

The background of the page is a photograph of a two-lane asphalt road stretching into the distance. The road has a white line on the left shoulder and dashed white lines in the center. To the left of the road are utility poles and green grass. To the right is a green field with some trees and small buildings in the distance. The sky is blue with scattered white clouds.

# **Regional Road Assessment: Broken Hill and Barrier Highway**

Report – June 2023

**Motor | Home | Travel**



## RAA at a glance



South Australia's largest  
**member-owned**  
organisation



Advocating for South  
Australians for over  
**115 years**



**790k+**  
current members  
(55% of SA adults)



**400k+**  
insured  
South Australians



**1000+**  
staff employed  
across SA



**337k+**  
roadside rescues  
per year



**280k+**  
uses of the MyRAA app  
fuel feature per month



**5000+**  
solar panel installations  
since 2020



**5000+**  
SA travel experiences  
booked per year



**31k+**  
school students  
educated on  
road safety each year



**8500+**  
child restraints  
fitted or checked  
each year




**\$350k+**  
per year invested  
in SA community  
organisations

Prepared by

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## Disclaimer

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## Thankyou

*RAA would like to thank our members and local communities who have provided valuable feedback and commentary to inform this assessment. RAA would also like to thank stakeholder organisations for their valuable feedback and insights into the region, including the Broken Hill City Council, Regional Development Australia Far West NSW, South Australian Country Fire Service, South Australia Police and the South Australian Freight Council. RAA also thanks the South Australian Department for Infrastructure and Transport for their provision of open-source data and continued engagement with RAA regional road assessments.*

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## Acknowledgement of Country

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We acknowledge and respect Aboriginal peoples as the state's first peoples and nations, and recognise them as traditional owners and occupants of land and waters in South Australia.

Further, we acknowledge that the spiritual, social, cultural and economic practices of Aboriginal peoples come from their traditional lands and waters, that they maintain their cultural and heritage beliefs, languages and laws which are of ongoing importance, and that they have made and continue to make a unique and irreplaceable contribution to the state.



## Executive Summary

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RAA has been a trusted advocate in transport and mobility developed over the last 119 years and represents 800,000 members. We have an expert understanding of transport and mobility in a South Australian context. This allows us to provide unique insights into services and public policy settings to encourage improved transport, mobility planning and services to help support and benefit our members and the broader South Australian community.

RAA aligns its advocacy with the following three principles:

- **Safe** – A safe system that not only achieves but outperforms national and international safety benchmarks. It encompasses safe people using safe vehicles, on safe roads, at safe speeds.
- **Accessible** – To have a cost-efficient, convenient, and reliable network that is accessible and inclusive, as an essential part of personal mobility.
- **Sustainable** – Encompasses the needs of current and future generations, and considers financial, societal, and environmental factors.

The methodology used to produce this regional road assessment report involved surveying Broken Hill residents and regular users of the Barrier Highway between Broken Hill and Adelaide and analysing their feedback prior to undertaking site assessments to review issues raised. RAA consulted with local government, Regional Development Australia, and local emergency services personnel to discuss issues raised throughout the community survey. The results of this survey along with field observations and recommendations are presented throughout this report with a review of crash and traffic data.

Recommendations throughout the report are for the consideration of several road authorities. The South Australian *Department for Infrastructure and Transport* are the road authority responsible for considering most recommendations on the South Australian side of the border, whilst *Transport for New South Wales* are the road authority responsible for considering most recommendations on the New South Wales side of the border. Several recommendations within Broken Hill are also for the consideration of *Broken Hill City Council*.

Most recommendations for the Barrier Highway throughout this report are tailored to increase the amount of three-star or higher AusRAP rated highway in line with the targets of the South Australian and national ten-year road safety strategies. RAA acknowledges that substantial steps towards this are currently being taken as part of the \$62.5m upgrade of Barrier Highway between Burra and Cockburn under the *Roads of Strategic Importance* program, which should ultimately result in much more of this 305km section being rated at least three-stars.

Despite this upgrade, the 70km section between Giles Corner and Burra is left in need of further upgrades and was a key area of concern to regular road users. Whilst short in comparison, this section accounts for more than 31% of travel on the South Australian section of Barrier Highway.

The key concern raised by the Broken Hill community was the use of the city road network by heavy vehicles, particularly at intersections and in residential areas. As a resource-rich region with a strong and continued mining heritage, there will be a residual need for large freight vehicles to export product from the region. The mining industry is still the largest employer of Broken Hill residents, and further investigation of a new freight route bypassing residential areas of Broken Hill is needed to determine the feasibility of this solution to improve safety and amenity within the city. Implementation of a new freight route would also present opportunities to progress several other road and intersection improvements that are required throughout the city.

RAA presents the following recommendations to improve safety and productivity along the Barrier Highway, as well as in Broken Hill.



# Key recommendations for the Barrier Highway

## Narrow bridges

Review and progressively upgrade narrow bridges, such as the Three Sisters Bridge south of Yunta, to improve safety and flood resilience of the Barrier Highway corridor.

## Roads of Strategic Importance upgrade

Ensure the current upgrade between Burra and Cockburn provides a minimum seal width of 9m consistently.

## Roadside hazards

Progressively install safety barriers along the highway, focusing on areas with curves and exposed roadside hazards in the hilly terrain between Oodla Wirra and Nackara. Reduce the frequency of exposed, hazardous vegetation south of Burra.



Roadside hazards south of Burra

## Road maintenance

Complete road resealing, sealed shoulder widening and localised pavement reconstruction between Giles Corner and north of Burra, prioritising the section between Saddleworth and Black Springs. Localised pavement repairs, resealing and sealed shoulder widening are also required between Cockburn and Broken Hill.



Deteriorated surface between Saddleworth and Black Springs

## Other upgrades

Improve rest stop facilities along the corridor and install one overtaking lane in each direction between Giles Corner and Burra.

Upgrade the intersection with Third Street, Terowie and remove the 'S' bend in the highway, north of Mount Bryan.

Once upgrades and maintenance are complete, ensure audio tactile line marking is installed along the full length of the Barrier Highway.





# Key recommendations for Broken Hill

## Freight

Undertake a Broken Hill freight study, which should look at reducing heavy vehicle movements through residential areas and determine the feasibility of a full or partial freight bypass of Broken Hill, incorporating a 24-hour truck stop.

## Drainage

Review and update the 2006 Urban Stormwater Master Plan for Broken Hill to determine which projects are still incomplete and to identify further priority projects in the city for future funding grants.

## Active transport

Improve pedestrian accessibility along Williams Street and review the Crystal Street/South Road corridor from a cycling and active transport perspective to identify opportunities to improve safety, connectivity and route continuity.

Improve pedestrian crossing signage at the Argent Street/Sulphide Street zebra crossing.

## Broken Hill CBD

Investigate the provision of a 40km/h or lower area speed limit in the Broken Hill CBD, expanding on the current 40km/h Argent Street speed limit.

Review parking utilisation around Argent Street and consider implementation of an east-west dedicated cycling corridor along Argent Street, Blende Street or Beryl Street.

## Intersection upgrades

Upgrade the Crystal Street/Gossan Street intersection to reduce the impact of poor sight distance, and improve warning signs at the Argent Street/Menindee Road intersection, while considering a major upgrade in the longer term.

Intersection upgrades required along the main freight route are dependent on the outcome of a Broken Hill freight study.

## Silverton Road

Reseal Silverton Road, considering localised pavement reconstruction and drainage improvements. In the short term, flood depth indicators and associated signage are required at all floodways along the road.



A floodway on Silverton Road

## Notes

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### Crash data

Unless otherwise specified, South Australian crash data quoted within this report is sourced from the Road Crash Data dataset uploaded by the Department for Infrastructure and Transport on the Data SA website<sup>1</sup>. New South Wales Crash data is sourced from the NSW Crash Data<sup>2</sup> dataset uploaded by Transport for New South Wales. Crash data is for the five-year period between 2017 and 2021 (unless otherwise specified) because it is the most recent data available at the time of publishing this report.

**Casualty crashes** are defined as a crash where at least one person is injured or killed as a result of the crash. Property damage only crashes are not considered in crash data analysis within this report unless explicitly specified.

**Units** within the road crash database include animals and objects, but for the purpose of analysing the units involved in crashes, only human controlled units are considered unless otherwise specified.

There are some differences in crash data availability between New South Wales and South Australia, including the timeliness of data availability, the way crashes are classified and the level of data provided. Reporting on crashes across jurisdictions has been undertaken as consistently as possible, given these differences and limitations.

Casualty crashes per 100 million vehicle kilometres travelled (vkt) have been calculated for some roads and road sections in this report for comparative purposes. The calculation for vehicle kilometres travelled is  $vkt = \text{average annual daily traffic (AADT)} \times \text{length of road}$  and can be considered the approximate number of kilometres travelled by vehicles on that particular section of road. Crashes per 100m vkt allows for a comparison of historic crash rates across different road sections.

### Traffic volume data

Unless otherwise specified, recent traffic volume data quoted within this report is sourced from the Traffic Volumes dataset uploaded by the Department for Infrastructure and Transport on the Data SA website<sup>3</sup>. Traffic volume data quoted is from the most recent year available, however at times, this can be several years out of date.

Generally, this traffic volume data is only available for the state-maintained road network and is presented as average annual daily traffic (AADT). This is the sum of traffic travelling in both directions on a two-way road over the period of one year, divided by the number of days in the year. AADT provides a useful snapshot of the average volume of traffic on a road section. However, due to its nature as an annual average, it does not represent seasonal fluctuations which can be prevalent due to popular tourism seasons throughout a region, as well as harvest season where daily heavy vehicle traffic volumes can be several times higher than an AADT figure would otherwise imply.

RAA are not aware of any detailed traffic volume data provided by Transport for New South Wales for Broken Hill or the Barrier Highway between Broken Hill and South Australia.

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<sup>1</sup> Data SA, Road Crash data, accessed at <<https://data.sa.gov.au/data/dataset/road-crash-data>>.

<sup>2</sup> Open Data, NSW Crash Data, accessed at <<https://opendata.transport.nsw.gov.au/dataset/nsw-crash-data>>.

<sup>3</sup> Data SA, Traffic Volumes, accessed at <<https://data.sa.gov.au/data/dataset/traffic-volumes>>.



## AusRAP star ratings

AusRAP star ratings are discussed for roads throughout this report. The AusRAP star rating system, a subsidiary of the International Road Assessment Program (iRAP), assesses key criteria to establish the safety rating of a road from one to five stars with the latter representing the safest. Star ratings have been provided for discrete sites (cross-sections) along the Barrier Highway and Silverton Road (Broken Hill) that are typical of the overall road network or to highlight certain deficiencies. These ratings have been calculated using the iRAP 'ViDA' demonstrator tool. AusRAP star ratings are based on the international iRAP model which estimates an average 40% reduction in fatal and serious crashes for each incremental increase in star rating<sup>4</sup>.

Table 1: Estimated reduction in fatalities and serious injuries with increases in AusRAP star rating (iRAP, 2020).

Star rating	Relative proportion of fatalities and serious injuries
1	1
2	0.6
3	0.36
4	0.216
5	0.1296

RAA advocates for all regional highways to be maintained/upgraded to achieve a minimum AusRAP star rating of three stars to reduce the number of lives lost and serious injuries on South Australian roads and has long been advocating for these ratings to form key metrics of state and national road safety planning. This has recently been acknowledged in both the South Australian (2022 – 2031) and National (2021 – 2030) road safety strategies, where a national target of 80% of travel on national highways and high-speed roads (80km/h or above) has been set. A key outcome of the *South Australian Road Safety Action Plan 2023 – 2025* is to measure the annual share of the regional road network that has an improvement in star rating.

Pavement condition and skid resistance are metrics of a road star rating, however, unless specifically mentioned, these metrics are assumed to be 'good' for sealed roads unless there are highly obvious deficiencies in the road surface, or the image is being used to highlight the impact that a poor road surface has on star rating.

In addition to the discrete one-to-five-star rating, a star rating score is also calculated for each road segment. This score is the base value used to determine the star rating, and score bands are associated with each star rating value. The star rating score can be used to determine whether a road segment is a 'high' or 'low' rating within its band and helps measure increases or reductions in safety, even when the before and after star ratings are within the same band.

Table 2: Star rating score bands

Star rating	Star rating score band
1	22.5+
2	12.5 to <22.5
3	5 to <12.5
4	2.5 to <5
5	0 to <2.5

<sup>4</sup> iRAP, 2020, *The Business Case for Safer Roads*, <<https://www.vaccinesforroads.org/business-case-for-safer-roads/>>.

## Performance based standards (PBS)

From the South Australian Government website<sup>5</sup>, the Performance Based Standards (PBS) scheme offers the potential for heavy vehicle operators to achieve higher productivity and safety through innovative vehicle design.

The National Heavy Vehicle Regulator (NHVR) administers the PBS scheme, assessing and approving PBS designs and vehicles on advice from the PBS Review Panel.

PBS vehicle routes are classified into four national networks between level 1 and level 4, including a class A and B category for the vehicle lengths. Table 3 below explains the PBS vehicle types permitted under each level.

Table 3: PBS examples

PBS level	Vehicle length	Example vehicles
Level 1A	Equal or less than 20m	Single articulated vehicle or truck/trailer combination
Level 2A	Equal or less than 26m	b-double
Level 2B	Greater than 26m by equal or less than 30m	b-double fitted with quad axle groups
Level 3A	Equal or less than 36.5m	Double road train, b-triple
Level 3B	Greater than 36.5m but equal or less than 42m	Double road train, b-triple
Level 4A	Equal or less than 53.5m	A-triple road train, BAB-quad

## Austrroads vehicle classifications

Austrroads vehicle classifications are referred to in tables throughout this report. The classification of vehicles is detailed within *Austrroads Guide to Pavement Technology Part 4K: Selection and Design of Sprayed Seals*<sup>6</sup>.

Table 4: Austrroads vehicle classification system

Length description	Class	Example
Up to 5.5m	1	Short vehicle (e.g sedan, wagon, 4WD, utility, light van, bicycle, motorcycle)
	2	Short vehicle towing (e.g trailer, caravan, boat)
5.5m to 14.5m rigid	3	Two axle truck or bus
	4	Three axle truck or bus
	5	Four axle truck
11.5m to 19m with articulation	6	Three axle articulated vehicle
	7	Four axle articulated vehicle
	8	Five axle articulated vehicle
	9	Six axle articulated vehicle
17.5m to 36.5m	10	B-double
	11	Double road train
Over 33m	12	Triple road train

<sup>5</sup> South Australian Government, 2017, *Performance Based Standards*, accessed at <<https://www.sa.gov.au/topics/driving-and-transport/heavy-vehicles/operating-a-heavy-vehicle/performance-based-standards>>.

<sup>6</sup> Austrroads, 2019, *Guide to Pavement Technology Part 4K: Selection and Design of Sprayed Seals*, accessed at <[https://austrroads.com.au/\\_data/assets/pdf\\_file/0024/107448/AGPT04K-18\\_Guide\\_to\\_Pavement\\_Technology\\_Part-4K\\_Selection-Design\\_Sprayed\\_Seals.pdf](https://austrroads.com.au/_data/assets/pdf_file/0024/107448/AGPT04K-18_Guide_to_Pavement_Technology_Part-4K_Selection-Design_Sprayed_Seals.pdf)>.



## Background

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RAA's Safety and Infrastructure team periodically evaluates the South Australian regional road network based on the concerns of regional RAA members, residents and stakeholders. Throughout this process, RAA gains valuable transport insights for the region from the community and stakeholders and seeks to make recommendations to improve the safety and productivity of the regional road network.

RAA has utilised the AusRAP star rating model to produce several 'typical' star ratings along the Barrier Highway and Silverton Road (Broken Hill), which demonstrate the current level of safety of the road infrastructure. AusRAP star ratings are used to test many of the recommendations for high-speed roads throughout this report, to show the safety benefits that can be achieved via the implementation of our recommendations.

This is RAA's first full review of the Barrier Highway since 2013. A review on the southern section between Giles Corner and Terowie was completed as part of our Clare and Goyder regional road assessment in 2018.

Throughout this assessment, RAA consulted with Broken Hill City Council, Regional Development Australia Far West NSW (RDA), and the South Australian Freight Council (SAFC), as well as personnel from the South Australian Country Fire Service (SACFS) and South Australia Police (SAPOL) and appreciates the time and input by all involved that has informed our assessment and reporting.

In September 2022, a detailed survey was emailed to 6,102 RAA members residing in Broken Hill, or in townships and localities adjacent the Barrier Highway in South Australia. The survey was constructed such that questions about the Barrier Highway were only asked to those who indicated that they were familiar with it, and that questions regarding transport in Broken Hill were only asked to those that resided in Broken Hill or visited on a regular basis. The survey received 476 responses of which 450 were familiar with the Barrier Highway, and 223 were familiar with the Broken Hill transport network. The survey sought to explore issues and concerns in relation to:

- Road design and maintenance
- Speed limits
- Driver behaviour
- Heavy and oversize vehicles
- Motorcycling
- Cycling
- Pedestrians
- Public transport
- Taxis and rideshare
- Facilities for tourists and other visitors.

The assessment area is shown in Figure 1 and is defined by the boundary of the Broken Hill City Council, and the full alignment of the Barrier Highway between Giles Corner and Broken Hill. Due to high levels of community feedback, the Silverton Road between Broken Hill and Silverton (northwest of Broken Hill) was also reviewed.

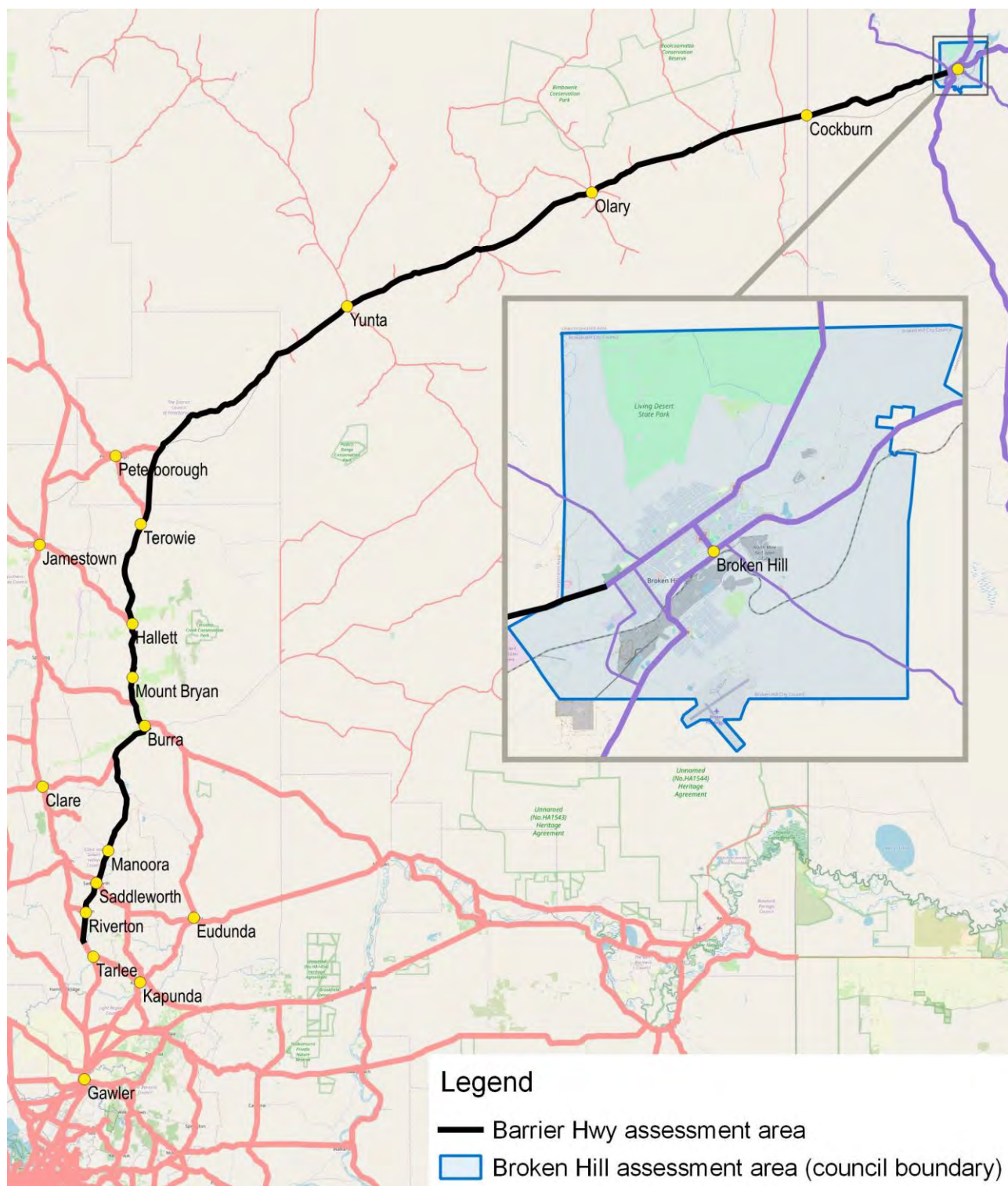


Figure 1: Broken Hill and Barrier Highway assessment area



## Recommendations

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### Recommendation colour scales

Recommendations throughout this report are ranked using a priority colour scale as depicted below. The primary factors considered when prioritising recommendations are the importance to community survey respondents, road safety, traffic volumes and importance to tourism and industry in the region. However, not all these factors may contribute to a given priority.

Recommendations in this report relating the Barrier Highway are prefixed “A”, while recommendations relating to transport in Broken Hill are prefixed with “B”.

Timeframes mentioned below are a general guide only and may not be applicable to every recommendation within this report.

#### **High priority recommendation**

This issue is of very high importance to the local community, has significant implications to road safety, is located on a busy road corridor and is important to tourism and industry in the region. These recommendations should be committed to within 12 months.

#### **Mid-high priority recommendation**

This issue is of high importance to the local community, has implications to road safety, is generally located on a busy road corridor and can be important to tourism and industry in the region. These recommendations should be committed to within 3 years or as part of routine maintenance.

#### **Mid priority recommendation**

This issue is moderately important to the local community, has some road safety implications and may be important to tourism and industry in the region. These recommendations should be committed to within 5 years or as part of routine maintenance.

#### **Mid-low priority recommendation**

This issue has been raised by the local community, may have some road safety implications or be important to tourism and industry in the region. These recommendations should be implemented as part of routine maintenance, or as part of a longer-term vision.

#### **Low priority recommendation**

This issue may have road safety implications or has some level of importance to tourism and industry in the region. These recommendations should be implemented as part of routine maintenance, rolled out gradually or as part of a longer-term vision.

## Full list of recommendations

### Barrier Highway

#### **Recommendation A1**

Widen sealed shoulders to ensure a consistent minimum sealed shoulder width of one metre is provided between Giles Corner and Burra, prioritising the section between Manoora and Burra.

#### **Recommendation A2**

Complete road widening between Burra and Cockburn to provide a total minimum sealed width of 9.0m (3.3m – 3.5m wide lanes with 1.0m – 1.2m wide shoulders).

#### **Recommendation A3**

Review narrow bridges such as the Three Sisters Bridge south of Yunta, to prioritise a program of bridge upgrade to widen and improve flood resilience.

#### **Recommendation A4**

Consider trials of township entry treatments (TET's) with distinctive signage and line marking at several locations along Barrier Highway, such as Burra, Manoora or Mount Bryan.

#### **Recommendation A5**

Implement progressive upgrades of the Barrier Highway to ensure a minimum three-star AusRAP rating for the full length of the corridor.

#### **Recommendation A6**

Progressively continue to install safety barriers, focusing on areas with curves and exposed roadside hazards in the hilly terrain between Oodla Wirra and Nackara, and focusing on reducing the frequency of exposed vegetation south of Burra.

#### **Recommendation A7**

Undertake road resealing, and potentially localised road reconstruction between Giles Corner and north of Burra (Goyder Hwy), prioritising the section between Saddleworth and Black Springs, north of Manoora.



**Recommendation A8**

Undertake localised pavement repairs and resurfacing and widen sealed shoulders between Cockburn and Broken Hill to repair and reduce the occurrence edge break up (Transport for New South Wales).

**Recommendation A9**

Following completion of road and shoulder widening works between Burra and Cockburn, install audio tactile line marking along the length of the South Australian section of Barrier Highway to mitigate the high volume of single vehicle crashes occurring.

**Recommendation A10**

Consider installing one overtaking lane (two total) in each direction between Giles Corner and Burra.

**Recommendation A11**

Upgrade roadside rest areas to provide minimum facilities of bins, shelters and seating, whilst strongly considering amenity improvements at some sites to create inviting places to stop and encourage better fatigue management.

**Recommendation A12**

1.5km north of Mount Bryan, realign the Barrier Highway to a straight section of road to remove the 'S' bend in the road, which was put in place to improve safety at the former level crossing at this location.

**Recommendation A13**

Upgrade the intersection with Third Street in Terowie by installing a channelised right turn lane to Third Street and consider measures such as a speed limit reduction or intersection realignment to improve minimum gap sight distance from Third Street to the south.

## Broken Hill

### Recommendation B1

Investigate the provision of a 40km/h or lower area speed limit in the Broken Hill CBD, expanding on the current 40km/h Argent Street speed limit.

### Recommendation B2

Undertake a Broken Hill freight study which should look at reducing heavy vehicle movements through residential areas and review the feasibility of a full or partial freight bypass of Broken Hill and incorporate a 24-hour truck stop.

### Recommendation B3

Review and update the 2006 *Urban Stormwater Master Plan* for Broken Hill to determine which projects are still incomplete and to identify further priority projects in the city for future funding grants.

### Recommendation B4

Improve pedestrian accessibility along and across Williams Street by upgrading missing or deteriorated pedestrian infrastructure and identify several locations to install pedestrian refuges, and/or zebra crossings and/or pedestrian actuated crossings.

### Recommendation B5

Review the Crystal Street/South Road corridor from a cycling and active transport perspective to identify opportunities to improve safety, connectivity, and route continuity – taking into account the need to make a return trip.

### Recommendation B6

Consider an intersection upgrade at Crystal Street/Gossan Street to reduce the impact of poor sight distance due to the crest on Crystal Street.

### Recommendation B7

Focus on sealing expansion joints and cracks at intersections and transverse expansion joints on Iodide Street and other concrete pavements in Broken Hill.

### Recommendation B8

Review parking utilisation in the Broken Hill CBD around Argent Street and consider implementation of an east-west dedicated cycling corridor along Argent Street, Blende Street or Beryl Street.



**Recommendation B9**

Install duplicated R3-1 pedestrian crossing signs prominently on both approaches to the Argent Street/Sulphide Street zebra crossing.

**Recommendation B10**

Improve signage on the Menindee Road approach to Argent Street (Barrier Highway) by replacing missing median give way sign, enlarging give way signs, and installing R3-2 'give way sign ahead' advance warning signs.

**Recommendation B11**

In the longer term, consider intersection signalisation or construction of a roundabout at the intersection with Menindee Road and Argent Street.

**Recommendation B12**

Reseal Silverton Road between Broken Hill and Silverton, considering localised pavement reconstruction and improvements to drainage including the addition of culverts and potentially a bridge over Black Hill Creek.

**Recommendation B13**

In the short term, install G9-22 flood depth indicators at all floodways on Silverton Road, and a G9-21 'ROAD SUBJECT TO FLOODING, INDICATORS SHOW DEPTH' sign prior to the first floodway.

## Survey results and analysis

To inform the Regional Road Assessment a targeted online survey was conducted in mid-September 2022. The survey link was sent to 6,102 RAA members living in relevant post codes, either in Broken Hill, or in towns and localities adjacent the Barrier Highway.

476 completed surveys were received, and the median completion time was around 11 minutes.

Survey responses have been aggregated by those that have experiences in Broken Hill, or the Barrier Highway, or both, where relevant.

### Respondent demographics

Almost half of survey respondents resided within the City of Broken Hill, whilst others lived in council districts along South Australian section of the highway. Those selecting 'other', typically resided in unincorporated areas between Peterborough and Broken Hill.

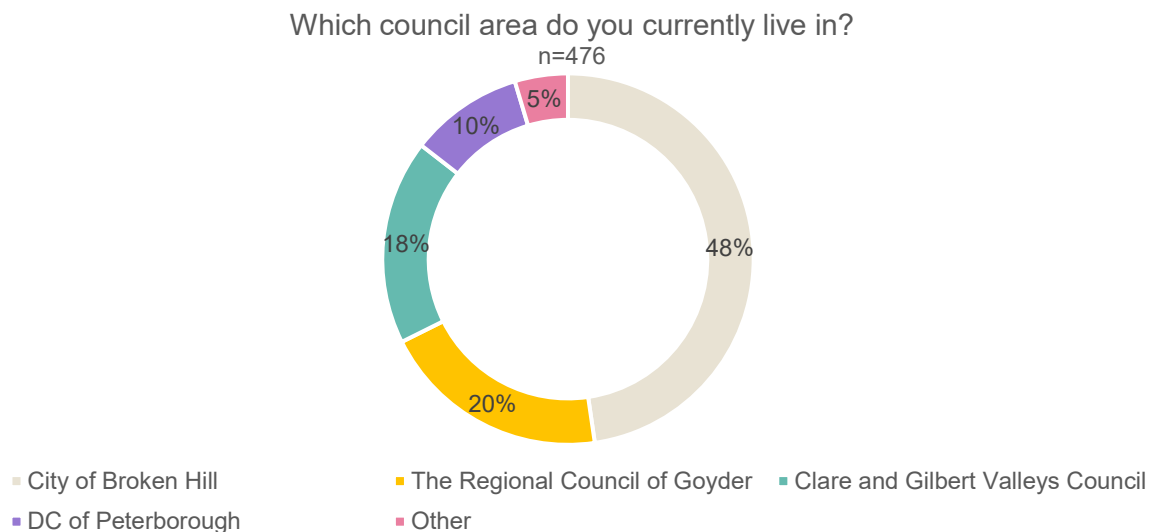


Figure 2: Residential council area of survey respondents

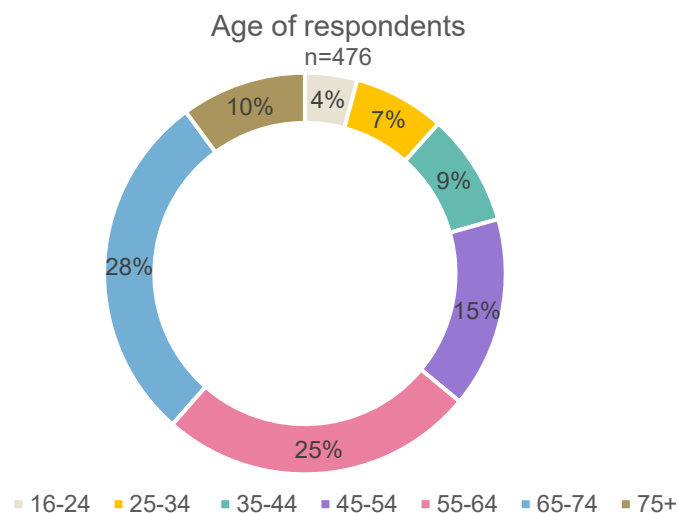


Figure 3: Age of survey respondents



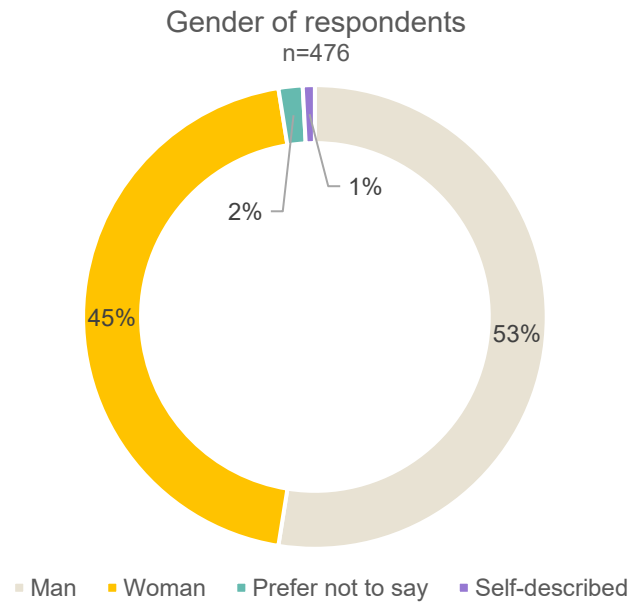


Figure 4: Gender of survey respondents

## Travel behaviours

Most survey respondents were motorists that regularly drive in the Broken Hill area or along the Barrier Highway.

Almost all survey respondents were motorists (95%), and aside from walking, all other modes had only been used by a small share of residents. Taxi use by residents was relatively common for residents of Broken Hill, where one in ten respondents had used a taxi in the last six months, whereas only 1% of Clare and Gilbert Valley Council area residents had used a taxi.

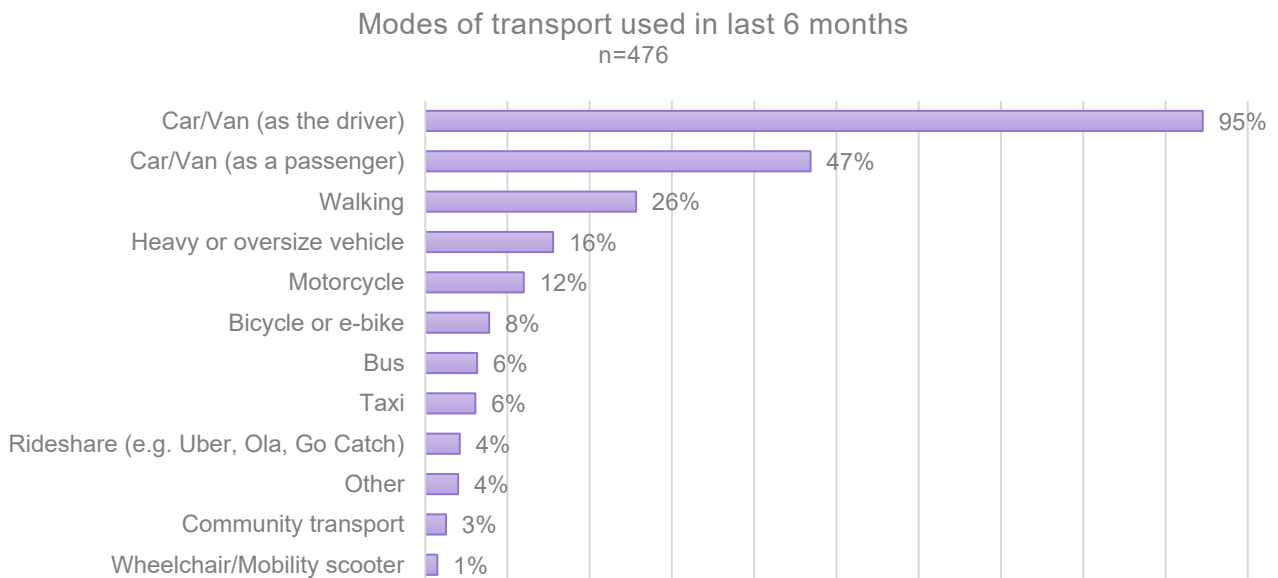


Figure 5: Mode of transport used by survey respondents

Around three in four respondents that drive a car/van stated that they drive “most days”.

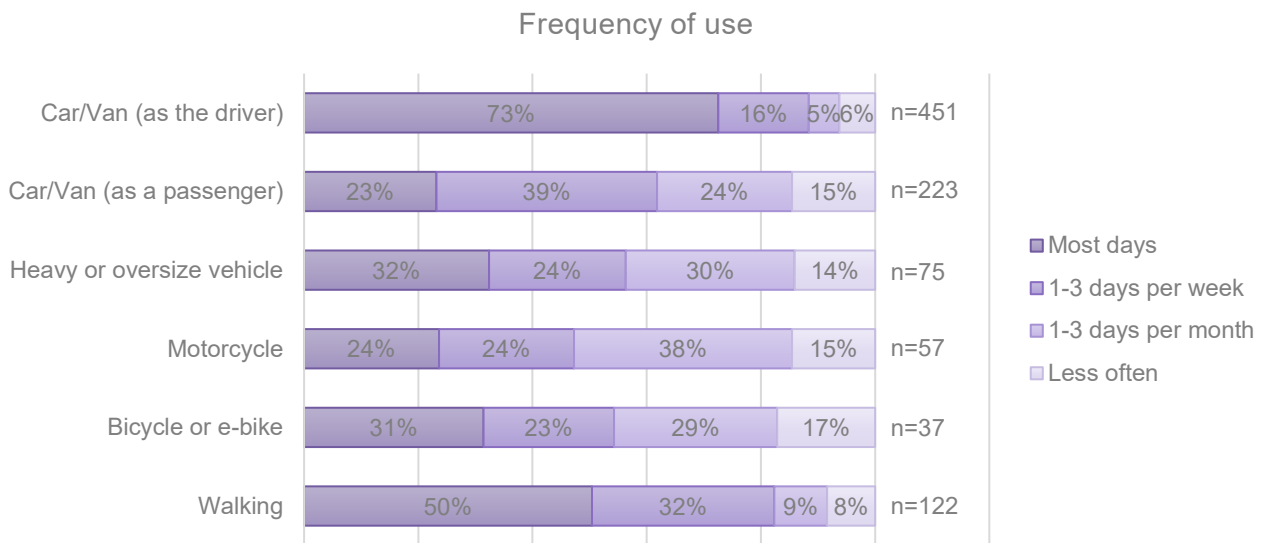


Figure 6: How often each mode of transport was used by survey respondents

Respondents were asked how often they travel on the South Australian section of the Barrier Highway. More than half of respondents used the Barrier Highway regularly, between “most days” and “at least monthly”. Barrier Highway users from Broken Hill were then asked the maximum distance they regularly travel on the Barrier Highway, 92% stated they travel from Broken Hill to Adelaide (420km+). This demonstrates that most respondents had sound knowledge and experiences with the highway.

How often do you travel on the SA side of the Barrier Highway?  
n=467

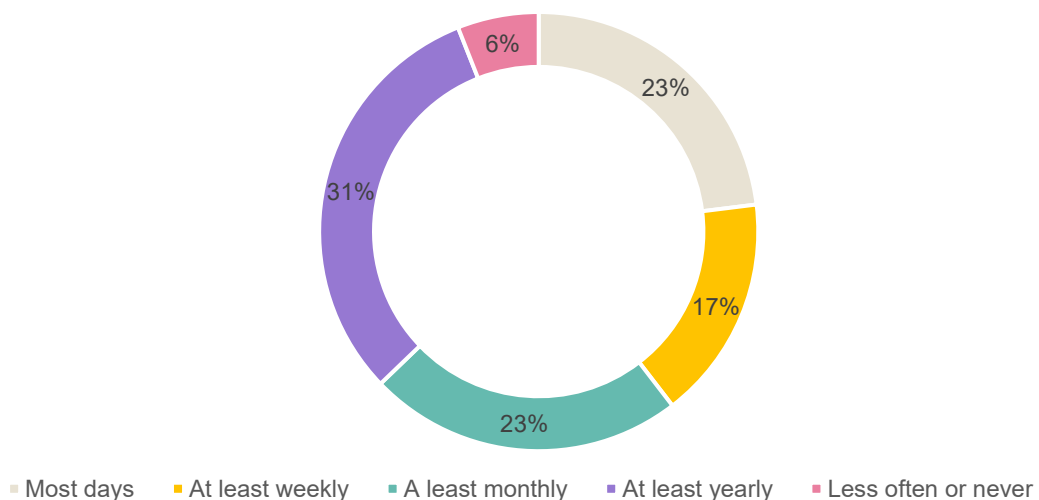


Figure 7: How often survey respondents travelled on the South Australian side of the Barrier Highway



## Overall rating of the region

A majority of respondents thought Broken Hill roads and the Barrier Highway were either in poor or very poor condition.

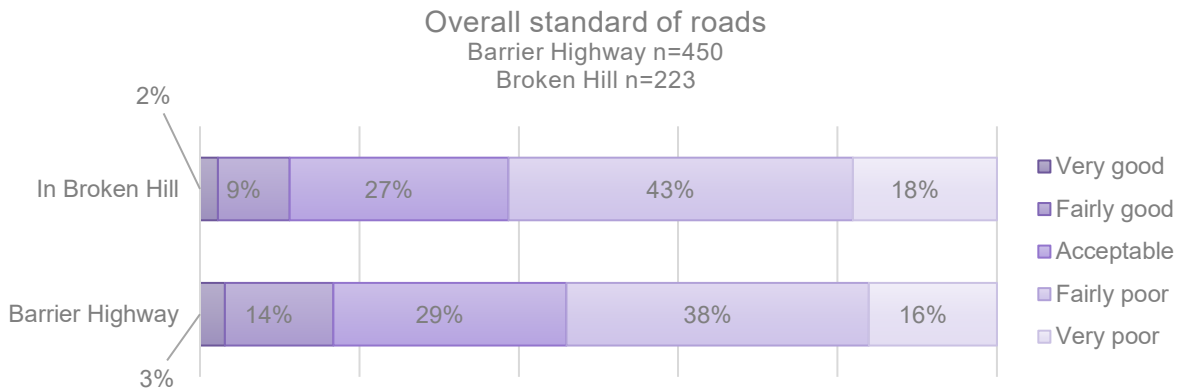


Figure 8: Survey respondents rating of the standard of roads in Broken Hill and of the Barrier Highway

Among Broken Hill residents, there were more respondents that considered it “fairly hard” or “very hard” to travel around town without a motor vehicle, compared to those that found it easy.

## Ease of travel around Broken Hill without a motor vehicle n=223

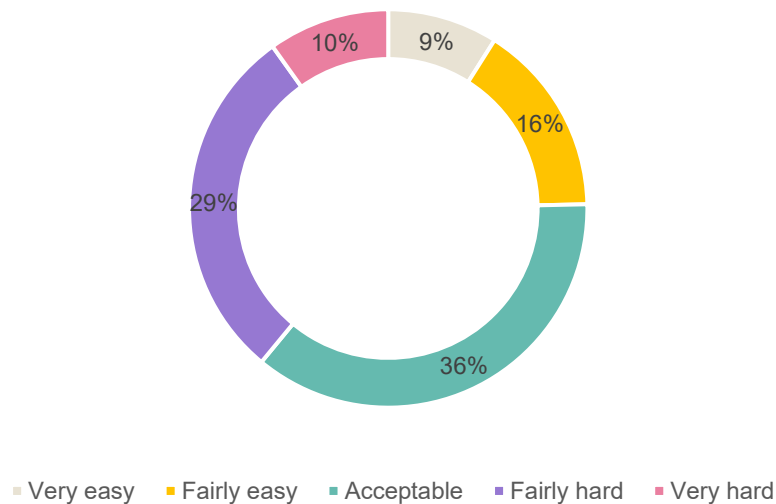


Figure 9: Ease of travel around Broken Hill without a motor vehicle

## Road maintenance and design

Maintenance issues dominated responses regarding roads within Broken Hill and for the Barrier Highway. When selecting the “number one issue in need of addressing”, for Broken Hill “road maintenance” was selected more than five times as much as the next highest concern (pedestrian infrastructure). When selecting multiple issues, poor drainage/flooding over roads was highlighted by 55% of respondents and poor road signage was raised by 18%.

### Top road issue in need of addressing in Broken Hill

n=223

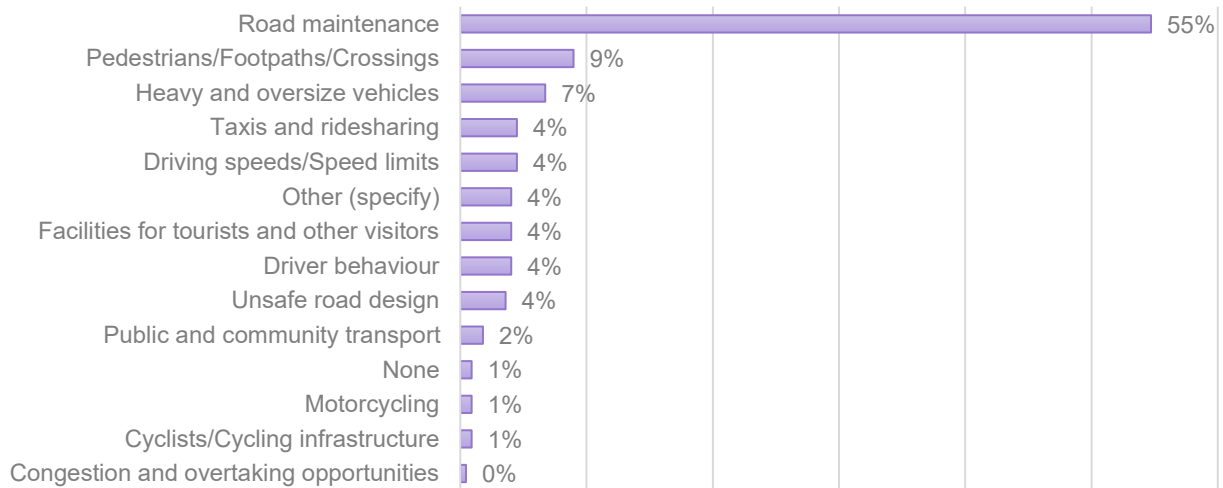


Figure 10: Top transport issues in need of addressing in Broken Hill

Concerns for the Barrier Highway varied depending on the respondent's location. For residents of the Clare and Gilbert Valleys Council Area "narrow or unsealed shoulders" and "not enough overtaking lanes" were more concerning issues compared to residents of other areas. For residents of the Regional Council of Goyder, congestion was raised by 11% of respondents and road alignment, such as blind corners, was raised more often than it was by other respondents.

### Concerns in need of addressing on Barrier Highway

n=431

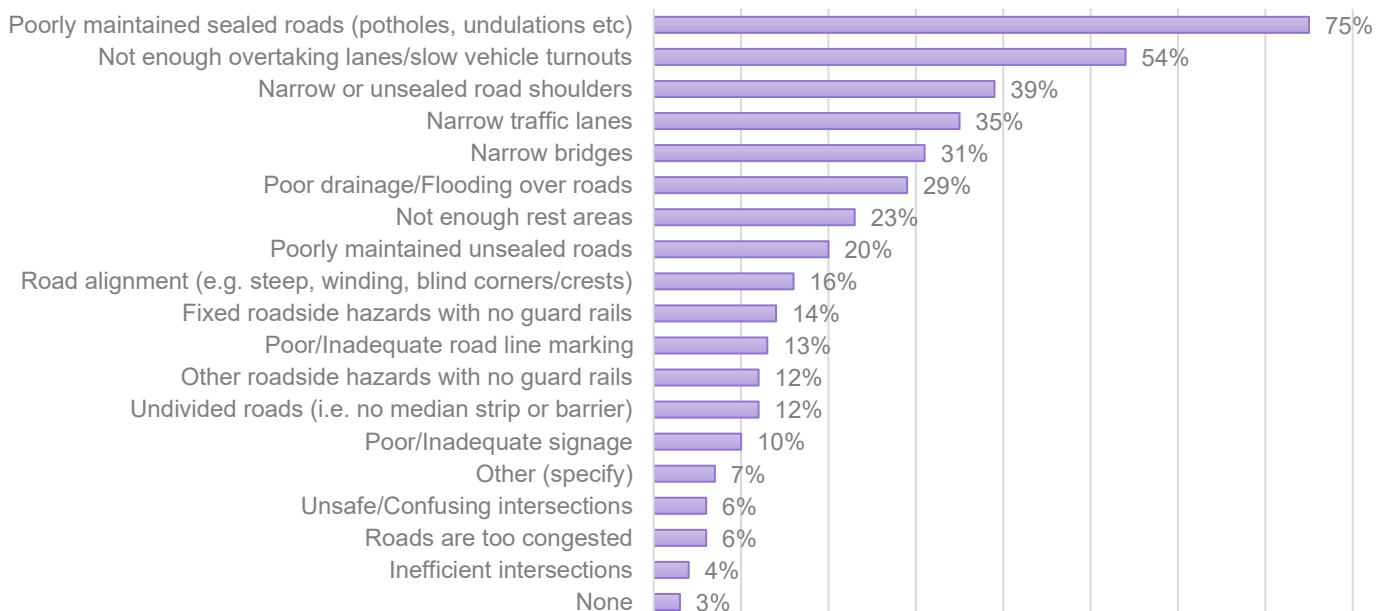


Figure 11: Top issues in need of addressing on the Barrier Highway

## Speed limits

Most respondents were happy with the current speed limit of 110km/h along the Barrier Highway, with only 7% of respondents stating they thought it was “too fast”. 77% thought it was “about right” and 16% said it was “too slow”.

## Heavy and oversize vehicles

Respondents were presented with a list of potential issues relating to the operation of heavy and oversize vehicles in the region and asked to select which were concerns for them and then which was their biggest concern.

In relation to Broken Hill, respondents identified a range of issues. Road maintenance, such as “damage caused to road surfaces” was the top issue selected in relation to heavy and oversize vehicles in Broken Hill, design issues such as intersections and road design not being suitable for heavy vehicles more generally were common issues.

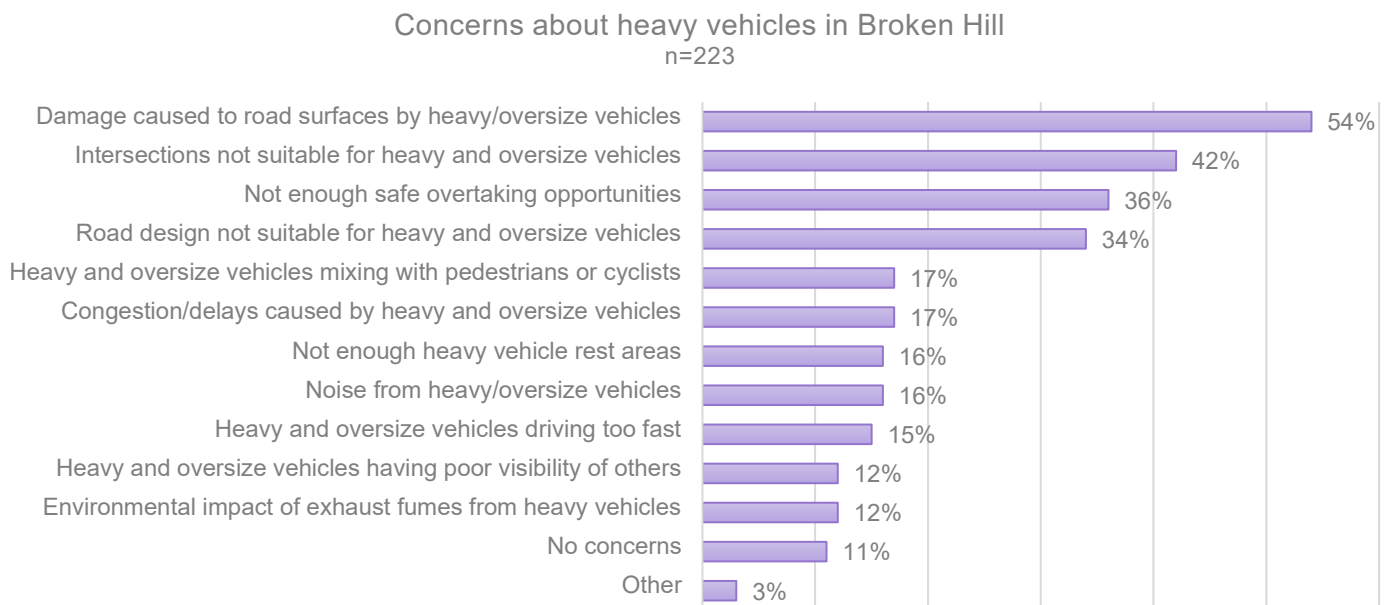


Figure 12: Concerns about heavy vehicles in Broken Hill

For users of the Barrier Highway, the main concerns were a lack of safe overtaking opportunities and road maintenance issues. Over 40% of respondents identified that the road design was not suitable for heavy vehicles and over a quarter (29%) stated that there are not enough heavy vehicle rest areas on the Barrier Highway.



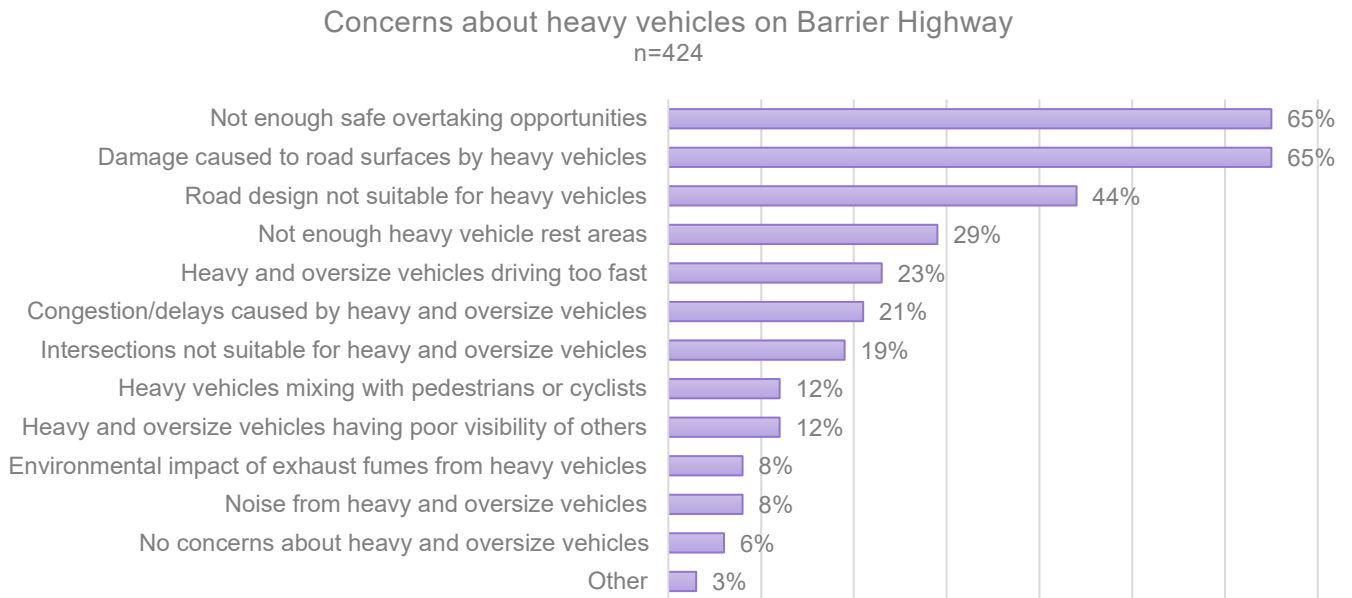


Figure 13: Concerns about heavy vehicles on Barrier Highway

## Opinions on Barrier Highway upgrade

Respondents were asked to share their opinion regarding the \$62.5m upgrade to the Barrier Highway between Cockburn and Burra. Overall, around one in seven (15%) felt that, when completed, the project will completely alleviate their concerns with the Highway. While around one in five (21%) felt that the project would not alleviate their concerns. Respondents from the southern council districts were more likely to suggest that the upgrade would not address their concerns, with about one in three (33%) respondents from Clare and Gilbert Valleys Council and more than one in four (27%) respondents from the Regional Council of Goyder responding “no” to this question compared to less than one in ten (9%) respondents from the City of Broken Hill and the District Council of Peterborough.

**Will the upgrade address your concerns with the Barrier Highway?**  
n=388

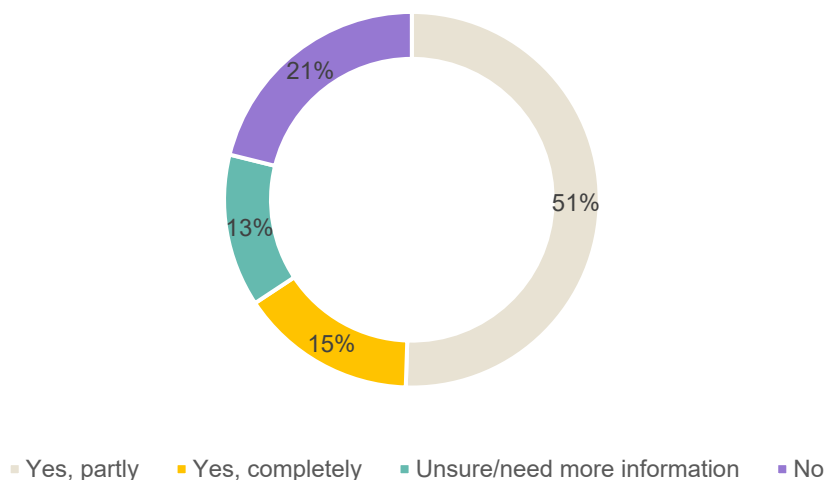


Figure 14: How the Burra to Cockburn upgrade addresses respondents concerns with the Barrier Highway

## Cycling and walking in Broken Hill

Only 37 of 475 respondents (8%) indicated that they had cycled in the six months prior to the survey. When asked, around half of Broken Hill respondents thought that there was not enough cycling infrastructure in Broken Hill.

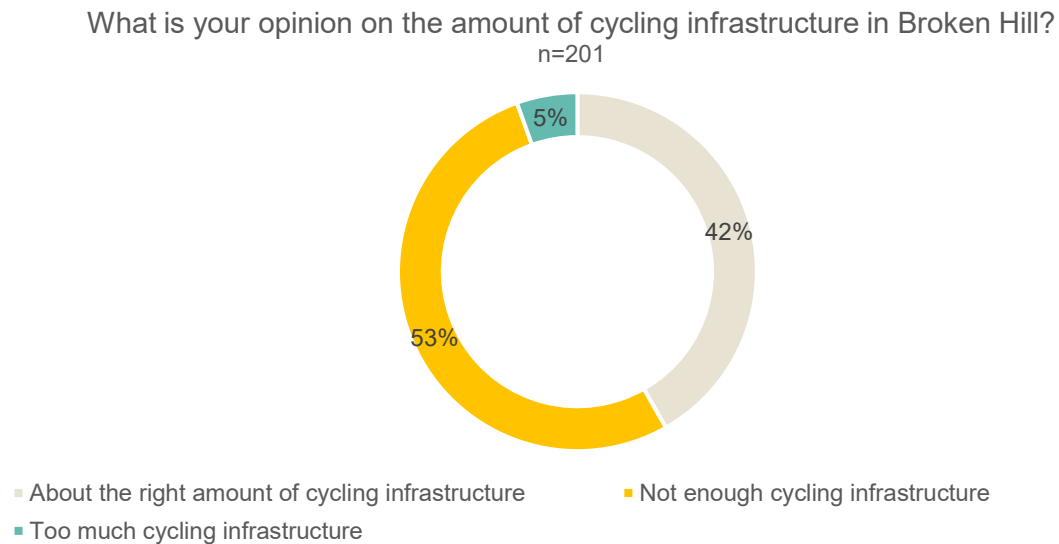


Figure 15: Survey respondents thoughts on the amount of cycling infrastructure in Broken Hill

Around 122 of 475 respondents (26%) stated that they had walked for transport in the six months prior to the survey.

Among Broken Hill residents, a lack of footpaths or poorly maintained footpaths were the top issues recognised. One quarter of respondents indicated that there were insufficient pedestrian crossings, refuges or ramps.

Overall, 66% of Broken Hill residents felt that Broken Hill did not have enough walking infrastructure, while 33% believed that current walking infrastructure was adequate.

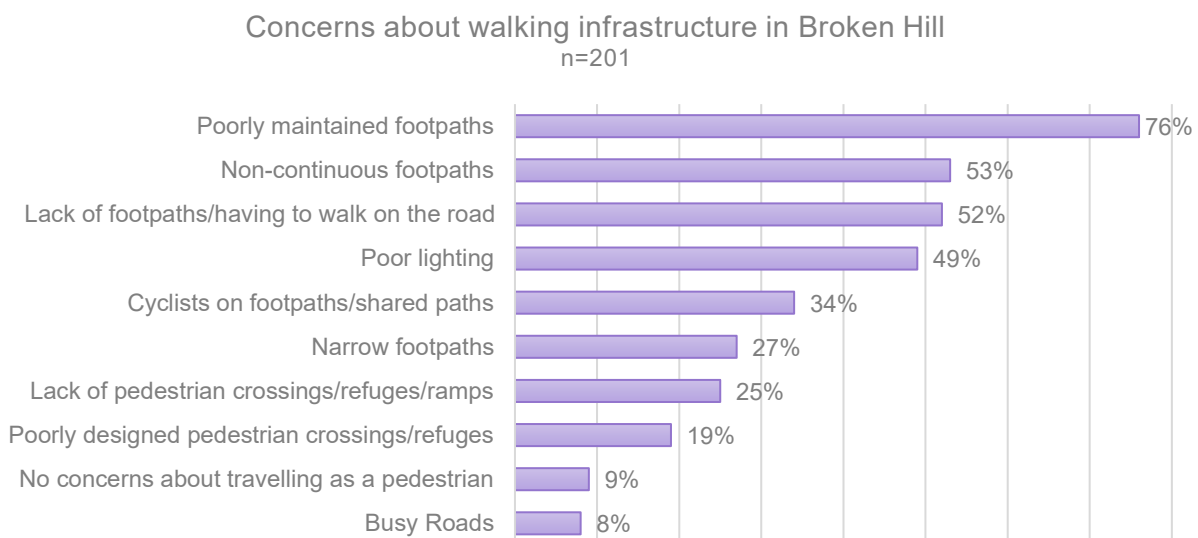


Figure 16: Survey respondents concerns with pedestrian infrastructure in Broken Hill

## Public transport and rideshare in Broken Hill

When asked about concerns with local public transport, the most common response was “no concerns or lack of knowledge”, by 42% of respondents. Infrequent, limited services and a lack of information were key concerns raised by respondents who did have knowledge or concerns about the network. Other highly raised concerns were a lack of shelters, or services being too far away.

Concerns about public transport in Broken Hill  
n=201

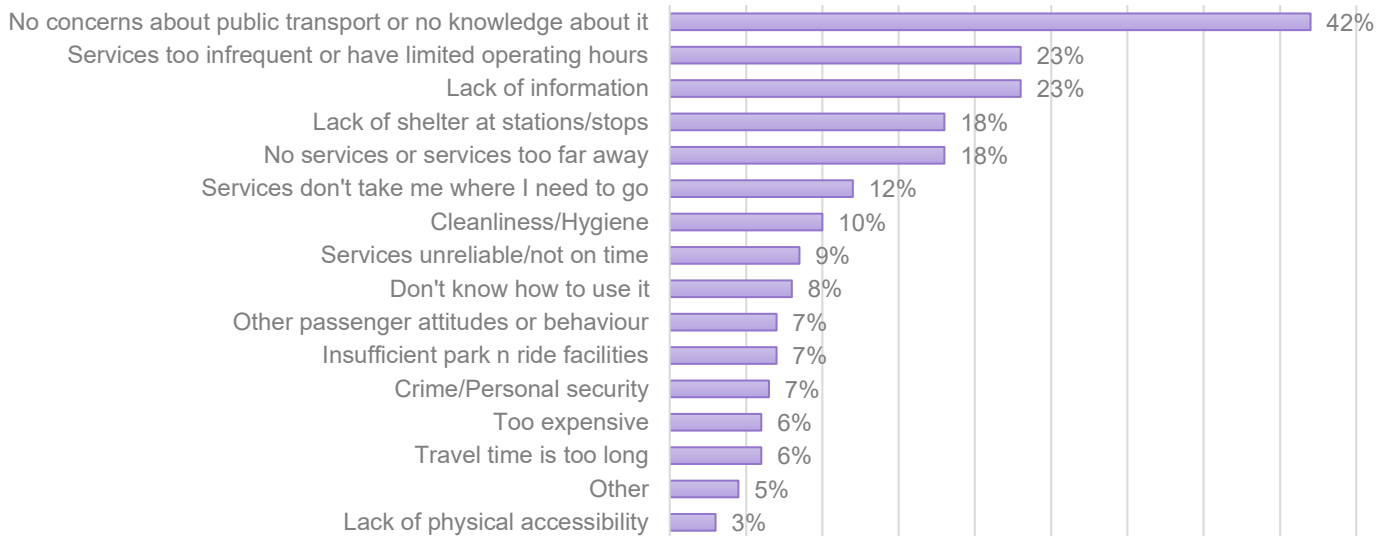


Figure 17: Respondents concerns about public transport in Broken Hill

Respondents were divided in their desire to use rideshare services, such as Uber, Ola and Go Catch. Just over a third (35%) of Broken Hill residents stated they would use these services if available, while 27% were unsure and 38% stated they would not. Most respondents (77%) had not used a rideshare service in the six months prior to the survey.

## Enhancing the tourism experience in Broken Hill

Broken Hill residents were generally supportive of increasing parking for caravans, coaches and RVs, improving mobile phone and internet coverage and installing more public toilets, identified as the top three areas in need of improvement to enhance the tourism experience in Broken Hill. Only 5% of respondents said that no improvements were needed to enhance the tourism experience.



### Areas in need of improvement to enhance tourism experience in Broken Hill

n=198

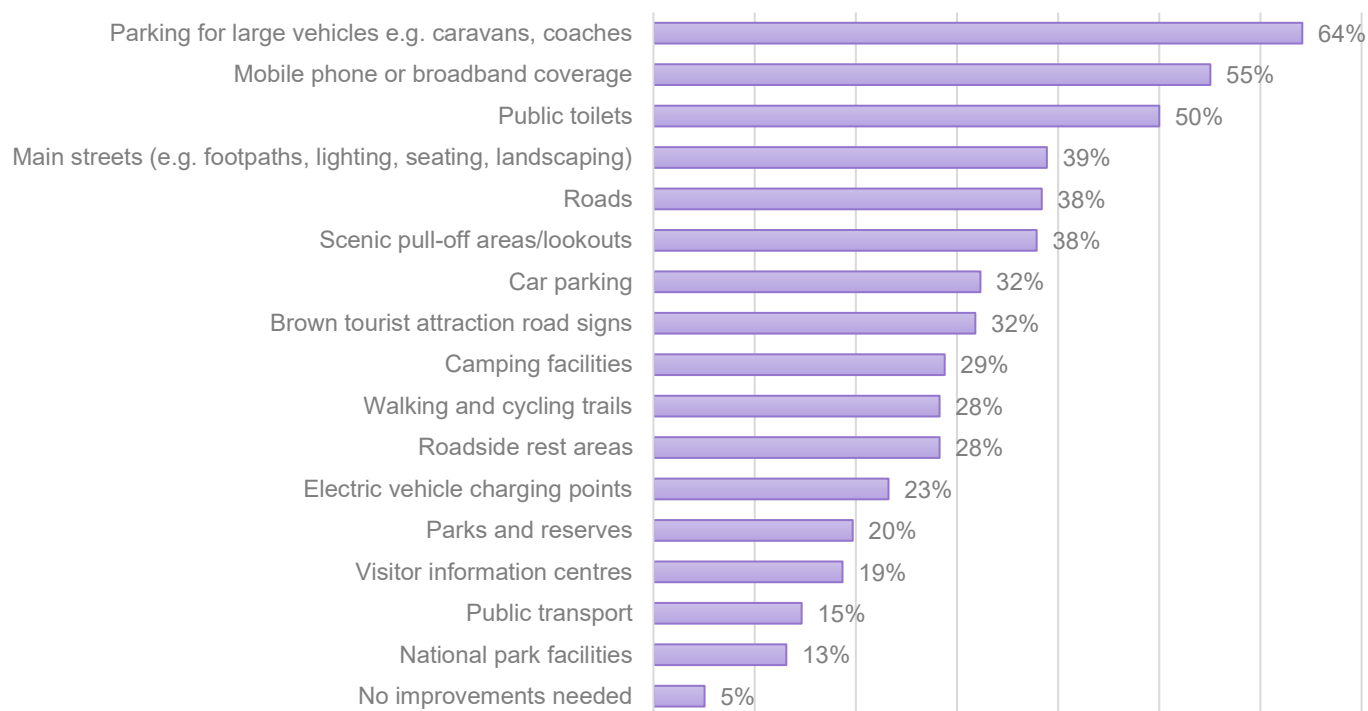


Figure 18: Areas in in need of improvement to enhance tourism experience in Broken Hill

## Barrier Highway investigation details and recommendations

Barrier Highway is a major interstate arterial corridor extending for approximately 1,010km between Giles Corner, north of the township of Tarlee in the southern Clare Valley, and Nyngan, in central New South Wales. For this assessment, RAA have reviewed the 420km section between Giles Corner and Broken Hill, of which 375km (90%) is in South Australia. The South Australian part of the highway is under the care and control of the Department for Infrastructure and Transport (DIT), whilst the New South Wales portion is under the care and control of Transport for New South Wales (TfNSW). The Barrier Highway does not form part of the national highway network and therefore maintenance and upgrades are generally the sole responsibility of state governments, despite some recent road improvements attracting federal government funding.

Barrier Highway forms the most direct route between Broken Hill and Adelaide, which is the closest capital city to Broken Hill, 510km away by road. The next closest capital cities are Melbourne (830km by road), Canberra (990km by road) and Sydney (1,150km by road). Between Giles Corner and Broken Hill, Barrier Highway traverses the townships of Riverton, Saddleworth, Manoora, Burra, Mount Bryan, Hallett, White Yarcowie, Terowie, Oodla Wirra, Yunta, Manna Hill, Olary and Cockburn.

Barrier Highway is not the most direct route for road travel between Sydney and Adelaide, with the Mallee Highway and Sturt Highway both providing a more direct link between the two capitals. However, it does form part of a direct route between Adelaide and Queensland (Brisbane).

Barrier Highway is a gazetted PBS level 3A route and as such is traversed by freight combinations as large as 35m a-double and b-triple road trains, of which there are about 40 movements along the highway each day (on average).



Figure 19: b-double on the Barrier Highway in Terowie

RAA last completed a highway assessment of Barrier Highway in 2013, and subsequently reviewed the section between Giles Corner and Terowie in 2018 as part of our Clare and Goyder Regional Road Assessment. Previous recommendations for the highway and their status at the time of writing this report are tabulated below.

Table 5: RAA's previous recommendations for Barrier Highway

RAA's 2013 recommendations	RAA's 2018 recommendations
Extend lane widths to a minimum of 3.5m for the entirety of the highway, the sections with 3m wide lanes should be prioritised, with particular attention to the section 15km prior to Oodla Wirra. <b>Status: Partially complete</b>	Install minimum 1.0m wide sealed shoulders and 3.3m wide lanes south of Mount Bryan and North of Hallett as a priority, with other insufficient sections to follow and meet this minimum requirement. <b>Status: Partially complete/In progress</b>
Extend the sealed pavement to provide a minimum sealed shoulder of 0.5m for the entirety of the highway. A 1m shoulder is desirable. <b>Status: In progress</b>	Review the 110km/h speed limit through Terowie and consider applying an 80km/h limit through Terowie. <b>Status: Incomplete</b>
Undertake pavement rehabilitation between Main North Road and Hallett and within the vicinity of Manoora. <b>Status: Partially complete</b>	Repaint missing line marking south of Saddleworth where recent repairs have been completed. <b>Status: Complete</b>
Refresh lining, with particular attention to north of Olary. Lining should be reinstated soon after pavement remedial work. <b>Status: Complete</b>	Undertake surface rehabilitation works between Saddleworth and Manoora. <b>Status: Incomplete</b>
Consider barrier installation to protect from fixed roadside hazards and embankments less than 8m from the seal. <b>Status: Partially complete</b>	Additional barrier protection to reduce to severity of single vehicle/inattention crashes where a vehicle runs off the road or hits a fixed object. <b>Status: Partially complete</b>
Upgrade rest areas to provide a minimum of sheltered seating and solar lighting. <b>Status: Partially complete</b>	Installation of ATLM between Horrocks Highway and Saddleworth, and between Burra and Terowie as a minimum. <b>Status: In progress (to be completed)</b>
	Remove the S bend built into the highway to cross the former rail corridor north of Mount Bryan. As a minimum, widen inside shoulders and the carriageway around the 'S bend' north of Mount Bryan as well as installing W1-8 'tilting truck' signs on each approach to warn of the rollover risk on this curve. <b>Status: Incomplete</b>
	Replace street name sign at Hilldrop Road and consider installing a stop sign at this intersection due to the reduced approach sight distance introduced by the W Beam barrier installed on Barrier Highway. <b>Status: Partially complete</b>



63% of survey respondents reported using the Barrier Highway at least once per month, and these respondents were asked a series of questions about the Barrier Highway. Respondents were asked about several topics including road design and maintenance, driving speeds and speed limits, driver behaviour, heavy and oversize vehicles.

Road design and maintenance concerns are displayed Figure 11 of this report, with the top three related to maintenance (75%), overtaking lanes (54%) and narrow shoulders (39%).

The comments below are typical of what was received in relation to the Barrier Highway

“Need to have overtaking lanes on the Barrier Highway so drivers don’t get stuck behind trucks.”

“The road between Manoora and Saddleworth is terrible. Undulating, potholes, narrow. Needs fixing.”

“The Barrier Highway between Broken Hill and Adelaide is currently having lots of work done to it along the way, which I may say that the new road sections that are completed are absolutely superb.”

“The section of Barrier Highway from Giles Corner and Saddleworth is pretty good to travel on, it could do with an overtaking lane. The section from Saddleworth to Burra is an absolute disgrace, it’s very rough as you come north to Manoora (cars have left the road on this stretch) then from Manoora to Burra is poor but not as bad as Saddleworth to Manoora. There are quite a few sections that need fixing and overtaking lanes are needed desperately from Saddleworth to Burra. A couple of rest stops wouldn’t go astray either. Also the section from Giles corner to Saddleworth which is very good is a 100km/h zone where from Saddleworth to Burra (the worst section) is 110kph, never could understand the logic in that.”

“Section between Manoora and Burra needs attention due to significant bumps and undulations that are unsafe for heavy vehicle drivers and other traffic that could be affected by loss of control of heavier vehicles.”

Land use adjacent the highway varies. South of Burra, most adjacent land is used for agriculture, with a small amount used for livestock grazing. Between Burra and Peterborough, agriculture is still the predominant land use, however, livestock is more prominent. North of Peterborough, the primary land use is livestock grazing.

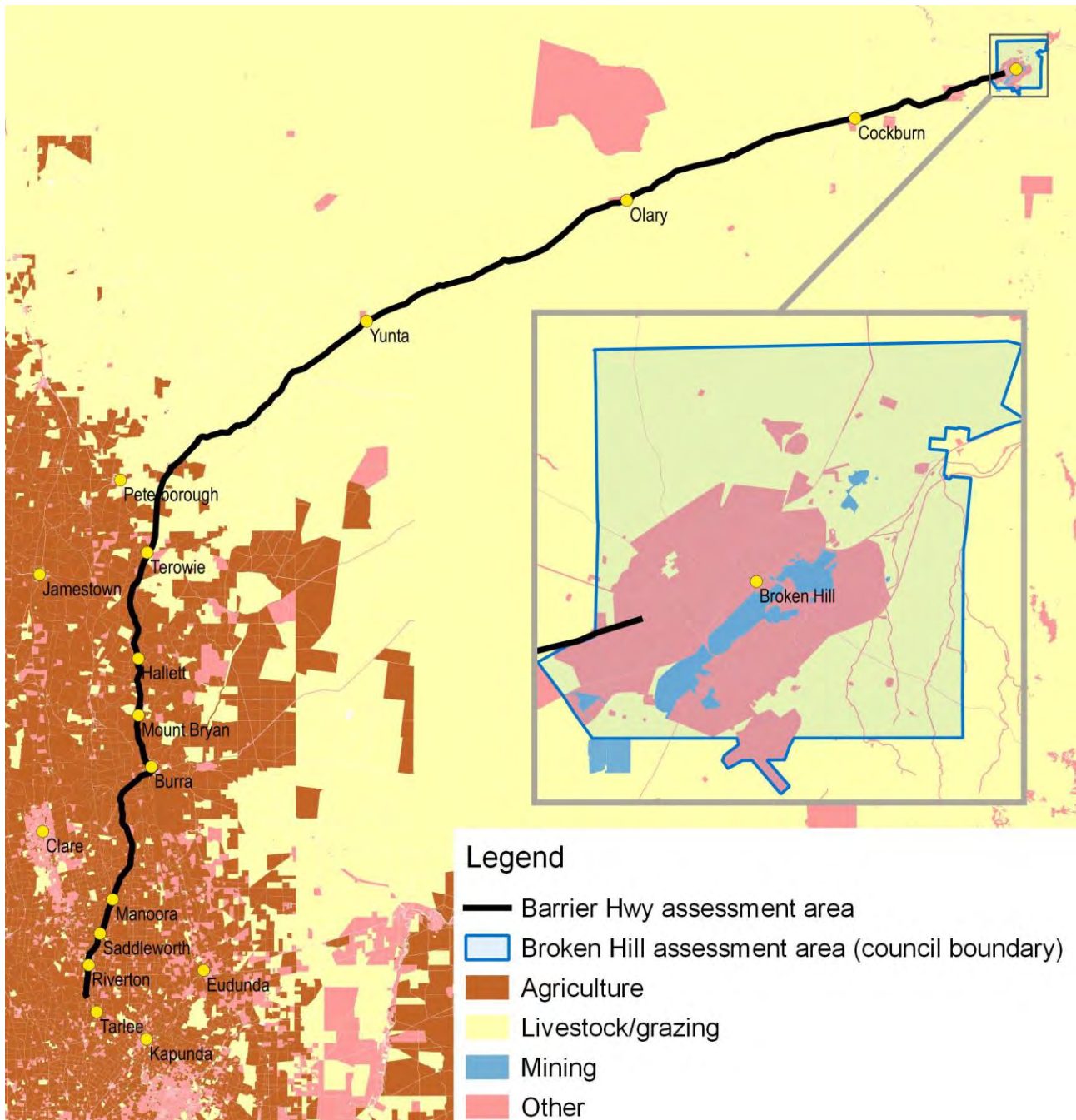


Figure 20: Generalised land use adjacent Barrier Highway<sup>7</sup>

<sup>7</sup> Sources: Data SA, accessed at <<https://data.sa.gov.au/data/dataset/land-use-generalised>> and SEED (NSW Government), accessed at <<https://datasets.seed.nsw.gov.au/dataset/nsw-landuse-2017-v1p2-f0ed>>.

Major east-west road freight routes cross the highway at Saddleworth (Saddleworth Road) and at Burra (Goyder Highway) with the Wilkins Highway in Hallett, Petersburg Road in Peterborough and Tea Tree Road in Yunta also providing important road train and b-double connectivity to the highway. In Broken Hill, Silver City Highway and Menindee Road are the key freight routes linking to the Barrier Highway in the city with Silverton Road also considered a b-double route.

The Australian Rail Track Corporation (ARTC) rail line through Broken Hill is of high national significance, providing rail connectivity between Queensland/New South Wales and South Australia, Western Australia and the Northern Territory via Crystal Brook and Port Augusta.

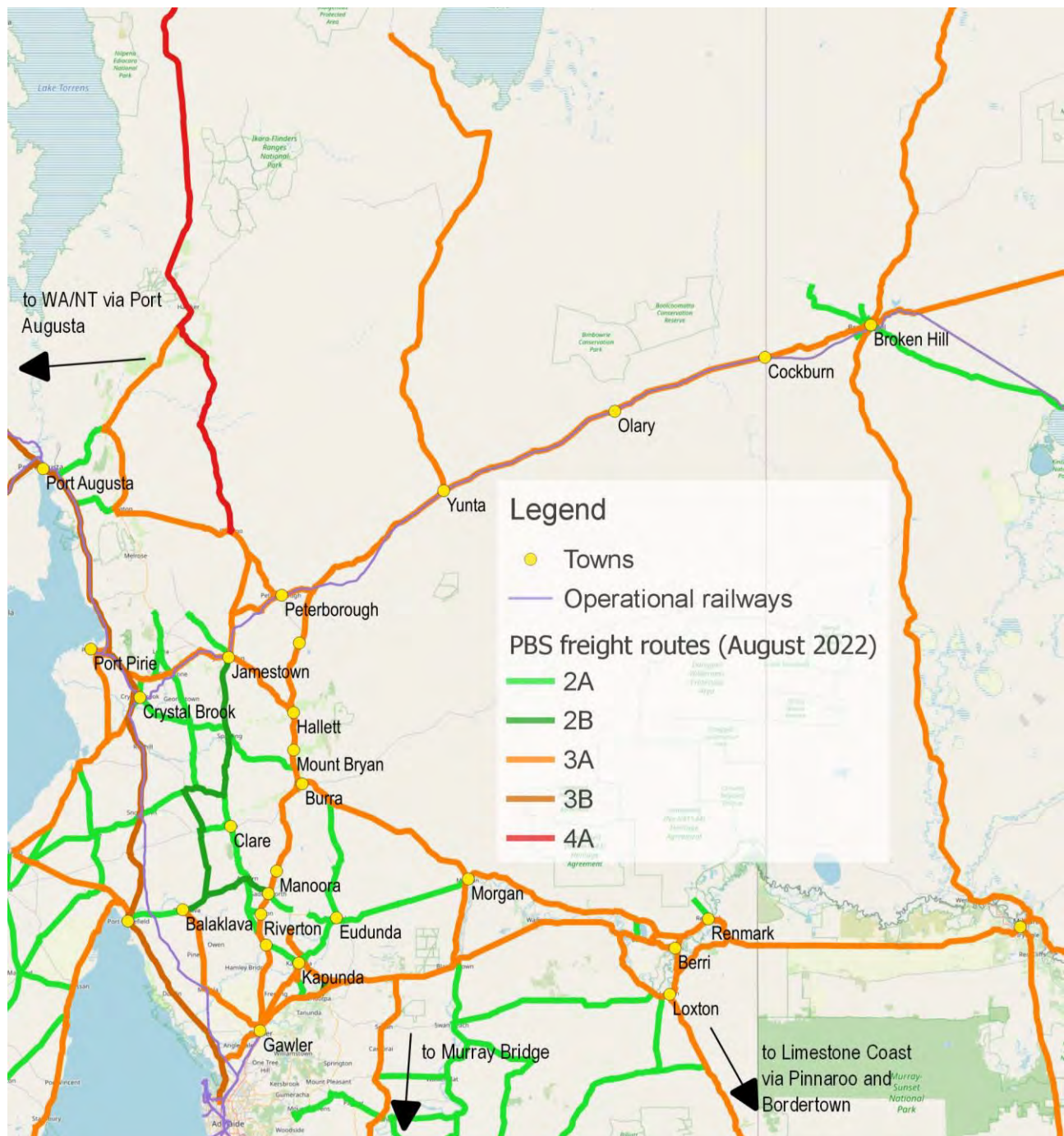


Figure 21: PBS freight route levels adjacent to the Barrier Highway



Barrier Highway is part of the most direct freight route between pastoral districts north of Burra and the Thomas Foods International processing facility recently built in Murray Bridge, which (at the time of writing) has not yet reached full production capacity. When fully operational, this facility may generate additional heavy vehicle traffic due to resultant stock transfers between the state's north and Murray Bridge. However, the impact of this increasing freight volume on Barrier Highway will be limited, with the state's largest cattle stations located in the Flinders Ranges and beyond and currently more likely to carry freight south via the Outback Highway which is a gazetted PBS level 4A route north of Orroroo. The resultant freight increase may therefore only be noticeable between Peterborough or Hallett and Burra, where freight is likely to turn onto the Goyder Highway towards Morgan.

Traffic volumes on the Barrier Highway vary by section. The busiest section is the 19km section between Giles Corner and Saddleworth, where an average of more than 1,500 vehicles including more than 15% freight traverses the highway per day.

Despite being short in contrast to the full South Australian section of the highway, making up 18% of the length, about 31% of travel occurs on the 70km section of Barrier Highway between Giles Corner and Burra.

Table 6: Average daily traffic volumes on Barrier Highway

Section	Length (km)	AADT	Commercial vehicles	Austroads vehicle classification				
				3 - 5	6 - 9	10	11	
Horrocks Hwy (Giles Corner) – Riverton	8.7	1,600	230 (14.5%)	120	65	50	0	
Riverton – Saddleworth	9.0	1,500	260 (17.5%)	120	55	50	36	
Saddleworth (Belvedere Rd – Saddleworth Rd)	0.8	2,000	330 (16.5%)	170	80	50	36	
Saddleworth – Farrell Flat Rd	38.8	1,000	230 (23.0%)	75	55	55	38	
Farrell Flat Rd – Copperhouse Rd (Burra freight bypass)	9.4	1,300	270 (21.0%)	130	55	49	40	
BURRA	Copperhouse Rd – John Barker St	2.9	800	120 (15.0%)	120	100	19	6
	John Barker St – Market Sq	0.7	1,600	250 (15.5%)	200	37	12	0
	Market Sq – Ludgven St (Goyder Hwy)	1.8	1,500	210 (14.0%)	180	33	1	0
	Ludgven St – West St	0.8	1,200	200 (16.5%)	100	55	39	3
Burra – Goyder Hwy	6.1	1,500	330 (22.0%)	120	85	80	40	
Goyder Hwy – Wilkins Hwy (Hallett)	24.1	850	210 (24.5%)	74	50	48	39	
Wilkins Hwy (Hallett) – Cleary Rd (Terowie)	33.3	650	170 (26.0%)	50	38	41	35	
Cleary Rd (Terowie) – Petersburg Rd	20.6	430	170 (39.5%)	40	43	48	42	
Petersburg Rd – NSW border (Cockburn)	222.8	600	210 (35.0%)	46	48	50	70	
NSW border – Broken Hill				Data not available				
Broken Hill								
Broken Hill - Wilcannia		680	190 (28.0%)	-	-	-	-	

Between 2020 and 2023, the state and federal governments have invested a total of \$62.5m towards improvements on 305km of the Barrier Highway between Cockburn and Burra.



Figure 22: Indicative upgrades as part of the \$62.5m Barrier Highway upgrade (Source: DIT<sup>8</sup>)

Upgrades to date and planned include shoulder sealing, bridge widening, new and upgraded rest areas, pavement rehabilitation, intersection upgrades and road safety upgrades including safety barriers and audio tactile line marking. RAA has reviewed the impact that these upgrades will have on the AusRAP star rating on several typical highway cross sections later in this report and are confident that a significant portion of the highway north of Burra will be rated three-stars or higher upon the completion of works.

Survey respondents were given information about these upgrades including a link to the project website for further information before being asked whether they believed that the upgrade would significantly address their concerns with the highway. Two thirds of respondents indicated that the upgrade would partly or completely address their concerns with the highway, with these responses discussed in Figure 14. Many respondents indicating that it would not address their concerns highlighted that their concerns were outside of the target area for these works.

<sup>8</sup> DIT, 2022, Roads of Strategic Importance (ROSI) Program: Barrier Highway, accessed at [https://dit.sa.gov.au/infrastructure/road\\_projects/south\\_australian\\_rural\\_highway\\_corridor\\_upgrades/roads\\_of\\_strategic\\_importance\\_rosi\\_program](https://dit.sa.gov.au/infrastructure/road_projects/south_australian_rural_highway_corridor_upgrades/roads_of_strategic_importance_rosi_program).

The responses below are typical of what was received when prompted for a comment on the upgrade works.

"I have travelled this highway many times in my adult life and numerous times since May this year [2022]. Can see the improvement from this work. Long overdue. Hopefully once this work is completed the highway will be maintained regularly. The highway between Broken Hill and Cockburn, and Burra and Gawler needs upgrading as well."

"The sections that are being done are great, but the section just out of Broken Hill before Thackaringa Hills is absolutely disgusting, hopefully this section is going to be done as well."

"Upgrade should include Giles Corner to Burra. How can it not?"

"These improvements have made those sections of road better - although were very frustrating for users during upgrade period. There are many other poor sections which also need urgent attention – for example, Saddleworth to Black Springs."

"As I mainly travel on the southern end of the Barrier highway, this will have no impact to the section of road between Saddleworth and Manoora, which is appalling and dangerous and a disgrace as a major highway. The undulations make it dangerous to travel at 110km/h in a car, let alone traverse it in a b-double truck. Just luck that there has not been a serious incident there to date."

## Crash history

The most recent 10 years of crash data for the South Australian section of the Barrier Highway reveals a relatively steady crash history in the most recent five years, with an average of six minor injury crashes and 2.8 fatal or serious injury (FSI) crashes occurring per year between 2017 and 2021. This is compared to an average of 7.6 minor injury crashes and 4.8 FSI crashes per year in the five years prior between 2012 and 2016. Whilst 2020 appears to have been one of the lowest years on record, RAA considers this potentially attributable to COVID-19 lockdowns and closures of the SA/NSW border that occurred over this time rather than due to any particular road safety interventions.

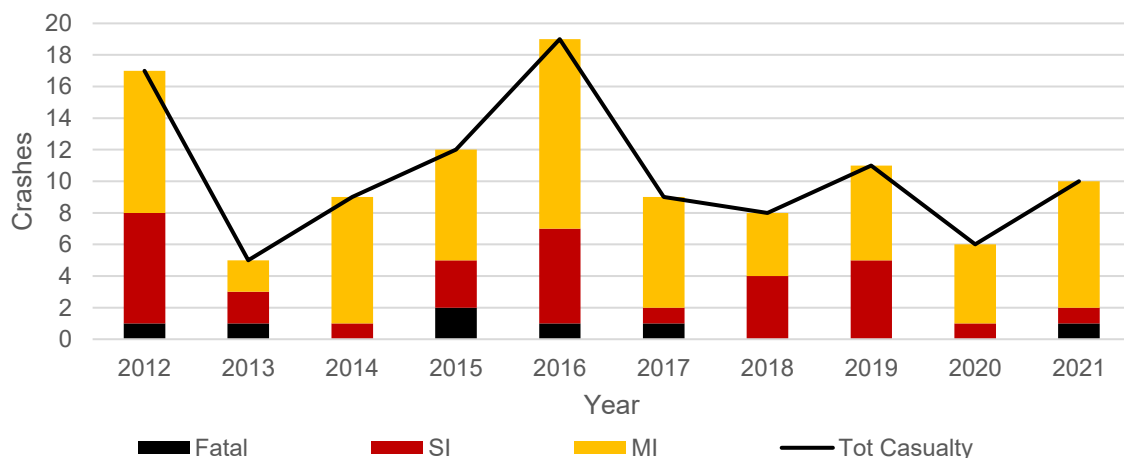


Figure 23: 10-year trend of casualty crashes occurring on the Barrier Highway (SA section)

Between 2017 and 2021, single vehicle run-off road (SVROR) crash types were most common on the Barrier Highway, accounting for three quarters of casualty crashes. Collisions with fixed objects were the most common SVROR crash type, with trees the most commonly involved fixed object, accounting for 47% of these.

Table 7: Casualty crash types occurring on the SA section of Barrier Highway between 2017 and 2021

Crash type	Number of casualty crashes	Crash severity		
		Minor	Serious	Fatal
Hit Fixed Object	15	10	4	1
Roll Over	14	10	4	0
Left Road - Out of Control	3	2	1	0
Head On	3	2	0	1
Hit Animal	3	2	1	0
Right Angle	2	2	0	0
Side Swipe	1	1	0	0
Hit Parked Vehicle	1	0	1	0
Rear End	1	1	0	0
Hit Object on Road	1	0	1	0

Of the above crashes,

- 89% occurred in 100km/h or 110km/h zones, and 7% occurred in 80km/h zones
- 91% occurred on a dry road
- 23% occurred at night

Cars were the dominant unit type involved in crashes on the highway, accounting for 77% of vehicles involved in casualty crashes. Trucks and motorcycles each made up 10% of units, whilst other or unknown vehicle types accounted for the remaining vehicles.

Table 8: Units involved in casualty crashes on the SA section of Barrier Highway between 2017 and 2021

Unit type	Number of units involved in crash
Car	40 (77%)
Truck	5 (10%)
Motorcycle	5 (10%)
Other/unknown	2 (4%)

Of the truck crashes, four were single vehicle crash types, and only one involved a second vehicle which was a car. This crash was attributable to the car driver who was overtaking the truck on the right when a side swipe crash occurred.

Of the motorcycle crashes, all five were single vehicle crash types. Two involved collisions with fixed objects, two involved collisions with animals and one was a roll over.

Despite only making up only 18% of the SA part of the highway, 45% of casualty crashes between 2017 and 2021 occurred along the 69km section between Giles Corner and Burra. Furthermore, when considering average traffic volumes to estimate the rate of casualty crashes per 100 million vehicle kilometres travelled (100m vkt), the casualty crash rate is almost twice as high south of Burra as it is north of Burra. Between 2017 and 2021, 13.3 casualty crashes per 100m vkt occurred south of Burra compared with 6.8 casualty crashes per 100m vkt north of Burra.



Whilst the currently ongoing major upgrade works are targeting the northern part of the highway, additional investment is required south of Burra to provide safer travel on this part of the highway.

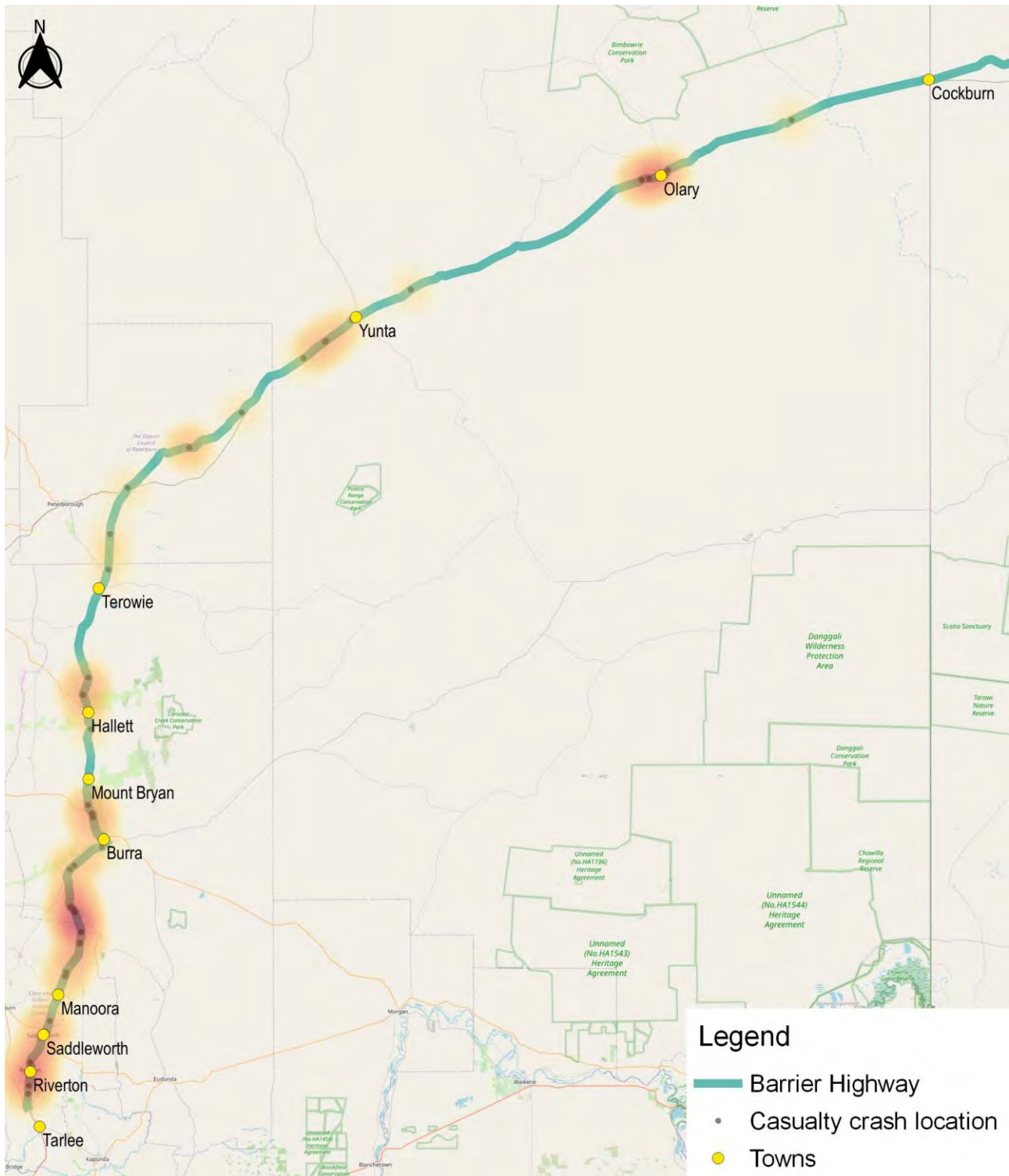


Figure 24: Heatmap of casualty crashes occurring between Giles Corner and Cockburn between 2017 and 2021

## Road width

Over the length of Barrier Highway, road widths measured were typically suitable for the purpose of the corridor, largely due to significant investment to widen lanes and sealed shoulders between Burra and Cockburn. Whilst work was ongoing or had not commenced for some sections of the corridor (e.g Manna Hill), the level of improvement on the widened sections was very clear.



Figure 25: Sections where work zones started and finished highlighted the scale of improvements being made

Table 9: Widths measured along Barrier Highway during October 2022 site assessment

Measurement location	Lane widths	Sealed shoulder width
Giles Corner (300m N of Horrocks Highway)	3.3m	0.8m / 1.0m
Black Springs (1,000m S of Flagstaff Road)	3.5m	1.1m / 1.2m
Black Springs (900m N of Flagstaff Road)	3.5m	0.3m / 0.6m
Burra (1,400m N of West Street)	3.4m	0.4m / 0.3m
Mount Bryan (1,100m N of Belcunda Road)	3.3m / 3.4m	1.5m
Nackara (400m W of Sholze Road)	3.3m / 3.2m	1.2m
Yunta (2,200m E of Wade Terrace)	3.3m	1.2m / 1.3m
Manna Hill (1,800m E of Benda Road)	3.3m	0.3m
Tikalina (1,000m W of Tikalina Road)	3.6m	0.5m
New South Wales (7,500m E of Cockburn)	3.5m	0.5m / 0.8m

Sealed shoulder widths between Giles Corner and Burra were typically quite variable but were often around one metre wide. The exception was the section between Manoora and Burra, where sealed shoulders were typically between 0.1 and 0.5m wide, and this section should be a priority

for shoulder widening works, ideally undertaken simultaneously with maintenance works required in the area.

### Recommendation A1

Widen sealed shoulders to ensure a consistent minimum sealed shoulder width of one metre is provided between Giles Corner and Burra, prioritising the section between Manoora and Burra.



Figure 26: (Top) RAA 2015 footage of Barrier Highway, just west of Wompinie Road (Mingarie) compared with (bottom) 2022 footage of the same location, highlighting the difference in final seal width when widening works are completed.

At the time of writing, it is assumed that current funding will be sufficient to upgrade the full length of the corridor between Burra and Cockburn to achieve a 9.0m sealed width (3.3m – 3.5m wide lanes with 1.0m – 1.2m wide shoulders). It is critical that this road geometry is consistent along the corridor, to provide consistent level of safety and freight productivity.



## Recommendation A2

Complete road widening between Burra and Cockburn to provide a total minimum sealed width of 9.0m (3.3m – 3.5m wide lanes with 1.0m – 1.2m wide shoulders).

Bridges represent pinch points along the corridor, and consequently potential risk locations. Therefore, further investment is required to widen key bridges to improve safety and also ensure network resilience in the event of extreme weather conditions. Anecdotal evidence from local stakeholders indicated that crashes at or near narrow bridges were common, and that flooding events can cause bridge closures at short notice on a fairly regular basis.

There are many narrow bridges along the highway, especially between Yunta and Broken Hill. These bridges cause opposing traffic, especially heavy vehicles to pass very closely, whilst bridge ends present a significant roadside hazard in very close proximity to the road. Some of these bridges are close to curves or crests on the road, which limits visibility of the bridge, and to opposing traffic on the bridge. Priority bridges on the highway include (but are not limited to) the:

- Three Sisters Bridges over Paratoo Creek, about 20km south of Yunta township
- Yunta Creek Bridge, immediately northeast of Yunta township
- Cavanaugh Chase Bridge, about 21.5km north of Yunta township
- Snakey Creek Bridge, about 1.7km west of Manna Hill township
- Wawirra Creek Bridge, about 10km east of Manna Hill township

These five examples are pictured below.



Figure 27: Three sisters bridge, 20km south of Yunta



Figure 28: Yunta Creek Bridge, northeast of Yunta





Figure 29: Cavanaugh Chase Bridge, northeast of Yunta



Figure 30: Snakey Creek Bridge, west of Manna Hill



Figure 31: Wawirra Creek Bridge, east of Manna Hill

### **Recommendation A3**

Review narrow bridges such as the Three Sisters Bridge south of Yunta, to prioritise a program of bridge upgrade to widen and improve flood resilience.

## Speed limit

Other than through built-up areas, and south of Saddleworth, Barrier Highway is subject to a 110km/h speed limit. A summary of speed limits and speed limit signage by section from south to north included in Table 10.

Table 10: Speed limits along Barrier Highway (south to north)

Section	Length (km)	Speed limit (km/h)	Section	Length (km)	Speed limit (km/h)
Giles Corner – Riverton	7.0	100	Whyte Yarcowie	1.1	80
Riverton	2.4	80 – 50 – 80	Whyte Yarcowie – Oodla Wirra	42.3	110
Riverton – Saddleworth	7.3	100	Oodla Wirra	1.6	60A – 60 – 25 (quarantine) – 60A
Saddleworth	2.4	80 – 60 – 80	Oodla Wirra – Yunta	58.9	110
Saddleworth – Manoora	7.3	110	Yunta	1.6	80 – 60 – 80
Manoora	2.1	80 – 60 (25 school zone) – 80	Yunta – Manna Hill	42.6	110
Manoora – Burra	40.6	110	Manna Hill	2.0	80 – 60 – 80
Burra	4.2	80 – 50 (25 when lights flashing) – 60 – 80	Manna Hill - Olary	35.8	110
Burra – Mount Bryan	12.9	110	Olary	0.9	80
Mount Bryan	1.3	60A – 60 – 80	Olary - Cockburn	67.5	110
Mount Bryan - Hallett	14.9	110	Cockburn	67.5	90 – 70 – 110
Hallett	2.0	80 – 60 – 80	Cockburn – Broken Hill	43.4	110
Hallett – Whyte Yarcowie	20.1	110	Broken Hill	8.0	80 – 50 – 80 – 110

On the NSW side of the border, speed limits are painted on the road adjacent to signage. This made speed changes more prominent on approach to Cockburn (from the east) and Broken Hill, which may result in better speed limit compliance through towns. RAA generally supports the idea of township entry treatments (TET's) that include distinctive signage and line marking to increase awareness of speed limit changes on approach to townships. There are limited South Australian examples of TET's in use, however locations along Barrier Highway, such as on the approaches to Burra may be viable for a South Australian trial. Other townships such as Manoora or Mount Bryan may also be appropriate to trial a TET.

### Recommendation A4

Consider trials of township entry treatments (TET's) with distinctive signage and line marking at several locations along Barrier Highway, such as Burra, Manoora or Mount Bryan.

Survey respondents were asked about whether they found the Barrier Highway speed limits, too high, too low, or about right. 77% of respondents to the question thought it was “about right”, whilst 16% said it was “too slow” and 7% said it was too fast. Respondents also had the opportunity to provide comments about any specific locations where they felt speeds were unsafe. Most responses related to the poor condition of the road, and that a lack of maintenance should not be used as a reason to lower the speed limit. Some respondents suggested that higher speed limits

would be more appropriate, whilst others suggested specific areas where the speed limit felt too high.

The verbatim comments below are typical of what was received in relation to speed limits.

“Living in Terowie it is dangerous to leave the highway to come back into town. The speed limit is 110km/h with no extra area to leave the road to turn towards town, quite daunting when you have someone following.”

“Due to the distances involved, a higher speed limit (perhaps in line with Europe’s 130km/h) would assist in decreasing the risk relating to driver fatigue. The Barrier highway is undergoing major road works, hopefully when completed it’ll allow higher speed limits.”

“110km/h is fine for single vehicles but trucks or vehicles towing especially caravans should be limited to 100km/h.”

“The speed limit is not an issue, but the state of the road surface is. With current state of the road, as with all road conditions, you need to slow down to be safe on the current road surface. Lowering the speed limit does not fix the road issues, but had been deployed in the past as a cheap fix to make roads safer, rather than spend money to make the road safe to travel on at 110km/h. When you travel distances on these roads daily, 110km/hr should be applicable.”

“Speed limits approaching and through towns ignored.”

“I suggest the road be fixed rather than slow the traffic as a lot now do not adhere to road speeds.”

“The Speed limit from Gilles Corner (south of Riverton) to Saddleworth has been lowered from 110km/h to 100km/h and this is by far the best part of the road. Why can't the speed be increased back to 110km/h, if the road from Saddleworth to Broken Hill is all 110km/h and is in the disgraceful condition it is in?”

“Through Whyte Yarcowie is 80km/h. It is too fast as we have children in this town as well as us trying to enter onto Barrier Highway.”

Terowie is a town of historical significance, especially from a heritage building and railways perspective, and is a popular rest stop due to the roadhouse and town amenities including large playground and public toilets. While the Barrier Highway bypasses Terowie, access to the Terowie roadhouse and motel is directly from the highway, near the intersection with Third Street which is also the primary access into Terowie. RAA considers the intersection with Third Street a priority for upgrade to provide channelised turn lanes, however, a reduced speed limit is also considered an effective safety measure. This intersection is discussed later in this report.

Whilst some survey respondents questioned the need for a lower speed limit between Giles Corner and Saddleworth, this section has higher traffic volumes, more frequent access from side roads and properties, and more frequently occurring roadside vegetation – all factors that increase level of crash risk. This is evident with crash data indicating a higher occurrence of casualty crashes on this section of the highway.

## AusRAP star rating

The AusRAP star rating along sections of the Barrier Highway typically varies between one and three stars and is most influenced by factors such as speed limit, proximity to roadside hazards, and road geometry.



The images below highlight some examples of the star-rating on typical road cross-sections across the length assessed. In some examples, footage from previous RAA assessments in 2013 and



2018 has been used to provide a “before and after” star rating of sections that have since received notable upgrades.




The New South Wales section reviewed typically has a better star rating due to a reduced frequency of exposed roadside obstructions and embankments and increased use of safety barriers. Audio tactile edge and centre lines are also welcome additions on the New South Wales part of the highway. Whilst audio tactile centre lines are seldom used in South Australia, RAA would expect audio tactile edge lines as a minimum to be installed upon the completion of road and shoulder widening works; which will provide a relatively consistent journey, in terms of geometry, between Burra and Broken Hill.



Table 11: Star rating examples on Barrier Highway

Site coordinates: -34.09230,138.77507 (heading north)	Star rating	Comments
The example below highlights a cross-section south of Saddleworth in the 100km/h zone where trees and property access points are far more frequent than they are further north on the highway. This section could be rated three stars (10.53) with shoulder widening and barriers on one side, or four stars (4.94) with shoulder widening and barriers on both sides. This section would only be rated one-star (24.14) with a 110km/h speed limit.		
	★★☆☆☆ (18.14)	<p><u>Positives</u></p> <ul style="list-style-type: none"> <li>• Straight section of road</li> <li>• Wide lane width</li> <li>• No intersections/property access points</li> </ul> <p><u>Negatives</u></p> <ul style="list-style-type: none"> <li>• Narrow shoulder width</li> <li>• Trees 1-5m both sides</li> <li>• 100km/h speed limit</li> </ul>
Site coordinates: -33.5945693,138.8913428 (heading south)	Star rating	Comments
The cross-section below highlights a straight section of Barrier Highway between Burra and Mount Bryan that was recently upgraded to provide wider lanes (>3.25m) and sealed shoulders (approx. 1.0m). Based on RAA's 2018 photo of the site, this section would have received a very low two-star rating of 22.09, whilst following upgrades, the section instead receives a very high two-star rating of 13.32. Installing a barrier to prevent collisions with the stobie pole would further increase star rating to a very high three-star rating of 5.88.		
<p>Before upgrade (RAA photo, 2018)</p> 	★★☆☆☆ (22.09)	<p><u>Positives</u></p> <ul style="list-style-type: none"> <li>• Straight section of road</li> <li>• Trees &gt;10m from edge LHS</li> <li>• No intersections/property access points</li> </ul> <p><u>Negatives</u></p> <ul style="list-style-type: none"> <li>• Stobie pole 1-5m from edge (RHS)</li> <li>• Unsealed shoulders</li> <li>• 110km/h speed limit</li> <li>• Poor delineation</li> <li>• Medium lane width</li> </ul>



<p>After upgrade (RAA footage, 2022)</p> 	<p>★★☆☆☆ (13.32)</p>	<p><u>Positives</u></p> <ul style="list-style-type: none"> <li>• Straight section of road</li> <li>• Trees &gt; 10m from edge LHS</li> <li>• No intersections/property access points</li> <li>• Good delineation</li> <li>• Medium sealed shoulders</li> <li>• Wide lane width</li> </ul> <p><u>Negatives</u></p> <ul style="list-style-type: none"> <li>• Stobie pole 1-5m from edge (RHS)</li> <li>• 110km/h speed limit</li> </ul>
<p><b>Site coordinates: -32.64927, 139.45866 (heading north)</b></p>	<p><b>Star rating</b></p>	<p><b>Comments</b></p>
<p>The example below highlights a cross-section on a moderate curve south of Yunta that was upgraded to provide wider lanes, sealed shoulders and audio tactile line marking. This upgrade substantially improved star rating to a moderately high two-star rating. A safety barrier on the outside of the curve would reduce roll over risk from traversing the downwards slope and would result in a subsequent three-star score of 8.47.</p> <p>An otherwise comparable location on a straight section of road instead of a curve would see an increase in star rating from two-stars (17.21) to three-stars (8.98).</p>		
<p>Before upgrade (RAA footage, 2013)</p> 	<p>★☆☆☆☆ (30.67)</p>	<p><u>Positives</u></p> <ul style="list-style-type: none"> <li>• Good pavement condition</li> <li>• No intersections/property access points</li> </ul> <p><u>Negatives</u></p> <ul style="list-style-type: none"> <li>• Downwards slope 1-5m (LHS)</li> <li>• No sealed shoulders</li> <li>• 110km/h speed limit</li> <li>• Moderate curvature</li> <li>• Poor delineation</li> <li>• Medium lane width</li> </ul>
<p>After upgrade (RAA footage, 2022)</p> 	<p>★★☆☆☆ (15.84)</p>	<p><u>Positives</u></p> <ul style="list-style-type: none"> <li>• Wide lane width</li> <li>• Medium sealed shoulders</li> <li>• Audio tactile edge lines</li> <li>• Good pavement condition</li> <li>• No intersections/property access points</li> <li>• Adequate delineation</li> </ul> <p><u>Negatives</u></p> <ul style="list-style-type: none"> <li>• Downwards slope 1-5m (LHS)</li> <li>• 110km/h speed limit</li> <li>• Moderate curvature</li> </ul>

Site coordinates: -32.52290, 139.70015 (heading northeast)	Star rating	Comments
The example below highlights a cross-section in Winnininnie that has been improved from a low two-star rating to a moderate three-star rating through the implementation of shoulder widening and the installation of a safety barrier on the outside of the curve.		
Before upgrade (RAA footage, 2013) 	★★☆☆☆ (20.59)	<u>Positives</u> <ul style="list-style-type: none"> <li>• Wide lane width</li> <li>• Good pavement condition</li> <li>• No intersections/property access points</li> <li>• Adequate delineation</li> </ul> <u>Negatives</u> <ul style="list-style-type: none"> <li>• Downwards slope 1-5m (LHS)</li> <li>• Narrow sealed shoulders</li> <li>• High speed limit</li> <li>• Moderate curvature</li> </ul>
After upgrade (RAA footage, 2022) 	★★★☆☆ (9.39)	<u>Positives</u> <ul style="list-style-type: none"> <li>• Wide lane width</li> <li>• Medium sealed shoulders</li> <li>• Good pavement condition</li> <li>• No intersections/property access points</li> <li>• Adequate delineation</li> <li>• Safety barrier 1-5m (LHS)</li> </ul> <u>Negatives</u> <ul style="list-style-type: none"> <li>• 110km/h speed limit</li> <li>• Moderate curvature</li> </ul>
Site coordinates: -32.07914, 140.98361 (heading east)	Star rating	Comments
The below cross-section shows the star rating of a narrow bridge on the approach to Cockburn. Several different barrier systems are used (as is typical for many bridges on the Barrier Highway) which are unlikely to function as effectively as a single, continuous barrier type.		
	★☆☆☆☆ (30.87)	<u>Positives</u> <ul style="list-style-type: none"> <li>• Wide lane width</li> <li>• Straight section of road</li> <li>• Good pavement condition</li> <li>• No intersections/property access points</li> <li>• Adequate delineation</li> </ul> <u>Negatives</u> <ul style="list-style-type: none"> <li>• 110km/h speed limit</li> <li>• Rigid bridge &lt;1m from edges</li> <li>• No sealed shoulder</li> </ul>

Site coordinates: -32.06112, 141.07266 (heading east)	Star rating	Comments
<p>The example below, in NSW indicates a straight, flat section of road with wide lanes and narrow sealed shoulders (&lt;1.0m). There are stobie poles on one side of the road, set back more than 10m, whilst the other clear zone is free of major hazards. Audio tactile edge and centrelines are also present. This cross section receives a four star rating, however, this would reduce to 3 stars should any fixed hazard be present within 10m of the road edges, or two stars if there are fixed hazards on both sides, and within 5m of at least one side.</p>		
	<p>★★★★☆ (4.13)</p>	<p><u>Positives</u></p> <ul style="list-style-type: none"> <li>• Wide lane width</li> <li>• Straight section of road</li> <li>• Adequate delineation</li> <li>• Stobie poles &gt;10m from edge</li> <li>• ATLM edge and centre line</li> </ul> <p><u>Negatives</u></p> <ul style="list-style-type: none"> <li>• 110km/h speed limit</li> <li>• Narrow shoulder width</li> </ul>
Site coordinates: -32.04925, 141.12202 (heading east)	Star rating	Comments
<p>The example below highlights a similar cross-section to above, but with moderate curvature as the highway traverses the Barrier Ranges on approach to Broken Hill. Whilst there are no significant roadside hazards in this example, any fixed hazard within 10m of the edges would cause the star rating to drop to two stars, whilst hazards within 5m of the edges would see a one-star rating given – highlighting that roadside hazards near curves correlate strongly with low star ratings.</p>		
	<p>★★★★☆ (6.32)</p>	<p><u>Positives</u></p> <ul style="list-style-type: none"> <li>• Wide lane width</li> <li>• Adequate delineation</li> <li>• No significant hazards within 10m of edges</li> <li>• ATLM edge and centre line</li> </ul> <p><u>Negatives</u></p> <ul style="list-style-type: none"> <li>• 110km/h speed limit</li> <li>• Narrow shoulder width</li> <li>• Moderate curvature</li> </ul>

## Recommendation A5

Implement progressive upgrades of the Barrier Highway to ensure a minimum three-star AusRAP rating for the full length of the corridor.



## Other observations

Since RAA's 2013 assessment, there has been a notable improvement in the number of curves treated with safety barriers between Oodla Wirra and Nackara, where the terrain is quite hilly, however, this area still needs to be a focus for continued barrier installations, with many roadside hazards remaining exposed. Exposed trees pose the most significant and frequently occurring roadside hazard south of Burra, and additional barrier protection on this section will reduce the likelihood of fatal and serious crashes involving trees and in most cases result in an incremental star rating increase.



Figure 32: Recent barrier installations in Nackara have provided a welcome improvement to safety on this section



Figure 33: High-risk curves are still present in the area, with this image showing an embankment and trees on the curve



### Recommendation A6

Progressively continue to install safety barriers, focusing on areas with curves and exposed roadside hazards in the hilly terrain between Oodla Wirra and Nackara, and focusing on reducing the frequency of exposed vegetation south of Burra.

Road maintenance issues were highly raised by survey respondents, with many acknowledging the notable improvement on recently upgraded sections between Burra and Cockburn. The sections of Barrier Highway outside of the project scope were most frequently nominated, with many raising the NSW part of the highway between Cockburn and Broken Hill, as well as the section south of Burra (especially between Saddleworth and Manoora).

RAA's site assessments confirmed this feedback. The surface immediately north of Burra (through to Goyder Highway), and south of Burra (through to Giles Corner) was in poor condition, with undulations and bumps in the surface especially prominent between Saddleworth and Black Springs (Barton Hill Road), north of Manoora. Shoulder widths are inconsistent between Giles Corner and Burra, and road geometry should also be improved as part of future maintenance works to ensure a minimum width sealed shoulder of one metre.



Figure 34: Short-term repairs north of Manoora had significantly deteriorated, with several similar examples experienced between Saddleworth and Black Springs





Figure 35: Potholes and fatigue cracking between Saddleworth and Manoora

#### **Recommendation A7**

Undertake road resealing, and potentially localised road reconstruction between Giles Corner and north of Burra (Goyder Hwy), prioritising the section between Saddleworth and Black Springs, north of Manoora.

Similarly, despite some ongoing patching being undertaken by the New South Wales government at the time of our assessment, the section between Cockburn and Broken Hill was generally in poor condition, with potholes and edge breakup the most commonly identified issues along this part of Barrier Highway.





Figure 36: Localised pavement failures leading to potholes between Cockburn and Broken Hill



Figure 37: Edge break up between Cockburn and Broken Hill

### **Recommendation A8**

Undertake localised pavement repairs and resurfacing and widen sealed shoulders between Cockburn and Broken Hill to repair and reduce the occurrence edge break up (Transport for New South Wales).

Audio tactile line marking (ATLM) was present for about 40km between Oodla Wirra and Yunta, and on the New South Wales part of the highway. Unfortunately, it was largely lacking for the length of the highway in South Australia. Given that single vehicle run-off road crash types account for three quarters of casualty crashes on Barrier Highway, installing ATLM for the full length of the highway should be a high priority once road and shoulder widening and renewal works are complete between Burra and Cockburn.

### **Recommendation A9**

Following completion of road and shoulder widening works between Burra and Cockburn, install audio tactile line marking along the length of the South Australian section of Barrier Highway to mitigate the high volume of single vehicle crashes occurring.

Insufficient overtaking opportunities were also frequently raised by survey respondents, with 54% of community survey respondents indicating that “not enough overtaking lanes/slow vehicle turnouts” was a key concern in need of addressing on the highway (see Figure 11). This made it the second most prominently raised concern of regular road users behind road maintenance.

Whilst traffic volumes north of Burra are moderate (typically around 600 vehicles per day), they are higher south of Burra, with an average of 1,000 vehicles per day travelling between Burra and Saddleworth, and 1,800 vehicles per day between Saddleworth and Giles Corner. Heavy vehicles typically account for around 20% of traffic south of Burra, and 30% of traffic north of Burra. Whilst these daily traffic volumes are generally lower than the typical volumes that warrant the installation of overtaking lanes, consideration should be given to installing at least one overtaking lane in each direction between Giles Corner and Burra to provide a safe opportunity for overtaking along this stretch of road, given its 70km length without many safe overtaking opportunities and its high percentage of heavy vehicle use.

### **Recommendation A10**

Consider installing one overtaking lane (two total) in each direction between Giles Corner and Burra.

All rest areas and townships along the highway were briefly reviewed by the survey team for basic amenities such as toilets, shelter, bins, seating, and parking space for vehicles of all sizes. From a safety perspective, advance warning signs, delineation of entry points, and the presence of entry and exit lanes was also checked. The presence of other facilities such as fuel and EV chargers, and places to purchase food or drinks was also checked.

In South Australia, toilets are only present within townships, whilst the three Thackaringa rest areas on the NSW side of the border have toilet facilities available. The Thackaringa rest areas were also the only ones to provide lighting at night, and two of these also provided a fire pit for travellers to light a small fire.

Between Burra and Broken Hill, the average distance between towns or rest areas is about 20km, with the furthest about 40km, between the Bulloo Creek rest areas and Cockburn. There is a



similar length spacing between Manna Hill and Yunta in the Adelaide-bound direction. For freight routes, the furthest distance between rest areas should be no more than 30km for short breaks and truck load checking areas. The Barrier Highway upgrade between Burra and Cockburn proposes three new/upgrade rest areas between Yunta and Cockburn, which should resolve the current spacing issues on this section of the highway.

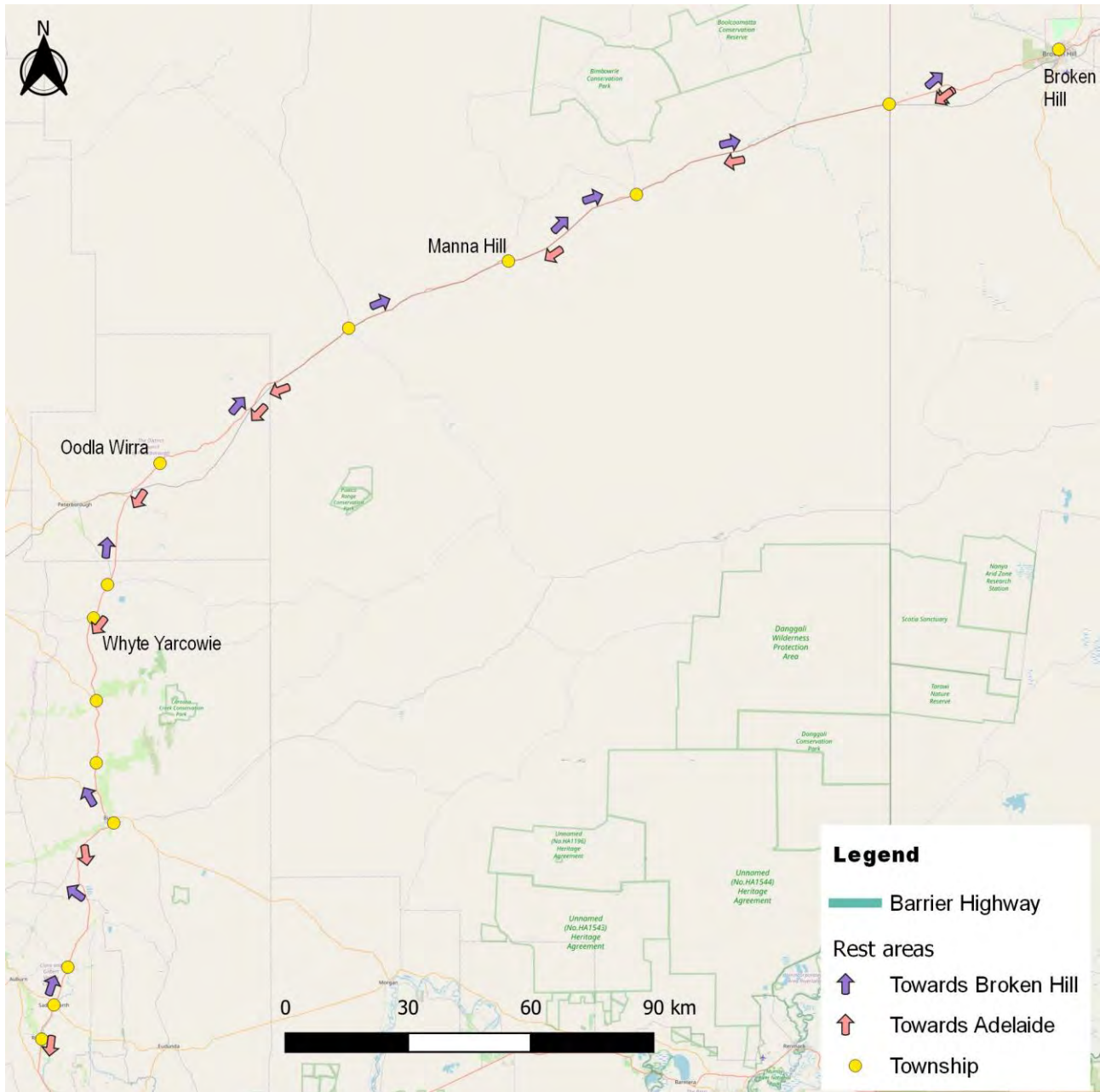


Figure 38: Formal rest areas and townships with rest area facilities along Barrier Highway

Four of 21 roadside (non-township) rest areas did not have bins, whilst nine did not have a built shelter. However, some had several trees which would provide suitable shade during some parts of the day.

Overall, most roadside rest areas are not particularly inviting, and at best have a bin, shelter and seat – with less than half (10/21) of roadside rest areas checked by RAA having all three of these amenities. Townships along the highway generally provide much better facilities and generally fit into the ‘major rest area’ category.

Ultimately, rest areas should be inviting to travellers to further encourage short driving breaks as part of a good fatigue management strategy. Information on local history, local Aboriginal culture, and interesting scenery/surrounds make for better locations to stop.

A good example is the Mount Bryan rest area, which has toilets, an undercover fenced playground, ample shade and seating, as well as information about wind turbines in the region. This information is prominently displayed alongside a full-size turbine blade, which is a popular photo opportunity and is a point of interest from a tourism perspective.

### **Recommendation A11**

Upgrade roadside rest areas to provide minimum facilities of bins, shelters and seating, whilst strongly considering amenity improvements at some sites to create inviting places to stop and encourage better fatigue management.

### **‘S’ bend north of Mt Bryan**

There was a high level of community concern regarding the large ‘S’ bend in the highway situated about 1.5km north of the Mount Bryan township. This bend was built into the highway whilst the Burra - Hallett rail line was still operational (pre-1990), so that the road could cross the rail line at a better angle. This rail line, which terminated in Peterborough was removed in the early 1990’s following the cessation of rail services along the corridor.

The comments below are typical of the responses received in the community survey.

“The upgrade north of Mt Bryan has not removed the S bend. This bend was for a railroad crossing, all train services ceased many decades ago. The S bend has had money spent on guard rails and resurfacing and yet the road has a straight alignment either side of the bend. Meeting road trains on this bend has forced me and many others off the road.”

“I believe the S bend just north of Mt Bryan to be a real safety hazard. I have had a few near misses with cars coming the other way being over the centre line and not realising until right on you.”

“Mount Bryan S bend should have been straightened in 1989 when the railway line was ripped up.”

“S-bend between Mount Bryan and Hallett is an ongoing and dangerous hazard and needs urgent attention.”

“Please see they remove the old S section at Mt Bryan where the railway used to cross 30 years ago to a straight road.”

At the time of our 2022 site assessments, road resurfacing and widening works had been undertaken either side of the S bend, and the speed limit was temporarily reduced to 60km/h around the S bend.

In the ten years up to 2021, one rollover casualty crash occurred on the S bend, resulting in minor injuries. This crash involved a southbound semi-trailer and occurred just beyond the inflection point of the S bend.

This location was also raised prominently when RAA reviewed the Giles Corner to Terowie section of Barrier Highway as part of our 2018 Clare and Goyder Regional Road Assessment. At the time, RAA recommended that the road be realigned as the preferred solution, however expected that a reasonably high cost may reduce feasibility of this. As a short-term solution, we also suggested

that the inside shoulders be widened, and W1-8 'tilting truck' warning signage be installed in each direction.

### **Recommendation A12**

1.5km north of Mount Bryan, realign the Barrier Highway to a straight section of road to remove the 'S' bend in the road, which was put in place to improve safety at the former level crossing at this location.

### **Intersection with Third Street, Terowie**

Safety concerns at the intersection with Third Street in Terowie were raised by several survey respondents. The intersection is a four-way crossroad, with Franklyn Road opposite Third Street providing access to largely undeveloped farmland west of the Barrier Highway, and Third Street providing primary access into the Terowie Township.

There is no history of casualty crashes occurring at the intersection over the five years between 2017 and 2021.

Typical responses received in the community survey are included below.

"Living in Terowie, it is dangerous to leave the Highway to come back into town. The speed limit is 110km/h with no extra area to leave the road to turn towards town, quite daunting when you have someone following."

"As I live in Terowie, we get a lot of trucks, cars and caravans. At the intersection of Barrier Highway and Third Street there can be a lot of confusion as there is a BP service station and only single road. If a car/van is turning in to Third Street and there is a truck trying to continue on the Barrier Highway, there is the possibility of near misses on a regular basis. A turning lane for the intersection would stop the possibility of an accident. Also, maybe a slow down to 80km/h on that stretch."

During RAA's site inspection, it was noted that sight distance from Third Street along Barrier Highway to the south was compromised due to the gradual curve in the highway which creates an undesirable observation angle to approaching northbound traffic. Austroads specifies a minimum gap sight distance for vehicles entering from the minor road to be 153m in a 110km/h speed limit zone. This sight distance is currently not met at the intersection and can only realistically be improved via a section of reduced speed limit, should an intersection upgrade and realignment not be considered feasible.



Figure 39: Sight distance along Barrier Highway to the south from Third Street in Terowie

Furthermore, whilst the southbound shoulder has previously been widened, there is limited width for a southbound vehicle to safely pass another southbound vehicle propped to turn right into Third Street, and consideration should be given to further shoulder widening or ideally providing a channelised right turn lane into Third Street. This would further reduce risk, should a vehicle also be entering or crossing Barrier Highway from Franklyn Road.





Figure 40: Widened shoulder on the Barrier Highway through the four-way crossroad at Third Street and Franklyn Road

### **Recommendation A13**

Upgrade the intersection with Third Street in Terowie by installing a channelised right turn lane to Third Street and consider measures such as a speed limit reduction or intersection realignment to improve minimum gap sight distance from Third Street to the south.

## Broken Hill investigation details and recommendations

### Crash data for Broken Hill City Council area

Unless otherwise specified, crash data within this section is for the five-year period between 2016 and 2020, which was the most recent data available at the time of this analysis.

Between 2016 and 2020, 153 people were injured, and one person was killed in 124 casualty crashes occurring within the Broken Hill City Council area. This is an average of 25 casualty crashes per year. There is a slight downwards trend over this time, with 2016 recording the highest number of casualty crashes (32), and 2017 recording the lowest (20).

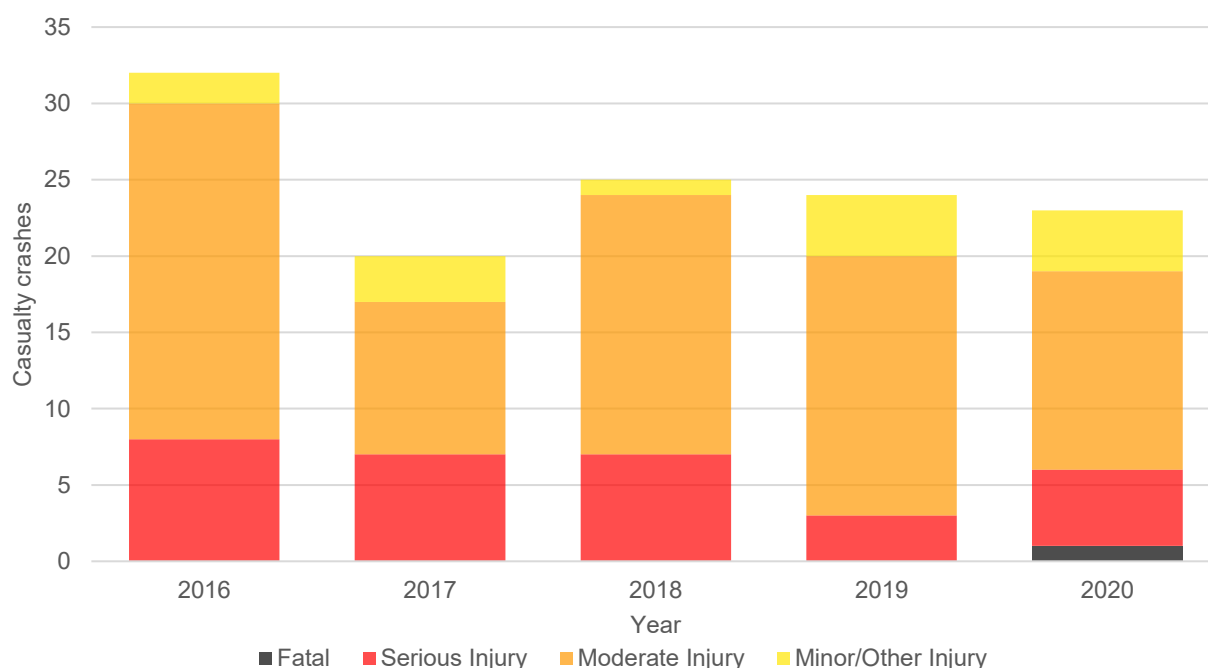


Figure 41: Annual number of casualty crashes in Broken Hill between 2016 and 2020

When plotting five years of casualty crash data across a map of Broken Hill, it is evident that crash hotspots are primarily along the state road network and the Broken Hill CBD. In the Broken Hill CBD, Argent Street is already subject to a 40km/h speed limit as an area of high pedestrian activity, however, investigation and community consultation should be undertaken to determine whether a more widespread 40km/h or lower speed limit would be suitable for the area between Beryl Street, Iodide Street, Crystal Street and Kaolin Street.

Despite possibly being the busiest of the three streets, Argent Street has a better casualty crash history than the adjacent Blende Street and Beryl Street, as highlighted in Table 12.

Table 12: Casualty crash history of Argent Street, Blende Street and Beryl Street from Iodide Street to Kaolin Street

Road name (Iodide St to Kaolin St only)	Total casualty crashes	Minor/Other injury	Moderate injury	Serious injury
Argent St	4	2	2	0
Blende St	8	1	3	4
Beryl St	4	0	3	1

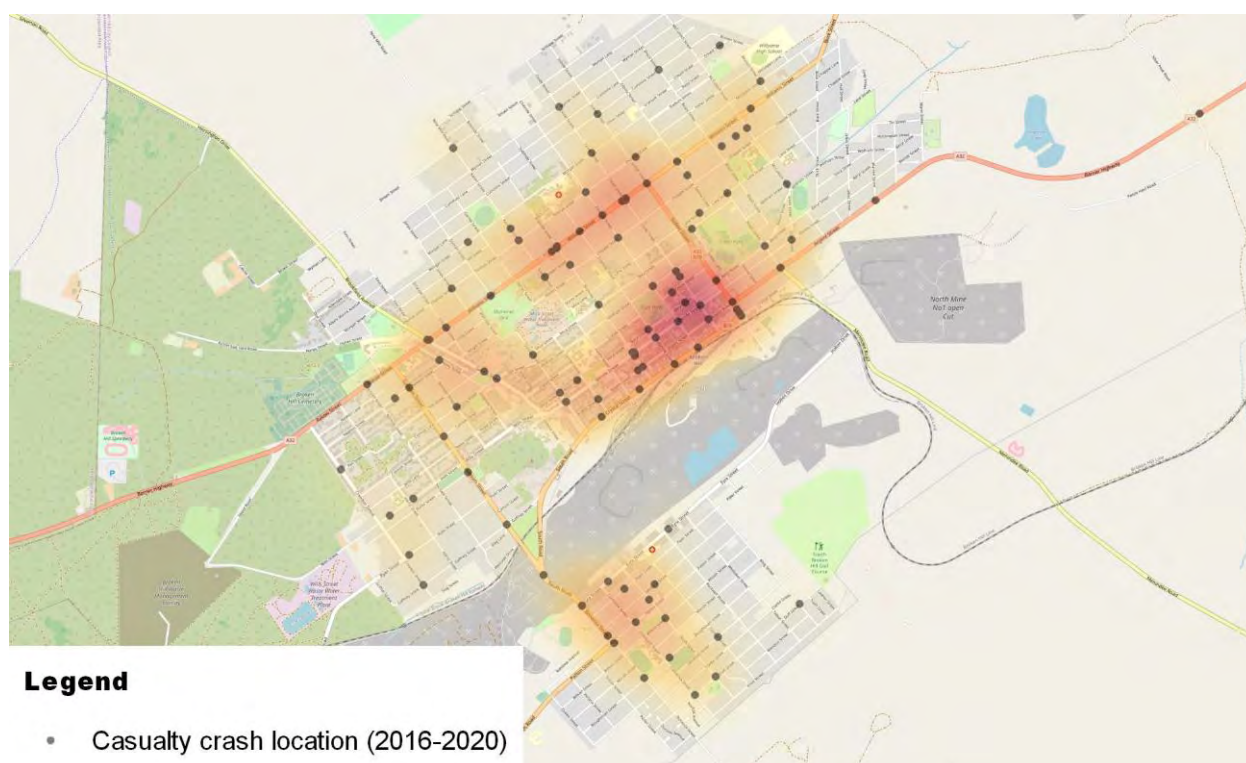


Figure 42: Heatmap of casualty crashes in Broken Hill between 2016 and 2020

### Recommendation B1

Investigate the provision of a 40km/h or lower area speed limit in the Broken Hill CBD, expanding on the current 40km/h Argent Street speed limit.

There were nine roads in Broken Hill that recorded more than three casualty crashes over the past five years.

Table 13: Broken Hill roads recording more than three casualty crashes between 2016 and 2020

Road	No. of crashes
Williams Street/Rakow Street	15
Blende Street	10
Argent Street	8
Iodide Street	8
South Road/Crystal Street	8
Bonanza Street	5
Beryl Street	4
Galena Street	4

There were ten intersections in Broken Hill that recorded multiple casualty crashes over the past five years.

Table 14: Broken Hill intersections recording multiple casualty crashes between 2016 and 2020

Road	No. of crashes
Williams St/Oxide St	3
Galena St/Mercury St/Talc St	3
Williams St/Galena St	2
Williams St/Bromide St	2
Kaolin St/Brown St/Nine Mile Rd	2
Iodide St/Beryl St	2
Argent St/Menindee Rd	2
Blende St/Gossan St	2
Eyre St/Bonanza St	2
Blende St/Chloride St	2

The first impact type gives some indication of the type of crash occurred for the purposes of identifying trends in the data. Right angle crashes at intersections made up more than one third of casualty crashes, whilst other angle crashes made up nearly 30% of crashes and were most common on two-way undivided roads. Collisions with objects, and rollovers – both of which usually involve a single vehicle, were also highly occurring crash types.

Table 15: First impact type of casualty crashes in Broken Hill

First impact type	No. of crashes
Right angle	43
Other angle	36
Vehicle - Object	15
Rollover	13
Rear end	7
Vehicle - Pedestrian	5
Person - Object	2
Vehicle - Animal	2
Head-on	1



A combined 221 traffic units were involved in casualty crashes across the five-year period, with cars accounting for 61% of units involved in casualty crashes and trucks accounting for 19% of units involved.

Table 16: Traffic units involved in crashes in Broken Hill

First impact type	No. of crashes
Car/car derivative	134
Light truck	36
Motorcycle	29
Pedal cycle	7
Pedestrian	6
Other motor vehicle	3
Articulated truck	3
Heavy rigid truck	2
Bus	1

When looking at truck involvement in casualty crashes, 30% of casualty crashes occurring in Broken Hill involved at least one truck, increasing to 37% of multi-vehicle crashes involving at least one truck. However, most of these crashes only involved a light truck, with only 5 heavy rigid or articulated trucks involved in casualty crashes over the five-year period.

## Most raised roads and intersections in Broken Hill

Several roads and intersections were frequently raised in the Broken Hill community survey. The most raised individual road was Williams Street, followed by Crystal Street and Iodide Street. The primary point of concern raised in nominations was the high heavy vehicle volumes on these roads. The most raised intersection was at Argent Street/Iodide Street, with all respondents raising this location from a freight perspective.

The most raised roads and intersections, as well as the question categories that they were raised in are tabulated below.

Figure 43: Most raised Broken Hill roads in the community survey

Road name	Total mentions	Survey question category					
		Maintenance	Design	Congestion	Freight	Cyclist	Pedestrian
Williams St	44	8	4	0	29	1	2
Crystal St	31	1	2	0	26	2	0
Iodide St	29	2	3	0	23	0	1
Argent St	29	2	3	0	19	3	2
South Rd	16	1	4	0	8	2	1
Gypsum St	15	0	6	0	7	2	0
Bonanza St	11	2	1	0	2	3	3
Oxide St	10	4	2	0	1	1	2
Menindee Rd	10	0	1	2	5	2	0
Silverton Rd	10	9	1	0	0	0	0
Blende St	10	8	1	0	1	0	0

Figure 44: Most raised Broken Hill intersections in the community survey

Intersection	Total mentions	Survey question category					
		Maintenance	Design	Congestion	Freight	Cyclist	Pedestrian
Argent St/Iodide St	8	0	0	0	8	0	0
Argent St/Menindee Rd	8	0	3	0	3	2	0
Iodide St/Williams St	6	0	2	0	4	0	0
Crystal St/Iodide St	4	0	0	0	4	0	0
Gypsum St/South Rd	4	0	0	0	4	0	0
Gossan St/South Rd	4	0	4	0	0	0	0
Bromide St/Crystal St	3	0	0	0	2	1	0
Cornish St/Gypsum St	3	0	3	0	0	0	0
Bagot St/Beryl St	3	0	2	0	0	1	0
Gypsum St/Rakow St	3	0	1	0	2	0	0

Some of these locations were reviewed by RAA during our regional assessment and are discussed later in this report.

## Heavy vehicles in Broken Hill

The overwhelming transport and road safety concern raised by Broken Hill residents in the community survey related to heavy vehicle travelling on the city streets of Broken Hill. The concerns raised included road and intersection design, interactions with other vehicles, vehicle noise, and damage caused to roads. The verbatim comments below are typical of what was received in the community survey, with several respondents indicating that a heavy vehicle bypass was needed.

“All the heavy truck routes - would be nice if they didn't have to go through Broken Hill and there was a ring road.”

“Too many trucks traveling to and from the mines via Crystal Street.”

“Noise fumes congestion.”

“A bypass road around the city is needed for heavy traffic.”

“Trucks should not be using the main streets of Broken Hill, there should be a heavy vehicle bypass.”

“The main streets are not open highways. Heavy traffic on many of these streets, as often claimed, do not support local businesses. Appropriate restrictions should be in place or in some cases, town bypasses should be considered.”

“Williams Street with multiple roundabout makes it treacherous driving for the truck drivers.”

“The Broken Hill sections of the Barrier Highway through town are in poor condition to support the heavy flow of traffic, with the majority of traffic winding through town on rapidly patched roads. A heavy vehicle bypass for road trains and mining equipment travelling via Broken Hill might be a safe idea to ensure that the roads in town could be better maintained for regular traffic compared to traffic that is just passing through.”

“Mine trucks driving down Crystal Street, then into Iodide Street and then into Argent Street – and then the return journey. These trucks should not be travelling the route they are from one mine to the other. These streets are high traffic areas for the people of The Hill. In Crystal Street there is a Community Health Centre, Medical Centre, a Credit Union and a Club. Children and senior citizens attend these facilities.”

“Williams Street and Iodide Street. Use of exhaust brakes by speeding trucks 24/7/365. No truck stops.”

The roads raised most frequently from a heavy vehicle perspective were Williams Street, Iodide Street, Crystal Street, Argent Street, South Road and Gypsum Street.

Except for Gypsum Street which is classified as a ‘regional road’ (i.e., council asset with additional avenues for state government funding), all these roads are classified as ‘state roads’ which are owned, maintained, and upgraded by Transport for NSW. Furthermore, these roads formulate the two major freight routes across Broken Hill, the Barrier Highway, and the Silver City Highway.

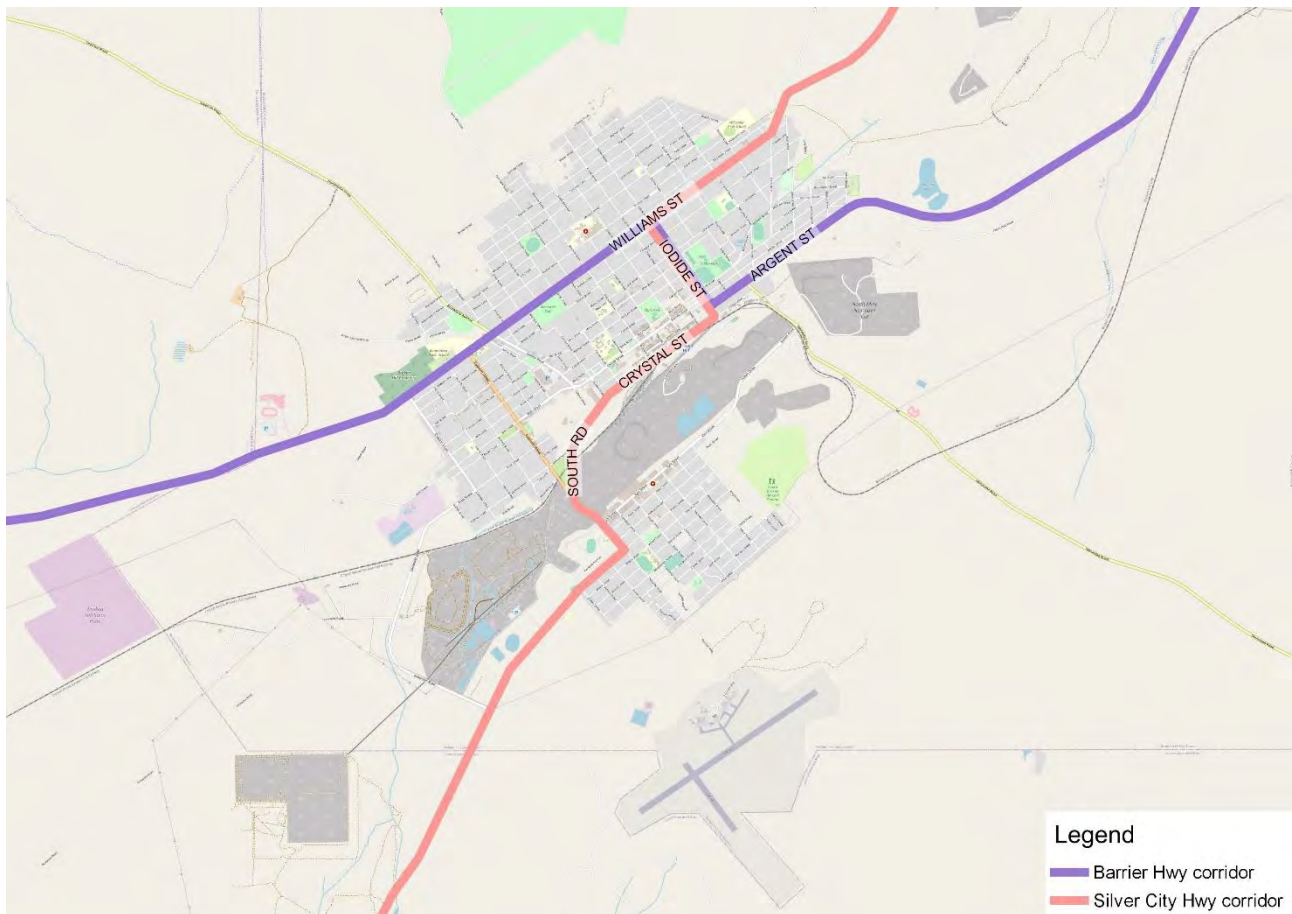


Figure 45: The Barrier Highway and Silver City Highway corridors via Broken Hill.

According to site observations and NSW government land use mapping from 2017<sup>9</sup>, land use along these corridors is mixed. Williams Street, Iodide Street and Argent Street land use is mostly urban residential, with scattered commercial, whilst Crystal Street/South Road is mostly commercial with some urban residential development between Gossan Street and Kaolin Street.

Whilst these corridors are considered the main freight routes, there are several detours and other roads within Broken Hill that function as bypasses of main streets or facilitate easier turn movements at tight intersections such as the Bonanza Street/Patton Street roundabout. The routes approved for b-triple and road train use are highlighted in Figure 46.

<sup>9</sup> New South Wales Government, SEED environmental data, *NSW Land Use 2017*, accessed at [https://geo.seed.nsw.gov.au/Public\\_View/index.html?viewer=Public\\_View&locale=en-AU&runWorkflow=AppendLayerCatalog&CatalogLayer=SEED\\_Catalog.281](https://geo.seed.nsw.gov.au/Public_View/index.html?viewer=Public_View&locale=en-AU&runWorkflow=AppendLayerCatalog&CatalogLayer=SEED_Catalog.281).



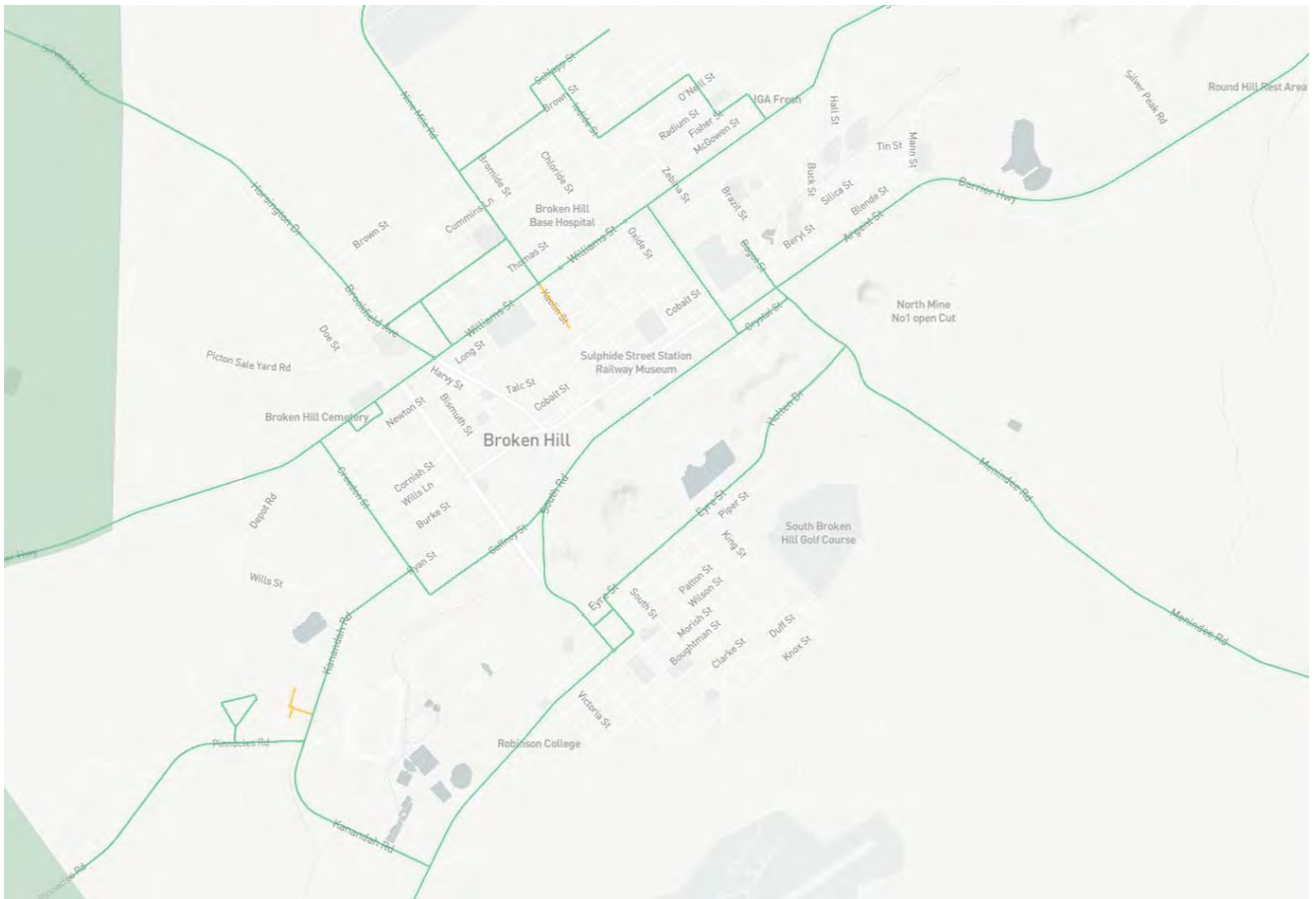


Figure 46: 36.5m road train/modular b-triple network in Broken Hill<sup>10</sup>

According to New South Wales crash data, 37 casualty crashes involving trucks occurred in Broken Hill between 2016 and 2020, accounting for 30% of all 124 casualty crashes in Broken Hill over these five years. Three of these involved an articulated truck, whilst two involved a heavy rigid truck. The remaining 32 crashes involved light trucks. Two of the three articulated truck crashes occurred outside the built-up area as shown in Figure 47.

<sup>10</sup> NHVR, *Route planner tool*, 'Road Train 36.5 Network' and 'Modular B-triple network' routes selected are accurate as at 4/11/2022, accessed via <<https://www.service.nhvr.gov.au/#page=informationHub/routePlannerTool>>.

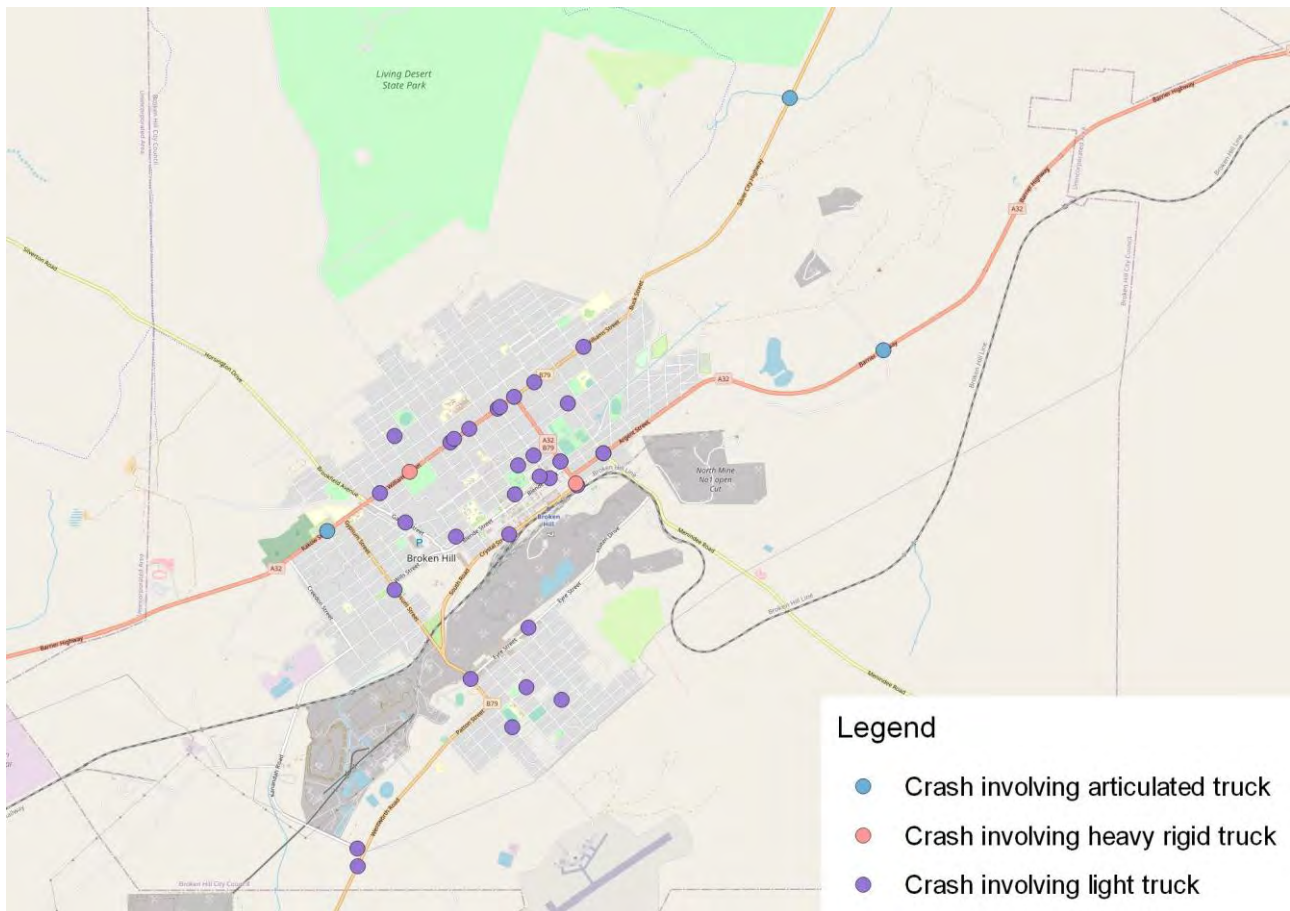


Figure 47: Locations of casualty crashes involving trucks between 2016 and 2020

Almost half (16/33) of truck crashes in built up areas of Broken Hill occurred on roads highly raised by the community from a freight perspective, including Williams Street/Rakow Street, Iodide Street, Argent Street, Crystal Street/South Road.

A detailed study of freight movements through Broken Hill needs to be undertaken which should consider the origin and destination of freight as well as the viability of a full or partial freight bypass incorporating a 24-hour truck stop.

## Recommendation B2

Undertake a Broken Hill freight study which should look at reducing heavy vehicle movements through residential areas and review the feasibility of a full or partial freight bypass of Broken Hill and incorporate a 24-hour truck stop.

A partial bypass would serve to remove or reduce heavy vehicle traffic from Williams Street and Iodide Street but would still see some heavy vehicle traffic through residential areas. It could utilise part of the Holten Drive/Eyre Street corridor before crossing South Road and potentially following the rail corridor for a short distance before following a new road alignment parallel to Crendon Street between Kanandah Road and Barrier Highway.

This corridor could be utilised for all freight approaching or departing Broken Hill to/from the east, west and south, however, it is likely that traffic approaching/departing to the north (Silver City Highway) would still need to use the existing corridors highlighted in Figure 45 unless a new road

link could also be built that connects the Silver City and Barrier Highways, on the northwest outskirts of Broken Hill.

Other important considerations are how heavy vehicles will access Holten Drive/Eyre Street from Argent Street/Barrier Highway (east), and whether interventions will be required near Eyre Street to avoid trucks passing close to residential areas on Eyre Street.

A full bypass of Broken Hill would need to connect Kanandah Road with Barrier Highway on the west, and Barrier Highway with Silver City Highway on the east and could potentially skirt the north or south of Broken Hill, with both options requiring 12-15km of new road construction.

Any full or partial bypass route should also incorporate a 24-hour truck stop with facilities including bathrooms, showers and ideally food and beverage options for purchase.

A partial bypass option may bisect north and south Broken Hill and is more likely to deliver a lower-cost alternative, and this option should seek to utilise existing road corridors that would require modification, especially at intersections. In all options considered by RAA, a Kanandah Road to Barrier Highway connection is required to remove heavy vehicle traffic from Creedon Street which is largely a built-up residential area. This would also help shift some heavy vehicle traffic from built up areas of Williams Street and Iodide Street.

Option	Pros	Cons
<i>Partial</i> Includes approx. 5-9km of new roads	<ul style="list-style-type: none"> <li>Potential lower cost than other options</li> <li>Less environmental impact</li> <li>Better accessibility to mine sites</li> <li>Eliminates most heavy vehicle traffic from Williams Street and Iodide Street</li> <li>Can be undertaken in stages</li> <li>Does not preclude future full bypass with some elements of partial bypass required for full bypass</li> </ul>	<ul style="list-style-type: none"> <li>Will not fully eliminate heavy vehicle traffic from residential areas unless Argent Street and Eyre Street are also partially bypassed (9km option)</li> <li>Potentially higher land acquisition cost depending on the chosen alignment</li> <li>Complex and potentially costly interface with South Road, Gypsum Street and the rail corridor (may require grade separation)</li> <li>Heavy vehicle noise near some residential areas</li> <li>Increased heavy vehicle traffic on some roads</li> </ul>
<i>Full – north</i> Includes approx. 11km of new roads	<ul style="list-style-type: none"> <li>Eliminates most heavy vehicle traffic from residential areas</li> <li>Allows intersection improvements in Broken Hill to be implemented, where freight routes were previously prohibitive</li> <li>May share some features with partial bypass option</li> </ul>	<ul style="list-style-type: none"> <li>Higher cost</li> <li>Some mining vehicles will still need to travel in residential areas</li> <li>Potential environmental impacts need to be explored</li> <li>Potential road safety issues introducing new intersections with freight routes crossing highways</li> <li>Major bypass road ineffective until full completion (limited opportunity for multi-stage project)</li> </ul>



Option	Pros	Cons
<b>Full – south</b> Includes approx. 12km of new roads	<ul style="list-style-type: none"> <li>Eliminates most heavy vehicle traffic from residential areas</li> <li>Allows safety improvements such as roundabouts and median upgrades in Broken Hill to be implemented, where freight routes were previously prohibitive</li> <li>May share some features with partial bypass option</li> </ul>	<ul style="list-style-type: none"> <li>Higher cost</li> <li>Some mining vehicles will still need to travel in residential areas</li> <li>Potential environmental impacts need to be explored</li> <li>Potential road safety issues introducing new intersections with freight routes crossing highways</li> <li>Major bypass road ineffective until full completion (limited opportunity for multi-stage project)</li> </ul>

Implementation of a freight bypass would also allow for upgrades at major intersections along the current freight route that were highly raised in the community survey, such as Iodide Street/Argent Street, Iodide Street/Crystal Street, and Iodide Street/Williams Street.

## Broken Hill roundabouts

General concerns were raised about several roundabouts in Broken Hill with community survey respondents indicating that they were not suitable for heavy vehicle use. The below verbatim comments are typical of the feedback received.

“Most of the roundabouts have limited access for heavy vehicles. In particular, the intersection of Silverton Road and Williams Street. They seem to cause damage when wheels run up and over poorly designed gutters.”

“Williams Street is a busy road with many roundabouts. As a bicycle rider this can be scary at times, though I do try to give way to trucks.”

“Roundabouts for the truck driver to get around easy as Williams Street for example, roundabouts are small a car can get around the roundabouts, but a truck is bigger vehicle and so many roundabouts. At each intersection along Williams Street, the truck driver needs more time and space compared to a car.”

“Excessive number of small, difficult to navigate roundabouts that larger vehicles typically passing through town have to go through. Undulations in road surface caused by heavy vehicles turning around roundabouts and driving along main street eg Williams Street.”

“Poor engineering and design of roundabouts median strips and roads.”

“Roundabouts on Williams Street as an example although they may be safe they are or could be awkward for the truck drivers to get around easy.”

“Heavy transport travelling through Broken Hill do not obey speed limits. They always make dangerous approaches to roundabouts. They always use their truck exhaust brakes in Broken Hill residential areas because they are always going too fast and can’t slow down in time for the roundabouts. This is noise pollution and should be illegal!”

An analysis of New South Wales casualty crash data for the five years between 2016 and 2020 indicates that 37 casualty crashes involving trucks occurred in Broken Hill during this time, with five of these being at roundabouts. All five roundabout crashes were right angle crashes, and the truck driver was determined to be responsible for the crash in two of the five crashes. Furthermore, each of the trucks involved in these crashes were classified as a ‘light truck’ with ‘articulated’ and ‘heavy rigid’ truck involvement in casualty crashes in Broken Hill low.

Whilst not always optimal, RAA considers the roundabout design within Broken Hill to be functional. Roundabouts offer a safer and often more efficient alternative to signposted or signalised crossroad intersections. However, roundabouts can introduce challenges for heavy vehicle movements, particularly when left or right turns are required. Observations at roundabouts on freight routes within Broken Hill are that they are augmented with wide concrete aprons which are traversable by large vehicles to account for the swept path of trailers but discourage smaller vehicles from travelling over them.

Should a full heavy vehicle bypass of Broken Hill be implemented, additional opportunities to improve intersection and roundabout design across the city would be available. These would include changes to lane width and approach angles (to convert roundabouts from tangential to radial design) as well as improvements to pedestrian accessibility across approach roads.



Figure 48: b-double navigating the roundabout at Crystal Street and Bromide Street



## Drainage

When asked about their concerns with the design and maintenance with roads in Broken Hill, 55% of Broken Hill respondents to the community survey selected “poor drainage/flooding over roads” to be an issue.

Broken Hill has limited underground stormwater infrastructure, with most stormwater runoff catered for by open channels. Some roads serve a dual purpose as drainage channels during high rainfall events, with central drainage channels observed on Williams Street (near Oxide Street) and Creedon Street that are likely to inundate the streets during high rainfall events.

According to the Bureau of Meteorology, Broken Hill recorded an annual mean rainfall of 224.8mm between 1994 and 2020. In March and April 2022, Broken Hill recorded almost five times the monthly average, with more than 200mm falling over these two months combined, compared to the average of 42mm. These high-rainfall months are likely to have been fresh in the mind of survey respondents when completing the survey in August and September 2022, and are not considered typical rainfall events for Broken Hill.

During RAA’s site assessments, some light to moderate rainfall was experienced, which caused partial inundation of the Gypsum Street/Wills Street roundabout and Cornish Street at the intersection with Gypsum Street.



Figure 49: Silt and mud over the road attributable to poor drainage at the Cornish Street/Gypsum Street intersection.



The comments below are typical of what was received in the community survey in relation to drainage in Broken Hill.

“There is either inefficient drainage or poorly maintained drainage for water across roads during major rainfall.”

“Broken Hill has really poor drainage when it rains. The water does seem to run away fairly quickly, but if you’re out and it rains, some roads become impassable. Like the intersection of Bagot and Beryl Streets – there have been cars washed away here before trying to cross the intersection.”

“Poor drainage [on Williams St] between Oxide Street and Chloride Street, several large bumps from start to end.”

“I’m building a new home and my whole street floods and runs like a river when it rains.”

“With heavy rains a lot of roads/intersections flood. A few drivers don’t obey the road closed signs or warnings of water over the road.”

“Gypsum Street/Cornish Street – the road is higher than footpath, seems to get flooded easy.”

In 2006, an Urban Stormwater Master Plan<sup>11</sup> was prepared for Broken Hill City Council. This plan identified \$5.5m of high priority drainage works and \$8.5m of low priority drainage works for the city. RAA recommends this plan be reviewed and updated to determine which projects are still incomplete, and to identify further priority projects in the city for future funding grants.

### **Recommendation B3**

Review and update the 2006 *Urban Stormwater Master Plan* for Broken Hill to determine which projects are still incomplete and to identify further priority projects in the city for future funding grants.

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<sup>11</sup> Tonkin, 2006, *Broken Hill – Urban Stormwater Master Plan*, accessed at <<https://www.brokenhill.nsw.gov.au/Council/Other-strategies-documents/Urban-Stormwater-Master-Plan>>.

## Broken Hill traffic investigation details

RAA's Safety and Infrastructure team undertook traffic investigations at several locations within Broken Hill based on commentary received throughout the community survey. The details of these investigations are summarised below.

### Williams Street

Williams Street forms a critical component of the Broken Hill transport network. Between the western outskirts of the city and Iodide Street, Williams Street forms part of the east-west Barrier Highway route through Broken Hill. Between Iodide Street and the northern outskirts of the city, Williams Street forms part of the north-south Silver City Highway route. Both routes are part of New South Wales's PBS level 3A network. Williams Street is classified as a state road under the NSW road network classifications, meaning that maintenance and upgrade funding is primarily a state government responsibility.

Williams Street was the highest raised road in the community survey, receiving 44 mentions, including six at the intersection with Iodide Street.

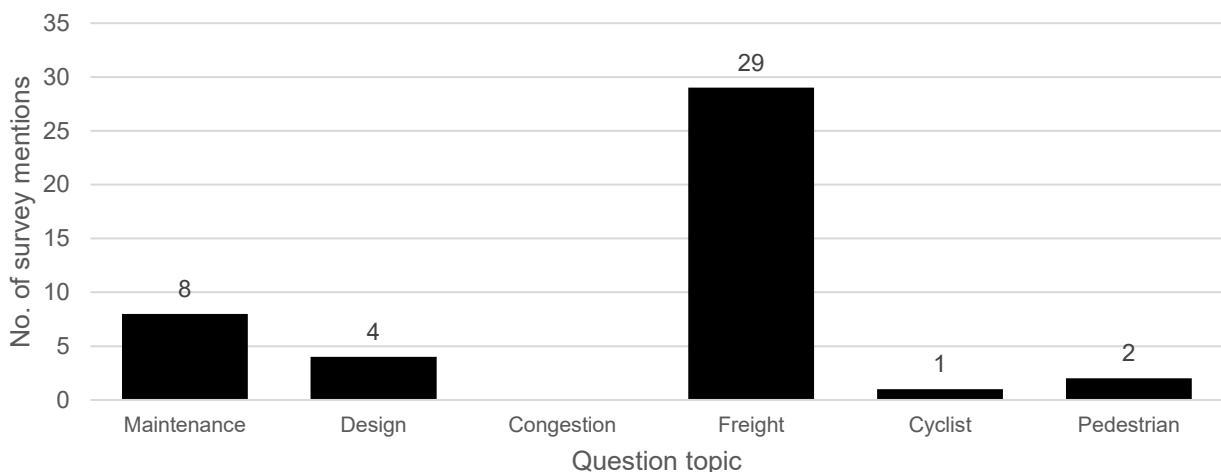


Figure 50: Williams Street – survey mentions by topic

Survey respondents cited several road maintenance concerns, however, the most common response was in relation to the high volumes of heavy vehicles. Concerns were raised about roundabouts along Williams Street that were reportedly too small for most trucks to easily navigate, as well as heavy vehicle drivers that frequently failed to give way to other drivers. The intersection with Iodide Street was the most highly raised individual location along the corridor.

Typical comments received are included below:

“Different road surfaces, poor joins in the cement sections which cause rough undulating surface. the road markings are hard to see.”

“Main road for heavy transport. Speeding trucks. Failure of trucks giving way at roundabouts. Use of truck exhaust brakes 23/7/365. HC Trucks parking in suburban streets next to service stations because there is no truck stop.”

“Poor drainage between oxide street and chloride street, several large bumps from start to end.”

“Williams Street is busy road with many roundabouts. As a bicycle rider this can be scary at times, though I do try to give way to trucks.”

“Roundabouts for the truck driver to get around easy as Williams Street for example roundabouts are small a car can get around the roundabouts but a truck is bigger vehicle & so many roundabouts at. Each intersection corner along Williams Street the truck driver needs more time & space prepared to a car.”

“The heavy vehicles use Williams Street a lot and fail to slow down and stop at the roundabouts. They drive over them causing damage and lucky I know they don’t stop as I always stop for them otherwise they will cause a lot of accidents.”

“No pavement for most of the south side footpath on Williams Street between McCulloch and Iodide Streets.”

In the five years between 2016 and 2020, 15 casualty crashes occurred along Williams Street, with six resulting in serious injury, seven in moderate injury and two in minor injury. Of these 15 crashes, 80% occurred at intersections, however, there were no more than two casualty crashes at a single intersection. The intersections recording two casualty crashes were typically busier intersections including at Oxide Street, Bromide Street and Brookfield Avenue/Galena Street.

Table 17: Casualty crash types occurring on Williams Street (2016-2020)

Crash type	Casualty crashes
Right angle	7
Other angle	3
Vehicle - Object	1
Rollover	1
Rear end	1
Vehicle - Pedestrian	1
Head-on	1



Figure 51: Williams Street casualty crash location map (2016 – 2020)



There are four roundabouts along Williams Street, with the local community seeming particularly concerned about the ability for heavy vehicles to negotiate these. Dimensionally, these roundabouts are quite small – with the central island diameter at four of the five roundabouts between 14 and 15m, including a 2m wide traversable concrete apron. The roundabout at Galena Street is a ‘mini roundabout’ with a 12m diameter including 2m wide traversable concrete apron.

Whilst the central islands of these roundabouts fall below the desirable Austroads dimensions, there are allowances in the design of the Broken Hill roundabouts to accommodate larger heavy vehicle movements, including;

- Tangential roundabout design
- Wide approach and circulating lanes
- Wide traversable apron on the central island

Furthermore, the primary freight route through Broken Hill does not require right turns at these roundabouts. Frequent right turn heavy vehicle movements require significantly larger roundabout diameters to accommodate PBS level 2 and 3 freight combinations.

Whilst potentially not optimal, RAA considers the design of the roundabouts along Williams Street to be functional. Roundabouts offer a safer and often more efficient alternative to signposted or signalised crossroad intersections. Of six roundabout casualty crashes occurring along Williams Street between 2016 and 2020, two involved only a single vehicle, and none involved heavy vehicles.

Should a full heavy vehicle bypass of Broken Hill be constructed, additional opportunities to improve roundabout design would be available. These would include changes to lane width and approach angles (to convert from a tangential design to a radial design) as well as improvements to pedestrian accessibility across approach roads.

Pedestrian infrastructure along Williams Street is present, however, deficiencies are evident along the corridor. Generally, concrete footpaths exist along both sides of the road, except for a missing link on the south side of the road between Iodide Street and Zebina Street. Connectivity between each side of the road is poor at intersections, with some missing ramps and footpaths, and no midblock crossing opportunities other than the pedestrian actuated crossing near Burke Ward Public School.



Figure 52: Poor link to splitter island at the Kaolin Street roundabout



Figure 53: Missing ramp on the north side of Williams Street at the Iodide Street intersection

The kerb-to-kerb width of Williams Street is typically around 14m, however, it is as wide as 25m between Chloride Street and Oxide Street due to the median drainage channel. This typical width provides ample opportunity to provide pedestrian refuge islands or pedestrian actuated crossings



at strategic locations. Zebra crossings are utilised in several busy pedestrian precincts around Broken Hill and may be another consideration to provide a midblock crossing opportunity.

The 2019 Broken Hill Active Transport Plan<sup>12</sup> uses examples along Williams Street to highlight some deficiencies with pedestrian infrastructure within Broken Hill. Due to time constraints, RAA did not undertake a detailed review of pedestrian infrastructure, however, it was evident from our visit that there was significant scope for improvement to pedestrian infrastructure along the corridor, such as at the locations highlighted in the images above.

### Recommendation B4

Improve pedestrian accessibility along and across Williams Street by upgrading missing or deteriorated pedestrian infrastructure and identify several locations to install pedestrian refuges, and/or zebra crossings and/or pedestrian actuated crossings.

### Intersection with Iodide Street

The Williams Street/Iodide Street intersection was the most frequently raised intersection on Williams Street, and the second most frequently raised intersection in Broken Hill. The intersection was mostly raised from a freight perspective, with most people mentioning the intersection doing so when asked about challenging freight locations.

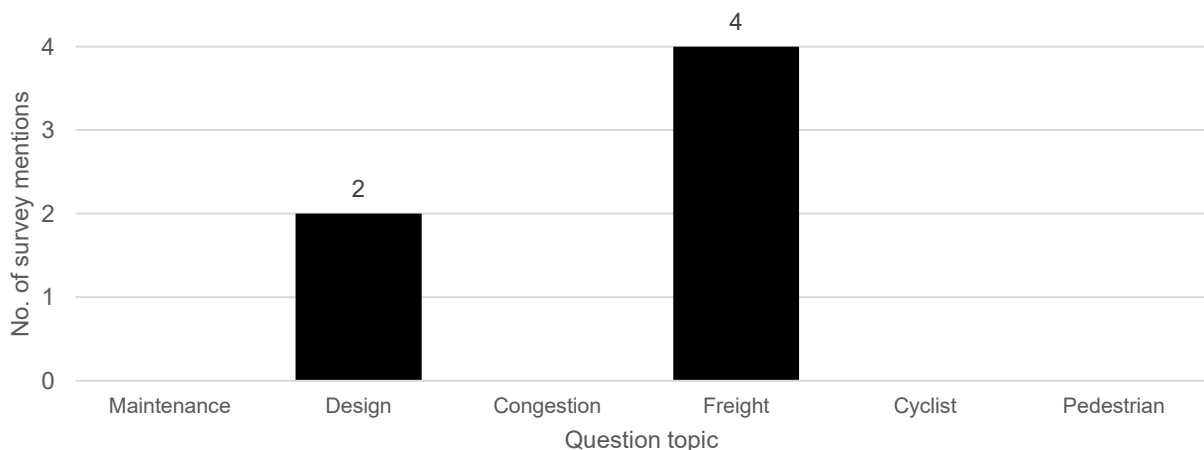


Figure 54: Williams Street/Iodide Street intersection – survey mentions by topic

The speed and movement of heavy vehicles traversing the intersection was raised by most respondents, with sight distance concerns also raised. One respondent suggested that a roundabout would be appropriate.

“Needs a roundabout.”

“Blind corners, too many overhanging trees.”

“Trucks go too fast around that corner.”

“Triple bogies cut corner because the intersection is too narrow.”

<sup>12</sup> Cardno, 2019, *Broken Hill Active Transport Plan*, accessed October 2022 at

<<https://www.brokenhill.nsw.gov.au/files/assets/public/documents/strategies-and-other-documents/broken-hill-active-transport-plan-2019.pdf>>.

Between 2016 and 2020, one right angle casualty crash occurred at the intersection, resulting in moderate injury.

RAA would support the construction of a roundabout at this intersection, however, the current use of the intersection as a major heavy vehicle corridor would preclude this due to the need to retain left and right turns and the level of land acquisition that would be required to accommodate a suitable roundabout.

Reviewing b-triple turn paths utilising Austroads templates indicates that the current intersection design only just allows left and right turns for b-triples. It is also possible that any roundabout design would require left turn slip lanes or a wide central island apron to provide adequate width for left turning b-triples. This would be to ensure that the circulating carriageway is not so wide that drivers of smaller vehicles use it like a dual lane roundabout.

Figure 55 highlights an approximate footprint of a 16m radius (including 5m apron) roundabout island at the intersection including a 6m wide circulating carriageway, but before the addition of footpaths, slip lanes, and required modifications to approach and departure legs.



Figure 55: Potential footprint for a roundabout and circulating carriageway facilitating b-triple movements

Given the dimensional constraints to create a roundabout suitable for heavy vehicles at the site, as well as the high cost and limited casualty crash history, RAA considers the current intersection design to suffice in the short to medium term. However, as discussed earlier in this report, a bypass for heavy vehicles would provide opportunities to upgrade this intersection at lower cost with less impact on surrounding property.



## Crystal Street and South Road

Crystal Street and South Road form part of the Silver City Highway corridor and are a key component of the Broken Hill freight transport network. Other than the short section of Crystal Street between Iodide Street and Medindee Road, both roads are classified as state roads under NSW road network classifications, meaning that maintenance and upgrade funding is primarily a state government responsibility.

Between 2016 and 2020, a combined six casualty crashes occurred along Crystal Street and South Road, each resulting in moderate injury. Three of these crashes occurred at intersections.

Table 18: Casualty crash types occurring on Crystal Street/South Road (2016-2020)

Crash type	Crashes
Rear end	2
Vehicle - Object	2
Other angle	1
Right angle	1

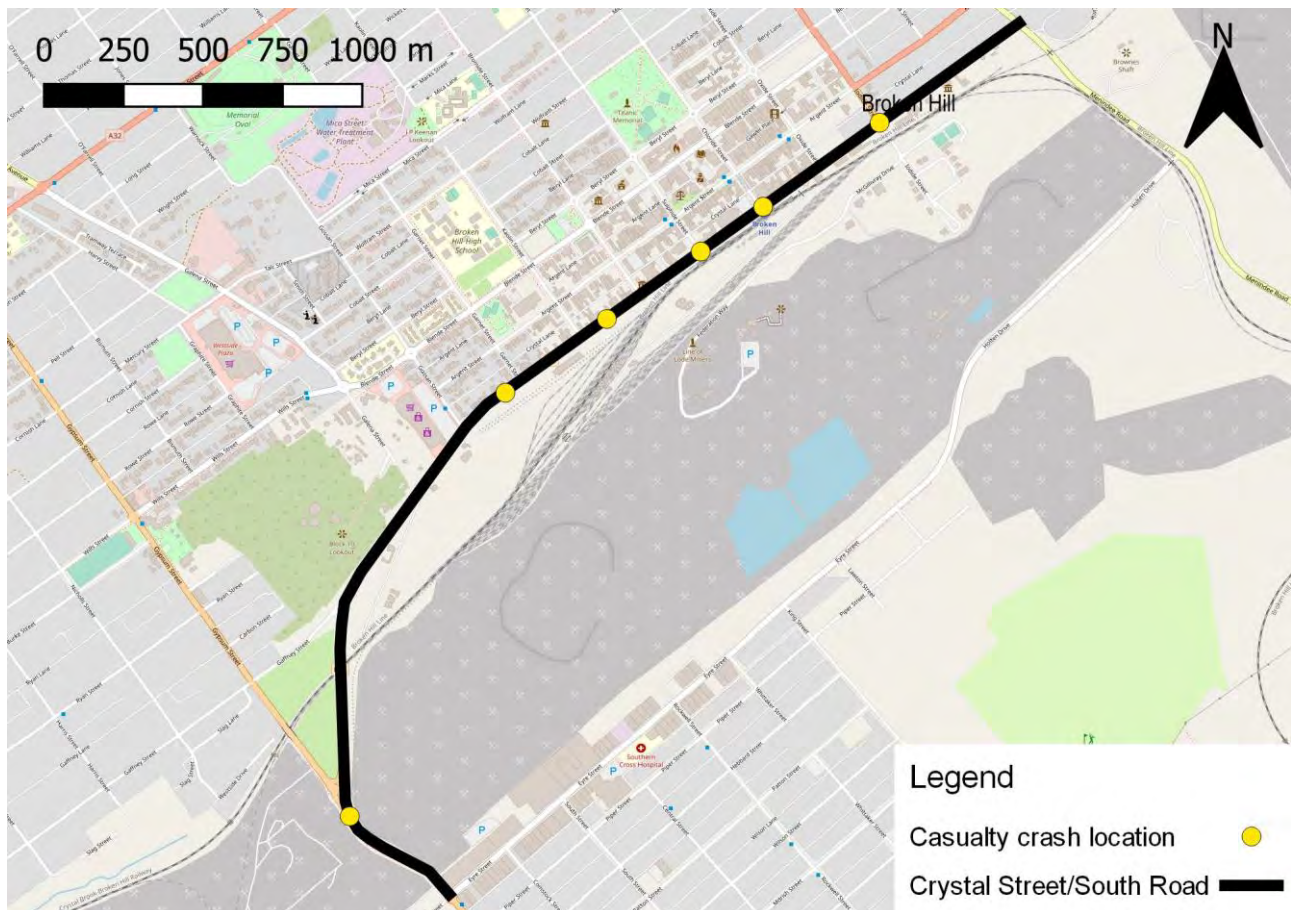


Figure 56: Crystal Street/South Road casualty crash location map (2016 – 2020)

A total of 31 respondents raised issues with Crystal Street or intersections along it, whilst 16 raised South Road or its intersections, combining for 47 mentions of the corridor. The three highest raised intersections along the corridor each received four mentions, and included Crystal Street/Bromide Street, Crystal Street/Gossan Street, and South Road/Gypsum Street.

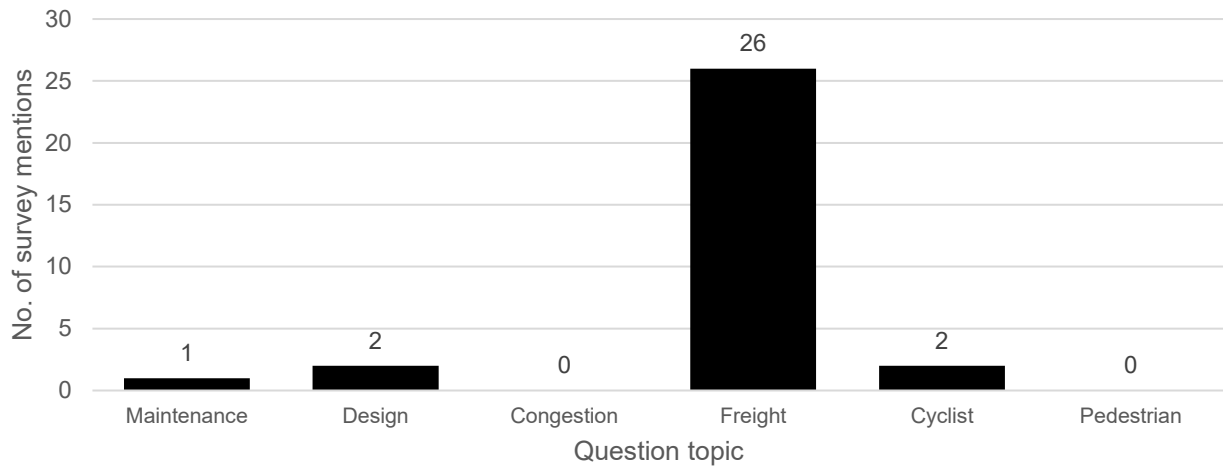


Figure 57: Crystal Street – survey mentions by topic

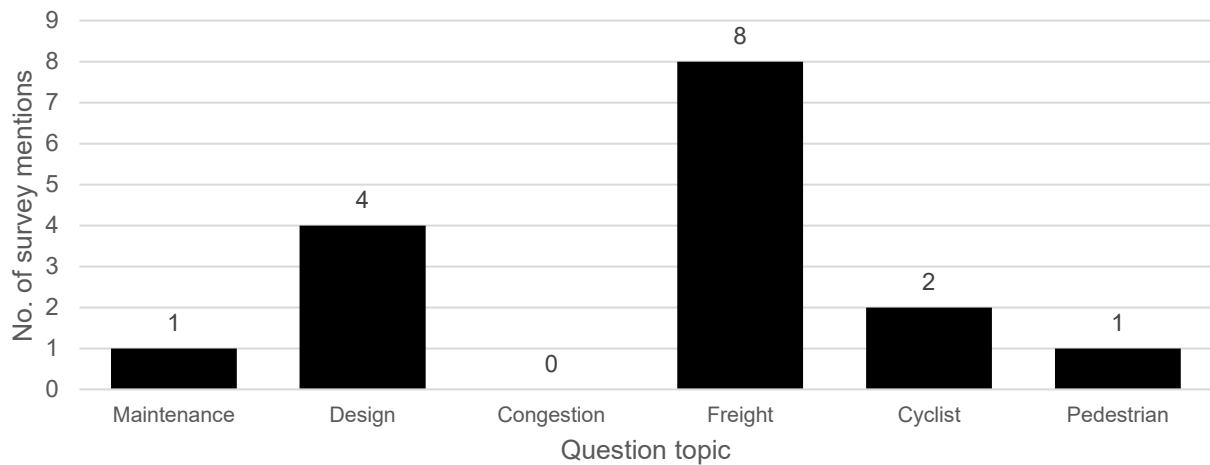


Figure 58: South Road – survey mentions by topic

The corridor was highly raised for the high volume of heavy vehicle traffic, and concerns were raised about the suitability of roundabouts for heavy vehicle movements. Some cycling concerns were also raised, with one respondent suggesting that cycle facilities were not well utilised. The dual lane “overpass” section of South Road was raised by multiple survey respondents for safety concerns.

The comments below are typical of what was received for Crystal Street.

“No signage to advise motorists of presence of cycle lane on length of Crystal Street between Gossan Street and Menindee Road.”

“Mine trucks driving down Crystal Street, then into Iodide Street and then into Argent Street – and then the return journey. These trucks should not be travelling the route they are from one mine to the other. These streets are high traffic areas for the people of The Hill. In Crystal Street there is a Community Health Centre, Medical Centre, a Credit Union and a Club. Children and senior citizens attend these facilities.”

“Too many trucks traveling to and from the mines via the street.”

The comments below are typical of what was received for South Road.

“South Road is sinking 75m from Eyre and Bonanza streets roundabout.”

“Dual lane section over hill is too narrow for 4 lanes. No median strip or barriers between each direction.”

“[Gossan Street intersection] Heavy vehicles at blind hill, congestion.”

“Trucks don't give ways properly as they don't care that they stop traffic on top of the overpass and it is dangerous.”

“Bike riders don't use them [cycle lanes], they need to be made aware that it is illegal.”

Crystal Street has edge lines painted which provide a variable width shoulder for parallel parking. In some areas, parallel parking bays are marked within the wide shoulder, which is likely done to reduce the likelihood of drivers using the space for angle parking. In the southwest direction, past the intersection with Gossan Street, this shoulder becomes a marked bike lane with signage and bicycle markings on the road. However, the cycle lane is not properly marked across intersections, with the edge line delineating the turn into side roads, rather than the continuity of the cycle lane.

Across the overpass, the cycle lane becomes a shared path divided by w-beam barrier, which gradually peters out without providing a safe entry back on to the road at the driveway to the mine site.

There is no cycle provision or shared path in the northeast direction along South Road, making the return trip across the overpass highly dangerous for cycling, especially given the narrow four-lane road, and lane layout through the Gypsum Street intersection.



Figure 59: The southwest bound cycle lane is not marked through intersections.





Figure 60: Cycling in the northeast direction as part of a return trip across the overpass is dangerous

A detailed review of this corridor is required to determine opportunities to improve cycle safety, connectivity and route continuity – especially taking into account the need for most cyclists to make a return trip.

There are also opportunities to extend formalised cycle lanes into Crystal Street to make this corridor safer for cyclists.

### Recommendation B5

Review the Crystal Street/South Road corridor from a cycling and active transport perspective to identify opportunities to improve safety, connectivity, and route continuity – taking into account the need to make a return trip.

Survey respondents were critical of the high freight volumes on this corridor, however, this is the only viable freight route to and from the south of Broken Hill, and unless a full or partial bypass route is implemented, there will be a need for heavy vehicles to continue using the corridor, mixing with other road users.

### Intersection with Gossan Street

The intersection with South Road, Crystal Street and Gossan Street was raised multiple times from a road design perspective in the Broken Hill community survey. The intersection can be busy as it is part of a major freight route, and has a large shopping centre on the corner, variety of shops including a supermarket, department store, pharmacy and food options.

Between 2016 and 2020, no casualty crashes occurred at the intersection.

Poor sight distance was the main issue raised at this intersection, with high traffic volumes and near misses reported. The comments below are typical of what was raised.



“No traffic lights or roundabout. Intersection on crest, limited vision, near shopping centre, heavy vehicle route.”

“Dangerous! Lots of traffic with lots of near misses.”

“Lots of blind intersections in Broken Hill, especially intersection of Gossan and South Road (on a rise, cannot see traffic or large road trains travelling south.”

“Intersection of South Road heading towards the south and Gossan Street requires work. The intersection is extremely dangerous and a high traffic area with numerous near misses.”

From Gossan Street, RAA measured an 80m sight distance to vehicles approaching over the crest, which for a 50km/h speed limit area, means it takes about 5.7 seconds from the point a vehicle can first be observed, to the conflict point where a collision could occur. For a vehicle exceeding the speed limit by 10km/h, this time is reduced to 4.8 seconds.

Australian Standard 1742.2:2022 details the warrants for the installation of a stop sign and specifies that stop signs should only be installed if there is 30m of sight distance or less in a 50km/h zone.

For vehicles entering the road from Gossan Street, the sight distance is slightly higher than the minimum required ‘minimum gap sight distance’ value of 69m specified by Austroads, given a 5 second critical gap acceptance time and a 50km/h 85<sup>th</sup> percentile approach speed.

Austroads also specifies a minimum ‘safe intersection sight distance’ (SISD), that should be provided to vehicles on the through road of vehicles entering the road at an intersection. For a 50km/h design speed and 1.5 second reaction time, and adjusted for grade at this intersection, SISD should be 94m for light vehicles, and 114m for heavy vehicles. These values were not physically checked on-site, however due to the higher position of a heavy vehicle driver, it is possible that this sight distance may be achieved.



Figure 61: Sight distance from Gossan Street along Crystal Street to the northeast is poor

Whilst RAA acknowledges that sight distance should be improved, inexpensive options to achieve this are not available. Reconstructing Crystal Street to remove the crest would resolve the sight distance issue and constructing a roundabout would reduce speeds through the intersection.

### Recommendation B6

Consider an intersection upgrade at Crystal Street/Gossan Street to reduce the impact of poor sight distance due to the crest on Crystal Street.

### Intersection with Iodide Street

The intersection with Crystal Street and Iodide Street was raised multiple times from a freight perspective in the Broken Hill community survey. The intersection is part of the road train freight route through Broken Hill and is part of the Silver City Highway corridor.

Between 2016 and 2020, there was one casualty crash at the intersection, which was a right angle crash involving a light truck and a car and resulted in moderate injuries.

Poor visibility at the intersection, and high volumes of turning heavy vehicles were the issues raised at this intersection, with the responses below typical of what was received.

“Poor vision.”

“To many heavy vehicles turning.”

“Trucks should not be using the main streets of Broken Hill there should be a heavy vehicle bypass.”

The current intersection design, whilst not optimal, has widened aprons to facilitate heavy vehicle turn movements. Further safety upgrades would be challenging to implement in the somewhat constrained environment unless a Broken Hill freight bypass could be implemented to eliminate major freight movements from the intersection.



Figure 62: The Crystal Street/Iodide Street intersection has wide aprons to facilitate heavy vehicle turn movements.



## Iodide Street

Iodide Street is critical for freight movement through and within Broken Hill, and forms part of both the Barrier Highway and Silver City Highway Corridors, serving as the connecting link for movements between the corridors as well as a core component of each. The section of Iodide Street between Williams Street and Crystal Street is classified as a state road under the NSW road network classifications, meaning that maintenance and upgrade funding is primarily a state government responsibility, whilst the remaining parts are classified as a local road under the care and control of Broken Hill City Council.

Between 2016 and 2020, eight casualty crashes occurred on Iodide Street, with seven of these occurring at intersections. One crash resulted in serious injuries, whilst seven resulted in moderate injuries.

Table 19: Casualty crash types occurring on Iodide Street (2016-2020)

Crash type	Crashes
Right angle	6
Other angle	2

Four casualty crashes occurred between Argent Street and Crystal Street (including one at each intersection), while two occurred at the intersection with Beryl Street, one at the intersection with Williams Street, and one at the intersection with Cummins Street.



Figure 63: Iodide Street casualty crash location map (2016 – 2020)

Iodide Street was raised 29 times in the community survey, with intersections being a key focus of nominations, including eight nominations at Argent Street, six at Williams Street and four at Crystal Street. Most survey comments in relation to Iodide Street were due to high heavy vehicle volumes, and difficulties for heavy vehicles navigating intersections. Some maintenance concerns were also highlighted by the community.

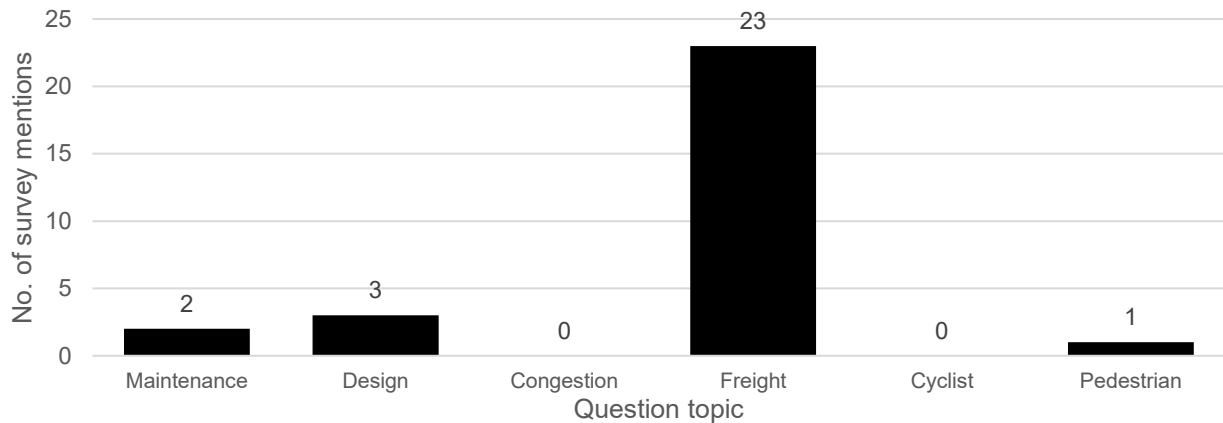


Figure 64: Iodide Street - survey mentions by topic

The comments below are typical of what was received in the community survey in relation to Iodide Street.

“Concrete road uneven and has large lumps in joints along road.”

“Trucks have to go wide to get around into Argent Street.”

“Trucks should not be using the main streets of Broken Hill, there should be a heavy vehicle bypass.”

“[Argent Street intersection] Not enough turning space, heavy vehicles have to stop on incline many run through the give way instead or turn in front of oncoming traffic to avoid braking.”

“Use of exhaust brakes by speeding trucks 24/7/365. No truck stop.”

RAA’s site inspection confirmed heavy vehicle use to be as high as expected, and cracks in the concrete pavement generated noticeable vibrations through the survey vehicle. Many of these cracks were sealed, however some open cracks were visible. Longitudinal cracks (in the direction of travel) and cracks at intersections pose a particular rollover risk for motorcyclists and cyclists, and should be priority for treatment.

### Recommendation B7

Focus on sealing expansion joints and cracks at intersections and transverse expansion joints on Iodide Street and other concrete pavements in Broken Hill.

Whilst concrete pavements have a much longer design life than asphalt pavements, planning for and gradual renewal of Broken Hills concrete pavements is required, as some sections are evidently in poor condition. Whilst initially more expensive, concrete pavements reduce whole of life maintenance costs when compared with traditional asphalt pavements. Should a Broken Hill freight bypass route be eventually implemented, this would substantially reduce or eliminate large heavy vehicle traffic from the city streets, and replacing existing concrete pavements with asphalt may be a consideration.





Figure 65: Sealant at cracks and joints in the concrete pavement



Figure 66: Open transverse expansion joint creating additional risk for motorcyclists and cyclists (Iodide Street/Cobalt Street pictured)

The intersection with Williams Street is discussed in the [Williams Street](#) part of this report, whilst the intersection with Crystal Street is discussed in the [Crystal Street and South Road](#) section.

## Intersection with Argent Street

The intersection with Iodide Street and Argent Street was the most highly raised intersection in Broken Hill, attracting 8 mentions in the community survey, which were all in response to freight concerns in the region.

Between 2016 and 2020, one casualty crash occurred at this intersection, resulting in moderate injuries. This crash was a right-through (right turning vehicle across opposing traffic in the opposite direction) crash involving two passenger vehicles.

Concerns raised at this intersection mostly related to the turn paths of heavy vehicles, and the high volumes of these vehicles. One respondent indicated that recently installed traffic islands were creating issues for heavy vehicles. The responses below are typical of those received in the community survey.

“The intersection of Argent and Iodide is a concern. This is where heavy vehicle's turn off the main road and the road is now in poor condition as damage has been done by these vehicles.”

“Council has erected traffic islands that are impractical and hinder heavy vehicles of all types.”

“Trucks have to go wide to get around into Argent Street.”

“Large vehicles turning into Argent Street poor signage in Argent Street and Iodide Street intersection.”

RAA reviewed the intersection, and observed damage to the pedestrian refuge islands, particularly on the northwestern leg of the intersection (Iodide Street) where this is likely hit by trucks turning right from Argent Street onto Iodide Street.

Figure 67 overlays the Austroads b-triple 15m radius turn template over the intersection, with the b-triple shown to be making a 90-degree right turn from the left shoulder of the road. This template uses an indicative turn speed of 5-15km/h and is the best turn path for this vehicle size. Whilst Austroads templates tend to be generous and are limited to a simple 90-degree turn (not considering more complex turn manoeuvres), it highlights how tight this intersection can be for larger heavy vehicles.

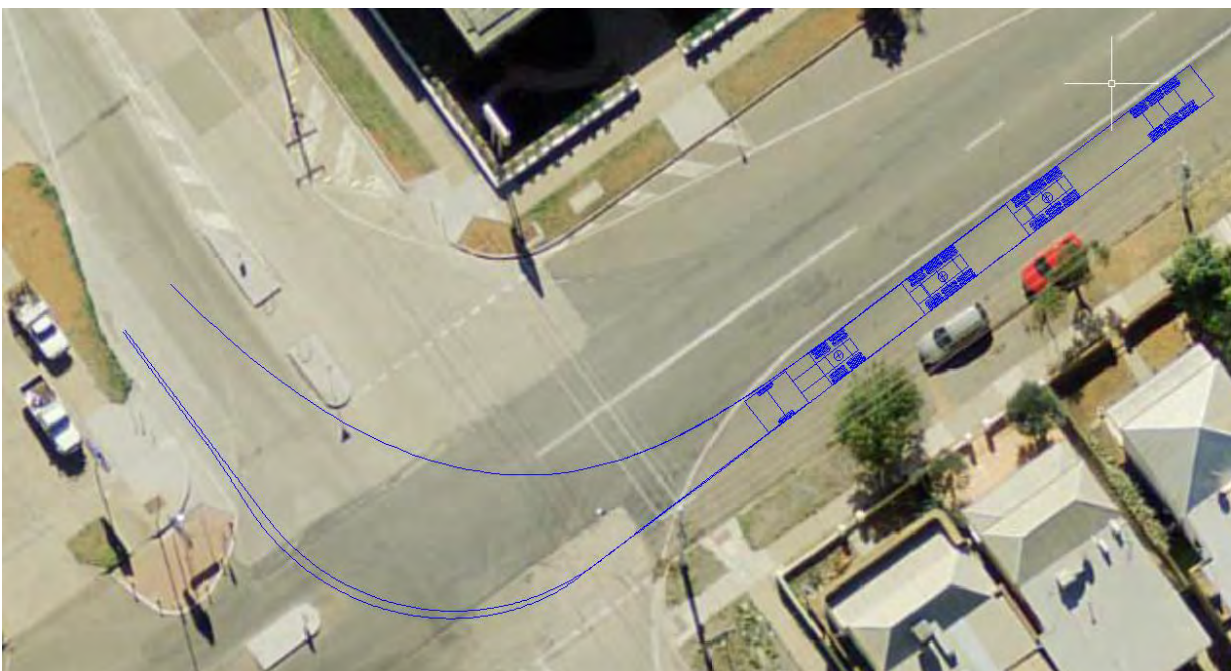


Figure 67: Austroads b-triple turn template showing right turn (from the shoulder) from Argent Street to Iodide Street





Figure 68: Refuge islands at the intersection with Iodide Street and Argent Street have visible damage due to strikes by turning vehicles.

Given the location of this intersection near a busy pedestrian precinct, and the width of the Iodide Street apron, the pedestrian refuge is beneficial in assisting pedestrians to safely cross the road. Further, it deters drivers from crossing the road centreline when turning right. Heavy vehicle collisions with this island are unlikely to result in vehicle damage but do increase the maintenance burden at the site.

Ultimately, a major intersection upgrade is needed to improve vehicle turn paths and reduce conflict, however this would be likely to require significant land acquisition to achieve an appropriate outcome that is sympathetic to the size of some heavy vehicle combinations. In the long term, should a Broken Hill freight bypass be implemented, opportunities would exist to upgrade the intersection without the requirement of major land acquisition.



## Argent Street

Argent Street is a major road in Broken Hill that serves several key functions along its length. On its southwestern end, it functions as a local road in a built-up residential area, whilst centrally it bisects the Broken Hill CBD's busy retail, hospitality, and business precinct, and on the northeastern end, it forms part of the Barrier Highway Corridor from Broken Hill to the east of New South Wales.

Under NSW road network classifications, Argent Street is classified as a local road under the care and control of Broken Hill City Council between Gossan Street and Iodide Street. The section northeast of Iodide Street forms part of the Barrier Highway corridor and is classified as a state road, meaning that maintenance and upgrade funding is primarily a state government responsibility.

Between 2016 and 2020, eight casualty crashes occurred along the length of Argent Street, with seven of these occurring at intersections. Seven of the eight crashes resulted in moderate injury, whilst one resulted in minor/other injury.

Table 20: Casualty crash types occurring on Argent Street (2016-2020)

Crash type	Crashes
Other angle	3
Right angle	2
Rear end	1
Vehicle - Object	1
Rollover	1

Argent Street was raised 29 times in the community survey, with more than two thirds of these nominations relating to intersections along the corridor. Eight nominations were received for the intersection with Iodide Street, and a further eight were received for the intersection with Menindee Road/Bagot Street.

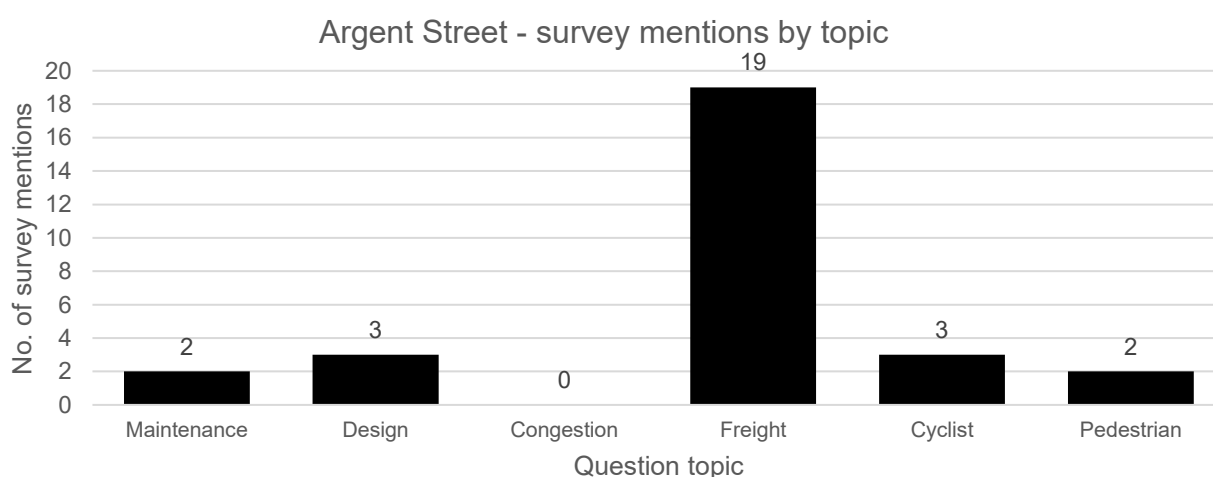


Figure 69: Argent Street – Survey mentions by topic

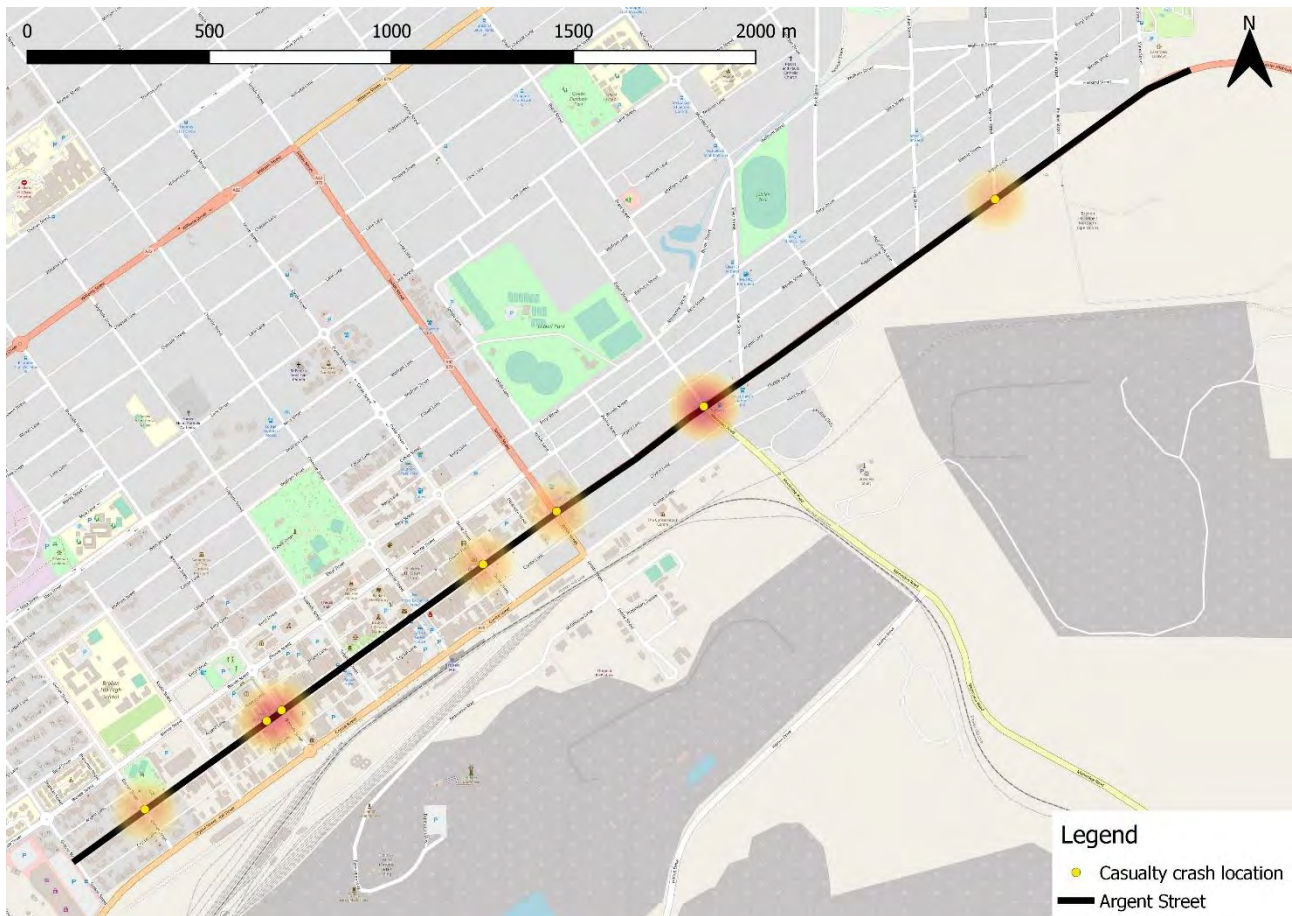


Figure 70: Argent Street casualty crash location map (2016 – 2020)

Argent Street was frequently raised in the community survey due to high volumes of heavy vehicles using the street. Difficulties for large heavy vehicles navigating the intersection with Iodide Street were highly raised. The Menindee Road/Bagot Street intersection was also highly raised for traffic flow issues more than heavy vehicle turning issues, as the dominant heavy vehicle movement through this intersection is straight along Argent Street.

The comments below are typical of what was received in the community survey in relation to Argent Street.

“Excavated holes have never been filled or bitumised properly, if you dig up sections of a street, repair it properly.”

“Used by very heavy vehicles, trucks semi-trailers, caravans.”

“[Menindee Rd/Bagot St intersection] Busy intersection with only a giveaway a lot of accidents occur. A roundabout or red lights might be safer.”

“Phillips, Jabez and Silver streets verge at acute angles onto Argent Street /Sydney/Wilcannia highway. Very hard to see clearly oncoming traffic from the Eastern side (Sydney, Wilcannia)”

“Our main street, main shopping area. Narrow and cyclists forced onto footpath.”

“No pedestrian crossings or pedestrian activated walk lights on the highway section of Argent Street.”

Argent Street has a 50km/h speed limit on the eastern and western ends, with a 40km/h speed limit applied for about 900m through the CBD precinct, between Iodide Street and Bromide Street. This 40km/h zone recognises the much higher level of activity in the area including higher pedestrian volumes and frequent parking/unparking manoeuvres.

Angle parking is provided along most of the corridor, which maximises parking capacity as Argent Street is a wide road. However, parking manoeuvres, especially reversing, create a high level of risk to pedestrians crossing at uncontrolled locations, and cyclists riding along Argent Street. This road environment is similar to adjacent east-west corridors in Beryl Street and Blende Street.

During RAA's site assessments in October 2022, parking appeared to be well utilised, however a parking review in the CBD should be undertaken to determine opportunities to improve safety in this busy precinct.

Ultimately, an east-west cycling corridor should be implemented to better connect residential areas with central Broken Hill, and this could be achieved by converting angle parking to parallel parking and providing a separated cycle lane on Argent Street. This would provide a safer road environment, whilst also providing more opportunities for longer vehicles including caravans and RVs to park near the town centre. Should Argent Street ultimately not be considered appropriate for this treatment, adjacent corridors in Blende Street and Beryl Street should be considered to provide an east-west cycle corridor.

The 2019 Broken Hill Active Transport Plan proposes Blende Street as a component of a future shared path network in Broken Hill. RAA acknowledges recent improvements to the Blende Street footpath to widen and renew the path have made this corridor more pedestrian friendly, however, this footpath environment is not overly conducive of cycling as it passes close to driveways and shop fronts. Therefore, RAA would expect many cyclists to continue utilising the road.

#### **Recommendation B8**

Review parking utilisation in the Broken Hill CBD around Argent Street and consider implementation of an east-west dedicated cycling corridor along Argent Street, Blende Street or Beryl Street.

It was also noted that signage at the zebra crossing on Sulphide Street was poor, with no warning sign in the eastbound direction, and only one warning sign in the westbound direction which could easily be concealed by a parked vehicle. Under Australian Standard *1742.10-2009: Pedestrian control and protection*, R3-1 pedestrian crossing (walking legs) signs are required to be used on both sides of the roadway, facing each approach to the crossing.

#### **Recommendation B9**

Install duplicated R3-1 pedestrian crossing signs prominently on both approaches to the Argent Street/Sulphide Street zebra crossing.





Figure 71: Westbound (top) and eastbound (bottom) approaches to the Sulphide Street zebra crossing

The volume of heavy vehicle traffic on the northeastern end of Argent Street was another concern to Broken Hill residents as this passes built-up residential areas. This is currently the only viable corridor for heavy vehicles to take through Broken Hill, and construction of a freight bypass is considered by RAA to be the most viable option to remove freight movements from residential areas in Broken Hill.

The highly raised intersection with Iodide Street is discussed in the [Iodide Street](#) part of this report.

### Intersection with Menindee Road/Bagot Street

The intersection with Menindee Road and Bagot Street is a four-way crossroad intersection, and was the highest raised intersection in Broken Hill, alongside the Argent Street/Iodide Street intersection. Menindee Road provides a direct link between Broken Hill and Menindee and is a gazetted PBS level 2A (b-double) route, whilst Bagot Street is a local road.

Between 2016 and 2020, two right angle casualty crashes resulting in moderate injury occurred at the intersection. Both crashes involved a northbound through vehicle on Menindee Road failing to give way to an eastbound through vehicle on Argent Street.

The comments below are typical of what was received in the community survey in relation to the intersection, with comments relating to heavy vehicles, signage, and congestion/traffic flow.

“Needs roundabout to slow them [heavy vehicles] down.”

“Insufficient signage for traffic returning from Menindee to give way.”

“Gets to congested and too many accidents happen there.”

“Trucks, buses, people pulling out of the Ampol and cars all at the same time in the morning.”

“Dangerous to cross could do with traffic lights.”

For a driver travelling the 110km (approx. 70mins travel time) distance between Menindee and Broken Hill, this intersection is the first time they are required to stop or slow down to give way to traffic at an intersection.

An assessment of signage along the northbound Menindee Road approach to the intersection indicated that intersection warning signage is minimal, with only a single give way sign installed inconspicuously on the left verge, and green directional signs on approach to the intersection which are not considered warning signs and do not indicate upcoming give way conditions.

It is evident that a second give way sign was installed on the concrete splitter island at some point in the past, however this is likely to have been knocked over by a turning vehicle and is no longer in place.



Figure 72: The give way sign is not prominent when approaching Argent Street along Menindee Road.

RAA recommends that the missing give way sign be replaced and give way signs be enlarged to improve visibility. Further, large R3-2 'give way sign ahead' signs should be installed in advance of the intersection to provide advance warning of the upcoming give way condition as it is the first in more than 100km of travel from Menindee.

#### **Recommendation B10**

Improve signage on the Menindee Road approach to Argent Street (Barrier Highway) by replacing missing median give way sign, enlarging give way signs, and installing R3-2 'give way sign ahead' advance warning signs.

In the longer term, signalisation of the intersection or construction of a roundabout would deliver safer treatments for all road users. The ultimate design of such an upgrade would be dependent on whether a freight bypass of Broken Hill was to be implemented, and what size vehicles would still be required to use the intersection.

#### **Recommendation B11**

In the longer term, consider intersection signalisation or construction of a roundabout at the intersection with Menindee Road and Argent Street.



Figure 73: Concrete islands delineate the intersection and are in poor condition due to apparent vehicle strikes



## Silverton Road

Silverton Road extends about 20km between Broken Hill and Silverton and is classified as a regional road under the NSW road hierarchy. As the road is largely within an unincorporated area, Transport for NSW is responsible for upgrade and maintenance funding of the road.

Silverton has a low population, with the 2021 Census indicating there are 48 residents. However, Silverton is highly popular from a tourism perspective, as a location used in the filming of multiple movies, and for its outback scenery. The Mad Max Museum and Mundi Mundi Lookout are popular destinations, whilst the annual Mundi Mundi Bash has proven a highly popular, sold-out music festival in recent years, drawing thousands of people, especially campers and caravanners, to the immediate vicinity over a three-day festival.

Between 2016 and 2020, three casualty crashes occurred on Silverton Road between Broken Hill and Silverton, with two resulting in moderate injury and one resulting in minor/other injury. These three crashes were all single vehicle crashes, with two involving light trucks running off the road (one rollover, one hit object) and one involving a collision between a motorcycle and an animal.

The road was raised by ten survey respondents to the community survey, with the primary issue raised in relation to maintenance of Silverton Road.

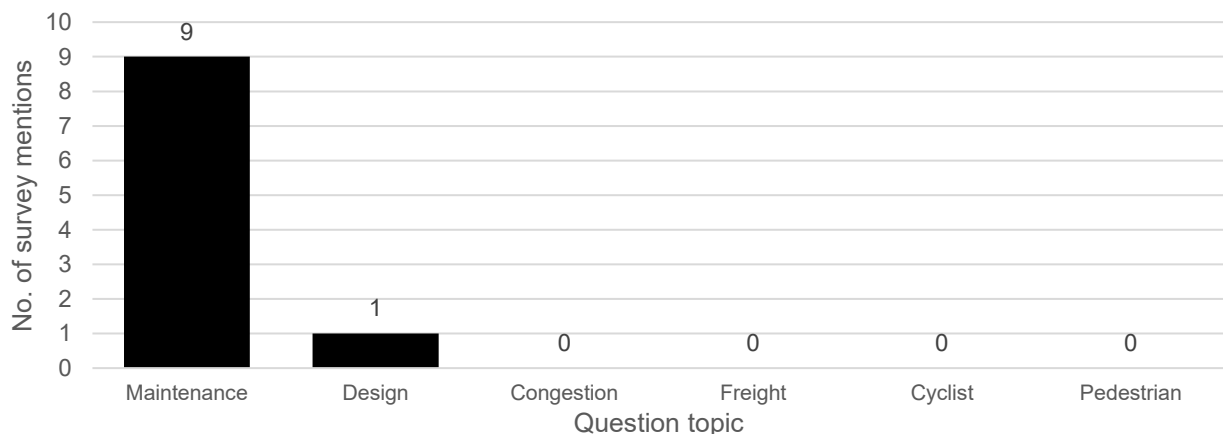


Figure 74: Silverton Road – survey mentions by topic

The verbatim comments below are typical of the responses received in relation to Silverton Road.

“Unsafe not to any modern day standards. Embarrassment to local tourism. High risk to vehicle damage & personal injury due to rough, bumpy surface. Attempted repairs could be perceived as gross misuse of public monies.

“Has been widened but not resealed resulting in pot holes. Huge tourist traffic on this road, 20,000 extra people this year alone with 2 Mundi Mundi Bashes.”

“The road to Silverton is rough and could be widened at shoulders. More incoming traffic can cause smashed windscreen or overtaken traffic because the other driver moving off the road can cause panic.”

“Poor drainage, dangerous dips, pot holes, unsafe.”

“Broken Hill to Silverton Road. Many dangerous dips, blind bends and hills on the road. Speed limit is posted as 90km/h. This is insane! I, as a local, never travel more than 60km/h. Don’t believe me? You come out and try doing 90km/h on this road. Impossible! Tourists have no idea how dangerous it is. I have witnessed hundreds of near head on collisions by impatient drivers.”

RAA reviewed the corridor between Broken Hill and the Silverton township and identified that maintenance was a key concern along the corridor. RAA acknowledges recent improvements to widen the road and seal shoulders, however, it appears that shoulder crossfall is not adequate to properly drain water away from the road, with water observed ponding at the join between the newly sealed shoulder and the old pavement, which will lead to the formation of potholes and early failure of the pavement.



Figure 75: Water ponding on the shoulders and in the join between newly sealed shoulders and the old pavement

While these widening works have made a safety improvement to Silverton Road, ultimately a full reseal and potentially localised pavement reconstruction is required to ensure the surface is safe for all road users, especially given the high percentage of tourist traffic likely to be unfamiliar with the road conditions.

Silverton Road is also not very resilient during rainfall events, with multiple floodways present across the road which deposit silt and debris onto the road when water stops flowing. The addition of culverts under the road, in conjunction with locally building up the height of the road will improve corridor resilience in smaller rainfall events. The existing Black Hill Creek Crossing is likely to require a more substantial improvement, or even construction of a bridge in the longer term to prevent inundation of the road.

### **Recommendation B12**

Reseal Silverton Road between Broken Hill and Silverton, considering localised pavement reconstruction and improvements to drainage including the addition of culverts and potentially a bridge over Black Hill Creek.



Whilst flood depth indicators are present at both Silverton Creek and Black Hill Creek crossings, there are no flood depth indicators at other floodways. To provide indication to road users of water depth, and to conform with the requirements of Australian Standard 1742.2:2022, G9-22 flood depth indicators are required at all floodways on Silverton Road, as well as a G9-21-1 'ROAD SUBJECT TO FLOODING, INDICATORS SHOW DEPTH' sign prior to the first floodway.

### **Recommendation B13**

In the short term, install G9-22 flood depth indicators at all floodways on Silverton Road, and a G9-21 'ROAD SUBJECT TO FLOODING, INDICATORS SHOW DEPTH' sign prior to the first floodway.



Figure 76: The current Black Hill Creek crossing





Figure 77: Mud and silt in a floodway over the road after relatively minor rainfall



The AusRAP star rating of Silverton Road is typically quite good. This is generally due to the relatively straight alignment, good geometry, lower than default speed limit of 90km/h, and the limited frequency of fixed roadside hazards – especially trees.

Table 21: Star rating examples on Silverton Road

Site coordinates: -31.89962, 141.30263 (heading south)	Star rating	Comments
The example below highlights a straight cross-section of Silverton Road, where trees are more than 10m away from the road edges and there are no other fixed hazards on the roadside. A cross-section like this would typically rate a high three stars at 100km/h or 110km/h, however, due to the 90km/h speed limit, achieves a low four star safety rating.		
	★★★★★☆ (4.62)	<p><u>Positives</u></p> <ul style="list-style-type: none"> <li>• Straight, flat section of road</li> <li>• Medium lane width</li> <li>• Medium sealed shoulder width</li> <li>• Low traffic volume</li> <li>• No intersections/property access points</li> </ul> <p><u>Negatives</u></p> <ul style="list-style-type: none"> <li>• Poor pavement condition</li> <li>• Trees &gt;10m away from edges</li> <li>• 90km/h speed limit</li> </ul>
Site coordinates: -31.93693, 141.41054 (heading south)	Star rating	Comments
The next example highlights a moderately curved section of Silverton Road with no significant fixed hazards on the roadside. This example section is rated three stars, mostly owing to the 90km/h speed limit. At 100km/h or 110km/h the star rating would likely be two stars, or a very low three stars due to the absence of roadside hazards.		
	★★★★★☆ (8.12)	<p><u>Positives</u></p> <ul style="list-style-type: none"> <li>• No significant roadside hazards</li> <li>• Medium lane width</li> <li>• Medium sealed shoulder width</li> <li>• Low traffic volume</li> <li>• No intersections/property access points</li> </ul> <p><u>Negatives</u></p> <ul style="list-style-type: none"> <li>• Poor pavement condition</li> <li>• Moderate curvature</li> <li>• 90km/h speed limit</li> </ul>