



Riverland

Regional Road Assessment June 2018



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RAA

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V1.1	5/6/2018	MV/PE	CM	Draft for comment.
V1.2	22/6/2018	MV/PE	CM	For Approval.
V1.3	6/7/2018	MV/PE	CM	For Issue.

Executive Summary

RAA's Road Safety team periodically evaluates the South Australian regional road network. This assessment of the Riverland region reviews the road network within the three Riverland Councils, the DC of Loxton Waikerie, Berri Barmera Council and Renmark Paringa Council. The selection of roads and locations to investigate is largely based on the leading concerns of RAA Members in the region.

RAA consulted the community through various stakeholder consultation sessions and a survey of Members and residents living in the Riverland region to determine areas of concern. RAA then undertook five days of site investigations covering a distance of approximately two thousand kilometres. These traffic and road assessments took place in late May and early June of 2018.

As a result of our investigations and community feedback, the RAA Road Safety Team have identified some key areas of improvement and further investigation that are required in the Riverland region including:

- A review of the consistency of highway speed limits, particularly on Old Sturt Highway,
- Development of a cycling and shared path strategy for the region with consideration to utilising previous rail corridors,
- Additional improvements to the Sturt Highway including duplication, and numerous intersection upgrades,
- Improvements to the b-triple freight route through the Riverland,
- Consideration of a freight bypass of Renmark and the Paringa Bridge,
- Safety improvements to Browns Well Highway,
- A reseal of Old Sturt Highway and upgrades at both intersections with Sturt Highway.

From the Member survey, key transport issues identified included:

- Difficult freight interactions on Sturt Highway and at a number of intersections with Sturt Highway,
- Concerns about the safety of b-triple freight through Loxton via Kingston Road, Bookpurnong Road and Stanitzki Road,
- Issues with cycling connectivity between towns and unsafe interactions between cyclists and freight,
- A lack of community transport services in the region.

Further to these points, RAA have listed key recommendations for a number of roads and intersections assessed in this report as a result of our traffic investigations in the region. These recommendations have been made to upgrade the roads assessed to a higher level of safety, however, RAA also understands the need to secure funding and prioritise projects based on traffic volumes and prior crash history. It is therefore understood that to implement all recommendations in this report will not be possible in a short timeframe, however should be used as a target for the region.

Notes

Note on Crash Data

Unless otherwise specified, all crash data discussed in this report refers to casualty crash data between the years 2012 and 2016 inclusive. For the purposes of this report, a casualty crash is defined as any crash that results in minor injuries, serious injuries or fatality. Property damage crashes are generally omitted from the broader analysis, however they have been reviewed at local areas that were assessed.

Not all crashes within the crash database are geocoded. Crash information shown on maps will only show geocoded crash data. Therefore, crashes without location data will not be included in the visual analysis. Non-geocoded crashes only make up a small portion of all crashes. For example, only 4 of 122 casualty crashes on Sturt Highway are non-geocoded.

Note on Traffic Volumes

Current estimated traffic volumes (AADT) quoted on state maintained roads in this report have been sourced through Data SA and these values generally refer to DPTI surveys conducted between 2014 and 2017. 2007 values refer to DPTI rural traffic volume estimate maps released in 2007.

List of Abbreviations

AADT

Average Annual Daily Traffic

ATLM

Audio Tactile Line Marking

BB

The Berri Barmera Council

CAM

Chevron Alignment Marker

DPTI

Department of Planning Transport and Infrastructure

FSI

Fatal or Serious Injury

ITLUP

The Integrated Transport and Land Use Plan

LW

The District Council of Loxton Waikerie

MI

Minor Injury

RAA

Royal Automobile Association

RP

Renmark Paringa Council

RRPM

Retroreflective Raised Pavement Markers

SI

Serious Injury

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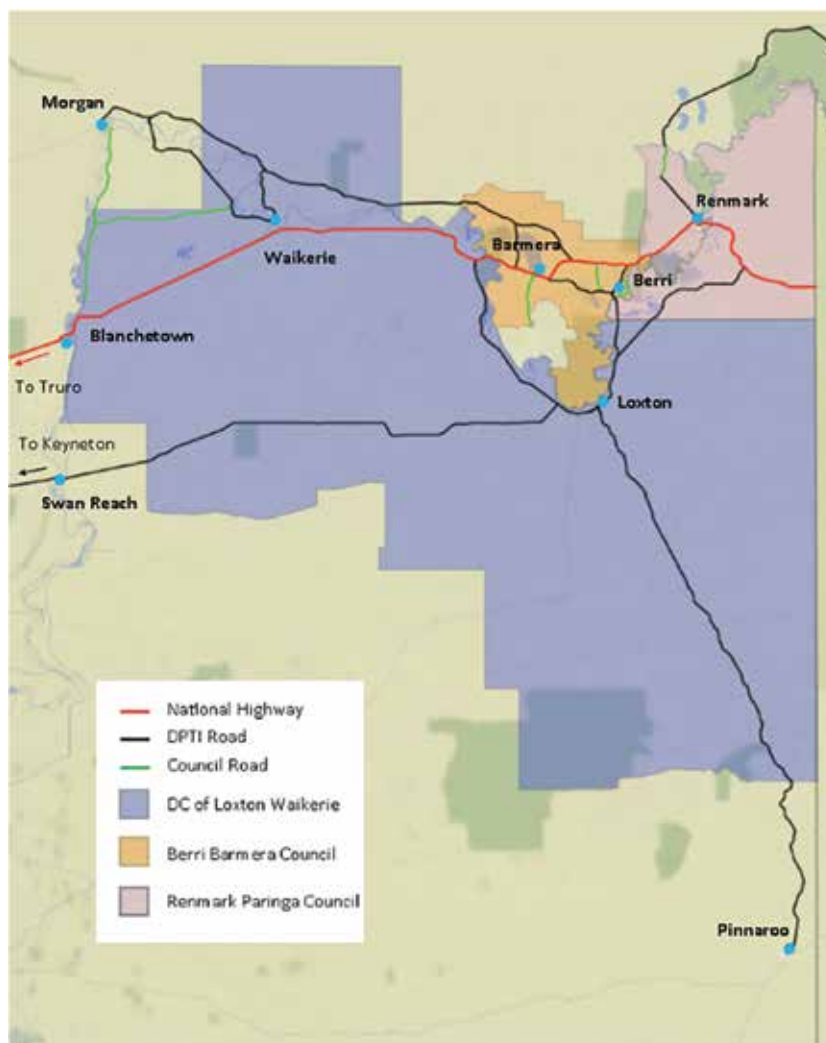
Background

The RAA Road Safety Team periodically evaluates the South Australian regional road network. This assessment of the Riverland region covered approximately two thousand kilometres assessing in excess of 30 roads and intersections over five days in late May and early June 2018. RAA have previously assessed some of the major highways in the region with an assessment of Sturt Highway last undertaken in August 2013, and other roads in the Riverland last assessed December 2014. Roads assessed in both 2014 and 2018 include Goyder Highway, Ramco Road/Cadell Valley Road, Kingston Road, Old Sturt Highway, Bookpurnong Road, Browns Well Highway, Murbko Road and Ral Ral Avenue.

RAA consulted with local authorities and stakeholders as well as sending a detailed survey to over five thousand Members residing in the Riverland region. We sought information on locations that posed safety concerns in order to assist with generating our list of traffic and road assessments to conduct over the five day assessment period.

The area assessed is shown in the map below and is defined by the combined boundaries of the Clare and Gilbert Valleys Council and the Regional Council of Goyder. For completeness of a number of highway assessments, the team travelled outside the region to towns including Keyneton, Truro, Morgan and Pinnaroo.

The roads and locations assessed are listed in **Appendix A** in the approximate order they appear in this report and a summary of crash statistics in **Appendix B**.



Map of all roads assessed as part of this regional road assessment

Recommendations

Key Recommendation	Authority
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It is recommended that the implications of different road users using current road infrastructure for different purposes are reviewed. In particular, the main highways which are shared by the freight industry, local drivers and tourists alike.

DPTI, LW,
RP, BB

Key Recommendation	Authority
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It is recommended that highway speed limits are reviewed in the region, with focus on safety and consistency of speed limits. Old Sturt Highway west of Berri was the most frequently raised road with speed limit concerns in the RAA Member Survey.

DPTI

Key Recommendation	Authority
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It is recommended that a cycling and shared path strategy is investigated for the region with consideration given to utilising previous rail corridors to provide better cycling and active transport connectivity between towns in the Riverland.

DPTI, LW,
RP, BB

Key Recommendation	Authority
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It is recommended that community transport schemes are reviewed in the region, with an aim to provide better access around the region for those using the services, and creating additional awareness of the services on offer.

DPTI, LW,
RP, BB

Sturt Highway – Key Recommendations	Authority
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General

● Review speed limit signage to ensure duplicated signs are matching in size, particularly where a speed limit is reduced.	DPTI
● Duplicate Sturt Highway between Nuriootpa and Victoria. This should be a longer term goal that is undertaken in multiple smaller stages.	DPTI
● Improve the facilities at rest stops along Sturt Highway, and clearly delineate entry points to these rest stops with a sealed deceleration lane and clear line marking.	DPTI
● Install ATLM in locations where it is currently not installed, and re-install adjacent to the edge line as per current DPTI operational instructions in other locations due to the treatment deteriorating and losing its effectiveness in many areas.	DPTI

Truro – Blanchetown

● Consider reseal east of Truro to improve surface texture.	DPTI
● Install barrier protection for trees located adjacent the highway just east of Truro.	DPTI
● Repair failing patches 2 kilometres west of Halfway House Road.	DPTI

Blanchetown – Waikerie

- At the intersection with Old Blanchetown Road: DPTI
 - Duplicate R1-2 'give way' signs.
 - Refresh line marking.
 - Conduct wet weather skid resistance testing and consider a reseal if pavement offers poor wet weather skid resistance.
 - For the 'Waikerie Bypass' – Review RAA road safety audit report and consider adopting recommendations outlined in this report to improve the overall safety in this location. DPTI, LW
-

Waikerie – Barmera

- Provide additional barrier protection for steep drop offs. As an interim measure, additional closely spaced guide posts should be installed to raise awareness of these hazards. DPTI
 - Consider installing an additional overtaking lane in each direction. DPTI, LW
 - At the intersection with Rogers Road in Cobdogla:
 - Install W2-4 'side road intersection' sign on Sturt Highway, in each direction.
 - Extend unbroken centre line applicable to northwest bound vehicles to the southeast by 100m.
 - Inspect w-beam crash barrier supports and replace/repair where necessary.
 - Consider barrier protection for significant gum trees west of McKenzie Road in Barmera. DPTI
-

Barmera – Renmark

- At the intersection with Old Sturt Highway (Barmera End): DPTI
 - Consider alternative treatments such as a roundabout that can cater to all heavy vehicle turn movements.
 - In the shorter term, refresh line marking.
 - Modify geometry of the left hand turn lane to cater for heavy vehicles turning movements without them having to turn left from the right hand lane.
 - Extend acceleration lane for vehicles turning left onto Sturt Highway towards Monash.
 - At the lane reduction, in the northeast direction, replace incorrect G9-15 'form 1 lane' sign with W4-9 'left lane ends' sign and W8-15 'merge right' plate with additional G9-73 'merge right' sign as per standard signage procedures for a lane reduction.
- At the intersection with Old Sturt Highway (Monash End): DPTI
 - Install a channelised left turn lane from Old Sturt Highway onto Sturt Highway towards Monash.
 - Install R1-2 'give way' sign, and set back holding line in the right turn lane on Sturt Highway for vehicles turning right onto Old Sturt Highway.
 - At the lane reduction, in the northeast direction, replace incorrect G9-15 'form 1 lane' sign with W4-9 'left lane ends' sign & W8-15 'merge right' plate with additional G9-73 'merge right' sign as per standard signage procedures for a lane reduction.

● For the intersection with Airport Road – Review RAA road safety audit report and consider adopting recommendations outlined in this report to improve the overall safety in this location.	DPTI, RP
● At the intersection with Twentyfirst Street:	DPTI
○ Consider installing a large roundabout. Signalisation may be another feasible option due to the 60km/h built up environment and high traffic volumes.	
○ Consider providing additional pedestrian crossing and footpath facilities for better pedestrian access.	
○ In the short term, refresh line marking.	
○ In the short term, shift northbound give way sign with consideration to installing it on the stobie pole or a more prominent position.	

Renmark – Victoria Border

● Construct an alternative route to the Paringa Bridge suitable for heavy freight, preferably as part of a wider Renmark freight bypass project.	DPTI
● Install a westbound overtaking lane between Yamba and Paringa.	DPTI
● Monitor polished and rutting surface and consider future reseal.	DPTI

Old Sturt Highway – Key Recommendations	Authority
● Reseal Old Sturt Highway in its entirety, with priority given to:	DPTI
○ The section between Berri and Barmera.	
○ The section outside Bunnings in Berri.	
● (Following reseal) Ensure RRPM's are installed correctly as specified in the DPTI Pavement Marking Manual, and line marking is accurate and refreshed.	DPTI

Browns Well Highway – Key Recommendations	Authority
● Widen road and seal shoulders to desirably achieve 3.5m lane widths and 1.0m sealed shoulders. 3.3m lanes and 0.5m shoulders should be the absolute minimum, with additional width provided around curves.	DPTI
● Consider installing at least two overtaking lanes in each direction, especially if the speed limit is returned to 110km/h.	DPTI
● Reseal the highway from 20 kilometres north of Pinnaroo, through to Pinnaroo due to significantly failing and undulating pavement.	DPTI
● Monitor other sections of road showing initial signs of failure and consider for future localised maintenance.	DPTI
● Install w-beam barrier to protect prevalent roadside drop offs.	DPTI

Kingston Road – Key Recommendations	Authority
● Should the section north of Moorook be subject to a 110km/h speed limit, install 110km/h speed limit signs for southbound traffic on Kingston Road, shortly after turning from Sturt Highway.	DPTI
● Reseal between Stott Highway and Loxton as a priority, with the remaining highway assessed and localised poor sections resealed.	DPTI
● Where possible, remove roadside hazards including steep drop offs, vegetation and stobie poles – otherwise provide barrier protection.	DPTI
● Consider ATLM due to high frequency of single vehicle crashes related to inattention.	DPTI
● Refresh edge lines around curves where the swept path of heavy vehicle has scrubbed away previous markings. Consider widening the marked lane width around curves to reduce reoccurrence.	DPTI
● Improve delineation around curves with the implementation of chevron alignment markers to indicate the curve and w-beam barrier and guide post treatments where necessary.	DPTI
● Improve the left turn from Kingston Road onto Sturt Highway. Consider extending an acceleration lane for left turners to the overtaking lane to the west of the intersection.	DPTI
● Test skid resistance of pavement on approach to Sturt Highway due to a highly polished surface approximately 40m from the intersection.	DPTI
Bookpurnong Road – Key Recommendations	Authority
● Reseal the poor sections between Edmondson Road and French Road and between Stanitzki Road and Gordon Road in the short term and consider resealing the road in its entirety.	DPTI
● Refresh faded line marking in the vicinity of Edmondson Road.	DPTI
● Install w-beam barrier to protect roadside hazards in the vicinity of Gurra Gurra Creek Bridge.	DPTI
● Consider installing an additional overtaking lane in each direction.	DPTI
● Review heavy vehicle turn paths at the Berri roundabout and consider altering geometry of the southern exit curve to better facilitate b-double access.	DPTI
Stanitzki Road – Key Recommendations	Authority
● Widen lanes on Stanitzki Road and install 1 metre wide sealed shoulders.	DPTI
● Consider installing RRPMS along the dividing line.	DPTI
● Extend the acceleration lane for vehicles turning left onto Bookpurnong Road in order to allow drivers to merge safely with Bookpurnong Road traffic.	DPTI
Goyder Highway – Key Recommendations	Authority
● Install minimum 0.5m sealed shoulders & install painted edge lines (Consider ATLM).	DPTI
● Reseal uneven section between Morgan Road and Overland Corner and sections where cracking and rutting is prominent.	DPTI
● Repair edge drop off in numerous locations along the Highway.	DPTI

Stott Highway – Key Recommendations	Authority
<ul style="list-style-type: none"> ● Review the downhill section between Keyneton and Sedan and install additional barriers and CAM's to protect drop offs and delineate all curves due to the poor crash history and high severity of potential crashes in this location. 	DPTI
<ul style="list-style-type: none"> ● Install minimum 0.5m sealed shoulders between Sedan and Loxton. 1.0m sealed shoulders are desirable. 	DPTI
Wentworth – Renmark Road – Key Recommendations	Authority
<ul style="list-style-type: none"> ● Maintenance is scheduled more frequently and resheeting is strongly considered. Sealing should be considered in the longer term. 	DPTI
Ramco Road/Cadell Valley Road – Key Recommendations	Authority
<ul style="list-style-type: none"> ● Install minimum 0.5m sealed shoulders between Medley Road & Mackintosh Road. 	DPTI
<ul style="list-style-type: none"> ● Consider installing w-beam barrier protection for vegetation, stobie poles and drop offs close to the edge of the road in various locations. 	DPTI
Morgan Road – Key Recommendations	Authority
<ul style="list-style-type: none"> ● Install 0.5 metre sealed shoulders. 	DPTI
<ul style="list-style-type: none"> ● Monitor the pavement condition and consider for future reseal programs. 	DPTI
<ul style="list-style-type: none"> ● Install barrier protection for the steep drop offs adjacent to Lake Bonney, just north of Nappers Bridge. 	DPTI
<ul style="list-style-type: none"> ● Install D4-3 'width marker' boards on Nappers Bridge to delineate the width of the carriageway over the bridge. 	DPTI
<ul style="list-style-type: none"> ● Protect the stobie pole just north of the Mcfarlanes Lane with w-beam barrier, with consideration to the impact on sight distance to the north when turning out of Mcfarlanes Lane. Additional delineation to emphasise the curve on Morgan Road is also recommended, including a local shoulder seal around the curve with a painted edge line and additional guide posts. 	DPTI
Ral Ral Avenue – Key Recommendations	Authority
<ul style="list-style-type: none"> ● Consider shoulder seal for the two kilometres between Government Road and Wentworth – Renmark Road. As a minimum shoulders need to be graded and flush with the road surface, potentially with new material added. 	DPTI
<ul style="list-style-type: none"> ● At the intersection with Thurk Street: <ul style="list-style-type: none"> ○ Refresh all line marking and ensure any previous line marking is scrubbed away to avoid confusion. ○ Remove outdated W2-1 'cross road' warning signs on both Thurk Street approaches. ○ Install W3-2 'give way sign ahead' sign on south west bound Thurk Street approach. 	DPTI/RP

Taylorville Road – Key Recommendations	Authority
<ul style="list-style-type: none"> ● Install sealed shoulders in the longer term. ● Consider w-beam barrier protection for Stobie poles. 	<p>DPTI</p> <p>DPTI</p>
Jury Road – Key Recommendations	Authority
<ul style="list-style-type: none"> ● Consider barrier protection for stobie poles. As a minimum D4-3 ‘width marker’ boards should be installed on any stobie poles within one metre of the pavement, and D4-1-2 ‘unidirectional hazard marker’ boards are installed at other stobie poles within three metres of the road. 	<p>BB</p>
<ul style="list-style-type: none"> ● Review signage on curves, & replace incorrectly installed unidirectional hazard markers with D4-6 ‘chevron alignment markers’ & set out as specified in AS 1742.2. 	<p>BB</p>
<ul style="list-style-type: none"> ● Install channelised left turn lane from Sturt Highway into Jury Road 	<p>DPTI/BB</p>
Other Recommendations	Authority
<ul style="list-style-type: none"> ● Murbko Road – <ul style="list-style-type: none"> ○ Install additional guide posts along the southern sections to delineate edges. ○ Consider installation of minimum 300mm shoulder seal. ○ Consider installation of w-beam barrier protection for drop offs. 	<p>LW</p>
<ul style="list-style-type: none"> ● Caddy Road – <ul style="list-style-type: none"> ○ Review road conditions regularly and grade with fresh material in locations where it is not possible to retrieve sufficient material from the shoulders. ○ Replace incorrectly installed D4-1-2 ‘unidirectional hazard marker’ boards with D4-6 ‘chevron alignment marker’ signs & set out as specified in Australian Standard AS 1742.2. ○ Install guide posts to delineate the carriageway at night. 	<p>BB</p>
<ul style="list-style-type: none"> ● For the school zone surrounding St Joseph’s School in Barmera – <ul style="list-style-type: none"> ○ Refresh school zone line markings in the correct locations prior to the school zone sign. ○ Install ‘zig zag’ line marking on Farmer Street prior to the school zone sign. ○ Shift signage on Joyce Street to a more prominent location. ○ Consider installation of a formal school crossing to provide a safe crossing location for students. 	<p>BB</p>
<ul style="list-style-type: none"> ● On Riverview Drive in Berri, D4-3 ‘width marker’ boards should be installed on any stobie poles within one metre of the pavement, & D4-1-2 ‘unidirectional hazard marker’ boards should be installed on other stobie poles within three metres of the road. 	<p>BB</p>

Discussion and Survey Analysis

Community Engagement

When planning a series of regional road assessments, we have found from previous experience that the most effective way to identify trouble spots is to ask those that use the roads regularly. The RAA Road Safety Team developed a survey for Members in the Riverland region, consisting of Berri Barmera Council, District Council of Loxton Waikerie and Renmark Paringa Council to best determine their access, mobility and safety concerns within the region.

During the analysis of the Member survey, and whilst determining the final roads for assessment, the RAA Road Safety Team met with a number of key stakeholders and community Members from the local Councils and Regional Development Australia. Consultation included information provided by RAA on local crash statistics, together with results from RAA's Risky Roads campaign and preliminary Riverland survey results, along with discussion on key transport issues faced by the region.

The information obtained from the survey and consultation sessions assisted RAA to develop a plan for road assessments in the region. Member commentary has been included throughout this report to provide additional insight into the primary concerns of RAA Members.

Member Sampling Frame

Over four thousand RAA Members were sent an email inviting them to participate in the confidential survey, along with a separate link forwarded to stakeholders for distribution.

A total of 618 responses were received, 395 directly from Member engagement and a further 223 through external engagement opportunities. When analysed, 601 responses were able to be cited, with 86 per cent of these respondents holding RAA Membership.

Approximately 37% of the survey respondents reside in the Loxton Waikerie council region, 29% live in the Berri Barmera council region and 22% in the Renmark Paringa council region. Only 13% of respondents live outside these three areas but they identify with the region.

The confidence interval recorded was within the acceptable range of less than $\pm 5\%$.

Confidence intervals of Member responses

	Riverland Regional Population	Sample (Members and Non Members)	Confidence Interval Accuracy at one point-in-time	Confidence Level
Online	31,507	601 (Respondents)	± 3.96	95%

The **confidence level** – accuracy at one point in time will provide how often the percentage of the population would choose a particular answer. When the confidence level is combined with the **confidence interval**, you can say that you are 95% sure that the true percentage of the population is between $\pm 3.96\%$. In addition the larger the sample size, the more you can be sure that the answers truly reflect the population.

The Region

In 2016 the Australian Bureau of Statistics reported a population for the region of 31,507 inhabitants. These correspond to Berri Barmera Council 10,545, District Council of Loxton Waikerie 11,487 and Renmark Paring Council 9,475.

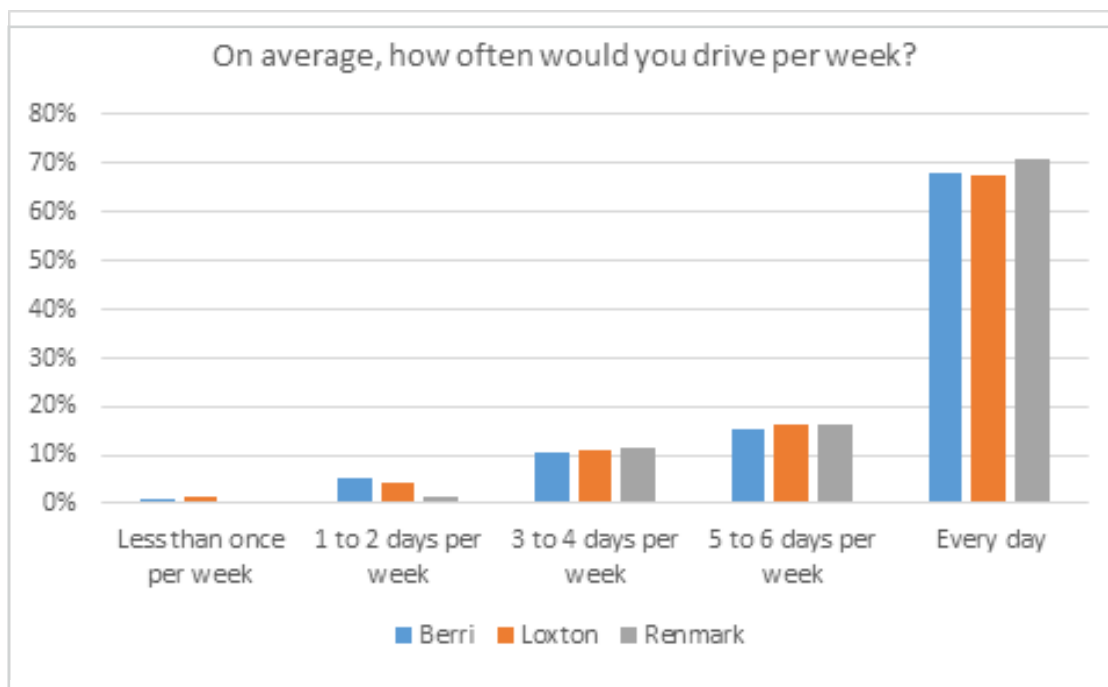
The three regions have a combined area of approximately 9,386 square kilometres, and the three Councils are responsible for the maintenance of over 1,000 kilometres of sealed roads and 2,000 kilometres of unsealed roads. In addition, there are over 600 km of sealed roads maintained by the Department of Planning, Transport and Infrastructure in the region, including Sturt Highway, a national highway with federal significance and funding allocation.

Key industries across the area include Agriculture, Forestry and Fishing; Health Care and Social Assistance; Retail Trade; and, Manufacturing. As shown on the table below, main industries have similarities in the relative importance for each local area.

MAIN INDUSTRIES IN THE RIVERLAND REGION		
Berri	Loxton	Renmark
Health Care and Social Assistance (14.1%)	Agriculture, Forestry and Fishing (23.8%)	Agriculture, Forestry and Forestry and fishing (19%)
Manufacturing (12.2%)	Health Care and Social Assistance (12.8%)	Health Care and Social Assistance (11%)
Agriculture, Forestry and Fishing (11.4%)	Retail Trade (9.6%)	Retail Trade (10.3%)
Retail Trade (11.1%)	Education and Training (7.7%)	Manufacturing (8.3%)

Mobility Profile

Cars and mobility are very important to our Members. When asked about their driving habits, residents in the Renmark Paringa district were slightly more inclined to drive 5 or more days a week (87%) compared to those living in Loxton and Berri (84% and 83% respectively).



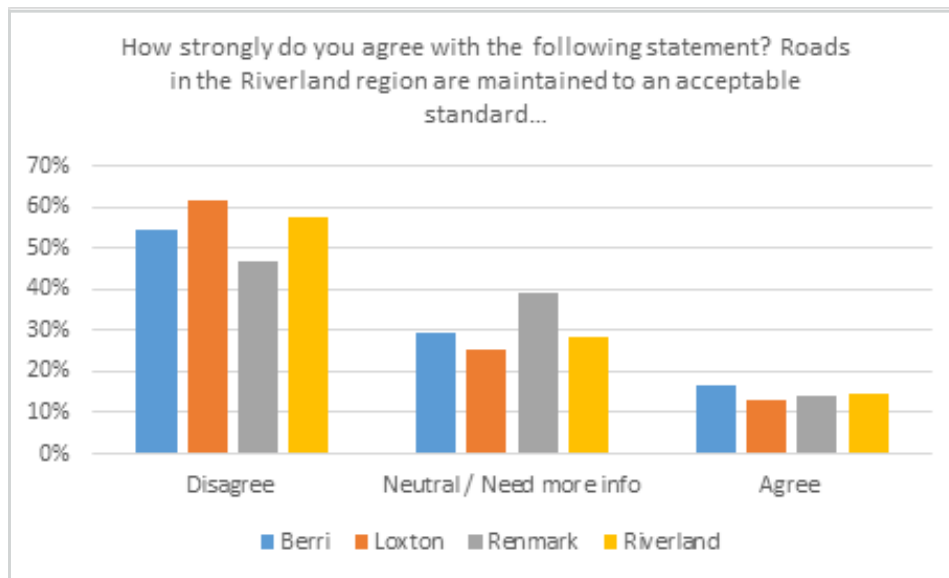
When asked about their regular travel, 90% of respondents cited regularly traveling outside of their region, with work, shopping, social events and health being the most common reasons.

Nineteen percent of respondents use alternative transport regularly, with the most common form being motorcycle (33%), bicycle (29%) and boat (14%).

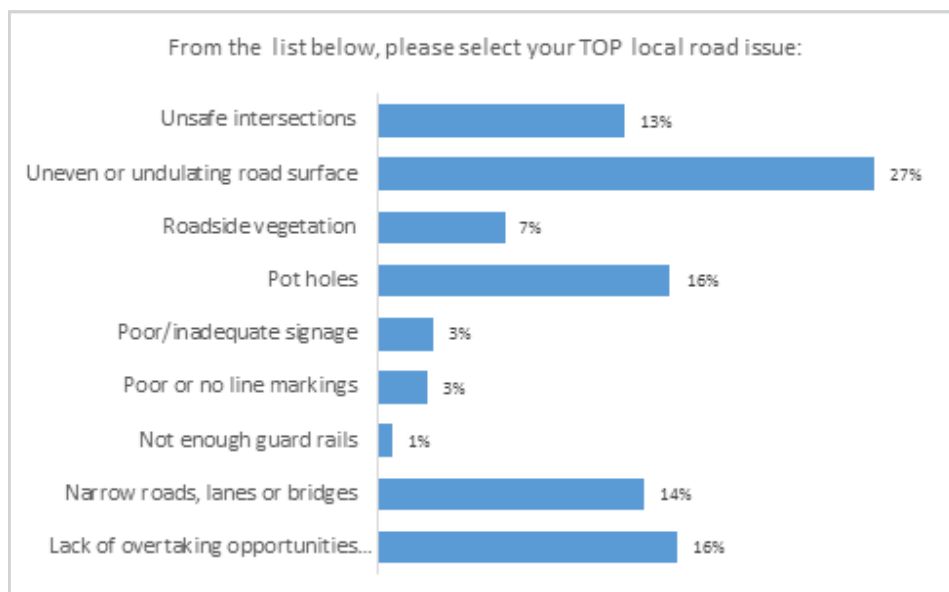
Road Maintenance

Roads are considered to be maintained to an acceptable standard in the Berri Barmera council region by 17% of respondents compared to only 14% and 13% in the Renmark Paringa and Loxton Waikerie council regions respectively.

A greater percentage of residents disagree that roads are maintained to an acceptable standard in the Loxton region (61%), compared to Berri (54%) and Renmark regions (47%).



Sturt Highway, Old Sturt Highway and Browns Well Highway are key roads in this assessment, known for their importance to the freight network, as well as their significance for local and tourist traffic.

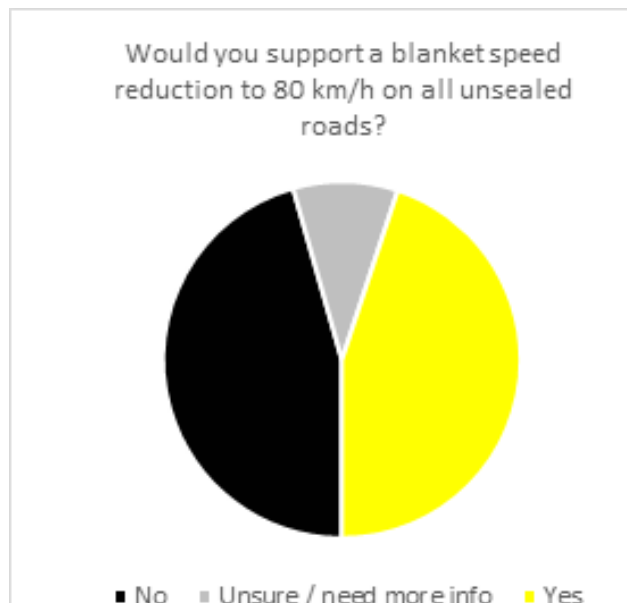
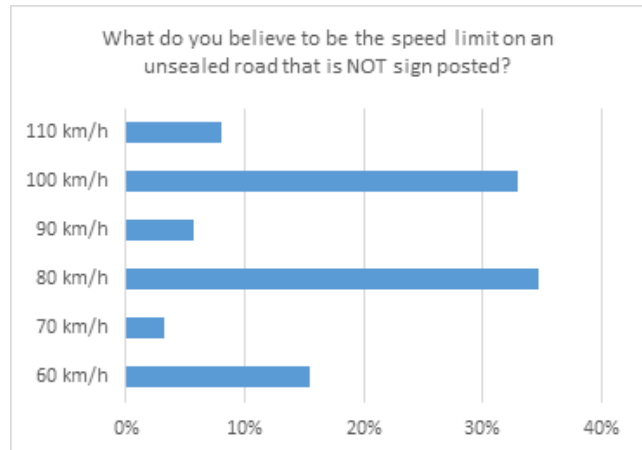


When asked to list the top three road maintenance concerns across the region, the top three were: undulating and uneven surface (27%), lack of overtaking opportunities (16%) and pot holes (16%).

Unsealed Roads

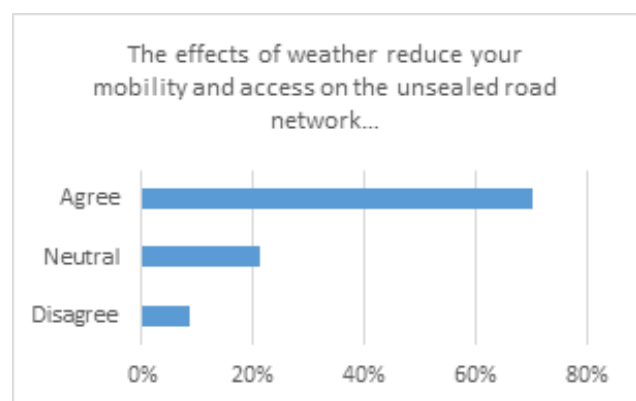
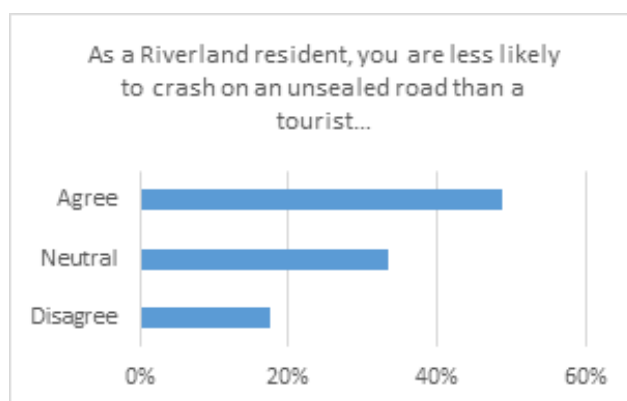
There are over two thousand kilometres of unsealed roads across the Riverland region which are a vital part of the road network, with many of these subject to a relatively high volume of seasonal traffic. Motorists driving these roads also have varying degrees of experience when driving in unpredictable road conditions.

Unsealed roads are subject to a default speed limit of 100km/h, however, 67% of respondents were not aware of this, with 8% citing a higher speed and 53% citing twenty or more kilometre per hour difference.



A subsequent question was asked to gauge support for a blanket speed reduction to 80km/h on unsealed roads. There is no clear support nor opposition in relation to this issue as 46% do not support the statement and 45% do support it, with 9% of respondents unsure about it.

When asked to compare perceived crash probabilities of local and tourist drivers on unsealed roads, 49 per cent of respondents felt they were less likely to crash on a gravel road compared to a tourist driver



Access to some unsealed roads was identified as a concern during consultations. When asked, 7 out of 10 respondents agreed that weather can reduce mobility and access on the unsealed road networks.

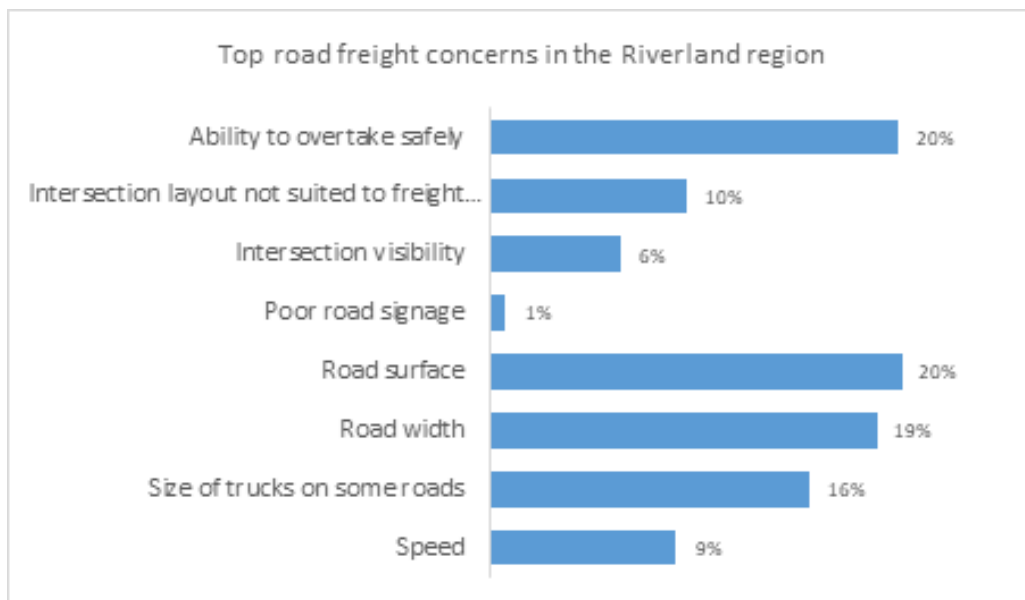
During consultation, it was raised that a number of the unsealed roads also support significant volumes of freight movement. Residents were given the opportunity to identify unsealed roads that they believed should be considered for sealing. Reasons given for roads nominated included, enhanced freight movement in a safer and more efficient manner, better access and reduction in dust cited as other key issues.

Key roads and Member comments include:

- Caddy Road, Barmera – Lots of traffic during holiday periods. People towing caravans would go to the camping areas more if the road was sealed.
- Enduro Road, Waikerie – It is the alternative route if Sturt Highway is closed for any reason.
- Wentworth – Renmark Road - Tourist and business access. Very poor condition.
- Wentworth – Renmark Road – Dust/Wet weather. High volumes of heavy traffic and becomes extremely unsafe at times as infrequently graded.

Freight transport

The most significant safety concerns when considering freight interactions were the ability to overtake safely and a poor road surface with about 20% of responses each, with road width reported in 19% of responses. This situation only varied slightly within the three Councils.



While in Berri Barmera, the three issues were top-ranked with 18% of responses, in Loxton Waikerie, ability to overtake (22%) was the highest road safety concern followed by road surface (20%) and road width (19%). In Renmark Paringa, the main priorities were the ability to overtake (19%) and size of trucks on some roads (19%), followed by road width (17%). As an important part of the national freight network and freight movement, which is critical for the local industry, the results highlight the significant concern placed by the community regarding the movement of trucks and the suitability of current road infrastructure.

In this regard, we sought insight into the b-triple freight route. While 40% of people support the b-triple route, an equal number of respondents do not support it. A high number (20%) are unsure or need more information about it. The below responses are indicative of the types of responses received:

- I believe that it is very good to have a b-triple freight route because there are too many trucks on the major roads now.
- The rail way isn't used anymore so road trains and b-triples are necessary but the roads need to be built to standard.
- The roads just require some work, it's great for the Riverland and businesses to have these trucks come through our area.

- I agree we need our freight transport system as it is an important part of keeping Australia's imports and exports running smoothly, however, roads need to be upgraded and maintained at a higher level due to the size and weight of a b-triple. If this freight route is used then wider roads with over taking lanes need to be addressed as well as lower speeds for the trucks. Some drivers don't realise that trucks doing 100 km/h can't stop as quickly as a car can. Too many car vs. truck accidents happen with tragic consequences for the car driver.
- In my opinion, b-triples should not be on ANY roads. As a past heavy vehicle driver they are just too big and heavy on the roads.
- My concern is when the roads were built they were not made for big trucks. The roads are deteriorating at a rapid rate with heavy vehicle use. The roads are ridiculously bumpy in places and worn away.
- Some marked roads are not sealed, most don't offer enough overtaking opportunities.
- The current condition of the roads on the route, the lack of safe overtaking opportunities and the fact it goes along the Browns Well Highway which had the speed limit reduced due to the poor condition instead of fixing the road. With the extra length and weight of b-triples and the potential for more wear of the roads, will they be maintained properly?
- Uneven roads, not wide enough, not enough tonnage supported, no overtaking opportunities.

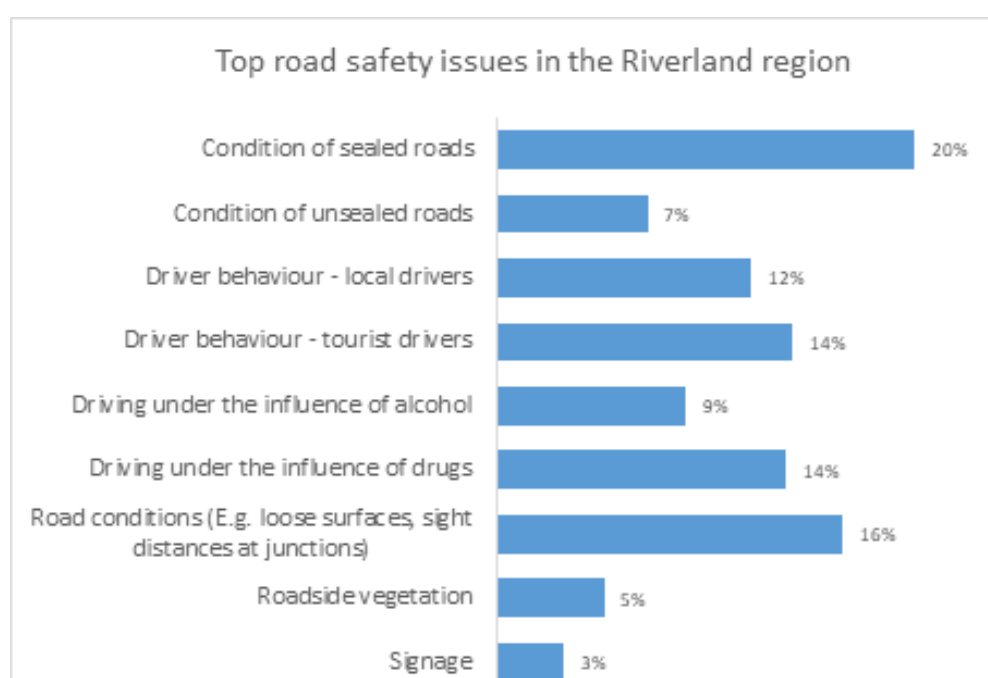
Comments were also received for areas where challenging interactions with freight vehicles were perceived. Key roads which received comments are:

- Browns Well Highway - The trucks, particularly larger trucks, frequently travel on the wrong side of the road around blind corners. The roads need to be suitable.
- Monash bypass Barmera side - The trucks just pull out in front of you. I have had heaps of near misses there.
- Old Sturt Highway & Twentyfirst Street Renmark - Many accidents involving trucks.
- Sturt Highway - Overtaking lanes not long enough for other trucks and cars to pass the road trains. Uneven/ Corrugated road.

Road Safety

Road safety is everyone's responsibility incorporating both road conditions, maintenance and human involvement. Road maintenance (Conditions of sealed roads with 20% of responses and road conditions with 16%) were the main concerns of respondents. This was followed by driver attitudes, represented by driver behaviour – tourist drivers and driving under the influence, with 14% responses for each one).

Looking at the three council regions in more detail, all three of them share the four issues highlighted as a major concern.



When asked about the road areas where unsafe interactions occurred 250 comments were received. The below Member commentary is indicative of the comments received:

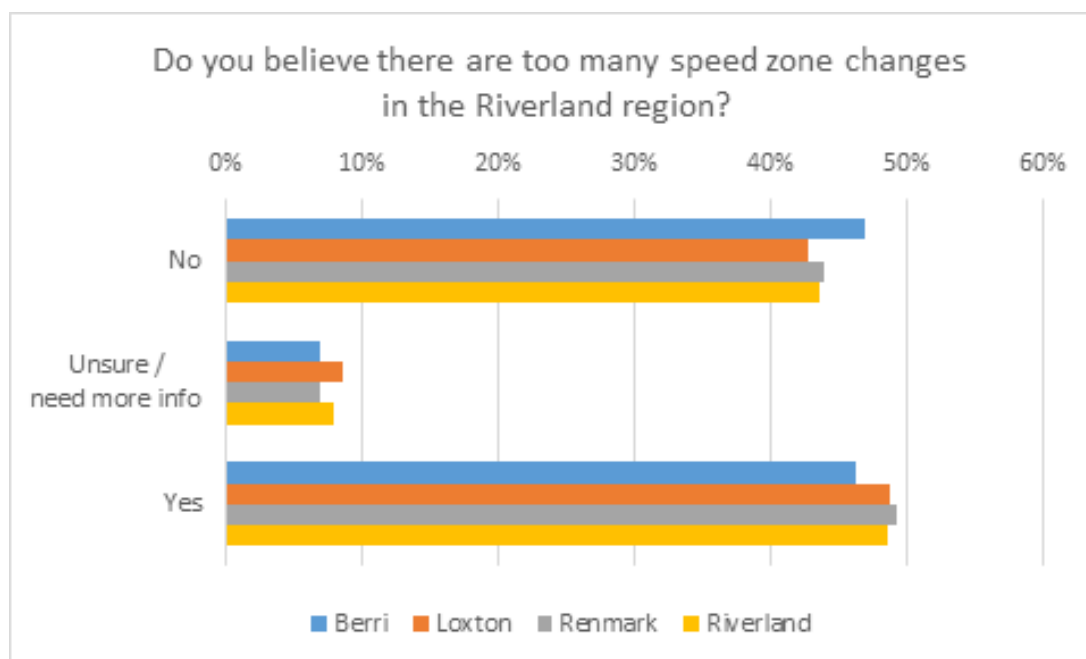
- Right hand turn off to Monash from the Sturt Hwy as you drive out of Berri towards Barmera, not far from the Berri Club. Narrow road, bottle neck, lots of traffic going both ways. Road needs to be wider and turning lanes installed in both directions.
- Any heavy vehicle road and a cyclist. Situations occur where cyclists need to go onto the shoulder to allow for safe overtaking for loaded trucks. As a truck has to slow and then try and overtake with little ability to accelerate and an approaching corner with no visibility.
- Twentyfirst Street Renmark to get onto the Highway. That's the most unsafe intersection it needs a roundabout. Lots of accidents always there including a car being hit by a truck.

These comments assist us to have a deeper view of specific road issues and interactions with diverse road users when undertaking our road investigations.

Key Recommendation	Authority
It is recommended that the implications of different road users using current road infrastructure for different purposes are reviewed. In particular, the main highways which are shared by the freight industry, local drivers and tourists alike.	DPTI, LW, RP, BB

Speed Zones

Changing speed zones can cause confusion for drivers, especially if there are multiple changes in what appears to be similar driving conditions over short stretches of road. Almost half of all respondents believe that there are too many speed zone changes in the Riverland region.



Approximately 49% of Riverland respondents think that there are too many speed zone changes in the region, with 44% of the opinion that there are not too many speed zones in the region. Across the three council regions, 47% of Berri Barmera residents disagree that there are too many speed zones, compared to 44% in Renmark Paringa and 43% in Loxton Waikerie.

Too many speed changes were identified in the comments along Sturt Highway and between Cobdogla and Berri. In total more than 250 comments were received, with the below commentary reflective of the issues raised by Members:

- Around Waikerie, and between Cobdogla to Renmark. There should be consistency where similar road conditions exist, and perhaps only 3 speed limits: 80, 100 and 110. Not 70, 80, 90, 100, 110.
- Coming in to towns - changes can go 90, 80, 60 then 50. Through Barmera to Cobdogla the changes go up and down 80, 90, 80, 90 – ridiculous.
- Highway between Berri & Barmera, 50 to 80 to 90 back to 60 to 80 to 90 keep it 90 right through.
- Browns Well Highway – poor quality road with lots of trucks and now having to slow down even more is insane.
- Sturt Highway from Cobdogla to Berri via Barmera and Glossop. Goes from 110 to 80 to 90 to 80 to 90 to 60 to 80 to 90 to 80 to 60.

Key Recommendation	Authority
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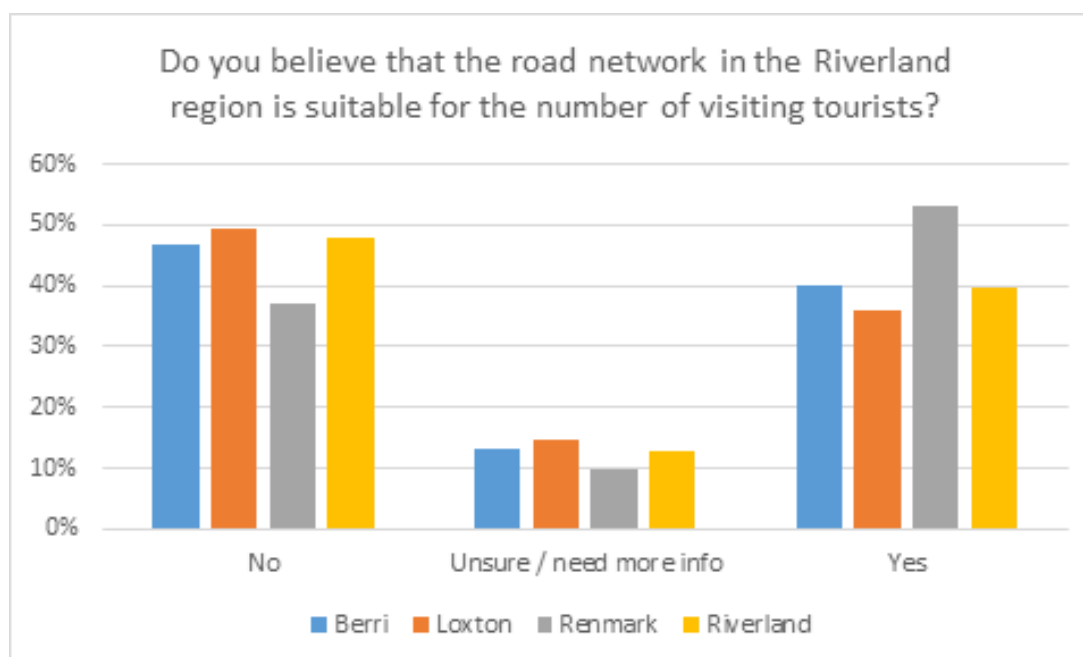
It is recommended that highway speed limits are reviewed in the region, with focus on safety and consistency of speed limits. Old Sturt Highway west of Berri was the most frequently raised road with speed limit concerns in the RAA Member Survey.

DPTI

Tourism

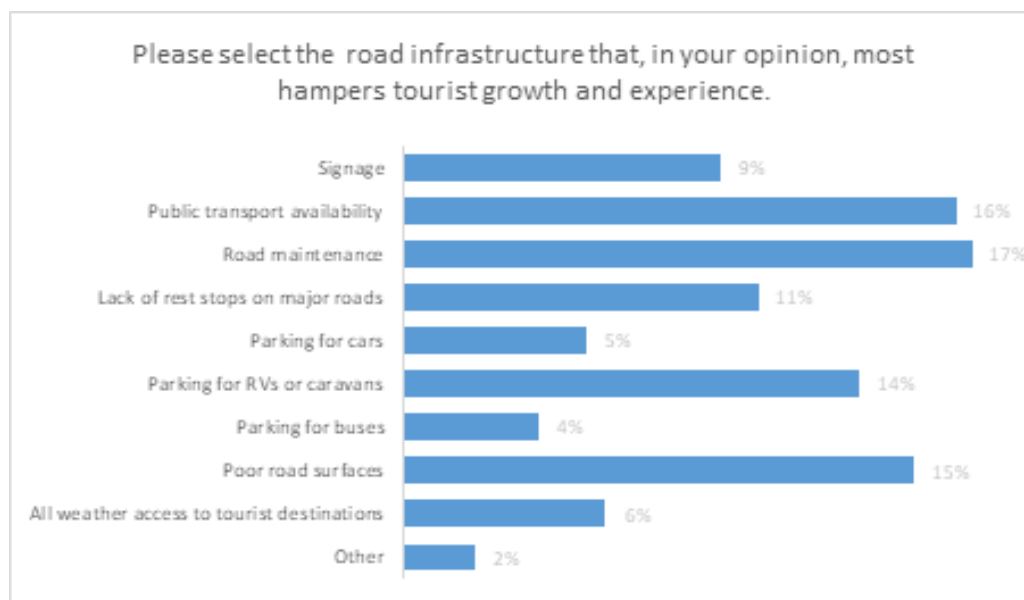
The South Australian Tourism Commission has valued the tourism in the Riverland region at a potential \$231 million by 2020, with a current (2017) value of \$173 million. The industry directly employs nine hundred people and receives 386,000 overnight visitors a year which contribute to 4.7 million domestic day trips.

About half of the respondents believe the road network in the Riverland region is not suitable for the number of visiting tourists. This sentiment varied across the three councils. 50 per cent of Loxton Waikerie residents believe the road network is not suitable for the number of visiting tourists, and 47 per cent of Berri Barmera residents are also of this opinion. In contrast, a majority of residents of Renmark Paringa (53%) believe the road network is suitable for tourists, with 37% of the opinion that it is not.



When asked about what improvements could be made in order to enhance visitor experience, road maintenance (17%) and public transport availability (16%) were the top-ranked options.

Poor road surfaces (15%) and Parking for RVs or caravans (14%) were selected third and fourth.



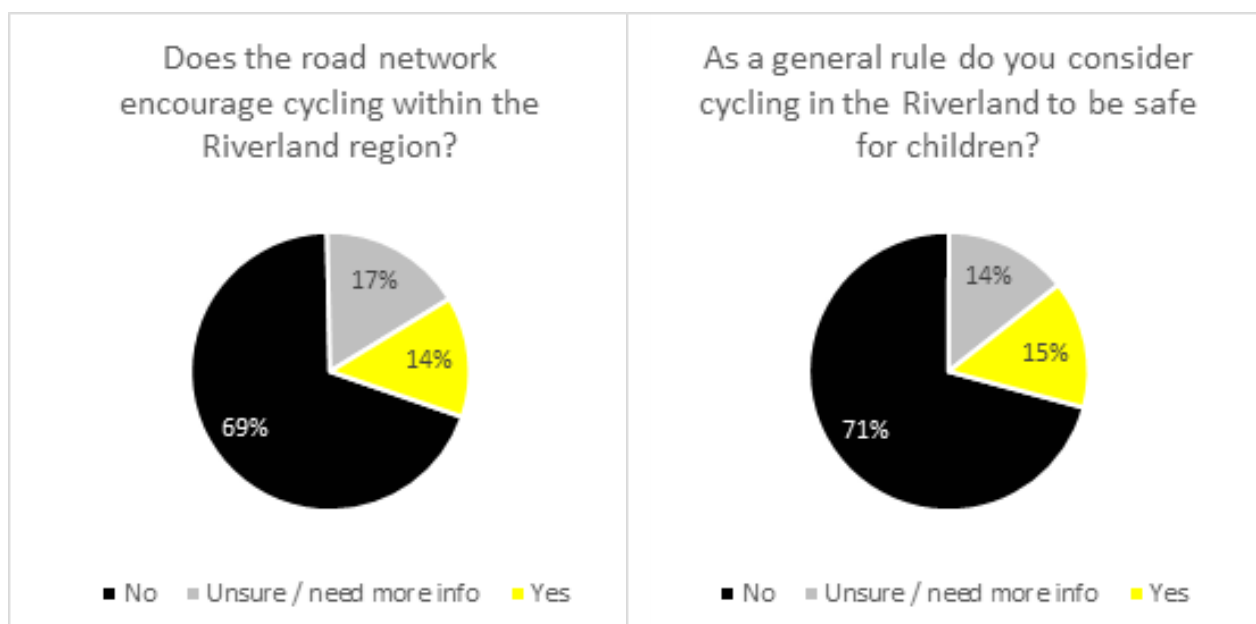
Comments received supported these trends and offered suggestions on how to improve the current situation:

- Adequate rest areas, consistency of speed limits, better signage and adequate parking for caravans. RV friendly sites and free or low cost sites for self-contained vehicles.
- Apart from better sealed roads, more tourist signage is needed.
- Better visitor information bays, more free camping sites for caravans, more overtaking or slow lanes for caravan drivers.
- Maintenance and resurfacing of the roads (not just putting bitumen and gravel over the potholes). There are sections of roads in the region that cause damage to vehicles because they are so bad.
- Overall improvement and maintenance of road system.
- Provide transport for people to get from town to town.

Cycling

Cycling was the second most commonly used alternative mode of transport in the region.

Seven out of ten respondents in the Riverland region consider the road network not encouraging for cycling. Furthermore, 71% do not consider cycling in the area to be safe for children. This indicates the potential to improve the cycling infrastructure.



Comments on cycling highlighted the importance of having dedicated bike lanes or wider roads. Some residents pointed out the danger of sharing roads with trucks as well as crossing high volume roads. Others mentioned the opportunities to develop bike lanes for tourists around the Riverland.

The following points illustrate some of the comments received in the Member survey:

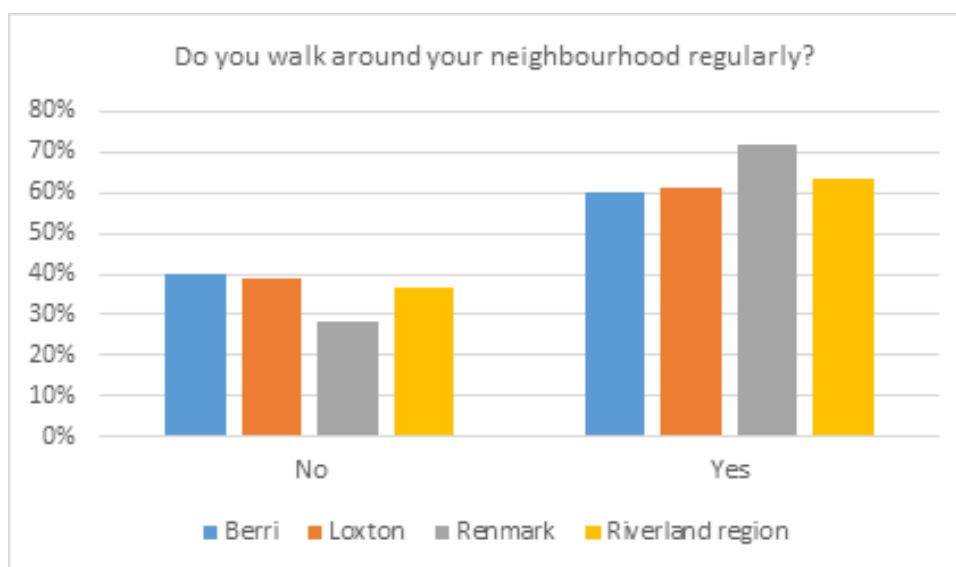
- Dedicated cycling paths. Safe crossing options to cross Sturt Highway. Even more imperative with more & larger trucks on the road.
- Cycle tracks both for everyday routes and a cycle route connecting towns for exercise and tourists.
- Separate bike paths are required. Use the old railway line as a bike track from Renmark to Berri as a tourist ride.
- More designated cycle tracks off the road to allow for cycles to travel safely.
- Trucks and cyclists should not be sharing roads, bikes need dedicated routes.
- The main roads from schools would ideally need bike lanes because when kids are cycling to and from school there is a lot of traffic taking kids in cars.
- I shudder when I see what cyclists get up to and when I have to pass them. It's a different age now and I don't think cars and cyclists should be on the same road.

Key Recommendation	Authority
It is recommended that a cycling and shared path strategy is investigated for the region with consideration given to utilising previous rail corridors to provide better cycling and active transport connectivity between towns in the Riverland.	DPTI, LW, RP, BB

Walking / Pedestrians

Motorists traditionally walk at some point in the journey so active mobility and improving people's choices provide an opportunity to look at the walking journey and how this can be enhanced.

Neighbourhood walking received a positive response from locals with 63 per cent indicating that they take regular walks around their neighbourhood. With similar attitudes across the three councils, Renmark appears to be the area where more people walk around their neighbourhood with 72% of respondents doing so.



The interest in walking aligns with the comments received where Members mostly referred to the development of new footpaths or improvement of current footpath conditions.

- Better care and maintenance of footpaths is required, trim back vegetation, footpaths that connect to each other, more doggy bags and enforcement cleaning up after dogs, drink fountains for people and dogs, more historical markers.
- Better lighting at night.
- Better maintained paths and more streetlights.
- Better road shoulders. Broken edges and prickles make it very difficult to step off the road.
- Footpaths need an even surface as I'm pushing a pram and it is difficult otherwise. Keep vegetation trimmed so it doesn't obstruct the path.
- Seal more footpaths in Berri. At least on one side of the street if not both.



37% of residents stated the streets are not easy to walk around. The main concerns were poor footpaths and lighting and having to walk on a busy road.

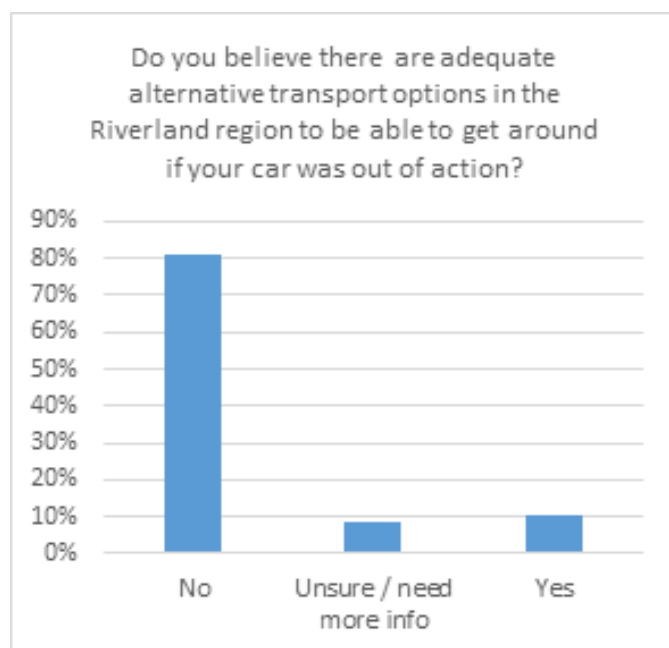
16 per cent of respondents do not consider the main streets of their town safe to cross. This ranges from 10% in Berri up to 21% in Renmark with Loxton (18%) falling in between.

Respondents provided comments on what would make the main street safer. Among the main things mentioned were the inclusion of pedestrian crossings for different road users including children, elderly and those pushing prams. The below comments are indicative of the Member responses:

- Better crossings and footpaths which allow prams (currently need to walk on the road in many spots).
- Waikerie, McCoy Street. Should be a one way street. Too difficult to cross during busy periods and parallel parking creating bottlenecks. Parking should be angle.
- Renmark needs a proper light controlled pedestrian crossing.
- Renmark crossing the highway for school kids.

Community Transport

81% of respondents believe there are not adequate alternative transport options in the Riverland region if a car is out of action. This is consistent across the three council regions with ranges between 82% and 84%.



Community transport services are available in the Riverland region for elderly and disabled residents with no other means of transport to access non-urgent medical appointments and social outings. However, only 33% of respondents know someone who had utilised the community transport services in the past 12 months and 71% of respondents were not aware of these services. Furthermore, 46% believe the services offered are not adequate to meet community need. This provides the potential to improve the community transport among the area, including enhancing awareness of these facilities.

Comments on community transport highlighted issues and proposed suggestions to improve the community transport. A selection of comments are listed below:

- Access for non-aged persons. Better service to Riverland towns from Waikerie to allow more time in the other towns.
- Booking times prevent people from using the service more. 48 hours' notice is too long. Often situations change and people need to get to doctor or appointments in shorter timeframes.
- Community transport needs to be more frequent and more localised as some people are unable to get to central pickup points.
- I work in a medical practice and assist people to access transport regularly. Some appointments are Saturday morning but there is no transport. We need to be able to access wider hours of community transport. The transport currently is dependent on volunteers, this works well most of the time however causes some restrictions. The tyranny of distance for Waikerie residents is a real problem. I believe with the increasing numbers of people coming to retire here the problem of transport will increase.
- Ideally I believe there should be public transport between the towns so that people without cars, even young people can get around and have the same opportunities as city citizens. I know of younger people who do not have a car and cannot get to interviews for jobs.
- More availability as there are an awful lot of elderly people in the community isolated as they cannot drive anymore.

Key Recommendation

It is recommended that community transport schemes are reviewed in the region, with an aim to provide better access around the region for those using the services, and creating additional awareness of the services on offer.

Authority

DPTI, LW,
RP, BB

Taxi/app-based ride-sharing

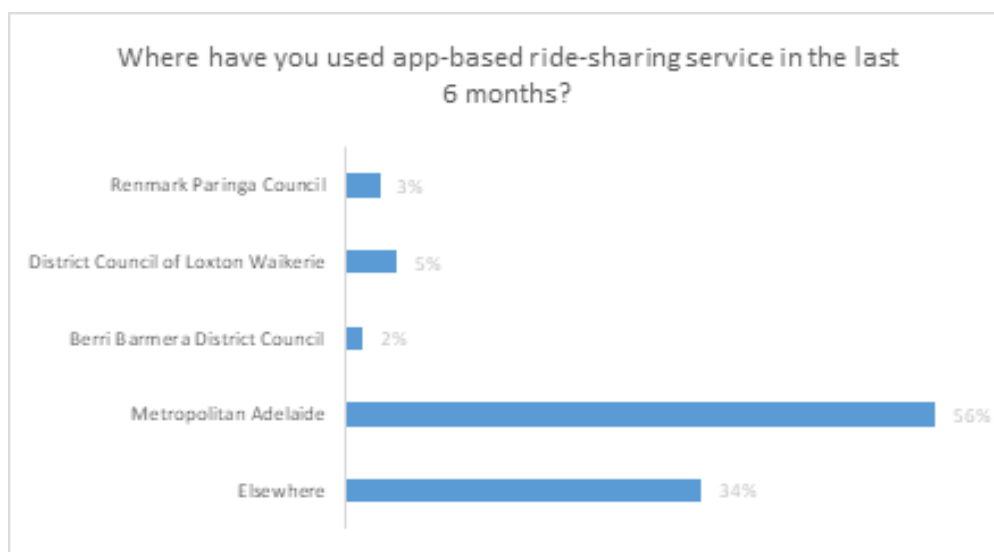
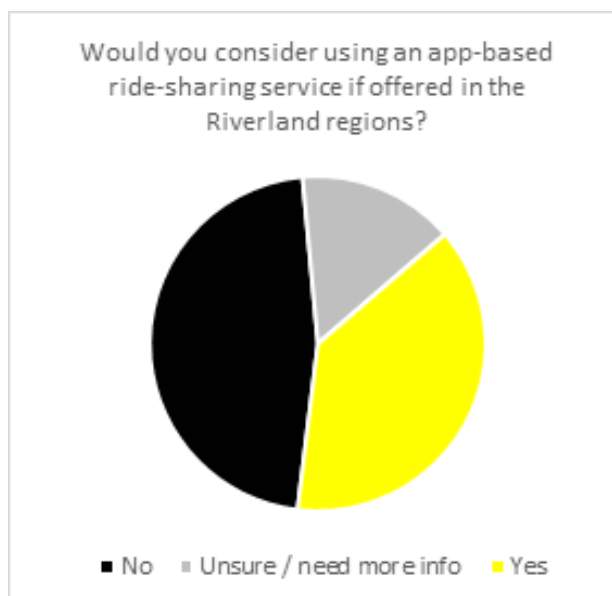
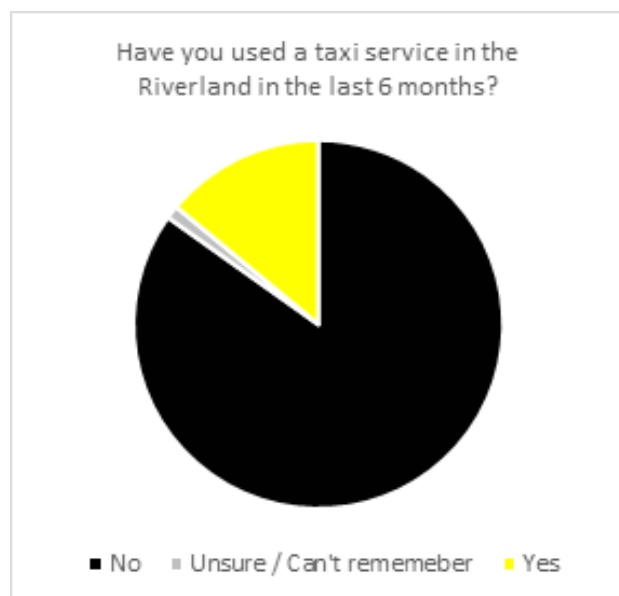
Taxi and Chauffeur cars have long operated in a market with limited disruption, the introduction of app-based ride-sharing services like Uber has changed the face of fare based services.

Uber was granted official accreditation to operate in April 2017, following the 2015 review of the taxi and chauffeur industry and subsequent 2016 legislation being introduced into State Parliament.

Regional towns often have limited alternative transport options, Taxi and Chauffeur services are limited, with little or no regular public transport. App-based ridesharing offers a localised alternative solution.

About 14% residents within the Riverland region have used a taxi service in the local area in the past six months.

Thirty eight per cent of residents would consider using an app-based ride-sharing service if offered in the Riverland region. A number of people have indicated that they have utilised a ride-sharing service in the past six months. While more than half of these occurred in Metropolitan Adelaide, about 10 per cent were used within the three councils of the Riverland region, indicating a presence of the service in the region.



Site Investigation Details and Recommendations

Sturt Highway (Truro – Victorian Border)

Sturt Highway is a national highway and key tourist and freight route between Adelaide and Sydney via the Barossa Valley, and Riverland Regions of South Australia. The section of Sturt Highway covered in this regional road assessment stretches approximately 190 kilometres between Truro and the Victorian Border. The remainder of Sturt Highway between Gawler and Truro was covered in our 2017 Barossa and Light regional road assessment.

RAA last assessed this section of Sturt Highway in 2013 and made a number of recommendations including removal of roadside hazards, installing barriers, installing additional ATLM, ensuring a minimum 1 metre shoulder seal, an upgrade of the Paringa Bridge and consideration for future duplication. It is positive to note that a number of improvements have been made since this highway assessment.

Sturt Highway was the highest mentioned road in the recent RAA Riverland Member survey, and the highest nominated Riverland Road in the recent RAA Risky Roads survey where it was nominated in the top twenty worst roads in the state by Members. In the Riverland Member survey, more than 100 Members mentioned sections of Sturt Highway or intersections with Sturt Highway as the major road improvements they thought were needed in the Riverland region.

As a result, RAA inspected not only the highway itself, but also a number of intersections or points of concern including (from east to west):

- The intersection with Old Blanchetown Road (Waikerie)
- 'Waikerie bypass' - between Ian Oliver Road and Curtis Road (Waikerie)
- The intersection with Holder Top Road and Searle Road (Waikerie)
- Both intersections with Old Sturt Highway (Barmera and Monash)
- The intersection with Airport Road (Renmark)
- The intersection with Twentyfirst Street (Renmark)
- Paringa Bridge (Paringa)

RAA conducted formal Road Safety Audits on the Sturt Highway in Waikerie (Waikerie bypass) and at the intersection with Airport Road in Renmark, with details of the findings at these and other locations detailed in the 'observations' sub-section. The full road safety audit reports have been included in Appendix C-1 and Appendix C-2 respectively.

The integrated transport and land use plan (ITLUP) produced by the state government in 2015 also outlines a number of key transport solutions for Sturt Highway with short, medium or long timeframes as specified below.

Item	Timeframe
Sturt Highway – road widening, shoulder sealing, overtaking lanes, delineation, capacity improvements and bridge and intersections upgrade, and potential further capacity improvements including duplication of sections in the longer term.	Short, Medium, Long
Sturt Highway – investigate need for potential future arterial road bypass of Renmark.	Long
Sturt Highway – arterial road bypass of Truro.	Medium
Paringa bridge replacement.	Long

RAA recognise a significant amount of work has been undertaken in recent years to improve Sturt Highway including \$24.9M funding (80/20 Federal/State government split) for:

- Bridge widening and strengthening projects,
- Barrier and intersection upgrades,
- New overtaking lanes,
- Shoulder sealing of the Berri Bypass.

In addition to this work, \$3.9M (80/20 Federal/State government split) was spent on shoulder sealing between Annadale and Waikerie. This work is welcomed by RAA and has improved overall safety on Sturt Highway.

Crash History:

122 casualty crashes occurred on Sturt Highway between 2012 and 2016 inclusive between Truro and the Victorian border. 18 of these crashes resulted in a fatality, 33 resulted in serious injuries and 71 resulted in minor injuries. The image below shows the locations of these crashes, with black circles indicating fatalities, red indicating serious injuries and orange indicating minor injuries.

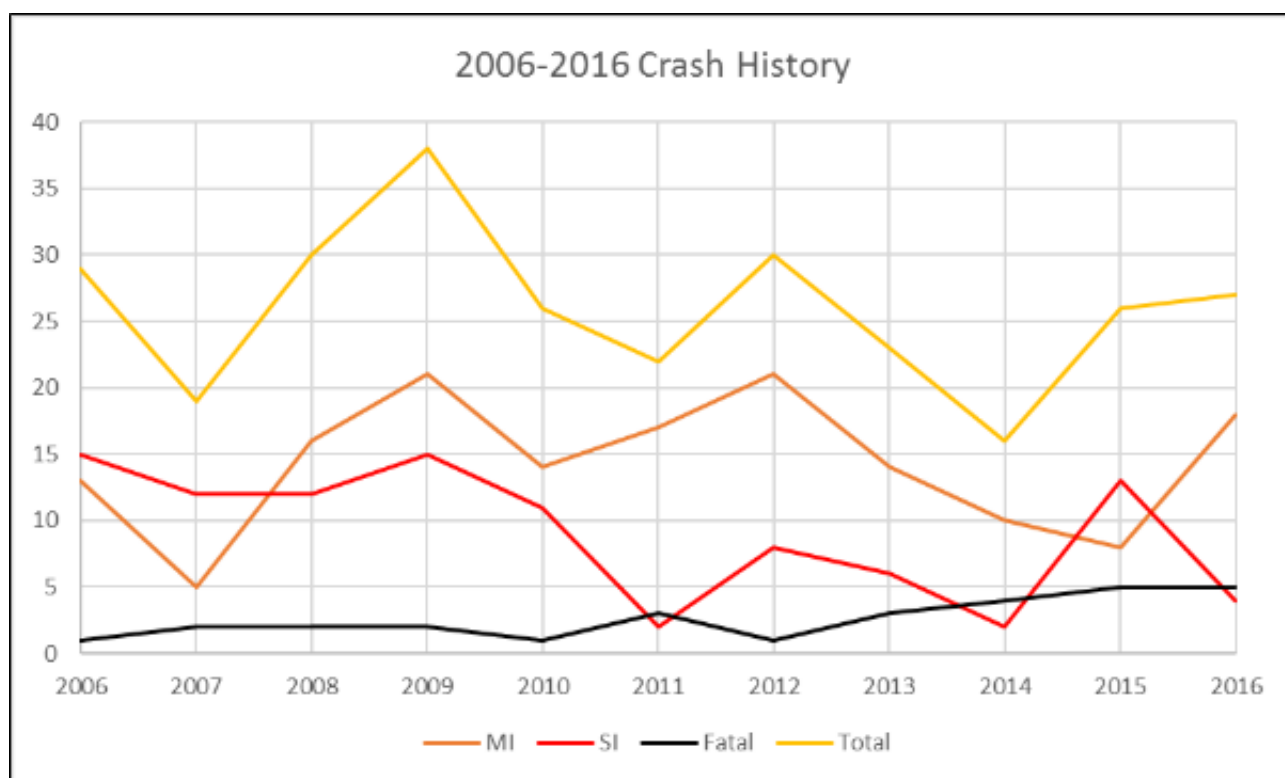


Five intersections with high or concerning crash history, based on 2012 to 2016 crash data are listed below.

Key Road	Cross Road	No. Casualty Crashes	MI	SI	Fatal
Sturt Hwy	Twentyfirst St	8	6	2	0
Sturt Hwy	Holder Top Rd	3	1	0	2
Sturt Hwy	Fowles St	3	1	1	1
Sturt Hwy	Old Blanchetown Rd	3	0	3	0
Sturt Hwy	Old Sturt Hwy (Bamera)	2	0	0	2

Most of these intersections were visited during our Riverland site investigations, with details of these assessments located in the 'observations' sub-section.

When looking at the number of casualty crashes since 2006, there have been no significant reductions in the number of annual casualty crashes along Sturt Highway. The number of fatal crashes per year is trending upwards with 2015 and 2016 the worst years in recent history with 5 fatal crashes each. Note that the figures quoted apply only to the section of Sturt Highway between Truro and the Victorian border.



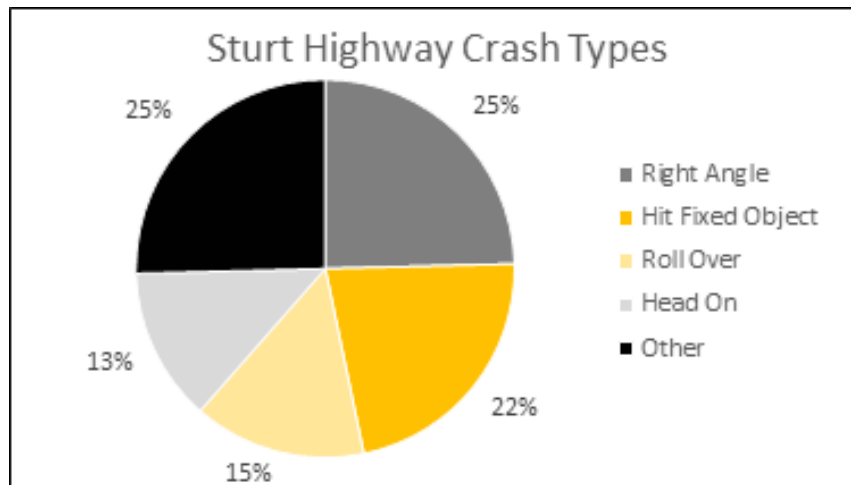
The below table summarises the different casualty crash types that have occurred on Sturt Highway, and the apparent errors leading to these crashes.

Sturt Highway Casualty Crash Types

Crash Type	No. of Crashes	Apparent Errors
Right Angle	30	Disobey – give way sign (19), disobey – stop sign (6), fail to give way (5)
Hit Fixed Object	27	Inattention (18), sick or asleep (4), D.U.I (3), vehicle fault (1), change lanes to endanger (1)
Roll Over	18	Inattention (15), D.U.I (2), vehicle Fault (1)
Head On	16	Fail to keep left (15), D.U.I (1)
Rear End	12	Inattention (6), follow too closely (5), dangerous driving (1)
Right Turn	10	Fail to stand (10)
Hit Animal	3	N/A
Hit Pedestrian	3	Inattention (3)
Side Swipe	1	Fail to give way (1)
Left Road – Out of Control	1	D.U.I (1)
Other	1	Insecure load (1)

Key points to take from this data are:

- Right angle crashes make up 25% (30) of all crashes (these are predominantly in or near towns, with 65% of these occurring in 80km/h speed limits or below)
- Single vehicle hit fixed object and roll over crashes make up over 37% (45) of all crashes (these are predominantly occurring between towns with 78% of these occurring in 110km/h speed limits)• New overtaking lanes,
- Head on crashes make up 13% (16) of all casualty crashes on Sturt Highway. Of these crashes 75% have resulted in serious injuries or a fatality, highlighting the very high severity of head on crashes.



Traffic Volumes:

Traffic volumes on Sturt Highway are generally very high with a significant percentage of commercial vehicles. Values quoted are the most recent DPTI estimates available and are generally based on 2014-2017 estimates. Some values through Renmark have been combined due to multiple short segments reported in DPTI data.

Since 2007, traffic volumes have substantially increased on most sections of the highway, with the section between Monash and through Renmark having one of the largest percentage increases over this time period.

Sturt Highway Traffic Volumes

Segment	Length	Current Estimated AADT	% Commercial Vehicles*	2007 Estimated AADT
Truro - Blanchetown	23.5km	3600	28.0% (1000)	2800
Blanchetown	2.3km	3700	23.0% (850)	2800
Blanchetown – Waikerie (Old Blanchetown Road)	36.9km	3100	27.5% (850)	2400
Old Blanchetown Road – Ian Oliver Drive (Waikerie)	3.0km	3000	31.5% (950)	2300
Ian Oliver Drive – Holmes Road (KOM)	34.4km	3300	26.0% (850)	3200
Holmes Road – Peterson Road	4.6km	3400	25.0% (850)	2700
Peterson Road – Arnold Coats Rd (Cobdogla)	6.8km	4200	19.0% (800)	3800
Arnold Coats Rd – Morgan Road	1.5km	4900	17.5% (850)	4300
Morgan Road – Nookamaka Terrace (Barmera)	2.7km	5300	17.0% (900)	5000
Nookamaka Terrace – Fowles Street	1.6km	5500	18.0% (1000)	4100
Fowles St – Old Sturt Highway	1.7km	7100	14.0% (1000)	6000
Old Sturt Highway – Goyder Highway	5.4km	2800	27.0% (750)	2300
Goyder Highway – Old Sturt Highway (Monash)	9.5km	3400	20.5% (700)	2200
Old Sturt Highway – Twentyfirst Street (Renmark)	12.7km	8000+	10.0%+ (800+)	6100
Twentyfirst Street – Eighteenth Street	1.0km	11500+	8.0%+ (800+)	8000
Eighteenth Street – Para Street	0.3km	5100	13.5% (700)	5000
Para Street – Paringa Bridge	1.9km	5700	19.5% (1100)	5000
Across Paringa Bridge (to Murtho Road)	0.8km	5600	20.0% (1120)	5000
Murtho Road – Lindsay Point Road (Paringa)	1.0km	2600	29.0% (750)	2200
Lindsay Point Road – Stanitzki Road	8.9km	2100	35.5% (750)	1700
Stanitzki Road – Victoria Border	12.5km	1900	37.0% (700)	1600

*Commercial vehicle traffic volumes may not be accurate since the implementation of the b-triple route through Loxton.

Road Widths:

Cross sectional widths along the Sturt Highway were measured at a number of locations as specified below. The lane and shoulder widths were good, with a seal width of at least 9.0m was generally maintained for the length of the Highway including wide sealed shoulders and often a relatively wide clear zone kept free of significant hazards.

Sturt Highway Widths

Location	Lane Width	Sealed Shoulder Width	Total Seal Width
East of Truro	3.5m	2.0-2.5m	11.5m
Between Blanchetown & Waikerie	3.5-3.7m	2.5m	12.2m
Between Waikerie & K.O.M	3.5-3.6m	0.9-1.1m	9.1m
Between K.O.M & Cobdogla	3.0-3.3m	1.2-1.4m	8.9m
Monash	3.5m	1.2-1.8m	10.0m
East of Paringa	3.6m	3.6m	10.2m

This road geometry is reflective of recent significant upgrades funded by the Federal and State governments.

Speed Limits:

The speed limit along the majority of the Sturt Highway are is 110km/h other than through towns (or built up town bypasses) where a reduction in speed is applied, generally to 80km/h, although 90km/h zones are also used for a number of relatively short sections of the highway where roadside development is much higher and a 110km/h would be inappropriate. The speed limit is reduced to 60km/h through Renmark and Yamba, with Yamba the only location where G9-79 'speed limit ahead' advisory signage is used to replace a traditional buffer zone on Sturt Highway, and was used for a reduction in speed from 110km/h to 60km/h. G9-79 'speed limit ahead' advisory signage was also used when approaching the 80km/h zone through Blanchetown.

In many locations, where speed limit signs were duplicated, the sizes did not match and it is recommended that these are reviewed and matching size signs installed, particularly where a speed limit is reduced.

Sturt Highway Speed Limit

Segment	Length (km)	Speed Limit (km/h)
Truro - Blanchetown	23.5	110
Blanchetown	2.3	80
Blanchetown – Waikerie (Old Blanchetown Rd)	36.9	110
Old Blanchetown Road – Ian Oliver Drive	3.3	100
Ian Oliver Drive – Holder Top Road	1.9	80
Holder Top Road – Cobdogla (Arnold Coats)	39	110
Arnold Coats Rd – Morgan Rd	1.2	80
Morgan Rd – English Rd	1.5	90
English Rd – Pike Rd	2.8	80
Pike Rd – Germein Rd	1.9	90
Germein Rd - Monash	7.1	110
Monash	1.0	80
Monash – Airport Rd (Renmark)	14	110
Airport Road – Bookmark Bridge	3.2	90
Bookmark Bridge – Twentyfirst St	0.7	80
Renmark	2.0	60
Renmark – Paringa Bridge	1.8	80
Paringa Bridge Buffer	0.5	60
Paringa Bridge	0.4	30
Paringa	1.0	60
Paringa Buffer	0.5	80
Paringa – Yamba	11.6	110
Yamba	0.8	60
Yamba – Vic Border	9.0	110

Observations:

The length of the Sturt Highway has been broken down into sections between major towns. A number of intersections and specific sections were also investigated and are discussed in their respective sections in the order they appear between Truro and the Victorian Border.

General comments

Duplication

Duplication must still be a priority for Sturt Highway in the longer term. Duplication will provide a much safer road by significantly reducing (or removing entirely) the risk of head on crashes, improving major intersections and providing a consistent, safe lane for vehicles to overtake. Duplication between Gawler and Greenock came at a cost of \$160M and was completed in 2010. To duplicate the section between Greenock and Renmark faces many challenges and could cost multiple billions of dollars depending on final alignment, factoring in town bypasses of Truro and Renmark, major bridge works and whether any interchanges will be constructed. Federal funding will ease some of the financial burden on state government, however, this project is still a lengthy one that should be progressively undertaken in multiple, smaller stages until complete.

Rest Stops

There are sufficient rest stops along the highway, however, the facilities at some of these rest stops are lacking. Along the Sturt Highway, only basic amenities such as shelters, benches and bins are provided at most rest stops with nothing else significant to note. Toilet and drinking water facilities could improve the appeal of these rest stops for drivers and encourage them to take more regular breaks. It was also noted that, although signage was in place, the actual entry point of many rest stops was not clear. It is recommended that entry points to rest stops along the highway are reviewed, with clear turn in lanes constructed and guide post delineators installed to clearly define the entry point.

Audio Tactile Line Marking

The majority of Sturt Highway between Truro and the Victorian border has been treated with ATLM, however, much of this ATLM is beginning to exceed its useful life. In many locations along the highway, the ATLM was not effective at creating substantial noise and vibration to alert a driver drifting over the edge line. It is recommended that ATLM is installed in locations where it is currently not installed, and re-installed adjacent the edge line as per current DPTI operational instructions to improve the overall effectiveness of this worthwhile safety treatment.

Truro – Blanchetown (45km)

Some minor rutting was noted when heading east out of Truro as well as a polished surface likely to reduce skid resistance in wet weather that was particularly prevalent for the one kilometre between Truro and the first overtaking lane, however, was also present in varying degrees between Truro and Blanchetown. It is recommended that a reseal is considered east of Truro to improve surface texture.

Trees line the highway approximately three metres from the edge line just east of Truro, and it is recommended that barrier protection is considered to reduce the crash severity should a vehicle run off the road in this location.



Surface polishing and trees along the edge of the Highway heading east out of Truro

Two overtaking lanes are provided in each direction, and a number of opportunities to overtake are presented outside of these overtaking lanes. Due to the high traffic volumes, however, it should not be expected to be able to overtake between overtaking lanes. A number of rest stops are also provided along this section of the highway. Rest stops only have basic facilities, with a shelter, a table, and a bin provided.

Vegetation and steep drop offs are generally protected by w-beam barrier, and chevron alignment markers (CAM's) are provided around substandard curves, with barrier protection also provided on a number of these curves.

ATLM is used for the majority of the edge lines in this section, with a short section of centre line ATLM near the bear fence lookout and rest stop. Significant sections of ATLM have deteriorated to the point that there was very little vibration or noise when driven over, reducing the overall effectiveness of the treatment. The general condition of line marking was good and the use of RRPMS and guide posts was effective to delineate the highway during inclement weather conditions.

Approximately two kilometres west of Halfway House Road, a number of previously repaired patches were deteriorating and the surface was uneven. It is recommended that this section is remediated and failing sections are repaired.

Other than near Truro, significant roadside hazards and drop offs were generally set back from the road or protected with barriers.

Blanchetown – Waikerie (40km)

The quality of the pavement for the forty kilometres of highway between Blanchetown and Waikerie was generally good, with no major defects to note. Line marking was in suitable condition and ATLM was installed for the majority of this section, however, was often significantly worn and no longer effective at providing substantial noise and vibration when traversed. Delineation measures including RRPMs and guide posts along this section were effective and the majority of side road intersections were advised of with advance warning signs.



Road geometry is good between Blanchetown and Waikerie

Two overtaking lanes are provided in each direction, and numerous long, straight sections are available to overtake, however, high traffic volumes severely limit safe overtaking opportunities.

A number of rest stops with limited facilities were provided along the length although some were lacking basic facilities such as seating and bins.

The intersections with Old Blanchetown Road and Holder Top Road were both visited, and a formal Road Safety Audit was undertaken in Waikerie near the rest stop and service station. These three locations are discussed in further detail below.

Intersection with Old Blanchetown Road (Lawrie Tce)

This intersection was not raised by Members in the region as a major issue, however, crash statistics indicated that there have been some issues here in the past.

Four crashes were reported at this location between 2012 and 2016, with three resulting in serious injuries, and one resulting in property damage only. All of these crashes involved semi-trailers. Three involved vehicles failing to give way to a semi-trailer when turning out of Lawrie Terrace, and one was a semi-trailer roll over (westbound on Sturt Highway). All four of these crashes occurred during dry, daylight conditions.

The visibility of the intersection on approach when southbound on Old Blanchetown Road is not very clear due to the geometry of the road however duplicated W3-2 'give way sign ahead' signs with '200m' supplementary plates and edge line markings emphasise the presence of the upcoming intersection. A long pavement bar treatment in the centre of the road has also been installed to emphasise the upcoming intersection.

A give way sign is installed on the pavement bar treatment in the centre of the road, however, a give way sign was not installed on the verge. Give way and continuity lines at the intersection were faded and the surface on Old Blanchetown Road was highly polished and we would expect skid resistance during wet weather to be very poor because of this.



A highly polished surface and faded line marking increase the risk at this intersection

Sight distance at the holding line was good in both directions, as was street lighting at the intersection.

It is recommended that R1-2 'give way' signage is duplicated and line marking is refreshed. It is also recommended that wet weather skid resistance testing is undertaken to determine the pavement friction, and Old Blanchetown Road is resealed at the intersection if skid testing indicates that the pavement performs poorly in wet weather.

Waikerie Bypass

Six crashes were reported between Ian Oliver Drive and Curtis Road between 2012 and 2016. All of these resulted in property damage only, with the exception of one where a cyclist fell from their bicycle and sustained minor injuries. The remaining five crashes were at the intersections of Ian Oliver Drive or Maggea Road, resulting in property damage only.



There are numerous safety hazards present on Sturt Highway through Waikerie

The issues in this location are not pertaining to a previous crash history, but a highly dangerous area where pedestrians may be crossing the highway as well as vehicles, including heavy vehicle combinations, entering and leaving the service road from different locations. Parked semi-trailers also cause issues, restricting visibility and creating further safety hazards along this stretch.

There were many comments regarding this location in the RAA Member survey, indicating that people believe the speed limit is inappropriate and the area is unsafe.

80km/h zone – Sturt Highway, Waikerie. Speed limit too fast. Poor visibility due to trucks blocking view. Pedestrians are regularly crossing main road.

The Sturt Highway just out of Waikerie really needs improvements. The speed was changed to 80km/h, however, the actual road can be confusing. There are no median strips or proper left or right turn lanes and I can see why there are so many accidents there. Also people park across the road from the shops and attempt to cross the road in dangerous conditions. Lastly, there is no structure as to parking in front of the shops, b-doubles, cars and RV's just park where they like and then have to negotiate how they are going to get back onto the highway.

RAA Members

The RAA Road Safety team conducted a formal road safety audit to identify the key issues at this location with the following recommendations coming out of the audit:

- Provide parking on the northern side of Sturt Highway for caravans and heavy vehicle combinations
- Provide dedicated pedestrian walkways
- Reduce speed limit to 60km/h from 80km/h for approximately 800m through the site, and consider an electronic variable speed limit to allow a higher limit outside of trading hours
- Install pedestrian refuges and fencing as part of a raised concrete island scheme
- Extend channelised right turn lane into Growers Wine Group
- Utilise raised concrete islands and medians as an alternative to painted islands between Ian Oliver Drive and Growers Wine Group
- Convert 90 degree parking in front of New Land bakery to 60 degree parking to reduce the number of vehicles reversing directly out onto Sturt Highway
- Underground power in certain locations to remove stobie pole hazards and create space for caravan and heavy vehicle parking
- Review street lighting if raised concrete island scheme is adopted
- Install channelised right turn lane in the median to allow westbound vehicles to safely access the northern service road
- Improve delineation with line marking and pavement bar treatments to restrict access onto Sturt Highway from Railway Terrace.

The full road safety audit report is available in **Appendix C-1**, and has been sent to the relevant road authorities for their consideration. The recommendations from this road safety audit should be strongly considered for implementation to improve the overall safety at this location. For the separate copy of the report, please email roadsafety@raa.com.au requesting this document.

Intersection with Holder Top Road

Three crashes were reported at this intersection between 2012 and 2016. Tragically, two of these were fatal with both involving vehicles exiting Holder Top Road and failing to give way to an eastbound semi-trailer. The third crash also involved a vehicle exiting Holder Top Road failing to give way to a westbound vehicle, resulting in minor injuries. All three of these crashes occurred during dry, daylight conditions.



Numerous deficiencies were identified at the intersection with Sturt Highway and Holder Top Road

This intersection is scheduled for an upgrade with \$1.5M in federal black spot funding to create a 'staggered T' intersection and will include sheltered turn lanes and upgraded street lighting. This work is expected to be completed by the middle of 2019. RAA will re-assess this intersection following completion of the upgrade.

Waikerie – Barmera (45km)

Wire rope barrier is used to protect vegetation on the north side of the Highway between Holder Top Road and Dunstone Drive, however, little protection is provided to roadside vegetation in the remainder of this section of Sturt Highway. A number of steep drop offs are unprotected through Lowbank and it is recommended that all steep drop offs are protected with w-beam or wire rope barrier along this section of Sturt Highway. Some drop offs were not even delineated with additional guide posts and these should be installed as an absolute minimum interim measure to provide additional awareness of the hazard.



Steep drop offs are prevalent between Waikerie and Barmera

Some sections of minor surface polishing and rutting were noted, however, these deficiencies were not significant at this stage but should be monitored.

A number of rest stops are located along this section, with basic facilities. Two overtaking lanes are provided in each direction, however, fewer overtaking opportunities are present due to the winding nature of the highway between Waikerie and Barmera. Installation of an additional overtaking lane in each direction should be considered for this section.

Line marking and RRPMS were generally in good condition along the length and ATLM was installed, however, in some locations ATLM was deteriorated and ineffective.

Rows of significant gum trees were situated close to the edges of the highway south of McKenzie Road in Barmera, and it is recommended that barrier protection is provided to prevent errant vehicles colliding with these trees.

Intersection with Rogers Road (Cobdogla)

Rogers Road is situated just north west of Cobdogla and intersects Sturt Highway at the beginning of a 110km/h zone shortly after the Cobdogla 80km/h zone. There is a significant straight section of highway that northwest bound vehicles regularly use to overtake.

Rogers Road is hardly visible from Sturt Highway in both directions due to the w-beam barrier used to protect the drop off where the highway has been built up.



Eastbound, approximately 50m from Rogers Road on the left

Sight distance from Rogers Road in each direction was acceptable, however would desirably be better to the west. Due to road geometry this is not possible and very low traffic volumes on Rogers Road means major changes to the layout are not viable.

It was mentioned that near misses regularly occur when a vehicle is turning left from Rogers Road and a northeast bound vehicle begins overtaking creating a risk of a head on collision.

No advance warning signage was noted prior to this intersection, and it is recommended that W2-4 'side road intersection' signage is installed in both directions to indicate the presence of this intersection as it is not clearly visible on approach.

It is also recommended that the unbroken centre line applicable to northwest bound vehicles is extended to the southeast by a length of 100 metres to reduce the risk of vehicles making risky overtaking manoeuvres in close proximity to the side road intersection.

It was also noted that w-beam guard rail supports at the intersection were in poor condition and their crashworthiness may be compromised. It is recommended that crash barriers are inspected and repairs made where required due to the high severity of a crash involving an errant vehicle driving over the edge.



W-beam barrier supports at this intersection are in poor condition

Barmera – Renmark (28km)

Two overtaking lanes are provided in each direction between Barmera and Renmark, providing (on average) nine kilometres between each overtaking lane in the same direction which is acceptable for current traffic conditions. A number of rest stops with limited facilities are also provided.

At each intersection with Old Sturt Highway, traffic turning left to continue on Sturt Highway is required to merge when the left turn acceleration lane ends. Currently, G9-15 'form 1 lane' signage is incorrectly installed in both of these locations at the taper and this should be replaced with W4-9 'left lane ends' signage with a W8-15 'merge right' plate attached and a G9-73 'merge right' sign.

It is also recommended that the left turn acceleration lane is extended at the Barmera intersection as it is very short and doesn't allow sufficient distance to accelerate and safely merge with through traffic.



Incorrect 'form1 lane' sign at the Barmera intersection with old sturt highway



Incorrect 'form1 lane' sign at the Monash intersection with old sturt highway

Audio tactile line marking is continued in parts, however, is often deteriorated and ineffective as previously noted along other sections of Sturt Highway. RRPMS and guide posts installed along the highway are effective at providing further delineation, particularly at night and during adverse weather conditions.

Intersection with Old Sturt Highway (Barmera End)

Seven crashes were reported at this intersection between 2012 and 2016. Six of these involved vehicles turning right from Sturt Highway and failing to give way to southeast bound vehicles continuing straight. One of these six crashes resulted in a fatality, two resulted in minor injuries, and the remaining three resulted in property damage only. There was another fatal crash involving a vehicle turning left from Sturt Highway onto Old Sturt Highway failing to give way to the southeast bound through traffic, which in this case was a semi-trailer. All crashes occurred during daylight in dry weather.

The crash diagram below highlights the common crash type occurring at this intersection, vehicles turning right from Sturt Highway failing to give way to southeast bound vehicles. For further detail on crash diagrams, please refer to **Appendix D**.



The common crash type is very clear on a crash diagram

There are a significant number of safety treatments in place on Sturt Highway (southwest bound) to advise motorists of the upcoming intersection, including:

- Large duplicated W3-2 'prepare to give way' signs with yellow backing board and 400m distance plates,
- Large green directional board, indicating upcoming intersection and layout,
- Large yellow 'prepare to give way' sign with yellow backing board, red 'prepare to give way' message and 200m distance plate,
- Large duplicated 'give way' signs with yellow backing board at the intersection,
- Pavement bar treatment on approach to the intersection,
- Multiple hazard boards opposite the 'T', and
- Street lighting, RRPMS and guide posts to further delineate the intersection at night and in adverse weather.

Most of these safety treatments have been in place for many years, with additional treatments being gradually installed over time.



There are many safety treatments installed at this intersection, however there is still a crash problem.

As seen in the above image, line marking is also substantially deteriorated as heavy vehicle combinations turn left from the right hand lane (as pictured below). This is due to the tight geometry of the left hand turn lane.



Long vehicles turn left from the right hand lane

It is recommended that alternative treatments are considered for this intersection such as a roundabout that can cater to all heavy vehicle turn movements. The current layout has a poor crash history and there are few additional safety treatments available to cost-effectively improve safety.

It is also recommended that, in the shorter term, line marking is refreshed, and the geometry of the left hand turn lane is altered to cater for heavy vehicle turning movements without them having to turn left from the right hand lane.

Intersection with Old Sturt Highway (Monash End)

Five reported crashes occurred at this intersection between 2012 and 2016. Two resulted in minor injuries and three resulted in property damage only. Two crashes involved southwest bound vehicles turning right onto Sturt Highway failing to give way to northeast bound vehicles. One of these crashes resulted in minor injuries and the other resulted in property damage only. A motorcyclist sustained minor injuries when travelling northwest, falling off their bike. Two crashes also involved drivers hitting trees, with both of these crashes resulting in property damage only. All of these crashes occurred during daylight in dry weather conditions.

This intersection was also of concern to regular users, with it raised a number of times in the RAA Member survey.

Waiting for vehicles to rear end other vehicles attempting to turn left onto the bypass when travelling Berri to Renmark and turning left towards Monash. There is no slip lane provided and most motorists incorrectly turn onto the painted island shoulder and interfere with others turning correctly at the junction proper. Vehicles constantly experience heavy braking and skidding trying to avoid vehicles turning left in this 110km/h area. There needs to be more solid delineation of the turn left markings for trucks turning right from Renmark towards Monash who routinely turn significantly earlier and routinely compromise the vehicles arriving from the Monash end turning right towards Berri at what is currently not a Stop sign. The accumulation of rubber across this intersection clearly demonstrates the paths of these vehicles.

RAA Members

There were two primary issues identified at this intersection following our site inspection. Firstly, some northeast bound vehicles turning left towards Monash would turn left from the through lane whilst others would utilise the painted island to make a safer left turn.



Turning left from the through lane is dangerous at this location

With a 110km/h speed limit in place, it is not desirable for vehicles to be turning left from the through lane at a major intersection and it is strongly recommended that a channelised left turn lane is installed to enable all vehicles to make a safer left turn.

The second issue relates to southwest bound vehicles, especially long heavy vehicle combinations, turning right towards Monash. The swept path of these vehicles often encroaches substantially into the right turn lane onto Old Sturt Highway. It is recommended that R1-2 'give way' signs are installed and a give way holding line is installed in the right turn lane that is set back from the intersection to allow for the swept path of long turning vehicles.

Intersection with Airport Road (Renmark)

When asked where Members had seen unsafe or challenging freight interactions, over twenty Members mentioned this intersection, making it one of the highest mentioned in this category.

Airport Road Renmark, high volume of heavy vehicles entering and exiting, would suggest a large roundabout.

Airport road and Renmark Avenue which has three major freight companies using this intersection and no merging or turning lane.

RAA Members

There were not any casualty crashes reported at this intersection between 2012 and 2016, however, freight movements into and out of Airport Road have significantly increased in recent years. There are growing safety concerns from the community regarding safe interactions with freight at this location, especially turning right out of Airport Road.



Freight movements from Airport Road into Sturt Highway are particularly concerning

The RAA Road Safety team conducted a formal road safety audit to identify the key issues at this intersection with the following recommendations coming out of the audit:

- Construct a roundabout or consider other treatments suitable for a high volume of freight. Consideration needs to be given to future freight demand and design for b-triple combinations to prevent this intersection becoming a future freight bottleneck
- Extend 90km/h zone by 300m to the west
- In the short term, or if a roundabout is not adopted, widening of Airport Road at the apron to cater for swept paths of heavy vehicles turning right into Airport Road
- Refresh line marking and schedule refreshing on a more regular basis
- Undertake skid testing on Sturt Highway and undertake pavement remediation should this show poor skid resistance properties in the wet
- Consider a reseal of Airport Road in the vicinity of the intersection.

The full road safety audit report is available in **Appendix C-2**, and has been sent to the relevant road authorities for their consideration. Recommendations from this audit should be strongly considered for implementation to improve the overall safety at this location. For the separate copy of the report, please email roadsafety@raa.com.au requesting this document.

Intersection with Twentyfirst Street (Renmark)

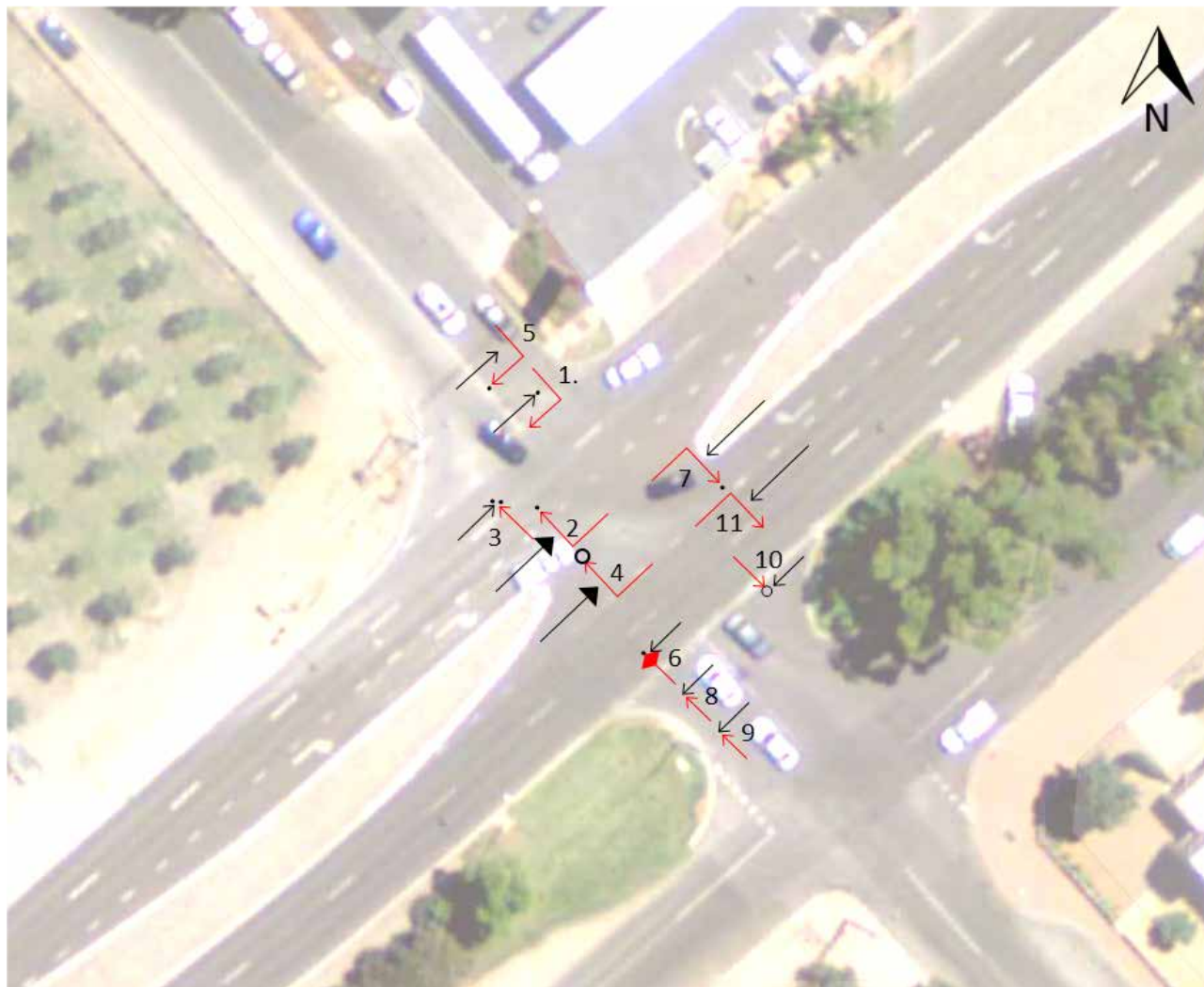
The intersection with Sturt Highway and Twentyfirst Street appeared multiple times in the RAA Riverland Member survey, with comments generally regarding the safety of the intersection, with suggestions that a roundabout or signalisation would significantly improve the intersection.

The intersection of Twentyfirst Street and the Sturt Highway in Renmark is ridiculous and dangerous. Multiple accidents happen there every year and a lot of locals avoid this intersection where possible.

RAA Members

Eleven crashes were reported at this intersection between 2012 and 2016. Eight of these were casualty crashes – the highest number of casualty crashes at an intersection in the region. Of these eight casualty crashes, six resulted in minor injuries and two resulted in serious injuries. A mix of vehicle types involved included passenger vehicles, semi-trailers and cyclists.

The crash diagram below depicts the many different crash types occurring at this intersection. For further information or crash diagrams, please refer to **Appendix D**.



Crash diagram for the intersection of Twenty First Street and sturt highway (Renmark Avenue)

Four crashes involved right turns from Sturt Highway onto Twentyfirst Street with three of these causing injury. Five crashes involved vehicles continuing across Sturt Highway and failing to give way to traffic. Three of these resulted in injuries. Two crashes involved southeast bound vehicles turning right onto Sturt Highway failing to give way to northeast bound vehicles.

Following a site inspection, a number of safety hazards were noted, including:

- A crest west of the intersection, partially obscuring sight distance to the west
- Pedestrians frequently crossing just west of the intersection
- Partially concealed give way sign on Twentyfirst Street in the northbound direction
- High traffic volumes on Sturt Highway (Renmark Avenue) creating few right turn opportunities from Twentyfirst Street.

The below image, looking north towards the intersection highlights the partially concealed give way sign. It is also noted that line marking at the intersection is very faded, and the line of stobie poles and trees gives an incorrect visual cue that Twentyfirst Street is the continuing Road. An inattentive driver, or one unfamiliar with the intersection could easily mistake Twentyfirst Street for the continuing Road due to these issues.



The north bound give way sign is particularly concealed by the stable pole and the upcoming give way condition is unclear

Multiple vehicles were witnessed making risky right turns from Twentyfirst Street onto Sturt Highway due to the high volumes of traffic. Long wait times were also experienced turning right during peak periods. This section of Sturt Highway has in excess of 10,000 AADT.

It is recommended that a large roundabout is considered to improve safety at this location, similar to that installed at the Eighteenth Street intersection in 2012. Due to space constraints with adjacent development and the potential requirement for land acquisition, signalisation is another option to improve safety at this location. Due to the 60km/h built up environment, it is not unreasonable to expect traffic signals at an intersection with traffic volumes this high and a poor crash history, however, would be the first signalised intersection in the Riverland.

The pedestrian ramps and refuge to the east of the intersection was recognised, but during the time of our assessment this was not utilised by any pedestrians, whilst many pedestrians were witnessed crossing at the intersection, or just west of the intersection. It is important that pedestrian facilities and desire lines are considered in any future upgrades of the intersection.

In the short term, it is recommended that line marking is refreshed and the northbound give way sign is shifted, with consideration given to enlarging and installing on the stobie pole.

Renmark – Victoria Border (25km)

Sturt Highway is generally satisfactory between Renmark and Paringa with the exception of the Paringa Bridge. This bridge was opened in 1927 and designed for very different traffic conditions than those that are faced today. The bridge is controlled by traffic signals that operate when the bridge is required to open and allow large vessels to pass up to two times per day at approximately 9:30 and 14:30. The lanes are very narrow and this restricts the type of vehicle that can pass over the bridge. A 30km/h speed limit has been imposed across the bridge due to the narrow carriageway, however, compliance with this speed limit amongst light vehicles appeared relatively low.



Heavy freight has minimal clearance crossing the Paringa Bridge

It is recommended that an alternative bridge is constructed that is not restrictive to freight in the region. This should be strongly considered as part of a wider project to construct a freight bypass of Renmark, leaving the Paringa bridge as a landmark and important piece of historical infrastructure open to light traffic between Renmark and Paringa.

Total AADT decreases significantly east of Paringa to less than 2000 vehicles per day, however the volume of commercial traffic is greater than 35%, and at similar levels to the remainder of Sturt Highway.

The pavement condition between Paringa and the Victorian border is generally good however some areas are exhibiting signs of polishing and rutting and this should be monitored, particularly when continuing east out of Paringa.

One overtaking lane is provided in the eastbound direction between Paringa and Yamba, and it is recommended that an additional overtaking lane is installed in the westbound direction between Yamba and Paringa.

Key Recommendations:

Sturt Highway – Key Recommendations	Authority
General	
● Review speed limit signage to ensure duplicated signs are matching in size, particularly where a speed limit is reduced.	DPTI
● Duplicate Sturt Highway between Nuriootpa and Victoria. This should be a longer term goal that is undertaken in multiple smaller stages.	DPTI
● Improve the facilities at rest stops along Sturt Highway, and clearly delineate entry points to these rest stops with a sealed deceleration lane and clear line marking.	DPTI
● Install ATLM in locations where it is currently not installed, and re-install adjacent to the edge line as per current DPTI operational instructions in other locations due to the treatment deteriorating and losing its effectiveness in many areas.	DPTI
Truro – Blanchetown	
● Consider reseal east of Truro to improve surface texture.	DPTI
● Install barrier protection for trees located adjacent the highway just east of Truro.	DPTI
● Repair failing patches 2 kilometres west of Halfway House Road.	DPTI
Blanchetown – Waikerie	
● At the intersection with Old Blanchetown Road: <ul style="list-style-type: none"> ○ Duplicate R1-2 ‘give way’ signs. ○ Refresh line marking. ○ Conduct wet weather skid resistance testing and consider a reseal if pavement offers poor wet weather skid resistance. 	DPTI
● For the ‘Waikerie Bypass’ – Review RAA road safety audit report and consider adopting recommendations outlined in this report to improve the overall safety in this location.	DPTI, LW
Waikerie – Barmera	
● Provide additional barrier protection for steep drop offs. As an interim measure, additional closely spaced guide posts should be installed to raise awareness of these hazards.	DPTI
● Consider installing an additional overtaking lane in each direction.	DPTI
● At the intersection with Rogers Road in Cobdogla: <ul style="list-style-type: none"> ○ Install W2-4 ‘side road intersection’ sign on Sturt Highway, in each direction. ○ Extend unbroken centre line applicable to northwest bound vehicles to the southeast by 100m. ○ Inspect w-beam crash barrier supports and replace/repair where necessary. 	DPTI
● Consider barrier protection for significant gum trees west of McKenzie Road in Barmera.	DPTI

Barmera – Renmark

- At the intersection with Old Sturt Highway (Barmera End):
 - Consider alternative treatments such as a roundabout that can cater to all heavy vehicle turn movements.
 - In the shorter term, refresh line marking.
 - Modify geometry of the left hand turn lane to cater for heavy vehicles turning movements without them having to turn left from the right hand lane. DPTI
 - Extend acceleration lane for vehicles turning left onto Sturt Highway towards Monash.
 - At the lane reduction, in the northeast direction, replace incorrect G9-15 'form 1 lane' sign with W4-9 'left lane ends' sign and W8-15 'merge right' plate with additional G9-73 'merge right' sign as per standard signage procedures for a lane reduction.

- At the intersection with Old Sturt Highway (Monash End):
 - Install a channelised left turn lane from Old Sturt Highway onto Sturt Highway towards Monash.
 - Install R1-2 'give way' sign, and set back holding line in the right turn lane on Sturt Highway for vehicles turning right onto Old Sturt Highway. DPTI
 - At the lane reduction, in the northeast direction, replace incorrect G9-15 'form 1 lane' sign with W4-9 'left lane ends' sign and W8-15 'merge right' plate with additional G9-73 'merge right' sign as per standard signage procedures for a lane reduction.

- For the intersection with Airport Road – Review RAA road safety audit report and consider adopting recommendations outlined in this report to improve the overall safety in this location. DPTI, RP

- At the intersection with Twentyfirst Street:
 - Consider installing a large roundabout. Signalisation may be another feasible option due to the 60km/h built up environment and high traffic volumes.
 - Consider providing additional pedestrian crossing and footpath facilities for better pedestrian access. DPTI
 - In the short term, refresh line marking.
 - In the short term, shift northbound give way sign with consideration to installing it on the stobie pole or a more prominent position.

Renmark – Victoria Border

- Construct an alternative route to the Paringa Bridge suitable for heavy freight, preferably as part of a wider Renmark freight bypass project. DPTI
- Install a westbound overtaking lane between Yamba and Paringa. DPTI
- Monitor polished and rutting surface and consider future reseal. DPTI

Old Sturt Highway

Old Sturt Highway is the former alignment of Sturt Highway through Berri and Glossop and is approximately 17 kilometres in length compared to the 15 kilometre stretch of Sturt Highway through Monash. Old Sturt Highway is controlled and maintained by DPTI.

Old Sturt Highway was mentioned over 50 times in the RAA Member Survey when asked what major transport improvements were needed in the Riverland. Complaints generally related to the poor condition of the pavement between Berri and Barmera, and the two major intersections with Sturt Highway. Both of these intersections were also mentioned by a significant number of Members when asked which intersections they had experienced or noticed challenging freight interactions, and were assessed individually by RAA as discussed in the Sturt Highway section of this report.

The below comments are reflective of the general issues raised by RAA Members.

The Old Sturt Highway from the intersection of the Sturt Highway at Barmera to the town of Berri would have to be the worst corrugated road in Australia due to the use by heavy vehicles.

Old Sturt Highway between Barmera and Berri is undulating and needs repairs. The intersections at either end of the Monash bypass road are unsafe.

RAA Members

RAA previously assessed the Old Sturt Highway in our 2014 Riverland Road Assessment with a number of recommendations made at the time including resealing in sections and further assessment and replacing of faded signage and line marking.

Crash History:

A total of twenty nine casualty crashes occurred on Old Sturt Highway or at intersections with Old Sturt Highway between 2012 and 2016, with twenty four of these resulting in minor injuries, three resulting in serious injuries, and two resulting in fatality. Both fatal crashes occurred at the intersection with Sturt Highway just east of Barmera.

Old Sturt Highway Casualty Crash Types

Crash Type	No. of Crashes	Apparent Errors
Rear End	8	Inattention (7), Follow Too Closely (1)
Right Angle	8	Disobey - Give Way Sign (5), Fail to Give Way (3)
Roll Over	4	D.U.I (2), Inattention (2)
Hit Fixed Object	3	Inattention (3)
Right Turn	3	Fail to Stand (3)
Side Swipe	2	Fail to Give Way (2)
Hit Pedestrian	1	Inattention (1)

Traffic Volumes:

Traffic volumes on Old Sturt Highway are high and primarily consist of light vehicles travelling through and between towns. Whilst Old Sturt Highway is b-double approved, these vehicles generally use Sturt Highway if intending to travel through the region.

Old Sturt Highway Traffic Volumes

Segment	Length (km)	AADT	% Commercial Vehicles	2007 Estimated AADT
Sturt Highway - Winkle Road	6.75	4400	8.5 (370)	4500
Winkle Road - Jury Road	3.24	5500	7.5 (400)	5200
Jury Road - Crawford Terrace	1.46	8800	4 (370)	8800
Crawford Terrace – Coombe St (Worman St)	0.53	6000	5.5 (340)	6000
Coombe St – Jellett Road (Worman St)	1.06	3800	9.5 (360)	3800
Jellett Road – Hoskin Road	1.67	5300	7.5 (390)	5300
Hoskin Road – Sturt Highway	2.07	5400	7 (370)	4600

Road Widths:

The geometry of Old Sturt Highway was generally very good with sufficient lane widths and wide sealed shoulders provided for the entirety.

Old Sturt Highway Widths

Location	Lane Width	Sealed Shoulder Width	Total Seal Width
West of Glossop	3.3-3.5m	2.3m	11.4m

Speed Limits:

Due to significant levels of adjacent development, the majority of Old Sturt Highway is subject to an 80km/h or 90km/h speed limit with reductions to 60km/h through Glossop and Berri. When approaching Berri from the northeast, speed limit ahead signage is used to advise of the upcoming speed reduction, with large duplicated G9-79 '60 ahead' signs.

Segment	Length (km)	Speed Limit (km/h)
Sturt Highway - Glossop	4.2	90
Glossop	1.4	60
Glossop – Lower Winkle Rd	1.3	80
Lower Winkle Rd – Berri	1.5	90
Berri Buffer	0.7	80
Berri	3.9	60
Berri - Sturt Highway	1.9	110

Observations:

The primary issue identified on Old Sturt Highway was the very poor condition of the pavement along the majority of the highway, with the section between Berri and Barmera the of particular concern. Significant corrugations, heavy polishing, rutting and undulations were noted along the length of the road and it is recommended that Old Sturt Highway is resealed in its entirety.



The surface Of old sturt highway is generally in very poor condition

It was also noted that RRPM's were incorrectly installed between Glossop and Sturt Highway. White markers were used incorrectly for edge and dividing lines. According to the DPTI Pavement Marking Manual, red markers should be used for left hand edge lines, and yellow markers for dividing lines. It is recommended that, on completion of a reseal it is ensured that correct RRPM's are used for consistency. This was the only location in the Riverland where this issue was noted, and RRPMs installed in other locations assessed were installed correctly.

The section of Old Sturt Highway near Bunnings in Berri was noted to be in extremely poor condition. The surface was highly polished and line marking was very faded. This section should be resealed as a priority due to the high number of turning movements at this location and presumably very poor skid resistance, especially in wet weather. Line marking must be refreshed to delineate traffic movements in this area.



Slippery pavement and very faded line marking is a major safety concern near Bunnings in Berri

Key Recommendations:

Old Sturt Highway – Key Recommendations	Authority
<ul style="list-style-type: none"> ● Reseal Old Sturt Highway in its entirety, with priority given to: <ul style="list-style-type: none"> ○ The section between Berri and Barmera. ○ The section outside Bunnings in Berri. 	DPTI
<ul style="list-style-type: none"> ● (Following reseal) Ensure RRPM's are installed correctly as specified in the DPTI Pavement Marking Manual, and line marking is accurate and refreshed. 	DPTI

Browns Well Highway

Browns Well Highway is just over 100 kilometres long and extends between Loxton in the north and Pinnaroo in the south. The only major settlement between Loxton and Pinnaroo is Paruna, located just off the Highway, thirty kilometres south of Loxton.

Browns Well Highway was one of the most frequently mentioned roads in the RAA Member survey. Members were mostly concerned with the poor condition of the road and were apprehensive of the safety of this major freight route, particularly in relation to b-triple access considering the narrow width.

The below comments are typical of the concerns raised by RAA Members.

The big trucks on the Loxton to Pinnaroo road cut the corners sometimes and you can nearly get run off the road. I have learnt to slow right down passing a truck. Plus also you can come unstuck going off the bitumen road onto the loose gravel.

The Browns Well Highway is very dangerous. I travel this road three times a week and it frightens me. I'm more worried about hitting a truck than hitting a kangaroo as the road is too narrow. Meeting a road train on a bend at night is frightening.

RAA Members

Very few Members raised concerns about the recently changed 100km/h speed limit as most were concerned with dangerous freight interactions and the poor condition. In 2017, as part of a number of speed limit changes across South Australia, the State Government at the time reduced the speed limit to 100km/h from 110km/h which has gained significant media and political attention. RAA are concerned that this speed limit reduction may have been implemented in place of routine maintenance and other safety improvements to safer facilitate freight access. The newly elected government intends to return the speed limit to 110km/h, however, RAA would only support this increase if numerous upgrades and safety improvements as detailed in this report were undertaken prior.

RAA previously assessed Browns Well Highway in our 2014 Riverland assessment with some recommendations including shoulder sealing, installation of ATLM and protection for roadside drop offs.

The Integrated Transport and Land Use Plan (ITLUP) indicates that road widening and shoulder sealing is a long term (15+ years) priority for Browns Well Highway, however, this should be given a much higher priority.

Crash History:

Between 2012 and 2016, eleven casualty crashes occurred on Browns Well Highway between Loxton and Pinnaroo. All eleven of these crashes resulted in minor injuries, with the most common crash type being a roll over in seven out of eleven casualty crashes.

Browns Well Highway Casualty Crash Types

Crash Type	No. of Crashes	Apparent Errors
Roll Over	7	Inattention (4), sick or asleep (1), overtake without due care (1), N/A (1)
Hit Animal	1	N/A
Side Swipe	1	Overtake without due care (1)
Left Road – Out of Control	1	Inattention (1)
Rear End	1	Follow too closely (1)

Based on crash data and survey responses, there were no particular locations or intersections that appear to be of particular concern, however, due to the curving nature of this highway, most crashes appear to have occurred on bends.

Traffic Volumes:

Browns Well Highway Traffic Volumes

Segment	Length (km)	AADT	% Commercial Vehicles	2007 Estimated AADT
Paruna Road - Drummond Avenue (Loxton)	0.75	500	24 (120)	2900
Drummond Avenue – Cameron Highway	31.78	370	23 (85)	360
Cameron Highway – Lovers Lane	68.27	310	27.5 (85)	290
Lovers Lane - Devon Terrace (Pinnaroo)	0.54	460	28.5 (130)	360

Road Widths:

Lane widths were typically around 3.2 metres in each direction with no edge lines or sealed shoulders, however, there was a short section with narrower lane widths and edge lines. This section extended for approximately ten kilometres between Durdin Road and The Dog Fence Road, and the painted edge lines created a very narrow sealed shoulder, and narrower lanes with no actual change in the total width of the road seal.



Ten kilometres of edge lines narrowed the lanes however delineated the road edges

Browns Well Highway Widths

Location	Lane Width	Sealed Shoulder Width	Total Seal Width
South of Loxton	3.2-3.4m	N/A	6.6m
South of Priest Rd	3.0-3.1	0.2-0.3	6.6m
North of Korah Bore Rd	3.2	N/A	6.4m

Speed Limits:

Browns Well Highway is governed by a 100km/h speed limit between Loxton and Pinnaroo, with a number of reminder signs in place along the highway. The speed limit in Loxton is 60km/h and Pinnaroo is 50km/h. 80km/h buffer zones are in place on approach to Loxton and Pinnaroo.

The speed limit was changed from 110km/h in 2017 for safety reasons. RAA believe that when the safety improvements identified in this report are implemented, the speed limit can safely be returned to 110km/h.

Observations:

Browns Well Highway is relatively narrow, particularly considering it is approved for b-triple and road train use. The highway has been marginally widened around some curves, however, this treatment has not been applied to all curves, and we question whether the swept path of long vehicles would remain entirely within the lane around these curves. RAA recommend that as a minimum, lanes are widened to 3.3 metres in each direction, and widened additionally around curves. A minimum 0.5 metre shoulder seal should be provided as traffic volumes are low. Preferably, geometry would be improved to 3.5 metre wide lanes and 1 metre wide sealed shoulders, and if any increase in freight movements is expected, this should be the minimum road geometry.



Interactions with oncoming freight were close

No overtaking lanes are provided between Loxton and Pinnaroo, and considering the AADT of less than 400 vehicles per day, it could be argued that they are not necessary at this point in time. Overtaking opportunities do present themselves, however, due to vertical and horizontal alignment, rarely is there sufficient distance to safely overtake a vehicle as large as a 36.5m double road train, nor is the road wide enough.

If the speed limit is returned to 110km/h, RAA recommend installing at least two overtaking lanes in each direction due to the potential of a 20km/h speed disparity between road trains (limited to 90km/h on most SA roads) and other traffic. Overtaking lanes should still be strongly considered if the speed limit remains at 100km/h.

From approximately twenty kilometres north of Pinnaroo through to Pinnaroo, the road was in very poor condition with significant undulations prevalent throughout this section. Road trains witnessed driving on this section appeared to do so very slowly and cautiously due to the undulations. It is recommended that this section is resealed to improve safety and efficiency. There are a number of other areas along the highway that were uneven and showing initial signs of failure, and these should be monitored and considered for future remediation.



The highway is deteriorating near Pinnaroo

Vegetation and other fixed objects were generally kept clear of the verge, however, there were numerous steep drop offs, including some around curves that were not protected by barriers. It is recommended that w-beam barrier is installed to protect errant vehicles from these drop offs.



Steep and unprotected drop offs are common occurrences

Key Recommendations:

Browns Well Highway – Key Recommendations	Authority
<ul style="list-style-type: none"> ● Widen road and seal shoulders to desirably achieve 3.5m lane widths and 1.0m sealed shoulders. 3.3m lanes and 0.5m shoulders should be the absolute minimum, with additional width provided around curves. 	DPTI
<ul style="list-style-type: none"> ● Consider installing at least two overtaking lanes in each direction, especially if the speed limit is returned to 110km/h. 	DPTI
<ul style="list-style-type: none"> ● Reseal the highway from 20 kilometres north of Pinnaroo, through to Pinnaroo due to significantly failing and undulating pavement. 	DPTI
<ul style="list-style-type: none"> ● Monitor other sections of road showing initial signs of failure and consider for future localised maintenance. 	DPTI
<ul style="list-style-type: none"> ● Install w-beam barrier to protect prevalent roadside drop offs. 	DPTI

Kingston Road

Kingston Road is approximately 35 kilometres long and connects Loxton to the Sturt Highway via Moorook and runs adjacent to the Murray River. Kingston Road forms part of the 35m b-triple (PBS level 3A) freight network, with b-triples travelling through the region to or from Victoria required to use Kingston Road rather than Sturt Highway due to constraints on Sturt Highway itself.

Numerous concerns were raised in the RAA Member survey regarding the suitability of Kingston Road for b-triple freight. It was suggested that the road is undulating and in poor condition, and that overtaking lanes would prevent frustration along this route. Shoulder sealing has been completed in the past few years.

The below comments are reflective of the general issues raised by RAA Members.

Kingston Road between Moorook and Loxton - undulating and surface breakup.

B-double trucks along Kingston-Loxton Road - that road isn't a highway like Sturt Highway is. They are dangerous on Kingston-Loxton Rd

RAA Members

The section between Stott Highway and Loxton was also recently raised by a Member in RAA's Report A Road system, with the poor surface of the road the primary concern.

RAA last assessed Kingston Road in 2014 and recommended road widening, shoulder sealing and installing edge lines, which have all been implemented since this assessment.

Crash History:

Between 2012 and 2016, nine casualty crashes occurred on Kingston Road. Three of these resulted in serious injuries and the remaining six resulted in minor injuries. Single vehicle hit fixed object or rollover crashes due to inattention are the primary casualty crash type occurring on this road, making up over 50% of casualty crashes on Kingston Road.

Kingston Road Casualty Crash Types

Crash Type	No. of Crashes	Apparent Errors
Hit Fixed Object	7	Inattention (4), D.U.I (2), N/A (1)
Right Angle	1	Disobey – give way sign (1)
Rollover	1	Inattention (1)

The 4.5 kilometre section between Stott Highway and Karoonda Highway has the poorest record, with three SI crashes and one MI crash in this section. Four property damage crashes were also reported on this section of Kingston Road

Traffic Volumes:

The majority of Kingston Road carries almost 1000 vehicles per day, and this increases between Karoonda Highway and the Loxton town centre. The DPTI figures quoted were estimated between 2014 and 2016, however, and may not reflect the current traffic volumes now that b-triple freight is permitted to use the route.

Kingston Road Traffic Volumes

Segment	Length (km)	AADT	% Commercial Vehicles	2007 Estimated AADT
Sturt Highway – Stott Highway	30.7	950	16.0% (150)	850
Stott Highway – Karoonda Highway	3.8	1200	15.0% (180)	750
Karoonda Hwy into Loxton	2.0	2200	15.0% (330)	2100
Loxton	1.6	5400	15.5 (840)	5400

Road Widths:

The total seal width was generally good considering recent shoulder sealing has improved the road geometry since our last assessment. Lane and shoulder widths remained fairly consistent along the length of Kingston Road.

Kingston Road Widths

Location	Lane Width	Sealed Shoulder Width	Total Seal Width
North of Moorook	3.1-3.3m	1.2-1.3m	8.9m

Speed Limits:

When entering Kingston Road from Sturt Highway, no speed limit was posted, indicating that the 100km/h default limit applies between Sturt Highway and Moorook. Information on government mapping websites, however, indicates that the speed limit is 110km/h. It is recommended that, if 110km/h is in fact the actual speed limit for this section, 110km/h signage is installed for southbound traffic just south of Sturt Highway.

South of Moorook, the speed limit is 110km/h with 80km/h buffer zones used to reduce the speed to 60km/h through Moorook and Loxton. RAA understands that the District Council of Loxton Waikerie have applied to have the Moorook speed limit changed from 50km/h to 60km/h.

Segment	Length (km)	Speed Limit (km/h)
Sturt Highway – Moorook	5.0	100/110
Moorook Buffer	1.0	80
Moorook	0.8	60
Moorook Buffer	0.6	80
Moorook – Loxton	29.0	110
Loxton Buffer	0.7	80
Loxton		60

Observations:

A number of issues were identified when driving Kingston Road from Sturt Highway to Loxton. Firstly, the condition of the road varied and in some sections was very poor, particularly south of Moorook, however, some sections of Kingston Road were in serviceable condition. The section between Stott Highway and Loxton was particularly poor with significant undulations prevalent. It is recommended that this section is resealed as a priority, and the remainder of the road is assessed with the poor sections resealed.

Numerous roadside hazards were present, including steep unprotected drop offs, vegetation in close proximity to the road, and stobie poles. It is recommended that these hazards are removed where possible, or w-beam or wire rope barrier protection installed to prevent collisions with these hazards due to the high frequency of 'hit fixed object' crashes on the road. ATLM should be considered as well to alert drivers that may be drifting off the road before a crash occurs.

There were also a number of locations, particularly on the approach to, and around curves, where the edge line was faded due to scrubbing of heavy vehicle tyres as lane widths around curves are too narrow to accommodate the swept path of long vehicles without traversing the edge line. It is recommended that edge lines are repainted, however, closer to the edges around curves such that they are not scrubbed away as rapidly.



Faded edge lines around curves were common, as were steep drop offs and fixed objects in the clear zone as pictured

Delineation around curves could also be improved with the implementation of chevron alignment markers to indicate the curve, along with w-beam barrier and guide post treatments where necessary.

Intersection with Sturt Highway

Issues were also noted at the intersection with Sturt Highway, primarily pertaining to the left turn from Kingston Road onto Sturt Highway. Previously, a left turn slip lane was provided with a very short acceleration lane which is not a supported treatment by RAA. The slip lane and acceleration lane were eventually removed by installing a painted island, straightening up the approach to Sturt Highway.

Currently, rather than following the edge line, most vehicles drive significantly across the painted island and enter Sturt Highway twenty metres or more to the west of the intersection. This is generally unexpected by westbound traffic on Sturt Highway, and has potential to cause confusion due to vehicles entering the road from an unexpected location. Drivers making this manoeuvre also increase the angle at which they are required to look in order to see oncoming traffic, increasing the chances that they enter the road without giving way to approaching traffic. Heavy vehicles turning left at this intersection understandably need to utilise the painted island due to the large turning radius and swept path.

It is recommended that a left turn slip lane is reinstated, however, only if the acceleration lane is extended such that heavy vehicles have sufficient space to accelerate up to speed before entering the westbound traffic stream. As there is an overtaking lane one kilometre to the west, this could be extended to the Kingston Road intersection in order to provide sufficient acceleration distance.

A highly polished surface was also noted on Kingston Road, approximately 40m set back from the intersection. It is recommended that the wet weather skid resistance of this pavement is tested and a reseal or pavement rehabilitation treatment is considered to improve wet weather skid resistance.



The highly polished surface on Kingston Road on approach to Sturt Highway is likely to perform poorly in wet weather

Key Recommendations:

Kingston Road – Key Recommendations	Authority
<ul style="list-style-type: none"> ● Should the section north of Moorook be subject to a 110km/h speed limit, install 110km/h speed limit signs for southbound traffic on Kingston Road, shortly after turning from Sturt Highway. 	
<ul style="list-style-type: none"> ● Reseal between Stott Highway and Loxton as a priority, with the remaining highway assessed and localised poor sections resealed. 	DPTI
<ul style="list-style-type: none"> ● Where possible, remove roadside hazards including steep drop offs, vegetation and stobie poles – otherwise provide barrier protection. 	DPTI
<ul style="list-style-type: none"> ● Consider ATLM due to high frequency of single vehicle crashes related to inattention. 	DPTI
<ul style="list-style-type: none"> ● Refresh edge lines around curves where the swept path of heavy vehicle has scrubbed away previous markings. Consider widening the marked lane width around curves to reduce reoccurrence. 	DPTI
<ul style="list-style-type: none"> ● Improve delineation around curves with the implementation of chevron alignment markers to indicate the curve and w-beam barrier and guide post treatments where necessary. 	DPTI
<ul style="list-style-type: none"> ● Improve the left turn from Kingston Road onto Sturt Highway. Consider extending an acceleration lane for left turners to the overtaking lane to the west of the intersection. 	DPTI
<ul style="list-style-type: none"> ● Test skid resistance of pavement on approach to Sturt Highway due to a highly polished surface approximately 40m from the intersection. 	DPTI

Bookpurnong Road

Bookpurnong Road is a state maintained road extending for approximately twenty kilometres between Loxton and Berri. The southern section forms part of the b-triple and road train route through the Riverland, with these vehicles required to make a right turn onto Stanitzki Road. B-double access is the highest level of freight approved for the remainder of the road.

RAA previously assessed the road in 2014, recommending wider shoulders (which have since been installed) and additional barrier protection where large trees are close to the road.

Primary concerns raised by RAA Members in the survey related to the poor condition of the road, with the below comment reflective of the general Member commentary.

Bookpurnong Road, Loxton to Berri is horrid and gets chewed up more and more every year by the winery traffic. Part was resealed last year but even that isn't even – the whole road needs to be re-levelled as there are so many spots where I could get airborne or lose traction.

RAA Members

Crash History:

Fifteen casualty crashes occurred on Bookpurnong Road between 2012 and 2016. Four of these resulted in serious injuries and ten resulted in minor injuries, with one fatality occurring between Stanitzki Road and Obst Road, likely due to driving under the influence of alcohol or drugs.

Bookpurnong Road Casualty Crash Types

Crash Type	No. of Crashes	Apparent Errors
Rear End	4	Follow too closely (2), inattention (2)
Hit Fixed Object	3	D.U.I (1), inattention (1), N/A (1)
Right Angle	3	Fail to give way (2), Disobey – give way sign (1)
Hit Animal	2	N/A (2)
Roll Over	1	D.U.I (1)
Side Swipe	1	Fail to give way (1)
Head On	1	Fail to keep left (1)

Traffic Volumes:

Bookpurnong Road is one of the highest trafficked roads in the Riverland, with each section recording over 3000 vehicles per day, on average.

Bookpurnong Road Traffic Volumes

Segment	Length (km)	AADT	% Commercial Vehicles	2007 Estimated AADT
Old Sturt Highway - Foreman Road	0.22	7900	4.0% (310)	7900
Foreman Road - Stanitzki Road	10.56	4200	10.5% (440)	3600
Stanitzki Road - Alamein Avenue	4.94	4400	7.5% (320)	3400
Alamein Avenue - Bookpurnong Terrace	3.38	6500	6.0% (400)	6500
Bookpurnong Terrace	0.59	7000	5.5% (390)	7000

Road Widths:

Geometry of Bookpurnong Road was good, with wide sealed shoulders provided for the entirety of the road.

Bookpurnong Road Widths

Location	Lane Width	Sealed Shoulder Width	Total Seal Width
Near Quast Road	3.2-3.4m	2.2-2.4m	11.2m
Near Gurra Road	3.3-3.4m	1.0-1.1m	8.8m

Speed Limits:

The speed limit along Bookpurnong Road is 110km/h with 80km/h buffer zones provided into and out of Loxton and Berri.

Observations:

The pavement of a significant portion of Bookpurnong Road is uneven, with corrugations and large undulations present. Undulations were particularly prevalent between Edmondson Road and French Road, with another section between Stanitzki Road and Gordon Road notably poor. As this section is governed by a 110km/h speed limit, the effects of the uneven surface are amplified, posing a hazard to traffic along this section. It is recommended that resealing is considered for the sections noted above in the shorter term, but for Bookpurnong Road in its entirety is needed in the longer term.

Line marking along the length of the road was generally sufficient, however, centre and edge line marking near Edmondson Road and Proud Avenue is faded. We recommend that this line marking is refreshed.



Faded line marking in the vicinity of Edmondson Road

When travelling past the Gurra Gurra Creek Bridge, trees on both sides of the road are prevalent. These trees form significant roadside hazards, especially as they are located less than five metres from the edge of the road and unprotected. RAA recommend that w-beam barriers are installed to improve the overall road safety in the vicinity.



Trees on both sides of the road near Gurra Gurra Creek Bridge

An overtaking lane is provided in each direction, however, due to limited overtaking opportunities and high traffic volumes, RAA recommend that an additional overtaking lane is considered in each direction.

RAA received numerous complaints from Members regarding the tight geometry at the Berri roundabout and heavy vehicles having difficulties negotiating the roundabout. RAVnet maps indicate that b-doubles are permitted to use this route to travel between Old Sturt Highway in Berri and Loxton. No casualty crashes occurred at this roundabout between 2012 and 2016.

At the time of our assessment, a single articulated vehicle was witnessed in the southbound direction and was required to cross the centreline on approach to the Berri Bridge in order to avoid running up the kerb. It is recommended that heavy vehicle turn paths are reviewed, and consideration is made to altering the geometry of the southern exit curve to better facilitate b-double access.



The exit curve of the roundabout in Berri is challenging for heavy vehicles to negotiate.

Key Recommendations:

Bookpurnong Road – Key Recommendations	Authority
● Reseal the poor sections between Edmondson Road and French Road and between Stanitzki Road and Gordon Road in the short term and consider resealing the road in its entirety.	DPTI
● Refresh faded line marking in the vicinity of Edmondson Road.	DPTI
● Install w-beam barrier to protect roadside hazards in the vicinity of Gurra Gurra Creek Bridge.	DPTI
● Consider installing an additional overtaking lane in each direction.	DPTI
● Review heavy vehicle turn paths at the Berri roundabout and consider altering geometry of the southern exit curve to better facilitate b-double access.	DPTI

Stanitzki Road

Formerly known as Loxton Main Road, Stanitzki Road is maintained by DPTI and extends 28 kilometres between Bookpurnong Road and Sturt Highway, west of Paringa. The road was not raised as a high priority in the Member Survey, however there were some comments suggesting pavement widening to improve safety due to the frequency of heavy freight use on the road. Stanitzki Road is significant to freight in the region and it has recently been included in the Riverland's b-triple and PBS level 3A freight network.

RAA previously assessed Stanitzki Road in 2014, recommending road widening and shoulder sealing along the entirety of the road.

Crash History:

Two casualty crashes occurred on Stanitzki Road between 2012 and 2016. Both of these crashes were rollover crashes due to inattention, resulting in minor injuries.

Traffic Volumes:

Stanitzki Road Traffic Volumes

Segment	Length (km)	AADT	% Commercial Vehicles	2007 Estimated AADT
Bookpurnong Road – Sturt Highway	28.22	420	19 (80)	430

Road Widths:

Stanitzki Road is narrow with 3.2 metre wide lanes provided and no sealed shoulder for the most part. A three kilometre section of shoulder seal has been provided near Pike Creek Road. This width is far too narrow considering its significance to the freight network and RAA recommend that lanes are widened, and 1 metre wide sealed shoulders are installed.

Stanitzki Road Widths

Location	Lane Width	Sealed Shoulder Width	Total Seal Width
Near Bugle Hut Road	3.2-3.3m	N/A	6.5m
Near Pike Creek Road	3.3-3.4m	0.8m	8.3m
Near Lyrup Main Road	3.1-3.3m	N/A	6.4m

Speed Limits:

Stanitzki Road is subject to a 110km/h speed limit for its entirety.

Observations:

The overall pavement condition on Stanitzki Road is adequate, however, the major concern on this road is the lack of sealed shoulders and the resulting significant edge drop-offs. Given that Stanitzki Road is a 36.5m Road Train and 35m b-triple freight route, it is important for the road to be upgraded to accommodate the ever increasing traffic demands without compromising road safety.

Edge drop-offs are caused by a lack of sealed shoulders and the width of traffic lane, and will be addressed when shoulders are sealed. In the short term, it is recommended that shoulders are graded on a regular basis to account for this 50mm to 100mm edge drop off.



Drop-offs were measured between 50-100mm along most of Stanitzki Road

Additionally, installation of raised reflective pavement markers (RRPMs) should be considered along dividing line. RRPMs will improve delineation of the lanes to drivers travelling in poor weather or at night on Stanitzki Road.

At the Bookpurnong Road intersection, the acceleration lane is too short for heavy vehicles to safely turn left and merge with traffic on Bookpurnong Road. According to Austroads Guide to Road Design, the minimum length of the acceleration lane should be at least 320m, which is nearly double the current length. It is recommended that the acceleration lane for vehicles turning left onto Bookpurnong Road is extended in order to allow drivers to merge safely with Bookpurnong Road traffic, in particular slow moving vehicle such as road trains.



The acceleration lane at the Stanitzki Road/Bookpurnong Road intersection is too short for slower vehicles to safely merge

Key Recommendations:

Stanitzki Road – Key Recommendations	Authority
● Widen lanes on Stanitzki Road and install 1 metre wide sealed shoulders.	DPTI
● Consider installing RRPMS along the dividing line.	DPTI
● Extend the acceleration lane for vehicles turning left onto Bookpurnong Road in order to allow drivers to merge safely with Bookpurnong Road traffic.	DPTI

Goyder Highway (Morgan – Sturt Highway)

More than ten Members mentioned Goyder Highway as one of the major road transport improvements required in the Riverland with comments reflecting its poor condition, and narrow lane width creating unsafe interactions with freight.

This assessment only refers to the 80 kilometre section of Goyder Highway between its start point at the intersection with Sturt Highway near Monash and Morgan. The segment of Goyder Highway between Spalding and Morgan was assessed during RAA's 2018 Clare and Goyder regional assessment.

The below comments are reflective of the general issues raised by RAA Members.

Goyder Highway between Morgan and the Barmera turnoff. The road is extremely rough on the Barmera end and there is a narrow bridge over Burra Creek on the outskirts of Morgan.

Goyder highway is narrow, rough and has potholes. It is so bad that trucks appear to have trouble staying on the road and within their lane – no overtaking lanes.

RAA Members

RAA last assessed Goyder Highway in our 2014 Riverland road assessment with a number of recommendations made at the time including shoulder sealing, repairs to edge breakup, barrier protection and upgrades to rest stops.

RAA are not aware of any significant safety improvements that have been made along this section of Goyder Highway in recent times.

Crash History:

Fourteen casualty crashes were reported on Goyder Highway between 2012 and 2016. Thirteen of the fourteen crashes were single vehicle crashes with many related to driver inattention, and the fourteenth a side swipe crash due to overtaking without due care. There were also a number of hit animal crashes occurring on the road, with five of these resulting in injury. These crash types were scattered along the highway and there are no specific areas generating a higher number of crashes involving animals. Kangaroo warning signage was observed in locations along the highway.

Goyder Highway Casualty Crash Types

Crash Type	No. of Crashes	Apparent Errors
Hit Animal	5	N/A
Hit Fixed Object	4	Inattention (3), Sick or asleep (1)
Roll Over	4	Inattention (4)
Side Swipe	1	Overtake without due care (1)

Traffic Volumes:

Traffic volumes on Goyder Highway are generally quite low with a high percentage of commercial vehicles. Traffic volume estimates show that, on average, more than 30 b-doubles traverse this section of Goyder Highway each day.

Goyder Highway Traffic Volumes

Segment	Length (km)	AADT	% Commercial Vehicles	2007 Estimated AADT
Morgan Terrace - Cadell Valley Road	9.87	600	23.5% (140)	490
Cadell Valley Road - Taylorville Road	22.59	490	32.5% (160)	390
Taylorville Road - Morgan Road	44.14	390	31.0% (120)	330
Morgan Road - Sturt Highway	12.64	300	28.5% (85)	290

Road Widths:

The majority of Goyder Highway is very narrow, with a total seal width below 6.5 metres, however, there was a section approximately five kilometres in length with a much wider seal that could accommodate 3.5 metre lanes with a 0.5 metre wide sealed shoulder if an edge line were to be installed. Short sections of the highway have edge lines and narrow sealed shoulders, near Cadell Valley Road and Morgan Road, however this is not representative of the highway as a whole. It is recommended that minimum 0.5 metre sealed shoulders and edge lines are provided along Goyder Highway between Monash and Morgan. Audio tactile edge lines should be considered due to the high frequency of inattention related crashes occurring.

Goyder Highway Widths

Location	Lane Width	Sealed Shoulder Width	Total Seal Width
Near Sturt Highway	3.1m	N/A	6.2m
Near Lock 3 Road	3.2m	N/A	6.4m
7km E of Taylorville Road	3.8-4.0m	N/A	8.0m



Typical geometry along the majority of Goyder Highway

Speed Limits:

The speed limit along this section of Goyder Highway is 110km/h. On approach to Morgan, speed limit ahead signage is used to advise of the upcoming speed reduction, with large duplicated G9-79 '50 ahead' signs.

Observations:

The surface quality varied significantly over the eighty kilometre journey between Monash and Morgan. Some sections were in good condition and it was evident that they had been resealed recently, however there was a particularly poor section between Morgan Road and Overland Corner. In this section, W5-43 'uneven surface' signage was installed to warn motorists of the poor surface. It was also noted that in this section the surface was significantly cracking and polished. Light rainfall was also causing water to pond on the road surface creating a risk of aquaplaning.



Water ponding on the surface after light rainfall

West of Overland Corner, a section of reseal approximately 10km in length significantly improves the surface quality, however when this section ends, the poor surface returns, and water ponding in the ruts is evident again. Sections of the highway felt uncomfortable at the 110km/h speed limit.

West of Devlin Pound Road, and through to Morgan, multiple steep drop offs were noted and it is recommended that barrier protection is provided in these locations.

The clear zone is maintained to approximately 5m for most of the highway, with moderately dense vegetation outside of this zone in some areas. Guide posts along the length of the highway are in good condition and consistently spaced approximately 200m apart.

Two rest stops were observed in the westbound direction, with basic amenities including shelters, benches and a bin provided.

Crumbling edges, and edge drop off was also prevalent in many locations along the highway. Sealing shoulders would address this issue, and reduce the likelihood if it regularly reoccurring.



Edge drop off was prevalent in a number of locations

Key Recommendations:

Goyder Highway – Key Recommendations	Authority
● Install minimum 0.5m sealed shoulders and install painted edge lines (Consider ATLM).	DPTI
● Reseal uneven section between Morgan Road and Overland Corner and sections where cracking and rutting is prominent.	DPTI
● Repair edge drop off in numerous locations along the Highway.	DPTI

Stott Highway (Keyneton – Loxton)

Stott Highway was assessed between Keyneton and Swan Reach, with the section between Angaston and Keyneton assessed in the RAAs Barossa Valley regional assessment in 2017. Stott Highway runs between Angaston in the Barossa Valley and Loxton and is approximately 145 kilometres in length.

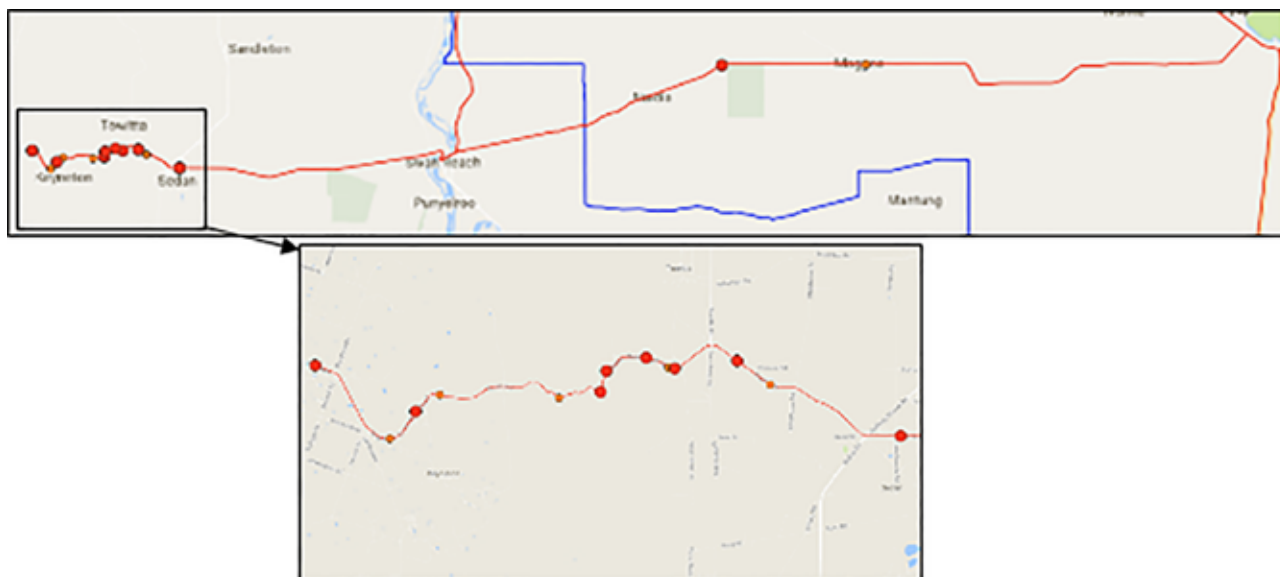
Stott Highway was not raised by RAA Members in our survey of Riverland Members and a portion of the highway lies outside of the Riverland region. For completeness, RAA decided to assess the remaining section of Stott Highway that was not assessed in the 2017 Barossa Valley regional assessment.

It is positive to note that the majority of the section between Angaston and Keyneton was undergoing a reseal and apparent widening which was an area identified in our 2017 Barossa Valley assessment as having poor sections of road surface.

Crash History:

Fifteen casualty crashes occurred on Stott Highway between Keyneton and Loxton, with twelve of these on the sixteen kilometre section between Keyneton and Sedan.

Although this section is within the Murraylands region of the state, it is a key route into the Riverland and is an alternative to Sturt Highway.



The majority of casualty crashes on Stott Highway are single vehicle crashes attributed to inattention. Stott Highway west of Sedan is a scenic route progressing from the Mount Lofty Ranges towards the low-lying floodplains of the Murraylands.

Stott Highway Casualty Crash Types

Crash Type	No. of Crashes	Apparent Errors
Hit Fixed Object	5	Inattention (4), D.U.I (1)
Roll Over	4	Inattention (4)
Left Road – Out of Control	3	Inattention (3)
Hit Animal	2	N/A
Rear End	1	Follow too closely (1)

Traffic Volumes:

Stott Highway Traffic Volumes

Segment	Length (km)	AADT	% Commercial Vehicles	2007 Estimated AADT
Angaston - Keyneton	8.55	1100	6% (65)	1000
Keyneton - Sedan	18.35	1100	6% (65)	700
Sedan - Swan Reach	27.03	330	10.5% (35)	390
Swan Reach	3.76	310	5% (15)	420
Swan Reach - Loxton	86.76	230	20% (46)	290

Road Widths:

Road widening works were taking place between Angaston and Keyneton at the time of our assessment, and the road width and shoulders between Keyneton and Sedan are generally constructed to an acceptable level. Lane widths were narrow between Sedan and Loxton with a total seal width just over six metres for the majority of this section. There were some short sections where edge lines are painted, however, the total seal with remains relatively constant. For the section between Sedan and Loxton, traffic volumes are very low and crash history is minimal, however, there is little margin for error in the case of driver misjudgement. It is therefore recommended that shoulders are considered for sealing to a minimum of 0.5 metres with a desirable width of 1 metre.

Stott Highway Widths

Location	Lane Width	Sealed Shoulder Width	Total Seal Width
East of Keyneton (Upgrade underway)	3.0-3.9m	1.6-1.8m	10.1m
West of Sedan	2.9-3.3m	N/A	6.2m
East of New Well Centre Road	3.2m	N/A	6.4m

Speed Limits:

Stott Highway is primarily governed by a 110km/h speed limit with the exception of the 26 kilometres between Angaston and Sedan governed by a 100km/h speed limit. The speed limit is also reduced to 60km/h in Keyneton, Sedan and Swan Reach by way of an 80km/h buffer zone as it passes through each town.

Stott Highway Speed Limit

Segment	Length (km)	Speed Limit (km/h)
Keyneton - Sedan	16.7	100
Sedan Buffer	0.5	80
Sedan	1.0	50
Sedan Buffer	0.5	80
Sedan – Swan Reach	18.0	110
Ferry	0.1	60
Swan Reach	0.6	60
Swan Reach Buffer	0.5	80
Swan Reach – Loxton	87.0	110

Observations:

Through the downhill section between Keyneton and Sedan, guard rail was generally prevalent, however, there were a number of curves lacking any form of barrier protection or delineation. It is recommended that this section is reviewed and additional barrier protection and CAM's are installed to protect drop offs and delineate all curves due to the poor crash history in this section and high severity of potential crashes in this location due to the drop-offs.

The surface condition on Stott Highway was generally good, with no significant issues identified, other than the narrow road width. At the time of our assessment, there had been a serious crash on Sturt Highway near Waikerie causing Sturt Highway to close in both directions. Due to this, road trains and caravans were diverting down Stott Highway from Loxton and presumably turning onto Hunter Road at Swan Reach to link back to Sturt Highway near Blanchetown. Although this was not a typical day, these interactions with Road trains were very uncomfortable due to the narrow carriageway width. Stott Highway is already b-double approved, however DPTI traffic volume estimates specify less than 10 b-double movements on average per day.



Interactions with heavy vehicles are uncomfortable on Stott Highway, however this is not a regular occurrence

Key Recommendations:

Stott Highway – Key Recommendations	Authority
<ul style="list-style-type: none">○ Review the downhill section between Keyneton and Sedan and install additional barriers and CAM's to protect drop offs and delineate all curves due to the poor crash history and high severity of potential crashes in this location.	DPTI
<ul style="list-style-type: none">○ Install minimum 0.5m sealed shoulders between Sedan and Loxton. 1.0m sealed shoulders are desirable.	DPTI

Wentworth-Renmark Road (unsealed section)

Comments/Survey information/quotes:

The majority of Wentworth – Renmark Road is unsealed, with a small section under the jurisdiction of Renmark Paranga Council that is sealed. The unsealed section is in unincorporated areas of the state and is hence under the jurisdiction of DPTI. Wentworth – Renmark Road was one of the highest mentioned unsealed roads in the RAA Member survey, receiving over twenty mentions when asked if any roads in the Riverland region needed sealing. This road is also referred to as Old Wentworth Road, Wentworth Road and Renmark Road.

Old Wentworth Road is awful and dangerous to drive on due to corrugation and a very uneven surface. A lot of traffic uses this road to go to Chowilla campsites. It has been a dangerous road for many years.

Old Wentworth Rd – tourist and business access, being used more due to Chowilla, government and tourism. Very poor condition, would be cheaper to maintain as a bitumen road.

RAA Members

Crash History:

Five casualty crashes occurred on Wentworth – Renmark Road between 2012 and 2016 with three resulting in minor injuries and two resulting on serious injuries. Three of the five crashes occurred at night.

Wentworth – Renmark Road Casualty Crash Types

Crash Type	No. of Crashes	Apparent Errors
Roll Over	4	Inattention (4)
Left Road – Out of Control	1	Inattention (1)

The fact that there were more casualty crashes at night indicated that reflective warning signage may be poor, or that guide posts may not have been used or were ineffective. On our road assessment, guide posts had been very recently installed clearly delineating the carriageway.

Traffic Volumes:

Traffic volumes are generally very low on Wentworth – Renmark Road.

Wentworth-Renmark Road Traffic Volumes

Segment	Length (km)	AADT	% Commercial Vehicles	2007 Estimated AADT
Ral Ral Avenue – Wentworth-Renmark Road	3.17	220	5.5% (12)	240
Wentworth-Renmark Road - NSW Borders	42.5	40	15% (6)	80

Speed Limits:

Wentworth – Renmark Road is subject to the rural default speed limit for unsealed roads of 100km/h, however, W1-SA101 'gravel roads – maximum 80km/h' advisory signage is periodically installed.



Gravel road 80km/h advisory signage is periodically installed on Wentworth – Renmark Road

Observations:

The prevailing issue with Wentworth-Renmark Road is the lack of regular maintenance, resulting in constant corrugations and potholes, and a build-up of loose material.

Correspondence with a local truck driver on site indicated that local landowners and road users carried out occasional maintenance work on the road as it would be otherwise not usable. This level of maintenance does not have a lasting impact and the road conditions often revert back to the previous poor state in a short timeframe.

A build-up of loose surface material on the road not only creates issues with skid resistance and traction, but generates significant levels of dust, which in turn reduces the line of sight for other road users. Given the number of curves on Wentworth-Renmark Road, it is important that the road is maintained on a regular basis. Prior to our assessment, RAA was concerned with the number of crashes occurring at night. It was evident that guide posts have been recently installed along the length of the road to the New South Wales border, which we are satisfied will begin to address this issue, however, the road condition itself should also be addressed to enhance the quality of the road, minimise dust issues and reduce the crash risk on this road.



Fine dust was prevalent and lingered, reducing driver visibility

The road surface is uneven and corrugated, in particular on inclines, and near the Chowilla Station turnoff and before Chowilla Game Reserve.



Corrugations on sections of the road, with the protruding rock bed a potential cause of tyre blowouts

It is recommended that maintenance is scheduled more frequently on Wentworth – Renmark Road, and resheeting is strongly considered, with sealing a longer term goal should traffic volumes increase upon today's levels.

Key Recommendations:

Wentworth – Renmark Road – Key Recommendations	Authority
<ul style="list-style-type: none">● Maintenance is scheduled more frequently and resheeting is strongly considered. Sealing should be considered in the longer term.	DPTI

Ramco Road/Cadell Valley Road

Ramco Road and Cadell Valley Road (Also known as Cadell – Waikerie Road) links Waikerie and Morgan via Cadell and Goyder Highway or Morgan – Cadell Road, and is maintained by DPTI. The road is known as Ramco Road for approximately fifteen kilometres between Waikerie and Murrayview Road, and Cadell Valley Road between Murrayview Road and Goyder Highway (north of Cadell). Cadell Valley Road incorporates a ferry crossing north of Cadell however traffic volumes are generally very low in this section. The road was not raised by Members in our survey however was on the way to other locations and a relatively busy road in terms of AADT.

RAA previously assessed the road in 2014 and made a number of recommendations at the time including shoulder sealing in sections, ATLM, and curve advisory signage with advisory speeds.

Crash History:

Six casualty crashes were reported on this road between 2012 and 2016. Four of these resulted in minor injuries with two resulting in serious injuries. There were no regularly occurring casualty crash types in this period

Cadell - Waikerie Road Casualty Crash Types

Crash Type	No. of Crashes	Apparent Errors
Right Angle	2	Fail to give way (2)
Head On	1	Fail to keep left (1)
Left Road – Out of Control	1	Inattention (1)
Hit Fixed Object	1	Inattention (1)
Hit Pedestrian	1	Inattention (1)

Traffic Volumes:

Traffic volumes are typically high between Ramco and Waikerie, however decrease west of Ramco. Commercial vehicle use is quite low, and generally consists of class 3 to 5 rigid vehicles, however there is also a low level of use by larger articulated vehicles and b-doubles.

Ramco Road/Cadell Valley Road Traffic Volumes

Segment	Length (km)	AADT	% Commercial Vehicles	2007 Estimated AADT
Goyder Highway - Hodge Road	3.9	85	3.5 (3)	140
Hodge Road – Murrayview Road	11.67	490	8 (38)	500
Murrayview Road – West Road	13.76	1800	10 (180)	1700
West Road – Leonard Norman Drive (Waikerie)	2.40	3200	10.5 (330)	2700

Road Widths:

Road and shoulder widths between Waikerie and Ramco are satisfactory, and lane widths north west of Ramco Road are also good, however, sealed shoulders are not provided in this section, meaning the total seal width is reduced by approximately two metres.

Sealed shoulders return just east of Mackintosh Road, outside of Cadell prior to a curving section of road. Approximately fifteen kilometres of road between Mackintosh Road and Medley Road has unsealed shoulders, and the road is fairly straight through this section unlike the curving horizontal geometry around Ramco, and near Cadell. RAA recommend that a 0.5 metre sealed shoulder is considered in this section.

Ramco Road/Cadell Valley Road Widths

Location	Lane Width	Sealed Shoulder Width	Total Seal Width
South east of Medley Road	3.3m	1.2-1.4m	9.2m
North west of Medley Road	3.4-3.6m	N/A	7.0m

Speed Limits:

Ramco Road/Cadell Valley Road Speed Limit

Segment	Length (km)	Speed Limit (km/h)
Goyder Highway to Ferry	0.4	100
Ferry	0.1	10
Ferry – Cadell	3.3	80
Cadell	0.4	60
Cadell – Mackintosh Road	1.6	80
Mackintosh Road - Murrayview Road	16.5	110
Murrayview Road – Ziegler Road	2.3	90
Murrayview Road – Greens Lane (Ramco)	2.3	80
Greens Lane – Ricciuto Road	1.2	60
Ricciuto Road – Waikerie	3.0	80
Waikerie	0.5	60

Observations:

Ramco Road and Cadell Valley road were generally in good condition, with some minor undulations experienced in the vicinity of Barclay Road. The gravel shoulders were kept relatively clear for at least three metres, however, unprotected vegetation, stobie poles and drop offs were present in some locations.



Stobie poles are a regular hazard present on Ramco Road/Cadell Valley Road

Some vegetation and drop offs were protected with w-beam barrier and most curves were satisfactorily delineated with guide posts or CAMs. RAA recommend installation of additional barrier protection for these unprotected roadside hazards.

Key Recommendations:

Ramco Road/Cadell Valley Road – Key Recommendations	Authority
○ Install minimum 0.5m sealed shoulders between Medley Road and Mackintosh Road.	DPTI
○ Consider installing w-beam barrier protection for vegetation, stobie poles and drop offs close to the edge of the road in various locations.	DPTI

Morgan Road

Morgan Road is a State Maintained Road and is approximately eight kilometres long, connecting the Sturt Highway near Cobdogla and the Goyder Highway. There were few mentions of Morgan Road in the Riverland survey and some general comments indicated that it was in poor condition.

Crash History:

Three casualty crashes occurred on Morgan Road between 2012 and 2016. Two involved vehicles hitting fixed objects just south of English Road (1 SI and 1 MI) and the third involved a vehicle failing to give way at the English Road intersection causing a right angle crash and minor injuries.

Traffic Volumes:

Although Morgan Road traffic volumes are very low, there is a high percentage of commercial vehicle traffic, predominantly between class 3 and 5 which includes rigid vehicles up to 14.5m in length. Vehicles class 6 and above, including articulated vehicles up to 19m in length or b-double combinations only make up a small percentage of commercial traffic, with generally fewer than 20 of these vehicles using Morgan Road per day.

Morgan Road Traffic Volumes

Segment	Length (km)	AADT	% Commercial Vehicles	2007 Estimated AADT
Goyder Highway - Arnold Coats Road	4.3	210	22% (46)	190
Arnold Coats Highway - Sturt Highway	3.63	230	16% (37)	300

Road Widths:

Morgan Road was generally quite narrow, with a total seal width only just over six metres consistent along the length. It is recommended that 0.5 metre wide sealed shoulders are installed to improve safety on Morgan Road.

Morgan Road Widths

Location	Lane Width	Sealed Shoulder Width	Total Seal Width
Near Neindorf Road	3.0-3.2	N/A	6.2

Speed Limits:

Morgan Road is subject to a 110km/h speed limit.

Observations:

The surface of Morgan Road was showing signs of deterioration and some sections were quite uneven. The condition of the road should be monitored and considered for future reseal programmes.

In general, the gravel shoulders were kept relatively free of hazards, however outside of this area, some large trees were present on the northern section of the road.

Of concern was the steep drop off into Lake Bonney just north of Nappers Bridge, and it is recommended that barrier protection is considered in this location to prevent vehicles running off the road into water. Nappers Bridge was lacking width markers, and it is recommended that D4-3 'width marker' boards are installed on the bridge on each approach to delineate the width of the carriageway over the bridge.



Width markers are not installed to delineate the width of Nappers Bridge

Also of concern was the stobie pole on the west side of Morgan Road, just north of the intersection with Mcfarlanes Lane as pictured below.



This stobie pole was directly in the path of vehicles.

This stobie pole was directly in the path of northbound vehicles due to the kink in Morgan Road. RAA recommend that this stobie pole be protected with w-beam barrier, with the change in sight distance to the north from Mcfarlanes Lane considered prior to installing any barrier. It is also recommended that additional delineation to emphasise the curve on Morgan Road is installed, including a shoulder seal around the curve with painted edge line and additional guide posts.

Key Recommendations:

Morgan Road – Key Recommendations	Authority
● Install 0.5 metre sealed shoulders.	DPTI
● Monitor the pavement condition and consider for future reseal programs.	DPTI
● Install barrier protection for the steep drop offs adjacent to Lake Bonney, just north of Nappers Bridge.	DPTI
● Install D4-3 ‘width marker’ boards on Nappers Bridge to delineate the width of the carriageway over the bridge.	DPTI
● Protect the stobie pole just north of the Mcfarlanes Lane with w-beam barrier, with consideration to the impact on sight distance to the north when turning out of Mcfarlanes Lane. Additional delineation to emphasise the curve on Morgan Road is also recommended, including a local shoulder seal around the curve with a painted edge line and additional guide posts.	DPTI

Ral Ral Avenue

Comments/Survey information/quotes:

Ral Ral Avenue is a major thoroughfare through Renmark, beginning at the intersection of Renmark Avenue and extending to the north west. The section of road under the care of DPTI was assessed, which extends for nine kilometres between Renmark Avenue and Wentworth-Renmark Road. Ral Ral Avenue was not mentioned highly in the RAA Member survey.

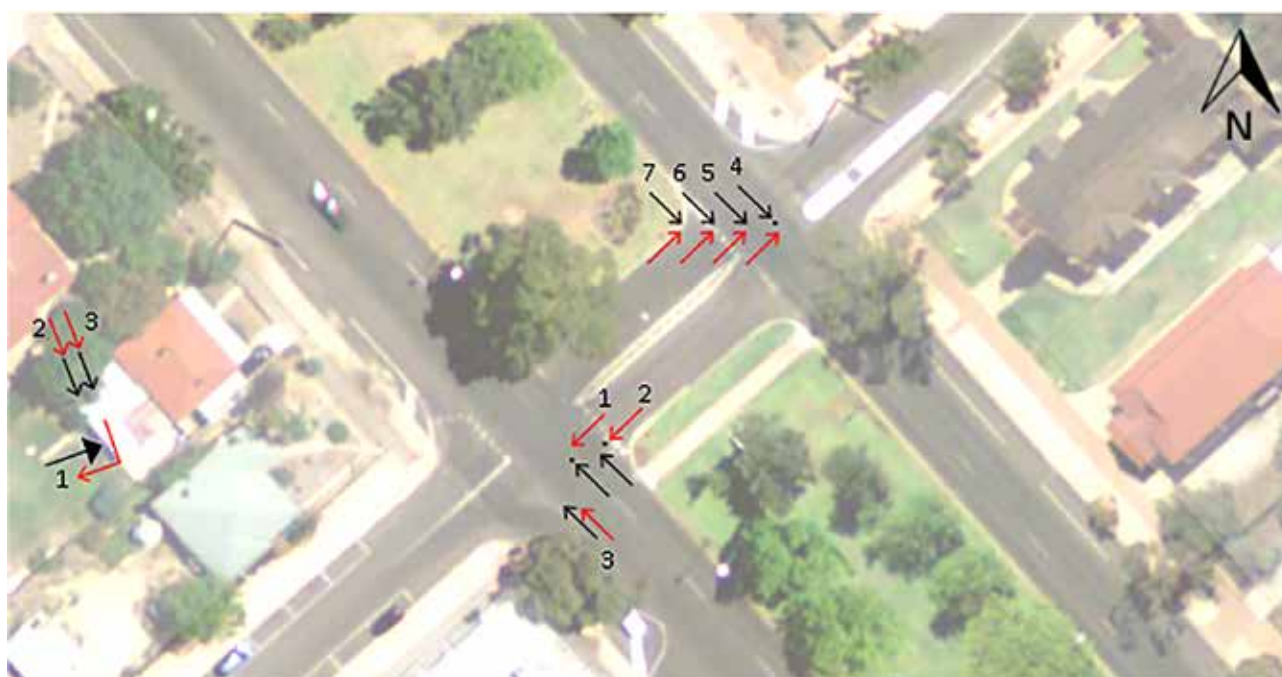
Crash History:

Between Renmark Avenue and Wentworth – Renmark Road there were eight casualty crashes, with most of these occurring at intersections in Renmark.

Ral Ral Avenue Casualty Crash Types

Crash Type	No. of Crashes	Apparent Errors
Right Angle	5	Disobey – give way sign (4), incorrect turn (1)
Rear End	1	Follow too closely (1)
Roll Over	1	Inattention (1)
Hit Fixed Object	1	Inattention (1)

Of particular concern is the intersection with Ral Ral Avenue and Thurk Street, recording three minor injury crashes and a four property damage crashes as shown in the below crash diagram. Further information on crash diagram symbology is available in Appendix D. All of these crashes occurred in dry daylight conditions and six of the seven involved vehicles continuing straight on Thurk Street failing to give way after crossing through the median. The other crash was a side swipe causing property damage due to a vehicle making an incorrect turn, however, further information is not available.



Crash diagram for the intersection of Ral Ral Avenue and Thurk Street

Traffic Volumes:

Traffic volumes are high on Ral Ral Avenue, particularly within the built up areas of Renmark.

Ral Ral Avenue Traffic Volumes

Segment	Length (km)	AADT	% Commercial Vehicles	2007 Estimated AADT
Renmark Avenue – Cowra St	0.55	8400	3.0% (260)	10800
Cowra St – Ral Ral Avenue	0.12	4200	5.5% (240)	4100
Ral Ral Avenue – Paringa St	0.15	4200	5.5% (230)	4100
Paringa St – Goolwa St	2.47	3300	4.5 (150)	2700
Goolwa St – Warrego St	2.81	2100	8.0% (170)	1700
Warrego St – Wentworth-Renmark Road	3.02	1200	10.0% (120)	1300

Road Widths:

Road geometry was sufficient between Renmark and Government Road, with good lane width and sufficient shoulder seal. It is recommended that shoulder sealing is considered for the two kilometre section between Government Road and Wentworth – Renmark Road. Sealing shoulders in this section will also address the edge drop-off present here.

Ral Ral Avenue Widths

Location	Lane Width	Sealed Shoulder Width	Total Seal Width
Near Tarcoola Street	3.2m	1.9-2.1m	10.4m
North of Government Road	2.8-3.2m	N/A	6.0m

Speed Limits:

Ral Ral Avenue Speed Limit

Segment	Length (km)	Speed Limit (km/h)
Renmark Avenue – Marrara St	1.0	50
Marrara St – Chino St	2.9	80
Chino St – Wentworth-Renmark Rd	5.2	100

Observations:

The overall road condition of Ral Ral Avenue in the built up area of Renmark is adequate, however, there are issues associated with the road that require attention outside of this area. The pavement is deteriorating, with ruts and surface polishing in both directions. Rut filling or resurfacing is recommended to address this. Additionally, edge drop off is prevalent north of Government Road and the previously recommended shoulder sealing will address this. As a minimum, shoulder grading is required, potentially with the addition of new material to bring the shoulders flush with the road surface.



Rutting on Ral Ral Avenue

Ral Ral Avenue/Thurk Street Intersection

Our findings indicate that the previous set back give way holding line is still visible on both approaches to Ral Ral Avenue. Holding lines at all locations within the intersection are faded and deteriorated and it is recommended that all line marking is refreshed, and previous line marking that is still visible is scrubbed away to reduce confusion.



The old give way holding line (2) is still visible

W2-1 'cross road' warning signs have been placed on both approaches to Ral Ral Avenue. This signage indicates that traffic is travelling on the through road and contradicts the give way condition at the intersection. In accordance with Australian Standard 1742.2, 'cross road' warning signs shall not be used on any approach controlled by 'give way' signs.

It is recommended that the W2-1 'cross road' warning signs on Thurk Street are removed, and a W3-2 'give way sign ahead' sign is installed on the south west bound approach. A 'give way sign ahead' sign is already installed in the north east bound direction. The 'give way sign ahead' sign will enable traffic on Thurk Street to anticipate the intersection ahead and reduce the likelihood of vehicles travelling across Ral Ral Avenue and failing to give way.

Key Recommendations:

Ral Ral Avenue – Key Recommendations		Authority
● Consider shoulder seal for the two kilometres between Government Road and Wentworth – Renmark Road. As a minimum shoulders need to be graded and flush with the road surface, potentially with new material added.		DPTI
● At the intersection with Thurk Street:		
○ Refresh all line marking and ensure any previous line marking is scrubbed away to avoid confusion.		
○ Remove outdated W2-1 'cross road' warning signs on both Thurk Street approaches.		DPTI/RP
○ Install W3-2 'give way sign ahead' sign on the south west bound Thurk Street approach.		

Taylorville Road

Taylorville Road is maintained by DPTI and extends for approximately ten kilometres between Waikerie and Goyder Highway over the Murray River via a ferry crossing. It was not raised by Members as an issue but was assessed on the way to other destinations in the region. Taylorville Road forms part of the b-double freight route in the region, however, commercial vehicle use is generally low.

Crash History:

No casualty crashes were reported on Taylorville Road between 2012 and 2016.

Traffic Volumes:

Taylorville Road Traffic Volumes

Segment	Length (km)	AADT	% Commercial Vehicles	2007 Estimated AADT
Goyder Highway – Waikerie Ferry	10.23	650	8.5 (55)	500
Waikerie Ferry – Rowe St	0.05	900	9 (80)	700

Road Widths:

Taylorville Road Widths

Location	Lane Width	Sealed Shoulder Width	Total Seal Width
North of Promnitz Road	3.0-3.4m	N/A	6.4m

Speed Limits:

Taylorville Road is subject to a 110km/h speed limit between the Waikerie Ferry and Goyder Highway.

Observations:

The surface condition on Taylorville Road was generally quite good, and no significant issues were detected with the surface. The road was narrow with lanes generally around 3.3m wide, however, commercial use is low, at 8.5 per cent. In the longer term, it is recommended that shoulder sealing is provided, however, the width of the carriageway is not a major issue at this stage when compared to other roads assessed in the region.

The clear zone was generally quite good but there were sections closer to the Murray River where vegetation was growing up to three metres from the edge. Stobie poles are prominent adjacent to sections of the road, and it is recommended that consideration is given to protecting stobie poles close to the carriageway.



Typical geometry of Taylorville Road

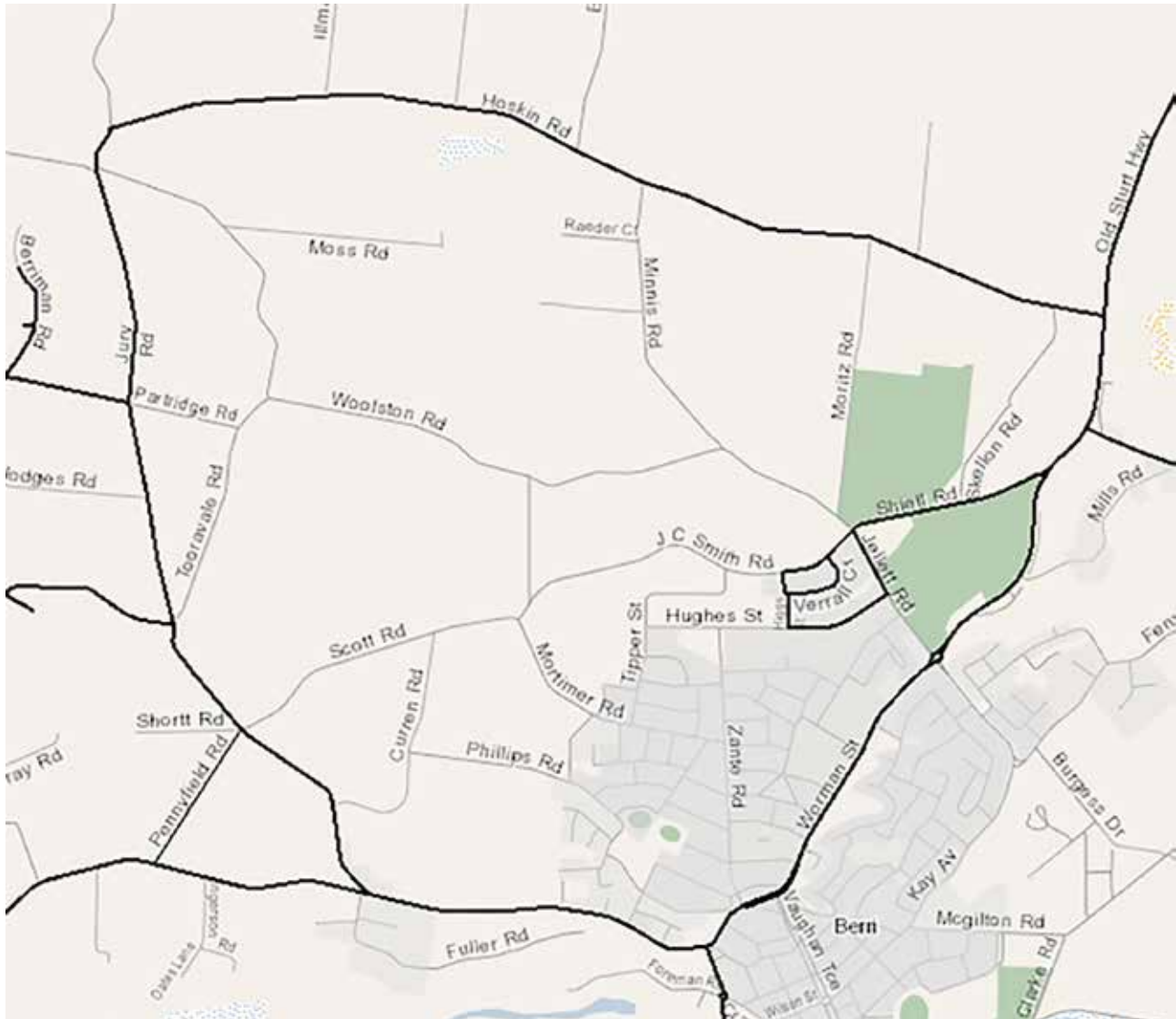
Key Recommendations:

Taylorville Road – Key Recommendations	Authority
<ul style="list-style-type: none"> ● Install sealed shoulders in the longer term. ● Consider w-beam barrier protection for Stobie poles. 	<p>DPTI</p> <p>DPTI</p>

Jury Road

Jury Road is under the care and responsibility of the Berri Barmera Council, and extends for approximately five kilometres between Old Sturt Highway in Berri and Sturt Highway in Monash. The road was raised a number of times in the RAA Member survey, with concerns about freight movement and the intersection with Sturt Highway raised.

Jury Road is approved for b-double usage between Old Sturt Highway and Hoskin Road which links back to Old Sturt Highway north of Berri.



RAVnet map indicating the approved Jury Road B Double freight route and surrounds

Crash History:

All casualty crashes on Jury Road occurred at intersections. Three casualty crashes occurred at the Shortt Road/Pennyfield five-way intersection, two casualty crashes occurred at the Trenaman Road/Partridge Road intersection and one occurred at the Sturt Highway intersection. The crash at the Sturt Highway intersection involved a vehicle hitting a fixed object at the intersection.

Road Widths:

Jury Road has consistent lane widths of 3.1 – 3.2 metres along its length, as well as numerous curves where the surface is marginally wider.

Speed Limits:

Jury Road does not have a posted speed limit, therefore, the default 100km/h speed limit applies outside of a built up area.

Observations:

Jury Road was typical of many sealed council roads in the Riverland, and was generally in good condition, however, quite narrow. The most significant roadside hazards were the stobie poles prevalent along most of the road, in some cases, very close to the edges. Although there is no record of collisions with these stobie poles in the 2012 to 2016 crash data, it is still advised that barrier protection is considered. As a minimum D4-3 'width marker' boards should be installed on any stobie poles within one metre of the pavement, and D4-1-2 'unidirectional hazard marker' boards are installed at other stobie poles within three metres of the road.



Stobie poles were located very close to the road and poorly delineated

It was also noted that D4-1-2 'unidirectional hazard marker' boards had been incorrectly used to delineate substandard curves. The image below relates to the curve between Hoskin Road and Jury Road, however, there are a number of substandard curves where this signage was incorrectly used. It is recommended that signage is reviewed, and incorrect unidirectional hazard markers are replaced with D4-6 'chevron alignment markers' and set out as specified in Australian Standard 1742.2.



Unidirectional hazards markers were incorrectly used around a number of curves

The intersection with Shortt Road and the intersection with Trenaman Road were both briefly assessed, with no major issues identified at the time of assessment. The intersection with Sturt Highway was also assessed and it is recommended that a channelised left turn lane is installed for westbound vehicles on Sturt Highway turning left onto Jury Road due to high vehicle speeds on Sturt Highway.

Key Recommendations:

Jury Road – Key Recommendations	Authority
<ul style="list-style-type: none"> ● Consider barrier protection for stobie poles. As a minimum D4-3 ‘width marker’ boards should be installed on any stobie poles within one metre of the pavement, and D4-1-2 ‘unidirectional hazard marker’ boards are installed at other stobie poles within three metres of the road. 	BB
<ul style="list-style-type: none"> ● Review signage on curves, and replace incorrectly installed unidirectional hazard markers with D4-6 ‘chevron alignment markers’ and set out as specified in Australian Standard 1742.2. 	BB
<ul style="list-style-type: none"> ● Install channelised left turn lane from Sturt Highway into Jury Road 	DPTI/BB

Other Locations Assessed

Murbko Road

Murbko Road was assessed between Morgan and Blanchetown, with a number of observations made during our assessment. Murbko Road is partially maintained by the Mid Murray Council in the north, and the District Council of Loxton Waikerie in the south.

The surface condition was generally good, and lane widths of approximately 3.2m were maintained. The northern section had narrow sealed shoulders and guide posts clearly delineated the edges of the road.

The southern section did not have any sealed shoulders and guide posts were generally lacking. There were also a number of steep drop offs unprotected by barriers.

RAA recommend that additional guide posts are installed on the southern section of Murbko road, and that a minimum 300mm shoulder seal is considered, considering that this road has low traffic volumes. Barrier protection should also be considered to protect drop offs.



Unprotected drop off on the southern section of Murbko Road.

Caddy Road

When asked which major improvements are needed in the Riverland region, as well as which gravel road should be considered for sealing, numerous Members mentioned Caddy Road. Caddy Road is the primary access to the Loveday 4x4 adventure park catering to many visitors over the year. Four wheel drive, rally driving and jet skiing activities are all available generating many different visitors. Camping sites are located around the park, and annual off-road racing events are also held here.

No casualty crashes occurred between 2012 and 2016, however a number of issues were noted with the condition of the road. The surface was deteriorating in some areas, and quite uneven with potholes forming and large sections of the wearing course eroded such that the base material was exposed. RAA recommend that Caddy Road is reviewed by council on a regular basis, and graded with some fresh surface material in locations where it is not possible to retrieve sufficient material from the shoulders.



Poor surface conditions on Caddy Road

It was also noted that D4-1-2 'unidirectional hazard marker' boards were installed to delineate substandard curves. These signs should be replaced with D4-6 'chevron alignment marker' signs and set out as specified in Australian Standard AS 1742.2.



Unidirectional hazard marker boards were incorrectly installed to delineate substandard curves.

Additionally, guide posts were scarcely used to delineate the edges of the carriageway. Due to the dense vegetation on either side of the road, it is recommended that guide posts are installed along Caddy Road to delineate the edges, especially at night.

Enduro Road

Enduro Road is an unsealed road extending for approximately 23 kilometres between Murbko Road Ramco, with the majority of Enduro Road unsealed. Numerous Members mentioned Enduro Road in the Riverland Member survey when asked which gravel roads they thought should be considered for sealing.

Enduro road, Waikerie. Because traffic down this road is very heavy and used very frequently. Road is constantly needing repair due to this.

RAA Members

At the time of our assessment, Enduro Road had been recently graded and was in very good condition. The unsealed surface was smooth and comfortable to travel at 100km/h. Recent 'Roads to Recovery' funding may have addressed the primary issues on Enduro Road. Delineation around curves was generally very good with closely spaced guide posts or chevron alignment markers utilised.



Enduro Road was in very good condition at the time of our assessment

St Joseph's School Zones, Barmera

The School Zones surrounding St Joseph's School have recently been raised by a Member through our online 'Report A Road' system, and were investigated as part of this regional road assessment.

A number of signage and line marking issues were identified, with a number of recommendations regarding this school zone:

- School zone 'zig zag' markings were substantially faded and these should be refreshed.
- R3-SA58 'school zone speed' signs on Joyce Street were situated very close to the intersection with Sturt Highway, and easy to miss when turning onto Joyce Street from Sturt Highway, particularly making a left turn. It is recommended that this signage is shifted further north to line up with the end of the 'zig zag' as specified by DPTI's 'Pavement Marking Manual'.
- 'Zig zag' line marking was missing on Langdon Street, and should be painted.
- 'Zig Zag' line marking on Langdon Terrace was installed beyond the school zone signage, this should be painted prior to the signage.

It is also recommended that a formal school crossing is considered in future to provide a safer location for students to cross the road.

Berri Scenic Tourist Drive (Riverview Drive)

RAA assessed the Berri scenic tourist drive, signposted from Sturt Highway. This route takes Riverview Drive from north of Berri along the Murray River and back towards the town centre. The most significant hazard identified was the presence of stobie poles very close to the road. It is recommended that D4-3 'width marker' boards are installed on any stobie poles within one metre of the pavement, and D4-1-2 'unidirectional hazard marker' boards are installed on other stobie poles within three metres of the road.

Other Recommendations	Authority
<ul style="list-style-type: none">● Murbko Road –<ul style="list-style-type: none">○ Install additional guide posts along the southern sections to delineate edges.○ Consider installation of minimum 300mm shoulder seal.○ Consider installation of w-beam barrier protection for drop offs.	LW
<ul style="list-style-type: none">● Caddy Road –<ul style="list-style-type: none">○ Review road conditions regularly and grade with fresh material in locations where it is not possible to retrieve sufficient material from the shoulders.○ Replace incorrectly installed D4-1-2 'unidirectional hazard marker' boards with D4-6 'chevron alignment marker' signs and set out as specified in Australian Standard AS 1742.2.○ Install guide posts to delineate the carriageway at night.	BB
<ul style="list-style-type: none">● For the school zone surrounding St Joseph's School in Barmera –<ul style="list-style-type: none">○ Refresh school zone line markings in the correct locations prior to the school zone sign.○ Install 'zig zag' line marking on Farmer Street prior to the school zone sign.○ Shift signage on Joyce Street to a more prominent location.○ Consider installation of a formal school crossing to provide a safe crossing location for students.	BB
<ul style="list-style-type: none">● On Riverview Drive in Berri, D4-3 'width marker' boards should be installed on any stobie poles within one metre of the pavement, and D4-1-2 'unidirectional hazard marker' boards should be installed on other stobie poles within three metres of the road.	BB

Appendices

Appendix A: List of roads and intersections assessed

- Sturt Highway (Between Truro and Victorian border), including
 - The intersection with Old Blanchetown Road (Waikerie)
 - 'Waikerie4 bypass' – between Ian Oliver Road and Curtis Road (Waikerie)
 - The intersection with Holder Top Road and Searle Road (Waikerie)
 - The intersection with Rogers Road (Cobdogla)
 - Both intersections with Old Sturt Highway (Barmera and Monash)
 - The intersection with Airport Road
 - The intersection with Twentyfirst Street (Renmark)
 - Paringa Bridge (Paringa)
- Old Sturt Highway
- Browns Well Highway
- Kingston Road
 - Including the intersection with Sturt Highway
- Bookpurnong Road
 - Including the roundabout in Berri
- Stanitzki Road
 - Including the intersection with Bookpurnong Road
- Goyder Highway (Between Morgan and Sturt Highway)
- Stott Highway (Between Keyneton and Loxton)
- Wentworth – Renmark Road (Between Renmark and NSW border)
- Ramco Road
- Cadell Valley Road
- Morgan Road
- Ral Ral Avenue
 - Including the intersection with Thurk Street
- Taylorville Road
- Jury Road
 - Including the intersection with Sturt Highway
- Murbko Road
- Caddy Road

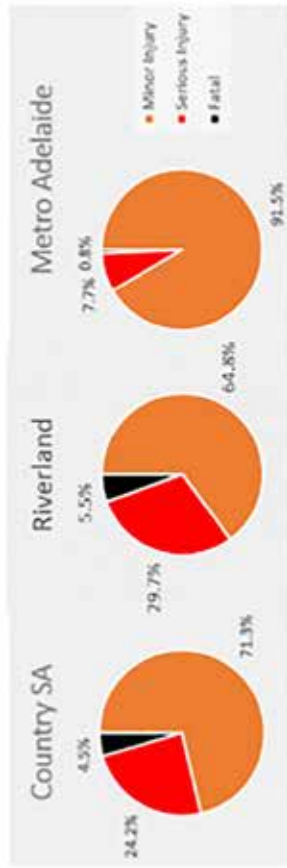
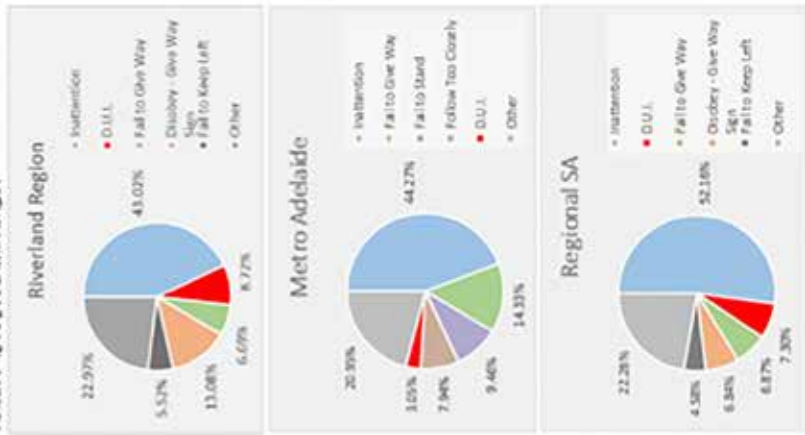
Appendix B: Summary of Crash Statistics

Riverland Tourism Region Crash Statistics (2012-2016)

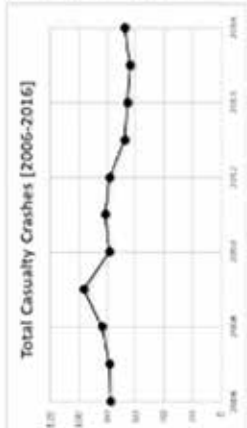


The highest number of casualty crashes in the Riverland region are fatal crashes with 344 total. Fatal crashes are the highest in the region, followed by serious injury crashes with 206 total. Minor injury crashes are the lowest in the region with 100 total.

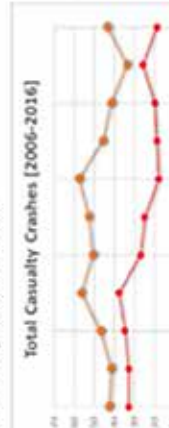
302 casualty crashes occurred in a road network with only 25 km of road in the region, which is a high density of road network.



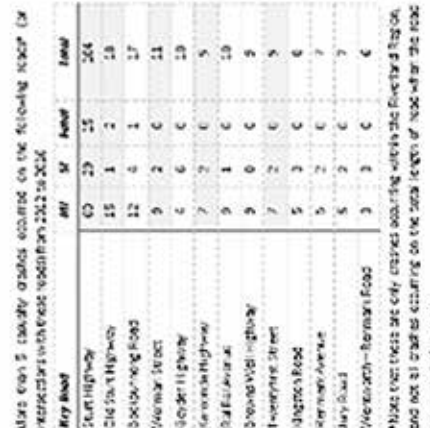
Adelaide is the most common location for casualty crashes in the region, followed by Riverland and then Metro Adelaide. The highest number of casualty crashes in the region are fatal crashes with 27 total. Fatal crashes are the highest in the region, followed by serious injury crashes with 26 total. Minor injury crashes are the lowest in the region with 40 total.



The casualty crash rate has not really declined since 2006. 2009 was the worst year recorded in the time period with 27 casualty crashes per km of road. The average of 27 for this time period. This average equates to at least one person being injured or more on Riverland road each year every 5 days.



Although the number of casualty crashes has declined since 2006, 2009 was the worst year recorded in the time period with 27 casualty crashes per km of road. The average of 27 for this time period. This average equates to at least one person being injured or more on Riverland road each year every 5 days.



Adelaide is the most common location for casualty crashes in the region, followed by Riverland and then Metro Adelaide. The highest number of casualty crashes in the region are fatal crashes with 27 total. Fatal crashes are the highest in the region, followed by serious injury crashes with 26 total. Minor injury crashes are the lowest in the region with 40 total.

Appendix C-1: RSA Report – Sturt Highway, Waikerie



Road Safety Audit

Sturt Highway – Waikerie

May 2018



raa.com.au

RAA

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V1.1	11/5/2018	MV	CM	Edits.
V1.2	23/5/2018	MV	CM	For issue.

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1 Introduction

This report presents the findings of a road safety audit carried out on 1/5/2018.

The safety audit was carried out due to a significant road safety complaints in this area and conducted by an audit team comprising:

- Senior Road Safety Auditor – Charles Mountain; and
- Road Safety Auditor – Matthew Vertudaches.

This road safety audit report identifies a number of issues relating to freight movements, parking accessibility, pedestrian safety and speed limits. This audit covers the extent of the Sturt Highway between Ian Oliver Drive and Curtis Road.

1.1 Purpose

The audit is undertaken in accordance with best practice principles in accordance with a safe system framework to ensure that road safety is a primary consideration at all times.

A driver's expectations about the standard of the carriageway, road markings, delineation and a forgiving roadside environment are a major contributing factor in his or her ability to negotiate the road environment safely.

Traffic safety principles need to be considered in order to provide road users with the safest road environment possible. Such principles include:

- Creating safe carriageways that facilitate appropriate tracking of motor vehicles, specifically at locations where topographical or property boundary constraints require changes to alignment;
- Ensuring all road user types are considered, with appropriate facilities to ensure safe operation and travel of all user types;
- Roadside features and constraints – typically close proximity features and intersections which increase the likelihood of crashes;
- Managing crash severity risk through the implementation of safety design principles to ensure injury is minimised in the event of a crash; and
- Ensuring that safety related design criteria such as appropriate sight distances, have been considered.

The findings, opinions and recommendations in this report are based on an examination of the location, and may not cover every deficiency that is present on site. It is considered that adoption of the recommendations set forth in this report should improve the level of safety on this section of the Sturt Highway in Waikerie.

1.2 Site Location

The site is located within the District Council of Loxton Waikerie area of jurisdiction and shown in Figure 1. Sturt Highway is under the care and control of the Department of Planning Transport and Infrastructure (DPTI). The intersections with Ian Oliver Drive, Maggea Road and Curtis Road are also under the care and control of DPTI.



Figure 1: Location Plan

1.3 Audit Team

The audit team comprised:

- Charles Mountain
Charles is the Senior Manager of Road Safety at RAA. He has extensive experience in transport, traffic and road safety. Prior to joining RAA he had over 25 years' experience in local government managing a wide variety of traffic, access and parking issues. Charles has qualifications in engineering, business management and is a qualified road safety auditor.
- Matthew Vertudaches
Matthew is a Traffic Engineer at RAA and has been with the organisation for 2 years. He has undertaken five days of Road Safety Audit training and Treatment of Crash Location training at the Queensland University of Technology. Matthew has qualifications in civil engineering with experience in civil and traffic engineering, traffic investigations and local government.

1.4 Audit Process Methodology

This Safety Audit has been undertaken in accordance with the Austroads Guide to Road Safety - Part 6: Road Safety Audits, and is aimed at ensuring that appropriate safety consideration is given, thus minimising the potential occurrence of crashes and reducing the severity of crashes that occur.

The entire length of the site was inspected on foot and also by vehicle on 1/5/2018. A night audit was not undertaken by the auditors as the issues are most prevalent during business

hours. The weather condition at the time of the inspection was fine with no rain. This site inspection forms the basis of the audit findings that are detailed in subsequent sections of this report.

Non-conformances and hazards have been identified using the Austroads guide and relevant guidelines or standards such as, Austroads 'Guide to Traffic Engineering Practice', DPTI technical standards and guidelines, and relevant Australian Standards.

Non-conformances or hazards identified in this report have been rated based on the probability and severity of possible crashes that could result from the identified issue. Possible actions have been suggested for the identified issues as a guide for consideration.

1.5 Responding to the Audit Report

Responsibility for road design always rests with the designer/project manager and not with a road safety auditor. A project manager or road authority is under no obligation to accept every recommendation set out in this report and it is not the auditor's role to agree or approve of the road authorities audit response.

It is expected that this formal road safety audit report will be responded to in writing with reasoning given for rejections of any recommendations made in this report. Written confirmation outlining how or when accepted recommendations may be useful and should be provided wherever possible.

To assist the road authority in responding, an area for formal response is provided in Appendix A of this road safety audit report.

2 Safety Audit Findings

Whilst it is important to ensure that a traffic control treatment and road environment is designed to a consistent standard, there are times when, due to physical or financial constraints, this is not always possible. This report does not consider the potential cost of projects, and makes recommendations based solely upon safety needs.

The following section describes each of the non-conformances or hazards identified during the audit. They are then summarised in section 2.4.

2.1 General Comments

Item 1: Parking

There is no convenient formalised parking on site for eastbound heavy vehicles or caravans. The parking facility on Maggea Road is recognised however at the time of our site inspection these were not utilised because an eastbound heavy vehicle or caravan is required to make three right turns, two of these across a Major Highway in order to access and leave this parking facility.

Heavy vehicle combinations and holidaymakers towing caravans instead utilise the eastbound service lane for parking, which creates safety issues due to restricted entry and egress issues for other vehicles.

During the audit teams' observations on site, the service lane was blocked or partially blocked by parked vehicles for the majority of the time which in turn results in dangerous entry and egress manoeuvres for other vehicles entering or leaving Sturt Highway to access businesses.

It is recommended that a formal parking arrangement on the north side of Sturt Highway be provided for eastbound caravans and heavy vehicle combinations. Vacant land opposite the Growers Wine Group driveway could potentially be used for this purpose. It is also recommended that upon providing parking to these vehicles, 'no parking' areas are clearly signed and marked out to discourage dangerous and illegal parking.

Item 2: Footpaths

Frequent pedestrian movements were noted between the various businesses on Sturt Highway. Pedestrians currently walk unprotected along the service road and contend with parked vehicles and moving vehicles in order to access multiple businesses. It is currently considered that there is a high risk of a crash involving a pedestrian at this site with this current practice.

It is recommended that dedicated pedestrian walkways are provided for pedestrians to safely access businesses in the precinct.

Item 3: Speed Limit

A number of reference documents can be used to determine an appropriate speed limit for a road, including:

- The Speed Limit Guideline for South Australia (Produced by DPTI)
- AS1742.4 Australian Standard Manual of uniform traffic control devices Part 4: Speed Controls
- Austroads Guide to Road Safety Part 3: Speed Limits and Speed Management.

The speed limit guideline for South Australia states that a 60km/h speed limit should apply to main roads in a built up area. The guideline uses the following definition for a built up area:

Built-up area – In relation to a length of road, an area in which either of the following is present for a distance of at least 500m, or if the length of road is shorter than 500m, for the whole road:

- *Buildings, not over 100m apart, on land next to the road.*
- *Street lights not over 100m apart.*

GIS software has been used to estimate the length of Sturt Highway in question between Waikerie Honda and the residence at 12937 Sturt Highway to be approximately 650m.

Typical 60km/h speed limit examples given in the guideline include roads in rural residential, commercial or retail areas which do not meet the legal definition for the urban default limit and main roads in rural towns outside of the central business district.

Typical 80km/h speed limit examples given in the guideline include rural roads in partially built up areas with limited adjacent development, typically a small village in a rural area, or roads through urban/rural fringe areas. Houses may be located on larger allotments and be set back from the road, allowing drivers accessing these properties to enter and leave the road in a forward direction.

AS1742.4 also suggests appropriate speed limits based on roadside development. The standard defines a fully built up area as:

Residential, business or industrial development extending along at least 90% of the road frontage on both sides of the road. The development may include schools, shops, playing fields etc. The appropriate speed limit is 60km/h but 70km/h or 80km/h may be appropriate on urban arterial roads with improved cross-section or reduced levels of direct access.

And a partially built up area as:

Residential, business or industrial development along 25% - 90% of the road frontage on both sides of the road. This is typical of an urban fringe area or a township in a rural area. The appropriate speed limit is generally 80km/h but 60km/h or 70km/h may be appropriate if there is extensive vehicular or pedestrian activity on the road

For the purposes of assessing the area against AS1742.4, the area would be classed as a partially built up area however due to limited development on the Southern side of Sturt Highway. Due to extensive vehicular and pedestrian traffic, a speed limit lower than 80km/h would be appropriate according to this standard.

The desirable minimum length for a 60km/h zone is 600m and the desirable minimum length for an 80km/h zone is 800m and this is consistent across both guidelines. When an 80km/h zone is used as a 'buffer zone' into a lower speed limit, 400m is the desirable length.

Austroroads Guide to Road Safety discusses typical speed limits and considerations that need to be made when setting a speed limit. This document specifies that previous crash history should be a strong consideration when reviewing a speed zone, as well as the roadside environment and operating performance of the road including:

- Activities that generate a large number of pedestrians
- Road cross section
- Whether there is restricted access on one or both sides of the road,
- Whether the development on each side of the road is similar or vastly different,
- The frequency and set back of driveways,
- The nature and level of the roadside environment (i.e. residential, commercial/shopping, industrial).

After assessing this area against each speed limit guideline, it is recommended that a 60km/h speed limit is applied for approximately 800m of Sturt Highway replacing 800m of the existing 80km/h speed limit zone. An electronic variable speed limit should be considered which could allow vehicles to travel 80km/h overnight where there are considerably less vehicles and pedestrians in the area. It is recommended that traffic counts and movements including pedestrian activity is reviewed in order to determine suitable times to implement a potential variable speed limit zone.

Figure 2 below outlines the recommended speed limit arrangement for Sturt Highway in Waikerie.





Figure 2: Recommended speed limit layout for Sturt Highway in Waikerie

This option utilizes an 80km/h buffer zone for approximately 400m on the western approach, a 60km/h zone of approximately 800m and a 1.7km 80km/h zone on the eastern approach. It should also be noted that the 60km/h zone in this option is contained entirely within the current 80km/h zone and changes to the total length of the speed zone are not required. By replacing 800m of 80km/h road with a 60km/h speed limit, the total increase in travel time is 12 seconds.


An 80km/h buffer zone is preferred to '60 ahead' advisory signage due to the risks associated with a potential increase in Sturt Highway speeds at the intersections with Ian Oliver Drive and Holder Top Road and these should be maintained at 80km/h in their own right.

2.2 Specific Findings

Item No.	Item Description
4	Lack of formalised entry/exit points to northern service road
	<div data-bbox="373 528 1362 840">  </div> <p data-bbox="443 846 1292 875">Figure 3: Satellite image of entry point to northern service road (Google, 2018)</p> <div data-bbox="373 922 1362 1346">  </div> <p data-bbox="501 1352 1228 1382">Figure 4: Current line marking on approach to northern service road</p> <p data-bbox="344 1429 1385 1637">A painted island separates the eastbound lane of Sturt Highway from the service road to access businesses on the north side. This island is continuous with no breaks or formalised entry or exit points. Vehicles are entering and leaving the service road at different locations across the island which is causing confusion and generates many near misses.</p> <p data-bbox="344 1688 1385 1854">It is recommended that entry and exit points to the service road are clearly defined and that a concrete island or other form of physical barrier be installed between Sturt Highway and the service road to prevent uncontrolled movements into and out of the service lane.</p>

5	Long vehicles parking on northern service road
	<div data-bbox="384 353 1342 891"></div> <p data-bbox="347 898 1378 965">Figure 5: Caravans parking in the service road. In this case caravans blocked designated parking spaces in front of New Land Bakery as well as the exit to the drive-through.</p> <div data-bbox="384 1010 1342 1547"></div> <p data-bbox="347 1554 1378 1693">Figure 6: B-Doubles and caravans parking on the service road. In this case B-Doubles blocked off the service road and a caravan blocked off a possible route around the B-Doubles. The only option for vehicles to pass was to drive across the painted island and onto the highway around the parked vehicles.</p> <p data-bbox="339 1744 1386 1823">Long vehicles such as freight and tourists towing caravans regularly stop on the service road to access businesses. This creates numerous issues including:</p> <ul data-bbox="387 1874 1386 2045" style="list-style-type: none">• Driver confusion about where to safely park• Reducing sight distance to other vehicles on the service road and pedestrians• Restricting access to businesses and blocking parking locations.

	<p>It is recommended that parking facilities are provided on the north side of Sturt Highway that are convenient and accommodate road trains and caravan drivers that regularly stop in Waikerie. The parking facility on Maggea Road is recognised however this is seldom utilised nor is it desirable for eastbound freight to perform three right turns in order to use this parking facility then continue east.</p> <p>This area could be used effectively for caravans, but needs improved signage to alert approaching drivers of this parking facility.</p> <p>Two locations that may be feasible to provide long vehicle parking include the currently vacant land east of Illalangi Gourmet Foods and the open paved area west of New Land Bakery. Both of these options should be explored for potential parking provisions.</p>
6	<p>Lack of safe or formalised pedestrian crossing location</p> <p>Pedestrians were noted to be regularly crossing Sturt Highway between Maggea Road and the Growers Wine Group driveway. There are no pedestrian refuges or any infrastructure in place to direct pedestrians to a common or safe crossing location. This causes pedestrians to cross the road close to where they park their vehicle. It is hazardous for pedestrians to be crossing a major highway and freight corridor with an 80km/h speed limit and no protection.</p> <p>It is recommended that, along with a scheme of concrete traffic islands and a lower speed limit, at least one pedestrian refuge is provided with pedestrian fencing restricting access across the highway at locations other than where the refuge is located.</p> <p>This could be located at a point between the New Land Bakery and Viewpoint Café, away from the right turn lane into Growers Wine Group.</p>

7	Heavy vehicles driving over painted median when turning right into Growers Wine Group
	<div data-bbox="363 405 1369 965"></div> <p data-bbox="368 974 1364 1037">Figure 7: The channelised right turn lane into Growers Wine Group was barely long enough, causing heavy vehicles to drive on the painted median prior to entering the turn lane.</p> <p data-bbox="341 1093 1390 1256">Heavy vehicles turning right into Growers Wine Group drive over the painted median island at high speed prior to entering the channelised right turn lane. This poses a high risk to pedestrians who regularly stand on this painted median when crossing Sturt highway.</p> <p data-bbox="341 1312 1390 1476">It is recommended that the channelised right turn lane is extended to safely accommodate deceleration and right turn movements, and a raised concrete median is installed to restrict vehicles from driving on the islands and increase the level of safety for pedestrians.</p>

8

Painted Traffic Islands




Figure 8: Vehicles regularly enter and exit the highway sporadically over painted islands.




Figure 9: Vehicles regularly enter and exit the highway sporadically over painted islands.

Painted traffic islands and medians on site are functioning poorly. The intention of these devices is generally to direct and restrict traffic however painted traffic islands are regularly being utilised for U-turns, right turns and entering and exiting the highway.

It is recommended that raised concrete islands and medians are utilised as an alternative to painted traffic islands between Ian Oliver Drive and Growers Wine Group. Sections of painted island may still be used on the noses of these island to

	<p>accommodate the wider swept paths of caravans and heavy vehicle where required.</p> <p>It is noted that if raised concrete traffic islands are installed that upgrades to street lighting will be required as discussed below in item 11.</p>
9	<p>90 degree parking in front of New Land Bakery</p> <div data-bbox="370 613 1362 1167"></div> <p>Figure 10: 90 degree parking in front of New Land Bakery causes some vehicles to back out onto Sturt Highway.</p> <p>Current 90 degree parking in front of New Land Bakery requires traffic to back out into the service road but in some cases vehicles are backing straight out onto Sturt Highway. Due to poorly parked vehicles, sight distance to the west is regularly restricted for these vehicles and they are backing out blind.</p> <p>It is recommended that 60 degree angle parking is installed to encourage drivers to back out into the service road rather than backing out onto the major highway. When parking in the area is formalised, sight distance issues for reversing vehicles should be far less common.</p>

10	Stobie Poles
	 <p>Figure 11: Stobie poles present a hazard and also restrict potential parking locations</p> <p>Stobie poles on site are a crash risk however are generally set back from Sturt Highway. Two stobie poles in particular raise concern, namely the stobie pole opposite Maggea Road and the stobie pole opposite the Growers Wine Group driveway.</p> <p>It is recommended that these two stobie poles are removed and power is undergrounded, with hazard signs installed on stobie poles in the short time. This will provide safety benefits by removing hazardous fixed objects within the clear zone but also provide clear space to consider for additional long vehicle parking spaces.</p>
11	Street Lighting
	<p>A low level of street lighting is currently provided on site. If raised concrete traffic islands are installed, the level of street lighting will need to be reviewed and upgraded as necessary to meet relevant DPTI and Australian standards and provide sufficient visibility of these devices.</p>
12	Lack of formalised right turn access into service road for westbound vehicles
	<p>Westbound vehicles were regularly sighted turning right from the painted median into parking spaces on the north side of the road or to perform a U-turn onto the service road. This manoeuvre puts pedestrians at risk who utilise the painted median to perform a two stage crossing. As there is currently no channelised right turn lane, this is causing drivers to turn right from many different locations depending on their destination.</p>

	<p>It is recommended that a channelised right turn lane is provided in the median to the south of Maggea Road with a break also provided in the service road island. This will formalise this right turn movement and allow safer right turns for vehicles and pedestrians.</p>
13	<p>Poor layout at Railway Terrace intersection</p> <div data-bbox="368 568 1369 1140"></div> <p>Figure 12: The end of Railway Terrace is very poorly delineated and priorities are not clear with the beginning of the Sturt Highway service road.</p> <p>The Railway Terrace intersection was causing a number of safety issues, including:</p> <ul style="list-style-type: none">• Vehicles turning right from Railway Terrace onto Sturt Highway,• Vehicles travelling west along the service lane to access Railway Terrace• Near misses between vehicles entering the service road from railway terrace and vehicles entering the service road from Sturt Highway. <p>It is recommended that this intersection is formalised with line marking and pavement bar treatments to restrict vehicle access directly onto Sturt Highway from Railway Terrace.</p> <p>Railway Terrace could be extended in front of residential properties to provide safe access to these properties and connect to the service road near the New Land Bakery.</p> <p>This would leave space between the Sturt Highway service road and the extension of Railway Terrace to consider for long vehicle parking, especially if the stobie pole is removed as recommended in item 10.</p>

2.3 Guide to Ranking System

The audit team has raised issues in respect to road safety that should be given due consideration. To assist and gauge the relevant importance of each of the safety issues documented in this report, the following risk matrix has been considered in and a priority ranking system shown in Table 4 has been adopted.

Table 1: Likelihood

Likelihood	Description
Highly probably	It is likely that more than one crash of this type could occur within a five year period.
Occasional	It is likely that less than one crash of this type could occur within a five year period.
Improbably	Less than one crash of this type could occur within a 10 year period.

Table 2: Severity

Severity	Description
Major	The crash is likely to result in a fatality or serious injuries
Moderate	The crash is likely to result in minor injuries or large scale of property damage.
Minor	The crash is likely to result in minor property damage or many near miss crash events.

Table 3: Safety Issue Ranking System

LIKELIHOOD \ SEVERITY	Improbable	Occasional	Highly Probable
Minor	Low	Low	Medium
Moderate	Low	Medium	High
Major	Medium	High	High

Table 4: Safety Issue Ranking System

Safety Issue Ranking	Likelihood of a crash resulting in serious or fatal injury
Priority 'A' (High)	A major concern that should be addressed and requires changes to avoid serious safety problems.
Priority 'B' (Medium)	A significant safety concern that requires consideration of changes to improve safety.
Priority 'C' (Low)	A safety concern of lesser significance, but which should be addressed as it may improve overall safety.
Comment	A concern or an action that may be outside the scope of the RSA, but which may improve the overall design or be of wider significance. The responsibility for any action on comments may fall to the response road authority.

2.4 Summary of Recommendations

The road safety audit findings and suggested actions detailed throughout this report have been summarised in Table 5.

Table 5: Audit Recommendations Summary

Item	Deficiency	Suggested Action	Risk Rating
1.	Parking	Provide parking on the northern side of Sturt Highway for caravans and heavy vehicle combinations	A
2.	Footpaths	Provide dedicated pedestrian walkways.	A
3.	Speed Limit	Reduce speed limit to 60km/h for approximately 800m through the site.	A
4.	Lack of formalised entry/exit points to northern service road	Clearly define entry and exit points to the service road by utilising raised concrete traffic islands.	A
5.	Long vehicles parking on northern service road	Provide parking on the northern side of Sturt Highway for caravans and heavy vehicle combinations	A
6.	Lack of safe or formalised pedestrian crossing location	Install pedestrian refuges and fencing as part of a raised concrete median scheme	A
7.	Heavy vehicles driving over painted median when turning right into Growers Wine Group	Extend channelized right turn lane	B
8.	Painted Traffic Islands	Utilise raised concrete islands and medians as an alternative to painted islands between Ian Oliver Drive and Growers Wine Group	A
9.	90 degree parking in front of New Land Bakery	Convert to 60 degree parking to reduce the number of vehicles reversing onto Sturt Highway	C
10.	Stobie Poles	Underground power in certain locations to remove stobie poles and create space for caravan and heavy vehicle parking.	C
11.	Street Lighting	Improve street lighting if raised concrete island scheme is adopted.	B
12.	Lack of formalised right turn access into service road for westbound vehicles	Install channelised right turn lane in the median to allow westbound vehicles to safely access the northern service road.	C
13.	Poor layout at Railway Terrace intersection	Improve delineation with line marking and pavement bar treatments to restrict direct access onto Sturt Highway from Railway Terrace	B

The sketch in Appendix B visually summarises the recommendations outlined in the Road Safety Audit Report. This is not to scale and should only be used to visualise some of the possible treatment options that have been recommended in this road safety audit report.

Audit Team Statement

The above safety audit findings and suggested actions are the opinion of the audit team, and are aimed at changes that may be implemented in order to improve safety. The issues raised in this report, together with recommendations, should be considered for implementation.



Date: 23/5/18,

Charles Mountain
Senior Manager of Road Safety
Lead Road Safety Auditor



Date: 23/5/18

Matthew Vertudaches
Traffic Engineer
Road Safety Auditor

Appendix A

Decision Tracking Form

Road Safety Audit Report Recommendations
DECISION TRACKING FORM

Project Title: Sturt Highway, Waikerie RSA
Department of Planning, Transport and Infrastructure,
Project Managers: District Council of Loxton Waikerie
Road Safety Auditors: Charles Mountain, Matthew Vertudachas
Road Safety Audit Stage: Existing Road Safety Audit
Designers: N/A

Item No.	Recommendation	Risk Rating	Road Authority Response/Comments	Road Authority Decision
1.	To prevent vehicles parking dangerously. Provide parking on the northern side of Sturt Highway for caravans and heavy vehicle combinations.	A		
2.	Provide dedicated pedestrian walkways.	A		
3.	Reduce speed limit to 40km/h for approximately 800m through the site.	A		
4.	Clearly define entry and exit points to the service road by utilising raised concrete traffic islands.	A		
5.	To prevent vehicles parking on the northern service road. Provide parking on the northern side of Sturt Highway for caravans and heavy vehicle combinations.	A		
6.	Install pedestrian refuges and fencing as part of a raised concrete median scheme.	A		
7.	Extend channelised right turn lane into Growers Wine Group.	B		
8.	Utilise raised concrete islands and medians as an alternative to painted islands between Ian Oliver Drive and Growers Wine Group.	A		
9.	Convert to 60 degree parking to reduce the number of vehicles reversing onto Sturt Highway.	C		
10.	Underground power in certain locations to remove stobie poles and create space for caravan and heavy vehicle parking.	C		
11.	Review street lighting and upgrade as necessary if raised concrete island scheme is adopted.	B		
12.	Install channelised right turn lane in the median to allow westbound vehicles to safely access the northern service road.	C		
13.	Improve delineation with line marking and pavement bar treatments to restrict direct access onto Sturt Highway from Railway Terrace.	B		

Appendix B

Sketch of audit recommendations

Sturt Highway, Waikerie

RAA Road Safety Audit Recommendations



List of Recommendations

- 1 Long vehicle parking
- 2 Footpath/sidewalks
- 3 Speed limit
- 4 Entry/exit points to service road
- 5 Long vehicle parking
- 6 Pedestrian bridge and fencing
- 7 Extend right turn lane
- 8 Base of concrete island adjacent
- 9 60 degree parking in front of bakery
- 10 Remove double poles
- 11 Street lighting upgrade (not shown)
- 12 Formid night turn WCCB
- 13 Improve Railway Terrace intersection



Appendix C-2: RSA Report – Intersection Sturt Highway and Airport Road, Renmark



Road Safety Audit

Intersection Sturt Highway & Airport Road, Renmark

May 2018

 raa.com.au

**RAA**

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1 Introduction

This report presents the findings of a road safety audit carried out on 1/5/2018.

The safety audit was carried out due to a significant complaints primarily regarding freight movements through this intersection and was conducted by an audit team comprising:

- Senior Road Safety Auditor – Charles Mountain; and
- Road Safety Auditor – Matthew Vertudaches.

This road safety audit report identifies issues relating to freight movements and accessibility to and from the Renmark industrial precinct via Airport Road.

1.1 Purpose

The audit is undertaken in accordance with best practise principles in accordance with a safe system framework to ensure that road safety is a primary consideration at all times.

A driver's expectations about the standard of the carriageway, road markings, delineation and a forgiving roadside environment are a major contributing factor in their ability to negotiate the road environment safely.

Traffic safety principles need to be considered in order to provide road users with the safest road environment possible. Such principles include:

- Creating safe carriageways that facilitate appropriate tracking of motor vehicles, specifically at locations where topographical or property boundary constraints require changes to alignment;
- Ensuring all road user types are considered, with appropriate facilities to ensure safe operation and travel of all user types;
- Roadside features and constraints – typically close proximity features and intersections which increase the likelihood of crashes;
- Managing crash severity risk through the implementation of safety design principles to ensure injury is minimised in the event of a crash; and
- Ensuring that safety related design criteria such as appropriate sight distances, have been considered.

The findings, opinions and recommendations in this report are based on an examination of the location, and may not cover every deficiency that is present on site. It is considered that adoption of the recommendations set forth in this report should improve the level of safety at the intersection of Sturt Highway and Airport Road in Renmark.

1.2 Site Location

The intersection is located within the Renmark Paranga Council area and shown in Figure 1. Sturt Highway is under the care and control of the Department of Planning Transport and Infrastructure (DPTI) with Airport Road controlled by the Renmark Paranga Council.



Figure 1: Location Plan

Airport Road is the primary entrance and egress point for heavy vehicles to the Renmark industrial precinct and for access to the Renmark Airport. Multiple large freight operators are based in this precinct with many heavy vehicles entering and exiting the precinct every day.

Figure 2 shows the currently B-Double approved routes at the intersection and in the immediate vicinity. The intersection is currently not approved for general Road Train, B Triple or PBS level 2B use at this stage, however consideration needs to be given to future approval of these vehicles types with any upgrades that are considered.



Figure 2: B-Double approved routes around Airport Road (RAVnet, May 2018)

1.3 Audit Team

The audit team comprised:

- Charles Mountain
Charles is the Senior Manager of Road Safety at RAA. He has extensive experience in transport, traffic and road safety. Prior to joining RAA he had over 25 years' experience in local government managing a wide variety of traffic, access and parking issues. Charles has qualifications in engineering, business management and is a qualified road safety auditor.
- Matthew Vertudaches
Matthew is a Traffic Engineer at RAA and has been with the organisation for 2 years. He has undertaken five days of Road Safety Audit training and Treatment of Crash Location training at the Queensland University of Technology. Matthew has qualifications in civil engineering with experience in civil and traffic engineering, traffic investigations and local government.

1.4 Audit Process Methodology

This Safety Audit has been undertaken in accordance with the Austroads Guide to Road Safety - Part 6: Road Safety Audits, and is aimed at ensuring that appropriate safety consideration is given, thus minimising the potential occurrence of crashes and reducing the severity of crashes that occur.

The site was inspected on foot and also by vehicle on 1/5/2018. A night audit was not undertaken by the auditors as the current issues are most prevalent during business hours. The weather condition at the time of the inspection was fine with no rain. This site inspection forms the basis of the audit findings that are detailed in subsequent sections of this report.

Non-conformances and hazards have been identified using the Austroads guide and relevant guidelines or standards such as, Austroads 'Guide to Traffic Engineering Practice', DPTI technical standards and guidelines, and relevant Australian Standards.

Non-conformances or hazards identified in this report have been rated based on the probability and severity of possible crashes that could result from the identified issue. Possible actions have been suggested for the identified issues as a guide for consideration.

1.5 Responding to the Audit Report

Responsibility for road design always rests with the designer/project manager and not with a road safety auditor. A project manager or road authority is under no obligation to accept every recommendation set out in this report and it is not the auditor's role to agree with or approve of the road authorities audit response.

It is expected that this formal road safety audit report will be responded to in writing with reasoning given for rejections of any recommendations made in this report. Written confirmation outlining how or when accepted recommendations may be useful and should be provided wherever possible.

To assist the road authority in responding, an area for formal response is provided in Appendix A of this road safety audit report.

2 Safety Audit Findings

Whilst it is important to ensure that a traffic control treatment and road environment is designed to a consistent standard, there are times when, due to physical or financial constraints, this is not always possible. This report does not consider the potential cost of projects, and makes recommendations based solely upon safety needs.

The following section describes each of the non-conformances or hazards identified during the audit. They are then summarised in section 2.4.

2.1 General Comments

Item 1

Freight Movements

Heavy freight including B-Doubles regularly use this intersection to access the Renmark industrial precinct. All turn movements are supported by the current layout and regularly used however right turn movements are of particular concern due to the time it takes for a heavy vehicle to complete the turn and fully clear the carriageway.



Figure 3: B Doubles regularly turn right from Airport Road

2014 DPTI traffic volume estimates on this section of Sturt Highway are 8300 vehicles per day inclusive of 13.5% (1100) commercial vehicles. B Doubles (Class 10) make up over one third of all commercial vehicles on Sturt Highway in this location, with an estimated 420 vehicles per day. These figures refer to the section between Old Sturt Highway and Twentyseventh Street.

Given these traffic volume figures, and based on observations on site and feedback provided to the audit team by RAA Members, heavy vehicles to turning right from Airport Road can regularly experience delays. This in turn causes drivers to make potentially dangerous turning manoeuvres due to the very limited opportunities where there is sufficient gap in both directions to commence a right turn.

After turning right from Airport Road, the majority of heavy vehicles immediately begin driving on the wide westbound shoulder in order to allow other westbound vehicles to pass whilst they accelerate to speed. This manoeuvre can be risky as the wide shoulder does not extend far enough for heavy vehicles to reach the speed limit and they are then required to merge back onto the busy highway at high speed.

Recommendation

It is recommended that a significant upgrade of this intersection is considered that will reduce speeds in the immediate vicinity, and provide timely opportunities for heavy vehicle operators to safely undertake a right turn from Airport Road on to Sturt Highway.

Options to consider include:

- Installation of a large roundabout suitable for all vehicle types using this intersection
- Installation of formal acceleration lane for right turning vehicles
- Grade Separation, in the long term, dependant on future development

Of these three options, a large roundabout is the preferred option due to the cost restraints of grade separation and the potential introduction of additional safety issues by introducing an acceleration lane prior to the overtaking lane west of the intersection.

Consideration should be given to larger heavy vehicle combinations including B-Triple and PBS level 3 combinations when designing this intersection such that the intersection is not a constraint when considering future freight movements through the Riverland.

Item 2

Speed Limit Change

The speed limit changes from 90km/h to 110km/h approximately 200m west of the intersection, at the beginning of the left turn lane taper.



Figure 4: (Looking west) the speed limit changes from 90km/h to 110km/h just beyond the intersection



Figure 5: (Looking east) the speed limit changes to 90km/h from 110km/h whilst approaching the intersection


At the time of our visit, although speeds were not formally recorded, there appeared to be a lack of compliance with this speed zone. Westbound vehicles were noted to be accelerating to the 110km/h speed limit at the intersection, before the 110km/h signage, however, signage was visible from the intersection. Similarly, westbound vehicles were slow to reduce speed from 110km/h to 90km/h and were noted to 'coast' to the lower speed limit after passing the 90km/h signage, which is fairly common practice.


This causes vehicle speeds on Sturt Highway to be in excess of the 90km/h on occasion, which in turn increases the length of the minimum gap sight distance (MGSD) required to safely turn from Airport Road and can lead to an increase of the severity of a potential crash. Referring to table 3.4 and 3.5 in Austroads Guide to Road Design – Part4A, the MGSD for approach speeds of 90km/h is 125m, and for approach speeds of 110km/h is 153m.


Recommendation

It is recommended that vehicle speeds on Sturt Highway are surveyed, and that consideration is given to extending the 90km/h zone by 300m to the west so that vehicle speeds on Sturt Highway are more consistent through the intersection.

2.2 Specific Findings

Item No.	Item Description
3	Right turn from Airport Road to Sturt Highway
	 <p>Figure 6: Heavy vehicles currently utilise the wide westbound shoulder to accelerate</p> <p>Turning right from Airport Road is most troublesome turning movement at this intersection and can be frustrating for heavy vehicle drivers due to the high volumes of traffic on Sturt Highway. Risky turn manoeuvres are often made in order to clear the intersection. Drivers currently utilise the westbound shoulder to accelerate to speed.</p> <p>It is recommended that a large roundabout accommodating all freight movements is installed at this intersection to improve safety by reducing frustration and the number of risky turns being made.</p>

4	Right turn from Sturt Highway to Airport Road
	<div data-bbox="357 338 1366 902"></div> <p data-bbox="544 909 1174 938">Figure 7: Heavy vehicles cut the corner when turning right</p> <p data-bbox="336 983 1385 1234">Heavy vehicles turning right from Sturt Highway onto Airport Road regularly cut the corner, posing a risk to vehicles turning right out of Airport Road. For smaller rigid vehicles this is more down to driver error however the swept path of larger articulated combinations requires this space. It was noted that some vehicles utilised the painted traffic island on the western corner of the intersection to generate additional turning space.</p> <p data-bbox="336 1290 1385 1451">As previously stated in the report, a roundabout is the recommended option and will address this issue. If a roundabout is not supported, in the short term, widening of Airport Road at the apron to create additional space for turning vehicles is recommended.</p>

5	Faded/deteriorated line markings
	<div data-bbox="336 349 1347 913"></div> <p data-bbox="531 920 1197 949">Figure 8: Line marking at the intersection is in poor condition</p> <p data-bbox="336 987 1394 1099">Line marking was noted to be in poor condition due to the constant heavy vehicle traffic. It is recommended that line marking is refreshed, and scheduled for refreshing on a more regular basis than it is currently.</p>

6	Skid resistance
	<div data-bbox="352 349 1326 887"></div> <div data-bbox="486 891 1236 920"><p>Figure 9: Sturt Highway is highly polished on approach to Airport Road.</p></div> <div data-bbox="373 958 1350 1503"></div> <div data-bbox="365 1507 1358 1563"><p>Figure 10: The transition between polished surface and the higher friction surface through the intersection</p></div> <p data-bbox="352 1603 1378 1709">The road surface on approach to the intersection is exhibiting heavy surface polishing, which leads to poor skid resistance, especially in wet weather and can lead to aquaplaning.</p> <p data-bbox="352 1753 1378 1966">It is recommended that skid testing is undertaken to determine the pavement friction supply, and remediation treatment is conducted if this shows poor skid resistance. RAA have previously tested the effectiveness of high pressure spray treatments to flush out bleeding binder material, with the result of these tests indicating large improvements to skid resistance and stopping distance on wet pavement.</p>

7	Failing pavement surface on Airport Road
	<div data-bbox="360 342 1386 916"></div> <div data-bbox="523 920 1222 952"><p>Figure 11: The surface of Airport Road is in very poor condition</p></div> <div data-bbox="360 992 1386 1568"></div> <div data-bbox="564 1574 1181 1606"><p>Figure 12: Potholes and cracks forming on Airport Road</p></div> <p data-bbox="336 1655 1410 1767">The surface on Airport Road is in very poor condition and large lumps are visible between the wheel paths and on the edges due to the turning motion of vehicles on approach to the intersection.</p> <p data-bbox="336 1816 1410 1935">Although not an immediate safety concern due to the low speed environment, there is potential to cause vehicle damage, which will increase as the road deteriorates further.</p> <p data-bbox="336 1995 1410 2027">It is recommended that Airport Road is resealed in the vicinity of this intersection.</p>

2.3 Guide to Ranking System

The audit team has raised issues in respect to road safety that should be given due consideration. To assist and gauge the relevant importance of each of the safety issues documented in this report, the following risk matrix has been considered in and a priority ranking system shown in Table 4 has been adopted.

Table 1: Likelihood

Likelihood	Description
Highly probably	It is likely that more than one crash of this type could occur within a five year period.
Occasional	It is likely that less than one crash of this type could occur within a five year period.
Improbably	Less than one crash of this type could occur within a 10 year period.

Table 2: Severity

Severity	Description
Major	The crash is likely to result in a fatality or serious injuries
Moderate	The crash is likely to result in minor injuries or large scale of property damage.
Minor	The crash is likely to result in minor property damage or many near miss crash events.

Table 3: Safety Issue Ranking System

LIKELIHOOD \ SEVERITY	Improbable	Occasional	Highly Probable
Minor	Low	Low	Medium
Moderate	Low	Medium	High
Major	Medium	High	High

Table 4: Safety Issue Ranking System

Safety Issue Ranking	Likelihood of a crash resulting in serious or fatal injury
Priority 'A' (High)	A major concern that should be addressed and requires changes to avoid serious safety problems.
Priority 'B' (Medium)	A significant safety concern that requires consideration of changes to improve safety.
Priority 'C' (Low)	A safety concern of lesser significance, but which should be addressed as it may improve overall safety.
Comment	A concern or an action that may be outside the scope of the RSA, but which may improve the overall design or be of wider significance. The responsibility for any action on comments may fall to the response road authority.

2.4 Summary of Recommendations

The road safety audit findings and suggested actions detailed throughout this report have been summarised in Table 5.

Table 5: Audit Recommendations Summary

Item	Deficiency	Suggested Action	Risk Rating
1.	Freight movements	Construct a roundabout or consider other treatments suitable for a high volume of freight. Consideration needs to be given of future freight demand and designing for B-Triple combinations to prevent this intersection from becoming a future bottleneck.	A
2.	Location of speed limit change	Extend 90km/h zone by 300m to the west	A
3.	Right turn Airport Road to Sturt Highway	Construct Roundabout suitable for high volume of freight traffic.	A
4.	Right turn from Sturt Highway to Airport Road	Roundabout suitable for high volume of freight traffic. If roundabout not adopted, widening of Airport Road at the apron to cater for swept path of heavy vehicles.	B
5.	Faded/deteriorated line markings	Refresh line marking and schedule refreshing on a more regular basis.	B
6.	Skid resistance	Undertake skid testing on Sturt Highway and consider remediation should this show poor skid resistance in the wet.	A
7.	Failing pavement on Airport Road	Comment: Pavement was noted to be in very poor condition and it is suggested that a reseal is considered in the vicinity of the intersection.	Comment


Audit Team Statement

The above safety audit findings and suggested actions are the opinion of the audit team, and are aimed at changes that may be implemented in order to improve safety. The issues raised in this report, together with recommendations, should be considered for implementation.



Date: 23/5/18

Charles Mountain
Senior Manager of Road Safety
Lead Road Safety Auditor



Date: 23/5/18

Matthew Vertudaches
Traffic Engineer
Road Safety Auditor

Appendix A

Decision Tracking Form







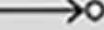





**Road Safety Audit Report Recommendations
DECISION TRACKING FORM**

Project Title: Intersection Sturt Highway & Airport Road, Renmark RSA
Department of Planning Transport and Infrastructure,
Project Manager: Renmark Paringa Council
Road Safety Auditor: Charles Mountain, Matthew Vertudaches
Road Safety Audit Stage: Existing Road Safety Audit
Designer: N/A

Item No.	Recommendation	Risk Rating	Road Authority Response/Comments	Road Authority Decision
1.	Construct a roundabout suitable for high volume of freight traffic, considering future freight needs.	A		
2.	Extend 90km/h zone by 300m to the west Roundabout suitable for high volume of freight traffic.	A		
3.	To address issues turning right from Airport Road. Construct a roundabout suitable for high volume of freight traffic, considering future freight needs.	A		
4.	To address issues turning right from Sturt Highway. If roundabout not adopted, in the short term, widening of Airport Road at the apron is recommended to cater for swept path of heavy vehicles.	B		
5.	Refresh line marking and schedule refreshing on a more regular basis.	B		
6.	Undertake skid testing on Sturt Highway and consider remediation should this show poor skid resistance in the wet.	A		
7.	Comment: Pavement was noted to be in very poor condition and it is suggested that a re-seal is considered in the vicinity of the intersection.	Comment		

Appendix D: Crash Diagram Symbolology

The following symbolology is used in crash diagrams located within this report.

Erroneous Vehicle 	Car 	Dry Daylight 1	Tree 
MI 	Semi-Trailer 	Wet Daylight <u>1</u>	Stobie Pole 
SI 	Motorcycle 	Dry Night 1.	Rollover 
Fatal 	Cyclist 	Wet Night <u>1.</u>	Left Road 

Within this report, the numbering used to number crashes is not in chronological order, and only refers to the order that crashes appear on our mapping software and can be used to discuss a particular crash on the diagram if required.