



# Lower Thames Crossing

## 9.15 Localised Traffic Modelling (Tracked changes version)

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### List of contents

	Page number
<b>1 Executive summary</b> .....	<b>1</b>
<b>2 Introduction</b> .....	<b>2</b>
2.1 Document purpose .....	2
2.2 Applicant’s position on impacts characterised through the localised traffic modelling .....	2
<b>3 Context</b> .....	<b>4</b>
3.1 A brief description of types of traffic models .....	4
3.2 The Applicant’s approach to undertaking traffic modelling.....	7
3.3 Action Point 8.....	9
3.4 Action Point 9.....	12
3.5 Action Point 10.....	13
<b>4 Comparative analysis of the findings of the localised traffic modelling and the LTAM</b> .....	<b>16</b>
4.2 Commentary on the results.....	33
4.3 Analysis conclusion .....	33
<b>5 Sharing of localised traffic modelling information</b> .....	<b>34</b>
<b>6 Commentary on reports submitted at Deadline 3</b> .....	<b>37</b>
6.2 Appendix J – ASDA roundabout VISSIM Forecasting Report.....	37
6.3 Appendix K - Five Bells & Pitsea Hall Forecasting Report.....	38
6.4 Appendix M – ASDA roundabout VISSIM Construction Report .....	38
<b>References</b> .....	<b>39</b>
<b>Glossary</b> .....	<b>40</b>
<b>Appendices</b> .....	<b>42</b>
<b>Appendix A Engagement with Thurrock Council on localised traffic modelling</b> .....	<b>43</b>

<b>Deleted: 1 Executive summary</b>	<b>1</b>
<b>2 Introduction</b>	<b>2</b>
2.1 Document purpose	2
2.2 Applicant’s position on impacts characterised through the localised traffic modelling	2
<b>3 Context</b>	<b>4</b>
3.1 A brief description of types of traffic models	4
3.2 The Applicant’s approach to undertaking traffic modelling	7
3.3 Action Point 8	9
3.4 Action Point 9	12
3.5 Action Point 10	13
<b>4 Comparative analysis of the findings of the localised traffic modelling and the LTAM</b>	<b>16</b>
4.2 Commentary on the results	33
4.3 Analysis conclusion	33
<b>5 Sharing of localised traffic modelling information</b>	<b>34</b>
<b>References</b>	<b>35</b>
<b>Glossary</b>	<b>36</b>
<b>Appendices</b>	<b>38</b>
<b>Appendix A Engagement with Thurrock Council on localised traffic modelling</b>	<b>39</b>

**List of plates**

	<b>Page number</b>
<a href="#">Plate 4.1 A13 Manorway junction analysis routes 1 and 2.....</a>	17
<a href="#">Plate 4.2 A13 Manorway junction analysis routes 3 and 4.....</a>	18
<a href="#">Plate 4.3 A13 Manorway junction analysis routes 5 and 6.....</a>	18
<a href="#">Plate 4.4 A13 Manorway junction analysis routes 7 and 8.....</a>	19
<a href="#">Plate 4.5 A13 Orsett Cock junction analysis routes .....</a>	24

**List of tables**

	<b>Page number</b>
<a href="#">Table 3.1 Requests for localised traffic modelling and the Applicant's Response. ....</a>	9
<a href="#">Table 3.2 Design development modelling.....</a>	12
<a href="#">Table 4.1 A13 Manorway junction, 07:00-08:00, 2030.....</a>	20
<a href="#">Table 4.2 A13 Manorway junction, 17:00-18:00, 2030.....</a>	21
<a href="#">Table 4.3 A13 Manorway junction, 07:00-08:00, 2045.....</a>	22
<a href="#">Table 4.4 A13 Manorway junction, 17:00-18:00, 2045.....</a>	23
<a href="#">Table 4.5 A13 Orsett Cock junction, 07:00-08:00, 2030 .....</a>	25
<a href="#">Table 4.6 A13 Orsett Cock junction, 17:00-18:00, 2030 .....</a>	27
<a href="#">Table 4.7 A13 Orsett Cock junction, 07:00-08:00, 2045 .....</a>	29
<a href="#">Table 4.8 A13 Orsett Cock junction, 17:00-18:00, 2045 .....</a>	31
<a href="#">Table 5.1 Associated modelling reports.....</a>	34
 <a href="#">Table A.1 Traffic modelling workshops .....</a>	 47

**Deleted:** Plate 4.1 A13 Manorway junction analysis routes 1 and 2 17¶  
 Plate 4.2 A13 Manorway junction analysis routes 3 and 4 18¶  
 Plate 4.3 A13 Manorway junction analysis routes 5 and 6 18¶  
 Plate 4.4 A13 Manorway junction analysis routes 7 and 8 19¶  
 Plate 4.5 A13 Orsett Cock junction analysis routes 24¶ ...

**Deleted:** Table 3.1 Requests for localised traffic modelling and the Applicant's Response. 9¶  
 Table 3.2 Design development modelling 12¶  
 Table 4.1 A13 Manorway junction, 07:00-08:00, 2030 20¶  
 Table 4.2 A13 Manorway junction, 17:00-18:00, 2030 21¶  
 Table 4.3 A13 Manorway junction, 07:00-08:00, 2045 22¶  
 Table 4.4 A13 Manorway junction, 17:00-18:00, 2045 23¶  
 Table 4.5 A13 Orsett Cock junction, 07:00-08:00, 2030 25¶  
 Table 4.6 A13 Orsett Cock junction, 17:00-18:00, 2030 27¶  
 Table 4.7 A13 Orsett Cock junction, 07:00-08:00, 2045 29¶  
 Table 4.8 A13 Orsett Cock junction, 17:00-18:00, 2045 31¶  
 Table 5.1 Associated modelling reports 34¶  
 ¶  
 Table A.1 Traffic modelling workshops 43¶ ...

## 1 Executive summary

- 1.1.1 This document has been prepared to set out the localised traffic modelling work completed by the Applicant during the development of the A122 Lower Thames Crossing (the Project), and to introduce additional information into the Examination process.
- 1.1.2 The Applicant has set out how the A122 Lower Thames Crossing (the Project) would provide alternative and faster route options, and that this would allow road users to make different decisions about their destinations and the routes they choose. As a result of this, there would be changes in the amount of traffic at many locations across the road network. In many places, and notably at the Dartford Crossing, this would lead to significant beneficial impacts on both journey times and journey reliability. In some locations this change in road user decisions could lead to adverse changes. Overall, the benefits on the road network would outweigh the adverse impacts.
- 1.1.3 The Applicant has developed a number of localised traffic models for use in development of the design and to support engagement with stakeholders on understanding how traffic flows through selected junctions. This document summarises the work done to date, the parties with whom that work was shared, and sets out the criteria used to make decisions on information sharing and that the Applicant proposes to continue to use in future.
- 1.1.4 The localised traffic modelling has been used to check the robustness of the findings of the Lower Thames Area Model (LTAM); the Project's strategic transport model, which forms the basis of all of the assessments included in the DCO application, and an assessment is provided to demonstrate that the localised traffic modelling supports the position of the Applicant, that the forecasts developed using the LTAM provide appropriate and robust information to support the decision making process.
- 1.1.5 Signposting information is also provided, to provide a guide between the various model exercises referenced and the additional information submitted into the Examination in the form of local junction modelling reports.

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## 2 Introduction

### 2.1 Document purpose

- 2.1.1 This document has been prepared to set out the localised traffic modelling work completed by the Applicant during the development of the A122 Lower Thames Crossing (the Project), and to introduce additional information into the Examination process.
- 2.1.2 The assessments provided within the DCO application are based on the Project's strategic transport model, the Lower Thames Area Model (LTAM). This model has been developed using SATURN software, and enables the forecasting of traffic movements across a large modelled area, with important functionality to produce forecasts of the change in traffic flows that arise from the new connectivity the A122 Lower Thames Crossing would create.
- 2.1.3 Localised traffic modelling has also been conducted by the Applicant, using a variety of software tools. This localised traffic modelling uses the traffic flows developed within the LTAM as inputs, and uses them to simulate flows to gain more understanding on how traffic will move through the network.
- 2.1.4 Following Issue Specific Hearing 1 (ISH1) (21 June and 23 June 2023) the Examining Authority issued a series of Action Points (Action Points from Issue Specific Hearing 1 (ISH1) - 21 June 2023 [\[EV-030a\]](#)). Action Point 8, 9 and 10 contained actions relating to localised traffic modelling, for submission at Deadline 1.
- 2.1.5 This document sets out:
- a. The context within which the Applicant has undertaken localised traffic modelling
  - a. Responses to the Action Points 8, 9 & 10
  - b. A comparative analysis of the findings of the localised traffic modelling and the LTAM
  - c. A summary of localised traffic modelling completed, with signposting to submitted detailed reports on the modelling work.

### 2.2 Applicant's position on impacts characterised through the localised traffic modelling

- 2.2.1 The Applicant has set out how the Project would provide alternative and faster route options, and that this would allow road users to make different decisions about their destinations and the routes they choose. As a result of this, there would be changes in the amount of traffic flowing at many locations across the road network. In many places on the network, and notably at the Dartford Crossing, this would lead to significant beneficial impacts on both journey times and journey reliability. In some locations this change in road user decisions could lead to adverse changes. Overall, the benefits on the road network would outweigh the adverse impacts.

- 2.2.2 This position has been set out in full in 7.9 Transport Assessment Appendix F: Wider Network Impacts Management and Monitoring Policy Compliance [APP-535].
- 2.2.3 The information set out in this document demonstrates that the localised traffic modelling work supports and validates the findings of the LTAM, and that conclusions drawn from the LTAM about the overall performance of the project remain valid at a local level, notably including:
- a. The performance of individual junctions
  - b. The scale of traffic impacts and benefits, and by extrapolation, the scale of economic disbenefits and benefits at individual junctions

## 3 Context

### 3.1 A brief description of types of traffic models

3.1.1 There are a variety of approaches available for producing a model or computer simulation of the transport system of an area. This includes:

- a. Strategic transport models
- b. Microsimulation models
- c. Junction models

#### Strategic transport models

3.1.2 Models that cover a wide study area belong to a group known as strategic, four-step transport models. These contain a representation of where people travel to and from in a particular time period, e.g. 17:00-18:00 on an average weekday in a particular month, divided up into separate categories, e.g. trips made in a vehicle or on public transport, trips made using a specific type of vehicle, trips made for a specific purpose, e.g. travel to work.

3.1.3 These models also contain a representation of the available transport network and calculate the route taken by all the trips, and the time and cost of making each trip. This provides information on the number of vehicles using each link in the network and the travel time along each link and through each junction given the number of vehicles using that link and junction.

3.1.4 The Lower Thames Area Model (LTAM) is one of these types of models. Within the Fully Modelled Area (shown in Plate 3.7 of Combined Modelling and Appraisal report - Appendix B - Transport Model Package [APP-520]), it contains a detailed description of all but the most minor roads in the network and a full description of the UK rail services. The road links are coded into the model with information on details such as the road type, the number and width of lanes, the maximum capacity of the link, and a speed flow curve which describes how the speed of a vehicle along the road depends on the number of other vehicles also on the link.

3.1.5 Junctions are also coded into such models, for example at traffic signals the length of time the lights are at red or green are defined, and the allowed turning movements from each lane are specified. A key feature of SATURN models is that the maximum capacity of a lane or a junction is an input into the model, calculated from the junction characteristics. The models cover a wide area and so standard capacity calculations are often used, based on geometric characteristics and standard patterns of settings for traffic lights.

3.1.6 The strength of a strategic model such as the LTAM is that it can cover a large area in detail; the LTAM covers Gravesham, Thurrock, most of Kent and Essex and a large part of East London in this amount of detail. It enables modelling of how people change their behaviour in response to a change in the transport network; such responses include changes in the frequency with which they travel, the time of day when they travel, the transport mode they use, their destination and the route they use. It is particularly useful to look at area wide re-routing of trips.

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- 3.1.7 The models are deterministic, that is every time the model is run with exactly the same inputs it will produce exactly the same outputs. This type of model is used to look at the impact of making a change to the network (e.g. providing a new road) and the resulting change in the model outputs that result solely from that change and not combined or lost in the noise introduced by random processes with the model.

### Microsimulation models

- 3.1.8 Microsimulation models are another type of modelling tool used to look at small areas of a network, sometimes a single junction and sometimes a small area of a few adjacent junctions. For highway microsimulation models the focus of the model is on modelling each individual driver and their driving behaviour. The software has the drivers arriving at junctions at varying times through the modelled time period and then simulates how the vehicle is driven through the junction e.g. including when they change lane, when and how quickly they accelerate or decelerate, how big a gap in traffic they need before pulling out, and how close they drive to the vehicle in front. The models use stochastic processes, that is the use of random numbers, so that each run of the model produces different results. The final results presented are usually the average of a number of model runs.

- 3.1.9 These models are useful for seeing how the traffic conditions may vary during the modelled time period and on different days. In these models the capacity of junctions are not an input into the model but rather an output from the model, influenced by not just the physical characteristics but also the driving behaviours of the people using them.

### Junction models

- 3.1.10 Another set of modelling tools are available for use in looking at a very small part of the network. These include tools such as Arcady for roundabouts which are again a deterministic tool but which model conditions at a junction in great detail, for instance for very small time periods.

### How each type of model has been used

- 3.1.11 It is inevitable that modelling the highway network using these different approaches will not provide exactly the same results but together they provide complementary insights into the performance of a network. They are used for different purposes in the development of an intervention in the transport network.
- 3.1.12 Strategic models such as the LTAM are used to answer questions such as what trips will be affected by the proposed intervention, how the pattern of trips that are made will change and what impact there would be on the number of vehicles on each part of the network and their journey times. The models are run for at least two forecast years so that the impacts when the intervention opens and into the future can be considered. The model outputs are used in the social, environmental and economic appraisal of the scheme over the whole affected area and to answer design questions such as what the advantages and disadvantages of different options for the location of the new road are, what are the traffic speeds if say two lanes were provided and would there be free flow traffic conditions.

- 3.1.13 Many checks have been carried out on the realism of the forecasts of the impacts of Project produced by using the LTAM. The LTAM was built using mobile phone data so as to capture trips made over a wide area, with the data supplemented by traffic counts and journey time information. A good match was achieved between the LTAM forecasts of traffic flows and travel times on the network and observed traffic flows and travel times. These are reported in the Combined Modelling and Appraisal report - Appendix B - Transport Model Package [APP-520]. The strength of the behavioural responses included in the LTAM were checked by looking at the sensitivity of the model to changes in fuel prices and public transport fares; again this is reported in the Combined Modelling and Appraisal report - Appendix B - Transport Model Package and the modelled responses matched with the expected responses based on UK evidence and provided in DfT's guidance on the building of transport models (known as Transport Analysis Guidance (TAG)).
- 3.1.14 The forecast impact on the road network predicted by the LTAM, including which roads would see an increase or decrease in traffic, has been shared with relevant authorities including planning authorities, highways authorities and Transport for London, as well as with the public at the Applicant's public consultations since 2018.
- 3.1.15 Microsimulation models are particularly useful in detailed design, especially at junctions, where they can be used to test changes in the fine details of a junction both in its geometry and other aspects such as traffic light settings, interaction with pedestrians etc. During the development of the Project, microsimulation was used to model the emerging design of the Project, particularly to see the speed profile along the mainline and through the junctions and how the high percentage of heavy goods vehicles on the road would affect the conditions on the road for other users.
- 3.1.16 The LTAM provides a consistent way to look at the impacts of the Project over a wide area. It highlights those junctions where travel times would increase and those where it will decrease as a result of the Project. For these reasons, the Applicant considers it best practice to consider the LTAM forecasts to be the most appropriate information on which to base the assessment of the Project, but recognises the benefits of microsimulation and junction modelling to support understanding of the outputs of LTAM.
- 3.1.17 Localised traffic modelling can be conducted using each of the three types of models characterised above. The selection of the model is determined by the need of the modelling exercise. However, for the following discussion, the focus of the localised traffic modelling is on the use of microsimulation models and junction models.

## 3.2 The Applicant's approach to undertaking traffic modelling

- 3.2.1 The Applicant also wishes to highlight paragraph 4.6 of the National Networks National Policy Statement which sets out that “*The Examining Authority and the Secretary of State do not need to be concerned with the national methodology and national assumptions around the key drivers of transport demand... We do encourage an assessment of the benefits and costs of schemes under high and low growth scenarios, in addition to the core case. The modelling should be proportionate to the scale of the scheme and include appropriate sensitivity analysis to consider the impact of uncertainty on project impacts.*”
- 3.2.2 The Applicant considers that the strategic modelling undertaken for the Project is appropriate and proportionate to the scale of the scheme, and while proportionate localised traffic modelling may be helpful for the purposes of considering the sensitivity of individual junctions, in addition to the work already completed using the LTAM and reported in 7.9 Transport Assessment [APP-529], further traffic analysis must not be taken as bringing into question the use of the national methodology (i.e., TAG) in respect of the modelling provided in the Transport Assessment.
- 3.2.3 The Applicant has used traffic modelling for two different reasons as set out below.

### Design development

- 3.2.1 During the development of the project, the Applicant has used localised traffic modelling to develop and test highway designs for various elements of the Project. As set out in documents 7.4 Project Design Report Part B [APP-507]; 6.1 Environmental Statement Chapter 2 Project Description [APP-140] and 6.1 Statement Chapter 3 Assessment of Reasonable Alternatives [APP-141], the design process is iterative, with interplay between the environmental and design disciplines. A core element of this iteration has been the use of traffic modelling to develop and test highways design solutions.
- 3.2.2 Localised traffic modelling, using microsimulation and junction models, has been undertaken for operational traffic flows, but not for construction flows. The Applicant considers it important to understand the different nature of these assessments:
- Operational models are considered to be reasonable forecasts of the future flows at the junction, within the constraints of the traffic forecasting process as set out in 7.7 Combined Modelling and Appraisal Report [APP- 518] and the relevant appendices. These models provide a useful tool to validate the findings of the LTAM, and to visualise the nature of flows to support the design process.
  - Construction models built to assess the Project represent a reasonable worse case scenario. As set out in Chapter 8 of 7.9 Transport Assessment [APP-529] each construction modelling phase brings together a number of assumptions as to the works being undertaken for each modelled time period. The construction modelling undertaken for this project using the

LTAM is complex and detailed considering the scale of the Project, and needs to be understood in the context that, should the DCO be granted, National Highways would work with the Contractors to develop more detailed construction plans, with a more refined construction plan designed to reduce the impacts on the highway network. The Applicant has secured controls on this process, through the outline Traffic Management Plan for Construction [APP-547] (the oTMPfC).

### Stakeholder discussions

- 3.2.3 The Applicant has recognised the need for certain stakeholders (planning authorities, highways authorities, Transport for London (TfL) and the operators of certain ports, including Port of Tilbury London Limited (PoTLL) and DP World London Gateway) to understand the changes in traffic flows that would result from the construction and operation of the Project. As a result, the Applicant has shared modelling information with these organisations.
- 3.2.4 The approach taken with planning authorities, highways authorities and Transport for London has been as follows:
- a. Following the development of an update to the LTAM, full datasets have been released in GIS format, to allow these organisations to interrogate changes on the network. These data sets include Do Minimum and Do Something flow and journey time forecasts, allowing the determination of future flows both without and with the Project, and to understand the change in flows and journey times.
  - b. Alongside the updated datasets, 'cordon' models have been released. These cordon model allows the organisation to interrogate the model within their local area to understand speeds and journey times on their highway network.
  - c. When the organisation has requested information that cannot be delivered through interrogation of the cordon model, a bespoke model output has been prepared. Examples of this include Select Link Analyses for key locations such as at the Dartford Crossing and the A122 Lower Thames Crossing tunnels, enabling the organisations who requested this to determine the origins and destinations of traffic using the crossings.
  - d. When requested and considered proportionate, the Applicant has prepared and shared operational phase localised traffic models (microsimulation and junction models) of selected junctions. As these are required to address specific concerns of the organisation, the models have been prepared on request, following agreement on the nature of the model (software), the scope (model extents), and on the core assumptions. Information supplied to the organisation includes reports on the model outputs and the actual models.

- e. When requested and considered proportionate, the Applicant has prepared bespoke operational strategic models, using the LTAM as a base, to test specific scenarios, such as emerging local plan concepts, and issued datasets and, when appropriate, cordon models as set out above.

3.2.5 The approach taken with the ports is as follows:

- a. Following the development of an update to the LTAM, meetings have been arranged with the organisation to brief them on the changes to traffic on key routes. The key routes have been discussed and agreed with the organisation, and requests for additional data have been accommodated.
- b. Where specific requests have been made for the provision of information made available to the local authorities, this has also been supplied. To date this has included provision of reports on selected elements of the local junction modelling work.

3.2.6 Three specific Action Points from ISH1 relate to the sharing of the information, and these are addressed specifically in the sections below.

### 3.3 Action Point 8

3.3.1 Action Point 8 states:

*“Provide a summary of requests made to them by the following Councils (Thurrock, Essex, LB Havering, Gravesham, Medway and Kent CC) and Ports (PoTLL and Gateway) for localised traffic modelling data and specific intersection modelling around LTC, which ones they have assisted with and provided information, and which ones they have not and why not?”*

3.3.2 Requests have been put to the Applicant for localised traffic modelling at the locations listed in Table 3.1, and the response of the Applicant is also provided.

**Table 3.1 Requests for localised traffic modelling and the Applicant’s Response.**

ID	Request	Response
1	A13 Orsett Cock junction Operational microsimulation model (Thurrock Council)	Model developed and shared with Thurrock Council. 2030 model reports supplied to Thurrock Council and Essex County Council, and presentations supplied on the 2045 forecasts. Briefings provided to PoTLL and DP World.
2	A13 Manorway junction Operational microsimulation model (Thurrock Council)	Model developed and shared with Thurrock Council. Reports supplied to Thurrock Council and Essex County Council. Briefings provided to DP World.
3	A13 Five Bells junction Operational microsimulation model (Thurrock Council)	Junction model developed, no microsimulation model developed. Model not shared with Thurrock Council. Information not considered to be in sufficiently close proximity to the project to

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ID	Request	Response
		meet with criterion 3.5.9 b(i) as set out below.
4	A13 Pitsea interchange Operational microsimulation model (Thurrock Council)*	Junction model developed, no microsimulation model developed Model not shared with Thurrock Council. Information not considered to be in authority area in accordance with criterion 3.5.9 a(i) as set out below.
5	Daneholes roundabout Operational microsimulation model (Thurrock Council)	Model developed (as part of East-West model) but not shared with Thurrock Council as work put on hold during Thurrock Council stand-down.
6	Marshfoot Interchange Operational microsimulation model (Thurrock Council)	Model developed (as part of East-West model) but not shared with Thurrock Council as work put on hold during Thurrock Council stand-down.
7	Stifford Interchange Operational microsimulation model (Thurrock Council)	Model developed (as part of East-West model) but not shared with Thurrock Council as work put on hold during Thurrock Council stand-down.
8	Treacle Mine roundabout Operational microsimulation model (Thurrock Council)	Model developed (as part of East-West model) but not shared with Thurrock Council as work put on hold during Thurrock Council stand-down.
9	A1089 ASDA roundabout Operational & construction microsimulation models (Thurrock Council & PoTLL)*	Model developed by National Highways Model not shared with Thurrock Council: Operational microsimulation models not shared due to criterion 3.5.9 b(i) - lack of adverse impacts. Construction model not shared for reasons set out at 3.5.10.
10	A12/ North Street Operational junction model (London Borough of Havering)	Model developed and shared with London Borough of Havering
11	A12/ Pettits Lane Operational junction model (London Borough of Havering)	Model developed and shared with London Borough of Havering
12	A12/ Harold Court Road Operational junction model (London Borough of Havering)	Model developed and shared with London Borough of Havering
13	A12/ Gubbins Lane Operational junction model (London Borough of Havering)	Model developed and shared with London Borough of Havering
14	A12/A127 Gallows Corner Operational junction model	Model developed and shared with London Borough of Havering and TfL

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ID	Request	Response
	(London Borough of Havering & TfL)	
15	A127/Ardleigh Green Road/Squirrels Heath Operational junction model (London Borough of Havering)	Model developed and shared with London Borough of Havering
16	A127/ Wingleye Lane Operational junction model (London Borough of Havering)	Model developed and shared with London Borough of Havering
17	A127/ Hall Lane Operational junction model (London Borough of Havering)	Model developed and shared with London Borough of Havering
18	A127/ Front Lane Operational junction model (London Borough of Havering)	Model developed and shared with London Borough of Havering
19	Marsh Way junction Operational junction model (London Borough of Havering)	Model developed and shared with London Borough of Havering
20	A13/A1306 Operational junction model (London Borough of Havering)	Model developed and shared with London Borough of Havering
21	A124/Station Road/B1421 (Bell Corner) Operational junction model (London Borough of Havering)	Model developed and shared with London Borough of Havering
	The Applicant has also undertaken modelling at the following locations using the Project's strategic transport model (LTAM), considering specified scenarios agreed with the relevant authorities (modelling meets Criteria c)	
22	A12/A127 Gallows Corner Specified scenario strategic model (operation) (London Borough of Havering & TfL)	Model developed and shared with London Borough of Havering & TfL
23	A127/A130 Fairglen junction Specified scenario strategic model (operation) (Essex County Council)	Model developed and shared with Essex County Council
24	A229 Bluebell Hill Specified scenario strategic model (operation) (Kent County Council)	Model developed and shared with Kent County Council
25	A13/A126 junction – east facing slips Specified scenario strategic model (operation) (Thurrock Council)	Model developed and shared with Thurrock Council

*[\\*Note – reporting of these models was submitted by the Applicant into the Examination at Deadline 3.](#)*

3.3.3 There has been extensive engagement with local planning authorities, highway authorities and Transport for London on the traffic modelling, including discussions with authorities on their request about localised traffic modelling as set out above. An example of the type of engagement is provided setting out the engagement with Thurrock Council, included at Appendix A of this document.

### 3.4 Action Point 9

3.4.1 Action Point 9 states:

*“Please provide a summary list of local intersections for which localised traffic modelling has been completed. If there are any intersections for which modelling has been completed but has not been shared with the relevant local highway authority, what is the reason for that decision?”*

3.4.2 As set out in Section 3.1, the Applicant has undertaken localised traffic modelling for the purposes of design development and stakeholder engagement. Table 3.1 sets out the localised traffic modelling that has been prepared and how it was shared.

3.4.3 During the development of the design, the Applicant has undertaken localised traffic modelling of the following locations set out in Table 3.2

**Table 3.2 Design development modelling**

ID	Location
<b>Grade separated network analysis</b>	
26	A122 Lower Thames Crossing – microsimulation model
27	A2/M2 corridor – microsimulation model
28	A13 corridor – microsimulation model
29	M25 corridor – microsimulation model
<b>Local roads analysis</b>	
30	M25 junction 29 – microsimulation model
31	Gravesend East interchange – microsimulation model
32	Henhurst Road – microsimulation model
33	Collector road junctions – microsimulation model
34	Thong Lane new junction – microsimulation model
35	Thong Lane to Brewers Road – microsimulation model
36	Brewers Road junction – microsimulation model
37	A1089 Asda roundabout – microsimulation model
38	A13 Five Bells junction – junction model
39	A13 Pitsea interchange– junction model

3.4.4 This modelling was conducted during the development of the design set out in the application. With the exception of the A1089 Asda roundabout, A13 Five Bells junction, A13 Pitsea junction, no requests were made for this information



and so it has not been shared to date. The reasons for not sharing items 37, 38 and 39 [during pre-application](#) are set out in the responses in Table 3.1.

## 3.5 Action Point 10

3.5.1 Action Point 10 states:

3.5.2 “[...] Further to actions 8 & 9, please provide a document describing the criteria that the Applicant will use going forward to determine whether and if so how to respond to requests for local / micro modelling of intersections. This relates to requests that have arisen from Thurrock Council (such as but not limited to the Dock Road/ Thurrock Park Asda roundabout (A1089) and Orsett Cock roundabout (A13/ Stanford Road)). However, in responding, the Applicant should take account of existing and possible future requests from other local authorities with local highway authority duties, from Gravesham Council as a main host local planning authority and from PoTLL and Gateway as major users of the local road network proposed to link to LTC.”

3.5.3 The Applicant recognises that its stakeholders have raised questions throughout engagement with them whilst developing the submission for development consent for the Project. The Applicant also acknowledges the responsibilities it has through its licence to cooperate with other persons or organisations and to encourage sustainable economic growth, whilst protecting the environment, improving safety and the quality of life for current and future generations.

3.5.4 The criteria below are those that the Applicant has used and will continue to use to determine its response to requests from stakeholders who request junction or local area modelling; which may use an alternative modelling platform to the Applicants strategic transport model – the Lower Thames Area Model (LTAM), and this would be agreed with the requestor as part of a collaborative working approach.

3.5.5 The Applicants approach to assessment in both construction and operation are presented.

3.5.6 Stakeholders considered within are:

- a. Local highway authorities
- b. Host planning authorities
- c. Port of Tilbury and London Gateway Port.

3.5.7 The Applicant will also engage with other major users of the road network, and consider requests, but recognises the importance of the Ports and the direct effects of the A122 Lower Thames Crossing on the access onto the wider Strategic Road Network for the two identified ports.

3.5.8 For completeness, the Applicant has also set out below its approach to the use/provision of data from the LTAM.

### Approach to junction / local area modelling

- 3.5.9 The Applicant is willing to undertake operational modelling in a proportionate manner, subject to the Applicant's responsibilities to ensure the proper use of public funds, and will seek to agree the nature of the modelling exercise with the requestor. Where simpler models are suitable to provide the information the requestor needs, the Applicant will encourage this to support the delivery of value for money. The Applicant considers that the request must meet both criterion a and b as set out below:
- a. Criterion a) Where it is relevant to the organisation, either:
    - i. because the organisation has authority over the highway, or authority over highways connecting to the area of consideration; or
    - ii. because the organisation is a major user of the highway network and have access through the area of consideration
  - b. Criterion b) Where the particular junction or link is strategically or locally important, existing sensitivity analysis does not provide the relevant information, and the request is for one of the following:
    - i. Network simulation (VISSIM or similar) where the location being requested is in close proximity to the Project and there are adverse impacts forecast through the LTAM; or
    - ii. Junction simulation (LINSIG or similar) where the location being requested is in close proximity to the Project;
- 3.5.10 In addition, in the past the Applicant has undertaken additional modelling under the duty of National Highways to collaborate with relevant authorities. The Applicant will continue to meet this obligation, but outside the Examination. Requests put to the applicant have been accepted if they meet Criterion a(i) above, and the following Criterion c):
- a. Criterion c) Where it is directly required in connection with the development of a local plan; or where it supports ongoing engagement that the requestor is having with DfT.
- 3.5.11 This modelling would reflect the Project in operation and not during the construction scenario. As stated above, the construction scenario represents a temporary period of time, and reflects a reasonable worst case based on the information known at the time of the application. The Applicant's delivery partners will develop the construction programme further and the Outline Traffic Management Plan for Construction [APP-547] states at paragraph 2.4.20 that in some instances, it may be deemed appropriate that junction modelling is carried out prior to works.

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3.5.12 For requests made under point b(i) above, the information would be intended for to be used to better understand the nature of the forecast traffic flows as developed using the LTAM, and presented in the application documents. The Applicant maintains that the appropriate information for undertaking the assessment and forming the consideration of the impacts and benefits of the Project is as presented within the application for development consent using outputs from the LTAM, but recognises that localised traffic modelling can be useful to the understanding of the nature of the traffic flows that inform these assessments.

3.5.13 For requests made under Criteria c) above, the information would not be intended to be used for the assessment of the Project, but to assist the organisation with the development of their plans in a scenario where the Project has gained consent and been constructed.

#### **Approach to providing information from the LTAM**

3.5.14 The Applicant has already provided datasets and cordon models for operation to organisations including :

- a. Brentwood Borough Council
- b. Essex County Council
- c. Dartford Borough Council
- d. Gravesham Borough Council
- e. Kent County Council
- f. London Borough of Havering
- g. Medway Council
- h. Thurrock Council
- i. Transport for London

3.5.15 The Applicant is willing to undertake modelling using the LTAM in the following circumstances (where it is agreed that junction or local modelling would not be appropriate):

- a. Where it is in support of local plan development
- b. Where it supports ongoing engagement that the requestor is having with DfT
- c. Where National Highways Spatial Planning have made a request for an assessment using the LTAM to assist in the consideration of a proposed development

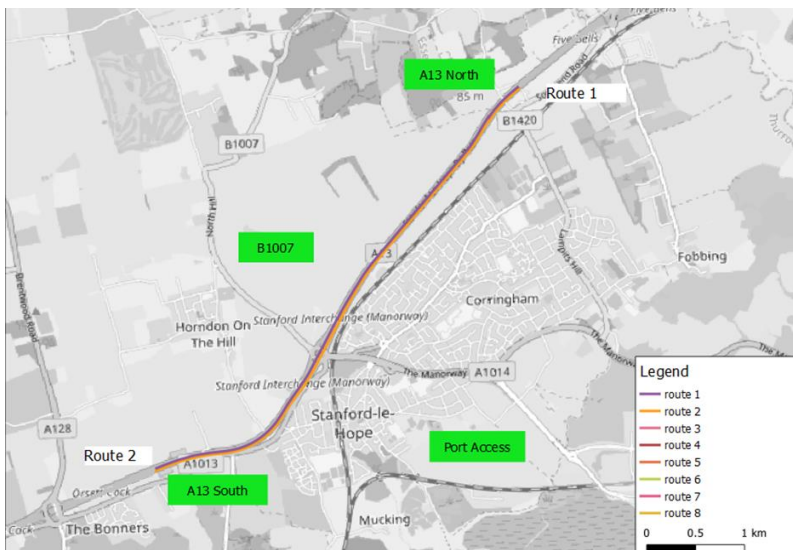
## 4 Comparative analysis of the findings of the localised traffic modelling and the LTAM

- 4.1.1 Throughout the development process, the Applicant has maintained checks to verify that the inputs of the localised traffic modelling remained aligned with the inputs of the strategic traffic model, and the outputs were reviewed to ensure check for consistency in the findings. An analysis is set out in this section to demonstrate that the scale of the impacts on junctions in the LTAM results are similar to those forecast using microsimulation modelling and shared this with stakeholders to show that any differences would not lead to a change in the benefit cost ratio of the Project.
- 4.1.2 It is not a straightforward exercise to compare exactly the forecasts produced by a SATURN model (LTAM) and a VISSIM microsimulation model. The links and the structure of the model are different, with for example the entrance and exit links being of different lengths. The traffic flows also differ slightly, as each of the models were prepared in discussion with the relevant authority and so contains assumptions that met the requirements of the requesting party.
- 4.1.3 A comparison has been undertaken at the A13 Manorway junction (as described in Table 3.1 D 2) and A13 Orsett Cock junction (as described in Table 3.1 ID 1) of the flows and times through the document.
- 4.1.4 Junctions in Saturn (LTAM) and VISSIM for both 2030 and 2045. For each junction a series of defined journeys through the junction have been specified, and the time taken to complete the journey, along with the number of vehicles completing that journey in one hour, have been determined. This has been completed for both the Do Minimum (without the Project) and the Do Something (with the Project) scenarios.
- 4.1.5 The tables show for each journey:
- the length of the journey in each model, which is not identical between models for reasons set out in paragraph 4.1.2;
  - flows making particular movements in the local area and the time forecast to make that section of a vehicle's overall trip. This allows comparison of the journey times between the two different models, and between the Do Minimum and Do Something scenarios. In reality, the section through the junction would be a small part of a longer trip.
  - the weighted time is obtained by multiplying the flow by the travel time for each movement. The benefit cost ratio calculation uses changes in the weighted travel time when estimating the monetary value of the changes in travel time.

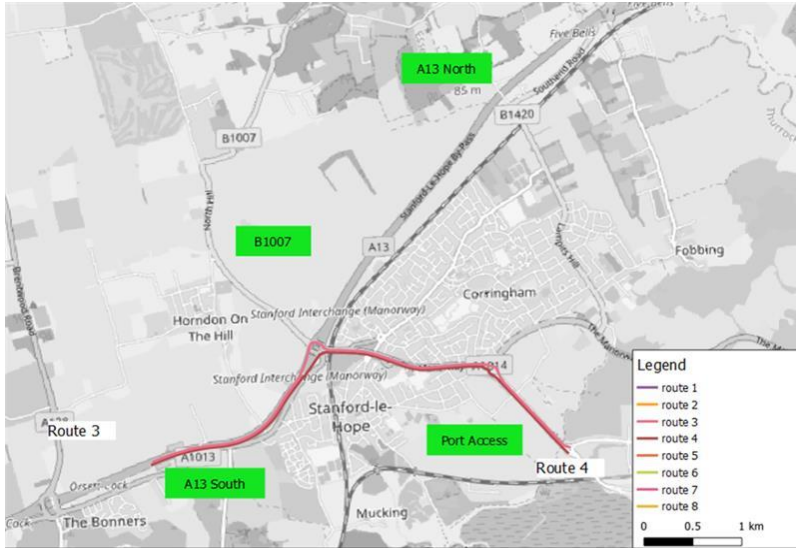
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- 4.1.6 Information is presented for the A13 Manorway junction as follows:
- Routes analysed are set out in Plates Plate 4.1, Plate 4.2, Plate 4.3 and Plate 4.4
  - Comparison of journey times in the AM peak, 2030 are provided in Table 4.1
  - Comparison of journey times in the PM peak, 2030 are provided in Table 4.2
  - Comparison of journey times in the AM peak, 2045 are provided in Table 4.3
  - Comparison of journey times in the PM peak, 2045 are provided in Table 4.4

**Plate 4.1 A13 Manorway junction analysis routes 1 and 2**



**Plate 4.2 A13 Manorway junction analysis routes 3 and 4**



**Plate 4.3 A13 Manorway junction analysis routes 5 and 6**

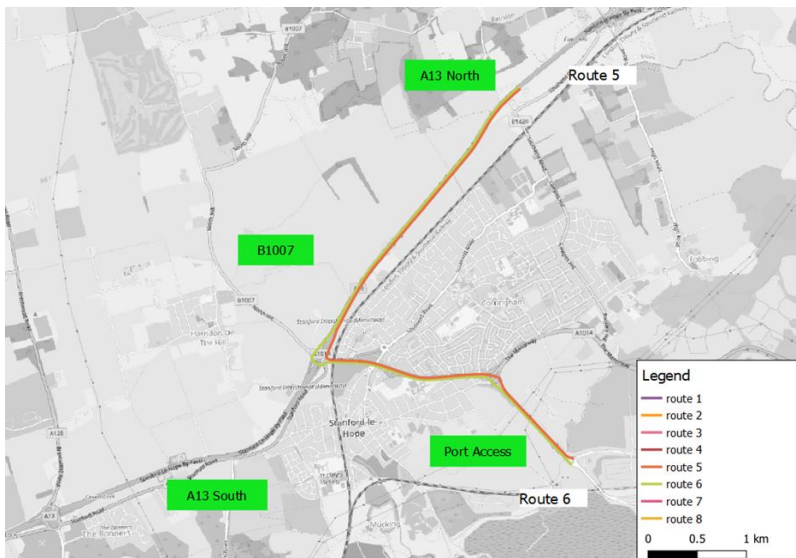
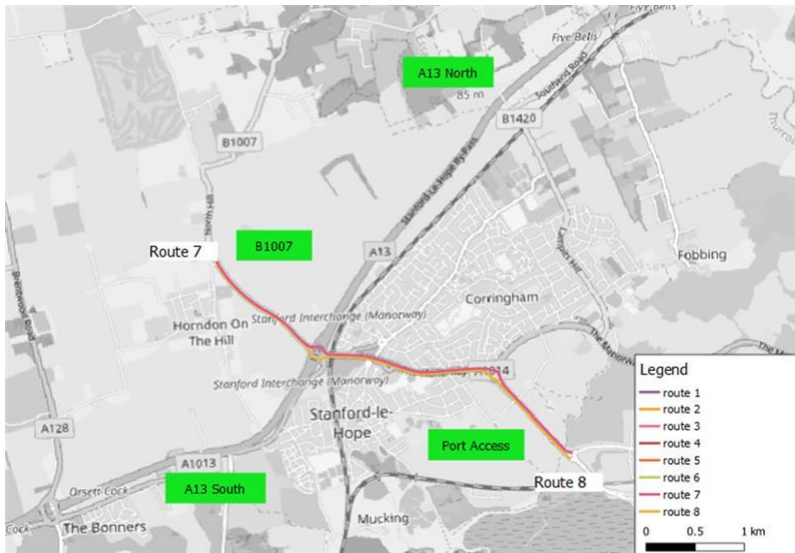


Plate 4.4 A13 Manorway junction analysis routes 7 and 8



**Table 4.1 A13 Manorway junction, 07:00-08:00, 2030**

Do Minimum								
Route	Distance (metres)		Flows (vehicles)		Time (secs)		Weighted time (mins)	
	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim
1	2,687	2,919	2,457	2,449	117	103	4,806	4,198
2	4,464	2,934	3,198	3,189	217	111	11,569	5,897
3	4,253	4,088	380	374	245	238	1,550	1479
4	3,822	4,009	161	153	232	225	625	574
5	3,280	3,309	246	246	208	205	853	843
6	3,660	3,527	109	104	253	258	461	447
7	4,446	3,329	84	83	453	205	632	284
8	4,472	3,345	5	4	290	207	23	13

Total weighted time, excluding mainline, hours

**69 61**

Do Something					
Flows (vehicles)		Time (secs)		Weighted time (mins)	
SATURN	Vissim	SATURN	Vissim	SATURN	Vissim
2,863	2,854	130	104	6,188	4,970
3,319	3,295	250	126	13,822	6,938
406	397	258	244	1,751	1,616
165	154	256	231	705	590
206	204	207	207	711	707
107	104	259	258	464	448
30	29	671	209	330	100
5	5	291	204	23	16

**66 58**



**Table 4.2 A13 Manorway junction, 17:00-18:00, 2030**

Route	Do Minimum								Do Something					
	Distance (metres)		Flows (vehicles)		Time (secs)		Weighted time (mins)		Flows (vehicles)		Time (secs)		Weighted time (mins)	
	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim
1	2,687	2,919	2,963	2,955	147	105	7,281	5,149	3,599	3,584	153	106	9,200	6,352
2	4,464	2,934	2,581	2,570	194	104	8,328	4,435	3,121	3,109	220	116	11,444	6,030
3	4,253	4,088	187	181	241	240	752	721	197	188	254	238	835	745
4	3,822	4,009	447	436	242	217	1,808	1579	490	472	259	232	2,112	1,830
5	3,280	3,309	112	110	205	204	380	375	108	108	205	207	369	372
6	3,660	3,527	239	231	284	282	1,128	1,086	154	151	427	276	1,099	694
7	4,446	3,329	9	8	292	206	44	29	9	9	277	203	44	31
8	4,472	3,345	99	94	324	210	535	327	80	75	314	216	421	271
Total weighted time, excluding mainline, hours							<b>77</b>	<b>69</b>			<b>81</b>	<b>66</b>		

**Table 4.3 A13 Manorway junction, 07:00-08:00, 2045**

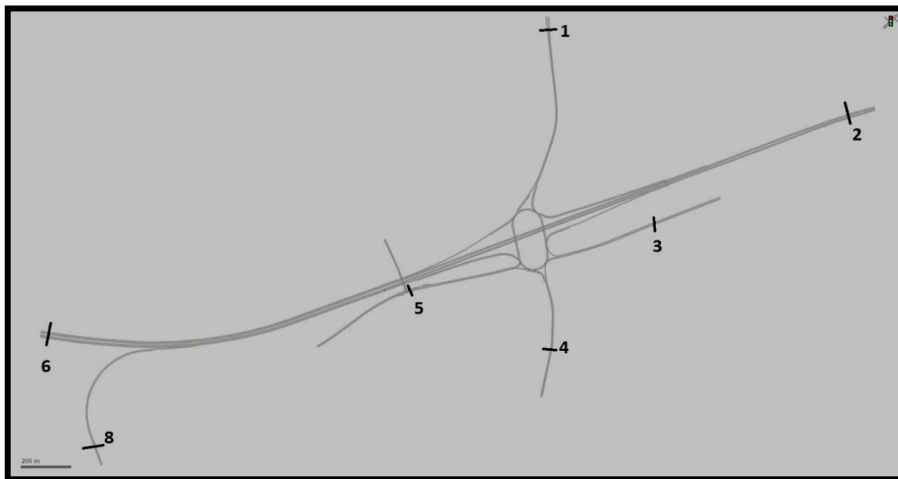
Route	Do Minimum								Do Something							
	Distance (metres)		Flows (vehicles)		Time (secs)		Weighted time (mins)		Flows (vehicles)		Time (secs)		Weighted time (mins)			
	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim		
1	2,687	2,919	2,853	2,842	149	105	7,071	4,968	3,293	3,282	152	106	8,351	5,808		
2	4,464	2,934	3,195	3,177	220	114	11,695	6,040	3,392	3,364	255	135	14,434	7,558		
3	4,253	4,088	375	369	253	240	1,585	1,479	410	401	266	242	1,819	1,619		
4	3,822	4,009	162	153	235	221	632	562	165	154	353	239	971	612		
5	3,280	3,309	234	233	208	206	811	799	187	183	208	213	647	650		
6	3,660	3,527	107	103	290	265	518	455	101	99	353	264	595	435		
7	4,446	3,329	43	43	588	208	424	149	35	34	716	207	413	119		
8	4,472	3,345	6	5	294	202	30	16	10	9	291	207	49	31		
Total weighted time, excluding mainline, hours							<b>67</b>	<b>58</b>							<b>75</b>	<b>58</b>

**Table 4.4 A13 Manorway junction, 17:00-18:00, 2045**

Route	Do Minimum								Do Something							
	Distance (metres)		Flows (vehicles)		Time (secs)		Weighted time (mins)		Flows (vehicles)		Time (secs)		Weighted time (mins)			
	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim		
1	2,687	2,919	3,090	3,078	149	105	7,649	5,391	3,780	3734	156	110	9,850	6,853		
2	4,464	2,934	3,031	3,020	205	109	10,374	5,468	3,500	3,452	247	140	14,385	8,053		
3	4,253	4,088	179	172	245	242	733	694	190	167	261	246	825	685		
4	3,822	4,009	443	430	248	224	1,837	1,602	471	453	444	246	3,483	1,858		
5	3,280	3,309	110	108	206	206	377	369	101	98	205	221	345	359		
6	3,660	3,527	232	222	335	290	1,295	1,075	95	93	538	281	852	435		
7	4,446	3,329	8	8	353	211	49	29	14	15	311	203	73	52		
8	4,472	3,345	103	99	331	213	568	352	89	84	319	220	473	308		
Total weighted time, excluding mainline, hours							<b>81</b>	<b>69</b>							<b>101</b>	<b>62</b>

- 4.1.7 Information is presented for the A13 Orsett Cock junction as follows:
- Routes analysed are set out in Plate 5
  - Comparison of journey times in the AM peak, 2030 are provided in Table 4.5
  - Comparison of journey times in the PM peak, 2030 are provided in Table 4.6
  - Comparison of journey times in the AM peak, 2045 are provided in Table 4.7
  - Comparison of journey times in the PM peak, 2045 are provided in Table 4.8

**Plate 4.5 A13 Orsett Cock junction analysis routes**



**Table 4.5 A13 Orsett Cock junction, 07:00-08:00, 2030**

Do Minimum									Do Something					
Route	Distance [m]		Flows (vehicles)		Time (secs)		Weighted time (mins)		Flows (vehicles)		Time (secs)		Weighted time (mins)	
	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim
1-->2	2,055	2,122	155	196	107	123	277	401	124	161	127	193	263	517
1-->3	1,898	1,396	67	61	159	118	178	120	32	29	173	188	92	91
1-->4	2,940	1,347	77	79	181	107	232	141	52	55	190	177	165	162
1-->5	2,301	1,533	211	101	163	125	572	210	108	36	179	199	322	120
1-->6	3,636	3,025	140	233	237	193	552	748	190	224	222	261	704	976
1-->8	3,386	2,439	93	43	223	171	346	123	117	156	194	265	378	689
2-->1	2,160	2,360	209	284	152	161	529	760	78	149	180	183	234	455
2-->3	1,603	1,653	0	7	116	100	0	12	0	8	138	111	0	15
2-->4	2,645	1,605	77	141	137	90	176	210	28	87	155	101	72	146
2-->5	2,006	1,791	580	504	119	107	1,152	901	390	258	144	123	934	528
2-->6	3,341	3,177	3,323	3,627	193	118	10,711	7,130	2,676	2,794	187	120	8,351	5,603
2-->8	3,091	3,315	299	392	180	131	897	856	219	234	159	188	580	735
3-->1	1,853	1,590	341	108	137	144	778	259	167	28	162	183	452	86
3-->2	2,096	2,215	0	3	136	161	0	8	0	4	179	212	0	14
3-->4	2,338	835	7	60	122	73	14	73	6	58	137	101	14	97
3-->5	1,699	1,021	98	288	104	91	170	435	93	243	126	123	195	497
3-->6	3,034	2,513	314	170	178	158	934	449	408	267	170	185	1,153	822
3-->8	2,784	1,927	36	29	165	137	99	66	46	27	141	188	108	85
4-->1	3,027	1,431	274	200	210	217	958	725	160	125	212	185	566	386
4-->2	3,270	2,056	128	231	209	235	445	903	96	222	229	214	367	792

Do Minimum								
Route	Distance [m]		Flows (vehicles)		Time (secs)		Weighted time (mins)	
	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim
4-->3	3,113	1,330	12	29	261	230	52	111
4-->5	2,873	862	0	71	177	164	0	194
4-->6	4,208	2,354	207	167	251	232	867	645
4-->8	3,958	1,768	0	8	238	211	0	28
5-->1	2,208	1,465	0	145	159	157	0	379
5-->2	2,451	2,090	617	433	158	174	1,623	1,255
5-->3	2,294	1,364	92	62	210	169	322	175
5-->4	3,336	1,315	0	15	231	158	0	40
5-->6	3,389	2,387	0	16	201	171	0	46
5-->8	3,139	1,802	0	0	187	150	0	0
6-->1	3,082	2,770	238	293	173	153	684	749
6-->2	3,325	3,347	3,061	3,222	171	122	8,738	6,537
6-->3	3,168	2,669	184	105	223	166	685	290
6-->4	4,210	2,621	51	49	245	155	208	127
6-->5	3,571	2,807	0	17	227	173	0	49
6-->8	4,656	3,713	0	0	287	219	0	0

Total weighted time, excluding mainline, hours

**212 191**

Do Something					
Flows (vehicles)		Time (secs)		Weighted time (mins)	
SATURN	Vissim	SATURN	Vissim	SATURN	Vissim
10	33	273	209	46	115
0	63	176	125	0	131
298	263	220	187	1,091	818
0	0	191	190	0	0
0	138	160	158	0	363
480	291	178	187	1,420	906
80	52	221	182	295	158
0	14	238	171	0	40
0	17	168	159	0	45
0	0	139	163	0	0
190	308	148	152	468	780
2,019	2,485	165	127	5,552	5,265
135	85	208	176	469	249
42	39	224	165	157	107
0	16	213	188	0	50
0	0	228	253	0	0

**176 183**

**Table 4.6 A13 Orsett Cock junction, 17:00-18:00, 2030**

Route	Do Minimum								Do Something					
	Distance [m]		Flows (vehicles)		Time (secs)		Weighted time (mins)		Flows (vehicles)		Time (secs)		Weighted time (mins)	
	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim
1-->2	2,055	2,122	172	242	113	134	323	540	133	201	140	196	310	656
1-->3	1,898	1,396	195	124	194	131	630	270	103	37	203	179	348	110
1-->4	2,940	1,347	272	40	213	115	965	77	147	103	215	167	527	286
1-->5	2,301	1,533	107	170	186	134	332	380	132	168	190	192	419	537
1-->6	3,636	3,025	130	236	233	185	504	726	151	207	228	244	574	842
1-->8	3,386	2,439	82	26	220	164	301	71	81	130	203	251	274	543
2-->1	2,160	2,360	93	133	142	161	220	357	34	65	194	496	110	537
2-->3	1,603	1,653	1	12	124	103	2	21	0	10	166	404	0	67
2-->4	2,645	1,605	174	39	143	88	414	57	69	120	178	392	205	783
2-->5	2,006	1,791	598	490	116	107	1,159	873	425	227	153	417	1,087	1,576
2-->6	3,341	3,177	2,987	3,220	163	114	8,095	6,106	2,399	2,628	191	118	7,648	5,174
2-->8	3,091	3,315	126	191	150	127	316	404	91	84	166	475	252	666
3-->1	1,853	1,590	129	134	128	139	276	310	43	59	177	218	127	214
3-->2	2,096	2,215	0	5	138	163	0	14	0	5	206	269	0	22
3-->4	2,338	835	12	13	129	66	26	14	10	102	162	114	27	193
3-->5	1,699	1,021	96	215	102	85	164	304	94	181	137	139	215	418
3-->6	3,034	2,513	314	119	149	135	779	268	333	129	175	191	970	410
3-->8	2,784	1,927	6	4	137	114	14	8	13	4	150	197	32	13
4-->1	3,027	1,431	117	73	178	136	347	165	63	26	211	177	221	77
4-->2	3,270	2,056	93	177	187	161	290	474	95	178	240	228	379	678
4-->3	3,113	1,330	7	84	268	157	31	220	6	85	301	211	30	300

Do Minimum								
Route	Distance [m]		Flows (vehicles)		Time (secs)		Weighted time (mins)	
	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim
4-->5	2,873	862	0	50	152	82	0	68
4-->6	4,208	2,354	106	105	198	132	350	231
4-->8	3,958	1,768	0	6	186	111	0	11
5-->1	2,208	1,465	71	30	143	131	170	65
5-->2	2,451	2,090	646	472	153	156	1,642	1,224
5-->3	2,294	1,364	132	277	234	152	515	704
5-->4	3,336	1,315	0	3	253	137	0	7
5-->6	3,389	2,387	0	24	164	127	0	51
5-->8	3,139	1,802	0	1	152	106	0	2
6-->1	3,082	2,770	301	516	163	149	818	1,283
6-->2	3,325	3,347	3,509	3,920	172	124	10,078	8,099
6-->3	3,168	2,669	349	150	254	171	1,475	427
6-->4	4,210	2,621	185	18	273	155	841	47
6-->5	3,571	2,807	0	14	246	174	0	41
6-->8	4,656	3,713	0	0	280	204	0	0

Total weighted time, excluding mainline, hours

**215**

**162**

Do Something					
Flows (vehicles)		Time (secs)		Weighted time (mins)	
SATURN	Vissim	SATURN	Vissim	SATURN	Vissim
0	37	171	98	0	60
172	173	208	150	597	432
0	0	183	156	0	0
77	33	156	159	200	87
531	351	185	211	1,633	1,232
104	250	245	194	425	807
0	53	258	182	0	160
0	25	153	132	0	55
0	0	128	139	0	0
224	506	149	205	556	1,726
2,729	3,462	178	165	8,089	9,526
271	137	238	239	1,075	547
166	69	249	227	688	261
0	11	224	252	0	46
0	0	237	311	0	0

**188**

**239**



**Table 4.7 A13 Orsett Cock junction, 07:00-08:00, 2045**

Route	Do Minimum								Do Something					
	Distance [m]		Flows (vehicles)		Time (secs)		Weighted time (mins)		Flows (vehicles)		Time (secs)		Weighted time (mins)	
	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim
1-->2	2,055	2,122	171	213	111	127	316	451	131	152	134	282	293	715
1-->3	1,898	1,396	75	71	165	119	206	141	39	31	180	276	117	143
1-->4	2,940	1,347	102	102	185	108	315	184	60	57	195	265	195	252
1-->5	2,301	1,533	234	121	169	135	659	272	158	27	186	287	491	129
1-->6	3,636	3,025	172	266	254	260	729	1152	208	224	228	348	790	1,301
1-->8	3,386	2,439	99	52	240	238	397	207	124	147	200	352	414	863
2-->1	2,160	2,360	236	312	152	163	599	849	70	140	189	181	221	423
2-->3	1,603	1,653	0	7	118	101	0	12	0	8	144	111	0	15
2-->4	2,645	1,605	56	120	138	90	129	180	25	85	159	100	66	142
2-->5	2,006	1,791	615	528	122	116	1,248	1,024	356	227	151	122	897	461
2-->6	3,341	3,177	3,398	3,702	207	121	11,729	7,461	2,575	2,704	193	120	8,267	5,420
2-->8	3,091	3,315	300	394	193	134	965	880	191	210	165	188	525	657
3-->1	1,853	1,590	376	140	137	157	859	365	134	17	171	191	381	54
3-->2	2,096	2,215	0	3	138	177	0	9	0	4	188	221	0	15
3-->4	2,338	835	7	59	123	83	14	82	6	58	141	109	14	106
3-->5	1,699	1,021	106	283	106	110	188	518	103	250	132	131	227	547
3-->6	3,034	2,513	427	297	192	235	1,365	1,161	421	272	174	193	1,220	875
3-->8	2,784	1,927	35	29	178	213	104	103	36	23	146	197	88	76
4-->1	3,027	1,431	191	108	301	353	960	635	243	167	227	298	920	828
4-->2	3,270	2,056	126	190	302	373	634	1182	108	187	244	328	440	1,022
4-->3	3,113	1,330	8	19	356	365	47	116	12	27	288	322	58	145

Do Minimum								
Route	Distance [m]		Flows (vehicles)		Time (secs)		Weighted time (mins)	
	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim
4-->5	2,873	862	0	51	271	306	0	260
4-->6	4,208	2,354	221	159	356	431	1,312	1,141
4-->8	3,958	1,768	0	7	342	409	0	48
5-->1	2,208	1,465	0	134	189	309	0	689
5-->2	2,451	2,090	607	383	190	329	1,918	2,103
5-->3	2,294	1,364	99	60	244	322	402	322
5-->4	3,336	1,315	0	15	264	311	0	78
5-->6	3,389	2,387	10	23	244	387	41	148
5-->8	3,139	1,802	0	0	230	365	0	0
6-->1	3,082	2,770	242	296	175	154	707	759
6-->2	3,325	3,347	3,566	3,711	176	124	10,441	7,656
6-->3	3,168	2,669	220	140	230	167	842	389
6-->4	4,210	2,621	56	54	250	156	233	140
6-->5	3,571	2,807	0	17	234	182	0	52
6-->8	4,656	3,713	0	0	305	286	0	0

Total weighted time, excluding mainline, hours

**253**

**261**

Do Something					
Flows (vehicles)		Time (secs)		Weighted time (mins)	
SATURN	Vissim	SATURN	Vissim	SATURN	Vissim
0	49	189	238	0	195
424	308	231	300	1,629	1,539
2	2	203	304	7	10
0	140	214	163	0	381
467	283	231	194	1,801	914
63	35	275	188	289	109
0	15	290	176	0	44
0	17	217	166	0	47
0	0	190	170	0	0
248	362	157	156	648	939
2,372	2,811	174	134	6,883	6,286
205	166	217	180	742	498
48	46	231	169	185	129
0	15	222	191	0	48
0	0	236	256	0	0

**211**

**227**

**Table 4.8 A13 Orsett Cock junction, 17:00-18:00, 2045**

Route	Do Minimum								Do Something					
	Distance [m]		Flows (vehicles)		Time (secs)		Weighted time (mins)		Flows (vehicles)		Time (secs)		Weighted time (mins)	
	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim
1-->2	2,055	2,122	209	283	116	138	403	653	112	161	150	428	281	1,147
1-->3	1,898	1,396	232	165	210	128	814	353	112	43	219	413	410	296
1-->4	2,940	1,347	320	48	232	113	1238	91	164	113	232	402	634	757
1-->5	2,301	1,533	135	202	206	136	463	458	158	175	207	427	546	1,245
1-->6	3,636	3,025	55	163	251	185	230	502	171	199	244	480	696	1593
1-->8	3,386	2,439	97	40	239	164	386	109	95	133	218	486	345	1,078
2-->1	2,160	2,360	115	156	145	165	278	428	22	55	213	371	78	341
2-->3	1,603	1,653	0	10	125	106	0	18	0	10	183	261	0	43
2-->4	2,645	1,605	179	38	147	91	439	58	64	117	196	249	209	486
2-->5	2,006	1,791	691	590	121	114	1,392	1,123	400	209	171	274	1,139	955
2-->6	3,341	3,177	3,348	3,580	166	115	9,279	6,859	2,558	2,699	208	119	8,855	5,345
2-->8	3,091	3,315	149	214	154	128	381	456	70	65	181	333	212	361
3-->1	1,853	1,590	160	169	131	144	348	406	29	57	194	235	94	224
3-->2	2,096	2,215	0	5	140	172	0	14	0	5	237	282	0	23
3-->4	2,338	835	13	15	133	71	29	18	12	104	177	113	35	196
3-->5	1,699	1,021	108	230	106	94	191	358	116	202	152	138	294	466
3-->6	3,034	2,513	338	143	152	142	855	339	305	109	189	192	961	348
3-->8	2,784	1,927	7	4	139	121	16	8	10	1	163	197	27	3
4-->1	3,027	1,431	143	100	181	201	432	334	99	53	219	267	361	236
4-->2	3,270	2,056	115	204	190	229	365	777	100	185	261	313	436	966
4-->3	3,113	1,330	7	87	285	219	33	317	4	85	328	299	22	424

Do Minimum								
Route	Distance [m]		Flows (vehicles)		Time (secs)		Weighted time (mins)	
	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim	SATURN	Vissim
4-->5	2,873	862	0	54	157	150	0	135
4-->6	4,208	2,354	127	131	202	199	428	434
4-->8	3,958	1,768	0	6	189	178	0	18
5-->1	2,208	1,465	20	2	146	131	49	4
5-->2	2,451	2,090	690	519	156	159	1,789	1,380
5-->3	2,294	1,364	129	275	250	149	538	685
5-->4	3,336	1,315	0	4	272	134	0	9
5-->6	3,389	2,387	0	24	167	130	0	52
5-->8	3,139	1,802	0	1	155	109	0	2
6-->1	3,082	2,770	316	532	164	150	866	1,328
6-->2	3,325	3,347	3,618	4,026	174	125	10,479	8,380
6-->3	3,168	2,669	304	107	269	168	1,361	299
6-->4	4,210	2,621	207	22	290	153	1,001	56
6-->5	3,571	2,807	0	13	264	176	0	38
6-->8	4,656	3,713	0	0	297	203	0	0

Total weighted time, excluding mainline, hours

**239**

**188**

Do Something					
Flows (vehicles)		Time (secs)		Weighted time (mins)	
SATURN	Vissim	SATURN	Vissim	SATURN	Vissim
0	37	177	170	0	105
270	278	214	223	962	1,034
1	0	188	229	3	0
9	0	162	188	24	0
530	350	204	234	1,806	1,367
114	262	271	220	516	961
0	52	284	209	0	181
0	25	157	144	0	60
0	0	131	150	0	0
243	518	155	345	626	2,982
2,842	3,538	197	173	9,325	10,215
279	136	263	378	1,223	856
173	76	274	366	790	464
0	12	249	391	0	78
0	0	260	450	0	0

**212**

**321**

## 4.2 Commentary on the results

### A13 Manorway junction

- 4.2.1 The journey times from the two modelling approaches are similar and, in some places, where the SATURN time is higher, for example on route 2, this is at least in part due to the longer distance extracted from the SATURN model.
- 4.2.2 In all time periods the total weighted time for the section of the trips that pass through the junction is higher in the SATURN model, even after excluding the trips on the mainline (routes 1 and 2) where the SATURN times and distances for the modelled section of the A13 are longer than in the VISSIM model. Overall, the journey times and the changes in journey times are similar in the two modelling approaches.
- 4.2.3 There would be no noticeable difference in the benefit cost ratio of the Project even if it were possible to substitute the change in journey times from the VISSIM model into the calculations in place of the SATURN time. In fact, the SATURN model presents a conservative disbenefit, for example in the evening peak hour in 2045 journeys times at Manorway Junction are longer in the SATURN model than in the VISSIM model.

### A13 Orsett Cock junction

- 4.2.4 The comparison of the times through the junction at Orsett Cock from the two modelling approaches are again similar, especially in 2030. In 2045 the greatest differences are in the evening peak, but these are times are sensitive to the traffic signal timings that are used in the model.
- 4.2.5 There is a higher divergence in traffic flows from point 2 onto the Orsett Cock circulatory in the evening peak in 2030, though notably not in traffic continuing along the A13 to point 6. This divergence is likely the result of the increased traffic flows onto and around the Orsett Cock junction, partially arising from the additional developments proposed along the A128 north of the junction.
- 4.2.6 Further differences become apparent on journeys originating from point 1 and point 4 in 2045. The increased traffic arising from this growth causes higher variability in the stochastic outputs developed by VISSIM. Such variability is highly sensitive to signal controls and refinements would be made during the detailed design stage, and with the collaboration of Thurrock Council in the early operational phase, to modify traffic light layout, timings and sequencing to optimise flows.

## 4.3 Analysis conclusion

- 4.3.1 A SATURN area wide strategic model is the type of model best suited for the assessment of a significant change in the highway network such as the provision of a new river crossing. It is a modelling approach that can provide insights into how drivers would change the destination of their trips once more capacity is provided across the river. It also can model the re-routing of trips over the area. It is also the tool best suited for providing the overall journey times that are used in the calculation of the benefit cost ratio of the Project and its use does not lead to a systemic over valuation of the overall time savings across the region achieved by the Project. The comparison of the modelled performance of the Orsett Cock and Manorway junctions using two different modelling approaches gives similar results, which further provides confidence in the use of the LTAM for the appraisal of the Project.

## 5 Sharing of localised traffic modelling information

5.1.1 A number of modelling reports are included as appendices to this document , as set out in Table 5.1.

**Table 5.1 Associated modelling reports**

Appendix	Report	Content	Date submitted into Examination
B	Orsett Cock - Local Model Validation Report	Modelling information as set out in Table 3.1 as ID 1	<a href="#">Deadline 1 – 18 July 2023</a>
C	Orsett Cock – Forecasting Report		<a href="#">Deadline 1 – 18 July 2023</a>
D	Manorway Forecasting Report	Modelling information as set out in Table 3.1 as ID 2	<a href="#">Deadline 1 – 18 July 2023</a>
E	Thurrock East-West - Local Model Validation Report	Modelling information as set out in Table 3.1 as IDs 5, 6, 7, and 8	<a href="#">Deadline 1 – 18 July 2023</a>
F	Thurrock East-West – Forecasting Report		<a href="#">Deadline 1 – 18 July 2023</a>
G	Traffic Operational Appraisal – VISSIM Local Model Validation Report (LMVR)	Modelling information as set out in Table 3.2 as IDs 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36	<a href="#">Deadline 1 – 18 July 2023</a>
H	Traffic Operational Appraisal - VISSIM Forecasting Report		<a href="#">Deadline 1 – 18 July 2023</a>
I	<a href="#">ASDA roundabout VISSIM Local Model Validation Report</a>	<a href="#">Modelling information as set out in Table 3.1 as ID 9</a>	<a href="#">Deadline 3 – 24 August 2023</a>
J	<a href="#">ASDA roundabout VISSIM Forecasting Report</a>	<a href="#">Modelling information as set out in Table 3.1 as ID 9</a>	<a href="#">Deadline 3 – 24 August 2023</a>
K	<a href="#">Five Bells &amp; Pitsea Hall Forecasting Report</a>	<a href="#">Modelling information as set out in Table 3.1 as IDs 3 and 4</a>	<a href="#">Deadline 3 – 24 August 2023</a>
L	<a href="#">Havering &amp; TfL Junctions Forecasting Report</a>	<a href="#">Modelling information as set out in Table 3.1 as IDs 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 and 21</a>	<a href="#">Deadline 3 – 24 August 2023</a>
M	<a href="#">ASDA roundabout VISSIM Construction Assessment Report</a>	<a href="#">Modelling information for the critical traffic modelling phases at the junction</a>	<a href="#">Deadline 3 – 24 August 2023</a>

Inserted Cells

5.1.2 Additional modelling information as set out in this document can be submitted into the Examination by request of the Examining Authority.

5.1.3 While the Applicant will consider any requests for additional models to those set out in this document, in accordance with the criteria provided in Section 3.4, it

**Deleted:** <#>It is currently proposed to submit further information into the Examination process at Deadline 3, which would include:  
 Operational microsimulation model of the A1089 Asda roundabout, as set out in Table 3.2 as ID 37  
 Operational junction model of the A13 Five Bells junction, as set out in Table 3.2 as ID 38  
 Operational junction model of the A13 Pitsea interchange, as set out in Table 3.2 as ID 39  
 As set out in paragraph 3.22, the Applicant considers that until the Contractor has developed more detailed construction plans, the use of the LTAM is appropriate for the consideration of the construction impacts, presenting a reasonably worst case. Nevertheless, in response to the discussion at Issue Specific Hearing 1, the Applicant is in the process of preparing a microsimulation model of A1089 Asda roundabout during the critical construction traffic modelling phases, which it is proposed to submit at Deadline 3. ¶

should be noted that the development time for new models may prove restrictive.





## 6 Commentary on reports submitted at Deadline 3

6.1.1 At Deadline 3, the Applicant has submitted a number of reports (as appendices to this document) detailing localised traffic modelling at a number of junctions, as set out in Table 5.1.

6.1.2 The Applicant would like to provide commentary to assist interested parties on the following appendices:

f. Appendix J – ASDA roundabout VISSIM Forecasting Report

g. Appendix K - Five Bells & Pitsea Hall Forecasting Report

h. Appendix M – ASDA roundabout VISSIM Construction Report

### 6.2 Appendix J – ASDA roundabout VISSIM Forecasting Report

6.2.1 This report provides details of the forecast operation of the A1089 ASDA roundabout in 2030 and 2045 with and without the Project, using a VISSIM microsimulation model of the junction.

6.2.2 The model results show that in 2045 adverse impacts are forecast in the DS scenario, primarily on the A126 Dock Road in the AM peak which would impact the local community's access to and through the Asda roundabout.

6.2.3 The Applicant has reviewed the outputs from the LTAM, which forms the basis of the traffic flows used in the VISSIM model of the junction. In 2045 in the Do Minimum scenario there are delays for traffic leaving the A1089 northbound at the Marshfoot Road junction and on the connection to the A13 westbound. These delays are of sufficient size to deter some residents from the Tilbury area from making discretionary trips. In the Do Something there would be relief at these junctions and the residents of Tilbury are no longer deterred from making these trips. This would lead to the increase in the flow on the A126 Dock Road seen between the Do Minimum and the Do Something scenarios, which contributes to the delays forecast on the A126 Dock Road approach to the Asda roundabout.

6.2.4 The LTAM predicts that residents wish to make these journeys along the A126 Dock Road even with the delays on the section of their journey on the approach to the Asda roundabout.

6.2.5 The Applicant has considered this balance in Transport Assessment - Appendix F - Wider Network Impacts Management and Monitoring Policy Compliance [APP-535] and has concluded that the overall beneficial impacts outweigh the identified adverse impacts, and that the adverse impacts are acceptable under the National Policy Statement for National Networks.

6.2.6 Notwithstanding this, the Applicant has proposed a traffic impact monitoring scheme which requires traffic monitoring to be carried out during the operational phase of the Project to identify changes in performance on the surrounding road network within the Wider Network Impacts Management and Monitoring Plan [APP-545]. One of the locations to be monitored is the A1089 Asda roundabout.

6.2.7 The data and data analysis would set out to identify traffic conditions that change following the Project coming into operation, as well as provide analysis on wider network changes that are not as a result of the Project. That data will then be available to local highway authorities as evidence to inform their intervention case making.

### **6.3 Appendix K - Five Bells & Pitsea Hall Forecasting Report**

6.3.1 This report provides details of the forecast operation of the Five Bells and Pitsea Hall junctions in 2030 and 2045 with and without the Project, using Junctions 9 software to model the junction.

6.3.2 The model results show that in 2045 that adverse impacts are forecast at the A13 Pitsea Hall junction, on the A13 eastbound off-slip in the AM peak, as a result of forecast queues extending close to (in the DM) and onto (in the DS) the A13 mainline.

6.3.3 Queues are forecast even without the Project, and the Project increases this moderately.

6.3.4 As with the Asda roundabout, the Applicant has considered this balance in Transport Assessment - Appendix F - Wider Network Impacts Management and Monitoring Policy Compliance [APP-535] and has concluded that the overall beneficial impacts outweigh the identified adverse impacts, and that the adverse impacts are acceptable under the National Policy Statement for National Networks.

6.3.5 The Applicant has proposed a traffic impact monitoring scheme which requires traffic monitoring to be carried out during the operational phase of the Project to identify changes in performance on the surrounding road network within the Wider Network Impacts Management and Monitoring Plan [APP-545]. One of the locations to be monitored is the A13 Pitsea Hall junction.

6.3.6 The data and data analysis would set out to identify traffic conditions that change following the Project coming into operation, as well as provide analysis on wider network changes that are not as a result of the Project. That data will then be available to local highway authorities as evidence to inform their network management duty and their case making for further interventions to optimise the road network.

### **6.4 Appendix M – ASDA roundabout VISSIM Construction Report**

6.4.1 This report provides details of the forecast operation of the A1089 ASDA roundabout in construction traffic phases 1 and 6 of the Project's construction phase, using a VISSIM microsimulation model of the junction.

6.4.2 The commentary on Appendix M, which confirms the precautionary nature of the assessments as well as other steps to monitor and manage the impacts, is included in section 2.3 of Appendix M and is not repeated here.

## References

## Glossary

Term	Abbreviation	Explanation
<b>A122</b>		The new A122 trunk road to be constructed as part of the Lower Thames Crossing project, including links, as defined in Part 2, Schedule 5 (Classification of Roads) in the draft DCO
<b>A122 Lower Thames Crossing</b>	<b>Project</b>	A proposed new crossing of the Thames Estuary linking the county of Kent with the county of Essex, at or east of the existing Dartford Crossing.
<b>A122 Lower Thames Crossing/M25 junction</b>		New junction with north-facing slip roads on the M25 between M25 junctions 29 and 30, near North Ockendon.
<b>A13/A1089/A122 Lower Thames Crossing junction</b>		Alteration of the existing junction between the A13 and the A1089, and construction of a new junction between the A122 Lower Thames Crossing and the A13 and A1089, comprising the following link roads: <ul style="list-style-type: none"> <li>• Improved A13 westbound to A122 Lower Thames Crossing southbound</li> <li>• Improved A13 westbound to A122 Lower Thames Crossing northbound</li> <li>• Improved A13 westbound to A1089 southbound</li> <li>• A122 Lower Thames Crossing southbound to improved A13 eastbound and Orsett Cock roundabout</li> <li>• A122 Lower Thames Crossing northbound to improved A13 eastbound and Orsett Cock roundabout</li> <li>• Orsett Cock roundabout to the improved A13 westbound</li> <li>• Improved A13 eastbound to Orsett Cock roundabout</li> <li>• Improved A1089 northbound to A122 Lower Thames Crossing northbound</li> <li>• Improved A1089 northbound to A122 Lower Thames Crossing southbound</li> </ul>
<b>A2</b>		A major road in south-east England, connecting London with the English Channel port of Dover in Kent.
<b>Application Document</b>		In the context of the Project, a document submitted to the Planning Inspectorate as part of the application for development consent.
<b>Construction</b>		Activity on and/or offsite required to implement the Project. The construction phase is considered to commence with the first activity on site (e.g. creation of site access), and ends with demobilisation.
<b>Development Consent Order</b>	<b>DCO</b>	Means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects (NSIP) under the Planning Act 2008.
<b>Development Consent Order application</b>	<b>DCO application</b>	The Project Application Documents, collectively known as the 'DCO application'.
<b>M2 junction 1</b>		The M2 will be widened from three lanes to four in both directions through M2 junction 1.
<b>M2/A2/Lower Thames Crossing junction</b>		New junction proposed as part of the Project to the east of Gravesend between the A2 and the new A122 Lower Thames Crossing with connections to the M2.

Term	Abbreviation	Explanation
<b>M25 junction 29</b>		Improvement works to M25 junction 29 and to the M25 north of junction 29. The M25 through junction 29 will be widened from three lanes to four in both directions with hard shoulders.
<b>National Highways</b>		A UK government-owned company with responsibility for managing the motorways and major roads in England. Formerly known as Highways England.
<b>Operation</b>		Describes the operational phase of a completed development and is considered to commence at the end of the construction phase, after demobilisation.
<b>The tunnel</b>		Proposed 4.25km (2.5 miles) road tunnel beneath the River Thames, comprising two bores, one for northbound traffic and one for southbound traffic. Cross-passages connecting each bore would be provided for emergency incident response and tunnel user evacuation. Tunnel portal structures would accommodate service buildings for control operations, mechanical and electrical equipment, drainage and maintenance operations. Emergency access and vehicle turn-around facilities would also be provided at the tunnel portals.

## Appendices

## Appendix A Engagement with Thurrock Council on localised traffic modelling

### A.1 Introduction

- A.1.1 The Applicant has worked with a number of authorities as set out in the main document, to share, explain and interrogate the Project's transport model and forecasts. The most extensive engagement has been with Thurrock Council, and so this is set out here as an example of the work completed in the pre-application phase.
- A.1.2 Throughout the process of running the Project's transport model – the Lower Thames Area Transport Model (LTAM) – to produce traffic forecasts for the Project, detailed outputs from the model have been provided to Thurrock Council in the form of GIS shapefiles and a cordon model.
- A.1.3 As well as the model runs that support the traffic data presented at the public consultations and in the DCO application, National Highways have carried out a series of model runs as specified by Thurrock Council to support the development of their emergent Local Plan, their work to support a potential case for new east-facing slips on the A13 at the junction with the A126 (for Lakeside shopping centre), investigations into alternative designs for the A13/A1089/A122 junction and assessments including a Tilbury Link Road.
- A.1.4 Additional analysis from the LTAM has also been provided when requested, such as journey times on routes selected by Thurrock Council and select link analysis, which show the origin and destination of trips that use a particular link on the network.
- A.1.5 Microsimulation modelling has also been carried out in collaboration with Thurrock Council through a series of workshops with the council and the sharing of base year and forecast year models as they have been developed through the workshop process. This microsimulation modelling has been conducted in the following locations:
- a. A13 Orsett Cock junction
  - b. A13 Manorway junction
  - c. Thurrock East-West model (covering the local road network south of the A13, extending from the Stifford interchange to west of the Orsett Cock junction in the east/west direction and from the A13 to Marshfoot roundabout in the north/south direction)

## A.2 GIS shapefiles

- A.2.1 The GIS shapefiles show all the highway links included in the Project's transport model across the whole of the Fully Modelled Area (as shown on Plate 3.7 of the Combined Modelling and Appraisal report - Appendix B - Transport Model Package [APP-520]), with detailed model outputs for the flow on each link by vehicle type, percentage heavy goods vehicles, travel time along the link, speed along the link and the volume/capacity ratio of the link. The Fully Modelled Area covers Thurrock, Gravesham, Medway, most of Kent and Essex, the M25 and parts of East and South London.
- A.2.2 This data allowed the council to re-produce the maps shown in the documents produced for the Project's public consultations and the Plates shown in the DCO documents (Traffic Forecasts Non-Technical Summary [APP-528], Combined Modelling and Appraisal Report - Appendix C - Transport Forecasting Package [APP-522] and Transport Assessment [APP-529]). It allows the Council to see the actual numbers behind the colour bands used in these documents. GIS shapefiles and cordon models together with a note explaining the content of the data were provided for the 2016 Base Year, Do Minimum (without the Lower Thames Crossing) and the Do Something (with the Lower Thames Crossing) model scenarios.
- A.2.3 GIS Shapefiles showing the outputs of the transport model for when the Project is open was provided for 2030, 2037, 2045 and 2051 for the three modelled time periods. It was issued first in June 2019 and it was re-issued in October 2019 with additional output data added at the request of Thurrock Council. When the modelling was revised, new updated GIS shapefiles were re-issued in April 2020, April 2022 and July 2022.
- A.2.4 Cordon models and GIS shapefiles showing the model outputs from the construction modelling, for all 11 construction modelling phases and modelled time periods were issued in March 2021 and May 2022.

## A.3 LTAM SATURN cordon models

- A.3.1 To further assist Thurrock Council a cordon from the LTAM (built using the SATURN software platform) was provided to the council. A cordon model is an extract from a full SATURN model that contains the network and trip matrices for a geographical sub-set of the whole model. This model can be run in SATURN so that the full range of analysis tools available in the SATURN software can be used by the user (in this case Thurrock Council) to study the model outputs. A cordon that covered the whole of the Thurrock local authority area was supplied as a set of SATURN files. This allowed the council to view the matrices in Thurrock to see the number of trips assumed to be coming in and out of each zone in the model's base year and the forecast years, both with



and without the Project. It also enables the user to amend those networks and matrices if they wish and to rerun the assignment of trips to the network. It also allows detailed investigations of the coding of the junctions in the model and to extract turning movements at junctions. It would allow the extraction of the data required for running more detailed local area modelling if desired.

- A.3.2 Cordon models were issued for the model base year, each forecast year, each modelled time period, for both the with and without the Project scenarios.
- A.3.3 Cordon models for the Project when open were issued in May-June 2019, April 2020, April 2021, July 2021 and April 2022. Cordon models of the impact of the Project during construction, for each of the 11 modelled construction phases and 3 modelled time periods were issued in March 2021 and May 2022.

## A.4 Additional VDM modelling

- A.4.1 Thurrock Council requested further testing in the full LTAM rather than the cordon model. The Applicant undertook these model runs. These covered three areas:
- a. Proposals for East Facing slips on the A13 (at its junction with the A126)
  - b. Local Plan investigations
  - c. Inclusion of a prospective Tilbury Link Road and alternatives to the design of the A13/A1089/A122 junction

### East Facing slips

- A.4.2 Thurrock Council requested that National Highways test several designs for east facing slips on the A13 at the junction with the A126. These tests were carried out in 2020 and cordon models for the model runs with designs for the east facing slips, with and without the Project, were supplied to Thurrock Council and their consultants in July 2020.

### Local Plan investigations

- A.4.3 Thurrock Council provided National Highways with indicative network plans and proposals for prospective development sites. National Highways ran five development scenarios with the LTAM and supplied detailed outputs and cordon models to Thurrock Council in October 2020.

## Prospective Tilbury Link Road

- A.4.4 National Highways also ran five tests for Thurrock of their proposals for a Tilbury Link Road and design changes at the A13/A1089/A122 junction. Detailed outputs were provided to Thurrock Council from each model run, including GIS shapefiles, cordon models, global statistics, scenario wide outputs, journey time data and select link analysis which shows the origin and destination of trips using a specific, selected, link in the network. This work was provided to Thurrock Council in June 2022 with an additional run requested and supplied in December 2022.

## A.5 Microsimulation modelling

- A.5.1 Microsimulation modelling was carried out in a series of collaborative workshops with Thurrock and their consultants. These workshops started in November 2021 and meetings were held every two weeks thereafter (a couple were postponed due to holidays) until December 2022 when Thurrock temporarily stopped work. The council were consulted at each stage of the model build and the production of the forecasts.
- A.5.2 Microsimulation has been conducted in the following locations:
- a. A13 Orsett Cock junction
  - b. A13 Manorway junction
  - c. Thurrock East-West model (covering the local road network south of the A13, extending from the Stifford interchange to west of the Orsett Cock junction in the east/west direction and from the A13 to Marshfoot roundabout in the north/south direction)
- A.5.3 For the Orsett Cock model the base year VISSIM model and Local Model Validation Report was issued in May 2022. This modelling was a collaborative exercise with, for example, the extent of the model being extended to cover the further sections of the A13. Following comments from the council, these were revised and re-issued in July 2022. The forecast year model was issued, following a presentation of the results, in September 2022.
- A.5.4 The Manorway VISSIM model and reports were issued in October 2022, after initial results were presented to the council in July 2022.
- A.5.5 The base year East-West model and Local Model Validation Report was issued in June 2022 and revised, following comments by the council and re-issued in September 2022. Further correspondence between the council and their consultants took place in November 2022, which informed the East-West Forecast model.
- A.5.6 A table showing the workshop dates is provided in Table A.1.

**Table A.1 Traffic modelling workshops**

<b>Workshop Number</b>	<b>Workshop Date</b>
1	Oct 21 and Nov 21
2	22-Nov-21
3	14-Dec-21
4	06-Jan-22
5	20-Jan-22
6	03-Feb-22
7	17-Feb-22
8	03-Mar-22
10	31-Mar-22
11	14-Apr-22
12	28-Apr-22
13	12-May-22
14	26-May-22
15	09-Jun-22
16	23-Jun-22
17	07-Jul-22
18	21-Jul-22
19	18-Aug-22
20	15-Sep-22
21	06-Oct-22
22	13-Oct-22
23	27-Oct-22
24	11-Nov-22
25	24-Nov-22

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