

Mareeba CBD Traffic Management Study

Planning Report



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Client: Mareeba Shire Council

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Quality Information

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1.0 Introduction

1.1 General

The township of Mareeba is located on the Atherton Tablelands in Far north Queensland 66km to the west of Cairns. The township has a population of approximately 12,000 people, however the broader shire has an estimated population of approximately 22,000 people over an area of 53,457km².

While the Mareeba Shire's economy relies heavily on agriculture, the area also supports an ever increasing tourism industry. In addition, the presence of a heavy industry hub on the northern side of the township has promoted the establishment of various heavy industries in the area.

The Mareeba CBD consists of main spine i.e. Byrnes Street, with a series of parallel roads and interconnecting side streets. Walsh Street and Constance Street run parallel to the Byrnes Street on the eastern side with Atherton, Hort, Rankin, Herberton and Basalt Streets intersecting with Byrnes Street and providing access to and from the parallel network. Byrnes Street is a 4 lane roadway with centre parking and angle parking down both sides. Byrnes Street is a state controlled asset and intersects with the Mulligan Highway to the north and the Kennedy Highway to the south.

Numerous businesses and facilities front Byrnes Street. These include various speciality retail outlets, newsagencies, shopping complexes, fast food outlets and service providers. An aerial photograph of the Mareeba CBD is shown in Figure 1 below.

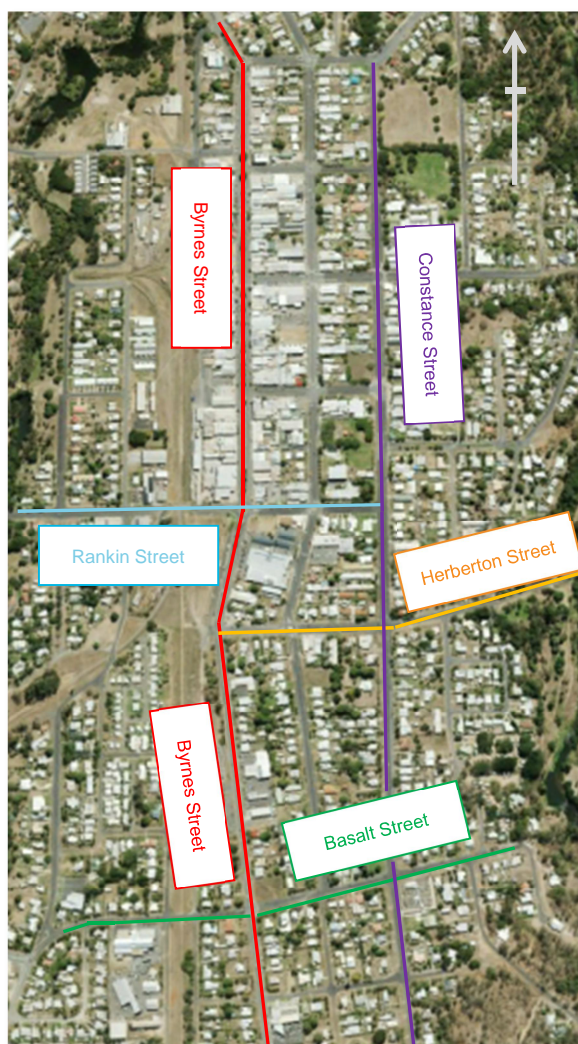


Figure 1 Mareeba Township CBD

1.2 Background

AECOM Pty Ltd (AECOM) was commissioned by Mareeba Shire Council to undertake the Mareeba CBD Traffic Management Study. The study, which was jointly funded by Mareeba Shire Council (MSC) and the Department of Transport and Main Roads (TMR), was initiated by MSC due to concerns regarding:

- Congestion at the Rankin / Byrnes Street and Rankin / Walsh Street intersections and the interaction of vehicular and pedestrian traffic.
- Operation of the Coles and Target Shopping Centre accesses along Walsh Street.
- Operation of the McDonalds Restaurant carpark access from Rankin Street as well as the entry and exit from Curcio's Bakery.

The study extents were then expanded in consultation with TMR to include various intersections along Byrnes Street and the intersection of Mareeba-Dimbulah Road and the Mulligan Highway.

The objectives of the study were to:

- Collect traffic data for the study area to determine current vehicular, pedestrian and cyclist demands.
- Develop upgrading options to address current safety and capacity issues at the various intersections.
- Model the upgraded intersection performance to determine the expected design life of the upgrade.
- Undertake an options analysis to determine the preferred options at each site.
- Prepare a concept estimate of cost for the preferred upgrading arrangements.
- Prepare a staging plan for the implementation of the proposed upgrade.

The intersections that were investigated as part of this study are summarised below and shown on Figure 2. All intersections with Byrnes Street are state controlled assets. Both the Mulligan Highway and Mareeba-Dimbulah Road are also state controlled links.

- Byrnes Street and Mareeba Connection Road/Costin Street.
- Byrnes Street and Basalt Street.
- Byrnes Street and Herberton Street.
- Byrnes Street and Atherton Street.
- Byrnes Street and Rankin Street.
- Byrnes Street and Haren Street.
- Herberton Street and Constance Street.
- Rankin Street and Walsh Street.
- Walsh Street and the Coles/Target Shopping Centre accesses.
- Mulligan Highway and Mareeba-Dimbulah Road.

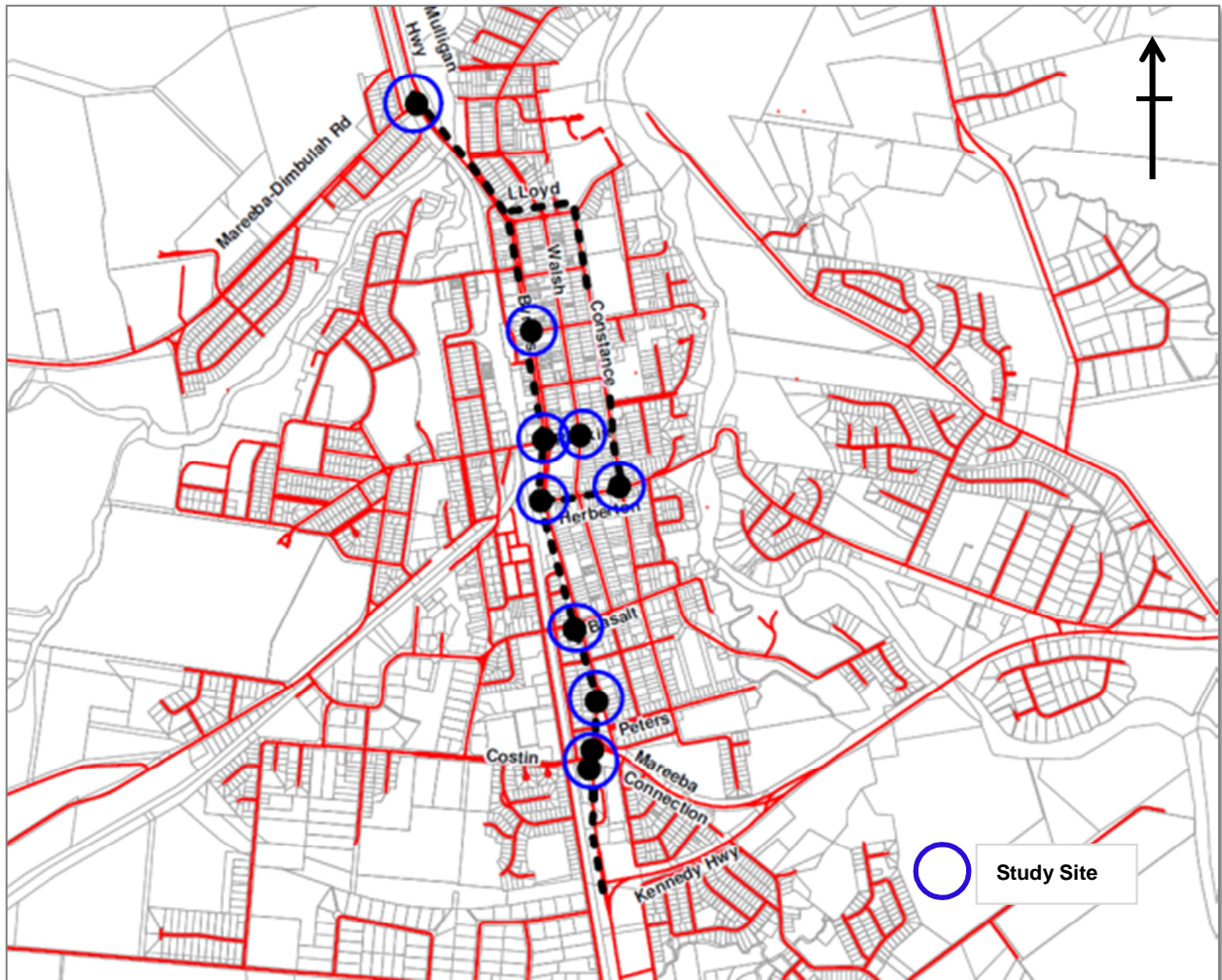


Figure 2 Study Extents

1.3 Purpose of Report

The purpose of this planning report is to outline:

1. The results of the various traffic counts undertaken in the CBD area.
2. The findings of the crash analysis.
3. The performance of the various study sites and the current traffic and/or potential safety issues.
4. The options developed for upgrading the various sites to address current capacity and safety issues.
5. The methodology and findings of the options analysis undertaken to determine the preferred upgrading solution at each site.
6. The opinion of construction cost for the preferred upgrades and the associated risks.
7. The Safety in Design requirements that will need to be considered when any of the upgrades are progressed to the detailed design and construction phases as well as during the operational phase of the upgrade.
8. The expected staging of the upgrades to address the priority sites and to ensure complimentary works are also undertaken at the same time.

1.4 Definitions

For the purposes of this planning report, the terms, abbreviations and acronyms along with their meaning are outlined in Table 1 below.

Table 1 Planning report definitions

Terms, abbreviations and acronyms	Meaning
AADT	Average annual daily traffic i.e. the 24hr volume averaged across a complete year including weekends
DOS	Degree of saturation i.e. the ratio of the traffic demand in a lane to its theoretical capacity
LOS	Level of service i.e. a qualitative measure used to relate the quality of traffic service with LOS A being the highest quality service and LOS F the poorest
MSC	Mareeba Shire Council
TMR	Queensland Department of Transport and Main Roads
SiD	Safety in Design i.e. the integration of hazard identification and risk assessment methods early in the design process to eliminate or minimise the risks of injury throughout the life of a product being designed
SIDRA	Signalised and unsignalised Intersection Design and Research Aid – An internationally recognised software tool used for the analysis of intersection configurations based on intersection geometry, control type, speed environment and traffic demands
vpd	Vehicles per day
vph	Vehicles per hour

2.0 Traffic Demands

To determine the performance of the existing intersections in the CBD, traffic counts were undertaken at the various intersections to determine the current volume of vehicles, pedestrians and cyclists at each site. The counts were undertaken on Tuesday 21st February 2017 over the 12 hour period from 6:00am to 6:00pm.

Figure 3 below shows the locations where the counts were undertaken and the volumes recorded on each of the intersection approaches over the 12hr period. Copies of the complete traffic counts at each intersection are contained in Appendix A of this report. These outline all the turning volumes as well as the number of pedestrians and cyclists.

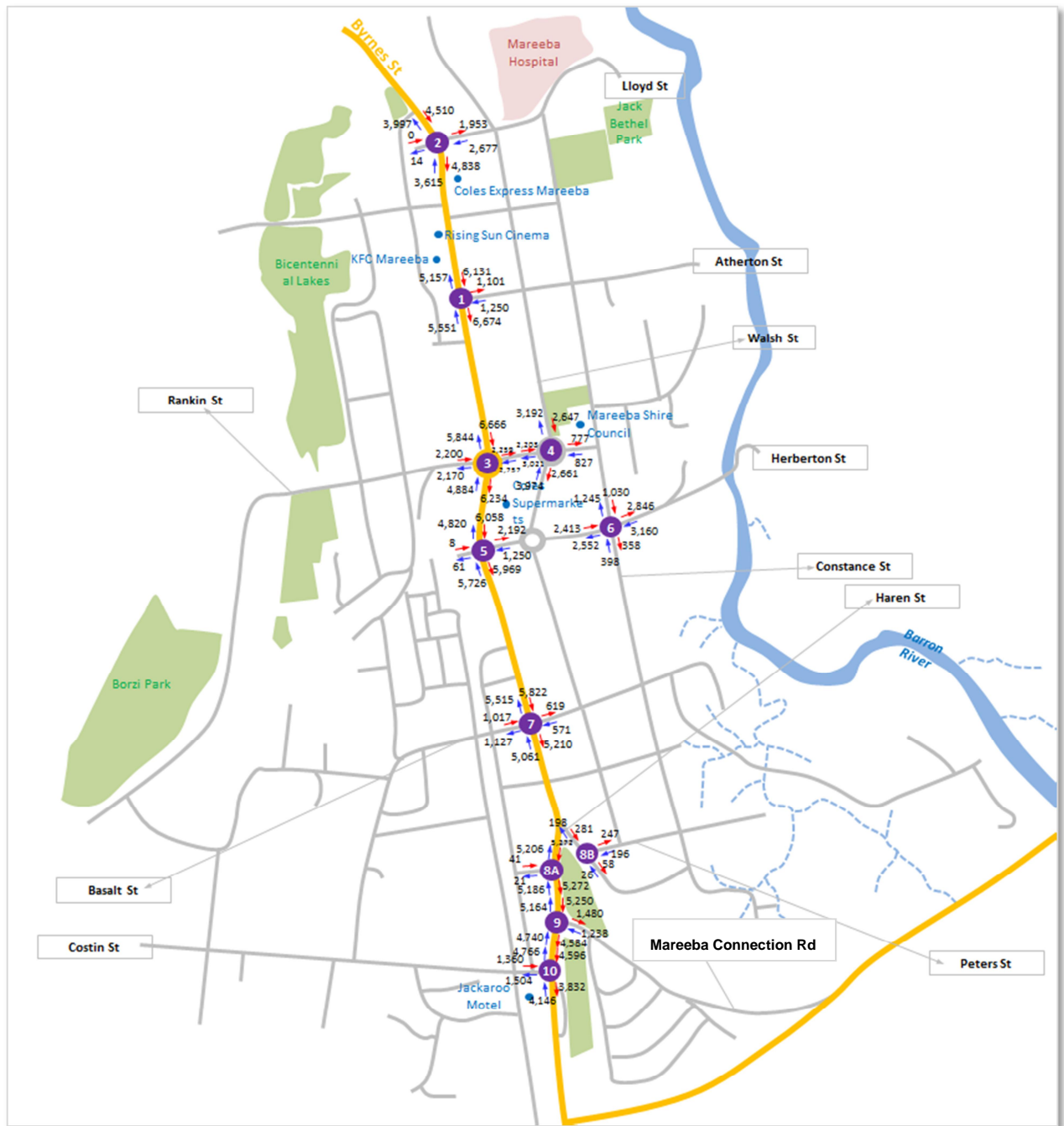


Figure 3 Mareeba CBD Traffic Volumes, Tuesday 21st February 2017 (6:00am to 6:00pm)

A review of the traffic counts indicates that the highest traffic demand occurs on the northern side of the Rankin Street intersection with a bi-directional flow of 12,510 vehicles over the 12hr period of the count. To determine the resultant 24hr flow, a conversion factor was derived from the Department of Transport and Main Roads (TMR) permanent counter located on the southern side of the Herberton Street intersection with Byrnes Street. This is the only permanent counter situated on Byrnes Street. The location of the permanent counter is shown in Figure 4 below.

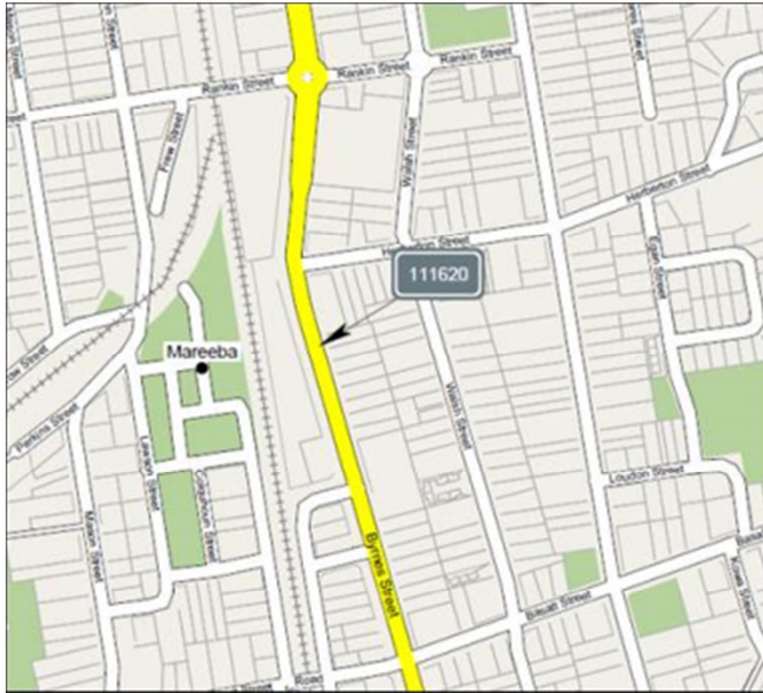


Figure 4 TMR Permanent Counter No.111620

The TMR counter returned the values shown in Table 2 below based on the average volumes throughout 2016. This returns a factor of 1.15 for the conversion of the 12hrs volumes to a 24hr value i.e. including the demands from 6:00pm to 6:00am. While this factor has been calculated for the permanent counter site to the south of the Rankin Street intersection with Byrnes Street, it would still be representative of the applicable factor on the northern side of Rankin Street due to its proximity.

Table 2 Conversion Factor - 12hr to 24hr

12hr Volume	24hr Volume	Conversion Factor
11,427 vehicles	13,166 vehicles	1.15

Based on the 1.15 conversion factor, the daily (24hr) volume on Byrnes Street to the north of Rankin Street is estimated to be approximately 15,000 vehicles per day (for an average weekday). This would represent the highest flow on Byrnes Street. As a comparison with other local townships, the average weekday flow on the Bruce Highway running through Innisfail is approximately 16,000 vehicles per day. It is worth noting that both the Lily Street and Grace Street intersections, which intersect with the highway through Innisfail, were signalised back in 2006 to address capacity and safety concerns at these sites.

It is also worth noting that over the 12hr period from 6:00am to 6:00pm, 328 pedestrians were recorded crossing Byrnes Street on the northern side of the Rankin Street roundabout. From 3:00pm to 3:30pm, 84 pedestrians were recorded performing this movement. These pedestrian demands along with the vehicular traffic at the Byrnes Street/Rankin Street are shown in Figure 5 below.

During the 30 minutes that the 84 pedestrians were recorded crossing on the northern side of the roundabout, the corresponding vehicular volume entering and leaving the roundabout on the northern side was 605 vehicles. This represents a significant demand, with the high volume of pedestrians required to find gaps in this flow to complete their uncontrolled crossing of Byrnes Street.



Figure 5 Byrnes Street/Rankin Street – Current Traffic Demands

The very high pedestrian demands on the northern side of the roundabout can be attributed to various attractors on the eastern side of Byrnes Street. This includes the McDonald Restaurant, bakery, Coles Shopping Centre and the skate park located adjacent to the Mareeba Police Station. Also, the Mareeba State High School is located back along Rankin Street west with a footpath on the northern side of the street. This path provides access to Byrnes Street and is heavily used by the high school students. Students then cross on the northern side of the roundabout to access the attractors on the eastern side of the Byrnes Street. Figure 6 below shows the location of the Mareeba State High School and the desire line for students leaving the school on foot in the afternoons.

In fact all legs of the Rankin Street roundabout currently accommodate high pedestrian demands due to the various attractors in close proximity to the intersection. While median storage areas have been provided on the Byrnes Street approaches, these cannot adequately accommodate the volumes of pedestrians at the site. Roundabouts are also generally not desirable where large numbers of pedestrians are present as pedestrian movements cannot be controlled.



Figure 6 Pedestrian desire line from Mareeba State High School

2.1 Peak Period

Fifteen minute traffic flows recorded at each intersection were reviewed to identify the timing of the morning and afternoon peak periods. Throughout the study area the peaks typically occur between 7:30am - 8:30am and 4:00pm - 5:00pm. Figure 7 below shows an example of a typical traffic profile recorded at the Byrnes Street / Rankin Street roundabout.

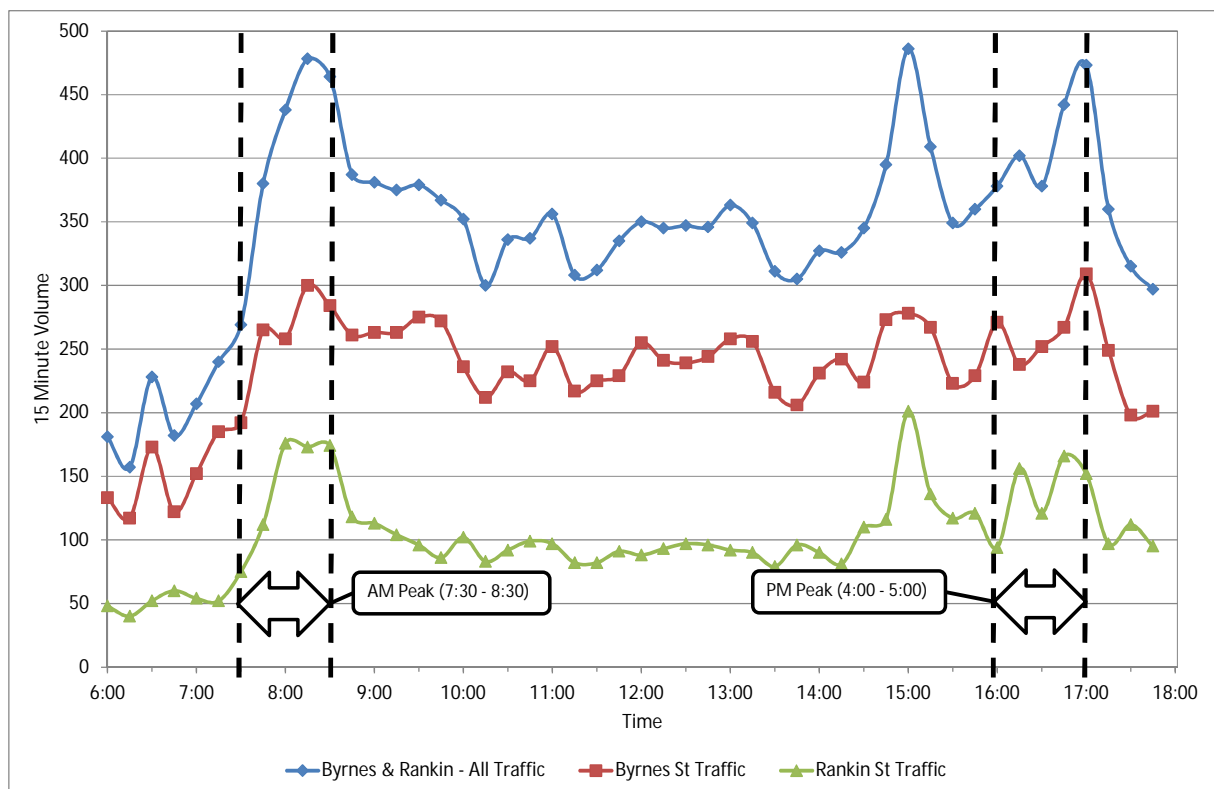


Figure 7 15 minute traffic flows – Byrnes Street / Rankin Street Roundabout

2.2 Traffic Growth

Historic traffic data provided by TMR along with historic population and population forecasts provided by the Queensland Government Statisticians Office (QGSO) have been reviewed to determine traffic growth within the Mareeba CBD.

QGSO projections (QGSO Med Series 2015 Edition) indicate that Mareeba's population will grow from the current (2015) estimate of 11,035 to 14,607 by 2036. This represents growth of 1.5% per annum based on 2015 population.

Review of historic daily traffic data captured at TMR's permanent counter on Byrnes Street (just south of Herberton Street) indicates that the growth trend between 2002 and 2015 has been approximately 2% per annum linear.

Historic population and traffic along with future projections are illustrated in Figure 8.

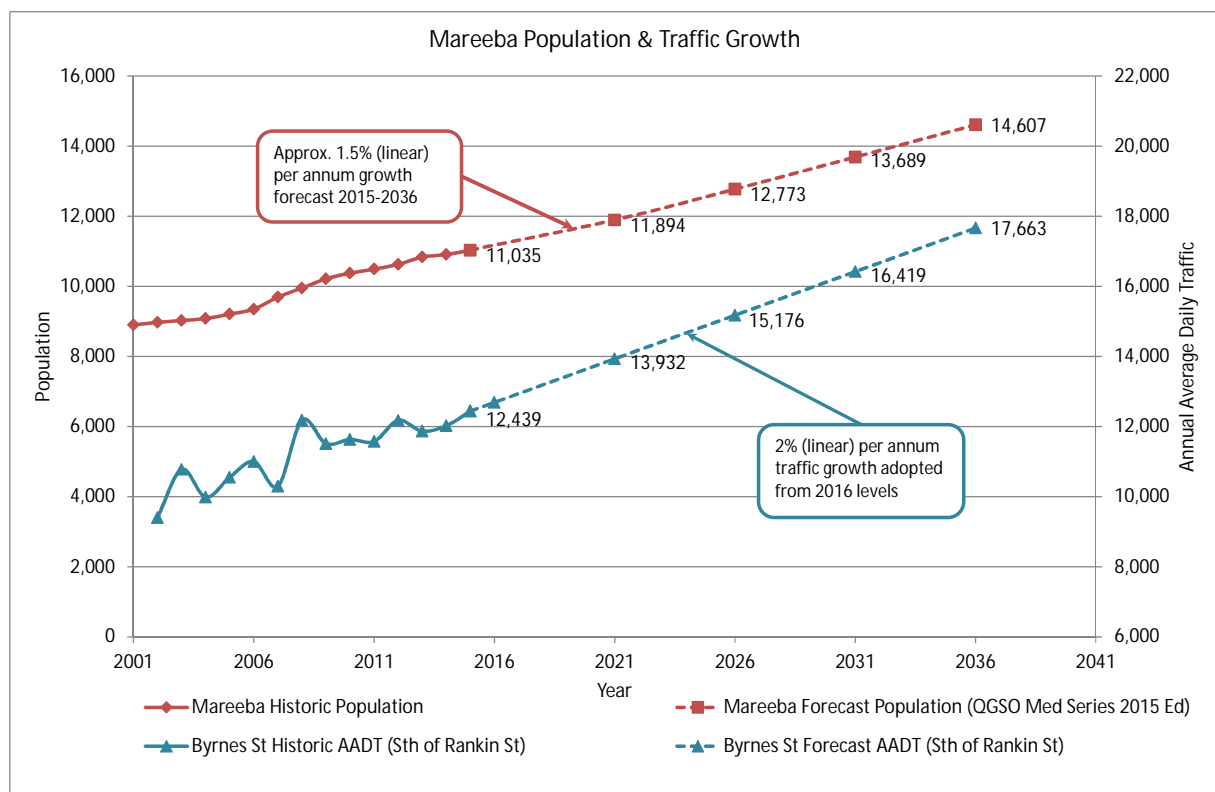


Figure 8 Mareeba Population and Traffic Growth

While local population has been increasing at a slightly lower rate to traffic, other regional factors are expected to be influencing traffic increase through the CBD. These may include underlying growth in traffic flows to/from Cairns and increasing tourist traffic within the region. As such, traffic growth of 2% per annum (linear) has been adopted to determine traffic forecasts for the study.

The highest daily traffic within the study area occurs on Byrnes Street, just north of the Rankin Street roundabout. Daily traffic at this location is estimated to be approximately 15,000 vehicles per day at present. With 2% per annum growth, traffic on Byrnes Street could be expected to reach approximately 20,000 vehicles per day in the next 15 years.

A traffic growth rate of 2% per annum (linear) has been adopted in the intersection analysis and is discussed further in Section 5.0.

3.0 Crash Analysis

To determine the incidence of crashes within the study area, a crash analysis was undertaken. Crash data was obtained from TMR's Data Analysis Unit (DAU). Available records back to 2005 were obtained for the analysis. The following qualifications were provided by the DAU with regards to the data they provided.

- property damage only incidences were no longer recorded after 31 December 2010
- fatality incidences were current to 31 October 2016
- non-fatal casualties were current to 30 June 2016
- property damage crashes were current to 31 December 2010.

Results of the crash analysis and are included in Appendix B of this report. Crashes have been categorised by type, severity and time of occurrence. Figure 9 below shows the number of crashes recorded along Byrnes Street between the intersections with the Kennedy Highway and the Mareeba-Dimbulah Road intersection from January 2005 to June 2016.

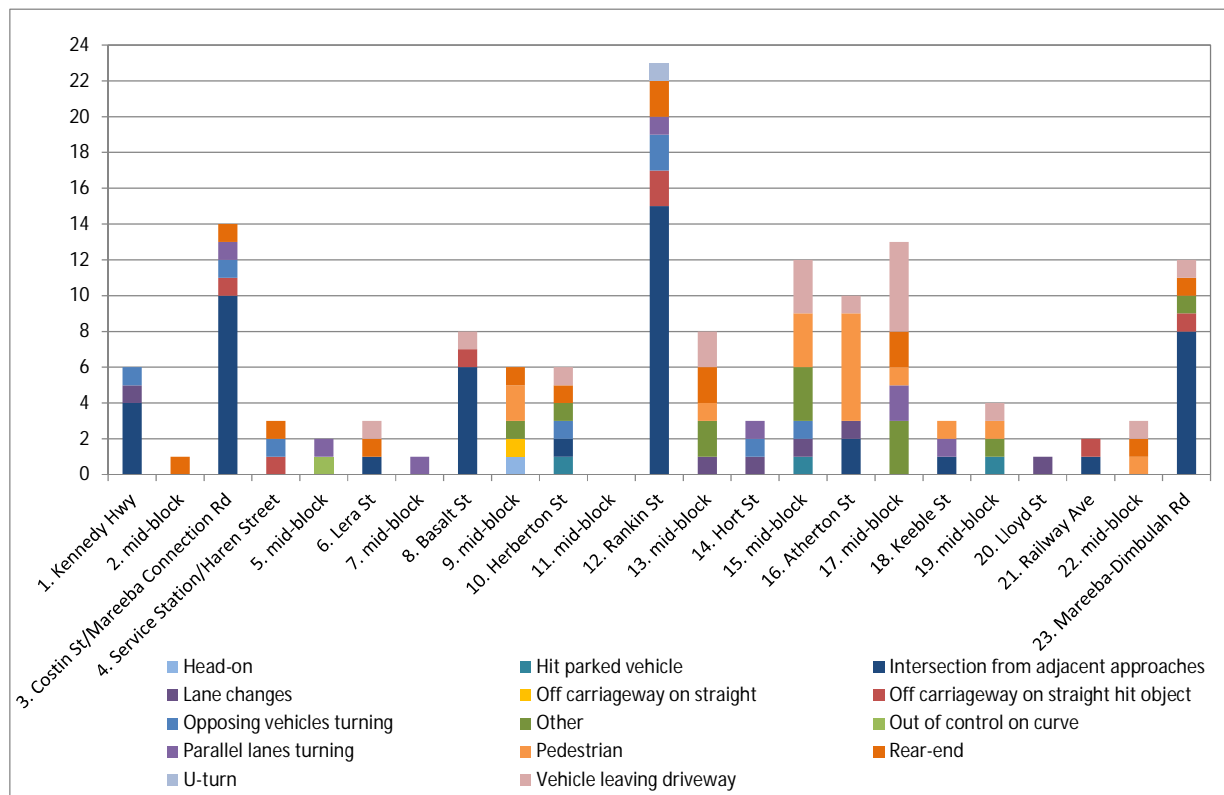


Figure 9 Byrnes Street Recorded Crashes

As shown in Figure 9 and the complete crash analysis results contained in Appendix B, the highest number of crashes has been recorded at the Byrnes Street/Rankin Street intersection followed by Byrnes Street/Mareeba Connection Road intersection. The highest number of pedestrian related incidences was recorded at the Byrnes Street/Atherton Street intersection.

Of the 23 crashes recorded at the Rankin Street intersection, 15 were a result of conflicts with vehicular movements on the other approaches. One of these crashes resulted in a fatality recorded in November 2012. Two incidences also involved pedestrians and 2 rear end crashes were also recorded. The high incidence of conflicts with vehicles on other approaches is typical of a roundabout arrangement accommodating high demands. The same is also true for the rear end and pedestrian crashes.

Significant occurrence of crashes has been recorded for vehicles from adjacent approaches at the Costin Street/Mareeba Connection/Byrnes Street intersection, Basalt Street intersection and Mareeba-Dimbulah Road intersection.

These crash types suggest issues may be present for turning vehicles, e.g. side road turn movements having difficulty finding gaps in the main line through traffic. This issue has been observed on site at both the Basalt Street and Mareeba Connection Road intersections.

Also of note is the large number of pedestrian related crashes (6 out of 10 crashes) at the Atherton Street intersection. Further inspection of the crash records indicates these crashes occurred at the zebra crossing with the majority a result of U-turning vehicles impacting pedestrians crossing the zebra crossing of Byrnes Street and others due to vehicles right turning into Atherton Street impacting pedestrians on the zebra crossing of Atherton Street.

4.0 Observed Issues

4.1 Overview

As noted previously, the Mareeba CBD Traffic Management study was initiated by MSC primarily due to concerns regarding:

- Congestion at the Rankin / Byrnes Street and Rankin / Walsh Street intersections and the interaction of vehicular and pedestrian traffic.
- Operation of the Coles and Target Shopping Centre accesses along Walsh Street.
- Operation of the McDonalds Restaurant carpark access from Rankin Street as well as the entry and exit from Curcio's Bakery.

The study extents were then expanded in consultation with TMR to include various intersections along Byrnes Street and the intersection of Mareeba-Dimbulah Road and the Mulligan Highway. To ensure the known traffic and safety issues were considered in the study, site observations of the performance of the network were undertaken. In addition, meetings with MSC, TMR and the Mareeba Police Traffic Division were held to discuss the various issues that are currently known to exist. Copies of the minutes from these meeting are included in Appendix C. The issues identified at the various sites with the CBD are discussed below.

4.1.1 Walsh Street / Rankin Street

A layout of the Walsh Street/Rankin Street intersection is given in Figure 10 below.

Known issues at the site include:

- Right turn movements into bakery from Rankin Street prop in through traffic lane immediately beyond the Walsh Street roundabout exit increasing the potential for rear end collisions.
- Right turn movement into bakery from Rankin Street is uncontrolled. High volumes on Rankin Street result in an increased potential for right turn/through conflicts.
- High volume of motorists exiting the bakery turn right to enter the Walsh Street roundabout. The movement crosses traffic exiting and approaching the roundabout resulting in a high potential for conflicts.
- The bakery attracts a high volume of foot traffic. No pedestrian refuges currently exist to accommodate
- Existing roundabout geometry does not provide sufficient deflection to slow vehicles using the intersection.



Figure 10 Walsh Street/Rankin Street intersection

4.1.2 Walsh Street/Coles and Target accesses

A layout of the Walsh Street/Coles and Target Shopping Centre accesses is given below in Figure 11.

Known issues at the site include:

- Queueing issues have been observed on Rankin Street during the peak periods.
- Queues can extend from the Rankin/Byrnes Street roundabout along Rankin Street in front of McDonalds and Curcio's Bakery and through the Rankin Street / Byrnes Street roundabout, impacting flow of traffic on Walsh Street.
- Vehicle propping on Walsh Street to turn into the Coles car park have been observed to stop through traffic, resulting in queues extending back through the Rankin Street / Walsh Street roundabout.



Figure 11 Walsh Street/Coles and Target Accesses

4.1.3 Rankin Street/McDonalds Restaurant access

A layout of the Rankin Street/McDonald Restaurant access is given in Figure 12.

Known issues at the site include:

- Multiple conflicting movements exist on Rankin Street adjacent to the entry/exit to McDonalds carpark.
- Vehicles right turning into the car park must prop within through traffic lane on Rankin Street resulting in a conflict point for vehicles accelerating out of the Rankin Street / Walsh Street roundabout.
- Vehicles right turning out of the carpark must give way to multiple movements on Rankin Street (right turn and through movements).



Figure 12 Rankin Street/McDonalds Restaurant access

4.1.4 Byrnes Street/Rankin Street

As discussed previously, the Byrnes Street/Rankin Street intersection is the most heavily trafficked intersection in Mareeba with bi-directional flows of approximately 15,000 vehicles per day on the northern side. It also accommodates high pedestrian demands with these movements occurring in an uncontrolled manner. The intersection also has the highest number of recorded crashes in the Mareeba CBD.

While not currently at capacity, the high incidence of crashes and the significant pedestrian demands would indicate that control of the movements is required to safely accommodate demands.

4.1.5 Byrnes Street/Basalt Street

A layout of the Byrnes Street/Basalt Street intersection is given in Figure 13 below.

Known issues at the site include:

- Left turn lane on Basalt Street is separated from the through and right lane, however the common hold line for both lanes results in line of sight for left turn movements potentially being obstructed by through/right turning vehicles.

Limited gaps in traffic on Byrnes Street during the peak periods results in difficulties performing through and right turn manoeuvres from the side roads. This results in frustrated motorists attempting unsafe movements and increased potential for crashes



Figure 13 Byrnes Street/Basalt Street intersection

4.1.6 Byrnes Street/Mareeba Connection Road/Costin Street

A layout of the Byrnes Street/Mareeba Connection Road/Costin Street intersection is given in Figure 14 below.

Known issues at the site include:

- Multiple conflicting movements
 - Right turn movement out of Mareeba Connection Road must give way to right turn from Byrnes Street, north and southbound through traffic on Byrnes Street and vehicles changing lanes on Byrnes Street to access the right turn lane into Costin Street.
 - Vehicles travelling from Costin Street to Mareeba Connection Road must weave across northbound through traffic on Byrnes Street while giving way to traffic on Byrnes Street that are moving into the right turn lane to Mareeba Connection Road.
 - Vehicles travelling from Mareeba Connection Road to Costin Street must cross four traffic lanes, while giving way to multiple turning movements (north and southbound through movements on Byrnes Street, right turn movement into Costin Street vehicles moving into the right turn lane into Mareeba Connection Road.
- A short right hand merge exists for movements turning right out of Mareeba Connection Road to merge into northbound traffic on Byrnes Street.

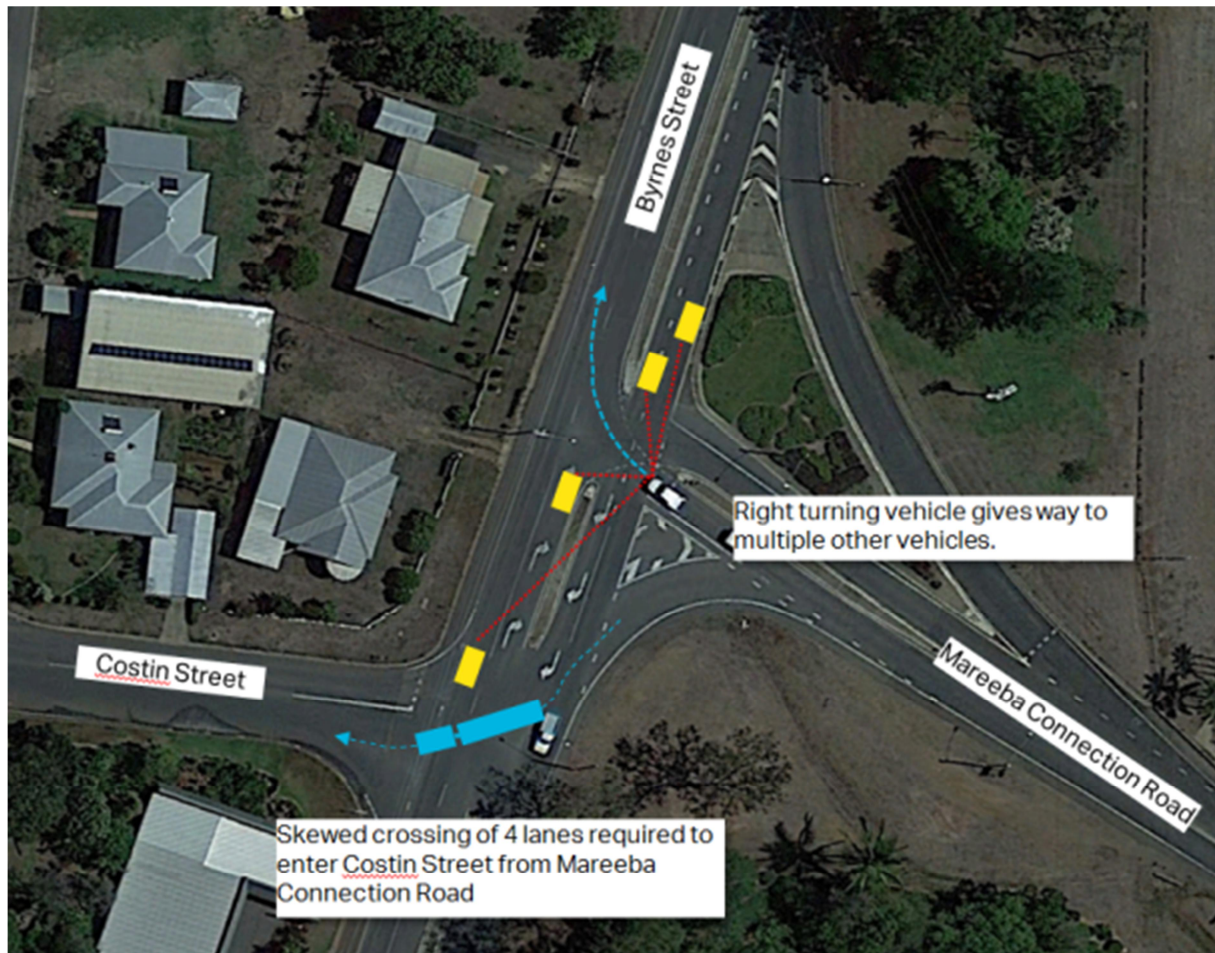


Figure 14 Byrnes Street/Mareeba Connection Road/Costin Street intersection

In addition, motorists are also generally unclear of the use of the merge arrangement when right turning from the Mareeba Connection Road and will give way to northbound traffic on Byrnes Street.



Figure 15 Mareeba Connection Road intersection – Northbound merge

4.1.7 Byrnes Street Parking

Byrnes Street is a median divided roadway with centre parking in some locations and a landscaped median in other areas. Angle parking is present along the majority of the northbound and southbound carriageways.

A known issue that currently exists with the angle parking is the limited ability to see oncoming traffic when reversing out of the parking. An example of this is shown in Figure 16 below.



Figure 16 Byrnes Street - Obstructed view when reversing from angle parking

As also illustrated in Figure 17 below, no buffer exists between the through lanes and the ends of the angle bays. This results in the sight line for the reversing motorist being obstructed by the adjacent parked vehicle and a high potential for reversing/through conflicts.



Figure 17 Byrnes Street – Line of sight for reversing from angle parking

A review of the existing cross section of Byrnes Street was undertaken to determine how it compared to that required with the adoption of current standards for lane and parking bay widths. The results of this comparison are shown in Figure 18 below.

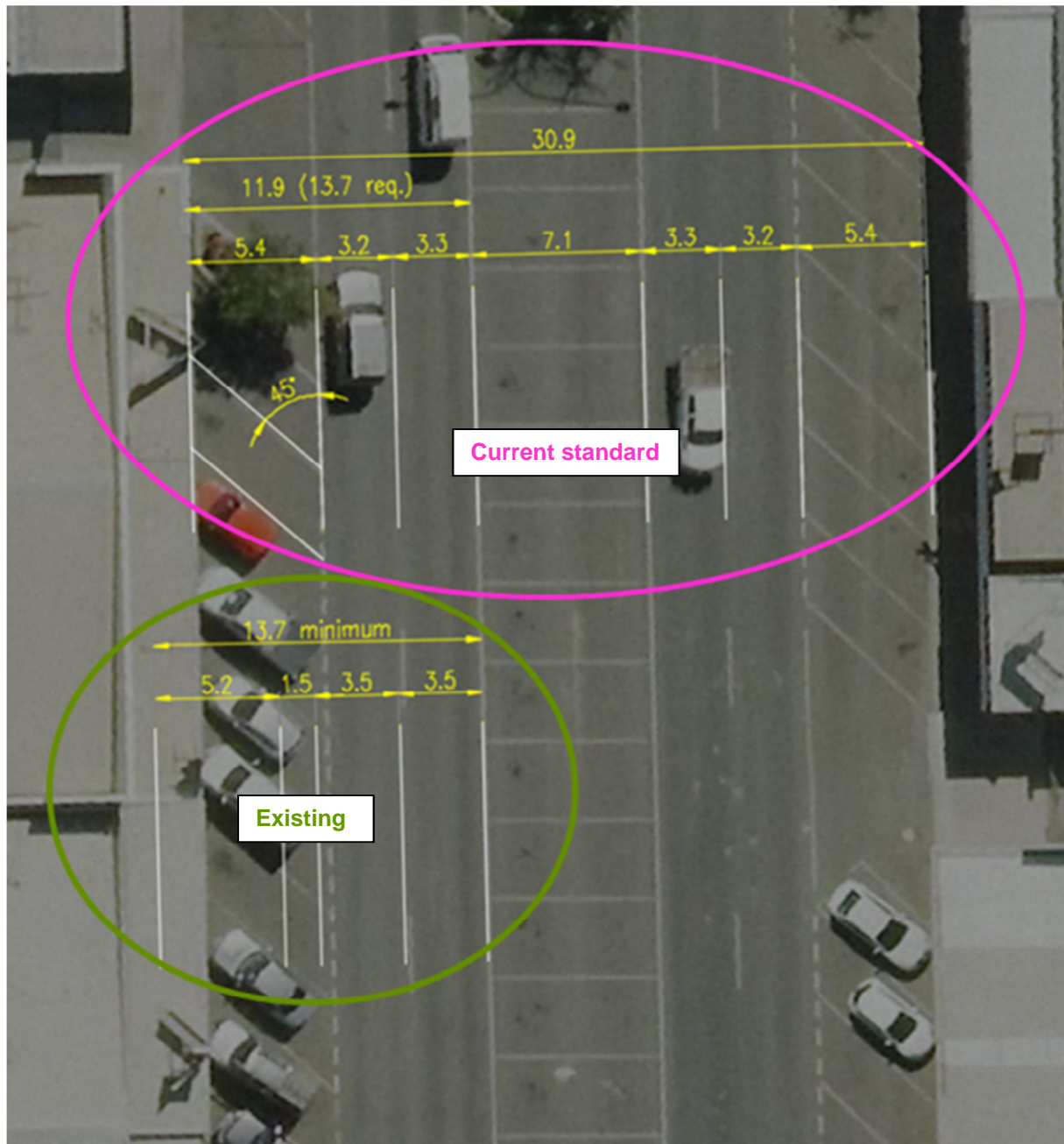


Figure 18 Byrnes Street - Existing vs “Current standard” cross section comparison

As shown, a difference of 1.8m exists between the existing northbound and southbound carriageway configuration and that which results with the application of current standards. The difference is primarily due to the inclusion of the 1.5m wide buffer.

Implementation of the wider cross section could be achieved through:

1. reconstruction of the existing footpaths area to move the kerb line further to the east and west
2. reduction of Byrnes Street to a single lane in each direction
3. removal of the centre parking.

The reconstruction of the footpaths to instate a new kerb line would be very costly and would likely impact on the numerous public utilities that would be located within this area. It would also be met with extreme resistance from the community and business owners due to the reduction in the footpath width.

Reduction of Byrnes Street to a single lane in each direction was touted by TMR some years ago as a means of providing cycle facilities on Byrnes Street. The reduction to single lane flows was met with strong objection from both the community and the local Chamber of Commerce due to the perception that the reduction would significantly increase congestion on Byrnes Street.

While the removal of the centre parking has not been placed in the public domain as a means of improving the configuration of the angle parking, it is highly likely that it would also not be palatable to the community and particularly business owners. This would be due to the loss of the centre parking impacting business operations due to insufficient on street parking to service patrons of the local businesses.

5.0 Existing Intersection Traffic Performance

Key intersections within the study area were analysed with SIDRA (**S**ignalised and unsignalised **I**ntersection **D**esign and **R**esearch **A**id) to ascertain the current traffic performance and future performance of the existing intersections under forecast traffic flows. The results of this analysis are summarised in Appendix D.

5.1 Priority Intersection Triggers for Upgrade

It should be noted that for simplicity the 'end of design life', for the priority (un-signalised) intersections has been defined as the point at which the worst movement exceeds LOS F. While LOS has been used as the measure in this study it is not the only determining factor for triggering upgrade of priority intersections. Safety and the incidence or occurrence of crashes at the intersection should also be monitored and assessed as the LOS is approaching the LOS F trigger. Safety issues, particularly with side road right turn manoeuvres being able to find gaps to turn out into the main line traffic stream, may require upgrade or safety treatments at the intersections before LOS and delay becomes an issue.

Similarly, there may not be significant observed issues with safety beyond the time that LOS triggers are exceeded. In this case, continued monitoring of the intersections for safety issues should be undertaken, beyond the LOS trigger being reached, to ensure a safe environment provided for all road users and appropriate action should be taken when safety becomes an issue.

6.0 Options Development and Assessment

Upgrade option layouts were developed for each of the key intersections to address the issues identified at each of the intersections within the study extents. The initial options were presented to TMR, MSC and Queensland Police during a project progress meeting. The purpose of the meeting was to review and interrogate each of the options to identify any shortcomings or further refinements required. Minutes and outcomes from the progress meeting are provided in Appendix C.

Upgrade layouts were then further refined to address the outcomes and actions from the progress meeting. An options assessment workshop, attended by TMR, MSC Officers, MSC's Councillors and AECOM personnel, was undertaken based on the refined layouts. Concept layouts presented during this workshop are included in Appendix E. Minutes from the workshop are given in Appendix C.

During this workshop each of the options were discussed in terms of the performance criteria noted below:

- Intersection design life – informed by traffic analysis.
- Provision for pedestrians – how well each option accommodates use by pedestrians.
- Provision for cyclists – how well each option accommodates use by cyclists.
- Re-use of the existing asset – to what degree does the option re-use existing infrastructure.
- Property impacts – assessment of the number and significance of property impacts.
- Maintains all existing movements – how well the option maintains the existing function (e.g. does the option reduce the existing function of the intersection by reducing or limiting particular movements, requiring road users to change travel patterns).


- Cost – expected overall cost of the upgrade.



Based on the inputs received at the workshop, the options were further refined and subject to an options assessment, based on the above criteria, to determine a preferred upgrade. The results of the options assessment are included in Appendix F of this report. The traffic assessment of each intersection used to inform the design life is also given in this appendix.

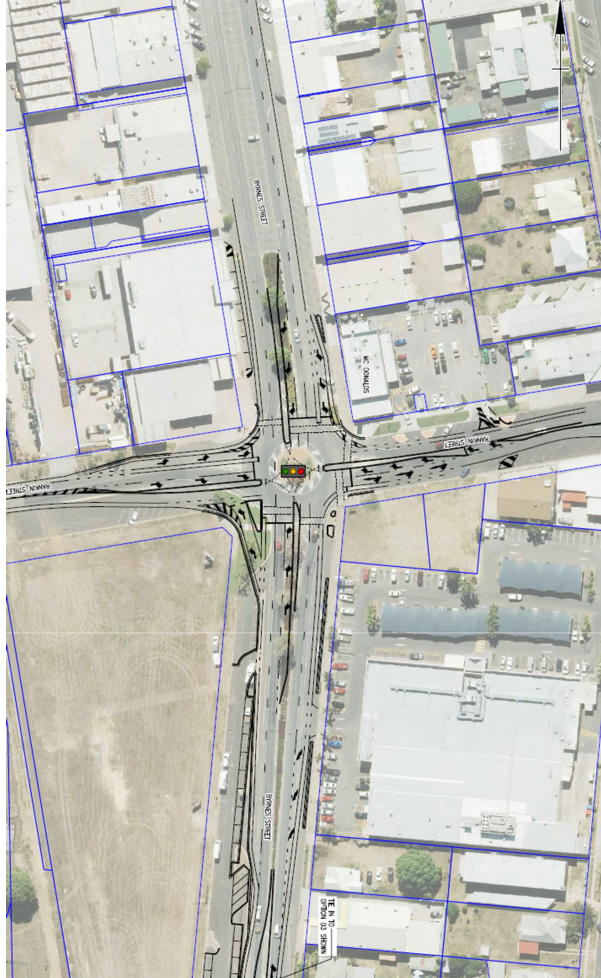

7.0 Preferred Upgrades


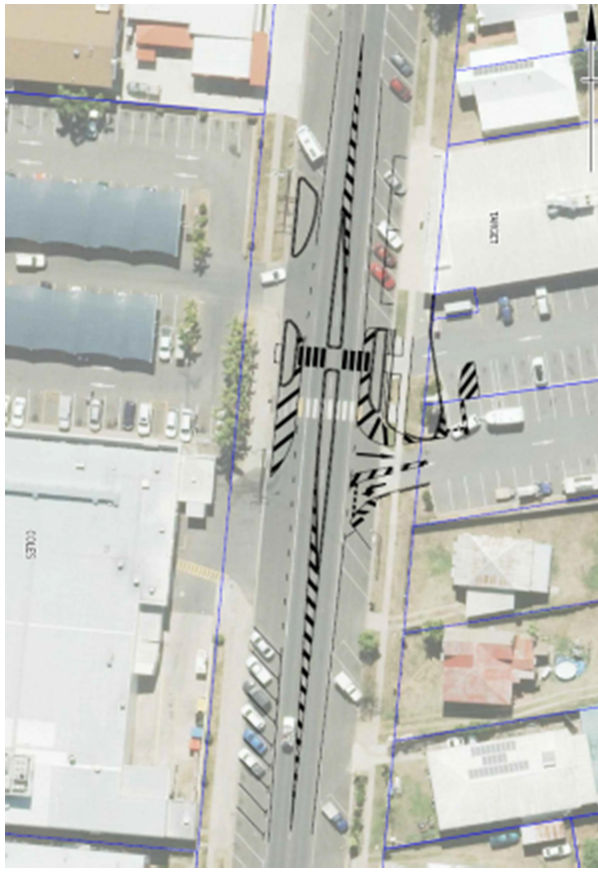
The preferred upgrade configurations of each of the intersections assessed in the study are described below in Table 3. Layouts for each preferred upgrade are included in Appendix G.

Table 3 Preferred Upgrade Arrangements

Preferred Upgrade	Description
	<p>Byrnes Street / Mareeba Connection Road / Costin Street Intersection and Byrnes Street / Haren Street Intersection</p> <ul style="list-style-type: none"> • Existing staggered 'T' arrangement rationalised to a four way signalised 'X' intersection through realignment of Mareeba Connection Road to opposite Costin Street. • Haren Street intersection movements rationalised and channelised turn movements provided to reduce conflicts. • Upgrades retain all existing traffic movements. • Signalisation provides enhanced control for movement turning from the side roads onto Byrnes Street. • Controlled pedestrian crossings of Byrnes Street and Mareeba Connection Road provided through signals to service high use market / park area. • Signalised intersection expected to provide capacity to cater for traffic demands over the next 15 years.

Preferred Upgrade	Description
	<p>Byrnes Street / Basalt Street Intersection</p> <ul style="list-style-type: none"> • Signalisation provides enhanced control for side road movements to safely access Byrnes Street. • All existing traffic movements retained. • The signalised intersection provides capacity to cater for traffic demands over the next 15 years. • Left turns on Byrnes Street shared with through lanes not desirable but necessary to avoid property impacts. Minimal impact to traffic performance expected. • Pedestrian crossing accommodated through signals. • Cycle lanes provided. • Significant new pavement required due to slight alignment shift west through the intersection to accommodate additional lanes.
	<p>Byrnes Street / Herberton Street Intersection</p> <ul style="list-style-type: none"> • Intersection fully signalised. • The upgraded intersection has capacity to cater for traffic demands over the next 15 years. • Could operate as an un-signalised T in this form for approximately 5 years, however un-signalised 'T' would likely warrant auxiliary left turn lane onto Herberton Street. • Signalised pedestrian crossing of Herberton Street provided. If un-signalised, median break would allow pedestrian to store and cross one lane at a time. • Existing pavement utilised with widening required to the western side of Byrnes St. • Access to parking area shifted to the north. Right turn access from Byrnes Street north removed.

Preferred Upgrade	Description
	<p>Byrnes Street / Rankin Street Intersection</p> <ul style="list-style-type: none"> Intersection fully signalised. The upgraded intersection has capacity to cater for traffic demands over the next 15 years. Through and left turn lanes on Rankin Street combined to limit property impacts. Pedestrian phases will provide for controlled crossings. Crossing of the northern side of the intersection where the highest pedestrian demand currently exists will be fully controlled. Channelised right turn provided for movement into McDonalds from Rankin St. Cycle lanes provided. Loss of angle parking fronting McDonalds Restaurant, however combined through/left turn lane could be adopted to maintain these bays. Majority of the upgrade re-uses the existing road asset reused with only limited pavement widening required. Reconstruction required through the existing roundabout. No property impacts. Car park configuration modified to improve control of movements entering and exiting the car park.
	<p>Byrnes Street / Atherton Street</p> <ul style="list-style-type: none"> U-turn movement moved to the south of the pedestrian crossing to remove the U-turn / pedestrian conflicts. U-turn provided on northern side of intersection. Right turn movement into Atherton Street removed conflicts between right turning vehicles and pedestrians crossing the zebra crossing of Atherton Street. The upgraded intersection has capacity to cater for traffic demands over the next 15 years.

Preferred Upgrade	Description
	<p>Mulligan Highway / Mareeba-Dimbulah Road</p> <ul style="list-style-type: none"> Provision for cyclist crossing slip lanes provided by cut-throughs to traffic islands. Channelised turns provided for access to Moody Street. Acceleration lane for the northbound slip lane onto the Mulligan Highway lengthened. The upgraded intersection has capacity to cater for traffic demands over the next 15 years.
	<p>Walsh Street / Coles and Target Accesses</p> <ul style="list-style-type: none"> Rationalises entry and exit points to Target Shopping Centre to a single location. Installation of centre median removes right turn manoeuvres to and from the Coles and Target Shopping Centre carparks. Zebra crossing location shifted to the north to improve clearance between Coles loading zone and pedestrian crossing location. Uncontrolled right turn movements into and out of shopping centre carparks removed. Existing high use angle parking bays on Walsh Street fronting the Coles Shopping Centre maintained. Existing angle parking bays directly fronting Target Shopping Centre changed to parallel bays. No new pavement required. New concrete islands, signage and linemarking only.

Preferred Upgrade	Description
	<p>Rankin Street / Walsh Street</p> <ul style="list-style-type: none"> • The roundabout has capacity to cater for traffic demands over the next 15 years. • Centre median provided along Rankin Street and Walsh Street to ban unsafe right turn manoeuvres in/out of bakery. • Median storage areas provided for pedestrian crossing on all approaches except Rankin Street north. • Roundabouts generally undesirable for cyclists especially with heavy vehicles present, however cycle lanes provided on all approaches and provision made for on road cyclists to enter footpath at north west corner due to departure shoulder area not being provided to minimise loss of parking. • Loss of 3 angle parking bays fronting Mareeba Shire Council Chambers. • Loss of 3 angle parking bays on Walsh Street. • No property impacts.
	<p>Herberton Street / Constance Street Intersection</p> <ul style="list-style-type: none"> • Existing zebra crossing maintained. Median storage areas provided to allow pedestrians to cross one lane at a time. • Layout retains same number of parking bays. Three angle parks changed to parallel bays. • Generally undesirable for cyclists especially with heavy vehicles present, however cycle lanes provided on all approaches. • Whilst upgrade fits within the existing pavement footprint, circulating section expected to require reconstruction to achieve required crossfall. • No impacts to properties. • The roundabout has capacity to cater for traffic demands over the next 15 years.

8.0 Concept Opinion of Cost

High level concept opinions of cost were prepared for each of the preferred upgrade arrangements. Opinions of Cost considered the following key items:

- Kerb (demolition and installation) – quantified per linear metre.
- Concrete medians (demolition and installation) – quantified per square metre.
- New pavement – quantified per cubic metre.
- Bitumen surfacing, including asphalt – quantified per square metre.
- Road furniture – quantified per lineal metre of roadway.
- Landscaping – quantified per square metre.
- Roadway lighting – assumption based on removal of existing lighting and upgrade.

- Contractors site facilities, provision for traffic, management plans, final design details, planning, survey and design, project administration – all costed as lump sum based on percentage of the total construction cost.
- Contingency – a 50% (of total construction cost) contingency has been applied due to the high level nature of the concept designs

Concept opinions of cost for each of the preferred intersection upgrades are summarised in Table 4 below. Cost schedules are included in Appendix H.

Table 4 Preferred Upgrade – Concept Opinions of Cost

Project	Opinion of Cost
Byrnes Street / Mareeba Connection Road / Costin Street Intersection and Byrnes Street / Haren Street	\$4.0m
Byrnes Street / Basalt Street	\$3.6m
Byrnes Street / Herberton Street	\$2.0m
Byrnes Street / Rankin Street	\$3.5m
Byrnes Street / Atherton Street	\$0.3m
Mulligan Highway / Mareeba Dimbulah Road	\$1.7m
Herberton Street / Constance Street	\$1.8m
Rankin Street / Walsh Street	\$1.2m
Walsh Street / Coles and Target Access	\$0.4m

It is stressed that these opinions of cost are concept in nature and are provided for information only. Further detailed investigations such as public utility potholing, geotechnical investigations and design development using a terrain model will be required to develop a higher level of confidence in the expected cost of the option. It should also be noted that the costs do not include any escalation.

9.0 Risk Analysis

A risk register has been developed and is included in Appendix I. The risk register was developed to capture the risks known at the time of preparing this study and to provide a record for the future use as the various projects enter the design development and construction phases.

Both risks and mitigation measures are included in the register. The risk rating before and after implementation of the mitigation measures is noted.

10.0 Safety in Design

To ensure Safety in Design has been addressed in the preparation of concept upgrading layouts for this study, a Safety in Design (SiD) risk event schedule has been developed as part of this study. This schedule includes the identification of risk events along with actions to be taken to avoid, reduce or control risk during each of the project stages i.e. design, construction, operation and maintenance.

A SiD report has been prepared to document this process and is included in Appendix J.

11.0 Prioritisation Plan

An upgrade prioritisation plan has been developed to provide a basis for staging the upgrades to the Mareeba CBD road network over the next 15 years. Upgrade prioritisation has been based on two key factors. These are:

- The need to improve traffic capacity.
- The need to improve safety and address the crash history.

Table 5 below defines the upgrade prioritisation developed as part of this study.

Table 5 Prioritisation Plan

Priority	Intersection	Asset Owner	Need
1	Byrnes Street / Rankin Street	TMR	<p>Highest crash rate in the Mareeba CBD (23 crashes including 1 fatality 2005-2016) and very high numbers of uncontrolled pedestrian crossings, made up of large numbers of school children, at the existing roundabout. Signalisation required to improve control of vehicular movements and improve safety for pedestrians.</p> <p>Upgrade would need to be undertaken in conjunction with the proposed improvements to the access to the McDonalds Restaurant access.</p>
2	Byrnes Street / Mareeba Connection Road / Costin Street Intersection and Byrnes Street / Haren Street	TMR	<p>Second highest crash occurrence in the Mareeba CBD.</p> <p>Intersection expected to exceed LOS F for right turn movements out of Mareeba Connection Road by 2019.</p>
3	Byrnes Street / Atherton Street	TMR	<p>High occurrence of u-turning vehicle / pedestrian collisions (12 crashes including 6 pedestrian related crashes 2005 -2016).</p> <p>Upgrade to remove U-turn / pedestrian conflicts.</p>
4	Byrnes Street / Basalt Street	TMR	<p>Right turn and through movements from Basalt Street currently exceed LOS F. Observed difficulties for these movements (i.e. long times waiting for a gap in through traffic on Byrnes Street) resulting in safety issues.</p> <p>Evidenced by high occurrence of crashes of vehicles from adjacent approach, i.e. right turning vehicles colliding with through traffic (6 adjacent approach crashes out of 8, 2010-16)</p> <p>Signalised upgrade to provide control for side road movements.</p>
5	Rankin Street / Walsh Street	MSC	<p>Upgrade not required in foreseeable future based on traffic capacity of the roundabout.</p> <p>High potential for conflicts resulting from movements entering and exiting the bakery.</p> <p>Potential for upgrade to be included as a package with the Byrnes Street / Rankin Street upgrade to signals.</p>
6	Byrnes Street / Herberton Street	TMR	<p>Right turn movements from Herberton Street expected to exceed LOS F by 2027. Turning movement safety to be monitored as traffic volumes on Byrnes Street increase.</p> <p>Upgrade to be implemented if safety concerns are identified in future or crash incidence increases.</p>
7	Walsh Street / Coles and Target	MSC	<p>High potential for conflicts resulting from movements into and out of the Coles and Target</p>

Priority	Intersection	Asset Owner	Need
	Accesses		Shopping Centres. Vehicles “propped” to right turn into the Coles Shopping Centre results in queue build up during the peak periods and increased potential for rear end collisions.
8	Herberton Street / Constance Street	MSC	<p>Upgrade not required in foreseeable future based on traffic capacity of the existing intersection.</p> <p>High occurrence of crashes of vehicles from adjacent approach (6 crashes from adjacent approaches out of 7 crashes, 2005-2016).</p> <p>Existing geometry of the intersection results motorists right turning from Herberton Street “sweeping” the centre line of Constance Street and an increased potential for head on collisions.</p> <p>Common hold line for left turning and through movements from Constance Street results in an obstructed line of sight when left turning from the side road with an adjacent vehicle present.</p>
9	Mulligan Hwy / Mareeba-Dimbulah Road	TMR	Upgrade not required in foreseeable future based on for traffic capacity alone.

Appendix A

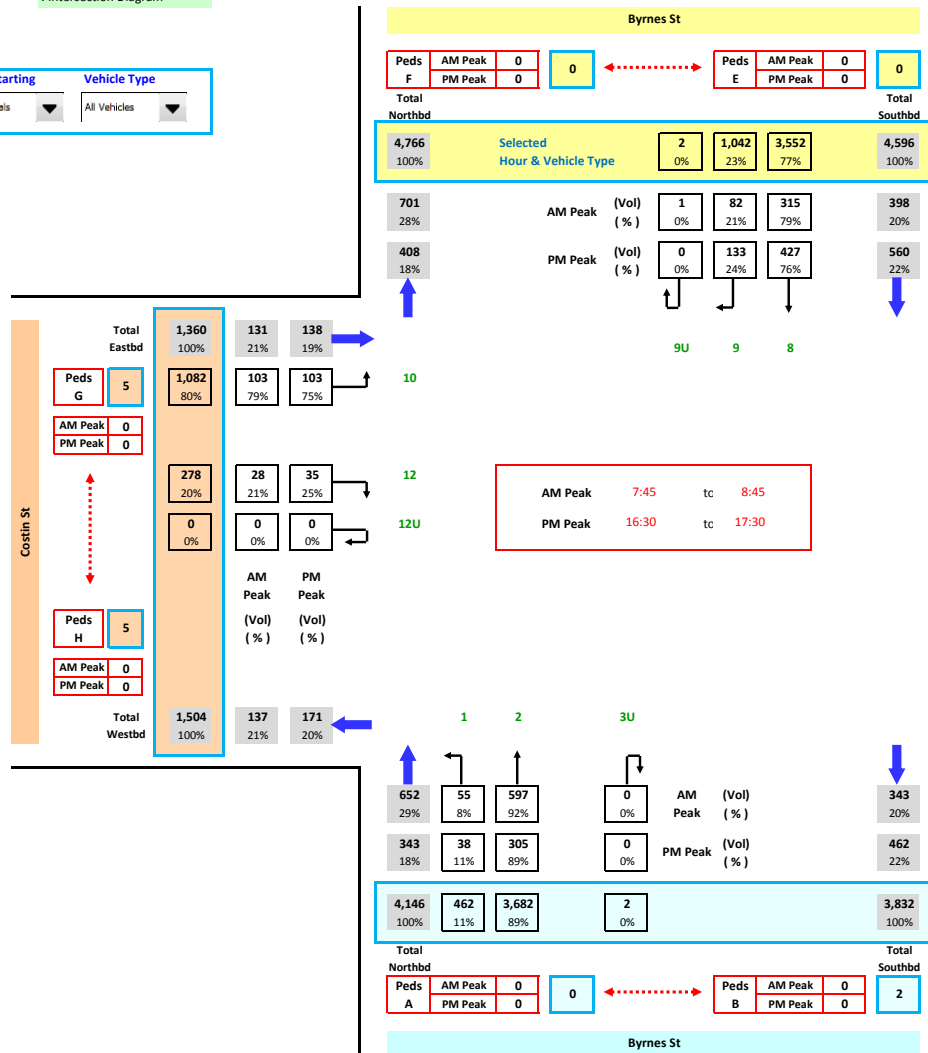
Traffic Counts

Job No. : Q1854
Client : AECOM
Suburb : Mareeba
Location : 10. Byrnes St / Costin St

Day/Date : Tue, 21st Feb 2017
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram



Hour Starting 12hr Totals Vehicle Type All Vehicles

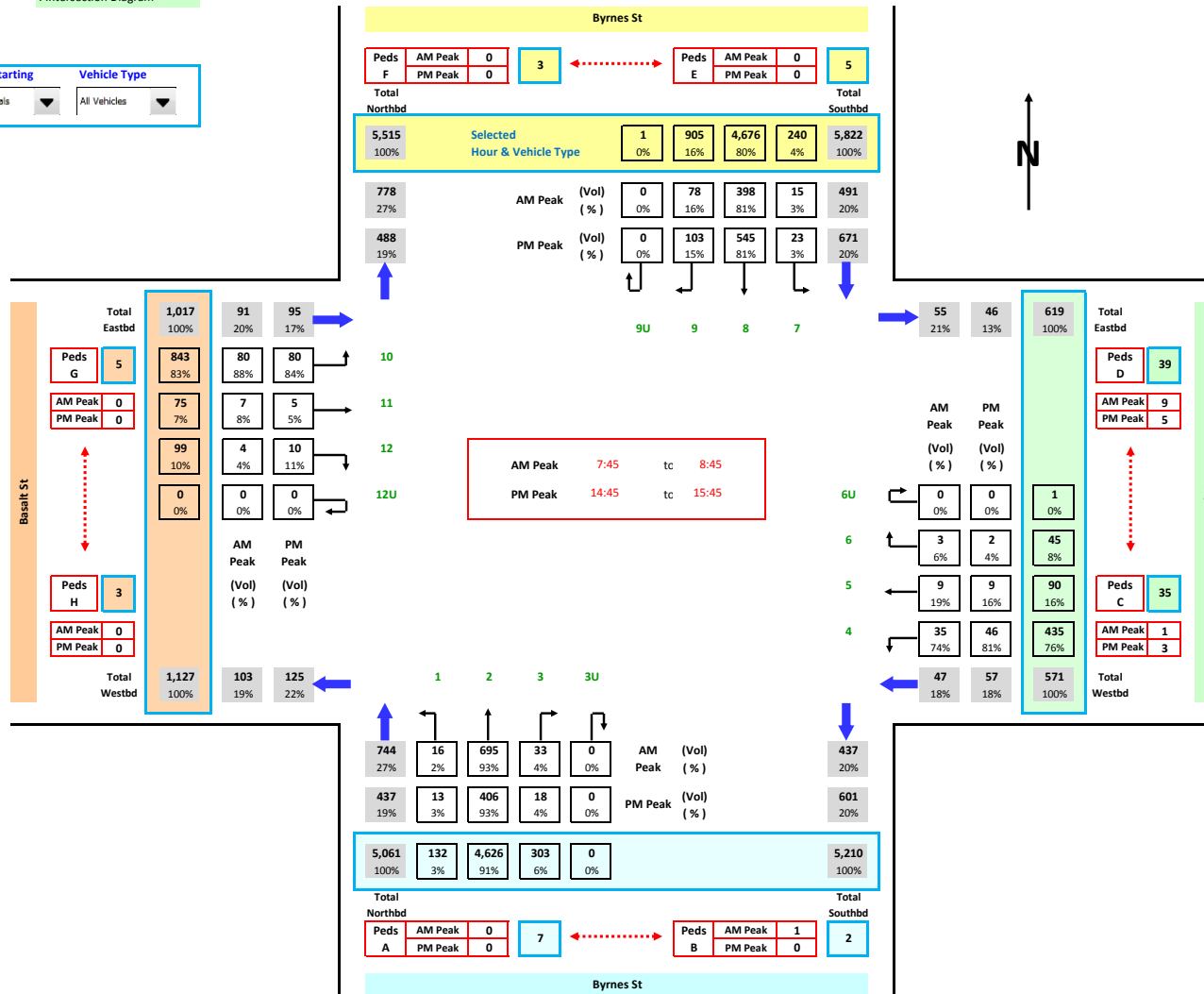


Job No. : Q1854
Client : AECOM
Suburb : Mareeba
Location : 7. Byrnes St / Basalt St

Day/Date : Tue, 21st Feb 2017
Weather : Fine
Description : Classified Intersection Count
Intersection Diagram



Hour Starting: 12hr Totals
Vehicle Type: All Vehicles

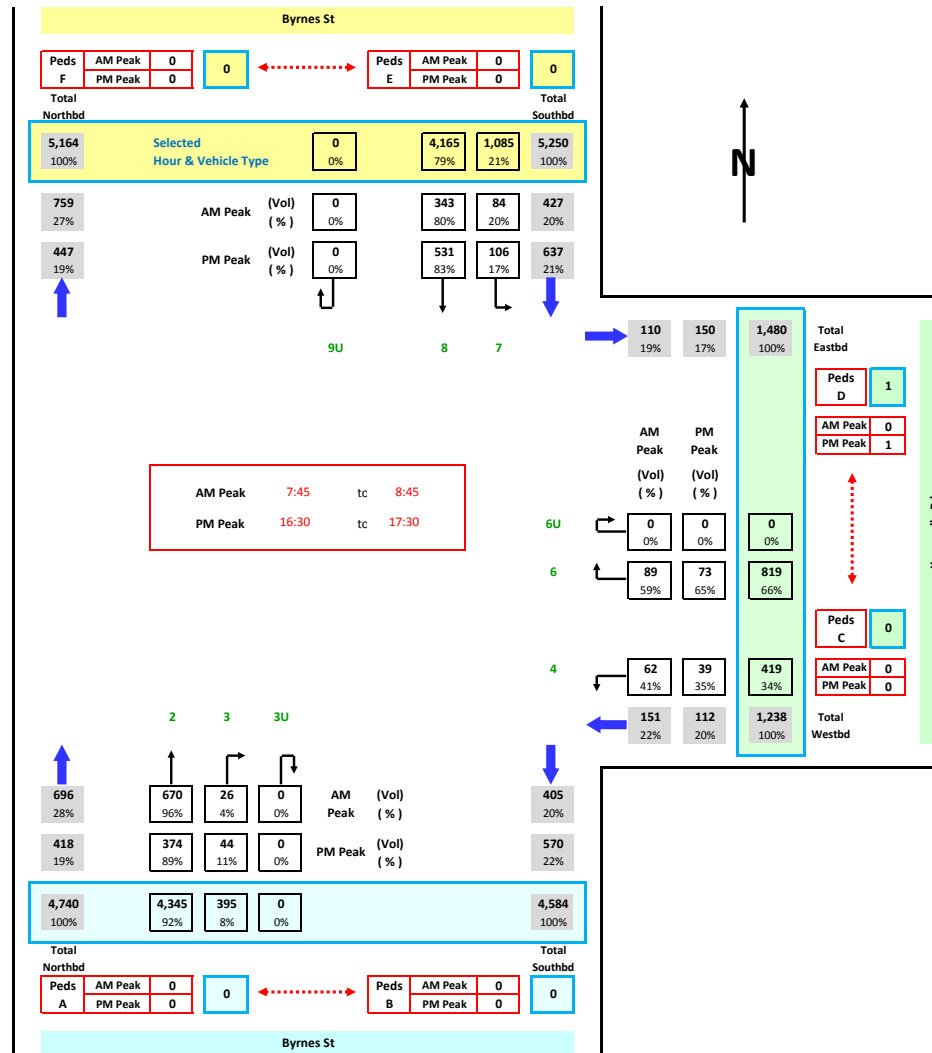


Job No. : Q1854
 Client : AECOM
 Suburb : Mareeba
 Location : 9. Byrnes St / Kenneally Rd

Day/Date : Tue, 21st Feb 2017
 Weather : Fine
 Description : Classified Intersection Count
 : Intersection Diagram



Hour Starting	Vehicle Type
12hr Totals	All Vehicles

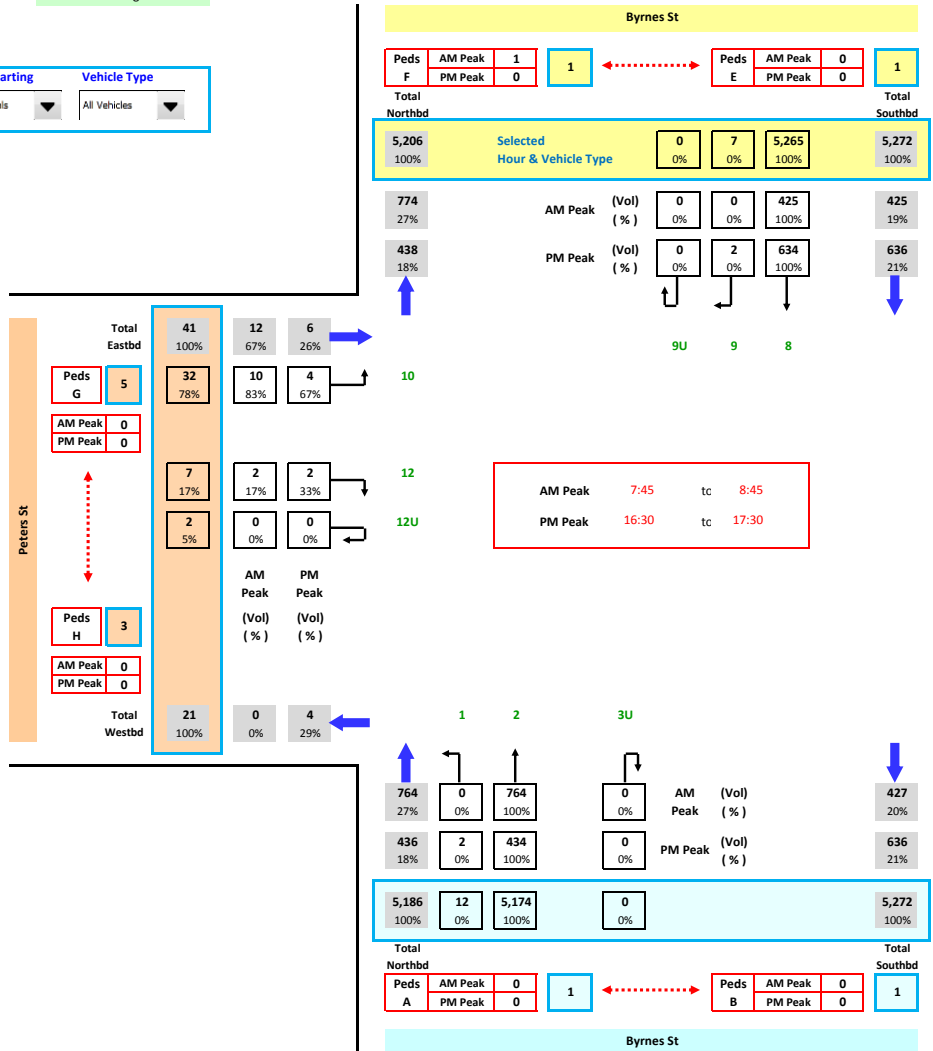


Job No. : Q1854
 Client : AECOM
 Suburb : Mareeba
 Location : 8A. Byrnes St / Peters St

Day/Date : Tue, 21st Feb 2017
 Weather : Fine
 Description : Classified Intersection Count
 : Intersection Diagram



Hour Starting: 12hr Totals
 Vehicle Type: All Vehicles

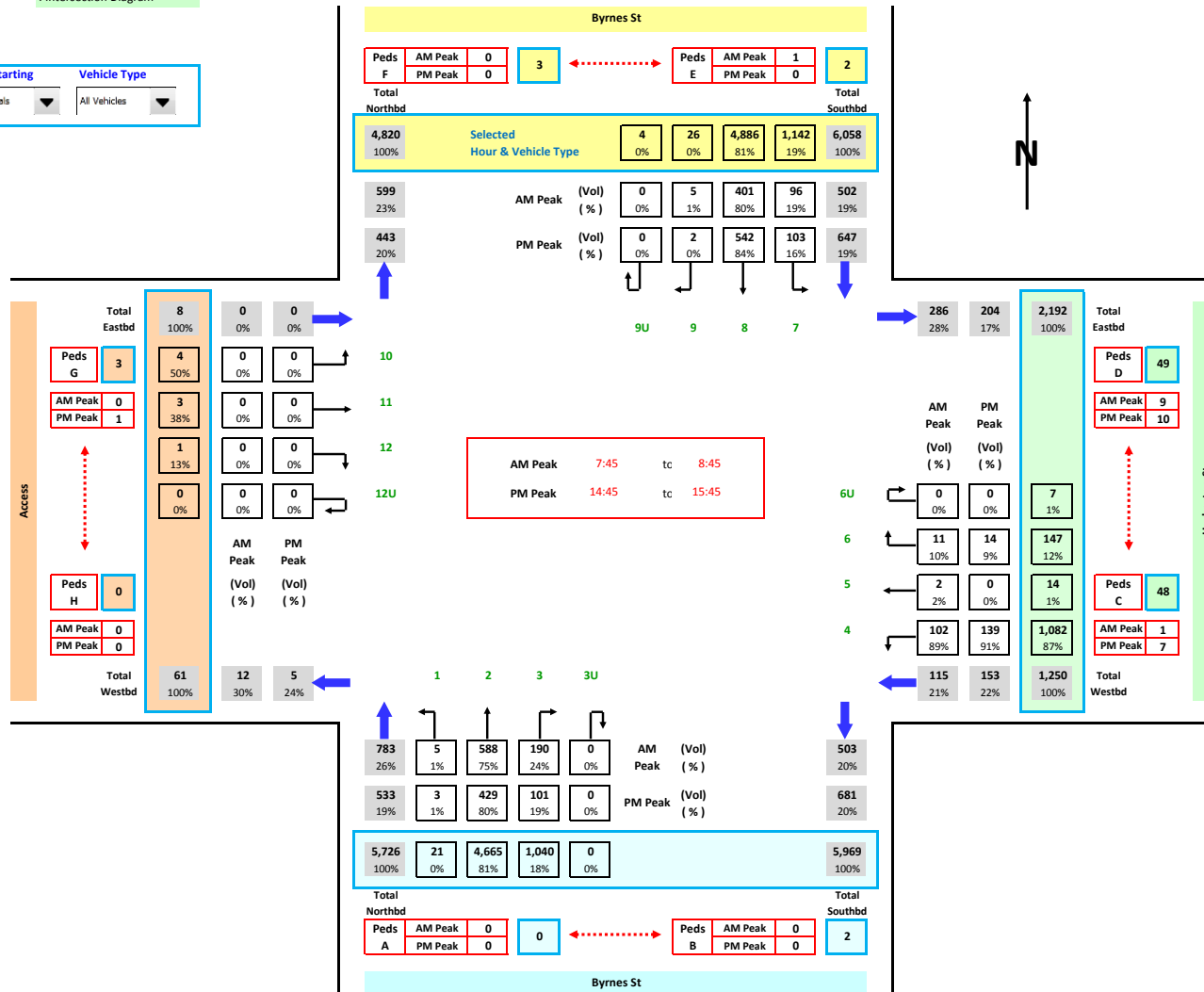


Job No. : Q1854
Client : AECOM
Suburb : Mareeba
Location : 5. Byrnes St / Herberton St

Day/Date : Tue, 21st Feb 2017
Weather : Fine
Description : Classified Intersection Count
Intersection Diagram



Hour Starting 12hr Totals Vehicle Type All Vehicles

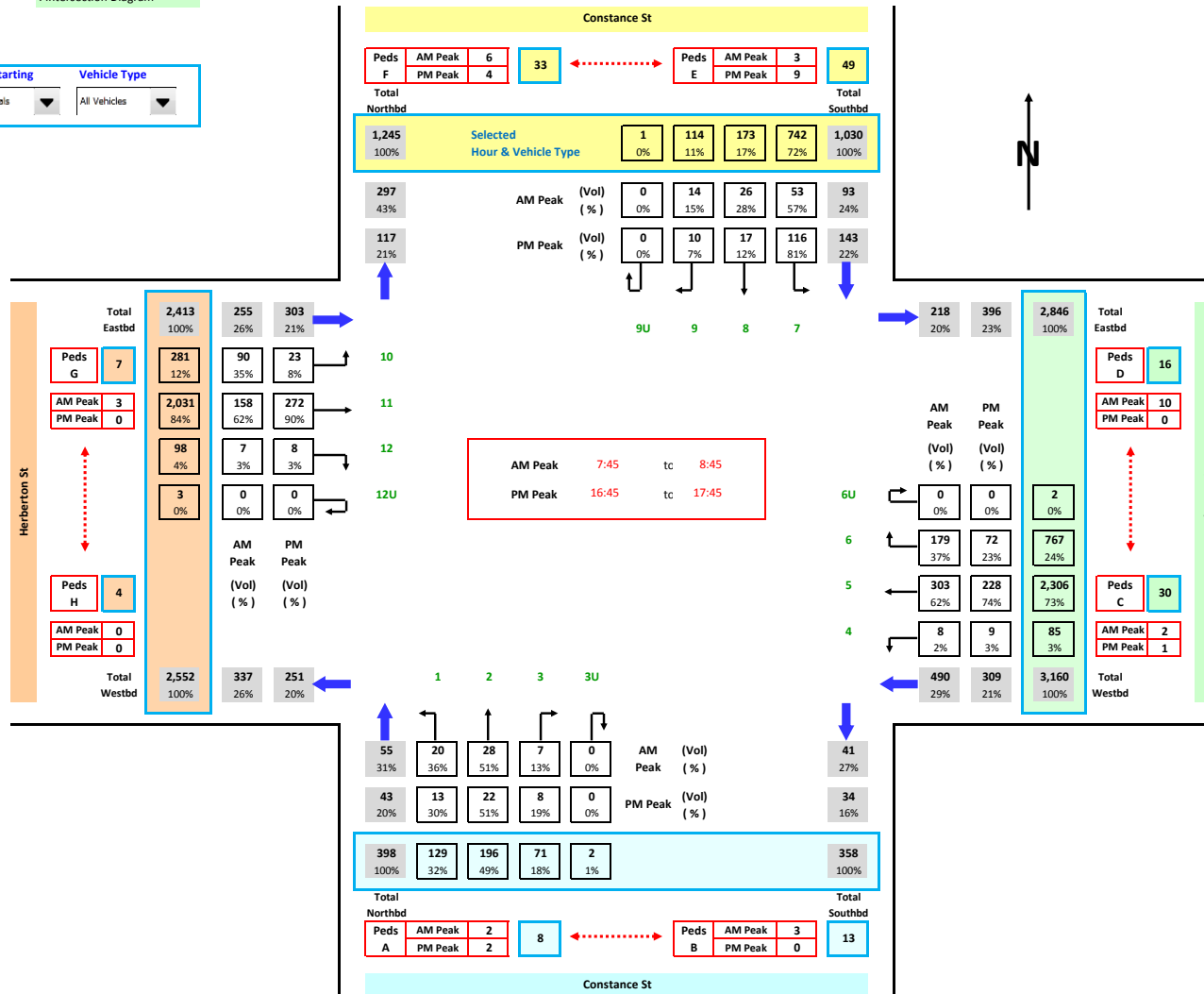


Job No. : Q1854
Client : AECOM
Suburb : Mareeba
Location : 6. Herberton St / Constance St

Day/Date : Tue, 21st Feb 2017
Weather : Fine
Description : Classified Intersection Count
Intersection Diagram



Hour Starting: 12hr Totals
Vehicle Type: All Vehicles

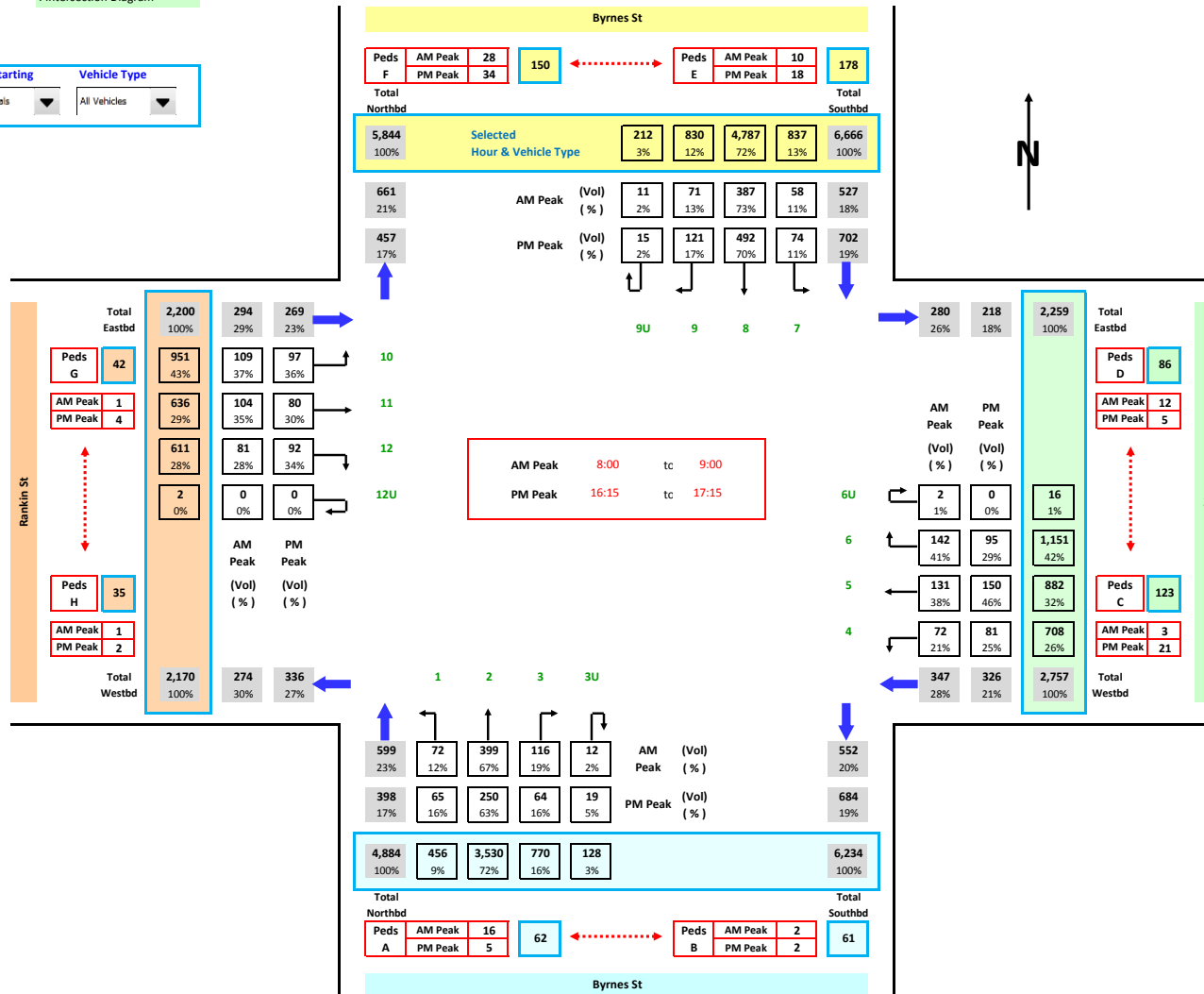


Job No. : Q1854
Client : AECOM
Suburb : Mareeba
Location : 3. Byrnes St / Rankin St

Day/Date : Tue, 21st Feb 2017
Weather : Fine
Description : Classified Intersection Count
Intersection Diagram



Hour Starting: 12hr Totals
Vehicle Type: All Vehicles

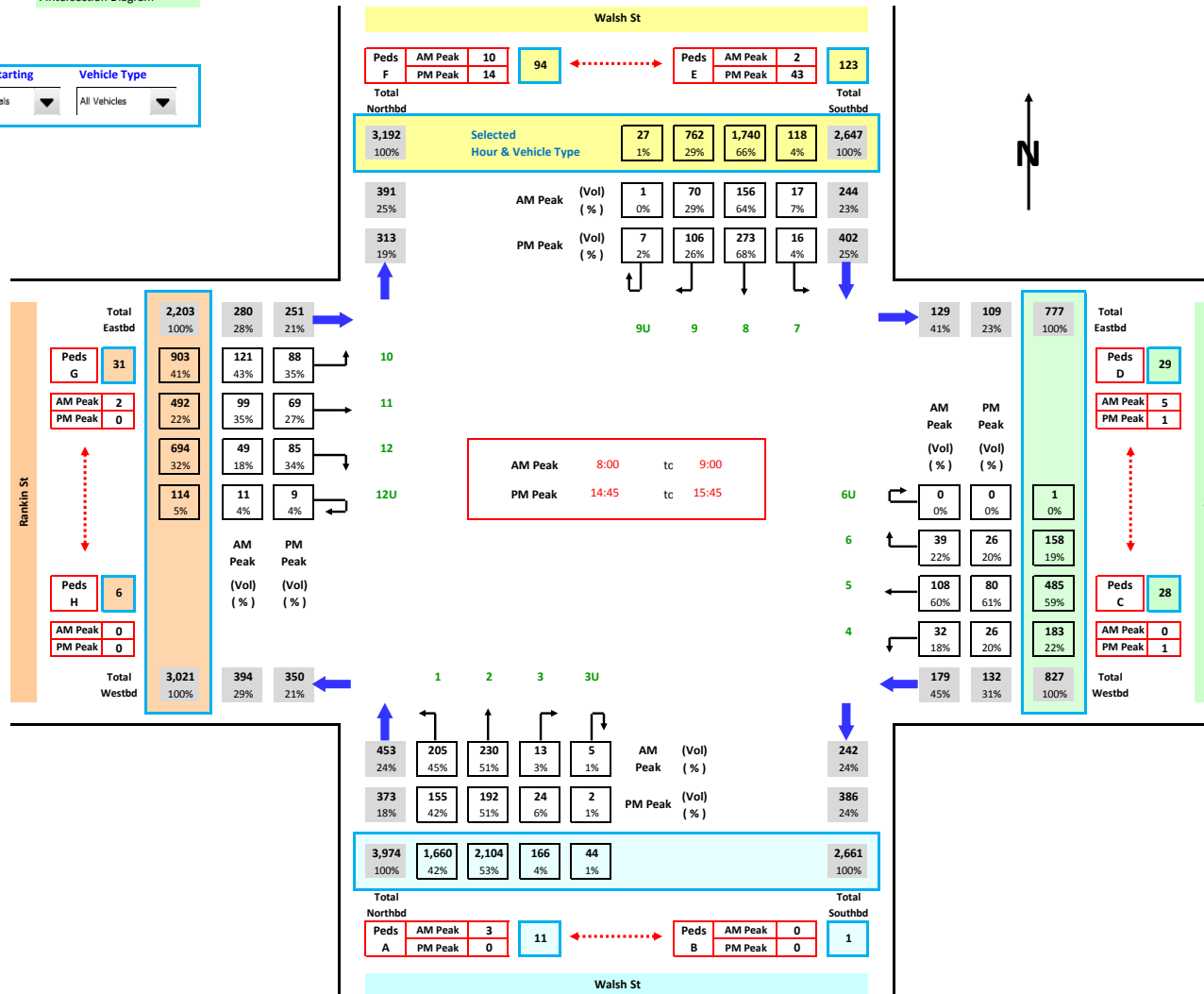


Job No. : Q1854
Client : AECOM
Suburb : Mareeba
Location : 4. Rankin St / Walsh St

Day/Date : Tue, 21st Feb 2017
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram



Hour Starting Vehicle Type
12hr Totals All Vehicles

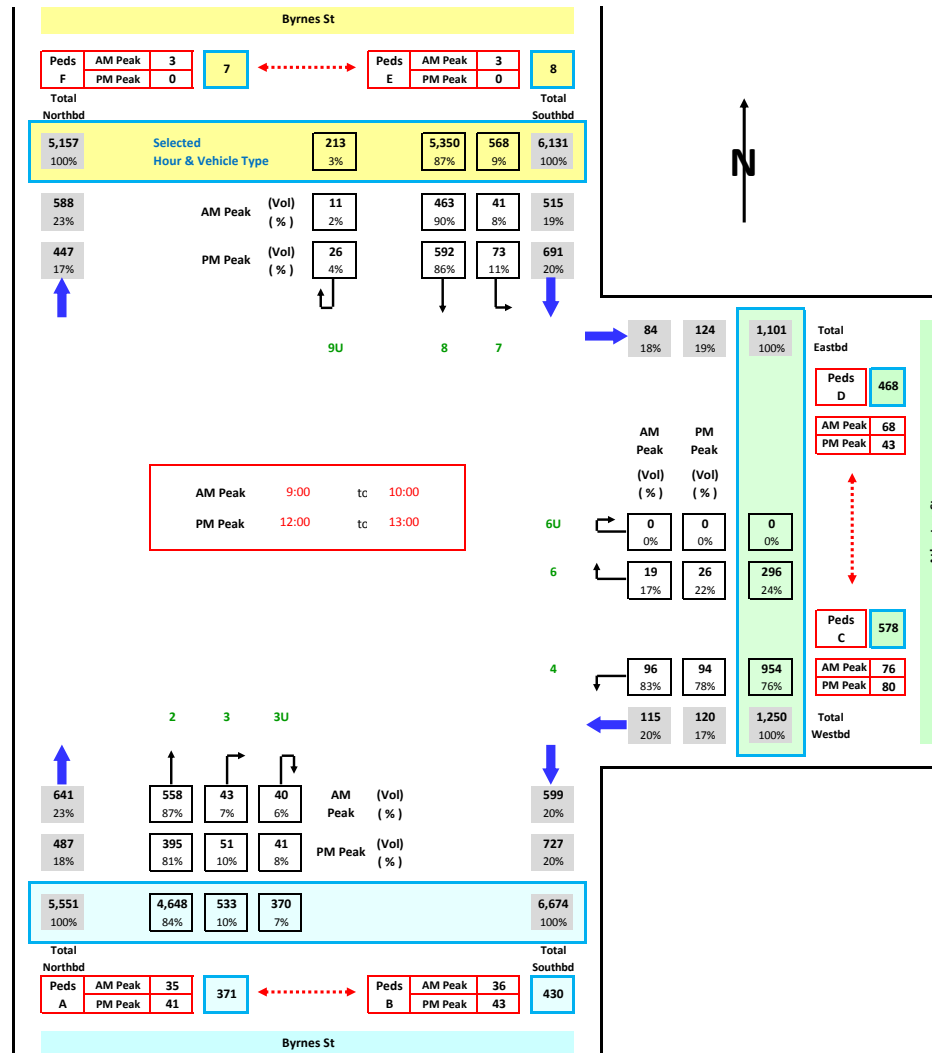


Job No. : Q1854
 Client : AECOM
 Suburb : Mareeba
 Location : 1. Byrnes St / Atherton St

Day/Date : Tue, 21st Feb 2017
 Weather : Fine
 Description : Classified Intersection Count
 : Intersection Diagram

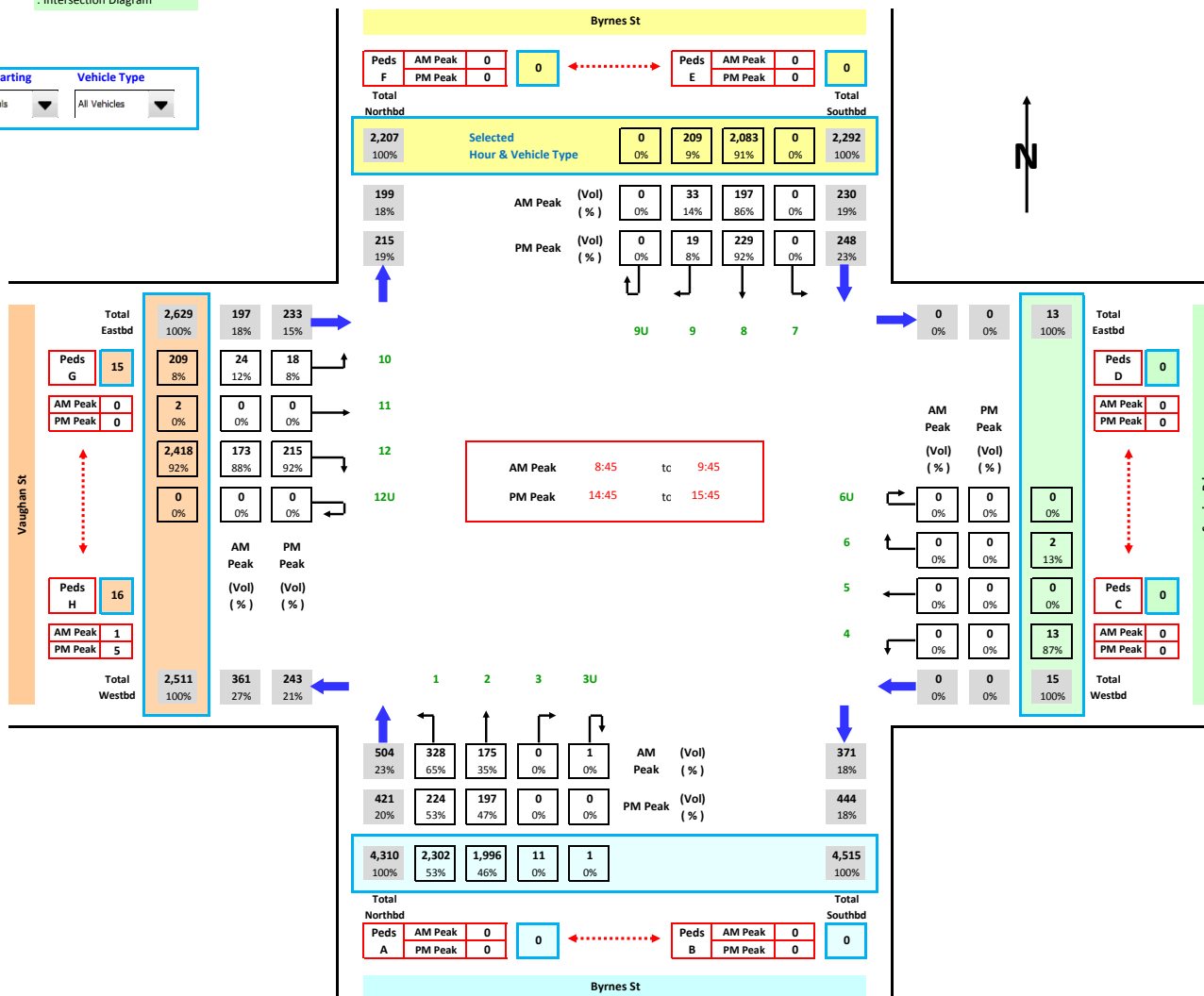


Hour Starting	Vehicle Type
12hr Totals	All Vehicles



Day/Date : Tue, 21st February 2017
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram

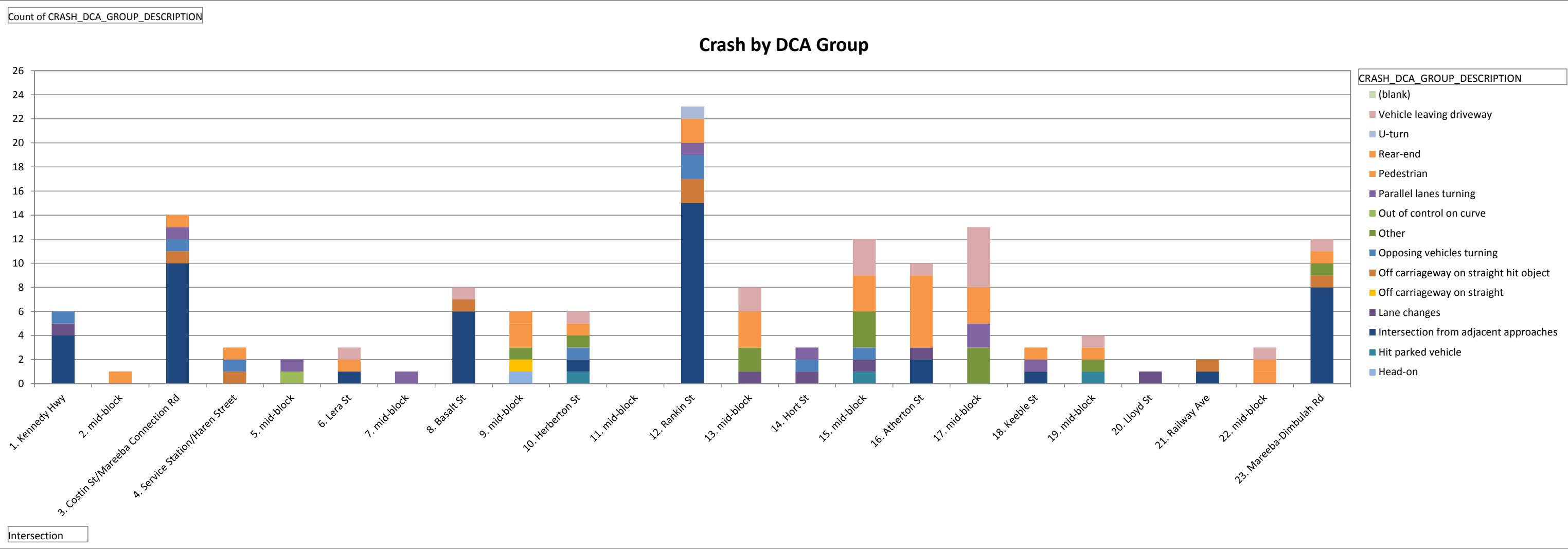
Hour Starting: 12hr Totals
Vehicle Type: All Vehicles



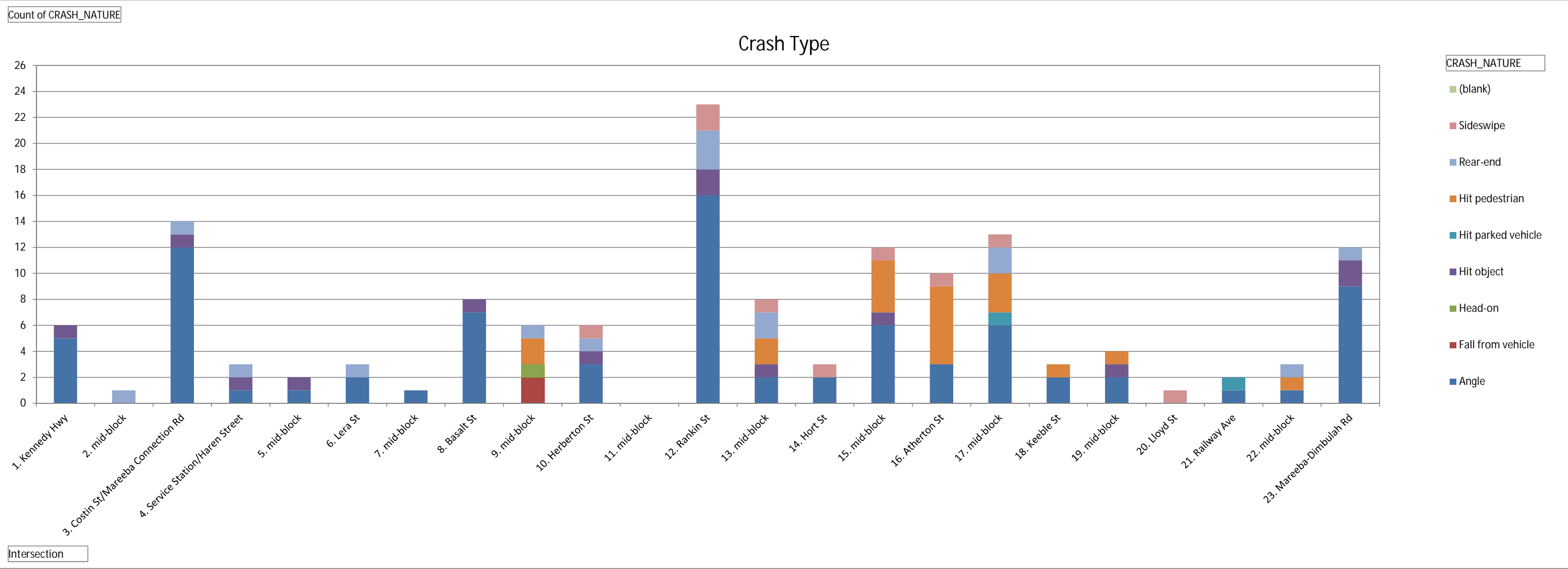
Appendix B

Crash Analysis

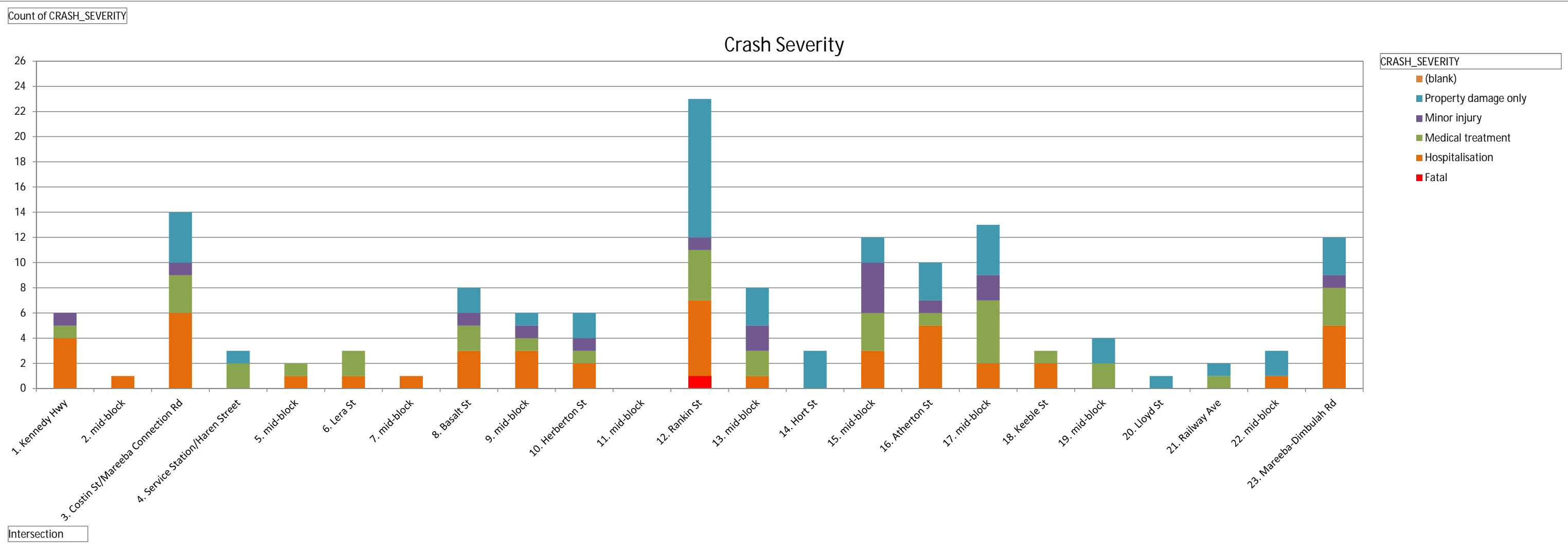
MAREEBA CBD TRAFFIC MANAGEMENT STUDY
CRASH OCCURRENCE SUMMARY
JANUARY 2005 - JUNE 2016



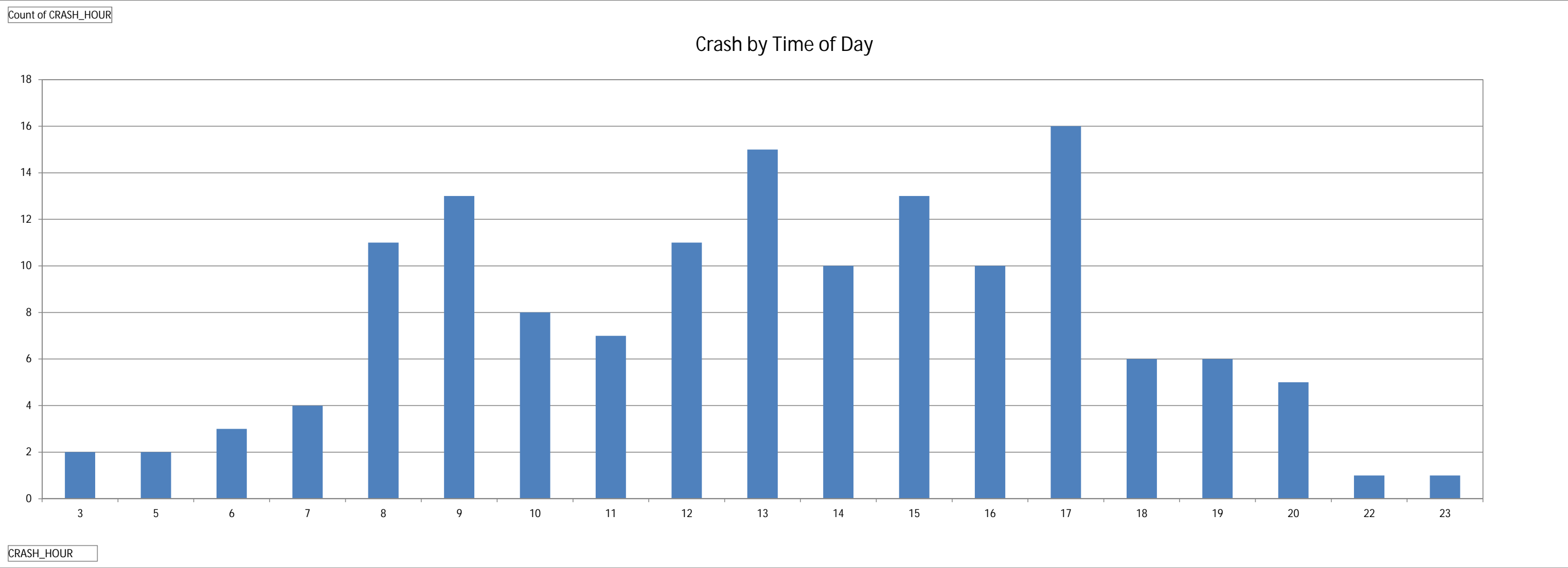
MAREEBA CBD TRAFFIC MANAGEMENT STUDY
CRASH OCCURRENCE SUMMARY
JANUARY 2005 - JUNE 2016



MAREEBA CBD TRAFFIC MANAGEMENT STUDY
CRASH OCCURRENCE SUMMARY
JANUARY 2005 - JUNE 2016



MAREEBA CBD TRAFFIC MANAGEMENT STUDY
CRASH OCCURRENCE SUMMARY
JANUARY 2005 - JUNE 2016



Appendix C

Meeting Minutes

Minutes of Meeting

Mareeba CBD Traffic Management Study

Subject	Progress Meeting No.1	Page	1
Venue	AECOM Cairns Office	Time	9:30am
Participants	Mareeba Shire Council Val Shannon (VS) Department of Transport and Main Roads Richard Evans (RE) Bernadette Dall'ozzo (BD) AECOM Australia Pty Ltd Frank D'Addona (FD) Steve Doeblen (SD) Justin Zanetich (JZ)		
Apologies	Pat White, Darryl Jones		
File/Ref No.	60535485	Date	05-Apr-2017
Distribution	As above		

No	Item	Action	Date
1.	All attendees were introduced		
2.	FD advised that the purpose of today's meeting was to outline progress on the study with both MSC and TMR officers in attendance and to outline results of the traffic analysis. FD also noted that the purpose of the meeting was to identify any additional upgrading options to be developed or required amendments to currently developed options.		
3.	FD provided an overview of crash analysis in study area and noted: <ul style="list-style-type: none">The highest number of crashes had been recorded at the Byrnes Street/Rankin Street intersection followed by Byrnes Street/Mareeba Connection Road and Mareeba-Dimbulah Road/Mulligan Highway.The highest number of pedestrian related incidences was recorded at the Byrnes Street/Atherton Street intersection.		
4.	FD provided a recap of discussions held with Mareeba Police and their experience regarding traffic and safety issues in the Mareeba CBD: <ul style="list-style-type: none">The angle parking along Byrnes Street can be difficult to back out from due to limited visibility to oncoming traffic. Many motorists are forced to rely on reflections		

No	Item	Action	Date
	<p>from the shop front mirrors to determine when gaps are in the Byrnes street flow.</p> <ul style="list-style-type: none"> • Centre parking can be problematic if motorists are not cautious when exiting these parks to ensure sufficient gaps in oncoming flow are present. Some motorists have also been observed reversing out of the centre parking. • A heavy vehicle bypass of Byrnes Street would be desirable to remove these vehicles from Byrnes Street, particularly those carting refuse to the Mareeba Land Fill. • Consideration would need to be given to the possible redistribution of traffic away from any new traffic signal installations due to the public not being used to signalised intersection in the township. <p>VS also noted that:</p> <ul style="list-style-type: none"> • Due to the wide circulating width at the Rankin Street Roundabout, some motorists would still treat it as a two lane roundabout even though it was now a single lane roundabout. • While TMR had previously considered reducing Byrnes Street to one way in each direction, the level of opposition from both the Mareeba Chamber of Commerce and the local Councillors had meant it was not an option that would be accepted by the majority of the public. • Any loss of on street parking is a major issue even when significant community consultation has been carried out to inform the public of removal of parking bays for other amenities. • While the reduction of Byrnes Street to single lane flow in each direction should be discussed in the report, it would need to be noted that previous discussions of this matter with TMR had revealed the very strong objection to this arrangement being implemented. 		
5.	<p>The various upgrading options developed to date were tabled for discussion with all parties. Key issues raised are outlined below:</p> <p>Basalt Street/Byrnes Street</p> <ul style="list-style-type: none"> • The current through and right turn movements from Basalt Street currently operate at LOS E and F. • To accommodate these through and right turn movements with a 'X' arrangement, traffic signals would be required. • While through and right turn movements could be banned, the 'X' arrangement would still result in a land impact on the proposed new retail site at the corner of the intersection. • A roundabout arrangement can be accommodated at the site without impacting the proposed retail site. A 2.5m verge width should be investigated to minimise/remove any impact to the existing private 	AECOM	

No	Item	Action	Date
	<p>lots at the other corners of the intersection.</p> <ul style="list-style-type: none"> RE noted that small diameter roundabouts are generally not desirable on state controlled roads due to the difficulties in safely accommodating cyclists in conjunction with heavy vehicle movements (such as b-doubles). FD noted that an additional signalised arrangement would be developed that accommodated the left and through movements from the sides roads through the signals (in lieu of having high entry free left turn lanes). This would reduce the footprint of the intersection but may also reduce the design life. Analysis with SIDRA would be undertaken to determine the design life impact. <p>Herberton Street/Byrnes Street</p> <ul style="list-style-type: none"> Signalised arrangement required to accommodate right and through movements during the peak periods. Provision of high entry free left turn results in a land impact to the vacant block which has recently been purchased by Charter Hall and will likely be used to expand the parking area at the Coles Shopping Centre Complex. Provision of a dedicated left turn from Byrnes Street onto Herberton Street also results in a land impact to the corner of the Mobil Service station where a large illuminated advertising sign is located. FD noted that an alternative arrangement would be developed that provided for the left turn from Herberton Street through the signals and also combined the left and through turn manoeuvres into a single signalised lane. This should eliminate the needs for any land acquisitions. Analysis with SIDRA would be undertaken to determine any reductions to design life associated with this arrangement. <p>Rankin Street/Byrnes Street</p> <ul style="list-style-type: none"> Two options developed. One which included a median along Rankine Street which would disallow right turn movements into the McDonalds Restaurant and drive through. The other provided for right turn movements via a break in the median. SD noted that the size of the break would not currently allow a vehicle to store fully with the back of the vehicle protruding into the through lane. SD also noted that this arrangement would be modified such that a right turning vehicle would not block through traffic on Rankin Street. VS noted that the change to the parking area on the western side of Byrnes Street was undesirable as vehicles would be reversing into through flow. Given this area is generally used by larger vehicles such as Winnebago's, this would be undesirable. SD advised that the exit point would be brought closer to the Rankin Street intersection which would 	<p>AECOM</p> <p>AECOM</p> <p>AECOM</p>	

No	Item	Action	Date
	<p>allow parallel parking to be implemented with bays within the parking area.</p> <p>Walsh Street/Coles and Target Accesses</p> <ul style="list-style-type: none"> Option developed that banned right turn movements into the Coles and Target Shopping Centres. This would remove vehicles propping in through lanes which a cause of queuing back through the roundabout and creates the potential for conflicts. VS noted that an option should be developed that does provide for right turn movements via a dedicated right turn slot. This would inform any discussion with the shopping centres in terms of impacts associated with provision of the turn lanes i.e. loss of parking bays on Walsh Street etc. <p>Walsh Street/Rankin Street</p> <ul style="list-style-type: none"> Existing roundabout geometry does not provide sufficient deflection to slow vehicles using the intersection. Also no provisions for pedestrians crossing at the site. Option developed that adjusts position of the centre island and provides the required deflection. Option also disallows right turn movements into the bakery from Rankin Street and right turn manoeuvres from the bakery exit onto Walsh Street. Both these manoeuvres have a high conflict potential. Provision of cyclist facilities does however impact the angle parking bays at fronting the Council Offices. VS noted that due to the limited number of cyclists using this intersection, the impact to the parking was undesirable. SD noted that provision for cyclists at the realigned roundabout would be examined further to reduce the impact to the parking. 	<p>AECOM</p> <p>AECOM</p>	
6.	<p>Options Workshop</p> <ul style="list-style-type: none"> FD noted that once the options had been finalised based on the comments received today an options workshop would be held to determine the preferred upgrading solutions and the proposed upgrading staging. FD advised that the Mareeba Police had expressed an interest in attending the workshop RE noted that TMR officers would also be in attendance. VS noted that the workshop would also be attended by Mareeba Shire Councillors so gain their inputs before the report was finalised. FD advised that the timing for the workshop would be confirmed once all the options were completed. 		

Meeting closed 11:30am

Minutes of Meeting

Mareeba CBD Traffic Management Study

Subject	Traffic and Road Safety Issues Meeting	Page	1
Venue	Mareeba Shire Council Works Depot Kowa Street	Time	9:00am
Participants	Mareeba Shire Council Pat White (PW) Val Shannon (VS) Mareeba Police John Ridgway (JR) Derek Garner (DG) AECOM Australia Pty Ltd Frank D'Addona (FD) Steve Doeblen (SD)		
Apologies			
File/Ref No.	60535485	Date	22-Mar-2017
Distribution	As above		

No	Item	Action	Date
1.	All attendees were introduced.		
2.	<p>FD provided an outline of the background to the study and noted:</p> <ul style="list-style-type: none">Commission was being undertaken for both Mareeba Shire Council (MSC) and the Department of Transport and Main Roads (TMR).TMR's interest was due to Byrnes Street being a state controlled road. <p>VS added that MSC's need for the study has stemmed from traffic and safety issues associated with:</p> <ul style="list-style-type: none">Right turn into and right turn out of the Coles Shopping Centre access on Walsh Street.Vehicles "propped" on Walsh Street to right turn into Coles causing queuing back through the Walsh Street/Rankin Street Roundabout during peak times.Right turn into Curcio's Bakery from Rankin StreetRight turn out of Curcio's Bakery onto Walsh StreetVery high pedestrian movements across Byrnes Street on the northern side of the Rankine Street Roundabout due to the McDonalds Restaurant located on the eastern side on the intersection.Queuing of vehicles, including school buses, through the Byrnes Street/Rankin Street Roundabout during peak times.		

No	Item	Action	Date
	<ul style="list-style-type: none"> Difficulty in crossing Byrnes Street at the intersection with Basalt Street as well as right turning onto Byrnes Street from either the eastern or western sides of Basalt Street during peak periods. Difficulty in right turning from Herberton Street onto Byrnes Street during peak periods. Users of the staggered Costin Street/Mareeba Connection Road intersection with Byrnes Street do not use the northbound merge properly. Arrangement also requires motorists from Mareeba Connection Road to turn across multiple lanes to enter Costin Street. This is especially problematic for heavy vehicles. 		
3.	<p>FD provided an outline of the methodology for delivering the study and noted:</p> <ul style="list-style-type: none"> Traffic counts at the various intersections completed Analysis of the intersections with SIDRA was underway to determine current and future year performance Upgrading layouts were being developed to address the current geometric and safety issues at the intersections. An options workshop would be held with key stakeholders to present the options developed and to determine a preferred arrangement. 		
4.	<p>FD tabled the results of the crash analysis and noted:</p> <ul style="list-style-type: none"> Data used obtained from TMR's Data Analysis Unit (DAU) back to 2005. Property damage only incidences were not recorded after 31 December 2010. Fatality incidences were current to 31 October 2016 Non-fatal casualties were current to 30 June 2016 Property damage crashes were current to 31 December 2010 Property damage crashes were no longer being recorded by the DAU and this was the reason no records were available after December 2010. The highest number of crashes had been recorded at the Byrnes Street/Rankin Street intersection followed by Byrnes Street/Mareeba Connection Road and Mareeba-Dimbulah Road/Mulligan Highway. The highest number of pedestrian related incidences was recorded at the Byrnes Street/Atherton Street intersection. 		
5.	<p>Local experience with problem areas within the study area was discussed by all the attendees. The following was raised:</p> <ul style="list-style-type: none"> The angle parking along Byrnes Street can be difficult to back out from due to limited visibility to oncoming traffic. VS advised that convex mirrors had been considered, however the posed a problem with distance perception. JR queried if reverse angle parking had been 		

No	Item	Action	Date
	<p>considered along Byrnes Street. VS note that it hadn't however the likelihood of incidences occurring due to the required reversing was still high.</p> <ul style="list-style-type: none"> SD noted that the angle of the parking could be reduced however this would significantly reduce the number of spaces and may draw objections from the local business fronting Byrnes Street. Several of the intersections were configured with hold bat for the left, through and right turn lanes at the same position. This resulted in the left turning motorists having their line of sight to oncoming traffic obstructed if a vehicle was in the adjacent lane. Existing roundabouts generally don't accommodate cyclists well especially where b-doubles were also present. 		
6.	<p>An overview of the typical intersection treatments developed to date was tabled. The following was noted:</p> <ul style="list-style-type: none"> A concept layout at the Mareeba Connection Road intersection with Byrnes Street allowed for the upgrading of the sweeping free left turn to a high entry treatment. DG noted that the existing turn lane posed no issues and should be left in its current configuration. This was supported by VS and JR. A 'X' arrangement which realigned the Mareeba Connection Road opposite Costin Street was tabled. All parties agreed this was a preferable arrangement and would better accommodate heavy vehicle movements onto Costin Street. Upgrading arrangements at Basalt Street that impact on the proposed new shopping development on the north east corner may not be possible as the developer may have already been conditioned. VS advised that the matter should be discussed with Brian Millard (BM). VS note that some of the Councillors had expressed their desire for the Basalt Street intersection to be upgraded to a roundabout. FD noted that a roundabout configuration would be developed to determine if there was sufficient road reserve to accommodate it. VS noted that any arrangement at the Constance Street/Herberton Street intersection would need to ensure that the small engine shop at the corner were still provided with shop front parking as this is used for the loading and unloading of mowers, quads, motorbikes etc. 	<p>AECOM to revised layout to maintain existing sweeping left</p> <p>AECOM to discuss the matter with BM</p> <p>AECOM to develop r/bout layout</p>	
7.	<p>The meeting was opened to any other matters that the attendees wanted to raise.</p> <ul style="list-style-type: none"> JR advised that the introduction of a new signalised intersection would likely result in motorists avoiding the site. While this might be a short term issue until the public become familiar with the operation of the signals, it could results in impacts at other intersections due to the traffic redistribution. FD noted that the analysis at the other impacted sites 	<p>AECOM to test</p>	

No	Item	Action	Date
	<p>could be tested in SIDRA to determine the impacts of additional traffic flows.</p> <ul style="list-style-type: none"> JR asked if a heavy vehicle bypass of had been considered via the use of Railway Avenue on the western side of Byrnes Street. VS noted that Railway Avenue did not currently extend through to Rankin Street and no road reserve currently existed south of the ANZ Bank carpark access. While the railway reserve could be used in the future to complete the link, the line was still active and insufficient width existed to establish a road reserve in addition to the live railway corridor. DG asked if it would be possible to obtain a copy of the traffic counts completed for the study. VS advised that FD would issue these. 	<p>redistribution of traffic.</p> <p>AECOM to issue copy of counts to DG</p>	
8.	<p>FD outlined where the study was progressing to from this point on and advised:</p> <ul style="list-style-type: none"> Traffic analysis was still ongoing to inform the development of the upgrading options. A progress meeting with TMR in attendance was planned for early April to outline work undertaken to date and to determine if TMR wanted further options investigated on Byrnes Street. On completion of the upgrading option and traffic analysis, an options workshop was planned with MSC and TMR and possibly Councillors in attendance. FD noted that JR and DG would be invited to this workshop. The aim of this workshop would be to determine the preferred upgrading solutions through the CBD. After the workshop, a report would be completed to document the study methodologies and outcomes. 		

Meeting closed 11:00am

Minutes of Meeting

Mareeba CBD Traffic Management Study

Subject	Options Workshop	Page	1
Venue	Mareeba Shire Council Chambers	Time	11:00am
Participants	Mareeba Shire Council (MSC) Peter Franks Councillors Pat White Val Shannon Department of Transport and Main Roads (TMR) Darryl Jones Richard Evans Mareeba Police (MP) Derek Garner AECOM Australia Pty Ltd (AECOM) Michael Arri Frank D'Addona Steve Doeblen		
Apologies	John Ridgway (Mareeba Police)		
File/Ref No.	60535485	Date	17-May-2017
Distribution	As above		

No	Item	Action	Date
1.	All attending parties were introduced and it was noted that in addition to MSC Officers and Councillors, TMR Officer and AECOM staff were also in attendance. It was also noted that AECOM were the engineering consultant commissioned to deliver the traffic management study.		
2.	AECOM outlined the project background and noted: <ul style="list-style-type: none">Study jointly funded by MSC and TMR.Initiated by MSC due to concerns with pedestrian and vehicular intersection on the local road networkExpanded in consultation with TMR to include various intersections along that state controlled network within Mareeba i.e. Byrnes Street and the intersection of Mareeba-Dimbulah Road/Mulligan Highway.		
3.	AECOM provided an outline of the current traffic issues within the study area along with current demands. It was noted that:		

No	Item	Action	Date
	<ul style="list-style-type: none"> The existing angle parking along Byrnes Street did not currently have a buffer between the parking and the through lanes which was causing site distance issues when reversing. The cross section would need to be widening by 2m to accommodate the required buffer and the desirable though lane widths. The Byrnes Street/Rankin Street roundabout was accommodating the highest demands with the study area with approximately 15,000vpd on the northern side of the intersection and 6,000vpd on the eastern and western approaches. The roundabout was also currently servicing approximately 700 pedestrians from 6:00am to 6:00pm. Walsh Street was currently accommodating 7,000vpd with the Rankin Street intersection currently servicing just over 200 pedestrians between 6:00am and 6:00pm on the northern approach. 		
4.	<p>AECOM provided a review of the options developed to date. Based on the comments received from the attendees, the following amendments and new arrangements are to be considered:</p> <ul style="list-style-type: none"> Byrnes Street/Rankin Street – Include options for left turn movements through the signals to provide full control for pedestrian movements. While free left turn will provide more traffic capacity, left turns through the signals are also to be considered due to the high pedestrian demands at the site. Byrnes Street/Rankin Street – Southbound merge on Byrnes Street shifted back to current location to avoid merging movements in front of Coles Shopping Centre access. Walsh Street/Coles and Target Shopping Centre accesses – Centre median is desirable to disallow right turn movements across Walsh Street traffic. Rationalisation of separate entry and exit movements to Target carpark to a single access. Hybrid arrangement to be developed. 	AECOM	
5.	<p>AECOM provided an overview of the methodology that would be adopted to assess the options with the aim of developing a preferred option at each site and noted options would be addressed against criteria such as:</p> <ul style="list-style-type: none"> Design life Provision for pedestrians Provision for cyclists Parking impacts Re-use of existing road asset Property impacts Relative estimated cost <p>AECOM also advised that the options assessment would be undertaken in close consultation with MSC and TMR</p>	AECOM	

No	Item	Action	Date
	to ensure the preferred solution meets the expectations of each stakeholder.		
6.	<p>AECOM provided an overview of how the study would now be progressed to completion. This included:</p> <ul style="list-style-type: none"> • Refine preferred options where required • Complete options assessment to determine preferred solution at each site • Complete upgrade staging plan • Complete planning report 	AECOM	
7.	<p>TMR noted that the options on the state controlled network would be examined further and inputs provided to the options assessment. TMR also noted that at this stage no funding has been allocated to any upgrades along Byrnes Street, however it would be possible to apply for Safer Roads Sooner (SRS) and Blackspot funding for some of the upgrades, depending on crash history.</p>		

Meeting closed : 12:30pm

Appendix D

Existing Intersection Traffic Performance

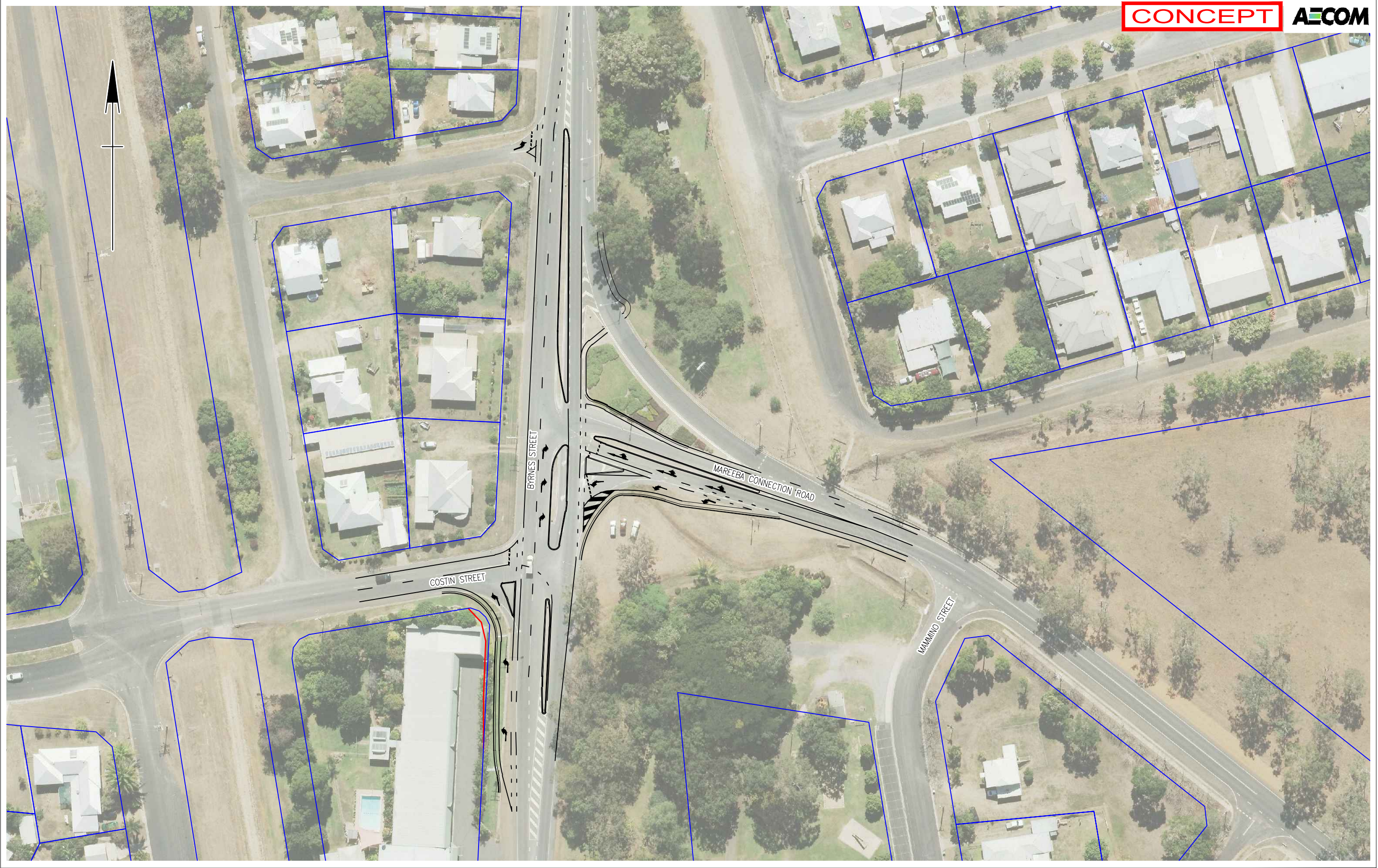
Appendix D Existing Intersection Traffic Performance

Intersection	Performance
Byrnes Street / Rankin Street Existing Roundabout	2017 AM <ul style="list-style-type: none"> LOS B (intersection) DOS 0.73 Worst queue: 66m, northbound through
	2017 PM <ul style="list-style-type: none"> LOS B (intersection) DOS 0.74 Worst queue: 72m, southbound through
	2022 AM (end of design life) <ul style="list-style-type: none"> LOS C (intersection) DOS 0.85 Worst queue: 105m, northbound through <p>Note: northbound through reaches DOS 1.00 by 2027</p>
	2022 PM (end of design life) <ul style="list-style-type: none"> LOS D (intersection) DOS 0.85 Worst queue: 110m, southbound through <p>Note: Rankin Street approach exceeds LOS E by 2024</p>
Byrnes Street / Herberton Street Existing priority 'T' intersection	2017 AM <ul style="list-style-type: none"> LOS D (right turn from Herberton St or carpark access) DOS 0.32
	2017 PM <ul style="list-style-type: none"> LOS D (right turn from Herberton St or carpark access) DOS 0.30
	2027 PM (end of design life) <ul style="list-style-type: none"> LOS F (right turn from Herberton St or carpark access) DOS 0.39
	2032 PM (end of design life) <ul style="list-style-type: none"> LOS F (right turn from Herberton St or carpark access) DOS 0.43
	<p>Note: while volumes right turning out of Herberton Street are low, difficulties have been observed for this movement during peak periods due to high volume on Byrnes Street. Design life of the intersection would be significantly impacted by increased traffic entering from the access (carpark) opposite Herberton Street. It is expected that signalisation would be required if any additional development were to occur opposite Herberton Street.</p>
Byrnes Street / Basalt Street Existing priority 4-way 'X' intersection	2017 AM <ul style="list-style-type: none"> LOS F (right turn from Basalt Street east and west) LOS E (through from Basalt Street east and west) DOS 0.39
	2027 PM <ul style="list-style-type: none"> LOS E (right turn from Basalt Street east and west) LOS D (through from Basalt Street east and west) DOS 0.31
	<p>Note: The intersection is currently exceeding LOS triggers for upgrade or treatment. Difficulties (i.e. long times waiting for a gap in through traffic on Byrnes Street) turning out of Basalt Street have been observed during the peak periods, confirming LOS F returned from the SIDRA analysis.</p>

Intersection	Performance
Byrnes Street / Mareeba Connection Road / Costin Street Existing priority 'staggered T' intersection	2017 AM <ul style="list-style-type: none"> LOS E (right turn from Mareeba Connection Road) DOS 0.69 – Mareeba Connection Road 'T' LOS C (right turn from Costin Street) DOS 0.36 – Costin Street 'T'
	2017 PM <ul style="list-style-type: none"> LOS D (right turn from Mareeba Connection Road) DOS 0.46 LOS C (right turn from Costin Street) DOS 0.23 – Costin Street 'T'
	2019 PM (end of design life) <ul style="list-style-type: none"> LOS F (right turn from Mareeba Connection Road) DOS 0.80
	2025 PM (end of design life) <ul style="list-style-type: none"> LOS F (right turn from Mareeba Connection Road) DOS 0.76
Herberton Street / Constance Street Existing priority 4-way 'X' intersection	2017 AM <ul style="list-style-type: none"> LOS A or B (all movements) DOS 0.31
	2017 PM <ul style="list-style-type: none"> LOS A or B (all movements) DOS 0.19
	2032 AM <ul style="list-style-type: none"> LOS C (right turn from Constance Street north and south) DOS 0.42
	2025 PM (end of design life) <ul style="list-style-type: none"> LOS C (right turn from Constance Street north and south) DOS 0.26
	Note: design life not reached within 15 years (i.e. 2017 to 2032)
Rankin Street / Walsh Street Existing roundabout	2017 AM <ul style="list-style-type: none"> LOS A or B (all movements) DOS 0.50
	2017 PM <ul style="list-style-type: none"> LOS A or B (all movements) DOS 0.19
	2032 AM <ul style="list-style-type: none"> LOS A or B (all movements) DOS 0.7
	2032 PM (end of design life) <ul style="list-style-type: none"> LOS A or B (all movements) DOS 0.6
	Note: design life not reached within 15 years (i.e. 2017 to 2032)

Appendix E

Concept Options



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MAREEBA CBD TRAFFIC STUDY
BYRNES AND COSTIN STREETS
OPTION 2
SKETCH-A2



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BYRNES AND BASALT STREETS
OPTION 2
SKETCH-C2



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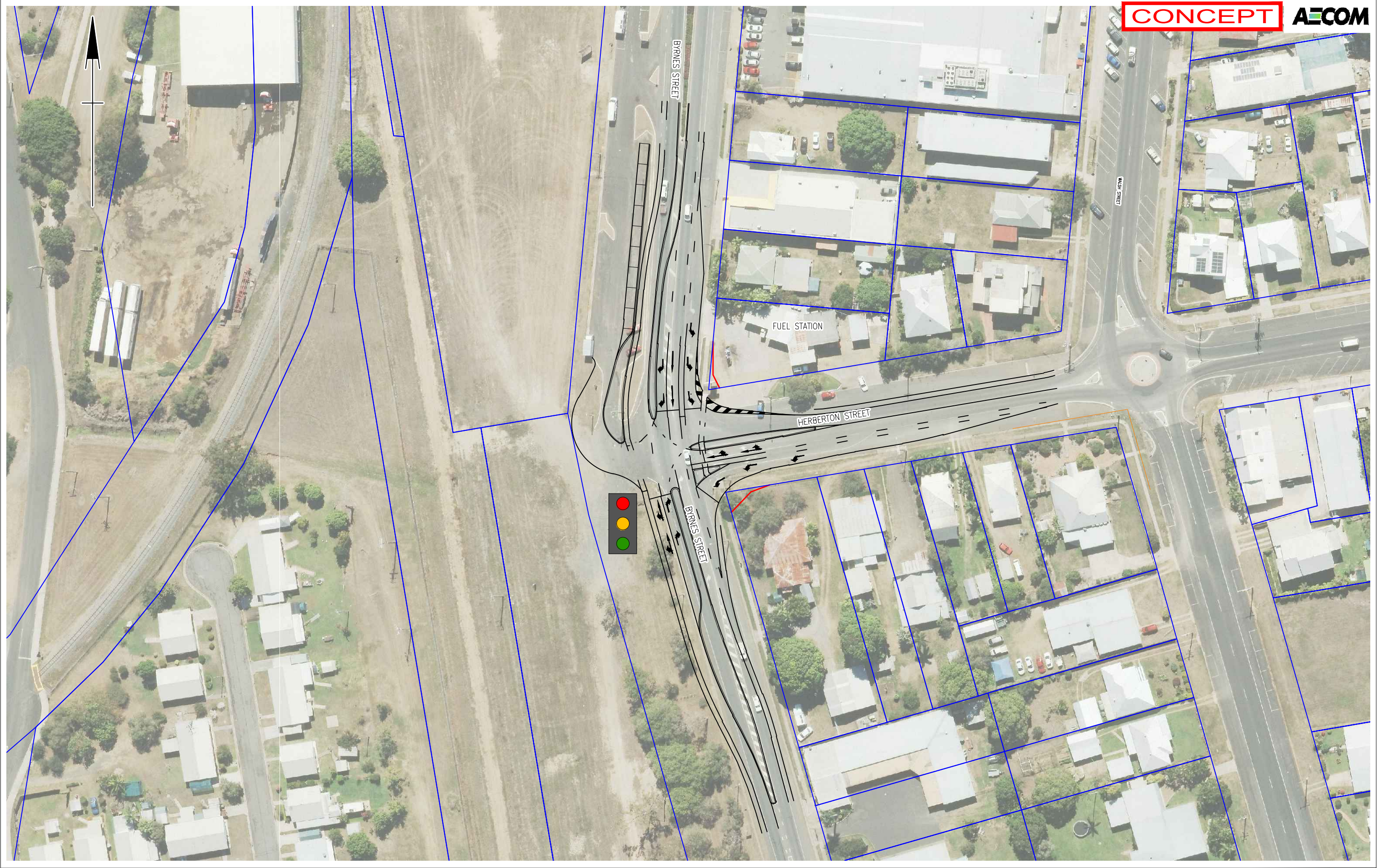
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MAREEBA CBD TRAFFIC STUDY
BYRNES AND BASALT STREETS
OPTION 4
SKETCH-C4



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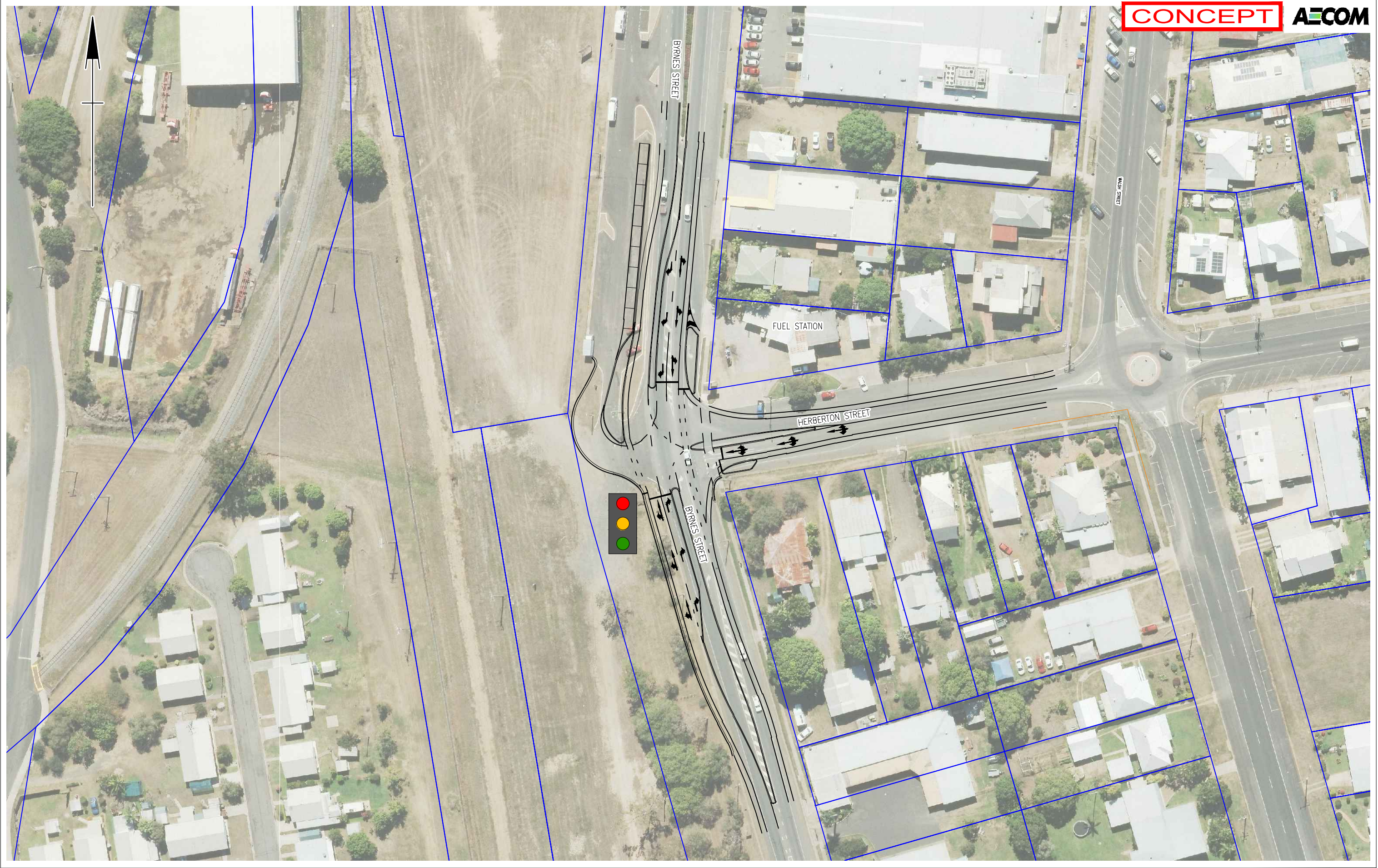
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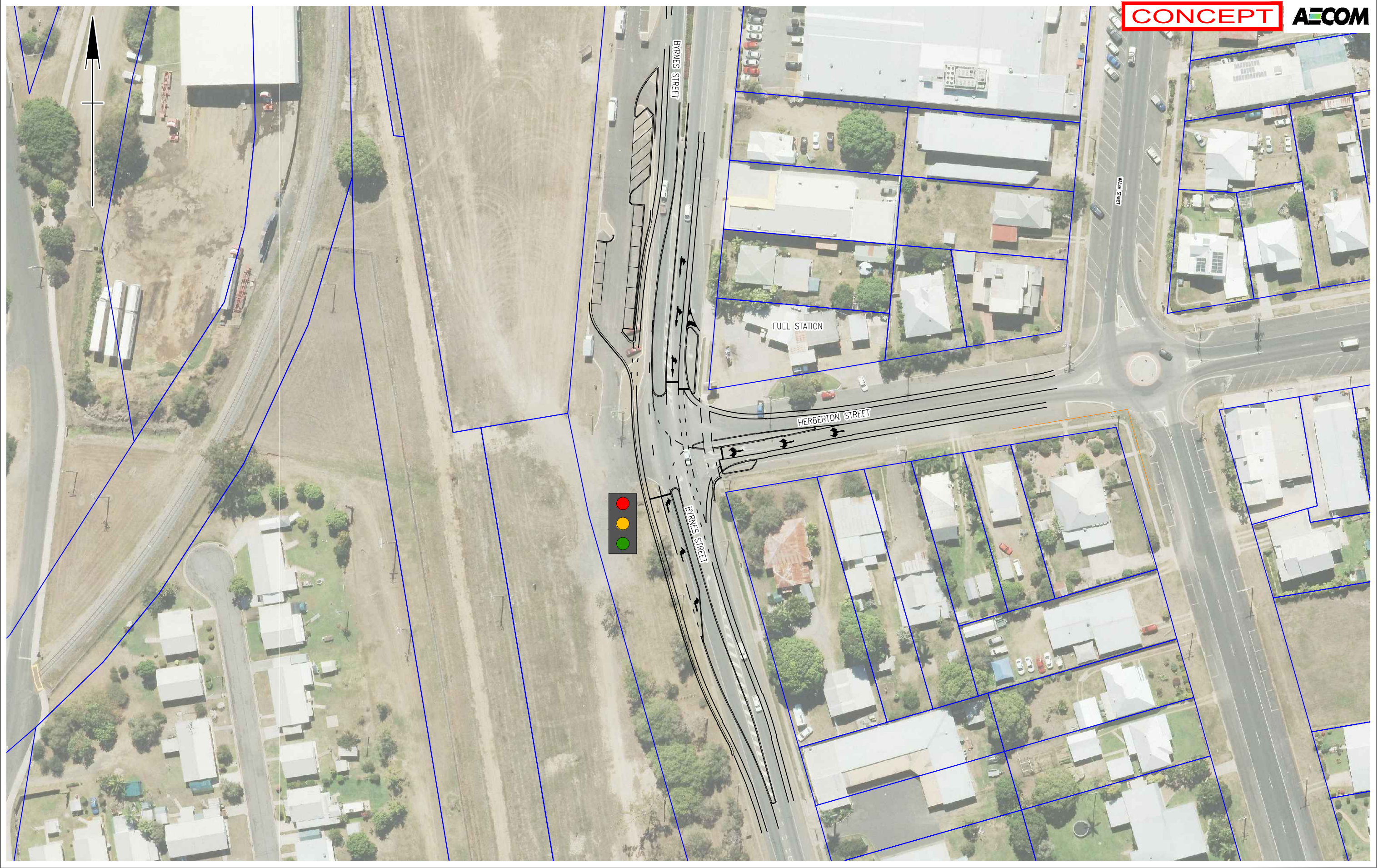
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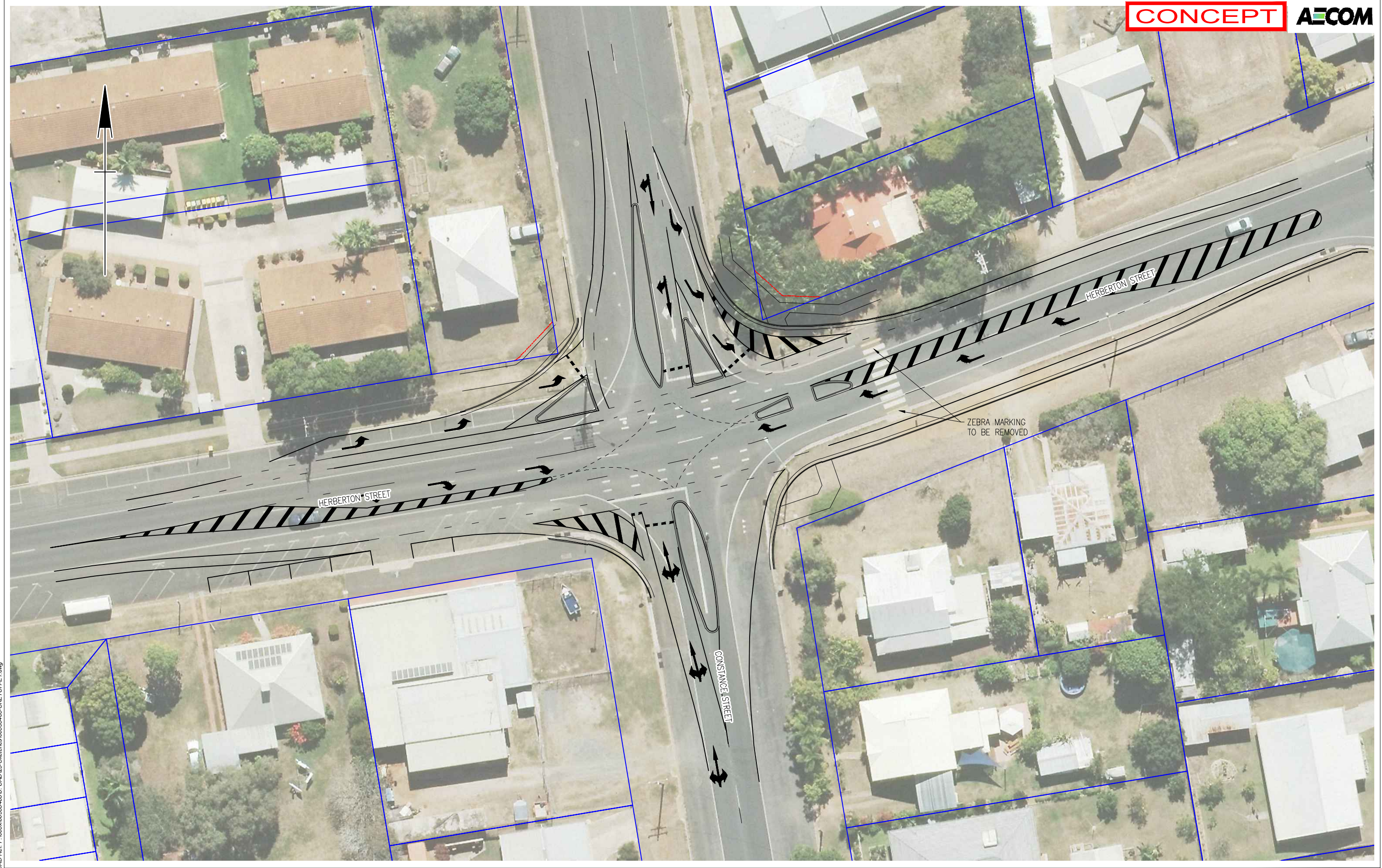
MAREEBA CBD TRAFFIC STUDY
BYRNES AND HERBERTON STREETS
OPTION 1
SKETCH-D1



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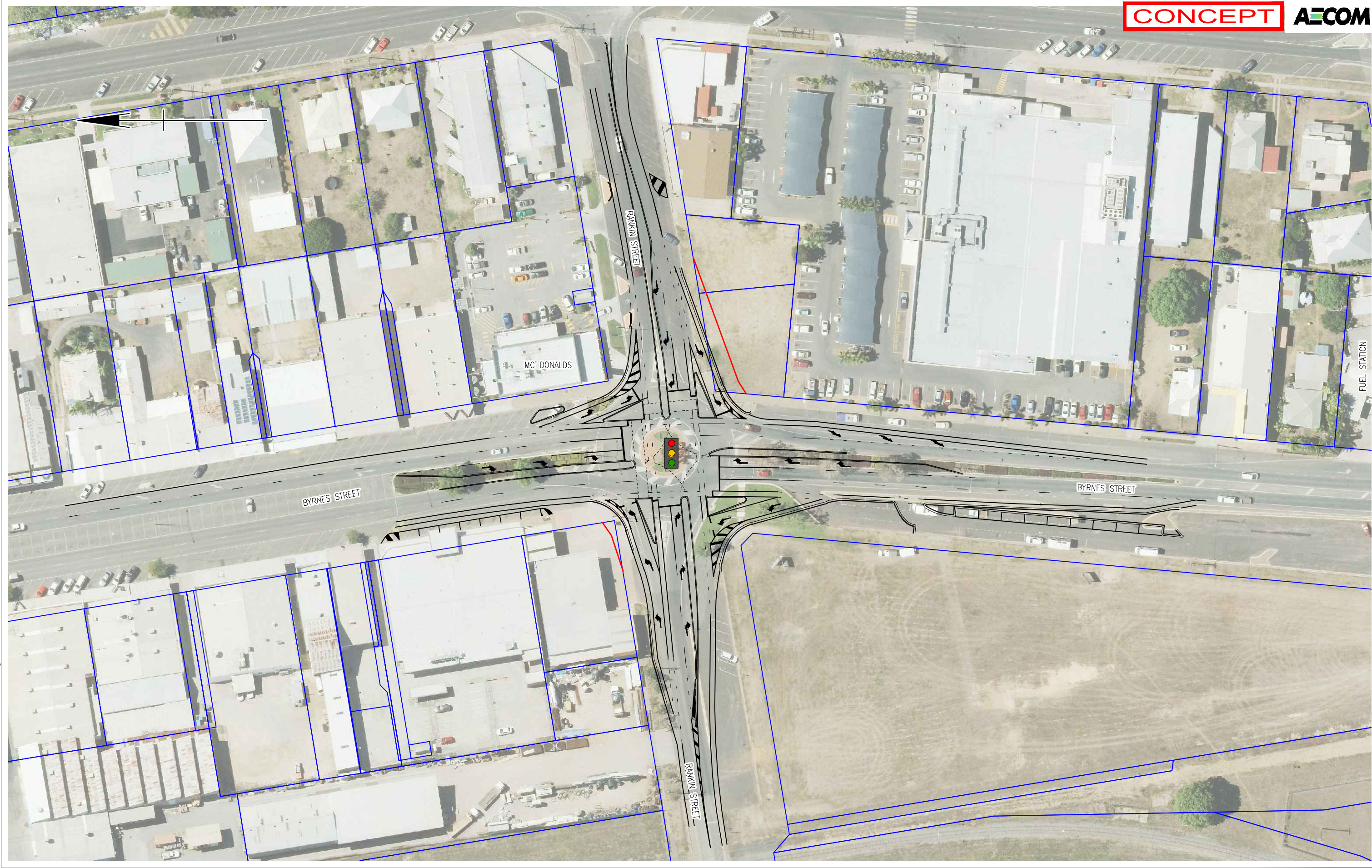
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MAREEBA CBD TRAFFIC STUDY
HERBERTON AND CONSTANCE STREETS
OPTION 2
SKETCH-E2



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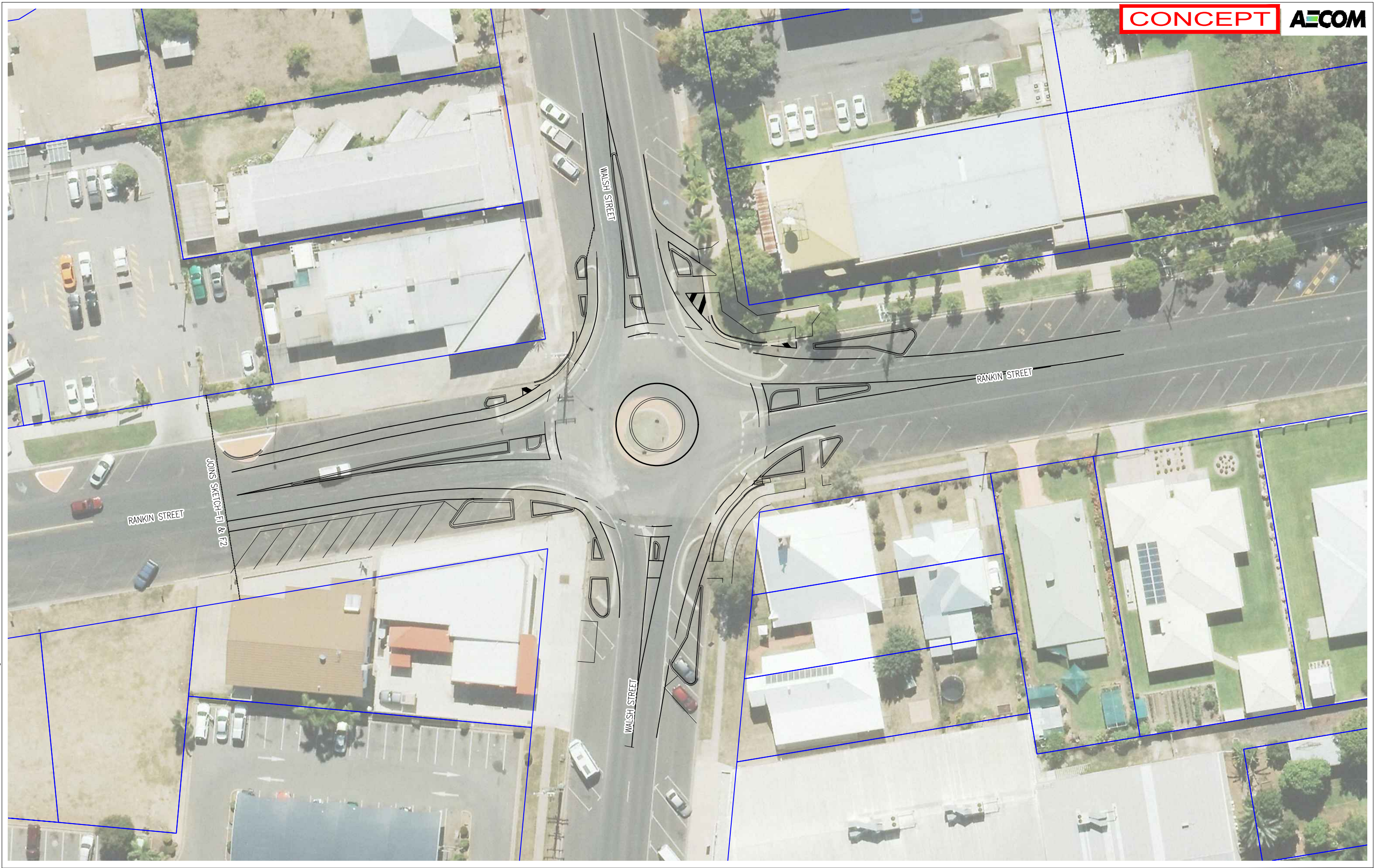
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MAREEBA CBD TRAFFIC STUDY
BYRNES AND RANKIN STREETS
OPTION 2
SKETCH-F2



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MAREEBA CBD TRAFFIC STUDY
□ ALSH AND RANKIN STREETS
OPTION 1
SKETCH-□ 1





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MAREEBA CBD TRAFFIC STUDY
BYRNES AND ATHERTON STREETS
OPTION 1
SKETCH-H1

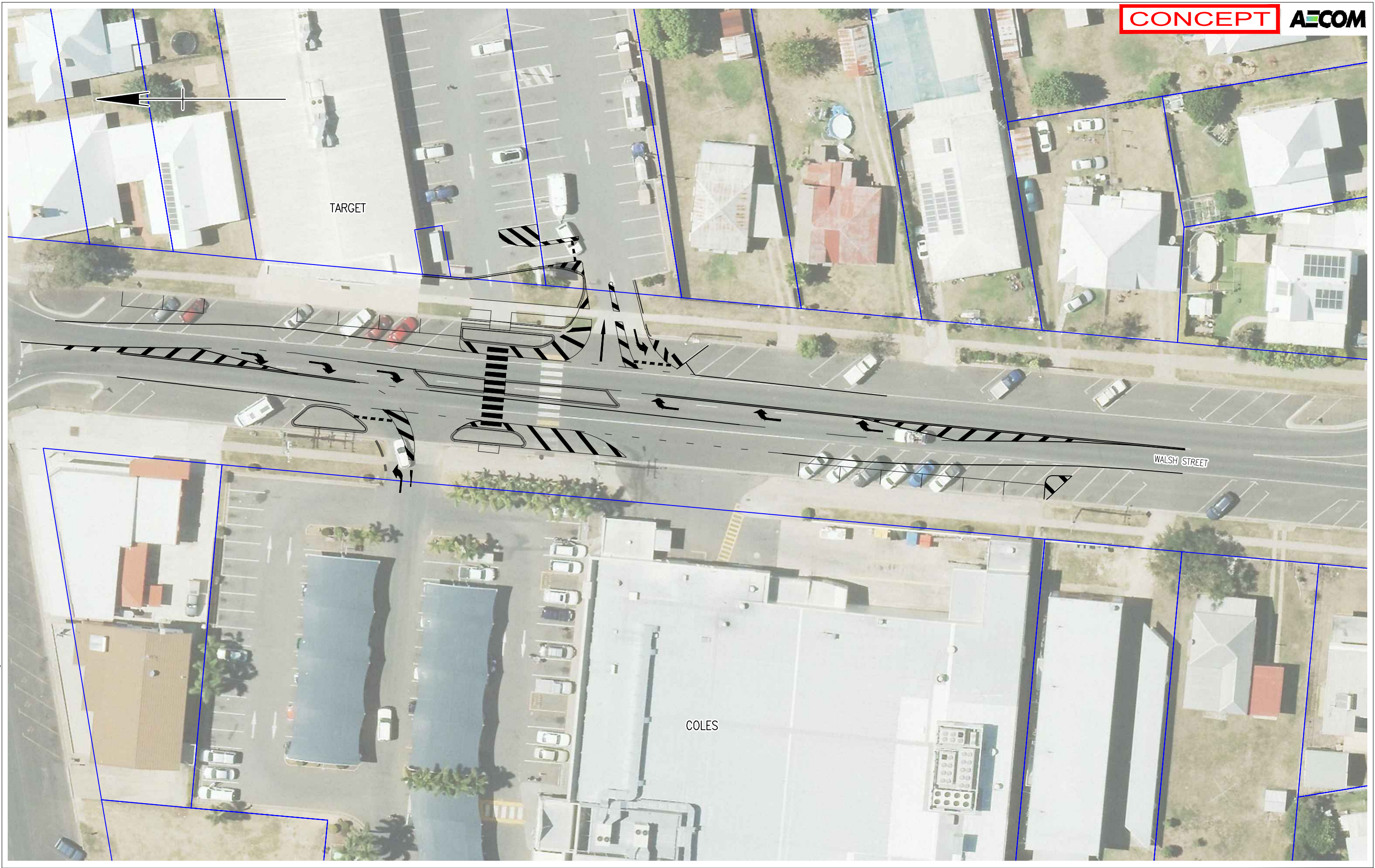


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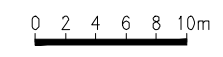
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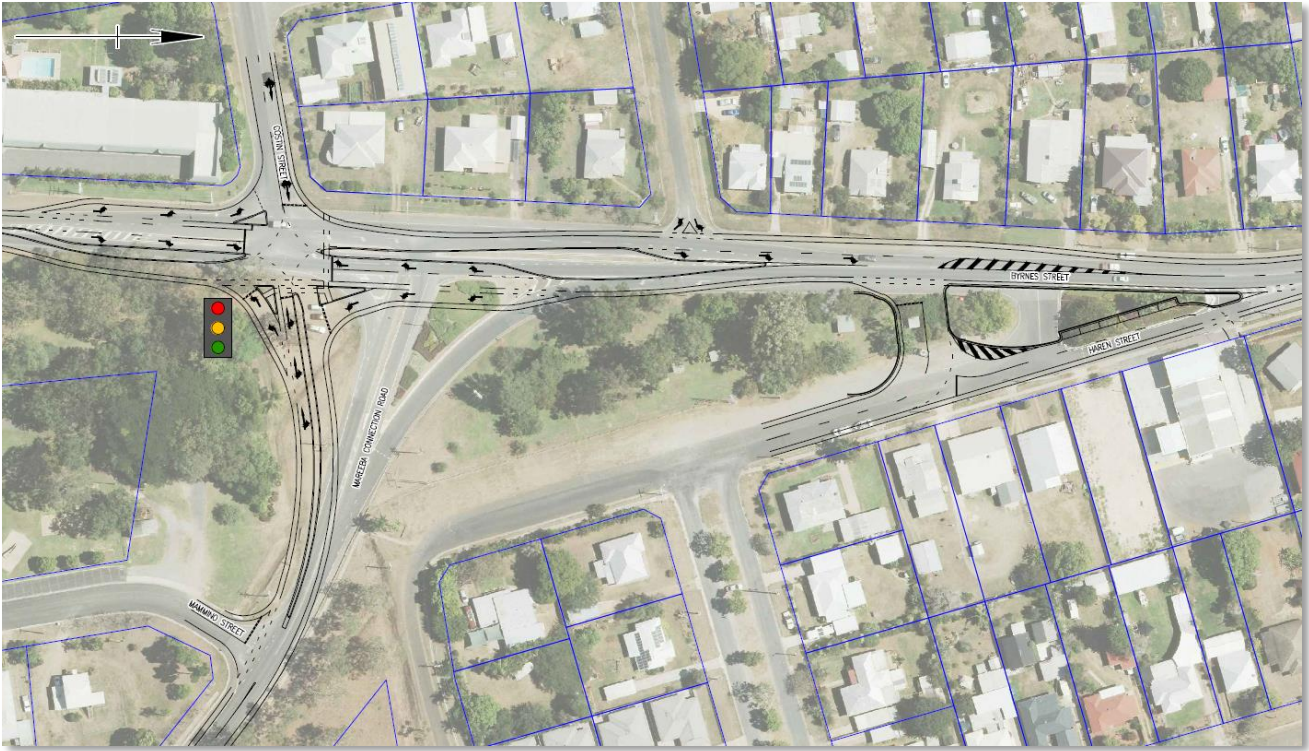
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MAREEBA CBD TRAFFIC STUDY
MULLIGAN HIGHWAY AND MAREEBA DIMBULAH ROAD
OPTION 1
SKETCH-K1

Appendix F



Options Assessment

MAREEBA CBD TRAFFIC MANGEMENT STUDY
BYRNES STREET/MAREEBA CONNECTION ROAD INTERSECTION
OPTIONS ASSESSMENT




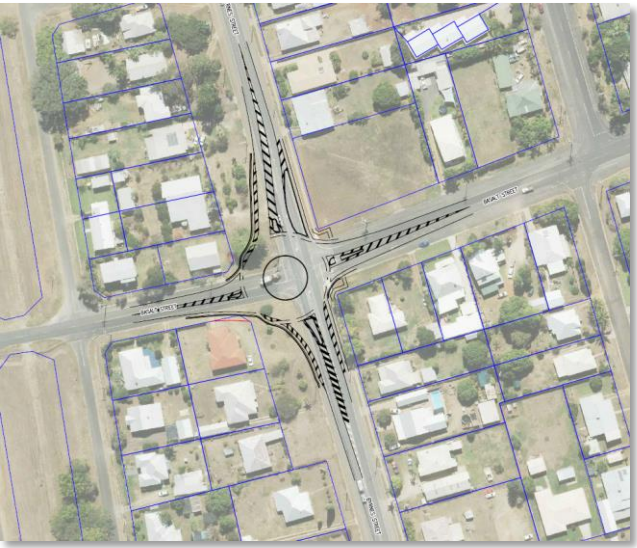
Criteria	Option 1	Option 2
		
Design Life	<ul style="list-style-type: none">3 - 5 years	<ul style="list-style-type: none">15+ years
Provision for Pedestrians	<ul style="list-style-type: none">Uncontrolled crossings	<ul style="list-style-type: none">Pedestrian phases will provide for controlled crossings
Provision for Cyclists	<ul style="list-style-type: none">Cycle lanes included	<ul style="list-style-type: none">Cycle lanes included
Re-use of Existing Road Asset	<ul style="list-style-type: none">All of existing road asset reused	<ul style="list-style-type: none">Existing road asset reused on 3 approaches, one leg fully realigned.New link onto Haren Street fronting the service station
Property Impacts	<ul style="list-style-type: none">Impacts to existing lot with motel	<ul style="list-style-type: none">No property impacts
Maintains all Existing Movements	<ul style="list-style-type: none">Movements from Mareeba Connection Road onto Costin Street to be disallowed. Right turn moments onto Costin Street to be disallowed	<ul style="list-style-type: none">All existing movements maintained and geometry significant improved
Cost	<ul style="list-style-type: none">Minimal new pavement required, however land requirement from a commercial premises	<ul style="list-style-type: none">New signalised 'X' arrangement and new link onto Haren Street fronting the service station

Legend
<div><div>Provides most desirable outcome</div><div></div><div></div><div></div><div>Provides least desirable outcome</div></div>

MAREEBA CBD TRAFFIC MANGEMENT STUDY
BYRNES STREET/MAREEBA CONNECTION ROAD INTERSECTION
OPTIONS ASSESSMENT





Existing	Option 1	Option 2
		
<ul style="list-style-type: none"> Design Life: 2 years 	<ul style="list-style-type: none"> Design Life: 2 years 	<ul style="list-style-type: none"> Design Life: 15+ years
2019 AM Peak <ul style="list-style-type: none"> LOS F – RT from MCR DOS 0.80 Queue – 38m RT from MCR 	2019 AM Peak <ul style="list-style-type: none"> LOS F – RT from MCR DOS 0.80 Queue – 38m RT from MCR 	2032 AM Peak <ul style="list-style-type: none"> LOS B – Intersection DOS 0.88 Queue – 250m Byrnes St NB
2025 PM Peak <ul style="list-style-type: none"> LOS F – RT from Basalt St DOS 0.76 Queue – 30m RT from MCR 	2025 PM Peak <ul style="list-style-type: none"> LOS F – RT from Basalt St DOS 0.76 Queue – 30m RT from MCR 	2032 PM Peak <ul style="list-style-type: none"> LOS B – Intersection DOS 0.77 Queue – 66m Byrnes St SB

MAREEBA CBD TRAFFIC MANGEMENT STUDY
BYRNES STREET/BASALT STREET INTERSECTION
OPTIONS ASSESSMENT




Criteria	Option 1	Option 2	Option 3	Option 4
				
Design Life	<ul style="list-style-type: none">15+ years	<ul style="list-style-type: none">15+ years	<ul style="list-style-type: none">15+ yearsPlacing left turns through signals will result in some additional delays out of peak periods, however design life still 15+ years	<ul style="list-style-type: none">15+ years
Provision for Pedestrians	<ul style="list-style-type: none">Pedestrian phases will provide for controlled crossings	<ul style="list-style-type: none">Uncontrolled pedestrians crossings due to unsignalised configuration	<ul style="list-style-type: none">Pedestrian phases will provide for controlled crossings	<ul style="list-style-type: none">Uncontrolled crossings due to unsignalised configuration, however median pedestrian storage areas could be provided
Provision for Cyclists	<ul style="list-style-type: none">Cycle lanes included	<ul style="list-style-type: none">Cycle lanes included	<ul style="list-style-type: none">Cycle lanes included	<ul style="list-style-type: none">Roundabouts generally undesirable for cyclists especially with heavy vehicles present
Re-use of Existing Road Asset	<ul style="list-style-type: none">Existing pavement used in upgrade	<ul style="list-style-type: none">Existing pavement used in upgrade	<ul style="list-style-type: none">Existing pavement used in upgrade	<ul style="list-style-type: none">Circulating section expected to require complete reconstruction to achieve required crossfalls, however existing approaches reused
Property Impacts	<ul style="list-style-type: none">Impacts to corner lots including propose new commercial development	<ul style="list-style-type: none">Impacts to corner lots including propose new commercial development	<ul style="list-style-type: none">No land impacts	<ul style="list-style-type: none">Land impact to residential property
Maintains all Existing Movements	<ul style="list-style-type: none">All movements maintained	<ul style="list-style-type: none">Through and right turn movements from Basalt Street disallowed	<ul style="list-style-type: none">All movements maintained	<ul style="list-style-type: none">All movements maintained
Cost	<ul style="list-style-type: none">Large area of new pavement and new traffic signals installation	<ul style="list-style-type: none">Large area of new pavement, but new traffic signal installation not required	<ul style="list-style-type: none">Large area of new pavement and new traffic signals installation	<ul style="list-style-type: none">New pavement, but no new traffic signal installation not required

Legend				
Provides most desirable outcome				Provides least desirable outcome

**MAREEBA CBD TRAFFIC MANGEMENT STUDY
BYRNES STREET/BASALT STREET INTERSECTION
OPTIONS ASSESSMENT**


Existing	Option 1	Option 2	Option 3	Option 4
				
<ul style="list-style-type: none"> 0 years 	<ul style="list-style-type: none"> 15+ years 	<ul style="list-style-type: none"> 15+ years 	<ul style="list-style-type: none"> 15+ years 	<ul style="list-style-type: none"> 15+ years
<ul style="list-style-type: none"> 2017 AM Peak LOS F – RT from Basalt St DOS 0.39 Queue – 10m Basalt St 	<ul style="list-style-type: none"> 2032 AM Peak LOS B - Intersection DOS 0.83 Queue – 155m Byrnes St NB 	<ul style="list-style-type: none"> 2032 AM Peak LOS C – LT from Basalt St West DOS 0.51 Queue – 10m Basalt St West 	<ul style="list-style-type: none"> 2032 AM Peak LOS B – Intersection DOS 0.85 Queue – 171m Byrnes St NB 	<ul style="list-style-type: none"> 2032 AM Peak LOS B – RT from Basalt St DOS 0.75 Queue – 73m Byrnes St NB
<ul style="list-style-type: none"> 2017 PM Peak LOS E – RT from Basalt St DOS 0.31 Queue – 10m Basalt St 	<ul style="list-style-type: none"> 2032 PM Peak LOS B – Intersection DOS 0.82 Queue – 105m Byrnes St SB 	<ul style="list-style-type: none"> 2032 PM Peak LOS B – LT from Basalt St East DOS 0.41 Queue – 5m RT from Byrnes St North 	<ul style="list-style-type: none"> 2032 PM Peak LOS C - Intersection DOS 0.90 Queue – 215m Byrnes St SB 	<ul style="list-style-type: none"> 2032 PM Peak LOS B – RT from Basalt St DOS 0.60 Queue – 50m Byrnes St SB

MAREEBA CBD TRAFFIC MANGEMENT STUDY
BYRNES STREET/HERBERTON STREET INTERSECTION
OPTIONS ASSESSMENT


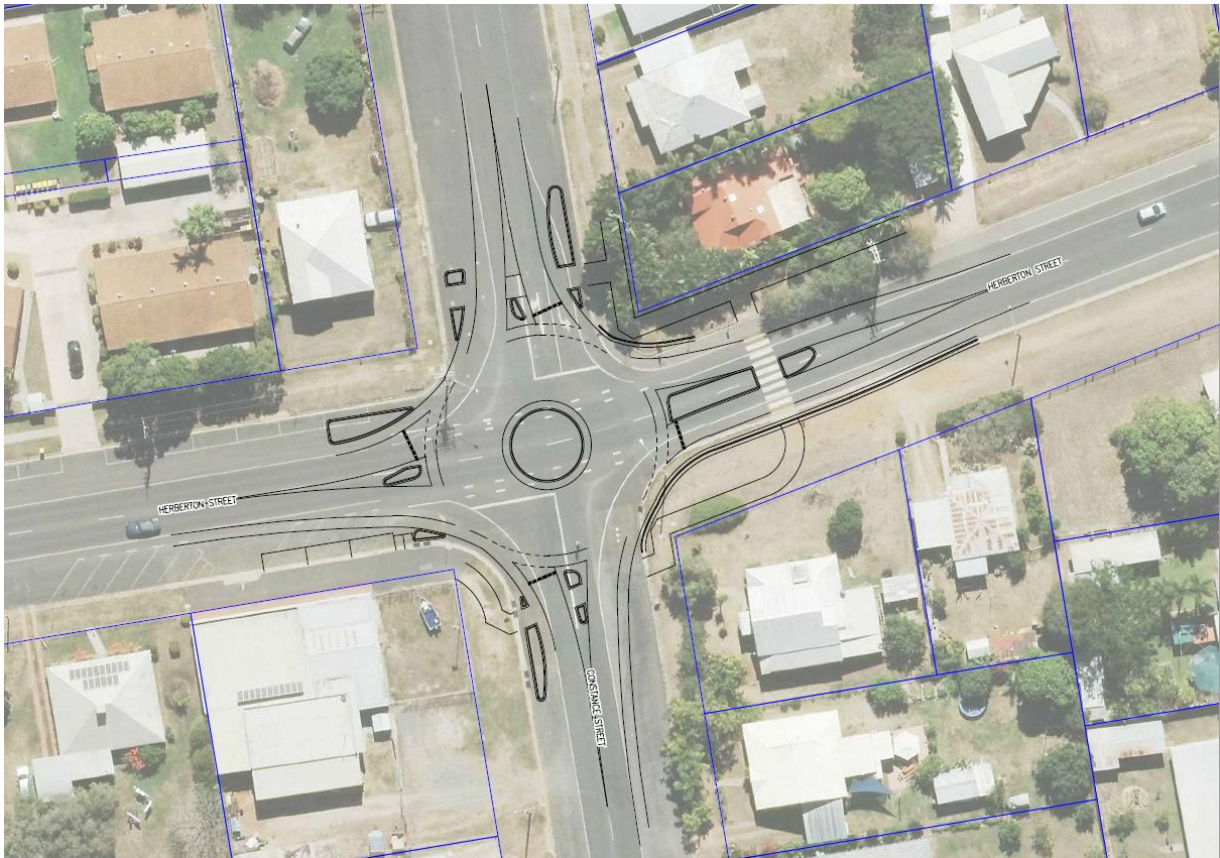
Criteria	Option 1	Option 2	Option 3
			
Design Life	<ul style="list-style-type: none">15+ years	<ul style="list-style-type: none">15 years	<ul style="list-style-type: none">15 yearsNote : Could operate as an unsignalised T in this form for approximately 5 years, however un-signalised 'T' would likely warrant auxiliary left turn lane onto Herberton Street.
Provision for Pedestrians	<ul style="list-style-type: none">Pedestrian crossing of the free left turn lane from Herberton Street onto Byrnes Street uncontrolled	<ul style="list-style-type: none">Fully controlled pedestrian crossing of Herberton Street.	<ul style="list-style-type: none">Fully controlled pedestrian crossing of Herberton Street.Note : If unsignalised, median break would allow pedestrian to store and only cross one lane at a time.
Provision for Cyclists	<ul style="list-style-type: none">Cycle lanes included	<ul style="list-style-type: none">Cycle lanes included	<ul style="list-style-type: none">Cycle lanes included
Re-use of Existing Road Asset	<ul style="list-style-type: none">Existing pavement used in upgrade	<ul style="list-style-type: none">Existing pavement used in upgrade	<ul style="list-style-type: none">Existing pavement used in upgrade
Property Impacts	<ul style="list-style-type: none">Land impact to corner of service station and residential property	<ul style="list-style-type: none">No land impacts	<ul style="list-style-type: none">No land impacts
Maintains all Existing Movements	<ul style="list-style-type: none">All movements maintained	<ul style="list-style-type: none">All movements maintained	<ul style="list-style-type: none">Access to parking area shifted to the north. Right turn access from Byrnes Street north removed.
Cost	<ul style="list-style-type: none">Some new pavement required, new traffic signal installation required for a 'X' configuration	<ul style="list-style-type: none">Some new pavement required, new traffic signal installation required for a 'X' configuration	<ul style="list-style-type: none">Some new pavement required, new traffic signal installation required, however decreased signals cost due to 'T' configurationNote : Cost of traffic signals could possibly be delayed until future development of western vacant lot.

Legend
<div><div>Provides most desirable outcome</div><div></div><div></div><div></div><div>Provides least desirable outcome</div></div>

**MAREEBA CBD TRAFFIC MANGEMENT STUDY
BYRNES STREET/HERBERTON STREET INTERSECTION
OPTIONS ASSESSMENT**



Existing	Option 1	Option 2	Option 3
			
<ul style="list-style-type: none"> 0 years 	<ul style="list-style-type: none"> 15+ years 	<ul style="list-style-type: none"> 15 years 	<ul style="list-style-type: none"> 15 years
<ul style="list-style-type: none"> 2017 AM Peak LOS F – RT from Herberton St DOS 0.39 Queue – 10m Herberton St 	<ul style="list-style-type: none"> 2032 AM Peak LOS B – Intersection DOS 0.88 Queue – 159m Byrnes St NB 	<ul style="list-style-type: none"> 2032 AM Peak LOS C – Intersection DOS 0.95 Queue – 256m Byrnes St NB 	<ul style="list-style-type: none"> 2032 AM Peak LOS C – Intersection DOS 0.94 Queue – 220m Byrnes St NB
<ul style="list-style-type: none"> 2017 PM Peak LOS E – RT from Herberton St DOS 0.31 Queue – 10m Herberton St 	<ul style="list-style-type: none"> 2032 PM Peak LOS A – Intersection DOS 0.71 Queue – 85m Byrnes St SB 	<ul style="list-style-type: none"> 2032 PM Peak LOS B – Intersection DOS 0.85 Queue – 144m Byrnes St SB 	<ul style="list-style-type: none"> 2032 PM Peak LOS B – Intersection DOS 0.85 Queue – 144m Byrnes St SB
<p>Existing as a T</p> <p>10 years design life</p> <ul style="list-style-type: none"> 2027 AM Peak LOS F – RT from Herberton St DOS 0.39 Queue – 13m Byrnes St NB <ul style="list-style-type: none"> 2032 PM Peak LOS F – RT from Herberton St DOS 0.43 Queue – 13m Herberton St 			

MAREEBA CBD TRAFFIC MANGEMENT STUDY
HERBERTON STREET/CONSTANCE STREET INTERSECTION
OPTIONS ASSESSMENT




Criteria	Option 1	Option 2
		
Design Life	<ul style="list-style-type: none">15+ years	<ul style="list-style-type: none">15+ years
Provision for Pedestrians	<ul style="list-style-type: none">Existing zebra crossing removed. Median storage area could be provided to allow pedestrians to cross one lane at a time.	<ul style="list-style-type: none">Existing zebra crossing maintained. Median storage areas provided to allow pedestrians to cross one lane at a time.
Provision for Cyclists	<ul style="list-style-type: none">Cycle lanes included	<ul style="list-style-type: none">Generally undesirable for cyclists especially with heavy vehicles present, however cycle lanes provided on all approaches
Parking Impacts	<ul style="list-style-type: none">Existing angle parking fronting business and parallel parking fronting unit development lost.	<ul style="list-style-type: none">No parking bays lost. Three (3) angle parks changed to parallel bays.
Re-use of Existing Road Asset	<ul style="list-style-type: none">Existing pavement reused	<ul style="list-style-type: none">Circulating section expected to require reconstruction to achieve required crossfalls, however existing approaches reused
Property Impacts	<ul style="list-style-type: none">Property impacts to two (2) residential lots	<ul style="list-style-type: none">No land impacts
Cost	<ul style="list-style-type: none">Significant amendment to existing arrangement including new pavement to accommodate introduction of turn lanes. Shifting of through lanes may also be required significant reconstruction to provide required crossfalls.	<ul style="list-style-type: none">While some reconstruction would be required for the circulating section of the roundabout, minimal work expected to the approaches.

Legend
<div><div>Provides most desirable outcome</div><div></div><div></div><div></div><div>Provides least desirable outcome</div></div>

**MAREEBA CBD TRAFFIC MANGEMENT STUDY
HERBERTON STREET/CONSTANCE STREET INTERSECTION
OPTIONS ASSESSMENT**



Existing	Option 1	Option 2
		
<ul style="list-style-type: none"> Design Life: 15+ years 	<ul style="list-style-type: none"> Design Life: 15+ years 	<ul style="list-style-type: none"> Design Life: 15+ years
2032 AM Peak <ul style="list-style-type: none"> LOS C – RT from Constance St DOS 0.42 Queue – 25m Herberton St WB 	2032 AM Peak <ul style="list-style-type: none"> LOS E – RT from Constance St Nth DOS 0.35 Queue – 10m Constance St RT 	2032 AM Peak <ul style="list-style-type: none"> LOS B – RT from Constance St DOS 0.48 Queue – 32m Herberton St WB
20232 PM Peak <ul style="list-style-type: none"> LOS C – RT from Constance St DOS 0.26 Queue – 10m Herberton St WB 	2032 PM Peak <ul style="list-style-type: none"> LOS B – RT from Constance St DOS 0.20 Queue – 5m Constance St LT 	20232 PM Peak <ul style="list-style-type: none"> LOS B – RT from Constance St DOS 0.35 Queue – 20m Herberton St EB

MAREEBA CBD TRAFFIC MANGEMENT STUDY
BYRNES STREET/RANKIN STREET INTERSECTION
OPTIONS ASSESSMENT



Criteria	Option 1	Option 2	Option 3
			
Design Life	<ul style="list-style-type: none">15+ years	<ul style="list-style-type: none">15+ years	<ul style="list-style-type: none">15+ years
Provision for Pedestrians	<ul style="list-style-type: none">Pedestrian phases will provide for controlled crossings, however crossing of left turn lanes on the northern side of the intersection will be uncontrolled where highest pedestrian demand occurs.	<ul style="list-style-type: none">Pedestrian phases will provide for controlled crossings, however crossing of left turn onto Rankin Street will be uncontrolled. Highest pedestrian demand occurs on northern side of intersection and crossing of this left turn lane would not be controlled.	<ul style="list-style-type: none">Pedestrian phases will provide for controlled crossings. Crossing of the northern side of the intersection where the highest pedestrian demand currently exists will be fully controlled.
Provision for Cyclists	<ul style="list-style-type: none">Cycle lanes included	<ul style="list-style-type: none">Cycle lanes included	<ul style="list-style-type: none">Cycle lanes included
Parking Impacts	<ul style="list-style-type: none">Loss of two (2) angle parks and some changes to parallel parking	<ul style="list-style-type: none">Loss of two (2) angle parks fronting McDonalds Restaurant and some changes to parallel parking on western side of Byrnes Street	<ul style="list-style-type: none">Loss of angle parking fronting McDonalds Restaurant, however combined through/left turn lane could be adopted to maintain these bays
Re-use of Existing Road Asset	<ul style="list-style-type: none">Existing road asset reused	<ul style="list-style-type: none">Existing road asset reused	<ul style="list-style-type: none">Existing road asset reused
Property Impacts	<ul style="list-style-type: none">Property impact to currently vacant lot	<ul style="list-style-type: none">No land impacts	<ul style="list-style-type: none">No land impacts
Cost	<ul style="list-style-type: none">Significant reconstruction required to convert existing roundabout to signalised 'X'. Includes new traffic signal installation.	<ul style="list-style-type: none">Significant reconstruction required to convert existing roundabout to signalised 'X'. Includes new traffic signal installation.	<ul style="list-style-type: none">Significant reconstruction required to convert existing roundabout to signalised 'X'. Includes new traffic signal installation.

Legend
<div><div></div>Provides most desirable outcome</div> <div><div></div></div> <div><div></div>Provides least desirable outcome</div>

MAREEBA CBD TRAFFIC MANGEMENT STUDY
BYRNES STREET/RANKIN STREET INTERSECTION
OPTIONS ASSESSMENT



Existing	Option 1	Option 2
		
<ul style="list-style-type: none">Design Life: 5 years	<ul style="list-style-type: none">Design Life: 15+ years	<ul style="list-style-type: none">Design Life: 15+ years
2022 AM Peak <ul style="list-style-type: none">LOS C – RT from Rankin StDOS 0.85Queue – 105m Byrnes St NBNote DOS 1.00 on Byrnes St NB reached at 2027AM	2032 AM Peak <ul style="list-style-type: none">LOS C – IntersectionDOS 0.84Queue – 130m Byrnes St SB	2032 AM Peak <ul style="list-style-type: none">LOS C – IntersectionDOS 0.87Queue – 110m Byrnes St SB
2022 PM Peak <ul style="list-style-type: none">LOS D – RT from Rankin StDOS 0.85Queue – 110m Byrnes St SBNote LOS E reached at 2024PM on Rankin St	2032 PM Peak <ul style="list-style-type: none">LOS C – IntersectionDOS 0.86Queue – 160m Byrnes St NB	2032 PM Peak <ul style="list-style-type: none">LOS C – IntersectionDOS 0.81Queue – 145m Byrnes St NB

MAREEBA CBD TRAFFIC MANGEMENT STUDY
WALSH STREET/RANKIN STREET INTERSECTION
OPTIONS ASSESSMENT


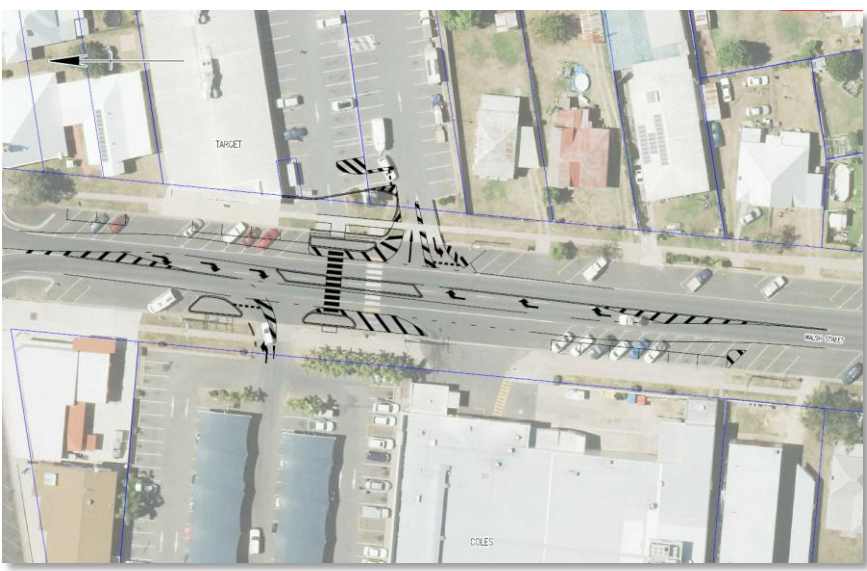

Criteria	Option 1	Option 2
		
Design Life	<ul style="list-style-type: none">15+ years	<ul style="list-style-type: none">15+ years
Provision for Pedestrians	<ul style="list-style-type: none">While pedestrian crossings will be uncontrolled, median storage areas provided on all approaches	<ul style="list-style-type: none">Median storage areas provided on all approaches except Rankin Street north
Provision for Cyclists	<ul style="list-style-type: none">Roundabouts generally undesirable for cyclists especially with heavy vehicles present, however cycle lanes provided on all approaches and provision made for on road cyclists to enter footpath at norther west corner due to departure shoulder area not provided to minimise loss of parking	<ul style="list-style-type: none">Roundabouts generally undesirable for cyclists especially with heavy vehicles present, however cycle lanes provided on all approaches and provision made for on road cyclists to enter footpath at norther west corner due to departure shoulder area not provided to minimise loss of parking
Parking Impacts	<ul style="list-style-type: none">Loss of 5 angle parking bays fronting Mareeba Shire Council ChambersLoss of 3 angle parking bays on Walsh Street	<ul style="list-style-type: none">Loss of 3 angle parking bays fronting Mareeba Shire Council ChambersLoss of 3 angle parking bays on Walsh Street
Re-use of Existing Road Asset	<ul style="list-style-type: none">Existing roundabout configuration maintained	<ul style="list-style-type: none">Existing roundabout configuration maintained
Property Impacts	<ul style="list-style-type: none">No land impacts	<ul style="list-style-type: none">No land impacts
Cost	<ul style="list-style-type: none">No major pavement reconstructions expected.Likely asphalt correction for shift of roundabout centre island	<ul style="list-style-type: none">No major pavement reconstructions expected.Likely asphalt correction for shift of roundabout centre island

Legend			
Provides most desirable outcome			Provides least desirable outcome

MAREEBA CBD TRAFFIC MANGEMENT STUDY
WALSH STREET/RANKIN STREET INTERSECTION
OPTIONS ASSESSMENT

Existing	Option 1	Option 2
		
Design Life: 15+ years	Design Life: 15+ years	Design Life: 15+ years
2032 AM Peak <ul style="list-style-type: none">• LOS B – Walsh St Sth• DOS 0.70• Queue – 60m Walsh St NB		
2032 PM Peak <ul style="list-style-type: none">• LOS B – Rankin St E• DOS 0.60• Queue – 40m Walsh St SB		

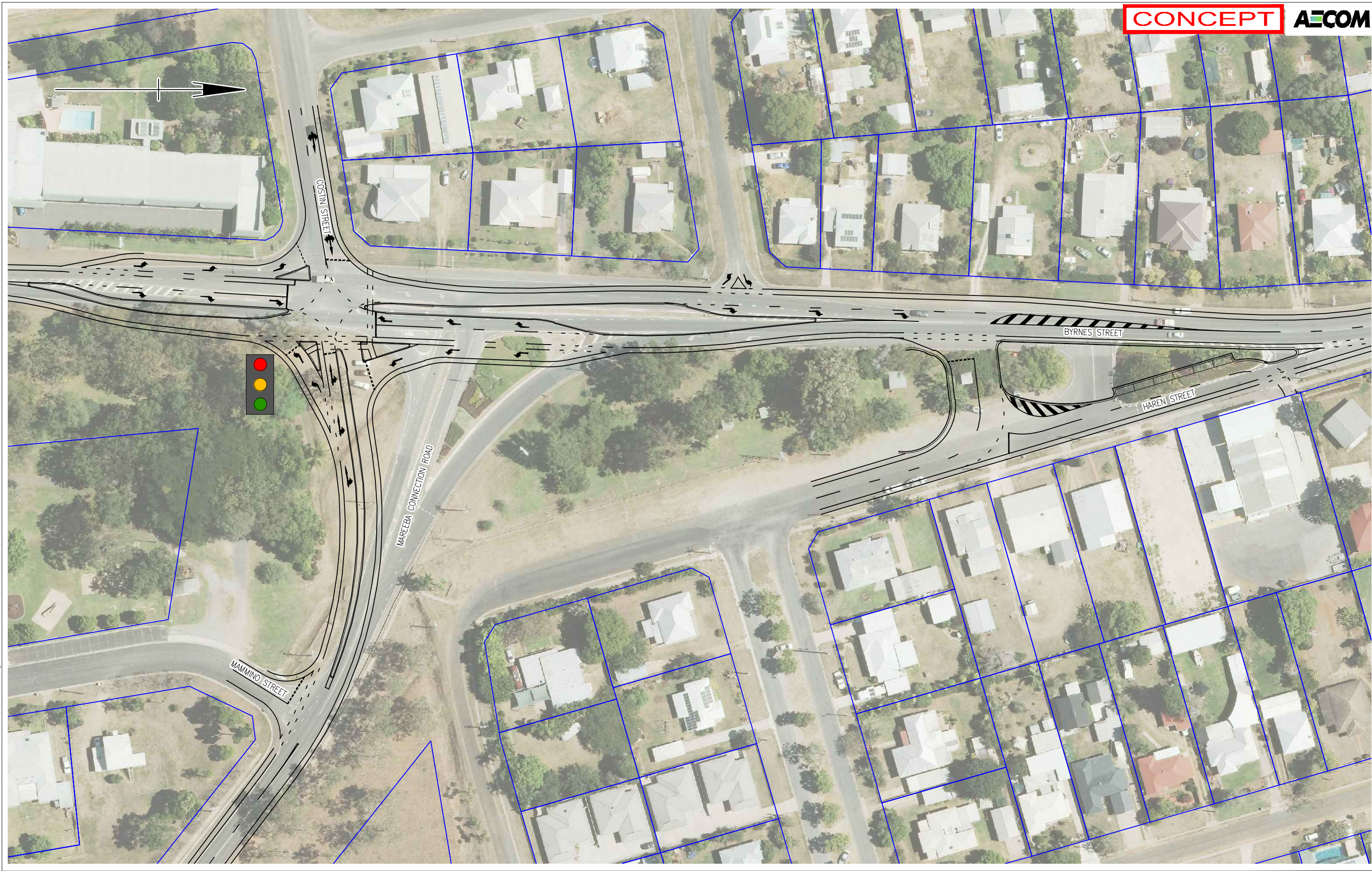
MAREEBA CBD TRAFFIC MANGEMENT STUDY
WALSH STREET/COLES AND TARGET SHOPPING CENTRE ACCESSES
OPTIONS ASSESSMENT

Criteria	Option 1	Option 2	Option 3
			
Maintains all Existing Movements	<ul style="list-style-type: none">Installation of centre median uncontrolled right turn manoeuvres to and from the Coles and Target Shopping Centre carparks	<ul style="list-style-type: none">Provides right turn storage slots for movements into the Coles and Target Shopping Centre carparks.Due to the limited distance between the Cole carpark access and the Walsh Street intersection with Rankin Street to the north, minimal storage only is possible for the right turn into the Coles carpark.Right out manoeuvres from both the Coles and Target carpark removed.	<ul style="list-style-type: none">Installation of centre median removes right turn manoeuvres to and from the Coles and Target Shopping Centre carparks
Provision for Pedestrians	<ul style="list-style-type: none">Pedestrian crossing maintained in its current location	<ul style="list-style-type: none">Pedestrian crossing maintained but relocated to the north	<ul style="list-style-type: none">Pedestrian crossing maintained but relocated to the north
Removes high potential right turn movements	<ul style="list-style-type: none">Uncontrolled right turn movements into and out of shopping centre carparks removed	<ul style="list-style-type: none">Uncontrolled right turn movements into and out of shopping centre carparks maintained	<ul style="list-style-type: none">Uncontrolled right turn movements into and out of shopping centre carparks removed
Rationalises movements	<ul style="list-style-type: none">Maintains separate entry and exit points to Target Shopping Centre	<ul style="list-style-type: none">Rationalises entry and exit points to Target Shopping Centre to a single location	<ul style="list-style-type: none">Rationalises entry and exit points to Target Shopping Centre to a single location
Parking Impacts	<ul style="list-style-type: none">Existing high use angle parking bays on Walsh Street fronting the Coles Shopping Centre maintained.Existing angle parking bays directly fronting Target Shopping Centre changed to parallel bays.	<ul style="list-style-type: none">Existing high use angle parking bays on Walsh Street fronting the Coles Shopping Centre changed to parallel bays.Existing angle parking bays directly fronting Target Shopping Centre changed to parallel bays.	<ul style="list-style-type: none">Existing high use angle parking bays on Walsh Street fronting the Coles Shopping Centre maintained.Existing angle parking bays directly fronting Target Shopping Centre changed to parallel bays.
Improves clearance between zebra crossing and Coles loading zone	<ul style="list-style-type: none">No change to location of existing zebra crossing	<ul style="list-style-type: none">Zebra crossing location shifted to the north to improve clearance between Coles loading zone and pedestrian crossing location.	<ul style="list-style-type: none">Zebra crossing location shifted to the north to improve clearance between Coles loading zone and pedestrian crossing location
Cost	<ul style="list-style-type: none">No new pavement required.New concrete islands ,signage and linemarking only	<ul style="list-style-type: none">No new pavement required.New concrete islands ,signage and linemarking only	<ul style="list-style-type: none">No new pavement required.New concrete islands ,signage and linemarking only

Legend				
Provides most desirable outcome				Provides least desirable outcome

Appendix G

Preferred Options



Last modified: 14 Jun 17 - 13:46
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60535485
ISSUE-2
04/04/17

**NOT TO BE USED
FOR CONSTRUCTION**

DRAWING IN PROGRESS	DATE: 14/06/2017
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0 5 10 15 20m

MAREEBA CBD TRAFFIC STUDY
BYRNES AND COSTIN STREETS
OPTION 2
SKETCH-A2



Last modified: 14 Jun 17 - 13:46
CAD Ref: P:\60535485\60535485.dwg

60535485
ISSUE-3
18/04/17

**NOT TO BE USED
FOR CONSTRUCTION**

DRAWING IN PROGRESS | DATE: 14/06/2017

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MAREEBA CBD TRAFFIC STUDY
BYRNES AND BASALT STREETS
OPTION 3
SKETCH-C3



Last modified: 14 Jun 17 - 13:47
CAD Ref: P:\60535485\60535485.dwg

60535485
ISSUE-3
18/04/17

**NOT TO BE USED
FOR CONSTRUCTION**

DRAWING IN PROGRESS | DATE: 14/06/2017

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MAREEBA CBD TRAFFIC STUDY
BYRNES AND HERBERTON STREETS
OPTION 3
SKETCH-D3



Last modified: 14 Jun 17 - 13:47
CAD Ref: P:\60535485\60535485.dwg

60535485
ISSUE-3
18/04/17

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FOR CONSTRUCTION**

DRAWING IN PROGRESS | DATE: 14/06/2017

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MAREEBA CBD TRAFFIC STUDY
HERBERTON AND CONSTANCE STREETS
OPTION 2
SKETCH-E2



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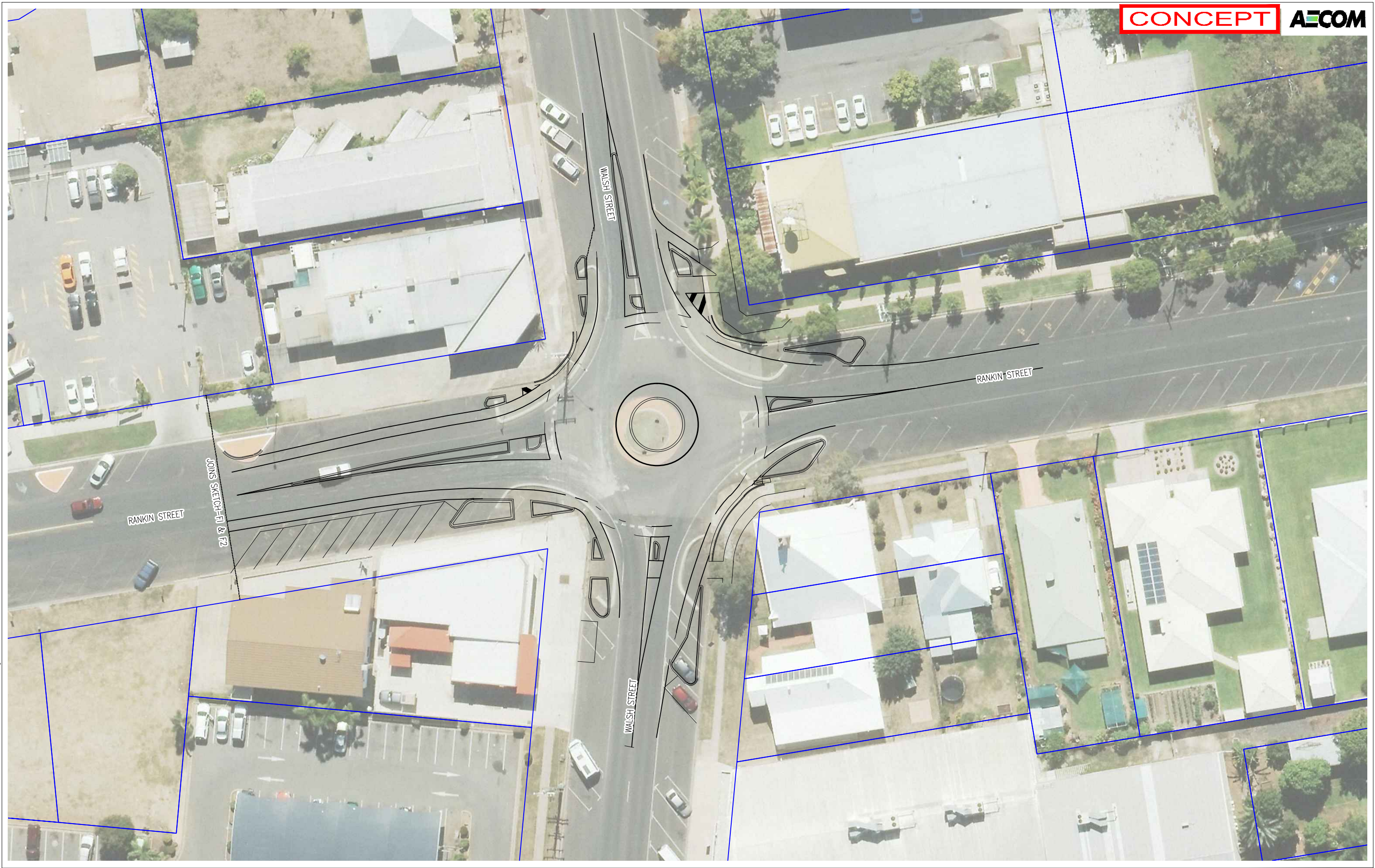
60535485
ISSUE-1
12/06/17

**NOT TO BE USED
FOR CONSTRUCTION**

DRAWING IN PROGRESS | DATE: 14/06/2017

0 5 10 15 20m

MAREEBA CBD TRAFFIC STUDY
BYRNES AND RANKIN STREETS
OPTION 3
SKETCH-F3



Last modified: 14 Jun 17 - 13:47
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60535485
ISSUE-3
18/04/17

**NOT TO BE USED
FOR CONSTRUCTION**

DRAWING IN PROGRESS	DATE: 14/06/2017
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0 2 4 6 8 10m

MAREEBA CBD TRAFFIC STUDY
□ ALSH AND RANKIN STREETS
OPTION 2
SKETCH-□2



Last modified: 10 Jul 17 - 09:15
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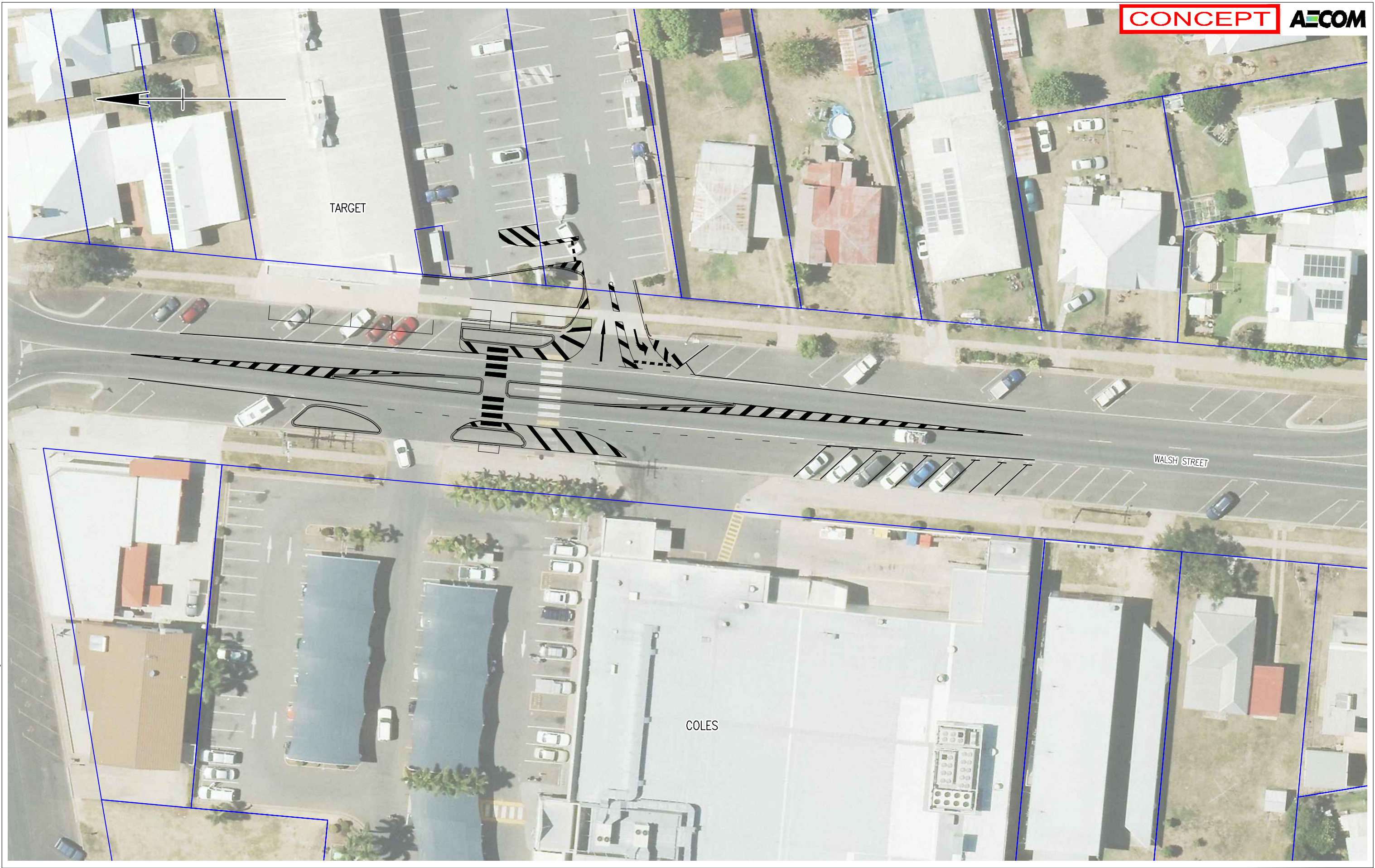
60535485
ISSUE-2
04/04/17

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FOR CONSTRUCTION**

DRAWING IN PROGRESS	DATE: 10/07/2017
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0 2 4 6 8 10m

MAREEBA CBD TRAFFIC STUDY
BYRNES AND ATHERTON STREETS
OPTION 1
SKETCH-H1



Last modified: 14 Jun 17 - 13:48
CAD Ref: P:\60535485\60535485.dwg

60535485
ISSUE-1
12/06/17

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DRAWING IN PROGRESS | DATE: 14/06/2017

0 2 4 6 8 10m

MAREEBA CBD TRAFFIC STUDY
□ ALSH STREET COLES ACCESS
OPTION 3
SKETCH-J3



Last modified: 04 Jul 17 - 15:48
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60535485
ISSUE-2
04/04/17

**NOT TO BE USED
FOR CONSTRUCTION**

DRAWING IN PROGRESS | DATE: 04/07/2017

0 5 10 15 20m

MAREEBA CBD TRAFFIC STUDY
MULLIGAN HIGHWAY AND MAREEBA DIMBULAH ROAD
OPTION 1
SKETCH-K1

Appendix H

Opinions of Cost

MAREEBA SHIRE COUNCIL/DEPARTMENT OF TRANSPORT AND MAIN ROADS
MAREEBA CBD TRAFFIC MANGEMENT STUDY
BYRNES STREET AND COSTIN STREET - CONCEPT OPTION 2
OPINION OF COST

AECOM

No.	Description	Unit	Quantity	Rate (2017 \$'s)	Amount (\$)
1.	CONTRACTORS SITE FACILITIES (a) Establishment and site facilities (5%)	Item	Lump Sum		95,407
2.	PROVISION FOR TRAFFIC (a) Provision for traffic (5%)	Item	Lump Sum		95,407
3.	MANAGEMENT PLANS (a) Environmental management plan (b) Control of erosion and sediment	Item Item	Lump Sum Lump Sum		10,000 50,000
4.	DEMOLITIONS (a) Kerb (b) Medians (c) Existing pavement	m m2 m2	405 257 1663	10.00 20.00 15.00	4,050 5,140 24,945
5.	CONCRETE WORKS (a) Kerb (b) Hand placed concrete paving to islands/medians (c) Kerb and channel (d) Kerb crossings	m m2 m each	889 971 558 1	80.00 150.00 80.00 1500.00	71,120 145,650 44,640 1,500
6.	MINOR DRAINAGE (10%)	Item	Lump Sum		59,880
7.	EARTHWORKS (a) Excavation (b) Embankment (c) Hand excavation	m3 m3 m3	2191 832 110	30.00 30.00 100.00	65,735 24,945 10,956
8.	PAVEMENT (a) Cement modified base (450mm) (b) Rock working platform (300mm) (c) Remove/replace unsuitable (300mm)	m3 m3 m3	1191 79 79	150.00 500.00 200.00	178,673 39,705 15,882
9.	BITUMEN SURFACING (a) Prime (b) 1st. seal coat (c) Asphalt milling (40mm) (d) Asphalt surfacing (40mm)	m2 m2 m2 m2	2647 12087 9440 12087	2.00 3.00 10.00 45.00	5,294 36,261 94,400 543,915
10.	ROAD FURNITURE (a) Furniture (b) Linemarking	m of road m of road	977 977	20.00 15.00	19,540 14,655
11.	LANDSCAPING (a) Turfing (including topsoil)	m2	2513	20.00	50,260
12.	MODIFICATION TO SERVICES (a) Telstra - Relocation (b) Ergon - Overhead pole relocation	m each	150 1	300.00 20000.00	45,000 20,000
13.	ROADWAY LIGHTING (a) Light pole removal (b) New roadway lighting	each each	3 12	2000.00 15000.00	6,000 180,000
14.	TRAFFIC SIGNAL INSTALLATION (a) Signal hardware and software	each	1	200000.00	200,000
15.	FINAL DESIGN DETAILS (10%)	Item	Lump Sum		215,896
	TOTAL CONSTRUCTION COST (\$)				2,374,856
16.	PLANNING, SURVEY AND DETAILED DESIGN (10%)	Item	Lump Sum		237,486
17.	PROJECT ADMINISTRATION (7%)	Item	Lump Sum		166,240
18.	CONTIGENCY (50%)	Item	Lump Sum		1,187,428
	OPINION OF TOTAL OUT TURN COST (\$)				3,966,009

Please note that AECOM has no control over the cost of labour, materials, equipment or services furnished by others, neither has it control over contractors methods for determining prices, competitive bidding or market conditions. The opinion of probable construction cost produced by AECOM will therefore be provided on the basis of its best judgement as an experienced and qualified engineering consultant, familiar with the construction industry. AECOM can therefore not guarantee that any tenders or actual construction costs will not vary from any opinion of probable construction cost provided.

MAREEBA SHIRE COUNCIL/DEPARTMENT OF TRANSPORT AND MAIN ROADS
MAREEBA CBD TRAFFIC MANGEMENT STUDY
BYRNES STREET AND BASALT STREET INTERSECTION - CONCEPT OPTION 3
OPINION OF COST

AECOM

No.	Description	Unit	Quantity	Rate (2017 \$'s)	Amount (\$)
1.	CONTRACTORS SITE FACILITIES (a) Establishment and site facilities (5%)	Item	Lump Sum		85,171
2.	PROVISION FOR TRAFFIC (a) Provision for traffic (5%)	Item	Lump Sum		85,171
3.	MANAGEMENT PLANS (a) Environmental management plan (b) Control of erosion and sediment	Item Item	Lump Sum Lump Sum		10,000 50,000
4.	DEMOLITIONS (a) Kerb (b) Medians	m m2	764 257	10.00 20.00	7,640 5,140
5.	CONCRETE WORKS (a) Kerb (b) Hand placed concrete paving to islands/medians (c) Kerb and channel (d) Kerb crossings	m m2 m each	1057 1190 821 2	80.00 150.00 80.00 1500.00	84,560 178,500 65,680 3,000
6.	MINOR DRAINAGE (10%)	Item	Lump Sum		74,702
7.	EARTHWORKS (a) Excavation (b) Embankment (c) Hand excavation	m3 m3 m3	1777 120 89	30.00 30.00 100.00	53,312 3,600 8,885
8.	PAVEMENT (a) Cement modified base (450mm) (b) Rock working platform (300mm) (c) Remove/replace unsuitable (300mm)	m3 m3 m3	1777 118 118	150.00 500.00 200.00	266,558 59,235 23,694
9.	BITUMEN SURFACING (a) Primerseal (b) 2nd. seal coat (c) Asphalt milling (40mm) (d) Asphalt surfacing (40mm)	m2 m2 m2 m2	3949 5792 3678 5792	2.00 3.00 10.00 45.00	7,898 17,376 36,780 260,640
10.	ROAD FURNITURE (a) Furniture (b) Linemarking	m of road m of road	1378 1378	20.00 15.00	27,560 20,670
11.	LANDSCAPING (a) Turfing (including topsoil)	m2	300	20.00	6,000
12.	MODIFICATION TO SERVICES (a) Water - Relocate (b) Telstra - Relocation (c) Ergon - Overhead pole relocation	m m each	230 110 5	300.00 300.00 20000.00	69,000 33,000 100,000
13.	ROADWAY LIGHTING (a) New roadway lighting	each	6	15000.00	90,000
14.	TRAFFIC SIGNAL (a) Signalalised intersection	each	1	200000.00	200,000
15.	FINAL DESIGN DETAILS (10%)	Item	Lump Sum		193,377
	TOTAL CONSTRUCTION COST (\$)				2,127,150
16.	PLANNING, SURVEY AND DESIGN (10%)	Item	Lump Sum		212,715
17.	PROJECT ADMINISTRATION (7%)	Item	Lump Sum		148,900
18.	CONTIGENCY (50%)	Item	Lump Sum		1,063,575
	OPINION OF TOTAL OUT TURN COST (\$)				3,552,340

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MAREEBA SHIRE COUNCIL/DEPARTMENT OF TRANSPORT AND MAIN ROADS
MAREEBA CBD TRAFFIC MANGEMENT STUDY
BYRNES STREET AND HERBERTON STREET - CONCEPT OPTION 3
OPINION OF COST

AECOM

No.	Description	Unit	Quantity	Rate (2017 \$'s)	Amount (\$)
1.	CONTRACTORS SITE FACILITIES (a) Establishment and site facilities (5%)	Item	Lump Sum		46,513
2.	PROVISION FOR TRAFFIC (a) Provision for traffic (5%)	Item	Lump Sum		46,513
3.	MANAGEMENT PLANS (a) Environmental management plan (b) Control of erosion and sediment	Item Item	Lump Sum Lump Sum		10,000 50,000
4.	DEMOLITIONS (a) Kerb (b) Medians	m m2	202 145	10.00 20.00	2,020 2,900
5.	CONCRETE WORKS (a) Kerb (b) Hand placed concrete paving to islands/medians (c) Kerb and channel (d) Kerb crossings	m m2 m each	584 682 193 2	80.00 150.00 80.00 1500.00	46,720 102,300 15,440 3,000
6.	MINOR DRAINAGE (10%)	Item	Lump Sum		39,045
7.	EARTHWORKS (a) Excavation (b) Hand excavation	m3 m3	963 48	30.00 100.00	28,877 4,813
8.	PAVEMENT (a) Cement modified base (450mm) (b) Rock working platform (300mm) (c) Remove/replace unsuitable (300mm)	m3 m3 m3	963 64 64	150.00 500.00 200.00	144,383 32,085 12,834
9.	BITUMEN SURFACING (a) Primerseal (b) 2nd. seal coat (c) Asphalt milling (40mm) (d) Asphalt surfacing (40mm)	m2 m2 m2 m2	2139 5336 3197 5336	2.00 3.00 10.00 45.00	4,278 16,008 31,970 240,120
10.	ROAD FURNITURE (a) Furniture (b) Linemarking	m of road m of road	500 500	20.00 15.00	10,000 7,500
11.	LANDSCAPING (a) Turfing (including topsoil)	m2	198	20.00	3,960
12.	MODIFICATION TO SERVICES (a) Water - Lower (b) Telstra - Relocation (c) Ergon - Overhead pole relocation	m m each	75 65 4	300.00 300.00 20000.00	22,500 19,500 80,000
13.	ROADWAY LIGHTING (a) New roadway lighting	each	4	15000.00	60,000
14.	TRAFFIC SIGNAL (a) Signalised intersection	each	0	200000.00	0
15.	FINAL DESIGN DETAILS (10%)	Item	Lump Sum		108,328
	TOTAL CONSTRUCTION COST (\$)				1,191,605
16.	PLANNING, SURVEY AND DESIGN (10%)	Item	Lump Sum		119,160
17.	PROJECT ADMINISTRATION (7%)	Item	Lump Sum		83,412
18.	CONTINGENCY (50%)	Item	Lump Sum		595,802
	OPINION OF TOTAL OUT TURN COST (\$)				1,989,980

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No.	Description	Unit	Quantity	Rate (2017 \$'s)	Amount (\$)
1.	CONTRACTORS SITE FACILITIES (a) Establishment and site facilities (5%)	Item	Lump Sum		39,904
2.	PROVISION FOR TRAFFIC (a) Provision for traffic (5%)	Item	Lump Sum		39,904
3.	MANAGEMENT PLANS (a) Environmental management plan (b) Control of erosion and sediment	Item Item	Lump Sum Lump Sum		20,000 50,000
4.	DEMOLITIONS (a) Kerb	m	168	10.00	1,680
5.	CONCRETE WORKS (a) Kerb (b) Hand placed concrete paving to islands/medians (c) Kerb and channel (e) Kerb crossings (f) Concrete path	m m2 m each m2	239 116 164 2 110	80.00 150.00 80.00 1500.00 150.00	19,120 17,400 13,120 3,000 16,500
6.	MINOR DRAINAGE (10%)	Item	Lump Sum		44,395
7.	EARTHWORKS (a) Excavation (b) Embankment (c) Hand excavation	m3 m3 m3	1301 500 650	30.00 30.00 100.00	39,015 15,000 65,025
8.	PAVEMENT (a) Cement modified base (450mm) (b) Rock working platform (300mm) (c) Remove/replace unsuitable (300mm)	m3 m3 m3	1301 87 87	150.00 500.00 200.00	195,075 43,350 17,340
9.	BITUMEN SURFACING (a) Primerseal (b) 2nd. seal coat (d) Asphalt surfacing (40mm)	m2 m2 m2	2890 2890 2890	2.00 3.00 45.00	5,780 8,670 130,050
10.	ROAD FURNITURE (a) Furniture (b) Linemarking	m of road m of road	221 221	20.00 15.00	4,420 3,315
11.	LANDSCAPING (a) Turfing (including topsoil)	m2	316	20.00	6,320
12.	MODIFICATION TO SERVICES (a) Water - Lower (d) Telstra - Relocation (e) Ergon - Overhead pole relocation	m m each	75 50 1	300.00 300.00 20000.00	22,500 15,000 20,000
13.	ROADWAY LIGHTING (a) Light pole removal (b) New roadway lighting	each each	1 6	2000.00 15000.00	2,000 90,000
14.	FINAL DESIGN DETAILS (10%)	Item	Lump Sum		94,788
	TOTAL CONSTRUCTION COST (\$)				1,042,670
15.	PLANNING, SURVEY AND DESIGN (10%)	Item	Lump Sum		104,267
16.	PROJECT ADMINISTRATION (7%)	Item	Lump Sum		72,987
17.	CONTINGENCY (50%)	Item	Lump Sum		521,335
	OPINION OF TOTAL OUT TURN COST (\$)				1,741,259

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MAREEBA SHIRE COUNCIL/DEPARTMENT OF TRANSPORT AND MAIN ROADS
MAREEBA CBD TRAFFIC MANGEMENT STUDY
BYRNES STREET AND RANKIN STREET - CONCEPT OPTION 3
OPINION OF COST

AECOM

No.	Description	Unit	Quantity	Rate (2017 \$'s)	Amount (\$)
1.	CONTRACTORS SITE FACILITIES (a) Establishment and site facilities (5%)	Item	Lump Sum		82,742
2.	PROVISION FOR TRAFFIC (a) Provision for traffic (5%)	Item	Lump Sum		82,742
3.	MANAGEMENT PLANS (a) Environmental management plan (b) Control of erosion and sediment	Item Item	Lump Sum Lump Sum		20,000 50,000
4.	DEMOLITIONS (a) Kerb (b) Medians (c) pavement	m m2 m2	858 676 3281	10.00 20.00 15.00	8,580 13,520 49,215
5.	CONCRETE WORKS (a) Kerb (b) Hand placed concrete paving to islands/medians (c) Kerb and channel (e) Kerb crossings	m m2 m each	901 467 126 4	80.00 150.00 80.00 1500.00	72,080 70,050 10,080 6,000
6.	MINOR DRAINAGE (10%)	Item	Lump Sum		53,834
7.	EARTHWORKS (a) Excavation (b) Embankment (c) Hand excavation	m3 m3 m3	1602 300 80	30.00 30.00 100.00	48,060 9,000 8,010
8.	PAVEMENT (a) Cement modified base (450mm) (b) Rock working platform (300mm) (c) Remove/replace unsuitable (300mm)	m3 m3 m3	1602 107 107	150.00 500.00 200.00	240,300 53,400 21,360
9.	BITUMEN SURFACING (a) Primerseal (b) 2nd. seal coat (c) Asphalt milling (40mm) (d) Asphalt surfacing (40mm)	m2 m2 m2 m2	3560 7540 3980 7540	2.00 3.00 10.00 45.00	7,120 22,620 39,800 339,300
10.	ROAD FURNITURE (a) Furniture (b) Linemarking	m of road m of road	1443 1443	20.00 15.00	28,860 21,645
11.	LANDSCAPING (a) Turfing (including topsoil)	m2	450	20.00	9,000
12.	MODIFICATION TO SERVICES (a) Water - Lower (b) Telstra - Relocation	m m	300 150	300.00 300.00	90,000 45,000
13.	ROADWAY LIGHTING (a) Light pole removal (b) New roadway lighting	each each	4 12	2000.00 15000.00	8,000 180,000
14.	TRAFFIC SIGNAL (a) Signalalised intersection	each	1	200000.00	200,000
15.	FINAL DESIGN DETAILS (10%)	Item	Lump Sum		189,032
	TOTAL CONSTRUCTION COST (\$)				2,079,349
16.	PLANNING, SURVEY AND DESIGN (10%)	Item	Lump Sum		207,935
17.	PROJECT ADMINISTRATION (7%)	Item	Lump Sum		145,554
18.	CONTIGENCY (50%)	Item	Lump Sum		1,039,675
	OPINION OF TOTAL OUT TURN COST (\$)				3,472,513

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No.	Description	Unit	Quantity	Rate (2017 \$'s)	Amount (\$)
1.	CONTRACTORS SITE FACILITIES (a) Establishment and site facilities (5%)	Item	Lump Sum		27,174
2.	PROVISION FOR TRAFFIC (a) Provision for traffic (5%)	Item	Lump Sum		27,174
3.	MANAGEMENT PLANS (a) Environmental management plan (b) Control of erosion and sediment	Item Item	Lump Sum Lump Sum		10,000 30,000
4.	DEMOLITIONS (a) Kerb	m	206	10.00	2,060
5.	CONCRETE WORKS (a) Kerb (b) Hand placed concrete paving to islands/medians (c) Kerb and channel (e) Kerb crossings (f) Concrete path	m m2 m each m2	367 247 48 4 100	80.00 150.00 80.00 1500.00 150.00	29,360 37,050 3,840 6,000 15,000
6.	MINOR DRAINAGE (10%)	Item	Lump Sum		25,880
7.	EARTHWORKS (a) Excavation (b) Embankment (c) Hand excavation	m3 m3 m3	610 400 31	30.00 30.00 100.00	18,300 12,000 3,050
8.	PAVEMENT (a) Cement modified base (450mm) (b) Rock working platform (300mm) (c) Remove/replace unsuitable (300mm)	m3 m3 m3	610 61 61	150.00 500.00 200.00	91,500 30,500 12,200
9.	BITUMEN SURFACING (a) Primerseal (b) 2nd. seal coat (c) Asphalt milling (40mm) (d) Asphalt surfacing (40mm)	m2 m2 m2 m2	2711 2711 610 2711	2.00 3.00 10.00 45.00	5,422 8,133 6,100 121,995
10.	ROAD FURNITURE (a) Furniture (b) Linemarking	m of road m of road	237 237	20.00 15.00	4,740 3,555
11.	LANDSCAPING (a) Turfing (including topsoil)	m2	50	20.00	1,000
12.	MODIFICATION TO SERVICES (d) Telstra - Relocation (e) Ergon - Overhead pole relocation	m each	36 1	300.00 20000.00	10,800 20,000
13.	ROADWAY LIGHTING (a) Light pole removal (b) New roadway lighting	each each	 5	2000.00 15000.00	0 75,000
14.	FINAL DESIGN DETAILS (10%) TOTAL CONSTRUCTION COST (\$)	Item	Lump Sum		63,783 701,617
15.	PLANNING, SURVEY AND DESIGN (10%)	Item	Lump Sum		70,162
16.	PROJECT ADMINISTRATION (7%)	Item	Lump Sum		49,113
17.	CONTINGENCY (50%)	Item	Lump Sum		350,808
	OPINION OF TOTAL OUT TURN COST (\$)				1,171,700

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No.	Description	Unit	Quantity	Rate (2017 \$'s)	Amount (\$)
1.	CONTRACTORS SITE FACILITIES (a) Establishment and site facilities (5%)	Item	Lump Sum		6,538
2.	PROVISION FOR TRAFFIC (a) Provision for traffic (5%)	Item	Lump Sum		6,538
3.	MANAGEMENT PLANS (a) Environmental management plan (b) Control of erosion and sediment	Item Item	Lump Sum Lump Sum		5,000 5,000
4.	DEMOLITIONS (a) Kerb (b) Medians	m m2	105 5	10.00 20.00	1,050 100
5.	CONCRETE WORKS (a) Kerb (b) Hand placed concrete paving to islands/medians	m m2	195 258	80.00 150.00	15,600 38,700
6.	MINOR DRAINAGE (10%)	Item	Lump Sum		6,092
7.	EARTHWORKS (a) Excavation (b) Hand excavation	m3 m3	27 5	30.00 100.00	810 500
8.	PAVEMENT (a) Cement modified base (450mm) (b) Rock working platform (300mm) (c) Remove/replace unsuitable (300mm)	m3 m3 m3	27 2 2	150.00 500.00 200.00	4,050 900 360
9.	BITUMEN SURFACING (a) Primerseal (b) 2nd. seal coat (c) Asphalt milling (40mm) (d) Asphalt surfacing (40mm)	m2 m2 m2 m2	60 160 100 160	2.00 3.00 10.00 45.00	120 480 1,000 7,200
10.	ROAD FURNITURE (a) Furniture (b) Linemarking	m of road m of road	80 80	20.00 15.00	1,600 1,200
11.	LANDSCAPING (a) Turfing (including topsoil)	m2	100	20.00	2,000
12.	ROADWAY LIGHTING (a) Light pole removal (b) New roadway lighting	each each	2 3	2000.00 15000.00	4,000 45,000
13.	FINAL DESIGN DETAILS (10%)	Item	Lump Sum		15,384
	TOTAL CONSTRUCTION COST (\$)				169,222
14.	PLANNING, SURVEY AND DESIGN (10%)	Item	Lump Sum		16,922
15.	PROJECT ADMINISTRATION (7%)	Item	Lump Sum		11,846
16.	CONTINGENCY (50%)	Item	Lump Sum		84,611
	OPINION OF TOTAL OUT TURN COST (\$)				282,601

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MAREEBA SHIRE COUNCIL/DEPARTMENT OF TRANSPORT AND MAIN ROADS
MAREEBA CBD TRAFFIC MANGEMENT STUDY
WALSH STREET AND COLES AND TARGET SHOPPING CENTRE ACCESESSES - CONCEPT OPTION 3
OPINION OF COST

AECOM

No.	Description	Unit	Quantity	Rate (2017 \$'s)	Amount (\$)
1.	CONTRACTORS SITE FACILITIES (a) Establishment and site facilities (5%)	Item	Lump Sum		8,955
2.	PROVISION FOR TRAFFIC (a) Provision for traffic (5%)	Item	Lump Sum		8,955
3.	MANAGEMENT PLANS (a) Environmental management plan (b) Control of erosion and sediment	Item Item	Lump Sum Lump Sum		5,000 5,000
4.	DEMOLITIONS (a) Kerb (b) Medians	m m2	30 50	10.00 20.00	300 1,000
5.	CONCRETE WORKS (a) Kerb (b) Hand placed concrete paving to islands/medians (e) Kerb crossings	m m2 each	179 150 2	80.00 150.00 1500.00	14,320 22,500 3,000
6.	MINOR DRAINAGE (10%)	Item	Lump Sum		3,982
7.	BITUMEN SURFACING (a) Tack coat (b) Asphalt milling (40mm) (c) Asphalt surfacing (40mm)	m2 m2 m2	1714 1714 1714	3.00 10.00 45.00	5,142 17,140 77,130
8.	ROAD FURNITURE (a) Furniture (b) Linemarking	m of road m of road	131 131	20.00 15.00	2,620 1,965
9.	ROADWAY LIGHTING (b) New roadway lighting	each	2	15000.00	30,000
10.	FINAL DESIGN DETAILS (10%)	Item	Lump Sum		20,701
	TOTAL CONSTRUCTION COST (\$)				227,710
11.	PLANNING, SURVEY AND DESIGN (10%)	Item	Lump Sum		22,771
12.	PROJECT ADMINISTRATION (7%)	Item	Lump Sum		15,940
13.	CONTIGENCY (50%)	Item	Lump Sum		113,855
	OPINION OF TOTAL OUT TURN COST (\$)				380,275

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MAREEBA SHIRE COUNCIL/DEPARTMENT OF TRANSPORT AND MAIN ROADS
MAREEBA CBD TRAFFIC MANGEMENT STUDY
MULLIGAN HIGHWAY AND MAREEBA DIMBULAH ROAD - CONCEPT OPTION 1
OPINION OF COST

AECOM

No.	Description	Unit	Quantity	Rate (2017 \$'s)	Amount (\$)
1.	CONTRACTORS SITE FACILITIES (a) Establishment and site facilities (5%)	Item	Lump Sum		39,839
2.	PROVISION FOR TRAFFIC (a) Provision for traffic (5%)	Item	Lump Sum		39,839
3.	MANAGEMENT PLANS (a) Environmental management plan (b) Control of erosion and sediment	Item Item	Lump Sum Lump Sum		5,000 30,000
4.	DEMOLITIONS (a) Kerb (b) Medians	m m2	250 90	10.00 20.00	2,500 1,800
5.	CONCRETE WORKS (a) Kerb (b) Hand placed concrete paving to islands/medians (c) Kerb crossings (d) Concrete path	m m2 each m2	671 145 4 320	80.00 150.00 1500.00 150.00	53,680 21,750 6,000 48,000
6.	MINOR DRAINAGE (10%)	Item	Lump Sum		34,109
7.	EARTHWORKS (a) Excavation (b) Embankment (c) Hand excavation	m3 m3 m3	870 200 44	30.00 30.00 100.00	26,108 6,000 4,351
8.	PAVEMENT (a) Cement modified base (450mm) (b) Rock working platform (300mm) (c) Remove/replace unsuitable (300mm) (d) Retaining wall	m3 m3 m3 m2	794 53 53 38	150.00 500.00 200.00 500.00	119,138 26,475 10,590 19,000
9.	BITUMEN SURFACING (a) Primerseal (b) 2nd. seal coat (c) Asphalt milling (40mm) (d) Asphalt surfacing (40mm)	m2 m2 m2 m2	1765 3665 1900 3665	2.00 3.00 10.00 45.00	3,530 10,995 19,000 164,925
10.	ROAD FURNITURE (a) Furniture (b) Linemarking	m of road m of road	246 246	20.00 15.00	4,920 3,690
11.	LANDSCAPING (a) Turfing (including topsoil)	m2	161	20.00	3,220
12.	MODIFICATION TO SERVICES (a) Water - Lower (d) Telstra - Relocation (e) Ergon - Overhead pole relocation	m m each	50 80 2	300.00 300.00 20000.00	15,000 24,000 40,000
13.	ROADWAY LIGHTING (a) Light pole removal (b) New roadway lighting	each each	1 5	3000.00 15000.00	3,000 75,000
14.	QR Works (a) Pedestrian maze for QR crossing	each	1	50000.00	50,000
15.	FINAL DESIGN DETAILS (10%)	Item	Lump Sum		91,146
	TOTAL CONSTRUCTION COST (\$)				1,002,604
16.	PLANNING, SURVEY AND DETAILED DESIGN (10%)	Item	Lump Sum		100,260
17.	PROJECT ADMINISTRATION (7%)	Item	Lump Sum		70,182
18.	CONTINGENCY (50%)	Item	Lump Sum		501,302
	OPINION OF TOTAL OUT TURN COST (\$)				1,674,349

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Appendix I

Risk Register

Mareeba CBD Traffic Management Study																																						
Risk Register																																						
Project/Program Objectives																	Current Rating			Treatment									Residual/ Retained Rating	Net Financial Impact (\$ (Optional Field)								
Reference Number	Reduce traffic congestion	Reduce crash occurrence rate	Improve efficiency of the link	Ensure all road users are safely accommodated including pedestrians and cyclists						Description	Causes/Sources	Impacts	Controls	Stakeholders	Risk Owner	Likelihood	Consequence	Rating	Treatment Option	Treatment	Treatment Owner	Treatment Due Date	Treatment Status	Likelihood	Consequence	Rating	Best Case	Most Likely Case	Worst Case	Risk review date	Comments							
										Project governance practices not followed	Project proceeds outside of TMR's or MSC's required governance framework	Delays and additional work to comply with governance requirements.	Prepare governance framework	TMR/ MSC/ Designer	TMR/MS	Likely	Moderate	High	Changing the likelihood	1. TMR or MSC Project Manager to prepare and circulate a project plan to all team members outlining governance requirements	TMR/MS																	
										Upgrade does not accommodate anticipated traffic demands	Traffic demands on opening of upgrade significantly higher than anticipated and grow at a higher rate than expected.	Upgrade cannot accommodate traffic demands and fails prematurely. Public backlash over inadequate performance of upgrade. Political involvement. Delays and queues return to pre-upgrade state much quicker than expected.	Traffic analysis	TMR/MS	Designer	Possible	Major	High	Changing the consequence	1. Determine existing traffic demands from a current site survey.	Designer	Completed																
										Pedestrian and cyclist expectations are not meet in the upgraded arrangement	changes to or removal of existing facilities for pedestrians and cyclists at intersection	Public backlash and or political interference	Stakeholder consultation	TMR/MS	Local Bicycle User Groups/ Designer	TMR/MS	Possible	Moderate	Medium	Changing the likelihood	1. Ensure design maintains existing pedestrian and cyclists facilities.	Designer																
										Potential Acid Sulphate Soils (PASS) are unexpected at the site, but exposed during construction	Possible presence of PASS	Unexpected delays to construction while material is treated. Additional costs incurred which were not allowed for in the project budget	Site investigations	TMR/Designer	Designer	Unlikely	Moderate	Medium	Changing the likelihood & consequence	1. Undertake field investigation works to confirm presence of PASS material.	TMR																	
										Public utility exposed and/or damaged during construction	Public utilities located at the site for which treatments have not been identified in the design	Project delays while redesign is completed to avoid major services and/or service is repaired. Backlash from users whose service is disrupted from damage to the utility. Commercial implications and claims for compensation for disruption of services to businesses cased by public utility damage. Possible injury or loss of life from striking service.	Dial Before you Dig Search Public utility potholing Liaison with public utility providers Contract documentation	TMR/MS/ Designer/ Contractor/Utility Provider	Designer	Almost Certain	Major	Extreme	Changing the likelihood	1. Undertake initial "Dial Before you Dig" search to identify general location of services at the site.	Designer/ Contractor																	
										Works expose items of significant cultural heritage value during construction and they may not be managed in the correct manner	Culturally significant items uncovered	Public backlash due to inappropriate handling of culturally significant items. Political involvement.	Cultural heritage assessment	TMR/MS	TMR/MS	Unlikely	Moderate	Medium	Changing the likelihood & consequence	1. Undertake cultural heritage assessment at the site to identify any potential for uncovering significant items	TMR/MS																	
										Cultural heritage interests arise after project commencement	Unknown cultural issues	Delays to project while cultural heritage items are dealt with.	Cultural heritage assessment	TMR/MS	TMR/MS	Unlikely	Moderate	Medium	Changing the likelihood & consequence	1. Undertake cultural heritage assessment at the site to identify any parties who may have an interest in the site	TMR/MS																	

Mareeba CBD Traffic Management Study Risk Register																																	
Project/Program Objectives																	Current Rating			Treatment								Residual/ Retained Rating		Net Financial Impact (\$) (Optional Field)			
Reference Number	Reduce traffic congestion	Reduce crash occurrence rate	Improve efficiency of the link	Ensure all road users are safely accommodated including pedestrians and cyclists						Description	Causes/Sources	Impacts	Controls	Stakeholders	Risk Owner	Likelihood	Consequence	Rating	Treatment Option	Treatment	Treatment Owner	Treatment Due Date	Treatment Status	Likelihood	Consequence	Rating	Best Case	Most Likely Case	Worst Case	Risk review date	Comments		
																			Changing the	4.													
																			5.														
										Changes in legislation and design standards result in new requirements for the design project and associated construction activities that are not allowed for in the project budget	Changes to legislation	Cost and delays due to design amendments and/or required changes to construction methodologies	Awareness and review of new legislation coming on line which impacts project	TMR/ Designer/ Contractor						1. Keep abreast of any new legislation and standards releases and review as soon as possible to determine impact	Designer/ Contractor												
															Designer	Possible	Moderate	Medium		2.													
																			3.														
																			4.														
																			5.														
										Excessive traffic delays during construction	Traffic management not adequate/appropriate	Public backlash from road users. Adverse media coverage. Political involvement. Increased occurrence of crashes due to inadequate and/or inappropriate traffic management.	Appropriate traffic management	TMR/ Contractor/ Designer						1. Consider constructability as part of design development and ensure upgrade can be constructed under traffic while maintaining the current level of service	Designer												
															TMR/MS/Designer/Contractor	Possible	Severe	High		2. Robust contract documentation that clearly specifies all requirements for management of traffic during construction of the upgrade.	Designer												
																			3. Review of Contractor's Traffic Management Plans by a suitably qualified individual prior to granting possession of site.	TMR/MS/													
																			4. Review to ensure all users, including cyclists are pedestrians, are considered and safely accommodated in the Traffic Management Plan	TMR/MS/													
																			5.														
										Assumption that existing pavement has sufficient remaining life to operate beyond expected design life of upgrade	Existing pavement	Existing pavement fails well before the expected design life of the upgrade. Site has to be re-established a relatively short time after completion of the upgrade to allow remediation works to be undertaken. Unbudgeted costs associated with repair works. Public backlash from possible traffic delays due to works occurring again at the site.	Pavement testing and analysis of results	TMR/ MS/ Designer						1. Undertake FWD testing and back-analysis of existing pavement during the detailed design phase to identify remaining life.	TMR/MS/ Designer												
															Designer	Possible	Moderate	Medium		2. Include strengthening or removal and replacement of existing pavement where required in upgrade design and documentation	Designer												
																			3.					Possible	Moderate	Medium							
																			4.														
																			5.														
										New pavement fails shortly after opening of upgrade	Incorrect pavement design	New pavement fails well before the expected design life of the upgrade. Site has to be re-established a short time after completion of the upgrade to allow remediation works to be undertaken. Unbudgeted costs associated with repair works. Public backlash from possible traffic delays due to works occurring again at the site.	Traffic analysis Geotechnical testing Pavement design	TMR/ MS/ Designer						1. Derive heavy vehicle content from current traffic data	Designer												
															Designer	Likely	Major	High		2. Apply appropriate future growth factor	Designer												
																			3. Undertake geotechnical investigations to identify subgrade strength	TMR				Unlikely	Major	Medium							
																			4. Complete pavement design in accordance with current standard	Designer													
																			5. Peer review of pavement design by both TMR, MSC and Designer	TMR/MS/ Designer													
										Large areas of unsuitable subgrade are exposed once construction commences	Investigations not undertaken or does not identify large areas of unsuitable materials at the site.	Large areas of unsuitable subgrade to be replaced. Increased project costs for unsuitable subgrade treatment. Construction delays as a result of large areas of treatment.	Geotechnical investigations	TMR/MS/ Designer/ Contractor						1. Ensure geotechnical testing locations are undertaken at a frequency which will provide a high level of confidence in the existing subgrade conditions.	Designer												
															Designer	Unlikely	Major	Medium		2. Include provisional allowances in the construction schedule for removal and replacement of unsuitable subgrade materials if identified in the testing.	Designer												
																			3. Include "if ordered" allowance for subgrade treatment in the construction schedule even if testing does not identify unsuitable subgrade materials.	Designer													
																			4.														
																			5.														

Appendix J

Safe Design Report

Safe Design Report

Mareeba CBD Traffic Management Study

Safe Design Report

Mareeba CBD Traffic Management Study

Client: Mareeba Shire Council

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Prepared by

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Quality Information

Document Safe Design Report

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Prepared by Frank D'Addona

Reviewed by Daniel Tierney

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Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
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1.0 Introduction

1.1 General

AECOM Pty Ltd (AECOM) has been commissioned by Mareeba Shire Council to undertake the Mareeba CBD Traffic Management Study. The study, jointly funded by Mareeba Shire Council (MSC) and the Department of Transport and Main Roads (TMR) was initiated MSC due to concerns regarding:

- Congestion at the Rankin / Byrnes Street and Rankin / Walsh Street intersections and the interaction of vehicular and pedestrian traffic.
- Operation of the Coles and Target Shopping Centre accesses along Walsh Street.
- Operation of the McDonalds Restaurant carpark access from Rankin Street as well as the entry and exit from Curcio's Bakery.

The study extents were then expanded in consultation with TMR to include various intersections along Byrnes Street and the intersection of Mareeba-Dimbulah Road/Mulligan Highway. Byrnes Street, Mareeba-Dimbulah Road and Mulligan Highway are all state controlled road.

1.2 Background

The works covered by this report are the concept intersection upgrades developed as part of the study. It is stressed that the upgrading layouts included in this report are concept in nature and have been developed over aerial imagery without ground survey. Progression of the concepts to construction would need to include the full rigours of the detailed design process.

Concept layouts for intersection upgrades within the Mareeba CBD were developed at:

- Byrnes Street and Mareeba Connection Road/Costin Street
- Byrnes Street and Basalt Street
- Byrnes Street and Herberton Street
- Byrnes Street and Atherton Street
- Byrnes Street and Rankin Street
- Herberton Street and Constance Street
- Rankin Street and Walsh Street
- Walsh Street and the Coles/Target Shopping Centre accesses
- Mulligan Highway and Mareeba-Dimbulah Road

1.3 Purpose of Report

This report:

1. outlines the legal context of the Safety in Design (SiD) process,
2. documents the approach taken by the design team to identify the risk events associated with the project
3. records the risk events and the relevant action/s proposed to reduce the likelihood of the risk event occurring to as low as reasonably practicable,
4. outlines a plan for future SiD management.

1.4 Scope of construction works

As discussed previously, concept upgrading layouts only have been developed as part of the Mareeba CBD Traffic Management Study. Progression of the concept to construction would include, but not be limited to, undertaking of site survey, risk assessment, preliminary and detailed design.

While no detailed design has been carried out, it is expected that construction activities required to implement the upgrades would include, but not be limited to:

- Identification and protection of or relocation of public utilities
- Locating and working around existing utilities
- Coordinating works with various utility providers
- Traffic management
- Demolition of:
 - existing surfacing
 - street lighting
 - damage kerb and channel
 - drainage structures
 - road furniture
- Pavement excavation
- Pavement supply/delivery and cartage
- Subgrade treatment
- Construction of new pavements
- Installation of:
 - culverts
 - manholes
 - subsoil drainage
 - kerb and concrete islands
 - roadway lighting
 - signs, linemarking, and road furniture
- Bitumen and asphalt surfacing
- Landscaping

Concept layouts of the proposed upgrades are included in Appendix A of this report.

The work activities outlined above are considered to be common in the road construction industry and consistent with the type of work that civil contractors regularly undertake in the region.

2.0 Safety in design (SiD)

2.1 What is safe design?

Safe Design can be defined as:

“the integration of hazard identification and risk assessment methods early in the design process to eliminate or minimise the risks of injury throughout the life of the product being designed. It

encompasses all design including facilities, hardware, systems, equipment, products, tooling, materials, energy controls, layout, and configuration”

Source: The Australian Safety and Compensation Council publication - Guidance on the Principles of Safe Design for Work (2006).

Safety in Design (SiD) also includes risks associated with construction, operation and maintenance, and decommissioning of an asset. It is applicable to all design activities and extends beyond verification and code compliance.

2.2 Legal context

Under the existing Queensland Work Health and Safety Act 2011 and Work Health and Safety Regulation 2011, designers of plant, substances and structures have a legal duty to provide for safe design. This has led to formalisation of safe design processes.

2.3 Principles of safe design

The principles of safe design:

- **Persons with control** – persons who make decisions affecting the design of products, facilities or processes are able to promote health and safety at the source.
- **Product lifecycle** – safe design applies to every stage in the lifecycle, from conception through to disposal. It involves eliminating hazards or preventing or minimising risks as early in the lifecycle as possible.
- **Systematic risk management** – the application of hazard identification, risk assessment and risk control processes to achieve safe design.
- **Safe design knowledge and capability** – should be either demonstrated or acquired by persons with control over design.
- **Information transfer** – effective communication and documentation of design and risk control information between all persons involved in the stages of the lifecycle, is essential for the safe design approach.

Source: The Australian Safety and Compensation Council publication - Guidance on the Principles of Safe Design for Work (2006).

2.4 Client's obligations

A Client has an obligation to consult with:

- If a designer designed any part of, construction work – the designer about how the construction work, in connection with the design, can be undertaken in a way that prevents or minimises all risks to health and safety
- If there is a project manager for the construction work – about how the construction work can be planned and managed in a way that prevents or minimises all risks to health and safety
- If there is a principal contractor for the construction work – about how the construction work can be undertaken in a way that prevents or minimises all risks to health and safety

The Act provides that if the client is aware of any information about hazards and risks relating to the site, at which the construction work is to be undertaken, the client must give this information to the designer, project manager or principal contractor.

2.5 Designer's obligations

Designers have obligations under the Act to prevent or minimise risks in the design of the works so that the design does not adversely affect the workplace health and safety of persons:

- During construction of the works.

- When the works has been constructed and is being used for the purpose for which it was designed.
- During routine maintenance.

The responsibility for achieving a safe design may rest with one or more parties who are in control or manage the design functions. This could extend to clients, developers, manufacturer, directors and managers in addition to architects and engineers who are directly involved in the design activity.

3.0 Safe design procedures

3.1 AECOM safety in design procedures

In the case of the concept intersection upgrades developed as part of the Mareeba CBD Traffic Management Study, the upgrades identified are considered to be common single discipline projects i.e. specialist contractors would not be required

As per the requirements of AECOM's safety in design procedure as outlined in Appendix B, the following has been undertaken:

- Team and peer review of possible design risks.
- Preparation of Concept Design Stage Risk Event Schedule.

A record of the outcomes from these procedures is attached as part of Risk Event schedule in Appendix C. A Risk Event is defined as a hazard that has the potential risk to cause damage to property or serious harm, injury or casualty to people associated with construction, operation and maintenance and demolition of the project, as well as the public interfacing with and around these operations. The schedule also outlines measures that will, or already have been undertaken, to mitigate these risks. The register will be a "living" document and updated as the project progresses to the detailed design and delivery phases and additional risks and mitigation strategies are identified.

It is noted that construction and demolition activities are generally not addressed as a designer's responsibility unless specifically requested by the client, but it is recognised that good design can assist in these areas.

3.2 Approach to safe design

The approach taken to Safety in Design within this project has been to understand and appreciate safety issues from the onset of the design, and to deal with these as an integral part of the day to day design process. This has ensured that the designs have been developed cognizant of construction staging and construction methodologies so that construction hazards have been considered.

Formalisation of the process is also necessary to document and record key decisions, risk appreciation and to identify where it has been impractical to completely eradicate risk.

During the design development, the team members identified project risks and discussion amongst the design team determined how best to manage these risks.

Where the risk event could not be completely or partially designed out, relevant actions were recorded to avoid, reduce or control the risk at the other stages for the life of the project. The responsibility for implementing any control measures during construction, operation and maintenance, and demolition will rest with the respective contractor or owner at that stage.

4.0 Assumptions

The following assumptions were made during the SiD process:

- Scope is limited to hazards reasonably foreseeable at the time of the review and resulting from design aspects of the facility for which AECOM is responsible. Hazards arising due to normal site construction, installation, maintenance or operation as covered by Workplace Health and Safety

Queensland, safe installation methods, Australian codes & standards, local codes and guidelines etc. are not part of this review.

- The SiD process was completed based on current industry good practice and knowledge, and to the standard of skill, care and diligence as is reasonably expected of a consultant performing the same or similar services.
- Any construction, operation, maintenance or demolition of the facilities will be carried out by organisations and/or personnel with appropriate knowledge, competence and skills to undertake such tasks.
- Any organisation or person responsible for any of construction, operation, maintenance or demolition of the facilities will review and update/incorporate any new risks into the Risk Register as and when required.
- Traffic through the site will fall under the control of a traffic management plan that will be prepared and approved by person whom has Temporary Traffic Management accreditation, Level 4.

5.0 Conclusions

5.1 General

The introduction of new legislation obligations for Clients, Project Managers, Designers, and Contractors under existing WH&S legislation has led to a formalisation of roles and responsibilities for projects, which has implications for the any upgrades identified in the Mareeba CBD Traffic Management Study that are progressed through to construction.

This report outlines the legal context of Safety in Design and documents the approach taken by the design team to identify the risk events associated with the project, record the risk events and document the relevant action proposed to reduce the likelihood of the risk event occurring to as low as reasonably practicable.

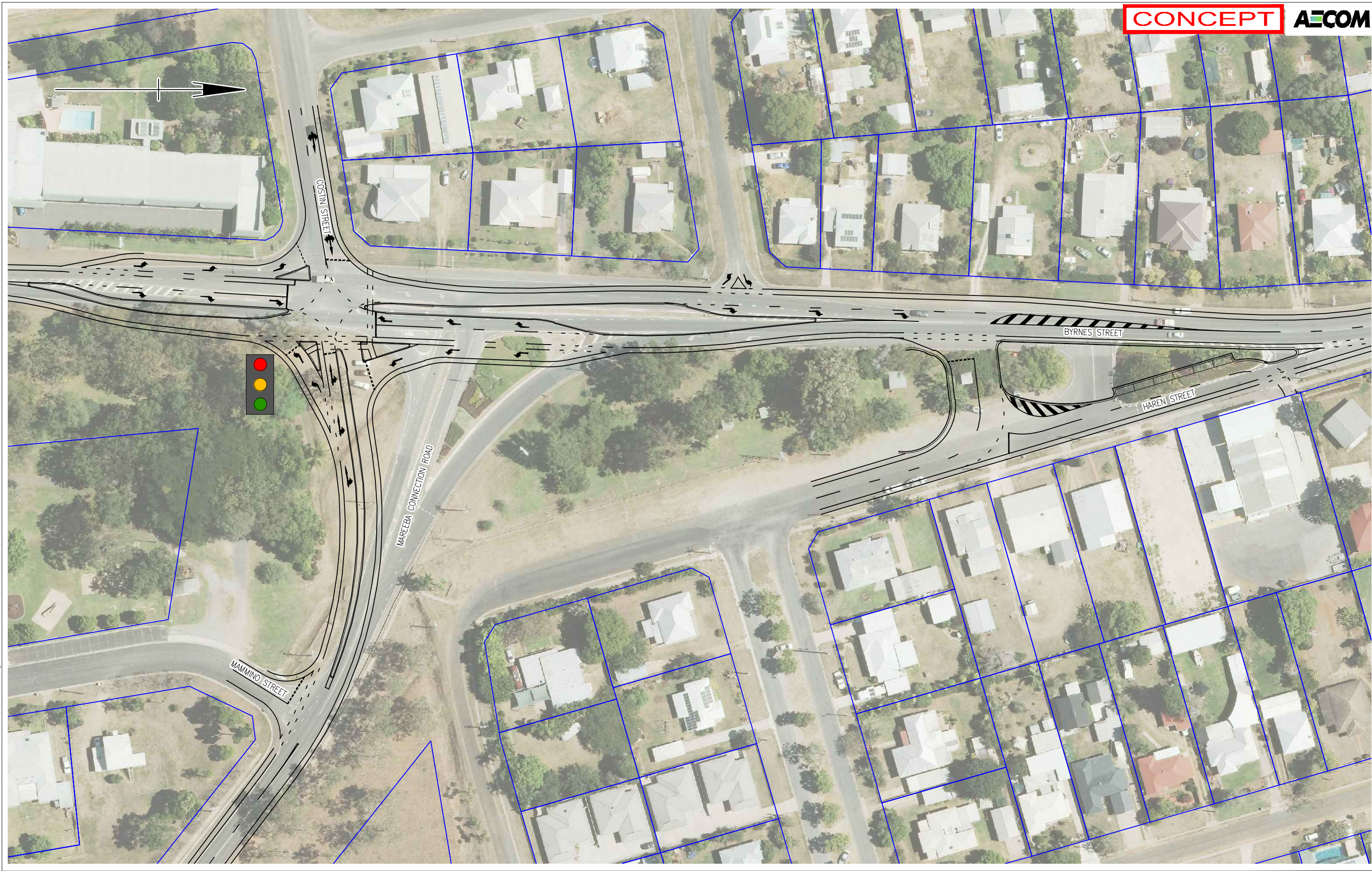
The AECOM internal process is mandatory for this project and the design team followed their in-house safe design procedures and planned what mitigating actions must be taken at the various stages of the project life.

Finally, it is worth reiterating that all parties involved in the project are responsible for workplace health and safety management so that all parties' duties are taken up as the project moves into the construction stage of its implementation. This report should be treated as a "living" document and used as a reference for the various management plans to be prepared by the Principal Contractor for the works as well as TMR and MSC (the asset owners) with regards to the operation and maintenance of the road.

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Appendix A

Concept Upgrading Layouts



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60535485
ISSUE-2
04/04/17

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DRAWING IN PROGRESS	DATE: 14/06/2017
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MAREEBA CBD TRAFFIC STUDY
BYRNES AND COSTIN STREETS
OPTION 2
SKETCH-A2



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60535485
ISSUE-3
18/04/17

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MAREEBA CBD TRAFFIC STUDY
BYRNES AND BASALT STREETS
OPTION 3
SKETCH-C3



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CAD Ref: P:\60535485\60535485.dwg



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60535485
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12/06/17

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FOR CONSTRUCTION**

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MAREEBA CBD TRAFFIC STUDY
BYRNES AND RANKIN STREETS
OPTION 3
SKETCH-F3



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60535485
ISSUE-2
04/04/17

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MAREEBA CBD TRAFFIC STUDY
MULLIGAN HIGHWAY AND MAREEBA DIMBULAH ROAD
OPTION 1
SKETCH-K1

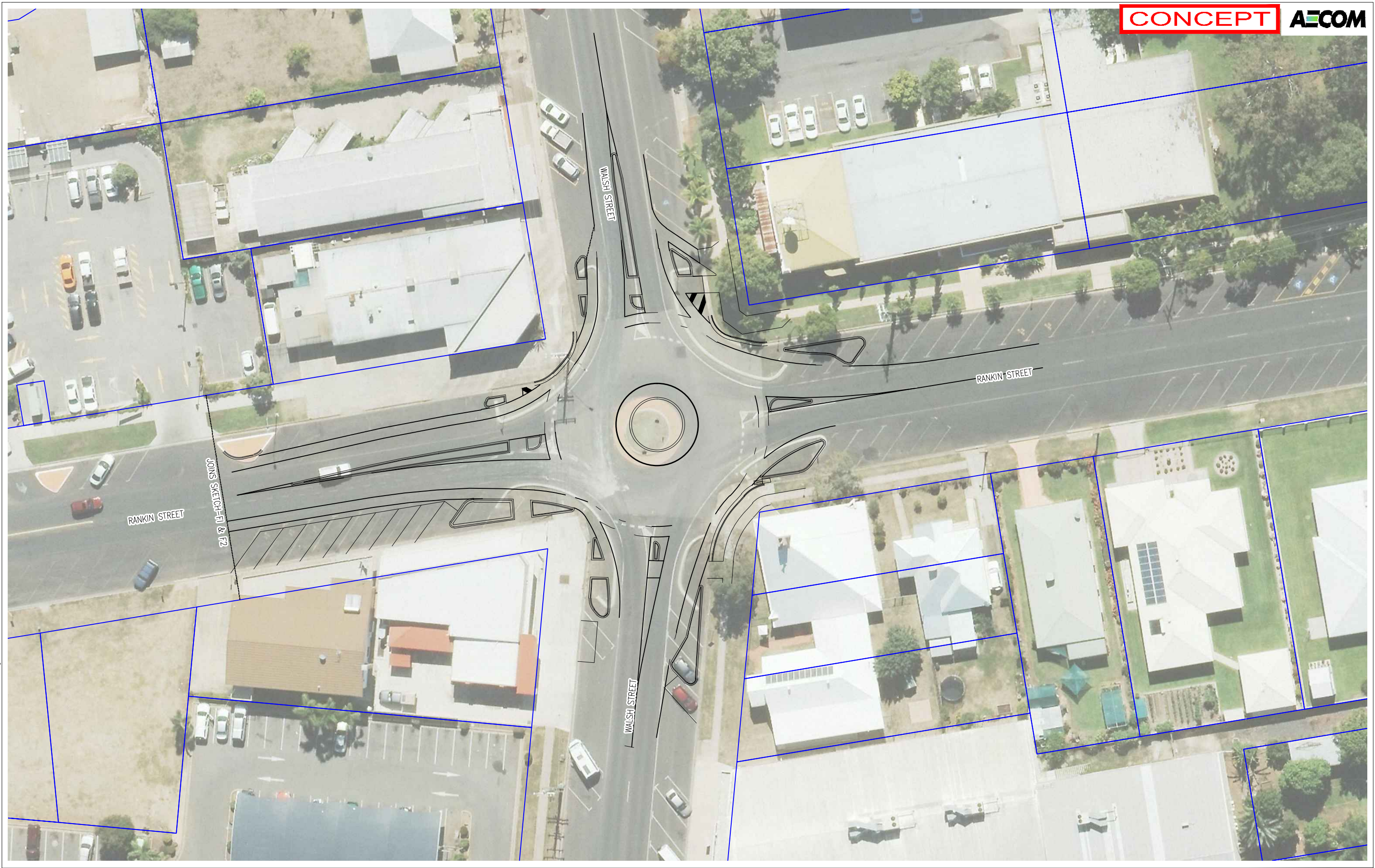


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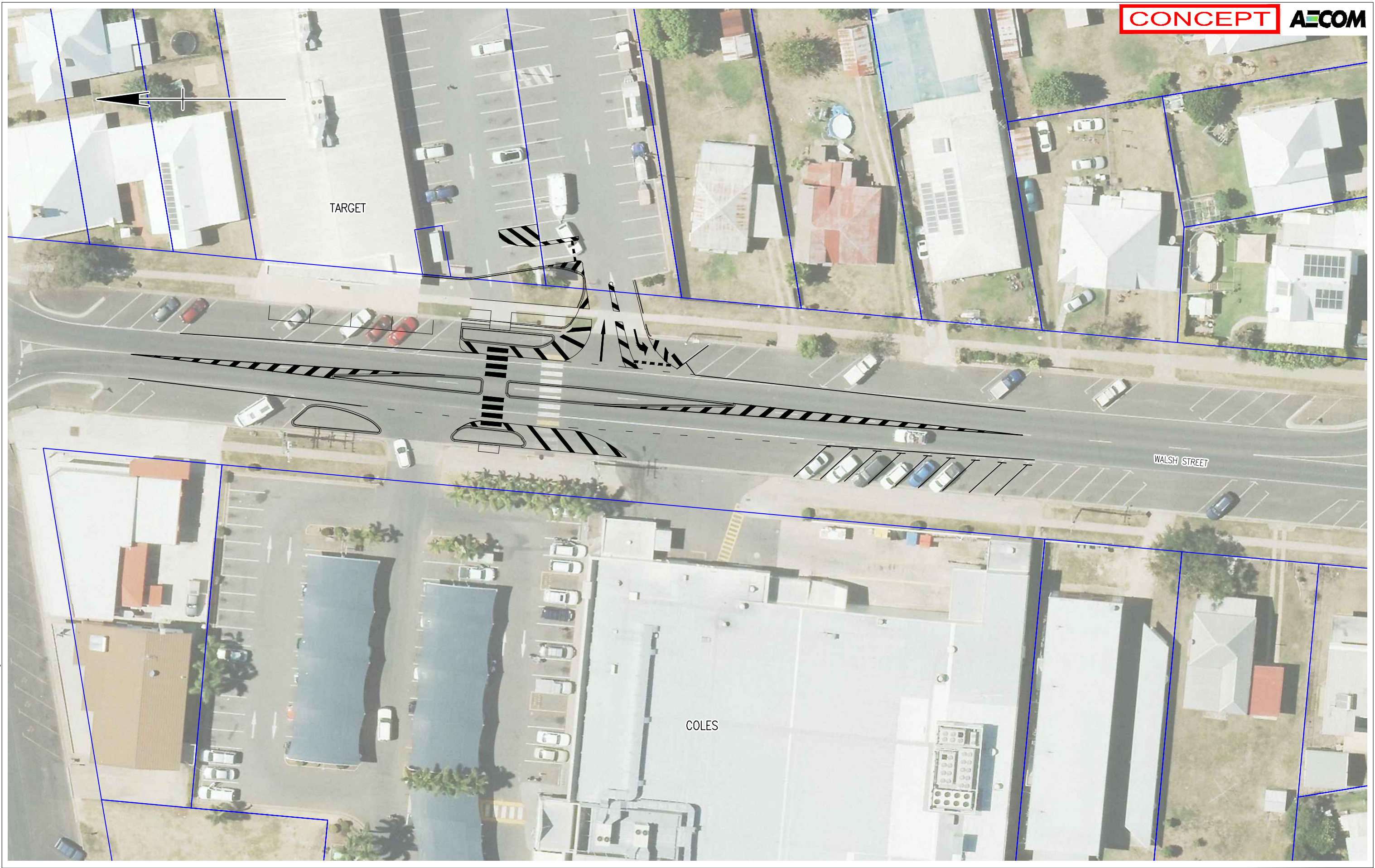
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MAREEBA CBD TRAFFIC STUDY
□ ALSH AND RANKIN STREETS
OPTION 2
SKETCH-□2



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12/06/17

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MAREEBA CBD TRAFFIC STUDY
□ ALSH STREET COLES ACCESS
OPTION 3
SKETCH-J3

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Appendix B

AECOM Safety in Design Procedure

Appendix B AECOM Safety in Design Procedure (I3AN-221-PR1)

TYPICAL PROJECT TYPES	TYPICAL SiD PROCESSES
<ul style="list-style-type: none"> Common (i.e. familiar) simple projects Single discipline projects 	Either (or both) of: <ul style="list-style-type: none"> Team Review Peer Review (independent)
<ul style="list-style-type: none"> Uncommon or unfamiliar projects for the project team Complex single discipline 	Either (or both) of: <ul style="list-style-type: none"> Peer Review (independent) "What if" or other self-guided study
<ul style="list-style-type: none"> Multi discipline common basis of design 	Either (or both) of: <ul style="list-style-type: none"> Team or peer review for each discipline "Workshop or formal study – level 1
<ul style="list-style-type: none"> Multi discipline uncommon (unfamiliar) basis of design High industry safety risks Very large projects High level of stakeholder interactions 	All of: <ul style="list-style-type: none"> Team or peer review for each discipline Workshops and formal studies – Level 2 May require several studies e.g. Different sections of the design and/or different stages of the design

Design Stage	SiD Requirements	Examples of Safe Design Considerations <i>(Note: This list is not exhaustive)</i>	Suggested Techniques & Tools
Concept	Identification of large scale issues and critical health and safety related risks that may affect the viability of the project.	<ul style="list-style-type: none"> • Site geology e.g. soft soils • Contaminated land • Emissions from development • Proposed use zoning • Relocating power lines or placing them underground before construction • Site layout for emergency response, security and separation of hazardous activities • Spatial relationships and congestion /pedestrian or vehicle separation • Demolition of existing assets • Staging / coordination issues • Materials options / construction techniques 	<ul style="list-style-type: none"> • Preliminary Hazard Analysis • Peer review
Schematic/ Preliminary	Identification of reasonably foreseeable safety risks considering construction, installation/commissioning, use, maintenance/repair, demolition/disposal.	<p>Specification of materials with high durability and low maintenance requirements</p> <p>Dangerous and hazardous goods requirements</p> <p>Redundancy – Introduction of duplicates to allow safe continued operation in the event of failure</p> <p>Providing safe access to roofs, plant rooms and windows for maintenance</p> <p>Considering human behaviour / potential for misuse.</p> <p>Physical characteristics of users</p> <p>Consideration of ergonomic principles e.g. avoid designing construction activities that require work in restricted spaces or designs that require repetitive or prolonged movements to complete task.</p>	<ul style="list-style-type: none"> • Preliminary Hazard Analysis • Human Reliability Analysis (HRA) • HAZOP or CHAIR study • Peer review
Detailed Design	Focus on ways in which a design can be fine-tuned to further improve safety aspects.	<p>Eliminating the need for installing temporary barriers, by integrated guardrail system along roof edges</p> <p>Inclusion of construction access into building fabric e.g. removable panels</p> <p>Instrumentation and its layout</p> <p>Positioning anchorage and hoisting points</p> <p>Details such as trip/slip and material handling hazards</p>	<ul style="list-style-type: none"> • HAZOP or Chair study • PEER reviews
Issued for Construction (IFC)	Focus on fine tuning residual safety risks and communications to all relevant stakeholders	<p>Review of Risk Register and/or report, ensuring that all safety issues have been minimised so far as is reasonably practicable and information about residual risks have been recorded.</p> <p>Communication protocols established covering all – relevant project team and stakeholders.</p>	<ul style="list-style-type: none"> • SiD Report Template

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Appendix C

Risk Event Schedule

REF	RISK EVENT	DATE ADDED	ACTIONS TAKEN TO AVOID, REDUCE OR CONTROL RISK				STATUS		
			DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE	Date	Status	Comment
GEOTECHNICAL									
1.1	Incorrect assumption about existing subgrade and pavement failLS (potholes, damaged surface, etc.)	6/07/17	Test pit investigations to be undertaken. Design CBR to be adopted based on lab testing (soaked CBR). Provisional scheduled items to be included for subgrade treatment included in schedule. FWD Testing to be undertaken on existing pavement to determine remaining design life.	Testing of subgrade and pavement layers to be undertaken via proof roll. Site inspector to be present to witness all hold points i.e. proof roll of subgrade prior to re-sheet and proof roll of compacted gravel re-sheet.		Asset Owner implement maintenance program. Continuing monitoring and of pavement for deformation/failures		Open	
CIVIL									
2.1	Raised islands and medians that pose potential hazards for vehicles	6/07/17	Intersections to be fully illuminated including lighting of median and island noses. Islands designed to have appropriate shy lines. Design to specify that Islands to be painted with white reflectorized paint.			Asset Owner to ensure that future projects/maintenance activities give consideration to the island and kerb heights		Open	
2.2	Provision for large vehicles not considered	6/07/17	Ensure lane widths and turn path are sufficient to accommodate the design vehicles without impacting on the safety of other road users.	Contractor to document how these road users will be managed as part of their Traffic Mangement Plan (TMP).				Open	Details of all "design " and "check" vehicles to be documented in the Designer's Detailed Design Report
2.3	Inadequate provision for cyclists and pedestrians.	6/07/17	Ensure design maintains existing cycle facilities and safety accommodates cyclist movements through intersections.	Contractor to document how these road users will be managed as part of their TMP				Open	
DRAINAGE									
3.1	Insufficient scour protection to drainage inlet/outlets causes undermining of formation and an unsafe road	2/11/15	Protection designed (where approved) at existing scoured inlets/outlets and river embankments.	Contractor to install protection as outlined in the design and where directed by the Contract Administrator.		Asset Owner to implement monitoring of drainage structures after flood events to identify any further scouring which may undermine road and result in unsafe conditions.		Open	
3.2	Maintenance of verge/table drains/batters slopes	2/11/15	Table drains/verges/batter slopes designed to enable safe maintenance.	Ensure batters are graded at 1:4 where required to be trafficable				Open	
STRUCTURES									
4.1	Vibratory compaction causing damage to existing structures	6/07/17		Contractor to ensure vibratory rollers not operated over existing structures resulting in damage and possibly failure of structure.				Open	
4.2	Damage to structures by construction traffic	6/07/17	Specifications to note that Contractor is required to investigate and determine existing load limits and implications for his proposed carting arrangements.	Contractor to document in TMP and WHSMP.		Asset Owner to implement a monitoring program for the bridge to ensure any issues with its structural performance are identified.		Open	
TRAFFIC MANAGEMENT									
5.1	Private accesses not safely accommodated during construction	6/07/17	Specification to note that TMP must provide for all local accesses.	Contractor to document as part of TMP				Open	
5.2	Emergency vehicle access not considered	6/07/17	Specification to note that TMP must account for access by emergency vehicles	Contractor to document as part of TMP				Open	
5.3	Road users are unaware of changed traffic conditions or restricted movements.	6/07/17	Where required, Contractor to consult with members of the public who will be directly affected by the work e.g. impacts to properly accesses etc.	Asset Owner to announce changes to traffic conditions in local newspapers and radio.				Open	
5.4	Limited available construction width	6/07/17	Design document include a concept traffic management plan to confirm the works are constructible	Contractor required to develop TMP that enables all roads users (including pedestrians and cyclists) to pass through site without risk based on proposed construction activities.				Open	
ENVIRONMENTAL									
6.1	Dangerous wildlife and protection against insects that may transmit disease e.g. mosquitoes.	6/07/17		Contractor to document in Workplace Health and Safety Mangement Plan (WHSMP).				Open	
6.2	Pollution - water, air, land including spillage control and exposure to dangerous substances.	6/07/17		Contractor to document in EMP including specific requirements for control of spillages.				Open	
6.4	Storm runoff from areas of exposed construction	6/07/17	Design specifies that Contractor must develop and implement an EMP including site specific erosion and sedimentation controls	Contractor to document in EMP and implement site specific ESCPs				Open	
PUBLIC UTILITY PLANT									
7.1	Striking live public utilities	6/07/17	Current DBYD enquiry to completed and known services plotted on construction drawings. Potholing of public utilities to be undertaken and depths noted on construction drawings.	Contractor required to investigate and identify all services prior to commencement of works.				Open	
7.2	New roadway lighting not energised when works are to be opened due to delays with point of supply.	6/07/17	Designer to laise with utility provider early in the design phase to ensure to delays to energisation.	Contractor to develop a staging plan that also includes lighting and when the existing light will be decommissioned.				Open	