Wellington Street Bicycle Infrastructure, between Johnston Street and Queens Parade

SAFE SYSTEM SOLUTIONS
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Road Safety Audit

Audit Stage: Existing Conditions

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Information Page

Document control

Document type	Existing Conditions [stage] road safety audit
Project title	Wellington Street Bicycle Infrastructure, between Johnston Street and Queens Parade
Report number	S20230305-REP-001

Revision history

Revision	Date	Description	Prepared by	Reviewed by	Approved by
A	22 Sep 2023	First issue	J Tovenati I Malagamba	M McCardel	

Contact details

Name	Max McCardel
Address	4/35 Hope Street, Brunswick VIC 3056
Phone	+61 3 9068 4805
Email	info@SafeSystemSolutions.com.au
Website	http://www.safesystemsolutions.com.au

Safe System Solutions Pty Ltd
Victoria: Brunswick I Camberwell
Queensland: Brisbane
Sweden: Lidköping
New Zealand: Auckland

ACN: 164 341 084 ABN: 98 164 341 084

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List of Abbreviations

AGRD – Austroads Guide to Road Design

RSA – Road Safety Audit

1. Introduction

Safe System Solutions Pty Ltd has been engaged by City of Yarra to undertake an Existing Conditions Road Safety Audit (herein referred to as either RSA or audit) for the Wellington Street Bicycle Infrastructure, between Johnston Street and Queens Parade.

The location of the RSA is shown in Figure 1.

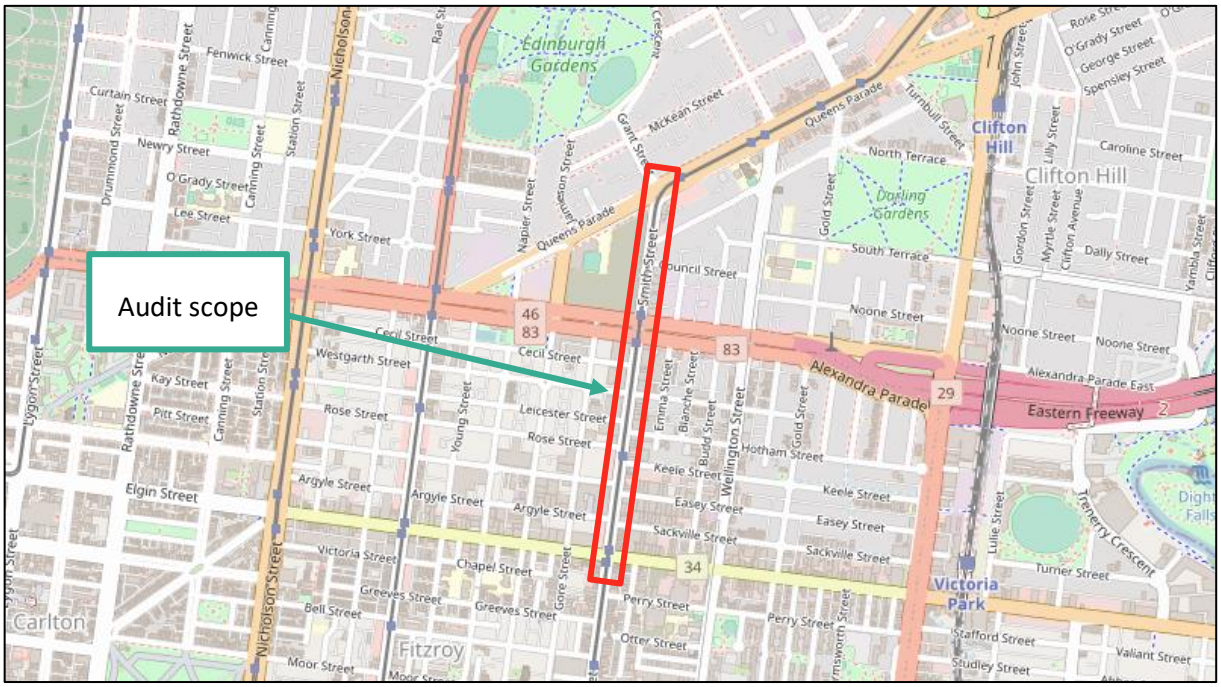


Figure 1: Locality plan (source: OpenStreetMap)

This report has been prepared by Safe System Solutions Pty Ltd for City of Yarra and may only be used and relied on by City of Yarra for the purposes of documenting the findings and recommendations of the completed RSA.

2. Guidance for RSA

RSA is a term used internationally to describe a recognised process which identifies road safety related risks and hazards. The primary objective of the RSA is to reduce road trauma at the RSA location. The Guide to Road Safety Part 6: Road Safety Audit (Austroads, 2022) is the primary guidance for undertaking RSAs in Australia and New Zealand.

An RSA is not a review or check of compliance with standards and/or guidelines for design projects or existing roads and it is possible that not every risk or hazard that affects road user safety has been identified.

Although the adoption of the audit recommendations will improve the level of safety of the audit location it will not, however, eliminate all the road user safety risks.

RSA is a formal process and responses to audit findings and recommendations should be documented by the client in writing. If recommendations are not accepted by the client then reasons should be included within the written response. A client is under no obligation to accept all the audit findings and recommendations and should consider these in conjunction with all other project considerations. It is not the role of the auditor to approve the client's response to an audit.

2.1 RSA within the Safe System

The RSA pre-dates the emergence of the Safe System approach. Within the Safe System, an RSA is relevant as it is recognised that full compliance with road standards alone may not result in a road system that eliminates fatal and serious injury road crashes.

The Guide to Road Safety Part 6: Road Safety Audit states:

Safe System principles must be given due consideration in all activities within the road safety management of a road network, including RSA.

In basic terms this is to be achieved during the RSA process by:

- *Identifying and considering key crash types that result in fatal and serious injury*
- *Relating possible crash forces to tolerable levels, regardless of the likelihood, when identifying and assessing risks/hazards*
- *Consideration of audit findings and mitigation measures by their alignment with the Safe System e.g. in terms of operating speed, impact angles etc.*

While RSAs are intended to identify risks and hazards associated with all crash types, increased focus is required to identify risks and hazards that may result in fatal and serious injury crashes. For this reason, sound knowledge in the Safe System is essential for all participants in the RSA process.

VicRoads Safe System Assessment Guidelines (2019) states that a Safe System assessment *must* be undertaken for any Victorian Government project greater than $5M in value, is *desirable* for where the project value is greater than $2M and *optional* for projects under $2M. Where A Safe System Assessment is not undertaken, the project team should document how the project has considered Safe System alignment. Safe System assessments are most valuable when conducted during the early stages of a project.

2.2 The RSA process

The simplified process to undertake an RSA is shown by Figure 8.1 (Austroads, 2022), reproduced as Figure 2.

Figure 2: Simplified RSA process (source: Austroads, 2022)

3. Conducting the RSA

3.1 Selection of the RSA team

It is a requirement in Victoria that audits are undertaken in teams of two or more, with at least one Senior Road Safety Auditor. Each auditor must be accredited and registered on VicRoads Register of Road Safety Auditors (www.vrsa.com.au). Table 1 provides details of the RSA team.

Table 1: RSA team

Name	Accreditation	Employer
Max McCardel	Senior Road Safety Auditor	Safe System Solutions Pty Ltd
Ilse Malagamba	Road Safety Auditor	Safe System Solutions Pty Ltd
Julian Tovenati	Road Safety Auditor	Safe System Solutions Pty Ltd

3.2 Existing conditions

The subject of this audit is the approximately 1.1km length of Wellinton Street bounded by Johnston Street, Collingwood to the south and Queens Parade, Clifton Hill to the north, including all the intersecting side streets as well as the Alexandra Parade and Queens Parade intersections. This audit focusses on existing bicycle infrastructure, and treatments to improve safety for cyclists using these facilities. As part of this audit, a site inspection was performed on a bicycle to achieve a better appreciation and perspective for the level of risk cyclists may face in the area.

Wellington Street is a two-way collector road that runs from Clifton Hill to East Melbourne, connecting residents of the northern suburbs to the CBD. The roadway is approximately 14.5m wide, with parking bays, bicycle lanes and traffic lanes in both directions. Wellington Street is divided in sections by a raised median, with breaks to allow left- and right-turn movements from side streets and private accesses. The posted speed limit on Wellington Street is 50km/h from Johnston Street to Alexandra Parade, and 40km/h from Alexandra Parade to Queens Parade. The AADT is 9,000 vehicles south of Alexandra Parade, and 5,000 vehicles north of Alexandra Parade.

Bicycle lanes are present in both directions for the extent of the audit length, with green conflict paint implemented at intersections between Wellington Street and its side roads, as well as the 'peanut' roundabout at Wellington Street and Hodgkinson Street. Temporary bicycle infrastructure has been installed from Alexandra Parade to Queens Parade, denoted by yellow pavement markings.

Alexandra Parade is a major arterial road that provides connection to the Eastlink Highway (M3) and Melbourne's eastern suburbs. It serves as a major thoroughfare for vehicles, with an AADT of approximately 70,000 vehicles and a posted speed limit of 60km/h.

Queens Parade is an arterial road that connects Fitzroy North to Heidelburg Road and Melbourne's eastern suburbs. There are hook-turn bicycle boxes for right-turning cyclists onto Queens Parade and painted bicycle lanes. It has a posted speed limit of 60km/h and an AADT of approximately 24,000 vehicles.

According to VicRoads Open Crash Data, in the 5-year period to October 2022 there have been 10 crashes along this length of Wellington Road that involve cyclists. Generally, these crashes are classified as side-swipe collisions where a vehicle has failed to sufficiently leave a gap for cyclists to pass.

3.3 Undertaking the RSA

3.3.1 Meetings and site inspection

Table 2 lists site inspections completed for the audit.

Table 2: Site inspections

Activity	Location	Date	Time
Day site inspection	Wellington Street Bicycle Infrastructure, between Johnston Street and Queens Parade	13 Aug 2023	1000
Night site inspection	Wellington Street Bicycle Infrastructure, between Johnston Street and Queens Parade	13 Aug 2023	1830

Photos taken during the site inspection are included as Appendix A.

3.3.2 Risk assessment

Risk and hazards identified by the audit have been assigned a risk rating based on the **likelihood** and **severity** of the crash type associated with the risk or hazard.

The Austroads risk assessment matrix (Figure 10.2, Austroads, 2022) is reproduced as Figure 3.

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

*see Severity Guidance Sheet

Safe System crash outcome threshold

Figure 3: Risk assessment matrix (source: Austroads, 2022)

Corresponding to the assessed level of risk, Austroads provides the priorities for mitigation:

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

The risk matrix is intended to be used in conjunction with the severity guidance sheet (Figure 10.3, Austroads 2022), reproduced as Figure 4. The severity guidance sheet provides an indication of crash severity outcomes for a range of crash types and crash speeds. Professional engineering judgement is required to confirm the severity outcomes indicated by the guidance sheet, as research into Safe System tolerance speeds continues to evolve.

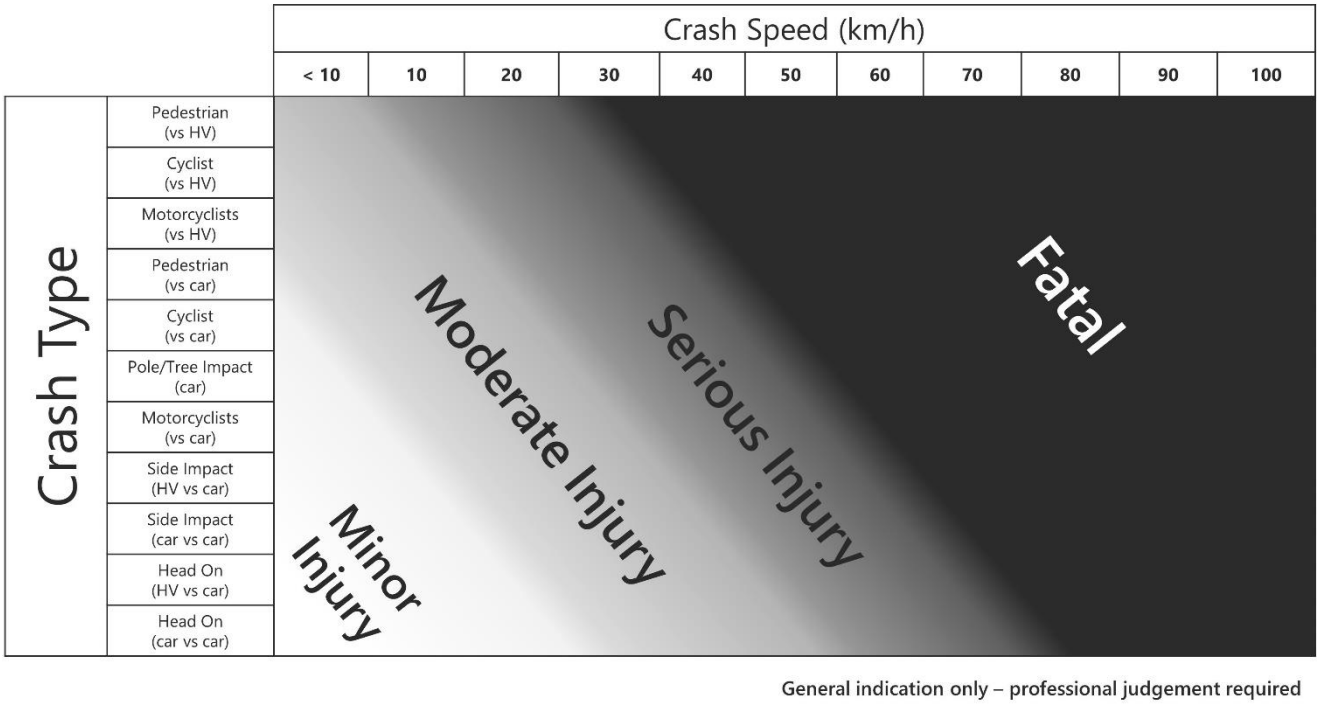


Figure 4: Severity guidance sheet (source: Austroads, 2022)

3.3.3 Making recommendations

Recommendations are provided for all identified risks and hazards. Recommendations are categorised into one of the Safe System treatment categories described in Table 3.

Table 3: Safe System treatment categories (source: Austroads, 2018)

Treatment category	Description
Primary	Road planning, design and management considerations that practically eliminate the potential of fatal and serious injuries occurring in association with the foreseeable crash types.
Supporting (step towards)	Road planning, design and management considerations that improve the overall level of safety associated with foreseeable crash types, but not expected to virtually eliminate the potential of fatal and serious injury occurring. Improves the ability for a Primary Treatment to be implemented in the future.
Supporting	Road planning, design and management considerations that improve the overall level of safety associated with foreseeable crash types, but not expected to virtually eliminate the potential of fatal and serious injury occurring. Does not change the ability for a Primary Treatment to be implemented in the future.
Non-Safe System Other Elements	Road planning, design and management considerations that are not expected to achieve an overall improvement in the level of safety associated with foreseeable crash types occurring. Reduces the ability for a primary treatment to be implemented in the future.

4. RSA findings and recommendations

A table containing audit findings and recommendations table is included as Appendix B.

5. Conclusion

This RSA has been conducted in accordance with the Guide to Road Safety Part 6: Road Safety Audit (Austroads, 2022).

The findings and recommendations of the RSA are provided for consideration and response by the client.

Auditors:

Max McCardel 22 September 2023
Senior Road Safety Auditor

Ilse Malagamba 22 September 2023
Road Safety Auditor

Julian Tovenati 22 September 2023
Road Safety Auditor

Appendix A: Site photos

Photo 1: Northbound view of the bicycle lane at the Wellington Street and Johnston Street intersection

Photo 2: Depressed drain cover within the bicycle lane, at the Wellington Street and Sackville Street intersection

Photo 3: Typical sight distance from side roads turning onto Wellington Street, facing north. Note the vegetation and parked vehicles that provide this obstruction

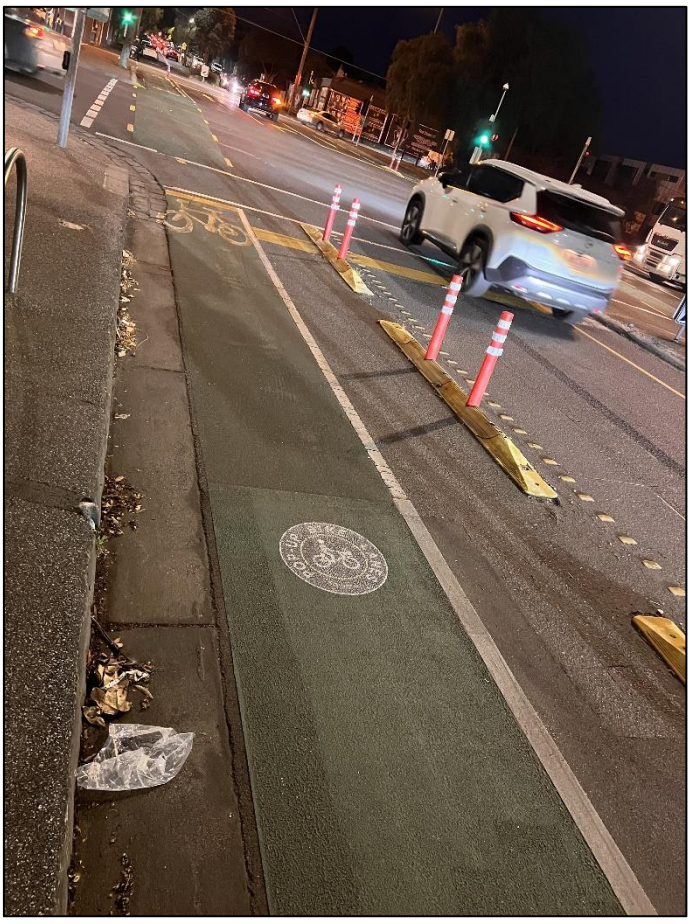
Photo 4: Temporary bicycle infrastructure at the Wellington Street and Alexandra Parade intersection

Photo 5: Northbound approach to the “peanut” roundabout at the Wellington Street and Hodgkinson Street intersection

Photo 6: View of the approach on Wellington Street to intersection with Alexandra Parade (night)

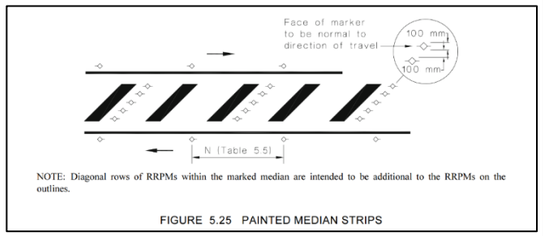
Photo 7: Typical lighting arrangement on Wellinton Street, facing south (night)

Photo 8: Temporary bicycle infrastructure on Wellington Street at its intersection with Alexandra Parade (night)

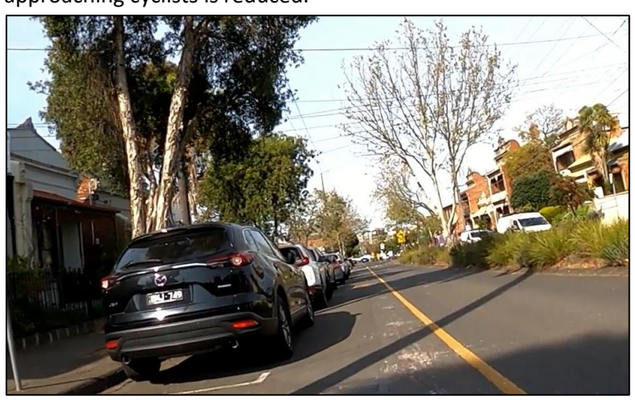
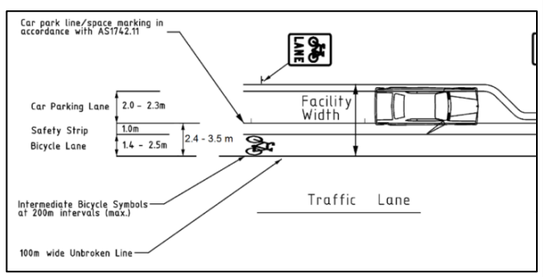


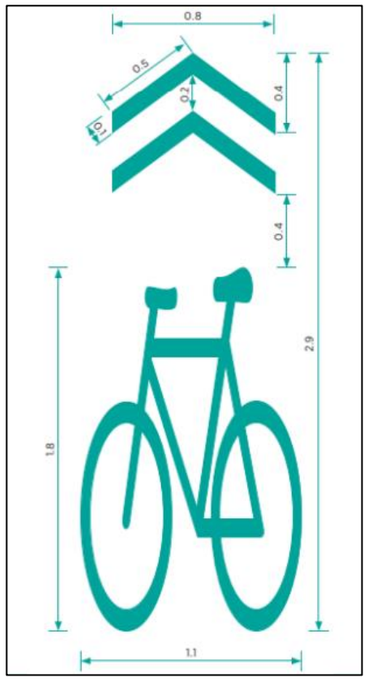
Appendix B: RSA findings and recommendations

Audit findings and recommendations

Audit Findings	Risk Assessment			Recommendations	Responsible Officer	
	Likelihood	Severity	Level of Risk	P – Primary S – Supporting	Accept Yes/No	Comments
The auditors noted recently planted trees within the median on Wellington Street between Johnston Street and Alexandra Parade. The existing median is approximately 1.5m wide. The auditors note two risks associated with this: 1) There is a risk of uprooting of the surrounding pavement as the trees mature. This would increase the likelihood of vehicle-cyclist crashes as vehicles may attempt to dodge pavement defects and encroach into the cycle lane.	**Rare**	**Serious**	**MEDIUM** **(FSI)** Safe System energy exceeds tolerable levels	Consider removing the trees and replacing the median with a narrow-painted median, per *AS1742.2*. Given the operating speed the risk for high severity head-on crashes can be expected to be low. (S)  NOTE: Diagonal rows of RRPMs within the marked median are intended to be additional to the RRPMs on the outlines. FIGURE 5.25 PAINTED MEDIAN STRIPS Consider conducting regular maintenance checks of any pavement defects and rectify. (S)		
2) The trees at this location are not protected by a kerb further increasing the risk for run-off-road crashes. Given the operating speed on Wellington Street impact speeds are likely to be below the Safe System tolerance for this crash type (50km/h). 	**Unlikely**	**Moderate**	**MEDIUM** Safe System energy within tolerable levels	Consider reducing the speed limit to reduce the risk of errant motorists striking the trees. (S) The auditors note the recommended speed reduction will improve the level of safety for all vulnerable road users within the area.		

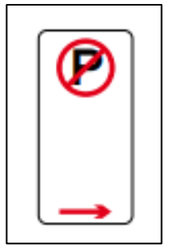
Audit Findings	Risk Assessment			Recommendations		Responsible Officer	
	Likelihood	Severity	Level of Risk	P – Primary	S – Supporting	Accept Yes/No	Comments
Auditors noted significant vegetation overgrowth along the kerbed medians. The auditors note two risks associated with this: 3) This obstructs the ability for vehicles to clearly identify the edge line and increases the risk of vehicles striking or mounting the median (increasing the risk of run-off-road crashes). 	**Unlikely**	**Minor**	**LOW** Safe System energy within tolerable levels	Consider conducting landscaping maintenance to reinstate kerb visibility. (S)			
4) Additionally, this may also lead to vehicles driving closer to the cycle lane to avoid the potential of striking the median. This increases the likelihood of vehicle-cyclist crashes as a result of vehicles encroaching into the cycle lane. 	**Rare**	**Serious**	**MEDIUM** **(FSI)** Safe System energy exceeds tolerable levels	Consider conducting landscaping maintenance to reinstate kerb visibility. (S)			

Audit Findings	Risk Assessment			Recommendations	Responsible Officer	
	Likelihood	Severity	Level of Risk	P – Primary S – Supporting	Accept Yes/No	Comments
5) The bicycle lanes on Wellington Street run adjacent to parallel-parked vehicles along the length of the audit site. Auditors are concerned of the dooring risk present. This could result in a cyclist colliding with a door or an oncoming vehicle in the adjacent lane. This risk increases during peak hours and night-time where there are greater volumes of vehicles and cyclists on the road, visibility is poor, and greater parking turnover.  Additionally, auditors also noted parked vehicles encroaching into adjacent cycle lane at several locations. This encroachment encourages cyclists to travel closer to the adjacent traffic lane and further increases the likelihood of a dooring accident as the available space to overtake an open vehicle door is decreased and sightlines for approaching cyclists is reduced. 	**Unlikely**	**Serious**	**HIGH** **(FSI)** Safe System energy exceeds tolerable levels	Consider continuing the configuration (protected bicycle lane) south of Johnston Street north to Queens Parade. Relocating cycle lanes between kerb and parking with a buffer between vehicles and the cycle lane reduces the risk of dooring or cyclist falling into oncoming traffic due to dooring. (P)  Consider physical barrier between cycle and parking lanes such as a non-mountable kerb or Klemmfix barriers to assure buffer space is maintained by parked vehicles. (P) Consider narrowing the median to provide greater space on the roadway for a “safety strip” between the parallel-parking bays and cycling lane to minimise dooring risk, per *Cycling Aspects of Austroads Guides and ARGRD part 3*. Refer to Finding 1 and 2 for further reasoning for a narrow median. (S) 		

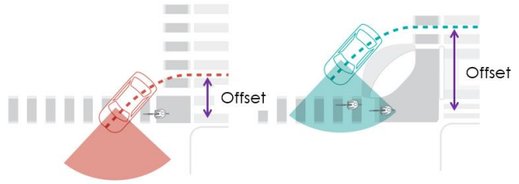
Audit Findings	Risk Assessment			Recommendations	Responsible Officer	
	Likelihood	Severity	Level of Risk	P – Primary S – Supporting	Accept Yes/No	Comments
6) There is a "peanut" roundabout at the Wellington Street and Hodgkinson Street intersection, that has a bicycle lane around its outer perimeter. Auditors are concerned that the unusual shape of the roundabout creates a circuitous route for cyclists (blue line), who will instead ride in the middle of the traffic lane (red line). This increases the likelihood of cyclist-vehicle crash types as vehicles may expect cyclists to stay within the painted bicycle lane. Given the shape of the roundabout, it is expected that crashes would occur at speeds greater than the Safe System tolerance for this crash type (30km/h). 	**Unlikely**	**Serious**	**HIGH** **(FSI)** Safe System energy exceeds tolerable levels	Consider removing the bicycle lane around the roundabout and installing "sharrows" to indicate a shared environment for bicycles and motor vehicles, per *VicRoads Supplement to AS1742.2*. (S)  Consider installing LATM treatments – such as a speed cushions – on approach to the roundabout to further lower vehicle speeds, per *AGRD Part 8*. (P)		

Audit Findings	Risk Assessment			Recommendations		Responsible Officer	
	Likelihood	Severity	Level of Risk	P – Primary	S – Supporting	Accept Yes/No	Comments
7) The auditors note significant pavement marking / linemarking fading along the length of Wellington St for bicycle infrastructure (bicycle lanes, bicycle hold boxes, etc.), parking limits, and at raised pavement and road hump locations. Pavement markings aid both motorists and cyclists in delineating road space and maintain separation between the different road users. Furthermore, it assists in highlighting oncoming road infrastructure or hazards. Faded pavement markings increase the risk for cyclist-vehicle crash types, such as side-swipe or clipping crashes, as vehicles may encroach into the bicycle lanes.  	**Rare**	**Serious**	**MEDIUM** **(FSI)** Safe System energy exceeds tolerable levels	Consider re-painting the faded pavement markings to reinstate visibility and reinforce delineation. (S)			

Audit Findings	Risk Assessment			Recommendations	Responsible Officer	
	Likelihood	Severity	Level of Risk	P – Primary S – Supporting	Accept Yes/No	Comments
8) The bicycle infrastructure on Wellington Street forms part of Victoria's Principal Bike Network (PBN), and Queens Parade is part of the Strategic Cycling Corridor (SCC). These classifications identify the routes as crucial for cycling. During the inspection auditors noted that there are significant portions of the bicycle infrastructure that is delineated with yellow line marking, indicating that these treatments are part of a trial or temporary treatment.  	**N/A**	**N/A**	**TO NOTE**	Consider removing yellow line marking and installing **consistent** treatments throughout project limits. (S) Consider carrying out mill and overlay works to remove conflicting line marking and improve clarity of delineation. (S) 		

9) Auditors note that vehicles turning onto Wellington Street from its side roads typically have obscured sightlines of oncoming traffic due to parked cars and vegetation. Auditors are concerned that motorists will hold their vehicle in the bicycle lane and may proceed through the intersection to have a clear view of any oncoming traffic, increasing the likelihood of bicycle-vehicle and vehicle-vehicle crash types. This issue is present at many side road intersections with Wellington Street.  SB sightlines at Sackville Street 	**Rare**	**Serious**	**MEDIUM** **(FSI)** Safe System energy exceeds tolerable levels	Consider pruning overgrown vegetation and banning parking close to the side road intersections (with NO PARKING signage), per *AS1742.11*, to open sightlines. (S)  Consider conducting sight line checks at all side streets to identify and prioritise high-risk sites. (S)		

Audit Findings	Risk Assessment			Recommendations	Responsible Officer	
	Likelihood	Severity	Level of Risk	P – Primary S – Supporting	Accept Yes/No	Comments
10) Auditors noted significant lighting issues at the west bound Hodgkinson Street approach to the Wellington Street Hodgkinson Street roundabout. This lack of lighting reduces visibility of cyclists moving through the roundabout as well as road hazards such as the splitter island and kerb outstands at the approach. This also reduces drivers ability to see pedestrians crossing at this location when approaching or existing the roundabout. This increases the risk of vehicles cyclist and vehicle pedestrian crash types. 	**Rare**	**Serious**	**MEDIUM** **(FSI)** Safe System energy exceeds tolerable levels	Consider installing lighting at this approach in accordance with *AS1158*. (S) Consider conducting street lighting assessments along the route. (S)		

Audit Findings	Risk Assessment			Recommendations		Responsible Officer	
	Likelihood	Severity	Level of Risk	P – Primary	S – Supporting	Accept Yes/No	Comments
11) Auditors note that at the Wellington Street and Johnston Street intersection, left-turning vehicles onto Johnston Street are required to cross the bicycle lane. Auditors are concerned that the layout of this intersection increases the likelihood of vehicle-cyclist crash types, and this risk is increased during free-flow and peak hours as well as night-time where visibility of the bicycle lane will be poor. Given the expected low speed of turning vehicles, impact speeds are likely to be below the Safe System tolerance for this crash type (30km/h).  	**Possible**	**Moderate**	**HIGH** **(FSI)** Safe System energy within tolerable levels	Consider reconfiguring the intersection to provide greater offset from the bicycle lane to the left-turn traffic lane. This would likely involve removing the right-turn lane. Increasing the offset will improve sight lines between left-turning motorists and through cyclists. (S) Adapted from, "NACTO Don't Give Up at the Intersection" – red sight lines on the left show a traditional intersection, and green sight lines on the right show an increased offset.  This risk is also applicable at the Queens Parade intersection.		