




Review of Lower Thames Crossing Capacity Options: Appraisal Methodology Report



Prepared by: 
 Ian Burrows
 Associate Director

Approved by: 
 Paul Hanson
 Regional Director

Checked by: 
 Paul Hanson
 Regional Director

Review of Lower Thames Crossing Capacity Options: Appraisal Methodology Report

Rev No	Comments	Checked by	Approved by	Date
1	Draft version for client comment	PH	PH	19 April 12
2	Updated draft reflecting workshop discussion	MD	PH	16 May 12
3	Updated reflecting DfT Comments	IB	PH	1 June 12
4	Revised version reflecting DfT comments of 18 June 2012	IB	PH	18 June 12

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

Job No Reference Date Created April 2012

This document has been prepared by AECOM Limited for the sole use of our client (the "Client") and in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM Limited and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM Limited, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM Limited.

Although this report was commissioned by the Department for Transport (DfT), the findings and recommendations are those of the authors and do not necessarily represent the views of the DfT. The information or guidance in this document (including third party information, products and services), is provided by DfT on an 'as is' basis, without any representation or endorsement made and without warranty of any kind whether express or implied.

Table of Contents

1	Introduction	2
1.1	Background	2
1.2	Report Objectives	2
1.3	Overview.....	3
2	Economic Appraisal.....	7
2.1	Transport Users and Providers	7
2.2	Reliability	13
2.3	Regeneration	13
2.4	Wider Impacts.....	14
3	Environmental Appraisal	19
3.1	Introduction.....	19
3.2	Noise	19
3.3	Air Quality	20
3.4	Greenhouse Gases.....	21
3.5	Landscape / Townscape.....	21
3.6	Heritage or Historic Resources	21
3.7	Biodiversity	22
3.8	Water Environment.....	22
4	Social.....	25
4.1	Introduction.....	25
4.2	Physical Activity.....	25
4.3	Journey Quality.....	25
4.4	Accidents	26
4.5	Security.....	26
4.6	Access to Services	26
4.7	Affordability.....	27
4.8	Severance	27
4.9	Option Values	28
5	SDI Impacts.....	30
5.1	Step 0: Initial Screening.....	30
5.2	Step 1: Confirm Areas Impacted.....	30
5.3	Step 2: Identification of Social Groups Affected.....	31
5.4	Step 3-5: Screening and Appraisal of SDIs	31
	Table 1: Schedule of Appraisal Metrics	3
	Figure 1: Demand Model Segmentation	11

1 Introduction

Capabilities on project:
Transportation

1 Introduction

1.1 Background

- 1.1.1 The first Dartford Thurrock River crossing, the A282, was first provided by a single tunnel which opened in 1963. In line with growth in demand, a second bore was completed 1980 and the Queen Elizabeth II bridge opened in 1991.
- 1.1.2 Notwithstanding the congestion charge, currently, the crossing suffers from significant congestion. The Dartford River Crossing Study (April 2009)¹ sets out the implication of these constraints and proposed both short term measures to address capacity constraints related, in particular, to the toll plazas and proposed three options to provide additional crossing capacity in the longer term.
- 1.1.3 In the 20 October 2010 Comprehensive Spending Review announcement, the DfT committed both to short and medium term measures to address congestion as well as to review the longer term capacity options.
- 1.1.4 The purpose of this study is to develop to review the longer term capacity options.
- 1.1.5 The study aim is to provide strategic outline business cases for the potential locations identified by the Dartford River Crossing Study for additional river crossing highway capacity in the Lower Thames area, and a comparison between four provisionally defined options and the Do Minimum option.

1.2 Report Objectives

- 1.2.1 The study is structured to provide a number of outputs:
 - Output 1 provides the transport model that will be used to forecast the impacts of the new crossing;
 - Output 2 comprises a high level design of the strategy options;
 - Output 3 comprises transport model forecasts using these outline design concepts;
 - Output 4 then sets out the results of appraising the strategic options; and
 - Outputs 5 and 6, respectively, bring together a business case for individual strategy options and provide a final report of the review.
- 1.2.2 The purpose of this document is to set out the appraisal methodology, defining how the performance of the strategy options will be measured and the proportionate methods that will be applied to develop the evidence. The document explains the application of the Department for Transport's appraisal guidance (WebTAG) and describes the scope of analysis that will be undertaken in appraising the options and reported in Output 4. It has been prepared in Output 1 to assist verification of the transport model requirements and of the scope of highway design.
- 1.2.3 Reflecting the project timeline, this document will be supplemented by additional documents that describe the assumptions and the scope of appraisal:
 - a specification of forecasting / appraisal assumptions that will be defined in task 3.1;
 - a specification of the transport model, its operation and segmentation (Output 1 report);
 - the estimation of construction costs for the new crossing strategy options (Output 2); and

¹ Dartford River Crossing Study into Capacity Requirement (April 2009), prepared by Parsons Brinckerhoff for DfT. Available at:

<http://webarchive.nationalarchives.gov.uk/+http://www.dft.gov.uk/about/strategy/capacityrequirements/dartfordrivercrossing/>

Capabilities on project:
Transportation

- estimation of operating cost estimates for a new crossing strategy (Output 3).

1.3 Overview

- 1.3.1 The objective of the appraisal process is to provide the evidence base which will support the subsequent application of the 5 case business model to judge the performance of LTC options. This involves the application of the WebTAG appraisal processes.
- 1.3.2 The evidence base is intended to inform strategy decisions rather than detailed design. The intent, therefore, will be to focus on the appraisal metrics that are expected to be of greatest significance in forming a view on strategy, and to limit the scope of analysis on other aspects to provide qualitative indicators that allow for consideration of the full range of impacts, without incurring undue cost at this stage.
- 1.3.3 The following sections of this report are structured to describe the methods and assumptions that will be applied to establish the performance metrics:
- appraisal of economic performance metrics are first described in Chapter 2;
 - environmental appraisal methods are next described in Chapter 3;
 - social appraisal methods are then discussed in Chapter 4; and
 - the screening and approach to appraising Social and Demographic Impacts is described in Chapter 5.
- 1.3.4 There are complimentary considerations of project delivery risks that will be identified as part of the outline design work that provides Output 2.
- 1.3.5 Table 1 provides a summary of the performance metrics that will be assessed. Table 1 briefly summarises the analysis method and references the remaining sections of this report that explain the methods and assumptions in more detail. The subsequent sections describe the proportionate approach that we will adopt, focussing on impacts that are most likely to be influential in considering the strategy and explaining where more detailed appraisal will be appropriate in potential subsequent detailed scheme design.

Table 1: Schedule of Appraisal Metrics

	Impact	Method	Section
Economy	Business users and transport providers	Application of TUBA ² to M25 Model forecasts, Drawing on relevant cost and revenue estimates	2.1
	Reliability Impact on Business Users	Stress based qualitative assessment, together with interpretation of network management options.	2.2
	Regeneration	Qualitative assessment of accessibility indicators	2.3
	Wider Impacts	Econometric analysis and projection of impacts of accessibility changes	2.4

² Transport User Benefit Appraisal (TUBA) is transport economic appraisal software used by DfT

Capabilities on project:
Transportation

	Impact	Method	Section
Environment	Noise	Estimation of traffic noise using traffic forecasts to estimate changes in population likely to be annoyed by noise.	3.2
	Air Quality	Assessment of changes in emissions arising from traffic forecasts	3.3
	Greenhouse Gases	Interpretation of TUBA carbon outputs	3.4
	Landscape / Townscape	Qualitative review impact and significance of new infrastructure	3.4
	Heritage of Historic resources	Qualitative assessment of impact on known archaeological remains and on historic sites, and potential implications for unrecorded archaeological remains	3.6
	Biodiversity	Qualitative scoring of impacts of options against biodiversity features	3.7
	Water Environment	Qualitative assessment of flood risk and of surface and ground water receptors along new alignments for the options.	3.8
Social	Commuting and Other users	Application of TUBA to M25 Model forecasts, Drawing on relevant cost and revenue estimates	2.1
	Reliability impact on Commuting and Other users	Stress based qualitative assessment, together with interpretation of network management options.	2.2
	Physical activity	Qualitative consideration as strategy options are not expected to have material physical impact.	4.2
	Journey quality	Impact anticipated to be neutral. Qualitative assessment to be undertaken.	4.3
	Accidents	A spreadsheet based approach using COBA accident rates, along with local incident rates.	4.4
	Security	Impact on security likely to be neutral. Qualitative assessment to be undertaken	4.5
	Access to services	Impact on public transport accessibility to be neutral, along with SDIs	4.6
	Affordability	Personal affordability to be determined from TUBA assessment of travel costs	4.7

Capabilities on project:
Transportation

	Impact	Method	Section
	Severance	Qualitative review of severance	4.8
	Option values	Impacts likely to be neutral. Qualitative assessment.	4.9
Public Accounts	Cost to Broad Transport Budget	Application of TUBA to M25 Model forecasts, drawing on relevant cost and revenue estimates	2.1
	Indirect Tax Revenues	Application of TUBA to M25 Model forecasts, drawing on relevant cost and revenue estimates	2.1

2 Economic Appraisal

Capabilities on project:
Transportation

2 Economic Appraisal

2.1 Transport Users and Providers

- 2.1.1 Our approach will be based on WebTAG units 3.5.1 to 3.5.4. Transport user benefits will be calculated from M25 Model outputs using TUBA. Operator revenues will be estimated using modelled traffic flows and toll assumptions. Capital costs estimates will be subject to risk assessment.
- 2.1.2 Guidance will be applied in adopting value of time and discounting assumptions to interpolate and extrapolate from the model forecasts. Similarly Highways Agency guidance on real cost inflation will be applied. The following paragraphs comment on specific aspects and assumptions, explaining the approach we will take in respect of developing specific assumptions or addressing issues that may emerge during the course of the work. As explained in Chapter 1, detailed assumptions will be set out in separate documents.

Procurement Method

- 2.1.3 The procurement method is yet to be determined but the Department for Transport has indicated that it is expecting some form of private sector involvement or even private sector funding for the crossing. This will be relevant in terms of the interpretation of costs and (toll) revenue streams, and the discount rate or rate of return that would be expected.
- 2.1.4 We would, however, propose that the strategic decision of where additional capacity should be located should be founded on the basis that the project would be funded as a conventional public sector project. This will provide a principled and consistent basis to assess the economic impacts and effects on public accounts of the alternative options.
- 2.1.5 In addition, the revenue and cost data will be available on an annual, as well as discounted Net Present Value (NPV) basis for consideration in the commercial case, and a secondary decision can be made, if appropriate at this stage, on the merits of private and public procurement alternatives.

Transport Model Noise / Convergence

- 2.1.6 Reflecting the national geographic coverage of the M25 Model, the previous assessment of Option A³, applied a masking process to exclude movements that are represented in the model but would not reasonably be expected to be affected by the provision of additional capacity at Dartford, such as for a journey between Cambridge and York. Model outputs related to such movements were deemed to be within the convergence noise of the model.
- 2.1.7 The effect of this masking was to reduce the estimated user benefits by 4%. Given the length of these masked trips and the comparatively small magnitude in estimated impacts, the masking had a material effect on the estimated indirect tax revenues, where the sign changed between total and masked outputs. Nevertheless, the absolute value of these tax revenue changes was less than 2% of estimated benefits. On the basis of the analysis then undertaken, the risks and uncertainties from model noise may be of consideration for the estimate of impacts on public accounts, but would be unlikely to be material in terms of estimating user benefits.
- 2.1.8 The focus of enhancements we are proposing to the model relate to its performance in the vicinity of the existing crossing, the representation of the A2 and A13 corridors to the east of the existing crossing and in the representation of choices for different tolling strategies. No improvements are proposed, for the reasons set out in the model review, to address model convergence in the external area. It will be the case, therefore, that a similar masking strategy will be required.

³ Lower Thames Crossing Capacity Study Option A, May 2010, Hyder Halcrow, for Highways Agency, Section 10.6

Capabilities on project:
Transportation

Measures of model convergence and the associated uncertainties in outputs will therefore be developed which better focus on the area influenced by the new crossing options.

- 2.1.9 Given the sensitivity of the public accounts to forecast changes in vehicle fuel duty revenue estimates we will undertake analysis to review of the value estimated from the masked TUBA outputs, providing an indication of the uncertainty that should be attached to the model outputs. Sectoral analysis will be undertaken of the outputs. In particular focus will be given to movements crossing the Thames (by any crossing) to reflect the net increase in demand, and changes in route that are predicted. This analysis will distinguish the primary source of expected additional tax revenue (additional and possibly longer trips crossing the Thames), from the reduction in tax revenues generated by, presumably fewer, trips made wholly within North Kent / South Essex, due to the existing Crossing constraints.

Annualisation

- 2.1.10 The M25 Model represents morning peak, inter-peak and evening peak conditions for a neutral (October) weekday. The Hyder Halcrow appraisal of Option A applied annualisation factors that expanded the model results to represent 253 weekdays (6am-10pm) but did not include weekends or the night period. The exclusion of night time traffic would be justified by the assumptions that there are no capacity constraints and that tolls remain zero at night. However exclusion of weekend and bank holidays would tend to understate benefits.
- 2.1.11 The analysis undertaken to estimate annualisation factors for the weekday peak and inter-peak factors is appropriate. We will assume that the benefits estimated for the inter-peak periods would be applicable for busy periods during the weekends and bank holidays. On this basis we will, for relevant count data, accumulate flows for the weekend /bank holidays between 6 am and 10 pm and compare these with average October inter-peak flows that the model represents. We will in addition review the flow profile to identify the proportion of flow for which demand is less than, say, 70% of the average inter-peak flow. If an appreciable proportion of the daytime traffic occurs during periods when flows are low we will reduce the annualisation factor better to reflect the proportion of traffic that would be expected to experience congestion and delays using the crossing.
- 2.1.12 We would also observe that HGVs comprise an appreciable proportion of traffic using the crossing, and given the role of the crossing to provide access to ports, the diurnal and seasonal profile for HGVs may be distinct from car traffic. We will therefore separately analyse light and heavy vehicle flow profiles and develop distinct annualisation factors.
- 2.1.13 Subject to the review of flow profiles, the evidence from the previous Halcrow/Hyder work would suggest that the annualisation factors would comprise:
- 955 – am peak period;
 - 1979 (weekday) + xxx (weekend/bank holiday) – inter-peak period; and
 - 735 – pm peak period
- 2.1.14 These factors will assume no benefits or revenues from traffic at night (10 pm to 6am) and possibly in periods of low traffic flow during weekends. These factors would be appropriate for consideration of user benefits for option A, but would be incomplete for assessment of carbon emissions and may understate benefits for Options B and C where users would gain time savings from more the direct routeing in the night period.
- 2.1.15 We will therefore, in addition, develop an estimate of an annualisation factor for night time traffic. This would be applied to increase the estimate of toll revenue calculated from inter-peak traffic

Capabilities on project:
Transportation

forecasts, should options which involve a charge during the night be considered and to estimate carbon impacts (Section 3.4).

- 2.1.16 For Options B and C benefits may be represented through changes in delays on the transport network and through changes in routing using the new crossing options. Exclusion of night time traffic from the annualisation would exclude benefits from the shorter routing offered by the new crossing options. However inclusion of night time traffic in the annualisation would overstate the impacts of delay which would be based on average inter-peak traffic flows. We will first review the magnitude of the difference between 'day time' and 'full day' annualisation factors to indicate the sensitivity of estimated benefits to the annualisation assumptions. Should the difference be of appreciable size and therefore warrant more detailed understanding we will undertake limited testing using the traffic model network and a trip matrix representing few trips to estimate 'free flow' conditions that might be expected in the night period to isolate the benefits that can be attributed to the additional and shorter routing that options B and C would offer for some movements.
- 2.1.17 In summary, traffic count data will be analysed to develop annualisation factors:
- separately for HGVs and for light vehicles; and
 - for benefits associated with morning peak, evening peak, other 'busy/day time' periods during quiet night time periods.
- 2.1.18 Analysis of the source of benefits at quiet / night time periods will be undertaken to identify the extent to which these are attributable to shorter route options rather than relief of congestion that might be forecast without new crossing capacity. The estimate of user benefits will be based on the three day time periods, plus any attributable benefits from the night time period. Measures of tax revenues and carbon emissions will be based on all four time periods.
- Modelled Years and Extrapolation*
- 2.1.19 The HA have advised that the design and construction of schemes such as a new Dartford crossing can take about eight years. We will undertake model tests for:
- 2025, as a nominal opening year; and
 - 2041, as a nominal design year.
- 2.1.20 TEMPRO forecasts do not currently extend beyond 2041, and we will extrapolate beyond 2041 to estimate a 60 year benefit and revenue stream. WebTAG and green book guidance set out assumptions on how:
- values of time increase from 2041, based on WebTAG 3.5.6 guidance; and
 - the discount rates (WebTAG 3.5.4) to establish the present value of benefits.
- 2.1.21 The uncertainties arising from this extrapolation thus relate to the potential change in traffic patterns and the associated changes in delay beyond 2041. We will consider alternative assumptions to set out the uncertainty in benefits.
- One interpretation commonly made is to assume no change in travel demand after 2041.
 - Another assumption sometimes considered is to extrapolate the changes in delay benefits between 2025 and 2041 to the period after 2041, on the assumption that trend in changes in travel demand and delays would continue.

Capabilities on project:
Transportation

- It can be that as new infrastructure reaches capacity the time savings and benefits become constrained. We will review the capacity provided by the options. Should our analysis indicate that demand is approaching capacity of the additional crossing, it would imply that delays would be expected to occur both with and without a new crossing. This would be represented by capping the projected benefits. This analysis will be undertaken separately for the three modelled periods.

2.1.22 If we were appraising a detailed design we would expect to undertake forecasts for an interim year between 2025 and 2041 which would allow better consideration of the profile of impacts and more refined interpolation. However, given that this is a strategic study we consider that an interim forecast would be of limited value. Effort will be expended instead by undertaking sensitivity tests better to understand the forecasting assumptions and uncertainties. On this basis forecasts of benefits and revenues between 2025 and 2041 will be interpolated, using TUBA, based on the forecast traffic and value of time trends.

Demand Segmentation

2.1.23 The level of segmentation in the M25 Model will vary at different stages in the demand and traffic model processing as illustrated in Figure 1. Given the planned work to integrate the highway and demand models the segmentation used in TUBA could be drawn at any of the levels of segmentation illustrated. Given the size of the model matrices, there are practical considerations in using TUBA that argue to using the most aggregated data. The suitability of the data at increasing levels of segmentation is discussed below.

- The assignment matrices (six user classes) would provide a distinction by business/non business and freight vehicles. The need for assumptions to disaggregate non work purposes between journey to work and other purposes would be a minor disadvantage. This level of analysis would however preclude an interpretation of the distribution of benefits across income groups. There would in addition be a technical complication in the appraisal of a second (new) tolled route option; the option would be represented as a new alternative, and additional care would then be needed to establish benefits.
- Working from matrices at the route choice level (9 segments), would provide the ability to analyse benefits by value of time (VoT) segment. However the cost data in the demand model at this stage would be composite costs over route. Given the importance of distinguishing revenue streams from non-money related benefits direct use of data at this level would not be suitable, although additional matrix calculations could be undertaken to derive demand weighted average costs.
- Working from the demand model level (13 segments) would have no significant advantages for the purpose of appraisal relative to the 9 segment route choice level; the distinction of home based and non-home based trips would merely be aggregated in TUBA. It would also suffer the same disadvantage.
- Working from matrices that are segmented by route option (21 segments) would provide the benefits of richer segmentation that addresses the deficiencies identified for the 5 segment assignment level of detail. There would remain however the issue of representing a second tolled route.

Capabilities on project:
Transportation

Figure 1: Demand Model Segmentation

	M25 Demand Model		For Route Choice	Representation of Tolling Routes			
	Existing	Proposed (Income)		All	Tolled	(Tolled 2)	Not tolled
	HBW	Low	HW - L		✓	✓	✓
		Med	HW - M		✓	✓	✓
		Hi	HW - H		✓	✓	✓
	HBO	Low	Oth - L		✓	✓	✓
		Med	Oth - M		✓	✓	✓
		Hi	Oth - H		✓	✓	✓
	NHBO	Low	EB		✓1		
		Med			Σ	Σ	Σ
		Hi			✓2	4	5
HBEB	All	HGV		✓3			
NHBEB	All						
LGV	All						
HGV	All						
Segments:	7	13	9			21	

Segments aggregated to six User classes for assignment

2.1.24 Noting that the benefit and revenue calculations undertaken in TUBA are equivalent to calculating trip weighted average travel costs, we would propose to minimise the number of matrices needed for TUBA, maintain the segmentation by income and purpose, and address the ‘new route’ issue by calculating average costs at the 9 segment level. This calculation will be incorporated within the demand model, allowing demand and cost matrices to be generated for input to TUBA.

2.1.25 In conclusion, cost and demand matrices will be extracted from the demand model at the following level of segmentation.

- Home based work – low value of time (VoT)
- Home based work – medium VoT
- Home based work – high VoT
- Other non business – low VoT
- Other non business – medium VoT
- Other non business – high VoT
- Employers’ business

Capabilities on project:
Transportation

- Light Goods Vehicles
- Heavy Goods Vehicles.

2.1.26 Highway travel cost matrices (time, distance, toll) will be calculated as the demand weighted average of the costs from the alternative routes (Dartford crossing or alternate Thames crossing).

SDI (Social Distributional Impact) analysis

2.1.27 Given our proposed approach to segment demand in TUBA, it will be possible directly to report benefits by income tertile, at the level represented in the model. Our interpretation of the distribution of user benefits will be based on this level of segmentation.

Toll Revenue

2.1.28 In principle the model will represent tolls and forecast demand at each crossing, from which revenues can be calculated directly. The intent is, in the demand model (as distinct from assignment model) to represent any discount for local residents, and these toll discounted costs will be included in the TUBA cost matrices.

2.1.29 In respect of HGVs and LGVs there will be a need to carefully consider the vehicle types represented in the model and the vehicle classifications used for defining the toll payable. Mappings will be developed to convert the vehicle types used for charging tolls with the modelled vehicle classification, based on an analysis of charges and comparison with the classified count data for the crossing and represented in the M25 Model.

Key uncertainties

2.1.30 Modelling uncertainties that may have particular significance for establishing user benefits relate to the quality of the trip matrices. Of particular relevance are:

- business trips, and the implication of economic benefits;
- HGV trips, with implications both for benefits and, through the interpretation of vehicle mix discussed in paragraph 2.1.29 above, revenues

2.1.31 We will review the composition of economic benefits and revenues and undertake sensitivity analysis of the resulting outputs to indicate the associated uncertainties.

Delays during Construction

2.1.32 Much of the construction for a new crossing would be 'off-line' and delays would therefore occur predominantly through the reduction of capacity during the construction of junctions / etc as the new infrastructure is tied into the existing road network.

2.1.33 We note that QUADRO is being withdrawn⁴, given the ability of network models to represent delays. Given that roadworks would extend over several months we do not judge that there would be a significant overstatement of diversion applying the M25 assignment model to estimate construction delays.

2.1.34 We will represent the impacts of speed restrictions and reduced capacity during construction using the M25 Model. This will start from the 'without scheme' opening year forecasts. The annualisation factors will be scaled to reflect the expected duration of the roadworks.

⁴ We assume this implies a change to the requirement in WebTAG 3.5.2, para 1.4.2 requiring use of QUADRO for inter urban roads.

Capabilities on project:
Transportation

2.2 Reliability

2.2.1 The provision of an additional crossing is expected to have two distinct effects that we discuss separately:

- increase the capacity and reduce traffic stress at the crossing, directly reducing the knock on effects and delays caused by incidents; and
- provide alternative routes that, when demand is below capacity, provide the operator with the ability to manage demand, and thus help mitigate delays caused by incidents by directing demand to the tunnel or bridge that remains open.

Direct Impacts

2.2.2 In discussion with DfT we have considered a number of options for the assessment of the direct impacts of reliability.

- INCA is recommended in WebTAG 3.5.7. Nevertheless, the DfT are withdrawing the tool and the pattern and severity of incidents observed in the existing Crossing were judged to be outside the range that INCA is calibrated to assess. On this basis the approach was deemed unsuitable.
- The HA are working towards the development of a new tool, however this has not developed to a point where the tool could be applied with confidence and is not therefore suitable given the time constraints of this study.
- A minimal approach of applying an uplift, which is typically taken as about 50% for strategic roads, to user benefits to allow for reliability.
- A stress based approach (Annex F of WebTAG 3.5.7).

2.2.3 Reflecting the uncertainties in valuing reliability we will apply the stress based methodology specified in WebTAG 3.5.7 Annex F. The assessment will consider the Dartford-Thurrock crossing, the new crossing options. Other trunk and motorway links will be considered in addition where there is an appreciable change in forecast traffic.

Network Management

2.2.4 Increased flexibility to allocate demand to different structures at times of day when sufficient capacity is available would allow the operator to reduce variability in travel times. We will undertake a qualitative assessment.

2.2.5 To inform this judgement we will review both the forecast pattern of incidents and the distribution of demand (traffic flow profile) to develop an understanding of the proportion of delay time that is of sufficiently long duration and occurs at times of day when capacity would be available. Based on this analysis we will estimate the proportion of delay that could be mitigated by effective management practices.

2.3 Regeneration

2.3.1 Regeneration related impacts will be considered at a strategic level reflecting the improved accessibility that is expected to be provided by a new crossing. It is noted that detailed design

Capabilities on project:
Transportation

considerations taken in any subsequent work to deliver a scheme would provide the basis to refine and optimise delivery performance in respect of more detailed impacts. Accordingly we propose the following qualitative approach to provide an indication of the likely nature of impacts.

- 2.3.2 Regeneration areas will be taken as the areas of multiple deprivation, within reasonable proximity (about 5Km) of the location of the new crossings. Areas identified as of specific interest to Kent or Essex County Councils or to TfL will in addition be considered (including for example major development sites).
- 2.3.3 Model zones will be identified best approximating to these regeneration areas.
- 2.3.4 The land use modelling undertaken to assess wider impacts (Section 2.4) will develop accessibility indicators for access to jobs and the accessibility of the workforce with and without the options for a new crossing using. Forecasts of the potential implications of these access changes for employment patterns will similarly be developed.
- 2.3.5 Reflecting the land use forecasting uncertainties, a qualitative interpretation of the change in these access indicators will be made providing an indication of the areas where the impacts are neutral, positive or negative. The magnitude of change in accessibility in each zone representing regeneration areas will be weighted by the zone's population / employment to provide an overall indicator.

2.4 Wider Impacts

- 2.4.1 WebTAG 3.5.14c specifies appraisal of wider impacts. Initial analysis can assume no change in land use. Sensitivity analysis, based on potential land use changes, can shed light on how the investment may affect wider economic and distributional outcomes, although with increasing uncertainty. For clarity and robustness, we propose a three stage approach to assessing wider impacts:
 1. first, calculate WIs according to WebTAG with no assumed changes in land use;
 2. secondly, calculate WIs according to WebTAG including changes in land use using conservative assumptions about employment redistribution; and
 3. thirdly, relax these assumptions and consider whether the land use modelling implies any other likely impacts or distributional consequences that could have material economic impacts.
- 2.4.2 WebTAG 3.5.14c sets out methodologies for assessing the following wider impacts:
 - WI1: Agglomeration
 - WI2: Impacts of increased competition (assumed to be zero)
 - WI3: change in output in imperfectly competitive markets
 - GP1: change in output from changes in labour supply
 - GP3: move to more or less productive jobs
 - WI4: Tax wedge on labour market impacts GP1 and GP3

Capabilities on project:
Transportation

- 2.4.3 Impacts prefixed with a WI refer to additional⁵ welfare impacts that can be included within a benefit cost calculation. Impacts prefixed with GP refer to impacts on economic output as measured by Gross Value Added; in part these benefits are reflected in the user time savings measured directly (Section 2.1).
- 2.4.4 First, wider impacts will be calculated with no assumed changes in land use. Note that in this case GP3 is zero because there are no assumed changes in employment location.
- 2.4.5 The analysis of wider impacts will be based on outputs from the M25 transport model. Wider impacts will be calculated for a geographical area defined as a subset of the M25 Model zones. In defining this area, there is a trade-off between the geographical disaggregation of this model (and hence the quality of access measures which can be derived) and the extent of the geographical coverage. We will define this area in consultation with the client group. Complete matrices (covering the whole of the UK) will be used to create the measures of effective economic density for those zones within the defined area.
- 2.4.6 The input matrices will be comprised of demand and generalised cost matrices for trips at model zone level. These will be segmented as described in section 2.1.25 by journey purpose and vehicle type. The zonal level model data will be converted into the formats required for the wider impacts calculations using the Formulas in webTAG unit 3.5.14c (a simple arithmetic weighted average across modes and journey purposes). We propose to use nine journey purpose segments that are used for route choice within the M25 Model. A further consideration is the time period of travel which will also be incorporated into the weighted average using data from the three time periods covered by the model. We propose to use weekday average costs for the agglomeration calculation. The matrices for road trips are complete without gaps.
- 2.4.7 Using weighted average generalised costs would require developing generalised cost information for all modes of transport. The M25 Model, however, represents absolute highway travel costs, but only changes in public transport costs and does not represent travel costs by active modes. We will therefore make assumptions about other costs where necessary. In general car is the dominant mode for most movements and the costs of public transport are generally appreciably greater than travel by car. Walking and Cycling are also only feasible for relatively short trips. A satisfactory approximation for non car travel costs can therefore be based on average assumptions, factoring an estimate from car costs. A possible exception to this is travel by rail to central London. In this case we will assess the contribution of central/inner London to effective densities. Where this exceeds 10% we propose to draw travel costs from the DfT PLANET model to provide a refined estimate of public transport travel costs to this key employment centre. The uncertainties created by this will be addressed by testing sensitivities with different materiality thresholds. The most recent Wider Impacts Dataset of socioeconomic data from DfT will be used for calculating wider impacts.
- 2.4.8 WebTAG 3.5.14c requires the central case analysis of Wider Impacts to be based on the assumption of fixed land use (see WebTAG 3.5.15c paragraph 1.2.3). However, changes in capacity and in network geometry could induce changes in land use and local development which may be of interest for two reasons. First, they may change the overall national welfare and GDP benefits of the appraisal. Methodologies for calculating WIs using variable land use models (as a sensitivity to the main analysis) are set out in WebTAG 3.5.14c. Second, the impact of investment options on the distribution of economic activity may also be of interest, particularly to those with more local interests. We confirm that central case estimates will be consistent with WebTAG

⁵ To user benefits discussed in Sections 2.1 and 2.2

Capabilities on project:
Transportation

guidance, and other approaches identified in this report (e.g. assumptions about land use development, different decay parameters etc.) will be presented as sensitivity tests.

- 2.4.9 KPMG will develop an econometric model to relate transport connectivity to business location choice. This will be calibrated relating business activity to accessibility, but will not consider planning constraints. There are many unknowns in representing likely changes in business location choice as a result of transport change. Key challenges relate to treatment of causation and the representation of other factors that can affect business location. These uncertainties will not be addressed directly in the land use modelling. Instead they will be addressed using our three stage approach (see paragraph 2.4.1). First, wider impacts will be estimated with no land use change. Second, wider impacts will be estimated based on variable land use, but fixed employment within the study area. Finally sensitivity analysis will be undertaken to estimate how the wider impacts could change if varying levels of employment are attracted to the study area. For simplicity, the land use modelling will be developed as a 'bolt-on' to the transport modelling, drawing data from it. The first round of land use effects will be calculated from transport model outputs but these will not then be fed back into the transport modelling to determine second round and subsequent effects to reach equilibrium. This will enable the modelling to operate efficiently and independently but at the loss of some consistency. This introduces a risk of overstatement of benefits because new development will tend to increase congestion and mitigate improvements in congestion. In other work we have found that the additional congestion caused by induced local economic development can choke off up to 20%⁶ of the overall economic impacts. We will scale impacts using suitable sensitivities to proxy not modelling the full equilibrium effects. However, this approach is simpler and more tractable and is considered more appropriate for this analysis.
- 2.4.10 The transport and land use model will need clear assumptions about the level of exogenous development that is to be included in the no investment case. It may be, for example that some expected development is unlikely to gain permission to proceed or is unlikely to be commercially viable without significant infrastructure investment. These central forecasting assumptions will be set out in Output 3, reflecting local planning documents in the vicinity of the crossing options and TEMPRO forecasts in the wider area.
- 2.4.11 The model will define measures of connectivity based on the journey time data and travel costs available from the transport models and on zonal socioeconomic data. Measures of connectivity must be created from three sources of data: journey time data, a deterrence function (or decay curve); and socioeconomic data in the origin or destination zone. Transport journey time and cost data for highway trips will be provided by the transport model, complemented with estimates of public transport generalised journey time as previously discussed. Socioeconomic data for resident population and workplace employment are available for transport model zones.
- 2.4.12 We propose to create three different measures of connectivity and use statistical analysis to examine how these affect business location. The three connectivity measures will be:
1. **commuter catchments:** based on home based work trip generalised costs, residential working age population by model zone and deterrence functions derived from the observed journey cost distribution of this segment;
 2. **business trip catchments:** based on non-home based employers' business trip generalised costs, employment by model zone and deterrence functions derived from the observed journey cost distribution of this segment; and

⁶ We can draw, for example, on sources describing work undertaken for Greater Manchester's Transport Innovation Fund bid.

Capabilities on project:
Transportation

3. **freight accessibility:** based on HGV trip generalised costs, employment by model zone and deterrence functions derived from the observed journey cost distribution of this segment.

2.4.13 WebTAG guidance for the calculation of agglomeration impacts uses a parameter, α , to define the exponential decay of employment as generalised cost increases in the calculation of effective density. This decay parameter has been calibrated based on national data to reflect the rate at which the productivity impacts of agglomeration decline as accessible employment becomes further away (in terms of generalised cost). Our proposed approach uses a different approach to this deterrence function calibrated to the decay of observed trip making as generalised cost increases. As a sensitivity, we propose to also use the WebTAG exponential decay formulation and the parameters from WebTAG in order to understand how sensitive our approach is to the deterrence function formulation selected.

2.4.14 The following Wider Impacts will then be calculated in the variable land use scenario:

- WI1: Agglomeration;
- WI3: change in output in imperfectly competitive markets⁷;
- GP1: change in output from changes in labour supply;
- GP3: moves to more or less productive jobs; and
- WI4: Tax wedge on labour market impacts GP1 and GP3;

2.4.15 In the first instance, we will assume that employment levels are fixed within the study area.

2.4.16 Having examined Wider Impacts under fixed and (limited) variable land use assumptions, the economic analysis will then examine whether any other impacts may be material to the appraisal. Factors of production can be mobile between areas⁸ and changes in connectivity could attract new employment to the study area. We propose to assess this using sensitivity analysis. The upper bound on changes in employment within the study area will be set by the accessibility relationships in the land use modelling. The origin of jobs attracted to the study area will affect the value of GP3 and WI4.

⁷ This will not be affected by modelled changes in land use because the transport model will not be rerun.

⁸ "In regional economics and economic geography it is entirely natural to assume high elasticity of factor supply to a particular region." Krugman, P (1997). Development, economic geography and economic theory. Cambridge, Massachusetts: MIT press. 8.

3 Environmental Appraisal

Capabilities on project:
Transportation

3 Environmental Appraisal

3.1 Introduction

3.1.1 The following sections outline the approach to the environmental appraisal for each of the following WebTAG topics.

- noise
- air quality
- greenhouse gases
- biodiversity
- heritage or historic resources
- landscape / townscape
- water environment

3.1.2 The assessment will be based upon WebTAG guidance using the methodology for strategies. It should be noted that since indicative route alignment information will be available for the options, in accordance with WebTAG guidance, some aspects of the methodology for plans will be undertaken. This will be proportionate to the strategic nature of this study and the environmental features identified in the Output 2 Specification Note reflect this approach.

3.1.3 Given that air quality and noise are likely to be particularly important local issues, these impacts will additionally be monetised to facilitate consideration in developing the economic case. Baseline data collection and initial constraints assessment will be undertaken at Output 2 with Output 4 focusing on the appraisal of route options. To avoid repetition, references are made to the Output 2 specification note in the following sections in relation to the environmental features to be considered for each topic and the data sources to be used.

3.2 Noise

3.2.1 A strategic level assessment will be undertaken as follows:

- estimating the change in average noise emission of zones alongside the existing highway network;
- analyse new offline options using a simple noise model, and
- calculate the net difference in the estimated population likely to be annoyed in the longer term as a result of the options compared to the without option scenario.
- estimate Present Value of Benefits for transport-related residential noise (at 2002 prices) discounted over the 60 year appraisal period.

3.2.2 The assessment will be carried out using the Method for Strategies guidance in WebTAG Unit 3.3.2, Section 1.8. This methodology uses road traffic flow predictions, to calculate a Basic Noise Level (BNL), as defined in the Calculation of Road Traffic Noise (CRTN) for each road link to estimate changes in average zonal noise emission levels alongside the existing highway network. To supplement, new road links will be modelled using Cadna-A noise modelling software which employs the CRTN methodology to predict road traffic noise in newly affected areas. Road traffic flow predictions will be generated during Output 3.

3.2.3 The WebTAG noise assessment calculates the percentage of people annoyed by changes in road traffic noise levels as a result of the proposed options. A monetary value is then associated to the

Capabilities on project:
Transportation

percentage annoyed which relates to a national average value per household per year at 2002 prices.

- 3.2.4 A comparison of the Do-Minimum scenario with each of the options will be carried out so each option can be rated in terms of annoyance and economic cost as a result of changes in road traffic noise levels. This strategic methodology will provide a zonal assessment based on population density of settlements and individual receptors will not be considered in the analysis.
- 3.2.5 Index of Multiple Deprivation (IMD) data will be used to determine the social distributional impact of the proposals in relation to the estimated population likely to be annoyed in the longer term.
- 3.2.6 A WebTAG worksheet will be produced for each option.
- 3.2.7 Data sources for the noise appraisal were outlined in Para 3.43 of the Output 2 Specification Note.
- 3.3 Air Quality
- 3.3.1 A critical issue is whether any of the options would cause a deterioration of air quality in an area that is expected to exceed the mandatory EU limit values or cause an exceedence of a limit value in a new area. If this is predicted to occur, it could represent a significant environmental constraint which puts at risk the delivery of a future scheme.
- 3.3.2 The air quality assessment will:
- assess the change in emissions of NO_x and PM₁₀ that would result from each option compared with the Do-Minimum;
 - use the change in emissions to monetise the impact using the Interdepartmental Group on Costs and Benefits (IGCB) cost estimates;
 - consider monetised impacts in the Value for Money criteria, and
 - consider implications of impacts in the Air Quality Management Areas (AQMA) identified at Output 2.
- 3.3.3 The following tasks will be undertaken during the air quality assessment.
- Predict pollutant concentrations at the locations most at risk to determine the change in concentrations that would result from each of the options. This will be done using the Highways Agency's Design Manual for Roads and Bridges (DMRB) air quality screening method and use the traffic data produced during Output 3 and will build upon the initial analysis undertaken during Output 2 which identifies the locations most at risk of a change in air quality for the purposes of informing the design development.
 - Assess the change in emissions of NO_x and PM₁₀ that would result from each option compared with the Do-Minimum using the DMRB regional impact assessment tool.
 - Use the change in emissions with the IMD data to determine the social distributional impact of the proposals.
 - Use the change in emissions to monetise the impact of air quality using the Interdepartmental Group on Costs and Benefits (IGCB) cost estimates⁹. Assess the overall change in exposure at properties using the WebTAG worksheets.

⁹ For NO_x, the monetary values in webTAG 3.3.3 draft, dated May 2012 will be used. For PM₁₀, the monetary values set by the IGCB and shown in their calculator for different environments rather than the monetary values in webTAG 3.3.3 since this is based on the change in concentrations at properties which is not calculated at a strategic level.

Capabilities on project:
Transportation

- 3.3.4 The assessment will be carried out using the strategic level assessment in WebTAG Unit 3.3.3C. A WebTAG table will be produced for each option.
- 3.3.5 Data sources for the air quality appraisal were outlined in Para 3.8 of the Output 2 Specification Note.
- 3.4 Greenhouse Gases
- 3.4.1 An assessment will be undertaken which will:
- calculate the mass of carbon from vehicle emissions¹⁰ produced for each of the options and the Do-Minimum in the opening and design years;
 - estimate data for other years based on the two sets of calculations so that 60 years of data is available; and
 - monetise impacts over 60 years using the greenhouse gases spreadsheet.
 - Calculations will be done using the TUBA (Transport Users Benefit Appraisal) software making sure that all 8760 hours in the year are included in the assessment (see 2.1.15).
- 3.4.2 The assessment will be carried out using WebTAG Unit 3.3.5. The output will be monetised greenhouse gases impact over 60 years.
- 3.4.3 Data sources include traffic data and link lengths from the M25 Model.
- 3.5 Landscape / Townscape
- 3.5.1 A strategic level assessment of potential effects to the local environment will be undertaken which will:
- determine the key landscape/townscape features and characteristics of the receiving environment at a strategic level through a desktop review of available information using the data collated at Output 2;
 - appraise the environmental / townscape capital to assess which features are important and why;
 - appraise the potential effects of each option in accordance with WebTAG.
- 3.5.2 The assessment will be carried out using WebTAG Units 3.3.7 and 3.3.8. A WebTAG worksheet will be produced summarising the overall assessment of each option. A three point scale (positive, negative, no impact) will be used as suggested in the method for strategies (Section 1.3 of WebTAG Units 3.3.7 and 3.3.8) with additional qualitative comment where necessary providing justification. Qualitative comments will be provided on potential cumulative effects with other proposed developments in the study area identified at Output 2.
- 3.5.3 The Output 2 Specification Note outlines the landscape and townscape designations and features to be considered (Para 3.33) and key visual impact receptors (Para 3.35). Data sources for the landscape / townscape appraisal were outlined in Para 3.36 of the same note.
- 3.6 Heritage or Historic Resources
- 3.6.1 The Thames has been a focus of settlement in Britain for thousands of years. Some of the earliest evidence of human remains found in Europe have been found in Swanscombe and date back

¹⁰ The strategic consideration of options in Output 2 will not undertake detailed design or construction methods for the new crossing and link roads that would be required to consider embedded carbon.

Capabilities on project:
Transportation

300,000 years. The southern side of the Thames is rich in prehistoric and Roman archaeology with several scheduled sites close to the proposed route alignments. Later periods are also well represented along this section of the Thames particularly in sites of military remains from the Tudor and Napoleonic periods as well as the Second World War. The assessment of the potential impacts on the archaeology and cultural heritage of the area will consider both physical impacts and the impact on the setting of these assets.

3.6.2 A strategic level assessment will be undertaken that will:

- describe the previously recorded heritage assets;
- assess the importance and designation of these features and any inter-relationships;
- assess the potential for previously unrecorded archaeological remains;
- describe how the options will impact on heritage at the local and broader scale, and
- assess the significance of the impacts in accordance with WebTAG..

3.6.3 The assessment will be carried out using WebTAG Unit 3.3.9. Strategy and plan level WebTAG worksheets will be produced for each option considering effects on heritage and historic resources. Qualitative comments will be provided on potential cumulative effects with other proposed developments in the study area identified at Output 2.

3.6.4 The heritage designations and features to be considered were outlined in Para 3.26 of the Output 2 Specification Note. Data sources for the heritage appraisal were outlined in Para 3.29 of the same note.

3.7 Biodiversity

3.7.1 A strategic level assessment will be undertaken that will:

- describe baseline biodiversity conditions including identification of internationally and nationally designated sites;
- appraise the environmental capital to assess which features are important and why;
- appraise the potential impacts of each option on each of the biodiversity features identified at Output 2;
- assess the significance of the impacts in accordance with WebTAG.

3.7.2 The assessment will be carried out using WebTAG Unit 3.3.10. Strategy and plan level WebTAG worksheets will be produced for each option considering effects on biodiversity. Qualitative comments will be provided on potential cumulative effects with other proposed developments in the study area identified at Output 2.

3.7.3 The biodiversity designations and features to be considered were outlined in Paras 3.14 and 3.15 of the Output 2 Specification Note. Data sources for the biodiversity appraisal were outlined in Para 3.19 of the same note.

3.8 Water Environment

3.8.1 The key issues associated with the proposed options will include the placement of new structures in, adjacent to, over or under the Thames (and other watercourses), the effects of highway runoff on receiving watercourses or groundwater, as well as spillage risk, both of which may alter depending on the scope of the option, changes to the existing highway network, traffic flows, and drainage pathways, for example e.g. provision of new treatment can lead to environmental

Capabilities on project:
Transportation

benefits. The appraisal will also take account of recreational and local value to determine the importance / sensitivity of the water features as required by WebTAG.

3.8.2 A strategic level assessment will be carried out to:

- identify key surface and groundwater receptors within the study area and determine their importance / sensitivity;
- determine indicative flood risk along each of the route options;
- identify potential effects during operation, and
- assess the magnitude and significance of effects in accordance with WebTAG.

3.8.3 The assessment will be carried out using WebTAG Unit 3.3.10 and informed by DMRB Vol 11, Section 3, Part 10 (HD45/09). A WebTAG worksheet will be produced for each option considering operational effects on the water environment. Qualitative comments will be provided on potential cumulative effects with other proposed developments in the study area identified at Output 2.

3.8.4 The water environment designations and features to be considered were outlined in Section 3.47 of the Output 2 Specification Note. Data sources for the water environment appraisal were outlined in Section 3.48 of the same note.

4 Social

Capabilities on project:
Transportation

4 Social

4.1 Introduction

4.1.1 This chapter discusses the appraisal of social impacts. The methods used to appraise impacts on commuting and other users and on the reliability of journey time impacts on these travellers are, respectively, explained in Section 2.1 and 2.2. The remaining sections of this chapter individually discuss the approach that will be taken to appraise other social impacts.

4.2 Physical Activity

4.2.1 There may be adverse effects from:

- trips that would otherwise be made by walking and cycling transferring to car due to the improved level of service provided on the strategic road network;
- reductions in trip length if mitigation for severance of existing routes provides more direct alternatives; and
- walking or cycling trips deterred by increased traffic volume or worsened noise or air quality changes along specific routes.

4.2.2 There may also be positive impacts from:

- trips that would otherwise be made by car transferring to walk or cycle modes due to the local congestion or by local improvements in air quality or noise;
- trips attracted to walk or cycle or making longer journeys due to arrangements to mitigate (and improve) local rights of way.

4.2.3 Many of these changes will require consideration during detailed option design and cannot therefore be assessed at this strategic stage. Our expectation is that a future scheme will, through the improved car accessibility, result in a slight reduction in walk and cycle trips. We will, in accordance with WebTAG 3.3.12, para 1.4.2) seek to confirm this and comment on the likely slight adverse impact on physical fitness.

4.2.4 We will review the M25 Model forecasts to confirm that the model forecasts an increase in car trips. (Since the M25 Model does not explicitly represent walk and cycle modes we have no data to translate this into an estimate of the change in demand.)

4.3 Journey Quality

4.3.1 The provision of an additional crossing is expected to deliver a similar driving experience to the existing crossing and there would, therefore, be limited implications for journey quality. Drawing on WebTAG 3.3.13 potential impacts may be attributable to:

- driver and passenger frustration and stress from the delays caused by congestion at the existing crossing location;
- access to the motorway services at Thurrock;
- the landscape visible from the new route; and
- changes in route uncertainty with additional routeing options.

4.3.2 While reductions in delay and the alignment of Options B and C might be expected generally to have a positive impact, the additional routeing complexity and risk that some trips cannot access services might be expected to have a negative impact. Overall we would expect the impact,

Capabilities on project:
Transportation

therefore, to be assessed as neutral, and will review this qualitative judgement when appraising the options.

4.4 Accidents

4.4.1 A spreadsheet-based approach will be adopted using COBA accident rates for the relevant road type(s) and costs combined with the outputs from the traffic model on vehicle kilometres by link. The approach will be consistent with the guidance set out in WebTAG Unit 3.4.1.

4.4.2 COBA's average accident rates are based on average accident statistics by link type. The review¹¹ identified a higher incident rate, particularly northbound through the tunnels, reflecting a range of factors including both those attributable to the narrow lanes and lack of hard shoulder, and to the consequences of the toll plaza (eg incidents from weaving movements and subsequent HGV brake failure). Given the short term commitment to deliver free flow tolling it would not be appropriate, therefore, directly to apply the current accident statistics. The HA/Hyder Dartford Freeflow study has considered the extent to which incidents are attributable to the crossing characteristics or to the toll plaza. We will apply the estimated incident rates developed for that study to interpret the accident rates that are likely to be applicable for the crossing in the future and apply these rates in assessing accident impacts.

4.4.3 Accident costs will be extrapolated over the 60 year assessment period based on the same assumptions used to establish user benefits (Section 2.1).

Social and distributional impacts

4.4.4 The options would be expected to have negligible impacts on urban traffic volumes and pedestrian and cycle users are excluded from motorways. Similarly a future scheme would not be expected materially to affect traffic volumes on local roads near schools or old people's homes. There would be negligible impact, therefore, on pedestrians, cyclists, young or old. We would also not expect the accident rate for motorcyclists relative to other vehicles to differ for the crossing compared with motorways in general. As such, an SDI for accidents can be screened out at this stage.

4.5 Security

4.5.1 Guidance set out in WebTAG Unit 3.4.2 reflects exposure to risk and the factors that mitigate those risks. The short term measures for the existing Dartford Crossing include the implementation of freeflow tolling and this arrangement will be assumed for the Do Minimum option against which the options for additional crossing capacity will be compared. On this basis vehicles will not need to stop and we would, in normal operation, expect no significant change to security risks to road users for any of the options.

4.5.2 Subject to confirmation of the concept layout design (Output 2) we would therefore assess the security impacts to be neutral.

Social and distributional impacts

4.5.3 Given the likelihood that the core security impacts will be assessed as neutral, and the absence of factors that would differentially affect vulnerable users in this context we would screen out an SDI assessment.

4.6 Access to Services

4.6.1 The appraisal of accessibility within WebTAG Unit 3.6.3 focuses on the public transport accessibility aspect of accessing employment, services and social networks, considering the

¹¹ Dartford River Crossing Study into Capacity Requirement (April 2009), prepared by Parsons Brinckerhoff for DfT

Capabilities on project:
Transportation

accessibility needs of different groups of people and taking into account a range of factors, including journey times to reach key destinations, service frequencies and provision of accessible boarding at stops.

- 4.6.2 Local bus services are unlikely to be affected by provision of a new crossing, unless the design severed local roads and hence caused changes to local bus services. Subsequent detailed scheme design would be required to assess whether the new route would sever or significantly divert local roads. Our assessment will, therefore, be limited to a consideration of the risks of severance that might be required in detailed design. Given that HA design standards seek to protect rights of way, we would expect these risks to be negligible in which case the accessibility impacts would be assessed as neutral.

Social and distributional impacts

- 4.6.3 Subject to confirming a neutral impact on local public transport accessibility, given the implication that there are no material changes, there would similarly be neutral impacts for vulnerable transport users.

4.7 Affordability

- 4.7.1 The congestion charge that applies, together with the discount for local residents, may be revised as part of developing the financial case for a new crossing. In which case the revised tolls could influence the cost and personal affordability of travel across the Thames.
- 4.7.2 The TUBA assessment (Section 2.1) will provide an estimate of changes in travel costs (both for tolls and the estimated effects on car fuel and non fuel costs). This should provide complete information on the forecast changes in travel costs, including the representation of any local discounts for using the crossing. (While variations in the charge by vehicle type may be approximated in the modelling and appraisal this is of limited relevance to personal affordability; motorcycles being the possible omission.)

Social and distributional impacts

- 4.7.3 As explained in Section 2.1, the transport model will represent income tertiles rather than quintiles and the distributional analysis of car travel cost changes will therefore be based on low, medium and high income groups to provide an indication of the distribution of impacts.
- 4.7.4 We will consider and focus on the impacts on journey to work trips separately from other purposes, given their typically higher frequency (especially in respect of the longer journeys that would be affected) to judge whether the changes in cost may appreciably affect overall expenditure on travel for low income users.

4.8 Severance

- 4.8.1 Severance is concerned with the impacts on those using non-motorised modes, especially pedestrians (but also cyclists and equestrians). The interventions are likely to include design standards that maintain existing rights of way and footpaths, and, if so, the impact would be neutral.
- 4.8.2 The designs for the options will be reviewed. Should some severance or diversion of rights of way have been deemed at risk or necessary as part of the design, a judgement will be set out, based on WebTAG 3.6.2/DMRB 11.3.8 and reflecting proximity to population centres, providing a qualitative view on the nature and scale of impacts: at the strategic level and given the design expectations it would be disproportionate to undertake the pedestrian surveys necessary to quantify any potential impacts.

Capabilities on project:
Transportation

Social and distributional impacts

- 4.8.3 Subject to the confirmation, if there is no risk of severance, there would be no impacts for any user groups. If this is not the case, the qualitative review of severance would consider the proximity to population centres and hence the risk that these would affect access to local facilities that could have a disproportionate impact on vulnerable groups.
- 4.9 Option Values
- 4.9.1 While the options would be expected to change the cost and time required for journeys across the Thames, it would be possible to make such journeys with the existing crossing and with the provision of an additional crossing.
- 4.9.2 WebTAG 3.6.1c (January 2007) notes that 'Notwithstanding that there is no quantitative evidence on option and non-use values for highway schemes it is expected that a significant step change in the quality of service offered by the road is required for the option and non-use value of the new road to be significantly different from that of the old road'. We would not consider that the changes offered by the new crossing options are of such significance, and would therefore assess the impacts as neutral.

5 Social and Distributional Impacts (SDI)

Capabilities on project:
Transportation

5 SDI Impacts

5.1 Step 0: Initial Screening

- 5.1.1 The strategic options being considered to provide additional capacity across the Thames would, if developed, involve construction of a bridge or tunnel, together with roads linking this structure with the existing motorway and trunk road network.
- 5.1.2 The options may have an impact on upon User Benefits, Noise, Air Quality and Affordability.
- 5.1.3 The options would be expected to have negligible impacts on urban traffic volumes and pedestrian and cycle users are excluded from motorways. Similarly a future scheme would not be expected materially to affect traffic volumes on local roads near schools or old people's homes. There would be negligible impact, therefore, on pedestrians, cyclists, young or old. We would also not expect the accident rate for motorcyclists relative to other vehicles to differ for the crossing compared with motorways in general. As such, an SDI for accidents can be screened out at this stage.
- 5.1.4 Highways Agency design standards seek to avoid severance. It is anticipated therefore that there will be no impacts for any user groups. For this study the design will proceed to a level sufficient to develop an understanding of risks and costs in the individual corridors, but not to the level of detail to deterring the impacts, if any, on individual rights of way. We will therefore review the risk (Paragraph 4.8.3) to provide guidance for consideration in any subsequent detailed design, but screen out SDI analysis of the strategy at this stage.
- 5.1.5 The options are being considered on the basis that they provide a connection of similar character to the existing Dartford-Thurrock crossing (with free-flow tolling). On this basis there would be negligible impacts on security and on local access to services and we therefore screen these impacts out of SDI analysis.

5.2 Step 1: Confirm Areas Impacted

- 5.2.1 The M25 transport represents a broad area in and around London. While subject to model testing, we would expect the expanse of impacts of the options to be focused on the relatively local area. The geographic extent of our analysis of SDI impacts will be based on the assessments described in Sections 2, 3, and 4, as summarised below.
 - User benefits. As informed by the traffic forecasts, the focus will be on travel crossing the Thames, together with more local access to the A13 and A2 and along the Eastern parts of the M25 (paragraph 2.1.6pp).
 - Noise, As informed by the traffic forecasts, the focus will be on new corridors and routes where traffic flows, speeds or HGV composition will lead to a significant change in noise level in the long term at the roadside; indicating potential change of noise level in adjacent areas containing sensitive receivers, including noise problem areas previously identified by the Defra noise action plan. The scale of change will be informed by DMRB Volume 11, Part 7, Noise and Vibration (Table 3.2 Classification of Magnitude of Noise Impacts in the Long Term) and the assessment will identify to what extent the route option alleviates the identified noise problem (Section 3.2)
 - Air Quality. As informed by the traffic forecasts, the focus will be on new and existing corridors and routes where traffic flows are forecast to change by at least 1000 AADT and 10% or significant changes are expected to speeds or HDV proportions (Section 3.3).

Capabilities on project:
Transportation

- Affordability. As informed by the traffic forecasts, the focus will be on travel crossing the Thames, together with more local access to the A13 and A2 and along the Eastern parts of the M25 (See 2.1.6pp).

5.3 Step 2: Identification of Social Groups Affected

- 5.3.1 In respect of User Benefits and Affordability, the transport model represents three value of time tertiles. These categories will be used directly to assess the SDI impacts.
- 5.3.2 In respect of Noise and Air Quality, there would be impacts both along the option's corridor and near other roads where traffic flows, compositions or speeds and forecast materially to change. We will identify the roads where forecasted change to traffic flows, speeds or %HGVs would lead to long term impact and review the Index of Multiple Deprivation (IMD) to identify whether the impact of the option is significant in extent or concentrated, or both. The focus will be on the strategic road network.
- 5.4 Step 3-5: Screening and Appraisal of SDIs
 - 5.4.1 The transport model will distinguish non work related travel by three value of time tertiles. The distribution of benefits between these will be assessed and reported to indicate the distribution of user benefits (paragraph 2.1.27pp).
 - 5.4.2 The assessment will allocate noise impacts to people groups or spatial areas affected based upon IMD information available and consider whether any expected negative impacts can be alleviated by amendment to the route options and would residual impacts be significant or concentrated (paragraph 3.2.5).
 - 5.4.3 The assessment will allocate the Air Quality impacts by income groups and for children (see 3.3.3)
 - 5.4.4 The tolls charged for the crossing will be represented in the economic appraisal. We will analyse the toll and car operating cost changes forecast by the model separately for the three value of time tertiles to indicate any distributional impacts (see 4.7.4).