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Gatton Prison Precinct - Traffic Engineering

For Project Services

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1.0 INTRODUCTION

This traffic engineering master plan study has been prepared on behalf of Project Services (Public Works) to provide advice in relation to the potential external works and intersection upgrades required as a result of the development of a Prison Precinct at Gatton.

The project involves the planning for a major correctional centre to be constructed over several stages with an ultimate capacity of approximately 3,000 beds. It is understood that the site will ultimately employ approximately 1,750 staff in addition to the 3,000 population. It is our understanding that land required for the Gatton Prison Precinct, between Millers Road and Krugers Road, Lake Clarendon, is currently being compulsorily acquired.

The report has been compiled in a clear and concise manner and is set out as follows:

Section 2 provides an assessment of the development context including the existing land use and traffic arrangements

Section 3 details the proposed development and forecasts the development generated traffic volumes to / from the prison precinct.

Section 4 evaluates the potential impact that the proposed prison precinct could have on the surrounding road network.

Section 5 identifies any infrastructure upgrades required to mitigate the potential impacts of the development and provides an opinion of possible cost for these upgrades.

Section 6 summarises the key outcomes of the traffic investigations.

Lambert & Rehbein has derived the data in this report primarily from the data provided by the Client, field inspections in April 2007 and discussions with Main Roads Officers. The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between Lambert & Rehbein and the Client. Lambert & Rehbein accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

2.0 CONTEXT OF THE DEVELOPMENT

This section of the report describes the nature of the existing development site, the surrounding area including land uses, and describes the extent of the existing transport system.

2.1 DEVELOPMENT SITE

The proposed prison precinct development site is located between Millers Road and Krugers Road, Lake Clarendon, which is approximately 12km north of Gatton. The site location, in relation to the surrounding road network, is displayed in **Figure 2-1**. A more detailed plan showing the lots dedicated to the Prison Precinct, prepared by the project architects Phillips Smith Conwell, is provided in **Appendix A**.

Figure 2-1 Gatton Prison Precinct Site Location

The surrounding land uses include rural residential properties, fruit orchards and some small rural businesses. The proposed Gatton Prison Precinct site occupied by two detached dwellings. The site is located within the Gatton Shire Council area.

2.2 SURROUNDING ROAD NETWORK

A site inspection of the land use, road condition, intersection characteristics, pedestrian access and cyclist provisions within the study area was undertaken in April 2007. The aim of these field reviews was to collect information about the road network, intersection operation, safety characteristics, public transport network, and specific network / land-use factors potentially of influence to the future long term road network structure. The information gathered throughout this field review has been used in the formulation of this assessment.

Gatton Esk Road is a two-way, two lane road, with a posted speed limit of 100km/h that forms part of the State Controlled Road Network. This connection, between the Warrego Highway and the Brisbane Valley Highway, is classified as a B-double route for 23 and 25 meter vehicles. Gatton Esk Road is the boundary between Gatton Shire Council and Laidley Shire Council. Three signed floodways were observed on Gatton Esk Road between Millers Road and the Warrego Highway. The field inspection indicated that there were no obvious low lying sections of Gatton Esk Road, north of Millers Road.

In the vicinity of Millers Road, Gatton Esk Road is a reasonably narrow road with no formal shoulder treatments.

Millers Road is a predominantly an unformed single lane dirt road within a 20m road reserve. There is currently no posted speed limit and the road form appears to follow the path of least resistance, travelling around trees and lowering for causeways. Millers Road appears to carry truck movements between the existing turf farm and Gatton Esk Road. The form of Millers Road, west of Gatton Esk Road, is displayed in **Figure 2-2**.

Figure 2-2 Millers Road, west of Gatton Esk Road

The priority intersection of Millers Road and Gatton Esk Road is currently a single lane approach from all three directions. The sight distance from Millers Road to the south is considered acceptable, while the sight distance to the north is approximately 110m. The form of this intersection, as viewed from the north, is displayed in **Figure 2-3.**

Figure 2-3 Intersection of Gatton Esk Road / Millers Road

Krugers Road, to the north the site, is a two-way local access road that services rural residential dwellings and orchards. The road is sealed bitumen of approximately 5m in width. Krugers Road intersects with Gatton Esk Road as a priority intersection, as displayed in **Figure 2-4**.

Figure 2-4 Krugers Road approach to Gatton Esk Road

2.3 TRAFFIC VOLUMES

Discussions with the Department of Main Roads (Toowoomba) Officers indicated that Gatton Esk Road was surveyed in 2006 to have an AADT of 1,418 vehicles per day. This 2006 traffic count data indicated that Gatton Esk Road was carrying approximately 14% heavy vehicles, which is considered relatively high, and is a reflection of the road classified as a B-double route. The forecast growth rate for the next 5 years is less than 2% increase per year.

Based on site observations and an estimate of the number of dwellings serviced by Millers Road, we have assumed 10 trips into and out of Millers Road, via Gatton Esk Road, currently occur during the peak periods. This is considered to be a conservatively high estimate of the traffic movements on this road.

These volumes will be adopted as the 2006 base case and will be increased, as per Main Roads projected growth rate, to estimate the volume of traffic at the key intersection to / from the site for the Stage 1 and ultimate opening year.

The background traffic volumes for the years 2008, 2010 and 2016 were estimated based on applying the 2% pa growth rate to the 2006 AADT recorded for Gatton Esk Road. These design

horizon years were adopted to coincide with the staging timeframes for the proposed facility. The forecast traffic volumes for the AM and PM peak periods are displayed in **Appendix B**.

2.4 CRASH DATA

The crash data provided a list of all incidents recorded in the study precinct from 2000 to 2005. This information included crash severity, atmospheric conditions, road features and alignment, vehicle type and the actual place of contact on the vehicle. A summary of the crash data for the study area, provided by Queensland Transport, is provided in **Table 2-1**.

Table 2-1 Crash Data for Gatton-Esk Road

Location	Year	Crash Severity	Road Feature	Notes
Gatton Esk Road, south of Millers Road	2001	Minor Injury	Straight Road	Water covering road
Gatton Esk Road / Krugers Road	2002	Property Damage	Priority Intersection	Fatigue, excessive speed
Gatton Esk Road, south of Krugers Road	2002	Hospitalisation	Straight Road	Undue care and attention
Gatton Esk Road, north of Millers Road	2004	Hospitalisation	Straight Road	Animal on road
Gatton Esk Road / Millers Road	2004	Property Damage	Priority Intersection	Fatigue / fell asleep
Gatton Esk Road / Krugers Road	2005	Property Damage	Priority Intersection	Crossed double lines

The recorded crash data suggests that there is an average of one to two accidents a year on Gatton Esk Road, within proximity to the proposed prison precinct. The crash data circumstance and situation description for the 7 crashes recorded form 2000-2005 suggest that the majority of the accidents were caused by driver error, rather than substandard road configuration.

2.5 ROAD NETWORK PLANNING

A review of the Main Roads Road Implementation Program (RIP) 2005-06 to 209-10 document suggests that there are currently no plans to upgrade the Gatton Esk Road within the next 5 years. A discussion with Main Roads officers confirmed that Main Roads are not planning to upgrade the pavement or intersections on Gatton Esk Road, or change the existing low lying floodways. During these discussions the DMR officer raised no particular issues in respect of the adjacent road network and indicated that there would be no requirement to upgrade Gatton Esk Road due to the alternative access route available.

3.0 PROPOSED DEVELOPMENT

This section of the report describes the nature of the proposed development, and forecasts the development generated traffic volumes for the precinct.

3.1 DETAILS OF GATTON PRISON PRECINT

The overall aim of the project is to develop a correctional precinct that accommodates all growth in the general prisoner population in South East Queensland for the foreseeable future. The site will be developed over for stages, with stage one to include a 1,000 bed male and a 300 bed female centre, with the ultimate capacity being of the order of 3,000 beds. Stage 1 is anticipated to be operational by 2011 with approximately 300 staff members. The staffing numbers are expected to increase to approximately 700 employees when the precinct is fully commissioned in 2016.

Employees of the prison precinct will work across the full range of corrections including custodial officers, administration staff, programs and educational staff and trade instructors. Based on the experience at the Woodford Correctional Centre, it is forecast that approximately 20 percent of the staff employed at the Gatton prison precinct will live in the local area.

It is understood that the prison typically operates on a skeleton staff during the evenings when the prison is in “lock down” and the full on-site staff numbers would be generally during the day when custodial and administrative staff would both be on-site.

The proposed prison precinct site location between Millers Road and Krugers Road, Lake Clarendon, as displayed in **Appendix A**. Access to / from the site will be via Gatton Esk Road and Millers Road. At this stage of the master planning for the project no connection via Krugers Road to / from the site is being considered. The proposed access location from Millers Road to the Gatton Prison Precinct is displayed in **Figure 3-1**. It is clear that significant infrastructure and security works will be required at this location.

Figure 3-1 Proposed access location from Millers Road

3.2 DEVELOPMENT GENERATED TRAFFIC VOLUMES

The proposed prison precinct development would result in a relatively substantial increase in the traffic volumes on the external road network immediately adjacent to the site (Millers Road and Gatton Esk Road). It is assumed that the worst case scenario for the development generated traffic would be a typical weekday morning or evening peak period. This is the period where traffic generated by the development would coincide with higher background traffic volumes. This has been used as the design period.

The road network surrounding the proposed prison precinct site is expected to experience increases in the traffic movements for the following design scenarios –

1. Construction phase – expect maximum of 50 heavy vehicles per day, and approximately 250-300 construction related staff on site. It is expected that the Stage 1 construction would include around 250 staff which would increase to 300 during the construction of Stage 2. This phase is planned to begin mid 2008.

2. Stage 1 – From 2010 it is understood that 1,300 beds will be available, with approximately 300 staff members expected on site. This would be expected to consist of 150 custodial staff and 150 administrative staff. The construction phase is likely to continue during the operation of Stage 1, as the ultimate prison precinct (Stage 2 works)

is constructed. As noted above the construction process for Stage 2 would result in approximately 300 construction related staff on-site also.

3. Ultimate Development – From 2016 a total of 3,000 beds available, with approximately 700 staff members. This would consist of approximately 350 custodial staff and 350 administrative staff. During this phase no construction traffic is expected.

4. In addition to the above there is a reasonable expectation for some level of visitation by members of the public with 100 – 200 expected for Stages 1 and 2 operation. It is noted that the arrival and departures times for these visitors is likely to be well outside the travel times of the other precinct population and will not have a significant impact on the external road network.

With no "typical" traffic generation rates available, the expected traffic generation of the prison precinct has been estimated based on first principals using the following assumptions. We have adopted this approach to the estimation of possible traffic movements as there is no existing "typical" data available for a similar development. Our estimates have been based on the following:

- All construction and prison staff trips to / from the site are made by private vehicle, as there are limited public transport, pedestrian or cyclist facilities servicing the site;
- Vehicle occupancy of 1.2 passengers per private vehicle for staff members (this equates to one in five vehicles having two passengers);
- Arrival and departure of staff is as identified in the table above
- Assume 10% of visitors arrive / depart during the peak period;
- During evenings the prison custodial staff numbers are expected to be extremely small with the prison in "lock down" mode;
- Visitors are expected to be limited to particular hours during the day (typically not commuter peak periods); and
- The distribution of the prison precinct generated trips is assumed to be 75% via the Warrego Highway (south) and the remaining 25% via Brisbane Valley Highway (north).

It is also noted that the shift times for some of the staff would typically vary based on the type of employment. It is our understanding that the following operational scenario will apply to the various staff numbers.

- Custodial Staff

It is expected that Custodial staff would typically work a 12 hour shift during the day. It is expected that the general arrival time would be between 6:30am – 7:00am. Departure would occur at around 7:30pm at the conclusion of the shifts. We have allowed a nominal 5% for custodial staff working night shifts that would depart in the AM and arrive in the PM.

- Administrative Staff

It is expected that the administrative staff would generally work the typical Qld Public Service hours and arrivals would generally be between 8:30am – 9:00am and departure would be around 5:00pm.

- Construction Staff

It is expected that the trades staff would work typical construction industry hours with the arrivals expected between 6:30am-7:00am and the departures at around 3:00pm. We have also assumed that there would be approximately 50 heavy vehicles visiting the site throughout the day with none of these movements coincidental with the peak periods.

The above information is summarised in Table 3-1 below.

Table 3-1 Travel Profile

Staff Category	Anticipated Arrival	Anticipated Departure
Custodial Staff	6:30 – 7:00am	7:30pm
Administrative Staff	8:30 – 9:00am	5:00pm
Visitors	Various non peak	Various non peak
Construction Staff	6:30 – 7:00am	3:00pm

Source: Project Services

Clearly from the information above, the worst case scenarios for AM and PM peaks would be as follows:

- AM Peak - Assume that Construction / Custodial traffic coincidental with background AM Peak traffic. Administrative Staff movements would be outside the background peak periods.
- PM Peak - The departure patters are more dispersed than AM arrival. Worst case is to assume that Administrative staff traffic is coincidental with the Background PM peak traffic.

We have adopted the above scenarios in the assessment of the impact of the development on the surrounding road network.

Based on the above assumptions the estimated traffic generated by each scenario of the proposed prison precinct is shown in **Table 3-2**.

Table 3-2 Development Traffic Generation

Scenario	AM (In)	AM (Out)	PM (In)	PM (Out)	Daily (In)	Daily (Out)
Phase 1 - Stage 1 Construction Only						
Construction	210	0	0	210	260	260
Total	**210**	**0**	**0**	**210**	**260**	**260**
Phase 2 - Stage 1 Operational / Stage 2 Construction						
Stage 1 Staff	125	8	0	125	250	250
Stage 1 Visitors	10	10	10	10	100	100
Construction	250	0	0	0	300	300
Total	***385***	***18***	***10***	***135***	***650***	***650***
Phase 3 - Ultimate Operation Only						
Ultimate Staff	292	8	8	292	584	584
Ultimate Visitors	23	23	23	23	230	230
Total	***315***	***31***	***31***	***315***	***814***	***814***

The construction phase is anticipated to generate approximately 420 staff vehicle movements (based on 1.2 occupancy) to and from the site each work day with the additional 100 heavy vehicle movements assumed. Stage 1, when the prison is open, will also experience construction traffic movements and visitor trips, therefore resulting in an estimate of 1,300 trips to and from the site each day. The ultimate development, with a total of 3,000 beds, is expected to generate in excess of 1,600 vehicle movements per day associated with the prison staff and visitor trips.

The distribution of the development generated traffic volumes on the adjacent intersection of Gatton Esk Road / Millers Road during the construction, Stage 1 and ultimate prison precinct scenarios are displayed in **Appendix B**. These volumes form the basis of the 'with development' scenarios analysed in **Section 4.**

We note that the traffic generation statistics formulated above have been derived from the information provided by the clients' representatives in relation to the likely operation of the proposed prison facility.

4.0 IMPACT ASSESSMENT

This section of the report describes the analysis scenarios and presents summaries of the potential impact that the Gatton Prison Precinct development generated traffic volumes could have on the adjacent key intersection of Gatton Esk Road / Millers Road.

4.1 INTERSECTION ANALYSIS ASSUMPTIONS

The following assumptions have been made whilst performing intersection analysis in SIDRA 3.1:

- A Saturation Flow of 1,950 through car units per hour;
- Heavy Vehicle volume of 14% for Gatton Esk Road, as per the surveys described in **Section 2.3**;
- No co-ordination of movements on Gatton Esk Road;
- Assume that the peak period equates to 8% of the AADT; and
- Gap Acceptance values extracted from *Austroads Part 5: Intersections at Grade*.

4.2 INTERSECTION ANALYSIS

4.2.1 CONSTRUCTION SCENARIO (2008)

Intersection analysis was undertaken for the Gatton Esk Road / Millers Road priority intersection, using the assumptions outlined in **Section 4.1**, for the construction phase (2008) 'without development' and 'with development' scenarios. This assessment adopts the existing configuration of the priority intersection with single lane approaches form the north, south and west. **Tables 4-1** and **4-2** provide a summary of the results for the intersection analysis, for the 'without development' and 'with development' scenarios, respectively. More detailed results are provided in **Appendix C**.

Table 4-1 2008 Without Construction Traffic Intersection Analysis Results

Intersection	Approach	Degree of Saturation	95th percentile Queue (m)	Delay (LoS)
Gatton Esk Road / Millers Road (AM peak)	S	0.037	0	1.3 (A)
	N	0.036	2	0.9 (A)
	W	0.009	0	9.3 (A)
Gatton Esk Road / Millers Road (PM peak)	S	0.037	0	1.3 (A)
	N	0.036	2	0.9 (A)
	W	0.009	0	9.3 (A)

Table 4-1 2008 With Construction Traffic Intersection Analysis Results

Intersection	Approach	Degree of Saturation	95th percentile Queue (m)	Delay (LoS)
Gatton Esk Road / Millers Road (AM peak)	S	0.122	0	9.2 (A)
	N	0.082	4	7.0 (A)
	W	0.011	0	9.9 (A)
Gatton Esk Road / Millers Road (PM peak)	S	0.037	0	1.3 (A)
	N	0.0.36	2	0.9 (A)
	W	0.207	8	9.5 (A)

The Sidra 3.1 intersection analysis undertaken for the construction phase (2008) forecast traffic volumes suggests that the Gatton Esk Road / Millers Road priority intersection is anticipated to operate adequately during the peak periods for both the 'without construction staff' and 'with with construction staff' scenarios.

The existing intersection layout is forecast to have sufficient spare capacity to cater for the construction staff movements to and from the site. Therefore, no changes to the Gatton Esk Road / Millers Road priority intersection are required for the construction phase, based on operational capacity.

4.2.2 STAGE 1 DEVELOPMENT SCENARIO (2010)

Intersection analysis was undertaken for the Gatton Esk Road / Millers Road priority intersection, using the assumptions outlined in **Section 4.1**, for the Stage 1 opening year (2010) 'without development' and 'with development' scenarios. We note that in undertaking this analysis we have assumed that the intersection of Gatton Esk Road / Millers Road is a single lane approach

from all three directions. **Tables 4-3** and **4-4** provide a summary of the results for the intersection analysis, for the 'without development' and 'with development' scenarios, respectively. The 'with development' scenario includes the forecast construction staff, prison staff and visitor movements, as detailed in **Section 3.2**. More detailed results are provided in **Appendix C**.

Table 4-3 2010 Without Development Intersection Analysis Results

Intersection	Approach	Degree of Saturation	95th percentile Queue (m)	Delay (LoS)
Gatton Esk Road / Millers Road (AM peak)	S	0.039	0	1.3 (A)
	N	0.037	2	0.8 (A)
	W	0.009	0	9.4 (A)
Gatton Esk Road / Millers Road (PM peak)	S	0.039	0	1.3 (A)
	N	0.037	2	0.8 (A)
	W	0.009	0	9.4 (A)

Table 4-4 2010 With Development Intersection Analysis Results

Intersection	Approach	Degree of Saturation	95th percentile Queue (m)	Delay (LoS)
Gatton Esk Road / Millers Road (AM peak)	S	0.194	0	10.4 (A)
	N	0.136	6	9.6 (A)
	W	0.033	1	10.5 (B)
Gatton Esk Road / Millers Road (PM peak)	S	0.042	0	2.3 (A)
	N	0.039	2	1.4 (A)
	W	0.138	5	9.5 (A)

The Sidra 3.1 intersection analysis undertaken for the Stage 1 opening year (2010) forecast traffic volumes suggests that the Gatton Esk Road / Millers Road priority intersection is anticipated to operate with considerable spare capacity during the peak periods for the 'without development' scenario.

The 'with development' scenario is forecast to experience a 95th percentile queue length of 1 vehicle during the AM peak period on Gatton Esk Road southbound direction (right turn movements). While this appears relatively minor it is noted that the existing function of Gatton Esk Road is a high speed rural road environment. During the PM peak period the Millers Road

approach to Gatton Esk Road is forecast, as expected, to experience an increase in queue lengths, due to the relatively high volume of construction and prison staff leaving the site. It is noted however that operationally this intersection would continue to be of very high standard.

Although the analysis forecasts the existing configuration of Gatton Esk Road / Millers Road priority intersection to experience an acceptable operational performance, the traffic volumes associated with turns into and out of the site are of a relatively high order and in the rural environment consideration would need to be given the "rural turn lane warrants" associated with this location. Refer to Section 4.3 of this report for this additional review of turn lane warrants.

4.2.3 ULTIMATE DEVELOPMENT SCENARIO

Intersection analysis was undertaken for the Gatton Esk Road / Millers Road priority intersection, using the assumptions outlined in **Section 4.1**, for the Ultimate prison precinct development (2016) 'without development' and 'with development' scenarios. This assessment adopts the existing intersection form of a single lane approach on Gatton Esk Road and Millers Road. **Tables 4-5** and **4-5** provide a summary of the results for the intersection analysis, for the 'without development' and 'with development' scenarios, respectively. The 'with development' scenario includes the forecast traffic movements for the prison staff and visitors during the AM and PM peak periods. More detailed results are provided in **Appendix C**.

Table 4-5 2016 Without Development Intersection Analysis Results

Intersection	Approach	Degree of Saturation	95th percentile Queue (m)	Delay (LoS)
Gatton Esk Road / Millers Road (AM peak)	S	0.043	0	1.1 (A)
	N	0.041	2	0.8 (A)
	W	0.010	0	9.4 (A)
Gatton Esk Road / Millers Road (PM peak)	S	0.043	0	1.1 (A)
	N	0.041	2	0.8 (A)
	W	0.010	0	9.4 (A)

Table 4-6 2016 With Development Intersection Analysis Results

Intersection	Approach	Degree of Saturation	95th percentile Queue (m)	Delay (LoS)
Gatton Esk Road / Millers Road (AM peak)	S	0.170	0	9.7 (A)
	N	0.118	6	8.3 (A)
	W	0.047	2	10.4 (B)
Gatton Esk Road / Millers Road (PM peak)	S	0.055	0	3.8 (A)
	N	0.048	2	2.1 (A)
	W	0.318	13	9.9 (A)

The Gatton Esk Road / Millers Road priority intersection is forecast to operate adequately, with considerable spare capacity, during the 2016 AM and PM peak periods with the background growth rate of 2% pa. No changes to the intersection are anticipated to be required as result of background traffic growth.

The addition of the prison staff movements for the ultimate scenario to the Gatton Esk Road / Millers Road intersection has some impacts on the operation of this intersection albeit that the intersection would operationally continue to function with considerable spare capacity.

Again it is noted that the turning volumes into/out of Millers Road associated with the proposed Prison would be substantial and would require detailed examination of the rural turn lane warrants.

4.3 TURN LANE WARRANT REVIEW

A review of the requirements for priority intersection layouts at Gatton Esk Road / Millers Road has been undertaken using the following documents -

- Austroads Guide to Traffic Engineering Practice – Part 5:Intersections at Grade (Rural Turn Lane Warrants); and
- *New Warrants for Unsignalised Intersection Turn Treatments*, Arndt & Troutbeck et.al. (2005).

This assessment has been undertaken in conjunction with the operational assessments identified in **Section 4.2**. It is noted that the nature of this area is relatively stable, with no significant changes to the road network in the foreseeable future.

The Gatton Esk Road / Millers Road priority intersection is currently a Basic Intersection (type BA), which suits the existing small volume of turning traffic. Using the above documents, we have

undertaken an assessment of the warrants for auxiliary turning lanes at the intersection for the three design scenarios of Construction, Stage 1 and Ultimate prison precinct development.

With the background traffic growth only, at 2% pa on Gatton Esk Road, and assuming that there are no changes to the land uses on Millers Road, the existing form would generally be appropriate for the intersection at 2008, 2010 (stage 1 opening year) and 2016 (ultimate development opening year).

The addition of the traffic movements generated by the Construction Stage staff members to and from the site is anticipated to require the Gatton Esk Road / Millers Road priority intersection to require upgrading. The upgrading requirements for the construction staff traffic movements includes the addition of right turn (CHR) and left turn (AUL) lanes from Gatton Esk Road to Millers Road.

As the trips to and from the site increase with the opening of Stage 1 (2010) and the ultimate scenario (2016) the length of the right turn lane increases as a reflection of the increase demand for storage of this movement. The upgrade of the Gatton Esk Road / Millers Road intersection is recommended to be designed for the ultimate scenario, with the forecast traffic movements detailed in Section 3.2.

It is therefore recommended that before construction of the prison precinct begins the priority intersection of Gatton Esk Road / Millers Road is to be upgraded to a chanellised right turn lane and a deceleration left turn lane. The details of the geometric requirements for these turn lanes is provided in Section 5.1.

On the basis of the assessment above, including the “Stage 1” and “Ultimate” intersection turning movements, it is considered that the intersection should be provided with the following general configuration as part of the Construction Stage commissioning.

- Northern Gatton Esk Road Approach
  - Single though lane heading southbound
  - Right turn lane from Gatton Esk Road to Millers Road;
- Southern Gatton Esk Road Approach
  - Single though lane heading northbound
  - Left turn deceleration lane from Gatton Esk Road to Millers Road; and
- Separate left turn and right turn stand up lanes on Millers Road.

In addition to the above it is also recommended that the speed limits on Gatton Esk Road be reviewed with a view to reducing this limit to 80km/hr or lower on the approaches to the intersection at Millers Road. With the presence of turning traffic it is considered that this

reduction in the speed limits would increase the safety in this location. It is noted that the concept plan developed in Section 5.1 has been based on the reduced design speed of 80km/hr.

In addition, while not essential, we consider that it is also reasonable that a secondary access be considered for the ultimate operational scenario. As part of the Master Planning process the design may allow the consideration of separation of the parking areas that could then also split the traffic movements and relieve some of the forecast demands on the Millers Road intersection with Gatton Esk Road.

4.4 IMPACT ON WIDER ROAD NETWORK

The forecast additional traffic generated as a result of the Gatton prison precinct, for the construction scenario (520 vehicles per day), stage 1 (1,300 trips per day) and ultimate prison precinct (1,628 trips per day) is a significant increase to the Gatton Esk Road 2006 AADT volumes of 1,418 two-way vehicles per day provided by the Department of Main Roads.

On this basis it is our opinion that the prison precinct development generated traffic could result in a need to undertake physical improvement works on the Gatton Esk Road, south of Millers Road, at the opening of Stage 1 of the development.

Discussions with Main Roads Officers have highlighted the potential need in the future to undertake repair work to Gatton Esk Road to mitigate the potential impact of the prison precinct traffic volumes.

There are currently three floodways on Gatton Esk Road, between the Warrego Highway and Millers Road, which appear to have low flood immunity. Main Roads Officers have advised that the subject development would not be required to upgrade these floodways, as there is an alternative access to / from the site via Gatton Esk Road to the north, via the Brisbane Valley Highway.

Council has raised some concerns in relation to the sight distance provisions at the following intersections with Gatton Esk Road:

- Orchard Road;
- Redland Creek Road; and
- Taralinga Road.

While these specific intersections have not been identified by the DMR as a particular issue, in this regard it is considered that further detailed assessment of these intersections may be necessary as the development progresses. To undertaken a detailed assessment of the sight distance provisions accurate field survey should be provided. This would allow us to accurately determine if these intersections meet appropriate sight distance requirements as identified in the

DMR Road Planning & Design Manual. Furthermore, given that the proposal will not be having any physical impact on these locations it would not be reasonable for the full costs of any upgrades to be a requirement of the subject development. Some form of appropriate costs sharing would be a reasonable approach to any necessary upgrade works.

5.0 DEVELOPMENT UPGRADE WORKS

5.1 INFRASTRUCTURE REQUIREMENTS

Based on the intersection capacity and authority requirement assessment undertaken in **Section 4** of this report, a concept layout plan of Millers Road / Gatton Esk Road intersection has been prepared to mitigate the impacts of the subject development. The plan is a broad concept plan that identifies the necessary access arrangement to provide a safe and efficient access solution and includes an indication of the upgrade / intersection works required. The concept plan for the ultimate scenario requirements for the Gatton Esk Road intersection with Millers Road is displayed in **Appendix D**.

It is important to highlight that the plan is conceptual only, as no detailed feature survey plans were available at the time of undertaking this work. More detailed plans of the ultimate form of the Gatton Esk Road / Millers Road intersection, using detailed feature survey, are recommended to be prepared at a subsequent stage of the project.

A typical cross section of Millers Road, between Gatton Esk Road and the prison precinct, to cater for approximately 3,500 vehicles per day is provided in **Appendix D**. Millers Road is recommended to be constructed with a minimum of 8.4m pavement width, including sealed 1.0m wide shoulders within the existing 20m road reserve. We note that this would be subject to detailed design and field survey to ascertain the extent of any batters and table drains required. It is understood that the Millers Road corridor would need to also cater for services to/from the Prison and it is reasonable to expect that these could be provided within the proposed corridor which would include 5.8m verge widths on each side of the road.

As noted that form of Millers Road is subject to preliminary and detailed design and the cross-sections as shown is conceptual only. The intersection of Gatton Esk Road / Millers Road is also subject to preliminary and detailed design and the configuration shown is a concept only at this stage.

A desk top review and site observations of Gatton Esk Road, between the Warrego Highway and Millers Road, highlighted three existing floodways. Discussions with Main Roads Officers suggest that these floodways are below the 1 in 100 year flood level. A field review of Gatton Esk Road, north of Millers Road, found that the route between Millers Road and the Brisbane Valley Highway has no signed floodways. At the time of writing this report, no contour plans of Gatton Esk Road were available for assessment. As such, and as confirmed by the DMR officers, it would not be reasonable for these floodways to be upgraded as a consequence of the development.

As detailed in **Section 4.4** the traffic generated by the proposed prison precinct is forecast to be a considerable increase to the traffic movements on Gatton Esk Road. Main Roads Officers have indicated that they could require some works to formalise the shoulder treatments on Gatton Esk Road between the Warrego Highway and Millers Road.

5.2 ORDER OF MAGNITUDE COST ESTIMATES

A broad opinion of possible cost estimate of the proposed upgrade works at the Gatton Esk Road / Millers Road intersection and the construction of Millers Road is provided within **Appendix E**. The upgrade of the Gatton Esk Road intersection with Millers Road, to include a channelised right turn lane, a left turn deceleration lane, and lighting to be of the order of approximately $650,000. This does not include culverts, drainage, kerb and channel or relocation of services.

The construction of Millers Road, between Gatton Esk Road and the site entrance, is forecast to cost, as a worst case, in the order of $100 per square meter of pavement. Assuming that Millers Road is approximately 2km in length between Gatton Esk Road and the site entrance, and adopting a pavement width of 8.4m, the construction of Millers Road is estimated to be in the order of $1.7M.

The broad opinion of possible cost estimates are indicative only, and should be reviewed at the detail design stage of the project, once a detailed survey of the area has been undertaken to confirm existing services, property boundaries and geographical features. Please note that this advice is preliminary in nature, and does not include a detailed traffic impact assessment, geotechnical investigations, detailed survey, environmental studies, hydraulic analysis or community consultation.

6.0 CONCLUSIONS AND RECOMMENDATIONS

This traffic assessment report has been prepared for Project Services (Queensland Government) as part of the master planning for the proposed prison precinct located approximately 12km north of Gatton. The site is planned to be constructed over two stages, with the first catering for 1,300 beds, and the ultimate development providing 3,000 beds. This report has assessed the external works required to mitigate the potential impacts of the construction staff, prison staff and visitor trips to and from the site.

The key conclusions drawn from this traffic impact assessment include the following –

- The existing traffic volume on Gatton Esk Road were surveyed by Main roads to have an AADT in 2006 of 1,418 vehicles per day and is currently a 100km/hr roadway;
- Gatton Esk Road, designated as a B-double route, was surveyed in 2006 to experience approximately 14% heavy vehicles;
- The proposed Gatton prison precinct is forecast to generate approximately 550 trips per day during the construction phase, 1,300trips to and from the site each day when stage one is open and construction is occurring for the ultimate development, and approximately 1,628 two-way prison staff and visitor trips per day when the prison precinct is complete;
- The Gatton Esk Road priority intersection with Millers Road is forecast by the Sidra analysis to operate with acceptable delays, level of service and degree of saturation for the 2008, 2010 and 2016 'without development' scenarios;
- The Sidra 3.1 intersection analysis for the 2008 AM and PM peak periods forecasts the Gatton Esk Road / Millers Road priority intersection to continue to operate with significant spare capacity with the addition of the construction staff traffic movements to and from the site and under all of the "design scenarios';
- Given the rural nature of the location a detailed assessment of the "rural turn lane" warrants has been undertaken. This clearly demonstrates that a fully chanelised intersection is required fort he intersection of Gatton Esk Road / Millers Road;

- The development generated traffic volumes for the ultimate scenario are forecast to be greater than 5% of the existing traffic movements on Gatton Esk Road and could trigger the need to upgrade this Gatton Esk Road between Millers Road and the Warrego Highway;
- From our discussions, the three existing floodways on Gatton Esk Road, south of Millers Road, are not anticipated to be required by Main Roads to be upgraded as part of the prison precinct development, as there is an alternative route to the north of Millers Road;
- An indicative order of magnitude cost estimate of the proposed channelised right turn and auxiliary left turn upgrades to the Gatton Esk Road / Millers Road intersection is approximately $650,000.00;
- A broad opinion of possible cost for the construction of Millers Road between Gatton Esk Road and the site entrance could be in the order of $1.7M; and
- No traffic and transport engineering matters have been identified that would preclude approval of the Gatton prison precinct at the proposed location.

The following key recommendations are made in relation to the master planning and future works:

- Detailed survey and design of the Gatton Esk Road / Millers Road priority intersection and the full length of Millers Road is recommended to be undertaken;
- Further hydraulic assessment of the route to / from the site via the northern approach on Gatton Esk Road is recommended before the detail design of the Gatton Esk Road / Millers Road priority intersection is undertaken;
- Continue liaison with Main Roads Officers to confirm the requirement to undertake shoulder works to Gatton Esk Road between the Warrego Highway and Millers Road; and
- Project Services could consider initiating discussions with TransLink, or a private transportation company, about the possibility of providing bus links between Gatton or Ipswich and the subject prison precinct for prison staff.

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APPENDIX A

PRISON PRECINCT SITE LOCATION

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APPENDIX B

TRAFFIC VOLUMES

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APPENDIX C

INTERSECTION ANALYSIS RESULTS

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APPENDIX D

CONCEPT DESIGNS

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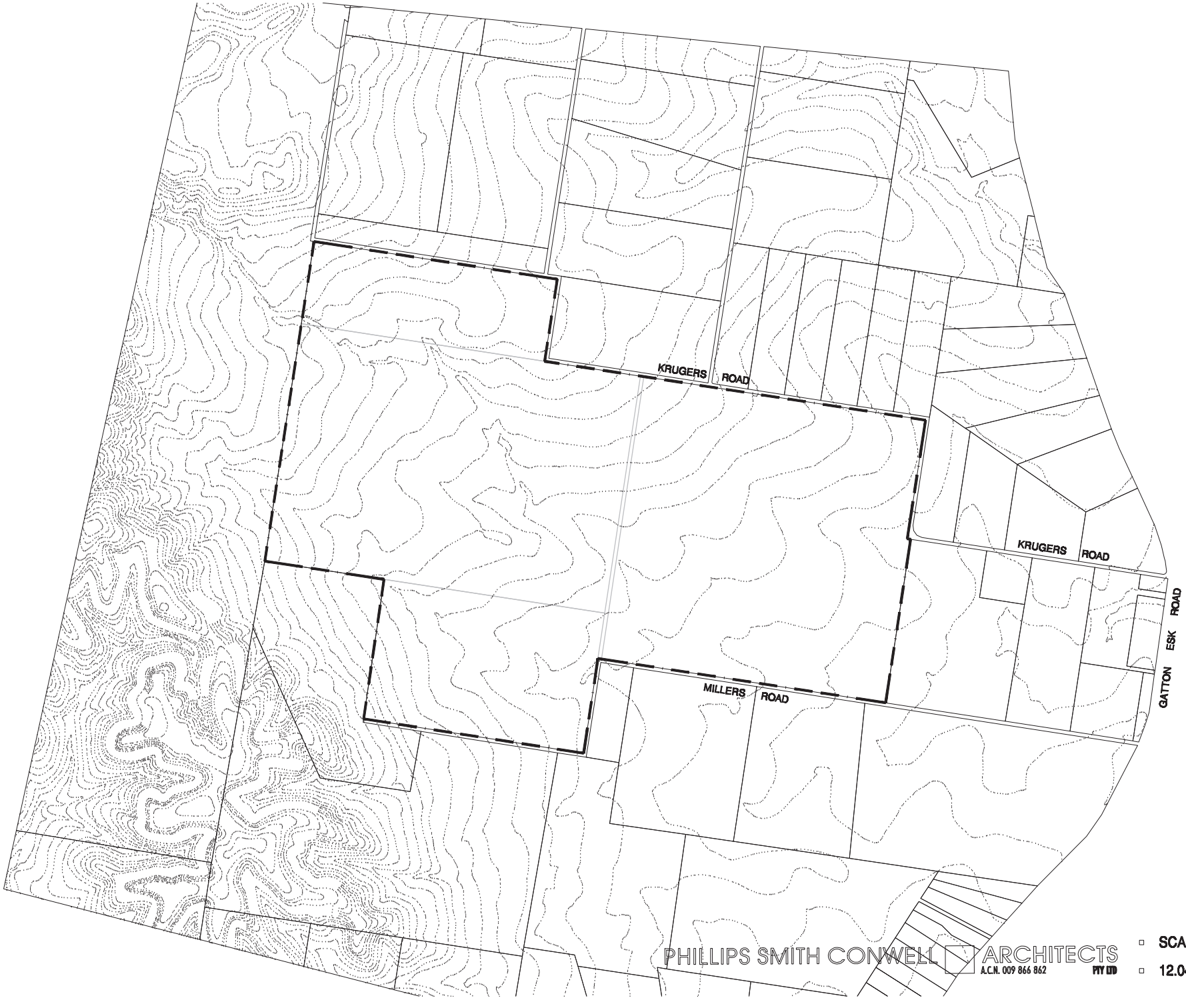
APPENDIX E

OPINION OF POSSIBLE COST



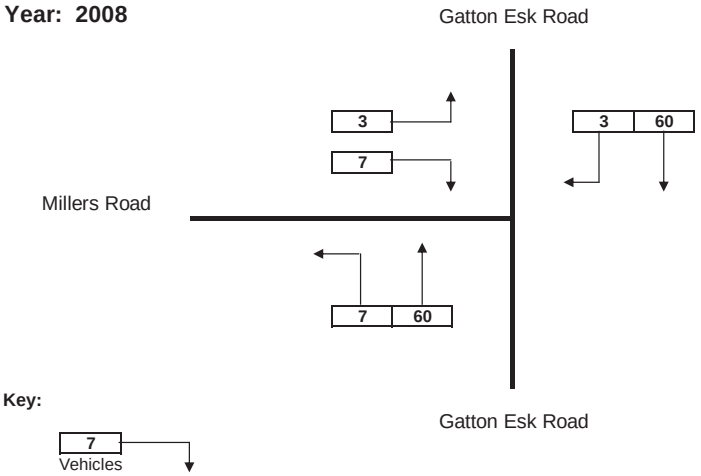
PHILLIPS SMITH CONWELL ARCHITECTS
A.C.N. 009 866 862 PTY LTD

SCALE 1:20000

12.04.07

AM Peak

Year: 2008

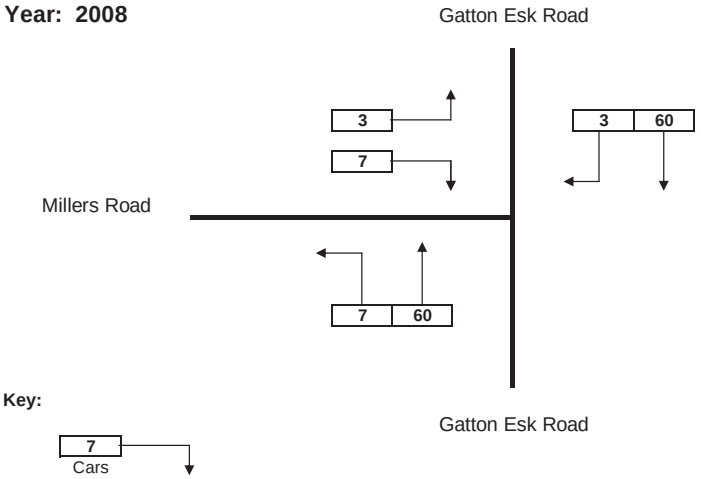


Key:

7
Vehicles

PM Peak

Year: 2008



Key:

7
Cars

2008 Forecast Volumes - Without Development
Gatton Esk Road / Millers Road
Figure B1

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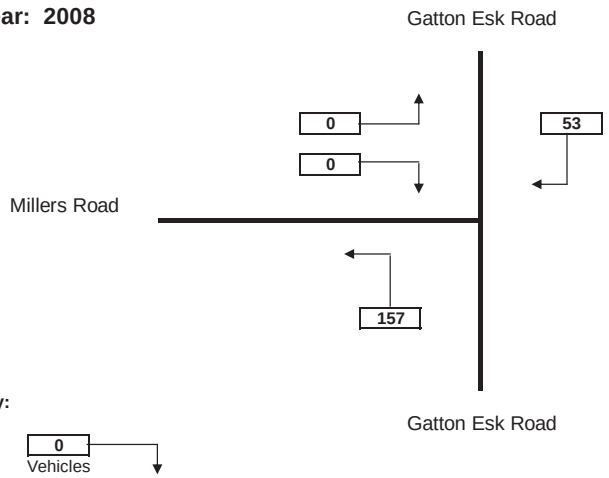
Project Name: Gatton Prison Precinct
Project Number: B07158

AM Peak

Year: 2008



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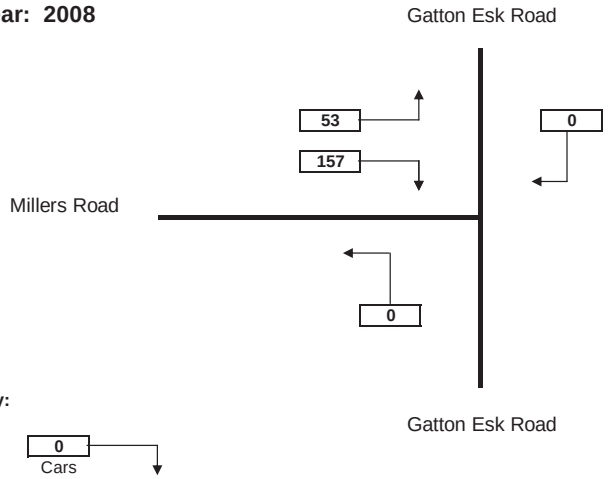
Vehicles

PM Peak

Year: 2008



Key:

0
Cars

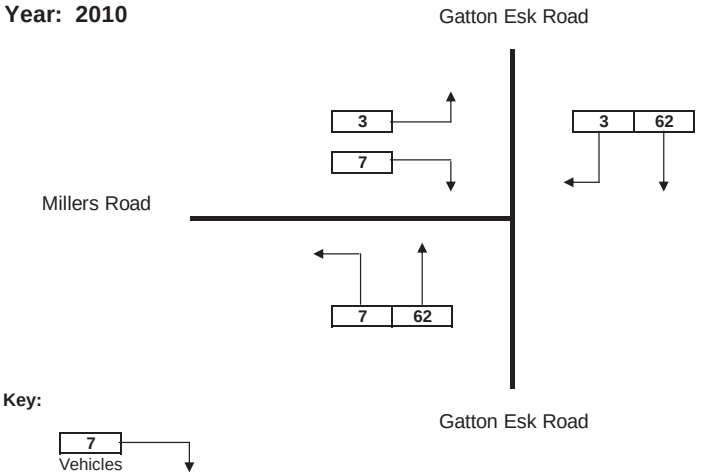
2008 Development Construction Traffic
Gatton Esk Road / Millers Road
Figure B2

LAMBERT & REHBEIN
ENGINEERS • MANAGERS • SCIENTISTS

Project Name: Gatton Prison Precinct
Project Number: B07158

AM Peak

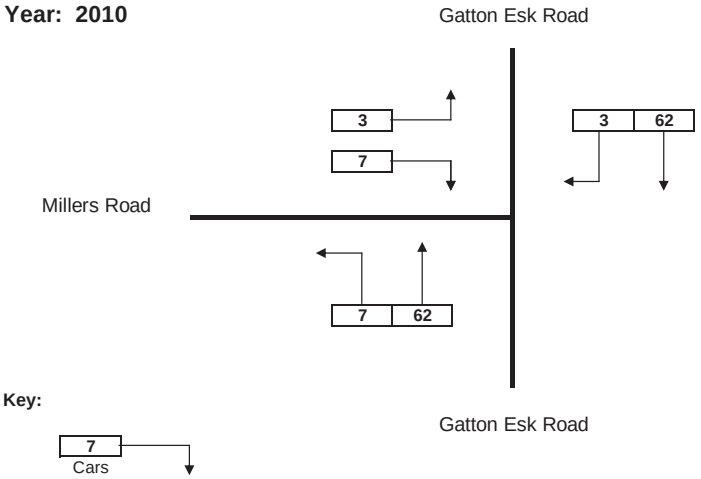
Year: 2010



Key:

PM Peak

Year: 2010



Key:

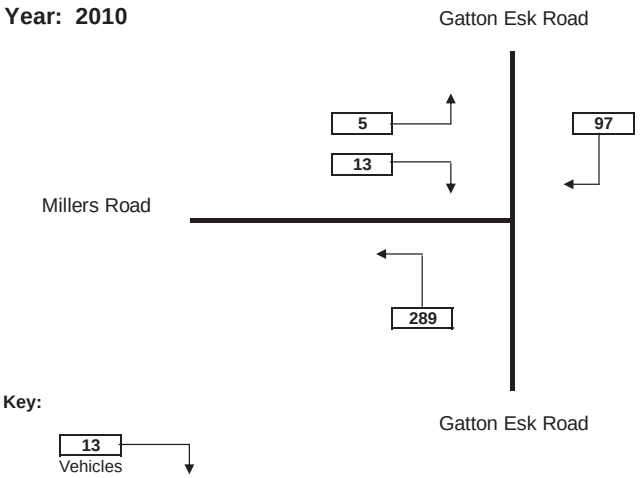
2010 Forecast Volumes - Without Development
Gatton Esk Road / Millers Road
Figure B3

LAMBERT & REHBEIN
ENGINEERS • MANAGERS • SCIENTISTS

Project Name: Gatton Pison Precinct
Project Number: B07158

AM Peak

Year: 2010

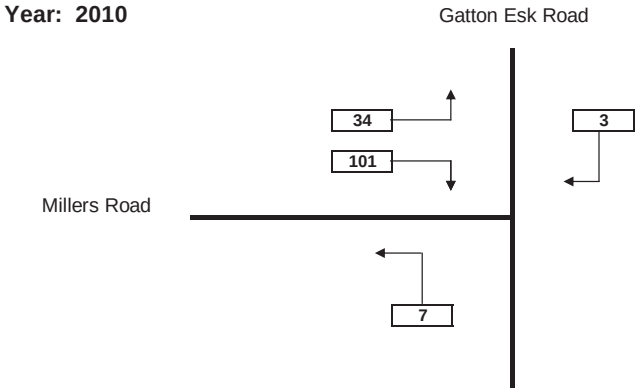


Key:

13
Vehicles

PM Peak

Year: 2010



Key:

13
Cars

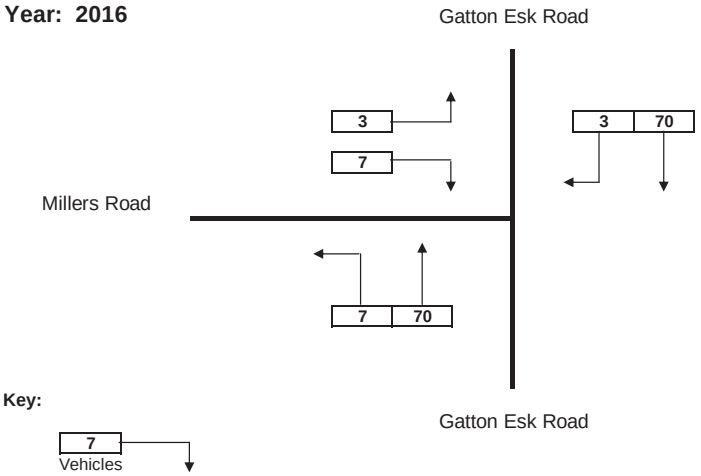
Stage 1 Prison Precinct
Gatton Esk Road / Millers Road
Figure B4

LAMBERT & REHBEIN
ENGINEERS • MANAGERS • SCIENTISTS

Project Name: Gatton Prison Precinct
Project Number: B07158

AM Peak

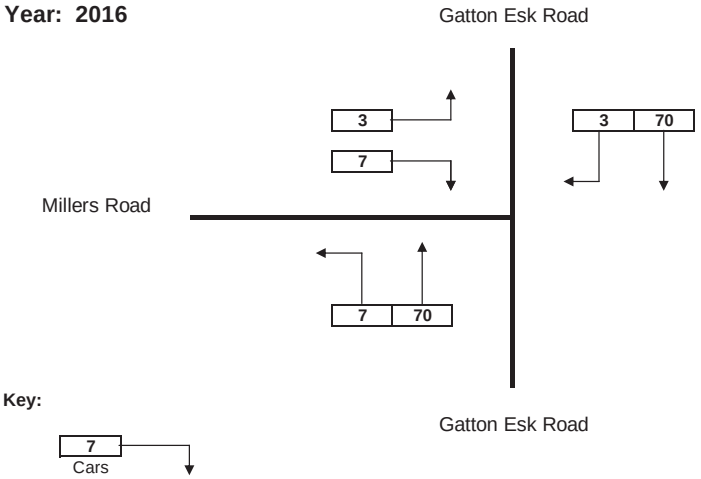
Year: 2016



Key:

PM Peak

Year: 2016



Key:

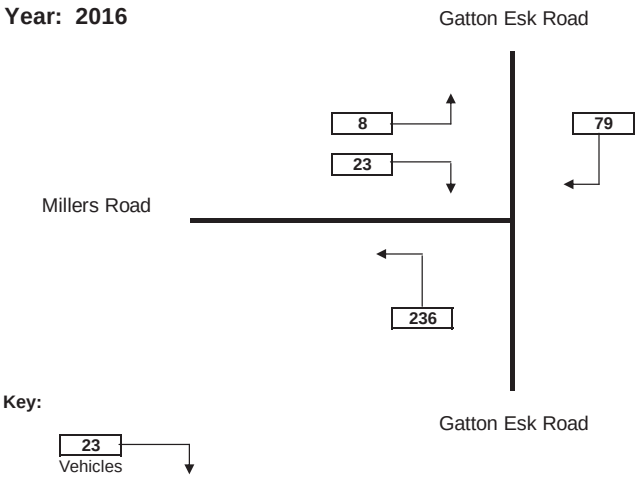
2016 Forecast Volumes - Without Development
Gatton Esk Road / Millers Road
Figure B5

LAMBERT & REHBEIN
ENGINEERS • MANAGERS • SCIENTISTS

Project Name: Gatton Pison Precinct
Project Number: B07158

AM Peak

Year: 2016

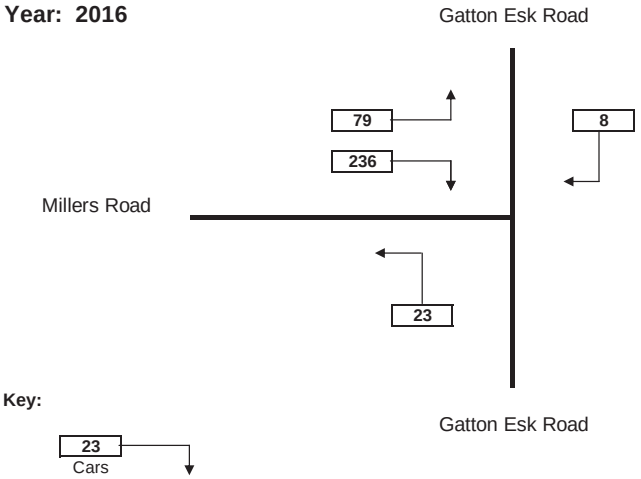


Key:

23
Vehicles

PM Peak

Year: 2016



Key:

23
Cars

Unltimate Prison Precinct
Gatton Esk Road / Millers Road
Figure B6

LAMBERT & REHBEIN
ENGINEERS • MANAGERS • SCIENTISTS

Project Name: Gatton Prison Precinct
Project Number: B07158

SIDRA INTERSECTION

Movement Summary

B07158 - Gatton Prison Precinct - Gatton Esk Rd / Millers Road

2008 AM Peak - with the development

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Gatton Esk Road (E)										
1	L	164	0.0	0.122	12.5	LOS B	0	0.00	0.75	63.3
2	T	60	13.3	0.122	0.0	LOS A	0	0.00	0.00	100.0
Approach		**224**	**3.6**	**0.122**	**9.2**	**LOS A**		**0.00**	**0.55**	**71.9**
Gatton Esk Road (W)										
8	T	60	13.3	0.082	1.0	LOS A	4	0.33	0.00	88.7
9	R	56	0.0	0.082	13.5	LOS B	4	0.33	0.72	61.1
Approach		**116**	**6.9**	**0.082**	**7.0**	**LOS A**	**4**	**0.33**	**0.35**	**74.8**
Millers Road										
10	L	3	0.0	0.011	10.0	LOS A	0	0.30	0.61	54.1
12	R	7	0.0	0.011	9.9	LOS A	0	0.30	0.66	54.3
Approach		**10**	**0.0**	**0.011**	**9.9**	**LOS A**	**0**	**0.30**	**0.65**	**54.3**
All Vehicles		**350**	**4.6**	**0.122**	**8.5**	**Not Applicable**	**4**	**0.12**	**0.49**	**72.1**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: 2008 - AM Peak - WITH DEVELOPMENT
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Processed Jun 06, 2007 05:21:50PM

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Produced by SIDRA Intersection 3.1.061208.34

SIDRA INTERSECTION

Movement Summary

B07158 - Gatton Prison Precinct - Gatton Esk Rd / Millers Road

2008 PM Peak - with the development

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Gatton Esk Road (E)										
1	L	7	0.0	0.037	12.5	LOS B	0	0.00	0.75	63.3
2	T	60	13.3	0.037	0.0	LOS A	0	0.00	0.00	100.0
Approach		**67**	**11.9**	**0.037**	**1.3**	**LOS A**		**0.00**	**0.08**	**95.5**
Gatton Esk Road (W)										
8	T	60	13.3	0.036	0.3	LOS A	2	0.18	0.00	93.6
9	R	3	0.0	0.036	12.8	LOS B	2	0.18	0.70	62.1
Approach		**63**	**12.7**	**0.036**	**0.9**	**LOS A**	**2**	**0.18**	**0.03**	**91.9**
Millers Road										
10	L	56	0.0	0.207	9.6	LOS A	8	0.24	0.63	54.3
12	R	164	0.0	0.207	9.5	LOS A	8	0.24	0.68	54.6
Approach		**220**	**0.0**	**0.207**	**9.5**	**LOS A**	**8**	**0.24**	**0.67**	**54.5**
All Vehicles		**350**	**4.6**	**0.207**	**6.4**	**Not Applicable**	**8**	**0.18**	**0.44**	**64.6**

Symbols which may appear in this table:

Following Degree of Saturation
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Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: 2008 - PM Peak - WITH DEVELOPMENT
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SIDRA INTERSECTION

Movement Summary

B07158 - Gatton Prison Precinct - Gatton Esk Rd / Millers Road

2010 AM Peak - with the development

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Gatton Esk Road (E)										
1	L	296	0.0	0.194	12.5	LOS B	0	0.00	0.75	63.3
2	T	62	14.5	0.194	0.0	LOS A	0	0.00	0.00	100.0
Approach		**358**	**2.5**	**0.194**	**10.4**	**LOS B**		**0.00**	**0.62**	**68.8**
Gatton Esk Road (W)										
8	T	62	14.5	0.136	1.8	LOS A	6	0.44	0.00	85.6
9	R	100	0.0	0.136	14.4	LOS B	6	0.44	0.78	60.0
Approach		**162**	**5.6**	**0.136**	**9.6**	**LOS A**	**6**	**0.44**	**0.48**	**69.4**
Millers Road										
10	L	8	0.0	0.033	10.6	LOS B	1	0.38	0.65	53.6
12	R	20	0.0	0.033	10.5	LOS B	1	0.38	0.71	53.7
Approach		**28**	**0.0**	**0.033**	**10.5**	**LOS B**	**1**	**0.38**	**0.69**	**53.7**
All Vehicles		**548**	**3.3**	**0.194**	**10.1**	**Not Applicable**	**6**	**0.15**	**0.59**	**67.8**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: 2010 - AM Peak - WITH DEVELOPMENT
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A0359, Unregistered, Medium Office
Produced by SIDRA Intersection 3.1.061208.34

SIDRA INTERSECTION

Movement Summary

B07158 - Gatton Prison Precinct - Gatton Esk Rd / Millers Road

2010 PM Peak - with the development

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Gatton Esk Road (E)										
1	L	14	0.0	0.042	12.5	LOS B	0	0.00	0.75	63.3
2	T	62	14.5	0.042	0.0	LOS A	0	0.00	0.00	100.0
Approach		**76**	**11.8**	**0.042**	**2.3**	**LOS A**		**0.00**	**0.14**	**92.2**
Gatton Esk Road (W)										
8	T	62	14.5	0.039	0.3	LOS A	2	0.19	0.00	93.2
9	R	6	0.0	0.039	12.9	LOS B	2	0.19	0.70	62.0
Approach		**68**	**13.2**	**0.039**	**1.4**	**LOS A**	**2**	**0.19**	**0.06**	**90.1**
Millers Road										
10	L	37	0.0	0.138	9.6	LOS A	5	0.24	0.63	54.3
12	R	108	0.0	0.138	9.5	LOS A	5	0.24	0.68	54.6
Approach		**145**	**0.0**	**0.138**	**9.5**	**LOS A**	**5**	**0.24**	**0.67**	**54.5**
All Vehicles		**289**	**6.2**	**0.138**	**5.7**	**Not Applicable**	**5**	**0.16**	**0.39**	**68.1**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: 2010 - PM Peak - WITH DEVELOPMENT
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Processed Jun 06, 2007 05:21:52PM

A0359, Unregistered, Medium Office
Produced by SIDRA Intersection 3.1.061208.34

SIDRA INTERSECTION

Movement Summary

B07158 - Gatton Prison Precinct - Gatton Esk Rd / Millers Road

2016 AM Peak - with the development

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Gatton Esk Road (E)										
1	L	243	0.0	0.170	12.5	LOS B	0	0.00	0.75	63.3
2	T	70	14.3	0.170	0.0	LOS A	0	0.00	0.00	100.0
Approach		**313**	**3.2**	**0.170**	**9.7**	**LOS A**		**0.00**	**0.59**	**70.4**
Gatton Esk Road (W)										
8	T	70	14.3	0.118	1.5	LOS A	6	0.41	0.00	86.5
9	R	82	0.0	0.118	14.1	LOS B	6	0.41	0.76	60.6
Approach		**152**	**6.6**	**0.118**	**8.3**	**LOS A**	**6**	**0.41**	**0.41**	**72.1**
Millers Road										
10	L	11	0.0	0.047	10.5	LOS B	2	0.37	0.65	53.7
12	R	30	0.0	0.047	10.4	LOS B	2	0.37	0.71	53.8
Approach		**41**	**0.0**	**0.047**	**10.4**	**LOS B**	**2**	**0.37**	**0.70**	**53.8**
All Vehicles		**506**	**4.0**	**0.170**	**9.4**	**Not Applicable**	**6**	**0.15**	**0.54**	**68.9**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: 2016 - AM Peak - WITH DEVELOPMENT
C:\Documents and Settings\aliciah\Desktop\Gatton Prison\SIDRA\Version 2 - 06-06-07\Gatton Esk Road Millers Road Existing Layout_With Development 06-06-07.aap
Processed Jun 06, 2007 05:21:53PM

A0359, Unregistered, Medium Office
Produced by SIDRA Intersection 3.1.061208.34

SIDRA INTERSECTION

Movement Summary

B07158 - Gatton Prison Precinct - Gatton Esk Rd / Millers Road

2016 PM Peak - with the development

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Gatton Esk Road (S)										
1	L	30	0.0	0.055	12.5	LOS B	0	0.00	0.75	63.3
2	T	70	14.3	0.055	0.0	LOS A	0	0.00	0.00	100.0
Approach		**100**	**10.0**	**0.055**	**3.8**	**LOS A**		**0.00**	**0.23**	**87.6**
Gatton Esk Road (N)										
8	T	70	14.3	0.048	0.4	LOS A	2	0.22	0.00	92.2
9	R	11	0.0	0.048	13.0	LOS B	2	0.22	0.70	61.8
Approach		**81**	**12.3**	**0.048**	**2.1**	**LOS A**	**2**	**0.22**	**0.10**	**87.6**
Millers Road (W)										
10	L	82	0.0	0.318	9.9	LOS A	13	0.31	0.64	54.0
12	R	243	0.0	0.318	9.8	LOS A	13	0.31	0.70	54.3
Approach		**325**	**0.0**	**0.318**	**9.9**	**LOS A**	**13**	**0.31**	**0.68**	**54.2**
All Vehicles		**506**	**4.0**	**0.318**	**7.4**	**Not Applicable**	**13**	**0.24**	**0.50**	**62.6**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: 2016 - PM Peak - WITH DEVELOPMENT
C:\Documents and Settings\aliciah\Desktop\Gatton Prison\SIDRA\Version 2 - 06-06-07\Gatton Esk Road Millers Road Existing Layout_With Development 06-06-07.aap
Processed Jun 06, 2007 05:21:54PM

A0359, Unregistered, Medium Office
Produced by SIDRA Intersection 3.1.061208.34

SIDRA INTERSECTION

Movement Summary

B07158 - Gatton Prison Precinct - Gatton Esk Rd / Millers Road

2008 AM Peak - without the development

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Gatton Esk Road (E)										
1	L	7	0.0	0.037	12.5	LOS B	0	0.00	0.75	63.3
2	T	60	13.3	0.037	0.0	LOS A	0	0.00	0.00	100.0
Approach		**67**	**11.9**	**0.037**	**1.3**	**LOS A**		**0.00**	**0.08**	**95.5**
Gatton Esk Road (W)										
8	T	60	13.3	0.036	0.3	LOS A	2	0.18	0.00	93.6
9	R	3	0.0	0.036	12.8	LOS B	2	0.18	0.70	62.1
Approach		**63**	**12.7**	**0.036**	**0.9**	**LOS A**	**2**	**0.18**	**0.03**	**91.9**
Millers Road										
10	L	3	0.0	0.009	9.4	LOS A	0	0.20	0.62	54.5
12	R	7	0.0	0.009	9.3	LOS A	0	0.20	0.65	54.7
Approach		**10**	**0.0**	**0.009**	**9.3**	**LOS A**	**0**	**0.20**	**0.64**	**54.7**
All Vehicles		**140**	**11.4**	**0.037**	**1.7**	**Not Applicable**	**2**	**0.09**	**0.10**	**89.2**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: 2008 - AM Peak - WITHOUT DEVELOPMENT
F:\Jobs\B07100\B07158\SIDRA\Version 2 - 06-06-07\Gatton Esk Road Millers Road Existing Layout_No Development - 06-06-07.aap
Processed May 04, 2007 12:18:39PM

A0359, Unregistered, Medium Office
Produced by SIDRA Intersection 3.1.061208.34

SIDRA INTERSECTION

Movement Summary

B07158 - Gatton Prison Precinct - Gatton Esk Rd / Millers Road

2008 PM Peak - without the development

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Gatton Esk Road (E)										
1	L	7	0.0	0.037	12.5	LOS B	0	0.00	0.75	63.3
2	T	60	13.3	0.037	0.0	LOS A	0	0.00	0.00	100.0
Approach		**67**	**11.9**	**0.037**	**1.3**	**LOS A**		**0.00**	**0.08**	**95.5**
Gatton Esk Road (W)										
8	T	60	13.3	0.036	0.3	LOS A	2	0.18	0.00	93.6
9	R	3	0.0	0.036	12.8	LOS B	2	0.18	0.70	62.1
Approach		**63**	**12.7**	**0.036**	**0.9**	**LOS A**	**2**	**0.18**	**0.03**	**91.9**
Millers Road										
10	L	3	0.0	0.009	9.4	LOS A	0	0.20	0.62	54.5
12	R	7	0.0	0.009	9.3	LOS A	0	0.20	0.65	54.7
Approach		**10**	**0.0**	**0.009**	**9.3**	**LOS A**	**0**	**0.20**	**0.64**	**54.7**
All Vehicles		**140**	**11.4**	**0.037**	**1.7**	**Not Applicable**	**2**	**0.09**	**0.10**	**89.2**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: 2008 - PM Peak - WITHOUT DEVELOPMENT
F:\Jobs\B07100\B07158\SIDRA\Version 2 - 06-06-07\Gatton Esk Road Millers Road Existing Layout_No Development - 06-06-07.aap
Processed May 04, 2007 12:18:39PM

A0359, Unregistered, Medium Office
Produced by SIDRA Intersection 3.1.061208.34

SIDRA INTERSECTION

Movement Summary

B07158 - Gatton Prison Precinct - Gatton Esk Rd / Millers Road

2010 AM Peak - without the development

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Gatton Esk Road (E)										
1	L	7	0.0	0.038	12.5	LOS B	0	0.00	0.75	63.3
2	T	62	14.5	0.039	0.0	LOS A	0	0.00	0.00	100.0
Approach		**69**	**13.0**	**0.039**	**1.3**	**LOS A**		**0.00**	**0.08**	**95.6**
Gatton Esk Road (W)										
8	T	62	14.5	0.037	0.3	LOS A	2	0.18	0.00	93.5
9	R	3	0.0	0.037	12.9	LOS B	2	0.18	0.70	62.1
Approach		**65**	**13.8**	**0.037**	**0.8**	**LOS A**	**2**	**0.18**	**0.03**	**91.8**
Millers Road										
10	L	3	0.0	0.009	9.4	LOS A	0	0.20	0.62	54.5
12	R	7	0.0	0.009	9.3	LOS A	0	0.20	0.65	54.7
Approach		**10**	**0.0**	**0.009**	**9.4**	**LOS A**	**0**	**0.20**	**0.64**	**54.6**
All Vehicles		**144**	**12.5**	**0.039**	**1.6**	**Not Applicable**	**2**	**0.10**	**0.10**	**89.3**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
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- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: 2010 - AM Peak - WITHOUT DEVELOPMENT
F:\Jobs\B07100\B07158\SIDRA\Version 2 - 06-06-07\Gatton Esk Road Millers Road Existing Layout_No Development - 06-06-07.aap
Processed May 04, 2007 12:18:40PM

A0359, Unregistered, Medium Office
Produced by SIDRA Intersection 3.1.061208.34

SIDRA INTERSECTION

Movement Summary

B07158 - Gatton Prison Precinct - Gatton Esk Rd / Millers Road

2010 PM Peak - without the development

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Gatton Esk Road (E)										
1	L	7	0.0	0.038	12.5	LOS B	0	0.00	0.75	63.3
2	T	62	14.5	0.039	0.0	LOS A	0	0.00	0.00	100.0
Approach		**69**	**13.0**	**0.039**	**1.3**	**LOS A**		**0.00**	**0.08**	**95.6**
Gatton Esk Road (W)										
8	T	62	14.5	0.037	0.3	LOS A	2	0.18	0.00	93.5
9	R	3	0.0	0.037	12.9	LOS B	2	0.18	0.70	62.1
Approach		**65**	**13.8**	**0.037**	**0.8**	**LOS A**	**2**	**0.18**	**0.03**	**91.8**
Millers Road										
10	L	3	0.0	0.009	9.4	LOS A	0	0.20	0.62	54.5
12	R	7	0.0	0.009	9.3	LOS A	0	0.20	0.65	54.7
Approach		**10**	**0.0**	**0.009**	**9.4**	**LOS A**	**0**	**0.20**	**0.64**	**54.6**
All Vehicles		**144**	**12.5**	**0.039**	**1.6**	**Not Applicable**	**2**	**0.10**	**0.10**	**89.3**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
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SIDRA SOLUTIONS

Site: 2010 - PM Peak - WITHOUT DEVELOPMENT
F:\Jobs\B07100\B07158\SIDRA\Version 2 - 06-06-07\Gatton Esk Road Millers Road Existing Layout_No Development - 06-06-07.aap
Processed May 04, 2007 12:18:42PM

A0359, Unregistered, Medium Office
Produced by SIDRA Intersection 3.1.061208.34

SIDRA INTERSECTION

Movement Summary

B07158 - Gatton Prison Precinct - Gatton Esk Rd / Millers Road

2016 AM Peak - without the development

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Gatton Esk Road (E)										
1	L	7	0.0	0.043	12.5	LOS B	0	0.00	0.75	63.3
2	T	70	14.3	0.043	0.0	LOS A	0	0.00	0.00	100.0
Approach		**77**	**13.0**	**0.043**	**1.1**	**LOS A**		**0.00**	**0.07**	**96.1**
Gatton Esk Road (W)										
8	T	70	14.3	0.041	0.3	LOS A	2	0.20	0.00	93.0
9	R	3	0.0	0.042	12.9	LOS B	2	0.20	0.70	62.0
Approach		**73**	**13.7**	**0.041**	**0.8**	**LOS A**	**2**	**0.20**	**0.03**	**91.6**
Millers Road										
10	L	3	0.0	0.010	9.5	LOS A	0	0.22	0.61	54.4
12	R	7	0.0	0.010	9.4	LOS A	0	0.22	0.66	54.7
Approach		**10**	**0.0**	**0.010**	**9.4**	**LOS A**	**0**	**0.22**	**0.64**	**54.6**
All Vehicles		**160**	**12.5**	**0.043**	**1.5**	**Not Applicable**	**2**	**0.10**	**0.09**	**89.8**

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x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
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SIDRA SOLUTIONS

Site: 2016 - AM Peak - WITHOUT DEVELOPMENT
F:\Jobs\B07100\B07158\SIDRA\Version 2 - 06-06-07\Gatton Esk Road Millers Road Existing Layout_No Development - 06-06-07.aap
Processed May 04, 2007 12:18:43PM

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Produced by SIDRA Intersection 3.1.061208.34

SIDRA INTERSECTION

Movement Summary

B07158 - Gatton Prison Precinct - Gatton Esk Rd / Millers Road

2016 PM Peak - without the development

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Gatton Esk Road (E)										
1	L	7	0.0	0.043	12.5	LOS B	0	0.00	0.75	63.3
2	T	70	14.3	0.043	0.0	LOS A	0	0.00	0.00	100.0
Approach		**77**	**13.0**	**0.043**	**1.1**	**LOS A**		**0.00**	**0.07**	**96.1**
Gatton Esk Road (W)										
8	T	70	14.3	0.041	0.3	LOS A	2	0.20	0.00	93.0
9	R	3	0.0	0.042	12.9	LOS B	2	0.20	0.70	62.0
Approach		**73**	**13.7**	**0.041**	**0.8**	**LOS A**	**2**	**0.20**	**0.03**	**91.6**
Millers Road										
10	L	3	0.0	0.010	9.5	LOS A	0	0.22	0.61	54.4
12	R	7	0.0	0.010	9.4	LOS A	0	0.22	0.66	54.7
Approach		**10**	**0.0**	**0.010**	**9.4**	**LOS A**	**0**	**0.22**	**0.64**	**54.6**
All Vehicles		**160**	**12.5**	**0.043**	**1.5**	**Not Applicable**	**2**	**0.10**	**0.09**	**89.8**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
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SIDRA SOLUTIONS

Site: 2016 - PM Peak - WITHOUT DEVELOPMENT
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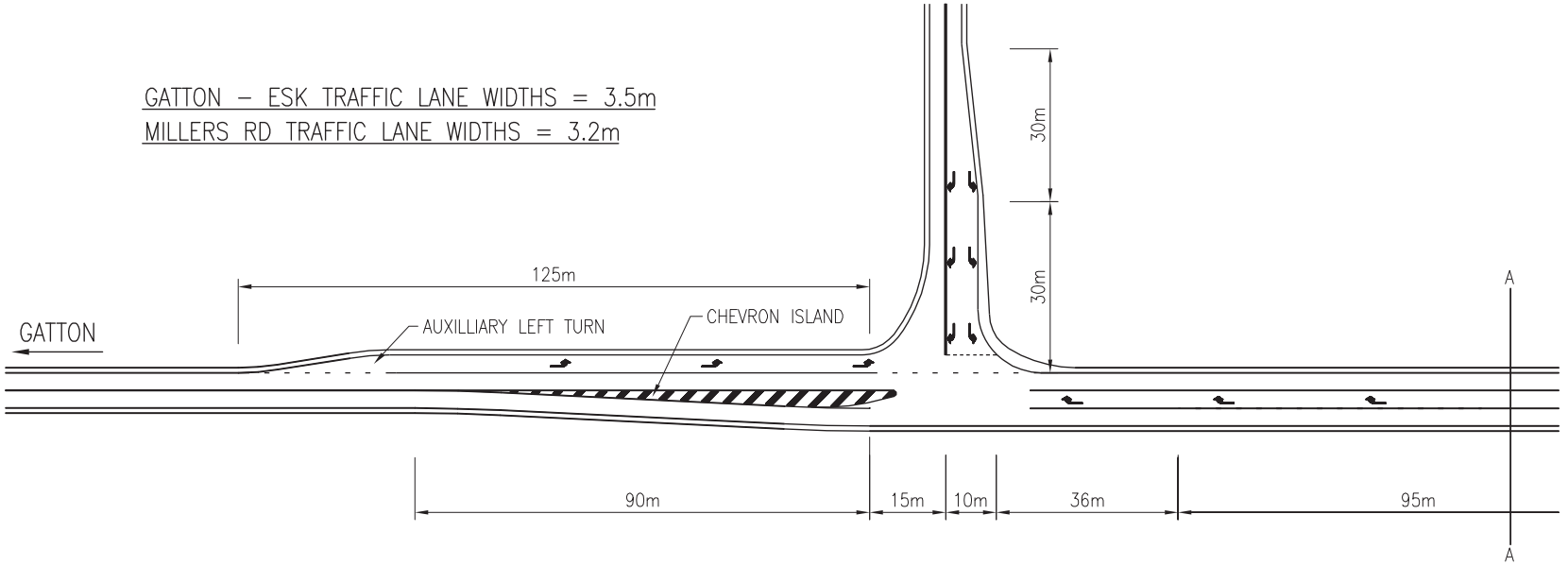
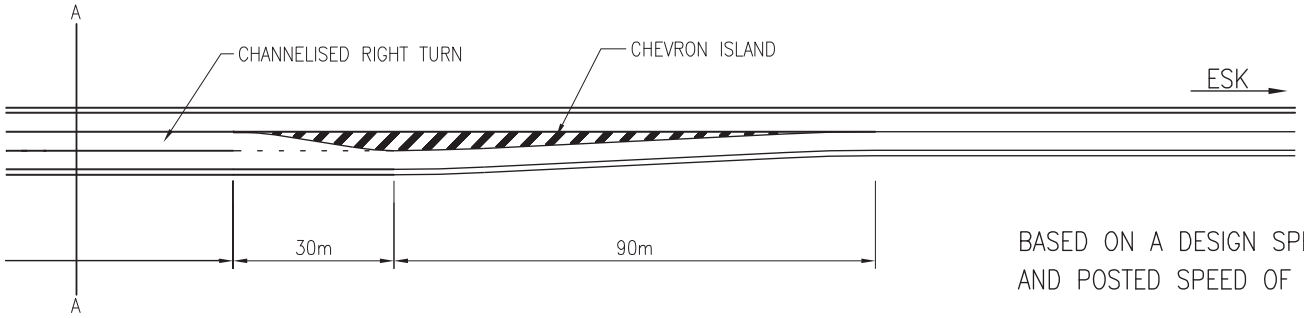
Processed May 04, 2007 12:18:44PM

A0359, Unregistered, Medium Office
Produced by SIDRA Intersection 3.1.061208.34

GATTON – ESK TRAFFIC LANE WIDTHS = 3.5m
MILLERS RD TRAFFIC LANE WIDTHS = 3.2m





BASED ON A DESIGN SPEED OF 90KM/HR
AND POSTED SPEED OF 80KM/HR

Project:

Client: *PROJECT SERVICES (QUEENSLAND GOVERNMENT)*

Title: GATTON–ESK ROAD / MILLERS ROAD PRIORITY INTERSECTION

LAMBERT & REHBEIN
ENGINEERS · MANAGERS · SCIENTISTS
CBD HOUSE
LEVEL 3, 120 WICKHAM STREET
FORTITUDE VALLEY QLD 4006
P.O. BOX 112 FORTITUDE VALLEY QLD 4006
TELEPHONE (07) 3250 9000
FACSIMILE (07) 3250 9001
EMAIL mail@lar.net.au
A.C.N. 010 451 902
The Association of Consulting Engineers Australia

Drawn: CD | Checked: AH | Approved: SW

Rev. A | Date 4/5/07

Figure No: FIGURE D4

Scale: 1:500 | Sheet Size: A1

File Ref: B07158_FIG_D2

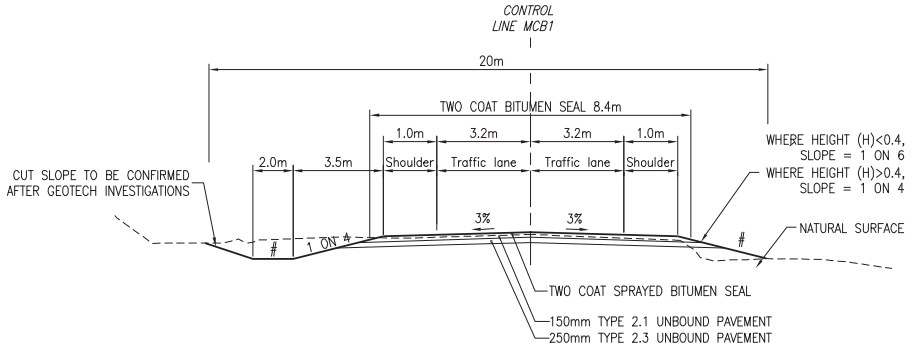
LEGEND

TURFING

* SCARIFY EXISTING PAVEMENT

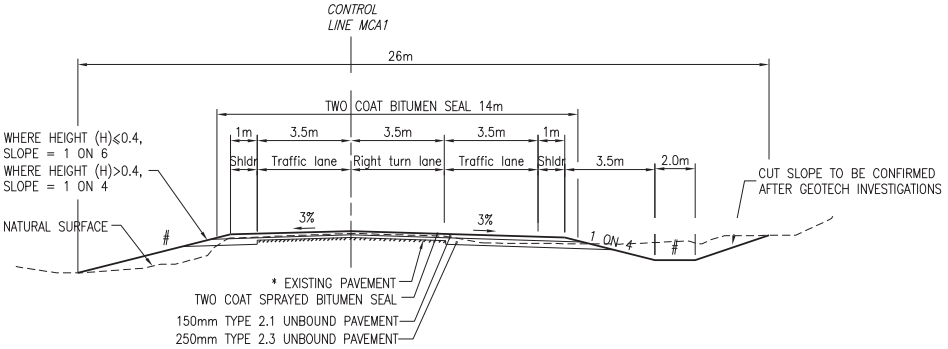
CONCEPT ONLY

NOTE:
CROSS SECTION BATTER SLOPES/WIDTHS
SUBJECT TO DETAILED SURVEY AND DESIGN



TYPICAL SECTION THROUGH MILLERS ROAD

NTS



TYPICAL SECTION THROUGH GATTON–ESK ROAD

NTS

	Project: MILLERS ROAD & GATTON–ESK ROAD TYPICAL SECTION PLAN	Client: *PROJECT SERVICES (QUEENSLAND GOVERNMENT)* Title: GATTON–ESK ROAD / MILLERS ROAD PRIORITY INTERSECTION	LAMBERT & REHBEIN ENGINEERS · MANAGERS · SCIENTISTS CBD HOUSE, LEVEL 3, 120 WICKHAM STREET, FORTITUDE VALLEY QLD 4006 P.O. BOX 112 FORTITUDE VALLEY QLD 4006 TELEPHONE (07) 3250 9000 FACSIMILE (07) 3250 9001 EMAIL mail@lar.net.au A.C.N. 010 451 902 The Association of Consulting Engineers Australia Drawn: CD · Checked: AH · Approved: SW	A 8/5/07 Rev. Date	Figure No: FIGURE D5 Scale: NTS File Ref: B07158_FIG_D3 A1 Sheet Size

LAMBERT & REHBEIN PTY LTD **PROJECT NO: B07158**

CONSULTING ENGINEERS

Client: Project Services (Qld Government)
Project: Intersection of Gatton-Esk Rd & Millers Rd
Prepared by: Clint Dykstra

ITEM NO.	DESCRIPTION	UNIT	RATE	QTY	AMOUNT
	Contractors Site Facilities & Camp MRS11.28				
1101.01	Contractor's Site Facilities	lump sum			$ 20,000
	Provision For Traffic MRS11.02				
1201.01	Provision For Traffic	lump sum			$ 10,000
1202.01	Traffic Management Plan	lump sum			$ 2,000
	Environmental Management MRS11.51				
1330.01	Environmental Inspections	lump sum			$ 1,000
1331.01	Develop Environmental Management Plan (Contruction)	lump sum			$ 500
1332.01	Implement Environmental Management Plan (Construction)	lump sum			$ 1,500
1351.01	Cultural Heritage Monitors	lump sum			$ 1,000
	Drainage, Retaining Structures & Protective Treatments MRS11.03				
2241.01	Supply & Installation of Concrete Pipe, Class 2, 450mm Dia	m	$236.30	24.4	$ 5,766
2317.01	Precast Concrete End Structures, 450mm	ea	$800.00	2	$ 1,600
2642.01	Grouted Rock Pitching	m^2	$125.00	8	$ 1,000
	General Earthworks MRS11.04				
3101.01	Clearing and Grubbing	m^2	$1.24	7950	$ 9,858
3103.01P	Stripping of Topsoil to Spoil (Provisional)	m^3	$17.82	250	$ 4,455
3103.02P	Stripping of Topsoil to Stockpile (Provisional)	m^3	$7.62	500	$ 3,810
3104.01	Ground Surface Treatment Under Embankment, Standard	m^2	$0.55	4000	$ 2,200
3108.01P	Excavation & Disposal of Unsuitable Material >10m3 (Provisional)	m^3	$23.78	500	$ 11,890
3201.01	Road Excavation, All Materials	m^3	$12.33	2000	$ 24,660
3301.01	Road Embankment	m^3	$21.39	1000	$ 21,390
3402.01P	Subgrade Treatment Type A In Cuttings & Embankments (Provisional)	m^2	$2.27	3000	$ 6,810
3501.01P	Backfill to Unsuitable Material Excavation (Provisional)	m^3	$30.39	500	$ 15,195
			Subtotal		**$ 124,634**
		BUDGET AMOUNT			***$ 125,000***
	Unbound Pavements MRS11.05				
4104.01	Subbase, Unbound Pavement, Type 2, Subtype 2.3	m^3	$85.00	1105	$ 93,925
4103.01	Base, Unbound Pavement, Type 2, Subtype 2.1	m^3	$95.00	930	$ 88,350
	Sprayed Bituminous Surfacing (Excluding Emulsion) MRS11.11				
5103.01	Seal, Class Polymer Modified (S2S), spray rate 1.8l/m2 Including Supply of Binder, Additives & 14mm Cover Aggregate	m2	$4.94	6192	$ 30,588
5104.01	Seal, Class Polymer Modified (S2S), spray rate 1.8l/m2 Including Supply of Binder, Additives & 14mm Cover Aggregate	m3	$4.94	6192	$ 30,588
	Non-Standard Items MRS99.99				
9000.01	Saw Cut Existing Pavement	m	$15.00	30	$ 450
9001.01	Profile Existing Pavement	m2	$11.39	180	$ 2,050
9003.01	Scarify Existing Biutmen Surfacing	m^3	$2.00	2967	$ 5,934
	Road Furniture MRS11.14				
6104.01	Removal & Re-erection of Road Furniture, as listed in Clause 4 of Annexure MRS11.14.1	lump sum			$ 2,000
6132.01	Installation of Regulatory, Warning & Hazard Signs	lump sum			$ 5,000
6134.01	Installation of Direction & Information Signs	lump sum			$ 2,000

Client: Project Services (Qld Government)
Project: Intersection of Gatton-Esk Rd & Millers Rd
Prepared by: Clint Dykstra

ITEM NO.	DESCRIPTION	UNIT	RATE	QTY	AMOUNT
	Landscape Works MRS11.16				
3841.01	Stripped Topsoil as Planting Media	m^3	$14.25	500	$ 7,125
3863.01	hydromulch	m^2	$4.44	4722	$ 20,966
	Pavement Marking MRS11.45				
6313.01	Linemarking (All Types)	m	$1.60	2000	$ 3,200
6332.01	Transverse Lines (Diagonal & Chevron Markings, Turn Arrows etc)	m2	$19.14	133	$ 2,546
6351.01	Retroreflective Raised Pavement Markers	ea	$10.52	143	$ 1,504
6111.01	Road Edge Guide Posts	ea	$45.00	55	$ 2,475
			Subtotal		**$ 298,702**
		BUDGET AMOUNT			***$ 299,000***
	Road Lighting MRS11.94				
6771.01	Supply & Installation of Slip Base Road Lighting Poles (2), 10m Vert Height, 3m Long Single Outreach Arm Extension with Loop in Loop out Cabling, Pits, Conduits, Cables & Point of Supply	lump sum			$ 20,000
	Surveying				
	Conduct detailed survey through area of proposed works	lump sum			$ 25,000
	Potholing				
	Locate existing services and locate electronically on survey	lump sum			$ 4,000
	Management of Utility Services & Ducts & Pits MRS11.91				
9002.01	Relocate 4 Energex Poles Clear of Works (Outside Clear Zone)	lump sum			$ 50,000
			Subtotal		**$ 99,000**
		BUDGET AMOUNT			***$ 99,000***
			Subtotal		***$ 523,000***
			Contingency - 20%		**104,600.0**

Total Budget Estimate **$ 627,600**

Earthworks

The opinion of costs allows for earthworks required for the construction of the intersection works to the finished design surface, or subgrade level in teh case of pavements

Note that the earthwork volumes are a conservative approximation only, as 3d modelling of the proposed intersection was not carried out at this stage. These figures should be reviewed during the detailed design phase of the project.

Roadworks

Based on the level of information provided, the opinion of costs allows for the majority of road works required to construct a Type 'CHR' intersection designed to DMR standards for an 80km/hr design speed, and intersecting road works includs: contractors site camp, environmental management, survey, traffic management, drainage, earthworks, pavement, bitumen surfacing , line marking and delineation, road signage, flag lighting and landscaping.

No allowance has been made in the opinion of costs for the access road to tie into the proposed internal road network as this information was not available at the time.

Stormwater and Flooding

No design has been conducted regarding stormwater runoff or quality treatment devices. The opinion of costs allows for a 450mm dia concrete pipe located under the existing access, and two new pre-cast headwalls for the pipe.

Sewerage and Water Reticulation

No allowance has been made in the opinion of costs for any sewage or water reticulation works that may be required to accommodate the development and associated access works.

Surveying

Surveying
The opinion of costs makes an allowance of $25,000 for a detailed survey, required to conduct the detailed design of the intersection.

Acoustic Barrier
No allowance has been made in the opinion of costs for any noise barriers or associated works.

Protection / Re-Location of Existing Services
The opinion of costs makes an allowance of $4,000 for the location of existing services (potholing). Additionally, there is also an allowance of $50,000 to relocate four Energex Poles. It should be noted that there may be significant expense in protection / re-location of existing services that may be affected by the development. These costs would be determined during the detailed design phase, based on information from service providers and potholing.

Road Lighting
The opinion of costs makes an allowance of $20,000 for construction of flag lighting of the proposed intersection. This cost allows for two road lighting poles and associated works (conduit, pits, point of supply). No allowance has been made in the opinion of costs for detailed lighting design (required before construction).

Landscaping
The opinion of costs makes allowance for stripped topsoil to be used as planting media and forhudromulching of all earthworks batters and distrubed surfaces.

Infrastructure Charges and Statutory Fees
No allowance has been made in the opinion of costs for any current infrastructure charges or statutory fees.

Opinion of Possible Civil Construction Costs
The summary of the opinion of possible civil construction costs is above.

In accordance with current practice we have allowed a contingency sum of 20% over the total budget estimate for the works pending final design. The above opinion of costs is exclusive of GST.

No allowances have been made in this opinion of costs for the following items:-

- Detailed Design;
- Land Acquisition;
- Public Consultation;
- Compensation costs;
- Site contamination works including investigation and disposal of material;
- Land content, stamp duty, real estate;
- Legal fees;
- Building Construction;
- Services Relocation (Telecommunications, Gas, Water, Sewer etc.); and
- Bikeways, concrete footpaths

The opinion of costs has been prepared without survey or geotechnical information and without any 3d modelling. The opinion of costs therefore is subject to review as this information is finalised and/or becomes available.

Rates used in the preparation of the above opinion of costs are current at this time but it should be realised that associated development costs will depend upon the extent of works which relates to the final intersection layout and associated Council conditions. In view of the above, Lambert & Rehbein Pty Ltd accepts no responsibility for any person or corporation who may use or rely on this opinion of costs. The above opinion of costs should only be used as a guide. A final detailed cost estimate can only be prepared following completion of the detailed engineering design.

Should you require any further information, please contact:

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Lambert & Rehbein Pty. Ltd.