Transport Planning and Design
Level 1, 284 Kilmore Street
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Berhampore to Newtown cycleway audit - safety and accessibility

90% design audit

Report prepared for

Paneke Pōneke
Bike network plan

Absolutely Positively
Wellington City Council
Me Heke Ki Pōneke

April 2023

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Disclaimer

The findings and recommendations in this report are based on the site visit undertaken by the cycleway audit team (CAT), an examination of available relevant plans, the specified road and environs, and the CAT's professional knowledge and experience. However, it must be recognised that no audit can guarantee the elimination of all possible safety concerns as all traffic environments consist of a multitude of elements that are never completely within the control of engineering design.

Safety and accessibility audits, by nature, focus on aspects relating to safety and accessibility and therefore do not constitute a complete review of design or assessment of standards with respect to engineering or planning documents. Similarly, the safety audit focuses on the plans provided and the relevant design stage.

This audit applies to the stated project. Whilst some issues covered are general and might be applicable to other locations, the CAT does not take any responsibility for transferral of concepts to other projects or locations.

While every effort has been made to ensure the accuracy of the report, it is made available on the basis that anyone relying on it does so at their own risk without any liability to the CAT or their organisation(s).

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1 Introduction

1.1 Brief and project description

ViaStrada (the cycleway audit team, a.k.a. CAT) have been commissioned by the client to audit for Paneke Pōneke – Wellington's transitional cycle network. The audit is to be a combination of road safety and accessibility audits and is henceforth referred to as a CASA – i.e. "Cycleway audit – safety and accessibility". A number of CASAs will be undertaken on the various routes / packages at various design stages. The CASA process complies with Waka Kotahi NZ Transport Agency *Safe System audit guidelines* (2022).

This CASA is for the 90% stage of the Berhampore to Newtown cycleway, as shown in Figure 1-1.

Figure 1-1: Extent of audit

ViaStrada has previously undertaken the 30% design stage audit for this route.

The infrastructure assessed in this audit includes: separated cycleways, cycle lanes, mixed traffic lanes, general traffic lanes, bus stops cycleway bus platforms, traffic signal hardware and phasing and raised platforms.

1.2 The cycleway audit team

The CASA was carried out by the Cycleway Audit Team (CAT) consisting of:

- Megan Gregory, the cycleway audit team leader, of ViaStrada Ltd
- David McCormick, Axel Downard-Wilke, and Glen Koorey, cycleway audit team members, of ViaStrada Ltd

1.3 Meetings and site visits

The daytime site visit was undertaken prior to the plans being received, on 29 July 2022, from 2:30 to 4pm.

Axel Wilke was briefed online when the 90% route designs were provided on 3 April 2023. Upon receipt of the signalised intersection plans, a wider online meeting was then held, including members of the CAT, the client, the designer and a Waka Kotahi representative on 12 April 2023, to outline the

CAT's initial points from the route designs and discuss the signal plans.

A night-time site visit was not undertaken.

1.4 Project information provided

The CAT has received the following plans and information on the roads and traffic within the audit area:

Table 1-1: plans reviewed

Document	Date	Description
DRAFT-TC Berhampore to Newtown Design Decisions Report 90% review stage.pdf	31/03/2023	Design decisions report
SCH-TC-BER TO NEW-combined_Optimized - 90% review stage drawings.pdf	31/03/2023	Route design
Adelaide Luxford Britomart Designs (1).pdf	31/03/2023	Adelaide / Luxford and Adelaide / Britomart intersection layouts
Adelaide Luxford Britomart Designs (2).pdf	31/03/2023	Mein / Riddiford and Riddiford / Rintoul intersection layouts
i=0730 proposed amendments.pdf	11/04/2023	Riddiford / Rintoul traffic signals plan
i=0780 PROPOSED AMENDMENTS FOR B2N TRANSITIONAL CYCLEWAY.pdf	6/4/2023	Rintoul / Te Wharepouri traffic signals plan
i=0800 Proposed amendments.pdf	11/04/2023	Adelaide / Luxford traffic signals plan
Rintoul Te Wharepouri Designs.pdf	31/03/2023	Rintoul / Te Wharepouri intersection layout

1.5 Design vehicles

For intersections, Austroads *Guide to Road Design Part 4: Intersections and Crossings: General* (AGRD4, 2017) describes a design vehicle as the largest vehicle that can perform any particular turning movement from the appropriate approach lane to the appropriate departure lane with adequate clearances to features such as kerbs and roadside furniture.

The CAT has assumed the following design vehicles for this project:

- 12m tour coach on the road network.
- People on bikes are anticipated to be confident riders with at least cycling competency of Grade 2 intermediate skills
- Being in the CBD, users of electric scooter users are expected to be common (including the current public share scooters by Beam and Flamingo). Unless otherwise specified, where an issue description refers to "cycle facility users" or simply "cyclists", this also includes users of electric scooters or other small-wheeled electric devices.

1.6 Items not covered

This 90% CASA does not cover the aspects of:

- Intersection operation at Hall / Mein / Riddiford
- Cycleway bus platform design and marking details (other than width)
- Parking management changes in the area
- Off-roadway footpath and other pedestrian area treatments (except for off-road cycleways)

2 Audit procedure and report format

This audit follows the Waka Kotahi NZ Transport Agency *Safe System Audit Guidelines* (2022). The primary objective of a Safe System audit is to deliver a project that achieves an outcome consistent with the Safe System approach, that is, minimisation of death and serious injury.

The following section(s) of this report detail the issues identified in the audit.

2.1 Crash probability

The probability of a crash is qualitatively assessed based on expected exposure (how many road users will be exposed to the site) and the likelihood of a crash resulting from the presence of the particular safety issue. Probability ranges from "very likely" to "very unlikely", and have been based on the categories in the Austroads *Guide to Road Safety part 6: Road Safety Audit* (2022) but adapted for the 4-tier probability structure used in the NZ guide (Waka Kotahi, 2022).

Table 2-1: Relationship between crash probability and frequency

Probability of a crash occurring	Frequency of crashes expected
Very likely	One crash every 3 months (4+ crashes / year)
Likely	One crash every 3-12 months (1-4 crashes / year)
Unlikely	One crash every 1-7 years (0.1-1 crashes / year)
Very unlikely	One crash every 7+ years (<0.1 crashes / year)

2.2 Crash severity

The expected severity outcome of a crash is qualitatively assessed based on factors such as expected speeds, type of collision, and type of user/vehicle/object involved; Figure 2-1, which is based on Austroads *Guide to Road Safety part 6: Road Safety Audit* (2022) but in colour instead of greyscale, gives an indication of the expected crash severity based on these factors. Table 2-2 describes the four crash severities used.

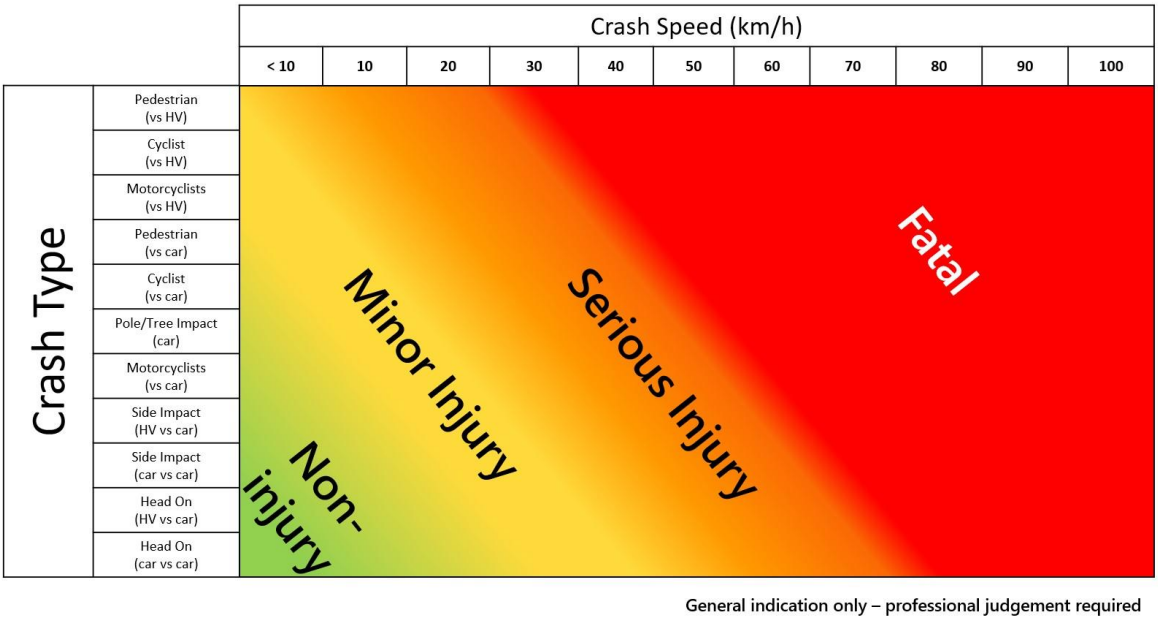


Figure 2-1: Expected crash severity by crash type and crash speed (adapted from Austroads GRS6, 2002)

Table 2-2: Crash severity descriptions (adapted from Waka Kotahi Safe Systems Audit Guidelines, 2022)

Severity outcome	Description
Fatal	Where Safe System boundary conditions are exceeded. A death occurring as the result of injuries sustained in a road crash within 30 days of the crash.
Serious	Where Safe System boundary conditions are exceeded. Injury (fracture, concussion, severe cuts or other injury) requiring medical treatment or removal to and retention in hospital.
Minor	Where Safe System boundary conditions are met. Injury that is not 'serious' but requires first aid, or that causes discomfort or pain to the person injured.
Non-injury	Where Safe System boundary conditions are met. Property damage crashes.

Reference to historic crash data or other research for similar elements of projects, or projects as a whole, have been drawn on where appropriate to assist in understanding the likely crash types, probability and severity that may result from a particular concern.

2.3 Crash risk rating

The probability and severity ratings are used together to develop a combined qualitative risk ranking for each safety issue using the Waka Kotahi Safety Concern Risk Rating Matrix shown in Table 2-3. The qualitative assessment requires professional judgement and experience from a wide range of projects of varying sizes and locations.

Table 2-3: Safety concern risk rating matrix (from Waka Kotahi Safe Systems Audit Guidelines, 2022)

		Severity outcome				
		Non-injury	**Minor**		**Serious**	**Fatal**
		Property damage only (PDO)	Injury which is not 'serious' but requires first aid, or which causes discomfort or pain to the person injured.	**Safe System injury threshold**	Injury (fracture, concussion, severe cuts or other injury) requiring medical treatment or removal to and retention in hospital.	A death occurring as the result of injuries sustained in a road crash within 30 days of the crash.
Probability of a crash	**Very likely**	Minor	Moderate		Serious	Serious
	Likely	Minor	Moderate		Serious	Serious
	Unlikely	Minor	Minor		Significant	Serious
	Very unlikely	Minor	Minor		Significant	Significant

While all safety concerns should be considered for action, the client will make the decision as to what action will be adopted. This report gives safety ranking guidance and it is acknowledged the client must consider factors other than safety alone. The suggested action for each concern category is given in Table 2-4.

Table 2-4: Concern categories

Risk	**Suggested Action**
Serious	Safety concern that must be addressed and requires changes to avoid serious safety consequences.
Significant	Significant concern that should be addressed and requires changes to avoid serious safety consequences.
Moderate	Moderate concern that should be addressed to improve safety
Minor	Minor concern that should be addressed where practical to improve safety.

In addition to the ranked safety issues, it is appropriate for the CAT to provide additional comments about items that may have a safety implication but lie outside the scope of the CASA. A comment may include: items where the safety implications are not yet clear due to insufficient detail for the stage of project; items outside the scope of the audit such as existing issues not impacted by the project; an opportunity for improved safety that is not necessarily linked to the project itself, or drawing/signage issues that should be addressed but are not necessarily safety related. While typically comments do

not require a specific recommendation, in some instances suggestions may be given by the CAT.

2.4 Recommendations

Each issue is accompanied by a list of recommendations to address the issue. As per the safe systems framework, these are classified as relating to either:

- Primary treatments – i.e. those capable of virtually eliminating death or serious injury resulting from the particular safety issue; or
- Supporting treatments – reduce the overall harm caused by the safety issue.

2.5 Affected user groups

For ease of interpretation, each issue heading in this CASA report includes the severity rating, as well as include letters to denote the main user groups affected. The first row in the table also includes icons to denote possible sub-groups. The user letters and icons are presented in Table 2-5:

Table 2-5: User groups included

Main user group	Heading letter	Possible sub-groups
Pedestrians	P	Vision impaired pedestrians 
		Mobility impaired pedestrians 
		Wheelchair users 
		Bus patrons (waiting / alighting) 
		All pedestrians 
Cyclists	C	Enthused & confident cyclists 
		Interested but concerned cyclists 
		Cyclists using electric bikes 
		All cyclists 
E-scooter / device users	E	E-scooter users; other electric small-wheeled devices 
Motorists	M	Drivers 

Main user group	Heading letter	Possible sub-groups
		Buses 
		Motorcyclists / moped users 

Section 5 presents a summary of the issues identified and the audit statement to be signed by the designer, responding auditor, safety engineer, project manager and project sponsor.

2.6 Project team response process

In accordance with the procedures set down in the Waka Kotahi NZ Transport Agency *Safe System Audit Guidelines* (2022) the audit report will be submitted to the client who will instruct the wider project team to respond.

No changes, however small they may appear, may be made to any of our writings in the main audit section of our report without our express review and consent. This restriction includes our CAT responses.

> We do not consent to any changes … to be made to the main audit section of our report.

The safety issues raised in this audit will require responses from the designer and, after the CAT has had a chance to clarify issues further, the project safety engineer. Finally, the client decision and action taken against the safety issues will also be recorded.

The following people have been identified by the client for these roles (Table 2-6).

Table 2-6: project team members relevant to this audit (to be completed by the client)

Role	Name	Organisation
Designer response	Billy Rodenburg	Tonkin + Taylor
Safety engineer	Soon Kong	WCC
Client decision	Brad Singh	WCC
Action taken by		

3 Crash history

Waka Kotahi holds a national database of crashes (CAS) for New Zealand. Crashes are generally investigated for the previous five years to ensure a crash pattern is monitored, rather than one off events.

All reported crashes along the proposed corridor (including but not limited to those involving cyclists), from Waka Kotahi, New Zealand Transport Agencies Crash Analysis System (CAS) over the five-year period 2017-2021 (inclusive) are plotted in Figure 3-1.

Figure 3-1: all crashes reported in the proposed Berhampore corridor

A total of 112 crashes were reported along the proposed Berhampore project corridor over the five-year period. Seven of these were serious (three involving a cyclists), 27 minor (seven involving cyclists) and 78 non-injury (five involving cyclists). Of those involving cyclists, 5 were on Adelaide Road (three causing no injury, and one minor and one serious injury). These were clustered towards the south.

The largest crash cluster involving motor vehicles is at the Riddiford and Mein Street intersection. Other notable crash clusters are present at the intersections of Rintoul and Te Wharepouri Street, Rintoul and Luxford Street, and Herald Street and Adelaide Road. There is also a cluster near Granville Flats, golf club and community gardens. These should be considered during the design process.

All crash factors by group are presented in Figure 3-2. Each crash may have several factors thus there are more factors at play then just the number of crashes.

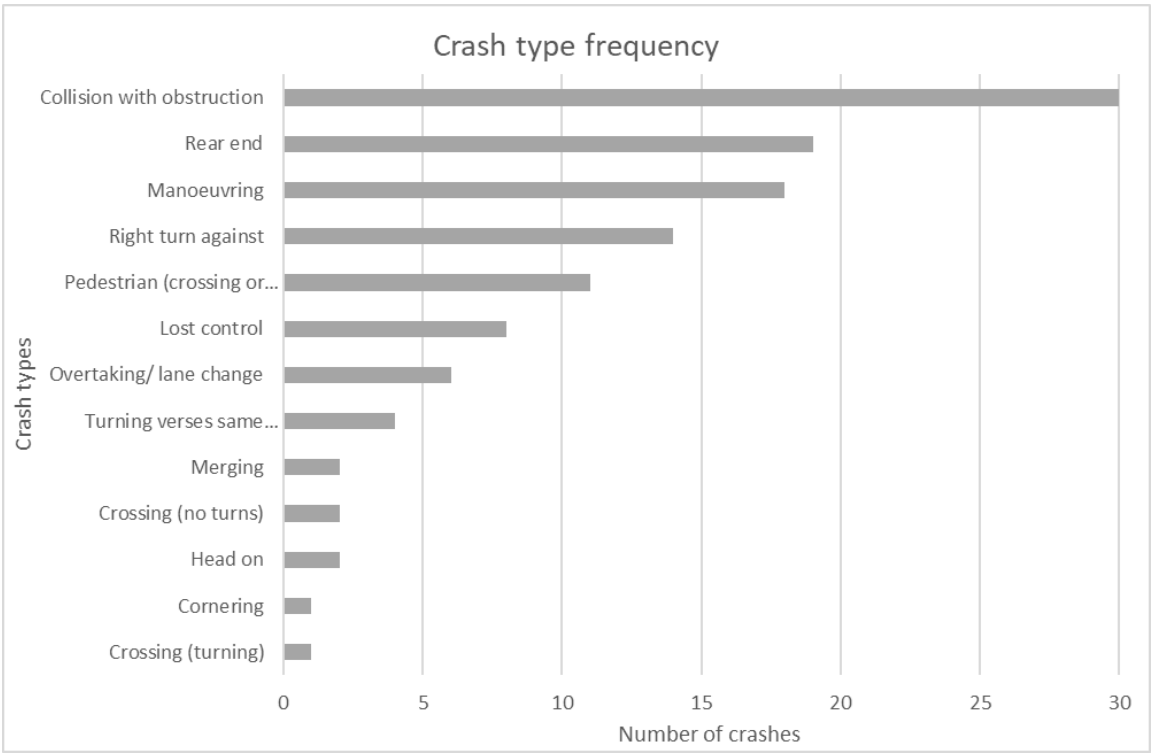


Figure 3-2: Reported crash factors (grouped)

The top four crash factors are collision with obstruction, rear ends and manoeuvring all point to the constricting environment of the road and amount of traffic on the route. Given the lack of alternative options, lack of space and the busy nature of the corridor these are unavoidable risks that should be minimised through design.

There are six clusters of crashes at along the corridor. Further detailed are summarised in Appendix A of the 30% CASA.

Recorded crashes showed some common trends:

- crashes occurred most on Thursday, Friday and Saturday (least amount on Tuesday and Wednesday)
- crashes peak with after school and evening commute traffic peaks:
    - 2pm-4pm (after school)
    - 5pm – 7pm (evening)
- as stated above, crashes were most often caused by collision with obstruction, rear ends and manoeuvring
- crashes involving cyclists most often resulted in minor injury (three serious, seven minor and five non-injury)
- crashes occurred most in November
- crashes peaked in 2019a and were only slightly less in 2019, crashes rates were comparatively lower in 2020 and 2021

4 CASA findings

4.1 Driveway treatments at separated cycleway (multiple locations) – C E Minor

The plans include speed humps at most high-volume driveways and cycle symbols on a green background at some lower-volume driveways, although not consistently. For example:

- Sheet 905111 – Rintoul Street southbound separated cycleway: a single cycle symbol with green background at the start of the cycleway, but it would be preferable to see a longer area to indicate the start of the cycleway and coinciding with the driveways at 9 and 11 Rintoul Street where speed humps have been applied.
- Speed hump, but no markings / colour at 33 Rintoul St driveway (medical centre).
- Driveway to 37 Rintoul St appears to service several properties but is in a passing area and therefore does not have a speed hump (see also issue 4.10).
- 55 Rintoul St – no marking at driveway

The crash type expected is motor vehicle vs cyclist.

The risk factors are: vehicle volumes crossing the cycleway, driver familiarity, gradient (which affects cyclist speed and control), visibility (could be impeded by street furniture, fences etc), traffic volume on the road (which affects gap availability and where drivers are focussing their attention).

The relevant standards are Waka Kotahi's Cycling Network Guidance (CNG) page on driveways, which links to a technical note on separated cycleways at side roads and driveways, plus another on high-use driveway treatments for cycle paths and shared paths.

Given that drivers' exposure to separated cycleways in Wellington in general is increasing, and that most drivers involved will be reasonably familiar with the location, crashes are expected to be unlikely. Given the slow turning speed of vehicles into tight driveways, crashes that do occur should only result in minor injury.

Probability of crash occurring	Unlikely
Expected crash severity	Minor injury
Primary treatment recommendations:	
4.1.1	N/A
Supporting treatment recommendations:	
4.1.2	Where a speed hump is deemed necessary, also include coloured surfacing; this should span the width of the driveway.
4.1.3	Apply cycle symbol plus green surface at all lower volume driveways.

Responses:	
Designer	The design intent, as set in the design standards report, is cycle symbols at;

	• Between 50 m and 100 m in urban areas is desirable (typically positioned in front of the nearest driveway) • Any break in the lane (e.g., bus stop) • The recommencement of the cycle lane after each intersection • At the start of any buffered or separated cycle lane • At any driveway wider than 7.0m While we agree with the CASA recommendations that additional green markings would improve awareness of cyclists, we consider the level of markings and separators provided to adequately demonstrate this especially given the increasingly large cycle network across Wellington meaning drivers will become more familiar with separated cycleways.
Safety Engineer	Agree with the Designer to adequately address the CASA findings
Proposed client action	Follow the design standards report approach in all of these locations
Action taken	

4.2 Driveway treatments at shared lanes (multiple locations) – C E Serious

The design uses shared lanes in many locations, generally in the downhill direction. These sections generally involve on-street parking as well as driveways accessing properties. For example, see Figure 4-1

The safety issue is that drivers exiting the driveways may have limited visibility due to parked vehicles and may not notice cyclists approaching in the shared lane.

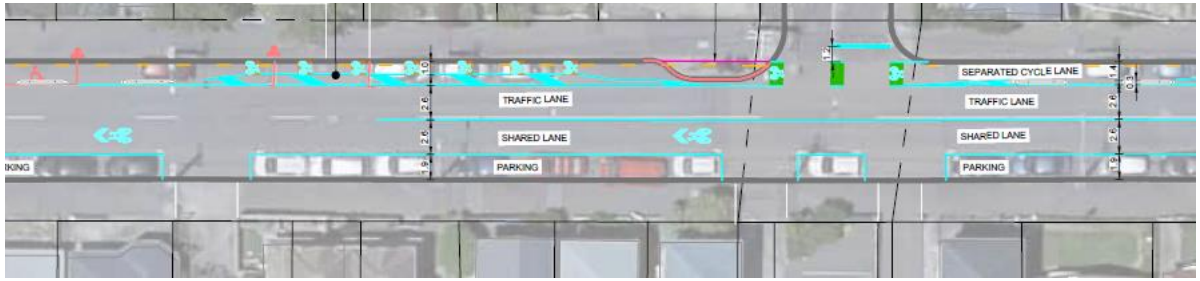


Figure 4-1: Shared lane on downhill with adjacent parking and driveways, Rintoul St

Probability of crash occurring	Likely
Expected crash severity	Serious injury
Primary treatment recommendations:	
4.2.1	Set parking further back from driveways on the approach (upstream) side.
Supporting treatment recommendations:	
4.2.2	Put sharrows on the upstream to (rather than the departure from) driveways, so that drivers exiting

The crash type expected is motor vehicle vs cyclist. The risk factors include: high parking occupancy along the route; cyclists travelling in the downhill direction do so at greater speeds; vehicles reversing from the driveway onto the road (limits driver visibility); and traffic volumes (which influence gap availability and driver propensity to try to enter a gap in traffic quickly without properly checking for cyclists). There are no relevant standards that apply to this particular issue. A first-principles approach should consider cyclist travel speed and visibility splays (for drivers of both forward-facing and reversing vehicles) to determine an appropriate parking setback at driveways. Given the high parking occupancy and the frequency of driveways, crashes are expected to be likely. Given the faster travel speeds of downhill cyclists, these crashes are expected to result in serious injury.		a driveway (who are looking upstream to find a gap in traffic) will be reminded of the likely presence of cyclists.

Responses:	
Designer	Agree with the recommended supporting treatment. The sharrow marking will be reallocated to upstream of major driveways. The client direction has been to generally maintain parking on the downhill side of the road. Parking has been removed in specific locations such as to improve lead in and out of bus stops, but otherwise is generally unchanged from the existing situation. We note that setting back of the parking spaces (similar to the guidance for separated cycleways, refer Waka Kotahi Technical note #2 - Separated cycleways at side roads and driveways, August 2020) would increase each setback from the current 1m to between 3m and 8m (depending on the length of parking) which would have a significant impact on the number of parking spaces removed.
Safety Engineer	Agree with the Designer to include the recommended supporting treatment with sharrow markings.
Proposed client action	Add sharrow markings upstream of major driveways
Action taken	

4.3 Lane width adjacent to bus stops (multiple locations) – M Minor

There are several bus stop locations where the adjacent traffic lane is significantly narrower than the legal minimum lane width of 2.5 m:	

Table 4-1: Bus stops with insufficient traffic lanes

Bus stop	Location	Sheet	Lane width	Comment
7120	76 Rintoul Street (northbound)	905113	1.9	Acceptable – too narrow for a car
7121	130 Rintoul Street (northbound)	905114	2.3	
6121	133 Rintoul Street (southbound)	905115	2.2	School stop?
6122	143 Rintoul Street (southbound)	905115	2.1	School stop?
6123	187 Rintoul Street (southbound)	905116	2.1	see Figure 4-2

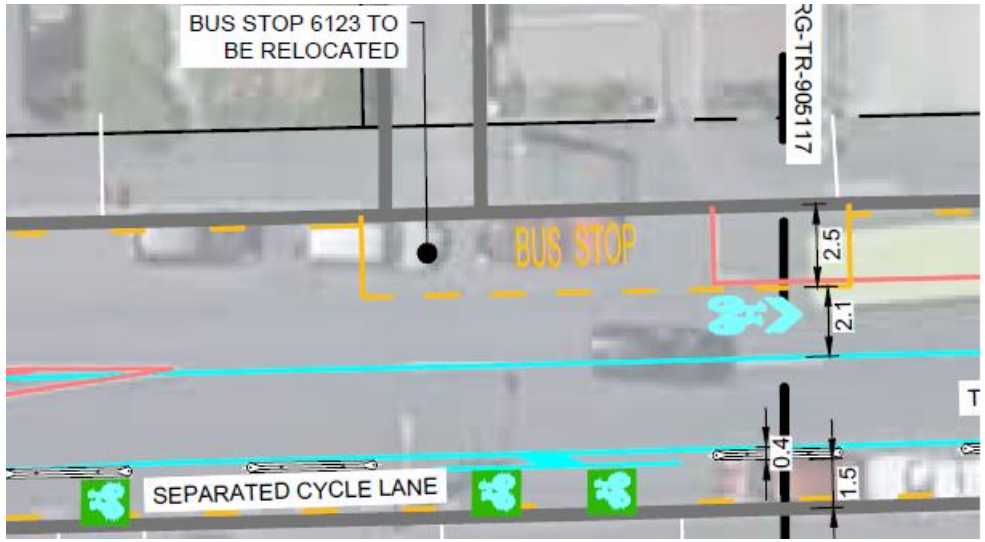


Figure 4-2: Bus stop 6123

Probability of crash occurring	Unlikely
Expected crash severity	Minor injury
Primary treatment recommendations:	
4.3.1	Table 4-2 outlines the possible treatments; the selection will depend on the particular stop. Option 1 is preferred for non-school bus stops, Option 4 is the only one considered suitable for school bus stops.
Supporting treatment recommendations:	
4.3.2	N/A

The safety issue is that drivers may assume they have enough space to pass the bus when they in fact do not.

The crash types expected include motor vehicle vs motor vehicle (head-on) and motor vehicle vs bus (side swipe).

The risk factors include: bus frequency; whether these stops are bus timing points or involve high passenger turn-over (i.e. affecting the time a bus spends in the stop); and traffic volumes.

The relevant legislation is the definition of lane in the Land Transport Road User Rule, which specifies 2.5 m minimum. The Bus Stop: Public Transport Design Guidance (section 4.4.2) prescribes a 1.5 m minimum gap between the bus stop cage and the lane line, although this is contradicted in subsequent text, which stipulates 1-1.5 m. The guide does not discuss the problem of wider gaps that motorists may attempt to drive in.

Crashes are expected to be unlikely (no more than one per year) and should not result in more than minor injury given the speeds expected.

Table 4-2 outlines the options to remedy this problem:

Table 4-2: Options to remedy insufficient lane width adjacent to bus stop

Option	Advantages	Disadvantages
1. Build kerb out a small amount, creating an in-lane bus stop with 1.5 m for cyclists to pass stopped bus.	Creates possibility for cyclists to pass a stopped bus (on the right hand side) whilst being obviously not enough space for car to pass.	Cyclists will likely be blocked if a car is waiting behind the bus first, or may attempt to weave through traffic to bypass the bus. Not suitable for school bus stops.
2. Build kerb out further to achieve 3.2 m traffic lane with an in-lane bus stop but no width for cyclists to pass a stopped bus.	Avoids cyclists trying to weave through traffic queued behind a stopped bus.	Extra delay to cyclists. Alternatively, cyclists may attempt to bike on the footpath to pass a stopped bus, and conflict with bus patrons /

		pedestrians. Not suitable for school bus stops.		
3. Use some footpath width to create an under-width cycleway bus platform (island bus stop).	Allows cyclists to bypass bus without potential for conflict with motor vehicles.	Potential of conflict between cyclists and bus patrons / pedestrians – see also issue 4.6. Not suitable for school bus stops.		
4. Remove the centreline in the vicinity of the bus stop.	Suitable for school bus stops. Traffic calming effect – motorists should exercise more caution to deal with the ambiguity. Vehicles and cycles can bypass the bus if there is room to do so.	Could result in conflict if motorists travelling in opposite directions misjudge the situation.		
5. Indent the kerb to achieve a 2.5 m traffic lane next to the bus stop.	Suitable for school bus stops. Cyclists and motorists can pass a stopped bus in single file.	Requires kerb work. Reduces footpath width.		

Responses:	
Designer	Generally agree with CASA recommendations, although we note that the Traffic Control Devices Manual Part 5 recommends painting a centre line on collector roads. Moreover, given the traffic volume and the width of Rintoul Street, CASA - option 4 does not appear to be a safe solution, particularly in the vicinity of the school. For Bus Stop 7120 we are able to realign the centreline to reduce the available space for passing stationary buses to 1.5 metres. For the other bus stops identified this solution is not recommended due to the existing geometry constraints, which will result in a kink that drivers may ignore, thereby causing a more unsafe condition. Based on the investigation of

	the proposed bus stop locations, three options have been identified for consideration by the client: 1- Removing separators next to the cycleway and reduce the width of the buffer to be able to widen the lane next to the bus stop markings to a width of 2.5 metres. This falls within the definition of a lane outlined by the Land Transport Road User Rule, allowing vehicular traffic to pass the bus safely. 2- Building a small kerb out, creating an in-lane bus stop with 1.5 metres for cyclists to pass stopped buses (CASA - option 1). 3- Keeping the existing design which matches the current bus stop and centreline layout on Rintoul Street.
Safety Engineer	Agree with the Designer to comply with TCD Manual Part 5. The CASA recommended Option 4 is unacceptable without the centreline to advise drivers when they encroach into the opposing traffic lane. Detailed layouts of the bus stops are to be provided for further review.
Proposed client action	Designer to assess each bus stop individually and advise best approach for each in next set of designs for review.
Action taken	

4.4 Red surfacing under cycle symbols (multiple locations) – C E

Comment

There are several locations where cycle symbols are paired with red surfacing, instead of green. The design decision report does not describe the reasoning behind the application. These markings are generally in tight locations where the cycle facility has insufficient / undesirable width (e.g. the Rintoul Street passing lanes – see issue 4.10, and the cycle lane on the inside of the bend at Luxford / Rintoul – see issue 4.15).

It is not clear whether permission has been obtained to use a colour other than green (which is specified in the TCD Manual for cycle facilities).

Probability of crash occurring	N/A
Expected crash severity	N/A

Recommendations:

4.4.1	Confirm reasoning for and permission to use red surfacing in these locations.
4.4.2	Consider marking red blocks only without cycle logos

Responses:

Designer	Agree with CASA findings regarding the red surfacing. We propose to change this surfacing to green as agreed with WCC in the

	Design Standards meeting on 13 April 2023.
Safety Engineer	Agree with the Designer.
Proposed client action	Agree with Designer - Change surfacing to green
Action taken	

4.5 Cycleway platform bus stops (multiple locations) – P C E Moderate

Table 4-3 outlines several island bus stops (i.e. where the cycleway goes on a platform between the bus and the footpath) that are narrower than Waka Kotahi's recommended 2.3 m minimum width for the nominal island bus stop design.

Table 4-3: Bus stop platforms of sub-standard width

Bus stop	Location	Sheet	Platform width	Notes
6120	59 Rintoul St (southbound)	905113	1.6 m	Appears width could be borrowed from footpath
7122	186 Rintoul St (northbound)	905116	2.1 m	Overlaps driveway for 190 Rintoul St – difficult to achieve platform.
6124	Luxford St corner at Adelaide Rd (westbound)	905118	1.8 m	See also issue 4.16
6126	541 Adelaide Rd (southbound)	905213	2.0 m	

Probability of crash occurring	Likely
Expected crash severity	Minor injury
Primary treatment recommendations:	
4.5.1	In locations with sufficient footpath width free of poles or street furniture etc, it would be preferable to incorporate some of the footpath width into the cycleway crossing.
Supporting treatment recommendations:	
4.5.2	Confirm bus stop platform design details, including measures to reduce cyclist speed and increase cyclist awareness at the affected locations.

7126	542 Adelaide Rd northbound	905213	1.9 m	

The safety issue is cyclists may conflict with bus patrons / pedestrians.

The risk factors are bus frequencies, patron numbers, cycle volumes and presence of bus patrons with specific mobility needs or cognitive limitations (e.g. children).

The relevant standards are outlined in the Bus Stop: Public Transport Design Guidance.

Crashes are expected to be likely (more than one per year) but should not result in more than minor injury as no motor vehicles are involved.

We note that the design decision report notes that exact markings for platform bus stops are to be determined, and the design may attempt to mitigate the effects of the narrow widths. We would have otherwise commented that the bus platforms that coincide with a cycleway require markings and tactile pavers. The ramp design details for the platforms are also missing from the designs.

Responses:	
Designer	Agree with CASA findings. However, as it is recommended in the primary treatment and also explained in the Design Decisions report, in cases where the condition of the existing footpath allows, the cycle lane will be partially extended onto the footpath to establish an appropriate buffer in the boarding/alighting zone. The precise delineation and layout of each bus platform will be prepared in the subsequent phase of the design process, subject to the client's approval of the proposed locations of platforms.
Safety Engineer	Agree with CASA primary and secondary treatment recommendations. Detailed designs are to be provided by the Designer for these bus stops for further review.
Proposed client action	Agree with CASA and designer.
Action taken	

4.6 Traffic lane lateral shifts (multiple locations) – M

There are several locations where the traffic lanes undergo a sharp lateral shift. For example, on Luxford Street at the 30 km/h threshold:

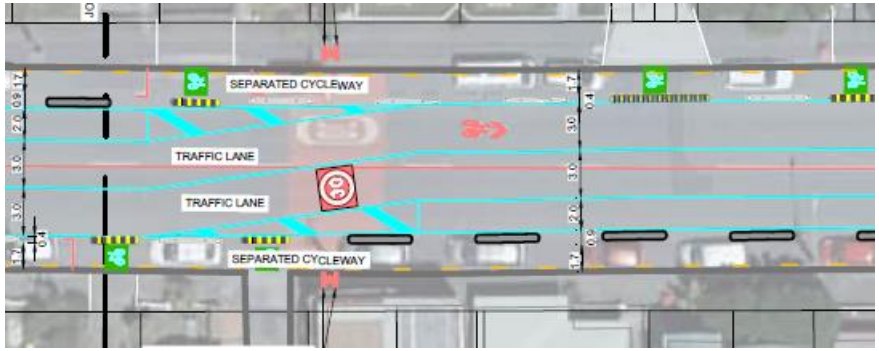


Figure 4-3: Sharp lateral shift on Luxford Street

The lateral shift appears to be approximately 2.25 m (this should be confirmed via CAD). In a 30 km/h zone, the taper length should therefore be approximately 31 m, as per the TCD Manual under "edge lines at abrupt changes in width" (see Equation 1); however, only 17 m is provided.

Equation 1: Taper length at lateral shift

$$L = V \times \frac{Y}{2.16}$$

Where:
L = taper length (rounded to nearest 5m)
V = 85th percentile traffic speed (km/h)
Y = lateral shift (difference in lane width, in metres, as measured from the road centre-line)

Ideally, this layout may result in drivers travelling at slower speeds, i.e. a positive safety effect. Where separated cycleways are provided, most cyclists will not be at risk of conflict with motor vehicles and there is low chance of any serious injury. Therefore, the sharp tapers are not overly concerning.

Comment

Probability of crash occurring	N/A
Expected crash severity	N/A
Primary treatment recommendations:	
4.6.1	N/A
Supporting treatment recommendations:	
4.6.2	Monitor these locations and confirm the sharp tapers have a positive traffic calming effect, rather than causing safety concerns.

Responses:	
Designer	Agree with CASA findings. It has been noted that the implementation of shorter tapers has a beneficial impact on calming the traffic.

	Additionally, the proposed lateral shifts have been checked for tracking of buses and are not expected to pose safety risks. Client to address this matter in the council's Monitoring Plan.
Safety Engineer	Agree with CASA findings and disagree with Designer to monitor as the shorter taper will cause vehicles to encroach into adjacent lanes as the operating speed is higher. Tapers should be extended.
Proposed client action	Agree with CASA and suggest lengthening hatched area back to black map boundary line on drawings on east side (left of drawing) and a similar distance on the west side although we note the minor impact on parking.
Action taken	

4.7 Riddiford bus stop / loading zone / cycle lane arrangement (905110) – C E M Serious

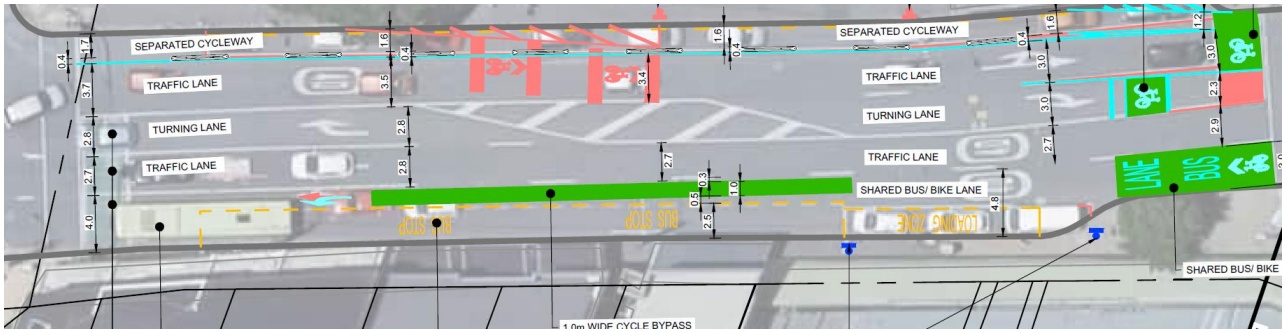


Figure 4-4: Riddiford bus stop / loading zone / cycle lane arrangement

The arrangement shown in Figure 4-4 is an improvement on the previous design; however, there are still some safety issues:

- There is only about one car-length between the end of the bus stop and the limit line.
  - If there is a car or a bus queued, subsequent cars will block the through lane.
  - Cyclists have less opportunity to take the lane or access the advanced stop box – therefore they are likely to get stuck on the right-hand side of a bus travelling through the intersection and would be unable to access the hook turn box if desired.
- If there is a vehicle parked in the loading zone, buses will not be able to access the start of the bus

Probability of crash occurring	Likely
Expected crash severity	Serious injury
Primary treatment recommendations:	
4.7.1	Increase the distance between the intersection limit line and the end of the bus stop, enough that the left turn arrow can appear in a section of full lane width.
4.7.2	Continue the green colour for the full length of the bus stop.

stop, i.e. reducing its effective length. (It is acknowledged that the loading zone is intended to be time-restricted for 9:30 am to 3 pm and therefore this would not be a problem during peak periods). • There is no green surfacing over the area where vehicles entering or exiting the loading zone would potentially conflict with cyclists travelling straight ahead. The crash types expected are all combinations between buses, cyclists, and motor vehicles. The risk factors are traffic volumes, bus frequencies, presence of vehicles in the loading zone, and coordination (or lack) of intersection phasing with bus departures from the bus stop. The relevant guidance is the Bus Stop: Public Transport Design Guidance; this does not deal specifically with the issues of queue lengths at signalised intersections affecting bus stop safety, but it does give the general rule that bus stops should be 20-60 m away from a signalised intersection to achieve safe sight lines and does mention the need for buses to be able to merge into their lane. Due to the bus and motor traffic volumes involved and the lack of queue space, it is expected that crashes will be likely (1-4 per year). Given the vulnerability of cyclists and the size of buses, but taking into account that buses will be travelling slowly, crashes that do occur are expected to result in serious injury.	4.7.3	Mark the cycle trajectory from the end of the bus-cycle lane to the cycle lane beside the bus stop.
	Supporting treatment recommendations:	
	4.7.4	Relocate the loading zone, e.g. to 14 Rintoul Street.
	4.7.5	An alternative option would be to reduce the length of the loading zone so that it only accommodates one van. This would be an improvement on the current proposal, but not as effective as the combination of the other mitigation measures proposed above.

Responses:	
Designer	Agree with CASA findings and recommendations. The relocation of the bus stop box to a more southerly position is supported in order to provide adequate space for both cyclists and motorists between the limit line and the end of the bus stop box. This adjustment aims to enhance the safety of the left turn lane, facilitating its use by both vehicles and cyclists. This repositioning would result in a reduction in the length of the loading zone so it can accommodate one vehicle. It has been observed that a vehicle occupying the loading zone may impede bus access to the start of the bus stop, thereby decreasing its overall effectiveness. However, it has been noted that the loading zone is scheduled to be time-restricted from 9:30 am to 3 pm, thereby avoiding potential issues during peak periods. During off peak periods the full bus stop length will not be required and there is sufficient lead in to the head of the stop. Additionally, the green paint marking will be extended from the loading zone to the end of the bus stop box.

Safety Engineer	Agree with CASA findings and primary treatment recommendations and the Designer to provide a revised layout for further review.
Proposed client action	Agree with designers proposed treatments.
Action taken	

4.8 Turning vehicles conflicting with pedestrians at Riddiford / Rintoul (905110) – P E Minor

Figure 4-5 shows the phasing for Riddiford / Rintoul; there is no partial pedestrian protection provided at the intersection. The 10-year crash history includes three crashes involving pedestrians, but these all appear to be due to pedestrians attempting to cross during the wrong phase.

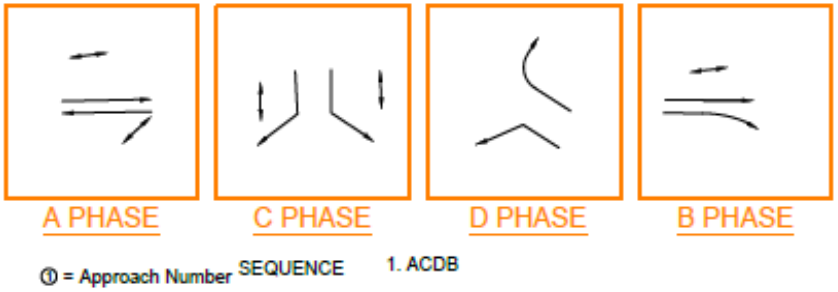


Figure 4-5: Phasing diagram for Riddiford / Rintoul

The safety issue is that turning motorists may not realise they have to give way to crossing pedestrians, due to the unusual angle of some legs.

The first location of concern is left turn from the south Riddiford Street approach into Rintoul Street, which has poor inter-visibility with pedestrians; however, the geometry of the turn means vehicles would be travelling slowly and pedestrians would be well into the crossing by the time drivers arrive at the conflict point; hence drivers should be able to discern the need to give way to crossing pedestrians. However, given potential pedestrian desire lines, it is likely that some pedestrians would cut across in front of the marked crosswalk.

The other location of concern is the left turn from Emmett Street to Riddiford Street south, as

Probability of crash occurring	Very unlikely
Expected crash severity	Minor injury
Primary treatment recommendations:	
4.8.1	Put the exposed crosswalks on raised safety platforms.
Supporting treatment recommendations:	
4.8.2	Consider slightly relocating the crosswalks across Rintoul St and Riddiford St south to improve visibility and awareness by turning traffic

the pedestrian crossing across Riddiford Street, which operates during the C phase, is some distance from Emmett Street. However, this distance also means that drivers will be face-on to the pedestrian crossing and therefore will have pedestrians in full view. The risk factors include: the intersection geometries (as detailed above); shared lanes that increase pressure on turning drivers to get out of the way of subsequent traffic; and increased risk at times of limited visibility (rain, night, sun glare etc). The Pedestrian Network Guide section on signalised intersections provides some guidance on this issue. Given the lack of crash history involving pedestrians at this intersection, crashes are expected to be very unlikely. Given the geometry that ensures vehicle turning speeds below the safe system threshold for pedestrians, those that do occur are not expected to cause more than minor injury. One possibility would be to apply partial pedestrian protection via a red arrow for left turners, which would result in a long delay to subsequent vehicles in the queue and could result in driver non-compliance. The best alternative would be to install raised safety platforms for the exposed pedestrian crosswalks.		

Responses:	
Designer	These crossings are outside of the current project scope. We note that the LGWM City Streets Newtown to Berhampore project includes this intersection and recommend this feedback is passed on to be considered in that design.
Safety Engineer	Noted.
Proposed client action	Team to pass feedback on to LGWM team
Action taken	

4.9 Rintoul Street approach to Riddiford Street (905110) – C E Serious

Figure 4-6: Emmet / Riddiford / Rintoul intersection

Figure 4-6 shows continuity lines to guide drivers turning from Rintoul Street into Riddiford Street towards the general traffic lane, rather than the bus-cycle lane.

The safety issue is it is expected that drivers will still cut the corner.

The crash type is motor vehicle vs cyclist.

The risk factors include: the geometry, drivers being accustomed to turning into the kerbside lane (which is now a bus lane), the tightness of the lanes and the single cycle symbol in a block of green at the start of the intersection is not considered enough indication for cyclists.

The Coloured surfacing principles: design guidance note does not specify colour options

Probability of crash occurring	Likely
Expected crash severity	Serious injury
Primary treatment recommendations:	
4.9.1	N/A
Supporting treatment recommendations:	
4.9.2	Develop a treatment using colour and/or cycle symbols in the cycle lane (either for the full area, or in blocks as per a side road crossing).

within signalised intersections. The design team have conveyed that they have been instructed by Waka Kotahi that it is not possible to use anything more than continuity lines within a signalised intersection. However, the CAT recommends that a treatment using colour and/or cycle symbols in the cycle lane (either for the full area, or in blocks as per a side road crossing) would be a stronger guide to motorists to stay out and cyclists to stay in the lane. Another possible option could be some flexi-posts with low kerb bases in the last section of Rintoul St prior to reaching Riddiford St. Given the reasonable forward visibility and colour at the start of the bus lane, crashes are expected to be unlikely, but those that do occur could involve motor vehicles travelling above the safe system threshold and therefore result in serious injury.		

Responses:	
Designer	Agree with CASA findings. In order to eliminate any ambiguity regarding continuity line markings, we prefer that only the outer continuity line would remain in the updated design. This outer continuity line serves to direct general traffic into the appropriate lane. It also allows buses to follow the line marking to enter the bus/bike shared lane, thereby keeping them away from the corner as much as possible. Given that there is a shared lane and Advance Stop Box located on Rintoul Street, it is expected that cyclists will position themselves well in advance of traffic. It is further anticipated that less-confident cyclists will follow the kerb line to access the shared lane. To reduce confusion at the intersection, we recommend that the green box and cycle symbol on the Rintoul Street approach on the intersection side of the pedestrian crosswalk lines should be removed.
Safety Engineer	Agree with CASA findings and supporting treatment recommendation. The designer should consider realigning the northwestern kerbline to ease the left turn from Rintoul St to Riddiford St to mitigate the risk identified by the CASA. I disagree with the Designer to remove the pedestrian crosswalk lines as pedestrians need guidance just like cyclists and drivers.
Proposed client action	It is out of scope for the transitional programme to move the kerbline here – the City Streets team at LGWM may do this as part of the permanent project (Pass on to LGWM). We are not suggesting removing ped crosswalk lines - only green box on the intersection side. We also propose adding an advance cycle light to give cyclists a head start in front of traffic.
Action taken	

4.10 Start of separated cycleway on Rintoul Street (905111) – C E Significant

The safety issue is insufficient indication to cyclists regarding the commencement of the southbound separated cycleway on Rintoul Street (see Figure 4-7) – cyclists may not realise they are expected to use the cycleway and instead continue sharing the narrow general traffic lane in the uphill direction.

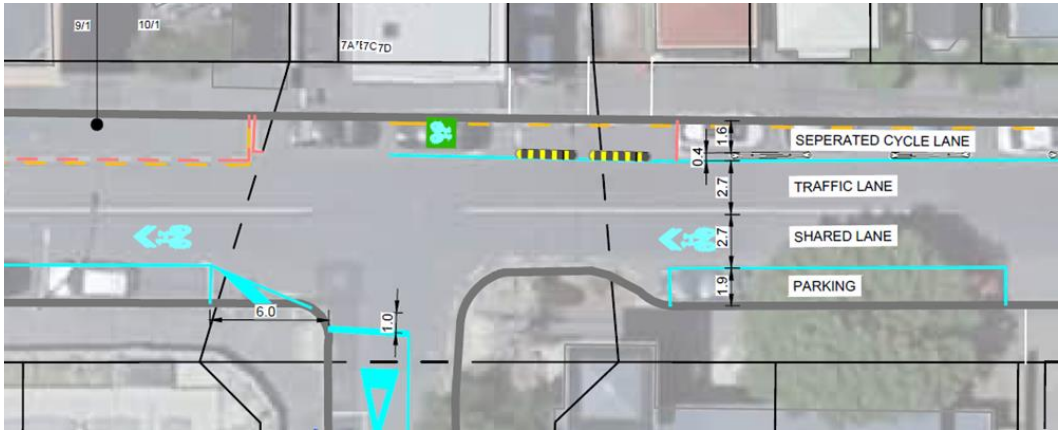


Figure 4-7: Start of southbound cycleway on Rintoul Street

The crash types expected are cyclist vs motor vehicle or cyclist v bus.

The risk factors are: the narrowness of the general traffic lane, the high speed differential between cyclists and motorists in the uphill direction, and the presence of high volume driveways (see also issue 4.1).

There are relevant standards that specifically refer to this issue. The Coloured surfacing principles best practice guidance note gives general principles that apply.

Crashes are expected to be unlikely (less than one per year) but those that do occur would result in serious injury, due to the speed differential and vulnerability of cyclists.

Probability of crash occurring	Unlikely
Expected crash severity	Serious injury
Primary treatment recommendations:	
4.10.1	Use a longer block of green at the start of the separated cycleway, plus across the adjacent high-risk driveways.
Supporting treatment recommendations:	
4.10.2	N/A

Responses:	
Designer	We agree with the CASA recommendation. Longer green boxes, 3.0m long, with cycle symbols painted at the beginning of the box should be utilised to

	emphasise the commencement of a separated cycle lane. To improve the visibility of the cycle lane and increase the awareness of drivers we also consider implementation of two standard green boxes with cycle symbols at entrances of high-risk / high-use driveways.
Safety Engineer	Agree with the CASA primary treatment recommendation.
Proposed client action	Agree with designer proposal for longer green box
Action taken	

4.11 Colombo Street setback (905111) – C E M

Significant

The safety issue is the setback of the proposed limit line for the Colombo Street approach to Rintoul Street, which is likely to result in visibility issues for Colombo Street drivers.

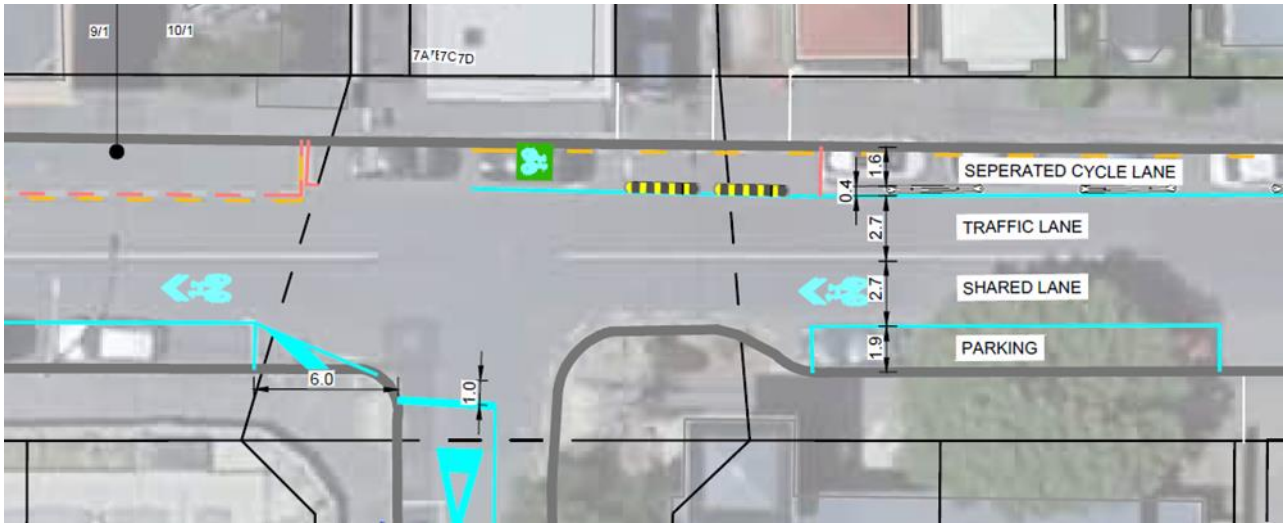


Figure 4-8: Colombo Street approach to Rintoul Street

The crash types expected are motor vehicle vs cyclist and motor vehicle vs motor vehicle.

The risk factors include: the limited visibility due to the kerb buildout, property fence and parking on the south-west corner of the intersection; and drivers perhaps not expecting cyclists in the shared downhill (northbound) lane.

Probability of crash occurring	Unlikely
Expected crash severity	Serious injury
Primary treatment recommendations:	
4.11.1	Confirm visibility for drivers on the Colombo Street approach to Rintoul Street – mitigate if possible e.g. by pushing out the limit line.
Supporting treatment recommendations:	
4.11.2	If necessary, convert Colombo Street to a stop control.

The relevant standard is the TCD Manual Part 4: intersections (still in draft format, but specified as the replacement for MOTSAM). Crashes are expected to be unlikely (less than one per year) but those that do occur would result in serious injury, due to the vulnerability of cyclists.		

Responses:	
Designer	We agree with the CASA recommendation that Colombo Street should be converted to a stop-controlled intersection due to insufficient visibility to Rintoul Street – Northbound direction. To improve the visibility (although not enough to provide for a give way), we also consider that the limit line could be relocated to the east and aligned with the north-western kerb line. The limit line would still be set back by at least 1.0 metre from the south-western kerb line.
Safety Engineer	Agree with CASA findings and primary treatment recommendation to relocate the limit line eastwards to align with the southwestern kerbline and extending the northwestern kerb corner. Conversion to Stop Control can only be justified if the sightlines at the Colombo St approach are inadequate after the limit line relocation.
Proposed client action	Relocate the limit line. Preference to change to a stop control given the speed of downhill cyclists sharing the lane at this point and the expected crash severity if one were to happen.
Action taken	

4.12 Parking on footpath outside 122 Rintoul Street (905114) – P C E

Comment

Google StreetView shows evidence of a vehicle parked on the footpath outside 122 Rintoul Street. If this is a regular occurrence, it could cause a safety issue for pedestrians, and cyclists in the adjacent shared traffic lane.

Probability of crash occurring	N/A
Expected crash severity	N/A

Recommendations:	
4.12.1	Confirm whether vehicles park on the footpath outside 122 Rintoul Street and, if so, apply enforcement to address this.

Responses:

Designer	The design team does not have access to any evidence indicating that this particular type of parking on the footpath is a recurrent event. However, no-stopping line marking is proposed adjacent to the kerb line to enforce the no parking regulation at this location.
Safety Engineer	Noted.
Proposed client action	No stopping marking to be added to enable enforcement
Action taken	

4.13 Rintoul Street passing areas (905111-905115) – C E Significant

Figure 4-9 shows an example of one of the passing areas planned on the north (uphill) side of Rintoul Street. The design decisions report indicates that this is to provide space on the narrow carriageway when there is a bus (or other large vehicle) travelling in either direction.

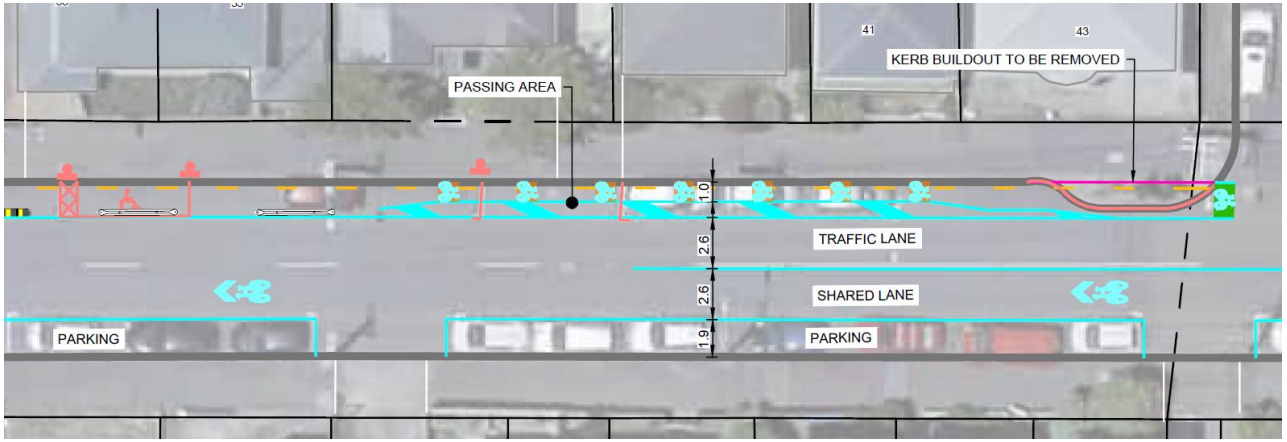


Figure 4-9: Rintoul Street passing area

The safety issue is that the passing area creates a cycle lane of 1.0 m, which is too narrow for cyclists travelling immediately adjacent to buses. It is also noted that the 1.0 m is measured to the kerb face, i.e. it includes the gutter, which is not always in cyclable condition along the route. The chevron area (0.8–0.9 m) is not dedicated cycling space and will not be physically available to cyclists if being used by a bus (or any

Probability of crash occurring	Unlikely
Expected crash severity	Serious injury
Primary treatment recommendations:	
4.13.1	Provide localised lane widening by removing parking on the other side of the road.
Supporting treatment recommendations:	
At the very least, if the passing areas in the cycleway are to be retained:	
4.13.2	Confirm treatment style with Waka Kotahi. In particular,

other vehicle). The crash type expected is cyclist vs bus, and there is the possibility for cyclist vs motor vehicle if drivers shy into the cycling space when encountering a bus in the opposite direction. The risk factors include: ability of cyclists and bus drivers to interpret the markings; cyclists travelling uphill do so at slower speeds and with more need for "wriggle room"; lack of physical separation means buses may encroach further into the cycle lane; conflicts with driveways that coincide with the passing area; and the frequency and length of passing areas (which affect exposure). An example of the driveways factor is there is a proposed passing area that includes the driveway to 75 Rintoul Street, the Alexandra Rest Home – this is likely to involve high vehicle movements and unfamiliar users and should therefore have a high-use driveway treatment (speed hump plus markings) applied. Such a treatment is not possible when there is a passing area included. With respect to the frequency between passing areas, the design decisions report cites NZS4404 (Land development and subdivision infrastructure) as the guiding source. Given that the extent of physical works for the transitional cycleways is to be kept to a minimum, it is not certain that this standard is the most appropriate in this case. The CAT would prefer to see justification of the spacing of passing spaces based on the anticipated likelihood of buses passing each other, and, where possible, existence of passing spaces that encroaching on cycling space be kept to an absolute minimum. The relevant standard is TCD Manual part 5 – cycle lanes which specifies an absolute minimum cycle lane width 1.4 m for a cycle lane next to a kerb (noting this is the cyclable space and does not include non-cyclable gutters). It is not clear why red boxes have been used under the cycle symbol. This is not a recognised colour for cycle facilities. See also issue 4.4. If these sections do not meet the minimum standards for cycle lanes then they should not be marked as such. Crashes are expected to be unlikely (no more than one per year) but could result in serious injury given the difference between buses and cyclists.		whether it is permittable and desirable to use red surfacing and cycle symbols in this application. 4.13.3 Confirm that passing areas are not provided in conjunction with non-residential driveways, or driveways catering to more than two houses (including but not limited to the identified concern at the Alexandra Rest Home). 4.13.4 Consider the number of passing lanes required from a first-principles basis of bus frequency and meeting likelihood.

Responses:	
Designer	Agree with CASA findings. Based on the bus frequency, it is expected that buses will meet once along Rintoul Street. However, due to the horizontal and vertical geometry and the surrounding conditions of the corridor, visibility along Rintoul Street is restricted. Therefore, a few passing areas are necessary to allow bus drivers to see oncoming buses with sufficient

	distance and pull over safely to let them pass. The proposed passing areas include the bus stops, which can serve as a safe spot for opposing buses to pass each other. Additionally, the design proposes to use the areas in front of condensed driveways and remove some parking spaces to provide passing areas. Four passing areas in the southbound direction and the only passing area in the northbound direction are proposed to be removed. Instead, the following locations are considered as safe spaces for two large vehicles to pass in opposite directions: 1- Northbound direction – In front of properties 120-124 Rintoul Street. This area is around 40m long. 2- Northbound direction - Remove one parking space in front of 104 Rintoul Street Rintoul Street. This area is around 30m long. 3- Northbound direction - Removal of two parking spaces in front of 38 and 40 Rintoul Street. This area is around 37m long. No line or pavement marking is proposed at the new passing areas, apart from no-stopping line marking, to prevent other vehicles from using the areas as a place to stop or park. Client to comment on the removal of three parking spaces to provide passing areas.
Safety Engineer	Agree CASA findings and primary treatment recommendation with the revised passing areas to be further reviewed. I am unclear what is meant by the Designer in stating: "No line or pavement marking is proposed at the new passing areas". The proposed passing areas are to be reviewed again.
Proposed client action	Removing the passing areas as outlined by designers and further review at 90% TR issue drawings.
Action taken	

4.14 Single lane on Te Wharepouri Street south approach to Rintoul (905116) – C E M Serious

The 90% design (see Figure 4-10) removes the right turn bay from the Rintoul Street south approach to Te Wharepouri Street, and creates a lane shared by left turning, through and right turning traffic. This is adjacent to a kerbside separated cycle facility.

Probability of crash occurring	Likely
Expected crash severity	Serious injury

Primary treatment recommendations:

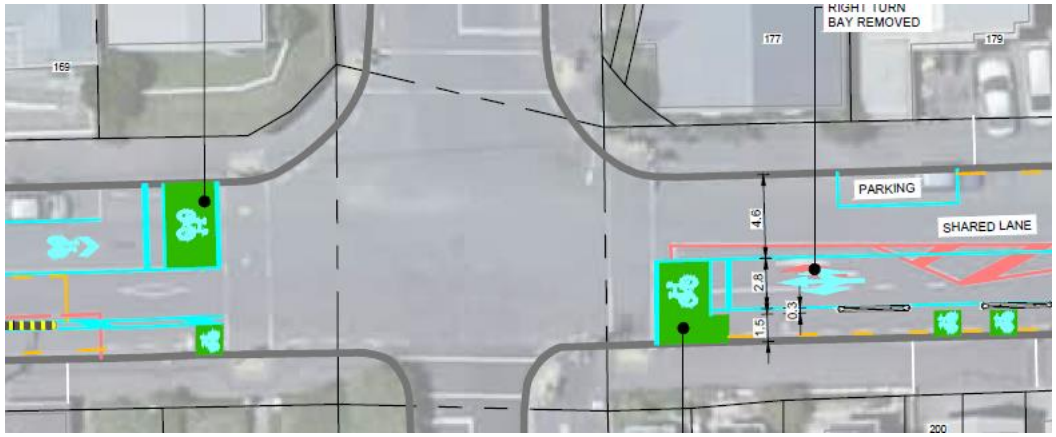


Figure 4-10: Rintoul / Te Wharepouri intersection layout

There several safety issues, depending on the vehicle movements involved:

Right turners will move into the intersection to wait for a gap in opposing through traffic. The alignment of the opposing lane means vehicles travelling straight through will have to undercut waiting right turners and will thus veer into the path of cyclists travelling straight through.

Left turning vehicles will have to give way to cyclists coming from the kerbside cycleway. This is concerning because these drivers may not expect to have to give way to cyclists coming from their left side, and is compounded by the pressure of not wanting to hold up subsequent through traffic – i.e. even if they are aware that a cyclist is approaching, left turners may be tempted to edge to the left or try to turn quickly across the cyclist's path to avoid delaying the driver(s) behind them. Furthermore, following drivers may be tempted to try to pass a waiting left turner, which would result in conflict with opposing through traffic. This concern is tempered by the fact that this leg of Te Wharepouri Street is a cul-de-sac with low volumes comprised of familiar drivers.

Vehicles turning right from the north approach will also cross the path of cyclists coming from the cycleway, although this conflict is less of a concern as these drivers will have forward visibility to cyclists and will have to check for a gap in the motor traffic in the same direction.

4.14.1	Remove parking on the east side of the north approach so the north approach lane is against the kerb and establish right turning bays in the centre of the intersection. (This, however, will not lead well to the planned future southbound separated cycleway.)
Supporting treatment recommendations:	
4.14.2	Mark the cycle trajectory across the intersection using continuity lines and any other treatment approved by Waka Kotahi.

4.14.3	Use some form of signalisation to assist cyclists who have already arrived at the start of the phase, e.g.:
	• A cycle-only phase.
	  ○ While generally not ideal (cyclists get frustrated being stuck at a red light while watching parallel traffic go) it may be the best solution in this constrained case.
	  ○ E.g. a cycle Barnes Dance, which would include cycling right from Rintoul St south to Te Wharepouri St, catering for those travelling to SWIS.
	• A head start for cyclists coming from the northbound separated cycleway.
	• Apply a red right turn arrow for the

The crash types expected are motor vehicle vs cyclist and motor vehicle vs motor vehicle (head-on or side swipe). The risk factors include: lack of signal protection for cyclists (e.g. head start or separate phase); lack of designated space for turning vehicles to wait and give way whilst through vehicles can continue; and the heavy right turn towards South Wellington Intermediate School (SWIS). Crashes are expected to be likely, and those that do occur could result in serious injury due to vehicle speeds involved. Ideally, the right turn from the south approach should be banned, but it is understood from the 30% CASA that this is not considered feasible. The recommendations therefore provide alternatives assuming the right turn must be retained. Overall, we suggest that the team should not be constrained by what may be planned in the future for this intersection. The objective ought to be to make the intersection as safe for users as is possible.		first few seconds of the phase (more efficient for through drivers at the start of the queue, although potentially frustrating for those stuck behind a right turner at a red arrow).

Responses:	
Designer	Agree with CASA findings. Unfortunately, the elimination of parking on the eastern side of Rintoul Street will not create sufficient space for the establishment of a right turn bay in the central section of the intersection (the three traffic lanes would all be less than 2.5m in width). In order to mitigate potential conflicts between left turning vehicles and cyclists, we consider installing an additional separator in close proximity to the intersection to enhance visibility of cyclists to left turners. Moreover, to improve visibility of cyclists traversing the intersection, continuity lines should be proposed for the cycleway. Changes to the signal aspects and phasing for this intersection are outside the scope of this project. We note that the LGWM City Streets Newtown to Berhampore project includes this intersection and recommend this feedback is passed on to be considered in that design.
Safety Engineer	Agree with CASA findings and serious risks of crashes with pedestrians and cyclists due inadequate consideration to separate these conflicts in a confined intersection layout. I do not support the CASA treatment recommendations at this stage until these options are further explored with road user safety benefits and safe intersection operation from all aspects.

Proposed client action	Install additional separator and add continuity lines to highlight the left turn conflict (least common movement at this intersection). Add an advance cycle light and/or advance northbound light in the morning peak which allows northbound traffic to move ahead of southbound traffic and should help to clear both right turners and straight ahead traffic. LGWM Modelling shows that going to one lane northbound and R turn has minimal effect on the operation of the intersection and traffic queuing.
Action taken	

4.15 Cycle lane on inside of bend at Luxford / Rintoul (905117) – C E Significant

Figure 4-11 shows the cycle lane on the inside of the bend at Luxford / Rintoul Street. Since the 30% plans, the width of the cycle lane has been narrowed and red coloured surfacing (see also issue 4.4) has been added under the cycle symbols.

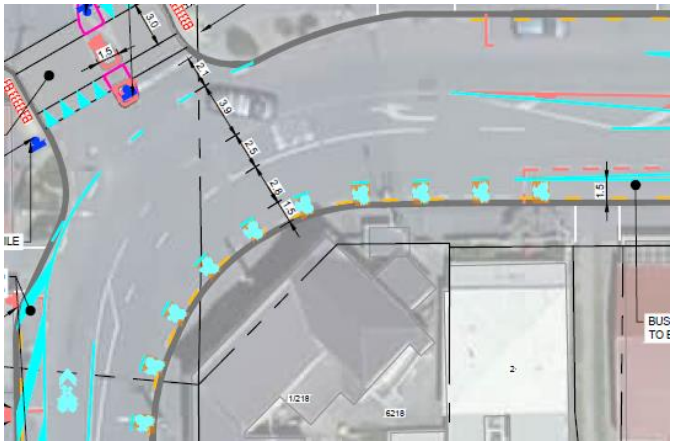


Figure 4-11: Cycle lane on inside of bend at Luxford / Rintoul

The safety issue is motor vehicles are expected to cut the corner and encroach on the cycle lane.

The crash type expected is motor vehicle vs cyclist.

The risk factors include: the tightness of the bend, the narrowness of the cycle lane, the lack of physical separation, and the additional movements associated with the intersection on

Probability of crash occurring	Unlikely
Expected crash severity	Serious injury
Primary treatment recommendations:	
4.15.1	The only way to fully mitigate this would be to provide physical separation around the corner.
Supporting treatment recommendations:	
4.15.2	Apply audio tactile pavers (ATP) around the bend on the lane line to deter motorists from cutting the corner.

the bend. The relevant standards is the TCD Manual part 5 – cycle lanes; while the proposed cycle lane is wider than the minimum width stated, the TCD Manual does not discuss the issue of motorists cutting into a cycle lane on the inside of a bend, neither does the CNG. Crashes are expected to be unlikely (no more than 1 per year) but those that do occur could result in serious injury due to the speeds of motor vehicles involved.			

Responses:	
Designer	In consideration of the tracking requirements of large vehicles such as buses, it is not feasible to propose physical separation for the cycle lane around the bend. Additionally, according to Guidelines for using ATP road markings, the use of ATP is not a viable solution due to the potential noise pollution caused by the vehicles tracking over ATP road markings, which may cause disturbance to the nearby residents. As described in Finding 4.4, the red markings initially proposed in the design to increase awareness for both cyclists and motorists will be changed to green.
Safety Engineer	Agree with CASA findings and the Designer should consider easing this corner by realigning the kerb and channel to increase the physical separation around the corner as physical separator is not feasible.
Proposed client action	We are working in with LGWM on changes they may be able to make alongside this project in advance of their work in the rest of this corridor. The options they are looking to progress are: 1. Realign kerbs and ban the right turn to provide protected cycle lanes in each direction and improve bus tracking; or 2. Change to signalised If LGWM are unable to progress their work on this intersection in time to consult and implement alongside us we will include in our drawings providing a raised lane on the footpath with a buildout on Rintoul where cyclists exit OR removing the turning lane and separating right around the corner. We will highlight these changes/additions to the designs to Transport and Infrastructure for review when they are available prior to TR designs and undertake a further safety audit on any changes.
Action taken	

4.16 Unconventional stop on Luxford Street turn bay (905117) – C E M Serious

Figure 4-12 shows the right turn from Luxford Street to Rintoul Street, which has a stop control applied. The safety issue is this situation is ambiguous, which can lead to unintended or unexpected behaviours. The main / priority route continuous around the bend between Luxford Street and Rintoul Street south of the intersection. Normally drivers turning from a main road would give way to opposing traffic, but not the side street traffic. In this case, however, right turning drivers faced with the stop control would be expected to give way to side street traffic (who have a GIVE WAY control). Some drivers coming from the side street may not be aware of the stop control placed against the right turn bay and therefore assume they have to wait for the right turners. It is also unusual to apply a stop sign in this configuration, where the rest of the approach traffic has no form of control.

Figure 4-12: Stop applied to right turn bay on Luxford Street into Rintoul Street

The crash types expected are any combination between the intersection users – bus, motor vehicle, bike, and pedestrian.

The risk factors include: the presence of buses (as noted in the 30% CASA where it was

Probability of crash occurring	Likely
Expected crash severity	Serious injury
Primary treatment recommendations:	
4.16.1	Revert the right turn from Luxford Street to a regular right turn bay (i.e. controlled by give way rules).
Supporting treatment recommendations:	
4.16.2	N/A

recommended to remove the right turn from Luxford Street); and the planned introduction of the raised speed platform across the side street, which further enforces the impression that the right turn from the main street should have precedence over the side street. The relevant standards are the Traffic Control Devices Rule. Crashes are expected to be likely (at least one per year) and could result in serious injury given the various users that could be involved.		

Responses:	
Designer	Agree with CASA findings and recommend that the right turn bay from Luxford Street to Rintoul Street be converted into a give-way controlled bay. This recommendation is based on the guidelines outlined in the Traffic Control Devices Manual - Part 4, which indicate that with the associated decrease in vehicle speed around the intersection, there is sufficient visibility for the right turn bay to be give way controlled. Furthermore, it should be noted that the minimum required gap sight distance is adequately met within the 30kph zone, and there is adequate SISD (Stopping Sight Distance) provided for the Rintoul Street Southbound direction.
Safety Engineer	Disagree with CASA findings and the Designer as the current intersection control operates relatively safely and caters for the main traffic flows and PT route. I do not support changing this intersection without further review of the proposed Give-Way T intersection layout and the potential crashes.
Proposed client action	Please see the above response in 4.15 – pending joint work with LGWM. If the intersection is to stay as is with right turn bay agree with Safety Engineer.
Action taken	

4.17 Luxford / Rintoul raised safety platform designation (905117) – P E Minor

Probability of crash occurring	Unlikely
Expected crash severity	Minor injury
Primary treatment recommendations:	
4.17.1	Mark a zebra crossing on the raised safety platform, to minimise confusion.

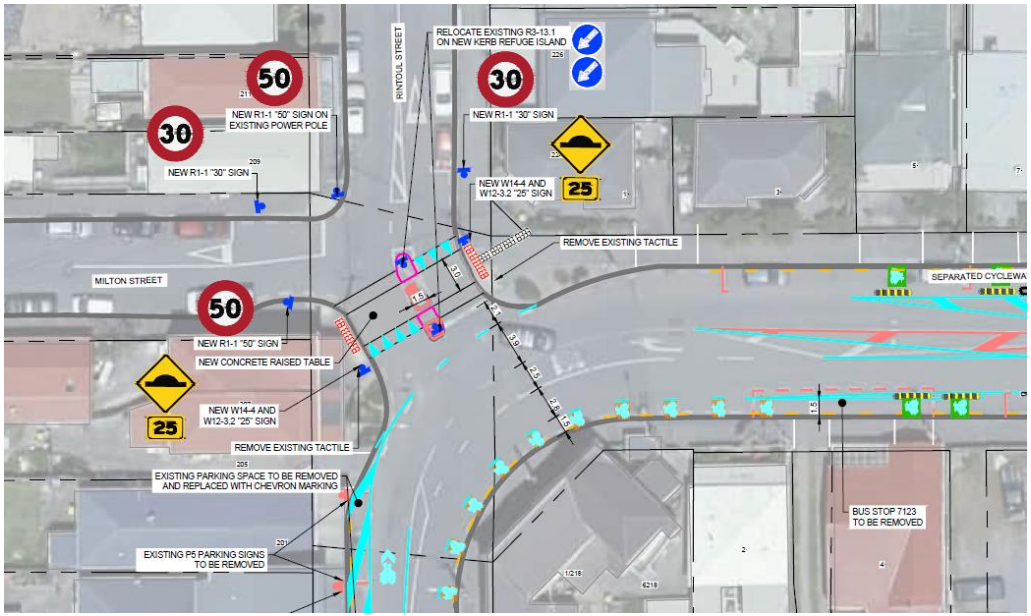


Figure 4-13: Luxford / Milton / Rintoul intersection

The raised safety platform at the Luxford / Milton / Rintoul intersection (see Figure 4-13) has been designed as a pedestrian courtesy crossing. The safety issue is this will create ambiguity - most drivers are likely to wait for pedestrians, but some will not.

The crash type expected is motor vehicle vs pedestrian.

Risk factors are related to the complicated nature of the intersection as discussed in other issues (4.15, 4.16, and 4.18) associated with this location.

Crashes are expected to be unlikely (no more than one per year), and the raised safety platform should keep motor vehicles travelling below the safe system threshold for pedestrians.

Supporting treatment recommendations:	
4.17.2	N/A

Responses:	
Designer	Per the design decision report in section 2.4, a proposal for a raised speed platform has been put forward during the 90% design stage. The purpose of this platform is to decrease the probability and severity of collisions by slowing down turning

	traffic. To reduce confusion regarding priority, a concrete platform has been suggested, with distinct textural differences from the adjacent footpath. Given the concept of the design for transitional cycleways that requires minimal physical changes, a zebra crossing was not chosen due to its additional visibility requirements, as well as the need for adequate lighting and signage assessments. The final decision on whether to incorporate a zebra crossing onto the raised platform will be made by the client.
Safety Engineer	Agree with the Designer that the raised speed platform minimises the probability and severity of crashes. Disagree with CASA primary treatment recommendation as the proposed layout of the Zebra crossing needs further assessment to comply with WK requirements.
Proposed client action	Please see the above response in 4.15 – pending joint work with LGWM. We propose making this a raised zebra crossing and will look into compliance with Waka Kotahi requirements.
Action taken	

4.18 Luxford / Rintoul raised safety platform island (905117) – M Moderate

The safety issue is the refuge island on the Milton Street side of the RSP proposed at the Luxford / Milton / Rintoul intersection (see Figure 4-13) will prevent vehicles from turning right out of Milton Street.

Crashes are expected to be motor vehicle vs kerb island.

The CAT acknowledges that the refuge islands have been included to achieve different ramp gradients for the approach and departure sides, in-line with current design guidance.

The risk factors include: the location of the intersection around the bend; the narrowness of the traffic lanes; the presence of the cycle lane on the inside of the curve (see also issue 4.15); and the presence of buses.

The relevant guidance is the Austroads research report R642-20 on Effectiveness and Implementation of Raised Safety Platforms, which specifies a median should be used if approach and departure ramps have different gradients.

However, the reason for including a median is to prevent vehicles from having wheels on different gradients at the same time, which can only be achieved if the vehicle is travelling perpendicular to the ramp. In the case of the Luxford / Milton / Rintoul intersection, the geometry means that most vehicles will still be turning when they arrive at the RSP, and

Probability of crash occurring	Likely
Expected crash severity	Minor injury
Primary treatment recommendations:	
4.18.1	Omit the island on the south side of the platform
Supporting treatment recommendations:	
4.18.2	N/A

therefore will not be perpendicular to the ramps. For example, those turning left from the Rintoul Street north approach will experience their front left wheel mounting the ramp before the front right wheel does. Similarly, regardless of the presence of the refuge island, a vehicle turning right from Milton Street would experience its right wheel mounting the ramp before the left wheel does; thus, the refuge island would not be able to achieve its aim. Furthermore, it is expected that vehicles turning right from Milton Street would do so below the design speed and capable of negotiating unequal gradients. Overall, if the right turn from Milton Street is to be retained, it seems reasonable to omit the island on the south side of the platform. It should be noted that other locations have achieved construction of asymmetrical platform ramp designs without the need for a central median (e.g. Salisbury Rd at Champion Road, Richmond, which does have a solid median island approaching the ramp). Crashes are expected to be likely (at least one per year) but should not result in anything more than minor injury to vehicle occupants.		

Responses:	
Designer	We agree with CASA recommendation. Due to the complex nature of the intersection, a refuge island was originally designed to provide protection and shelter for pedestrians crossing Rintoul Street. To facilitate right turns from Milton Street, the refuge island on the south side of the platform should be omitted. This exclusion does not compromise pedestrian safety since there is adequate visibility from the eastern side of the crossing to the northbound direction of Rintoul Street. Furthermore, the geometry of the refuge island on the northern side should be upgraded to accommodate northbound movements on Rintoul Street and to allow for the installation of an R3-13.1 sign facing the northbound direction of Rintoul Street.
Safety Engineer	Agree with CASA primary treatment recommendation and agree with Designer response.
Proposed client action	Agree with CASA, Designer and safety engineer.
Action taken	

4.19 Transition to shared lane between bus stop and slip lane at Adelaide / Luxford (905118) – C E Serious

The safety issue is westbound cyclists on Luxford Street will traverse the bus stop platform then immediately have to merge with general traffic prior to or on the slip lane to Adelaide Road (see Figure 4-14).

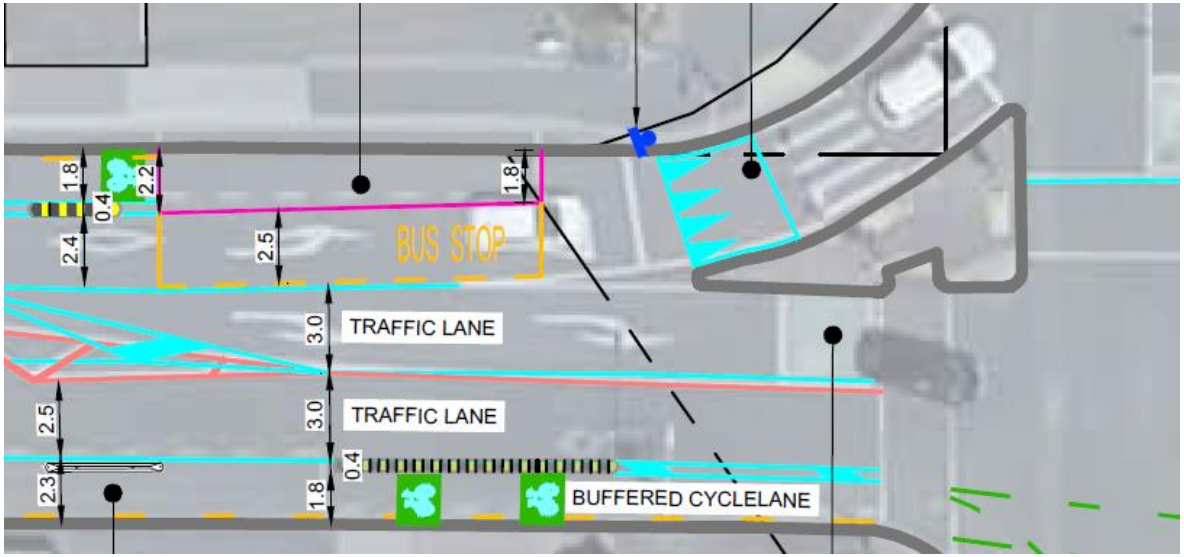


Figure 4-14: Slip lane onto Adelaide Road

The crash type expected is motor vehicle vs cyclist or bus vs cyclist.

The risk factors include: the proximity of several elements that require drivers' attention (bus stop, merge to shared lane, slip lane); the slip lane width is in the "in-between" range and undesirable for shared use (i.e. motorists and cyclists may think there is enough width to travel side by side, but, it is dangerous to do so); buses pulling out of the bus stop at the merge point; lack of sharrow or any other indication to motorists and bus drivers that cyclists are merging into a shared lane.

There are no specific standards relating to this issue. Best practice would be placing sharrows at, and just prior to, the merge location, but it is not possible to provide these due to the proximity of the bus stop and the slip lane ramp.

Given the complexities of the site and the volumes involved, crashes are expected to be likely. Those

Probability of crash occurring	Likely
Expected crash severity	Serious injury
Primary treatment recommendations:	
4.19.1	Shift bus stop 6124 further back from the intersection
Supporting treatment recommendations:	
4.19.2	Use sharrows with coloured surfacing at, and just prior to, the merge location, to clearly indicate the transition from the separated cycleway to shared traffic.

that do occur involving a bus would likely result in serious injury.			
Responses:			
Designer	We have discussed this with the LGWM City Streets team who are still to confirm a preferred location for this bus stop. However we note stakeholder feedback has prioritised keeping this bus stop in or adjacent to the existing village centre between Luxford Street and Britomart Street. There is potential that this bus stop may be relocated south of Herald Street which would address this concern. The client has previously confirmed that this bus stop platform would be constructed with permanent materials to accommodate the driveway across the rear part of the bus stop. The LGWM City Streets team have advised that their current design proposes further changes to the kerb line at this location, with a high likelihood of re-doing our proposed changes. If the bus stop is to remain in its current location we propose; • This bus stop remains kerbside in its existing position (no bus platform) • The cycle lane transitions to a shared lane in advance of the bus stop. Cyclists can choose to merge into the traffic lane and pass a bus or wait for the bus to depart. When no bus is stopped cyclists can continue through the bus stop • Markings are added as per recommendation 4.19.2 • This will separate the merge points for cyclists, buses and vehicles, and improve the visibility in advance of the cycle merge point • This will increase the length of shared lane for southbound cyclists by approximately 20m (noting this shared lane extends along Adelaide Road, and that cyclists have also shared a lane for part of Rintoul Street), and this additional section remains within the 30km/hr town centre.		
Safety Engineer	Agree with CASA findings but as the bus stop location is unclear at this stage, I cannot comment further from a safety perspective.		
Proposed action	Bus stop will not become a platform bus stop and will remain kerbside, cycle transition moved back as per designers recommendations		

Client decision	
Action taken	

4.20 Bus stops at Adelaide / Luxford (905210) – C E M

Significant

We are aware that the locations of the bus stops in the vicinity of the Adelaide / Luxford and Adelaide / Britomart intersections (see Figure 4-15) may change due to changes in the City Streets plans.

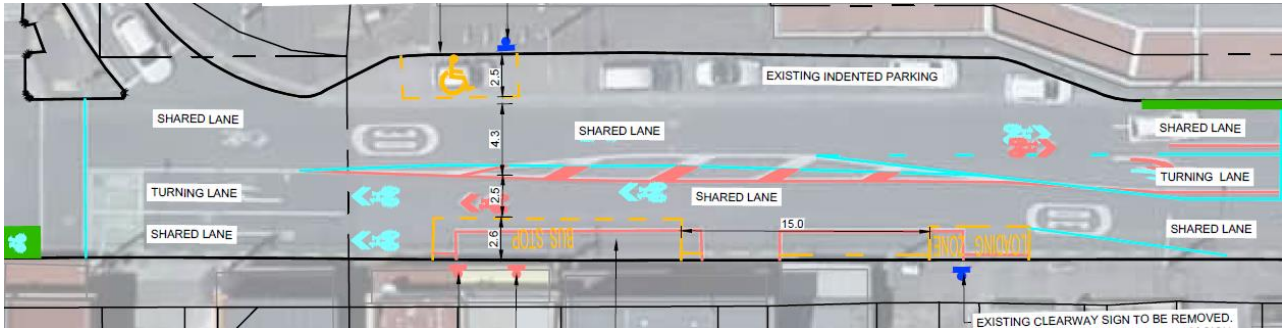


Figure 4-15: Bus stops on Adelaide Road between Luxford Street and Britomart Street

As currently proposed, the bus stops on Adelaide Road between the two intersections are shown as being right against the existing kerb; in reality, it will not be possible for buses to park right up against the kerb as they would hit the adjacent power pole and verandas.

There are several safety issues with this arrangement:

Buses would park out from the kerb, which results in a hazard for people stepping on and off the bus, especially the mobility-impaired. This will also result in the bus encroaching on the adjacent traffic lane, which is already at the minimum legal width, thus making it akin to the locations discussed in issue 4.2.

Furthermore, the proposed design requires cyclists to merge into the short section of shared lane, then transition back to a kerbside position to access the hook turn, which means they weave across the path of buses exiting the bus stop. The main bus route turns right into Luxford Street and there might be considerable conflict with heavy through traffic preventing the bus from changing lanes. Property damage might occur if bus drivers misjudge the intention of drivers.

The risk factors include: traffic volumes; short block length between the two intersections (which affects queue lengths and capacity); vehicle movements to / from the loading zone.

Probability of crash occurring	Unlikely
Expected crash severity	Serious injury
Primary treatment recommendations:	
4.20.1	Provide a cycleway bus platform and shift the bus stop out so it becomes an in-lane stop that blocks all general traffic. This would be subject to modelling, especially given short block length between Luxford Street and Britomart Street.
Supporting treatment recommendations:	
4.20.2	N/A

The Bus Stop: Public Transport Design Guidance notes the importance of considering the crossfall of the road at the bus stop. Crashes are expected to be unlikely (no more than one per year) but those that do occur could result in serious injury, due to the potential for motor vehicle speeds above the safe system threshold and the presence of buses.		

Responses:	
Designer	Following review with the LGWM City Streets team we considered the proposed inline bus stop, but this did not work for traffic modelling. We propose the following to address the CAT finding; • A small bus stop buildout (approximately 0.5m wide) is provided to allow the buses to pull up against the kerb (maintain accessibility) without impacting the building canopies. • The bus stop is moved slightly south to improve the lead in to the right turn lane • Additional width from the southbound lane (currently 4m wide) is reallocated to maintain a northbound traffic lane past this bus stop This also links to Finding 4.21 (the 0.5m bus stop platform leads into the protection proposed for the cycle hook turn box). We also note that the raised crossing across Adelaide Road and Britomart Street will control vehicle speeds approaching this bus stop to improve reaction time and reduce the severity of a crash should it occur.
Safety Engineer	Agree with CASA findings. Agree with Designer traffic modelling outcome and the proposal outlined above.
Proposed client action	Agree with designer proposed response.
Action taken	

4.21 Adelaide Road footpath hook turn (905210) – P C E Significant

Probability of crash occurring	Unlikely
Expected crash severity	Serious injury

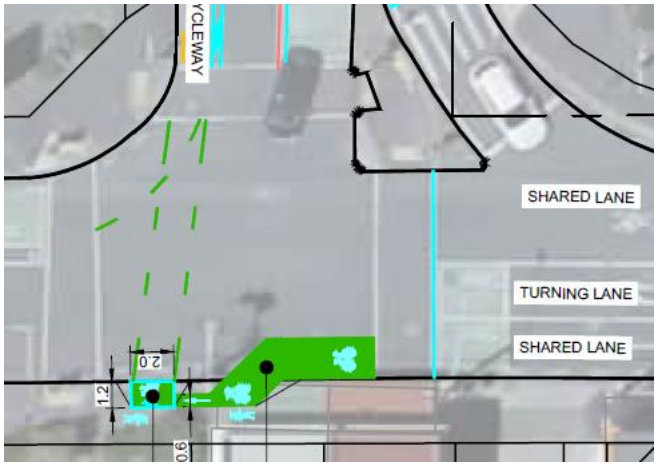


Figure 4-16: Jug handle (hook turn box on footpath) provision for Adelaide Road to Luxford Street

Figure 4-16 shows the jug handle (hook turn box on footpath) provision for cyclists turning right from Adelaide Road to Luxford Street; there are three associated safety issues:

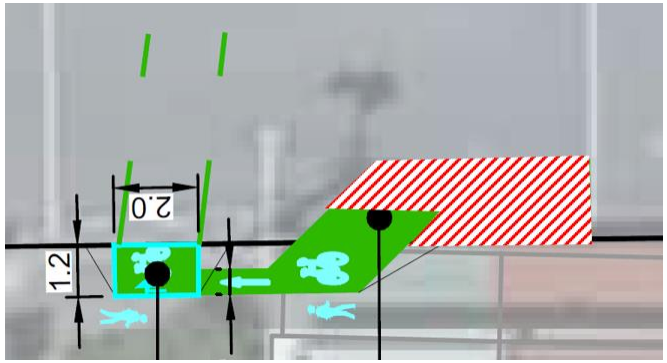
Firstly, the approach marking consists of a solid green path with cycle symbols. This makes it looks like a cycle lane, but it is located in the trajectory of the shared lane.

Secondly, the hook turn box is only 1.2 m deep, which is shorter than a standard bike (approximately 1.8 m long) and doesn't satisfy the CNG requirements that each side of a hook turn box should be at least 1.5 m long, with a minimum area of 3 m^2. This means cyclists will either try to orient their bike with the long side of the box, which is perpendicular to their direction of travel across the intersection, or (more likely) they will overlap onto the footpath space or into the intersection.

Lastly, the continuity lines for the left turn from the Adelaide Road north approach lead into the separated cycleway.

The crash type expected is cyclist vs motor vehicle.

The risk factors are: traffic volumes, traffic speeds, and road user unfamiliarity

Primary treatment recommendations:	
4.21.1	Remove most of the section of green on-road that looks like a marked cycle lane – leave a short on-road section leading to the footpath section. 
4.21.2	Consider means of increasing the size of the hook turn box, without further disadvantaging pedestrians, possibly by means of a small kerb extension.
4.21.3	Fix the continuity lines from the Adelaide Road left turn.
Supporting treatment recommendations:	
4.21.4	N/A

with this type of manoeuvre in Wellington. The relevant standards are outlined in the CNG section on cyclist waiting facilities at intersections. Crashes are expected to be unlikely, but those that do occur could involve vehicle speeds above the safe system threshold for cyclists and therefore result in serious injury.		

Responses:	
Designer	Agree with CASA findings. As a result of these findings and other feedback received regarding the 90% design, a redesign of the area is being planned prior to the submission of the Traffic Resolution (TR) design. The current width of the footpath surrounding the proposed hook-turn box is 2.5m. However, allocating 1.2m of this width to the hook-turn box would result in only 1.3m remaining for the footpath, which falls below the absolute minimum width requirement of 1.5m for footpaths. Since it is not possible to occupy more space from the footpath, a kerb extension will be considered to improve the design of the hook-turn box in the TR submission. Furthermore, the continuity line markings for the left turn from the Adelaide Road north approach will be updated accordingly.
Safety Engineer	Agree with CASA findings and agree with Designer response to redesign this area.
Proposed client action	Agree with CASA and Designer. With bus stop placement on this town centre section of road and removal of bus stop north of here a better hook turn design is possible and will be added to the TR issue designs.
Action taken	

4.22 Cable run at Riddiford / Rintoul (905300) – P C E M Significant

The safety issue is one of the cable runs (see Figure 4-17) includes poles 7, 8 and 9 – which contain all the signal faces for the Rintoul Street approach. If pole 7 were to be hit by an errant vehicle, there would be no signals for Rintoul Street and the controller should shut the intersection down (i.e. go into flashing yellow mode). Drivers would have to negotiate the intersection among themselves and there would be risk of crashes.

Probability of crash occurring	Very unlikely
Expected crash severity	Serious injury
Primary treatment recommendations:	
4.22.1	Introduce redundancy to the cable runs

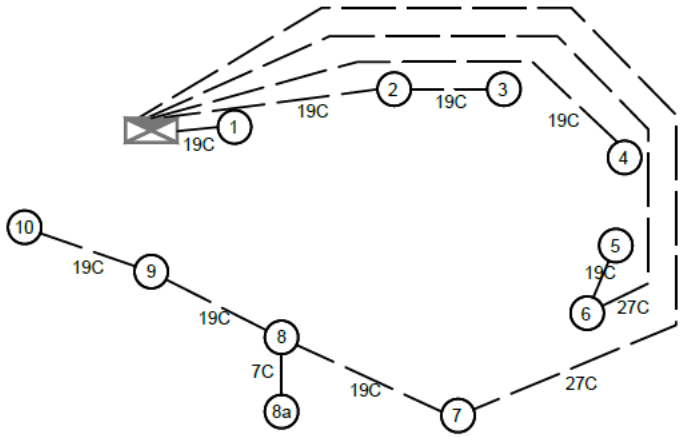


Figure 4-17: Riddiford / Rintoul traffic signal cable run

The crash types expected are any combination between the intersection users – bus, motor vehicle, bike, and pedestrian.

The risk factors include: the intersection's unusual geometry, the parking on the approach to pole 7, and the driveway adjacent to pole 7.

The principle of redundancy is not documented in any relevant standards but is considered best-practice among signals engineers, to avoid shutting the intersection down. An event that disables pole 7 and causes subsequent crashes is expected to be very unlikely. Those that do occur, however, could well cause serious injury, due to the users and the ambiguity involved.

	so that if one signal is disabled, each approach will still have an adequate number of working signal faces.
Supporting treatment recommendations:	
4.22.2	N/A

Responses:	
Designer	This is as existing. Changes to the cabling beyond the additional detector loop input are outside the scope of this project. We recommend this finding is passed on to the WCC Traffic Operations Centre to be considered as part of future intersection works.
Safety Engineer	Noted.
Proposed client action	Noted – pass on to WCC traffic operations centre.

Action taken	

5 Audit statement

We certify that we have used the available plans, and have examined the specified roads and their environment, to identify features of the project we have been asked to look at that could be changed, removed or modified to improve safety.

The safety issues identified and noted in this report are summarised in Table 5-1.

Table 5-1: Summary of Issues

Serious	*Significant*	*Moderate*	*Minor*	*Comments*	*Total*
6	*7*	*2*	*4*	*3*	*22*

Issue	*Ranking*
2.1 Issue title (be specific)	Serious
2.2 Auto generate outside the table using TOC, then convert text to table	Significant
2.3	Moderate
2.4	Minor
2.5	Comment

Issue	**Description**	**Severity**	**Page**
4.1	Driveway treatments at separated cycleway (multiple locations)	Minor	13
4.2	Driveway treatments at shared lanes (multiple locations)	Serious	14
4.3	Lane width adjacent to bus stops (multiple locations)	Minor	15
4.4	Red surfacing under cycle symbols (multiple locations)	Comment	18
4.5	Cycleway platform bus stops (multiple locations)	Moderate	19
4.6	Traffic lane lateral shifts (multiple locations)	Comment	20
4.7	Riddiford bus stop / loading zone / cycle lane arrangement (905110)	Serious	22
4.8	Turning vehicles conflicting with pedestrians at Riddiford / Rintoul (905110)	Minor	23
4.9	Rintoul Street approach to Riddiford Street (905110)	Serious	25
4.10	Start of separated cycleway on Rintoul Street (905111)	Significant	27
4.11	Colombo Street setback (905111)	Significant	29
4.12	Parking on footpath outside 122 Rintoul Street (905114)	Comment	30
4.13	Rintoul Street passing areas (905111-905115)	Significant	30
4.14	Single lane on Te Wharepouri Street south approach to Rintoul (905116)	Serious	32

4.15	Cycle lane on inside of bend at Luxford / Rintoul (905117)	Significant	34
4.16	Unconventional stop on Luxford Street turn bay (905117)	Serious	36
4.17	Luxford / Rintoul raised safety platform designation (905117)	Minor	37
4.18	Luxford / Rintoul raised safety platform island (905117)	Moderate	39
4.19	Transition to shared lane between bus stop and slip lane at Adelaide / Luxford (905118)	Serious	40
4.20	Bus stops at Adelaide / Luxford (905210)	Significant	42
4.21	Adelaide Road footpath hook turn (905210)	Significant	43
4.22	Cable run at Riddiford / Rintoul (905300)	Significant	45

Designer:	Billy Rodenburg	Position	StepChange Project Manager
Signature		Date	08/05/2023
Safety Engineer:	Soon Kong	Position	Engineering and Operations Manager
Signature		Date	15 May 2023
Client:	Bradley Singh	Position	Manager – Transport & Infrastructure
Signature		Date	07 August 2023
Project Manager	Nicola Mitchell	Position	Project Lead – Transitional Team
Signature		Date	7/08/23
Audit report distributed on:		Date	