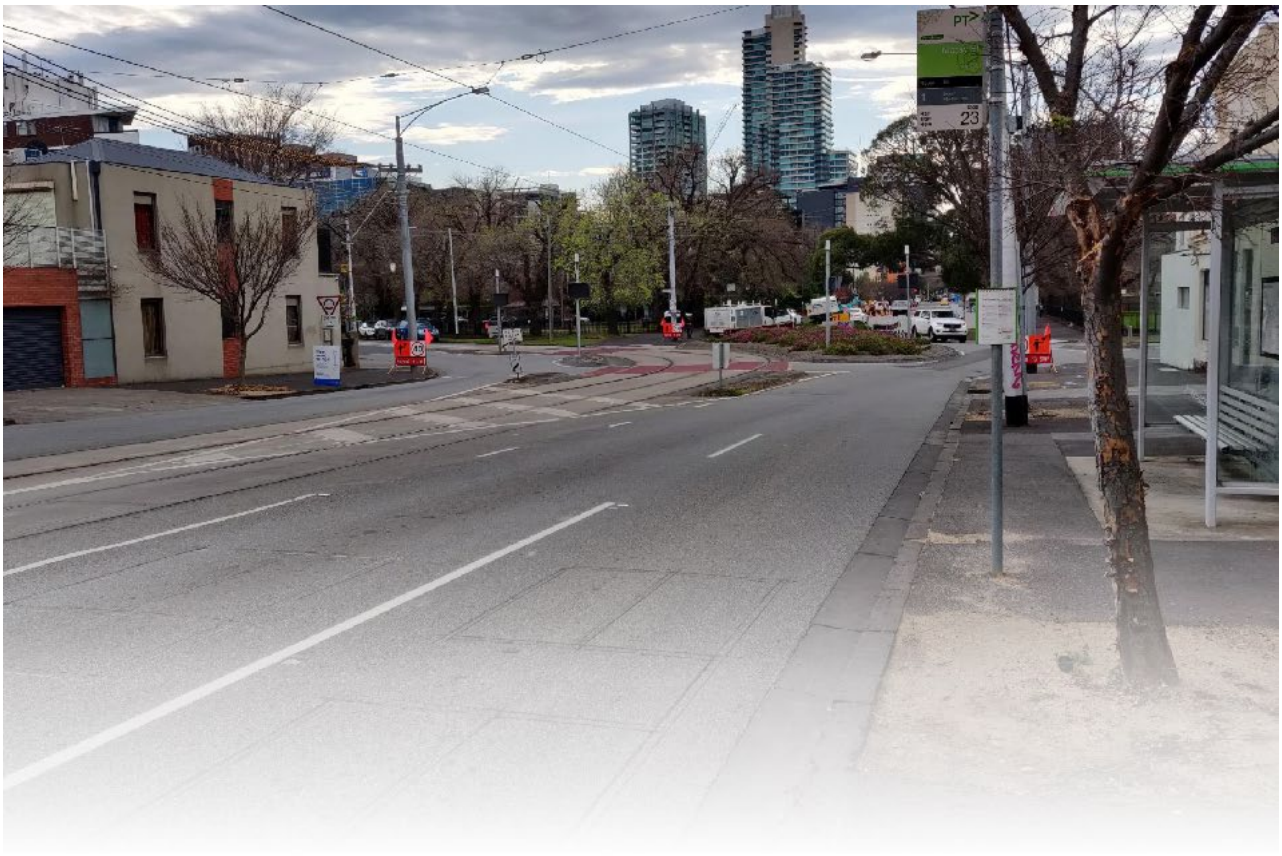

Park Street Bike Link

Safe System Assessment

Report for SMEC

SAFE SYSTEM SOLUTIONS
ROAD SAFETY · AUDITING · ENGINEERING · PROJECT DEVELOPMENT

SMEC
Member of the Surbana Jurong Group

safesystemsolutions.com.au

Information Page

DATE: 21/09/2021

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QUALITY RECORD:

Issue	*Date*	*Description*	*Prepared By*	*Reviewed By*	*Approved By*
1	13/09/2021	Safe System Assessment - First Issue	Max McCardel Nathan Louey	Thuan Nguyen	
2	21/09/2021	Safe System Assessment – Second Issue	Max McCardel Nathan Louey	Thuan Nguyen	

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Executive Summary

SMEC on behalf of the City of Port Phillip, is preparing concept designs for a bicycle link on Park Street, South Melbourne between St Kilda Road and Moray Street.

Safe System Solutions Pty Ltd has been engaged by SMEC to conduct a Safe System Assessment on the concept designs for the proposed bicycle link as identified in the 30042212 drawings for the Original Design and Alt Option. The assessment examines the existing conditions of the project area as well as the design options.

For the purposes of this assessment, Park Street has been split up into two homogenous sections – that is sections where the road environment and surrounding land use is similar and consistent. Each homogenous section of Park Street has been individually assessed and has their own SSA matrix. The homogenous sections of the route have been marked up in **Figure 1** and include:

- Section One – Park Street between Kings Way and Moray Street
- Section Two – Park Street between St Kilda Road and Kings Way

The results of the existing conditions assessment and the design options are shown in the table below.

Table 1 Matrix Scores (lower scores are better, indicating better alignment with Safe System principles)

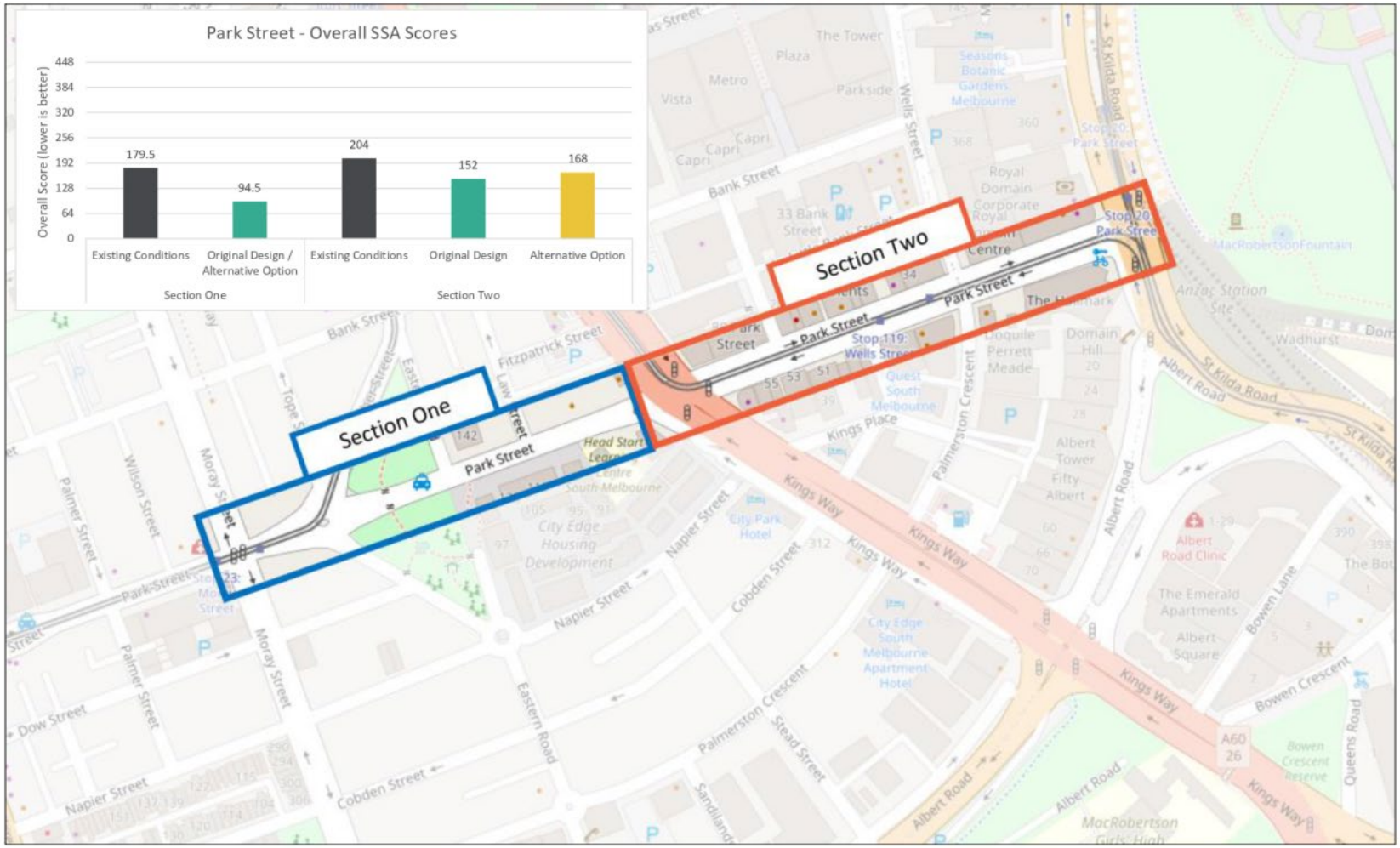
	Option	SSA Score
Section One Park Street between Kings Way and Moray Street	Existing Conditions	179.5 / 448
	Original Design / Alternative Option	94.5 / 448
Section Two Park Street between St Kilda Road and Kings Way	Existing Conditions	204 / 448
	Original Design	152 / 448
	Alternative Option	168 / 448

The results of the assessment show that the proposed design options have a lower SSA Score when compared with the existing conditions and are therefore better aligned with Safe System principles, with the Original Design having the best score. The key findings from the assessment are:

- Narrowing the roadway in Section 1 reduces the likelihood of hooning and excessive speeding
- Proposed speed cushions and sharrow markings at the Heather Street roundabout should slow vehicles on approaches and increase awareness of cyclists in the area

- Original Design provides a bicycle lane throughout both Sections 1 and 2 which run in the traffic lane provides a greater level of safety for cyclists compared to sharing the traffic lane
- Alternative Option provides a bicycle lane throughout both Sections 1 and 2, however the bicycle lane in Section 2 is predominantly through the footpath which increases potential safety concerns compared to the Original Design

Figure 1 Park Street Bike Link – Project Extents and SSA Results



Other factors separately examined included:

- Safe road users
- Safer vehicles
- Advanced vehicle technology
- Maintenance and post-crash response and care

This Safe System Assessment provides a series of recommendations/options to move the Project further Towards Zero.

Key recommendations that should be considered to further improve the Safe System Alignment Scores for the project are described below. A full list of recommendations is shown in **Section 3** of this report.

1. Consider raising the bike lanes where they cross the accesses and minor legs. Raising these crossing points not only reduces traffic speeds at these conflict points but also increases the conspicuity of pedestrians / cyclists crossing in this space.

2. Consider reconfiguring the design at the Heather Street roundabout so motorists drive over the speed cushion before the cyclist merge point. This would reduce general traffic speeds before cyclists are forced to merge (before the conflict point).

3. Consider installing the speed cushions on all approach legs of the Heather Street roundabout.

4. A door can swing approximately 1.2m from a vehicle. Wherever parking is proposed adjacent the bicycle lane, consider increasing the buffer to cater for a full door opening. This is particularly relevant to the 0.3m buffer proposed in some locations. If the buffer cannot be increased, consider removing parking to remove this risk.

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List of Abbreviations

AADT – Annual Average Daily Traffic

SSA – Safe System Assessment

VPD – vehicles per day

VMS – Variable Message Board

ITS – Intelligent Transport Systems

1. Background

1.1. The Safe System

The Safe System is a road safety philosophy that requires roads to be designed and managed so that crash-related death and serious injury are avoidable. The basic principles are:

1. Humans are fallible, and will inevitably make mistakes when driving, riding or walking.
2. Despite this, road trauma should not be accepted as inevitable. No one should be killed or seriously injured on our roads.
3. Consequently, to prevent serious trauma, the road system must be forgiving so that the forces of collisions do not exceed limits that the human body can tolerate.

In Victoria, the Safe System is represented by the diagram in **Figure 2**.

Figure 2 The Safe System

The Safe System is divided into five core interrelated components shown in **Figure** 3.

Figure 3 The Components of the Safe System

1.2. Safe System Assessment

A Safe System Assessment is a safety examination of a road-related program, project or initiative. The procedure for undertaking a Safe System Assessment is outlined in *AP-R509-16 Austroads Safe System Assessment Framework*. The Assessment can be undertaken on any of the following:

- An existing road, intersection or length;
- A road investment project, whether at feasibility, design or pre-opening stages;
- A community road safety program or application for funding;
- A road transport policy, strategy or operating procedure.

These assessments are carried out by a specialist, independent and qualified team that considers each of the core components of the Safe System.

1.3. Type and Depth of Assessment

Safe System Assessments can be carried out to assess existing conditions or a future project, they can also be undertaken to compare two or more options.

Safe System Assessments can be conducted by a suitably qualified individual, a team or through a workshop. The depth of investigation can also vary from an in-depth assessment to an expert-opinion based assessment.

This Safe System Assessment has the following characteristics:

Type: Existing conditions and Design Options
Method: Assessment team – investigation and site inspection
Depth: Safe System Assessment

1.4. Assessment Team

This Safe System Assessment was conducted and reviewed by:

- Thuan Nguyen (BEng), Traffic Leads, Safe System Solutions Pty Ltd
- Max McCardel (BEng (Hons)), Senior Projects Engineer, Safe System Solutions Pty Ltd
- Nathan Louey (BEng (Hons)), Traffic Engineer, Safe System Solutions Pty Ltd

Endorsed Safe System Assessors are listed on VicRoads website at www.vicroads.vic.gov.au/business-and-industry/technical-publications/safe-system-engineering

1.5. Site Inspections and Meetings

A site inspection was carried-out as part of the assessment as detailed in **Table 2** below.

Table 2 Site Inspection Details

Activity	Location	Date	Time
Site visit DAYTIME	Park Street between Moray Street and St Kilda Road, South Melbourne	03.09.21	09:00
Site visit NIGHTTIME	Park Street between Moray Street and St Kilda Road, South Melbourne	03.09.21	20:30

2. Assessment Framework

2.1. Project Background

SMEC on behalf of the City of Port Phillip, is preparing concept designs for a bicycle link on Park Street, South Melbourne between St Kilda Road and Moray Street.

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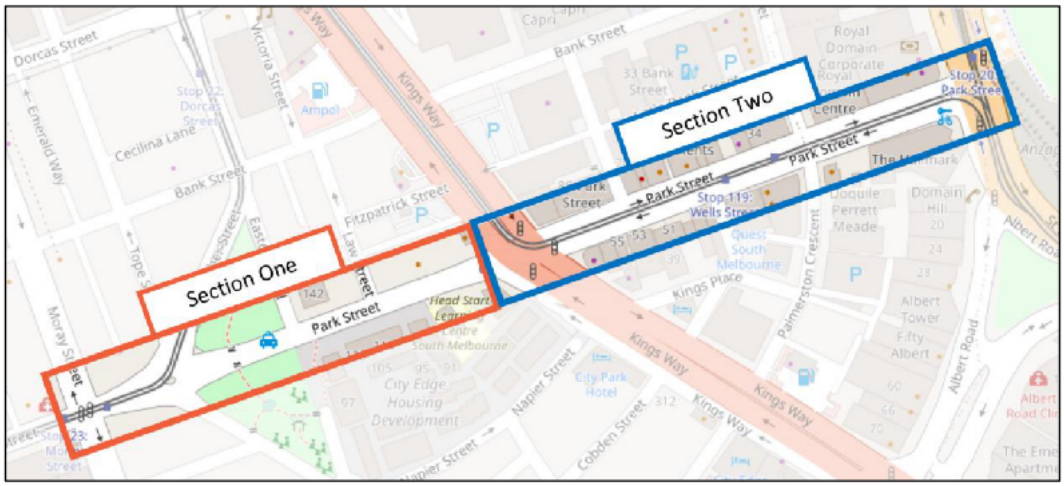
For the purposes of this assessment, Park Street has been split up into two homogenous sections – that is sections where the road environment and surrounding land use is similar and consistent. Each homogenous section of Park Street has been individually assessed and has their own SSA matrix. The homogenous sections of the route have been marked up in **Figure 1** and include:

- Section One – Park Street between Kings Way and Moray Street
- Section Two – Park Street between St Kilda Road and Kings Way

The assessment location is shown in **Figure 4**.

Figure 4 Map showing the section under assessment (source: OpenStreetMap)



2.2. Existing Conditions

Section One – Park Street between Kings Way and Moray Street:

Park Street is a local street with the following characteristics:

- Posted speed limit of 60km/h.
- Three-lane, two-way configuration (two eastbound lanes, one wide westbound lane)
- On-street parallel parking
- Straight horizontal and vertical alignments
- Dual tram tracks in centre of carriageway between Moray Street and Heather Street
- The Heather Street roundabout is complex (crosses tram tracks) and atypical (not circular)
- The Moray Street intersection is fully signalised

Photo 1 Park Street at the Heather Street roundabout, facing west

Section Two – Park Street between St Kilda Road and Kings Way:

Park Street is a local street with the following characteristics:

- Posted speed limit of 40km/h.
- Two-lane, two-way configuration
- Bicycle sharrows (pavement markings) installed
- On-street parallel parking
- Straight horizontal and vertical alignments (relatively steep grade near the St Kilda Road intersection)
- Dual tram tracks in centre of carriageway delineated by raised kerbs (providing physical separation)
- The St Kilda Road intersection is fully signalised
- The Kings Way intersection is fully signalised and very large. The angle of this intersection also means users crossing have further to cross (compared to a perpendicular intersection)
- Recent traffic counts indicate that significant numbers of cyclists (50+ units per day) are currently using the footpath rather than the road.

Photo 2 Park Street at the tram stop, facing east

2.3. Project Options

The concept designs show alternative configurations to the proposed bicycle link. The design options have been summarised below.

Table 3 Project Options Summarised

	Section One – Park Street between Kings Way and Moray Street	Section Two – Park Street between St Kilda Road and Kings Way
Original Design	• Parking lane offset from kerb • Kerbside bicycle lane proposed (shielded from the traffic lane by the parking lane) • 1.0m buffer between parking lane and bicycle lane • Speed cushions on approach to the Heather Street roundabout • Yellow spike-down lane separator on western approach to the Heather Street roundabout • Proposed speed reduction (40km/h)	• Parking lane removed (except outside 88 Park Street) • Kerbside separated bicycle lane proposed (0.3m separator island) • Bicycle path brought on to the footpath outside the tram stops and approaching Kings Way and St Kilda Road
Alternative Option	• No changes from "Original Design" described above	• Parking lane retained • Bicycle path predominately off-road (adjacent the footpath)

As noted above, there are no design changes between the Original Design and Alternative Option in Section One. As such, this report only assesses the existing conditions and ONE PROPOSED design for Section One.

2.4. Context of Assessment

As per Table 4.1 of the Austroads Project AP-R509-16 Austroads Safe System Assessment Framework, the existing conditions are comprised of the elements as described in Table 4 below.

Table 4 Project Context

Austroads AP-R509-16 Prompts	Comments
What is the reason for the project? Is there a specific crash type risk? Is it addressing specific issues such as poor speed limit compliance, road access, congestion, future traffic growth, freight movement, amenity concerns from the community, etc.	• The Park Street Bike Link project is being developed to improve the cycling connectivity and safety along Park Street between St Kilda Road and Moray Street. • A primary objective of the project is to improve the level of safety for cyclists travelling within this area.
What is the function of the road? Consider location, roadside land use, area type, speed limit, intersection type, presence of parking, public transport services and vehicle flows. What traffic features exist nearby (e.g. upstream and downstream)?	• Park Street is a local street that functions as a collector road. • Due to the proximity to Melbourne's CBD and significant arterial roads (St Kilda Road and Kings Way), Park Street would experience relatively high levels of vehicular traffic and congestion • Park Street is designated as a primary cycling route (C1) and is categorised as a Strategic Cycling Corridor • The surrounding land use is a mixture of commercial and residential (there are several multi-story apartments) • Tram #58 runs between Kings Way and St Kilda Road and Tram #1 runs between Moray Street and Heather Street • On-street parking is provided on both sides of the carriageway
What is the speed environment? What is the current speed limit? Has it changed recently? Is it similar to other roads of this type? How does it compare to Safe System speeds? What is the acceptability of lowering the speed limit at this location?	• Park Street has a speed limit of 60km/h west of Kings Way and 40km/h east of this intersection • These speed limits are above the Safe System tolerance for some crash types. The Safe System tolerance speeds are: ▪ 70km/h for head-on crashes ▪ 50km/h for side impact crashes ▪ 30km/h for run-off-road crashes (side impact into a point source hazard) ▪ 30km/h for crashes with vulnerable road users (pedestrians, cyclists and motorcyclists

Austroads AP-R509-16 Prompts	Comments
What road users are present? Consider the presence of elderly, school children and cyclists. Also note what facilities are available to vulnerable road users (e.g. signalised crossings, bicycle lanes, school zone speed limits, etc.).	• Given the access to the tram network and the number of residential properties, this area would attract a diverse range of demographics. Elderly, school children, mobility-impaired and disabled are just a few of the road users expected within this area. • Sharrows are provided on Park Street between Kings Way and St Kilda Road. This means cyclists would claim the traffic lane to cycle in this space. There are no cycling facilities west of the Kings Way intersection
What is the vehicle composition? Consider the presence of heavy vehicles (and what type), motorcyclists and other vehicles using the roadway.	• Park Street functions as a collector road and would attract a variety of vehicle types. • B-doubles and larger heavy vehicles are not permitted to travel along Park Street.

2.5. Austroads AP R509 16 Matrix

As per Table 4.4 of the Austroads Project AP-R509-16 Austroads Safe System Assessment Framework, a Safe System Matrix was used for this Safe System Assessment.

The purpose of the matrix is to use a risk assessment approach to assess different major crash types (those identified as the predominant contributors to fatal and serious crash outcomes) against the **exposure** to that crash risk, the **likelihood** of it occurring and the **severity** of the crash should it occur. These three attributes form the rows of the matrix.

The columns of the Safe System matrix show the crash types that represent the main crash and road user types that contribute to death and serious injury. They are included as an element of the matrix to help concentrate thinking on crash causes and solutions. They are also provided in this way to ensure that vulnerable road users are directly considered.

The seven major crash types as shown in the matrix columns are:

1. run-off-road (also referred to as 'loss of control', or 'off path on curve/straight')
2. head-on (or 'vehicles from opposing directions')
3. intersection ('vehicles from adjacent directions')
4. other (this incorporates all same direction, manoeuvring, overtaking, on path and miscellaneous crashes)
5. pedestrian
6. cyclist
7. motorcyclist

Safe System Matrix

- Exposure, likelihood, severity
- Other Safe System pillars

When quantifying alignment with Safe System principles, the matrix scoring method as described in Table 4.4 of the Austroads report AP-R509-16 Safe System Assessment Framework is used. This Table is reproduced below as **Table 5**.

Table 5 Safe System Matrix Scoring Method

Road user exposure	Crash likelihood	Crash severity
0 = there is no exposure to a certain crash type. This might mean there is no side flow or intersecting roads, no cyclists, no pedestrians, or motorcyclists).	0 = there is only minimal chance that a given crash type can occur for an individual road user given the infrastructure in place. Only extreme behaviour or substantial vehicle failure could lead to a crash. This may mean, for example, that two traffic streams do not cross at grade, or that pedestrians do not cross the road.	0 = should a crash occur, there is only minimal chance that it will result in a fatality or serious injury to the relevant road user involved. This might mean that kinetic energies transferred during the crash are low enough not to cause a fatal or serious injury (FSI), or that excessive kinetic energies are effectively redirected/dissipated before being transferred to the road user. Users may refer to Safe System-critical impact speeds for different crash types, while considering impact angles, and types of roadside hazards/barriers present.
1 = volumes of vehicles that may be involved in a particular crash type are particularly low, and therefore exposure is low. For run-of-road, head-on, intersection and 'other' crash types, AADT is < 1 000 per day. For cyclist, pedestrian and motorcycle crash types, volumes are < 10 units per day.	1 = it is highly unlikely that a given crash type will occur.	1 = should a crash occur, it is highly unlikely that it will result in a fatality or serious injury to any road user involved. Kinetic energies must be fairly low during a crash, or the majority is effectively dissipated before reaching the road user.
2 = volumes of vehicles that may be involved in a particular crash type are moderate, and therefore exposure is moderate. For run-of-road, head-on, intersection and 'other' crash types, AADT is between 1 000 and 5 000 per day. For cyclist, pedestrian and motorcycle crash types, volumes are 10–50 units per day.	2 = it is unlikely that a given crash type will occur.	2 = should a crash occur, it is unlikely that it will result in a fatality or serious injury to any road user involved. Kinetic energies are moderate, and the majority of the time they are effectively dissipated before reaching the road user.
3 = volumes of vehicles that may be involved in a particular crash type are high, and therefore exposure is high. For run-of-road, head-on, intersection and 'other' crash types, AADT is between 5 000 and 10 000 per day. For cyclist, pedestrian and motorcycle crash types, volumes are 50–100 units per day.	3 = it is likely that a given crash type will occur.	3 = should a crash occur, it is likely that it will result in a fatality or serious injury to any road user involved. Kinetic energies are moderate, but are not effectively dissipated and therefore may or may not result in an FSI.
4 = volumes of vehicles that may be involved in a particular crash type are very high, or the road is very long, and therefore exposure is very high. For run-of-road, head-on, intersection and 'other' crash types, AADT is > 10 000 per day. For cyclist, pedestrian and motorcycle crash types, volumes are > 100 units per day.	4 = the likelihood of individual road user errors leading to a crash is high given the infrastructure in place (e.g. high approach speed to a sharp curve, priority movement control, filtering right turn across several opposing lanes, high speed).	4 = should a crash occur, it is highly likely that it will result in a fatality or serious injury to any road user involved. Kinetic energies are high enough to cause an FSI crash, and it is unlikely that the forces will be dissipated before reaching the road user.

2.6. Safe System Matrices

Table 6 Safe System Matrix – Section One – Existing Conditions

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist
Exposure	Traffic volume data has been provided by SMEC. Traffic counts were conducted 12 June 2018 between Kings Place and Wells Street. The 7 Day Average was calculated as 8,952 vehicles per day. While the traffic count location is outside this Section, this proxy has been used to estimate the AADT.				Pedestrian volume data are unknown but considering the area is within a metropolitan area and is surrounded by commercial, business and residential areas, pedestrian volumes are assumed to be greater than 100 units per day (Austroads trigger)	Cyclist volume data has been provided by the City of Port Phillip which indicate volumes to be greater than 100 units per day (Austroads trigger).	Motorcycle volumes are unknown. For the purposes of the assessment, motorcyclist volumes are assumed to be 1% of AADT, or between 50 and 100 riders per day (Austroads trigger)
	For run-off-road crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)	For head-on crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)	For intersection crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)	For 'other' crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)			
	3/4	3/4	3/4	3/4	4/4	4/4	3/4
Likelihood	Factors that **increase** the likelihood include: • The 60km/h speed limit gives errant motorists less time to correct their movement prior to running off road • The wide westbound traffic lane may increase the risk of hooning and excessive speeding Factors that **decrease** the likelihood include: • The straight horizontal and vertical alignments (lack of curves)	Factors that **increase** the likelihood include: • The 60km/h speed limit gives errant motorists less time to correct their movement prior to colliding head-on • The wide westbound traffic lane may increase the risk of hooning and excessive speeding Factors that **decrease** the likelihood include: • The straight horizontal and vertical alignments (lack of curves) • The tram tracks in the middle of the carriageway between Moray Street and Heather Street act as a buffer between opposing traffic streams	Factors that **increase** the likelihood include: • The 60km/h speed limit gives motorists less time to react and engage emergency manoeuvres to avoid an intersection crash • The Heather Street roundabout is complex and atypical • There are restricted sight lines at the Heather Street roundabout • The Moray Street signalised intersection allows uncontrolled right-turn movements. This relies on motorists picking a gap in traffic • The Eastern Road intersection is priority controlled (via GIVE WAY treatment). Parked vehicles on Park Street block sight lines for exiting vehicles Factors that **decrease** the likelihood include: • The Heather Street roundabout has more favourable crash angles compared to a standard cross intersection. • The Heather Street roundabout would slow operating speeds through this intersection	Factors that **increase** the likelihood include: • The multi-lane arrangement increases the risk of side swipe crashes • Motorists cross tram tracks at Heather Street thus there is a risk of vehicle – tram collision • Congestion in the area may increase the risk of rear-end crash types Factors that **decrease** the likelihood include: • There is a vehicle activated "GIVE WAY TO TRAMS" sign that would reduce the risk of a vehicle-tram collision	Factors that **increase** the likelihood include: • The 60km/h speed limit gives motorists less time to react and engage emergency manoeuvres to avoid a pedestrian • The restricted sight lines at the Heather Street roundabout increase the risk of a pedestrian-vehicle collision • There is no pedestrian crossing facility on the western leg of the Heather Street roundabout (pedestrians would need to use Moray Street signals to cross). This increases the risk of jay-walking at this location Factors that **decrease** the likelihood include: • Wide footpaths are provided on either side of Park Street • The signalised intersection at Moray Street provides prioritised pedestrian crossing	Factors that **increase** the likelihood include: • The 60km/h speed limit gives motorists less time to react and engage emergency manoeuvres to avoid a cyclist • There are no cycling facilities in this area • Cyclists are forced to ride adjacent the parking lane, within the dooring zone • The restricted sight lines at the Heather Street roundabout increase the risk of a cyclist-vehicle collision • Crossing the tram tracks at Heather Street may have a destabilising effect for cyclists Factors that **decrease** the likelihood include: • The wide westbound traffic lane gives motorists ample width to overtake cyclists • There are formalised hook-turn boxes for cyclists to store and wait and the Moray Street intersection	Factors that **increase** the likelihood include: • The 60km/h speed limit gives motorists less time to react and engage emergency manoeuvres to avoid a motorcyclist • The Heather Street roundabout is complex and atypical • There are restricted sight lines at the Heather Street roundabout • The Moray Street signalised intersection allows uncontrolled right-turn movements. This relies on motorists picking a gap in traffic • The Eastern Road intersection is priority controlled (via GIVE WAY treatment). Parked vehicles on Park Street block sight lines for exiting vehicles • The wide westbound traffic lane may increase the risk of hooning and excessive speeding • Crossing the tram tracks at Heather Street may have a destabilising effect for motorcyclists Factors that **decrease** the likelihood include: • The Heather Street roundabout would slow operating speeds through this intersection • Generally, the pavement appeared in the site inspection to be in a reasonable condition
	2/4	1.5/4	2.5/4	2/4	2.5/4	3/4	2.5/4

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist
Severity	*Side impacts with fixed objects at speeds greater than 30 km/h are likely to cause death or serious injury.* Factors that **increase** the severity include: • The 60km/h posted speed limit is above the threshold for side impact crashes with fixed objects • Non-frangible roadside hazards (power poles, trees) increase the severity Factors that decrease the severity include: • Errant motorists would likely strike parked vehicles rather than non-frangible roadside hazards. Striking parked vehicles would have a more forgiving crash outcome	*Impacts with an oncoming vehicle at speeds greater than 70 km/h are likely to cause death or serious injury.* Factors that **increase** the severity include: • None Factors that **decrease** the severity include: • The 60km/h posted speed limit is below the threshold for head-on crash types	*Side-on impacts with a vehicle at speeds greater than 50 km/h are likely to cause death or serious injury.* Factors that **increase** the severity include: • The 60km/h posted speed limit are above the threshold for intersection crash types Factors that **decrease** the severity include: • None	Factors that **increase** the severity include: • The presence of trams and potential vehicle-tram collisions Factors that **decrease** the severity include: • None	*Pedestrians struck at speeds above 30 km/h (the Safe System tolerance) are likely to be seriously injured or killed. Also, vehicle/pedestrian crashes at even lower speeds (especially involving heavy vehicles) can cause serious injury.* Factors that **increase** the severity include: • The 60km/h posted speed limit is above the threshold for pedestrian crash types Factors that **decrease** the severity include: • None	*Cyclists struck at speeds above 30 km/h (the Safe System tolerance) are likely to be seriously injured or killed. Also, vehicle/cyclist crashes at even lower speeds (especially involving heavy vehicles) can cause serious injury.* Factors that **increase** the severity include: • The 60km/h posted speed limit is above the threshold for cyclist crash types Factors that **decrease** the severity include: • None	*Due to the vulnerability of motorcyclists, a crash between a motorcycle and a roadside hazard or parked car is likely to result in serious trauma unless speeds are very low.* Factors that **increase** the severity include: • The 60km/h posted speed limit is above the threshold for motorcyclist crash types • Non-frangible roadside hazards (power poles, trees) increase the severity Factors that **decrease** the severity include: • None
	2/4	2/4	3/4	3/4	4/4	4/4	4/4
Product	12/64	9/64	22.5/64	18/64	40/64	48/64	30/64

TOTAL	**179.5 / 448**

LEGEND
Black text: Common factor between the 'Existing Conditions' and this option
~~Factor~~ (strikethrough): factor that is removed or significantly diminished between the 'Existing Conditions' and this option
Red text: New or significantly altered in this option compared to the 'Existing Conditions'

Table 7 Safe System Matrix - Section One – Original Design / Alternative Option

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist
Exposure	Traffic volume data has been provided by SMEC. Traffic counts were conducted 12 June 2018 between Kings Place and Wells Street. The 7 Day Average was calculated as 8,952 vehicles per day. While the traffic count location is outside this Section, this proxy has been used to estimate the AADT.				Pedestrian volume data are unknown but considering the area is within a metropolitan area and is surrounded by commercial and residential areas, pedestrian volumes are assumed to be greater than 100 units per day (Austroads trigger)	Cyclist volume data has been provided by the City of Port Phillip which indicate volumes to be greater than 100 units per day (Austroads trigger)	Motorcycle volumes are unknown. For the purposes of the assessment, motorcyclist volumes are assumed to be 1% of AADT, or between 50 and 100 riders per day (Austroads trigger)
	For run-off-road crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)	For head-on crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)	For intersection crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)	For 'other' crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)			
	3/4	3/4	3/4	3/4	4/4	4/4	3/4
Likelihood	Factors that **increase** the likelihood include: • The 60km/h speed limit gives errant motorists less time to correct their movement prior to running off road • ~~The wide westbound traffic lane may increase the risk of hooning and excessive speeding~~ Factors that **decrease** the likelihood include: • The straight horizontal and vertical alignments (lack of curves) • Narrowing the westbound traffic lane would reduce the risk of hooning and excessive speeding and likely also reduce operating speeds in this section • The proposed speed reduction (40km/h)	Factors that **increase** the likelihood include: • The 60km/h speed limit gives errant motorists less time to correct their movement prior to colliding head-on • ~~The wide westbound traffic lane may increase the risk of hooning and excessive speeding~~ Factors that **decrease** the likelihood include: • The straight horizontal and vertical alignments (lack of curves) • The tram tracks in the middle of the carriageway between Moray Street and Heather Street act as a buffer between opposing traffic streams • Narrowing the westbound traffic lane would reduce the risk of hooning and excessive speeding and likely also reduce operating speeds in this section • The proposed speed reduction (40km/h)	Factors that **increase** the likelihood include: • The 60km/h speed limit gives motorists less time to react and engage emergency manoeuvres to avoid an intersection crash • The Heather Street roundabout is complex and atypical. • There are restricted sight lines at the Heather Street roundabout • The Moray Street signalised intersection allows uncontrolled right-turn movements. This relies on motorists picking a gap in traffic. • The Eastern Road intersection is priority controlled (via GIVE WAY treatment). Parked vehicles on Park Street block sight lines for exiting vehicles • The design proposes to offset the parking bays further from the kerb. This further restricts sight lines for exiting vehicles at Eastern Road Factors that **decrease** the likelihood include: • The Heather Street roundabout has more favourable crash angles compared to a standard cross intersection.	Factors that **increase** the likelihood include: • ~~The multi-lane arrangement increases the risk of side swipe crashes~~ • Motorists cross tram tracks at Heather Street thus there is a risk of vehicle – tram collision • Congestion in the area may increase the risk of rear-end crash types Factors that **decrease** the likelihood include: • There is a vehicle activated "GIVE WAY TO TRAMS" sign that would reduce the risk of a vehicle-tram collision • Narrowing the westbound traffic lane would reduce the risk of hooning and excessive speeding and likely also reduce operating speeds in this section • The proposed speed reduction (40km/h)	Factors that **increase** the likelihood include: • The 60km/h speed limit gives motorists less time to react and engage emergency manoeuvres to avoid a pedestrian • The restricted sight lines at the Heather Street roundabout increase the risk of a pedestrian-vehicle collision • There is no pedestrian crossing facility on the western leg of the Heather Street roundabout (pedestrians would need to use Moray Street signals to cross). This increases the risk of jay-walking at this location Factors that **decrease** the likelihood include: • Wide footpaths are provided on either side of Park Street • The signalised intersection at Moray Street provides prioritised pedestrian crossing • The proposed speed cushions on approaches to the Heather Street roundabout would slow operating speeds through this intersection • Narrowing the westbound traffic lane would reduce the risk of hooning and excessive speeding and likely also reduce operating speeds in this	Factors that **increase** the likelihood include: • The 60km/h speed limit gives motorists less time to react and engage emergency manoeuvres to avoid a cyclist • ~~There are no cycling facilities in this area~~ • ~~Cyclists are forced to ride adjacent the parking lane, within the dooring zone~~ • The restricted sight lines at the Heather Street roundabout increase the risk of a cyclist-vehicle collision • Crossing the tram tracks at Heather Street may have a destabilising effect for cyclists • The design proposes a 1.0m wide buffer between the parking lane and bicycle facility. There is still a risk of a dooring type collision (passenger side door opening). • Westbound traffic approaching the Heather Street roundabout may not expect to see cyclists come from the kerb and claim the traffic lane. Parked cars would inhibit sight lines Factors that **decrease** the likelihood include: • ~~The wide westbound traffic lane gives motorists ample width to overtake cyclists~~	Factors that **increase** the likelihood include: • The 60km/h speed limit gives motorists less time to react and engage emergency manoeuvres to avoid a motorcyclist • The Heather Street roundabout is complex and atypical. • There are restricted sight lines at the Heather Street roundabout • The Moray Street signalised intersection allows uncontrolled right-turn movements. This relies on motorists picking a gap in traffic. • The Eastern Road intersection is priority controlled (via GIVE WAY treatment). Parked vehicles on Park Street block sight lines for exiting vehicles • The design proposes to offset the parking bays further from the kerb. This further restricts sight lines for exiting vehicles at Eastern Road • ~~The wide westbound traffic lane may increase the risk of hooning and excessive speeding~~ • Crossing the tram tracks at Heather Street may have a destabilising effect for motorcyclists Factors that **decrease** the likelihood include:

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist
			• The Heather Street roundabout would slow operating speeds through this intersection • The proposed speed cushions on approaches to the Heather Street roundabout would slow operating speeds through this intersection • The proposed speed reduction (40km/h)		section. This also reduces the crossing distance for pedestrians • The proposed speed reduction (40km/h)	• There are formalised hook-turn boxes for cyclists to store and wait and the Moray Street intersection • The parking lane is proposed to be offset and a bicycle lane is shifted to the kerb. Parked vehicles act as a shield / buffer between the traffic lanes and cyclists • Sharrow markings are provided throughout the circulating carriageway and on some approaches of the roundabout • The proposed speed cushions on approaches to the Heather Street roundabout would slow operating speeds through this intersection • Narrowing the westbound traffic lane would reduce the risk of hooning and excessive speeding and likely also reduce operating speeds in this section • The proposed speed reduction (40km/h)	• The Heather Street roundabout would slow operating speeds through this intersection • The proposed speed cushions on approaches to the Heather Street roundabout would slow operating speeds through this intersection • Generally, the pavement appeared in the site inspection to be in a reasonable condition • Narrowing the westbound traffic lane would reduce the risk of hooning and excessive speeding and likely also reduce operating speeds in this section • The proposed speed reduction (40km/h)
	1 ~~2~~/4	0.5 ~~1.5~~/4	2 ~~2.5~~/4	1 ~~2~~/4	2 ~~2.5~~/4	1 ~~3~~/4	2 ~~2.5~~/4
Severity	*Side impacts with fixed objects at speeds greater than 30 km/h are likely to cause death or serious injury.* Factors that **increase** the severity include: • The 40km/h ~~60km/h~~ posted speed limit is above the threshold for side impact crashes with fixed objects. • Non-frangible roadside hazards (power poles, trees) increase the severity Factors that decrease the severity include: • Errant motorists would likely strike parked vehicles rather than non-frangible roadside hazards. Striking parked vehicles would have a more forgiving crash outcome. • Narrowing the westbound traffic lane would reduce the risk of hooning and excessive	*Impacts with an oncoming vehicle at speeds greater than 70 km/h are likely to cause death or serious injury.* Factors that **increase** the severity include: • None Factors that **decrease** the severity include: • The 40km/h ~~60km/h~~ posted speed limit is below the threshold for head-on crash types. • Narrowing the westbound traffic lane would reduce the risk of hooning and excessive speeding and likely also reduce operating speeds in this section	*Side-on impacts with a vehicle at speeds greater than 50 km/h are likely to cause death or serious injury.* Factors that **increase** the severity include: • The 60km/h posted speed limit are above the threshold for intersection crash types. Factors that **decrease** the severity include: • The proposed speed cushions on approaches to the Heather Street roundabout would slow operating speeds through this intersection	Factors that **increase** the severity include: • The presence of trams and potential vehicle-tram collisions Factors that **decrease** the severity include: • Narrowing the westbound traffic lane would reduce the risk of hooning and excessive speeding and likely also reduce operating speeds in this section • The proposed speed reduction (40km/h)	*Pedestrians struck at speeds above 30 km/h (the Safe System tolerance) are likely to be seriously injured or killed. Also, vehicle/pedestrian crashes at even lower speeds (especially involving heavy vehicles) can cause serious injury.* Factors that **increase** the severity include: • The 40km/h ~~60km/h~~ posted speed limit is above the threshold for pedestrian crash types Factors that **decrease** the severity include: • Narrowing the westbound traffic lane would reduce the risk of hooning and excessive speeding and likely also reduce operating speeds in this section • The proposed speed cushions on approaches to the Heather Street roundabout would slow	*Cyclists struck at speeds above 30 km/h (the Safe System tolerance) are likely to be seriously injured or killed. Also, vehicle/cyclist crashes at even lower speeds (especially involving heavy vehicles) can cause serious injury.* Factors that **increase** the severity include: • The 40km/h ~~60km/h~~ posted speed limit is above the threshold for cyclist crash types Factors that **decrease** the severity include: • Narrowing the westbound traffic lane would reduce the risk of hooning and excessive speeding and likely also reduce operating speeds in this section • The proposed speed cushions on approaches to the Heather Street roundabout would slow	*Due to the vulnerability of motorcyclists, a crash between a motorcycle and a roadside hazard or parked car is likely to result in serious trauma unless speeds are very low.* Factors that **increase** the severity include: • The 40km/h ~~60km/h~~ posted speed limit is above the threshold for motorcyclist crash types • Non-frangible roadside hazards (power poles, trees) increase the severity Factors that **decrease** the severity include: • Narrowing the westbound traffic lane would reduce the risk of hooning and excessive speeding and likely also reduce operating speeds in this section • The proposed speed cushions on approaches to the Heather Street roundabout would slow operating speeds through this intersection

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist
	speeding and likely also reduce operating speeds in this section				operating speeds through this intersection	operating speeds through this intersection	
	1 ~~2~~/4	1 ~~2~~/4	2 ~~3~~/4	2 ~~3~~/4	4/4	4/4	4/4
Product	3 ~~12~~/64	1.5 ~~9~~/64	12 ~~22.5~~/64	6 ~~18~~/64	32 ~~40~~/64	16 ~~48~~/64	24 ~~30~~/64

TOTAL	**94.5 / 448**

Table 8 Safe System Matrix – Section Two – Existing Conditions

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist
Exposure	Traffic volume data has been provided by SMEC. Traffic counts were conducted 12 June 2018 between Kings Place and Wells Street. The 7 Day Average was calculated as 8,952 vehicles per day.				Pedestrian volume data are unknown but considering the area is within a metropolitan area and is surrounded by commercial, business and residential areas, pedestrian volumes are assumed to be greater than 100 units per day (Austroads trigger)	Cyclist volume data has been provided by the City of Port Phillip which indicate volumes to be greater than 100 units per day (Austroads trigger)	Motorcycle volumes are unknown. For the purposes of the assessment, motorcyclist volumes are assumed to be 1% of AADT, or between 50 and 100 riders per day (Austroads trigger)
	For run-off-road crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)	For head-on crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)	For intersection crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)	For 'other' crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)			
	3/4	3/4	3/4	3/4	4/4	4/4	3/4
Likelihood	Factors that **increase** the likelihood include: • The lane width adjacent the tram stop is very narrow. Additionally, there are roadside hazards (planters, trees, pedestrian fencing) close to the edge of the traffic lane Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives errant motorists more opportunity to correct their movement prior to running off road • The straight horizontal and vertical alignments (lack of curves)	Factors that **increase** the likelihood include: • None Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives errant motorists more opportunity to correct their movement prior colliding head-on • The tram reserve acts as a buffer between opposing traffic streams • Head-on collisions are further protected by the raised kerb adjacent the tram tracks	Factors that **increase** the likelihood include: • The Kings Way intersection has a high number of stand-up lanes, increasing the number of potential conflict points • The posted speed limit of 60km/h on Kings Way gives motorists less time to react and engage emergency manoeuvres to avoid an intersection crash Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives motorists more time to react and engage emergency manoeuvres to avoid an intersection crash • Several minor legs are left-in, left-out – reducing the number of potential conflict points • The Kings Way intersection is fully signalised	Factors that **increase** the likelihood include: • Congestion in the area may increase the risk of rear-end crash types • There are two eastbound through stand-up lanes at the Kings Way intersection. These through lanes merge to one directly after the intersection, increasing the risk of a side swipe crash. • Motorists cross tram tracks at Kings Way and travel adjacent trams on Park Street thus there is a risk of vehicle – tram collision Factors that **decrease** the likelihood include: • The signal phasing on Kings Way is designed so general traffic will not conflict with tram movements	Factors that **increase** the likelihood include: • The Kings Way intersection is large and increases the distance pedestrians are forced to cross • There are no pedestrian median refuges on Park Street at the Kings Way intersection. Pedestrians are forced to cross in one phase • Recent traffic counts indicate that significant numbers of cyclists (50+ units per day) are currently using the footpath rather than the road. This increases the risk of a pedestrian being struck by a cyclist. Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives motorists more time to react and engage emergency manoeuvres to avoid a pedestrian • Footpaths are provided on either side of Park Street • The signalised intersections at Kings Way and St Kilda Road provide prioritised pedestrian crossings • The POS either side of the tram stop provides prioritised pedestrian crossings • There are pedestrian median refuges on Kings Way which enable staged crossing	Factors that **increase** the likelihood include: • The Kings Way intersection is very large and increases the distance cyclists are exposed to traffic • Cyclists are forced to ride adjacent the parking lane, within the dooring zone • Crossing the tram tracks at Kings Way may have a destabilising effect for cyclists Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives motorists more time to react and engage emergency manoeuvres to avoid a cyclist • Sharrows are installed indicating to motorists that cyclists share the traffic lane	Factors that **increase** the likelihood include: • The Kings Way intersection has a high number of stand-up lanes, increasing the number of potential conflict points • The posted speed limit of 60km/h on Kings Way gives motorists less time to react and engage emergency manoeuvres to avoid an intersection crash • Crossing the tram tracks at Kings Way may have a destabilising effect for motorcyclists Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives motorists more time to react and engage emergency manoeuvres to avoid a motorcyclist • Generally, the pavement appeared in the site inspection to be in a reasonable condition
	1.5/4	0.5/4	3.5/4	2/4	3.5/4	2.5/4	3.5/4

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist
Severity	*Side impacts with fixed objects at speeds greater than 30 km/h are likely to cause death or serious injury.* Factors that **increase** the severity include: • The 40km/h posted speed limit is above the threshold for side impact crashes with fixed objects. • Non-frangible roadside hazards (power poles, trees) increase the severity Factors that decrease the severity include: • Errant motorists would likely strike parked vehicles rather than non-frangible roadside hazards. Striking parked vehicles would have a more forgiving crash outcome.	*Impacts with an oncoming vehicle at speeds greater than 70 km/h are likely to cause death or serious injury.* Factors that **increase** the severity include: • None Factors that **decrease** the severity include: • The 40km/h posted speed limit is below the threshold for head-on crash types.	*Side-on impacts with a vehicle at speeds greater than 50 km/h are likely to cause death or serious injury.* Factors that **increase** the severity include: • The 60km/h posted speed limit on Kings Way is above the threshold for intersection crash types Factors that **decrease** the severity include: • The 40km/h posted speed limit on Park Street is below the threshold for intersection crash types.	Factors that **increase** the severity include: • The presence of trams and potential vehicle-tram collisions Factors that **decrease** the severity include: • None	*Pedestrians struck at speeds above 30 km/h (the Safe System tolerance) are likely to be seriously injured or killed. Also, vehicle/pedestrian crashes at even lower speeds (especially involving heavy vehicles) can cause serious injury.* Factors that **increase** the severity include: • The 40km/h posted speed limit is above the threshold for pedestrian crash types Factors that **decrease** the severity include: • None	*Cyclists struck at speeds above 30 km/h (the Safe System tolerance) are likely to be seriously injured or killed. Also, vehicle/cyclist crashes at even lower speeds (especially involving heavy vehicles) can cause serious injury.* Factors that **increase** the severity include: • The 40km/h posted speed limit is above the threshold for cyclist crash types Factors that **decrease** the severity include: • None	*Due to the vulnerability of motorcyclists, a crash between a motorcycle and a roadside hazard or parked car is likely to result in serious trauma unless speeds are very low.* Factors that **increase** the severity include: • The 40km/h posted speed limit is above the threshold for motorcyclist crash types • Non-frangible roadside hazards (power poles, trees) increase the severity Factors that **decrease** the severity include: • None
	1/4	1/4	4/4	3/4	4/4	4/4	4/4
Product	4.5/64	1.5/64	42/64	18/64	56/64	40/64	42/64

TOTAL	**204 / 448**

LEGEND
Black text: Common factor between the 'Existing Conditions' and this option
~~Factor~~ (strikethrough): factor that is removed or significantly diminished between the 'Existing Conditions' and this option
Red text: New or significantly altered in this option compared to the 'Existing Conditions'

Table 9 Safe System Matrix - Section Two – Original Design

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist
Exposure	Traffic volume data has been provided by SMEC. Traffic counts were conducted 12 June 2018 between Kings Place and Wells Street. The 7 Day Average was calculated as 8,952 vehicles per day.				Pedestrian volume data are unknown but considering the area is within a metropolitan area and is surrounded by commercial, business and residential areas, pedestrian volumes are assumed to be greater than 100 units per day (Austroads trigger)	Cyclist volume data has been provided by the City of Port Phillip which indicate volumes to be greater than 100 units per day (Austroads trigger)	Motorcycle volumes are unknown. For the purposes of the assessment, motorcyclist volumes are assumed to be 1% of AADT, or between 50 and 100 riders per day (Austroads trigger)
	For run-off-road crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)	For head-on crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)	For intersection crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)	For 'other' crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)			
	3/4	3/4	3/4	3/4	4/4	4/4	3/4
Likelihood	Factors that **increase** the likelihood include: • The lane width adjacent the tram stop is very narrow. Pedestrian fencing is close to the edge of the traffic lane. ~~Additionally, there are roadside hazards (planters, trees, pedestrian fencing) close to the edge of the traffic lane.~~ Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives errant motorists more opportunity to correct their movement prior to running off road • The straight horizontal and vertical alignments (lack of curves) • The proposed 0.3m wide kerb separator between the traffic lane and bicycle facility would give errant motorists increased opportunity (and haptic warning) they are leaving the traffic lane • Roadside hazards (trees and planters) are being removed where the traffic lane narrows approaching the tram stop	Factors that **increase** the likelihood include: • None Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives errant motorists more opportunity to correct their movement prior colliding head-on • The tram reserve acts as a buffer between opposing traffic streams. • Head-on collisions are further protected by the raised kerb adjacent the tram tracks	Factors that **increase** the likelihood include: • The Kings Way intersection has a high number of stand-up lanes, increasing the number of potential conflict points • The posted speed limit of 60km/h on Kings Way gives motorists less time to react and engage emergency manoeuvres to avoid an intersection crash • The design proposes to offset the parking bays further from the kerb. This further restricts sight lines for exiting vehicles at Little Bank Street Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives motorists more time to react and engage emergency manoeuvres to avoid an intersection crash • Several minor legs are left-in, left-out – reducing the number of potential conflict points • The Kings Way intersection is fully signalised • The Wells Street/Palmerston Crescent intersection is fully signalised • A raised platform is proposed on Millers Lane threshold	Factors that **increase** the likelihood include: • Congestion in the area may increase the risk of rear-end crash types • ~~There are two eastbound through stand-up lanes at the Kings Way intersection. These through lanes merge to one directly after the intersection, increasing the risk of a side swipe crash.~~ • Motorists cross tram tracks at Kings Way and travel adjacent trams on Park Street thus there is a risk of vehicle – tram collision Factors that **decrease** the likelihood include: • The signal phasing on Kings Way is designed so general traffic will not conflict with tram movements	Factors that **increase** the likelihood include: • The Kings Way intersection is large and increases the distance pedestrians are forced to cross. • There are no pedestrian median refuges on Park Street at the Kings Way intersection. Pedestrians are forced to cross in one phase. • ~~Recent traffic counts indicate that significant numbers of cyclists (50+ units per day) are currently using the footpath rather than the road. This increases the risk of a pedestrian being struck by a cyclist.~~ • Passengers boarding / alighting from the tram must cross the bicycle lane. There is an increased risk of a pedestrian-cyclist collision. • Where the bicycle path transitions to the footpath, there is an increased risk of a pedestrian-cyclist collision. Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives motorists more time to react and engage emergency manoeuvres to avoid a pedestrian	Factors that **increase** the likelihood include: • The Kings Way intersection is very large and increases the distance cyclists are exposed to traffic • ~~Cyclists are forced to ride adjacent the parking lane, within the dooring zone~~ • Crossing the tram tracks at Kings Way may have a destabilising effect for cyclists • The design proposes a 0.3m wide buffer between the parking lane and bicycle facility. There is a risk of a dooring type collision (passenger side door opening). Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives motorists more time to react and engage emergency manoeuvres to avoid a cyclist • Sharrows are installed indicating to motorists that cyclists share the traffic lane • A separated bicycle facility (with a 0.3m separator island) is proposed • A raised platform is proposed on Millers Lane threshold • A bicycle lane is proposed across the Kings Way intersection (westbound) – reducing the risk of general	Factors that **increase** the likelihood include: • The Kings Way intersection has a high number of stand-up lanes, increasing the number of potential conflict points • The posted speed limit of 60km/h on Kings Way gives motorists less time to react and engage emergency manoeuvres to avoid an intersection crash • Crossing the tram tracks at Kings Way may have a destabilising effect for motorcyclists • The design proposes to offset the parking bays further from the kerb. This further restricts sight lines for exiting vehicles at Little Bank Street. • The lane width adjacent the tram stop is very narrow. Pedestrian fencing is close to the edge of the traffic lane Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives motorists more time to react and engage emergency manoeuvres to avoid a motorcyclist • Generally, the pavement appeared in the site inspection to be in a reasonable condition • A raised platform is proposed on Millers Lane threshold

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist
					• Footpaths are provided on either side of Park Street • The signalised intersection at Kings Way and St Kilda Road provides prioritised pedestrian crossing • The POS either side of the tram stop provides prioritised pedestrian crossing • There are pedestrian median refuges on Kings Way which enable staged crossing. • A raised platform is proposed on Millers Lane threshold • Currently there are high numbers of cyclists using the footpath rather than the road. The proposed cycling facility would likely shift more cyclists away from the footpath and thus reduce the risk of a cyclist colliding with a pedestrian.	traffic creeping into the cyclist space • Removing the slip lane at Kings Way intersection creates a tighter turning radius for left-turning traffic. This will slow operating speeds for left-turning traffic	• The proposed 0.3m wide kerb separator between the traffic lane and bicycle facility would give errant motorists increased opportunity (and haptic warning) they are leaving the traffic lane • Roadside hazards (trees and planters) are being removed where the traffic lane narrows approaching the tram stop
	1 ~~1.5~~/4	0.5/4	3 ~~3.5~~/4	1.5 ~~2~~/4	2.5 ~~3.5~~/4	1 ~~2.5~~/4	3.5/4
Severity	*Side impacts with fixed objects at speeds greater than 30 km/h are likely to cause death or serious injury.* Factors that **increase** the severity include: • The 40km/h posted speed limit is above the threshold for side impact crashes with fixed objects. • Non-frangible roadside hazards (power poles, trees) increase the severity Factors that decrease the severity include: • Errant motorists would likely strike parked vehicles or the 0.3m wide kerb separator rather than non-frangible roadside hazards. Striking parked vehicles would have a more forgiving crash outcome.	*Impacts with an oncoming vehicle at speeds greater than 70 km/h are likely to cause death or serious injury.* Factors that **increase** the severity include: • None Factors that **decrease** the severity include: • The 40km/h posted speed limit is below the threshold for head-on crash types.	*Side-on impacts with a vehicle at speeds greater than 50 km/h are likely to cause death or serious injury.* Factors that **increase** the severity include: • The 60km/h posted speed limit on Kings Way is above the threshold for intersection crash types Factors that **decrease** the severity include: • The 40km/h posted speed limit on Park Street is below the threshold for intersection crash types. • A raised platform is proposed on Millers Lane threshold – reducing speeds at this location	Factors that **increase** the severity include: • The presence of trams and potential vehicle-tram collisions Factors that **decrease** the severity include: • None	*Pedestrians struck at speeds above 30 km/h (the Safe System tolerance) are likely to be seriously injured or killed. Also, vehicle/pedestrian crashes at even lower speeds (especially involving heavy vehicles) can cause serious injury.* Factors that **increase** the severity include: • The 40km/h posted speed limit is above the threshold for pedestrian crash types Factors that **decrease** the severity include: • A raised platform is proposed on Millers Lane threshold – reducing speeds at this location	*Cyclists struck at speeds above 30 km/h (the Safe System tolerance) are likely to be seriously injured or killed. Also, vehicle/cyclist crashes at even lower speeds (especially involving heavy vehicles) can cause serious injury.* Factors that **increase** the severity include: • The 40km/h posted speed limit is above the threshold for cyclist crash types Factors that **decrease** the severity include: • A raised platform is proposed on Millers Lane threshold – reducing speeds at this location	*Due to the vulnerability of motorcyclists, a crash between a motorcycle and a roadside hazard or parked car is likely to result in serious trauma unless speeds are very low.* Factors that **increase** the severity include: • The 40km/h posted speed limit is above the threshold for motorcyclist crash types • Non-frangible roadside hazards (power poles, trees) increase the severity Factors that **decrease** the severity include: • A raised platform is proposed on Millers Lane threshold – reducing speeds at this location
	1/4	1/4	4/4	3/4	4/4	4/4	4/4
Product	3 ~~4.5~~/64	1.5/64	36 ~~42~~/64	13.5 ~~18~~/64	40 ~~56~~/64	16 ~~40~~/64	42/64

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist
TOTAL							**152 / 448**

LEGEND
Black text: Common factor between the 'Existing Conditions' and this option
~~Factor~~ (strikethrough): factor that is removed or significantly diminished between the 'Existing Conditions' and this option
Red text: New or significantly altered in this option compared to the 'Existing Conditions'

Table 10 Safe System Matrix - Section Two – Alternative Option

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist
Exposure	Traffic volume data has been provided by SMEC. Traffic counts were conducted 12 June 2018 between Kings Place and Wells Street. The 7 Day Average was calculated as 8,952 vehicles per day.				Pedestrian volume data are unknown but considering the area is within a metropolitan area and is surrounded by commercial, business and residential areas, pedestrian volumes are assumed to be greater than 100 units per day (Austroads trigger)	Cyclist volume data has been provided by the City of Port Phillip which indicate volumes to be greater than 100 units per day (Austroads trigger)	Motorcycle volumes are unknown. For the purposes of the assessment, motorcyclist volumes are assumed to be 1% of AADT, or between 50 and 100 riders per day (Austroads trigger)
	For run-off-road crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)	For head-on crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)	For intersection crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)	For 'other' crash types, the AADT is between 5,000 and 10,000 vehicles per day (Austroads trigger)			
	3/4	3/4	3/4	3/4	4/4	4/4	3/4
Likelihood	Factors that **increase** the likelihood include: • The lane width adjacent the tram stop is very narrow. Pedestrian fencing is close to the edge of the traffic lane ~~Additionally, there are roadside hazards (planters, trees, pedestrian fencing) close to the edge of the traffic lane.~~ Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives errant motorists more opportunity to correct their movement prior to running off road • The straight horizontal and vertical alignments (lack of curves) • The proposed 0.3m wide kerb separator between the traffic lane and bicycle facility would give errant motorists increased opportunity (and haptic warning) they are leaving the traffic lane • Roadside hazards (trees and planters) are being removed where the traffic lane narrows approaching the tram stop	Factors that **increase** the likelihood include: • None Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives errant motorists more opportunity to correct their movement prior colliding head-on • The tram reserve acts as a buffer between opposing traffic streams. • Head-on collisions are further protected by the raised kerb adjacent the tram tracks	Factors that **increase** the likelihood include: • The Kings Way intersection has a high number of stand-up lanes, increasing the number of potential conflict points • The posted speed limit of 60km/h on Kings Way gives motorists less time to react and engage emergency manoeuvres to avoid an intersection crash Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives motorists more time to react and engage emergency manoeuvres to avoid an intersection crash • Several minor legs are left-in, left-out – reducing the number of potential conflict points • The Kings Way intersection is fully signalised • The Wells Street/Palmerston Crescent intersection is fully signalised • A raised platform is proposed on Millers Lane threshold	Factors that **increase** the likelihood include: • Congestion in the area may increase the risk of rear-end crash types • ~~There are two eastbound through stand-up lanes at the Kings Way intersection. These through lanes merge to one directly after the intersection, increasing the risk of a side swipe crash.~~ • Motorists cross tram tracks at Kings Way and travel adjacent trams on Park Street thus there is a risk of vehicle – tram collision Factors that **decrease** the likelihood include: • The signal phasing on Kings Way is designed so general traffic will not conflict with tram movements	Factors that **increase** the likelihood include: • The Kings Way intersection is large and increases the distance pedestrians are forced to cross. • There are no pedestrian median refuges on Park Street at the Kings Way intersection. Pedestrians are forced to cross in one phase. • ~~Recent traffic counts indicate that significant numbers of cyclists (50+ units per day) are currently using the footpath rather than the road. This increases the risk of a pedestrian being struck by a cyclist.~~ • Passengers boarding / alighting from the tram must cross the bicycle lane. There is an increased risk of a pedestrian-cyclist collision • Where the bicycle path transitions to the footpath, there is an increased risk of a pedestrian-cyclist collision • The bicycle path on the northern side near Little Bank Street has hazards near the edge of the path (~70mm to Telstra pillar and 0.5m to trees). There is an increased risk of cyclists tracking onto the footpath to provide a greater	Factors that **increase** the likelihood include: • The Kings Way intersection is very large and increases the distance cyclists are exposed to traffic • ~~Cyclists are forced to ride adjacent the parking lane, within the dooring zone~~ • Crossing the tram tracks at Kings Way may have a destabilising effect for cyclists • The bicycle path on the northern side near Little Bank Street has hazards near the edge of the path (~70mm to Telstra pillar and 0.5m to trees). There is an increased risk of cyclists colliding with these hazards • Cyclists are forced to cross Little Bank Street at the threshold. Exiting vehicles may not expect to see cyclists in this space. Further, the sight lines at this intersection are extremely limited • Similarly, cyclists crossing the "Hallmark Complex" access point are brought closer to the property boundary. Exiting vehicles may not expect to see cyclists in this space. Further, the sight lines at this intersection are extremely limited	Factors that **increase** the likelihood include: • The Kings Way intersection has a high number of stand-up lanes, increasing the number of potential conflict points • The posted speed limit of 60km/h on Kings Way gives motorists less time to react and engage emergency manoeuvres to avoid an intersection crash • Crossing the tram tracks at Kings Way may have a destabilising effect for motorcyclists • The design proposes to offset the parking bays further from the kerb. This further restricts sight lines for exiting vehicles at Little Bank Street • The lane width adjacent the tram stop is very narrow. Pedestrian fencing is close to the edge of the traffic lane Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives motorists more time to react and engage emergency manoeuvres to avoid a motorcyclist • Generally, the pavement appeared in the site inspection to be in a reasonable condition • A raised platform is proposed on Millers Lane threshold

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist
					clearance from these hazards and colliding with pedestrians Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives motorists more time to react and engage emergency manoeuvres to avoid a pedestrian • Footpaths are provided on either side of Park Street • The signalised intersection at Kings Way and St Kilda Road provides prioritised pedestrian crossing • The POS either side of the tram stop provides prioritised pedestrian crossing • There are pedestrian median refuges on Kings Way which enable staged crossing. • A raised platform is proposed on Millers Lane threshold • There are sections of rumble strip provided between the bicycle lane and the footpath to alert cyclists which may stray towards the footpath • Currently there are high numbers of cyclists using the footpath rather than the road. The proposed cycling facility would likely shift more cyclists away from pedestrians and thus reduce the risk of a cyclist colliding with a pedestrian.	Factors that **decrease** the likelihood include: • The 40km/h posted speed limit gives motorists more time to react and engage emergency manoeuvres to avoid a cyclist • Sharrows are installed indicating to motorists that cyclists share the traffic lane • A separated bicycle facility (predominately using the footpath) • A raised platform is proposed on Millers Lane threshold • A bicycle lane is proposed across the Kings Way intersection (westbound) – reducing the risk of general traffic creeping into the cyclist space • Removing the slip lane at Kings Way intersection creates a tighter turning radius for left-turning traffic. This will slow operating speeds for left-turning traffic • There are sections of rumble strip provided between the bicycle lane and the footpath to alert cyclists if they stray towards the footpath	• Roadside hazards (trees and planters) are being removed where the traffic lane narrows approaching the tram stop
	1 ~~1.5~~/4	0.5/4	3 ~~3.5~~/4	1.5 ~~2~~/4	3 ~~3.5~~/4	1.5 ~~2.5~~/4	3.5/4
Severity	*Side impacts with fixed objects at speeds greater than 30 km/h are likely to cause death or serious injury.* Factors that **increase** the severity include: • The 40km/h posted speed limit is above the threshold for side impact crashes with fixed objects. • Non-frangible roadside hazards (power poles, trees) increase the severity Factors that decrease the severity include:	*Impacts with an oncoming vehicle at speeds greater than 70 km/h are likely to cause death or serious injury.* Factors that **increase** the severity include: • None Factors that **decrease** the severity include: • The 40km/h posted speed limit is below the threshold for head-on crash types.	*Side-on impacts with a vehicle at speeds greater than 50 km/h are likely to cause death or serious injury.* Factors that **increase** the severity include: • The 60km/h posted speed limit on Kings Way is above the threshold for intersection crash types Factors that **decrease** the severity include: • The 40km/h posted speed limit on Park Street is below the threshold for intersection crash types.	Factors that **increase** the severity include: • The presence of trams and potential vehicle-tram collisions Factors that **decrease** the severity include: • None	*Pedestrians struck at speeds above 30 km/h (the Safe System tolerance) are likely to be seriously injured or killed. Also, vehicle/pedestrian crashes at even lower speeds (especially involving heavy vehicles) can cause serious injury.* Factors that **increase** the severity include: • The 40km/h posted speed limit is above the threshold for pedestrian crash types Factors that **decrease** the severity include:	*Cyclists struck at speeds above 30 km/h (the Safe System tolerance) are likely to be seriously injured or killed. Also, vehicle/cyclist crashes at even lower speeds (especially involving heavy vehicles) can cause serious injury.* Factors that **increase** the severity include: • The 40km/h posted speed limit is above the threshold for cyclist crash types Factors that **decrease** the severity include:	*Due to the vulnerability of motorcyclists, a crash between a motorcycle and a roadside hazard or parked car is likely to result in serious trauma unless speeds are very low.* Factors that **increase** the severity include: • The 40km/h posted speed limit is above the threshold for motorcyclist crash types • Non-frangible roadside hazards (power poles, trees) increase the severity Factors that **decrease** the severity include:

	Run-off-road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist
	• Errant motorists would likely strike parked vehicles or the 0.3m wide kerb separator rather than non-frangible roadside hazards. Striking parked vehicles would have a more forgiving crash outcome.		• A raised platform is proposed on Millers Lane threshold – reducing speeds at this location		• A raised platform is proposed on Millers Lane threshold – reducing speeds at this location	• A raised platform is proposed on Millers Lane threshold – reducing speeds at this location	• A raised platform is proposed on Millers Lane threshold – reducing speeds at this location
	1/4	1/4	4/4	3/4	4/4	4/4	4/4
Product	3 ~~4.5~~/64	1.5/64	36 ~~42~~/64	13.5 ~~18~~/64	48 ~~56~~/64	24 ~~40~~/64	42/64
TOTAL							**168 / 448**

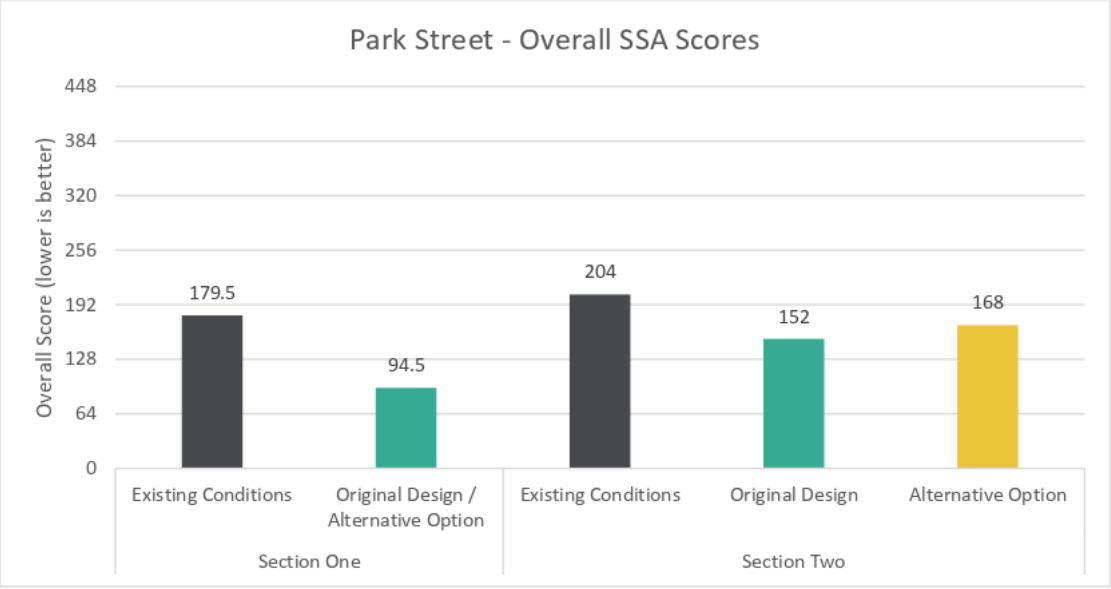
2.7. Safe System Matrix Results

The Safe System Assessment scores for existing conditions and design options for the Park Street Bike Link are shown in the table and graph below:

Table 11 Overall SSA Scores (the lower the score the better, indicating better alignment with Safe System principles)

	Option	SSA Score
Section One Park Street between Kings Way and Moray Street	Existing Conditions	179.5 / 448
	Original Design and Alternative Option	94.5 / 448
Section Two Park Street between St Kilda Road and Kings Way	Existing Conditions	204 / 448
	Original Design	152 / 448
	Alternative Option	168 / 448

Graph 1 Overall SSA Scores

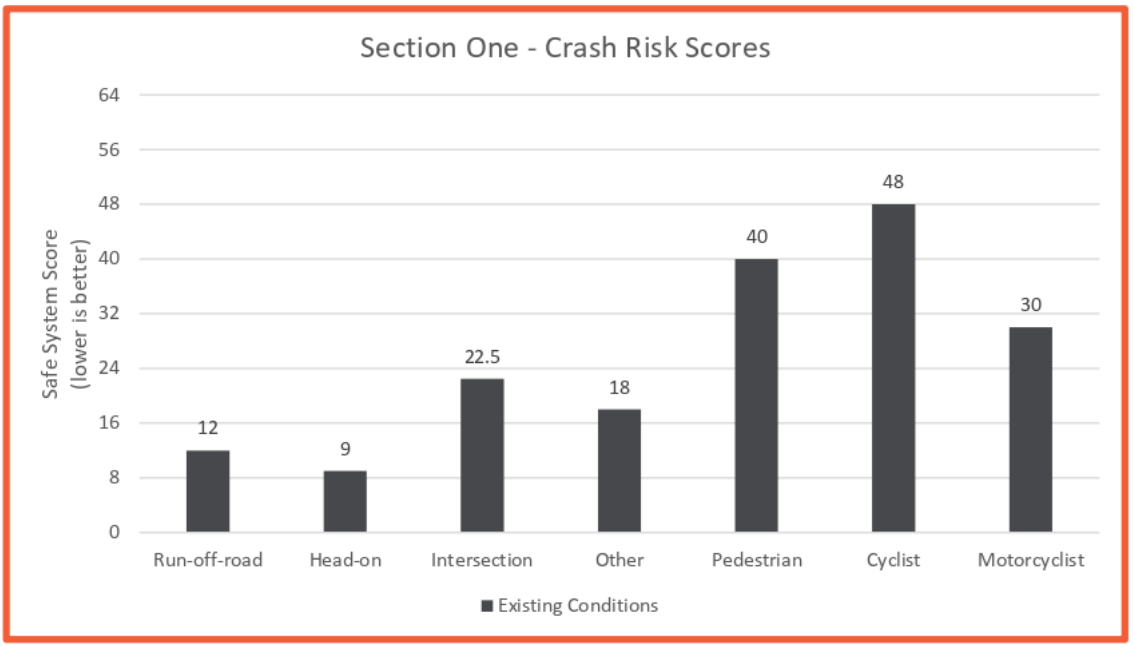


On the pages overleaf, are some key factors that determined the Safe System Alignment Score for each crash type and design option.

Section One – Existing Conditions

The SSA Matrix was developed reviewing the existing road environment and scoring based on current conditions. The Crash Risk Scores for Section One – Existing Conditions is shown in **Graph 2**.

Graph 2 Section One Existing Conditions Crash Risk Scores



A summary of the key factors that determined the score for each crash type has been provided on the pages overleaf.

Run-off-road

- The 60km/h speed limit gives errant motorists less time to correct their movement prior to running off road
- The wide westbound traffic lane may increase the risk of hooning and excessive speeding
- The straight horizontal and vertical alignments (lack of curves) reduces the risk of running off road

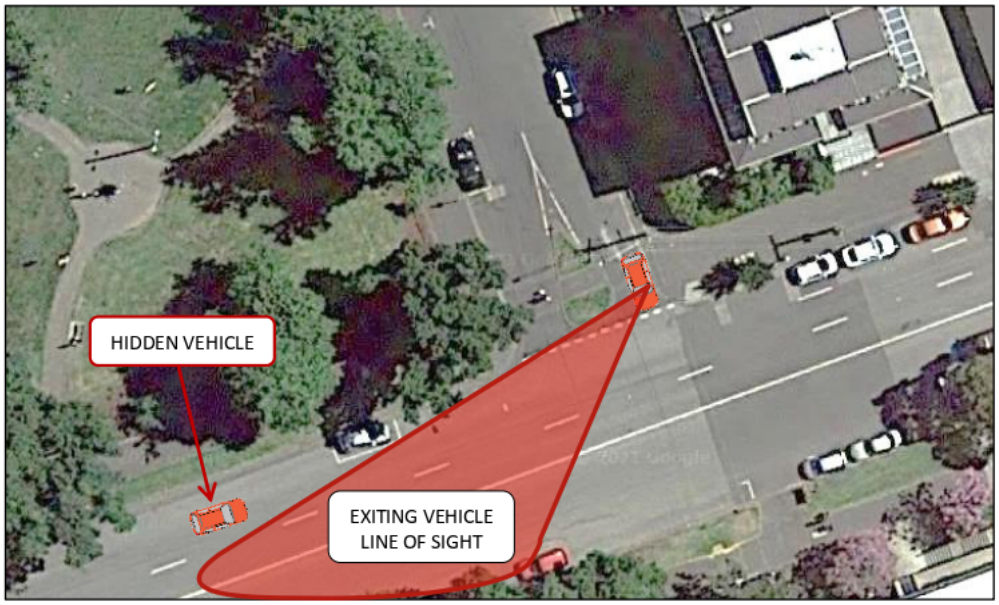
Head-on

- The 60km/h speed limit gives errant motorists less time to correct their movement prior to running off road
- The wide westbound traffic lane may increase the risk of hooning and excessive speeding
- The tram tracks in the middle of the carriageway between Moray Street and Heather Street act as a buffer between opposing traffic streams

Intersection

- The Heather Street roundabout is complex and atypical.
- There are restricted sight lines at the Heather Street roundabout
- The Eastern Road intersection is priority controlled (via GIVE WAY treatment). Parked vehicles on Park Street block sight lines for exiting vehicles. This risk has been shown in **Figure 5**

Figure 5 Parked vehicles restricting sight lines



Other

- The multi-lane arrangement increases the risk of side swipe crashes
- Motorists cross tram tracks at Heather Street thus there is a risk of vehicle – tram collision
- Congestion in the area may increase the risk of rear-end crash types

Pedestrian

- The 60km/h speed limit gives motorists less time to react and engage emergency manoeuvres to avoid a pedestrian
- Wide footpaths are provided on either side of Park Street
- The signalised intersection at Moray Street provides prioritised pedestrian crossing

Cyclist

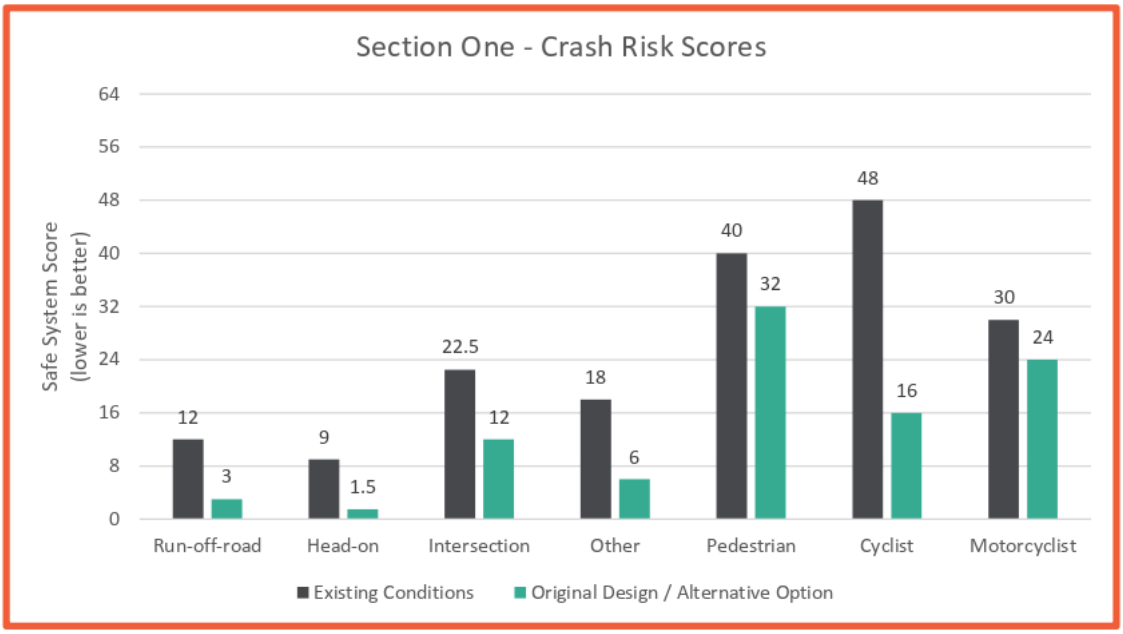
- The 60km/h speed limit gives motorists less time to react and engage emergency manoeuvres to avoid a cyclist
- There are no cycling facilities in this area
- Cyclists are forced to ride adjacent the parking lane, within the dooring zone
- The restricted sight lines at the Heather Street roundabout increase the risk of a cyclist-vehicle collision

Motorcyclist

- Several of the above risks also apply to motorcyclists riders. In addition, crossing the tram tracks at Heather Street may have a destabilising effect for motorcyclists

Section One – Original Design / Alternative Option

Graph 3 Section One Original Design Crash Risk Scores



As shown in **Graph 3**, the Section One Original Design / Alternative Option has a lower overall SSA score. This indicates that the proposed design is better aligned with Safe System principles when compared to the existing conditions.

The proposed design has the greatest safety benefits for reducing Cyclist crash types. Run-off-road, Intersection, Other, Pedestrian and Motorcyclist crash types also see reductions in risk. The level of risk for Head-on collisions remains the same.

A summary of the key factors that determined the score for each crash type has been provided on the pages overleaf.

Run-off-road

- Narrowing the westbound traffic lane would reduce the risk of hooning and excessive speeding and likely also reduce operating speeds in this section
- The proposed speed reduction (40km/h)
-

Head-on

- The proposed speed reduction (40km/h)

Intersection

- The design proposes to offset the parking bays further from the kerb. This further restricts sight lines for exiting vehicles at Eastern Road. Refer to **Figure 5**
- The proposed speed cushions on approaches to the Heather Street roundabout would slow operating speeds through this intersection

Other

- Narrowing the westbound traffic lane would reduce the risk of hooning and excessive speeding and likely also reduce operating speeds in this section
- The proposed speed reduction (40km/h)

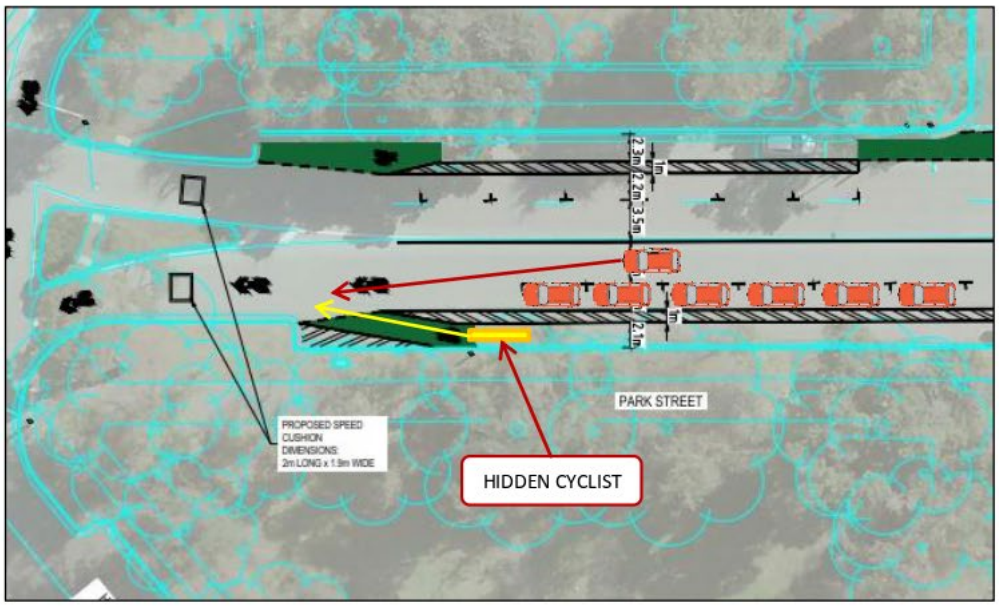
Pedestrian

- The proposed speed cushions on approaches to the Heather Street roundabout would slow operating speeds through this intersection
- Narrowing the westbound traffic lane would reduce the risk of hooning and excessive speeding and likely also reduce operating speeds in this section. This also reduces the crossing distance for pedestrians

Cyclist

- The design proposes a 1.0m wide buffer between the parking lane and bicycle facility. There is still a risk of a dooring type collision (passenger side door opening)
- Sharrow markings are provided throughout the circulating carriageway and on some approaches of the roundabout indicating to motorists that cyclists share the traffic lane
- Westbound traffic approaching the Heather Street roundabout may not expect to see cyclists come from the kerb and claim the traffic lane. Parked cars would inhibit sight lines. This risk has been shown in **Figure 6**

Figure 6 Parked vehicles block kerbside cyclist



- The parking lane is proposed to be offset and a bicycle lane is shifted to the kerb. Parked vehicles act as a shield / buffer between the traffic lanes and cyclists
- The proposed speed cushions on approaches to the Heather Street roundabout would slow operating speeds through this intersection
- Narrowing the westbound traffic lane would reduce the risk of hooning and excessive speeding and likely also reduce operating speeds in this section.

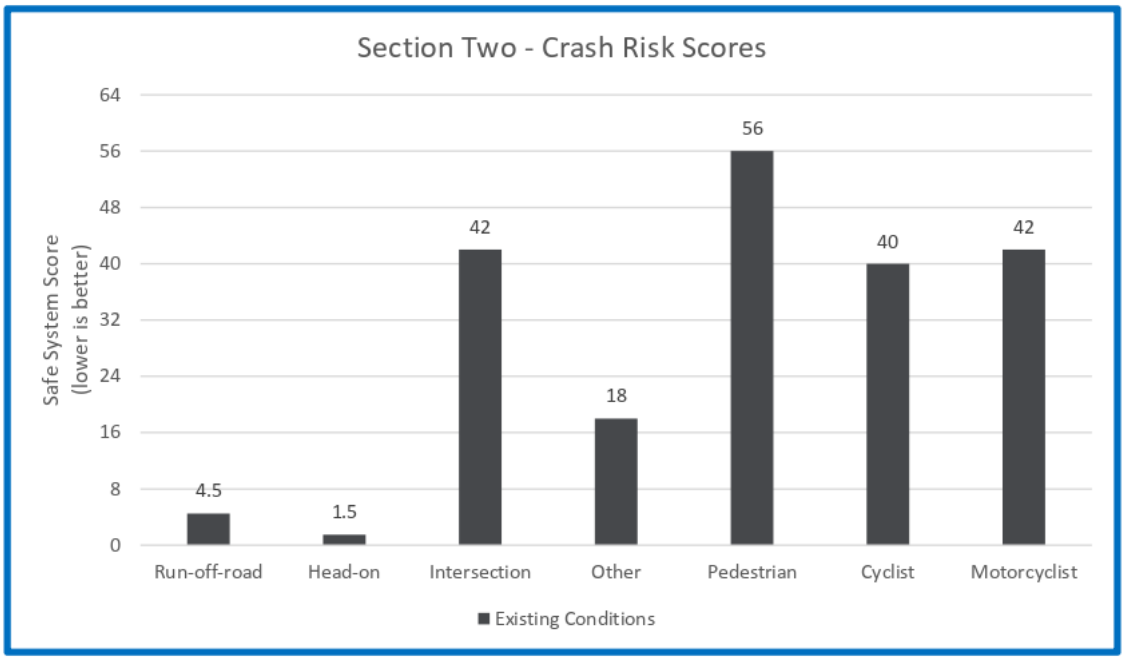
Motorcyclist

- The proposed speed cushions on approaches to the Heather Street roundabout would slow operating speeds through this intersection
- The proposed speed reduction (40km/h)

Section Two – Existing Conditions

The SSA Matrix was developed reviewing the existing road environment and scoring based on current conditions. The Crash Risk Score for Section Two – Existing Conditions is shown in **Graph 4**.

Graph 4 Section Two Existing Conditions Crash Risk Scores



A summary of the key factors that determined the score for each crash type has been provided on the pages overleaf.

Run-off-road

- The lane width adjacent the tram stop is very narrow. Additionally, there are roadside hazards (planters, trees, pedestrian fencing) close to the edge of the traffic lane
- The 40km/h posted speed limit gives errant motorists more opportunity to correct their movement prior to running off road
- The straight horizontal and vertical alignments (lack of curves) reduces the risk of running off road

Head-on

- The 40km/h posted speed limit gives errant motorists more opportunity to correct their movement prior colliding head-on
- The tram reserve acts as a buffer between opposing traffic streams.
- Head-on collisions are further protected by the raised kerb adjacent the tram tracks

Intersection

- The Kings Way intersection has a high number of stand-up lanes, increasing the number of potential conflict points
- The posted speed limit of 60km/h on Kings Way gives motorists less time to react and engage emergency manoeuvres to avoid an intersection crash
- The 40km/h posted speed limit gives motorists more time to react and engage emergency manoeuvres to avoid an intersection crash
- Several minor legs are left-in, left-out reducing the number of potential conflict points
- The Kings Way intersection is fully signalised

Other

- Congestion in the area may increase the risk of rear-end crash types
- There are two eastbound through stand-up lanes at the Kings Way intersection. These through lanes merge to one directly after the intersection, increasing the risk of a side swipe crash

Pedestrian

- The Kings Way intersection is large and increases the distance pedestrians are forced to cross
- There are no pedestrian median refuges on Park Street at the Kings Way intersection. Pedestrians are forced to cross in one phase
- Footpaths are provided on either side of Park Street
- Recent traffic counts indicate that significant numbers of cyclists (50+ units per day) are currently using the footpath rather than the road. This increases the risk of a pedestrian being struck by a cyclist.
- The signalised intersection at Kings Way and St Kilda Road provides prioritised pedestrian crossings
- The POS either side of the tram stop provides prioritised pedestrian crossings

Cyclist

- The Kings Way intersection is very large and increases the distance cyclists are exposed to traffic
- Cyclists are forced to ride adjacent the parking lane, within the dooring zone

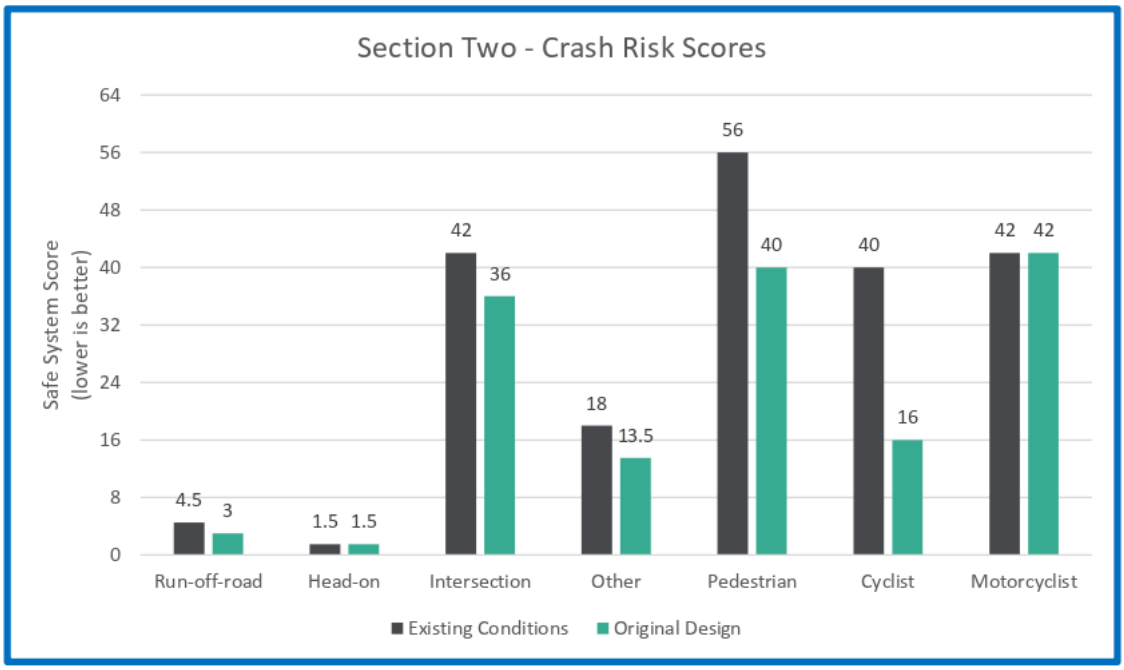
- Sharrows are installed indicating to motorists that cyclists share the traffic lane

Motorcyclist

- Several of the above risks also apply to motorcyclists riders. In addition, crossing the tram tracks at Kings Way may have a destabilising effect for motorcyclists

Section Two – Original Design

Graph 5 Section Two Original Design Crash Risk Scores



As shown in **Graph 1**, the Section Two Original Design has a lower overall SSA score. This indicates that the proposed design is better aligned with Safe System principles when compared to the existing conditions.

The proposed design has the greatest safety benefits for reducing Cyclist crash types. Run-off-road, Intersection and Other crash types have a slight reduction whereas Head-on and Motorcyclist risk levels remain the same. The crash risk for pedestrians increases in the Original Design.

A summary of the key factors that determined the score for each crash type has been provided on the pages overleaf.

Run-off-road

- The proposed 0.3m wide kerb separator between the traffic lane and bicycle facility would give errant motorists increased opportunity (and haptic warning) they are leaving the traffic lane
- Roadside hazards (trees and planters) are being removed where the traffic lane narrows approaching the tram stop

Head-on

- No significant changes to reduce head-on collisions

Intersection

- The design proposes to offset the parking bays further from the kerb. This further restricts sight lines for exiting vehicles at Little Bank Street
- A raised platform is proposed on Millers Lane threshold
- Intersection at Wells Street / Palmerston Crescent to be fully signalised

Other

- The two eastbound stand-up lanes at Kings Way intersection are simplified to one lane. This eliminates the side swipe crash risk (two lanes merging into one past the intersection)

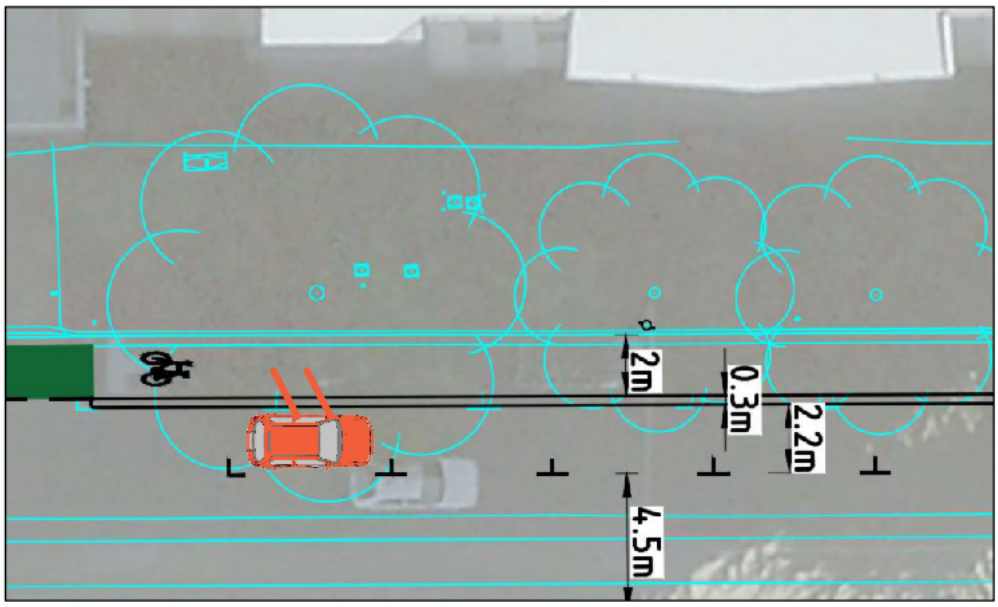
Pedestrian

- Passengers boarding / alighting from the tram must cross the bicycle lane. There is an increased risk of a pedestrian-cyclist collision
- Where the bicycle path transitions to the footpath, there is an increased risk of a pedestrian-cyclist collision

Cyclist

- The design proposes a 0.3m wide buffer between the parking lane and bicycle facility. There is a risk of a dooring type collision (passenger side door opening). This risk has been shown in **Figure 7**

Figure 7 Passenger side dooring risk



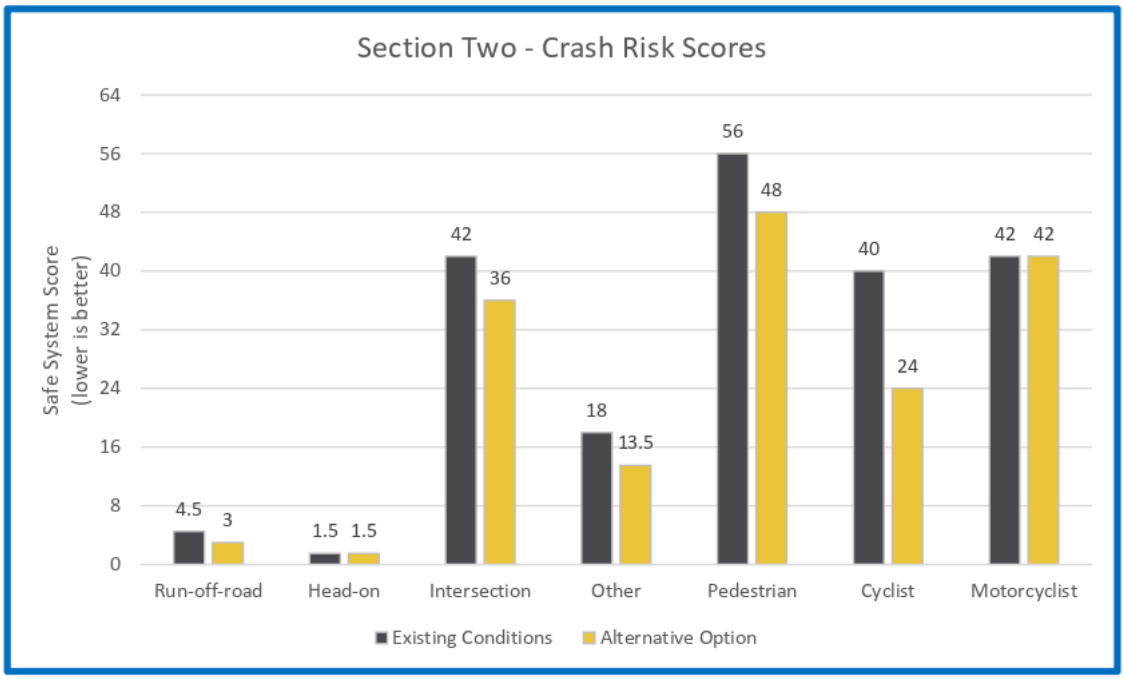
- A separated bicycle facility (with a 0.3m separator island) provides a greater level of safety for cyclists compared to sharing the traffic lane
- A bicycle lane is proposed across the Kings Way intersection (westbound) – reducing the risk of general traffic creeping into the cyclist space
- Removing the slip lane at Kings Way intersection creates a tighter turning radius for left-turning traffic. This will slow operating speeds for left-turning traffic

Motorcyclist

- No significant changes to reduce motorcyclist collisions

Section Two – Alternative Option

Graph 6 Section Two Alternative Option Crash Risk Scores



As shown in **Graph 1**, the Section Two Alternative Option has a lower overall SSA score. This indicates that the proposed design is better aligned with Safe System principles when compared to the existing conditions.

The proposed design has the greatest safety benefits for reducing Cyclist crash types. Run-off-road, Intersection and Other crash types also see slight reductions in risk. The level of risk for Head-on and Motorcyclist remains the same whereas the risk for Pedestrian collisions increases.

A summary of the key factors that determined the score for each crash type has been provided on the pages overleaf.

Run-off-road

- The proposed 0.3m wide kerb separator between the traffic lane and bicycle facility would give errant motorists increased opportunity (and haptic warning) they are leaving the traffic lane
- Roadside hazards (trees and planters) are being removed where the traffic lane narrows approaching the tram stop

Head-on

- No significant changes to reduce head-on collisions

Intersection

- A raised platform is proposed on Millers Lane threshold
- Intersection at Wells Street / Palmerston Crescent to be fully signalised

Other

- The two eastbound stand-up lanes at Kings Way intersection are simplified to one lane. This eliminates the side swipe crash risk (two lanes merging into one past the intersection)

Pedestrian

- Passengers boarding / alighting from the tram must cross the bicycle lane. There is an increased risk of a pedestrian-cyclist collision
- Where the bicycle path transitions to the footpath, there is an increased risk of a pedestrian-cyclist collision
- Section of rumble strip are provided where the bicycle lane is along the footpath to alert cyclists if they stray towards the footpath
- The bicycle path on the northern side near Little Bank Street has hazards near the edge of the path (~70mm to Telstra pillar and 0.5m to trees). There is an increased risk of cyclists tracking onto the footpath to provide a greater clearance from these hazards and colliding with pedestrians

Cyclist

- The bicycle path on the northern side near Little Bank Street has hazards near the edge of the path (~70mm to Telstra pillar and 0.5m to trees). There is an increased risk of cyclists colliding with these hazards
- Section of rumble strip are provided where the bicycle lane is along the footpath to alert cyclists if they stray towards the footpath
- Cyclists are forced to cross Little Bank Street at the threshold. Exiting vehicles may not expect to see cyclists in this space. Further, the sight lines at this intersection are extremely limited as shown in **Photo 3**

Photo 3 Little Bank Street facing towards Park Street (south)

- Similarly, cyclists crossing the "Hallmark Complex" access point are brought closer to the property boundary. Exiting vehicles may not expect to see cyclists in this space. Further, the sight lines at this intersection are extremely limited
- A separated bicycle facility (predominately using the footpath) provides a greater level of safety for cyclists (compared to sharing the lane with traffic)
- A bicycle lane is proposed across the Kings Way intersection (westbound) – reducing the risk of general traffic creeping into the cyclist space
- Removing the slip lane at Kings Way intersection creates a tighter turning radius for left-turning traffic. This will slow operating speeds for left-turning traffic.

Motorcyclist

- No significant changes to reduce motorcyclist collisions

2.8. Safer Vehicles, People and Post-Crash Care (high level comments)

Table 12 High level comments

Safe System Element	Prompt	Comments/issues
Road User	Are road users likely to be alert and compliant? Are there factors that might influence this?	• Given the built-up nature of this environment, and relatively high traffic volumes, road users are likely to be alert and attentive.
Road User	What are the expected compliance and enforcement levels (alcohol/drugs, speed, road rules, and driving hours)? What is the likelihood of driver fatigue? Can enforcement of these issues be conducted safety?	• This area is within Metropolitan Melbourne and passes through several signalised intersections with high volumes of pedestrian and cyclist activity. Driver fatigue has not been considered a significant issue within this area. • Compliance levels are expected to be similar to other collector roads within the area.
Road User	Are there special road uses (e.g. entertainment precincts, elderly, children, on-road activities, motorcyclist route), distraction by environmental factors (e.g. commerce, tourism), or risk-taking behaviours?	• The surrounding land use is residential and commercial. • All demographics of road users are expected within this assessment area.
Vehicle	What level of alignment is there with the ideal of safer vehicles?	• There are no features of the road that would compromise vehicle safety features.
Vehicle	Are there factors which might attract large numbers of unsafe vehicles? Is the percentage of heavy vehicles too high for the proposed/existing road design? Is this route used by recreational motorcyclists?	• There is nothing to suggest large numbers of unsafe vehicles would operate within this space
Vehicle	Are there enforcement resources in the area to detect non-roadworthy, overloaded or unregistered vehicles and thus remove them from the network? Can enforcement of these issues be conducted safely?	• Enforcement activities would most likely be conducted under traffic management (closing a lane or using a parking lane).
Vehicle	Has vehicle breakdown been catered for?	• Parking lanes could be used to shelter broken down vehicles

Safe System Element	Prompt	Comments/issues
		• The straight alignment throughout the area results in good sight distances to broken down vehicles
Vehicle	Have advanced vehicle features been considered?	• With good line marking, including edge lines, there is nothing to suggest that autonomous vehicle functions would struggle in this environment.
Post-crash care	Are there issues that might influence safe and efficient post-crash care in the event of a severe injury (e.g. congestion, access stopping space)?	• Congestion within the area may impact on emergency service arrival times • On the other, emergency vehicles could use the tram lanes to access crash sites
Post-crash care	Do emergency and medical services operate as efficiently and rapidly as possible?	• The closest hospital is the Alfred Hospital which is approximately 2km south-east of the area under assessment. As such, emergency arrival times would be expected to be relatively rapid.
Post-crash care	Are other road users and emergency response teams protected during a crash event? Are drivers provided the correct information to address travelling speeds on the approach and adjacent to the incident? Is there reliable information available via radio, VMS etc.	• There is no permanent VMS or other incident warning systems for communicating and managing crashes
Maintenance	Can all road features be maintained in a safe and efficient manner?	• Road maintenance would be carried out under a traffic management plan which is likely to apply a lower speed limit or to provide detours if all lanes are closed

3. Recommendations

Infrastructure recommendations are classified into categories as instructed in *AP-R509-16 Austroads Safe System Assessment Framework*.

Definitions of the alignment with Safe System principles are:

Primary Treatments: Road planning, design and management considerations that virtually eliminate the potential of fatal or serious injuries occurring in association with the foreseeable crash types.

Supporting Treatments: Road planning, design and management considerations that improve the overall level of safety associated with foreseeable crash types, but do not virtually eliminate the potential of fatal or serious injuries occurring. When applied to an existing road environment they may improve the ability for a primary treatment to be installed in the future.

Project managers are encouraged to implement as many of the recommendations as possible, with preference for Primary Treatments.

Where matrix scores remain high, project managers are encouraged to look to the other elements of the Safe System to reduce risk.

Recommendations on moving the Project further Towards Zero are provided in the table below.

Table 13 Recommended Primary Treatments

Primary Treatments:	
Ideas for consideration	**Project response**
1. Consider raising the bike lanes where they cross the accesses and minor legs. Raising these crossing points not only reduces traffic speeds at these conflict points but also increases the conspicuity of pedestrians / cyclists crossing in this space.	
2. Consider reconfiguring the design at the Heather Street roundabout so motorists drive over the speed cushion **before** the cyclist merge point. This would reduce general traffic speeds **before** cyclists are forced to merge (before the conflict point).	
3. Consider installing the speed cushions on all approach legs of the Heather Street roundabout.	
4. A door can swing approximately 1.2m from a vehicle. Wherever parking is proposed adjacent the bicycle lane, consider increasing the buffer to cater for a full door opening. This is particularly relevant to the 0.3m buffer proposed in some	

Primary Treatments:	
Ideas for consideration	**Project response**
locations. If the buffer cannot be increased, consider removing parking to remove this risk.	

Table 14 Recommended Supporting Treatments

Supporting Treatments:	
Ideas for consideration	**Project response**
5. The design shows a painted separator west of Kings Way. Consider providing physical separation (kerb and islands) to provide added protection for cyclists.	
6. The westbound bicycle lane is linemarked across the Kings Way. There is no linemarking for eastbound cyclists. Consider linemarking the eastbound bicycle lane at this location.	
7. The design shows cyclists riding across the downgrade of the raised platform at Millers Lane. Consider reviewing the design so cyclists are riding on a flat surface.	
8. The POS on the south side of Park Street is close to Millers Lane and may block vehicles attempting to enter. Consider relocating POS away from the intersection.	

4. Conclusions

Safe System Solutions Pty Ltd has been engaged by SMEC to conduct a Safe System Assessment on the concept designs for the proposed bicycle link as identified in the 30042212 drawings for the Original Design and Alt Design. The assessment examines the existing conditions of the project area as well as the design options.

The results of the assessment show that the proposed design options have a lower SSA Score when compared with the existing conditions and are therefore better aligned with Safe System principles, with the Original Design having the best score. The key findings from the assessment are:

- Narrowing the roadway in Section 1 reduces the likelihood of hooning and excessive speeding
- Proposed speed cushions and sharrow markings at the Heather Street roundabout should slow vehicles on approaches and increase awareness of cyclists in the area
- Original Design provides a bicycle lane throughout both Sections 1 and 2 which run in the traffic lane provides a greater level of safety for cyclists compared to sharing the traffic lane
- Alternative Option provides a bicycle lane throughout both Sections 1 and 2, however the bicycle lane in Section 2 is predominantly through the footpath which increases potential safety concerns compared to the Original Design

There are a number of features that can be added be added to the design option to further improve the alignment with Safe System principles. These recommendations are detailed in **Section 3 Recommendations** of this report.

Appendix A Photos

Photo 4: Park Street at Palmerston Crescent intersection, facing west

Photo 5: Park Street at Heather Crescent roundabout, facing west

Photo 6: Park Street at Eastern Road intersection, facing east

Photo 7: Park Street at Little Bank Street intersection, facing east

Photo 8: Park Street, facing west (night)

Photo 9: Park Street at Millers Lane intersection, facing west (night)

Photo 10: Park Street, facing east (night)

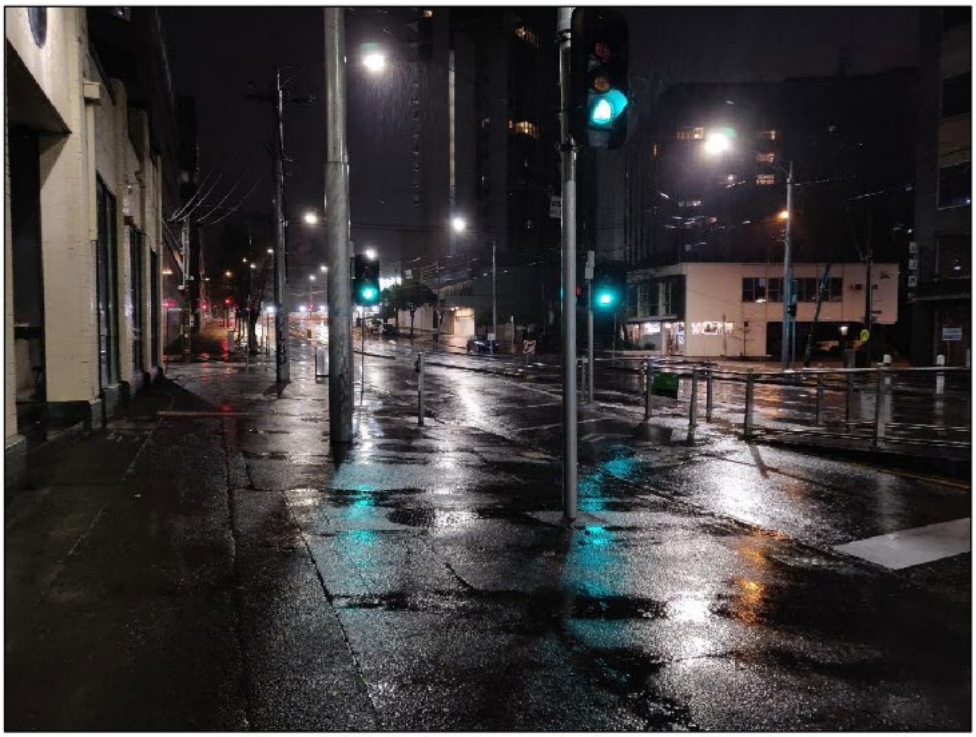
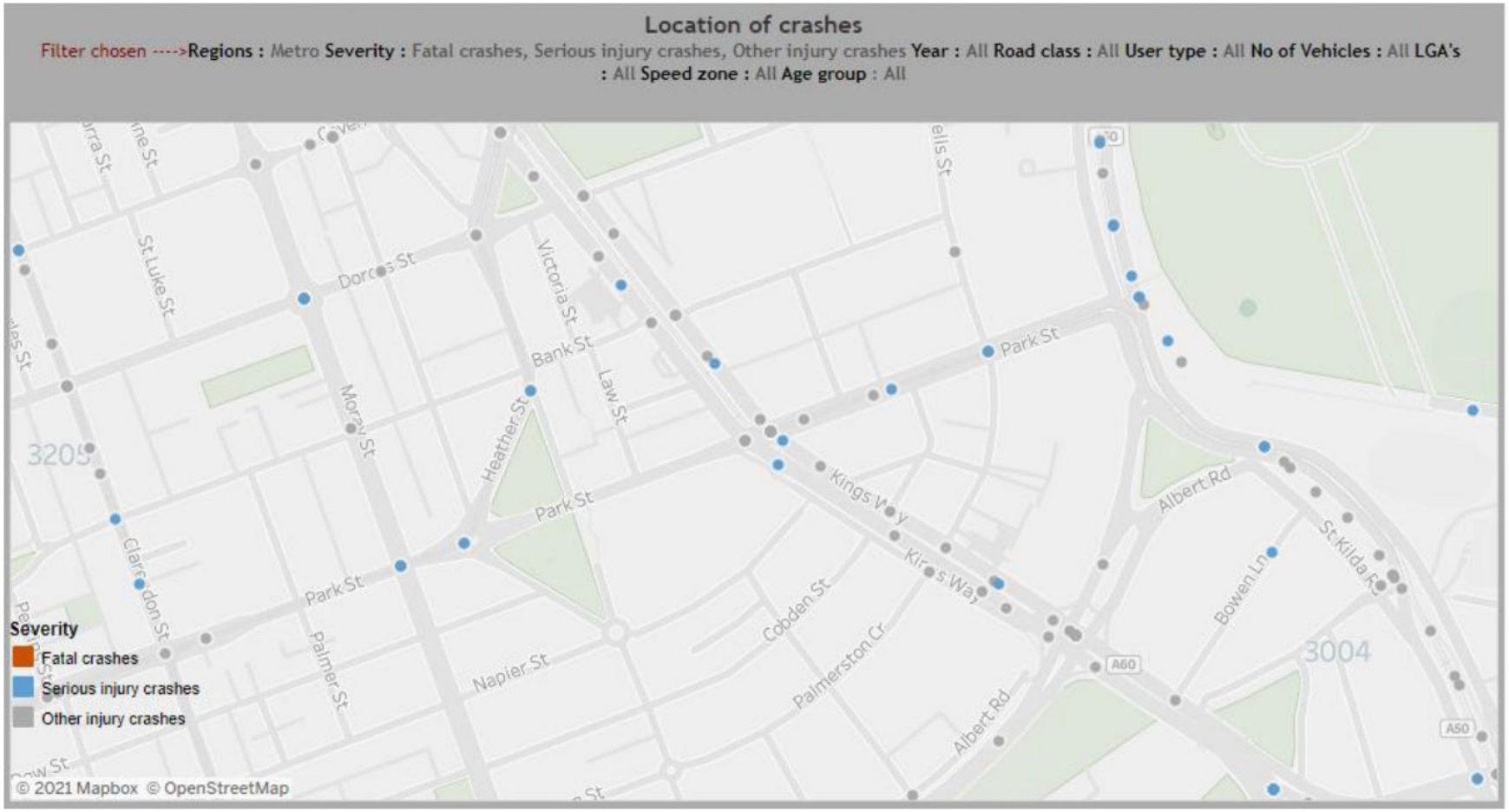


Photo 11: Park Street at tram stop POS, facing east (night)

Appendix B Crashes Past Five Years



Source: VicRoads

Appendix C Surrounding Land Use

Source: VicPlan