Attachment 3 – Traffic Impact Assessment (28 April 2023)

TRANSPORT IMPACT ASSESSMENT

EMMANUEL ANGLICAN COLLEGE – MASTER PLAN

62 HORIZON DRIVE, BALLINA

(RESPONSE TO TNSW AND COUNCIL)

Prepared for:

EMMANUEL ANGLICAN COLLEGE

28 APRIL 2023

DOCUMENT REGISTER

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Prepared by Luke Rytenskild, Dare Janzekovic

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COMPANY INFORMATION

CRG Traffic Pty Ltd as trustee for the Rytenskild CRG Trust trading as Rytenskild Traffic Group
ABN 24 401 134 418
ACN 151 846 847
Director: Luke Rytenskild RPEQ 6293

GOLD COAST
Unit 2,
24 Surfers Avenue
Mermaid Beach QLD 4218

BRISBANE
Suite 52
149 Wickham Tce
Spring Hill QLD 4000

SYDNEY
Level 26
44 Market Street
Sydney NSW 2000

Phone: 1300 220020
Facsimile: 1300 087177
Email: info@rytenskildtraffic.com
Web: www.rytenskildtraffic.com

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1.0 INTRODUCTION

1.1 Background

Rytenskild Traffic Engineering (RTE) has been engaged by the Emmanuel Anglican College (EAC) to prepare a Transport Impact Assessment of its proposed master plan for its campus at West Ballina. This report forms part of a Development Application to be lodged with the Ballina Shire Council.

This version of the report (version 4) responds to further issues raised by Council relating to the design of car parking along Riverbend Drive, and allows for the proposed southern driveway on Horizon Drive to operate as two way.

It is noted that Council provided the following comments in relation to traffic and transport matters during the Information Request meeting held on the 20th of September 2022. Ballina Shire Council referred the application to the Transport for NSW (TfNSW), a response was provided on the 13th of August 2022. An amended report was issued on the 6th March 2023 and Council and TfNSW replied with further comments on the 9th March 2023 and 30th March 2023, respectively. Council's concerns primarily related to:

- The accuracy or correct formatting of the traffic count data;
- A queuing analysis for the proposed access arrangements;
- Issues raised by the Road Safety Audit in relation to the design and management of proposed car parking arrangements in Riverbend Drive.

In response to correspondence received in March 2023, the following amendments have been made:

- The traffic count data along Horizon Drive has been re-analysed and reformatted. It is noted that the existing exit point at the southern end of Horizon Drive was not included in the results.
- The turn diagrams have been reformatted to reflect existing arrangements.
- SIDRA modelling for the River St / Horizon Drive and River Street / Barlows Road / Keppel Street intersections have been updated.
- Further information has been provided in relation to the management of queuing at the proposed southern entry point (refer to section 6).
- Recommendations in response to concerns raised by the Road Safety Audit in relation to Riverbend Drive have been included (refer to section 8).

Previous responses to the Information Request items raised by Council and TfNSW are provided in Sections 1.2 and 1.3 below.

1.2 Response to Ballina Shire Council Information Request

1. **Traffic Impact Assessment – Transport for NSW comments**
   The application was referred to Transport for NSW (TfNSW) in accordance with Section 3.58 of SEPP (Transport and Infrastructure) 2021. A response was provided on 12 August 2022:

   The supporting Traffic Impact Assessment (TIA) dated 23 November 2021 is not considered a robust, reliable and/or complete assessment of the traffic and transport impacts to be generated by the existing and proposed development. The Statement of Environmental Effects and TIA do not directly address all matters to be considered under Section 3.58 of the SEPP.

   The TIA does not identify a clear base case for existing and future conditions, the demand generated for all travel modes, or consider opportunities to minimise private car travel. The proposed changes to vehicular access and car parking areas have potential to increase conflict between vehicles and people, both within the site and on adjoining public roads. The TIA does not include a road safety assessment for existing and proposed arrangements.

   The complete response is attached to this letter. Council's Civil Services Division supports the comments and recommendations made by TfNSW, which are required to be addressed.

Response:

This version of the report includes additional traffic survey data and modelling, to address the various concerns raised by Council and Transport NSW. A Road Safety Audit of the proposed traffic arrangements has been prepared by CML Civil and submitted under separate cover.

2. **Road Safety Audit**
   In relation to the road safety issues raised by TfNSW, a formal Road Safety Audit (RSA) is required to be prepared to identify both internal and external road safety issues, their risk rating and suggested treatments to address identified safety issues.

Response:

Design input has been provided by experienced traffic engineers who are also road safety auditors. The surrounding road network has also been reviewed by the same team.

Notwithstanding the above, a Road Safety Audit has been prepared by CML Civil and provided under separate cover. A response to the items identified by the RSA is provided in section 8.

3. **Traffic congestion and queuing**
   The southern school access from Horizon Drive is proposed to be relocated further south, closer to the River Street intersection. This reduces the available queuing storage in Horizon Drive (north of River Street) for northbound vehicles in Horizon Drive accessing the school. Any queuing of school access traffic into River Street will compromise the functionality of River Street which is likely to have future daily volumes of up to 30,000 vpd.

   Analysis is required to determine, in peak hour at full development and 10 years traffic growth, the likely extent of queuing of northbound entry traffic in Horizon Drive and if (aided by sensitivity analysis) queuing is likely to extend into River Street. This analysis is to include consideration of internal movements (drop off/pick up, parking etc) that may cause congestion within the school site that in turn impacts on the free flow of northbound traffic in Horizon Drive into the school access and subsequent impacts on Horizon Drive and River Street.

   A revised TIA is also to examine impacts of school generated traffic on the River Street/Barlows Road/Keppel Street roundabout in am and pm peak hours.

Response:

The southern entry is proposed to be located approximately 120 metres from River Street, which is a considerable separation distance from River Street. Video survey indicates that traffic enters the existing drop off facility efficiently and without generating significant queuing into Horizon Drive.

The proposed layout provides increased capacity for on-site queuing and car parking, in accordance with the proposed increase in enrolments, and as queuing will not extend beyond current levels. Visitors will enter the site and travel internally in a clockwise direction. Ninety-degree angle parking has been replaced with an efficient parallel parking layout. Two exit points will be available for traffic to exit the primary set down / pick up facility.

Traffic counts have been carried out at the River Street / Barlows Road / Keppel Street intersection, and traffic modelling carried out for projected 10-year peak periods. The modelling indicates that traffic generated by the proposed increase in enrolments would only increase the Degree of saturation of the roundabout by approximately 3%. This would only occur during the school peak period, which occurs outside of the commuter peak traffic period.

4. **Traffic Impact Assessment – Other issues**
   In addition to the comments raised by TfNSW, the following matters are required to be addressed:
   - Provide the dimensions of all development components (i.e. car parking envelope, driveway widths etc).
   - Please provide a swept path diagram to confirm that vehicles are able to enter and exit the new parking spaces and the loading bay on the northern-west boundary in a forward direction (using the formalised service road behind the Discovery Centre).
   - The TIA indicates there are two school access points, however the available aerial imagery and Council's inspection of the site has confirmed three school accesses plus one exit only driveway. Please clarify and amend the traffic analysis in accordance with the plan and existing site components.

Response:

The figures in this report have been updated accordingly (refer to section 4).

The traffic analysis and survey data has been updated to include the northern entry to the school. The turn diagrams and traffic data have been amended to reflect existing arrangements.

1.3 Response to Transport for NSW comments

1. The supporting Traffic Impact Assessment (TIA) dated 23 November 2021 is not considered a robust, reliable and/or complete assessment of the traffic and transport impacts to be generated by the existing and proposed development. The Statement of Environmental Effects and TIA do not directly address all matters to be considered under Section 3.58 of the SEPP.

   The TIA does not identify a clear base case for existing and future conditions, the demand generated for all travel modes, or consider opportunities to minimise private car travel. The proposed changes to vehicular access and car parking areas have potential to increase conflict between vehicles and people, both within the site and on adjoining public roads. The TIA does not include a road safety assessment for existing and proposed arrangements.

   To ensure that the proposed development meets the needs of the Community and transport customers, TfNSW recommends that Council consider requesting additional information to address observed gaps in the development application. TfNSW recommendations are further outlined in **Attachment A** for Council's consideration.

ATTACHMENT A

Traffic Analysis & Intersection Performance

- The baseline for traffic analysis is taken from traffic counts collected on 13 May 2021 for an unspecified peak hour. It is unclear what time of day the traffic counts were collected and whether the identified peak periods correspond with observed network and/or school peak periods. It is unclear what proportion of baseline traffic flows are buses or heavy vehicles. It is unclear what assumptions informed the adopted growth rate. The baseline data and adopted assumptions should be further explained and justified.

- Traffic counts undertaken during 2021 may not be representative of traffic volumes prior to COVID-19 restrictions and any subsequent changes in travel behaviour. The adopted baseline may not be indicative of normal traffic flow, and it is typically recommended that such data be used as a sensitivity analysis and compared to traffic count data collected prior to the COVID-19 pandemic.

- The TIA includes modelled intersection performance for the River Street and Horizon Drive intersection under baseline 2021 volumes with and without development. No modelling is provided to demonstrate performance over the initial 10 years from opening, corresponding with the progressive increase in student numbers. No analysis is provided to demonstrate the performance other intersections in the vicinity of the development, in particular Rivers Street and Riverbend Drive will provide secondary access to the proposed development.

- Council should be satisfied that the traffic modelling informing the TIA is robust and accurately reflects the current and future traffic conditions. Council may wish to request further analysis to clarify network performance under existing and future conditions.

Response:

Updated traffic counts were carried out in November 2022 and February 2023. Traffic modelling has also been carried out for projected traffic conditions at the year 2034.

The analysis assumes eight percent heavy vehicles on River Street and two percent heavy vehicles on Horizon Drive, which are typical percentages for the respective road classifications and a built-up environment such as West Ballina.

Road Safety

- The TIA does not identify any existing road safety concerns or reported crashes on adjoining public road. TfNSW notes that crash statistics reported between 2016-2020 identify 3 crashes in the vicinity of school accesses on Horizon Drive and Riverbend Road, which resulted in moderate and serious injuries.
- The TIA does not include details of any consultation with the School Operator, the Roads Authority (Council), or Bus Service Providers to inform assessment of existing road safety.
- Proposed access and car parking arrangements on Riverbend Road are in the vicinity of the Riverbend Retirement Village. The TIA has not considered the potential for conflict between vehicles and pedestrians, particular with respect to student drivers and vulnerable road users.
- The TIA does not include a road safety assessment addressing the proposed increase in travel demand or changes to traffic and transport arrangements. Council should be satisfied that the TIA has identified and addressed all existing road safety concerns, internal or external to the site, prior to the introduction of additional demand.

Response:

A Road Safety Audit has been prepared by CML Civil and provided under separate cover. A response to the items identified by the RSA is provided in section 8.

Road crash data does not suggest any safety concerns in relation to the existing and school traffic facilities.

The condition and safety of surrounding transport infrastructure has been carried out through inspection and traffic surveys. RTE has consulted with Ballina Buslines (Mr. Ben Wilson, Operations Manager) and discussed some changes to the layout which will provide better access and manoeuvring for large buses. It was agreed that further consultation with Ballina Buslines would occur during the detailed design process to ensure satisfactory outcomes for bus access.

The proposed car parking along Riverbend Drive is intended to be used for spectators associated with sporting events on the sports field, which will generally occur outside of peak traffic periods. The parking is positioned well away (over 30 metres) from the River Street roundabout. A painted double centreline and painted U-turn facility will be provided so that drivers do not turn into the parking spaces from the northbound lane.

The safety of proposed access and parking facilities is a primary concern in any traffic engineering design and has been such in this case. RTE has worked with the architects to ensure that the proposed facilities will be safe for all road users including pedestrians.

Site Layout, Access & Car Parking Design

- The TIA provides no assessment of existing traffic facilities and treatments. Further consideration should be given to existing facilities and treatments, and further advice should be obtained from Council's Engineer and/or the Local Traffic Committee (LTC) where required. TfNSW recommends that the proposed masterplan be referred to LTC for comment prior to determination of the development application.

- The current access arrangements on Horizon Drive are not consistent with the existing or proposed masterplans. The proposed arrangement will change the circulation of vehicles and priority of movements at decision points. Further consideration should be given to potential conflict between pedestrians, cyclists and vehicles.

- Access driveways, internal manoeuvring, car parking and servicing areas should be designed and constructed in accordance with AS.2890 and to Council specifications. Any landscaping should have consideration for sight lines between vehicles and people.

- Council should be satisfied that the on-site carparking is sufficient to accommodate for both staff and students. Any proposed on-street parking should be suitably designed and delineated with regulatory signs and devices where appropriate. Any regulatory signs and devices must be referred to Local Traffic Committee for endorsement prior to Council approval.

- Swept path analysis for all relevant design vehicles should be provided to demonstrate accessibility and to clarify any potential for conflict between vehicles. Further consideration should be given to service vehicles.

Response:

This report includes traffic counts and analysis of surrounding road intersections, and a review of existing traffic facilities and treatments that are relevant for the school.

It is considered that the proposed access arrangements will provide a more logical and efficient circulation pattern than the existing facilities, as visitors will enter the site and travel internally in a clockwise direction. Ninety degree angle parking has been replaced with an efficient parallel parking layout. Two exit points will be available for traffic to exit the primary set down / pick up facility.

The layout and dimensions of the proposed access and car parking arrangements, together with swept paths are shown in Section 4.

Active Transport

- The TIA does not identify existing and proposed active transport demands along Horizon Drive, Riverbend Drive and River Street. TfNSW understands that Council is undertaking a program of works to duplicate River Street, which includes improvements to intersections and crossing facilities for pedestrians. The TIA does not include details of any gaps in connectivity or existing safety concerns for pedestrians and cyclists on surrounding roads.
- Further consideration should be given to existing and proposed demand for bicycle parking and storage racks with consideration for 'End of Trip' (EoT) facilities to support cyclists.
- Council should be satisfied that existing and proposed demand for pedestrian and cyclist infrastructure has been identified and addressed. Council should consider whether planned improvements in this area can accommodate the proposed development, and whether any further works are required to improve safety or address any proposed increase in demand.

Response:

New footpaths have recently been constructed along River Street and Horizon Drive. Upgraded crossing facilities have been provided on River Street at Riverbend Drive and also at Quays Drive.

There are two crossing facilities (refuge islands) provided along Horizon Drive, with the northern one provided for a connection to Westland Drive.

Additional bicycle parking has been included on the master plan, commensurate with the proposed increase in enrolments. The school monitors the demand for bicycle parking and increases storage as required.

Public Transport

- The TIA provides no assessment of existing school bus services with respect to existing capacity and/or consideration for increasing patronage to reduce private car travel. Further consideration should be given to travel demand management aimed at encouraging bus travel. TfNSW recommends that Council consider the merit of requiring the preparation and implementation of a School Travel Plan (STP). See below for further comments.

Response:

The proposal master plan includes a doubling of existing bus stop capacity (ie from 3 to 6 spaces), even though enrolments will only increase by 40%. Such will allow for increase mode shift to bus transport.

RTE has consulted with Ballina Buslines (Mr. Ben Wilson, Operations Manager) and discussed some changes to the layout which will provide better access and manoeuvring for large buses. It was agreed that further consultation with Ballina Buslines would occur during the detailed design process to ensure satisfactory outcomes for bus access.

Travel Demand Management

- *Future Transport Strategy 2056* emphasises the importance of walking and cycling for short trips and reinforces the importance of walking and cycling to increase the catchment of public transport as part of the whole customer journey.

  Building Momentum - State Infrastructure Strategy 2018-2038 includes recommendations related to walking and cycling, including integrating transport with land use; managing travel demand; unlocking capacity in existing assets; and improving population health outcomes through more active transport.

  TfNSW recommends the preparation and implementation of a School Travel Plan (STP) to address the ongoing impacts of the proposed development. The STP needs to identify mode share targets and supporting strategies to encourage the use of sustainable transport options with the intent to reduce dependence on single-occupant car journeys. The plans should be evidence based, informed by the ongoing collection of a comprehensive data set. Any STP should be prepared in consultation with Staff, Students, Ballina Shire Council and TfNSW. Further information to assist the development of Travel Plans can be accessed online here.

Response:

Walking and cycling is already encouraged through the provision of high standard footpath and bicycle infrastructure, and also bicycle parking and end of trip facilities within the school. The school is well connected to surrounding residential areas with sealed walkways and safe crossing facilities at critical locations.

The school already encourages parents and carers to car pool where possible. There does not appear to be any other strategies whereby students will be encouraged to travel to school by walking or cycling.

Construction Traffic Management

- Council should ensure that appropriate traffic measures are in place during the construction phase of the project to minimise the impacts of construction vehicles on traffic efficiency and road safety within the vicinity.
- TfNSW recommends the preparation and implementation of a Construction Traffic Management Plan to address traffic and transport impacts during the construction phase of the development.

Response:

Construction activities will be contained to the site and not have a significant impact upon the public road network. The construction of the proposed access and car parking facilities will occur during school holiday periods.

A Construction Management Plan will be prepared closer to commencement of the construction phase.

2.0 SUBJECT SITE

2.1 Location of Subject Site

As shown in Figure 2.1, the subject site is located on the northern side of River Street, western frontage to Riverbend, and eastern frontage to Horizon Drive. The site is currently occupied by Emmanuel Anglican College and is identified as Lot 10 on DP1001995.

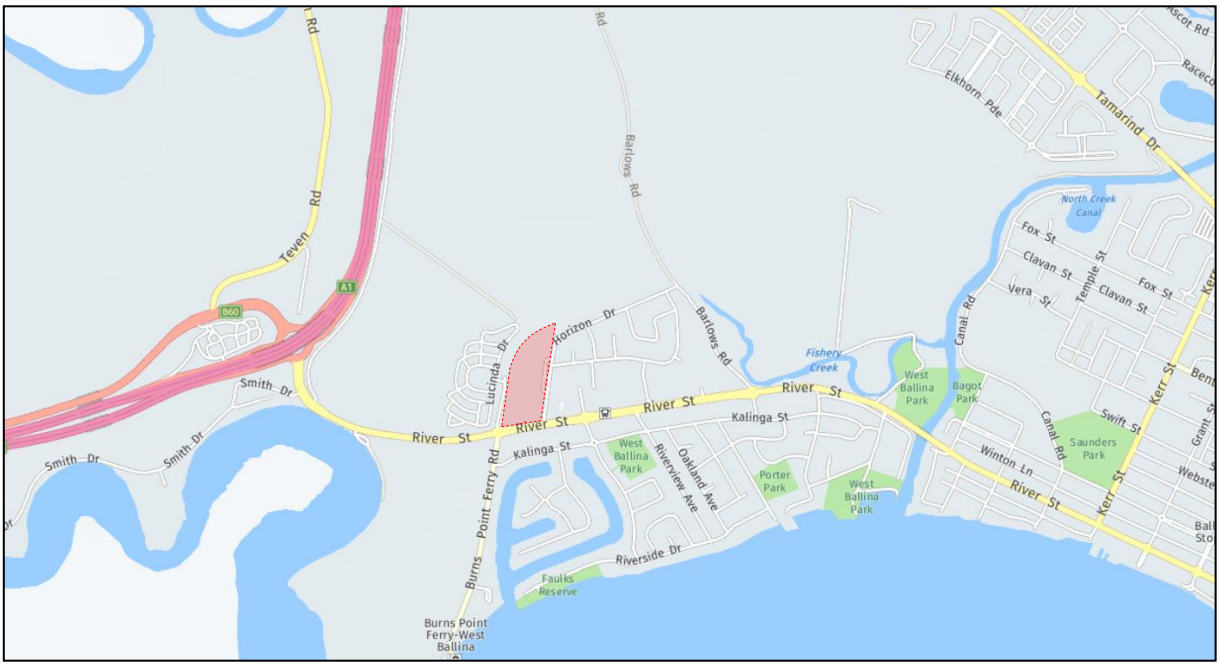


FIGURE 2.1 – LOCATION OF SUBJECT SITE

2.2 Existing College enrolments and access / parking arrangements

Under the current approval, the College is permitted to have up to 794 students and 93 staff members.

Vehicular access is gained from four driveways along Horizon Drive. A one way service driveway links the northern end of the campus car park to Riverbend Drive.

The existing layout of the College, together with car parking areas is shown in Figures 2.2 – 2.5.

There are 150 car parking spaces provided on the existing campus, including car parking recently constructed as part of the Multi Purpose Centre project.

FIGURE 2.2 – EXISTING COLLEGE CAMPUS AND SURROUNDS

FIGURE 2.3 – CAR PARKING PROVIDED NEAR NEW MULTI PURPOSE CENTRE

FIGURE 2.4 – EXISTING CAR AND BUS ARRANGEMENTS IN CENTRAL AREA OFF HORIZON DR

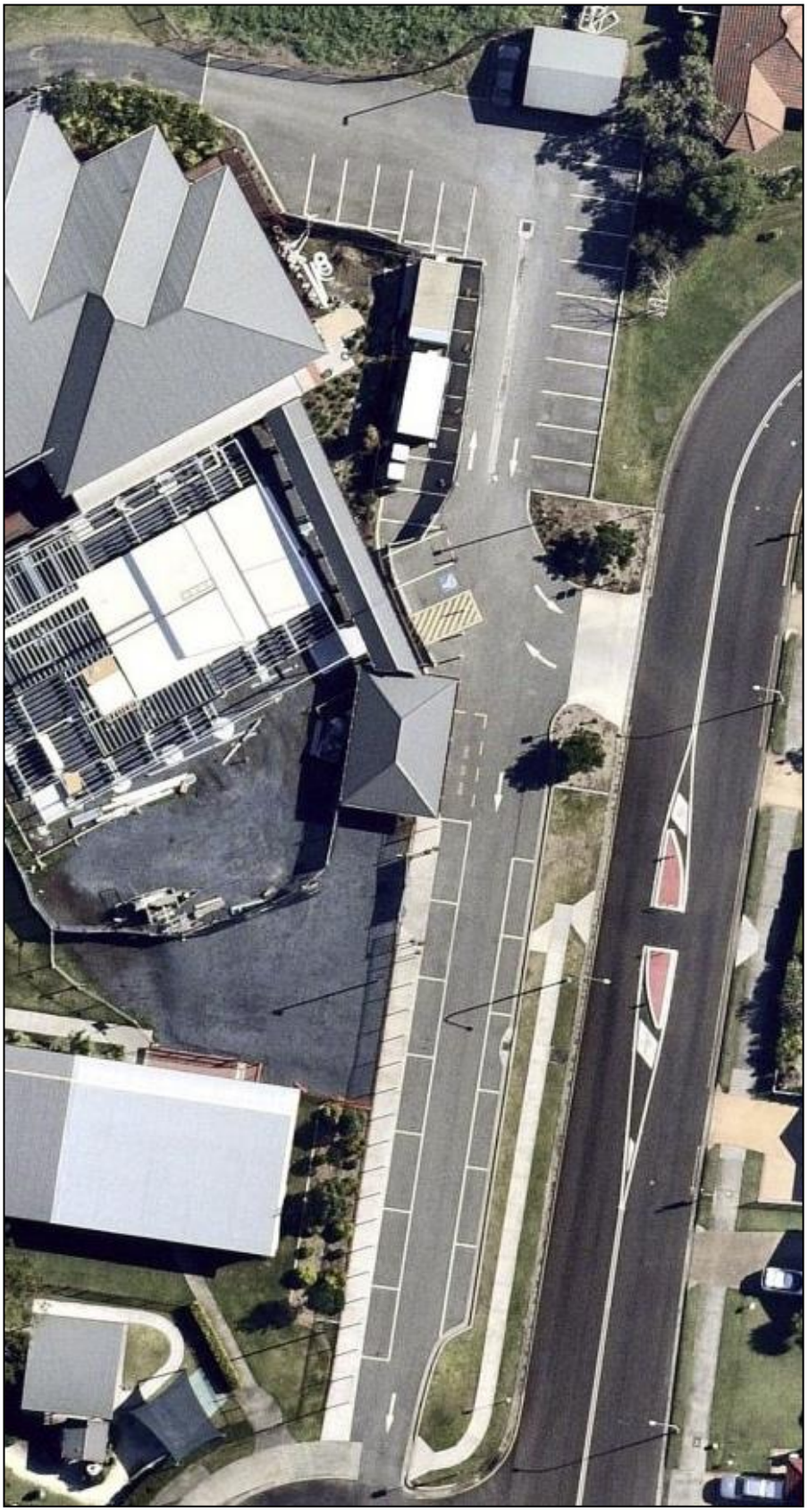


FIGURE 2.5 – EXISTING CAR PARKING ARRANGEMENTS AT NORTHERN END OF CAMPUS

2.3 Surrounding Road Network

The site has frontage to Horizon Drive (east), River Street (south) and Riverbend Drive (west). Horizon Drive functions as a collector road and has a posted speed limit of 50 Km / Hr, with a 40 Km / Hr school zone in place.

River Street is functions as an arterial road and has a posted speed limit of 60km/hr. The River Street / Horizon Drive intersection is restricted to left in / left out only, with U-turn movement facilitated by roundabouts located at the Riverbend Drive and Quays Drive intersections with River Street.

Images of local road conditions are shown in Figures 2.6 – 2.8.

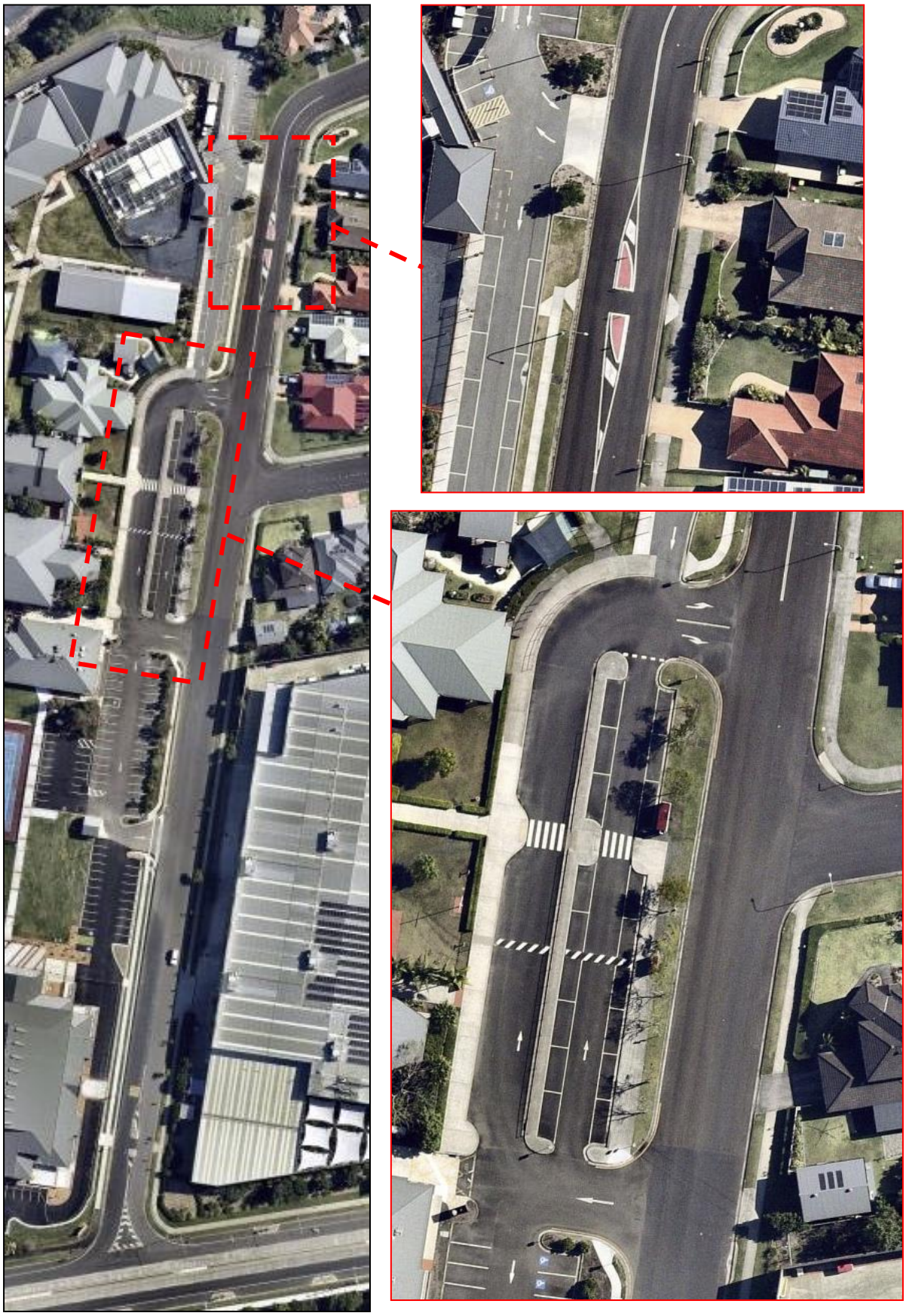
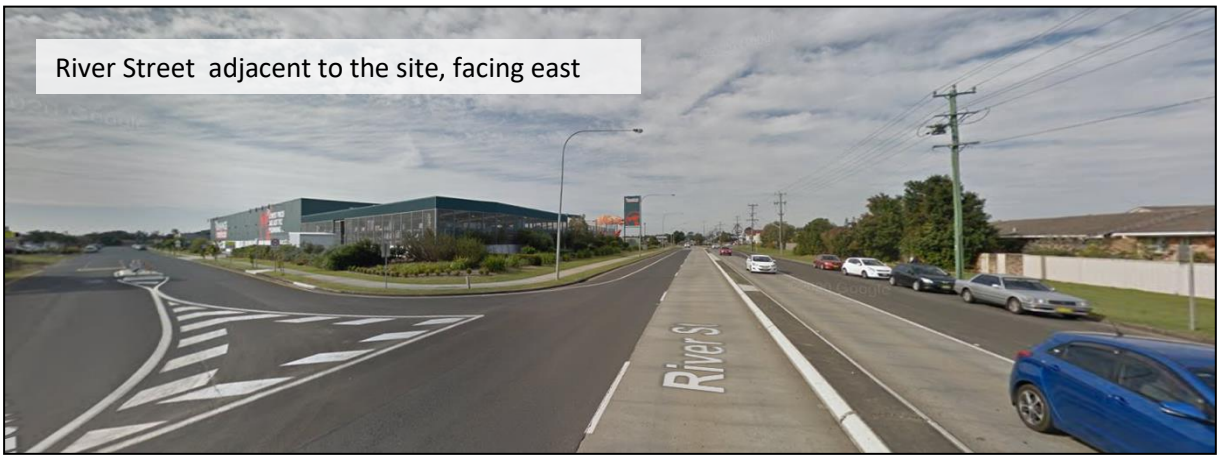


FIGURE 2.6 – HORIZON DRIVE ADJACENT TO EMMANUEL COLLEGE



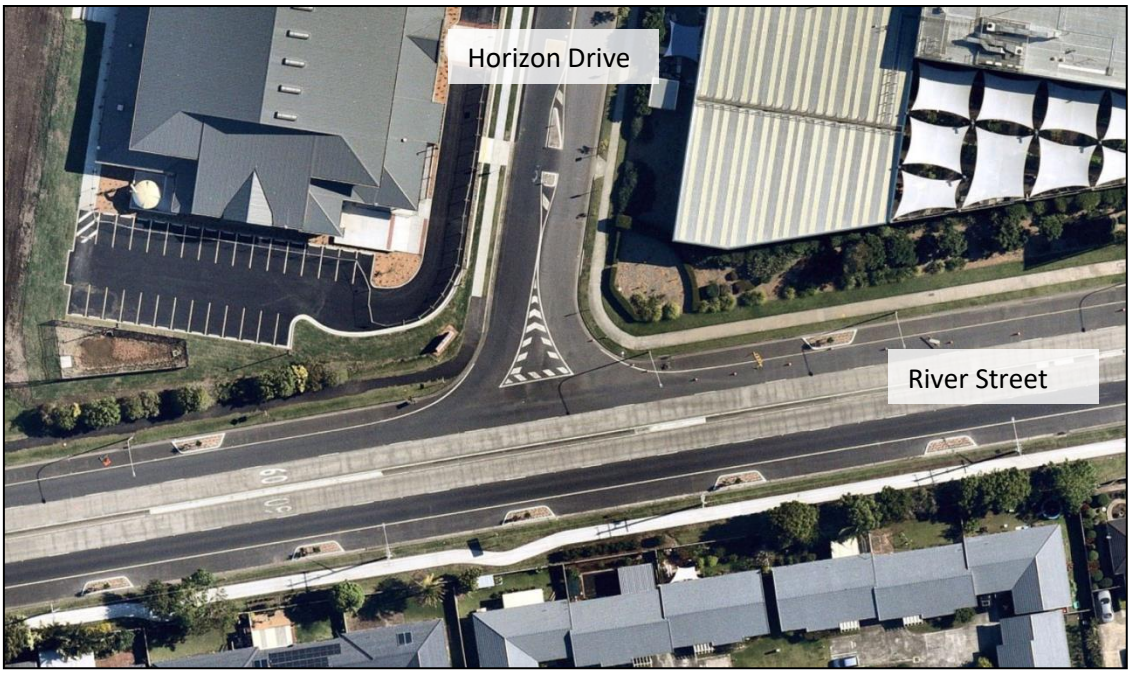


FIGURE 2.7 – RIVER STREET / HORIZON DRIVE INTERSECTION

FIGURE 2.8 – AERIAL OF RIVER ST / RIVERBEND DR / BURNS POINT FERRY RD INTERSECTION

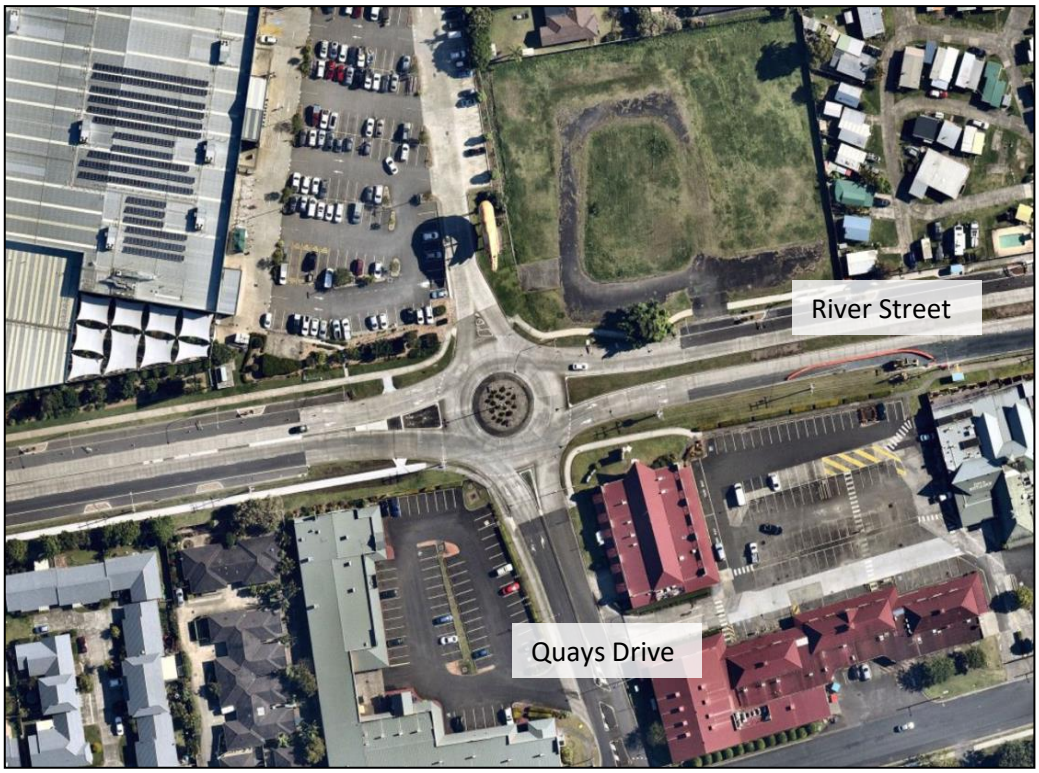


FIGURE 2.9 – AERIAL OF RIVER STREET / QUAYS DRIVE INTERSECTION ADJACENT TO SUBJECT SITE

2.4 Surveyed Traffic Volumes

RTE has carried out traffic surveys at the following intersections:

- Four school driveways along Horizon Drive (Wed 8 February 2023);
- Horizon Drive / River Street (Thurs 13 May 2021);
- Horizon Drive / Westland Drive (Wed 8 Feb 2023);
- River Street / Barlow Street (Fri 25 Nov 2022).

It is noted that the above surveys were carried out during Covid-19, and therefore further surveys were carried out on Tuesday 29th November 2022 to ensure accuracy of results. In addition, further traffic surveys were carried out in Horizon Drive at the school access points and Westland Drive, in February 2023. These are shown in Figure 2.12.

A background annual growth factor of 2.0% has been applied to estimate future (year 2034) traffic conditions. Council has advised that this growth rate is consistent with its strategic modelling.

The full traffic surveys are provided in Appendices A and B, with peak period traffic volumes summarised in Figure 2.10 and 2.11.

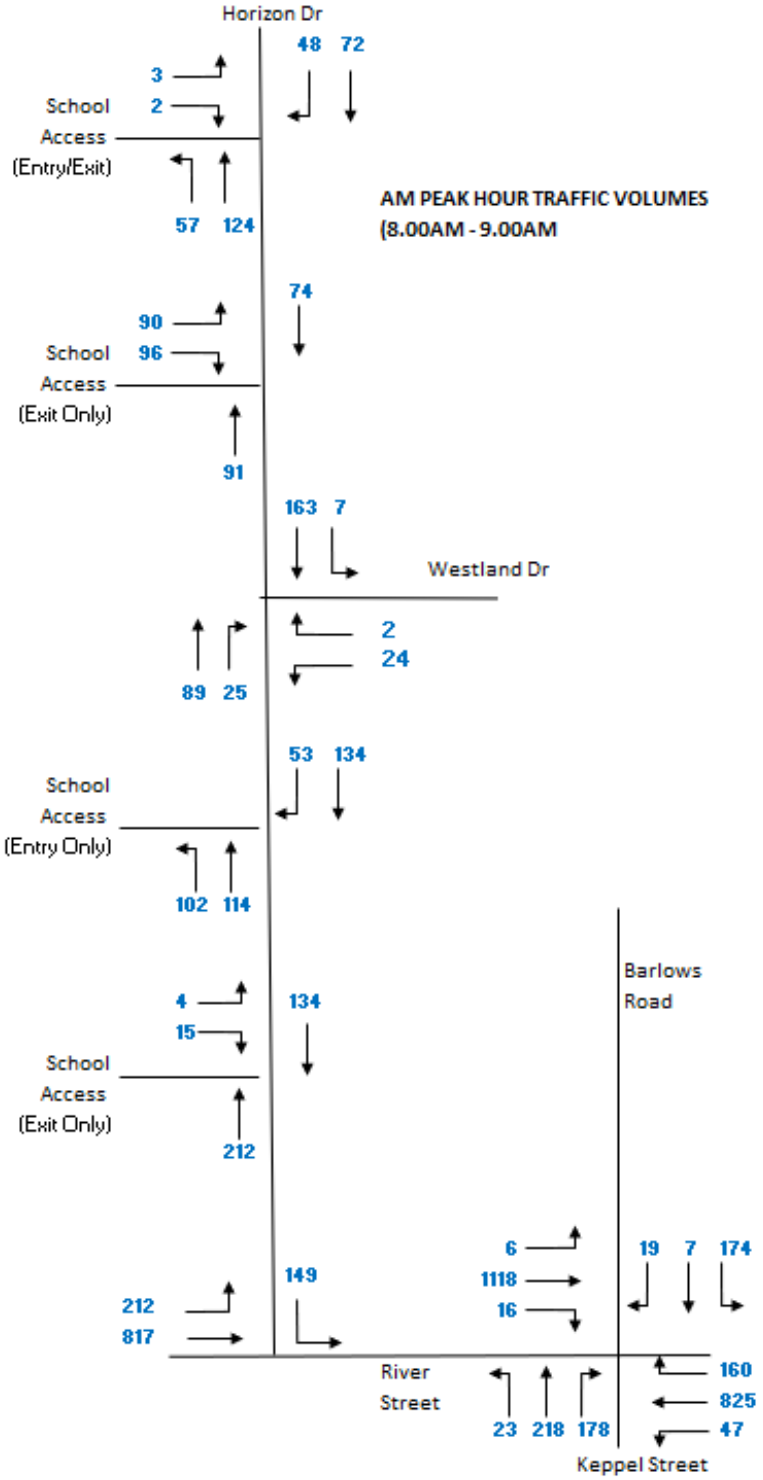


FIGURE 2.10 – SURVEYED MORNING PEAK HOUR TRAFFIC VOLUMES (WED 8TH FEB 2023 AND RIVER ST / BARLOWS RD DATA FROM TUES 29TH NOV 2022)

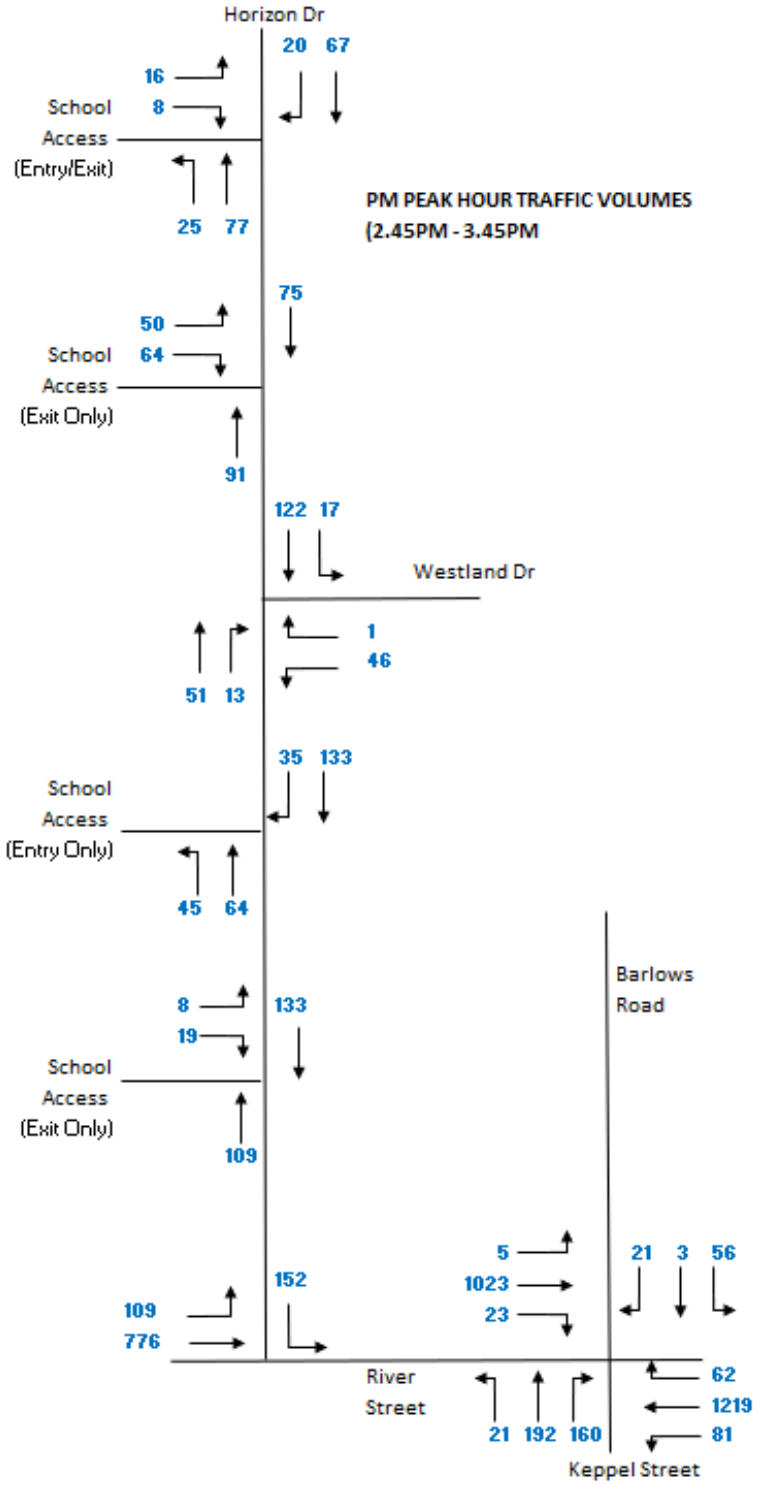


FIGURE 2.11 – SURVEYED AFTERNOON PEAK HOUR TRAFFIC VOLUMES (WED 8TH FEB 2023 AND RIVER ST / BARLOWS RD DATA FROM TUES 29TH NOV 2022)

3.0 PROPOSED MASTER PLAN

The current master plan as approved by Council is shown as Figure 3.1. It is noted that the Multi Purpose Centre and associated access and parking arrangements located in the south eastern corner of the site, has recently been completed.

The proposed Master Plan shown in Figure 3.2 includes the following new learning facilities:

1. 'Stem and Digital Technology Centre' containing 12x senior classrooms plus breakout area and integrated staff offices, occupation early 2024;
2. 'Endeavour Centre' – Currently under assessment via DA2021/516;
3. One-classroom extension to Early Learning Centre (stage 3) 1a/1b
4. 'Collaboration Centre', containing 6 x junior classrooms, occupation early 2025; and
5. 'Performance Centre', containing the Performance Centre along with 4 Drama/Music classrooms, estimated 2027.

The proposed master plan facilitates an increase in the College population from the current level of approximately 794 students and 93 staff members, to 1,114 students and 119 staff members by the year 2031.

The proposed master plan includes an increase in bus capacity from three spaces on the approved plan, to six spaces. An additional parallel set down / pick up facility is also proposed, providing for 14 car spaces. Proposed changes to the primary car set down / pick up facilities, and bus stop arrangements are shown in Figure 3.3.

It is noted that the proposed master plan includes an upgrade of the service road (to asphalt surface) linking the northern end of the campus to Riverbend Drive. This will continue to be restricted to staff and maintenance vehicles only, with a boom gate installed to prevent unauthorised use.

It is proposed that formal on-street parking (30 spaces) be constructed along the eastern side of Riverbend Drive, to be used for overflow parking and events held on the adjoining sports field. This parking will be provided in addition to that required on-site to satisfy the DCP.

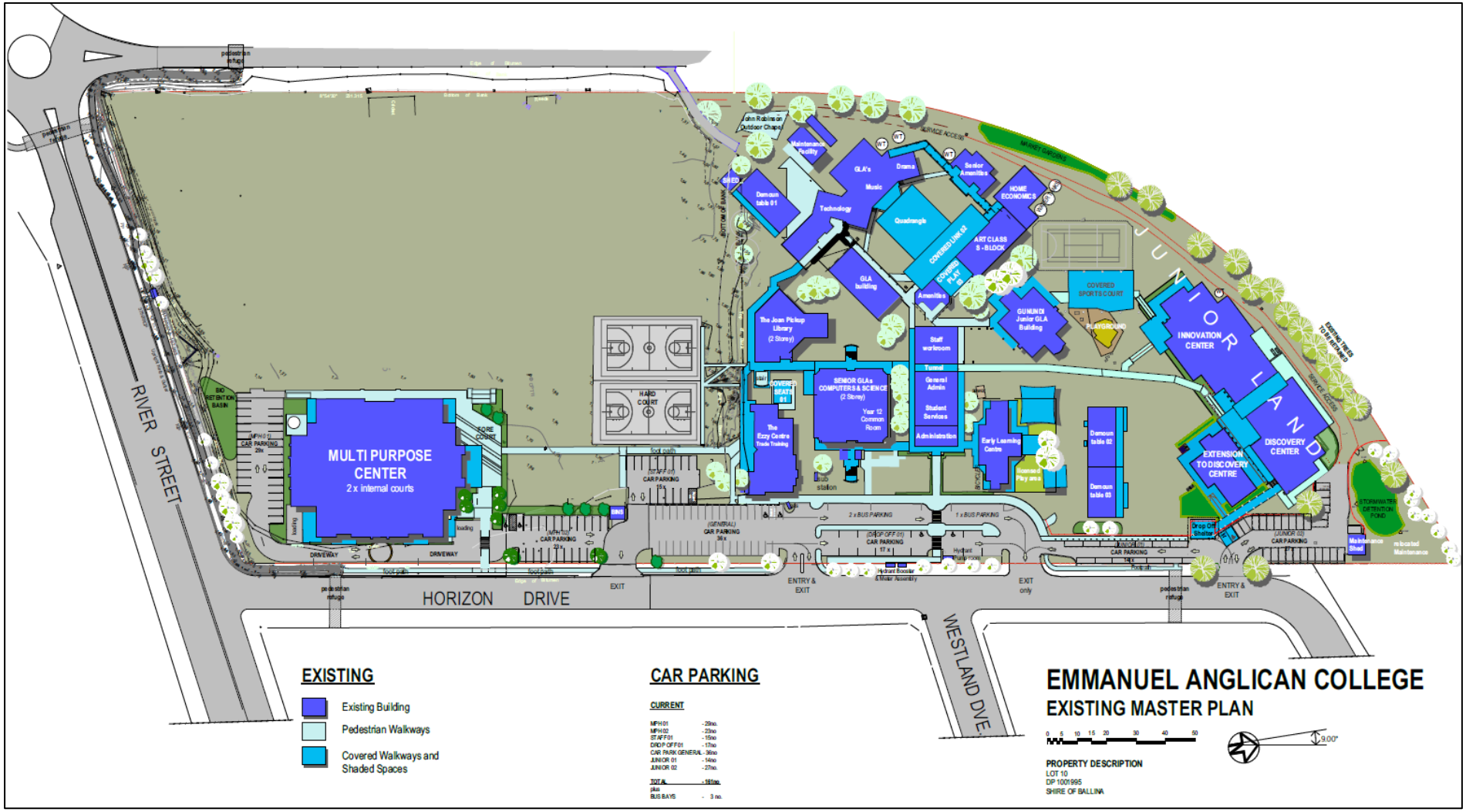


FIGURE 3.1 – CURRENT MASTER PLAN

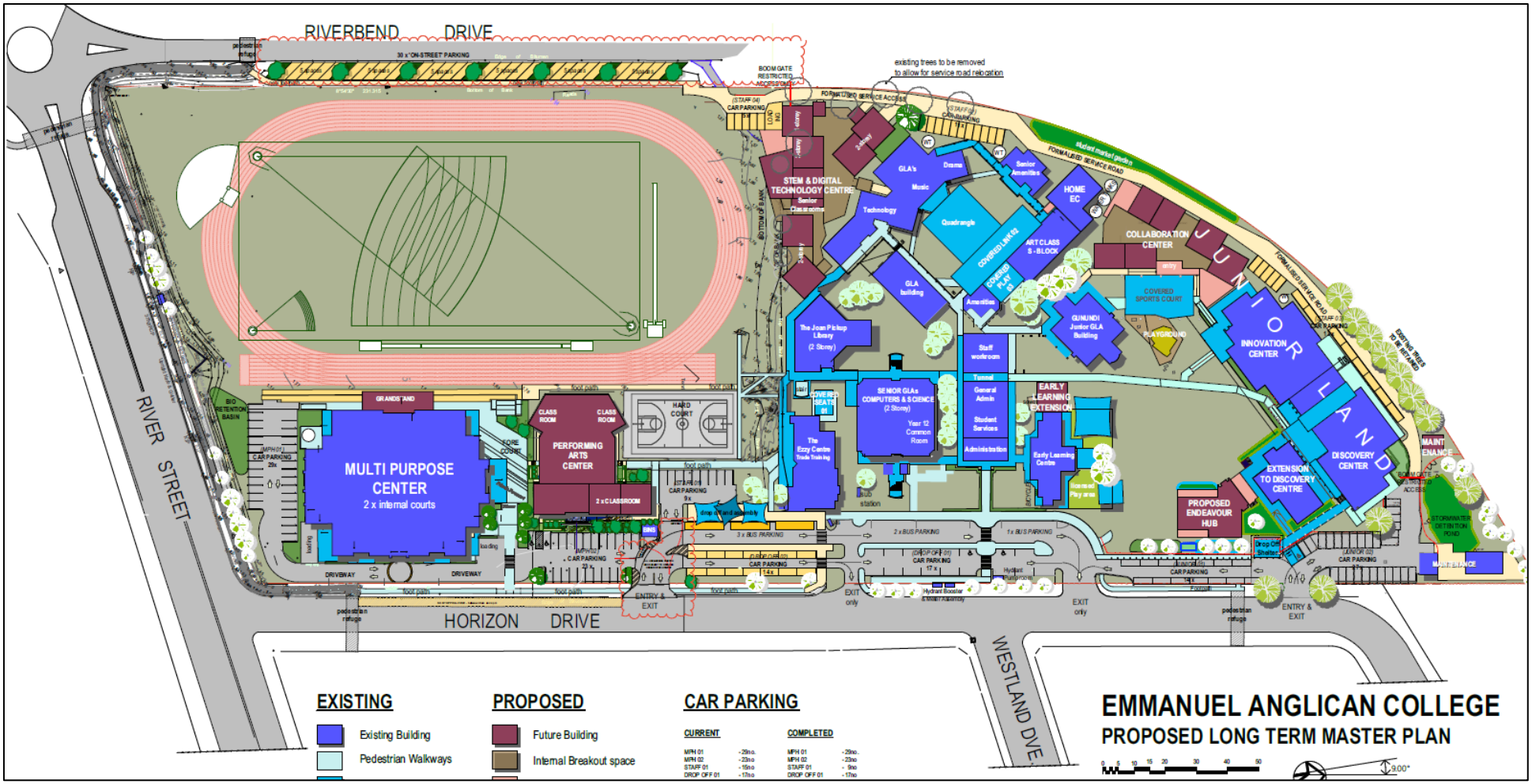


FIGURE 3.2 – PROPOSED LONG TERM MASTER PLAN

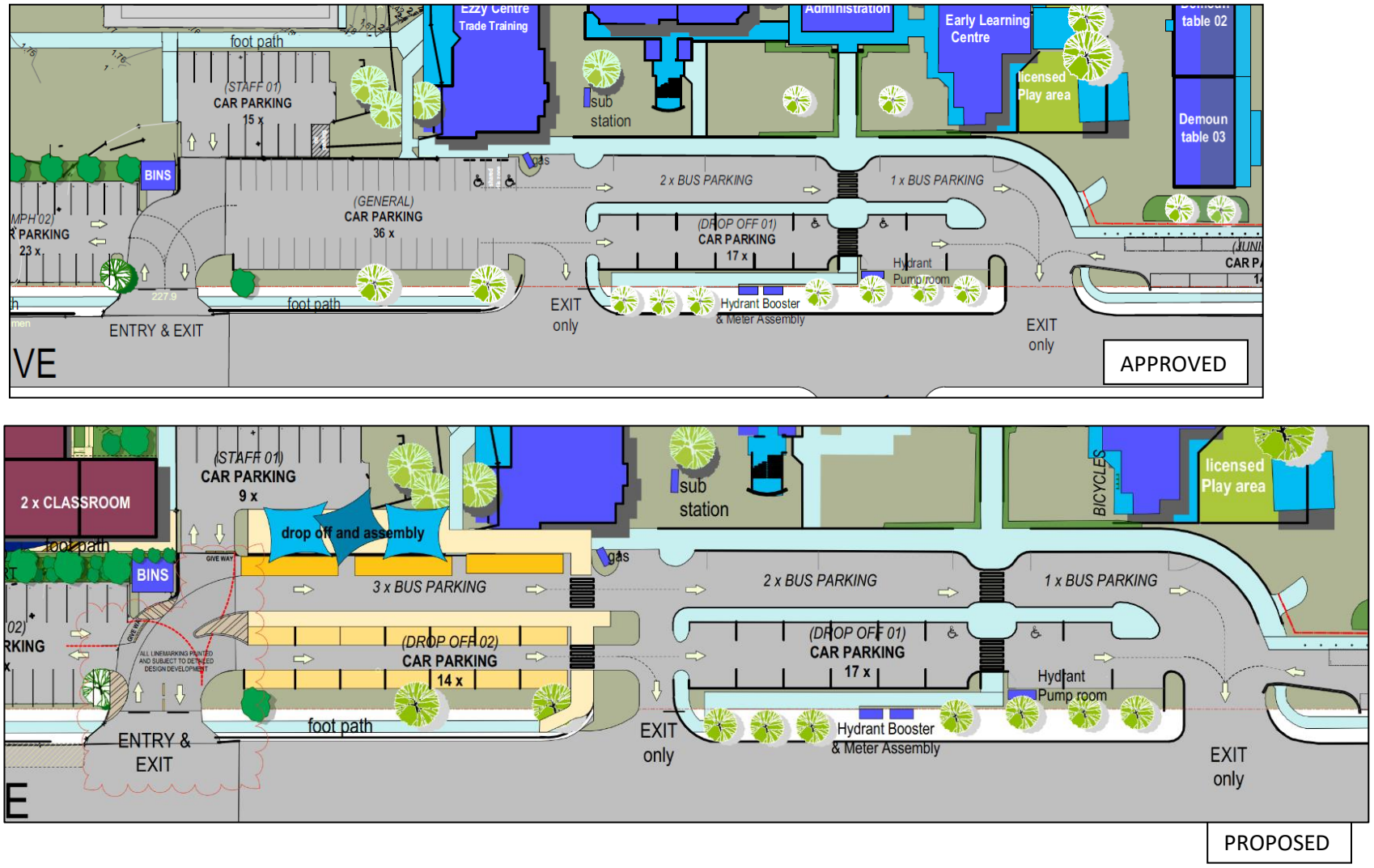


FIGURE 3.3 – PROPOSED MODIFICATION OF APPROVED CAR PARKING, SET DOWN AND BUS FACILITIES

4.0 CAR PARKING

4.1 Supply

In accordance with the Ballina Shire Council's DCP, *Chapter 2* states the following requirements for Educational Establishment:

Educational establishment (Primary)	1 space per 12 students plus 1 space per 2 employees
Educational establishment (Secondary)	1 space per 10 students plus 1 space per 2 employees

In accordance with these rates, the planned overall population of 1114 students and 119 staff members requires the following parking provisions:

- 570 Senior students - 57 spaces
- 544 Junior students - 45 spaces
- 119 staff members - 60 spaces
- Total - 162 spaces

The proposed car parking provisions therefore meet the DCP requirements, with a total of 162 spaces, as follows:

MPH 01	- 29no.
MPH 02	- 23no
STAFF 01	- 9no
DROP OFF 01	- 17no
DROP OFF 02	- 14no
JUNIOR 01	- 14no
JUNIOR 02	- 27no.
STAFF 02	- 11no
STAFF 03	- 13no.
STAFF 04	- 5no.
TOTAL	**- 162no**
plus BUS BAYS	- 6 no.
RIVERBEND DR	- 30no

It is proposed that formal on-street parking (30 spaces) be constructed along the eastern side of Riverbend Drive, to be used for overflow parking and events held on the adjoining sports field. This parking will be provided in addition to that required on-site to satisfy the DCP.

4.2 Design

A swept path analysis of the proposed car park indicates that the required design vehicle will be able to access and manoeuvre within the facility satisfactorily. A fully dimensioned car parking layout is provided in Figures 4.1 - 4.3. Swept paths for B99 and B85 vehicles and large buses (14.5 metre) are shown in Figures 4.4 - 4.6.

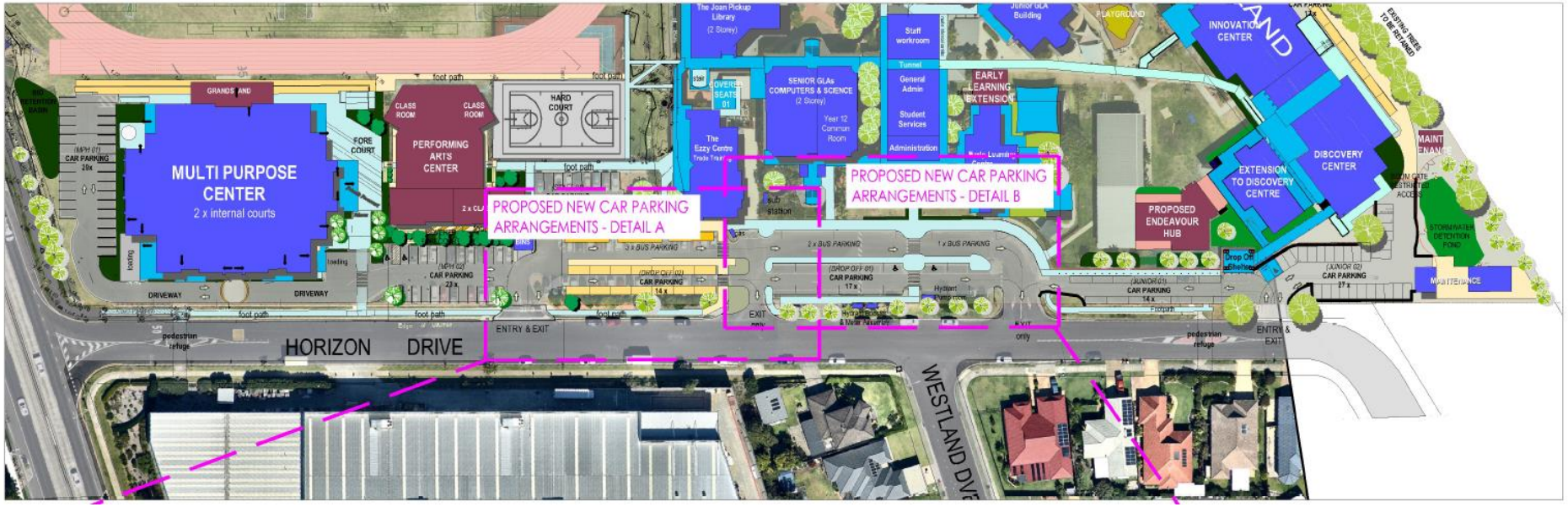


FIGURE 4.1 – PROPOSED CAR PARKING LAYOUT AND DIMENSIONS

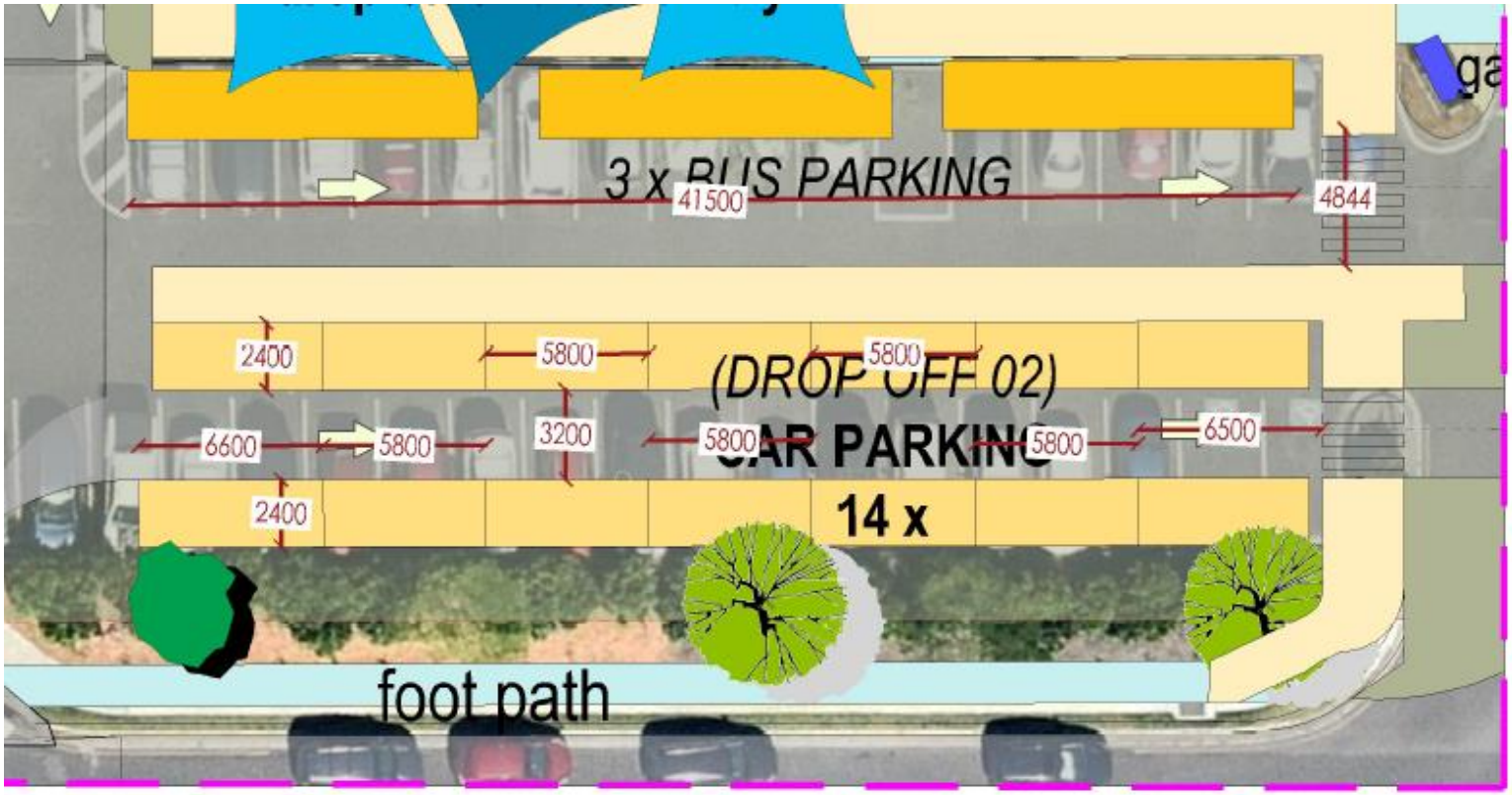


FIGURE 4.2 – PROPOSED CAR PARKING LAYOUT AND DIMENSIONS (DETAIL A)

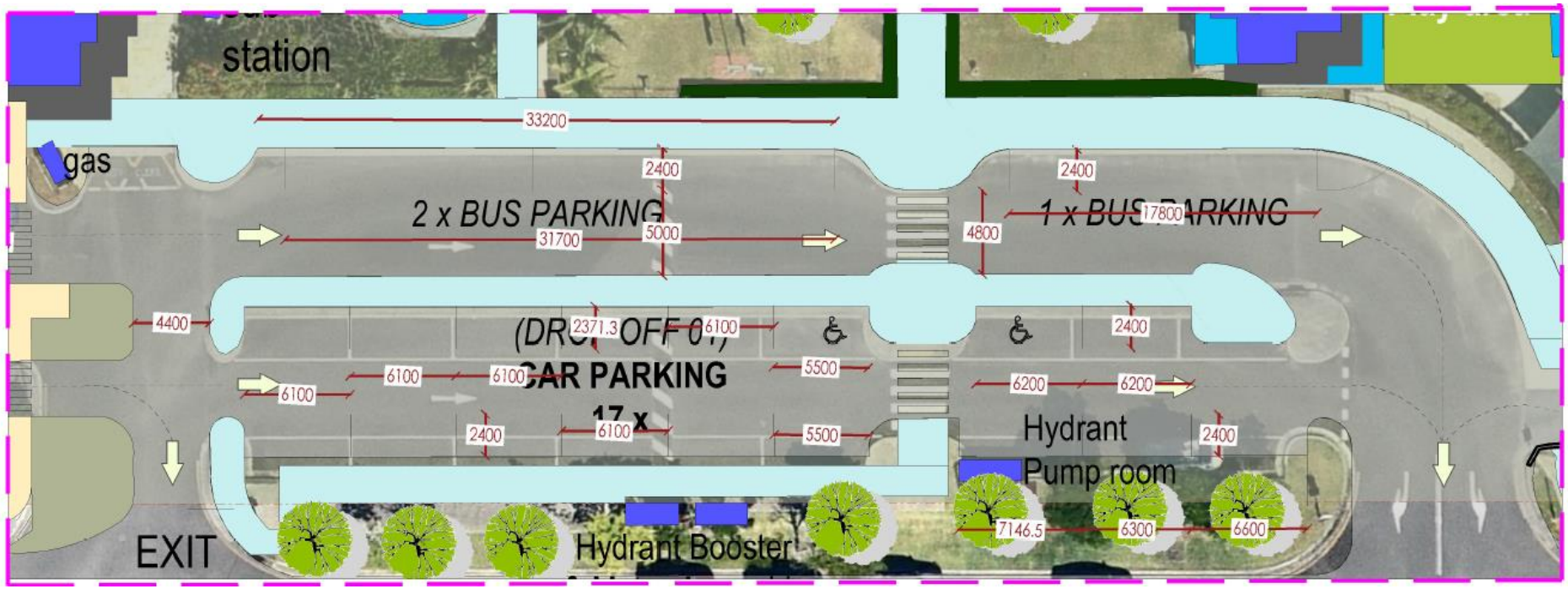


FIGURE 4.3 – PROPOSED CAR PARKING LAYOUT AND DIMENSIONS (DETAIL B)

FIGURE 4.4 – B99 VEHICLE SWEPT PATHS

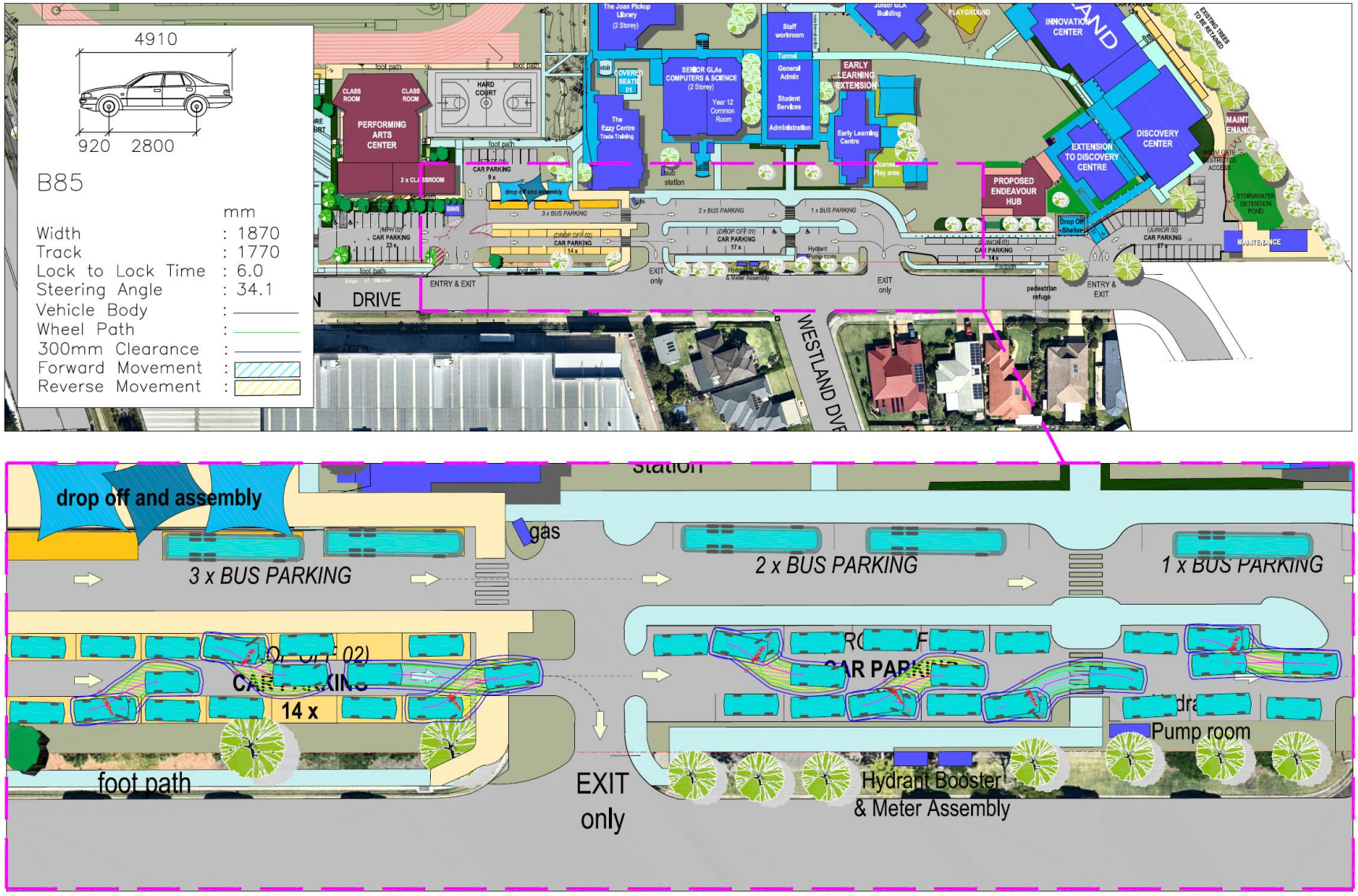


FIGURE 4.5 – B85 VEHICLE SWEPT PATHS

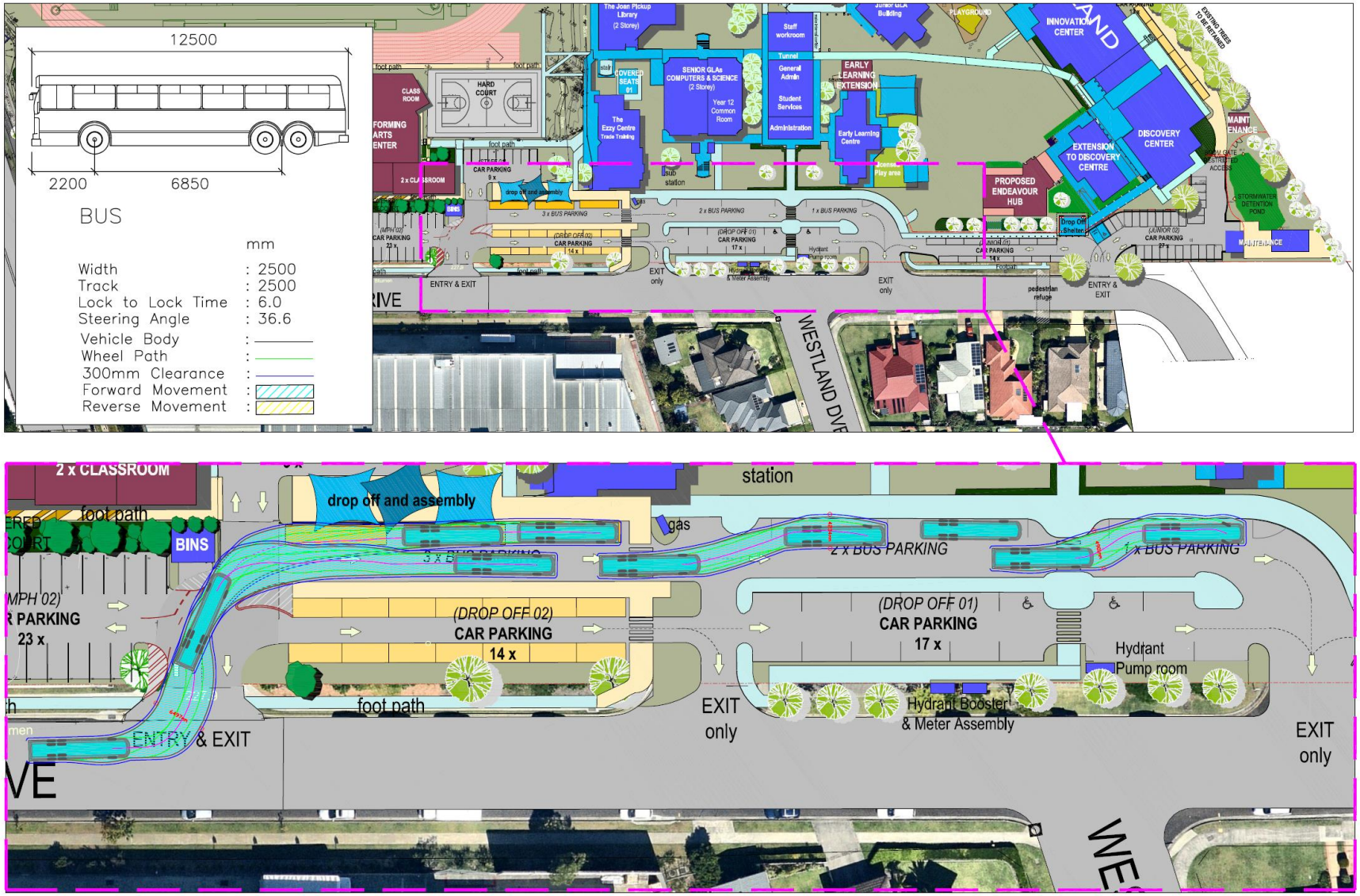


FIGURE 4.6 – 14.5 METRE RIGID BUS PATHS SWEPT PATHS

5.0 ROAD NETWORK IMPACT

5.1 Development traffic estimates

The proposal seeks to increase the current level of approximately 794 students and 93 staff members to 1,114 students and 119 staff members by the year 2031.

Traffic generation rates have been sourced from a report prepared by GTA Consultants for Transport for NSW. The following vehicle trip rates are considered appropriate for the subject school:

AM Peak hour: 0.62 per student
PM Peak hour: 0.43 per student

Application of these rates results in the following trip generation estimates for the planned increase in enrolments.

Table 5.1 - Estimated Development Traffic Generation of proposed additional enrolments

Component	Morning Peak			Afternoon Peak		
	In	Out	Total	In	Out	Total
320 enrolments	100	100	**199**	69	69	**138**

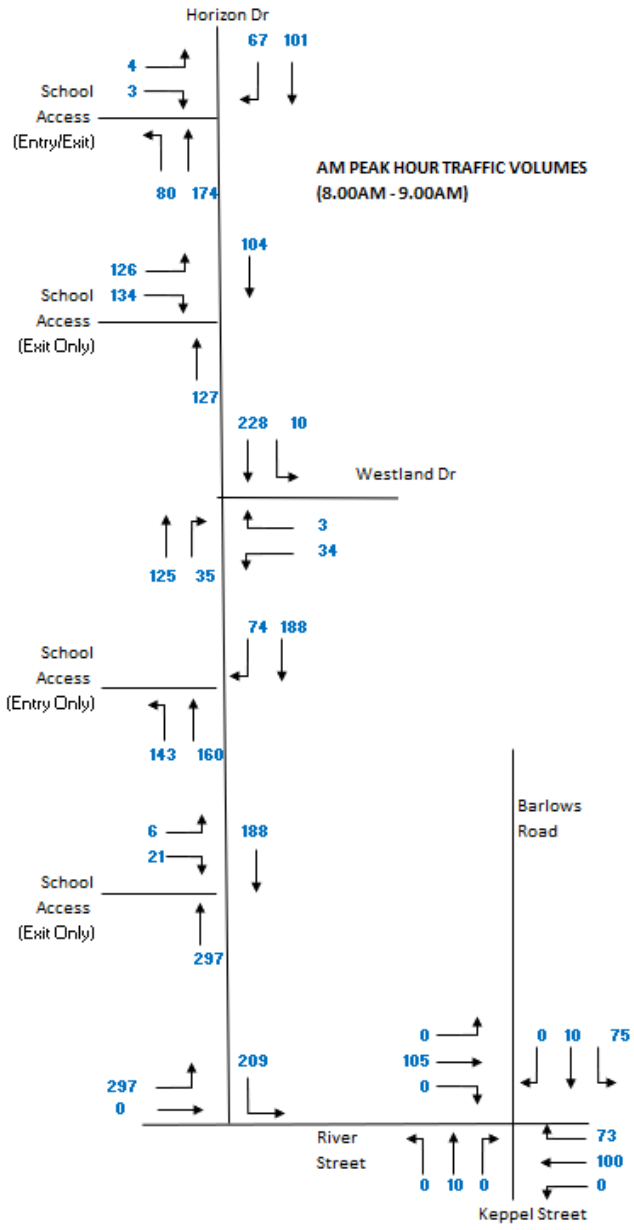
Peak Hour Distribution: AM Peak: 50/50, PM Peak: 50/50

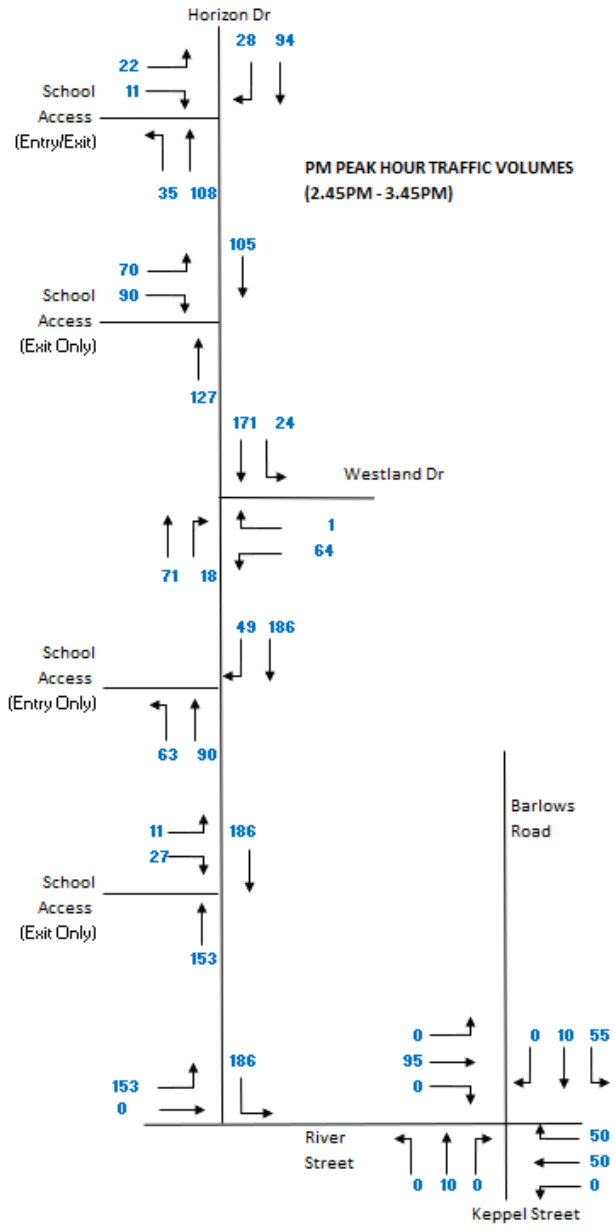
The traffic generation of the proposed additional enrolments has been estimated by factoring the surveyed volumes (of the existing school) in accordance with the proposed increase in enrolments (ie 1114 / 794 = 1.4). It has been assumed that 50% of school traffic that uses the northern section of Horizon Drive, proceeds via Barlows Road to River Street, and vice versa. Resultant estimates of traffic movements generated by the existing school and with the proposed expansion, are shown in Figures 5.1 – 5.2 assuming the existing access arrangements. Figure 5.3 shows the adjusted distribution, assuming the proposed access arrangements (and with the southern driveway as an entry only).

5.2 Road network impact

Traffic modelling has been carried out using SIDRA software for the River Street / Horizon Drive and Barlows Road / River Street / Keppel Street intersections.

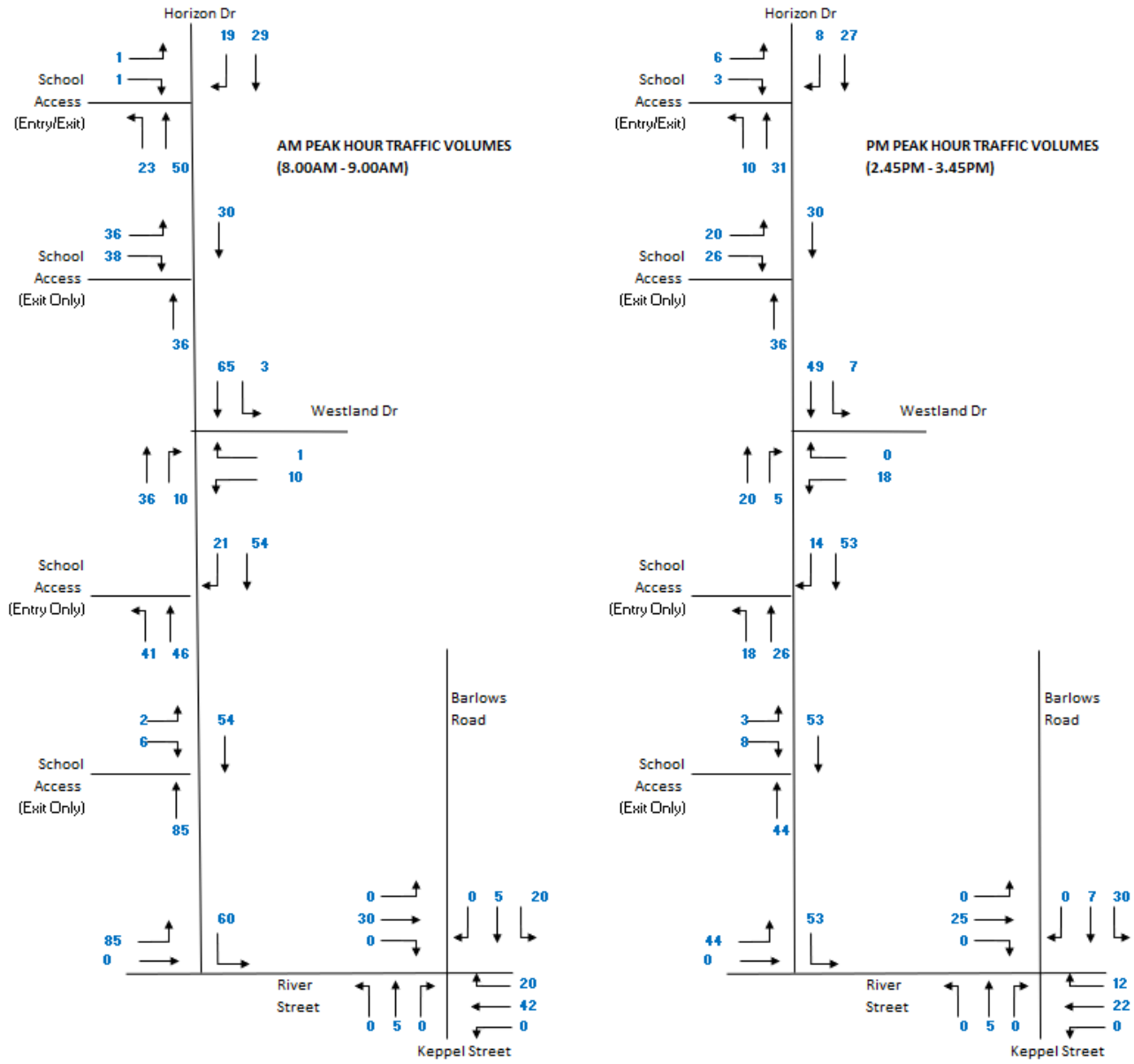
As indicated by the results provided as Appendix C and D, the modelling indicates that the River Street / Horizon Drive intersection will perform at a degree of saturation of up to 38%, with no significant queuing. The River Street / Barlows Road intersection will perform at approximately 93% DoS during the year 2034 morning peak hour, with the proposal contributing approximately 3%. Queuing and delays are acceptable with an average delay of 13 seconds and maximum queue of approximately 13 vehicles.





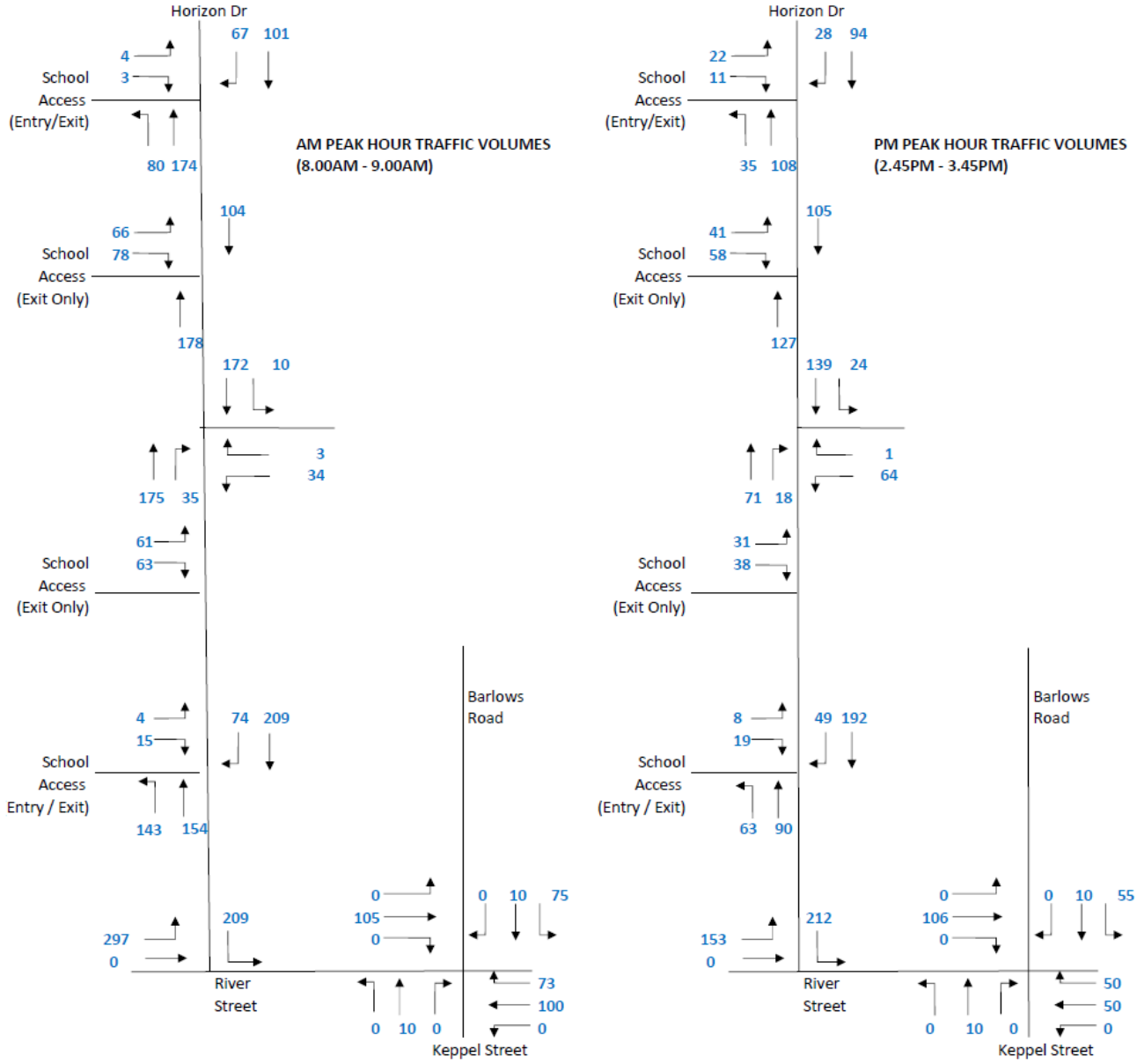
(BASED ON EXISTING SCHOOL ACCESS ARRANGEMENTS)

FIGURE 5.1 – ESTIMATED PEAK HOUR SCHOOL TRAFFIC MOVEMENTS (EXISTING SCHOOL + PROPOSED EXPANSION)



(BASED ON EXISTING SCHOOL ACCESS ARRANGEMENTS)

FIGURE 5.2 – ESTIMATED PEAK HOUR SCHOOL TRAFFIC MOVEMENTS
(ONLY TRAFFIC GENERATED BY PROPOSED INCREASE IN ENROLMENTS)



(BASED ON **PROPOSED** SCHOOL ACCESS ARRANGEMENTS)

FIGURE 5.3 – ESTIMATED PEAK HOUR SCHOOL TRAFFIC MOVEMENTS (EXISTING SCHOOL + PROPOSED EXPANSION)

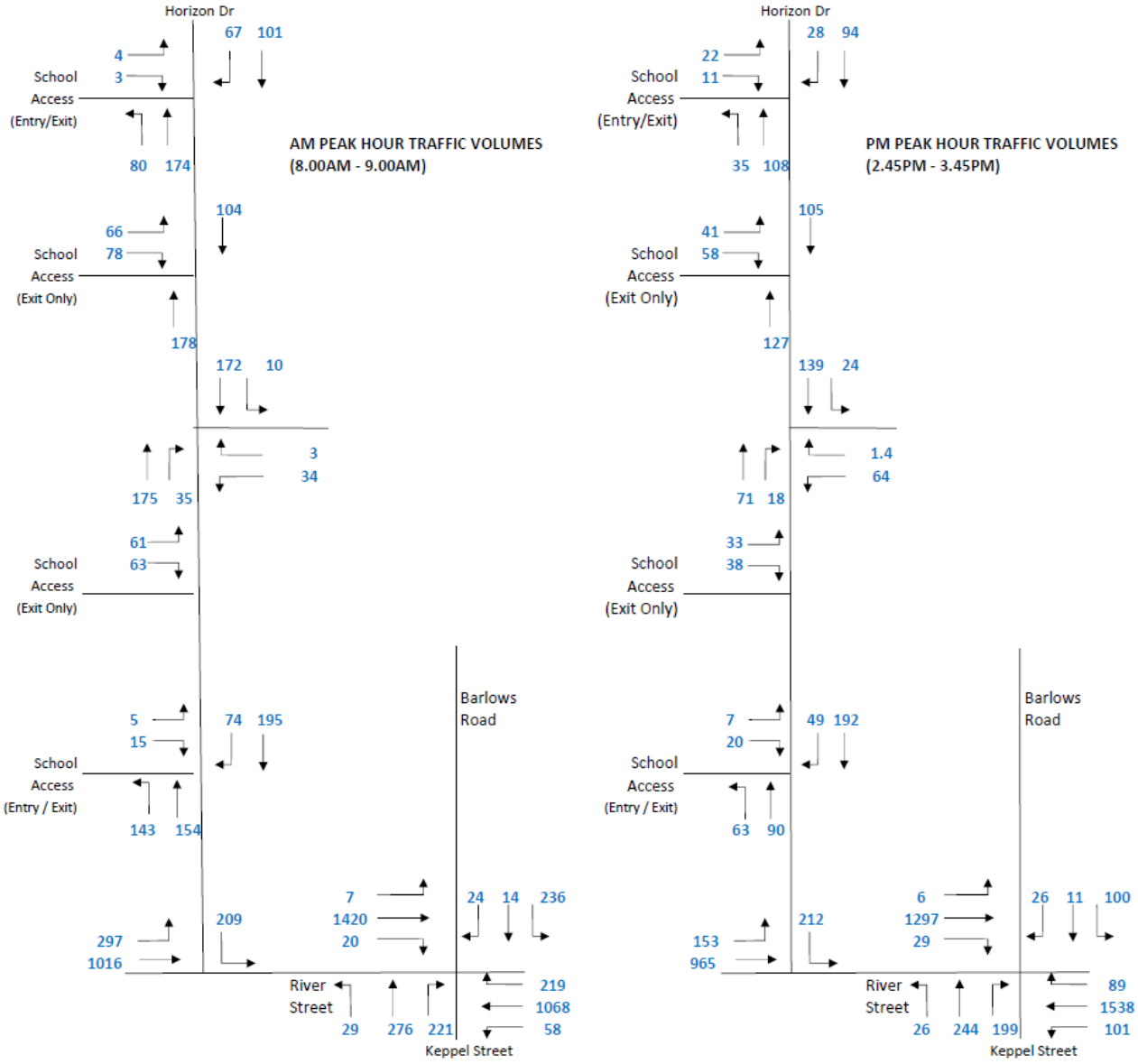


FIGURE 5.4 – DESIGN PEAK HOUR TRAFFIC VOLUMES (YEAR 2034)
(EXISTING TRAFFIC PLUS PROPOSED EXPANSION)

6.0 VEHICLE ACCESS AND QUEUING

Capacity

The proposed access arrangements maintain two points of ingress with increased set down / drop off capacity (for 31 x car set down / pick up spaces and 6 x bus spaces). The proposed layout provides improved queuing capacity at the southern entry, with the conversion of the 36 space car parking area (shown on the approved master plan) to a parallel set down / pick up facility.

It is proposed that the southern access point on Horizon Drive will operate as entry and exit, and the central driveway to operate as exit only (currently entry only). The existing exit driveway located north of Westland Drive would be retained for exit movements.

Queuing

As indicated by Figure 5.4, it is estimated that 217 vehicles and 112 vehicles will enter the southern driveway during the morning and afternoon peak hours, respectively.

Traffic generally arrives evenly during the morning peak hour with an average arrival rate of 4 vehicles per minute. This will be comfortably accommodated by the proposed set down capacity of 31 spaces, with minimal queuing.

During the afternoon period, vehicle arrivals are distributed over a shorter period of approximately 30 minutes. The projected entry demand of 112 vehicles per hour equates to an arrival rate of approximately 4 vehicles per minute, assuming that all traffic arrives over a 30 minute period. The proposed pick up capacity of 31 spaces will satisfactory cater for this demand, however supervision will be required to ensure that traffic flows through the pick up zone and visitors do not park for extended periods.

Management

It is noted that the operation of the internal intersection within the southern access will need to be supervised during peak periods, particularly the afternoon when there is a concentration of traffic movements at the end of school. Supervision will need to ensure that cars do not 'double park' in the circulation roads and block the entry point. Such traffic management measures are typical for schools where there is a high volume of vehicle arrivals during the afternoon peak period.

It is recommended that a No Stopping zone (8am – 4pm, Mon-Fri) be implemented along Horizon Drive so that any overflow queue at the southern driveway can be accommodated kerbside without conflicting with through traffic. This is shown conceptually in Figure 6.1.

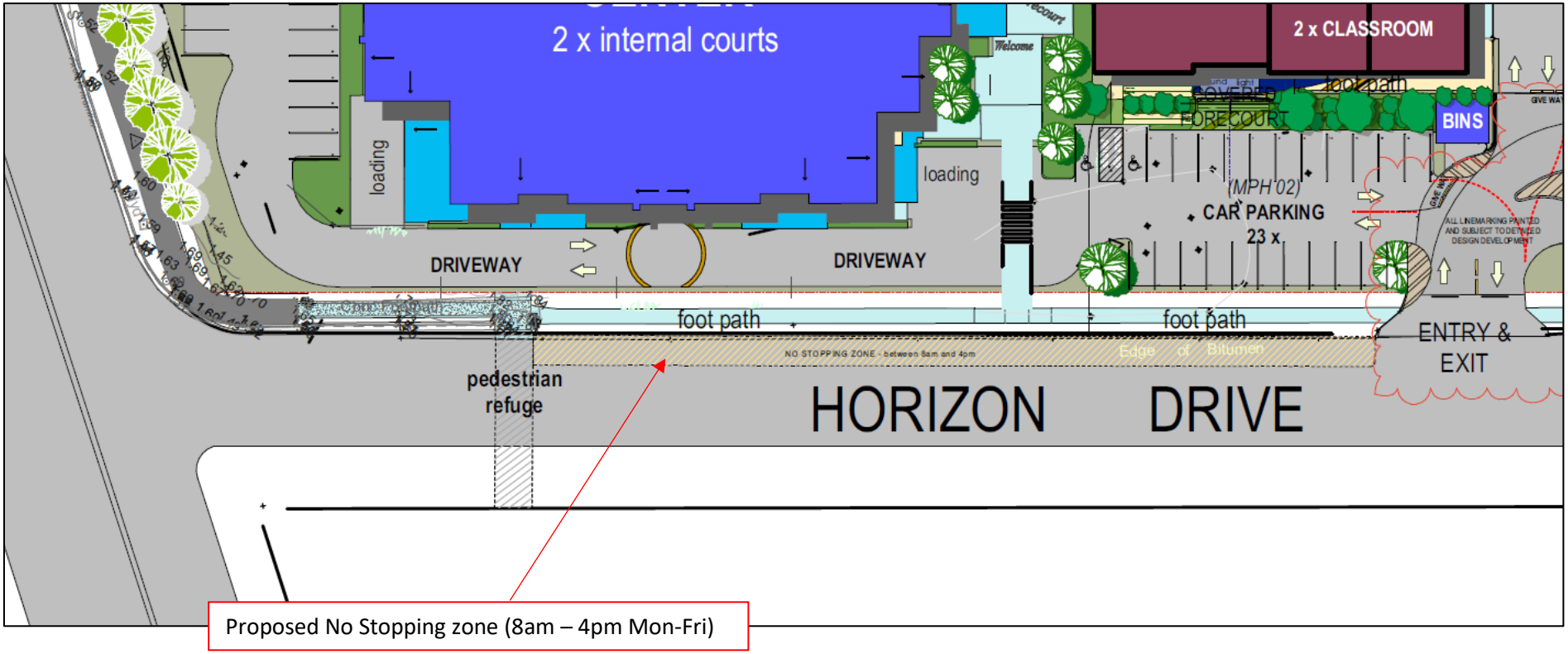


FIGURE 6.1 – PROPOSED NO STOPPING ZONE ALONG HORIZON DRIVE

7.0 PROVISION FOR SERVICE VEHICLES

The proposed increase enrolment capacity will not significantly change the servicing requirements of the school. It is noted that the proposed master plan includes an upgrade of the service road (to asphalt surface) linking the northern end of the campus to Riverbend Drive. This will continue to be restricted to staff and maintenance vehicles only, with a boom gate installed to prevent unauthorised use.

It is considered that the service lane at the rear of the campus, together with the additional access areas around the new parking facilities will provide for satisfactory access by service and maintenance vehicles.

8.0 ROAD SAFETY

A road safety audit for the proposed access and car parking arrangements has been carried out by CML Civil (provided under separate cover). The following comments are provided in response to the various items raised:

Section 1 - General Comments					
S1-1	Traffic Volumes have been provided within the supplied Traffic Impact Assessment.	General Comment			Traffic data detailed within TIA identifies a low ongoing LoS. As there is a proposed sporting field and performing arts centre within the Master Plan, consideration to the analysis of a specific event (sporting or musical) should be undertaken to determine the roadway capacity during these events to ensure roadway can accommodate this usage.
S1-2	Design has not been prepared and review is based on a master plan "mock-up' for the proposed upgrades. No detailed measurements/offsets have been provided.	General Comment			During further design process, the detailed design of the proposed upgrades will require further auditing to ensure suitable design standards have been utilised in the car parking and roadway formalisation to ensure design life is achieved for the proposed works.
Section 2 - Proposed Drop-Off Zone Upgrade (Horizon Drive)					
S2-1	Entry/Exit on approach to proposed new Drop off Zone (Southern access point) supports minimal vehicle queuing. This may be of concern due to the adjacent parking zone and the conflict/vehicle crossover when exiting the parking area. There is potential for queuing onto the roadway.	Possible	Serious	High (FSI)	Ensure suitable priority control is implemented to minimis the queuing onto the roadway on the access crossover. (P)
S2-2	Proposed Drop-Off zone contains drop-off bays on both sides of the through movement. Potential for impacts due to simultaneous egress from each side due to focus being on gaps within through movement	Possible	Moderate	High	Crash data does not show any incidents within the existing drop off zone with similar arrangement. Investigation on existing arrangement and crash history to be undertaken to ensure proposed arrangement will be suitable and safe for ongoing use. (S)
S2-3	The removal of 36 std parking spaces (Off Horizon Dr) has been proposed to be replaced with 14 drop-off spaces and 30+ parking spaces on Riverbend Dr however no pedestrian connectivity from the new Riverbend Dr parking bays is identified into the school grounds.	Possible	Minor	Medium	The TIA does not investigate existing car parking usage throughout a general day to determine the carking rate for each day. If this on-road parking will be heavily utilised for Business As Usual activities/visitors - pedestrian connectivity should be investigated to ensure pedestrian safety is considered along with wayfinding etc. All weather scenarios should also be identified in this investigation. (S)
Section 3 - Proposed On-Road Parking and Formalised Service Access					
S3-1	No traffic assessment has been conducted for the proposed 30+ spaces of formal on-road parking to be supplied on Riverbend Dr.	Likely	Serious	Extreme (FSI)	Traffic analysis for the Riverbend Dr/River St intersection should be conducted for the sporting event scenario to ensure the roadway does not require upgrades to cater for these events. (P)
S3-2	Turn around facilities have not been detailed within the Riverbend Dr proposed works.	Possible	Serious	High (FSI)	Detailed design to be undertaken for Riverbend Dr for the proposed parking along with the provision of turn-around capabilities in accordance with local authority requirements. (P)
S3-3	Formalised service road has been identified however no details on width have been provided to determine if this is 2-way or 1-way flow.	Possible	Moderate	High	Identification on travel arrangements for formalised (Staff) service road to identify priority and access/egress locations with respect to traffic impact for both Horizon Dr and Riverbend Dr. (S)
S3-4	On-Road parking has been proposed however on Riverbend Dr which is in proximity to the Riverbend Retirement Village. No details have been provided within the Master Plan to identify how the parking will be separated from the thoroughfare of Riverbend traffic especially since the mixture of road users will be retirement village visitors/residents, potential learner drivers from the college and school collection activities	Likely	Serious	Extreme (FSI)	Investigations and subsequent notations to be undertaken to identify the potential need for additional delineation or safety devices to ensure suitable separation of vehicle movement when considering the mixture of vulnerable road users i.e. retirement village patrons, learner/school aged drivers, pedetrians etc. (P)

Item S1-1 -
The use of the sporting field for events will be infrequent and generally on weekends and outside of peak traffic periods.

Item S1-2 -
This report has been amended to show that the proposed concept layout complies with relevant standards.

Item S2-1 -
The access and car parking layout has been modified to include a widened crossover and line marking to manage internal queuing, and the movement of vehicles to and from car parking areas located to the south of the driveway. The design of the line marking and priority controls will be reviewed during detailed design.

Item S2-2 -
The proposal for parallel drop off bays along each side is common and does not raise any concerns in relation to “simultaneous egress”.

Item S2-3 –
Pedestrians will walk directly from the car parks along Riverbend Drive over grass to the sporting field. Dedicated pedestrian access is not proposed.

Item S3-1 -
Riverbend Drive is a minor leg at its connection to the River Street roundabout. An increase in traffic volume would have a minor impact upon the performance of the roundabout and may even cause some marginal improvement to the overall performance of the roundabout by balancing the flows.

Item S3-2 -
There is an existing cul-de-sac head provided at the end of Riverbend Drive. It is proposed that a painted central island be constructed to manage U-turn movements, with a painted double centre line provided along Riverbend Drive to force traffic to proceed to the U-turn facility, rather than manoeuvre into the proposed parking spaces from the northbound lane (refer Figure 8.1).

Item 3-3 -
The service road would operate as one way from the east to west (exiting to Riverbend Drive).

Item 3-4 -
The proposed parking along Riverbend Drive will comply with on-street car parking standards, and as such sufficient space will be available for vehicles to manoeuvre to and from car parking spaces without adversely impacting upon the through traffic flow. The painted island and centreline arrangements shown in Figure 8.1 would ensure that parking manoeuvres do not impede northbound flow. The design of the car parking and line marking arrangements are subject to detailed design.

The car parking is proposed to commence on the northern side of the existing pedestrian crossing point on Riverbend Drive. Residents of the retirement village walk along the western side of Riverbend Drive and then cross at this point, and will be therefore clear of parking manoeuvres.

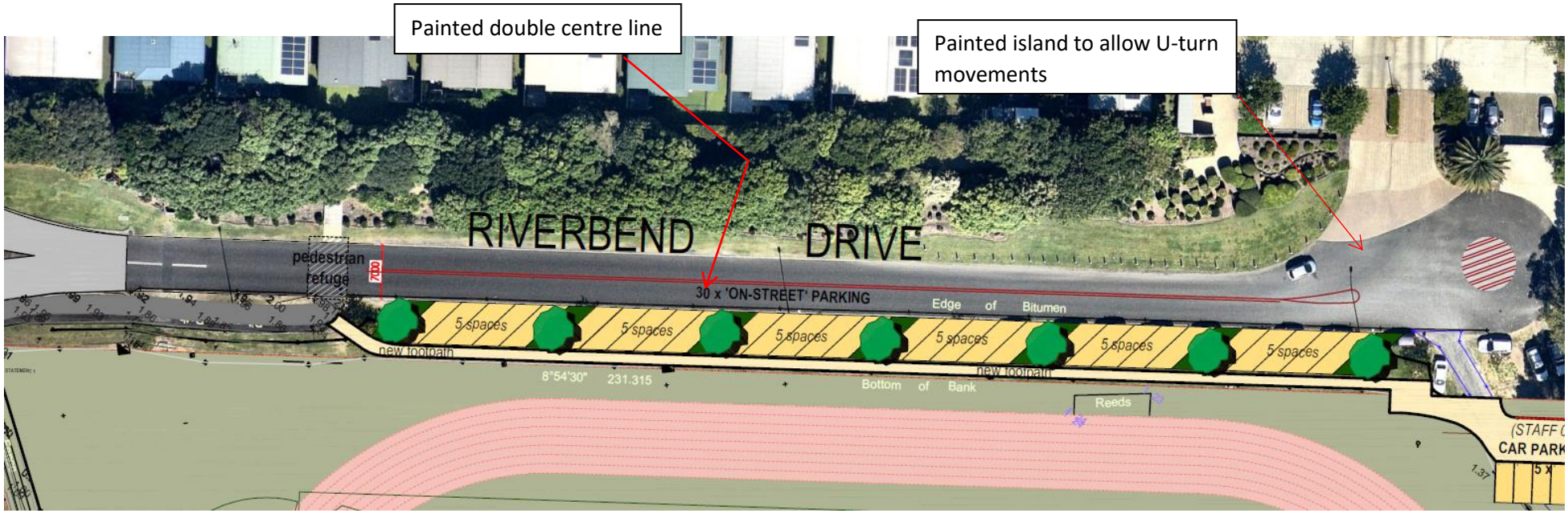


FIGURE 8.1 – PROPOSED ON-STREET PARKING AND ASSOCIATED TRAFFIC MANAGEMENT ARRANGEMENTS ALONG RIVERBEND DRIVE

9.0 SUMMARY OF CONCLUSIONS & RECOMMENDATIONS

- Under the current approval, the College is permitted to have up to 794 students and 93 staff members. Vehicular access is gained from four driveways along Horizon Drive. A one-way service driveway links the northern end of the campus car park to Riverbend Drive. There are 150 car parking spaces provided on the existing campus, including car parking recently constructed as part of the Multi-Purpose Centre project.

- The proposed master plan facilitates an increase in the College population from the current level of approximately 794 students and 93 staff members, to 1,114 students and 119 staff members by the year 2031. The proposed master plan includes an increase in bus capacity from three spaces on the approved plan, to six spaces.

- The proposed car parking supply of 162 spaces meets the requirements of the DCP. In addition, it is proposed that formal on-street car parking be provided along Riverbend Drive, to support after school and weekend activities on the sporting field.

- The proposed master plan includes an upgrade of the service road (to asphalt surface) linking the northern end of the campus to Riverbend Drive. This will continue to be restricted to staff and maintenance vehicles only, with a boom gate installed to prevent unauthorised use.

- Traffic modelling indicates that the River Street / Horizon Drive and River Street / Barlows Road intersections will function satisfactorily with additional traffic generated by the proposed master plan.

- Discussions with the bus operator has identified some design items that can be addressed during future design. Similarly, a Road Safety Audit has identified some design items that can be addressed during detailed design.

APPENDICES

APPENDIX A – TRAFFIC COUNT DATA – MAY 2021
APPENDIX B – TRAFFIC COUNT DATA – NOVEMBER 2022 (IR)
APPENDIX C – TRAFFIC COUNT DATA – FEBRUARY 2023 (IR)
APPENDIX D – SIDRA MODELLING (RIVER STREET / HORIZON DR INTERSECTION)
APPENDIX E – SIDRA MODELLING (RIVER STREET / BARLOWS RD / KEPPEL ST INTERSECTION)

APPENDIX A – TRAFFIC COUNT DATA – MAY 2021 (DA)

TRAFFIC COUNTS – MAY 2021 – DEVELOPMENT APPLICATION

MANUAL TRAFFIC SURVEY RESULTS

Unit Type: Camera
RTE ID: 21047
Location: Horizon Drive / School access
Date: Thursday, 13 May 2021
Comments: Fine weather

Class **All Vehicles**

Time	N-Thru	N-Right	N-Left	S-Thru	S-Right	S-Left	E-Thru	E-Right	E-Left	W-Thru	W-Right	W-Left	Total	Cumul Tot
7:30	8	0	0	3	0	0	0	0	0	0	0	0	11	
7:45	9	0	0	2	0	0	0	0	0	0	6	12	29	
8:00	18	0	0	23	0	0	0	0	0	0	13	17	71	
8:15	15	0	0	28	0	0	0	0	0	0	18	31	92	203
8:30	27	0	0	49	0	0	0	0	0	0	27	47	150	342
8:45	11	0	0	22	0	0	0	0	0	0	25	30	88	401
14:00	4	0	0	1	0	0	0	0	0	0	1	0	6	
14:15	5	0	0	5	0	0	0	0	0	0	1	0	11	
14:30	5	0	0	9	0	0	0	0	0	0	0	1	15	
14:45	17	0	0	16	0	0	0	0	0	0	6	7	46	78
15:00	36	0	0	26	0	0	0	0	0	0	18	21	101	173
15:15	15	0	0	13	0	0	0	0	0	0	17	27	72	234
15:30	10	0	0	7	0	0	0	0	0	0	9	10	36	255
15:45	10	0	0	4	0	0	0	0	0	0	6	7	27	236
AM PEAK HR	**71**	**0**	**0**	**122**	**0**	**0**	**0**	**0**	**0**	**0**	**83**	**125**	**401**	
PM PEAK HR	**78**	**0**	**0**	**62**	**0**	**0**	**0**	**0**	**0**	**0**	**50**	**65**	**255**	
3 1/2 HR TOT	**190**	**0**	**0**	**208**	**0**	**0**	**0**	**0**	**0**	**0**	**147**	**210**	**755**	

MANUAL TRAFFIC SURVEY RESULTS

Unit Type: Camera
RTE ID: 21047
Location: Horizon Drive / School access
Date: Thursday, 13 May 2021
Comments: Fine weather

Class **All Vehicles**

Time	N-Thru	N-Right	N-Left	S-Thru	S-Right	S-Left	E-Thru	E-Right	E-Left	W-Thru	W-Right	W-Left	Total	Cumul Tot
7:30	11	2	0	8	0	3	0	0	0	0	0	0	24	
7:45	14	9	0	9	0	18	0	0	0	0	0	0	50	
8:00	21	11	0	26	0	18	0	0	0	0	0	0	76	
8:15	24	8	0	35	0	22	0	0	0	0	0	0	89	239
8:30	37	20	0	53	0	27	0	0	0	0	0	0	137	352
8:45	27	11	0	20	0	13	0	0	0	0	0	0	71	373
14:00	5	2	0	3	0	0	0	0	0	0	0	0	10	
14:15	10	0	0	7	0	1	0	0	0	0	0	0	18	
14:30	3	4	0	12	0	3	0	0	0	0	0	0	22	
14:45	9	9	0	21	0	16	0	0	0	0	0	0	55	105
15:00	28	12	0	28	0	8	0	0	0	0	0	0	76	171
15:15	29	8	0	14	0	10	0	0	0	0	0	0	61	214
15:30	17	7	0	6	0	7	0	0	0	0	0	0	37	229
15:45	13	5	0	8	0	8	0	0	0	0	0	0	34	208
AM PEAK HR	**109**	**50**	**0**	**134**	**0**	**80**	**0**	**0**	**0**	**0**	**0**	**0**	**373**	
PM PEAK HR	**83**	**36**	**0**	**69**	**0**	**41**	**0**	**0**	**0**	**0**	**0**	**0**	**229**	
3 1/2 HR TOT	**248**	**108**	**0**	**250**	**0**	**154**	**0**	**0**	**0**	**0**	**0**	**0**	**760**	

MANUAL TRAFFIC SURVEY RESULTS

Unit Type: Camera
RTE ID: 21047
Location: Horizon Drive / River Street
Date: Thursday, 13 May 2021
Comments: Fine weather

Class **All Vehicles**

Time	N-Thru	N-Right	N-Left	S-Thru	S-Right	S-Left	E-Thru	E-Right	E-Left	W-Thru	W-Right	W-Left	Total	Cumul Tot
7:30	0	0	5	0	0	0	0	0	0	142	0	4	151	
7:45	0	0	3	0	0	0	0	0	0	145	0	9	157	
8:00	0	0	6	0	0	0	0	0	0	120	0	4	130	
8:15	0	0	9	0	0	0	0	0	0	171	0	8	188	626
8:30	0	0	11	0	0	0	0	0	0	243	0	14	268	743
8:45	0	0	16	0	0	0	0	0	0	283	0	31	330	916
14:00	0	0	11	0	0	0	0	0	0	165	0	7	183	
14:15	0	0	7	0	0	0	0	0	0	199	0	3	209	
14:30	0	0	7	0	0	0	0	0	0	178	0	4	189	
14:45	0	0	3	0	0	0	0	0	0	193	0	3	199	780
15:00	0	0	7	0	0	0	0	0	0	184	0	6	197	794
15:15	0	0	12	0	0	0	0	0	0	189	0	9	210	795
15:30	0	0	5	0	0	0	0	0	0	218	0	18	241	847
15:45	0	0	9	0	0	0	0	0	0	185	0	35	229	877
AM PEAK HR	**0**	**0**	**42**	**0**	**0**	**0**	**0**	**0**	**0**	**817**	**0**	**57**	**916**	
PM PEAK HR	**0**	**0**	**33**	**0**	**0**	**0**	**0**	**0**	**0**	**776**	**0**	**68**	**877**	
3 1/2 HR TOT	**0**	**0**	**111**	**0**	**0**	**0**	**0**	**0**	**0**	**2615**	**0**	**155**	**2881**	

MANUAL TRAFFIC SURVEY RESULTS

Unit Type: Camera
RTE ID: 21047
Location: Horizon Drive / Westland Drive
Date: Thursday, 13 May 2021
Comments: Fine weather

Class **All Vehicles**

Time	N-Thru	N-Right	N-Left	S-Thru	S-Right	S-Left	E-Thru	E-Right	E-Left	W-Thru	W-Right	W-Left	Total	Cumul Tot
7:30	8	0	0	3	4	0	0	0	4	0	0	0	19	
7:45	9	0	0	2	5	0	0	0	6	0	0	0	22	
8:00	18	0	2	23	2	0	0	0	5	0	0	0	50	
8:15	13	0	4	28	5	0	0	0	5	0	0	0	55	146
8:30	25	0	4	49	4	0	0	0	8	0	0	0	90	217
8:45	10	0	2	21	2	0	0	1	5	0	0	0	41	236
14:00	4	0	0	1	2	0	0	0	2	0	0	0	9	
14:15	4	0	1	5	2	0	0	0	5	0	0	0	17	
14:30	5	0	0	9	3	0	0	0	2	0	0	0	19	
14:45	14	0	5	15	4	0	0	1	1	0	0	0	40	85
15:00	26	0	10	23	6	0	0	3	10	0	0	0	78	154
15:15	15	0	0	12	1	0	0	1	8	0	0	0	37	174
15:30	10	0	0	6	1	0	0	1	3	0	0	0	21	176
15:45	9	0	2	3	4	0	0	0	2	0	0	0	20	156
AM PEAK HR	**66**	**0**	**12**	**121**	**13**	**0**	**0**	**1**	**23**	**0**	**0**	**0**	**236**	
PM PEAK HR	**65**	**0**	**15**	**56**	**12**	**0**	**0**	**6**	**22**	**0**	**0**	**0**	**176**	
3 1/2 HR TOT	**170**	**0**	**30**	**200**	**45**	**0**	**0**	**7**	**66**	**0**	**0**	**0**	**518**	

APPENDIX B – TRAFFIC COUNT DATA – NOVEMBER 2022 (IR)

MANUAL TRAFFIC SURVEY RESULTS

Unit Type: Camera
RTE ID: 21047
Location: Horizon Drive / Westland Drive / School access
Comments: Fine weather
Class **All Vehicles**

Morning Peak Period - Tuesday, 29 November 2022

Time	N-Thru	N-Right	N-Left	S-Thru	S-Right	S-Left	E-Thru	E-Right	E-Left	W-Thru	W-Right	W-Left	Total	Cumul Tot
7:00	0	0	0	1	4	1	0	0	1	0	6	3	16	
7:15	3	3	0	1	4	1	0	0	4	0	8	2	26	
7:30	6	1	0	5	2	5	0	1	6	0	1	0	27	
7:45	1	6	0	4	2	5	0	1	5	1	0	0	25	94
8:00	11	18	0	12	7	22	0	0	6	2	16	14	108	186
8:15	2	9	1	15	2	20	0	0	5	1	23	27	105	265
8:30	9	11	0	17	4	29	0	0	6	2	28	30	136	374
8:45	7	10	0	5	3	20	0	0	3	3	32	27	110	459
9:00	2	2	1	4	4	3	0	0	7	0	8	4	35	386
9:15	5	1	0	1	5	6	0	2	1	0	7	2	30	311
9:30	1	2	0	2	2	1	0	0	2	0	0	1	11	186
9:45	2	0	0	1	1	1	0	1	2	0	1	1	10	86
AM PEAK HR	**29**	**48**	**1**	**49**	**16**	**91**	**0**	**0**	**20**	**8**	**99**	**98**	**459**	

Afternoon Peak Period - Tuesday, 29 November 2022

14:30	1	4	2	6	2	5	0	0	4	0	0	1	25	
14:45	2	6	3	11	5	13	0	2	2	0	7	1	52	
15:00	21	15	4	19	4	9	0	1	8	1	32	25	139	
15:15	10	5	1	15	2	9	0	0	5	2	15	11	75	291
15:30	7	8	1	6	2	6	1	0	3	1	10	7	52	318
15:45	7	6	0	1	2	3	0	1	5	0	8	5	38	304
16:00	9	2	1	1	2	10	0	1	6	1	7	1	41	206
16:15	4	1	1	0	5	4	0	0	7	0	7	1	30	161
16:30	4	2	0	8	5	0	0	0	12	0	5	1	37	146
16:45	3	1	0	4	5	0	0	0	7	0	2	1	23	131
17:00	3	2	0	3	1	0	0	0	6	0	2	1	18	108
17:15	1	1	2	3	6	2	0	0	8	0	0	2	25	103
PM PEAK HR	**40**	**34**	**9**	**51**	**13**	**37**	**1**	**3**	**18**	**4**	**64**	**44**	**318**	

MANUAL TRAFFIC SURVEY RESULTS

Unit Type: Camera
RTE ID: 21047
Location: Barlow Road / Keppel Street / River Street
Comments: Fine weather
Class **All Vehicles**

Morning Peak Period - Friday, 25 November 2022

Time	N-Thru	N-Right	N-Left	S-Thru	S-Right	S-Left	E-Thru	E-Right	E-Left	W-Thru	W-Right	W-Left	Total	Cumul Tot
7:00	3	8	27	38	30	7	196	44	7	271	3	1	635	
7:15	1	3	39	59	49	8	200	40	6	313	4	3	725	
7:30	2	5	58	58	49	6	184	56	12	289	4	0	723	
7:45	1	3	50	63	50	2	245	20	22	245	5	2	708	2791
8:00	1	4	17	48	37	9	200	9	14	268	5	3	615	2771
8:15	0	3	7	54	42	10	196	7	20	245	7	3	594	2640
8:30	0	2	12	62	46	13	215	10	19	295	6	2	682	2599
8:45	1	1	12	39	32	7	204	11	19	277	7	2	612	2503
9:00	1	2	13	47	35	10	214	8	24	255	9	2	620	2508
9:15	0	2	7	45	33	11	199	16	26	231	6	1	577	2491
9:30	0	1	3	48	37	9	227	10	16	273	4	2	630	2439
9:45	0	4	9	53	43	9	243	7	28	268	6	0	670	2497
AM PEAK HR	**7**	**19**	**174**	**218**	**178**	**23**	**825**	**160**	**47**	**1118**	**16**	**6**	**2791**	

Afternoon Peak Period - Thursday, 24 November 2022

14:30	0	5	27	50	36	7	210	23	23	254	6	1	642	
14:45	1	4	18	48	39	5	328	23	21	265	3	1	756	
15:00	1	7	12	45	42	2	303	18	26	269	5	2	732	
15:15	1	4	13	46	35	7	329	11	14	233	9	1	703	2833
15:30	0	6	13	53	44	7	259	10	20	256	6	1	675	2866
15:45	2	0	13	62	53	8	305	19	10	216	1	2	691	2801
16:00	1	3	12	43	36	4	315	11	19	225	1	0	670	2739
16:15	2	1	13	44	28	11	209	16	12	206	5	1	548	2584
16:30	0	7	6	44	36	8	200	14	13	207	3	0	538	2447
16:45	0	0	6	31	26	5	172	3	15	178	1	0	437	2193
17:00	1	0	4	23	20	3	177	6	15	149	2	0	400	1923
17:15	1	0	2	20	18	2	144	12	8	121	2	1	331	1706
PM PEAK HR	**3**	**21**	**56**	**192**	**160**	**21**	**1219**	**62**	**81**	**1023**	**23**	**5**	**2866**	

MANUAL VEHICLE QUEUING SURVEY RESULTS

Unit Type: Camera
RTE ID: 21047
Location: Horizon Drive

Times (AM)	Thursday, 24 Nov 2022			Tuesday, 29 Nov 2022		
	Upto Point 1	Upto Point 2	Beyond Point 2	Upto Point 1	Upto Point 2	Beyond Point 2
7:00	No	-	-	No	-	-
7:15	No	-	-	No	-	-
7:30	No	-	-	No	-	-
7:45	No	-	-	No	-	-
8:00	No	-	-	No	-	-
8:15	No	-	-	No	-	-
8:30	No	-	-	No	-	-
8:45	No	-	-	No	-	-
9:00	No	-	-	No	-	-
9:15	No	-	-	No	-	-
9:30	No	-	-	No	-	-
9:45	No	-	-	No	-	-
10:00	No	-	-	No	-	-
10:15	No	-	-	No	-	-
10:30	No	-	-	No	-	-
10:45	No	-	-	No	-	-
11:00	No	-	-	No	-	-
11:15	No	-	-	No	-	-
11:30	No	-	-	No	-	-
11:45	No	-	-	No	-	-

Times (PM)	Friday, 25 Nov 2022			Tuesday, 29 Nov 2022		
	Upto Point 1	Upto Point 2	Beyond Point 2	Upto Point 1	Upto Point 2	Beyond Point 2
12:00	No	-	-	No	-	-
12:15	No	-	-	No	-	-
12:30	No	-	-	No	-	-
12:45	No	-	-	No	-	-
13:00	No	-	-	No	-	-
13:15	No	-	-	No	-	-
13:30	No	-	-	No	-	-
13:45	No	-	-	No	-	-
14:00	No	-	-	No	-	-
14:15	-	-	Yes	No	-	-
14:30	No	-	-	No	-	-
14:45	No	-	-	No	-	-
15:00	No	-	-	Yes	-	-
15:15	No	-	-	No	-	-
15:30	No	-	-	No	-	-
15:45	No	-	-	No	-	-
16:00	No	-	-	No	-	-
16:15	No	-	-	No	-	-
16:30	No	-	-	No	-	-
16:45	No	-	-	No	-	-
17:00	No	-	-	No	-	-
17:15	No	-	-	No	-	-
17:30	No	-	-	No	-	-
17:45	No	-	-	No	-	-

MANUAL TRAFFIC SURVEY RESULTS

Unit Type: Camera
RTE ID: 21047
Location: Horizon Drive / School access
Comments: Fine weather

Class	All Vehicles

Morning Peak Period - Tuesday, 29 November 2022

Time	N-Right	S-Left	W-Right	W-Left	Total	Cumul Tot
7:00	0	0	2	0	2	
7:15	0	0	8	0	8	
7:30	0	0	0	0	0	
7:45	0	0	0	0	0	10
8:00	0	1	2	0	3	11
8:15	0	0	0	0	0	3
8:30	0	1	2	0	3	6
8:45	0	1	3	4	8	14
9:00	0	0	2	1	3	14
9:15	0	0	0	0	0	14
9:30	0	0	1	0	1	12
9:45	0	1	0	0	1	5
AM PEAK HR	**0**	**3**	**7**	**4**	**14**	

Afternoon Peak Period - Tuesday, 29 November 2022

14:30	0	0	1	0	1	
14:45	0	1	0	0	1	
15:00	0	0	2	1	3	
15:15	0	0	18	7	25	30
15:30	0	0	12	3	15	44
15:45	0	0	3	0	3	46
16:00	0	0	3	2	5	48
16:15	0	0	4	1	5	28
16:30	0	0	5	2	7	20
16:45	0	0	2	0	2	19
17:00	0	0	0	0	0	14
17:15	0	0	0	0	0	9
PM PEAK HR	**0**	**0**	**36**	**12**	**48**	

APPENDIX C – TRAFFIC COUNT DATA – FEBRUARY 2023

MANUAL TRAFFIC SURVEY RESULTS

Unit Type: Camera
RTE ID: 21047
Location: Horizon Drive / Westland Drive / School exit driveway
Date: Wednesday, 08 February 2023
Comments: Fine weather

Class **All Vehicles**

Time	N-Thru	N-Right	N-Left	S-Thru	S-Right	S-Left	E-Thru	E-Right	E-Left	W-Thru	W-Right	W-Left	Total	Cumul Tot
07:30	12	0	0	4	2	0	0	0	1	0	2	1	22	
07:45	13	0	0	17	3	0	0	2	1	0	14	3	53	
08:00	20	0	0	20	6	0	0	1	3	1	14	11	76	
08:15	16	0	1	25	5	0	0	0	5	0	19	25	96	247
08:30	14	0	2	24	10	0	0	0	6	1	29	28	114	339
08:45	21	0	0	20	4	0	0	1	10	2	30	26	114	400
AM PEAK HR	**71**	**0**	**3**	**89**	**25**	**0**	**0**	**2**	**24**	**4**	**92**	**90**	**400**	

14:30	4	0	0	14	1	0	0	2	1	0	1	1	24	
14:45	9	0	6	13	2	0	0	0	6	0	5	2	43	
15:00	33	0	5	26	5	0	0	0	17	3	19	19	127	
15:15	12	0	0	6	3	0	0	0	11	1	25	23	81	275
15:30	10	0	0	6	3	0	0	1	12	2	9	6	49	300
15:45	8	0	2	5	2	0	0	1	3	0	9	2	32	289
PM PEAK HR	**64**	**0**	**11**	**51**	**13**	**0**	**0**	**1**	**46**	**6**	**58**	**50**	**300**	

MANUAL TRAFFIC SURVEY RESULTS

Unit Type: Camera
RTE ID: 21047
Location: Horizon Drive / School entry driveway
Date: Wednesday, 08 February 2023
Comments: Fine weather

Class **All Vehicles**

Time	N-Thru	N-Right	N-Left	S-Thru	S-Right	S-Left	E-Thru	E-Right	E-Left	W-Thru	W-Right	W-Left	Total	Cumul Tot
07:30	12	7	0	6	0	12	0	0	0	0	0	0	37	
07:45	20	9	0	26	0	11	0	0	0	0	0	0	66	
08:00	23	18	0	24	0	25	0	0	0	0	0	0	90	
08:15	25	11	0	32	0	24	0	0	0	0	0	0	92	285
08:30	36	10	0	35	0	29	0	0	0	0	0	0	110	358
08:45	45	14	0	26	0	24	0	0	0	0	0	0	109	401
AM PEAK HR	**129**	**53**	**0**	**117**	**0**	**102**	**0**	**0**	**0**	**0**	**0**	**0**	**401**	
14:30	5	4	0	15	0	4	0	0	0	0	0	0	28	
14:45	12	6	0	18	0	16	0	0	0	0	0	0	52	
15:00	58	17	0	30	0	13	0	0	0	0	0	0	118	
15:15	38	6	0	7	0	11	0	0	0	0	0	0	62	260
15:30	22	6	0	9	0	5	0	0	0	0	0	0	42	274
15:45	16	3	0	6	0	8	0	0	0	0	0	0	33	255
PM PEAK HR	**130**	**35**	**0**	**64**	**0**	**45**	**0**	**0**	**0**	**0**	**0**	**0**	**274**	

MANUAL TRAFFIC SURVEY RESULTS

Unit Type: Camera
RTE ID: 21047
Location: Horizon Drive / School access
Date: Wednesday, 08 February 2023
Comments: Fine weather

Class **All Vehicles**

Time	N-Thru	N-Right	N-Left	S-Thru	S-Right	S-Left	E-Thru	E-Right	E-Left	W-Thru	W-Right	W-Left	Total	Cumul Tot
07:30	12	4	0	3	0	2	0	0	0	0	0	0	21	
07:45	12	6	0	10	0	10	0	0	0	0	0	0	38	
08:00	20	8	0	16	0	13	0	0	0	0	0	0	57	
08:15	18	9	0	24	0	19	0	0	0	0	0	0	70	186
08:30	16	25	0	34	0	16	0	0	0	0	1	2	94	259
08:45	21	6	0	39	0	9	0	0	0	0	1	1	77	298
AM PEAK HR	**75**	**48**	**0**	**113**	**0**	**57**	**0**	**0**	**0**	**0**	**2**	**3**	**298**	
14:30	3	4	0	7	0	9	0	0	0	0	0	1	24	
14:45	18	7	0	7	0	7	0	0	0	0	1	0	40	
15:00	31	4	0	30	0	14	0	0	0	0	3	8	90	
15:15	14	9	0	28	0	2	0	0	0	0	2	4	59	213
15:30	9	0	0	13	0	2	0	0	0	0	2	4	30	219
15:45	10	1	0	4	0	2	0	0	0	0	1	0	18	197
PM PEAK HR	**72**	**20**	**0**	**78**	**0**	**25**	**0**	**0**	**0**	**0**	**8**	**16**	**219**	

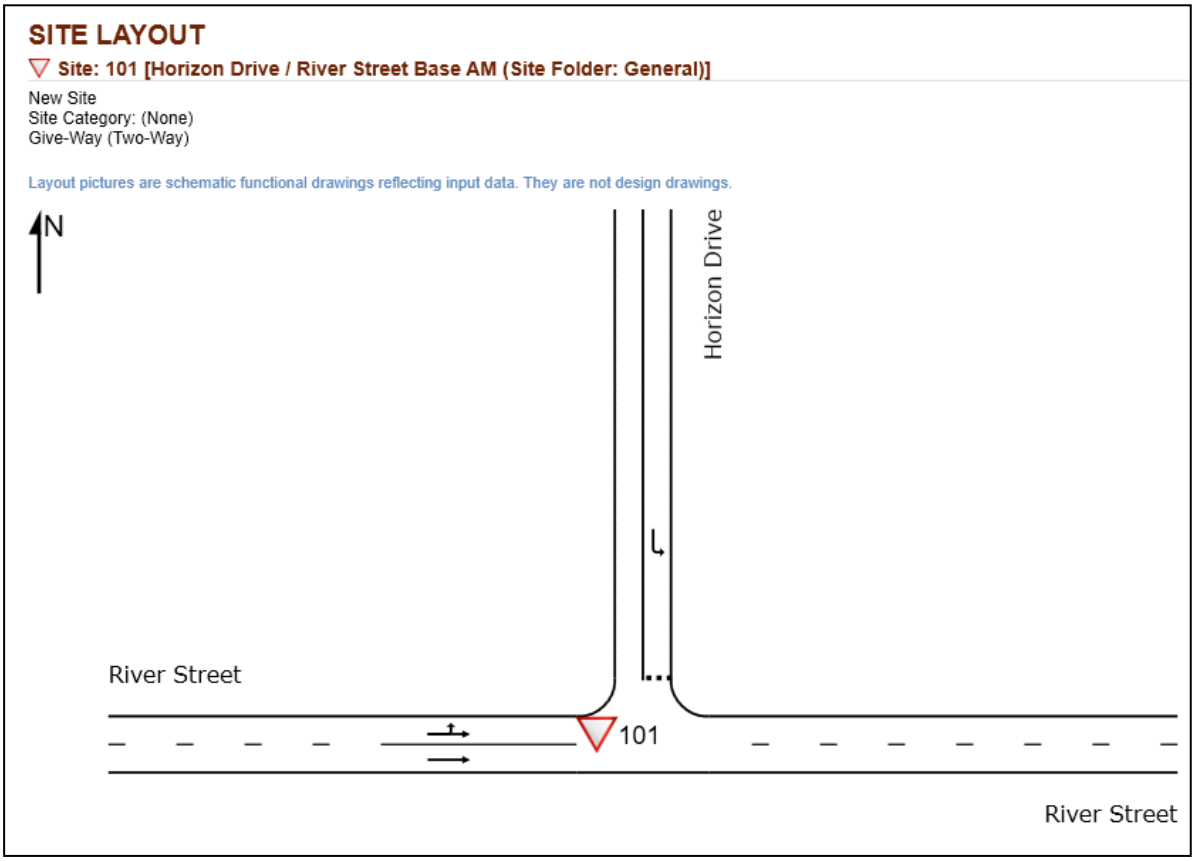
MANUAL SURVEY RESULTS - KIDS WALKING, VEHICLE QUEUING, BUSES AND VEHICLES TURNING FROM DRIVEWAY

Unit Type: Camera
RTE ID: 21047
Location: Horizon Drive / School entry and exit points
Date: Wednesday, 08 February 2023

	Kids walking - Cam 1			Kids walking - Cam 2			Cam 2		Cam 3 - School access driveway			
Time	North	South	East	North	South	East	Queue	Buses	Left (Oneway)	Right (Carpark)	Right Out	Left Out
7:30	0	0	0	0	0	0	0	0	3	3	0	0
7:45	0	1	1	0	0	0	0	0	11	5	0	0
8:00	1	0	0	0	0	2	0	2	13	8	0	0
8:15	0	1	1	0	1	0	0	3	23	5	0	0
8:30	1	0	0	0	0	2	2	1	36	5	1	2
8:45	2	0	0	0	0	0	0	5	13	2	1	1
AM PEAK HR	**4**	**1**	**1**	**0**	**1**	**4**	**2**	**11**	**85**	**20**	**2**	**3**
14:30	0	0	0	0	0	0	0	0	11	2	0	1
14:45	0	0	0	0	0	0	0	1	6	8	1	0
15:00	1	4	8	0	0	3	2	6	14	4	3	8
15:15	1	3	3	0	0	6	0	0	11	0	2	4
15:30	0	0	0	0	0	0	0	0	1	1	2	4
15:45	0	0	0	0	0	2	0	3	2	1	1	0
PM PEAK HR	**2**	**7**	**11**	**0**	**0**	**9**	**2**	**7**	**32**	**13**	**8**	**16**

APPENDIX D – SIDRA MODELLING (RIVER STREET / HORIZON DRIVE)

RIVER STREET / HORIZON DRIVE



2023 BASE MORNING PEAK HOUR

MOVEMENT SUMMARY

▽ Site: 101 [Existing 2023 Peak Traffic AM (Site Folder: Horizon Drive / River Street)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
North: Horizon Drive														
7	L2	149	2.0	157	2.0	0.130	6.8	LOS A	0.5	3.8	0.40	0.63	0.40	52.3
Approach		149	2.0	157	2.0	0.130	6.8	LOS A	0.5	3.8	0.40	0.63	0.40	52.3
West: River Street														
10	L2	212	8.0	223	8.0	0.295	5.7	LOS A	0.0	0.0	0.00	0.25	0.00	55.8
11	T1	817	8.0	860	8.0	0.295	0.1	LOS A	0.0	0.0	0.00	0.09	0.00	59.0
Approach		1029	8.0	1083	8.0	0.295	1.2	NA	0.0	0.0	0.00	0.12	0.00	58.3
All Vehicles		1178	7.2	1240	7.2	0.295	1.9	NA	0.5	3.8	0.05	0.19	0.05	57.5

2023 BASE AFTERNOON PEAK HOUR

MOVEMENT SUMMARY

▽ Site: 101 [Existing 2023 Peak Traffic PM (Site Folder: Horizon Drive / River Street)]

With proposed master plan
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
North: Horizon Drive														
7	L2	152	2.0	160	2.0	0.138	7.0	LOS A	0.6	4.1	0.42	0.65	0.42	52.2
Approach		152	2.0	160	2.0	0.138	7.0	LOS A	0.6	4.1	0.42	0.65	0.42	52.2
West: River Street														
10	L2	109	8.0	115	8.0	0.253	5.7	LOS A	0.0	0.0	0.00	0.15	0.00	56.6
11	T1	776	8.0	817	8.0	0.253	0.1	LOS A	0.0	0.0	0.00	0.06	0.00	59.3
Approach		885	8.0	932	8.0	0.253	0.8	NA	0.0	0.0	0.00	0.07	0.00	58.9
All Vehicles		1037	7.1	1092	7.1	0.253	1.7	NA	0.6	4.1	0.06	0.16	0.06	57.8

2034 BACKGROUND VOLUMES (MORNING PEAK HOUR) WITH PROPOSED MASTER PLAN

MOVEMENT SUMMARY

Site: 101 [Design 2034 Peak Traffic AM (Site Folder: Horizon Drive / River Street)]

With proposed master plan
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
North: Horizon Drive														
7	L2	209	2.0	220	2.0	0.195	7.2	LOS A	0.8	5.9	0.45	0.67	0.45	52.1
Approach		209	2.0	220	2.0	0.195	7.2	LOS A	0.8	5.9	0.45	0.67	0.45	52.1
West: River Street														
10	L2	297	8.0	313	8.0	0.377	5.7	LOS A	0.0	0.0	0.00	0.27	0.00	55.5
11	T1	1016	8.0	1069	8.0	0.377	0.1	LOS A	0.0	0.0	0.00	0.09	0.00	58.9
Approach		1313	8.0	1382	8.0	0.377	1.4	NA	0.0	0.0	0.00	0.13	0.00	58.1
All Vehicles		1522	7.2	1602	7.2	0.377	2.2	NA	0.8	5.9	0.06	0.21	0.06	57.2

2034 BACKGROUND VOLUMES (AFTERNOON PEAK HOUR) WITH PROPOSED MASTER PLAN

MOVEMENT SUMMARY

Site: 101 [Design 2034 Peak Traffic PM (Site Folder: Horizon Drive / River Street)]

With proposed master plan
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
North: Horizon Drive														
7	L2	212	2.0	223	2.0	0.210	7.5	LOS A	0.9	6.3	0.49	0.71	0.49	52.0
Approach		212	2.0	223	2.0	0.210	7.5	LOS A	0.9	6.3	0.49	0.71	0.49	52.0
West: River Street														
10	L2	153	8.0	161	8.0	0.320	5.7	LOS A	0.0	0.0	0.00	0.16	0.00	56.4
11	T1	965	8.0	1016	8.0	0.320	0.1	LOS A	0.0	0.0	0.00	0.07	0.00	59.2
Approach		1118	8.0	1177	8.0	0.320	0.9	NA	0.0	0.0	0.00	0.08	0.00	58.8
All Vehicles		1330	7.0	1400	7.0	0.320	1.9	NA	0.9	6.3	0.08	0.18	0.08	57.6

APPENDIX E – SIDRA MODELLING (RIVER STREET / BARLOWS RD / KEPPEL ST INTERSECTION)

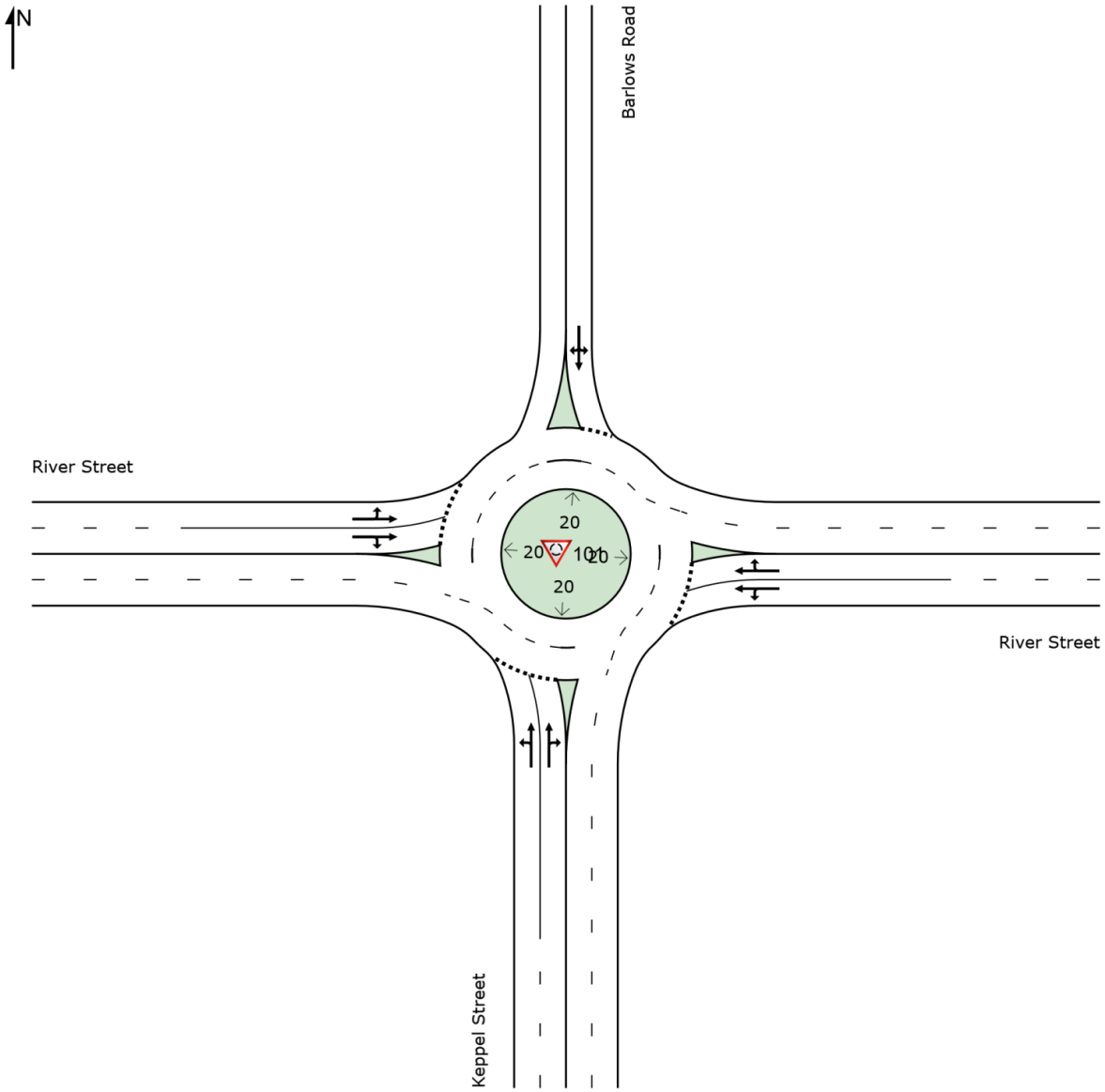
RIVER STREET / BARLOW RD / KEPPEL ST INTERSECTION

SITE LAYOUT

Site: 101 [Background 2024 Peak Traffic AM (Site Folder: River Street / Barlows Road)]

River Street / Barlows Road / Keppel Street
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



2023 BASE MORNING PEAK HOUR

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Keppel Street														
1	L2	23	5.0	24	5.0	0.096	8.9	LOS A	0.3	2.5	0.60	0.78	0.60	51.7
2	T1	218	5.0	229	5.0	0.441	8.0	LOS A	2.3	16.5	0.67	0.86	0.76	52.3
3	R2	178	5.0	187	5.0	0.441	12.6	LOS B	2.3	16.5	0.67	0.87	0.78	52.0
Approach		419	5.0	441	5.0	0.441	10.0	LOS B	2.3	16.5	0.67	0.86	0.76	52.1
East: River Street														
4	L2	47	5.0	49	5.0	0.375	4.4	LOS A	2.4	17.7	0.19	0.41	0.19	54.4
5	T1	825	5.0	868	5.0	0.375	4.4	LOS A	2.4	17.7	0.20	0.44	0.20	55.5
6	R2	160	5.0	168	5.0	0.375	9.1	LOS A	2.4	17.4	0.20	0.49	0.20	54.8
Approach		1032	5.0	1086	5.0	0.375	5.1	LOS A	2.4	17.7	0.20	0.45	0.20	55.4
North: Barlows Road														
7	L2	174	5.0	183	5.0	0.437	10.4	LOS B	2.3	16.9	0.81	0.95	0.95	50.4
8	T1	7	5.0	7	5.0	0.437	10.6	LOS B	2.3	16.9	0.81	0.95	0.95	51.6
9	R2	19	5.0	20	5.0	0.437	15.3	LOS B	2.3	16.9	0.81	0.95	0.95	51.5
Approach		200	5.0	211	5.0	0.437	10.8	LOS B	2.3	16.9	0.81	0.95	0.95	50.5
West: River Street														
10	L2	6	5.0	6	5.0	0.647	8.4	LOS A	5.2	37.9	0.75	0.89	0.93	51.8
11	T1	1118	5.0	1177	5.0	0.647	8.7	LOS A	5.2	37.9	0.76	0.91	0.94	53.2
12	R2	16	5.0	17	5.0	0.647	13.6	LOS B	5.1	36.9	0.76	0.94	0.96	52.9
Approach		1140	5.0	1200	5.0	0.647	8.7	LOS A	5.2	37.9	0.76	0.91	0.94	53.1
All Vehicles		2791	5.0	2938	5.0	0.647	7.7	LOS A	5.2	37.9	0.54	0.73	0.64	53.6

2023 BASE AFTERNOON PEAK HOUR

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Keppel Street														
1	L2	21	5.0	22	5.0	0.095	9.7	LOS A	0.3	2.5	0.66	0.81	0.66	51.1
2	T1	192	5.0	202	5.0	0.437	9.0	LOS A	2.3	16.8	0.72	0.91	0.84	51.7
3	R2	160	5.0	168	5.0	0.437	13.6	LOS B	2.3	16.8	0.73	0.93	0.87	51.5
Approach		373	5.0	393	5.0	0.437	11.0	LOS B	2.3	16.8	0.72	0.91	0.84	51.6
East: River Street														
4	L2	81	5.0	85	5.0	0.493	4.5	LOS A	3.6	26.0	0.23	0.41	0.23	54.2
5	T1	1219	5.0	1283	5.0	0.493	4.5	LOS A	3.6	26.0	0.23	0.42	0.23	55.7
6	R2	62	5.0	65	5.0	0.493	9.2	LOS A	3.5	25.9	0.24	0.43	0.24	55.3
Approach		1362	5.0	1434	5.0	0.493	4.7	LOS A	3.6	26.0	0.23	0.42	0.23	55.6
North: Barlows Road														
7	L2	56	5.0	59	5.0	0.158	8.2	LOS A	0.7	5.1	0.72	0.87	0.72	51.4
8	T1	3	5.0	3	5.0	0.158	8.4	LOS A	0.7	5.1	0.72	0.87	0.72	52.7
9	R2	21	5.0	22	5.0	0.158	13.1	LOS B	0.7	5.1	0.72	0.87	0.72	52.6
Approach		80	5.0	84	5.0	0.158	9.5	LOS A	0.7	5.1	0.72	0.87	0.72	51.7
West: River Street														
10	L2	5	5.0	5	5.0	0.554	6.8	LOS A	4.0	29.0	0.67	0.69	0.73	52.2
11	T1	1023	5.0	1077	5.0	0.554	7.0	LOS A	4.0	29.0	0.67	0.71	0.74	53.6
12	R2	23	5.0	24	5.0	0.554	11.9	LOS B	3.9	28.6	0.68	0.74	0.75	53.4
Approach		1051	5.0	1106	5.0	0.554	7.1	LOS A	4.0	29.0	0.67	0.72	0.74	53.6
All Vehicles		2866	5.0	3017	5.0	0.554	6.5	LOS A	4.0	29.0	0.47	0.61	0.51	54.2

2034 BASE MORNING PEAK HOUR

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Keppel Street														
1	L2	29	5.0	31	5.0	0.132	9.7	LOS A	0.5	3.5	0.66	0.81	0.66	51.1
2	T1	271	5.0	285	5.0	0.606	10.3	LOS B	3.9	28.7	0.77	0.98	1.04	50.8
3	R2	221	5.0	233	5.0	0.606	15.0	LOS B	3.9	28.7	0.79	1.01	1.08	50.5
Approach		521	5.0	548	5.0	0.606	12.2	LOS B	3.9	28.7	0.77	0.98	1.04	50.7
East: River Street														
4	L2	58	5.0	61	5.0	0.472	4.5	LOS A	3.6	25.9	0.25	0.41	0.25	54.1
5	T1	1026	5.0	1080	5.0	0.472	4.5	LOS A	3.6	25.9	0.26	0.45	0.26	55.3
6	R2	199	5.0	209	5.0	0.472	9.2	LOS A	3.5	25.6	0.27	0.49	0.27	54.5
Approach		1283	5.0	1351	5.0	0.472	5.2	LOS A	3.6	25.9	0.26	0.45	0.26	55.1
North: Barlows Road														
7	L2	216	5.0	227	5.0	0.761	21.2	LOS C	5.3	38.7	0.94	1.14	1.48	43.9
8	T1	9	5.0	9	5.0	0.761	21.5	LOS C	5.3	38.7	0.94	1.14	1.48	44.8
9	R2	24	5.0	25	5.0	0.761	26.1	LOS C	5.3	38.7	0.94	1.14	1.48	44.7
Approach		249	5.0	262	5.0	0.761	21.7	LOS C	5.3	38.7	0.94	1.14	1.48	44.0
West: River Street														
10	L2	7	5.0	7	5.0	0.893	16.3	LOS B	13.2	96.6	0.97	1.31	1.82	46.9
11	T1	1390	5.0	1463	5.0	0.893	17.1	LOS B	13.2	96.6	0.97	1.32	1.85	47.6
12	R2	20	5.0	21	5.0	0.893	22.7	LOS C	12.6	91.9	0.97	1.32	1.88	46.9
Approach		1417	5.0	1492	5.0	0.893	17.2	LOS B	13.2	96.6	0.97	1.32	1.85	47.5
All Vehicles		3470	5.0	3653	5.0	0.893	12.3	LOS B	13.2	96.6	0.68	0.93	1.11	50.3

2034 BASE AFTERNOON PEAK HOUR

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Keppel Street														
1	L2	26	5.0	27	5.0	0.139	10.9	LOS B	0.6	4.0	0.74	0.85	0.74	50.2
2	T1	239	5.0	252	5.0	0.637	12.8	LOS B	4.4	32.3	0.84	1.05	1.20	49.1
3	R2	199	5.0	209	5.0	0.637	17.7	LOS B	4.4	32.3	0.85	1.07	1.27	48.7
Approach		464	5.0	488	5.0	0.637	14.8	LOS B	4.4	32.3	0.84	1.05	1.21	49.0
East: River Street														
4	L2	101	5.0	106	5.0	0.621	4.6	LOS A	5.7	41.3	0.32	0.42	0.32	53.8
5	T1	1516	5.0	1596	5.0	0.621	4.7	LOS A	5.7	41.3	0.33	0.44	0.33	55.2
6	R2	77	5.0	81	5.0	0.621	9.3	LOS A	5.6	41.1	0.34	0.45	0.34	54.9
Approach		1694	5.0	1783	5.0	0.621	4.9	LOS A	5.7	41.3	0.33	0.44	0.33	55.1
North: Barlows Road														
7	L2	70	5.0	74	5.0	0.261	9.6	LOS A	1.2	9.1	0.81	0.91	0.81	50.4
8	T1	4	5.0	4	5.0	0.261	9.9	LOS A	1.2	9.1	0.81	0.91	0.81	51.6
9	R2	26	5.0	27	5.0	0.261	14.5	LOS B	1.2	9.1	0.81	0.91	0.81	51.5
Approach		100	5.0	105	5.0	0.261	10.9	LOS B	1.2	9.1	0.81	0.91	0.81	50.7
West: River Street														
10	L2	6	5.0	6	5.0	0.751	9.9	LOS A	8.0	58.1	0.86	1.00	1.14	51.0
11	T1	1272	5.0	1339	5.0	0.751	10.2	LOS B	8.0	58.1	0.86	1.02	1.15	52.1
12	R2	29	5.0	31	5.0	0.751	15.3	LOS B	7.7	56.3	0.87	1.04	1.17	51.6
Approach		1307	5.0	1376	5.0	0.751	10.4	LOS B	8.0	58.1	0.86	1.02	1.15	52.1
All Vehicles		3565	5.0	3753	5.0	0.751	8.3	LOS A	8.0	58.1	0.61	0.74	0.76	53.0

2034 DESIGN (WITH PROPOSAL) MORNING PEAK HOUR

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Keppel Street														
1	L2	29	5.0	31	5.0	0.138	9.9	LOS A	0.5	3.7	0.68	0.82	0.68	51.0
2	T1	276	5.0	291	5.0	0.632	10.8	LOS B	4.2	31.0	0.79	1.00	1.09	50.5
3	R2	221	5.0	233	5.0	0.632	15.6	LOS B	4.2	31.0	0.81	1.03	1.15	50.1
Approach		526	5.0	554	5.0	0.632	12.8	LOS B	4.2	31.0	0.79	1.00	1.09	50.3
East: River Street														
4	L2	58	5.0	61	5.0	0.499	4.5	LOS A	4.0	28.8	0.28	0.42	0.28	54.0
5	T1	1068	5.0	1124	5.0	0.499	4.5	LOS A	4.0	28.8	0.29	0.45	0.29	55.1
6	R2	219	5.0	231	5.0	0.499	9.2	LOS A	3.9	28.4	0.29	0.50	0.29	54.3
Approach		1345	5.0	1416	5.0	0.499	5.3	LOS A	4.0	28.8	0.29	0.46	0.29	54.9
North: Barlows Road														
7	L2	236	5.0	248	5.0	0.871	31.3	LOS C	7.3	53.7	0.97	1.28	1.91	39.2
8	T1	14	5.0	15	5.0	0.871	31.6	LOS C	7.3	53.7	0.97	1.28	1.91	39.9
9	R2	24	5.0	25	5.0	0.871	36.2	LOS D	7.3	53.7	0.97	1.28	1.91	39.8
Approach		274	5.0	288	5.0	0.871	31.7	LOS C	7.3	53.7	0.97	1.28	1.91	39.3
West: River Street														
10	L2	7	5.0	7	5.0	0.926	19.8	LOS B	16.1	117.2	1.00	1.44	2.16	44.9
11	T1	1420	5.0	1495	5.0	0.926	20.8	LOS C	16.1	117.2	1.00	1.45	2.19	45.4
12	R2	20	5.0	21	5.0	0.926	26.7	LOS C	15.2	110.7	1.00	1.45	2.23	44.7
Approach		1447	5.0	1523	5.0	0.926	20.9	LOS C	16.1	117.2	1.00	1.45	2.19	45.4
All Vehicles		3592	5.0	3781	5.0	0.926	14.7	LOS B	16.1	117.2	0.70	1.00	1.30	48.7

2034 DESIGN (WITH PROPOSAL) AFTERNOON PEAK HOUR

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Keppel Street														
1	L2	26	5.0	27	5.0	0.145	11.1	LOS B	0.6	4.3	0.75	0.86	0.75	50.1
2	T1	244	5.0	257	5.0	0.666	13.5	LOS B	4.8	35.1	0.86	1.07	1.26	48.7
3	R2	199	5.0	209	5.0	0.666	18.6	LOS B	4.8	35.1	0.87	1.10	1.34	48.2
Approach		469	5.0	494	5.0	0.666	15.5	LOS B	4.8	35.1	0.86	1.07	1.27	48.5
East: River Street														
4	L2	101	5.0	106	5.0	0.640	4.7	LOS A	6.1	44.5	0.36	0.43	0.36	53.6
5	T1	1538	5.0	1619	5.0	0.640	4.7	LOS A	6.1	44.5	0.37	0.45	0.37	55.0
6	R2	89	5.0	94	5.0	0.640	9.4	LOS A	6.1	44.3	0.38	0.46	0.38	54.6
Approach		1728	5.0	1819	5.0	0.640	5.0	LOS A	6.1	44.5	0.37	0.45	0.37	54.9
North: Barlows Road														
7	L2	100	5.0	105	5.0	0.368	10.8	LOS B	1.9	13.8	0.84	0.95	0.93	49.8
8	T1	11	5.0	12	5.0	0.368	11.1	LOS B	1.9	13.8	0.84	0.95	0.93	51.0
9	R2	26	5.0	27	5.0	0.368	15.7	LOS B	1.9	13.8	0.84	0.95	0.93	50.9
Approach		137	5.0	144	5.0	0.368	11.8	LOS B	1.9	13.8	0.84	0.95	0.93	50.1
West: River Street														
10	L2	6	5.0	6	5.0	0.774	10.4	LOS B	8.6	62.7	0.88	1.04	1.20	50.6
11	T1	1297	5.0	1365	5.0	0.774	10.9	LOS B	8.6	62.7	0.88	1.06	1.22	51.7
12	R2	29	5.0	31	5.0	0.774	16.0	LOS B	8.3	60.6	0.89	1.08	1.24	51.2
Approach		1332	5.0	1402	5.0	0.774	11.0	LOS B	8.6	62.7	0.89	1.06	1.22	51.6
All Vehicles		3666	5.0	3859	5.0	0.774	8.8	LOS A	8.6	62.7	0.64	0.77	0.81	52.6

CML CIVIL
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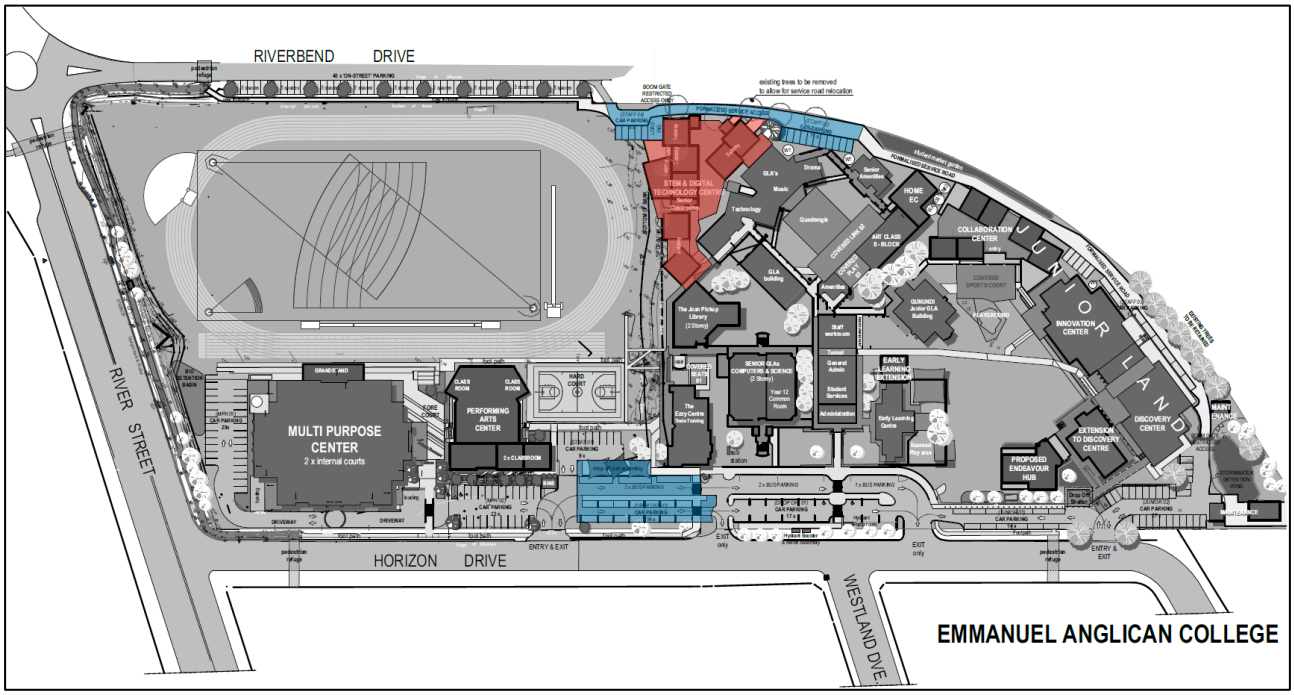
Road Safety Audit
Preliminary Design Stage
Emmanuel Anglican College – 62 Horizon Drive, Ballina



Rytenskiled Traffic Engineering

Reference: 2448-RSA-01
March 23

CML Civil Pty Ltd
ABN 34 662 540 687

1 Dily St, Hillcrest QLD 4118
PO Box 3107, Browns Plains QLD 4118
T: 0435 63 64 65 **E**: casey@cmlcivil.com

Rev No.	Author	Reviewed/Approved		Description	Date
		Name	Signature		
1	C.Lee	Craig Nethery		Original Issue	01 Mar 2023
2					
3					

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1. Introduction

1.1. Project Overview

CML Civil has been engaged by Luke Rytenskild of Rytenskild Traffic Engineering to undertake a desktop Road Safety Audit of the provided preliminary design stage of the Emmanuel Anglican College located at 62 Horizon Dr, West Ballina NSW 2478, on the northern side of River Street, western frontage to Riverbend, and eastern frontage to Horizon Drive. The site is currently occupied by Emmanuel Anglican College and is identified as Lot 10 on DP1001995.

This Audit report will form part of an ongoing collection of RSA's to be undertaken throughout the design phase of the project lifecycle. These audits will be conducted at each design phase to aide in the most suitable and safe solution for the proposed works.

1.2. Project Scope

The existing site caters for 794 students and 93 staff with the expectation that by 2031, the school will need to cater for 1114 students and 119 staff. The proposed master plan includes an increase in bus capacity from three spaces (approved) to six spaced (proposed) with an additional parallel set down / pick up facility providing for 14 additional car spaces. Additionally, there is a proposed upgrade to the service road (to asphalt surfacing) linking the northern end of the campus to Riverbend Dr however this will be restricted to staff and maintenance vehicles.

Also proposed is an additional 45 (approximately) formal on-street spaces along the eastern side of Riverbend Dr to be utilised for overflow parking and events held on the adjoining sports field.

1.3. Subject Site, Location and Audit Staging

The proposed preliminary design information being audited as part of this report, which was undertaken on February 27th 2023 is identified in Figure 1.1 and also listed below:

- Increase of bus capacity from three to six spaces
- Inclusion of additional parallel set down / pick up facilities (approx. 14 spaces)
- Service Road upgrade to asphalt for staf and maintenance vehicles
- Increase of 45 (approx.) on street parking spaces

The above information is contained within the provided site layout drawing identifying the proposed buildings, pathways, roadways and car parks – Refer to Fig 1.1 below.

Figure 1.1: Site Location

2. Road Safety Audit (RSA)

2.1. Scope of Audit

The Road Safety Audit (RSA) has been conducted as a "Audit of Traffic Management" as per the Transport and Main Roads, Queensland Guide to Road Safety (QGRS) Part 6 (November 2022), in conjunction with Austroads Guide to Road Safety Part 6: Road Safety Audit. The Audit examines the safety of the prepared Traffic Guidance Scheme design and the implementation of the signage for the temporary works.

2.2. Road Safety Audit Process

2.2.1. Roles and Responsibilities

The following flow chart is reproduced from Austroads Guide to Road Safety Part 6: Road Safety Audit – Figure 8.1

The roles and responsibility of the audit team are highlighted in yellow.

Figure 2.1: Steps in a Road Safety Audit

2.2.2. Background Information used in the Audit

The following information was used as part of the assessment process in this audit:

- Design Plan/s (Refer Table 2.2 below)
- Traffic Impact Assessment developed by Rytenskild
- Crash Data (Refer Section 2.2.3)

The following table details the information and/or design plans that were supplied by the client to undertake this audit:

Table 2.2: Client Supplied Design Plans

Document No	Rev.	Title	Sheets	Issue	Date
19457_SK-100	C	Emmanuel Anglican College Proposed Long Term Master Plan	1	DA – Not for Construction	5/12/22
21047	1	Traffic Impact Assessment (Rytenskild)	34	Final	23/11/21

2.2.3. Crash Data

The Transport for NSW (Centre for Road Safety) Mapping website was accessed to determine if there was any accident history in the vicinity of the project site. The website indicated that there has been a number of crashes in the vicinity of the project, as shown in the diagram below.

Reporting year	Crash Id	Degree of crash	RUM - code	RUM - description	Type of location	Natural lighting	Longitude	Latitude	Number killed
2018	1183713	Serious Injury	85	Off rt/lft bnd=>obj	2-way undivided	Daylight	153.531434	-28.861073	
2020	1236305	Moderate Injury	75	Off end of road	2-way undivided	Daylight	153.529159	-28.862726	
2019	1219273	Moderate Injury	47	Emerging from drive	2-way undivided	Daylight	153.530958	-28.863303	
2020	1254274	Minor/Other Injury	34	Lane change right	Roundabout	Daylight	153.528270	-28.864797	
2021	1269902	Serious Injury	30	Rear end	Roundabout	Daylight	153.528943	-28.864717	
2019	1205986	Moderate Injury	33	Lane sideswipe	Roundabout	Darkness	153.528819	-28.864832	
2020	1253901	Minor/Other Injury	30	Rear end	Divided road	Daylight	153.531928	-28.864215	

Figure 2.3: Hinterland Way Crash Map

As can be seen form the plan above, there has been only 3 recoded crashes within proximity to the subject site accesses on either Horizon Dr or Riverbend Dr in the past 6 years with them

being between 2018 and 2020 and of a moderate to serious injury outcome. All other crashes identified on the map (Fig 3.4) are within River St at the intersection of River St and Riverbend Dr roundabout.

2.2.4. Audit Team

Table 2.4: Audit Team

Name	Accreditation
Craig Nethery (Lead)	NSW RSA Lv3 (RSA-02-0230)
Casey Lee	NSW RSA Lv2 (RSA-07-0760)

The auditing team consists of a Lead (Senior) auditor and one (1) additional auditor with staff of RytenSkild Traffic engineering performing the review and commentary on the audit report and findings. This team was selected as the qualifications are the most relevant to the stage of the audit being conducted.

2.2.5. Commencement Meeting

An initial review of the proposed design was undertaken prior to the conducting of the road safety audit on Monday 27th February , 2023 by the auditors. Within this review the specifics of the project were identified along with the interpretation of the scoping documents and design drawings that were supplied by the client.

2.2.6. Design Review

A preliminary design audit was completed by the audit team for the proposed site improvements and configuration. The surrounding road network and design requirements have been taken into account during the review.

2.3. Reference Material

The design standards/manuals used to assess the proposal are as follows:

- Transport – Roads & Traffic Authority 'Guidelines for Road Safety Audit Practices'
- Austroads 'Guide to Road Safety Part 6: Managing Road Safety Audits'
- Austroads 'Guide to Road Safety Part 6A: Implementation of Road Safety Audits'
- Austroads 'Guide to Road Design'
- NSW Road Rules Document
- Australian Standards

2.4. Previous or Influencing Audits

CML Civil has not previously undertaken any audits for this project however any additional or ongoing audits will be detailed within this section if/when they are undertaken.

3. Audit Findings

3.1. Risks to Road Safety

The list of road safety issues contained in Appendix A of the report contains rankings of safety issues which are based on Criteria set out in '*Austroads Guide to Road Safety Part 6: Road Safety Audit'*. The assessment of risk uses these principals. The Austroads Risk Assessment Matrix (Figure 10.2, Austroads, 2022) is shown below:

Likelihood (includes exposure)			Severity*				
			Insignificant	Minor	Moderate	Serious	Fatal
			Property damage	Minor first aid	Major first aid and/or presents to hospital (not admitted)	Admitted to hospital	Death within 30 days of the crash
	Almost Certain	One per quarter	Medium	High	High	Extreme (FSI)	Extreme (FSI)
	Likely	Quarter to 1-year	Medium	Medium	High	Extreme (FSI)	Extreme (FSI)
	Possible	1 to 3 Years	Low	Medium	High	High (FSI)	Extreme (FSI)
	Unlikely	3 to 7 Years	Negligible	Low	Medium	High (FSI)	Extreme (FSI)
	Rare	7 years+	Negligible	Negligible	Low	Medium (FSI)	High (FSI)

*see Severity Guidance Sheet

Safe System crash outcome threshold

Figure 3.1: Risk Matrix

In relation to the identified/assessed level of Risk, Austroads provides the priorities for mitigation:

- Negligible – no action required
- Low – should be corrected or the risk reduced if the treatment cost is low
- Medium – should be corrected or the risk significantly reduced, if the treatment cost is moderate, but not high
- High – should be corrected or the risk significantly reduced, even if the treatment cost is high
- Extreme – must be corrected regardless of cost

The risk matrix is intended to be use in conjunction with the severity guidance sheet (Figure 10.3, Austroads, 2022), which is shown below in Figure 3.2. The severity guidance sheet provides an indication of crash severity outcomes for a range of crash types with varying speeds. As Safe System tolerance speeds continue to evolve, Professional engineering judgement is required to confirm the severity outcomes indicated by the guidance sheet.

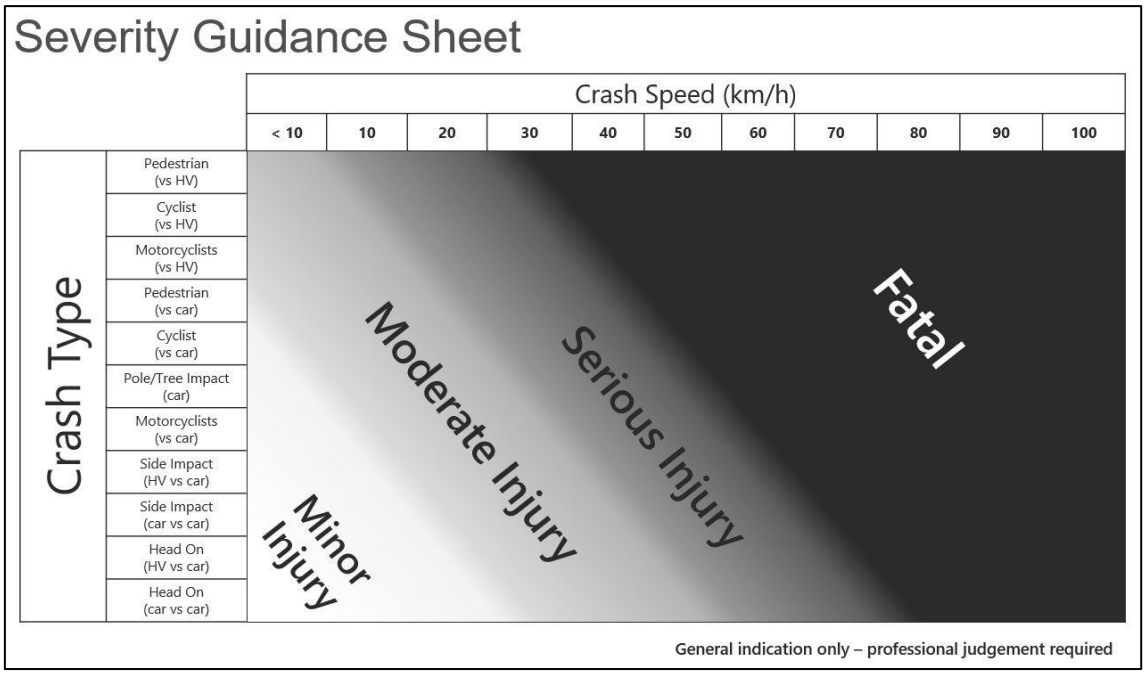

Figure 3.2: Severity Guidance Sheet

3.2. Identified Road Safety Issues

A summary of the audit findings is provided in Appendix A of this report with recommendations being categorised into one of the Safe System treatment categories (detailed in Table 3.1 below).

Table 3.3: Safe System Treatment Categories

Treatment Category	Description
Primary	Road planning, design and management considerations that practically eliminate the potential of fatal and serious injuries occurring in association with the foreseeable crash types.
Supporting (step towards)	Road planning, design and management considerations that improve the overall level of safety associated with foreseeable crash types, but not expected to virtually eliminate the potential of fatal and serious injury occurring.
Supporting	Road planning, design and management considerations that improve the overall level of safety associated with foreseeable crash types, but not expected to virtually eliminate the potential of fatal and serious injury occurring.
Non-Safe System Other Elements	Road planning, design and management considerations that are not expected to achieve an overall improvement in the level of safety associated with foreseeable crash types occurring.

Source: Austroads (2018a)

Disclaimer: While every effort has been made to identify potential safety hazards in this audit, no guarantee can be made that every issue has been identified. This is the case with any road safety audit.

3.3. Responding to the Audit Report

As set out in the road safety audit guidelines (Section 2), the responsibility for planning, road design and construction of the project always remains with the client and the implementation team, and not with the auditor/s. It is **not** the role of the auditor to redesign to take over construction implementation of projects but to provide independent advice via audit findings and/or recommendations where requested by the clients.

The client/implementation team are under no obligation to accept all the audit findings/recommendations. Also, it is not the role of the auditor to agree to, or approve of, the client/implementation team's response to the audit. Rather, the audit provides the opportunity to highlight potential problems and have them formally considered in conjunction with all other project considerations.

This formal Road Safety Audit Report should be responded to in writing following delivery. Should it be required, a completion meeting can be conducted to address any findings that may require further discussion and/or clarification. This response should indicate acceptance or rejection of the suggested remedial measures. Reasons are usually provided where a road safety deficiency or suggested remedial measure is rejected.

Appendix A contains a list of road safety audit issues, risk rating for the issue and a column for the client/implementation team to provide a response to as a Corrective Action of No Action Required.

4. Concluding Statement

We have undertaken the Road Safety Audit while simultaneously undertaking an examination of the supplied plans. The audit has been carried out for the sole purpose of identifying any features that could be altered/removed/amended to the proposed design with the expectation that the proposal will:

a) Identify any road safety issues that may be present as part of the proposed design/configuration,

b) Improve the safety of the proposed site arrangement/configuration, and

c) Identify any road safety issues that may be present as part of the proposed design, future design and construction/use of the proposed site access.

The identified issues have been noted in this report. The accompanying findings and recommendations are put forward for the Client's considerations.

Craig Nethery, Lead Road Safety Auditor (RSA-02-0230)
Streetwise Road Safety & Traffic Services

Casey Lee, Road Safety Auditor (RSA-07-0760)
CML Civil (RPEQ# 17008, TMD 291)

Appendix A Audit Findings

Emmanuel College - 62 Horizon Drive, Ballina

Appendix A - Audit Findings

Audit conducted Monday February 27th, 2023

CML CIVIL
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Item #	Issue / Location	Risk Rating			Recommendation P - Primary, S - Supporting	Client Comments	
		Frequency	Severity	Level		Accept Yes / No	Reason / Comments
Section 1 - General Comments							
S1-1	Traffic Volumes have been provided within the supplied Traffic Impact Assessment.	General Comment			Traffic data detailed within TIA identifies a low ongoing LoS. As there is a proposed sporting field and performing arts centre within the Master Plan, consideration to the analysis of a specific event (sporting or musical) should be undertaken to determine the roadway capacity during these events to ensure roadway can accommodate this usage.		
S1-2	Design has not been prepared and review is based on a master plan "mock-up' for the proposed upgrades. No detailed measurements/offsets have been provided.	General Comment			During further design process, the detailed design of the proposed upgrades will require further auditing to ensure suitable design standards have been utilised in the car parking and roadway formalisation to ensure design life is achieved for the proposed works.		
Section 2 - Proposed Drop-Off Zone Upgrade (Horizon Drive)							
S2-1	Entry/Exit on approach to proposed new Drop off Zone (Southern access point) supports minimal vehicle queuing. This may be of concern due to the adjacent parking zone and the conflict/vehicle crossover when exiting the parking area. There is potential for queuing onto the roadway.	Possible	Serious	High (FSI)	Ensure suitable priority control is implemented to minimis the queuing onto the roadway on the access crossover. (P)		
S2-2	Proposed Drop-Off zone contains drop-off bays on both sides of the through movement. Potential for impacts due to simultaneous egress from each side due to focus being on gaps within through movement	Possible	Moderate	High	Crash data does not show any incidents within the existing drop off zone with similar arrangement. Investigation on existing arrangement and crash history to be undertaken to ensure proposed arrangement will be suitable and safe for ongoing use. (S)		
S2-3	The removal of 36 std parking spaces (Off Horizon Dr) has been proposed to be replaced with 14 drop-off spaces and 30+ parking spaces on Riverbend Dr however no pedestrian connectivity from the new Riverbend Dr parking bays is identified into the school grounds.	Possible	Minor	Medium	The TIA does not investigate existing car parking usage throughout a general day to determine the carking rate for each day. If this on-road parking will be heavily utilised for Business As Usual activities/visitors - pedestrian connectivity should be investigated to ensure pedestrian safety is considered along with wayfinding etc. All weather scenarios should also be identified in this investigation. (S)		
Section 3 - Proposed On-Road Parking and Formalised Service Access							
S3-1	No traffic assessment has been conducted for the proposed 30+ spaces of formal on-road parking to be supplied on Riverbend Dr.	Likely	Serious	Extreme (FSI)	Traffic analysis for the Riverbend Dr/River St intersection should be conducted for the sporting event scenario to ensure the roadway does not require upgrades to cater for these events. (P)		
S3-2	Turn around facilities have not been detailed within the Riverbend Dr proposed works.	Possible	Serious	High (FSI)	Detailed design to be undertaken for Riverbend Dr for the proposed parking along with the provision of turn-around capabilities in accordance with local authority requirements. (P)		
S3-3	Formalised service road has been identified however no details on width have been provided to determine if this is 2-way or 1-way flow.	Possible	Moderate	High	Identification on travel arrangements for formalised (Staff) service road to identify priority and access/egress locations with respect to traffic impact for both Horizon Dr and Riverbend Dr. (S)		
S3-4	On-Road parking has been proposed however on Riverbend Dr which is in proximity to the Riverbend Retirement Village. No details have been provided within the Master Plan to identify how the parking will be separated from the thoroughfare of Riverbend traffic especially since the mixture of road users will be retirement village visitors/residents, potential learner drivers from the college and school collection activities	Likely	Serious	Extreme (FSI)	Investigations and subsequent notations to be undertaken to identify the potential need for additional delineation or safety devices to ensure suitable separation of vehicle movement when considering the mixture of vulnerable road users i.e. retirement village patrons, learner/school aged drivers, pedetrians etc. (P)		