Humber Bridge Review - HETM Model Assessment of Options

This report has been prepared under contract to WSP on behalf of the WSP-PB led consortium for Lot 4 of the DfT Framework for Transport – Related Technical Advice and Research (Contract PPRO 4/45/4).

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Table of Contents

1 Introduction

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1.1 Study Overview

The Humber Estuary Transport Model (HETM) has been developed by AECOM, on behalf of the Department for Transport and HM Treasury, to investigate travel patterns in and around the Humber Estuary area with a view to considering the changes that may occur to those patterns in response to changes in toll levels on the Humber Bridge.

1.2 Purpose of this Report

This report is intended to summarise all aspects of the work associated with using the validated base year model to forecast the transport and economic impacts of a variety of future year scenarios.

The production of a Forecasting Report and a, usually separate, Economic Assessment Report are requirements of the Design Manual for Roads and Bridges (DMRB) and the contents are determined by those standards and the guidance provided by the Department for Transport (DfT) via WebTAG.

1.3 Project Steering Group

The contents of this report is formed from the input of various technical notes produced for the understanding and approval of the forecasting methodology, and includes agreement from the project steering group on the approach to HETM Forecasting.

The project steering group included representatives from:

- AECOM;
- WSP;
- DfT;
- Treasury; and
- Local authorities from the HETM area.

1.4 Related Reports

The reports which have already been produced, and approved by the DfT, which are of direct relevance to this document are:

- Model Scoping Report;
- Traffic Survey Report;
- Network Development Report; and
- Local Model Validation Report.

1.5 Contents of this Report

In producing this document, reference has been made to the Highways Agency's Interim Advice Note 106/08, which brings together the aforementioned DMRB and WebTAG guidance and sets out the required contents for such documents.

However, the study is somewhat unusual in road traffic modelling because it is about modelling the response to a change in a user charge rather than a new piece of infrastructure, e.g. a new road or capacity enhancement. This means that in the economic appraisal the Present Value of Costs doesn't represent a capital cost; it represents the present value of the foregone stream of toll revenue in each option. This has a bearing on the values reported in the economic appraisal.

2 Overview of Forecasting Approach

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2.1 Overview

2.1.1 Forecast Years

Typically a transport model is used to assess the impacts of a piece of proposed infrastructure and the selection of forecast years relates to key dates in respect of the construction of that infrastructure. The dates selected will usually include the opening year, a design year (commonly 10-15 years after opening) and optionally an additional year further into the future.

In the case of HETM, there is no new infrastructure and the forecasting approach has therefore been designed to align with previous studies in the area in order that comparative results may be drawn.

The selected years, in addition to the model base year of 2010, are:

- 2021; and
- 2033.

The model calculates demand responses in production-attraction (PA) format at the 12-hour level (07:00 to 19:00) for a typical weekday, and assigns origin-destination (OD) matrices covering the following time periods:

- Average AM peak hour (07:00 to 09:00);
- Average inter peak hour (10:00 to 19:00); and
- Average PM peak hour (16:00 to 18:00).

Using the base year also as a forecast year is unusual but is a consequence of there being no construction period, or other lead time, required for this proposal.

2.1.2 Charging Scenarios

A number of forecast charging scenarios for the Bridge have been assessed as follows:

- Do Minimum - no change in tolls in real terms over time;
- 10% toll reduction;
- 26% toll reduction;
- 63% toll reduction, and
- Tolls are removed from the Bridge completely.

For the remainder of this report, these scenarios are referred to as ‘Do Min’, ‘10% reduction’, ‘26% reduction’, ‘63% reduction’ and ‘No Toll’.

2.1.3 Demand Assumptions

The forecasts for growth in trip demand have been constrained to the forecasts prepared for the National Trip End Model (NTEM) in accordance with WebTAG guidance.

2.2 Variable Demand Modelling

Any change to transport conditions will, in principle, cause a change in demand. The purpose of variable demand modelling is to predict and quantify these changes.

The Standing Advisory Committee on Trunk Road Appraisal (SACTRA) considered all these effects in 1994 and emphasised the importance of establishing a realistic scenario in the absence of the scheme or strategy, the extent of travel suppression in the "without-scheme" case, and the extra traffic induced in the "with-scheme" case.

Although the modelling effort needs to be proportionate to the scale of the scheme, the need to consider variable demand is not simply a question of the size of the scheme. Since both demand changes and benefits tend to scale with the size of the scheme, changes in demand can have similar proportionate effects on benefits for both large and small schemes. Thus changes in demand can seriously undermine the economic efficiency justification for schemes of any size.

There may be wider effects of the scheme, on the environment, accessibility or safety, for example, which will also be affected by changes in demand: these must be judged separately from the economic efficiency of the scheme. Any reduction in any type of benefit can undermine the justification for the scheme, since this depends on the balance between the benefits and the costs of the scheme.

2.2.1 Software Choice

The demand modelling was carried out using DIADEM version 5.0. This package has been produced on behalf of the Department for Transport for the purpose of implementing WebTAG variable demand modelling processes and is thus the most appropriate basis for the work.

DIADEM is fully compatible with the SATURN suite which was used for the assignment modelling. Further information on the SATURN software, and its use within HETM, is provided in Chapter 2 of the Local Model Validation Report.

2.3 Key Inputs, Outputs and Model Form

The model has been developed in the form of an incremental model as described in WebTAG Unit 3.10.2. The final forecasts are produced according to the methodology shown in Figure 1

The inputs to the forecasting process are:

- The base year calibrated model to provide pivot costs for the do minimum model;
- The base year matrices to provide the basis for creating reference case future matrices;
- Growth rates by zone for future year demands; and
- Future year do minimum and scheme networks

The forecasting process then follows the three steps set out in WebTAG:

- Growth factors are applied to the base year matrix to produce a reference matrix;
- Pivot off the reference case, using base year costs, to produce a do minimum matrix; and
- Pivot off the do minimum matrix to get to the do something matrix.

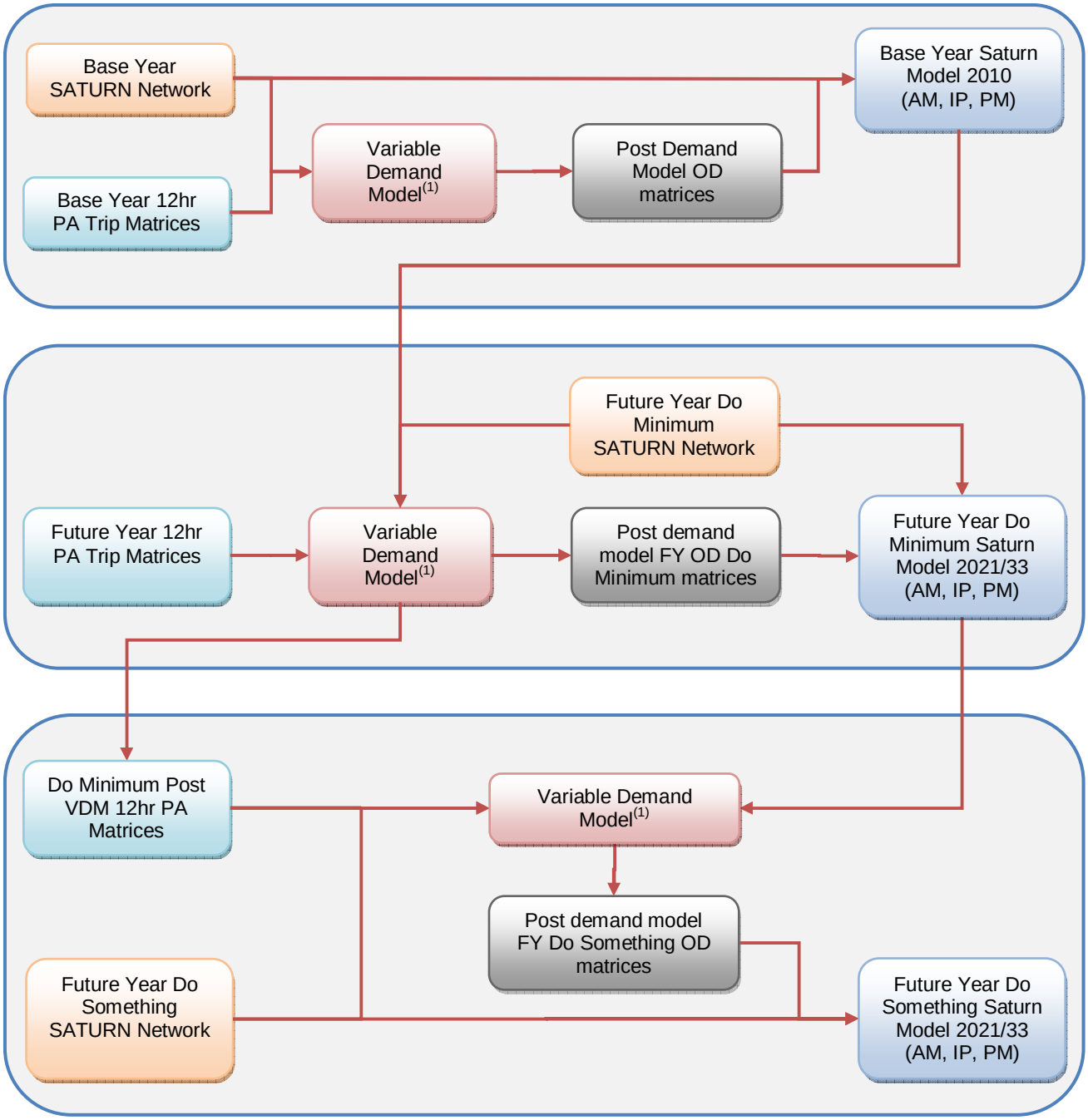
The responses modelled in the process are:

- Trip destination; and
- Trip generation (frequency).

The development and calibration of the demand model is described in full detail in Appendix I of the Local Model Validation Report.

The outputs from the model forecasting process are the future year travel demand patterns for assignment to the network to identify future year network traffic conditions, which in turn are used as inputs to the economic assessment of the proposal.

Figure 1 Summary of Key Process



Notes:
(1) Variable Demand Model response includes trip frequency and trip redistribution.

3 Forecast Network Development

3 Forecast Network Development

3.1 Overview

Any modelling assessment needs to consider changes in supply and demand over time in order to produce forecasts that are as robust as possible. This chapter is concerned with changes in supply, that is, changes in terms of the transportation network and the identification of those that are likely to have a material impact on the assessment of the proposal.

In considering potential changes to the network, the following years have been considered:

- 2021; and
- 2033.

In accordance with WebTAG Unit 3.15.5 (April 2011), an Uncertainty Log was produced which considered key transport scheme proposals across the HETM model area.

In producing the log, the following authorities were consulted, in addition to the Highways Agency:

- North Lincolnshire;
- Kingston Upon Hull;
- East Riding;
- Doncaster; and
- North East Lincolnshire.

Based on our consultation with these bodies, each scheme was assigned a probability (uncertainty) to gauge the likelihood of it being implemented in the future. Probabilities have been assigned separately for the two future model years 2021 and 2033.

The final scoring for each scheme was agreed with the project steering group and a copy of the complete log is provided in Appendix A of this document.

3.2 Summary of Uncertainty Log Outcomes

3.2.1 Introduction

The schemes which were included in the future year modelling as a consequence of the Uncertainty Log analysis are summarised in Table 1.

The uncertainty rating is according to the following index:

- 1 = Near Certain;
- 2 = More than likely;
- 3 = Reasonably Foreseeable; and
- 4 = Hypothetical.

Schemes not considered for inclusion fell into one of the following categories:

- Only hypothetical in 2021 and 2033;
- Not of sufficient scale to impact on the modelling work; or
- Rail only, therefore not modelled within HETM.

The location of the included schemes is shown in **Figure 2**

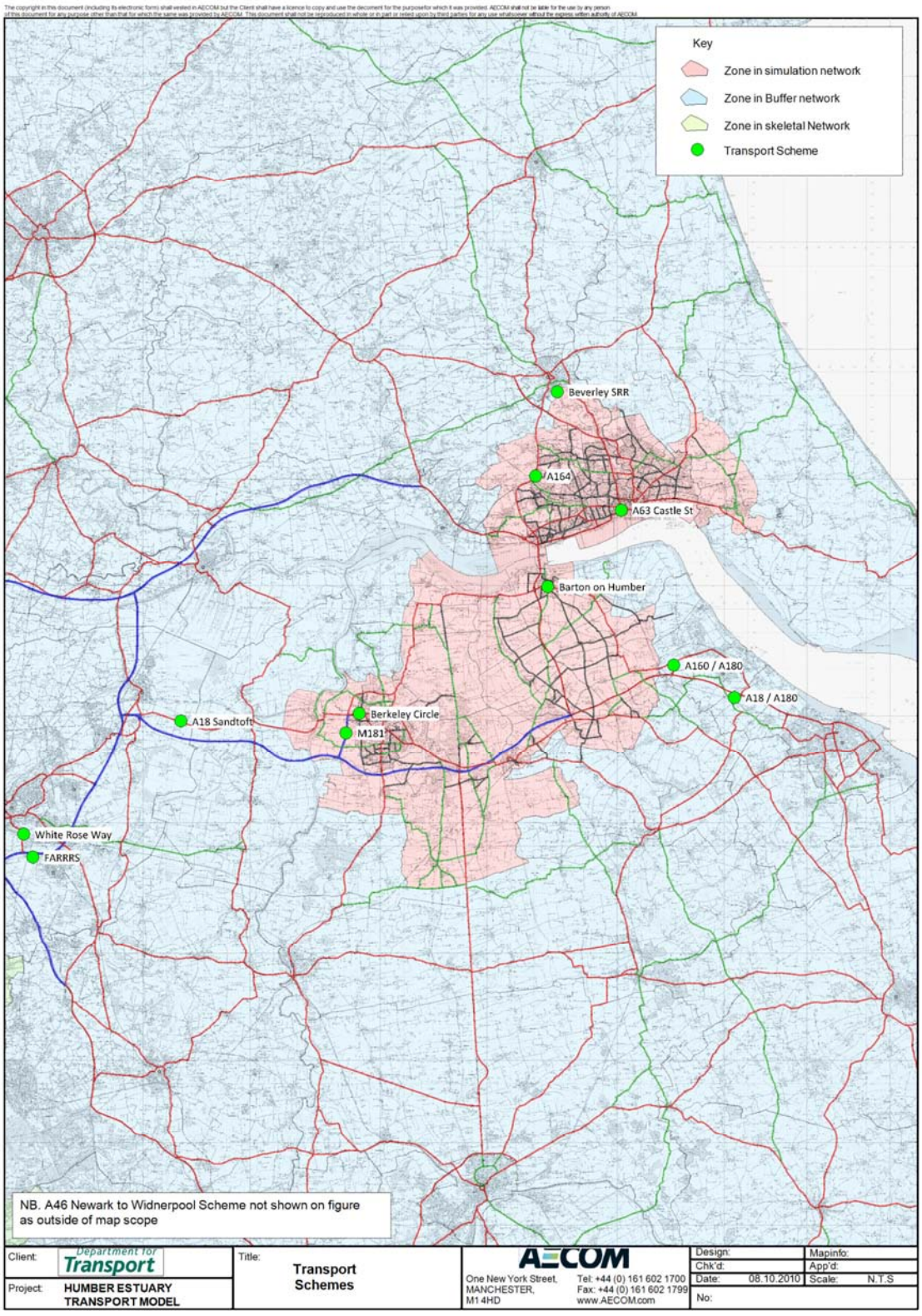
Capabilities on project:
Transportation

.**Table 1 Summary of Schemes Included in Future Year Modelling (DM & DS)**

Development/Scheme	2021		2033	
	Uncertainty	Included	Uncertainty	Included
A63 Castle Street	3		2	✓
Beverley Southern Relief Road	2	✓	2	✓
A164 – Beverley to Humber Br.	2	✓	2	✓
A160 / A180 Immingham	3		2	✓
M181 new junction & De-trunking	2	✓	2	✓
A18 Sandtoft Airfield	3		2	✓
Scunthorpe / Berkeley circle	2	✓	2	✓
Barton on Humber	2	✓	2	✓
A18 / A180 Link	2	✓	2	✓
FARRRS	3		2	✓
White Rose Way	2	✓	2	✓
A46 Newark to Widmerpool	1	✓	1	✓

Capabilities on project:
Transportation

Figure 2 Location of Schemes



The following sections provide further detail on those schemes which have been included in the modelling work.

It is important to note that none of these schemes are dependent on the Humber Bridge proposal and therefore are included in both the Do-Minimum and Do-Something scenarios for the relevant modelled years.

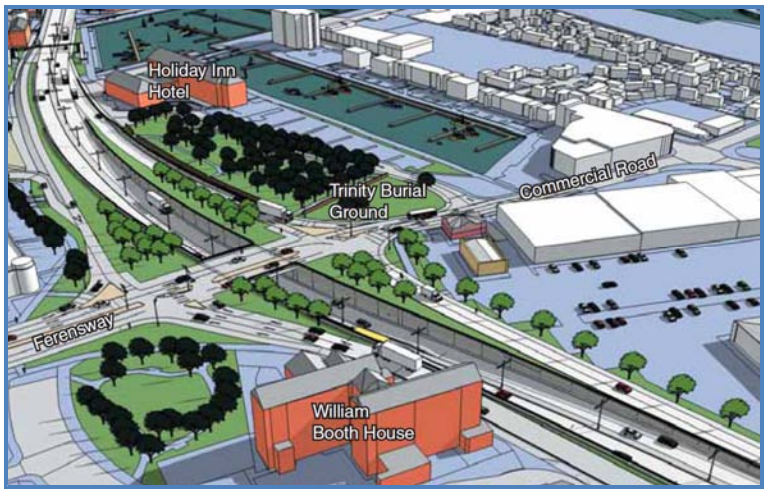
3.2.2 A63 Castle Street

The A63 Castle Street scheme is a Highways Agency planned improvement to the network for the A63 in the centre of Hull, options include a grade separated junction at the junction with Ferrensway, a plan showing the extent of the scheme and an artist's impression of the proposed grade separated junction (Castle Street / Ferrensway) is shown below. The preferred route for this scheme was announced in March 2010.

Figure 3 A63 Castle Street Scheme Plan: Preferred Route

Source: Castle Street A63 Improvements Preferred (Highways Agency – March 2010)

Figure 4 A63 Castle Street Scheme Plan: Preferred Route Underpass Option

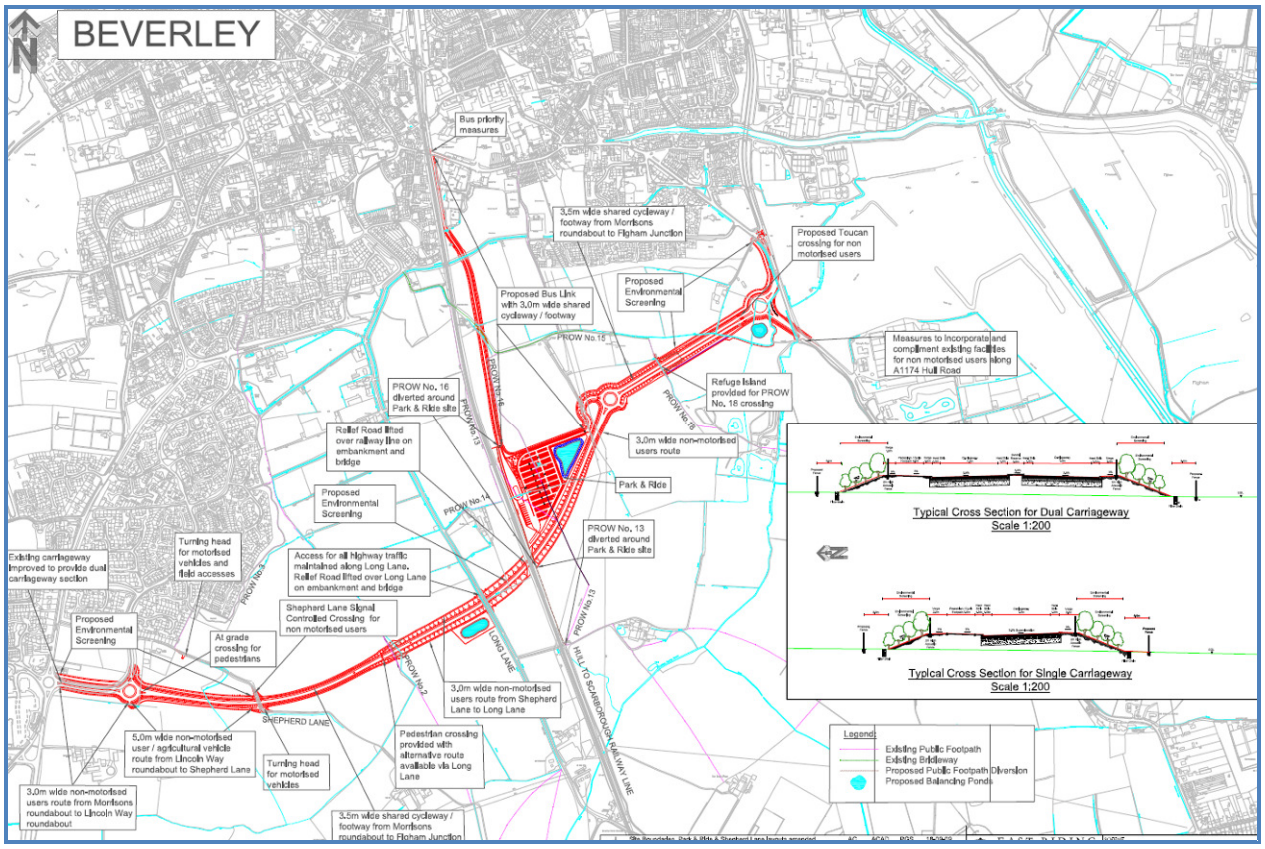


Source: Castle Street A63 Improvements (Highways Agency – March 2010)

3.2.3 Beverley Southern Relief Road

As part of the Beverley integrated travel plan, a southern Relief Road is proposed which will provide a link road between A1174 Hull Road and the A164 Victoria Road.

Figure 5 Beverley Southern Relief Road Scheme Plan

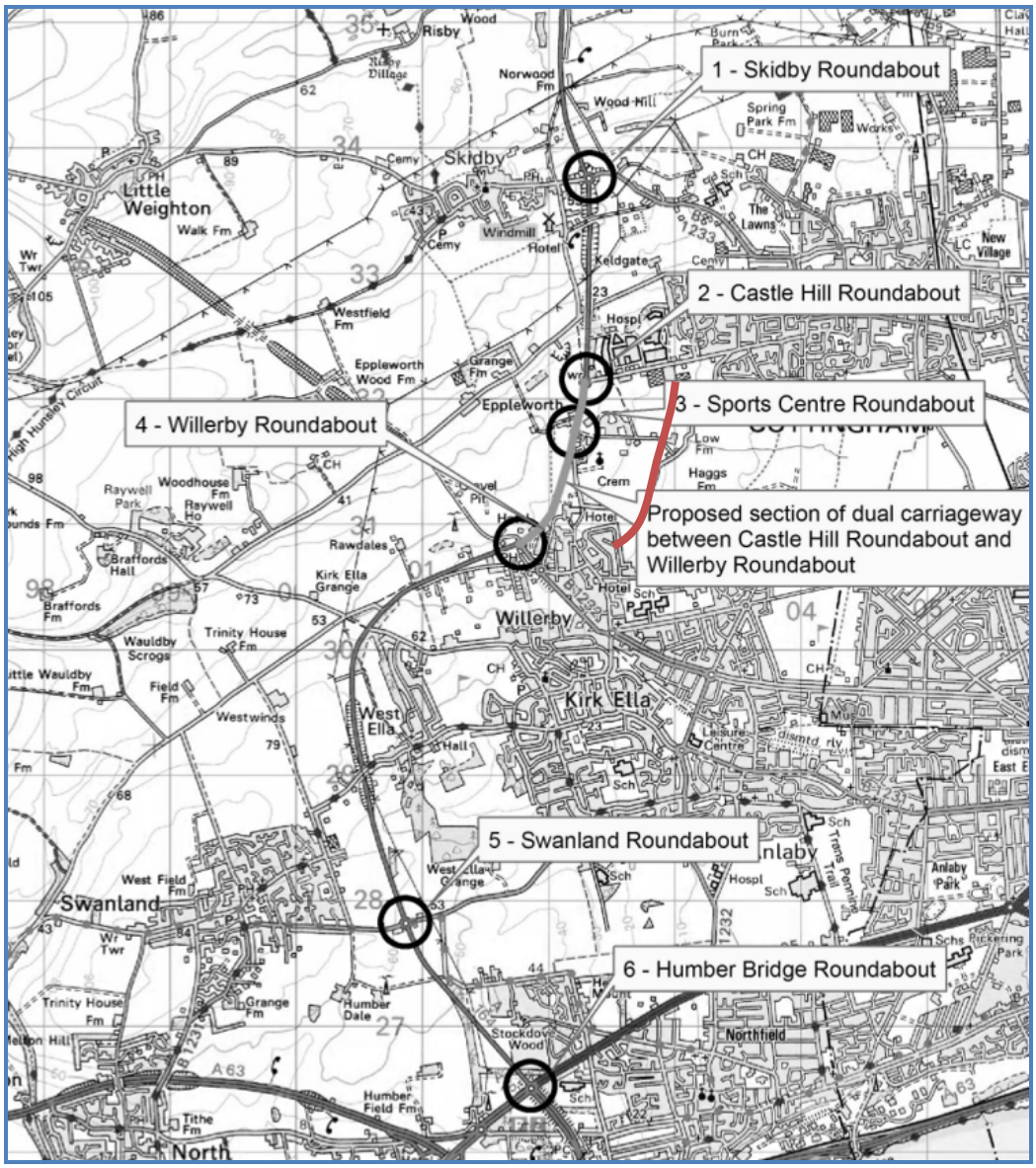


Source: Proposed General Arrangement Drawing for the Beverley Southern Relief Road October 2010 (East Riding of Yorkshire Council)

3.2.4 A164 Beverley to Humber Bridge Corridor Improvement

A number of highway improvements are proposed on the A164 between the Humber Bridge and Skidby. These include a number of junction improvements and the introduction of a dual carriageway section between the Willerby and Castle Hill roundabouts.

Figure 6 A164 Beverley to Humber Bridge Corridor Improvement Scheme Plan

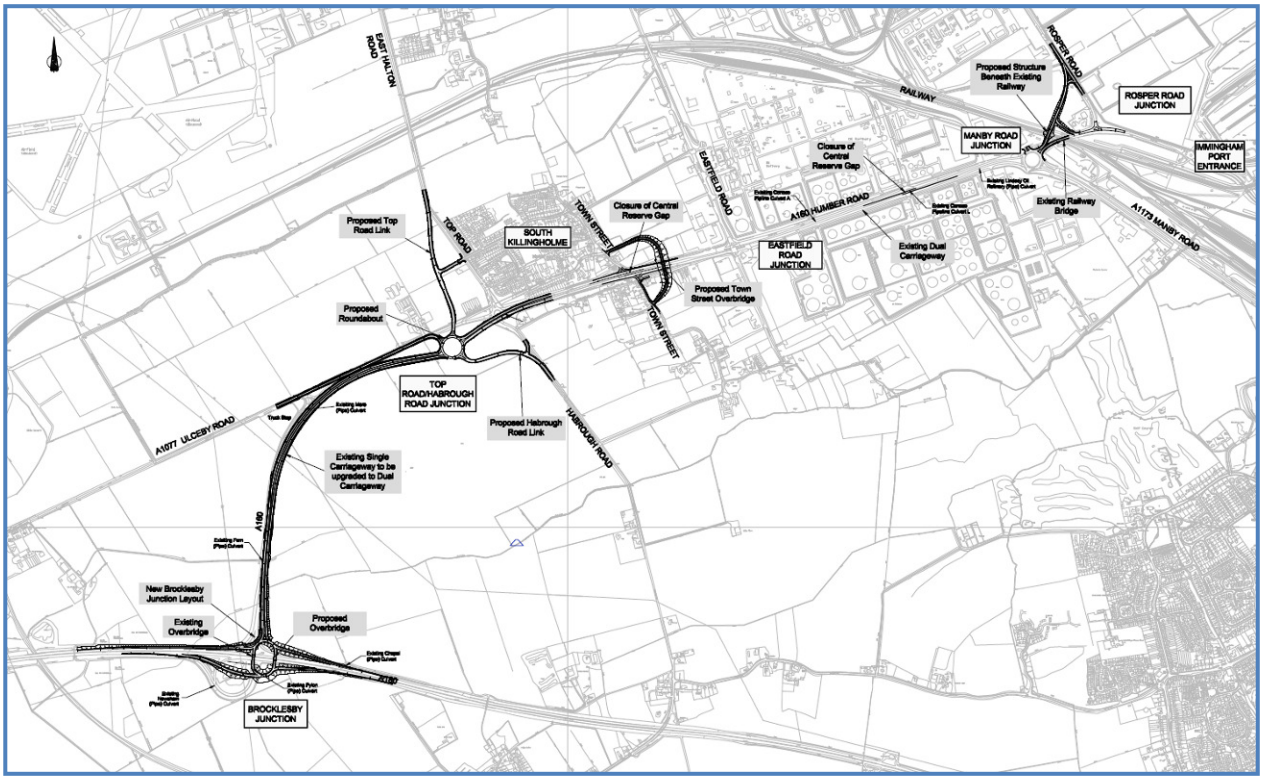


Source: Proposed A164 Improvements (East Riding of Yorkshire Council)

3.2.5 A160 / A180 Immingham

A number of improvements are proposed to the A160 in the vicinity of Immingham. This scheme includes a new roundabout at the junction of A1077 and an improved access and junction with the A180. A plan summarising the improvements associated with this scheme is provided in Figure 7.

Figure 7 A160 / A180 Immingham Scheme Plan

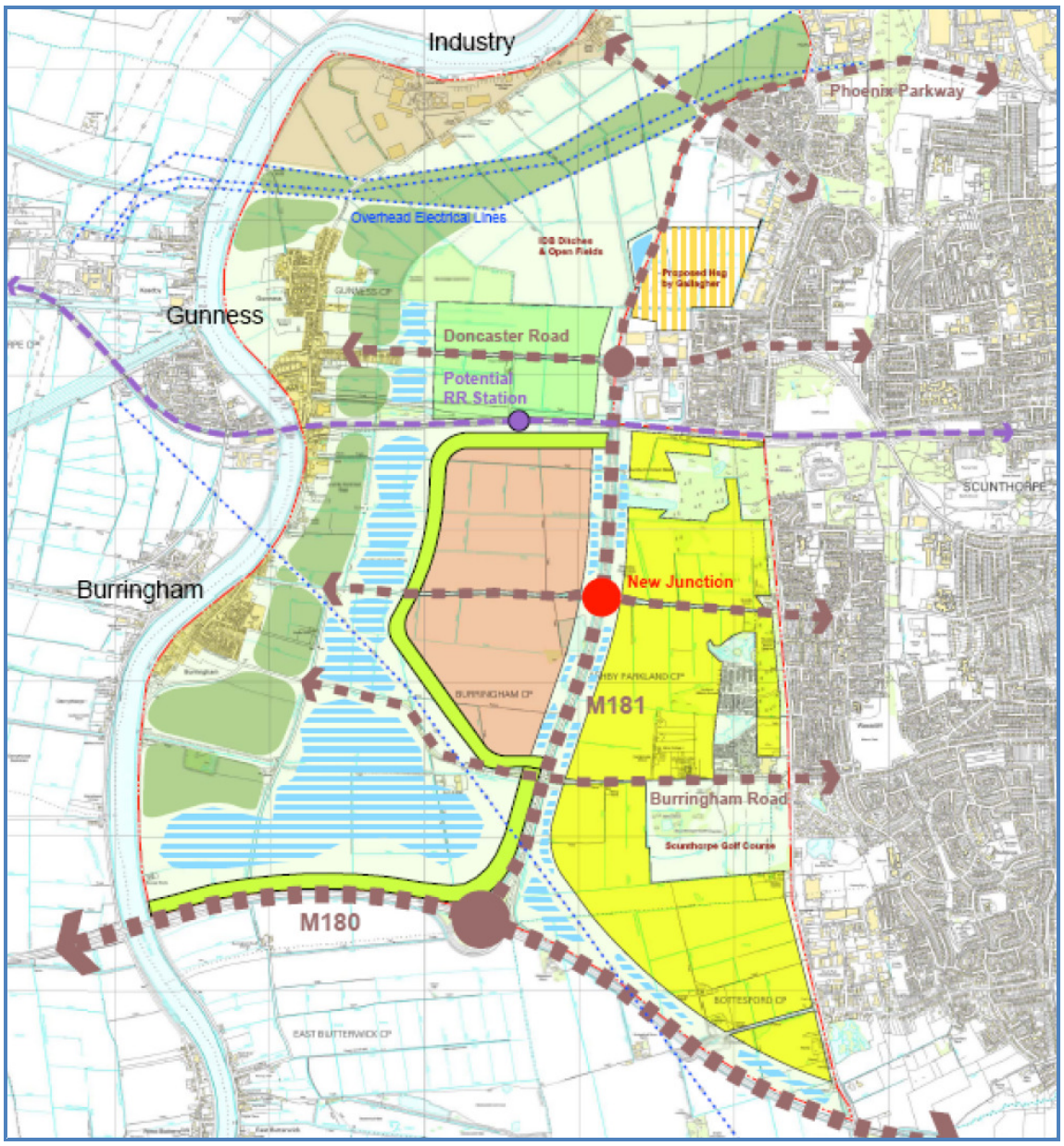


Source: A160 Port of Immingham Improvements Preferred Route Scheme Plan (Pell Frischmann)

3.2.6 Proposed New Junction on the M181 and Partial De-trunking

This scheme, which relates to the Lincolnshire Lakes development, includes the de-trunking of the M181 which provides the key access between the M180 and the west of Scunthorpe. The proposal includes a new junction on the M181 which will provide access to the wider Lincolnshire Lakes Development and local access to the west of Scunthorpe. A plan illustrating the proposed changes is shown in Figure 8 below.

Figure 8 Proposed New Junction on the M181

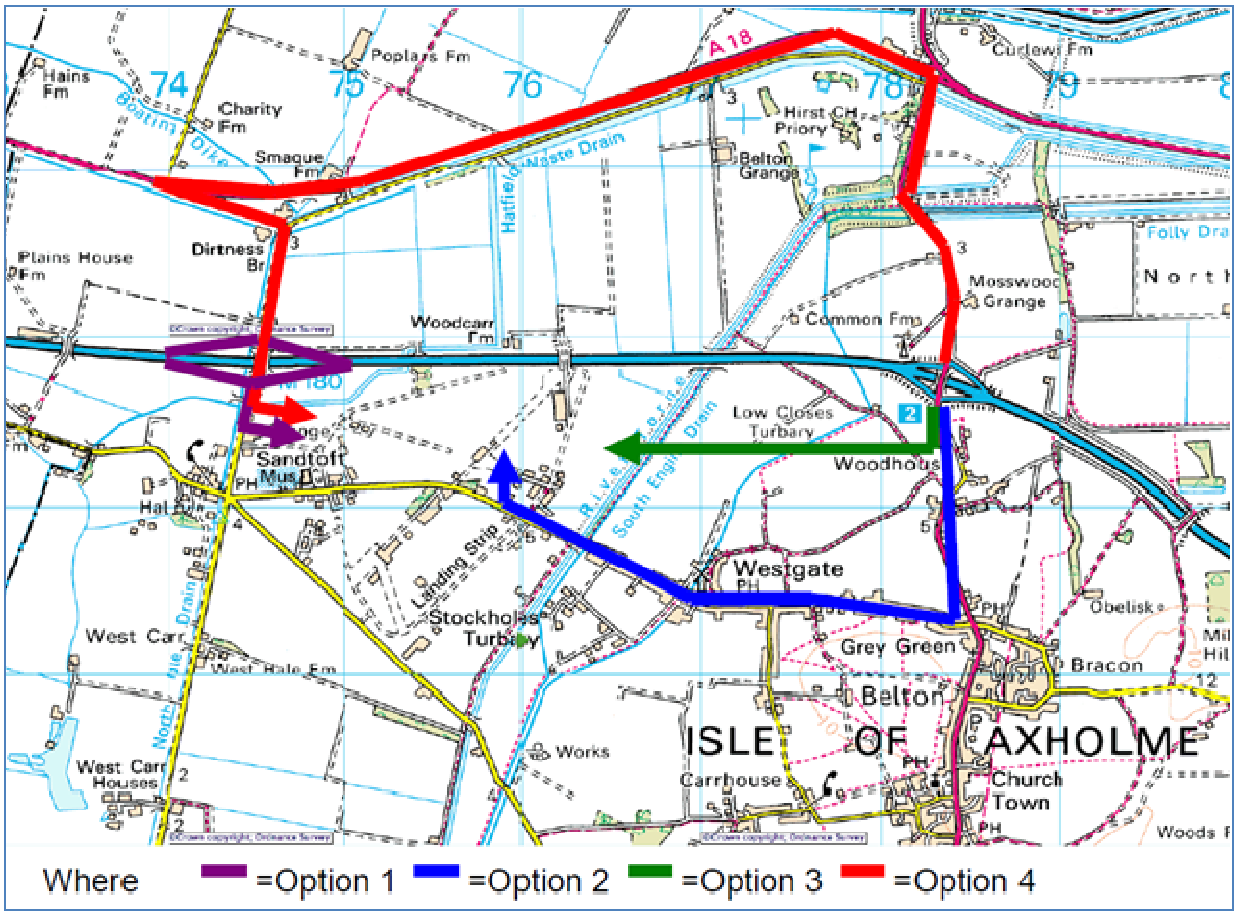


Source: Lincolnshire Lakes Business Case Report April 2010 (Halcrow)

3.2.7 Sandtoft Airfield

Figure 9 shows the four options presented as part of the Sandtoft Evidence Base, July 2009. Information from North Lincolnshire Council is that the most likely option for the scheme will be option 4. We have therefore included that version of the scheme in our model. The scale of change is quite small as it only involves adjustments to zone loading points to reflect new access arrangements.

Figure 9 - Sandtoft Airfield Scheme Plan

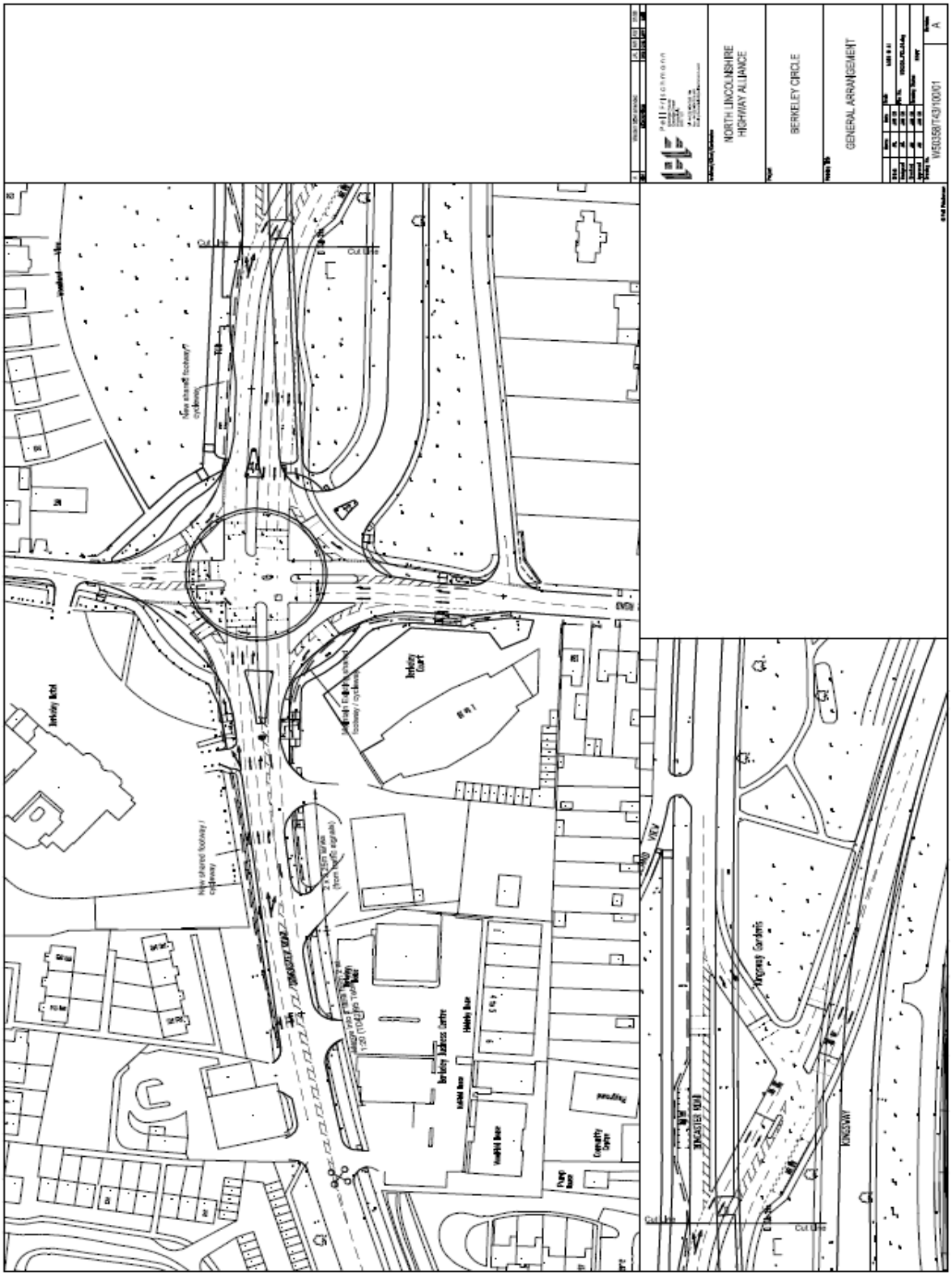


Source: Sandtoft Evidence Base July 2009 (North Lincolnshire Council / Pell Frischmann)

3.2.8 Scheme 8 – Scunthorpe – Berkeley Circle

This involves the replacing of a town centre roundabout with a traffic signal arrangement. The impacts are very localised.

Figure 10 Plan of Berkley Circle Scheme



3.2.9 Barton on Humber

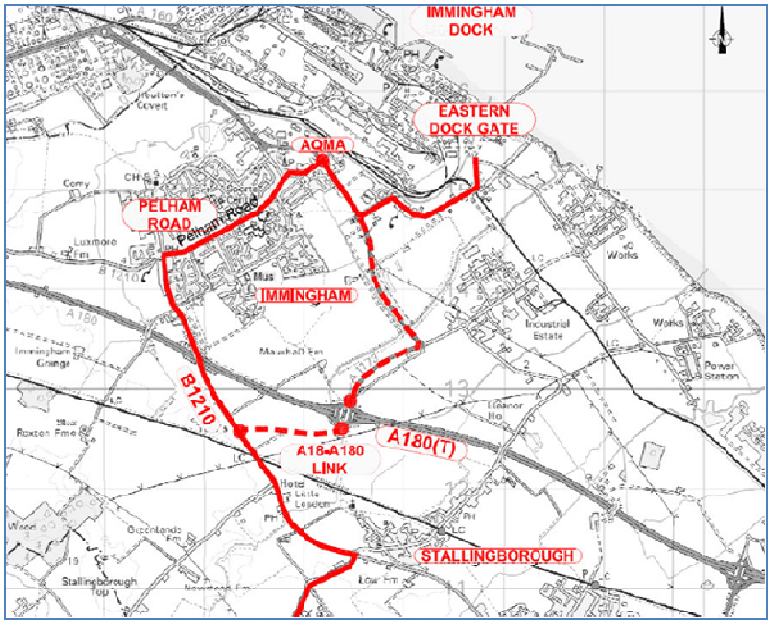
North Lincolnshire Council has provided a description of the improvement proposed for the A1077 through the centre of Barton on Humber. The following elements have been considered as relevant as they can be coded in to the model network:

- New signals at Market Place comprising a controlled signal crossing at the A1077 / George Street / Brigg Road junction;
- Hungate Mini Roundabout, the Hungate arm of the Hungate / Holydyke mini roundabout changed to exit only; and
- Falkland Way Junction, the introduction of a traffic signal controlled junction.

3.2.10 A18 / A180

The proposal provides improved access to Immingham industrial area via a new link road which has been incorporated in the model. The link is illustrated in the plan below and reduces through traffic on a residential area.

Figure 11 A18 / A180 Link Scheme Plan



Source: A18 – A180 Link Major Scheme Business Case January 2009 (NE Lincolnshire Council)

3.2.11 Finningley and Rossington Regeneration Route Scheme

This scheme provides 4km of new road from Junction 3 of the M18 to the A638 at Parrot's Corner and a new link to Rossington.

Figure 12 FARRRS (Finningley and Rossington Regeneration Route Scheme) Plan

Source: FARRRS Plan (South Yorkshire PTE)

3.2.12 White Rose Way

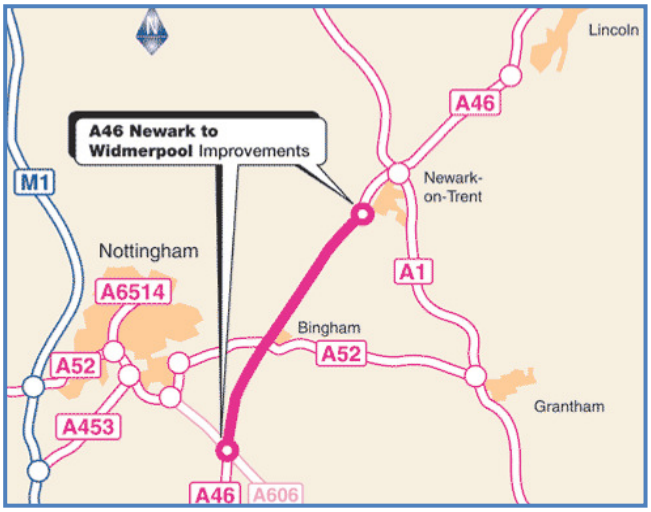
The Major Scheme Business Case documentation (Doncaster Council / Mouchel; 2009) describes the Preferred Scheme Option as comprising the widening of 1.9km of the existing carriageway to dual carriageway plus improvements to 250m of existing carriageway to the west of Lady Bank junction. The improvements widen the road to the west of the existing alignment between Junction 3 of the M18 and Potteric Carr and to the east of the existing carriageway from Potteric Carr up to Lady Bank junction.

3.2.13 A46 Newark to Widmerpool

The Highways Agency is constructing a new 17 miles long two-lane dual carriageway from the A606 two level junction at Widmerpool to an improved roundabout at Farndon, just south of Newark. The improvement will provide a bypass for East Stoke and Farndon.

New two level junctions will be provided at Roehoe, Owthorpe, Stragglethorpe, Saxondale, Margidunum, Red Lodge, Flintham and Lodge Lane.

Figure 13 A46 Newark to Widmerpool Scheme Plan



Source: A46 Newark to Winderpool Improvement Location Map (Highways Agency)

3.3 Do Something Network Amendments

The only planned additional changes to the Do Something networks, over and above the schemes identified in Table 1, are associated with the toll charges prevailing on the Bridge. These are coded within the SATURN networks as link based penalties reflecting the following scenarios:

- 10% reduction in toll;
- 26% reduction in toll;
- 63% reduction in toll; and
- Removal of all tolls.

The complete removal of tolls is clearly the most extreme test possible within the model. The 63% reduction reflects a scenario whereby tolls are set broadly at the level required to fund the maintenance of the facility. This relates to a target revenue figure which could be reached in a variety of ways. The approach adopted was to set the car tolls at £1.00 (2010 values & prices) and factor all other toll levels accordingly. This test is comparable with the recommendations of Colin Buchanan in their 2008 study ("Humber Bridge Tolls Impact Assessment, Final Report, October 2008" carried out on behalf of East Riding of Yorkshire, Hull, North Lincolnshire and North East Lincolnshire Councils).

The toll charges as applied in the model for each scenario are summarised in Table 2.

Table 2 Summary of Toll for Each Scheme Test

Class	Description	Toll Sensitivity Test (quoted in pence)				
		DM	-10%	-26%	-63%	No Toll
1	Motor Cycles	n/a	n/a	n/a	n/a	n/a
2	Cars and Goods vehicles having a maximum weight not exceeding 3.5 tonnes including Motor Caravans	213	192	158	79	0
3	Goods vehicles having a maximum gross vehicle weight exceeding 3.5 tonnes but not exceeding 7.5 tonnes. Vehicles within Class 2 above, with trailers. Small buses (with seating for 9-16 passengers)	386	348	286	143	0
4	Goods vehicles having a maximum gross vehicle weight exceeding 7.5 tonnes with 2 axles. Large buses (with seating for 17 or more passengers)	859	773	636	318	0
5	Goods vehicles having a maximum gross vehicle weight exceeding 7.5 tonnes with 3 axles	1150	1035	852	426	0
6	Goods vehicles having a maximum gross vehicle weight exceeding 7.5 tonnes with 4 or more axles	1442	1298	1068	534	0

Notes:
(1) Toll levels quoted at 2010 values discounted to 2002 prices.

(2) Motorcycles were not modelled within HETM.

3.4 Do Something Scenarios – Additional Network Sensitivity Test

Analysis of the planned scenario tests revealed that, for the no toll and low toll options, there was congestion occurring in the vicinity of the Bridge. An additional notional network improvement was therefore tested to see if the congestion was having a material impact on the economic results.

This comprised an improvement at the roundabout to the north of the Bridge (A15 / A164 / A1105) to provide additional capacity on all arms.

3.5 Future Year Assignment Parameters

The model assignment parameters for value of time and vehicle operating cost were updated for the future year scenarios of 2021 and 2033 based on the guidance recommended by WebTAG Unit 3.5.6 and 3.12.2.

To adjust the value of time by income groups for the Home Based Work and Home Based Other trips, the income data from the RSI surveys was used. The base and forecast year parameters are summarised in Table 3 below.

Table 3 Future Year Assignment Parameters

Vehicle Type / Purpose	2010		2021		2033	
	VoT(1)	VOC(2)	VoT(1)	VOC(2)	VoT(1)	VOC(2)
Car – HBW – Low Income	6.38	5.47	7.09	4.34	7.71	2.95
Car – HBW – Med Income	9.24		10.28		11.17	
Car – HBW – High Income	13.18		14.65		15.93	
Car – HBEB	68.20	10.12	77.11	9.08	85.37	7.92
Car – HBO – Low Income	10.63	5.47	11.82	4.34	12.85	2.95
Car – HBO – Med Income	12.08		13.43		14.60	
Car – HBO – High Income	13.83		15.39		16.73	
Car – NHBEB	67.93	10.12	76.80	9.08	85.04	7.92
Car – NHBO	18.09	5.47	20.12	4.34	21.88	2.95
Goods 1	23.80	25.07	28.08	27.05	32.31	29.10
Goods 2						
Goods 3		44.47		47.28		51.28
Goods 4						

(1) VoT = Value of Time, measured in pence per minute
(2) VOC = Vehicle Operating Cost, measured in pence per mile
(3) Figures quoted are 2002 prices and values

3.6 Review of Network Impacts

Following the coding of the Do Minimum Schemes, a review of the model was undertaken to ensure that the impacts of the various schemes appeared sensible and that the coding modifications has not introduced any errors into the existing network.

A review of the differences in traffic flows and model delay between the Base and Future Year Models are presented in Figure 14 to Figure 17. All of the observed changes were as expected and provided no cause for concern.

Capabilities on project:
Transportation

Figure 14 Change in Flow Base Year DM and 2021 Do Minimum (AM Peak)

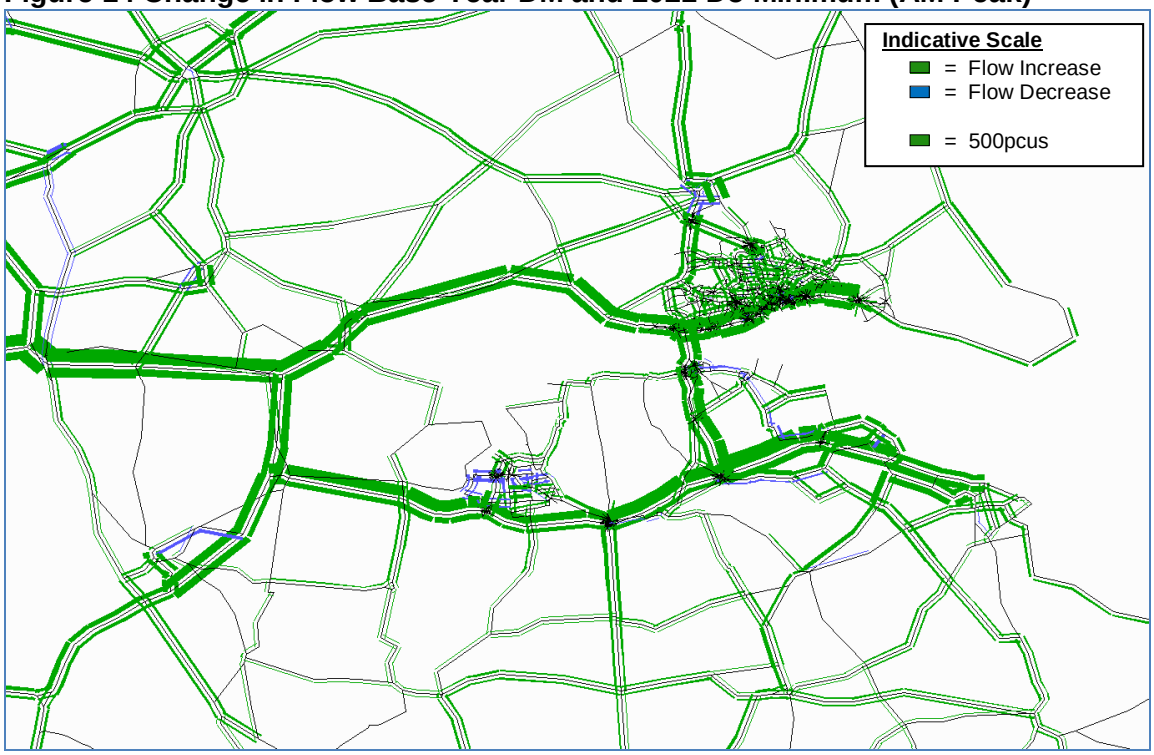
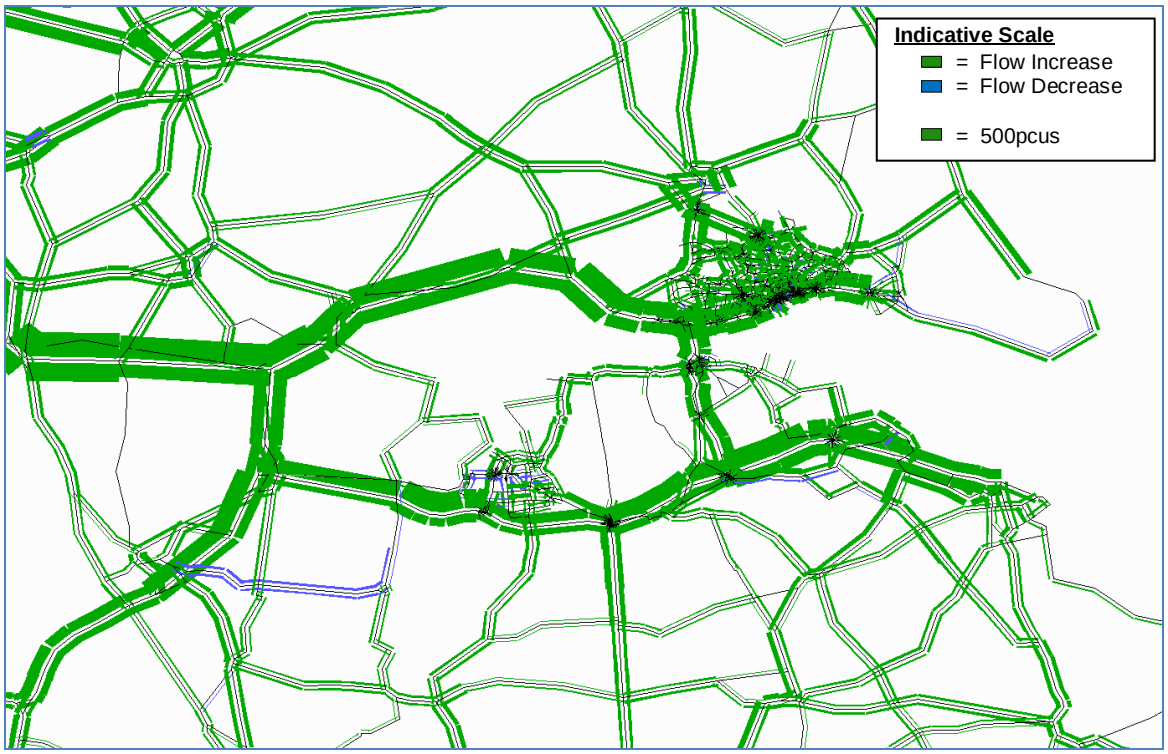


Figure 15 Change in Flow Base Year DM and 2033 Do Minimum (AM Peak)



Capabilities on project:
Transportation

Figure 16 2021 – 2010 Changes in Delay – Do Minimum (AM Peak)

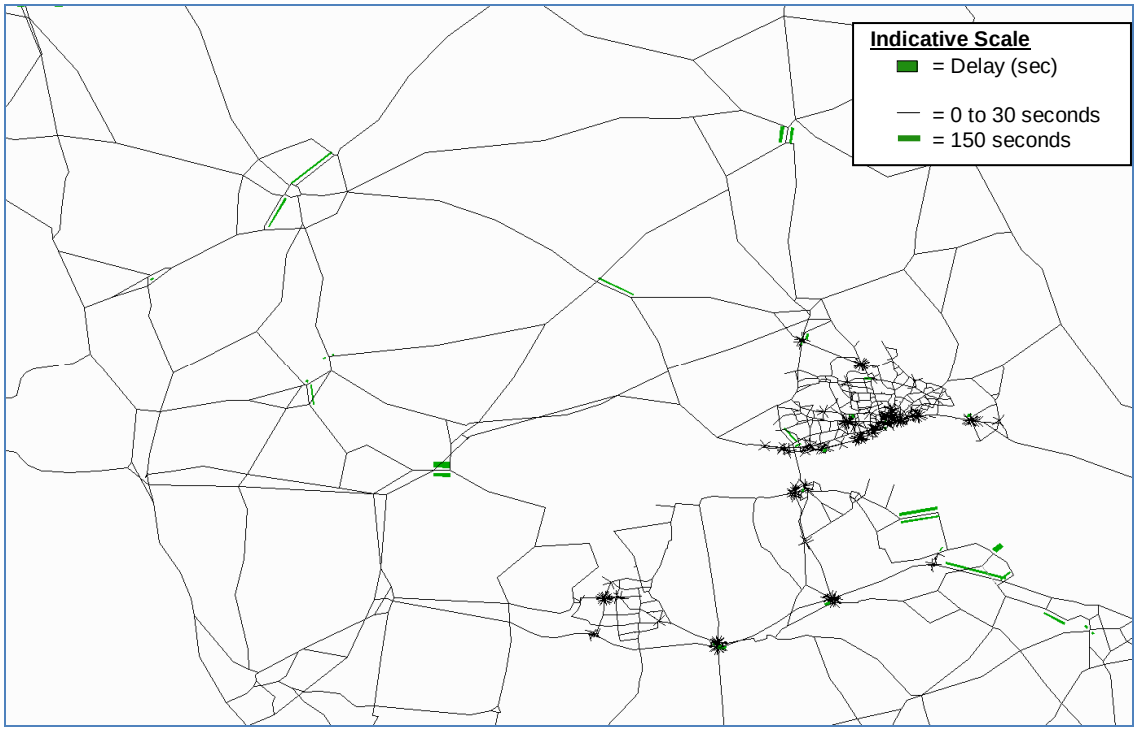
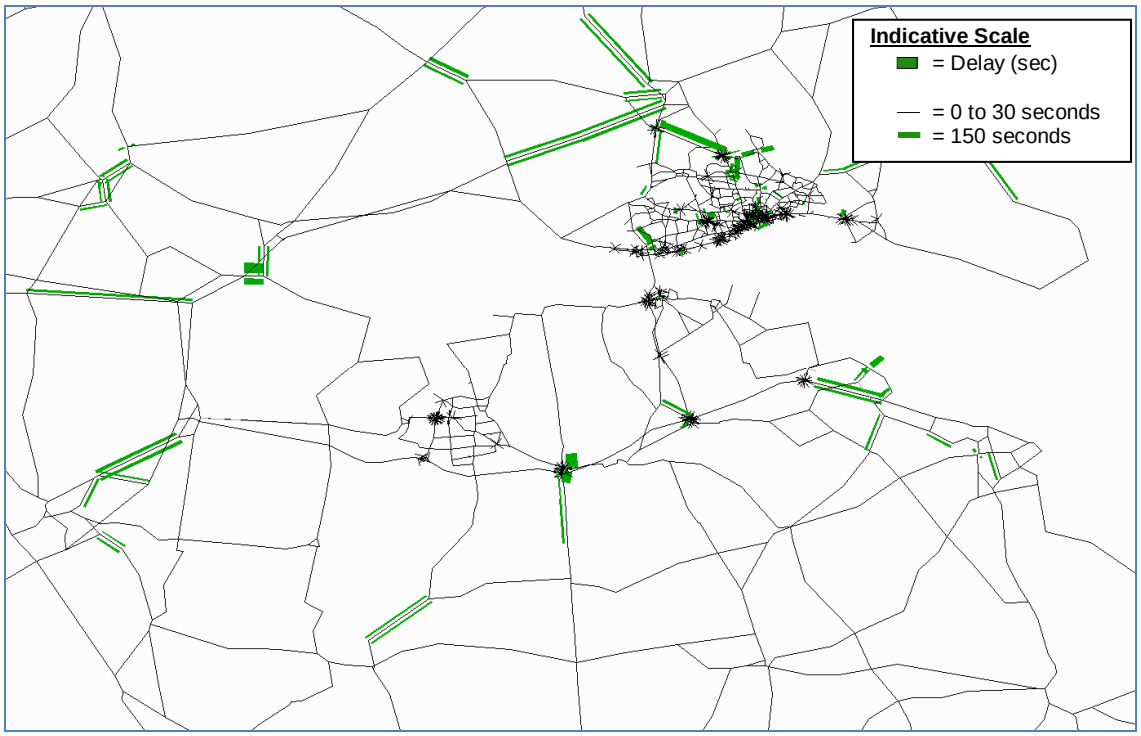


Figure 17 2033 – 2010 Change in Delay Do Minimum (AM Peak)



4 Forecast Matrix Development

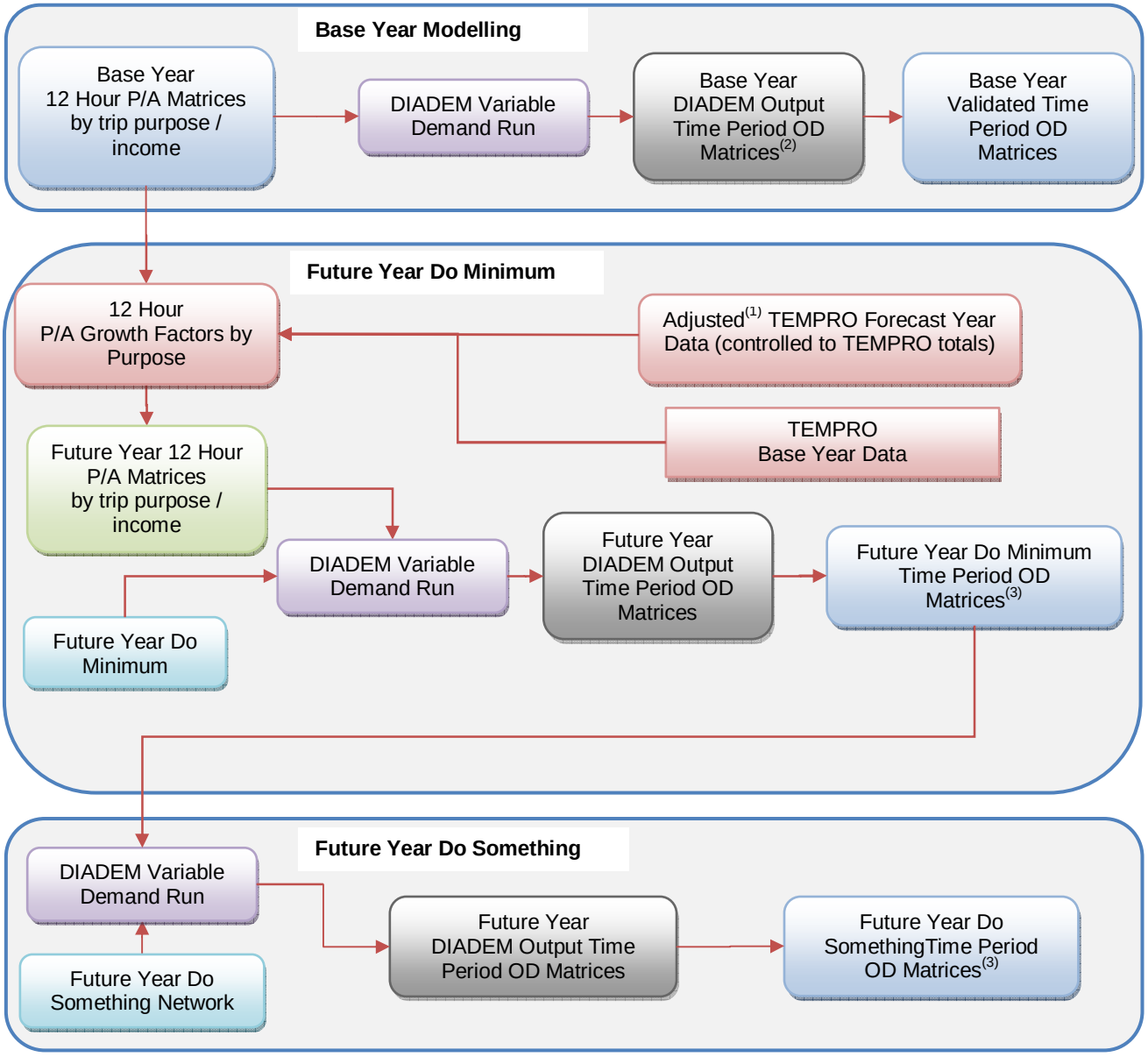
4 Forecast Matrix Development

4.1 Overview

The development of the forecast matrices to inform the future year modelling for HETM has been developed via a range of processes which are summarised in **Figure 18**. The remainder of this section of the report discusses:

- The Use of National and Local Growth rates;
- The inclusion of known developments; and
- The use of the demand model to predict future year trip levels.

Figure 18 Summary of Core Forecast Matrices Development



Notes:
(1) TEMPRO adjusted to reflect specific scenario developments.
(2) A base year DIADEM run is required to generate DIADEM equivalent base year OD matrices. These will be similar, but not identical, to the validated base year OD matrices.
(3) The future year OD matrices will apply the incremental changes from the DIADEM base and future year matrices to the validated base year matrices.

4.2 Use of National / Local Growth Rates

The primary purpose of producing demand forecasts for this modelling exercise is to enable TUBA and WITA assessments to be undertaken in order to assess the economic impacts of any changes to toll levels on the Bridge.

It has been agreed that forecasts will be prepared for two years, in addition to the base year, as follows:

- 2033 (to align with the Colin Buchanan work); and
- 2021 (as an intermediate year).

The forecasts are required to provide reference case estimates of trip demand which can then be input into the variable demand (DIADEM) process.

4.3 Forecasting Approach

4.3.1 Overview

The requirements of trip forecasting are twofold:

- To reflect local knowledge on specific developments to a reasonable degree; and
- To ensure consistency with wider national estimates of population, households etc.

Information on specific developments and interventions has been obtained by direct liaison with the local authorities in the area including:

- North Lincolnshire;
- Hull;
- East Riding;
- Doncaster; and
- North East Lincolnshire.

The results of those discussions feed the production of the Uncertainty Log which is discussed in more detail later in this chapter.

4.3.2 Use of National Trip Ends Model (NTEM)

In order to ensure that the results from HETM are consistent with model outputs from elsewhere, the demand forecasts are controlled to National Trip End Model (NTEM) forecasts. These forecasts are used to define the total level of growth in demand to apply to the future year models for the car and LGV matrices (user classes 1 to 9).

At the time of writing, the currently approved version of NTEM is version 6.2. This became the Department's definitive data set in April 2011 and has been used to underpin the future year modelling for HETM as reported here.

4.3.3 Local Developments – Uncertainty Log Approach

In a similar fashion to the process described in Chapter 3 with regard to transport schemes, an Uncertainty Log was created to determine land use development proposals within the study area should be incorporated in the HETM forecasts.

WebTAG 3.15.5 describes the process of creating an Uncertainty Log for use as a tool in identifying and selecting significant future year inputs. The log is intended to provide a comprehensive input of future year proposals which can then be used to help establishing alternative growth scenarios and sensitivity tests.

The Guidance provides the following classifications to assist in identifying the uncertainty and assess the likelihood of an input.

Table 4 Uncertainty Log – Probability versus Status

Probability of Input	Status
Near certain: The outcome will happen or there is a high probability that it will happen.	- Intent announcement by proponent to regulatory agencies - Approved development proposals - Projects under construction
More than likely: The outcome is likely to happen but there is some uncertainty.	- Submission of planning or consent application imminent - Development application within the consent process
Reasonably foreseeable: The outcome may happen, but there is significant uncertainty	- Identified within a development plan - Not directly associated with the transport strategy / scheme, but may occur if the strategy / scheme is implemented - Development condition upon the transport strategy / scheme proceeding - Or, a committed policy goal, subject to tests (e.g. of delivery) whose outcomes are subject to significant uncertainty
Hypothetical: There is considerable uncertainty whether the outcome will ever happen.	- Conjecture based upon currently available information - Discussion on a conceptual basis - One of a number of possible inputs in an initial consultation process - Or, a policy aspiration

Source: WebTAG Unit 3.15.5

4.3.4 Summary of Uncertainty Log Outcomes

The following authorities have contributed to the discussions regarding developments and the uncertainty log:

- North Lincolnshire;
- Kingston Upon Hull;
- East Riding;
- Doncaster; and
- North East Lincolnshire.

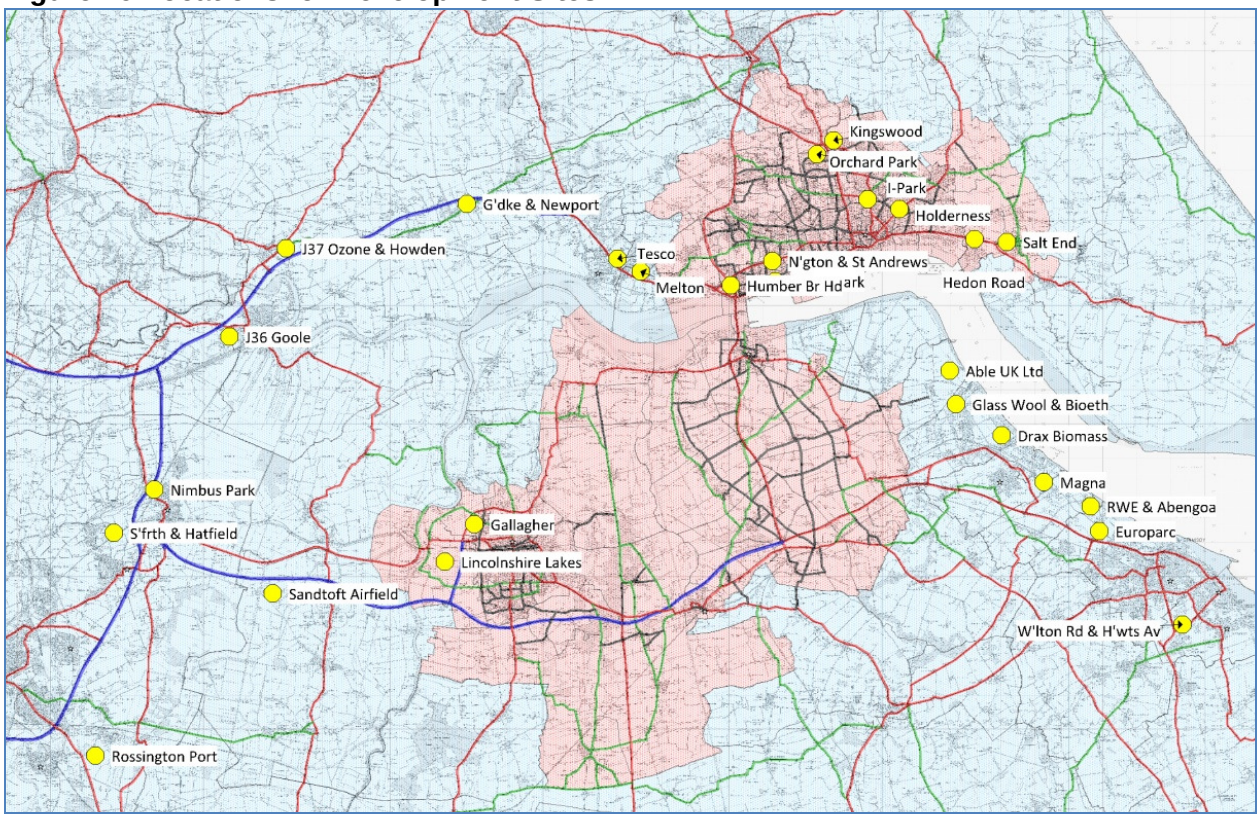
The final rating for each development was agreed with the project steering group and a copy of the full uncertainty log is included within Appendix A of this report. A summary is provided in Table 5 below.

Table 5 Summary of Uncertainty Log

Development/Scheme	2021		2033	
	Uncertainty	Included	Uncertainty	Included
Newington and St Andrews Area Action Plan	2	✓	1	✓
Holderness Rd - New Bridge Road	3		2	✓
Holderness Rd – Ings/Preston Rd	2	✓	1	✓
Holderness Rd – Ings/Preston Rd (N Approved)	3		2	✓
Kingswood – Approved	2	✓	1	✓
Kingswood – Not Approved	3		3	✓
Orchard Park	4		3	
William Wright and Albert Docks	4		4	
Drypool	4		4	
Hedon Rd - Somerden Rd	2	✓	1	✓
1251 Hedon Road	2	✓	1	✓
Priory Park	2	✓	1	✓
I-Park (Bankside)	2	✓	1	✓
Humber Bridge Head	2	✓	1	✓
J36 Goole	4		3	
Howden	4		3	
Gilberdike - Newport	4		3	
Melton	4		3	
Brough Tesco	4		3	
Salt End (Hedon - Haven)	3		2	✓
Lincolnshire Lakes	4		3	
South Humber Bank: Logistics Park	2	✓	1	✓
South Humber Bank: Marine Energy Park	4		3	
Drax Biomass - South Killingholme	2	✓	1	✓
Glass Wool Insulation Plant - N Killingholme	2	✓	1	✓
Bio ethanol Plant - N Killingholme	2	✓	1	✓
Sandtoft Airfield	4		3	
Europarc Phase 4	4		3	
Wilton Road and Hewitts Ave Business	2	✓	1	✓
Magna Holdings Ltd.	2	✓	1	✓
RWE Npower Renewable	2	✓	1	✓
Abengoa Bio energy UK	2	✓	1	✓
Stainforth	4		3	
Hatfield Power Park	2	✓	1	✓
Rossington Inland Port (Poteric Carr)	3		2	✓
Nimbus Park, Thorne	2	✓	1	✓

A plan showing the locations of these developments is shown in Figure 19.

Figure 19 Locations for Development Sites



4.4 Incorporating Uncertainty Log Outcomes Within Overall Demand Forecasts

4.4.1 Use of TEMPRO

The DfT have made available to modellers a software tool called TEMPRO which allows the interrogation of NTEM forecast information. The latest version of TEMPRO includes an 'Alternative Planning Assumptions Facility' which enables the user to test the impact of varying the input values of households and employment numbers by area. As the outputs are fully compatible with the requirements of the HETM modelling process, and also clearly consistent with the wider demand modelling within NTEM, this has been used to generate production and attraction rates by purpose by period for households and employment numbers.

4.4.2 Issues with Incomplete Development Information

The TEMPRO Alternative Planning Assumption Tool requires household numbers or employment numbers as input values. This information was not available for all of the development sites within the Uncertainty Log. Where only floorspace information was available, existing research into the relationship between floor space and number of jobs for the Yorkshire area has been used to provide estimates of the future jobs created. Full details of this process are provided in Appendix C.

4.4.3 Application within HETM

A spreadsheet tool was developed to derive the final growth factors for each HETM model zone, based on the Uncertainty Log, whilst ensuring overall compatibility with NTEM outputs.

The overall approach is illustrated in Figure 20 but may also be summarised as follows:

1) Allocate development site information to appropriate HETM model zone;

2) Identify which HETM zone corresponds to which NTEM zone (this can be a many to one or one too many relationship depending on the zone sizes);

3) Use NTEM dataset to derive control 12 hour P/A forecast trip totals by purpose for each NTEM zone;

4) Reduce the NTEM planning inputs (households & jobs) in each NTEM zone by the amounts identified in the Uncertainty Log with reference to the correspondence list from (2);

5) Apply the same reduction at the NTEM zone level for those zones unaffected by developments;

6) Add in the additional known development data to the relevant NTEM zones;

7) Check that overall NTEM inputs (households & jobs) are maintained as a consequence of (5) and (6) at the model area level;

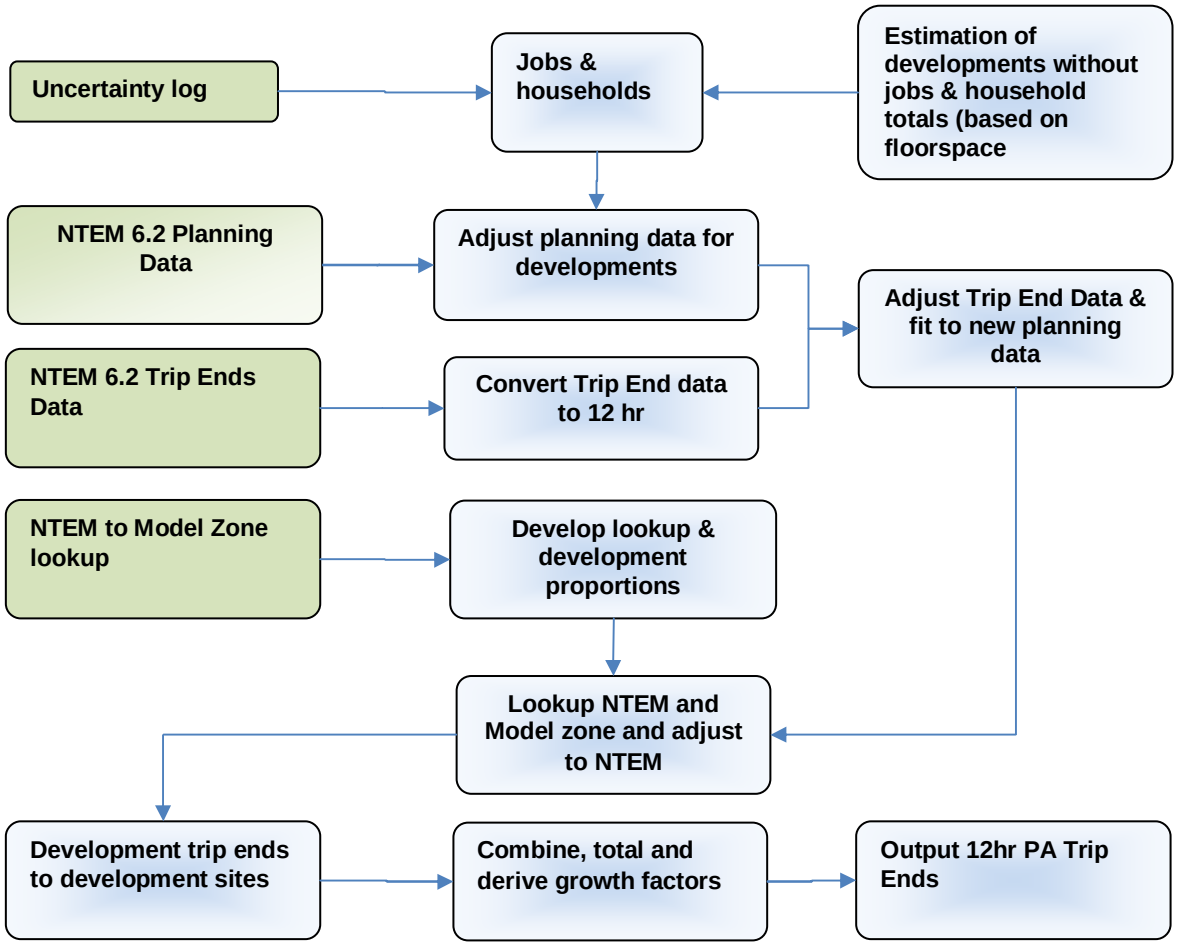
8) For HETM zones unaffected by new developments, apply the reduced NTEM growth factors output from step (4);

9) For HETM zones with development activity, apply the NTEM relationships to produce the appropriate growth factors;

10) Combine the outputs from (8) and (9) to produce final growth factors (P/A by purpose level) for every HETM zone.

The end product of this process is a series of model zone growth factors (P/A purpose level) which reflect the precise location of known developments but which also ensure that overall growth levels accord with NTEM forecasts.

Figure 20 Summary of the Process for Including Known Developments



4.5 Application of Growth to Goods Vehicles

NTEM does not provide forecasted growth for HGV's as a result an alternative approach was used to generate growth assumptions for user classes 10 to 13. This is based on forecasts provided by the Department for Transport's National Transport Model in the report Road Transport Forecasts 2009, a summary of the growth factors from base to future year are shown in Table 6.

Table 6 HGV Growth Forecasts

Type	2010 to 2021	2010 to 2033
HGV – Lights (uc10)	27.5%	66.0%
HGV – Rigid 2 (uc11)	9.3%	15.6%
HGV – Rigid 3 (UC12)	9.3%	15.6%
HGV – Artics (UC13)	3.8%	15.7%

4.6 Matrices Totals

The resultant matrix totals for each year and time period are presented in Table 7.

Table 7 Do Minimum Matrices Totals

Scenario	AM Peak	Interpeak	PM Peak
Base Year 2010	111,578	99,029	126,494
Forecast Year 2021	126,822	113,545	144,286
Forecast Year 2033	141,137	129,090	161,481

5 Forecast Assignments

5 Forecast Assignments

As discussed in Section 3, forecast model runs have been carried out for four scenarios:

- 10% reduction in toll;
- 26% toll reduction;
- 63% toll reduction, and
- All tolls removed.

For each toll scenario model runs have been carried out for the forecast years 2015 and 2033.

5.1 Forecasting Approach

5.1.1 Variable Demand Modelling

Forecast year runs have been carried out for 2015 and 2033. In each case the do minimum model has been run with the demand 'pivoting off' the base year costs. This means that the difference between the base and future year do minimum costs is what drives the demand changes.

The forecast year do something model then pivots off the forecast year do minimum. So it is the difference between the do minimum and do something costs, for the forecast year, which drives the demand changes. In theory, the forecast year do something model could also pivot from the base but this is not regarded as best practise as there is greater scope for spurious impacts due to convergence issues.

Forecast model runs have been carried out using the variable demand modelling structure outlined in Figure 18. Detail on the validation and calibration of the Diadem model are reported in Appendix I of the Local Model Validation Report but the final model parameters are shown in Table 8.

Table 8 Variable Demand Model Parameters

Trip Purpose	Destination choice	Trip Frequency	Cost Damping	
	λ	θ	β	μ
Home based work	0.065	0.16	0.8	1.3
Home based employers business	0.067	-	0.8	1.3
Home based other	0.090	0.16	0.8	1.3
Non home based employers business	0.081	-	0.8	1.3
Non home based other	0.077	0.12	0.8	1.3

Assignment parameters in terms of the value of operating costs and time are as shown in Section 3.5.

The inputs to the modelling process are:

- Future year demand matrices (as discussed in Section 3); and
- Future year networks (discussed in Section 4).

5.1.2 Convergence in Assignment Modelling

Whilst standard practice for SATURN model convergence has previously involved the monitoring of the percentage of links on which flow changes by less than 5% on consecutive iterations, the more recent trend has been towards measuring the level of convergence by assessment of the duality gap value. Indeed the gap value has a sound theoretical basis and SATURN guidance states that the gap value should be viewed as the most important indication of overall convergence. DMRB Volume 12 states that 'the duality gap expresses the flow-weighted difference between current total cost estimates on the

network, as determined by the present flow pattern and the speed/flow curves, and the costs if all traffic would use minimum cost routes (as calculated by the next all-or-nothing assignment).'

DMRB states that the value should be less than 1% but that values of typically less than 0.1% are preferred.

In Saturn, STPGAP represents the critical gap value (%) used to terminate the assignment-simulation loops, and represents the difference between the current total vehicle costs on the assigned routes and the total vehicle costs if all drivers were to use minimum cost routes with the costs fixed. Within HETM, the STPGAP value in the model is set to 0.05 so that the model continues to run until this is achieved.

In addition to achieving the necessary duality gap value, DMRB recommends that percentage flow change on links should also be monitored, with 95% of links having flows changing by less than 5% on consecutive iterations.

The convergence of the base model is provided in Table 9 to enable comparison to the forecast modelling as reported in Table 10.

Table 9 Summary of Base Model Convergence

Time Period	Number of Assignment Loops	% Links With Flow Change < 5%	% Links With Delay Change < 5%	Gap
AM Peak	19	99.3%	99.7%	0.024
Inter peak	12	99.0%	99.7%	0.017
PM Peak*	49	98.9%	99.4%	0.036

*The PM Peak achieves a gap values of around 0.07% after 24 iterations, however takes a total of 49 iterations to achieve consecutive iterations below a gap of 0.05.

Capabilities on project:
Transportation

Table 10 Model Convergence Summary

Option		2010				2021				2033			
		No. Loop	% Flow	% Delay	Gap	No. Loop	% Flow	% Delay	Gap	No. Loop	% Flow	% Delay	Gap
DM	AM	13	99.2	99.7	0.028	20	98.8	99.4	0.037	25	99.3	99.3	0.031
	IP	8	98.2	99.9	0.015	8	98.2	99.9	0.015	21	99.0	99.1	0.032
	PM	21	99.5	99.9	0.016	21	99.5	99.8	0.050	20	98.8	99.4	0.038
-10%	AM	12	98.8	99.6	0.038	29	99.0	99.4	0.034	23	98.4	99.1	0.035
	IP	8	98.5	99.9	0.016	16	99.4	99.7	0.001	21	99.2	99.5	0.023
	PM	18	99.4	99.9	0.019	24	99.4	99.7	0.050	17	98.7	99.2	0.041
-26%	AM	12	99.1	99.7	0.026	26	99.8	99.5	0.028	33	98.6	99.0	0.024
	IP	8	98.9	99.8	0.015	10	98.6	99.7	0.031	17	98.2	98.8	0.033
	PM	11	99.0	99.9	0.034	22	99.4	99.9	0.036	21	98.5	99.3	0.035
-63%	AM	10	98.7	99.6	0.290	29	99.0	99.4	0.034	29	99.2	99.3	0.028
	IP	8	99.0	99.9	0.015	16	99.4	99.7	0.028	17	98.7	99.0	0.041
	PM	16	99.3	99.8	0.028	24	99.4	99.7	0.050	19	99.0	99.4	0.036
No Toll	AM	14	99.2	99.7	0.026	20	98.9	99.6	0.033	26	98.6	99.0	0.041
	IP	9	98.7	99.8	0.049	10	98.7	99.7	0.040	19	98.9	99.3	0.032
	PM	13	99.2	99.9	0.041	21	99.4	99.8	0.049	19	99.1	99.4	0.039

5.2 Convergence in Demand Modelling

Convergence of the demand model is measured by the demand supply gap defined in WebTAG Module 3.10.4. It is suggested that in many cases gap values of lower than 0.1% can be achieved, although recognises that this is not always possible, and that values of less than 0.2% would be generally acceptable.

Initial tests with the HETM model attempted to get convergence below 0.1%, however, this lead to model run times in excess of two days for 2033 model runs, and even at that time the convergence did not always fall below 0.1%. For the final assignments a gap of 0.15% was used to terminate the assignments. This produced acceptable run times and ensured that model convergence was consistently well below the 0.2% upper bound.

5.3 Do Something Matrix

The variable demand process can result in changes to the distribution of trips within each matrix and the overall number of trips. Table 11 provides a summary of them matrix totals with further detail provided in Appendix H.

Table 11 Do Something Matrices Totals by Scenario

Year	Period	Do Minimum	10% Reduction	26% Reduction	63% Reduction	No Toll
2010	AM	111,578	111,592	111,631	111,719	111,850
	(diff)		***14***	***54***	***141***	***272***
	IP	99,029	99,038	99,062	99,096	99,170
	(diff)		***9***	***33***	***67***	***141***
	PM	126,494	126,507	126,554	126,638	126,779
	(diff)		***13***	***60***	***144***	***285***
2021	AM	126,822	126,842	126,876	126,963	127,070
	(diff)		***20***	***54***	***141***	***248***
	IP	113,545	113,503	113,521	113,568	113,632
	(diff)		***-42***	***-24***	***23***	***87***
	PM	144,286	144,383	144,418	144,511	144,628
	(diff)		***97***	***132***	***226***	***342***
2033	AM	141,137	141,075	141,106	141,190	141,279
	(diff)		***-62***	***-31***	***53***	***142***
	IP	129,090	128,950	128,965	129,005	129,055
	(diff)		***-140***	***-125***	***-85***	***-35***
	PM	161,481	161,762	161,793	161,885	161,977
	(diff)		***281***	***312***	***404***	***495***

5.4 Presentation of Model Forecasts

5.4.1 Overview

This section of the report presents a summary review of the key results from the forecast year assignments from the highway model. The following parts of this section consider:

- Traffic flows on key links;
- Levels of junction delay; and
- Journey Time Impacts.

The impact on Bridge traffic itself is considered separately later in this Chapter.

5.4.2 Traffic Flows on Key Links

A comparison between traffic flows for each option is summarised in the figures and fables below.

As expected the reduction in toll on the Humber Bridge results in a significant increase in usage of the bridge comprised of increases in traffic flows from Grimsby and Scunthorpe to north of the Bridge and from areas such as Hull to the north which are attracting new trips.

For longer distance trips, under larger reductions in the toll, there are some increases in traffic on the A15 from Lincoln and also the A1079 between York and Market Weighton. These increase contrast to some small scale reductions in traffic flows on the A1(M), M18, and M180.

Figure 21 Flow Different Plot 2010 AM (No Toll – Do Minimum)

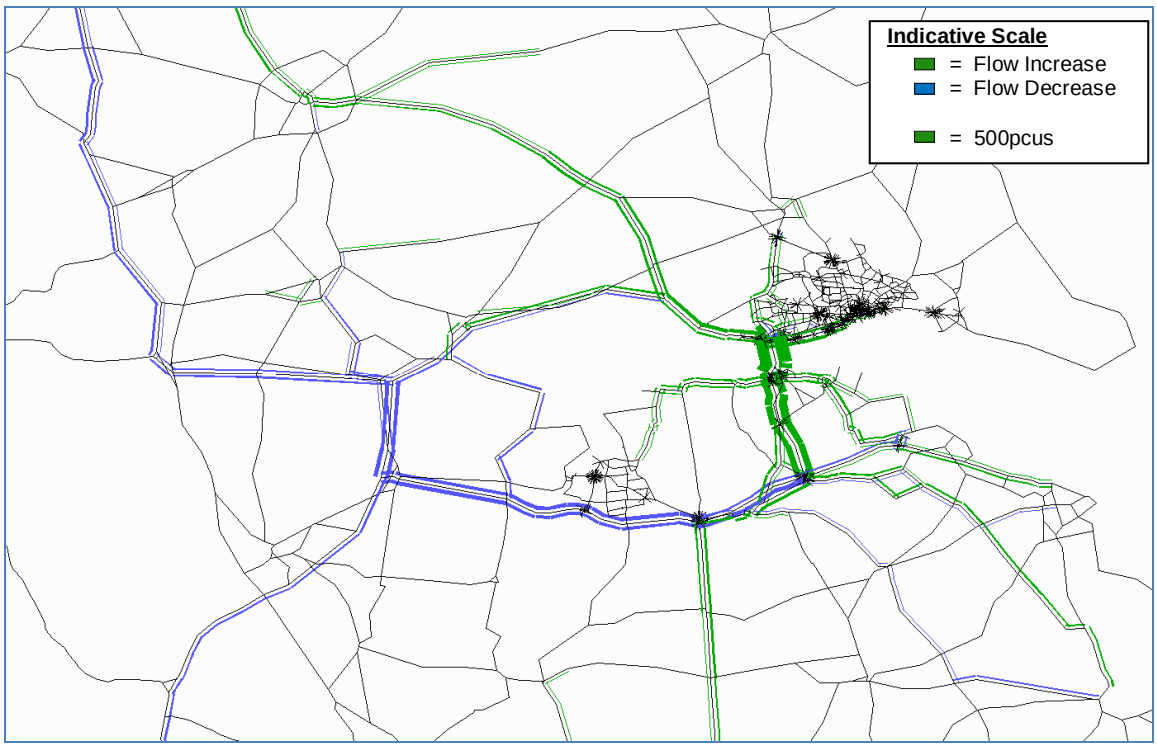
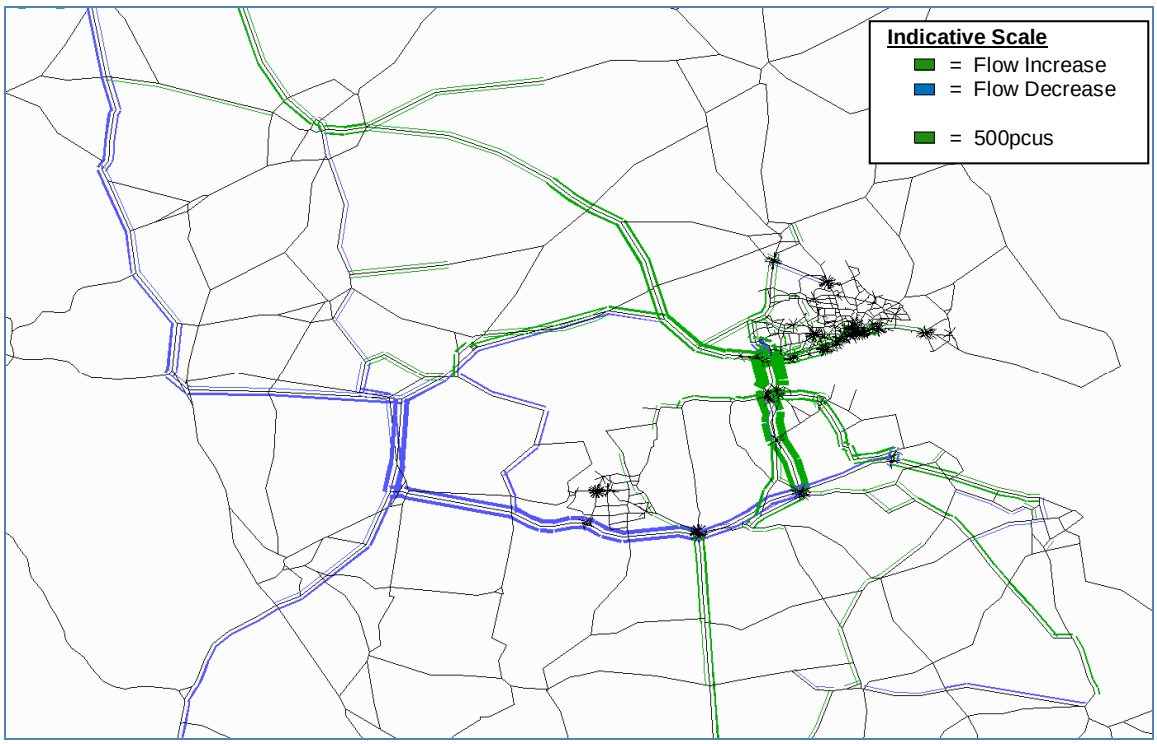


Figure 22 Flow Different Plot 2021 AM (No Toll – Do Minimum)



Capabilities on project:
Transportation

Figure 23 Flow Different Plot 2033 AM (No Toll – Do Minimum)

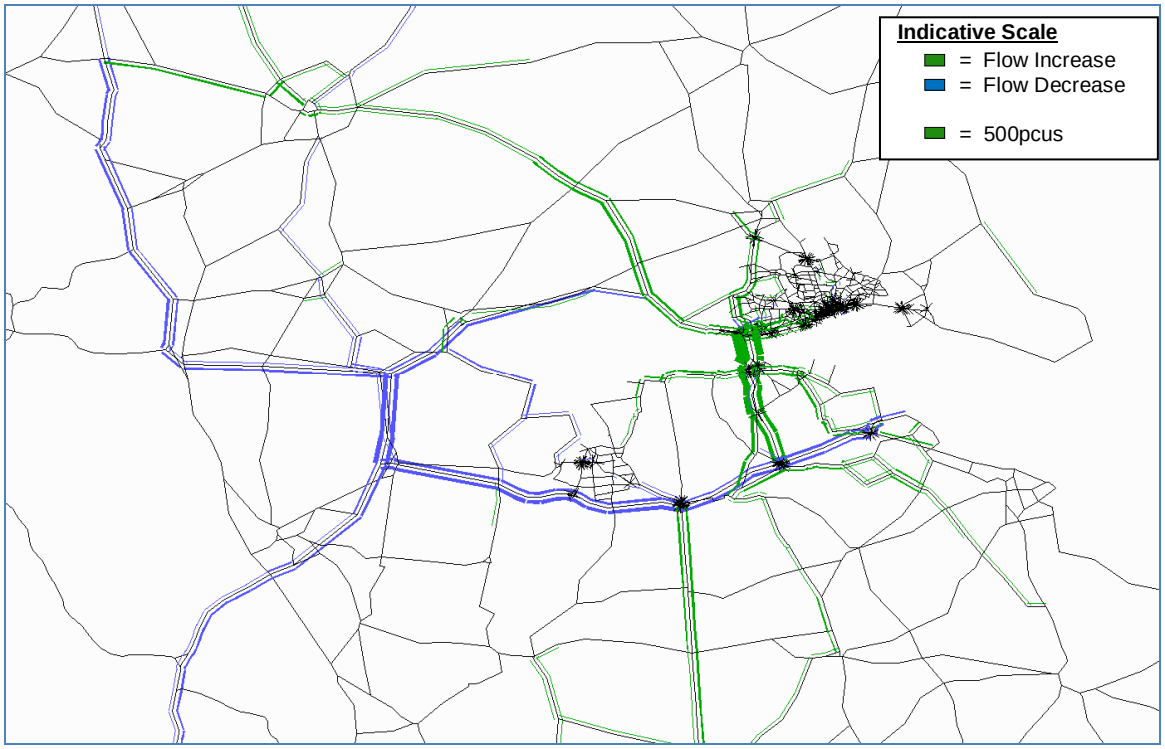


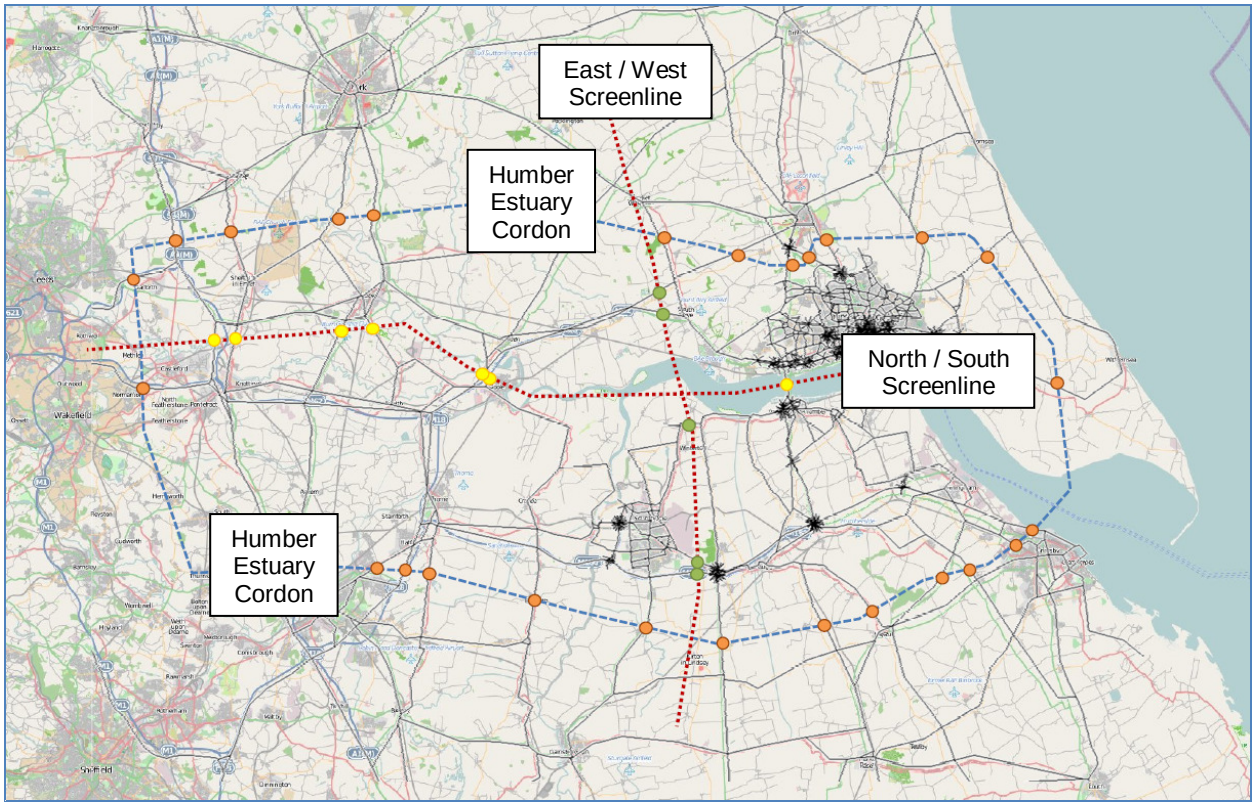
Figure 24, below shows the locations of screenlines and a cordon used to review the impacts of the proposal. The traffic flows for each are shown in Tables 12 to 23.

The key impacts of the proposal may be summarised as follows:

- Decreases or removal of the toll result in an overall increase in cross Humber movements, comprising of increases at the Humber Bridge (A15) and decreases at the M62 Crossing;
- There is a net reduction in east west traffic movements as a result of the proposal; and
- Traffic flows into the central study area (cordon flows) increase slightly as a result of the proposal.

Capabilities on project:
Transportation

Figure 24 Summary of Screenline/Cordon



Capabilities on project:
Transportation

Table 12 AM - North/South Screenline

Description	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll
Northbound															
Humber Bridge	1,043	1,070	1,147	1,408	1,620	1,307	1,354	1,452	1,708	1,936	1,590	1,649	1,736	1,955	2,215
A614 Goole	705	705	704	706	769	846	847	847	850	924	965	967	967	973	1,014
M62 Goole Jcn 36 & 37	1,512	1,505	1,500	1,492	1,494	1,941	1,938	1,932	1,926	1,929	2,459	2,461	2,454	2,428	2,401
A1041 Selby	529	528	524	519	515	542	539	528	528	531	602	598	584	580	571
A19 Selby	868	860	871	869	869	932	929	930	933	935	972	969	968	970	972
A162 Knottingley	250	250	250	250	250	222	222	222	222	222	310	310	310	310	310
A1M Knottingley Jcn 41	797	803	793	711	707	1,072	1,072	1,070	998	970	1,081	1,068	1,069	1,043	974
Total	**5,704**	**5,721**	**5,790**	**5,955**	**6,224**	**6,861**	**6,901**	**6,981**	**7,165**	**7,446**	**7,978**	**8,022**	**8,089**	**8,258**	**8,456**
Southbound															
Humber Bridge	1,234	1,267	1,368	1,607	1,887	1,630	1,697	1,800	2,060	2,253	1,847	1,912	1,992	2,124	2,188
A614 Goole	840	840	840	842	850	949	948	947	946	956	1,094	1,095	1,095	1,097	1,108
M62 Goole Jcn 36 & 37	1,548	1,545	1,538	1,508	1,491	1,858	1,854	1,846	1,793	1,784	2,213	2,205	2,182	2,167	2,112
A1041 Selby	567	556	549	529	522	607	597	591	577	573	681	668	650	648	643
A19 Selby	911	915	916	919	915	976	980	977	986	986	1,039	1,043	1,045	1,047	1,048
A162 Knottingley	233	232	231	231	231	204	202	202	200	200	288	285	284	285	284
A1M Knottingley Jcn 41	797	792	774	752	759	1,085	1,084	1,066	1,035	1,034	1,080	1,081	1,079	1,041	1,029
Total	**6,129**	**6,148**	**6,216**	**6,387**	**6,653**	**7,310**	**7,361**	**7,430**	**7,597**	**7,786**	**8,241**	**8,289**	**8,327**	**8,409**	**8,411**

Capabilities on project:
Transportation

Table 13 AM - East/West Screenline

Description	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll
Eastbound															
M62 Jcn 38 to North	165	163	162	160	160	237	238	238	237	238	385	398	397	401	404
M62 Jcn 38 to A63 Hull	1,700	1,699	1,695	1,701	1,776	2,179	2,177	2,179	2,175	2,270	2,691	2,691	2,690	2,672	2,691
A1077 Winterton - N of Scunthorpe	290	291	298	313	335	341	342	348	364	381	447	453	460	480	505
A18 Scunthorpe	1,406	1,405	1,405	1,403	1,402	1,575	1,585	1,584	1,578	1,577	1,776	1,786	1,778	1,768	1,750
M180 Scunthorpe - Jcn	1,201	1,190	1,160	1,111	1,018	1,663	1,653	1,625	1,573	1,466	1,773	1,770	1,752	1,706	1,662
Total	**4,761**	**4,749**	**4,720**	**4,688**	**4,690**	**5,995**	**5,994**	**5,973**	**5,927**	**5,932**	**7,072**	**7,097**	**7,077**	**7,028**	**7,012**
Westbound															
M62 Jcn 38 to North	192	191	187	194	197	254	253	250	251	250	375	374	369	368	370
M62 Jcn 38 to A63 Hull	1,779	1,778	1,777	1,737	1,732	2,075	2,072	2,067	2,018	2,034	2,475	2,468	2,454	2,445	2,420
A1077 Winterton - N of Scunthorpe	470	469	479	499	510	507	509	512	513	500	607	610	621	627	625
A18 Scunthorpe	2,076	2,075	2,072	2,041	2,062	2,062	2,066	2,067	2,062	2,093	2,079	2,072	2,063	2,057	2,046
M180 Scunthorpe - Jcn	1,238	1,234	1,226	1,117	1,087	1,442	1,437	1,419	1,344	1,287	1,566	1,562	1,544	1,500	1,392
Total	**5,754**	**5,747**	**5,741**	**5,588**	**5,588**	**6,340**	**6,336**	**6,315**	**6,188**	**6,163**	**7,103**	**7,086**	**7,052**	**6,998**	**6,853**

Capabilities on project:
Transportation

Table 14 AM – Humber Estuary Cordon Inbound

Description	2010					2021					2033				
	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll
A1033 Withernsea	387	386	387	387	386	493	496	496	500	503	512	514	515	517	521
B1238 Aldbrough	454	454	454	455	457	500	500	500	501	500	626	625	625	626	627
A165 Hornsea	272	272	271	271	270	323	323	322	321	320	423	422	422	422	420
A1174 Woodsmansey –	370	369	372	376	381	411	413	417	416	416	448	449	449	450	454
A1079 Beverley	878	877	873	866	860	1,031	1,032	1,025	1,023	1,025	1,116	1,118	1,116	1,119	1,114
A164 Beverley	1,002	1,003	1,012	1,024	1,034	1,245	1,248	1,256	1,265	1,273	1,459	1,467	1,475	1,492	1,507
B1230 Walkington	278	277	273	280	283	332	331	327	328	326	451	449	445	443	444
A1034 South of Market	399	410	438	466	479	439	456	479	521	521	549	556	568	597	609
A614 West of M Weighton	590	593	592	588	587	644	643	643	634	630	725	722	719	718	705
A19 York	1,074	1,052	1,071	1,053	1,060	1,136	1,124	1,123	1,112	1,115	1,202	1,199	1,201	1,194	1,196
B1222 York	514	530	506	511	501	618	615	613	611	608	684	668	651	658	655
A162 South of Tadcaster	553	553	553	553	554	518	518	518	518	517	668	668	669	669	669
A1M betw Jcn 44 and 43	2,341	2,344	2,327	2,315	2,320	2,894	2,894	2,877	2,862	2,861	3,224	3,226	3,225	3,191	3,181
M1 betw Jcn 46 and 47	1,669	1,670	1,671	1,672	1,674	1,973	1,973	1,974	1,976	1,979	2,434	2,443	2,443	2,446	2,448
M62 Castleford betw Jcn	3,284	3,284	3,284	3,285	3,276	3,939	3,946	3,946	3,948	3,947	4,670	4,677	4,677	4,677	4,679
A1M Doncaster betw Jcn	106	106	106	106	106	130	130	130	130	129	147	148	148	149	149
A638 Doncaster betw Jcn	54	54	54	54	54	60	60	60	60	60	87	87	87	87	87
A19 Doncaster	17	17	17	17	17	17	17	17	17	17	25	25	25	25	25
A18 Doncaster to Thorne	137	130	136	133	134	139	138	139	139	139	252	253	253	253	252
M18 Thorne betw Jcn 4	1,278	1,285	1,274	1,266	1,261	1,709	1,704	1,701	1,688	1,679	2,203	2,199	2,193	2,170	2,159
A614 Thorne	61	58	58	58	58	73	74	74	74	73	124	124	124	123	123
A161 Haxey/Epworth	566	566	566	567	568	665	665	665	666	666	560	561	564	568	583
A159 Scotter - South of	610	610	611	620	617	673	672	672	672	670	756	746	746	746	748
A15 Kirton in Lyndsey	913	916	924	943	965	1,092	1,097	1,103	1,124	1,140	1,231	1,243	1,250	1,269	1,284
B1434 North Kelsey	105	105	107	108	113	125	124	125	130	137	115	117	120	130	144
A1084 Caistor	370	370	372	375	378	383	382	384	390	394	445	437	437	439	443
A1173 Irby upon Humber	320	319	316	312	310	498	510	510	511	515	538	550	551	554	552
A18 Irby upon Humber	616	615	616	606	595	809	814	809	780	800	742	749	750	761	776
A1136 Grimsby	388	388	388	386	382	711	711	703	678	680	737	733	732	731	736
A180 Europarc/Grimsby	1,496	1,497	1,501	1,517	1,546	1,836	1,841	1,857	1,904	1,893	2,106	2,108	2,112	2,116	2,107
TOTAL	**21,100**	**21,109**	**21,132**	**21,170**	**21,227**	**25,415**	**25,451**	**25,465**	**25,498**	**25,536**	**29,256**	**29,286**	**29,292**	**29,339**	**29,396**

Capabilities on project:
Transportation

Table 15 AM – Humber Estuary Cordon Outbound

Description	2010					2021					2033				
	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll
A1033 Withernsea	329	328	329	329	329	347	346	346	349	349	305	299	300	297	297
B1238 Aldbrough	435	436	436	437	438	536	544	544	545	548	679	691	691	694	693
A165 Hornsea	282	282	282	281	279	314	315	315	314	315	356	353	355	355	353
A1174 Woodsmansey	390	389	394	397	406	419	418	418	421	419	450	453	454	455	452
A1079 Beverley	982	983	978	976	970	1,156	1,152	1,149	1,141	1,134	1,344	1,342	1,335	1,337	1,339
A164 Beverley	1,042	1,044	1,052	1,067	1,085	1,237	1,238	1,245	1,258	1,274	1,375	1,378	1,381	1,392	1,407
B1230 Walkington	234	231	230	229	228	307	308	308	306	307	444	454	453	455	457
A1034 South of Market	295	298	302	392	396	305	304	320	388	414	382	384	399	429	491
A614 West of M Weighton	658	659	657	646	645	732	729	721	721	719	825	823	816	811	806
A19 York	1,116	1,129	1,122	1,122	1,118	1,156	1,161	1,159	1,155	1,156	1,232	1,235	1,219	1,232	1,240
B1222 York	491	477	481	484	486	583	573	566	578	578	670	662	670	659	659
A162 South of Tadcaster	566	566	567	568	569	539	541	541	540	541	712	714	714	714	714
A1M betw Jcn 44 and 43	2,517	2,518	2,520	2,441	2,438	3,084	3,084	3,087	3,025	3,003	3,529	3,529	3,529	3,507	3,443
M1 betw Jcn 46 and 47	1,562	1,563	1,564	1,564	1,565	1,849	1,850	1,850	1,850	1,851	2,200	2,203	2,204	2,206	2,207
M62 Castleford betw Jcn	3,420	3,419	3,420	3,423	3,425	3,867	3,863	3,863	3,865	3,868	4,457	4,448	4,448	4,449	4,452
A1M Doncaster betw Jcn	142	141	142	142	142	179	179	179	179	178	212	212	212	211	212
A638 Doncaster betw Jcn	92	92	92	92	92	103	102	102	102	101	136	137	137	137	137
A19 Doncaster	17	17	17	17	17	17	17	17	17	17	36	36	36	36	36
A18 Doncaster to Thorne	58	58	58	58	58	64	64	64	64	64	206	207	207	207	207
M18 Thorne betw Jcn 4	1,083	1,083	1,080	1,034	1,010	1,313	1,308	1,307	1,250	1,238	1,518	1,511	1,504	1,485	1,426
A614 Thorne	76	76	71	71	71	78	78	73	73	73	116	117	112	111	111
A161 Haxey/Epworth	679	679	679	681	682	779	779	779	779	781	648	645	654	655	657
A159 Scotter - South of	645	645	644	644	644	668	665	665	664	664	771	762	762	762	762
A15 Kirton in Lyndsey	797	796	806	854	877	922	928	934	985	986	1,022	1,024	1,035	1,051	1,095
B1434 North Kelsey	102	103	103	106	108	130	130	132	137	128	158	161	164	169	174
A1084 Caistor	398	399	398	396	373	443	443	443	443	425	524	524	525	525	521
A1173 Irby upon Humber	287	286	287	285	282	292	289	289	285	285	300	297	297	296	298
A18 Irby upon Humber	700	701	706	716	770	825	829	834	847	900	872	874	878	892	911
A1136 Grimsby	386	384	385	385	385	610	610	609	607	604	597	595	596	598	600
A180 Europarc/Grimsby	1,402	1,402	1,406	1,415	1,427	1,676	1,684	1,686	1,692	1,700	1,980	1,991	1,993	1,995	1,999
TOTAL	**21,182**	**21,185**	**21,206**	**21,250**	**21,315**	**24,531**	**24,531**	**24,544**	**24,581**	**24,619**	**28,056**	**28,061**	**28,079**	**28,123**	**28,156**

Capabilities on project:
Transportation

Table 16 IP - North/South Screenline

Description	2010					2021					2033				
	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll
Northbound															
Humber Bridge	811	837	895	1,088	1,329	1,035	1,063	1,140	1,362	1,614	1,258	1,298	1,373	1,600	1,882
A614 Goole	703	703	702	705	714	817	814	814	825	832	986	991	991	1,001	1,004
M62 Goole Jcn 36 & 37	1,260	1,257	1,246	1,243	1,201	1,599	1,591	1,586	1,571	1,532	2,006	1,998	1,984	1,960	1,894
A1041 Selby	517	513	511	508	489	548	547	543	535	525	594	591	589	583	573
A19 Selby	787	793	788	790	790	877	870	867	872	873	923	912	912	915	916
A162 Knottingley	206	205	205	205	205	190	190	190	190	189	271	272	272	272	272
A1M Knottingley Jcn 41	669	665	669	616	610	923	928	931	874	863	1,037	1,043	1,042	997	970
Total	**4,953**	**4,973**	**5,017**	**5,154**	**5,338**	**5,988**	**6,003**	**6,070**	**6,228**	**6,427**	**7,076**	**7,105**	**7,163**	**7,328**	**7,510**
Southbound															
Humber Bridge	841	864	929	1,136	1,432	1,072	1,104	1,192	1,429	1,747	1,282	1,320	1,412	1,661	1,931
A614 Goole	714	716	716	715	724	832	830	829	829	841	971	975	975	978	987
M62 Goole Jcn 36 & 37	1,536	1,531	1,522	1,515	1,454	1,925	1,921	1,911	1,886	1,828	2,393	2,394	2,375	2,350	2,306
A1041 Selby	591	588	578	572	537	619	615	607	600	560	690	688	674	666	617
A19 Selby	790	794	791	792	790	886	881	877	884	884	931	930	930	935	935
A162 Knottingley	211	211	211	209	208	198	198	198	197	195	281	281	281	280	278
A1M Knottingley Jcn 41	720	718	718	662	663	966	972	973	925	909	1,054	1,053	1,055	997	976
Total	**5,403**	**5,422**	**5,465**	**5,602**	**5,808**	**6,497**	**6,521**	**6,589**	**6,749**	**6,965**	**7,601**	**7,641**	**7,701**	**7,868**	**8,030**

Capabilities on project:
Transportation

Table 17 IP - East/West Screenline

Description	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll
Eastbound															
M62 Jcn 38 to North Cave	146	146	145	146	143	195	195	195	194	194	312	310	309	309	309
M62 Jcn 38 to A63 Hull	1,442	1,441	1,437	1,433	1,442	1,786	1,779	1,775	1,780	1,794	2,249	2,230	2,222	2,215	2,220
A1077 Winterton - N of Scunthorpe	291	293	296	302	316	323	325	328	340	352	407	410	416	436	458
A18 Scunthorpe	1,592	1,592	1,594	1,600	1,590	1,656	1,655	1,660	1,653	1,654	1,796	1,791	1,788	1,786	1,780
M180 Scunthorpe - Jcn 4	1,115	1,113	1,107	1,045	966	1,411	1,406	1,390	1,331	1,247	1,561	1,554	1,533	1,454	1,373
Total	**4,586**	**4,585**	**4,579**	**4,526**	**4,457**	**5,371**	**5,360**	**5,348**	**5,298**	**5,241**	**6,324**	**6,294**	**6,267**	**6,200**	**6,140**
Westbound															
M62 Jcn 38 to North Cave	172	172	171	170	168	225	226	225	225	224	350	347	345	345	345
M62 Jcn 38 to A63 Hull	1,696	1,697	1,692	1,683	1,652	2,096	2,094	2,088	2,066	2,036	2,579	2,569	2,557	2,537	2,527
A1077 Winterton - N of Scunthorpe	331	332	337	350	363	356	356	360	357	353	449	447	448	450	439
A18 Scunthorpe	1,524	1,524	1,524	1,521	1,511	1,657	1,646	1,648	1,657	1,670	1,843	1,822	1,817	1,835	1,850
M180 Scunthorpe - Jcn 4	929	923	922	868	817	1,218	1,208	1,203	1,139	1,101	1,383	1,379	1,364	1,295	1,242
Total	**4,652**	**4,647**	**4,645**	**4,591**	**4,512**	**5,552**	**5,529**	**5,523**	**5,443**	**5,383**	**6,603**	**6,564**	**6,531**	**6,463**	**6,403**

Capabilities on project:
Transportation

Table 18 IP – Humber Estuary Cordon Inbound

Description	2010					2021					2033				
	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll
A1033 Withernsea	294	294	294	295	297	363	362	362	365	366	384	384	384	385	387
B1238 Aldbrough	382	382	382	382	382	438	437	438	436	438	576	573	574	575	575
A165 Hornsea	230	230	230	230	231	271	271	270	272	271	357	355	355	354	353
A1174 Woodsmansey –	279	279	279	282	278	292	290	290	288	288	512	491	505	497	501
A1079 Beverley	862	863	862	859	861	983	982	982	979	978	1,081	1,098	1,083	1,092	1,095
A164 Beverley	922	922	928	941	955	1,161	1,163	1,170	1,185	1,200	1,358	1,346	1,352	1,366	1,380
B1230 Walkington	234	234	232	231	230	288	288	287	287	286	408	407	408	407	412
A1034 South of Market	300	302	310	369	392	338	342	354	400	432	432	433	446	496	516
A614 West of M Weighton	562	563	562	559	556	628	627	626	622	617	723	723	722	716	709
A19 York	1,009	1,012	1,008	1,002	1,013	1,100	1,101	1,096	1,095	1,079	1,187	1,179	1,175	1,177	1,169
B1222 York	468	463	462	457	444	520	511	503	501	516	586	576	569	564	572
A162 South of Tadcaster	484	485	485	484	485	458	457	458	456	457	616	615	615	617	617
A1M betw Jcn 44 and 43	2,241	2,241	2,239	2,189	2,187	2,829	2,825	2,823	2,787	2,773	3,275	3,263	3,261	3,213	3,197
M1 betw Jcn 46 and 47	1,502	1,502	1,502	1,503	1,503	1,817	1,818	1,818	1,818	1,819	2,210	2,213	2,213	2,214	2,216
M62 Castleford betw Jcn	3,072	3,073	3,073	3,073	3,059	3,613	3,612	3,612	3,612	3,602	4,315	4,311	4,310	4,311	4,310
A1M Doncaster betw Jcn	96	96	96	96	97	122	122	122	122	121	161	161	161	161	161
A638 Doncaster betw Jcn	30	30	29	26	22	32	32	32	33	28	67	62	65	69	62
A19 Doncaster	16	16	16	17	17	16	16	16	16	17	24	24	24	24	24
A18 Doncaster to Thorne	35	35	35	34	33	19	19	19	19	19	217	216	216	216	216
M18 Thorne betw Jcn 4	1,169	1,169	1,165	1,153	1,097	1,451	1,450	1,443	1,428	1,372	1,785	1,776	1,763	1,736	1,675
A614 Thorne	21	21	20	20	20	39	38	38	38	38	63	63	62	61	61
A161 Haxey/Epworth	531	530	530	531	532	585	585	585	585	586	531	530	531	536	547
A159 Scotter - South of	604	604	604	603	603	639	642	641	645	645	686	692	692	690	692
A15 Kirton in Lyndsey	748	749	754	772	833	890	891	901	925	988	1,101	1,108	1,126	1,158	1,209
B1434 North Kelsey	86	87	89	92	107	130	130	133	136	139	127	128	127	136	147
A1084 Caistor	340	340	341	342	349	387	385	386	387	390	457	458	454	454	452
A1173 Irby upon Humber	320	320	317	316	308	389	390	392	392	395	389	389	389	390	391
A18 Irby upon Humber	526	528	531	547	532	605	606	592	562	544	544	553	542	529	560
A1136 Grimsby	374	371	373	374	370	580	583	575	554	525	566	568	560	554	559
A180 Europarc/Grimsby	1,262	1,262	1,265	1,273	1,286	1,532	1,525	1,542	1,588	1,636	1,908	1,894	1,913	1,937	1,925
TOTAL	**18,996**	**19,001**	**19,017**	**19,053**	**19,077**	**22,515**	**22,500**	**22,506**	**22,532**	**22,564**	**26,646**	**26,587**	**26,595**	**26,636**	**26,689**

Table 19 IP – Humber Estuary Cordon Outbound

Description	2010					2021					2033				
	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll
A1033 Withernsea	272	272	272	273	274	346	345	344	349	349	400	397	397	398	400
B1238 Aldbrough	427	427	428	428	428	496	495	497	494	495	605	602	603	604	604
A165 Hornsea	300	300	300	299	299	346	347	347	347	347	457	459	457	459	459
A1174 Woodsmansey	444	435	446	444	444	498	494	496	497	496	534	524	529	530	534
A1079 Beverley	1,010	1,020	1,006	1,004	1,002	1,192	1,199	1,193	1,190	1,184	1,202	1,207	1,194	1,207	1,195
A164 Beverley	974	977	981	1,001	1,021	1,198	1,200	1,209	1,222	1,241	1,406	1,409	1,417	1,433	1,467
B1230 Walkington	211	210	209	210	207	261	260	260	260	259	387	385	384	384	384
A1034 South of Market	304	306	309	356	368	350	351	353	410	426	486	488	489	526	529
A614 West of M Weighton	575	575	574	569	566	655	655	649	641	637	746	746	743	737	732
A19 York	1,037	1,049	1,031	1,023	1,006	1,108	1,099	1,103	1,096	1,091	1,182	1,180	1,182	1,187	1,179
B1222 York	466	453	471	472	487	536	538	532	534	536	604	596	596	588	594
A162 South of Tadcaster	489	490	489	488	489	461	463	463	462	463	619	622	622	622	623
A1M betw Jcn 44 and 43	2,191	2,192	2,190	2,147	2,139	2,788	2,790	2,789	2,742	2,733	3,238	3,241	3,240	3,200	3,173
M1 betw Jcn 46 and 47	1,511	1,512	1,512	1,513	1,513	1,839	1,835	1,834	1,835	1,836	2,262	2,253	2,252	2,255	2,257
M62 Castleford betw Jcn	3,138	3,138	3,138	3,138	3,134	3,737	3,739	3,737	3,738	3,738	4,470	4,477	4,477	4,477	4,474
A1M Doncaster betw Jcn	108	108	108	107	108	133	133	133	133	132	164	164	164	165	165
A638 Doncaster betw Jcn	95	95	95	84	83	107	107	107	106	94	148	148	148	148	133
A19 Doncaster	18	18	18	18	18	19	19	19	19	19	26	26	26	26	26
A18 Doncaster to Thorne	35	35	35	35	35	31	31	31	31	31	150	149	149	149	148
M18 Thorne betw Jcn 4	1,081	1,078	1,073	1,060	990	1,365	1,364	1,358	1,331	1,265	1,684	1,674	1,655	1,635	1,599
A614 Thorne	37	37	37	37	37	37	37	37	37	36	55	54	54	54	53
A161 Haxey/Epworth	583	583	583	583	583	649	648	647	647	652	529	527	528	534	549
A159 Scotter - South of	642	642	642	641	644	696	696	696	695	694	806	809	809	808	809
A15 Kirton in Lyndsey	820	823	831	849	913	947	946	954	987	1,036	1,069	1,078	1,096	1,120	1,144
B1434 North Kelsey	101	102	103	109	113	151	152	153	156	162	196	193	193	202	205
A1084 Caistor	368	368	368	369	369	395	395	396	395	396	475	475	475	475	476
A1173 Irby upon Humber	314	311	312	312	305	391	392	385	368	365	379	379	373	368	376
A18 Irby upon Humber	585	587	592	609	619	735	733	738	750	777	762	759	762	773	802
A1136 Grimsby	465	464	462	463	461	686	688	689	691	690	700	699	700	700	695
A180 Europarc/Grimsby	1,299	1,300	1,303	1,310	1,316	1,507	1,506	1,508	1,511	1,517	1,768	1,770	1,774	1,783	1,793
TOTAL	**19,901**	**19,905**	**19,917**	**19,951**	**19,968**	**23,658**	**23,654**	**23,655**	**23,675**	**23,698**	**27,509**	**27,493**	**27,489**	**27,545**	**27,579**

Capabilities on project:
Transportation

Table 20 PM - North/South Screenline

Description	2010					2021					2033				
	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll
Northbound															
Humber Bridge	1,015	1,046	1,139	1,334	1,572	1,374	1,437	1,541	1,772	2,052	1,593	1,653	1,750	1,998	2,280
A614 Goole	999	998	998	1,004	1,005	1,232	1,229	1,239	1,236	1,241	1,492	1,491	1,498	1,494	1,497
M62 Goole Jcn 36 & 37	1,469	1,465	1,464	1,477	1,480	1,953	1,938	1,944	1,940	1,942	2,489	2,483	2,471	2,448	2,408
A1041 Selby	506	509	506	500	501	562	561	558	555	552	671	677	672	671	664
A19 Selby	1,016	1,015	1,021	1,020	1,031	1,071	1,066	1,068	1,071	1,071	1,126	1,132	1,134	1,132	1,136
A162 Knottingley	215	215	214	215	214	205	206	206	206	205	338	339	339	339	339
A1M Knottingley Jcn 41	784	786	775	766	757	1,058	1,074	1,071	1,050	1,050	1,057	1,066	1,064	1,055	1,038
Total	**6,004**	**6,033**	**6,118**	**6,315**	**6,561**	**7,454**	**7,511**	**7,627**	**7,831**	**8,114**	**8,766**	**8,839**	**8,926**	**9,137**	**9,362**
Southbound															
Humber Bridge	906	943	1,033	1,304	1,559	1,139	1,202	1,334	1,607	1,859	1,453	1,526	1,619	1,830	2,059
A614 Goole	929	929	925	932	944	1,172	1,166	1,162	1,162	1,202	1,395	1,387	1,383	1,390	1,404
M62 Goole Jcn 36 & 37	1,388	1,385	1,387	1,372	1,362	1,978	1,949	1,941	1,935	1,919	2,705	2,694	2,695	2,660	2,633
A1041 Selby	517	514	510	508	495	567	563	560	557	547	625	619	617	612	592
A19 Selby	991	994	998	993	993	1,033	1,027	1,032	1,029	1,030	1,115	1,107	1,109	1,108	1,111
A162 Knottingley	239	238	236	235	234	223	229	227	224	225	373	374	374	374	373
A1M Knottingley Jcn 41	899	898	897	841	842	1,245	1,249	1,245	1,196	1,188	1,260	1,268	1,265	1,263	1,195
Total	**5,870**	**5,899**	**5,986**	**6,185**	**6,430**	**7,357**	**7,384**	**7,502**	**7,711**	**7,970**	**8,926**	**8,976**	**9,062**	**9,237**	**9,367**

Capabilities on project:
Transportation

Table 21 PM - East/West Screenline

Description	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll
Eastbound															
M62 Jcn 38 to North Cave	258	257	255	257	258	316	316	317	316	312	360	364	364	366	366
M62 Jcn 38 to A63 Hull	1,572	1,571	1,570	1,591	1,614	1,927	1,920	1,927	1,931	1,966	2,480	2,496	2,489	2,467	2,461
A1077 Winterton - N of Scunthorpe	477	478	482	486	508	500	503	495	502	516	590	577	583	601	624
A18 Scunthorpe	2,055	2,056	2,053	2,056	2,052	2,102	2,096	2,091	2,089	2,086	2,246	2,236	2,234	2,236	2,233
M180 Scunthorpe - Jcn 4	1,361	1,354	1,354	1,277	1,246	1,591	1,580	1,576	1,518	1,468	1,713	1,700	1,688	1,669	1,583
Total	**5,722**	**5,717**	**5,715**	**5,667**	**5,678**	**6,436**	**6,415**	**6,406**	**6,355**	**6,349**	**7,388**	**7,372**	**7,359**	**7,339**	**7,267**
Westbound															
M62 Jcn 38 to North Cave	187	185	184	182	180	244	244	243	242	242	435	435	435	433	434
M62 Jcn 38 to A63 Hull	1,512	1,508	1,508	1,511	1,522	2,027	2,020	2,004	1,999	2,051	2,568	2,578	2,579	2,556	2,567
A1077 Winterton - N of Scunthorpe	317	321	332	347	372	428	436	451	452	461	538	548	555	574	585
A18 Scunthorpe	1,728	1,728	1,724	1,725	1,722	1,763	1,770	1,771	1,769	1,772	1,828	1,840	1,842	1,821	1,813
M180 Scunthorpe - Jcn 4	1,002	999	990	961	938	1,490	1,504	1,498	1,482	1,426	1,661	1,686	1,675	1,646	1,596
Total	**4,745**	**4,741**	**4,737**	**4,728**	**4,735**	**5,953**	**5,975**	**5,967**	**5,945**	**5,952**	**7,029**	**7,087**	**7,086**	**7,029**	**6,996**

Capabilities on project:
Transportation

Table 22 PM – Humber Estuary Cordon Inbound

Description	2010					2021					2033				
	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll
A1033 Withernsea	370	370	371	372	372	456	459	460	463	465	438	438	439	439	440
B1238 Aldbrough	452	452	452	452	453	524	526	528	531	533	699	707	708	710	713
A165 Hornsea	363	363	363	364	366	454	457	457	456	456	598	608	607	609	611
A1174 Woodsmansey –	478	479	482	479	482	460	463	468	470	472	460	458	455	463	460
A1079 Beverley	945	944	942	942	937	1,140	1,139	1,136	1,131	1,125	1,109	1,119	1,121	1,115	1,118
A164 Beverley	1,154	1,157	1,164	1,183	1,201	1,311	1,314	1,322	1,331	1,343	1,566	1,568	1,579	1,587	1,602
B1230 Walkington	277	275	274	272	269	333	332	330	330	329	504	505	504	502	503
A1034 South of Market	348	351	356	416	423	376	383	391	445	464	476	482	483	490	563
A614 West of M Weighton	691	692	688	684	682	790	789	784	781	774	898	901	895	891	883
A19 York	1,214	1,211	1,209	1,215	1,226	1,251	1,247	1,248	1,251	1,256	1,326	1,333	1,331	1,331	1,331
B1222 York	705	707	705	701	690	823	833	828	833	825	904	925	930	928	938
A162 South of Tadcaster	618	618	616	615	615	606	602	601	598	598	809	812	812	812	811
A1M betw Jcn 44 and 43	2,926	2,927	2,931	2,875	2,878	3,614	3,629	3,630	3,580	3,578	4,275	4,296	4,296	4,296	4,231
M1 betw Jcn 46 and 47	1,920	1,921	1,921	1,922	1,923	2,351	2,345	2,344	2,347	2,350	2,879	2,874	2,873	2,877	2,879
M62 Castleford betw Jcn	3,872	3,872	3,872	3,874	3,875	4,461	4,459	4,458	4,459	4,457	5,198	5,193	5,191	5,192	5,192
A1M Doncaster betw Jcn	124	124	124	124	124	158	158	158	158	160	214	215	216	229	233
A638 Doncaster betw Jcn	34	34	34	34	34	37	37	37	37	35	55	56	56	56	56
A19 Doncaster	17	17	17	17	17	16	16	17	17	17	29	30	29	30	30
A18 Doncaster to Thorne	114	114	114	114	114	116	115	118	119	119	262	262	262	261	261
M18 Thorne betw Jcn 4	1,159	1,159	1,156	1,153	1,146	1,450	1,443	1,435	1,430	1,421	1,872	1,863	1,852	1,824	1,811
A614 Thorne	48	48	47	48	48	52	52	52	51	51	154	160	161	161	161
A161 Haxey/Epworth	676	676	676	676	677	785	783	782	783	784	691	682	688	691	718
A159 Scotter - South of	716	716	715	717	717	737	734	734	733	733	813	813	813	815	818
A15 Kirton in Lyndsey	914	915	922	935	955	1,144	1,156	1,169	1,177	1,192	1,326	1,338	1,346	1,357	1,363
B1434 North Kelsey	112	113	117	124	131	117	113	123	131	152	154	154	156	173	191
A1084 Caistor	474	475	476	482	485	530	529	533	534	541	571	567	566	571	577
A1173 Irby upon Humber	437	437	437	430	432	398	392	391	388	382	457	452	449	450	441
A18 Irby upon Humber	615	616	619	603	554	581	570	561	577	600	588	595	604	620	638
A1136 Grimsby	572	575	574	567	563	680	678	673	667	685	698	696	697	702	702
A180 Europarc/Grimsby	1,442	1,443	1,446	1,471	1,517	1,803	1,831	1,844	1,846	1,813	2,100	2,116	2,119	2,108	2,098
TOTAL	**23,787**	**23,799**	**23,819**	**23,859**	**23,902**	**27,554**	**27,585**	**27,612**	**27,654**	**27,711**	**32,124**	**32,219**	**32,238**	**32,288**	**32,371**

Capabilities on project:
Transportation

Table 23 PM – Humber Estuary Cordon Outbound

Description	2010					2021					2033				
	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll	Do Min	-10%	-26%	-63%	No Toll
A1033 Withernsea	398	398	398	399	400	510	512	512	517	520	585	584	585	588	590
B1238 Aldbrough	571	571	571	572	572	636	636	636	638	639	739	737	738	739	740
A165 Hornsea	296	295	295	294	293	322	321	321	321	322	386	384	383	383	381
A1174 Woodsmansey	347	346	348	350	354	361	359	360	361	363	398	401	397	399	401
A1079 Beverley	879	879	874	865	857	998	996	996	992	984	1,225	1,199	1,216	1,206	1,208
A164 Beverley	1,024	1,026	1,035	1,050	1,069	1,297	1,303	1,311	1,327	1,343	1,328	1,337	1,331	1,343	1,347
B1230 Walkington	358	358	355	359	359	404	404	404	403	400	458	456	454	453	452
A1034 South of Market	329	332	342	357	363	386	389	394	419	425	446	450	454	472	510
A614 West of M Weighton	608	609	609	608	608	669	668	667	664	665	743	746	740	736	737
A19 York	1,123	1,130	1,120	1,122	1,119	1,200	1,204	1,203	1,200	1,197	1,289	1,281	1,282	1,289	1,283
B1222 York	612	606	611	609	612	726	744	746	747	748	782	804	806	797	799
A162 South of Tadcaster	578	578	578	578	579	580	578	577	577	576	752	747	748	748	749
A1M betw Jcn 44 and 43	2,600	2,601	2,598	2,587	2,588	3,253	3,245	3,246	3,232	3,233	3,736	3,729	3,727	3,720	3,710
M1 betw Jcn 46 and 47	2,050	2,050	2,051	2,052	2,054	2,438	2,446	2,446	2,448	2,452	3,067	3,076	3,078	3,079	3,082
M62 Castleford betw Jcn	3,404	3,404	3,405	3,404	3,405	4,112	4,112	4,113	4,114	4,113	4,854	4,859	4,859	4,859	4,862
A1M Doncaster betw Jcn	102	102	102	102	102	133	134	133	133	132	195	195	195	196	195
A638 Doncaster betw Jcn	67	67	67	67	67	74	74	74	74	74	104	104	104	103	103
A19 Doncaster	39	39	39	39	39	46	46	46	46	46	62	62	62	62	62
A18 Doncaster to Thorne	65	65	65	65	65	59	59	59	59	59	177	177	176	176	176
M18 Thorne betw Jcn 4	1,198	1,198	1,197	1,190	1,179	1,587	1,573	1,562	1,556	1,548	1,913	1,913	1,912	1,883	1,874
A614 Thorne	43	42	42	42	42	57	57	56	56	56	79	79	80	79	78
A161 Haxey/Epworth	640	640	640	639	640	783	783	788	794	800	687	688	689	692	698
A159 Scotter - South of	667	667	668	667	667	725	728	728	728	728	797	801	801	801	802
A15 Kirton in Lyndsey	981	983	986	995	1,010	1,061	1,072	1,088	1,094	1,101	1,118	1,109	1,112	1,132	1,138
B1434 North Kelsey	106	107	109	120	134	185	186	188	193	210	226	232	235	246	257
A1084 Caistor	408	407	407	408	410	441	442	444	444	450	550	554	553	556	556
A1173 Irby upon Humber	524	527	527	516	488	562	564	564	555	553	595	625	621	618	606
A18 Irby upon Humber	664	666	675	685	698	867	871	875	885	891	896	897	900	910	918
A1136 Grimsby	564	566	564	565	566	878	875	872	873	871	927	912	918	924	908
A180 Europarc/Grimsby	1,483	1,482	1,485	1,495	1,508	1,794	1,799	1,806	1,810	1,823	2,057	2,074	2,073	2,083	2,109
TOTAL	**22,729**	**22,741**	**22,765**	**22,802**	**22,845**	**27,144**	**27,180**	**27,214**	**27,262**	**27,322**	**31,171**	**31,213**	**31,229**	**31,270**	**31,330**

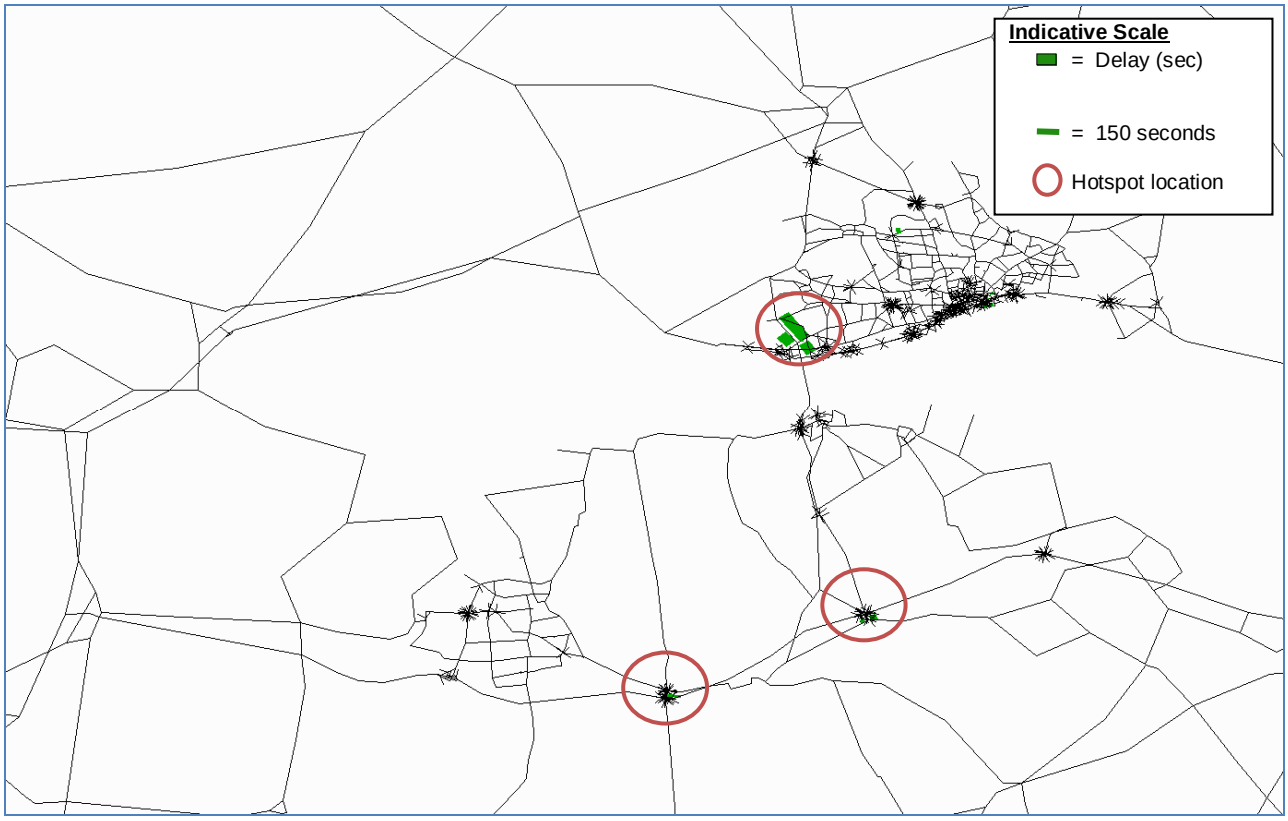
5.4.3 Impact on Junction Delays

A review of network delays was undertaken for each scenario tested. In the majority of cases, the levels of delays were relatively minor; however under a 'No Toll' scenario in 2033, significant increases in delay occurred at the following locations on the network:

- A15/A164/A1105 (Roundabout to the north of the Humber Bridge), up to several minutes of delay;
- A15/A180/M180, delays of up to 2.5 minutes on the westbound A180 off-slip; and
- A18/A15 (north of M180 Junction 4), A18 Westbound approach with delays of up to a minute.

These locations are shown in the diagram below.

Figure 25 Impacts on Delay 2033 AM Peak ('No Toll' compared to 'Do Min')



A sensitivity test was undertaken to relieve the impacts of the congestion at this junction as all trips accessing the Humber Bridge must pass through this junction. This was undertaken by introducing filter lanes on all four arms of the junction, so that left turning traffic could avoid the junction. This provided a significant improvement reducing junction delays on most arms, however some junction delay remained due to heavy right turn movements through the junction.

A run of the demand model was undertaken to assess the impacts of these changes, to assess the materiality of this congestion on the network. The resultant change in the total matrices, was extremely minor (approximately 20pcus change), however some changes of trip routing was apparent.

Figure 26 summarises the change in traffic flow as a result of a run of the demand model showing some increased usage of the Humber Bridge (circa additional 180pcus per hr – AM Peak).

Figure 26 Impact of Junction Sensitivity Test – Traffic Flows

5.4.4 Summary of Journey Time Impacts

A review of journey times under each scenario was undertaken for a number of journeys across the network. The routes are described in Table 24.

Table 24 Description of Routes Used for Journey Time Analysis

Route Ref	Description
1	HULL TO LINCOLN (Via Humber Bridge)
2	HULL TO GRIMSBY (Via Humber Bridge)
3	HULL TO IMMINGHAM (Via Humber Bridge)
4	HULL TO THORNE (Via Humber Bridge)
5	HULL TO SCUNTHORPE NTH (Via Humber Bridge)
6	HULL TO SCUNTHORPE STH (Via Humber Bridge)
7	HULL TO THORNE (via M62)
8	GRIMSBY TO YORK (Via Humber Bridge)
9	LINCOLN TO DRIFIELD (Via Humber Bridge)
10	HULL TO YORK VIA THORNE (via M62)

Figures 27 to 32 illustrate the impacts by scenario by time period.

Capabilities on project:
Transportation

Figure 27 2021 AM Peak – Comparison of Journey Times by Scenario: Inbound

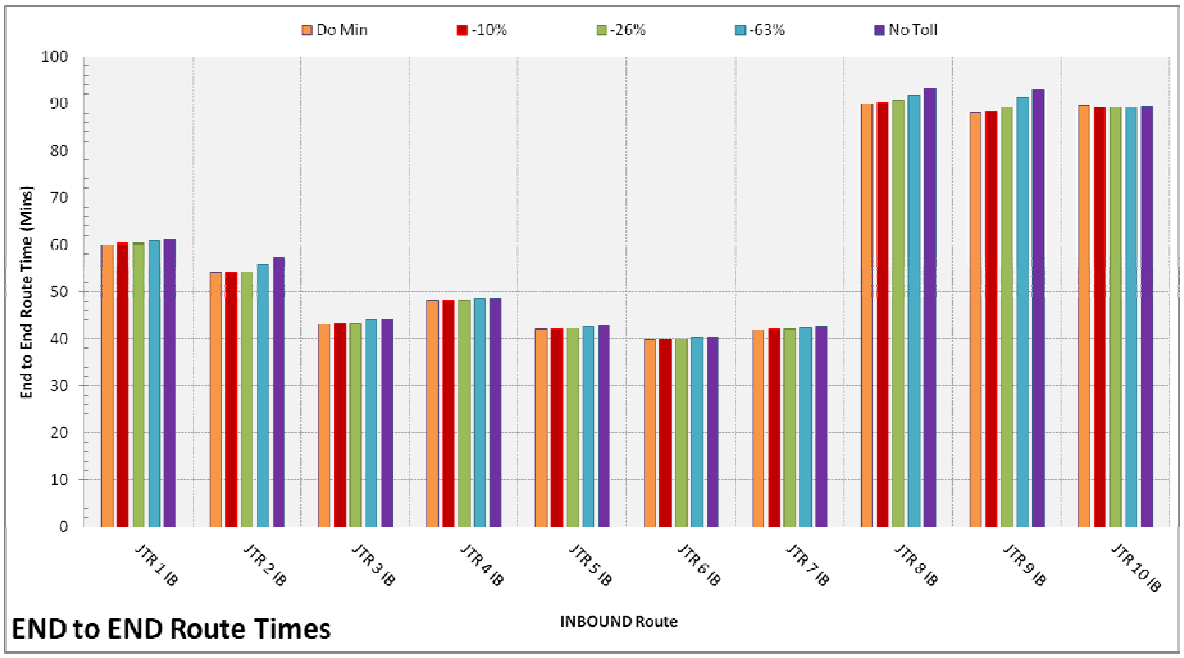
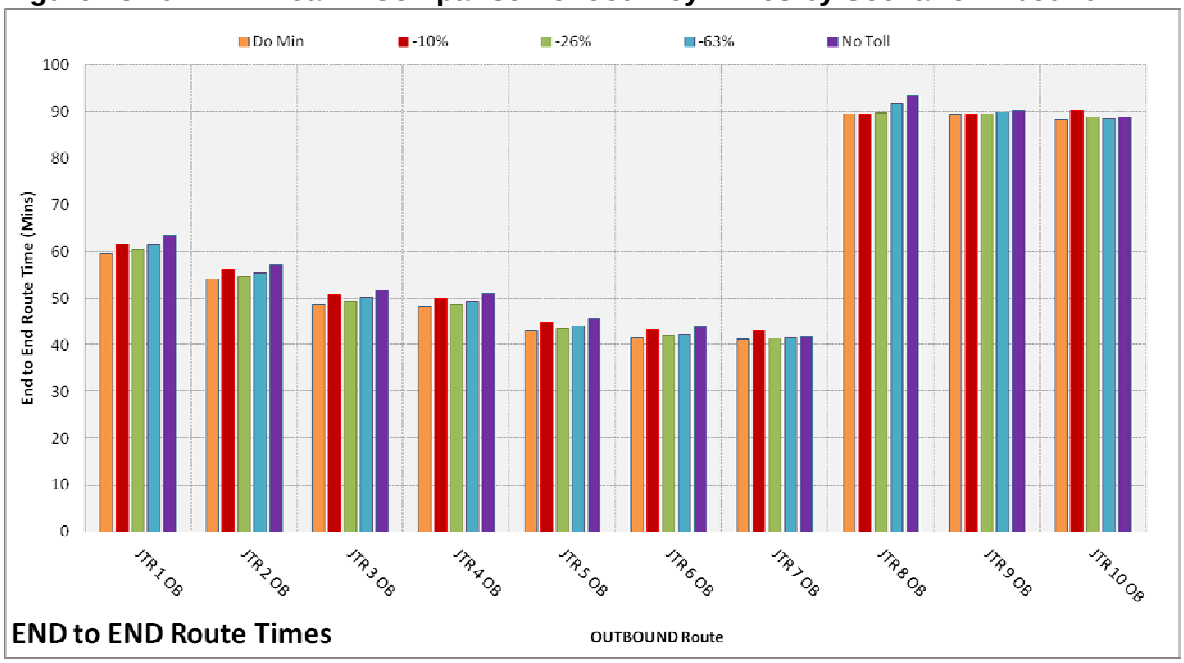


Figure 28 2021 AM Peak – Comparison of Journey Times by Scenario: Inbound



Capabilities on project:
Transportation

Figure 29 2021 Interpeak – Comparison of Journey Times by Scenario: Inbound

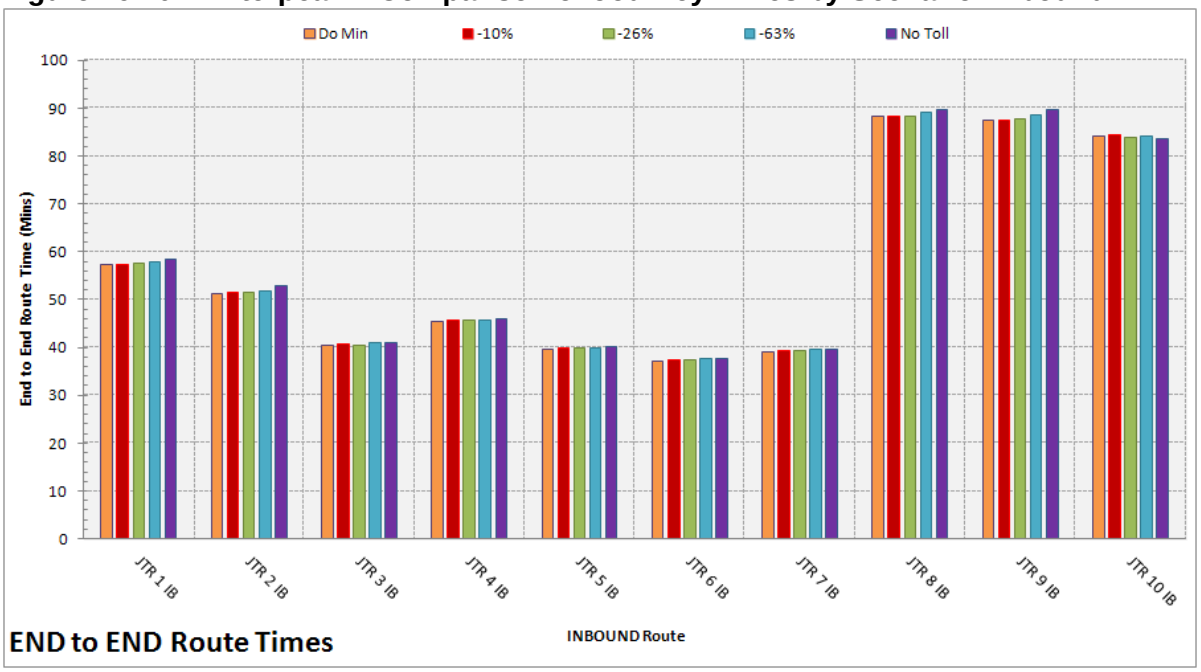


Figure 30 2021 Interpeak – Comparison of Journey Times by Scenario: Inbound

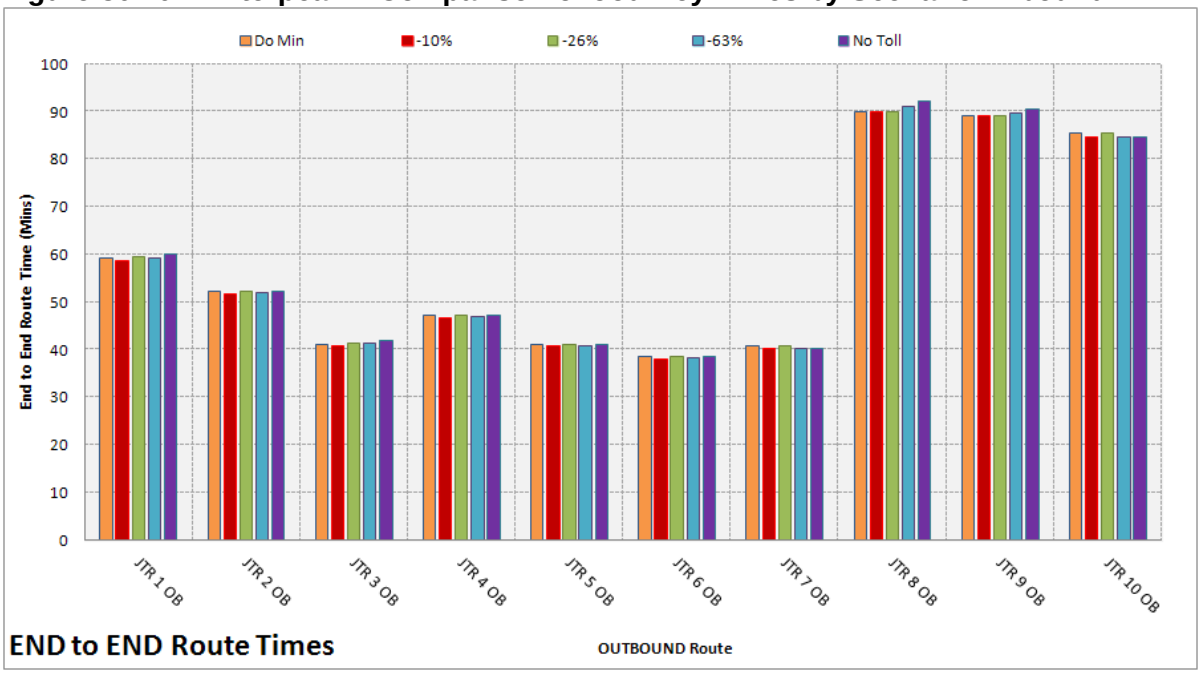


Figure 31 2021 PM Peak – Comparison of Journey Times by Scenario: Inbound

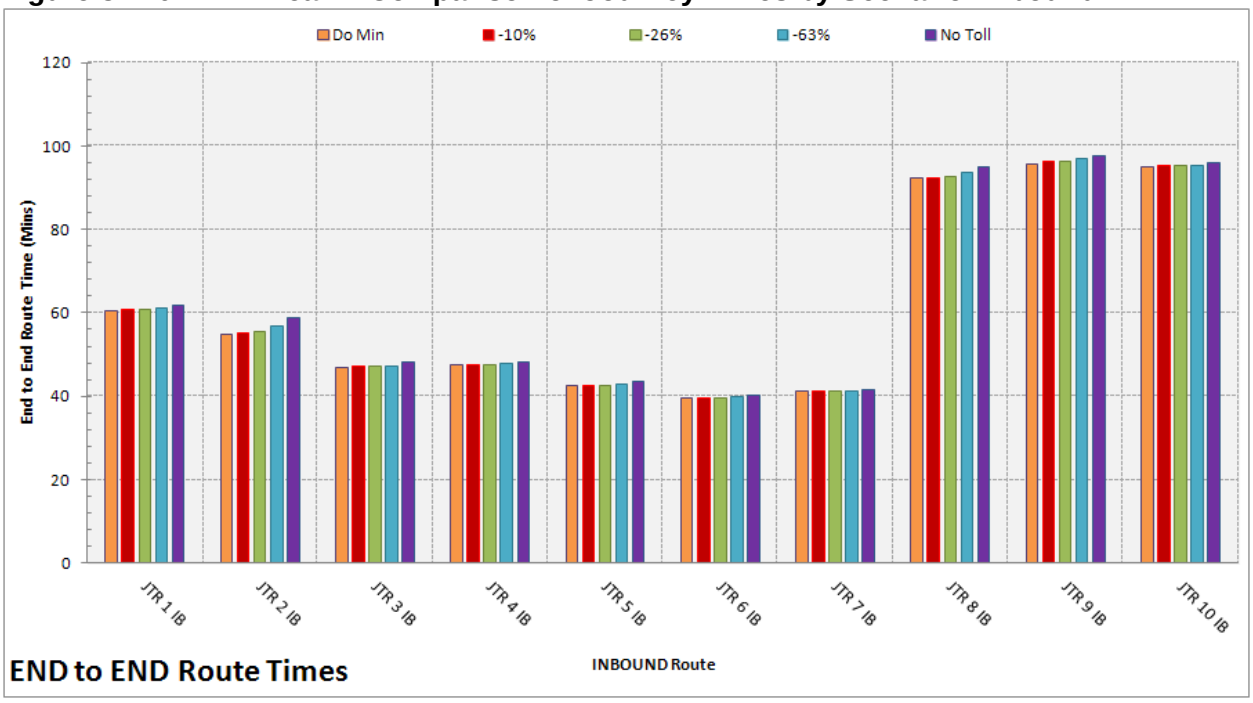
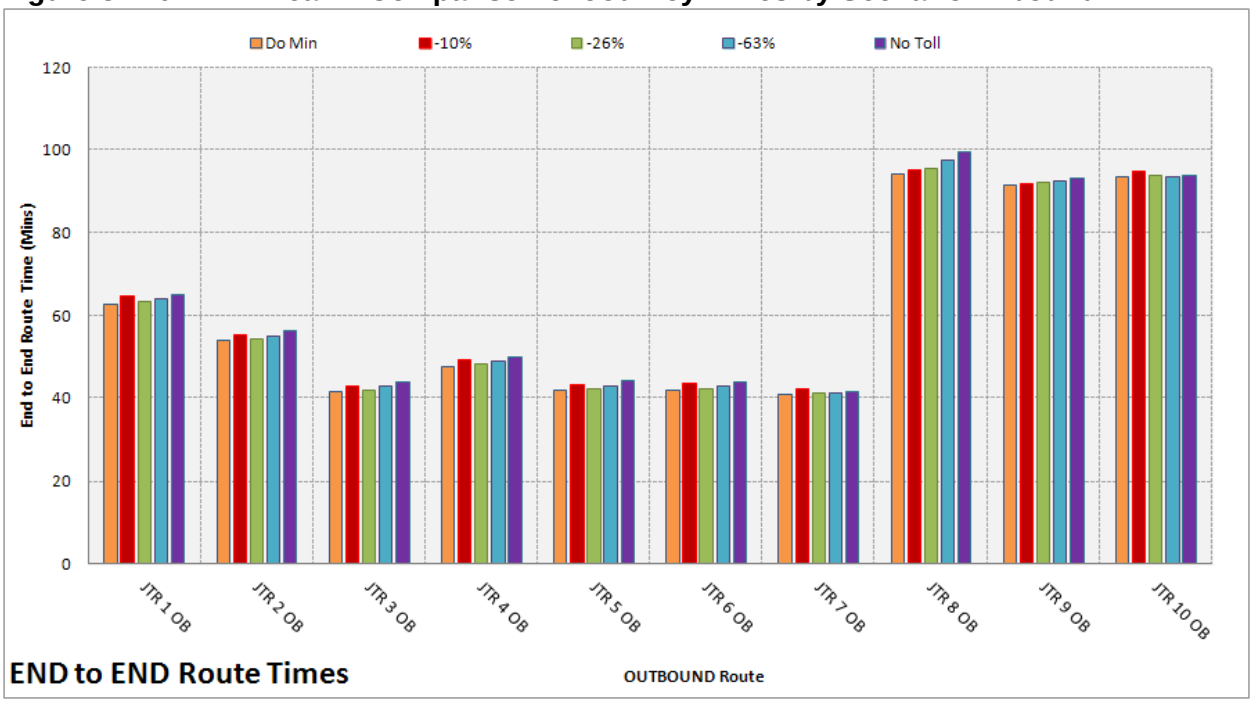


Figure 32 2021 PM Peak – Comparison of Journey Times by Scenario: Inbound



A further comparison was undertaken to compare the no toll scenario and the do minimum under each of the forecast years. Over time there is a general increase in journey times across the network which is to be expected due to a general increase in traffic flows. There is also, in 2033, a more significant difference between do minimum and No Toll journey times for a number of routes using the Bridge. In particular, in the southbound direction, where differences in journey times may exceed 7 minutes. For example, a journey between Hull and Immingham (Route 3) may take up to 45% longer than was observed in the 2010 validated base model. These results are presented in Figure 33 and Figure 34 for the AM peak and in Figures 35 to 38 for the remaining periods.

Capabilities on project:
Transportation

Figure 33 AM Peak Do Min and Do Something Comparison between Forecast Years: Northbound

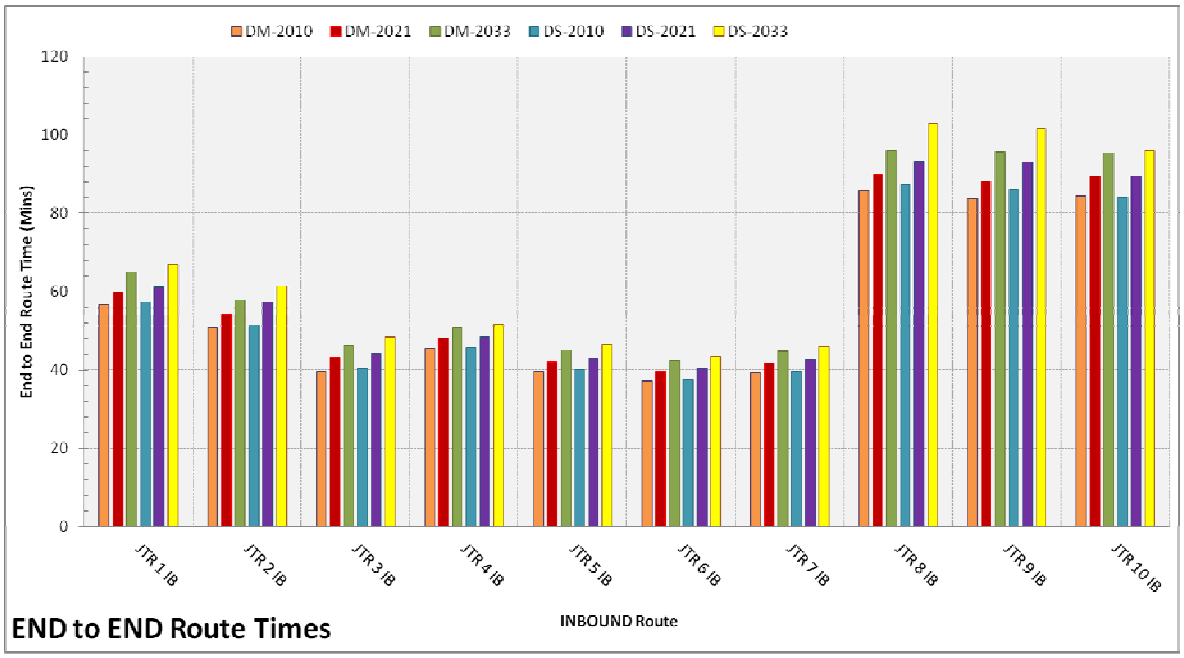
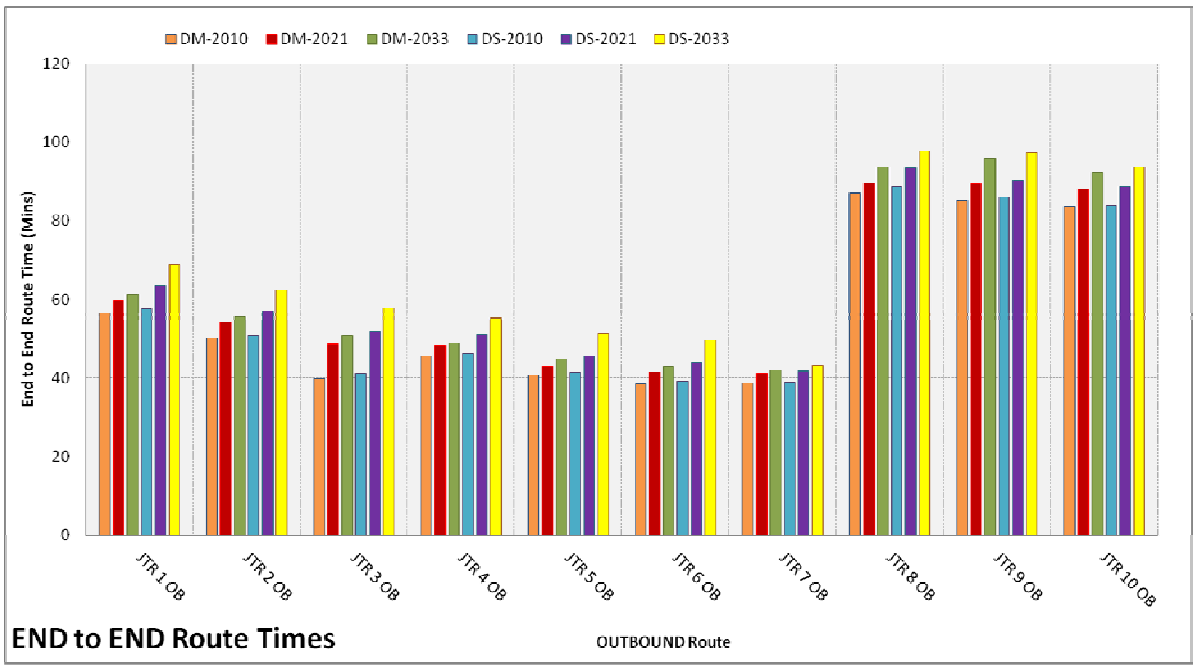


Figure 34 AM Peak Do Min and Do Something Comparison between Forecast Years: Southbound



Capabilities on project:
Transportation

Figure 35 Interpeak Do Min and Do Something Comparison between Forecast Years: Northbound

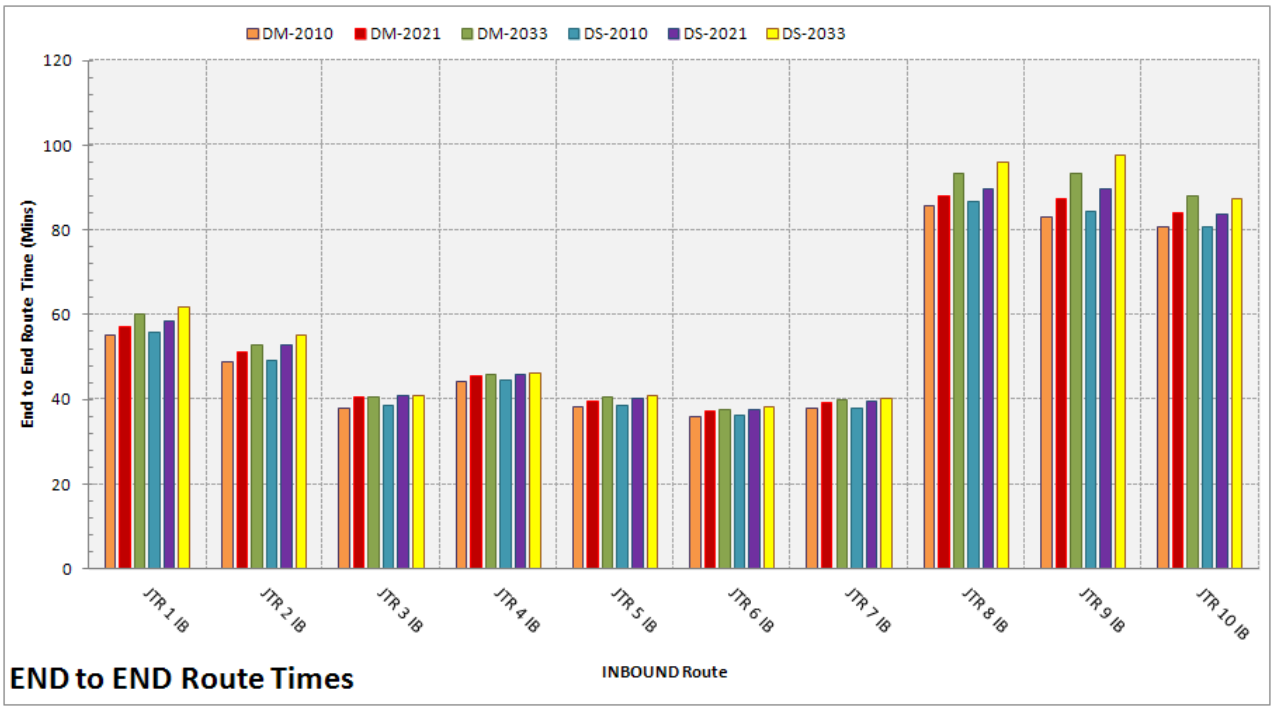


Figure 36 Interpeak Do Min and Do Something Comparison between Forecast Years: Southbound

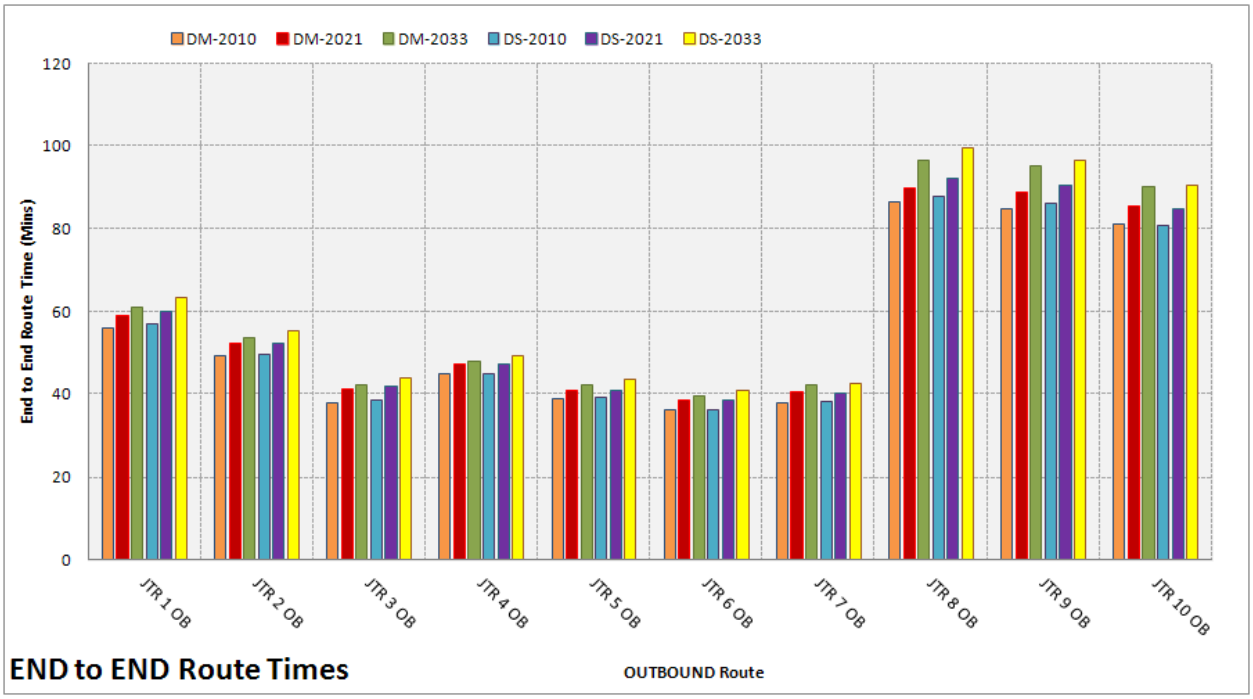


Figure 37 PM Peak Do Min and Do Something Comparison between Forecast Years: Northbound

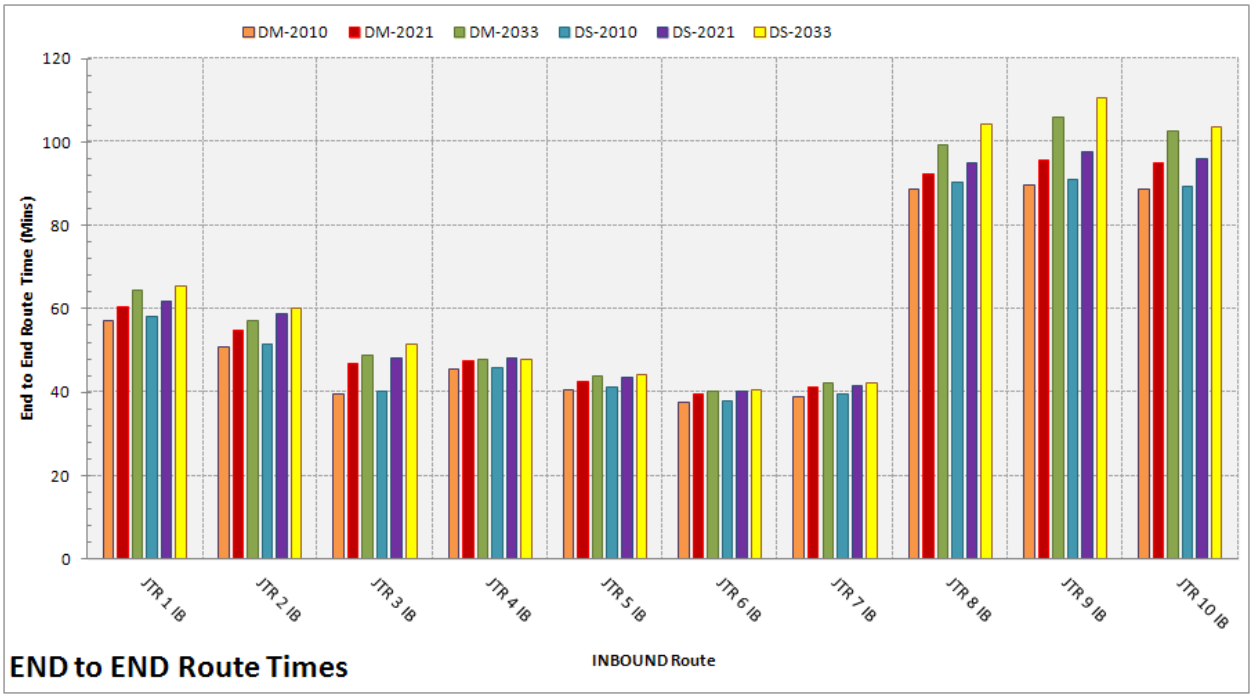
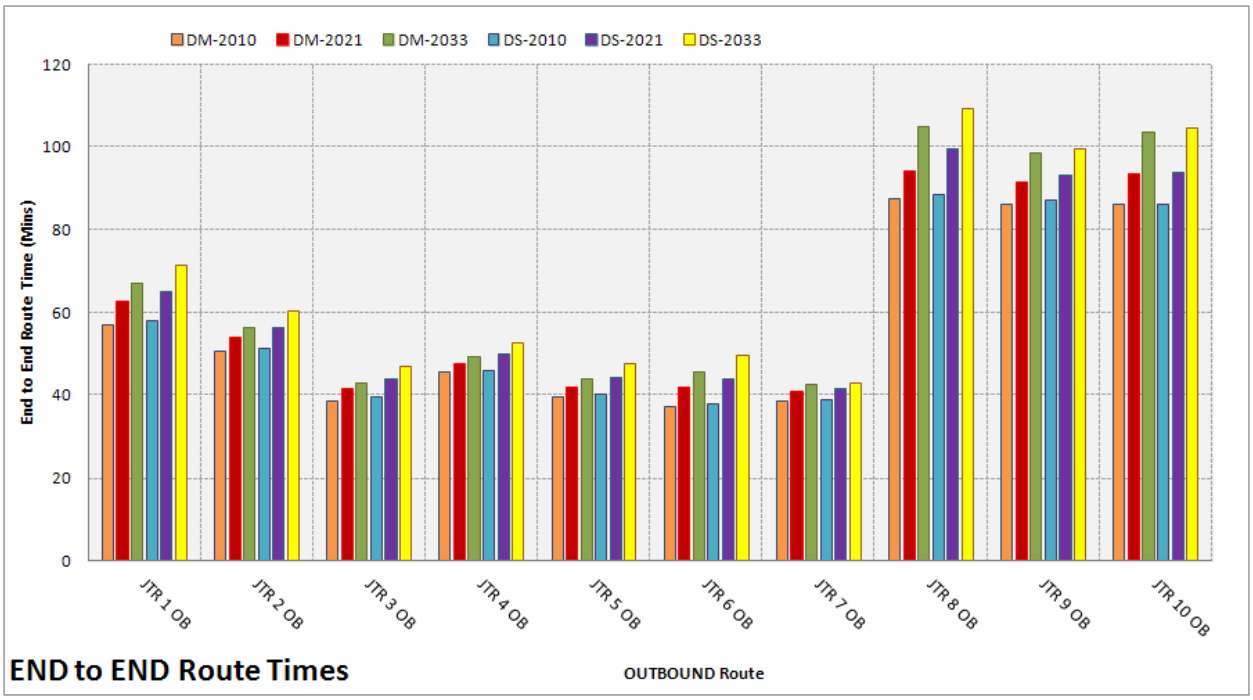


Figure 38 PM Peak Do Min and Do Something Comparison between Forecast Years: Southbound



5.5 Cross Humber Traffic Flows

A review of cross Humber movements was undertaken to identify the impacts of each toll scenario. This is summarised in Table 25.

Table 25 Summary of Traffic Crossing the Humber Estuary

	A15 Humber Bridge			M62 Humber Crossing		
Name of test	**AM Peak**	**Interpeak**	**PM Peak**	**AM Peak**	**Interpeak**	**PM Peak**
2010						
DM	2,277	1,652	1,921	3,060	2,796	2,857
DS -10%	2,337	1,701	1,989	3,050	2,788	2,850
DS -26%	2,515	1,824	2,172	3,038	2,768	2,851
DS -63%	3,015	2,224	2,638	3,000	2,758	2,849
DS No Toll	3,507	2,761	3,131	2,985	2,655	2,842
2021						
DM	2,937	2,107	2,513	3,799	3,524	3,931
DS -10%	3,051	2,167	2,639	3,792	3,543	3,887
DS -26%	3,252	2,332	2,875	3,778	3,497	3,885
DS -63%	3,768	2,791	3,379	3,719	3,457	3,875
DS No Toll	4,189	3,361	3,911	3,713	3,360	3,861
2033						
DM	3,437	2,540	3,046	4,672	4,399	5,194
DS -10%	3,561	2,618	3,180	4,666	4,390	5,183
DS -26%	3,728	2,783	3,370	4,636	4,358	5,166
DS -63%	4,119	3,261	3,828	4,595	4,310	5,108
DS No Toll	4,403	3,813	4,339	4,513	4,200	5,041

A more detailed review was also undertaken on the traffic flows using the bridge to identify the impacts on different vehicle classes of changes to the toll (see Tables 26 to 34). The following key points were identified:

- The vehicle types who are least impacted by changes to the toll are business trips (HBEB and NHBEB) which result in increases of around 5% – 10% under no toll conditions;
- The vehicles types most impacted by the toll are the more cost sensitive low income groups in the Home Based Work and Home Based Other Category showing around a doubling of trips as a result of removing the toll; and
- The HGV class most affected by the toll are the largest HGV size which currently experiences the highest charge. As a result of removing the toll, this vehicle class received the most significant time saving (due to the cost saving).

Table 26 AM Peak 2010 Two Way Traffic Flows Over the Humber Bridge

Description	Do Min	-10%	-26%	-63%	No Toll
HBW (Low)	147	155	178	245	332
HBW (Med)	185	191	216	270	337
HBW (High)	358	372	406	477	563
HBEB	303	303	307	317	322
HBO (Low)	96	102	116	156	207
HBO (Med)	63	67	76	98	125
HBO (High)	103	107	122	152	190
NHBEB	155	156	158	164	168
NHBO	85	88	97	112	129
HGV (3.5t to 7.5t)	374	375	383	425	424
HGV (over 7.5t 2 axles)	123	125	125	127	128
HGV (over 7.5t 3 axles)	91	101	128	138	167
HGV (over 7.5t & 4+ axles)	193	194	203	332	415
Total	**2277**	**2337**	**2515**	**3015**	**3507**

Table 27 Interpeak 2010 Two Way Traffic flows over the Humber Bridge

Description	Do Min	-10%	-26%	-63%	No Toll
HBW (Low)	47	49	57	77	105
HBW (Med)	59	61	69	85	107
HBW (High)	113	117	129	152	179
HBEB	87	90	90	93	95
HBO (Low)	160	171	196	265	350
HBO (Med)	106	112	127	166	212
HBO (High)	174	182	205	257	321
NHBEB	234	236	239	250	255
NHBO	128	135	146	169	197
HGV (3.5t to 7.5t)	188	191	198	207	249
HGV (over 7.5t 2 axles)	82	83	84	88	103
HGV (over 7.5t 3 axles)	102	103	106	121	176
HGV (over 7.5t & 4+ axles)	172	172	179	293	414
Total	**1652**	**1701**	**1824**	**2224**	**2761**

Table 28 PM Peak 2010 Two Way Traffic flows over the Humber Bridge

Description	Do Min	-10%	-26%	-63%	No Toll
HBW (Low)	136	143	166	228	310
HBW (Med)	171	179	200	252	315
HBW (High)	332	346	377	450	527
HBEB	172	173	175	179	183
HBO (Low)	164	174	201	269	358
HBO (Med)	107	113	130	169	217
HBO (High)	176	185	210	264	329
NHBEB	154	156	158	164	168
NHBO	84	87	96	112	130
HGV (3.5t to 7.5t)	216	216	224	235	237
HGV (over 7.5t 2 axles)	35	38	42	43	46
HGV (over 7.5t 3 axles)	40	45	50	56	61
HGV (over 7.5t & 4+ axles)	111	111	122	195	232
Total	**1898**	**1966**	**2151**	**2616**	**3113**

Table 29 AM Peak 2021 Two Way Traffic flows over the Humber Bridge

Description	Do Min	-10%	-26%	-63%	No Toll
HBW (Low)	226	253	288	374	469
HBW (Med)	279	292	321	386	450
HBW (High)	520	540	583	664	745
HBEB	351	352	355	355	344
HBO (Low)	135	146	168	213	263
HBO (Med)	84	91	104	127	152
HBO (High)	132	142	160	191	223
NHBEB	188	191	193	194	187
NHBO	107	112	121	135	147
HGV (3.5t to 7.5t)	474	480	481	529	512
HGV (over 7.5t 2 axles)	137	137	138	138	134
HGV (over 7.5t 3 axles)	102	114	123	149	166
HGV (over 7.5t & 4+ axles)	200	200	220	314	397
Total	**2937**	**3051**	**3252**	**3768**	**4189**

Table 30 Interpeak 2021 Two Way Traffic flows over the Humber Bridge

Description	Do Min	-10%	-26%	-63%	No Toll
HBW (Low)	75	80	91	120	157
HBW (Med)	89	92	102	124	151
HBW (High)	166	171	185	217	250
HBEB	103	103	104	105	106
HBO (Low)	230	243	280	368	470
HBO (Med)	143	152	173	220	272
HBO (High)	225	240	269	331	399
NHBEB	288	289	292	299	304
NHBO	164	170	183	212	239
HGV (3.5t to 7.5t)	245	246	254	262	305
HGV (over 7.5t 2 axles)	91	91	92	98	111
HGV (over 7.5t 3 axles)	112	113	115	132	187
HGV (over 7.5t & 4+ axles)	177	177	192	302	410
Total	**2107**	**2167**	**2332**	**2791**	**3361**

Table 31 PM Peak 2021 Two Way Traffic Flows over the Humber Bridge

Description	Do Min	-10%	-26%	-63%	No Toll
HBW (Low)	216	231	268	349	447
HBW (Med)	253	268	299	360	427
HBW (High)	477	503	542	613	704
HBEB	199	200	201	203	201
HBO (Low)	226	248	289	374	468
HBO (Med)	142	157	177	223	272
HBO (High)	224	246	275	335	399
NHBEB	187	189	191	194	193
NHBO	107	112	119	135	151
HGV (3.5t to 7.5t)	277	276	289	293	297
HGV (over 7.5t 2 axles)	40	45	46	47	50
HGV (over 7.5t 3 axles)	48	48	52	60	65
HGV (over 7.5t & 4+ axles)	117	117	126	193	237
Total	**2513**	**2639**	**2875**	**3379**	**3911**

Capabilities on project:
Transportation

Table 32 AM Peak 2033 Two Way Traffic flows over the Humber Bridge

Description	Do Min	-10%	-26%	-63%	No Toll
HBW (Low)	280	302	335	462	522
HBW (Med)	326	345	365	453	469
HBW (High)	596	617	642	752	758
HBEB	385	386	385	402	351
HBO (Low)	157	178	205	273	300
HBO (Med)	117	126	134	167	176
HBO (High)	197	209	222	24	274
NHBEB	189	193	192	200	173
NHBO	119	124	128	146	140
HGV (3.5t to 7.5t)	602	600	601	637	592
HGV (over 7.5t 2 axles)	142	141	142	146	127
HGV (over 7.5t 3 axles)	109	121	121	153	142
HGV (over 7.5t & 4+ axles)	219	220	255	304	378
Total	**3437**	**3561**	**3728**	**4119**	**4403**

Table 33 Interpeak 2033 Two Way Traffic Flows over the Humber Bridge

Description	Do Min	-10%	-26%	-63%	No Toll
HBW (Low)	92	97	109	145	186
HBW (Med)	109	113	122	143	167
HBW (High)	195	200	209	241	270
HBEB	116	116	116	117	115
HBO (Low)	276	306	359	463	584
HBO (Med)	208	218	234	287	343
HBO (High)	344	359	386	457	528
NHBEB	296	296	298	305	303
NHBO	189	193	201	223	243
HGV (3.5t to 7.5t)	307	310	313	335	376
HGV (over 7.5t 2 axles)	95	96	98	101	112
HGV (over 7.5t 3 axles)	118	119	119	138	168
HGV (over 7.5t & 4+ axles)	196	197	219	305	418
Total	**2540**	**2618**	**2783**	**3261**	**3813**

Table 34 PM Peak 2033 Two Way Traffic Flows over the Humber Bridge

Description	Do Min	-10%	-26%	-63%	No Toll
HBW (Low)	263	283	313	407	499
HBW (Med)	309	324	349	407	463
HBW (High)	559	579	605	666	722
HBEB	219	221	221	218	208
HBO (Low)	271	293	334	455	555
HBO (Med)	203	216	234	279	325
HBO (High)	342	361	385	447	503
NHBEB	191	193	193	192	183
NHBO	120	124	130	141	150
HGV (3.5t to 7.5t)	350	367	372	371	366
HGV (over 7.5t 2 axles)	42	42	44	44	50
HGV (over 7.5t 3 axles)	46	46	50	56	66
HGV (over 7.5t & 4+ axles)	130	131	140	144	250
Total	**3046**	**3180**	**3370**	**3828**	**4339**

5.5.1 Select Link Analysis – The Bridge

A select link analysis was undertaken to identify the routeing of traffic using the Humber Bridge under each of the scenarios. A series of select link plots within SATURN were generated showing the routings of traffic using the bridge, a summary of these are shown in Figures 39 and 40.

A simple 9 x 9 sector system was also developed to identify changes in origins and destinations as a result of the scheme, in particular identifying the origins and destinations of additional trips using the bridge.

These are summarised in Table 35.

Figure 39 Humber Bridge Northbound - 2021 AM Peak (No Toll – Do Min)

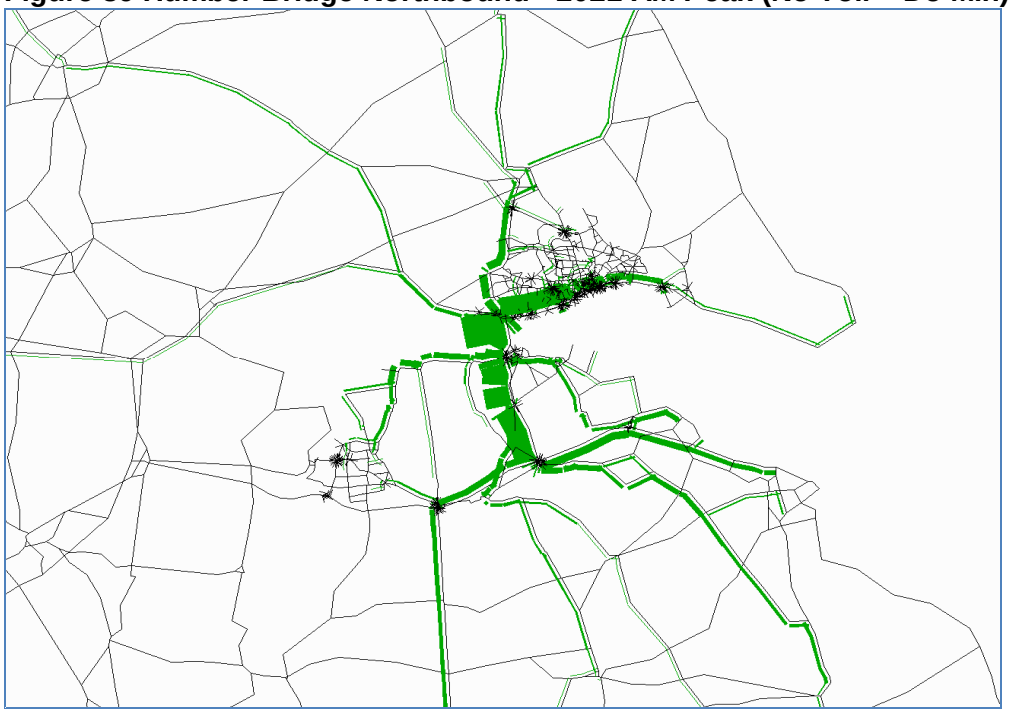


Figure 40 Humber Bridge Southbound - 2021 AM Peak (No Toll – Do Min)

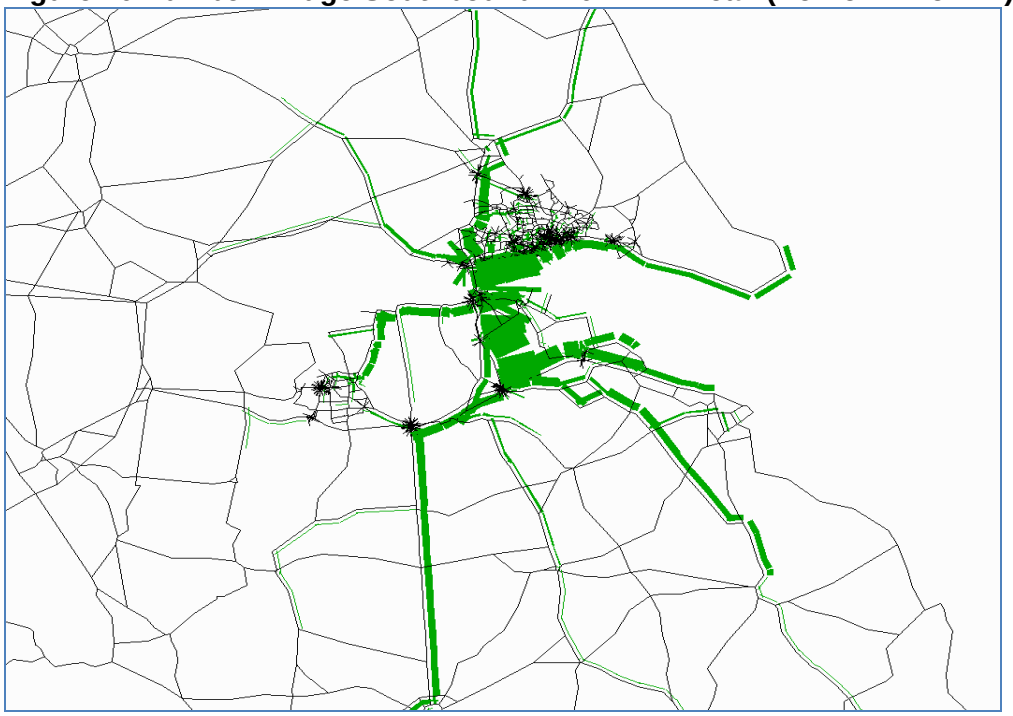


Table 35 Summary of Changes in Traffic Flows Using the Humber Bridge (2033 AM Peak) Between 'No Toll' and 'Do Min' Scenarios

Zone Description	Zone	1	2	3	4	5	6	7	8	9
Do Minimum										
Hull & Beverley	1	No Flow				257	371	688	253	197
North of Hull (Driffield & N Yorks)	2					11	29	167	6	1
West of Hull (Market Weighton)	3					11	17	28	37	2
North (York & Outer area)	4					1	32	24	8	0
Scunthorpe and surroundings	5	266	14	12	1	No Flow				
Barton Upon Humber & Brigg	6	417	32	16	43					
Immingham & Grimsby	7	459	30	45	32					
Lincolnshire	8	235	13	38	7					
South (Outer area – inc Doncaster)	9	131	1	2	0					
Do Something										
Hull & Beverley	1	No Flow				293	425	771	268	241
North of Hull (Driffield & N Yorks)	2					15	34	187	12	1
West of Hull (Market Weighton)	3					13	21	35	41	3
North (York & Outer area)	4					2	43	93	9	0
Scunthorpe and surroundings	5	377	23	17	3	No Flow				
Barton Upon Humber & Brigg	6	581	45	23	70					
Immingham & Grimsby	7	555	47	52	152					
Lincolnshire	8	307	19	48	11					
South (Outer area – inc Doncaster)	9	190	1	4	0					
% Difference										
Hull & Beverley	1					14	15	12	6	22
North of Hull (Driffield & N Yorks)	2					31	18	12	103	47
West of Hull (Market Weighton)	3					18	19	25	11	26
North (York & Outer area)	4					53	33	295	18	-4
Scunthorpe and surroundings	5	42	65	45	125					
Barton Upon Humber & Brigg	6	39	41	41	64					
Immingham & Grimsby	7	21	58	15	379					
Lincolnshire	8	30	43	27	65					
South (Outer area - inc Doncaster)	9	46	120	69	14					

5.6 Do Something Impacts Without Variable Demand

In addition to the full variable demand work, additional tests were undertaken to identify the pure reassignment effects i.e. with no variable demand.

The purpose of this test was to try and assess the impacts of the variable demand modelling, in particular because this project is non-standard (due to the lack of an infrastructure scheme). Also, the removal of the toll will offer a significant time saving (circa 20 minutes due to the removal of this cost), far greater than for a standard road scheme, and as a result we expected the variable demand element to show significant impacts.

Table 36 summarises the impacts comparing the 'with' and 'without' variable demand for the No Toll scenario for the Humber Crossing Points.

Table 36 Summary of No Variable Demand (VDM) Impacts

Name of test	AM Peak		Interpeak		PM Peak	
	Flow (pcus)	% diff DM	Flow (pcus)	% diff DM	Flow (pcus)	% diff DM
	2010					
Do Minimum	2,277		1,652		1,921	
No Toll – No VDM	2,747	21%	2,147	30%	2,225	16%
No Toll – With VDM	3,507	54%	2,761	67%	3,131	63%
	2021					
Do Minimum	2,937		2,107		2,513	
No Toll – No VDM	3,476	18%	2,668	27%	2,932	17%
No Toll – With VDM	4,189	43%	3,361	60%	3,911	56%
	2033					
Do Minimum	3,437		2,540		3,046	
No Toll – No VDM	3,933	14%	3,130	23%	3,516	15%
No Toll – With VDM	4,403	28%	3,813	50%	4,339	42%

5.7 Summary

The review of model impacts discussed in this chapter summarises the key changes in traffic flows within the Humber Estuary area, in particular showing changing travel patterns due to the changes in the tolls on the Humber Bridge. In general under each of the scenarios, as would be expected, the greater the reduction in toll, the higher the demand for using the Humber Bridge. A number of additional routings appear to show some transfer of traffic routings which were previously on the margins of route choice between the M62 Humber Crossing and the A15 Humber Bridge, which when the toll is reduced (or removed) favour the A15 route. Examples of these include trips between the Grimsby Cleethorpes area to destinations to the south east of York. It is also noted that long distance motorway trips, such as those from outside the study area (eg London or Sheffield to Hull) are unaffected by changes to the toll.

6 Economic Assessment Report

6 Economic Assessment Report

6.1 Overview

The overarching purpose of this project was to attempt to determine, via a properly specified transport model, whether or not there was an economic case to reducing toll levels on the Humber Bridge.

This section provides an overview of the tools used to inform the value for money assessments, along with any non standard parameters used. The appraisal results are summarised in Section 6.7, with a series of sensitivity tests presented in Section 6.8.

6.2 Estimation of Costs

This scheme is different from a usual transport scheme in that the Do Something scenarios do not include any infrastructure and hence this is reflected in the costs which feed the appraisal.

6.3 Estimation of Standard Economic Benefits

6.3.1 Explanation of Appraisal Tools

To undertake the scheme appraisal, costs and benefits over a 60 year appraisal period were calculated using TUBA, with further Wider Economic Benefits derived from WITA and added to the TUBA results to derive an indication of each proposal's value for money.

6.3.2 TUBA

TUBA was run using Version 1.8, and is based on recently updated economic input files which are consistent with NTEM dataset 6.2

Period of Appraisal

Two alternative appraisal periods have been investigated, these are:

- Standard 60 year appraisal (2011 – 2071); and
- 23 year appraisal (2011 – 2034).

The rational for developing a 23-year appraisal is that with the current tolling regime the debts relating to bridge construction would be repaid by 2034. Beyond this it is assumed that the toll would be reduced to a level at which it covers just the ongoing maintenance of the bridge. Thus the full benefits of reducing tolls are only felt in the period up to 2034, any benefits beyond then would be the difference between a maintenance toll (i.e. a toll level designed to cover maintenance costs only) and no toll.

Three modelled years were used to inform the model, these are 2010 (Base Year), 2021, and 2033.

Annualisation

The model outputs are expressed in terms of the time periods the models represent, namely average peak and off peak hours. The TUBA program requires a set of factors, referred to as annualisation factors, which it uses to translate the modelled period outputs into annual costs and benefits. It is common practice to assume benefits arise only during the weekday daytime, since this is when the great majority of traffic flow occurs and when the greatest benefits occur. It is admissible to include also benefits for overnight and weekend periods. However if these periods are not explicitly modelled, then the weekday models have to be used as a proxy for weekend conditions and appropriate annualisation factors calculated. This requires the assumption that weekend flows are similar to weekday flows, which is clearly not always the case.

For the present study therefore, we have assumed that only weekdays are included in the benefit calculations, thus it may be noted that costs and benefits reported relate only to these periods and the actual annual figures may be expected to be slightly higher.

Annualisation factors have been calculated on the basis of flow levels on the major trunk roads in the immediate modelled area for which long term flow statistics were available, namely:

- A63 East of Humber Bridge;
- A63 West of Humber Bridge; and
- A180 West of Grimsby.

It was assumed that there are 255 normal working weekdays per year. Thus, given that the AM Peak and PM Peak models both represent average two hour periods (07:00-09:00 and 16:00-18:00 respectively) the annualisation factors used for the peak hour models assume two of each peak hour per working day over the year.

The modelled off peak hour represents an average of the five-hour period 10:00 to 15:00. To complete the necessary 12 hour period the off peak hour model outputs were also used to represent the remaining single hours 09:00-10:00, 15:00-16:00 and 18:00-19:00. The count data was used to examine the relationship between the average modelled inter peak volume in the 10:00-15:00 period, and the average volumes in these other hours, to express these hours in terms of average inter peak hour equivalents. The results are shown in Table 37.

Table 37 Inter Peak Hour Expansion Factors

Time Period	Hours per day
09:00 – 10:00	1.06
10:00 – 15:00	5.00
16:00 – 17:00	1.13
18:00 – 19:00	0.91
Total	8.10

Thus, the final expansion factors used in TUBA are shown in Table 38.

Table 38 Annualisation Factors

Time Period	Hours per day	Factor from Weekday Peak to annual
AM Peak	2.0	510
Interpeak	8.1	2066
PM Peak	2.0	510

6.4 Estimation of Wider Economic Impacts

6.4.1 Overview

WITA was used to assess the wider economic benefits of the scheme. The section below provides a background to the WITA process, and its application within the HETM study.

6.4.2 Background

WITA (Wider Impacts in Transport Appraisal) is a computer program developed for the Department for Transport (DfT) to estimate the wider impacts of transport schemes that are not part of conventional transport user benefits appraisals. The version that was used for this analysis is Version 1.1i-2 beta.

The Economy Objective has five sub-objectives one of which is to provide wider impacts through productivity and wider welfare gains and to support the regeneration of an area. WebTag Unit 2.8C (September 2009) states that “It is generally accepted that, under conditions of perfect competition for both the transport and transport-using sectors, a properly specified Cost Benefit Analysis (CBA) of a transport scheme would accurately estimate all welfare impacts”

Both the report Transport and the Economy (DETR, 1999) by SACTRA and the Eddington Transport Study (DfT) commented that markets are often not perfect, and as such Wider Impacts (WIs), positive and negative, may result. It was noted that in some cases these impacts can be significant, "and are therefore an important part of the overall cost benefit assessment". The impacts were identified as productivity and welfare changes associated with the impact of transport on agglomeration and labour supply.

In a presentation in June 2009, Tom Worsley of the Department for Transport presented wider impacts from a number of recent studies (Table 39). This indicates that for these schemes the additions to conventionally measured benefits ranged from 17% to 44%. For the four road based schemes the range was 17% to 33%.

Table 39 DfT View on Wider Impacts How Much do WIs Matter? (Source: DfT)

	Description	Agglomeration	Imperfect Competition	Labour Market	Sum Additional Benefits
Rail	Crossrail	19%	3%	22%	44%
Road	Leeds to Bradford Improved Highways	21%	4%	21%	37%
Road	Leeds Urban Area Improved Highways	22%	4%	7%	33%
PT	Leeds to Bradford PT Improvements	15%	2%	4%	21%
Bus	Intra Leeds bus subsidy	11%	2%	6%	19%
Road	Leeds to Sheffield Improved Highway	19%	5%	-6%	17%
Road	M6 Shoulder	12%	5%	0%	17%
Bus	West Yorkshire County Bus Subsidy	9%	2%	6%	17%
PT	Leeds Urban Area Major PT Investment	9%	3%	6%	17%
Bus	South & West Yorkshire Bus Subsidy	7%	2%	5%	17%
Average:		**13%**	**3%**	**5%**	**22%**

6.4.3 The Components of Wider Impacts

The impacts considered under the WebTag guidance are summarised below with the first three strongly influenced by changes in generalised time and distance.

- Agglomeration Impacts;
- Output change in imperfectly competitive markets;
- Labour supply impacts; and
- Move to more or less productive jobs.

In WebTAG, the impact of transport on agglomeration and output change in imperfectly competitive markets (see below) is captured via direct user benefits such as journey time savings. The labour market impacts ('labour supply' and 'move to more or less productive jobs') are partially, but not wholly, captured through user benefits.

Agglomeration Impacts: This refers to the concentration of economic activity over an area. Transport is considered as a means of increasing the accessibility of an area to a greater number of firms and

workers, thereby impacting on the level of agglomeration. Agglomeration has an impact on UK welfare "through its impact on productivity and UK Gross Domestic Product (GDP)."

The TAG states "A transport scheme is likely to impact on productivity (and welfare) through the impact of the scheme on agglomeration if the transport investment increases accessibility in an area in sufficient proximity to an economic centre or large employment centre. In such cases the appraisal of the agglomeration impact of the scheme and the resulting welfare impact, must be appraised and reported."

The agglomeration estimation is on the basis of the impact that the estimated change in user travel time and costs has on the accessibility of firms and workers to each other. The productivity impact is estimated by applying a value to reflect the likely change in productivity for each fractional change in agglomeration. The output is a welfare estimate of the scheme's agglomeration impact.

Output change in imperfectly competitive markets: In most cases, markets are not 'perfectly competitive' and this can lead to lower production and higher prices than would exist in the case of a competitive market, normally to the detriment of consumers and the economy as a whole. A reduction in transport costs (to business and/or freight) allows for an increase in production or output in the goods or service markets that use transport. A transport intervention that leads to an expansion of output will deliver a welfare gain as consumers of the goods and services will value any increases in production by more than the cost of the additional units of production. The impact is estimated in a simplified form – essentially up-lifting the estimate of conventional travel time and travel cost benefits to business users (and to freight where relevant) to account for this missing element.

Labour supply impacts: Transport costs are likely to affect the overall costs and benefits to an individual from working. In deciding whether or not to work, an individual will weigh travel costs against the wage rate of the job travelled to. It is assumed that a change in transport costs is therefore likely to affect the incentives of individuals to work and hence the overall level of labour supplied in the economy.

The labour supply impact is estimated using the modelled commuting costs resulting from the scheme to estimate how the net benefit from working affects overall labour supply. This is done by applying an evidence-based elasticity value to the net wage change.

Move to more or less productive jobs: Transport can affect the incentives for firms and workers to locate and work in different locations. This is different from agglomeration which assumes that employment is not relocated within the area that is modelled. Estimating the impact of transport on employment location across areas and over time is challenging and requires use of a Land Use Transport Interaction (LUTI) model. For this reason the assessment of the move to more or less productive jobs is not a core requirement of the wider impacts assessment.

6.4.4 The Case for Wider Impacts (HETM)

With the potential for Highway main user benefits to be positive there is reasonable confidence that Wider Impacts exist for this scheme even before undertaking a more detailed assessment. However we also note that whilst agglomeration and labour supply impacts are positive, change in outputs may be neutral or negative.

The average results for the four road schemes in Table 39 for each component were:

- Agglomeration 18.5%
- Output Change in Imperfect Competitive Markets 4.5%
- Labour Market Supply 5.5%

6.4.5 Outline of Methodology

WITA has four methods to calculate the Wider Impacts; these four methods are a staged approach in complexity:

- Method 1: Fixed Trip matrices, combining all the industry sectors;
- Method 2: Variable trip matrices, DM and DS, combining all the industry sectors;
- Method 3: Fixed Trip matrices, disaggregating the industry sectors; and
- Method 4: Variable trip matrices, DM and DS, disaggregated by industry sectors.

Method 1 and 2 allows for the incremental testing of the trips and employment data by showing the difference between the DM and DS trip matrices. Method 3 and 4 disaggregates the employment data into different industry sectors therefore the demographics of the area is taken into consideration when calculating the Wider Impacts. This is important as different employment sectors have a different propensity to travel depending on the level of income.

Method 4 was adopted as the core approach for this study with a sensitivity test using Method 3.

6.4.6 Functional Urban Regions (FUR)

The DfT has identified areas across England where, if a scheme falls within the area, an agglomeration WITA appraisal should be undertaken; these are referred as 'Functional Urban Regions'. The Group for European Metropolitan Areas Comparative Analysis (GMACA) identified regions according to economic activity rather than administrative boundaries.

The results for WITA are output at Local Authority level therefore any detailed disaggregation of results would mean splitting a Local Authority. The process was undertaken by calculating the population of the area of interest, and calculating the total population or total employment of the Local Authority, and taking a proportion of the Wider Impacts based on the population or employment inside the region.

Hull is in FUR region 40 which covers the whole of Kingston of Hull and the west of the city which is part of East Yorkshire of Riding.

6.4.7 Option Testing

Our approach investigated a number of options, these are highlighted below:

- Across the whole country;
- Within the Wider Modelled Area; and,
- Within the Central Modelled Area.

6.4.8 Development of WITA Zoning System

Using WITA there are three zoning systems that are used which bring together the Local Authority boundaries and data with the Transport Model Zones in the model.

Transport Model Zones (TMZ)

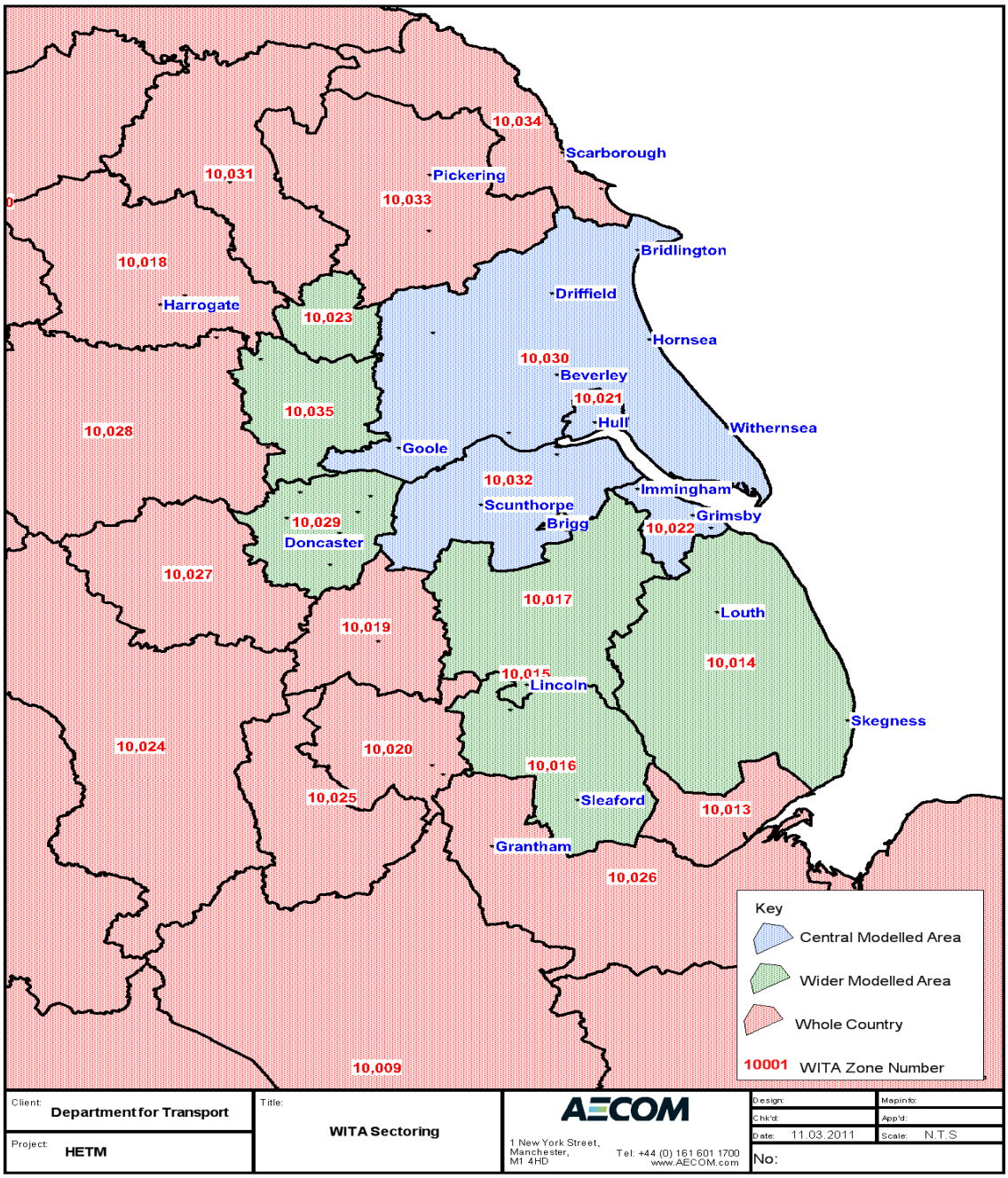
This is the zone system within the transport model used for the scheme appraisal. All input trips, travel time and distance matrices for the WITA appraisal will use this zoning system as the data is directly extracted from the traffic model. TMZs are likely to be smaller than local authority districts (LADS) in the core model area, but larger than LADs on the fringes.

Local Authority District Zones (LAD)

There are 408 LADs in Great Britain when the 2001 census was undertaken and these are the boundaries the employment and economic data has been matched to.

Capabilities on project:
Transportation

Figure 41 Summary of WITA Zoning



6.4.9 WITA Analysis Zones

There is a need to reconcile the TMZs and LADs at a level of detail to which both the transport model data and LAD-level economic data can be converted. This is the role of the WITA analysis zones. The WITA analysis zones form the lowest common denominator between the transport model and LAD zones.

Where TMZs are smaller than LADs, which will usually be the case in the core model area, it is expected that WITA analysis zones will be equivalent to LADs. This is shown in Figure 42 with WITA zone 10021, which is the equivalent of Kingston upon Hull, encompassing 78 transport model zones.

Where TMZs are larger than LADs, such as for the external model zones, it is expected that the WITA analysis zones will usually be equivalent to the TMZs. This is shown in Figure 43 with WITA zone 10001, which is the South of England, equivalent to TMZ 227 that encompasses 111 LADs.

Figure 42 WITA Zoning System – Local Area

Capabilities on project:
Transportation

Figure 43 Wider Area Zoning System

6.4.10 Calculating Proxy PT Wider Impacts

HETM is a highway model where the effects of public transport (PT) are not modelled. However WITA requires PT impacts to be calculated. The purpose of calculating PT Wider Impacts is that it is possible for changes in bridge costs (i.e. reduction or removal of tolls) to generate an increase in the flow of vehicles across the bridge with a consequent increase in the number of vehicles in the City Centre. This may have a knock-on effect on the traffic speeds in the urban area, thereby increasing the bus journey time especially during the commuting peaks.

Proxy PT demand matrices were created using the National Statistics 2001 Journey to Work data. FUR Area 40 was used as the catchment for PT Trips as this outlines the edge of the Functional Urban Region, and the area believed to be affected by a possible reduction in car speeds due to a potential increase in traffic. For all the model zones within FUR Area 40, an origin and destination matrix was calculated for Car and Bus users separately. The ratio between Car (driver and passenger) and Bus was calculated and then applied to the car trips matrices in the model, creating proxy PT trips, which could then be affected by a change in road speeds in the urban area.

The PT Cost Matrices were created for all bus movements in Hull. They were created by taking the highway journey time runs in the model, and the bus timetables, and factoring up the car time matrix to provide a proxy PT time matrix.

6.5 Convergence of the Appraisal Model

TUBA reports the following values for scheme benefits as a percentage of total user costs for each test, as presented in Table 40.

Table 40 Convergence of the Appraisal Model

Option	2010	2021	2033
-10% Toll Reduction	0.04%	0.03%	0.02%
-26% Toll Reduction	0.12%	0.13%	0.09%
-63% Toll Reduction	0.29%	0.24%	0.13%
No Toll	0.50%	0.42%	0.24%

TUBA guidance suggests that, to avoid distortion due to model noise in the results, the model convergence, both in the demand model and the assignment model, should be significantly less than these values. It suggests a factor of 10 lower, although acknowledges that this factor may well be subject to change in the future.

6.6 Non Standard Parameters

The appraisal follows best practice guidance identified in webTAG. Below is a description of any non standard procedures used:

- As discussed in section 2, the base year modelling has been used to inform the value for money assessment. This is not considered standard practice, though is considered appropriate for this study because there is no construction period and the Do Something scenario could be delivered under today's highway network; and
- The WITA calculations adopted the economic growth assumptions associated with NTEM 6.2 to ensure consistency with the modelling. However, when applying these factors in WITA, a number of the early years showed negative growth. Unfortunately the WITA software is not able to accept negative economic growth. As a result, negative growth was set to zero and future years growth was reduced to ensure a compatible overall growth with the NTEM6.2 economic assumptions.

6.7 Appraisal Results: 60 Year Appraisal Summary

The results of the Economic Appraisal are presented in Table 41 showing the economic impacts for each of the toll scenarios assessed using HETM.

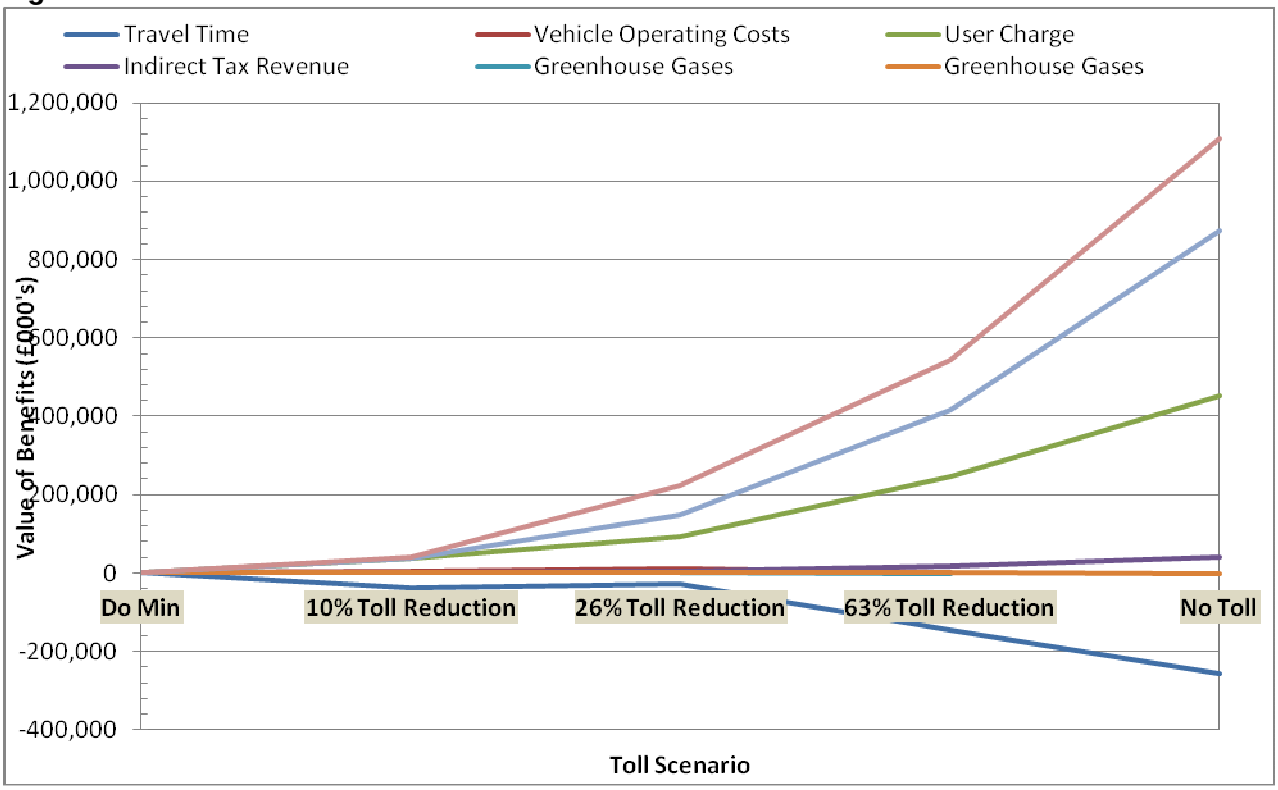
Table 41 Summary TEE Results: 60 Year Appraisal (Including VDM)

Scenario	10% Toll Reduction	26% Toll Reduction	63% Toll Reduction	No Toll
Benefits				
Travel Time	-36,227	-28,692	-144,558	-257,344
Vehicle Operating Costs	1,618	4,227	9,935	287
User Charge	37,095	92,752	245,176	451,039
Indirect Tax Revenue	1,633	5,398	16,400	41,019
Greenhouse Gases	64	171	668	-551
WITA	36,394	148,834	415,319	874,931
PVB	**40,577**	**222,690**	**542,940**	**1,109,381**
Costs				
Public Accounts	32,363	79,007	222,482	438,100
PVC	**32,363**	**79,007**	**222,482**	**438,100**
NPV	8,214	143,683	320,458	671,281
BCR	**1.25**	**2.82**	**2.44**	**2.53**

Values in (£000's)

The purpose of undertaking a number of toll scenarios was to be able to test the impacts on the scheme benefits under a range of intermediate points. Figure 44, below demonstrates the impacts on the scheme PVB of reducing the toll on the bridge. A set of full TEE tables for these options can be found in Appendix G.

Figure 44 Review of Scheme Benefits



6.8 Appraisal Results: 23 year Appraisal

A further test was undertaken to cut the appraisal after 23 years, the reason for this was to that after 23 years, it is likely that the loan on the bridge will be paid off, hence the do minimum position could represent a maintenance only toll, as a result is it likely that a full 60 year appraisal may over estimate the benefits of toll reductions over the longer term. The results of this appraisal test are presented in Table 42.

The impact on the appraisal of reducing the period of appraisal period from 60 years to 23 years, has only a marginal impact on the resultant BCRs. This results in a slight increase in BCR in all cases except for the 26% toll reduction.

Table 42 Summary TEE Results: Sensitivity Test - 23 Year Appraisal (Including VDM)

Scenario	10% Toll Reduction	26% Toll Reduction	63% Toll Reduction	No Toll
Benefits				
Travel Time	-10,424	-10,666	-60,181	-108,261
Vehicle Operating Costs	1,894	2,136	8,219	1,157
User Charge	21,506	54,230	141,988	265,132
Indirect Tax Revenue	705	3,516	9,430	25,423
Greenhouse Gases	85	-133	123	-834
WITA	22,701	75,318	225,651	496,055
PVB	**36,467**	**124,401**	**325,230**	**678,672**
Costs				
Public Accounts	18,978	45,755	127,537	255,648
PVC	**18,978**	**45,755**	**127,537**	**255,648**
NPV	17,489	78,646	197,693	423,024
BCR	**1.92**	**2.70**	**2.55**	**2.65**

Values in (£000's)

6.9 Appraisal Results: Sensitivity Tests

A series of sensitivity appraisal tests were undertaken to gain further confidence in the appraisal results, these are described in detail below.

6.9.1 Sensitivity Test – No Variable Demand Modelling

Due to the nature of the scheme, the impacts of the variable demand modelling are likely to have a significant impact on the modelling and appraisal of HETM. To understand these impacts, a further appraisal sensitivity test was undertaken to review these impacts on the business case. This is because a standard infrastructure transport scheme will often offer a just a few minutes journey time improvement, which is likely to offer a slight variable demand impact. This scheme however, having no infrastructure changes, yet the removal of tolls, will result in a significant time saving due to the removal of the toll, hence resulting in a notable impact on the modelled VDM impacts.

The review in Table 43 indicates that the inclusion of VDM has reduced the overall BCR for the no Toll option, however it should be noted that the WITA benefits under the No VDM option are significant.

Table 43 Summary TEE Results: Sensitivity Testing – No VDM (60 yr Appraisal)

Scenario	10% Toll Reduction	63% Toll Reduction	No Toll
Benefits			
Travel Time	-5,121	-62,602	-125,091
Vehicle Operating Costs	4,642	43,283	60,836
User Charge	36,668	226,328	401,928
Indirect Tax Revenue	1,725	2,628	7,531
Greenhouse Gases	419	6,798	10,537
WITA	**n/a**	**n/a**	1,085,298
PVB	**38,333***	**216,435***	**1,441,039**
Costs			
Public Accounts	39,889	247,857	438,100
PVC	**39,889**	**247,857**	**438,100**
NPV	-1,556*	-31,422*	1,002,939
BCR			**3.29**

*Excludes WITA benefits /Values in (£000's)

6.9.2 Sensitivity Test – 2033 0.1% Gap Assumptions

A further sensitivity test was undertaken to investigate the tightening of the model gap values to 0.1% in the final forecast year of 2033 to assess the impact this would have on the economic case. The results in Table 44 provide a summary of these impacts under a 10% toll reduction and a 26% toll reduction. For the 26% the impacts on the business case are largely unchanged, with the BCR reducing from 2.82 to 2.69. However the impacts under the 10% reduction are more significant, this is mainly driven by the WITA benefits which show a significant difference between the core option, resulting in a much higher NPV increasing the BCR from 1.25 to 2.15.

Table 44 Summary TEE Results: Sensitivity Testing – 0.1% Gap 2033 (60 Yr Appraisal)

Scenario	10% Toll Reduction	26% Toll Reduction
Benefits		
Travel Time	-23,141	-33,751
Vehicle Operating Costs	2,592	3,694
User Charge	37,101	92,539
Indirect Tax Revenue	1,376	5,424
Greenhouse Gases	192	154
WITA	51,360	143,856
PVB	**69,480**	**211,916**
Costs		
Public Accounts	32,279	78,771
PVC	**32,279**	**78,771**
NPV	37,201	133,145
BCR	**2.15**	**2.69**

Values in (£000's)

6.9.3 Sensitivity Test – Alternative WITA Methods

Within the WITA software, there are a range of options available for applying the cost averaging calculations. This calculation aligns with WebTAG unit 3.5.14 and relates to the calculation for transforming generalised costs from transport model-zone level to WITA Zone level.

There are four available methods for use within WITA, with Method 4 being recommended by the Department to form the central case modelling. In addition a further sensitivity test has been undertaken using Method 3. A summary of the WITA outputs is provided in Table 45.

Table 45 Summary of WITA Benefits – Methods 3 & 4

Scenario	WITA Method 3 (£000's)	WITA Method 4 (£000's)
10% Toll Reduction	33,349	36,394
26% Toll Reduction	138,954	148,834
63% Toll Reduction	369,076	415,319
No Toll	596,349	874,931

7 Conclusions

7 Conclusions

7.1 Overview

The Humber Estuary Transport Model (HETM) has been developed by AECOM, on behalf of the Department for Transport (DfT) and the Treasury, to investigate travel patterns in and around the Humber Estuary area. The objective of the project was to identify the changes that may occur to those patterns in response to changes in toll levels on the Humber Bridge and to investigate the associated economic impacts.

The development of the base model was reported in the HETM Local Model Validation Report.

This report has provided details of all aspects of the work associated with using the validated base year model to forecast the transport and economic impacts of a variety of future year scenarios.

The production of a Forecasting Report and a, usually separate, Economic Assessment Report are requirements of the Design Manual for Roads and Bridges (DMRB) and the contents are determined by those standards and the guidance provided by the DfT via WebTAG.

7.2 Summary of Forecasting Approach

The HETM[1] base year model was used as a platform to generate future year scenarios for the years 2021 and 2033, with changes applied to both the transport network (supply) and the volume of trips (demand).

Potential changes to the transport network were identified following consultations with local authorities in the area and the Highways Agency.

The changes to demand considered overall growth as well as the localised impacts of particular developments. Overall growth was determined using the NTEM dataset Version 6.2 which was definitive at the time of modelling.

Local developments were based on the latest available planning data and consultation with local planning authorities but with overall trip totals constrained to NTEM projections in accordance with WebTAG guidance.

The forecasting approach utilised the DIADEM[2] software to account for what are termed variable demand impacts. This means that the forecast patterns are not fixed, but respond to land use and congestion effects.

A number of toll scenario options were assessed using HETM with investigations into the traffic and economic impacts. The economic appraisal used TUBA[3] software which calculates a range of scheme impacts including changes in:

- travel times
- vehicle operating costs;
- user charges;
- Indirect Tax Revenue impacts (related to fuel usage); and
- Greenhouse gases.

In addition, wider economic impacts were assessed using the DfT's WITA[4] software, which is also based on outputs from the transport model.

7.3 Key Findings

This study is somewhat unusual in road traffic modelling because it is about modelling the response to a change in a user charge rather than to a new piece of infrastructure, e.g. a new road or a capacity enhancement. This means that the Present Value of Costs doesn't represent a capital cost; it represents the present value of the foregone stream of toll revenue in each option. This has a bearing on the values

[1] National Trip End Model
[2] Dynamic integrated assignment and demand modelling
[3] Transport user benefit appraisal
[4] Wider Impacts in Transport Appraisal

reported in the economic appraisal. In addition to the standard 60-year approach, a 23-year appraisal period was tested, as this would be the length of time that the toll in each option would be lower than in the future year base scenario (legislation ensures that the Humber Bridge toll would be reduced to the level necessary to cover ongoing maintenance costs only once the debt is paid off in the 2030s).

A summary of the results for a variety of toll reduction scenarios is presented below in Table 46 (which reproduces Table 42 from Chapter 6).

The indicators used in table are as follows:

- Present Value of Benefits (PVB) – the sum of all changes in modelled benefits, summed over the appraisal period and discounted back to 2002 values and prices in accordance with Treasury advice prevailing at the time of the appraisal;
- Present Value of Costs (PVC) – as above but considering costs;
- Net Present Value (NPV) – PVB minus PVC; and
- Benefit to Cost ratio (BCR) – PVB divided by PVC.

Table 46 Summary of Economic Appraisal Results (23 Year Appraisal Period)

Scenario	10% Toll Reduction	26% Toll Reduction	63% Toll Reduction	No Toll
Benefits				
Travel Time	-10,424	-10,666	-60,181	-108,261
Vehicle Operating Costs	1,894	2,136	8,219	1,157
User Charge	21,506	54,230	141,988	265,132
Indirect Tax Revenue	705	3,516	9,430	25,423
Greenhouse Gases	85	-133	123	-834
WITA	22,701	75,318	225,651	496,055
PVB	**36,467**	**124,401**	**325,230**	**678,672**
Costs				
Public Accounts	18,978	45,755	127,537	255,648
PVC	**18,978**	**45,755**	**127,537**	**255,648**
NPV	17,489	78,646	197,693	423,024
BCR	**1.92**	**2.70**	**2.55**	**2.65**

All values shown above are in £000's

The travel time dis-benefits grow as the level of toll reduction increases. This is because the reduction in trip cost increases the traffic levels across the Bridge which, in turn, increases congestion levels. These congestion impacts are felt by all affected trips.

The changes in user charges are similar to the costs hitting the public accounts, although not identical due to the ways in which consumer surplus is assessed by the TUBA process.

Clearly the majority of the benefits are due to the wider economic impacts calculated using the WITA process. These include:

- Agglomeration Impacts;
- Output change in imperfectly competitive markets; and
- Labour supply impacts.

Finally the BCR values in the table above need to be seen in the context of the DfT's classification of schemes whereby a BCR of between 1.5 and 2.0 represents moderate value for money, whilst a value greater than 2.0 represents high value for money.

Appendix A – Uncertainty Log

Appendix A – Uncertainty Log

Input	Uncertainty - 2021	Uncertainty - 2033	Uncertainty justification	Authority	Start date	Completion date	Information source	Notes - General
Factors affecting supply for transport								
A63 Castle Street	Reasonably foreseeable	More than likely	HA planned scheme. HA Major Road Scheme; post 2015 construction.	Hull	2015	2018	HA Website / DfT News	Preferred Route announced in March 2010. The DfT have announced that this is an HA Major Road Scheme that would not be consttructed until after 2015.
A1079 Park & Ride site	Hypothetical	Hypothetical	Referred to in liason with Hull Council	Hull	2012	2013	Hull Council	Schemes considered unlikely to proceed in the near future.
A1033 Park & Ride site	Hypothetical	Hypothetical	Referred to in liason with Hull Council	Hull	2012	2013	Hull Council	
Beverley Integrated Transport Plan - Southern Relief Road	More than likely	More than likely	Referred to in liason with East Riding Council. DfT 'development group' scheme; post 2012 / 2013 construction.	East Riding of Yorks	2010	2014	Core Strategy / East Riding Council / DfT News	The Plan includes the southern relief road, park and ride facility and junction improvements. Programme Entry status. Currently being reviewed as part of the DfT 'development group' - any construction would be post 2012 / 2013.
A164 - Beverley to Humber Bridge Corridor Improvement	More than likely	More than likely	Referred to in liason with East Riding Council. DfT 'development group' scheme; post 2012 / 2013 construction.	East Riding of Yorks	2010	2012	Core Strategy / East Riding Council / DfT News	Funding from the DfT is in the process of being sourced; this is priority scheme. Currently being reviewed as part of the DfT 'pre-qualification group' - any construction would be post 2012 / 2013.
A1079 - between Hull and York: rounabout improvement	Near certain	Near certain	Referred to in liason with East Riding Council	East Riding of Yorks	2010	2011	Core Strategy / East Riding Council	Pocklington roundabout improvement is in the process of being implemented to better serve nearby industrial estate.
Hull / Beverley to York railway route	Hypothetical	Hypothetical	Referred to in liason with East Riding Council	East Riding of Yorks	2010	2026	Core Strategy / East Riding Council	Aspiration to re-open the route.
A160 / A180 Immingham	Reasonably foreseeable	More than likely	Referenced in the Core Strategy and emerging LTP3; HA planned scheme. HA Major Road Scheme; post 2015 construction.	North Lincolnshire	2013	2015	Core Strategy / HA Website / DfT News	Originally identified as part of the Yorkshire and Humber Regional Funding Allocation. Preferred Route announced March 2010. The DfT have announced that this is an HA Major Road Scheme that would not be consttructed until after 2015.
A15: M180 - Lincoln	Hypothetical	Reasonably foreseeable	Referred to in liason with North Lincs Council.	North Lincolnshire	-	-	North Lincs Council	This scheme is only at the aspirationl stage at the moment and as such no formal plans are drawn up.
Doncaster - Immingham Railway Line	Reasonably foreseeable	More than likely	Referenced in the Core Strategy and emerging LTP3; will support South Humber Bank	North Lincolnshire	2010	2026	Core Strategy	Improved rail link to / from Immingham; some speed and junction improvements already complete. Part of GRIPP programme 2012.
Killingholme Rail Loop	Reasonably foreseeable	More than likely	Referenced in the Core Strategy and emerging LTP3; will support South Humber Bank	North Lincolnshire	2010	2026	Core Strategy	Improvements to the rail network to Immingham Dock and the Humber Sea Terminal. Part of GRIPP programme 2012.
Proposed new junction on the M181 and partial de-trunking (Lincolnshire Lakes)	More than likely	More than likely	Strong local authority support for the scheme	North Lincolnshire	2010	2026	Core Strategy / LL Breifing Note	Proposed new junction on the M181 to serve the Lincolnshire Lakes development.
A18 Sandtoft Airfield	Reasonably foreseeable	More than likely	Referenced in the Core Strategy	North Lincolnshire	2010	2026	Core Strategy	Access improvements to better serve proposed logistics park at Sandtoft Airfield.
Scunthorpe / Berkely circle	More than likely	More than likely	Referred to in liason with North Lincs Council.	North Lincolnshire	-	-	SATS (2004) / North Lincs Council	Localised improvements to support nearby development. PA/2007/0828.
Barton on Humber - package of measures to improve A1077	More than likely	More than likely	Referred to in liason with North Lincs Council.	North Lincolnshire	-	-	Barton Upon Humber TS (2002)	Some of the improvement work already completed.
A18 / A180 Link	More than likely	More than likely	Major Scheme Business Case. DfT 'development group' scheme; post 2012 / 2013 construction.	North East Lincolnshire	-	-	NE Lincs LTP / DfT News	Major Scheme Business Case Proposal to improve southern access to the Port of Immingham. Currently being reviewed as part of the DfT 'development group' - any construction would be post 2012 / 2013.
M18 J5 link road	Reasonably foreseeable	More than likely	Referenced to in liason with Doncaster Council	Doncaster	2011	2026	Core Strategy	M18 J5: the Hatfield spur. The scheme has planning permission.
FARRRS	Reasonably foreseeable	More than likely	Referenced to in liason with Doncaster Council	Doncaster	2011	2026	Core Strategy	Finningley and Rossington Regeneration Route Scheme (FARRS) - Airport link to the M18 (Major scheme business case).
White Rose Way	More than likely	More than likely	Referenced in the Core Strategy. DfT 'development group' scheme; post 2012 / 2013 construction.	Doncaster	2011	2026	Core Strategy / DfT News	Previously granted 90% funding from the RFA. Currently being reviewed as part of the DfT 'development group' - any construction would be post 2012 / 2013.
A46 Newark to Winderpool	Near certain	Near certain	HA current scheme	Newark and Sherwood	2009	2012	HA Website	Currently under construction.
A64 Rillington Bypass	Hypothetical	Hypothetical	HA On hold scheme	Ryedale	-	-	HA Website	Scheme not identified as funding priority in the period up to 2016.
A1 Elkesley Junction	Hypothetical	Hypothetical	HA On hold scheme	Bassetlaw	-	-	HA Website	Public Inquiry postponement due to Government spending review August 2010. Preferred Route announced March 2008.

Input		Uncertainty - 2021	Uncertainty - 2033	Planning Application Status	Supporting Information	Authority	Start date	Completion date	Information source	Final Development Size			
										Housing		Employment	
Factors affecting underlying demand													
Newington and St Andrews Area Action Plan (AAP)		More than likely	Near certain	Application Granted	The Newington and St Andrews AAP is has been adopted. It is proposed for completion within the Core Strategy period.	Hull	-	2026	Hull Core Strategy / AAP / Hull Council	68	Dwellings		
Holderness Road Corridor Area Action Plan (AAP)	New Bridge Road and Holderness Road	Reasonably foreseeable	More than likely	No Applications	The Holderness Road Corridor AAP is split into three areas: New Bridge Road and Holderness Road, Ings and Preston Road. The AAP is not yet adopted but it is proposed that it will be completed within the Core Strategy period.	Hull	-	2026	Hull Core Strategy / AAP / Hull Council	129	Dwellings		
	Ings	More than likely	Near certain	Full - 238 dwellings						238	Dwellings		
		Reasonably foreseeable	More than likely	No Applications (remainng site)						603	Dwellings		
	Preston Road	More than likely	Near certain	Full - 64 dwellings						64	Dwellings		
		Reasonably foreseeable	More than likely	No Applications (remainng site)						1,197	Dwellings		
Kingswood	449 dwellings	More than likely	Near certain	Full - 449 dwellings only	The Kingswood development is a large scale mixed use site. It is anticipated that there will be a dwelling build rate of 200 dwellings/annum over the next 20 years. Construction on parts of the site has already been completed. 459 dwellings currently have Full Planning Application status.	Hull	2010	2030	Core Strategy / JRP website / Hull Council	449	Dwellings		
	remaining site	Reasonably foreseeable	Reasonably foreseeable	No Applications						3,551	Dwellings	151,000	m^2 (GFA)
Orchard Park		Hypothetical	Reasonably foreseeable	No Applications	Orchard Park is a PFI involving 1,700 new homes which will be provided with a net gain of 295; 50% by 2016 and 100% by 2018.	Hull	2010	2018	Core Strategy / Hull Council	295	Dwellings		
William Wright and Albert Docks		Hypothetical	Hypothetical	No Applications	Although there are currently no firm proposals, this site could be used for non port related purposes; however this is a post Core Strategy period site.	Hull	post 2026	-	Core Strategy / Hull Council				
Drypool		Hypothetical	Hypothetical	No Applications	Currently there are no firm proposals this site and it is a post Core Strategy period site.	Hull	post 2026	-	Core Strategy / Hull Council				
Hedon Road	Somerden Rd	More than likely	Near certain	Full - part of the plot only	This is an employment site where some individual sites on the plot have received full planning permission.	Hull	-	2026	Core Strategy / Hull Council			11,234	m^2 (GFA)
	1251 Hedon Road	More than likely	Near certain	Full - one site on the plot only	This is an employment site where one site on the plot has received full planning permission.	Hull	-	2026	Core Strategy / Hull Council			9,210	m^2 (GFA)
Priory Park		More than likely	Near certain	Outline - for most sites where an application has been received	This is an employment site where one site on the plot is currently under construction, one site has full planning permission and four sites have outline planning permission.	Hull	-	2026	Hull Council			47,142	m^2 (GFA)
I-Park (Bankside)		More than likely	Near certain	Full - part of the plot only	This development involves the creation of 11 acres of new build business space. Three sites on the plot currently have Full Planning permission.	Hull	-	2026	Core Strategy / Hull Council			2,325	m^2 (GFA)
Humber Bridge Head		More than likely	Near certain	Outline	This site consists of approx. 20 Ha of allocated land (Beverley Borough Local Plan) allocated for employment and tourism purposes. Outline planning permission has been granted.	East Riding of Yorks	-	2026	East Riding Council			80,000	m^2 (GFA)
J36 Goole		Hypothetical	Reasonably foreseeable	No Applications	Guardian Glass and the Tesco distribution centre currently operate from this site. There are approx. 250,000 acres (100 Ha) designated for further development.	East Riding of Yorks	-	2026	East Riding Council			100	Ha
J37 Ozone		Hypothetical	Reasonably foreseeable	Unknown	In liaison with East Riding Council this site was referred to as having already undergone some development and it was anticipated that development would continue into the near future.	East Riding of Yorks	-	2026	East Riding Council			7	Ha
Howden		Hypothetical	Reasonably foreseeable	No Applications	An allocated housing development site of some 600 dwellings. Although there are currently no Planning Applications, East Riding Council anticipate that they will be forthcoming in the near future.	East Riding of Yorks	-	2026	East Riding Council	600	dwellings		
Gilberdike - Newport		Hypothetical	Reasonably foreseeable	Unknown	This is an employment site allocation which it is anticipated would constitute a number of smaller type offices and industrial units (18.5 Acres).	East Riding of Yorks	-	2026	East Riding Council			1,850	m2 (GFA)
Melton		Hypothetical	Reasonably foreseeable	Unknown	This site would comprise a of mainly office and distribution type developments. The plot area is 50 acres (20 Ha).	East Riding of Yorks	-	2026	East Riding Council			20	Ha
Brough Tesco		Hypothetical	Reasonably foreseeable	Unknown	This proposed new Tesco superstore at Brough was mentioned in liaison with East Riding Council.	East Riding of Yorks	-	2026	East Riding Council			7,714	m^2 (GFA)
Salt End (Hedon - Haven)		Reasonably foreseeable	More than likely	No Applications	This is a development site mentioned in liaison with East Riding Council that would be ideally suited for port and industrial related land uses.	East Riding of Yorks	-	2026	East Riding Council			80	Ha

Input	Uncertainty - 2021	Uncertainty - 2033	Planning Application Status	Uncertainty justification	Authority	Start date	Completion date	Information source	Development size			
									Housing		Employment	
Factors affecting underlying demand												
Lincolnshire Lakes	Hypothetical	Reasonably foreseeable	No Applications	This proposal has strong support from the local authority who are currently in discussions with an investor (Lucent) who are interested in delivering the whole project. This is described as a sustainable development providing a high quality urban extension to the west of the Scunthorpe.	North Lincolnshire	-	2026	Core Strategy / North Lincs Council.	10,000	Dwellings	10	Ha
Gallagher Development	More than likely	Near certain	Final Decision	This is a residential development site located close to the proposed Lincolnshire Lakes on the west side of Scunthorpe.	North Lincolnshire	-	2026	Core Strategy / North Lincs Council.	1,200	Dwellings		
South Humber Bank: Logistics Park	More than likely	Near certain	Final Decision	Combined, these two Able UK sites would deliver around 10,000 on site jobs with a further 17,000 in the wider region. The Logistics Centre and Business Park is currently subject to a planning application (PA/2009/0600) which recently received provisional planning approval from NLC. The Marine Energy Park will encompass an area of 52 Ha reclaimed Humber Estuary land and 247 Ha land onshore.	North Lincolnshire	-	2026	Core Strategy / Able News Release / PP				
South Humber Bank: Marine Energy Park	Hypothetical	Reasonably foreseeable	No Applications		North Lincolnshire	-	2026	Core Strategy / Able News Release			299	Ha
Drax Biomass - South Killingholme	More than likely	Near certain	Under Consideration	This proposals involves the construction of a 290 MW biomass fuelled electricity generating station. This is a recent application cited as important by the local authority (PA/2009/1269).	North Lincolnshire	-	2026	Core Strategy / Planning Portal			8,756	m^2 (GFA)
Glass Wool Insulation Plant - North Killingholme	More than likely	Near certain	Final Decision	This proposal involves the construction of a glass wool insulation producing manufacturing plant. This is a recent application cited as important by the local authority (PA/2008/0988)	North Lincolnshire	-	-	Planning Portal (PP)			27,500	m^2 (GFA)
Bio ethanol Plant - North Killingholme	More than likely	Near certain	Final Decision	This proposal involves the construction of a bio ethanol plant which would produce 200,000 tons of ethanol / year from wheat. This is a recent applications cited as important by the local authority (PA/2010/0325).	North Lincolnshire	-	-	Planning Portal (PP)			15	Ha
Sandtoft Airfield	Hypothetical	Reasonably foreseeable	No Applications	The proposal is for a Logistics Park covering a plot area of 59.5 Ha. The site is referenced in North Lincolnshire's evolving Core Strategy.	North Lincolnshire	-	2026	Core Strategy			59	Ha
Europarc Phase 4	Hypothetical	Reasonably foreseeable	No Applications	This is a major site identified for development in North East Lincolnshire's evolving Core Strategy. It is currently undeveloped without any applications or consents.	North East Lincolnshire	-	2026	Core Strategy			142	Ha
Wilton Road and Hewitts Ave Business Parks	More than likely	Near certain	Application Granted	Identified as a key development site in North East Lincolnshire's evolving Core Strategy, the majority of this site is concerned with two planning applications; one application has Full Consent while the other is a Re-Submission - both have been approved.	North East Lincolnshire	-	2026	Core Strategy			6	Ha
Magna Holdings Ltd.	More than likely	Near certain	Outline - Application Granted	Identified in Liaison with North East Lincolnshire, this site has Outline permission for a mixed use B1, B2 & B8 industrial Park with ancillary units.	North East Lincolnshire	-	2026	Liaison with NE Lincs Council			29	Ha
RWE Npower Renewable	More than likely	Near certain	Supplementary Statement	Identified in liaison with North East Lincolnshire Council this is a proposal for a 65MWe Biomass Power Station. The application is currently undergoing amendments to the original proposal via a Supplementary Statement.	North East Lincolnshire	-	2026	Liaison with NE Lincs Council			34	Ha
Abengoa Bio energy UK	More than likely	Near certain	Application Granted	Identified in liaison with North East Lincolnshire Council, this proposal involves the erection of a Bio ethanol Plant.	North East Lincolnshire	-	2026	Liaison with NE Lincs Council			44	Ha
Stainforth	Hypothetical	Reasonably foreseeable	No Applications	This major regeneration site has been scaled down to approx 1,500 dwellings.	Doncaster	-	2026	Core Strategy / Doncaster Council	1,500	Dwellings		
Hatfield Power Park	More than likely	Near certain	Application Granted	The Hatfield Power Park will include a power station and a cluster of small businesses. The Masterplan for a mixed use development of Hatfield Colliery and proposal for a Waste Re-cycling facility have been granted Full Planning Permission.	Doncaster	-	2026	Core Strategy			15,500	m^2 (GFA)
											100,000	m^2 (GFA)
Rossington Inland Port (Poteric Carr)	Reasonably foreseeable	More than likely	Pending Decision	This is a Strategic Freight Interchange near Robin Hood Airport. Technically, this Planning Application is Pending a decision. In Liaison with Doncaster Council this proposal was described as having Council and Government backing.	Doncaster	-	2026	Core Strategy / Doncaster Council			562,000	m^2 (GFA)
Nimbus Park, Thorne	More than likely	Near certain	Application Granted	Phase 1 is developed; Phase 2 is planned which will involved 19,498 m2 of warehousing and 900 m2 of office development. The Distribution / manufacturing unit and Warehouse unit with offices have all been granted planning permission.	Doncaster	-	2026	Doncaster Council			20,398	m^2 (GFA)

Appendix B – Traffic Flows

Capabilities on project:
Transportation

Appendix B – Traffic Flows

Traffic Flows Crossing the Humber Estuary (with and without VDM Modelling)

	A15 Humber Bridge			M62 Humber Crossing		
Name of test	**AM Peak**	**Interpeak**	**PM Peak**	**AM Peak**	**Interpeak**	**PM Peak**
2010 Forecast Year						
Do Minimum	2,277	1,652	1,921	3,060	2,796	2,857
No VDM						
DS -10% Toll	2,306	1,675	1,953	3,051	2,787	2,854
DS -26% Toll	2,371	1,710	2,006	3,037	2,778	2,850
DS -63% Toll	2,594	1,888	2,147	3,004	2,757	2,851
DS – No Toll	2,747	2,147	2,225	2,989	2,653	2,839
With VDM						
DS -10% Toll	2,337	1,701	1,989	3,050	2,788	2,850
DS -26% Toll	2,515	1,824	2,172	3,038	2,768	2,851
DS -63% Toll	3,015	2,224	2,638	3,000	2,758	2,849
DS – No Toll	3,507	2,761	3,131	2,985	2,655	2,842
2021 Forecast Year						
Do Minimum	2,937	2,107	2,513	3,799	3,524	3,931
No VDM						
DS -10% Toll	2,983	2,134	2,566	3,792	3,521	3,899
DS -26% Toll	3,066	2,194	2,647	3,778	3,498	3,887
DS -63% Toll	3,313	2,394	2,797	3,715	3,464	3,876
DS – No Toll	3,476	2,668	2,932	3,706	3,362	3,871
With VDM						
DS -10% Toll	3,051	2,167	2,639	3,792	3,543	3,887
DS -26% Toll	3,252	2,332	2,875	3,778	3,497	3,885
DS -63% Toll	3,768	2,791	3,379	3,719	3,457	3,875
DS – No Toll	4,189	3,361	3,911	3,713	3,360	3,861
2033 Forecast Year						
Do Minimum	3,437	2,540	3,046	4,672	4,399	5,194
No VDM						
DS -10% Toll	3,473	2,568	3,077	4,657	4,376	5,215
DS -26% Toll	3,540	2,634	3,137	4,631	4,344	5,209
DS -63% Toll	3,732	2,846	3,255	4,540	4,287	5,146
DS – No Toll	3,933	3,130	3,516	4,490	4,182	5,059
With VDM						
DS -10% Toll	3,561	2,618	3,180	4,666	4,390	5,183
DS -26% Toll	3,728	2,783	3,370	4,636	4,358	5,166
DS -63% Toll	4,119	3,261	3,828	4,595	4,310	5,108
DS – No Toll	4,403	3,813	4,339	4,513	4,200	5,041

Appendix C – Calculating the Number of Jobs/Households

Appendix C – Calculating the Numbers of Jobs/Households

C.1 Introduction

For the reasons outlined in Section 4, the TEMPRO Alternative Planning Assumption Tool, which allows the input of additional households and jobs to NTEM zones, has been used to derive trip productions and attractions by journey purpose for sample household and employment increases.

For some employment sites, there is currently no data available for number of jobs likely to be created. As a result, existing research investigating the relationship between floor space and number of jobs for the Yorkshire area has been used to provide estimates of the future jobs created. These are described in more detail below.

C.2 Deriving the Level of Jobs from Known Floorspace

As not all development sites have details of the number of jobs available, though do have information about type of employment site and floor area, analysis has been undertaken to estimate the level of jobs for each site based on floorspace and type of development.

Earlier this year, Yorkshire Forward published a study[5] investigating the relationship between floor space and workers in the Yorkshire area. The following results from that report have been used to derive the number of jobs for each of the development sites. The study reports on, inter alia, the floorspace per head ratio which they refer to as F/L.

The study has divided employment sites into three core types: these included Office, Industrial, and Foodstore. Relationships were derived for each of these types.

Table C1: Relationship Between Office Floor Space and Number of Jobs

Local Authority Type	F/L(1)	Sample	Average Size (sqm)
Leeds	14.1	67	610
Other urban	17.2	176	345
mixed	13.4	19	120
rural	15.9	24	196
Total	**15.7**	**286**	**381**

Source: Table 3.2, 'Planning for Employment Land' – Roger Tym, 2010
Notes: (1) F/L is the study acronym for floor space per worker measured in sqm.

Table C2: Relationship Between Industrial Floor Space and Number of Jobs

Local Authority type	F/L(1)	Sample	Average Size (sqm)
Leeds	61	76	1,996
Other urban	70	376	1,451
mixed	68	53	1,355
rural	60	56	1,146
Total	**67**	**561**	**1,482**

Source: Table 3.5, 'Planning for Employment Land' – Roger Tym, 2010
Notes: (1) F/L is the study acronym for floor space per worker measured in sqm.

[5] 'Planning for Employment Land' by Roger Tym & Partners for Yorkshire Forward – Final Report, April 2010

Table C3: Relationship Between Foodstore Floor Space and Number of Jobs

Type	Based on Net Sales Area		Based on Gross Area	
	Total Employment F/L[(1)]	Full Time Employment F/L[(1)]	Total Employment F/L[(1)]	Full Time Employment F/L[(1)]
Convenience Store	10	22		
Discounter	46	192		
Freezer Hall	15	94		
Supermarket <2,500 sq.m	13	22	20	35
Supermarket >2,500 sq.m	10	22	18	39
Supermarket >5,000 sq.m	12	32	19	52
Total	**11**	**25**	**18**	**41**

Source: Table A5 & A6, 'Planning for Employment Land' – Roger Tym, 2010
Notes: (1) F/L is the study acronym for floor space per worker measured in sqm.

C.3 Use of the TEMPRO Alternative Planning Assumption Tool

In order to develop a suitable methodology for allocating the trips associated with new developments by journey purpose, a TEMPRO based approach has been adopted. This is summarised in the note below.

In addition to deriving the forecasted level of growth for specific geographical areas, TEMPRO also has an additional feature, the alternative planning assumption which has the ability to assess the trip generation of zones based on the addition/exclusion of additional households and jobs from each TEMPRO zone. These assumptions can then be applied within TEMPRO to generate a split of new trips to and from the adjusted TEMPRO zone by journey purpose.

To undertake this analysis TEMPRO Version 6.2 was used, with TEMPRO 5.4 data set which is consistent with advice from DfT. All review of trip generation has been analysed based on 'Car Driver' and has been analysed through changes to the input planning variables, either households or jobs, to generate changes in the number of trips and the results are then presented by trip purpose.

Factoring

It was hypothesised that there may be some differences between the rates generated and so a sample size of 5 TEMPRO zones from the core of the modelled network was undertaken, comprising the following, which provide a reasonable geographical spread:

- Kingston Upon Hull (Hull);
- Grimsby (North East Lincolnshire);
- Scunthorpe (North Lincolnshire);
- Great Driffield (East Riding of Yorkshire); and
- Horncastle (Lincolnshire).

The review was also based on future year forecasts of 2021 and 2033, for changes to 'Car Driver'.

Household Related Trips

For each of the 5 sample TEMPRO zones an additional 1000 households was added within TEMPRO as an alternative planning assumption, these were then applied within TEMPRO and a review of the resulting trip generation was review over a 12hour period. These are summarised in the tables below:

Table C4: Trips Generated (Production/Attraction)

TEMPRO Zone	Number of Production trips created (12hr)	Number of Attraction trips created (12hr)
Horncastle	1,033	121
Great Driffield	1,074	103
Kingston upon Hull(main)	911	101
Grimsby	942	104
Scunthorpe	1,009	109
Average	**994**	**108**

Based on the average of the five sites the following can be derived:

- 1 additional household would generate 0.994 productions and 0.108 attractions.

The split of trips by journey purpose for home based purposes was reviewed and the following proportions were identified.

Table C5: Proportion Split of Additional Trips by Journey Purpose for Additional Households (Home Based Trips Only)

Zone	Work		Employers business		Education		Shopping		Personal Business		Recreation / social		Visiting Friends		Holiday	
	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P	A
Horncastle	0.33		0.04		0.06		0.20		0.09		0.15		0.11	1.00	0.015	
Gt Driffield	0.36		0.05		0.07		0.19		0.08		0.14		0.10	1.00	0.015	
Hull	0.39		0.05		0.08				0.07		0.13		0.10	1.00	0.015	
Grimsby	0.37		0.05		0.08		0.18		0.07		0.14		0.10	1.00	0.015	
Scunthorpe	0.36		0.05		0.07		0.18		0.07		0.14		0.10	1.00	0.015	
Average	**0.36**		**0.05**		**0.07**		**0.19**		**0.08**		**0.14**		**0.10**	**1.00**	**0.015**	

The relevant journey purpose splits from Table C5 for the HETM demand segments are as follows:

- HETM HBW = Work;
- HETM HBEB = Employers Business; and
- HETM HBO = Education, Shopping, Personal Business, Recreation, Visiting & Holidays.

Application of these to the rates from Table C4 results in the following productions / attractions per new household:

- HBW (0.994 * 0.36) 0.358 Productions;
- HBEB (0.994 * 0.05) 0.050 Productions; and
- HBO (0.994 * 0.645) 0.591 Productions, (0.108 * 1.00) 0.108 Attractions.

Employment Related Trips

A similar exercise was also undertaken for employment site trips, based on the application of 1000 jobs to each of the development sites, Tables C6 through to C8 show the resulting 12hr trip generation in productions and attractions.

Table C6: Employment Trips Production and Attraction

TEMPRO Zone	Number of Production trips applied (12hr)	Number of Attraction trips applied (12hr)
Horncastle	357	1,360
Great Driffield	289	1,094
Kingston upon Hull(main)	278	1,085
Grimsby	290	1,115
Scunthorpe	292	1,140
Average	**301**	**1,159**

- 1 additional job would generate 0.301 productions and 1.159 attractions.

Table C7: Proportion Split of Additional Trips by Journey Purpose for Home Based Trips

Zone	Work		Employers business		Education		Shopping		Personal Business		Recreation / social		Visiting Friends		Holiday	
Horncastle		0.26		0.04		0.05		0.15		0.06		0.17				0.02
Gt Driffield		0.29		0.04		0.06		0.16		0.07		0.12				0.02
Hull		0.31		0.04		0.07		0.15		0.06		0.12				0.00
Grimsby		0.29		0.04		0.07		0.17		0.06		0.11				0.01
Scunthorpe		0.31		0.04		0.06		0.14		0.06		0.12				0.01
Average		0.29		0.04		0.06		0.15		0.06		0.13				0.01

Table C8: Proportion Split of Additional Trips by Journey Purpose for Non Home Based Trips

Zone	Work		Employers business		Education		Shopping		Personal Business		Recreation / social		visiting friends		Holiday	
	P	**A**	**P**	**A**	**P**	**A**	**P**	**A**	**P**	**A**	**P**	**A**	**P**	**A**	**P**	**A**
Horncastle	0.27	0.06	0.21	0.06	0.03	0.01	0.22	0.05	0.07	0.02	0.14	0.04	0.05	0.02	0.27	0.06
Gt Driffield	0.27	0.07	0.23	0.06	0.03	0.01	0.22	0.06	0.08	0.02	0.12	0.03	0.04	0.01	0.27	0.07
Hull	0.27	0.07	0.26	0.07	0.04	0.01	0.21	0.06	0.08	0.02	0.12	0.03	0.02	0.00	0.27	0.07
Grimsby	0.27	0.07	0.24	0.06	0.04	0.01	0.22	0.06	0.07	0.02	0.12	0.03	0.03	0.01	0.27	0.07
Scunthorpe	0.27	0.07	0.26	0.07	0.04	0.01	0.21	0.05	0.07	0.02	0.12	0.03	0.03	0.01	0.27	0.07
Average	**0.27**	**0.07**	**0.24**	**0.06**	**0.04**	**0.01**	**0.22**	**0.06**	**0.07**	**0.02**	**0.13**	**0.03**	**0.04**	**0.01**	**0.27**	**0.07**

The relevant journey purpose splits from Tables C7 & C8 for the HETM demand segments are as follows:

- HETM HBW = Work;
- HETM HBEB = Employers Business;
- HETM HBO = Personal Business; (other Home based purposes excluded & rebased)
- HETM NHBEB = Employers Business; and
- HETM NHBO = Personal Business (other Non Home based purposes excluded & rebased).

Application of these to the rates from Table C6 results in the following productions / attractions per new job:

- HBW (1.159 * 0.616) 0.715 Attractions;
- HBEB (1.159 * 0.085) 0.099 Attractions;
- HBO (1.159 * 0.128) 0.148 Attractions;
- NHEB (1.159 * 0.128) 0.148 Attractions, (0.301 * 0.774) 0.233 Productions; and
- NHBO (1.159 * 0.043) 0.049 Attractions, (0.301 * 0.226) 0.068 Productions.

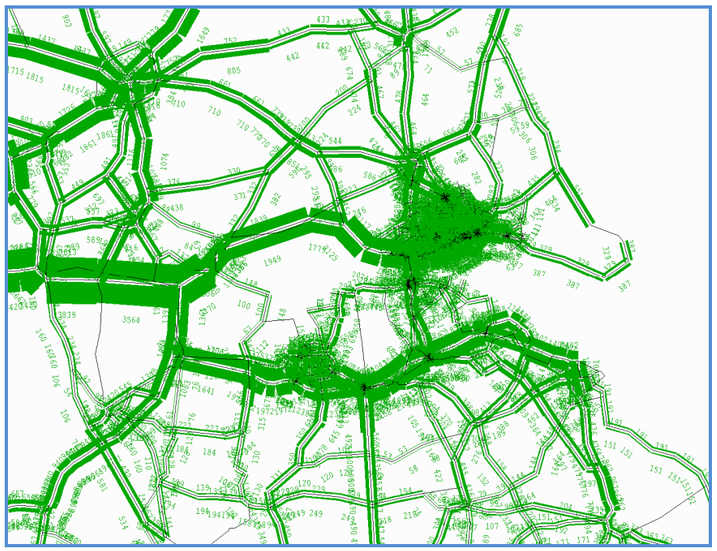
Appendix D – Model Outputs: 10% Toll Reduction

Appendix D – Model Outputs: 10% Toll Reduction

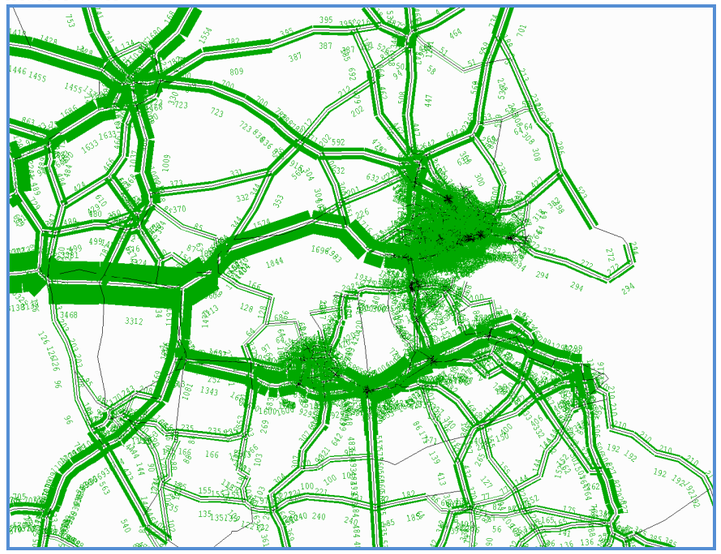
D.1 Flow Plots: Base Model 2010

Plots below are shown in pcus for flows in excess of 50pcus. Bandwidth units=400/mm.

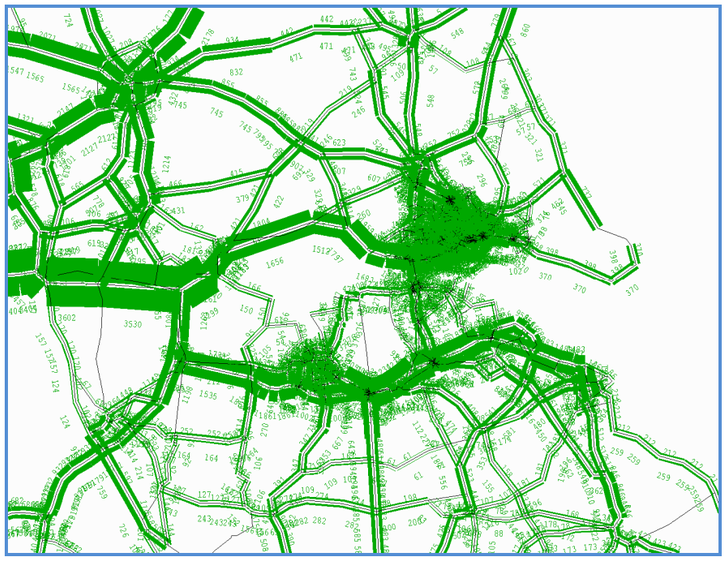
AM Peak



Inter Peak



PM Peak

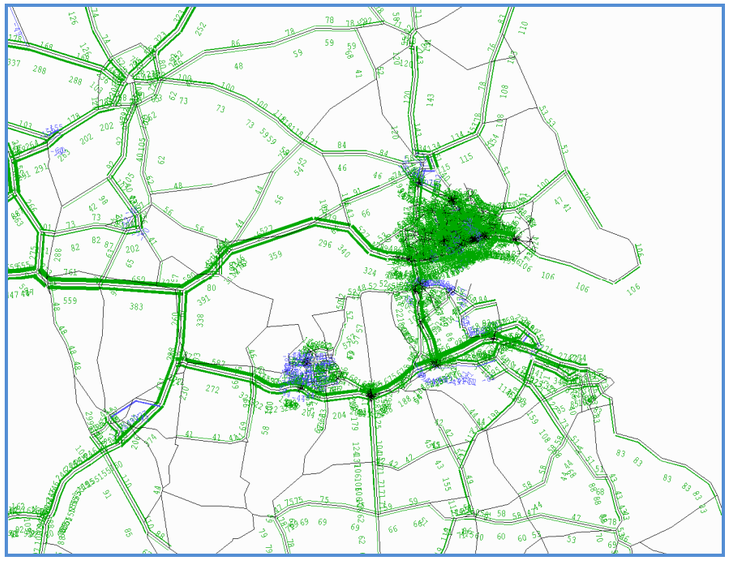


Capabilities on project:
Transportation

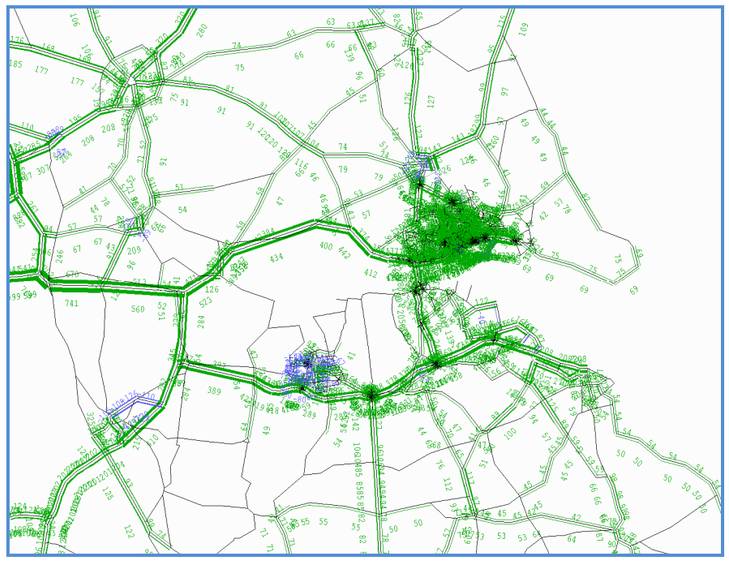
D.2 Growth Between 2010 and 2021 (NTEM 6.2 With Development Adjustments)

Diagrams below compare the changes in traffic flows between base 2010 and 2021, taking account of NTEM 6.2 growth and the reallocation of known developments. Traffic flows are shown in pcus for flow differences in excess of 30 pcus (green = increase, blue = decrease). Bandwidth units=400/mm.

AM Peak



Inter Peak



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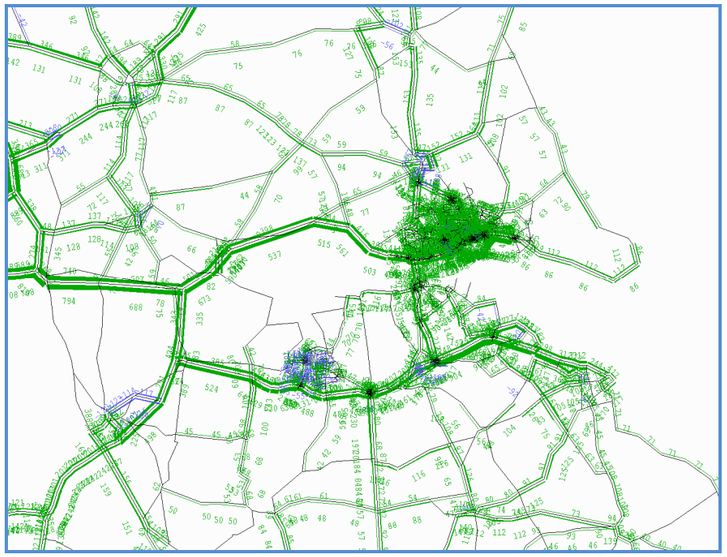
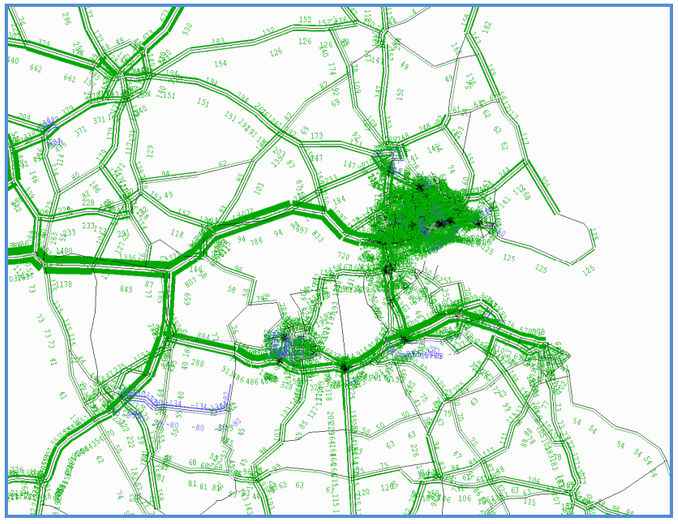


Capabilities on project:
Transportation

Growth Between 2010 and 2033 (NTEM 6.2 With Development Trips)

Diagrams below compare the changes in traffic flows between base 2010 and 2033, taking account of NTEM 6.2 growth and the reallocation of known developments. Traffic flows are shown in pcus for flow differences in excess of 30 pcus (green = increase, blue = decrease). Bandwidth units=400/mm.

AM Peak



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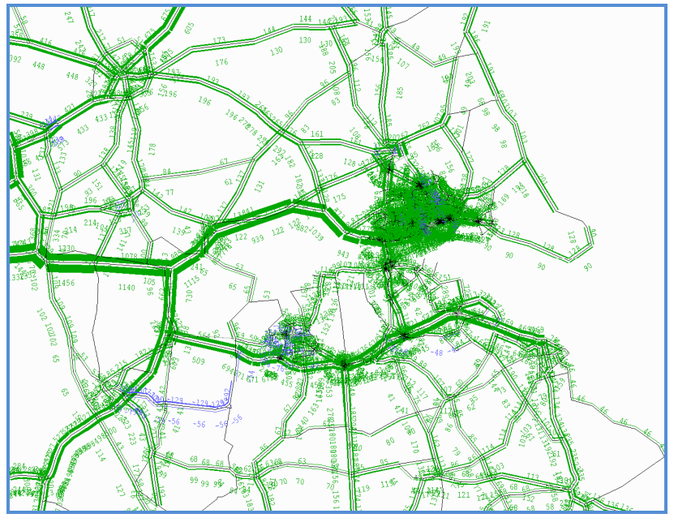

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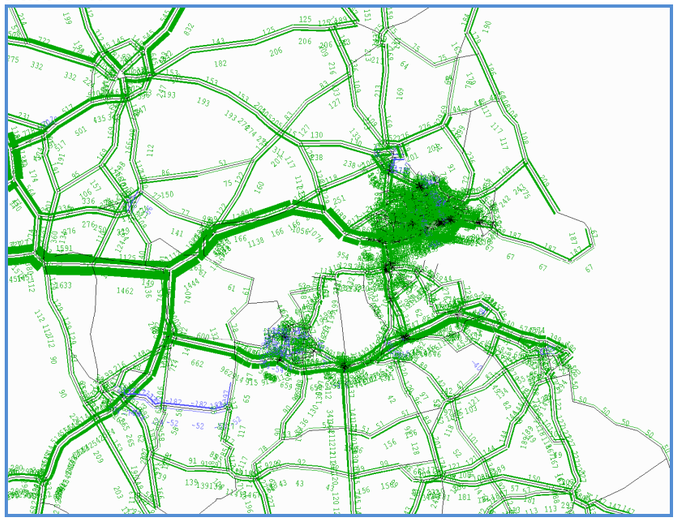


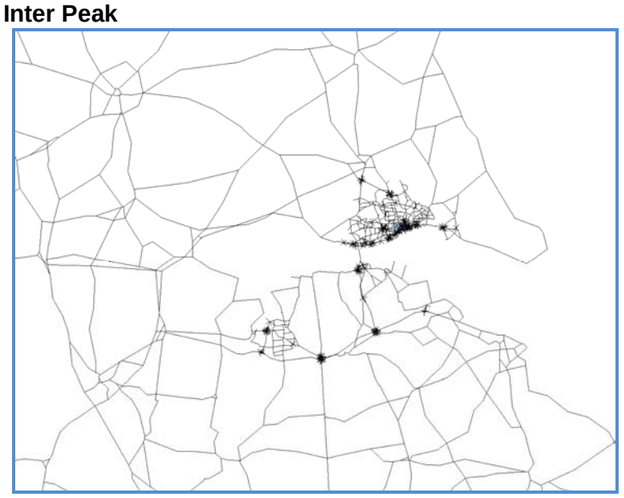
D.3 Flow Difference Plots: DS (with VDM) – Do Minimum

Flow plots comparing the changes in traffic flows between do minimum and do something. The diagrams show flow changes in excess of 30pcus, with green = flow increase & blue = flow decrease. Bandwidth units=100/mm.

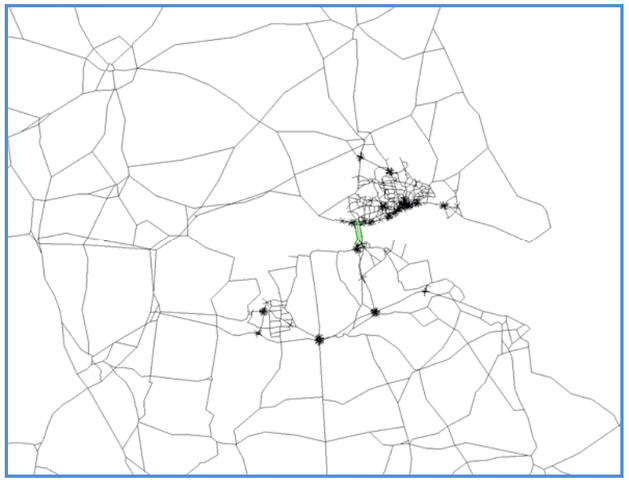
Flow Difference Plots – 2010

AM Peak

Inter Peak



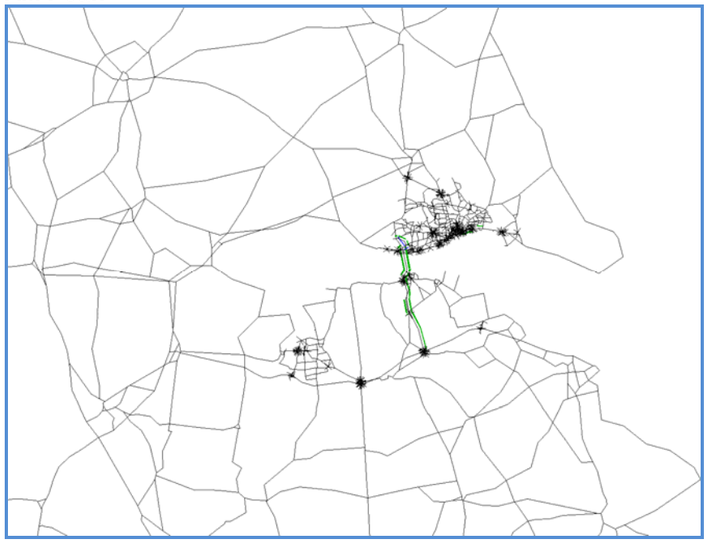
PM Peak



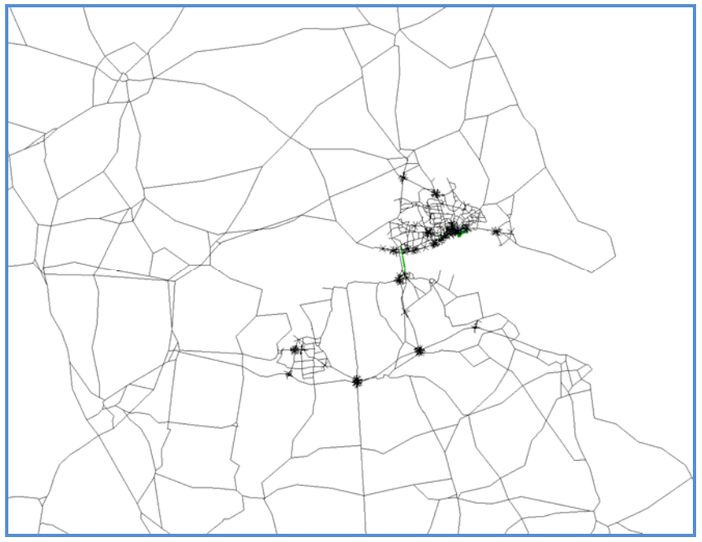
Capabilities on project:
Transportation

Flow Difference Plots – 2021

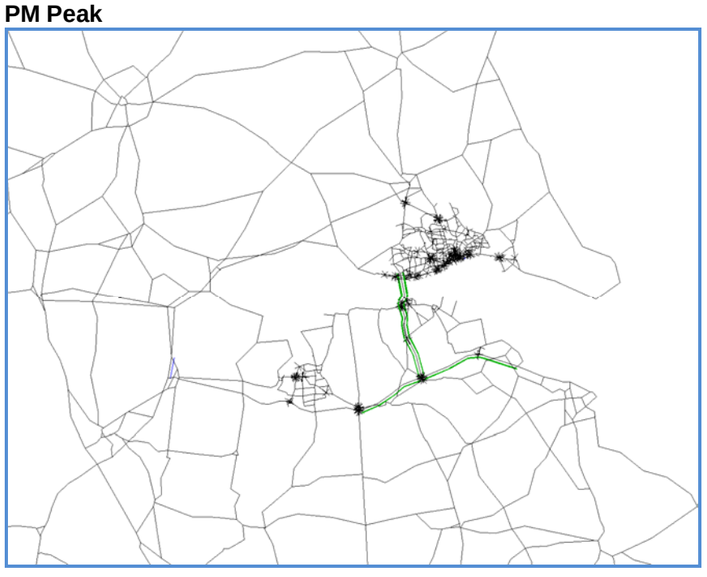
AM Peak



Inter Peak



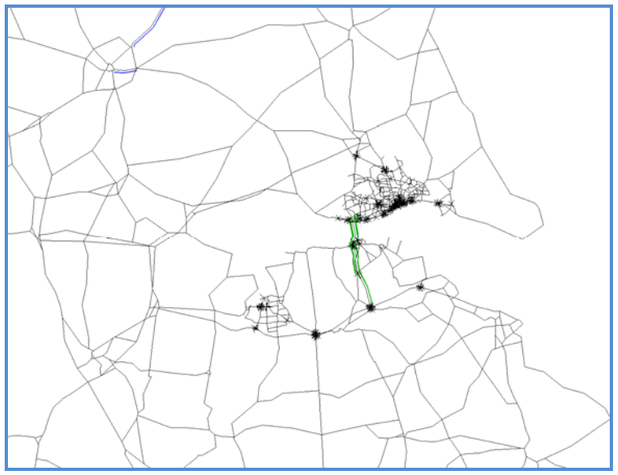
PM Peak



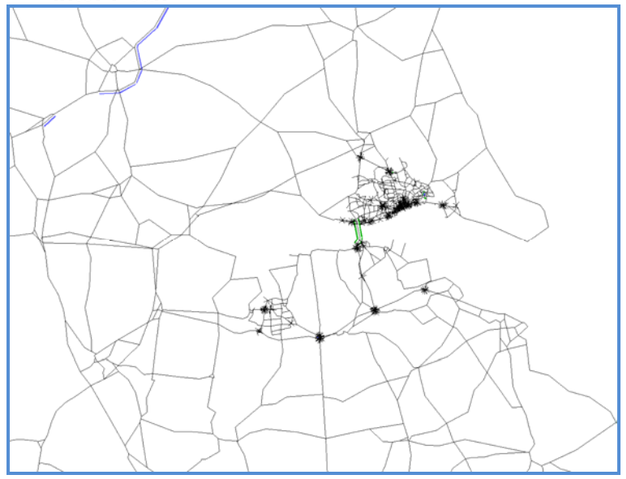
Capabilities on project:
Transportation

Flow Difference Plots – 2033

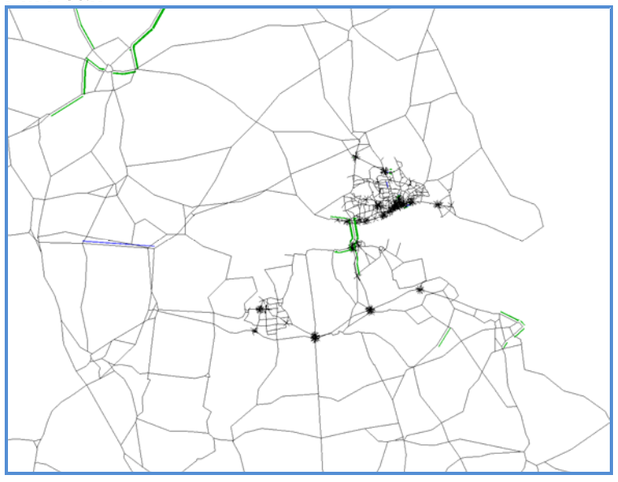
AM Peak



Inter Peak



PM Peak



D.4 Traffic Crossing the Humber Bridge – Summary

(All flows quoted are in pcus)

	The Humber Bridge						M62 (Humber Crossing)					
Scenario	**AM Peak**		**Interpeak**		**PM Peak**		**AM Peak**		**Interpeak**		**PM Peak**	
	NB	**SB**	**NB**	**SB**	**NB**	**SB**	**NB**	**SB**	**NB**	**SB**	**NB**	**SB**
DM 2010	1043	1234	811	841	1015	906	1512	1548	1260	1536	1469	1388
DS 2010 (No VDM)												
DS 2010 (With VDM)	1,070	1,267	837	864	1,046	943	1505	1545	1257	1531	1465	1385
DM 2021	1307	1630	1035	1072	1374	1139	1941	1858	1599	1925	1953	1978
DS 2021 (No VDM)												
DS 2021 (With VDM)	1,354	1,697	1,063	1,104	1,437	1,202	1938	1854	1591	1952	1938	1949
DM 2033	1590	1847	1258	1282	1593	1453	2459	2213	2006	2393	2489	2705
DS 2033 (No VDM)												
DS 2033 (With VDM)	1,649	1,910	1,298	1,320	1,653	1,526	2462	2205	1998	2694	2483	2694

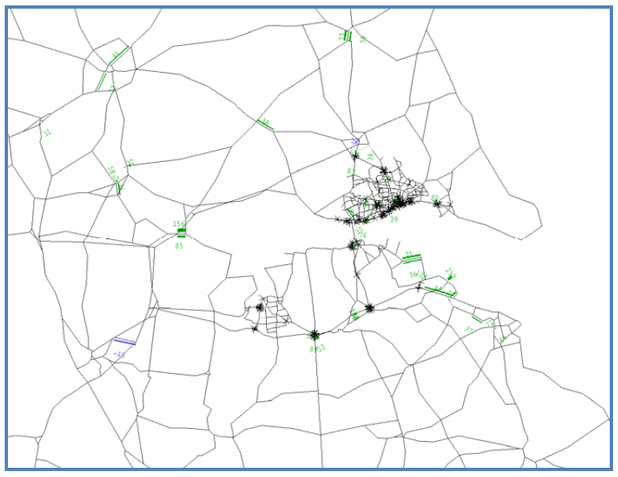
Capabilities on project:
Transportation

D.5 Network Delay Difference Plots: Do Minimum Forecast Year - 2010 Base

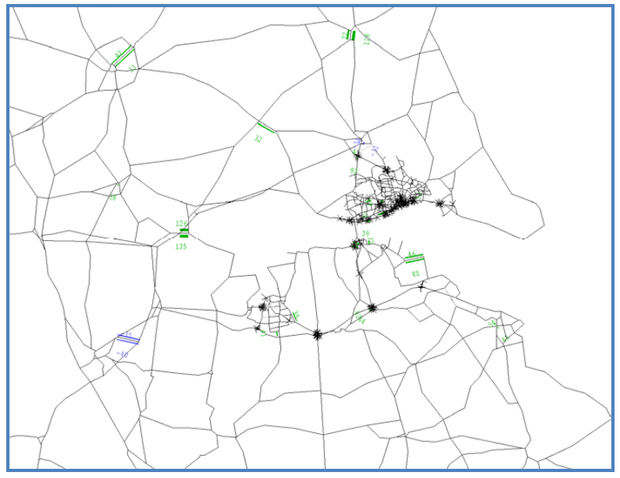
Difference plots comparing changes in network delay between the forecast year do minimum and 2010 base scenario. All values are in seconds for delay changes in excess of 30 seconds. Green = increases in delay, blue = decreases in delay. Bandwidth units=100/mm.

Do Minimum 2010 to 2021

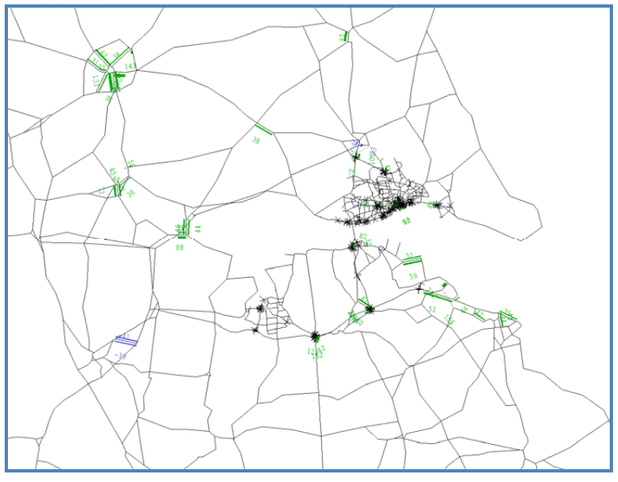
AM Peak



Inter Peak



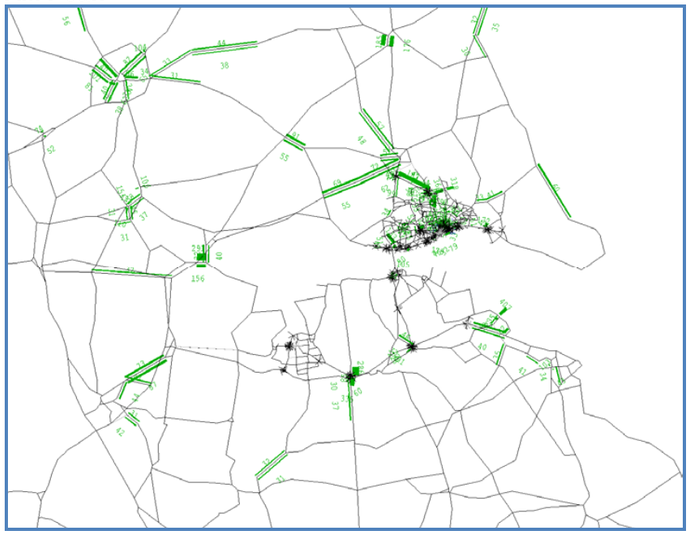
PM Peak



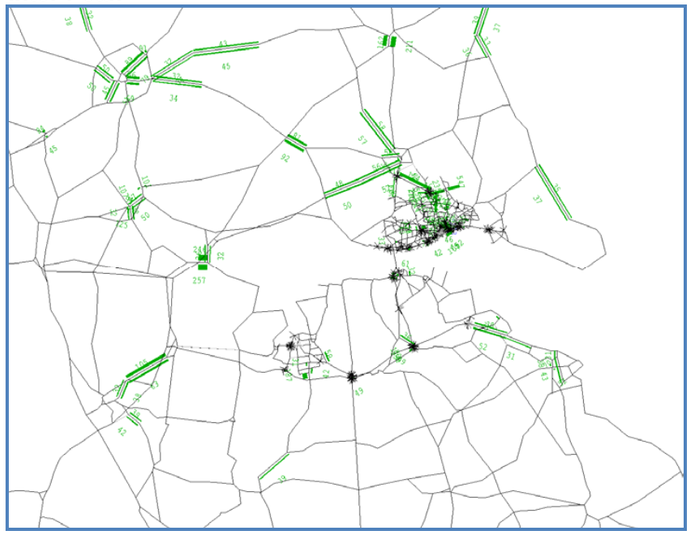
Capabilities on project:
Transportation

Do Minimum 2010 to 2033

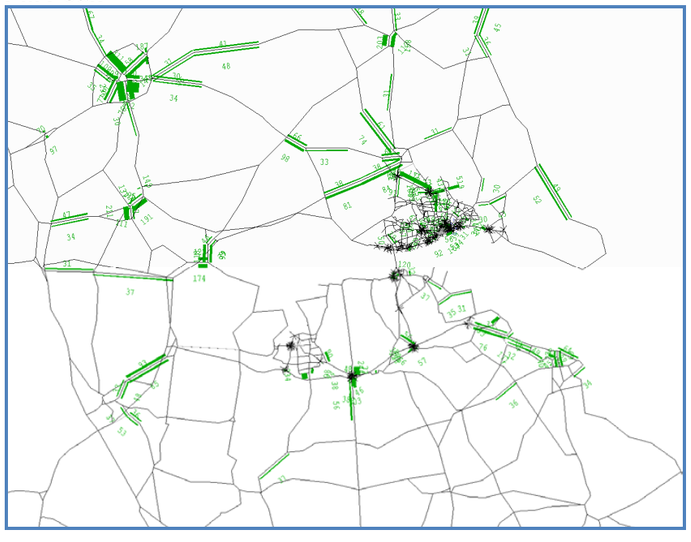
AM Peak



Inter Peak



PM Peak

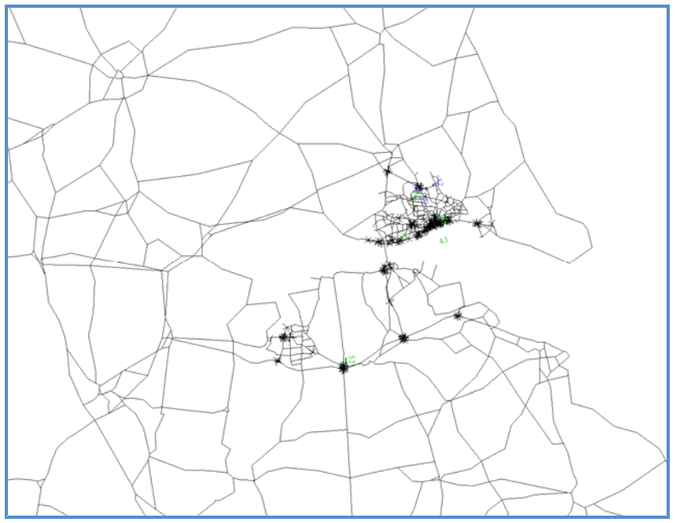


D.6 Network Delay Difference Plots: Do Something (with VDM) – Do Minimum

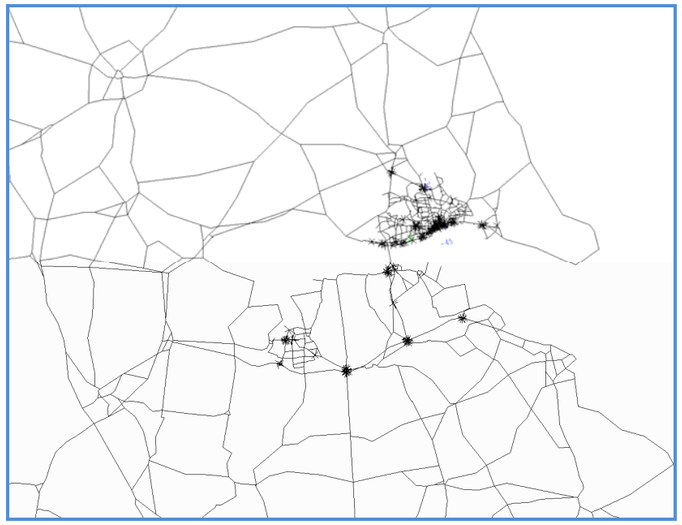
Difference plots comparing changes in network delay between the forecast year do minimum and 2010 base scenario. All values are in seconds for delay changes in excess of 30 seconds. Green = increases in delay, blue = decreases in delay. Bandwidth units=100/mm.

Do Something 2033

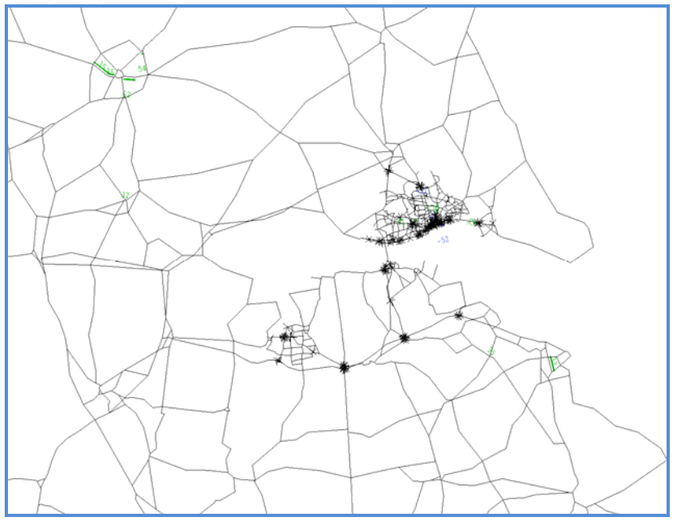
AM Peak



Inter Peak



PM Peak



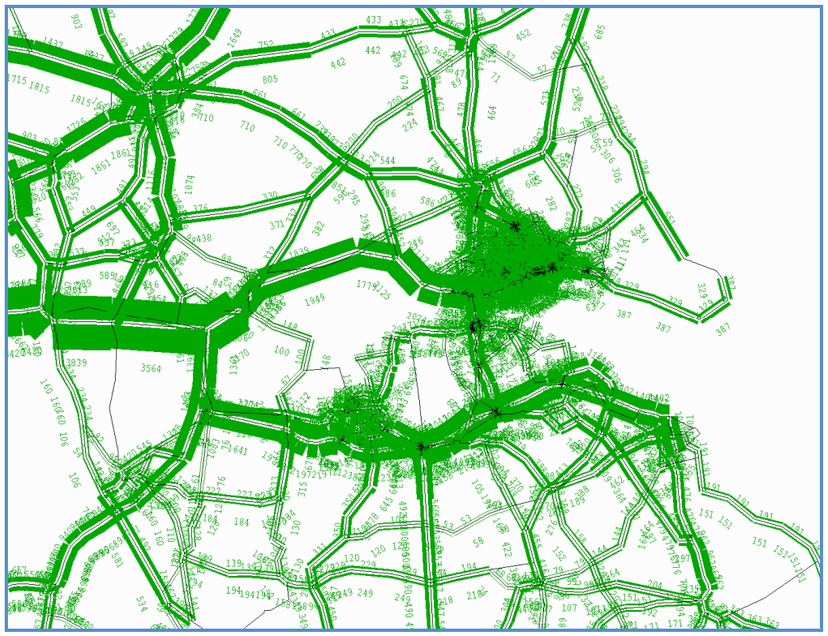
Appendix E - Model Outputs: 63% Toll Reduction

Appendix E - Model Outputs: 63% Toll Reduction

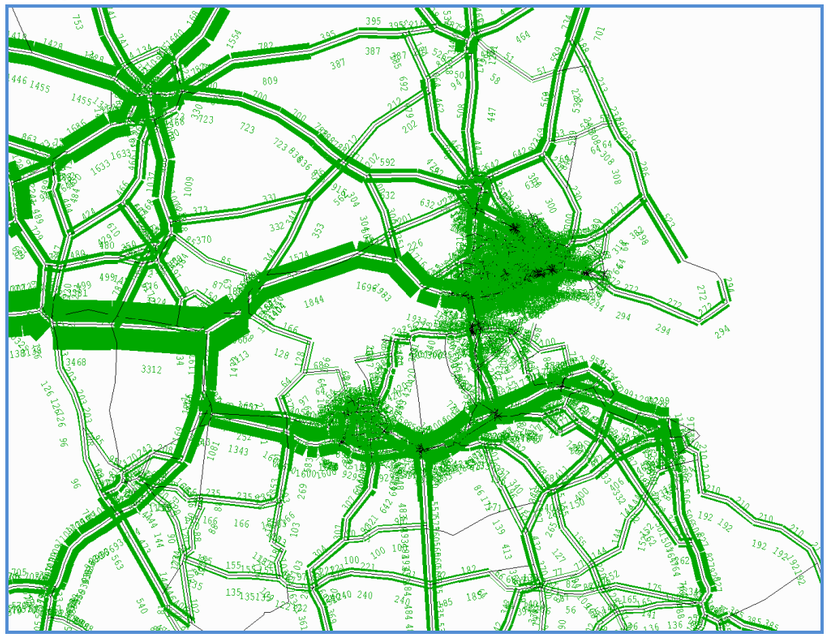
E.1 Flow Plots: Base Model 2010

Plots below are shown in pcus for flows in excess of 50pcus. Bandwidth units=400/mm.

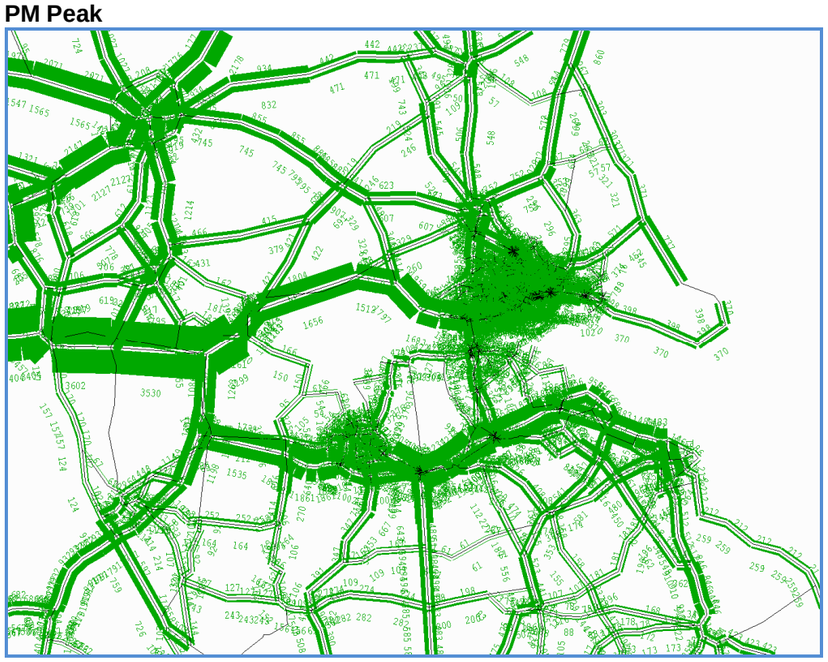
AM Peak



Inter Peak



PM Peak



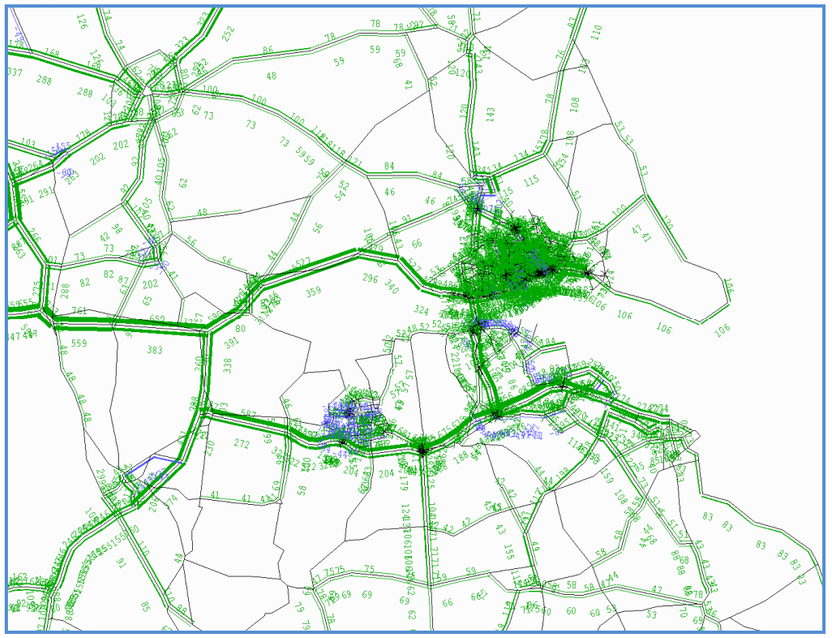
Capabilities on project:
Transportation

E.2 Growth Between 2010 and 2021 (NTEM 6.2 With Development Adjustments)

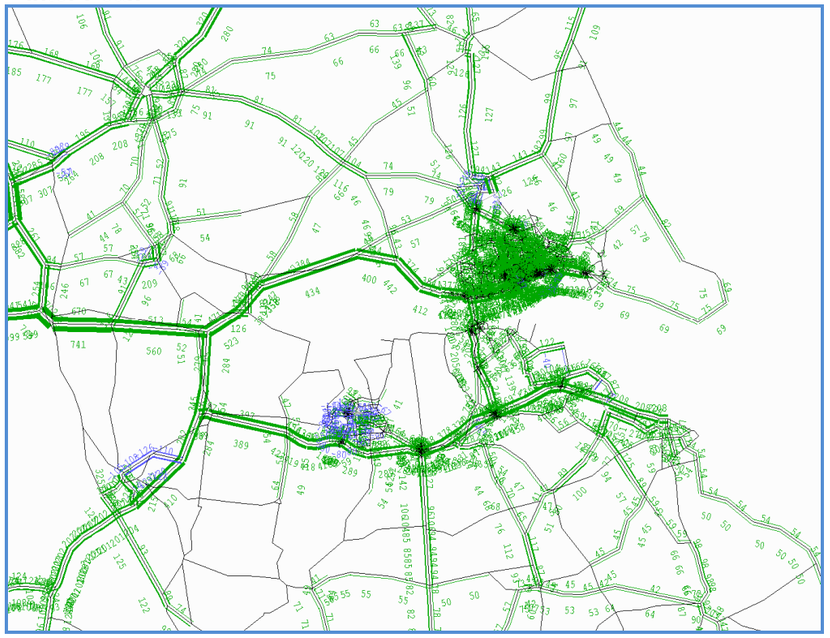
Diagrams below compare the changes in traffic flows between base 2010 and 2021, taking account of NTEM 6.2 growth and the reallocation of known developments.

Traffic flows are shown in pcus for flow differences in excess of 30 pcus (green = increase, blue = decrease). Bandwidth units=400/mm.

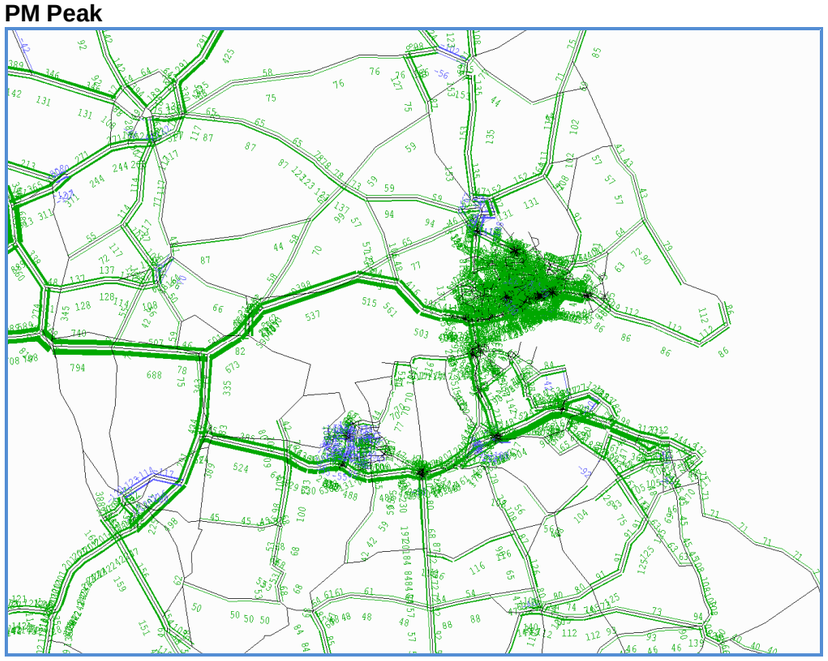
AM Peak



Inter Peak



PM Peak



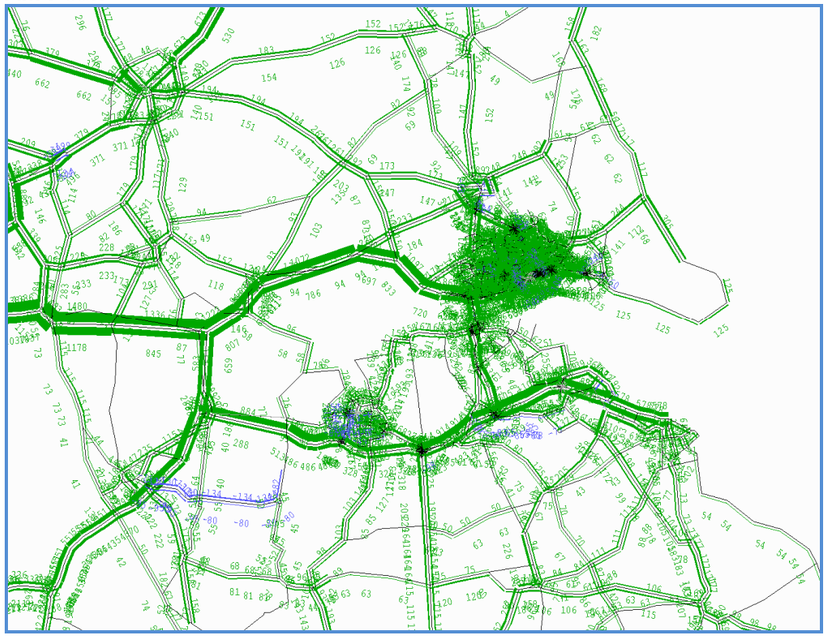
Capabilities on project:
Transportation

Growth Between 2010 and 2033 (NTEM 6.2 With Development Trips)

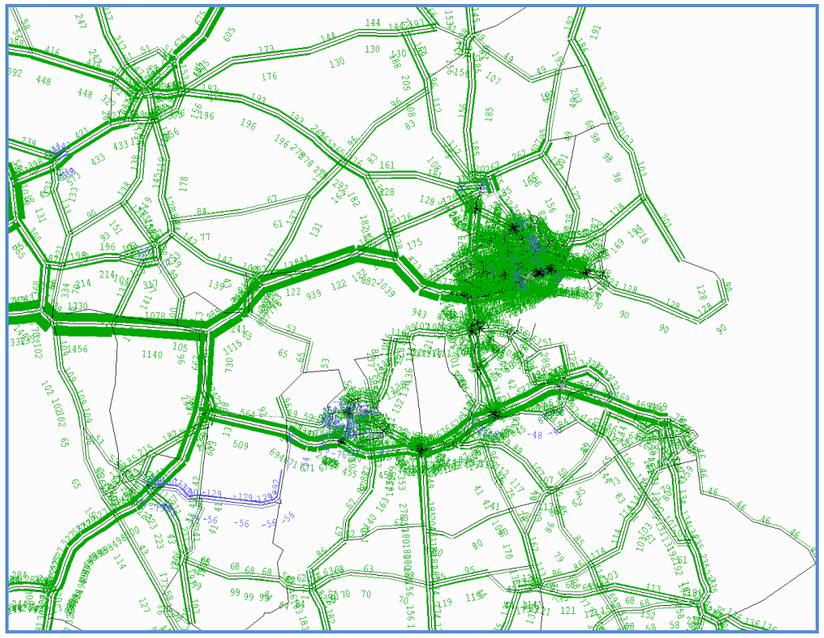
Diagrams below compare the changes in traffic flows between base 2010 and 2033, taking account of NTEM 6.2 growth and the reallocation of known developments.

Traffic flows are shown in pcus for flow differences in excess of 30 pcus (green = increase, blue = decrease). Bandwidth units=400/mm.

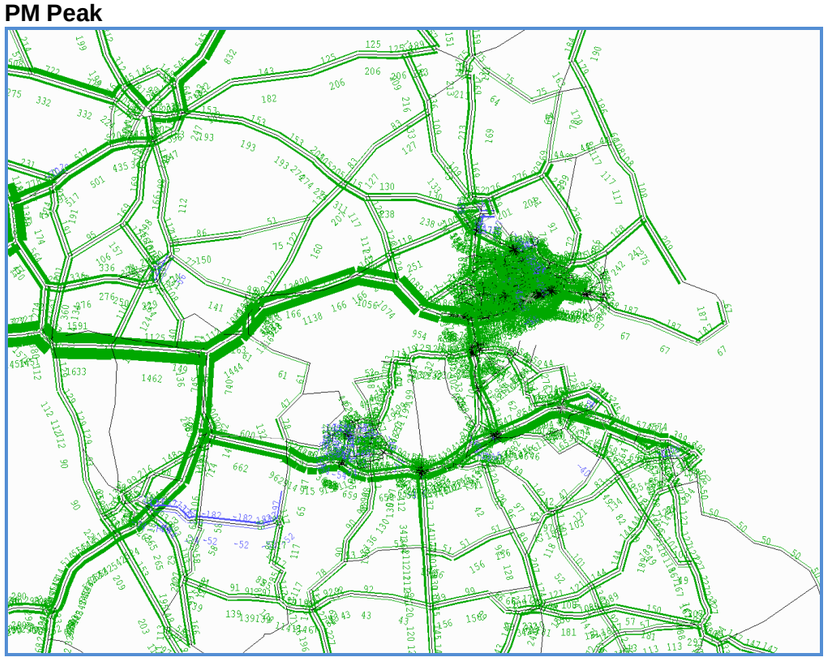
AM Peak



Inter Peak



PM Peak



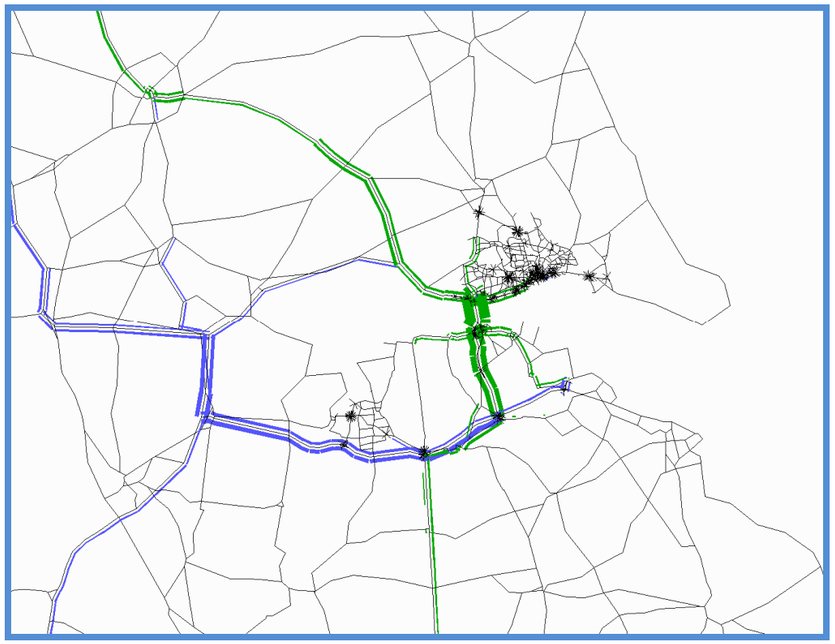
Capabilities on project:
Transportation

E.3 Flow Difference Plots: DS (with VDM) – Do Minimum

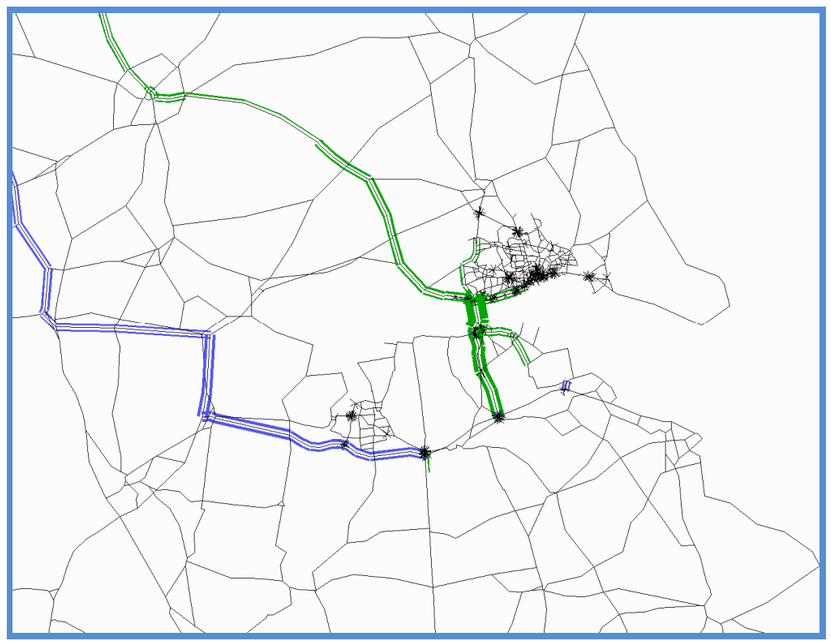
Flow plots comparing the changes in traffic flows between do minimum and do something. The diagrams show flow changes in excess of 30pcus, with green = flow increase & blue = flow decrease. Bandwidth units=100/mm.

Flow Difference Plots – 2010

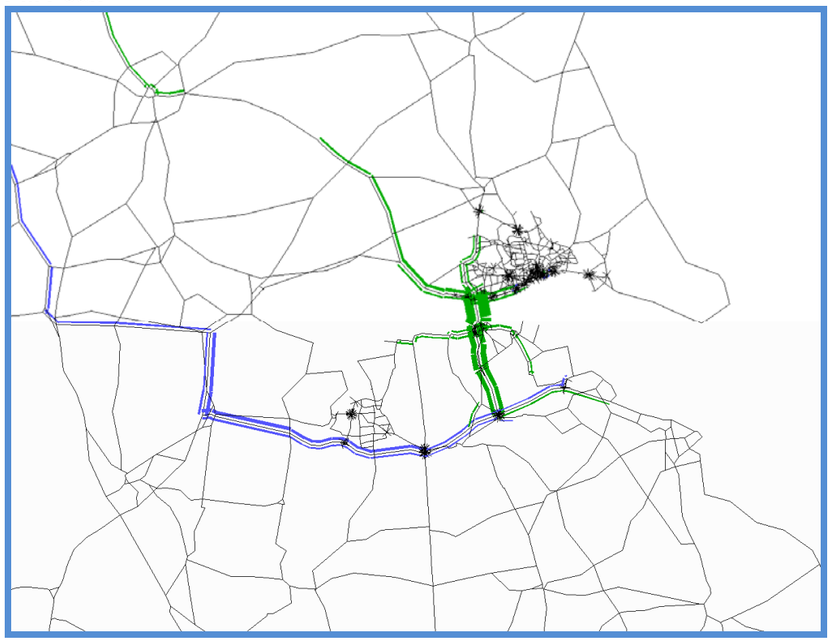
AM Peak



Inter Peak



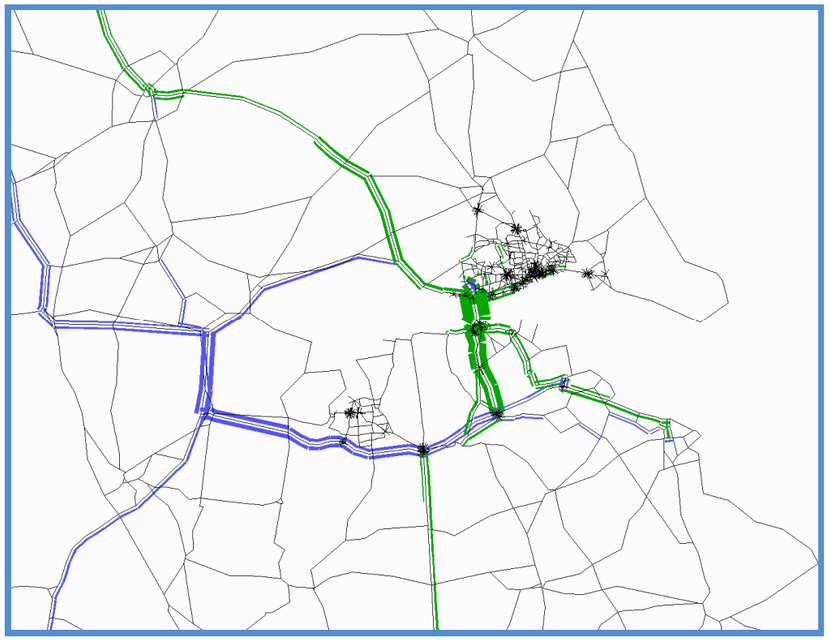
PM Peak



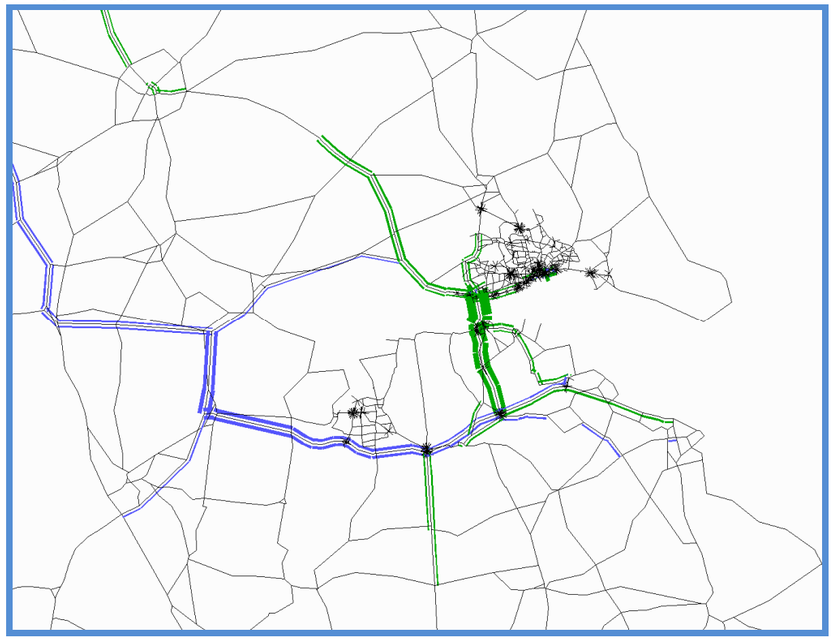
Capabilities on project:
Transportation

Flow Difference Plots – 2021

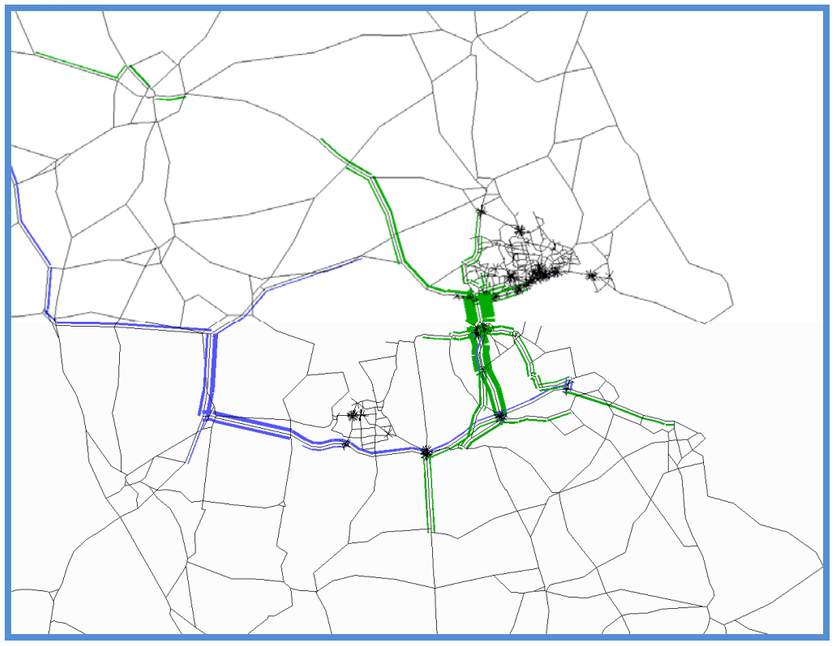
AM Peak



Inter Peak



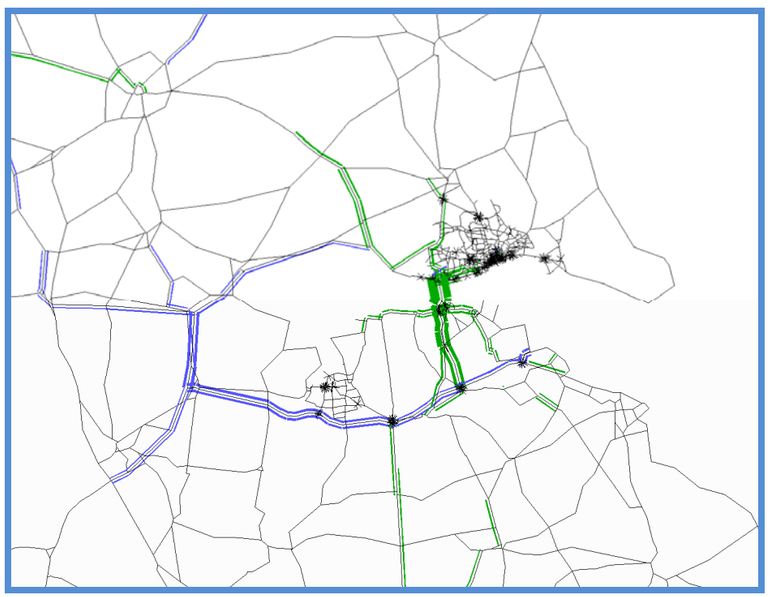
PM Peak



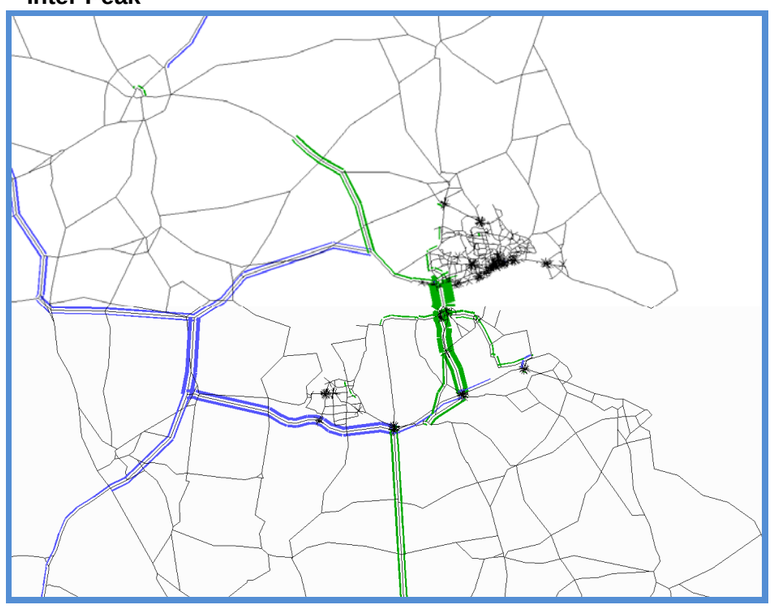
Capabilities on project:
Transportation

Flow Difference Plots – 2033

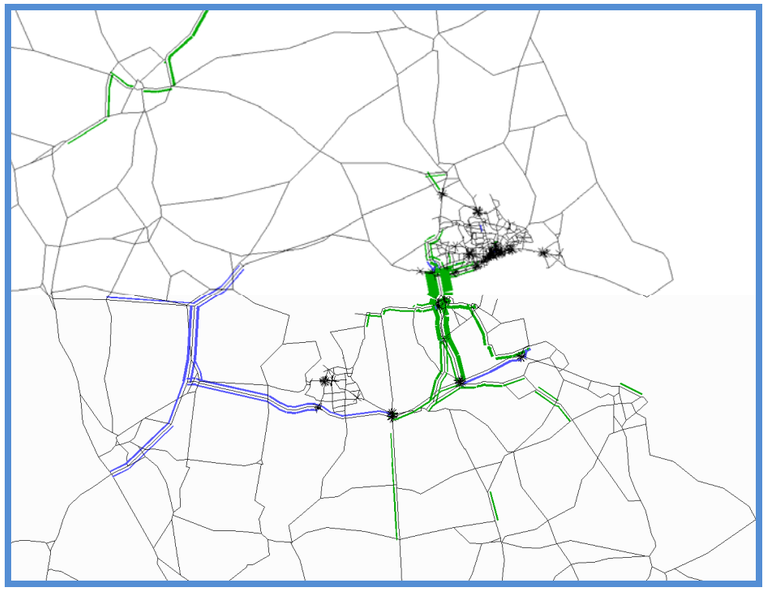
AM Peak



Inter Peak



PM Peak



Capabilities on project:
Transportation

E.4 Traffic Crossing the Humber Bridge – Summary

(All flows quoted are in pcus)

	The Humber Bridge						M62 (Humber Crossing)					
Scenario	**AM Peak**		**Interpeak**		**PM Peak**		**AM Peak**		**Interpeak**		**PM Peak**	
	NB	**SB**	**NB**	**SB**	**NB**	**SB**	**NB**	**SB**	**NB**	**SB**	**NB**	**SB**
DM 2010	1043	1234	811	841	1015	906	1512	1548	1260	1536	1469	1388
DS 2010 (No VDM)												
DS 2010 (With VDM)	1,408	1,607	1,088	1,136	1,334	1,304	1492	1508	1243	1515	1477	1372
DM 2021	1307	1630	1035	1072	1374	1139	1941	1858	1599	1925	1953	1978
DS 2021 (No VDM)												
DS 2021 (With VDM)	1,708	2,060	1,362	1,429	1,772	1,607	1926	1793	1571	1886	1940	1935
DM 2033	1590	1847	1258	1282	1593	1453	2459	2213	2006	2393	2489	2705
DS 2033 (No VDM)												
DS 2033 (With VDM)	1,995	2,124	1,600	1,661	1,998	1,830	2428	2167	1960	2350	2448	2660

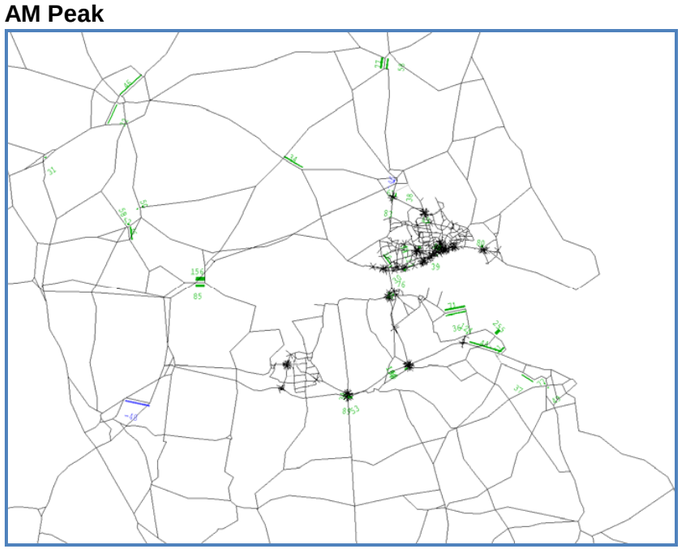
Capabilities on project:
Transportation

Network Delay Difference Plots: Do Minimum Forecast Year - 2010 Base

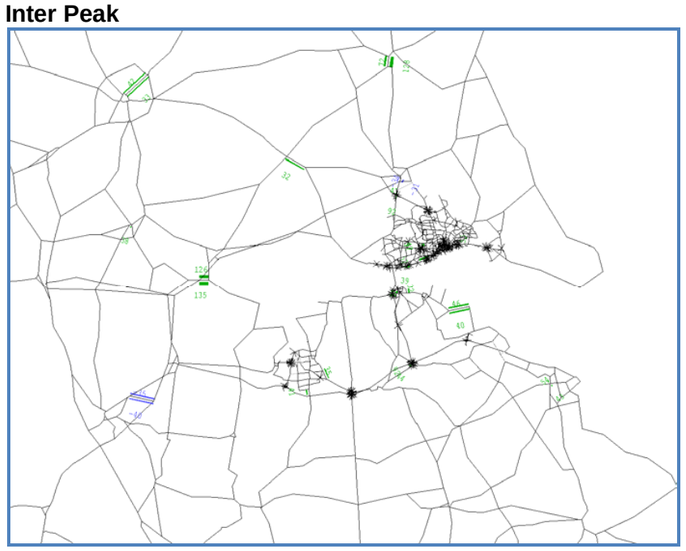
Difference plots comparing changes in network delay between the forecast year do minimum and 2010 base scenario. All values are in seconds for delay changes in excess of 30 seconds. Green = increases in delay, blue = decreases in delay. Bandwidth units=100/mm.

E.5 Do Minimum 2010 to 2021

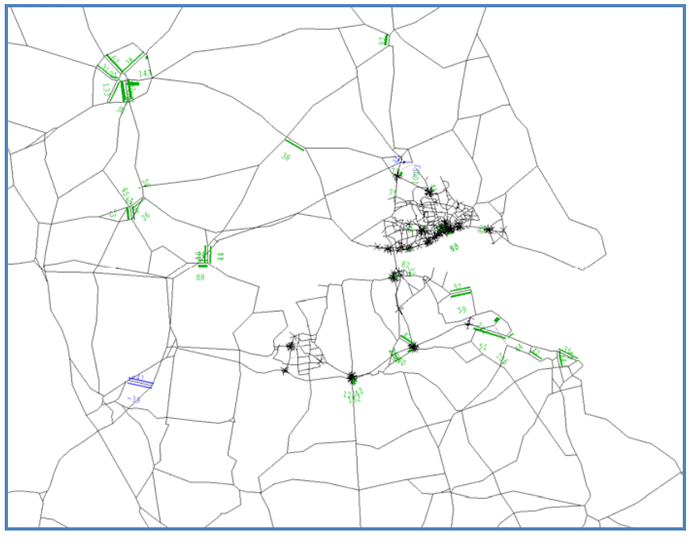
AM Peak



Inter Peak



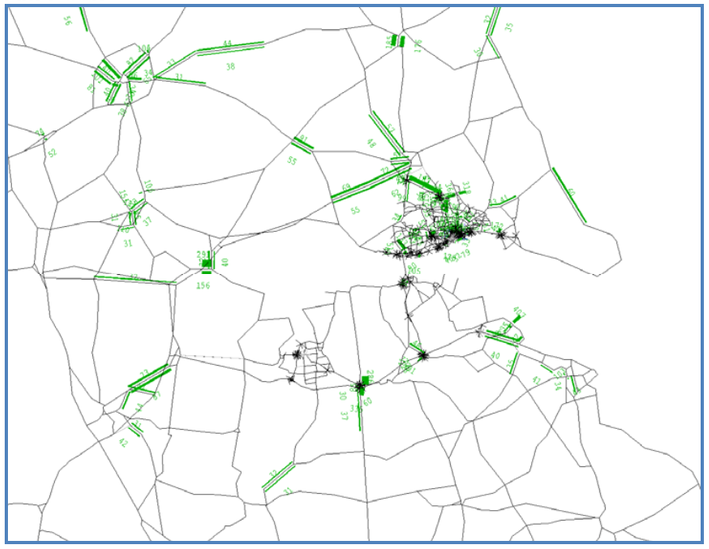
PM Peak



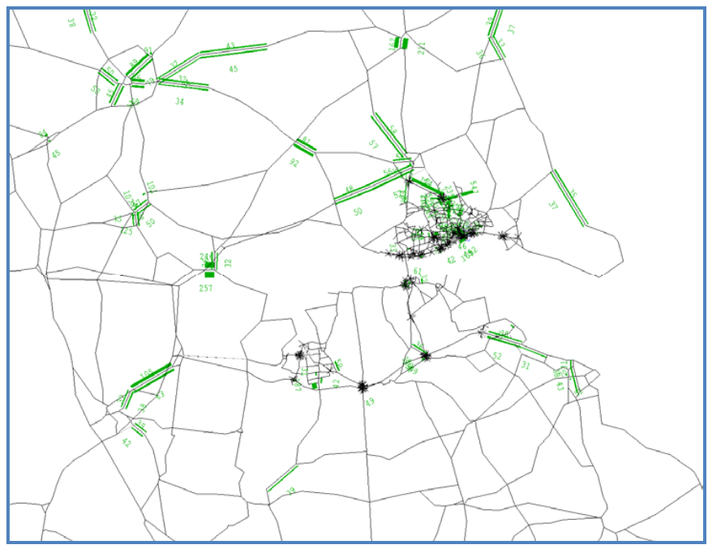
Capabilities on project:
Transportation

Do Minimum 2010 to 2033

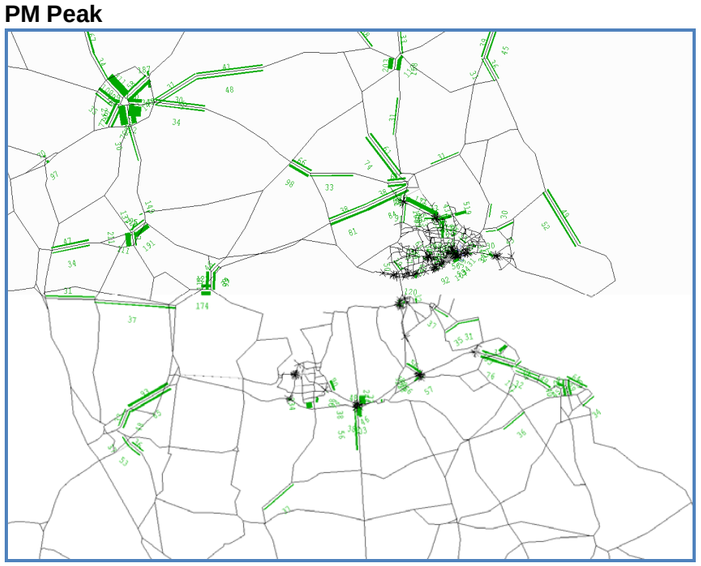
AM Peak



Inter Peak



PM Peak

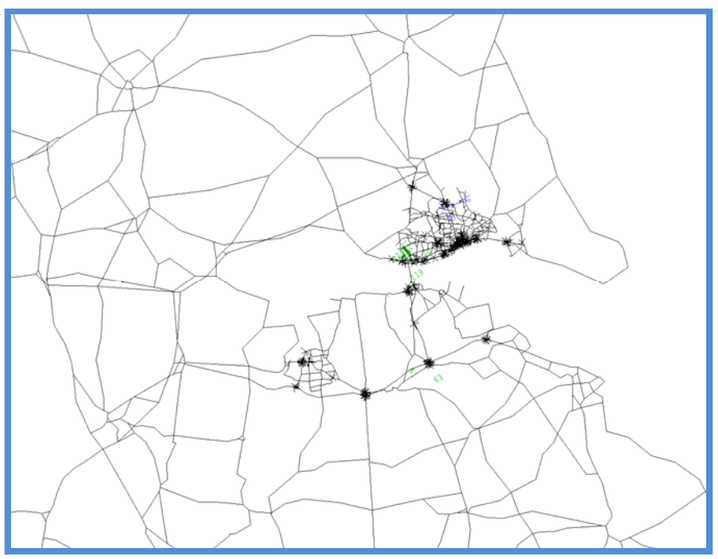


E.6 Network Delay Difference Plots: Do Something (with VDM) – Do Minimum

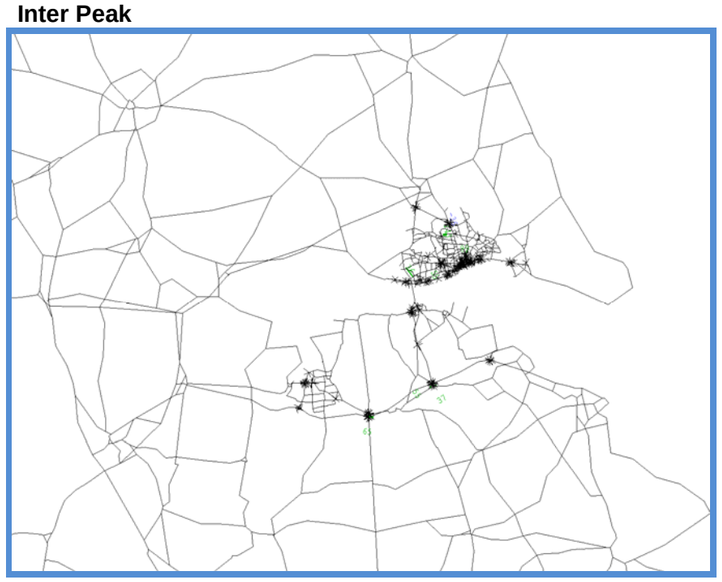
Difference plots comparing changes in network delay between the forecast year do minimum and 2010 base scenario. All values are in seconds for delay changes in excess of 30 seconds. Green = increases in delay, blue = decreases in delay. Bandwidth units=100/mm.

Do Something 2033

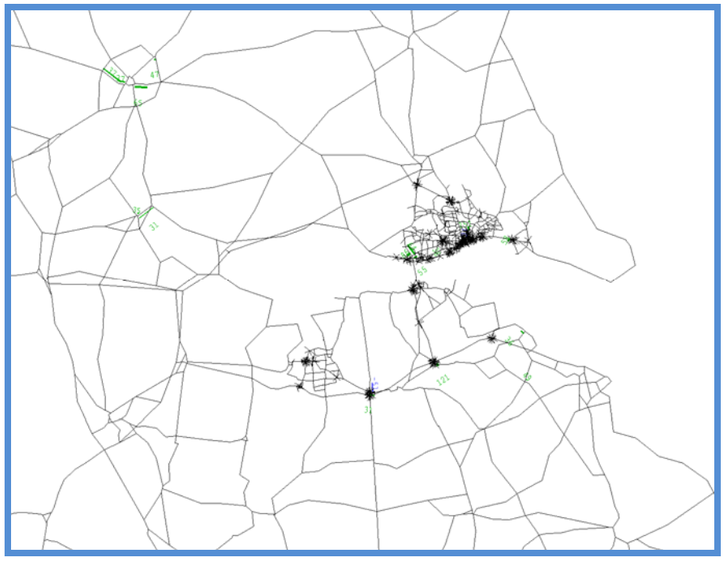
AM Peak



Inter Peak



PM Peak



Appendix F – Model Outputs: No Toll

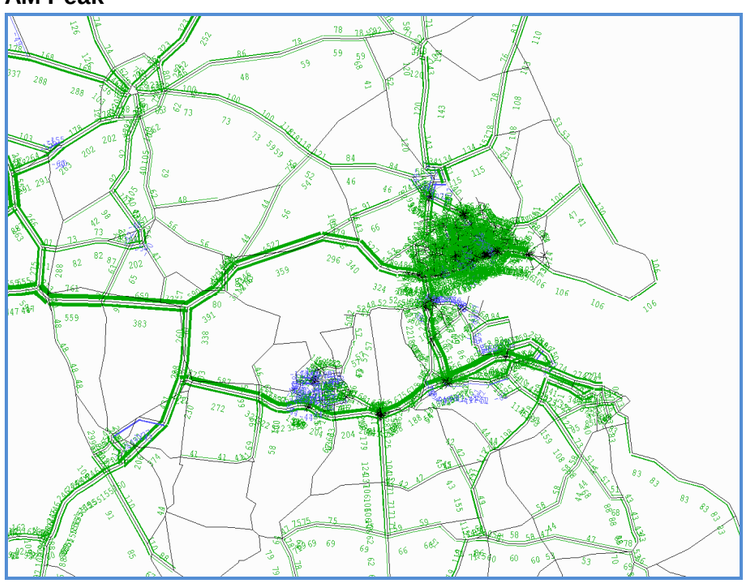
Capabilities on project:
Transportation

Appendix F - Model Outputs: No Toll

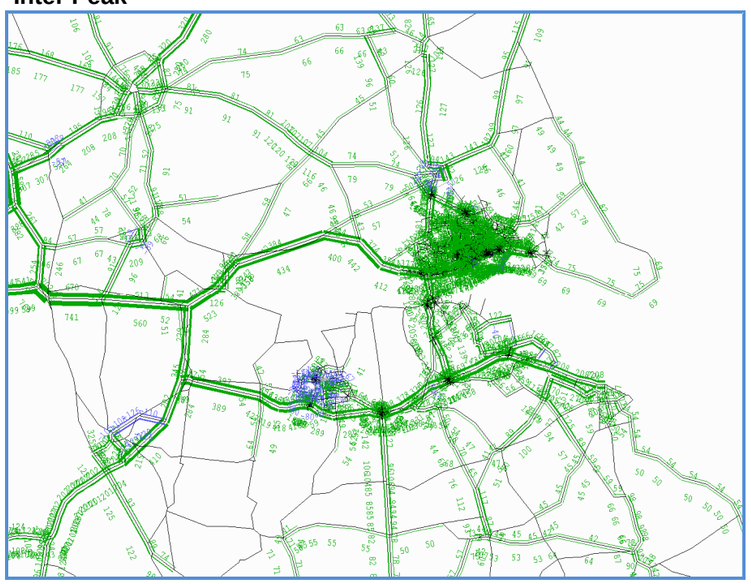
F.1 Growth Between 2010 and 2021 (NTEM 6.2 With Development Adjustments)

Diagrams below compare the changes in traffic flows between base 2010 and 2021, taking account of NTEM 6.2 growth and the reallocation of known developments. Traffic flows are shown in pcus for flow differences in excess of 30 pcus (green = increase, blue = decrease). Bandwidth units=400/mm.

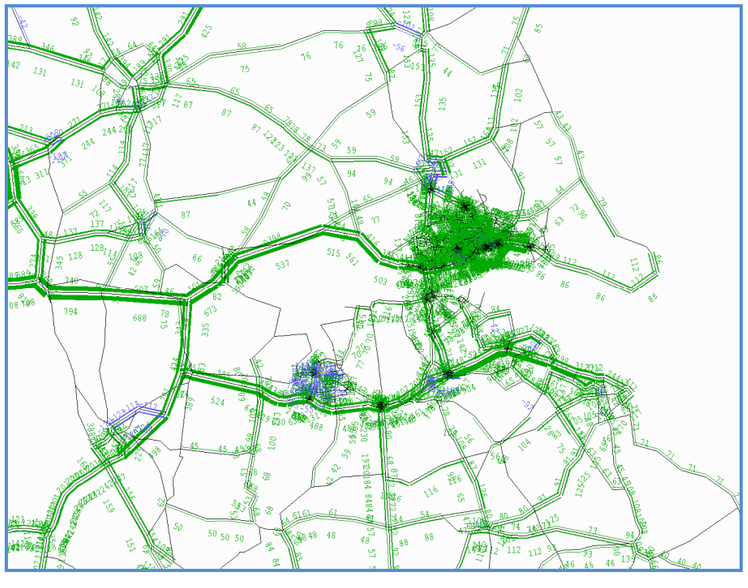
AM Peak



Inter Peak



PM Peak

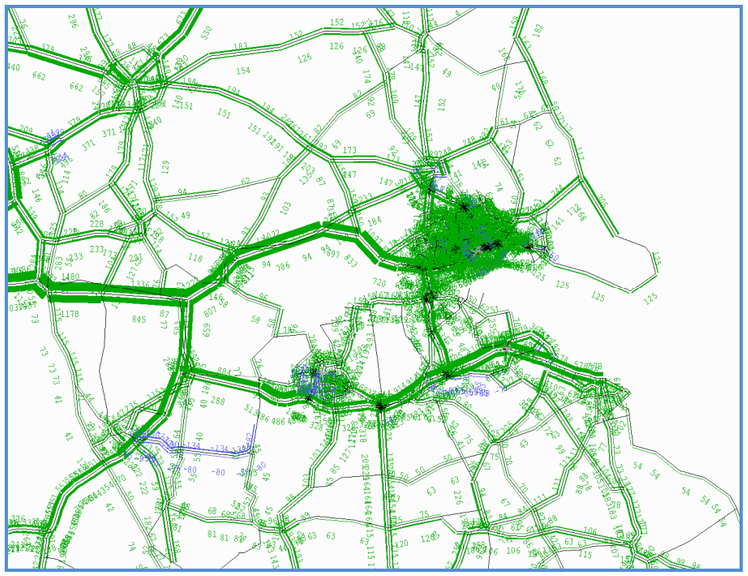


Capabilities on project:
Transportation

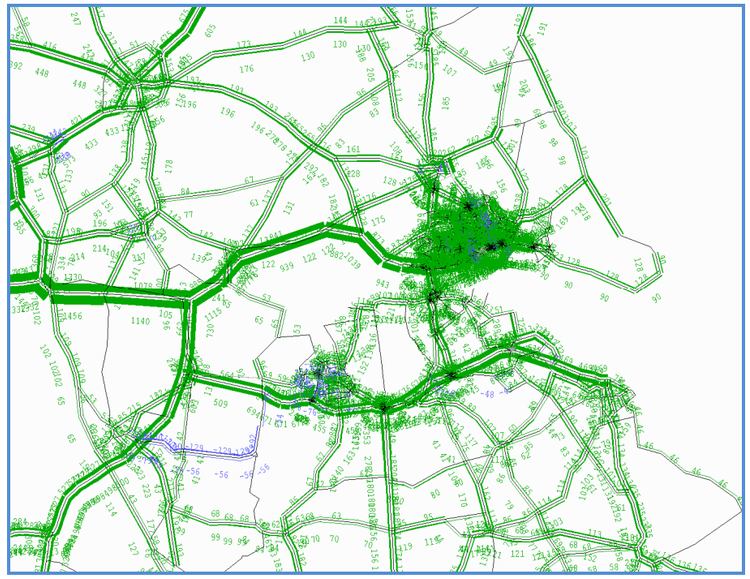
Growth Between 2010 and 2033 (NTEM 6.2 With Development Trips)

Diagrams below compare the changes in traffic flows between base 2010 and 2033, taking account of NTEM 6.2 growth and the reallocation of known developments. Traffic flows are shown in pcus for flow differences in excess of 30 pcus (green = increase, blue = decrease). Bandwidth units=400/mm.

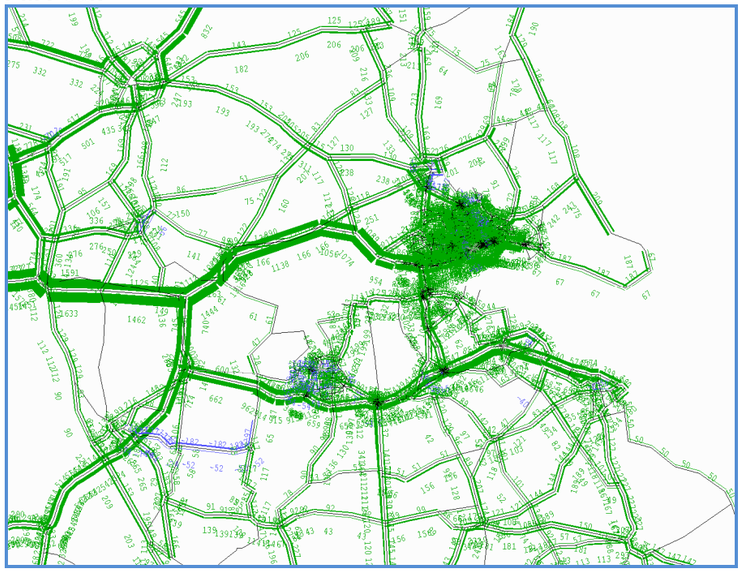
AM Peak



Inter Peak



PM Peak

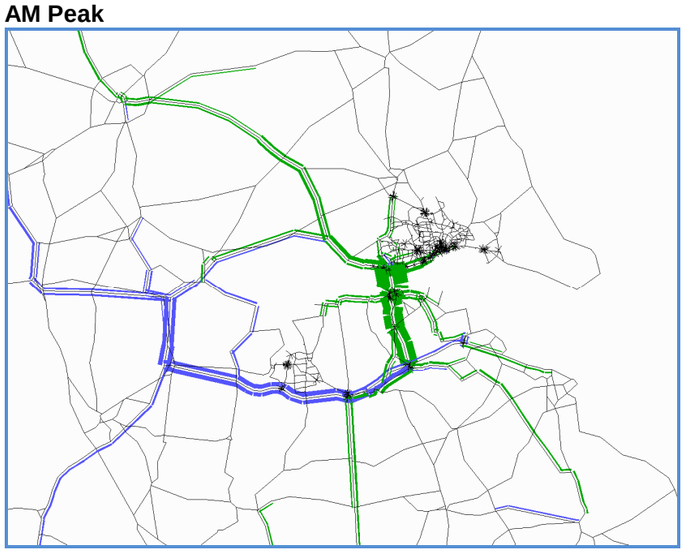


F.2 Flow Difference Plots: DS (with VDM) – Do Minimum

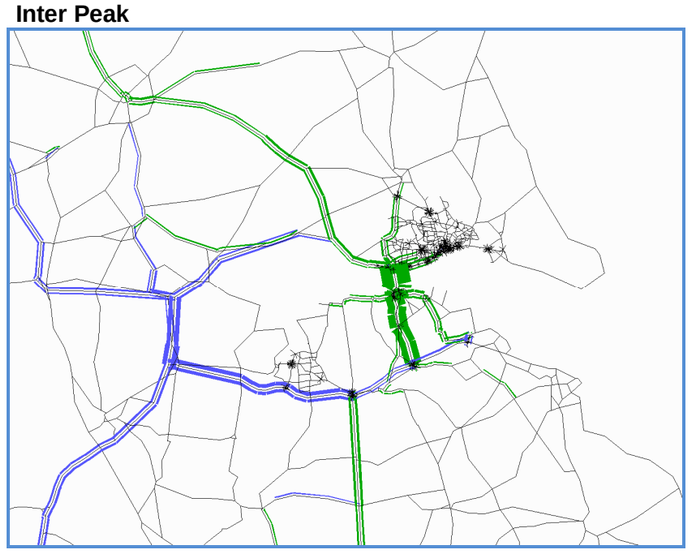
Flow plots comparing the changes in traffic flows between do minimum and do something. The diagrams show flow changes in excess of 30pcus, with green = flow increase & blue = flow decrease. Bandwidth units=100/mm.

Flow Difference Plots – 2010

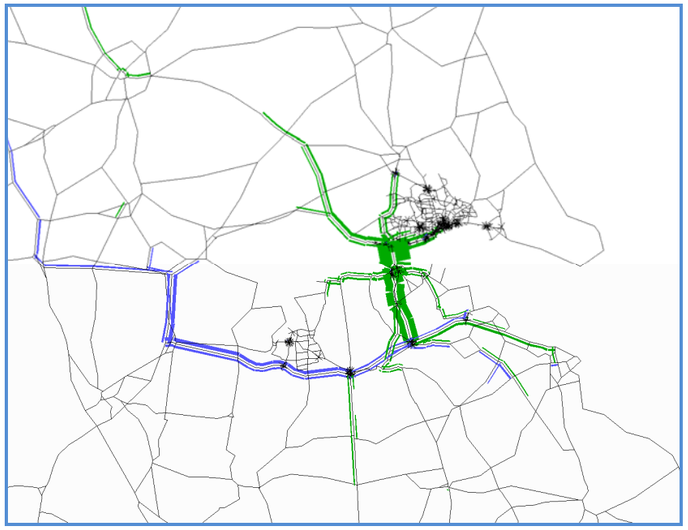
AM Peak



Inter Peak



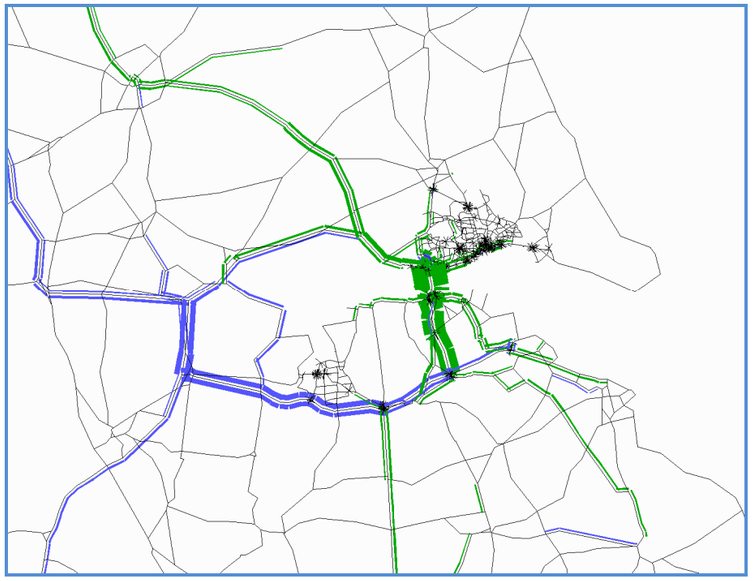
PM Peak



Capabilities on project:
Transportation

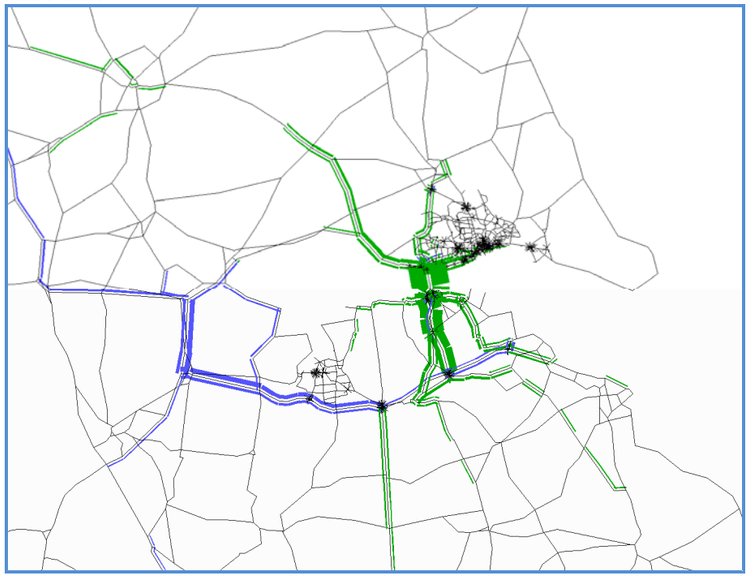
Flow Difference Plots – 2021

AM Peak



Inter Peak

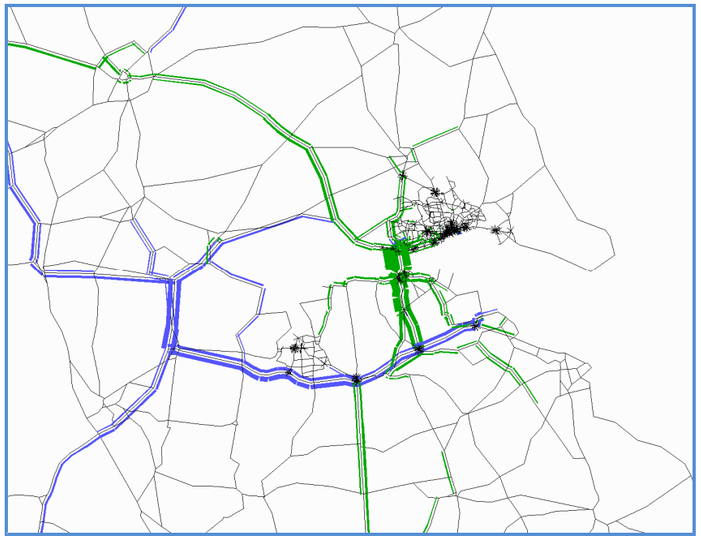
PM Peak



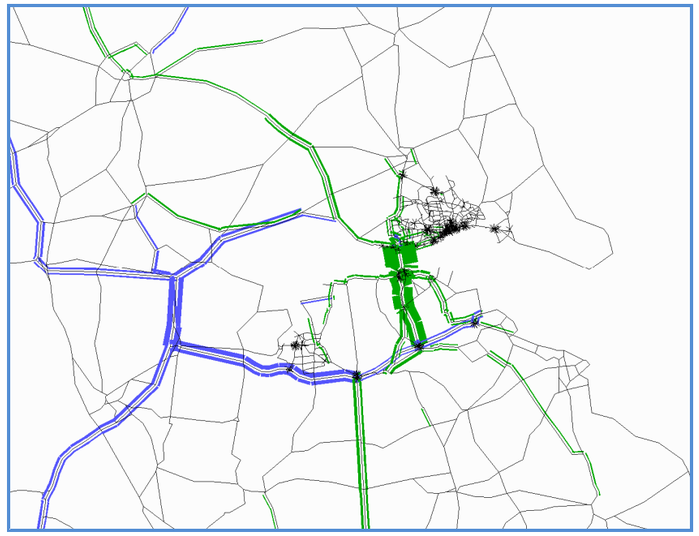
Capabilities on project:
Transportation

Flow Difference Plots – 2033

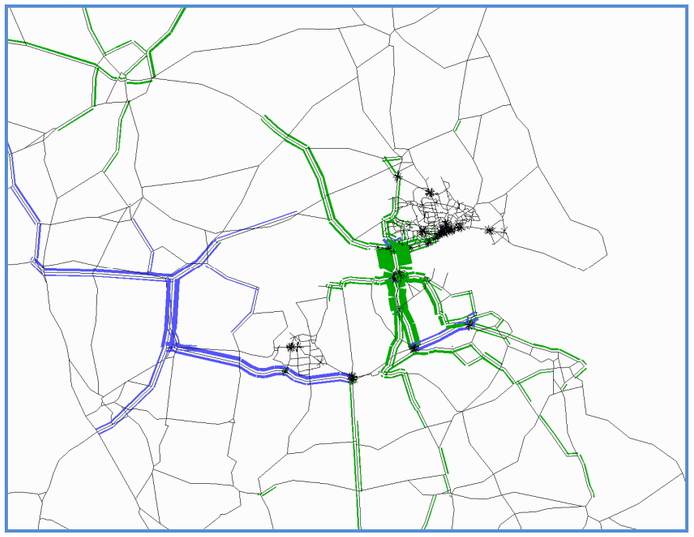
AM Peak



Inter Peak



PM Peak



F.3 Traffic Crossing the Humber Bridge – Summary
(All flows quoted are in pcus)

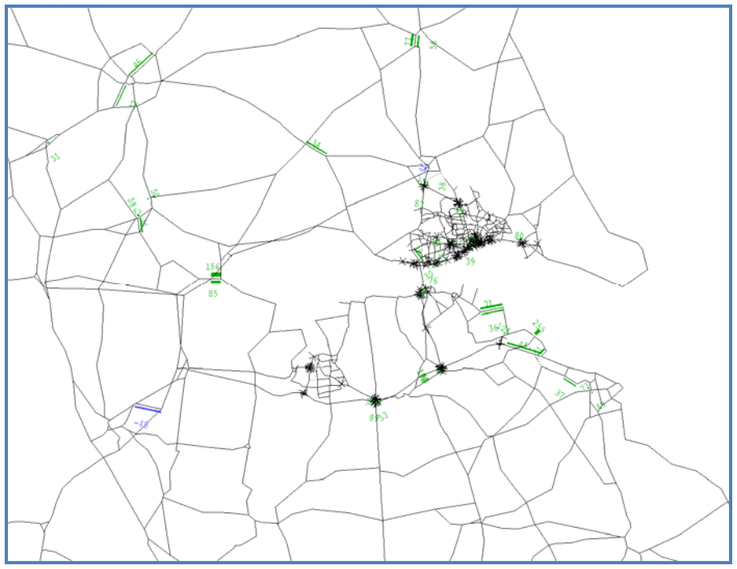
Scenario	The Humber Bridge						M62 (Humber Crossing)					
	AM Peak		Interpeak		PM Peak		AM Peak		Interpeak		PM Peak	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
DM 2010	1043	1234	811	841	1015	906	1512	1548	1260	1536	1469	1388
DS 2010 (No VDM)												
DS 2010 (With VDM)	1620	1887	1329	1432	1572	1559	1494	1491	1201	1454	1480	1362
DM 2021	1307	1630	1035	1072	1374	1139	1941	1858	1599	1925	1953	1978
DS 2021 (No VDM)												
DS 2021 (With VDM)	1936	2253	1614	1747	2052	1859	1929	1784	1532	1828	1942	1919
DM 2033	1590	1847	1258	1282	1593	1453	2459	2213	2006	2393	2489	2705
DS 2033 (No VDM)												
DS 2033 (With VDM)	2215	2188	1882	1931	2290	2059	2401	2112	1894	2306	2408	2633

Network Delay Difference Plots: Do Minimum Forecast Year - 2010 Base

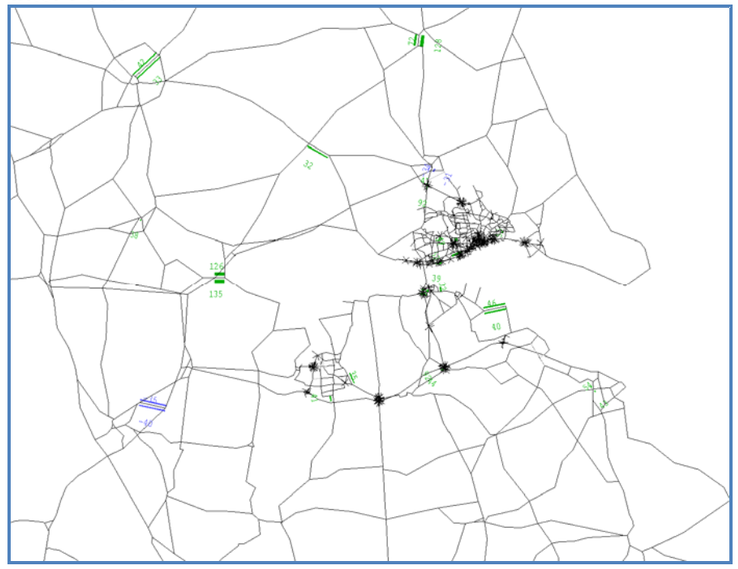
Difference plots comparing changes in network delay between the forecast year do minimum and 2010 base scenario. All values are in seconds for delay changes in excess of 30 seconds. Green = increases in delay, blue = decreases in delay. Bandwidth units=100/mm.

F.4 Do Minimum 2010 to 2021

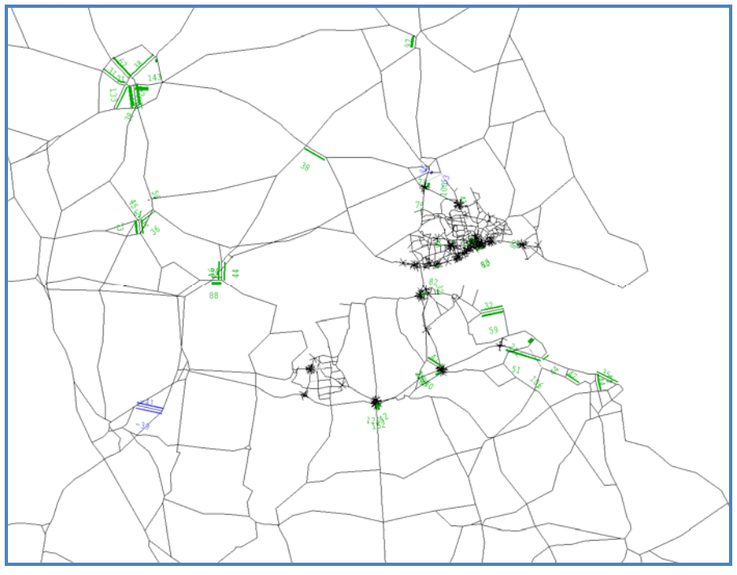
AM Peak



Inter Peak



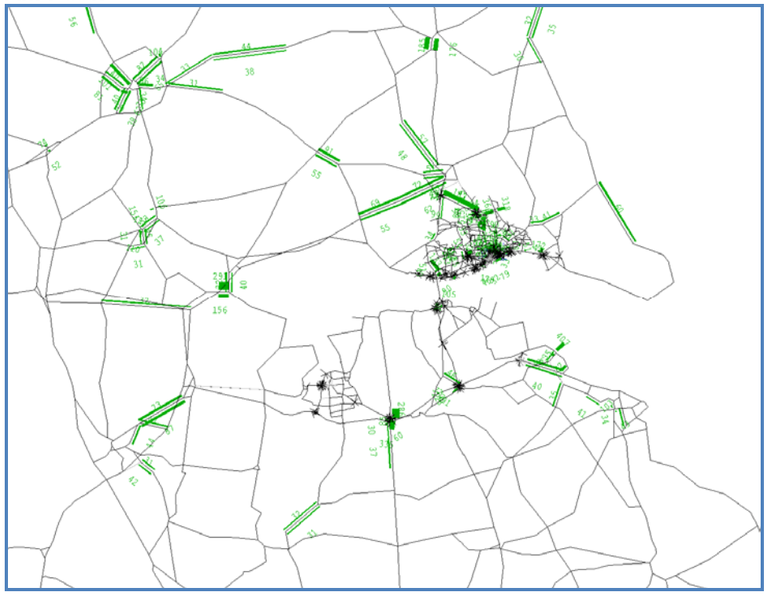
PM Peak



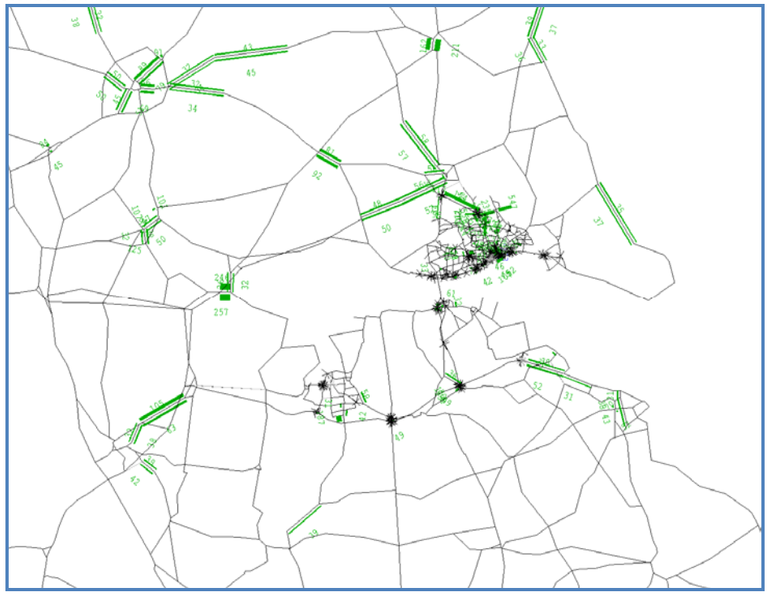
Capabilities on project:
Transportation

Do Minimum 2010 to 2033

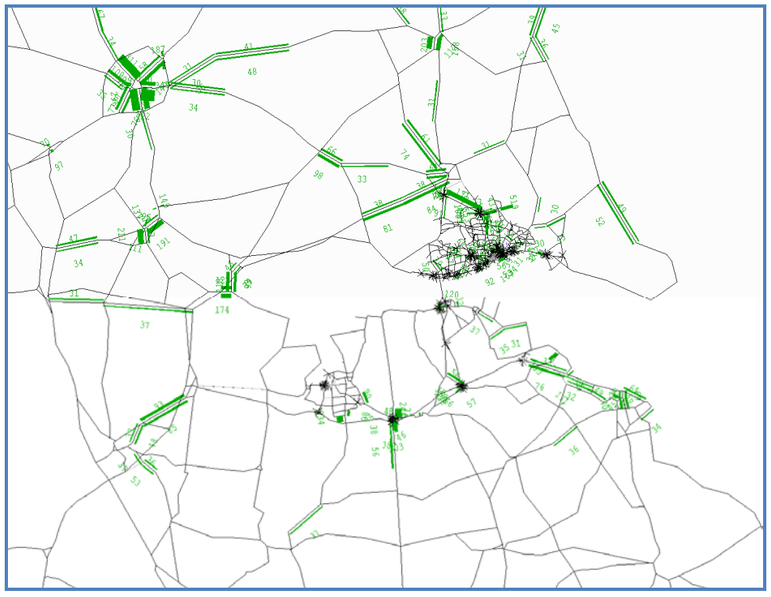
AM Peak



Inter Peak



PM Peak

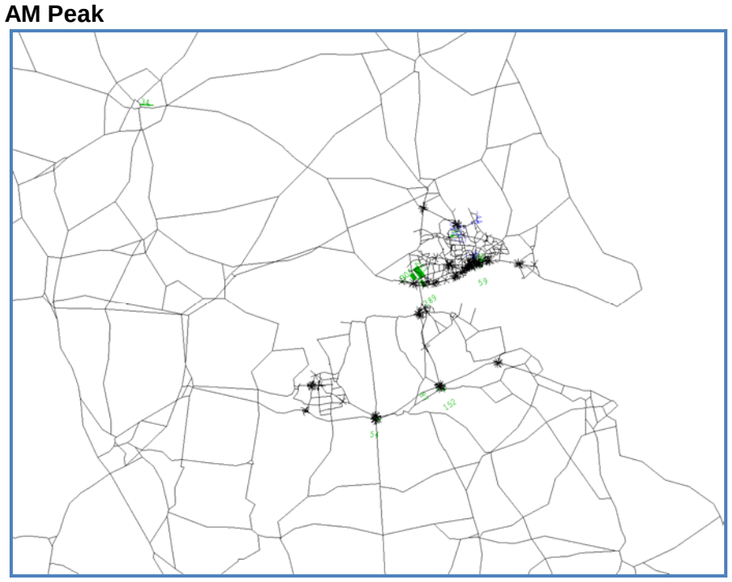


F.5 Network Delay Difference Plots: Do Something (with VDM) – Do Minimum

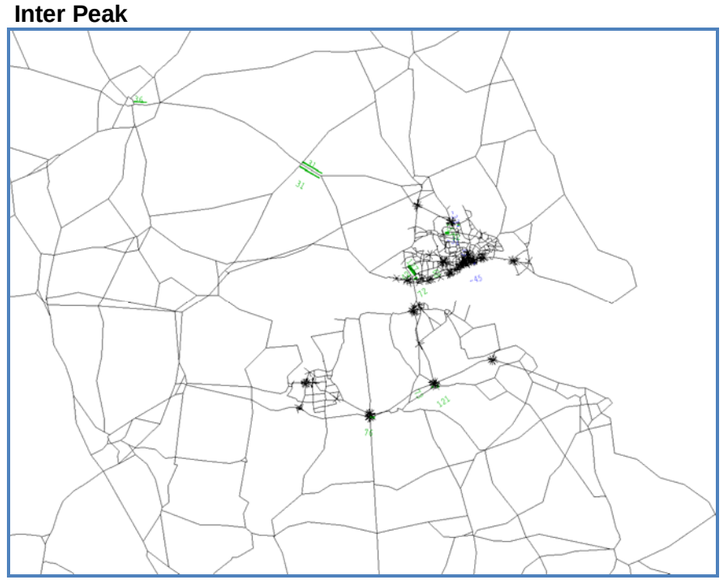
Difference plots comparing changes in network delay between the forecast year do minimum and 2010 base scenario. All values are in seconds for delay changes in excess of 30 seconds. Green = increases in delay, blue = decreases in delay. Bandwidth units=100/mm.

Do Something 2033

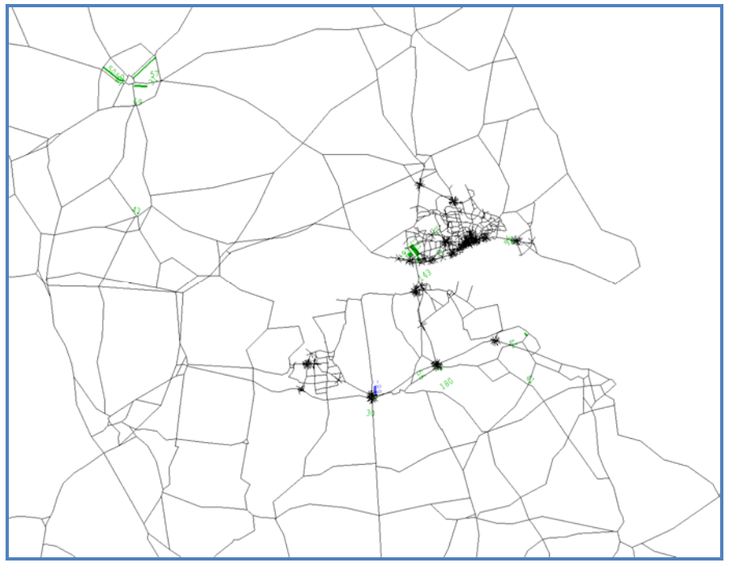
AM Peak



Inter Peak



PM Peak



Appendix G - Disaggregation of Appraisal Results

Appendix G - Disaggregation of Appraisal Results

60 Year Appraisal - 10 % Toll Reduction (60 Year Appraisal)

Economy:Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Road**	**Bus**
Travel Time	-10,637	-10,637	0
Vehicle operating costs	-320	-320	0
User charges	7,023	7,023	0
During Construction & Maintenance	0	0	0
NET CONSUMER - COMMUTING BENEFITS	-3,934	-3,934	0

Consumer - Other user benefits	**All Modes**	**Road**	**Bus**
Travel Time	-13,359	-13,359	0
Vehicle operating costs	2,709	2,709	0
User charges	8,811	8,811	0
During Construction & Maintenance	0	0	0
NET CONSUMER - OTHER BENEFITS	-1,838	-1,838	0

Business	**All Modes Road**	**Personal**	**Road Freight**	**Bus Personal**	**Bus Freight**
Travel Time	-12,231	-9,875	-2,357	0	0
Vehicle operating costs	-771	-480	-291	0	0
User charges	21,261	6,500	14,761	0	0
During Construction & Maintenance	0	0	0	0	0
Subtotal	8,259	-3,854	12,113	0	0

Private Sector Provider Impacts			
Revenue	0	0	0
Operating costs	0	0	0
Investment costs	0	0	0
Grant/subsidy	0	0	0
Subtotal	0	0	0

Other business Impacts			
Developer contributions	0	0	0
NET BUSINESS IMPACT	8,259		

TOTAL Present Value of Transport Economic Efficiency Benefits (TEE)	2,487

Public Accounts Local Government Funding	**ALL MODES**	**Road**	**Bus**
Revenue	32,363	32,363	0
Operating Costs	0	0	0
Investment Costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	32,363	32,363	0

Central Government Funding: Transport	**ALL MODES**	**Road**	**Bus**
Revenue	0	0	0
Operating costs	0	0	0
Investment costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	0	0	0

Central Government Funding: Non-Transport			
Indirect Tax Revenues	-1,633	-1,633	0
TOTALS			
Broad Transport Budget	32,363	32,363	0
Wider Public Finances	-1,633	-1,633	0

Analysis of Monetised Costs and Benefits	
Greenhouse Gases	64
WITA (Method 4)	36,394
Economic Efficiency: Consumer Users (commuting)	-3,934
Economic Efficiency: Consumer Users (Other)	-1,838
Economic Efficiency: Business Users and providers	8,259
Wider Public Finances (Indirect Taxation Revenue)	1,633
Present Value of Benefits (PVB)	40,578
Broad Transport Budget	32,363
Present Value of Costs (PVC)	32,363
OVERALL IMPACTS	
Net Present Value (NPV)	8,215
Benefit to Cost Ratio (BCR)	1.25

26% Toll Reduction (60 Year Appraisal)

Economy:Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Road**	**Bus**
Travel Time	-9,368	-9,368	0
Vehicle operating costs	-2,826	-2,826	0
User charges	18,576	18,576	0
During Construction & Maintenance	0	0	0
NET CONSUMER - COMMUTING BENEFITS	6,382	6,382	0

Consumer - Other user benefits	**All Modes**	**Road**	**Bus**
Travel Time	-10,510	-10,510	0
Vehicle operating costs	1,387	1,387	0
User charges	23,520	23,520	0
During Construction & Maintenance	0	0	0
NET CONSUMER - OTHER BENEFITS	14,397	14,397	0

Business	**All Modes Road**	**Personal**	**Road Freight**	**Bus Personal**	**Bus Freight**
Travel Time	-8,814	-8,830	16	0	0
Vehicle operating costs	5,666	-620	6,287	0	0
User charges	50,656	16,369	34,287	0	0
During Construction & Maintenance	0	0	0	0	0
Subtotal	47,508	6,918	40,590	0	0

Private Sector Provider Impacts			
Revenue	0	0	0
Operating costs	0	0	0
Investment costs	0	0	0
Grant/subsidy	0	0	0
Subtotal	0	0	0

Other business Impacts			
Developer contributions	0	0	0
NET BUSINESS IMPACT	47,508		

TOTAL Present Value of Transport Economic Efficiency Benefits (TEE)	68,287

Public Accounts Local Government Funding	**ALL MODES**	**Road**	**Bus**
Revenue	79,007	79,007	0
Operating Costs	0	0	0
Investment Costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	79,007	79,007	0

Central Government Funding: Transport	**ALL MODES**	**Road**	**Bus**
Revenue	0	0	0
Operating costs	0	0	0
Investment costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	0	0	0

Central Government Funding: Non-Transport			
Indirect Tax Revenues	-5,398	-5,398	0
TOTALS			
Broad Transport Budget	79,007	79,007	0
Wider Public Finances	-5,398	-5,398	0

Analysis of Monetised Costs and Benefits	
Greenhouse Gases	171
WITA (Method 4)	148,834
Economic Efficiency: Consumer Users (commuting)	6,382
Economic Efficiency: Consumer Users (Other)	14,397
Economic Efficiency: Business Users and providers	47,508
Wider Public Finances (Indirect Taxation Revenue)	5,398
Present Value of Benefits (PVB)	222,690
Broad Transport Budget	79,007
Present Value of Costs (PVC)	79,007
OVERALL IMPACTS	
Net Present Value (NPV)	143,683
Benefit to Cost Ratio (BCR)	2.82

63% Toll Reduction (60 Year Appraisal)

Economy:Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Road**	**Bus**
Travel Time	-24,436	-24,436	0
Vehicle operating costs	-10,570	-10,570	0
User charges	51,160	51,160	0
During Construction & Maintenance	0	0	0
NET CONSUMER - COMMUTING BENEFITS	16,154	16,154	0

Consumer - Other user benefits	**All Modes**	**Road**	**Bus**
Travel Time	-41,718	-41,718	0
Vehicle operating costs	-6,526	-6,526	0
User charges	69,634	69,634	0
During Construction & Maintenance	0	0	0
NET CONSUMER - OTHER BENEFITS	21,390	21,390	0

Business	**All Modes Road**	**Personal**	**Road Freight**	**Bus Personal**	**Bus Freight**
Travel Time	-78,404	-51,524	-26,880	0	0
Vehicle operating costs	27,031	-2,340	29,371	0	0
User charges	124,382	40,544	83,838	0	0
During Construction & Maintenance	0	0	0	0	0
Subtotal	73,009	-13,320	86,329	0	0
Private Sector Provider Impacts					
Revenue	0		0		0
Operating costs	0		0		0
Investment costs	0		0		0
Grant/subsidy	0		0		0
Subtotal	0		0		0
Other business Impacts					
Developer contributions	0		0		0
NET BUSINESS IMPACT	73,009				
TOTAL					
Present Value of Transport Economic Efficiency Benefits (TEE)	110,553				

Public Accounts			
Local Government Funding	**ALL MODES**	**Road**	**Bus**
Revenue	222,482	222,482	0
Operating Costs	0	0	0
Investment Costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	222,482	222,482	0
Central Government Funding: Transport	**ALL MODES**	**Road**	**Bus**
Revenue	0	0	0
Operating costs	0	0	0
Investment costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	0	0	0
Central Government Funding: Non-Transport			
Indirect Tax Revenues	-16,400	-16,400	0
TOTALS			
Broad Transport Budget	222,482	222,482	0
Wider Public Finances	-16,400	-16,400	0

Analysis of Monetised Costs and Benefits	
Greenhouse Gases	668
WITA (Method 4)	415,319
Economic Efficiency: Consumer Users (commuting)	16,154
Economic Efficiency: Consumer Users (Other)	21,390
Economic Efficiency: Business Users and providers	73,009
Wider Public Finances (Indirect Taxation Revenue)	16,400
Present Value of Benefits (PVB)	542,940
Broad Transport Budget	222,482
Present Value of Costs (PVC)	222,482
OVERALL IMPACTS	
Net Present Value (NPV)	320,458
Benefit to Cost Ratio (BCR)	2.44

No Toll (60 Year Appraisal)

Economy:Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Road**	**Bus**
Travel Time	-41,893	-41,893	0
Vehicle operating costs	-20,898	-20,898	0
User charges	91,939	91,939	0
During Construction & Maintenance	0	0	0
NET CONSUMER - COMMUTING BENEFITS	29,147	29,147	0

Consumer - Other user benefits	**All Modes**	**Road**	**Bus**
Travel Time	-69,400	-69,400	0
Vehicle operating costs	-18,689	-18,689	0
User charges	129,189	129,189	0
During Construction & Maintenance	0	0	0
NET CONSUMER - OTHER BENEFITS	41,100	41,100	0

Business	**All Modes Road**	**Personal**	**Road Freight**	**Bus Personal**	**Bus Freight**
Travel Time	-146,051	-92,462	-53,589	0	0
Vehicle operating costs	39,874	-4,132	44,006	0	0
User charges	229,911	64,848	165,063	0	0
During Construction & Maintenance	0	0	0	0	0
Subtotal	123,734	-31,747	155,480	0	0
Private Sector Provider Impacts					
Revenue	0		0		0
Operating costs	0		0		0
Investment costs	0		0		0
Grant/subsidy	0		0		0
Subtotal	0		0		0
Other business Impacts					
Developer contributions	0		0		0
NET BUSINESS IMPACT	123,734				
TOTAL					
Present Value of Transport Economic Efficiency Benefits (TEE)	193,981				

Public Accounts			
Local Government Funding	**ALL MODES**	**Road**	**Bus**
Revenue	438,100	438,100	0
Operating Costs	0	0	0
Investment Costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	438,100	438,100	0
Central Government Funding: Transport	**ALL MODES**	**Road**	**Bus**
Revenue	0	0	0
Operating costs	0	0	0
Investment costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	0	0	0
Central Government Funding: Non-Transport			
Indirect Tax Revenues	-41,019	-41,019	0
TOTALS			
Broad Transport Budget	438,100	438,100	0
Wider Public Finances	-41,019	-41,019	0

Analysis of Monetised Costs and Benefits	
Greenhouse Gases	-551
WITA (Method 4)	874,931
Economic Efficiency: Consumer Users (commuting)	29,147
Economic Efficiency: Consumer Users (Other)	41,100
Economic Efficiency: Business Users and providers	123,734
Wider Public Finances (Indirect Taxation Revenue)	41,019
Present Value of Benefits (PVB)	1,109,380
Broad Transport Budget	438,100
Present Value of Costs (PVC)	438,100
OVERALL IMPACTS	
Net Present Value (NPV)	671,280
Benefit to Cost Ratio (BCR)	2.53

23 Year Appraisal

10% Toll Reduction (23 Years)

Economy:Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Road**	**Bus**
Travel Time	-3,270	-3,270	0
Vehicle operating costs	-31	-31	0
User charges	3,896	3,896	0
During Construction & Maintenance	0	0	0
NET CONSUMER - COMMUTING BENEFITS	595	595	0

Consumer - Other user benefits	**All Modes**	**Road**	**Bus**
Travel Time	-3,595	-3,595	0
Vehicle operating costs	1,529	1,529	0
User charges	4,823	4,823	0
During Construction & Maintenance	0	0	0
NET CONSUMER - OTHER BENEFITS	2,757	2,757	0

Business	**All Modes Road**	**Personal**	**Road Freight**	**Bus Personal**	**Bus Freight**
Travel Time	-3,559	-3,069	-490	0	0
Vehicle operating costs	396	-79	475	0	0
User charges	12,787	3,912	8,875	0	0
During Construction & Maintenance	0	0	0	0	0
Subtotal	9,624	763	8,861	0	0

Private Sector Provider Impacts			
Revenue	0	0	0
Operating costs	0	0	0
Investment costs	0	0	0
Grant/subsidy	0	0	0
Subtotal	0	0	0

Other business Impacts			
Developer contributions	0	0	0
NET BUSINESS IMPACT	9,624		

TOTAL Present Value of Transport Economic Efficiency Benefits (TEE)	12,976

Public Accounts Local Government Funding	**ALL MODES**	**Road**	**Bus**
Revenue	18,978	18,978	0
Operating Costs	0	0	0
Investment Costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	18,978	18,978	0

Central Government Funding: Transport	**ALL MODES**	**Road**	**Bus**
Revenue	0	0	0
Operating costs	0	0	0
Investment costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	0	0	0

Central Government Funding: Non-Transport			
Indirect Tax Revenues	-705	-705	0
TOTALS			
Broad Transport Budget	18,978	18,978	0
Wider Public Finances	-705	-705	0

Analysis of Monetised Costs and Benefits	
Greenhouse Gases	85
WITA Benefits (Method 4)	22,701
Economic Efficiency: Consumer Users (commuting)	595
Economic Efficiency: Consumer Users (Other)	2,757
Economic Efficiency: Business Users and providers	9,624
Wider Public Finances (Indirect Taxation Revenue)	705
Present Value of Benefits (PVB)	36,467
Broad Transport Budget	18,978
Present Value of Costs (PVC)	18,978
OVERALL IMPACTS	
Net Present Value (NPV)	17,489
Benefit to Cost Ratio (BCR)	1.92

26% Toll Reduction (23 Years)

Economy:Economic Efficiency of the Transport System (TEE)					
Consumer - Commuting user benefits	**All Modes**		**Road**		**Bus**
Travel Time	-3,090		-3,090		0
Vehicle operating costs	-1,500		-1,500		0
User charges	10,425		10,425		0
During Construction & Maintenance	0		0		0
NET CONSUMER - COMMUTING BENEFITS	5,835		5,835		0
Consumer - Other user benefits	**All Modes**		**Road**		**Bus**
Travel Time	-3,275		-3,275		0
Vehicle operating costs	-205		-205		0
User charges	13,080		13,080		0
During Construction & Maintenance	0		0		0
NET CONSUMER - OTHER BENEFITS	9,600		9,600		0
Business	**All Modes Road**	**Personal**	**Road Freight**	**Bus Personal**	**Bus Freight**
Travel Time	-4,301	-4,112	-189	0	0
Vehicle operating costs	3,841	-258	4,098	0	0
User charges	30,725	9,898	20,826	0	0
During Construction & Maintenance	0	0	0	0	0
Subtotal	30,265	5,529	24,736	0	0
Private Sector Provider Impacts					
Revenue	0		0		0
Operating costs	0		0		0
Investment costs	0		0		0
Grant/subsidy	0		0		0
Subtotal	0		0		0
Other business Impacts					
Developer contributions	0		0		0
NET BUSINESS IMPACT	30,265				
TOTAL					
Present Value of Transport Economic					
Efficiency Benefits (TEE)	45,700				
Public Accounts					
Local Government Funding	**ALL MODES**	**Road**		**Bus**	
Revenue	45,755	45,755		0	
Operating Costs	0	0		0	
Investment Costs	0	0		0	
Developer Contributions	0	0		0	
Grant/Subsidy Payments	0	0		0	
NET IMPACT	45,755	45,755		0	
Central Government Funding: Transport	**ALL MODES**	**Road**		**Bus**	
Revenue	0	0		0	
Operating costs	0	0		0	
Investment costs	0	0		0	
Developer Contributions	0	0		0	
Grant/Subsidy Payments	0	0		0	
NET IMPACT	0	0		0	
Central Government Funding: Non-Transport					
Indirect Tax Revenues	-3,516	-3,516		0	
TOTALS					
Broad Transport Budget	45,755	45,755		0	
Wider Public Finances	-3,516	-3,516		0	
Analysis of Monetised Costs and Benefits					
Greenhouse Gases					-133
WITA (Method 4)					75,318
Economic Efficiency: Consumer Users (commuting)					5,835
Economic Efficiency: Consumer Users (Other)					9,600
Economic Efficiency: Business Users and providers					30,265
Wider Public Finances (Indirect Taxation Revenue)					3,516
Present Value of Benefits (PVB)					124,401
Broad Transport Budget					45,755
Present Value of Costs (PVC)					45,755
OVERALL IMPACTS					
Net Present Value (NPV)					78,646
Benefit to Cost Ratio (BCR)					2.72

63% Toll Reduction (23 Years)

Economy:Economic Efficiency of the Transport System (TEE)					
Consumer - Commuting user benefits	**All Modes**		**Road**		**Bus**
Travel Time	-9,912		-9,912		0
Vehicle operating costs	-6,235		-6,235		0
User charges	29,266		29,266		0
During Construction & Maintenance	0		0		0
NET CONSUMER - COMMUTING BENEFITS	13,119		13,119		0
Consumer - Other user benefits	**All Modes**		**Road**		**Bus**
Travel Time	-15,951		15,951		0
Vehicle operating costs	-5,480		-5,480		0
User charges	39,201		39,201		0
During Construction & Maintenance	0		0		0
NET CONSUMER - OTHER BENEFITS	17,771		17,771		0
Business	**All Modes Road**	**Personal**	**Road Freight**	**Bus Personal**	**Bus Freight**
Travel Time	-34,318	-22,689	-11,630	0	0
Vehicle operating costs	19,934	-1,127	21,061	0	0
User charges	73,521	24,544	48,977	0	0
During Construction & Maintenance	0	0	0	0	0
Subtotal	59,137	729	58,409	0	0
Private Sector Provider Impacts					
Revenue	0		0		0
Operating costs	0		0		0
Investment costs	0		0		0
Grant/subsidy	0		0		0
Subtotal	0		0		0
Other business Impacts					
Developer contributions	0		0		0
NET BUSINESS IMPACT	59,137				
TOTAL					
Present Value of Transport Economic					
Efficiency Benefits (TEE)	90,027				
Public Accounts					
Local Government Funding	**ALL MODES**	**Road**		**Bus**	
Revenue	127,537	127,537		0	
Operating Costs	0	0		0	
Investment Costs	0	0		0	
Developer Contributions	0	0		0	
Grant/Subsidy Payments	0	0		0	
NET IMPACT	127,537	127,537		0	
Central Government Funding: Transport	**ALL MODES**	**Road**		**Bus**	
Revenue	0	0		0	
Operating costs	0	0		0	
Investment costs	0	0		0	
Developer Contributions	0	0		0	
Grant/Subsidy Payments	0	0		0	
NET IMPACT	0	0		0	
Central Government Funding: Non-Transport					
Indirect Tax Revenues	-9,430	-9,430		0	
TOTALS					
Broad Transport Budget	127,537	127,537		0	
Wider Public Finances	-9,430	-9,430		0	
Analysis of Monetised Costs and Benefits					
Greenhouse Gases				123	
WITA (Method 4)				225,651	
Economic Efficiency: Consumer Users (commuting)				13,119	
Economic Efficiency: Consumer Users (Other)				17,771	
Economic Efficiency: Business Users and providers				59,137	
Wider Public Finances (Indirect Taxation Revenue)				9,430	
Present Value of Benefits (PVB)				325,231	
Broad Transport Budget				127,537	
Present Value of Costs (PVC)				127,537	
OVERALL IMPACTS					
Net Present Value (NPV)				197,694	
Benefit to Cost Ratio (BCR)				2.55	

No Toll (23 Years)

Economy:Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Road**	**Bus**
Travel Time	-16,984	-16,984	0
Vehicle operating costs	-12,661	-12,661	0
User charges	53,144	53,144	0
During Construction & Maintenance	0	0	0
NET CONSUMER - COMMUTING BENEFITS	23,500	23,500	0

Consumer - Other user benefits	**All Modes**	**Road**	**Bus**
Travel Time	-27,831	-27,831	0
Vehicle operating costs	-13,608	-13,608	0
User charges	73,449	73,449	0
During Construction & Maintenance	0	0	0
NET CONSUMER - OTHER BENEFITS	32,010	32,010	0

Business	**All Modes Road**	**Personal**	**Road Freight**	**Bus Personal**	**Bus Freight**
Travel Time	-63,446	-40,605	-22,841	0	0
Vehicle operating costs	27,426	-2,263	29,689	0	0
User charges	138,539	39,393	99,146	0	0
During Construction & Maintenance	0	0	0	0	0
Subtotal	102,519	-3,474	105,993	0	0
Private Sector Provider Impacts					
Revenue	0		0		0
Operating costs	0		0		0
Investment costs	0		0		0
Grant/subsidy	0		0		0
Subtotal	0		0		0
Other business Impacts					
Developer contributions	0		0		0
NET BUSINESS IMPACT	102,519				
TOTAL					
Present Value of Transport Economic Efficiency Benefits (TEE)	158,029				

Public Accounts			
Local Government Funding	**ALL MODES**	**Road**	**Bus**
Revenue	255,648	255,648	0
Operating Costs	0	0	0
Investment Costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	255,648	255,648	0
Central Government Funding: Transport	**ALL MODES**	**Road**	**Bus**
Revenue	0	0	0
Operating costs	0	0	0
Investment costs	0	0	0
Developer Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	0	0	0
Central Government Funding: Non-Transport			
Indirect Tax Revenues	-25,423	-25,423	0
TOTALS			
Broad Transport Budget	255,648	255,648	0
Wider Public Finances	-25,423	-25,423	0

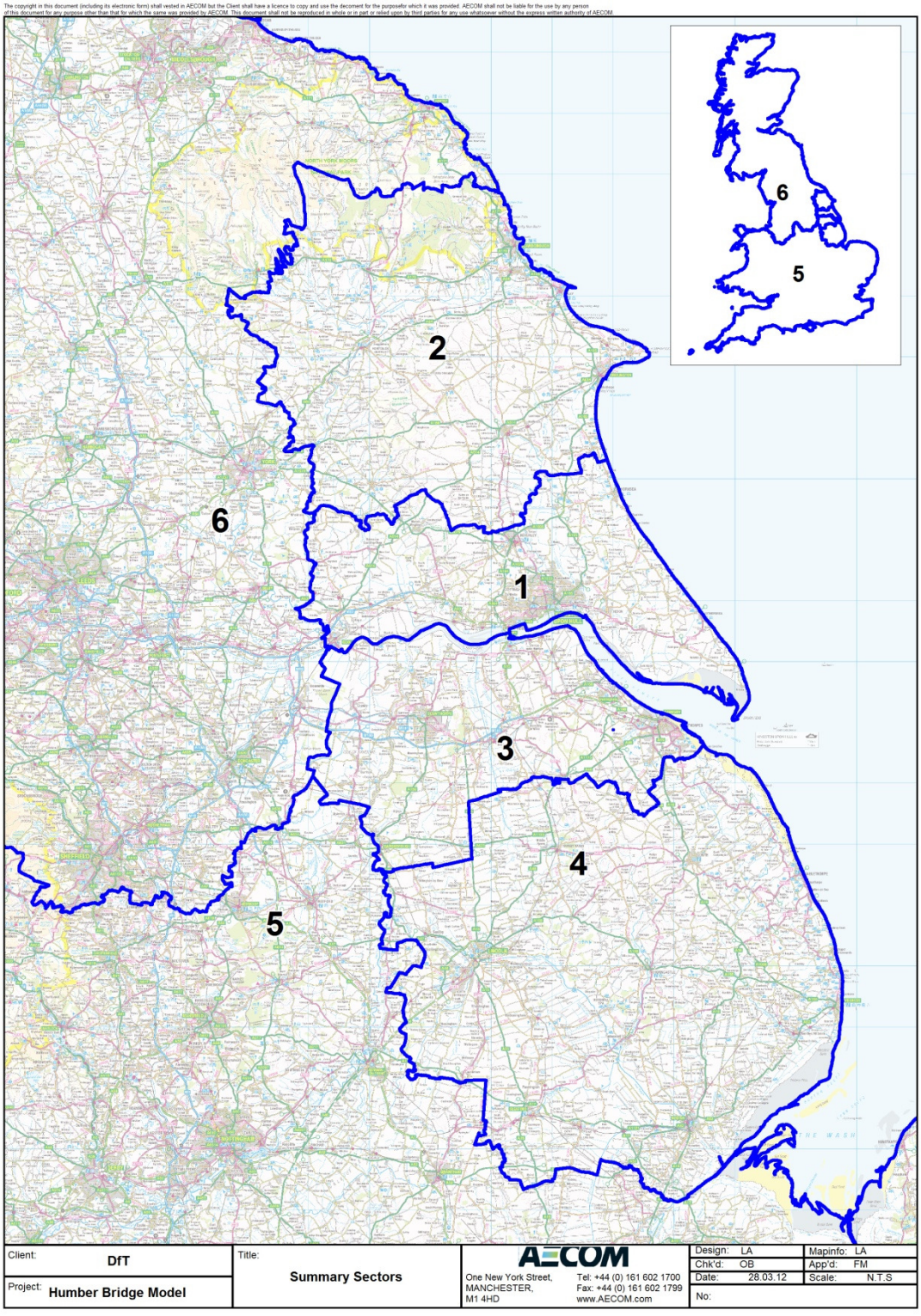
Analysis of Monetised Costs and Benefits	
Greenhouse Gases	-834
	496,055
Economic Efficiency: Consumer Users (commuting)	23,500
Economic Efficiency: Consumer Users (Other)	32,010
Economic Efficiency: Business Users and providers	102,519
Wider Public Finances (Indirect Taxation Revenue)	25,423
Present Value of Benefits (PVB)	678,673
Broad Transport Budget	255,648
Present Value of Costs (PVC)	255,648
OVERALL IMPACTS	
Net Present Value (NPV)	423,025
Benefit to Cost Ratio (BCR)	2.65

Appendix H – Sectoring of the Trip Matrices

Capabilities on project:
Transportation

Appendix H – Sectoring of the Trip Matrices

This Appendix illustrates the changes within the trip matrices due to the redistribution of demand within the matrices. A diagram showing the sector system used is provided below.



Capabilities on project:
Transportation

H1 AM 2010

Do Minimum

OD	1	2	3	4	5	6	Total
1	21,773	2,100	803	142	420	3,245	**28,483**
2	1,969	10,891	40	19	26	3,533	**16,478**
3	752	47	14,478	1,877	980	710	**18,844**
4	112	17	1,686	9,722	2,026	70	**13,633**
5	370	14	1,095	1,234	1,051	922	**4,687**
6	3,097	3,076	655	73	495	22,057	**29,453**
Total	**28,074**	**16,144**	**18,758**	**13,066**	**4,998**	**30,537**	**111,578**

10% Toll Reduction

OD	1	2	3	4	5	6	Total
1	21,761	2,099	816	143	420	3,246	**28,486**
2	1,969	10,891	41	19	26	3,535	**16,480**
3	765	47	14,468	1,877	980	710	**18,846**
4	114	18	1,685	9,722	2,026	70	**13,634**
5	371	14	1,095	1,234	1,051	922	**4,687**
6	3,098	3,077	655	73	495	22,059	**29,458**
Total	**28,077**	**16,146**	**18,761**	**13,067**	**4,998**	**30,543**	**111,592**

26% Toll Reduction

OD	1	2	3	4	5	6	Total
1	21,724	2,098	861	149	422	3,243	**28,496**
2	1,967	10,893	43	20	26	3,535	**16,483**
3	810	49	14,435	1,875	979	710	**18,858**
4	120	18	1,683	9,722	2,026	70	**13,639**
5	372	14	1,095	1,234	1,052	923	**4,688**
6	3,094	3,077	656	73	495	22,071	**29,466**
Total	**28,086**	**16,149**	**18,772**	**13,071**	**4,999**	**30,554**	**111,631**

63% Toll Reduction

OD	1	2	3	4	5	6	Total
1	21,629	2,094	972	163	425	3,240	**28,522**
2	1,963	10,897	48	22	26	3,535	**16,490**
3	921	54	14,352	1,871	977	714	**18,888**
4	134	21	1,678	9,722	2,027	71	**13,652**
5	374	14	1,093	1,233	1,052	924	**4,691**
6	3,092	3,078	658	73	496	22,078	**29,476**
Total	**28,115**	**16,157**	**18,801**	**13,083**	**5,002**	**30,562**	**111,719**

No Toll

OD	1	2	3	4	5	6	Total
1	21,508	2,090	1,111	180	428	3,239	**28,556**
2	1,958	10,901	54	24	26	3,536	**16,499**
3	1,065	59	14,253	1,864	975	718	**18,935**
4	153	23	1,671	9,722	2,027	71	**13,668**
5	377	14	1,091	1,233	1,054	926	**4,694**
6	3,091	3,079	661	73	496	22,096	**29,497**
Total	**28,153**	**16,167**	**18,842**	**13,096**	**5,006**	**30,586**	**111,850**

Capabilities on project:
Transportation

H2 IP 2010

Do Minimum

OD	1	2	3	4	5	6	Total
1	19,946	2,001	610	92	360	3,086	**26,095**
2	1,910	10,348	40	23	22	2,718	**15,062**
3	596	41	12,839	1,709	807	569	**16,562**
4	84	16	1,647	8,989	1,492	75	**12,304**
5	320	17	883	1,531	912	345	**4,010**
6	3,023	2,874	664	81	312	18,044	**24,997**
Total	**25,880**	**15,297**	**16,683**	**12,426**	**3,906**	**24,836**	**99,029**

10% Toll Reduction

OD	1	2	3	4	5	6	Total
1	19,937	2,000	619	94	361	3,085	**26,095**
2	1,910	10,348	41	24	22	2,718	**15,062**
3	606	41	12,833	1,708	807	569	**16,565**
4	86	17	1,647	8,989	1,492	75	**12,305**
5	321	17	883	1,531	912	345	**4,010**
6	3,022	2,873	664	81	312	18,050	**25,002**
Total	**25,881**	**15,296**	**16,687**	**12,427**	**3,906**	**24,841**	**99,038**

26% Toll Reduction

OD	1	2	3	4	5	6	Total
1	19,905	1,998	653	99	362	3,084	**26,102**
2	1,908	10,347	43	25	22	2,717	**15,063**
3	640	43	12,809	1,706	807	570	**16,574**
4	91	18	1,645	8,987	1,492	75	**12,308**
5	322	17	882	1,531	912	345	**4,010**
6	3,021	2,873	665	81	312	18,054	**25,006**
Total	**25,887**	**15,297**	**16,696**	**12,429**	**3,907**	**24,845**	**99,062**

63% Toll Reduction

OD	1	2	3	4	5	6	Total
1	19,831	1,994	738	111	365	3,078	**26,118**
2	1,904	10,347	48	28	22	2,715	**15,064**
3	724	48	12,749	1,701	805	573	**16,601**
4	103	21	1,640	8,983	1,491	75	**12,314**
5	325	17	881	1,531	912	345	**4,011**
6	3,016	2,871	667	82	312	18,040	**24,988**
Total	**25,904**	**15,299**	**16,723**	**12,436**	**3,908**	**24,826**	**99,096**

No Toll

OD	1	2	3	4	5	6	Total
1	19,736	1,989	847	125	369	3,076	**26,142**
2	1,899	10,346	54	31	22	2,713	**15,066**
3	830	54	12,669	1,695	801	575	**16,625**
4	117	24	1,635	8,980	1,490	76	**12,322**
5	329	17	878	1,529	913	345	**4,012**
6	3,014	2,870	670	82	312	18,055	**25,003**
Total	**25,925**	**15,299**	**16,753**	**12,444**	**3,908**	**24,841**	**99,170**

Capabilities on project:
Transportation

H3 PM 2010

Do Minimum

OD	1	2	3	4	5	6	Total
1	23,788	2,242	758	108	322	3,626	**30,844**
2	2,465	12,834	44	21	22	3,660	**19,047**
3	782	51	16,579	1,932	1,059	573	**20,974**
4	109	17	2,168	11,306	1,704	76	**15,379**
5	367	18	1,103	2,390	1,238	479	**5,596**
6	3,782	3,793	686	75	857	25,461	**34,654**
Total	**31,293**	**18,955**	**21,337**	**15,831**	**5,203**	**33,876**	**126,494**

10% Toll Reduction

OD	1	2	3	4	5	6	Total
1	23,774	2,242	772	110	322	3,626	**30,846**
2	2,464	12,834	44	21	22	3,660	**19,047**
3	796	51	16,569	1,931	1,059	573	**20,980**
4	111	17	2,166	11,305	1,704	76	**15,380**
5	368	18	1,102	2,390	1,239	479	**5,596**
6	3,782	3,793	686	75	857	25,464	**34,658**
Total	**31,295**	**18,956**	**21,341**	**15,832**	**5,203**	**33,879**	**126,507**

26% Toll Reduction

OD	1	2	3	4	5	6	Total
1	23,731	2,239	823	117	324	3,624	**30,859**
2	2,462	12,835	47	23	22	3,660	**19,050**
3	847	54	16,531	1,928	1,058	574	**20,993**
4	118	18	2,164	11,304	1,703	77	**15,385**
5	369	18	1,102	2,390	1,239	479	**5,597**
6	3,780	3,794	687	75	858	25,477	**34,671**
Total	**31,308**	**18,959**	**21,354**	**15,838**	**5,204**	**33,890**	**126,554**

63% Toll Reduction

OD	1	2	3	4	5	6	Total
1	23,621	2,235	951	135	327	3,620	**30,889**
2	2,457	12,838	53	26	22	3,660	**19,056**
3	975	61	16,438	1,922	1,056	577	**21,029**
4	134	22	2,159	11,302	1,703	77	**15,397**
5	374	18	1,099	2,391	1,240	479	**5,601**
6	3,775	3,792	691	75	859	25,475	**34,666**
Total	**31,335**	**18,965**	**21,391**	**15,851**	**5,207**	**33,888**	**126,638**

No Toll

OD	1	2	3	4	5	6	Total
1	23,479	2,228	1,115	156	331	3,617	**30,927**
2	2,450	12,841	60	30	22	3,661	**19,064**
3	1,141	69	16,321	1,916	1,054	581	**21,082**
4	155	25	2,151	11,300	1,702	78	**15,412**
5	378	18	1,095	2,391	1,241	480	**5,603**
6	3,771	3,793	696	76	860	25,494	**34,690**
Total	**31,375**	**18,975**	**21,438**	**15,869**	**5,211**	**33,912**	**126,779**

Capabilities on project:
Transportation

H4 AM 2021

Do Minimum

OD	1	2	3	4	5	6	Total
1	24,890	2,305	1,135	168	518	3,505	**32,522**
2	2,254	12,067	66	26	34	3,950	**18,397**
3	938	62	16,808	1,985	1,135	826	**21,753**
4	149	25	2,070	10,605	2,374	94	**15,317**
5	495	21	1,397	1,465	1,166	1,035	**5,580**
6	3,610	3,565	877	100	539	24,563	**33,253**
Total	**32,337**	**18,045**	**22,353**	**14,348**	**5,765**	**33,974**	**126,822**

10% Toll Reduction

OD	1	2	3	4	5	6	Total
1	24,893	2,294	1,169	172	518	3,492	**32,538**
2	2,246	12,061	68	26	34	3,932	**18,367**
3	962	63	16,798	1,975	1,132	825	**21,755**
4	154	25	2,072	10,600	2,376	95	**15,322**
5	497	21	1,397	1,462	1,166	1,034	**5,578**
6	3,621	3,567	881	100	539	24,574	**33,282**
Total	**32,373**	**18,032**	**22,385**	**14,335**	**5,764**	**33,952**	**126,842**

26% Toll Reduction

OD	1	2	3	4	5	6	Total
1	24,847	2,292	1,223	178	519	3,490	**32,549**
2	2,244	12,063	71	27	33	3,932	**18,372**
3	1,014	66	16,752	1,973	1,132	827	**21,763**
4	162	27	2,068	10,597	2,375	95	**15,324**
5	499	21	1,397	1,461	1,166	1,035	**5,578**
6	3,620	3,568	881	100	539	24,582	**33,290**
Total	**32,386**	**18,036**	**22,391**	**14,336**	**5,765**	**33,960**	**126,876**

63% Toll Reduction

OD	1	2	3	4	5	6	Total
1	24,752	2,287	1,351	192	522	3,486	**32,589**
2	2,239	12,068	78	30	33	3,932	**18,380**
3	1,138	72	16,639	1,968	1,131	829	**21,776**
4	180	29	2,058	10,590	2,375	95	**15,328**
5	503	21	1,394	1,460	1,167	1,036	**5,581**
6	3,616	3,570	882	100	540	24,599	**33,308**
Total	**32,428**	**18,047**	**22,402**	**14,340**	**5,769**	**33,977**	**126,963**

No Toll

OD	1	2	3	4	5	6	Total
1	24,630	2,281	1,494	207	525	3,486	**32,624**
2	2,233	12,074	87	33	33	3,933	**18,392**
3	1,282	78	16,517	1,962	1,130	834	**21,803**
4	202	32	2,047	10,584	2,375	96	**15,337**
5	507	21	1,391	1,459	1,169	1,037	**5,584**
6	3,616	3,573	885	101	541	24,614	**33,330**
Total	**32,469**	**18,060**	**22,421**	**14,346**	**5,774**	**34,000**	**127,070**

Capabilities on project:
Transportation

H5 IP 2021

Do Minimum

OD	1	2	3	4	5	6	Total
1	22,990	2,302	771	118	478	3,506	**30,166**
2	2,179	11,648	61	32	33	3,133	**17,085**
3	765	61	14,682	1,979	1,000	724	**19,212**
4	110	26	1,901	9,925	1,808	112	**13,881**
5	423	27	1,077	1,833	1,036	386	**4,783**
6	3,418	3,332	808	113	350	20,397	**28,418**
Total	**29,885**	**17,395**	**19,300**	**14,001**	**4,705**	**28,258**	**113,545**

10% Toll Reduction

OD	1	2	3	4	5	6	Total
1	22,966	2,305	785	120	478	3,509	**30,164**
2	2,178	11,655	62	32	33	3,115	**17,075**
3	777	62	14,654	1,976	1,000	722	**19,191**
4	111	26	1,902	9,922	1,808	112	**13,882**
5	423	27	1,078	1,832	1,036	387	**4,783**
6	3,423	3,336	807	113	350	20,377	**28,408**
Total	**29,879**	**17,411**	**19,288**	**13,996**	**4,706**	**28,222**	**113,503**

26% Toll Reduction

OD	1	2	3	4	5	6	Total
1	22,932	2,302	824	126	481	3,508	**30,173**
2	2,176	11,653	65	34	33	3,116	**17,076**
3	815	64	14,621	1,974	999	722	**19,195**
4	117	28	1,900	9,919	1,807	112	**13,883**
5	425	27	1,077	1,832	1,036	387	**4,784**
6	3,423	3,336	808	113	350	20,380	**28,410**
Total	**29,888**	**17,410**	**19,295**	**13,998**	**4,706**	**28,223**	**113,521**

63% Toll Reduction

OD	1	2	3	4	5	6	Total
1	22,850	2,296	920	140	485	3,504	**30,196**
2	2,171	11,650	73	38	33	3,114	**17,078**
3	911	72	14,544	1,968	996	725	**19,216**
4	131	32	1,894	9,910	1,806	112	**13,885**
5	429	27	1,075	1,830	1,037	387	**4,786**
6	3,419	3,335	811	113	350	20,379	**28,408**
Total	**29,912**	**17,412**	**19,317**	**14,000**	**4,707**	**28,220**	**113,568**

No Toll

OD	1	2	3	4	5	6	Total
1	22,751	2,289	1,036	157	491	3,500	**30,223**
2	2,164	11,646	82	42	33	3,113	**17,080**
3	1,026	80	14,453	1,959	993	728	**19,240**
4	147	36	1,885	9,902	1,804	113	**13,887**
5	434	27	1,073	1,828	1,037	387	**4,787**
6	3,417	3,333	815	114	350	20,387	**28,416**
Total	**29,939**	**17,412**	**19,343**	**14,002**	**4,708**	**28,227**	**113,632**

Capabilities on project:
Transportation

H6 PM 2021

Do Minimum

OD	1	2	3	4	5	6	Total
1	27,224	2,563	955	148	450	4,222	**35,561**
2	2,756	14,332	63	32	35	4,268	**21,487**
3	1,105	83	19,073	2,372	1,341	791	**24,765**
4	134	24	2,355	12,388	2,017	108	**17,027**
5	486	29	1,305	2,842	1,399	526	**6,587**
6	4,163	4,240	832	115	965	28,545	**38,860**
Total	**35,869**	**21,271**	**24,583**	**17,896**	**6,207**	**38,460**	**144,286**

10% Toll Reduction

OD	1	2	3	4	5	6	Total
1	27,210	2,563	977	153	452	4,224	**35,578**
2	2,761	14,327	65	34	34	4,315	**21,536**
3	1,140	86	19,071	2,381	1,344	796	**24,818**
4	139	25	2,343	12,390	2,014	109	**17,021**
5	486	29	1,301	2,847	1,399	526	**6,588**
6	4,135	4,223	830	115	964	28,575	**38,842**
Total	**35,872**	**21,252**	**24,587**	**17,920**	**6,207**	**38,545**	**144,383**

26% Toll Reduction

OD	1	2	3	4	5	6	Total
1	27,157	2,559	1,036	162	454	4,225	**35,594**
2	2,757	14,328	68	36	34	4,315	**21,538**
3	1,202	90	19,019	2,377	1,343	797	**24,828**
4	148	27	2,340	12,385	2,014	109	**17,023**
5	488	29	1,300	2,846	1,399	527	**6,589**
6	4,134	4,224	831	115	964	28,577	**38,846**
Total	**35,887**	**21,257**	**24,594**	**17,921**	**6,208**	**38,550**	**144,418**

63% Toll Reduction

OD	1	2	3	4	5	6	Total
1	27,043	2,554	1,180	185	460	4,219	**35,640**
2	2,749	14,331	76	40	34	4,316	**21,545**
3	1,351	101	18,896	2,365	1,340	799	**24,852**
4	166	31	2,334	12,374	2,012	109	**17,027**
5	493	29	1,298	2,845	1,400	527	**6,592**
6	4,127	4,219	835	116	965	28,594	**38,856**
Total	**35,929**	**21,264**	**24,618**	**17,925**	**6,211**	**38,564**	**144,511**

No Toll

OD	1	2	3	4	5	6	Total
1	26,898	2,546	1,350	211	465	4,216	**35,686**
2	2,741	14,333	85	45	34	4,314	**21,553**
3	1,522	112	18,754	2,352	1,337	803	**24,880**
4	186	35	2,326	12,365	2,011	110	**17,033**
5	499	28	1,295	2,844	1,401	529	**6,597**
6	4,122	4,219	840	117	966	28,615	**38,878**
Total	**35,967**	**21,274**	**24,650**	**17,934**	**6,215**	**38,587**	**144,628**

Capabilities on project:
Transportation

H7 AM 2031

Do Minimum

OD	1	2	3	4	5	6	Total
1	28,799	2,545	1,266	198	676	3,894	**37,377**
2	2,463	13,222	73	33	45	4,386	**20,223**
3	1,109	72	17,845	2,208	1,304	993	**23,531**
4	185	33	2,267	11,213	2,699	139	**16,538**
5	668	32	1,636	1,716	1,286	1,129	**6,466**
6	4,186	4,022	1,073	160	591	26,971	**37,002**
Total	**37,409**	**19,926**	**24,161**	**15,529**	**6,601**	**37,512**	**141,137**

10% Toll Reduction

OD	1	2	3	4	5	6	Total
1	28,765	2,532	1,313	203	675	3,861	**37,350**
2	2,453	13,196	76	35	45	4,339	**20,144**
3	1,147	74	17,822	2,192	1,302	992	**23,529**
4	192	34	2,269	11,209	2,700	140	**16,544**
5	674	32	1,639	1,706	1,285	1,128	**6,463**
6	4,206	4,015	1,079	160	591	26,994	**37,046**
Total	**37,438**	**19,883**	**24,199**	**15,504**	**6,598**	**37,453**	**141,075**

26% Toll Reduction

OD	1	2	3	4	5	6	Total
1	28,725	2,529	1,362	209	677	3,858	**37,360**
2	2,451	13,198	79	36	45	4,337	**20,145**
3	1,196	76	17,783	2,189	1,302	993	**23,539**
4	201	35	2,264	11,207	2,700	140	**16,547**
5	675	32	1,639	1,705	1,285	1,128	**6,465**
6	4,204	4,015	1,080	160	591	27,000	**37,050**
Total	**37,451**	**19,885**	**24,208**	**15,507**	**6,600**	**37,456**	**141,106**

63% Toll Reduction

OD	1	2	3	4	5	6	Total
1	28,622	2,524	1,487	225	680	3,853	**37,392**
2	2,444	13,203	87	40	45	4,335	**20,152**
3	1,321	82	17,679	2,184	1,301	996	**23,564**
4	222	39	2,253	11,202	2,700	140	**16,556**
5	678	32	1,639	1,704	1,286	1,129	**6,469**
6	4,196	4,011	1,083	161	592	27,016	**37,058**
Total	**37,482**	**19,891**	**24,228**	**15,515**	**6,605**	**37,470**	**141,190**

No Toll

OD	1	2	3	4	5	6	Total
1	28,514	2,519	1,611	240	683	3,846	**37,414**
2	2,438	13,207	94	43	45	4,328	**20,155**
3	1,452	88	17,571	2,177	1,301	1,002	**23,592**
4	244	42	2,241	11,198	2,700	141	**16,568**
5	681	32	1,639	1,703	1,288	1,131	**6,474**
6	4,189	4,011	1,087	161	593	27,035	**37,076**
Total	**37,518**	**19,900**	**24,245**	**15,523**	**6,610**	**37,483**	**141,279**

Capabilities on project:
Transportation

H8 IP 2031

Do Minimum

OD	1	2	3	4	5	6	Total
1	27,308	2,564	887	142	683	3,958	**35,543**
2	2,461	13,054	71	42	51	3,554	**19,234**
3	891	71	15,773	2,230	1,190	924	**21,079**
4	135	36	2,144	10,737	2,172	199	**15,423**
5	601	42	1,269	2,177	1,174	433	**5,695**
6	3,889	3,818	1,001	182	390	22,837	**32,116**
Total	**35,286**	**19,586**	**21,144**	**15,510**	**5,659**	**31,905**	**129,090**

10% Toll Reduction

OD	1	2	3	4	5	6	Total
1	27,281	2,573	906	144	684	3,970	**35,558**
2	2,455	13,049	72	42	51	3,507	**19,175**
3	909	72	15,728	2,223	1,188	921	**21,041**
4	138	37	2,144	10,718	2,173	198	**15,409**
5	599	42	1,269	2,180	1,174	434	**5,699**
6	3,898	3,824	1,000	181	391	22,774	**32,069**
Total	**35,280**	**19,598**	**21,119**	**15,489**	**5,660**	**31,804**	**128,950**

26% Toll Reduction

OD	1	2	3	4	5	6	Total
1	27,253	2,570	943	150	685	3,968	**35,568**
2	2,452	13,047	75	44	51	3,505	**19,174**
3	946	75	15,695	2,220	1,187	921	**21,044**
4	144	39	2,140	10,716	2,171	198	**15,409**
5	600	42	1,269	2,179	1,174	434	**5,698**
6	3,896	3,822	1,001	181	391	22,780	**32,071**
Total	**35,292**	**19,596**	**21,123**	**15,490**	**5,659**	**31,805**	**128,965**

63% Toll Reduction

OD	1	2	3	4	5	6	Total
1	27,168	2,563	1,042	166	692	3,960	**35,591**
2	2,445	13,047	83	49	51	3,498	**19,172**
3	1,045	83	15,619	2,211	1,185	923	**21,066**
4	161	44	2,131	10,707	2,169	198	**15,411**
5	607	42	1,267	2,177	1,175	434	**5,701**
6	3,888	3,811	1,004	182	391	22,788	**32,064**
Total	**35,313**	**19,590**	**21,146**	**15,492**	**5,662**	**31,802**	**129,005**

No Toll

OD	1	2	3	4	5	6	Total
1	27,078	2,555	1,156	185	697	3,950	**35,621**
2	2,440	13,045	91	54	51	3,491	**19,172**
3	1,154	91	15,527	2,200	1,183	928	**21,082**
4	179	50	2,121	10,699	2,166	198	**15,412**
5	611	42	1,265	2,174	1,175	434	**5,702**
6	3,880	3,807	1,010	182	391	22,796	**32,066**
Total	**35,341**	**19,590**	**21,170**	**15,494**	**5,663**	**31,798**	**129,055**

Capabilities on project:
Transportation

H9 PM 2031

Do Minimum

OD	1	2	3	4	5	6	Total
1	31,545	2,872	1,158	190	636	4,921	**41,322**
2	3,036	15,789	75	46	51	4,854	**23,851**
3	1,240	94	20,266	2,633	1,566	1,004	**26,803**
4	161	32	2,649	13,166	2,375	174	**18,558**
5	696	46	1,552	3,302	1,574	585	**7,755**
6	4,622	4,675	1,054	206	1,054	31,581	**43,191**
Total	**41,300**	**23,508**	**26,755**	**19,542**	**7,256**	**43,119**	**161,481**

10% Toll Reduction

OD	1	2	3	4	5	6	Total
1	31,505	2,864	1,189	200	639	4,926	**41,323**
2	3,057	15,818	78	48	52	4,970	**24,022**
3	1,283	97	20,282	2,652	1,570	1,013	**26,897**
4	166	34	2,638	13,189	2,371	176	**18,574**
5	696	46	1,546	3,306	1,574	584	**7,752**
6	4,580	4,642	1,050	207	1,052	31,663	**43,194**
Total	**41,287**	**23,501**	**26,783**	**19,602**	**7,258**	**43,332**	**161,762**

26% Toll Reduction

OD	1	2	3	4	5	6	Total
1	31,460	2,861	1,246	210	640	4,924	**41,341**
2	3,052	15,817	81	50	51	4,970	**24,023**
3	1,339	101	20,236	2,646	1,570	1,015	**26,905**
4	173	36	2,634	13,187	2,371	176	**18,577**
5	697	46	1,545	3,305	1,575	584	**7,753**
6	4,578	4,642	1,050	207	1,053	31,666	**43,195**
Total	**41,299**	**23,503**	**26,791**	**19,605**	**7,259**	**43,335**	**161,793**

63% Toll Reduction

OD	1	2	3	4	5	6	Total
1	31,333	2,852	1,394	236	644	4,917	**41,375**
2	3,045	15,818	90	56	51	4,963	**24,023**
3	1,487	112	20,115	2,631	1,569	1,019	**26,933**
4	194	41	2,626	13,179	2,369	177	**18,584**
5	704	46	1,543	3,304	1,576	585	**7,757**
6	4,574	4,643	1,053	207	1,054	31,683	**43,213**
Total	**41,336**	**23,511**	**26,820**	**19,613**	**7,263**	**43,342**	**161,885**

No Toll

OD	1	2	3	4	5	6	Total
1	31,192	2,846	1,555	264	649	4,907	**41,413**
2	3,035	15,821	98	62	52	4,961	**24,028**
3	1,654	123	19,982	2,617	1,568	1,026	**26,971**
4	216	46	2,616	13,170	2,367	177	**18,593**
5	710	46	1,541	3,302	1,577	585	**7,762**
6	4,559	4,629	1,059	207	1,055	31,700	**43,209**
Total	**41,366**	**23,510**	**26,852**	**19,624**	**7,268**	**43,357**	**161,977**