

Arthurs Seat Road
Road Safety Assessment

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Executive Summary

Safe System Solutions Pty Ltd has been engaged by Mornington Peninsula Shire Council to undertake an independent assessment of the Arthurs Seat Road Black Spot project between White Hill Road and Red Hill Road.

This road safety assessment has been undertaken by examining the Black Spot submission documents, publicly available data, referenced guidelines and tools. The authors of this report are qualified engineers and independent from the Black Spot project. To define this independence, the authors of this report, and the broader team at Safe System Solutions Pty Ltd, were not involved in the development of the Arthurs Seat Road Black Spot project between White Hill Road and Red Hill Road. We have not provided any consultancy services related to this project to Mornington Peninsula Shire Council or any other parties engaged to develop this Black Spot project. This road safety assessment is the first exposure we have had to this Black Spot project.

The authors' review of the Scope Approval Report (SAR) submitted as part of the Black Spot application concluded that the project meets the Federal Black Spot eligibility criteria and guidelines. The authors believe the SAR submission adequately covered all the detail required for Federal Black Spot Program and the quality of the report and appendices were suitable.

Additionally, we have employed road safety risk assessment methodologies, namely the International Road Assessment Programme (iRAP) and Infrastructure Risk Rating (IRR), to analyse the level of risk before the Black Spot project and post-completion. The iRAP Star Ratings for both passenger vehicles and motorbike users are showing an increase at locations where barriers have been installed. Each increase in star rating approximately halves the risk of death and serious injury. Thus, the improvements created in these sections of Arthurs Seat Road are considerable.

The IRR Risk Scores similarly showed a reduction in risk by ~32% with the implementation of the road safety barrier and appropriate end terminals.

Both assessment methodologies have indicated that the Black Spot project has improved the level of safety for road users. Additionally, both assessment methodologies have indicated that implementing the 60km/h speed zone (without the other Black Spot project interventions) would not have been as effective as implementing the Black Spot project.

We understand that members of the community have concerns associated with the Black Spot project and have included a section within the report to respond to these queries.

Finally, we have used a Benefit Cost Ratio tool to predict the number of casualty crashes saved as a result of this project. Over the project's life span, 6.3 people in the community are predicted to avoid serious injuries (e.g. hospitalisation) as a result of the safety interventions of the Black Spot project. The authors acknowledge this is a conservative estimate.

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List of Abbreviations

AADT	Annual Average Daily Traffic
ATLM	Audio Tactile Line Marking
BCR	Benefit Cost Ratio
BSP	Black Spot Program
CAMs	Curve Alignment Markers
CRF	Crash Reduction Factor
DCA	Definition for Classifying Accidents
DTP	Department of Transport and Planning
FSI	Fatal and Serious Injury
GREAT	Gating Redirective Energy Absorbing Terminal
iRAP	International Road Assessment Programme
IRR	Infrastructure Risk Rating
MPSC	Mornington Peninsula Shire Council
RCIS	Road Crash Information System

RDN	Road Design Note
RRPMs	Raised Reflective Pavement Markers
RSA	Road Safety Audit
SAR	Scope Approval Report
VRU	Vulnerable Road User (pedestrians and cyclists)

1. Introduction & Background

Safe System Solutions Pty Ltd has been engaged by Mornington Peninsula Shire Council to undertake an independent assessment of the Arthurs Seat Road Black Spot project between White Hill Road and Red Hill Road (refer to Figure 1).

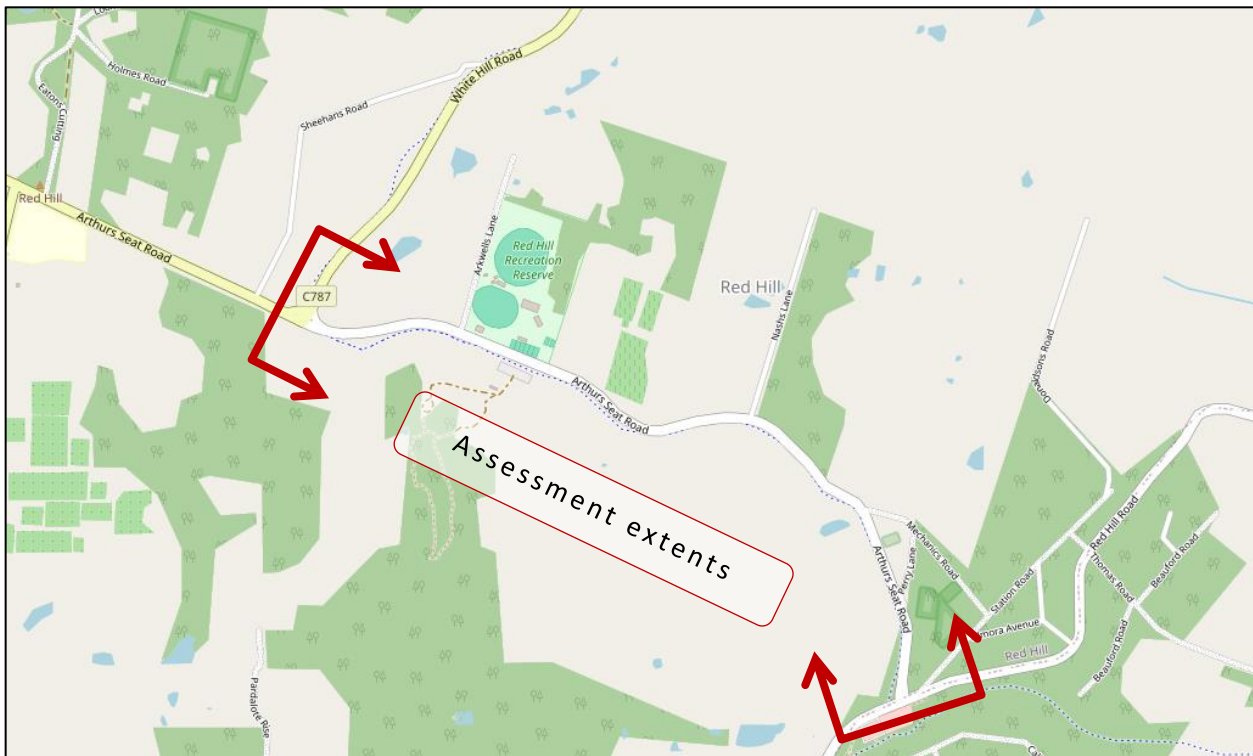


Figure 1: Map of assessment area (Source: OpenStreetMap)

Arthurs Seat Road between White Hill Road and Red Hill Road is a two-lane, two way with a curvilinear alignment. A posted speed limit of 60km/h applies to this section (installed December 2023), however during the submission of the Black Spot project the posted speed limit was 70km/h.

The adjacent land use is primarily green wedge. There is also a Public Park and Recreation Zone (Red Hill Recreation Reserve).¹

The Black Spot project includes:

- Installation of guardrail including motorcycle protection rail with G.R.E.A.T. terminals at 3 locations
- Installation of double sided CAMs at curves
- Installation of W3-V112 (Curve Tightens) signs on both approaches to a compound curve
- Upgrade RRPMs along centreline and edgelines
- Upgrade guideposts along entire section

This independent assessment involves:

¹ <https://mapshare.vic.gov.au/vicplan/>

- Conducting a site inspection (day and night) of the area
- Reviewing the Scope Approval Report (SAR) submitted as part of the Black Spot application.
 - Reviewing the Black Spot’s application against the Black Spot eligibility criteria and guidelines
- Assessing the road safety devices installed as part of the Black Spot project
- Articulating the road safety performance of Arthurs Seat Road prior to the Black Spot project and post-project. We have used the iRAP star ratings methodology and the Infrastructure Risk Rating methodology to articulate the road safety performance before and after the interventions
- Calculating the estimated number of Fatal and Serious Injury crashes (FSIs) that have been saved due to the Black Spot project.
- Responding to community queries regarding the Black Spot project

1.1 Documents reviewed

The documents listed in Table 1 were reviewed by the authors as part of this independent road safety assessment.

Table 1 Documents reviewed

File Name	File Type	Author
Copy of MP203 Federal Blackspot program BCR Pro-Forma 2023-24 updated Oct 2022_	.xlsx	HDS Australia
301 MP203 Arthurs Seat Rd RBCE Option 1	.xlsm	HDS Australia
301 MP203 Arthurs Seat Rd Risk Assessment	.pdf	HDS Australia
Arthurs Seat Road - Black Spot project - Information summary - Sept 2024 1	.pdf	MPSC
Arthurs Seat Road, Red Hill - Application-FBS235724	.pdf	MPSC
RSA_Arthurs-Seat-Road 2024	.pdf	Road Solutions
Scope Approval Report & Crash Report - Arthurs Seat Road	.pdf	HDS Australia
Red Hill Traffic Management Plan	.pdf	Onemilegrid
“Arthurs Seat Road - 85th Percentile” – containing snips of Compass IoT data	.msg	email from carolyn.lindsey@mornpen.vic.gov.au 10/10/24
barrier meeting with SSS v2	.docx	Dr Elli Tutungi
Katanya Barlow	.docx	Sam Norris
Safe System Solution Submission	.pdf	Red Hill Community Association

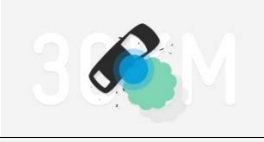
2. The Safe System

The Safe System is the road safety philosophy adopted by the Mornington Peninsula Shire Council, Victorian and Australian governments. The principles of the Safe System are:

People make mistakes. To err is human, and while we continue to control our vehicles manually, our errors will continue to result in crashes. However, such crashes should not result in a fatality or serious injury. The Safe System recognises the unavoidable nature of human error, and rather than placing the blame on the road user, it recognises the need for those involved in road design and management to share responsibility for the large variety of factors that contribute to a crash and its severity. We all make mistakes, but no one should have to pay for the mistakes with their life or health.

People are vulnerable. If the vehicles we use on our roads every day crash at high-speed, then our bodies are subject to forces that they cannot withstand. The forces the human body can handle in different crash types are shown in Table 2 (adapted from *Mornington Peninsula Towards Zero 2020-2025 Technical Report*).

Table 2 Crash Types and Speed Thresholds

	Crash Type	Speed Threshold (passenger vehicle)
	Head-On	70km/h
	Side Impact (90°)	50km/h
	Side Impact into Point Source Hazard (eg. Tree, Power Pole)	30km/h
	Pedestrian, Cyclist, Motorcyclist	30km/h

While it may not be possible to prevent all impacts, the energy levels of crashes should be contained to levels that are low enough to prevent fatalities or serious injuries.

Shared responsibility. Creating a safe road network is everyone's responsibility. Businesses, governments, organisations and individuals all have a role to play in order for us to move Towards Zero.

An aspiration of zero deaths and serious injuries. A commitment that we do not knowingly trade off human life or health for other objectives, and the only ethical aspiration is zero death and serious injury.

3. Adherence to the Black Spot Guidelines

The Black Spot Program (BSP) is a Federal Government road safety program that commenced in 1996. The intent of the program is to reduce the social and economic costs of road trauma by:

- identifying and applying cost-effective treatments at locations with a record of crashes causing serious injury or death
- placing significant focus on the need to reduce rural road trauma, in accordance with national road safety policy objectives
- using a proportion of funds to treat sites identified as potential crash locations, and to implement other road safety measures.

The Australian Government provides funding to improve the physical condition or management of sites where crashes are occurring, or are at risk of occurring – known as Black Spots.²

3.1 Eligibility

Historically, funding has been available for the treatment of Black Spot sites, or road lengths, with a proven history of crashes. In more recent years, the BSP has recognised that there are road locations that could be considered as 'accidents waiting to happen'. Therefore, some program funds are used to treat sites where road traffic engineers have completed a Road Safety Audit or Safe Systems Assessment or equivalent report, and found that remedial work is necessary. **This allows an opportunity for proactive safety works to be undertaken before casualties occur.**

The Arthurs Seat Road Black Spot project was **not** submitted as a 'proactive' project.

A Scope Approval Report (SAR) is a document used to support the Black Spot application. The SAR submitted by MPSC stated the following:

Historical crash data was reviewed for the roads for the five year period from July 2016 to June 2021.

This Blackspot application is for Arthurs Seat Road between White Hill Road and Red Hill Road. This section was identified as it included a total of 6 eligible crashes, with 3 Serious Injury Crashes.

4 crashes were loss of control type crashes with vehicles leaving the carriageway (DCA codes 180, 181 and 183), while 2 crashes were head on collisions (DCA code 120);

- 1 of the crashes occurred during wet conditions;
- 4 of the crashes occurred during dark or dawn/dusk conditions;
- 1 of the crashes involved a motorcycle.

The authors of this document have conducted their own, independent crash query via the publicly available dataset (<https://discover.data.vic.gov.au/dataset/victoria-road-crash-data>). We have filtered crash data on Arthurs Seat Road between White Hill Road and Red Hill Road and found a total of 15 crashes, shown in Figure 2. A table excerpt of this data has also been provided in Figure 3.

² Australian Government, Black Spot Guidelines – July 2024

Figure 2 Crash data map

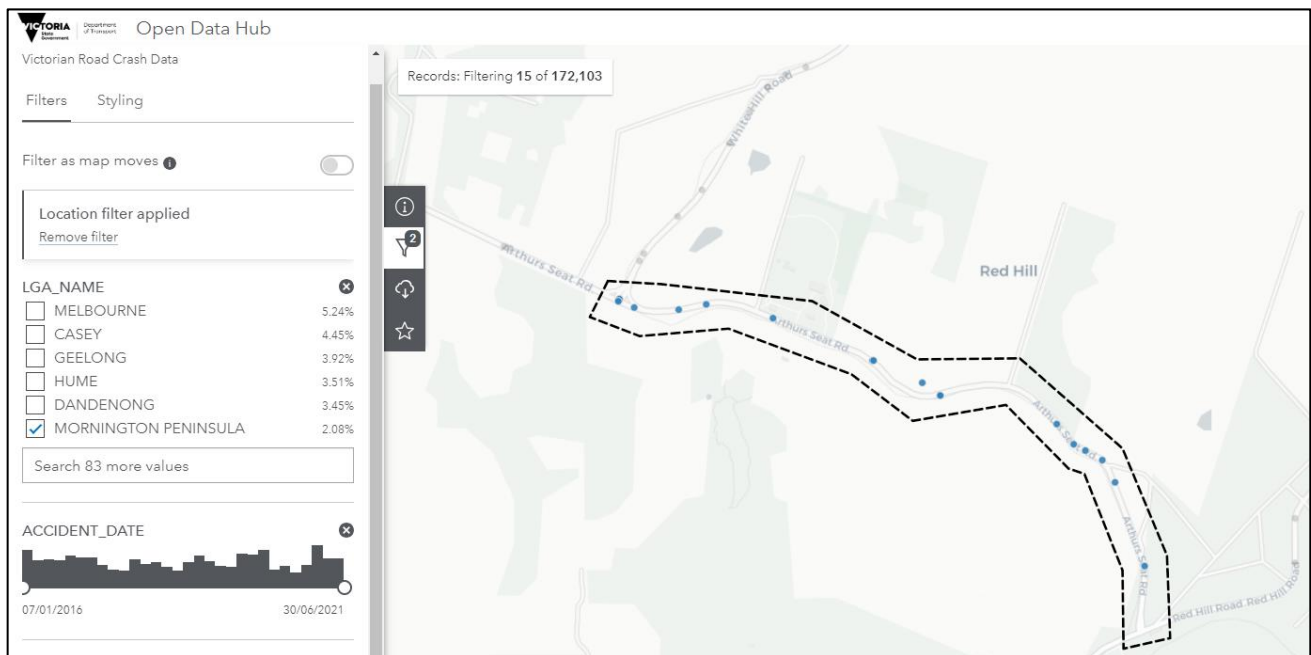


Figure 3 Crash data table excerpt

ACCIDENT_NO	ACCIDENT_DATE	ROAD_NAME	ROAD_TYPE	DCA_CODE	DCA_CODE_DESCRIPTION
T20160018662	2016/08/26	ARTHURS SEAT	ROAD	181	OFF RIGHT BEND INTO OBJECT/PARKED VEHICLE
T20160024506	2016/11/13	ARTHURS SEAT	ROAD	120	HEAD ON (NOT OVERTAKING)
T20170011385	2017/06/10	ARTHURS SEAT	ROAD	140	U TURN
T20170013828	2017/07/16	ARTHURS SEAT ROAD -WHITE HILL	ROAD	130	REAR END(VEHICLES IN SAME LANE)
T20180000556	2018/01/10	ARTHURS SEAT	ROAD	132	RIGHT REAR.
T20180018204	2018/09/27	ANDREWS	LANE	113	RIGHT NEAR (INTERSECTIONS ONLY)
T20180023696	2018/11/08	ARTHURS SEAT	ROAD	183	OFF LEFT BEND INTO OBJECT/PARKED VEHICLE
T20190000255	2019/01/03	ARTHURS SEAT	ROAD	183	OFF LEFT BEND INTO OBJECT/PARKED VEHICLE
T20190001120	2019/01/19	ARTHURS SEAT ROAD -WHITE HILL	ROAD	121	RIGHT THROUGH
T20190020612	2019/10/20	ARTHURS SEAT ROAD -WHITE HILL	ROAD	113	RIGHT NEAR (INTERSECTIONS ONLY)
T20190024915	2019/12/10	ARTHURS SEAT ROAD -WHITE HILL	ROAD	113	RIGHT NEAR (INTERSECTIONS ONLY)
T20200006719	2020/03/21	ARTHURS SEAT	ROAD	131	LEFT REAR
T20200014249	2020/07/13	ARTHURS SEAT	ROAD	180	OFF CARRIAGEWAY ON RIGHT BEND
T20200022509	2020/12/09	ARTHURS SEAT ROAD -WHITE HILL	ROAD	113	RIGHT NEAR (INTERSECTIONS ONLY)
T20210012305	2021/06/01	ARTHURS SEAT ROAD -WHITE HILL	ROAD	120	HEAD ON (NOT OVERTAKING)
		Included in SAR RCIS Summary			
		Not included in SAR RCIS Summary			
		BOLD TEXT Part of Black Spot project			

The authors note:

- 4 of the crashes that have occurred in this section were run-off-road (loss of control) crash types.
- 6 of the crashes that have occurred in this section were at the intersection Arthurs Seat Road and White Hill Road.
 - 5 of these crashes have **not** been used / referenced as part of the Black Spot SAR. They were all intersection crash types.
 - The 1 crash that was used /reference as part of the Black Spot SAR was a head-on, serious crash

The authors note that this crash is referenced in the collision diagram (crash 1) yet is absent in the RCIS Summary. Additionally, the collision diagram states this crash was 'Other' severity (Figure 4), yet the publicly available data states this was a 'Serious' crash (Figure 5).

Figure 4 Snip from collision diagram

1 NW*- 120 01/06/21 Tue Dark 5:35:00 PM Dry Other injury
 2 NE*- 181 26/08/16 Fri Dusk 5:59:00 AM Wet Serious injury
 3 E*- 183 08/11/18 Thu Dark 11:00:00 PM Dry Serious injury
 4 SE*- 120 13/11/16 Sun Day 3:30:00 PM Wet Other injury
 5 N*- 180 13/07/20 Mon Dusk 6:45:00 AM Muddy Serious injury
 6 N*- 183 03/01/19 Thu Day 7:45:00 PM Dry Other injury

Figure 5 Snip from publicly available data

ACCIDENT_NO	ACCIDENT_DATE	ROAD_NAME	ROAD_TYPE	DCA_CODE	DCA_CODE	FATALITY	SERIOUS INJURY
T20210012305	2021/06/01	ARTHURS ROAD		120	HEAD ON	0	1

- 1 of the crashes that occurred in this section was at the intersection of Arthurs Seat Road and Andrews Lane.
 - This crash has **not** been used / referenced as part of the Black Spot SAR.
- 1 of the crashes that occurred in this section was a Manoeuvring crash type (U-Turn).
 - This crash has **not** been used / referenced as part of the Black Spot SAR.
- 2 of the crashes that occurred in this section were Vehicles from the same direction crash type (Right rear and left rear).
 - These crashes have **not** been used / referenced as part of the Black Spot SAR.
 - The Accident No "T20200006719" was not found in the RCIS Summary. The authors cannot confirm why this crash did not appear in the RCIS Summary.

The crashes used / referenced as part of the Black Spot SAR have been filtered below:

Table 3 Black Spot Referenced Crashes

ACCIDENT NO	DATE	DCA CODE	LIGHT CONDITION	FATALITY	SERIOUS INJURY	OTHER INJURY	MOTORCYCLE
T20160018662	2016/08/26	181	Dusk/Dawn	0	2	1	0
T20160024506	2016/11/13	120	Day	0	0	1	0
T20180023696	2018/11/08	183	Dark No street lights	0	1	0	0
T20190000255	2019/01/03	183	Day	0	0	1	1
T20200014249	2020/07/13	180	Dusk/Dawn	0	1	0	0
T20210012305	2021/06/01	120	Dark Street lights on	0	1	1	0

The authors note the highlighted Serious Injury crash was listed as an Other Injury crash in the Black Spot application.

This project was submitted for consideration as a **Black Spot** and needed to meet:

The crash requirements of the program are that there must be at least 3 eligible crashes

The project has nominated 6 eligible crashes, thus meeting the eligibility requirements.

3.2 SAR Submission

As shown in Table 3, the publicly available data confirms the SAR's statements:

- 4 of the crashes occurred during dark or dawn/dusk conditions;
- 1 of the crashes involved a motorcycle.

The authors used the 'Atmospheric Condition' dataset to check the weather conditions, summarised below:

Table 4 Crashes Atmospheric Conditions

ACCIDENT NO	ATMOSPHERIC CONDITIONS
T20160018662	Clear
T20160024506	Clear
T20180023696	Clear
T20190000255	Clear
T20200014249	Raining
T20210012305	Clear

This dataset confirms the SAR's statement:

- 1 of the crashes occurred during wet conditions;

However, the authors did note that the collision diagram listed 2 crashes (T20160018662 and T20160024506) as wet and 1 as muddy (T20200014249) as shown in Figure 6. These descriptions are not consistent with the publicly available dataset. The authors do not believe that this inconsistency has any weight on the eligibility of the Black Spot project.

Figure 6 Snip from SAR Collision Diagram

1 NW*- 120 01/06/21 Tue Dark 5:35:00 PM Dry Other injury
2 NE*- 181 26/08/16 Fri Dusk 5:59:00 AM Wet Serious injury
3 E*- 183 08/11/18 Thu Dark 11:00:00 PM Dry Serious injury
4 SE*- 120 13/11/16 Sun Day 3:30:00 PM Wet Other injury
5 N*- 180 13/07/20 Mon Dusk 6:45:00 AM Muddy Serious injury
6 N*- 183 03/01/19 Thu Day 7:45:00 PM Dry Other injury

The authors note the focus of the Black Spot project has been to reduce the risk of loss of control and head-on crash types. 6 crashes along Arthurs Seat Road occurred at intersections, with 5 of these crashes at White Hill Road. The intersection crashes could have been used / referenced as part of this Black Spot SAR. However, the Black Spot project scope would have had to have been altered to include infrastructure upgrades to improve the safety at the intersections. As the Black Spot SAR did not include any alterations to these intersections, not including these crashes that occurred is valid.

Similarly, the crashes that involved Manoeuvring or Vehicles from the same direction were not included in the Black Spot SAR. These crashes could have been included, but would have meant the project treatments

would have had to have been altered to include infrastructure upgrades to reduce these risks. As the Black Spot SAR did not include any alterations to specifically reduce these risks, not including these crashes that occurred is valid.

In Table 5, the authors have listed the SAR's document headings and provided comments regarding the content of each heading.

Table 5 SAR Contents Review

Table of Contents Heading	Authors Review Comments
Background	- In Section 1.1 "Funding Background" the project is: <i>to be considered as a Black <u>Length</u> for funding</i> However, in the Application Submission – the project was submitted as a Black <u>Spot</u>: Federal Blackspot Program 2023-24 Federal Blackspot Program 2023-24 Application FBS235724 From Mornington Peninsula Shire Council Form Submitted 28 Oct 2022, 11:31am AEDT Is this project being submitted as a Blackspot or a Blacklength? * ☐ Blacklength ☒ Blackspot The authors suggest there was a typo in the SAR. - In section 1.2.3. "Existing Road Configuration" there is an opportunity to mention the horizontal alignment of Arthurs Seat Road. It is curvi-linear.
Problem Definition	- In section 2, the "lack of <u>proper</u> delineation" is somewhat subjective. A more common adjective would be "adequate" or "features poor delineation" 2.1 Crash History – the text refers to '3 Serious Injury Crashes'. The authors from their own crash history investigation concluded there have been '4 Serious Injury Crashes' along the route. Refer to Table 3.
Benefits	Typically the Crash Reduction Factor is detailed. The authors cannot confirm how the Crash Reduction Factors were derived but have assumed the CRF for "Guardrail including on median" has been adopted for this project.
Strategic Response	The authors are unable to confirm the Movement & Place rating. This is typically provided by Council or Department of Transport and Planning.
Options Discussion and Recommended Solution	- The recommended option and project deliverables are consistent with the focus of the SAR i.e. the treatments listed are focussed on reducing the risk of loss of control and head-on crash types. - The inclusion of motorcycle underrun protection, given that there was a motorcycle crash on this route, is reasonable.
Community and Stakeholder Engagement	This approach appears consistent with other similar Black Spot projects.

Table of Contents Heading	Authors Review Comments
Project Risks and Other Considerations	A Risk Assessment Register was developed for this project “301 MP203 Arthurs Seat Rd Risk Assessment”. This document could have been referenced in this section.
Approvals	No comments.
Appendix	No comments.

Overall, the authors believe the SAR submission adequately covered all the detail required for Federal Black Spot Program. The quality of the report and appendices were suitable. The authors also acknowledge that each SAR is reviewed and endorsed by the Department of Transport and Planning (DTP). The fact that this SAR received DTP endorsement further demonstrates the suitability of this submission.

3.3 Barrier locations

Three locations were selected for the implementation of the Ramshield Barrier TL3 system. One of these locations was replacing the old Type B guardrail.

The authors acknowledge the project is not required to treat the specific locations where the run-off-road crashes occurred – but rather treat the highest-risk areas along the alignment. A crash history along an alignment is an indication that the route is high risk.

To a certain extent, run-off-road crashes occur sporadically. Isolated occurrences do not necessarily suggest an elevated road safety risk profile. As per the Austroads Guide to Road Safety Part 2: Safe Roads:

There are several reasons why a vehicle might leave the roadway and enter the roadside environment. Factors include driver inattention, driver fatigue, driving while intoxicated or under the influence of drugs, excessive speed, poor visibility, inadequate visual cues of the road path, poor road condition and vehicle failure (e.g. brake failure or worn tyres). The locations of these types of crashes are often random in nature. Therefore, reactive approaches to treating discrete locations will not achieve a step change in trauma reduction³.

For the purposes of developing Black Spot projects, there is no singular methodology to identify and treat high-risk areas. MPSC engaged a traffic engineering consultancy HDS Australia to develop a suitable scope for the area. A site visit was conducted on 5 August 2022 by a senior traffic engineer from HDS Australia. During the site visit, the following observations were made:

- Large number of trees located near the edge of traffic lane;
- Power poles located near the edge of traffic lane;
- Minimum of guidepost provided along entire section;
- No curve warning sign or CAMs provided at any of the bends;
- Shoulders were unsealed;
- Centreline and edgelines are provided however without RRPMS.

³ Austroads Guide to Road Safety Part 2: Safe Roads

The authors cannot confirm why the three locations were selected for the implementation of the Ramshield Barrier TL3 system and have assumed professional judgement, experience and collaboration between parties was utilised. We have completed our own site inspection on 24 September 2024 and believe the sites targeted for safety barrier were reasonable. Each of the barrier sites:

- Are situated on the outside of the curve
- Shield errant motorists from numerous fixed, point hazards (trees, utility poles etc.) or steep embankments
- Do not block existing access points / side streets

Other locations along Arthurs Seat Road could be treated with barrier systems however:

- May require more significant earthworks to install
- May require environmental permits / offsets
- May require tree removal
- May require drainage upgrades
- May block existing access points / sides streets and/or impact on sight lines at these locations

To this end, the authors are satisfied that the locations selected for barrier systems were appropriate.

4. iRAP Assessment

iRAP (the International Road Assessment Programme) is the umbrella programme for Road Assessment Programmes (RAPs) worldwide. iRAP provides a platform for star rating roads for the safety of its users. The methodology inputs over 60 road attributes and is an internationally recognised process that is founded on high quality research and evidence.

Further information about iRAP can be found at www.irap.org

In Australia, an iRAP assessment is referred to as an AusRAP assessment.

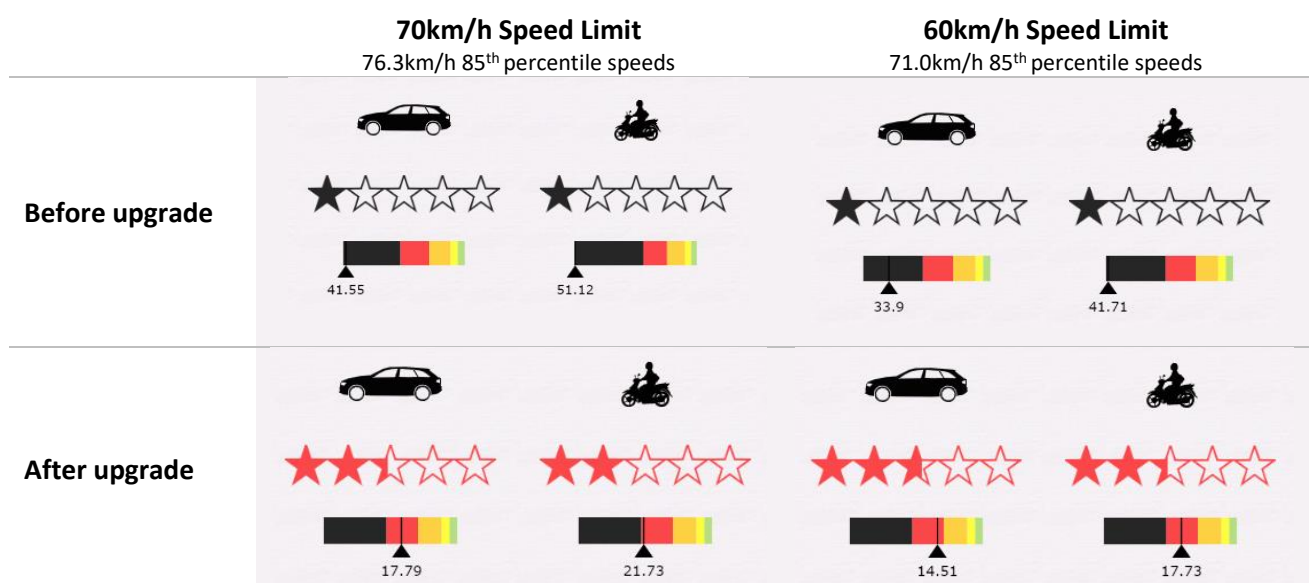


The AusRAP/iRAP assessment for Arthurs Seat Road was completed for the following cases:

- Before upgrade with 70km/h speed limit
- Before upgrade with 60km/h speed limit
- After Black Spot project upgrade with 70km/h speed limit
- After Black Spot project upgrade with 60km/h speed limit

The AusRAP assessment was not completed for each 100 m segment of Arthurs Seat Road but was rather a representative AusRAP assessment. Coding of road attributes was completed based on a representative cross section of the 'before upgrade' determined from supplied photographs, data and historical information available. The 'upgraded' was based on site inspection information at sites with the installation of the barrier systems. For completeness, four scenarios were assessed as represented below.

Figure 7 Before and after upgrade AusRAP Star Rating (Four scenarios)



Several transport organisations have pledged to achieve the national target that at least 80% of travel occurs on roads with a 3-star rating or higher by 2030. Further information can be found

<https://austroads.com.au/latest-news/ausrap-partners-pledge-commitment-to-safer-roads-for-all-users>.

Each increase in star rating approximately halves the risk of death and serious injury. Thus, the improvements created in these sections of Arthurs Seat Road are considerable.

5. Infrastructure Risk Rating

Infrastructure Risk Rating (IRR) is a road safety risk assessment methodology that is calculated by coding the following road and roadside features:

- Land use
- Road stereotype
- Lane and shoulder width
- Horizontal alignment
- Roadside hazards
- Intersection density
- Access density
- Traffic volume – rural roads only
- Speed limit – rural roads only

Several jurisdictions across Australia and New Zealand have adopted the use of IRR to identify and evaluate the risk levels in different road environments. The Victorian road authority, DTP, has developed an IRR Tool, “TEM Vol 3 Part 211B Infrastructure Risk Rating IRR Tool v 10” to allow practitioners to calculate the IRR risk score.

The authors have completed an assessment of Arthurs Seat Road Black Spot project using the IRR Tool. The authors have referenced the Austroads Report, “Infrastructure Risk Rating Manual for Australian Roads” to calibrate the inputs. The assessment does not focus on the entire length of Arthurs Seat Road. Instead, the authors have focused their assessment where the road safety interventions have been installed. The locations and assumptions of this assessment have been summarised in Table 6:

Table 6 IRR Assumptions

Location	Before the Black Spot project	After the Black Spot project
Curve near Arkwell Lane	20+ non-frangible point hazards per km (≥ 1 per 50m) including: Trees, signs, posts, poles ≥ 10 cm diameter Within 5m from the edgeline	Metal or concrete safety barriers [Flexible guard rail system installed] Within 5m from the edgeline
Curve adjacent 120 Arthurs Seat Road, Red Hill	20+ non-frangible point hazards per km (≥ 1 per 50m) including: Trees, signs, posts, poles ≥ 10 cm diameter Within 5m from the edgeline	Metal or concrete safety barriers [Flexible guard rail system installed] Within 5m from the edgeline

The authors acknowledge road safety interventions were also installed at the curve adjacent 137 Arthurs Seat Road, Red Hill. However, we have not included this section as part of the IRR assessment. The reason this section has been omitted is the IRR tool is not granular enough to analyse the safety benefits from replacing the old Type B guard rail with a new flexible guard rail system and GREATs. The IRR Tool similarly does not take into account any of the delineation upgrades.

The IRR outputs have been summarised in Table 7.

Table 7 IRR Outputs Summary – 70km/h speed zone

Location	Before the Black Spot project		After the Black Spot project	
	Risk Score	Risk Band	Risk Score	Risk Band
Curve near Arkwell Lane	1.94	Medium	1.32	Low
Curve adjacent 120 Arthurs Seat Road, Red Hill	1.94	Medium	1.32	Low

Table 8 IRR Outputs Summary - 60km/h speed zone

Location	Before the Black Spot project		After the Black Spot project	
	Risk Score	Risk Band	Risk Score	Risk Band
Curve near Arkwell Lane	1.75	Medium	1.13	Low
Curve adjacent 120 Arthurs Seat Road, Red Hill	1.75	Medium	1.13	Low

Based on the IRR Assessment, the curves that have been analysed demonstrate an improved safety performance. The IRR Risk Scores are reduced by ~32% with the implementation of the road safety barrier and GREATs (not taking into consideration the speed reduction). The curves' risk bands move from 'Medium' prior to the intervention to 'Low' after the Black Spot project.

The IRR Assessment indicates an improved level of safety following the completion of the Black Spot project.

If the 60km/h speed zone was implemented without the Black Spot project interventions, a risk score of 1.75 was calculated for the curves. If the 70km/h was maintained, but the Black Spot project interventions were implemented, a risk score of 1.32 was calculated for the curves. Thus, the Black Spot project interventions (namely the barrier system) was assessed as more influential in reducing the level of risk compared to the speed limit reduction to 60km/h alone.

The authors also acknowledge that the upgrades to the signs, RRPMS and guideposts would also improve the level of safety for road users along Arthurs Seat Road – yet these safety improvements have not been quantified using the IRR Tool. To this end, the authors contend the IRR assessment is conservative and the Black Spot project may have reduced the level of risk even further.

The IRR Tool inputs can be found in Appendix B.

6. Estimation of FSIs

DTP has developed a 'BCR Spreadsheet' that calculates the expected benefit associated with road safety projects. MPSC submitted this spreadsheet as part of the FBS application. Snips from this spreadsheet have been provided in Figure 8.

Figure 8 BCR Spreadsheet

VicRoads REGION	LGA	Federal Electorate	Road Name	Intersecting Road (or start for Blacklength)	Intersecting road (end for blacklength)	Locality	Map Directory Reference	PROBLEM DIAGNOSIS (please describe problems/issues - NOT listing the number or types of crashes)	PROJECT DESCRIPTION (major scope items incl. length and % of TEC - follow example) CAM: Chevron Alignment Marker; DCE: Drivable Culvert Endwall DDA: Disability Discrimination Act; FCRT: Fully Controlled Right Turn JUMA: Joint Use Mast Arm; RRPm: Reflective Raised Pavement Markers
Greater Metro Region	Mornington Peninsula Shire	Flinders	Arthurs Seat Road	White Hill Rd	Red Hill Rd	Red Hill	190 K4	Issues include high traffic speeds and poor delineation around bends resulting a history of loss of control type crashes.	Installation of safety barriers Installation of CAMs and guideposts and RRPm's

Crash Period (Must be 1/7/16 to 30/6/21)	Fatal Crash No	Serious Injury Crash No	Other Injury Crash No	All Casualty Crash No	Fatality No	Serious Injury No	Other Injury No	All Casualty No	Definitions for Classifying Accidents (DCA)
1/7/16 to 30/6/21	0	3	3	6	0	4	4	8	120x2, 180,181,183x2

CRF	TEC	Yr 1	BCR	Cost per Serious Casualty Saved	No of Serious Casualties Saved per Year per \$100m Invested	Number of Serious Casualty Crashes (FSI) Saved over Project Life	Number of Serious Casualties (DSI) Saved over Project Life	Project Life Span years (refer CRF tab)	Speed Zone (km/h)	Mtc cost Onlu use values from table
45	\$546,000	\$546,000	3.9	\$86,586.23	49.5	5.4	6.3	20	70	\$2,280

As mentioned in Section 3, the authors have conducted their own crash history assessment. The crash T20210012305 appears to have been labelled as an 'Other Injury' crash – although the publicly available data suggests this was a Serious Injury crash. If this crash had been included in the BCR Spreadsheet as a Serious Injury, the estimated benefits of the project would have been higher. For the purposes of this report, we have not altered the BCR Spreadsheet.

The Black Spot project has adopted a Crash Reduction Factor (CRF) of 45%. As per the CRF notes:

If a project contains one major treatment and a number of minor treatments, adopt only the CRF for the major treatment which can treat the majority of the crashes.

The project team has adopted the major treatment for the project – implementation of guardrail for run-off-road crashes, highlighted in yellow in Figure 9. Four out of the six eligible crashes were run-off-road. So the ‘majority of crashes’ could be treated through the implementation of guardrail.

The authors acknowledge that the barrier system installed was Ramshield Barrier TL3. This product is referred to as a ‘Flexible’ barrier system and provides more forgiving crash outcomes in comparison to the Type B Guardrail (referred to as a ‘semi-rigid’ barrier system). The Ramshield Barrier TL3 product performs similar to an Ezy-Guard Smart product which, as shown in Figure 9, has a higher CRF (65% highlighted in green) for run-off-road crashes. The authors contend that a higher CRF could have been used for this project, and the 45% is conservative.

Figure 9 CRFs

No	Treatments	CRF for All Casualty Crashes %	CRF for Specific Casualty Crash Type	Treatment Life	Reference No (see list of references at end of listing) and Note
4	Guardrail including on median	40	32% FSI crashes (100km/h) 61% FSI crashes (110km/h) 45% Run off road crashes	20	1
5	Ezy-Guard Smart		18% FSI crashes 65% Run off road crashes	20	VicRoads

The BCR Spreadsheet also automatically calculates the Predicted No. of Serious Injury Crashes Saved p.a. The formula for this figure has been reproduced below:

$$\text{Predicted No. of Serious Injury Crashes Saved p.a.} = \text{No of Serious Injury Crashes p.a.} \times \text{CRF (\%)}$$

There have been 3 run-off-road, Serious Injury Crashes within the 5-year time period (refer to Table 3). Thus the per annum (p.a.) rate is:

$$\text{No of Serious Injury Crashes p.a.} = \frac{3}{5} = 0.6$$

As previously mentioned, the adopted CRF was 45%.

Thus the Predicted No. of Serious Injury Crashes Saved p.a is:

$$\text{Predicted No. of Serious Injury Crashes Saved p.a.} = 0.6 \times 0.45$$

$$\text{Predicted No. of Serious Injury Crashes Saved p.a.} = 0.27$$

As per the BCR Spreadsheet, the treatment life of barrier systems is 20 years. Thus, over the lifetime of this project an estimated 5.4 Serious Injury Crashes have been saved. Within a single Serious Injury Crash, there may be multiple people that sustain Serious Injuries (yet this is still recorded as a single Injury Crash). To this end, the BCR Spreadsheet provides a ratio to convert the number of **crashes** into the number of **people**. As shown in Figure 10, this conversion ratio is 1.168.

Figure 10 BCR Spreadsheet - Crash to Person Conversion Ratio

Crash to Person Conversion ratios (RCIS 2011-15)				
	Fatal	Serious Injury	Other Injury	All Injury
Ratio	1.094	1.168	1.319	1.268

Thus, over the project’s lifetime an estimated 6.3 people will be saved from Serious Injuries.

7. Responses to community concerns

On Tuesday 8 October 2024, 4-5PM a meeting was held at Mornington Peninsula Shire Council’s Rosebud office for selected community members to directly share their concerns with the Black Spot project. The attendees of this meeting have been listed in Table 9. This section of the report has been added to respond to some of the community members feedback regarding the Black Spot project.

Table 9 Meeting attendees

Community Members	Mornington Peninsula Shire Council Staff	Safe System Solutions Pty Ltd
Sam Norris – CFA	Katanya Barlow – Acting Director Planning & Environment	
Elli Tutungi – Eldridge Estate	Brett Whitwam – Acting Manager Strategic & Infrastructure Planning	Max McCardel – Senior Engineer
Carolynn Massola – Red Hill Community Association	Carolyn Lindsey – Acting Team Leader Traffic & Transport	

7.1.1 Crash data referenced within the Black Spot project application are not eligible crashes

The Black Spot project application nominated 6 crashes that have occurred along Arthurs Seat Road over the nominated 5-year period. The authors have conducted a separate, independent crash analysis to verify the crashes that were put forward as part of the application (refer to Table 3) and concluded that the nominated 6 crashes were valid.

The term ‘eligible’ crashes is not explicitly defined within the Federal Black Spot Program guidelines. However, the authors in their professional experience, and in developing and reviewing other Black Spot projects over the past 20 years, have taken ‘eligible’ to mean any crash that has been recorded in the Road Crash Information System (RCIS) Database.

The authors are satisfied that the 6 crashes nominated as part of the Black Spot project were eligible as part of the Black Spot Program. This deduction is further bolstered by the fact that DTP reviewed the crashes and endorsed the application.

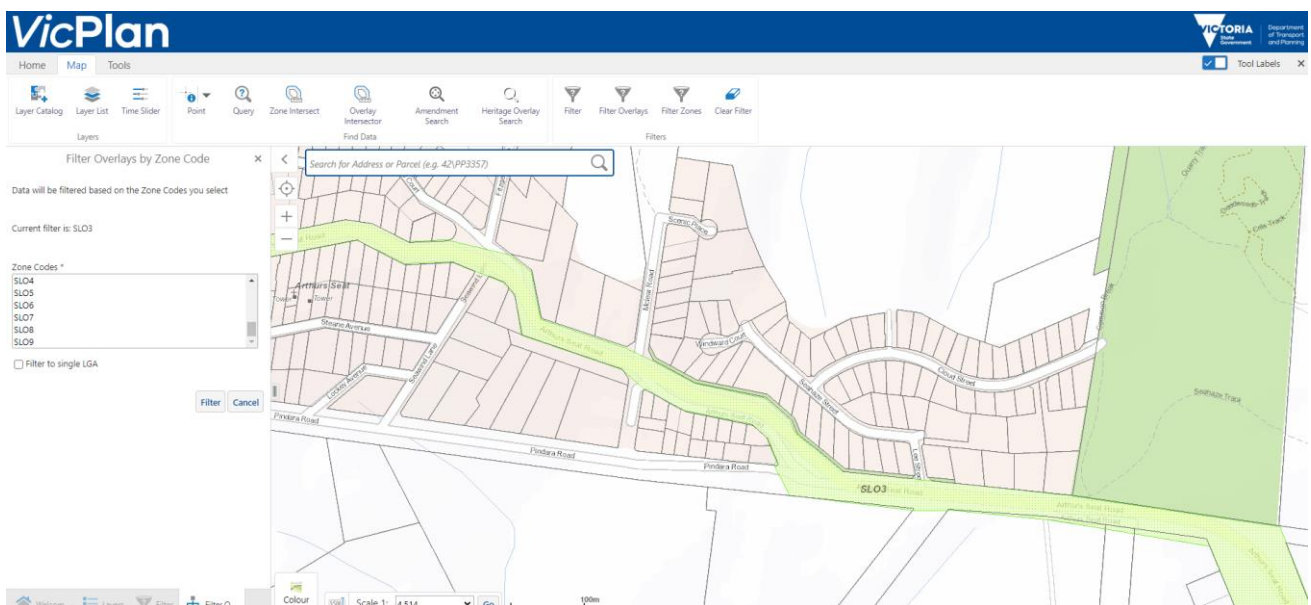
7.1.2 The Scope Approval Report does not mention that Arthurs Seat Road is a ‘Scenic Road Corridor’ under the Victorian Planning Scheme

The site information listed within Section 1.2 of the Scope Approval Report is generally well defined and consistent with other Black Spot applications. The authors acknowledge that there is no mention that Arthurs Seat Road has a ‘Significant Landscape Overlay (SLO3)’ under the Victorian Planning Scheme within this section.

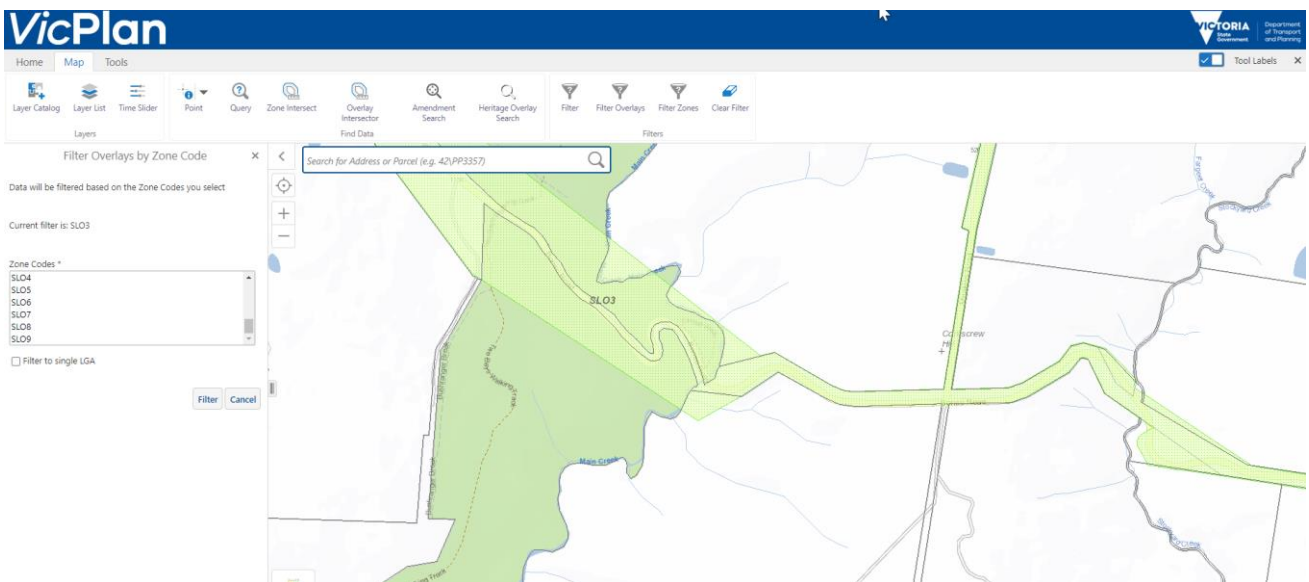
However, the authors are confident that this omission would not have had any effect on the eligibility of the Black Spot project. Other areas of the road network covered with a ‘Significant Landscape Overlay (SLO3)’

have had similar road safety treatments (barrier, underrun protections, curve warning signs, CAMs etc) implemented. A few examples have been provided below:

- 760 Arthurs Seat Road, Arthurs Seat

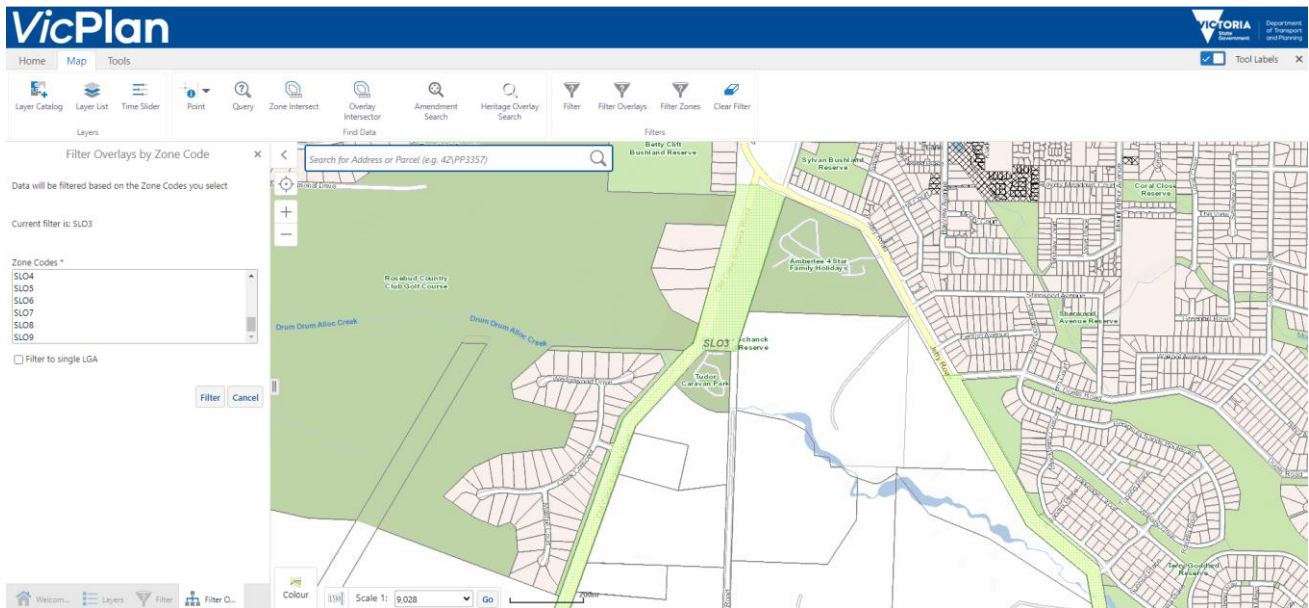


- Boneo Road, Cape Schank



- 189 Old Cape Schanck Rd, Rosebud





The authors are not aware of any Black Spot project that has been rejected on the basis of the road has a Significant Landscape Overlay (SLO3). To this end, the authors are confident the omission of this detail in the Black Spot application would not have affected the eligibility of the project.

7.1.3 The speed reduction to 60km/h should have been included in the Black Spot application

The Black Spot application states a speed limit change was **not** proposed as part of the Black Spot project, and the current 70km/h speed zone would be maintained. The justification for maintaining the current speed limit was:

Speed limit reduction was considered however was dismissed because the local community was not supportive of the proposal.

The authors acknowledge if the speed zone change had been proposed as part of the Black Spot project, this would have made the project's BCR and benefits higher due to:

- Additional crashes could have been included as part of the application, as they were being treated by the speed reduction. For instance, the rear-end crash and the manoeuvring crash.
- An additional CRF (~15%) could have been included as part of the BCR calculation to include the benefit of the speed zone reduction. Below is a snip from the BCR Spreadsheet

Figure 11 BCR Spreadsheet speed limit reduction

No	Treatments	CRF for All Casualty Crashes %
	SPEED LIMIT REDUCTION - Static Signs	
1	100 to 90km/h	
2	100 to 80 km/h	15
3	80 to 60 km/h	20
4	60 to 50 km/h	20
5	All other reductions in speed limit	15

The authors cannot derive why the application states the speed limit reduction was dismissed. However, if the speed limit reduction had been included in the application, the authors contend that this would have strengthened the application further.

7.1.4 Why was Audio Tactile Line Marking discounted as an option?

The Black Spot application lists 'High maintenance cost' and 'Noise issue to nearby properties' as reasons that Audio Tactile Linemarking (ATLM) was discounted.

DTP's RDN 03-10, *Audio Tactile Line Marking* (June 2020) provides a number of issues that may occur with ATLMs, including:

- Cracking of existing seal
- Shattering due to temperature
- Adhesion on older seals
- Adhesion on lower texture seals
- Shattering and plucking due to audio tactile rib mixture

A minimum 0.3m of sealed shoulder behind the audio tactile ribs is also required. Thus, it is reasonable for the application to state the maintenance implications of implementing ATLM.

With regards to the noise issues, the RDN 03-10 also states:

3.3 Noise Considerations

Audio Tactile Line Marking should be stopped 150m from residential dwellings where dwellings are within 150m of the road. Where there is a cluster of residential dwellings, ATLM should be stopped 150m from the first and last residential dwelling that is located within 150m of the road.

While there are sections of Arthurs Seat Road where this noise consideration would not be applicable (as residents are further from the road), acknowledging the noise issues in the application is pertinent.

7.1.5 Could Wire Rope Barrier Systems have been installed?

The authors have not done a detailed review of the locations to confidently state whether Wire Rope Barrier Systems could have been implemented in lieu of the Ramshield Barrier. Detailed site investigation would be required to make this declaration, confirming:

- Batter hinge point
- Offset to hazards
- Deflection of the system
- Post spacing
- Curve radius

However, the authors note that there is currently no approved Wire Rope Barrier System with underrun protection. Underrun protection will virtually eliminate the risk of errant motorcyclists sliding into barrier posts and/or roadside hazards. While Wire Rope Barrier System posts may be fitted with protection, none of these system have been tested and their effectiveness is unknown. Also an errant motorcyclists could still pass in between these posts and collide with roadside hazards. Thus, the decision to implement Ramshield Barrier with a tested and fitted underrun protection system will reduce the severity of motorcycle crashes.

7.1.6 The application stated minimal community engagement - and this was to be following successful funding. How come there was no opportunity to comment on the application prior to its submission?

The application states:

It is anticipated that the community is unlikely to be against the proposal.

The authors note, in their professional experience, and in developing and reviewing other Black Spot projects, that projects involving interventions such as edge barriers, signs, guideposts, RRPMS etc. typically elicit very little community comment. Interventions that typically require greater community engagement include: changes to the roadway, changes to intersection layouts, changes to speed zones, removal of car parking, median barriers, continuous barrier systems, environmental changes (loss of trees / habitat), areas with cultural heritage etc. To this end, the authors do not believe there was negligence or naivety in assuming the community would be unlikely to be against the project.

Nonetheless, understanding the strong connection the community has to this road and adjacent landscape, a more detailed engagement strategy would have been prudent. The authors are of course making this assessment with the benefit of hindsight and are not suggesting that the application was made with disregard of the community's sentiment.

The authors also acknowledge it is common practice when submitting Black Spot applications to conduct community engagement only if the project is successful in securing funding.

7.1.7 The roadside signage is excessive and adds to the visual clutter

The below is an excerpt from AS 1742.2:2022 clause 4.3.1:

Horizontal curves shall be considered to be substandard if the advisory speed of the curve is at least 15 km/h less than the 85th percentile speed on the immediate preceding section of road.

There are several curve warning signs, advisory speed panels and Curve Alignment Markers (CAMs). The authors are not aware whether a ball-bank indicator survey has been conducted along the route and/or 85th percentile speeds have been collected recently at all curves that have been treated. The authors note if the 85th percentile speeds are at or below the speed limit of 60km/h – the curve warning signs, advisory speed panels and CAMs may not be required.

The authors recommend MPSC conduct a ball-bank indicator survey along the route and/or collect 85th percentile speeds at all curves that have been treated with signage to determine the validity of the signage.

7.1.8 Why can't sealed shoulders be implemented in lieu of barriers?

Sealed shoulders do improve the safety performance of roads as they give errant motorists additional time and space to correct their movement. According to DTP's BCR Spreadsheet, sealed shoulders achieve a 30% CRF for run-off road crashes (refer to Figure 12) which is less effective than the installation of a barrier (CRF 45%).

Figure 12 BCR Spreadsheet sealed shoulder CRF

No	Treatments	CRF for All Casualty Crashes %	CRF for Specific Casualty Crash Type
11	Seal shoulder and edgeline from nothing		30% Run off road crashes 14% FSI crashes

Sealed shoulders do reduce the likelihood of run-off road crashes, however the severity remains the same. Conversely, barrier systems are designed to contain errant vehicles and reduce the severity of run-off road crashes. The authors acknowledge both interventions offer road safety benefit, however, barrier systems are more effective in reducing road trauma compared to sealing shoulders alone.

8. Conclusion

This road safety assessment has been undertaken by examining the Black Spot submission documents, publicly available data, referenced guidelines and tools. The authors of this report are qualified engineers and independent from the Black Spot project that was developed at this location.

The authors conclude that the Arthurs Seat Road Black Spot project adheres to the Black Spot Guidelines. While there were sections of the Scope Approval Report that showed inconsistencies or could have been bolstered with more information, the deficiencies were immaterial. Overall, the authors believe the SAR submission adequately covered all the detail required for Federal Black Spot Program and the quality of the report and appendices were suitable.

Additionally, we have employed road safety risk assessment methodologies, namely iRAP and IRR, to analyse the level of risk before the Black Spot project and post-completion. The iRAP Star Ratings increased after consideration of the road safety interventions. The IRR Risk Scores similarly showed a reduction in risk by ~32% with the implementation of the road safety barrier and GREATs. Both assessment methodologies have indicated that the Black Spot project has improved the level of safety for road users.

Finally, we have used a Benefit Cost Ratio tool to estimate the number of casualty crashes saved post-completion. Over the Project's Life Span, 6.3 people in the community will avoid serious injuries (e.g. hospitalisation) as a result of the safety interventions of the Black Spot project.

The authors would like to also acknowledge the trend of intersection crashes occurring at Arthurs Seat Road and White Hill Road. While not considered during the development of the Black Spot project, the recurring crashes at this intersection suggests poor road safety performance. The authors suggest MPSC liaise with DTP to investigate the road safety risks at this intersection and develop appropriate solutions.



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21 October 2024

Appendix A: Site photos

Photo 1: Arthurs Seat Road approximately 200m east of White Hill Road, facing east



Photo 2: Arthurs Seat Road near Red Hill Pre School, facing west



Photo 3: Arthurs Seat Road near Andrews Lane, facing east



Photo 4: Arthurs Seat Road near Andrews Lane, facing west



Photo 5: Arthurs Seat Road adjacent Eldridge Estate, facing east



Photo 6: Arthurs Seat Road adjacent Eldridge Estate, facing west



Photo 7: Arthurs Seat Road approximately 200m east of White Hill Road, facing east (night)



Photo 8: Arthurs Seat Road near Andrews Lane, facing east (night)

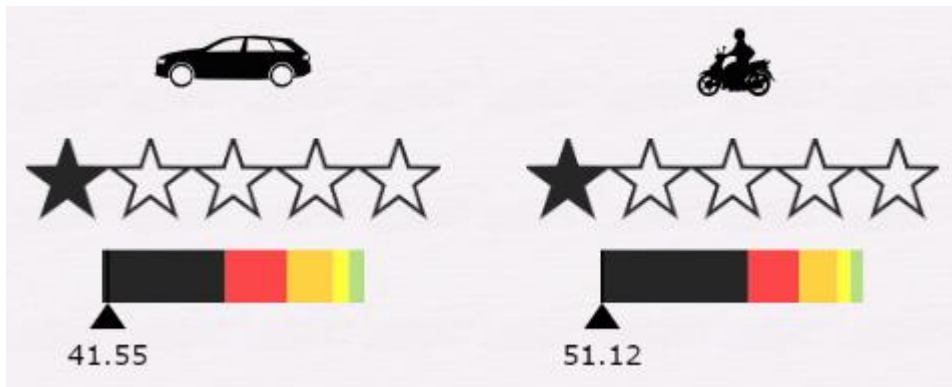


Photo 9: Arthurs Seat Road adjacent Eldridge Estate, facing east (night)



Appendix B: iRAP Inputs

Before upgrade:



	Roadside	Mid-block	Intersections	Flow	VRU facilities and land use	Speeds
Roadside severity - driver-side distance	1 to <5m					
Roadside severity - driver-side object	Tree >=10cm dia.					
Roadside severity - passenger-side distance	1 to <5m					
Roadside severity - passenger-side object	Tree >= 10cm dia.					
Shoulder rumble strips	Not present					
Paved shoulder - driver-side	None					
Paved shoulder - passenger-side	None					

	Roadside	Mid-block	Intersections	Flow	VRU facilities and land use	Speeds
Carriageway label	Undivided road					
Upgrade cost	Low					
Median type	Centre line					
Centreline rumble strips	Not present					
Number of lanes	One					
Lane width	Wide (>= 3.25m)					
Curvature	Sharp					
Quality of curve	Poor					
Grade	>= 0% to <7.5%					
Road condition	Good					

Skid resistance / grip	Sealed - adequate	▼
Delineation	Poor	▼
Street lighting	Not present	▼
Vehicle parking	None	▼
Service road	Not present	▼
Roadworks	No road works	▼
Sight distance	Adequate	▼

					
Intersection type					
None					
Intersection channelisation					
Not present					
Intersecting road volume					
None					
Intersection quality					
Not applicable					
Property access points					
None					

					
Vehicle flow (AADT)					
4000					
Motorcyclist %					
1% - 5%					
Pedestrian peak hour flow across the road					
0					
Pedestrian peak hour flow along the road driver-side					
0					
Pedestrian peak hour flow along the road passenger-side					
0					
Bicyclist peak hour flow					
None					

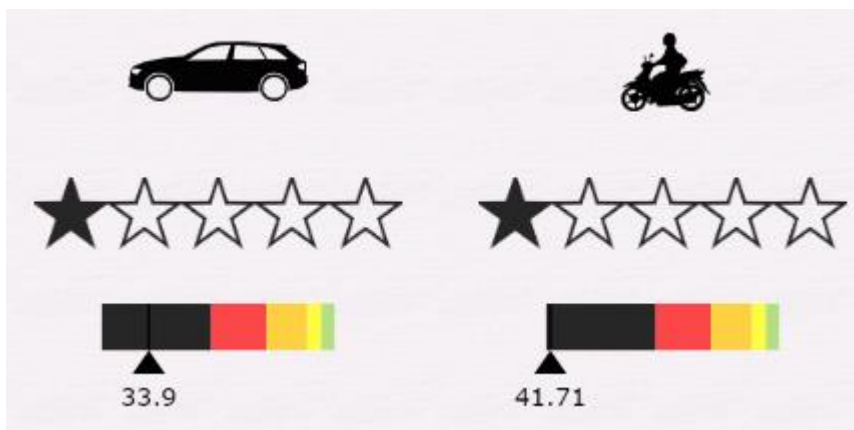
					
Land use - driver-side					
Undeveloped areas					
Land use - passenger-side					
Undeveloped areas					
Area type					
Rural / open area					
Pedestrian crossing facilities - inspected road					
No facility					
Pedestrian crossing quality					
Not applicable					
Pedestrian crossing facilities - intersecting road					
No facility					
Pedestrian fencing					
Not present					
Sidewalk - driver-side					
None					
Sidewalk - passenger-side					
None					
Facilities for motorised two wheelers					
None					

	Speeds
Speed limit	70km/h
Differential speed limits	Not present
Speed management / traffic calming	Not present
Operating Speed (85th percentile)	75km/h

Just speed limit changes:

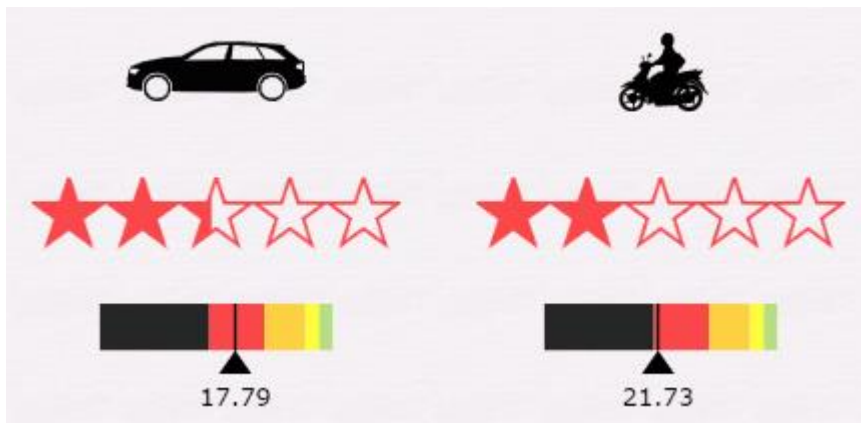
Speed Limit: 60

85thile: 71



	Speeds
Speed limit	60km/h
Differential speed limits	Not present
Speed management / traffic calming	Not present
Operating Speed (85th percentile)	70km/h

Upgrade at original speed limit:



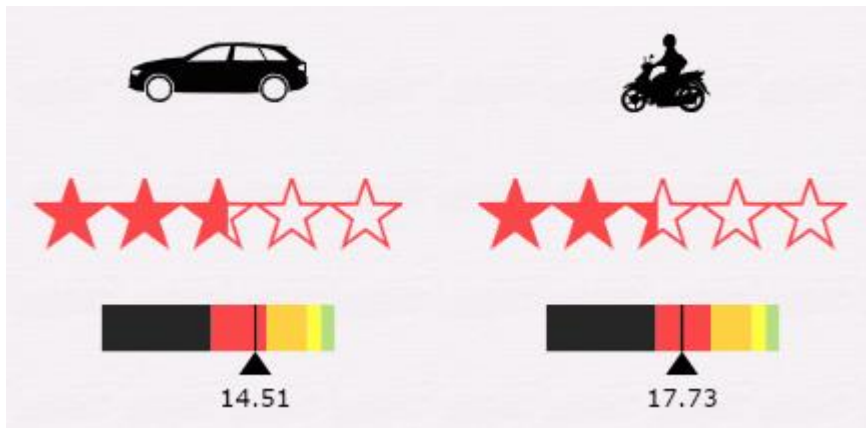
	Roadside	Mid-block	Intersections	Flow	VRU facilities and land use	Speeds
Roadside severity - driver-side distance	1 to <5m					
Roadside severity - driver-side object	Tree >=10cm dia.					
Roadside severity - passenger-side distance	1 to <5m					
Roadside severity - passenger-side object	Safety barrier - motorcycle friendly					
Shoulder rumble strips	Not present					
Paved shoulder - driver-side	None					
Paved shoulder - passenger-side	None					

	Roadside	Mid-block	Intersections	Flow	VRU facilities and land use	Speeds
Carriageway label	Undivided road					
Upgrade cost	Low					
Median type	Centre line					
Centreline rumble strips	Not present					
Number of lanes	One					
Lane width	Wide (>= 3.25m)					
Curvature	Sharp					
Quality of curve	Adequate					
Grade	>= 0% to <7.5%					
Road condition	Good					

Skid resistance / grip	Sealed - adequate
Delineation	Adequate
Street lighting	Not present
Vehicle parking	None
Service road	Not present
Roadworks	No road works
Sight distance	Adequate

(all others same)

Upgrade with speed limit reduction



	Speeds
Speed limit	60km/h
Differential speed limits	Not present
Speed management / traffic calming	Not present
Operating Speed (85th percentile)	70km/h

Appendix C: IRR Tool Outputs

Curve near Arkwells Lane (70km/h):

ARTHURS SEAT ROAD, RED HILL SAFETY IMPROVEMENT PLAN



High Speed Infrastructure Risk Rating

Road Name	Arthurs Seat Road
Location	Arkwells Lane
Between	BEFORE BLACK SPOT PROJECT
Distance	150m
Land use	Rural residential
Score	1.5
Road Sterotype	Two-lane undivided
Score	3.7
Shoulder Width	Very narrow shoulder (0 to <0.5m)
Lane Width	Medium (3.0-3.5m)
Score	1.79
Horizontal Alignment	Curved
Score	1.8
Roadside Hazard	Severe
Score	2.8
Intersection Density	<1 intersection / km
Score	1
Access Density	<1 access / km
Score	1
Traffic Volume	1,000 - <6,000 vehicles per day
Score	1.4
Speed limit	70 km/h
Score	1.25
Infrastructure Risk Rating	1.94
Risk Band	Medium

High Speed Infrastructure Risk Rating

Road Name	Arthurs Seat Road
Location	Arkwells Lane
Between	AFTER BLACK SPOT PROJECT
Distance	150m
Land use	Rural residential
Score	1.5
Road Sterotype	Two-lane undivided
Score	3.7
Shoulder Width	Very narrow shoulder (0 to <0.5m)
Lane Width	Medium (3.0-3.5m)
Score	1.79
Horizontal Alignment	Curved
Score	1.8
Roadside Hazard	Minor
Score	0.67
Intersection Density	<1 intersection / km
Score	1
Access Density	<1 access / km
Score	1
Traffic Volume	1,000 - <6,000 vehicles per day
Score	1.4
Speed limit	70 km/h
Score	1.25
Infrastructure Risk Rating	1.32
Risk Band	Low

Curve near Arkwells Lane (60km/h):

ARTHURS SEAT ROAD, RED HILL SAFETY IMPROVEMENT PLAN



High Speed Infrastructure Risk Rating

Road Name	Arthurs Seat Road
Location	Arkwells Lane
Between	BEFORE BLACK SPOT PROJECT
Distance	150m
Land use	Rural residential
Score	1.5
Road Stereotype	Two-lane undivided
Score	3.7
Shoulder Width	Very narrow shoulder (0 to <0.5m)
Lane Width	Medium (3.0-3.5m)
Score	1.79
Horizontal Alignment	Curved
Score	1.8
Roadside Hazard	Severe
Score	2.8
Intersection Density	<1 intersection / km
Score	1
Access Density	<1 access / km
Score	1
Traffic Volume	1,000 - <6,000 vehicles per day
Score	1.4
Speed limit	60 km/h
Score	0.81
Infrastructure Risk Rating	1.75
Risk Band	Medium

High Speed Infrastructure Risk Rating

Road Name	Arthurs Seat Road
Location	Arkwells Lane
Between	AFTER BLACK SPOT PROJECT
Distance	150m
Land use	Rural residential
Score	1.5
Road Stereotype	Two-lane undivided
Score	3.7
Shoulder Width	Very narrow shoulder (0 to <0.5m)
Lane Width	Medium (3.0-3.5m)
Score	1.79
Horizontal Alignment	Curved
Score	1.8
Roadside Hazard	Minor
Score	0.67
Intersection Density	<1 intersection / km
Score	1
Access Density	<1 access / km
Score	1
Traffic Volume	1,000 - <6,000 vehicles per day
Score	1.4
Speed limit	60 km/h
Score	0.81
Infrastructure Risk Rating	1.13
Risk Band	Low

Curve adjacent 120 Arthurs Seat Road, Red Hill (70km/h):



High Speed Infrastructure Risk Rating

Road Name	Arthurs Seat Road
Location	Curve adjacent 120 Arthurs Seat Road, Red Hill
Between	BEFORE BLACK SPOT PROJECT
Distance	350m
Land use Score	Rural residential 1.5
Road Sterotype Score	Two-lane undivided 3.7
Shoulder Width Lane Width Score	Very narrow shoulder (0 to <0.5m) Medium (3.0-3.5m) 1.79
Horizontal Alignment Score	Curved 1.8
Roadside Hazard Score	Severe 2.8
Intersection Density Score	<1 intersection / km 1
Access Density Score	<1 access / km 1
Traffic Volume Score	1,000 - <6,000 vehicles per day 1.4
Speed limit Score	70 km/h 1.25
Infrastructure Risk Rating Risk Band	1.94 Medium

High Speed Infrastructure Risk Rating

Road Name	Arthurs Seat Road
Location	Curve adjacent 120 Arthurs Seat Road, Red Hill
Between	AFTER BLACK SPOT PROJECT
Distance	350m
Land use Score	Rural residential 1.5
Road Sterotype Score	Two-lane undivided 3.7
Shoulder Width Lane Width Score	Very narrow shoulder (0 to <0.5m) Medium (3.0-3.5m) 1.79
Horizontal Alignment Score	Curved 1.8
Roadside Hazard Score	Minor 0.67
Intersection Density Score	<1 intersection / km 1
Access Density Score	<1 access / km 1
Traffic Volume Score	1,000 - <6,000 vehicles per day 1.4
Speed limit Score	70 km/h 1.25
Infrastructure Risk Rating Risk Band	1.32 Low

Curve adjacent 120 Arthurs Seat Road, Red Hill (60km/h):



High Speed Infrastructure Risk Rating

Road Name	Arthurs Seat Road
Location	Curve adjacent 120 Arthurs Seat Road, Red Hill
Between	BEFORE BLACK SPOT PROJECT
Distance	350m
Land use Score	Rural residential 1.5
Road Sterotype Score	Two-lane undivided 3.7
Shoulder Width Lane Width Score	Very narrow shoulder (0 to <0.5m) Medium (3.0-3.5m) 1.79
Horizontal Alignment Score	Curved 1.8
Roadside Hazard Score	Severe 2.8
Intersection Density Score	<1 intersection / km 1
Access Density Score	<1 access / km 1
Traffic Volume Score	1,000 - <6,000 vehicles per day 1.4
Speed limit Score	60 km/h 0.81
Infrastructure Risk Rating Risk Band	1.75 Medium

High Speed Infrastructure Risk Rating

Road Name	Arthurs Seat Road
Location	Curve adjacent 120 Arthurs Seat Road, Red Hill
Between	AFTER BLACK SPOT PROJECT
Distance	350m
Land use Score	Rural residential 1.5
Road Sterotype Score	Two-lane undivided 3.7
Shoulder Width Lane Width Score	Very narrow shoulder (0 to <0.5m) Medium (3.0-3.5m) 1.79
Horizontal Alignment Score	Curved 1.8
Roadside Hazard Score	Minor 0.67
Intersection Density Score	<1 intersection / km 1
Access Density Score	<1 access / km 1
Traffic Volume Score	1,000 - <6,000 vehicles per day 1.4
Speed limit Score	60 km/h 0.81
Infrastructure Risk Rating Risk Band	1.13 Low