (Veh-hours)	34,235	-0.5%	-0.3%	-0.9%	-0.9%
	Queues End of Hour (Veh)	13,630	-1.4%	-1.4%	-1.3%	-1.6%
	Average Speed (kph)	44.3	0.6%	0.8%	1.1%	1.3%
PM Peak	Vehicle Time (Veh-hours)	119,697	0.2%	0.8%	0.8%	0.7%
	Vehicle Delay (Veh-hours)	50,807	-0.1%	0.2%	0.1%	-0.2%
	Queues End of Hour (Veh)	20,136	-0.5%	-0.6%	0.3%	-0.2%
	Average Speed (kph)	41.2	0.3%	0.7%	0.8%	1.0%

Table 4.6: 2041 Forecast Network Performance, With and Without New Crossings, Policy Area

		No New Crossing	Option A	Option B	Option C	Option $C_{variant}$
AM Peak	Vehicle Time (Veh-hours)	132,871	0.3%	0.6%	0.7%	0.6%
	Vehicle Delay (Veh-hours)	61,993	-0.1%	0.0%	-0.1%	-0.5%
	Queues End of Hour (Veh)	28,428	-1.9%	-1.3%	-1.4%	-2.0%
	Average Speed (kph)	37.6	0.6%	0.8%	1.1%	1.4%
Interpeak	Vehicle Time (Veh-hours)	111,676	0.4%	0.9%	0.9%	0.8%
	Vehicle Delay (Veh-hours)	48,181	-0.2%	0.1%	-0.1%	-0.4%
	Queues End of Hour (Veh)	21,027	-2.6%	-2.0%	-1.8%	-2.4%
	Average Speed (kph)	40.1	0.7%	0.9%	1.2%	1.4%
PM Peak	Vehicle Time (Veh-hours)	139,255	0.2%	0.8%	0.8%	0.8%
	Vehicle Delay (Veh-hours)	65,598	0.0%	0.5%	0.2%	0.0%
	Queues End of Hour (Veh)	28,578	-0.4%	0.2%	0.1%	-0.2%
	Average Speed (kph)	37.6	0.4%	0.5%	1.0%	1.2%

4.4 Forecast Crossing Flows and Journey Times

4.4.1 Forecast crossing flows for the options and the no new crossing scenario are shown in Table 4.7 and Table 4.8. Average hourly traffic over the 12 hour modelled period is shown, as the general pattern is the same across all modelled time periods. More detailed tables of crossing flows, including flows by time period, can be found in Appendix C.

4.4.2 All options are forecast to increase traffic over the Thames, and Options B and C are forecast to reduce traffic on the existing Dartford-Thurrock Crossing. Traffic in the Blackwall Tunnel is not forecast to change noticeably as it is currently operating close to capacity.

4.4.3 More northbound than southbound traffic is induced in the option forecasts; this is especially true for Option A. This reflects the capacity constraint northbound on the existing Dartford-Thurrock Crossing.

4.4.4 Option $C_{variant}$ generates more traffic in total than Option C, and is also forecast to divert slightly more traffic from the existing crossing; however, both of these effects are slight. As the plots in Section 4.5 show, the main effects of the A229 improvement (the addition of which constitutes the Option $C_{variant}$) are relatively localised.

Table 4.7: 2025 Crossing Vehicle Flows, With and Without New Crossings, Average Hour, 0700-1900

		Vehicle Flows					Change vs. No New Crossing			
		NoNC	OptA	OptB	OptC	$OptC_{var}$	OptA	OptB	OptC	$OptC_{var}$
Northbound Thames Screenline	Blackwall Tunnel	3,161	3,161	3,159	3,162	3,162	-1	-3	0	0
	Dartford-Thurrock Crossing	4,883	5,942	4,710	4,484	4,482	1,059	-173	-399	-401
	Option B/C	0	0	1,770	2,125	2,197	0	1,770	2,125	2,197
	Total	**8,044**	**9,102**	**9,639**	**9,771**	**9,840**	**1,058**	**1,595**	**1,726**	**1,796**
Southbound Thames Screenline	Blackwall Tunnel	2,972	2,970	2,945	2,945	2,949	-2	-27	-27	-23
	Dartford-Thurrock Crossing	5,383	5,649	4,791	4,535	4,530	266	-592	-849	-853
	Option B	0	0	1,543	1,828	1,908	0	1,543	1,828	1,908
	Total	**8,355**	**8,619**	**9,279**	**9,307**	**9,387**	**264**	**924**	**952**	**1,032**

Table 4.8: 2041 Crossing Vehicle Flows, With and Without New Crossings, Average Hour, 0700-1900

		Vehicle Flows					Change vs. No New Crossing			
		NoNC	OptA	OptB	OptC	$OptC_{var}$	OptA	OptB	OptC	$OptC_{var}$
Northbound Thames Screenline	Blackwall Tunnel	3,112	3,110	3,108	3,110	3,111	-1	-4	-2	-1
	Dartford-Thurrock Crossing	4,725	6,494	4,728	4,825	4,842	1,769	3	100	117
	Option B/C	0	0	2,129	2,245	2,275	0	2,129	2,245	2,275
	Total	**7,836**	**9,604**	**9,965**	**10,180**	**10,227**	**1,768**	**2,128**	**2,343**	**2,391**
Southbound Thames Screenline	Blackwall Tunnel	2,930	2,922	2,895	2,890	2,896	-8	-35	-39	-34
	Dartford-Thurrock Crossing	5,626	6,163	5,227	5,039	5,032	537	-399	-587	-594
	Option B	0	0	1,679	1,900	1,995	0	1,679	1,900	1,995
	Total	**8,556**	**9,085**	**9,801**	**9,830**	**9,923**	**529**	**1,245**	**1,274**	**1,367**

4.4.5 Queued vehicles, either immediately prior to the crossings or further upstream, at the end of the PM peak hour (which has the longest modelled queues), are shown in Table 4.9. All options reduce queues for northbound traffic, and produce smaller increases southbound.

Table 4.9: 2041 Suppressed Traffic (Queuing), With and Without New Crossings, PM Peak, 1700-1800

		Queued Vehicles					Change vs. No New Crossing			
		NoNC	OptA	OptB	OptC	$OptC_{var}$	OptA	OptB	OptC	$OptC_{var}$
Northbound Thames Screenline	Blackwall Tunnel	1,193	1,155	1,142	1,148	1,146	-38	-51	-45	-47
	Dartford-Thurrock Crossing	814	514	422	406	404	-300	-392	-408	-410
	Option B/C	0	0	171	146	127	0	171	146	127
	Total	**2,007**	**1,669**	**1,735**	**1,699**	**1,677**	**-338**	**-272**	**-308**	**-330**
Southbound Thames Screenline	Blackwall Tunnel	519	517	508	511	512	-2	-11	-9	-7
	Dartford-Thurrock Crossing	554	568	415	430	424	13	-140	-125	-131
	Option B	0	0	253	316	339	0	253	316	339
	Total	**1,073**	**1,085**	**1,176**	**1,256**	**1,275**	**11**	**102**	**183**	**201**

4.4.6 Journey times over the existing and new crossings have also been extracted from the model, as shown in Figure 4.2. These are quoted in Table 4.10 and Table 4.11. Four journeys have been examined in more detail. Journey 1, from M25 junction 29 to M25 Junction 3, is used to assess Option A. Journey 2, from M25 junction 3 to the A13 junction with the A1014, is used to assess Option B. Journey 3, from M25 Junction 29 to M20 Junction 7, is used to assess Option C. The journey in each scenario allows the choice of route between the

existing Dartford-Thurrock Crossing and the new crossing to be a reasonably balanced one; for example, obviously travellers going entirely round the eastern edge of the M25 are unlikely to benefit from using Option B or Option C, since the routes are considerably longer.

4.4.7 Journey 4 is considered in the Option C and Option $C_{variant}$ tests; it has the same start and end point as Journey 3, but routes via the M20 onto the M25. This demonstrates the effect of the Option C tests on congestion on this parallel route.

4.4.8 All Options are forecast to improve journey times crossing the river, as expected. Northbound savings are considerably larger than southbound savings for all three options; this is due to the lower capacity limit assumed northbound.

4.4.9 Options A and B are forecast to provide northbound time savings to similar degrees, with each saving 3-5 minutes in 2025. Option B delivers similar savings on journey 2 whether the new crossing or the existing Dartford-Thurrock Crossing is used. Option C provides a larger benefit (for trips using Journey 3) of 7-8 minutes, with the $C_{variant}$ providing an additional 3-8 minutes.

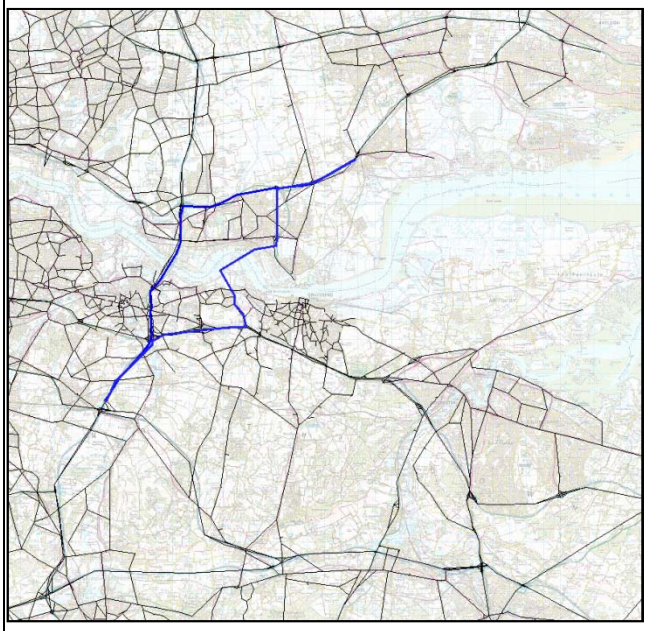
4.4.10 Southbound, Option B is a little better than Option A, but neither Option is forecast to provide savings of more than a minute in 2025, rising to 1-3 minutes in 2041. Option B is actually slower southbound than the existing crossing (in both the with and without new crossing scenarios) by about a minute in 2025, but the new crossing does provide positive saving for the Dartford-Thurrock Crossing, and will of course be quicker for some local traffic.

4.4.11 Modest savings are observed on Journey 4 due to Option C.

Figure 4.2: Journey Time Routes

Journey 1 (Across Dartford)

Journey 2 (Two routes, One Via Option B)



Journey 3 (Two Routes, One Via Option C)

Journey 4 (M20, Alternative to Option $C_{variant}$)

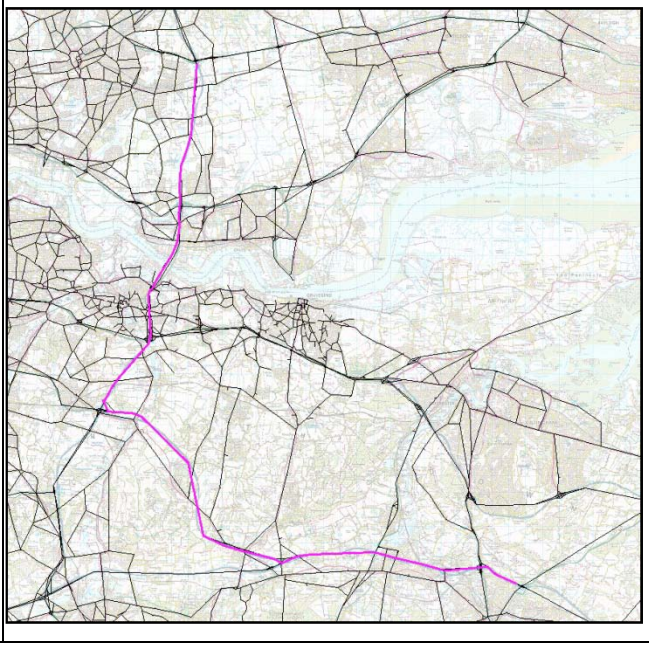


Table 4.10: Changes in Journey Time, With and Without New Crossings, Northbound, minutes

		2025			2041		
Journey and Route	**Scenario**	**AM**	**IP**	**PM**	**AM**	**IP**	**PM**
Journey1 (Dartford)	No New Crossing	20.4	18.6	19.6	24.4	22.6	22.7
Journey1 (Dartford)	Option A	-4.8	-3.5	-3.9	-7.0	-6.0	-5.6
Journey2 (Dartford)	No New Crossing	28.1	24.6	27.0	34.8	29.7	29.8
Journey2 (Dartford)	Option B	-4.5	-3.0	-3.2	-4.9	-4.3	-3.2
Journey2 (Option B)	Option B	-4.8	-3.5	-3.5	-7.4	-6.1	-4.9
Journey3 (Dartford)	No New Crossing	43.5	38.9	43.4	48.4	43.3	49.1
Journey3 (Dartford)	Option C	-3.4	-3.1	-1.9	-5.1	-4.2	-3.5
Journey3 (Option C	Option C	-8.3	-7.6	-8.2	-9.5	-8.1	-11.1
Journey3 (Dartford)	Option $C_{variant}$	-7.3	-4.7	-3.6	-9.7	-7.0	-4.4
Journey3 (Option $C_{variant}$)	Option $C_{variant}$	-12.0	-9.8	-13.3	-13.9	-11.4	-15.9
Journey4 (Option $C_{variant}$)	No New Crossing	41.8	37.6	43.1	46.4	42.2	49.4
Journey4 (Option $C_{variant}$)	Option C	-5.0	-3.2	-1.9	-6.7	-4.2	-4.4
Journey4 (Option $C_{variant}$)	Option $C_{variant}$	-5.6	-3.4	-3.2	-7.7	-5.8	-4.7

Table 4.11: Changes in Journey Time, With and Without New Crossings, Southbound, minutes

		2025			2041		
Journey and Route	**Scenario**	**AM**	**IP**	**PM**	**AM**	**IP**	**PM**
Journey1 (Dartford)	No New Crossing	14.6	15.4	15.0	16.4	18.0	16.1
Journey1 (Dartford)	Option A	-0.2	-0.5	-0.3	-0.7	-1.3	-0.4
Journey2 (Dartford)	No New Crossing	18.8	19.6	25.7	20.9	23.9	28.5
Journey2 (Dartford)	Option B	-0.4	-0.8	-0.4	-1.2	-2.4	-3.5
Journey2 (Option B)	Option B	1.3	0.2	-0.5	-0.3	-2.4	-3.8
Journey3 (Dartford)	No New Crossing	37.8	35.3	38.3	41.1	38.9	40.7
Journey3 (Dartford)	Option C	0.2	-0.4	0.6	-0.5	-1.9	0.3
Journey3 (Option C	Option C	-3.9	-3.9	-3.3	-5.3	-5.8	-3.8
Journey3 (Dartford)	Option $C_{variant}$	-4.5	-3.2	-3.6	-6.4	-5.2	-4.7
Journey3 (Option $C_{variant}$)	Option $C_{variant}$	-8.8	-6.7	-7.6	-11.3	-9.1	-9.0
Journey4 (Option $C_{variant}$)	No New Crossing	34.1	34.4	35.3	36.2	37.5	37.0
Journey4 (Option $C_{variant}$)	Option C	-0.5	-1.2	-1.1	-1.3	-2.8	-1.5
Journey4 (Option $C_{variant}$)	Option $C_{variant}$	-0.7	-1.3	-1.5	-1.8	-2.9	-2.1

4.5 Network Flow Plots

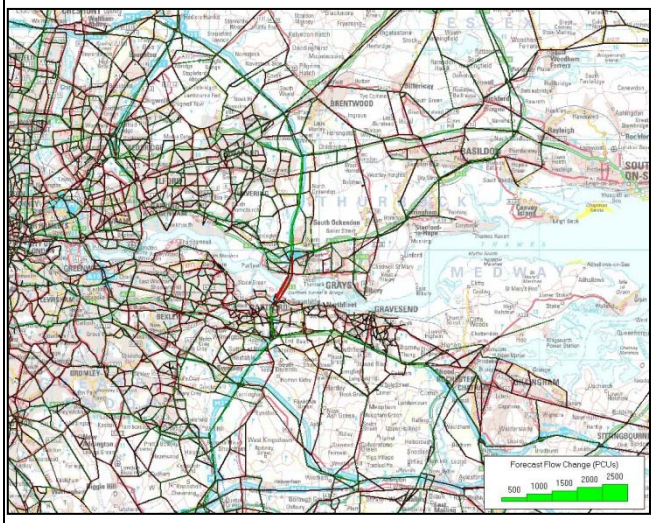
4.5.1 Plots showing the forecast change in vehicle flow between the No New Crossing scenario and each of the three Options A, B and C are shown in Figure 4.3. In addition, the cumulative effect of the Option $C_{variant}$ upon Option C is shown in the bottom right of the figure. Increases in traffic are shown in green; decreases in red.

4.5.2 Increases in traffic flows on the M25, the A2/M2, the M20, and the A13 are forecast in most cases. Some reduction in flows on the A2 inside the M25 is also noticeable; this is due to a small amount of re-routeing from Blackwall Tunnel to the Dartford-Thurrock Crossing. However, it is clear from these plots and from Table 4.7 and Table 4.9 that interaction between the Dartford-Thurrock Crossing and Blackwall Tunnel is quite minimal.

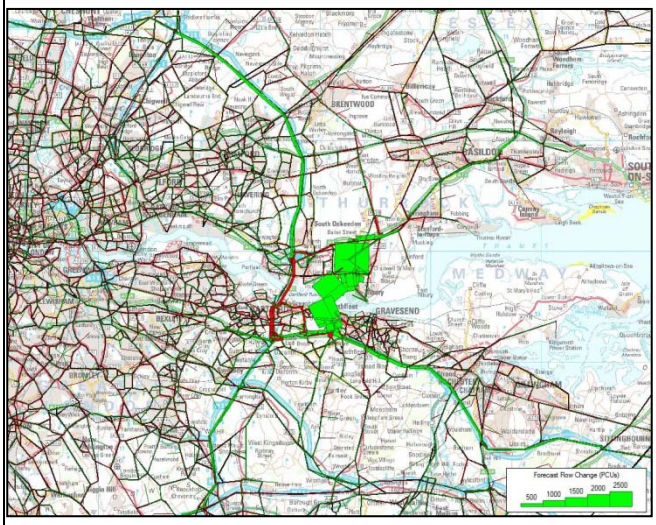
4.5.3 Options B and C are forecast to generate intuitive reductions in flow on the Dartford-Thurrock Crossing and the road links used to access it. Option C also results in notable reductions on the M20, as vehicles re-route to the new crossing.

Figure 4.3: Traffic Flow Changes, With and Without New Crossing, 2041, AM Peak[6]

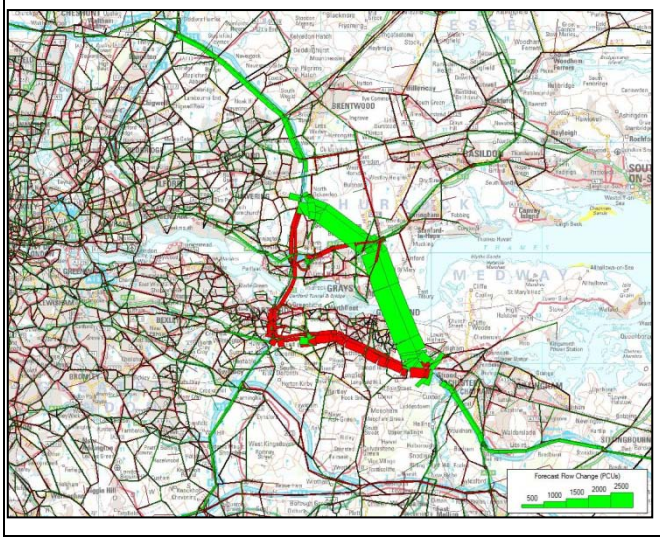
Option A vs. No New Crossing



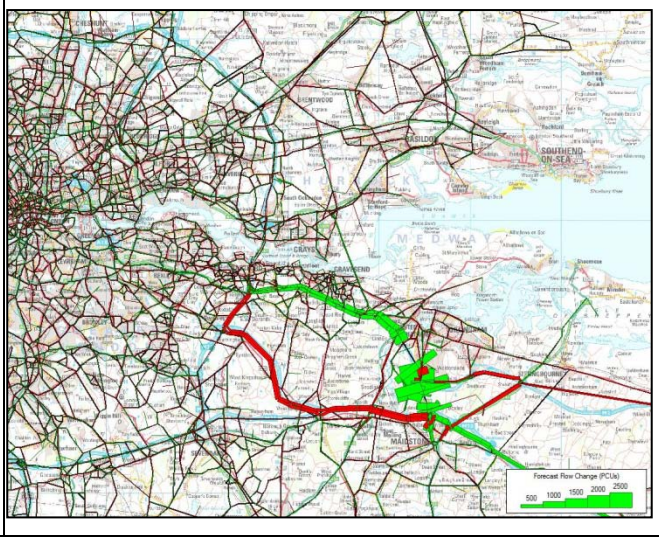
Option B vs. No New Crossing



Option C vs. No New Crossing



Option $C_{variant}$ vs. Option C



4.6 Summary

4.6.1 Four scenarios with options to increase cross-Thames capacity at or east of Dartford have been assessed against the Without New Crossing scenario where no new crossing capacity is provided. Generally Option A has the smallest impact, followed by Option B, Option C, and Option $C_{variant}$ with A229 widening, in that order.

4.6.2 All four scenarios result in more traffic, higher average speeds, more traffic across the river, reduced queues, and shorter journey times across the river, as expected.

4.6.3 All scenarios have a greater impact on northbound travel than southbound, because the Dartford-Thurrock Crossing capacity is assumed to have lower capacity northbound due to safety considerations reflecting the operating constraint of the existing tunnels.

4.6.4 Traffic in South Essex and North Kent is forecast to increase by between 0.5% and 3% in 2025 as a result of these schemes, with Option A generating the least additional traffic and Option $C_{variant}$ the most. Little impact on South Kent is expected, except in the case of the Option $C_{variant}$, in which a traffic increase of 3-4% increase is forecast.

4.6.5 The schemes are forecast to increase cross-Thames traffic by 1000-2000 vehicles per hour. The new crossings are not forecast to carry more than 2500 vehicles per hour in any of the core scenarios to 2041 (however, some of the assumptions feeding into this are further investigated in Chapter 5).

[6] Passenger Car Units (PCUs) from SATURN; cars and vans are counted as 1; Heavy Goods Vehicles as 2.

4.6.6 Diversion of traffic to Options B and C is forecast to relieve some of the congestion at the existing crossing. Despite being further east, Option C is forecast to have a greater impact than Option B.

4.6.7 The schemes reduce journey times over the crossing by 3-10 minutes, depending on option, route, time period and year. Journey times are reduced noticeably both when using the new crossings (for appropriate journeys), and, for Options B and C, on the existing Dartford-Thurrock Crossing as well. Option $C_{variant}$ saves a further 3-6 minutes for journeys from the east of the M20 onto the M25 northbound.

4.6.8 Traffic flows on the M25, M2/A2 and A13 are expected to increase somewhat due to the new crossings, by up to around 500 vehicles per hour closest to the new crossings. Option $C_{variant}$, while having a strong impact locally, does not significantly increase forecast traffic upon the Option C crossing.

5 Sensitivity Testing

5.1 Introduction

5.1.1 In consultation with the DfT, a set of sensitivity tests has been defined to understand the potential variation in the model forecasts with changes in one or more of the input assumptions:

- model runs for Option A, Option B and Option C in 2025 with an increase in forecast tolls on the crossings compared to the core forecasts;
- model runs for Option A, Option B and Option C in 2041 with an increase in forecast tolls on the crossings compared to the core forecasts;
- a model run based on the "without scheme" assumptions but with the inclusion of the proposed Silvertown Crossing in London in 2041; and
- a "without new crossing" and Option A, B and C tests with both optimistic and pessimistic assumptions about traffic growth levels over time.

5.1.2 The following sections (Sections 5.2, 5.3 and 5.4) detail the results of the sensitivity tests carried out.

5.2 Charge Sensitivity

5.2.1 The first set of sensitivity tests is the Option A, Option B and Option C forecasts with higher future year toll assumptions. These have been run for 2025 and 2041 forecast years with an increase in future year tolls of £2 in 2015 prices for the car cash toll. This is an 80% increase in tolls from £2.50 to £4.50[7] for this vehicle type and payment method, and this percentage increase has been applied to all other vehicle types and payment methods.

5.2.2 As expected, these increases in forecast tolls for the Dartford-Thurrock Crossing and scheme options results in lower forecast flows for the crossings. Table 5.1 shows the forecast flows for the three option tests both with the core scheme assumptions and with these higher tolls.

Table 5.1: Forecast Crossing Flows With Increased Toll Assumptions, 2025, Average Hour, 0700-1900

Ave Hr		Actual Flow			Change from Core		
		OptA	OptB	OptC	OptA	OptB	OptC
Northbound Thames Screenline	Blackwall Tunnel	3,161	3,158	3,158	0%	0%	0%
	Dartford-Thurrock Crossing	5,144	4,203	3,887	-13%	-11%	-13%
	Option B/C	0	1,350	1,844	-	-24%	-13%
	Total	**8,305**	**8,710**	**8,889**	**-9%**	**-10%**	**-9%**
Southbound Thames Screenline	Blackwall Tunnel	3,008	2,988	2,988	1%	1%	1%
	Dartford-Thurrock Crossing	4,708	4,014	3,726	-17%	-16%	-18%
	Option B/C	0	1,185	1,572	-	-23%	-14%
	Total	**7,716**	**8,187**	**8,286**	**-10%**	**-12%**	**-11%**

[7] Tolls have been assumed at £4.50 for the purposes of carrying out a sensitivity test to gauge how demand for a new crossing is affected by toll levels. No decisions about whether a new crossing should be tolled have been made and the Government does not intend to increase the charges that apply at the existing Dartford-Thurrock Crossing beyond the levels already announced.

Table 5.2: Forecast Crossing Flows With Increased Toll Assumptions, 2041, Average Hour 0700-0900

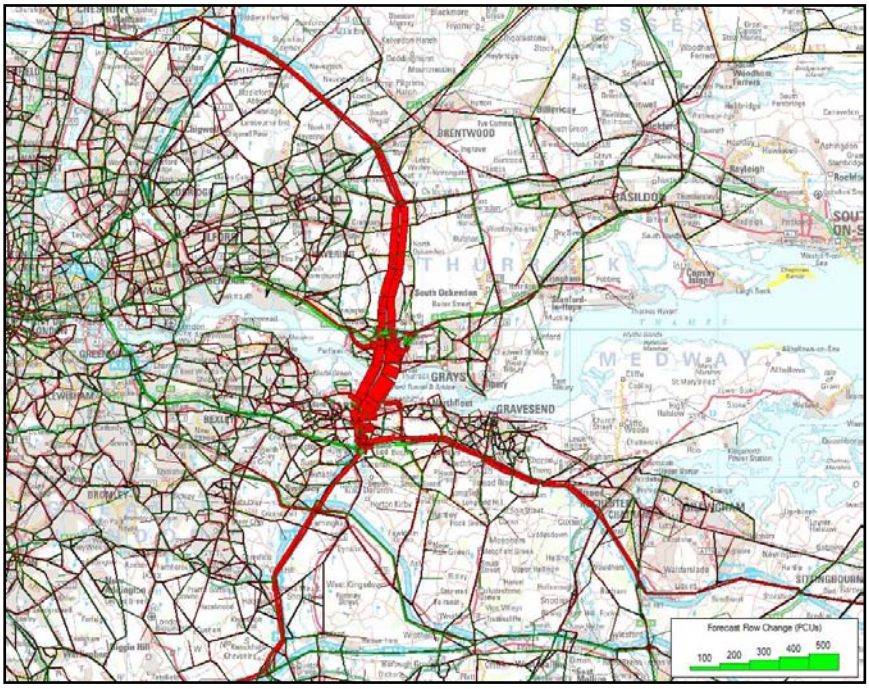
		Actual Flow			Change from Core		
		OptA	OptB	OptC	OptA	OptB	OptC
Northbound Thames Screenline	Blackwall Tunnel	3,108	3,108	3,108	0%	0%	0%
	Dartford-Thurrock Crossing	5,938	4,640	4,441	-9%	-2%	-8%
	Option B/C	0	1,767	2,093	-	-17%	-7%
	Total	**9,046**	**9,515**	**9,642**	**-6%**	**-5%**	**-5%**
Southbound Thames Screenline	Blackwall Tunnel	2,944	2,918	2,918	1%	1%	1%
	Dartford-Thurrock Crossing	5,432	4,679	4,376	-12%	-10%	-13%
	Option B/C	0	1,356	1,717	-	-19%	-10%
	Total	**8,376**	**8,952**	**9,011**	**-8%**	**-9%**	**-8%**

5.2.3 Naturally, increasing tolls reduces patronage. However, the forecast sensitivity is quite small. In 2025, the 80% increase in toll results in falls in traffic on the Dartford-Thurrock Crossing and the new crossings by around 13% northbound and 16% southbound. This is an elasticity of around -0.18, and implies that higher tolls would be likely to generate higher revenues. Reductions are smaller still in 2041, due to rising GDP/capita and thus reduced perception of tolls, which are modelled to increase only in-line with CPI, less than income growth.

5.2.4 Flow on the Blackwall Tunnel, unaffected by the toll increases, increases very slightly overall (some traffic re-routes to avoid the higher toll), but is largely unchanged. Option B exhibits an additional effect, whereby the higher toll moves some traffic from the new crossing back to the Dartford-Thurrock Crossing; this is likely to be due to relative congestion levels. The same effect is not observed for Option C.

5.2.5 Figure 5.1, Figure 5.2 and Figure 5.3 show the forecast change in actual flows (in Passenger Car Units[8]) with the higher toll assumptions for Option A, Option B and Option C respectively. Each of these plots is for the AM peak hour (08:00 – 09:00), with green indicating an increase in forecast actual flow with the higher toll assumptions, and red indicating a reduction in the forecast actual flow.

Figure 5.1: AM Peak Forecast Flow Change with Increased Toll Assumptions – Option A



[8] Cars and vans are counted as 1 PCU; heavy goods vehicles as 2

Figure 5.2: AM Peak Forecast Flow Change with Increased Toll Assumptions – Option B

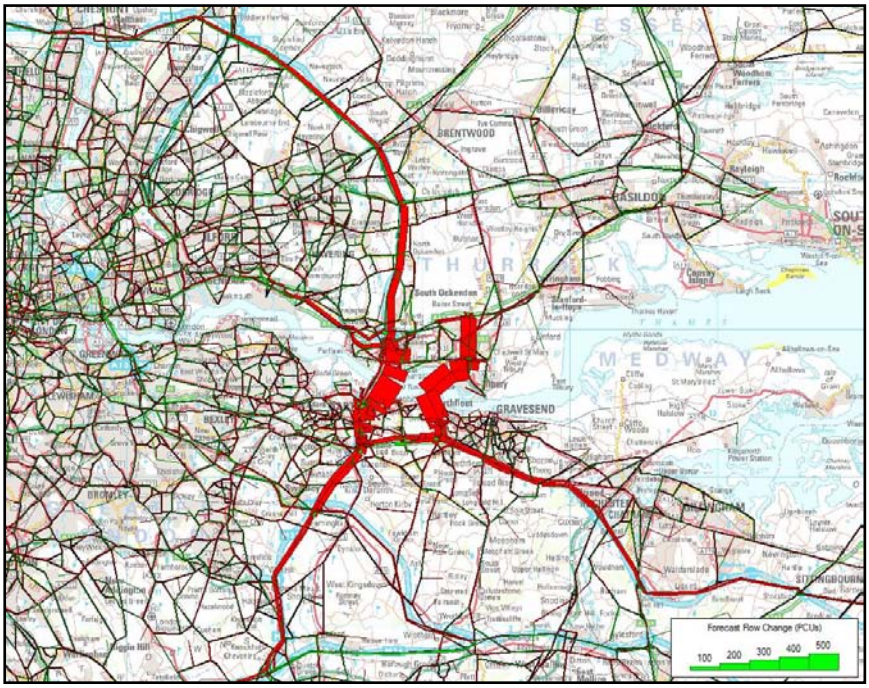
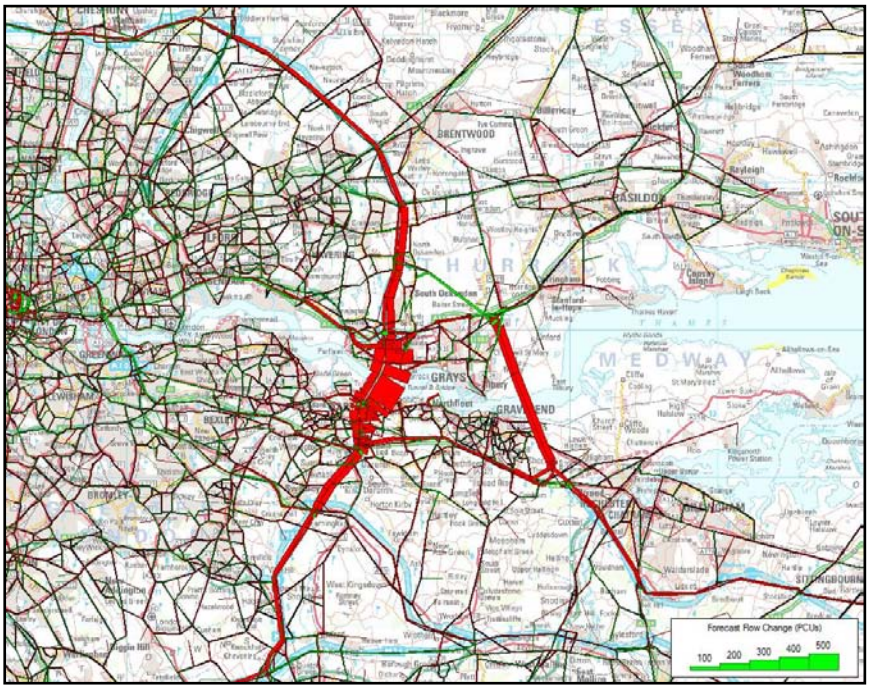


Figure 5.3: AM Peak Forecast Flow Change with Increased Toll Assumptions – Option C



5.2.6 All three of these figures show the forecast reduction in actual flows on the existing Dartford-Thurrock Crossing and the proposed options. As noted previously, this forecast reduction in flow is greater for southbound traffic than for northbound traffic at the existing crossing due to the capacity restraints northbound, particularly in Option B and Option C.

5.3 Silvertown Crossing

5.3.1 This sensitivity tests aims at looking at the impact of the proposed Silvertown Crossing on the Dartford-Thurrock Crossing, to assess if this proposed scheme is likely to impact on the forecast flows for the existing, and any potential new crossings. This sensitivity test has run a 2041 Without New Crossing scenario with the inclusion of the proposed Silvertown Crossing to assess its impact in this scenario.

5.3.2 The proposed Silvertown Crossing links the A1020 Silvertown Way to the existing Blackwall Tunnel on the south side of the river. It has been assumed in this study that this new crossing, *and* the existing Blackwall Tunnel, will become tolled with the inclusion of the new Silvertown Crossing.

5.3.3 For the purposes of this testing, these tolls have been assumed to be the same as those assumed for the Dartford-Thurrock Crossing and the proposed scheme options. This includes the assumptions on a discount scheme, such as the DART-Tag, and that this discount and the uptake of the scheme are the same as that assumed for the Dartford-Thurrock Crossing.

5.3.4 Forecast flows on the Thames crossings are shown below. It should be noted that, due to the introduction of charging on the Blackwall Tunnel, the scheme actually reduces overall Thames crossing traffic despite the addition of new capacity. The main effect of the scheme is to suppress traffic using the Blackwall and/or Silvertown crossings by around 17%; this is quite comparable with the effect of increasing the toll on the Dartford-Thurrock Crossing by 80% as discussed in Section 5.2.

5.3.5 Silvertown Crossing itself is not heavily used in the model, but as the LTCM is a strategic model, it should not be relied upon to allocate travellers between two routes so close to one another; the total Blackwall/Silvertown Crossing traffic is a more robust forecast.

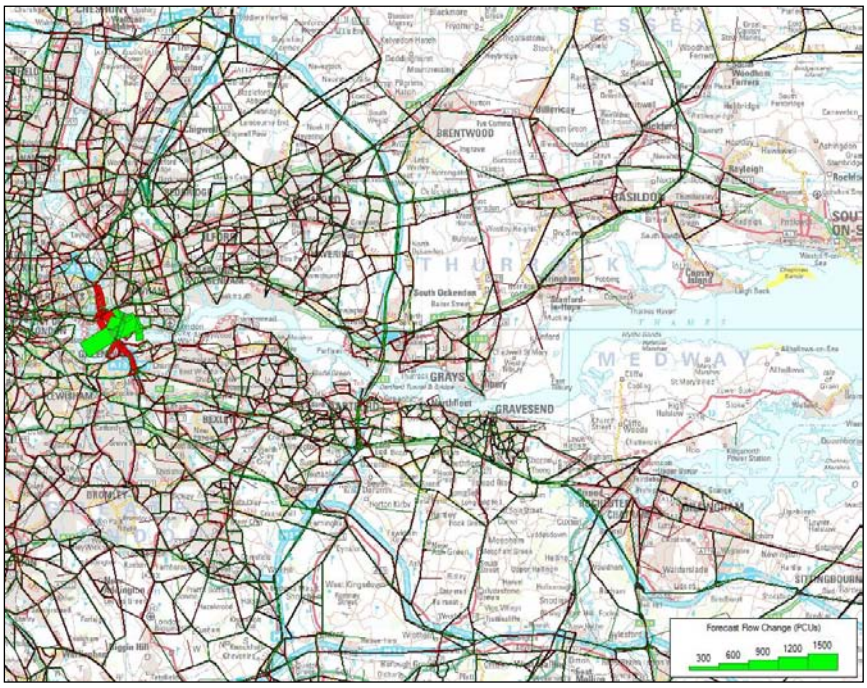
5.3.6 The scheme overall is forecast to essentially have no effect on the traffic using the Dartford-Thurrock Crossing, with 32 fewer vehicles northbound and 5 more southbound.

Table 5.3: Forecast Flows With and Without Silvertown Crossing, Average Hour, 0700-1900

		Core	Silvertown	Change
Northbound Thames Screenline	Blackwall Tunnel	3,240	2,639	-19%
	Silvertown Crossing	0	104	-
	Dartford-Thurrock Crossing	4,913	4,881	-1%
	Total	**8,153**	**7,624**	-6%
Southbound Thames Screenline	Blackwall Tunnel	3,272	2,357	-28%
	Silvertown Crossing	0	291	-
	Dartford-Thurrock Crossing	5,585	5,590	0%
	Total	**8,858**	**8,237**	-7%

5.3.7 Figure 5.4 shows the forecast change in actual flows (in PCUs) in the 2041 Without New Crossing scenario with and without the proposed Silvertown Crossing. This figure shows the forecast actual flow changes in the AM peak hour (08:00 – 09:00), with green indicating where flows are forecast to increase with the inclusion of Silvertown Crossing and red indicating where flows are forecast to reduce.

Figure 5.4: AM Peak Forecast Actual Flow Change with Silvertown Crossing



5.3.8 This figure shows that there is negligible strategic re-routing due to the introduction of Silvertown Crossing. The majority of the forecast flow change is located around the proposed new crossing and the Blackwall Tunnel as traffic moves from the Blackwall Tunnel onto the new Silvertown Crossing. The impact on the Dartford-Thurrock Crossing is, as noted above, extremely small.

5.4 Optimistic and Pessimistic Assumptions

2041 forecasts have been undertaken with both "Pessimistic" and "Optimistic" forecast assumptions about traffic growth, where "optimistic" is used to mean high growth in traffic.

Optimistic Scenario

5.4.1 Three changes to the forecast assumptions have been made for the Optimistic scenario:

- Economic conditions more favourable to traffic growth than the core scenario (such as high GDP growth, high fuel efficiency, low cost of fuel) have been approximated using the guidance in WebTAG 3.15.5, §1.4.13 in which growth in travel is assumed to be higher than the Core by a factor depending on the number of years ahead being forecast. This results in around 14% more travel in the Optimistic Reference scenario compared to the Reference scenario discussed in Chapter 3.
- Increased population and employment in the model area over the Core scenario has been assumed by taking, for each of the 11 districts and Greater London (see Section 2.4), the *higher* estimate of growth from NTEM or the districts, rather than controlling all totals to NTEM as in the Core scenario.
- Additional development of the road network has been assumed, as shown in Table 5.4.

Table 5.4: Additional Optimistic Highway Schemes

Scheme Name	Scheme Description
M25 Junction 30 – Additional Improvements	Additional capacity improves over and above those included in the core scenario assumptions
A13 Orsett Cock to Stanford-le-Hope	Widening of section of A13 to three-lanes
A13 / A126 East-facing slips	Provision of east-facing slips at this A13 junction
A2 Bean and Ebbsfleet Junction Improvements	Additional capacity at these two junctions to address forecast delays and bottlenecks
M2 Junction 3 Improvements	Additional capacity at this junction to address forecast delays
Silvertown Crossing	Addition of new Thames crossing at Silvertown, with the inclusion of tolls on this new crossing and the existing Blackwall Tunnel. (See Section 5.3 for details on toll assumptions.)
Galleon's Reach	Additional Thames crossing to the east of the Woolwich ferry

Pessimistic Scenario

5.4.2 In the Pessimistic scenario, the road network that has been assumed is the same as for the Core. In other respects, the Pessimistic scenario assumptions are equal and opposite to those of the Optimistic scenario:

- Economic conditions less favourable to traffic growth than the core scenario (such as low GDP growth, less fuel efficiency improvement than currently forecast, high cost of fuel) have been approximated using the guidance in WebTAG 3.15.5 §1.4.13 in which growth in travel is assumed to be 2.5% times the square root of the period in years lower than the Core. This results in around 14% less travel in the Reference scenario.
- Reduced population and employment in the model area over the core scenario has been assumed by taking, for each of the 11 districts and London (see Section 2.4), the *lower* estimate of growth from NTEM or the districts, rather than controlling all totals to NTEM as in the core scenario.

Population and Employment

5.4.3 Households and Employment in the three scenarios (Optimistic, Pessimistic and Core) are shown in Table 5.5. All changes in the Optimistic scenario are positive and all changes in the Pessimistic scenario are negative. Because the district data generally overstate jobs compared to NTEM and understated households, the Pessimistic scenario generally constraints households down and leaves employment unchanged, and vice versa for the Optimistic scenario.

Table 5.5: Changes in Households and Employment, Optimistic and Pessimistic Scenarios, 2041

	Pessimistic		Core		Optimistic	
	Households	Jobs	Households	Jobs	Households	Jobs
Basildon	0.00%	0.00%	81,063	104,202	1.32%	0.00%
Brentwood	-1.81%	-2.95%	35,583	48,968	0.00%	0.00%
Castle Point	-4.62%	0.00%	44,596	26,306	0.00%	2.45%
Dartford	-2.03%	0.00%	71,707	93,174	0.00%	8.54%
Gravesham	-8.31%	0.00%	54,917	31,606	0.00%	5.71%
Maidstone	0.00%	0.00%	78,423	87,669	0.71%	3.69%
Medway	-1.95%	0.00%	137,368	104,760	0.00%	12.55%
Sevenoaks	-0.70%	0.00%	51,835	56,587	0.00%	0.00%
Southend-on-Sea	-6.73%	0.00%	96,902	77,010	0.00%	6.42%
Thurrock	0.00%	0.00%	102,103	75,768	0.53%	15.47%
Tonbridge and Malling	-1.91%	0.00%	66,524	70,455	0.00%	0.02%
Total (Districts)	**-2.38%**	**-0.19%**	**821,020**	**776,503**	**0.26%**	**5.60%**
Greater London	-0.31%	0.00%	4,321,067	5,498,142	0.00%	1.20%

Trips and Vehicle Kilometres (Traffic)

5.4.4 Highway person productions (two-legged trips) in the Pessimistic, Optimistic and Core are shown in Table 5.6. Overall trips vary around 10% between the Core and the two other scenarios.

Table 5.6: Optimistic and Pessimistic Person Trips, Without New Crossing Scenario

	Total Trips			Change	
	Pessimistic	Core	Optimistic	Pessimistic	Optimistic
South Essex	1,658,019	1,925,955	2,149,972	-13.9%	11.6%
North Kent	2,140,928	2,365,928	2,672,568	-9.5%	13.0%
North East London	4,002,664	4,582,128	5,187,482	-12.6%	13.2%
South East London	2,270,347	2,510,199	2,886,368	-9.6%	15.0%
North West London	8,587,782	9,579,322	11,012,708	-10.4%	15.0%
South West London	4,042,057	4,472,796	5,136,678	-9.6%	14.8%
North Essex	1,311,300	1,456,594	1,615,394	-10.0%	10.9%
South Kent	530,074	565,143	652,342	-6.2%	15.4%
Rest of Great Britain: North	86,889,146	95,037,619	105,890,970	-8.6%	11.4%
Rest of Great Britain: South	23,712,629	25,949,075	28,896,046	-8.6%	11.4%
All	**135,144,947**	**148,444,757**	**166,100,528**	-9.0%	11.9%

5.4.5 Traffic levels in the Pessimistic, Optimistic and Core are shown in Table 5.7. Overall traffic levels in the Policy Area are 4-5% higher in the Optimistic scenario and 4-5% lower in the Pessimistic scenario.

5.4.6 This difference is perhaps smaller than might be expected given the input assumption of 14% extra/less growth in addition to changes in land-use. However, it results from a number of factors that apply equally to the Optimistic and Pessimistic scenarios. Taking the Optimistic scenario for the purposes of illustration:

- The WebTAG guidance is for 14% of the *base* traveller demand to be added to the Optimistic scenario, not 14% of the *forecast Core*. Since growth to 2041 is around 35%, this results in an increase in trips over the Core of only around 10%, overall.
- Furthermore, the increase for long-distance freight trips, which contribute a significant traffic, is still lower, since the Core assumptions are for 50-100% freight growth. Because of this freight effect, the increase in traffic in the Reference scenario is lower, at around 8.5% overall.
- Because the Policy Area is quite congested, when traffic is assigned to the road network, some of it re-routes away from the Policy Area, resulting in lower traffic growth, of around 7.5%. This is suppressed in the demand model due to high congestion, resulting in a forecast difference of only 4.5%, as shown below.

5.4.7 The differences in London, where congestion is highest, are lower than average, while those in Kent, which is relatively uncongested by comparison with the rest of the Policy Area, particularly after the additional

Optimistic scenario road improvements, are larger. Differences are also larger in the less-congested interpeak, and slightly larger in the Optimistic than Pessimistic scenarios, due to the additional road capacity.

Table 5.7: Optimistic and Pessimistic Traffic (Vehicle km), Without New Crossing Scenario

		Totals			Change	
		Pessimistic	**Core**	**Optimistic**	**Pessimistic**	**Optimistic**
AM Peak	South Essex	1,012,908	1,046,033	1,101,886	-3.2%	5.3%
	North Kent	1,855,349	1,956,624	2,067,157	-5.2%	5.6%
	North East London	1,232,322	1,278,308	1,333,360	-3.6%	4.3%
	South East London	687,548	719,637	749,571	-4.5%	4.2%
	North West London	2,565,967	2,657,579	2,754,711	-3.4%	3.7%
	South West London	1,019,906	1,050,378	1,079,191	-2.9%	2.7%
	North Essex	1,802,954	1,878,457	1,944,145	-4.0%	3.5%
	South Kent	608,922	640,009	667,311	-4.9%	4.3%
Inter-peak	South Essex	928,551	972,886	1,030,270	-4.6%	5.9%
	North Kent	1,523,500	1,636,801	1,753,234	-6.9%	7.1%
	North East London	1,144,885	1,195,371	1,250,033	-4.2%	4.6%
	South East London	632,795	669,362	701,119	-5.5%	4.7%
	North West London	2,289,154	2,409,176	2,528,827	-5.0%	5.0%
	South West London	914,419	955,366	994,110	-4.3%	4.1%
	North Essex	1,499,467	1,591,504	1,672,912	-5.8%	5.1%
	South Kent	464,884	501,749	536,270	-7.3%	6.9%
PM Peak	South Essex	1,070,976	1,103,448	1,158,539	-2.9%	5.0%
	North Kent	1,939,069	2,036,986	2,152,926	-4.8%	5.7%
	North East London	1,280,662	1,325,792	1,383,938	-3.4%	4.4%
	South East London	742,149	770,409	798,284	-3.7%	3.6%
	North West London	2,594,163	2,694,405	2,796,760	-3.7%	3.8%
	South West London	1,034,772	1,064,313	1,095,809	-2.8%	3.0%
	North Essex	1,842,267	1,929,898	2,005,491	-4.5%	3.9%
	South Kent	611,496	643,124	677,839	-4.9%	5.4%
All Day	**All Traffic**	**122,090,216**	**127,979,498**	**134,101,409**	**-4.6%**	**4.8%**

Crossing Flows

5.4.8 Due to the considerable congestion in the Policy Area, which suppresses the overall traffic growth down to ±4.5% as discussed in the previous section, the effect of the Optimistic and Pessimistic tests on strategic traffic flows is very small. This is shown in Figure 5.5 and Figure 5.6, below. The largest increases in the Optimistic scenario on the M25 are around 500 vehicles, or around 7% of the flow; generally the differences are smaller.

5.4.9 On the Dartford-Thurrock Crossing itself, which is particularly constrained, there is no significant change in flow at all between the three traffic-growth scenarios (Pessimistic, Core and Optimistic). The differences are, as before, slightly larger in the Optimistic scenario on certain stretches of road due to some capacity improvements assumed (Table 5.4).

5.4.10 The general pattern is one of the strategic road network being heavily congested and approaching capacity in 2041. Consequently, assumptions about the background economic and land-use conditions have relatively little effect upon strategic traffic flows.

Figure 5.5: AM Peak Without New Crossing, 2041, Pessimistic versus Core

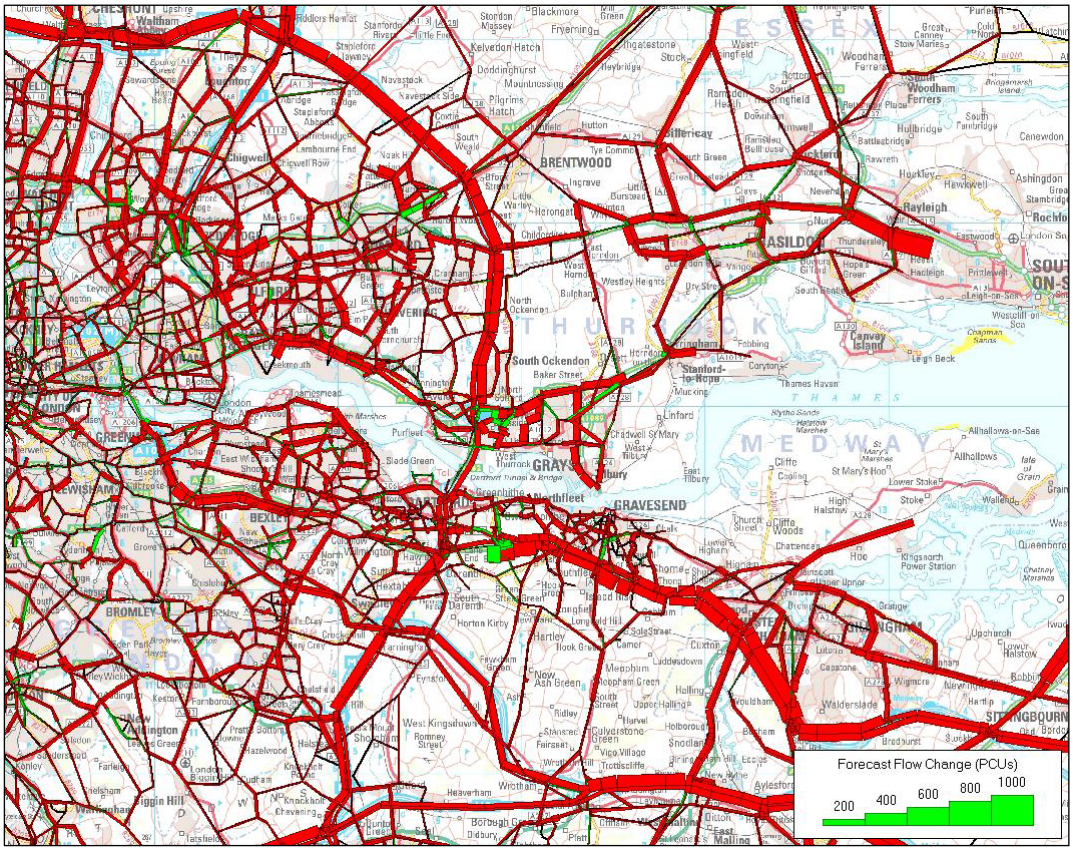
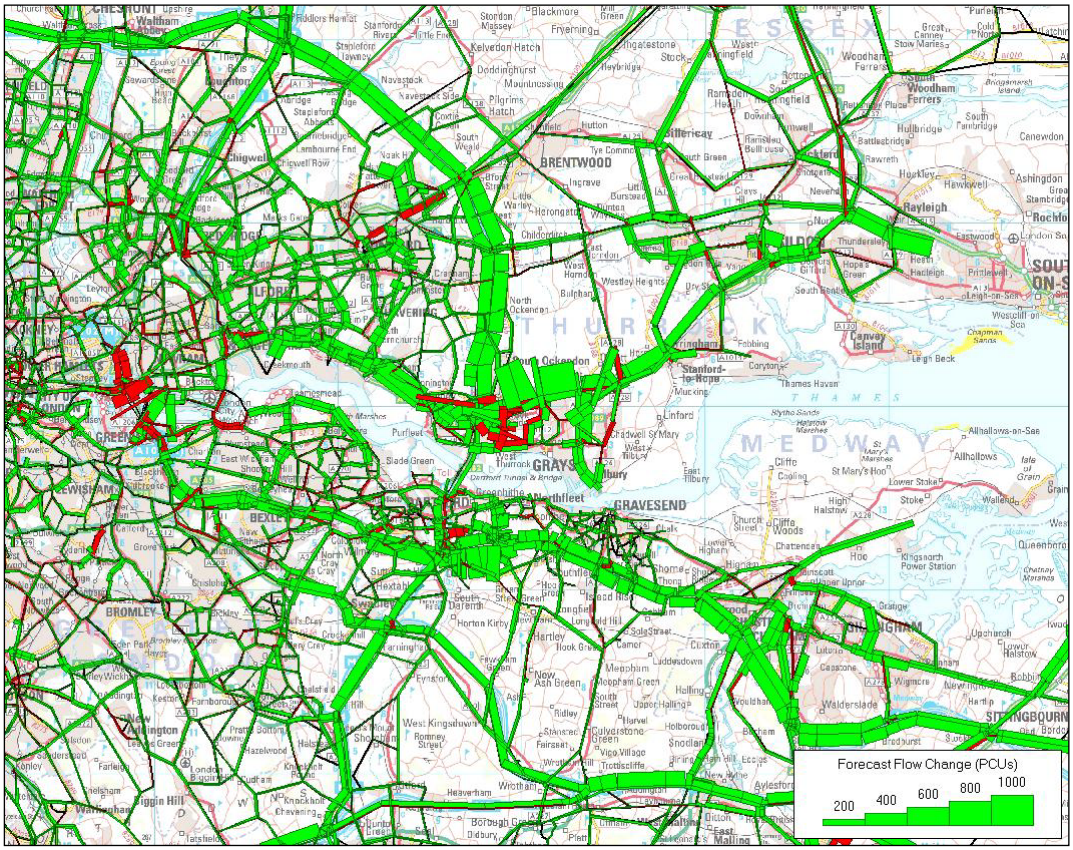


Figure 5.6: AM Peak Without New Crossing, 2041, Optimistic versus Core



5.4.11 Crossing flows for the Optimistic and Pessimistic scenarios are shown in the tables below. More detailed tables, by time period, can be found in Appendix C. The effect of the two changes in growth assumptions on

the crossing flows is generally not intuitive, due to the high levels of congestion on the strategic road network, which suppress, and, locally in places, changes the sign of, increases or decreases in traffic.

5.4.12 The large reductions in flow on the Blackwall Tunnel in the Optimistic scenario are not due to changes in travel demand assumptions, but to the addition of two new crossings; Silvertown and Galleon's Reach. The combined flow across the three does fall in the Optimistic scenario, but not by much.

5.4.13 Generally speaking, neither the Optimistic nor the Pessimistic scenarios have a significant impact upon the crossing flows for any option, with changes of less than or around 1% observed in most cases. This results from the capacity constraints on the network in general. Flows on the crossings generally fall slightly in the Optimistic scenario, contrary to intuition, because increased congestion is constraining traffic.

5.4.14 The Blackwall Tunnel, being in London, is worse affected by this than the Dartford-Thurrock Crossing or the new Option B and C routes, which do experience modest increases southbound. In the Pessimistic scenario, flows on Blackwall are higher than the Core for the same reason (congestion elsewhere).

5.4.15 Southbound, the effects are generally intuitive, but they remain small; a few percent of total traffic.

Table 5.8: Optimistic and Pessimistic Crossing Flows, Average Hour, 0700-1900

		Pessimistic				Optimistic			
		No NC	**OptA**	**OptB**	**OptC**	**No NC**	**OptA**	**OptB**	**OptC**
Northbound Thames Screenline	Blackwall Tunnel	3,136	3,135	3,132	3,134	2,531	2,478	2,486	2,464
	Silvertown Crossing	0	0	0	0	471	452	441	442
	Galleon's Reach	0	0	0	0	190	193	191	191
	Dartford-Thurrock Crossing	4,779	6,395	4,767	4,811	4,676	6,574	4,691	4,797
	Option B/C	0	0	2,066	2,215	0	0	2,030	2,210
	Total	**7,915**	**9,530**	**9,965**	**10,159**	**7,869**	**9,696**	**9,839**	**10,105**
		0	0	0	0	0	0	0	0
Southbound Thames Screenline	Blackwall Tunnel	2,943	2,940	2,909	2,909	2,050	2,025	1,993	1,979
	Silvertown Crossing	0	0	0	0	327	327	323	323
	Galleon's Reach	0	0	0	0	193	193	191	192
	Dartford-Thurrock Crossing	5,600	6,059	5,171	4,939	5,610	6,224	5,201	5,097
	Option B/C	0	0	1,630	1,866	0	0	1,721	1,907
	Total	**8,543**	**8,999**	**9,711**	**9,715**	**8,179**	**8,768**	**9,429**	**9,498**

Table 5.9: Optimistic and Pessimistic Crossing Flows, Changes from Core, Average Hour, 0700-1900

		Pessimistic				Optimistic			
		No NC	**OptA**	**OptB**	**OptC**	**No NC**	**OptA**	**OptB**	**OptC**
Northbound Thames Screenline	Blackwall Tunnel	0.8%	0.8%	0.8%	0.8%	-18.7%	20.3%	20.0%	20.7%
	Silvertown Crossing	-	-	-	-	-	-	-	-
	Galleon's Reach	-	-	-	-	-	-	-	-
	Dartford-Thurrock Crossing	1.1%	-1.5%	0.8%	-0.3%	-1.0%	1.2%	-0.8%	-0.6%
	Option B/C	-	-	-3.0%	-1.4%	-	-	-4.7%	-1.6%
	Total	**1.0%**	**-0.8%**	**0.0%**	**-0.2%**	**0.4%**	**1.0%**	**-1.3%**	**-0.7%**
Southbound Thames Screenline	Blackwall Tunnel	0.5%	0.6%	0.5%	0.6%	-30.0%	30.7%	31.2%	31.5%
	Silvertown Crossing	-	-	-	-	-	-	-	-
	Galleon's Reach	-	-	-	-	-	-	-	-
	Dartford-Thurrock Crossing	-0.5%	-1.7%	-1.1%	-2.0%	-0.3%	1.0%	-0.5%	1.1%
	Option B/C	-	-	-2.9%	-1.8%	-	-	2.5%	0.4%
	Total	**-0.2%**	**-0.9%**	**-0.9%**	**-1.2%**	**-4.4%**	**-3.5%**	**-3.8%**	**-3.4%**

5.5 Local Employment Growth

5.5.1 The new location options are expected, in practice, to generate some growth in the local areas surrounding them, in terms of both population and employment. This has not been explicitly accounted for in any transport modelling, but the scale of the latter effect has been estimated using a land-use model (documented elsewhere in forthcoming the business case documentation).

5.5.2 This has been compared to the scale and location of employment growth modelled in the Optimistic scenario, demonstrating that such growth is not likely to have a large impact on the performance of any of the crossing options. A comparison of the forecast induced employment changes using the land use model and the Optimistic scenario employment assumptions is provided in Table 5.10.

Table 5.10: Forecast Land Use Model-Induced Employment Changes vs. Optimistic Scenario

	Central Case Total Jobs	Optimistic Case Additional Jobs	Forecast Induced Jobs by Option			
			OptA	OptB	OptC	$C_{variant}$
Basildon	104,202	0	-43	292	134	116
Brentwood	48,968	0	46	153	153	143
Castle Point	26,306	645	26	166	149	143
Dartford	93,174	7,958	-251	167	551	546
Gravesham	31,606	1,805	8	8	178	156
Maidstone	87,669	3,237	51	264	498	1,243
Medway Towns	104,760	13,143	9	249	575	1,081
Sevenoaks	56,587	1	38	109	139	148
Southend-on-sea	77,010	4,942	-374	2	-36	-21
Thurrock	75,768	11,724	219	576	378	405
Tonbridge & Malling	70,455	15	65	188	294	581
Greater London	5,498,142	65,893	-256	-2,459	-2,798	-4,489

5.5.3 It is clear that the changes in employment forecast in the Optimistic scenario are themselves much larger than the forecast induced jobs resulting from the crossing options. In four districts; Basildon, Brentwood, Sevenoaks and Tonbridge & Malling, the latter is larger, but since these increases are very small compared to the total jobs in the districts, the effect is considered to be effectively immaterial to the forecasts.

5.6 Summary

5.6.1 Three sets of alternative assumptions have been considered to investigate uncertainties in core forecasts.

5.6.2 The impact of higher tolls on the Dartford-Thurrock Crossing and any new crossings has been tested. This is forecast to reduce traffic, as expected, but not very strongly, with an elasticity of around -0.18. It is expected that any increases in tolls within reasonable limits would result in higher outturn revenue.

5.6.3 The impact of the proposed Silvertown Crossing has also been tested. The model forecasts demonstrate negligible impact upon the Dartford-Thurrock Crossing and other strategic flows.

5.6.4 Model runs have been carried out to examine the effect of higher and lower traffic growth than the Core. These demonstrate severe capacity problems on and in the vicinity of the crossings, which effectively constrain flows on the crossings. This will need to be considered carefully in further work, as, while capacity constraints certainly do exist in reality, the model forecasts will be quite sensitive to their scale and location.

5.6.5 In addition, the magnitude of forecast induced employment has been compared with the Optimistic scenario assumptions, with the latter generally significantly in excess of the induced employment forecasts. The impact of not including induced employment in the Core With Scheme scenarios is therefore considered to be slight.

6 Conclusions

6.1 Conclusions

6.1.1 The Lower Thames Crossing Model (LTCM) has been used to provide forecasts of the future transport situation with and without new crossing location options over the river Thames at or to the east of the existing Dartford-Thurrock Crossing.

6.1.2 Road traffic is forecast to increase over time. This is a consequence of a number of factors, but the main driver is the forecast increases in population. This will drive increases in car trips, which in-turn will increase traffic flows. Traffic flows are forecast to increase from 2009 to 2041 by around 30%, including the effect of road schemes considered likely to be implemented by 2041.

6.1.3 This increase in highway travel will affect the Dartford-Thurrock Crossing. Flows between 2009 and 2041 are forecast to increase 10-20% southbound, and 2-10% northbound; the latter heavily constrained due to lack of capacity.

6.1.4 Four scenarios with options to increase cross-Thames capacity at or east of Dartford have been assessed against the Without New Crossing scenario. All four scenarios result in more traffic, higher average speeds, more traffic across the river, reduced queues, and shorter journey times across the river, as expected.

6.1.5 All scenarios have a greater impact on northbound travel than southbound, because the Dartford-Thurrock Crossing is assumed to have lower capacity northbound due to safety considerations reflecting the operating constraint of the existing tunnels.

6.1.6 The different options for new crossings at each location are forecast to increase cross-Thames traffic by 1000-2000 vehicles per hour. New crossing options are not forecast to carry more than 2500 vehicles per hour in any of the core scenarios to 2041. Diversion of traffic to Options B and C is forecast to relieve some of the congestion at the existing Dartford-Thurrock Crossing, with forecast queues reducing by up to a half, depending on direction and time of day. Journey times in the busiest northbound direction are forecast to reduce by up to a third, depending on the time of day and the journey route of travellers.

6.1.7 Three sets of alternative assumptions have been considered to investigate uncertainties in core forecasts.

6.1.8 The impact of higher tolls on the Dartford-Thurrock Crossing and any new crossings has been tested. This is forecast to reduce traffic, as expected, but not very strongly, with an elasticity of around -0.18. It is expected that any increases in tolls within reasonable limits would result in higher outturn revenue.

6.1.9 The impact of the proposed Silvertown Crossing has also been tested. The model forecasts demonstrate negligible impact upon the Dartford-Thurrock Crossing and other strategic flows.

6.1.10 Model runs have been carried out to examine the effect of higher and lower traffic growth than the Core scenarios. These demonstrate severe capacity problems on and in the vicinity of the crossings, which would effectively constrain flows on the crossings.

Appendices

Appendix A: Core Highway Schemes

Source	Scheme	Status	Completion	Include	Justification
Free-flow charge model	Dartford-Thurrock River Crossing Free-flow Charging	Approved by the HA	2014	INCLUDE	Considered 'more than likely' or 'near certain'
Free-flow charge model	M25 J16-23 Widening	Under Construction	By 2025	INCLUDE	Committed scheme under construction, with probable impact on Dartford Crossing flows
Free-flow charge model	M25 Widening J1b-3	Completed	Base	INCLUDE	Scheme forms part of the base year network
Free-flow charge model	M25 J27-30/31 Widening	Under Construction	By 2025	INCLUDE	Committed scheme under construction, with probable impact on Dartford Crossing flows
Free-flow charge model	M25 Junction 28 Improvements	Completed	Base	INCLUDE	Scheme forms part of the base year network
Free-flow charge model	Widening of M25 J12-15	Completed	Base	INCLUDE	Scheme forms part of the base year network
Free-flow charge model	Widening of M1 J6a-10	Completed	Base	INCLUDE	Scheme forms part of the base year network
Free-flow charge model	M1 J10-13 Hard Shoulder Widening	Under Construction	By 2025	INCLUDE	Whilst this scheme is outside of the modelled area, it is of strategic importance as to how traffic may route from the north to the M25, potentially influencing direction of travel around the M25 and thus use of the crossing.
Free-flow charge model	M2 J2 Reconfiguration	Completed	Base	INCLUDE	Scheme forms part of the base year network
Free-flow charge model	M27 J3-4 Widening	Completed	Base	INCLUDE	Scheme forms part of the base year network
Free-flow charge model	M40/A404 Handy Cross Improvements	Completed	Base	INCLUDE	Scheme forms part of the base year network
Free-flow charge model	M42 J3a-7 Active Traffic Management	Completed	Base	INCLUDE	Scheme is out of area but complete prior to 2009 and thus included in base-year model.
Free-flow charge model	A11 Attleborough Bypass Dualling	Completed	Base	INCLUDE	Scheme is out of area but complete prior to 2009 and thus included in base-year model.
Free-flow charge model	A2 Bean to Cobham	Completed	Base	INCLUDE	Scheme forms part of the base year network
Free-flow charge model	A414 Hastingwood Road	Under Construction	By 2025	INCLUDE	Scheme may influence traffic routing between the A10 and M11 corridors, potentially affecting direction of travel around the M25.
Free-flow charge model	A47 Thorney By-Pass	Completed	Base	INCLUDE	Scheme is out of area but complete prior to 2009 and thus included in base-year model.
Free-flow charge model	A421 Great Barford Bypass (Bedford Southern)	Completed	Base	INCLUDE	Scheme is out of area but complete prior to

Source	Scheme	Status	Completion	Include	Justification
					2009 and thus included in base-year model.
Free-flow charge model	A428 Caxton Common to Hardwick Improvements	Completed	Base	INCLUDE	Scheme is out of area but complete prior to 2009 and thus included in base-year model.
Free-flow charge model	A4146 Stoke Hammond and Linslade Western Bypass	Completed	Base	INCLUDE	Scheme is out of area but complete prior to 2009 and thus included in base-year model.
Free-flow charge model	A505 Baldock Bypass	Completed	Base	INCLUDE	Scheme is out of area but complete prior to 2009 and thus included in base-year model.
Free-flow charge model	A505 Luton East Corridor Dualling	Completed	By 2025	INCLUDE	Scheme may influence traffic routing onto the M1, with the potential to affect routing around the M25.
Free-flow charge model	A6 Elstow to Wilstead Dualling	Completed	Base	INCLUDE	Scheme is out of area but complete prior to 2009 and thus included in base-year model.
Free-flow charge model	A507 Ridmont Bypass	Completed	Base	INCLUDE	Scheme is out of area but complete prior to 2009 and thus included in base-year model.
Free-flow charge model	A41 Hunton Bridge Improvements	Completed	By 2025	INCLUDE	Scheme is directly connected to the M25 within the Rest of the Fully Modelled Area.
Free-flow charge model	B3270 Lower Earley Way	Completed	N/A	EXCLUDE	Out of area of influence. Highly unlikely to influence crossing routing
Free-flow charge model	A406 North Circular Road/A10 Junction	Completed	Base	INCLUDE	Scheme forms part of the base year network
Free-flow charge model	A11 Fiveways to Thetford	Start Pre 2015	By 2025	INCLUDE	Scheme is regionally important and could unlock capacity for long-distance traffic to/from the M11.
Free-flow charge model	A3 Hindhead	Under Construction	By 2025	INCLUDE	Scheme is strategically important, with the potential to unlock significant capacity for trips travelling to/from the M25.
Free-flow charge model	A419 Blunsdon Bypass	Completed	Base	INCLUDE	Scheme is out of area but complete prior to 2009 and thus included in base-year model.
Free-flow charge model	A421 Bedford to M1 J13	Under Construction	By 2025	INCLUDE	Scheme is regionally important and on the margins of the Fully Modelled area.
Free-flow charge model	A4010 Chapel Lane Junction Improvements	Under Construction	By 2025	INCLUDE	This is a marginal scheme on the boundary of the model area.
Free-flow charge model	A503 Finsbury Park	Under Construction	By 2025	INCLUDE	This is a marginal scheme on the boundary of the model area.
Free-flow charge model	A428 Bedford Western Bypass	Completed	By 2025	INCLUDE	This is a marginal scheme on the boundary of the model area.
Free-flow charge model	A23 Handcross to Warninglid	Start Post 2015	By 2025	INCLUDE	This is a marginal scheme on the boundary of the model area.
Free-flow charge model	M40 J1a/M25 J16 Improvements	Completed	Base	INCLUDE	Scheme forms part of the base year network
Free-flow charge model	M25 J12 and M3 New Road Layout	Completed	Base	INCLUDE	Scheme forms part of the base year network
Free-flow charge model	M4 J4 Improvement	Completed	Base	INCLUDE	Scheme is out of area but complete prior to 2009 and thus included in base-year model.

Source	Scheme	Status	Completion	Include	Justification
Free-flow charge model	A130/A13 Sadlers Farm	Under Construction	By 2025	INCLUDE	Committed scheme under construction, with potential impact on Dartford Crossing flows
Free-flow charge model	A244 Walton Bridge	Conditional Approved		EXCLUDE	Replacement of bridge will not have a strategic impact.
Free-flow charge model	A21 Tonbridge to Pembury Dualling	Start Post 2015	By 2025	INCLUDE	Potential impact on Dartford Crossing flows
Free-flow charge model	A5 - M1 Dunstable Bypass	Start Post 2015		INCLUDE	Peripheral, but potential impact on Dartford Crossing flows
Free-flow charge model	M25 J30	Start Post 2015		INCLUDE	Likely impact on Dartford Crossing flows
Free-flow charge model	M4 Junction 3 -12 Hard Shoulder Running	Start Post 2015	By 2025	INCLUDE	Scheme increases capacity of motorways connected to the M25 and is thus strategically important.
Free-flow charge model	M3 Junction 2 - 4A Hard Shoulder Running	Start Post 2015	By 2025	INCLUDE	Scheme increases capacity of motorways connected to the M25 and is thus strategically important.
Free-flow charge model	West Thurrock Regeneration	Unknown		INCLUDE	Likely impact on Dartford Crossing flows
Free-flow charge model	A24 Horsham to Capel	Unknown		INCLUDE	This is a marginal scheme on the boundary of the model area.
Free-flow charge model	A228 Main Road to Ropers Lane	Complete	Base	INCLUDE	Scheme is out of area but complete prior to 2009 and thus included in base-year model.
Free-flow charge model	Third Thames Bridge crossing in Reading	Unknown		EXCLUDE	Scheme not considered more than likely to go ahead. The centre of Reading is also too remote from the Lower Thames area.
Free-flow charge model	A14 Ellington to Fen Ditton	To be re-examined		EXCLUDE	Out of area. Highly unlikely to influence crossing routing
Free-flow charge model	A14 Kettering Bypass	Starting post 2015		EXCLUDE	Out of area. Highly unlikely to influence crossing routing
Highways Agency	M25 J5-6/7 Hard Shoulder Running	Starting 2013/14	2014	INCLUDE	Potential impact on Dartford Crossing flows
Highways Agency	M25 J23-J27 Widening	Starting 2013/14	2014	INCLUDE	Potential impact on Dartford Crossing flows
Transport for London	Kender Street and Besson Street A2/A202 Sydenham Road Area Based Scheme A212	Unknown	By 2025	INCLUDE	Affects A2 and A20 thus strategic in area of interest.
Transport for London	Removal of Western Expansion charging Zone	Complete	By 2025	EXCLUDE	WEZ not modelled in base.
Transport for London	White Post Lane/E28 link, Waterden Road/Carpenters Road Lea Interchange/Waterden Rd	Unknown	By 2025	EXCLUDE	Scheme Unknown
Transport for London	E28 Link and LO3 Safeguarding	Unknown	By 2025	EXCLUDE	Not of strategic significance to the key modelled area.
Transport for London	Highway in the vicinity of Aquatics / Stratford City Southern Access Road Marshgate Lane / Southern Loop Road Park Street / Velodrome Link	Unknown	By 2025	EXCLUDE	Not of strategic significance to the key modelled area.
Transport for London	L10 North Loop Road / Velodrome Link	Unknown	By 2025	EXCLUDE	Not of strategic significance to the key modelled area.

Source	Scheme	Status	Completion	Include	Justification
Transport for London	North Loop Road / Temple Mill Lane	Unknown	By 2025	EXCLUDE	Not of strategic significance to the key modelled area.
Transport for London	Ruckholt Road	Unknown	By 2025	EXCLUDE	Not of strategic significance to the key modelled area.
Transport for London	Highway Link Assessment	Unknown	By 2025	EXCLUDE	Scheme Unknown
Transport for London	OPTEMS - as of 2009 OPTEMS Strategy	Unknown	By 2025	EXCLUDE	Not of strategic significance to the key modelled area.
Transport for London	H02 Cadogan Terrace Traffic Calming	Unknown	By 2025	EXCLUDE	Not of strategic significance to the key modelled area.
Transport for London	H03B* Eastway Improvements	Unknown	By 2025	EXCLUDE	Scheme Unknown
Transport for London	H10 Balls Pond Road/ Southgate Road	Unknown	By 2025	EXCLUDE	Not of strategic significance to the key modelled area.
Transport for London	N15-2* North-South Residential Traffic Priorities - Implementation	Unknown	By 2025	EXCLUDE	Not of strategic significance to the key modelled area.
Transport for London	TH07 & TH08 Cadogan Terrace & 'Missing Link' Enhancements	Unknown	By 2025	EXCLUDE	Not of strategic significance to the key modelled area.
Transport for London	WF01* Ruckholt Road Area	Unknown	By 2025	EXCLUDE	Not of strategic significance to the key modelled area.
Transport for London	Canning Town Roundabout change to signals	Unknown	By 2025	INCLUDE	Located on the A13 feeds directly to M25 and Lower Thames Crossing therefore could affect strategic trips across the crossing.
Thurrock	West Thurrock Marshes Relief Road - Phase 2	Proposed	2011 - 2016	EXCLUDE	Likelihood only possible due to funding being developer dependant.
Thurrock	A13 / A126 Junction east-facing slip roads	Proposed	2012 - 2016	EXCLUDE	Likelihood only possible due to unknown funding source.
Thurrock	A13 Link 5 widening for London Gateway	Proposed	2012 - 2016	EXCLUDE	No detailed plans for scheme, including funding source.
Kent	Ashford Smartlink BRT	Proposed	Post-2015	EXCLUDE	Bus routes and priority not represented in the highway model due to its strategic nature. It is also outside of the key modelled area.
Kent	M20 Junction 10a Improvements	Proposed	Post-2015	INCLUDE	HA recommend inclusion of scheme prior to 2025.
Kent	A28 Chart Road Phases 1-3	Proposed	2016	EXCLUDE	Outside of key modelled area, and unlikely to influence routing of strategic trips inside the key modelled area.
Kent	A2 Bean Junction Improvements	Proposed	2014 - 2015	EXCLUDE	HA advice is to exclude scheme as no realistic funding mechanism has been identified. The scheme will be included as a sensitivity test
Kent	A2 Demand Management	Proposed	2012 - 2013	EXCLUDE	Not included after consultation with local districts.

Source	Scheme	Status	Completion	Include	Justification
Kent	A2 / B259 Ebbsfleet Junction Improvements	Proposed	2014 - 2015	EXCLUDE	HA advice is to exclude scheme as no realistic funding mechanism has been identified. The scheme will be included as a sensitivity test
Kent	A226 Thames Way Dualling	Proposed	2015 - 2016	INCLUDE	Likelihood probable and has funding. Also in key modelled area with potential influence on proposed new crossings.
Kent	A226 / B255 London Road / St. Clements Way Junction Improvements	Proposed	2014	INCLUDE	Likelihood probable and has funding. Also in key modelled area with potential influence on proposed new crossings. (Note: provision of underpass will not be represented.)
Kent	A226 Dartford Town Centre Ring Road Improvements	Complete	2010 - 2011	INCLUDE	Completed scheme affecting the central ring road in Dartford, with potential impacts within the key modelled area. (Note: Improvements to public transport hub will not be represented.)
Kent	A206 / Marsh Street Bob Dunn Way Junction Signalisation	Proposed	2018	EXCLUDE	Not included after consultation with local districts.
Kent	B262 / Hall Road Junction Improvement	Proposed	2016	EXCLUDE	Not included after consultation with local districts.
Kent	Dover BRT Phase 1	Proposed	2011 - 2018	EXCLUDE	Unknown funding source. Also, bus routes are not represented in the strategic highway model.
Kent	Dover BRT Phase 2	Proposed	2019 - 2023	EXCLUDE	Unknown funding source. Also, bus routes are not represented in the strategic highway model.
Kent	Dover BRT Phase 3	Proposed	2024 - 2031	EXCLUDE	Unknown funding source. Also, bus routes are not represented in the strategic highway model.
Kent	Dover Port Terminal 2	Proposed	Unknown	EXCLUDE	Outside of key study area. Unlikely to influence routing of strategic trips, and only possible likelihood with unknown funding.
Kent	A228 Colts Hill Bypass	Proposed	Unknown	EXCLUDE	Not included after consultation with local districts.
Kent	M20 Junction 4 Overbridge	Proposed		EXCLUDE	No funding specified and no scheme details available.
Kent	M2 Junction 5A	Proposed		EXCLUDE	No funding specified and no scheme details available.
Kent	A228 Peters Village Crossing	Proposed		EXCLUDE	Funding developer dependant.
Kent	M20 Operation Stack Lorry Park	Proposed		EXCLUDE	Impact of Operation Stack is not represented in the highway model Core forecasts.
Kent	Bifurcation A2 Brenley corner	Proposed		EXCLUDE	No funding specified and no details available.

Source	Scheme	Status	Completion	Include	Justification
Kent	Bifurcation A2 Lydden - Dover Dualling	Proposed		EXCLUDE	Outside of key modelled area. Unlikely to influence routing of strategic trips and no funding specified.
Kent	Thanet Parkway Station	Proposed		EXCLUDE	Rail scheme and therefore not represented in the strategic highway model.
Kent	A2 Slips Bridge, Canterbury	Proposed		EXCLUDE	Outside of key modelled area. Unlikely to influence routing of strategic trips and funding developer dependant.
Kent	A2 Off slip, Wincheap, Canterbury	Proposed		EXCLUDE	Outside of key modelled area. Unlikely to influence routing of strategic trips and funding developer dependant.
Kent	M2 Junction 5/A249 Stockbury Rbt	Proposed		EXCLUDE	No funding specified and no scheme details available.
Kent	Bapchild Link, Sittingbourne	Proposed		EXCLUDE	No funding specified, developer dependant.
Kent	A20 Corridor West of Maidstone	Proposed		EXCLUDE	Bus priority measures not represented in the strategic highway model.
Kent	East Kent Access Phases 1 and 2	Complete	2012	EXCLUDE	Outside of key modelled area. Unlikely to influence routing of strategic trips within key modelled area.
Kent	Gravesend Transport Quarter Phase 3 - Rathmore Road Link	Proposed	Post-2015	INCLUDE	Within key modelled area with funding and likelihood is probable. (Note: scheme is relatively minor in terms of strategic nature of model.)
Kent	Victoria Way Improvements	Complete	2011	EXCLUDE	Outside of key modelled area. Unlikely to influence routing of strategic trips.
Kent	Drovers Roundabout - M20 Junction 9 Improvements	Complete	2011	INCLUDE	Potential impact on strategic network, with increased capacity at this junction.
Kent	A28/A2 On Slip Road	Complete	2011	INCLUDE	Potential impact on strategic network, with change in allowed movements at this junction.
Swale	A249 Iwade to Queenborough Improvements	Complete	2006	INCLUDE	Scheme was completed in 2006 and as such is already included in the 2009 Base Year model.
Swale	Sittingbourne Northern Relief Road	Complete	2011	EXCLUDE	Not of strategic significance to the key modelled area.
Swale	Rushenden Link Road	Complete	2011	EXCLUDE	Not of strategic significance to the key modelled area.
Southend	A13 PT Corridor Phase 1	Complete	2006 - 2011	EXCLUDE	Primarily public transport related, therefore not of strategic significance to highway.
Southend	A13 PT Corridor Phase 2	Complete	2006 - 2011	EXCLUDE	Primarily public transport related, therefore not of strategic significance to highway.
Southend	A13 PT Corridor Phase 3	Complete	2006 - 2011	EXCLUDE	Primarily public transport related, therefore not of strategic significance to highway.

Source	Scheme	Status	Completion	Include	Justification
Southend	A127 Progress Road Junction Improvement	Complete	2008 - 2011	EXCLUDE	Unlikely to influence routing of strategic trips.
Southend	A127 Cuckoo Corner Junction Improvement	Complete	2006 - 2011	EXCLUDE	Unlikely to influence routing of strategic trips.
Southend	Victoria Gateway	Complete	2008 - 2011	EXCLUDE	Public realm improvements not included in strategic highway model
Southend	City Beach	Complete	2008 - 2011	EXCLUDE	Public realm improvements not included in strategic highway model
Southend	SERT	Proposed	2008 - 2013	EXCLUDE	Bus services not represented in strategic highway model.
Southend	Access to East Southend and Rochford	Proposed	2011 - 2026	EXCLUDE	Unlikely to influence routing of strategic trips.
Southend	London Southend Airport Access Package	Proposed	2011 - 2016	EXCLUDE	Unlikely to influence routing of strategic trips.
Southend	A127 Kent Elms Junction	Proposed	2011 - 2016	EXCLUDE	Unlikely to influence routing of strategic trips.
Southend	A127 Tesco Roundabout	Proposed	2011 - 2016	EXCLUDE	Unlikely to influence routing of strategic trips.
Southend	A127 The Bell Junction	Proposed	2011 - 2016	EXCLUDE	Unlikely to influence routing of strategic trips.
Southend	Victoria Gateway Phase 2,3,4	Proposed	2011 - 2016	EXCLUDE	Public realm improvements not included in strategic highway model
Southend	City Beach Phase 2	Proposed	2011 - 2016	EXCLUDE	Public realm improvements not included in strategic highway model
Southend	SERT phase 2	Proposed	2008 - 2016	EXCLUDE	Bus services not represented in strategic highway model.
Southend	Hamlet Court Road Regeneration	Complete	2012 - 2016	EXCLUDE	Not included after consultation with local districts.
Southend	East Shoebury Highway Improvements	Proposed	2012 - 2016	EXCLUDE	Not included after consultation with local districts.
Southend	Chatham Ring Road Reconfiguration	Complete	2007	INCLUDE	Completed in 2007 so already included within 2009 Base Year model
Medway	A289 Medway Tunnel Upgrade	Ongoing	2011	EXCLUDE	Specifies no impact on the operation of the highway network.
Medway	A229 Gyratory Junction Improvements	Proposed	2011 - 2016	EXCLUDE	Likelihood only possible as funding source unknown. Also scheme to address mainly road safety issues and is yet to be developed
Medway	A289 Medway Tunnel - Four Elms link	Proposed	2011 - 2021	INCLUDE	Funding identified and scheme likelihood is probable. Potential impact on routing of traffic to / from M2.
Medway	M2 junction 3 improvement	Proposed	2011 - 2021	EXCLUDE	No scheme details available, and no funding identified
Medway	A2 Corporation Street Bus Priority Works	Complete	2011 - 2021	EXCLUDE	Bus routes and priority not represented in the highway model due to its strategic nature.
Medway	A2 Canal Road bus only link [changed title]	Proposed	2011 - 2021	EXCLUDE	Bus routes and priority not represented in the highway model due to its strategic

Source	Scheme	Status	Completion	Include	Justification
					nature.
Medway	A2 Chatham Hill - Canterbury Street link	Proposed	2016 - 2021	EXCLUDE	Not included after consultation with local districts and no design solution identified.
Medway	A228 Darnley Arch Widening	Proposed	2011-2016	EXCLUDE	Rail bridge scheme, and therefore will not impact on the highway network significantly.
Medway	A2 / A228 Gyratory in Strood town centre	Proposed	2016 - 2021	EXCLUDE	Likelihood only possible and funding not specified and dependant on A228 Darnly Arch Widening which is "probable" but does not have any funding specified.
Medway	A228 / Darnley Road junction improvements	Proposed	2016 - 2021	EXCLUDE	Likelihood only possible and funding not specified and dependant on A228 Darnly Arch Widening which is "probable" but does not have any funding specified.
Medway	A2 Star Hill Junction improvements	Proposed	2016 - 2021	EXCLUDE	Funding developer dependant, and not of influence to strategic traffic.
Medway	A231 Dock Road / Wood Street Junction improvements	Proposed	2016 - 2021	EXCLUDE	No scheme details available and primarily relating to bus journey time reliability.
Medway	A278 Sharsted Way / Wigmore Road improvements	Proposed	2016 - 2021	EXCLUDE	No scheme details, Likelihood only possible and funding not specified.
Medway	A2 / Mierscourt Road junction improvements	Proposed	2016 - 2021	EXCLUDE	Not included after consultation with local districts.
Medway	A2 / A278 and A289 junction improvements	Proposed	2021 - 2026	EXCLUDE	No scheme details, Likelihood only possible and funding not specified.
Essex	A12 Improvement Package	Proposed	TBC	EXCLUDE	At present no scheme details or funding in place for this scheme.
Essex	A12 Incremental Improvements	Proposed	TBC	EXCLUDE	No scheme details at present.
Essex	A12 Technology Package	Proposed	TBC	EXCLUDE	At present no scheme details or funding in place for this scheme.
Essex	A120 Braintree to A12 Dualling	Proposed	TBC	EXCLUDE	At present no scheme details or funding in place for this scheme.
Essex	A120 Hare Green to Harwich Dualling	Proposed	TBC	EXCLUDE	No scheme details at present and funding developer dependent.
Essex	A127 Capacity Enhancements M25 to Southend Boundary	Proposed	TBC	EXCLUDE	At present no scheme details or funding in place for this scheme.
Essex	A13 Improvements	Proposed	TBC	EXCLUDE	At present no scheme details or funding in place for this scheme.
Essex	A130/A131 Chelmsford NE Bypass	Proposed	Post 2021	EXCLUDE	At present no scheme details or funding in place for this scheme.
Essex	Canvey; new or improved access	Proposed	TBC	EXCLUDE	At present no scheme details or funding in place for this scheme.
Essex	Galleys Corner junction improvement	Proposed	TBC	EXCLUDE	At present no scheme details or funding in place for this scheme.

Source	Scheme	Status	Completion	Include	Justification
Essex	Harlow J7a	Proposed	TBC	EXCLUDE	At present no scheme details or funding in place for this scheme.
Essex	M11 widening	Proposed	TBC	EXCLUDE	At present no scheme details or funding in place for this scheme.
Essex	Nethermayne, Basildon	Proposed	5 years	EXCLUDE	At present no scheme details or funding in place for this scheme.
Essex	Roscommon Way phase II	Proposed	TBC	EXCLUDE	At present no scheme details or funding in place for this scheme.
Essex	South Essex Rapid Transit Route 1	Proposed	Post-2015	EXCLUDE	Bus routes and priority not represented in the highway model due to its strategic nature.
Essex	South Essex Rapid Transit Route 2	Proposed	Post-2015	EXCLUDE	Bus routes and priority not represented in the highway model due to its strategic nature.
Essex	South Essex Rapid Transit Route 3	Proposed	Post-2015	EXCLUDE	Bus routes and priority not represented in the highway model due to its strategic nature.
Essex	A13 Basildon - Hadleigh Passenger Transport Improvements	Under construction	2012	EXCLUDE	Bus routes and priority not represented in the highway model due to its strategic nature.
Essex	A120 Marks Tey - Braintree Highway Improvements	Withdrawn	2011 - 2016	EXCLUDE	Scheme withdrawn
Essex	A120 Marks Tey - Braintree Highway Dualling	Withdrawn	Post-2021	EXCLUDE	Scheme withdrawn
Essex	A127 Junction Improvements/Basildon Enterprise Corridor	Complete	2012	INCLUDE	Completed in 2011 and located in the strategic model to impact on routing to the crossing.
Essex	A130 Roscommon Way Extension	Complete	2011	EXCLUDE	Canvey Island only has one access road so the highways improvement will not affect strategic routing.
Essex	A12 Cuckoo Farm Junction Improvements - Known as Junction 28 on A12	Complete	2012	EXCLUDE	Outside of key modelled area. Unlikely to influence routing of strategic trips.

Appendix B: Forecasting Uncertainty Log

Input	Uncertainty	Potential Impact	Comments
Uncertainties in transport model data:			
Base matrix quality	Unknown	High	As discussed in the Model Capability Report, the quality of the base matrix varies by area. The relevance of this depends on the scale and distribution of scheme benefits. Most of the relevant matrix data is known to be between 5 and 10 years old.
Local forecast planning data quality	Unknown	Low-Moderate	Local planning data have been provided for 11 districts and Greater London. The district data vary significantly from TEMPRO.
Factors affecting underlying demand:			
DP World Development	Near certain	Low-Moderate	
Additional local development occurs in response to a new crossing.	Reasonably foreseeable	Low-Moderate	This is probably more of concern for Option B, which is more local in nature, than for Options A or C. Current traffic on Dartford is overwhelming long-distance non-local traffic.
Thames Gateway airport development	Hypothetical	High	Not assessed – as a fundamental change to the regional economy and transport system.
Operation of free-flow charging:			
Uncertainty relating to the operation of the existing barriers on the northbound crossing	Near certain	High	This has a potentially large impact on the benefits associated with Option A in particular, as the northbound flow is currently heavily constrained.
Operation of a new crossing:			
Operation of Option C	Near certain	High	There is uncertainty regarding precisely how the charge would be applied. As modelled, significant new infrastructure between the A13 and M25 could be used without a charge as the charge is applied only to the bridge itself. Similarly, it is uncertain what arrangements with respect to the charge would apply to the Option C variant upgrade to the A229.
Operation of Option $C_{Variant}$	Near certain	High	
Future charges on Dartford-Thurrock Crossing and new options deviate from those assumed.	Reasonably foreseeable	Moderate	Currently it seems the response of crossing flow to charges is relatively low. This might be more sensitive under a less capacity-constrained scenario, however, but given the lack of alternative routes, sensitivity of traffic to charge is expected to be quite weak.
Factors affecting transport supply:			
TfL Silvertown Crossing	Reasonably foreseeable	Low-Moderate	Testing in the model suggests interaction between Blackwall and Dartford is extremely low.
J30/A13 Upgrade (linked to DP World)	Reasonably foreseeable	Low	-
Local schemes	Reasonably foreseeable	Low	-
Additional transport infrastructure occurs as a response to a new crossing.	Hypothetical	Low-Moderate	-
Factors affecting generalised cost of transport:			
WebTAG 3.5.6D parameters	Unknown	Moderate	Parameter values have recently been revised and so are up-to-date. There is particular uncertainty in forecast GDP which is a key driver of these parameters.

Appendix C: Crossing Flow Tables

Table C.1: 2025 Crossing Vehicle Flows, With and Without New Crossings, Core

AM Peak		Actual Flow					Change			
		NoNC	OptA	OptB	OptC	OptC Var	OptA	OptB	OptC	OptC Var
Northbound Thames Screenline	Blackwall Tunnel	3,305	3,302	3,301	3,303	3,301	-4	-4	-2	-4
	Dartford-Thurrock Crossing	5,053	6,320	4,886	4,614	4,609	1,267	-167	-439	-445
	Option B/C	0	0	1,927	2,352	2,370	0	1,927	2,352	2,370
	Total	**8,359**	**9,622**	**10,115**	**10,270**	**10,280**	**1,263**	**1,756**	**1,911**	**1,921**
Southbound Thames Screenline	Blackwall Tunnel	3,349	3,350	3,339	3,342	3,341	2	-10	-6	-7
	Dartford-Thurrock Crossing	5,097	5,356	4,679	4,540	4,531	259	-418	-557	-567
	Option B	0	0	1,208	1,345	1,427	0	1,208	1,345	1,427
	Total	**8,446**	**8,706**	**9,226**	**9,227**	**9,299**	**261**	**780**	**782**	**853**

Interpeak		Actual Flow					Change			
		NoNC	OptA	OptB	OptC	OptC Var	OptA	OptB	OptC	OptC Var
Northbound Thames Screenline	Blackwall Tunnel	3,173	3,172	3,170	3,175	3,176	-1	-3	2	3
	Dartford-Thurrock Crossing	4,897	5,821	4,634	4,363	4,355	924	-263	-534	-542
	Option B/C	0	0	1,659	2,084	2,156	0	1,659	2,084	2,156
	Total	**8,070**	**8,993**	**9,463**	**9,621**	**9,687**	**923**	**1,393**	**1,551**	**1,616**
Southbound Thames Screenline	Blackwall Tunnel	2,961	2,958	2,933	2,931	2,937	-3	-28	-30	-24
	Dartford-Thurrock Crossing	5,634	5,945	5,058	4,724	4,735	311	-576	-910	-899
	Option B	0	0	1,600	1,963	2,035	0	1,600	1,963	2,035
	Total	**8,595**	**8,903**	**9,591**	**9,618**	**9,707**	**308**	**996**	**1,023**	**1,112**

PM Peak		Actual Flow					Change			
		NoNC	OptA	OptB	OptC	OptC Var	OptA	OptB	OptC	OptC Var
Northbound Thames Screenline	Blackwall Tunnel	3,385	3,388	3,384	3,385	3,384	3	-1	-0	-1
	Dartford-Thurrock Crossing	5,291	6,559	5,286	5,176	5,190	1,268	-5	-114	-101
	Option B/C	0	0	2,070	2,247	2,384	0	2,070	2,247	2,384
	Total	**8,676**	**9,947**	**10,741**	**10,808**	**10,958**	**1,271**	**2,065**	**2,133**	**2,282**
Southbound Thames Screenline	Blackwall Tunnel	2,978	2,975	2,933	2,932	2,940	-3	-45	-46	-38
	Dartford-Thurrock Crossing	5,818	6,026	4,934	4,690	4,656	208	-883	-1,127	-1,162
	Option B	0	0	1,965	2,271	2,375	0	1,965	2,271	2,375
	Total	**8,796**	**9,000**	**9,832**	**9,892**	**9,970**	**205**	**1,037**	**1,097**	**1,175**

Table C.2: 2041 Crossing Vehicle Flows, With and Without New Crossings, Core

AM Peak		Actual Flow					Change			
		NoNC	OptA	OptB	OptC	OptC Var	OptA	OptB	OptC	OptC Var
Northbound Thames Screenline	Blackwall Tunnel	3,240	3,236	3,234	3,234	3,234	-4	-6	-6	-6
	Dartford-Thurrock Crossing	4,913	6,881	4,947	4,988	4,981	1,968	35	75	68
	Option B/C	0	0	2,374	2,354	2,381	0	2,374	2,354	2,381
	Total	**8,153**	**10,117**	**10,555**	**10,576**	**10,596**	**1,964**	**2,403**	**2,423**	**2,443**
Southbound Thames Screenline	Blackwall Tunnel	3,272	3,269	3,261	3,261	3,261	-3	-11	-12	-11
	Dartford-Thurrock Crossing	5,585	6,066	5,311	5,202	5,193	481	-274	-384	-393
	Option B	0	0	1,340	1,375	1,462	0	1,340	1,375	1,462
	Total	**8,858**	**9,335**	**9,912**	**9,837**	**9,916**	**477**	**1,054**	**979**	**1,058**

Interpeak		Actual Flow					Change			
		NoNC	OptA	OptB	OptC	OptC Var	OptA	OptB	OptC	OptC Var
Northbound Thames Screenline	Blackwall Tunnel	3,114	3,114	3,110	3,114	3,116	-0	-4	-0	2
	Dartford-Thurrock Crossing	4,706	6,457	4,690	4,811	4,849	1,751	-16	105	143
	Option B/C	0	0	2,048	2,193	2,217	0	2,048	2,193	2,217
	Total	**7,820**	**9,571**	**9,848**	**10,118**	**10,181**	**1,751**	**2,028**	**2,298**	**2,361**
Southbound Thames Screenline	Blackwall Tunnel	2,931	2,919	2,890	2,881	2,889	-12	-41	-50	-42
	Dartford-Thurrock Crossing	5,795	6,489	5,515	5,309	5,317	694	-279	-486	-478
	Option B	0	0	1,762	2,077	2,165	0	1,762	2,077	2,165
	Total	**8,726**	**9,408**	**10,167**	**10,267**	**10,371**	**682**	**1,442**	**1,541**	**1,646**

PM Peak		Actual Flow					Change			
		NoNC	OptA	OptB	OptC	OptC Var	OptA	OptB	OptC	OptC Var
Northbound Thames Screenline	Blackwall Tunnel	3,366	3,364	3,365	3,364	3,364	-2	-1	-3	-2
	Dartford-Thurrock Crossing	5,166	6,990	5,177	5,294	5,292	1,824	12	128	127
	Option B/C	0	0	2,318	2,528	2,577	0	2,318	2,528	2,577
	Total	**8,532**	**10,354**	**10,860**	**11,185**	**11,234**	**1,822**	**2,329**	**2,654**	**2,702**
Southbound Thames Screenline	Blackwall Tunnel	2,940	2,935	2,890	2,889	2,895	-5	-50	-51	-44
	Dartford-Thurrock Crossing	6,014	6,335	5,176	4,923	4,883	321	-838	-1,091	-1,130
	Option B	0	0	2,065	2,304	2,435	0	2,065	2,304	2,435
	Total	**8,954**	**9,270**	**10,131**	**10,116**	**10,214**	**317**	**1,177**	**1,162**	**1,260**

Table C.3: 2041 Pessimistic and Optimistic Crossing Flows, With and Without New Crossings

AM Peak		Pessimistic				Optimistic			
		No NC	OptA	OptB	OptC	No NC	OptA	OptB	OptC
Northbound Thames Screenline	Blackwall Tunnel	3,274	3,272	3,268	3,268	2,698	2,646	2,649	2,631
	Silvertown Crossing	0	0	0	0	152	90	88	88
	Galleon's Reach	0	0	0	0	199	206	204	204
	Dartford-Thurrock Crossing	4,972	6,835	5,012	5,034	4,854	6,716	4,890	4,853
	Option B/C	0	0	2,258	2,348	0	0	2,216	2,347
	Total	**8,246**	**10,107**	**10,537**	**10,649**	**7,903**	**9,659**	**10,047**	**10,123**
Southbound Thames Screenline	Blackwall Tunnel	3,328	3,328	3,315	3,317	2,400	2,374	2,349	2,347
	Silvertown Crossing	0	0	0	0	308	311	308	307
	Galleon's Reach	0	0	0	0	202	202	202	202
	Dartford-Thurrock Crossing	5,522	5,884	5,132	5,041	5,618	6,213	5,386	5,271
	Option B/C	0	0	1,328	1,348	0	0	1,414	1,452
	Total	**8,849**	**9,212**	**9,776**	**9,705**	**8,529**	**9,100**	**9,657**	**9,578**

Interpeak		Pessimistic				Optimistic			
		No NC	OptA	OptB	OptC	No NC	OptA	OptB	OptC
Northbound Thames Screenline	Blackwall Tunnel	3,141	3,140	3,136	3,139	2,549	2,471	2,481	2,451
	Silvertown Crossing	0	0	0	0	492	478	462	461
	Galleon's Reach	0	0	0	0	195	197	194	195
	Dartford-Thurrock Crossing	4,771	6,304	4,725	4,746	4,649	6,606	4,650	4,828
	Option B/C	0	0	1,965	2,197	0	0	1,994	2,219
	Total	**7,912**	**9,444**	**9,826**	**10,083**	**7,884**	**9,752**	**9,781**	**10,154**
Southbound Thames Screenline	Blackwall Tunnel	2,948	2,939	2,904	2,903	2,002	1,966	1,936	1,909
	Silvertown Crossing	0	0	0	0	398	396	393	392
	Galleon's Reach	0	0	0	0	199	200	200	200
	Dartford-Thurrock Crossing	5,768	6,381	5,489	5,187	5,786	6,587	5,475	5,356
	Option B/C	0	0	1,683	2,015	0	0	1,813	2,105
	Total	**8,716**	**9,320**	**10,076**	**10,105**	**8,385**	**9,149**	**9,817**	**9,963**

PM Peak		Pessimistic				Optimistic			
		No NC	OptA	OptB	OptC	No NC	OptA	OptB	OptC
Northbound Thames Screenline	Blackwall Tunnel	3,377	3,379	3,378	3,379	2,640	2,629	2,641	2,632
	Silvertown Crossing	0	0	0	0	819	830	820	828
	Galleon's Reach	0	0	0	0	195	196	194	194
	Dartford-Thurrock Crossing	5,199	6,941	5,206	5,325	5,141	7,186	5,165	5,279
	Option B/C	0	0	2,347	2,393	0	0	2,172	2,324
	Total	**8,575**	**10,320**	**10,931**	**11,097**	**8,796**	**10,840**	**10,991**	**11,257**
Southbound Thames Screenline	Blackwall Tunnel	2,904	2,908	2,864	2,863	2,045	2,043	1,997	1,997
	Silvertown Crossing	0	0	0	0	234	234	229	230
	Galleon's Reach	0	0	0	0	194	192	186	187
	Dartford-Thurrock Crossing	6,024	6,310	5,177	4,920	5,929	6,233	5,072	4,996
	Option B/C	0	0	2,036	2,322	0	0	2,058	2,195
	Total	**8,927**	**9,219**	**10,077**	**10,105**	**8,402**	**8,702**	**9,541**	**9,606**

Appendix D: Traffic Flow Change Plots

Figure D.1: Option A, 2025, AM Peak, Vehicle Flow Change From No New Crossing Scenario

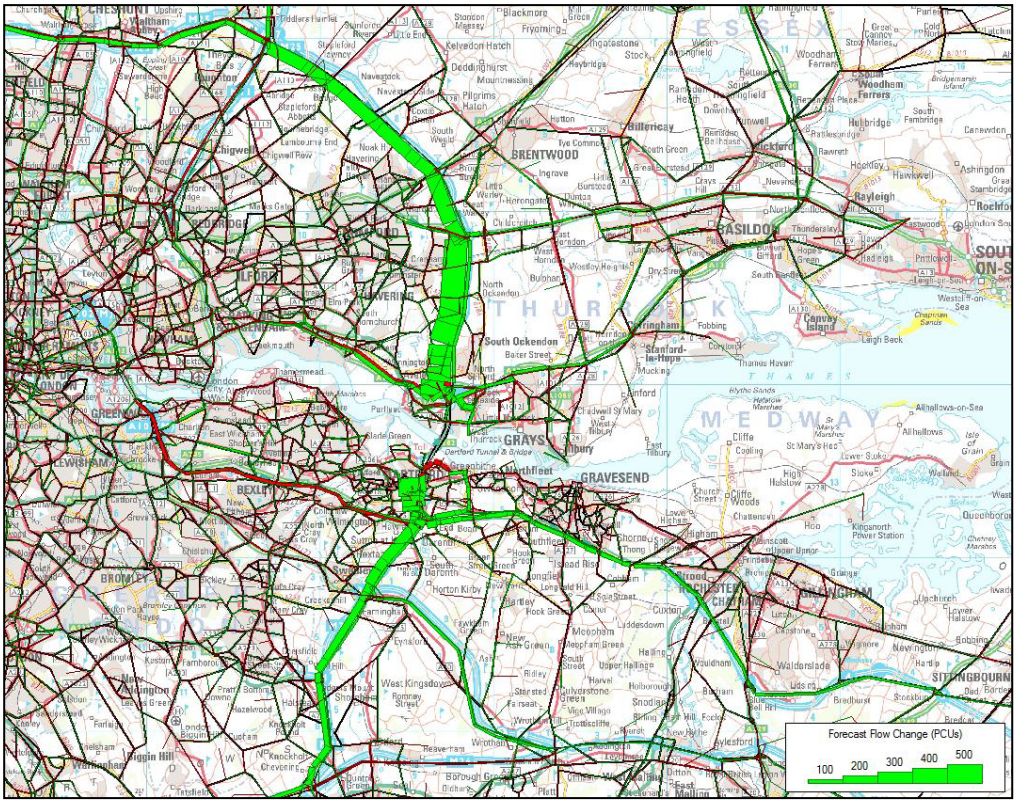
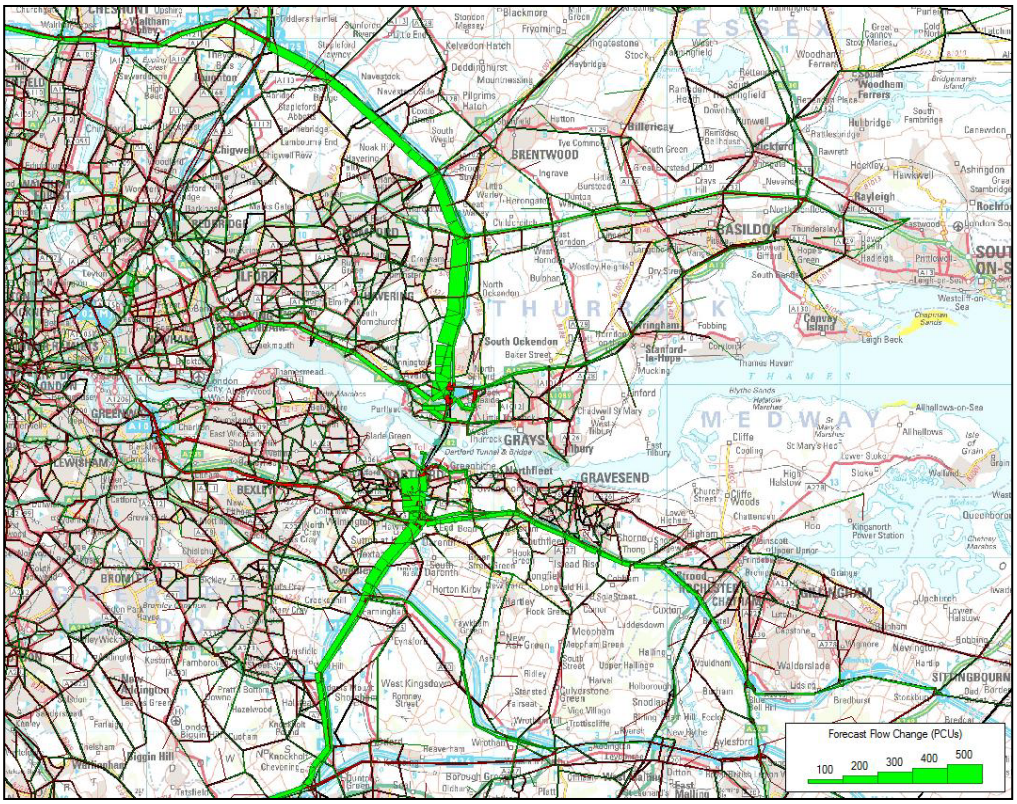


Figure D.2: Option A, 2025, Interpeak, Vehicle Flow Change From No New Crossing Scenario



Capabilities on project:
Error! Reference source not found.

Figure D.3: Option A, 2025, PM Peak, Vehicle Flow Change From No New Crossing Scenario

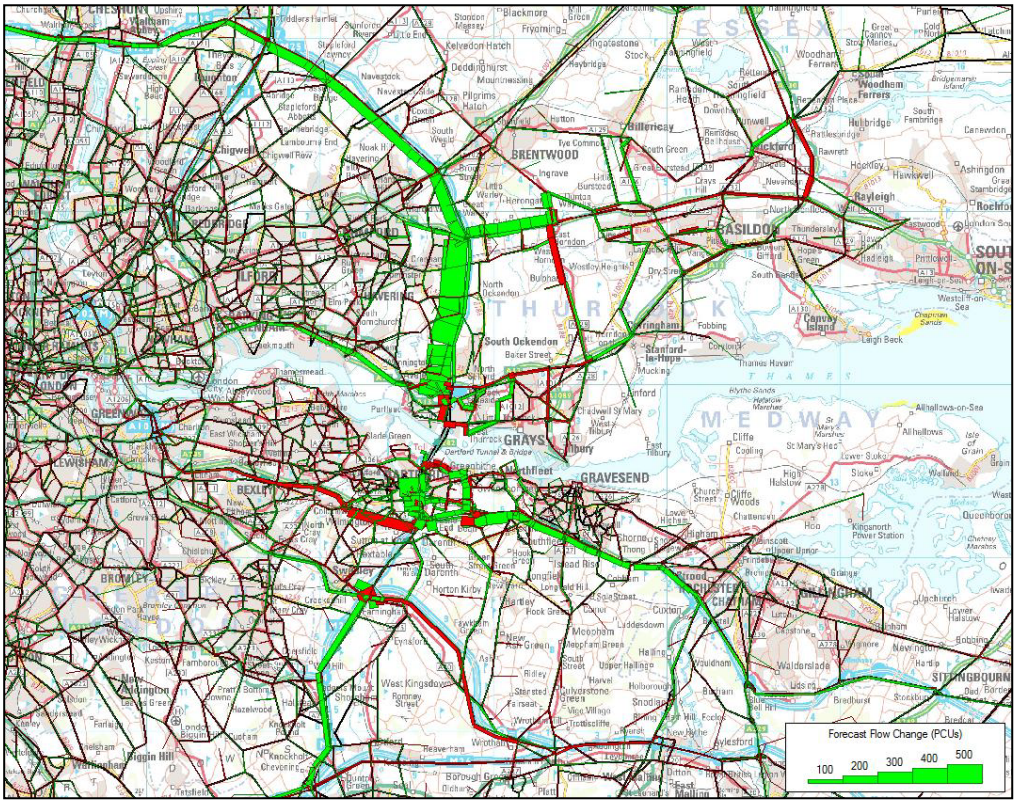
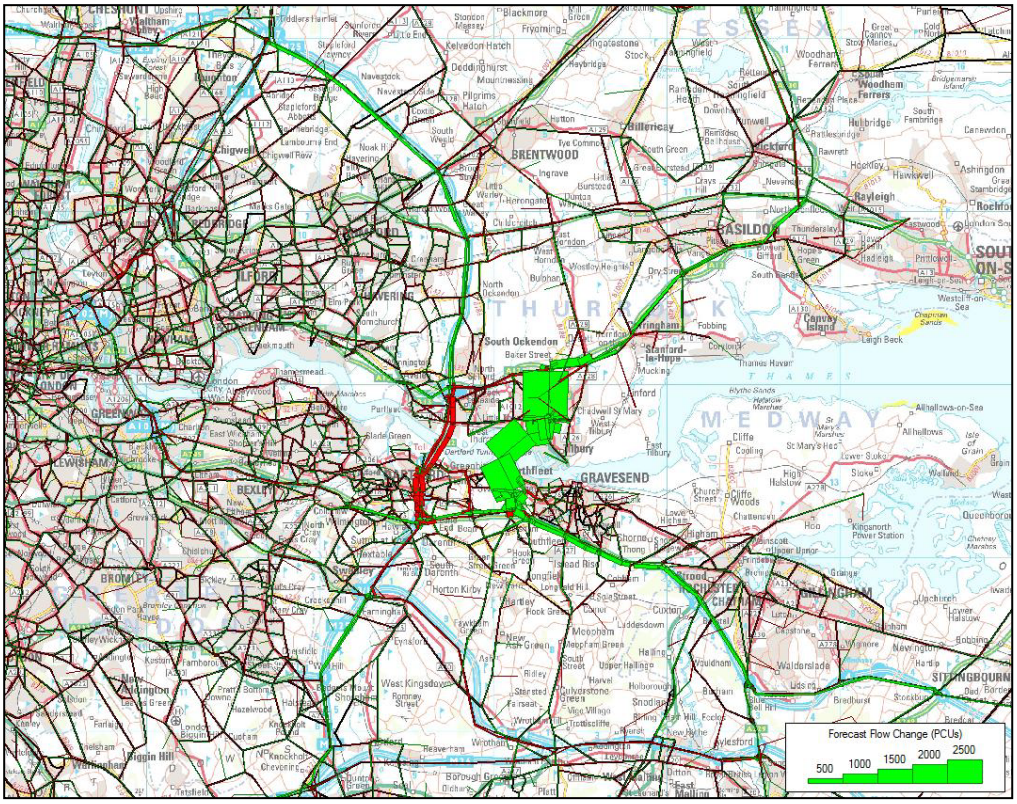


Figure D.4: Option B, 2025, AM Peak, Vehicle Flow Change From No New Crossing Scenario



Capabilities on project:
Error! Reference source not found.

Figure D.5: Option B, 2025, Interpeak, Vehicle Flow Change From No New Crossing Scenario

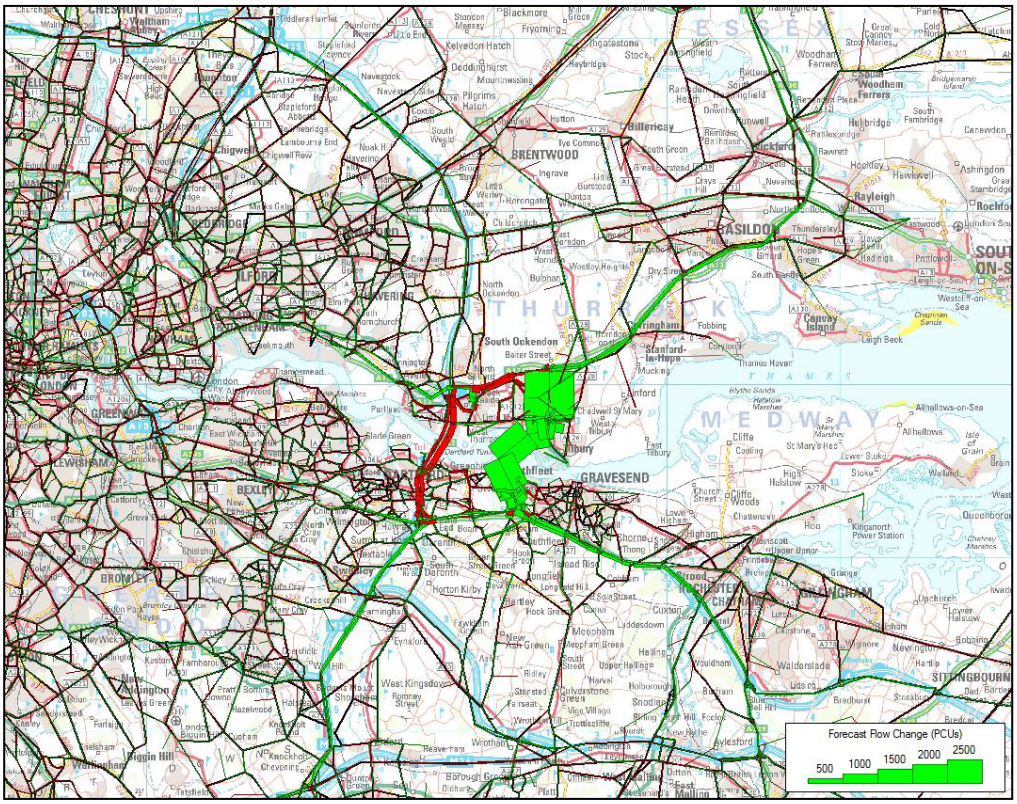
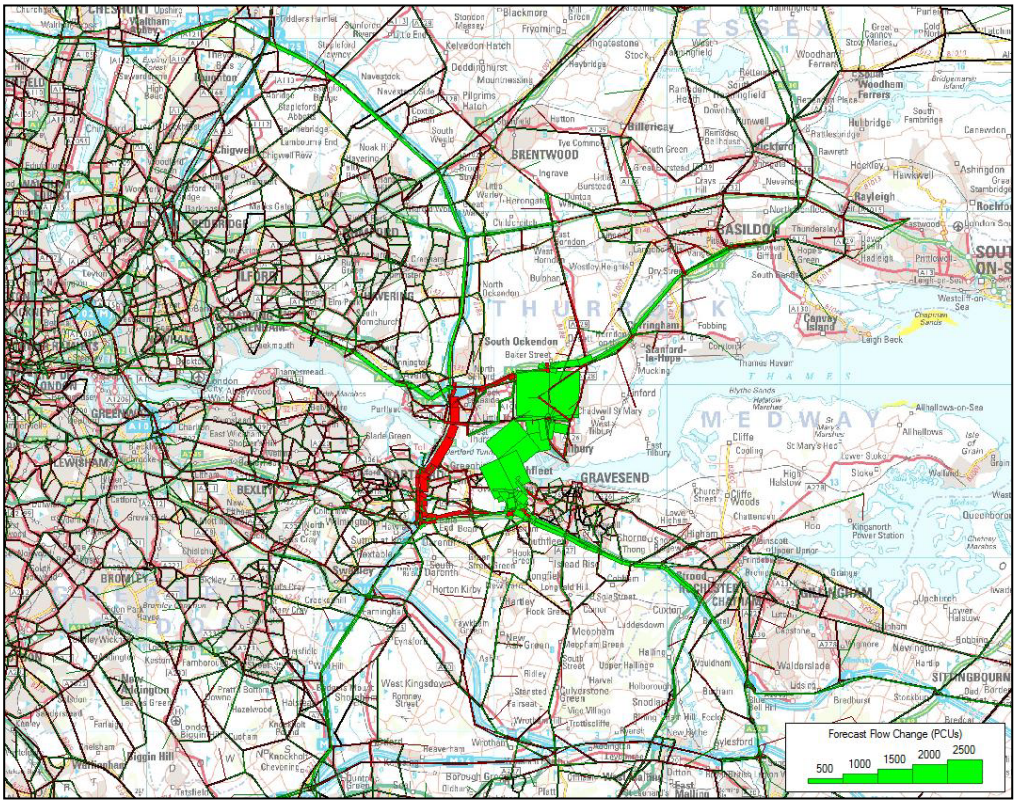


Figure D.6: Option B, 2025, PM Peak, Vehicle Flow Change From No New Crossing Scenario



Capabilities on project:
Error! Reference source not found.

Figure D.7: Option C, 2025, AM Peak, Vehicle Flow Change From No New Crossing Scenario

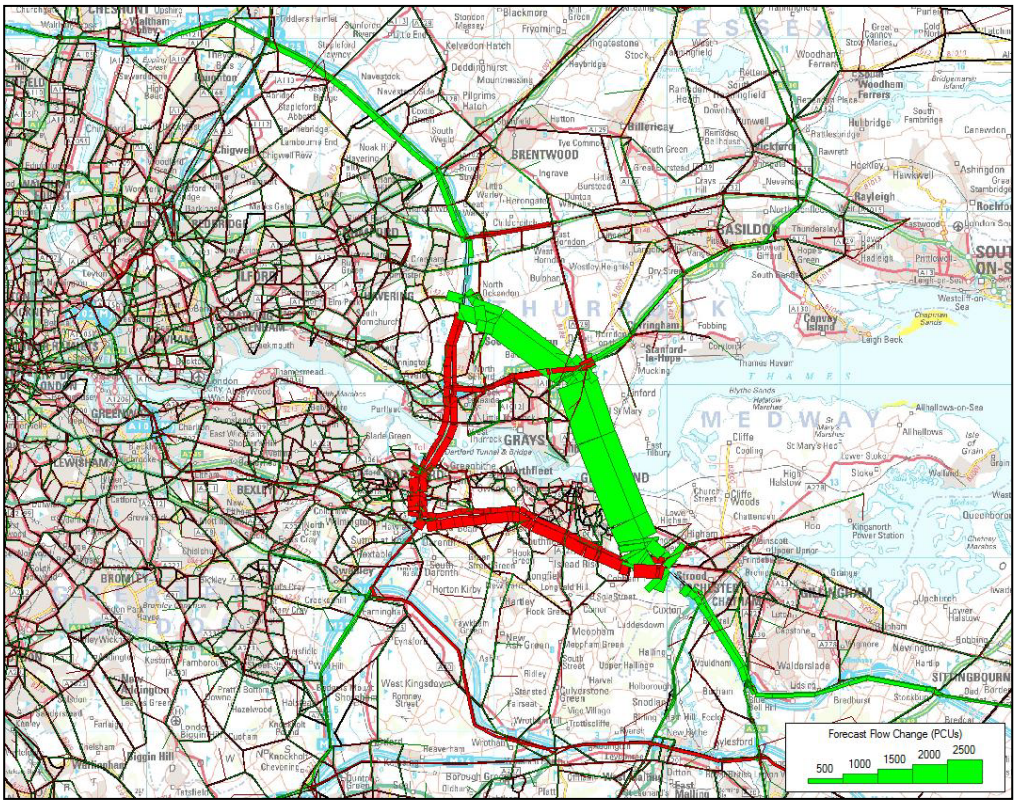
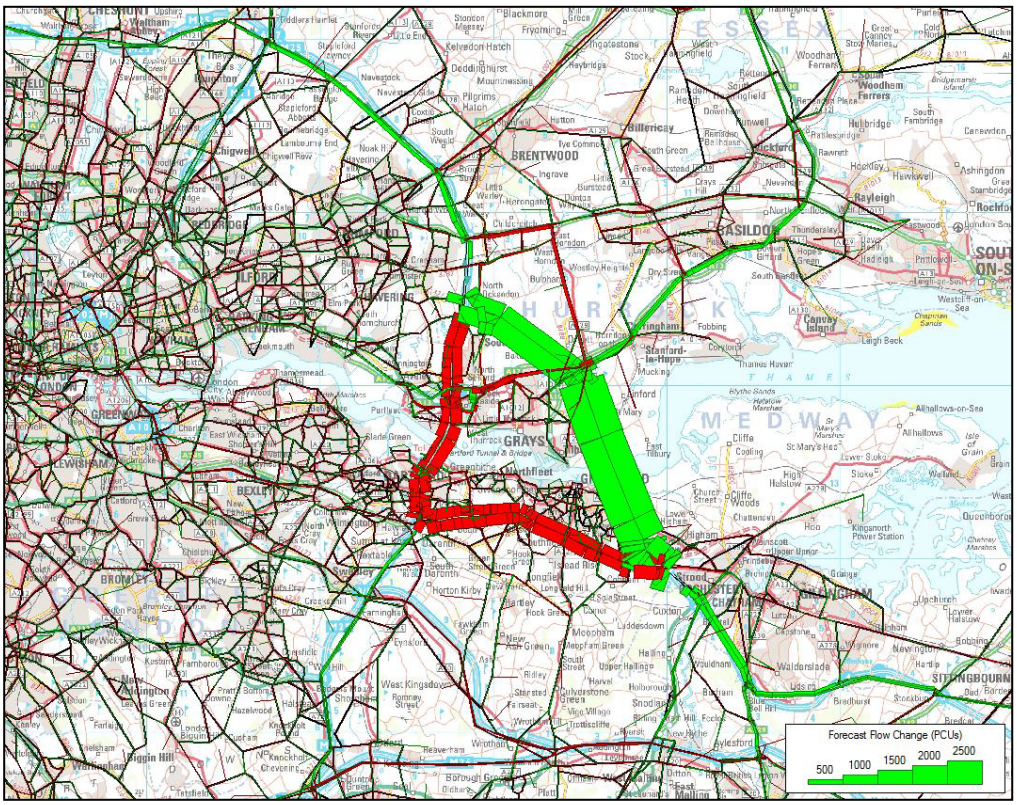


Figure D.8: Option C, 2025, Interpeak, Vehicle Flow Change From No New Crossing Scenario



Capabilities on project:
Error! Reference source not found.

Figure D.9: Option C, 2025, PM Peak, Vehicle Flow Change From No New Crossing Scenario

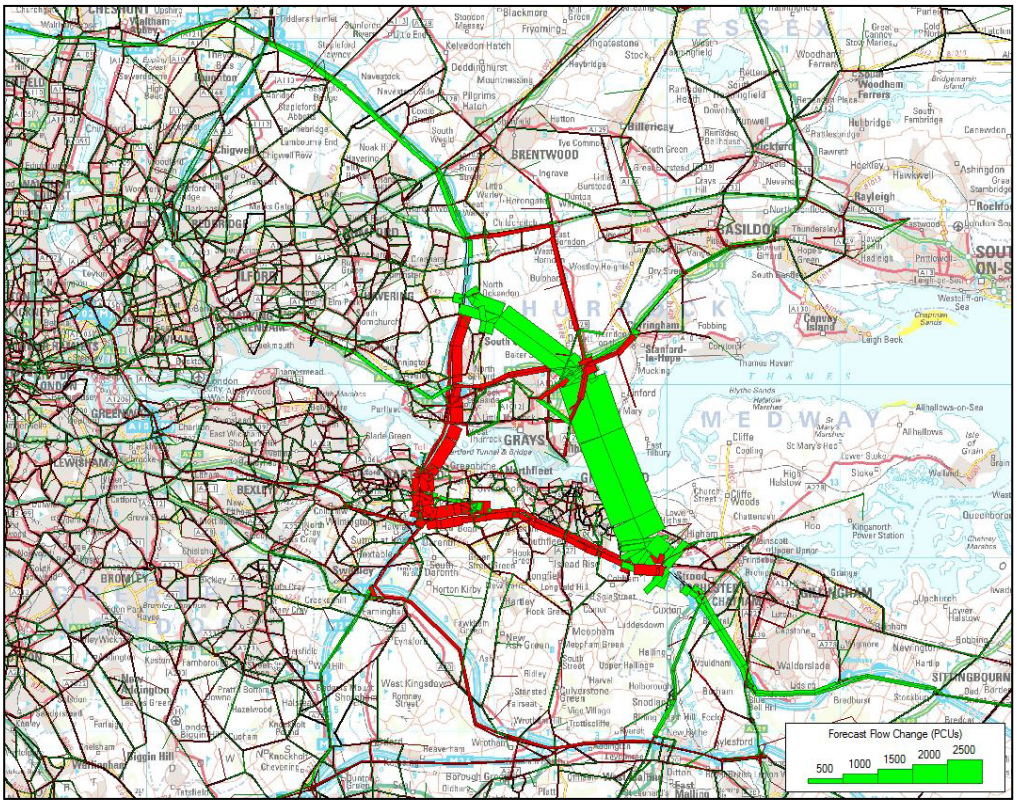
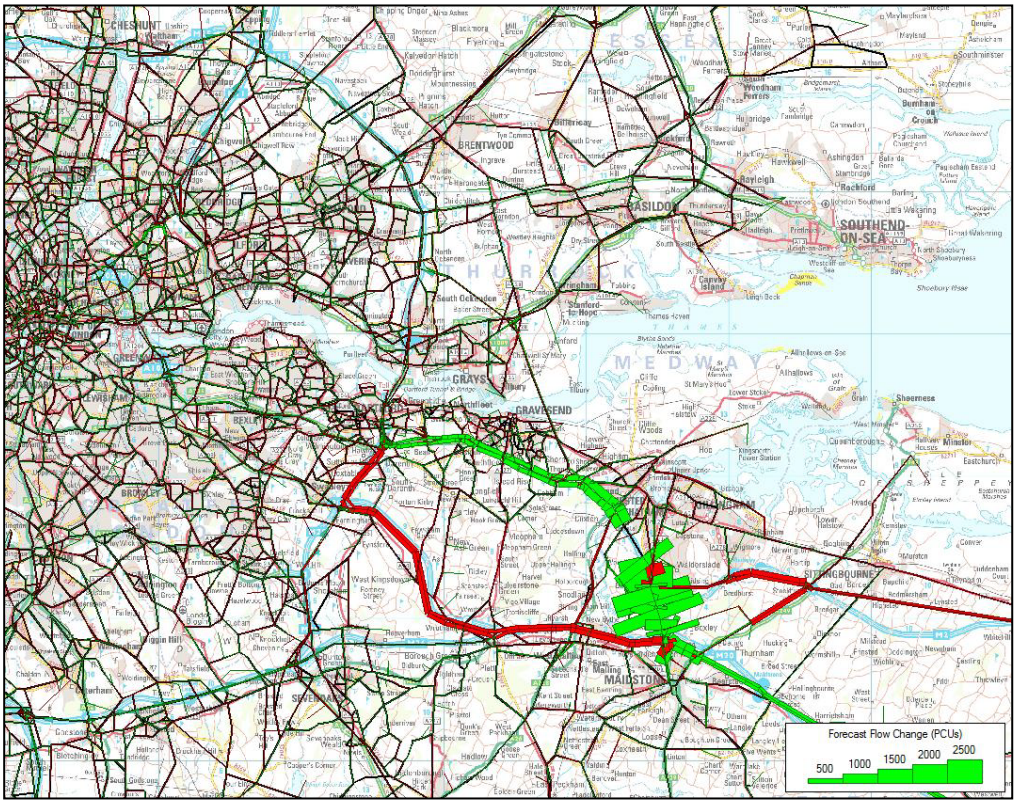


Figure D.10: Option $C_{variant}$, 2025, AM Peak, Vehicle Flow Change From Option C Scenario



Capabilities on project:
Error! Reference source not found.

Figure D.11: Option $C_{variant}$, 2025, Interpeak, Vehicle Flow Change From Option C Scenario

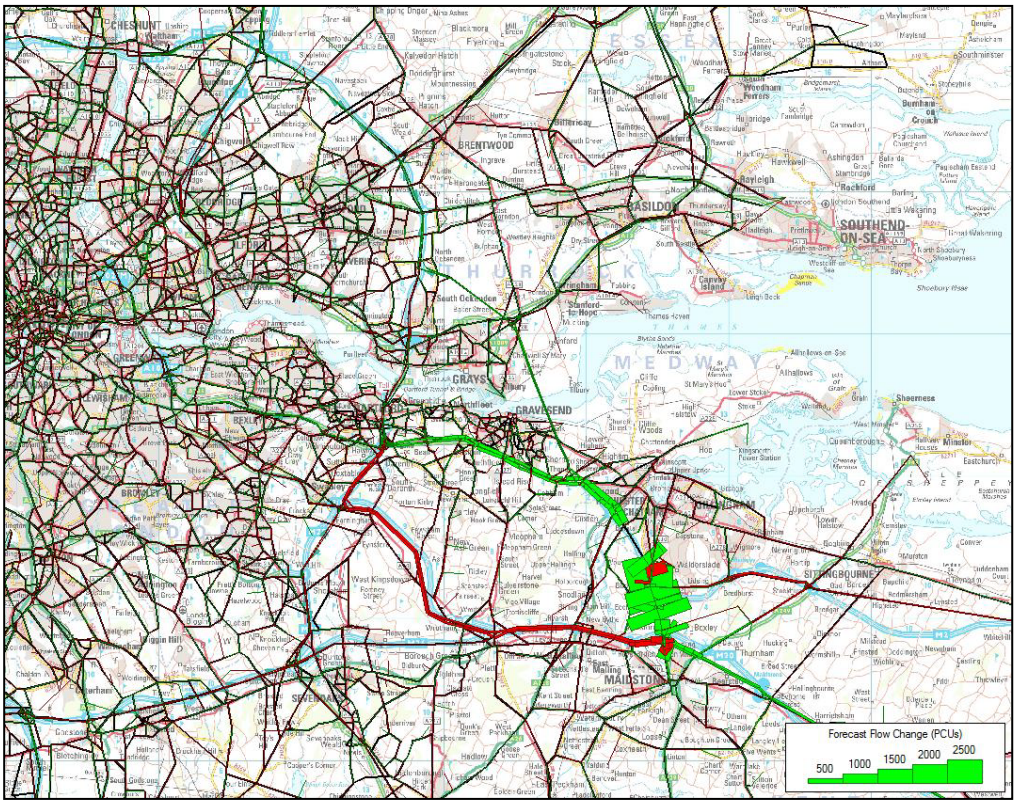
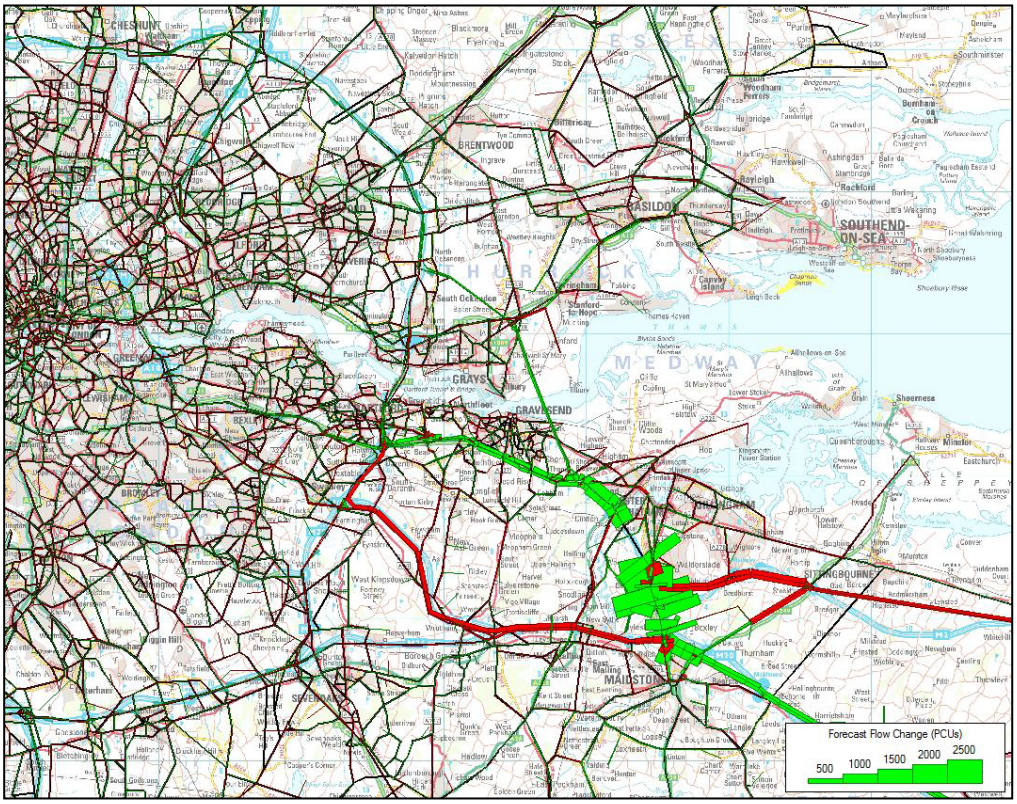


Figure D.12: Option $C_{variant}$, 2025, PM Peak, Vehicle Flow Change From Option C Scenario



Capabilities on project:
Error! Reference source not found.

Figure D.13: Option A, 2041, AM Peak, Vehicle Flow Change From No New Crossing Scenario

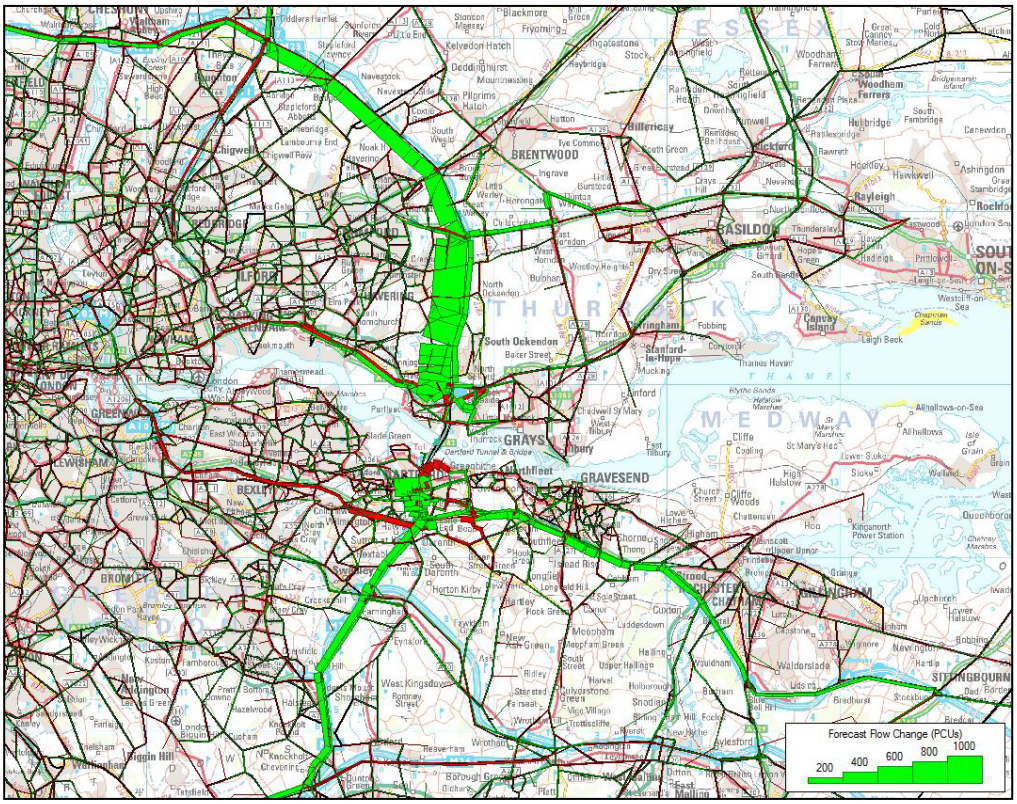
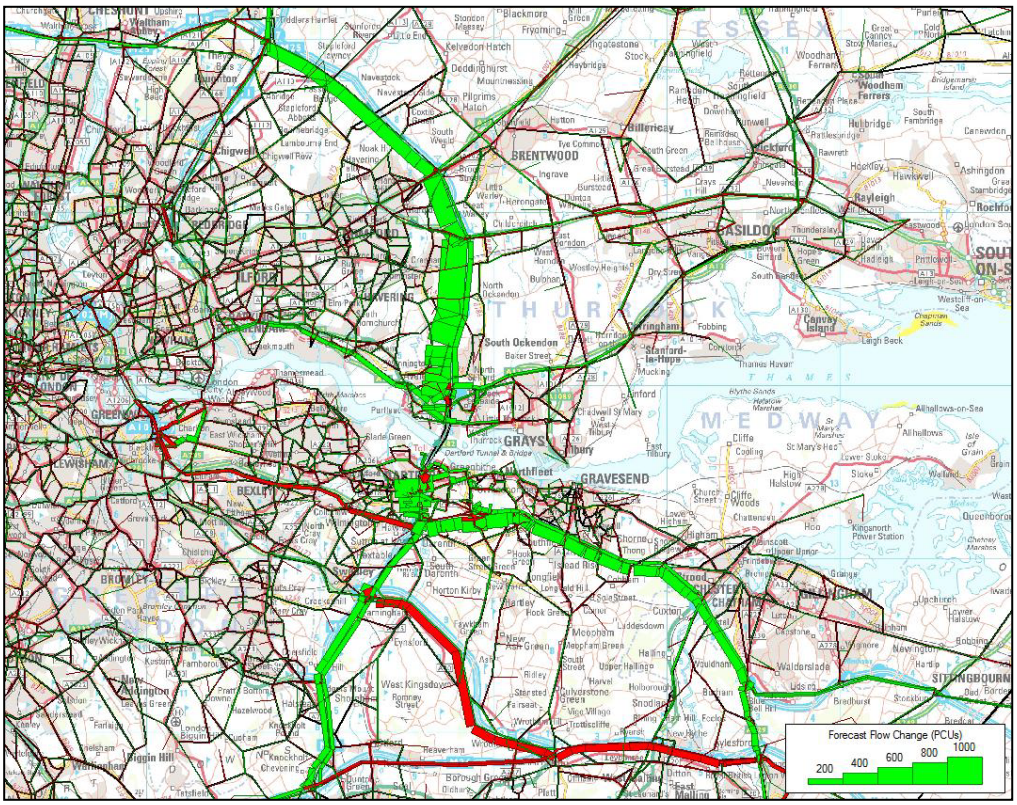


Figure D.14: Option A, 2041, Interpeak, Vehicle Flow Change From No New Crossing Scenario



Capabilities on project:
Error! Reference source not found.

Figure D.15: Option A, 2041, PM Peak, Vehicle Flow Change From No New Crossing Scenario

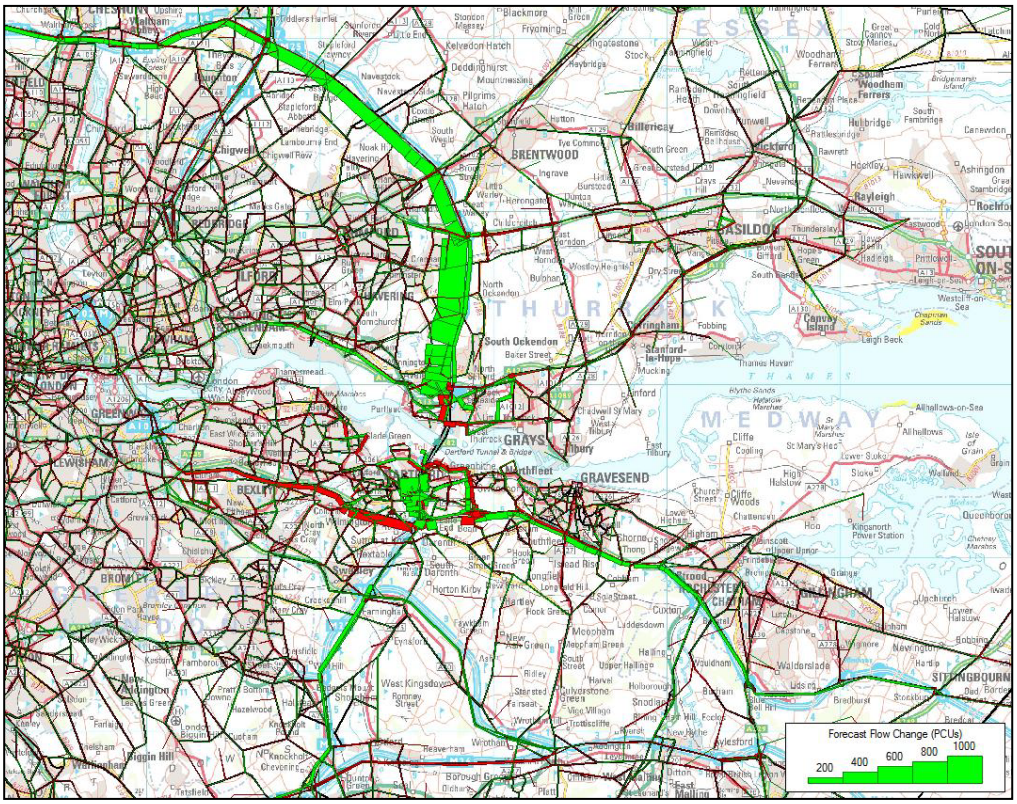
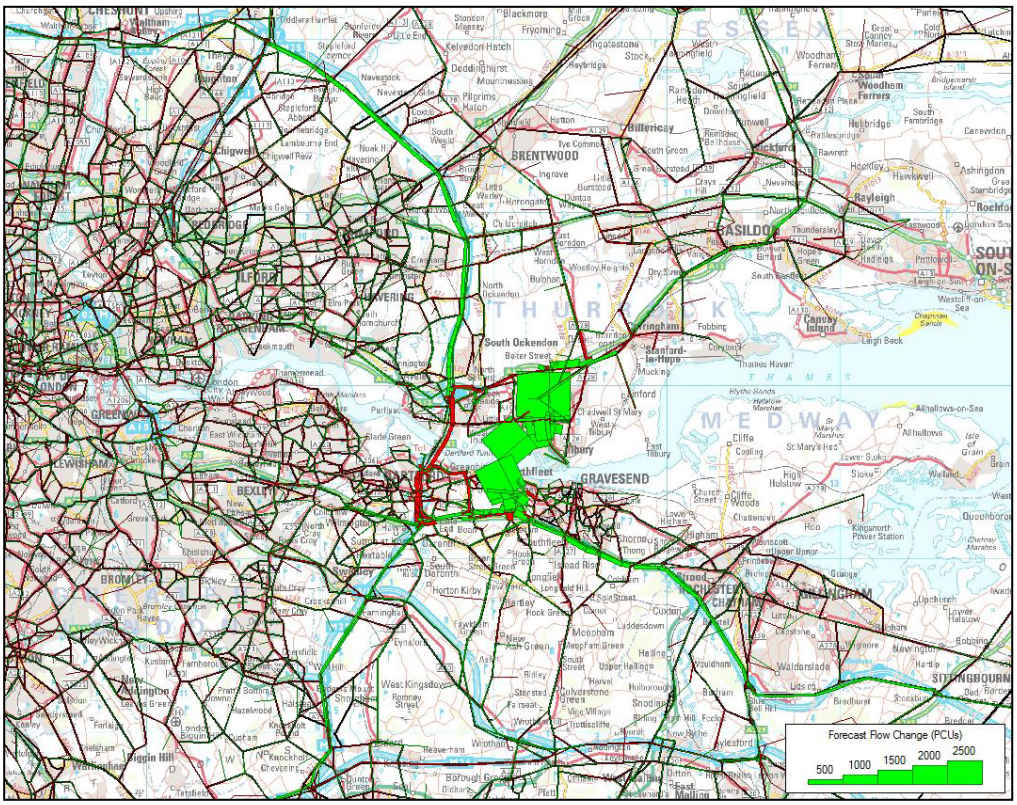


Figure D.16: Option B, 2041, AM Peak, Vehicle Flow Change From No New Crossing Scenario



Capabilities on project:
Error! Reference source not found.

Figure D.17: Option B, 2041, Interpeak, Vehicle Flow Change From No New Crossing Scenario

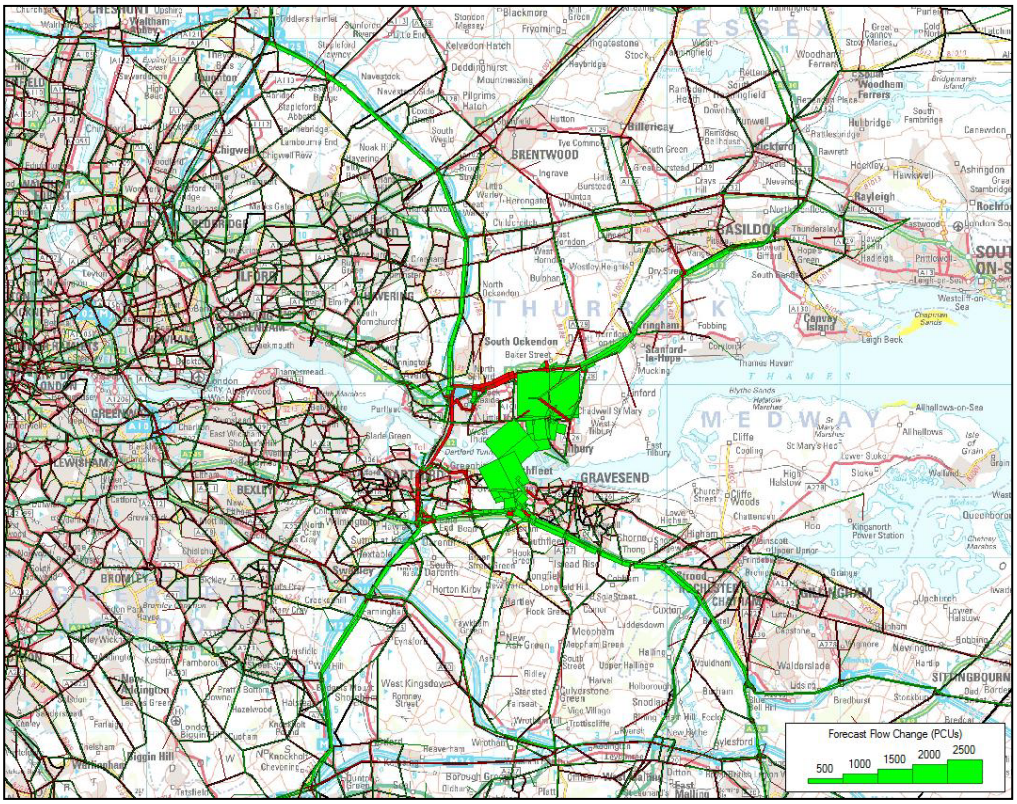
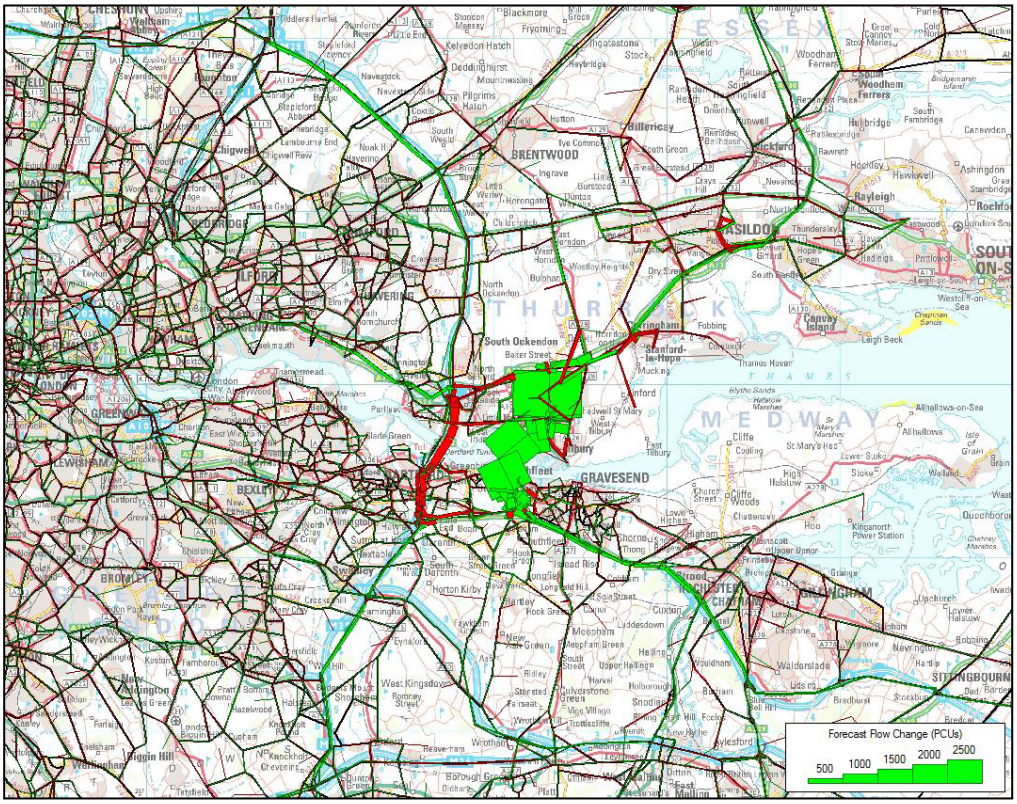


Figure D.18: Option B, 2041, PM Peak, Vehicle Flow Change From No New Crossing Scenario



Capabilities on project:
Error! Reference source not found.

Figure D.19: Option C, 2041, AM Peak, Vehicle Flow Change From No New Crossing Scenario

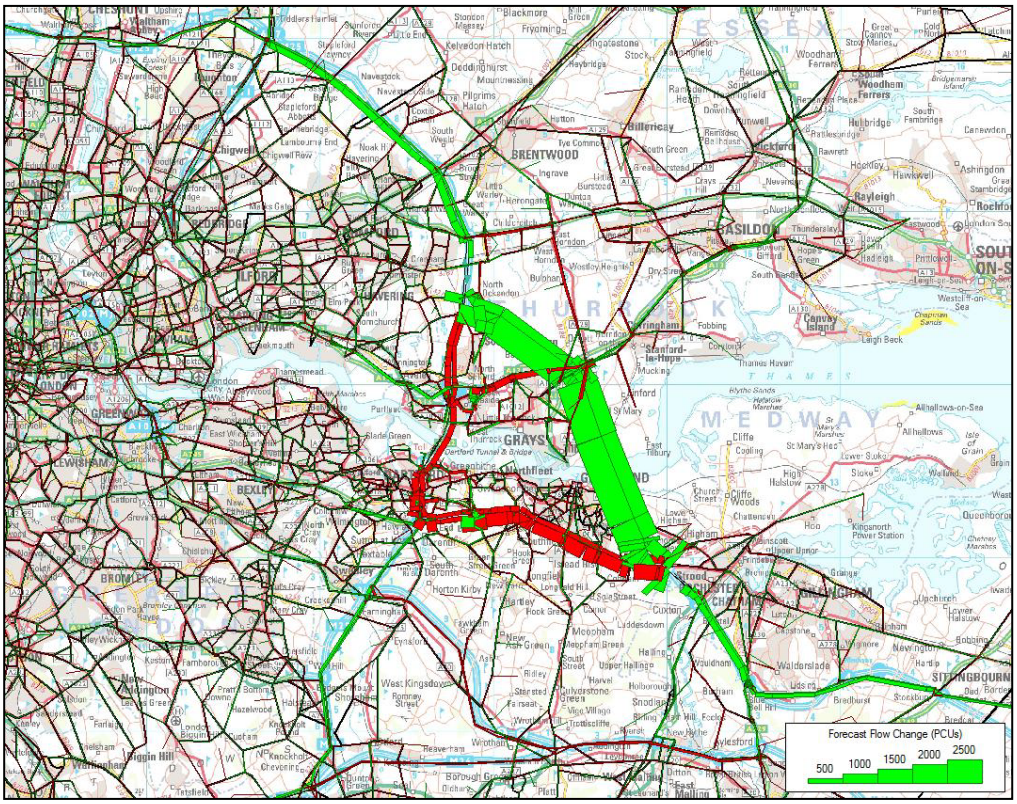
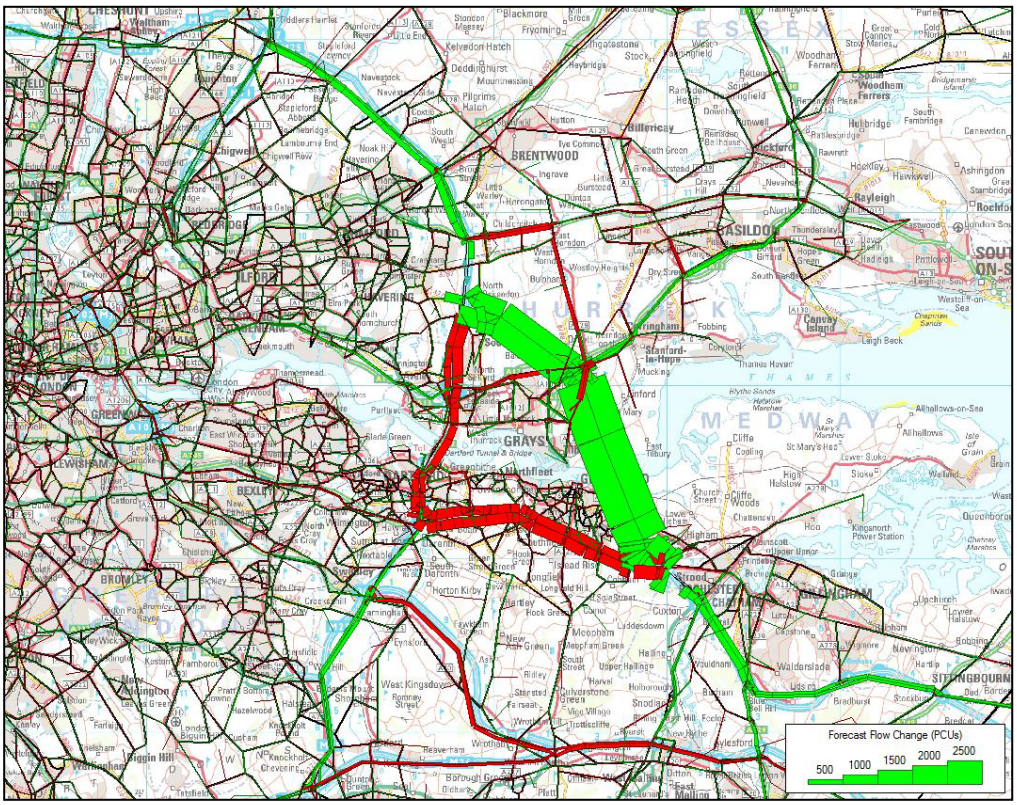


Figure D.20: Option C, 2041, Interpeak, Vehicle Flow Change From No New Crossing Scenario



Capabilities on project:
Error! Reference source not found.

Figure D.21: Option C, 2041, PM Peak, Vehicle Flow Change From No New Crossing Scenario

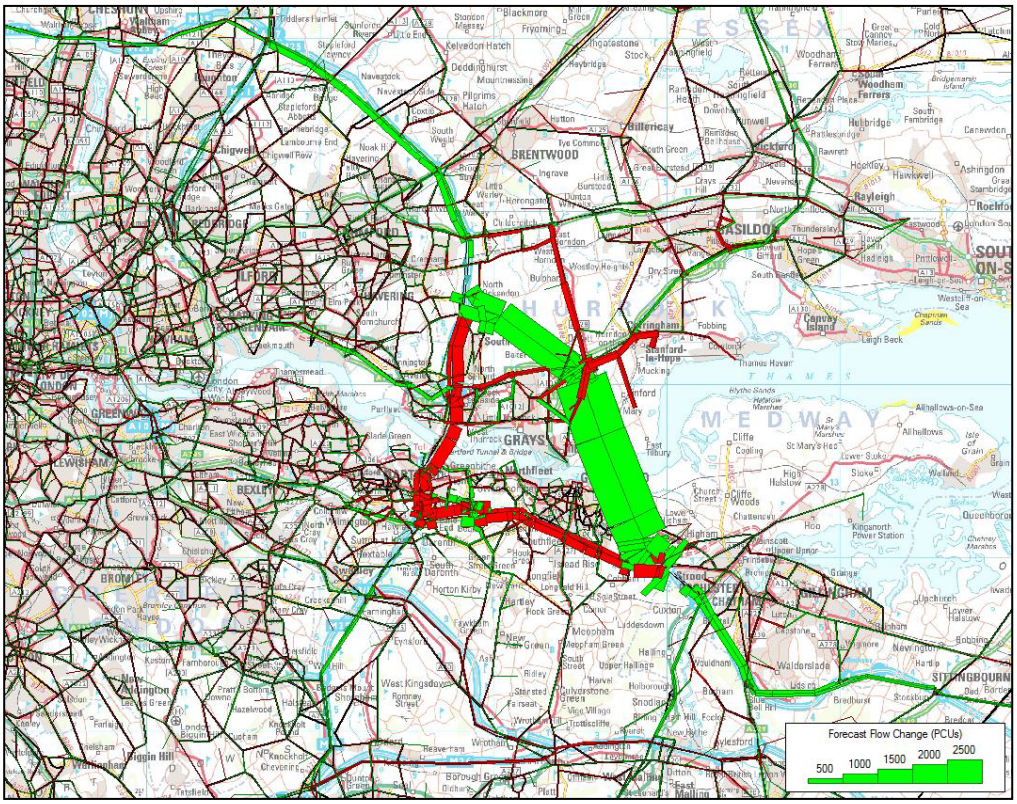
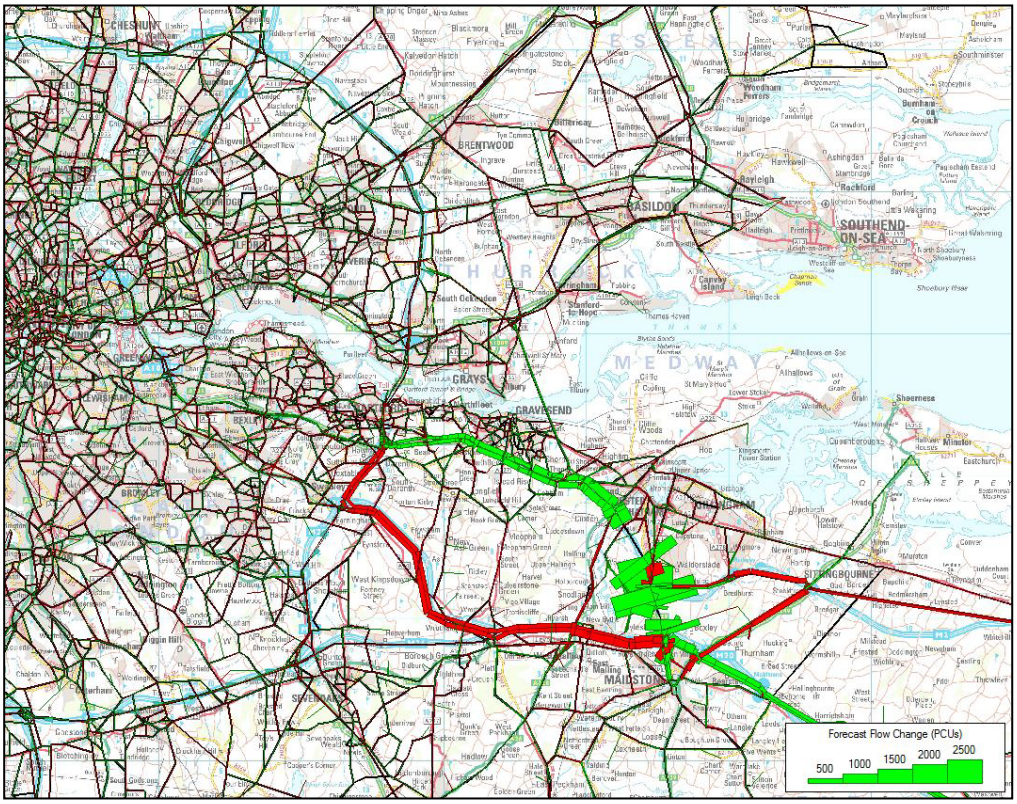


Figure D.22: Option $C_{variant}$, 2041, AM Peak, Vehicle Flow Change From Option C Scenario



Capabilities on project:
Error! Reference source not found.

Figure D.23: Option $C_{variant}$, 2041, Interpeak, Vehicle Flow Change From Option C Scenario

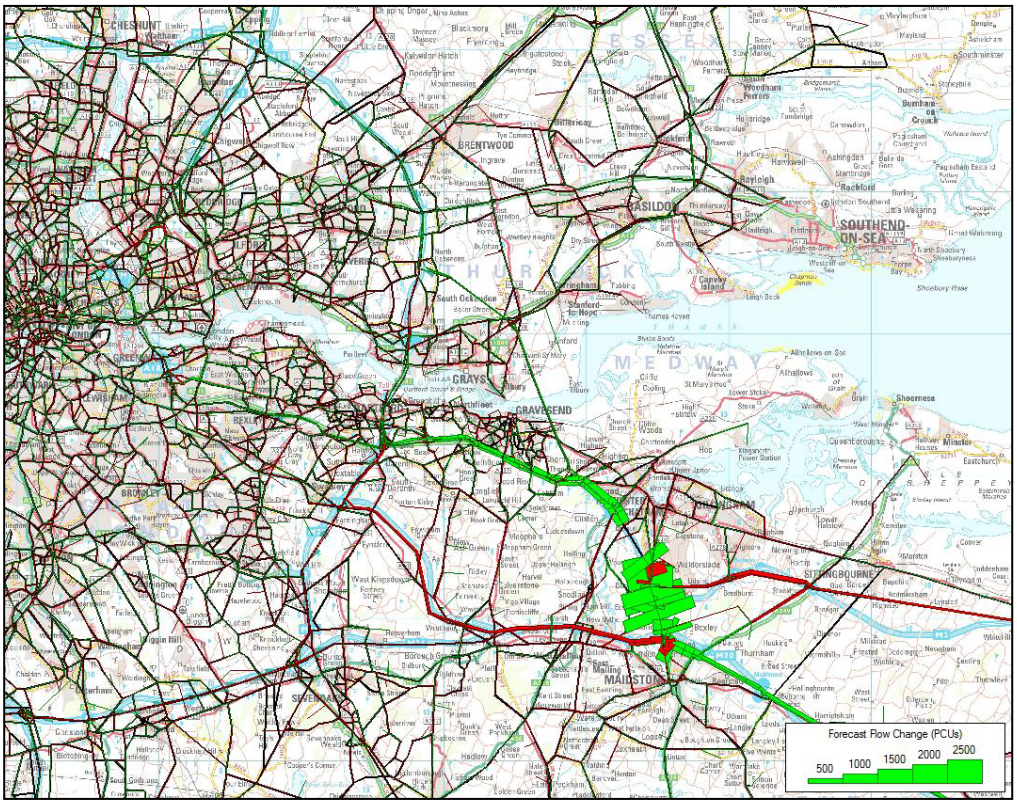


Figure D.24: Option $C_{variant}$, 2041, PM Peak, Vehicle Flow Change From Option C Scenario