

**THE MAROOTA FRIABLE SANDSTONE
EXTRACTION PROJECT**

**STAGE 5
ROAD SAFETY AUDIT REPORT
FOR
EXISTING ROAD AND INTERSECTIONS IN
OLD NORTHERN ROAD AND WISEMANS
FERRY ROAD
AT MAROOTA**

Volume 2 Report

Ref. 20003RSA.R2

30 September 2020

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1.0 INTRODUCTION

1.1 Background

This report details the results of a Road Safety Audit of Old Northern Road and Wisemans Ferry Road between Roberts Road and Blakers Road at Maroota. **Figure 1** shows the road sections audited.

The Road Safety Audit was requested as part of the SEARS for Traffic and Road Transport matters for the proposed Maroota Friable Sandstone Extraction Project which is a new quarry project.

As part of the SEARS, Department of Planning, Industry and Environment requested “a detailed assessment of potential traffic impacts on the capacity, condition, safety and efficiency of the local and State road network, including a road safety audit.”

The detail assessment of potential traffic impacts on the capacity, condition, safety and efficiency of the local and state road network is addressed in the Traffic Impact Assessment Report for the proposal, which is Volume 1.

The proposed vehicle access to the proposed quarry is via Patricia Fay Drive which intersects with Wisemans Ferry Road approximately 400 metres south of Old Northern Road.

Wisemans Ferry Road and Old Northern Road will be the principal transport routes for the proposed quarry.

This report Volume 2 documents the results of the road safety audit of the existing road network at Maroota, that form part of the transport routes.

The road section audited is approximately 4.0km long and includes the principal access intersection to the new quarry and the other principal intersection on the road network in Maroota.

The audit is a Stage 5 road safety audit of the existing road and intersections in this section of Old Northern Road and Wisemans Ferry Road at Maroota. The audit has examined existing road conditions to identify any road safety deficiencies.

1.2 Audit Methodology and Auditors

The audit has been carried out following the procedures set out in the Austroads Guide to Road Safety – Part 6: Managing Road Safety Audits and Part 6A: Implementing Road Safety Audits. The audit examines the features of the existing road network which may affect road user safety and it has sought to identify potential safety hazards.



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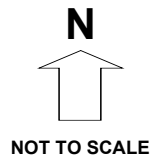


FIGURE 1
 ROAD SAFETY AUDIT OF EXISTING ROAD AND INTERSECTIONS
 IN OLD NORTHERN ROAD AND WISEMANS FERRY ROAD, MAROOTA
SECTION OF ROAD AUDITED

JOB NO. 20003

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However, the auditors point out that no guarantee is made that every deficiency has been identified. Further, if all the recommendations in this report were to be followed, this would not confirm that the road network is 'safe'; rather, adoption of any actions should improve the level of safety of the audited road network.

The Road Safety Audit Team included:

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Accredited Level 3 Road Safety Auditor (Audit Leader)
Auditor ID: RSA-02-002

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Accredited Level 3 Road Safety Auditor
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1.3 References & Documentation

The following references and documents were reviewed as part of the Audit.

References

- Austroads Guide to Road Safety: Part 1: Road Safety Overview and Part 6: Managing Road Safety Audits and Part 6A: Implementing Road Safety Audits.
- Austroads - Guide to Road Design.
- RMS - Supplements to Austroads Guide to Road Design.
- RMS Delineation Manual.
- RMS Safety Barrier Systems Acceptance Conditions.

Documentation

- Recent traffic volumes collected for the traffic impact assessment; and
- Road crash statistics as supplied by Transport for NSW (TfNSW).

1.4 Audit Process

The Road Safety Audit included the following tasks:

- A review of all relevant information to conduct the audit.
- Site Inspection and on-site auditing of the existing road network.
- Identification of any non-conformances and road safety considerations
- Preparation of Road Safety Audit Report.

The road network was inspected and audited on 21 July 2020 and examined relative to applied design standards in terms of:

- Road alignment and cross sections
- Auxiliary Lanes
- Intersections
- Signs and Lighting
- Markings and Delineation
- Crash Barriers and Clear Zones
- Pedestrians, Cyclists and Public Transport

- Bridges and Culverts
- Pavement
- Provision for Heavy Vehicles
- Parking
- Miscellaneous Issues

A follow up site inspection was undertaken on 29 September 2020.

1.5 Responding to the Audit Report

As set out in the road safety audit guidelines, responsibility for the road design/road network always rests with the road designer/road authority and not with the auditor. The road designer/road authority is under no obligation to accept any or all the audit recommendations. Also, it is not the role of the auditor to agree to or approve of the road designer/road authority's response to the audit. Rather, the audit provides the opportunity to highlight potential problems and have them formally considered by the road designer/road authority, in conjunction with all other relevant considerations.

To assist with this, a table contained within Audit Findings provides a column for any response.

2.0 DESCRIPTION OF THE AUDITED ROAD NETWORK

2.1 Road Network and Intersections

Old Northern Road

Old Northern Road is a state arterial road under the control of the TfNSW. As a state road, Old Northern Road has a function to carry a range of vehicle types including heavy vehicles.

Old Northern Road between Maroota and Baulkham Hills is an approved 25/26 metre B double route and has a high level of traffic management consistent with a state road.

The section of Old Northern Road between Wisemans Ferry Road and Robert Street at Maroota is a 2 lane rural road and forms part of one of the transport routes for the proposed quarry.

Intersections in this section of Old Northern Road include:

- Wisemans Ferry Road which is a T-junction intersection with single lane approach and departure lanes.
- Roberts Road which is a channelised T-junction intersection with a CHR (Channelised right turn bay) in the south eastern approach of Old Northern Road.

The speed limit in this section of Old Northern Road is:

- 60km/h at the Wisemans Ferry Road intersection; and
- 90km/h at the Roberts Road intersection.

The speed changes to 90km/h some 220 metres south east of Wisemans Ferry Road.

Figure 2 shows the existing traffic management and traffic controls in this section of Old Northern Road.

Wisemans Ferry Road

Wisemans Ferry Road forms part of the state road arterial route between Maroota and Windsor and is under the control of TfNSW.

Wisemans Ferry Road is an approved 25m/26m B-double route and has a high level of traffic management.

The section at Maroota between Old Northern Road and Blakers Road is a two lane rural road and forms part of the Wisemans Ferry Road transport route for the proposed quarry.

Intersections in this section of Wisemans Ferry Road include:

- Old Northern Road which is a T-junction intersection with single lane approaches and departures, where Wisemans Ferry Road forms the stem of the T and is under Priority (Give Way) control;
- Patricia Fay Drive which is a channelised cross junction intersection with CHR (right turn) treatments and AUL (Auxiliary left turn treatments) in both approaches of Wisemans Ferry Road;
- Hitchcock Road which is a T-junction intersection with single lane approaches and departures;
- Haerses Road which is a channelised T-junction intersection with a short right turn bay in the south western approach of Wisemans Ferry Road. The intersection is currently being upgraded. It was noted in the site inspection of 29 September 2020 that the improvement works appear to be completed;
- A new left in/left out T-junction intersection at the property access approximately 550 metres north east of Blakers Road. This intersection has an AUL (left turn auxiliary lane) in the south western approach of Wisemans Ferry Road; and
- Blakers Road which is T-junction intersection with single lane approach and departure lanes. This intersection has limited sight lines to the south in Wisemans Ferry Road for vehicles turning out of Blakers Road.

The speed limit in Wisemans Ferry Road is 60km/h at the Old Northern Road intersection and changes to 80km/h, 50 metres south west of Old Northern Road.





Figure 2 shows the existing traffic management and traffic controls in this section of Wisemans Ferry Road.

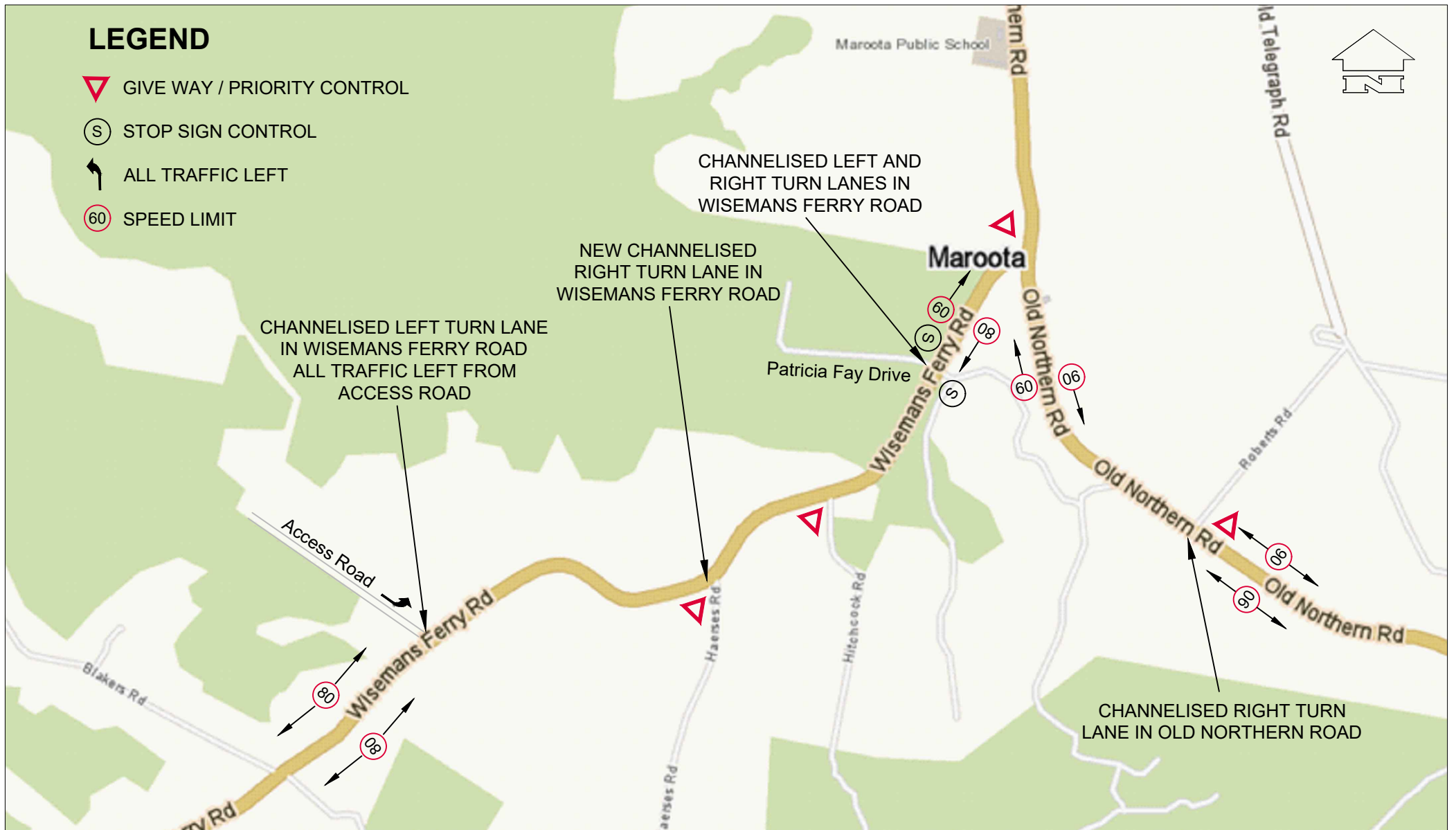
2.2 Traffic Conditions

Weekdays carry the highest traffic volumes on the road network and weekday AM and PM peak hours represent the busiest times. Table 2.1 shows the weekday (5 day average) and daily (7 day average) two way traffic volumes using Old Northern Road and Wisemans Ferry Road at Maroota.

For the average weekday, Old Northern Road carries two way volumes of 2043 vehicles per day (vpd).

LEGEND

-  GIVE WAY / PRIORITY CONTROL
-  STOP SIGN CONTROL
-  ALL TRAFFIC LEFT
-  SPEED LIMIT



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FIGURE 2

ROAD SAFETY AUDIT OF EXISTING ROAD AND INTERSECTIONS IN OLD NORTHERN ROAD AND WISEMANS FERRY ROAD, MAROOTA

EXISTING TRAFFIC CONTROLS

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Average weekday two way volumes in Wisemans Ferry Road are in the order of 2008 to 2039vpd.

Table 2.2 shows the two way traffic volumes in the weekday AM and PM peak hours using Old Northern Road and Wisemans Ferry Road.

Weekday AM peak hour two way traffic volumes in Old Northern Road and Wisemans Ferry Road are 169vph and 153vph respectively. The PM peak hour two way traffic volumes are 181vph and 169vph respectively.

SIDRA traffic modelling undertaken for the principal intersections of Old Northern Road/Wisemans Ferry Road and Wisemans Ferry Road/Patricia Fay Drive as part of the traffic assessment, shows that traffic conditions in terms of vehicle delay and Level of Service are generally satisfactory to good in the weekday AM and PM peak hours, with both intersections operating at a Level of Service A or B operation.

TABLE 2.1

DAILY TWO WAY TRAFFIC VOLUMES ON ROAD NETWORK

Location	Average Weekday (5 day average)	Average Day (7 day average)
Old Northern Road, south east of Roberts Road	2043	2118
Wisemans Ferry Road, south west of Patricia Fay Drive	2039	2002
Wisemans Ferry Road, south west of Haerses Road	2008	1984

TABLE 2.2

WEEKDAY AM AND PM PEAK HOUR TWO WAY TRAFFIC VOLUMES

Location	AM Peak Hour	PM Peak Hour
Old Northern Road, south east of Wisemans Ferry Road	169	181
Wisemans Ferry Road south of Patricia Fay Drive	153	169
Wisemans Ferry Road south west of Haerses Road	150	166

2.3 Crash Records

Road crash data was obtained from TfNSW for the 3 year period, 1 October 2016 to 30 September 2019 for Old Northern Road and Wisemans Ferry Road at Maroota.

The road sections examined included;

- Old Northern Road between Old Telegraph Road, Maroota and Canoelands Road, Canoelands (approximately 8.5km long); and
- Wisemans Ferry Road between Old Northern Road and Cliftonville Road, Maroota (approximately 5km long).

For the Old Northern Road section, there were two (2) crashes including one (1) mid block rear end crash east of Roberts Road and one (1) rear end intersection crash at the intersection of Wisemans Ferry Road. Both crashes were non injury crashes.

The rear end intersection crash involved two southbound vehicles in Old Northern Road, one (1) of which was turning right into Wisemans Ferry Road.

For the Wisemans Ferry Road section, there were a total of six (6) crashes, four (4) of which were injury crashes.

Five (5) of the crashes were run off the road type crashes involving a single vehicle (truck, car and motorcycle).

These occurred at different locations between Patricia Fay Drive and Weavers Road (i.e. over 5.5km length).

The other crash was a rear end crash which occurred adjacent the Shell Service Station, north east of Blakers Road.

There were no reported crashes at the intersection of Wisemans Ferry Road/Patricia Fay Drive.

As noted above, there was one non injury crash at the intersection of Old Northern Road/Wisemans Ferry Road.

An examination of the crash types and locational spread of the crashes indicates that there is not treatable pattern that could be addressed by specific remedial measures.

3.0 AUDIT FINDINGS

3.1 Road Alignment and Cross Section

Old Northern Road between Wisemans Ferry Road and Roberts Road

This section of Old Northern Road is constructed as a 2 lane rural road with a sealed carriageway of 7.0 metres between the edgelines with 2 x 3.5 metre lanes and sealed road shoulders generally 1.0-1.5 metres.

The horizontal alignment includes a mixture of straight sections with several curves. The vertical alignment varies with flat sections and moderate crests.

The speed limit is 60km/h at the Wisemans Ferry Road intersection and increases to 90km/h approximately 220 metres south of the Wisemans Ferry Road intersection.

Wisemans Ferry Road between Old Northern Road and Blakers Road

Wisemans Ferry Road in this section is constructed as a two lane rural road. It provides a 7.0 metre wide sealed carriageway between the edgelines with 2 x 3.5 metre wide lanes, as well as sealed shoulder 1.0 to 1.5 metres wide.

The horizontal alignment includes a number of curves in the section south west of Patricia Fay Drive. The vertical alignment is relatively flat in the section between Old Northern Road and south west of Patricia Fay Drive with moderate grades in the section between Hitchcock Road and Blakers Road.

The speed limit in this section of Wisemans Ferry Road is generally 80km/h and reduces to 60km/h at the Old Northern Road intersection.

Summary

The road alignment and cross sections in Old Northern Road and Wisemans Ferry Road match the terrain in the area and are consistent with other roads in rural and semi rural areas.

3.2 Auxiliary Lanes

Old Northern Road

An auxiliary lane is provided in Old Northern Road at the Roberts Road intersection to cater for right turns into Roberts Road.

Wisemans Ferry Road

Auxiliary lanes are provided at a number of intersections including:

- Patricia Fay Drive;
- Haerses Road; and
- Property Access 550 metres north east of Blakers Road.

The Haerses Road intersection is currently being upgraded to lengthen the right turn bay (CHR treatment) in Wisemans Ferry Road, as part of the Haerses Road Quarry Modification 3 Proposal.

The auxiliary lanes at the Patricia Fay Drive intersection are discussed in Section 3.3 below.

The auxiliary lane (AUL treatment) at the property access has recently been constructed and is consistent with current Austroads guidelines.

3.3 Intersections

Intersection treatments in the sections of Old Northern Road and Wisemans Ferry Road that are subject to this audit are detailed in Section 2.1 of this report. The principle intersections that will be used by trucks generated by Maroota Friable Sandstone Extraction Project will be;

- Wisemans Ferry Road/Patricia Fay Drive; and
- Old Northern Road/Wisemans Ferry Road.

A description and assessment of these intersections is detailed below.

Wisemans Ferry Road/Patricia Fay Drive

This intersection will provide direct access to the proposed quarry via Patricia Fay Drive.

The speed limit at the intersection in Wisemans Ferry Road is 80km/h. The traffic management at the intersection includes:

- A cross junction intersection with a small length of kerb and guttering at the intersection on the western side;
- A CHR (right turn) lane treatment and an AUL (auxiliary left turn) lane treatment in the northern approach of Wisemans Ferry Road;
- A CHR (right turn) lane treatment and an AUL (auxiliary left turn) lane treatment in the southern approach of Wisemans Ferry Road;
- Patricia Fay Drive is sealed for the first 190 metres from the intersection with a sealed pavement width of 8-9 metres and flaring at the intersection, with Stop Sign Control.

Sight distance in both directions of Wisemans Ferry Road i.e. to and from the intersection is considered satisfactory (i.e. 240 metres to and from the south and 270 metres to and from the north) and meets Austroad requirements for Safe Intersection Sight distance for the 80km/h speed limit.

The AUL left turn lane into Patricia Fay Drive from the southern approach of Wisemans Ferry Road is short (approximately 60 metres long including taper) and narrow (2.0-2.2 metres) and does not meet current Austroad Guidelines.

Similarly, the CHR (right turn) lane in the northern approach of Wisemans Ferry Road for the right turn into Patricia Fay Drive is also short (approximately 55 metres long including taper).

The eastern leg of the intersection opposite Patricia Fay Drive provides access to a sand quarry on the eastern side of Wisemans Ferry Road. The eastern leg is subject to Stop Sign control and is gated with a locked gate and No Entry signs.

The CHR (right turn) treatment in the southern approach of Wisemans Ferry Road is 70 metres long including taper. The AUL (auxiliary left turn) lane treatment in the northern approach is 85 metres long.

Isolated (minor) street lighting is provided at the intersection. Multiple truck warning signs are provided in both approaches of Wisemans Ferry Road at the intersection.

Summary

The AUL left turn lane in the southern approach of Wisemans Ferry Road and the CHR right turn lane in the northern approach of Wisemans Ferry Road cater for the turning vehicles into and out of Patricia Fay Drive. The usage of these lanes will increase with the Project.

As noted above, the current lengths and widths of these lanes do not meet Austroad Guidelines for the posted 80km/h speed limit at the intersection and therefore should be upgraded.

Old Northern Road/Wisemans Ferry Road Intersection

The speed limit at the intersection is 60km/h and the traffic management includes:

- Single lane approach and departure lanes in the northern and southern legs of Old Northern Road, together with a basic BAL (left turn) treatment in the southern approach of Old Northern Road for the left turn into Wisemans Ferry Road.
- Single lane approach and departure lanes in Wisemans Ferry Road, together with a Basic BAL (left turn) lane treatment for the left turn from Wisemans Ferry Road into Old Northern Road.

Both the BAL left turn treatment are suitable for longer heavy vehicles.

Wisemans Ferry Road is subject to Give Way (Priority) control at the intersection.

Sight distance at the intersection is good with 120 metres of sight distance to and from the north in Old Northern Road and 160 metres of sight distance to and from the south in Old Northern Road. The available sight distance meets Austroads requirements for Safe Intersection Sight Distance for the posted 60km/h speed limit in Old Northern Road.

Isolated (minor) street lighting is provided at the intersection.

Summary

While the intersection has single lane approach and departure lanes, given the relatively low traffic volumes that use the intersection and the 60km/h speed limit that applies, the existing traffic management is considered to be satisfactory.

3.4 Signs and Lighting

Signage includes speed limit signs and other regulatory signage such as Give Way signs as well as advisory signs, directional signs and warning signs.

The signage in the sections of Old Northern Road and Wisemans Ferry Road subject to this audit is considered to be effective and is generally in satisfactory condition.

A single street light is provided at the intersections including:

- Old Northern Road/Wisemans Ferry Road
- Old Northern Road/Roberts Road
- Wisemans Ferry Road/Bishop Road
- Wisemans Ferry Road/Haerses Road
- Wisemans Ferry Road/Blakers Road

There is no street lighting in the midblock areas.

3.5 Road Markings and Delineation

Centreline and edgeline markings are provided in both Old Northern Road and Wisemans Ferry Road.

Other markings include directional arrows and intersection markings (TB lines) and chevron markings at some intersections. RRPMs (Raised Reflective Pavement Markers) are provided in both Old Northern Road and Wisemans Ferry Road, as well as guidepost and reflectors.

The road marking and delineation is considered to be satisfactory.

3.6 Crash Barriers and Clear Zone

Some trees that line sections of Old Northern Road and Wisemans Ferry Road in the sections subject to this audit, are within the nominal clearzone, particularly in the higher speed zone areas of 80km/h and 90km/h. A number of ESPs (Electricity Supply Poles) are also within the clearzone. This is consistent with other sections of Old Northern Road and Wisemans Ferry Road that are not subject to this audit.

Sections of guardrail with appropriate end treatments are used in Wisemans Ferry Road at the Haerses Road intersection.

3.7 Pedestrian, Cyclists and Public Transport

The frontage development in Old Northern Road and Wisemans Ferry Road does not generate much pedestrian activity crossing either road. Some pedestrian activity is generated by the bus routes.

There is limited cyclist use of either Old Northern Road and Wisemans Ferry Road in the sections that is being audited. There are no formal cycle routes or bike lanes on either road.

The 672 bus route which operates between Wisemans Ferry Road and Windsor uses Wisemans Ferry Road and the Old Northern Road/Wisemans Ferry Road intersection. This bus stops at three locations in Wisemans Ferry Road between Old Northern Road and Bakers Lane. A number of school buses also use the stops. Bus pull off areas are provided at several locations.

3.8 Bridges and Culverts

There are no bridges in the sections of Old Northern Road and Wisemans Ferry Road that are subject to this audit. There are several drainage structures. These are marked with guideposts / reflectors, as they are within the nominal clearzone.

3.9 Pavement

The road pavement in the sections of Old Northern Road and Wisemans Ferry Road that are subject to this audit is generally in satisfactory condition, although future maintenance will be required in some sections.

3.10 Provision of Heavy Vehicles

Both Old Northern Road and Wisemans Ferry Road are state arterial roads under the control of TfNSW and have a road function to cater for heavy vehicles. Both roads are approved 25/26 metres B-double routes. Heavy vehicles make up 17.5% and 22.3% of total traffic volumes in Old Northern Road and Wisemans Ferry Road on an average weekday.

3.11 Parking

Parking adjacent the road edge does not occur in the sections of Old Northern Road and or Wisemans Ferry Road that are subject to this audit. Most properties are rural residential and or rural properties with no requirements for street/road parking.

3.12 Miscellaneous

There were no miscellaneous issues identified in the audit.

3.13 Audit Summary and Risk Ranking

The audit findings that require follow up are listed in Table 3.1, together with the risk ranking.

Risks and potential safety issues have been identified and ranked using Austroads Ranking method, based on frequency, severity, overall level of risk and treatment approach presented in Tables 4.1 to 4.4 in Guide to Road Safety Part 6: Road Safety Audit (See Appendix 1).

The risk rankings and Austroads suggested treatment approach are defined as follows:

- Intolerable - Must be corrected
- High - Should be corrected or the risk significantly reduced, even if the treatment cost is high
- Medium - Should be corrected or the risk significantly reduced, if the treatment cost is moderate, but not high
- Low - Should be corrected or the risk reduced, if the treatment cost is low

In addition, Appendix 2 shows the auditors comments on all matters considered as part of the audit.

TABLE 3.1

AUDIT FINDINGS AND RISK RANKING

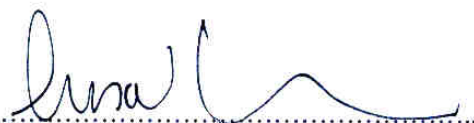
Item	Issue	Risk Ranking	Response by Road Authorities
Intersection of Wisemans Ferry Road/Patricia Fay Drive	Existing CHR and AUL right and left turn lanes in Wisemans Ferry Road for the right and left turns into Patricia Fay Drive do not meet current Austroad Guidelines for 80km/h speed limit and should be upgraded to reduce potential conflicts and improve potential road safety at the intersection.	High	

4.0 FORMAL STATEMENT

We have examined the road sections described in Section 1.1 and shown in **Figure 1** and we have audited these road sections in accordance with the procedures set out in the Austroads Guidelines for Road Safety Audits. The audit has been carried out for the sole purpose of identifying any features of the road network that could be altered or reconsidered to improve road safety. One issue has been identified and is detailed in Table 3.1.



.....
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30 September 2020

APPENDIX 1

Austroads Risk Assessment Table 4.1 to 4.4 Extract

How does the client decide whether or not to accept an audit finding or recommendation?

Part of the answer can lie at the start of the design process: could an audit have been undertaken earlier? Certainly, the earlier an audit is undertaken, the sooner a potential problem can be addressed. This generally means it will be easier or cheaper to resolve the problem.

Faced with an audit finding or recommendation that is difficult to resolve, the client needs to consider the:

- likelihood that the identified problem will result in harm
- severity of that harm
- effectiveness of a remedy in reducing the harm
- the designer’s advice/response to the audit
- cost of remedying the problem (there may be several alternative treatments).

This requires engineering judgement and additional road safety engineering advice about managing the risk.

There may be occasions that the audit recommendations require consideration of issues outside the original scope of the project. This should not be an excuse to dismiss these and they still require consideration by the appropriate authority or person. It may be that the original scope of the project needs to be altered.

C. Risk ranking of safety issues

The following tables may be useful to provide an indication of the level of risk and how to respond to it. Determine into which category in Table 4.1 and Table 4.2 the issue best fits. From this select the risk category in Table 4.3 and its suggested treatment approach in Table 4.4. This is not a scientific system and professional judgement should be used. Section 9.3 provides an evidence based approach to prioritising the treatment of works emanating from road safety audits of existing roads.

Table 4.1: How often is the problem likely to lead to a crash?

Frequency	Description
Frequent	Once or more per week
Probable	Once or more per year (but less than once a week)
Occasional	Once every five or ten years
Improbable	Less often than once every ten years

Table 4.2: What is the likely severity of the resulting crash type?

Severity	Description	Examples
Catastrophic	Likely multiple deaths	High-speed, multi-vehicle crash on a freeway. Car runs into crowded bus stop. Bus and petrol tanker collide. Collapse of a bridge or tunnel.
Serious	Likely death or serious injury	High or medium-speed vehicle/vehicle collision. High or medium-speed collision with a fixed roadside object. Pedestrian or cyclist struck by a car.
Minor	Likely minor injury	Some low-speed vehicle collisions. Cyclist falls from bicycle at low speed. Left-turn rear-end crash in a slip lane.
Limited	Likely trivial injury or property damage only	Some low-speed vehicle collisions. Pedestrian walks into object (no head injury). Car reverses into post.

Table 4.3: The resulting level of risk

	Frequent	Probable	Occasional	Improbable
Catastrophic	Intolerable	Intolerable	Intolerable	High
Serious	Intolerable	Intolerable	High	Medium
Minor	Intolerable	High	Medium	Low
Limited	High	Medium	Low	Low

Table 4.4: Treatment approach

Risk	Suggested treatment approach
Intolerable	Must be corrected.
High	Should be corrected or the risk significantly reduced, even if the treatment costs is high.
Medium	Should be corrected or the risk significantly reduced, if the treatment cost is moderate, but not high.
Low	Should be corrected or the risk reduced, if the treatment cost is low.

D. Implementing the agreed changes

Once the corrective action report has been finalised, the agreed actions need to be implemented. The designer has to develop design changes that address the safety problems. If one is at the pre-opening stage, the actions need to be implemented as soon as possible on site. Temporary warning, delineation or other treatment may be needed until the agreed solution is implemented.

Actions taken should be recorded (for example, description of work, by whom and when). This is to fully close out the road safety audit finding as well as to factual record what works were completed. Reasons for any variations from the proposed action must also be set out in writing.

Framing responses to audit findings or recommendations

When an audit finding or recommendation is not accepted, or is accepted only in part, care should be taken about framing the corrective action report, bearing in mind that it may become a public document in the event of a crash occurring.

Consider the following responses to findings or recommendations made during a pre-opening audit of a project to widen the carriageway of a two-lane, two-way road to provide an overtaking lane:

- *Safety issues:*
‘Fixed objects within the new clear zone. These include a concrete bus shelter and stockpiles of aggregate and box culverts.’ Three sections of guard fence are now nearer the edge line, but do not have safe end treatments.
- *Findings or recommendations*
Take action to reinstate appropriate clear zones for this road. Pay attention to the guard fence.
- *Responses:*
‘The bus shelter was constructed before work on the overtaking lane. It is 4 m from the edge line. The expense of moving it is not considered justified. Most of this highway has objects within the clear zone, for example 3 km to the south there are 150 trees within 1.5 m to 6 m from the edge line. The stockpiles cannot be removed as there are few stockpile sites in the area. All the guard fence was constructed before construction of the overtaking lane. Compared with other guard fence in this region, it is not considered a priority and no action is planned to install the correct end treatment.’
How might these responses be viewed by someone injured in a collision with the bus shelter, a stockpile or a guard fence end (or by a lawyer)? It would be of little comfort for drivers to know they would have been even worse off had the car veered off the road 3 km further on, or that the road authority had a problem finding stockpile sites, or that it’s not the client’s problem because the fixed objects were put in earlier by someone else. What these responses lack, and what any response needs, is a consideration of points in the previous inset (‘How does the client decide whether or not to accept an audit finding or recommendation’, in B above), an explanation of why action cannot be taken (for example, financial implications) and consideration of other possible options to reduce the risk associated with significant problem.

APPENDIX 2

Checklist 6 – Existing Roads and Road Safety Audit

CHECKLIST 6: EXISTING ROADS: ROAD SAFETY AUDIT

APPENDIX 2 – OLD NORTHERN ROAD AND WISEMANS FERRY ROAD, MAROOTA

Issue	Yes	No	Comment
6.1 Road alignment and cross-section			
6.1.1 Visibility; sight distance			
Is sight distance adequate for the speed of traffic using the route?	✓		
Is adequate sight distance provided for intersections and crossings? (for example, pedestrian, cyclist, cattle, railway)	✓		
Is adequate sight distance provided at all private driveways and property entrances?	✓		
6.1.2 Design speed			
Is the horizontal and vertical alignment suitable for the (85th percentile) traffic speed?	✓		
If not: <ul style="list-style-type: none"> ▪ are warning signs installed? ▪ are advisory speed signs installed? 	✓		
Are the posted advisory speeds for curves appropriate?	✓		
6.1.3 Speed limit/speed zoning			
Is the speed limit compatible with the function, road geometry, land use and sight distance?	✓		
6.1.4 Overtaking			
Are safe overtaking opportunities provided?			N/A
6.1.5 Readability by drivers			
Is the road free of elements that may cause confusion? For example: <ul style="list-style-type: none"> ▪ is alignment of the roadway clearly defined? ▪ has disused pavement (if any) been removed or treated? ▪ have old pavement markings been removed ▪ properly? ▪ do tree lines follow the road alignment? 	✓ ✓ ✓		N/A N/A

Issue	Yes	No	Comment
<ul style="list-style-type: none"> ▪ does the line of street lights or the poles follow the road alignment? 			
Is the road free of misleading curves or combinations of curves?	✓		
6.1.6 Widths			
Are medians and islands of adequate width for the likely users?			N/A
Are traffic lane and carriageway widths adequate for the traffic volume and mix?	✓		
Are bridge widths adequate?			N/A
6.1.7 Shoulders			
Are shoulders wide enough to allow drivers to regain control of errant vehicles?	✓		
Are shoulders wide enough for broken-down or emergency vehicles to stop safely?	✓		
Are shoulders sealed?	✓		
Are shoulders trafficable for all vehicles and road users? (i.e. are shoulders in good condition)	✓		
Is the transition from road to shoulder safe? (no drop-offs)	✓		
6.1.8 Crossfalls			
Is appropriate superelevation provided on curves?	✓		
Is any adverse crossfall safely managed (for cars, trucks, etc.)?	✓		
Do crossfalls (carriageway and shoulder) provide adequate drainage?	✓		
6.1.9 Batter slopes			
Are batter slopes traversable by cars and trucks that run off the road?	✓		
6.1.10 Drains			
Are roadside drains and culvert end walls traversable?		✓	

Issue	Yes	No	Comment
6.2 Auxiliary lanes			
6.2.1 Tapers			
Are starting and finishing tapers located and aligned correctly?			N/A
Is there sufficient sight distance to the end of the auxiliary lane?			N/A
6.2.2 Shoulders			
Are appropriate shoulder widths provided at merges?			N/A
Have shoulder widths been maintained beside the auxiliary lane?			N/A
6.2.3 Signs and markings			
Have all signs been installed in accordance with the appropriate guidelines?	✓		
Are all signs conspicuous and clear?	✓		
Does all linemarking conform with these guidelines?	✓		
Is there advance warning of approaching auxiliary lanes?	✓		
6.2.4 Turning traffic			
Have right turns from the through lane been avoided?		✓	
Is there advance warning of turn lanes?		✓	
6.3 Intersections			
6.3.1 Location			
Are all intersections located safely with respect to the horizontal and vertical alignment?	✓		
Where intersections occur at the end of high-speed environments (for example, at approaches to towns), are there traffic control devices to alert drivers?			N/A
6.3.2 Visibility; sight distance			
Is the presence of each intersection obvious to all road users?	✓		
Is the sight distance appropriate for all movements and all road users?	✓		
Is there stopping sight distance to the rear of any queue or slow-moving turning vehicles?	✓		

Issue	Yes	No	Comment
Has the appropriate sight distance been provided for entering and leaving vehicles?	✓		
6.3.3 Controls and delineation			
Are pavement markings and intersection control signs satisfactory?	✓		
Are vehicle paths through intersections delineated satisfactorily?	✓		
Are all lanes properly marked (including any arrows)?	✓		
6.3.4 Layout			
Are all conflict points between vehicles safely managed?	✓		
Is the intersection layout obvious to all road users?	✓		
Is the alignment of kerbs obvious and appropriate?			N/A
Is the alignment of traffic islands obvious and appropriate?			N/A
Is the alignment of medians obvious and appropriate?			N/A
Can all likely vehicle types be accommodated?	✓		
Are merge tapers long enough?	✓		
Is the intersection free of capacity problems that may produce safety problems?	✓		
6.3.5 Miscellaneous			
Particularly at rural sites, are all intersections free of loose gravel?	✓		
6.4 Signs and lighting			
6.4.1 Lighting			
Has lighting been adequately provided where required?	✓		Limited street lighting provided at intersections only.
Is the road free of features that interrupt illumination? (for example, trees or overbridges)			N/A
Is the road free of lighting poles that are a fixed roadside hazard?			Some poles are within nominal clear zone.
Are frangible or slip-base poles provided?		✓	
Ambient lighting: if it creates special lighting needs, have these been satisfied?			N/A
Is the lighting scheme free of confusing or misleading effects on signals or signs?	✓		

Issue	Yes	No	Comment
Is the scheme free of any lighting black patches?			N/A
6.4.2 General signs issues			
Are all necessary regulatory, warning and direction signs in place? Are they conspicuous and clear?	✓		
Are the correct signs used for each situation, and is each sign necessary?	✓		
Are all signs effective for all likely conditions? (for example, day, night, rain, fog, rising or setting sun, oncoming headlights, poor lighting)	✓		
If restrictions apply for any class of vehicle, are drivers adequately advised?			N/A
If restrictions apply for any class of vehicle, are drivers advised of alternative routes?			N/A
6.4.3 Sign legibility			
In daylight and darkness, are signs satisfactory regarding visibility and: <ul style="list-style-type: none"> ▪ clarity of message? ▪ readability/legibility at the required distance? 	✓		
Is sign retroreflectivity or illumination satisfactory?	✓		
Are signs able to be seen without being hidden by their background or adjacent distractions?	✓		
Is driver confusion due to too many signs avoided?	✓		
6.4.4 Sign supports			
Are sign supports out of the clear zone?		✓	
If not, are they: <ul style="list-style-type: none"> ▪ frangible? ▪ shielded by barriers (for example, guard fence, crash cushions)? 	✓		Signs mounted on 80mm pipe stems
6.5 Markings and delineation			
6.5.1 General issues			
Is the line marking and delineation: <ul style="list-style-type: none"> ▪ appropriate for the function of the road? ▪ consistent along the route? ▪ likely to be effective under all expected conditions? (day, night, wet, dry, fog, rising and setting sun position, oncoming headlights, etc.) 	✓		

Issue	Yes	No	Comment
Is the pavement free of excessive markings? (for example, unnecessary turn arrows, unnecessary barrier lines, etc.)	✓		
6.5.2 Centrelines, edgelines, lane lines	✓		
Are centrelines, edgelines, lane lines provided? If not, do drivers have adequate guidance?	✓		
Have RRPMS been installed where required?	✓		
If RRPMS are installed, are they correctly placed, correct colours, in good condition?	✓		
Are profiled (audible) edgelines provided where required?		✓	
Is the linemarking in good condition?	✓		Generally. Some maintenance required in some sections.
Is there sufficient contrast between linemarking and pavement colour?	✓		
6.5.3 Guideposts and reflectors			
Are guideposts appropriately installed?	✓		
Are delineators clearly visible?	✓		
Are the correct colours used for the delineators?	✓		
Are the delineators on guard fences, crash barriers and bridge railings consistent with those on guideposts?	✓		
6.5.4 Curve warning and delineation			
Are curve warning signs and advisory speed signs installed where required?	✓		
Are advisory speed signs consistent along the route?	✓		
Are the signs correctly located in relation to the curve? (i.e. not too far in advance)	✓		
Are the signs large enough?	✓		
Are chevron alignment markers (CAMs) installed where required?	✓		
Is the positioning of CAMs satisfactory to provide guidance around the curve?	✓		
Are the CAMs the correct size?	✓		
Are CAMs confined to curves? (not used to delineate islands, etc)	✓		

Issue	Yes	No	Comment
6.6 Crash barriers and clear zones			
6.6.1 Clear zones			
Is the clear zone width traversable? (i.e. drivable)			Generally
Is the clear zone width free of rigid fixtures? (if not, can all of these rigid fixtures be removed or shielded?)		✓	
Are all power poles, trees, etc., at a safe distance from the traffic paths?		✓	Some trees and power poles are within the nominal clear zone.
Is the appropriate treatment or protection provided for any objects within the clear zone?			No Treatment provided for trees and power poles.
6.6.2 Crash barriers			
Are crash barriers installed where necessary?	✓		
Are crash barriers installed at all necessary locations in accordance with the relevant guidelines?	✓		
Are the barrier systems suitable for the purpose?	✓		
Are the crash barriers correctly installed?	✓		
Is the length of crash barrier at each installation adequate?	✓		
Is the guard fence attached correctly to bridge railings?			N/A
Is there sufficient width between the barrier and the edge line to contain a broken-down vehicle?		✓	
6.6.3 End treatments			
Are end treatments constructed correctly?	✓		
Is there a safe run-off area behind breakaway terminals?	✓		
6.6.4 Fences			
Are pedestrian fences frangible?			N/A
Are vehicles safe from being speared by horizontal fence railings located within the clear zone?			N/A
6.6.5 Visibility of barriers and fences			
Is there adequate delineation and visibility of crash barriers and fences at night?	✓		

Issue	Yes	No	Comment
6.7 Traffic signals			
6.7.1 Operations			
Are traffic signals operating correctly?			N/A
Are the number, location and type of signal displays appropriate for the traffic mix and traffic environment?			N/A
Where necessary, are there provisions for visually impaired pedestrians? (for example, audio-tactile push buttons, tactile markings)			N/A
Where necessary, are there provisions for elderly or disabled pedestrians? (for example, extended green or clearance phase)			N/A
Is the controller located in a safe position? (i.e. where it is unlikely to be hit, but maintenance access is safe)			N/A
Is the condition (especially skid resistance) of the road surface on the approaches satisfactory?			N/A
6.7.2 Visibility			
Are traffic signals clearly visible to approaching motorists?			N/A
Is there adequate stopping sight distance to the ends of possible vehicle queues?			N/A
Have any visibility problems that could be caused by the rising or setting sun been addressed?			N/A
Are signal displays shielded so that they can be seen only by the motorists for whom they are intended?			N/A
Where signal displays are not visible from an adequate distance, are signal warning signs and/or flashing lights installed?			N/A
Where signals are mounted high for visibility over crests, is there adequate stopping sight distance to the ends of traffic queues?			N/A
Is the primary signal free from obstructions on the nearside footway to approaching drivers? (trees, light poles, signs, bus stops, etc.)			N/A
6.8 Pedestrians and cyclists			
6.8.1 General issues			
Are there appropriate travel paths and crossing points for pedestrians and cyclists?			Low pedestrian and very low cyclist activity

Issue	Yes	No	Comment
Is a safety fence installed where necessary to guide pedestrians and cyclists to crossings or overpasses?			N/A
Is a safety barrier installed where necessary to separate vehicle, pedestrian and cyclist flows?			N/A
Are pedestrian and bicycle facilities suitable for night use?			N/A
6.8.2 Pedestrians			
Is there adequate separation distance between vehicular traffic and pedestrians on footways?			N/A
Is there an adequate number of pedestrian crossings along the route?			N/A
At crossing points is fencing oriented so pedestrians face oncoming traffic?			N/A
Is there adequate provision for the elderly, the disabled, children, wheelchairs and baby carriages? (for example, holding rails, kerb and median crossings, ramps)			N/A
Are adequate hand rails provided where necessary? (for example, on bridges, ramps)			N/A
Is signing about pedestrians near schools adequate and effective?			N/A
Is signing about pedestrians near any hospital adequate and effective?			N/A
Is the distance from the stop line to a cross walk sufficient for truck drivers to see pedestrians?			N/A
6.8.3 Cyclists			
Is the pavement width adequate for the number of cyclists using the route?			Low cyclist usage of both roads.
Is the bicycle route continuous? (i.e. free of squeeze points or gaps)			N/A Squeeze points at several locations.
Are drainage pit grates bicycle safe?			N/A
6.8.4 Public transport			
Are bus stops safely located with adequate visibility and clearance to the traffic lane?	✓		
Are bus stops in rural areas signposted in advance?		✓	

Issue	Yes	No	Comment
Are shelters and seats located safely to ensure that sight lines are not impeded? Is clearance to the road adequate?			N/A
Is the height and shape of the kerb at bus stops suitable for pedestrians and bus drivers?			N/A
6.9 Bridges and culverts			
6.9.1 Design features			
Are bridges and culverts the full formation width?			N/A
Are bridge and culvert carriageway widths consistent with approach conditions?			N/A
Is the approach alignment compatible with the 85th percentile travel speed?			N/A
Have warning signs been erected if either of the above two conditions (i.e. width and speed) are not met?			N/A
6.9.2 Crash barriers			
Are there suitable traffic barriers on bridges and culverts and their approaches to protect errant vehicles?			N/A
Is the connection between barrier and bridge safe?			N/A
Is the bridge free of kerbing that would reduce the effectiveness of barriers or rails?			N/A
6.9.3 Miscellaneous			
Are pedestrian facilities on the bridge appropriate and safe?			N/A
Is fishing from the bridge prohibited? If not, has provision been made for safe fishing?			N/A
Does delineation continue over the bridge?			N/A
6.10 Pavement			
6.10.1 Pavement defects			
Is the condition of the pavement edges satisfactory?			Generally. Some sections of pavement edge are worn.
Is the transition from pavement to shoulder free of dangerous edge drop offs?	✓		

Issue	Yes	No	Comment
Is the pavement free of defects (for example, excessive roughness or rutting, potholes, loose material, etc.) that could result in safety problems (for example, loss of steering control)?	✓		
6.10.2 Skid resistance			
Does the pavement appear to have adequate skid resistance, particularly on curves, steep grades and approaches to intersections?	✓		
Has skid resistance testing been carried out where necessary?		✓	
6.10.3 Ponding			
Is the pavement free of areas where ponding or sheet flow of water could contribute to safety problems?			Not known
6.10.4 Loose stones/material			
Is the pavement free of loose stones and other material?	✓		
6.11 Parking			
6.11.1 General issues			
Are the provisions for, or restrictions on, parking satisfactory in relation to traffic safety?			N/A
Is the frequency of parking turnover compatible with the safety of the route?			N/A
Is there sufficient parking for delivery vehicles so that safety problems due to double parking do not occur?			N/A
Are parking manoeuvres along the route possible without causing safety problems? (for example, angle parking)			N/A
Is the sight distance at intersections and along the route, unaffected by parked vehicles?	✓		
6.12 Provision for heavy vehicles			
6.12.1 Design issues			
Are overtaking opportunities available for heavy vehicles where volumes are high?			No provision for overtaking.
Does the route generally cater for the size of vehicle likely to use it?	✓		

Issue	Yes	No	Comment
Is there adequate manoeuvring room for large vehicles along the route, at intersections, roundabouts, etc.?	✓		
Is access to rest areas and truck parking areas adequate for the size of vehicle expected? (consider acceleration, deceleration, shoulder widths, etc.)			N/A
6.12.2 Pavement/shoulder quality			
Are shoulders sealed at bends to provide additional pavement for long vehicles?	✓		
Is the pavement width adequate for heavy vehicles?	✓		
In general, is the pavement quality sufficient for the safe travel of heavy and oversized vehicles?	✓		
On truck routes, are reflective devices appropriate for truck drivers' eye heights?	✓		
6.13 Floodways and causeways			
6.13.1 Ponding, flooding			
Are all sections of the route free from ponding or flow across the road during wet weather?			Not Known
If there is ponding or flow across the road during wet weather, is there appropriate signposting?			N/A
Are floodways and causeways correctly signposted?			N/A
6.13.2 Safety of devices			
Are all culverts or drainage structures located outside the clear roadside recovery area?		✓	Guidepost and reflectors provided adjacent road shoulder, to mark drainage structures.
If not, are they shielded from the possibility of vehicle collision?		✓	
6.14 Miscellaneous			
6.14.1 Landscaping			
Is landscaping in accordance with guidelines? (for example, clearances, sight distance)			N/A
Will existing clearances and sight distances be maintained following future plant growth?			N/A. Any vegetation on road edges requires maintenance.

Issue	Yes	No	Comment
Does the landscaping at roundabouts avoid visibility problems?			N/A
6.14.2 Temporary works			
Are all locations free of construction or maintenance equipment that is no longer required?			N/A
Are all locations free of signs or temporary traffic control devices that are no longer required?			N/A
6.14.3 Headlight glare			
Have any problems that could be caused by headlight glare been addressed? (for example, a two-way service road close to main traffic lanes, the use of glare fencing or screening)			N/A
6.14.4 Roadside activities			
Are the road boundaries free of any activities that are likely to distract drivers?	✓		
Are all advertising signs installed so that they do not constitute a hazard?	✓		
6.14.5 Errant vehicles			
Is the roadside furniture on the verges and footways free of damage from errant vehicles that could indicate a possible problem, hazard or conflict at the site?	✓		
6.14.6 Other safety issues			
Is the embankment stability safe?	✓		
Is the route free of unsafe overhanging branches?	✓		
Is the route free of visibility obstructions caused by long grass?	✓		
Are any high-wind areas safely dealt with?			N/A
If back-to-back median kerbing is used is it: <ul style="list-style-type: none"> ▪ adequately delineated? ▪ obvious where it starts? ▪ obvious at intersections? ▪ unlikely to be a hazard to pedestrians? 			N/A

Issue	Yes	No	Comment
6.14.7 Rest areas			
Is the location of rest areas and truck parking areas along the route appropriate?			N/A
Is there adequate sight distance to the exit and entry points from rest areas and truck parking areas at all times of the day?			N/A
6.14.8 Animals			
Is the route free from large numbers of animals? (for example, cattle, sheep, kangaroos, koalas, wombats, etc.)			Not known
If not, is it protected by animal-proof fencing?			N/A. No animal proof fencing.
6.14.9 Safety aspects for heavy vehicles not already covered			
Have all other matters which may have a bearing on safety for heavy vehicles been addressed?	✓		