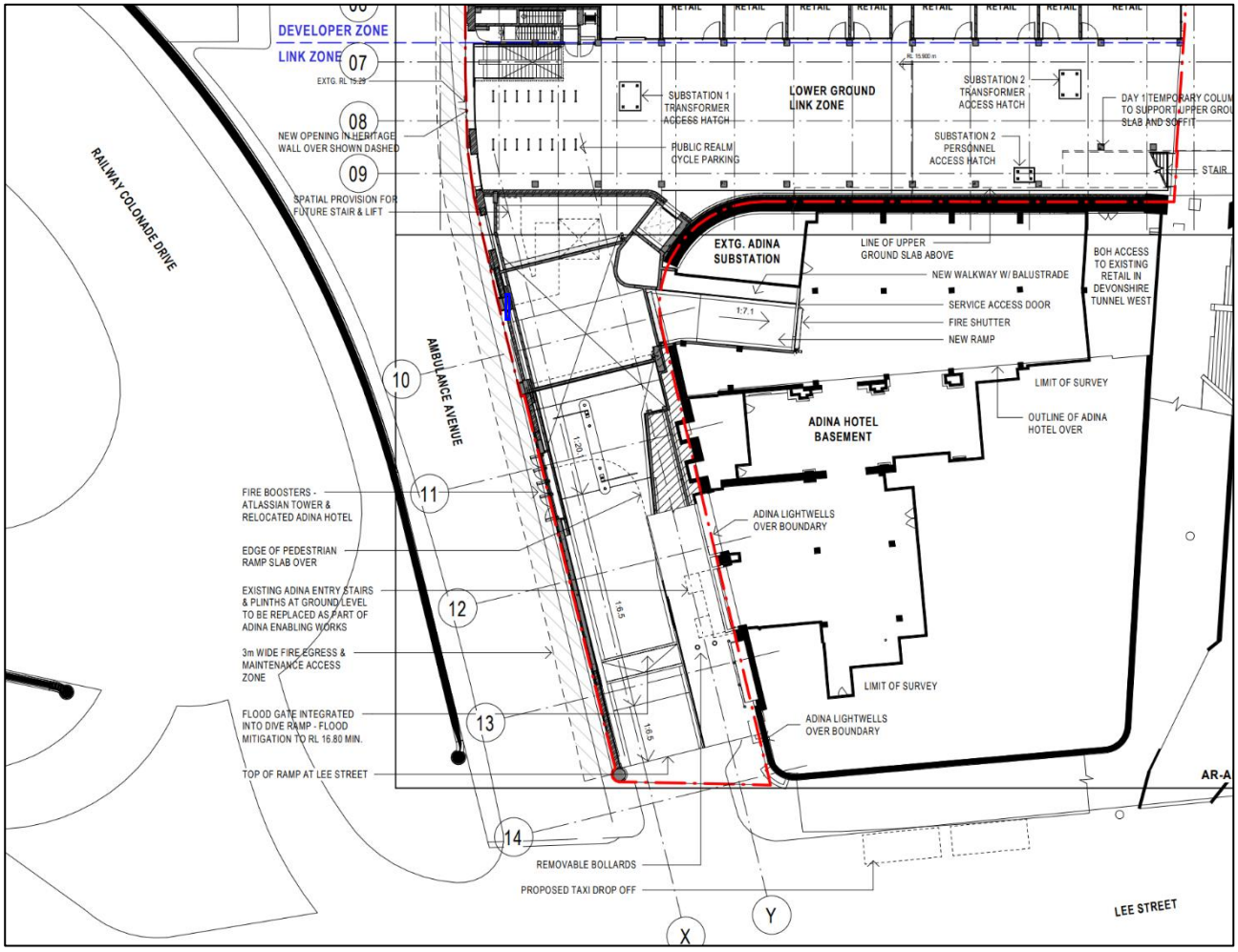
TRAFFIC ENGINEERING

# JMT Consulting

# Atlassian Central

## Detailed design road safety audit



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# Atlassian Central

## Detailed design road safety audit

**Authors** Damien Chee

**Report No** JMT-PROJ-0001-03 DD RSA ATLASSIAN REV 2

**Date** 5/8/2022

This report has been prepared for JMT Consulting.

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## Appendices

# 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 layout of Upper Carriage Lane as the access-egress to the future Atlassian Development, in Chippendale. |
| **Client/ contact** | Josh Milston<br>Director<br>JMT Consulting<br>Ph: 0415 563 177<br>E: josh.milston@jmtconsulting.com.au |
| **Audit type** | *Concept design* road safety audit. |
| **Purpose** | A *detailed design* road safety audit was required to identify potential safety issues associated with the proposed modified use of Upper Carriage Lane as the access-egress to the future Atlassian Development. |
| **Background** | Tech Central is an earmarked 24-hectare precinct from Central Railway Station to Cleveland Street where technology start-up companies, universities and research institutions, and the community will collaborate to deliver technology research and innovation projects. This precinct is proximate to many pre-existing stakeholders such as the University of Sydney, University of Technology Sydney (UTS), CSIRO's Data 61, the Australian Technology Park, and Royal Prince Alfred Hospital.<br>The Western Gateway will be a sub-precinct within Tech Central and located on the western side of Central Railway Station. This will include the Atlassian Headquarters, a 40-storey tower as well as Dexus and Frasers Property with two office towers of 37 storeys and 30 storeys, on an adjacent land parcel.<br>The Atlassian development plans to use the existing Upper Carriage Lane (which stems off the eastern side of Lee Street) as its vehicle access-egress. Traffic forecasting analysis indicates that there could be up to 15 inbound and 15 outbound movements in the busiest hour of the day. This is comprised of 11 light vehicle movements and four heavy vehicle movements (two-way movements).<br>The concept to use the existing Upper Carriage Lane formation as the access-egress to the Atlassian development was required to be formally examined via a *detailed design* road safety audit. This was also to fulfil a requirement from Transport for NSW (TfNSW). In these respects, this report documents the processes and findings of the *detailed design* road safety audit. |
| **Scope of project/ audit** | The following plans were issued to the audit team and regarded as the auditable materials:<br>▪ DA-09A-XXX-02 [Rev 11] – Site plan lower levels.<br>▪ AR-09B-G00-00 [Rev 14] – General arrangement plan lower ground level.<br>▪ CI-20B-P00-01 [Rev A] – Site works plan.<br>▪ AR-11D-XXX-02 [Rev 10] – Dive ramp section.<br>▪ SKT24 [dated 31/5/2021] – SRV & MRV entry via Lee Street.<br>▪ SKT25 [dated 31/5/2021] – SRV & MRV entry via Lee Street.<br>▪ SKT26 [dated 31/5/2021] – MRV &B99 entry via Lee Street.<br>▪ SKT27 [dated 31/5/2021] – B99 entry via Lee Street.<br>▪ SKT28 [dated 31/5/2021] – MRV entry via Lee Street.<br>The revision numbers for each plan are listed above. |
| **Audit team details** | Damien Chee, DC Traffic Engineering (level 3 and lead auditor – RSA-02-0094).<br>Linda Chee, DC Traffic Engineering (level 2 road safety auditor - RSA-02-1069). |

| | |
|---|---|
| **Audit methodology** | The audit was undertaken using the following methodology:<br>▪ Review of the plans on 29/7/2022.<br>▪ A familiarisation site inspection was carried out on 13/6/2021 at the *concept design* road safety audit as well as 30/6/2022 as part of the *detailed design* road safety audit.<br>▪ 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). The audit findings are documented in Section 3.<br>▪ As required from the Conditions of Consent, recommended improvement measures were required to address the reported audit findings. These are provided in Section 4.<br>▪ This report includes completed *checklist 3 –detailed design stage audit* as sourced from the Austroads *Guide to Road Safety Part 6A: Implementing Road Safety Audits*. |
| **Material supplied** | See *Scope of audit*. |
| **Meeting and assessment details** | Review of plans carried out on 29/7/2022.<br>Site inspections carried out on 13/6/2021 and 30/6/2022. |

## 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.

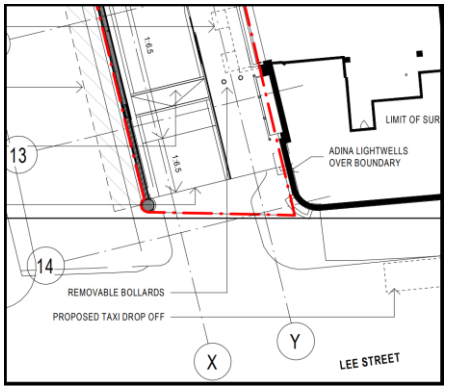
## 1.3 Previous audits

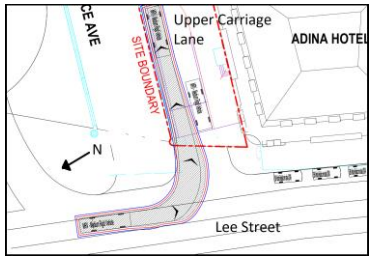
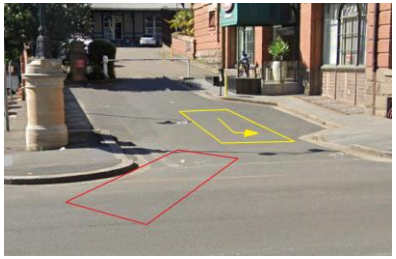
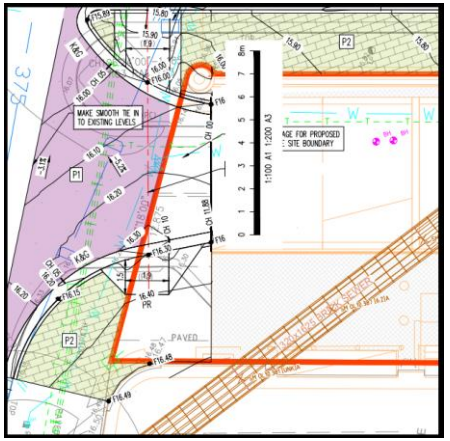
A *concept design* road safety audit was undertaken by DC Traffic Engineering (DCTE) in June 2021. This was documented in the DCTE report registered as JMT-PROJ-0001-01 (revision 1, dated 16/6/2021).

The findings from that road safety audit have been provided in Table 2 along with a commentary from the current audit team. Each of the findings have been numbered as C1, C2 etc where "C" refers to *concept design stage audit* and the suffix numbers are the same sequential order as the previous reports.

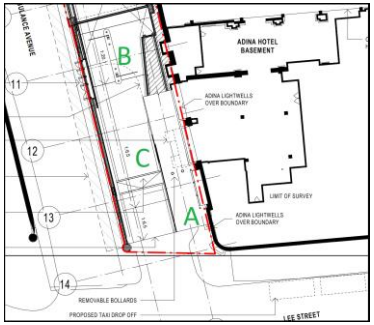
The audit team takes the position that if issues were raised and documented in previous road safety audits, and made known to the project team at the time, then these need not be re-reported in the current audit. This is based on the assumption that the project team considered and reached a close out position on each matter at that time. In these respects, previously reported items are considered to be precluded items from this current audit.

**Table 2 Previous road safety audit findings – concept design stage (sourced from DCTE report JMT-PROJ-0001-01 Rev 1).**

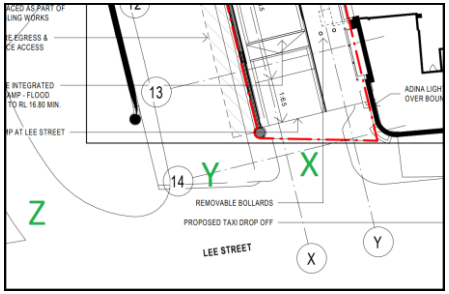
| *Ref* | *Location* | *Previous road safety audit finding – concept design stage* | Comment as part of current audit |
|---|---|---|---|
| *C1* | *Right turn movements into and out of Upper Carriage Lane.* | *At present, there are no signposted restrictions on turning right into or out of Upper Carriage Lane. Northbound vehicles on Lee Street are not physically inhibited from making a right-turn into this side road. Similarly, outbound vehicles from Upper Carriage Lane are not physically inhibited from making a right-turn to egress from this side road. Whilst there is a BB double barrier centreline on Lee Street, this is only considered a deterrent, but not a physical inhibitor.*<br>*With the proposed modified function of Upper Carriage Lane, including access for the Atlassian development, there should be more stringent controls and prohibitions against these right-turn movements. Furthermore, there should be physical inhibitors in place such as a raised median. If right-turns are not physically inhibited, the audit team assumes that these will happen at some point (even if on a very occasional frequency). This imposes the following risks:*<br>▪ *Northbound right-turners heading into Upper Carriage Lane would mostly likely need to stop in the right-most northbound lane of Lee Street to wait for suitable gaps. By doing so, they would be exposed to rear-end impacts by trailing traffic. They would also obstruct this lane for the duration that they are required to wait. This could have significant traffic operational flow-on effects including reducing the capacity of the George Street/ Pitt Street/ Lee Street intersection.*<br>▪ *The same northbound right-turning drivers would be required to detect and select gaps in two southbound lanes of Lee Street. This includes any left-turning vehicles from Pitt Street which may be outside the right-turning driver's field of view. This is a challenging gap acceptance requirement and would have considerable right-thru crash risks.*<br>▪ *Egressing right-turning vehicles from Upper Carriage Lane would need to view and judge gaps in two southbound traffic lanes, and at least one of the northbound traffic lanes. Furthermore, they would need to assess for coinciding gaps in these lanes. With high traffic demands throughout the day, these coinciding gaps may simply not present themselves and the driver is likely to resort to using small gaps. As stated above, many of the conflicting southbound vehicles may be left-turning vehicles from Lee Street which may not be easily seen due to the curved approach alignment from Pitt Street to Lee Street.*<br>▪ *The Upper Carriage Lane intersection is also very close to the George Street/ Pitt Street/ Lee Street intersection. This puts these two intersections, as possible crash conflict points, in close proximity to each other. Any conflicts from one intersection may affect safety and operations at the other. For example, the start-stop-release pattern of the signalised intersection at the George Street/ Pitt Street/ Lee Street intersection may result in variable approach speeds in the southbound direction of Lee Street when approaching Upper Carriage Lane. This may also make it difficult to assess and accept suitable gaps.*<br>*Consideration should be given to restricting the Lee Street/ Upper Carriage Lane intersection to left-in-left-out only (via NO RIGHT TURN signs) and providing appropriate physical inhibitors to further deter and discourage such turning movements. For example, a raised median could be provided on Lee Street immediately at this cross over point into and out of Upper Carriage Lane.* | Upper Carriage Lane will still operate as a two-way facility. The detailed design did not indicate any intended controls or prohibitions on right-turns into and out of this side road.<br>  <br><br>***Above:*** *Extract from the detailed design showing the intersection of Lee Street with Upper Carriage Lane. There is no stated intention to control or prohibit right-turns into and out of this property.* |

| Ref | Location | Previous road safety audit finding – concept design stage | Comment as part of current audit |
|---|---|---|---|
| C2a | *Lee Street/ Upper Carriage Lane intersection.* | *The development proposes to use Upper Carriage Lane as its vehicular access and egress. The kerb-to-kerb width of Upper Carriage Lane is approximately 6.0m. This width would impose the following safety risks:*<br>▪ *With 6.0m of width, there is limited passing clearance for two-way traffic movements. This is especially since both inbound and outbound vehicles are likely to be performing turning movements and hence would have a wider footprint. There would be risks of head-on collisions between inbound and outbound vehicles.*<br>▪ *Alternatively, and more realistically due to the low-speed environment, opposing vehicles will tend to come head-to-head without incident but one or both vehicles would be required to stop to allow the other to pass through first. If the inbound vehicle is forced to stop, it could be left stranded and exposed to rear-end collisions by other trailing vehicles on Lee Street. This is illustrated in the right-hand image with the inbound vehicle (red) being forced to stop midway through the turn to provide clearance for the outbound vehicle (yellow) to egress first. Whilst waiting in this position, the red vehicle would be exposed to rear-end impacts by other southbound vehicles on Lee Street. It may even be forced to reverse back out into Lee Street to create more clearance. This reversing movement is fraught with risk since many approaching vehicles would not be easily seen by this reversing driver. In particular, any southbound vehicles from Pitt Street that turn into Lee Street would be difficult to see. It is emphasised that even if the two opposing vehicles are able to spatially clear each other, in reality, most drivers will stop if there is a perceived risk of impacting the other vehicle. This even applies to minor impacts with more trivial consequences (scraped side panels, damaged wing mirror etc).*<br>▪ *The above risk is further exacerbated since the outbound vehicle (yellow) may not be able to continue their egressing movement if they cannot see the approaching southbound traffic on Lee Street, if their visibility is blocked by the stopped inbound vehicle.*<br>*This side road may need to be widened to better service the inbound and outbound traffic demands. Since Lower Carriage Lane will be re-developed as a shared environment, this presents an opportunity to modify the ramp structure of Upper Carriage Lane.*<br>  <br>  <br>***Right-hand:*** *Looking inbound into Upper Carriage Lane where an inbound vehicle (red) is forced to stop to provide clearance for the outbound vehicle to clear this point first.*<br>***Left-hand:*** *Extract from the swept path model showing the swept path envelope of an inbound medium rigid vehicle. The model strongly indicates that the left-turning inbound vehicle would cross over the "centreline" of Upper Carriage Lane and would be likely to impose a head-on crash risk with outbound vehicles. Under this model, the outbound medium rigid vehicle is forced to stop and allow the inbound vehicle to complete the movement first. Also, note that this vehicle is required to stop well upstream of the interface with Lee Street. If the outbound vehicle stops any further west of this point, they may block the inbound path. Extract from the concept design.* | These issues would still persist with the detailed design. The pavement plan indicates that the laneway would still be approximately 6m wide (see image below with scale marker placed adjacent to the channel).<br>  <br>***Above:*** *Extract from the detailed design (pavement plan) showing the kerb-to-kerb width of the road access to Atlassian.* |

| Ref | Location | Previous road safety audit finding – concept design stage | Comment as part of current audit |
|---|---|---|---|
| *C2b* | *Lee Street/ Upper Carriage Lane intersection.* | *Continued from item C2a…*<br>  <br>***Above:*** *Looking eastbound into Upper Carriage Lane (right-hand channel) from Lee Street. The kerb-to-kerb width is approximately 6m wide. This imposes an isolated squeeze point for inbound and outbound traffic where width is critically needed for swept path and clearance requirements. Consideration should be given to widening this channel.* | See comments to item C2a. |

| Ref | Location | Previous road safety audit finding – concept design stage | Comment as part of current audit |
|---|---|---|---|
| C3a | *Inbound movements into Upper Carriage Lane.* | *Further to the issues described in item C2, any obstructions to the inbound traffic flows into Upper Carriage Lane, particularly when departing from Lee Street, could have queue spillback risks into Lee Street. Any vehicle that is left standing partially or wholly in Lee Street (and forced to wait due to the obstruction), could be exposed to rear-end impacts by trailing southbound vehicles on Lee Street. Some examples of obstructions include:*<br>▪ *Any parking/ stopping manoeuvres: This includes vehicles stopping and reversing into a kerbside parking position within Upper Carriage Lane.*<br>▪ *Any stopping required for dropping off or picking up passengers. This includes legal stopping as well as double parking.*<br>▪ *Low-speed movements by drivers looking for parking spaces or opportunities to stop. It is noted that the Adina Hotel lobby is located on the southern side of Upper Carriage Lane and would generate stopping movements, particularly in the outbound direction.*<br>▪ *Any u-turning or three-point turning movements which hold up other vehicles. On this note, the audit team has also assumed that there are sufficient opportunities in the site to turn around and head outbound in a forward direction. This includes any inbound movements in error, which then require the driver to turn around. For example, at present under pre-project conditions, there is a boom gate in place a short distance into Upper Carriage Lane. Any drivers that enter this side road in error would be inclined to reverse back out into Lee Street since there is a lack of space to perform a safe u-turn movement.*<br>*The immediate approach-departure length in Upper Carriage Lane should be kept free of obstructions such as parked cars, stopped buses and vans, deliveries, drop off/pick up transactions etc. Any stopping needs should be confined to further inside this side road well away from the intersection with Lee Street.*<br>  <br><br>***Above:** There is currently a considerable demand for stopping and kerbside parking in Upper Carriage Lane. Such parked vehicles would pose as obstructions and may lead to queues forming and building up. In particular, any queues in the inbound direction could spill back towards Lee Street.* | These issues would still persist with the revised design (shown below). The audit team notes the following:<br>▪ Pedestrians accessing the site would need to use the start of the ramp at "A". As such, there could be many inbound trips generated to pick up or drop pedestrians from point A. By stopping at this location, there would be risks of queue spillback as discussed in item C3a.<br>▪ There is a boom gate at point B. Any queuing as a result of this facility may also spill back towards Lee Street.<br>▪ The driveway channel C is narrow and does not facility u-turns (eg. by vehicles aborting due to the boom gates). Any three-point turns or "five-point turns" could cause delays and queue spillback.<br>  <br><br>***Above:** Extract from the detailed design showing the revised layout of the vehicular and pedestrian access to the site.* |

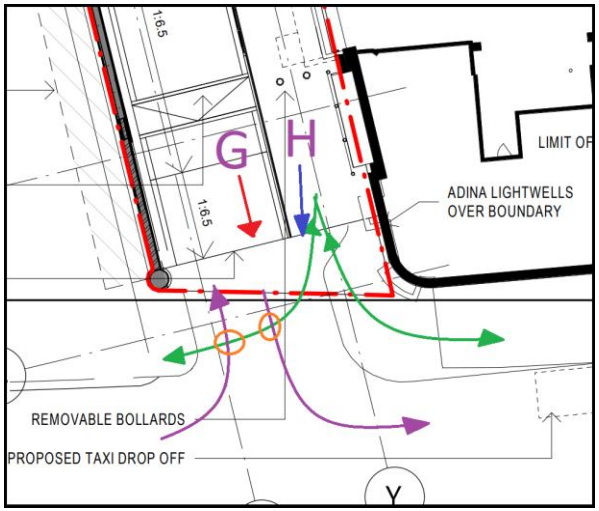
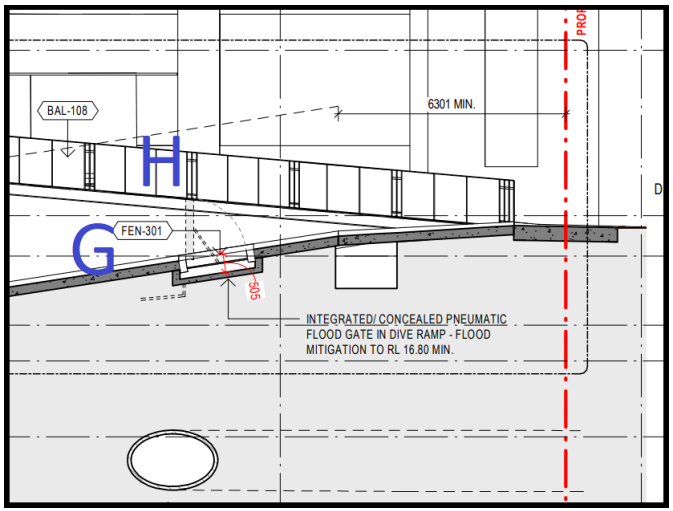
| Ref | Location | Previous road safety audit finding – concept design stage | Comment as part of current audit |
|---|---|---|---|
| *C3b* | *Inbound movements into Upper Carriage Lane.* | *Continued from item C3a…*<br>  <br>***Above:*** *Looking eastbound in Upper Carriage Lane under current, pre-project conditions. If features such as the boom gate and kerbside parking are retained in the post-build scenario, these could result in vehicles stopping and generating queues that could spill back into Lee Street. Similarly, any drop off/ pick up transactions at the Adina Hotel could also generate similar stopping behaviour.* | The revised layout of the driveway will be significantly different than the existing conditions shown here. However, as discussed in item C3a, there would still be a risk of queue spillback into Lee Street. |

| Ref | Location | Previous road safety audit finding – concept design stage | Comment as part of current audit |
|---|---|---|---|
| *C4* | *Egressing movements from Upper Carriage Lane.* | *All egressing drivers from Upper Carriage Lane re required to look to the north to assess and judge for gaps in the southbound traffic stream. However, as shown below (which is the reverse direction of this sight line), the minimum gap sight distance (MGSD)* from Upper Carriage Lane to the north could be blocked by an outbound vehicle from the Central Station Country Link drop off road (outbound vehicle superimposed by yellow rectangle). Any poor gap acceptance could lead to cross traffic crashes between egressing vehicles from Upper Carriage Lane and southbound vehicles on Lee Street. This is particularly the case when the southbound vehicle is approaching from Pitt Street. As shown below, a view from a driver in Pitt Street, this sight line crosses over the outbound lane from the Country Link terminal. Furthermore, the close proximity of the Country Link outbound lane and the Upper Carriage Lane means there will be two conflict points in close succession. For example, if outbound left-turners from the Country Link terminal and outbound left-turners from Upper Carriage Lane move into Lee Street at the same time, there may be a rear-end crash conflict as a result. This is especially since both vehicles are likely to use the common gap in southbound traffic to complete this turning movement.*<br>** MGSD is the sight line required by a driver in a side road to view traffic on the main road and judge for safe gaps in which to complete their turning movement. It is a time-based gap where critical minimum gap times are required for drivers to perform their desired turning movement.*<br>  <br>***Above:** Looking southbound from Pitt Street towards the subject access road - Upper Carriage Lane. If an outbound vehicle is stopped in the Country Link egress lane (yellow rectangle). This would block the sight line between the southbound driver on Pitt Street and the outbound driver from Upper Carriage Lane. This includes the MGSD sight line needed by the outbound vehicle from Upper Carriage Lane to detect and select safe gaps to turn into.* | This would still be the case under the detailed design layout. In fact, there are three outbound driveways in close succession. Z is the outbound lane from the Country Link drop off. Y is the inbound-outbound driveway to Ambulance Avenue (Lower Carriage Lane) and X is the inbound-outbound driveway to Upper Carriage Lane.<br>  <br>***Above:** Extract from the detailed design showing the retained risk of the three closely spaced driveways.* |

# 2 Safety audit findings

The road safety audit findings, based on the review of the detailed design, are presented in Table 3.

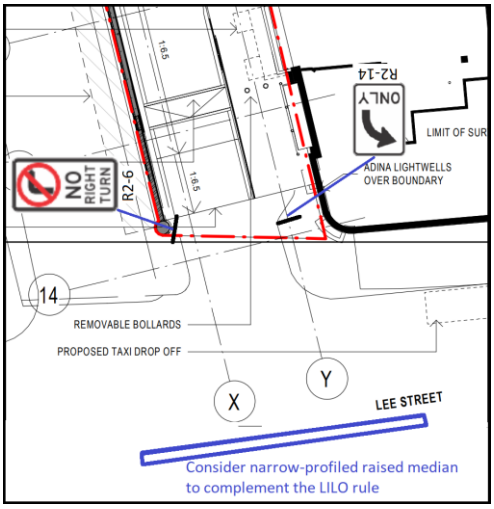
**Table 3 Road safety audit findings – detailed design stage.**

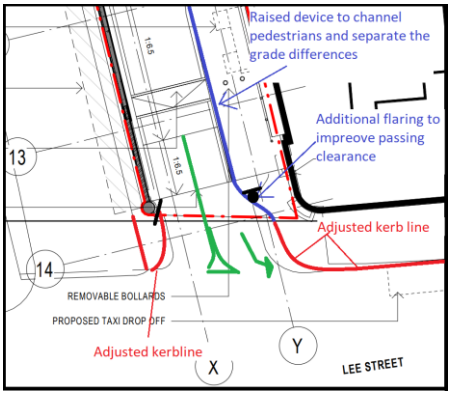
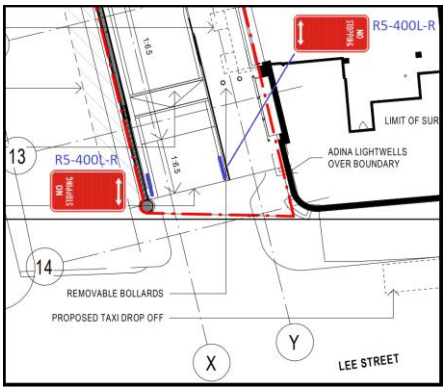
| Ref | Location | Road safety audit finding – detailed design stage | Priority |
|---|---|---|---|
| 3.1 | Interaction between vehicles and pedestrians in Upper Carriage Lane at its opening from Lee Street. | The revised design has a dive structure for road vehicles to access to the Adina Hotel basement and Atlassian, as well as a ramp for pedestrian access to these properties. Northbound vehicles on the ascending ramp and northbound pedestrians on the descending ramp would converge towards each other from different grades/ levels with risks of each user not being able to see the other clearly. This could increase the risk of *vehicle-pedestrian* collisions. This is especially if the pedestrian walks centrally along their ramp such that the driver's view of them is obstructed by the ramp itself. The same conflict would arise for vehicles at G versus cyclists descending from point H. It should be noted that there are bicycle racks proposed for the development and would be accessible via the pedestrian ramp.<br>There are also multiple *vehicle-pedestrian* conflicts involving pedestrians crossing to/from the north, and inbound-outbound vehicles.<br>  <br>  <br>***Left:*** *Outbound vehicles would tend to ascend the ramp from point G and converge towards pedestrians that descend their ramp from point H. These two users would converge on each other with potentially limited visibility of each other. This could increase the risk of vehicle-pedestrian collisions. Other vehicle-pedestrian conflicts are also circled in orange.* ***Right:*** *A long section showing the impact of the different grades/ levels that pedestrians (H) and vehicles (G) would converge towards each other from.* | Medium |

# 3 Summary of recommendations

Tables 2 and 3 of this report correspond to the audit findings at the concept and detailed design stages respectively. Whilst the primary function of these tables was to report on the road safety issue, brief descriptions of the recommended improvement measures were also included. These recommendations are further summarised in Table 4.

**Table 4 Summary of audit recommendations.**

| Ref | Summary of issue | Recommended improvement measure |
|---|---|---|
| Table 2, item C1 | Lack of right-turn restrictions into and out of Upper Carriage Lane. | The signage scheme as illustrated below could be implemented to effect a *left-in-left-out* (LILO) rule. A narrow-profiled median could also be considered to complement this scheme. The signage scheme would consist of:<br>▪ An R2-6 NO RIGHT TURN sign facing south to prohibit northbound right-turns from Lee Street to Upper Carriage Lane.<br>▪ An R2-14 LEFT TURN ONLY sign facing outbound traffic in Upper Carriage Lane to force all outbound traffic to turn left.<br>  <br>***Above:*** *Improvement measures for effecting a LILO scheme using signage and a narrow-profiled median island. Note that if modifications in item C2 are adopted, then sign positions may need to be revised.* |

| Ref | Summary of issue | Recommended improvement measure |
|---|---|---|
| Table 2, item C2 | Limited passing clearance for inbound and outbound traffic in Upper Carriage Lane. | The layout changes as suggested in the illustration below could be adopted. This would include:<br>▪ Widening and flaring of the trafficable portion of the driveway. A raised wall/ device could be extended and flared as per the blue line to channel pedestrians and separate the grade difference between the pedestrian ramp and the vehicle ramp.<br>▪ The kerblines on Lee Street would be adjusted accordingly as per the red lines.<br>▪ Linemarking and pavement markings (left-turn arrow) could be installed as per the green markings.<br>Note that if these measures are taken in tandem with the signage suggestions (item C1), then the signs would need to be relocated accordingly.<br>  <br>***Above:*** *A suggested layout to improve passing clearance at the start of the driveway (Upper Carriage Lane).* |
| Table 2, item C3 | Potential obstructions and flow-breakdown in the immediate departure of Upper Carriage Lane. | The signage scheme as illustrated below could be implemented The signage scheme would consist of:<br>▪ NO STOPPING signs either side of the driveway with double sided arrows.<br>  <br>***Above:*** *Signage measures for keeping the driveway clear of stopped vehicles and obstructions. Note that if modifications in item C2 are adopted, then sign positions may need to be revised.* |
| Table 2, item C4 | Potential sight obstructions for outbound traffic from Atlassian, due to obstructions and queued vehicles in the Country Link driveway. | There is not much scope to improve this aspect since it lies outside the project boundary. However, if an opportunity presents, a signage scheme similar to that in item C3 could be adopted for the Country Link driveway. |

| Ref | Summary of issue | Recommended improvement measure |
|---|---|---|
| Table 3, item 3.1 | Conflict between vehicles and pedestrians in Upper Carriage Lane at its opening from Lee Street. | See the recommendation for item C2 above. |

# 4 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**<br>▪ 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).<br>▪ Has the design of the project remained unchanged since previous audit (if any)? | The previous audit findings were reviewed against the new design. This is covered in Section 1.3. |
| **3.1.2 Drainage**<br>▪ Will the new road drain adequately?<br>▪ Are the road grades and crossfalls adequate for satisfactory drainage?<br>▪ Are flat spots avoided or adequately dealt with at start/end of superelevation?<br>▪ Has the possibility of surface flooding been adequately addressed, including overflow from surrounding or intersecting drains and water courses?<br>▪ Is gully pit spacing adequate to limit flooding?<br>▪ Is pit grate design safe for pedal cycles? (i.e. gaps not parallel with wheel tracks)<br>▪ Will footpaths drain adequately? | Yes. Flood interceptor pit shown on dive structure. |
| **3.1.3 Climatic conditions**<br>▪ 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**<br>▪ Will drivers be able to see pedestrians (and vice versa) past or over the landscaping?<br>▪ Will intersection sight lines be maintained past or over the landscaping?<br>▪ Will safety be adequate with seasonal growth? (for example, no obscuring of signs, shading or light effects, slippery surface, etc.)<br>▪ Will roadside safety be adequate when trees or plantings mature (no roadside hazard)?<br>▪ Has 'frangible' vegetation been used in possible run-off road areas? | NA. |
| **3.1.5 Services**<br>▪ Does the design adequately deal with buried and overhead services? (especially in regard to overhead clearances, etc.)<br>▪ 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) | Services plans not provided. |

| Checklist questions | Comments |
|---|---|
| **3.1.6 Access to property and developments**<br>▪ Can all accesses be used safely?<br>▪ Is the design free of any downstream or upstream effects from accesses, particularly near intersections?<br>▪ Do rest areas and truck parking area have adequate sight distance at access points? | Issues raised with *vehicle-pedestrian* conflicts. |
| **3.1.7 Emergencies, breakdowns, emergency and service vehicle access**<br>▪ Has provision been made for safe access and movements by emergency vehicles?<br>▪ Does the design and positioning of medians and vehicle barriers allow emergency vehicles to stop and turn without unnecessarily disrupting traffic?<br>▪ Have broken-down vehicles or stopped emergency vehicles been adequately considered?<br>▪ Is provision for emergency telephones satisfactory?<br>▪ Are median breaks on divided carriageways safely located? (i.e. frequency, visibility) | Yes. |
| **3.1.8 Future widening and/or realignments**<br>▪ 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?)<br>▪ Is the transition between single and dual carriageway (either way) handled safely? | Unknown. |
| **3.1.9 Staging of the scheme**<br>▪ If the scheme is to be staged or constructed at different times:<br>  ▪ are the construction plans and program arranged to ensure maximum safety?<br>  ▪ 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**<br>▪ 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**<br>▪ Does the design handle accesses to major adjacent generators of traffic and developments safely?<br>▪ Is drivers' perception of the road ahead free of misleading effects of any lighting or traffic signals on an adjacent road?<br>▪ Has the need for screening against glare from lighting of adjacent property been adequately considered? | Yes. |

| Checklist questions | Comments |
|---|---|
| **3.1.12 Stability of cut and fill**<br>▪ Is the stability of batters satisfactory? (for example, no potential for loose material to affect road users) | Structures will be used for level differences. |
| **3.1.13 Skid resistance**<br>▪ 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**<br>▪ Does the horizontal and vertical design fit together correctly?<br>▪ Is the vertical alignment consistent and appropriate throughout?<br>▪ Is the horizontal alignment consistent throughout?<br>▪ Is the alignment consistent with the function of the road?<br>▪ 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**<br>▪ Are lane widths, shoulders, medians and other cross section features adequate for the function of the road?<br>▪ Are the shoulder widths adequate for stationary vehicles and errant vehicles?<br>▪ Are median widths adequate for road furniture?<br>▪ Is superelevation consistent with the road environment?<br>▪ Is the width of traffic lanes and carriageways suitable in relation to:<br>  ▪ alignment?<br>  ▪ traffic volume?<br>  ▪ vehicle dimensions?<br>  ▪ the speed environment?<br>  ▪ combinations of speed and traffic volume?<br>▪ Are the shoulder crossfalls safe for vehicles to traverse?<br>▪ Are batter slopes drivable for cars, trucks?<br>▪ Are side slopes under structures appropriate?<br>▪ Have adequate facilities been provided for pedestrians and cyclists? | Narrow width would be susceptible to queuing and spill back. |
| **3.2.3 Effect of cross-sectional variation**<br>▪ Is the design free of undesirable variations in cross section design?<br>▪ Are crossfalls safe? (particularly where sections of existing highway have been used, there have been compromises to accommodate accesses, at narrowings at bridges, etc.)<br>▪ Are any curves with adverse crossfall within appropriate limits?<br>▪ Is superelevation provided and sufficient at all locations where required? | Yes. |

| Checklist questions | Comments |
|---|---|
| **3.2.4 Roadway layout**<br>▪ Are all traffic management features designed so as to avoid creating unsafe conditions?<br>▪ Is the layout of road markings and reflective materials able to deal satisfactorily with changes in alignment? (particularly where the alignment may be substandard)<br>▪ Is there adequate provision for overtaking?<br>▪ Are overtaking lanes provided where required and safely commenced and ended?<br>▪ Are overtaking requirements satisfactory?<br>▪ Is the design free of sunrise/sunset problems?<br>▪ Have public transport requirements been adequately catered for? | NA. |
| **3.2.5 Shoulders and edge treatment**<br>▪ Are the shoulders likely to be safe if used by slow moving vehicles or cyclists?<br>▪ Are the following safety aspects of shoulder provision satisfactory?<br>  ▪ provision of sealed or unsealed shoulders<br>  ▪ width and treatment on embankments<br>  ▪ crossfall of shoulders | NA. |
| **3.2.6 Effect of departures from standards or guidelines**<br>▪ Any approved departures from standards or guidelines:is safety maintained?<br>▪ Any hitherto undetected departures from standards: is safety maintained? | Yes. |
| **3.2.7 Visibility and sight distance**<br>▪ Are horizontal and vertical alignments consistent with visibility requirements?<br>▪ Has an appropriate design speed been selected for visibility requirements? | Limited visibility between outbound drivers and outbound pedestrians. |
| **3.2.8 Environmental treatments**<br>▪ 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**<br>▪ Are horizontal and vertical alignments consistent with the visibility requirements?<br>▪ Is the design free of sight line obstructions due to safety fences or barriers?<br>  ▪ boundary fences?<br>  ▪ street furniture?<br>  ▪ parking facilities?<br>  ▪ signs?<br>  ▪ landscaping?<br>  ▪ bridge abutments?<br>  ▪ parked vehicles in laybys or at the kerb?<br>  ▪ queued traffic?<br>▪ Are railway crossings, bridges and other hazards all conspicuous?<br>▪ Is the design free of any other local features which may affect visibility?<br>▪ 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?<br>▪ Has a clear headroom or a high vehicle detour been provided where necessary?<br>▪ Is visibility adequate at:<br>  ▪ any pedestrian, bicycle or cattle crossings?<br>  ▪ access roads, driveways, on and off ramps, etc.?<br>▪ Has the minimum sight triangle been provided at:<br>  ▪ entry and exit ramps?<br>  ▪ gore areas?<br>  ▪ intersections?<br>  ▪ roundabouts?<br>  ▪ other conflict points? | See item 3.2.7. |

| Checklist questions | Comments |
|---|---|
| **3.3.2 New/existing road interface**<br>▪ Have implications for safety at the interface been considered?<br>▪ Is the transition from old road to the new scheme satisfactory?<br>▪ If the existing road is of a lower standard than the new scheme, is there clear and unambiguous warning of the reduction in standard?<br>▪ Have the appropriate provisions for safety been made where sudden changes in speed are required?<br>▪ Is access or side friction handled safely?<br>▪ 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)<br>▪ If carriageway standards differ, is the change effected safely?<br>▪ Is the transition where the road environment changes (for example, urban to rural; restricted to unrestricted; lit to unlit) done safely?<br>▪ Has the need for advance warning been considered? | Interface conflicts noted between vehicles and pedestrians. |
| **3.3.3 Readability of the alignment by drivers**<br>▪ Will the general layout, function and broad features be recognised by drivers in sufficient time?<br>▪ Will approach speeds be suitable and will drivers correctly track through the scheme? | Yes. |
| **3.3.4 Detail of geometric design**<br>▪ Are the design standards appropriate for all the requirements of the scheme?<br>▪ Is consistency of general standards and guidelines, such as lane widths and crossfalls, maintained? | Yes. |
| **3.3.5 Treatment at bridges and culverts**<br>▪ 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**<br>▪ Are horizontal and vertical alignments at the intersection or on the approaches to the intersection consistent with the visibility requirements?<br>▪ Is the standard adopted for provision of visibility appropriate for the speed of traffic and for any unusual traffic mix?<br>▪ Will the design be free of sight line obstructions due to safety fences or barriers<br>  ▪ boundary fences?<br>  ▪ street furniture?<br>  ▪ parking facilities?<br>  ▪ signs?<br>  ▪ landscaping?<br>  ▪ bridge abutments?<br>  ▪ parked vehicles in laybys and at the kerb?<br>  ▪ queued traffic?<br>▪ Are railway crossings, bridges and other hazards all conspicuous?<br>▪ Is the design free of any other local features which may affect visibility? | Yes. Outbound traffic is expected to be travelling at a very low speed. |
| **3.4.2 Layout**<br>▪ Are intersections and accesses adequate for all vehicular movements?<br>▪ Have the appropriate design vehicle and check vehicle been used for turning dimensions?<br>▪ Are swept paths accommodated for all likely vehicle types? (has the appropriate design vehicle been used?)<br>▪ Are intersections free of any unusual features which could affect road safety?<br>▪ Are pedestrian fences provided where needed? (for example, to guide pedestrians or discourage parking)<br>▪ Has pavement anti-skid treatment been provided where needed?<br>▪ Have islands and signs been provided where required?<br>▪ Vehicles which may park at or close to the intersection: can they do this safely or does this activity need to be relocated?<br>▪ Are safety hazards due to parked vehicles avoided? | Issues raised at detailed design stage regarding conflicts between inbound and outbound vehicles.<br>Swept path modelling shows some spatial conflicts. |

| Checklist questions | Comments |
|---|---|
| **3.4.3 Readability by drivers**<br>▪ Will the existence of the intersection and its general layout, function and broad features be perceived correctly and in adequate time?<br>▪ Are the approach speeds and likely positions of vehicles tracking through the intersection safe?<br>▪ Is the design free of misleading elements?<br>▪ Is the design free of sunrise or sunset problems which may create a hazard for motorists? | Yes. |
| **3.4.4 Detailed geometric design**<br>▪ Can the layout safely handle unusual traffic mixes or circumstances?<br>▪ Does any median or any island safely account for:<br>  ▪ vehicle alignments and paths?<br>  ▪ future traffic signals?<br>  ▪ pedestrian storage space and surface?<br>  ▪ turning path clearance?<br>  ▪ stopping sight distance to the nose?<br>  ▪ mountability by errant vehicles?<br>▪ Is adequate vertical clearance to structures provided? (for example, powerlines, shop awnings) | NA. |
| **3.4.5 Traffic signals**<br>▪ Is the signal phasing/sequence safe?<br>▪ Is adequate time provided for traffic movements and pedestrian movements?<br>▪ Will the signal lanterns be visible? (for example, not obstructed by trees, poles, signs or large vehicles)<br>▪ Are lanterns for other approach directions adequately shielded from view?<br>▪ Are high-intensity signals and/or target boards provided if likely to be affected by sunrise/sunset?<br>▪ Does the alignment (vertical and horizontal) provide satisfactory stopping sight distance to the intersection or back of queue?<br>▪ Are pedestrian facilities provided where they are required?<br>▪ Will approaching drivers be able to see pedestrians?<br>▪ Are partially or fully controlled turning phases provided where required?<br>▪ Are signal posts located where they are not an undue hazard?<br>▪ Are road markings for turning traffic satisfactory?<br>▪ Have adequate pedestrian phases been provided? | NA. |

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

| Checklist questions | Comments |
|---|---|
| **3.5.2 Pedestrians**<br>▪ Can pedestrians cross safely at:<br>  ▪ intersections?<br>  ▪ signalised and pedestrian crossings?<br>  ▪ refuges?<br>  ▪ kerb extensions?<br>  ▪ bridges and culverts?<br>  ▪ other locations?<br>▪ Is each crossing point satisfactory for:<br>  ▪ visibility, for each direction?<br>  ▪ use by the disabled?<br>  ▪ use by the elderly?<br>  ▪ use by children/schools?<br>▪ Is pedestrian fencing on reservations and medians provided where required for each crossing?<br>▪ Is fencing adequate on freeways?<br>▪ Are pedestrians deterred from crossing roads at unsafe locations?<br>▪ Are pedestrian related signs appropriate and adequate?<br>▪ Is width and gradient of pedestrian paths, crossings, etc. satisfactory?<br>▪ Is surfacing of pedestrian paths, crossings, etc.satisfactory?<br>▪ Have dropped kerbs been provided for each crossing?<br>▪ Have channels and gullies been avoided at each crossing?<br>▪ Is lighting satisfactory for each crossing?<br>▪ Are crossings sited to provide maximum use?<br>▪ Is avoidance of a crossing unlikely? (for example, by more direct but less safe alternative) | *Vehicle-pedestrian* conflict identified. |
| **3.5.3 Cyclists**<br>▪ Have the needs of cyclists been considered:<br>  ▪ at intersections (particularly roundabouts)?<br>  ▪ especially on higher speed roads?<br>  ▪ on cycle routes and crossings?<br>  ▪ at freeway entry and exit ramps?<br>▪ Are shared cycleway/footway facilities (including subways and bridges) safe and adequately signed? | Same as *vehicle-pedestrian* conflicts. |

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

| Checklist questions | Comments |
|---|---|
| **3.6.1 Lighting**<br>▪ Has lighting been adequately provided where required?<br>▪ Is the design free of features which interrupt illumination? (for example, trees or overbridges)<br>▪ Is the design free of lighting poles that would present a fixed roadside hazard?<br>▪ Are frangible or slip-base poles to be provided?<br>▪ Ambient lighting: if it creates special lighting needs, have these been satisfied?<br>▪ Is the lighting scheme free of confusing or misleading effects on signals or signs?<br>▪ Does the lighting adequately illuminate crossings, nearby paths, refuges, etc.?<br>▪ Are all gore areas adequately illuminated?<br>▪ Are all merge areas adequately illuminated?<br>▪ Is the scheme free of any lighting black patches?<br>▪ If there are locations with accident problems that are<br>▪ known to be amenable to treatment with improved lighting, has this lighting been provided? | Yes, assumed to be same as existing. |
| **3.6.2 Signs**<br>▪ Are signs appropriate for their location?<br>▪ Are signs located where they can be seen and read in adequate time?<br>▪ Will signs be readily understood?<br>▪ Are signs appropriate to the driver's needs? (for example, direction signs, advisory speed signs, etc.)<br>▪ Are signs located so that drivers' sight distance is maintained?<br>▪ Are signs located so that visibility is maintained:<br>  ▪ to/from accesses and intersecting roads?<br>  ▪ to/from pedestrians and important features on the road?<br>▪ Have the consequences of vehicles striking signposts been considered?<br>▪ Are sign supports out of the clear zone?<br>▪ If not, are they:<br>  ▪ frangible?<br>  ▪ shielded by barriers (e.g. guard fence, crash cushions)?<br>▪ Has an over-reliance on signs (in lieu of adequate geometric design) been avoided?<br>▪ Are signs on the new scheme consistent with those on the adjoining section of road (or will the previous signs need to be upgraded)? | Signage details not provided in plans. |

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

| Checklist questions | Comments |
|---|---|
| **3.7.3 Crash barriers**<br>▪ Are crash barriers provided where necessary and properly detailed? (for example, at embankments, structures, trees,<br>▪ 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.)<br>▪ Are the end conditions of the crash barrier safe and satisfactory?<br>▪ Is the guard fence designed according to standards for:<br>  ▪ end treatments?<br>  ▪ anchorages?<br>  ▪ post spacing?<br>  ▪ block outs?<br>  ▪ post depth?<br>  ▪ rail overlap?<br>  ▪ stiffening at rigid obstacles?<br>▪ Is all guard fence necessary? (i.e. what it shields is a greater hazard than the fence)<br>▪ 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**<br>▪ Are bridge barriers and culvert end walls safe regarding:<br>  ▪ visibility?<br>  ▪ ease of recognition?<br>  ▪ proximity to moving traffic?<br>  ▪ the possibility of causing injury or damage?<br>  ▪ collapsible or frangible ends?<br>  ▪ signs and markings?<br>  ▪ connection of crash barriers?<br>  ▪ roadside hazard protection?<br>▪ Is the bridge railing at the correct level and strong enough?<br>▪ Is the shoulder width on the bridge the same as on the adjacent road lengths?<br>▪ Is safe provision made for non-vehicular traffic over structures? (for example, pedestrians, pedal cycles, horses/stock, etc).<br>▪ Are all culvert end walls (including driveway culverts) drivable or outside the clear zone?<br>▪ Have causeways/floodways etc. been given correct signing and adequate sight distance? | NA. |
| **3.8 Additional questions to be considered for development proposals** | Questions omitted as issues adequately covered by other checklist questions. |
| **3.9 Any other matter** | |

| Checklist questions | Comments |
|---|---|
| **Safety aspects not already covered**<br>▪ Is the road able to safely handle oversize vehicles, or large vehicles like trucks, buses, emergency vehicles, road maintenance vehicles?<br>▪ If required, can the road be closed for special events in a safe manner?<br>▪ If applicable, are special requirements of scenic or tourist routes satisfied?<br>▪ Have all unusual or hazardous conditions associated with special events been considered?<br>▪ Have all other matters which may have a bearing on safety been addressed? | No. |