Lower Thames Crossing

9.15 Localised Traffic Modelling (Tracked changes version)

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Lower Thames Crossing

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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.

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

b. Responses to the Action Points 8, 9 & 10

c. A comparative analysis of the findings of the localised traffic modelling and the LTAM

d. 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.

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

3.2.4 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.

3.2.5 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:

a. 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.

b. 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

3.2.6 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.

3.2.7 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.

3.2.8 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.

3.2.9 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

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 model 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 (London Borough of Havering & TfL)	Model developed and shared with London Borough of Havering and TfL

ID	Request	Response
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/ Wingletye 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
Grade separated network analysis	
26	A122 Lower Thames Crossing – microsimulation model
27	A2/M2 corridor – microsimulation model
28	A13 corridor – microsimulation model
29	M25 corridor – microsimulation model
Local roads analysis	
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 worse 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.

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:

a. the length of the journey in each model, which is not identical between models for reasons set out in Paragraph 4.1.2;

b. 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.

c. 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.

4.1.6 Information is presented for the A13 Manorway junction as follows:

a. Routes analysed are set out in Plates Plate 4.1, Plate 4.2, Plate 4.3 and Plate 4.4

b. Comparison of journey times in the AM peak, 2030 are provided in Table 4.1

c. Comparison of journey times in the PM peak, 2030 are provided in Table 4.2

d. Comparison of journey times in the AM peak, 2045 are provided in Table 4.3

e. 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

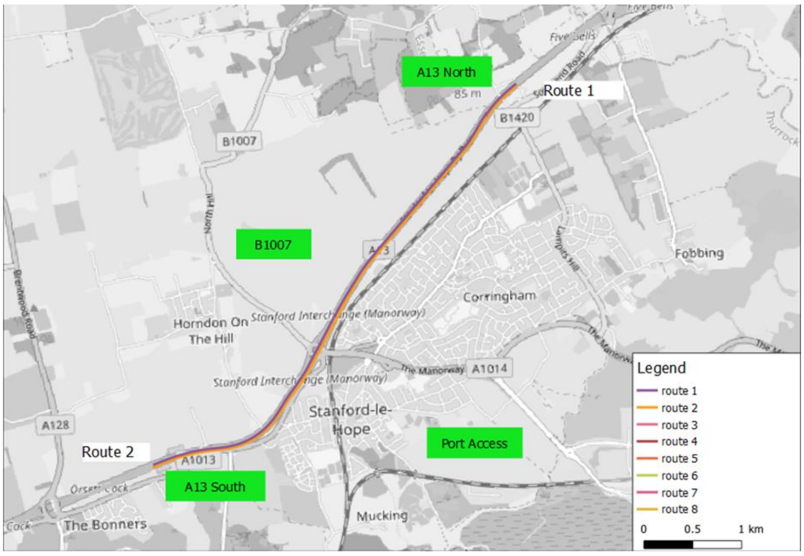

Plate 4.2 A13 Manorway junction analysis routes 3 and 4

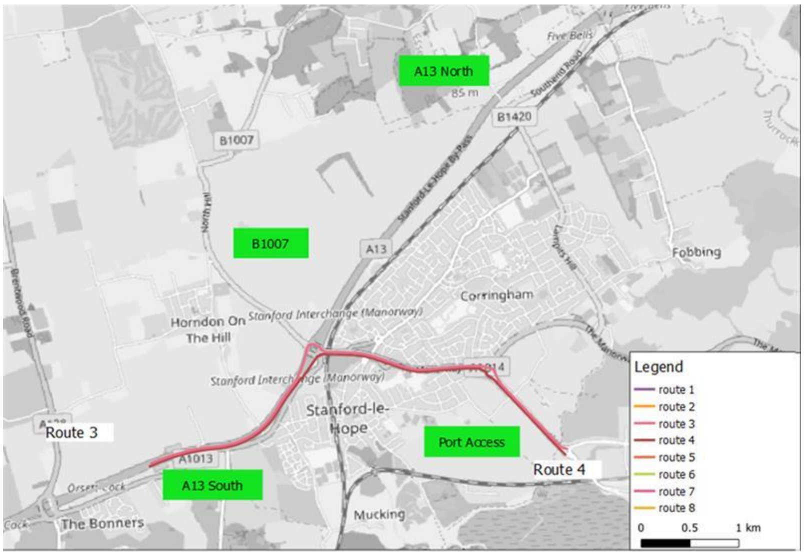

Plate 4.3 A13 Manorway junction analysis routes 5 and 6

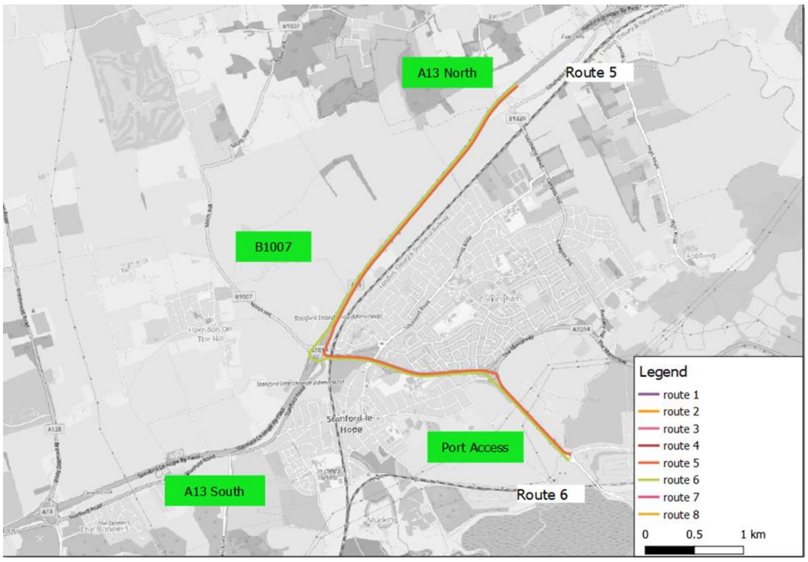

Plate 4.4 A13 Manorway junction analysis routes 7 and 8

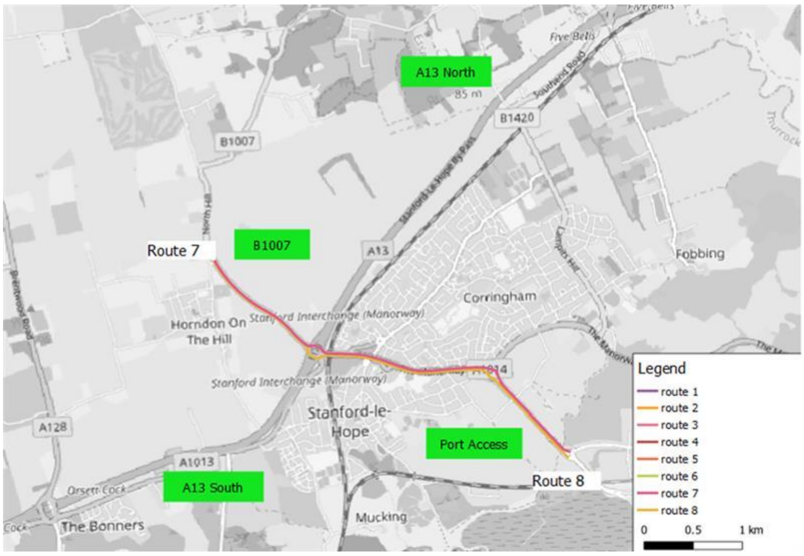

Table 4.1 A13 Manorway junction, 07:00-08:00, 2030

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	2,457	2,449	117	103	4,806	4,198	2,863	2,854	130	104	6,188	4,970
2	4,464	2,934	3,198	3,189	217	111	11,569	5,897	3,319	3,295	250	126	13,822	6,938
3	4,253	4,088	380	374	245	238	1,550	1479	406	397	258	244	1,751	1,616
4	3,822	4,009	161	153	232	225	625	574	165	154	256	231	705	590
5	3,280	3,309	246	246	208	205	853	843	206	204	207	207	711	707
6	3,660	3,527	109	104	253	258	461	447	107	104	259	258	464	448
7	4,446	3,329	84	83	453	205	632	284	30	29	671	209	330	100
8	4,472	3,345	5	4	290	207	23	13	5	5	291	204	23	16
	Total weighted time, excluding mainline, hours						**69**	**61**					**66**	**58**

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

Do Minimum									Do Something					
Route	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						**77**	**69**					**81**	**66**

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

	Do Minimum								Do Something					
Route	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						**67**	**58**					**75**	**58**

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						**81**	**69**					**101**	**62**

4.1.7 Information is presented for the A13 Orsett Cock junction as follows:

a. Routes analysed are set out in Plate 4.5

b. Comparison of journey times in the AM peak, 2030 are provided in Table 4.5

c. Comparison of journey times in the PM peak, 2030 are provided in Table 4.6

d. Comparison of journey times in the AM peak, 2045 are provided in Table 4.7

e. Comparison of journey times in the PM peak, 2045 are provided in Table 4.8

Plate 4.5 A13 Orsett Cock junction analysis routes

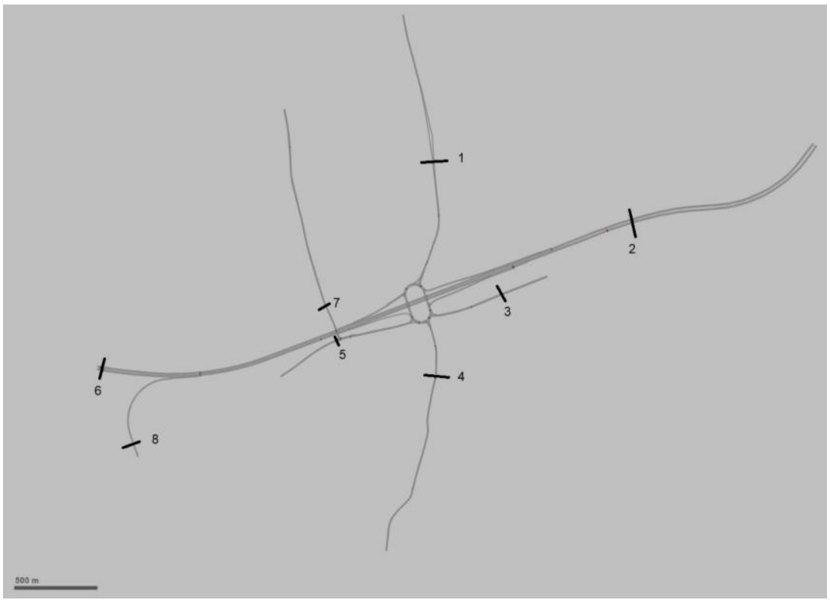

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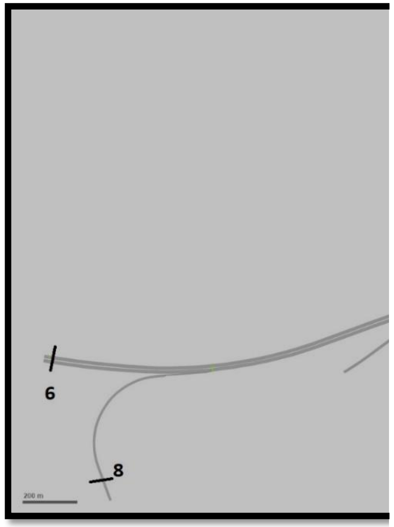
Table 4.5 A13 Orsett Cock junction, 07:00-08:00, 2030

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	155	193	107	131	277	420		124	163	129	171	267	465
1-->3	1,898	1,396	67	60	159	127	178	127		32	29	173	164	92	79
1-->4	2,940	1,347	77	78	181	116	232	151		52	55	190	154	165	141
1-->5	2,301	1,533	211	99	163	134	572	221		108	36	179	175	322	105
1-->6	3,636	3,025	140	232	237	203	552	785		190	195	222	242	704	786
1-->7	2,366	1,754	0	18	178	156	0	47		0	18	202	193	0	58
1-->8	3,386	2,439	93	42	223	216	346	151		117	129	194	242	378	520
2-->1	2,160	2,360	209	283	152	162	529	762		78	152	180	186	234	472
2-->3	1,603	1,653	0	7	116	100	0	12		0	8	138	112	0	15
2-->4	2,645	1,605	77	141	137	90	176	211		28	92	155	102	72	156
2-->5	2,006	1,791	580	501	119	108	1152	901		390	268	144	123	934	551
2-->6	3,341	3,177	3,323	3,628	193	118	10,711	7,163		2,676	2,986	187	123	8,351	6,119
2-->7	2,071	2,007	62	50	134	130	139	108		42	33	167	141	117	77
2-->8	3,091	3,329	299	393	180	131	897	861		219	247	159	190	580	781
3-->1	2,118	1,590	341	108	193	146	1,096	263		167	27	212	192	590	87
3-->2	2,361	2,215	0	3	192	163	0	8		0	4	229	223	0	15
3-->4	2,603	835	7	60	178	75	21	75		6	58	187	108	19	104
3-->5	1,964	1,021	98	287	160	93	262	443		93	240	176	129	272	518
3-->6	3,299	2,513	314	169	234	161	1227	455		408	259	219	196	1,491	846
3-->7	2,029	1,240	16	42	175	115	47	80		11	37	199	147	37	91



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Route	Do Minimum: Distance [m] SATURN	Do Minimum: Distance [m] Vissim	Do Minimum: Flows (vehicles) SATURN	Do Minimum: Flows (vehicles) Vissim	Do Minimum: Time (secs) SATURN	Do Minimum: Time (secs) Vissim	Do Minimum: Weighted time (mins) SATURN	Do Minimum: Weighted time (mins) Vissim	Do Something: Flows (vehicles) SATURN	Do Something: Flows (vehicles) Vissim	Do Something: Time (secs) SATURN	Do Something: Time (secs) Vissim	Do Something: Weighted time (mins) SATURN	Do Something: Weighted time (mins) Vissim
3-->8	3,049	1,927	36	29	221	174	133	84	46	25	191	196	146	82
4-->1	3,027	1,431	274	198	210	223	958	736	160	124	212	192	566	398
4-->2	3,270	2,056	128	228	209	240	445	911	96	219	229	223	367	813
4-->3	3,113	1,330	12	28	261	236	52	110	10	32	273	216	46	115
4-->5	2,873	862	0	69	177	169	0	195	0	63	176	130	0	136
4-->6	4,208	2,354	207	167	251	238	867	663	298	270	220	196	1,091	882
4-->7	2,938	1,076	13	15	192	191	42	48	6	12	200	147	20	29
4-->8	3,958	1,768	0	8	238	251	0	33	0	0	191	196	0	0
5-->1	2,208	1,465	0	145	159	168	0	405	0	137	160	164	0	375
5-->2	2,451	2,090	617	432	158	184	1,623	1,328	480	289	178	195	1,420	938
5-->3	2,294	1,364	92	62	210	180	322	186	80	52	221	187	295	162
5-->4	3,336	1,315	0	15	231	170	0	43	0	14	238	177	0	41
5-->6	3,389	2,387	0	16	201	183	0	49	0	18	168	168	0	50
5-->7	1,191	217	207	25	66	19	229	8	177	9	73	19	217	3
5-->8	3,139	1,802	0	0	187	196	0	0	0	0	139	168	0	0
6-->1	3,082	2,770	238	293	173	154	684	752	190	314	148	153	468	799
6-->2	3,325	3,347	3,061	3,224	171	122	8,738	6,543	2,019	2,506	165	128	5,552	5,334
6-->3	3,168	2,669	184	105	223	167	685	292	135	86	168	176	378	252
6-->4	4,210	2,621	51	49	245	157	208	128	42	39	184	166	129	108
6-->5	3,571	2,807	0	17	227	174	0	49	0	15	215	188	0	47
6-->7	3,636	3,026	0	1	242	197	0	3	0	0	238	205	0	0

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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
6-->8	4,656	3,713	0	0	287	256	0	0	0	0	173	254	0	0
7-->1	2,273	1,665	0	27	181	223	0	100	0	25	203	216	0	90
7-->2	2,516	2,300	84	67	180	240	252	268	69	55	220	246	253	226
7-->3	2,359	1,567	6	11	232	236	23	43	5	12	264	239	22	48
7-->4	3,401	1,516	4	2	253	226	17	8	4	0	281	229	19	0
7-->5	1,191	225	82	68	96	100	131	113	163	153	110	65	297	166
7-->6	3,454	2,590	0	2	223	238	0	8	0	0	211	220	0	0
7-->8	3,204	2,727	23	0	209	251	80	0	21	7	182	219	64	26
	Total weighted time, excluding mainline, hours						**241**	**211**					**201**	**194**

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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	58	113	204	323	197	133	200	142	175	314	583
1-->3	1,898	1,396	195	41	194	208	630	142	103	37	203	158	348	98
1-->4	2,940	1,347	272	51	213	197	965	167	147	105	215	147	527	257
1-->5	2,301	1,533	107	38	186	214	332	136	132	171	190	168	419	478
1-->6	3,636	3,025	130	61	233	265	504	269	151	185	228	225	574	694
1-->7	2,366	1,754	0	6	205	240	0	24	0	25	216	185	0	77
1-->8	3,386	2,439	82	6	220	278	301	28	81	98	203	231	274	378
2-->1	2,160	2,360	93	135	142	211	220	475	34	66	194	512	110	564
2-->3	1,603	1,653	1	12	124	152	2	30	0	10	166	407	0	68
2-->4	2,645	1,605	174	241	143	140	414	563	69	122	178	396	205	804
2-->5	2,006	1,791	598	489	116	157	1,159	1,283	425	232	153	417	1,087	1,611
2-->6	3,341	3,177	2,987	3,216	163	115	8,095	6,145	2,399	2,694	191	119	7,648	5,328
2-->7	2,071	2,007	76	54	135	183	171	165	57	33	180	434	171	239
2-->8	3,091	3,315	126	191	150	128	316	406	91	87	166	480	252	696
3-->1	2,118	1,590	129	134	174	169	373	378	43	59	208	271	149	266
3-->2	2,361	2,215	0	5	183	194	0	16	0	5	236	321	0	27
3-->4	2,603	835	12	103	174	98	35	169	10	104	192	154	32	267
3-->5	1,964	1,021	96	216	148	116	236	416	94	181	167	175	262	529
3-->6	3,299	2,513	314	119	194	166	1,016	330	333	125	205	233	1139	484
3-->7	2,029	1,240	21	34	167	141	58	80	20	34	194	192	65	109

Deleted: 242
Deleted: 134
Deleted: 540
Deleted: 201
Deleted: 140
Deleted: 196
Deleted: 310
Deleted: 656
Deleted: 124
Deleted: 131
Deleted: 270
Deleted: 179
Deleted: 110
Deleted: 40
Deleted: 115
Deleted: 77
Deleted: 103
Deleted: 167
Deleted: 286
Deleted: 170
Deleted: 134
Deleted: 380
Deleted: 168
Deleted: 192
Deleted: 537
Deleted: 236
Deleted: 185
Deleted: 726
Deleted: 207
Deleted: 244
Deleted: 842
Deleted: 26
Deleted: 164
Deleted: 71
Deleted: 130
Deleted: 251
Deleted: 543
Deleted: 133
Deleted: 161
Deleted: 357
Deleted: 65

Route	Do Minimum: Distance [m] SATURN	Distance [m] Vissim	Flows (vehicles) SATURN	Flows (vehicles) Vissim	Time (secs) SATURN	Time (secs) Vissim	Weighted time (mins) SATURN	Weighted time (mins) Vissim	Do Something: Flows (vehicles) SATURN	Flows (vehicles) Vissim	Time (secs) SATURN	Time (secs) Vissim	Weighted time (mins) SATURN	Weighted time (mins) Vissim
3-->8	3,049	1,927	6	4	182	179	18	12	13	4	180	239	39	16
4-->1	3,027	1,431	117	73	178	150	347	182	63	27	211	195	221	88
4-->2	3,270	2,056	93	174	187	174	290	505	95	178	240	245	379	728
4-->3	3,113	1,330	7	82	268	179	31	244	6	85	301	229	30	324
4-->5	2,873	862	0	50	152	96	0	80	0	37	171	100	0	61
4-->6	4,208	2,354	106	106	198	147	350	259	172	182	208	157	597	476
4-->7	2,938	1,076	26	11	171	121	74	22	4	0	197	117	13	0
4-->8	3,958	1,768	0	6	186	160	0	16	0	0	183	163	0	0
5-->1	2,208	1,465	71	30	143	129	170	65	77	33	156	177	200	97
5-->2	2,451	2,090	646	467	153	154	1,642	1,199	531	348	185	227	1,633	1,318
5-->3	2,294	1,364	132	274	234	158	515	723	104	251	245	210	425	880
5-->4	3,336	1,315	0	48	253	147	0	117	0	53	258	199	0	176
5-->6	3,389	2,387	0	24	164	127	0	51	0	26	153	139	0	60
5-->7	1,191	217	207	177	68	19	236	56	207	178	77	19	265	57
5-->8	3,139	1,802	0	1	152	140	0	2	0	0	128	145	0	0
6-->1	3,082	2,770	301	517	163	151	818	1,300	224	497	149	206	556	1703
6-->2	3,325	3,347	3,509	3,918	172	124	10,078	8,109	2,729	3,463	178	167	8,089	9,642
6-->3	3,168	2,669	349	145	254	180	1,475	435	271	135	189	239	855	537
6-->4	4,210	2,621	185	89	273	168	841	249	166	68	201	227	555	258
6-->5	3,571	2,807	0	13	246	185	0	40	0	11	226	248	0	46
6-->7	3,636	3,026	0	2	265	211	0	7	0	1	252	266	0	4

Deleted: 2,784
Deleted: 137
Deleted: 114
Deleted: 14
Deleted: 8
Deleted: 150
Deleted: 197
Deleted: 32
Deleted: 13
Deleted: 136
Deleted: 165
Deleted: 26
Deleted: 177
Deleted: 77
Deleted: 177
Deleted: 161
Deleted: 474
Deleted: 228
Deleted: 678
Deleted: 84
Deleted: 157
Deleted: 220
Deleted: 211
Deleted: 300
Deleted: 82
Deleted: 68
Deleted: 98
Deleted: 60
Deleted: 105
Deleted: 132
Deleted: 231
Deleted: 173
Deleted: 150
Deleted: 432
Deleted: 111
Deleted: 11
Deleted: 156
Deleted: 131
Deleted: 159
Deleted: 87
Deleted: 472

	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
6-->8	4,656	3,713	0	0	280	249	0	0	0	0	176	312	0	0
7-->1	2,273	1,665	0	28	194	311	0	145	0	29	207	255	0	123
7-->2	2,516	2,300	60	85	204	336	204	476	51	74	235	305	200	376
7-->3	2,359	1,567	5	65	285	340	24	369	5	66	296	288	25	317
7-->4	3,401	1,516	6	9	304	329	30	49	5	11	309	277	26	51
7-->5	1,191	225	126	137	126	225	264	515	142	154	123	96	291	246
7-->6	3,454	2,590	0	5	215	309	0	26	0	0	204	217	0	0
7-->8	3,204	2,727	7	1	203	322	24	5	8	7	179	223	24	26
Total weighted time, excluding mainline, hours							240	207					204	270

Deleted: 204
Deleted: 237
Deleted: 311
Deleted: 215
Deleted: 162
Deleted: 188
Deleted: 239

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

	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	171	210	111	137	316	481	131	156	136	245	297	638
1-->3	1,898	1,396	75	69	165	130	206	150	39	32	180	239	117	127
1-->4	2,940	1,347	102	98	185	120	315	196	60	58	195	229	195	222
1-->5	2,301	1,533	234	118	169	147	659	289	158	29	186	252	491	122
1-->6	3,636	3,025	172	263	254	257	729	1128	208	199	228	318	790	1,054
1-->7	2,366	1,754	0	16	185	174	0	46	0	18	210	269	0	81
1-->8	3,386	2,439	99	51	240	270	397	230	124	128	200	318	414	679
2-->1	2,160	2,360	236	311	152	164	599	851	70	146	189	187	221	455
2-->3	1,603	1,653	0	7	118	101	0	12	0	8	144	112	0	15
2-->4	2,645	1,605	56	120	138	91	129	181	25	88	159	102	66	150
2-->5	2,006	1,791	615	530	122	118	1248	1039	356	235	151	125	897	488
2-->6	3,341	3,177	3,398	3,708	207	121	11,729	7,480	2,575	2,890	193	123	8,267	5,938
2-->7	2,071	2,007	65	52	138	144	149	125	40	30	175	142	116	71
2-->8	3,091	3,315	300	393	193	134	965	878	191	221	165	191	525	704
3-->1	2,118	1,590	376	138	211	164	1324	376	134	16	275	274	613	73
3-->2	2,361	2,215	0	3	212	185	0	9	0	4	292	306	0	20
3-->4	2,603	835	7	58	197	90	23	87	6	54	245	189	24	170
3-->5	1,964	1,021	106	282	181	117	319	549	103	232	237	212	406	819
3-->6	3,299	2,513	427	293	266	227	1,894	1,109	421	250	278	278	1,951	1,157
3-->7	2,029	1,240	17	37	197	143	56	88	6	30	260	229	26	114

Deleted: 213
Deleted: 127
Deleted: 451
Deleted: 152
Deleted: 134
Deleted: 282
Deleted: 293
Deleted: 715
Deleted: 71
Deleted: 119
Deleted: 141
Deleted: 31
Deleted: 276
Deleted: 143
Deleted: 102
Deleted: 108
Deleted: 184
Deleted: 57
Deleted: 265
Deleted: 252
Deleted: 121
Deleted: 135
Deleted: 272
Deleted: 27
Deleted: 287
Deleted: 129
Moved up [1]: 1152
Deleted: 266
Deleted: 260
Deleted: 224
Deleted: 348
Deleted: 301
Deleted: 52
Deleted: 238
Deleted: 207
Deleted: 147
Deleted: 352
Deleted: 863
Deleted: 312
Deleted: 163
Deleted: 849

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
3-->8	3,049	1,927	35	29	252	240	147	116	36	19	250	278	150	88
4-->1	3,027	1,431	191	106	301	339	960	599	243	202	227	215	920	724
4-->2	3,270	2,056	126	189	302	360	634	1,134	108	225	244	247	440	926
4-->3	3,113	1,330	8	19	356	353	47	112	12	33	288	241	58	132
4-->5	2,873	862	0	52	271	292	0	253	0	60	189	153	0	153
4-->6	4,208	2,354	221	162	356	402	1,312	1,087	424	380	231	218	1,629	1,383
4-->7	2,938	1,076	8	7	287	319	38	37	7	12	212	170	25	34
4-->8	3,958	1,768	0	7	342	416	0	48	2	4	203	219	7	15
5-->1	2,208	1,465	0	141	189	267	0	627	0	132	214	208	0	457
5-->2	2,451	2,090	607	410	190	288	1,918	1,968	467	269	231	240	1,801	1,074
5-->3	2,294	1,364	99	64	244	281	402	300	63	33	275	233	289	128
5-->4	3,336	1,315	0	15	264	271	0	68	0	15	290	224	0	56
5-->6	3,389	2,387	10	24	244	330	41	132	0	17	217	211	0	60
5-->7	1,191	217	303	114	68	19	344	36	235	57	74	19	291	18
5-->8	3,139	1,802	0	0	230	343	0	0	0	0	190	212	0	0
6-->1	3,082	2,770	242	296	175	155	707	763	248	377	157	158	648	990
6-->2	3,325	3,347	3,566	3,710	176	124	10,441	7,665	2,372	2,853	174	137	6,883	6,517
6-->3	3,168	2,669	220	141	230	169	842	397	205	170	173	183	590	519
6-->4	4,210	2,621	56	53	250	159	233	140	48	46	186	174	149	133
6-->5	3,571	2,807	0	17	234	186	0	53	0	15	225	196	0	49
6-->7	3,636	3,026	0	1	250	212	0	4	0	0	248	213	0	0

Deleted: 2,784
Deleted: 178
Deleted: 213
Deleted: 104
Deleted: 103
Deleted: 23
Deleted: 146
Deleted: 197
Deleted: 88
Deleted: 76
Deleted: 108
Deleted: 353
Deleted: 635
Deleted: 167
Deleted: 298
Deleted: 828
Deleted: 190
Deleted: 373
Deleted: 1182
Deleted: 187
Deleted: 328
Deleted: 1,022
Deleted: 365
Deleted: 116
Deleted: 27
Deleted: 322
Deleted: 145
Deleted: 51
Deleted: 306
Deleted: 260
Deleted: 49
Deleted: 238
Deleted: 195
Deleted: 159
Deleted: 431
Deleted: 141
Deleted: 308
Deleted: 300
Deleted: 539
Deleted: 409
Deleted: 2

	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
6-->8	4,656	3,713	0	0	305	309	0	0	0	0	176	263	0	0
7-->1	2,273	1,665	0	23	220	471	0	180	0	23	264	257	0	99
7-->2	2,516	2,300	93	59	220	492	341	484	39	32	282	289	183	154
7-->3	2,359	1,567	6	10	274	485	27	81	2	9	325	283	11	42
7-->4	3,401	1,516	4	2	294	475	20	16	2	0	340	273	11	0
7-->5	1,191	225	83	40	108	210	149	140	176	169	119	63	350	178
7-->6	3,454	2,590	26	8	275	534	119	71	0	0	268	261	0	0
7-->8	3,204	2,727	23	0	261	547	100	0	21	6	240	261	84	26
Total weighted time, excluding mainline, hours							**295**	**278**					**246**	**243**

Deleted: 286

Deleted: 236

Deleted: 256

Deleted: 253

Deleted: 261

Deleted: 211

Deleted: 227

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

	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	209	91	116	392	403	595	112	180	152	214	284	643
1-->3	1,898	1,396	232	71	210	416	814	493	112	46	219	200	410	153
1-->4	2,940	1,347	320	103	232	405	1238	695	164	126	232	189	634	396
1-->5	2,301	1,533	135	64	206	425	463	454	158	199	207	211	546	699
1-->6	3,636	3,025	55	62	251	475	230	491	171	203	244	269	696	912
1-->7	2,366	1,754	0	9	226	453	0	68	0	26	233	228	0	99
1-->8	3,386	2,439	97	11	239	488	386	90	95	112	218	274	345	511
2-->1	2,160	2,360	115	158	145	215	278	567	22	56	213	424	78	395
2-->3	1,603	1,653	0	10	125	154	0	26	0	10	183	304	0	51
2-->4	2,645	1,605	179	251	147	143	439	597	64	118	196	293	209	576
2-->5	2,006	1,791	691	592	121	163	1,392	1,609	400	211	171	315	1,139	1,107
2-->6	3,341	3,177	3,348	3,574	166	116	9,279	6,883	2,558	2,856	208	120	8,855	5,731
2-->7	2,071	2,007	86	64	141	191	202	204	55	30	196	332	180	166
2-->8	3,091	3,315	149	213	154	128	381	456	70	69	181	378	212	435
3-->1	2,118	1,590	160	171	180	287	480	818	29	57	254	331	123	314
3-->2	2,361	2,215	0	5	189	315	0	26	0	5	296	378	0	31
3-->4	2,603	835	13	105	182	214	39	375	12	105	237	200	47	350
3-->5	1,964	1,021	108	231	156	235	280	903	116	205	212	222	410	759
3-->6	3,299	2,513	338	148	201	284	1,133	702	305	107	249	281	1,265	501

Deleted: 283
Deleted: 138
Deleted: 653
Deleted: 161
Deleted: 150
Deleted: 428
Deleted: 281
Deleted: 1,147
Deleted: 165
Deleted: 128
Deleted: 353
Deleted: 43
Deleted: 413
Deleted: 296
Deleted: 48
Deleted: 113
Deleted: 91
Deleted: 113
Deleted: 402
Deleted: 757
Deleted: 202
Deleted: 136
Deleted: 458
Deleted: 175
Deleted: 427
Deleted: 1,245
Deleted: 163
Deleted: 185
Deleted: 502
Deleted: 199
Deleted: 480
Deleted: 1593
Deleted: 40
Deleted: 164
Deleted: 109
Deleted: 133
Deleted: 486
Deleted: 1,078
Deleted: 156
Deleted: 165
Deleted: 428

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
3-->7	2,029	1,240	22	36	176	262	64	157	13	26	237	239	51	104
3-->8	3,049	1,927	7	4	188	297	22	20	10	1	222	285	37	5
4-->1	3,027	1,431	143	100	181	185	432	308	99	53	219	282	361	250
4-->2	3,270	2,056	115	201	190	213	365	713	100	186	261	329	436	1,021
4-->3	3,113	1,330	7	85	285	237	33	336	4	84	328	315	22	441
4-->5	2,873	862	0	53	157	132	0	117	0	37	177	174	0	107
4-->6	4,208	2,354	127	132	202	182	428	401	270	286	214	233	962	1,109
4-->7	2,938	1,076	28	14	177	160	82	37	5	0	203	191	17	0
4-->8	3,958	1,768	0	6	189	195	0	20	1	0	188	237	3	0
5-->1	2,208	1,465	20	2	146	132	49	4	9	0	162	207	24	0
5-->2	2,451	2,090	690	516	156	160	1,789	1,379	530	348	204	254	1,806	1,471
5-->3	2,294	1,364	129	276	250	184	538	848	114	257	271	239	516	1,025
5-->4	3,336	1,315	0	51	272	173	0	147	0	52	284	228	0	198
5-->6	3,389	2,387	0	24	167	130	0	52	0	26	157	157	0	68
5-->7	1,191	217	283	251	70	19	330	81	312	281	79	20	409	92
5-->8	3,139	1,802	0	1	155	143	0	2	0	0	131	161	0	0
6-->1	3,082	2,770	316	532	164	152	866	1346	243	511	155	417	626	3,555
6-->2	3,325	3,347	3,618	4,029	174	125	10,479	8,388	2,842	3,560	197	182	9,325	1,0793
6-->3	3,168	2,669	304	105	269	204	1,361	357	279	133	193	450	896	998
6-->4	4,210	2,621	207	114	290	193	1,001	366	173	74	204	439	588	541

Deleted: 2,784
Deleted: 139
Deleted: 121
Deleted: 16
Deleted: 8
Deleted: 163
Deleted: 197
Deleted: 27
Deleted: 3
Deleted: 201
Deleted: 334
Deleted: 267
Deleted: 236
Deleted: 204
Deleted: 229
Deleted: 777
Deleted: 185
Deleted: 313
Deleted: 966
Deleted: 87
Deleted: 219
Deleted: 317
Deleted: 85
Deleted: 299
Deleted: 424
Deleted: 54
Deleted: 150
Deleted: 135
Deleted: 170
Deleted: 105
Deleted: 131
Deleted: 199
Deleted: 434
Deleted: 278
Deleted: 223
Deleted: 034
Deleted: 178
Deleted: 18
Deleted: 229
Deleted: 131
Deleted: 188

	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
6-->5	3,571	2,807	0	13	264	213	0	46	0	11	252	461	0	84
6-->7	3,636	3,026	0	2	284	241	0	8	0	1	277	478	0	8
6-->8	4,656	3,713	0	0	297	276	0	0	0	0	177	524	0	0
7-->1	2,273	1,665	0	24	210	381	0	153	0	29	226	315	0	152
7-->2	2,516	2,300	67	83	220	410	245	567	54	81	268	362	242	489
7-->3	2,359	1,567	6	59	314	434	31	426	5	66	335	348	28	382
7-->4	3,401	1,516	6	8	336	422	34	56	6	11	348	337	35	62
7-->5	1,191	225	118	113	144	319	283	601	155	168	139	125	360	349
7-->6	3,454	2,590	0	4	231	379	0	25	0	0	221	265	0	0
7-->8	3,204	2,727	8	0	219	392	29	0	9	10	195	269	29	45
Total weighted time, excluding mainline, hours							**269**	**296**					**234**	**344**

Deleted: 176
Deleted: 38
Deleted: 12
Deleted: 249
Deleted: 391
Deleted: 78
Deleted: 203
Deleted: 260
Deleted: 450
Deleted: 239
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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 am peak hour, 7:00 – 8:00. the greatest difference is in the 2045 evening peak hour, but these times are sensitive to the traffic signal timings that are used in the model, the use of lanes by drivers and the modelled behaviour of drivers when they or other drivers are switching lanes.

4.2.5 The differences in journey times between the two models is greatest when the overall volume of traffic using the junction is higher. The degree of variability between the two modelling approaches is sensitive to the settings of the signal controls and lane markings. 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.

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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	Deadline 1 – 18 July 2023
C	Orsett Cock – Forecasting Report		Deadline 1 – 18 July 2023*
D	Manorway Forecasting Report	Modelling information as set out in Table 3.1 as ID 2	Deadline 1 – 18 July 2023
E	Thurrock East-West - Local Model Validation Report	Modelling information as set out in Table 3.1 as IDs 5, 6, 7, and 8	Deadline 1 – 18 July 2023
F	Thurrock East-West – Forecasting Report		Deadline 1 – 18 July 2023
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	Deadline 1 – 18 July 2023
H	Traffic Operational Appraisal - VISSIM Forecasting Report		Deadline 1 – 18 July 2023
I	ASDA roundabout VISSIM Local Model Validation Report	Modelling information as set out in Table 3.1 as ID 9	Deadline 3 – 24 August 2023
J	ASDA roundabout VISSIM Forecasting Report	Modelling information as set out in Table 3.1 as ID 9	Deadline 3 – 24 August 2023
K	Five Bells & Pitsea Hall Forecasting Report	Modelling information as set out in Table 3.1 as IDs 3 and 4	Deadline 3 – 24 August 2023
L	Havering & TfL Junctions Forecasting Report	Modelling information as set out in Table 3.1 as IDs 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 and 21	Deadline 3 – 24 August 2023
M	ASDA roundabout VISSIM Construction Assessment Report	Modelling information for the critical traffic modelling phases at the junction	Deadline 3 – 24 August 2023

** The Applicant submitted an update to Appendix C at Deadline 6; see Chapter 7 for more details*

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

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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:

a. Appendix J – ASDA roundabout VISSIM Forecasting Report

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

c. 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.

7 Commentary on reports submitted at Deadline 6

7.1 Appendix C – Orsett Cock VISSIM Forecasting Report

7.1.1 At Deadline 6, the Applicant updated the Orsett Cock VISSIM Forecasting Report to reflect updates made to the model following discussions with a number of Interested Parties, including Thurrock Council, Port of Tilbury London Limited, Essex County Council and DP World London Gateway.

7.1.2 These parties have been provided with a copy of the model files as well as a draft version of the updated Appendix C.

7.1.3 Full details of the changes are set out in Annex A of the Forecasting Report.

7.1.4 The update to the Orsett Cock VISSIM model was action point 7 as set out in Annex A of Joint Position Statement: Orsett Cock junction [**REP5-084**].

7.1.5 In addition to updating Appendix C, the Applicant has updated Table 4.5–Table 4.8 inclusive, and the accompanying analysis in Section 4.2.

7.1.6 The Applicant is continuing discussions with those Interested Parties set out above and is progressing action points 9 and 10 (which relate to Further sensitivity analysis of the A122 / A13 / A1089 junction, including the Orsett Cock junction) as set out in the Joint Position Statement.

7.1.7 The Applicant has also completed three tests requested by Thurrock Council to take outputs from the VISSIM model into the LTAM. The results of these tests were provided to a number of Interested Parties, including Thurrock Council, Port of Tilbury London Limited, Essex County Council and DP World London Gateway. These tests are reported in Appendix B of this document.

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Glossary

Term	Abbreviation	Explanation
A122		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
A122 Lower Thames Crossing	**Project**	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.
A122 Lower Thames Crossing/M25 junction		New junction with north-facing slip roads on the M25 between M25 junctions 29 and 30, near North Ockendon.
A13/A1089/A122 Lower Thames Crossing junction		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: • Improved A13 westbound to A122 Lower Thames Crossing southbound • Improved A13 westbound to A122 Lower Thames Crossing northbound • Improved A13 westbound to A1089 southbound • A122 Lower Thames Crossing southbound to improved A13 eastbound and Orsett Cock roundabout • A122 Lower Thames Crossing northbound to improved A13 eastbound and Orsett Cock roundabout • Orsett Cock roundabout to the improved A13 westbound • Improved A13 eastbound to Orsett Cock roundabout • Improved A1089 northbound to A122 Lower Thames Crossing northbound • Improved A1089 northbound to A122 Lower Thames Crossing southbound
A2		A major road in south-east England, connecting London with the English Channel port of Dover in Kent.
Application Document		In the context of the Project, a document submitted to the Planning Inspectorate as part of the application for development consent.
Construction		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.
Development Consent Order	**DCO**	Means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects (NSIP) under the Planning Act 2008.
Development Consent Order application	**DCO application**	The Project Application Documents, collectively known as the 'DCO application'.
M2 junction 1		The M2 will be widened from three lanes to four in both directions through M2 junction 1.
M2/A2/Lower Thames Crossing junction		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
M25 junction 29		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.
National Highways		A UK government-owned company with responsibility for managing the motorways and major roads in England. Formerly known as Highways England.
Operation		Describes the operational phase of a completed development and is considered to commence at the end of the construction phase, after demobilisation.
The tunnel		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

Workshop Number	Workshop Date
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

Appendix B Incorporating VISSIM model findings into the LTAM

B.1 Introduction

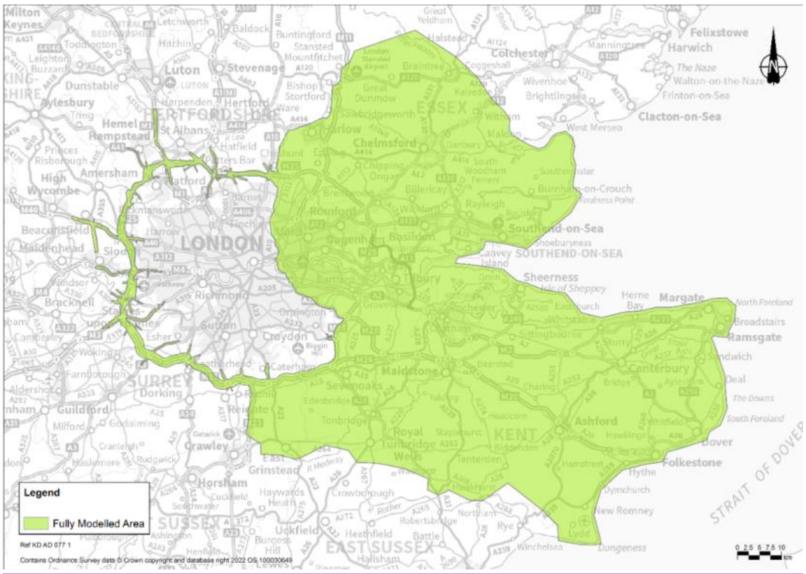
B.1.1 This Appendix has been produced to meet action point 8 of Joint Position Statement: Orsett Cock junction [**REP5-084**].

B.1.2 The Lower Thames Area Model (LTAM) is a strategic transport model developed using the SATURN software. It is a variable demand model and was built following the Department for Transport (DfT) Transport Analysis Guidance (TAG). It models drivers' response to a change in travel times, such as changing their destination, time of travel and model of travel. It also selects the best route for vehicles based on the time and cost of the alternative routes, given the other traffic on the network.

B.1.3 The development of the 2016 base year model is recorded in Combined Modelling and Appraisal Report Appendix B: Transport Model Package [**APP-520**]. The modelling for the forecast years is recorded in Combined Modelling and Appraisal Report Appendix C: Transport Forecasting Package [**APP-522**]. The trips in the model area are based on mobile phone data and traffic counts over weekdays for two weeks in March 2016.

B.1.4 The Fully Modelled Area is shown in Plate B.1. It covers most of Essex, Kent, Thurrock, Medway, the eastern part of Greater London and the entire M25 orbital route. In this area the network is coded in great detail, including comprehensive coding of the layout of the junctions. The model extends with less detail to cover the rest of the UK, so as to capture the time and cost of the entire length of journeys.

Plate B.1 LTAM fully modelled area

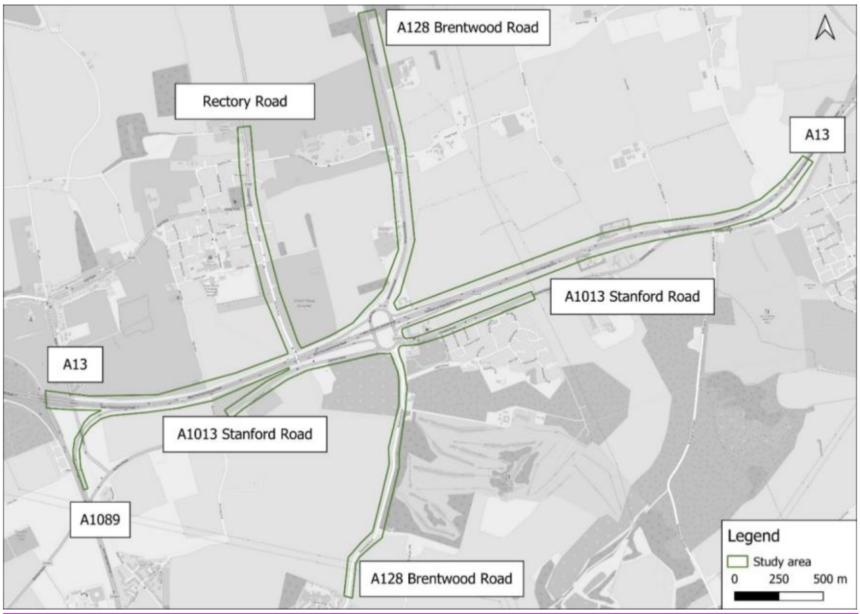


B.1.5 The Orsett Cock junction model is a microsimulation model developed using the VISSIM software. There is no DfT guidance on microsimulation modelling but the model was developed following TfL's Traffic modelling guidelines. The development of the 2016 base year model is recorded in Localised Traffic Modelling Appendix B: Orsett Cock VISSIM Local Model Validation Report [**REP1-188**]. The modelling for the forecast years is recorded in Localised Traffic Modelling Appendix C: Orsett Cock Forecasting Report (Version 2) [**Document Reference 9.15 Appendix C (2)**], submitted at Deadline 6.

B.1.6 The model is based on one day turning counts recorded at the Orsett Cock junction in October 2016. This was before the current layout of the junction was built and the A13 between the Orsett Cock and Manorway junctions was widened from two to three lanes.

B.1.7 The extent of the Orsett Cock junction VISSIM model is shown in Plate B.2.

Plate B.2 Orsett Cock junction VISSIM model extents



B.1.8 This note reports on three tests:

a. Taking the signal timings from the VISSIM model into the LTAM

b. Taking the saturation flows from the VISSIM model into the LTAM

c. Taking the forecast delays from the VISSIM model into the LTAM

B.2 Comparison of SATURN and VISSIM matrices

B.2.1 The 2016 LTAM model is based on average weekday flows in March 2016. The 2016 VISSIM model is based on a one day turning count taken in October 2016.

B.2.2 The LTAM modelled peak hours are 07:00 – 08:00 and 17:00 – 18:00. The VISSIM modelled hours are 07:00 – 08:00, 08:00 – 09:00 and 17:00 – 18:00.

B.2.3 A comparison of the LTAM and VISSIM flows in 2016 is provided in Table B.1 for flows on the entry links to Orsett Cock junction and in Table B.2 for flows on the exits from the Orsett Cock junction.

Table B.1 LTAM and VISSIM flows on entries to Orsett Cock junction, 2016

Link name	07.00 – 08.00		08.00 – 09.00	17.00 – 18.00	
	LTAM	VISSIM	VISSIM	LTAM	VISSIM
A128 Brentwood Rd (North)	659	641	696	809	869
A13 (East)	667	693	783	509	444
A1013 Stanford Rd (East)	823	672	613	513	492
Brentwood Rd (South)	422	630	607	272	408
A1013 Stanford Rd (West)	604	618	710	938	983
A13 (West)	512	518	494	928	872

Table B.2 LTAM and VISSIM flows on exits from Orsett Cock junction, 2016

Link name	07.00 – 08.00		08.00 – 09.00	17.00 – 18.00	
	LTAM	VISSIM	VISSIM	LTAM	VISSIM
A128 Brentwood Rd (North)	1,004	1,067	863	783	898
A13 (East)	560	605	673	650	668
A1013 Stanford Rd (East)	377	312	386	861	865
Brentwood Rd (South)	160	293	310	470	551
A1013 Stanford Rd (West)	840	867	1127	668	683
A13 (West)	743	628	544	537	403

B.2.4 The future year flows in the VISSIM model are calculated by taking the change in flows in the LTAM from, say 07:00–08:00 in 2030 to 07:00–08:00 in 2016 and adding these trips to the 2016 VISSIM 07:00–08:00 trip data. If the flows for a particular movement are lower in 2030 than in 2016, due to re-routing of traffic, then the percentage reduction in traffic in the Saturn model was applied to the VISSIM 2016 matrix.

Table B.3 LTAM and VISSIM flows at Orsett Cock, 2030, 07:00–08:00

Link name	Flows on approaches to Orsett Cock				Flows on exit from Orsett Cock			
	Do Minimum		Do Something		Do Minimum		Do Something	
	LTAM	VISSIM	LTAM	VISSIM	LTAM	VISSIM	LTAM	VISSIM
A128 Brentwood Rd (North)	743	735	621	662	1,091	1,125	836	994
A13 (East)	929	955	756	567	964	1,013	749	801
A1013 Stanford Rd (East)	811	661	734	675	359	293	557	493

Link name	Flows on approaches to Orsett Cock				Flows on exit from Orsett Cock			
	Do Minimum		Do Something		Do Minimum		Do Something	
	LTAM	VISSIM	LTAM	VISSIM	LTAM	VISSIM	LTAM	VISSIM
Brentwood Rd (South)	635	845	571	780	220	351	361	490
A1013 Stanford Rd (West)	826	829	658	672	998	1,018	809	887
A13 (West)	472	478	1,530	1,525	811	704	1,557	1470

Table B.4 LTAM and VISSIM flows at Orsett Cock, 2045, 07:00–08:00

Link name	Flows on approaches to Orsett Cock				Flows on exit from Orsett Cock			
	Do Minimum		Do Something		Do Minimum		Do Something	
	LTAM	VISSIM	LTAM	VISSIM	LTAM	VISSIM	LTAM	VISSIM
A128 Brentwood Rd (North)	853	846	719	705	1,039	1,106	1,014	1,214
A13 (East)	971	998	683	518	967	1,028	713	775
A1013 Stanford Rd (East)	968	818	706	678	406	343	648	590
Brentwood Rd (South)	553	763	797	1,009	229	359	407	540
A1013 Stanford Rd (West)	869	873	592	607	1,068	1,083	865	873
A13 (West)	516	523	1,960	1,960	1,001	902	1,788	1,711

Table B.5 LTAM and VISSIM flows at Orsett Cock, 2030, 17:00–18:00

Link name	Flows on approaches to Orsett Cock				Flows on exit from Orsett Cock			
	Do Minimum		Do Something		Do Minimum		Do Something	
	LTAM	VISSIM	LTAM	VISSIM	LTAM	VISSIM	LTAM	VISSIM
A128 Brentwood Rd (North)	956	1,036	746	828	709	908	620	844
A13 (East)	941	876	677	521	954	981	795	821
A1013 Stanford Rd (East)	579	578	513	505	704	723	1,114	1,141
Brentwood Rd (South)	348	485	341	499	655	732	882	957
A1013 Stanford Rd (West)	928	1,058	782	910	922	938	911	930
A13 (West)	835	779	2,423	2,355	643	530	1,155	1,021

Table B.6 LTAM and VISSIM flows at Orsett Cock, 2045, 17:00–18:00

Link name	Flows on approaches to Orsett Cock				Flows on exit from Orsett Cock			
	Do Minimum		Do Something		Do Minimum		Do Something	
	LTAM	VISSIM	LTAM	VISSIM	LTAM	VISSIM	LTAM	VISSIM
A128 Brentwood Rd (North)	1,047	1,126	812	894	754	976	619	883
A13 (East)	1,072	1,007	611	476	1,081	1,093	765	804
A1013 Stanford Rd (East)	648	646	487	497	678	711	1,192	1,218
Brentwood Rd (South)	419	556	480	622	724	810	955	1,025
A1013 Stanford Rd (West)	927	1,082	727	893	1,071	1,084	972	987
A13 (West)	827	770	2,795	2,734	631	514	1,402	1,275

Saturation flows

B.2.5 The second test was to take the saturation flows which are output from the VISSIM model and use them as inputs in the LTAM. A saturation flow is the maximum number of vehicles that can leave a link within an hour. The total saturation flow from VISSIM is then used as a maximum for the combined capacity of the turning movements coded into the LTAM leaving each link.

Delays

B.2.6 The time reported by VISSIM for each link was compared to the time reported in the LTAM. The difference between these times was calculated and added as a time penalty to the link in the LTAM.

Results

B.2.7 In each test, once the LTAM network coding was amended, either by adjusting the signal timings, saturation flows or by adding in a time penalty on a link, the LTAM was re-run through the variable demand model. This modelled the full range of drivers' behavioural response to the changes at the Orsett Cock junction, including the re-routing of their trips.

B.2.8 The results of each of the tests are reported in Table B.7 to Table B.22 for both 2030 and 2045, and for the 07:00–08:00 and 17:00–18:00 time periods.

B.2.9 In each set of tables, the data is provided first for the LTAM CS72 run, as used in the DCO application. The table shows the input values at each entry arm of the Orsett Cock junction. This is the flow in the LTAM, the saturation flow, the capacity, the volume to capacity ratio and the amount of green and inter green time at the signals. These are inputs into the LTAM. The tables also show the travel time in seconds, the delay time in seconds, the average queue in Passenger Car Units (PCUs) and the length of the queue in metres. These are outputs from the LTAM.

B.2.10 The other tables then show the same data for each of the three tests. The tables also show the change in the relevant input values (either signal green time, saturation flows or hard coded delay), and the change in time and flows which is an output from the SATURN model.

B.2.11 The results from the tests show that there is only a slight change in flows at the Orsett Cock junction if the signal timings and saturation flows from the VISSIM model are used in the LTAM.

B.2.12 Plate B.3 to Plate B.14 show the change in flows in the area if the delays from the VISSIM model are hard coded into the LTAM. The change is a reduction in traffic on the approach roads to the Orsett Cock junction and an increase in traffic on the M25 and the A13 west of the Orsett Cock junction. The smallest stacking capacity on the circulatory at the Manorway junction is the area between the exit and entry for the A1014. Here no increases in flow are forecast in the AM peak in 2030 and the PM peak hour in either 2030 or 2045. There is an increase of 5 PCUs in the AM peak hour in 2045 at this location.

B.2.13 If the revised flows from the LTAM, which shows how drivers would react to such an increase in journey times through the Orsett Cock junction, were to be input into the VISSIM model then the delays at the Orsett Cock junction in the VISSIM model would be reduced.

B.3 Interaction between SATURN and VISSIM

B.3.1 The standard process of interaction between a strategic SATURN model and a VISSIM model is to take the flows from the SATURN model and use these in a VISSIM model of a junction or small area. If the junction is then re-designed using the insights from the VISSIM model on the performance of the junction, the new junction layout is then re-coded into SATURN.

B.3.2 During this process the signal settings from the VISSIM model, especially if vehicle activated signals are modelled at the junction, are taken from the VISSIM model and used in the SATURN model. There are other alternative and well established methods for setting the signal timings in SATURN which include taking the signal timings from a LINSIG model of the junction, or manually calculating the signal timings and refining them after a series of test runs were undertaken to establish the flows that route through the junction.

B.3.3 The LTAM uses the latter technique and the signal timings at Orsett Cock were set to match the use of the junction by traffic in the model.

B.3.4 The saturation flows in the LTAM were coded following National Highways' Regional Transport Model coding manual. This results in consistency in the coding of the saturation flows across all junctions in the Fully Modelled Area. The sensitivity test shows that if the saturation flows from the VISSIM model were used in the LTAM, there would only be a small change in flow and times in the LTAM.

B.3.5 The final sensitivity test was to hard code the delays from the VISSIM model into the LTAM. This shows that, as a result of the variable demand modelling in the LTAM, the flows at the Orsett Cock junction change substantially. If these flows were taken back into the VISSIM model then the travel times in the VISSIM model would then, in turn, change. This is the reason why it is not industry practice to follow this approach. The test was taken to see how the flows at the Manorway junction would change if the delays reported in the VISSIM model were placed into the LTAM. This shows that there would be few additional vehicles using the Manorway junction.

Table B.7 Orsett Cock junction LTAM data, 2030, AM peak, Core (LR_CS72_2030)

Arm	Saturation flow (PCU)	Green time (sec)	Inter time (sec)	% Green time	Capacity (PCU)	Total flow (PCU)	V/C	Travel time (sec)	Delays (sec)	Time penalty (sec)	Average queue (PCU)	Queue length (m)
A128 N	5,740	12	8	20%	1,148	726	0.63	31	26	0	4	26
A13 E	3,790	17	7	28%	1,074	779	0.73	43	25	0	4	24
A1013 E	2,500	Give way	-	-	898	790	0.88	24	21	0	4	21
A128 S	3,790	10	8	17%	910	575	0.63	32	29	0	4	21
A1013 W	2,500	Give way	-	-	788	675	0.86	24	21	0	3	18
A13 W	5,740	28	8	47%	2,679	1727	0.64	25	14	0	6	34

Table B.8 Orsett Cock junction LTAM data, 2030, AM peak, Core with VISSIM v3.6 signal timings (LEO_CS32_2030)

Arm	Saturation flow (PCU)	Green time (sec)	Inter time (sec)	% Green time	Capacity (PCU)	Total flow (PCU)	V/C	Travel time (sec)	Delays (sec)	Time penalty (sec)	Average queue (PCU)	Queue length (m)
A128 N	5,740	9	5	15%	861	709	0.82	41	36	0	5	28
A13 E	3,790	17	5	28%	1,074	790	0.74	43	26	0	4	25
A1013 E	2,500	Give way	-	-	824	782	0.95	35	31	0	6	34
A128 S	3,790	9	5	15%	831	569	0.69	35	31	0	4	22
A1013 W	2,500	Give way	-	-	723	670	0.93	33	31	0	5	29
A13 W	5,740	29	5	48%	2,774	1843	0.66	25	14	0	6	35

Arm	Input	Output		
	Change in % green time	Change in total time	Change in total flow	% Change in total flow
A128 N	-5%	10	-17	-2%
A13 E	0%	0	11	1%
A1013 E	0%	11	-8	-1%
A128 S	-2%	2	-5	-1%
A1013 W	0%	10	-5	-1%
A13W	2%	0	116	7%

Table B.9 Orsett Cock junction LTAM data, 2030, AM peak, Core with VISSIM v3.6 saturation flows (LEO_CS33_2030)

Arm	Saturation flow (PCU)	Green time (sec)	Inter time (sec)	% Green time	Capacity (PCU)	Total flow (PCU)	V/C	Travel time (sec)	Delays (sec)	Time penalty (sec)	Average queue (PCU)	Queue length (m)
A128 N	5,750	12	8	20%	1,150	720	0.63	31	26	0	4	25
A13 E	3,848	17	7	28%	1,090	778	0.71	42	25	0	4	24
A1013 E	2,500	Give way	-	-	909	790	0.87	23	20	0	3	20
A128 S	3,975	10	8	17%	948	575	0.61	32	28	0	4	21
A1013 W	2,500	Give way	-	-	792	664	0.84	22	20	0	3	17
A13 W	5,630	28	8	47%	2,627	1722	0.66	25	14	0	6	34

Arm	Input	Output		
	Change in saturation flow	Change in total time	Change in total flow (PCU)	% Change in total flow
A128 N	10	0	-7	-1%
A13 E	58	16	-1	0%
A1013 E	0	11	0	0%
A128 S	185	39	1	0%
A1013 W	0	4	-11	-2%
A13 W	-110	-51	-5	0%

Table B.10 Orsett Cock junction LTAM data, 2030, AM peak, Core with VISSIM v3.6 delays (LEO_CS34_2030)

Arm	Saturation flow (PCU)	Green time (sec)	Inter time (sec)	% Green time	Capacity (PCU)	Total flow (PCU)	V/C	Travel time (sec)	Delays (sec)	Time penalty (sec)	Average queue (PCU)	Queue length (m)
A128 N	5,740	12	8	20%	1,148	522	0.45	29	24	54	3	18
A13 E	3,790	17	7	28%	1,074	739	0.69	42	24	26	4	23
A1013 E	2,500	Give way	-	-	1,117	744	0.67	14	10	40	1	7
A128 S	3,790	10	8	17%	910	432	0.47	30	26	71	3	16
A1013 W	2,500	Give way	-	-	1,009	527	0.52	12	9	58	1	4
A13 W	5,740	28	8	47%	2,679	1694	0.63	25	14	15	6	33

Arm	Input	Output		
	Change in time penalty	Change in total time	Change in total flow	% Change in total flow
A128 N	54	52	-204	-28%
A13 E	26	25	-40	-5%
A1013 E	40	29	-47	-6%
A128 S	71	69	-143	-25%
A1013 W	58	46	-149	-22%
A13 W	15	15	-34	-2%

Table B.11 Orsett Cock junction LTAM data, 2030, PM peak, Core (LR_CS72_2030)

Junction	Saturation flow (PCU)	Green time (sec)	Inter time (sec)	% Green time	Capacity (PCU)	Total flow (PCU)	V/C	Travel time (sec)	Delays (sec)	Time penalty (sec)	Average queue (PCU)	Queue length (m)
A128 N	5,740	10	8	17%	957	779	0.81	39	34	0	5	30
A13 E	3,790	13	7	22%	821	698	0.85	54	37	0	4	25
A1013 E	2,500	Give way			668	534	0.80	24	20	0	2	14
A128 S	3,790	10	8	17%	910	343	0.38	29	25	0	2	12
A1013 W	2,500	Give way			1,460	792	0.54	10	7	0	1	4
A13 W	5,740	32	8	53%	3,061	2,567	0.84	27	16	0	8	48

Table B.12 Orsett Cock junction LTAM data, 2030, PM peak, Core with VISSIM v3.6 signal timings (LEO_CS32_2030)

Junction	Saturation flow (PCU)	Green time (sec)	Inter time (sec)	% Green time	Capacity (PCU)	Total flow (PCU)	V/C	Travel time (sec)	Delays (sec)	Time penalty (sec)	Average queue (PCU)	Queue length (m)
A128 N	5,740	12	5	20%	1,148	855	0.74	34	29	0	5	31
A13 E	3,790	8	5	13%	505	518	1.03	169	152	0	10	57
A1013 E	2,500	Give way	-	-	723	564	0.78	22	18	0	2	13
A128 S	3,790	8	5	13%	752	344	0.46	32	28	0	2	13
A1013 W	2,500	Give way	-	-	1,469	957	0.65	11	8	0	1	6
A13 W	5,740	28	5	47%	2,679	2,549	0.95	39	28	0	11	63

Arm	Input	Output		
	Change in % green time	Change in total time	Change in total flow	% Change in total flow
A128 N	3%	-5	76	10%
A13 E	-8%	115	-180	-26%
A1013 E	0%	-2	30	6%
A128 S	-3%	3	1	0%
A1013 W	0%	1	164	21%
A13 W	-7%	12	-17	-1%

Table B.13 Orsett Cock junction LTAM data, 2030, PM peak, Core with VISSIM v3.6 saturation flows (LEO_CS33_2030)

Junction	Saturation flow (PCU)	Green time (sec)	Inter time (sec)	% Green time	Capacity (PCU)	Total flow (PCU)	V/C	Travel time (sec)	Delays (sec)	Time penalty (sec)	Average queue (PCU)	Queue length (m)
A128 N	5,750	10	8	17%	958	767	0.80	38	33	0	5	29
A13 E	3,848	13	7	22%	834	698	0.84	52	35	0	4	25
A1013 E	2,500	Give way	-	-	676	534	0.79	23	20	0	2	13
A128 S	3,975	10	8	17%	948	337	0.36	29	25	0	2	12
A1013 W	2,500	Give way	-	-	1,465	722	0.49	9	7	0	1	3
A13 W	5,921	32	8	53%	3,158	2,578	0.82	26	15	0	8	48

Arm	Input	Output		
	Change in saturation flow	Change in total time	Change in total flow	% Change in total flow
A128 N	10	-1	-12	-2%
A13 E	58	13	0	0%
A1013 E	0	7	0	0%
A128 S	185	39	-6	-2%
A1013 W	0	5	-71	-9%
A13 W	181	97	11	0%

Table B.14 Orsett Cock junction LTAM data, 2030, PM peak, Core with VISSIM v3.6 delays (LEO_CS34_2030)

Junction	Saturation flow (PCU)	Green time (sec)	Inter time (sec)	% Green time	Capacity (PCU)	Total flow (PCU)	V/C	Travel time (sec)	Delays (sec)	Time penalty (sec)	Average queue (PCU)	Queue length (m)
A128 N	5,740	10	8	17%	957	674	0.70	35	30	40	4	25
A13 E	3,790	13	7	22%	821	152	0.19	39	22	294	1	5
A1013 E	2,500	Give way	-	-	1496	436	0.29	9	6	92	0	1
A128 S	3,790	10	8	17%	910	208	0.23	28	24	66	1	7
A1013 W	2,500	Give way	-	-	2,189	525	0.24	7	5	90	0	1
A13 W	5,740	32	8	53%	3,061	1,907	0.62	22	12	121	5	30

Arm	Input	Output		
	Change in time penalty	Change in total time	Change in total flow	% Change in total flow
A128 N	40	36	-105	-13%
A13 E	294	279	-546	-78%
A1013 E	92	78	-98	-18%
A128 S	66	65	-135	-39%
A1013 W	90	88	-268	-34%
A13 W	121	117	-659	-26%

Table B.15 Orsett Cock junction LTAM data, 2045, AM peak, Core (LR_CS72_2045)

Junction	Saturation flow (PCU)	Green time (sec)	Inter time (sec)	% Green time	Capacity (PCU)	Total flow (PCU)	V/C	TOTAL Time (sec)	Delays (sec)	Time penalty (sec)	Average queue (PCU)	Queue length (m)
A128 N	5,740	12	8	20%	1148	833	0.73	33	28	0	5	30
A13E	3,790	15	7	25%	948	705	0.74	45	28	0	4	23
A1013 E	2,500	Give way	-	-	748	760	1.02	82	79	0	15	89
A128 S	3,790	11	8	18%	989	808	0.82	37	33	0	5	30
A1013W	2,500	Give way	-	-	604	609	1.01	74	71	0	11	65
A13W	5,740	28	8	47%	2679	2166	0.81	28	17	0	8	47

Table B.16 Orsett Cock junction LTAM data, 2045, AM peak, Core with VISSIM v3.6 signal timings (LEO_CS32_2045)

Junction	Saturation flow (PCU)	Green time (sec)	Inter time (sec)	% Green time	Capacity (PCU)	Total flow (PCU)	V/C	TOTAL Time (sec)	Delays (sec)	Time penalty (sec)	Average queue (PCU)	Queue length (m)
A128 N	5,740	9	5	15%	861	782	0.91	51	46	0	5	31
A13 E	3,790	17	5	28%	1,074	722	0.67	41	24	0	4	22
A1013 E	2,500	Give way	-	-	737	750	1.02	87	84	0	16	94
A128 S	3,790	12	5	20%	1,068	826	0.77	34	30	0	5	30
A1013 W	2,500	Give way	-	-	574	583	1.02	91	88	0	13	77
A13 W	5,740	29	5	48%	2,774	2,219	0.80	27	17	0	8	46

Arm	Input	Output		
	Change in % green time	Change in total time	Change in total flow	% Change in total flow
A128 N	-5%	18	-50	-6%
A13 E	3%	-4	17	2%
A1013 E	0%	5	-10	-1%
A128 S	2%	-3	18	2%
A1013 W	0%	17	-26	-4%
A13 W	2%	-1	53	2%

Table B.17 Orsett Cock junction LTAM data, 2045, AM peak, Core with VISSIM v3,6 saturation flows (LEO_CS33_2045)

Junction	Saturation flow (PCU)	Green time (sec)	Inter time (sec)	% Green time	Capacity (PCU)	Total flow (PCU)	V/C	TOTAL Time (sec)	Delays (sec)	Time penalty (sec)	Average queue (PCU)	Queue length (m)
A128 N	5,750	12	8	20%	1150	826	0.72	33	28	0	5	30
A13 E	3,834	15	7	25%	959	703	0.73	45	28	0	4	23
A1013 E	2,500	Give way	-	-	763	771	1.01	73	70	0	14	80
A128 S	3,965	11	8	18%	1,029	804	0.78	35	31	0	5	30
A1013 W	2,500	Give way	-	-	608	611	1.00	69	66	0	10	60
A13 W	5,795	28	8	47%	2,704	2,153	0.80	28	17	0	8	47

Arm	Input	Output		
	Change in saturation flow	Change in total time	Change in total flow	% Change in total flow
A128 N	10	0	-7	-1%
A13 E	44	11	-2	0%
A1013 E	0	15	12	2%
A128 S	175	40	-3	0%
A1013 W	0	4	2	0%
A13 W	55	26	-13	-1%

Table B.18 Orsett Cock junction LTAM data, 2045, AM peak, Core with VISSIM v3.6 delays (LEO_CS34_2045)

Junction	Saturation flow (PCU)	Green time (sec)	Inter time (sec)	% Green time	Capacity (PCU)	Total flow (PCU)	V/C	TOTAL Time (sec)	Delays (sec)	Time penalty (sec)	Average queue (PCU)	Queue length (m)
A128 N	5,740	12	8	20%	1,148	438	0.38	28	23	117	3	15
A13 E	3,790	15	7	25%	948	666	0.70	44	27	25	4	22
A1013 E	2,500	Give way	-	-	1,106	849	0.77	16	12	69	2	11
A128 S	3,790	11	8	18%	989	426	0.43	29	25	104	3	15
A1013 W	2,500	Give way	-	-	970	704	0.73	15	13	47	2	10
A13 W	5,740	28	8	47%	2,679	2,021	0.75	27	16	18	7	43

Arm	Input	Output		
	Change in time penalty	Change in total time	Change in total flow	% Change in total flow
A128 N	117	112	-395	-47%
A13 E	25	24	-39	-6%
A1013 E	69	3	90	12%
A128 S	104	96	-381	-47%
A1013 W	47	-12	96	16%
A13 W	18	17	-144	-7%

Table B.19 Orsett Cock junction LTAM data, 2045, PM peak, Core (LR_CS72_2045)

Junction	Saturation flow (PCU)	Green time (sec)	Inter time (sec)	% Green time	Capacity (PCU)	Total flow (PCU)	V/C	TOTAL Time (sec)	Delays (sec)	Time penalty (sec)	Average queue (PCU)	Queue length (m)
A128 N	5,740	10	8	17%	957	849	0.89	45	40	0	6	33
A13 E	3,790	11	7	18%	695	629	0.91	65	48	0	4	24
A1013 E	2,500	Give way	-	-	514	509	0.99	66	62	0	8	44
A128 S	3,790	10	8	17%	910	493	0.54	31	27	0	3	18
A1013 W	2,500	Give way	-	-	1,200	738	0.62	11	9	0	1	6
A13 W	5,740	33	8	55%	3,157	2,946	0.93	32	21	0	10	59

Table B.20 Orsett Cock junction LTAM data, 2045, PM peak, Core with VISSIM v3.6 signal timings (LEO_CS32_2045)

Junction	Saturation flow (PCU)	Green time (sec)	Inter time (sec)	% Green time	Capacity (PCU)	Total flow (PCU)	V/C	TOTAL Time (sec)	Delays (sec)	Time penalty (sec)	Average queue (PCU)	Queue length (m)
A128 N	5,740	12	5	20%	1,148	970	0.85	38	33	0	6	36
A13 E	3,790	7	5	12%	442	445	1.01	140	123	0	4	26
A1013 E	2,500	Give way	-	-	563	567	1.01	74	70	0	10	60
A128 S	3,790	8	5	13%	752	500	0.66	36	32	0	3	20
A1013 W	2,500	Give way	-	-	1,242	953	0.77	14	11	0	2	11
A13 W	5,740	29	5	48%	2,774	2,803	1.01	79	68	0	25	146

Arm	Input	Output		
	Change in % green time	Change in total time	Change in total flow	% Change in total flow
A128 N	3%	-7	122	14%
A13 E	-7%	75	-185	-29%
A1013 E	0%	8	58	11%
A128 S	-3%	5	7	1%
A1013 W	0%	2	214	29%
A13 W	-7%	47	-143	-5%

Table B.21 Orsett Cock junction LTAM data, 2045, PM peak, Core with VISSIM v3.6 saturation flows (LEO_CS33_2045)

Junction	Saturation flow (PCU)	Green time (sec)	Inter time (sec)	% Green time	Capacity (PCU)	Total flow (PCU)	V/C	TOTAL Time (sec)	Delays (sec)	Time penalty (sec)	Average queue (PCU)	Queue length (m)
A128 N	5,750	10	8	17%	958	842	0.88	44	39	0	6	33
A13 E	3,834	11	7	18%	703	633	0.90	64	47	0	4	24
A1013 E	2,500	Give way	-	-	513	502	0.98	63	60	0	7	40
A128 S	3,965	10	8	17%	946	483	0.51	30	27	0	3	18
A1013 W	2,500	Give way	-	-	1,210	697	0.58	11	8	0	1	5
A13 W	5,954	33	8	55%	3,275	2,974	0.91	29	19	0	10	58

Arm	Input	Output		
	Change in saturation flow	Change in total time	Change in total flow	% Change in total flow
A128 N	10	-1	-6	-1%
A13 E	44	8	4	1%
A1013 E	0	-1	-7	-1%
A128 S	175	36	-10	-2%
A1013 W	0	10	-41	-6%
A13 W	214	118	29	1%

Table B.22 Orsett Cock junction LTAM data, 2045, PM peak, Core with VISSIM v3.6 delays (LEO_CS34_2045)

Junction	Saturation flow (PCU)	Green time (sec)	Inter time (sec)	% Green time	Capacity (PCU)	Total flow (PCU)	V/C	TOTAL Time (sec)	Delays (sec)	Time penalty (sec)	Average queue (PCU)	Queue length (m)
A128 N	5,740	10	8	17%	957	803	0.84	41	36	77	5	31
A13 E	3,790	11	7	18%	695	323	0.46	44	27	181	2	11
A1013 E	2,500	Give way	-	-	1,352	529	0.39	10	7	96	0	2
A128 S	3,790	10	8	17%	910	128	0.14	27	24	144	1	4
A1013 W	2,500	Give way	-	-	2,106	453	0.22	7	5	118	0	1
A13 W	5,740	33	8	55%	3,157	1,335	0.42	20	9	297	3	17

Arm	Input	Output		
	Change in time penalty	Change in total time	Change in total flow	% Change in total flow
A128 N	77	72	-46	-5%
A13 E	181	159	-306	-49%
A1013 E	96	40	21	4%
A128 S	144	141	-364	-74%
A1013 W	118	114	-285	-39%
A13 W	297	285	-1611	-55%

Plate B.3 2030 AM plots VISSIM delays hard coded into SATURN, Thurrock

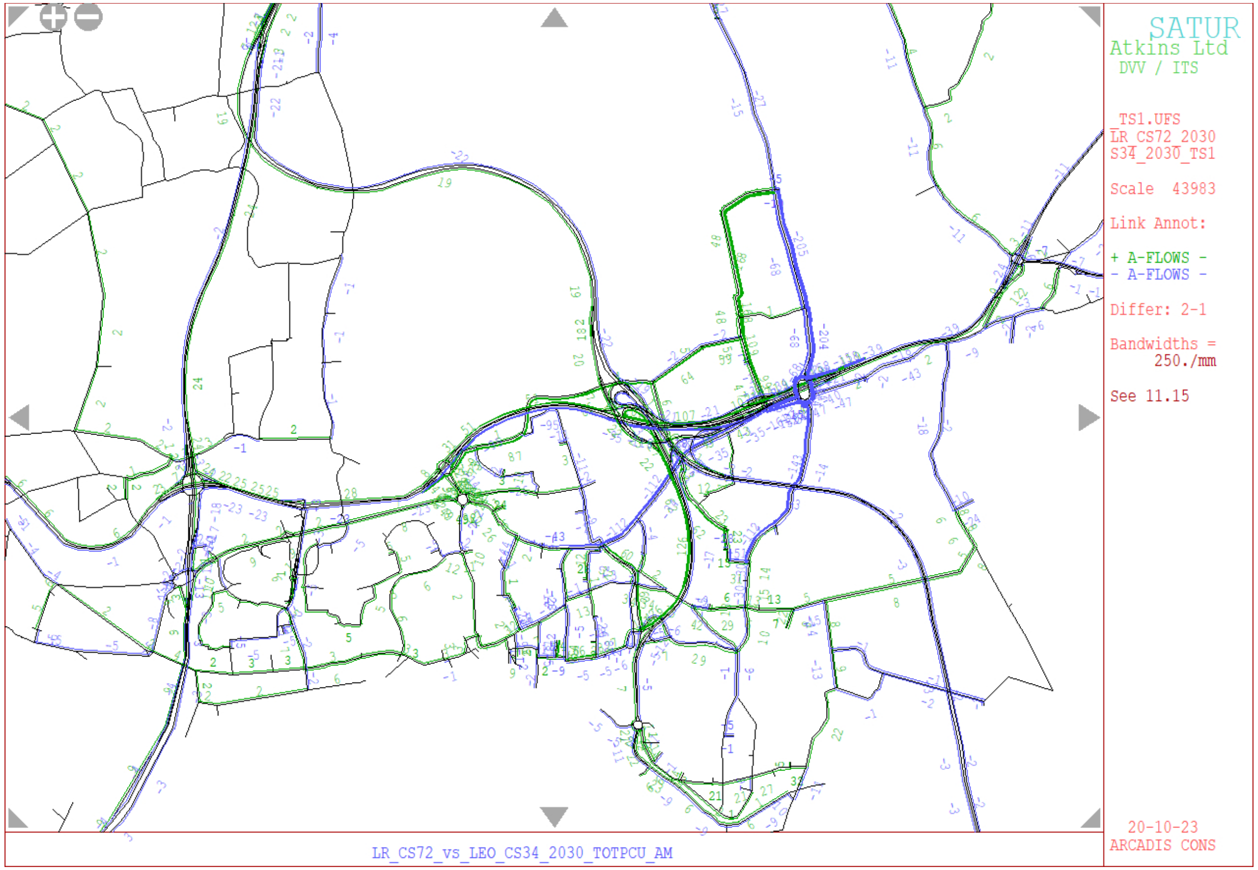


Plate B.4 2030 AM plots VISSIM delays hard coded into SATURN, Orsett Cock

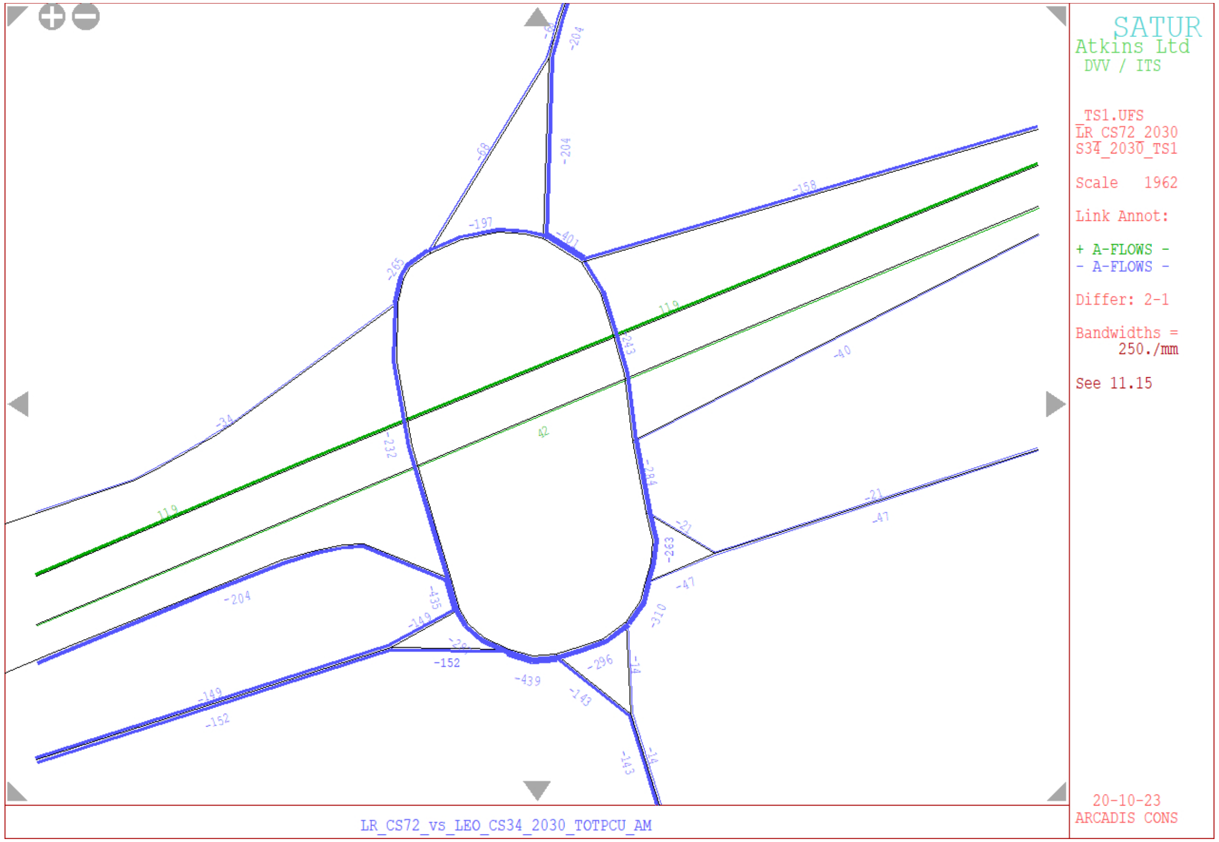


Plate B.5 2030 AM plots VISSIM delays hard coded into SATURN, Manorway

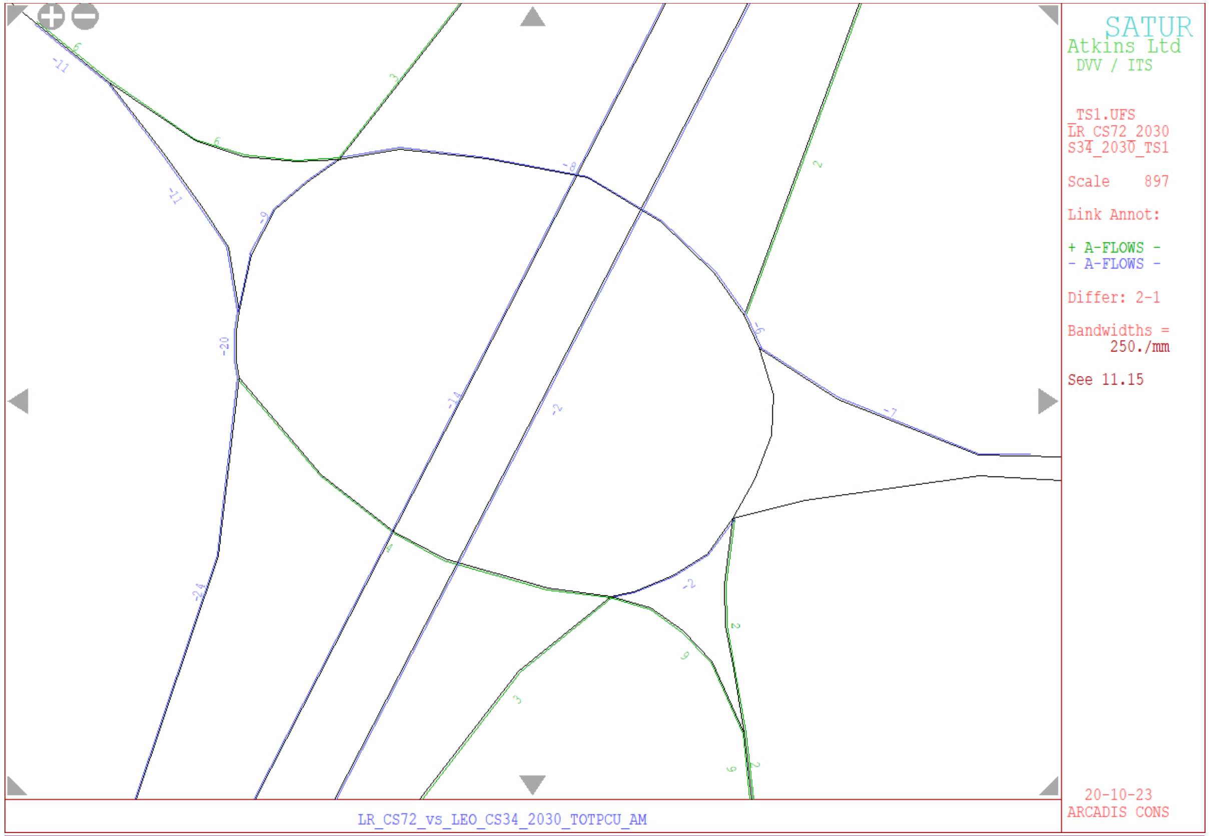


Plate B.6 2030 PM plots VISSIM delays hard coded into SATURN, Thurrock

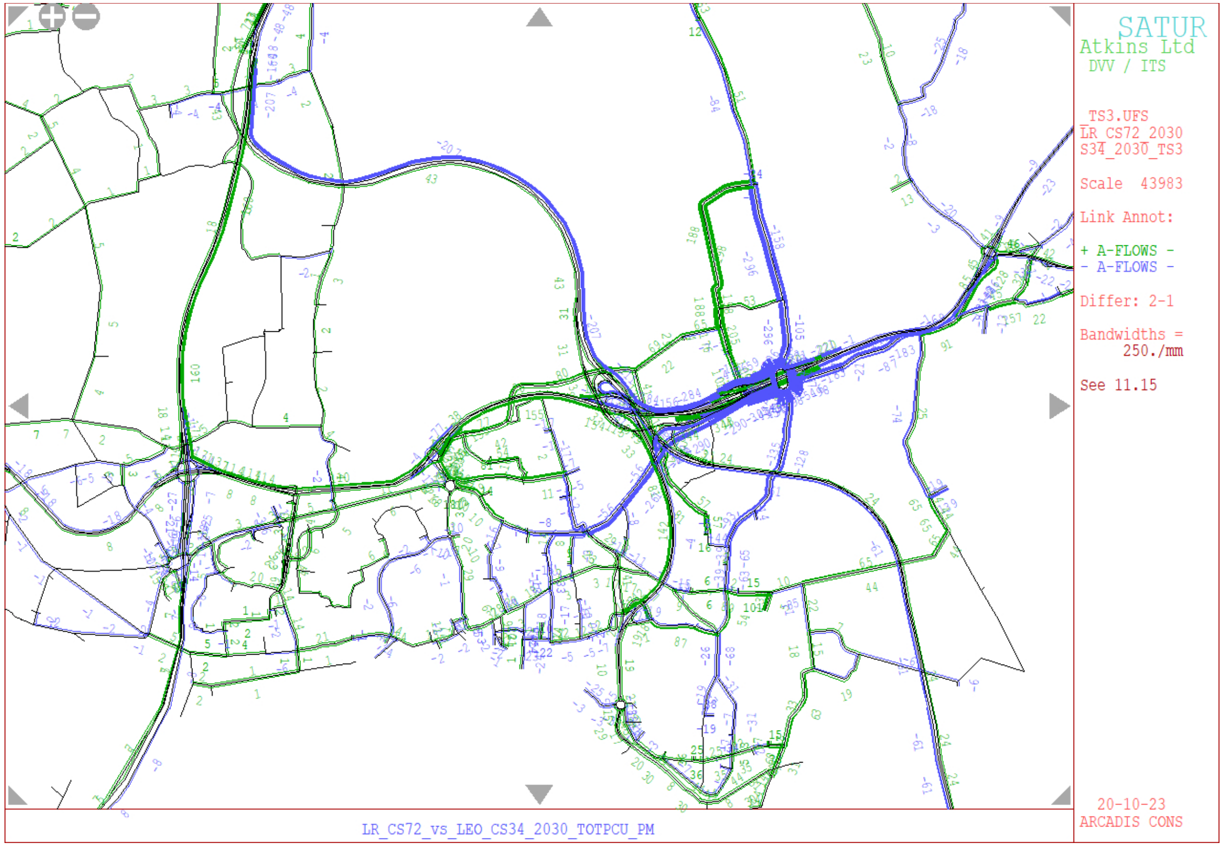


Plate B.7 2030 PM plots VISSIM delays hard coded into SATURN, Orsett Cock

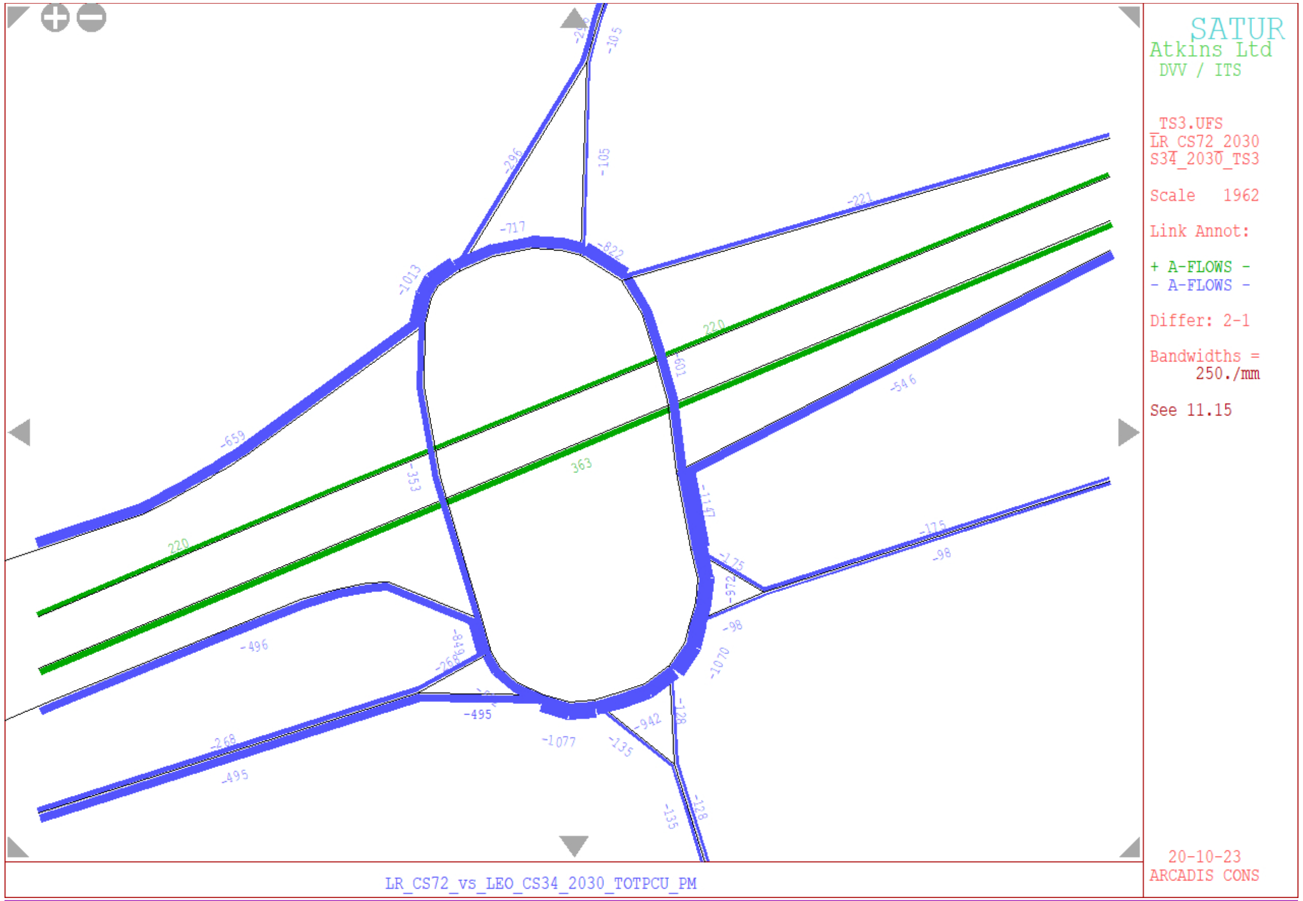


Plate B.8 2030 PM plots VISSIM delays hard coded into SATURN, Manorway

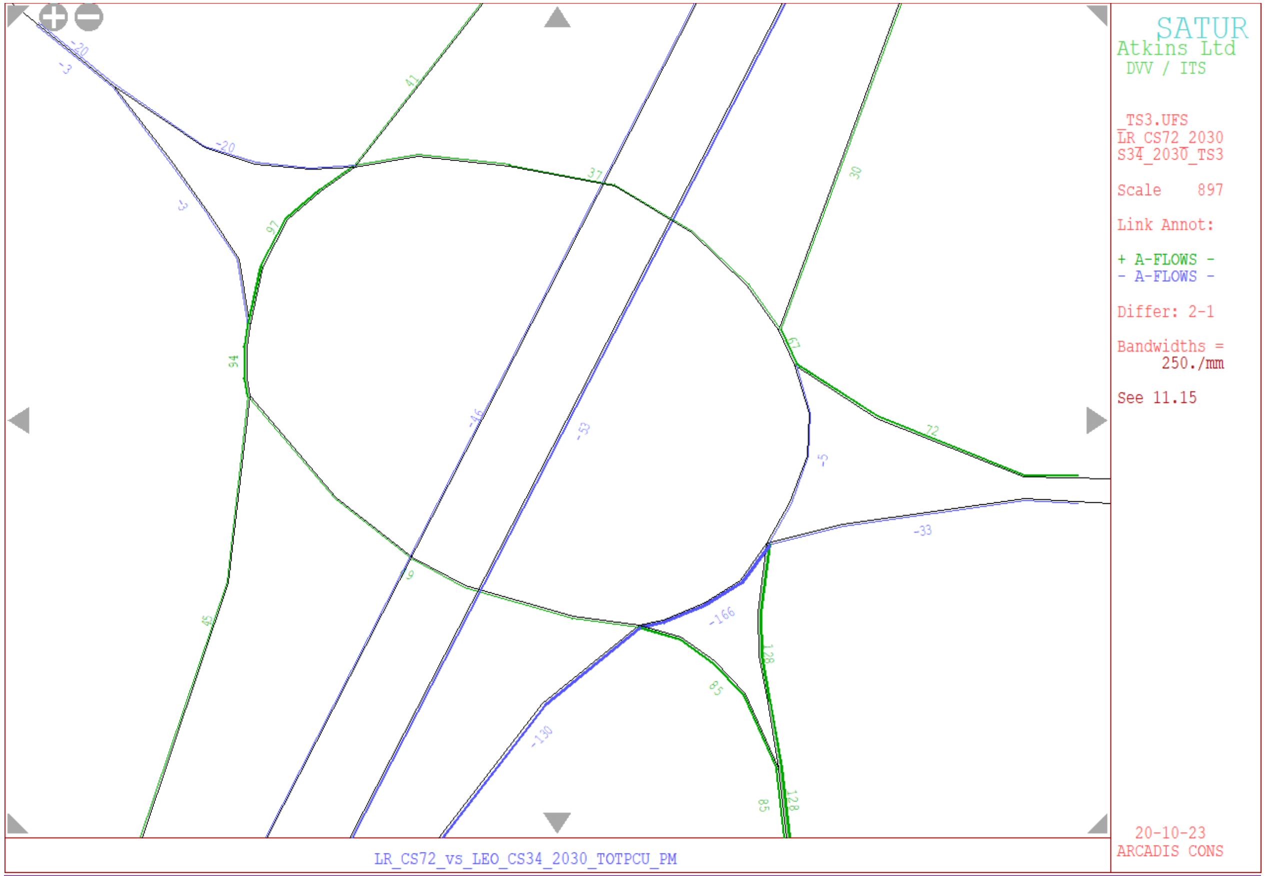


Plate B.9 2045 AM plots VISSIM delays hard coded into SATURN, Thurrock

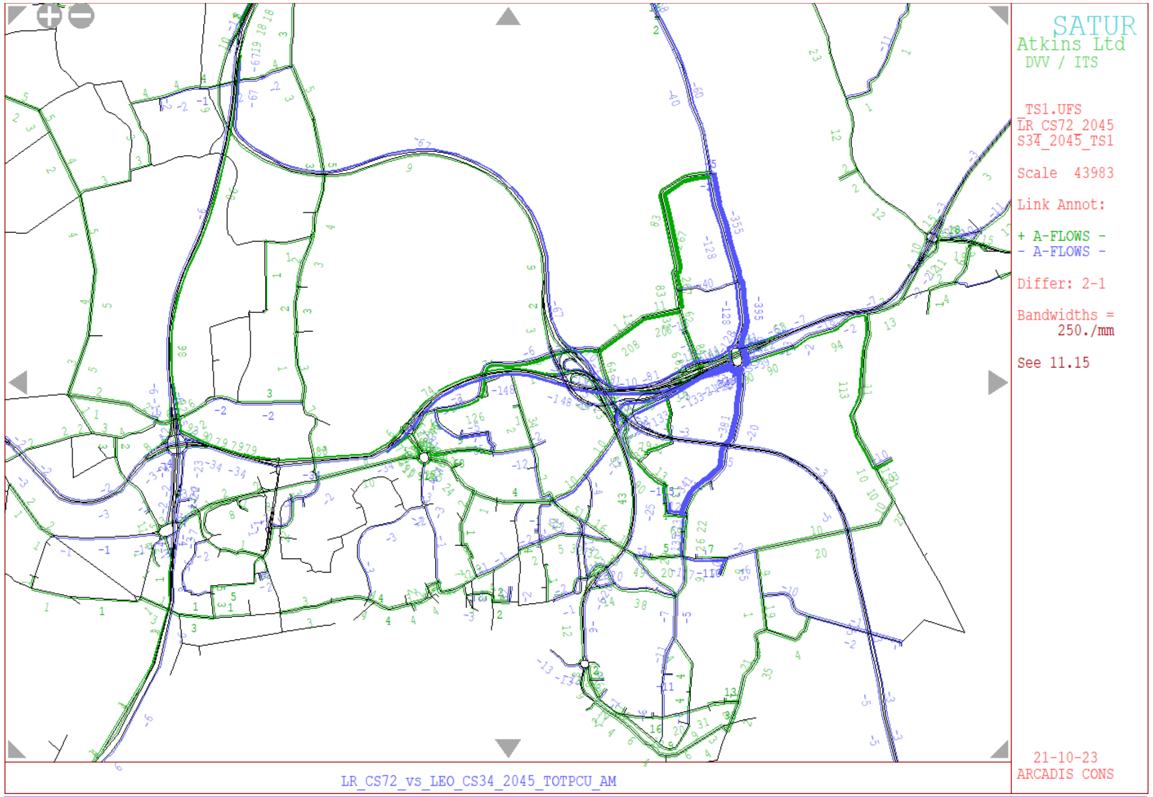


Plate B.10 2045 AM plots VISSIM delays hard coded into SATURN, Orsett Cock

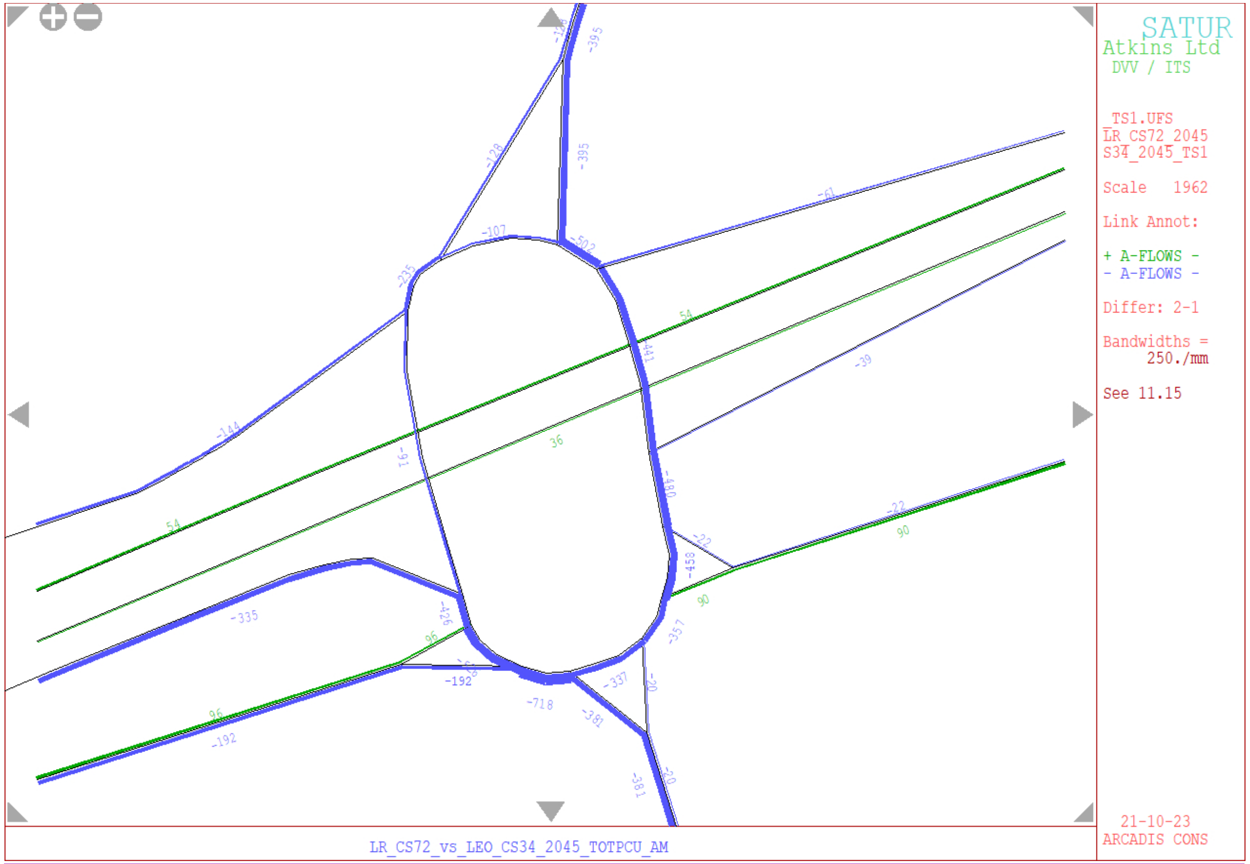


Plate B.11 2045 AM plots VISSIM delays hard coded into SATURN, Manorway

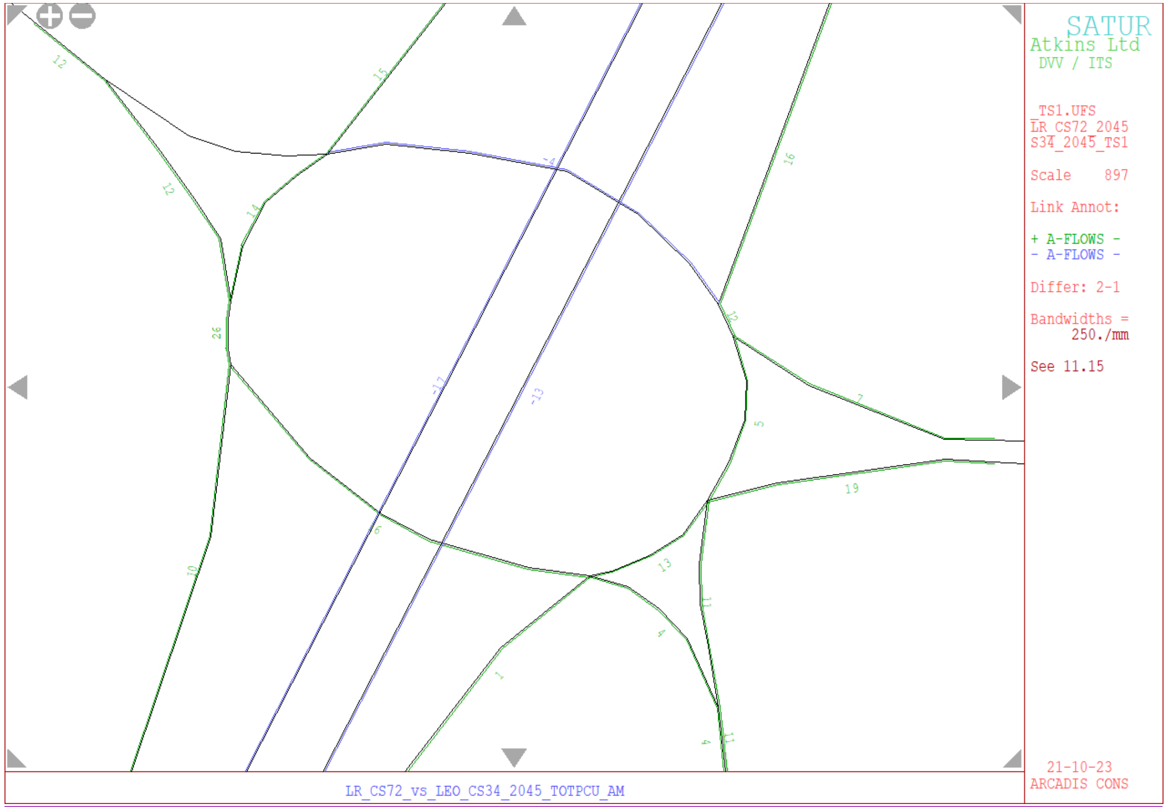


Plate B.12 2045 PM plots VISSIM delays hard coded into SATURN, Thurrock

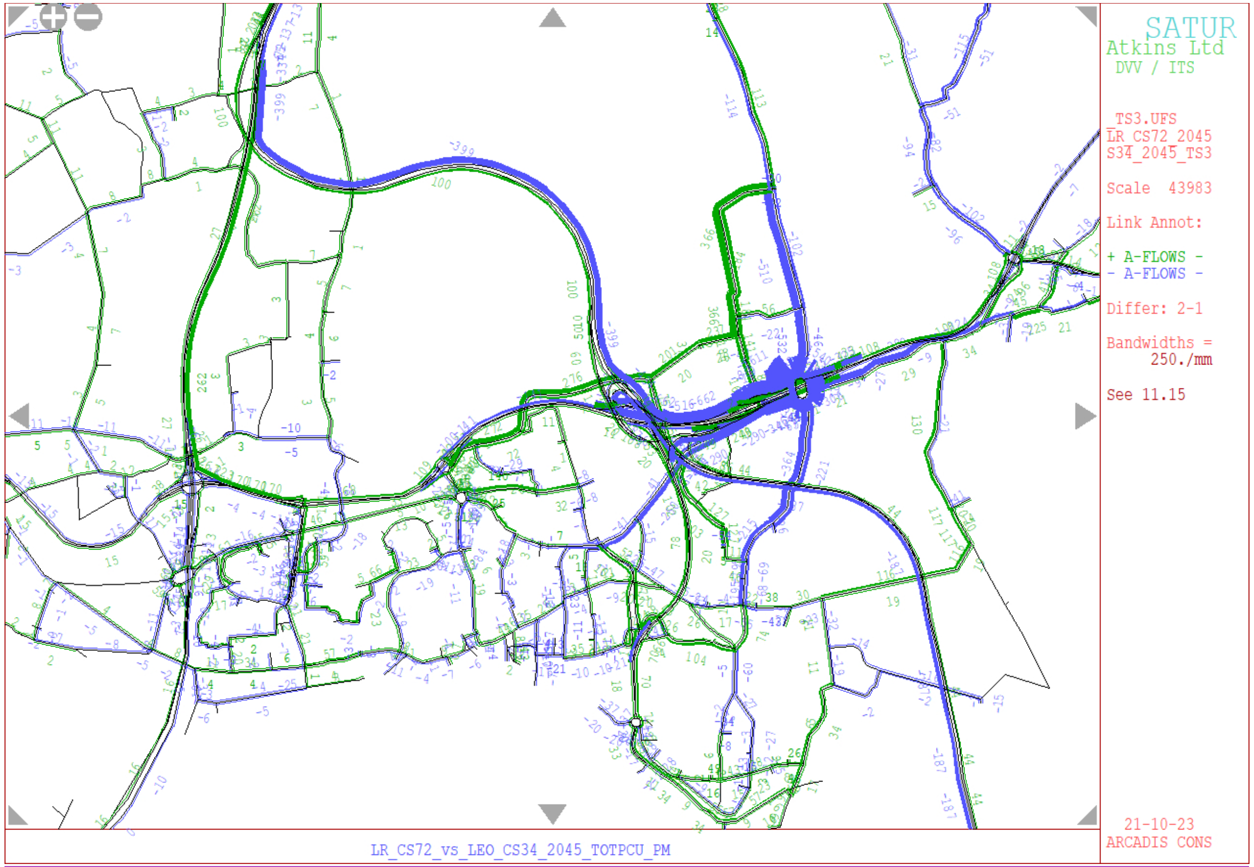


Plate B.13 2045 PM plots VISSIM delays hard coded into SATURN, Orsett Cock

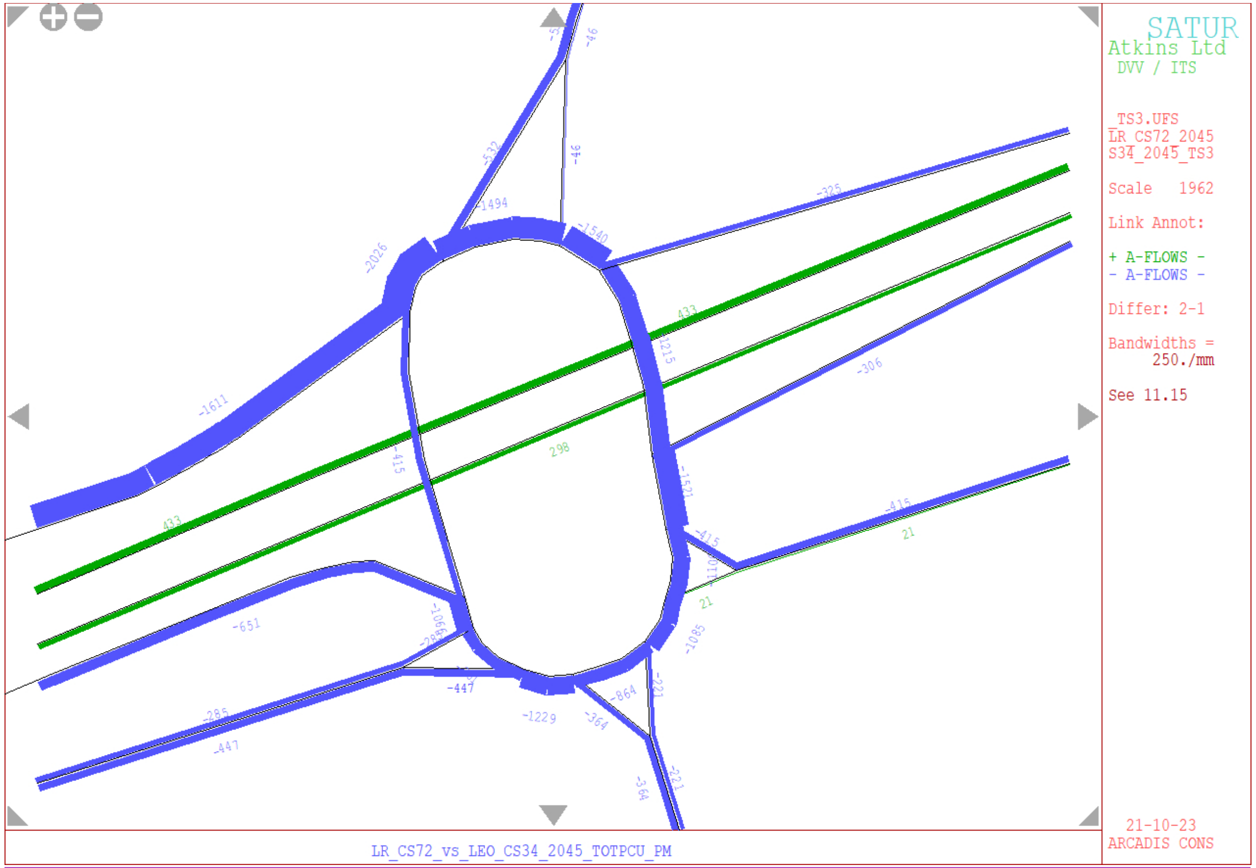
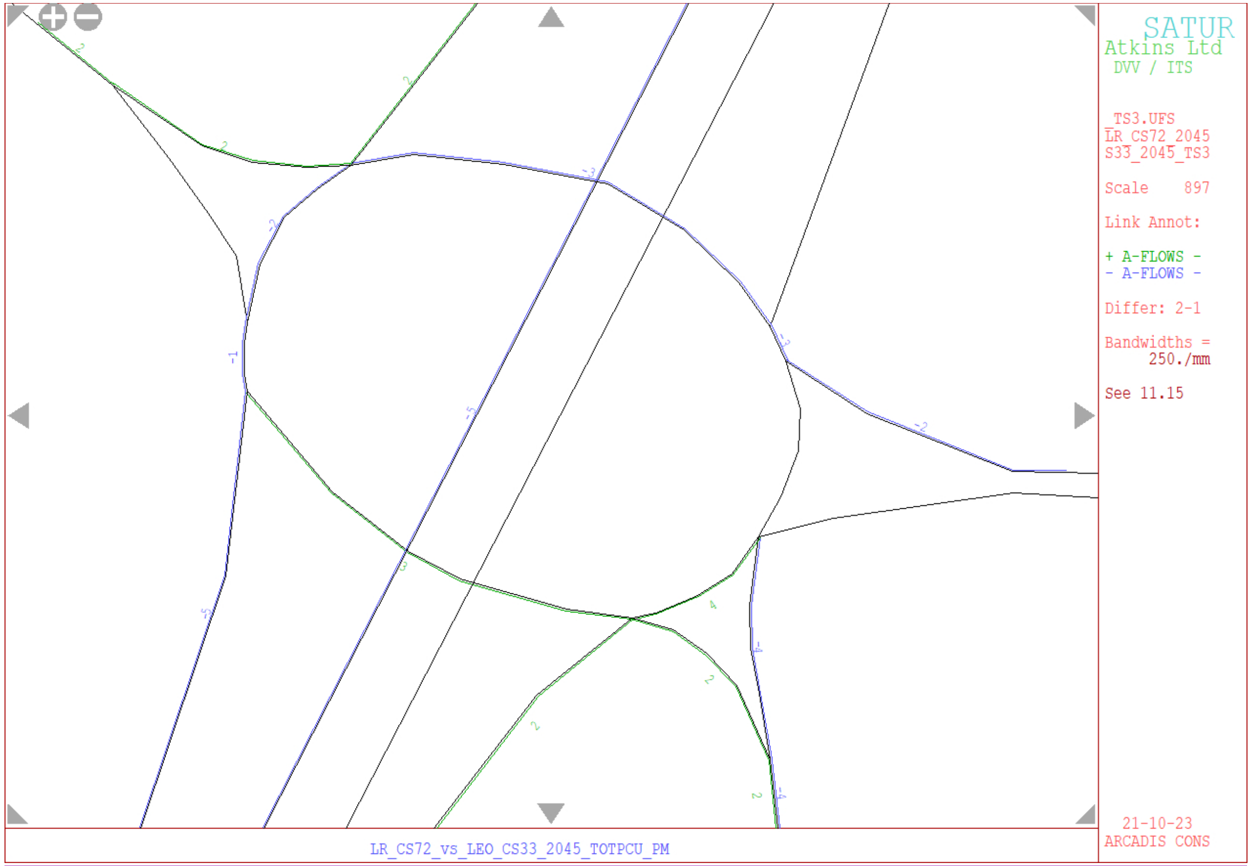


Plate B.14 2045 PM plots VISSIM delays hard coded into SATURN, Manorway



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