RPA
Railway Procurement Agency

METRO NORTH

ORAL HEARING

Ballymun Model Development Report

MVA

January 2009

Assisting Decisions

Metro North Construction Impacts

Report for Rail Procurement Agency (RPA)

January 2009

mvaconsultancy

Document Control

Project Title:	Metro North Construction Impacts
MVA Project Number:	C81112
Document Type:	Ballymun Model Development Report
Directory & File Name:	G:\Contracts\Live\C8111200 RPA Jacobs Metro North Construction Impacts\Model Validation Reports\Ballymun Validation report Draft_v1.3

Document Approval

Primary Author:	David Conlon
Other Author(s):	Stephen Camp and Grant Paterson
Reviewer(s):	Michelle Steel
Formatted by:	David Conlon

Distribution

Issue	Date	Distribution	Comments
1	28/04/2009	Ian Byrne	Draft for Issue

Contents

1 Introduction 1.1

1.1 Our Involvement in Metro North 1.1
1.2 Background to Model Development 1.1
1.3 Structure of Report 1.2

2 Network Development 2.1

2.1 Overview 2.1
2.2 Network Coverage 2.1
2.3 Modelled Time Periods 2.1
2.4 Model Data 2.2
2.5 Signal Controlled Junctions 2.2
2.6 Speed Restrictions 2.3
2.7 Bus Services 2.3
2.8 Other Model Assumptions 2.3

3 Survey Data and Other Data Sources 3.1

3.1 Introduction 3.1
3.2 Count Data 3.1
3.3 Journey Time Survey Data 3.1

4 Model Validation and Calibration 4.1

4.1 Introduction 4.1
4.2 Calibration and Validation Measures 4.1
4.3 Calibration Statistics 4.1
4.4 Validation Statistics 4.2

5 Conclusions and Future Model Application 5.1

5.1 Conclusions 5.1

Tables

Table 2.1 Speed Distributions by Vehicle Type 2.3
Table 3.1 Number of Journey Time Survey Runs 3.2
Table 4.1 Link Calibration Summary – Actual Traffic Flows (Using Survey data only for 2008 base model) 4.2
Table 4.2 Northbound Journey Time Validation Summary 4.3
Table 4.3 Journey Time Validation Summary - Southbound 4.3

mvaconsultancy

Figures

Figure 2.1 Extent of Dublin City Centre VISSIM Model 2.2

Appendices

A Bus Service Details
B Traffic Flow Diagrams
C Traffic Flow Comparisons
D Journey Time Comparisons

1 Introduction

1.1 Our Involvement in Metro North

1.1.1 In March 2006, MVA Consultancy was 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 The Construction of Metro North will involve considerable alterations to the current road network in the Ballymun area. These alterations include replacing the existing 3 lane dual carriageway including bus lanes with a 2 lane dual carriageway including bus lanes and will be carried out on a phased basis. As a result, we have been requested to advise the RPA and Jacobs Engineering on detailed traffic related impacts associated with the construction of the scheme in the area.

1.1.3 To undertake an assessment of this level of complexity, it was deemed necessary to develop a micro-simulation model of the Ballymun Road (R108). This report outlines the development of the Ballymun Road Traffic Model, a critical element of the Metro North Construction Impacts 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 our Ballymun 2008 Base VISSIM Model. We have developed this model using the VISSIM micro-simulation software, release 5.00.08.

1.2.2 The Ballymun Road (R108) corridor model runs between the M50 interchange in the north and St Canice's Road in the south. For the development of the model an extensive series of traffic counts were commissioned, and carried out at all junctions along the Ballymun Road between the M50 and St Canice's Road.

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).

1.2.4 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 R132 Swords Corridor and Dublin City Centre VISSIM models were developed using this approach.

1.2.8 Using the 'Static' routing approach we have developed, calibrated and validated models for the morning peak period. Separate user classes were input for cars, goods vehicles and taxis utilising all of the available count data. 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, respectively, and also presents information on queue lengths; 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 Ballymun Road;
- assessing the impact of traffic management proposals on general traffic, taxis and buses; and
- assessing the detailed operation of the major junctions along the Ballymun Road during the construction phasing.

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. An extensive data collection exercise has been undertaken in order to produce a detailed and accurate representation of the Ballymun road network. This includes:

- junction inventories of all modelled intersections;
- a review of all signal controlled junctions including pedestrian demands;
- a comprehensive review of taxi operations; and
- a comprehensive review of all bus services.

2.1.3 We have adopted standard VISSIM model coding procedures, in accordance with guidance available, when developing the models.

2.2 Network Coverage

2.2.1 The modelled network represents present 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.

Figure 2.1: Ballymun Modelled Network

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
- existing signal data.

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 in the network area was taken from 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 Distributions	
Speed Limit	**Cars & Taxis**	**Heavies & Buses**
50 kph	43-53 kph	40-45 kph
60 kph	58-68 kph	53-63 kph

Values are kilometres per hour

2.7 Bus Services

2.7.1 Bus services in the modelled network are coded as fixed route services with designated start times and a frequency. A comprehensive review of all public bus services in the Ballymun area has been undertaken and collated for input into the model. It is considered that every public bus service in the area as at December 2008 has been included in the model.

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. We have included all bus stops in the modelled area.

2.8 Other Model Assumptions

2.8.1 Parking restrictions have been modelled as they were observed to operate rather than assuming complete adherence to regulations by the public. This is to ensure the model reflects the true operational characteristics of the local area.

2.8.2 Taxi ranks have not been included in the area. However, taxi movements are replicated throughout the modelled area.

2.8.3 Motor and pedal cycles have not been included in the modelling.

3 Survey Data and Other Data Sources

3.1 Introduction

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

- Manual Classified Count Data;
- Journey Time Surveys
- MNTM SATURN model;
- Dublin Bus website; and
- Site visits.

3.2 Count Data

3.2.1 Manual Classified Junction turning counts were provided for the Ballymun Road area covering for the 0700 – 1900 period at 15 junction locations. The data was collected in December 2008.

3.2.2 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 times were undertaken on Wednesday 28th January 2009. The journey time survey was conducted between the following junctions:

- Southbound – M50 Interchange / R108 (Ballymun Road) and St Canices Rd / R108 (Ballymun Road); and
- Northbound – St Canices Rd/ R108 (Ballymun Road) and M50 Interchange / R108 (Ballymun Road).

3.3.2 Journey times were recorded at each of the following timing points within the modelled area:

Southbound

- Node 101 – R108 / M50 Interchange;
- Node 102 – R108 / Northwood Business Park;
- Node 103 – R108/ sentry Cross;
- Node 104 – R108 / Coultry Gardens
- Node 105 – R108 / Shangan Road;
- Node 106 – R108/ Siloge Rd;
- Node 107 – R108/ Gateway Crescent;
- Node 108 - R108/ Gateway Avenue;

- Node 109 - R108/ Shanliss Rd;
- Node 110 - R108/ Collins Avenue;
- Node 111 - R108/ Albert College Drive;
- Node 112 - R108/ St Pappins Rd;
- Node 113 - R108/ St Canice's Rd

Northbound

- Node 201 - R108/ St Canice's Rd;
- Node 202 - R108/ St Pappins Rd;
- Node 203 - R108/ Albert College Drive;
- Node 204 - R108/ Collins Avenue;
- Node 205 - R108/ Shanliss Rd;
- Node 206 - R108/ Gateway Avenue;
- Node 207 – R108/ Gateway Crescent;
- Node 208 – R108/ Siloge Rd;
- Node 209 – R108 / Shangan Road;
- Node 210 – R108 / Coultry Gardens
- Node 211 – R108/ Santry Cross;
- Node 212 – R108/ Northwood Business Park
- Node 213 – R108/ M50 Interchange

3.3.3 The journey time survey runs utilised a standard method as outlined in the DMRB Traffic Appraisal Manual. 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, however, we consider the sample sufficient for the validation of this model. Table 3.1 indicates the actual number of runs undertaken.

Table 3.1 Number of Journey Time Survey Runs

Time Period	Number of Journey Time Survey Runs	
	Northbound	Southbound
0730-0900	4	5

3.3.4 Details of the average journey time survey results 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 Ballymun VISSIM model 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;
- Reduced speed areas have been defined and placed on turning sections to realistically model vehicles slowing down on the approach to each turn.

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 Chapter 4 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 flow comparisons for all traffic flows and compares them against the DMRB criteria. Appendix C contains full details of the traffic flow comparisons.

Table 4.1 Link Calibration Summary – Actual Traffic Flows (Using Survey data only for 2008 base model)

	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
DMRB Criteria	**>85%**	**n/a**	**n/a**	**>85%**	**>85%**
Lights	95	98	98	97	95
Heavies	94	96	100	94	-
Taxis	86	100	100	98	-
TOTAL	92	98	99	96	95

vph = vehicles per hour

4.3.3 Table 4.1 indicates that 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 are well matched to observed data throughout the modelled area.

4.4 Validation Statistics

4.4.1 The Design Manual for Roads and Bridges (DMRB) Volume 12, Section 2, Chapter 6 recommends that data should be plotted on graph where the observed mean journey time are showing the 95% confidence range for each section with the modelled journey time. This allows for comparison of the modelled with the observed journey time as detailed in Chapter 3.

4.4.2 The graph in Appendix D compare the average modelled journey times (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 graphs. Tables 4.2 and 4.3 summarise the 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;

Table 4.2 Northbound Journey Time Validation Summary

Section	Description	AM Peak
102	St Canice's Road - St Pappins Road	X
103	St Pappins Road – Albert College Drive	x
104	Albert College Drive - Collins Avenue	X
105	Collins Avenue - Shanliss Road	X
106	Shanliss Road - Gateway Avenue	X
107	Gateway Avenue - Gateway Crescent	x
108	Gateway Crescent - Siloge Road	X
109	Siloge Road - Shangan Road	X
110	Shangan Road - Coultry Gardens	x
111	Coultry Gardens - Santry Cross	X
112	Santry Cross - Santry Business Park	X
113	Santry Business Park - M50 Interchange	X
NB	Total Northbound	X

Table 4.3 Journey Time Validation Summary - Southbound

Section	Description	AM Peak
201	M50 Ballymun/ Interchange - Santry Business Park	X
202	Santry Business Park - Santry Cross	X
203	Santry Cross - Coultry Gardens	X
204	Coultry Gardens - Shangan Road	X
205	Shangan Road - Siloge Road	X
206	Siloge Road - Gateway Crescent	X
207	Gateway Crescent - Gateway Avenue	X

208	Gateway Avenue - Shanliss Road	X
209	Shanliss Road - Collins Avenue	X
210	Collins Avenue – Albert College Drive	X
211	Albert College Drive - St Pappins Road	O
212	St Pappins Road - St Canice's Road	X
SB	Total Southbound	X

4.4.5 Table 4.2 above indicates that 100% (12 out of 12) of the journey time sections in the southbound direction fall within the 95% confidence limits. Similarly, Table 4.3 indicates that 92% (11 out of 12) fall within the 95% confidence limits in the northbound direction.

4.4.6 Overall 96% (24 out of 24) of the journey time sections fall within the 95% confidence limits. This level of validation against independent data is excellent and highlights that the model provides a robust basis on which the Metro North construction impacts can be evaluated.

5 Conclusions and Future Model Application

5.1 Conclusions

5.1.1 The development of the Ballymun Traffic Model has been presented in this report. The model development has made use of extensive data, 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 excellent for model time period. The validation of the model to independent journey time data is also excellent and this adds confidence to the future use of the model.

5.1.3 We consider that the Ballymun Traffic Model will provide a reliable and robust base against which to test construction impacts of the Metro North, Metro Stations and mitigating traffic management proposals.

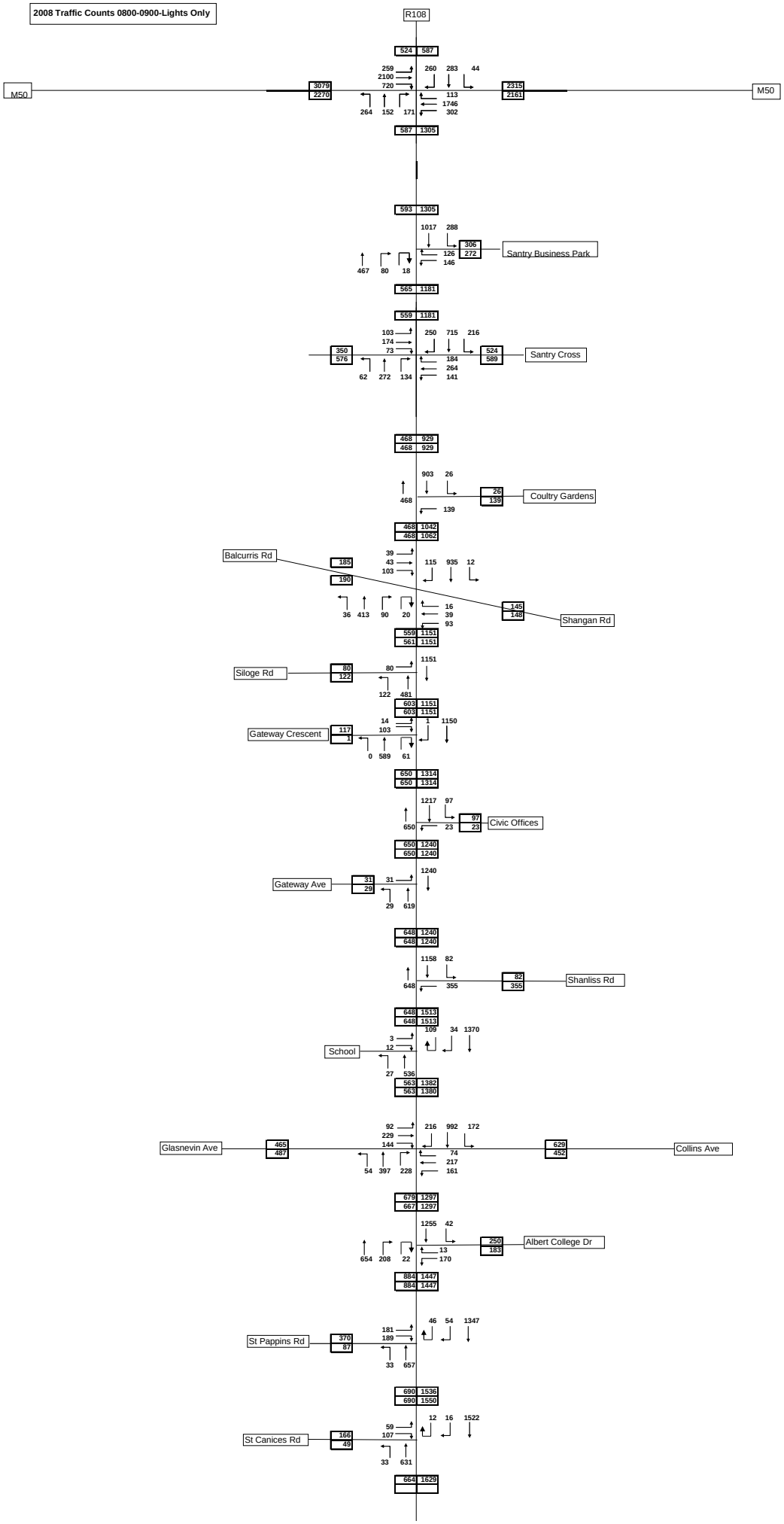
Appendix A – Bus Service Details

Ballymun Vissim Model- Coded Bus Services

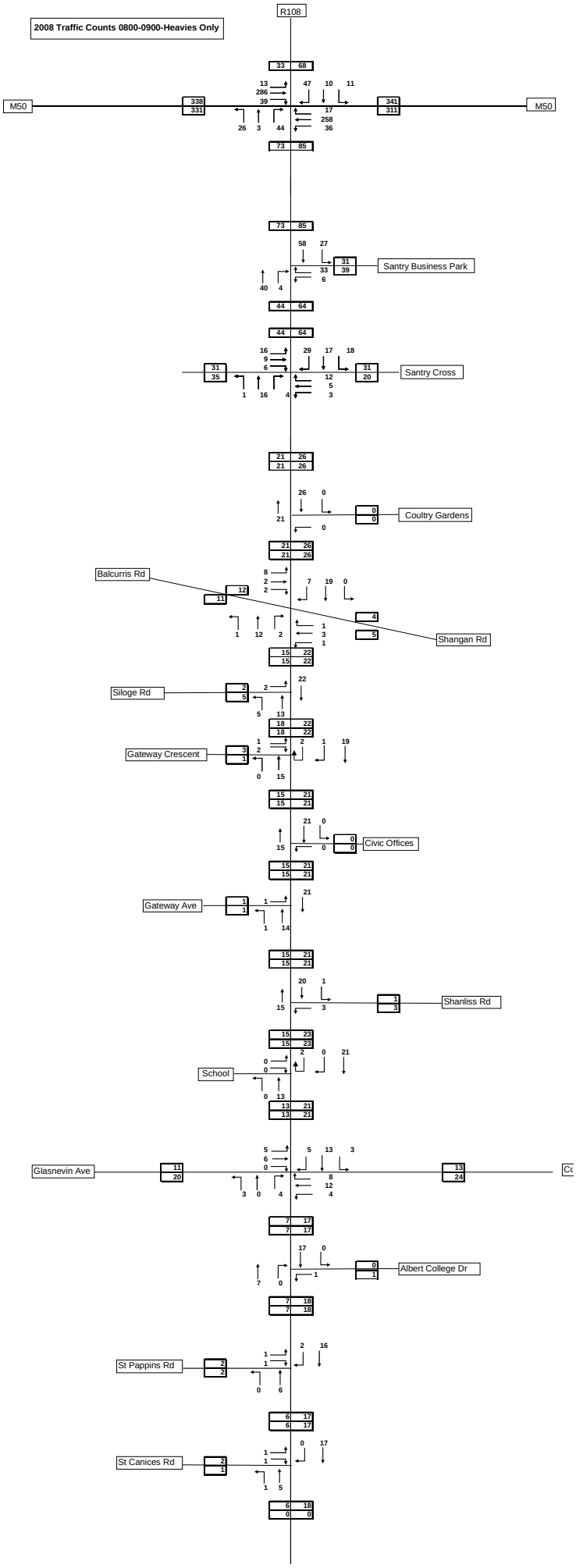
				AM (0700-0800)				AM Peak (0800-0900)			
Vissim Line No.	Ser. No.	Direction		Initial Service Time	Vissim Start Time (Secs)	No. of services in period	Vissim Service Rate (Secs)	Initial Service Time	Vissim Start Time (Secs)	No. of services in period	Vissim Service Rate (Secs)
Dublin Bus											
8	13/13A	SB	M50 Interchange, Poppintree, Siloge Rd, Ballymun Rd (The Rise)	07:15	900	2	1350	08:00	3600	7	510
31	13/13A	NB	Ballymun Rd (The Rise), Siloge Rd, Poppintree, M50 Interchange	07:20	1200	2	1200	08:00	3600	4	900
12	17	NB	Glasnevin Avenue, Balcurris Road, Santry Avenue	07:01	60	3	1200	09:00	3600	6	600
13	17	SB	Santry Avenue, Balcurris Road, Glasnevin Avenue	07:00	0	3	1200	09:00	3601	7	510
14	104	SB	Santry Avenue, Balcurris Road	-	-	-	-	09:30	5400	1	Single Service
15	104	NB	Balcurris Road, Santry Avenue	-	-	-	-	09:36	5800	1	Single Service
16	103	NB	Collins Avenue, Balcurris Road, Santry Avenue	-	-	-	-	09:40	6000	1	Single Service
18	103	SB	Santry Avenue, Balcurris Road, Collins Avenue	-	-	-	-	09:38	5900	1	Single Service
19	19A	SB	Glasnevin Avenue, Ballymun Road (The Rise)	07:02	110	3	1200	09:03	3800	5	650
25	19A	NB	Ballymun Road (The Rise), Glasnevin Avenue	07:02	120	3	1200	09:03	3750	5	650
21	11/A/B	SB	St Pappins Road, Ballymun Road (The Rise)	07:08	500	2	1550	09:03	3800	4	850
24	11/A/B	NB	Ballymun Road (The Rise), St Pappins Road	07:03	200	2	1700	09:05	3900	4	825
26	4	NB	Ballymun Road (The Rise), Santry Avenue, M50 Interchange	07:00	0	6	600	09:03	3800	6	560
27	4	SB	M50 Interchange, Santry Avenue, Ballymun Rd (The Rise)	07:01	100	6	600	09:03	3800	7	485

Appendix B – Traffic Flow Diagrams

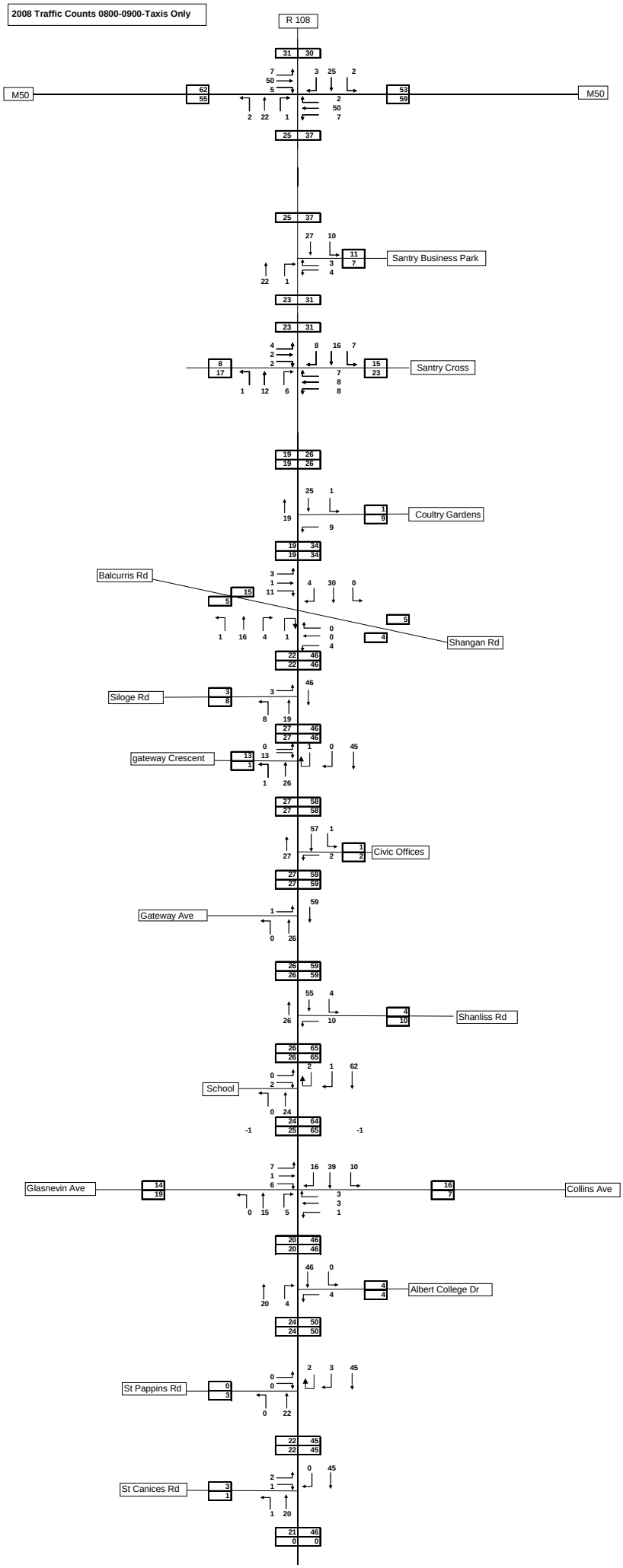
2008 Traffic Counts 0800-0900-Lights Only



2008 Traffic Counts 0800-0900-Heavies Only



2008 Traffic Counts 0800-0900-Taxis Only



Appendix C – Traffic Flow Comparisons

					Count Data				Modelled				Difference			
ID	VISSIM Counter Numbers	Road	Direction	Location	Lights	Taxis	Heavies	Vehs	Lights	Taxis	Heavies	Vehs	Lights	Taxis	Heavies	Vehs
101	101-102	R108 Ballymun Road	SB	Between Ballymun interchange and Santry Business P	1305	37	85	1427	1254	29	99	1382	-51	-8	14	-45
103	103-104	R108 Ballymun Road	NB	Between Ballymun interchange and Santry Business P	593	25	73	691	530	26	67	623	-63	1	-6	-68
105	105	Santry Business Park	EB	Business Park	306	11	31	348	360	6	26	392	54	-5	-5	44
106	106-107	Santry Business Park	WB	Business Park	272	7	39	318	272	7	39	318	0	0	0	0
109	109-110	R108 Ballymun Road	SB	Between Ballymun Business park and Santry Cross	1181	31	64	1276	1139	28	81	1248	-42	-3	17	-28
111	111-112	R108 Ballymun Road	NB	Between Ballymun Business park and Santry Cross	559	23	44	626	501	25	36	562	-58	2	-8	-64
113	113-115	R108 Ballymun Road	SB	Between Ballymun Cross and Coultry Gardens	929	26	26	981	916	24	31	971	-13	-2	5	-10
116	116-118	R108 Ballymun Road	NB	Between Balcurris Road and Balbutcher Lane	468	19	21	508	422	22	13	457	-46	3	-8	-51
119	119-122	R108 Ballymun Road	SB	Between Coultry Gardens and Shangan road	1042	34	26	1102	1031	32	31	1094	-11	-2	5	-8
123	123-125	R108 Ballymun Road	NB	Between Siloge Rd and Balcurris Road	561	22	15	598	0	0	0	0	-561	-22	-15	-598
126	126-128	R108 Ballymun Road	SB	South of Shangan Road	1151	46	22	1219	1121	53	31	1205	-30	7	9	-14
129	129-131	R108 Ballymun Road	NB	South of Gateway Avenue	648	26	15	689	612	48	8	668	-36	22	-7	-21
132	132-134	R108 Ballymun Road	SB	South of Gateway Avenue	1240	59	21	1320	1198	74	32	1304	-42	15	11	-16
141	141-143	R108 Ballymun Road	NB	Between St Alberts and Collins Avenue	679	20	7	706	610	16	6	632	-69	-4	-1	-74
144	144-146	R108 Ballymun Road	SB	Between Collins avenue and St Alberts	1297	46	17	1360	1234	15	23	1272	-63	-31	6	-88
147	147-150	R108 Ballymun Road	NB	Between St Pappins and St alberts	884	24	7	915	862	20	6	888	-22	-4	-1	-27
151	151-153	R108 Ballymun Road	SB	Between St Alberts And St Pappins	1447	50	18	1515	1356	18	24	1398	-91	-32	6	-117
154	154-156	R108 Ballymun Road	NB	Between St Canices and St Pappins	690	22	6	718	718	22	5	745	28	0	-1	27
157	157-159	R108 Ballymun Road	SB	Between St Pappins and St Canices	1536	45	17	1598	1411	16	23	1450	-125	-29	6	-148
160	160-162	R108 Ballymun Road	NB	South of St Canices	664	21	6	691	663	21	6	690	-1	0	0	-1
163	163-165	R108 Ballymun Road	SB	South of St Canices	1629	46	18	1693	1487	17	25	1529	-142	-29	7	-164
170	170	St Albert College Drive	WB	East of R108	183	4	1	188	177	4	1	182	-6	0	0	-6
171	171	St Albert College Drive	EB	East of R108	250	4	0	254	256	4	0	260	6	0	0	6
172	172	Collins Avenue	WB	East of R108	452	7	24	483	451	7	24	482	-1	0	0	-1
173	173	Collins Avenue	EB	East of R108	629	16	13	658	537	45	14	596	-92	29	1	-62
174	174	Glasnevin Avenue	WB	West of R108	487	19	20	526	485	3	26	514	-2	-16	6	-12
175	175	Glasnevin Avenue	EB	West of R108	465	14	11	490	434	14	11	459	-31	0	0	-31
176	176	School	WB	West of R108	0	0	0	0	65	3	0	68	65	3	0	68
177	177	School	EB	West of R108	0	0	0	0	15	2	0	17	15	2	0	17
178	178	Shanliss Road	WB	East of R108	355	10	3	368	356	10	3	369	1	0	0	1
179	179	Shanliss Road	EB	East of R108	82	4	1	87	70	2	1	73	-12	-2	0	-14
180	180	Gateway Avenue	WB	West of R108	29	0	1	30	32	0	0	32	3	0	-1	2
181	181	Gateway Avenue	EB	West of R108	31	1	1	33	31	1	1	33	0	0	0	0
182	182	Civic Offices	WB	East of R108	23	2	0	25	23	2	0	25	0	0	0	0
183	183	Civic Offices	EB	East of R108	97	1	0	98	104	1	0	105	7	0	0	7
184	184	Gateway Place	WB	West of R108	1	1	1	3	18	1	1	20	17	0	0	17
185	185	Gateway Place	EB	West of R108	117	13	3	133	117	13	3	133	0	0	0	0
186	186	Siloge Rd	WB	West of R108	122	8	5	135	113	6	4	123	-9	-2	-1	-12
187	187	Siloge Rd	EB	West of R108	80	3	2	85	80	3	2	85	0	0	0	0
188	188	Shangan Rd	WB	East of R108	148	4	5	157	148	4	5	157	0	0	0	0
201	201	Ballymun/ M50 Interchange	WB	M50 Off Ramp	415	9	53	477	378	3	86	467	-37	-6	33	-10
202	202-203	Ballymun/ M50 Interchange	WB	M50 Off Ramp	415	9	53	477	377	3	87	467	-38	-6	34	-10
204	204-205	Ballymun Interchange r'about (Soutl	Clockwise	Ballymun /M50 Interchange	373	5	64	442	372	4	79	455	-1	-1	15	13
206	206	M50 On Ramp	WB	Ballymun /M50 Interchange	524	5	73	602	482	5	77	564	-42	0	4	-38
207	207	M50 Off Ramp	EB	Ballymun /M50 Interchange	979	12	52	1043	991	7	57	1055	12	-5	5	12
208	208-209	Ballymun Interchange r'about (West	Clockwise	Ballymun /M50 Interchange	436	24	64	524	420	24	69	513	-16	0	5	-11
210	210-211	Ballymun Interchange r'about (Nortl	Clockwise	Ballymun /M50 Interchange	891	6	83	980	869	5	63	937	-22	-1	-20	-43
212	212-213	Ballymun Interchange r'about (East)	Clockwise	Ballymun /M50 Interchange	1263	33	96	1392	1250	30	91	1371	-13	-3	-5	-21
214	214-215	M50 On Ramp	EB	Ballymun /M50 Interchange	587	3	55	645	591	28	67	686	4	25	12	41
216	216-217	R108 on to M50 R'about	NB	Ballymun /M50 Interchange	587	25	73	685	531	26	67	624	-56	1	-6	-61
218	218-219	M50 Westbound	WB	East of Roundabout	1757		258	2015	1745	61	405	2211	-12	61	147	196
220	220-221	M50 Eastbound	EB	East of Roundabout	1809		317	2126	2030	49	291	2370	221	49	-26	244
222	222-223	M50 Eastbound	EB	West of Roundabout	1809		317	2126	2018	50	288	2356	209	50	-29	230
224	224-225	M50 Westbound	WB	West of Roundabout	1757		258	2015	1747	61	405	2213	-10	61	147	198
226	226	R108	SB	North of Ballymun Road Interchange	587	30	68	685	587	30	67	684	0	0	-1	-1
227	227	R108	NB	North of Ballymun Road Interchange	524	31	33	588	543	26	62	631	19	-5	29	43

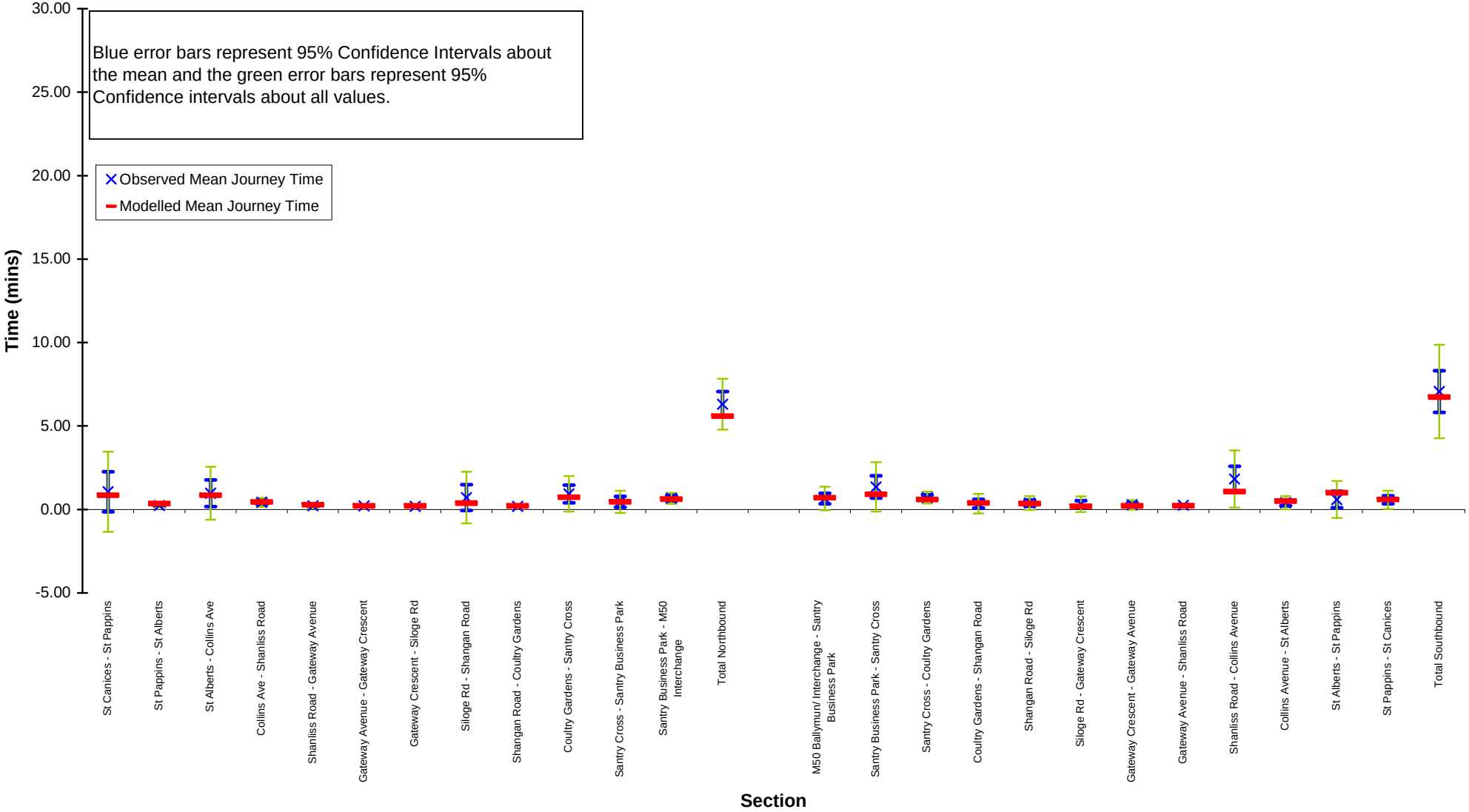
SUMMARY - Entry/Exit Links Only	Lights	Taxis	Heavies
GEH less than 5	95%	84%	97%
GEH less than 7	97%	100%	100%
GEH less than 10	97%	100%	100%
Flows within 100 for flows less than 700	96%	100%	100%
Flows within 15% for flows 700 – 2,700 vph	100%	-	-

SUMMARY - Between Junctions Only	Lights	Taxis	Heavies
GEH less than 5	94%	92%	88%
GEH less than 7	100%	100%	88%
GEH less than 10	100%	100%	100%
Flows within 100 for flows less than 700	100%	100%	88%
Flows within 15% for flows 700 – 2,700 vph	100%	-	-

SUMMARY - All Links	Lights	Taxis	Heavies
GEH less than 5	94%	86%	94%
GEH less than 7	98%	100%	96%
GEH less than 10	98%	100%	100%
Flows within 100 for flows less than 700	97%	100%	96%
Flows within 15% for flows 700 – 2,700 vph	100%	-	-

Appendix D – Journey Time Comparisons

ID	Section Description	Observed	Modelled	Difference	% Difference	Within Confidence Interval about mean	Within Confidence Interval about all values
201	St Canices - St Pappins	64	50	-14	-21%	yes	yes
202	St Pappins - St Alberts	14	19	4	31%	yes	yes
203	St Alberts - Collins Ave	59	55	-3	-6%	yes	yes
204	Collins Ave - Shanliss Road	26	27	1	4%	yes	yes
205	Shanliss Road - Gateway Avenue	14	17	3	20%	yes	yes
206	Gateway Avenue - Gateway Crescent	13	14	1	11%	yes	yes
207	Gateway Crescent - Siloge Rd	12	13	1	12%	yes	yes
208	Siloge Rd - Shangan Road	43	23	-21	-48%	yes	yes
209	Shangan Road - Coultry Gardens	11	12	1	13%	yes	yes
210	Coultry Gardens - Santry Cross	56	43	-13	-23%	yes	yes
211	Santry Cross - Santry Business Park	28	28	0	1%	yes	yes
212	Santry Business Park - M50 Interchange	40	37	-3	-8%	yes	yes
NB	**Total Northbound**	**379**	**338**	**-41**	**-11%**	**yes**	**yes**
101	M50 Ballymun/ Interchange - Santry Business Park	39	42	2	6%	yes	yes
102	Santry Business Park - Santry Cross	81	55	-26	-32%	yes	yes
103	Santry Cross - Coultry Gardens	43	35	-8	-19%	yes	yes
104	Coultry Gardens - Shangan Road	21	22	1	5%	yes	yes
105	Shangan Road - Siloge Rd	23	21	-2	-7%	yes	yes
106	Siloge Rd - Gateway Crescent	19	12	-7	-38%	yes	yes
107	Gateway Crescent - Gateway Avenue	17	12	-4	-26%	yes	yes
108	Gateway Avenue - Shanliss Road	15	13	-2	-13%	yes	yes
109	Shanliss Road - Collins Avenue	110	72	-38	-35%	yes	yes
110	Collins Avenue - St Alberts	24	33	8	35%	yes	yes
111	St Alberts - St Pappins	36	69	33	91%	no	yes
112	St Pappins - St Canices	35	37	2	5%	yes	yes
SB	**Total Southbound**	**424**	**423**	**-1**	**0%**	**yes**	**yes**


Blue error bars represent 95% Confidence Intervals about the mean and the green error bars represent 95% Confidence intervals about all values.
Observed Mean Journey Time
Modelled Mean Journey Time
Time (mins)
30.00
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
St Canices - St Pappins
St Pappins - St Alberts
St Alberts - Collins Ave
Collins Ave - Shaniss Road
Shaniss Road - Gateway Avenue
Gateway Avenue - Gateway Crescent
Gateway Crescent - Siloge Rd
Siloge Rd - Shangan Road
Shangan Road - Coultry Gardens
Coultry Gardens - Santry Cross
Santry Cross - Santry Business Park
Santry Business Park - M50 Interchange
Total Northbound
M50 Ballymun/ Interchange - Santry Business Park
Santry Business Park - Santry Cross
Santry Cross - Coultry Gardens
Coultry Gardens - Shangan Road
Shangan Road - Siloge Rd
Siloge Rd - Gateway Crescent
Gateway Crescent - Gateway Avenue
Gateway Avenue - Shaniss Road
Shaniss Road - Collins Avenue
Collins Avenue - St Alberts
St Alberts - St Pappins
St Pappins - St Canices
Total Southbound
Section

MVA Consultancy provides advice on transport and other policy areas, to central, regional and local government, agencies, developers, operators and financiers.

A diverse group of results-oriented people, we are part of a 350-strong team worldwide. Through client business planning, customer research and strategy development we create solutions that work for real people in the real world.

For more information visit www.mvaconsultancy.com

Birmingham
Second Floor, 37a Waterloo Street
Birmingham B2 5TJ United Kingdom
T: +44 (0)121 233 7680 F: +44 (0)121 233 7681

Dubai
PO Box 123166 Dubai, 803 - 805 Arbift Tower
Baniyas Road, Deira, Dubai UAE
T: +971 (0)4 223 0144 F: +971 (0)4 223 1088

Dublin
First Floor, 12/13 Exchange Place
Custom House Docks, IFSC, Dublin 1, Ireland
T: +353 (0)1 542 6000 F: +353 (0)1 542 6001

Edinburgh
Stewart House, Thistle Street, North West Lane
Edinburgh EH2 1BY United Kingdom
T: +44 (0)131 220 6966 F: +44 (0)131 220 6087

Glasgow
Seventh Floor, 78 St Vincent Street
Glasgow G2 5UB United Kingdom
T: +44 (0)141 225 4400 F: +44 (0)141 225 4401

London
Second Floor, 17 Hanover Square
London W1S 1HU United Kingdom
T: +44 (0)20 7529 6500 F: +44 (0)20 7529 6556

Lyon
11, rue de la République, 69001 Lyon, France
T: +33 (0)4 72 10 29 29 F: +33 (0)4 72 10 29 28

Manchester
25th Floor, City Tower, Piccadilly Plaza
Manchester M1 4BT United Kingdom
T: +44 (0)161 236 0282 F: +44 (0)161 236 0095

Marseille
76, rue de la République, 13002 Marseille, France
T: +33 (0)4 91 37 35 15 F: +33 (0)4 91 91 90 14

Paris
12-14, rue Jules César, 75012 Paris, France
T: +33 (0)1 53 17 36 00 F: +33 (0)1 53 17 36 01

Woking
First Floor, Dukes Court, Duke Street
Woking, Surrey GU21 5BH United Kingdom
T: +44 (0)1483 728051 F: +44 (0)1483 755207

Email: info@mvaconsultancy.com

Offices also in
Bangkok, Beijing, Hong Kong, Shenzhen and Singapore

mvaconsultancy

MVA Consultancy provides advice on transport and other policy areas, to central, regional and local government, agencies, developers, operators and financiers.

A diverse group of results-oriented people, we are part of a 350-strong team worldwide. Through client business planning, customer research and strategy development we create solutions that work for real people in the real world.

For more information visit www.mvaconsultancy.com

Birmingham
Second Floor, 37a Waterloo Street
Birmingham B2 5TJ United Kingdom
T: +44 (0)121 233 7680 F: +44 (0)121 233 7681

Dubai
PO Box 123166 Dubai, 803 - 805 Arbift Tower
Baniyas Road, Deira, Dubai UAE
T: +971 (0)4 223 0144 F: +971 (0)4 223 1088

Dublin
First Floor, 12/13 Exchange Place
Custom House Docks, IFSC, Dublin 1, Ireland
T: +353 (0)1 542 6000 F: +353 (0)1 542 6001

Edinburgh
Stewart House, Thistle Street, North West Lane
Edinburgh EH2 1BY United Kingdom
T: +44 (0)131 220 6966 F: +44 (0)131 220 6087

Glasgow
Seventh Floor, 78 St Vincent Street
Glasgow G2 5UB United Kingdom
T: +44 (0)141 225 4400 F: +44 (0)141 225 4401

London
Second Floor, 17 Hanover Square
London W1S 1HU United Kingdom
T: +44 (0)20 7529 6500 F: +44 (0)20 7529 6556

Lyon
11, rue de la République, 69001 Lyon, France
T: +33 (0)4 72 10 29 29 F: +33 (0)4 72 10 29 28

Manchester
25th Floor, City Tower, Piccadilly Plaza
Manchester M1 4BT United Kingdom
T: +44 (0)161 236 0282 F: +44 (0)161 236 0095

Marseille
76, rue de la République, 13002 Marseille, France
T: +33 (0)4 91 37 35 15 F: +33 (0)4 91 91 90 14

Paris
12-14, rue Jules César, 75012 Paris, France
T: +33 (0)1 53 17 36 00 F: +33 (0)1 53 17 36 01

Woking
First Floor, Dukes Court, Duke Street
Woking, Surrey GU21 5BH United Kingdom
T: +44 (0)1483 728051 F: +44 (0)1483 755207

Email: info@mvaconsultancy.com

Offices also in
Bangkok, Beijing, Hong Kong, Shenzhen and Singapore

mvaconsultancy

Railway Procurement Agency
Ghníomaireacht um Fháil Iarnród
Parkgate Business Centre,
Parkgate Street, Dublin 8, Ireland
Phone +353 1 646 3400
Fax +353 1 646 3401
www.rpa.ie

Responsible for

LUAS METRO Integrated Ticketing System

With funding and support from

transport21 progress in motion

NDP National Development Plan 2007 - 2013

EUROPEAN REGIONAL DEVELOPMENT FUND