RAA Highway Assessment

Riddoch Highway

June 2013

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Date 17 June 2013

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Date 01 May 2014

Revision History

Rev	Date	Author	Approver	Comment
0	17/06/13	IB, RB, MJ	CM	Draft
A	01/05/14	IB, RB, MJ	CM	For Issue.

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Executive Summary

The Riddoch Highway is located in South Australia's southeast, connecting Mt. Gambier with the Dukes Highway, and other regions of the state. It is 210 km in length and is predominately in a north-south direction, passing through the towns of Naracoorte and Penola. The Riddoch Highway attracts large volumes of tourist traffic since it is one of the major routes between South Australia and Victoria. It also carries large volumes of commercial traffic as it also functions as a key freight route for the southeast.

The Riddoch Highway has been analysed by RAA through a highway assessment in 2012. These results are following on the previous documents produced by RAA including Towards 2020 (2009) and Backwater to Benchmark (2005) which gave ratings and recommendations to improve the safety and performance of the highway.

The RAA's highway assessment found that the Riddoch Highway has satisfactory lane widths at 3.5m and there were no concerns identified over narrow lane widths. Following Towards 2020, seven overtaking lanes have been provided along Riddoch Highway however these have all been constructed along the southern half and there continues to be lack of overtaking opportunities in the north.

Audio Tactile Line Marking (ATLM) are a good addition to the highway. These create sound and vibration when a vehicle wheel passes over the line, alerting the driver that they are drifting from the traffic lane. The provision of ATLM has however been limited to within approximately the first 29km after Keith and the last 48km prior to Mount Gambier. While the introduction of this safety feature is welcome, the RAA wish to see ATLM being used for the entire length of the highway.

The Riddoch Highway was found to have a very smooth ride quality for most of its length. There were exceptions to the south of Willalooka where the ride quality was found to be below average with a number of undulations that reduced the smoothness of the ride. Rutting was found to be acceptable (between 5mm and 10mm depth) for most of the highway. In the northern half, a number of sections were above average with a rut depth of less and 5mm however the southern half had a number of sections that were below average with a rut depth between 10mm to 15mm. The pavement survey found that the surface is well textured throughout most of the highway however a few isolated sections had a smooth texture.

Roadside hazards were identified as a risk to motorists in towards 2020 and the 2012 assessment found that these continued to present a major risk. There has not been significant provision of barrier protection for these hazards however it is encouraging to note that some protection has been provided, mainly on the southern half of the highway between Naracoorte and Mt Gambier.

The highway assessment found ten rest areas on the Riddoch Highway with an average of 21km between each, which is considered satisfactory when the additional rest areas provided by the townships are considered. While the RAA welcome the number of available rest areas, it was noted that many areas only consist of a layby and bin. Provision of at least one sheltered seating area would improve the benefits and encourage more drivers to use these areas.

The RAA has analysed the highway assessment for the Riddoch Highway and submit the following recommendations.

- **Installation of roadside barriers**
- **Provision of audio tactile edge lines for its entirety**
- **Pavement rehabilitation**
- **Shoulder sealing to a minimum of 1.5m**
- **Additional overtaking areas in the north**
- **Improve rest areas to include shaded seating areas**

1 Traffic Volumes

The Riddoch Highway is located in South Australia's southeast, connecting Mt. Gambier with the Dukes Highway, and other regions of the state. It is 210 km in length and is predominately in a north-south direction, passing through the towns of Naracoorte and Penola. The Riddoch Highway attracts large volumes of tourist traffic since it is one of the major routes between South Australia and Victoria. It also carries large volumes of commercial traffic as it also functions as a key freight route for the southeast.

At the time of *Towards 2020,* the Riddoch Highway carried between 1,100 to 4,200 vehicles per day, with 21% of this being commercial vehicles. Traffic volumes in 2013 are similar with between 1,400 and 4,100 vehicles using the Riddoch Highway daily. The section of road between Penola and Mount Gambier continues to be the busiest, with 2,400 to 4,200 vehicles per day. Commercial vehicles currently make up approximately 16% of the total traffic volume for the entirety of the Riddoch Highway, which is less than in 2009 (21%).

Traffic volumes are an important consideration for the Riddoch Highway as it carries similar traffic volumes to that of the Dukes Highway including traffic composition. Despite this, *Towards 2020* identified that the Riddoch Highway has significantly lower safety standards. The crash data for 2006 to 2012 is also similar between the Dukes and Riddoch Highways. The Riddoch Highway had a total of 92 casualty crashes for that five-year period, including 4 fatal crashes and the Dukes Highway had a total of 98 casualty crashes, including 15 fatal crashes. This reflects the similarity of risks faced by motorists on both corridors, and as such the countermeasure treatment should be consistently applied between both highways.

Crashes for both the Riddoch and Dukes Highway were predominately due to hitting fixed objects after leaving the roadway. This highlights the need for roadside protection and other measures to prevent motorists from leaving the driving lane, such as barriers and Audio Tactile Line Marking (ATLM). Other frequent crash types include roll-overs, rear end, and head on collisions. Crashes involving animal strikes are three times more frequent on the Riddoch Highway than on the Dukes Highway.

2 Crash Statistics

The following image illustrates the number crashes by section along the Riddoch Highway for the five year period of 2008 to 2012.

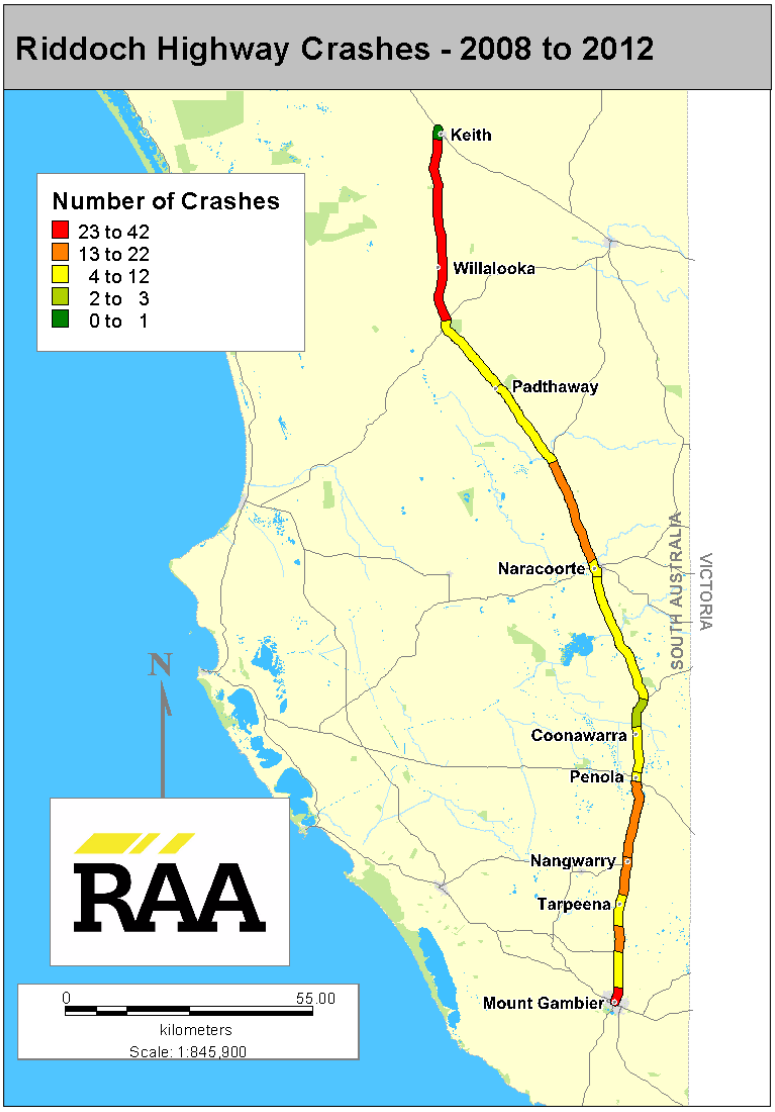

Figure 1 – Crashes Along Riddoch Highway, 2008-2012

Crash totals tend to vary along different sections of the Riddoch Highway, but the highest frequency of crashes occur between Keith and Willalooka, Keppoch to Naracoorte, Penola to Nangwarry and on the approach to Mount Gambier.

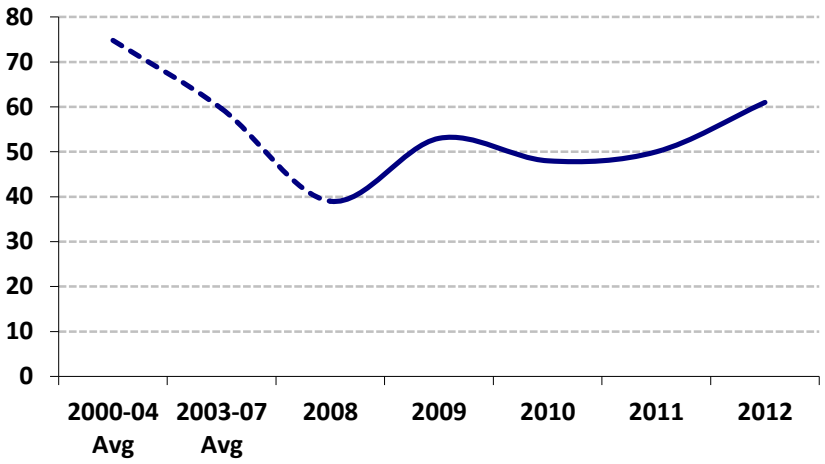

Figure 2 – Crashes On Riddoch Highway, 2008-2012

Between 2008 and 2012 there has been an average of 50 crashes per year along the Riddoch Highway. As the chart above shows, the number of crashes reduced between 2000 and 2007, then remained reasonably constant between 2009 and 2011 but has since started to increase. During 2012, there were 61 crashes along the Riddoch Highway.

In terms of severity, the majority of crashes along the Riddoch Highway tend to involve property damage only. During the five year monitoring period there have been 159 property damage only crashes, 60 minor injury crashes, 28 serious injury crashes and 4 fatal crashes. Two of these fatal crashes on the Riddoch Highway occurred in 2011 and one fatality in 2012.

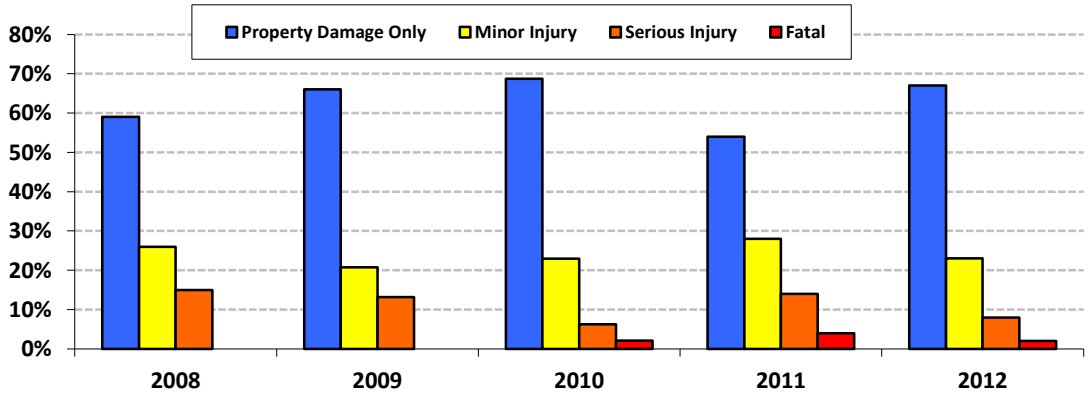

Figure 3 – Crashes By Severity, 2008-2012

Crash Severity	Cost per Crash[1]	Number of crashes	Total Cost (2011 Values)
Property Damage Only	$11,743	159	$1,867,137
Minor Injury	$17,309	60	$1,038,540
Serious Injury	$340,000	28	$9,520,000
Fatal	$7,200,000	4	$28,800,000

Table 1 - Cost Of Crashes On Riddoch Highway (2012 Values), 2008-2012

Crashes along the Riddoch Highway between 2008 and 2012 cost $41,225,677. This figure includes losses to workplace and households as well as a number of medical, insurance, legal and repair costs. The above table breaks down the cost of crashes by severity for the past five years and highlights that each fatality costs just over $7m, which is 21 times higher than the cost of a serious injury. Therefore any change in the number of fatalities would have a significant impact on the overall cost for a particular road or area.

3 Highway Geometry

3.1 Lane Widths

It was recommended in *Towards 2020* that for a key freight route of this kind there should be lane widths of at least 3.5 metres, with sealed shoulders of 1.5 metres for the entirety of the Riddoch Highway. The 2012 highway assessment has shown that driving lane widths are satisfactory for most of the Riddoch Highway, at around 3.5 metres wide. It was encouraging to note that there were no sections recorded that had a particularly narrow lane width.

There were however many sections of the highway with unsatisfactory shoulder seal widths, not meeting the 1.5 metre recommended minimum. The shoulder seal varied along the length of the highway of between 0.1m to 1m. It is however encouraging to note that the entire length of the highway benefits from edge of carriageway markings, providing some degree of shoulder seal. In comparison to some other key freight routes in South Australia, which do not have edge lines for the entirety of their length, this is a positive step.

3.2 Overtaking Lanes

Towards 2020 highlighted the lack of regularly spaced overtaking lanes as a major issue which should be considered to improve safety and efficiency. As a short term recommendation, the RAA asked for eight additional overtaking lanes to be constructed. It is evident that as of 2012 there are seven overtaking lanes on the Riddoch Highway, all between Naracoorte and Mt. Gambier. These are frequent and spaced evenly along

[1] Property damage only and minor injury costs derived from 'Cost of Crashes in Australia 2006', BITRE Research Report 118; Figures amended to reflect 2012 values. Serious jury and fatal costs derived from AusRAP 2013 'Star Rating Australia's National Roads'. Note that the costs displayed are for each crash type and not for each casualty.

the Southern 52 km of the highway, including two new overtaking lanes constructed near Nangwarry.

The Southern section of the Riddoch Highway between Penola and Mt. Gambier is the busiest section in terms of traffic volume. Despite this, the provision of overtaking lanes along the entire length of the highway is inconsistent as there remain no overtaking lanes in the northern half. It is therefore recommended that further overtaking lanes are provided in the north.

Construction bypasses around major towns is another key improvement which would provide safety and efficiency benefits. A bypass of Mount Gambier to directly connect to the Princess Highway has been constructed, and plans to bypass Penola have been discussed, but as of 2012/13, were still in the early planning stages.

3.3 Audio Tactile Line Markings

A good addition to the safety features on the Riddoch Highway is the use of Audio Tactile Line Marking (ATLM). ATLM is a series of raised bars positioned on the edge lines of the highway, 50mm wide, 150mm long and at 200mm spacing along the edge line. Currently, the Department of Planning, Transport, and Infrastructure use *Thermoplastic Rib Profile ATLM* on South Australian highways, and it is their policy to install ATLM on key arterial roads which have a high frequency of crashes due to driver fatigue (DPTI 2009).

ATLM reduce crashes resulting from driver fatigue by alerting the driver when they begin to drift out of the driving lane. When a wheel passes over the ATLM noise and vibration is created, alerting the driver to move back into the driving lane. ATLM also helps to highlight delineation in wet or low visibility situations, such as heavy rain or fog.

ATLM is used discontinuously for the first 29 km of the Riddoch Highway after Keith and for the last 48 km prior to Mount Gambier. Providing ATLM for the entire length of the highway would be a great safety improvement and would assist in reducing crashes resulting from driver fatigue. It is shown to be an effective countermeasure with a high benefit to cost ratio (DPTI 2009).

ATLM is most effective when used in conjunction with an adequate sealed shoulder, so that when a driver is alerted by sound and vibration, they have sufficient time and space provided by the shoulder seal to correct their position back into the driving lane. The installation of ATLM should therefore coincide with any plans to increase sealed shoulders to the minimum of 1.5 metres, as recommended by RAA in *Towards 2020*.

4 Pavement Performance

The only pavement defect identified by RAA in Towards 2020 is rutting, and was a main issue of concern. Rutting is dangerous as can trap water in the channels which can cause aquaplaning and result in a loss of control of the vehicle. Severe cases of rutting can also act as “guide rails” for the tyres, affecting steering performance and the tracking of trailers.

The 2012 highway assessment conducted by RAA did not identify severe cases of rutting on the highway. Nevertheless there were noticeable instances of undulations, mainly on the Keith to Naracoorte stretch of the Riddoch Highway. There were also a few isolated cases of patching, and two instances of pavement failure which, over a 210km stretch is reasonably good. The surface texture was also noted to be very good with only one section recorded as having aggregate loss near maintenance marker 18.

Improvements to the surface quality of the Riddoch Highway could be achieved through routine maintenance.

4.1 Ride Quality

Pavement surveys can measure the roughness, or ride quality of a pavement and express the results as an International Roughness Index (IRI). The lower the IRI value, the smoother and more comfortable the ride experience is for motorists.

A pavement survey of Riddoch Highway (Figure 4) shows that the ride quality is acceptable (IRI between 2.69 to 3.45) between Keith and Willalooka. South of Willalooka, the ride quality is generally below average (IRI 3.46 to 5.33) and drivers are likely to experience many undulations with some level of discomfort. From Padthaway to Mount Gambier, the pavement survey shows that the ride quality is very good (IRI less than 1.94) and is at a level that is comparative to a newly constructed road. While overall the ride quality on Riddoch Highway is very good, further work is required as part of the ongoing maintenance program, to improve the ride quality at the poorer sections identified above.

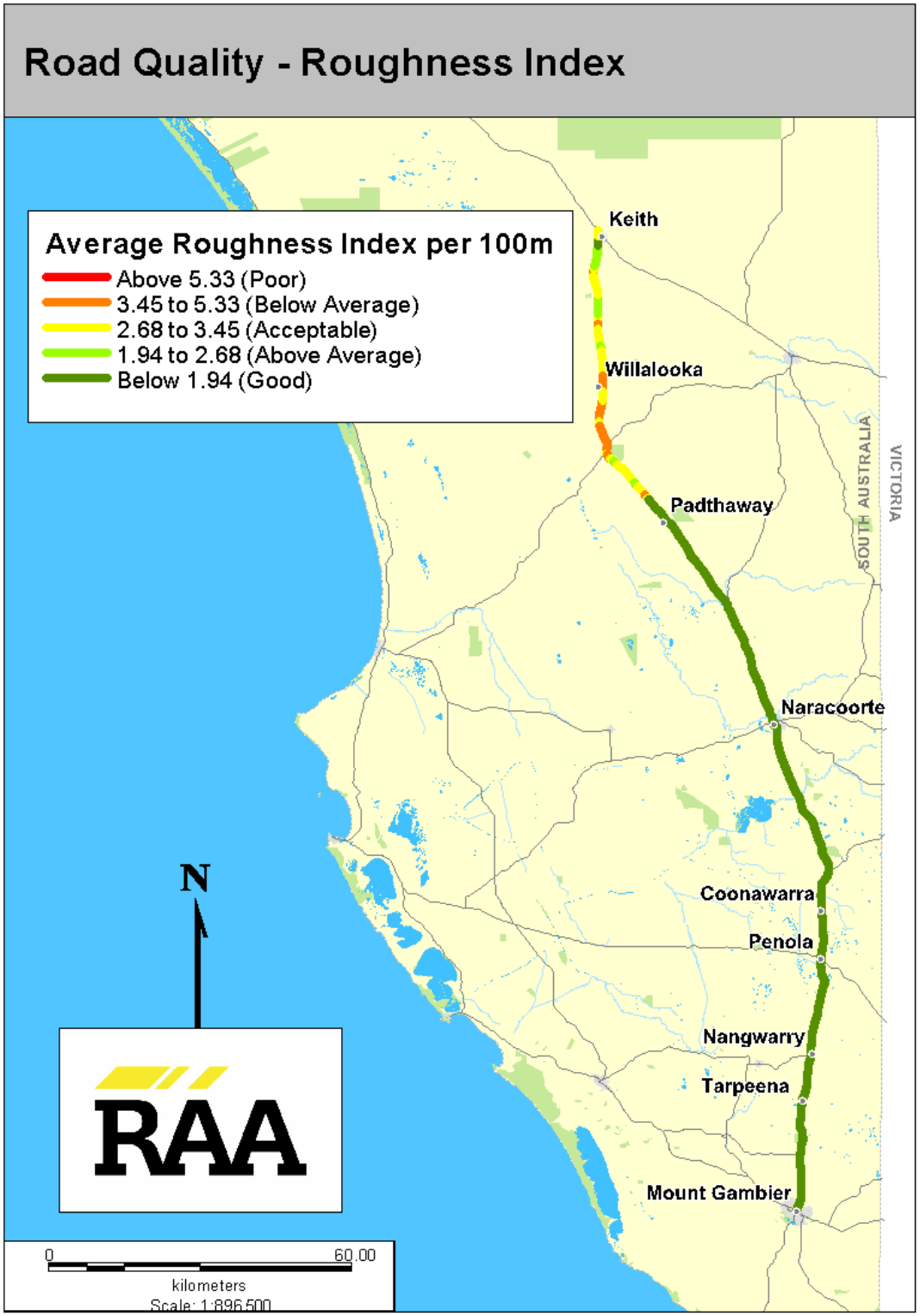

Figure 4 - Ride Quality Map for Riddoch Highway

4.2 Rutting

For the majority of the route, pavement rutting is less than 10mm which is acceptable. There are a few exceptions highlighted in the top section of the highway in Figure 5. The most notable instances of rutting defects appear to be concentrated between Penola and just south of Tarpeena, where several sections of the route show rut depths of between 10mm to 15mm which is below average. These sections attract a higher risk of aquaplaning and the potential to reduce steering performance. In September 2012, DPTI filled ruts along a 2km section in this area but while this is a step forward, significant pavement rehabilitation is still required to reduce rutting in this region of Riddoch Highway.

4.3 Texture

The pavement survey results for texture depth measurements are shown in Figure 6. With the exception of some areas, the texture is between 1.1mm and 1.89mm for most of the route representing a well textured surface. Areas of concern are the minor sections immediately south of Keith and just north of Willalooka, as well as various sections around Naracoorte. The texture at these locations was found to be smooth with depths ranging between 0.7mm and 1mm. This results in a high risk of vehicles leaving the road and drivers may experience poor breaking action due to insufficient friction between the tyre and pavement surface. The texture does not allow for adequate drainage of water, increasing the risk of aquaplaning. Remedial works to provide better surface texture at the locations identified should be undertaken as a matter of urgency.

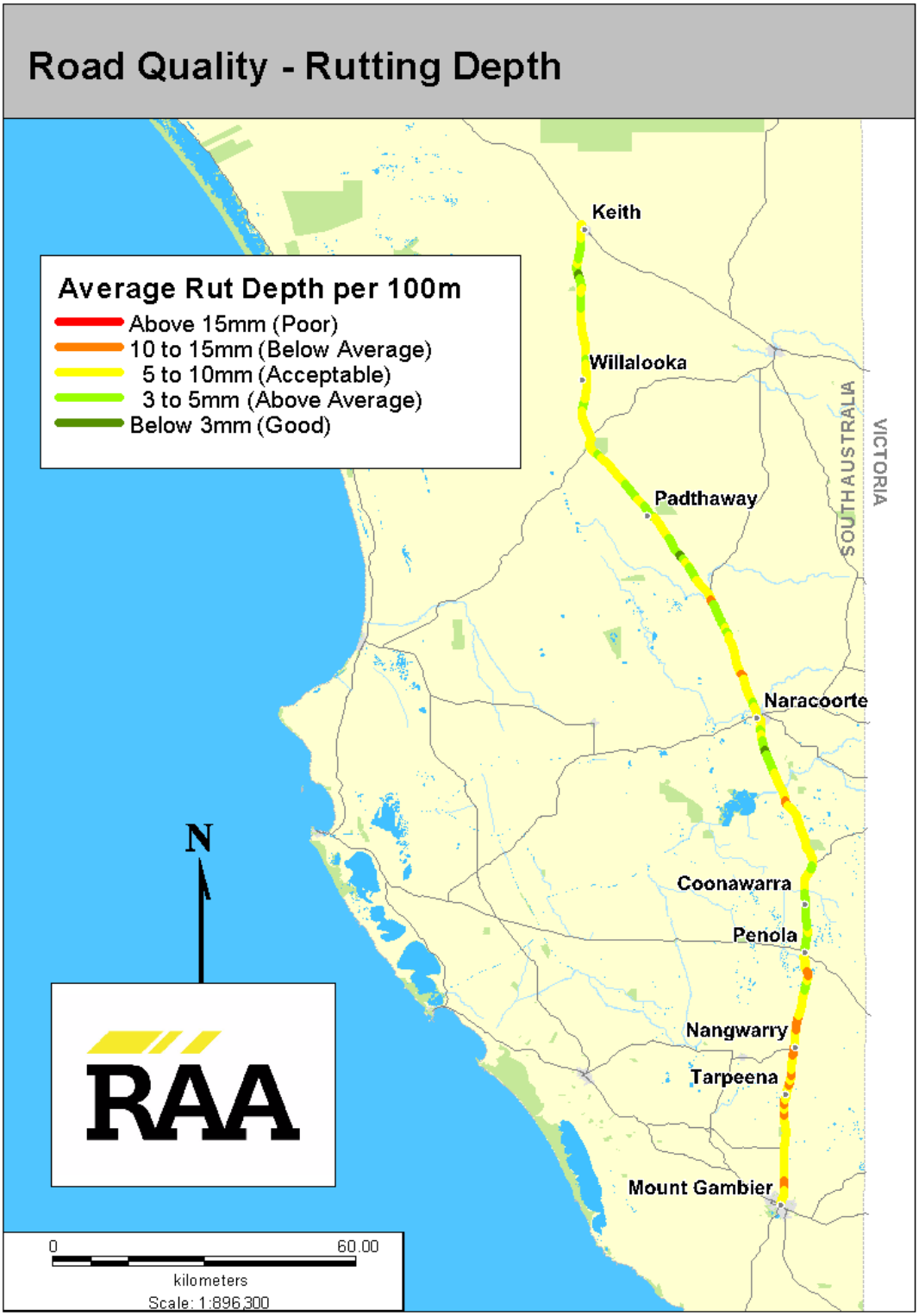

Figure 5 – Rutting Map for Riddoch Highway

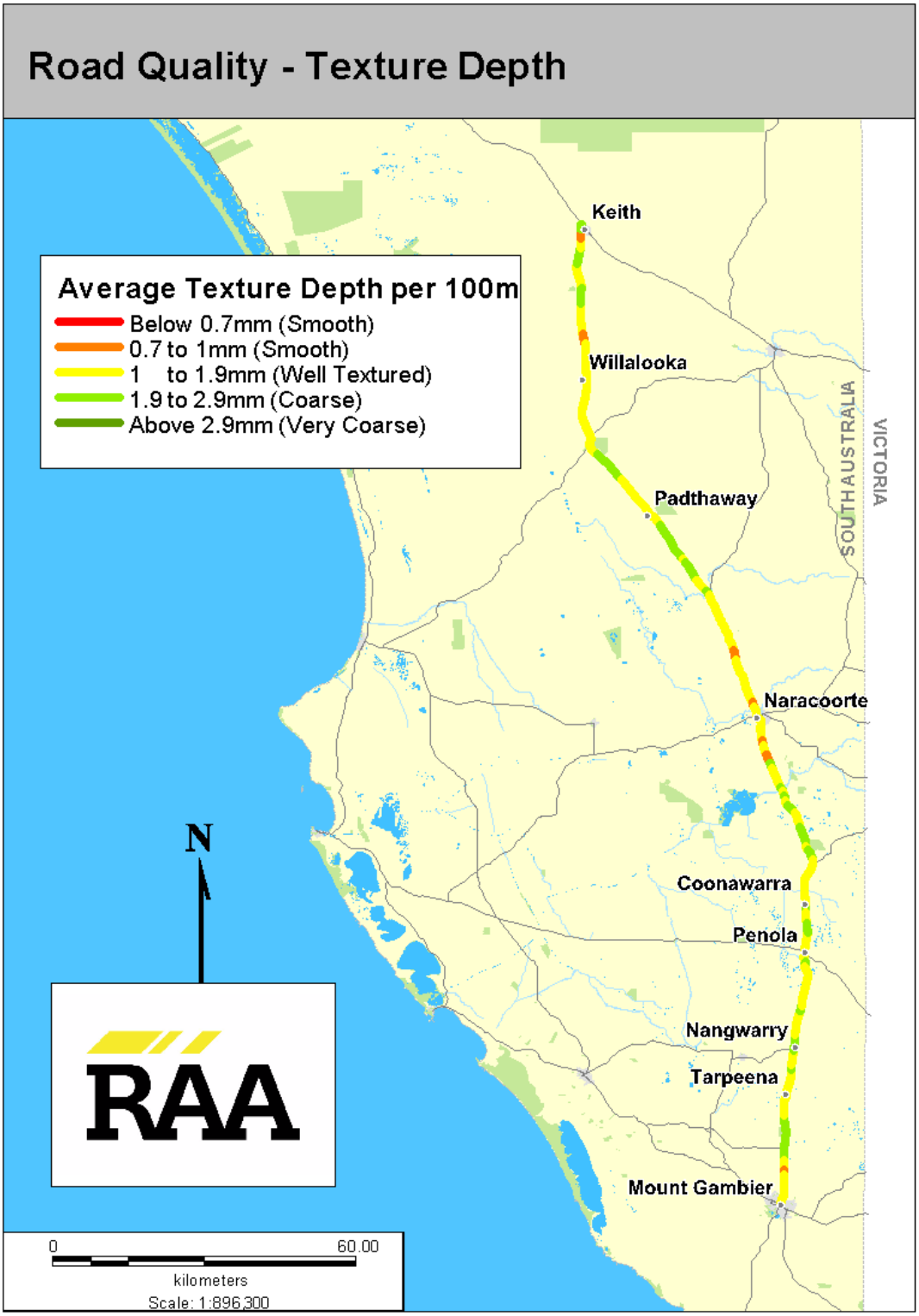

Figure 6 – Texture Map for Riddoch Highway

5 Roadside Hazards

Roadside hazards are a significant danger to motorists who run off the road and can potentially turn a minor incident into a serious injury or a fatality. In Towards 2020 RAA requested roadside barriers for all hazards which are less than 10 metres from the road edge. The 2012 highway assessment showed that roadside hazards continue to be an issue for the Riddoch Highway. Generally, vegetation runs along the side of the majority of the highway, posing a threat to vehicles that run off the road. Significant roadside hazards include large trees, Stobie poles, and steep embankments. Many of these hazards are currently unprotected at numerous locations between Keith and Mount Gambier.

It was encouraging to note that some significant roadside hazards are protected, mainly in the southern half of the highway between Naracoorte and Mt. Gambier and it is recommended that this treatment continue throughout the remainder of the highway.

6 Rest Areas

The 2012 assessment of the Riddoch Highway showed that rest areas are frequent and evenly spaced. Ten rest areas were counted over the 210 km of the highway, averaging approximately one rest area per 21 km. *Towards 2020* did not identify a lack of rest areas as a concern. The frequency of rest areas combined with several country towns to stop at is more than satisfactory.

Nevertheless, some of the rest areas that were assessed had limited facilities, with the only provision being a layby and bin. Improvements would encourage more motorists to stop and rest and could include provision of facilities such as toilets, shelter, and drinking water. It is important to encourage more motorists to use these areas to prevent driver fatigue.

7 Recommendations

The RAA has analysed the highway assessment for the Riddoch Highway and submit the following recommendations.

- **Installation of roadside barriers**
- **Provision of audio tactile edge lines for its entirety**
- **Pavement rehabilitation**
- **Shoulder sealing to a minimum of 1.5m**
- **Additional overtaking areas in the north**
- **Improve rest areas to include shaded seating areas**

Appendix A

Pavement Performance Factors

Overview of Pavement Properties

Roughness

The pavement roughness refers to the irregularities in the road's surface in the direction of travel. These irregularities vary from 0.5m to 50m long and are measured in relation to the intended road surface and recorded in terms of the International Roughness Index (IRI). As the IRI increases, it indicates a rougher pavement surface which will produce an uncomfortable ride for the vehicle's occupants through bumps and undulations. Figure 1 shows the longitudinal profile of a road with an exaggerated surface. The red line indicated the intended surface level and the difference between the lines is the measured roughness.

The roughness is not only important for the ride quality experienced by the motorist but prolonged vehicle exposure to a rough road may also increase wear, maintenance and fuel consumption.

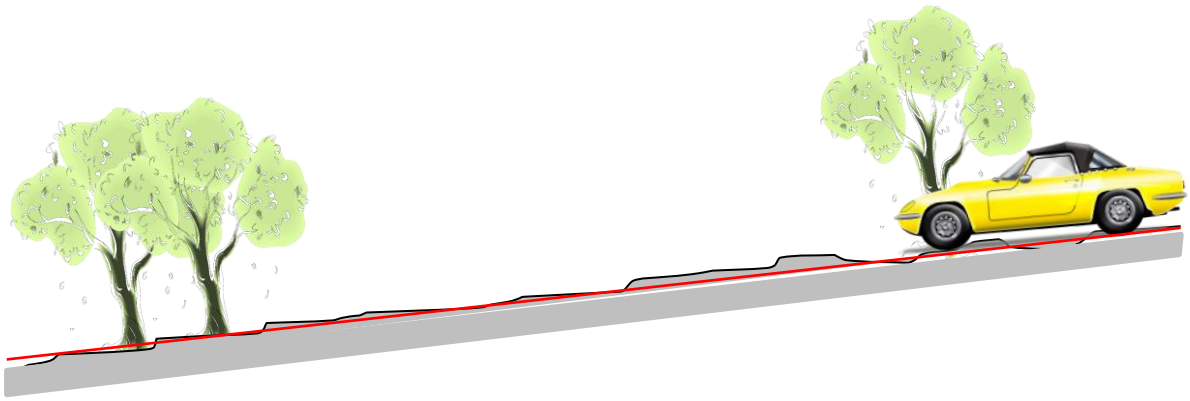

Figure 1 – Longitudinal Road Section

Rutting

A rut is a defect in the form of a longitudinal depression in the pavement surface. It usually occurs in the wheel path of vehicles (Figure 2) and is caused by high volumes of heavy vehicles over time. Ruts can also form as a result of environmental influences such as extensive rainfall combined with a poorly sealed surface. This can permit moisture to enter the pavement foundations which can weaken the structure or cause movement in the soil beneath, both of which can lead to rutting.

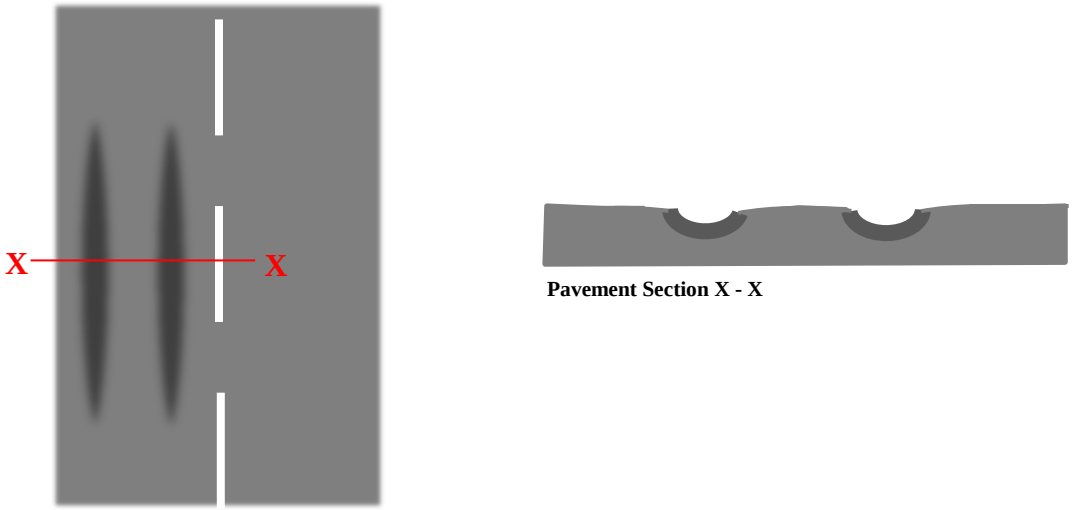

Figure 2 – Pavement Rutting

While rutting can lead to further pavement deterioration, several other problems may also arise as a result. Deep ruts can cause a “guide channel” for wheels and drivers may experience reduced steering performance or having difficulty with trailers tracking the vehicle. Ruts are also prone to filling with water which can increase the potential for aquaplaning, depending on the vehicle speed and depth of the rut. Drivers should always exercise caution when driving in wet weather but particularly on roads that are prone to bad rutting.

Texture

The pavement texture is important to ensure safety for motorists as it provides friction between the contact area of the tyre and the pavement surface. If there is insufficient friction between the tyre and surface the braking distance will be significantly reduced and if the vehicle speed is too high, there may be a loss of control on curves and bends resulting in collisions with roadside objects.

There are two forms of texture within the road surface, the microtexture and macrotexture. The microtexture is created by the rough surface of the aggregate in the surface the road and contributes to the friction that ensures the vehicle maintains contact with the road and provides good braking performance. The macrotexture is formed from the grooves created in the road surface by the different heights and shape of the aggregate and is important to ensure that rainwater drains away from the tyre, reducing the potential for aquaplaning.

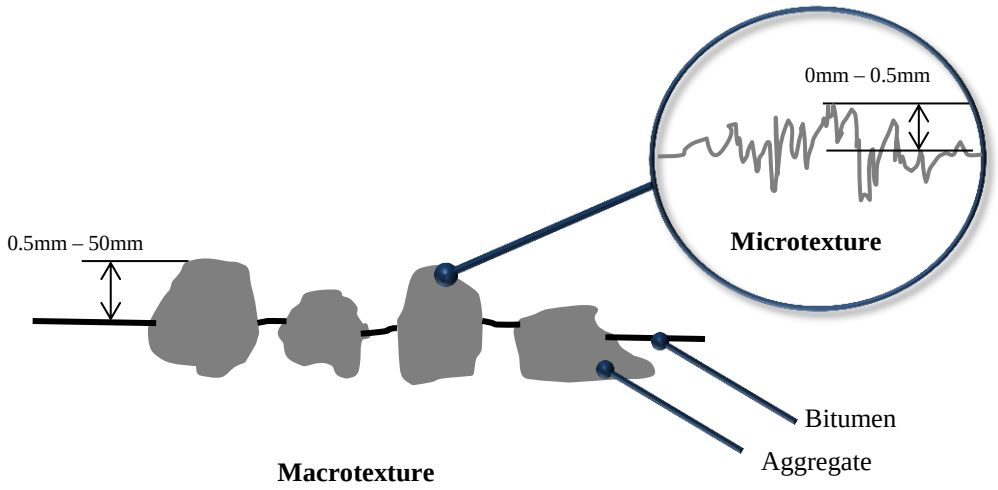

Figure 3 – Pavement Texture