

Safe System Assessment (Rapid)

Sydney Road Improvement Project

February 2019

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our communities

Executive Summary

This document should be read in conjunction with the Sydney Road Movement and Place Rapid Assessment.

A Rapid Safe System Assessment (SSA) has been conducted by the assessment team for proposed concept options along Sydney Road, between Bell Street and Park Street. The existing five concept options have been assessed with respect to the *VicRoads Safe System Assessment Guidelines* and the SSA Matrix score are shown in the table below.

Option	Score
Existing conditions <ul style="list-style-type: none"> ▪ No changes to Sydney Road 	188 / 448
Option 1A <ul style="list-style-type: none"> ▪ Installation of kerbside raised tram stop (like High Street, Swanston Street) ▪ Widened footpaths and parking removed at location of tram stop. 	164 / 448
Option 1B <ul style="list-style-type: none"> ▪ Installation of easy-access tram stops (like Bridge Road, Nicholson Street, etc) with vehicles driving over platform and following tram. ▪ Parking removed at tram stop locations. 	186 / 448
Option 2 <ul style="list-style-type: none"> ▪ Raised tram stops (Option 1B) with tram lane in peak periods ▪ No improvements for cyclists ▪ General traffic restricted to one lane 	172/448
Option 3 <ul style="list-style-type: none"> ▪ Raised tram stops (Option 1A) ▪ Fully protected bicycle lane ▪ All parking removed ▪ Widened footpath for more trading space and placemaking ▪ General traffic restricted to one lane 	104/448
Option 4 <ul style="list-style-type: none"> ▪ Raised tram stop (Option 1A) ▪ Majority parking retained ▪ Parking banned during peak periods to facilitate wide kerbside bicycle lane ▪ General traffic reduced to one lane 	128/448

It can therefore be concluded that Option 3 is best aligned with the Safe System principles. Further work is required when the detail design progresses to address crash types and vulnerable user groups. A full Safe System Assessment is required during detailed design to assess treatments best aligned with Safe System Principles.

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1. Assessment Details

1.1. Type of Assessment

The Safe System Assessment (SSA) has been conducted to evaluate how concept options for the Sydney Road corridor align with the Safe System principles. A Rapid SSA has been used in accordance with VicRoads Safe System Assessment Guidelines as these options are concept options only before proceeding with detailed design at a later stage.

1.2. Assessment Team

The assessment has been carried out by Mr Rizwan Reddy, Senior Engineer and Sydney Road Project Lead at VicRoads' Metropolitan North-West Region.

2. Project Context and Description

Sydney Road is currently a four-lane arterial road with two-lanes in each direction (trams/vehicles share the middle lane) and a narrow kerbside bicycle lane (operating in the peak direction only). An aerial view of Sydney Road is shown in **Attachment A. Table 1** provides a summary of existing conditions and the reason for the proposed study.

Table 1: Project Context

PROMPTS	COMMENTS
What is the reason for the project ? Is there 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, maintenance/asset renewal, etc.	The aim of the project is to achieve the principles and objectives outlined in the Movement & Place assessment and Co-Design workshops. This includes; <ul style="list-style-type: none"> - Support improvements to tram performance - Support improvements for road safety - Support improvements for cycling infrastructure - Support improvements for placemaking
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)? What alternative routes exist?	Sydney Road is an arterial road under the care and management of VicRoads and functions as a primary movement corridor for trams, cycling and walking. As per the Movement and Place framework, Sydney Road is identified as a localised general traffic route (GT3). Sydney Road is a strategically important 'place' of activity with a place function of P3 and P4 throughout the corridor. The Upfield Shared Path is the primary movement corridor for cyclists through Moreland, providing the north-south route in and out of the Melbourne CBD.
What is the speed environment? What is the current speed limit? Has it changed recently? Is it like 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?	The current speed limit on Sydney Road is 40km/h which is appropriate for the environment and use. Lower speed limits are not being considered at this time.
What road users are present? Consider the presence of elderly pedestrians, school children and cyclists. Also note what facilities are available to vulnerable road users (e.g. signalised crossings, bicycle lanes, school speed limits, etc.)	There are approximately 900 cyclists on Sydney Road per day and a significant number of pedestrians accessing all the shops along the 4km strip of road. There is a narrow marked kerbside bicycle lane in the peak periods, outside peak periods cyclists must ride between parked vehicles and traffic. There are several signalised intersections and pedestrian operated signals for pedestrian to cross the road.
What is the vehicle composition? Consider the presence of heavy vehicles (and what type), motorcyclists and other vehicles using the roadway.	Sydney Road has a truck ban and only heavy vehicles or freight using Sydney Road are accessing or delivering to the local area.

2.1. Options

Five (5) concept options have been developed in conjunction with the Co-Design group. Each option presents varying benefits and implications for each stakeholder group. Visual representations of each option are shown in **Attachment B**.

Option 1A – Kerbside raised tram stops with no other changes along Sydney Road.

- Installation of kerbside raised tram stop (like High Street, Swanston Street, etc).
- Widened footpaths.
- Parking removed at location of tram stops.
- No other changes to Sydney Road.
- This tram stop design works best in conjunction with Option 3 and 4.

Option 1B – Kerbside raised tram stops with no other changes along Sydney Road.

- Installation of easy-access tram stops (like Bridge Road, Nicholson Street, etc) with vehicles driving over platforms and following trams.
- Parking removed at tram stop locations.
- No other changes to Sydney Road.
- This tram stop design works best in conjunction with Option 2.

Option 2 – Raised tram stops with dedicated tram lane in peak periods, no other change outside peak periods.

- Raised tram (Option 1B) with tram lane in peak periods.
- No improvements for cyclists.
- General traffic restricted to one lane.

Option 3 – Raised tram stops with continuous protected bicycle, widened footpaths and removal of parking in sections with protected bicycle lane.

- Raised tram stop (Option 1A).
- Fully protected bicycle lanes.
- All parking removed.
- Widened footpath for more trading space and placemaking.
- General traffic restricted to one lane.

Option 4 – Raised tram stops with partially protected kerbside bicycle lane, wider footpaths at select locations, parking banned during peak periods.

- Raised tram stop (Option 1A)
- Majority of parking retained.
- Parking banned during peak periods to facilitate wide kerbside bicycle lane
- General traffic reduced to one lane.

3. Assessment of Project Design Options

3.1. Assessment Summary

The Safe System Assessment Matrix scores for the existing conditions and the proposed design options are shown in **Table 2**. The scores for each crash type are shown in **Figure 1**. The detailed assessments are presented in **Section 3.2**.

Observations and conclusions based on the assessment are as follows:

- Option 3 best aligns with Safe System principles with significant improvements for vulnerable road users, including cyclists and pedestrians.
- All options are an improvement over the existing conditions.
- When the detail design progresses, additional isolated treatments should be considered to improve to further align with design with Safe Systems principles.

Table 2: SSA Matrix Scores for the Project

Option	Score
Existing conditions	188 / 448
Option 1A	164 / 448
Option 1B	186 / 448
Option 2	172/448
Option 3	104/448
Option 4	128/448

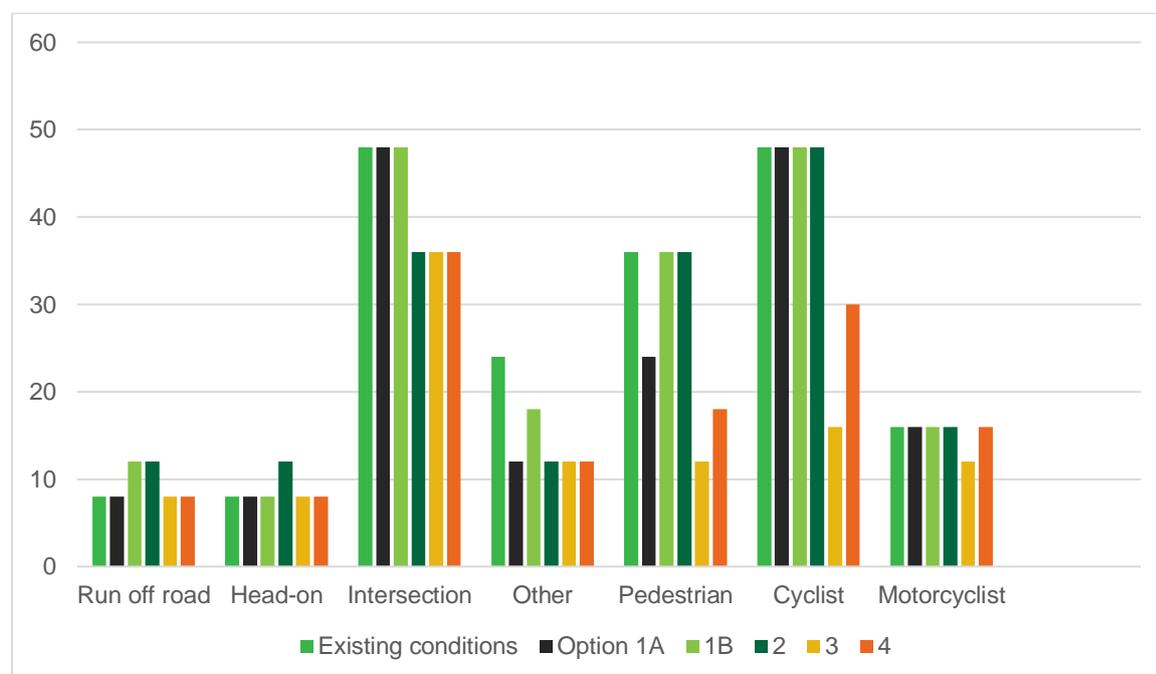


Figure 1: SSA Scores for Crash Types

3.2. Safe System Assessment Matrices

Table 3A: SSA Matrix – Existing Conditions

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure Comments:	20, 000 vpd	20, 000 vpd	20, 000 vpd	Other will be considered as crashes relating to trams	There are greater than 100 pedestrians along Sydney Road	900/day	There are at least 200 motorcyclists on Sydney Road.
Exposure Score:	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Likelihood Comments:	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> • Service Infrastructure (power poles, light poles, etc) <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> • 40km/h speed limit • Congestion • Parked Vehicles 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> • No separation from oncoming traffic <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> • 40km/h speed limit • Road alignment • Congestion 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> • Uncontrolled intersections • Filtering turning movements <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> • 40km/h speed limit • Congestion • Signalised intersection • Turn bans 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> • Trams sharing lane with cars • Cars overtaking trams • Cars not stopping at tram stops <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> • 40km/h speed limit • Congestion • No accessible tram stops 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> • Uncontrolled pedestrian crossing points • No Pedestrian refuge island <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> • Pedestrian operated signals • 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> • No dedicated bicycle lane during interpeak • Narrow bicycle lane during peak • Parked vehicles <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> • 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> • Uncontrolled intersections • Tram tracks • Lane filtering between parked vehicles and traffic lane <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> • 40km/h speed limit
Likelihood Score:	1/4	1/4	4/4	2/4	3/4	4/4	2/4
Severity Comments:	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> • Service infrastructure (power poles, light poles, etc) <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> • 40km/h speed limit • Offset to roadside hazards • Parked vehicles as a buffer 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> • Overtaking during off-peak times <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> • 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> • Higher speeds during off-peak times • Conflict angle of crashes <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> • 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> • Impact angles • Force of the tram <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> • 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> • Nil <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> • 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> • Dooring risk <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> • 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> • Service infrastructure (power poles, light poles, etc) • Parked cars <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> • Nil
Severity Score:	2/4	2/4	3/4	3/4	3/4	3/4	2/4
Product (multiply scores above for crash type)	8/64	8/64	48/64	24/64	36/64	48/64	16/64
TOTAL							188/448

Table 4B: SSA Matrix – Option 1A – Kerbside Raised Tram Stop w/ no other changes to Sydney Road

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure Comments:	20, 000 vpd	20, 000 vpd	20, 000 vpd	Other will be considered as crashes relating to trams	There are greater than 100 pedestrians along Sydney Road	900/day	There are at least 200 motorcyclists on Sydney Road.
Exposure Score:	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Likelihood Comments:	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Service Infrastructure (power poles, light poles, etc) <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Congestion Parked Vehicles 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> No separation from oncoming traffic <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Road alignment Congestion 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Uncontrolled intersections Filtering turning movements <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Congestion Signalised intersection Turn bans 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Trams sharing lane with cars Cars overtaking trams <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Congestion 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Uncontrolled pedestrian crossing points No Pedestrian refuge Reduced crossing distances at and near tram stop locations <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> Pedestrian operated signals 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> No dedicated bicycle lane during interpeak Narrow bicycle lane during peak Parked vehicles <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Uncontrolled intersections Tram tracks Lane filtering between parked vehicles and traffic lane <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit
Likelihood Score:	1/4	1/4	4/4	1/4	2/4	4/4	2/4
Severity Comments:	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Service infrastructure (power poles, light poles, etc) <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Offset to roadside hazards Parked vehicles as a buffer 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Overtaking during off-peak times <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Higher speeds during off-peak times Conflict angle of crashes <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Impact angles Force of the tram <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Nil <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Dooring risk <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Service infrastructure (power poles, light poles, etc) Parked cars <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> Nil
Severity Score:	2/4	2/4	3/4	3/4	3/4	3/4	2/4
Product (multiply scores above for crash type)	8/64	8/64	48/64	12/64	24/64	48/64	16/64
TOTAL							164/448

Table 5C: SSA Matrix – Option 1B – Easy-Access Raised Tram Stop w/ no other change to Sydney Road

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure Comments:	20, 000 vpd	20, 000 vpd	20, 000 vpd	Other will be considered as crashes relating to trams	There are greater than 100 pedestrians along Sydney Road	900/day	There are at least 200 motorcyclists on Sydney Road.
Exposure Score:	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Likelihood Comments:	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Service Infrastructure (power poles, light poles, etc) Vehicles can veer off drive-over platforms <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Congestion Parked Vehicles 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> No separation from oncoming traffic <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Road alignment Congestion 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Uncontrolled intersections Filtering turning movements <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Congestion Signalised intersection Turn bans 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Trams sharing lane with cars Cars overtaking trams using left lane <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Congestion 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Uncontrolled pedestrian crossing points No Pedestrian refuge island Conflict between cyclist and pedestrian on platform <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> Pedestrian operated signals 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> No dedicated bicycle lane during interpeak Narrow bicycle lane during peak Parked vehicles Conflict between cyclist and pedestrian on platform <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Uncontrolled intersections Tram tracks Lane filtering between parked vehicles and traffic lane <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit
Likelihood Score:	1.5/4	1/4	4/4	1.5/4	3/4	4/4	2/4
Severity Comments:	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Service infrastructure (power poles, light poles, etc) <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Offset to roadside hazards Parked vehicles as a buffer 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Overtaking during off-peak times <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Higher speeds during off-peak times Conflict angle of crashes <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Impact angles Force of the tram <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Nil <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Dooring risk <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Service infrastructure (power poles, light poles, etc) Parked cars <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> Nil
Severity Score:	2/4	2/4	3/4	3/4	3/4	3/4	2/4
Product (multiply scores above for crash type)	12/64	8/64	48/64	18/64	36/64	48/64	16/64
TOTAL							186/448

Table 6D: SSA Matrix – Option 2 – Part Time Tram Lane w/ raised accessible tram stop

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure Comments:	20, 000 vpd	20, 000 vpd	20, 000 vpd	Other will be considered as crashes relating to trams	There are greater than 100 pedestrians along Sydney Road	900/day	There are at least 200 motorcyclists on Sydney Road.
Exposure Score:	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Likelihood Comments:	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Service Infrastructure (power poles, light poles, etc) Vehicles can veer off drive-over platforms <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Congestion Parked Vehicles 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> No separation from oncoming traffic during off-peak <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Road alignment Separation during tram lane times 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Uncontrolled intersections Filtering turning movements <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Congestion Signalised intersection More turn bans 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Trams sharing lane with cars during off-peak Cars overtaking trams during off-peak <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Congestion 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Uncontrolled pedestrian crossing points No Pedestrian refuge island Conflict between cyclist and pedestrian on platform <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> Pedestrian operated signals 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> No dedicated bicycle lane during interpeak Narrow bicycle lane during peak Parked vehicles Conflict between cyclist and pedestrian on platform <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Uncontrolled intersections Tram tracks Lane filtering between parked vehicles and traffic lane <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit
Likelihood Score:	1.5/4	1.5/4	3/4	1/4	3/4	4/4	2/4
Severity Comments:	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Service infrastructure (power poles, light poles, etc) <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Offset to roadside hazards Parked vehicles as a buffer 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Overtaking during off-peak times <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Higher speeds during off-peak times Conflict angle of crashes <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Impact angles Force of the tram <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Nil <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Dooring risk <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Service infrastructure (power poles, light poles, etc) Parked cars <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> Nil
Severity Score:	2/4	2/4	3/4	3/4	3/4	3/4	2/4
Product (multiply scores above for crash type)	12/64	12/64	36/64	12/64	36/64	48/64	16/64
TOTAL							172/448

Table 7E: SSA Matrix – Option 3 – Protected Bicycle Lane w/raised accessible tram stop

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure Comments:	20, 000 vpd	20, 000 vpd	20, 000 vpd	Other will be considered as crashes relating to trams	There are greater than 100 pedestrians along Sydney Road	900/day	There are at least 200 motorcyclists on Sydney Road.
Exposure Score:	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Likelihood Comments:	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Service Infrastructure (power poles, light poles, etc) <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Congestion 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> No separation from oncoming traffic <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Road alignment Congestion 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Uncontrolled intersections Filtering turning movements <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Congestion Signalised intersection More Turn bans 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Nil <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Congestion Raised tram stops for pedestrians 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Uncontrolled pedestrian crossing points <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> Pedestrian operated signals 40km/h speed limit Reduced crossing distances at and near tram stop locations Reducing crossing distance due to kerb extension 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Conflict points at uncontrolled intersections <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Uncontrolled intersections Tram tracks <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit
Likelihood Score:	1/4	1/4	3/4	1/4	1/4	2/4	1.5/4
Severity Comments:	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Service infrastructure (power poles, light poles, etc) <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Offset to roadside hazards 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Nil <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit No opportunities to overtake due to kerb extensions 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Higher speeds during off-peak times Conflict angle of crashes <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Impact angles Force of the tram <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Nil <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Nil. <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Service infrastructure (power poles, light poles, etc) <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> Nil
Severity Score:	2/4	2/4	3/4	3/4	3/4	2/4	2/4
Product (multiply scores above for crash type)	8/64	8/64	36/64	12/64	12/64	16/64	12/64
TOTAL							104/448

Table 8F: SSA Matrix – Option 4 – Kerbside Bicycle Lane (Peak Periods) w/ raised accessible tram stop.

	Run-off road	Head-on	Intersection	Other	Pedestrian	Cyclist	Motorcyclists
Exposure Comments:	20, 000 vpd	20, 000 vpd	20, 000 vpd	Other will be considered as crashes relating to trams	There are greater than 100 pedestrians along Sydney Road	900/day	There are at least 200 motorcyclists on Sydney Road.
Exposure Score:	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Likelihood Comments:	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Service Infrastructure (power poles, light poles, etc) <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Congestion Parked Vehicles 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> No separation from oncoming traffic <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Road alignment Congestion 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Uncontrolled intersections Filtering turning movements <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Congestion Signalised intersection More Turn bans 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Trams sharing lane with cars <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Congestion Raised tram stops for pedestrians 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Uncontrolled pedestrian crossing points <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> Pedestrian operated signals 40km/h speed limit Reduced crossing distances at and near tram stop locations Reducing crossing distance due to kerb extension 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> No dedicated bicycle lane during interpeak Parked vehicles <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Wide kerbside lane during peak periods 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Uncontrolled intersections Tram tracks Lane filtering between parked vehicles and traffic lane <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit
Likelihood Score:	1/4	1/4	3/4	1/4	1.5/4	2.5/4	2/4
Severity Comments:	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Service infrastructure (power poles, light poles, etc) <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit Offset to roadside hazards Parked vehicles as a buffer 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Nil <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit No opportunities to overtake due to kerb extensions 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Higher speeds during off-peak times Conflict angle of crashes <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Impact angles Force of the tram <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Nil <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Dooring risk <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> 40km/h speed limit 	<p>Factors that increase the likelihood include:</p> <ul style="list-style-type: none"> Service infrastructure (power poles, light poles, etc) Parked cars <p>Factors that decrease the likelihood include:</p> <ul style="list-style-type: none"> Nil
Severity Score:	2/4	2/4	3/4	3/4	3/4	3/4	2/4
Product (multiply scores above for crash type)	8/64	8/64	36/64	12/64	18/64	30/64	16/64
TOTAL							128/448

4. Treatments to Improve Safe System Alignment

Error! Reference source not found. lists treatments that will improve the Safe System alignment of the project and should be considered during the detailed design stage of the project. Primary treatments have not been considered given the variance of the options proposed above. Additional primary treatments should be considered when an option is determined for the corridor.

Table 4: Supporting Treatments

Treatments for consideration	Project response
Raised threshold treatments at intersecting side roads	To be considered during detailed design
Additional pedestrian operated signals	To be considered during detailed design
Painted median to reduce crossing distances for pedestrians	To be considered during detailed design
Right turn bans to reduce conflict with cyclists and pedestrians	To be considered during detailed design
Pedestrian priority at signals including early start pedestrian phasing (where applicable) and longer pedestrian walk times (where appropriate)	To be considered during detailed design
Electronic warning signage for pedestrians at signalised intersections	To be considered during detailed design

Primary treatments are those measures that have the potential to eliminate or come close to eliminating the risk of fatal and serious injury (FSI) crashes.

Supporting treatments are effective in reducing the risk of FSI crashes but not to the extent of a primary treatment (i.e. there is a residual moderate or significant FSI crash risk). Implementation of a primary treatment should be given priority over a supporting treatment that may be targeting a similar crash risk.

Implementation of a primary treatment should be given priority over a supporting treatment that may be targeting a similar crash risk.

Further detailed design work is required to finalise the most appropriate solution for the corridor where a full Safe System Assessment is required. Once this is complete, primary and secondary treatments can be considered to improve the Safe System alignment of the project. Treatments such as raised platforms, painted median, right turn bans could be considered.

5. Conclusions

The five design options for the upgrade of Sydney Road vary in their alignment with the Safe System principles. All five options represent different and competing interests from stakeholder groups and differ in their ability to cater for the needs of all users.

The areas of highest risk for Option 1A, 1B and 2 are not addressing cyclist safety and pedestrian safety. There is potential to further reduce risks to pedestrians by reducing crossing distances and considering the installation of more pedestrian crossing with traffic lights.

Options 3 and 4 provides significant improvements for cyclists and pedestrians.

Further detailed design work is required to finalise the most appropriate solution for the corridor where a full Safe System Assessment is required.

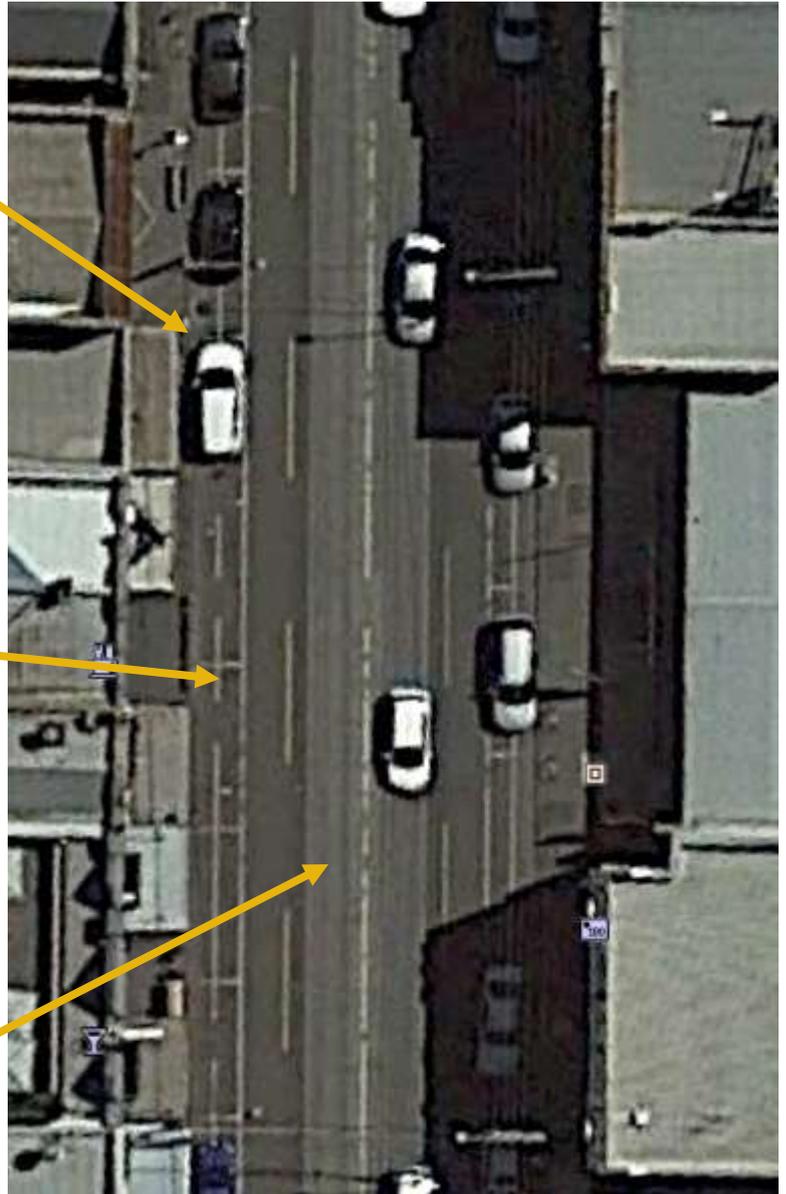
6. Appendices

Attachment A

Peak Kerbside
Bicycle Lane

Clearway Traffic
Lane/Parking Lane

Shared
traffic/tram lane



Attachment B

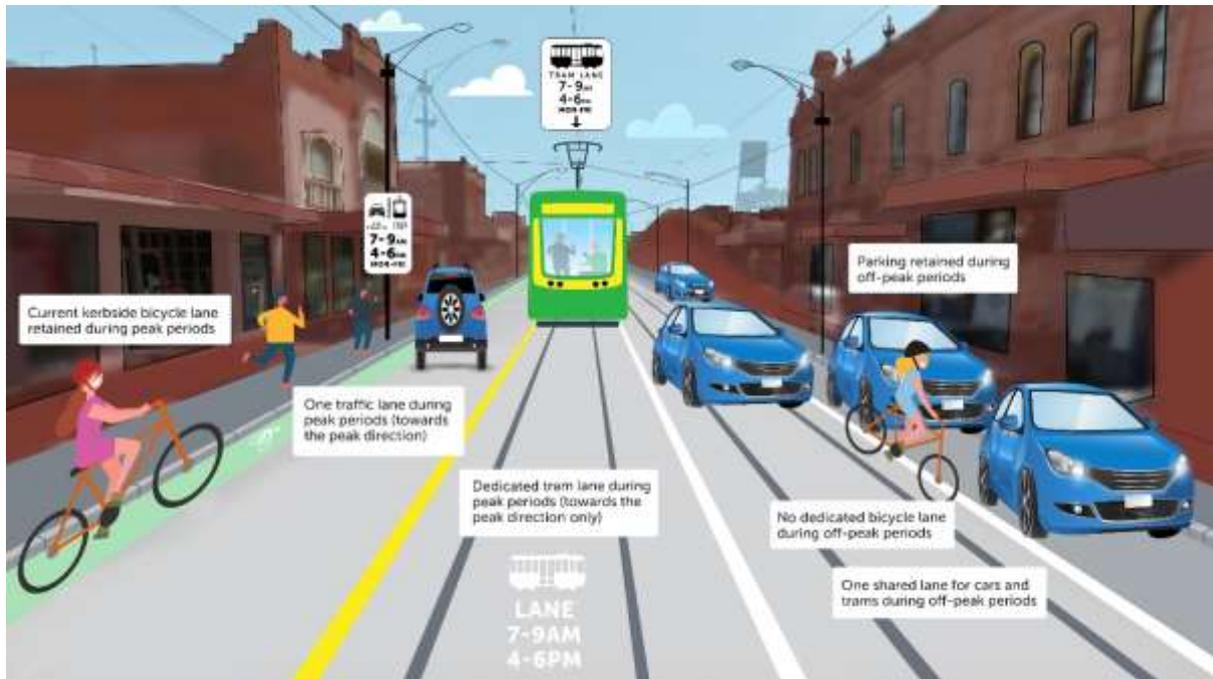
Option 1A – Kerbside raised tram stops with no other changes along Sydney Road.



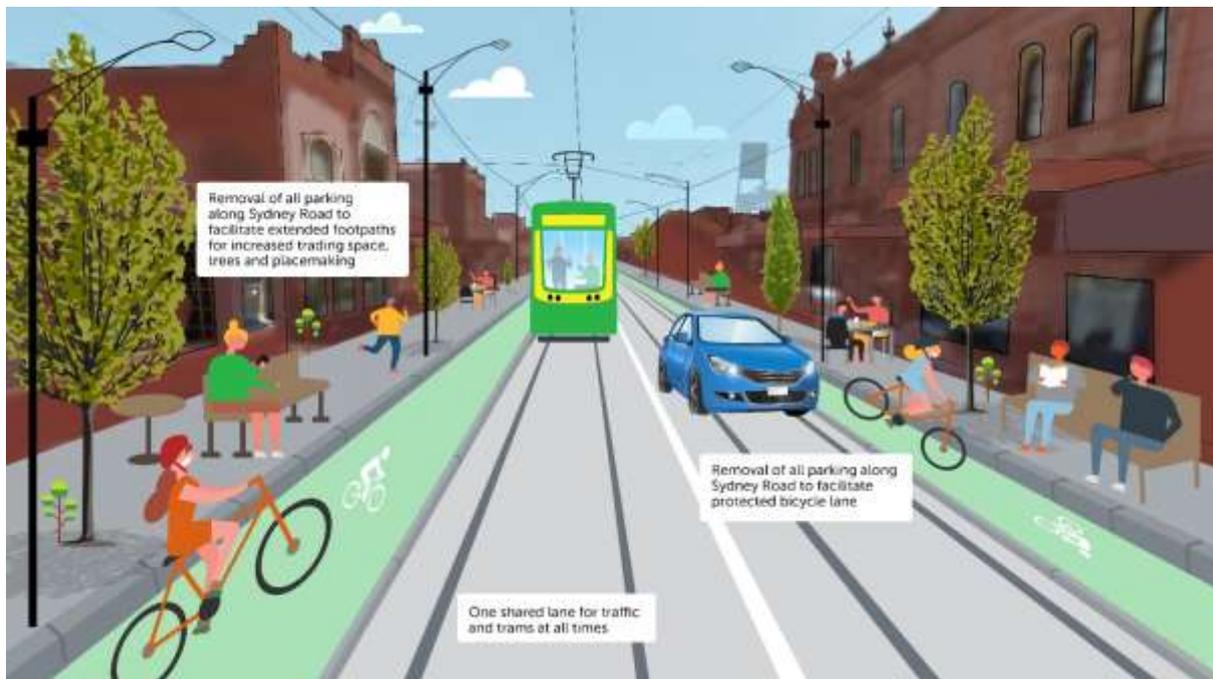
Option 1B – Kerbside raised tram stops with no other changes along Sydney Road.



Option 2 – Raised tram stops with dedicated tram lane in peak periods, no other change outside peak periods.



Option 3 – Raised tram stops with continuous protected bicycle, widened footpaths and removal of parking in sections with protected bicycle lane.



Option 4 – Raised tram stops with partially protected kerbside bicycle lane, wider footpaths at select locations, parking banned during peak periods.

