

# RACQ - Star Rating and Crash Risk AusRAP Assessment



**Brisbane Valley Highway  
Queensland, Australia  
2018**



# About AusRAP

The Australian Road Assessment Program (AusRAP) is a program run by the Australian Automobile Association (AAA) and State and Territory motoring clubs including the RACQ, dedicated to saving lives through advocating for safer road infrastructure. AusRAP is part of the International Road Assessment Program (iRAP), a worldwide movement to improve the safety of roads and a proud supporter of the Decade of Action for Road Safety 2011-2020, a global plan to reduce the number of road deaths worldwide.

AusRAP's objectives are to:

- reduce deaths and injuries on Australia's roads by systematically assessing risk and identifying safety shortcomings that can be addressed with practical road-improvement measures; and
- put risk assessment at the heart of strategic decisions on road improvements, crash protection and standards of road management.

The Star Ratings and SRIPs measure the inherent safety of a road's infrastructure – that is, the degree to which built-in safety features prevent crashes from occurring and reduce the severity of those crashes which do occur.

Each road is assigned a Star Rating which tells us how safe the road itself is and allows road safety improvements to be identified and costs to be estimated.

Crash risk mapping is a measure of the real-life performance of a road network: it is based on casualty crashes that have actually occurred.

Examination of a road's infrastructure elements is done at a single point in time and AusRAP cannot take into account routine maintenance issues such as potholes. Funding for routine road maintenance is a separate issue which remains a strong focus of the Australian motoring clubs.

## For more information

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# Brisbane Valley Highway - Results

Due to RACQ and community safety concerns on the Brisbane Valley Highway in south-eastern Queensland, the RACQ undertook an AusRAP assessment of road infrastructure risk.

The Brisbane Valley Highway is a State Government controlled road and is an important north-south corridor for freight, tourism and general traffic from the Warrego Highway at Blacksoil, to the D'Aguilar Highway at Harlin. The highway is approximately 90km in total length and is mostly single lane each-way undivided carriageway.

## Crash History

Based on Department of Transport and Main Roads crash data from 2012 – 2016 on the Brisbane Valley Highway, there were 4 fatal crashes resulting in 5 deaths. There were 60 Fatal and Serious Injury (FSI) crashes, resulting in 79 FSI casualties (5 deaths and 74 hospitalisations). Further analysis of crash history is detailed in Table 3 of this report.

## Star Ratings (before)

The AusRAP assessment examines the risk of death and serious injury for vehicle occupant and motorcycle road users. A total of 89 kilometres of highway was assessed utilising video data collected by the Department of Transport and Main Roads in 2015, with star rating analysis prepared by the Australian Road Research Board (ARRB). The Safer Roads Investment Plan (SRIP) was prepared by RACQ.

AusRAP Star Ratings are based on road inspection data and provide a simple and objective measure of the level of safety which is 'built-in' to the road for vehicle occupants, motorcyclists, bicyclists and pedestrians.

This report focusses on vehicle occupant star ratings. 5-star roads are the safest and lowest risk while 1-star roads are the most dangerous and highest risk.

The current star ratings before any upgrades can be seen in Figure 1 and Table 2, and show that:

- For vehicle occupants, only 41% of the **road length** is rated as 3-star or more, with 55% rated as 2-star and 3% rated as 1-star.
- For vehicle occupants, 36% of **vehicle kilometres travelled** is rated as 3-star or more.
- For vehicle occupants, 64% of **vehicle kilometres travelled** is rated as 2-star or less.

## Safer Roads Investment Plan (SRIP)

AusRAP considers more than 90 proven road improvement options to generate affordable and economically sound Safer Road Investment Plans (SRIP) that will save lives.

The SRIP shows a list of economically sound road safety treatments, specifically tailored to reduce risk on the surveyed roads. Each proposed countermeasure is supported by evidence that, if implemented, it will prevent deaths and serious injuries in a cost-effective way.

Note: There was insufficient fatality crash data to appropriately distribute in the fatality calibration model to generate the SRIP. After discussion with iRAP, it was decided to use both fatal and hospitalisation crashes (2012-16) to provide adequate data for distribution of crash types occurring along the corridor. After analysis, the crash distribution resulted in approx. 45% run-off road, 15% head-on, 15% intersection and 25% other (including property access). This is close to a typical distribution of crashes on regional high-speed highways.

## SRIP Results











**The SRIP is only to be used as a guide to identify problems and propose some potential low-cost engineering treatments.** Regardless of information contained in this report, each SRIP countermeasure should be subject to additional investigation, prioritisation, concept planning and detailed design before implementation. The Department of Transport and Main Roads will determine the most suitable countermeasures for implementation, and the costs.

The Brisbane Valley Highway has problems with **run-off road** crash risk, and to a lesser extent **intersection** and **head-on** crash risk. The SRIP countermeasures (see Table 1) shows that an estimated investment in low-cost safety treatments in the order of \$25 - \$30 million could result in a saving of approximately 115 fatal and serious injuries (FSIs) over 20 years (>5 per year on average).

The SRIP indicates that improvements should focus on:

- Making roadsides more forgiving of driver error - Clearing roadsides or installing safety barriers to reduce the significance of **run-off road** crash risk (predicted at approx. 90 FSIs saved over 20 years)
- Shoulder rumble strips (ATLM) with other delineation and skid resistance improvements are also worthwhile, as is investigating improvements at approx. 11 intersections

**Table 1 - Safer Roads Investment Plan (SRIP) - ranked by Fatal and Serious Injuries (FSI) saved**

Countermeasure	Length / Sites	FSIs saved ▲
 Roadside barriers - passenger side	30.90 km	36
 Roadside barriers - driver side	30.70 km	36
 Clear roadside hazards - driver side	21.30 km	9
 Clear roadside hazards - passenger side	18.10 km	8
 Skid Resistance (paved road)	3.70 km	8
 Shoulder rumble strips	13.90 km	8
 Improve Delineation	11.10 km	5
 Protected turn lane (unsignalised 4 leg)	4 sites	2
 Protected turn lane (unsignalised 3 leg)	7 sites	1
 Central hatching	1.20 km	0
 Centreline rumble strip / flexi-post	1.20 km	0
 Sideslope improvement - passenger side	0.30 km	0
 Shoulder sealing passenger side (>1m)	1.10 km	0
 Shoulder sealing driver side (>1m)	0.80 km	0
		115

## Star Ratings (after)

Table 2 shows the Star Rating (after) results after SRIP countermeasures:

- For vehicle occupants, 100% of **vehicle kilometres travelled** is rated at 3-star or more, an increase of 58%
- For vehicle occupants, 10% of **vehicle kilometres travelled** is rated as 4-star

Implementing these safety treatments would eliminate all 1 and 2-star sections of the Brisbane Valley Highway for vehicle occupants, reducing road trauma and exceeding both the National Road Safety Strategy target (80% by 2020) and RACQ target (90% by end 2022) of travel on state roads at AusRAP 3-star or better.

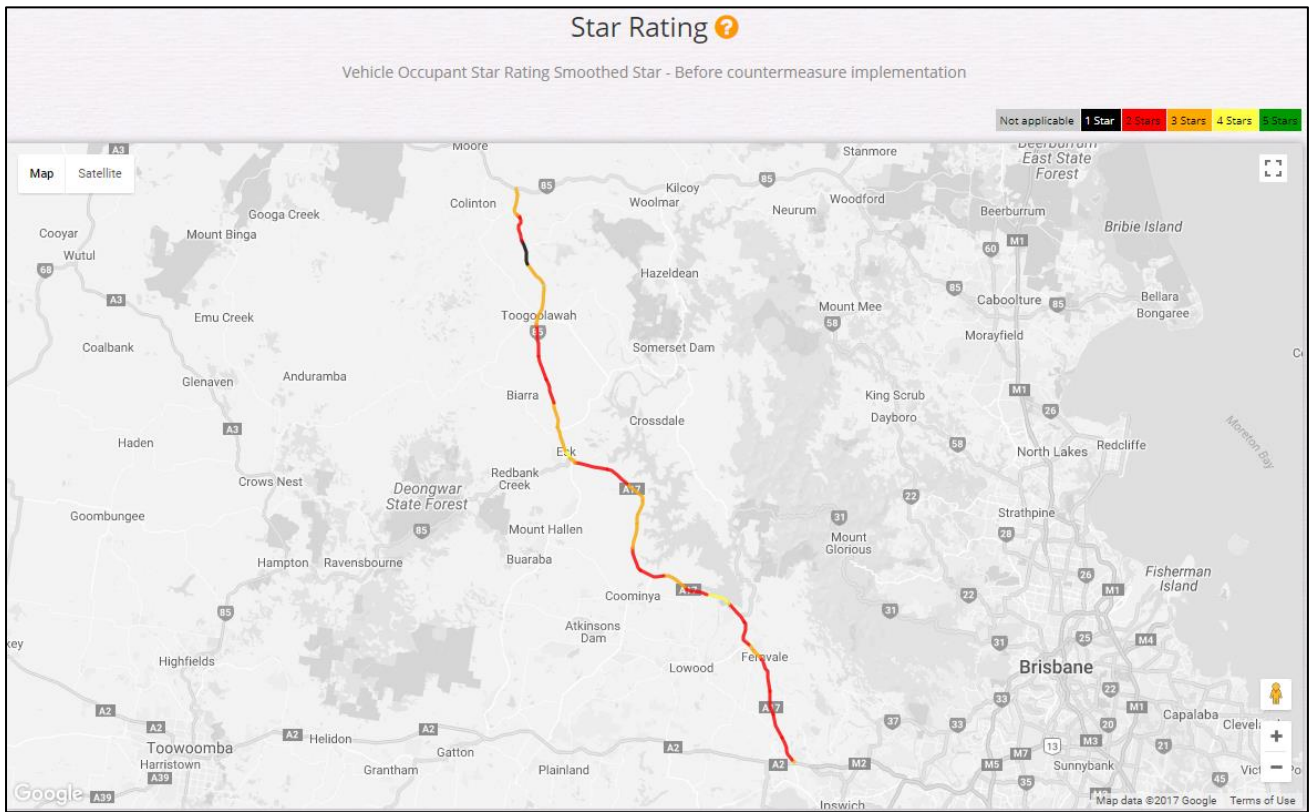
**Table 2 Star Rating change (vkt) – Before and After SRIP countermeasures (Vehicle occupants)**

Star Ratings by Travel (vkt)						
Star Ratings	Before		After		Change	
	Km travelled	Percent	Km travelled	Percent	Km travelled	Percent
5 Stars	0	0%	0	0%	0	0%
4 Stars	13,427	4%	35,073	10%	21,647	6%
3 Stars	118,873	32%	331,620	90%	212,747	58%
2 Stars	223,301	61%	0	0%	-223,301	-61%
1 Star	11,093	3%	0	0%	-11,093	-3%
Not applicable	1,109	0%	1,109	0%		
<b>Totals</b>	367,802	100%	367,802	100%		

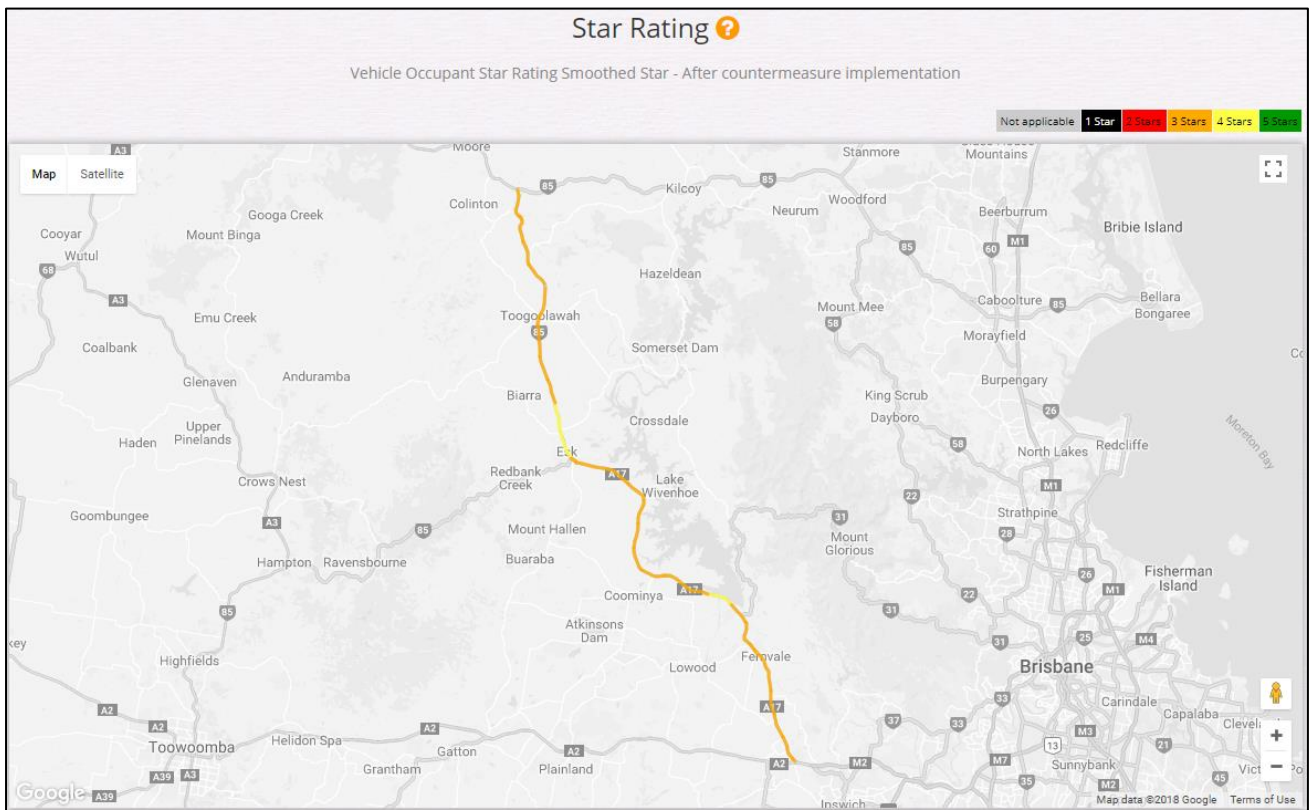
Star rating before and after maps for vehicle occupants are shown in Figures 1 and 2 over page.

The detailed results of the project and access to the iRAP online software (<http://vida.irap.org>) will be provided to key stakeholders for further exploration and use.

**Figure 1 - Star Ratings results (smoothed) for Brisbane Valley Highway (before countermeasures)**



**Figure 2 - Star Ratings results (smoothed) for Brisbane Valley Highway (after SRIP countermeasures)**



## Crash Risk

An investigation of the recorded crash history of the Brisbane Valley Highway for the 5 years 2013-17 was conducted utilising the AusRAP Risk Mapping protocol with the results shown in Table 3 below. Eligibility for assessment typically requires that a road have a speed limit of 90km/h or more, though some lower speed limit sections are included where they form an integral part of the otherwise higher speed route.

**Collective risk** shows the density, or total number, of casualty crashes over a given length of road and is calculated by dividing the number of casualty crashes per annum by the length of highway.

**Individual risk** shows the casualty crash rates per vehicle kilometre travelled. This effectively represents the risk of being involved in a crash faced by an individual driver, by taking traffic volumes into account. Individual risk is calculated by dividing the frequency of crashes per annum by the distance travelled on each section of highway per annum.

**Combined risk rating** - Collective and Individual Risk have been scaled and combined with equal weighting to produce a single risk score per road section (the Combined risk score). Once a section of highway has received a combined risk score, it is assigned one of five corresponding rating bands and colours from Low to High (the Combined Risk Rating). The cut-off points between rating bands are determined by ranking sections from worst to least Combined risk score across the 21,485km of Queensland roads included in this assessment (October 2018, see link below) and then dividing this result into the five rating bands, each representing as close as possible to 20 per cent of the network assessed. The **Combined risk rating** provides clear targets for those roads requiring upgrades: governments should focus on roads coloured in black (High) and red (Medium-high) as a priority, especially higher volume roads that also have an AusRAP 1 or 2-Star road infrastructure rating.

The Brisbane Valley Highway recorded Medium-high and High *Individual Risk* ratings (casualty crashes per 100M vehicle kilometres travelled) from Ipswich to Fernvale and Esk to Harlin. These two sections also recorded a Medium-high and High *Collective risk* (crashes per kilometre) rating.

The **Ipswich to Fernvale** and **Esk to Harlin** sections received a High and Medium-high *Combined risk rating* respectively, indicating that these sections of the Brisbane Valley Highway require upgrades to improve safety, especially with a significant proportion of vehicle kilometres travelled (64%) rated at 2-star or less for vehicle occupants.

The Combined risk rating and AusRAP Star Ratings map can be found under the AusRAP tab at <https://www.racq.com.au/cars-and-driving/representing-queensland-drivers/road-surveys-and-assessments>

**Table 3 AusRAP Risk Mapping result – Brisbane Valley Highway (2013-17)**

From-To	Carriageway Type	Length km	Traffic Avg. Vehicles per day	Casualty crashes 2013-17	Deaths 2013-17	Collective Risk Rating Annual average casualty crashes per km	Individual Risk Rating Annual average casualty crashes per 100M veh-km	Combined Risk Rating	Rank / 312 sections		
<b>Brisbane Valley Highway</b>											
Ipswich to Fernvale	Single	13	9050	33	3	0.49	High	14.83	Medium-high	High	84
Fernvale to Esk	Single	37	3200	23	1	0.12	Medium	10.63	Medium	Medium	217
Esk to Harlin	Single	34	3400	36	1	0.21	Medium-high	17.04	High	Medium-high	128

\*Due to generally rating sections of highway with a speed limit of 90km/h or more, data totals in Table 3 may not add up to totals recorded over the whole highway.

Crash and traffic data for (2013-17) are shown above. When compared to analysis performed using 2012-16 data, there are increased traffic volumes but small reductions in casualty crashes across all sections. This has resulted in a decrease in the *Collective* and *Individual* risk values, but has not resulted in changes in risk bands.

# Appendix A

## Methodology

The iRAP v3 model used by AusRAP considers the physical attributes of a road and quantifies the safety risk associated with each of these to produce a Star Rating Score, from which Star Ratings can be determined. The model produces different Star Ratings for vehicle occupants, motorcycles, cyclists and pedestrians as the safety risks from a given road attribute vary for each of these road user groups.

The road attributes are analysed every 100 metres, and the results are smoothed to reduce fluctuations in Star Ratings that might otherwise occur every 100m. All results presented in this report are smoothed.

For divided roads with carriageways separated by a dividing median, each carriageway is analysed separately.

Further information on the methodology is available from [www.irap.org](http://www.irap.org), [www.toolkit.irap.org/](http://www.toolkit.irap.org/) and <http://capacity.irap.org/>.

## Modelling Parameters

For the calculation of the Safer Roads Investment Plans, the analysis model requires values for the modelling parameters to be set. These are shown in the Table 4 below. The model also requires the specification of costs of potential road treatments that can be applied to reduce or eliminate safety risks. Where provided, costs from road authorities were used in the model, and the model also considers situations in which additional cost may be incurred, for example with significant earthworks required. The costs are calculated such that the treatments are projected to last for 20-years, and the cost of treatments with a service life of less than 20-years are scaled to be over a 20-year timeframe.

The recommended treatments in the SRIP are based on an assessment of the safety of the road at the 100 metre level. A more detailed engineering investigation would be required to optimise treatments and costs at specific locations.

The benefits of the Safer Roads Investment Plans are calculated over a 20-year period, estimating the fatalities and serious injuries that can be saved, and the associated economic benefits. The estimated costs and benefits of each potential road treatment are evaluated and the benefit cost ratio is determined, and only those treatments with a benefit cost ratio greater than one are contained in this report. This is consistent with current government practice to select projects that have a return on investment.

**Table 4** Key values and assumptions used in the analyses

Item	Value / assumption	Source / comments
Value of human life	AUD \$7,200,000	Department of Transport and Main Roads, Queensland, 2016
Value of serious injury	AUD \$340,000	Department of Transport and Main Roads, Queensland, 2016
Ratio of serious injuries to deaths	15:1	Calculated using validated crash data 2012-2016 supplied by the Department of Transport and Main Roads, Queensland
Road death under reporting rate	1.0	Fatality crash reporting is accurate in Queensland. Therefore no underreporting of fatalities was used in this assessment.
Traffic volume growth	No growth	To simplify the economic analyses, it was assumed that there would be no growth in traffic volumes. To the extent that it is in fact likely that traffic volumes will grow, the benefit cost ratios of safety countermeasures identified in this report are likely to be underestimated.