

Pig's Head Corner

Road Safety Audit



October 2016


RAA

**Pig's Head Corner
Road Safety Audit**



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1 Introduction

1.1 Introduction

The Tourist Region Assessment (TRA) program aims to identify road issues, examine potential improvements and where possible, seek potential funding for infrastructure upgrade projects. As part of RAA's TRA program for Kangaroo Island, a stakeholder consultation was conducted on local road issues. Stakeholders included RAA members, Kangaroo Island Council and Kangaroo Island Road Safety Committee as well as other members of the community. Out of the consultation that took place, the intersection of Willson River Road, Blue Gums Road, Doug Road and Moffatt Road, locally known and henceforth referred to as Pigs Head Corner, was identified as an area of concern.

The 2016 TRA for Kangaroo Island proposes to nominate this intersection for black spot funding to facilitate the upgrades necessary to improve safety at this intersection. As part of the black spot funding process, this audit has been conducted by RAA to identify safety issues at the intersection, and where possible, provide recommendations for infrastructure improvements.

1.2 About the Road Safety Audit

A road safety audit is a formal examination of an existing or proposed road or intersection, by an independent and qualified multidisciplinary team. The purpose of the audit is to identify risks and hazards that may result in a collision and provide broad recommendations that will reduce the probability and/or consequence of a collision occurring.

The audit is conducted in accordance with the *Austroads Guide to Road Safety, Part 6: Road Safety Audit*, which defines a multi-stage review process for the audit, and incorporates the following stages:

- Feasibility / Concept Design
- Preliminary Design
- Detailed Design
- Construction (Road Works)
- Pre-Opening to Traffic
- Existing Road Audits

The Road Safety Audit undertaken at Pig's Head Corner is classed as an existing road audit.

1.3 Road Safety Audit Team

The road safety audit team comprised of the following members of staff:



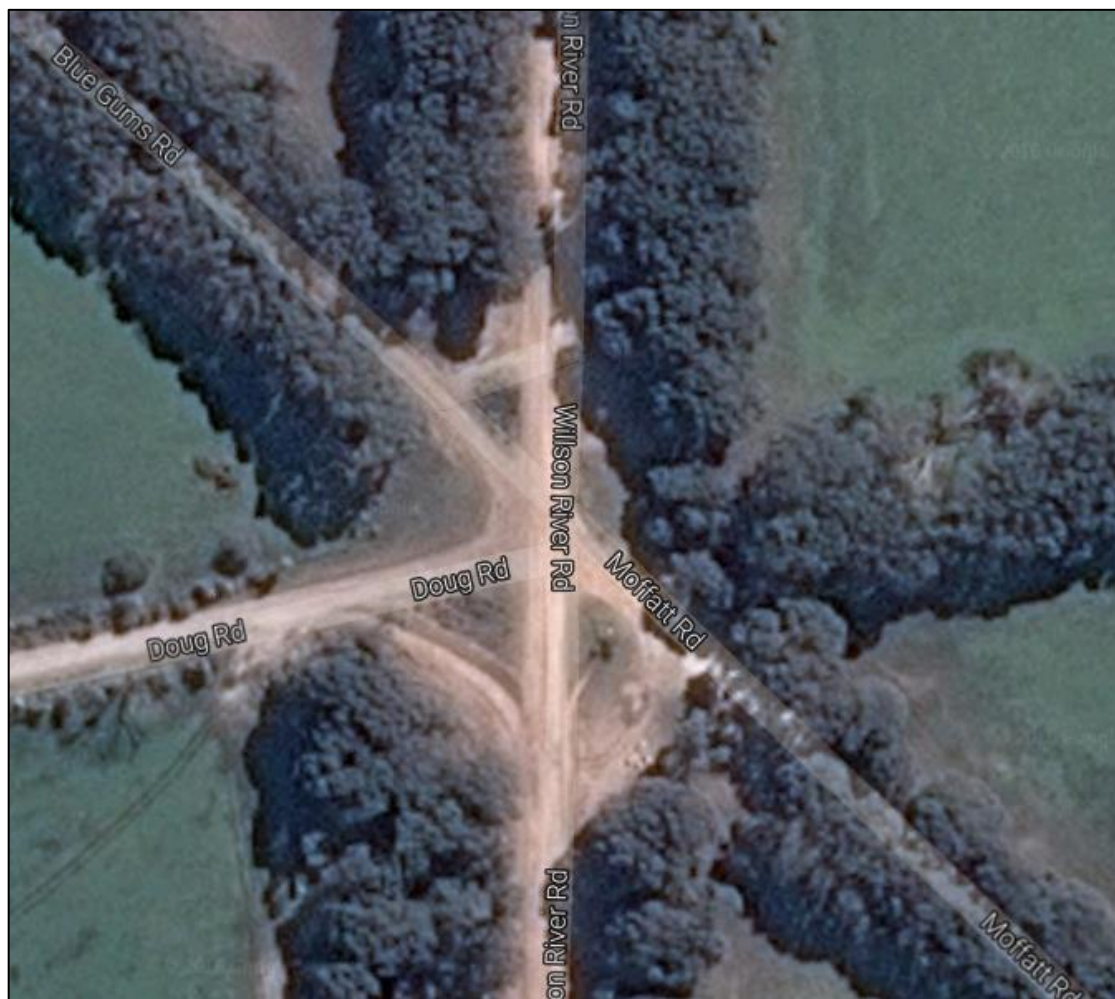
Ian Bishop is a Traffic Engineer at RAA and an accredited road safety auditor. He has over 10 years' experience in Civil & Traffic Engineering including highways, intersection design and modelling, road safety mass action treatments and design and implementation of local area traffic management.



Richard Butler is an Analyst within RAA's Traffic and Safety section. He has been an analyst, for over 10 years. Richard joined the RAA in 2012 and is responsible for the analysis of crash, road quality and survey data. He also conducts and analyses travel time runs across metropolitan Adelaide and has undertaken a number of highway assessments across the state.

1.4 Background

Located in the heart of the Dudley Peninsula on Kangaroo Island, 10km south of Penneshaw, Pig's Head Corner inherited its name from local tradition. Historically, when farmers killed a wild pig, they would mount the pig's head at the intersection. The intersection has five arms, connecting Blue Gums Road, Moffatt Road and Doug Road to Willson River Road. All arms are unsealed and formed from Ironstone material.



Source: Google Maps

Figure 1 – Pig's Head Corner

There have been no reportable crashes at the intersection over the last five years however anecdotal evidence from the community suggests that many property damage crashes or near hit incidents are left unreported. The intersection does not form part of a likely tourism route and primarily serves only members of the community and farm traffic. Nevertheless the intersection has been included in regional assessment program due to the perceived road safety risks.

2 Site Investigation

RAA undertook the Road Safety Audit on 20th September 2016 at 16:00. Weather at the time of the assessment was overcast. There had previously been heavy showers and the pavement surface was saturated. It was noted that there was a high percentage of fine material in the top surface which formed a sludge when saturated and was noticeably slippery under foot at some areas around the intersection.

3 Audit Findings

3.1 General

- a) The pavement appeared to offer a poor trafficable surface when wet with many saturated and boggy areas. A high level of fine material, made the pavement noticeably slippery under foot where water had been laying. RAA undertook a Pavement Friction Assessment (Appendix B) which confirmed a poor level skid resistance. Poor skid resistance may result in vehicles overshooting the intersection or failing to come to a stop before a hazard. It is recommended that the approaches to the intersection are sealed. Additionally, advance warning signs on all approaches should be considered to provide sufficient notice to allow the vehicle to safely stop.



Figure 2 – A poor surface when wet results in reduced skid resistance.

- b) The intersection has many arms converging within a short distance of each other, increasing the number of potential vehicle conflicts. The proximity of Blue Gums Road and Doug Road is a particular issue. When vehicles indicate to turn into either of these roads, it is not clear which of the roads the vehicle may be turning into and may increase the risk of right angle crashes. It is recommended that the intersection is realigned to reduce it to a 4 way staggered intersection.
- c) Moffatt Road and Blue Gums Road form a straight alignment over the intersection and from a distance, appear to be a continuous road. There is a risk of motorists

failing to give way and continuing over the intersection at speed. It is recommended that the intersection is re-aligned to alter the line of sight and make the primary road more conspicuous. Duplication of “GIVE WAY”, “STOP” signs

- d) in conjunction with advanced warning signs could also be considered.



Figure 3 – Blue Gums Road appears to continue straight onto Moffatt Road.

3.2 Willson River Road

- a) The intersection warning sign on Willson River Road is non-compliant and could be confusing to motorists. The sign is also situated too close to the intersection, especially given the default 100km/h limit. It is recommended that the existing sign is removed and a W2-1 sign is installed at the distance prescribed in Table D1 of AS1742.2.



Figure 4 – Intersection warning sign is non-standard and in close proximity to the intersection.

3.3 Moffatt Road

- b) Sight distance to the right along Willson River Road is between 50 and 60m; well below the recommended Safe Intersection Sight Distance (SISD) detailed in AustRoads Guide to Road Design (AGRD). “Give Way” signs are installed at the intersection but there is an increased crash risk due to the restricted sight distance. Because of this, it is recommended that “STOP” signs are installed in accordance with AS1742.2 Figure 2.2.



Figure 5 – Sight distance (northbound) from Moffatt Road is restricted by a crest on Willson River Road.

3.4 Doug Road

- a) Sight distance from Doug Road to the north is restricted by a crest on Willson River Road and is restricted to the south by vegetation. It is therefore recommended that the vertical alignment is altered on Willson River Road to remove the crest, and vegetation trimming or removal is undertaken to the south of the intersection.
- b) There is no “GIVE WAY” sign on Doug Road. Motorists approaching the intersection may not therefore be aware of requirement to give way ahead, increasing the probability of a crash occurring. It is recommended that “GIVE WAY” signs are installed on Doug Road.

3.5 Blue Gums Road

- a) The Approach Sight Distance (ASD) to the intersection is restricted on Blue Gums Road by a crest and falls below the requirements in the AGRD for a road with a speed limit of 100km/h. Despite the “GIVE WAY” sign provided, motorists may not be aware on approach to the intersection that they must give way. It is

recommended that the crest is reduced as far as possible and advance warning signs are provided.




Figure 6 – Poor Approach Sight Distance to the intersection caused by a crest on Blue Gums Road.

- b) Sight distance from Blue Gums Road along Willson River Road is restricted to both the north and south. To the north sight distance is restricted by a crest and to the south, vegetation. It is recommended that the vertical alignment of Willson River Road is altered to the north to remove the crest and vegetation trimming and removal undertaken to the south of the intersection. Additionally, “STOP” signs may be installed in accordance with AS1742.2 Figure 2.2.

4 Summary & Recommendations

The road safety audit at Pigs' Head Corner has identified a number of recommendations, a summary of which is provided in Table 1 below. Suggested priorities have also been included, where 1 is high priority and 3 is low priority. A further table is provided in Appendix A to enable the road authority to respond to the audit.

Table 1 – Summary of Recommendations


Item No.	Risk / Hazard Description	Recommendation	Priority
3.1 – General			
a	Surface condition of the wet pavement is poor and skid resistance falls well below intervention levels. Increases risk of angle and rear end crashes.	<ul style="list-style-type: none"> Seal all approaches to the intersection. 	1
b	Close proximity of intersection arms increases the vehicle conflict points. Increased risk of angle crashes.	<ul style="list-style-type: none"> Realign the intersection to reduce the number of arms to 4. It is recommended that Blue Gums and Doug Road are considered. 	1
c	The sight line continues between Moffatt and Blue Gums Road creating the perception of a continuous road. Increased risk of angle crashes.	<ul style="list-style-type: none"> Realign the intersection to alter the sight lines. Duplicate regulatory signage and install advance warning signs. 	1
3.2 – Willson River Road			
a	The intersection warning sign is non-standard and installed within close proximity to the intersection.	<ul style="list-style-type: none"> Install sign W2-1 at the prescribed distance in AS1742.2. 	2
3.3 – Doug Road			
a	Restricted sight distance caused by a crest to the north and vegetation to the south could increase the crash risk.	<ul style="list-style-type: none"> Remove crest and undertake vegetation removal and trimming. 	2
b	Missing "GIVE WAY" sign on Doug Road.	<ul style="list-style-type: none"> Install "GIVE WAY" signs. 	1

Item No.	Risk / Hazard Description	Recommendation	Priority
3.4 – Blue Gums Road			
a	Sight distance of the intersection is restricted by a crest on Blue Gums Road. Motorists may fail to recognise the intersection as a result.	<ul style="list-style-type: none"> ▪ Remove crest. ▪ Duplicate “GIVE WAY” signs. ▪ Install advance warning signs. 	1
b	Sight distance from Blue Gum Road along Willson’s River Road is restricted to the north and south.	<ul style="list-style-type: none"> ▪ Remove crest and undertake vegetation removal and trimming. 	2

5 Concluding Statement

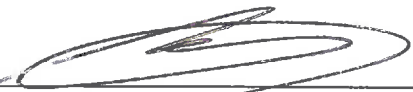
This road safety audit has been conducted by the audit team through an on-site inspection for the purposes of identifying infrastructure and/or environmental issues that may present safety risks for road users.

The identified issues have been noted in this report and the accompanying recommendations have been submitted for the consideration of the road authority.



Ian Bishop
Traffic Engineer
Lead Auditor


14 / 11 / 16



Richard Butler
Traffic & Road Safety Analyst
Audit Team Member

14 / 11 / 16

Reviewed by:




Charles Mountain
Senior Manager Road Safety
Auditor

14 / 11 / 16

Appendix A – Response to Road Safety Audit



Table A1 – Summary of Recommendations and Response to Audit

Item No.	Risk / Hazard Description	Recommendation	Priority	Authority Response
3.1 – General				
a	Surface condition of the wet pavement is poor and skid resistance falls well below intervention levels. Increases risk of angle and rear end crashes.	<ul style="list-style-type: none"> Seal all approaches to the intersection. 		
b	Close proximity of intersection arms increases the vehicle conflict points. Increased risk of angle crashes.	<ul style="list-style-type: none"> Realign the intersection to reduce the number of arms to 4. It is recommended that Blue Gums and Doug Road are considered. 		
c	The sight line continues between Moffatt and Blue Gums Road creating the perception of a continuous road. Increased risk of angle crashes.	<ul style="list-style-type: none"> Realign the intersection to alter the sight lines. Duplicate regulatory signage and install advance warning signs. 		
3.2 – Willson River Road				
a	The intersection warning sign is non-standard and installed within close proximity to the intersection.	<ul style="list-style-type: none"> Install sign W2-1 at the prescribed distance in AS1742.2. 	2	

Item No.	Risk / Hazard Description	Recommendation	Priority	Authority Response
3.3 – Doug Road				
a	Restricted sight distance caused by a crest to the north and vegetation to the south could increase the crash risk.	<ul style="list-style-type: none"> Remove crest and undertake vegetation removal and trimming. 	2	
b	Missing “GIVE WAY” sign on Doug Road.	<ul style="list-style-type: none"> Install “GIVE WAY” signs. 	1	
3.4 – Blue Gums Road				
a	Sight distance of the intersection is restricted by a crest on Blue Gums Road. Motorists may fail to recognise the intersection as a result.	<ul style="list-style-type: none"> Remove crest. Duplicate “GIVE WAY” signs. Install advance warning signs. 	1	
b	Sight distance from Blue Gum Road along Willson’s River Road is restricted to the north and south.	<ul style="list-style-type: none"> Remove crest and undertake vegetation removal and trimming. 	2	

Appendix B – RAA Pavement Friction Assessment



Pig's Head Corner

Pavement Friction Testing Report



November 2016


RAA

Pig's Head Corner Pavement Friction Testing Report



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A	11/11/16	IAB	CM	For Issue.
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Pavement Friction Testing Report

DISCLAIMER

The data contained within this report has been prepared solely to guide road authorities on the performance of their pavement assets.

Any references to vehicle speed and/or stopping distance within this report is for the purposes of assessing and benchmarking pavement infrastructure only. Such references should not be interpreted as driving advice.

Motorists should obey posted speed limits and drive appropriately to the road conditions at all times.

Neither RAA nor any individual author of this publication accepts any responsibility whatsoever for any acts or omissions resulting from reliance upon the content from any part of this publication.

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Pig's Head Corner Pavement Friction Testing Report

1 Introduction

1.1 Introduction

RAA's Tourist Region Assessment (TRA) program aims to identify road safety and traffic issues, examine potential improvements and where possible, seek funding for these improvements. As part of the TRA program for Kangaroo Island, RAA conducted a stakeholder consultation on local road issues. Stakeholders included RAA members and Kangaroo Island Council as well as the local community and road safety group. Out of the consultation that took place, the intersection of Willson River, Blue Gums, Doug and Moffatt Road, locally known and henceforth referred to as Pigs Head Corner, was identified as an area of concern.

The 2016 TRA for Kangaroo Island proposes to nominate the intersection for black spot funding to provide road safety improvements. A Road Safety Audit was conducted by HDS Australia in March 2015 which highlighted a number of issues including sight distance at the intersection. Although pavement issues were not identified as part of the audit, a visual inspection conducted by RAA suggested a high proportion of fine material on the surface. As a result of the poor sight distance on some arms and in support of a black spot funding nomination, RAA have undertaken a pavement friction assessment to determine the level of friction provided by the pavement and the potential resultant braking distances.

1.2 About the Pavement Friction Assessment

The purpose of the Pavement friction Assessment is to determine the Coefficient of Friction (CoF), or level of grip, between the pavement surface and a vehicle. A high CoF is critical on curves, to prevent the vehicle sliding, as well as other areas where good braking performance is required, for example approaches to intersections.

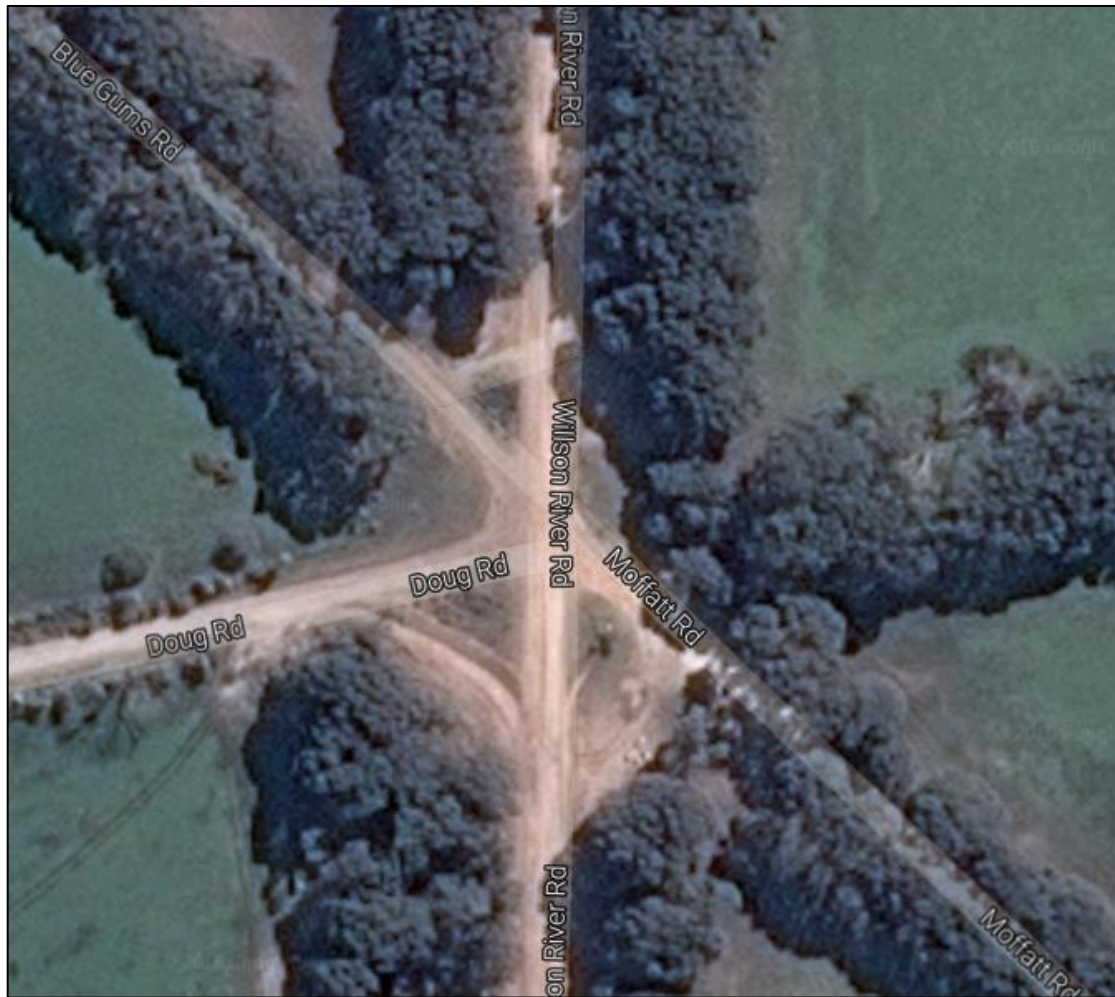
The CoF in its simplest term is a rate of deceleration and is measured relative to gravity (G).

When undertaking the assessment, the vehicle's ABS is enabled. This allows the 20% slip friction to be measured. This means that for the distance the vehicle is braking, 20% of the distance reached is through skidding while the remainder is through tyre rotation. The 20% slip value is the absolute maximum level of friction that can be achieved and any lateral force greater than this will cause the vehicle to slide. ABS represents how a majority of Australia's vehicle fleet will operate under normal conditions and therefore represents the default position for testing.

1.3 Background

Located in the heart of the Dudley Peninsula on Kangaroo Island, Pig's Head Corner inherited its name from local tradition. Historically, when farmers killed a wild pig, they would mount the Pig's head at the intersection. The intersection has five arms, connecting Blue Gums Road, Moffat Road and Doug Road to Willson River Road. All arms are unsealed, formed from Ironstone material.

Pig's Head Corner Pavement Friction Testing Report



Source: Google Maps

Figure 1 – Pig's Head Corner

Over the last five years, there haven't been any reported crashes at the intersection however it is understood that unless a fatal or serious injury occurs, many crashes on Kangaroo Island involving property damage go unreported.

Pig's Head Corner Pavement Friction Testing Report

1.4 About the Assessment

RAA conducted the skid test assessment on 20 September 2016 at 16:00. Weather at the time of the assessment was overcast. There had previously been heavy showers and the pavement surface was saturated. It was noted that there was a high percentage of fine material in the top surface which formed a sludge when saturated and was noticeably slippery under foot at some areas around the intersection.

1.5 Assessment Procedure

The assessment procedure involves mounting a Vericom VC4000DAQ accelerometer to an RAA survey vehicle. To obtain the coefficient of friction, the vehicle accelerates to a target speed of between 50 and 60km/h. When the vehicle reaches the section of pavement to be tested, the driver hits the pedal as hard as possible in one continuous application, leaving the ABS to manage the braking and wheel lock. This places the vehicle into a controlled skid and once stopped, the VC4000 outputs a value for the coefficient of friction, based on the rate of deceleration.

The test is repeated a minimum of 3 times, ensuring each value recorded is within 10% of the median and the results of all tests are averaged.

For the friction tests at Pig's Head Corner, tests were undertaken on the side arms, with emergency braking applied just after the Give Way sign. Moffatt Road continues onto Blue Gums Road and at a distance, it can be difficult to distinguish the presence of the intersection. The location of the skid test attempted to simulate an inattentive motorist who perhaps doesn't notice the intersection until they are almost upon it. Braking performance should be sufficient to bring a vehicle to a safe stop when brakes are applied between the advance warnings and give way signs when the vehicle is travelling at the posted limit.

2 Results

2.1 Friction Supply

The peak friction supply results recorded during the tests are shown in Table 1.

Table 1 – Pavement Test Results

Site	Test Run	Coefficient of Friction (G)
Moffatt Road Approach	1	0.319
	2	0.288
	3	0.275
	Average	0.294

Pig's Head Corner Pavement Friction Testing Report

The results indicate a very poor level of skid resistance. A comparison of typical results expected from different pavement surfaces in wet weather is shown in Table 2. It is likely that the poor results observed are a combination of the marble-like shape of the Ironstone material together with the high percentage of saturated fines.

Table 2 – Wet Weather Pavement Material Comparison

Test Site (Ironstone) Wet Weather Average (G)	Typical Wet Weather Unsealed Limestone (G)	Typical Wet Weather Sealed Road (G)
0.294	0.500 - 0.600	0.800 – 0.900

The RTA/VicRoads have defined SCRIM intervention levels for various infrastructure sites. According to the correlated values, maintenance is required on approach to intersections when the coefficient of friction is found to be 0.45 or below. Pigs Head Corner therefore falls well below the recommended intervention levels and pavement upgrades should be considered for the intersection.

2.2 Calculated Braking Distances

From the data collated, expected skid-to-stop braking distances can be calculated for the pavement using the following formula:

$$D = \frac{S^2}{254 * f}$$

Where

D = Distance (m)

S = Speed (km/h)

f = Coefficient of Friction (G)

Based on the formula, the stopping distances shown in Table 3 have been calculated. These are the absolute minimum stopping distances achieved by emergency braking on the subject pavement and an average sealed pavement. The results show that the stopping distance achieved at the site is over 2.5 times greater than stopping under similar circumstances on an average sealed road. The figures below do not allow for the distance travelled during the driver's reaction time. An additional 30% should be added to these totals to account for a driver reaction time of 2 seconds.

Pig's Head Corner Pavement Friction Testing Report

Table 3 - Calculated Skid-to-Stop Distances by Speed

Speed (km/h)	Test Site (0.294G) Calculated Wet Stopping Distance (m)	Typical Bitumen Road (0.8G) Calculated Wet Stopping Distance (m)
40	21.4	7.9
50	33.5	12.3
60	48.2	17.7
70	65.6	24.1
80	85.7	31.5
90	108.5	39.9
100	133.9	49.2

For the purposes of determining signage requirements the road authority should assess whether the posted limit can be achieved on approach to the intersection. It may be appropriate to consider requirements based on the measured 85th percentile speed. Placement of advance warning signs are given in Table D1 of AS 1742.2 however where the stopping distances above are greater than the distances provided in AS1742, it is recommended that the distances calculated from the pavement testing (and factoring in reaction time), should be used. Under such circumstances, it may be appropriate to install additional advance warnings signs.

3 Summary

Pavement friction testing at the Pig's Head Corner intersection has proven the unsealed surface is substandard in accordance with minimum friction intervention levels expected on approach to intersections.

The marble-like structure of the Ironstone material combined with a high percentage of fine surface material significantly reduces skid resistance when the pavement is wet.

Testing has also determined that the overall stopping distances at various speed are significant and there is a need to undertake a risk assessment based on the measured vehicle speeds on each of the arms. At 100km/h, the overall stopping distance, including reaction time, is likely to be a minimum of around 170m.

It is therefore recommended that the pavement is sealed, to significantly increase the coefficient of friction necessary for effective braking. If sealing the pavement is not economically viable, the use of different unsealed materials (such as limestone) on the approaches could significantly improve braking performance.

It is also recommended that advanced warning signs are provided at sufficient distance from the intersection to allow safe and controlled deceleration on approach, ensuring the vehicle can stop before the hold point.