Ardill Payne & PARTNERS

ENGINEERS PLANNERS SURVEYORS ENVIRONMENTAL PROJECT MANAGEMENT

ROAD SAFETY AUDIT

EXISTING ROAD
Lismore Railway Viaducts at:

- Union Street, South Lismore
- Terania Street, North Lismore
- Winterton Parade, North Lismore
- Alexandra Parade, North Lismore

for:

lismore city council

November 2022
(Revision 1)

BALLINA
45 River Street
PO Box 20
BALLINA NSW 2478
02 6686 3280

GUNNEDAH
Germane House
285 Conadilly Street
GUNNEDAH NSW 2380
02 6742 9955

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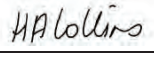
1	6/12/22	H. Collins		T Cromack	
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Revision No:	Description
0	Original Issue
1	Alexandra Parade viaduct added
2	

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1. Project Information

1.1 Introduction

Lismore City Council (Council) has engaged Ardill Payne & Partners (APP) to undertake a Road Safety Audit (RSA) of four (4) railway viaducts in Lismore at:

- Site 1: Union Street, South Lismore
- Site 2: Terania Street, North Lismore
- Site 3: Winterton Parade, North Lismore
- Site 4: Alexandra Parade, North Lismore

The viaducts are on the disused Murwillumbah to Casino (via Lismore) railway line. Services on this line ceased in May 2004.

A locality plan is shown in **Figure 1.** An aerial photo (courtesy of SIX Maps) of each of the sites is shown in **Figures 2, 3, 4, and 5.**

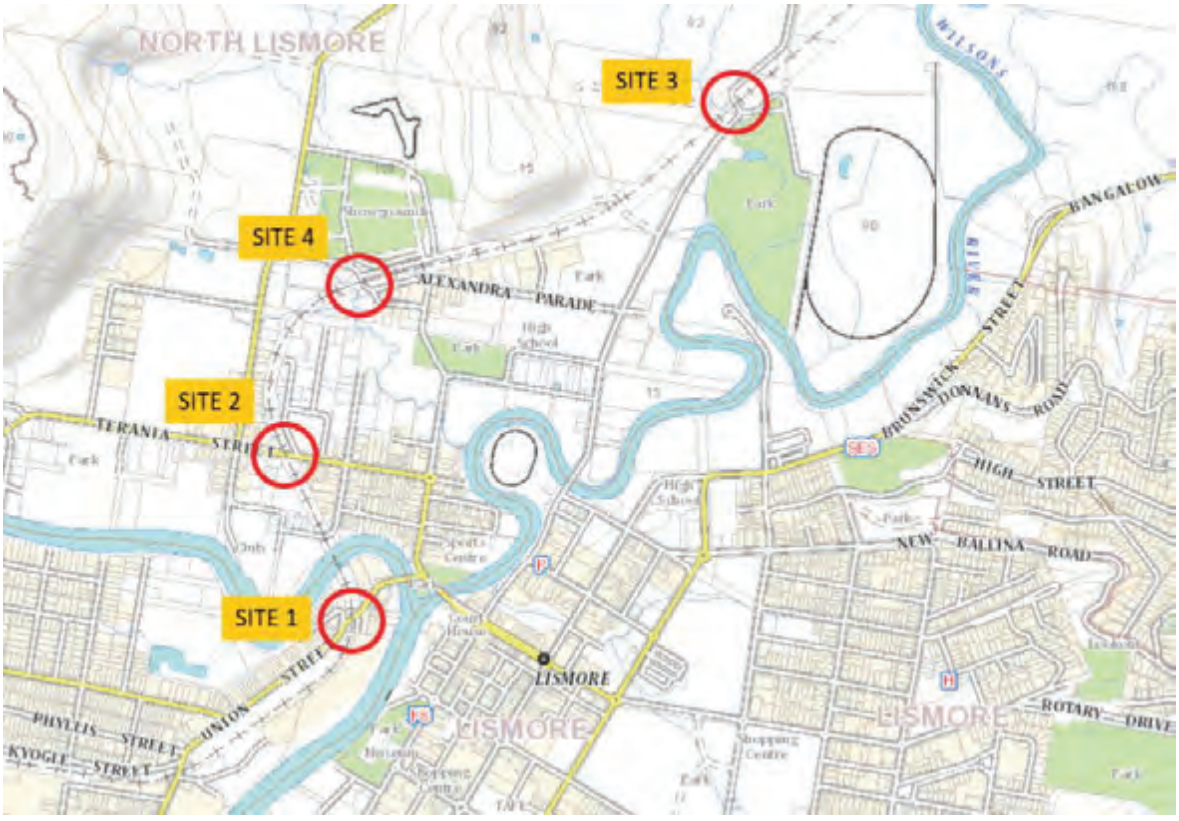


Figure 1: Locality Plan

Figure 2: Aerial Photo Site 1 – Union Street, South Lismore

Figure 3: Aerial Photo Site 2 – Terania Street, North Lismore

Figure 4: Aerial Photo Site 3 – Winterton Parade, North Lismore

Figure 5: Aerial Photo Site 4 – Alexandra Parade, North Lismore

1.2 Description of the Sites

1.2.1 Site 1: Union Street, South Lismore

Union Street is an important link road in South Lismore, connecting the Bruxner Highway to Kyogle Road and Nimbin Road. The area near the viaduct is a mix of light industrial and residential premises. There are intersections and driveways both sides of the viaduct.

The road approaches to the viaduct are a series of reverse curves. The sealed road width is approx. 7m. The minimum clearance between edge of road and pylon is approx. 1m. The vertical clearance is 3.4m.

Approx. 25m north of the Union Street viaduct is the Frank Street viaduct. The sealed road width beneath this viaduct is approx. 4m, with a minimum edge clearance to the pylon of approx. 0.5m. The vertical clearance is 4.5m.

Union Street is sealed, and centreline marked, and the posted speed limit is 50 km/h.

1.2.2 Site 2: Terania Street, North Lismore

Terania Street is the main road to Nimbin. The immediate area surrounding the viaduct is mainly residential.

The road approach to the viaduct is straight. The viaduct comprises 3 separate spans over the road. The centre span is over a two-way road with a sealed road width of approx. 4.5m, and minimum clearance to the pylons of approx. 0.5m. The vertical clearance is 3.8m.

The outer 2 spans are over one-way roads. The westbound span has a sealed road width of approx. 4m, with a minimum clearance to the pylons of approx. 0.5m. The vertical clearance is 4.0m. The eastbound span has a sealed road width of approx. 3.5m, with a minimum clearance to the pylons of approx. 0.5m. The vertical clearance is 4.0m.

Terania Street is sealed, and centreline marked, and the posted speed limit is 50 km/h.

1.2.3 Site 3: Winterton Parade, North Lismore

Winterton Parade is the main road to St Johns College, Woodlawn, and the Lismore Turf Club. The immediate area surrounding the viaduct is rural.

The road approach to the viaduct is two reverse 90^0 bends. The access road to the Lismore Turf Club intersects with the southern bend. The sealed road width is approx. 5.5-6.0m, with a minimum clearance to the pylons of approx. 0.3m. The vertical clearance is 4.5m.

Winterton Parade is sealed, and centreline marked, and the posted speed limit is 80 km/h.

1.2.4 Site 4: Alexandra Parade, North Lismore

Alexandra Parade is a link road between Dunoon Road and Winterton Parade. The Lismore Showground is on the northern side of the road, north of the viaduct. South of the viaduct are some residential properties and vacant land.

The road approach to the viaduct is two reverse (approx.) 90^0 bends. A showground access road intersects the bend north of the viaduct.

The viaduct comprises 2 separate spans over the road. The main (eastern) span is over a two-way road with a sealed road width of approx. 5.2m, and minimum clearance to the pylons of approx. 0.6m. The vertical clearance is 2.8m. The western span is over a one-way road with a sealed width of approx. 4.0m, and a minimum clearance to the pylons of approx. 1.0m. The vertical clearance is 3.5m.

Alexandra Parade is sealed, and centreline marked, and the posted speed limit is 50 km/h.

1.3 Traffic and Crash Data

Council has provided the following traffic volume data:

- Site 1: Union Street, South Lismore (outside #27, south of viaduct) – weekday ADT 5759 (2022), 10.3% HV. (Note: 85th percentile speed 52.9km/h; maximum speed 100km/h)
- Site 2: Terania Street, North Lismore (west of viaduct) – ADT 3468 (2013), 8.2% HV (Note: 85th percentile speed 58.7km/h; 95th percentile speed 64.1km/h)
- Site 3: Winterton Parade, North Lismore (outside #57, south of viaduct) – weekday ADT 1227 (2022), 9.1% HV. (Note: 85th percentile speed 63km/h; maximum speed 92km/h)
- Site 4: Alexandra Parade, North Lismore (west of viaduct) – ADT 1280 (2013), 3.7% HV. (Note: 85th percentile speed 58.3km/h).

Crash data has been obtained from the *'Transport for NSW, Centre for Road Safety'* website. Between 2017 and 2021, there has been a total of 7 crashes recorded within the audit sections:

- Site 1: One occurred at the Union Street viaduct. Non-casualty crash in daylight. Vehicle collided with object in its path. No further details available. Historically there has been approx. 8-9 recorded crashes between 2000 and 2021.
- Site 2: Four crashes occurred at Terania Street viaduct. All were either non-casualty or minor injury crashes. In 3 of the crashes, a vehicle collided with some part of the viaduct. All occurred in daylight.
- Site 3: Two crashes occurred at the Winterton Parade/Lismore Turf Club intersection, approx. 30m south of the viaduct. Both crashes occurred at night and resulted in a serious injury. The crashes are possibly related to the road/intersection geometry. Historically there has been approx. 5-6 recorded crashes between 2000 and 2021.
- Site 4: No recorded crashes at the site.

Note: traffic and crash data was not reviewed until after the RSA findings were documented.

1.4 Audit Scope and Objective

This RSA of four (4) railway viaducts in Lismore has been undertaken in accordance with the prescribed methods in Austroads '*Guide to Road Safety, Part 6: Road Safety Audit*' (2022), with consideration of the NSW TfNSW '*Guidelines for Road Safety Audit Practices, Part 1: Road Safety Audit*' (2011).

The objective of the RSA is to identify any potential road safety risks/hazards associated with the existing arrangements from the perspective of all road users, during daylight and night conditions, that may need to be investigated and rectified. Risks/hazards identified will be described and given a risk rating. Positive aspects of the road environment have not been recorded.

The TfNSW Guide does not permit the inclusion of recommendations in a RSA. However, the Austroads Guide does permit the inclusion of recommendations, if requested by the client. We have included a supplement to the RSA documenting our 'Suggested Mitigation Measures' to improve road safety to enable Council to make informed decisions for future upgrade works. The suggested mitigation measures indicate the nature or direction of a solution rather than precise details. Responsibility for that will rest with Council.

1.5 Audit Team

The RSA has been carried out by Tony Cromack (APP) and Hayley Collins (Council). Tony Cromack is the lead auditor.

Lead Auditor – Tony Cromack

- Senior Civil Engineer and Principal at Ardill Payne & Partners, with over 35 years' experience in urban and rural road design
- Bachelor of Technology (Engineering) – University of Southern Queensland (1999)
- Technologist Member – Engineers Australia
- Member – Institute of Public Works Engineering Australasia (IPWEA)
- NSW SafeWork accreditation to Prepare Work Zone Traffic Management Plans (valid 2020)
- Road Safety Audit Course (IPWEA) (2014)
- Lead Road Safety Audit Course (IPWEA) (2017)
- Registered Level 3 Road Safety Auditor (NSW) – Auditor # RSA-02-0414

Auditor – Hayley Collins

- Design Officer at Lismore City Council, with 11 years' experience in urban and rural road design (Richmond Valley Council and Lismore City Council)
- Certificate IV in Surveying – Brisbane North Institute of TAFE (2011)
- Diploma Civil Construction Design – TAFE NSW Riverina Institute – Leeton Campus (2013)
- Prepare a Work Zone Traffic Management Plan

- Implement Traffic Control Plans – RMS
- Designing for Pedestrians and Bicycle Riders – RMS (2016)
- Conduct Road Safety Audits (RSACRS002A) – IPWEA (2017)
- Registered Level 2 Road Safety Auditor (NSW) – Auditor # RSA-02-1277

2. Road Safety Audit Program

2.1 Commencement Meeting

The commencement meeting was held via teleconference on 28 November 2022. Barry Goodwin represented the Council (the client) and Tony Cromack represented the audit team.

A summary of the meeting is as follows:

- Mr. Goodwin confirmed that Council is investigating the possibility of removing 4 viaducts in the LGA area including Union Street, Terania Street, Winterton Parade, and Alexandra Parade. The viaducts are on the Murwillumbah to Casino railway line, which ceased operations in 2004.
- There are no existing or previous Road Safety Audits for the sites.
- Council's main concerns are:
  - lane widths and horizontal clearances
  - vertical clearances
  - road alignment in approaches (Site 1, 3, and 4).
- Council has advised that there may be resistance from relevant authorities and the community to the removal of the structures (potentially heritage listed structures).
- Council has advised that all sites experience flooding issues in major flood events. Fog can be an issue at the Winterton Parade site.
- Further detail and specifics of any Council concerns were not raised or discussed to ensure the audit team could undertake an unbiased RSA.
- Mr. Cromack explained the audit process, reiterating that it is not a compliance or design check, and advised that recommendations are only provided if requested. Mr. Goodwin requested that recommendations for improvements identified by the team be provided. 'Suggested Mitigation Measures' will be included as a supplement to the final report.
- Mr. Goodwin was advised that it is the audit teams' task to identify and document safety issues, and the Council's task to respond and act on those issues
- Council will provide road traffic volume data, where available.

2.2 Field Audit

The field audit for Sites 1-3 was carried out by the audit team on the afternoon and evening of Monday 21 November 2022. The field audit for Site 4 was carried out on Monday 5 December 2022. The team drove through the sites in each direction and filmed the drive from the dashboard of the vehicle.

The daylight audits for Sites 1-3 took place between 5:00 and 6:00pm AEDT, and the evening audits between 7:45 and 8:15pm AEDT. The daylight audit for Site 4 took place between 10:00 and 10:30am AEDT, and the night audit between 5:15 and 5:30am AEDT.

The weather during the inspection of Sites 1, 2 and 4 was fine. The road was dry. A storm hit just prior to the inspection of Site 3. It was raining during this inspection, and the road was wet.

Photographs of any risks/hazards found were taken and notes were made. Site photographs are provided in **Attachment 1**.

Some key physical and observed features of the viaducts and approaches are:

Site 1:

- Inadequate advance warning signs for the viaduct
- No edge lines
- Minimal clearance from edge of road to pylons
- Vertical clearance less than 4.6m
- Frank Street viaduct – width, priorities unclear, no intersection controls
- Poor condition of some signs and lines
- Concealed driveways either side of the viaduct.

Site 2:

- Inadequate advance warning signs for the viaduct
- Narrow road width in two-way centre span
- Inadequate edge lines
- Minimal clearance from edge of road to pylons
- Vertical clearance less than 4.6m
- Lane priorities unclear (merge)
- Poor condition of some signs and lines.

Site 3:

- Inadequate advance warning signs for the viaduct and bends
- No edge lines
- Minimal clearance from edge of road to pylons
- Vertical clearance less than 4.6m
- Roadside hazards
- Damage to the pavement edges/shoulders.
- Poor condition of some signs and lines.

Site 4:

- Inadequate advance warning signs for the viaduct
- No edge lines
- Minimal clearance from edge of road to pylons
- Vertical clearance considerably less than 4.6m (main span only 2.8m)
- Side viaduct – width, priorities unclear, no intersection controls
- Lane priorities unclear (merge)
- Poor condition of road
- Missing width markers
- Poor condition of some signs and lines.

2.3 Completion Meeting

A completion meeting generally involves the auditor and the client and is an opportunity for clarification of aspects of the audit. A completion meeting has not been held at the time of preparing this report.

3. Risk Level Determination

Risks/hazards raised in relation to the audit have been given a risk level based on the associated safety priority, as categorised using Error! Reference source not found. to **Table 3**. The risk tables below are reproduced from Austroads '*Guide to Road Safety, Part 6: Road Safety Audit*' (2022).

Table 1: Austroads RSA Risk Matrix

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

*see Severity Guidance Sheet

Safe System crash outcome threshold

Table 2: Austroads Severity Guidance Sheet

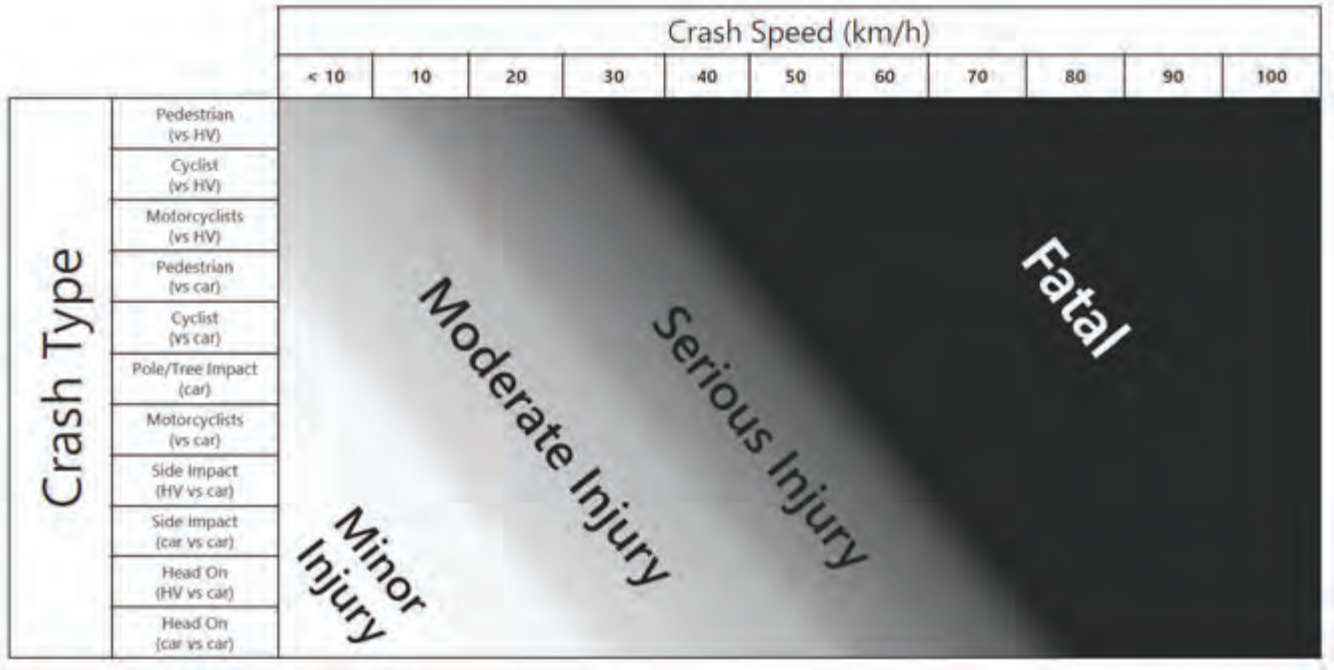


Table 3: Treatment

Level of Risk	Treatment Approach
Negligible	No action required.
Low	Should be corrected or the risk reduced if the treatment cost is low.
Medium	Should be corrected or the risk significantly reduced, if the treatment cost is moderate, but not high.
High	Should be corrected or the risk significantly reduced, even if the treatment cost is high.
Extreme	Must be corrected regardless of cost

4. Road Safety Audit Findings

The following audit findings were identified during the RSA inspection. Audit findings are a listing of identified safety risks/hazards: what is potentially dangerous about the road or what could lead to crashes occurring or injury resulting. Relevant photographs of the findings are provided in **Attachment 1**.

Table 4: Audit Findings

Number	Description	Risk Rating
Site 1	**Union Street, South Lismore**	
1	**No Advance Warning Sign for the Low Clearance (Northbound)** There is no advance warning sign ('Low Bridge Ahead, High Vehicle Detour') northbound. There is a risk that a high vehicle could collide with the viaduct.	Likelihood: Rare Severity: Moderate Risk: Low
2	**Minimal Vertical Clearance** The vertical clearance at the viaduct is less than 4.6m, which is the typical minimum for clearance over a roadway (5.4m for main and arterial roads). Without adequate advance warning, and suitable high vehicle detour routes in place, there is a risk that a high vehicle could collide with the viaduct.	Likelihood: Rare Severity: Moderate Risk: Low
3	**No Outer Lane Delineation** There are no edge lines on Union Street beneath the viaduct. Edge lines help to delineate the path of travel through the viaduct. There is a risk that a vehicle could collide with a viaduct pylon. *Refer to Photo 1*	Likelihood: Possible Severity: Serious Risk: High
4	**Edge Clearances** There is minimal clearance from edge of the road carriageway to the pylons. There is a risk that a vehicle could collide with a viaduct pylon. *Refer to Photo 2*	Likelihood: Possible Severity: Serious Risk: High
5	**Missing Width Marker** There is no width marker on the pylon, southbound, left-hand side. There is a risk that a vehicle could collide with a viaduct pylon. *Refer to Photo 3*	Likelihood: Rare Severity: Serious Risk: Medium

6	**Frank Street Viaduct** The width of the roadway is only suitable for one way traffic – priorities are not defined. There is a risk of a head-on or rear-end collision in the viaduct. There is a further risk of stopped vehicles queuing onto Union Street. *Refer to Photo 4*	Likelihood: Rare Severity: Serious Risk: Medium
7	**Frank Street Intersections** There are no intersection controls ('Stop/Give Way' signs; hold lines; lane or edge lines) at either of the Frank Street/Union Street intersections. Vehicles entering or leaving Frank Street do not have a clearly defined travel path. There is a risk of a collision at the intersections. *Refer to Photo 5*	Likelihood: Rare Severity: Serious Risk: Medium
8	**Condition of Signs and Lines** Some signs are in poor condition (not reflective; damaged; vandalised). The line marking generally is badly worn in places. There are no raised retro-reflective pavement markers (RRPM's). Without adequate delineation, there is a risk that drivers could be confused by the road alignment, particularly at night, increasing the risk of a crash. *Refer to Photo 6*	Likelihood: Rare Severity: Moderate Risk: Low
9	**Industrial Driveways Northern Side of Viaduct** There is a large area of bitumen providing access to multiple industrial buildings on the northern side of the viaduct (river side of Union Street). Uncontrolled access/egress from this area was observed during the site inspection. Sight distance for vehicles exiting this area to travel north is compromised by the viaduct pylons. There is a risk that vehicles egressing from this area onto Union Street may collide with through traffic. *Refer to Photo 7*	Likelihood: Rare Severity: Serious Risk: Medium
Site 2	**Terania Street, North Lismore**	
10	**No Advance Warning Signs for the Low Clearance (Westbound)** There is no advance warning sign ('Low Clearance' or 'Low Bridge Ahead, High Vehicle Detour') westbound. There is a risk that a high vehicle could collide with the viaduct.	Likelihood: Rare Severity: Moderate Risk: Low

11	**Minimal Vertical Clearance** The vertical clearance at the viaduct is less than 4.6m, which is the typical minimum for clearance over a roadway (5.4m for main and arterial roads). Without adequate advance warning, and suitable high vehicle detour routes in place, there is a risk that a high vehicle could collide with the viaduct.	Likelihood: Rare Severity: Moderate Risk: Low
12	**Narrow Road Width in Centre Span** Recent works to support and protect the northern pylon of the centre span has substantially reduced the road width. The road is two-way and has a sealed width of only 4.5m. If two vehicles try to pass in the centre span, there is a risk of a head-on crash, or a crash into the pylons. *Refer to Photo 8*	Likelihood: Possible Severity: Serious Risk: High
13	**Inadequate Outer Lane Delineation** There are no outer edge lines on Terania Street beneath the viaduct. There are some edge lines around the centre pylons, but these are inadequate. Edge lines help to delineate the path of travel through the viaduct. There is a risk that a vehicle could collide with a viaduct pylon. *Refer to Photo 9*	Likelihood: Possible Severity: Serious Risk: High
14	**Edge Clearances** There is minimal clearance from edge of the road carriageway to the pylons. There is a risk that a vehicle could collide with a viaduct pylon. *Refer to Photo 10*	Likelihood: Possible Severity: Serious Risk: High
15	**Ends of Safety Barrier** Recent works have been undertaken to support and protect the northern pylon of the centre span. This has included the placement of a New Jersey style concrete barrier around the pylon. The leading ends are protected by large sand-filled bags (one of which is broken). Delineation and protection of the ends is inadequate. There is a risk that an approaching driver may not adequately perceive the barrier ends and collide with the barrier. *Refer to Photo 11, 12*	Likelihood: Possible Severity: Serious Risk: High

16	**Lane Merge Priorities Unclear** On approach to the viaduct (from either direction), a driver can opt to pass through either the centre or outer span. On departure, merge priorities are unclear. There are no lines or signs to guide drivers. There is a risk of a collision when vehicles merge. *Refer to Photo 13*	Likelihood: Rare Severity: Serious Risk: Medium
17	**Condition of Signs and Lines** Some signs are in poor condition (not reflective; damaged). The line marking generally is badly worn in places. There are no painted chevrons in the traffic islands. The traffic island edge lines are under the concrete barriers. There are no RRPM's. Without adequate delineation, there is a risk that drivers could be confused by the road alignment, particularly at night, increasing the risk of a crash. *Refer to Photo 14*	Likelihood: Rare Severity: Moderate Risk: Low
Site 3	**Winterton Parade, North Lismore**	
18	**No Advance Warning Sign for the Low Clearance (Northbound)** There is no advance warning sign ('Low Clearance') northbound. There is a risk that a high vehicle could collide with the viaduct.	Likelihood: Rare Severity: Moderate Risk: Low
19	**Minimal Vertical Clearance** The vertical clearance at the viaduct is less than 4.6m, which is the typical minimum for clearance over a roadway (5.4m for main and arterial roads). Without adequate advance warning, and suitable high vehicle detour routes in place, there is a risk that a high vehicle could collide with the viaduct.	Likelihood: Rare Severity: Moderate Risk: Low
20	**No Outer Lane Delineation** There are no edge lines on Winterton Parade beneath the viaduct. Edge lines help to delineate the path of travel through the viaduct. There is a risk that a vehicle could collide with a viaduct pylon. *Refer to Photo 15*	Likelihood: Possible Severity: Serious Risk: High

21	**Edge Clearances** There is minimal clearance from edge of the road carriageway to the pylons. There is a risk that a vehicle could collide with a viaduct pylon. *Refer to Photo 15*	Likelihood: Possible Severity: Serious Risk: High
22	**No Advance Warning Signs or Advisory Speed for the 90^0 Bends in Approaches** There are no advance warning signs or advisory speed signs for the bends (both approaches). Without adequate advance warning and advice, there is a risk that motorists will not correctly anticipate the road's alignment, particularly at night, resulting in a collision with an oncoming vehicle, a roadside hazard, or a viaduct pylon.	Likelihood: Possible Severity: Serious Risk: High
23	**Inadequate Definition of Curve Alignments** There are some alignment delineation devices on the southern bend, none on the northern bend. The devices on the southern bend are obscured by vegetation (northbound) and the viaduct pylons (southbound). These alignments could be considered hazardous without adequate delineation devices. Without adequate delineation, there is a risk that motorists may not correctly anticipate the road's alignment, particularly at night, resulting in a collision with an oncoming vehicle, a roadside hazard, or a viaduct pylon. *Refer to Photo 16, 17*	Likelihood: Possible Severity: Serious Risk: High
24	**No Advance Warning of Intersection** There are no advance warning signs ('Side Road Intersection on Curve') in either approach to the Lismore Turf Club intersection. This intersection could be considered busy on race days. There is a risk of rear-end collisions if a vehicle is slowing to turn at this intersection and other drivers are not anticipating vehicles stopping ahead.	Likelihood: Possible Severity: Serious Risk: High
25	**Lismore Turf Club Intersection** There is no line marking in the intersection, or 'Stop' or 'Give Way' signs. Sight distance to the north from the intersection (through the viaduct) is limited. There is a risk that vehicles exiting the Lismore Turf Club could collide with through traffic. *Refer to Photo 18*	Likelihood: Possible Severity: Serious Risk: High

26	**Roadside Hazards** There are numerous roadside hazards at Site 3 – steep embankments, drains, and trees (and the viaduct pylons). An impact with any of these roadside hazards may increase the severity of a run-off-road crash. There is a risk that an errant vehicle could leave the roadway, resulting in a collision with a roadside hazard. *Refer to Photo 19, 20*	Likelihood: Possible Severity: Serious Risk: High
27	**Road Condition** On the inside of the bend opposite the Lismore Turf Club intersection, the pavement and bitumen surface are uneven and badly damaged. There is a risk that vehicles will lose control on the damaged surface, resulting in a collision with a roadside hazard or another vehicle. There is a further risk to cyclists using the road. *Refer to Photo 21*	Likelihood: Possible Severity: Serious Risk: High
28	**Roadside Drainage** The road shoulders are ponding water on the roadway in the approaches to and beneath the viaduct. This can lead to increased damage to pavement edges. There is a risk that vehicles may hit the water or damaged edges and lose control, resulting in a collision with a roadside hazard or another vehicle. There is a further risk to cyclists using the road. *Refer to Photo 22*	Likelihood: Unlikely Severity: Serious Risk: High
29	**Condition of Signs and Lines** Some signs are in poor condition (not reflective; damaged, vandalised). The line marking generally is badly worn in places. There are no RRPM's. Without adequate delineation, there is a risk that drivers could be confused by the road alignment, particularly at night, increasing the risk of a crash. *Refer to Photo 23*	Likelihood: Rare Severity: Moderate Risk: Low
30	**Night Visibility of Bends and Viaduct** The bends and the viaduct are poorly delineated at night. The line marking, guideposts, and delineation are inadequate. There are no RRPM's. Without adequate delineation, particularly at night, there is the potential for a crash on the bends or at the viaduct. *Refer to Photo 24*	Likelihood: Rare Severity: Serious Risk: Medium

Site 4	Alexandra Parade, North Lismore	
31	**Inadequate Advance Warning Signs for the Low Clearance** It is considered that the existing advance warning signs for the viaduct ('Low Clearance') are inadequate. There is a risk that a high vehicle could collide with the viaduct.	Likelihood: Rare Severity: Moderate Risk: Low
32	**Minimal Vertical Clearance** The vertical clearance at the viaduct is considerably less than 4.6m, which is the typical minimum for clearance over a roadway (5.4m for main and arterial roads). Without adequate advance warning, and suitable high vehicle detour routes in place, there is a risk that a high vehicle could collide with the viaduct.	Likelihood: Rare Severity: Moderate Risk: Low
33	**No Outer Lane Delineation** There are no edge lines on Alexandra Parade or the bypass road beneath the viaduct. Edge lines help to delineate the path of travel through the viaduct. There is a risk that a vehicle could collide with a viaduct pylon. *Refer to Photo 25*	Likelihood: Possible Severity: Serious Risk: High
34	**Edge Clearances** There is minimal clearance from edge of the road carriageway to the pylons, particularly in the main carriageway. There is a risk that a vehicle could collide with a viaduct pylon. *Refer to Photo 25*	Likelihood: Possible Severity: Serious Risk: High
35	**Missing Signs** There are no width markers on the western pylons (outer pylon on 3.5m clearance lane), either direction. A 'Low Clearance' sign is missing on the central pylon, eastbound. There is a risk that a vehicle could collide with a viaduct pylon. *Refer to Photo 26*	Likelihood: Rare Severity: Serious Risk: Medium
36	**Bypass Viaduct Width** The roadway width of the bypass viaduct is only suitable for one way traffic – priorities are not defined. There is a risk of a head-on or rear-end collision in the bypass viaduct. *Refer to Photo 27*	Likelihood: Rare Severity: Serious Risk: Medium

37	**Access/Egress Bypass Viaduct** To access the bypass viaduct (eastbound), a driver must cross double barrier lines on a bend, with sight distance obstructed by the viaduct and embankments. On departure from the bypass viaduct (westbound), merge priorities are unclear. There are no lines or signs to guide drivers. There is a risk of a collision when vehicles use the bypass viaduct. *Refer to Photo 28*	Likelihood: Rare Severity: Serious Risk: Medium
38	**Narrow Road Width in Centre Span** The two-way road under the main span has a sealed width of only 5.2m. This is less than Councils minimum standards. If two vehicles try to pass, there is a risk that these vehicles may collide with each other or into a pylon.	Likelihood: Possible Severity: Serious Risk: High
39	**Advance Warning of Intersection** There is no advance warning sign ('Side Road Intersection on Curve') in the westbound approach to the Showground access road. This intersection could be considered busy on days or nights when the showground is in use. The intersection is obscured by the viaduct. There is a risk of rear-end collisions if a vehicle is slowing to turn at this intersection and other drivers are not anticipating vehicles stopping ahead.	Likelihood: Rare Severity: Serious Risk: Medium
40	**Showground Access Road Intersection** There is no line marking in the intersection, or 'Stop' or 'Give Way' signs. Sight distance to the south from the intersection (through the viaduct) is limited. (It is noted that this is probably a private road). There is a risk that vehicles exiting the Showground access road could collide with through traffic. *Refer to Photo 29*	Likelihood: Rare Severity: Serious Risk: Medium
41	**Road Condition** There are some potholes in the eastbound lane. There is a risk of a crash if vehicles try to avoid the potholes. There is a further risk to cyclists using the road. *Refer to Photo 30*	Likelihood: Possible Severity: Serious Risk: High

42	**Roadside Drainage** Eastbound lane, inside of curve, on south side of viaduct – roadside drainage is inadequate. Water flows on the road edge. This can lead to increased damage to pavement edges. There is a risk that vehicles may hit the water or damaged edges and lose control, resulting in a collision with a roadside hazard or another vehicle. There is a further risk to cyclists using the road. *Refer to Photo 31*	Likelihood: Rare Severity: Moderate Risk: Low
43	**Condition of Signs and Lines** Some signs are in poor condition (not reflective; damaged). The line marking generally is badly worn in places. There are no RRPM's. Without adequate delineation, there is a risk that drivers could be confused by the road alignment, particularly at night, increasing the risk of a crash. *Refer to Photo 32*	Likelihood: Rare Severity: Moderate Risk: Low
44	**Night Visibility of Bends and Viaduct** The bends and the viaduct are poorly delineated at night, in particular eastbound. The line marking, guideposts, and delineation are inadequate. There are no RRPM's. Without adequate delineation, particularly at night, there is the potential for a crash on the bends or at the viaduct. *Refer to Photo 33*	Likelihood: Rare Severity: Serious Risk: Medium

5. Concluding Statement

We, the audit team, declare that we are independent of the project and have appropriate experience and training.

The audit has been carried out for the sole purpose of identifying any features of the railway viaducts and road approaches which could compromise road safety at the site. The identified issues have been noted in this report in **Table 4**. The accompanying 'Suggested Mitigation Measures' (**Attachment 2**) are put forward for consideration by Council for implementation. The suggested mitigation measures indicate the nature or direction of a solution rather than precise details. Responsibility for that will rest with Council. APP does not take any responsibility for any suggested design changes made in this report.

It should be noted that while every effort has been made to identify potential safety risks/hazards, there is no guarantee that every risk/hazard has been identified.

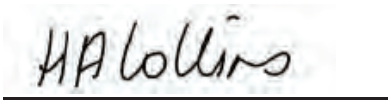
No 'extreme' risks were identified during the audit. As per **Table 3:**

- risks with a 'high' ranking '*should be corrected or the risk significantly reduced, even if the treatment cost is high*'
- risks with a 'medium' ranking '*should be corrected or the risk significantly reduced, if the treatment cost is moderate, but not high*.'

It is recommended that audit findings be investigated with satisfactory corrective actions identified and implemented.

6/12/2022

Tony Cromack
AUDIT TEAM LEADER # RSA-02-0414



6/12/2022

Hayley Collins
AUDIT TEAM MEMBER # RSA-02-1277

6. Attachments

Attachment 1	Site Photographs
Attachment 2	Suggested Mitigation Measures

ATTACHMENT 1

Attachment 1: Site Photographs

Photo 1: No edge lines - Union Street viaduct

Photo 2: Minimal edge clearance - Union Street viaduct

Photo 3: Missing width marker on pylon - Union Street viaduct

Photo 4: Road width - Frank Street viaduct

Photo 5: Lack of intersection controls - Frank St/Union St intersection

Photo 6: Damaged signs - Union Street viaduct

Photo 7: Industrial driveways north of Union Street viaduct

Photo 8: Narrow road width centre span - Terania Street viaduct

Photo 9: No edge lines - Terania Street viaduct

Photo 10: Minimal edge clearance - Terania Street viaduct

Photo 11: End of safety barrier (eastbound) - Terania Street viaduct

Photo 12: End of safety barrier (westbound) - Terania Street viaduct

Photo 13: Lane merge priorities unclear (westbound) - Terania Street viaduct

Photo 14: Poor condition and placement of lines - Terania Street viaduct

Photo 15: No edge lines and minimal edge clearance – Winterton Parade viaduct

Photo 16: Inadequate definition of curve alignment – northbound approach to Winterton Parade viaduct

Photo 17: Inadequate definition of curve alignment – southbound approach to Winterton Parade viaduct

Photo 18: No signs and lines – Lismore Turf Club intersection

Photo 19: Roadside hazards – drain and trees on outside of bend (northbound) – Winterton Parade

Photo 20: Roadside hazards – embankment on inside of bend (northbound) – Winterton Parade

Photo 21: Damaged road pavement - inside of bend (northbound) – Winterton Parade

Photo 22: Roadside drainage at Winterton Parade viaduct

Photo 23: Vandalised signs – Winterton Parade viaduct

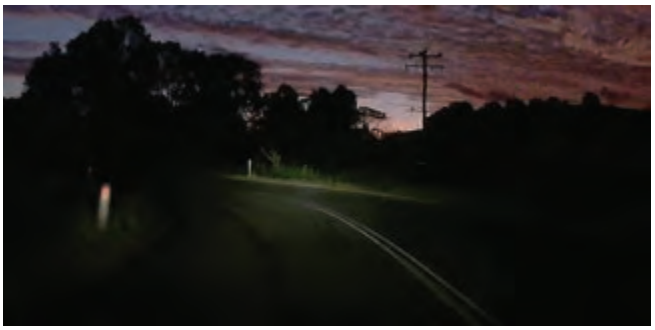


Photo 24: Night visibility - southbound approach to Winterton Parade viaduct

Photo 25: No edge lines and minimal edge clearance – Alexandra Parade viaduct

Photo 26: Missing width marker and Low Clearance sign – Winterton Parade viaduct eastbound

Photo 27: Missing width marker – Winterton Parade viaduct eastbound

Photo 28: Road width – Alexandra Parade bypass viaduct

Photo 29: Eastbound approach to bypass viaduct – Alexandra Parade. Driver must cross BB lines

Photo 30: Sight distance from Showground access road through Alexandra Parade viaduct (courtesy Google Street View)

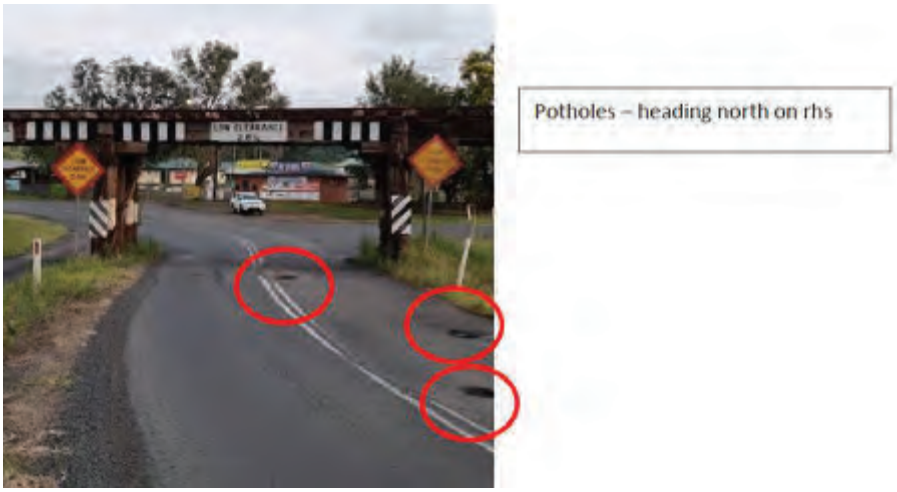


Photo 31: Road condition – Alexandra Parade eastbound

Photo 32: Lack of roadside drainage – Alexandra Parade eastbound, south of viaduct

Photo 33: Night visibility - eastbound approach to Alexandra Parade viaduct

ATTACHMENT 2

Attachment 2: Suggested Mitigation Measures

Suggested Mitigation Measures

Following is a list of suggested mitigation measures which may be of some use to Council. It should be noted that while every effort has been made to identify potential safety risks/hazards, there is no guarantee that every hazard has been identified, therefore the list of suggested mitigation measures may not be exhaustive.

The measures indicate the nature or direction of a solution rather than precise details. Responsibility for that will rest with Council.

The measures do not take into consideration future project budgets, community objectives, project constraints, political agendas, or possible competing interests from other project needs (e.g., landscaping, utilities, etc.).

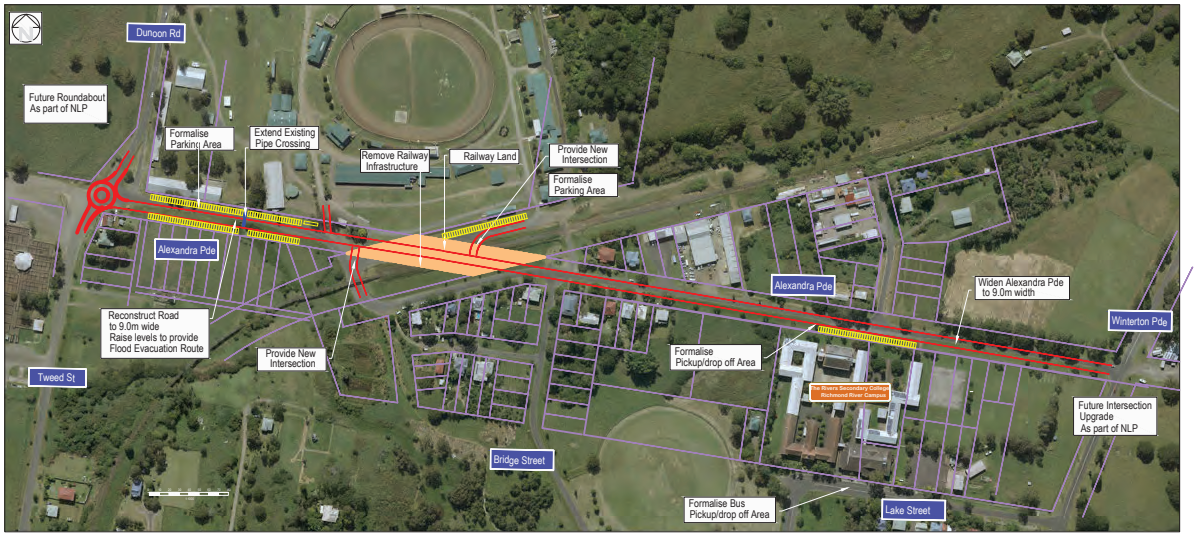
- Ensure that suitable high vehicles detours/bypasses are available (where necessary) and adequately signposted.
- Provide adequate advance warning signs for low clearances in the approaches to all viaducts.
- Improve centre line marking at all sites. Provide edge lines if possible and if width allows.
- If compliant lane widths and clearances are not (and cannot be) provided at viaducts, consider providing 'Road Narrows' signs (or similar) in the approaches.
- Replace all damaged, vandalised, or non-reflective signs.
- At the Union Street viaduct:
  - Replace missing width marker (southbound, left-hand side).
  - Establish priority direction for one-way viaduct on Frank Street. Priority should be given to southbound traffic to reduce risk of southbound vehicles having to queue onto Union Street. Install appropriate line marking and signs to indicate priority.
  - Provide line marking in the Frank Street intersections. This may include edge and centre lines. Check warrants and provide either a 'Stop' or 'Give Way' sign, and the relevant hold line.
- At the Terania Street viaduct:
  - the width of the centre span is too narrow for a two-way road. Consider closing the centre span completely and directing all traffic to the outer spans. Provide suitable line marking and signs to direct traffic
  - check lane widths and clearances of outer spans. Provide edge lines if possible and if width allows
  - if the centre span is not closed, provide suitable line marking and signage on departure side of viaduct (in each direction) to establish lane merge priorities
  - if the centre span is not closed, provide compliant line marking around centre pylons/safety barriers.

- Provide compliant end treatments or crash attenuators on the safety barriers around the pylons. This should include provision of all necessary signs, line marking, and reflectors (as required)

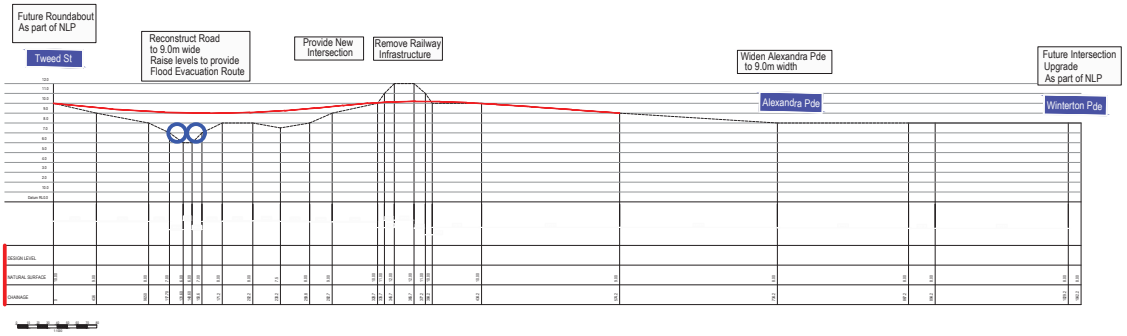
- At the Winterton Parade viaduct:
  - Provide advance warning signs and advisory speeds for the 90^0 bends in the approaches to the viaduct.
  - Assess warrants for the provision of curve delineation devices on the 90^0 bends in Winterton Parade, such as CAMs and guideposts. Provide additional devices as warranted. RRPM's may also be warranted to delineate bends and intersections at night.
  - Provide advance warning signs (both directions) for the Lismore Turf Club intersection.
  - Provide line marking in the Lismore Turf Club intersection. This may include edge and centre lines. This may also include RRPM's.
  - At the Lismore Turf Club intersection, provide either a 'Stop' or 'Give Way' sign (depending on warrants), and the relevant hold line.
  - Roadside hazards (trees, embankments, drains) have been identified at the Winterton Parade viaduct. Assess if the hazard can be removed. If not, assess warrants for safety barriers and consider installation as required.
  - The damaged section of Winterton Parade opposite the Lismore Turf Club intersection is a hazard to drivers and cyclists, as noted in the Findings. Determine the reasons for damage and rectify. Recommend undertaking pavement reconstruction for this area. Any upgrade should consider including wider shoulders.
  - Measures to improve roadside drainage should be investigated, to ensure surface water flows away from the road surface.

- At the Alexandra Parade viaduct:
  - Replace missing width markers and Low Clearance sign.
  - Establish priority direction for one-way bypass viaduct. Priority should be given to westbound traffic. Install appropriate line marking and signs to indicate priority. Check that legal access is available for eastbound traffic – consider removing a section of the BB line if appropriate.
  - Provide line marking in the Showground access road intersection. This may include edge and centre lines. Check warrants and provide either a 'Stop' or 'Give Way' sign, and the relevant hold line.
  - Provide advance warning sign (westbound) for the Showground access road intersection.
  - The damaged section of Alexandra Parade is a hazard to drivers and cyclists, as noted in the Findings. Determine the reasons for damage and rectify. Recommend undertaking pavement reconstruction for this area. Any upgrade should consider including wider shoulders.
  - Measures to improve roadside drainage should be investigated, to ensure surface water flows away from the road surface.

Alexandra Parade alternate route plans by LCC (Ref. No. 8)



CONCEPT PLAN



LONGITUDINAL SECTION

PLAN
LONG. SECTION HORIZ VERT
CROSS SECTION HORIZ VERT
SCALE BAR @A1
DATUM
CONTOUR INTERVAL
SURVEYED BY
DATE
FILE
DESIGNED
DRAWN
CHECKED

APPROVED
DESIGN SERVICES ENGINEER - DATE
MANAGER - WORKS - DATE

AMENDMENTS	BY	DATE	TRIM REFERENCE
CONCEPT			
50% PLAN			
80% PLAN			
100% PLAN			

SERVICES	PLANS CHECKED BY	DATE	ACTION Y/N
SEWER			
WATER			
GAS			
TELSTRA			
E ENERGY			
T.C.F			

LISMORE CITY COUNCIL

PROPOSED ROAD REALIGNMENT
ALEXANDRA PARADE, NORTH LISMORE
CONCEPT PLAN AND LONGITUDINAL SECTION

AUTOCAD 2021-077 Concept Plan.dwg
ECAD

SHEET No. 1
No. OF SHEETS 7

PLAN No. 2021-077
TRIM No.

Proposed Road Realignment
Alexandra Parade
North Lismore

Estimate $ 2,874,185.54

construction costs

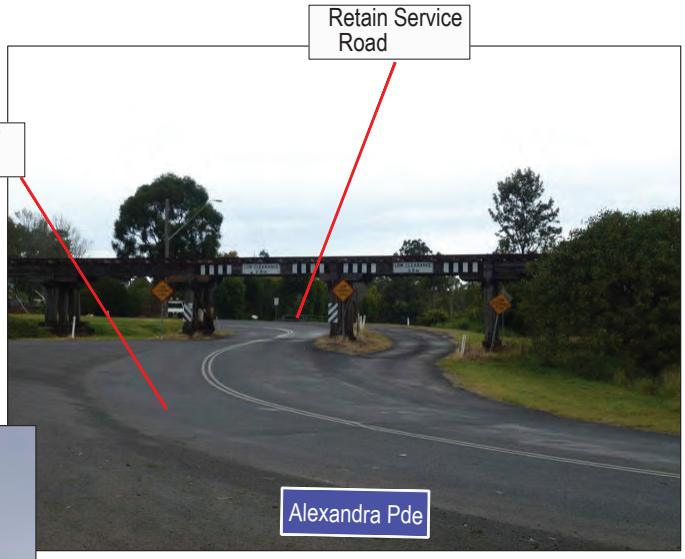
Cost Code	Description	quantity	UNIT	High Traffic - Low Productivity	Medium Traffic - Average Productivity	Low Traffic - Good Productivity	selected rate	cost
310	Traffic Control	20	day	$ 1,500.0	$ 1,500.0	$ 1,500.0	$ 1,500.0	$ 30,000.0
150	Clear & Grub	5	shift	$ 5,000.0	$ 5,000.0	$ 5,000.0	$ 5,000.0	$ 25,000.0
220	Kerb & Gutter		m	$ 180.0	$ 160.0	$ 150.0	$ 150.0	$ -
222	Drainage		m	$ 850.0	$ 800.0	$ 850.0	$ 850.0	$ -
225	Sub-soil Drains	200	m	$ 170.0	$ 100.0	$ 80.0	$ 170.0	$ 34,000.0
227	Table Drains		m3	$ 110.0	$ 100.0	$ 30.0	$ 100.0	$ -
315	Earthworks - Embankment		m3	$ 100.0	$ 80.0	$ 60.0	$ 90.0	$ -
315	Reuse Excavated material - fill for Parking Areas	200	m3				$ 80.0	$ 16,000.0
	Remove Railway tracks & Ballast & haul to Waste Facility	180	m3				$ 200.0	$ 36,000.0
	Alexandra Parade - Reconstruction - West of Railway Crossing							
310	Earthworks - Excavation	800	m3	$ 100.0	$ 90.0	$ 80.0	$ 100.0	$ 80,000.0
	Import Fill or Culvert	200	m3				$ 100.0	$ 20,000.0
343	Supply & Haul Select	500	m3	$ 121.4	$ 115.9	$ 110.4	$ 115.9	$ 57,950.0
383	Spread, lay & compact Select	500	m3	$ 100.0	$ 90.0	$ 90.0	$ 90.0	$ 45,000.0
349	Supply & Haul Rock	250	m3	$ 121.4	$ 115.9	$ 110.4	$ 110.4	$ 27,600.0
382	Spread, lay & compact Bridging	250	m3	$ 100.0	$ 80.0	$ 80.0	$ 80.0	$ 20,000.0
344	Supply & Haul Subbase	540	m3	$ 121.4	$ 115.9	$ 110.4	$ 110.4	$ 59,616.0
384	Spread, lay & compact Subbase	540	m3	$ 100.0	$ 80.0	$ 80.0	$ 80.0	$ 43,200.0
345	Supply & Haul Base	540	m3	$ 121.4	$ 115.9	$ 110.4	$ 110.4	$ 59,616.0
385	Spread, lay & compact Base	540	m3	$ 100.0	$ 90.0	$ 80.0	$ 80.0	$ 43,200.0
395	Unsuitable Material	200	m3	$ 100.0	$ 100.0	$ 100.0	$ 100.0	$ 20,000.0
410	2 coat seal	1750	m2	$ 15.0	$ 13.0	$ 11.0	$ 11.0	$ 19,250.0
412	primer seal		m2			$ 7.7	$ 7.7	$ -
237	375mm Stormwater	200	m	$ 950.0	$ 900.0	$ 850.0	$ 700.0	$ 140,000.0
247	1800mm Stormwater	15	m	$ 950.0	$ 900.0	$ 850.0	$ 1,000.0	$ 15,000.0
238	Stormwater Pits	3					$ 4,500.0	$ 13,500.0
	Alexandra Parade - New Road							
310	Earthworks - Excavation	500	m3	$ 100.0	$ 90.0	$ 80.0	$ 100.0	$ 50,000.0
344	Supply & Haul Subbase	300	m3	$ 121.4	$ 115.9	$ 110.4	$ 110.4	$ 33,120.0
384	Spread, lay & compact Subbase	300	m3	$ 100.0	$ 80.0	$ 80.0	$ 80.0	$ 24,000.0
345	Supply & Haul Base	300	m3	$ 121.4	$ 115.9	$ 110.4	$ 110.4	$ 33,120.0
385	Spread, lay & compact Base	300	m3	$ 100.0	$ 90.0	$ 80.0	$ 80.0	$ 24,000.0
410	2 coat seal	1050	m2	$ 15.0	$ 13.0	$ 11.0	$ 11.0	$ 11,550.0
	Alexandra Parade - Widening							
310	Earthworks - Excavation	450	m3	$ 100.0	$ 90.0	$ 80.0	$ 100.0	$ 45,000.0
344	Supply & Haul Subbase	450	m3	$ 121.4	$ 115.9	$ 110.4	$ 110.4	$ 49,680.0
384	Spread, lay & compact Subbase	450	m3	$ 100.0	$ 80.0	$ 80.0	$ 80.0	$ 36,000.0
345	Supply & Haul Base		m3	$ 121.4	$ 115.9	$ 110.4	$ 110.4	$ -
385	Spread, lay & compact Base		m3	$ 100.0	$ 90.0	$ 80.0	$ 90.0	$ -
410	2 coat seal	4200	m2	$ 15.0	$ 13.0	$ 11.0	$ 11.0	$ 46,200.0
	Formalise parking Areas							
310	Earthworks - Excavation	840	m3	$ 100.0	$ 90.0	$ 80.0	$ 80.0	$ 67,200.0
385	Spread, lay & compact Base	840	m3	$ 100.0	$ 90.0	$ 80.0	$ 80.0	$ 67,200.0
345	Supply & Haul Base	840	m3	$ 121.4	$ 115.9	$ 110.4	$ 110.4	$ 92,736.0
410	2 coat seal	2800	m2	$ 15.0	$ 13.0	$ 11.0	$ 11.0	$ 30,800.0
420	Stabilise		m2	$ 25.0	$ 23.0	$ 21.0	$ 21.0	$ -
	[illegible]							
[illegible]	Communication Activities						$ 100.0	$ 3,000.0
[illegible]	Environmental Consultant						$ 5,000.0	$ 5,000.0
[illegible]	Survey and Design						$ [illegible]	$ 35,000.0
[illegible]	Public Utilities - Locations						$ 500.0	$ -
[illegible]	Service Location - potholing						$ 3,000.0	$ -
	Adjust Telstra - Nextgen		item				$ 20,000.0	$ 20,000.0
[illegible]	Building Inspection						$ 1,000.0	$ -
[illegible]	Signs/Guideposting		item				$ 40.0	$ -
[illegible]	Linemarking	3000	m				$ [illegible]	$ 3,000.0
[illegible]	Driveways	5	each				$ 1,000.0	$ 5,000.0
[illegible]	Guardrail - remove						$ 55.0	$ -
[illegible]	Guardrail - new						$ 110.0	$ -
[illegible]	Guardside	15					$ 4,500.0	$ 67,500.0
[illegible]	Signage install		item				$ 500.0	$ -
[illegible]	grass seed/hydromulch		m2				$ 2.0	$ -
[illegible]	Turf	3000	m2				$ 8.5	$ 25,500.0
	Raw Amount							$ [illegible]
	Contingency	[illegible]	for 85% Plans					$ [illegible]
	Project Management	[illegible]						$ [illegible]
			Total					$ [illegible]

LISMORE CITY COUNCIL	SHEET 2 of 6
Proposed Road Realignment Alexandra Parade North Lismore Concept Estimate	AUTOCAD 2021-077.DWG DRAWN B.V.G. PLAN No. 2021-077

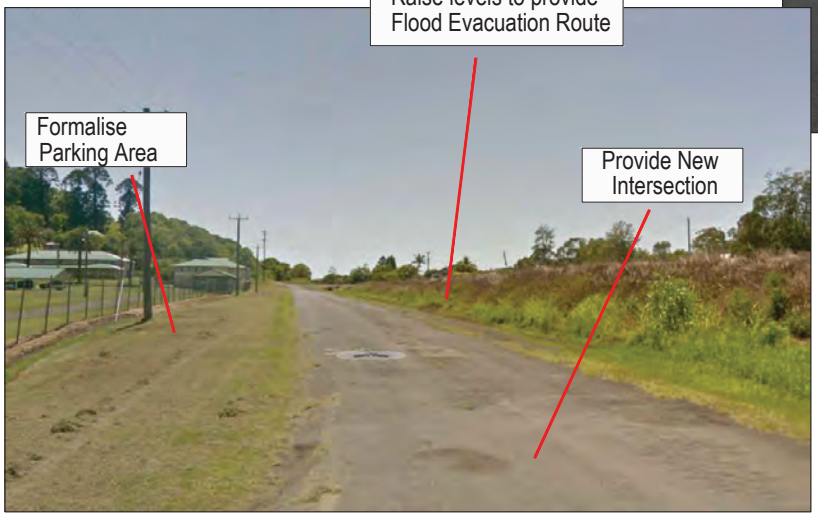
VIEW TO NORTH FROM TWEED STREET

PROPOSED ROUNDABOUT TWEED STREET AND ALEXANDRA PARADE

lismore city council	**LISMORE CITY COUNCIL** Proposed Road Realignment Alexandra Parade North Lismore Site Photos and Details	SHEET 3 of 7 AUTOCAD 2021-077.DWG DRAWN B.V.G. PLAN No. 2021-077



VIEW TO SOUTH FROM ALEXANDRA PARADE (WEST)



VIEW TO SOUTH FROM ALEXANDRA PARADE (WEST)

lismore city council	**LISMORE CITY COUNCIL** Proposed Road Realignment Alexandra Parade North Lismore Site Photos and Details	SHEET 4 of 7 AUTOCAD 2021-077.DWG DRAWN B.V.G. PLAN No. 2021-077

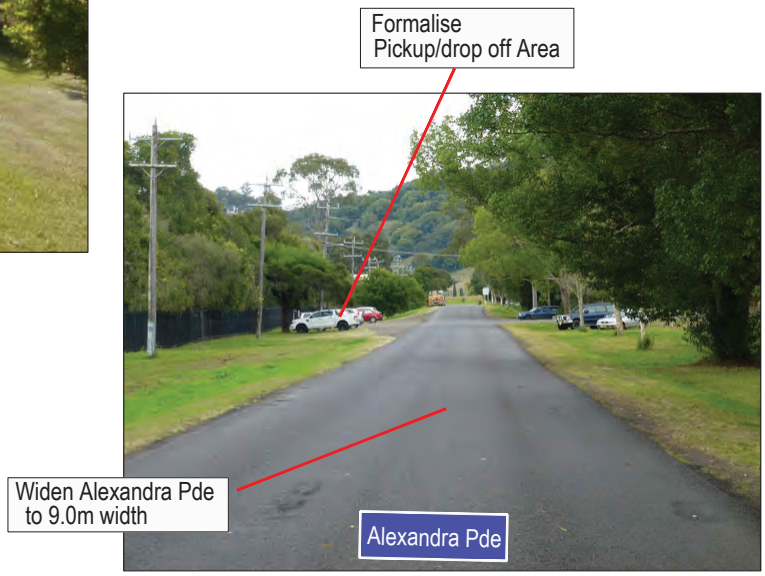
VIEW TO WEST FROM ALEXANDRA PARADE (EAST)

VIEW TO WEST FROM ALEXANDRA PARADE (EAST)

lismore city council

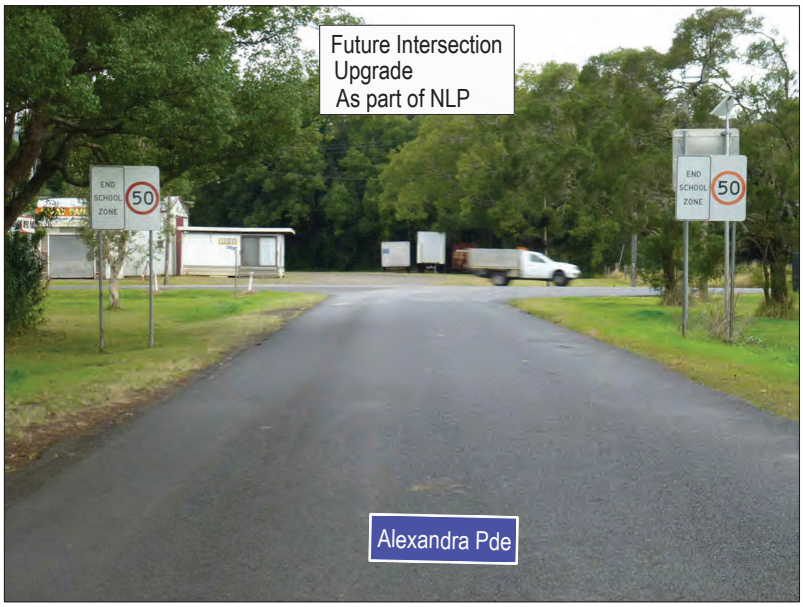
LISMORE CITY COUNCIL	SHEET 5 of 7
Proposed Road Realignment Alexandra Parade North Lismore Site Photos and Details	AUTOCAD 2021-077.DWG DRAWN B.V.G. PLAN No. 2021-077

VIEW TO EAST FROM ALEXANDRA PARADE (EAST)



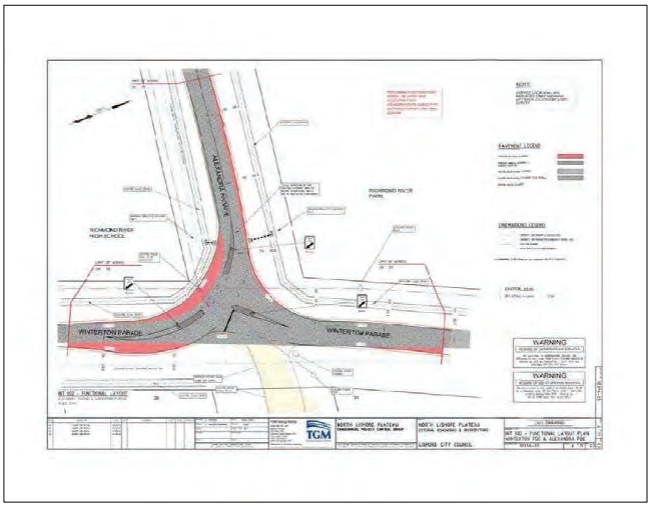
VIEW TO WEST FROM ALEXANDRA PARADE (EAST)

lismore city council	**LISMORE CITY COUNCIL** Proposed Road Realignment Alexandra Parade North Lismore Site Photos and Details	SHEET 6 of 7 AUTOCAD 2021-077.DWG DRAWN B.V.G. PLAN No. 2021-077



VIEW TO EAST FROM ALEXANDRA PARADE (EAST)

PROPOSED INTERSECTION UPGRADE ALEXANDRA PARADE AND WINTERTON PARADE



Future Intersection
Upgrade
As part of NLP

lismore city council	**LISMORE CITY COUNCIL** Proposed Road Realignment Alexandra Parade North Lismore Site Photos and Details	SHEET 7 of 7 AUTOCAD 2021-077.DWG DRAWN B.V.G. PLAN No. 2021-077