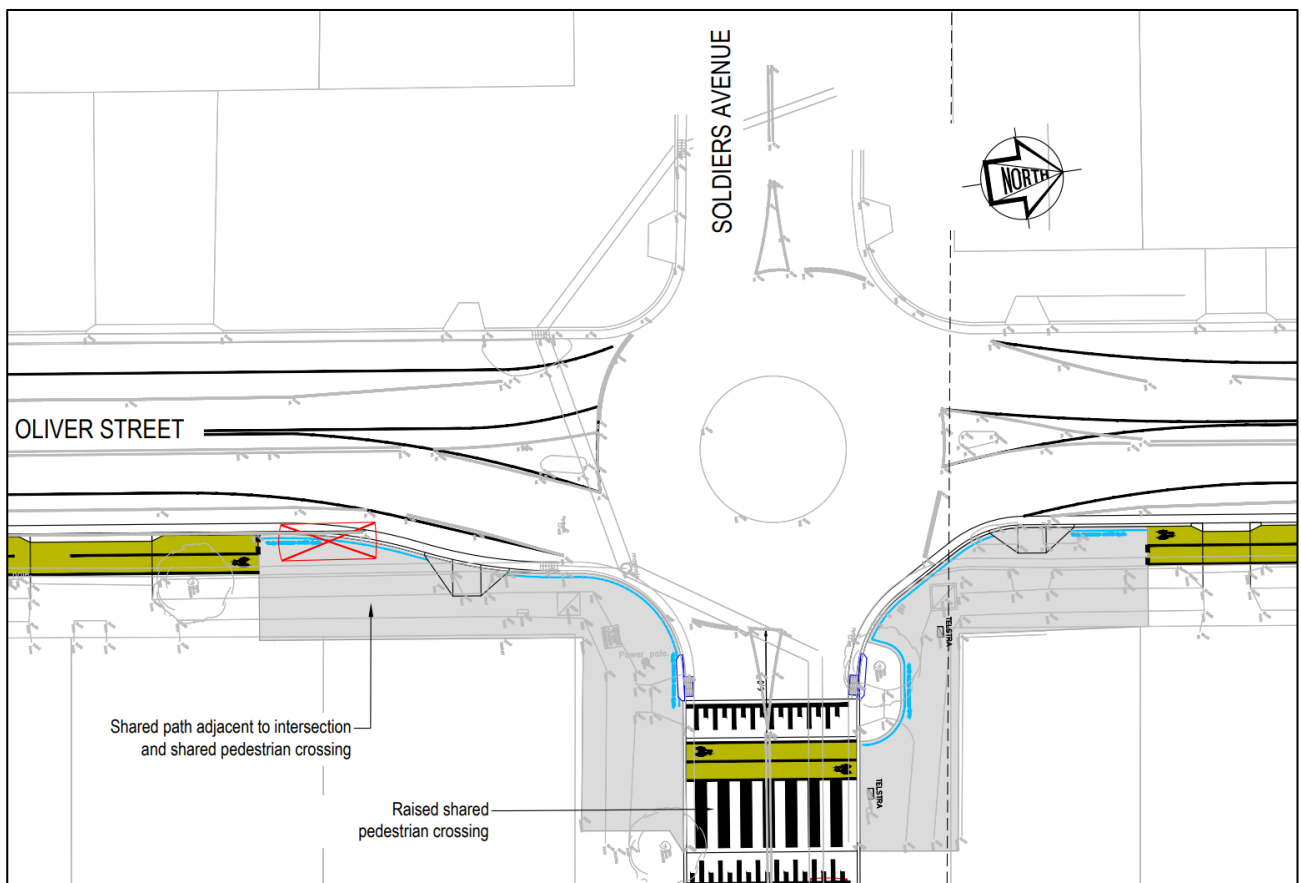


Northern Beaches Council

Oliver Street-Bennett Street-Park Street bicycle route, Freshwater

Concept design road safety audit



Northern Beaches Council

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Concept design road safety audit

Authors

Damien Chee

A handwritten signature in black ink that reads 'Damien Chee'. The signature is written in a cursive style with a horizontal line underneath it.

Report No

NBC-PROJ-0008-01 CD RSA OLIVER-BENNETT REV 1

Date

2/7/2022

This report has been prepared for Northern Beaches Council.

CONTENTS

1	Introduction	2
1.1	Project and audit details	2
1.2	Responding to the audit report	3
1.3	Previous audits	3
2	Safety audit findings	4
3	Issues raised by project team	15
4	Concluding statement	17

Appendices

- Appendix A
- 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 bicycle route along Oliver Street-Bennett Street-Park Street between Lawrence Street and John Fisher Park (Curl Curl).
Client/ contact	Michell Carter Strategic Transport Coordinator Northern Beaches Council Ph: 0434 073 289 E: Michelle.Carter@northernbeaches.nsw.gov.au
Audit type	<i>Concept design</i> road safety audit.
Purpose	A <i>concept design</i> road safety audit was required so that safety issues could be considered and addressed in the refinement of the design.
Background	<p>Northern Beaches Council has received funding from Transport for NSW (TfNSW) through the Federal Stimulus School Zone program to construct:</p> <ul style="list-style-type: none">Two-way dedicated cycleway/shared path in Oliver Street-Bennett Street, Freshwater between Lawrence Street and Park Street.A 10km shared zone in Park Street, Freshwater with stamped asphalt. <p>Council requested an independent road safety audit to be carried out on the draft concept design. This report details the processes and findings associated with this <i>concept design</i> road safety audit.</p>
Scope of project/ audit	<p>As a <i>concept design</i> road safety audit, the following plans from project package 3321 were issued to the audit team and considered to be the auditable materials and scope:</p> <ul style="list-style-type: none">100.01100.02100.04 to 10.12Typical cross section sheet 1. <p>All plans were marked as revision A.</p> <p>As a <i>concept design</i> stage road safety audit, the primary focus of the audit was on the higher-level planning issues such as the route alignment and choice, method of traffic control and pedestrian-bicycle crossings over each road, the choice of facility/ amenity (footpath, shared path, bicycle only path etc), and the suitability of the designed route to the likely bicycle user groups that are likely to use these facilities. The more detailed aspects of the project (which were not included in the design anyway) were not examined as these would generally be more comprehensively reviewed at the detailed design stage. This would include consideration of specific locations along the route and more “microscopic” assessment of the potential safety issues (eg. impact of tree roots on path slab uplift, potential for leaf litter over bicycle paths etc).</p>
Audit team details	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	<p>The audit was undertaken using the following methodology:</p> <ul style="list-style-type: none"> ▪ The concept design was reviewed on 27/6/2022. ▪ A site inspection was carried out on 29/6/2022. This was only for familiarisation purposes, to understand the pre-existing road, traffic and land use conditions, and to contextualise the setting/ environment that the landscaping works would be delivered in. ▪ The road safety audit findings have been documented in this report in accordance with the NSW Centre for Road Safety's <i>Guidelines for Road Safety Audit Practices</i> (2011). The audit findings are documented in Section 2. ▪ The project team also issued a list of concerns as raised by the community. These were only reviewed by the audit team after the review of the plans and the documentation of the audit findings (Section 2). This was to ensure that the audit was conducted independently and objectively, without influence from pre-determined community concerns. ▪ This report includes completed road safety audit checklist as sourced from the Austroads <i>Guide to Road Safety Part 6A: Implementing Road Safety Audits</i>.
Material supplied	See <i>scope of audit</i> .
Meeting and assessment details	<p>Review of plans on 27/6/2022.</p> <p>Site inspection carried out on 29/6/2022.</p>

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 audit reports of direct relevance to this project that were issued to the audit team.

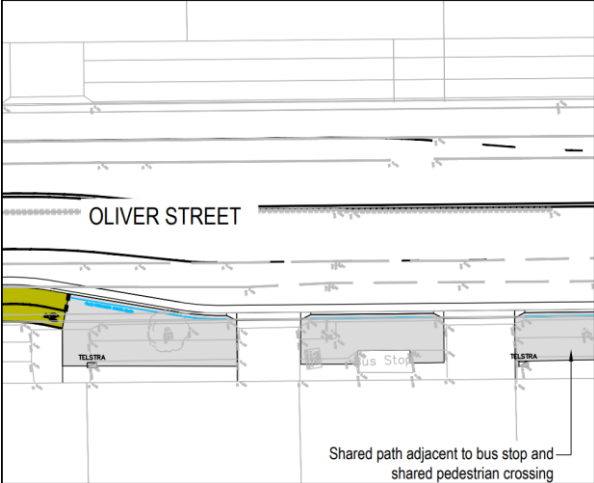

2 Safety audit findings

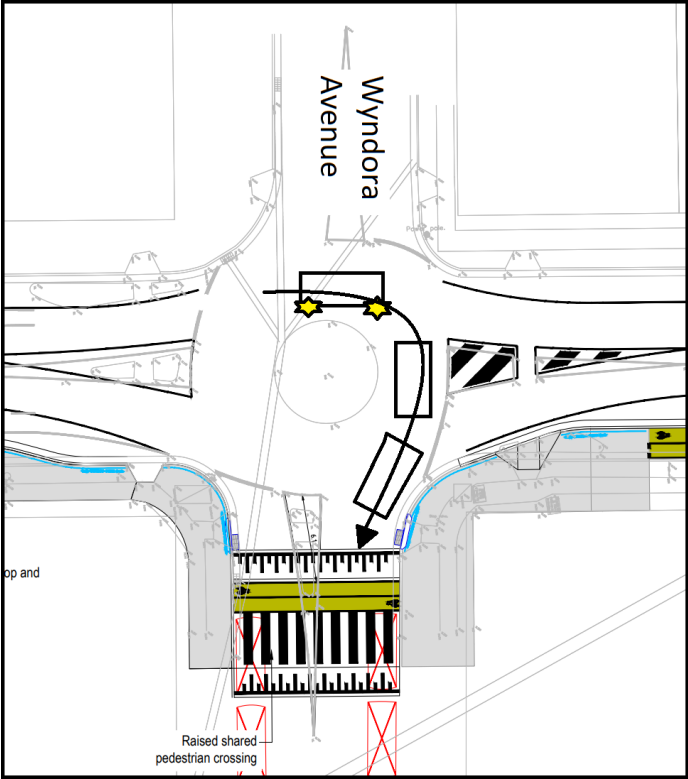
The road safety audit findings are documented in Table 2.

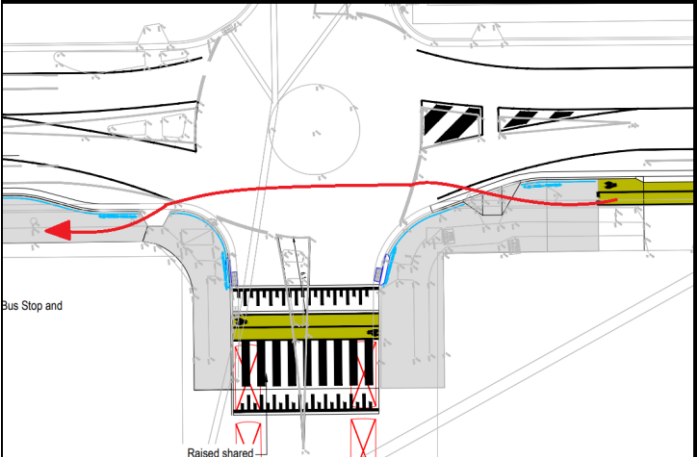
Table 2 Road safety audit findings.

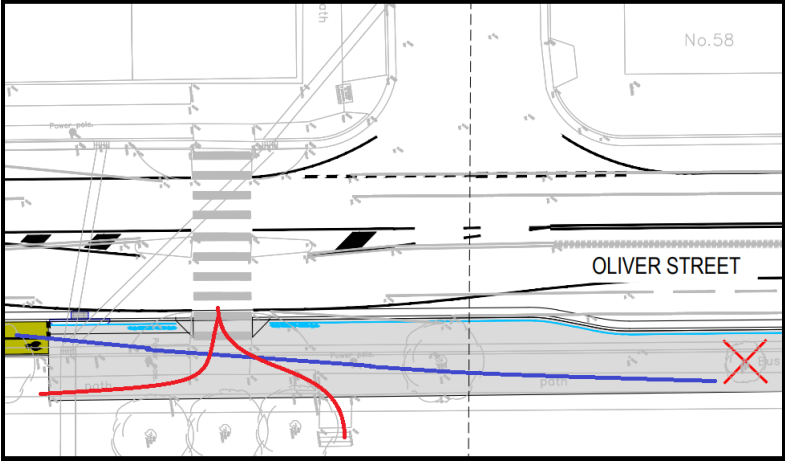
Ref	Location/ priority	Road safety audit finding	Priority
1	North-eastern corner of the Oliver Street/ Brighton Street intersection.	<p>The left-hand image shows the proposed layout of the pedestrian-bicycle crossings over Oliver Street and Brighton Street as well as the two-way cycleway extending to the north, along the western side of Oliver Street. The relative arrangement of the zebra stripes (marking the pedestrian crossing) and the green coloured paving (marking the bicycle route) creates an unnecessary cross over conflict as shown, between pedestrians and cyclists. This could result in <i>bicycle-pedestrian</i> crashes.</p> <p>The right-hand image shows a simple revision to the design which has switched the relative positions of the zebra markings and the green coloured bicycle crossing over the Brighton Street eastern leg of the intersection. This simple revision is more likely to reduce the need for pedestrian and bicycle cross over movements.</p> <p>Note: In each diagram, the blue line represents the bicycle travel path and the red line represents the pedestrian travel path.</p> <p>Left: The relative positions of the zebra markings and the green coloured bicycle paths would create an unnecessary cross over conflict between these two users as shown. Right: By switching the relative positions of the zebra markings and the green coloured bicycle crossing in the Brighton Street eastern leg, this could reduce the degree of conflict between the two road user groups.</p>	Medium

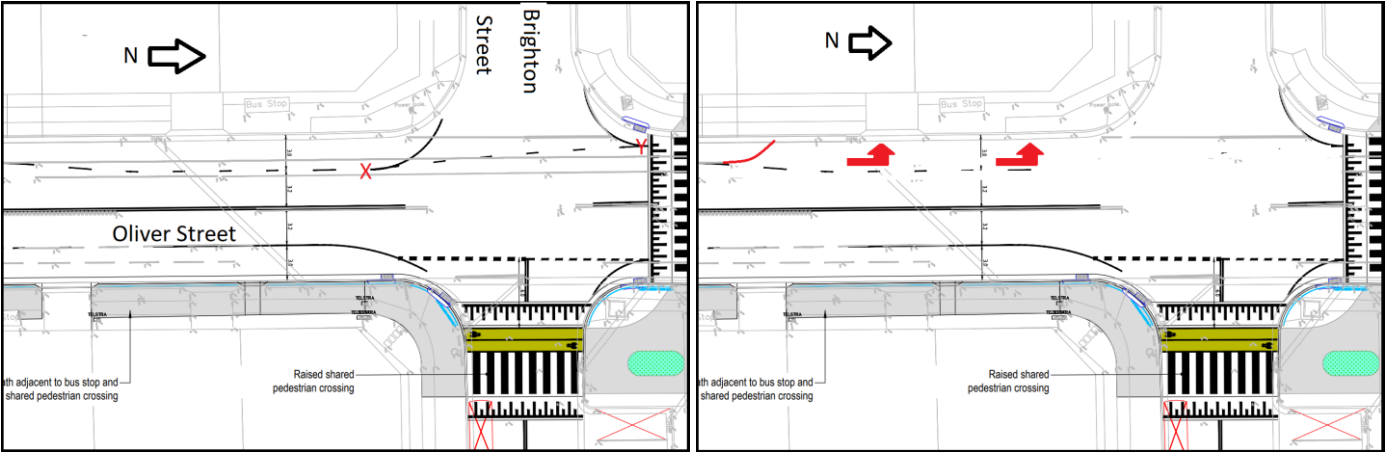
Ref	Location/ priority	Road safety audit finding	Priority
2	<p>General – Implications of pedestrian-bicycle crossings in side roads which are close to the intersection with Oliver Street.</p> <p>NB. Although the Oliver Street/ Brighton Street intersection is used as the example in the diagrams, this issue and the stated risks should be considered at ALL crossings over minor road legs to intersections.</p>	<p>The design proposes several pedestrian-bicycle crossings in the side roads stemming off Oliver Street. In general, these are offset 6m from the hold lines of the intersection. The audit team notes the following concerns and crash conflicts:</p> <ul style="list-style-type: none"> Any vehicles stopped at the hold lines may generate queuing and queue spillback over the crossing as shown in the left-hand image (row of green cars). This may block the crossing which therefore has several reactive risks by pedestrians and cyclists, as follows: <ul style="list-style-type: none"> Pedestrians-cyclists that cross from the far side of the crossing (movement 1) may become trapped on the road and unable to complete the crossing due to the queued vehicles. This could prolong their presence on the road, and increase exposure to impacts by other vehicles. Pedestrians-cyclists from the near side of the road may attempt to cross between or behind queued traffic (movement 2). This is dangerous as these crossing road users may be hidden from the view of other drivers, such as (in this case) the northbound right-turning vehicle marked as movement 3. Any vehicles that turn into the side road may not expect to encounter a crossing this close to the intersection, nor the need to stop in response to a crossing road user. Using the left-hand image, the northbound right-turning driver (movement 3) would tend to look to the north to judge for gaps in the southbound <i>through</i> traffic stream. By doing so, they may fail to observe the conditions in the Brighton Street departure including the crossing, and any crossing road users. This could lead to a <i>right-turn on pedestrian/ bicycle</i> crash. Also, if they accept a substandard gap in the southbound traffic stream, they may tend to accelerate hard when making the turn, only to be faced with the immediate need to slow down and/or stop. Most drivers tend to accelerate when departing from an intersection. Even if the eastbound departing vehicle stops in response to crossing pedestrian-bicycle (green car in the right-hand image), this could leave them exposed to impacts by other vehicles (eg. purple vehicle), especially if they extend back into the control area of the intersection. In most cases, the hold line was not in line with the projection line of the kerbs either side of the intersection. Using the left-hand image, the first green vehicle at the head of queue has stopped clear of the hold line, but would still be exposed to impacts by southbound vehicles on Oliver Street due to the lack of protection from the kerblines. <div style="display: flex; align-items: flex-start;"> <div style="margin-left: 20px;"> <p>Left-hand image: If a vehicle in the side road stops at the hold line, it could generate a queue which extends over and blocks the pedestrian-bicycle crossing.</p> <p>Right-hand image: If a vehicle entering the side road (green vehicle) stops in response to a crossing road user (yellow dot), this could leave the green vehicle exposed to impacts by other vehicles (eg. purple vehicle).</p> </div> </div>	Medium

Ref	Location/ priority	Road safety audit finding	Priority
3	General - Pedestrian safety at bus stops and pick up zones throughout the project.	<p>The design proposes several shared paths where pedestrians and cyclists will share common use of the path without any formal designation of bicycle only lanes, or pedestrian exclusive areas. This includes several bus stops along Oliver Street and Bennett Street. Overall, there are noted risks of:</p> <ul style="list-style-type: none"> ▪ Pedestrians being impacted by bicycles moving past the bus stops. This includes standing pedestrians as they wait for buses to arrive. ▪ Bicycle crashes into the multitude of structures at these locations including poles, bus shelters etc. ▪ The squeeze point created at these locations with substantial occupation of the area by pedestrians, structures etc. This could simply make the area impassable by bicycles. <p>The same issues apply to the school drop off and pick up zone at Harbord Primary School. The eastern kerbline of Oliver Street at this school could contain many school children as they wait for and move towards their vehicles. It may also include many parents/ carers as they wait for and walk their children home. During peak school zone periods, parts of this footpath could also become impassable by cyclists.</p> <div style="display: flex; align-items: center;">   </div> <p>Left: Extract from the design showing an example of a proposed shared path and bus stop. Right: The same bus stop as viewed under existing and pre-project conditions. Note the general lack of verge space due to the bus shelter, utility poles and trees. This verge would be even more obstructed with bus passengers waiting for or alighting from buses.</p>	Medium

Ref	Location/ priority	Road safety audit finding	Priority
4	Oliver Street roundabouts with Wyndora Avenue and Soldiers Avenue.	<p>The Oliver Street intersections with Wyndora Avenue and Soldiers Avenue are both roundabouts. Under the proposed design, these will both contain pedestrian-bicycle crossings over the eastern leg, which is in the immediate approach-departure to the roundabout. Item 2 discussed the risks associated with having crossings too close to priority control points. These included risks of queues from the intersection spilling back over the crossing, or alternatively, queues from the crossing spilling back into the intersection. The issues described in item 2 would all persist with the two roundabouts at the Wyndora Avenue and Soldiers Avenue intersections. Furthermore, drivers departing into the eastern legs may have even less expectation of the crossing (and crossing pedestrians and cyclists) compared with non-roundabout intersections. This is because of the circular path driven by drivers, especially in right-turn movements. As shown below, a right-turning driver would need to negotiate a 90-degree turn through a circulating path. This would also involve sight lines in the forward view which would be, for most of the time, angled well away from the subject crossing. Drivers also tend to accelerate when departing roundabouts, and most drivers do not expect to encounter situations that require them to stop this soon after departing from a roundabout.</p> <p>Although the Wyndora Avenue intersection is shown below, this issue also applies to the Soldiers Avenue intersection.</p>  <p><i>Left: Drivers using the roundabout, especially right-turners would not expect to encounter a crossing or the need to stop this soon after departing from the roundabout.</i></p>	Medium

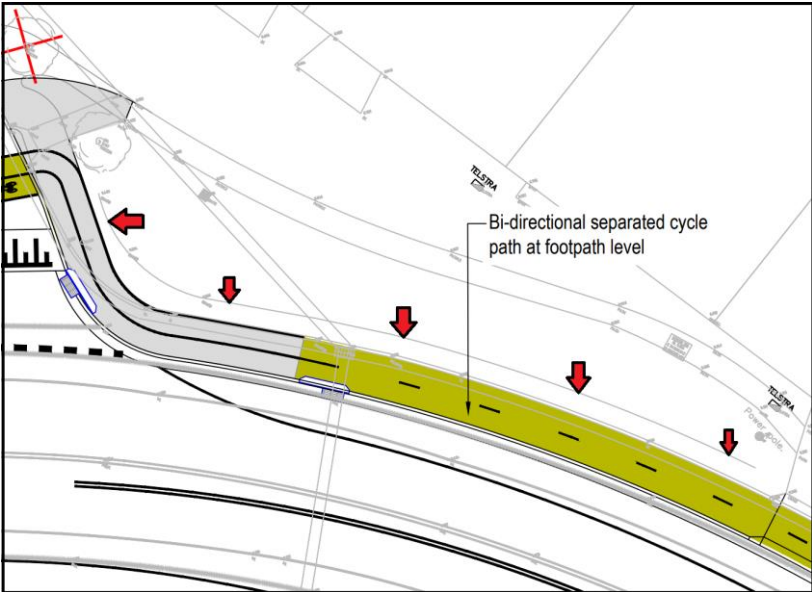
Ref	Location/ priority	Road safety audit finding	Priority
5	Bicycle movements at the Oliver Street/ Wyndora Avenue roundabout and the Oliver Street/ Soldiers Avenue roundabout.	<p>The project team should be mindful of the types of cyclists that are likely to, or expected to use the cycleway. Under current, pre-project conditions, these cyclists would be ones that travel on the road and adjacent to the northbound and southbound road traffic. As such, they would have a higher risk tolerance and would tend to be more competent cyclists compared with (say) recreational cyclists that would opt to use a shared path. In these respects, the re-distribution of these cyclists to the proposed cycleway may not perform as expected and some deviations from expected behaviour should be expected.</p> <p>Firstly, these cyclists may experience frustration and dissatisfaction in the level of service offered by the shared path portions of the project. In the pre-project scenario, these cyclists would have shared on road space with road vehicles and would enjoy faster travel times and less physical hinderances. In the post-project scenario, these same cyclists would need to negotiate kerb ramps; shared paths that may contain slow-moving or stationary pedestrians; bus loading/ unloading activity; and obstructions such as trees, signs, poles and bus shelters.</p> <p>Secondly, the crossings at the two roundabouts are “bent out” facilities requiring cyclists to deviate significantly from the otherwise straight line travel route. Rather than deviate this course to use the designated crossing, many of these cyclists may bypass the crossing altogether and use the roadway. The image below shows an example of this where the cyclist would use the kerb ramps to enter the road space, circulate the roundabout and then use the corresponding kerb ramp on the departure side to re-enter the downstream shared path. This puts them at unnecessary risk of impacts by other road vehicles. Also, there does not appear to be anything illegal about making this crossing (although a crossing in the reverse direction, whilst still being an equal temptation would at least be illegal due to the “wrong way” travel through the roundabout).</p> <p>In addition to the roundabouts, this “pick and choose” route-selection behaviour may also occur at various other locations along the route, especially when considering that these would have been cyclists that use the on-road facilities in the pre-project scenario.</p>  <p>Left: Cyclists may be tempted to bypass slower operating facilities such as shared paths and crossings that deviate from the otherwise “straight-line” travel route.</p>	Medium

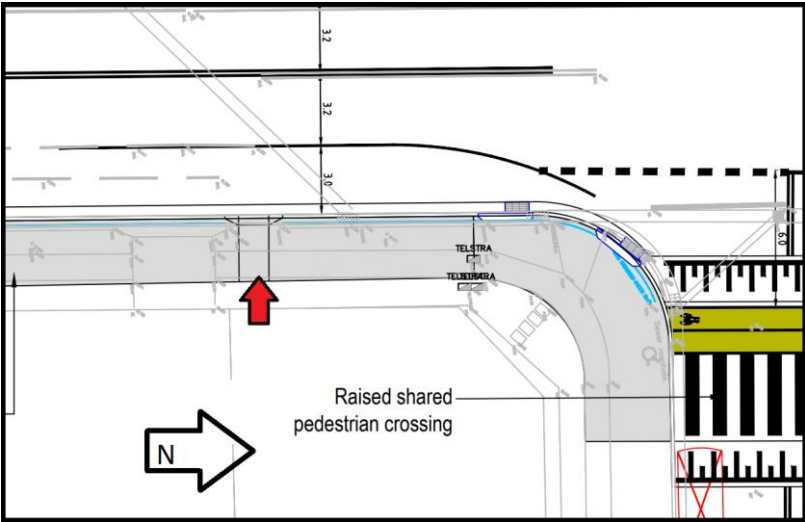

Ref	Location/ priority	Road safety audit finding	Priority
6	Zebra crossing over Oliver Street opposite Johnson Street, and the shared path-cycleway interface	<p>Similar to item 1, there may also be a <i>bicycle-pedestrian</i> cross over conflict in the shared path on the eastern side of Oliver Street opposite Johnson Street. As shown below, the shared path will interface with a cycleway and pedestrian-exclusive footpath to the south. The shared path would allow co-mingling of pedestrians and cyclists. However, as a cyclist heads southbound, they would tend to shift to the west to access the cycleway as per the blue line. By contrast, any pedestrians emerging from the zebra crossing and also heading south would tend to move to the east to access the footpath. This would create a cross over conflict at this point. There may also be other cross over conflicts such as with pedestrians crossing the shared path to access the park.</p> <p>Whilst some degree of cross over conflict would always arise at such shared path interface points with cycleways, there may be merit in shifting this interface point further away from high-use facilities such as zebra crossings. The zebra crossing presents an obvious drainage point for pedestrians and the cross over and interaction with cyclists is almost inevitable given the close distance away from the cycleway.</p>  <p>Left: There is a cross over conflict create due to the transition from shared path to cycleway, and the close proximity to the zebra crossing.</p>	Medium

Ref	Location/ priority	Road safety audit finding	Priority
7	Northbound traffic lane of Oliver Street in approach to Brighton Street.	<p>Throughout most of the project, Oliver Street will have a revised cross section including parking lanes either side of the road and a single traffic lane per direction. The existing and pre-project on-road bicycle lanes will be removed and this space used to reconfigure the traffic and parking lanes as well as to accommodate a two-way cycleway (or widened shared path). However, in the Oliver Street southern leg to its intersection with Brighton Street, the northbound parking lane appears to open up and is separated by a dashed line. The audit team were uncertain what the design intention was at this point, and whether this is supposed to be a left-turn lane. Furthermore, the dashed line through the control area of the intersection is misleading as it guides northbound road traffic from a "pushed out" position at point X to a kerbside position at point Y. Yet further north of this point, this traffic is expected to shift back towards the east due to the presence of the two-way cycleway on the western side of the road.</p> <p>If the design intention was to create a dedicated left-turn lane, then the linemarking arrangement should be revised as shown in the right-hand image.</p>  <p>Left: Extract from the design showing the proposed linemarking layout in the northbound direction of Oliver Street in its approach to Brighton Street. Right: If the design intention is to create a dedicated left-turn lane, then this would be a clearer layout.</p>	Low

Ref	Location/ priority	Road safety audit finding	Priority
8	General – Issues with the relative layout of the cycleway, driveways and the parking lane.	<p>The design includes re-allocation of road width to create a two-way cycleway running along one side of Oliver Street and Bennett Street. The following issues were noted:</p> <ul style="list-style-type: none"> The affected side of the road will include extension of property driveways and new laybacks on the kerblines. The project team should be aware that the laybacks will reduce the effective width of the cycleway. This is both <i>directly</i>, in taking up physical width which would otherwise be used for bicycle transit; as well as <i>indirectly</i> since many cyclists will consciously veer away from these laybacks. There would be a perceived and actual high risk of tracking over the laybacks due to the depressions in the path surface and the abrupt slopes involved. This is especially in wet surface conditions and/or at night time where there could be risks of bicycle slide-out events. The secondary impact of the laybacks is that cyclists would veer away from these and hence occupy the more central part of the cycleway where there would be increased risks of <i>head-on</i> crashes with opposing cyclists. Overall, there is also a risk of car door openings into the cycleway with potential collisions between bicycles and car doors. The parking lane appears to abut the kerbline with minimal lateral buffer to the cycleway. Any pedestrians that alight from parked cars may be under imminent threat of an impact by a cyclist. The new layout may also introduce risks of <i>vehicle-bicycle</i> collisions involving vehicles enter the driveways. In situations where there are vehicles in the parking lane either side of the driveway, a driver may not have a clear view of cyclists on the cycleway, due to these parked cars. These drivers may enter a driveway lacking awareness of a cyclist moving along the cycleway. <div data-bbox="463 660 1727 1046"> </div> <p>Above: Two examples of where driveway laybacks may reduce the effective width of the cycleway. In the right-hand example, near Surfside Parade, a northbound cyclist would be reluctant to keep to the designated northbound bicycle lane due to the high frequency of driveways. If they used the northbound bicycle lane they would need to constantly move in and out to avoid each of the respective laybacks. In reality, they would simply take a straight trajectory down the middle of the cycleway and even possibly in the southbound bicycle lane.</p>	Low

Ref	Location/ priority	Road safety audit finding	Priority
9	Pedestrian-bicycle crossing over Bennett Street, to the west of Oliver Street.	<p>Bennet Street West has a sudden curve in its immediate approach to Oliver Street. This is due to the reversed priority of this T intersection (ie. normally Bennett Street as the straight east-west road would be the higher priority route). The design has responded by making the pedestrian-bicycle crossing in this leg a skewed angled crossing (see left-hand image as an extract of the original design). However, this is not ideal since:</p> <ul style="list-style-type: none"> ▪ The crossing direction is somewhat diagonal and requires a longer crossing length and hence crossing duration. This would unnecessarily increase the time exposure on the roadway. ▪ The crossing direction is not perpendicular with the kerblines. Typically, crossings should be as perpendicular as possible to make these legible to all pedestrian classes (including mobility and vision affected users). ▪ As shown in the left-hand image, the marked centrelines either side of the raised threshold do not match up with each other. The driver would need to “guess” the alignment of the lane as it curves horizontally through the crossing. <p>The right-hand image shows a suggested amendment. This would involve a more perpendicularly aligned crossing with a shorter crossing distance and hence shorter crossing duration. It also means the sloped flanges either side of the threshold are parallel with each other. As shown, there is also a better opportunity to improve the centreline legibility either side of the crossing as well as the expected centreline division/ continuation across the crossing.</p> <div data-bbox="461 632 1715 1174"> </div> <p>Left: Extract from the original design showing the skewed angle of the crossing. Right: A suggested amendment to the design to make this more legible and to reduce the crossing length and duration.</p>	Low

Ref	Location/ priority	Road safety audit finding	Priority
10	Guardrail on the northern side of the Bennett Street/ Oliver Street intersection.	<p>There is an existing guardrail on the northern side of the intersection as marked by the red arrows below. The audit team were uncertain of the reason for this guardrail but it was presumably in response to a noted <i>run off road</i> crash and the need to provide containment and protection against property damage. If this is the case, then the proposed cycleway running along the outside of the guardrail would, all things being equal, expose these cyclists to the same <i>run off road</i> crash problem. Cyclists on this new facility could therefore be exposed to impacts by errant road vehicles. If there is indeed a <i>run off road</i> crash problem, then consideration should be given to relocating the guardrail so that it shields the cycleway as well as the verge beyond.</p>  <p>Left: There is a guardrail on the northern side of the Bennett Street/ Oliver Street intersection as marked by the red arrows.</p>	Low

Ref	Location/ priority	Road safety audit finding	Priority
11	Eastern side of Oliver Street to the south of Brighton Street.	<p>The design shows what appears to be a kerb ramp or driveway layback on the eastern kerbline of Oliver Street as marked by the black arrow. However, the audit team were uncertain as to what this facility is. More clarity/ explanation is needed in the design.</p>  <p>Left: The audit team were uncertain as to what the facility is as marked by the black arrow. It appears to be a kerb ramp or driveway with layback.</p>	Low
12	General – Impact of lane re-configurations on Oliver Street and Bennett Street.	<p>The design involves removal of the two on-road cycleways and reallocation of this width-space to shift the traffic lanes accordingly and to accommodate a two-way cycleway. The project team should be aware that as well as functioning as a bicycle facility, the bicycle lanes provide door-opening envelopes and clearance for parked cars. They also create a buffer between the moving traffic stream and the parked cars. Using the photo below, the cars parked on the kerbline are hard up against the dashed line of the cycleway. This dashed line is also the approximate edge of the shifted traffic lane under post-project conditions. As such, there would be substantially less width to open a car door. Any opened doors are likely to extend considerably into the adjacent traffic lane with corresponding risks of being impacted. Similarly, there is less buffer for drivers to access and alight from these parked vehicles.</p>  <p>Left: With the on-road bicycle lane removed, there will be considerably less offset between the parked cars and the adjacent traffic stream. This photo is looking northbound on Oliver Street to the north of Lawrence Street. However, the issue generally applies to the whole project.</p>	Low

3 Issues raised by project team

The project team raised a number of issues and requested commentary from the audit team. As noted in Section 1, these were only considered after the plans were reviewed and the audit findings compiled. This was specifically to ensure that the audit was conducted independently and objectively.

Table 3 lists the issues and includes a commentary from the audit team.

Table 3 Concerns raised by the project team.

Issue/ concern	Commentary from audit team
Safety of cyclists using the proposed on-road cycleway, particular car dooring by passengers when entering or exiting the vehicle.	Agreed that this is a valid concern. Issue raised in item 8 of the audit findings.
Safety of cyclists and pedestrians when using the existing shared path and proposed shared path in Oliver Street. Consideration of proposed and existing pedestrian crossings.	The audit team raised several issues in these regards. In the first instance, it should be acknowledged that the types of cyclists that the cycleway is designed for are those that currently use the on-road facilities. These tend to be more competent cyclists with a higher risk tolerance. By relocating these cyclists to shared paths, pedestrians could be put at risk simply by virtue of these cyclists being higher speed travellers (as opposed to recreational cyclists that would normally use a shared path). Secondly, many of these shared paths will be cluttered with structures and slow-moving/ stationary pedestrians using the bus stops and crossings. There may be a need for speed management devices at the interface points, such as bollards and the usual shared path signs and pavement markings.
Safety of pedestrians when exiting or entering vehicles and crossing over the two-way dedicated cycleway.	Also acknowledged as a risk in item 8 of the audit findings.
Reduced width to minimum standards for: <ul style="list-style-type: none"> ▪ Dedicated two-way cycleway. ▪ Parking lane (east and west side of the road). ▪ Traffic lanes (each direction). 	Item 12 discussed the impact of the loss of on-road bicycle lanes in their ancillary role as a buffer between road traffic lanes and the parking lane. It also discussed the lack of door-opening clearance from the revised parking lanes relative to the adjacent traffic lanes.
Location of the pedestrian crossing in Oliver Street, near Brighton Street:	Item 1 discussed the layout of the pedestrian and bicycle crossing paths and the unnecessary cross over conflict created in the north-eastern verge area.
Line of sight for pedestrians to view vehicles travelling from the east towards Freshwater Public School. AND Line of sight to view pedestrians on the crossing when travelling from the east to towards Freshwater Public School.	The audit team assumes that this refers to the crossing over Brighton Street in the eastern leg to its intersection with Oliver Street, and the sightline between pedestrians and westbound vehicles. The design indicates the planned removal of some on-street parking. This will improve sightlines to some degree. The full impact of parked cars and sightlines would need to be re-assessed when the designs are solidified (detailed design stage) as well as checked on site after implementation (pre-opening stage).

Issue/ concern	Commentary from audit team
Lawrence Street, Freshwater: Upgrade of pedestrian crossing to shared pedestrian and cyclists crossing.	<p>This would need to be accompanied by a formal change in path status to <i>shared paths</i>, either side of the crossing. More consideration would be needed on the travel mode and functionality of Lawrence Street as the design progresses into detailed design. For example, the following strategies could be considered:</p> <ul style="list-style-type: none"> ▪ Changing the status of road side areas to be shared paths/ shared spaces. ▪ “Down-grading” the speed environment through this retail area and encouraging more sharing of space in the road (either as a formal shared zone or a traffic calmed environment). ▪ Retention of pedestrian priority on paths and regulatory measures stipulating that cyclists need to dismount and walk.
Soldiers Avenue, Freshwater: New shared pedestrian and cyclists crossing .	See items 4 and 5 of the audit findings.
Wyndora Avenue, Freshwater: New shared pedestrian and cyclists crossing.	
Wyuna Avenue, Freshwater: New shared pedestrian and cyclists crossing.	Item 2 is a general finding applying to all situations such as this.
Brighton Street, Freshwater: New shared pedestrian and cyclists crossing.	
Bennett Street, Freshwater: New shared pedestrian and cyclists crossing.	See item 2 as well as item 9. Item 9 discusses the alignment of the crossing over Bennett Street.
<p>Council also requires the road safety audit to identify all concerns relating to safety and not just concerns detailed above. This may include items such as:</p> <ul style="list-style-type: none"> ▪ Proposed and existing shared path. ▪ Bus stops and related infrastructure. ▪ Vegetation and trees. ▪ Lighting. 	<p>As a <i>concept design</i> road safety audit, the focus was on higher level issues such as route choice and alignment, choice of road crossing method and choice of facility (shared path, cycleway, pedestrian-exclusive footpath). More specific issues such as the impact of individual trees on the path should be examined at the detailed design stage once the route (as refined from this concept design stage) is confirmed.</p> <p>Issues surrounding bus stops were discussed in item 3.</p> <p>The audit team assumed that streetlighting would remain the same and the only additional lighting needs would be the new crossings. This is an issue to be examined in the detailed design stage.</p>

4 Concluding statement

DC Traffic Engineering has undertaken a *concept 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

Issue	Comment
2.1 General topics	
1 Changes since previous audit <ul style="list-style-type: none"> Do the conditions for which the scheme was originally designed still apply? (eg. no changes to the surrounding network, area activities or traffic mix) Has the general form of the project design remained unchanged since previous audit (if any)? 	There were no previous road safety audit reports issued to the audit team.
2 Drainage <ul style="list-style-type: none"> Will the scheme drain adequately? Has the possibility of surface flooding been adequately addressed, including overflow from surrounding or intersecting drains and water courses? 	Yes.
3 Climatic conditions <ul style="list-style-type: none"> Has consideration been given to weather records or local experience which may indicate a particular problem? (eg. snow, ice, wind, fog). 	Yes.
4 Landscaping <ul style="list-style-type: none"> If any landscaping proposals are available, are they compatible with safety requirements (eg. sight lines and hazards in clear zones)? 	A more detailed check of each existing tree's impact on the proposed shared path would be needed at the detailed design stage.
5 Services <ul style="list-style-type: none"> Does the design adequately deal with buried and overhead services (especially in regard to overhead clearances, etc)? Has the location of fixed objects or furniture associated with services been checked, including the position of poles? 	Yes.
6 Access to property and developments <ul style="list-style-type: none"> Can all accesses be used safely? (entry and exit/merging). Is the design free of any downstream or upstream effects from accesses, particularly near intersections? Have rest areas and truck parking accesses been checked for adequate sight distance, etc.? 	Driveway laybacks will reduce the effective width of the cycleway.
7 Adjacent developments <ul style="list-style-type: none"> Does the design handle accesses to major adjacent generators of traffic and developments safely? Is the drivers' perception of the road ahead free of misleading effects of any lighting or traffic signals on an adjacent road? 	Yes.
8 Emergency vehicles and access <ul style="list-style-type: none"> 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 & turn without unnecessarily disrupting traffic? 	Yes.

Issue	Comment
9 Future widening and/or realignments <ul style="list-style-type: none"> ▪ 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.
10 Staging of the scheme <ul style="list-style-type: none"> ▪ If the scheme is to be staged or constructed at different times: <ul style="list-style-type: none"> ▪ 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.
11 Staging of the works <ul style="list-style-type: none"> ▪ If the construction is to be split into several contracts, are they arranged safely? 	Unknown.
12 Maintenance <ul style="list-style-type: none"> ▪ Can maintenance vehicles be safely located? 	Yes. Similar to existing conditions.
2.2 Design issues (general)	
1 Design standards <ul style="list-style-type: none"> ▪ Is the design speed and speed limit appropriate (eg. consider the terrain; function of the road)? ▪ Has the appropriate design vehicle and check vehicle been used? 	Yes.
2 Typical cross sections <ul style="list-style-type: none"> ▪ Are lane widths, shoulders, medians and other cross section features adequate for the function of the road? ▪ Is the width of traffic lanes and carriageway suitable in relation to: • <ul style="list-style-type: none"> ▪ Alignment? ▪ Traffic volume? ▪ Vehicle dimensions? ▪ The speed environment? ▪ Combinations of speed and traffic volume? ▪ Are overtaking/climbing lanes provided if needed? ▪ Have adequate clear zones been achieved? 	Loss of door-opening envelope noted. Door-opening impact on cycleway noted. Impact of driveway laybacks noted on cycleway.

Issue	Comment
3 The effect of cross sectional variation <ul style="list-style-type: none"> Is the design free of undesirable variations in cross section design? Are crossfalls safe? (particularly where sections of existing highway have been utilised or there have been compromises to accommodate accesses, etc.) Does the cross section avoid unsafe compromises such as narrowings at bridge approaches or past physical features? 	See previous.
4 Roadway layout <ul style="list-style-type: none"> 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.) 	Issues raised.
5 Shoulders and edge treatment <ul style="list-style-type: none"> Are the following safety aspects of shoulder provision satisfactory: <ul style="list-style-type: none"> Provision of sealed or unsealed shoulders? Width and treatment on embankments? Cross fall of shoulders? Are the shoulders likely to be safe if used by slow moving vehicles or cyclists? Are any rest areas and truck parking areas safely designed? 	Loss of door opening clearance due to the removal of the on-road cycleways.
6 Effect of departures from standards or guidelines <ul style="list-style-type: none"> Any approved departures from standards or guidelines: is safety maintained? Any hitherto undetected departures from standards: is safety maintained? 	Yes.
2.3 Alignment details	
1 Geometry of horizontal and vertical alignment <ul style="list-style-type: none"> Does the horizontal and vertical design fit together correctly? Is the design free of visual cues that would cause a driver to misread the road characteristics (eg. visual illusions, subliminal delineation such as lines of trees, poles, etc.)? Does the alignment provide for speed consistency? 	Yes.

Issue	Comment
<p>2 Visibility; sight distance</p> <ul style="list-style-type: none"> ▪ Are horizontal and vertical alignments consistent with the visibility requirements? ▪ Will the design be free of sight line obstructions due to: <ul style="list-style-type: none"> ▪ 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? 	<p>Potential loss of sight line from drivers to cycleway due to vehicles parked on the kerbside lane.</p>
<p>3 New/existing road interface</p> <ul style="list-style-type: none"> ▪ Does the interface occur well away from any hazard? (eg. 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 (eg. urban to rural; restricted to unrestricted; lit to unlit) Is it done safely? ▪ Has the need for advance warning been considered? 	<p>Yes.</p>
<p>4 'Readability' of the alignment by drivers</p> <ul style="list-style-type: none"> ▪ Will the general layout, function and broad features be recognised by drivers in sufficient time? ▪ Will approach speeds be suitable and can drivers correctly track through the scheme? 	<p>Yes.</p>
<p>2.4 Intersections</p>	

Issue	Comment
<p>1 Visibility to and visibility at intersections</p> <ul style="list-style-type: none"> ▪ Are horizontal and vertical alignments at the intersection or on the approaches to the intersection consistent with the visibility requirements? ▪ Will drivers be aware of the presence of the intersection (especially on the minor road approach)? ▪ Will the design be free of sight line obstructions due to: <ul style="list-style-type: none"> ▪ Safety fences or barriers? ▪ Boundary fences? ▪ Street furniture? ▪ Parking facilities? ▪ Signs? ▪ Landscaping? ▪ Bridge abutments? ▪ Are railway crossings, bridges and other hazards near intersections conspicuous? ▪ Will the design be free of any local features which adversely affect visibility? ▪ Will intersection sight lines be obstructed by permanent or temporary features such as parked vehicles in laybys, or by parked or queued traffic generally? 	<p>Yes.</p>
<p>2 Layout, including the appropriateness of type</p> <ul style="list-style-type: none"> ▪ Is the type of intersection selected (cross roads, T, roundabout, signalised, etc.) appropriate for the function of the two roads? ▪ Are the proposed controls (Give Way, Stop, Signals, etc.) appropriate for the particular intersection? ▪ Are junction sizes appropriate for all vehicle movements? ▪ Are the intersections free of any unusual features which could affect road safety? ▪ Are the lane widths and swept paths adequate for all vehicles? ▪ Is the design free of any upstream or downstream geometric features which could affect safety? (eg. merging of lanes.) ▪ Are the approach speeds consistent with the intersection design? ▪ Where a roundabout is proposed: <ul style="list-style-type: none"> ▪ Have pedal cycle movements been considered? ▪ Have pedestrian movements been considered? ▪ Are details regarding the circulating carriageway sufficient? 	<p>Yes.</p>

Issue	Comment
3 Readability by drivers <ul style="list-style-type: none"> Will the general type, function and broad features be perceived correctly by drivers? Are the approach speeds and likely positions of vehicles as they track through the scheme safe? Is the design free of sunrise or sunset problems which may create a hazard for motorists? 	Yes.
2.5 Special road users	
1 Adjacent land <ul style="list-style-type: none"> Will the scheme be free of adverse effects from adjacent activity and intensity of land use? (If not, what special measures are needed?) 	Yes.
2 Pedestrians <ul style="list-style-type: none"> Have pedestrian needs been satisfactorily considered? If footpaths are not specifically provided, is the road layout safe for use by pedestrians (particularly at blind corners or on bridges)? Are pedestrian subways or footbridges sited to provide maximum use? (i.e. Is the possibility of pedestrians crossing at grade in their vicinity minimised?) Has specific provision been made for pedestrian crossings, school crossings or pedestrian signals? Where present, are these facilities sited to provide maximum use with safety? Are pedestrian refuges/kerb extensions provided where needed? Has specific consideration been given to provision required for special groups (eg. young, elderly, disabled, deaf or blind)? 	Several <i>bicycle-pedestrian</i> crash risks noted.
3 Cyclists <ul style="list-style-type: none"> Have the needs of cyclists been satisfactorily considered, especially at intersections? Have cycle lanes been considered? Are all cycleways of standard or adequate design? Where a need for shared pedestrian/cycle facilities exists, have they been safely treated? Where cycleways terminate at intersections or adjacent to the carriageway, has the transition treatment been handled safely? Have any needs for special cycle facilities been satisfactorily considered? (eg. cycle signals) 	Most of the issues noted were with respects to bicycle safety.

Issue	Comment
4 Motorcyclists <ul style="list-style-type: none"> Has the location of devices or objects which might destabilise a motorcycle been avoided on the road surface? 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 shielded? 	Yes.
5 Equestrians and stock <ul style="list-style-type: none"> 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.
6 Freight <ul style="list-style-type: none"> Have the needs of truck drivers been considered, including turning radii and lane widths? 	Similar to existing.
7 Public transport <ul style="list-style-type: none"> Has public transport been 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? 	<i>Bicycle-pedestrian</i> crash conflicts at bus stops noted.
8 Road maintenance vehicles <ul style="list-style-type: none"> Has provision been made for road maintenance vehicles to be used safely at the site? 	Yes.
2.6 Signs and lighting	
1 Lighting <ul style="list-style-type: none"> Is this project to be lit? Will safety be maintained if the project is not lit? Is the design free of features which make illuminating sections of the road difficult (eg. Shadow from trees or overbridges)? Has the question of siting of lighting poles been considered as part of the general concept of the scheme? Are frangible or slip-base poles to be provided? Are any special needs created by ambient lighting? Will safety be maintained if special treatments are not provided? Have the safety consequences of vehicles striking lighting poles (of any type) been considered? 	Assumed to be similar to existing.

Issue	Comment
<p>2 Signs</p> <ul style="list-style-type: none"> 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 located so that visibility to and from accesses and intersecting roads is maintained? Are signs appropriate to the driver's needs (eg. destination signs, advisory speed signs, etc.)? Have the safety consequences of vehicles striking sign posts been considered? Are signs located so that drivers' sight distance is maintained? Any signs to be located in the clear zone: are they frangible or adequately shielded by a crash barrier? 	<p>Signage not included on the plans since these were only concept level plans.</p>
<p>3 Marking and delineation</p> <ul style="list-style-type: none"> Has the appropriate standard of delineation and marking been adopted? Are the proposed markings consistent with the works in the adjoining section of the route? Are the previous/adjacent markings to be upgraded? If not, will safety be maintained? 	<p>Linemarking anomaly noted at Bennett Street.</p>
<p>2.7 Traffic management</p>	
<p>1 Traffic flow and access restrictions</p> <ul style="list-style-type: none"> Can traffic volumes from the proposed scheme be safely accommodated on existing sections of road? Has parking provision and parking control been adequately considered? Can any turn bans be implemented without causing problems at adjacent intersections? Has the effect of access to future developments been considered? Any traffic diverting to other roads (eg. to avoid a traffic control device): is safety maintained? 	<p>Less offset between traffic lanes and parking lanes noted.</p>

Issue	Comment
2 Overtaking and merges <ul style="list-style-type: none"> Is overtaking sight distance and stopping distance adequate? Have suitable shoulder widths been provided at lane drop merges? Have standard signs and markings been provided for any lane drop? Has adequate sight distance been provided to any lane drop? Are shoulders wide enough opposite access points and intersections? 	Yes.
3 Rest areas and stopping zones Are there sufficient roadside stopping areas, rest areas and truck parking areas? Are any entries and exits to rest areas or truck parking areas safe?	NA.
4 Construction and operation <ul style="list-style-type: none"> If the scheme is to be constructed "under traffic", can this be done so safely? Can the scheme be safely constructed? Have the maintenance requirements been adequately considered? Is safe access to and from the works available? 	Road occupancy required.
2.8 Additional questions to be considered for development proposals	Questions omitted. This is not a development proposal.
2.9 Any other matter	
1 Safety aspects not already covered <ul style="list-style-type: none"> Will there be special events? Have any consequent unusual or hazardous conditions been considered? 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? 	No.