



**METRO NORTH  
ORAL HEARING**

Swords Model Development Report V1.3

MVA

August 2007

# Assisting Decisions

## Metro North Construction Impacts – Swords (R132) VISSIM Model Validation Report

Report for Rail Procurement Agency (RPA)

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# 1 Introduction

## 1.1 Our Involvement in Metro North

- 1.1.1 In March 2006, we were appointed as sub-consultant by ERM to undertake the traffic assessment element of the Environmental Impact Statement for Metro North. In undertaking this work, we are required to advise the RPA on traffic related impacts associated with the single preferred route and associated construction methodology. This assessment is on-going, and when complete will provide a picture of the impact of the scheme in 2011 (assumed indicative construction year), 2014 (assumed year of opening) and 2029 (assumed horizon year).
- 1.1.2 It is evident that the likely impact on all modes of transport associated with construction of Metro North is crucial in scheme development. As a result, we have been requested to advise the RPA and Jacobs Engineering on detailed multi-modal traffic related impacts associated with the construction of the project. In particular, we are now required to assess the comparative impact of phasing options for construction works along sections of the alignment in outer urban areas.
- 1.1.3 To assess the potential impact it was deemed necessary to develop a micro-simulation model of the R132 Swords Corridor. This report outlines the development of the Swords Traffic Model, a critical element of this element of the study, and summarises the calibration and validation processes.

## 1.2 Background to Model Development

- 1.2.1 One of the key elements of the project to-date was to develop the Metro North SATURN Traffic Model (MNTM) to assess the impact of the Metro North alignment. We have therefore utilised this model to supplement available survey data in the production of the Swords VISSIM Model. We have developed this model using the latest version of the VISSIM micro-simulation software, release 5.00.08.
- 1.2.2 The R132 Swords corridor model runs between Lissenhall Interchange in the north and Cloughran Roundabout in the south. This model extent provides the required geographical coverage and encompasses all major junctions along the corridor. The development of the model has made use of all available survey data. Where no count data was available we have utilised the MNTM traffic model to inform traffic levels.
- 1.2.3 The VISSIM micro-simulation package offers two mechanisms of modelling routing choice:
- Static Routing - where the simulated vehicles follow routes through the network that are manually defined (vehicles in the simulation have no choice on which way to go from their origin to destination); or
  - Dynamic Assignment – used where the road network provides several route options from one point to another (the assignment requires Origin-Destination matrices and distributes vehicles over these alternative routes based on generalised costs).

## 1 Introduction

- 1.2.4 In this situation, both approaches are equally viable, however it is essential we consider the approach in conjunction with other applicable factors, ie the availability of a strategic model covering the network area.
- 1.2.5 The 'Dynamic' approach is generally adopted for larger networks where route choice will be an important factor when assessing future proposals similar to this study; however, we adopted the 'Static' routing option as this could easily be used in conjunction with the detailed larger strategic MNTM SATURN model.
- 1.2.6 The main reasons why we have adopted this approach include:
- the development of the model and associated run times are substantially less than the 'Dynamic' assignment approach;
  - the MNTM SATURN model has been updated to contain sufficient detail in the Ballymun area to inform routing patterns through the VISSIM model area; and
  - the MNTM SATURN model would also consider the wider area routing impacts of the whole scheme alignment.
- 1.2.7 In addition, the existing Ballymun Road (R108) and Dublin City Centre VISSIM models were developed using this approach.
- 1.2.8 We have developed, calibrated and validated models for the morning peak period. Separate user classes were developed for cars, goods vehicles and taxis using the available count data and the MNTM SATURN Model. In addition, all bus services have been coded as fixed routes in the model.

### 1.3 Structure of Report

- 1.3.1 Following this introductory chapter, the Model Development Report consists of six further chapters:
- Chapter 2 details the model coverage area and network building procedures;
  - Chapter 3 discusses the traffic data collected during this study and utilised in the model development;
  - Chapter 4 presents the calibration and validation to observed traffic flows and journey time data; and
  - Chapter 5 provides our conclusions on the model development and its suitability for future use.

## 2 Network Development

### 2.1 Overview

- 2.1.1 During the scoping stage of the study, it was identified that the model must be capable of:
- assessing the construction impacts of Metro North along the length of the R132 Swords Eastern Bypass;
  - assessing the detailed operation of the corridor during the construction phasing, including impact on junction operation; and
  - assessing the impact of traffic management proposals on general traffic, taxis and buses.
- 2.1.2 Therefore, the preparation of the modelled network is a critical stage in the development of a robust, reliable traffic model suitable for the above purposes. A comprehensive data collection exercise was undertaken in order to produce a detailed and accurate representation of the R132 Swords Corridor. This included:
- junction inventories at all modelled intersections; and
  - a review of all signal controlled junctions.
- 2.1.3 We have adopted standard VISSIM model coding procedures, in accordance with available guidance when developing the models.

### 2.2 Network Coverage

- 2.2.1 The modelled network represents 2007 traffic conditions and covers the area shown in Figure 2.1.
- 2.2.2 We are confident that the model area is sufficiently detailed in terms of network representation to provide a robust base model to undertake scheme assessments to satisfy the objectives of this study.

### 2.3 Modelled Time Periods

- 2.3.1 We have developed a VISSIM traffic model for the AM peak period (0800-0900), in line with our MNTM SATURN Model. The model incorporates a preload period of 1 hour (0700-0800) which facilitates the accurate representation of traffic conditions at the beginning of the peak period.

### 2.4 Model Data

2.4.1 We have utilised the following data in the production of the models:

- AutoCAD mapping (in electronic format);
- junction inventories, including photographic records; and
- MNTM SATURN model.

### 2.5 Signal Controlled Junctions

2.5.1 Timings for the signal controlled junctions within the network area were extracted from the MNTM SATURN Model and supplemented by site visits.

2.5.2 We have assumed that the pedestrian stage is called every cycle at signal controlled junctions. Pedestrian flows are not modelled within this model.

2.5.3 During the Model Validation and Calibration process we have re-optimised the signals as required to reflect the optimisation of the signal times and co-ordination that would occur on-street with Dublin City SCATS Urban Traffic Control system.

2.5.4 Information on pedestrian crossings within the network area was extracted from the MNTM SATURN Model.

### 2.6 Speed Restrictions

2.6.1 Information on speed limits along the corridor was recorded during our site observations. Using this data, speed distributions were defined in the model for each speed restriction and vehicle type. The speed distributions used in the models are shown below in Table 2.1.

**Table 2.1 Speed Distributions by Vehicle Type**

Speed Limit	Speed Distributions	
	Cars & Taxis	Heavies & Buses
50 kph	48-58 kph	43-53 kph
60 kph	58-68 kph	53-63 kph
80 kph	78-88 kph	68-78 kph

### 2.7 Bus Services

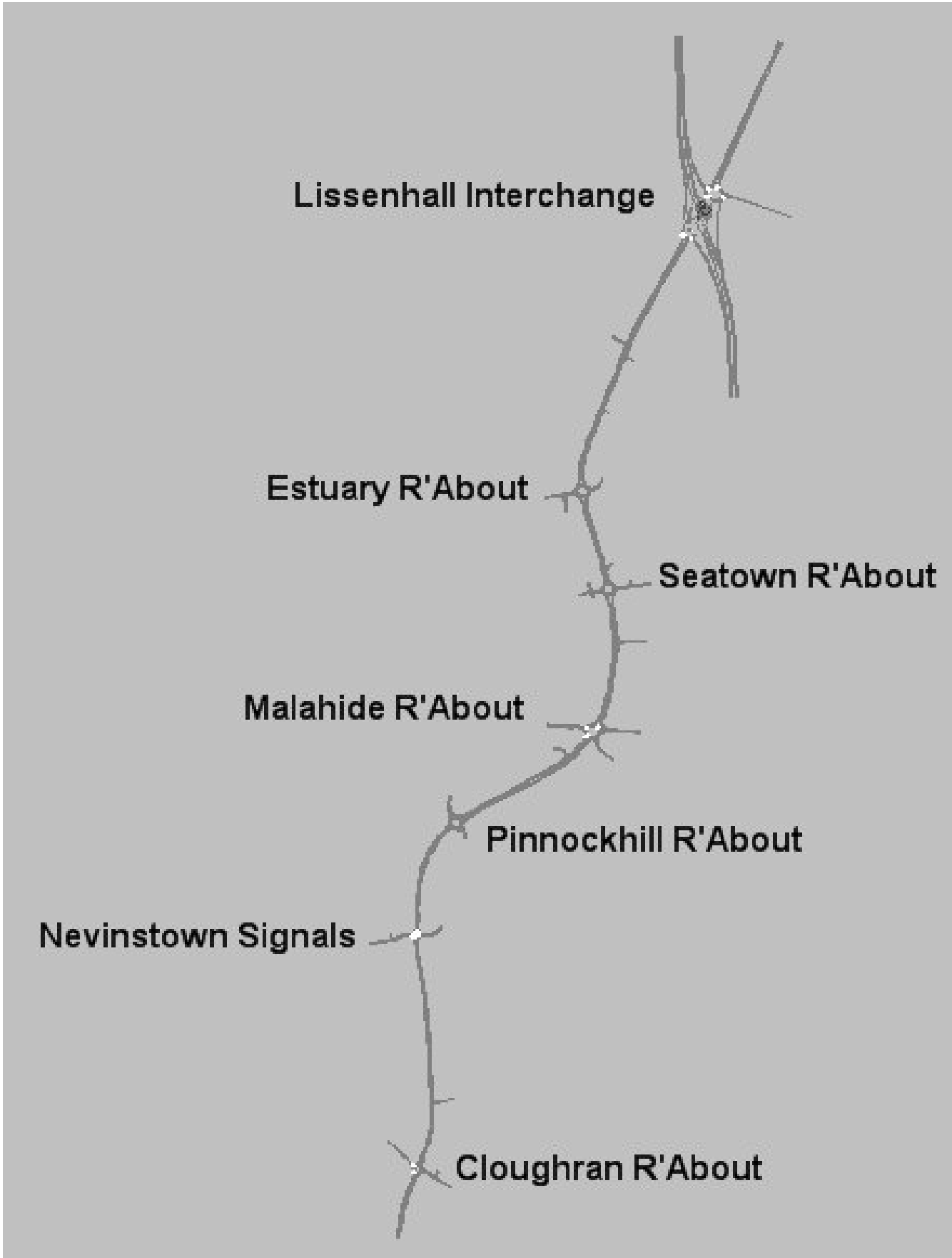
2.7.1 Bus services in the modelled network are coded as fixed route services with designated start times. A comprehensive review of all public bus services in the Swords area has been undertaken and collated for input into the model. It is considered that every public bus service on the corridor as at June 2007 has been included in the model.

## 2 Network Development

- 2.7.2 Using the collated data, bus routes were coded in VISSIM with start times based on timetable information. Appendix A includes details on all the bus services coded within the model.
- 2.7.3 The stopping characteristics at individual bus stops are determined by bus stop dwell time distributions. Bus stops in the network were assigned the following dwell time distribution:
- mean time 20 seconds, standard deviation 10 seconds.
- 2.7.4 In addition to the timetabled bus services, additional bus routes and stopping locations have been coded into the network to account for private bus movements.

### 2.8 Other Model Assumptions

- 2.8.1 Lane usage has been modelled as it was observed to operate rather than assuming complete adherence to traffic regulations by the public. This is to ensure the model reflects the true operational characteristics of the local area.
- 2.8.2 Motor, pedal cycles and pedestrian movements have not been included in the modelling.



Extent of R132 Swords Corridor  
VISSIM Model

Figure 2.1

## 3 Survey Data and Other Data Sources

### 3.1 Introduction

3.1.1 In order to develop a robust and reliable R132 Swords Corridor Traffic Model it was necessary to utilise various data resources, including:

- Manual Classified Count Data;
- MNTM SATURN model;
- Dublin Bus, Bus Eireann and Urbus websites; and
- Site visits.

### 3.2 Count Data

3.2.1 Manual Classified Junction turning counts were provided for the City Centre area covering for the 0700 – 0900 period at 5 junction locations. The data was collected in February 2005 but is considered appropriate for 2007 conditions as no major traffic management plans have been implemented since the data collection exercise was undertaken.

3.2.2 Where no junction turning count data was available we utilised 'Actual Flow' data from the MNTM SATURN model. The MNTM SATURN model was specifically developed for evaluating the impact of the Metro North alignment options and is considered 'fit-for-use' for this purpose.

3.2.3 Details of all traffic flows used in the VISSIM model development are contained in Appendix B.

### 3.3 Journey Time Survey Data

3.3.1 Car based journey time surveys were available in the southbound direction. Journey times were recorded at each of the following timing points:

- Node 1 – Lissenhall Interchange;
- Node 2 – Estuary Roundabout;
- Node 3 – Malahide Roundabout;
- Node 4 – Pinnockhill Roundabout; and
- Node 5 – Cloughran Roundabout.

3.3.2 The runs were spread throughout each survey period to avoid a cluster at any particular time. It is normal practice to have a minimum of 6 runs per direction per time period. Only four journey time runs were available. However, we consider the sample sufficient for use in the validation of the model.

3.3.3 Unfortunately, no journey time survey data was available in the northbound direction. We therefore utilised the 'Joyride' function in the SATURN software to extract average journey times for the sections between the nodes highlighted above from the MNTM SATURN Model.

### 3 Survey Data and Other Data Sources

- 3.3.4 Details of the average journey times and the modelled results are discussed later in Chapter 4.

# 4 Model Validation and Calibration

## 4.1 Introduction

- 4.1.1 This chapter details the steps taken to produce and validate the VISSIM models using the data outlined in the previous chapters.
- 4.1.2 The surveyed traffic data has been directly input into VISSIM as entry flows at the network edges and turning proportions at each modelled junction. This is to ensure modelled flows are directly equivalent to the observed traffic flows.
- 4.1.3 Validation is the process of comparing observed data against corresponding modelled data. Validation has been undertaken using the journey times for the routes detailed in Chapter 3.

## 4.2 Calibration and Validation Measures

- 4.2.1 The following measures were applied to achieve a good level of validation in the models:
  - Within VISSIM there is a parameter 'Waiting Time Before Diffusion', which determines the maximum time a vehicle can remain stationary within the network, eg waiting to changing lane. When this time is reached the vehicle is taken out of the network and a warning message is written to the error file. We have maintained the default value of 60 seconds for the purposes of this model.
  - New link types have been defined within VISSIM for congested links within the modelled network. This effectively increases the saturation flow and reduces the headway on the links thus providing a more accurate representation of driver behaviour in congested conditions.
  - Reduced speed areas have been defined and placed on turning sections to realistically model vehicles slowing when performing turning manoeuvres.

## 4.3 Calibration Statistics

- 4.3.1 The criteria set out in the Design Manual for Roads and Bridges (DMRB) Volume 12, Section 2, Part 1 were referenced when evaluating the model. The DMRB criterion makes use of the GEH summary statistic, which is defined as:

$$GEH = \sqrt{\frac{(observed - modelled)^2}{0.5 * (observed + modelled)}}$$

- 4.3.2 Table 4.1 summarises the calibration flow comparisons for all flows and compares them against the DMRB criteria. Appendix C contains full details of the flow comparisons.

**Table 4.1 Link Calibration Summary**

	GEH <5	GEH <7	GEH <10	Flows within 100 for links with flows of less than 700vph	Flows within 15% for links with flows 700 – 2700vph
<b>DMRB Criteria</b>	<b>&gt;85%</b>	<b>n/a</b>	<b>n/a</b>	<b>&gt;85%</b>	<b>&gt;85%</b>
Lights	95%	97%	97%	100%	88%
Taxis	100%	100%	100%	100%	100%
Heavies	100%	100%	100%	100%	100%
Buses	100%	100%	100%	100%	100%
<b>Total</b>	<b>95%</b>	<b>97%</b>	<b>97%</b>	<b>100%</b>	<b>93%</b>

vph = vehicles per hour

4.3.3 Table 4.1 indicates that the DMRB criteria for all vehicle classes have been fully satisfied which indicates that the calibration of the model is excellent.

4.3.4 Closer inspection of the link flow comparisons shows that the modelled flows along the corridor are very well matched to observed data.

#### 4.4 Validation Statistics

4.4.1 Comparisons are provided for each journey time section for the journey time data discussed in Chapter 3.

4.4.2 The graphs in Appendix D compare the average modelled journey times, in the southbound direction (shown as the red line on the graphs), to three values:

- the average observed journey times (shown as a blue cross);
- 95% confidence levels about the mean journey time (shown as a blue bar); and
- 95% confidence levels about the population (shown as the green bar).

4.4.3 The 95% confidence interval about the mean is the most exacting validation criteria. The 95% confidence level about the population is a less exacting validation criterion.

4.4.4 Appendix D contains the complete journey time comparisons, including journey time graph for the southbound direction. Table 4.2 summarises the southbound validation results. The notation used in the tables is as follows:

- X – Satisfies 95% confidence level about the mean criteria;
- O – Satisfies 95% confidence level about the population criteria; and
- Neither – fails to meet either validation criteria.

**Table 4.2 Southbound Journey Time Validation Summary**

Section	Section Description	Level of Validation
101	Lissenhall Interchange to Estuary R'About	X
102	Estuary R'About to Malahide R'About	X
103	Malahide R'About to Pinnockhill R'About	X
104	Pinnockhill R'About to Cloughran R'About	X
<b>SB</b>	<b>Total Southbound</b>	<b>X</b>

4.4.5 As no journey time survey data was available in the northbound direction we could not undertake the same analysis as above. Therefore, we have utilised the GEH statistic, discussed previously with regard to the traffic flow levels, to provide an appropriate measure of the validation exercise. Table 4.3 summarises the northbound validation results.

**Table 4.3 Northbound Journey Time Validation Summary**

Section	Section Description	GEH Statistic
201	Cloughran R'About to Pinnockhill R'About	1.62
202	Pinnockhill R'About to Malahide R'About	1.37
203	Malahide R'About to Estuary R'About	2.26
204	Estuary R'About to Lissenhall Interchange	0.93
<b>NB</b>	<b>Total Northbound</b>	<b>1.04</b>

# 5 Conclusions and Future Model Application

## 5.1 Conclusions

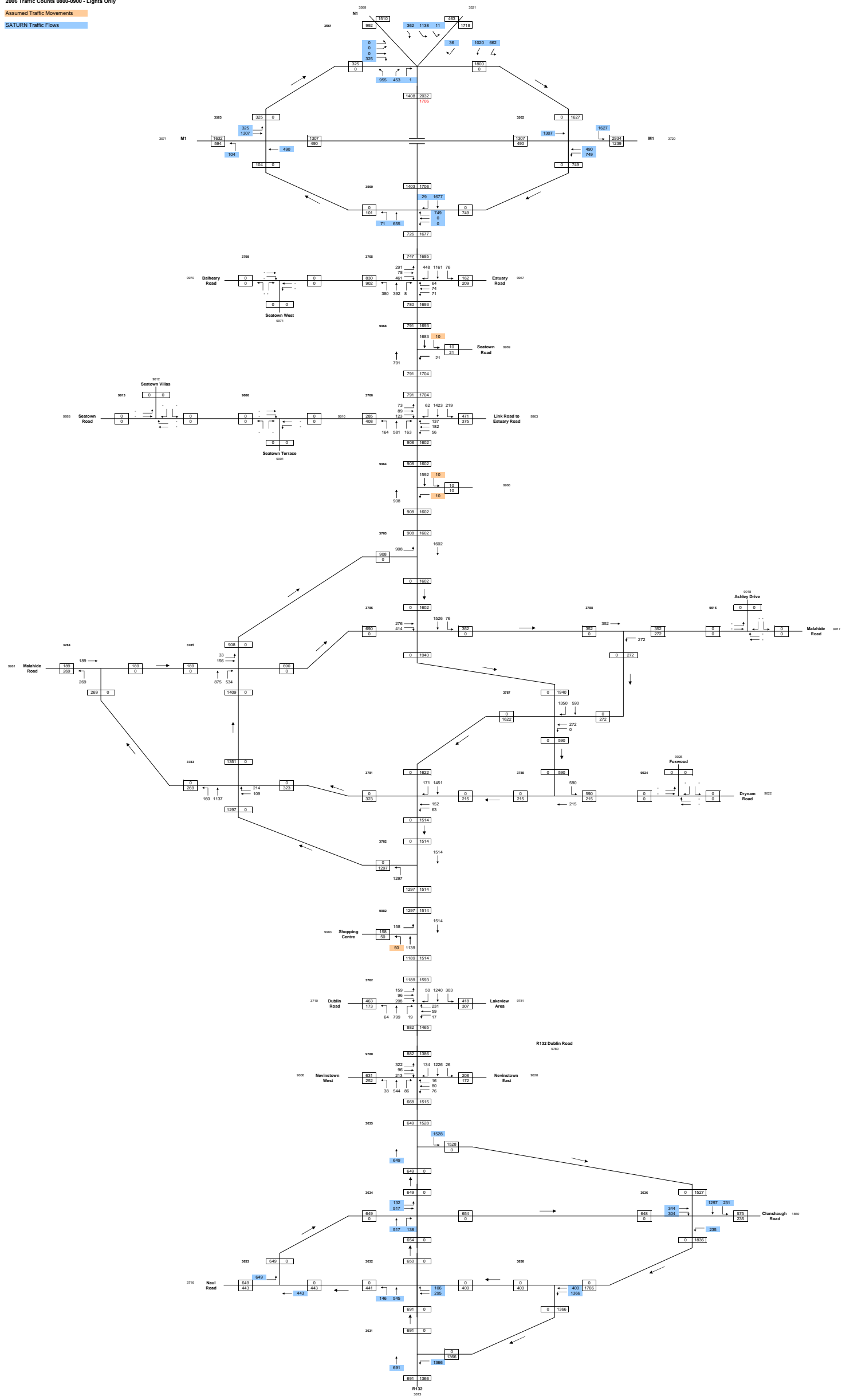
- 5.1.1 The development of the R132 Swords Corridor Traffic Model has been presented in this report. The model development has made use of an extensive data collection exercise, which has allowed for a detailed representation of the modelled network.
- 5.1.2 The calibration of the model to link flows has been presented and has been shown to be very good. The validation of the model to independent journey time data is also very good and this adds confidence to the future use of the model.
- 5.1.3 We consider that the R132 Swords Corridor Traffic Model will provide a reliable and robust base against which to test construction impacts and mitigating traffic management proposals.

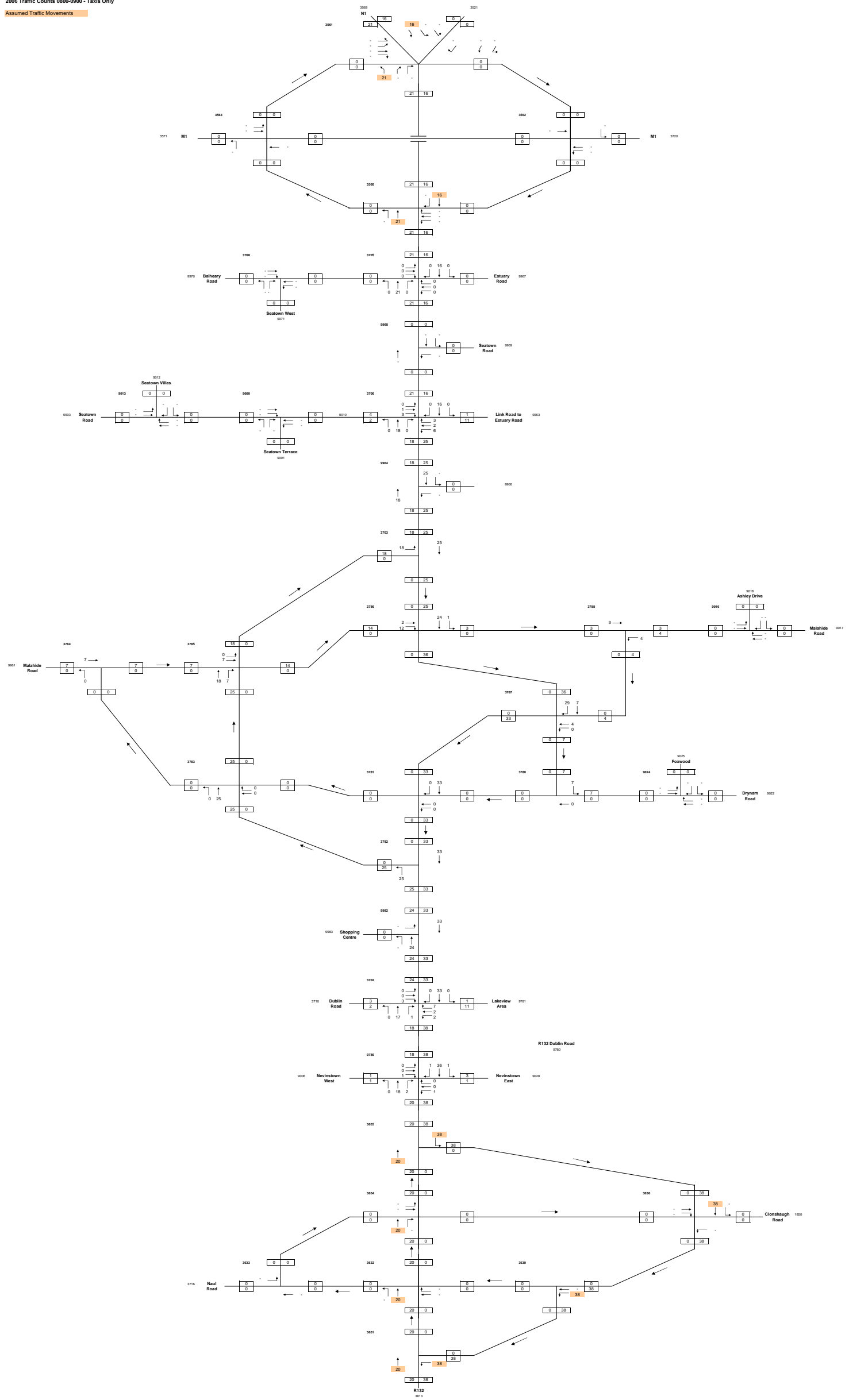
# Appendix A – Bus Service Details

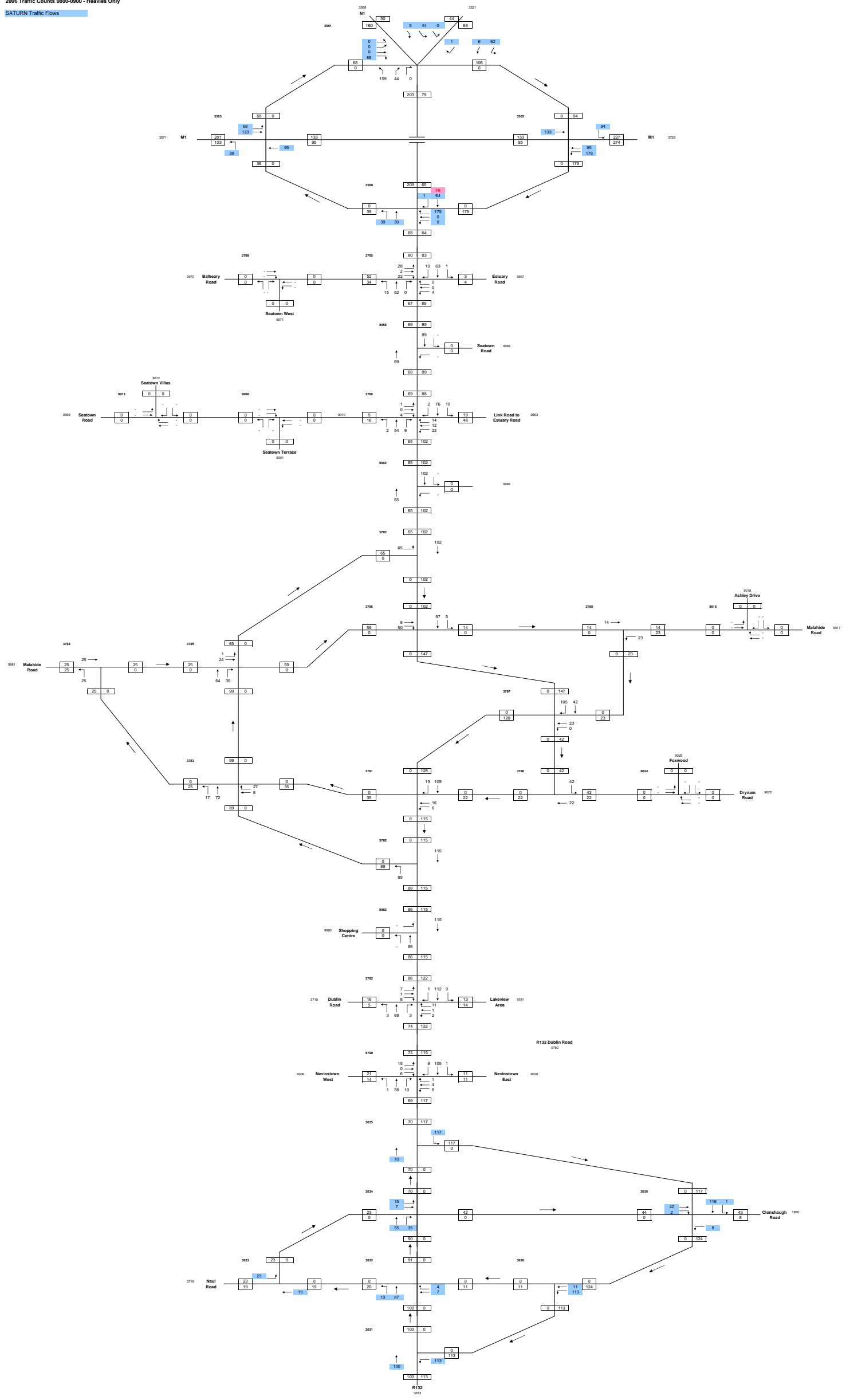
Swords VISSIM Model - Coded Bus Services

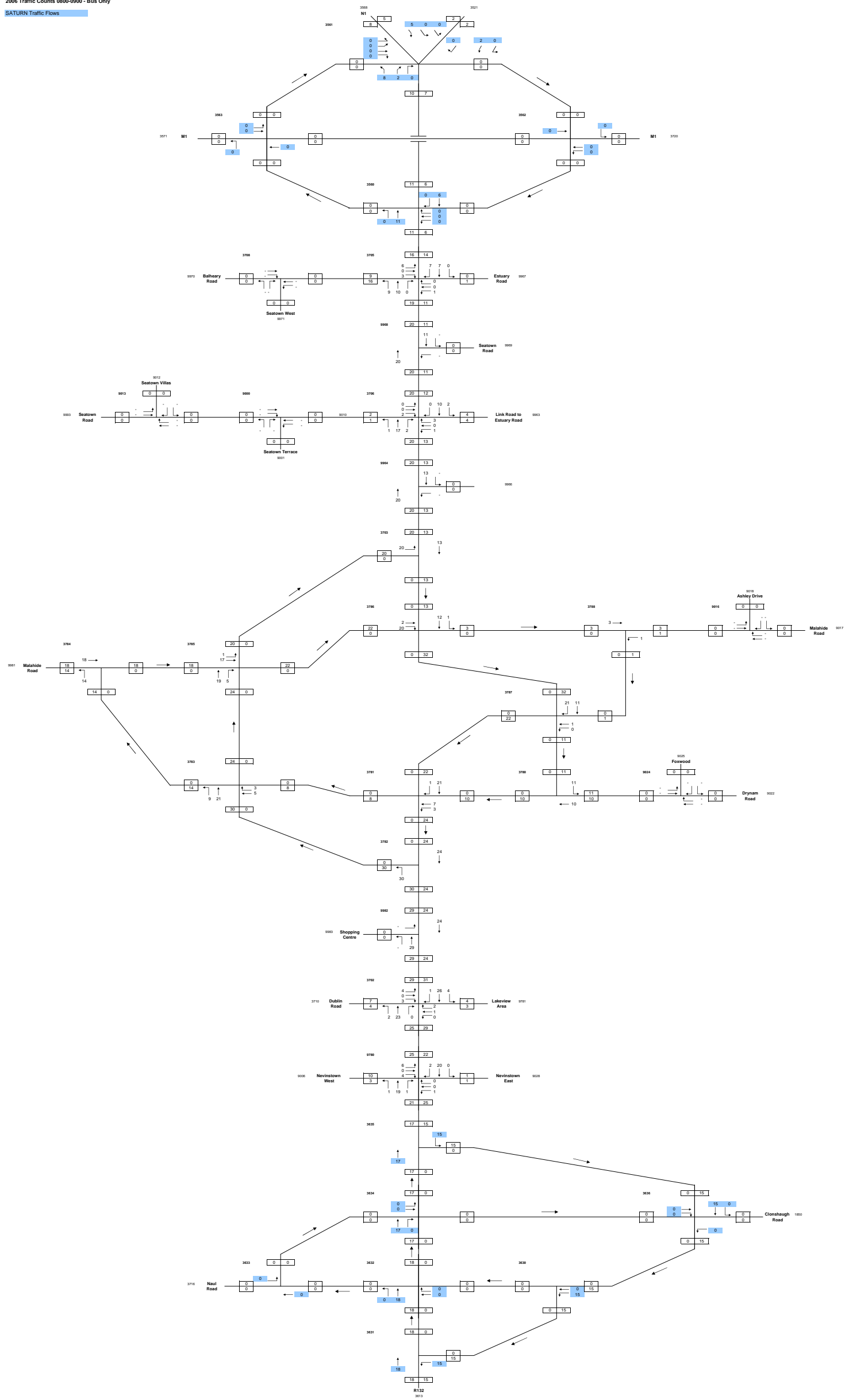
VISSIM Line No	Ser. No.	Direction		AM Peak (0700 - 0800)				AM Peak (0800-0900)			
				Initial Service Time	VISSIM Start Time (secs)	No of Services in Period	VISSIM Service Rate (secs)	Initial Service Time	VISSIM Start Time	No of Services in Period	VISSIM Service Rate (secs)
<b>Dublin Bus</b>											
1	230	WB	R106 Malahide Road, Malahide R'About, Malahide Road	0735	2100	2	1200	0820	4800	2	1800
2	230	EB	Malahide Road, Malahide R'About, R106 Malahide Road	0740	2400	2	300	0810	4200	2	300
3	33	NB	Cloughran R'About, Pinnockhill R'About, Dublin Road	0725	1500	2	1200	0805	3900	2	2100
4	33	SB	Dublin Road, Pinnockhill R'About, Cloughran R'About	0700	0	2	1500	0800	3600	4	900
5	33A	NB	No services in period	-	-	-	-	-	-	-	-
6	33A	SB	No services in period	-	-	-	-	-	-	-	-
7	33B	NB	Main Street, Balheary Road, Estuary R'About, R132, R126	-	-	-	-	0800	3600	2	1800
8	33B	SB	R126, R132, Estuary R'About, Balheary Road, Main Street	0730	1800	2	1200	0800	3600	3	1500
9	41	NB	Malahide Road, Malahide Roundabout, R132, Pinnockhill R'About, Dublin Road, Cloughran R'About	0735	2100	1	Single Service	0815	4500	6	450
10	41	SB	Cloughran R'About, Dublin Road, Pinnockhill R'About, R132, Malahide R'About, Malahide Road	0700	0	4	900	0805	3900	5	600
11	41A	NB	No services in period	-	-	-	-	-	-	-	-
12	41A	SB	Malahide Road, Malahide Roundabout, R132, Pinnockhill R'About, Dublin Road, Cloughran R'About	0740	2400	1	Single Service	-	-	-	-
13	41B	NB	Cloughran R'About, Dublin Road, Pinnockhill R'About, R132, Malahide R'About, Malahide Road	0720	1200	1	Single Service	-	-	-	-
14	41B	SB	Malahide Road, Malahide Roundabout, R132, Pinnockhill R'About, Dublin Road, Cloughran R'About	0745	2700	1	Single Service	-	-	-	-
15	41C	NB	Cloughran R'About, Dublin Road, Nevinstown	0740	2400	1	Single Service	0805	3900	2	1200
16	41C	SB	Main Street, Dublin Road, Pinnockhill R'About, Dublin Road, Cloughran R'About	0710	600	4	900	0822	4920	3	760
17	41X	SB	Malahide Road, Malahide R'About, R132, Pinnockhill R'About, Dublin Road, Cloughran R'About	0735	2100	4	360	0800	3600	1	Single Service
18	43	WB	Malahide Road, Malahide R'About, Malahide Road	0745	2700	1	Single Service	0800	3600	3	1200
19	43	EB	Main Street, Balheary Road, Estuary R'About, R132, Seatown R'About, R132, Malahide R'About, Malahide Road	0700	0	4	900	0800	3600	4	900
<b>UR BUS</b>											
20	1	NB	Cloughran R'About, Dublin Road, Pinnockhill R'About, Dublin Road	0706	360	1	Single Service	0820	4800	1	Single Service
21	1	SB	Malahide Road, Malahide Roundabout, R132, Pinnockhill R'About, Dublin Road, Cloughran R'About	0745	2700	1	Single Service	0815	4500	1	Single Service
<b>Bus Eireann</b>											
22	100	NB	Cloughran R'About, Dublin Road, Pinnockhill R'About, R132 Swords Bypass, M1 Interchange, N1	0735	2100	1	Single Service	0800	3600	1	Single Service
23	100	SB	N1, M1 Interchange, R132 Swords Bypass, Pinnockhill R'About, R132, Dublin Road, Cloughran R'About	-	-	-	-	0800	3600	1	Single Service
24	101	NB	Cloughran R'About, Dublin Road, Pinnockhill R'About, R132 Swords Bypass, M1 Interchange, N1	-	-	-	-	0830	5400	2	900
25	101	SB	N1, M1 Interchange, R132 Swords Bypass, Pinnockhill R'About, R132, Dublin Road, Cloughran R'About	0700	0	4	900	0815	4500	3	900

# Appendix B – Traffic Flow Diagrams









# Appendix C – Traffic Flow Comparisons

ID	VISSIM Counter Numbers	Road	Direction	Location	Count Data					Modelled					Difference				
					Lights	Taxis	Heavies	PSVs	Vehs	Lights	Taxis	Heavies	PSVs	Vehs	Lights	Taxis	Heavies	PSVs	Vehs
01	1	M1 On-Ramp	NB	Away from Lissenhall Interchange	102	0	38	0	141	92	0	47	0	139	-10	0	9	0	-2
02	2-3	M1	NB	Between On and Off Ramps	490	0	95	0	585	463	0	90	0	553	-27	0	-5	0	-32
04	4-5	M1	SB	Between On and Off Ramps	1307	0	133	0	1440	1291	0	139	0	1430	-16	0	6	0	-10
06	6	M1 Off-Ramp	SB	Approach to Lissenhall Interchange	325	0	68	0	393	399	0	65	0	464	74	0	-3	0	71
07	7-8	N1	NB	Away from Lissenhall Interchange	992	21	160	8	1181	979	18	176	9	1182	-13	-3	16	1	1
09	9-10	N1	SB	Approach to Lissenhall Interchange	1510	16	50	0	1576	1274	16	49	4	1343	-236	0	-1	4	-233
11	11	R126	EB	Away from Lissenhall Interchange	463	0	44	2	509	461	0	48	0	509	-2	0	4	-2	0
12	12	R126	WB	Approach to Lissenhall Interchange	1718	0	68	0	1785	498	0	68	3	569	-1220	0	0	3	-1216
13	13	M1 On-Ramp	SB	Away from Lissenhall Interchange	1713	0	100	0	1814	402	0	103	0	505	-1311	0	3	0	-1309
14	14-15	M1 Off-Ramp	NB	Approach to Lissenhall Interchange	749	0	179	0	928	772	0	184	0	956	23	0	5	0	28
16	16	Estuary Road	EB	Away from Estuary R'About	162	0	3	0	165	179	0	2	0	181	17	0	-1	0	16
17	17	Estuary Road	WB	Approach to Estuary R'About	209	0	4	1	214	209	0	4	0	213	0	0	0	-1	-1
18	18	Balheary Road	WB	Away from Estuary R'About	902	0	34	16	952	912	0	36	15	963	10	0	2	-1	11
19	19	Balheary Road	EB	Approach to Estuary R'About	830	0	52	9	891	831	0	52	11	894	1	0	0	2	3
20	20	Seatown Road (East)	EB	Away from R132	10	0	0	0	10	11	0	0	0	11	1	0	0	0	1
21	21	Seatown Road (East)	WB	Approach to R132	21	0	0	0	21	19	0	0	0	19	-2	0	0	0	-2
22	22	Link Road towards Estuary Road	EB	Away from Seatown R'About	471	1	19	4	495	463	1	23	5	492	-8	0	4	1	-3
23	23	Link Road towards Estuary Road	WB	Approach to Seatown R'About	375	11	48	4	438	375	11	48	5	439	0	0	0	1	1
24	24	Seatown Road (West)	WB	Away from Seatown R'About	408	2	16	1	427	402	2	16	0	420	-6	0	0	-1	-7
25	25	Seatown Road (West)	EB	Approach to Seatown R'About	285	4	5	2	296	285	4	5	0	294	0	0	0	-2	-2
26	26	Access Road to Office Complex	EB	Away from R132	10	0	0	0	10	12	0	0	0	12	2	0	0	0	2
27	27	Access Road to Office Complex	WB	Approach to R132	10	0	0	0	10	10	0	0	0	10	0	0	0	0	0
28	28	Malahide Road (East)	EB	Away from Malahide R'About	294	6	17	7	323	289	2	32	6	329	-5	-4	15	-1	6
29	29	Malahide Road (East)	WB	Approach to Malahide R'About	272	4	22	1	299	272	4	23	5	304	0	0	1	4	5
30	30	Drynam Road	EB	Away from Malahide R'About	590	7	31	11	639	605	9	44	8	666	15	2	13	-3	27
31	31	Drynam Road	WB	Approach to Malahide R'About	215	0	12	10	237	215	0	22	10	247	0	0	10	0	10
32	32-33	Malahide Road (West)	WB	Away from Malahide R'About	269	0	11	14	294	279	0	13	15	307	10	0	2	1	13
34	34-35	Malahide Road (West)	EB	Approach to Malahide R'About	189	7	7	18	221	188	7	25	21	241	-1	0	18	3	20
36	36	Shopping Centre Access Road	WB	Away from R132	50	0	0	0	50	41	0	0	0	41	-9	0	0	0	-9
37	37	Shopping Centre Access Road	EB	Approach to R132	158	0	0	0	158	158	0	0	0	158	0	0	0	0	0
38	38	Lakeview/Airside	EB	Away from Pinnockhill R'About	418	1	13	4	436	374	0	10	10	394	-44	-1	-3	6	-42
39	39	Lakeview/Airside	WB	Approach to Pinnockhill R'About	307	11	14	3	335	307	11	14	0	332	0	0	0	-3	-3
40	40	Dublin Road	NB	Away from Pinnockhill R'About	173	2	5	4	184	170	3	1	3	177	-3	1	-4	-1	-7
41	41-42	Dublin Road	SB	Approach to Pinnockhill R'About	463	3	16	7	489	464	3	16	7	490	1	0	0	0	1
43	43	Nevinstown Lane (East)	EB	Away from Traffic Signals	208	3	11	1	223	209	1	16	0	226	1	-2	5	-1	3
44	44	Nevinstown Lane (East)	WB	Approach to Traffic Signals	172	1	11	1	185	154	1	10	0	165	-18	0	-1	-1	-20
45	45	Nevinstown Lane (West)	WB	Away from Traffic Signals	252	1	14	3	270	247	1	15	2	265	-5	0	1	-1	-5
46	46-47	Nevinstown Lane (West)	EB	Approach to Traffic Signals	631	1	21	10	663	630	1	21	10	662	-1	0	0	0	-1
48	48	Clonshaugh Road	EB	Away from Cloughran R'About	575	0	43	0	617	564	0	42	0	606	-11	0	-1	0	-11
49	49	Clonshaugh Road	WB	Approach to Cloughran R'About	235	0	8	0	243	235	0	8	0	243	-0	0	0	0	-0
52	52-53-54	R132 Dublin Road	NB	Approach to Cloughran R'About	691	20	100	18	829	693	20	100	18	831	2	0	0	1	2
50	50-51	R132 Dublin Road	SB	Away from Cloughran R'About	1366	38	113	15	1532	1420	35	96	20	1571	54	-3	-17	5	39
55	55	Naul Road	WB	Away from Cloughran R'About	443	0	19	0	463	383	0	16	0	399	-60	0	-3	0	-64
56	56	Naul Road	EB	Approach to Cloughran R'About	649	0	23	0	671	647	0	23	0	670	-2	0	0	0	-1
101	101-102	Lissenhall Interchange	NB	Between Lissenhall Interchange R'Abouts	1406	21	206	11	1643	1436	18	223	9	1686	30	-3	17	-2	43
103	103-104	Lissenhall Interchange	SB	Between Lissenhall Interchange R'Abouts	1706	16	79	6	1807	1731	15	78	7	1831	25	-1	-1	1	24
105	105-106	R132	NB	Between Estuary R'About and M1 Lissenhall Interchange	736	21	74	14	845	752	18	86	10	866	16	-3	12	-4	21
107	107-108	R132	SB	Between M1 Lissenhall Interchange and Estuary R'About	1681	16	74	10	1781	1691	15	79	7	1792	10	-1	5	-3	11
109	109-110	R132	NB	Between Seatown R'About and Estuary R'About	786	21	68	20	894	804	18	60	20	902	19	-3	-8	1	8
111	111-112	R132	SB	Between Estuary R'About and Seatown Road	1693	8	89	11	1801	1688	14	72	13	1787	-5	6	-17	2	-14
113	113-114	R132	SB	Between Seatown Road and Seatown R'About	1704	8	89	12	1812	1693	14	72	13	1792	-11	6	-17	2	-20
115	115-116	R132	NB	Between Malahide R'About and Seatown R'About	908	18	65	20	1011	919	14	63	25	1021	11	-4	-2	5	10
117	117-118	R132	SB	Between Seatown R'About and Access Road to Office Complex	1602	25	102	13	1742	1604	21	91	18	1734	2	-4	-11	5	-8
119	119-120	R132	SB	Between Access Road to Office Complex and Malahide R'About	1602	25	102	13	1742	1602	21	91	18	1732	0	-4	-11	5	-10
121	121-122-123	R132	NB	Between Pinnockhill R'About and Shopping Centre Access Road	1189	24	86	29	1328	1149	26	100	22	1297	-40	2	14	-7	-31
124	124-125-126	R132	NB	Between Shopping Centre Access Road and Malahide R'About	1297	25	88	30	1439	1268	26	102	22	1418	-29	2	15	-8	-21
127	127-128-129	R132	SB	Between Malahide R'About and Pinnockhill R'About	1554	33	119	28	1733	1459	31	108	22	1620	-95	-2	-11	-6	-113
130	130-131	R132	NB	Between Nevinstown and Pinnockhill R'About	882	18	74	25	999	824	20	81	26	951	-58	2	7	1	-48
132	132-133-134	R132	SB	Between Pinnockhill R'About and Nevinstown	1426	38	119	26	1608	1364	36	110	19	1529	-62	-2	-9	-7	-79
135	135-136	R132	NB	Between Cloughran R'About and Nevinstown	658	20	70	19	767	629	21	82	18	750	-29	1	13	-1	-17
137	137-138	R132	SB	Between Nevinstown and Cloughran R'About	1522	38	117	20	1697	1428	38	101	19	1586	-94	0	-16	-1	-111

SUMMARY - All Links					
GEH less than 5	95%	100%	100%	100%	95%
GEH less than 7	97%	100%	100%	100%	97%
GEH less than 10	97%	100%	100%	100%	97%
Flows within 100 for flows less than 700	100%	100%	100%	100%	100%
Flows within 15% for flows 700 - 2,700 vph	88%	-	-	-	93%

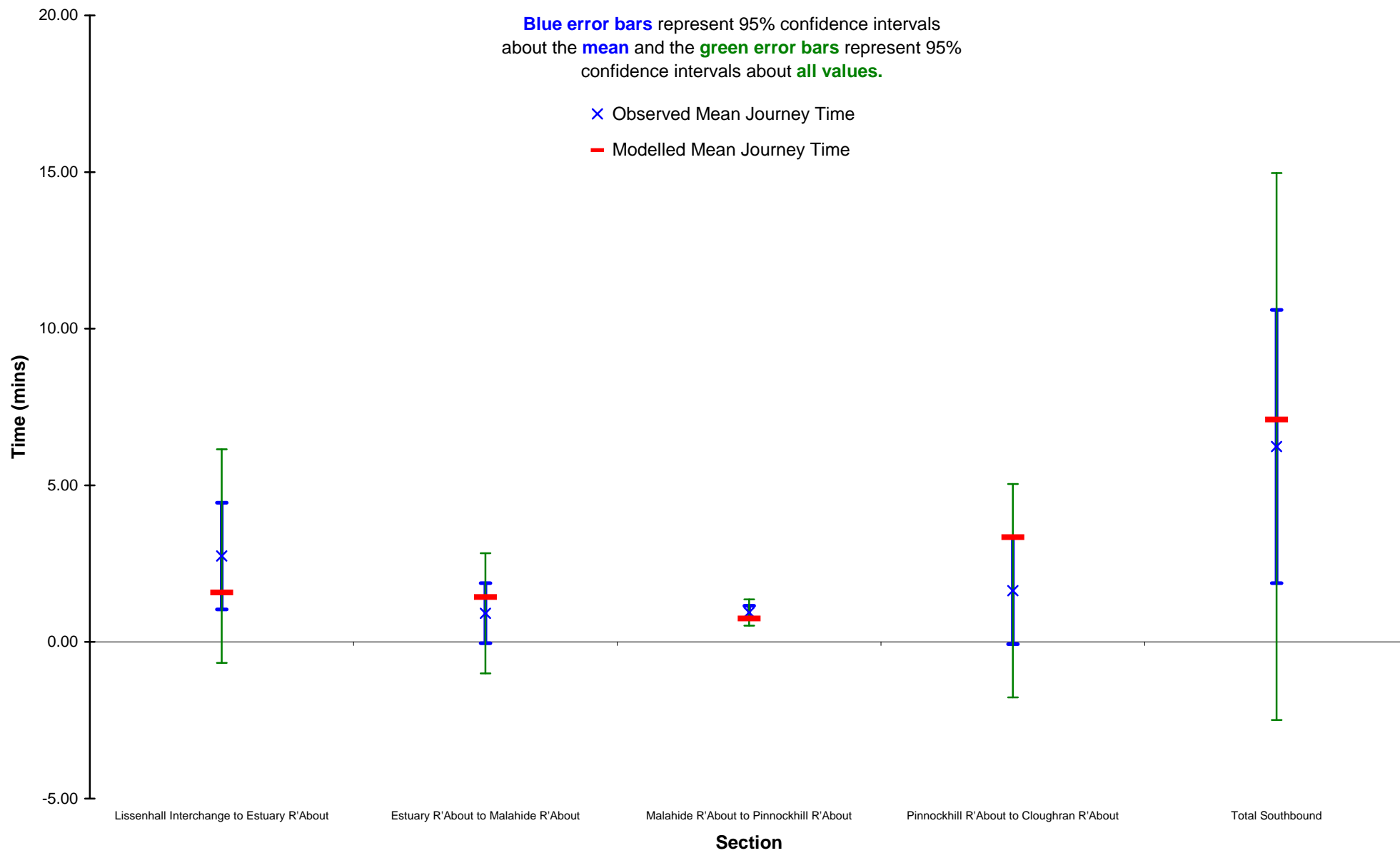
# Appendix D – Journey Time Comparisons

ID	Section Description	Observed	Modelled	Difference	% Difference	Within Confidence Interval about mean	Within Confidence Interval about all values
101	Lissenhall Interchange to Estuary R'About	165	95	-70	-42%	yes	yes
102	Estuary R'About to Malahide R'About	55	86	31	56%	yes	yes
103	Malahide R'About to Pinnockhill R'About	57	45	-12	-21%	yes	yes
104	Pinnockhill R'About to Cloughran R'About	98	200	102	104%	yes	yes
<b>SB</b>	<b>Total Southbound</b>	374	426	52	14%	yes	yes

<b>GEH Statistic</b>						
201	Cloughran R'About to Pinnockhill R'About	161	141	-20	-12%	1.62
202	Pinnockhill R'About to Malahide R'About	44	54	10	22%	1.37
203	Malahide R'About to Estuary R'About	89	69	-20	-23%	2.26
204	Estuary R'About to Lissenhall Interchange	107	117	10	9%	0.93
<b>NB</b>	<b>Total Northbound</b>	401	381	-21	-5%	1.04

Note: No Journey Time Surveys available northbound - Joyride Times extracted from MNTM SATURN model for comparison

Figure D.1: AM Peak Car Journey Time Validation



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