

CONTRACT REPORT

Road Safety Audit - Cambridge and Moorebank Avenues, Moorebank - Construction Traffic Accesses

Project No: PRS17114

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Karndacharuk

for Sydney Intermodal Terminal Alliance
(SIMTA)

date August 2017

Road Safety Audit - Cambridge and Moorebank Avenues, Moorebank - Construction Traffic Accesses

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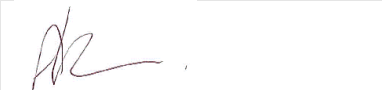
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1 INTRODUCTION

CPB Contractors and Arcadis (on behalf of the Sydney Intermodal Terminal Alliance (SIMTA)) each engaged the Australian Road Research Board (ARRB) to undertake a road safety audit of the existing road environment along Cambridge and Moorebank Avenues at Moorebank (Figure 1.1).

The purpose of the audit was to identify potential road safety issues for road users resulting from construction traffic associated with a large-scale development on adjacent lands, when accessing and egressing these two roads and interacting with road users.

In addition to identifying road safety issues, SIMTA requested the audit team to identify potential risk mitigation measures that would assist reducing the level of risk associated with the traffic interactions.

There are 11 gates or construction accesses to the SIMTA site along Cambridge and Moorebank Avenues; these are described in Table 1.1, below.

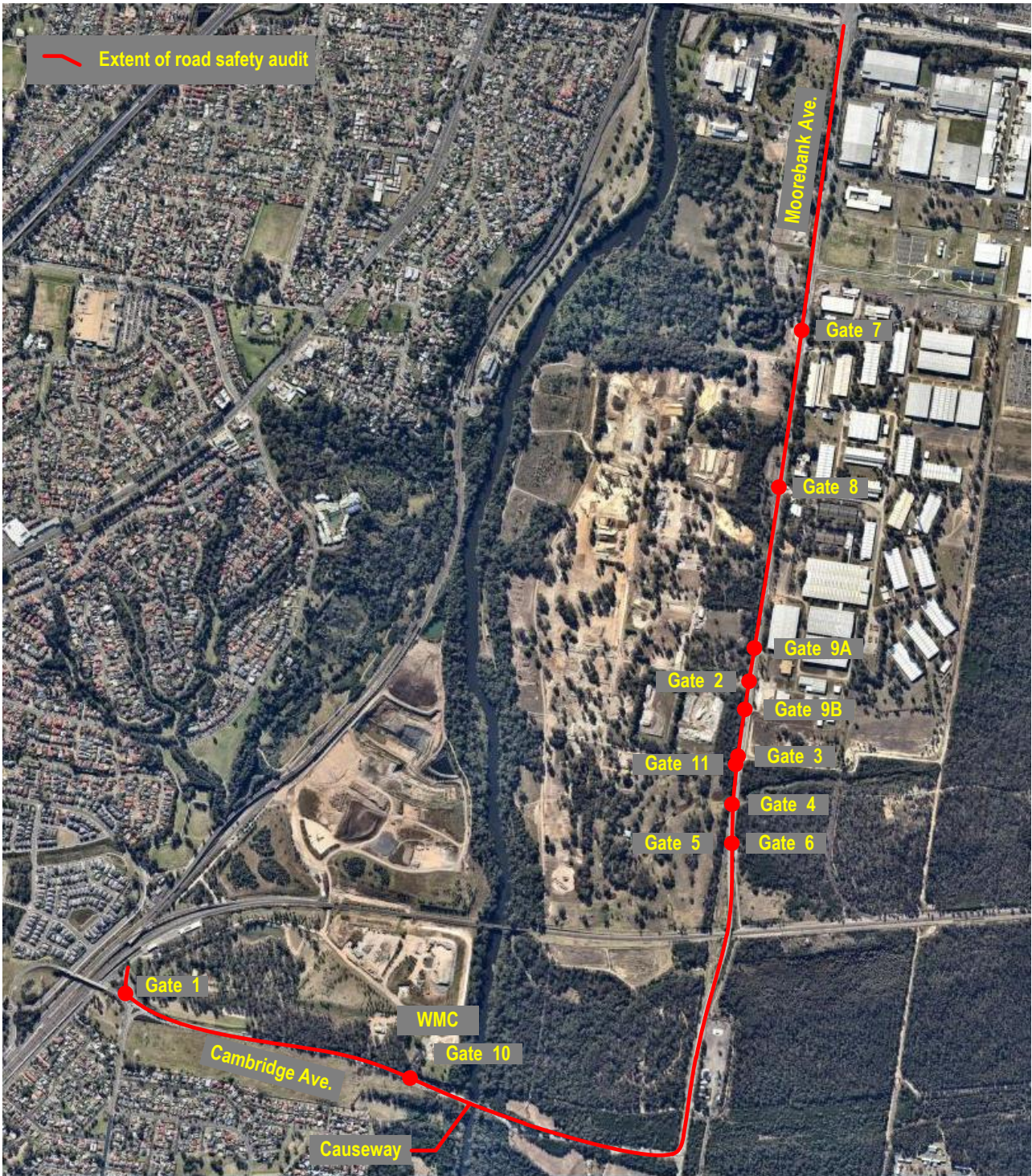
The location of each access is illustrated in Figure 1.1.

Table 1.1: Construction traffic access gates

Access gate no.	Name	Location (off)
1	Rail West Compound	Railway Parade
2	Georges River Compound	Chatham Avenue/Moorebank Avenue
3	Moorebank access to rail link north	Moorebank Avenue
4	Moorebank access adjacent Anzac Creek to rail link	Moorebank Avenue
5	Rail East Compound	Moorebank Avenue
6	Moorebank access to rail link south	Moorebank Avenue
7	Main Construction Compound Access	Moorebank Avenue
8	Secondary Construction Compound	Moorebank Avenue
9*	Materials and emergency access point on the southern edge of the Project	Moorebank Avenue
10	Rail West Compound	Cambridge Avenue
11	Georges River Compound	Moorebank Avenue

Note: * There are two existing gates on-site in the vicinity of Gate 9 as marked on the CTAMP. In this report both gates have been audited and tagged Gate 9A and Gate 9B. Gate 9A is currently marked 'ENTRY' only and Gate 9B is currently marked 'EXIT' only.

Figure 1.1: Extent of road safety audit – route and specific site entrances



Source: Nearmap (modified by ARRB)

2 ROAD SAFETY AUDIT METHOD

The consent for the developments contained the following clauses:

Prior to the commencement of construction, the Applicant shall undertake a Road Safety Audit in consultation with TfNSW and the relevant Council for the proposed construction vehicle access points on public roads. The audit shall be undertaken by an independent TfNSW accredited road safety auditor in accordance with the relevant Austroads guidelines to identify any safety issues for the proposed construction vehicle access. The audit shall recommend corrective actions for any identified safety issues and propose appropriate traffic management measures (i.e. temporary traffic signals).

And,

A road safety audit will be undertaken of Moorebank Avenue and Cambridge Avenue to identify the traffic safety risks associated with construction vehicles using these roads and to determine the appropriate traffic controls to be implemented to mitigate any risks identified as part of the preparation of the Construction Traffic Management Plan (CTMP). The effectiveness of any measures implemented will be monitored during the construction phase.

In accordance with the conditions of consent for the development, ARRB has undertaken an independent review of road safety issues along Cambridge and Moorebank Avenues by applying the principles and approach of the *Austroads Guide to Road Safety: Part 6 Road Safety Audit*.

2.1 Site visits

Two site visits were undertaken by the road safety audit team, each visit focussing on the site construction traffic entry/exits associated with the SIMTA developments along Moorebank Avenue.

2.1.1 First site visit

Audit Team: David McTiernan, Noha Elazar, Aut Karndacharuk

Date of Audit: 4 April 2017

Time of Audit: 1.30 pm (day-time audit)
6.30 pm (night-time audit)

Weather condition: Rain with dry breaks

Commencement meeting:

A commencement meeting was held via teleconference on Monday 3 April 2017. Attending were the ARRB road safety audit team and from CPB Contractors was Mr Aaron Chan, Mr Russell Hoad and Ms Sallyanne Rinehart.

A site induction meeting was held on site prior to the commencement of the Road safety Audit. This induction meeting involved the audit team and Mr Aaron Chan, Project Engineer CPB, where the extent and objectives of the road safety audit were confirmed and matters of safety for the conduct of the audit outlined.

2.1.2 Second site visit

Audit Team: David McTiernan, Noha Elazar

Date of Audit: 11 May 2017

Time of Audit: 9.30 pm

Weather condition: Sunny with clear skies

Commencement meeting:

A commencement meeting was held on site prior to the commencement of the Road Safety Audit. This meeting involved the audit team and Mr Brett O'Donovan, Principal Environmental Consultant at Arcadis (on behalf of SIMTA), where the extent and objectives of the road safety audit were confirmed.

2.1.3 Site audit

The audit of the site involved reviewing the nominated route (i.e. Cambridge and Moorebank Avenues) from the perspective of the road user, with consideration of the potential interaction of road users with the proposed construction traffic. This included a review of road safety issues at each nominated entry/exit location for construction traffic along both roads, the existing road intersections at Chatham Avenue (Gate 2), the Waste Management Centre (Gate 10) and the existing and proposed new access roads, as indicated in Figure 1.1.

3 ROAD SAFETY AUDIT FINDINGS

A summary of the findings of the road safety audit, as they relate to each designated construction access/gate, is presented in Table 3.1, below.

A detailed tabulation of all the road safety audit findings along Moorebank and Cambridge Avenues is presented in Table 3.2, with the location of each issue shown in Figure 3.1.

Photographs of the identified road safety issues are provided in Appendix A; these are cross-referenced with the issues described in Table 3.2, along with the risk rating, suggested action/s to mitigate the risk and the residual risk remaining if actions are implemented.

The following should be noted about the road safety audit:

1. The audit team have sought to identify all issues along Cambridge and Moorebank Avenues that may adversely impact on the safety of road users. It is likely that some issues are not the primary responsibility of SIMTA to rectify, since they are existing hazards presenting a degree of risk to current road users and the construction traffic associated with the development may or may not contribute to the overall risk posed.
2. The level of risk indicated (i.e. high, medium, or low) is a subjective assessment by the audit team based on guidance contained in the *Austroads Guide to Road Safety: Part 6 Road Safety Audit*, combined with the perception and experience of the audit team with these types of road safety issues. While factors such as the exposure and potential likely severity of a crash incident have been considered, the basis of the risk level is not drawn from actual site data such as traffic volumes or crash history.

The levels of risk indicated for each road safety issue should be read as relative to one another and may not be comparable to similar hazards/issues in other road environments or to other types of hazards associated with construction processes.

Table 3.1: Summary road safety audit findings – CTAMP constructions accesses

Access gate no.	Name	Road safety issue (cross-reference with Table 3.2)
1	Rail West Compound	23
2	Georges River Compound	9, 10, 30
3	Moorebank access to rail link north	12, 29
4	Moorebank access adjacent Anzac Creek to rail link	13, 28
5	Rail East Compound	13, 28
6	Moorebank access to rail link south	13, 28
7	Main Construction Compound Access	4A, 4B, 5
8	Secondary Construction Compound	7, 8
9A, 9B	Materials and emergency access point on the southern edge of the Project	11
10	Rail West Compound	No issues identified
11	Georges River Compound	12, 29

Table 3.2: Road safety audit findings and suggested actions

Issue no.	Site photo	Road safety issue	Risk rating	Suggested actions (Risk mitigation options)	Residual risk	Primary responsibility	Client response/action
Moorebank Avenue southbound commencing at M5 Motorway							
1	A	Missing stop lines at the signalised intersection with a pedestrian crossing. A vehicle may stop further into the path of crossing pedestrians and turning vehicles. Risk of collision with turning vehicles and crossing pedestrians.	Medium	Install Stop lines at traffic signals to indicate location for stopped traffic and pedestrian path	Low	Road asset manager	
2	B	Unprotected and non-delineated culvert may create a hazard for a vehicle moving outside the lane particularly in darkness.	High	<ol style="list-style-type: none"> 1. Adjust culvert to remove the impact hazard (e.g. convert to a side entry pit for example. 2. Delineate culvert by installing two delineator posts to indicate to drivers the location and extent of culvert. 	Very low Low	Road asset manager	
3	C, D	Non-conforming safety barrier terminal which may spear a vehicle in the event of a crash. Further, the barrier terminates at a non-frangible tree, directing an errant vehicle toward impact with this tree.	High	Install an approved (RMS compliant) road safety barrier terminal and consider removal of the tree or extending the safety barrier past tree.	Low	Road asset manager	
4A	E	Gate 7 is presently an uncontrolled entry/exit gate, which risks collisions with through traffic, and disruption of traffic along Moorefield Avenue.	High	Activate the existing traffic signals (No. 2646) at Gate 7 to permit all turning in/out of Gate 7.	Low	Road asset manager/SIMTA	
4B	E	Gate 7 : 'Do Not Queue Across Intersection' sign is old faded and inappropriately located, i.e. too low. It is a hazard that partly obstructs line of sight view to approaching traffic.	Medium	Remove sign, and if considered required, relocated to an alternate location.	Low	Road asset manager/SIMTA	
5	F	Gate 7 : A large project advertising sign is located too close to the intersection partly blocking line of sight for exiting traffic.	Medium	Remove Project sign to allow clear line of sight to the south.	Low	SIMTA	

Issue no.	Site photo	Road safety issue	Risk rating	Suggested actions (Risk mitigation options)	Residual risk	Primary responsibility	Client response/action
6	G	The row of trees at this location is very close to the edgeline at approximately 1 m distance. These large trees are a roadside impact hazard and in the path of vehicles that may veer slightly off the edgeline, particularly in darkness.	High	It is preferable to remove these trees, or alternatively provide a suitable road safety barrier (offset may preclude this). However, if this is not possible then action is required to provide enhanced delineation and audit-tactile linemarking of the road edge and highlight the trees to allow them to be visible to drivers.	Medium Medium-high	Road asset manager	
7	H, I	Gate 8: Deteriorated pavement arrow markings on both the left turn lane and straight lane at the signalised intersection. This may cause confusion and result in a conflict between left turning and straight vehicles without clear direction for the correct lane manoeuvre.	Medium	Renew all pavement markings to ensure clear delineation and guidance for road users.	Low	Road asset manager	
8	J, K	Gate 8: Deteriorated pavement markings for the merge lane south of the traffic signals, which may result in vehicles merging suddenly resulting in a crash with straight through traffic	Medium	Renew all pavement markings to ensure clear delineation and guidance for road users.	Low	Road asset manager	
9	L, M	Gate 2: Deteriorated pavement markings at the signalised intersection and turn into Chatham Ave (Gate 2). This may cause confusion and result in conflict between vehicles movements due to poor direction about correct lane manoeuvres.	Medium	Renew all pavement markings to ensure clear delineation and guidance approaching and at the intersection of Moorebank Ave and Chatham Ave (Gate 2).	Low	Road asset manager/SIMTA	
10	N	Gate 2: Heavy vehicles turning left into Gate 9A may hold up the traffic on the one through lane and could increase the risk of a rear end collisions.	Medium	Upgrade the shoulder area to provide a left turn lane to remove turning vehicles from the through traffic and protect the roadside area from deterioration.	Low	Road asset manager/SIMTA	

Issue no.	Site photo	Road safety issue	Risk rating	Suggested actions (Risk mitigation options)	Residual risk	Primary responsibility	Client response/action
11	O	<p>Gate 9A, 9B: Heavy vehicles turning left out of Gate 9B will have a wheel path on the unsealed shoulder which also has a drop from the sealed carriageway. This manoeuvre will cause deterioration to the unsealed shoulder, the edge of seal and create unstable driving conditions for vehicles, particularly in wet conditions.</p>	Medium	<p>Upgrade shoulder area to provide sufficient turning path onto Moorebank Ave, and repair the edge drop at the sealed pavement shoulder interface.</p>	Low	Road asset manager/SIMTA	
12	P	<p>Gate 3 and 11: The traffic movements associated with the staggered T intersection (formed by proposed Gate 3 and Gate 11 with Moorebank Ave) may create traffic flow disruptions and the potential for rear end crashes on Moorebank Avenue.</p> <p><i>[Note: Advice from CPB Contractors is that right turn movements from Moorebank Ave into Gates 3 and 11 are not required for the proposed operations and therefore potential safety issues associated with these movements are not considered.]</i></p>	Medium	<p>Formalise the Gate 3 and Gate 11 intersections with Moorebank Ave by appropriately treating the road shoulder areas to provide for left turn movements (i.e. both from and into Moorebank Ave) for the largest regular vehicle using the location.</p> <p>Provide 'Truck Turning' warning signs (to AS1742 design) on the north and southbound approaches.</p>	Low	SIMTA	

Issue no.	Site photo	Road safety issue	Risk rating	Suggested actions (Risk mitigation options)	Residual risk	Primary responsibility	Client response/action
13	Q	<p>Gate 4, 5, 6: Traffic movements associated with Gates 4, 5 and 6 may create traffic flow disruptions and potential rear-end and side-swipe crashes.</p> <p>Additionally, Gate 5 will run parallel with Moorebank Ave and potentially form an 'on-ramp merge' arrangement in close proximity to Gate 4.</p> <p><i>[Note: Advice from CPB Contractors is that right turn movements from Moorebank Ave into Gates 4, 5 and 6 are not required for the proposed operations and therefore potential safety issues associated with these movements are not considered.]</i></p>	Medium	<p>Formalise the Gate 4 and Gate 6 intersections with Moorebank Ave by appropriately treating the road shoulder areas to provide for left turn movements (i.e. both from and into Moorebank Ave) for the largest regular vehicle using the locations.</p> <p>Formalise Gate 5 by appropriately treating the road verge and shoulder areas to form a suitable merge lane onto Moorebank Ave (ensure due regard to the presence of the overhead powerlines).</p> <p>Provide 'Truck Turning' warning signs (to AS1742 design) on the north and southbound approaches.</p>	Low	SIMTA	
14	R, S	The ramped footpath at the bridge over the rail line combined with poor delineation may cause errant vehicles to launch off the bridge onto the rail line below.	High	<ul style="list-style-type: none"> ▪ Improve delineation of the road curve through renewed linemarking, RPMs and signage such as lateral shift markers. ▪ Replace the bridge fence with an appropriate safety barrier 	Low	Road asset manager	
Cambridge Ave Westbound							
15	T	Road flooding occurs at culvert creating a possible run off road crash.	Low	Improve drainage and delineation to reduce the likelihood of water ponding on the traffic lanes.	Nil	Road asset manager	
16	U, V	Incorrect sign used for warning of narrow bridge (causeway). Sign is located too far ahead of bridge location. This presents incorrect information of the road conditions ahead and the effectiveness of the warning signs is diminished.	Low	Replace incorrect 'Road Narrows' sign with (W4-1) 'Narrow Bridge' sign and install in accordance with AS 1742.2.	Nil	Road asset manager	

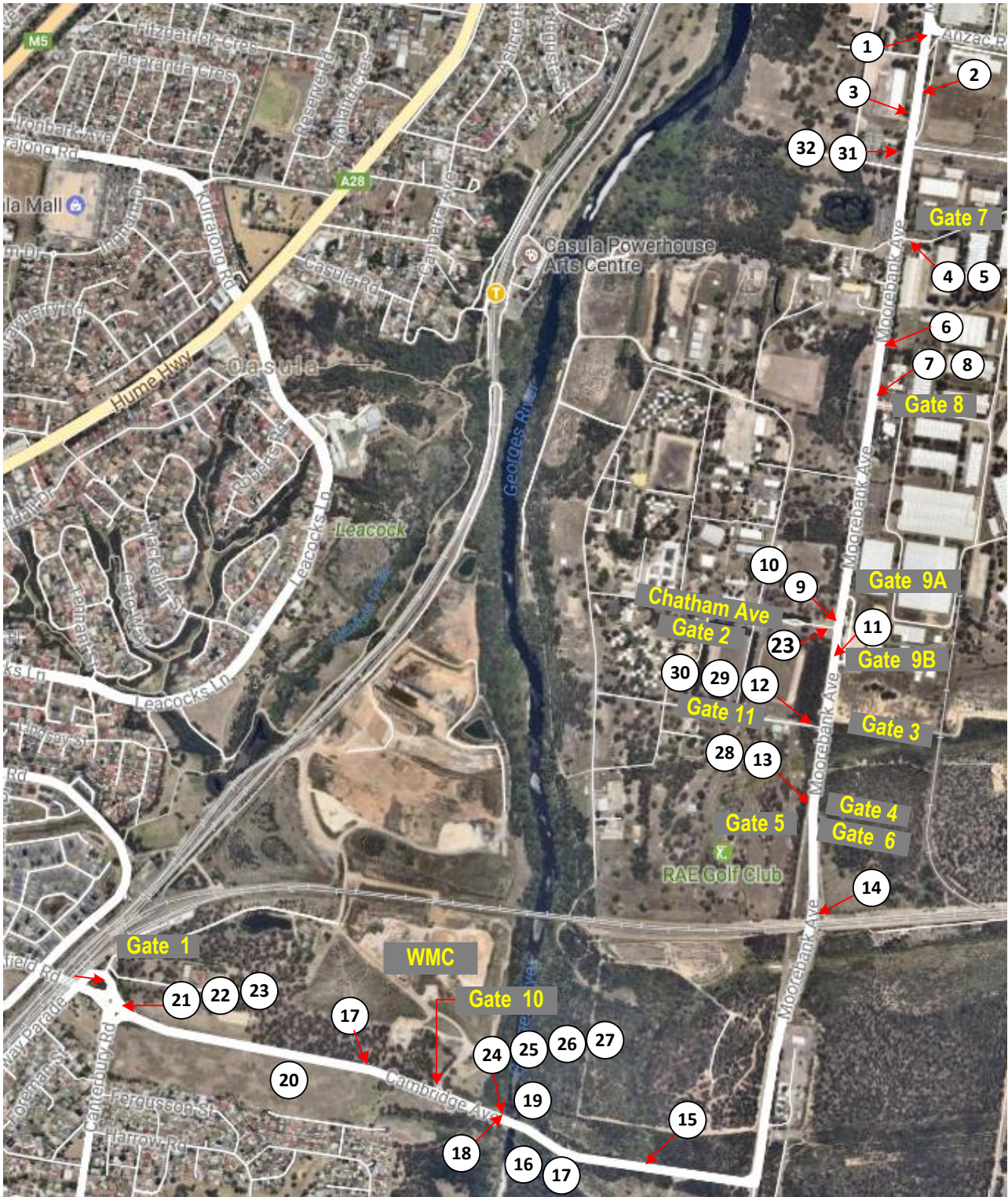
Issue no.	Site photo	Road safety issue	Risk rating	Suggested actions (Risk mitigation options)	Residual risk	Primary responsibility	Client response/action
17	W, X	Curve warning sign is hidden behind overgrown vegetation. Missing curve alignment marker (CAM), creating insufficient warning of curvature of road ahead and curve/bridge advisory speed.	Medium	To improve driver's awareness of the road curve, trim vegetation and replace missing CAM's in accordance with AS1742.2.	Low	Road asset manager	
18	Y, Z	'Narrow Causeway' sign is located too close to other warning signs, risking drivers missing the warning message. This sign is also located too far from the bridge/causeway.	Medium	To ensure drivers are provided adequate warning of the narrow bridge, relocate 'Narrow Causeway' sign closer to the causeway in accordance with AS1742.2.	Low	Road asset manager	
19	AA, AB	It is noted that light and heavy vehicles are currently permitted to use the narrow bridge/causeway. The following factors are considered to contribute to an increased risk of vehicle collisions on the bridge/causeway: <ul style="list-style-type: none"> ▪ Restricted line of sight (westbound) around curved road approach due to overgrown vegetation on the east riverbank ▪ Lack of effective delineation approaching and along the bridge. Missing left road width marker.	Medium	To improve a driver's awareness and approach to the narrow bridge: <ul style="list-style-type: none"> ▪ Trim and remove the excessive vegetation obstructing driver lines of sight ▪ Replace missing left road width markers Improve linemarking and reflector delineation on the approach and across the bridge.	Low	Road asset manager	
20	AC, AD	Deteriorated linemarking creates inadequate delineation in darkness which may cause a driver to veer into the power poles located along the side of the road.	Medium	Remark road edge and centrelines and improve delineation with the use of raised pavement markers.	Low	Road asset manager	
21	AE, AF	Damaged guardrail has reduced capacity to protect the structure behind from an errant vehicle crash	High	Repair damaged guardrail sections.	Low	Road asset manager	

Issue no.	Site photo	Road safety issue	Risk rating	Suggested actions (Risk mitigation options)	Residual risk	Primary responsibility	Client response/action
22	AG, AH	Missing linemarking on roundabout exit creates confusion for drivers as to the correct lane and may cause sideswipe crashes. Truck sign is hidden behind vegetation and vehicles miss the warning of presence of trucks.	Medium	Repaint correct lane linemarking and trim vegetation to improve sign visibility.	Low	Road asset manager/SIMTA	
Cambridge Ave Eastbound							
23	AI, AJ, AK, AL, AM, AN	Gate 1: Damaged guardrail has reduced capacity to protect the structure behind from a heavy vehicle crash.	High	Repair damaged guardrail sections.	Low	Road asset manager	
24	AO, AP	Overgrown vegetation covering guardrail at the start of a merge reduces the effectiveness of the delineation of the barrier end and may cause a vehicle to crash into the hidden guardrail. Incorrect sign used for warning of narrow bridge. Sign is located too far ahead of location and presents incorrect information of road ahead. The warning sign installed too far ahead are not effective in warning of hazard ahead.	Low	Remove vegetation to allow guardrail to be visible. Replace incorrect 'Road narrows' sign with (W4-1) 'Narrow bridge' sign and install in accordance with AS 1742.2.	Nil	Road asset manager	
25	AQ, AR	'Narrow Causeway' sign and speed advisory sign are hidden behind vegetation. 'Narrow causeway' sign is located too far from the causeway. Drivers may not see the signs hidden not at the correct location.	Medium	Trim vegetation and relocate 'Narrow Causeway' sign closer to the bridge/causeway in accordance with AS1742.2.	Low	Road asset manager	
26	AS, AT	Lateral shift markers are incorrectly used at this location. Vehicles travelling in the shoulder in darkness may think they can turn right which may cause a crash into the back of the guardrail.	Medium	Replace lateral shift marker signs with road narrow width marker signs.	Low	Road asset manager	

Issue no.	Site photo	Road safety issue	Risk rating	Suggested actions (Risk mitigation options)	Residual risk	Primary responsibility	Client response/action
27	AU, AV	Rotated CAM and missing CAM removes proper delineation of curve and in darkness may cause a vehicle to veer to the other side of the road by going straight on the curve.	Medium	Correct rotation of existing CAM and install missing CAMs in accordance with AS1742.2.	Low	Road asset manager	
Moorebank Ave Northbound							
28	Q	Gate 4, 5, 6: Refer to Issue 13					
29	P	Gate 3, 11: Refer to Issue 12					
30	AW	Gate 2: Major stormwater ponding adjacent the kerb and drainage swale on approach to Chatham Avenue potentially creates an unsafe vehicle turning path with the possibility of loss of control (aquaplaning) and impact with traffic signals or other vehicles. Drivers may choose to turn from the right side of the lane to avoid flooding, which may further risk a crash into another oncoming vehicle.	Medium	Improve drainage at intersection to remove flood hazard.	Low	Road asset manager/SIMTA	
31	AX, AY	Old linemarking creates confusion as to the correct line to follow particularly at night. This increases the risk of a crash with adjacent or oncoming traffic.	Medium	Ensure old linemarking is better removed/obscured and remark existing linemarking to better differentiate old vs new and provide drivers with improved guidance.	Low	Road asset manager	
32	AZ	Deteriorated pavement marking and stop line at signalised intersection may cause confusion as to the correct movement from each lane and increase the risk of side swipe crashes.	Medium	Renew Stop lines and correct lane linemarking.	Low	Road asset manager	

Issue no.	Site photo	Road safety issue	Risk rating	Suggested actions (Risk mitigation options)	Residual risk	Primary responsibility	Client response/action
General Issues - present along the length of each road at numerous locations							
33	BA	Sections of faded, non-reflective linemarking and missing linemarking are present along the length of Moorebank Ave and Cambridge Ave. This creates poor delineation and guidance which increases the risk of drivers to veering off the road or into the path of oncoming vehicles particularly when in the wet and dark conditions.	Medium	Repaint linemarking in reflective white paint.	Low	Road asset manager	
34	BB	Unsealed shoulders combined with narrow carriageway have created a drop off edge along sections of the audited road. This increases the risk for run off road type crashes due to the combined conditions of the drop off and the unstable conditions on the shoulders, particularly in wet conditions.	Medium	Construct and seal shoulders and re-stabilise the unsealed shoulders. Repair edge of road seal and ensure edge linemarking is provided along the length of the road to ensure adequate delineation.	Low	Road asset manager	

Figure 3.1: Road safety audit location of issues



Source: Nearmap (modified by ARRB)

4 CONCLUDING STATEMENT

This Road Safety Audit report has been conducted in accordance with *Austrroads Guide to Road Safety: Part 6 Road Safety Audit*. The roads have been inspected under day and night conditions and in this instance included both dry and wet road conditions.

The audit has been conducted with the purpose of identifying issues that present a potential safety hazard for road users, with a particular attention to the interaction between typical traffic and the traffic associated with construction of the SIMTA development on lands adjacent to Cambridge and Moorebank Avenues.

The suggested actions reported provide an indication of the type of road infrastructure-based measures that should be considered to address the identified road safety issues and level of risk. There may be alternative treatment options available that eliminate or further reduce the level of risk.

The identified issues and suggested remedial actions are presented in Table 3.2 in Section 3 of this report. No guarantee is given that every safety deficiency has been identified by this audit.

There are several road safety issues present that existing under current road and traffic conditions and there are issues that will arise due to changes to the road to accommodate works by SIMTA. The audit team has nominally identified the primary responsibility to address the road safety issues to assist clarifying potential action, however, the road safety audit team is not necessarily informed about, nor required to assign, the ultimate responsibility for addressing the identified road safety issues. Any remedial action may therefore need to be negotiated between SIMTA and the appropriate road asset manager.

The road safety audit team believe that adoption of the suggested actions will improve the level of safety across the route, but does not guarantee its absolute safety.

Audit Team



David McTiernan
Audit Leader



Noha Elazar
Audit Team Member



Aut Karndacharuk
Audit Team Member

APPENDIX A SITE PHOTOGRAPHS

Photo Id Site photograph

Moorebank Avenue Southbound

A



B



C



Photo Id
D

Site photograph



E



F



Photo Id

Site photograph

G



H



I



J



Photo
Id
K

Site photograph



L



M



Photo
Id
N

Site photograph



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Site photograph

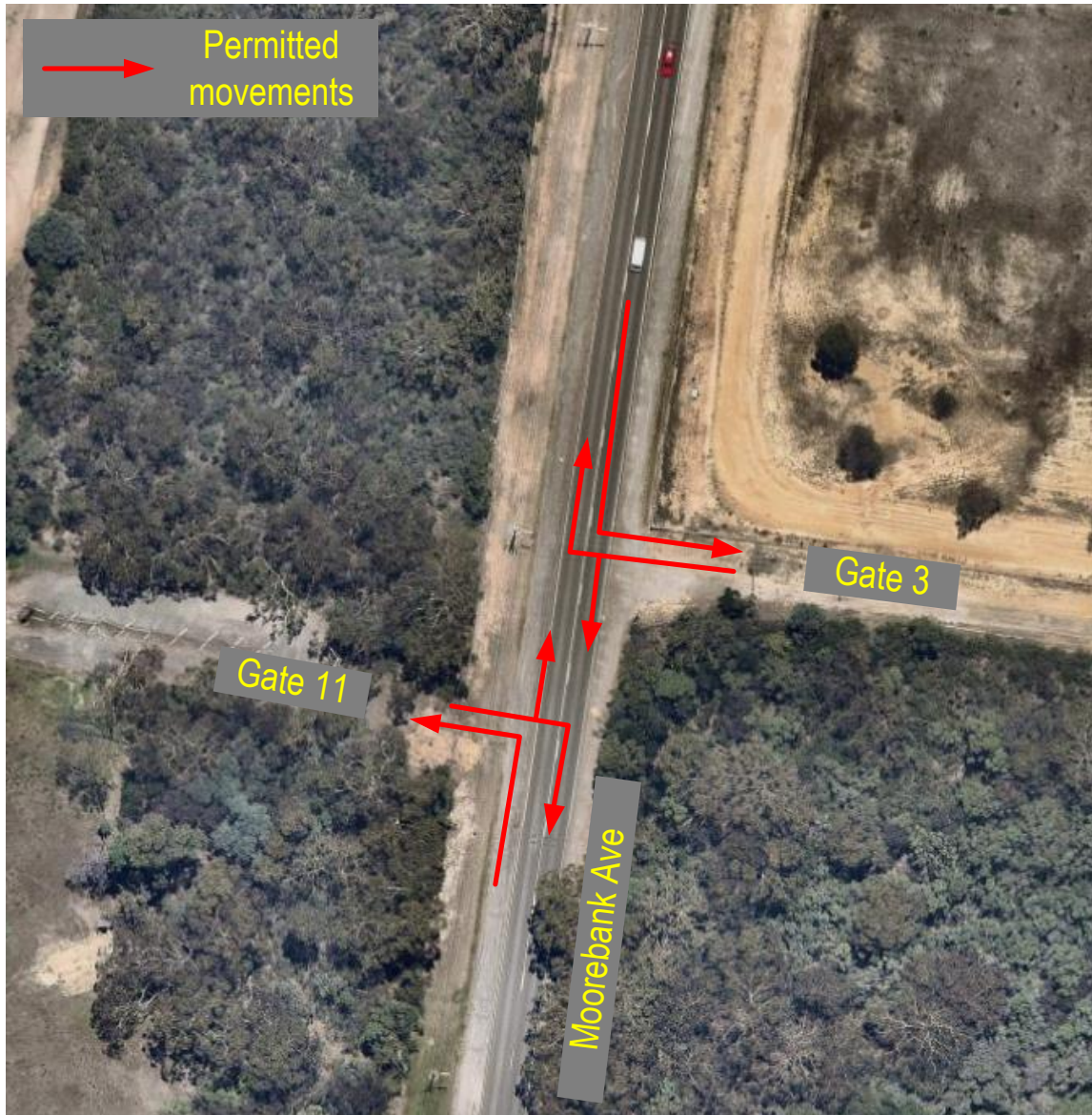


Photo
Id
Q

Site photograph



R



Photo
Id
S

Site photograph



Cambridge Avenue Westbound

T



U



Photo
Id

Site photograph

V



W



X



Photo

Site photograph

Y



Z



AA



Photo
Id
AB

Site photograph



AC



Photo

Site photograph

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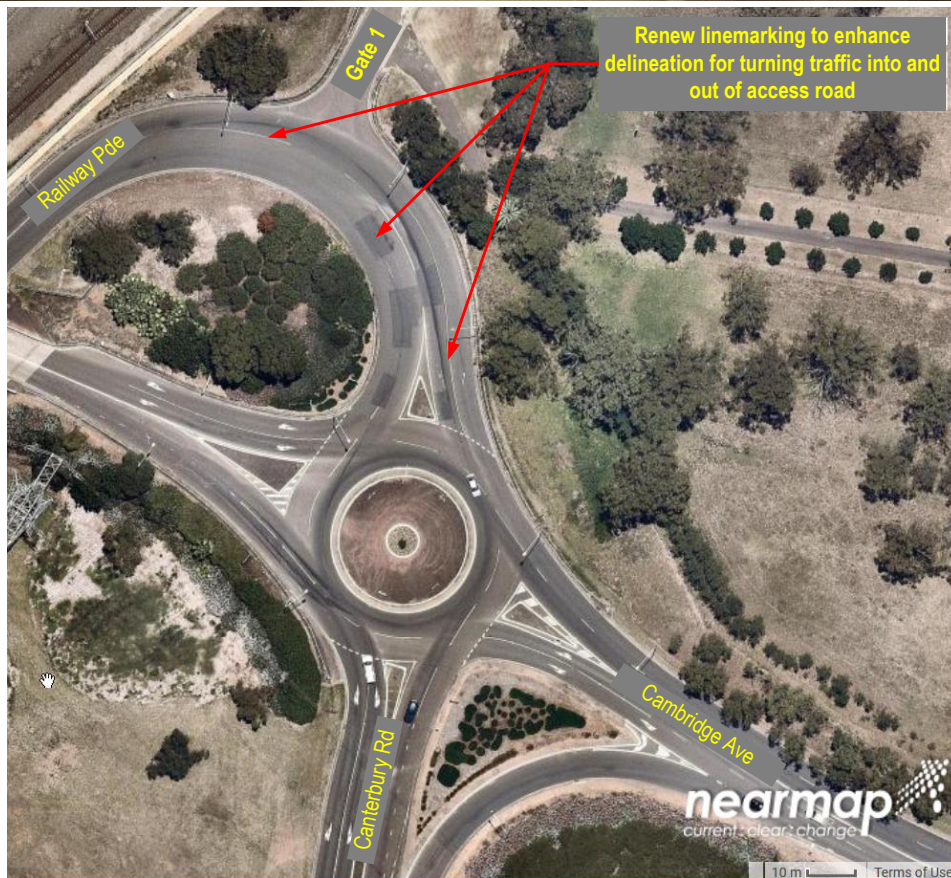


Photo Id

Site photograph

Cambridge Avenue Eastbound

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Photo Id

Site photograph

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AP



AQ



Photo
Id

Site photograph

AR



AS



AT



AU



Photo
Id

Site photograph

AV



Moorebank Ave northbound

AW



Photo
Id
AX

Site photograph



AY



Photo
Id
AZ

Site photograph



General Issues

BA



Photo
Id
BY

Site photograph

