Halcrow MWT

Queensland Curtis LNG Project EIS
Microsimulation Assessment

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QGC - A BG Group Business

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Microsimulation Assessment

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Contents

List of figures

List of tables

1 Introduction

1.1 Background

Halcrow Pacific Pty Ltd (trading as Halcrow MWT) was commissioned by QGC - A BG Group Business (QCG) to undertake a microsimulation assessment for the Environmental Impact Statement (EIS) of the proposed Queensland Curtis LNG (QCLNG) Project ('the Project'). The Project includes the development of existing coal seam gas fields in the Surat Basin of western Queensland, the construction of a liquefied natural gas (LNG) processing and export facility on Curtis Island near Gladstone in central Queensland and the construction of a pipeline network linking the gas fields to the processing and export facility.

The coverage of this study relates exclusively to the Project's LNG processing and exporting facility. This report is to be read in conjunction with the Road Impact Assessment (the 'RIA'), *Queensland Curtis LNG Project EIS Traffic and Transport Impact Assessment* (Halcrow MWT, 2009), contained in the overarching Environmental Impact Statement (EIS) document.

1.2 Purpose of this Report

The purpose of this report is to further enhance the findings of the RIA, which was developed from a comprehensive set of SIDRA analyses. Although SIDRA is a robust and industry accepted software package, its intersection evaluation can be somewhat limited when more complex network considerations come into play. This could include situations where intersections are closely spaced or operating under signal co-ordination. Microsimulation packages can incorporate all of these network considerations, in addition to providing a visual medium in which to observe the modelled future scenarios. For the purposes of this project, microsimulation modelling was undertaken within the latest Paramics V6.5 software package.

A site investigation in 2008 of the broader Gladstone transport network revealed that there are two areas that would benefit from additional microsimulation modelling. These areas are:

- The section of Glenlyon Road which is bound by William Street in the north and Tank Street in the south; and
- The Dawson Highway/Phillip Street signalised roundabout.

These locations are show in Figure 2-1.

1.3 Structure of this report

The microsimulation assessment is presented in this report in the following sections:

- **Section 2** describes the scope of the assessment.
- **Section 3** describes the model development process (methodology) and outlines the raw data that was utilised in order to create the models.
- **Section 4** presents the results of the network analysis; and
- **Section 5** presents the study conclusions.

2 Scope of Assessment

2.1 Study Area

The scope of the assessment was separated into two model areas. These areas are indicated in Figure 2-1.

Model 1 encompasses the following intersections:

- Glenlyon Road /William Street;
- Glenlyon Road /Port Access Road/Railway Street;
- Glenlyon Road /Bramston Street/Dawson Highway;
- Glenlyon Road /Herbert Street;
- Glenlyon Road /Tank Street; and
- Bramston Road /Goondoon Street.

The Model 1 area was selected as it encompasses the key confluence of the two major roads within Gladstone City and will therefore form part of the likely route choice for peak construction generated traffic when Auckland Point is utilised. Site investigations also revealed that this area has the greatest potential for impact due to the existing levels of congestion observed during the peaks. In addition to the above, the intersections within the modelled area are closely spaced (in the vicinity of Port Access Road) and signal co-ordination exists for the intersections located at Port Access Road and Bramston Street.

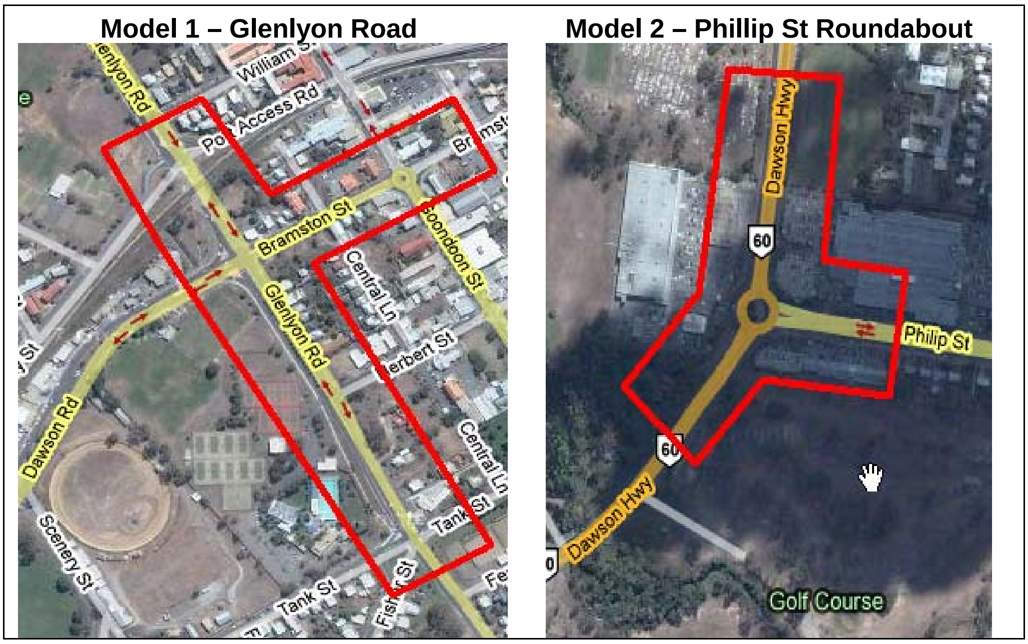


Figure 2-1 Study Area

Model 2 incorporates the area surrounding the Dawson Highway/Phillip Street roundabout. This region was selected not only because of the observed levels of congestion, but also due to the presence of signal metering on the roundabout. As mentioned in the RIA, SIDRA is able to roughly approximate intersection performance through a series of iterations involving analysis of performance 'with' and then 'without' the meter. Given the coarseness of this technique it was considered that microsimulation was a more appropriate tool for evaluating likely future year performance.

2.2 Scenarios for Assessment

The scenarios for assessment are summarised in Table 2-1. These scenarios represent a selection of the full assessment undertaken for the RIA. The selected scenarios represent the base reference scenario (i.e. Construction Camp Option D) along with a complete set of reference years without the proposed development. It should be noted that due to the adopted traffic assignment, there is no difference in modelled volumes at either model locations for road bridge option 1 and 2. Therefore, the assessment only includes the scenarios pertaining to road bridge option 1.

Table 2-1 Traffic Assessment Scenarios

Scenario / Year	No Dev	Construction			Operation			Road Option	Camp Option
		Train 1	Train 2	Train 3	Train 1	Train 2	Train 3		
Scenario 1 / 2008	✓							N/A	N/A
Scenario 2 / 2010	✓							N/A	N/A
Scenario 3d / 2010		✓	✓					N/A	D
Scenario 4 / 2013	✓							N/A	N/A
Scenario 5d / 2013			✓		✓			1	D
Scenario 7d / 2013			✓		✓			No Bridge	D
Scenario 12 / 2018	✓							N/A	N/A
Scenario 13d / 2018				✓	✓	✓		1	D
Scenario 15d / 2018				✓	✓	✓		No Bridge	D
Scenario 16 / 2021	✓							N/A	N/A
Scenario 17 / 2021					✓	✓	✓	1	N/A
Scenario 19 / 2021					✓	✓	✓	No Bridge	N/A

3 Model Development

3.1 Network Coding

The latest available aerial photograph was used at the time of model development to detail the microsimulation traffic models. This method allows for the precise replication of the existing road layout, including lane allocation, precise turn pocket lengths, turning lanes, and lane widths. The coded base case networks are shown in Figure 3-1 and Figure 3-2.

Traffic signal information throughout the base networks has been based on the use of fixed time signals and information obtained from DMR. Where signal coordination exists between intersections, details have been included within the model to replicate the existing conditions. A summary of DMR provided signal phasing data is included in Appendix A.

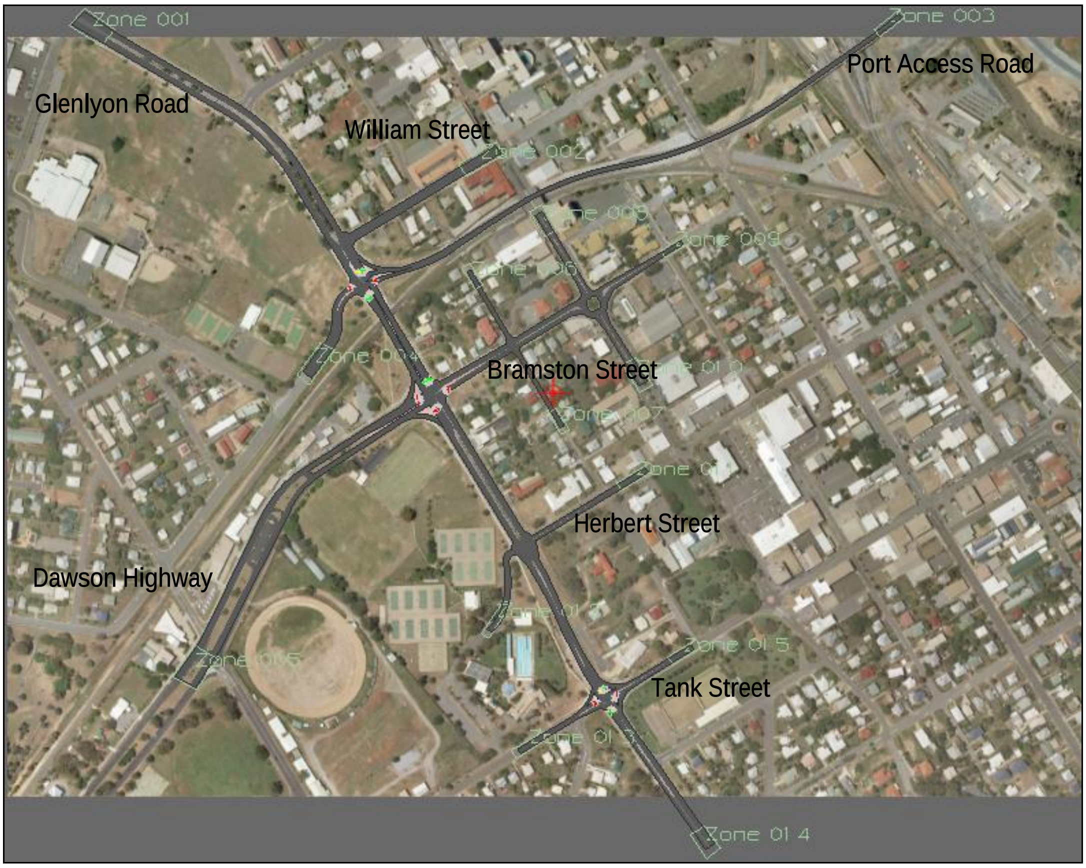


Figure 3-1 Modelled Existing Network –Area 1 (Glenlyon Road)

Figure 3-2 Modelled Existing Network – Area 2 (Phillip Street Roundabout)

3.2 Base Assumptions

Default Paramics model parameters have been used in the majority of the modelling process. These are validated and calibrated to replicate typical traffic conditions and have been used successfully in a vast number of simulation projects. Specific parameters have been changed in line with Halcrow-MWT standard practice and these include vehicle composition and the generalised cost coefficients. The value changes are based on fully adopted values by the New South Wales RTA and general peer acceptance of these values as best practice in replicating general Australian conditions.

3.3 Base Demand Matrix Estimation

3.3.1 Estimation Process

In order to replicate the existing traffic conditions for both the morning and evening peak hour periods, a 'matrix estimation' process was undertaken. This considers the relationship between link and turn flows and the desire to travel between origin and destination zones. The result is a matrix of trips that best replicates the observed trip patterns and is validated against known traffic count information.

Analysis of classified turning count data revealed that varying trip patterns emerge for different vehicle classifications. In order to accurately model current travel behaviour, 4 separate matrices were developed for the base models. These matrices are detailed as follows:

- Matrix 1 – Light vehicles – includes AUSTROADS class 1 and 2;
- Matrix 2 – Heavy rigid vehicles – includes AUSTROADS class 3, 4 and 5;
- Matrix 3 – Heavy vehicles – includes AUSTROADS class 6, 7, 8 and 9; and
- Matrix 4 – Oversize heavy vehicles – includes AUSTROADS class 10 and 11.

3.3.2 Base Traffic Generating Assumptions

The findings presented in this report are based upon the traffic generating assumptions and methodology discussed within the RIA. Since undertaking the microsimulation modelling exercise elements of the traffic generation have been revised, a summary of these changes is provided in Table 3-1 below.

Table 3-1 RIA Original and Refined Assumptions

Original Assumptions[1]	Refined Assumptions[2]
1. 2000 personnel for the Train 1 and 2 construction phase; 2. Fortnightly rotation assumption of 10 days on/4 days off; 3. Hybrid Construction Camp Option D all non local personnel residing in the camp (i.e. 45% of total workforce); 4. Anticipated pipeline movements are: • Dawson Highway – 168 trucks/day for 167 days; and • Gladstone Mt Larcom Road – 54 trucks/day for 21 days; and 5. Operations Phase Train 1 and 2 – 104 personnel, and Train 3 130 personnel.	1. 1500 personnel for the Train 1 and 2 construction phase; 2. 9 days on a fortnight (i.e. 5 days on/2 days off, then 4 days on/3 days off, being 90 hours per fortnight); 3. Hybrid Construction Camp Option D all non local personnel residing in the camp (i.e. 30% of total workforce); 4. Gladstone Port for the receipt of 260kms of 42" pipe in 18m lengths, 3 lengths/truck – equates to on average 20 trucks/day. On average 1.08 km/day of pipe moved over 25 day duration, equating to 10-11 month pipe transportation. Transport of 25km of pipe/ship/month, total 11 ships on average by end 2011. 5. Operations Phase Train 1 and 2 – 76 personnel, and Train 3 – 100 personnel.

[1] Used within RIA and microsimulation model

[2] Not used in RIA or microsimulation but covered by the original assumptions

The refined assumptions are important considerations when reviewing the microsimulation results. The results included within this report represent a 'worst case scenario' and demonstrate that there is significant 'headroom' factored into the microsimulation, exemplified by the following:

- Anticipated peak employee requirements are to be reduced by 25%, from 2000 personnel to 1500 personnel;
- Employee movements will be distributed over 4 movements in a fortnight rather than the 2 movements currently assumed within this report;
- Anticipated daily truck movements will also decrease; and

- Operations personnel will be slightly reduced from the 104 assumed within this report to 76 for Train 1 and 2. A slight reduction is also anticipated for Train 3 operations, with 130 personnel being reduced to 100 personnel.

The proposed mitigation measures presented in this report are based upon the 'worst case scenario' and are not reflective of the refined assumptions mentioned in Table 3-1 above.

3.3.3 Validation Process

The developed base matrices are assigned to the modelled road network after which link and turn data is extracted and compared to the base count data set to ensure that the two data groups match (within an acceptable GEH range).

Once the assignment estimation loop is completed and the vehicle flows are accepted the overall model is deemed to be validated and 'fit for purpose'.

In order to assess the relationship between the assigned flows and the observed data set, the GEH statistic has been used. The GEH statistic is commonly used in modelling to evaluate the accuracy of modelled volumes when compared to actual flows. The standard protocol used for modelling validation is to endeavour to establish GEH values below 10, with any value between 5 and 10 representing a good match while GEH values less than 5 are considered to be very good matches and values over 10 should be investigated and where necessary either explained or rectified.

The model validation tables in Appendix B demonstrate that the base micro-simulation models for the project are considered to be suitably accurate representations of actual flows within the 2 model cordons. All turn movements have an acceptable GEH factor of less than 5 during both morning and afternoon peak periods.

GEH is a statistical analysis method developed by Geoffrey E. Havers in the 1970's in the United Kingdom and is a form of Chi-squared statistic. It is now adopted as a key measure of network validation throughout the traffic modelling industry.

The formula for the GEH statistic is: $GEH = \sqrt{(M-C)^2 / (0.5 \times (M+C))}$

where M = modelled flows and C = observed values

3.4 Future Demand Matrix Estimation

3.4.1 Background Traffic

In line with the historical data analysis undertaken for the RIA, an annual growth of 5% and 3% (compounding) has been adopted for rural and urban roads, respectively.

3.4.2 Development Traffic

Separate matrix files were developed for all future years with the development. Development generated traffic was determined through the traffic generation and assignment process detailed within the RIA. Development related matrices are detailed as follows:

- Matrix 5 – Development Traffic Light Vehicles – includes AUSTROADS class 1 and 2;
- Matrix 6 – Development Traffic Heavy Vehicles – includes AUSTROADS class 3 and 9; and
- Matrix 7 – Development Traffic Bus – equivalent to AUSTROADS class 3.

4 Network Analysis

4.1 Existing Network Configuration

The 'do nothing' network (i.e. the existing network configuration, see Figure 3-1 and Figure 3-2) was tested with the future demand matrices, 'with' and 'without' the proposed LNG facility. Results are presented in Sections 4.1.1 and 4.1.2 below.

4.1.1 Model 1 – Glenlyon Road

A summary of SIDRA and Paramics findings for Model 1 at Glenlyon Road are presented in Table 4-1. The SIDRA findings are taken from the results provided in the *Queensland Curtis LNG Project EIS Traffic and Transport Impact Assessment* (Halcrow MWT, 2009) whilst the Paramics findings are a summary of visual inspection, coupled with analysis of the extracted network operational characteristics (results provided in Table 4-2).

Table 4-1 Model 1 Network Performance – Commentary 'Do Nothing'

	SIDRA*	Paramics
Scenario 1 Scenario 2	Individual intersections are either at or close to saturation. The only intersection operating with acceptable DOS is Port Access Road.	Visually, the network operates adequately. No improvements are required.
Scenario 3d	All intersections are operating at or above saturation.	Paramics confirms that the network requires remedial works. Visual inspection indicates that the cause of degradation originates from the heavy demand into and out of Port Access Road from Glenlyon Road.
Scenario 4	Individual intersections are either at or close to saturation. The only intersection operating with acceptable DOS is Port Access Road.	The network operates adequately in the morning peak, however, slight adjustments to the signal phasing is required in the afternoon peak. Additional green time allocation for the southbound movement will improve operations to acceptable levels.
Scenario 5d	All intersections are operating at or above saturation.	Paramics confirms that the network requires remedial works. In the morning peak the source of the congestion originates from the Dawson Highway/Glenlyon Road and Port Access Road intersections, with heavy northbound movements being unable to clear the intersections within the allocated green time. As would be expected, the reverse occurs in the afternoon peak.
Scenario 7d	All intersections are operating at or	During the morning peak, the network

	above saturation.	performs adequately for Scenarios 7d, 12, 13d and 15d. However, signal reconfiguration is required in the afternoon peak to accommodate the oversaturated southbound movements under a 'do nothing' network.
Scenario 12	Not tested within SIDRA.	
Scenario 13d		
Scenario 15d		
Scenario 16		During morning peak operations, a small amount of vehicle blocking is observed at the Tank Street intersection. Reconfiguration of signal timing will rectify the issue. For the afternoon peak, the issues identified in the previous Scenarios (i.e. 7d to 15d) are also observed for Scenarios 16, 17 and 19. Therefore, similar to the above, additional green time allocation is required for the southbound movement from Glenlyon Road (north).
Scenario 17		
Scenario 19		

* Information pertains to Glenlyon Road intersecting at Port Access Road, Dawson Highway and Tank Street
Information extracted from *Queensland Curtis LNG Project EIS Traffic and Transport Impact Assessment* (Halcrow MWT, 2009)

The data presented in Table 4-2 was extracted from Paramics and colour coded according to the severity of performance degradation. The severity has been judged through consideration of the number of blocked vehicles, the decrease in average vehicle speed and general engineering judgement obtained from visual inspection of the models.

The number of blocked vehicles represents the number of vehicles which are queued outside of the model boundary at the end of the simulated period. This is effectively an indication of the latent demand and increased numbers of blocked vehicles indicate undesirable operations. However, the presence of blocked vehicles does not automatically indicate poor network performance. In cases where signalised intersections are located close to the model cordon, the reported number of blocked vehicles could simply be the usual queuing during a red phase. Upon return to green, all vehicles would then be released and the number of blocked vehicles would then return to zero. Another situation where the presence of blocked vehicles would be deemed to be acceptable is when there is adequate space for vehicles to queue, and the presence of the queue would not impact upon the operations of the rest of the network. An example of this is Port Access Road, where the adjacent intersection at Tug Berth Access Road is located more than 800m from Glenlyon Road.

The vehicle kilometres travelled (VKT) is the summation of all kilometres travelled for all vehicles which have passed through the network during the simulated period. A decrease in the VKT indicates that a smaller proportion of trips have been able to be completed during the simulation period. The vehicle hours travelled (VHT) is the summation of travel time for all vehicles which have passed through the network during the simulation period. Increases in VHT represent greater delays.

The five items that have been reported upon are intermingled and a decrease in performance in one criterion is matched with a decrease in performance in all other criteria also. For example, a substantial increase in the number of blocked vehicles indicates that congestion levels have increased, which therefore leads to decreased travel speeds and VKT and increased VHT.

Based on the results reported in Table 4-2, an alternative network configuration has been detailed for Scenario 3d (see Section 4.2.1). The revised network was then tested against all other future demands which did not perform adequately under the 'do nothing' network configuration (i.e. Scenarios 5d through to 19). No further modelling is required for Scenarios 1, 2 or 4.

Table 4-2 Model 1 Network Performance – Model Results (Existing Network)

	Scenario											
	1	2	3d	4	5d	7d	12	13d	15d	16	17	19
AM Peak												
Ave veh speed (km/hr)[1]	39	37	6	36	6	31	26	23	24	19	23	19
VKT[2]	2640	2775	2305	3035	2305	3435	3475	3775	3650	3710	3830	3680
VHT[3]	70	80	375	85	375	135	135	175	165	205	165	210
No. blocked vehicles[4]	0	0	1720	0	1720	30	30	40	20	80	80	110
% veh blocked[5]	0.00%	0.00%	39.03%	0.00%	44.75%	0.76%	0.76%	0.96%	0.49%	1.86%	1.85%	2.55%
PM Peak												
Ave veh speed (km/hr)[1]	15	14	6	10	5	4	5	5	4	5	4	5
VKT[2]	2615	2615	2630	2980	2580	2310	2630	2630	2480	2570	2475	2630
VHT[3]	250	250	440	300	515	535	575	575	570	585	560	545
No. blocked vehicles[4]	0	50	1470	160	960	1000	1330	1170	1290	1320	1450	1280
% veh blocked[5]	0.00%	1.46%	31.16%	4.28%	22.90%	25.03%	30.75%	25.60%	28.89%	27.98%	30.50%	27.03%

[1] The average vehicle speed is taken as the mean speed for all vehicles within the simulated period and includes geometric delays and stopped time at intersections

[2] VKT = Vehicle Kilometres Travelled

[3] VHT = Vehicle Hours Travelled

[4] The number of blocked vehicles represents the number of vehicles which are queued outside of the model cordon at the end of the simulated period

[5] Represents the number of blocked vehicles as a proportion of the matrix total

Legend

- (green) Network performs adequately, no further modelling required
- (yellow) Minor adjustments are required in order to improve operations to acceptable
- (orange) Serious network deficiencies, further investigation required

4.1.2 Model 2 – Dawson Highway/Phillip Street Roundabout

Similar to the process detailed for Model 1, a summary of SIDRA and Paramics findings for Model 2 at the Dawson Highway/Phillip Street roundabout are presented in Table 4-3. The SIDRA findings are taken from the results provided in the *Queensland Curtis LNG Project EIS Traffic and Transport Impact Assessment* (Halcrow MWT, 2009) whilst the Paramics findings are a summary of visual inspection, coupled with analysis of the extracted network operational characteristics (results provided in Table 4-4).

Table 4-3 Model 2 Network Performance – Commentary 'Do Nothing'

	SIDRA*	Paramics
Scenario 1	Unsignalised roundabout arrangement identified serious operational deficiencies for all future and base year conditions (excluding the 2008 AM Peak).	Visually, the network operates adequately. No improvements are required.
Scenario 2		
Scenario 3d		During morning peak operations, the southern Dawson Highway and eastern Phillip Street approaches are oversaturated. For the afternoon peak, the heavy southbound demand from the northern Dawson Highway approach restricts vehicles from entering the roundabout at Phillip Street. In the afternoon, the northern Dawson Highway and eastern Phillip Street approaches are oversaturated.
Scenario 4		The blocked vehicles during the morning peak originate from the Phillip Street approach. Signal reconfiguration is likely to improve operations back to acceptable.
Scenario 5d		
Scenario 7d		Similar problems to those identified for Scenario 3d are inherent to Scenarios 7d through to Scenario 19. During the morning peak the southern Dawson Highway and eastern Phillip Street approaches are oversaturated, whilst in the afternoon, the northern Dawson Highway, eastern Phillip Street and western shopping centre approaches are oversaturated. Operations get progressively worse with each future year.
Scenario 12		
Scenario 13d		
Scenario 15d		
Scenario 16		
Scenario 17		
Scenario 19		

* Information extracted from *Queensland Curtis LNG Project EIS Traffic and Transport Impact Assessment* (Halcrow MWT, 2009)

Similar to the process discussed above in Section 4.1.1, the data presented in Table 4-4 was extracted from Paramics and colour coded according to the severity of performance degradation. The severity has been judged through consideration of the number of blocked vehicles, the decrease in average vehicle speed and general engineering judgement obtained from visual inspection of the models.

Based on the results reported in Table 4-4, an alternative network configuration has been detailed for Scenario 3d (see Section 4.2.2). The revised network was then tested against all other future demands which did not perform adequately under the 'do nothing' network configuration (i.e. Scenarios 5d through to 19). No further modelling is required for Scenarios 1, 2 or 4.

Table 4-4 Model 2 Network Performance – Model Results (Existing Network)

	Scenario											
	1	2	3d	4	5d	7d	12	13d	15d	16	17	19
AM Peak												
Ave veh speed (km/hr)[1]	43	24	13	18	15	10	12	11	9	9	9	9
VKT[2]	2830	2935	3195	3095	3160	3200	3335	3345	3335	3430	3415	3440
VHT[3]	65	125	250	180	210	335	285	315	380	370	380	380
No. blocked vehicles[4]	0	10	170	80	160	550	320	390	680	630	650	660
% veh blocked[5]	0.00%	0.29%	4.16%	2.09%	4.00%	12.19%	7.21%	8.61%	14.15%	12.99%	13.36%	13.48%
PM Peak												
Ave veh speed (km/hr)[1]	48	44	11	26	18	11	11	10	9	9	7	9
VKT[2]	3320	3490	3445	3725	3745	3785	3830	3865	3860	3970	3170	3985
VHT[3]	70	79	315	150	210	360	345	375	3970	465	370	465
No. blocked vehicles[4]	0	0	380	30	70	650	470	550	880	810	660	850
% veh blocked[5]	0.00%	0.00%	7.80%	0.63%	1.43%	11.90%	8.54%	9.83%	14.90%	13.48%	10.95%	14.04%

[1] The average vehicle speed is taken as the mean speed for all vehicles within the simulated period and includes geometric delays and stopped time at intersections

[2] VKT = Vehicle Kilometres Travelled

[3] VHT = Vehicle Hours Travelled

[4] The number of blocked vehicles represents the number of vehicles which are queued outside of the model cordon at the end of the simulated period

[5] Represents the number of blocked vehicles as a proportion of the matrix total

Legend

- (green) Network performs adequately, no further modelling required
- (yellow) Minor adjustments are required in order to improve operations to acceptable
- (orange) Serious network deficiencies, further investigation required

4.2 Future Network Configuration

Based on the outcomes of the 'do nothing' analyses a number of scenarios have been flagged as requiring remedial works. The 'do something' solutions, along with the model results, are presented in Sections 4.2.1 and 4.2.2 below.

4.2.1 Model 1 – Glenlyon Road

The 'do nothing' results presented in Section 4.1.1 indicated that upgrade works will be required for 2010 'with development' conditions (i.e. Scenario 3d). Extensive model testing has concluded that to accommodate the anticipated 2010 'with development' volumes, the following works will be required:

Glenlyon Road/Port Access Road Intersection

- To accommodate the heavy afternoon peak, development generated traffic demand from Port Access Road into the Dawson Highway, a dual left turn signalised slip lane is required on the Port Access Road approach (shown in Figure 4-1); and
- Similar to existing, signal coordination needs to be retained between the Port Access Road intersection and the Dawson Highway intersection. However, the signal cycle time also needs to be extended to 150 seconds.

Glenlyon Road/Dawson Highway/Bramston Street Intersection

- To allow for coordination between this intersection and Port Access Road, the signal cycle time requires to be extended to 150 seconds;
- The northern approach should be reconfigured to cater for a dual right turn lane (middle lane to be shared through/right) and the turn pocket should be extended as far north as practicable (bearing in mind the constraints of the rail bridge);
- The eastern approach is to remain as two approach lanes. However, the lane designation for the median lane should accommodate a shared right/through movement. This means that the eastern approach will allow for through movements on both approach lanes; and
- Following the reconfiguration of lane designation on the northern and eastern approaches, modifications to the signal phasing arrangements are required.

Glenlyon Road/Tank Street Intersection

- The microsimulation modelling confirms that the already proposed four laning of Glenlyon Road between Bramston and Derby Streets is required. No other modifications are required.

Note that there are some discrepancies between the RIA and microsimulation findings. Where discrepancies exist, the findings of the microsimulation supersede that of the RIA.

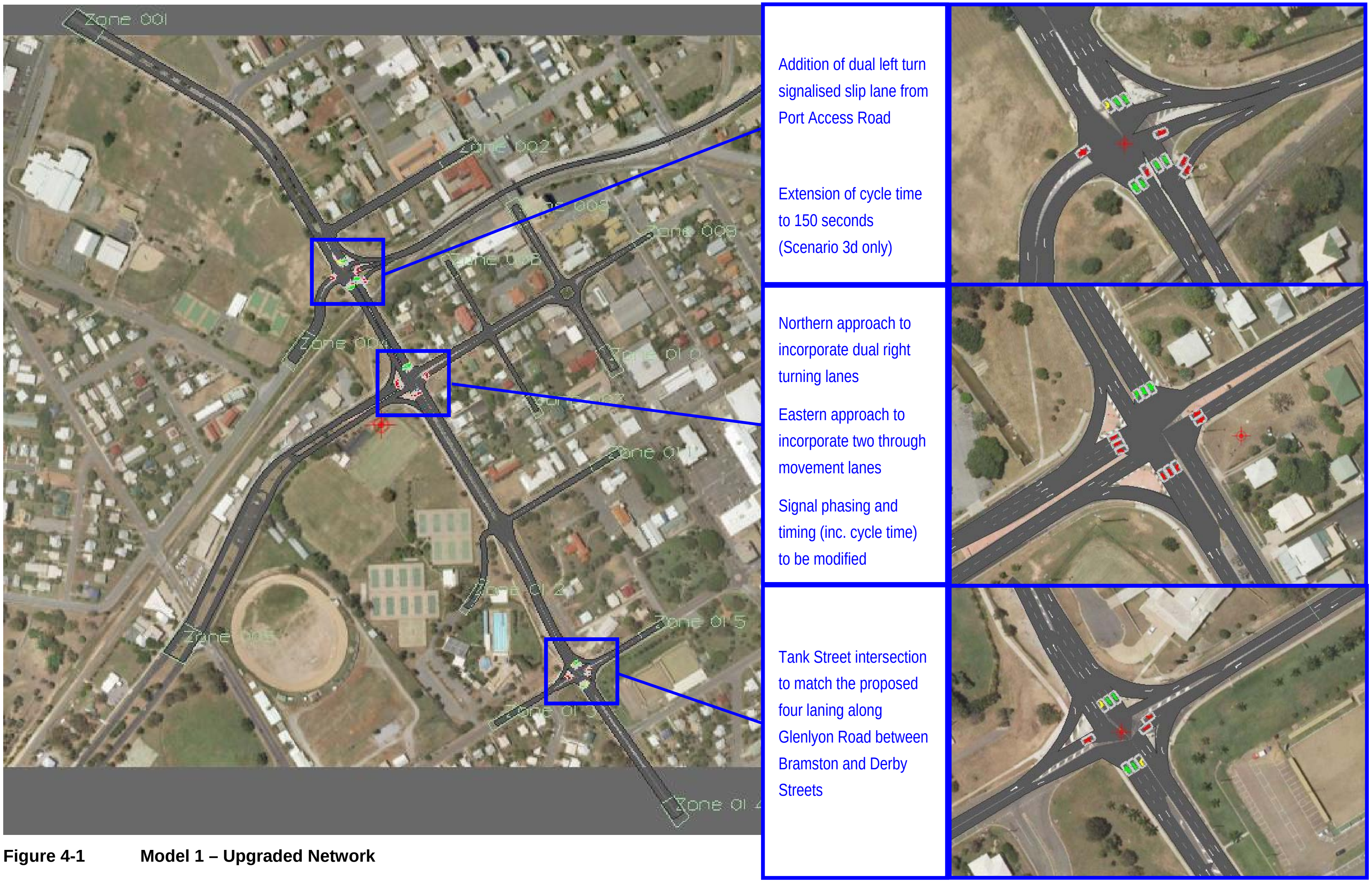


Figure 4-1 Model 1 – Upgraded Network

The results for the upgraded network (Model 1) are provided in Table 4-5 below. As can be seen in the results, the proposed network operates satisfactorily for all future years, 'with' and 'without' the proposed development.

It should be noted that the traffic distribution changes after 2010 (Scenario 3d). This is due to the presence of the road bridge, or the shifting of water transport access to the end of Alf O'Rourke Drive rather than Auckland Point. Model testing has shown that the revised traffic volumes (post 2010) are able to be accommodated within the layout presented above with some minor signal phasing changes. In addition to this, a cycle time of 150 seconds is no longer required and the Dawson Highway and Port Access Road intersections are able to operate satisfactorily with a cycle time ranging from 100 – 120 seconds.

Table 4-5 Model 1 Network Performance – Model Results (Upgraded Network)

	Scenario											
	1	2	3d	4	5d	7d	12	13d	15d	16	17	19
AM Peak												
Ave veh speed (km/hr)[1]			18		37	37	33	32	33	30	32	31
VKT[2]			4660		3735	3490	3600	3935	3805	3630	3705	3870
VHT[3]			260		100	95	110	120	115	120	115	125
No. blocked vehicles[4]			0		0	0	0	0	0	0	0	0
% veh blocked[5]			0.00%		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
PM Peak												
Ave veh speed (km/hr)[1]			17		32	36	35	31	34	33	32	32
VKT[2]			5025		4300	3995	4115	4520	4390	4585	4600	4590
VHT[3]			300		135	110	115	145	130	140	140	140
No. blocked vehicles[4]			150		0	0	0	0	0	0	0	0
% veh blocked[5]			4.66%		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

[1] The average vehicle speed is taken as the mean speed for all vehicles within the simulated period and includes geometric delays and stopped time at intersections

[2] VKT = Vehicle Kilometres Travelled

[3] VHT = Vehicle Hours Travelled

[4] The number of blocked vehicles represents the number of vehicles which are queued outside of the model cordon at the end of the simulated period

[5] Represents the number of blocked vehicles as a proportion of the matrix total

Legend

Green	Network performs adequately, no further modelling required
Yellow	Given the constraints of the site, operation is acceptable
Orange	Serious network deficiencies, further investigation required
Hatched	Assessment has not been undertaken

4.2.2 Model 2 – Dawson Highway/Phillip Street Roundabout

The 'do nothing' results presented in Section 4.1.2 indicated that upgrade works will be required for 2010 'with development' conditions (i.e. Scenario 3d). Based on the existing geometric constraints of the site, only one improvement may be accommodated, and this involves the inclusion of a left turn slip lane from Phillip Street into Dawson Highway (south), as shown in Figure 4-2. The modelled configuration has been cross-checked against the requirements set out in the *Road Planning and Design Manual – Part 14 Roundabouts* (DMR, 2006) and preliminary investigations indicate that the slip lane can be accommodated. However, the exact geometry and hence, suitability will need to be drawn and detailed by a qualified road designer using appropriate software tools such as AutoCAD.

Figure 4-2 Model 2 – Upgraded Roundabout

The results (see Table 4-6) indicate that the upgraded roundabout is able to provide acceptable performance for Scenario 3d, 4 and 5d. However, if Scenario 7d proceeds further upgrade to signalisation will be required by 2013. Otherwise, the upgrade to signalisation will be required at 2018, regardless of whether the development proposal proceeds.

Table 4-6 Model 2 Network Performance – Model Results (Upgraded Roundabout)

	Scenario											
	1	2	3d	4	5d	7d	12	13d	15d	16	17	19
AM Peak												
Ave veh speed (km/hr)[1]			15	29	17	10	14					
VKT[2]			3245	3225	3215	3220	3445					
VHT[3]			220	115	195	335	255					
No. blocked vehicles[4]			130	10	110	520	220					
% veh blocked[5]			3.18%	0.26%	2.75	11.52%	4.96%					
PM Peak												
Ave veh speed (km/hr)[1]			29	30	31	13	17					
VKT[2]			3885	3770	3930	4010	4155					
VHT[3]			135	125	125	310	245					
No. blocked vehicles[4]			30	10	10	420	200					
% veh blocked[5]			0.62%	0.21%	0.20%	7.69%	3.64%					

[1] The average vehicle speed is taken as the mean speed for all vehicles within the simulated period and includes geometric delays and stopped time at intersections

[2] VKT = Vehicle Kilometres Travelled

[3] VHT = Vehicle Hours Travelled

[4] The number of blocked vehicles represents the number of vehicles which are queued outside of the model cordon at the end of the simulated period

[5] Represents the number of blocked vehicles as a proportion of the matrix total

Legend

- (green) Network performs adequately, no further modelling required
- (yellow) Given the constraints of the site, operation is acceptable
- (orange) Serious network deficiencies, further investigation required
- (hatched) Assessment has not been undertaken

The upgraded signalised arrangement is indicated in Figure 4-3.

Figure 4-3 Model 2 – Upgrade to Signalisation

The proposed configuration includes the following:

Northern Approach

- Three stand up lanes and a short left turn slip lane. The stand up lanes are to consist of two dedicated through lanes and a dedicated right turn lane; and
- Three exit lanes, which is an increase from the existing of two. The kerbside lane is proposed to be a short downstream lane of approximately 100m.

Eastern Approach

- The left turn slip lane required as a result of Scenario 3d is retained as part of the signalised configuration; and
- Similar to existing, Phillip Street will remain as two stand up approach and exit lanes. However, the approach is to accommodate a dual right turn lane, with the kerbside stand up to incorporate a shared through and right turn movement.

Southern Approach

- Due to the anticipated heavy northbound movement in the future year morning peaks, the southern approach requires four approach lanes consisting of three through lanes (kerbside lane to be a shared left and through) and one short right turn lane; and
- The intersection located directly to the south also requires some minor adjustments so that the transition from the two lanes on Dawson Highway to the four lane flare is more gradual. Instead of the dedicated left turn auxiliary lane which is currently provided for the park access, it is proposed that this become a shared left and through lane as indicated in Figure 4-3 above.

Western Approach

- The proposed configuration on the western approach will match the existing provision of two approach and two exit lanes.

The results presented in Table 4-7 indicate that the signalised arrangement provides adequate capacity for all years, leading up to and including 2021 'with' the proposed development (i.e. Scenario 19).

Table 4-7 Model 2 Network Performance – Model Results (Upgraded to Signalisation)

	Scenario											
	1	2	3d	4	5d	7d	12	13d	15d	16	17	19
AM Peak												
Ave veh speed (km/hr)[1]						26	37	36	26	34	34	32
VKT[2]						3780	3740	3825	4025	4120	4125	4150
VHT[3]						150	100	105	160	120	125	130
No. blocked vehicles[4]						0	0	0	0	0	0	0
% veh blocked[5]						0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
PM Peak												
Ave veh speed (km/hr)[1]						25	27	23	19	20	19	18
VKT[2]						4240	4325	4370	4555	4680	4670	4645
VHT[3]						170	160	200	250	230	245	265
No. blocked vehicles[4]						10	20	30	80	20	40	100
% veh blocked[5]						0.18%	0.36%	0.54%	1.35%	0.33%	0.66%	1.65%

[1] The average vehicle speed is taken as the mean speed for all vehicles within the simulated period and includes geometric delays and stopped time at intersections

[2] VKT = Vehicle Kilometres Travelled

[3] VHT = Vehicle Hours Travelled

[4] The number of blocked vehicles represents the number of vehicles which are queued outside of the model cordon at the end of the simulated period

[5] Represents the number of blocked vehicles as a proportion of the matrix total

Legend

- (green) Network performs adequately, no further modelling required
- (yellow) Given the constraints of the site, operation is acceptable
- (orange) Serious network deficiencies, further investigation required
- (hatched) Assessment has not been undertaken

5 Conclusions

The microsimulation assessment for the proposed QCLNG project has been completed. A number of scenarios were assessed and these included the base reference scenario (i.e. Construction Camp Option D) along with a complete set of reference years without the proposed development.

The assessment was undertaken with due consideration of the findings of the RIA, *Queensland Curtis LNG Project EIS Traffic and Transport Impact Assessment* (Halcrow MWT, 2009) and has built upon the recommendations presented in that report. Based on the network analyses of the two modelled areas, a summary of remedial works are as follows:

Works to be completed by 2010 – Scenario 3d

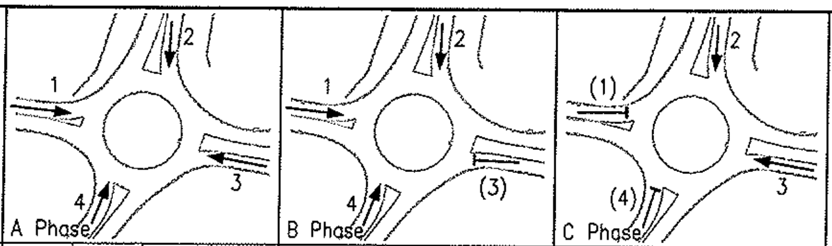
- Port Access Road to incorporate a dual left turn signalised slip lane, along with an extension of signal cycle time to 150 seconds;
- Dawson Highway/Glenlyon Road Intersection to incorporate minor lane reconfigurations on the northern and eastern approaches. Signal cycle time also to be extended to 150 seconds;
- Tank Street intersection to accommodate already proposed four laning of Glenlyon Road between Bramston and Derby Streets; and
- Phillip Street roundabout to incorporate a left turn slip lane from the Phillip Street approach into the Dawson Highway (south).

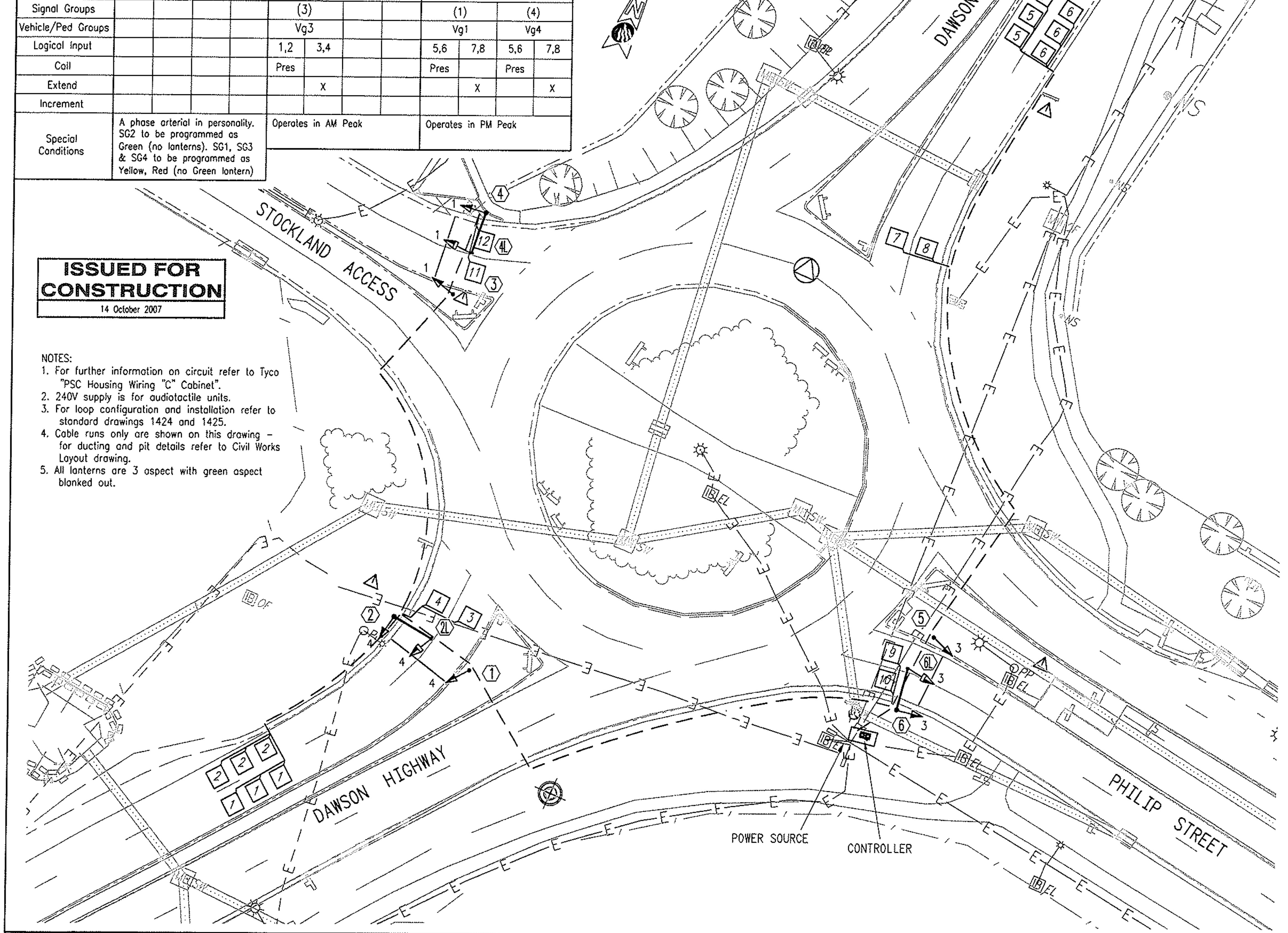
Works required post 2010 – Scenario 5d – 19

- Cycle times and signal phasing to be optimised for Port Access Road, Dawson Highway/Glenlyon Road and Tank Street intersections to allow for the change in development generated traffic distribution;
- If the proposed road bridge between Curtis Island and Gladstone does not proceed, the roundabout at Dawson Highway/Phillip Street will need to be upgraded to full signalisation by 2013; and
- If the proposed road bridge between Curtis Island and Gladstone does proceed, the signalised roundabout is able to provide adequate service until 2018. Upgrade to full signalisation will be required in this year, even without the presence of the proposed development.

The results presented within this report and summarised above, represent a 'worst case scenario' and are not reflective of the refined assumptions discussed in Section 3.3.2.

Appendix A. Base Coding – Signals & Int. Layout

Phase Diagrams	A Phase				B Phase				C Phase			
												
Signal Groups					(3)				(1)		(4)	
Vehicle/Ped Groups					Vg3				Vg1		Vg4	
Logical Input					1,2	3,4			5,6	7,8	5,6	7,8
Coil					Pres				Pres		Pres	
Extend						X				X		X
Increment												
Special Conditions	A phase arterial in personality. SG2 to be programmed as Green (no lanterns). SG1, SG3 & SG4 to be programmed as Yellow, Red (no Green lantern)				Operates in AM Peak				Operates in PM Peak			



ISSUED FOR CONSTRUCTION
14 October 2007

NOTES:
1. For further information on circuit refer to Tyco "PSC Housing Wiring "C" Cabinet".
2. 240V supply is for audiotactile units.
3. For loop configuration and installation refer to standard drawings 1424 and 1425.
4. Cable runs only are shown on this drawing – for ducting and pit details refer to Civil Works Layout drawing.
5. All lanterns are 3 aspect with green aspect blanked out.

Signal Groups	Function	Controller Terminals	Run 1 Connections: Finial Terminals	Run 1: Cncts ⊠ ⟨1⟩ ⟨2⟩ ⟨3⟩ ⟨4⟩ (Cores Used)	Run 1: Cncts ⟨2⟩ ⟨4⟩ ⟨2L⟩ ⟨4L⟩ (Cores Used)	Run 2 Connections: Finial Terminals	Run 2: Cncts ⊠ ⟨6⟩ ⟨5⟩ (Cores Used)	Run 2: Cncts ⟨6⟩ ⟨6L⟩ (Cores Used)	Run 3 Connections: Finial Terminals	Run 3: Cncts (Cores Used)	Run 3: Cncts (Cores Used)	Run 4 Connections: Finial Terminals	Run 4: Cncts (Cores Used)	Run 4: Cncts (Cores Used)
1	Red	A5	1	1	1									
	Yellow	A4	2	2	2									
	Green	A3												
2	Red	A8												
	Yellow	A7												
	Green	A6												
3	Red	A11				5	5	5						
	Yellow	A10				6	6	6						
	Green	A9												
4	Red	A14	7	7	7									
	Yellow	A13	8	8	8									
	Green	A12												
5														
6														
7														
8														
9														
10														
11														
12														
240V		A2	A	16		A	16							
Det Common		E3	PR	Gy		PR	Gy							
Neutral		A1,B1 C1,D1	N	Bk	Bk Bk	N	Bk	Bk						
Spare Cores to earth link			/	3–6 9–15		/	1–4 7–15		/			/		
Cable Size			/	19	19 19	/	19	19	/			/		

Detector Table – PSC PD200 Series Intergrated Detector System

Physical Input	Controller Terminal	Logical Input	Loop/PB Configuration	Dist to Stop Line	Physical Input	Controller Terminal	Logical Input	Loop/PB Configuration	Dist to Stop Line
Loop 1	P1	1	Queue				17		
Loop 2	P2	2	Queue				18		
Loop 3	P3	3	Stop Line				19		
Loop 4	P4	4	Stop Line				20		
Loop 5	P5	5	Queue				21		
Loop 6	P6	6	Queue				22		
Loop 7	P7	7	Stop Line				23		
Loop 8	P8	8	Stop Line				24		
Loop 9	Q9	9	Counting				25		
Loop 10	Q10	10	Counting				26		
Loop 11	Q11	11	Counting				27		
Loop 12	Q12	12	Counting				28		
		13					29		
		14					30		
		15					31		
		16					32		

Revisions		Certified	Date	Microfiled
A	Original Issue A1/A3			

CAD FILES \\MR10150733\..\Signals.dwg; Layout: Electrical

Filename: E:\Hodson & Smith & Moore\Jobs in Progress\MRD Rockhampton\Gladstone & Caroline\4551_378954_A.dwg Date: 06/07/2007 – 8:22 am
Xrefs:

Associated Job Nos

Auxiliary Drg Nos: 404050–404052

Survey Data	
Horiz. Datum	ISG 2000 Zone 56/1
Azimuth Datum	ISG 2000 Zone 56/1
Height Datum	AHD derived
Survey Books	MR85820–46A

GDA

Scales: 0 2 4 6 8 10m

Dimensions shown in meters except where shown otherwise

GLADSTONE CITY
DAWSON HIGHWAY (GLADSTONE – BILOELA)
DAWSON HWY & PHILIP ST

Reference Points

Preceding RP	Dist. to start of job (km)	From start to end of job	From end to Following RP	Following RP
46A/2A	0.00	0.00	4.78	46A/3

Through Chainage from Start of gazettal 3.13km

TRAFFIC SIGNAL INSTALLATION
ITS DESIGN
TYCO PSC–ID CONTROLLER

Site Number: 4622

Drawing	Design	Design Review	Engineering Certification
R Smith	R Smith		
Checked	Verified	Date: 10/07	RPEQ No. 2696
J Chuong	J Chuong		

For scheme approval status refer Drg. No. 404050 (1 of 3)

Queensland Government
Department of Main Roads

Job No.	161/46A/205
Contract No.	
Drawing No.	404052 A
Series Number	3 of 3

MRT_Detail (08/06)

MRR Detail A1 (08/01)

Phase Diagrams	A Phase				B Phase	C Phase		D Phase
Signal Groups	1	2	16	17	3	4	18	5
Vehicle/Ped Groups	Vg1	Vg2	Pg1	Pg2	Vg3	Vg4	Pg3	Vg5
Logical Input	4,7,8,9	2,3,4,5	16	15	1	16	14	2
Call	X	X	X	X	X	X	X	PRES
Extend	X	X			X	X		X
Increment								
Special Conditions								

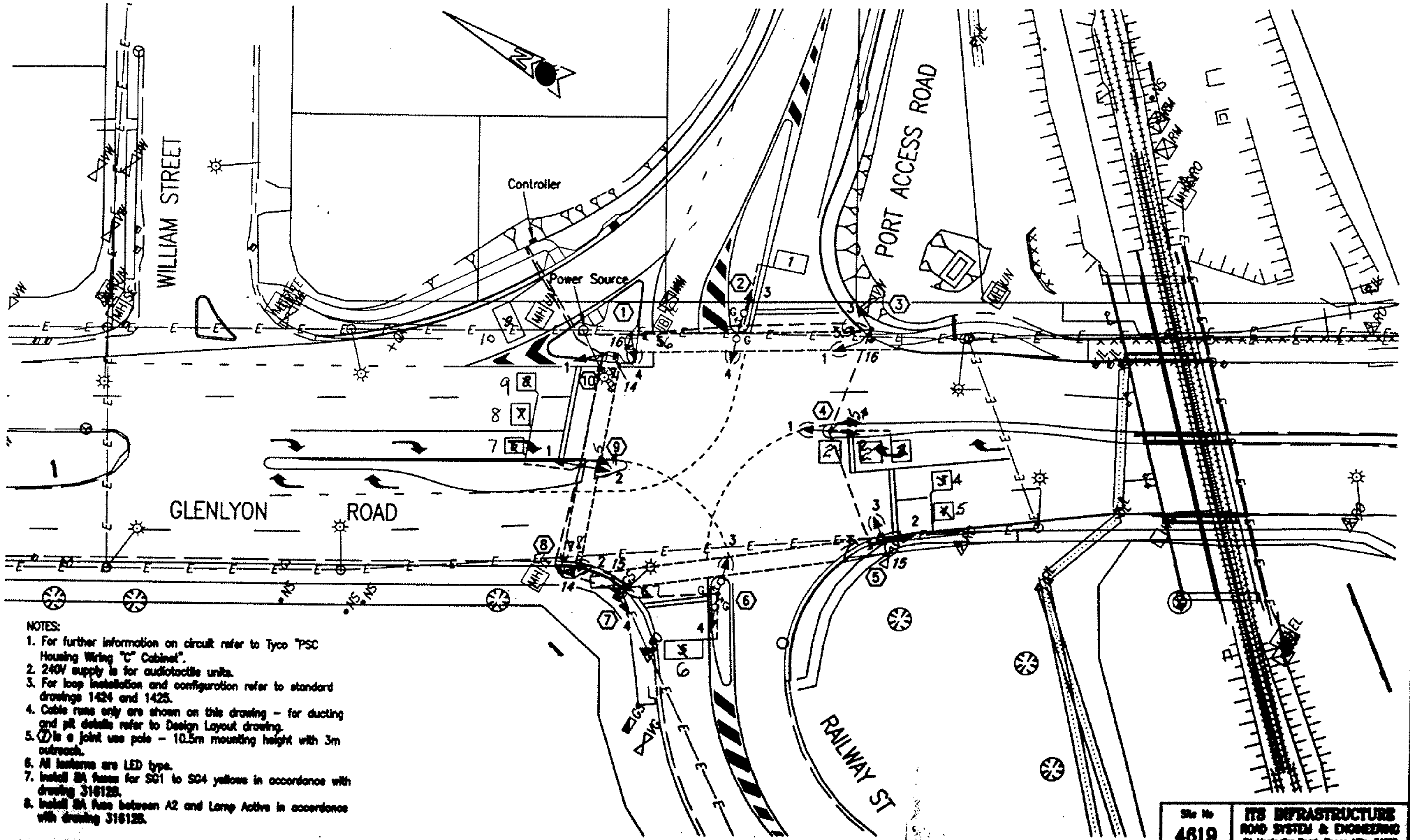
Conflict Table (X - indicates conflict)

		V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	P1	P2	P3	P4
Vehicle Groups	1			X	X	X										X	
	2			X	X											X	
	3	X	X		X	X								X	X	X	
	4	X	X	X		X								X	X		
	5	X		X	X									X			
	6																
	7																
	8																
	9																
	10																
	11																
	12																
Ped Groups	1			X	X	X											
	2			X	X												
	3	X	X	X													
	4																

Controller Terminals	Function		Run 1 Field Terminals	Run 1 Cncts (Cores Used)	Run 1 Cncts	Run 2 Field Terminals	Run 2 Cncts (Cores Used)	Run 2 Cncts	Run 3 Field Terminals	Run 3 Cncts	Run 3 Cncts	Run 4 Field Terminals	Run 4 Cncts	Run 4 Cncts
A5	Red	1	1	1		1	1							
A4	Yellow	1	2	2		2	2							
A3	Green	1	3	3		3	3							
A8	Red	2	4	4		4	4							
A7	Yellow	2	5	5		5	5							
A6	Green	2	6	6		6	6							
A11	Red	3	7	7		7	7							
A10	Yellow	3	8	8		8	8							
A9	Green	3	9	9		9	9							
A14	Red	4	10	10		10	10							
A13	Yellow	4	11	11		11	11							
A12	Green	4	12	12		12	12							
B5	RED	5	13	13		13	13							
B4	YELLOW	5	14	14		14	14							
B3	GREEN	5	15	15		15	15							
B8	Red D/Walk	6	16	16		[illegible]	[illegible]							
	Ped 2													
B6	Green Walk	6	17	17		[illegible]	[illegible]							
B11	Red D/Walk	7	18	18		18	18							
	Ped 3													
B9	Green Walk	7	19	19		19	19							
B14	RED D/WALK	8				20	20							
	PED 3													
B12	GREEN WALK	8				21	21							
A2	240V (See Note2)		32	Gy		32	Gy							
E5	Ext Det 1		22	22										
E6	Ext Det 2		23	23		23	23							
E7	Ext Det 3					24	24							
E3	Det Common		26	26		26	26							
A1,B1 C1,D1	Neutral		NL	Bk		NL	Bk							
	Spare Cores			13-15 20,21 24,25			13-17 22,25							
	Cable Size			29			29							

Detector Table - PSC PD200 Series Intergrated Detector System

Physical Input	Controller Terminal	Logical Input	Loop/PB Configuration	Detector Mode	Physical Input	Controller Terminal	Logical Input	Loop/PB Configuration	Detector Mode
Loop 1	P1	1	Stop Line	Locked			17		
Loop 2	P2	2	Stop Line	Locked			18		
Loop 3	P3	3	Stop Line	Locked			19		
Loop 4	P4	4	Stop Line	Locked			20		
Loop 5	P5	5	Stop Line	Locked			21		
Loop 6	P6	6	Stop Line	Locked			22		
Loop 7	P7	7	Stop Line	Locked			23		
Loop 8	P8	8	Stop Line	Locked			24		
Loop 9	Q9	9	Counting	Locked			25		
		10					26		
		11					27		
		12					28		
		13					29		
EXT 3	E7	14	Pb3-Audio				30		
EXT 2	E6	15	Pb2-Audio				31		
EXT 1	E5	16	Pb1-Audio				32		



NOTES:
1. For further information on circuit refer to Tyco "PSC Housing Wiring "C" Cabinet".
2. 240V supply is for audiotactile units.
3. For loop installation and configuration refer to standard drawings 1424 and 1425.
4. Cable runs only are shown on this drawing – for ducting and pit details refer to Design Layout drawing.
5. (7) is a joint use pole – 10.5m mounting height with 3m outreach.
6. All lanterns are LED type.
7. Install 8A fuses for SO1 to SO4 yellows in accordance with drawing 316128.
8. Install 8A fuse between A2 and Lamp Active in accordance with drawing 316128.

Site No 4619

ITS INFRASTRUCTURE ROAD SYSTEM & ENGINEERING

Revisions	Certified	Date	Microfilmed
B New base dwg & notes changed			
A Original Issue			

Associated job nos

Auxiliary drawing nos

(Office use only)

Dimensions in metres except where shown otherwise. Culvert sizes in millimetres.

Scales 0 2 4 6 8 10m

Survey books MR78797 to 79809-183; MR80229 to 80222-183

Through chainage from

GLADSTONE CITY

GLADSTONE PORT ACCESS ROAD

CTL CHGE 00 - 858.257

Reference Points: Preceding RPC | Dist. to start of job (km) | From start to end of job | From end to following RPC | Following RPC

Survey | Bdys | Drawn ROS | Design ROS | Examined JNC | Certified J Cheong 20/3/03 RPEQ 2806 | Approved T Hill 7/4/03 District Director Central District

Chd GO'D | Chd GO'D

TRAFFIC SIGNAL INSTALLATION
TYCO PSC-ID CONTROLLER
CABLE CONNECTIONS

Queensland Government Department of Main Roads

JOB No. 161/183/2

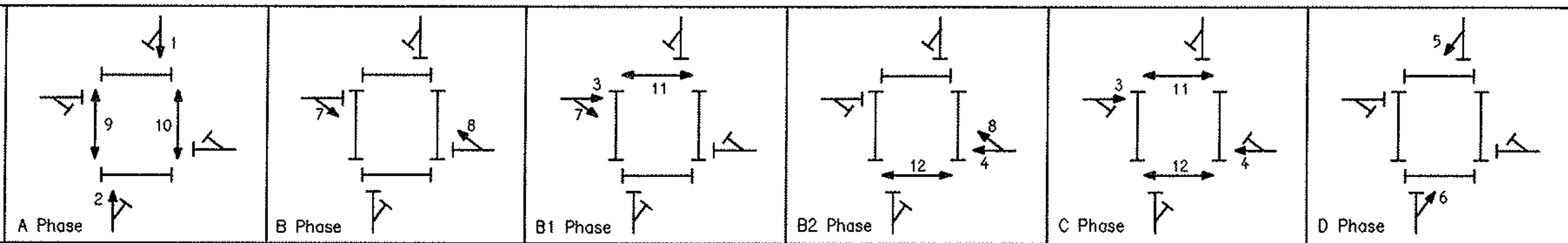
No.39 of 47 drgs

Drawing No. 330167

Contract No. CEND/123

A | B

Phase diagrams



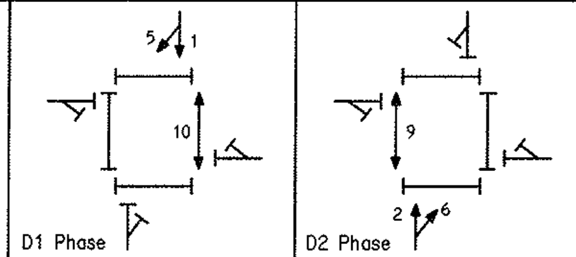
	A Phase				B Phase				B1 Phase				B2 Phase				C Phase				D Phase	
Signal groups	1	2	9	10	7	8			3	7	11		4	8	12		3	4	11	12	5	6
Vehicle\Ped groups	Vg1	Vg2	Pg1	Pg2	Vg 7	Vg 8			Vg3	Vg 7	Pg3		Vg4	Vg 8	Pg4		Vg 3	Vg 4	Pg3	Pg4	Vg 5	Vg 6
Detector input	15,16	5,6	32	31	8	1											10,11	3	30	29	13	4
Call	X	X	X	X	Pres	Pres											X	X	X	X	Pres	Pres
Extend	X	X			X	X											X	X			X	X
Increment	X	X																				
Special Conditions	SG5 & SG6 OFF after Late Start Period				B0 Demands on dets 8 & 1. If only det 8 or 1 demands, then call B10 or B20. If gap occurs in B0 then call B10 or B20. If no gap occurs in B0 then B0 terminated by max. If gap occurs in B10 or B20 & demands on det 10,11 or det 3 overlap SG3 or SG4 to C0. Else terminate B0.												SG7 & SG8 OFF after Late Start Period					

Conflict table (X – Indicates conflict)

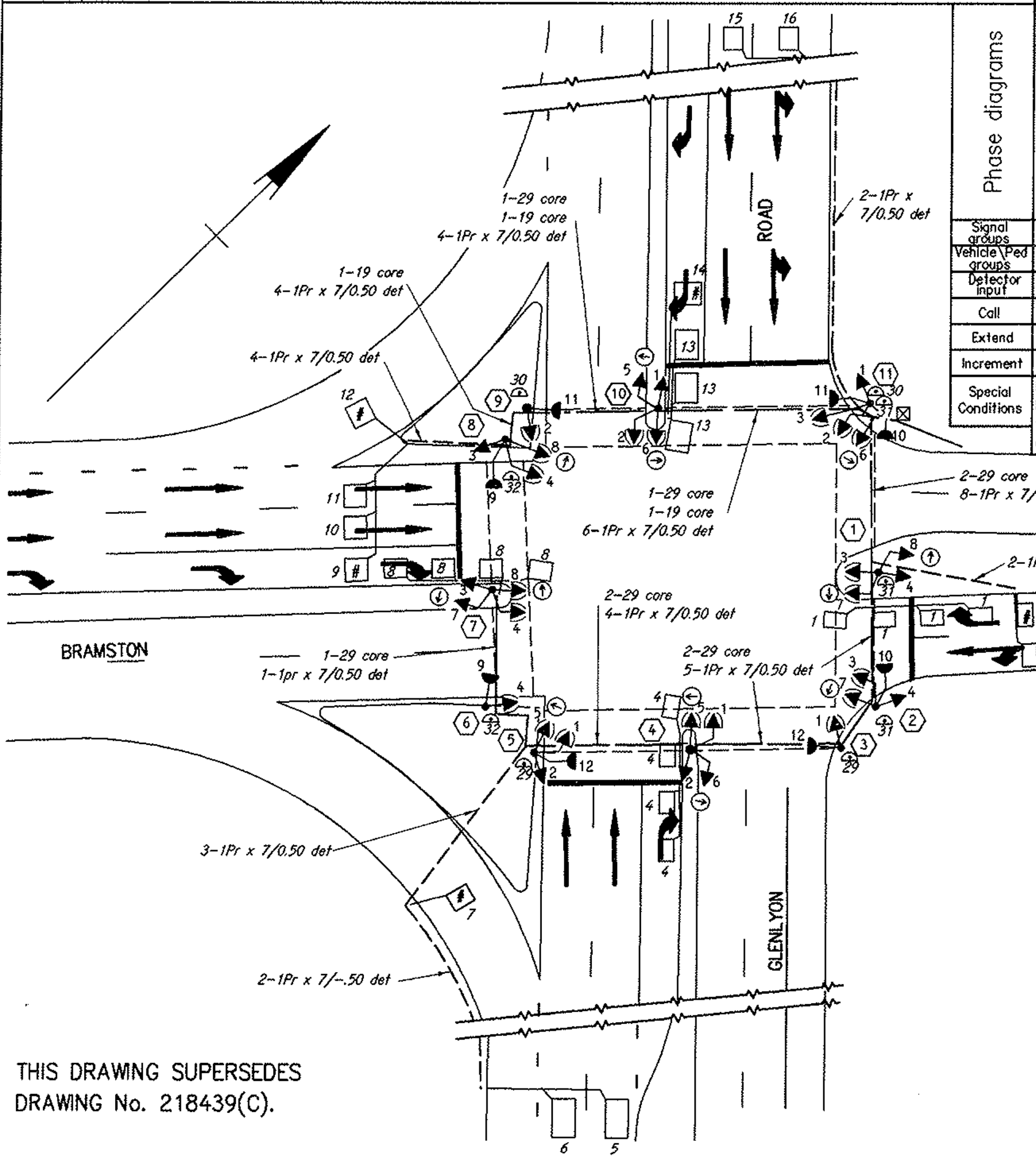
		Vehicle groups 1	2	3	4	5	6	7	8	9	10	11	12	Ped groups 1	2	3	4
Vehicle groups	1			X	X		X	X	X							X	X
	2			X	X	X		X	X							X	X
	3	X	X			X	X		X					X	X		
	4	X	X			X	X	X						X	X		
	5		X	X	X			X	X					X		X	
	6	X		X	X			X	X						X		X
	7	X	X		X	X	X							X			X
	8	X	X	X		X	X								X	X	
	9																
	10																
	11																
	12																
Ped groups	1			X	X	X		X									
	2			X	X		X		X								
	3	X	X			X			X								
	4	X	X				X	X									

Cable connections

Controller terminals	Function	Run 1 connections – Final terminals	Run 1 Cncts ⊠ 1 2 6 7 – Cores used	Run 2 connections – Final terminals	Run 2 Cncts ⊠ 3 4 5 – Cores used	Run 3 connections – Final terminals	Run 3 Cncts ⊠ 11 10 9 – Cores used	Run 4 connections – Final terminals	Run 4 Cncts ⊠ 8 – Cores used
A5	Red 1			1	1	1	1		
A4	Yellow 1			2	2	2	2		
A3	Green 1			3	3	3	3		
A8	Red 2			4	4	4	4		
A7	Yellow 2			5	5	5	5		
A6	Green 2			6	6	6	6		
A11	Red 3	1	1			7	7	1	1
A10	Yellow 3	2	2			8	8	2	2
A9	Green 3	3	3			9	9	3	3
A14	Red 4	4	4					4	4
A13	Yellow 4	5	5					5	5
A12	Green 4	6	6					6	6
B5	Red 5			7	7	10	10		
B4	Yellow 5			8	8	11	11		
B3	Green 5			9	9	12	12		
B8	Red 6			10	10	13	13		
B7	Yellow 6			11	11	14	14		
B6	Green 6			12	12	15	15		
B11	Red 7	7	7						
B10	Yellow 7	8	8						
B9	Green 7	9	9						
B14	Red 8	10	10					7	7
B13	Yellow 8	11	11					8	8
B12	Green 8	12	12					9	9
C5	Red Dont walk 9	13	13					10	10
	Ped 1								
C3	Green Walk 9	14	14					11	11
C8	Red Dont walk 10	15	15			16	16		
	Ped 2								
C6	Green Walk 10	16	16			17	17		
C11	Red Dont walk 11					18	18		
	Ped 3								
C9	Green Walk 11					19	19		
C14	Red Dont walk 12			13	13				
	Ped 4								
C12	Green Walk 12			14	14				
EA2	240V.(see Note 2.)								
EA5	Ext det 1	17	17					12	12
EA6	Ext det 2	18	18			20	20		
EA7	Ext det 3					21	21		
EA8	Ext det 4			15	15				
EA3	Det. comm.	26	26	26	26	26	26	26	16
A1·B1 C1·D1	Neutral	Nl	Bk	Nl	Bk	Nl	Bk	Nl	Bk
	Spare cores		19–25 Gy		16–25 Gy		22–25 Gy		13–15 Gy
	Cable size		29		29		29		19



	D1 Phase				D2 Phase			
Signal groups	1	5	10		2	6	9	
Vehicle\Ped groups	Vg 1	Vg 5	Pg 2		Vg 2	Vg 6	Pg 1	
Detector input								
Call								
Extend								
Increment								
Special Conditions	D0 demands on dets 13 & 4. If only 13 or 4 demands, then call D10 or D20. If gap occurs in D0 then call D10 or D20. If no gap occurs in D0 then D0 terminated by max. If gap occurs in D10 or D20 & demands on det 15,16 or det 5,6 overlap SG1 or SG2 to A0. Else terminate D0.							



Detector Table

Multi-Channel – Integral Rack

	Det. inputs	Detector, or Loop and loop config.	Contr. term.	Patch card Input	Patch card Output	Det. mode (see note3)	Detune Y/N
	1	Lp1– 4a(152)	P1	LDU1	CPU 1	Pres	N
ex. 2a	2	Lp2– 76μH	P2	LDU2	CPU 2	Pres	N
ex. 2a	3	Lp3– 76μH	P3	LDU3	CPU 3	Pres	N
	4	Lp4– 4a(152)	P4	LDU4	CPU 4	Pres	N
ex. 2d	5	Lp5– 107μH	P5	LDU5	CPU 5	Pres	N
ex. 2d	6	Lp6– 107μH	P6	LDU6	CPU 6	Pres	N
	7	Lp7– 1b(174)	Q7	LDU7	CPU 7	Pres	N
	8	Lp8– 4b(174)	Q8	LDU8	CPU 8	Pres	N
ex. 3c	9	Lp9– 128μH	Q9	LDU9	CPU 9	Pres	N
ex. 3c	10	Lp10–128μH	Q10	LDU10	CPU 10	Pres	N
ex. 3c	11	Lp11–128μH	Q11	LDU11	CPU 11	Pres	N
	12	Lp12–1c(194)	Q12	LDU12	CPU 12	Pres	N
exist	13	Lp13–3g(269)	R13	LDU13	CPU 13	Pres	N
	14	Lp14–1d(213)	R14	LDU14	CPU 14	Pres	N
ex. 3b	15	Lp15–113.3μH	R15	LDU15	CPU 15	Pres	N
ex. 3b	16	Lp16–113.3μH	R16	LDU16	CPU 16	Pres	N
	17				CPU 17		
	18				CPU 18		
	19				CPU 19		
	20				CPU 20		
	21				CPU 21		
	22				CPU 22		
	23				CPU 23		
	24				CPU 24		
	25				CPU 25		
	26				CPU 26		
	27				CPU 27		
	28				CPU 28		
	29	Pb4	EA8	EXT4	CPU 29		
	30	Pb3	EA7	EXT3	CPU 30		
	31	Pb2	EA6	EXT2	CPU 31		
	32	Pb1	EA5	EXT1	CPU 32		

Notes

1. For further information on circuit refer to Philips "PSC Housing wiring 'C' cabinet." Philips drawing no. 9584 811 21370–21380–21390.
2. 240V supply is for audiotactile units and/or external detectors if required.
3. Hold time for all detector channels to be set to 10 minutes (Philips) & 16 minutes (AWA).
4. For Loop Configurations refer Standard Drawing 1426.
5. Loops shown with a hash (#) are for traffic counting purposes only.
6. Cable runs only are shown on this drawing – for ducting and pit details refer to Design Layout drawing.

THIS DRAWING SUPERSEDES DRAWING No. 218439(C).

Site No. **4606**

ENGINEERING & TRAFFIC DESIGN
Transport Technology Division
CAD File: PSCC272507

	Revisions	Checked	Certified	Approved	Microfiled
		/ /	RPEQ / /	/ /	/ /
		/ /	RPEQ / /	/ /	/ /
		/ /	RPEQ / /	/ /	/ /
		/ /	RPEQ / /	/ /	/ /
A	Original issue				

Associated job nos

Auxiliary drawing nos: 272506 – 272507

(Office use only)

Dimensions in metres except where shown otherwise

Scales: 0 2 4 6 8 10m

GLADSTONE CITY

GLADSTONE – MT. LARCOM ROAD

INTERSECTION OF GLENLYON RD. AND BRAMSTON ST.

TRAFFIC SIGNAL INSTALLATION
PHILIPS PSC 2000 TYPE 'C' CABINET (IR)
CABLE CONNECTIONS

Drawn | Checked | Design | Checked | Certified RPEQ | Approved District Director Central 2/7/97

Main Roads

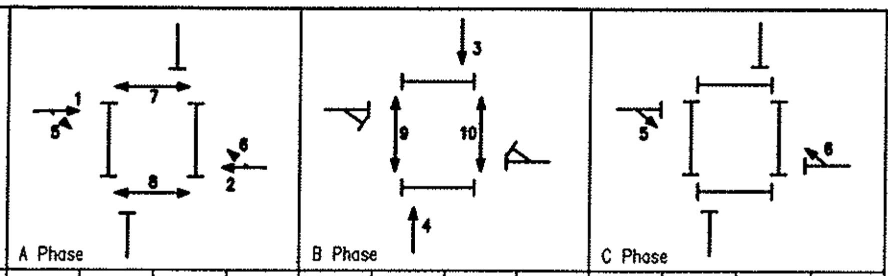
JOB No. 161/181/201

No. 2 of 2 dwgs

Drawing No.

A

PHASE DIAGRAMS



	A Phase				B Phase				C Phase			
Signal Groups	1	2	7	8	3	4	9	10	5	6		
Assoc Detectors	6	11,12	P1	P2	7	1,2	P3	P4	4	9		
Call	X	X	X	X	X	X	X	X	X	X		
Extend	X	X			X	X			X	X		
Increment	X											
Special Conditions	Red Arrow Drop Off After Late Start											

CONFLICT TABLE (X indicates conflict)

	SG 1	SG 2	SG 3	SG 4	SG 5	SG 6	SG 7	SG 8	SG 9	SG 10	SG 11	SG 12	Ped 7	Ped 8	Ped 9	Ped 10
Signal Group 1			X	X		X									X	X
Signal Group 2			X	X	X										X	X
Signal Group 3	X	X			X	X							X	X		
Signal Group 4	X	X			X	X							X	X		
Signal Group 5		X	X	X										X	X	
Signal Group 6	X		X	X									X			X
Signal Group 7																
Signal Group 8																
Signal Group 9																
Signal Group 10																
Signal Group 11																
Signal Group 12																
Ped group 1			X	X		X										
Ped group 2			X	X	X											
Ped group 3	X	X			X											
Ped group 4	X	X				X										

VEHICLE CLEARANCE TIMES

FROM PHASE	YELLOW TIMES (SEC)	ALL RED TIMES (SEC) A	B	C	D	E	F	G
A	4		2	2				
B	4	2		2				
C	4	2	2					
D								
E								
F								
G								

DETECTORS

FIELD INPUT	LOOP / P/BUTTON	CONFIGURATION	CABLE	CONTR TERM	LOGIC INPUT
1	Lp1	Existing		P1	1
2	Lp2	Existing		P2	2
3	Lp3	Existing		P3	3
4	Lp4	Existing		P4	4
5	Lp5	Existing		P5	5
6	Lp6	Existing		P6	6
7	Lp7	Existing		P7	7
8	Lp8	Existing		P8	8
9	Lp9	Existing		Q9	9
10	Lp10	Existing		Q10	10
11	Lp11	Existing		Q11	11
12	Lp12	Existing		Q12	12
13	Lp13	Existing		Q13	13
14					14
15					15
16					16
17					17
18					18
19					19
20					20
21					21
22					22
23					23
24					24
25					25
26					26
27					27
28					28
29	P/B 4	Audio			29
30	P/B 3				30
31	P/B 2				31
32	P/B 1				32

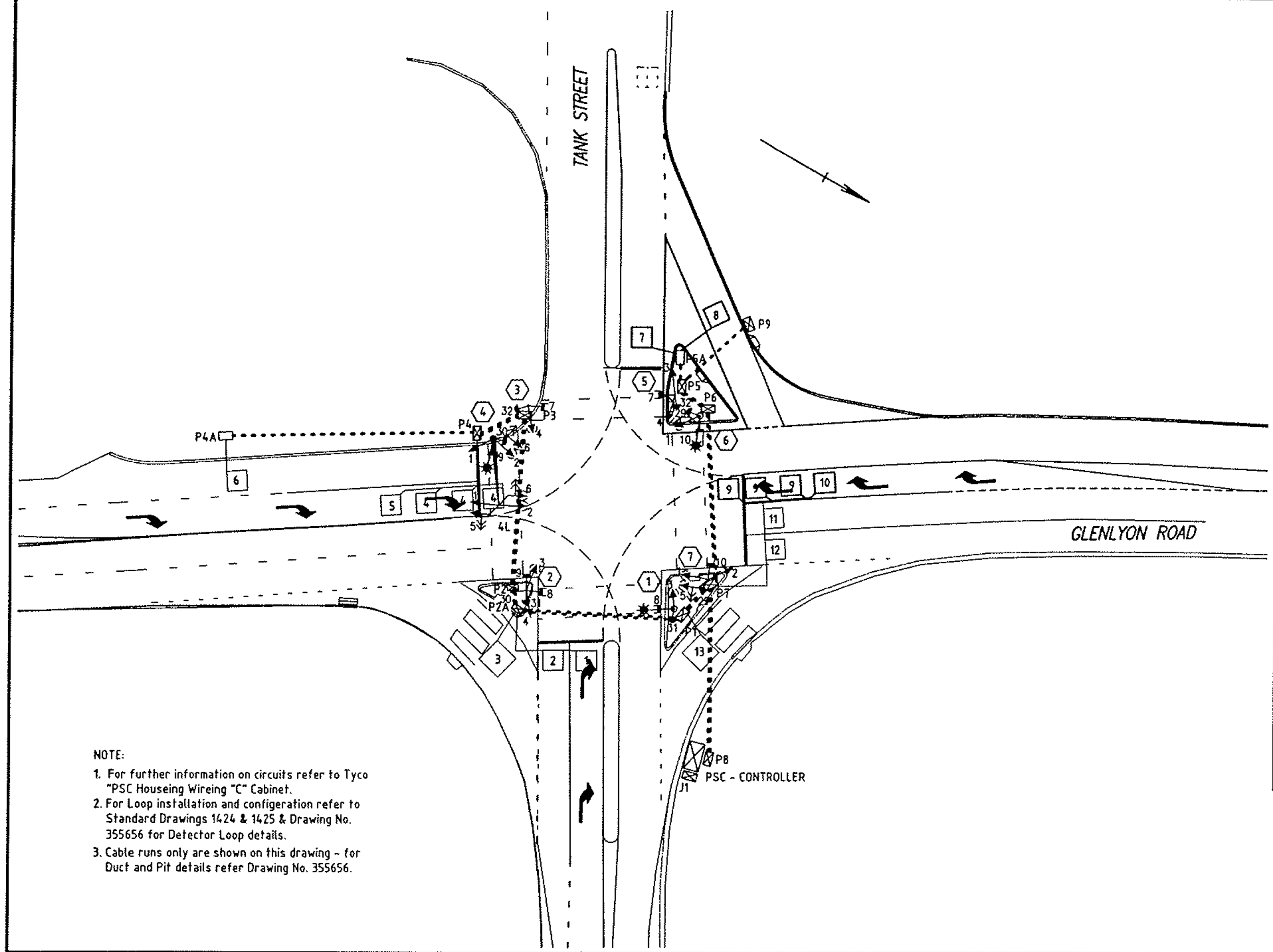
CABLE CONNECTIONS

RUN 1 CONNECTIONS: Connects ☒ 1 TO 2. RUN 2 CONNECTIONS: Connects ☒ 7 TO 5. RUN 3 CONNECTIONS: Connects ☒ 3 TO 4; Connects 4 / 4L.

CONTROLLER TERMINALS	Signal Group Function	Run 1 Final Terminals	Run 1 Cores used			Run 2 Final Terminals	Run 2 Cores used			Run 3 Final Terminals	Run 3 Cores used		
A5	RED 1					1	1			1	1	1	
A4	YELLOW 1					2	2			2	2	2	
A3	GREEN 1					3	3			3	3	3	
A8	RED 2					4	4			4	4	4	
A7	YELLOW 2					5	5			5	5	5	
A6	GREEN 2					6	6			6	6	6	
A11	RED 3	7	7			7	7						
A10	YELLOW 3	8	8			8	8						
A9	GREEN 3	9	9			9	9						
A14	RED 4	10	10			10	10			10	10		
A13	YELLOW 4	11	11			11	11			11	11		
A12	GREEN 4	12	12			12	12			12	12		
B5	RED 5					13	13			13		13	
B4	YELLOW 5					14	14			14		14	
B3	GREEN 5					15	15			15		15	
B8	RED 6									16	16	16	
B7	YELLOW 6									17	17	17	
B6	GREEN 6									18	18	18	
B11	RED D/WALK7					19	19			19	19		
B10	PED 1												
B9	GREEN WALK7					20	20			20	20		
B14	RED D/WALK8	19	19										
B13	PED 2												
B12	GREEN WALK8	20	20										
C5	RED D/WALK9	21	21							21	21		
C4	PED 3												
C3	GREEN WALK9	22	22							22	22		
C8	RED D/WALK10					21	21						
C7	PED 4												
C6	GREEN WALK10					22	22						
C11	RED 11												
C10	YELLOW 11												
C9	GREEN 11												
C14	RED 12												
C13	YELLOW 12												
C12	GREEN 12												
A2	240V SUPPLY	26	26			26	26			26	26		
E5	PED 1 DET –					23	23			23	23		
E6	PED 2 DET –	23	23										
E7	PED 3 DET –									24	24		
E8	PED 4 DET –					24	24						
E3	DET COMMON	27	27			27	27			27	27		
A1,B1,C1,D1	NEUTRAL	NL	BK	BK		NL	BK	BK		NL	BK	BK	
	SPARE CORES		1–6 13–18 24–26				16–18 25,26				7–9 13–15 25,26	7–12 19–26	
	CABLE SIZE		29				29				29	19	

NOTES

1. Clearance times calculated for 60km/hr.
2. For traffic signal symbols see STD DWG 1436 (7/97)



NOTE:

1. For further information on circuits refer to Tyco "PSC Houseing Wireing "C" Cabinet.
2. For Loop installation and configeration refer to Standard Drawings 1424 & 1425 & Drawing No. 355656 for Detector Loop details.
3. Cable runs only are shown on this drawing – for Duct and Pit details refer Drawing No. 355656.

Site No. 4605

Revisions	Certified	Date	Microfiled	Associated job nos	Dimensions in metres except where shown otherwise. Culvert sizes in millimetres.	Survey books
A Original issue				Auxiliary drawing nos	Scales 0 2 4 6 8 10m SCALE 1:250	Through chainage from
				(Office use only)		

GLADSTONE CITY
(GLADSTONE TO MT LARCOM)

CTL CHGE 2720m – 2850m

Reference Points				
Preceding RPC	Dist. to start of job (km)	From start to end of job	From end to following RPC	Following RPC

Survey	Bdys	Drawn	Design	Examined	Certified	Approved
		NRS	NRS			
Ckd	Ckd	Ckd DWC	Ckd JDC		RPEQ	District Director Peninsula / /

TRAFFIC SIGNAL INSTALLATION
PHILIPS PSC QC8-ID CONTROLLER
CABLE CONNECTIONS

Queensland Government
Department of Main Roads

JOB No. 161/181/12
Contract No.

No. 7 of 7 drgs
Drawing No. 355657
A

CAD REF: KEC406-001-C-DWG-007

Appendix B. Base Year Validation

TURN SUMMARY - AM

Location	Approach	Mvmt	ID	Count	Seed Values					Avg	St Dev	GEH
					560	28	7771	86524	2849			
Glenlyon Rd/William St	North	L	12:2:13	45	44	50	54	37	57	48	8	0.497531
		T	12:2:14	419	420	437	425	429	401	422	13	0.165765
	East	L	13:2:14	25	25	27	21	33	31	27	5	0.468879
		R	13:2:12	0	0	0	0	0	0	0	0	0
	South	T	14:2:12	738	720	721	751	747	758	739	18	0.05151
		R	14:2:13	97	98	111	106	93	97	101	7	0.402015
Glenlyon Rd/Railway St/Port Access Rd	North	L	14:19:18	44	55	49	56	51	46	51	4	1.025849
		T	14:1:20	390	385	411	385	395	375	390	14	0.003097
		R	14:1:16	10	7	8	5	16	5	8	5	0.479331
	East	L	18:1:20	6	5	5	3	5	8	5	2	0.338062
		T	18:1:16	5	6	6	8	9	6	7	1	0.816497
		R	18:1:14	54	68	79	68	65	76	71	6	2.212175
	South	L	21:1:16	30	31	32	27	25	36	30	4	0.036454
		T	21:1:14	774	743	745	783	765	771	761	17	0.447944
		R	21:1:19	13	6	5	14	12	7	9	4	1.272143
	West	L	16:1:14	8	6	8	6	10	8	8	2	0.003764
		T	16:1:19	6	5	4	6	10	5	6	2	0
		R	16:1:20	14	12	9	9	11	11	10	1	1.030677
Glenlyon Rd/Dawson Hwy/Bramston St	North	L	20:3:26	27	27	24	16	24	22	23	4	0.854486
		T	20:3:29	249	246	284	257	259	249	259	15	0.624546
		R	20:3:23	134	126	115	126	127	125	124	5	0.919472
	East	L	26:3:29	1	0	0	0	0	0	0	0	1.429889
		T	26:3:23	91	72	79	94	90	92	85	9	0.594599
		R	26:3:25	66	62	68	65	71	61	65	4	0.129187
	South	L	29:23:4	29	32	33	18	27	26	27	6	0.339562
		T	29:3:25	471	449	459	470	461	476	463	10	0.38292
		R	29:3:26	14	13	10	18	16	17	15	3	0.210819
	West	L	30:25:21	279	270	256	294	267	279	273	14	0.354172
		T	30:3:26	263	260	283	241	254	231	254	20	0.555599
		R	30:3:29	143	140	140	134	147	117	136	11	0.637077
Glenlyon Rd/Tank St	North	L	40:39:33	117	125	126	105	111	109	115	10	0.210687
		T	40:6:41	202	206	230	207	204	197	209	12	0.448556
		R	40:6:38	50	43	54	62	54	57	54	7	0.505971
	East	L	39:41:35	52	60	53	47	63	52	55	6	0.410152
		T	39:6:38	104	99	86	115	100	104	101	10	0.316228
		R	39:6:40	91	91	86	76	96	91	88	8	0.309474
	South	L	41:6:38	41	38	47	47	40	38	42	5	0.15523
		T	41:6:40	412	395	416	407	399	414	406	9	0.267859
		R	41:6:39	79	76	87	74	85	81	81	6	0.179109
	West	L	38:40:37	12	12	7	17	8	10	11	4	0.277828
		T	38:6:39	247	261	243	248	235	249	247	9	0.012723
		R	38:6:41	24	18	38	19	26	24	25	8	0.202031
Goondoon St/Bramston St	North	L	9:8d:8a:10	16	10	18	14	16	12	14	3	0.516398
		T	9:8d:8b:11	75	77	78	81	74	58	74	9	0.162418
		R	9:8d:8c:26	24	24	18	26	13	16	19	5	0.97825
		U	9:8d:8d:9	0	0	0	0	0	0	0	0	0
	East	L	10:8a:8b:11	20	24	20	26	17	27	23	4	0.605273
		T	10:8a:8c:26	65	61	56	63	68	55	61	5	0.555258
		R	10:8a:8d:9	21	30	16	19	26	26	23	6	0.509372
		U	10:8a:8a:10	0	0	0	0	0	0	0	0	0
	South	L	11:8b:8c:26	69	53	79	71	77	84	73	12	0.473162
		T	11:8b:8d:9	181	180	195	170	151	174	174	16	0.525411
		R	11:8b:8a:10	39	43	40	48	29	34	39	7	0.032067
		U	11:8b:8b:11	0	0	0	0	0	0	0	0	0
	West	L	26:8c:8d:9	84	82	82	73	92	74	81	8	0.349519
		T	26:8c:8a:10	106	100	120	96	95	100	102	10	0.404023
		R	26:8c:8b:11	114	121	120	109	108	100	112	9	0.217029
		U	26:8c:8c:26	0	0	0	0	0	0	0	0	0

TURN SUMMARY - PM

Location	Approach	Mvmt	ID	Count	Seed Values 560	28	7771	86524	2849	Avg	St Dev	GEH
Glenlyon Rd/William St	North	L	12:2:13	49	27	43	59	52	54	47	13	0.288675
		T	12:2:14	891	908	915	868	848	870	882	29	0.30901
	East	L	13:2:14	81	86	80	67	90	92	83	10	0.220863
		R	13:2:12	0	0	0	0	0	0	0	0	0
	South	T	14:2:12	501	497	490	487	483	492	490	5	0.503199
		R	14:2:13	34	39	35	30	39	32	35	4	0.170251
Glenlyon Rd/Railway St/Port Access Rd	North	L	14:19:18	50	43	48	40	39	35	41	5	1.269201
		T	14:1:20	899	924	917	871	876	901	898	24	0.024852
		R	14:1:16	24	26	31	23	25	29	27	3	0.572787
	East	L	18:1:20	20	10	26	13	22	19	18	7	0.458831
		T	18:1:16	5	6	4	6	4	8	6	2	0.260623
		R	18:1:14	41	44	43	41	35	45	42	4	0.08056
	South	L	21:1:16	43	37	38	38	48	35	39	5	0.592738
		T	21:1:14	473	473	462	462	461	454	462	7	0.507471
		R	21:1:19	17	16	18	6	8	18	13	6	0.977902
	West	L	16:1:14	21	18	15	12	23	22	18	5	0.578842
		T	16:1:19	14	10	15	16	5	7	11	5	0.969452
		R	16:1:20	59	62	64	66	66	58	63	3	0.537315
Glenlyon Rd/Dawson Hwy/Bramston St	North	L	20:3:26	59	51	60	59	57	51	56	4	0.409463
		T	20:3:29	638	656	666	624	628	658	646	19	0.324391
		R	20:3:23	281	285	276	252	270	265	270	12	0.667419
	East	L	26:3:29	22	19	18	24	21	17	20	3	0.428078
		T	26:3:23	225	240	223	213	183	220	216	21	0.624867
		R	26:3:25	68	73	72	58	67	64	67	6	0.15716
	South	L	29:23:4	40	26	39	43	53	35	39	10	0.127128
		T	29:3:25	259	246	245	248	240	236	243	5	1.017541
		R	29:3:26	18	18	15	22	15	18	18	3	0.094809
	West	L	30:25:21	206	207	198	200	210	207	204	5	0.123079
		T	30:3:26	191	193	208	172	175	174	184	16	0.484067
		R	30:3:29	110	116	103	100	112	99	106	8	0.356437
Glenlyon Rd/Tank St	North	L	40:39:33	104	96	112	101	120	122	110	11	0.575237
		T	40:6:41	561	570	562	525	551	568	555	18	0.265356
		R	40:6:38	75	69	83	80	72	56	72	11	0.389635
	East	L	39:41:35	154	159	160	166	161	154	160	4	0.478852
		T	39:6:38	167	164	150	165	191	156	165	16	0.139665
		R	39:6:40	96	83	94	85	100	112	95	12	0.096846
	South	L	41:6:38	46	55	43	44	46	50	48	5	0.233882
		T	41:6:40	217	207	204	224	206	176	203	17	0.91013
		R	41:6:39	19	15	20	15	15	20	17	3	0.471405
	West	L	38:40:37	3	1	2	4	3	1	2	1	0.372747
		T	38:6:39	106	105	94	105	135	98	107	16	0.135533
		R	38:6:41	16	17	13	20	18	21	18	3	0.437854
Goondoon St/Bramston St	North	L	9:8d:8a:10	16	12	17	11	13	17	14	3	0.516398
		T	9:8d:8b:11	75	72	55	89	64	70	70	13	0.58722
		R	9:8d:8c:26	46	46	46	38	39	34	41	5	0.754858
		U	9:8d:8d:9	0	0	0	0	0	0	0	0	0
	East	L	10:8a:8b:11	20	18	21	27	16	27	22	5	0.393731
		T	10:8a:8c:26	131	125	119	108	110	122	117	7	1.251374
		R	10:8a:8d:9	21	24	18	30	22	28	24	5	0.713618
		U	10:8a:8a:10	0	0	0	0	0	0	0	0	0
	South	L	11:8b:8c:26	139	138	128	133	105	123	125	13	1.152625
		T	11:8b:8d:9	181	191	191	177	195	178	186	8	0.398418
		R	11:8b:8a:10	39	42	43	47	40	44	43	3	0.655131
		U	11:8b:8b:11	0	0	0	0	0	0	0	0	0
	West	L	26:8c:8d:9	74	69	85	70	62	62	70	9	0.48551
		T	26:8c:8a:10	94	107	112	83	100	87	98	13	0.383549
		R	26:8c:8b:11	100	90	89	91	84	97	90	5	1.002354
		U	26:8c:8c:26	0	0	0	0	0	0	0	0	0

TURN SUMMARY - AM

Location	Approach	Mvmt	ID	Count	Seed Values 560	28	7771	86524	2849	Avg	St Dev	GEH
Dawson Hwy/Phillip St	North	L	3c:3ba:3bb:3	200	189	185	197	195	194	192	5	0.559431
		T	3c:3ba:3bc:22	386	382	377	391	370	374	379	8	0.374833
		R	3c:3ba:3bd:3f	52	54	57	49	50	61	54	5	0.296481
		U	3c:3ba:3ba:3c	3	0	0	0	0	0	0	0	2.44949
	East	L	3:3bb:3bc:22	384	412	388	406	412	398	403	10	0.967773
		T	3:3bb:3bd:3f	83	88	72	86	91	87	85	7	0.196513
		R	3:3bb:3ba:3c	210	225	222	218	200	203	214	11	0.281221
		U	3:3bb:3bb:3	26	23	27	21	30	24	25	4	0.19803
	South	L	22:3bc:3bd:3f	87	77	78	89	93	83	84	7	0.324443
		T	22:3bc:3ba:3c	1,138	1132	1136	1115	1152	1143	1136	14	0.060434
		R	22:3bc:3bb:3	491	482	489	491	475	486	485	6	0.271504
		U	22:3bc:3bc:22	0	0	0	0	0	0	0	0	0
	West	L	3f:3bd:3ba:3c	63	60	48	53	64	60	57	6	0.756069
		T	3f:3bd:3bb:3	46	32	41	44	44	45	41	5	0.66411
		R	3f:3bd:3bc:22	30	31	36	23	29	24	29	5	0.258639
		U	3f:3bd:3bd:3f	0	0	0	0	0	0	0	0	0
Phillip St/Shopping Centre	North	L	10:8:7	25	23	18	24	27	29	24	4	0.161296
		R	10:8:3	25	30	30	13	29	28	26	7	0.19803
	East	T	3:8:7	678	677	695	696	710	704	696	12	0.720735
	West	L	3:8:10	44	49	47	57	34	44	46	8	0.327593
		T	3:8:7	718	677	695	696	710	704	696	12	0.812237

TURN SUMMARY - PM

Location	Approach	Mvmt	ID	Count	Seed Values					Avg	St Dev	GEH
					560	28	7771	86524	2849			
Dawson Hwy/Phillip St	North	L	3c:3ba:3bb:3	491	510	455	474	449	520	482	32	0.404778
		T	3c:3ba:3bc:22	862	838	854	894	892	869	869	24	0.250413
		R	3c:3ba:3bd:3f	103	109	99	104	125	107	109	10	0.519936
		U	3c:3ba:3ba:3c	4	0	0	0	0	0	0	0	2.828427
	East	L	3:3bb:3bc:22	594	619	605	626	642	568	612	28	0.733017
		T	3:3bb:3bd:3f	115	110	120	125	121	101	115	10	0.037268
		R	3:3bb:3ba:3c	153	152	153	141	154	142	148	6	0.390646
		U	3:3bb:3bb:3	75	64	66	71	65	78	69	6	0.731185
	South	L	22:3bc:3bd:3f	89	91	74	87	82	84	84	6	0.581284
		T	22:3bc:3ba:3c	606	563	553	614	644	635	602	42	0.183721
		R	22:3bc:3bb:3	269	292	297	277	260	268	279	16	0.573208
		U	22:3bc:3bc:22	0	0	0	0	0	0	0	0	0
	West	L	3f:3bd:3ba:3c	143	136	147	132	134	152	140	9	0.276029
		T	3f:3bd:3bb:3	60	61	55	66	59	57	60	4	0.073035
		R	3f:3bd:3bc:22	162	150	167	173	172	137	160	16	0.173438
		U	3f:3bd:3bd:3f	0	0	0	0	0	0	0	0	0
Phillip St/Shopping Centre	North	L	10:8:7	135	161	142	142	149	158	150	9	1.289166
		R	10:8:3	101	90	102	112	107	95	101	9	0.019891
	East	T	3:8:7	836	898	841	855	805	888	857	37	0.728626
	West	L	3:8:10	34	26	30	32	27	34	30	3	0.743625
		T	3:8:7	861	898	841	855	805	888	857	37	0.122816

Appendix C. Paramics Video Files