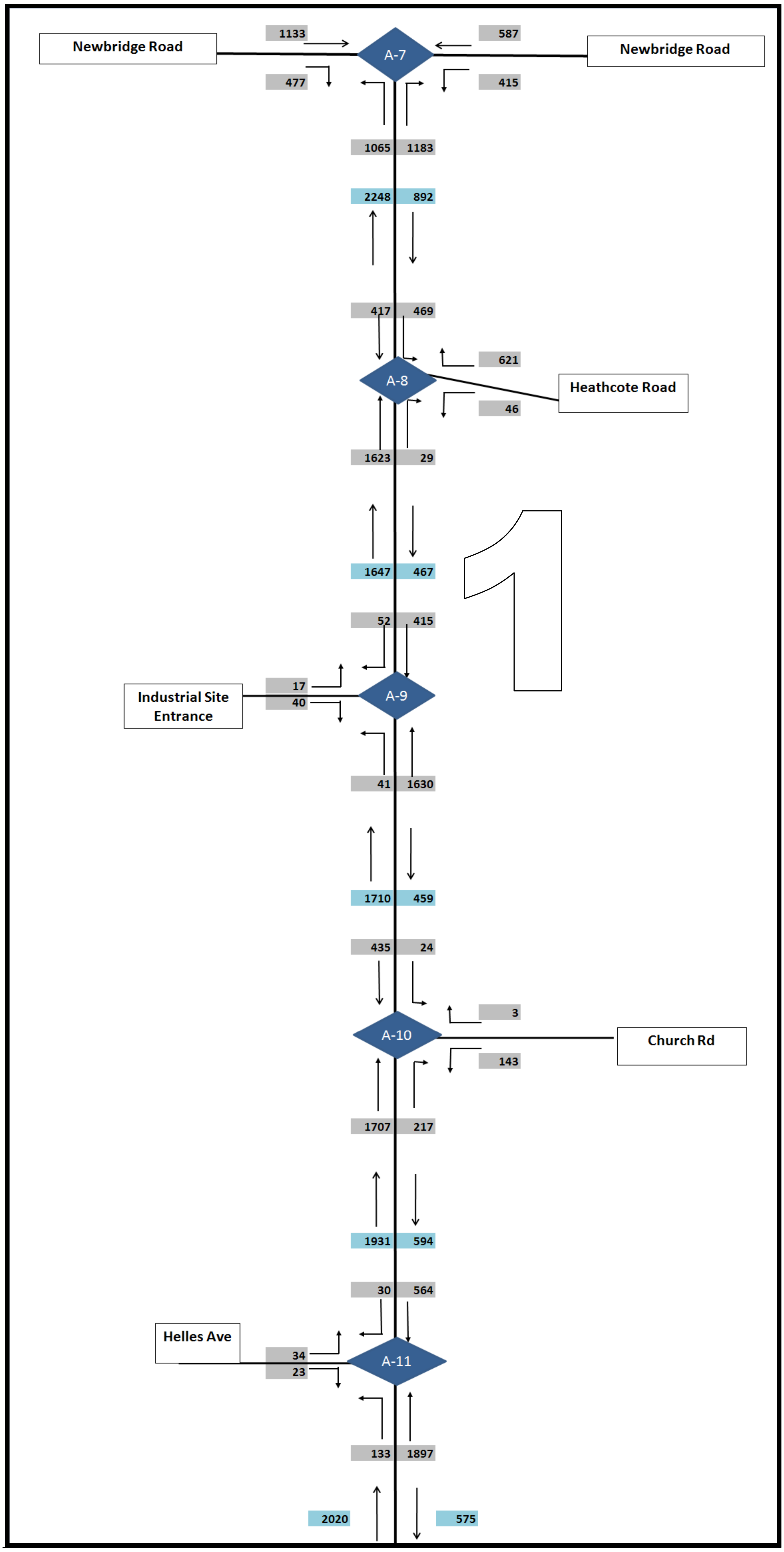
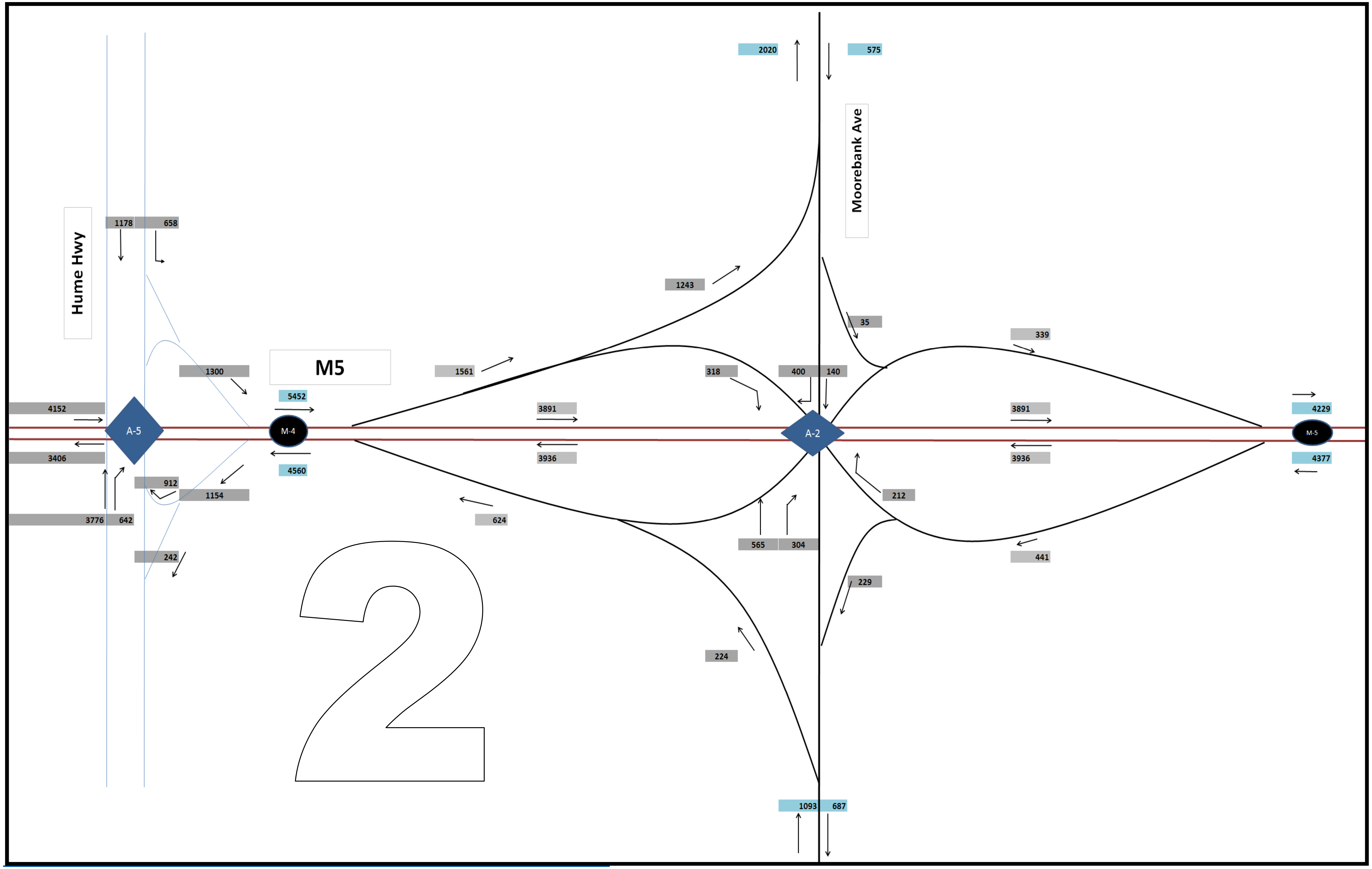
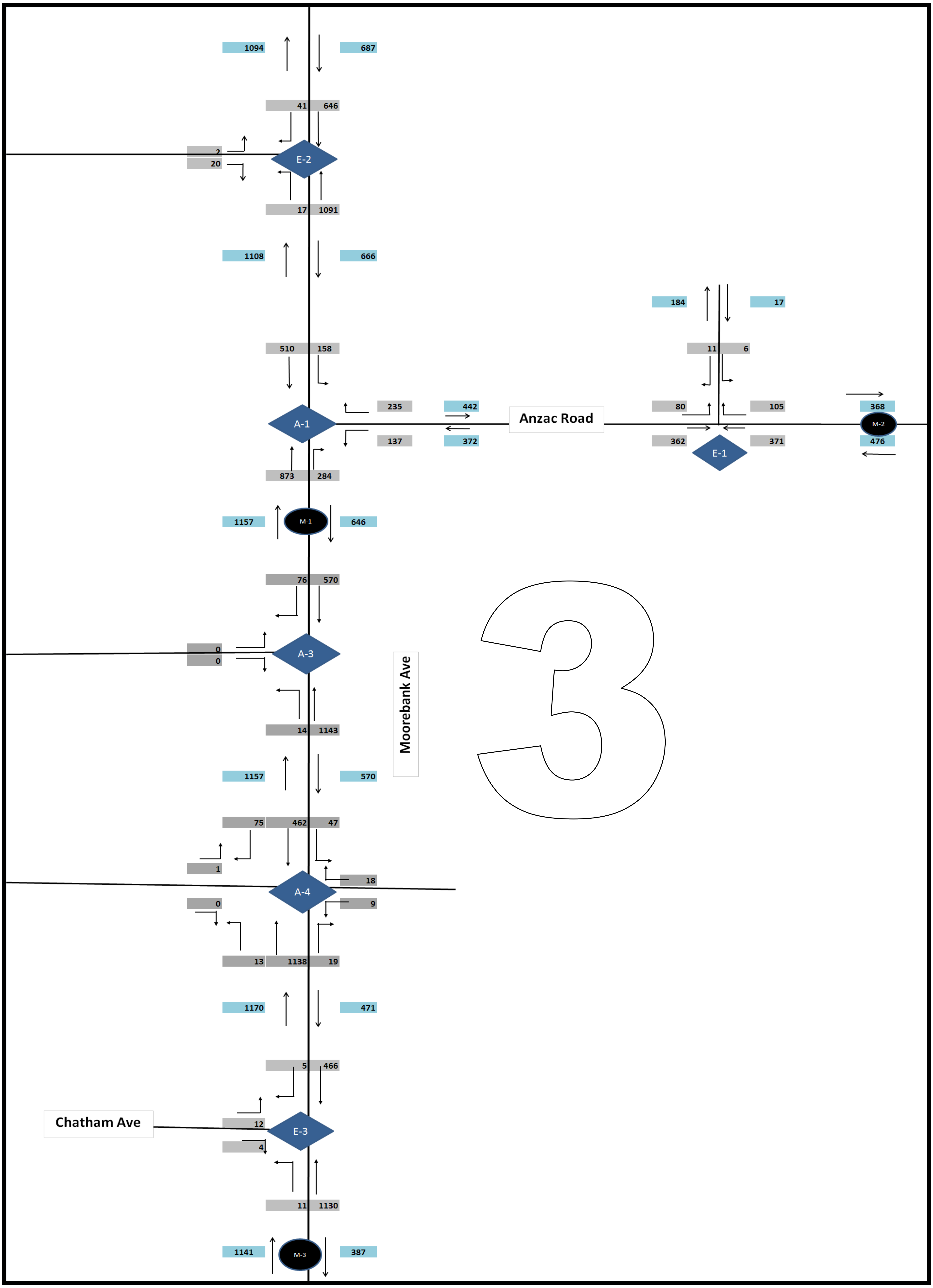
The following Figures show the hourly turn and link count diagrams for the AM and PM peak periods. The Stick diagrams are split in three sections as of the following figure.

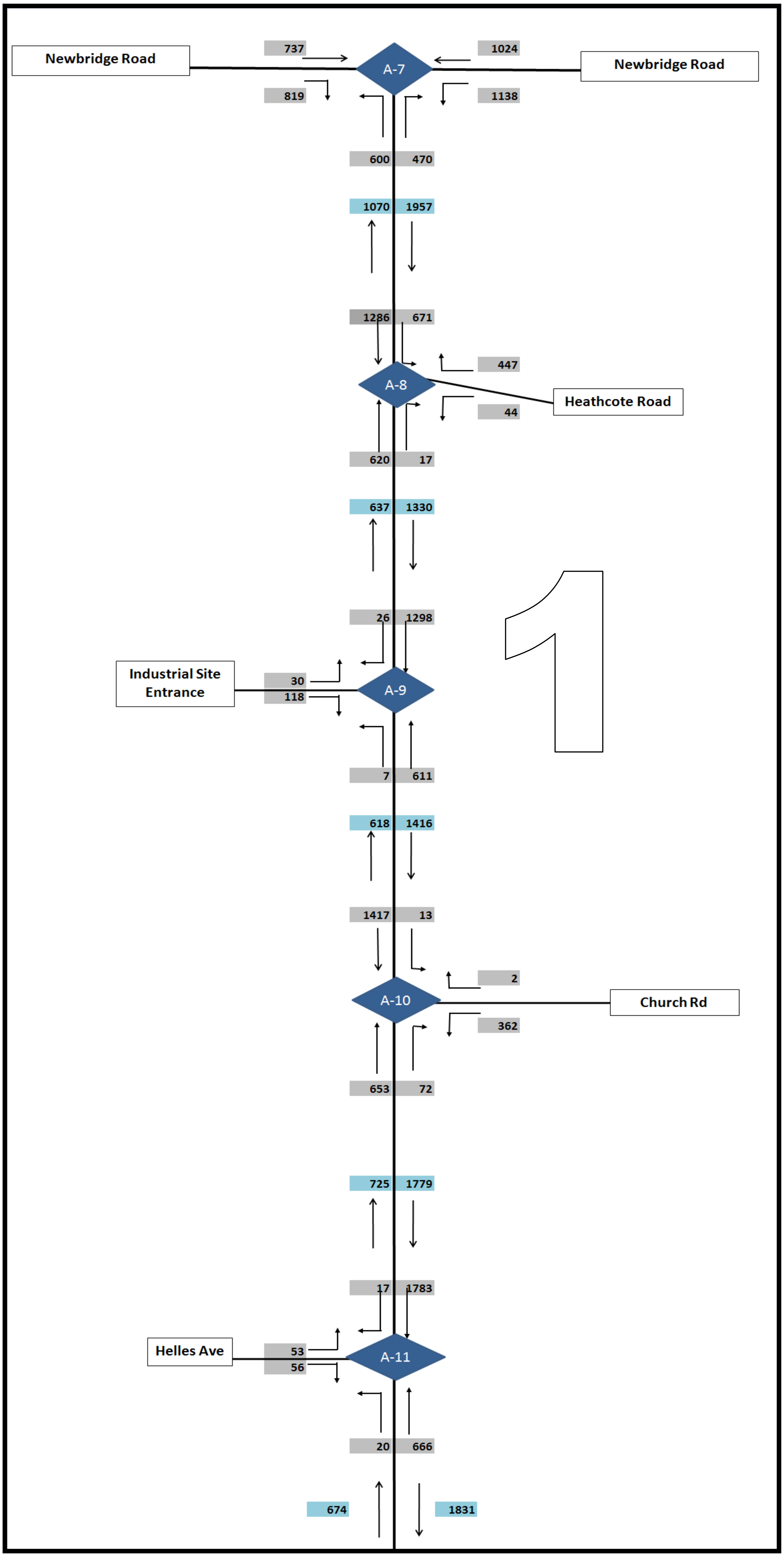
AM Peak Turn and Link Counts Stick Diagram

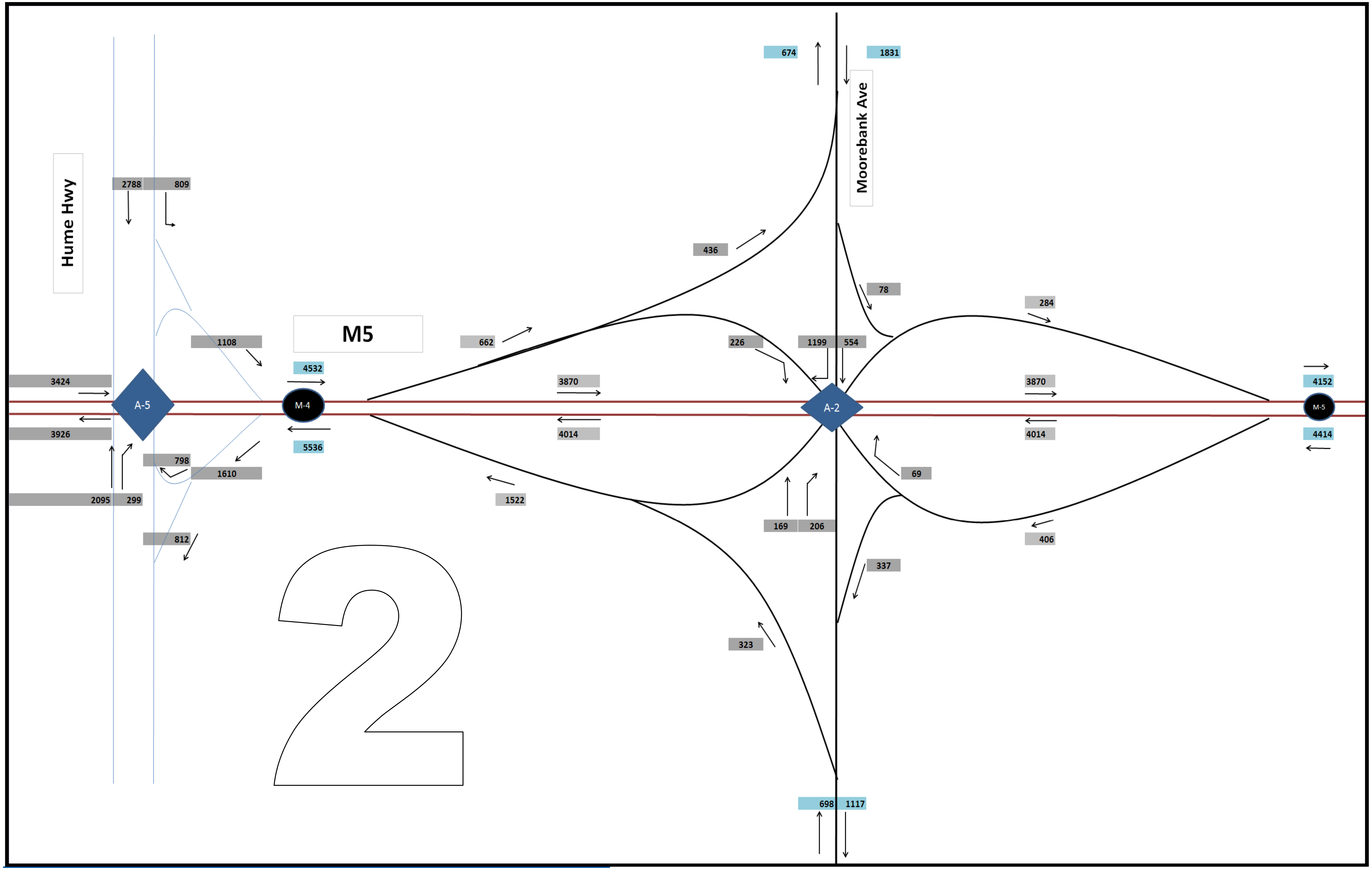


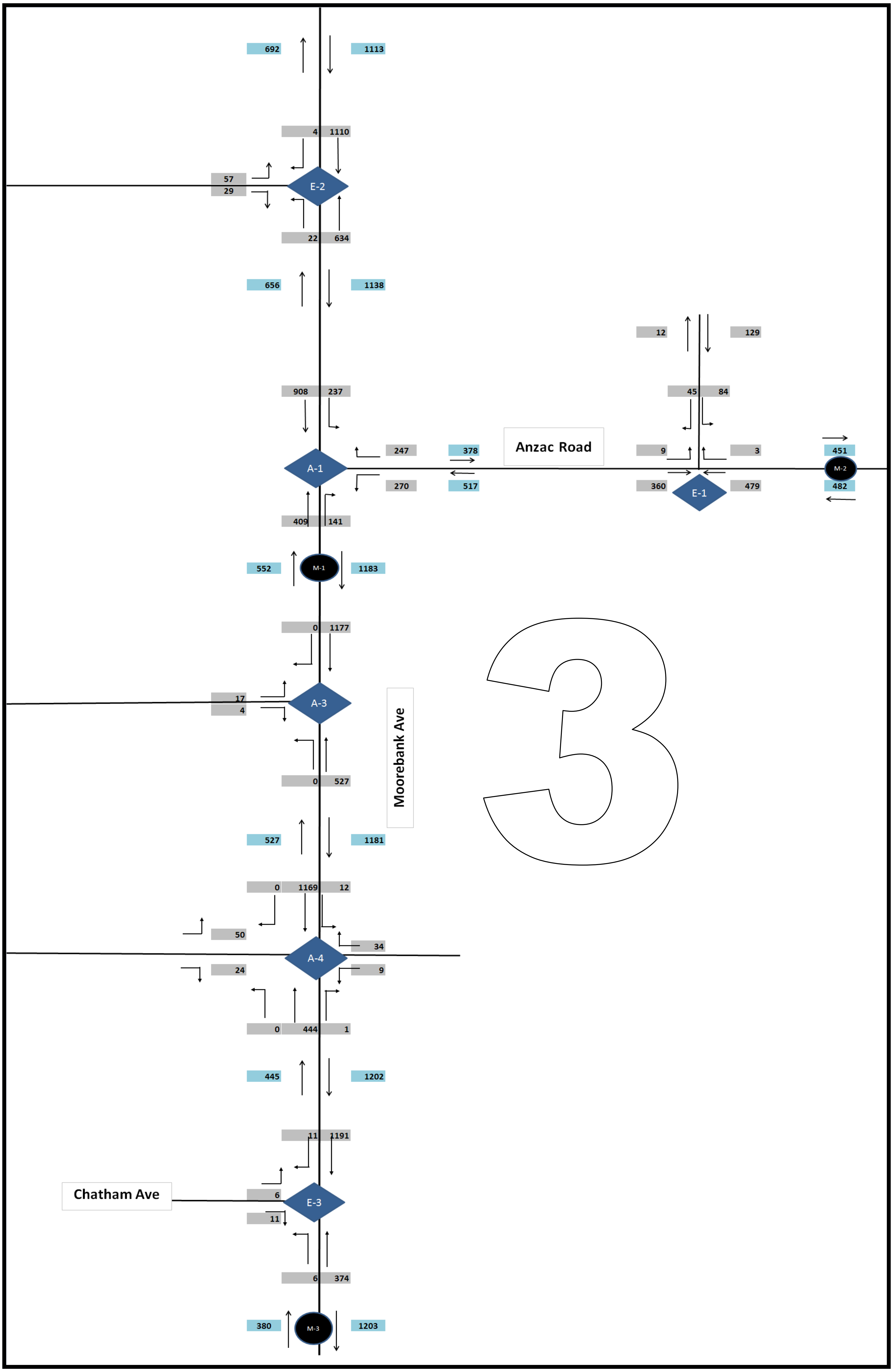

Hume Hwy
M5
Moorebank Ave
A-5
M-4
A-2
M-5
2
2020
575
1178
658
1243
35
339
1300
1561
318
400
140
5452
4152
3891
3891
4229
3406
3936
3936
4377
4560
912
1154
212
624
3776
642
565
304
441
242
229
224
1093
687


1094
687
41
646
2
20
E-2
17
1091
1108
666
184
17
510
158
11
6
A-1
235
442
Anzac Road
80
105
368
M-2
137
372
362
E-1
371
476
873
284
1157
M-1
646
76
570
0
0
A-3
Moorebank Ave
3
14
1143
1157
570
75
462
47
1
18
A-4
0
9
13
1138
19
1170
471
5
466
Chatham Ave
12
E-3
4
11
1130
1141
M-3
387

PM Peak Turn and Link Counts Stick Diagram




Hume Hwy
M5
Moorebank Ave
2788
809
1108
4532
3424
3926
5536
798
1610
2095
299
812
662
3870
4014
1522
436
674
1831
78
226
1199
554
284
4152
4414
69
169
206
406
337
323
698
1117
A-5
M-4
A-2
M-5
2


692
1113
4
1110
57
29
E-2
22
634
656
1138
12
129
908
237
45
84
Anzac Road
247
378
9
3
451
A-1
M-2
270
517
360
E-1
479
482
409
141
552
M-1
1183
0
1177
3
17
4
A-3
Moorebank Ave
0
527
527
1181
0
1169
12
50
34
A-4
24
9
0
444
1
445
1202
11
1191
Chatham Ave
6
E-3
11
6
374
380
M-3
1203

APPENDIX C

INNER AREA PARAMICS MODEL DEVELOPMENT, CALIBRATION AND VALIDATION

C1. MODEL DEVELOPMENT

Appendix C of this report documents calibration and validation of the inner area micro-simulation models.

Quadstone Paramics Microsimulation Package (Version 6.6.1) was used for modelling.

The Paramics models were developed for both AM peak and PM peak periods:

- AM peak period between 7:00 and 9:00, and
- PM peak period between 15:00 and 18:00.

C1.1 Road Links

Previous Figure 6 in this report shows Paramics modelling network for inner area.

The following road key roads were coded in the microsimulation models:

- **M5 Motorway** – Between F5 Freeway and Nuwarra Road overpass, including M5 interchanges with M7 Motorway, Hume Hwy, Moorebank Avenue and Heathcote Road.
- **Hume Highway and Campbelltown Road** – Between Hoxton Park Road and Hume Highway / Campbelltown Road overpass. This section includes a six lane divided highway and a major interchange with the M5 Motorway.
- **Moorebank Avenue** – Between Cambridge Avenue and Newbridge Road. This section mainly includes two lane undivided road (one lane each direction) up to south of its intersection with the M5 and provides a north-south link between Liverpool and Glenfield.
- **Heathcote Road** – Between Newbridge Road and Macarthur Drive. This road is generally a four-lane major road and extends north-south between Moorebank and Heathcote, where it links to the Southern Freeway (F6).
- **Anzac Road** – Anzac Road is an east-west local road that connects Moorebank Avenue and Heathcote Road. It provides access to Moorebank Business Park and the residential area of Wattle Grove. This is generally a two lane undivided road.
- **Cambridge Avenue and Glenfield Road** – Between Moorebank Avenue and Campbelltown Road.
- **Macquarie Street / Terminus Street / Newbridge** – Between Hoxton Park Road and Nuwarra Road. These roads provide east-west access to Liverpool.
- **Camden Valley Way** – Between Ash Road and Campbelltown Road. This road provides access to M7 / M5 Motorway and Hume Highway.

C1.2 Intersection Control

In total 22 traffic junctions were coded and included in the micro simulation models. Table C1 shows the intersection description and control type.

Table C1 Major intersections in the microsimulation model

ID	Intersection/Interchange	Intersection Type	Control Type
	M5 Motorway and		
	M7 Motorway	Grade separated	Interchange
A-5	Hume Highway	Grade separated	Signal
A-2	Moorebank Avenue	Grade separated	Signal
I-36	Heathcote Road	Grade separated	Signal
	Moorebank Avenue and		
A-13	Chatham Avenue	At-grade	Signal
A-3, A-4	Car park access	At-grade	Priority
A-1	Anzac Road	At-grade	Signal
A-11	Helles Avenue	At-grade	Priority
A-10	Church Road	At-grade	Priority
A-13	M5 Industrial Park access road	At-grade	Priority
A-9	M5 Industrial Park access road	At-grade	Signal
A-8	Heathcote Road	At-grade	Signal
A-7	Newbridge Road	At-grade	Signal
	Hume Highway and		
B-10	Hoxton Park Road / Macquarie Street	At-grade	Signal
B-9	Congressional Place / Reilly Street	At-grade	Signal
B-8	De Meyrick Avenue	At-grade	Signal
B-2	Camden Valley Way / Campbelltown Road	At-grade	Signal
	Newbridge Road and		
B-15	Nuwarra Road	At-grade	Signal
B-14	Stockton Avenue	At-grade	Signal
B-13	Speed Street	At-grade	Signal
I-29	Heathcote Road and Nuwarra Road	At-grade	Signal
A-6	Cambridge Avenue and Canterbury Road	At-grade	Roundabout

C1.3 Traffic Survey Data

Section 3.1 of Transport and Accessibility Impact Assessment Report documented traffic surveys undertaken for the inner area.

C1.4 Public Transport

Following fixed bus routes were coded in the models including:

- 851: Carnes Hill – Liverpool;
- 855: Austral – Bringelly – Narellan – Liverpool;
- 864: Carnes Hill – Glenfield via Hornigsea Park;
- 865: Casula – Liverpool via Lurnea;
- 867: Prestons – Glenfield via Prestons;
- 870: Campbelltown – Ingleburn – Liverpool;
- 900: Strathfield Station – Liverpool;
- 901: Liverpool – Holsworthy;
- 902: Liverpool – Holsworthy; and
- 903: Liverpool – Chipping Norton.

C2. RMS Standards for Paramics Modelling

C2.1 Paramics flies

The following RMS standard Paramics files were incorporated in the models

- Vehicles;
- Categories;
- Configuration;
- Acceleration Profiles; and
- Behaviour.

C2.2 Traffic assignment

For inner area Paramics modelling dynamic feedback assignment method was used. Perturbation was set to the default values 5% (using the Percentage Algorithm) according to the RMS's default value. With this option enabled, link costs are perturbed for each individual vehicle on a random basis. This means vehicles travelling between the same origin and destination with multiple routing options with up to 5% difference in the drivers' perceived costs can be assigned on different routes. Feedback smoothing was applied to successive feedback periods.

C2.3 Additional techniques

Additional Paramics techniques were used to adjust model parameters to replicate the existing traffic conditions. They are defined as follow:

- Next Lanes – Forcing into the correct lanes and avoiding the attractive but incorrect lanes which the vehicles should not move into;
- Cost Factor – The effect of this is to improve the attractiveness of major links to vehicles;
- Sign Posting – Increasing the signposting distance as long as possible, which is often subject to the link length to improve earlier lane changes and reduce unrealistic congestion/weaving;
- Node Blocking – Avoiding vehicle staying at signalised intersection where congestion occurs;
- Force Merge / Across – Forcing turning vehicle to cross the oncoming traffic after they have been delayed for some time where oncoming traffic leaves a gap at non-signalised intersection. This function was mainly activate when minor traffic tries to merge or turn into heavily congested/queued major stream;
- Reaction Factor – The Mean Driver Reaction Time for all vehicles on the link can be modified using this factor. This factor is mainly applied on links to reduce shockwave effect where drivers are aware of the surrounding condition;
- Headway Factor – The Mean Target Headway for all vehicles on the link can be modified using the factor. This factor is applied on high volume/low speed links where appropriate; and
- Approach Visibility – This function specifies length from an intersection that vehicle will be able to visibly see conflicts and judge if they will have to yield.

The model parameters are documented as per RMS's standard pro-forma. Should RMS requires a copy of model parameters for auditing, Hyder can provide them on request.

C2.4 Road Network Coding

Aerial photography and design drawing were primarily utilised to code the road network for the base model. The geo-reference aerial photography provided adequate information for the network coding task including road length, lane width, and number of lanes, lane discipline and intersection configurations. The model network was coded in the RMS Lamberts 94 coordinate system as per the RMS's recommendations. A link types and categories were coded based on the RMS Paramics manual.

C2.5 Signal Coding

Signal timing and phasing was coded as fixed time based on IDM record (SCATS data). During site visit signal timing and phasing was verified. .

C3. TRAFFIC DEMAND

CA3.1 Source of Traffic Demand

The Paramics demand matrix was estimated using Hyder's own Sydney Strategic Traffic Model (SSTM) via a sub-area modelling technique. The SSTM sub area model contained about 58 travel zones. Further travel zones and network refinement were undertaken in Paramics. A total 67 travel zones are modelled in Paramics. The sub area demand matrix was calibrated using traffic counts data collected for this study.

Figures C1 and C2 show the zoning system used in SSTM's sub-area and Paramics models respectively.

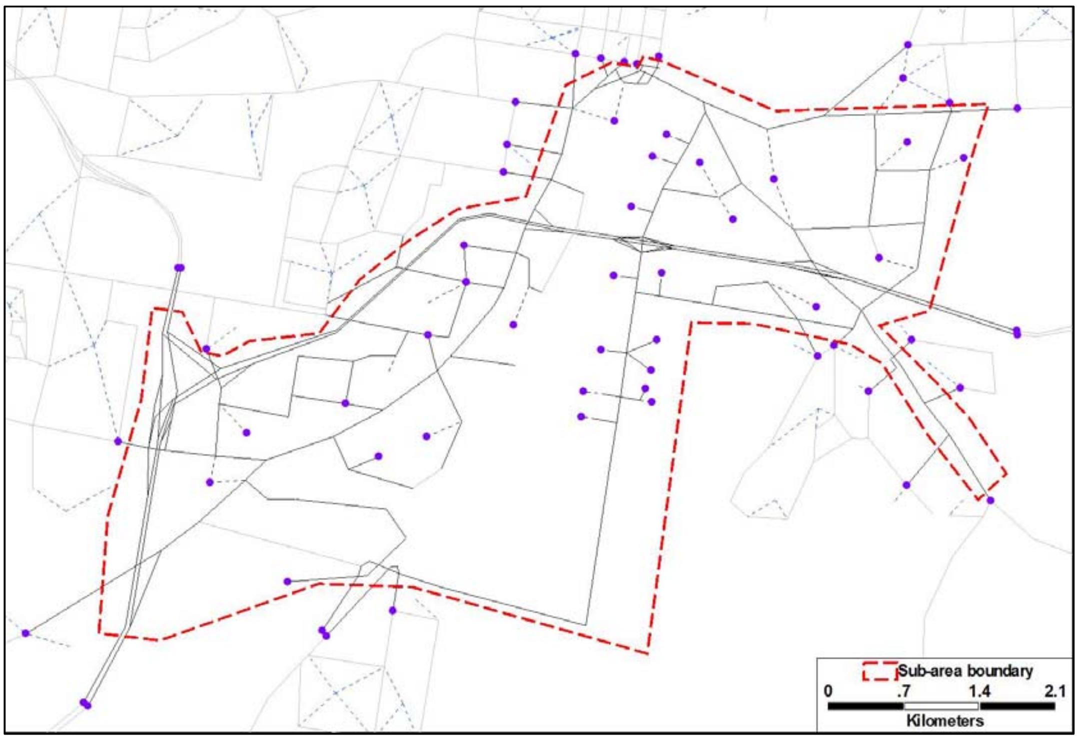


Figure C1 Zoning system in SSTM's sub-area

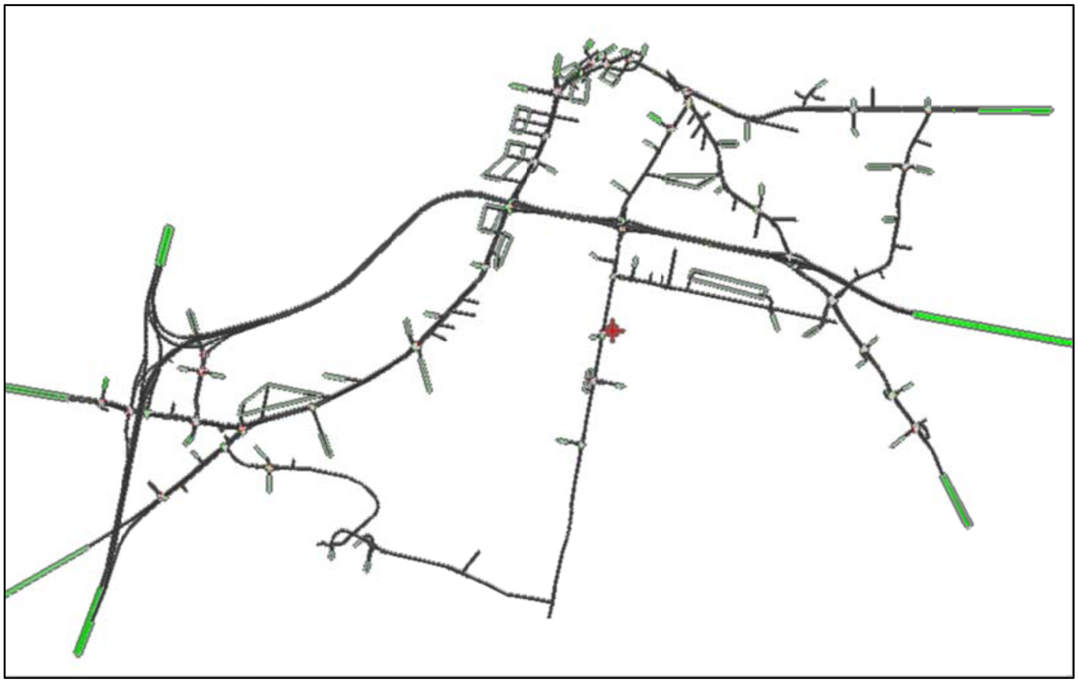


Figure C2 Zoning system in Paramics models

C3.2 Vehicle Classification

The demand matrices were produced for three main vehicle classes of:

- Light vehicle
- Truck/Bus
- Semi-Trailer and B-Double

Table C2 shows the proportion of vehicles in the matrices. The proportions have been modified according to the RTA Paramics guideline.

Table C2 Vehicle type proportion in the Paramics models

Matrix Number	Vehicle Type	Paramics Car Type	Proportion In Paramics Matrices
1	Private Car (Small)	type 1 car	31.223
	Private Car (Medium)	type 2 car	42.437
	Private Car (Large)	type 3 car	24.835
	Taxi	type 4 car	1.504
2	LGV	type 5 LGV	55.931
	STA Mini Bus – fixed	type 6 minibus	fixed route
	Non STA Mini Bus - fixed	type 7 minibus	fixed route
	STA Bus – fixed	type 8 bus	fixed route
	fixed route	fixed route	fixed route
	OD Bus	type 10 bus	0.786
	Rigid (Light)	type 11 OGV1	5.263
	Rigid (Medium)	type 12 OGV1	32.757
	Rigid (Heavy)	type 13 OGV1	5.263
3	Semi Trailer (Light)	type 14 OGV2	12.264
	Semi Trailer (Medium)	type 15 OGV2	69.811
	Semi Trailer (Heavy)	type 16 OGV2	12.264
	B-Double (Light)	type 17 OGV2	0.943
	B-Double (Medium)	type 18 OGV2	3.774
	B-Double (Heavy)	type 19 OGV2	0.943

C3.3 Temporal Distribution

Temporal traffic profiles for the inner area models were developed for 15-minute time slice for the entire simulation periods based on observed traffic flows data. About 28 directional traffic data was used to estimate sector-to-sector demand release profiles. About 13 sectors were identified for the modelling study area (see Figure A3).

In addition, 30 minutes warm-up and 30 minutes cool-down periods were applied based on the observed data.

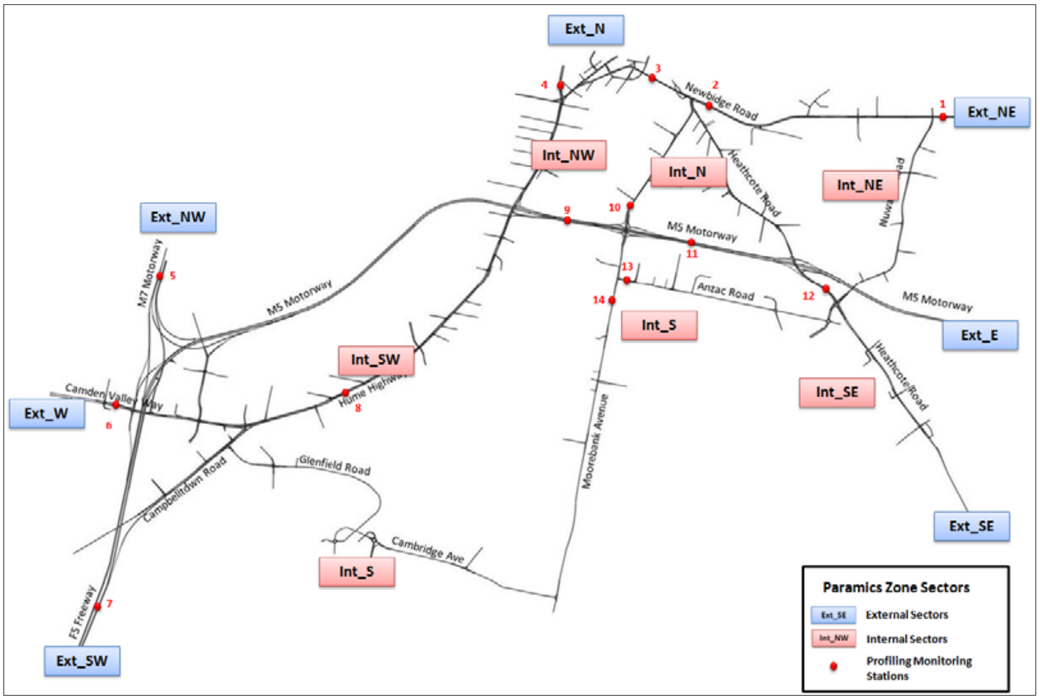


Figure C3 Paramics zone sections and profile monitoring stations

C4. CALIBRATION

The base year models were calibrated against set of survey data. Model calibration is the process that adjusts model parameters to adequately reflect the observed traffic behaviour and condition in the study area. The microsimulation calibration main guidelines were based on the following sources:

- RMS's Paramics Microsimulation Modelling Version 1.0 issued in May 2009,
- UK Design Manual for Road and Bridge (DMRB) issued by the Highway Agency, UK and last amended in November 2009.

C4.1 Link Flows and Intersection Turn Volumes

Individual link flows and intersection turning volumes have been assessed based on the calibration criteria. Tables C3 and C4 summarise the calibration results for AM and PM peak models. Tables C5 and C6 show link flow comparison for AM and PM peak models. Should RMS require a copy of turn flows comparison at individual intersections, Hyder can provide them on request.

The model calibration results summarised in this section demonstrate that both AM and PM peak models are calibrated adequately and models are fit for purpose.

Table C3 2010 AM peak Paramics model calibration summary

Link Flows		
Individual links		
Number of individual link flows (by direction)	22	
< 700 vhp	*3*	
700 - 2,700 vhp	*10*	
> 2,700 vhp	*9*	
Average link flow	2359	vph
Meet the assessment criteria (UK-DMRB)	**Target**	**Achieved**
Difference in link flow within 100 for flows <700 vph	85%	100%
Difference in link flow within 15% for flows 700-2,700 vph	85%	100%
Difference in link flow within 400 for flows >2700 vph	85%	89%
Difference of total screen line flows	10%	3%
GEH Statistic less than 5 of all individual modelled flow	85%	95%
Intersection Turning Volunms		
Number of turn flows	199	(24 intersections)
< 700 vhp	*154*	
700 - 2,700 vhp	*43*	
> 2,700 vhp	*2*	
Average turn flow	422	vph
Meet the assessment criteria (UK-DMRB)	**Target**	**Achieved**
Difference in link flow within 100 for flows <700 vph	85%	93%
Difference in link flow within 15% for flows 700-2,700 vph	85%	88%
Difference in link flow within 400 for flows >2,700 vph	85%	100%
GEH Statistic less than 5 of all individual modelled flow	85%	83%
Demand Release		
Meet the assessment criteria (RTA Guideline)	**Target**	**Achieved**
Release for the base model	100%	100%

Model code: 2010 AM_TZ067_BC_RevH

Table C4 2010 PM peak Paramics model calibration summary

Link Flows		
Individual links		
Number of individual link flows (by direction)	22	
< 700 vhp	*3*	
700 - 2,700 vhp	*10*	
> 2,700 vhp	*9*	
Average link flow	2409	vph
Meet the assessment criteria (UK-DMRB)	**Target**	**Achieved**
Difference in link flow within 100 for flows <700 vph	85%	100%
Difference in link flow within 15% for flows 700-2,700 vph	85%	90%
Difference in link flow within 400 for flows >2700 vph	85%	89%
Difference of total screen line flows	10%	2%
GEH Statistic less than 5 of all individual modelled flow	85%	91%
Intersection Turning Volunms		
Number of turn flows	199	(24 intersections)
< 700 vhp	*155*	
700 - 2,700 vhp	*41*	
> 2,700 vhp	*3*	
Average turn flow	Mean Flow	vph
Meet the assessment criteria (UK-DMRB)	**Target**	**Achieved**
Difference in link flow within 100 for flows <700 vph	85%	94%
Difference in link flow within 15% for flows 700-2,700 vph	85%	85%
Difference in link flow within 400 for flows >2,700 vph	85%	100%
GEH Statistic less than 5 of all individual modelled flow	85%	83%
Demand Release		
Total vehicle demand input to network (From Demand Modelling)		
Modelled - Total vehicles released from the zones in Paramics	94,491	
Modelled - Total vehicles Blocked in the zones	757	
Meet the assessment criteria (RTA Guideline)	**Target**	**Achieved**
Release for the base model	100%	99.2%

Model code: 2010 PM_TZ067_BC_RevC

Table C5 Comparisons of link flows - AM Peak

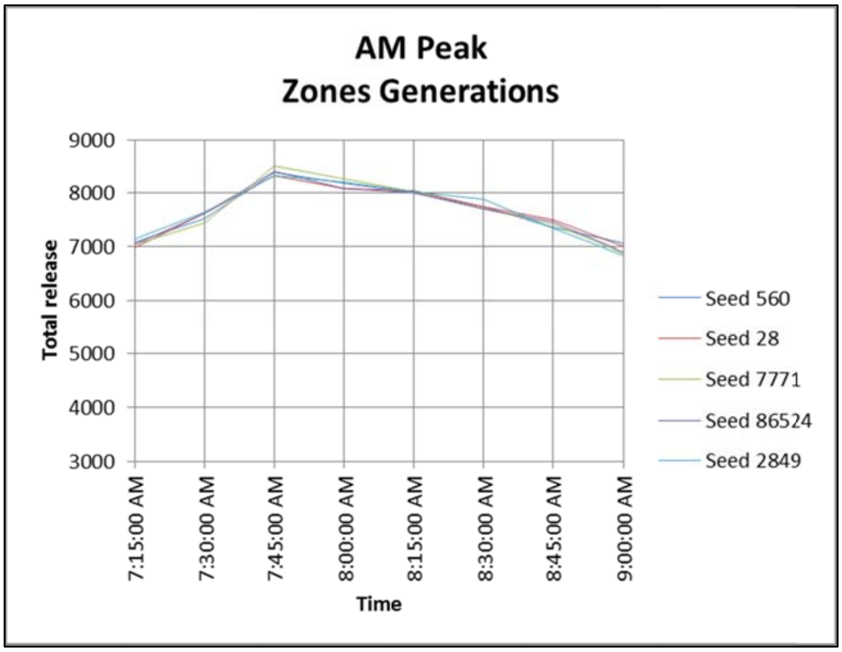
Road/Location	Observed			Modelled			Difference			GEH		
	NB/EB	SB/WB	Two-Way	NB/EB	SB/WB	Two-Way	NB/EB	SB/WB	Two-Way	NB/EB	SB/WB	Two-Way
M5 Motorway-East of Moorebank Avenue	4,071	4,214	8,285	4,210	3,800	8,000	3%	-10%	-3%	2	7	3
M5 Motorway-West of Moorebank Avenue	5,249	4,390	9,638	5,080	4,350	9,430	-3%	-1%	-2%	2	1	2
M5 Motorway-South of Kurrajong Road	3,997	3,280	7,277	3,920	3,030	6,950	-2%	-8%	-4%	1	4	4
Moorebank Avenue-North of M5 Motorway	1,945	554	2,499	2,050	530	2,580	5%	-4%	3%	2	1	2
Moorebank Avenue-South of Anzac Road	1,114	622	1,735	1,050	550	1,600	-6%	-12%	-8%	2	3	3
Moorebank Avenue-South of Jacquinot Road	1,098	372	1,471	1,070	310	1,390	-3%	-17%	-5%	1	3	2
Newbridge Road-East of Moorebank Avenue	2,229	965	3,194	2,200	1,040	3,240	-1%	8%	1%	1	2	1
Newbridge Road-West of Moorebank Avenue	1,549	1,590	3,140	1,600	1,680	3,280	3%	6%	4%	1	2	2
Newbridge Road-East of Nuwarra Road	2,740	1,185	3,925	2,890	1,270	4,160	5%	7%	6%	3	2	4
F5 Freeway-South of Campbelltown Road	4,442	3,079	7,521	4,350	3,100	7,450	-2%	1%	-1%	1	0	1
Heathcote Road-South of Nuwarra Road	1,845	1,360	3,205	1,840	1,320	3,160	0%	-3%	-1%	0	1	1

Table C6 Comparisons of link flows - PM Peak

Road/Location	Observed			Modelled			Difference			GEH		
	NB/EB	SB/WB	Two-Way	NB/EB	SB/WB	Two-Way	NB/EB	SB/WB	Two-Way	NB/EB	SB/WB	Two-Way
M5 Motorway-East of Moorebank Avenue	4,107	4,367	8,474	4,680	4,130	8,810	14%	-5%	4%	9	4	4
M5 Motorway-West of Moorebank Avenue	4,483	5,477	9,960	4,410	5,480	9,890	-2%	0%	-1%	1	0	1
M5 Motorway-South of Kurrajong Road	3,404	3,865	7,269	3,290	3,720	7,000	-3%	-4%	-4%	2	2	3
Moorebank Avenue-North of M5 Motorway	669	1,818	2,487	720	1,880	2,600	7%	3%	4%	2	1	2
Moorebank Avenue-South of Anzac Road	587	1,117	1,704	530	1,220	1,750	-10%	9%	2%	3	3	1
Moorebank Avenue-South of Jacquinot Road	376	1,190	1,566	320	1,210	1,530	-14%	2%	-2%	3	1	1
Newbridge Road-East of Moorebank Avenue	1,199	2,147	3,345	1,100	2,280	3,390	-8%	6%	1%	3	3	1
Newbridge Road-West of Moorebank Avenue	1,545	1,612	3,157	1,810	1,430	3,250	17%	-11%	3%	7	5	2
Newbridge Road-East of Nuwarra Road	1,556	2,784	4,340	1,480	2,760	4,240	-5%	-1%	-2%	2	0	2
F5 Freeway-South of Campbelltown Road	3,873	3,660	7,532	3,870	3,480	7,350	0%	-5%	-2%	0	3	2
Heathcote Road-South of Nuwarra Road	1,477	1,686	3,163	1,490	1,780	3,260	1%	5%	3%	0	2	2

C4.2 Model Stability

The stability of the Paramics modes was checked by running the model for five different seeds recommended by the RMS (seed 560, 28, 7771, 86524 and 2849) and producing the zone release graphs over time. Figure A4 and Figure A5 show the model stability graphs. The results confirm that both models are stable.



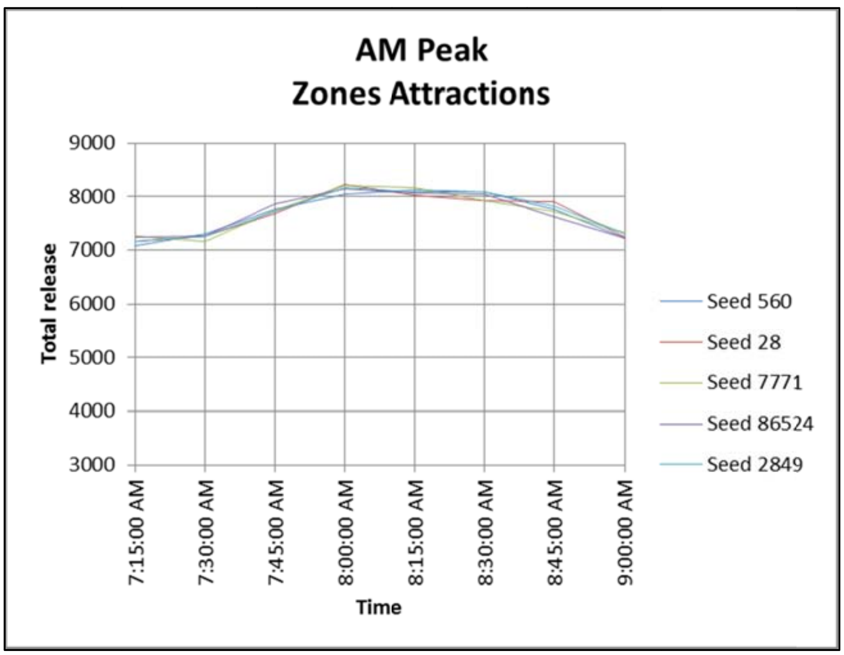
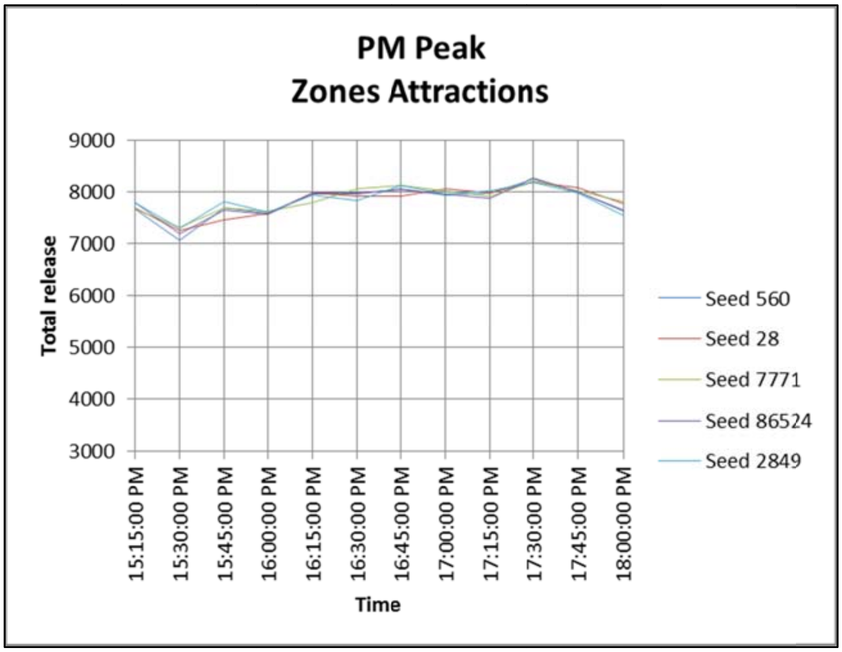


Figure C5 Model stability check – AM peak model



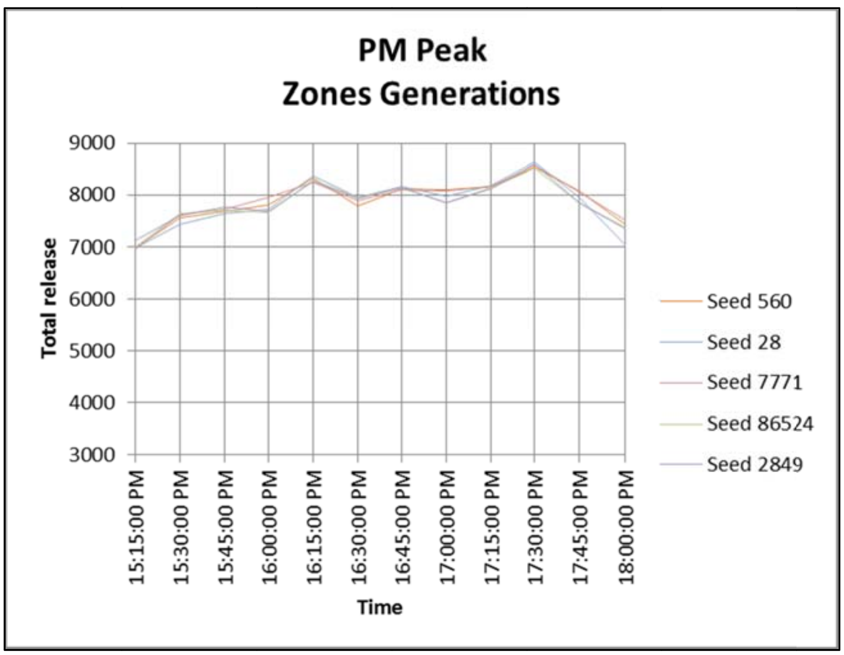


Figure C6 Model stability check – PM peak model

C5. VALIDATION

The Paramics models were validated against observed screenline flows, travel time, traffic profiles and queue length. An analytical model based on HCM 2000 was developed to assess the performance of the weaving section in AM and PM peak periods. This was based on the Origin-Destination survey on M5 eastbound between Hume Highway Interchange and Moorebank Avenue Interchange. The results of HCM 2000 modelling were further compared with Paramics results to provide an independent verification of the modelled weaving section.

C5.1 Screenline

Screenline flows comparison provides a good indication that the calibrated models accurately replicate observed traffic patterns on the major routes. Figure C6 shows six screenlines developed for the study area.

The comparison results in Tables C7 and C8 indicates close match within 10 per cent different between observed and modelled screenline flows. This indicates that the models replicate the observed traffic pattern for the study area.

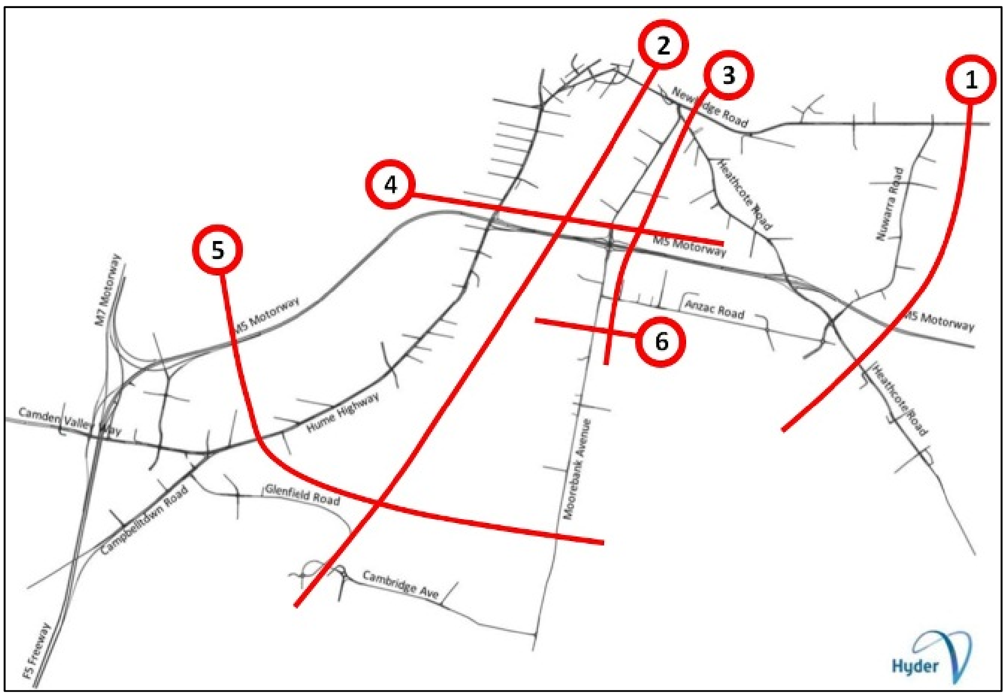


Figure C6 Screenline locations – inner area model

Table C7 Screenline flow comparisons – AM peak

Screenline Comparisons	Observed		Model		Achieved Values		
	All - AM 1Hr		All - AM 1Hr		All - AM 1Hr		
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	Two-way
1	7,473	5,821	8,200	6,200	10%	7%	9%
2	7,349	6,557	7,200	6,900	-2%	5%	1%
3	7,134	6,279	7,500	5,800	5%	-8%	-1%
4	5,291	2,396	5,300	2,200	0%	-9%	-3%
5	7,671	4,898	7,200	5,000	-6%	2%	-3%
6(1)	1,114	622	1,000	600	-6%	-11%	-8%

Note: (1) Screenline 6 consist of one road, Moorebank Avenue

Table C8 Screenline flow comparisons – PM peak

Screenline Comparisons	Observed		Model		Achieved Values		
	All - AM 1Hr		All - AM 1Hr		All - AM 1Hr		
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	Two-way
1	6,423	8,604	6,600	8,700	3%	1%	2%
2	6,724	7,521	6,800	7,500	1%	0%	1%
3	6,436	7,477	6,800	7,500	5%	1%	3%
4	2,976	5,324	2,900	5,400	-2%	2%	1%
5	5,221	7,658	5,300	7,800	2%	2%	2%
6(1)	587	1,117	500	1,200	-10%	9%	2%

Note: (1) Screenline 6 consist of one road, Moorebank Avenue

C5.2 Queue Length

In order to validate the observed queue length, extensive queue surveys were carried out during AM peak and PM peak for the following key intersections in the study area:

- Moorebank Avenue and Anzac Road;
- M5 and Moorebank Avenue;
- M5 and Hume Highway;
- Newbridge Road and Moorebank Avenue;
- Moorebank Avenue and Heathcote Road;
- Newbridge Road and Nuwarra Road;
- Heathcote Road and Nuwarra Road;
- M5 and Heathcote Road;
- Newbridge Road and Speed Street;

- Hume Highway and Hoxton Park Road; and
- Camden Valley Way and Campbelltown Road.

The queue length data were compared for minimum, maximum, average and 95th percentile queue length. During validation period, queue length data from video survey was observed.

Should RMS require a copy of queue length comparison between observed and modelled condition, Hyder can provide them on request.

C5.3 Travel Time

Travel time comparison provides a good indication that the calibrated models accurately reflect delay conditions on major routes in the study area. Modelled travel time was validated against observed data for three key strategic routes for the study area as shown in Figure C7.

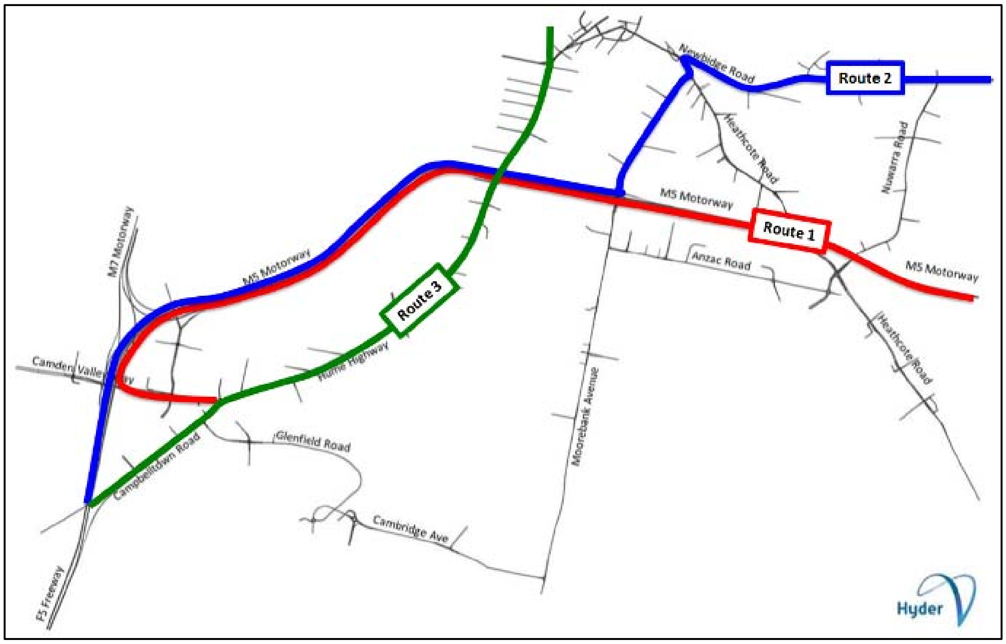


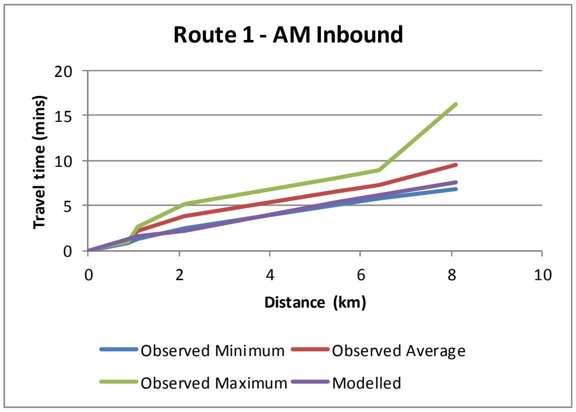
Figure C7 Travel time validation routes

The travel time comparisons in Figures C8 and C9 below show the modelled travel times well within the upper and lower bounds of observed travel times.

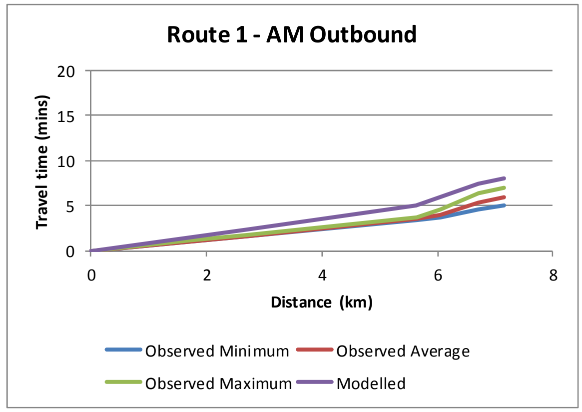
In a summary, inner area Paramics models are validated against observed queue length and travel time data for both AM and PM peak period.

AM Peak

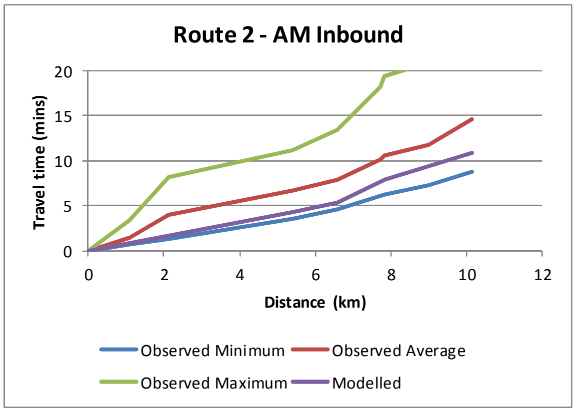
Route 1 - Inbound



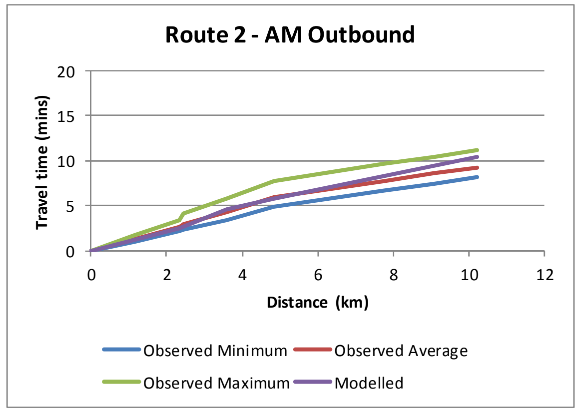
Route 1 - Outbound



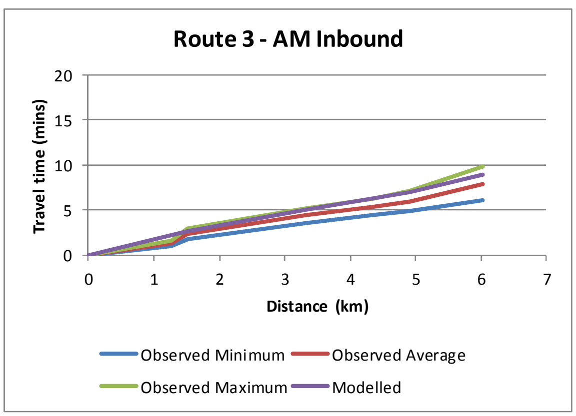
Route 2 - Inbound



Route 2 - Outbound



Route 3 - Inbound



Route 3 - Outbound

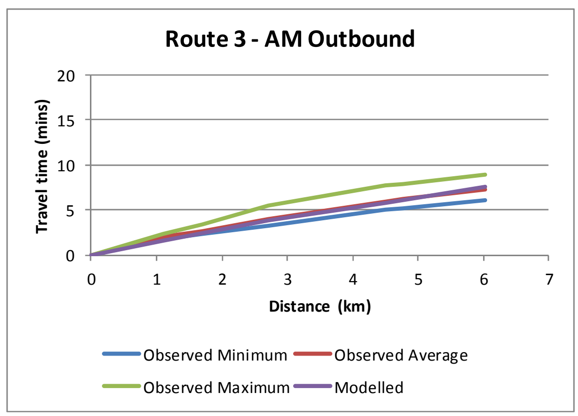
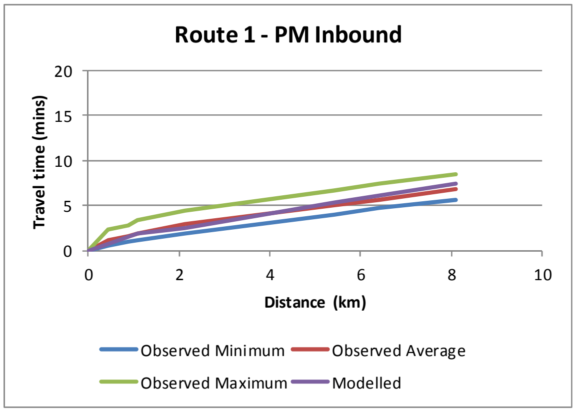


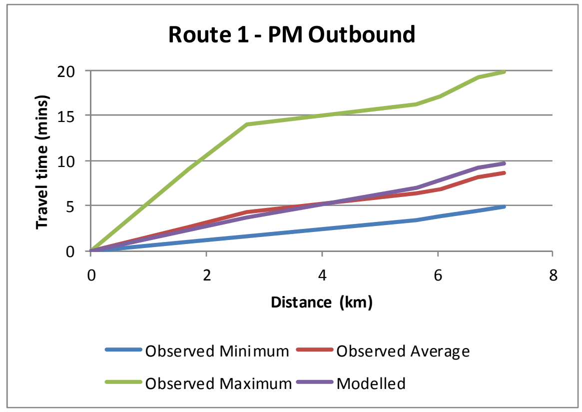
Figure C8 Travel time comparisons – AM Peak

PM Peak

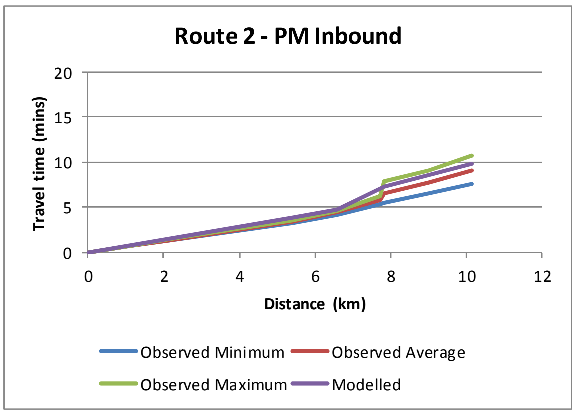
Route 1 - Inbound



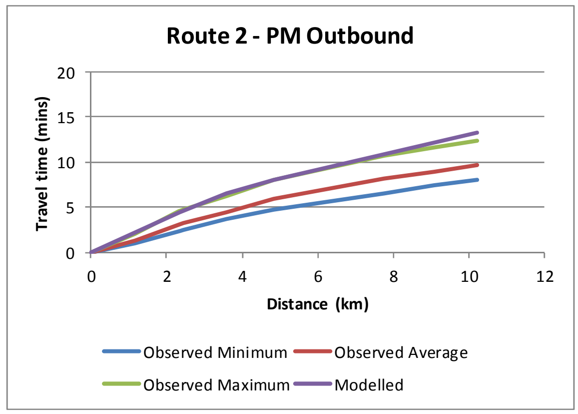
Route 1 - Outbound



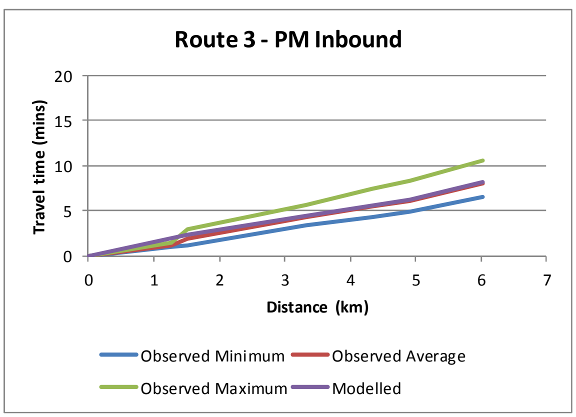
Route 2 - Inbound



Route 2 - Outbound



Route 3 - Inbound



Route 3 - Outbound

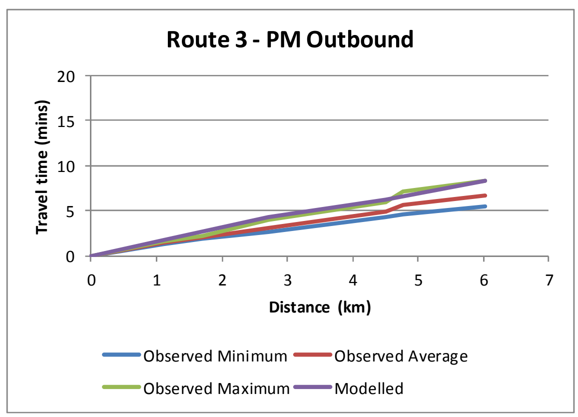


Figure C9 Travel time comparisons – PM Peak

C5.4 Demand Profile

Demand profile validation was undertaken at 15-minute intervals against observed data at 28 monitoring stations across the study area. Figures C10 to C13 show comparison between observed and modelled profiling. The results suggest that models are validated to reflect travel behaviour across the study area.

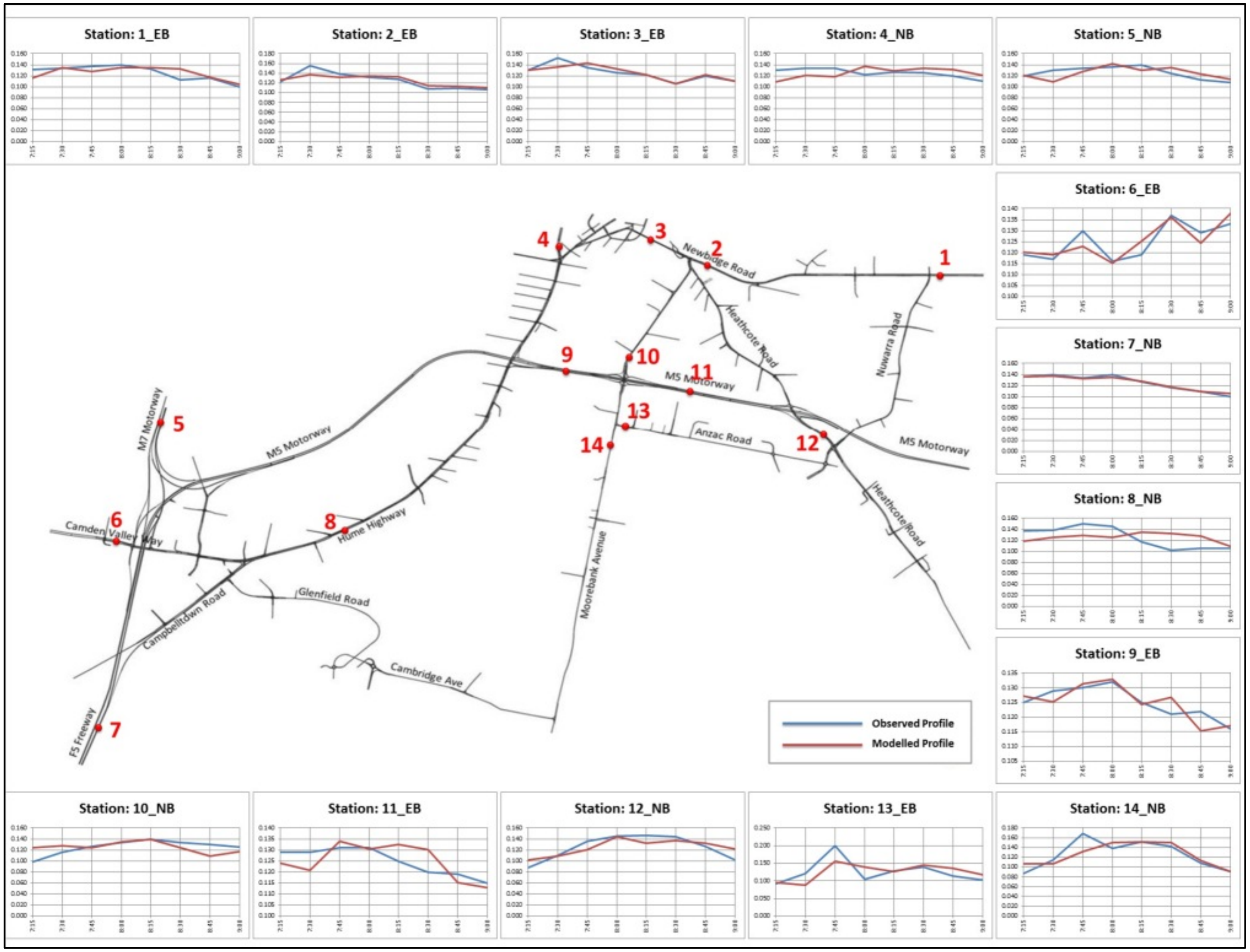


Figure C10 Demand profile validation – AM Peak Northbound/Eastbound

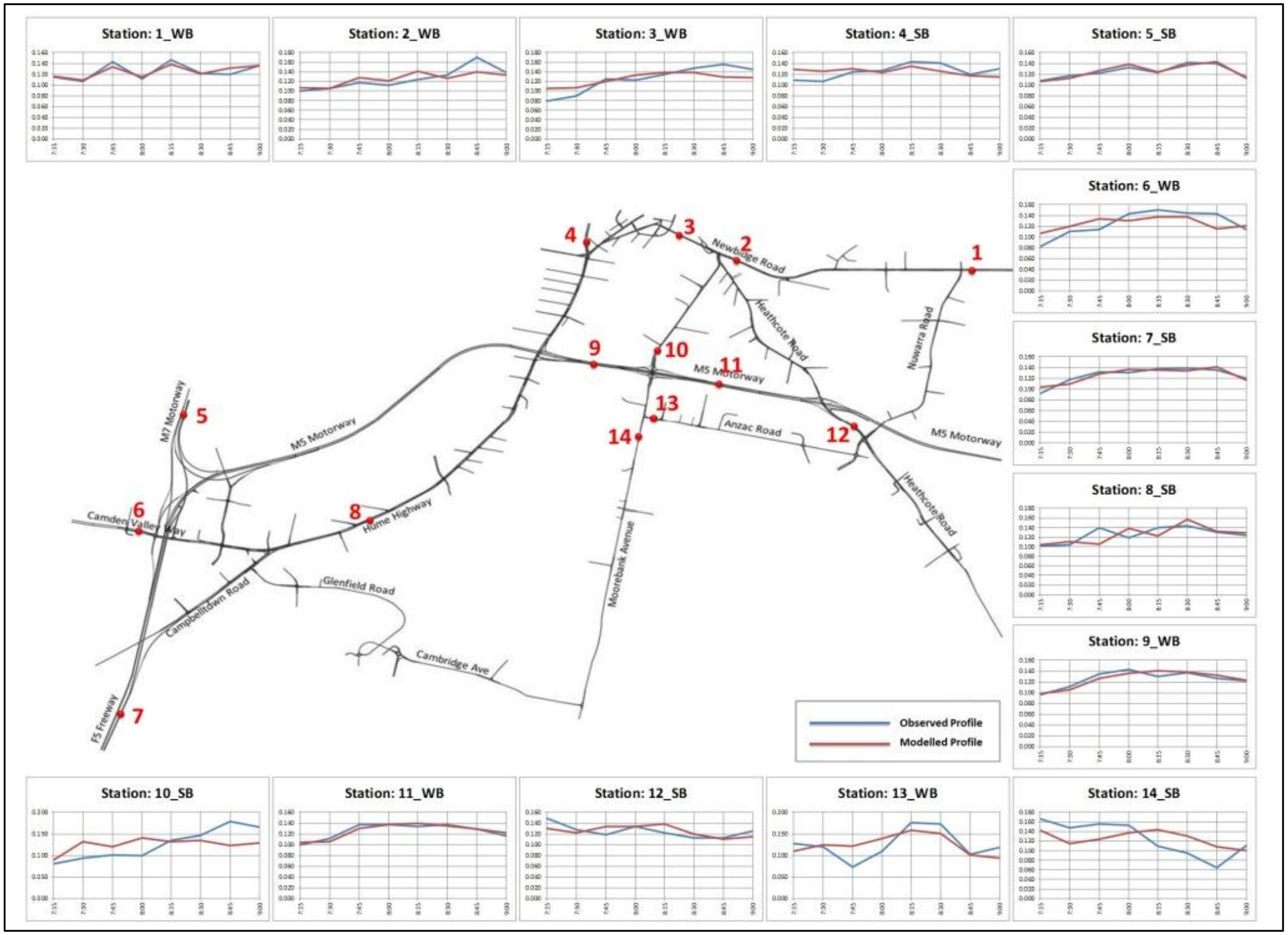


Figure C11 Demand profile validation – AM Peak Southbound/Westbound

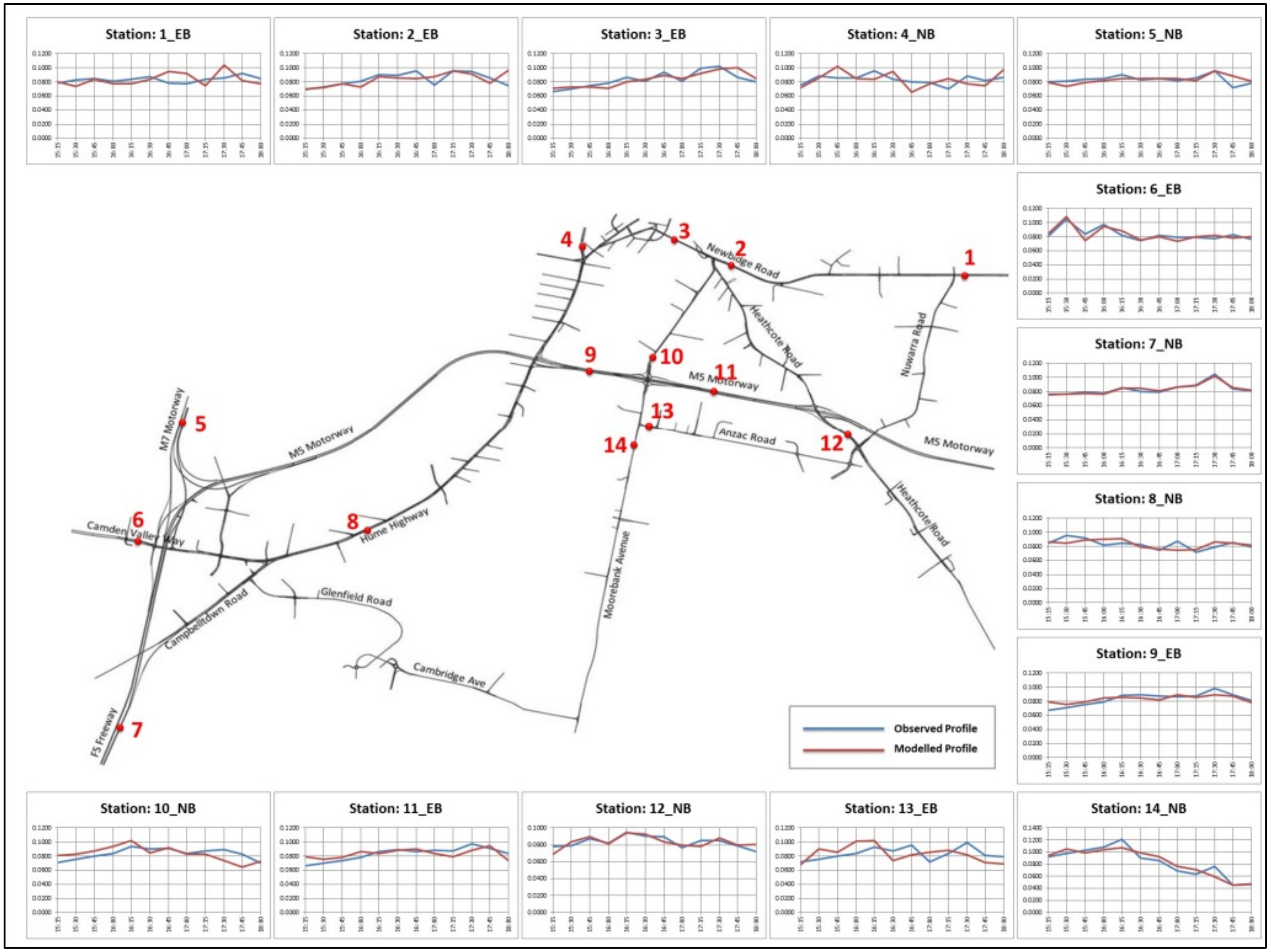


Figure C12 Demand profile validation – PM Peak Northbound/Eastbound

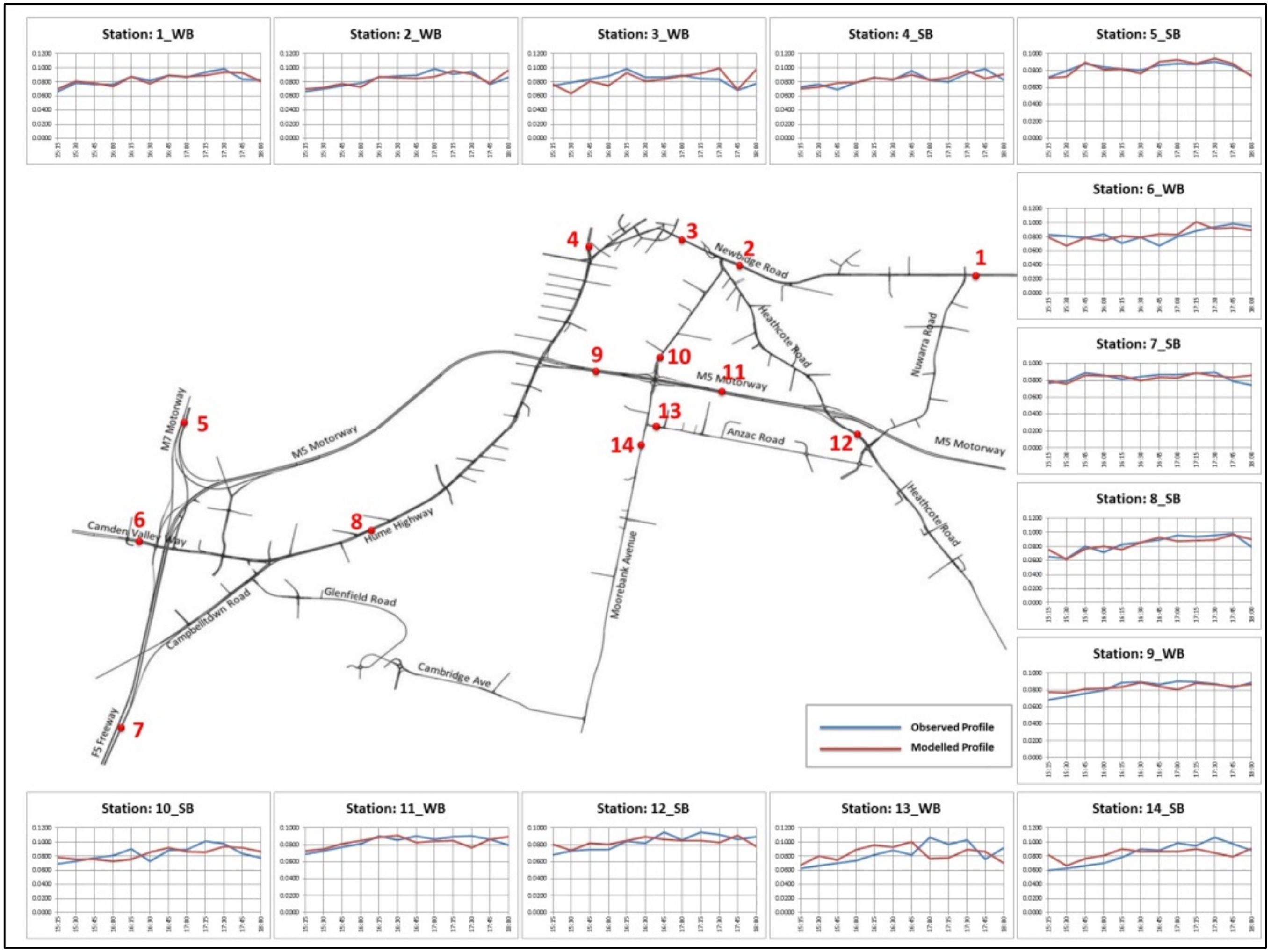


Figure C13 Demand profile validation – PM Peak Southbound/Westbound

C5.5 M5 Weaving Validation

The weaving analysis for M5 eastbound between Hume Highway and Moorebank Avenue was repeated using inner area Paramics models (see Table C9 below). The inner area Paramics shows similar weaving results to previous analysis. The inner area Paramics modelling results here do not change the previous conclusions drawn in the Transport and Accessibility Impact Assessment Report (Section 3.3.5).

Table C9 Weaving validation results

Performance Index	AM Peak (7-8 am)		PM Peak (5-6 pm)	
	HCM 2000[1]	Paramics	HCM 2000[1]	Paramics
Weaving segment speed (km/h)	62.96	51.90	72.82	77.62
Weaving segment density (pc/km/ln)	23.60	26.59	16.50	14.76
Weaving segment LoS	E	E	C	C
Weaving flow Ratio (VR)	0.39		0.32	

Note: 1. Analysis based on Highway Capacity Manual (2000) weaving segment Type A

C6. SUMMARY

The modelling results presented above confirmed that both AM and PM peak Paramics models for “inner area” were calibrated and validated adequately and models are fit for the study purpose.

APPENDIX D

EXISTING ROAD NETWORK PERFORMANCE OUTSIDE CORE AREA

D1. Existing Network Capacity Outside Core Area

Similar to traffic assessment undertaken for core area reported in previous sections, modelling was undertaken for key intersections outside the core area. The existing network performance on RMS's State Road was undertaken at eight key locations outside core area. Level of service for AM and PM peak hours was estimated for eight key intersections outside the core area. The intersections are:

- Hume Highway / Camden Valley Way;
- Hume Highway / Kurrajong Road;
- Hume Highway / De Meyrick Avenue;
- Hume Highway / Hoxton Park Road / Macquarie Street;
- Newbridge Road / Speed Street;
- Newbridge Road / Nuwarra Road;
- Heathcote Road / Nuwarra Road; and
- M5 Motorway / Heathcote Road.

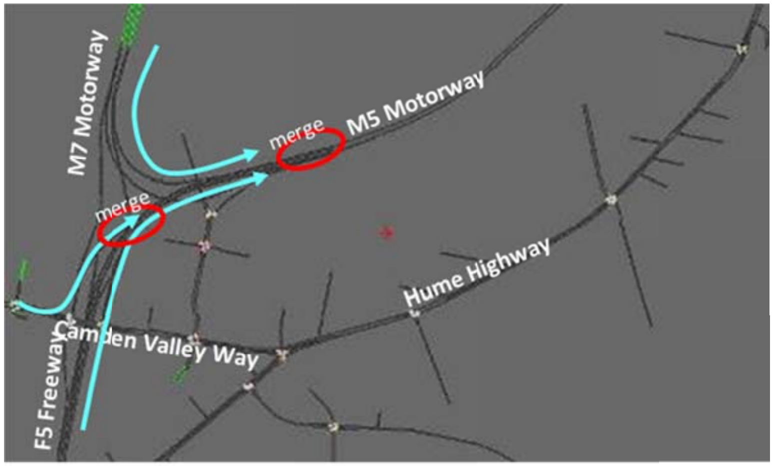
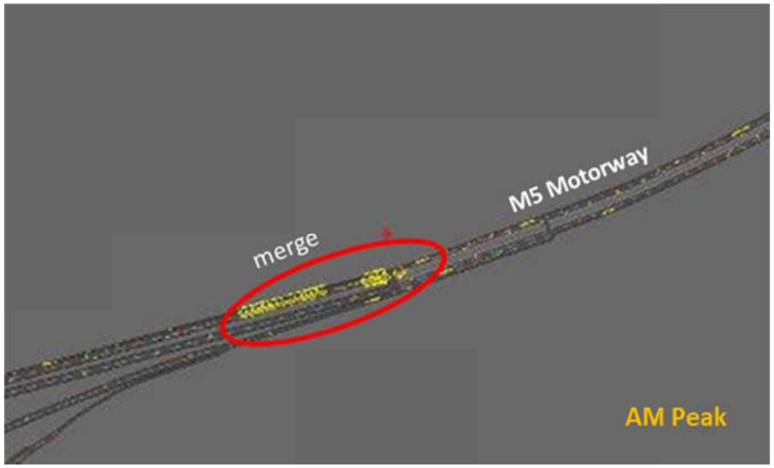
Hyder's inner area Paramics model was used as a basis to determine level of service for eight key intersections outside the core.

Section 3.4 of the Transport and Accessibility Impact Assessment Report documented LoS results in AM and PM peak hours for eight intersections assessed on RMS's State Road.

Table D1 (overleaf) shows existing network operational issues observed from traffic model for core study area.

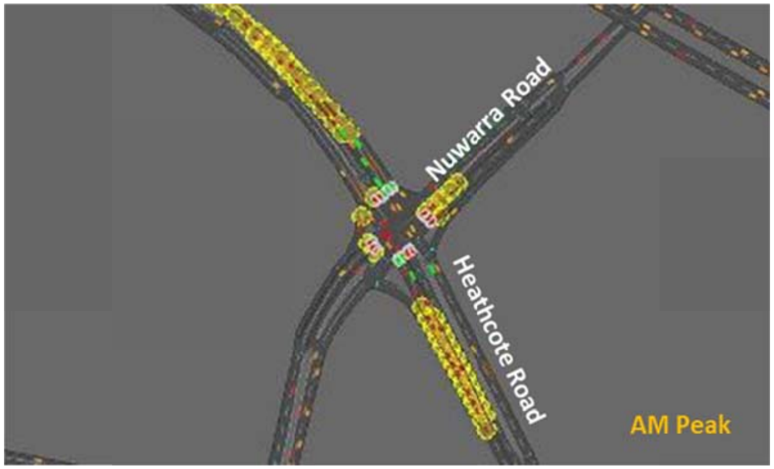
The results suggest that currently there are network capacity issues on the regional road network outside the core area.

Table D1 Existing Network Operational Issues –Outside Core Area

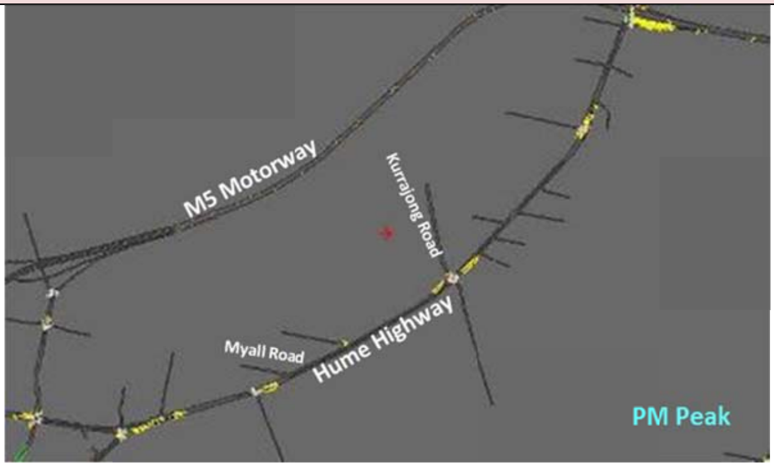
Network Operational Issues – Outside Core Area		
Intersection	**Network operational issue**	**Paramics snapshot**
M5 Motorway, between Camden Valley Way and Hume Highway	11) Slow traffic movement is observed on eastbound direction during AM peak due the merge of eastbound traffic from M7 Motorway and Camden Valley Way onto M5 Motorway. There are only two lanes provided in each direction.	 

Network Operational Issues – Outside Core Area		
Intersection	**Network operational issue**	**Paramics snapshot**
Terminus Street between Hume Highway and Newbridge Road	12) The congestion is observed at this section during PM peak due to the four closely-spaced signalised intersections and several direct access points along this road. Extensive queues and delays are observed on westbound direction. Modelling results suggest queue extension from Hume Highway/Hoxton Park Road intersection and its spill backs to adjacent intersections.	
Hume Highway/ Hoxton Park Road/ Macquarie Street intersection	13) This intersection is operating over capacity at LoS F in both peak periods due to heavy southbound traffic from Macquarie Street. Extensive queues are observed on Macquarie Street back to upstream intersections on Terminus Street. Queues and delay are also observed on Hume Highway and Hoxton Park Road approaches in both peak periods.	

Network Operational Issues – Outside Core Area		
Intersection	**Network operational issue**	**Paramics snapshot**
		
Newbridge Road/ Nuwarra Road intersection	14) Model indicated that in critical PM peak period intersection operates at low LoS E due to high westbound through traffic flow (1,850 veh/hr) and high left turn demand from Newbridge Road west to Nuwarra Road south (950 veh/hr). Model indicated high delays on Newbridge Road in westbound direction in PM peak.	

Network Operational Issues – Outside Core Area		
Intersection	**Network operational issue**	**Paramics snapshot**
M5 Motorway / Heathcote Road interchange	15) This interchange consists of two surface road traffic signals with Heathcote Road. The intersections currently operate at LoS C and LoS E in AM and PM peak periods respectively. Model indicated that in critical PM peak period interchange operates at low LoS E due to high southbound traffic flows coming from M5 eastbound off-ramp and Heathcote Road northern approach. Long queues are observed on Heathcote Road southbound in PM peak;	
Heathcote Road/ Nuwarra Road intersection	16) Model predicts LoS C during both AM and PM peaks for the entire intersection. Some queues and delays are occasionally observed on Nuwarra Road during PM peak. The observed queues clear at each cycle time.	

Network Operational Issues – Outside Core Area		
Intersection	Network operational issue	Paramics snapshot
		
Hume Highway between M5 Motorway and Camden Valley Way	17) Occasional queues are observed along Hume Highway. The queue clears at each cycle time. No residual queue is observed. Key intersections LoS: ▪ Hume Highway and Camden Valley Way intersection LoS is forecast D during PM peak period, average delay of 50 s. ▪ Hume Highway and Kurrajong Road intersection LoS is forecast D during both peak periods, average delay between 45-50 s. ▪ Hume Highway and De Meyrick Avenue is forecast LoS B during both peak periods, average delay about 20 s.	

Network Operational Issues – Outside Core Area		
Intersection	**Network operational issue**	**Paramics snapshot**
		

Appendix C

Technical Note 5
Strategic Modelling Calibration / Validation and Forecasting Results.

SIMTA SYDNEY INTERMODAL TERMINAL ALLIANCE

Part 3A Concept Plan Application

Traffic and Transport

August 2011

SYDNEY INTERMODAL TERMINAL ALLIANCE (SIMTA)

MOOREBANK INTERMODAL TERMINAL FACILITY (MITF)

TECHNICAL NOTE 5

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SYDNEY INTERMODAL TERMINAL ALLIANCE (SIMTA)

MOOREBANK INTERMODAL TERMINAL FACILITY (MITF)

TECHNICAL NOTE 5

STRATEGIC MODELLING

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Report No	5
Date	August 2011

REVISIONS

Revision	Date	Description	Prepared By	Approved By
A	8 Aug 2011	DRAFT for internal Review	MR	JF
B	31 Aug 2011	Final Report	MR	NM

CONTENTS

1 TRAFFIC FORECASTING MODEL

A strategic traffic model was developed for the specific purpose of investigating traffic impact from SIMTA proposal. The demand in Hyder's strategic model is based on the Sydney-wide Strategic Travel Model (STM) developed by the Bureau of Transport Statistics (BTS).

Paramics model was developed to assess the network capacity with and without the SIMTA proposal.

1.1 Overview of Strategic Traffic Modelling Approach

Hyder has produced the overall strategic traffic forecasting model for the specific SIMTA project purpose with inputs from STM model. The STM model adopts a four-step approach for determining transport demand.

- Trip generation – calculating the number of trips originating from each geographical area – based on land use, population and employment forecasts;
- Trip distribution – determining the linkages between trip origins and destinations;
- Mode choice – estimating the proportion of travel by each transport mode (eg. car, public transport) between each origin and destination;
- Assignment – determining the roads and public transport services used by each traveller between each origin and destination.

Hyder's strategic traffic model is based on BTS's 2006 travel zone system covering the Sydney Metropolitan Area. Hyder's base and future year models were developed using STM trip tables. The land use assumptions in STM was based on recent population and employment forecast (October 2009 Release). The population and employment forecast was compatible with Department of Planning (now call Department of Planning and Infrastructure) 2008 Release Population Projections and the 2010 Metropolitan Plan.

Hyder's Sydney Strategic Traffic Modelling (SSTM) process is comprised the following key elements:

- A representation of the physical road network/system. The basic network in Hyder's model was sourced from the RTA's Strategic Model (Emme2).
- A representation of the trips that take place on that system. Trip tables (also known as demand matrices) are used to quantify the demand for travel across the entire model area between each small geographic area (travel zone or TZ). Vehicle demand for existing and future years was obtained from BTS's STM model. Future year travel demand matrices represent the government's forecast of future land use development in Sydney.
- A software package that can assign the demand to the network in a way which accurately reflects the constraints of the network, economic and behavioural decisions made by motorists. The demand model is a multi-class highway assignment model. The model has been developed by Hyder using TransCAD modelling software.

For validation/calibration purposes, the model was constructed for a "current" year for which widespread traffic count data on Sydney's' network was available (2008/2010). This was the year used for Hyder's model calibration/validation purpose:

- The RTA had collected comprehensive traffic data on 184 permanent sites across Sydney in year 2008. This was the latest data available on RTA's major screenlines. For STM model, BTS conducted traffic survey at some 66 sites in year 2008. All 2008 data was used in Hyder's major screenlines validation purpose.

- The RTA's Emme2 base year represented 2008 network condition.
- Consistent with screenlines counts, travel time data on RTA's regional routes was obtained for year 2008. RTA provided travel time data for 18 routes.
- Hyder's comprehensive traffic survey for the Moorebank study area was undertaken in 2010 and 2011.

The model specifically quantifies traffic for an average weekday, by way of modelling the morning and evening peaks explicitly, then applying factors to expand to represent an average weekday traffic.

- AM 7:00 am to 9:00 am; and
- PM 3:00 pm to 6:00 pm.

These time periods coincide with those adopted by BTS's STM model.

The calibrated/validated model was then used to assess impact from full SIMTA development for future year 2031 for both AM and PM peak period.

1.2 Fit for Purpose

Hyder's Sydney Strategic Traffic Model (SSTM) was updated for the specific purpose of investigating traffic impact from SIMTA Site. There are several main purposes in developing the traffic forecasting model for SIMTA proposal:

- Creating a tool capable of forecasting the traffic volumes on Moorebank study area under different access and network scheme scenarios, with outputs sufficiently detailed to provide demand and growth estimates as input to micro simulation models (Paramics).
- Providing input for intersection geometry analysis, for pavement design, and to assist in the decision process quantifying network impact from full development.
- Assessing background traffic growth for core and inner area with and without the SIMTA proposal considering the characteristics of catchment employees/residents.
- Prepare a traffic report which can be used as a basis for infrastructure upgrade attributable to SIMTA development.

1.3 Model Software

Hyder's Sydney Strategic Model (SSTM) was built and operated in TransCAD Transportation GIS software. Version 4.7 was used for SSTM. TransCAD fully integrates GIS with planning, modelling and logistics applications. It combines the capabilities of digital mapping, geographic database management and presentation graphics with sophisticated transport models. TransCAD provides a full complement of traffic assignment procedures that are used for modelling urban traffic. TransCAD is widely used in both the public and private sectors. Hyder has updated two large scale strategic models for the RTA including Lower Hunter and Central Coast. Hyder used TransCAD software for modelling impact analysis from large developments for Wyong Shire Council and private developers. Hyder recently used SSTM model for assessing a large complex development in West Menai, Heathcote Ridge.

1.4 Years and Time Periods Modelled (Strategic Model)

The DGR's for Concept Plan Study identified that traffic analysis should include a base case model and a separate model with full development and background traffic growth (to year 2031). In general. STM model reflects the long-term growth potential of the region and forecasts are available for Australian Population Census years (2001, 2006, 2011, 2016, 2026, 2031 etc). In line with STM and DGR's requirements for SIMTA proposal, Hyder's strategic network traffic modelling has been undertaken for:

- 2008/2010 base year;
- 2031 the last year for which full development is expected for SIMTA Site.

The starting point for producing trip tables for the project is the output of the STM model. This is a traditional four-step model (generation, distribution, mode choice, and assignment) developed and operated by the State Government's Bureau of Transport Statistics (BTS). Both data and models output produced by the BTS are available for commercial purchase.

Detailed modelling for SIMTA Site was undertaken for an average weekday, split into two time periods comprising:

- Morning peak two hours (7:00 – 9:00 am); and
- Evening peak three hours (3:00 – 6:00 pm).

1.5 Traffic Data

Considerable work was undertaken to compile and process traffic volume and travel time data for use in strategic network model calibration/validation purpose. Hyder sourced traffic data at various levels for about 200 locations around the Sydney Metropolitan Area. Consistent with trip tables AM and PM time period, traffic counts comprised AM for 2 hours (7-9) and PM for 3 hours. The data and its level of detail are summarised in Table 1-1 below.

Table 1-1 Summary of Traffic Data Used in Hyder's Model

Data Source	Sites	Vehicle Types	Counting Unit	Count Type	Year of Count
RTA Permanent Sites	184	Total	Vehicles	7 Days, Hourly	2008
BTS Sites	65	Cars and HV	Vehicles	7 Days, Hourly	2008
ATS Sites(1)	41	Cars and HV	Vehicles	AM & PM, Daily	2010/2011

Note: 1= Section 3 documented traffic survey undertaken for Moorebank study. About 33 intersections were counted and 8 mid block locations.

Hyder purchased 2008 travel time data from RTA for about 18 routes across the Sydney. The travel time data was aggregated by direction for the modelling time periods (i.e. AM and PM). The travel time survey data was used to assess the performance of speed flow curves of the model.

1.6 Network

The base network for Hyder's model covers the Sydney Metropolitan Area. The initial source of road networks was the network adopted by the RTA for their Greater Sydney Metropolitan (GMA) EMME road network model. The basic road network purchased from the RTA represented the road network in the year 2008. It comprised all relevant roads, including motorway, freeway, arterial, sub-arterial, collector roads and key local roads. Road attributes were obtained from the RTA's EMME data base included:

Nodes	Links	Turn bans
Node number	A-node number	About 1092 turn bans across the entire network.
X coordinate	B-node number	
Y coordinate	Length (kms)	
Node type	Mode	
	Link type	
	Number of lanes	
	LGA code (Sydney)	
	Region code (Sydney)	

The RTA's EMME data base did not include posted speed data. The additional data including posted speed was purchased from Sensis "Whereis™ StreetNet database". During the building of the Hyder's SSTM model, comprehensive consistency checking (between RTA and Sensis) and adding of other modelling attributes (capacity, free flow travel time, speed flow function, tolling, value of travel time saving, etc) were undertaken to complete the Hyder's base network. An internal network review was undertaken for the purpose of checking its data quality as part of the network validation.

Several adjustments were made to the base network to ensure adequate modelling for SIMTA development for wider study area and surrounding M5 corridor:

- For the base year calibration model, projects that were opened between 2008 and early 2011 were added to base network; the most significant was the F5 Duplication - Camden Valley Way to Brook Road, opened to traffic in 2008. F5 Duplication - Brook Road to Raby Road opened to traffic in Feb 2011; these projects were then re-introduced for future year networks.
- Speed flow functions were created for each link class for the entire Sydney Metropolitan network.
- Tolls were added (2008 values) at all existing toll plazas including distance based/capped toll at M7. These tolls are added to the composite cost of trips passing through the toll plaza during the assignment process. The M4 toll was modelled given that counts on M4 represented year 2008 traffic condition.
- Penalties were added to provide a refinement to link-based volume-delay functions by adding a network entering penalty depending on the relative ranking of the approach roads hierarchy.

Further travel zone refinements were undertaken for SIMTA core catchment study area. The model was sufficiently detailed in core area for replicating intersection turn movements. About 10 additional travel zones were added which improved base network loading points. In the future year network, about 3 travel zones were added for explicitly modelling SIMTA development traffic.

Table 1-2 below shows travel zones for Hyder's SSTM model.

Table 1-2 Travel Zone for SSTM for Sydney Metropolitan Area

2006 Travel Zones	2008 Base	2031 Future
Internal	2132	2135
Externals	11	11
Totals	2143	2146

Note: STM had some 2690 travel zones covering Greater Metropolitan Area (GMA) of NSW. The GMA includes Sydney Metropolitan Area, Blue Mountains, Newcastle, Gosford Wyong, Wollongong and Illawarra.

Figure 1-1 shows the base year road network in the context of SIMTA development and surrounding M5 corridor.

Figure 1-1 Existing Base Case Road Network

1.7 Trip Tables

In general trip tables represent the travel demand or number of trips that occur between each origin-destination ("O-D pair"). Hyder's SSTM trip tables are based on those produced by the BTS and use the same zoning system. The trip table comprised both car and truck travel demand. The truck trip matrices are based on Freight Movement Model (FMM) produced by BTS. Future year travel matrices were provided by BTS and demand data represented the government's forecasts on future land use development in Sydney. Individual trip tables are developed for cars and trucks so that each can be modelled separately. As car travel patterns differ, car trip tables are further split into three trip tables each of which represents a different user class and travel purpose as follows:

- Commuting – travel to and from work;
- Business; and
- Other (a mix of predominantly home based personnel travel, but includes NHB personnel trips).

BTS's trip tables were obtained for:

- Morning peak two hours (7:00 – 9:00 am); and
- Evening peak three hours (3:00 – 6:00 pm).

The morning and afternoon peaks were explicitly calibrated and modelled for SIMTA proposal. Expansion factors have been developed to produce daily traffic estimates.

Trip tables are used in two key areas:

- Model calibration purposes, current year trip tables, adjusted to match observed traffic volumes in key screenline locations and are used. The initial 2008 trip table is estimated by interpolating between 2006 and 2011 BTS trip tables (by purpose). Trip tables were adjusted by undertaking a large number of select link runs on groups of roads comprising screenlines. Adjustments to trip tables were required to match the number of crossings observed on trip tables.
- Future year trip tables are developed to match the BTS model forecast year also taking into account the calibration adjustment to the base year.

The container models developed for SIMTA provided input to Hyder's SSTM truck trip tables. Annual container movements were converted into average truck movements per weekday. The future truck trip table was adjusted with and without SIMTA proposal. Technical Note 1 (Chapter 6, Appendix D in Volume 2 of Hyder's Main Traffic Report) documented truck trip table adjustment process.

1.8 Network Assignment

Hyder's Sydney Strategic Traffic Model (SSTM) is a multi class vehicle assignment model covering the Sydney Metropolitan Area. The vehicle demand obtained from Bureau of Transport Statistics (BTS)'s Sydney Strategic Travel model (BTS). The method used to assign the trip tables to the networks is via a standard transport planning technique: multi-class stochastic user equilibrium assignment process (SUE). The generalised cost of travel is defined as a composite cost, reflecting both travel time and toll, where the toll is expressed in terms of a time penalty incurred by the use of the toll road. The value of travel time by trip purpose varied with a higher value was used for business trips. The $33.00 average value of time (2008 value) applied in the SSTM model and is consistent with research applied in analysis of the Sydney[1].

1.9 Model calibration and validation

A base year (2008/2010) highway model was calibrated, covering both cars and heavy vehicles. This base year is selected because it represents the most recent set of comprehensive network-wide traffic counts undertaken by the RTA and BTS. The following set of calibration and validation standards was adopted for Sydney Strategic Model (SSTM). Hyder's SSTM is in progressive state of improvements.

Table 1-3 below summarises model calibration and validation compliance against target.

[1] The RTA has indicated that an average all-vehicle value of time of $30 per hour is required to replicate observed traffic volumes on Sydney toll roads. Western Sydney Employment Hub, Proposed Erskine Park Link Road Network, May 2007, Prepared for Roads and Traffic Authority, Prepared by Maunsell Australia Pty Ltd.

Table 1-3 Summary of SSTM Model Compliance

Calibration Objective	Calibration Target	Model Compliance	
		AM peak period	PM peak period
1. Trip table matches observed travel demand using screenline comparisons	± 10% on major screenlines	Most screenlines <10% See Figure 1-2 and 1-3 for screenline locations. Detailed comparison are shown in Table 1-4	Most screenlines <10% See Figure 1-2 and 1-3 for screenline locations. Detailed comparison are shown in Table 1-5
2. Road traffic characteristics lead to realistic route choice using scatter plot analysis (R^2)	R^2 > 0.85 for observed-modelled traffic in screenlines - 163 directional links	R^2 > 0.98 See Figure 1-4	R^2 > 0.95 See Figure 1-5
3. Road traffic characteristics lead to realistic route choice using % Root Mean Square Error (%RSME)	≤ 30%	%RSME = 9%	%RSME = 12%
4. GEH Statistics Screenline flows			
≤ 5	Most screenlines	100%	92%
Individual flows			
≤ 5	≥ 60% of links	94%	93%
≤ 10	≥ 95% of links	99%	100%
≤ 20	100% of links	100%	100%
6. Validation of modelled travel times on key strategic routes in and around proposed development. See Figure 1-6		Modelled travel times for 3 routes by direction to lie within the bands of observed travel times, following the same trends. See Figure 1-7	Modelled travel times for 3 routes by direction to lie within the bands of observed travel times, following the same trends. See Figure 1-8

Sources:

1. Model Validation and Reasonableness Checking Manual, FHWA 1997 (USA)
2. Design Manual for Roads and Bridges (DMRB), Volume 12, Section 2, Department for Transport 1996 (UK)
3. Project Evaluation Manual, Transfund New Zealand, 2001
4. M5 West Widening Project, Environment Assessment RTA September 2010

Model code: V3R1_SSTM F:\AA003210\D-Calculations\Traffic and Modelling_POST DGR\Data Processing\Model Calibration\V3_SSTM_SIMTA model calibration results

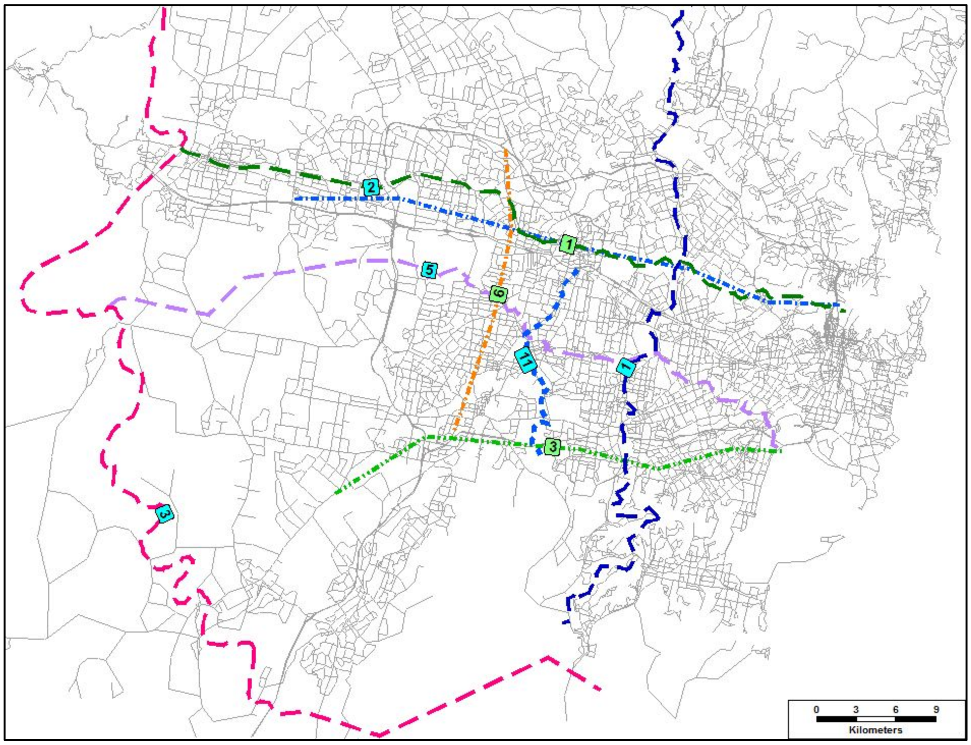


Figure 1-2 Screenlines Locations – RTA and BTS

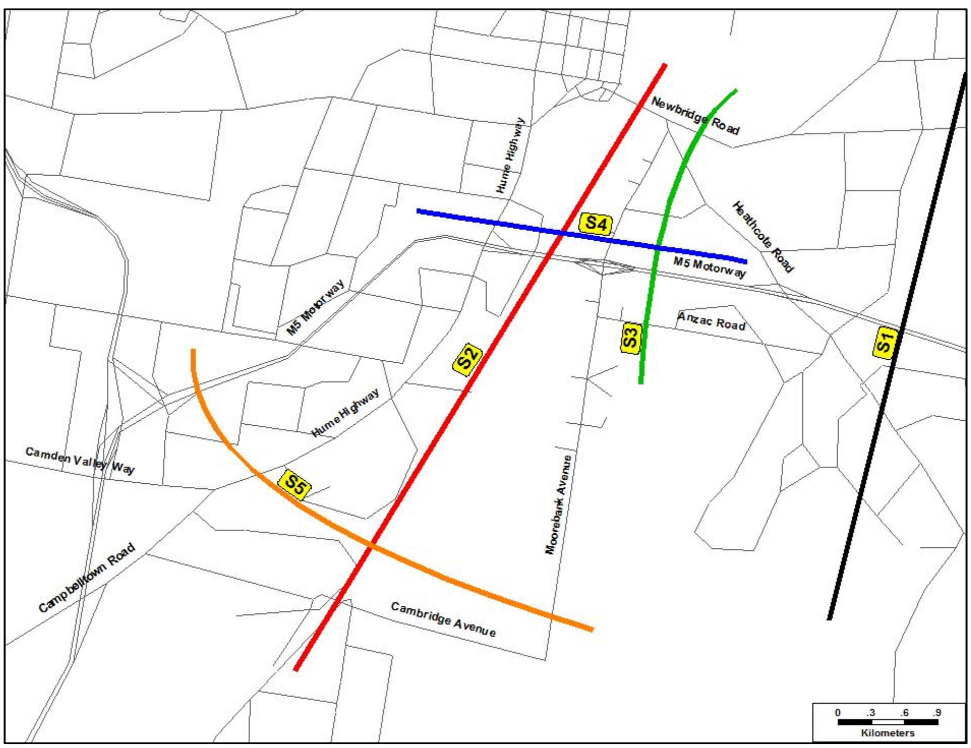


Figure 1-3 Screenlines Locations – Moorebank Sub Screenlines

Figures 1-4 and 1-5 compare observed flows and modelled flows at individual locations for AM and PM peak period respectively.

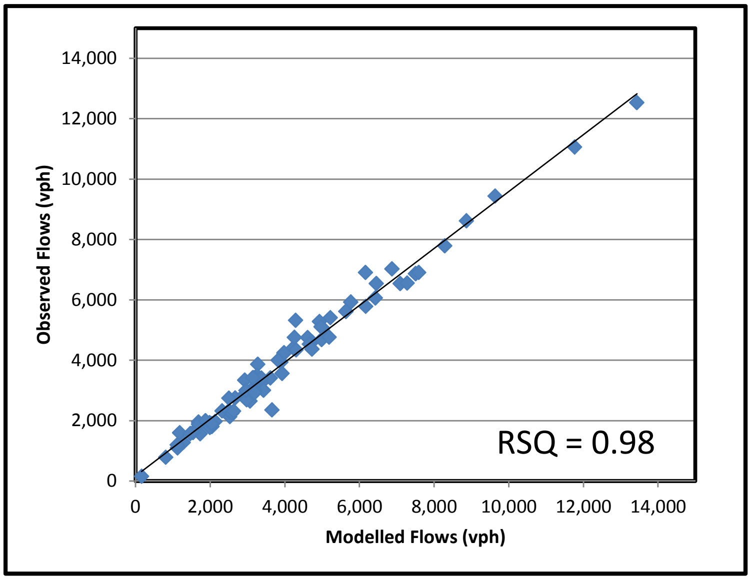


Figure 1-4 **Scatter Plot of Observed versus Individual Link Flows (AM) – within screenlines**

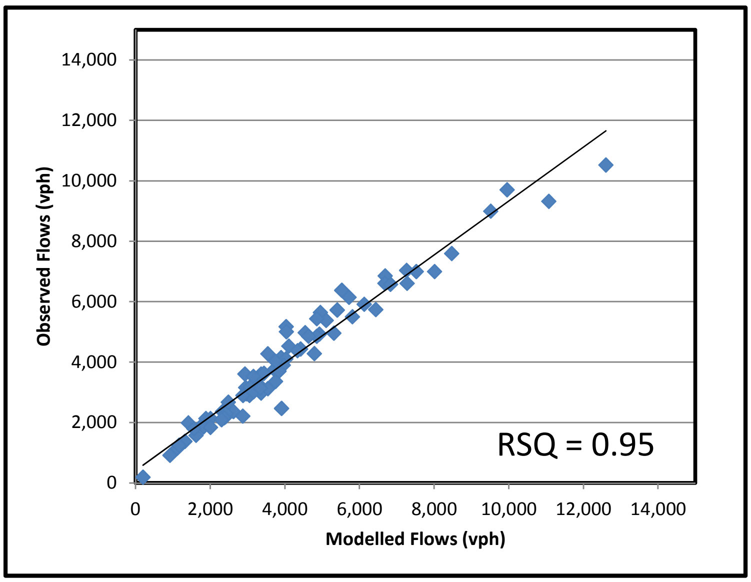


Figure 1-5 **Scatter Plot of Observed versus Individual Link Flows (PM) – within screenlines**

The above network model calibration and validation results provide the following outcomes:

- Most statistical criteria tests have been achieved for both AM and PM peak period models. Screenline comparisons are within the 10% target in most of cases. R^2 values for are between 0.95 and 0.98 respectively, showing a very close match between counts and model at individual site (see Figures 1-4 to 1-5).
- The model has been validated to an appropriate detailed for the wider network in the context of SIMTA site.

- The calibration/validation results demonstrate that Hyder's SSTM model has been calibrated and validated appropriately in accordance with the industry practice acceptance criteria. A robust calibration and validation has been achieved for both AM and PM peak period strategic models, providing confidence that network traffic models are appropriate for assessing the SIMTA development and associated road improvement options and strategies for the Site.

The detailed calibration and validation outcomes from strategic model are shown in below.

Table 1-4 Screenline Calibration - AM Peak

Screenline Comparisons	Observed		Model		Achieved Values		
	All - AM 1Hr		All - AM 1Hr		All - AM 1Hr		
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	Two-way
RTA Screenline No.							
R1	22,114	14,743	21,700	15,300	-2%	4%	0%
R2	32,216	37,097	31,800	35,800	-1%	-4%	-2%
R3	4,079	7,339	4,000	7,000	-2%	-4%	-3%
R5	32,050	16,262	30,900	16,400	-4%	1%	-2%
R11	7,339	4,914	7,100	5,000	-4%	3%	-1%
BTS Screenline No.							
B1	20,371	19,566	19,500	18,900	-4%	-4%	-4%
B3	17,684	8,648	18,300	8,800	4%	1%	3%
B6	18,711	14,024	18,600	12,900	0%	-8%	-4%
Sub Screenlines.							
S1	7,473	5,821	8,100	5,400	8%	-8%	7,473
S2	7,349	6,557	7,500	6,400	2%	-2%	7,349
S3	7,134	6,279	7,000	5,700	-2%	-10%	7,134
S4	5,291	2,396	5,100	2,400	-4%	1%	5,291
S5	7,671	4,898	7,200	4,900	-6%	0%	7,671

Model code: V3R1_SSTM F:\AA003210\D-Calculations\Traffic and Modelling_POST DGR\Data Processing\Model Calibration\V3_SSTM_SIMTA model calibration results

Table 1-5 Screenline Calibration - PM Peak

Screenline Comparisons	Observed		Model		Achieved Values		
	All - PM 1Hr		All - PM 1Hr		All - PM 1Hr		
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	Two-way
RTA Screenline No.							
R1	16,329	20,988	17,800	21,300	9%	2%	5%
R2	36,817	34,798	36,400	33,200	-1%	-5%	-3%
R3	7,597	5,030	7,400	4,900	-2%	-2%	-2%
R5	19,488	27,517	18,800	26,000	-3%	-5%	-5%
R11	5,595	7,672	6,700	7,700	20%	0%	9%
BTS Screenline No.							
B1	20,005	19,846	20,000	19,900	0%	0%	0%
B3	10,058	17,808	9,500	17,800	-6%	0%	-2%
B6	15,157	19,540	14,900	18,700	-2%	-4%	-3%
Sub Screenlines.							
S1	6,423	8,604	6,500	7,900	1%	-8%	-4%
S2	6,724	7,521	6,900	7,400	3%	-1%	1%
S3	6,436	7,477	6,000	6,900	-7%	-8%	-7%
S4	2,976	5,324	3,000	5,100	2%	-4%	-2%
S5	5,221	7,658	5,300	8,500	2%	11%	7%

Model code: V3R1_SSTM F:\AA003210\D-Calculations\Traffic and Modelling_POST DGR\Data Processing\Model Calibration\V3_SSTM_SIMTA model calibration results

Table 1-6 Link Validation for Core Area - AM Peak

Roads/Locations	Observed			Modelled			Difference (veh)			Difference (%)			GEH		
	NB/ EB	SB/ WB	Two-Way	NB/ EB	SB/ WB	Two-Way	NB/ EB	SB/ WB	Two-Way	NB/ EB	SB/ WB	Two-Way	NB/ EB	SB/ WB	Two-Way
Moorebank Avenue-South of Anzac Road	1,114	622	1,735	1,230	620	1,850	120	0	110	10%	0%	7%	3	0	3
Anzac Road-East of Moorebank Avenue	354	458	812	370	410	780	20	-50	-30	5%	-10%	-4%	1	2	1
Moorebank Avenue-South of Jacquinot Road	1,098	372	1,471	1,160	410	1,570	60	40	100	6%	10%	7%	2	2	3
M5 Motorway-West of Moorebank Avenue	5,249	4,390	9,638	5,430	4,010	9,440	180	-380	-200	3%	-9%	-2%	2	6	2
M5 Motorway-East of Moorebank Avenue	4,071	4,214	8,285	4,190	3,590	7,790	120	-620	-490	3%	-15%	-6%	2	10	6

Model code: V3R1_SSTM F:\AA003210\D-Calculations\Traffic and Modelling_POST DGR\Data Processing\Model Calibration\V3_SSTM_SIMTA model calibration results

Table 1-7 Link Validation for Core Area - PM Peak

Roads/Locations	Observed			Modelled			Difference (veh)			Difference (%)			GEH		
	NB/ EB	SB/ WB	Two-Way	NB/ EB	SB/ WB	Two-Way	NB/ EB	SB/ WB	Two-Way	NB/ EB	SB/ WB	Two-Way	NB/ EB	SB/ WB	Two-Way
Moorebank Avenue-South of Anzac Road	546	1,170	1,716	700	1,270	1,970	150	100	250	28%	9%	15%	6	3	6
Anzac Road-East of Moorebank Avenue	447	476	923	410	500	910	-40	20	-10	-8%	5%	-1%	2	1	0
Moorebank Avenue-South of Jacquinot Road	376	1,190	1,566	530	1,270	1,800	150	80	230	41%	7%	15%	7	2	6
M5 Motorway-West of Moorebank Avenue	4,483	5,477	9,960	4,340	5,360	9,700	-140	-120	-260	-3%	-2%	-3%	2	2	3
M5 Motorway-East of Moorebank Avenue	4,107	4,367	8,474	3,600	3,990	7,590	-510	-380	-880	-12%	-9%	-10%	8	6	10

Model code: V3R1_SSTM F:\AA003210\D-Calculations\Traffic and Modelling_POST DGR\Data Processing\Model Calibration\V3_SSTM_SIMTA model calibration results

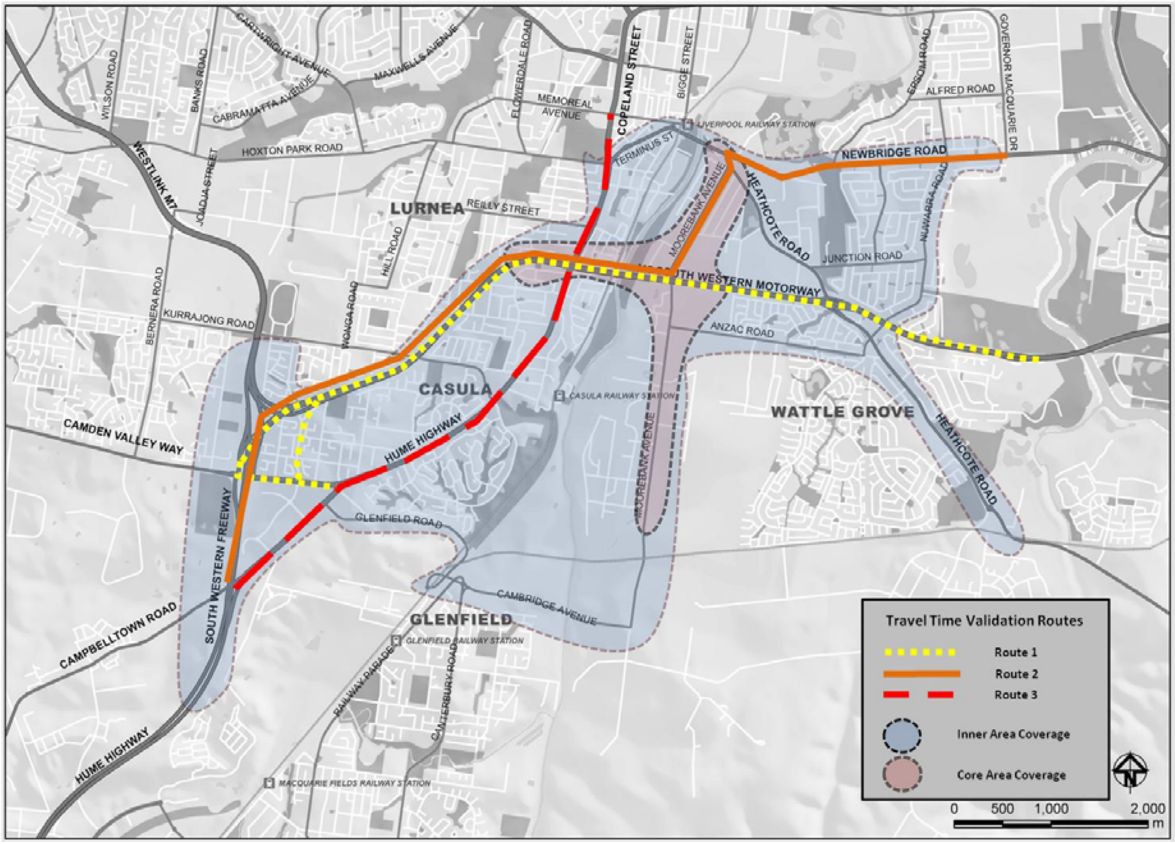
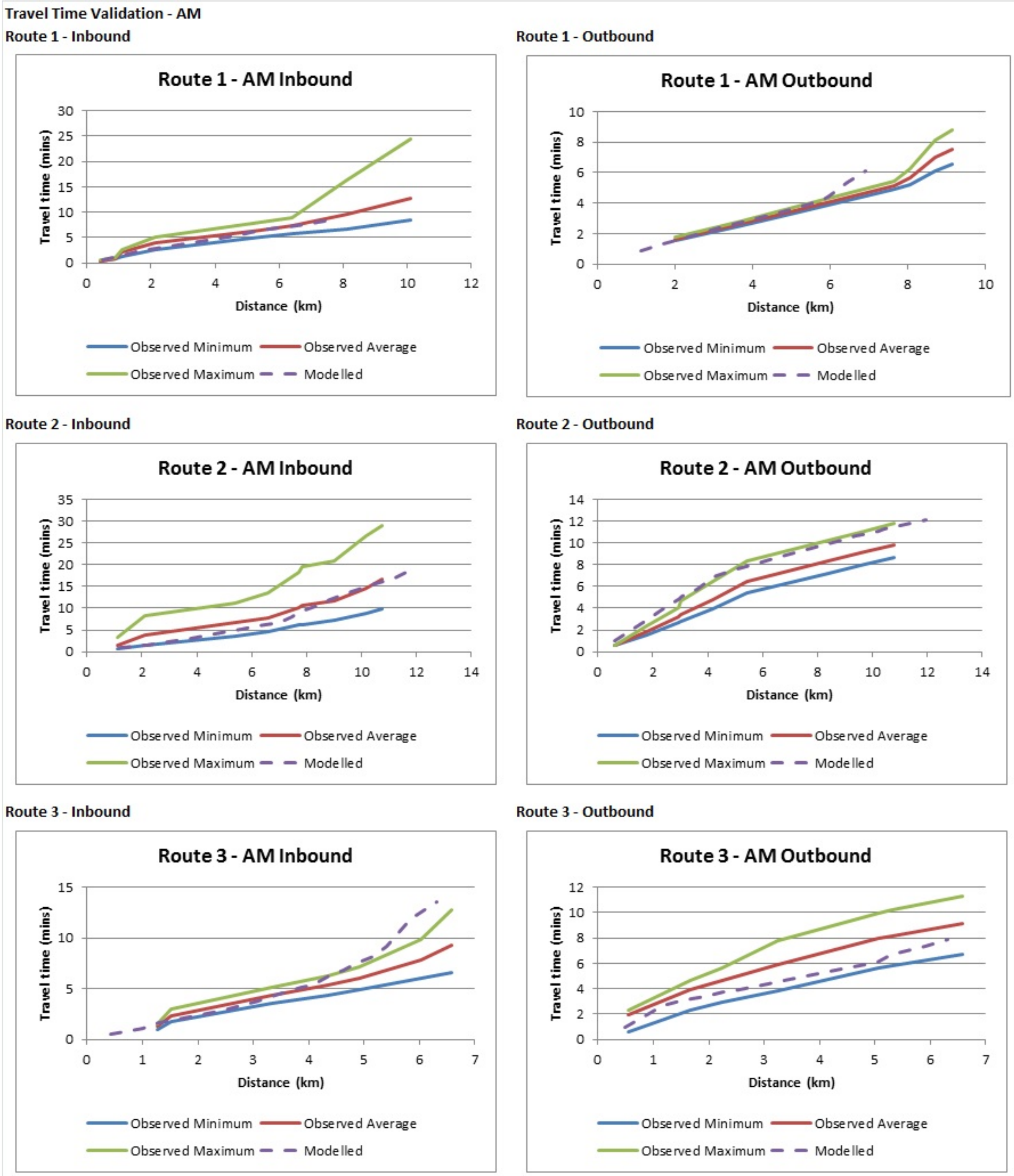


Figure 1-6 Travel Time Validation Routes

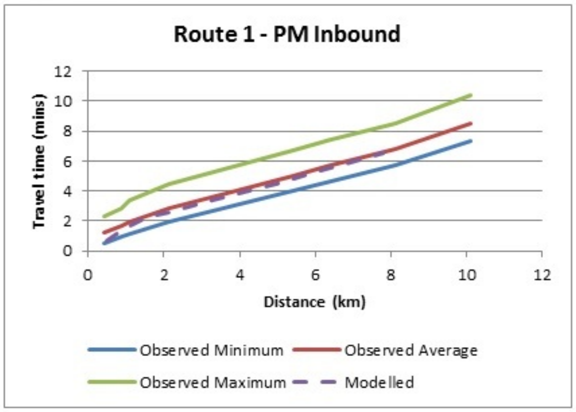


Model code: V3R1_SSTM F:\AA003210\D-Calculations\Traffic and Modelling_POST DGR\Data Processing\Model Calibration\V3_SSTM_SIMTA model calibration results

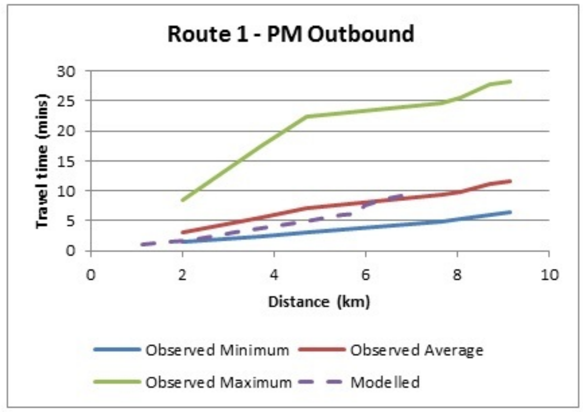
Figure 1-7 Travel Time Validation Results – AM Peak

Travel Time Validation

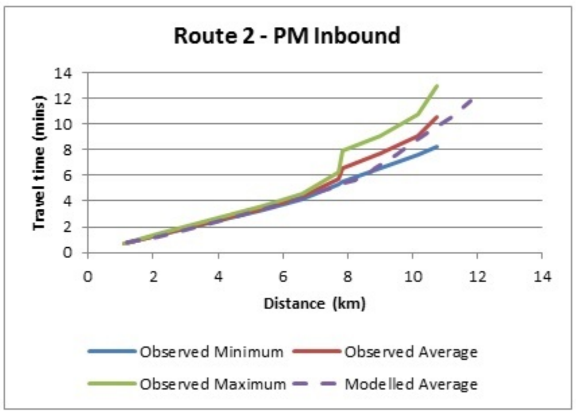
Route 1 - Inbound



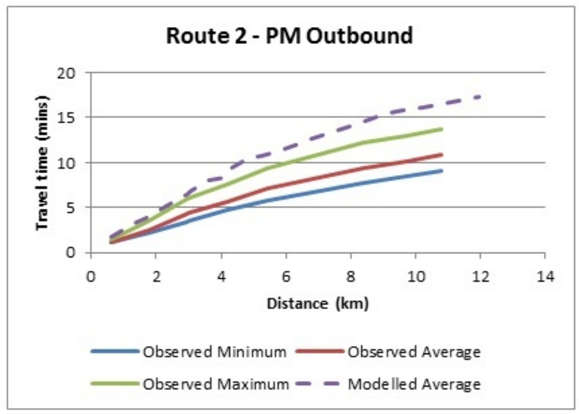
Route 1 - Outbound



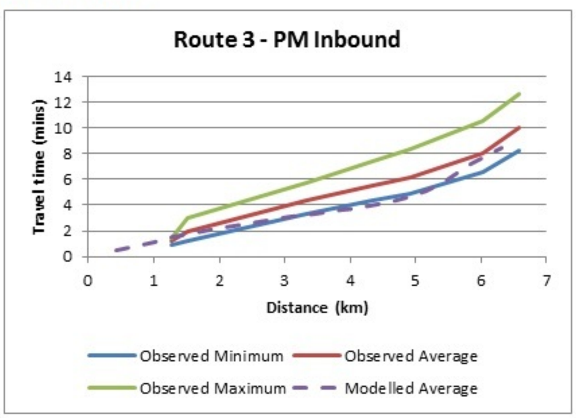
Route 2 - Inbound



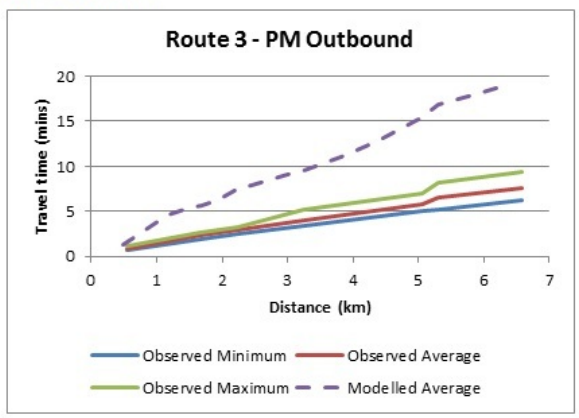
Route 2 - Outbound



Route 3 - Inbound



Route 3 - Outbound



Model code: V3R1_SSTM F:\AA003210\D-Calculations\Traffic and Modelling_POST DGR\Data Processing\Model Calibration\V3_SSTM_SIMTA model calibration results

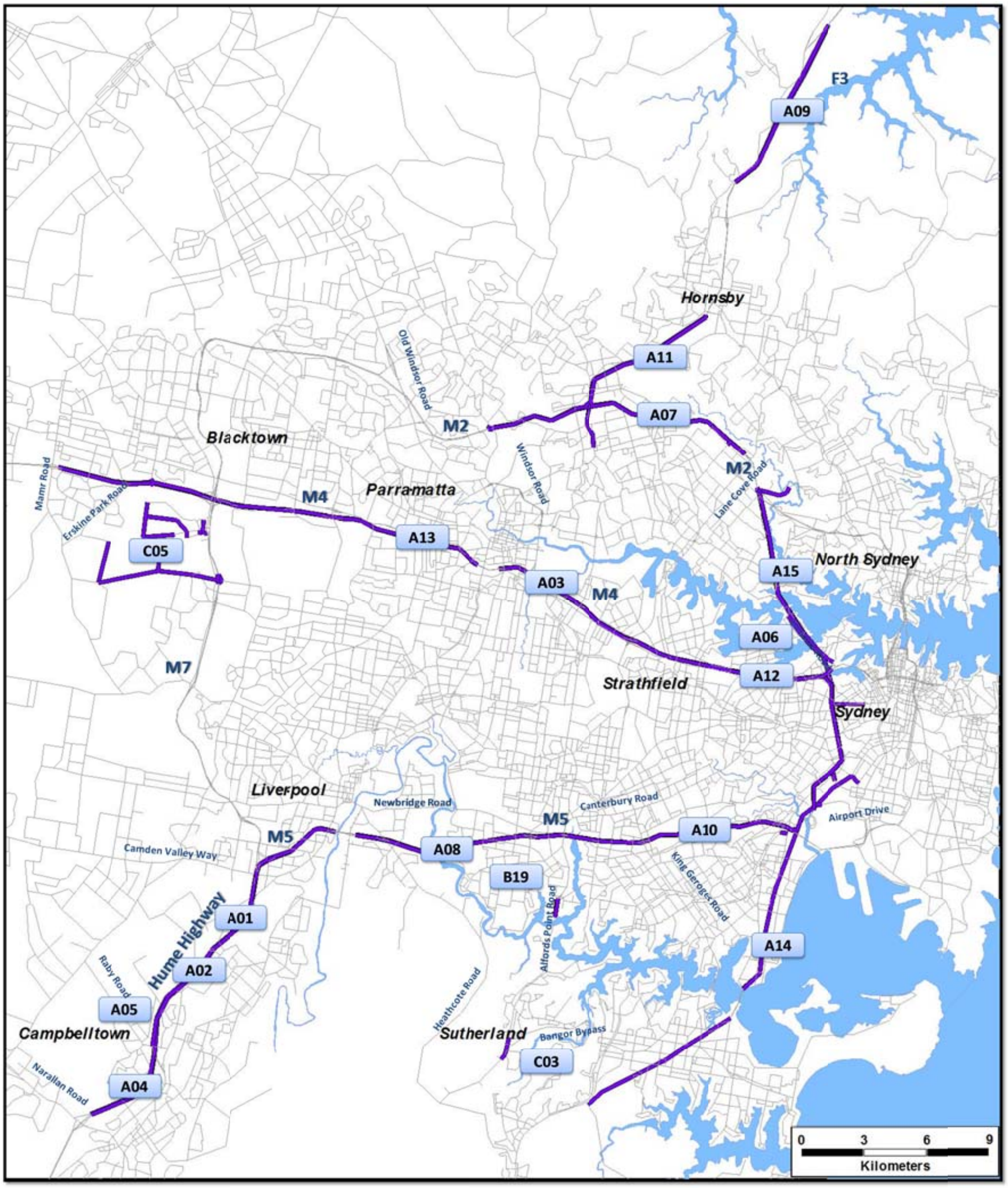
Figure 1-8 Travel Time Validation Results – PM Peak

1.10 Future Road Improvement Project

Table 1.4 summarises the future road improvement projects and time frame used for modelling purpose. Figure 1 shows road improvement projects.

Table 1-4 Future road improvement projects

Hyder Reference ID	Project/Description	Improvement Scope	Modelled years				
			2016	2021	2026	2031	2036
A01	F5 Duplication - Camden Valley Way to Brook Road - 8 Lanes	8 lanes from Camden Valley Way to Brook Road - Opened to traffic in 2008.	✓	✓	✓	✓	✓
A02	F5 Duplication - Brook Road to Raby Road - 8 Lanes	8 lanes from Brook Road to Raby Road - Opened to traffic in late 2010.	✓	✓	✓	✓	✓
A03	M4 Toll Removal	Toll free was implemented in February 2010	✓	✓	✓	✓	✓
A04	F5 Upgrade - Raby Road to Narellan Road - 6 Lanes	6 lanes from Raby Road to Narellan Road - Expected for completion in late 2011.	✓	✓	✓	✓	✓
A05	New F5 north facing on ramp	New F5 north facing on-ramp from Raby Road to F5	✓	✓	✓	✓	✓
A06	Inner West	Tidal flow, bus lanes and duplication of Iron Cove Bridge, Victoria Road	✓	✓	✓	✓	✓
A07	M2 Widening	1. Add the third eastbound lane from Windsor Road to Lane Cove Road 2. Add the third westbound lane from Beecraft Road to Cumberland Highway 3. New westbound off ramp from M2 to Herring Rd 4. New eastbound on ramp from Christie Rd to M2 5. New eastbound off ramp from M2 to Windsor Rd 6. New westbound on ramp from Windsor Rd to M2	✓	✓	✓	✓	✓
A08	M5 West Widening	Preferred option description. Widening M5 South West Motorway to three lanes each way (3/3) between Camden Valley Way, Prestons to King Georges Road, Beverly Hills.	✓	✓	✓	✓	✓
A09	F3 Widening	Upgrade from 4 to 6 lanes from Mount Kuring-gai to Cowan	✓	✓	✓	✓	✓
A10	M5 East Duplication	Preferred option description. Widening of the M5 East to four lanes each way (4/4) between King Georges Road, Beverly Hills to Bexley Road, Earlwood. New M5 east tunnel between Bexley Road, Earlwood to Marsh Street, Arncliffe. A new surface arterial road from M5 East to the airport and inner southern Sydney.		✓	✓	✓	✓
A11	F3 to M2	New link between F3 Freeway and M2 Motorway				✓	✓
A12	M4 Extension	Completion of works from Strathfield to Airport/Port, including Qantas Drive and O'Riordan St Intersection and M4 8-laning from North Strathfield to Church Street			✓	✓	✓
A13	M4 Widening	8 lanes from Church Street and Mamre Road			✓	✓	✓
A14	F6	4 lanes from Loftus to St Peters, with connection to M4 Extension				✓	✓
C05	Western Sydney Employ Hub, Erskine Park	New development land	✓	✓	✓	✓	✓
C03	Banjor Bypass Stage 2, West Menai	Extension of New Illawarra Rd, South of Banjor Bypass (Stage 2), Opened to traffic in April 2011.	✓	✓	✓	✓	✓
Note: (A15) M2 to M4 - Extension from Macquarie Park via Glagesville Bridge to M4 East at White Bay is expected for 2041							
F:\AA003695\D-Calculations\Traffic and Modelling\Calculations\Network Development\Future Road Projects\Future Road Improvement Projects.xlsx							



Future1-9 Road improvement projects

2 FUTURE TRAFFIC PROJECTIONS

Tables 2-1 and 2-2 show the results of the network modelling with and without SIMTA, for selected roads within the study area during the AM peak hour and PM peak hour respectively.

With SIMTA proposal, the highest increase in traffic is forecast on the Moorebank Avenue north of SIMTA site (M-1). Anzac Road is expected not to carry trucks generated by the SIMTA proposal but will carry small employee related traffic to and from SIMTA. Beyond the core area, the increasing in peak hour traffic resulting from the SIMTA is small.

With the SIMTA proposal the container model forecasts reductions in truck trips to and from Port Botany and Eastern Creek. The modelling analysis suggests that the operation of SIMTA at Moorebank would have the potential to reduce the volumes of heavy vehicles movements along the M5 corridor. These heavy vehicle movements would be primarily redistributed to the west of M5/Moorebank interchange in Liverpool, part of South West and Industrial West of Sydney. Beyond the core area, where the SIMTA heavy vehicle volume increases, it is generally by a small margin. The additional truck activity generated by the SIMTA proposal would be concentrated on key arterial roads such as M5 Motorway, Hume Highway and M7 Motorway.

The results in Table 2-1 and 2-2 showed that Moorebank Avenue showed contra flow traffic distribution. The northbound traffic showed the highest peaks in the AM. The reverse distribution was observed in the southbound direction in PM. In 2031, SIMTA site traffic would counterbalance traffic flows on the Moorebank Avenue. Model forecasts that in the AM, SIMTA employee cars would be dominant in the southbound direction, as they would be destined for the site. Similarly, in the PM, SIMTA employee car would be dominant in the northbound direction.

Table 2-5 Predicted Traffic Volume on Key Roads– AM Peak (2010- 2031)

ID	Roads/ Locations	2010 Existing	2031 Base Without SIMTA	2031 With SIMTA	Annual Growth 2010-2031 (%)	
					Without SIMTA	With SIMTA(1)
Northbound/Eastbound						
M-1	Moorebank Avenue - South of Anzac Road	1,110	1,530	1,600	1.8%	2.1%
M-2	Anzac Road - East of Moorebank Avenue	350	430	440	1.1%	1.2%
M-3	Moorebank Avenue - South of Jacquinot Road	1,100	1,130	1,185	0.1%	0.4%
M-4	M5 Motorway - West of Moorebank Avenue	5,250	8,230	8,440	2.7%	2.9%
M-5	M5 Motorway - East of Moorebank Avenue	4,070	6,380	6,340	2.7%	2.7%
M-7	M5 Motorway - South of Campbelltown Road	4,440	5,930	5,980	1.6%	1.7%
M-8	Hume Highway -between Myall Road and Pine Road	2,580	2,630	2,645	0.1%	0.1%
Southbound/Westbound						

ID	Roads/ Locations	2010 Existing	2031 Base Without SIMTA	2031 With SIMTA	Annual Growth 2010-2031 (%)	
					Without SIMTA	With SIMTA(1)
M-1	Moorebank Avenue - South of Anzac Road	620	860	1,250	1.8%	4.8%
M-2	Anzac Road - East of Moorebank Avenue	460	560	600	1.0%	1.4%
M-3	Moorebank Avenue - South of Jacquinot Road	370	380	435	0.1%	0.8%
M-4	M5 Motorway - West of Moorebank Avenue	4,390	6,880	6,960	2.7%	2.8%
M-5	M5 Motorway - East of Moorebank Avenue	4,210	6,600	6,680	2.7%	2.8%
M-7	M5 Motorway - South of Campbelltown Road	3,080	4,110	4,140	1.6%	1.6%
M-8	Hume Highway -between Myall Road and Pine Road	1,240	1,260	1,285	0.1%	0.2%

Note 1: The 2031 base without SIMTA, proposed network upgrades were assumed as per Table 1-4.) In 2031 with SIMTA traffic forecasts includes both truck redistribution effect and additional employee car.

Table 2-6 Predicted Traffic Volume on Key Roads– PM Peak (2010-2031)

ID	Roads/ Locations	2010 Existing	2031 Base Without SIMTA	2031 With SIMTA	Annual Growth 2010-2031 (%)	
					Without SIMTA	With SIMTA(1)
Northbound/Eastbound						
M-1	Moorebank Avenue - South of Anzac Road	550	730	1,110	1.6%	4.8%
M-2	Anzac Road - East of Moorebank Avenue	440	530	570	1.0%	1.4%
M-3	Moorebank Avenue - South of Jacquinot Road	380	390	445	0.1%	0.8%
M-4	M5 Motorway - West of Moorebank Avenue	4,490	7,600	7,700	3.3%	3.4%
M-5	M5 Motorway - East of Moorebank Avenue	4,110	6,960	7,020	3.3%	3.4%
M-7	M5 Motorway - South of Campbelltown Road	3,870	5,340	5,380	1.8%	1.9%
M-8	Hume Highway -between	1,440	1,470	1,485	0.1%	0.1%

ID	Roads/ Locations	2010 Existing	2031 Base Without SIMTA	2031 With SIMTA	Annual Growth 2010-2031 (%)	
					Without SIMTA	With SIMTA[1]
	Myall Road and Pine Road					
Southbound/Westbound						
M-1	Moorebank Avenue - South of Anzac Road	1,170	1,560	1,690	1.6%	2.1%
M-2	Anzac Road - East of Moorebank Avenue	480	580	590	1.0%	1.1%
M-3	Moorebank Avenue - South of Jacquinot Road	1,190	1,210	1,235	0.1%	0.2%
M-4	M5 Motorway - West of Moorebank Avenue	5,470	9,260	9,450	3.3%	3.5%
M-5	M5 Motorway - East of Moorebank Avenue	4,360	7,380	7,370	3.3%	3.3%
M-7	M5 Motorway - South of Campbelltown Road	3,660	5,040	5,090	1.8%	1.9%
M-8	Hume Highway -between Myall Road and Pine Road	2,600	2,650	2,705	0.1%	0.2%

Note 1: The 2031 base without SIMTA, proposed network upgrades were assumed as per Table 1-4.) In 2031 with SIMTA traffic forecasts includes both truck redistribution effect and additional employee car.

Appendix D

Technical Note 3
Traffic Generation

SIMTA SYDNEY INTERMODAL TERMINAL ALLIANCE

Part 3A Concept Plan Application

Traffic and Transport

August 2013

SYDNEY INTERMODAL TERMINAL ALLIANCE (SIMTA)

MOOREBANK INTERMODAL TERMINAL FACILITY (MITF)

TECHNICAL NOTE 3

TRAFFIC GENERATION

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SYDNEY INTERMODAL TERMINAL ALLIANCE (SIMTA)

MOOREBANK INTERMODAL TERMINAL FACILITY (MITF)

TECHNICAL NOTE 3

TRAFFIC GENERATION

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Approver	Mukit Rahman
Report No	3
Date	August 2011

REVISIONS

Revision	Date	Description	Prepared By	Approved By
A	15/04/11	DRAFT for client review	NC	MR
B	17/06/11	DRAFT	MR	
C	05/08/11	Updated in line with Halcrow's review and comments	MR	NM

EXECUTIVE SUMMARY

The Sydney Intermodal Terminal Alliance (SIMTA) is a joint venture between Stockland, Qube Logistics and QR National. The SIMTA Moorebank Intermodal Terminal Facility (SIMTA proposal) is proposed to be located on the land parcel currently occupied by the Defence National Storage and Distribution Centre (DNSDC) on Moorebank Avenue, Moorebank, south west of Sydney. SIMTA proposes to develop the DNSDC site into an intermodal terminal facility and warehouse/distribution facility, which will offer container storage and warehousing solutions with direct rail access. Hyder has prepared this technical note to document the trip generation methodology and key assumptions used for the SIMTA proposal.

The SIMTA site is located in the Liverpool Local Government Area. It is 27 kilometres west of the Sydney CBD, 16 kilometres south of the Parramatta CBD, 5 kilometres east of the M5/M7 Interchange, 2 kilometres from the main north-south rail line and future Southern Sydney Freight Line, and 0.6 kilometres from the M5 motorway.

The project will be undertaken as a staged development. An annual operating capacity of one million TEUs is anticipated in the ultimate stage, when fully developed.

Freight will arrive by rail and be transported to the warehouse and distribution facilities within the SIMTA site, or be directly loaded on to trucks for transport to warehouses and nearby logistics centres. Exports and empty freight containers will be transported within the facility by truck and then loaded onto rail for transport back to Port Botany.

The site will generate articulated trucks (B-doubles, semi-trailers) and rigid trucks related to freight movements, and car trips related to direct employment at the site. When SIMTA site is fully developed and reaches its one million TEU capacity, approximately 2,600 daily truck movements are expected to be generated to and from site.

The analysis has found that approximately 3,600 daily car movements are expected to be generated to and from site. The key “business as usual” assumptions are documented within the report.

Sensitivity analysis was carried out to understand the impact of three key assumptions: (a) increasing the proportion of 40ft equivalent containers, (b) improving vehicle utilisation, and (c) increased employment. Testing shows that the current trend towards larger containers and larger vehicles results in reduced truck generation from the site. It also showed that since employee numbers are directly related to car trip rates, an increase in staff numbers will result in a pro-rata increase in car trip generation.

CONTENTS

APPENDICES

1 INTRODUCTION

Hyder has prepared this technical note to document the methodology and key assumptions underpinning the calculation of SIMTA truck and employee car trip generation.

1.1 Background

The Sydney Intermodal Terminal Alliance (SIMTA) is a joint venture between Stockland, Qube Logistics and QR National. The SIMTA Moorebank Intermodal Terminal Facility (SIMTA proposal) is proposed to be located on the land parcel currently occupied by the Defence National Storage and Distribution Centre (DNSDC) on Moorebank Avenue, Moorebank, south west of Sydney. SIMTA proposes to develop the DNSDC site into an intermodal terminal facility and warehouse/distribution facility, which will offer container storage and warehousing solutions with direct rail access

The SIMTA site, approximately 83 hectares in area, is currently operating as a Defence storage and distribution centre. The SIMTA site is legally identified as Lot 1 in DP1048263 and zoned as General Industrial under Liverpool City Council LEP 2008.

The parcels of land to the south and south west that would be utilised for a proposed rail link are referred to as the rail corridor. The proposed rail corridor covers approximately 65 hectares and adjoins the Main Southern Railway to the north. Existing land use includes vacant land, golf course, extractive industries, and a waste disposal depot.

The SIMTA site is located in the Liverpool Local Government Area. It is 27 kilometres west of the Sydney CBD, 16 kilometres south of the Parramatta CBD, 5 kilometres east of the M5/M7 Interchange, 2 kilometres from the main north-south rail line and future Southern Sydney Freight Line, and 0.6 kilometres from the M5 motorway.

Figure 1 shows the SIMTA proposal in the context of road and rail network.

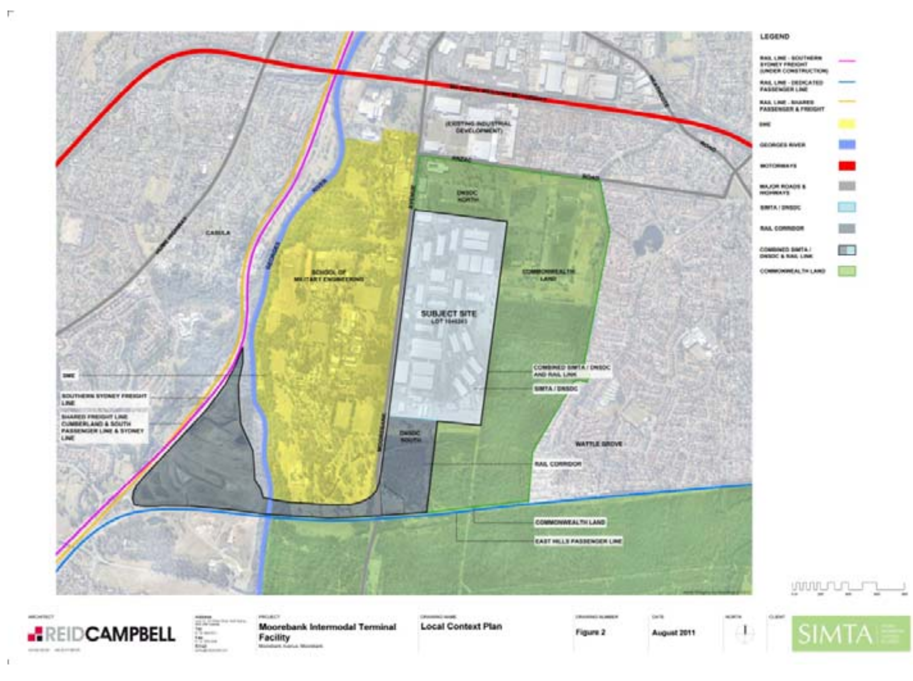

Figure 1-1 Moorebank Intermodal Terminal Site (SIMTA proposal)

The SIMTA proposal comprises the following key components:

- **Rail Link** – connecting the SIMTA site with the Southern Sydney Freight Line. The detailed design of the rail infrastructure comprising the rail link will be subject to a further application and approval process.
- **Intermodal Terminal** – proposed to include on-site freight rail sidings to accommodate local freight trains to Port Botany. Containerised import freight will arrive from Port Botany by rail and be transported to the warehouse and distribution facilities within the SIMTA site, or be directly loaded on to trucks for transport to warehouses and nearby logistics centres. Exports and empty freight containers will be transported to the facility by truck and then loaded onto rail for transport back to Port Botany. The terminal is expected to contain four rail sidings, with areas for container handling and storage, and is anticipated to have the capacity to handle up to 1 million twenty foot equivalent units (TEUs) per annum.
- **Empty Container Storage** – will be provided within the site. Empty containers would either be packed on-site ready for transport to the port by rail, or trucked to off-site locations where they would be packed and returned to the SIMTA site to be loaded onto rail and transported to the port.
- **Warehouse and Distribution Facilities** – with approximately 300,000m^2 of warehouses and ancillary offices will be constructed to the east of the intermodal terminal. These buildings are proposed to be constructed in stages in response to site servicing availability and market demands. It is expected that warehouses will range in size, depending on tenant needs.
- **Freight Village** – approximately 8,000m^2 of support services will be provided on site. These may include site management and security offices, meeting rooms, driver facilities and convenience retail and business services.

The project will be undertaken as a staged development and it is intended that an overall Master Plan, for the entire site, be undertaken for the purpose of applying for Concept Plan approval under Part 3A of the Environmental Planning and Assessment Act 1979.

1.2 Purpose of Technical Note

The Director-General, along with the RTA, Transport NSW and Liverpool City Council are interested in understanding the potential impact of the SIMTA proposal in Moorebank. These authorities have outlined their key concerns in their responses to the Director-General's Requirements (DGR's 24 December 2010). Transport network capacity issues are highlighted as a key area of interest in each response. This technical note has been prepared in order to document the methodology and key assumptions underpinning the calculation of SIMTA trip generation to be applied during the transport impact assessment.

1.2.1 Scope of the report

As part of the transport impact assessment it is necessary to predict the volume of traffic that the site will generate across the day, and distribute across the immediate state and local road network. This technical note sets out the method by which that traffic generation is a calculated. It includes:

- A summary of the traffic surveys already undertaken to understand the traffic volumes in the study area.
- The method and assumptions used to calculate the truck and private vehicle traffic generation for each hour of a typical weekday.
- An outline of the assumed truck and private vehicle distribution throughout the study network; and

- The results of independent traffic generation calculations in order to validate (i.e. reality check) the traffic generation results for the SIMTA proposal.
- Sensitivity testing of key trip generation assumptions, as proposed by RTA's Officers on 3 March 2011[1].

1.3 Document Structure

This technical note is composed of the following sections:

Executive Summary – provides a concise summary of the trip generation and distribution methodology and assumptions.

Chapter 1: Introduction – outlines the project context and purpose of this report.

Chapter 2: Trip Generation – describes the methodology and "business as usual" assumptions behind the calculation of trip generation for the full development of the SIMTA site.

Chapter 3: Validation of Truck Generation – provides a comparison between traffic generation calculations in this report and independent sources of data.

Chapter 4: Sensitivity Testing – describes the sensitivity tests undertaken around some of the key assumptions.

[1] SIMTA Moorebank Intermodal Terminal Facility Meeting Minutes - RTA, TNSW, Hyder, Stockland. 03/03/11.

2 TRIP GENERATION

The primary purpose of the SIMTA proposal will be the transfer of shipping containers to and from Port Botany by rail and the distribution of freight throughout south western Sydney. The SIMTA proposal allows for the unpacking of a proportion of the containers on site and the distribution of their contents. These freight-based activities will generate heavy goods vehicle (rigid trucks, semi-trailers and B-doubles) trips. The calculation of freight-generated vehicle trips is discussed in Section 2.1.

In addition to freight activities, the site will provide employment in the operation of the Intermodal Terminal, in the warehouses and ancillary freight village. The calculation of employee generated vehicle trips is discussed in Section 2.2.

2.1 Freight Generated Traffic

Freight generated traffic was calculated from first principles based on a set of empirical parameters[2]. This section describes the calculation methodology and assumptions used for SIMTA.

2.1.1 Movement of Containers and Freight

Freight will arrive by rail and be transported to the warehouse and distribution facilities within the SIMTA site, or be directly loaded on to trucks for transport to warehouses and nearby logistics centres. Exports and empty freight containers will be transported to the facility by truck and then loaded onto rail for transport back to Port Botany.

An annual operating capacity of one million TEUs is anticipated in the ultimate stage to meet NSW Government objectives[3]. SIMTA have provided the following breakdown of site operations for the full development "business as usual" scenario:

- The volume of container activity through terminal is proposed to be approximately one million TEU per annum moving to and from Port Botany and SIMTA site.
- Containers arriving by rail from Port Botany (500,000 TEUs) will be unloaded onto rail stacks within the intermodal facility. The 500,000 TEUs would be returned to the port by rail. Containers that were unloaded on site (200,000 TEUs), now empty will be loaded onto trains for return to Port Botany.
- Of those 500,000 TEUs containers arriving by rail, 200,000 TEUs will be transported to warehouses within the intermodal facility and unloaded onsite. The remaining 300,000 TEUs will be transferred directly onto trucks for transport offsite.
- Of the containers that were transported offsite (300,000 TEUs), 175,000 TEUs will be unloaded at external depots and returned to SIMTA for loading onto trains for return to Port Botany. The remaining containers that were transported offsite (125,000 TEUs) will return full, to be loaded onto trains for return to Port Botany and export.

SIMTA have advised that some imported containers (125,000TEUs) will be transported to external depots and re-packed off-site ready to be returned to SIMTA for export. This assumes that depots receiving full containers (importing) will also use those same containers for export.

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[2] Intermodal Logistics Centre at Enfield-Environmental Assessment, 2005, Sinclair Knight Merz (SKM)

[3] NSW State Plan 2010 sets an objective to ensure 40% of container movements out of Port Botany are transported via rail by 2016.