TRAFFIC ENGINEERING

Richard Crookes Constructions

Jordan Springs Public School

Detailed design road safety audit

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Report No RC-PROJ-0001-01 DD RSA JORDAN SPRINGS REV 1

Date 19/9/2019

This report has been prepared for Richard Crookes Constructions.

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Road Safety Audit Checklist

1 Introduction

1.1 Project and audit details

Details of the audit have been summarised in Table 1.

Table 1 Details of the road safety audit.

Audited project	Proposed interfaces of Jordan Springs Public School with the external road and footpath network.
Client/ contact	Tom Hemmett Site Engineer Richard Crookes Constructions Ph: (02) 9902 4700 / 0437 969 849 E: HemmettT@richardcrookes.com.au
Audit type	*Detailed design* road safety audit.
Purpose	A *detailed design* road safety audit was required to identify potential safety risks prior to the construction stage. This was also stipulated in Condition D9 of the Notice of Determination, quoted as follows: D9. Prior to commencement of operation and upon completion of the works outlined in Condition B22 or connecting to a public road, a Road Safety Audit (RSA), as per the NSW Centre for Road Safety Guidelines for Road Safety Audit Practices and Austroads Guide to Road Safety Part 6: Road Safety Audit) must be undertaken in consultation with Council for all relevant sections of road utilised for bus and private vehicle pick-up and drop-off, any traffic management facilities, signage and line-marking. The Applicant must submit a copy of the plans to the Planning Secretary for information. The Applicant must address the findings of the RSA and the proposed measures mentioned above must incorporate any required modifications to address the findings, in consultation with Council. *Note: Any RSA is to be undertaken by an independent TfNSW accredited auditor.* Note: In order to maintain independence of the audit team, the reference to "consultation with Council" was interpreted to mean that the audit report would be issued to Council and Council would provide responses accordingly. The undertaking of the audit itself, cannot be done in consultation with Council as this would be a breach of the audit team's independence.
Background	The NSW Government is investing $6.7 billion over the next four years to deliver 190 new and upgraded schools to support communities across NSW. A project is underway to provide a new public school for Jordan Springs, which will be situated in the parcel of land to the east of Lakeside Parade, and the northern side of Cullen Avenue. This project will include innovative learning spaces, a library and hall, modern core facilities such as staff and administration area and covered outdoor learning areas (COLAs). Group GSA has prepared architectural plans for the layout of the school. An extract of this plan is shown on the front cover of this report. The plan includes: ▪ Two proposed pedestrian accesses from Lakeside Parade ▪ An inbound and outbound driveway to a 63-space car park on the eastern side of Lakeside Parade. ▪ An inbound and outbound driveway to a special needs drop off area on the northern side of Cullen Avenue. ▪ A porte cochere style drop off and pick up zone on the northern side of Cullen Avenue. This includes a pedestrian access to the school. ▪ A zebra crossing across Cullen Avenue leading to a pedestrian access to the reception building. As noted above, to satisfy Consent Condition D9, a *detailed design* road safety audit was required of the school and its proposed interfaces with external roads and footpaths.

Scope of project/ audit	The following design plans were provided to the audit team and were formally examined as the auditable materials: ▪ JS-AR-1100 [1] Proposed site and roof plan. ▪ C04.01 [4] Siteworks and stormwater management plan Sheet 01. ▪ C04.03 [4] Siteworks and stormwater management plan Sheet 03. The revision numbers for each of the plans is also provided above in square brackets.
Audit team members	Damien Chee, level 3 (lead) road safety auditor - Registration number: RSA-02-0094. Linda Chee, level 2 road safety auditor –Registration number RSA-02-1069.
Audit methodology	The audit was undertaken using the following methodology: ▪ Review of the detailed design plans listed in *scope of project/audit* was carried out on 18/9/2019. ▪ A supporting site inspection was carried out on 12/9/2019. This was only for the purposes of contextualising the detailed design against the existing road, traffic and land use conditions. This was in order to enhance the audit team's appreciation of factors influencing the design. It should be noted that at the time of the inspection, the subject land was still under construction. ▪ The road safety audit findings have been documented in this report in accordance with the NSW Centre for Road Safety's *Guidelines for Road Safety Audit Practices* (2011). ▪ This report includes completed *checklist 3 –detailed design stage audit* as sourced from the Austroads *Guide to Road Safety Part 6: Road Safety Audit*.
Material supplied	See *scope of audit*.
Meeting and assessment details	Audit carried out on 18/9/2019. Site inspection carried out on 12/9/2019.

1.2 Responding to the audit report

Road safety audits provide the opportunity to highlight potential road safety problems and have them formally considered by the project manager in conjunction with all other project considerations.

The responsibility for the project rests with the project manager, not with the auditor. The project manager is under no obligation to accept the audit findings. Also, it is not the role of the auditor to agree to, or approve the project manager's responses to the audit.

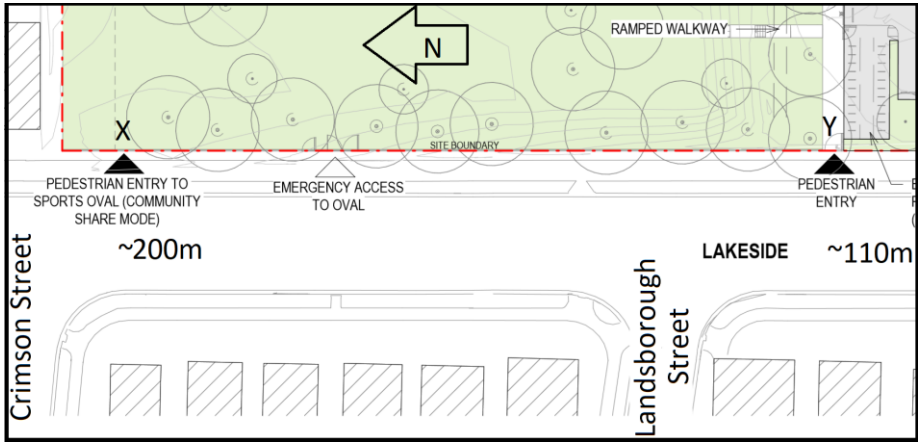
1.3 Previous audits

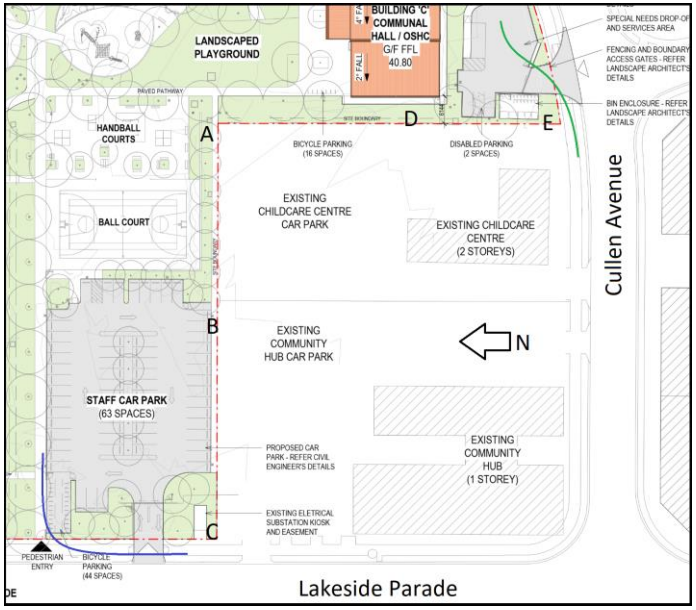
There were no previous road safety audits of direct relevance to this project that were issued to the audit team.

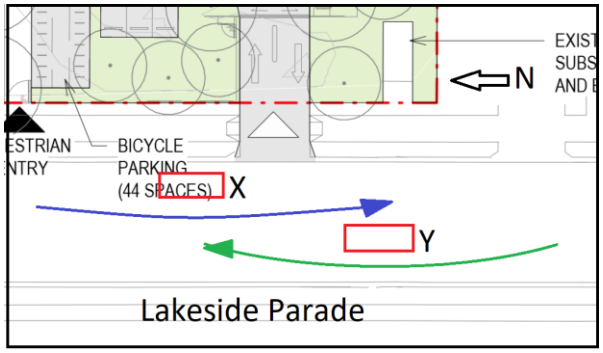
2 Safety audit findings

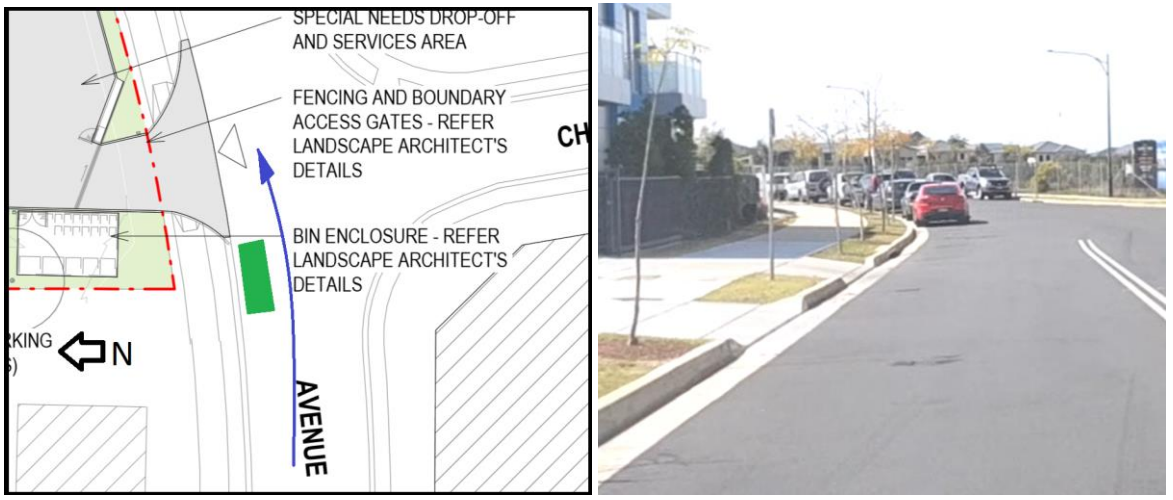
The road safety audit findings are presented in Table 2.

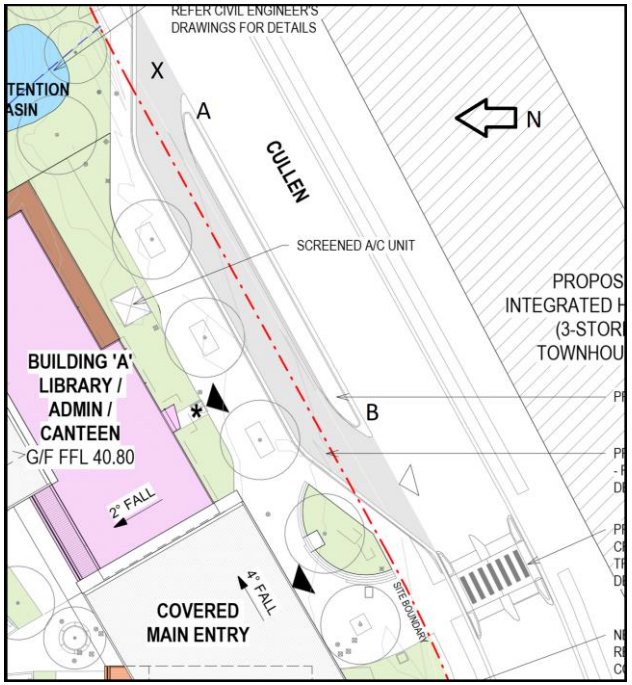
Table 2 Road safety audit findings.

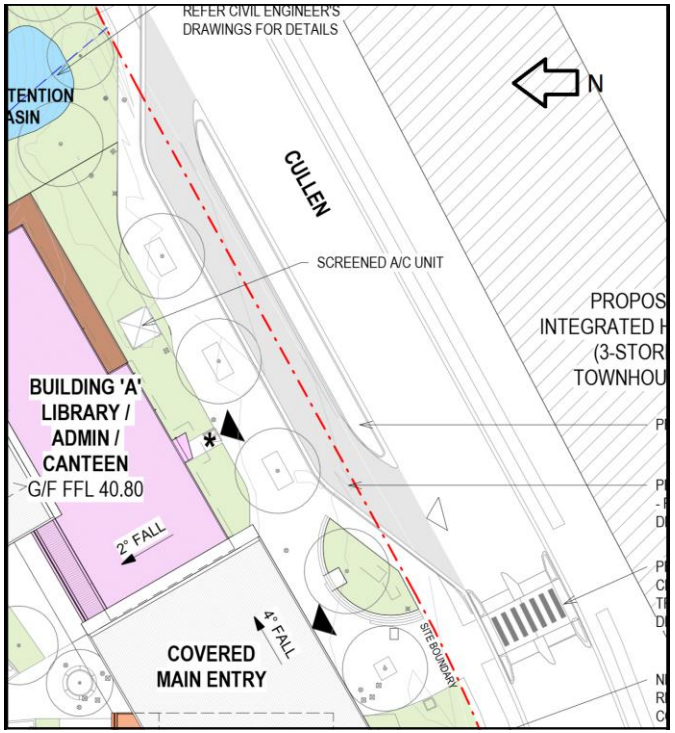
Ref	Location	Road safety audit finding	Priority
1	Pedestrian gates on Lakeside Parade.	There are two pedestrian gates proposed on the Lakeside Parade frontage to the school – labelled X and Y below. These will inevitably generate pedestrian entry/ egress movements. These are also likely to generate demands for road-crossing movements in the midblock. These would mostly be uncontrolled crossing movements requiring the pedestrian to judge and select gaps in the northbound and southbound flows on Lakeside Parade. This would generate *vehicle-pedestrian* crash conflicts, particularly if school children are involved. Children tend to have poorer peripheral awareness and vigilance when crossing the road. The audit team appreciates that as this is a significant frontage length, pedestrian access points would be a reasonable amenity. As such, to a large extent, these midblock crossing demands will be inevitable. It should be noted that gates X and Y are approximately 200m and 110m (respectively) from the signalised crossing at the Cullen Avenue/ Lakeside Parade/ Water Gum Drive intersection. These distances would impose a severe time-penalty for pedestrians, especially those heading to Crimson Street, Landsborough Street and Pitt Street, as well as the northern portions of Lakeside Parade. The school would need to manage these risks with access-egress strategies and policies. The outbound movements would be relatively easy to manage under teacher supervision. However, the inbound movements involving crossing movements from the western side to the eastern side of the road would be more difficult to prevent. Concepts such as one-way (outbound only) gates could be considered. Alternatively, the gates could simply be locked when there is no ground supervision.  ***Above:*** *Two pedestrian gates are proposed on the Lakeside Parade frontage which are likely to generate pedestrian crossing demands at these points.*	Medium

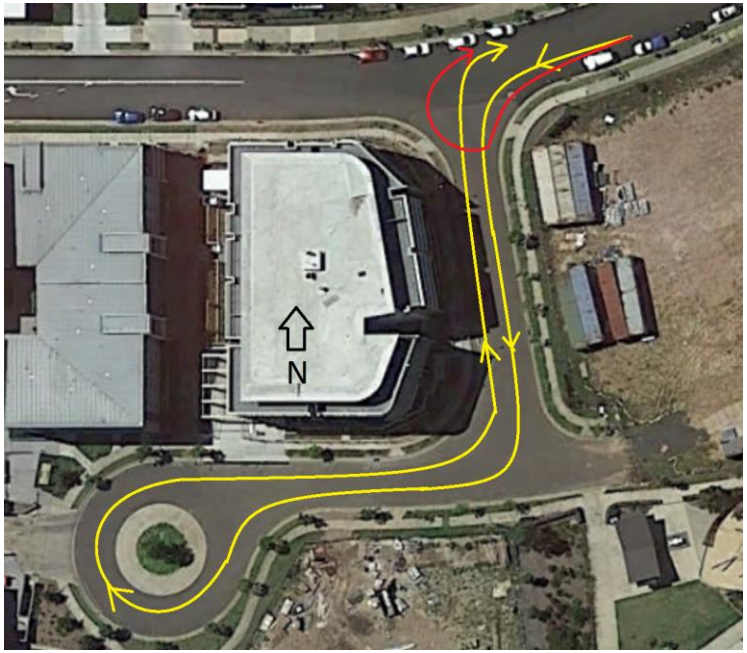
Ref	Location	Road safety audit finding	Priority
2	*Vehicle-pedestrian* conflicts at the driveways on Lakeside Parade and Cullen Avenue.	The design shows a staff car park on the eastern side of Lakeside Parade and a special needs car park and drop off area on the northern side of Cullen Avenue. Both of these facilities will have inbound-outbound driveways connecting to Lakeside Parade and Cullen Avenue respectively. As the project is still in design phase, there are several opportunities to reduce *vehicle-pedestrian* conflicts at the driveways. The audit team envisages that the Jordan Springs Town Centre will be a major attractor-generator of pedestrian trips to and from the school. Any pedestrian that emerges from the Lakeside Parade gate and heads towards the Town Centre would need to cross the staff car park driveway as shown by the blue line below. The same applies for the inbound trip in the reverse direction. This presents unnecessary conflicts with vehicles entering and egressing from the driveway. This is especially a risk when there are northbound right-turn movements into the driveway. These drivers would tend to look to the north to check for gaps in the southbound traffic stream and by doing so, may not observe pedestrians walking across the driveway. If there was also a pedestrian gate to the south of the car park driveway (eg. along line A-B-C), this could possibly eliminate such conflicts. Similarly, any pedestrians that emerge from the southern side of the school and head towards the Town Centre would tend to follow the green line. This passes through the special needs car park and driveway. There could be similar *vehicle-pedestrian* crash risks at this location as well. Similar to above, consideration could be given to providing a pedestrian access along the line A-D-E. Along the same theme of avoiding driveway conflicts, the plan below shows that the 44 bicycle parking spaces would be joined to the staff car park. As such, these cyclists would need to share the driveway with road vehicles which presents unnecessary *vehicle-bicycle* crash conflicts. Consideration should be given to linking the bicycle parking facility to the adjacent pedestrian walkway. This is indeed the layout shown on plan C04.01.  ***Left:** Extract from the design showing the likely pedestrian walk-trip paths from the western and southern sides of the school due to the large attraction/ generation potential of the Jordan Springs Town Centre.*	Medium

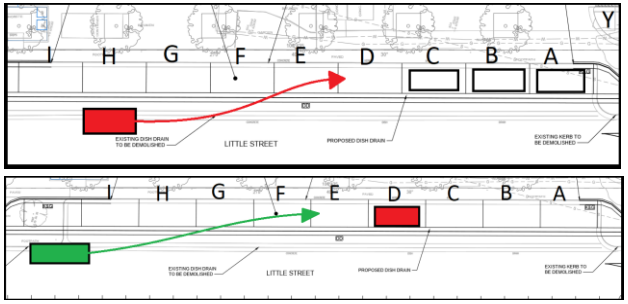
Ref	Location	Road safety audit finding	Priority
3a	Stopping/ parking restrictions on the kerblines – Lakeside Parade at the staff car park.	The plans do not indicate whether there will be any *no stopping* zones along the Lakeside Parade and Cullen Avenue kerblines. Some critical locations were identified including the staff car park on the eastern side of Lakeside Parade, the special needs car park on the northern side of Cullen Avenue, and the pick up/ drop off bay on the northern side of Cullen Avenue. These have been discussed separately in items 3a, 3b and 3c. <u>Staff car park on the eastern side of Lakeside Parade</u> The star car park will inevitably generate southbound left-turn movements, and northbound right-turn movements by inbound traffic. Southbound left-turners would tend to slow down when approaching and turning into the car park. If the eastern kerbline allows vehicles to stop or park, then the left-turning vehicle would need to commence the turn from a more central position in the road. This offers little passing opportunity for trailing southbound vehicles. By contrast, if a short *no stopping* zone is put in place along the eastern kerbline, the left-turning vehicle (red vehicle marked X) could shift to the kerbline and allow trailing vehicles to pass around as indicated by the blue arrow. As such, a *no stopping* zone should be considered on the eastern kerbline. Similarly, if northbound right-turners (red vehicle marked Y) stop to wait for gaps, any vehicles stopped along the western kerbline would restrict any passing opportunity by other trailing northbound vehicles. If a short *no stopping* zone is put in place on the western kerbline, trailing southbound vehicles could then use this space to pass around the stopped vehicle (green arrow). The above two scenarios illustrate the value of *no stopping* zones to improve passing clearance and to reduce *rear-end* crash potential. Short lengths of *no stopping* zones either side of the car park driveway would also help to preserve sight lines from the driveway to the north and south. Students and pedestrians moving along the eastern footpath and car park driveway would be less likely to be obscured by parked cars, and hence would be more visible to any drivers turning into the driveway.   ***Left:*** *Extract from the design showing the criticality of passing opportunities on Lakeside Parade at the staff car park. This could be improved by implementing short lengths of no stopping zones on the eastern and western kerblines.* ***Right:*** *Looking southbound along Lakeside Parade from Crimson Street. Note the kerbside parking demand under pre-existing conditions.*	Medium

Ref	Location	Road safety audit finding	Priority
3b	Stopping/ parking restrictions on the kerblines – *Special needs* car park on the northern side of Cullen Avenue. Continued from item 3a…	Continued from item 3a… <u>*Special needs* car park on the northern side of Cullen Avenue</u> The *special needs* car park on the northern side of Cullen Avenue will inevitably generate eastbound left-turn movements into the car park. If vehicles are allowed to stop along the northern kerbline of Cullen Road, the left-turning vehicle would be forced to take a more central position in the roadway. This would limit any passing opportunity by trailing eastbound vehicles. Any passing attempt could also generate *head-on* crash risks with westbound vehicles. By contrast, if a short length of *no stopping* zone is put in place on the western side of the driveway, the left-turning vehicle could shift to the north (green vehicle in left-hand image). This would allow eastbound trailing vehicles to pass around the slowed vehicle without encroaching into the westbound lane. Also, a *no stopping* zone would also improve sightlines of drivers egressing from the driveway. This is especially since the driveway will be located midway along a horizontal curve, and on the inside of the curve. The combined effect of the horizontal curvature of the road and vehicles stopped along the northern kerbline may reduce the *minimum gap sight distance* (MGSD) from the driveway. This is the sight line needed by egressing drivers to view approaching traffic streams, judge gaps and then enter those traffic streams. The potentially restricted MGSD sight line may lead to *cross traffic* crashes.  ***Left:*** *Extract from the design showing the proposed layout of the special needs car park on the northern side of Cullen Avenue.* ***Right:*** *Looking eastbound along Cullen Avenue showing the kerbside parking demands under pre-existing conditions. Note also the impact of the horizontal curve and parked cars, on the sight line between eastbound drivers and the future driveway, and vice versa.*	Medium

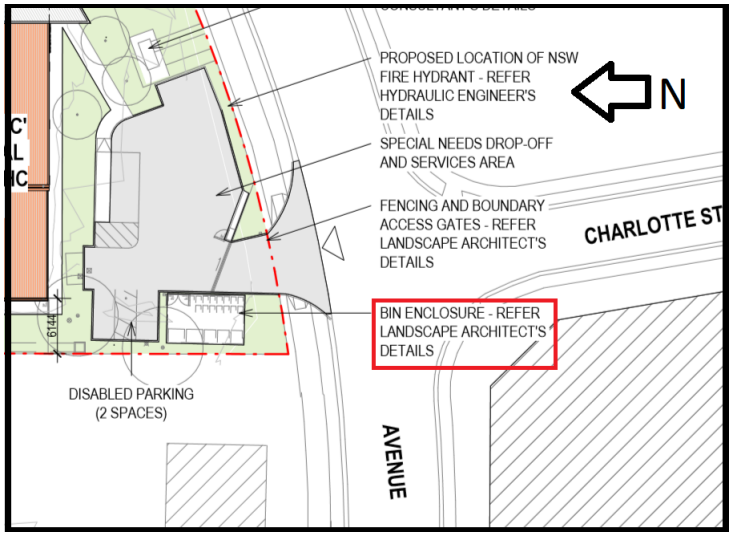
Ref	Location	Road safety audit finding	Priority
3c	Stopping/ parking restrictions on the kerblines –Pick up/ drop off bay on the northern side of Cullen Avenue. Continued from item 3b…	Continued from item 3b… <u>Pick up/ drop off bay on the northern side of Cullen Avenue</u> The kerbline adjacent to the pick up/ drop off bay (marked A-B below) would also need to be signposted as a *no stopping* zone. This is to preserve sight lines from the egress point at X to the west. That is, any vehicles stopped along this kerbline could block the *minimum gap sight distance* (MGSD) sight line from the egress point to the west. Also, if vehicles are allowed to stop along this kerbline, it may be mis-used by parents/ carers when picking up children. These drivers may consciously avoid entering the pick up bay and joining its queue. They may resort to waiting on kerbline A-B. This is especially undesirable as it would encourage students to cross the pick up bay with risks of impacts by vehicles moving along this facility. Also, the students would be forced to wait and board/ alight the vehicle from the narrow traffic island between the pick up/ drop off bay and Cullen Avenue.  ***Left:*** *Extract of the design showing the proposed layout of the pick up/ drop off bay.*	Medium

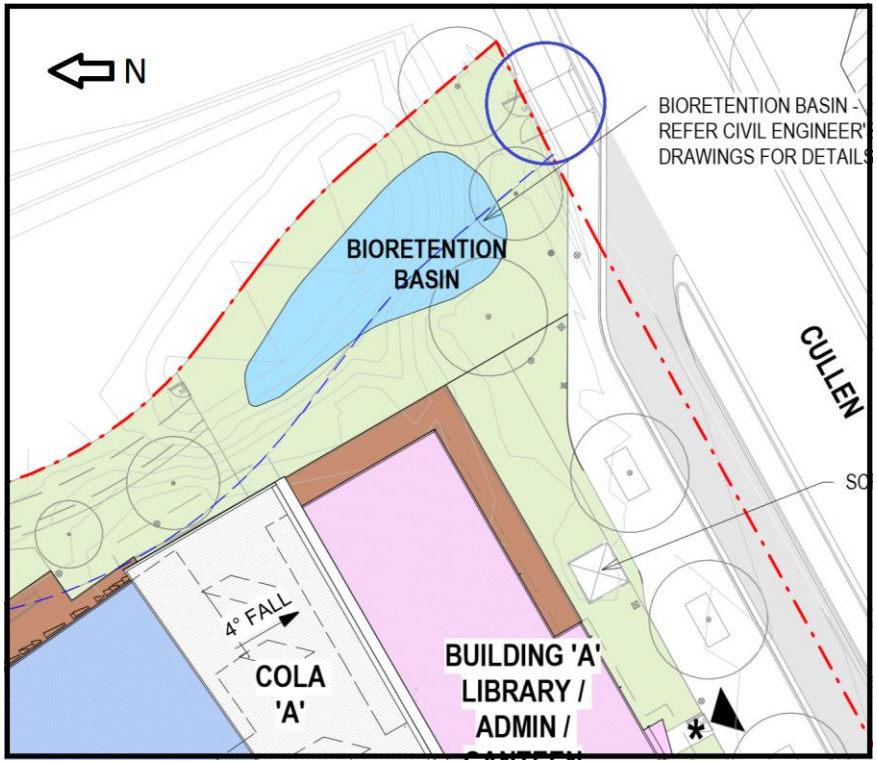
Ref	Location	Road safety audit finding	Priority
4a	Operational impacts of the pick up/ drop off bay on the northern side of Cullen Avenue.	There are likely to be significant queuing and queue-related road safety impacts due to the pick up/ drop off bay. This would be especially during afternoon pick up periods following each school day. The audit team notes the following: ▪ It is assumed that the pick up/ drop off bay will be a one-way *eastbound only* traffic lane and that all entry would be via the western opening and all egress will be via the eastern opening. Signs and pavement markings should be included, as appropriate, to stipulate this one-way rule and to prohibit entry into the eastern opening. ▪ The pick up/ drop off bay is configured as a *left-in only* access at its western end and a *left-out only* egress at its eastern opening. This is considered a reasonably safe layout assuming that all drivers comply with these turn restrictions. Signs and pavement arrows (as appropriate) should be considered to prohibit right-turns into or out of the pick up/ drop off bay. The westbound right-turn into the western opening would be a sharp hairpin turn. Some vehicles may not be able to perform this as a single manoeuvre and may need to resort to three-point turns (including a reversing adjustment with associated crash risks). The right-turn entry movement to the western opening could be a tempting movement since any vehicles that approach from the east would have very few other practical methods of turning around (see item 4b). By contrast the prohibited outbound right-turn movement (from the eastern opening) could be replaced by a left-turn out, and a u-turn at the Alinta Promenade roundabout (further east). Continued in item 4b…  ***Left:*** *The proposed layout of the pick up/ drop off bay.*	Medium

Ref	Location	Road safety audit finding	Priority
4b	Operational impacts of the pick up/ drop off bay on the northern side of Cullen Avenue. Continued from item 4a…	Continued from item 4a… ▪ As described in item 4a, the pick up/ drop off bay is configured as a *left-in only* access at its western end, and a *left-out only* egress at its eastern end. The inhibited right-turn entry movement at its western end may generate "q-turns" at the Cullen Avenue/ Charlotte Street intersection (ie. a westbound left-turn into Charlotte Street, followed by a u-turn, and followed by a right-turn back into Cullen Avenue such that the entire movement resembles a "q"). Typical "q-turn" movements are illustrated below – including a short "q-turn along the red path and a longer version illustrated by the yellow path. Both of these will generate right-turn movements from Charlotte Street. This would generate crash conflicts with westbound and eastbound vehicular movements on Cullen Avenue. Typically, right-turns from the minor leg of intersections are the most difficult turning manoeuvres since there are gap acceptance (and hence gap-checking) requirements in both major road flows. The short "q-turn" path illustrated by the red arrow also introduces a u-turn in the control area of the intersection which could have its own crash conflicts such as with vehicles turning into or out of Charlotte Street. Consideration may be needed for signposted time-based prohibitions (bans) on right-turns from Charlotte Street during school zone periods.  ***Left:*** *With no other restrictions in place, the audit team envisages that Charlotte Street will be used by westbound drivers to perform "q-turns" to access the pick up/ drop off bay in lieu of the likely prohibited right-turn entry to the bay.*	Medium

Ref	Location	Road safety audit finding	Priority
4c	Operational impacts of the pick up/ drop off bay on the northern side of Cullen Avenue. Continued from item 4b…	Continued from item 4b… Queue management is especially critical to the road safety performance of the pick up/ drop off bay, especially during afternoon pick up periods. If the pick up operations are untidy and cause queuing, these queues could easily spill back out of the pick up bay and into Cullen Avenue, where the back of queue would be exposed to *rear-end* crashes. The queue may also spill back to and across the zebra crossing. This is largely a traffic management issue during the operational phase. However, there are some design measures that could be used to mitigate these risks. Simple linemarking solutions in the pick up bay could be used to guide drivers where to queue and where to stop to pick up students. This would also create a wide residual space for other vehicles (that have completed their pick up "transactions") to pass around other vehicles that are still loading. The audit team notes that the long pick-up rank and kerbline must be managed diligently to operate efficiently. Firstly, in order for the pick up zone to be used efficiently, the student would need to predict which part of the pick up bay their parent/ carer will arrive at. Unless this can happen, there will always be several pick up spaces that students will take substantially longer to reach from their dispatch point. Using the top image, if the student dispatch point is at Y, then the student will take longer to reach their parent/ carer's car in spaces G, H and I and hence these cars will be delayed much more than those in the leading spaces. Similarly, if the student dispatch point is midway along the bay, then cars in spaces A, B and C would experience more delays compared with the trailing bays. The differential waiting times across the pick up rank would lead to different "transaction" times which means the fully occupied rank cannot move off in a single platoon. Rather, cars will leave the rank as they complete their transaction, not when ALL other cars in the rank have completed their transactions. There would be a mixture of occupied spaces and vacant spaces since the spaces will not all vacate at the same time. The top image also shows what would happen when cars in spaces A, B and C are still completing pick up operations and another car (red vehicle) arrives at the rank, this vehicle would enter bay D instead of waiting until A, B and C become vacant. The bottom image shows what happens next after vehicles A, B and C vacate the rank. The next vehicle that arrives would typically enter space E rather than cutting in front of car D to access A, B or C. Hence the storage capacity of the rank diminishes due to the inefficient loading and transactions. Alternatively, if the green vehicle does head towards A, B or C they could generate a *cross over* crash conflict with the red vehicle as it pulls out. In the audit team's experience with other schools, a long-rank style pick up zone works best if the pick up operations are confined to the first few spaces (say A to C), and the remaining spaces are only used as a lead-up queue. The children would be dispatched from point Y which therefore limits the longest walk-distance to the Y-C distance. Although this is a traffic management decision, the design could assist by creating more road-side waiting space, and perhaps shelter at the leading portion of the bay to encourage all loading to occur at this end of the bay.  ***Top and bottom:*** *A typical scenario that would occur at a long-rank style pick up zone. Descriptions are provided in the body text.*	Medium

Ref	Location	Road safety audit finding	Priority
5	Shared path designation on Cullen Avenue and Lakeside Parade.	The pre-existing footpaths surrounding the school site are not well defined with respects to their status as shared paths or common footpaths. On Cullen Avenue, to the east of the school site, the footpath is a designated shared path (see signage in image below). This legally allows usage by pedestrians and cyclists. However, aside from this sign, there are no other signs to confirm or terminate the shared path status. The northern footpath of Cullen Avenue has the appearance and width of a shared path. As such, with no other reassurance signage, this could be a lost opportunity for improving bicycle safety. If cyclists simply believe that the paths are common footpaths, then they would tend ride on the roadways (unless they are eligible to cycle on the footpath under NSW Road Rule 250). By riding on the roadway, this could increase exposure to *vehicle-bicycle* crashes. The audit team acknowledges that there are 44 bicycle spaces are proposed in the staff car park, and hence there is a predicted demand for bicycle travel to and from Jordan Springs Public School. Similarly, the footpath on Lakeside Parade is not defined as a shared path although it appears wide and flat enough to operate as one. This is also a lost opportunity, especially since this footpath would be directly accessible from the bicycle parking area. Consideration could be given to formalising the status of these footpaths and if appropriate, signposting these as shared paths.  ***Left:*** *Pre-existing signs on the northern path of Cullen Avenue indicate that this is a designated shared path. This sign is along the northern footpath to the east of the school site.*	Low

Ref	Location	Road safety audit finding	Priority
6	*Special needs* car park on the northern side of Cullen Avenue.	The plan indicates that a bin enclosure area will be provided in the *special needs* car park on the northern side of Cullen Avenue. This implies that garbage collection will take place at this location. If these are dumplex bins, then typically the waste collection truck would need to enter the premises, lift and empty the bins and then egress. If so, this car park area does not seem large enough for a truck to perform a u-turn in a single manoeuvre. This would inevitably require a three-point turn including a reversing movement. This could increase the risk of impacts with other parked cars, structures or pedestrians. If these bins are wheeled sulo bins, then consideration could be given to providing a separate paved path for these to be wheeled to the kerbline. Otherwise the bins would need to be wheeled to the street via the driveway. The audit team were also uncertain whether the disabled parking spaces are intended for (i) drivers to drop off and pick up disabled students, or (ii) for use by disabled drivers (staff or visitors), or (iii) both. If intended to be used by disabled drivers, these parking spaces will be difficult to use. If the vehicles are parked *front-in*, then the driver would inevitably need to perform a difficult reverse weaving movement to egress from the parking space. This would also require sight line checks at various angles to check for other vehicular or pedestrian movements. Drivers with neck mobility limitations may not be able to achieve these visibility checks. The bin enclosure area could also block driver visibility. If drivers park *rear-in*, they would need to perform an awkward reverse weaving manoeuvre into the spaces. This could also prove difficult for disabled drivers, especially those with neck mobility limitations.  ***Left:*** *Extract of the design showing the proposed layout of the special needs parking area, on the northern side of Cullen Avenue.*	Low

Ref	Location	Road safety audit finding	Priority
7	Maintenance access gate at the eastern end of the property – on the northern side of Cullen Avenue.	The design indicates that a maintenance gate will be provided on the northern side of Cullen Avenue at the eastern end of the property. This is presumably so that vehicles can access the bioretention basin and other landscaped areas on the eastern side of the school buildings. Overall, this gate would have low-volume usage. However, it still creates an unnecessary driveway conflict point into Cullen Avenue. There is an opportunity to relocate this gate to the pick up/ drop off bay and hence rationalise the number of conflict points that would have a direct connection to Cullen Avenue. By relocating the gate accordingly, this may also improve access by maintenance vehicles. By contrast, the currently proposed maintenance gate appears to lead vehicles directly towards a steep embankment and towards the basin.  ***Above:*** *Proposed layout of the maintenance gate (circled in blue) and its close proximity to the pick up/ drop off bay.*	Low

3 Concluding statement

DC Traffic Engineering has undertaken a *detailed design* road safety audit of this project in accordance with the methodology outlined in Section 1 of this report.

Issues identified have been noted in this report for the Project Manager to review, assess, and where appropriate, make the necessary recommendations to improve safety.

Damien Chee
Audit Team Leader
DC Traffic Engineering Pty Ltd

Appendix A

Road Safety Audit Checklist

Checklist questions	Comments
3.1 General topics	
3.1.1 Changes since previous audit ▪ Do the conditions for which the scheme was originally designed still apply? (i.e. no significant changes to the surrounding network or area to be served, or traffic mix). ▪ Has the design of the project remained unchanged since previous audit (if any)?	There were no previous road safety audits of direct relevance to this project that were issued to the audit team.
3.1.2 Drainage ▪ Will the new road drain adequately? ▪ Are the road grades and crossfalls adequate for satisfactory drainage? ▪ Are flat spots avoided or adequately dealt with at start/end of superelevation? ▪ Has the possibility of surface flooding been adequately addressed, including overflow from surrounding or intersecting drains and water courses? ▪ Is gully pit spacing adequate to limit flooding? ▪ Is pit grate design safe for pedal cycles? (i.e. gaps not parallel with wheel tracks) ▪ Will footpaths drain adequately?	Yes.
3.1.3 Climatic conditions ▪ Has the design taken into account weather records or local experience which may indicate a particular problem? (for example, snow, ice, wind, fog)	Yes.
3.1.4 Landscaping ▪ Will drivers be able to see pedestrians (and vice versa) past or over the landscaping? ▪ Will intersection sight lines be maintained past or over the landscaping? ▪ Will safety be adequate with seasonal growth? (for example, no obscuring of signs, shading or light effects, slippery surface, etc.) ▪ Will roadside safety be adequate when trees or plantings mature (no roadside hazard)? ▪ Has 'frangible' vegetation been used in possible run-off road areas?	Yes.
3.1.5 Services ▪ Does the design adequately deal with buried and overhead services? (especially in regard to overhead clearances, etc.) ▪ Has the location of fixed objects/furniture associated with services been checked? (including any loss of visibility, position of poles, and clearance to overhead wires)	Yes.

Checklist questions	Comments
3.1.6 Access to property and developments ▪ Can all accesses be used safely? ▪ Is the design free of any downstream or upstream effects from accesses, particularly near intersections? ▪ Do rest areas and truck parking area have adequate sight distance at access points?	All issues were with respects to the accesses to and from the property.
3.1.7 Emergencies, breakdowns, emergency and service vehicle access ▪ Has provision been made for safe access and movements by emergency vehicles? ▪ Does the design and positioning of medians and vehicle barriers allow emergency vehicles to stop and turn without unnecessarily disrupting traffic? ▪ Have broken-down vehicles or stopped emergency vehicles been adequately considered? ▪ Is provision for emergency telephones satisfactory? ▪ Are median breaks on divided carriageways safely located? (i.e. frequency, visibility)	Yes.
3.1.8 Future widening and/or realignments ▪ If the scheme is only a stage towards a wider or dual carriageway is the design adequate to impart this message to drivers? (is the reliance on signs minimal/appropriate, rather than excessive?) ▪ Is the transition between single and dual carriageway (either way) handled safely?	Unknown

3.1.9 Staging of the scheme
▪ If the scheme is to be staged or constructed at different times:
  ▪ are the construction plans and program arranged to ensure maximum safety?
  ▪ do the construction plans and program include specific safety measures, signing; adequate transitional geometry; etc. for any temporary arrangements?
	Unknown.

3.1.10 Staging of the work ▪ If the construction is to be split into several subprojects, is the order safe? (i.e. the stages are not constructed in an order that creates unsafe conditions)	Unknown.
3.1.11 Adjacent developments ▪ Does the design handle accesses to major adjacent generators of traffic and developments safely? ▪ Is drivers' perception of the road ahead free of misleading effects of any lighting or traffic signals on an adjacent road? ▪ Has the need for screening against glare from lighting of adjacent property been adequately considered?	All issues raised had considered vehicular and pedestrian traffic generated by the school.

Checklist questions	Comments
3.1.12 Stability of cut and fill ▪ Is the stability of batters satisfactory? (for example, no potential for loose material to affect road users)	Yes.
3.1.13 Skid resistance ▪ Has the need for anti-skid surfacing been considered where braking or good road adhesion is most essential? (for example, on gradients, curves, approaches to intersections and signals)	Yes.
3.2 Design issues (general*)*	
3.2.1 Geometry of horizontal and vertical alignment ▪ Does the horizontal and vertical design fit together correctly? ▪ Is the vertical alignment consistent and appropriate throughout? ▪ Is the horizontal alignment consistent throughout? ▪ Is the alignment consistent with the function of the road? ▪ Is the design free of misleading visual cues? (for example, visual illusions, subliminal delineation like lines of poles)	Yes.

3.2.2 Typical cross-sections
▪ Are lane widths, shoulders, medians and other cross section features adequate for the function of the road?
▪ Are the shoulder widths adequate for stationary vehicles and errant vehicles?
▪ Are median widths adequate for road furniture?
▪ Is superelevation consistent with the road environment?
▪ Is the width of traffic lanes and carriageways suitable in relation to:
  ▪ alignment?
  ▪ traffic volume?
  ▪ vehicle dimensions?
  ▪ the speed environment?
  ▪ combinations of speed and traffic volume?
▪ Are the shoulder crossfalls safe for vehicles to traverse?
▪ Are batter slopes drivable for cars, trucks?
▪ Are side slopes under structures appropriate?
▪ Have adequate facilities been provided for pedestrians and cyclists?
	Yes. However, *no stopping* zones should be considered for improved passing clearance and sight lines.

3.2.3 Effect of cross-sectional variation ▪ Is the design free of undesirable variations in cross section design? ▪ Are crossfalls safe? (particularly where sections of existing highway have been used, there have been compromises to accommodate accesses, at narrowings at bridges, etc.) ▪ Are any curves with adverse crossfall within appropriate limits? ▪ Is superelevation provided and sufficient at all locations where required?	See above.

Checklist questions	Comments
3.2.4 Roadway layout ▪ Are all traffic management features designed so as to avoid creating unsafe conditions? ▪ Is the layout of road markings and reflective materials able to deal satisfactorily with changes in alignment? (particularly where the alignment may be substandard) ▪ Is there adequate provision for overtaking? ▪ Are overtaking lanes provided where required and safely commenced and ended? ▪ Are overtaking requirements satisfactory? ▪ Is the design free of sunrise/sunset problems? ▪ Have public transport requirements been adequately catered for?	Some of the kerbline space should be quarantined of parking to maintain passing clearance around slow-moving or stopped vehicles.

3.2.5 Shoulders and edge treatment
▪ Are the shoulders likely to be safe if used by slow moving vehicles or cyclists?
▪ Are the following safety aspects of shoulder provision satisfactory?
  ▪ provision of sealed or unsealed shoulders
  ▪ width and treatment on embankments
  ▪ crossfall of shoulders
	Yes.

3.2.6 Effect of departures from standards or guidelines ▪ Any approved departures from standards or guidelines:is safety maintained? ▪ Any hitherto undetected departures from standards: is safety maintained?	Yes.
3.2.7 Visibility and sight distance ▪ Are horizontal and vertical alignments consistent with visibility requirements? ▪ Has an appropriate design speed been selected for visibility requirements?	*No stopping* zones should be considered for improved passing clearance and sight lines. The MGSD sight line from the pick up/ drop off bay and the special needs parking area may be compromised by parked cars and the curvature of the road.
3.2.8 Environmental treatments ▪ Has safety been considered in the location of environmental features? (for example, noise fences)	Yes.
3.3 Alignment details	

Checklist questions	Comments

3.3.1 Visibility; sight distance
▪ Are horizontal and vertical alignments consistent with the visibility requirements?
▪ Is the design free of sight line obstructions due to safety fences or barriers?
  ▪ boundary fences?
  ▪ street furniture?
  ▪ parking facilities?
  ▪ signs?
  ▪ landscaping?
  ▪ bridge abutments?
  ▪ parked vehicles in laybys or at the kerb?
  ▪ queued traffic?
▪ Are railway crossings, bridges and other hazards all conspicuous?
▪ Is the design free of any other local features which may affect visibility?
▪ Is the design free of overhead obstructions (for example, road or rail overpasses, sign gantries, overhanging trees) which may limit sight distance at sag curves?
▪ Has a clear headroom or a high vehicle detour been provided where necessary?
▪ Is visibility adequate at:
  ▪ any pedestrian, bicycle or cattle crossings?
  ▪ access roads, driveways, on and off ramps, etc.?
▪ Has the minimum sight triangle been provided at:
  ▪ entry and exit ramps?
  ▪ gore areas?
  ▪ intersections?
  ▪ roundabouts?
  ▪ other conflict points?
	See item 3.2.7.

Checklist questions	Comments
3.3.2 New/existing road interface ▪ Have implications for safety at the interface been considered? ▪ Is the transition from old road to the new scheme satisfactory? ▪ If the existing road is of a lower standard than the new scheme, is there clear and unambiguous warning of the reduction in standard? ▪ Have the appropriate provisions for safety been made where sudden changes in speed are required? ▪ Is access or side friction handled safely? ▪ Does the interface occur well away from any hazard? (for example, a crest, a bend, a roadside hazard or where poor visibility/distractions may occur) ▪ If carriageway standards differ, is the change effected safely? ▪ Is the transition where the road environment changes (for example, urban to rural; restricted to unrestricted; lit to unlit) done safely? ▪ Has the need for advance warning been considered?	Yes.
3.3.3 Readability of the alignment by drivers ▪ Will the general layout, function and broad features be recognised by drivers in sufficient time? ▪ Will approach speeds be suitable and will drivers correctly track through the scheme?	Yes.
3.3.4 Detail of geometric design ▪ Are the design standards appropriate for all the requirements of the scheme? ▪ Is consistency of general standards and guidelines, such as lane widths and crossfalls, maintained?	Yes.
3.3.5 Treatment at bridges and culverts ▪ Is the geometric transition from the standard cross-section to that on the bridge handled safely?	NA.
3.4 Intersections	

Checklist questions	Comments

3.4.1 Visibility to and at intersections
▪ Are horizontal and vertical alignments at the intersection or on the approaches to the intersection consistent with the visibility requirements?
▪ Is the standard adopted for provision of visibility appropriate for the speed of traffic and for any unusual traffic mix?
▪ Will the design be free of sight line obstructions due to safety fences or barriers
  ▪ boundary fences?
  ▪ street furniture?
  ▪ parking facilities?
  ▪ signs?
  ▪ landscaping?
  ▪ bridge abutments?
  ▪ parked vehicles in laybys and at the kerb?
  ▪ queued traffic?
▪ Are railway crossings, bridges and other hazards all conspicuous?
▪ Is the design free of any other local features which may affect visibility?
	See comment to item 3.2.7.

3.4.2 Layout ▪ Are intersections and accesses adequate for all vehicular movements? ▪ Have the appropriate design vehicle and check vehicle been used for turning dimensions? ▪ Are swept paths accommodated for all likely vehicle types? (has the appropriate design vehicle been used?) ▪ Are intersections free of any unusual features which could affect road safety? ▪ Are pedestrian fences provided where needed? (for example, to guide pedestrians or discourage parking) ▪ Has pavement anti-skid treatment been provided where needed? ▪ Have islands and signs been provided where required? ▪ Vehicles which may park at or close to the intersection: can they do this safely or does this activity need to be relocated? ▪ Are safety hazards due to parked vehicles avoided?	Issues raised with respects to three-point turns and reversing adjustments.

Checklist questions	Comments
3.4.3 Readability by drivers ▪ Will the existence of the intersection and its general layout, function and broad features be perceived correctly and in adequate time? ▪ Are the approach speeds and likely positions of vehicles tracking through the intersection safe? ▪ Is the design free of misleading elements? ▪ Is the design free of sunrise or sunset problems which may create a hazard for motorists?	Yes.

3.4.4 Detailed geometric design
▪ Can the layout safely handle unusual traffic mixes or circumstances?
▪ Does any median or any island safely account for:
  ▪ vehicle alignments and paths?
  ▪ future traffic signals?
  ▪ pedestrian storage space and surface?
  ▪ turning path clearance?
  ▪ stopping sight distance to the nose?
  ▪ mountability by errant vehicles?
▪ Is adequate vertical clearance to structures provided? (for example, powerlines, shop awnings)
	Yes.

3.4.5 Traffic signals ▪ Is the signal phasing/sequence safe? ▪ Is adequate time provided for traffic movements and pedestrian movements? ▪ Will the signal lanterns be visible? (for example, not obstructed by trees, poles, signs or large vehicles) ▪ Are lanterns for other approach directions adequately shielded from view? ▪ Are high-intensity signals and/or target boards provided if likely to be affected by sunrise/sunset? ▪ Does the alignment (vertical and horizontal) provide satisfactory stopping sight distance to the intersection or back of queue? ▪ Are pedestrian facilities provided where they are required? ▪ Will approaching drivers be able to see pedestrians? ▪ Are partially or fully controlled turning phases provided where required? ▪ Are signal posts located where they are not an undue hazard? ▪ Are road markings for turning traffic satisfactory? ▪ Have adequate pedestrian phases been provided?	NA. There is a pre-existing signalised intersection further south. However, this will remain unchanged.

Checklist questions	Comments
3.4.6 Roundabouts ▪ Is adequate deflection provided to reduce approach speeds? ▪ If splitter islands are needed, are they adequate for sight distance, length, pedestrian storage, etc.? ▪ Is the central island prominent? ▪ Can the appropriate design vehicle and check vehicle be accommodated? ▪ Are the central island details satisfactory? (delineation, mountability, conspicuousness) ▪ Can pedestrians be seen by drivers in sufficient time? ▪ Can pedestrians determine whether vehicles are turning? (no obstructions to sight lines) ▪ Are direction markings in approach lanes provided where required? ▪ Is the lighting adequate?	NA.
3.4.7 Other intersections ▪ Has the need for kerbed or painted islands and refuges been considered? ▪ Do intersections have adequate queue length/storage for turning movements (including in the centre of a staggered intersection)?	Yes.
3.5 Special road users	
3.5.1 Adjacent land ▪ Are all accesses to and from adjacent land/properties safe? ▪ Have the special needs of agriculture and stock movements been considered?	MGSD implications noted due to un-restricted kerbside parking.

Checklist questions	Comments

3.5.2 Pedestrians
▪ Can pedestrians cross safely at:
  ▪ intersections?
  ▪ signalised and pedestrian crossings?
  ▪ refuges?
  ▪ kerb extensions?
  ▪ bridges and culverts?
  ▪ other locations?
▪ Is each crossing point satisfactory for:
  ▪ visibility, for each direction?
  ▪ use by the disabled?
  ▪ use by the elderly?
  ▪ use by children/schools?
▪ Is pedestrian fencing on reservations and medians provided where required for each crossing?
▪ Is fencing adequate on freeways?
▪ Are pedestrians deterred from crossing roads at unsafe locations?
▪ Are pedestrian related signs appropriate and adequate?
▪ Is width and gradient of pedestrian paths, crossings, etc. satisfactory?
▪ Is surfacing of pedestrian paths, crossings, etc.satisfactory?
▪ Have dropped kerbs been provided for each crossing?
▪ Have channels and gullies been avoided at each crossing?
▪ Is lighting satisfactory for each crossing?
▪ Are crossings sited to provide maximum use?
▪ Is avoidance of a crossing unlikely? (for example, by more direct but less safe alternative)
	Several pedestrian safety issues noted. This included conflicts at the driveways.

3.5.3 Cyclists
▪ Have the needs of cyclists been considered:
  ▪ at intersections (particularly roundabouts)?
  ▪ especially on higher speed roads?
  ▪ on cycle routes and crossings?
  ▪ at freeway entry and exit ramps?
▪ Are shared cycleway/footway facilities (including subways and bridges) safe and adequately signed?
	Opportunity noted for converting the footpaths to designated shared paths.

Checklist questions	Comments
3.5.4 Motorcyclists ▪ Has the location of devices or objects that might destabilise a motorcycle been avoided on the road surface? ▪ Is the roadside clear of obstructions where motorcyclists may lean into curves? ▪ Will warning or delineation be adequate for motorcyclists? ▪ Has barrier kerb been avoided in high-speed areas? ▪ In areas more likely to have motorcycles run off the road is the roadside forgiving or safely yielded? ▪ Are all unnecessary poles, posts and devices removed or appropriately shielded? ▪ Are drainage pits and culverts traversable by motorcycle?	NA. This is a low-speed environment.
3.5.5 Equestrians and stock ▪ Have the needs of equestrians been considered, including the use of verges or shoulders and rules regarding the use of the carriageway? ▪ Can underpass facilities be used by equestrians/stock?	NA.
3.5.6 Freight ▪ Have the needs of truck drivers been considered, including turning radii and lane widths? ▪ Have the needs of freight transport been considered, adequately signed and catered for?	Issues noted with maintenance access.
3.5.7 Public transport ▪ Have the needs for public transport been considered, adequately signed and catered for? ▪ Have the needs of public transport users been considered? ▪ Have the manoeuvring needs of public transport vehicles been considered? ▪ Are bus stops well positioned for safety?	Yes.
3.5.8 Road maintenance vehicles ▪ Have the needs of road maintenance vehicles been considered, adequately signed and catered for? ▪ Can maintenance vehicles be safely located?	Issues noted with maintenance access.
3.6 Lighting, signs and delineation	

Checklist questions	Comments
3.6.1 Lighting ▪ Has lighting been adequately provided where required? ▪ Is the design free of features which interrupt illumination? (for example, trees or overbridges) ▪ Is the design free of lighting poles that would present a fixed roadside hazard? ▪ Are frangible or slip-base poles to be provided? ▪ Ambient lighting: if it creates special lighting needs, have these been satisfied? ▪ Is the lighting scheme free of confusing or misleading effects on signals or signs? ▪ Does the lighting adequately illuminate crossings, nearby paths, refuges, etc.? ▪ Are all gore areas adequately illuminated? ▪ Are all merge areas adequately illuminated? ▪ Is the scheme free of any lighting black patches? ▪ If there are locations with accident problems that are ▪ known to be amenable to treatment with improved lighting, has this lighting been provided?	Streetlighting plans not provided.

3.6.2 Signs
▪ Are signs appropriate for their location?
▪ Are signs located where they can be seen and read in adequate time?
▪ Will signs be readily understood?
▪ Are signs appropriate to the driver's needs? (for example, direction signs, advisory speed signs, etc.)
▪ Are signs located so that drivers' sight distance is maintained?
▪ Are signs located so that visibility is maintained:
  ▪ to/from accesses and intersecting roads?
  ▪ to/from pedestrians and important features on the road?
▪ Have the consequences of vehicles striking signposts been considered?
▪ Are sign supports out of the clear zone?
▪ If not, are they:
  ▪ frangible?
  ▪ shielded by barriers (e.g. guard fence, crash cushions)?
▪ Has an over-reliance on signs (in lieu of adequate geometric design) been avoided?
▪ Are signs on the new scheme consistent with those on the adjoining section of road (or will the previous signs need to be upgraded)?
	Generally, there were no signs shown on the plans.

Checklist questions	Comments
3.6.3 Marking and delineation ▪ Are markings (lines, arrows, etc.) consistent with standard markings? ▪ Have any locations where standard markings might be confusing or misread been identified and treated in a way which considers road users' likely responses? ▪ Are barrier lines (no overtaking) provided where required? ▪ Are raised retroreflective pavement markers (RRPMs) provided where necessary? ▪ Are curve warning signs, advisory speed plates or chevron alignment markers provided where required? ▪ Are markings on the new scheme consistent with those on the adjoining section of road (or will the previous markings need to be upgraded)? ▪ Are diagonal markings or chevrons painted where required? ▪ Will markings and delineation be visible at night-time? ▪ Will markings and delineation be visible in wet weather? ▪ Has the need for profiled (audible) line marking been considered? ▪ Have both high and low-beam cases been considered? ▪ Are guide posts of the frangible type?	Linemarking not shown on the plans.
3.7 Physical objects	
3.7.1 Median barriers ▪ Have median barriers been considered and properly detailed? ▪ Have all design features that require special attention (for example, end treatments) been considered?	NA.
3.7.2 Poles and other obstructions ▪ Are all poles located well away from moving traffic? ▪ Have frangible or breakaway poles been included where required? ▪ Are median widths adequate to accommodate lighting poles or trees? ▪ Is the position of traffic signal controllers and other service apparatus satisfactory? ▪ Is the roadside clear of any other obstructions that may create a safety hazard? ▪ Have all necessary measures been taken to remove, relocate or shield all hazards? ▪ Can roadside drains and channels be safely traversed by any vehicle that runs off the road?	Yes.

Checklist questions	Comments

3.7.3 Crash barriers
▪ Are crash barriers provided where necessary and properly detailed? (for example, at embankments, structures, trees,
▪ poles, drainage channels, bridge piers, gore areas) Is the crash barrier safe? (i.e. unlikely to create a danger for road users including pedestrians, cyclists, motorcyclists, etc.)
▪ Are the end conditions of the crash barrier safe and satisfactory?
▪ Is the guard fence designed according to standards for:
  ▪ end treatments?
  ▪ anchorages?
  ▪ post spacing?
  ▪ block outs?
  ▪ post depth?
  ▪ rail overlap?
  ▪ stiffening at rigid obstacles?
▪ Is all guard fence necessary? (i.e. what it shields is a greater hazard than the fence)
▪ Where pedestrians and cyclists travel behind guard fence, is the rear of the fence safe for them?
	NA.

3.7.4 Bridges, culverts and causeways/ floodways
▪ Are bridge barriers and culvert end walls safe regarding:
  ▪ visibility?
  ▪ ease of recognition?
  ▪ proximity to moving traffic?
  ▪ the possibility of causing injury or damage?
  ▪ collapsible or frangible ends?
  ▪ signs and markings?
  ▪ connection of crash barriers?
  ▪ roadside hazard protection?
▪ Is the bridge railing at the correct level and strong enough?
▪ Is the shoulder width on the bridge the same as on the adjacent road lengths?
▪ Is safe provision made for non-vehicular traffic over structures? (for example, pedestrians, pedal cycles, horses/stock, etc).
▪ Are all culvert end walls (including driveway culverts) drivable or outside the clear zone?
▪ Have causeways/floodways etc. been given correct signing and adequate sight distance?
	NA.

3.8 Additional questions to be considered for development proposals	

Checklist questions	Comments
3.8.1 Horizontal alignment ▪ Is visibility adequate for drivers and pedestrians at proposed accesses? ▪ Is adequate turning space provided for the volume and speed of traffic? ▪ Are curve radii and forward visibility satisfactory? ▪ Are sight and stopping distances adequate?	The horizontal curve on Cullen Avenue could affect the MGSD sight line from the *special needs* parking area and the pick up/ drop off bay. This is especially if there are vehicles parked along the northern kerbline of Cullen Avenue.
3.8.2 Vertical alignment ▪ Are gradients satisfactory? ▪ Are sight and stopping distances adequate?	Vertical geometry was considered satisfactory.
3.8.3 Parking provision ▪ Is on-site parking adequate to avoid on-street parking and associated risks? ▪ Are parking areas conveniently located? ▪ Is adequate space provided in parking areas for circulation and intersection sight distance?	Issue noted with access to the disabled parking spaces. Issue noted with connection of bicycle spaces to the adjacent staff car park, instead of the safer alternative of linking this to the adjacent pedestrian path.
3.8.4 Servicing facilities ▪ Are off-street loading/unloading areas adequate? ▪ Are turning facilities for large vehicles provided in safe locations? ▪ Is emergency vehicle access adequate?	The waste collection operations will occur in the space-confined area of the *special needs* car park. There does not appear to be enough space for u-turns.
3.8.5 Signs and markings ▪ Have necessary traffic signs and road markings been provided as part of a development? ▪ Is priority clearly defined at all the intersection points within the car park and access routes? ▪ Will the signs and markings be clear in all conditions, including day/night, rain, fog, etc.?	Issues noted with lack of *no stopping* signs.
3.8.6 Landscaping ▪ Does landscaping maintain visibility at intersections, bends, accesses and pedestrian locations? ▪ Has tree planting been avoided where vehicles are likely to run off the road?	Yes.
3.8.7 Traffic management ▪ Have any adverse area-wide effects been addressed? ▪ Will the design keep travel speeds at a safe level? ▪ Are the number and location of accesses appropriate? ▪ Are the facilities for public transport services safely located? ▪ Are any bicycle facilities safely located in respect of vehicular movements? ▪ Are pedestrian facilities adequate and safely located?	Effective traffic and queue management will be critical to the safety performance of the pick up/ drop off bay.

Checklist questions	Comments
3.8.8 Other ▪ Has appropriate street lighting been provided? ▪ Are all roadside hazards appropriately dealt with? ▪ Has safe pedestrian access to the development been provided?	Streetlighting plans were not provided and hence this could not be assessed.
3.9 Any other matter	
Safety aspects not already covered ▪ Is the road able to safely handle oversize vehicles, or large vehicles like trucks, buses, emergency vehicles, road maintenance vehicles? ▪ If required, can the road be closed for special events in a safe manner? ▪ If applicable, are special requirements of scenic or tourist routes satisfied? ▪ Have all unusual or hazardous conditions associated with special events been considered? ▪ Have all other matters which may have a bearing on safety been addressed?	NA.