North East Lincolnshire SATURN Model

Local Model Validation Report

Report

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1 Introduction

General

1.1 In September 2007 JMP was appointed by North East Lincolnshire Council (NELC) to prepare a major scheme business case for the A18-A180 Link Road. The study required the updating of the NELC SATURN model in order to test the impact of the scheme.

1.2 A scoping report for updating the model was produced and presented to the Department for Transport (DfT) in December 2007. A meeting was subsequently held with the Department in April 2008 to discuss the scope of works. The minutes of this meeting are included as **Appendix A**.

Purpose of this Report

1.3 This report gives a detailed description of how the North East Lincolnshire SATURN highway model was updated for the purposes of testing the A18-A180 Link Road. It also explains how the model was calibrated and validated.

1.4 The assumptions and methodology underlying the preparation of the traffic forecasts, and the impact of the strategies that were tested will be explained in a separate report.

Report Structure

1.5 Following this introductory section the remainder of this report sets out the steps involved in updating and checking the model and in presenting the validation. **Section 2** describes the modelling approach with **Section 3** outlining the data sources used. **Section 4** and **Section 5** deal with the zone system and base year networks respectively. **Section 6** covers the development of the base year demand matrix. **Section 7** and **Section 8** cover the calibration and validation of the base year model, whilst **Section 9** draws some conclusions.

2 Modelling Approach

Introduction

2.1 The key requirement of the NELC Model is that it should be capable of both accurately reflecting the existing traffic pattern to and from Immingham and also be sensitive to route choice in the local road network. Typically, traffic models developed to assess local schemes such as the A18-A180 Link Road scheme use a junction based network with traffic demand represented in the two peak hours (AM and PM) and an average inter peak hour of an average day.

2.2 The objectives of the modelling process are achieved by using a junction based simulation model for the study area with a link based buffer network for the wider network. Models were built for the AM and PM peak hours and an average inter peak hour.

Outline Methodology

2.3 In accordance with DfT guidance, maximum use was made of existing data where this is both appropriate and reasonably recent. Generally traffic count data from 2007 was used for matrix estimation and model validation, however, there were a couple of locations where older data from 2005 was used. This was supplemented by interviews of Heavy Goods Vehicles at the eastern and western gates at Immingham Docks which were undertaken in November 2007. In addition 2001 Census 'journey to work' data and ITIS journey time data, primarily from 2007 was used. The various data sources and traffic surveys are described in more detail in **Section 3**.

2.4 The zone system was modified for this study. The detail of the zone system is discussed in further detail in **Section 4**.

2.5 The highway network was extended to enable route choice from Lincolnshire to be modelled. The network checking is dealt with in detail in **Section 5**.

2.6 The base year matrices were updated using data from the HGV surveys, journey to work data and matrix estimation techniques using Manual Classified Turning Counts (MCTCs). Trips are assigned to the network as separate Car/Light/Medium Goods Vehicles and Heavy Goods Vehicles (HGVs). This process is fully described in **Section 6**.

2.7 As part of the process of calibration, the network and matrix data underwent checking to remove errors and/or inconsistencies. This included errors in network link characteristics such as length and connectivity. These checking procedures and any adjustments made to achieve calibration are dealt with in **Section 7**.

2.8 The validation of the SATURN model was performed using data collected in 2007 in the Immingham area. In accordance with standard good practice the validation data was independent of any data used in the construction of the model matrices. This process is set out in more detail in **Section 8**.

3 Data Sources

Introduction

3.1 Several data sources were used for this study, consistent with the guidance to make best use of existing information where such data are both relevant and recent. A review of existing data, undertaken with NELC and subsequent discussions, identified the need for observed Origin – Destination (O-D) movements in the Immingham area, and therefore surveys of Heavy Goods Vehicles leaving Immingham Dock were undertaken and supplemented by Journey to Work data for the Docks.

Historical Count Data

Manual Classified Turning Counts (MCTCs)

3.2 A series of MCTCs were undertaken for NELC in March 2007. These comprise:

- T22 - Pelham Road/B1210Stallingborough Road/B1210 Habrough Road/Bluestone Lane;
- T23 - B1210 Stallingborough Road/ Station Road/A1173 Riby Road;
- T24 - Great Coates Interchange - A180/ A1136/Europarc;
- T25 - A1173 Kings Road/Pelham Road;
- T26 – Stallingborough Interchange - A180/A1173;
- T27 – Immingham Interchange – A180/A160;
- T28 – A1173 Kings Road/Queens Road;
- T29 – A160/A1173 Manby Road/Humber Road.

3.3 An additional MCTC (T30) of B1210 Stallingborough Road, Keelby Road was undertaken in May 2008 and a MCTC for Riby crossroads undertaken on 1 April 2008 was obtained from Lincolnshire County Council.

3.4 ATC data from August 2005 on the following links was used:

- Laporte Road;
- Station Road, Stallingborough;
- Hobson Way.

3.5 These count locations are shown on **Figure 3.1**. From these data peak period flows were obtained which were used for matrix estimation and validation.

ITIS Journey Time Data

3.6 In order to provide further network validation, ITIS journey time data for key routes across Immingham was collated from sources maintained by a private sector provider of traffic data, ITIS Holdings plc (ITIS). Data was collated for the following routes:

- Route 1 – From B1210 Stallingborough Road/A1173 Riby Road Roundabout to A1173 Kings Road/Queens Road Roundabout via Pelham Road;
- Route 2 – From B1210 Stallingborough Road/A1173 Riby Road Roundabout to A1173/A160 roundabout via Station Road, Stallingborough, South Marsh Road, North Moss Lane, A1173 Kings Road, A1173 Manby Road;
- Route 3 – From Stallingborough Interchange to Hobson Way/Laporte Road roundabout via Kiln Lane.

3.7 Routes 1 and 3 could not be extended to the eastern gate of the docks as there was minimal data for Queens Road and Laporte Road. The three journey time survey routes are shown in **Figure 3.2.**

3.8 Initially data only from 2007 was used. These data were checked to ensure that there were sufficient records for each individual ITIS link for each modelled time period. The coefficient of variation was calculated for each link and checked against Table 11/1 From DMRB Vol 13 to ensure that there were sufficient records to achieve an accuracy of +/- 10% at the 95% confidence level. Where there were insufficient records, data from 2006 was added. There were sufficient records on most links, apart from Route 2 on Station Road and North Moss Lane for an accuracy of +/- 10% although there were sufficient records to produce an accuracy of +/- 20% except on North Moss Lane westbound in the PM Peak. The results of these checks are included in **Appendix B**.

Journey to Work Data

3.9 Journey to Work data from the 2001 Census was used to obtain a distribution of work trips to and from Immingham Docks.

New Data

HGV interview Surveys

3.10 A survey of HGVs leaving Immingham Dock was undertaken on 14th and 15th November 2007. Surveys were undertaken at both the eastern and western gates. In order to minimise queues into the port and disruption to dock operations, surveys were only undertaken on outbound dock traffic. Therefore, drivers were asked about the trip to the dock. **Table 3.1** shows the number of HGVs surveyed and the total HGV count which enables the proportion surveyed to be derived. This information is given for the eastern and western gates separately.

Table 3.1 Proportion of HGVs Surveyed

Time	Western Gate			Eastern Gate		
	HGVs Surveyed	Total HGVs	% HGVs surveyed	HGVs Surveyed	Total HGVs	% HGVs surveyed
0700 - 0800	17	122	14%	15	36	42%
0800 - 0900	32	152	21%	12	23	52%
0900 - 1000	33	157	21%	16	29	55%
1000 - 1100	37	141	26%	12	29	41%
1100 - 1200	36	137	26%	10	22	45%
1200 - 1300	27	166	16%	11	31	35%
1300 - 1400	80	262	31%	26	47	55%
1400 - 1500	30	168	18%	13	45	29%
1500 - 1600	36	133	27%	20	33	61%
1600 - 1700	22	93	24%	25	57	44%
1700 - 1800	11	41	27%	11	32	34%
1800 - 1900	18	53	34%	7	20	35%
Total	379	1625	23%	178	404	44%

3.11 As with all surveys of this type, a number of records were 'lost' at the data cleaning stage as no origin and/or destination details were recorded. This matter is discussed in more detail in Section 6.

Dock Traffic Counts

3.12 When the HGV interview survey was undertaken a traffic count was conducted only in the outbound direction, and therefore a manual classified count of vehicles into and out of the eastern and western dock gates was undertaken on Tuesday 13th May 2008.

4 Zone System

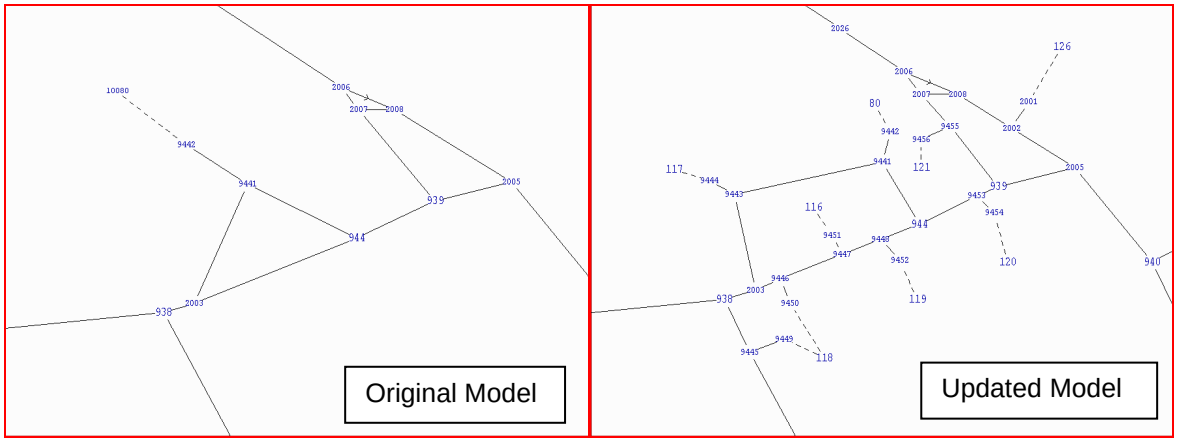
Introduction

4.1 The original NELC traffic model is structured around a series of 115 zones connected into the model network. The original zone system has a greater level of disaggregation in the Grimsby Cleethorpes area where the network is more detailed. Around Immingham, the zone system in the original model is much coarser with, for example, Immingham represented as a single zone. Therefore, the zone system was disaggregated in this area as part of this work.

Zone Disaggregation

4.2 Zone 80 representing Immingham, has been split into 6 additional new zones 116-120 as shown in **Figure 4.1**. The associated trips were disaggregated by looking at the proportion of households within each zone as taken from the 2001 Census.

Figure 4.1 Zone Disaggregation in Immingham



4.3 A new Zone 126 as shown in **Figure 4.1**, has been added to represent the industrial area accessed off Kings Road.

4.4 Immingham Docks was originally represented as a single zone and this has been split into to two zones so that the trips to and from the eastern and western gates can be modelled more accurately.

4.5 The industrial areas on Laporte Road and Kiln Lane were previously represented as a single zone. This zone has been split into two.

4.6 Three new zones have been added to represent areas in Lincolnshire as follows:

- Zone 123 - Market Rasen area
- Zone 124 – Gainsborough/Retford area;
- Zone 125 – Lincoln/ Grantham/Newark area.

4.7 The updated model now has a total of 128 zones compared with 115 in the original model.

5 The Base Year Network

Introduction

5.1 The original model primarily focused on Grimsby and Cleethorpes, with less detail in the Immingham area. The detailed model area covers the whole of North East Lincolnshire extending from Killingholme to the north, the A18 in the east and Ludborough in the south. The whole of the network was coded as simulation network.

5.2 Following discussions with the DfT it has been recognised that for this study it is important to model route choice for trips from the Lincolnshire area. Therefore, the modelled network has been extended to enable these route choices to be made.

5.3 Also, a detailed check of the network north west of Grimsby was undertaken.

Network Extension

5.4 The network was extended to include the A15, A46 and A1103 to ensure that the model could reflect route choice from the Lincolnshire area. This additional network was coded as buffer network and free flow modelled journey times were checked against journey times obtained from route planning information.

Network Checks

5.5 All of the modelled junctions north west of Grimsby were checked. This included checking junction layouts against aerial photographs and having discussions with NELC officers. Coded saturation flows were checked against 'typical' saturation flows in Passenger Car Units (PCUs) as shown in **Table 5.1**.

Table 5.1 Typical Junction Saturation Flows per Lane

Junction Type/Movement	Saturation flow (pcu/hr)
Traffic Signals	
Left turn	1,650
Straight ahead	1,950
Right turn	1,700
Priority Junctions	
Unopposed left turn	1,800
Straight ahead	1,950
Opposed major right turn	615
Opposed minor left turn	625
Opposed right turn	575
Roundabouts	
All movements	1,500

5.6 Free flow speeds were checked from site visits and against traffic regulation orders to ensure that modelled free flow speeds were not greater than speed limits.

6 Base Year Trip Matrices

Introduction

6.1 Base year matrices from the original model were only available for the morning (AM) and evening (PM) peak periods. The matrices were split by the following vehicle types:

- Car/light/medium goods vehicles;
- Heavy Goods Vehicles (HGVs).

6.2 The base year matrices were updated using the HGV interview data and journey to work data for the docks as well as traffic count data from 2007 for matrix infilling using matrix estimation procedures. Not all available data was used for updating the matrices as some was retained for independent assignment validation.

6.3 An average inter peak hour matrix was derived from the two peak hour matrices which were combined and updated using traffic data and matrix estimation techniques.

Observed Data

6.4 The following processes relate to converting the observed HGV and journey to work data into matrix information for each vehicle type and time period combination. Zone numbers were attributed to the origin and destination addresses manually.

HGV Trips To and From the Docks

6.5 It was considered whether some of the HGV survey records could be recovered where there was only either a recorded origin or destination and thereby making an assumption about the proportion which have the same origin or destination. However, data was also collected on the route they used to access or egress the docks, therefore assumptions could be made as to which zones these trips should be assigned. Only a small proportion of records were lost except for the Western Gate outbound where nearly 30% of records were lost. However, this still left a sample rate of 23% for the Western Gate outbound.

6.6 As there were few records for the AM and PM Peak hours, a trip distribution pattern of trips to and from the each of the gates across the whole day was derived. This results in a less coarse distribution of trips to and from the docks.

6.7 The appropriate trip distribution patterns were applied to the number of HGV trips in to and out of each of the dock gates, as taken from the survey undertaken in May 2008. This produced the number of HGV trips to and from the two zones representing the docks which replaced the data for the dock zone within the original HGV matrix.

Journey to Work Trips

6.8 Journey to work data for car drivers to the area representing Immingham Docks was used to derive a trip distribution pattern for light vehicle trips to and from the zones representing the dock.

6.9 The appropriate trip distribution patterns were than applied to the number of light vehicle trips in to and out of each of the dock gates, as taken from the survey undertaken in May 2008. This produced the number of light vehicle trips to and from the two zones representing the docks which replaced the data for the dock zone within the original light vehicle matrix.

Matrix Estimation

6.10 The HGV interview surveys and journey to work data only captured data on trips to and from Immingham Docks. Matrix estimation, using some of the MCTC data was undertaken in order to replicate other trip movements.

6.11 Matrix estimation is the procedure where an old or prior trip matrix and current traffic counts are used to estimate the most likely trip matrix consistent with the information contained in the counts using as a starting point the prior trip matrix. This process is described in more detail in the following section.

7 Calibration

Introduction

7.1 Calibration of the network and matrices was undertaken to ensure that the model outputs provided an accurate representation of observed traffic flows and behaviour. The calibration process involves the refinement of network detail and characteristics to ensure assignment and route choice is well represented. It also involves adjustment of trip matrices to achieve a reasonable distribution of trip origins and destinations, and the removal of any errors or inconsistencies.

Network Calibration

7.2 The checking and correction of network data was carried out for the following characteristics:

- link length;
- link speed/flow relationship;
- location of zone connectors.

7.3 The link lengths of key routes were checked against Ordnance Survey mapping and a plot of network distances obtained. This allowed a check of a sample of network link lengths and orientation in the Immingham area.

7.4 Checks on speed/flow characteristics were undertaken. This included checks on the location of changes in speed limits and the review of speeds and capacities using local knowledge of links important to the study area.

7.5 The locations at which traffic loads onto the network can influence route choice. The zone connectors can have a significant impact on movements at an individual junction or over a longer section of route, particularly if there is a close alternative.

Matrix Estimation

7.6 Ten junction turning counts were used in the matrix estimation process. The matrix estimation was constrained to traffic counts at the east and west gates of the docks, Europarc and Hobson Way.

Convergence

7.7 The matrix estimation process employed within model calibration was designed to adjust travel patterns to match observed traffic counts. This process adjusts the total of all trips originating or ending in a zone using available observed traffic counts to give the best fit matrix in terms of estimated trip ends. This is dependent on several factors including the quality of the 'prior' or initial matrix, traffic routing and network constraints and the priority order and consistency of the observed traffic counts. Thus it is essential that the process is monitored closely to ensure the trip matrix is converging to a stable solution.

7.8 The matrix estimation procedure is an iterative process that allows comparison between iterations to determine which one provides the best calibrated model assignment. The matrix estimation process was therefore monitored to ensure that the estimated matrix readily converged to a stable solution. The variation in total trips for the iterations that converge is shown in **Table 7.1.**

Table 7.1 Matrix Convergence Statistics

Iteration	Total Trips					
	AM Peak		Inter Peak		PM Peak	
	Lights	Heavies	Lights	Heavies	Lights	Heavies
Original	24649	4349	12981	3581	27276	2814
1	24346	4086	13119	3778	27019	2966
2	24374	4079	13120	3795	27009	2998
3	24409	4075	13128	3805	27056	2989
4	24388	4075	13122	3794	27029	2988
5	24399	4075	13117	3795	27043	2986

Matrix Calibration

7.9 The observed matrix was updated using the most accurate and complete data for Immingham. This was achieved by fully utilising the observed HGV survey data collected in 2007 and the journey to work data for the docks. Different measures can be used to compare modelled and observed traffic flows. However each of these different measures have its shortcomings. For example, using a percentage difference can accentuate small differences when the flows are small. Using absolute differences can cause the differences in high flow links to overshadow major inconsistencies in lower flow links.

7.10 A measure that has been devised to overcome this problem is the GEH error statistic (after Geoff Havers of the GLC). The GEH error statistic compares two values and weights the difference according to the average of the two flows. The weighting is not linear but takes the form of a square root function.

$$GEH = \sqrt{\frac{(M-C)^2}{(M+C)/2}}$$

where: M = Modelled Flow and C = Observed Flow

7.11 The Design Manual for Roads and Bridges (DMRB) requires that the GEH statistic is less than 5 for at least 85% of turning movements. **Table 7.2** shows that in all cases, more than 85% of links have a GEH <5. Another measure is R^2 which is a measure of the 'Goodness of Fit'. An R^2 of greater than 0.95 represents a good level of fit. **Table 7.2** shows that in all cases an R^2 value of 0.95 is achieved. A complete set of matrix calibration statistics are provided at **Appendix C**.

Table 7.2 Matrix Calibration

	AM Peak		Inter Peak		PM Peak	
	Lights	Heavies	Lights	Heavies	Lights	Heavies
Calibration Counts	95	80	97	92	95	73
Counts GEH<5	92	79	93	89	86	69
% Counts	97%	99%	96%	97%	91%	96%
R^2	0.987	0.995	0.981	0.992	0.985	0.989

Model Convergence

7.12 A full run of the NELC SATURN Model consists of a series of iterations within the SATURN SATALL assignment program until acceptable levels of convergence is achieved. The guidance in DMRB (Volume 12 Section 2 Part 1 Table 4.1) recommends two criteria for acceptable model convergence, as follows:

- 'Delta' or Gap value – less than 1% or at least stable, with convergence fully documented and all other criteria met;
- Flow change – less than 5% for four consecutive iterations, for 90% of links.

7.13 The convergence statistics obtained under the above conditions were extracted from the final iterations within the SATALL assignment model run. A summary of the convergence statistics is given in **Table 7.3.**

Table 7.3 Model Convergence Statistics

Convergence Statistic		AM Peak	Inter Peak	PM Peak
% Gap		0.09	0.00	0.09
% flows	Last-3	97.6%	98.0%	99.6%
	Last-2	97.7%	98.1%	99.8%
	Last-1	99.6%	98.7%	99.9%
	Last	98.3%	99.2%	99.9%

8 Validation

Introduction

8.1 Validation is the process of demonstrating the quality of the model by comparing model output with observed data, which should be independent of data used for model development wherever possible. The purpose of this section of the report is to demonstrate validation for the three time period models.

8.2 In accordance with DfT guidance, validation of the model comprises the following:

- journey time validation;
- link flow validation.

Journey Time Validation

8.3 Observed journey times were taken from ITIS data. Three routes were analysed in both directions of flow as shown on **Figure 3.2** and these are as follows:

- Route 1 – From B1210 Stallingborough Road/A1173 Riby Road Roundabout to A1173 Kings Road/Queens Road Roundabout via Pelham Road;
- Route 2 – From B1210 Stallingborough Road/A1173 Riby Road Roundabout to A1173/A160 roundabout via Station Road, Stallingborough, South Marsh Road, North Moss Lane, A1173 Kings Road, A1173 Manby Road;
- Route 3 – From Stallingborough Interchange to Hobson Way/Laporte Road roundabout via Kiln Lane.

8.4 Journey time validation is based upon comparisons of observed and modelled journey times along these routes. The validation criteria is based upon modelled times being within 15% of observed times, or 1 minute if greater, for 85% of routes. The results of the journey time validation are shown in **Tables 8.1 to 8.3.**

Table 8.1 Journey Time Validation – AM Peak

	Mean -15%	Mean	Mean +15%	Observed	Validated
1 NB	375	441	507	435	✓
1 SB	377	444	511	415	✓
2 NB	541	636	731	609	✓
2 SB	524	617	710	580	✓
3 NB	151	178	205	202	✓
3 SB	167	196	225	178	✓

Table 8.2 Journey Time Validation – Inter Peak

	Mean -15%	Mean	Mean +15%	Observed	Validated
1 NB	376	442	508	411	✓
1 SB	387	455	523	411	✓
2 NB	547	643	739	591	✓
2 SB	516	607	698	574	✓
3 NB	150	176	202	181	✓
3 SB	167	197	227	180	✓

Table 8.3 Journey Time Validation – PM Peak

	Mean -15%	Mean	Mean +15%	Observed	Validated
1 NB	377	444	511	417	✓
1 SB	377	443	509	453	✓
2 NB	558	657	756	604	✓
2 SB	536	630	725	596	✓
3 NB	142	167	192	179	✓
3 SB	166	195	224	204	✓

8.5 **Tables 8.1 to 8.3**, show that all of the routes in all three time periods give modelled journey times within 15% of the observed journey time, and therefore meet DMRB criteria.

Link Flow Validation

8.6 The assigned flows are the basis of scheme assessment and are the outputs upon which the model is most easily judged. Differences between modelled output link flows and observed values may reflect errors and inconsistencies in the assignment, network or matrices, and therefore, are important indicators of the overall accuracy of the model.

8.7 The criteria used are consistent with DfT guidance and are that individual modelled flows, for 85% of cases, should be:

- within 100 vehicles per hour (vph) for flows less than 700 vph;
- within 15% for observed flows of 700-2700 vph;
- within 400vph for flows greater than 2,700 vph;
- GEH < 5.

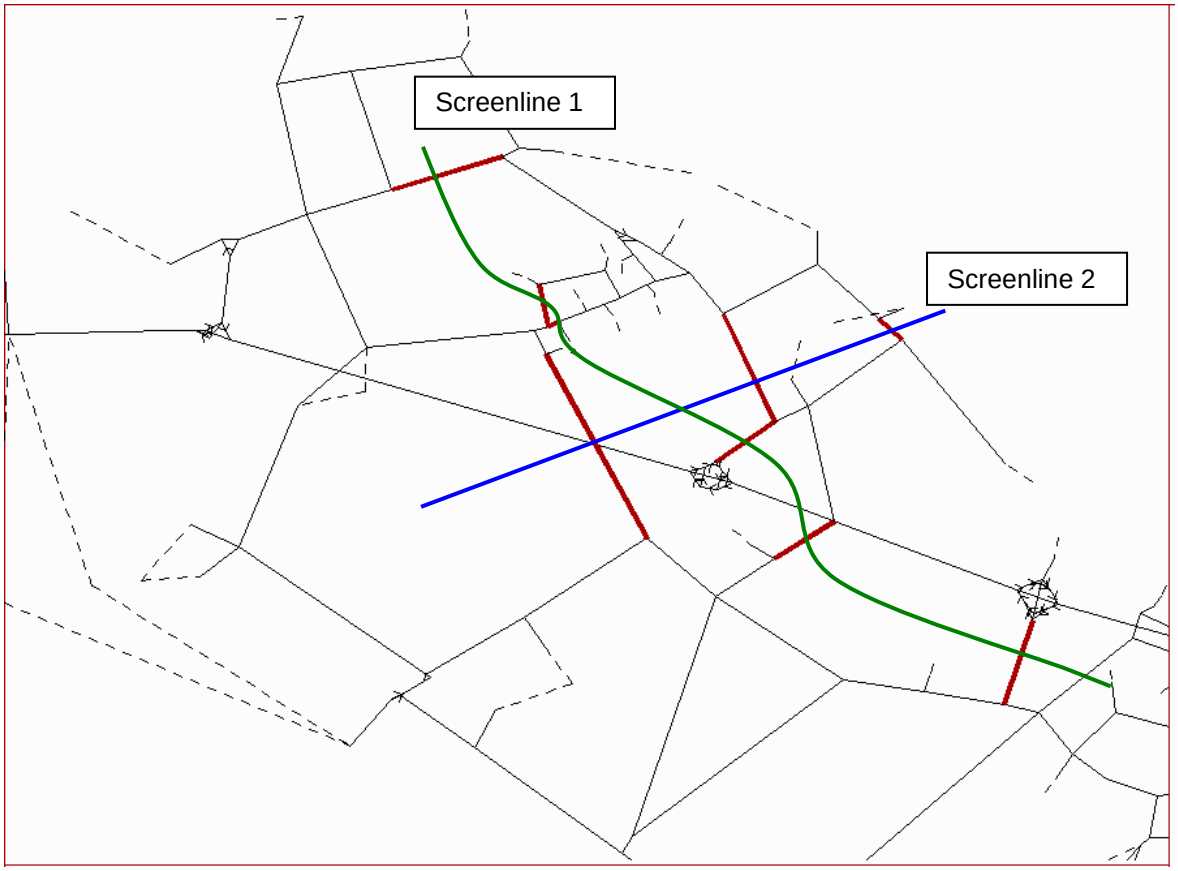
8.8 Screenline totals should be within 5% and have a GEH less than 4 for all or nearly all of the screenlines.

8.9 In assessing the validation of the traffic model, those links that are critical to the scheme appraisal have been identified. Two screenlines were created for validation purposes as follows:

- Screenline 1 – A160 Humber Road, Bluestone Lane, Pelham Road, A1173, Station Road, A1136;
- Screenline 2 – B1210 Stallingborough Road, Kings Road, Laporte Road.

8.10 The locations of these screenlines are shown in **Figure 8.1**.

Figure 8.1 Validation Screenlines



8.11 A series of validation tables have been produced to illustrate the level of validation achieved on the critical links. The link flow validation results are presented in **Tables 8.4 and 8.5** showing the location, count type, observed and modelled flow, percentage difference (modelled – observed) and the corresponding GEH value. The links have been validated for light vehicles and HGVs separately as well as for the total flow

Tables 8.4 and 8.5 show that the individual link flows validate well. Only a few screenline vehicle totals do not meet the within 5% validation criteria, but achieve the GEH requirements.

Table 8.4 Screenline 1 Validation

AM Peak						Total Vehicles						Light Vehicles						Heavy Vehicles					
a node	b node	Location	Count Type/Source	Month	Year	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria
936	937	Humber Road EB	MCC	03	07	488	500	12	3	0.56	OK	357	349	-8	-2	0.44	OK	131	152	21	16	1.74	OK
2003	9443	Bluestone Lane EB	MCC	03	07	110	104	-6	-6	0.60	OK	108	104	-4	-4	0.39	OK	2	0	-2	-100	2.09	OK
2003	9446	Pelham Road EB	MCC	03	07	519	437	-82	-16	3.75	OK	500	418	-82	-16	3.83	OK	19	19	0	0	0.00	OK
6241	941	A1173 EB	MCC	03	07	829	839	10	1	0.33	OK	755	764	9	1	0.33	OK	74	74	0	1	0.05	OK
927	9271	Station Road EB	ATC	08	05	232	143	-88	-38	6.46	OK	231	143	-87	-38	6.37	OK	1	0	-1	-100	1.62	OK
656	6205	A1136 NB	MCC	03	07	856	898	42	5	1.43	OK	839	880	41	5	1.40	OK	17	18	1	8	0.34	OK
						3034	**2922**	**-112**	**-3.7**	2.06	OK	**2790**	**2658**	**-131**	**-4.7**	2.52	OK	**244**	**263**	19	**8**	1.19	
a node	b node	Location	Count Type/Source	Month	Year	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria
937	936	Humber Road WB	MCC	03	07	429	420	-9	-2	0.44	OK	226	225	-1	-1	0.08	OK	203	195	-8	-4	0.55	OK
9443	2003	Bluestone Lane WB	MCC	03	07	169	171	2	1	0.13	OK	169	171	2	1	0.13	OK	0	0	0	0	0.00	OK
9446	2003	Pelham Road WB	MCC	03	07	336	291	-45	-13	2.54	OK	309	265	-44	-14	2.59	OK	27	26	-1	-4	0.20	OK
941	6241	A1173 WB	MCC	03	07	425	415	-10	-2	0.51	OK	355	344	-11	-3	0.58	OK	70	70	0	1	0.05	OK
9271	927	Station Road WB	ATC	08	05	31	38	7	23	1.23	OK	31	38	8	25	1.30	OK	0	0	-0	-100	0.93	OK
6205	656	A1136 SB	MCC	03	07	338	341	3	1	0.18	OK	325	328	3	1	0.18	OK	13	13	0	1	0.03	OK
						1728	**1676**	**-52**	**-3.0**	1.26	OK	**1415**	**1371**	**-43**	**-3.1**	1.16	OK	**313**	**305**	-9	**-3**	0.49	OK

Inter Peak						Total Vehicles						Light Vehicles						Heavy Vehicles					
a node	b node	Location	Count Type/Source	Month	Year	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria
936	937	Humber Road EB	MCC	03	07	408	394	-14	-3	0.71	OK	216	200	-16	-7	1.11	OK	192	194	2	1	0.13	OK
2003	9443	Bluestone Lane EB	MCC	03	07	82	92	10	12	1.05	OK	81	92	11	13	1.15	OK	1	0	-1	-100	1.32	OK
2003	9446	Pelham Road EB	MCC	03	07	281	286	5	2	0.33	OK	263	267	4	2	0.24	OK	18	19	2	9	0.35	OK
6241	941	A1173 EB	MCC	03	07	400	400	-0	0	0.01	OK	297	296	-1	0	0.08	OK	103	105	1	1	0.11	OK
927	9271	Station Road EB	ATC	08	05	44	35	-9	-20	1.43	OK	43	35	-8	-20	1.36	OK	0	0	-0	-100	0.93	OK
656	6205	A1136 NB	MCC	03	07	264	272	8	3	0.47	OK	251	264	13	5	0.84	OK	13	8	-6	-42	1.73	OK
						1479	**1479**	**-0**	**0.0**	0.01	OK	**1151**	**1153**	**2**	**0.2**	0.06	OK	**328**	**326**	**-2**	**-1**	0.13	OK
a node	b node	Location	Count Type/Source	Month	Year	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria
937	936	Humber Road WB	MCC	03	07	417	394	-23	-5	1.12	OK	237	223	-14	-6	0.95	OK	180	172	-8	-5	0.62	OK
9443	2003	Bluestone Lane WB	MCC	03	07	96	78	-18	-19	1.94	OK	95	78	-17	-18	1.85	OK	1	0	-1	-100	1.32	OK
9446	2003	Pelham Road WB	MCC	03	07	326	307	-19	-6	1.06	OK	310	292	-18	-6	1.02	OK	16	15	-1	-7	0.28	OK
941	6241	A1173 WB	MCC	03	07	447	463	16	4	0.75	OK	350	364	14	4	0.75	OK	97	99	2	2	0.20	OK
9271	927	Station Road WB	ATC	08	05	54	45	-9	-16	1.23	OK	52	45	-7	-14	1.06	OK	1	0	-1	-100	1.62	OK
6205	656	A1136 SB	MCC	03	07	355	297	-58	-16	3.21	OK	338	286	-52	-15	2.95	OK	17	11	-6	-36	1.61	OK
						1694	**1584**	**-110**	**-6.5**	2.72		**1382**	**1288**	**-95**	**-6.8**	2.59		**312**	**296**	**-15**	**-5**	0.89	OK

PM Peak						Total Vehicles						Light Vehicles						Heavy Vehicles					
a node	b node	Location	Count Type/Source	Month	Year	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria
936	937	Humber Road EB	MCC	03	07	399	337	-62	-15	3.22	OK	261	204	-57	-22	3.75	OK	138	133	-5	-3	0.40	OK
2003	9443	Bluestone Lane EB	MCC	03	07	163	164	1	1	0.10	OK	163	164	1	1	0.10	OK	0	0	0	0	0.00	OK
2003	9446	Pelham Road EB	MCC	03	07	380	364	-15	-4	0.80	OK	372	357	-15	-4	0.80	OK	8	8	-0	-2	0.04	OK
6241	941	A1173 EB	MCC	03	07	429	418	-11	-2	0.52	OK	369	361	-8	-2	0.41	OK	60	57	-3	-5	0.36	OK
927	9271	Station Road EB	ATC	08	05	38	29	-10	-26	1.69	OK	38	29	-9	-25	1.62	OK	0	0	-0	-100	0.93	OK
656	6205	A1136 NB	MCC	03	07	378	395	17	5	0.88	OK	370	385	15	4	0.79	OK	8	10	2	23	0.61	OK
						1787	**1708**	**-79**	**-4.4**	1.89	OK	**1573**	**1500**	**-73**	**-4.6**	1.86	OK	**214**	**208**	-6	-3	0.42	OK
a node	b node	Location	Count Type/Source	Month	Year	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria
937	936	Humber Road WB	MCC	03	07	556	559	3	1	0.12	OK	405	406	1	0	0.03	OK	151	153	2	1	0.18	OK
9443	2003	Bluestone Lane WB	MCC	03	07	114	97	-17	-15	1.62	OK	114	97	-17	-15	1.62	OK	0	0	0	0	0.00	OK
9446	2003	Pelham Road WB	MCC	03	07	551	543	-8	-1	0.32	OK	535	528	-7	-1	0.32	OK	16	16	-0	-1	0.05	OK
941	6241	A1173 WB	MCC	03	07	984	1009	25	3	0.78	OK	928	954	26	3	0.84	OK	56	55	-1	-2	0.15	OK
9271	927	Station Road WB	ATC	08	05	210	158	-52	-25	3.87	OK	210	158	-52	-25	3.87	OK	0	0	0	0	0.00	OK
6205	656	A1136 SB	MCC	03	07	1082	987	-95	-9	2.94	OK	1075	983	-92	-9	2.88	OK	7	5	-2	-32	0.91	OK
						3497	**3353**	**-144**	**-4.1**	2.46	OK	**3267**	**3125**	**-142**	**-4.4**	2.52	OK	**230**	**229**	**-1**	**-1**	0.09	OK

Table 8.5 Screenline 2 Validation

AM Peak

						Total Vehicles						Light Vehicles						Heavy Vehicles					
a node	b node	Location	Count Type/Source	Month	Year	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria
9445	928	Stallingborough Road SB	MCC	05	08	282	304	22	8	1.28	OK	254	280	26	10	1.59	OK	12	24	12	96	2.75	OK
940	941	Kings Road SB	MCC	03	07	426	399	-27	-6	1.34	OK	341	370	29	8	1.53	OK	37	29	-8	-22	1.39	OK
945	943	Laporte Road SB	ATC	08	05	129	93	-37	-28	3.49	OK	53	49	-4	-7	0.53	OK	35	43	8	24	1.36	OK
						837	**795**	**-42**	**-5.0**	1.47		**648**	**699**	**51**	**7.9**	1.96		**82**	**96**	**14**	**17**	1.46	
a node	b node	Location	Count Type/Source	Month	Year	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria
928	9445	Stallingborough Road NB	MCC	05	08	326	342	16	5	0.87	OK	315	325	10	3	0.55	OK	11	17	6	57	1.65	OK
941	940	Kings Road NB	MCC	03	07	536	554	18	3	0.78	OK	487	506	19	4	0.84	OK	49	49	-0	-1	0.07	OK
943	945	Laporte Road NB	ATC	08	05	322	244	-78	-24	4.66	OK	288	214	-74	-26	4.67	OK	34	30	-4	-13	0.78	OK
						1184	**1140**	**-44**	**-3.7**	1.29	OK	**1090**	**1045**	**-45**	**-4.2**	1.39	OK	**93**	**95**	**3**	**3**	0.30	OK

Inter Peak

						Total Vehicles						Light Vehicles						Heavy Vehicles					
a node	b node	Location	Count Type/Source	Month	Year	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria
9445	928	Stallingborough Road SB	MCC	05	08	244	261	17	7	1.09	OK	229	246	17	8	1.12	OK	15	15	0	0	0.01	OK
940	941	Kings Road SB	MCC	03	07	353	331	-22	-6	1.18	OK	297	252	-45	-15	2.71	OK	56	79	23	42	2.83	OK
945	943	Laporte Road SB	ATC	08	05	117	131	14	12	1.29	OK	82	118	35	43	3.55	OK	35	14	-21	-61	4.30	OK
						713	**723**	**10**	**1.4**	0.37	OK	**608**	**616**	**8**	**1.3**	0.31	OK	**103**	**107**	**4**	**4**	0.36	OK
a node	b node	Location	Count Type/Source	Month	Year	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria
928	9445	Stallingborough Road NB	MCC	05	08	214	247	33	15	2.14	OK	197	228	31	16	2.11	OK	17	19	2	11	0.44	OK
941	940	Kings Road NB	MCC	03	07	322	339	17	5	0.92	OK	264	261	-3	-1	0.21	OK	58	79	20	35	2.45	OK
943	945	Laporte Road NB	ATC	08	05	96	63	-33	-34	3.70	OK	64	51	-13	-21	1.73	OK	32	12	-20	-62	4.24	OK
						632	**649**	**16**	**2.6**	0.65	OK	**525**	**539**	**14**	**2.7**	0.62	OK	**106**	**110**	**4**	**3**	0.35	OK

PM Peak

						Total Vehicles						Light Vehicles						Heavy Vehicles					
a node	b node	Location	Count Type/Source	Month	Year	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria
9445	928	Stallingborough Road SB	MCC	05	08	430	457	27	6	1.29	OK	420	441	21	5	1.03	OK	10	16	6	58	1.63	OK
940	941	Kings Road SB	MCC	03	07	631	636	5	1	0.20	OK	592	597	5	1	0.21	OK	39	39	0	0	0.02	OK
945	943	Laporte Road SB	ATC	08	05	238	298	60	25	3.66	OK	210	268	58	28	3.76	OK	28	30	2	6	0.33	OK
						1299	**1392**	**92**	**7.1**	2.52		**1222**	**1307**	**85**	**6.9**	2.38		**75**	**85**	**10**	**13**	1.11	
a node	b node	Location	Count Type/Source	Month	Year	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria	Observed Flow (veh)	Modelled Flow (veh)	difference	%diff	GEH	Meets Link Flow Criteria
928	9445	Stallingborough Road NB	MCC	05	08	243	266	23	9	1.43	OK	238	258	20	8	1.28	OK	5	8	3	50	1.01	OK
941	940	Kings Road NB	MCC	03	07	433	457	24	5	1.13	OK	405	405	0	0	0.02	OK	28	51	23	84	3.73	OK
943	945	Laporte Road NB	ATC	08	05	70	39	-31	-44	4.16	OK	48	34	-14	-30	2.24	OK	22	6	-16	-75	4.44	OK
						746	**762**	**16**	**2.1**	0.57	OK	**691**	**697**	**6**	**0.9**	0.23	OK	**53**	**65**	**12**	**22**	1.51	

9 Conclusions

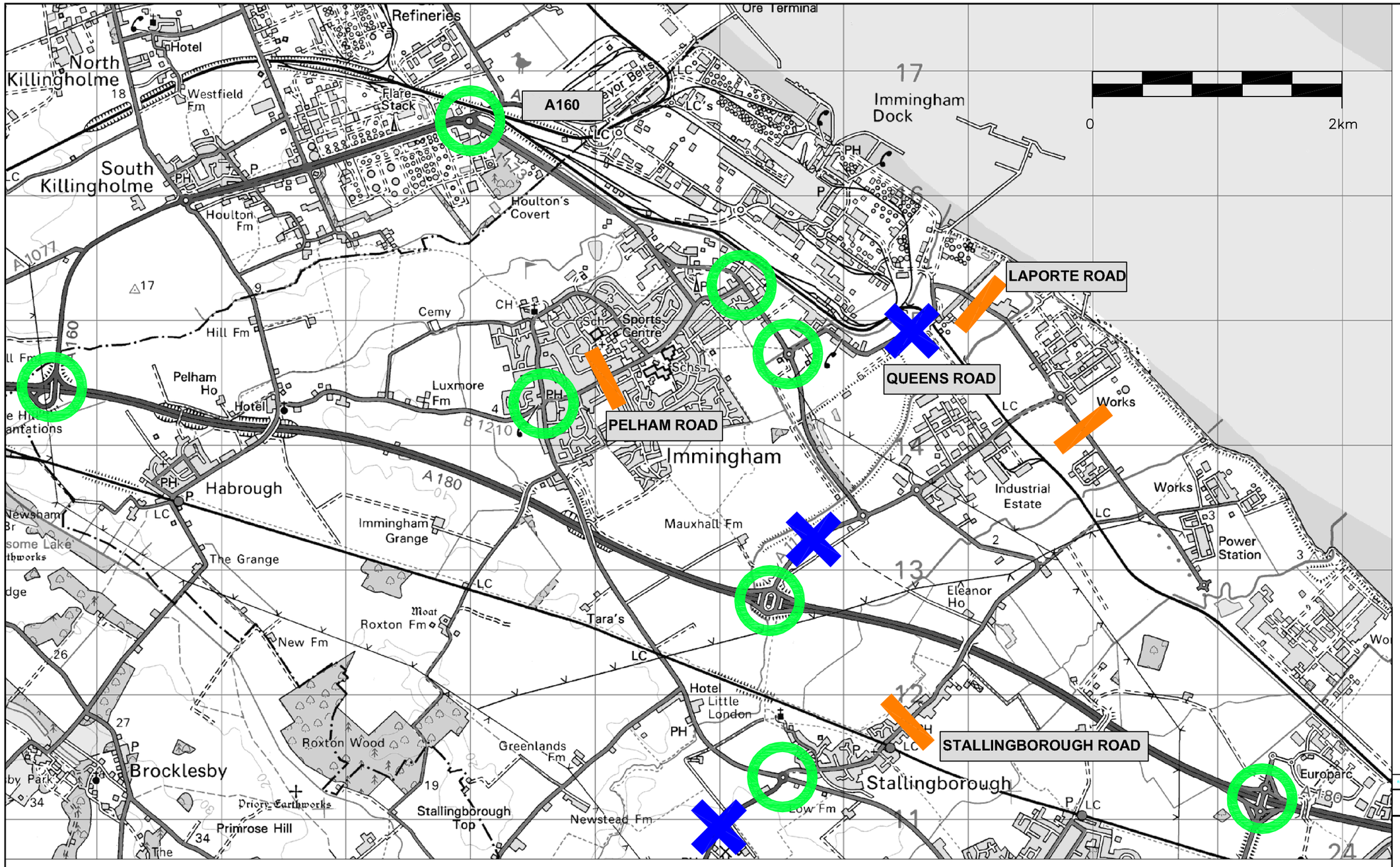
9.1 The NELC SATURN model has been updated focusing on the Immingham area and to produce a tool which is suitable for testing the A18-A180 Link Road. A buffer network was added to the simulation network in order for route choice from the Lincolnshire and east of England areas to be modelled.

9.2 The matrices were updated using data from Heavy Goods Vehicle driver interviews at Immingham Docks and from Journey to work data from the 2001 Census. The original model only represented the morning (AM) and evening (PM) peak hours and therefore an inter peak model was derived from a combination of the AM and PM models.

9.3 Journey time validation was undertaken on three routes across the study area in both directions of flow covering the main routes to and from the docks. Journey time validation was very good with all routes in all three time periods meeting DMRB criteria.

9.4 The models illustrate good convergence and excellent link flow validation. All but one of the individual links met DMRB link flow validation criteria but all met the GEH criteria. Validation across screenlines is also very good with all screenlines meeting the GEH criteria.

9.5 The model is therefore considered to provide a sound basis for traffic forecasting and the assessment of the A18-A180 Link Road.



KEY:

- MCC TURN
  07:00 - 19:00HRS - MARCH 2007
- MCC LINK
  07:00 - 19:00HRS - OCT 2007
- ATC 24HR COUNT

JMP
Minerva House,
East Parade,
Leeds,
LS1 5PS
T 0113 244 4347
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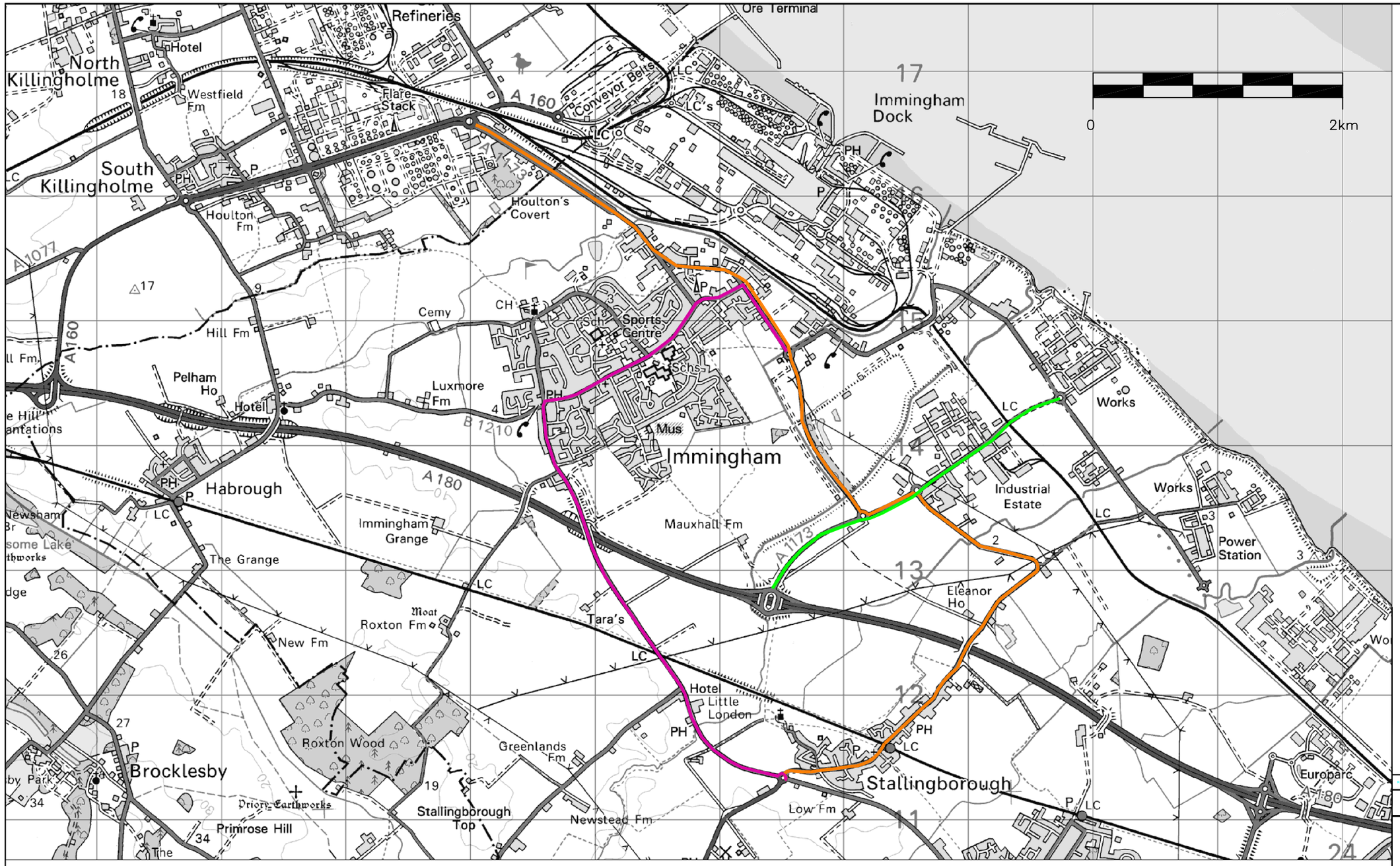
W www.jmp.co.uk

Client: North East Lincolnshire Council

Project: A18- A180 Link MSBC

Title: Traffic Count Locations

Drawn	Checked	Approved
MW	EW	EW
Original Pkg. size	Date	Scale
A3	SEP 08	NTS
Drawing Status	Drawing Number	Rev.
Information	Figure 3.1	



KEY:

- JOURNEY TIME ROUTE 1
- JOURNEY TIME ROUTE 2
- JOURNEY TIME ROUTE 3

JMP
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Client: North East Lincolnshire Council

Project: A18- A180 Link MSBC

Title: Journey Time Roootes

Drawn	Checked	Approved
MW	EW	EW
Originating size: A3	Date: SEP 08	Scale: NTS
Drawing Status: Information	Drawing Number: Figure 3.2	Rev:

Appendix A

Minutes of Meeting with DfT

Meeting Minutes

Date	17 April 2008
Meeting date	10 April 2008
Venue	Department for Transport
Job No/ Name	D087019
Present	Steve Berry - DfT, Peter Apostolou - DfT, John Collins - DfT, Simon Moss - NELC, Ian Turvey - JMP , Emma Warman - JMP
Subject	A18-A180 Link Road

Meeting items	**Actions**
1. SB explained the changing roles at DfT and stated that PA would now be dealing with the A18-A180 scheme.	
2. JC reiterated that the methodology needs to be compliant with guidance including checking whether variable demand modelling is required but DfT accepted that some degree of proportionality is appropriate.	
3. JC liked that new HGV data had been collected since the last meeting, however, clarification is required as to how this data is going to be used. The DfT also thought that the matrix disaggregation was appropriate and that there is potentially sufficient count data for matrix calibration and validation.	
4. The original TUBA analysis needs to be examined to determine where the benefits are coming from: • If there are significant benefits to LGVs, then further work to improve the LGV matrix will be required. • Are there significant benefits accruing from the inter peak. If the scheme has borderline vfm and/or significant benefits accrue from movements that are not well represented in the model, then more information/refinement will be required for the modelling. JC advised RSIs on the B1210 and Station Road through Stallingborough could be used to enhance the analysis if required.	JMP
5. The methodology proposes using journey to work data to Immingham Docks. JC wondered whether we could use Journey to Work data to other zones.	JMP

6. Need to validate against more journey time routes including the A180 and A1173. JC stated that ITIS data could be used as long as there is sufficient data available. Therefore need to check standard deviations for the data.	JMP
7. The spatial extent of the model needs to ensure any rerouting effects are captured if required. Therefore need to check journey time and distance for alternative routes. Also check RSI data for the A180.	JMP
8. JC would look at any further evidence regarding the modelling prior to the submission of the MSBC, however, he would need warning of when to expect anything so that he can programme it into his schedule.	
9. PA would like to visit the site. NELC to organise in conjunction with Mark Duggleby at GOYH..	NELC

Distribution	Those present
Name/ Signed	Emma Warman

Appendix B

ITIS Journey Time Data Check

Accuracy of Journey Time Surveys (Table 11/1 From DMRB Vol 13)

Coeff. Of Variation of Observed Journey Times (CV = (s/m)*100) %	Number of Journey Time Runs	
	For a = 10% = 1/10	For a = 20% = 1/5
5	4	2
10	7	2
15	11	3
20	18	5
30	35	9
40	64	16
50	100	25

Journey Time Route 1

AM Peak Northbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
2934	63	61	8	86	46	2	12
2740	68	103	12	134	71	3	12
3974	91	42	8	80	27	2	19
4124	60	86	12	127	71	3	14
4069	236	53	10	112	37	1	19
4087	93	45	21	174	22	4	46
3258	310	51	9	144	24	1	18

Average Inter Peak Northbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
2934	725	62	10	191	26	1	17
2740	705	104	14	188	73	1	13
3974	809	43	12	166	18	1	28
4124	635	85	14	186	42	1	17
4069	1038	53	14	229	19	1	26
4087	658	45	19	219	17	1	42
3258	2689	49	9	156	19	0	17

PM Peak Northbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
2934	38	62	8	82	46	3	13
2740	35	106	14	147	78	5	13
3974	44	46	15	95	19	5	33
4124	32	84	12	131	68	4	14
4069	59	55	16	112	34	4	30
4087	50	44	15	135	22	4	35
3258	135	48	9	85	23	1	18

AM Peak Southbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
3258	298	54	9	108	35	1	16
4087	93	43	12	101	29	2	28
4069	99	52	12	96	37	2	22
4124	54	84	20	194	65	5	23
3974	72	39	8	60	25	2	20
2740	66	105	12	142	78	3	11
2934	74	66	11	107	49	3	17

Average Inter Peak Southbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
3258	2640	56	11	194	15	0	19
4087	809	44	19	238	10	1	44
4069	932	58	18	213	28	1	31
4124	406	87	21	237	33	2	25
3974	645	40	12	181	18	1	31
2740	537	105	15	203	65	1	14
2934	642	64	10	125	40	1	16

PM Peak Southbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
3258	146	59	13	99	33	2	22
4087	94	41	8	86	28	2	21
4069	332	61	17	134	31	2	27
4124	206	80	11	172	54	2	14
3974	271	38	10	115	25	1	26
2740	249	104	10	145	81	1	10
2934	129	60	10	92	46	2	16

Journey Time Route 2

AM Peak Northbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
1554	21	28	7	40	18	3	24
2884	12	178	14	201	159	8	8
1234	15	75	20	136	57	10	27
1474	353	38	6	66	24	1	17
1175	309	85	11	120	63	1	12
3258	298	54	9	108	35	1	16
5247	232	55	11	110	33	1	20
5261	216	45	18	221	27	2	40
6275	347	78	17	223	54	2	22

Average Inter Peak Northbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
1554	299	30	12	142	12	1	39
2884	114	187	43	459	136	8	23
1234	148	77	23	202	28	4	30
1474	2606	38	10	187	11	0	26
1175	2411	83	11	221	51	0	13
3258	2640	56	11	194	15	0	19
5247	1688	55	16	376	22	1	30
5261	1824	43	18	301	15	1	43
6275	2514	74	16	226	44	1	21

PM Peak Northbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
1554	29	31	10	63	19	4	32
2884	7	192	32	240	151	24	17
1234	8	83	28	139	62	19	34
1474	127	38	11	135	23	2	30
1175	204	80	15	245	63	2	18
3258	146	59	13	99	33	2	22
5247	68	57	11	86	37	3	20
5261	318	43	14	127	24	2	33
6275	106	74	17	186	52	3	23

AM Peak Southbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
6304	231	77	21	215	50	3	27
5261	195	36	11	114	21	2	30
5247	229	46	12	162	24	2	26
3258	310	51	9	144	24	1	18
1175	311	89	14	184	64	2	16
1474	322	35	9	121	21	1	25
1234	29	72	14	109	48	5	19
2884	22	180	33	275	122	14	18
1554	28	30	12	80	16	5	41

Average Inter Peak Southbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
6304	2977	77	25	315	48	1	33
5261	1754	36	11	232	14	1	31
5247	2189	46	14	226	19	1	30
3258	2689	49	9	156	19	0	17
1175	2627	87	13	288	59	1	15
1474	2815	34	8	173	14	0	24
1234	128	72	14	123	46	2	19
2884	106	178	35	329	130	7	20
1554	254	28	9	74	7	1	33

PM Peak Southbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
6304	328	76	25	297	46	3	33
5261	369	38	13	146	20	1	34
5247	133	47	16	205	28	3	35
3258	135	48	9	85	23	1	18
1175	134	87	11	122	67	2	13
1474	122	34	12	112	20	2	36
1234	12	74	16	109	57	9	22
2884	15	199	56	368	140	28	28
1554	30	26	8	50	17	3	31

Journey Time Route 3

AM Peak Northbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
6004	419	60	8	92	41	1	14
1474	322	35	9	121	21	1	25
3123	153	83	10	110	62	2	12

Average Inter Peak Northbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
6004	3543	59	8	166	23	0	14
1474	2815	34	8	173	14	0	24
3123	1289	83	16	275	58	1	20

PM Peak Northbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
6004	242	55	9	93	27	1	17
1474	122	34	12	112	20	2	36
3123	60	79	15	160	55	4	20

AM Peak Southbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
3123	182	92	10	127	71	1	11
1474	353	38	6	66	24	1	17
6004	519	66	10	101	43	1	15

Average Inter Peak Southbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
3123	1364	92	15	342	56	1	16
1474	2606	38	10	187	11	0	26
6004	3959	67	12	211	23	0	17

PM Peak Southbound

LINK	RECORDS	MEAN	STDEV	MAX	MIN	95% CI	CoV
3123	81	90	20	235	54	4	22
1474	127	38	11	135	23	2	30
6004	207	67	14	176	38	2	22

Appendix C

Matrix Calibration

AM Peak Light Vehicles

NO.	ANODE	BNODE	CNODE	COUNT	MODELLED FLOW	CAPACITY	DIFF	% DIFF	GEH
1	9445	938	933	82	51	1017	-30	-38.18	3.84
2	9445	938	2003	347	266	1345	-80	-23.23	4.6
3	938	2003	9443	69	71	653	2	2.3	0.19
4	938	2003	9446	425	343	1015	-81	-19.22	4.17
5	933	938	2003	147	148	716	1	0.35	0.04
6	933	938	9445	65	62	474	-2	-4.12	0.34
7	9443	2003	938	94	96	261	2	2.14	0.21
8	9443	2003	9446	75	75	396	0	-0.43	0.04
9	9446	2003	938	270	232	1129	-37	-14.18	2.42
10	9446	2003	9443	39	33	435	-5	-14.48	0.94
11	2003	938	9445	252	215	960	-36	-14.55	2.4
12	2003	938	933	112	112	808	0	0.36	0.04
13	928	927	9271	61	69	1006	8	13.06	0.99
14	928	927	926	242	241	1175	0	-0.47	0.07
15	928	927	925	56	52	1029	-3	-6.88	0.52
16	9271	927	928	37	37	579	0	-0.02	0
17	9271	927	926	111	111	650	0	-0.02	0
18	9271	927	925	21	21	559	0	-1.84	0.08
19	926	927	928	176	176	1334	0	-0.26	0.03
20	926	927	9271	97	97	1251	0	-0.29	0.03
21	926	927	925	10	0	1149	-9	-100	4.47
22	925	927	928	118	116	1511	-1	-1.98	0.22
23	925	927	9271	130	129	1499	0	-1.03	0.12
24	925	927	926	18	0	1367	-17	-100	6
25	6242	6202	6209	300	304	1446	4	1.17	0.2
26	6202	6209	6208	75	75	1661	0	0.01	0
27	6202	6209	6207	225	229	1800	4	1.56	0.23
28	220	6208	6207	30	30	1800	0	0.66	0.04
29	6208	6203	620	41	40	1374	0	-2.39	0.15
30	6207	6208	220	296	296	1711	0	0.01	0
31	6207	6203	620	296	332	1748	36	12.21	2.04
32	6207	6204	6206	13	13	1639	0	-0.14	0.01
33	6207	6204	6205	242	246	1881	4	1.54	0.24
34	6203	620	662	337	372	1411	35	10.46	1.87
35	620	6201	6205	83	83	1764	0	-0.52	0.05
36	662	620	6201	219	214	1375	-4	-2.07	0.31
37	6201	6204	6207	136	132	1284	-3	-3.01	0.35
38	6206	6202	6242	396	397	1399	1	0.16	0.03
39	6205	6206	6202	383	384	1773	1	0.17	0.03
40	6205	6204	6207	543	496	1437	-46	-8.61	2.05
41	939	2005	939	4	0	680	-3	-100	2.83
42	939	2005	2002	62	62	747	0	0.26	0.02
43	939	2005	940	330	310	1011	-19	-6.08	1.12
44	2002	2005	939	35	47	867	12	34.71	1.9
45	2002	2005	940	157	148	1014	-8	-5.89	0.75
46	940	2005	939	168	171	802	3	1.87	0.24
47	940	2005	2002	201	205	874	4	2.03	0.29
48	9322	624	6245	159	159	1800	0	-0.27	0.03
49	6245	6241	941	755	764	1800	9	1.22	0.33
50	6245	6241	6246	4	0	968	-3	-100	2.83
51	6241	6246	6242	324	306	1756	-17	-5.5	1
52	6241	6246	6243	35	38	1544	3	8.63	0.5
53	941	6241	6246	355	344	1804	-10	-3.04	0.58
54	6242	6243	6244	601	605	1804	4	0.73	0.18
55	6243	6244	624	38	38	1219	0	-0.07	0
56	6243	6244	6245	598	606	1756	8	1.26	0.31
57	9324	932	9321	329	328	1616	0	-0.24	0.04
58	932	9321	2012	329	328	1630	0	-0.24	0.04
59	9321	9322	624	211	213	1315	2	1.02	0.15
60	9321	9325	9324	147	148	1800	1	0.45	0.05
61	2012	9321	9322	211	213	1800	2	1.02	0.15
62	9322	9323	9325	119	119	1450	0	-0.29	0.03
63	9323	9325	9321	119	119	1800	0	-0.29	0.03
64	9325	9324	2016	147	148	1749	1	0.45	0.05
65	9325	9321	2012	119	119	1136	0	-0.29	0.03
66	941	940	2005	330	330	1306	0	0	0
67	941	940	2024	157	176	1113	19	11.94	1.45
68	2005	940	941	318	317	900	0	-0.33	0.06
69	2005	940	2024	140	141	714	1	0.53	0.06
70	2024	940	941	23	53	1003	30	129.9	4.85
71	2024	940	2005	46	46	1005	0	0.44	0.03
72	936	937	2010	159	159	2080	0	0.15	0.02
73	936	937	2026	188	190	1850	2	0.82	0.11
74	2010	937	936	45	45	1240	0	-0.63	0.04
75	2010	937	2026	55	56	917	1	0.91	0.07
76	2026	937	936	180	180	1742	0	-0.01	0
77	2026	937	2010	213	212	1794	0	-0.63	0.09
78	9445	928	927	234	260	1400	26	11.14	1.66
79	9445	928	9292	20	20	407	0	-0.51	0.02
80	927	928	9292	42	44	1100	2	5.53	0.35
81	927	928	9445	274	284	1200	10	3.6	0.59
82	9292	928	9445	41	41	437	0	-0.24	0.02
83	9292	928	927	108	102	279	-5	-5.66	0.6
84	959	602	925	20	60	1184	40	199.56	6.31
85	959	602	601	402	398	1727	-3	-1.09	0.22
86	925	602	601	101	99	363	-1	-1.79	0.18
87	925	602	959	9	0	116	-8	-99.91	4.24
88	603	601	6021	12	25	916	13	111.13	3.09
89	603	601	602	709	722	1771	13	1.79	0.48
90	6021	601	602	107	59	235	-47	-44.71	5.25
91	6021	601	603	17	34	107	17	102.85	3.45
92	601	602	959	485	485	1496	0	0.09	0.02
93	601	602	925	331	295	340	-35	-10.73	2.01
94	602	601	603	463	464	1744	1	0.12	0.03
95	602	601	6021	40	33	226	-6	-16.87	1.12

AM Peak HGVs

NO.	ANODE	BNODE	CNODE	COUNT	MODELLED FLOW	CAPACITY	DIFF	% DIFF	GEH
1	9445	938	2003	39	39	1345	0	-0.9	0.06
2	938	2003	9443	2	0	653	-1	-100	2
3	938	2003	9446	44	44	1015	0	0.09	0.01
4	933	938	2003	7	5	716	-1	-23.15	0.65
5	9446	2003	938	60	60	1129	0	-0.67	0.05
6	9446	2003	9443	2	0	435	-1	-100	2
7	2003	938	9445	53	54	960	1	2.44	0.18
8	2003	938	933	7	5	808	-1	-24.19	0.68
9	928	927	9271	5	5	1006	0	0.19	0
10	928	927	926	2	2	1175	0	-1.24	0.02
11	928	927	925	51	45	1029	-5	-12.51	0.92
12	926	927	928	9	10	1334	1	6.97	0.21
13	926	927	925	12	0	1149	-11	-100	4.9
14	925	927	928	35	28	1511	-6	-19.74	1.23
15	925	927	9271	14	4	1499	-9	-73.46	3.46
16	925	927	926	2	0	1367	-1	-100	2
17	6242	6202	6209	28	27	1446	0	-1.92	0.1
18	6202	6209	6208	14	14	1661	0	0	0
19	6202	6209	6207	14	13	1800	0	-3.83	0.14
20	220	6208	6207	14	13	1800	0	-5.49	0.21
21	6208	6203	620	12	12	1374	0	-1.93	0.07
22	6207	6208	220	9	11	1711	2	24.89	0.7
23	6207	6203	620	16	17	1748	1	7.11	0.28
24	6207	6204	6206	9	9	1639	0	-1.96	0.06
25	6207	6204	6205	18	18	1881	0	-0.72	0.03
26	6203	620	662	28	29	1411	1	3.2	0.17
27	620	6201	6205	12	12	1764	0	3.27	0.11
28	662	620	6201	18	19	1375	1	7.78	0.32
29	6201	6204	6207	7	7	1284	0	0.11	0
30	6206	6202	6242	30	30	1399	0	-0.97	0.05
31	6205	6206	6202	21	21	1773	0	-0.48	0.02
32	6205	6204	6207	23	21	1437	-1	-7.09	0.35
33	939	2005	2002	23	4	747	-18	-81.01	5.04
34	939	2005	940	18	21	1011	3	17.19	0.7
35	2002	2005	939	32	17	867	-14	-47.6	3.08
36	2002	2005	940	51	63	1014	12	23.33	1.58
37	940	2005	939	32	33	802	1	1.97	0.11
38	940	2005	2002	53	71	874	18	34.71	2.33
39	9322	624	6245	92	93	1800	1	1.07	0.1
40	6245	6241	941	170	171	1800	1	0.53	0.07
41	6241	6246	6242	53	53	1756	0	-0.42	0.03
42	6241	6246	6243	108	109	1544	1	1.09	0.11
43	941	6241	6246	161	162	1804	1	0.59	0.08
44	6242	6243	6244	81	78	1804	-2	-3.75	0.34
45	6243	6244	624	110	109	1219	0	-0.87	0.09
46	6243	6244	6245	78	78	1756	0	-0.02	0
47	9324	932	9321	338	336	1616	-1	-0.73	0.13
48	932	9321	2012	338	336	1630	-1	-0.73	0.13
49	9321	9322	624	18	18	1315	0	0.4	0.02
50	9321	9325	9324	610	607	1800	-2	-0.41	0.1
51	2012	9321	9322	18	18	1800	0	0.4	0.02
52	9322	9323	9325	18	18	1450	0	1.7	0.07
53	9323	9325	9321	18	18	1800	0	1.7	0.07
54	9325	9324	2016	610	607	1749	-2	-0.41	0.1
55	9325	9321	2012	18	18	1136	0	1.7	0.07
56	941	940	2005	83	75	1306	-7	-9.18	0.86
57	941	940	2024	30	37	1113	7	21.76	1.13
58	2005	940	941	62	47	900	-14	-24.48	2.06
59	2005	940	2024	37	37	714	0	0.43	0.03
60	2024	940	941	23	20	1003	-2	-13.79	0.69
61	2024	940	2005	28	29	1005	1	2.34	0.12
62	936	937	2010	248	304	2080	56	22.69	3.39
63	936	937	2026	44	44	1850	0	0.67	0.04
64	2010	937	936	384	385	1240	1	0.26	0.05
65	2010	937	2026	51	51	917	0	0.23	0.02
66	2026	937	936	64	64	1742	0	0.46	0.04
67	2026	937	2010	85	84	1794	0	-0.78	0.07
68	9445	928	927	28	48	1400	20	70.68	3.21
69	927	928	9445	25	33	1200	8	33.13	1.53
70	9292	928	927	12	4	279	-7	-68.16	2.91
71	959	602	925	5	5	1184	0	-3.78	0.09
72	959	602	601	69	70	1727	1	2.1	0.17
73	925	602	601	53	52	363	0	-1.26	0.09
74	925	602	959	2	0	116	-1	-97.12	1.92
75	603	601	602	48	48	1771	0	-0.25	0.02
76	6021	601	602	35	34	235	0	-3.03	0.18
77	601	602	959	48	48	1496	0	-0.63	0.04
78	601	602	925	35	34	340	0	-2.7	0.16
79	602	601	603	74	74	1744	0	0.57	0.05
80	602	601	6021	48	48	226	0	0.78	0.05

Inter Peak Light Vehicles

NO.	ANODE	BNODE	CNODE	COUNT	MODELLED FLOW	CAPACITY	DIFF	% DIFF	GEH
1	9445	938	933	44	45	1087	1	1.98	0.13
2	9445	938	2003	200	190	1347	-9	-5	0.72
3	938	2003	9443	55	56	746	1	1.73	0.13
4	938	2003	9446	255	243	1031	-11	-4.56	0.74
5	933	938	2003	110	109	784	0	-0.6	0.06
6	933	938	9445	50	50	546	0	-0.61	0.04
7	9443	2003	938	54	54	296	0	0.34	0.02
8	9443	2003	9446	41	24	450	-16	-42.48	3.06
9	9446	2003	938	272	257	1109	-14	-5.66	0.95
10	9446	2003	9443	38	36	488	-1	-6.05	0.38
11	2003	938	9445	218	203	966	-14	-6.97	1.05
12	2003	938	933	108	108	844	0	0	0
13	928	927	9271	33	33	1317	0	-0.34	0.02
14	928	927	926	153	148	1438	-4	-3.16	0.39
15	928	927	925	47	44	1353	-2	-5.53	0.38
16	9271	927	928	32	32	632	0	-0.4	0.02
17	9271	927	926	51	51	651	0	-0.5	0.04
18	9271	927	925	28	27	626	0	-2.08	0.11
19	926	927	928	149	151	1418	2	1.05	0.13
20	926	927	9271	51	51	1315	0	-0.2	0.01
21	926	927	925	16	0	1263	-15	-100	5.66
22	925	927	928	45	42	1754	-2	-7.19	0.49
23	925	927	9271	26	24	1708	-1	-7.24	0.38
24	925	927	926	15	0	1681	-14	-100	5.48
25	6242	6202	6209	149	150	1539	1	0.52	0.06
26	6202	6209	6208	15	15	1756	0	-1.46	0.06
27	6202	6209	6207	134	135	1800	1	0.74	0.09
28	220	6208	6207	57	56	1800	0	-1.61	0.12
29	6208	6203	620	58	57	1695	0	-1.61	0.12
30	6207	6208	220	60	71	1772	11	18.97	1.4
31	6207	6203	620	85	84	1733	0	-1.03	0.1
32	6207	6204	6206	22	22	1718	0	-1.92	0.09
33	6207	6204	6205	169	170	1867	1	0.3	0.04
34	6203	620	662	142	141	1465	0	-0.57	0.07
35	620	6201	6205	85	116	1800	31	37.01	3.13
36	662	620	6201	122	150	1564	28	23.23	2.43
37	6201	6204	6207	37	34	1361	-2	-8.43	0.52
38	6206	6202	6242	155	164	1527	9	6.05	0.74
39	6205	6206	6202	143	143	1755	0	-0.14	0.02
40	6205	6204	6207	166	122	1546	-43	-26.73	3.7
41	939	2005	939	3	0	826	-2	-100	2.45
42	939	2005	2002	29	29	867	0	-0.29	0.02
43	939	2005	940	180	185	1037	5	2.71	0.36
44	2002	2005	939	38	38	840	0	-0.96	0.06
45	2002	2005	940	141	145	1027	4	2.78	0.33
46	940	2005	939	208	202	870	-5	-3.07	0.45
47	940	2005	2002	113	110	859	-2	-2.48	0.27
48	940	2005	940	1	0	651	0	-100	0
49	9322	624	6245	38	37	1800	0	-2.09	0.13
50	6245	6241	941	297	296	1800	0	-0.45	0.08
51	6245	6241	6246	7	0	1367	-6	-100	3.74
52	6241	6246	6242	309	314	1747	5	1.66	0.29
53	6241	6246	6243	48	50	1468	2	4.09	0.28
54	941	6241	6246	350	364	1804	14	4.02	0.75
55	6242	6243	6244	265	258	1804	-6	-2.47	0.4
56	6243	6244	624	50	50	1535	0	-0.07	0.01
57	6243	6244	6245	263	258	1747	-4	-1.72	0.28
58	9324	932	9321	123	123	1800	0	-0.06	0.01
59	932	9321	2012	123	123	1661	0	-0.06	0.01
60	9321	9322	624	93	92	1566	0	-0.72	0.07
61	9321	9325	9324	149	149	1800	0	-0.15	0.02
62	2012	9321	9322	93	92	1800	0	-0.72	0.07
63	9322	9323	9325	90	91	1602	1	0.78	0.07
64	9323	9325	9321	90	91	1800	1	0.78	0.07
65	9325	9324	2016	149	149	1800	0	-0.15	0.02
66	9325	9321	2012	90	91	1151	1	0.78	0.07
67	941	940	2005	232	230	1395	-1	-0.68	0.1
68	941	940	2024	32	30	1200	-1	-5.75	0.33
69	2005	940	941	250	250	968	0	-0.03	0.01
70	2005	940	2005	2	0	629	-1	-100	2
71	2005	940	2024	80	80	739	0	-0.16	0.01
72	2024	940	941	47	2	968	-44	-95.37	9.04
73	2024	940	2005	82	81	984	0	-0.74	0.07
74	936	937	2010	50	50	2375	0	-0.98	0.07
75	936	937	2026	160	150	2218	-9	-5.98	0.77
76	2010	937	936	68	67	1154	0	-1.79	0.15
77	2010	937	2026	103	104	943	1	0.52	0.05
78	2026	937	936	185	156	1958	-28	-15.76	2.23
79	2026	937	2010	77	76	1889	0	-1.53	0.13
80	9445	928	927	205	204	1400	0	-0.47	0.07
81	9445	928	9292	24	42	464	18	75.63	3.16
82	927	928	9292	36	32	1100	-3	-11.71	0.72
83	927	928	9445	178	192	1200	14	8.1	1.06
84	9292	928	9445	19	35	487	16	85.71	3.13
85	9292	928	927	31	21	333	-9	-30.92	1.87
86	959	602	925	10	8	1338	-1	-17.01	0.56
87	959	602	601	252	241	1773	-10	-4.32	0.69
88	925	602	601	79	76	450	-2	-3.4	0.31
89	925	602	959	11	43	268	32	287.53	6.11
90	603	601	6021	8	27	1290	19	238.74	4.56
91	603	601	602	286	266	1769	-19	-6.85	1.18
92	6021	601	602	31	20	429	-10	-35.7	2.19
93	6021	601	603	11	23	255	12	107.29	2.87
94	601	602	959	246	214	1710	-31	-12.91	2.09
95	601	602	925	71	72	439	1	1.57	0.13
96	602	601	603	296	296	1764	0	-0.04	0.01
97	602	601	6021	35	22	411	-12	-38.44	2.53

Inter Peak HGVs

NO.	ANODE	BNODE	CNODE	COUNT	MODELLED FLOW	CAPACITY	DIFF	% DIFF	GEH
1	9445	938	933	3	5	1087	2	59.34	0.9
2	9445	938	2003	40	40	1347	0	-1.23	0.08
3	938	2003	9443	1	0	746	0	-100	0
4	938	2003	9446	44	44	1031	0	1.13	0.08
5	933	938	2003	5	5	784	0	-0.19	0
6	933	938	9445	3	3	546	0	6.02	0.1
7	9443	2003	938	1	0	296	0	-100	0
8	9443	2003	9446	2	0	450	-1	-100	2
9	9446	2003	938	36	34	1109	-1	-4.24	0.26
10	9446	2003	9443	1	0	488	0	-100	0
11	2003	938	9445	33	31	966	-1	-6.23	0.36
12	2003	938	933	4	4	844	0	-11.74	0.24
13	928	927	9271	2	2	1317	0	-3.66	0.05
14	928	927	926	7	7	1438	0	-1.23	0.03
15	928	927	925	27	26	1353	0	-2.66	0.14
16	9271	927	928	3	3	632	0	-1.12	0.02
17	9271	927	926	3	3	651	0	-0.75	0.01
18	9271	927	925	2	2	626	0	1.04	0.01
19	926	927	928	5	5	1418	0	-2.47	0.06
20	926	927	9271	1	1	1315	0	-0.03	0
21	926	927	925	9	0	1263	-8	-100	4.24
22	925	927	928	31	31	1754	0	0.88	0.05
23	925	927	9271	3	3	1708	0	2.79	0.05
24	925	927	926	8	0	1681	-7	-100	4
25	6242	6202	6209	25	25	1539	0	0.77	0.04
26	6202	6209	6208	14	13	1756	0	-3.72	0.14
27	6202	6209	6207	12	12	1800	0	-2.38	0.08
28	220	6208	6207	18	18	1800	0	2.59	0.11
29	6208	6203	620	9	10	1695	1	5.97	0.18
30	6207	6208	220	9	10	1772	1	13.73	0.4
31	6207	6203	620	13	0	1733	-12	-100	5.1
32	6207	6204	6206	14	15	1718	1	5.97	0.22
33	6207	6204	6205	15	15	1867	0	2.29	0.09
34	6203	620	662	23	10	1465	-12	-58.53	3.34
35	620	6201	6205	9	9	1800	0	0.43	0.01
36	662	620	6201	16	16	1564	0	0.24	0.01
37	6201	6204	6207	7	7	1361	0	-0.01	0
38	6206	6202	6242	29	30	1527	1	2.01	0.11
39	6205	6206	6202	15	15	1755	0	-1.69	0.07
40	6205	6204	6207	17	3	1546	-13	-80.96	4.33
41	939	2005	2002	27	12	867	-14	-53.9	3.28
42	939	2005	940	24	26	1037	2	8.63	0.41
43	2002	2005	939	26	13	840	-12	-49.62	2.92
44	2002	2005	940	88	93	1027	5	6.21	0.57
45	940	2005	939	15	18	870	3	16.79	0.62
46	940	2005	2002	89	98	859	9	10.2	0.94
47	9322	624	6245	133	131	1800	-1	-1.57	0.18
48	6245	6241	941	238	241	1800	3	1.13	0.17
49	6245	6241	6246	2	0	1367	-1	-100	2
50	6241	6246	6242	118	121	1747	3	2.63	0.28
51	6241	6246	6243	108	106	1468	-1	-1.47	0.15
52	941	6241	6246	223	228	1804	5	2.03	0.3
53	6242	6243	6244	108	110	1804	2	1.65	0.17
54	6243	6244	624	109	106	1535	-2	-2.38	0.25
55	6243	6244	6245	106	110	1747	4	3.56	0.36
56	9324	932	9321	533	526	1800	-6	-1.38	0.32
57	932	9321	2012	533	526	1661	-6	-1.38	0.32
58	9321	9322	624	20	20	1566	0	-0.43	0.02
59	9321	9325	9324	462	458	1800	-3	-0.8	0.17
60	2012	9321	9322	20	20	1800	0	-0.43	0.02
61	9322	9323	9325	21	21	1602	0	0.26	0.01
62	9323	9325	9321	21	21	1800	0	0.26	0.01
63	9325	9324	2016	462	458	1800	-3	-0.8	0.17
64	9325	9321	2012	21	21	1151	0	0.26	0.01
65	941	940	2005	99	87	1395	-11	-11.66	1.2
66	941	940	2024	35	93	1200	58	165.98	7.26
67	2005	940	941	92	90	968	-1	-2.7	0.26
68	2005	940	2005	3	0	629	-2	-100	2.45
69	2005	940	2024	30	30	739	0	0.06	0
70	2024	940	941	37	92	968	55	148.04	6.83
71	2024	940	2005	29	28	984	0	-2.96	0.16
72	936	937	2010	329	352	2375	23	7.06	1.26
73	936	937	2026	94	94	2218	0	0.04	0
74	2010	937	936	319	324	1154	5	1.63	0.29
75	2010	937	2026	76	77	943	1	0.82	0.07
76	2026	937	936	71	71	1958	0	-0.3	0.03
77	2026	937	2010	83	83	1889	0	-0.47	0.04
78	9445	928	927	31	31	1400	0	0.44	0.02
79	9445	928	9292	3	3	464	0	-0.39	0.01
80	927	928	9292	3	0	1100	-2	-92.39	2.18
81	927	928	9445	38	39	1200	1	2.34	0.14
82	9292	928	9445	2	5	487	3	170.07	1.77
83	9292	928	927	4	4	333	0	-0.34	0.01
84	959	602	925	2	16	1338	14	701.05	4.67
85	959	602	601	53	54	1773	1	1.09	0.08
86	925	602	601	37	35	450	-1	-4.77	0.29
87	603	601	602	62	82	1769	20	32.32	2.36
88	6021	601	602	53	53	429	0	0.94	0.07
89	601	602	959	71	91	1710	20	28.79	2.27
90	601	602	925	44	44	439	0	0.21	0.01
91	602	601	603	48	48	1764	0	-0.08	0.01
92	602	601	6021	41	41	411	0	-0.36	0.02

PM Peak Light Vehicles

NO.	ANODE	BNODE	CNODE	COUNT	MODELLED FLOW	CAPACITY	DIFF	% DIFF	GEH
1	9445	938	933	64	65	1072	1	1.73	0.14
2	9445	938	2003	228	230	1327	2	0.74	0.11
3	938	2003	9443	83	84	697	1	1.42	0.13
4	938	2003	9446	323	326	1004	3	0.87	0.16
5	933	938	2003	178	180	769	2	1.3	0.17
6	933	938	9445	70	69	418	0	-1.25	0.1
7	9443	2003	938	65	66	205	1	2.29	0.18
8	9443	2003	9446	49	31	419	-17	-37.02	2.87
9	9446	2003	938	455	448	1071	-6	-1.65	0.35
10	9446	2003	9443	80	80	374	0	0.14	0.01
11	2003	938	9445	361	355	918	-5	-1.78	0.34
12	2003	938	933	159	159	688	0	0.25	0.03
13	928	927	9271	42	42	1121	0	-0.48	0.03
14	928	927	926	237	264	1331	27	11.23	1.68
15	928	927	925	121	96	1159	-24	-20.88	2.43
16	9271	927	928	58	58	454	0	-0.07	0
17	9271	927	926	103	102	500	0	-1.18	0.12
18	9271	927	925	155	154	549	0	-0.61	0.08
19	926	927	928	244	247	1160	3	1.22	0.19
20	926	927	9271	93	92	1003	0	-0.73	0.07
21	926	927	925	17	0	911	-16	-100	5.83
22	925	927	928	62	62	1502	0	-0.48	0.04
23	925	927	9271	26	26	1459	0	1.4	0.07
24	925	927	926	18	0	1429	-17	-100	6
25	6242	6202	6209	490	504	1511	14	2.88	0.63
26	6202	6209	6208	18	18	1410	0	0.74	0.03
27	6202	6209	6207	472	486	1800	14	2.96	0.64
28	220	6208	6207	226	233	1763	7	3.06	0.46
29	6208	6203	620	146	138	1643	-7	-5.29	0.65
30	6207	6208	220	83	83	1777	0	0.04	0
31	6207	6203	620	113	119	1660	6	5.27	0.55
32	6207	6204	6206	81	81	1258	0	0.14	0.01
33	6207	6204	6205	617	638	1818	21	3.37	0.83
34	6203	620	662	259	257	1299	-1	-0.69	0.11
35	620	6201	6205	345	345	1800	0	-0.04	0.01
36	662	620	6201	389	380	1510	-8	-2.19	0.43
37	6201	6204	6207	44	36	813	-7	-19.1	1.33
38	6206	6202	6242	299	300	1404	1	0.38	0.07
39	6205	6206	6202	218	219	1694	1	0.47	0.07
40	6205	6204	6207	257	166	1486	-90	-35.26	6.23
41	939	2005	939	5	0	836	-4	-100	3.16
42	939	2005	2002	16	32	875	16	100.83	3.29
43	939	2005	940	189	199	1039	10	5.22	0.71
44	2002	2005	939	125	120	677	-4	-3.77	0.43
45	2002	2005	940	297	311	944	14	4.74	0.81
46	940	2005	939	413	395	882	-17	-4.24	0.87
47	940	2005	2002	132	126	671	-5	-4.46	0.52
48	9322	624	6245	25	25	1800	0	-1.23	0.06
49	6245	6241	941	369	361	1800	-7	-2.13	0.41
50	6245	6241	6246	6	0	1410	-5	-100	3.46
51	6241	6246	6242	792	811	1691	19	2.46	0.69
52	6241	6246	6243	142	142	1035	0	0.26	0.03
53	941	6241	6246	928	954	1804	26	2.79	0.84
54	6242	6243	6244	348	336	1804	-11	-3.39	0.64
55	6243	6244	624	142	142	1516	0	0.15	0.02
56	6243	6244	6245	348	336	1691	-11	-3.33	0.63
57	9324	932	9321	174	177	1761	3	1.56	0.2
58	932	9321	2012	174	177	1514	3	1.56	0.2
59	9321	9322	624	148	150	1473	2	1.14	0.14
60	9321	9325	9324	397	400	1800	3	0.64	0.13
61	2012	9321	9322	148	150	1800	2	1.14	0.14
62	9322	9323	9325	193	193	1478	0	-0.07	0.01
63	9323	9325	9321	193	193	1800	0	-0.07	0.01
64	9325	9324	2016	397	400	1795	3	0.64	0.13
65	9325	9321	2012	193	193	1188	0	-0.07	0.01
66	941	940	2005	381	381	1428	0	-0.06	0.01
67	941	940	2024	24	25	1085	1	2.29	0.11
68	2005	940	941	460	461	1013	1	0.3	0.06
69	2005	940	2024	48	49	539	1	1.25	0.09
70	2024	940	941	132	136	885	4	2.76	0.31
71	2024	940	2005	141	141	907	0	-0.11	0.01
72	936	937	2010	48	48	2395	0	0.14	0.01
73	936	937	2026	210	156	2353	-53	-25.79	4
74	2010	937	936	188	193	985	5	2.83	0.39
75	2010	937	2026	268	265	853	-2	-1.04	0.17
76	2026	937	936	211	212	1758	1	0.59	0.09
77	2026	937	2010	91	91	1649	0	-0.16	0.02
78	9445	928	927	372	324	1400	-47	-13.03	2.6
79	9445	928	9292	48	118	408	70	145.48	7.67
80	927	928	9292	125	133	1100	8	6.35	0.7
81	927	928	9445	216	234	1200	18	8.19	1.18
82	9292	928	9445	22	24	476	2	11.33	0.52
83	9292	928	927	48	78	258	30	61.74	3.74
84	959	602	925	26	0	911	-25	-99.59	7.17
85	959	602	601	657	683	1755	26	3.97	1.01
86	925	602	601	375 >	228	229	-146	-39.2	8.47
87	925	602	959	6	33	124	27	445.27	6.07
88	603	601	6021	26	60	1203	34	128.98	5.13
89	603	601	602	415	412	1731	-2	-0.61	0.12
90	6021	601	602	47	44	379	-2	-6.22	0.43
91	6021	601	603	8	39	87	31	386	6.38
92	601	602	959	346	342	1683	-3	-1.23	0.23
93	601	602	925	116	115	221	0	-0.96	0.1
94	602	601	603	922	902	1790	-19	-2.13	0.65
95	602	601	6021	11	11	351	0	-3.05	0.1

PM Peak HGVs

NO.	ANODE	BNODE	CNODE	COUNT	MODELLED FLOW	CAPACITY	DIFF	% DIFF	GEH
1	9445	938	2003	16	16	1327	0	-1.79	0.07
2	938	2003	9446	18	18	1004	0	-1.52	0.06
3	933	938	2003	2	2	769	0	0.19	0
4	933	938	9445	2	1	418	0	-72.1	1.27
5	9446	2003	938	37	37	1071	0	-1.3	0.08
6	2003	938	9445	37	36	918	0	-2.98	0.18
7	928	927	925	37	1	1159	-35	-97.61	8.3
8	926	927	925	7	0	911	-6	-100	3.74
9	925	927	928	12	11	1502	0	-4.27	0.15
10	925	927	926	9	0	1429	-8	-100	4.24
11	6242	6202	6209	14	12	1511	-1	-16.92	0.66
12	6202	6209	6208	7	5	1410	-1	-32.63	0.94
13	6202	6209	6207	7	7	1800	0	-1.21	0.03
14	220	6208	6207	5	5	1763	0	-1.21	0.03
15	6208	6203	620	2	2	1643	0	2.98	0.04
16	6207	6208	220	2	4	1777	2	113.5	1.28
17	6207	6203	620	7	8	1660	1	9.7	0.25
18	6207	6204	6206	5	4	1258	0	-12.6	0.29
19	6207	6204	6205	7	7	1818	0	6.93	0.18
20	6203	620	662	9	10	1299	1	8.31	0.24
21	620	6201	6205	2	3	1800	1	71.99	0.87
22	662	620	6201	5	5	1510	0	8.95	0.2
23	6201	6204	6207	2	2	813	0	0.32	0
24	6206	6202	6242	16	17	1404	1	3.45	0.14
25	6205	6206	6202	12	12	1694	0	1.52	0.05
26	6205	6204	6207	12	10	1486	-1	-17.15	0.62
27	939	2005	2002	14	7	875	-6	-52.2	2.27
28	939	2005	940	5	4	1039	0	-17.9	0.42
29	2002	2005	939	30	14	677	-15	-53.04	3.39
30	2002	2005	940	97	90	944	-6	-7.38	0.74
31	940	2005	939	12	12	882	0	-3.92	0.14
32	940	2005	2002	90	70	671	-19	-22.02	2.21
33	9322	624	6245	85	81	1800	-3	-4.77	0.45
34	6245	6241	941	138	132	1800	-5	-4.61	0.55
35	6241	6246	6242	60	56	1691	-3	-6.17	0.49
36	6241	6246	6243	69	70	1035	1	1.56	0.13
37	941	6241	6246	129	126	1804	-2	-2.04	0.23
38	6242	6243	6244	53	51	1804	-1	-4.31	0.32
39	6243	6244	624	69	70	1516	1	1.45	0.12
40	6243	6244	6245	53	51	1691	-1	-4.25	0.31
41	9324	932	9321	439	435	1761	-3	-0.82	0.17
42	932	9321	2012	439	435	1514	-3	-0.82	0.17
43	9321	9322	624	7	7	1473	0	-0.04	0
44	9321	9325	9324	472	468	1800	-3	-0.91	0.2
45	2012	9321	9322	7	7	1800	0	-0.04	0
46	9322	9323	9325	39	39	1478	0	1.23	0.08
47	9323	9325	9321	39	39	1800	0	1.23	0.08
48	9325	9324	2016	472	468	1795	-3	-0.91	0.2
49	9325	9321	2012	39	39	1188	0	1.23	0.08
50	941	940	2005	53	52	1428	0	-0.98	0.07
51	941	940	2024	12	65	1085	53	445.25	8.59
52	2005	940	941	78	78	1013	0	-0.25	0.02
53	2005	940	2005	2	0	474	-1	-100	2
54	2005	940	2024	9	16	539	7	79.2	2.01
55	2024	940	941	12	12	885	0	3.96	0.14
56	2024	940	2005	30	29	907	0	-2.54	0.14
57	936	937	2010	232	228	2395	-3	-1.51	0.23
58	936	937	2026	78	78	2353	0	-0.2	0.02
59	2010	937	936	288	301	985	13	4.58	0.77
60	2010	937	2026	122	97	853	-24	-20.09	2.34
61	2026	937	936	51	51	1758	0	-0.21	0.02
62	2026	937	2010	64	63	1649	0	-0.91	0.07
63	9445	928	927	23	19	1400	-3	-16.63	0.83
64	927	928	9292	2	0	1100	-1	-92.64	1.79
65	927	928	9445	12	16	1200	4	31.41	1.01
66	959	602	601	71	92	1755	21	29.79	2.34
67	925	602	601	48	1	229	-46	-96.91	9.35
68	603	601	602	35	34	1731	0	-2.2	0.13
69	6021	601	602	14	13	379	0	-4.52	0.17
70	601	602	959	9	20	1683	11	120.11	2.85
71	601	602	925	28	28	221	0	-0.94	0.05
72	602	601	603	69	66	1790	-2	-3.96	0.33
73	602	601	6021	51	25	351	-25	-50.08	4.13

Figures 3.1 and 3.2 are referenced in the document but are not included, so the relevance of the data used is difficult to gauge.

The figures are included in this zip archive as “Figure 3-1 Traffic Count Locations.pdf” and “Figure 3-2 Journey Time Routes.pdf”.

No mention is made of factoring of the data to a common base (e.g. to account for day to day or seasonal variability). This will need to be covered and any factors applied shown. It is noted that there are a number of aspects of data details that are not included in this report (see MSBC checklist requirements under ‘Existing Data and Traffic Surveys Report’), although it may be intended to pick these up in other report.

Data was not adjusted for seasonal variability. The vast majority of counts were undertaken in March. Traffic flows from the Automatic Traffic Counter on Pelham road has been analysed (see attached spreadsheet “Pelham Class 2006 monthly summary.xls”), and it is apparent that the counts from March are similar to the neutral months. A small number of counts were undertaken in August which may be on the low side when compared with neutral month counts. The calibration/validation criteria in effect take into account small variations in traffic flows such as these.

I have some concern about whether the model is unnecessarily detailed in Grimsby and could cause convergence problems in forecasting and potentially influence appraisal output. This is an area that can be picked up through further analysis of forecasts and appraisal results.

Grimsby was included in the assignment models as it was thought that there may be some re-assignment of trips through Grimsby in the presence of the scheme. The matrices of skimmed values, however, were cordoned so as to exclude the zones making up Grimsby for the TUBA analysis. The convergence statistics have been checked for all the future year models and they all reach adequate convergence. %Gap denotes the difference between the current total vehicles costs on assigned routes and the total vehicle costs if all vehicles were to the minimum cost paths. All models show %GAP of less than 1%.

The %flows statistic show the proportion of modelled links which experience flow changes of less than 5% from one iteration to the next. If %flows is greater than 95% for four consecutive iterations, then the assignment routine is generally considered to have converged.

The figures below indicate that all models reached adequate convergence.

Model Convergence Statistics 2012 Do Minimum

Convergence Statistic		AM Peak	Inter Peak	PM Peak
% Gap		0.09	0.00	0.21
% flows	Last	99.6%	99.5%	99.8%
	Last-1	99.9%	99.4%	99.7%
	Last-2	99.5%	98.9%	99.5%
	Last-3	98.3%	98.3%	99.4%

Model Convergence Statistics 2012 Do Something

Convergence Statistic		AM Peak	Inter Peak	PM Peak
% Gap		0.12	0.00	0.19
% flows	Last	98.0%	99.1%	99.6%
	Last-1	99.9%	99.1%	99.7%
	Last-2	99.6%	98.9%	99.6%
	Last-3	98.3%	97.6%	99.6%

Model Convergence Statistics 2027 Do Minimum

Convergence Statistic		AM Peak	Inter Peak	PM Peak
% Gap		0.24	0.02	0.21
% flows	Last	99.6%	98.1%	99.9%
	Last-1	99.6%	97.6%	99.7%
	Last-2	99.7%	98.1%	99.9%
	Last-3	99.6%	98.6%	99.4%

Model Convergence Statistics 2027 Do Something

Convergence Statistic		AM Peak	Inter Peak	PM Peak
% Gap		0.13	0.00	0.20
% flows	Last	99.9%	97.7%	99.9%
	Last-1	99.8%	99.2%	99.7%
	Last-2	99.7%	99.1%	99.6%
	Last-3	99.8%	99.1%	99.3%

Section 5 makes mention of the A1103 – I presume this should be the A1173?

Correct

Section 5 also provides example of saturation values used in the assignment model. The source of these (and any calculations) should be shown.

The example saturation flows are based upon:

- Signalised junctions – TRL Research Report 67
- Roundabout junctions TRL Research Report 36
- Priority junction Opposed movements – TRL Research Report 35
- Priority Junction, unopposed movements – TRL research Report 67

There are a number of details of the assignment model that need further clarification e.g. use of speed flow curves (and definition of these), genralised cost formulation, etc

The generalised cost formulation used:

AM Peak Model: Lights PPM=1.0, PPK=0.8; Heavies PPM=1.0, PPK= 0.6;

Inter Peak Model; Lights PPM=1.0, PPK=0.5; Heavies PPM=1.0, PPK=1.0;

PM Peak Model: Lights PPM=1.0, PPK=0.8; Heavies PPM=1.0, PPK= 0.6;

The following speed-flow curves were used in the model.

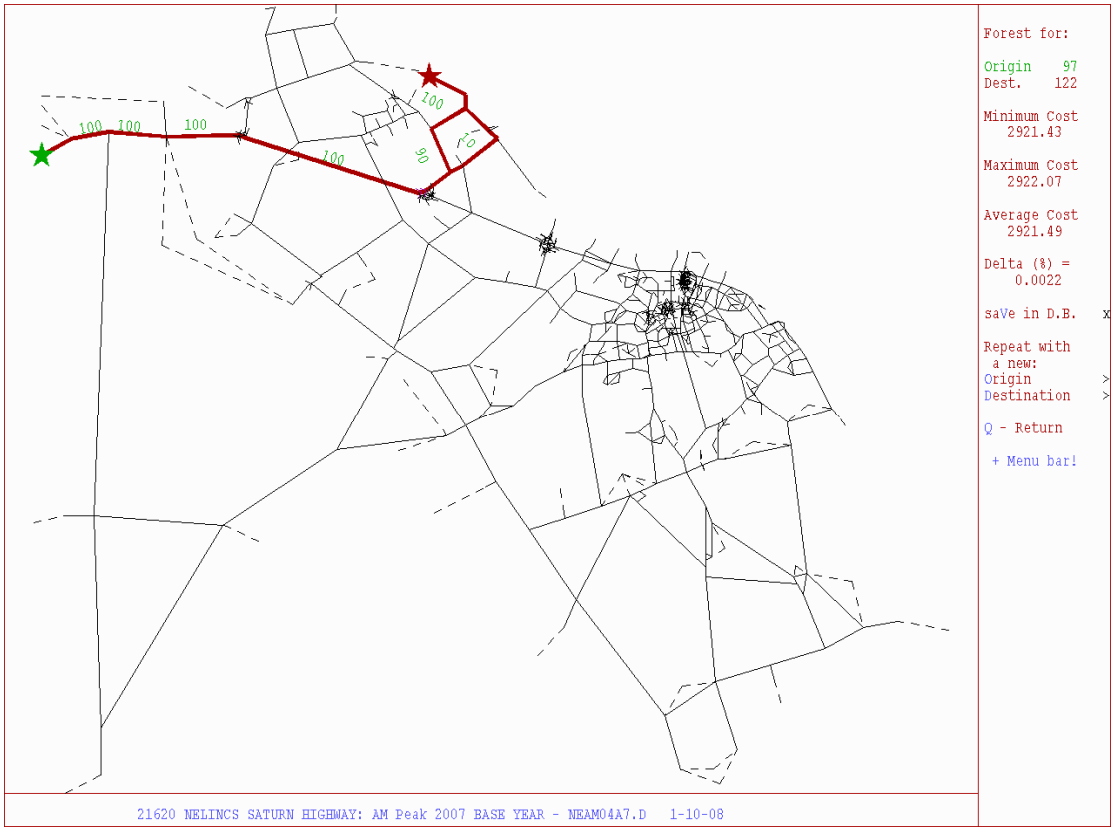
Free-Flow Speed / kph	Speed at Capacity / kph	Capacity / pcu per hour	Power
29	15	495	1.6
32	25	250	1.6
32	25	715	1.5
34	15	465	1.6
34	15	693	1.7
37	15	814	1.8
45	25	715	1.5
45	27	715	1.5
48	25	550	1.6
48	25	1078	1.7
48	25	1397	2.3
49	25	715	1.6
49	25	858	1.6
49	25	858	1.9
54	25	1078	1.7
54	25	1397	2.3
54	25	2794	2.0
61	25	1397	2.3
61	25	1597	2.3
64	25	1903	3.7
64	45	1111	1.8

64	45	1518	2.1
64	45	1804	2.2
64	45	2794	2.0
67	45	1111	1.8
68	25	1903	3.7
68	25	2000	3.7
68	25	2150	3.7
68	35	3806	3.3
71	35	2794	2.0
72	25	2100	3.7
72	34	3806	3.3
72	35	1826	2.1
72	45	1518	2.1
72	45	1804	2.2
72	45	1826	2.1
78	35	3806	3.3
78	45	1518	1.8
78	45	1518	2.1
78	45	1804	2.2
84	45	1826	2.1
87	45	1518	2.1
87	45	1804	2.2
105	45	4796	3.7
109	45	7458	3.7

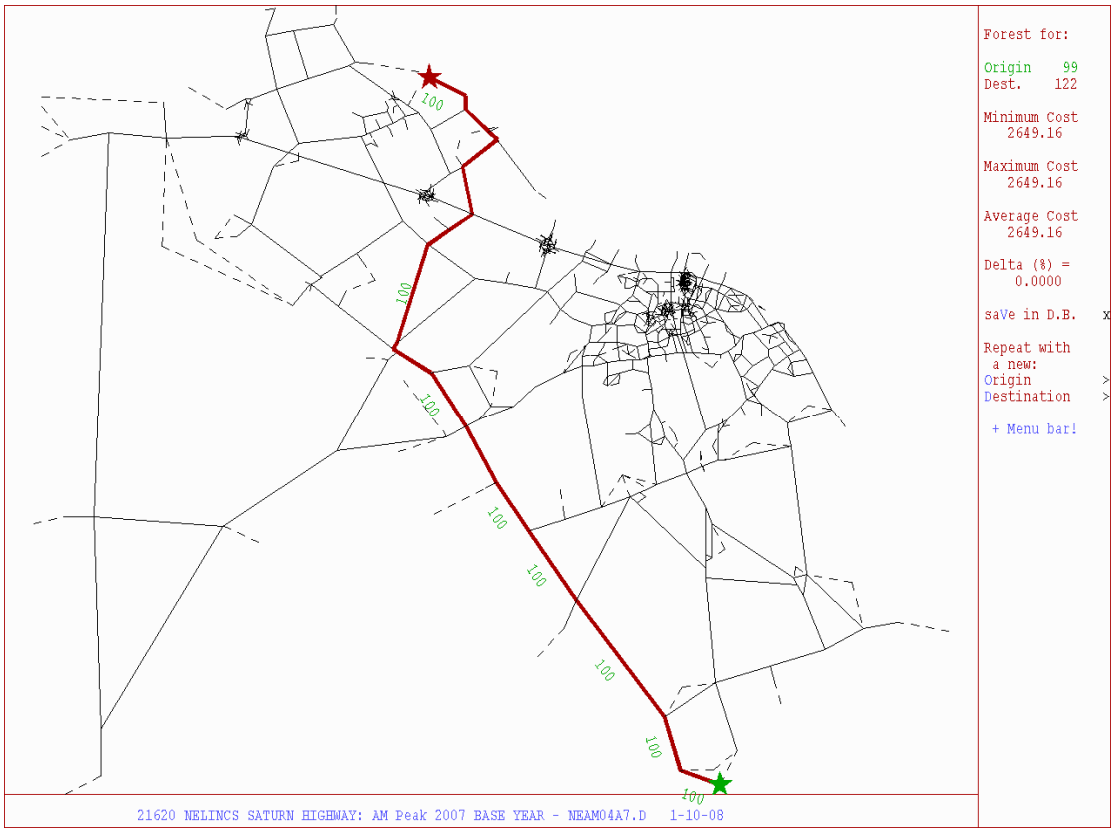
Route choice evidence needs to be provided for a range of origin and destinations (across time periods) to show the plausibility of the model output.

Plots are provided for the three modelled time periods for a range of origin an destinations, focussed on trips accessing and leaving the docks at Immingham.

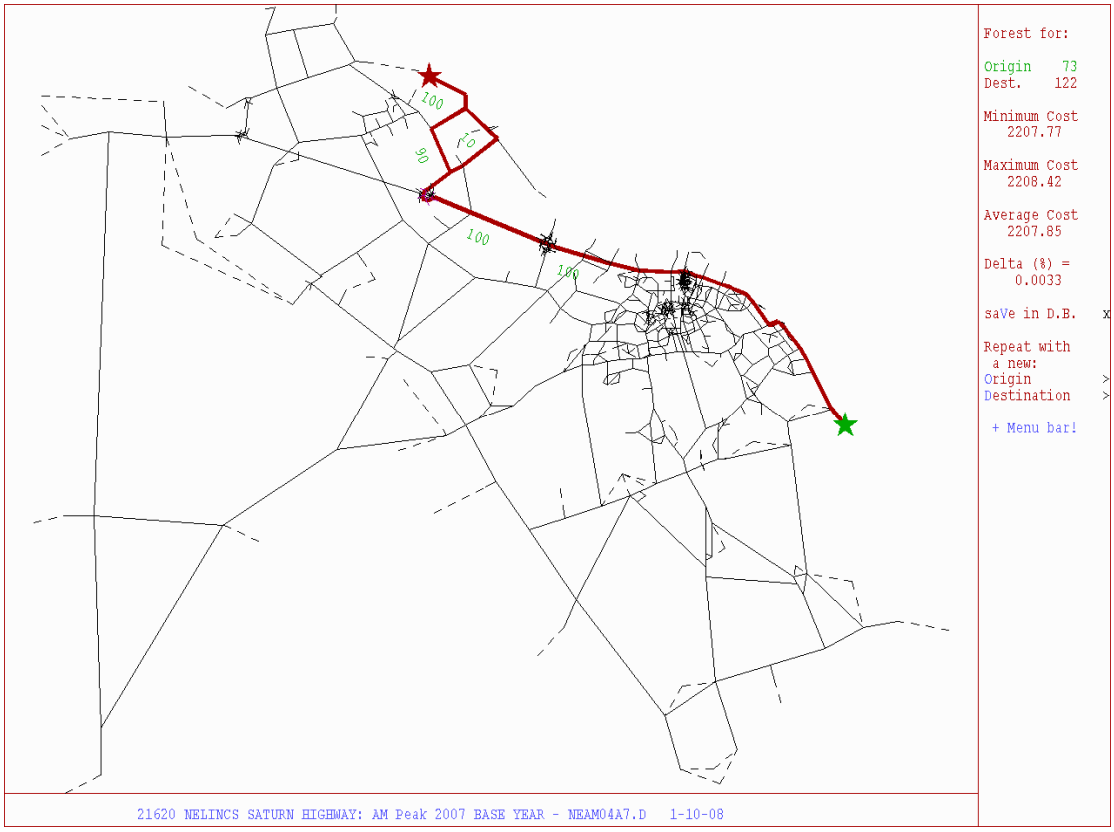
Plots for other origins and destinations can be provided.



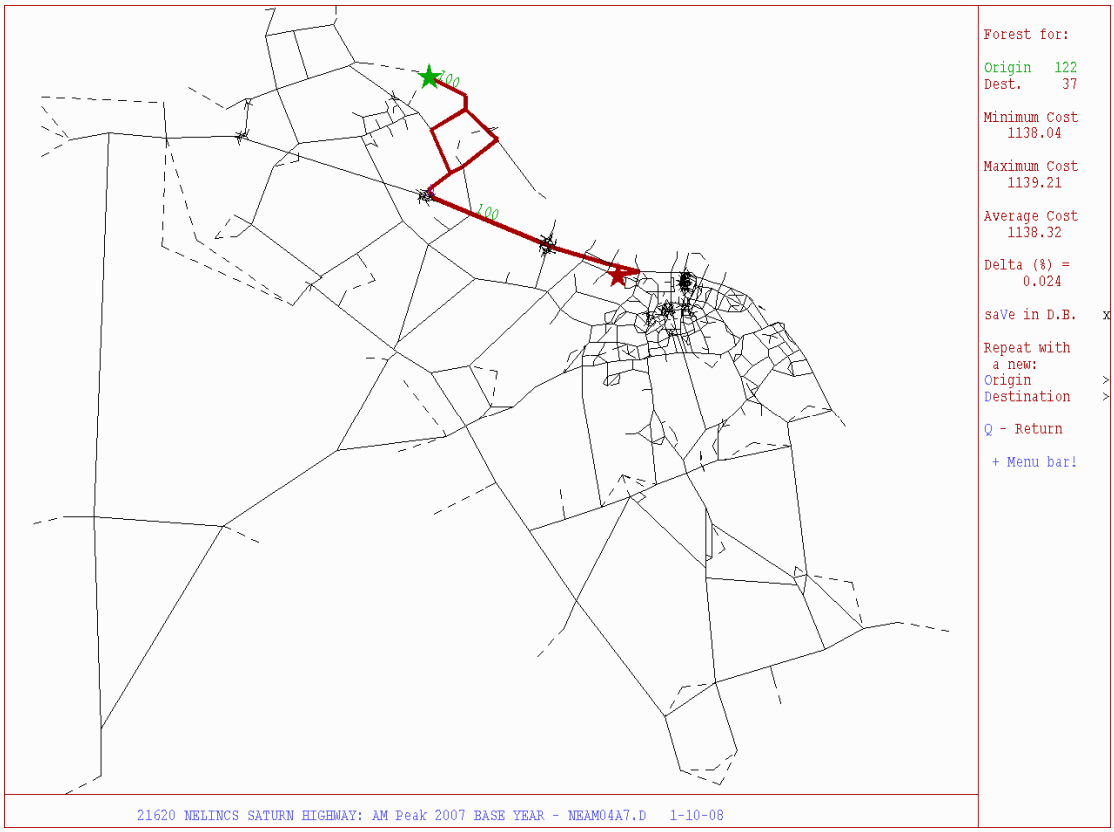
Route choice for trips from A180 west (zone 97) to Immingham docks (zone 122) - AM



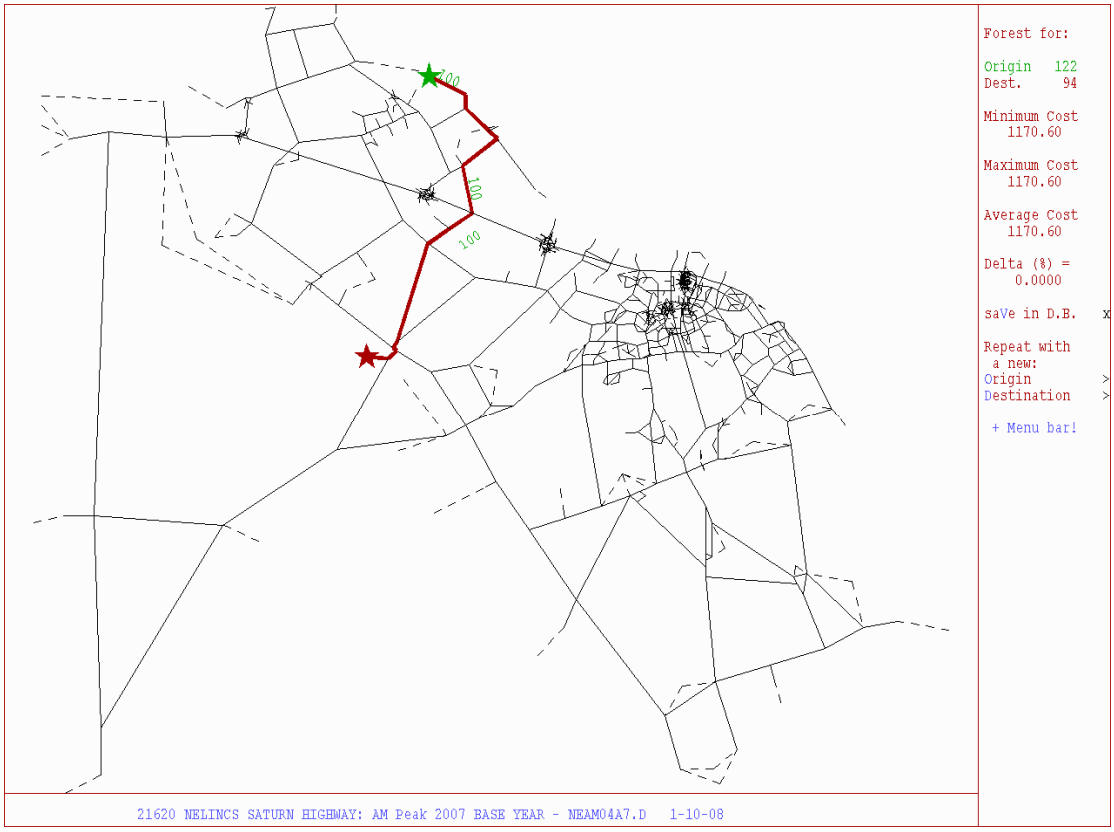
Route choice for trips from A16 south (zone 99) to Immingham docks (zone 122) - AM



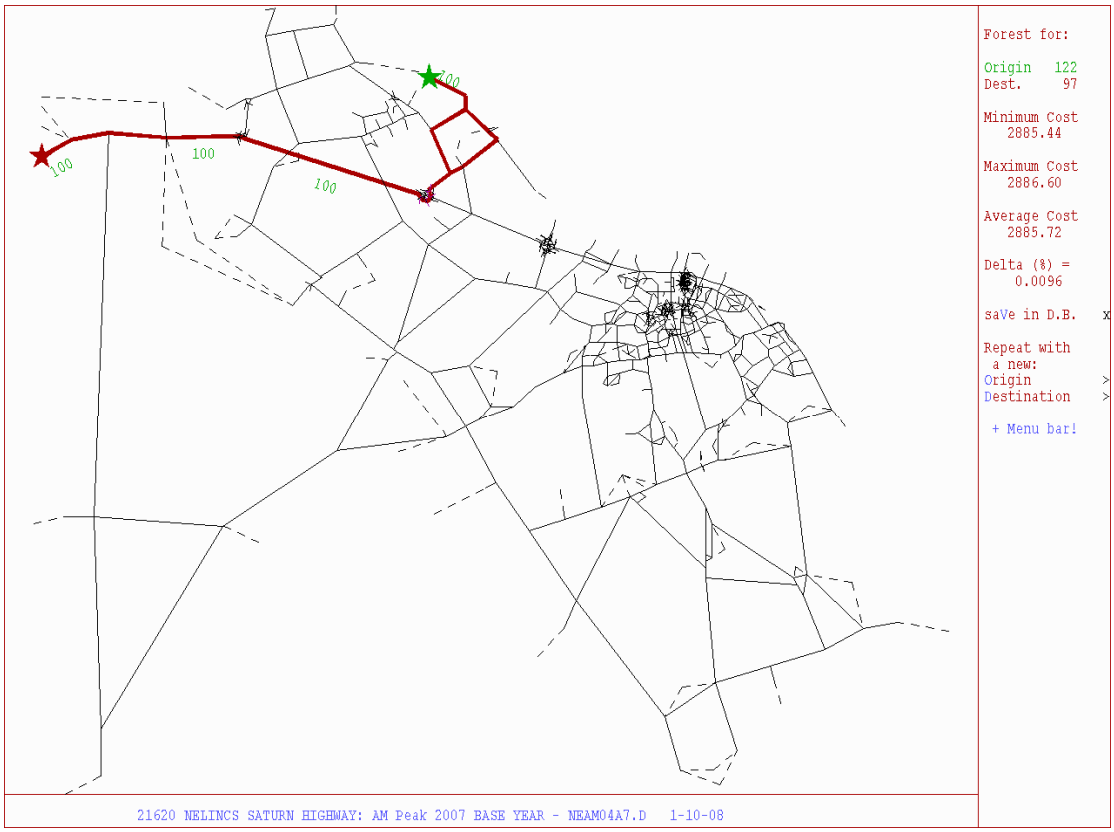
Route choice for trips from Humberston (zone 73) to Immingham docks (zone 122) - AM



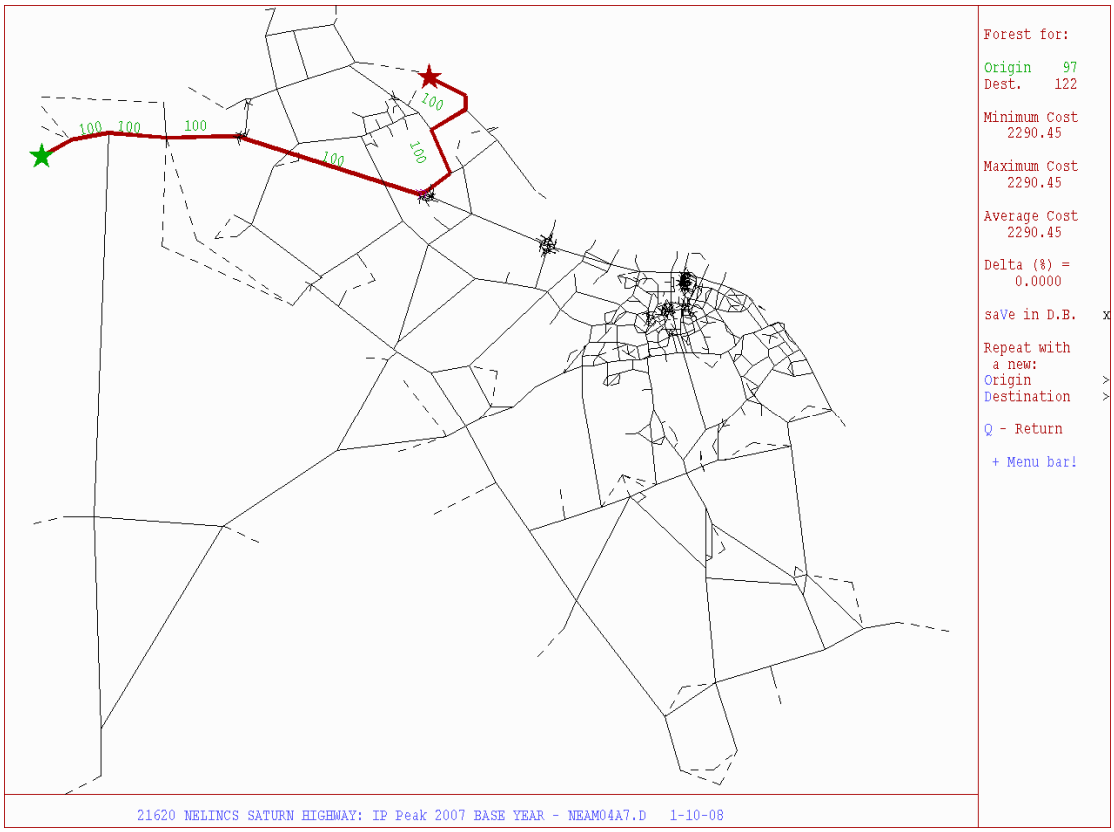
Route choice for trips from Immingham docks (zone 122) to western edge of Grimsby (zone 37) – AM



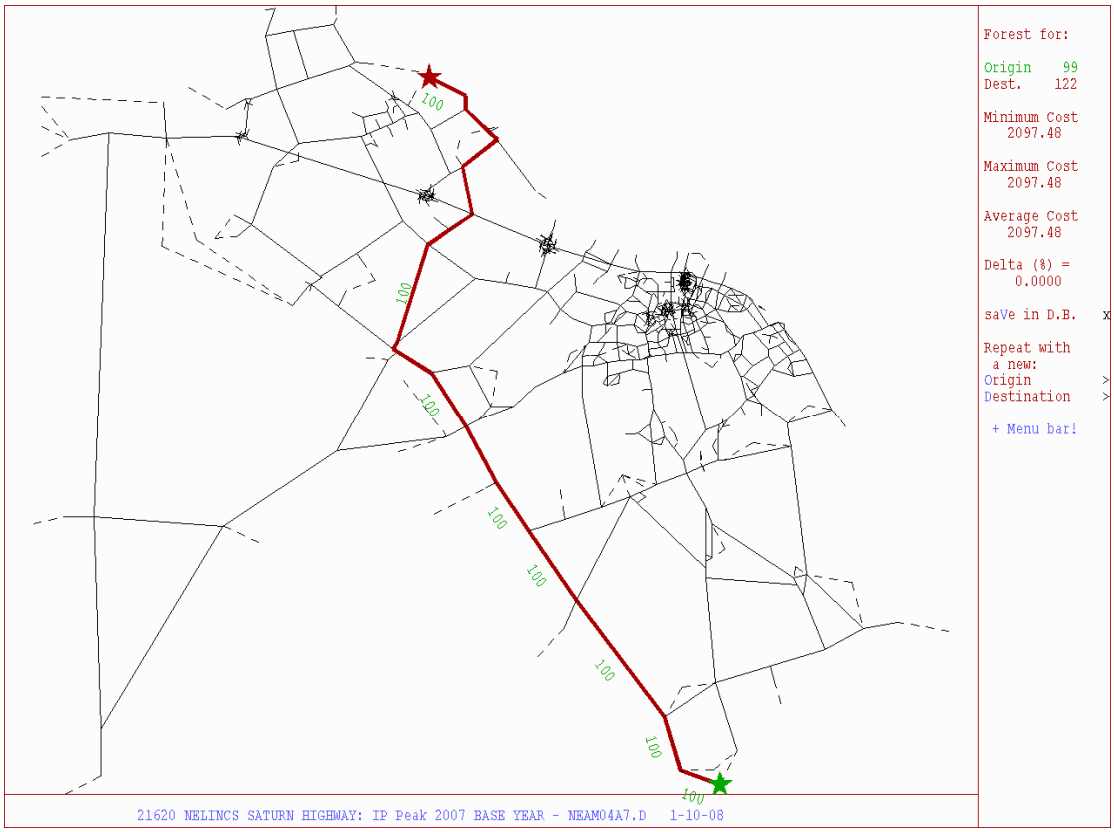
Route choice for trips from Immingham docks (zone 122) to Riby (zone 94)– AM



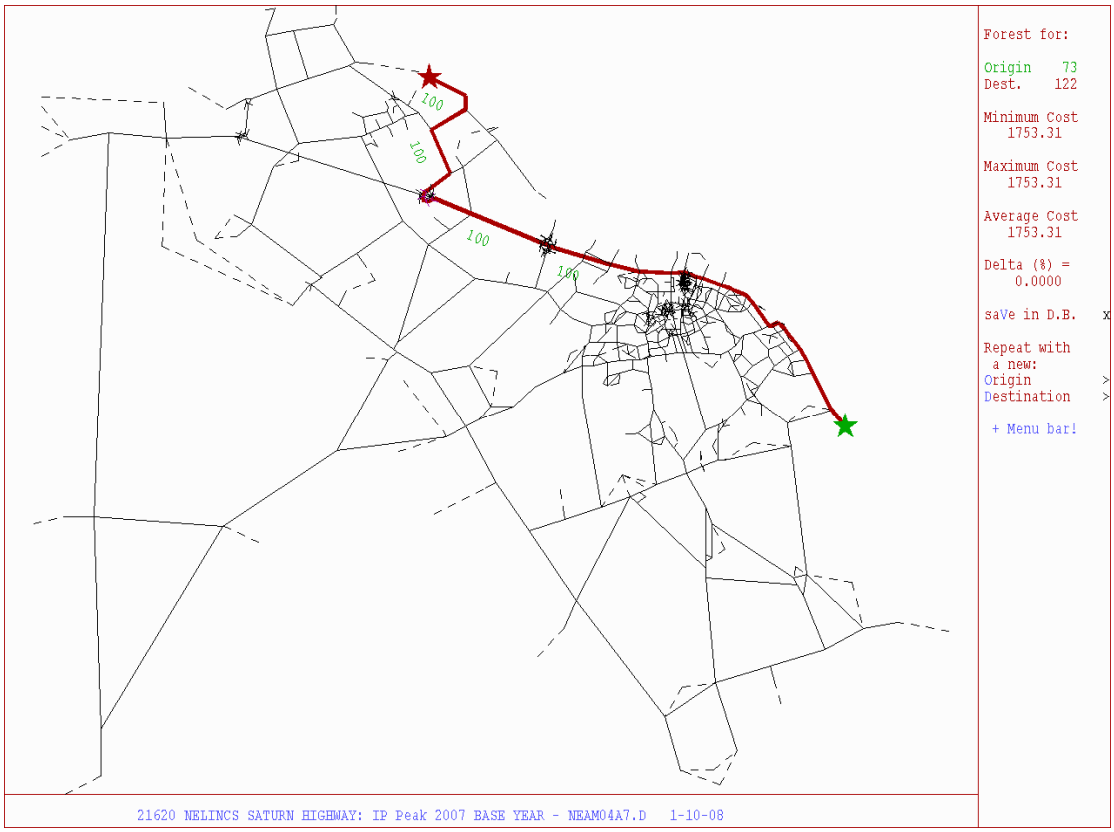
Route choice for trips from Immingham docks (zone 122) to A180 West (zone 97)- AM



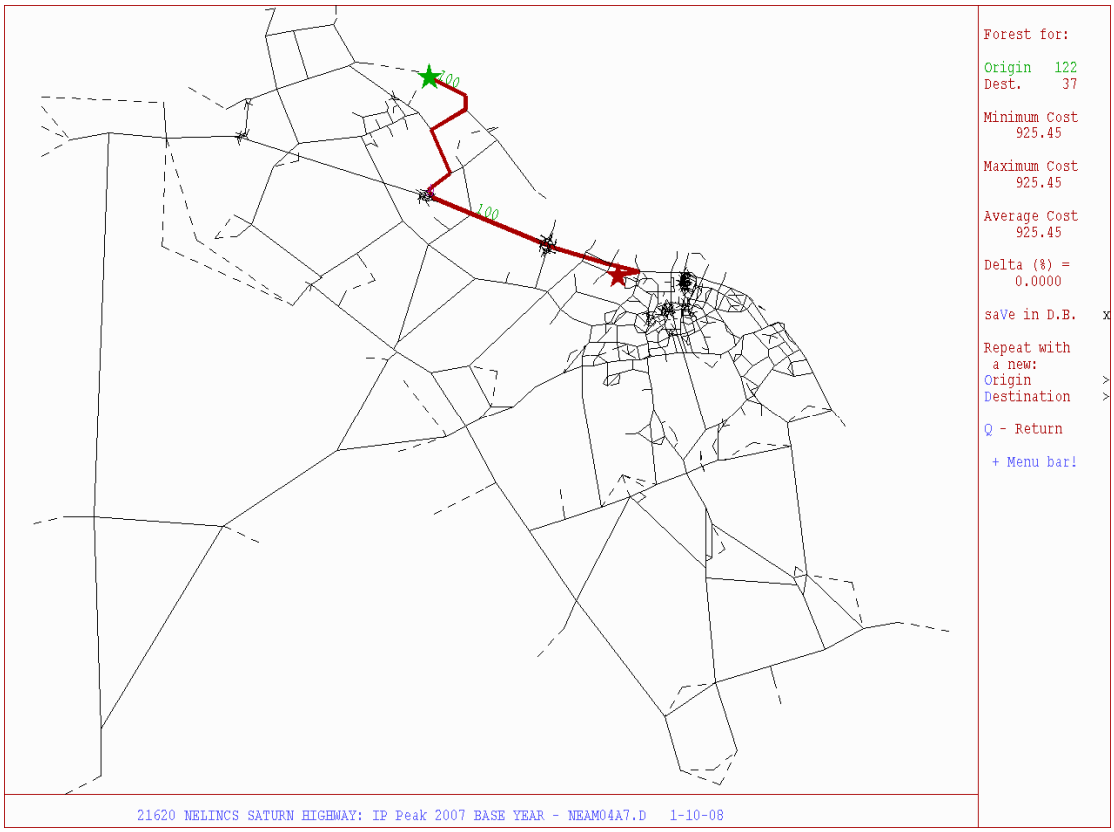
Route choice for trips from A180 West (zone 97) to Immingham Docks (zone 122) - Inter Peak



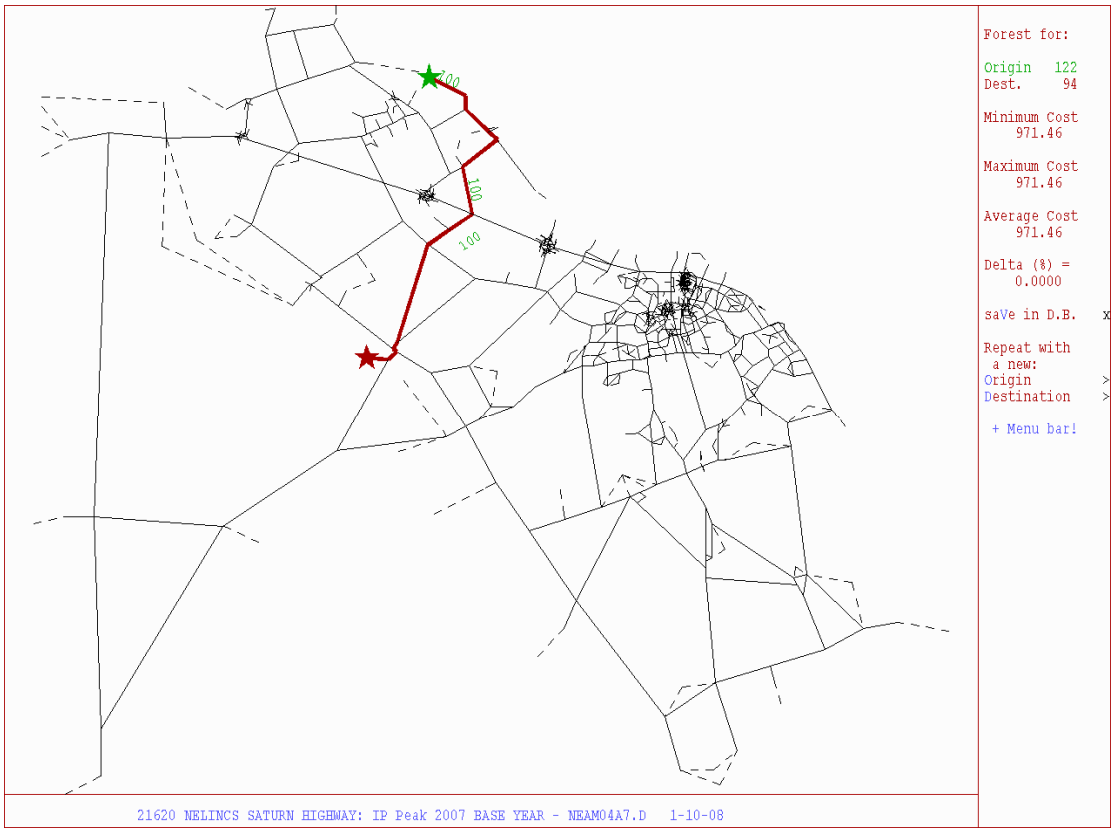
Route choice for trips from A16 South (zone 99) to Immingham Docks (zone 122) - Inter Peak



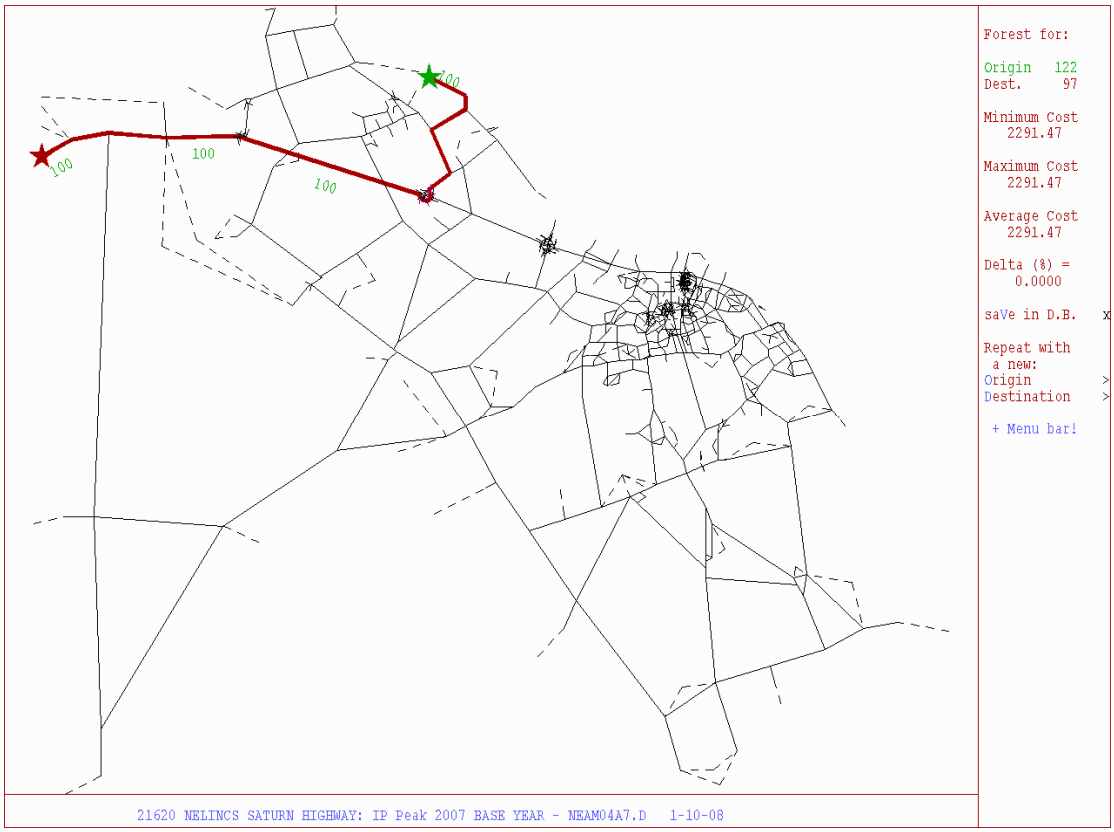
Route choice for trips from Humberston (zone 73) to Immingham Docks (zone 122) - Inter Peak



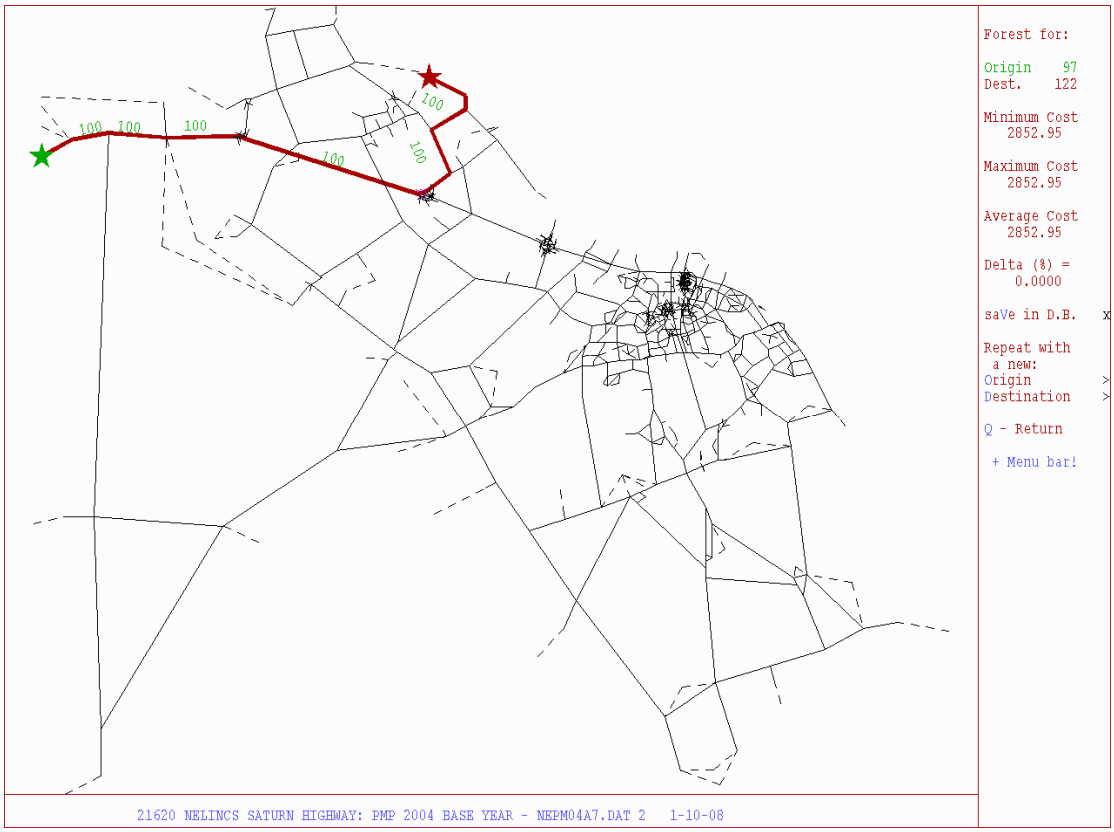
Route choice for trips from Immingham docks (zone 122) to western edge of Grimsby (zone 37) – Inter Peak



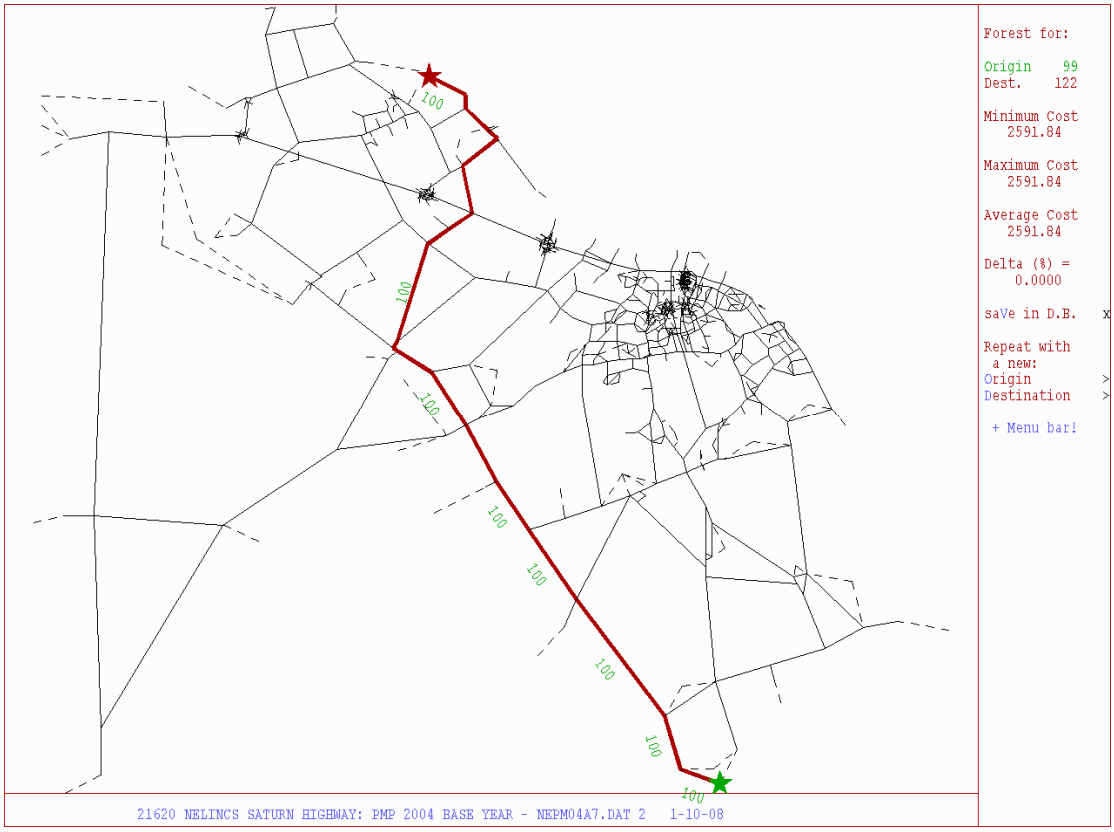
Route choice for trips from Immingham docks (zone 122) to Riby (zone 94) – Inter Peak



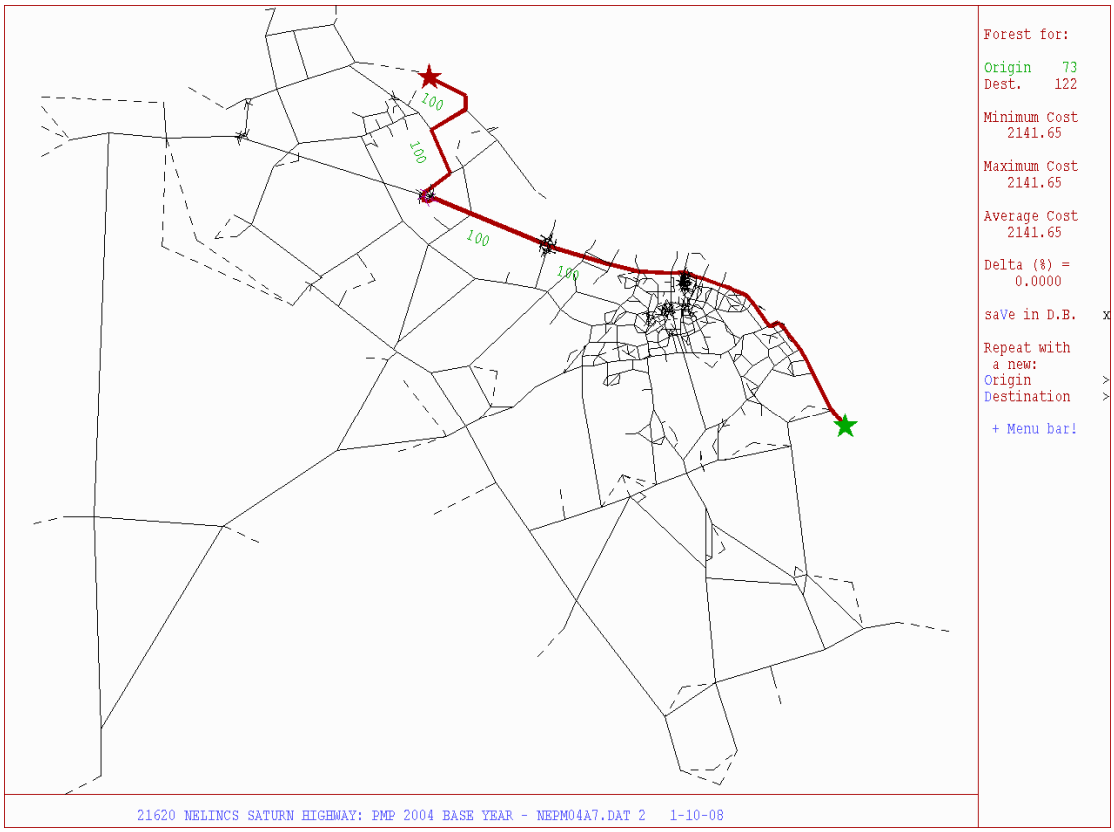
Route choice for trips from Immingham docks (zone 122) to A180 West (zone 97) – Inter Peak



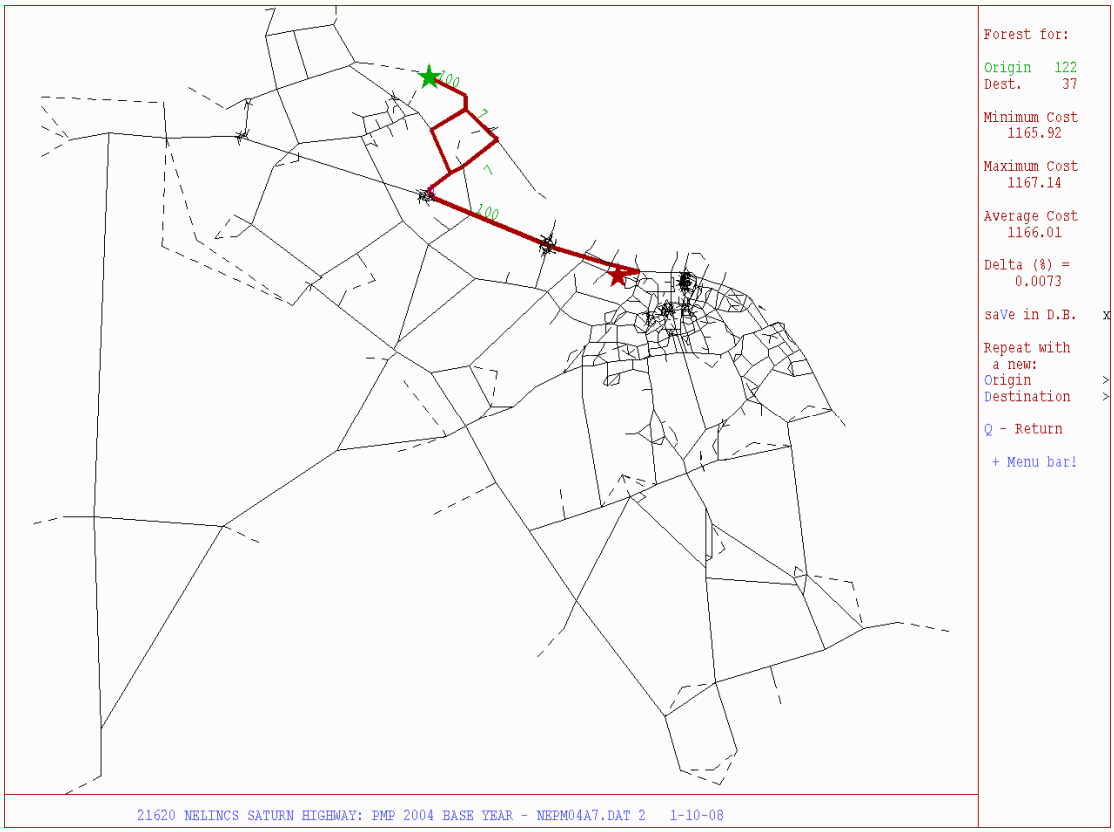
Route choice for trips from A180 West (zone 97) to Immingham Docks (zone 122) - PM



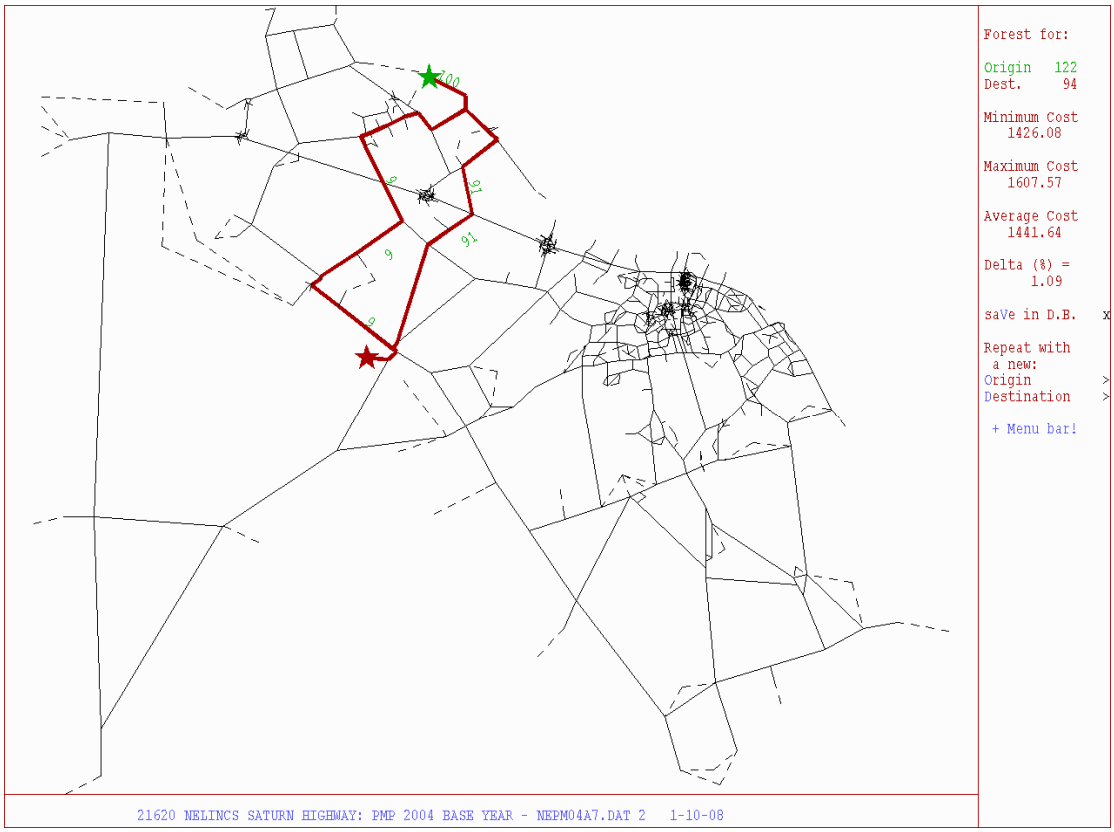
Route choice for trips from A16 South (zone 97) to Immingham Docks (zone 122) - PM



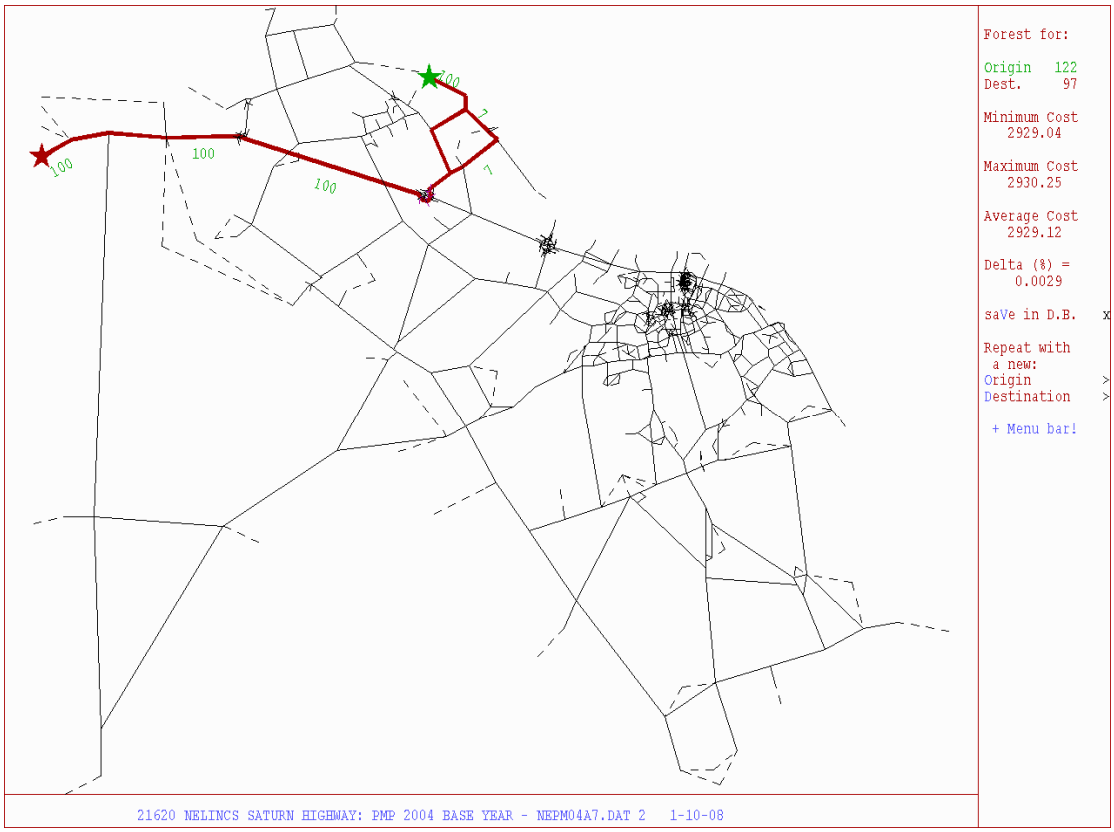
Route choice for trips from Humberston (zone 73) to Immingham Docks (zone 122) - PM



Route choice for trips from Immingham docks (zone 122) to western edge of Grimsby (zone 37) – PM



Route choice for trips from Immingham docks (zone 122) to Riby (zone 94) - PM



Route choice for trips from Immingham docks (zone 122) to A180 West (zone 97) – PM

Some observed desire line diagram material could be usefully included if available – and comparison provided against select link data from the model at a sectoral level.

This is not available at present, but could be produced if required.

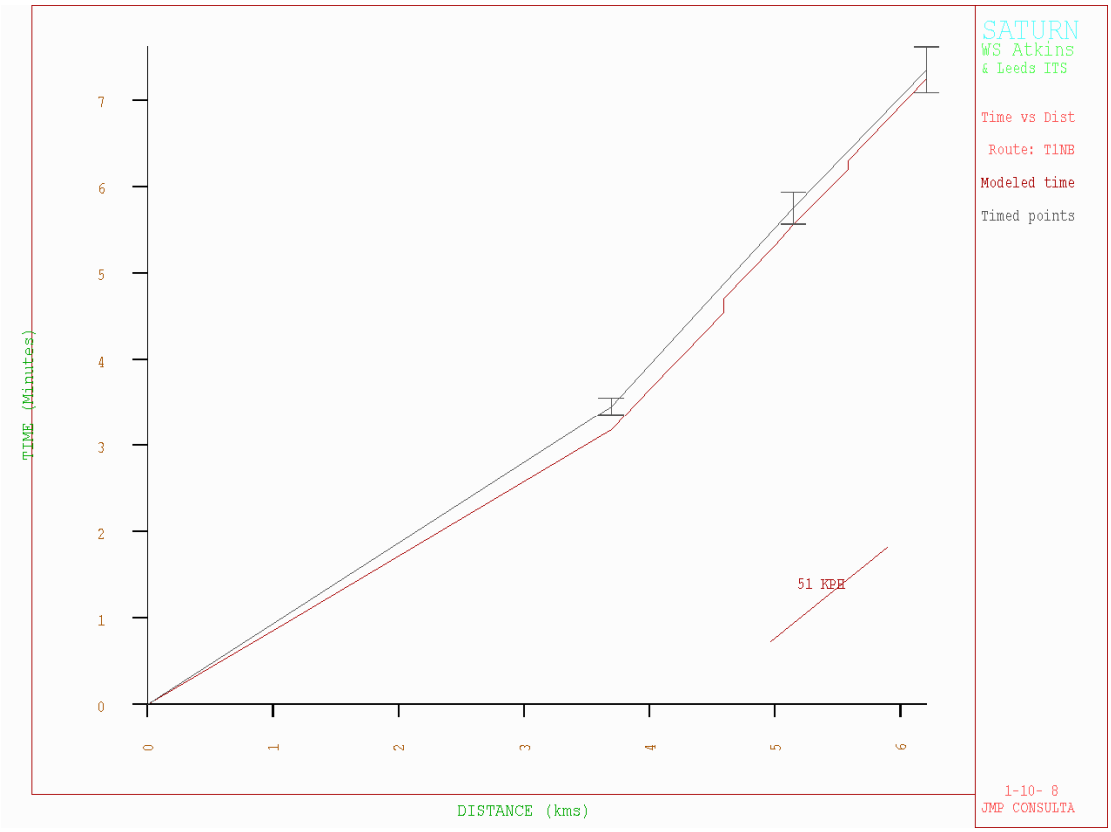
The effect of the matrix estimation process on the prior matrix should be demonstrated – preferably at a sectoral level highlighting movements of most influence to the appraisal of the scheme.

The sectoral demand matrices for the two user classes before and after matrix estimation are shown in the attached spreadsheet ("sectorAnalysis.xls"). The movements of most influence to the appraisal are Sector 2 (Immingham Docks) to and from Sector 7 (South and East of modelled area).

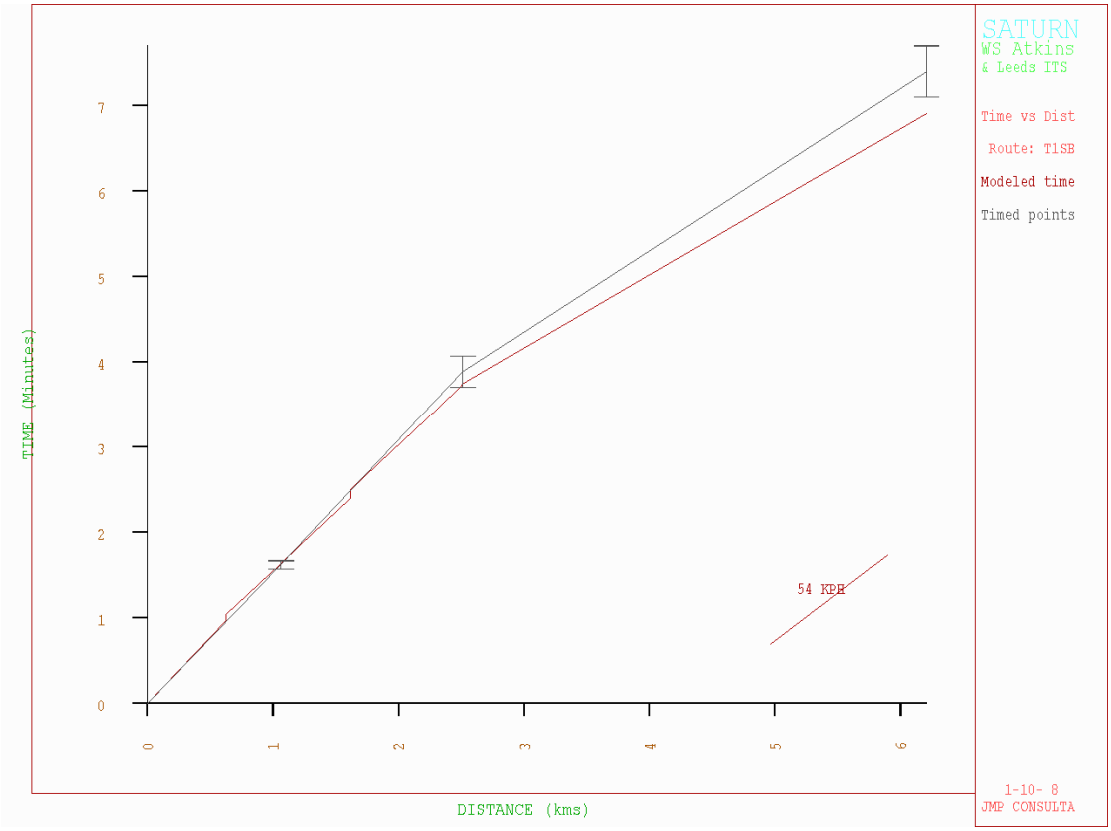
The journey time data comparisons could be usefully shown as time/distance plots.

In total, six journey time routes were used in each of the time periods. The time-distance plots from SATURN are shown below.

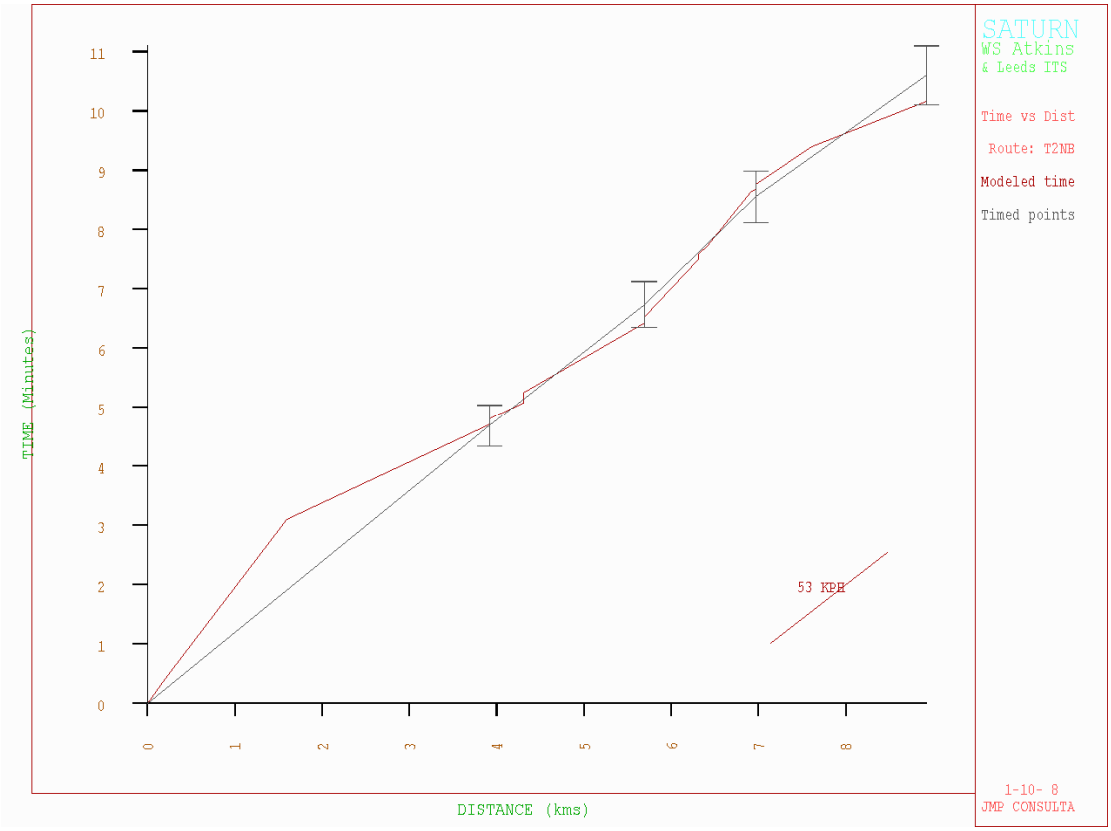
AM Journey Time Plots



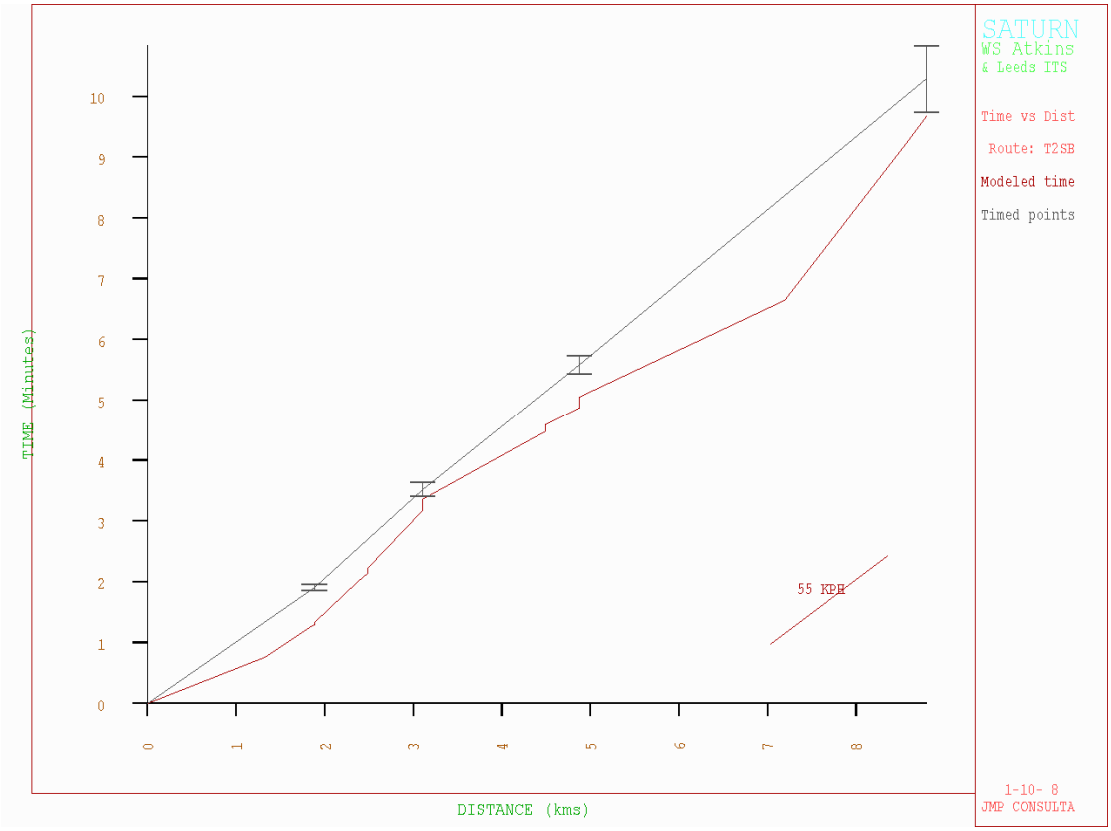
Route 1 Northbound - AM



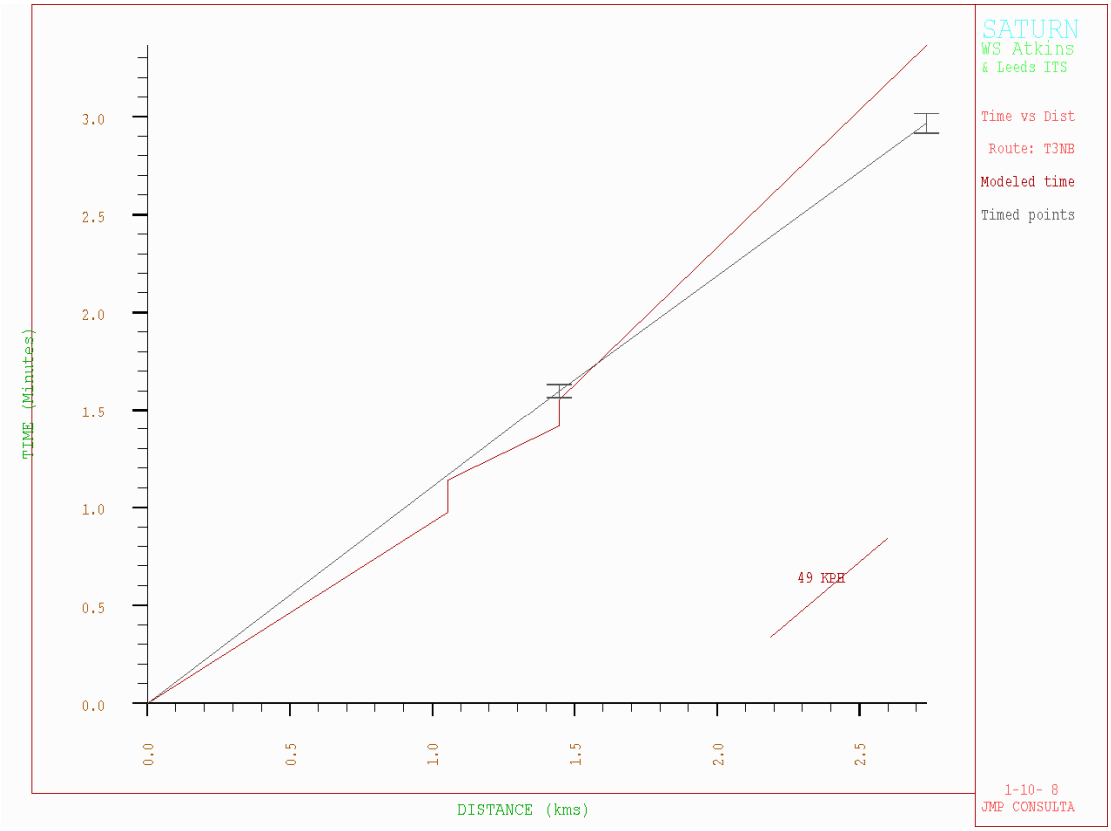
Route 1 Southbound - AM



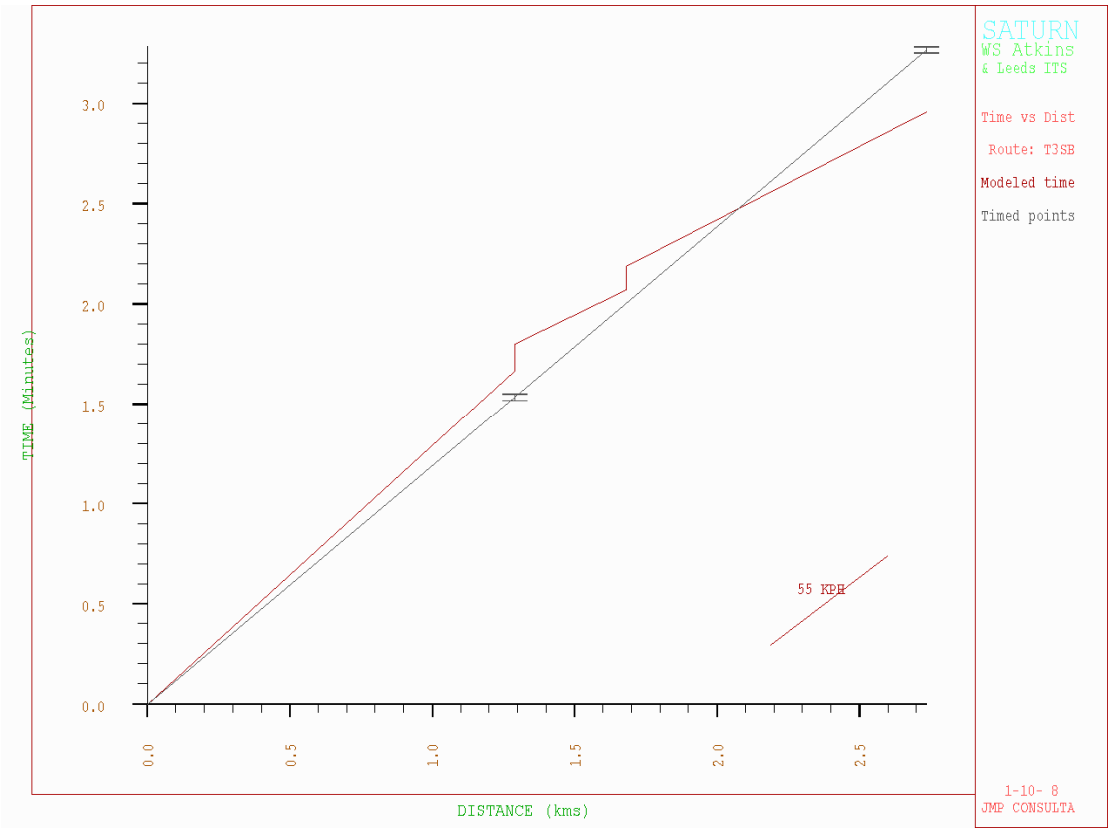
Route 2 Northbound AM



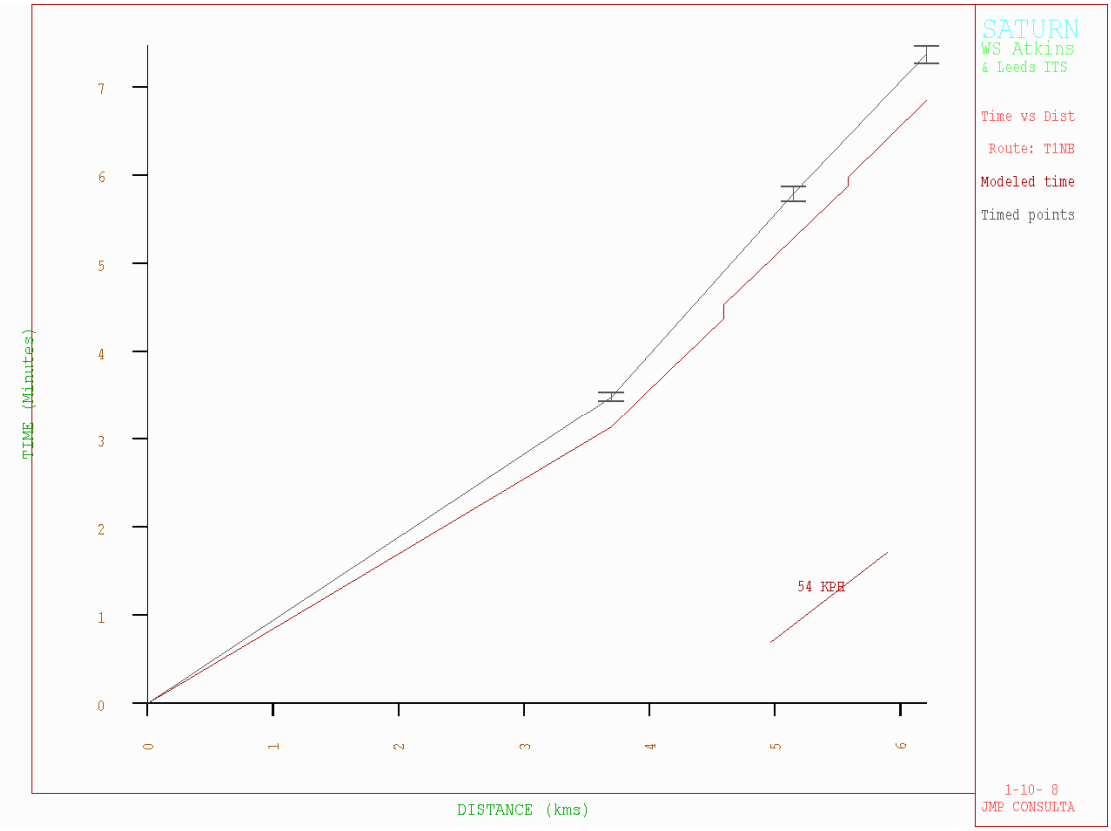
Route 2 Southbound AM



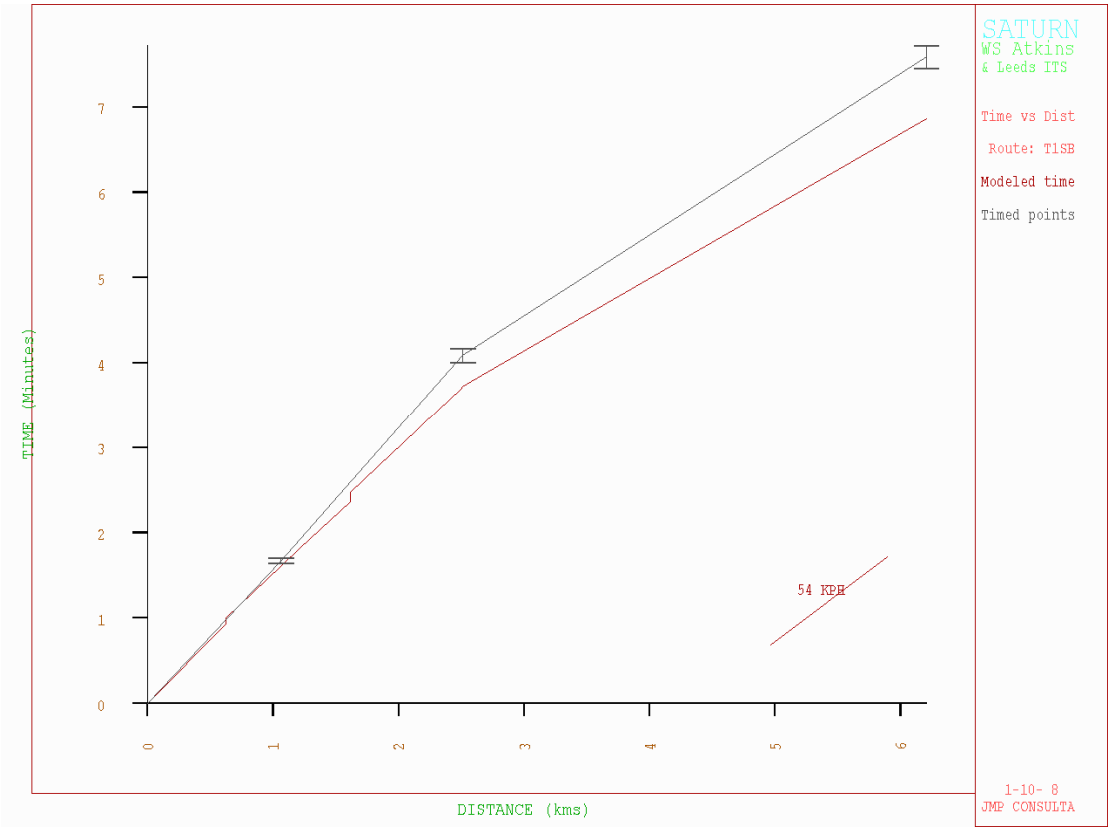
Route 3 Northbound AM



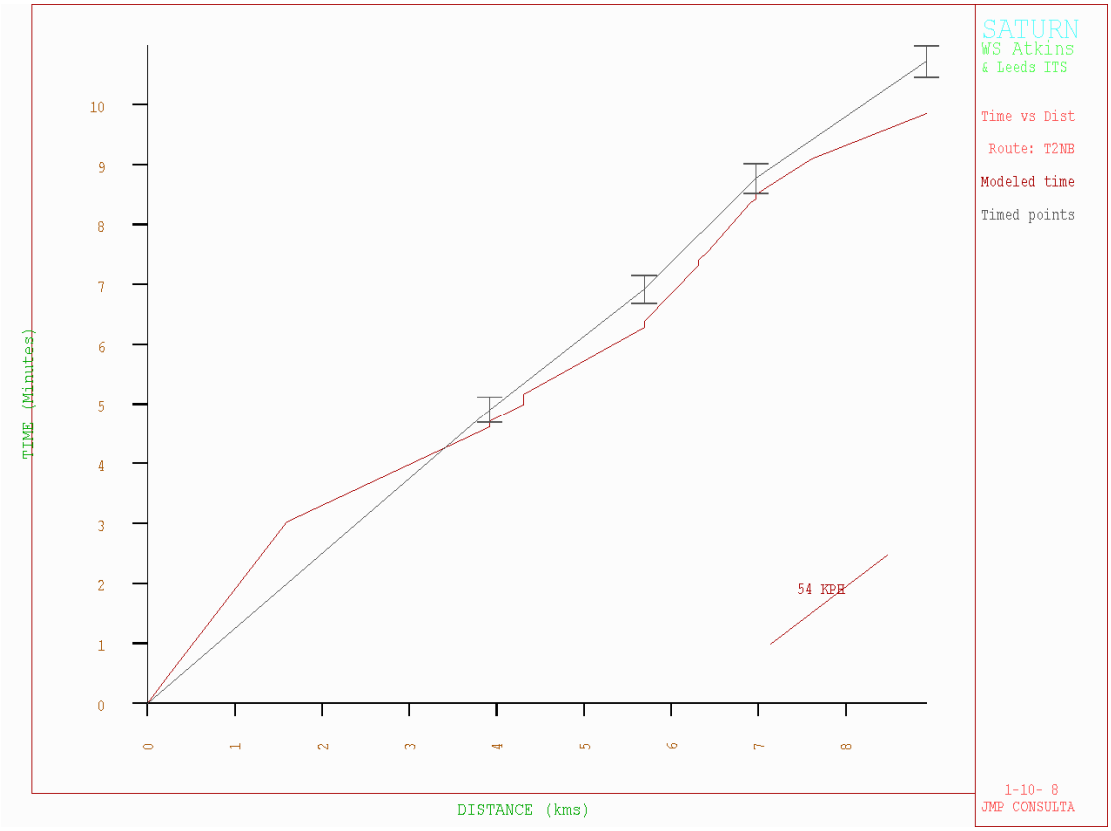
Route 3 Southbound AM



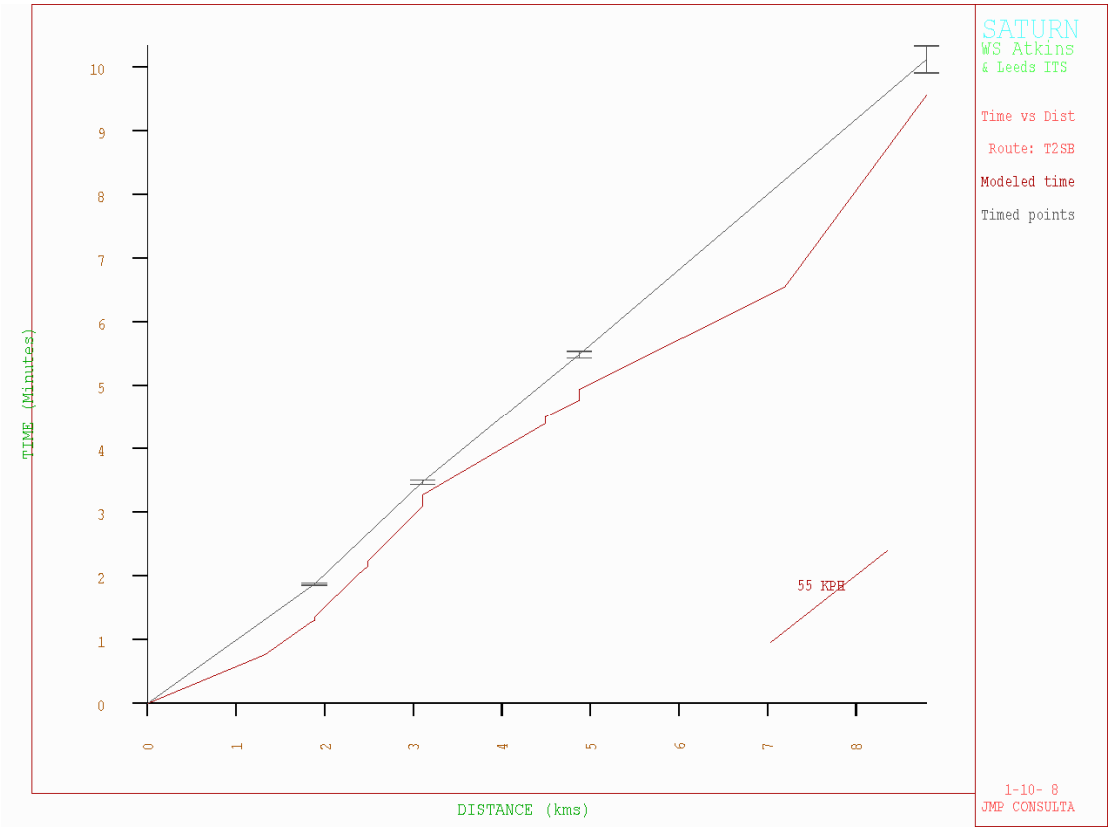
Route 1 Northbound IP



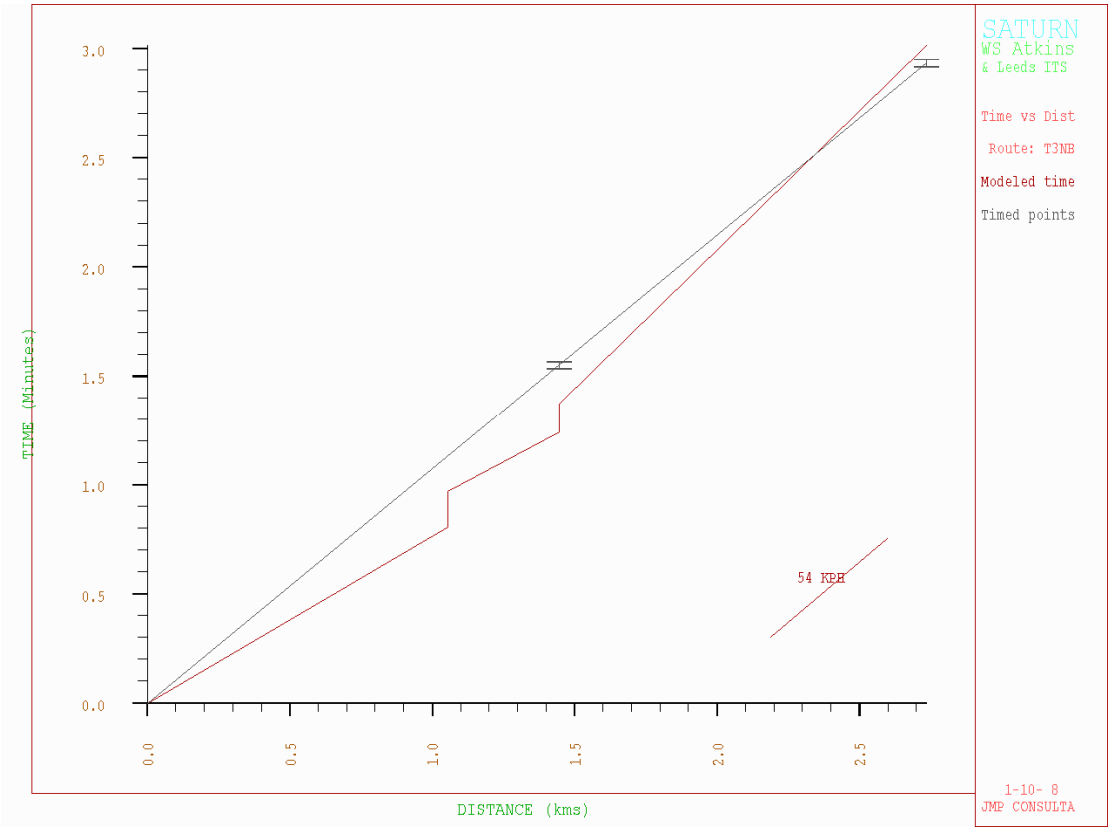
Route 1 Southbound IP



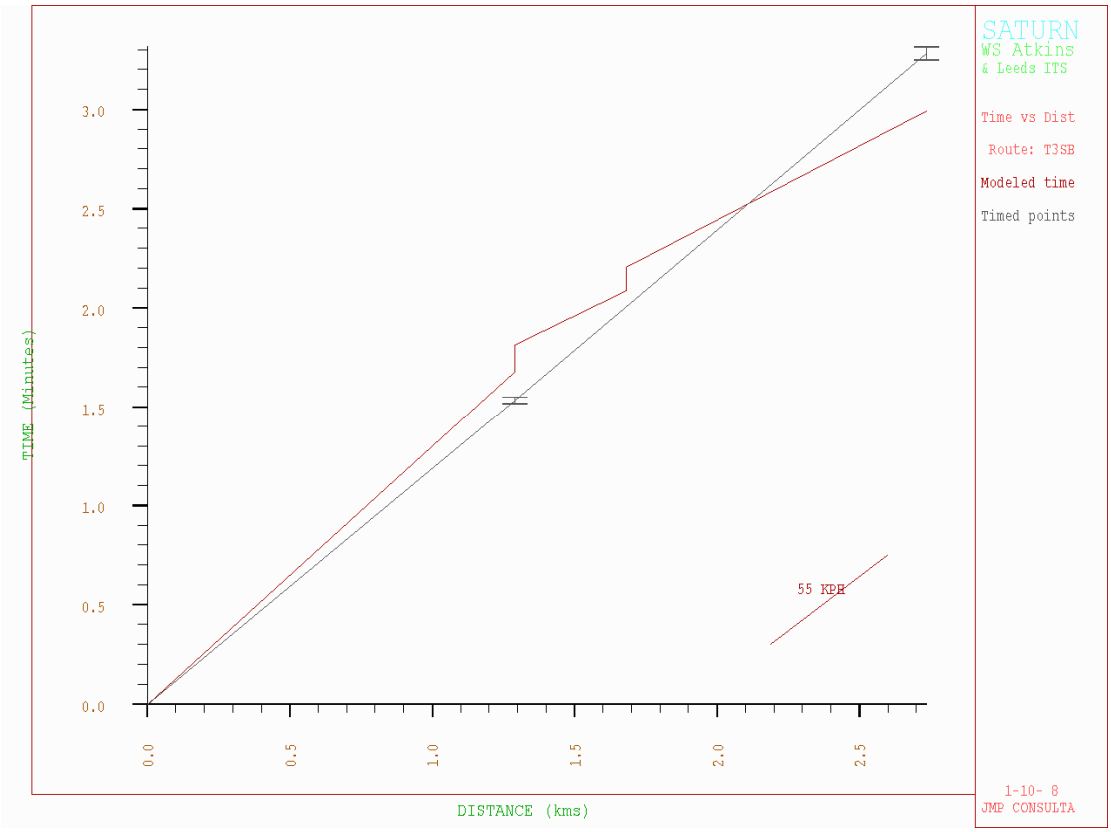
Route 2 Northbound IP



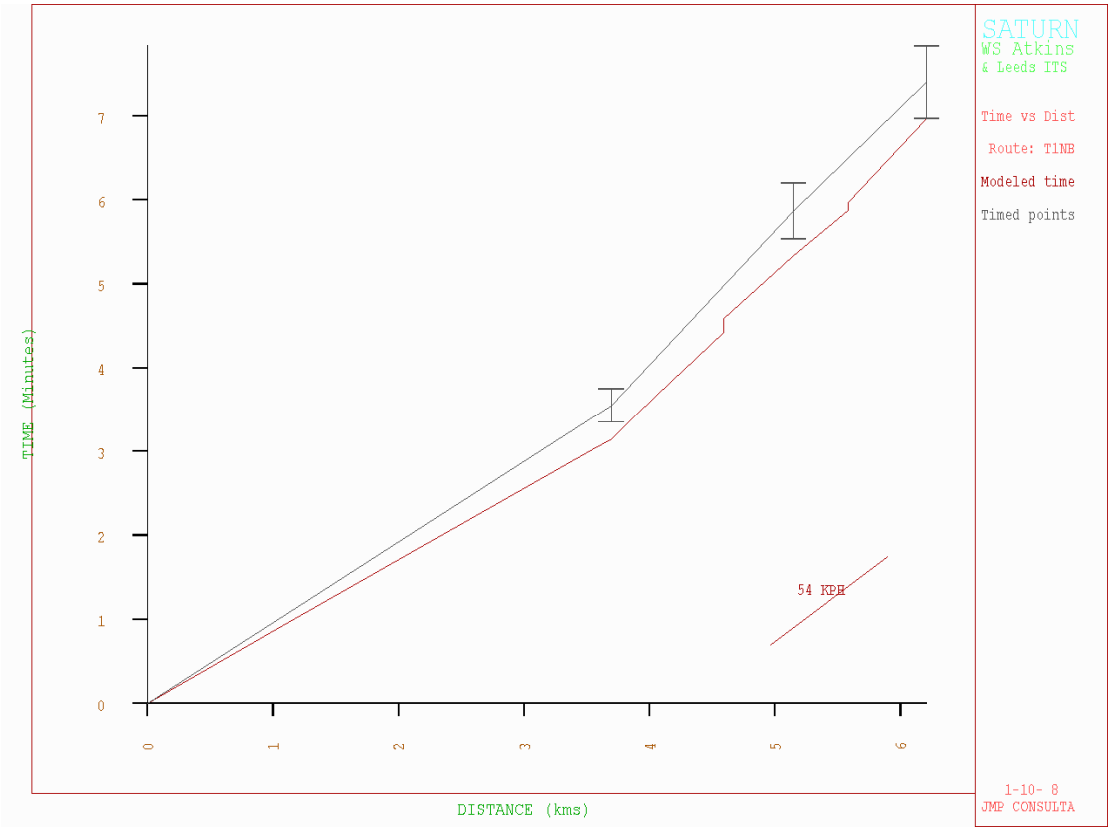
Route 2 Southbound IP



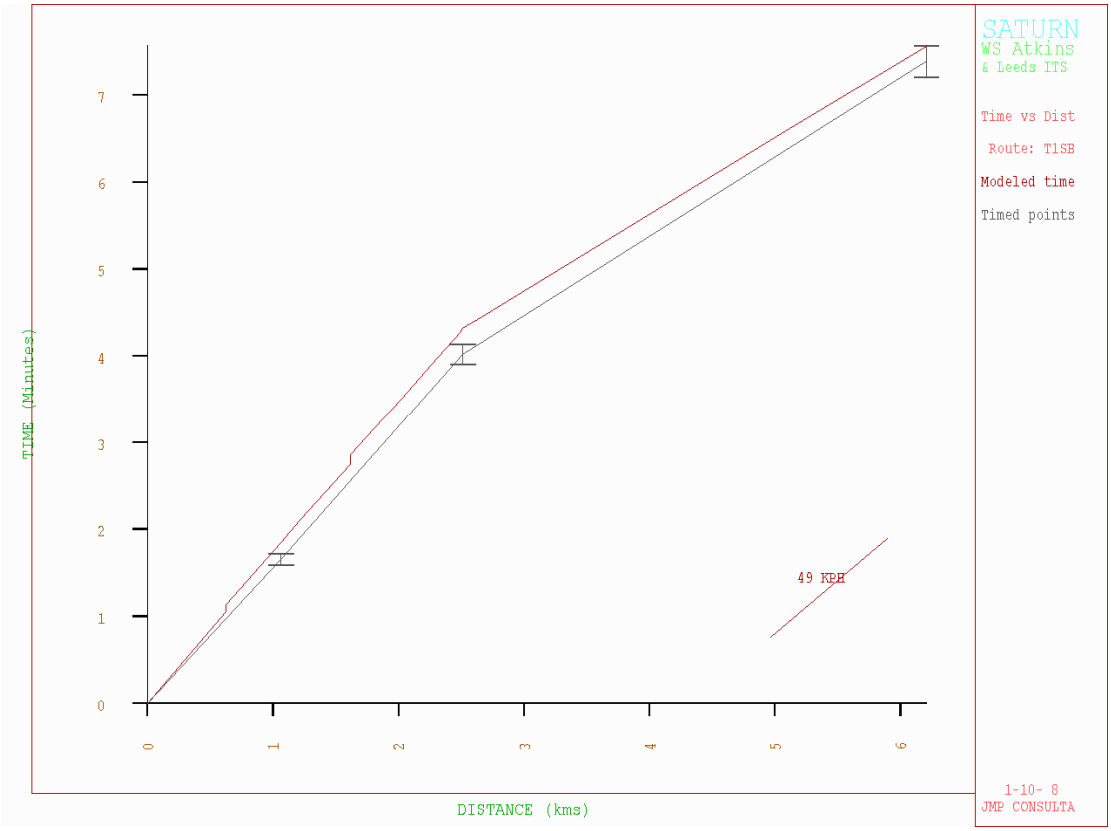
Route 3 Northbound IP



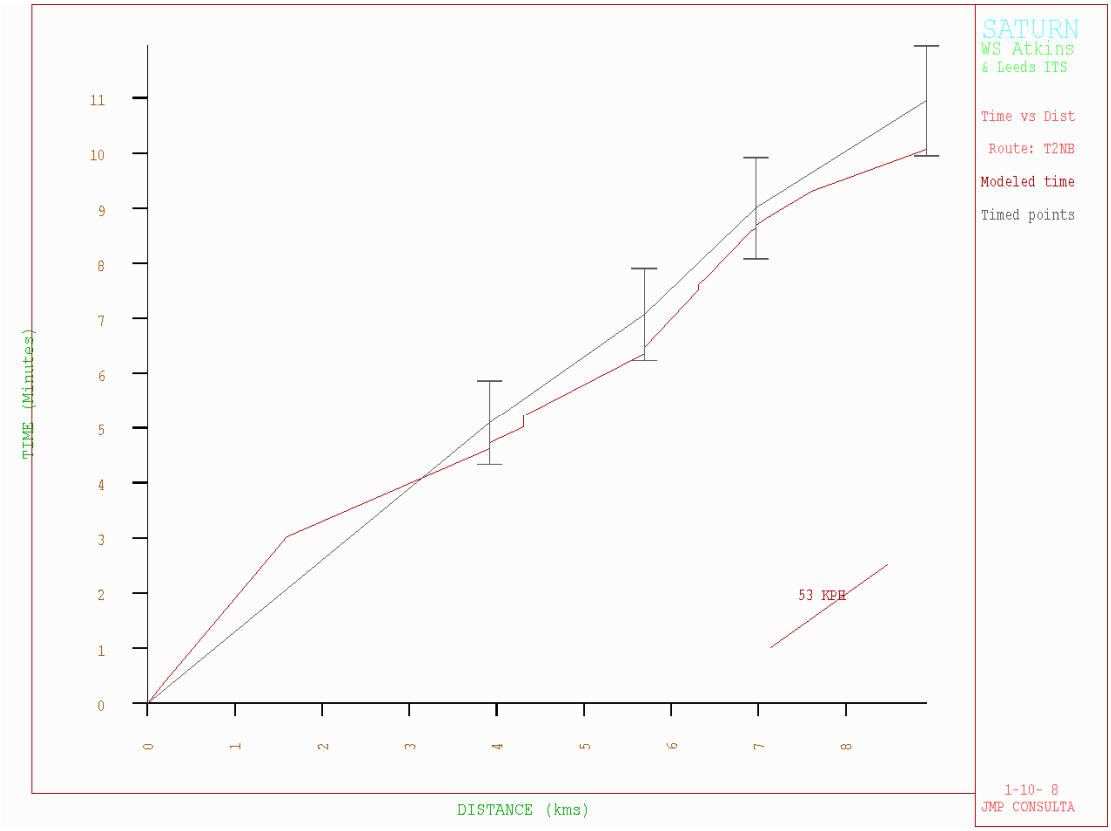
Route 3 Southbound IP



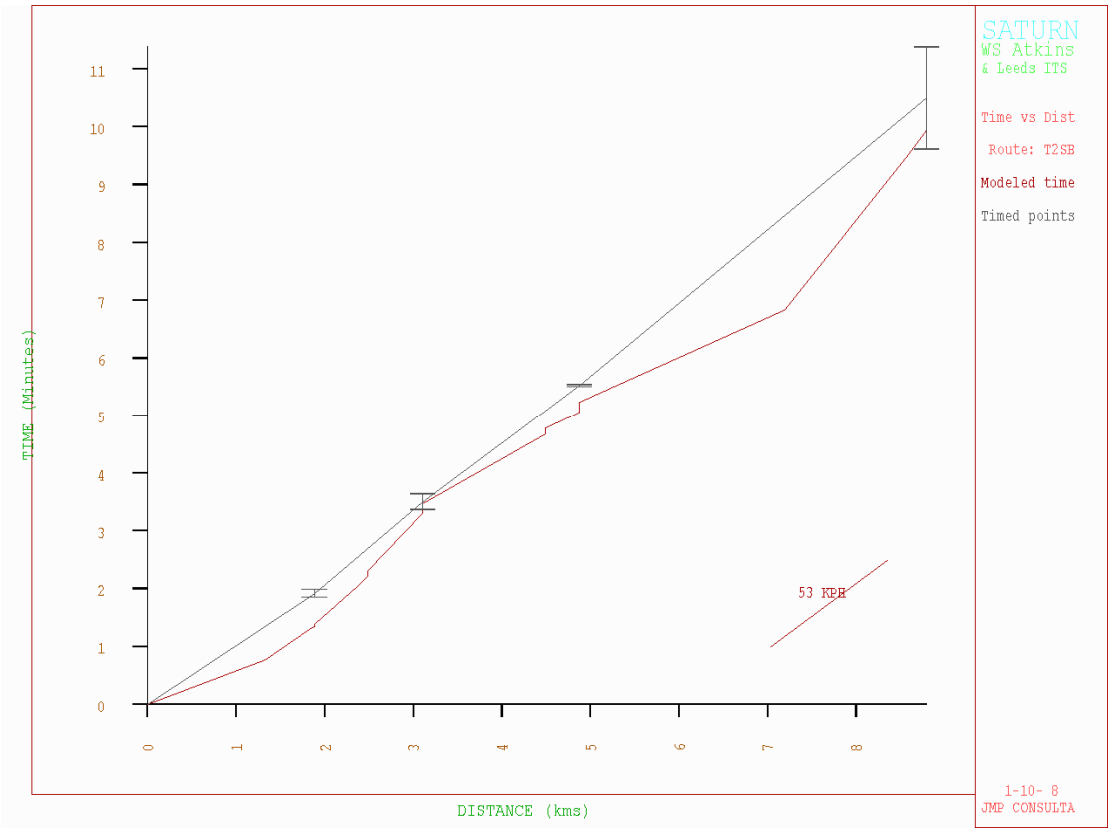
Route 1 Northbound IP



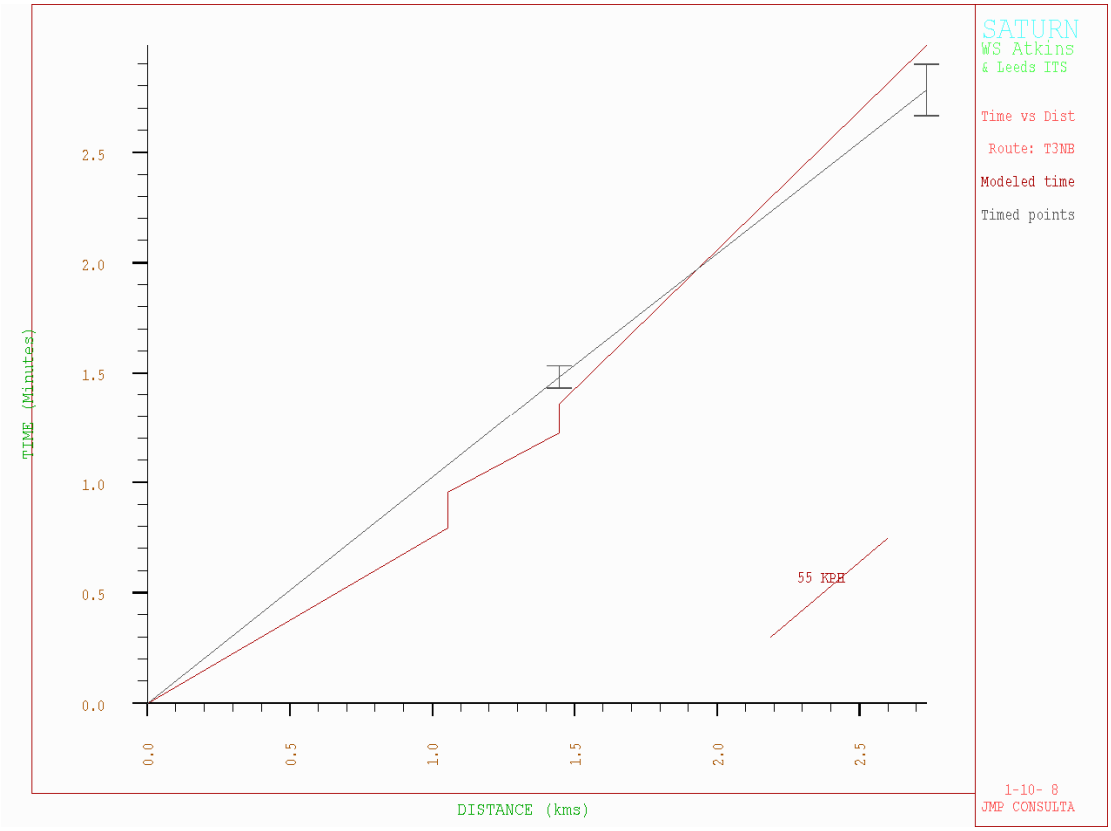
Route 1 Southbound PM



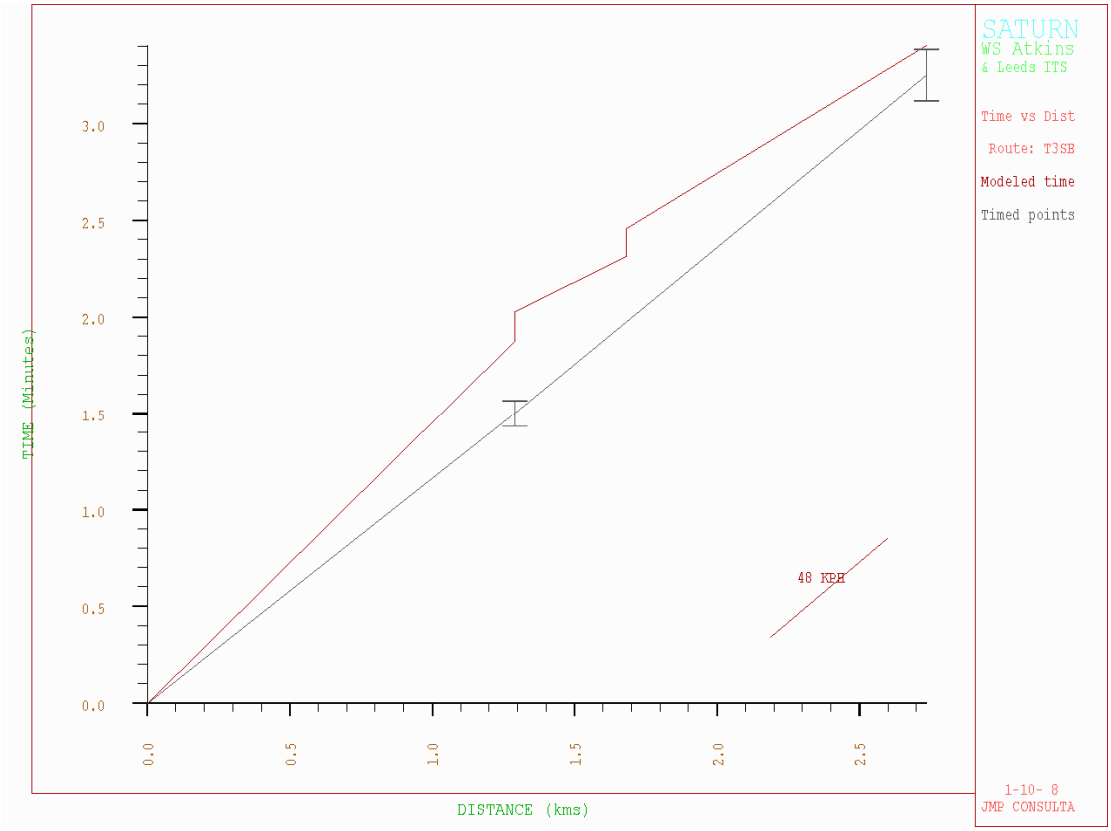
Route 2 Northbound PM



Route 2 Southbound PM



Route 3 Northbound PM



Route 3 Southbound PM

Pelham Class 2006 Monthly Summary

	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	12-month average	Neutral Month Average
00:00	44	43	37	29	48	53	52	54	47	51	65	54	48	50
01:00	22	24	21	22	27	28	30	30	28	26	31	30	27	27
02:00	18	17	21	23	21	17	21	22	22	19	24	21	21	20
03:00	27	23	31	59	24	23	26	24	25	28	27	28	29	25
04:00	55	57	98	234	64	59	59	59	58	60	51	50	75	60
05:00	240	238	264	351	231	231	225	225	244	228	185	215	240	234
06:00	332	358	454	727	359	362	348	348	354	337	321	298	383	353
07:00	719	748	811	794	709	749	758	730	791	750	659	623	737	750
08:00	853	857	886	698	842	880	883	747	892	883	879	729	836	874
09:00	688	698	738	734	738	778	760	655	744	752	798	648	728	753
10:00	677	700	730	804	711	739	734	717	741	737	733	697	727	732
11:00	755	755	816	982	772	800	787	774	791	807	770	776	799	793
12:00	952	965	981	934	953	988	989	987	983	983	968	933	968	977
13:00	930	949	939	842	939	970	957	926	951	961	950	881	933	955
14:00	826	860	868	861	840	872	854	828	854	887	885	797	853	863
15:00	898	872	962	1031	866	915	913	812	907	913	910	830	902	900
16:00	1017	1047	1089	1058	1032	1094	1065	1020	1063	1065	1013	916	1040	1064
17:00	1042	1069	1061	767	1069	1085	1116	1077	1122	1136	1112	924	1048	1103
18:00	699	760	705	512	781	759	785	739	776	819	855	638	736	784
19:00	469	500	462	355	537	540	549	533	535	531	555	452	502	536
20:00	303	320	320	294	374	372	404	372	368	347	372	305	346	365
21:00	272	275	266	225	317	309	349	302	288	292	293	267	288	302
22:00	208	212	193	122	238	250	252	226	223	226	238	212	217	234
23:00	115	112	105	60	128	127	132	120	120	128	148	122	118	126

Sector Analysis AM

Pre ME2

Lights

	1	2	3	4	5	6	7	Total
1	0.0	107.4	84.9	45.2	52.5	314.7	33.5	**638.2**
2	40.6	0.0	124.2	21.2	88.3	125.6	12.2	**412.1**
3	130.7	82.0	132.9	186.6	34.6	666.3	15.6	**1248.6**
4	23.6	44.8	71.8	97.8	30.5	1298.5	74.9	**1641.9**
5	65.0	222.0	147.3	143.4	8.1	620.0	18.5	**1224.4**
6	220.4	253.3	547.3	953.1	566.1	14035.7	762.2	**17338.0**
7	38.1	26.3	91.1	185.1	34.2	1474.3	46.8	**1896.0**
Total	**518.5**	**735.7**	**1199.5**	**1632.5**	**814.3**	**18535.1**	**963.6**	**24399.1**

Heavies

	1	2	3	4	5	6	7	Total
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
2	0.0	4.7	26.1	16.1	552.0	18.8	10.7	**628.4**
3	0.0	60.3	11.3	39.9	44.7	59.9	0.0	**216.1**
4	0.0	27.9	44.8	46.9	163.6	104.5	5.2	**392.9**
5	0.0	394.9	32.1	33.4	16.2	79.7	11.2	**567.5**
6	0.0	54.5	52.3	52.0	88.5	1743.7	134.3	**2125.3**
7	0.0	10.4	5.2	15.2	2.2	105.4	6.9	**145.3**
Total	**0.0**	**552.7**	**171.7**	**203.5**	**867.2**	**2112.0**	**168.3**	**4075.4**

Post ME2

Lights

	1	2	3	4	5	6	7	Total
1	0.0	127.7	27.1	31.5	48.7	278.2	35.3	**548.5**
2	77.6	0.0	52.6	33.5	67.2	201.1	22.1	**454.0**
3	115.0	86.5	120.0	213.5	101.8	664.4	13.9	**1315.1**
4	18.7	55.1	68.3	103.9	36.7	1326.1	100.2	**1708.9**
5	48.9	110.5	120.1	55.8	8.1	624.4	17.0	**984.9**
6	197.3	331.0	748.0	1018.4	607.5	14035.7	762.2	**17700.1**
7	30.5	36.3	80.3	220.4	49.3	1474.3	46.8	**1938.0**
Total	**488.0**	**747.2**	**1216.3**	**1676.9**	**919.3**	**18604.2**	**997.5**	**24649.5**

Heavies

	1	2	3	4	5	6	7	Total
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
2	0.0	3.1	47.5	64.6	395.7	22.4	15.4	**548.7**
3	0.0	50.0	11.5	83.9	24.1	170.5	0.1	**340.0**
4	0.0	31.0	72.7	64.3	52.7	128.7	5.5	**354.9**
5	0.0	377.1	31.8	22.5	16.2	88.9	24.8	**561.2**
6	0.0	23.4	207.3	177.2	82.5	1743.7	134.3	**2368.4**
7	0.0	16.7	22.2	21.8	2.5	105.4	6.9	**175.5**
Total	**0.0**	**501.3**	**392.9**	**434.2**	**573.8**	**2259.6**	**186.8**	**4348.7**

1 Immingham
2 Immingham Docks
3 North West Local
4 South East Local
5 North West Long Distance
6 Grimsby
7 Long Distance South East

Sector Analysis IP

Pre ME2

Lights

	1	2	3	4	5	6	7	**Total**
1	0.0	36.4	86.3	17.2	52.3	216.1	25.1	**433.4**
2	53.7	0.0	99.0	33.9	99.6	122.0	9.6	**417.8**
3	105.1	72.8	69.0	105.8	35.1	316.1	18.7	**722.6**
4	16.8	25.0	103.8	35.4	35.2	584.2	82.4	**882.9**
5	47.8	73.7	30.5	26.3	4.6	233.4	19.9	**436.2**
6	219.2	95.6	309.3	548.4	266.5	7461.6	565.2	**9465.7**
7	21.2	9.5	30.6	57.8	18.1	617.3	23.4	**777.9**
Total	**463.7**	**312.9**	**728.5**	**824.6**	**511.5**	**9550.7**	**744.4**	**13136.3**

Heavies

	1	2	3	4	5	6	7	**Total**
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
2	0.0	0.6	42.1	13.2	464.0	50.2	7.4	**577.6**
3	0.0	19.7	21.1	25.4	37.0	74.1	0.0	**177.3**
4	0.0	11.9	51.7	47.4	105.7	117.0	4.7	**338.4**
5	0.0	530.0	68.9	80.0	14.2	65.0	22.1	**780.2**
6	0.0	41.1	116.0	65.0	61.1	1408.5	112.2	**1804.1**
7	0.0	5.5	9.8	13.2	0.7	80.2	6.9	**116.3**
Total	**0.0**	**608.8**	**309.7**	**244.3**	**682.7**	**1795.0**	**153.4**	**3793.9**

Post ME2

Lights

	1	2	3	4	5	6	7	**Total**
1	0.0	44.9	26.8	12.8	25.6	139.5	33.3	**283.0**
2	54.9	0.0	37.1	23.7	47.4	142.1	15.6	**320.7**
3	32.5	30.4	61.9	69.8	59.3	303.1	16.7	**573.7**
4	14.1	19.4	68.5	48.4	27.4	595.9	127.3	**901.0**
5	27.4	38.9	55.7	19.1	4.6	265.5	35.2	**446.4**
6	130.1	116.4	391.8	695.5	280.2	7461.6	565.2	**9640.7**
7	14.9	12.8	33.1	91.0	23.2	617.3	23.4	**815.7**
Total	**273.8**	**262.8**	**675.0**	**960.4**	**467.6**	**9525.0**	**816.7**	**12981.3**

Heavies

	1	2	3	4	5	6	7	**Total**
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
2	0.0	2.8	45.7	59.2	377.5	20.7	14.2	**520.0**
3	0.0	40.7	23.1	53.4	29.1	154.2	0.1	**300.6**
4	0.0	25.0	49.2	47.7	46.6	108.5	5.0	**281.9**
5	0.0	306.9	29.6	14.8	14.2	73.8	20.9	**460.1**
6	0.0	18.9	160.5	122.5	62.8	1408.5	112.2	**1885.5**
7	0.0	13.5	13.9	17.2	1.3	80.2	6.9	**133.0**
Total	**0.0**	**407.8**	**321.9**	**314.9**	**531.5**	**1845.8**	**159.3**	**3581.1**

1 Immingham
2 Immingham Docks
3 North West Local
4 South East Local
5 North West Long Distance
6 Grimsby
7 Long Distance South East

Sector Analysis PM

Pre ME2
Lights

	1	2	3	4	5	6	7	Total
1	3.8	38.0	102.7	28.4	108.4	275.0	119.0	**675.3**
2	163.2	0.3	101.1	94.4	193.9	275.7	44.7	**873.3**
3	93.4	101.5	123.3	78.5	160.3	647.0	120.4	**1324.5**
4	49.7	22.2	172.2	60.2	156.2	1176.5	365.7	**2002.8**
5	111.3	50.5	37.5	33.6	10.3	418.1	109.6	**770.8**
6	355.5	89.3	512.6	1409.1	521.1	15810.0	1498.5	**20196.3**
7	34.1	9.8	36.4	100.2	45.4	994.9	46.9	**1267.6**
Total	**811.0**	**311.6**	**1085.8**	**1804.4**	**1195.6**	**19597.2**	**2305.0**	**27110.6**

Post ME2
Lights

	1	2	3	4	5	6	7	Total
1	0.0	52.0	80.2	19.9	53.6	279.7	98.0	**583.4**
2	141.8	0.0	95.9	61.1	122.6	367.1	40.3	**828.9**
3	15.0	35.2	127.5	65.8	135.4	548.1	52.8	**979.8**
4	37.8	22.4	205.8	89.9	72.9	1057.6	408.8	**1895.1**
5	60.5	45.0	102.9	20.5	10.3	437.7	124.0	**800.8**
6	323.1	134.6	819.3	1763.6	513.1	15810.6	1498.5	**20862.8**
7	29.1	14.8	52.2	143.7	43.3	994.9	46.9	**1324.8**
Total	**607.2**	**303.9**	**1483.8**	**2164.5**	**951.2**	**19495.7**	**2269.2**	**27275.6**

Heavies

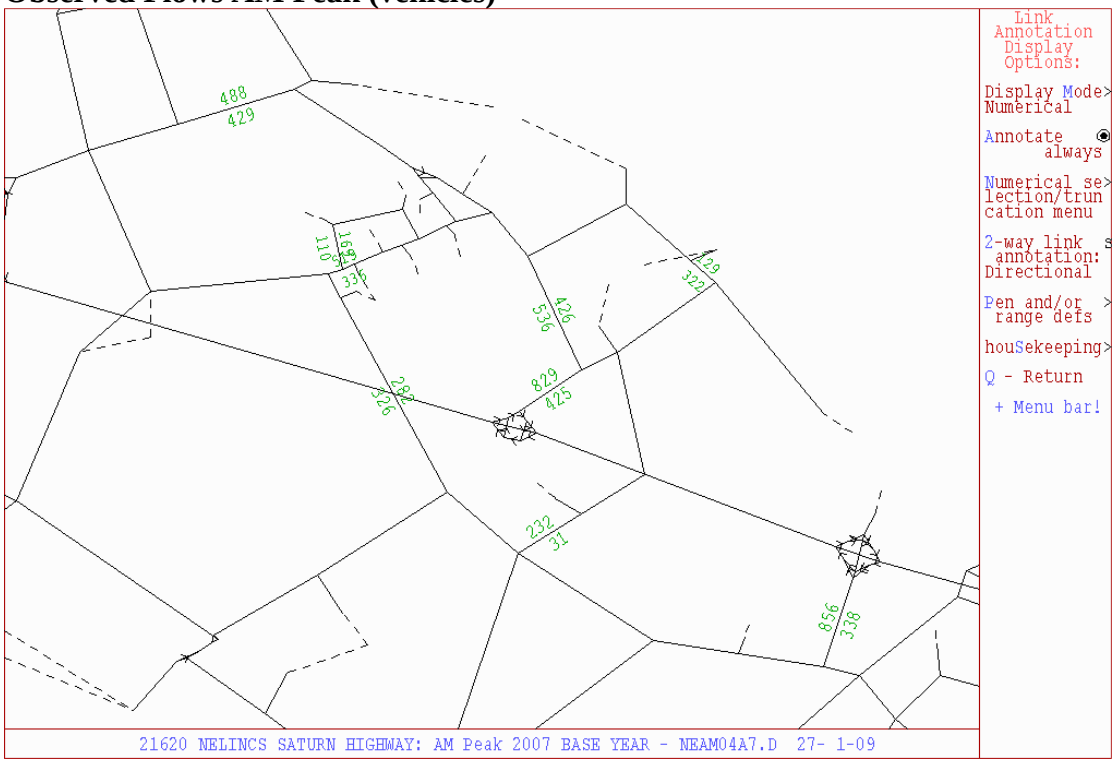
	1	2	3	4	5	6	7	Total
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
2	0.0	1.8	37.5	67.9	397.4	26.7	12.4	**543.7**
3	0.0	14.7	31.3	9.0	54.1	77.9	0.0	**187.1**
4	0.0	10.1	21.0	21.3	114.8	63.1	4.4	**234.7**
5	0.0	357.8	91.3	38.9	12.1	55.2	41.2	**596.5**
6	0.0	15.1	82.7	37.9	41.9	1073.2	90.1	**1340.9**
7	0.0	6.4	2.1	9.0	0.1	54.9	7.0	**79.4**
Total	**0.0**	**405.8**	**265.8**	**184.0**	**620.4**	**1351.0**	**155.2**	**2982.3**

Heavies

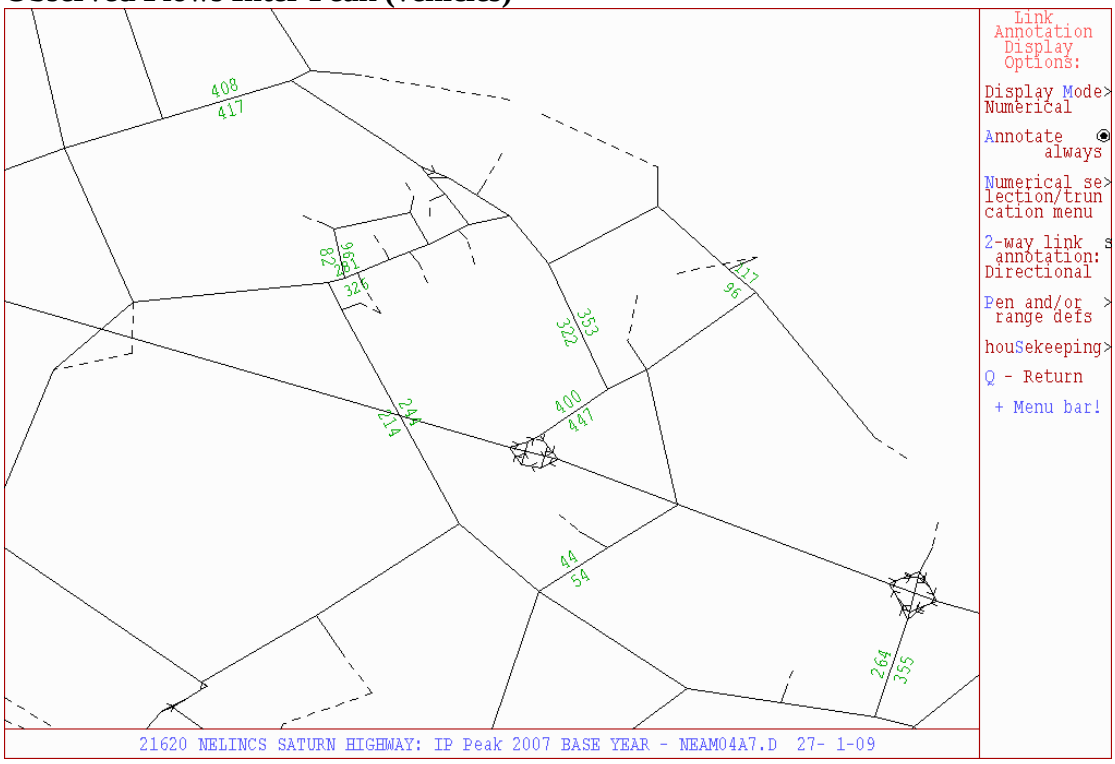
	1	2	3	4	5	6	7	Total
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
2	0.0	2.4	43.9	53.8	359.2	18.9	13.0	**491.4**
3	0.0	31.5	34.8	22.9	34.1	137.9	0.1	**261.2**
4	0.0	18.9	25.7	31.1	40.5	88.3	4.5	**208.9**
5	0.0	236.7	27.5	7.1	12.1	58.6	17.1	**359.1**
6	0.0	14.4	113.6	67.9	43.2	1073.3	90.1	**1402.5**
7	0.0	10.3	5.5	12.7	0.1	54.9	7.0	**90.5**
Total	**0.0**	**314.2**	**250.9**	**195.5**	**489.2**	**1431.9**	**131.8**	**2813.5**

1 Immingham
2 Immingham Docks
3 North West Local
4 South East Local
5 North West Long Distance
6 Grimsby
7 Long Distance South East

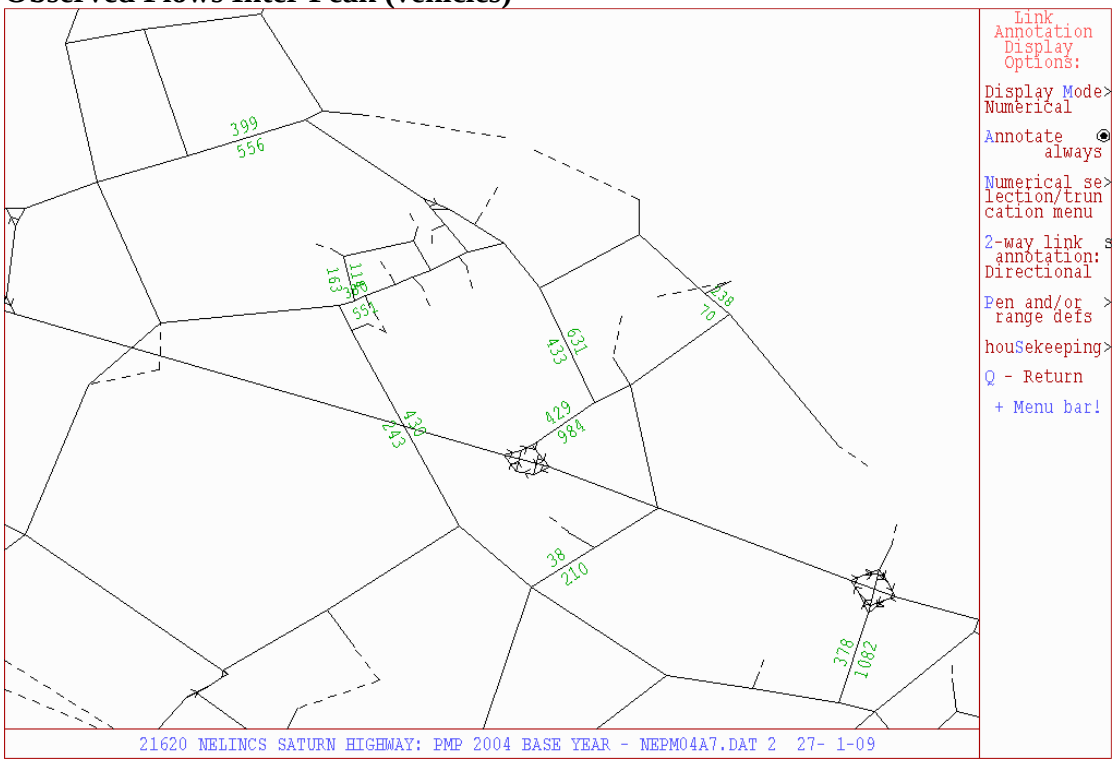
Observed Flows AM Peak (vehicles)



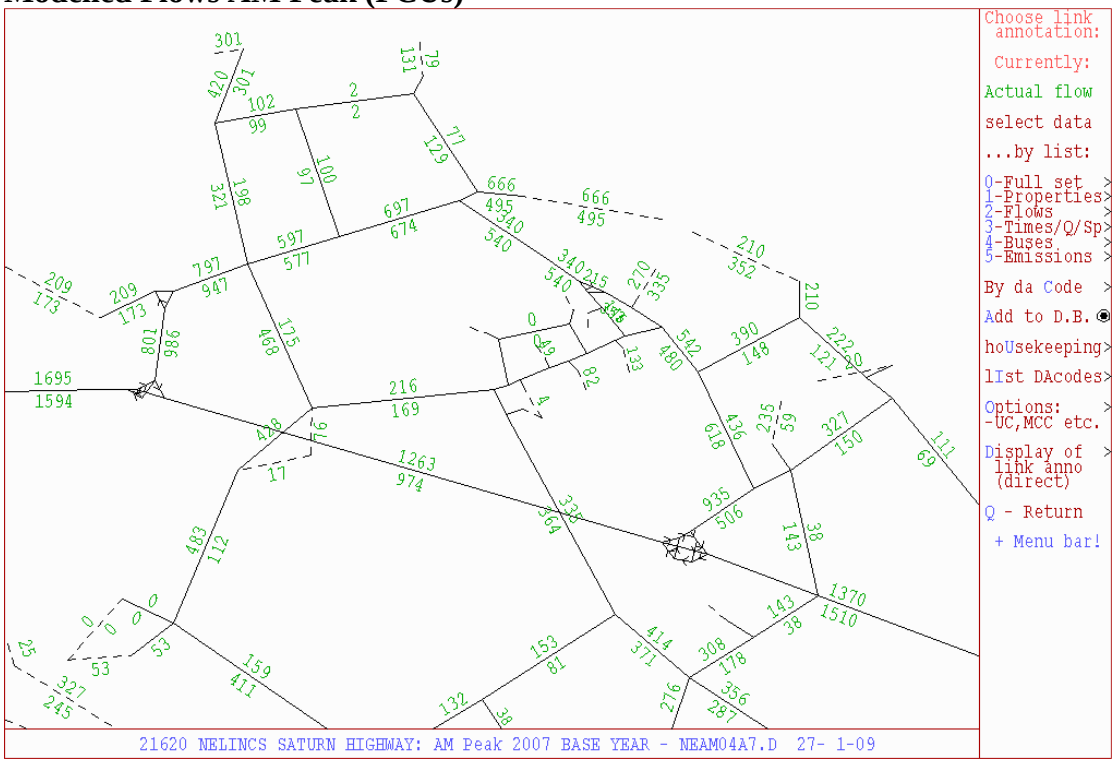
Observed Flows Inter Peak (vehicles)

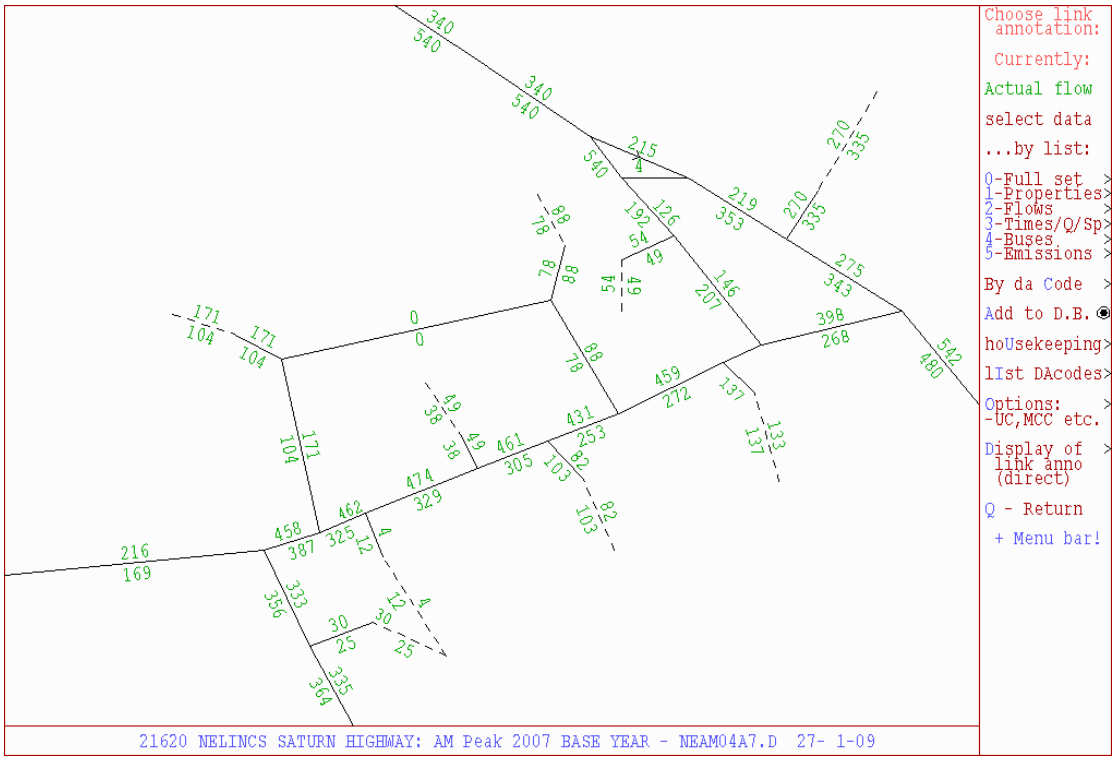


Observed Flows Inter Peak (vehicles)

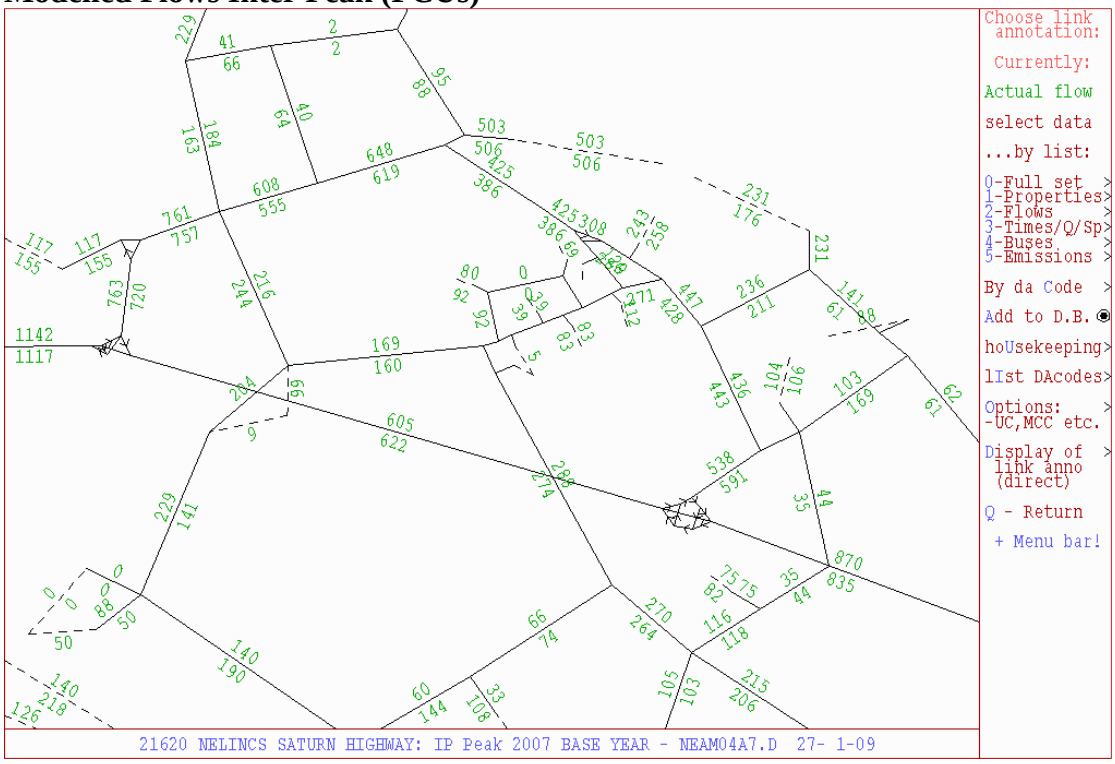


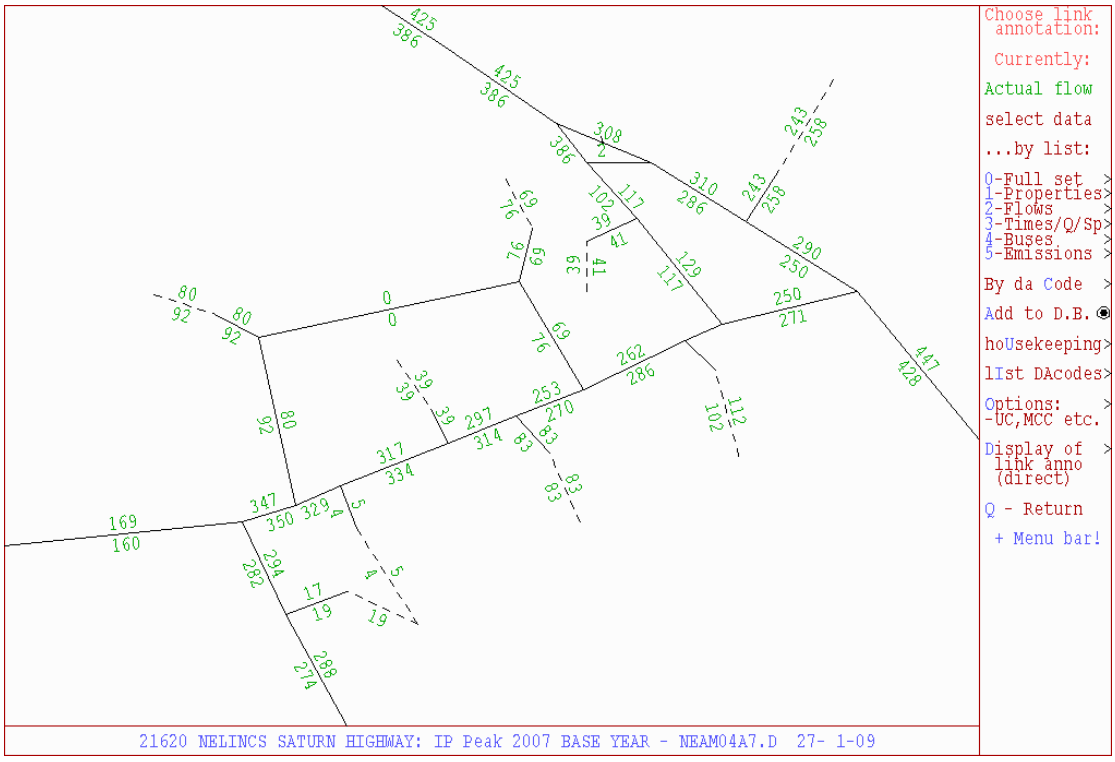
Modelled Flows AM Peak (PCUs)





Modelled Flows Inter Peak (PCUs)





Modelled Flows PM Peak (PCUs)