



RAA Regional Road Assessment

# Eyre Peninsula



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# Contents

<b>Executive Summary</b>	<b>1</b>
<b>1 Traffic Volumes</b>	<b>4</b>
<b>2 Crash Map</b>	<b>5</b>
<b>3 Lincoln Highway</b>	<b>7</b>
3.1 Traffic Volumes	7
3.2 Crash History	7
3.3 Eyre Highway to Whyalla	9
3.3.1 Lane Widths and Lines	9
3.3.2 Signs and Delineation	9
3.3.3 Pavement Condition	9
3.3.4 Roadside Hazards	9
3.3.5 Recommendations	10
3.4 Whyalla to Cowell	10
3.4.1 Lane Widths and Lines	11
3.4.2 Signs and Delineation	11
3.4.3 Pavement Condition	11
3.4.4 Roadside Hazards	11
3.4.5 Recommendations	12
3.5 Cowell to Arno Bay	12
3.5.1 Lane Widths and Lines	12
3.5.2 Signs and Delineation	13
3.5.3 Pavement Condition	13
3.5.4 Roadside Hazards	13
3.5.5 Recommendations	13
3.6 Arno Bay to Port Lincoln	13
3.6.1 Lane Widths and Lines	14
3.6.2 Signs and Delineation	14
3.6.3 Pavement Condition	14
3.6.4 Roadside Hazards	14
3.6.5 Recommendations	15
<b>4 Flinders Highway</b>	<b>16</b>
4.1 Traffic Volumes	16
4.2 Crash History	16

4.3	Port Lincoln to Elliston	18
4.3.1	<i>Lane Widths and Lines</i>	18
4.3.2	<i>Signs and Delineation</i>	18
4.3.3	<i>Pavement Condition</i>	19
4.3.4	<i>Roadside Hazards</i>	19
4.3.5	<i>Recommendations</i>	20
4.4	Elliston to Streaky Bay	20
4.4.1	<i>Lane Widths and Lines</i>	20
4.4.2	<i>Signs and Delineation</i>	21
4.4.3	<i>Pavement Condition</i>	21
4.4.4	<i>Roadside Hazards</i>	21
4.4.5	<i>Recommendations</i>	22
4.5	Streaky Bay to Ceduna	22
4.5.1	<i>Lane Widths and Lines</i>	23
4.5.2	<i>Signs and Delineation</i>	23
4.5.3	<i>Pavement Condition</i>	23
4.5.4	<i>Roadside Hazards</i>	23
4.5.5	<i>Recommendations</i>	24
<b>5</b>	<b>Birdseye Highway</b>	<b>24</b>
5.1	Traffic Volumes	24
5.2	Crash History	25
5.3	Elliston to Lock	26
5.3.1	<i>Lane Widths and Lines</i>	27
5.3.2	<i>Signs and Delineation</i>	27
5.3.3	<i>Pavement Condition</i>	28
5.3.4	<i>Roadside Hazards</i>	28
5.3.5	<i>Recommendations</i>	29
5.4	Lock to Cowell	29
5.4.1	<i>Lane Widths and Lines</i>	29
5.4.2	<i>Signs and Delineation</i>	30
5.4.3	<i>Pavement Condition</i>	30
5.4.4	<i>Roadside Hazards</i>	30
5.4.5	<i>Recommendations</i>	31
<b>6</b>	<b>Tod Highway</b>	<b>31</b>
6.1	Traffic Volumes	31
6.2	Crash History	31
6.3	Kyancutta to Lock	33
6.3.1	<i>Lane Widths and Lines</i>	34
6.3.2	<i>Signs and Delineation</i>	34

6.3.3	<i>Pavement Condition</i>	34
6.3.4	<i>Roadside Hazards</i>	34
6.3.5	<i>Recommendations</i>	35
6.4	Port Lincoln to Lock	35
6.4.1	<i>Lane Widths and Lines</i>	35
6.4.2	<i>Signs and Delineation</i>	35
6.4.3	<i>Pavement Condition</i>	36
6.4.4	<i>Roadside Hazards</i>	36
6.4.5	<i>Recommendations</i>	36
<b>7</b>	<b>Bratten Way</b>	<b>37</b>
7.1	Traffic Volumes	37
7.2	Crash History	37
7.3	Tumby Bay to Cummins	38
7.3.1	<i>Lane Widths and Lines</i>	39
7.3.2	<i>Signs and Delineation</i>	39
7.3.3	<i>Pavement Condition</i>	39
7.3.4	<i>Roadside Hazards</i>	39
7.3.5	<i>Recommendations</i>	40
7.4	Cummins to Flinders Highway (East-West)	40
7.4.1	<i>Lane Widths and Lines</i>	40
7.4.2	<i>Signs and Delineation</i>	41
7.4.3	<i>Pavement Condition</i>	41
7.4.4	<i>Roadside Hazards</i>	42
7.4.5	<i>Recommendations</i>	42
<b>8</b>	<b>Streaky Bay Highway</b>	<b>43</b>
8.1	Traffic Volumes	43
8.2	Crash History	43
8.3	Streaky Bay to Poochera	45
8.3.1	<i>Lane Widths and Lines</i>	45
8.3.2	<i>Signs and Delineation</i>	45
8.3.3	<i>Pavement Condition</i>	45
8.3.4	<i>Roadside Hazards</i>	45
8.3.5	<i>Recommendations</i>	46
<b>9</b>	<b>Kimba – Cleve Road</b>	<b>46</b>
9.1	Traffic Volumes	46
9.2	Crash History	46
9.2.1	<i>Lane Widths and Lines</i>	48
9.2.2	<i>Signs and Delineation</i>	48

9.2.3	<i>Pavement Condition</i>	49
9.2.4	<i>Roadside Hazards</i>	49
9.2.5	<i>Recommendations</i>	49
<b>10</b>	<b>Arno Bay Road</b>	<b>50</b>
10.1	<i>Traffic Volumes</i>	50
10.2	<i>Crash History</i>	50
10.3	<i>Lane Widths and Lines</i>	51
10.4	<i>Signs and Delineation</i>	51
10.5	<i>Pavement Condition</i>	51
10.6	<i>Roadside Hazards</i>	52
10.7	<i>Recommendations</i>	52
<b>11</b>	<b>Coffin Bay Road</b>	<b>52</b>
11.1	<i>Crash History</i>	52
11.2	<i>Crash History</i>	52
11.3	<i>Lane Widths and Lines</i>	53
11.4	<i>Signs and Delineation</i>	53
11.5	<i>Pavement Condition</i>	54
11.6	<i>Roadside Hazards</i>	54
11.7	<i>Recommendations</i>	54
<b>12</b>	<b>Summary and Recommendations</b>	<b>55</b>
	<b>Appendix A - Pavement Performance Factors</b>	<b>58</b>

## Executive Summary

RAA undertook a regional roads assessment of the Eyre Peninsula in October 2014. The assessment sought to review the driveability and infrastructure provided on both the Lincoln Highway and the other B-class roads that serve as key transport corridors, connecting the Peninsula. The assessment considered the level of safety built into the route and outlined a number of recommendations for safety improvements.

Traffic volumes across the Peninsula vary with the functional classification of the road. The main arterial route into the Peninsula is the Lincoln Highway which supports an average daily traffic volume of 1,780 vehicles, but this increases to 2,000 vehicles per day around Whyalla and up to 3,500 on approach to Port Lincoln. The Flinders Highway ranks as having the second highest volume with the majority of traffic (2,100 vpd) travelling between Port Lincoln and Coffin Bay while the Tod Highway also supports a relatively high volume (775 vpd) travelling between Cummins and the Flinders Highway. The traffic has increased across the Peninsula by approximately 10.4% over the last five years. On average, heavy vehicles make up about 18.5% of the total traffic across the Peninsula. The total volume of heavy vehicles has increased by 45% over the last five years reflecting the growing agricultural and grain industries.

With a few exceptions, the majority of the fatal crashes occur on the B-class or minor road network which is likely to reflect the reduced safety infrastructure on these lower volume routes. The Flinders Highway between Port Lincoln and Coffin Bay also has a high crash history and a number of fatal crashes have occurred on this route. When this is compared to the Lincoln Highway, with similar traffic volumes but no fatal crashes in the last five years, it suggests that targeted infrastructure safety improvements may be required on the Flinders Highway between Port Lincoln and Coffin Bay.

RAA's 2014 regional road assessment of the Eyre Peninsula sought to review the driveability and infrastructure provided on both the Lincoln Highway and the other B-class roads that serve as key transport corridors, connecting the Peninsula. The assessment considered the level of safety built into the route and outlined a number of recommendations for safety improvements. Table 12 provides a summary of the recommendations for the roads on the Eyre Peninsula.

A number of key issues were identified during the assessment, which include, but not limited to:

- Width of shoulder seals
- The requirement for barrier protection
- The requirement for pavement and unsealed shoulder rehabilitation

A summary of the recommendations across the Peninsula is provided in Table 1 below. Many of the crashes that occur on the Peninsula involve vehicles hitting fixed object or rollovers, indicating that driver fatigue and inattention is a growing problem together with an unforgiving road environment in places. The extension of sealed shoulders, particularly in combination with audio tactile line marking, will afford drivers a greater opportunity to recover if their vehicle starts to drift from the road and will assist in lowering the number of crashes, due to run-off and rollover.

While crash barrier systems are widely used across the Peninsula, the assessment identified that there were inconsistencies in their application. Some low severity hazards have been protected by a barrier system while others, particularly steep embankments over five metres high have not. In the long term, mass action treatments have proven to be a more effective approach at addressing road safety infrastructure and it is hoped that funds permitting, this model may be adopted in the future.

The assessment noted the need for overtaking lanes to be constructed along the Lincoln Highway but particularly between Whyalla and Port Augusta. While there are a number of straight sections along the highway, the traffic volumes in both directions reduce the available overtaking opportunities. It is noted that Whyalla Council is now calling for overtaking lanes to be constructed to reduce crashes on this section of route. RAA has called for overtaking lanes since *Towards 2020* but acknowledge that this is a long term requirement. Roadway departures continue to be the highest crash type on the Lincoln Highway and countermeasures in the short to medium term should address preventing and minimising the severity of run-off road and roll over crashes.

The posted speeds on the Peninsula of 110km/h and 100km/h were generally found to be appropriate for the road conditions with two exceptions. It was felt that on the Birdseye Highway, between Lock and Cowell, the speed limit should be reduced from 110km/h to 100km/h for approximately 15km west of Cowell. This reduction should assist in reducing the crash risk and severity resulting from the series of bends with steep drops on either side of the road along that section of the highway. A reduction of 110km/h to 100km/h is also recommended for Bratten Way between Tumby Bay and Cummins due to the frequency and severity of roadside hazards.

RAA acknowledges the limited funding options for the regional road network. At a time when it is a challenge to secure funding to upgrade the national highway network a minimum 3-star safety rating, the opportunity to achieve such goals on the state and regional network appears bleak. RAA will continue to lobby the Federal Government for increased funding to the state to enable regional mass action treatments to be undertaken. Until then, treatments require careful selection to maximise the safety benefit and return on the infrastructure funding.



### Table 1 – Summary of Recommendations

		Road Geometry & Pavement				Signs				Linemarking			Delineation			Intersections		Hazard Protection		Rest Areas					
Highway	Section	Shoulder seal extension	Pavement rehabilitation	Unsealed shoulder rehabilitation	Drainage improvements	Construction of overtaking lanes	Review / Install intersection warning signage	Review / Install bend warning signage	Review / install speed signage	Speed reduction to 100km/h	Installation of distance signage	Refresh linemarking	Line marking corrections	Application of edge lines	Audio Tactile Line Marking (ATLM)	Additional hazard marker posts	Install Chevron Alignment Markers (CAMs) on bends	Raised Reflective Pavement Markers (RRPMs)	Intersection upgrades	Rail crossing upgrade	Barrier Protection	Vegetation trimming / removal	Explore installation of additional rest stops	Upgrade existing rest areas with seating	Upgrade existing key rest areas (shelter & LED lighting)
Lincoln Highway	Port Augusta to Whyalla	✓				↖									↖	↖									
	Whyalla to Cowell		✓	✓		↖																			
	Cowell to Tumby Bay		✓		✓	↖																			
	Tumby Bay to Port Lincoln	✓	✓			✓	✓												✓		✓				✓
Flinders Highway	Port Lincoln to Elliston	✓		✓								↖	↖		↖①		↖		✓			✓		✓	
	Elliston to Streaky Bay														✓						✓			✓	
Tod Highway	Streaky Bay to Ceduna	✓	✓	✓								↖			✓						✓				✓
	Kyancutta to Lock	✓	✓	✓										✓							✓				✓
Birdseye Highway	Flinders Highway to Lock	✓	✓	✓										✓							✓				
	Elliston to Lock																				✓				
Bratten Way	Lock to Cowell	✓①	✓						✓②					✓①							✓				
	Tumby Bay to Cummins	✓							✓						✓						✓				
Streaky Bay Highway	Cummins to Flinders Hwy	✓	✓								✓				✓						✓				
	Streaky Bay to Poochera	✓												✓											
Cleve Road	Kimba to Cleve		✓					✓							✓①		✓		✓①						
	Cleve to Arno Bay		✓				✓	✓							✓①				✓①		✓				
Coffin Bay Road	Flinders Highway to Coffin Bay															✓①					✓				

① Application of treatment should be prioritised on bends.

② At specific locations identified in report.

# 1 Traffic Volumes

The traffic volumes throughout the Eyre Peninsula are summarised in Table 2 below. Being the main arterial route into the Peninsula and attracting a large tourist base to Port Lincoln, the Lincoln Highway supports the greatest volume of traffic with an average daily traffic volume of 1,780 vehicles along the entire highway with up to 2,000 vehicles per day around Whyalla and up to 3,500 on approach to Port Lincoln. The Flinders Highway has the second highest volume with the majority of traffic (2,100 vpd) travelling between Port Lincoln and Coffin Bay while the Tod Highway also supports a relatively high volume (775 vpd) travelling between Cummins and the Flinders Highway. The traffic has increased across the Peninsula by approximately 10.4% over the last five years.

On average, heavy vehicles make up about 18.5% of the total traffic across the Peninsula. The total volume of heavy vehicles has increased by 45% over the last five years reflecting the growing agricultural, grain and mining industries.

**Table 2- Summary of Traffic Volumes**

Highway/Road	Road Section	Average Annual Daily Traffic	Average No. Heavy Vehicles	Percentage Heavy Vehicles %
Lincoln Highway	Port Augusta to Whyalla	2000	370	18.5
	Whyalla to Cowell	1100	230	21
	Cowell to Tumby Bay	800	140	17.5
	Tumby Bay to Port Lincoln	1500-3500	300	8.5-20
Flinders Highway	Port Lincoln to Coffin Bay Road	2100	330	15.5
	Coffin Bay Road to Elliston	300	39-180	14-33
	Elliston to Streaky Bay	390	47-110	14.5-24
	Streaky Bay to Ceduna	490	90-130	19-26
Tod Highway	Kyancutta to Lock	250	65	26
	Lock to Cummins	240	100	18
	Cummins to Flinders Hwy	775	180	25
Birdseye Highway	Elliston to Lock	139	16	11.5
	Lock to Cleve	350	25	15
	Cleve to Cowell	80-160	43	16.5
Bratten Way	Tumby Bay to Cummins	290	60	20.5
	Cummins to Flinders Hwy	290	60	20.5
Streaky Bay Highway	Streaky Bay to Poochera	250	49	19.5
Cleve Road	Kimba to Cleve	210	27	13
Arno Bay Road	Cleve to Arno Bay	380	75	19

## **2 Crash Map**

The map shown in Figure 1 summarises the type of crashes and their locations across the Peninsula. The highest number of crashes occurs along the Lincoln and Eyre Highway which reflects the high traffic volumes typical of these roads. The map also shows that with few exceptions on the Eyre Highway, the majority of the fatal crashes occur on the B-class or minor road network which may reflect on the standard of infrastructure and nature of roadside hazards along these roads. The Flinders Highway between Port Lincoln and Coffin Bay also shows a high number of crashes together with fatality crash types. This is perhaps also a function of the traffic volume along this section of the Flinders Highway; however the relative number of fatal and serious injury crashes is a clear indication that infrastructure improvements are required there.

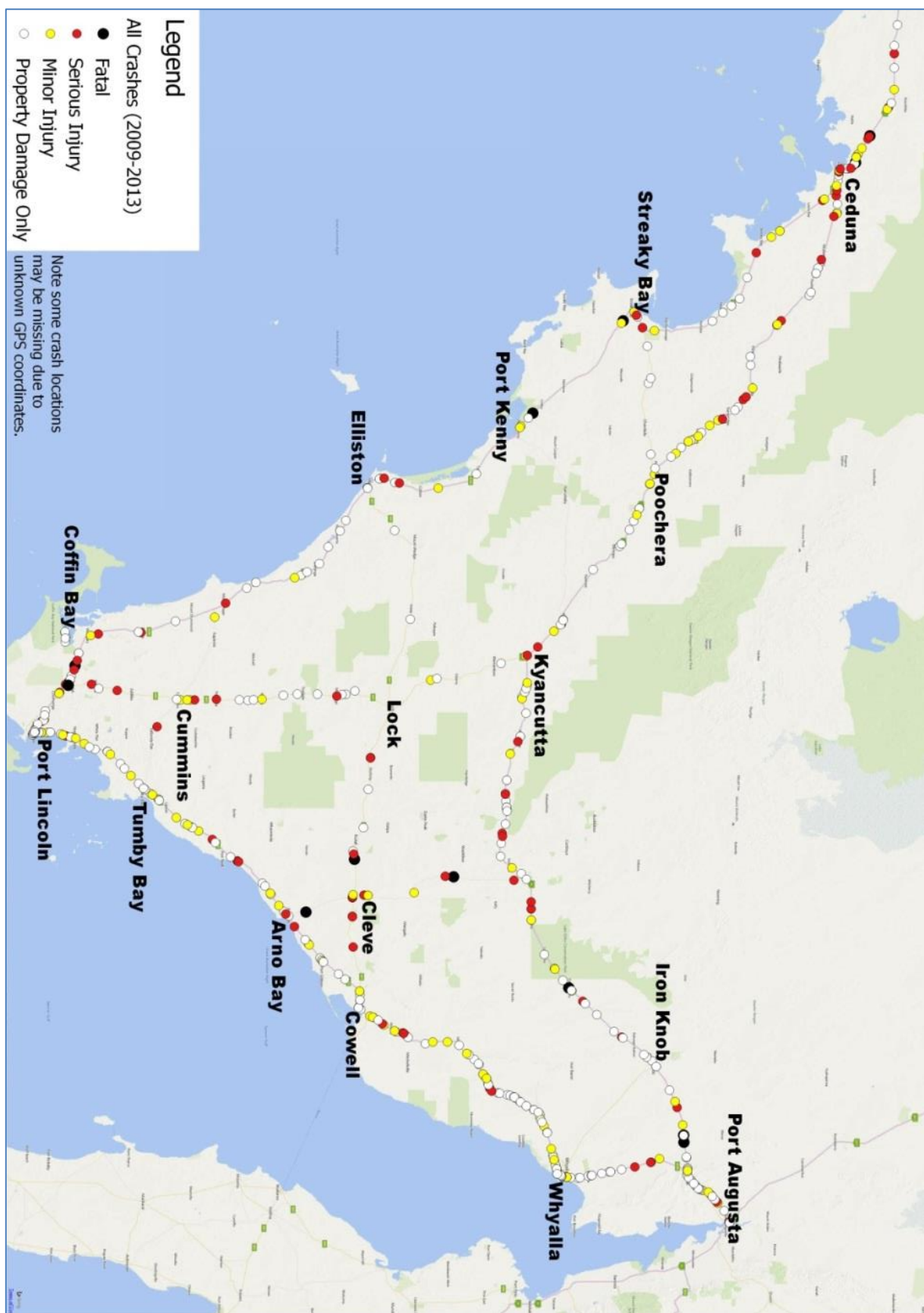


Figure 1 - Eyre Peninsula Crash Summary Map

## 3 Lincoln Highway

### 3.1 Traffic Volumes

The traffic volumes along the Lincoln Highway vary between 800 and 2,500 vehicles per day. The average volume along the highway has increased by 10.8% in the last 5 years. The average number of heavy vehicles has increased by just over 6% and heavy vehicles now make up just over 16% of the total traffic composition. RAA previously identified in *Towards 2020* the need for overtaking lanes. The present traffic volumes continue to support this recommendation, particularly along sections such as Port Augusta to Whyalla where traffic volumes restrict the overtaking opportunities.

### 3.2 Crash History

The number of crashes on the Lincoln Highway peaked at 83 in 2009 but has fallen to 63 in 2013. The top three crash types are:

- Right angle (79 crashes)
- Hit fixed object (75 crashes)
- Rear end (51 crashes)

The crash history suggests that the priorities are upgrading key intersections, barrier protection from drops and significant roadside objects, and protected turn lanes at intersections with high volumes of turning movements.

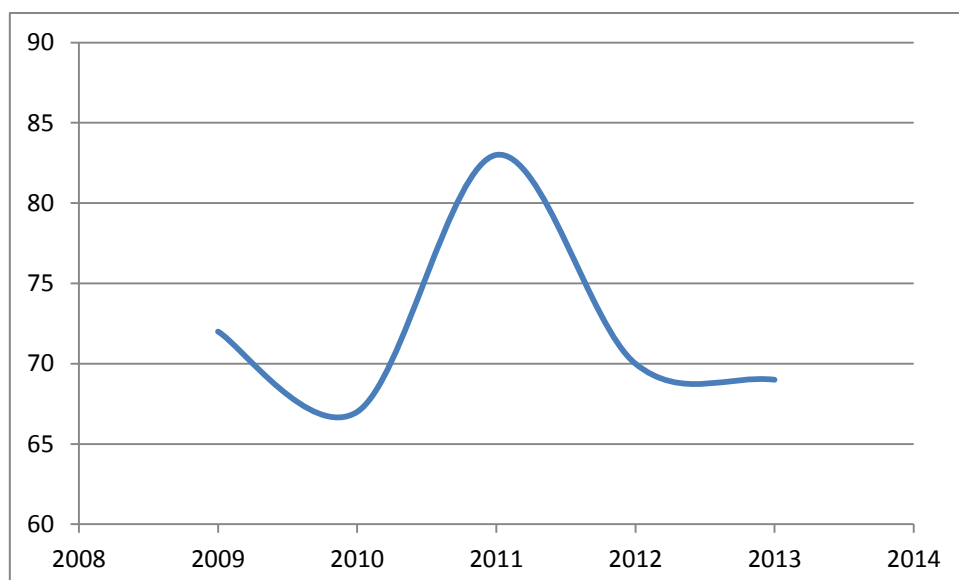
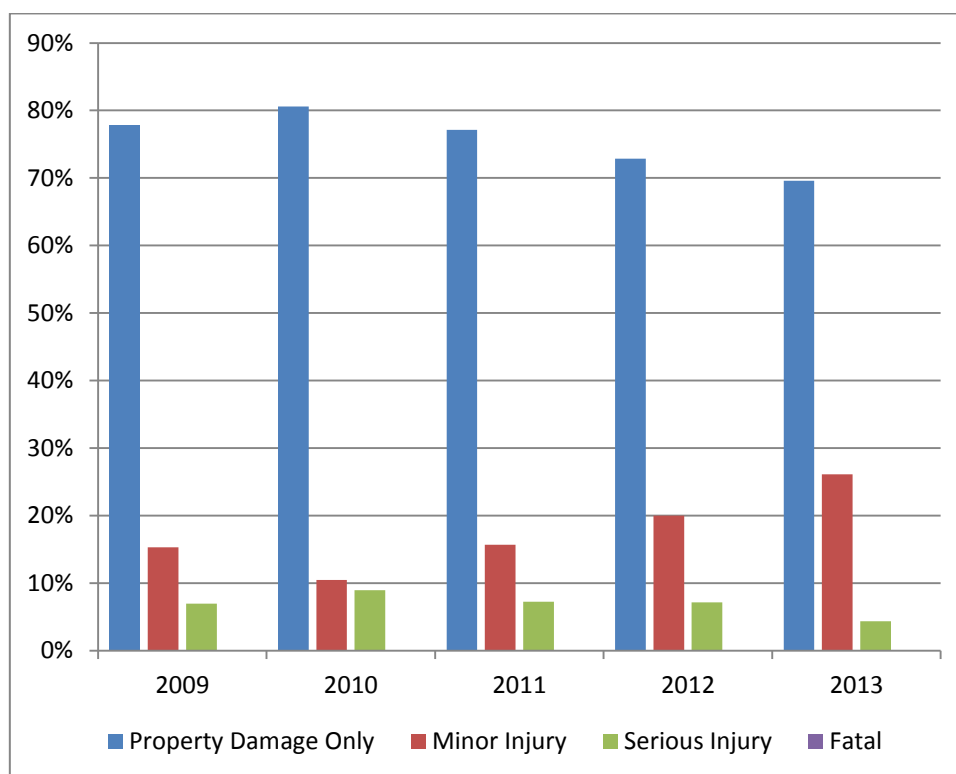


Figure 2 - Crashes on Lincoln Highway, 2009-2013

The majority of crashes along the Lincoln Highway tend to involve property damage only. During the five year monitoring period there were 72 property damage only crashes, 67 minor injury crashes and 83 serious injury crashes. While there have been no fatal crashes recorded on the Lincoln Highway in the last five years, at the time of publishing this report, at least one fatal crash resulting in three fatalities occurred in 2015.



**Figure 3 – Crashes by Severity, 2009-2013**

**Table 3 - Cost of Crashes on Lincoln Highway (2014 Values), 2009-2013**

Crash Severity	Cost per Crash <sup>1</sup>	Number of Crashes	Total Cost (2014 Values)
Property damage only	\$12,330	273	\$3,366,090
Minor injury	\$18,174	63	\$1,144,962
Serious injury	\$340,000	25	\$8,500,000
Fatal	\$7,200,000	0	\$0

The estimated economic cost of crashes along the Lincoln Highway between 2009 and 2013 is \$13,011,052. This figure includes losses to workplace and households as well as a number of medical, insurance, crash investigation, legal, and repair costs. The above table breaks down the cost of crashes in the last five years by severity.

<sup>1</sup> Property damage only and minor injury costs derived from 'Cost of Crashes in Australia 2006', BITRE Research Report 118; Figures amended to reflect 2014 values. Serious injury and fatal costs derived from AusRAP 2013 'Star Rating Australia's National Roads'. Note that the costs displayed are for each crash type and not for each casualty.

### **3.3 Eyre Highway to Whyalla**

This section of road is 49.5km and was driven in a northerly direction from Whyalla to the Eyre Highway. The speed limit was 110km/h. The trip meter was started when passing over the railway line. This road consists of many long straight stretches, with only a few bends. The terrain is quite flat for the majority of the journey. There was an unsealed rest area with a table and bin provided approximately half way between Whyalla and Port Augusta.

#### **3.3.1 Lane Widths and Lines**

The lane widths of this section of road are very consistent at 3.5m with edge lines, 1m sealed shoulder and 2m unsealed shoulder. Only on the very southern section of the road does this change to a slightly narrower sealed shoulder of 0.3m; which is between Point Bonython Road and Whyalla. The line markings were good for the entire stretch of road and provided a good contrast with the road. Audio Tactile Line Marking (ATLM) was used on all but the southern section, again to the south of Point Bonython Road. The combination of the above treatments provided an easier drive and will reduce the risk of run-off road crashes.

#### **3.3.2 Signs and Delineation**

Hazard marker posts were used well at 150m spacing and were clearly visible. There were a number of bends that would benefit from having the marker posts increased in frequency to help delineate the road in times of low visibility. It was also noted that more speed restriction signage repeaters would be beneficial for tourists that do not drive the road regularly. Directional signage for side roads was in good condition and clearly displayed the message.

#### **3.3.3 Pavement Condition**

On the southern section of this road there was some slight rutting, repair work patches and bumps on the road surface. There was also slight bleeding which became worse in close proximity to Point Bonython Road. After 18.5km from the start of the trip meter, the pavement condition improved with little to no rutting or bleeding, and also a coarse textured surface. Further north at 30km, there were some minor signs of bleeding in the surface. After 40km, the road became bumpier, which reduced the ride quality, however there were little or no signs of bleeding or rutting in the surface.

#### **3.3.4 Roadside Hazards**

Roadside hazards along this road include small shrubs and trees on the roadside set back 3-5m. These can be quite dense in some locations, but in the middle section of the journey they became sparse as the terrain opens up for some long sections. There are also power lines that run alongside the road for approximately 2km on the southern end near Whyalla. These are set back approximately 5m and are another hazard that would benefit from construction of audio tactile line marking to prevent run-off road crashes occurring at that location. Each end of the road, closer to both Whyalla and the intersection of the Eyre Highway was where the most dense shrubbery and foliage was located. In these areas there is an animal hazard which is demonstrated by the crash history with a number of recorded

animal crashes in the area. It is also common for these types of minor crashes to not be reported to authorities. Therefore RAA also recommends the installation of kangaroo warning signs on the locations with dense foliage.



**Figure 4 – Typical road and environment between Whyalla and the Eyre Highway**

### **3.3.5 Recommendations**

RAA recommends the following improvements for the Lincoln Highway between the Eyre Highway and Whyalla:

- Install audio tactile line marking for 5km on southern section
- Increase shoulder seal by 300mm for first 5km on southern section (prior to Point Bonython Road)
- Increase the frequency of hazard marker posts on bends where required
- Review key intersections and provide upgrades to address safety issues
- Investigate the presence of wildlife and the possibility for kangaroo warning signage on densely foliated areas

## **3.4 Whyalla to Cowell**

This road is 106km in length and was driven in a northerly direction from Cowell to Whyalla. The sign posted speed limit is 110km/h. It was noted that the speed limit of 110km/h was not suitable for the first sharp right hand bend on exit of Cowell. The speed limit signage should be changed to include this bend in the 80km/h zone and then change to 110km/h following on from the bend. In general the road is quite straight and easy to drive with some hills and bends which cause it to be difficult to overtake in some areas. Further north the road becomes flatter and straighter with good opportunities for overtaking. The road also includes multiple rest areas which generally provide a sheltered seating area and two bins. The trip meter was started at the intersection of Main Street and the Lincoln Highway.



### **3.4.1 Lane Widths and Lines**

The lane widths for this road are consistent at 3.5m with 0.5m sealed shoulder with edge lines. The unsealed shoulders vary between 0.5m and 2m. It is interesting to note that audio tactile line marking is not present here despite it being present on most other sections of the Lincoln Highway. The quality of line marking was good in general; however the road becomes quite dusty for a 10km section around the entrance to a mine site. As a result the line markings don't provide a good contrast to the road.

### **3.4.2 Signs and Delineation**

It was noted that there was an abundance of distance advisory markers to Whyalla. Hazard marker posts were in good condition and were set apart at 150m and increased in frequency where necessary. Speed signage was well placed excepting the 110km/h speed limit sign on the exit from Cowell. RAA suggests that this sign be relocated to after the sharp right and left hand bends that are currently protected with W-beam barriers.

### **3.4.3 Pavement Condition**

The pavement condition varies from relatively poor condition on the southern section of the road then generally improves on the northern section. Exiting Cowell there are many sections of bleeding and rutting on road. There was also evidence of edge break which had previously been repaired. Ride quality was quite smooth and pleasant to drive on despite the rutting. At approximately 29km from the start of the trip meter, the pavement condition improves with no signs of bleeding or rutting. At this location the texture is quite good with a coarse surface. The surface remains unchanged for another 35km. Just north of the Kimba-Whyalla road intersection the road surface changes in colour and becomes more rutted with bleeding on the passenger wheel path. After 83.3km there were some small sections of edge break and edge drops of 50-80mm from the sealed surface to the unsealed shoulder. The shoulders should be regraded with extra material at this location.

### **3.4.4 Roadside Hazards**

Small to medium shrubs and the occasional large tree are present on the roadside for the majority of the journey, and there are only a couple of sections of road where the foliage opens up for short sections of up to 2km. Roadside drops were occasionally seen, and some of the worst were already protected with W-beam or wire rope barriers. There were some unprotected roadside drops recorded at 5.34km, 44.4km, 48km, and 56.3km from the trip meter which should be protected with barriers. There were also Stobie poles on right and left hand side on the exit from Cowell, although these veered away from the road after 1km. There were numerous rises to the side of the road where the road surface has been cut into a hill. At these locations the rises are within 1m of the seal and are hazardous for run-off road crashes. These are protected with hazard boards at the beginning of each rise. It was noted that in some locations near the 40km mark, the unsealed shoulder consisted of quite loose dirt and was soft and unkempt with grasses and tufts of plants growing on it. At approximately 82km, sheep were encountered on the roadside which is also hazardous for vehicles driving this route especially if this occurs in a location where trees and shrubs block

the view of the animals. If sheep regularly escape from the paddocks in this area, animal warning signage may be required.



**Figure 5 – Typical road environment with bitumen bleeding, roadside drops and large trees**

### **3.4.5 Recommendations**

RAA recommends the following improvements for the Lincoln Highway between Whyalla and Cowell:

- Install audio tactile line marking for entire length to reduce run-off road crashes
- Repair to sections of rutting and bleeding on the southern end of the road near Cowell
- Relocate 110km sign on exit of Cowell to after the sharp bends
- Regrade shoulders with extra material approximately 40km from Cowell

## **3.5 Cowell to Arno Bay**

This section of road is 44.6km in length and was driven in a north easterly direction from Arno Bay to Cowell. The sign posted speed limit is 110km/h. In general the road is quite straight and easy to drive with some hills and bends which limit overtaking in some areas. The trip meter was started at the intersection of Arno Bay Road and the Lincoln Highway.

### **3.5.1 Lane Widths and Lines**

Lane widths along the Lincoln Highway between Cowell and Arno Bay were found to be between 3.4m and 3.7m with a 1.5m to 1.7m sealed shoulder. These widths are appropriate for the highway given traffic volumes and its composition are considered.

Line marking was found to show some signs of wear but generally remained clearly visible along all of the highway. Centre lines and edge of carriageway lines have been provided along the highway with ATLM used for the edge lines. A heavy vehicle was observed drifting

over the line on numerous occasions and pulling back into the lane, indicating that the ATLM is effective.

### **3.5.2 Signs and Delineation**

There were no issues found along this section of the highway that related to signage or delineation.

### **3.5.3 Pavement Condition**

The ride quality along the highway north of Arno Bay was found to be average with isolated sections offering a rough ride which coincides with rutting observed under the vehicle wheel path.

It was also noted that seal extension slopes towards the road which could be a problem during heavy rain as the water may channel along the lane and increase the risk of aquaplaning.

North of the intersection for the B91 to Cleve, the quality of the pavement surface deteriorates with bad bitumen bleeding and polishing of the surface.

It is recommended that the road is re-profiled as part of future repair work to reduce the pooling of water between the seal and seal extension and surfacing work is undertaken to address the polishing observed.

### **3.5.4 Roadside Hazards**

Vegetation runs along both sides of the highway and barrier protection may be considered as a long term solution in areas where there are significant crash risks.

### **3.5.5 Recommendations**

RAA recommends the following treatments for the Lincoln Highway between Arno Bay and Cowell:

- Pavement rehabilitation to address poor texture in areas
- Undertake work as part of future maintenance to improve surface drainage

## **3.6 Arno Bay to Port Lincoln**

This road is 116km in length and was driven in a south westerly direction from Arno Bay to Port Lincoln. The sign posted speed limit is 110km/h. The trip meter was started at the intersection of Arno Bay Road and the Lincoln Highway.

### **3.6.1 Lane Widths and Lines**

South of Arno Bay, lane widths on the Lincoln Highway were measured as 3.4m to 3.5m with a 0.5m sealed shoulder and 1.5m unsealed shoulder. The traffic lane widths remained consistent to Port Lincoln however the degree of shoulder seal varied between 200mm and 1.2m. The traffic lane dimensions are suitable given the volume and composition of traffic using the road, however since the Lincoln Highway is the arterial road into the Peninsula, sealed shoulders of 1m would be desirable. It is therefore recommended that shoulder extensions are undertaken to achieve a minimum of 500mm throughout the entire section with a long term target of 1m for the entire highway.

The quality of the line marking is reasonably good offering bright lines. ATLM has been provided along many sections of the highway although appears to be worn in some areas.

### **3.6.2 Signs and Delineation**

It was noted that there was an absence of advance warning signs for intersection on bend for some intersections and it is recommended that such signage is installed, particularly when the intersections are concealed.

South of the intersection leading to Tumby Bay, Raised Reflective Pavement Markers (RRPMs) have been installed along the centre and edge of carriageway lines. RAA welcomes the installation of the markers which improve night time delineation. It was not clear however why the markers are only present south of Tumby Bay and RAA would recommend that they are installed throughout the highway for consistency.

Some of the bends encountered had intersections located on the midpoint of the bend however there was no warning signage provided for these intersections. Installing further warning signs should be considered.

### **3.6.3 Pavement Condition**

The ride quality along the Lincoln Highway was found to be smooth and the texture appeared to be reasonably coarse thought to offer good drainage and skid resistance.

About 25km north of Port Lincoln, longitudinal cracking in the pavement surface was observed. Pavement rehabilitation should be carried to protect the pavement from further damage. Within the last 30km prior to Port Lincoln, rutting was noted under both passenger and driver wheel path in many areas and some sections of the pavement had been patched.

### **3.6.4 Roadside Hazards**

The assessment noted the presence of edge drop of up to 40mm at many locations along the highway. This creates a run-off road risks and makes recover onto the asphalt difficult. It is recommended that the shoulder material is graded to provide a smooth transition to the sealed surface.

Approximately 20km south of Arno Bay, drops of up to 2m were identified on the outside of curves. These create a high risk of vehicle rollovers and should be protected. About 28km south of Arno Bay, another major SA water pipeline runs along the road within 5m of the seal. Barrier installation should be considered at this location to protect both the motorist and the infrastructure. Further drops of up to 5m were identified about 35km south of Arno Bay. While these occurred on straight sections, the embankments should be protected with W-beam barrier given the height of the drop.

It is encouraging to note however that W-beam barrier has been provided across culverts to protect the headwalls and has also been used on some bends to protect from drops of around 2m. The application of crash barriers along the Lincoln Highway is however inconsistent, since on the north side of Boston, there are quite significant drops down to the water which potentially pose a greater risk than a 2m embankment, yet have not been protected.

The assessment noted at least five rest areas between Arno Bay and Port Lincoln which exclude any rest areas provided in towns. This equates to a rest area about every 23km which RAA supports as frequent rest stops aid in preventing driver fatigue. Of the rest stops inspected, basic provisions of an off-road layby with bins and some seating have been made. It would be worth upgrading at least some of the rest stops to provide shaded seating and LED lighting to encourage motorists to stop in hot weather and at night. It's also worth noting that not all rest areas were signed and it is recommended that the road signage is upgraded to clearly indicate their location.

### **3.6.5 Recommendations**

RAA recommends the following treatments for the Lincoln Highway between Arno Bay and Port Lincoln:

- Short/medium term – Increase shoulder width to 500mm throughout
- Long term – Increase shoulder widths to 1m throughout
- Application of RRPMS throughout
- Pavement rehabilitation
- Barrier protection for key roadside hazards
- Review intersection warning signage
- Provide sheltered seating and LED lighting at key rest areas

## **4 Flinders Highway**

### **4.1 Traffic Volumes**

Excluding the very first section from Port Lincoln to the Tod Highway turnoff, this road carries a relatively low traffic volume of between 300 to 490 vehicles per day. Approximately 22% of these are heavy vehicles. The very first section from Port Lincoln to the Tod Highway turnoff has a much higher traffic volume of 2,100 vehicles with 15.5% heavy vehicles.

### **4.2 Crash History**

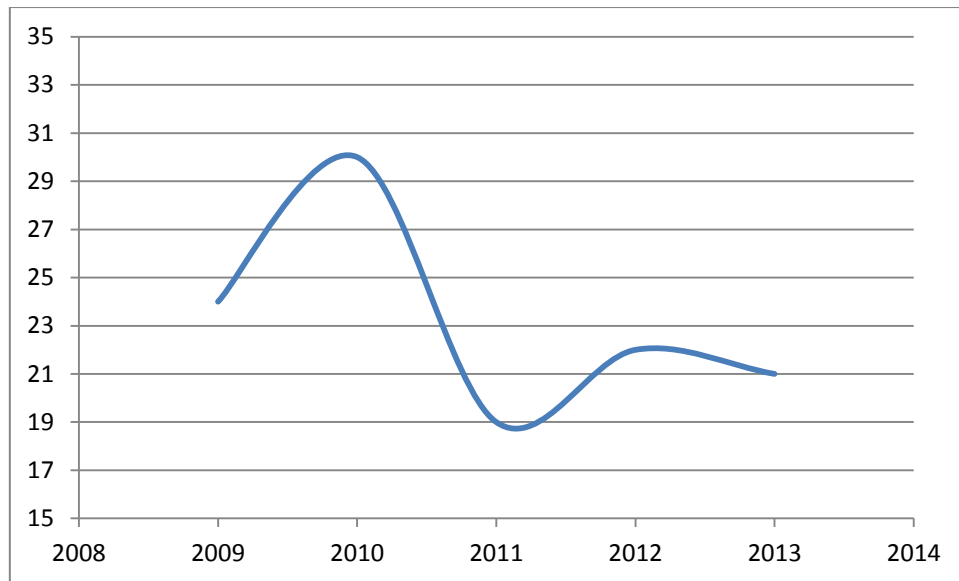
The number of crashes along the Flinders Highway has shown a declining trend over the last five years. 2010 saw the highest number of crashes (30) after which the number rapidly declined until 2012 when there was a slight rise. Since then the crash numbers have continued to decline. The top three crash types are:

- 1) Animal collisions (27 crashes)
- 2) Vehicle rollovers (25 crashes)
- 3) Hit fixed objects (19 crashes)

Unfortunately, there are limited treatments to address animal collisions, vegetation removal at the side of the road may assist but this is impractical over long distances. The best form of protection is to avoid driving at dawn or dusk. Where this is necessary, drivers should use headlights on high beam, when it is safe and legal to do so.

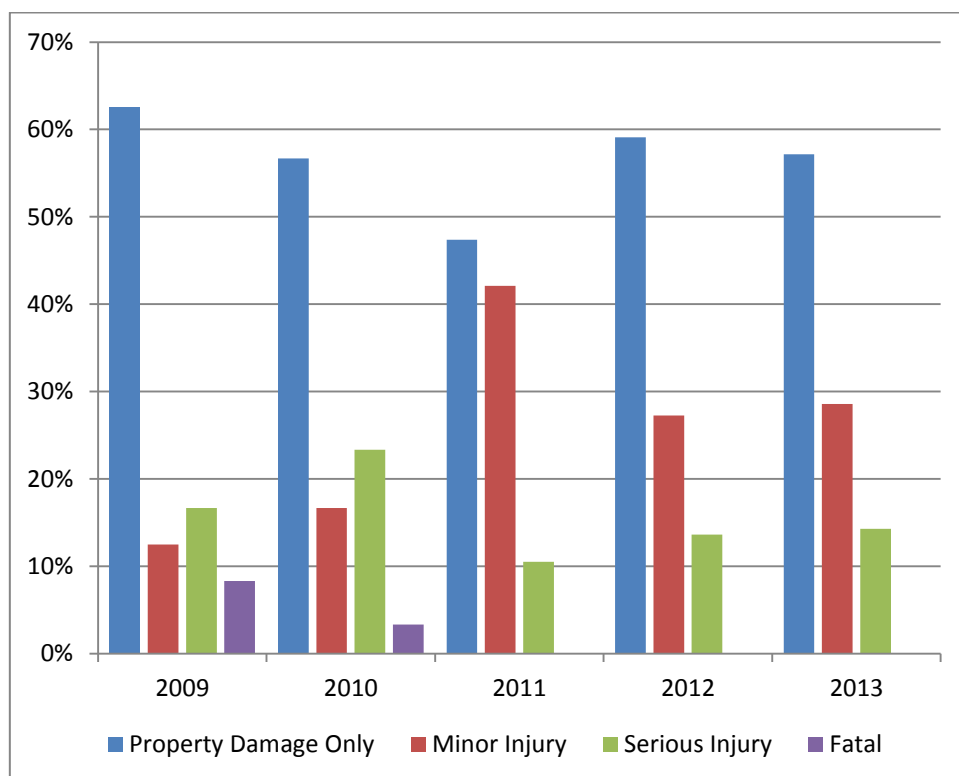
Crash history for Elliston to Streaky Bay was made up almost entirely of run-off road crashes, and hit animal incidents. Fatigue may be a contributing factor to the high number of run-off road crashes along this section of road. As such, ATLM and additional rest stops should be considered.

Between Streaky Bay and Ceduna, 8 out of the 15 recorded crashes were rollover crashes. 3 were hit animal, 3 were hit fixed object and 1 head on. Such a high proportion of rollover crashes is an indication that significant drops are not being sufficiently protected. It is recommended that a W-beam barrier treatment program be implemented to protect vehicles from roadside drops of greater than 3m.



**Figure 6 - Crashes on Flinders Highway, 2009-2013**

The majority of crashes along the Lincoln Highway tend to be property damage only. During the five year monitoring period there were 66 property damage only crashes, 28 minor injury crashes, 19 serious injury crashes and three fatal crashes.



**Figure 7 – Crashes by Severity, 2009-2013**

**Table 4 - Cost of Crashes on Flinders Highway (2014 Values), 2009-2013**

<b>Crash Severity</b>	<b>Cost per Crash<sup>2</sup></b>	<b>Number of crashes</b>	<b>Total Cost (2014 Values)</b>
Property damage only	\$12,330	66	\$813,780
Minor injury	\$18,174	28	\$508,872
Serious injury	\$340,000	19	\$6,460,000
Fatal	\$7,200,000	3	\$21,600,000

The estimated economic cost of crashes along the Flinders Highway between 2009 and 2013 was \$29,382,652. This figure includes losses to workplace and households as well as a number of medical, insurance, crash investigation, legal, and repair costs. The above table breaks down the cost of crashes in the last five years by severity.

### **4.3 Port Lincoln to Elliston**

This road is 168km in length and was driven in a northerly westerly direction from Port Lincoln to Elliston. The sign posted speed limit is 110km/h.

#### **4.3.1 Lane Widths and Lines**

Lane widths along the Flinders Highway were found to be 3.5m with a 1m to 1.2m sealed shoulder. The lane widths then reduce to approximately 3.2m to 3.3m about 33km west of Port Lincoln. Some sections of the highway to the east of Mount Hope do not have sealed shoulders and it is recommended that sealed shoulders should be constructed in these areas to achieve consistency with the rest of the highway.

The quality of line marking varied noticeably along the highway. A 100m section about 25km west of Port Lincoln was noted as having badly faded lines and requires relining. Further sections were noted to be in reasonable condition but had some sections showing signs of fading and wear along the centre line. West of Mount Hope, the lines were found to be in a better condition and were clearly visible. There are a number of bends to the west of Port Lincoln with drops of up to 1m. While these do not necessarily require barrier protection it would be beneficial to upgrade the edge of carriageway lines at these locations to include ATLM.

#### **4.3.2 Signs and Delineation**

During the assessment, at least three intersections that occurred on bends with reduced visibility did not have appropriate warning signage. It is recommended that such signage is installed to warn motorists that other road users may be turning in and out of these side roads.

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<sup>2</sup> Property damage only and minor injury costs derived from 'Cost of Crashes in Australia 2006', BITRE Research Report 118; Figures amended to reflect 2014 values. Serious injury and fatal costs derived from AusRAP 2013 'Star Rating Australia's National Roads'. Note that the costs displayed are for each crash type and not for each casualty.



The highway passes over a railway line approximately 13km west of Port Lincoln and prior to this; there is a bend which obscures the sight of the crossing. Since heavy vehicles have a long braking distance, it would be advisable to provide advance warning prior to the bend of the crossing activation. This has been achieved in other states and countries by providing wig wag flashers at a predetermined distance prior to the crossing and connecting them to the crossing controls. RAA recommends that the road authority explores this as an option to improve safety at the level crossing.

White RRMPs are installed along the centreline of the road between Port Lincoln and Coffin Bay. After Coffin Bay however the use of the RRMPs cease, which is disappointing since they enhance delineation and increase visibility of bends in low light and wet weather. It is recommended that RRPMS are applied throughout the remainder of the Flinders Highway.

32km north of Coffin Bay, the line marking was found to be ambiguous. Overtaking has been restricted with double solid lines; however the previous lines permitting overtaking had not been removed and were showing through. This could cause a problem in wet weather and low light when the lines are less visible and the intended restriction may not be clear. This should be corrected as part of the lining maintenance program.

#### **4.3.3 Pavement Condition**

The pavement was found to have a good texture, improving drainage and skid resistance, however some sections of the highway were noted as having bad asphalt edge break of up to 40mm to 50mm between the sealed and unsealed surfaces.

It was felt that the ride quality experienced along this section was average with a number of sections offering a rougher ride, thought to be caused by rutting and patch repairs.

South of Elliston, the assessment noted a number of sections with an unsealed shoulder with adverse cross fall and loose material. It is recommended that these sections are graded and compacted to provide a smoother running surface and prevent loss of control of the vehicle if entered onto at speed.

#### **4.3.4 Roadside Hazards**

Throughout the corridor, vegetation lines the highway and significant gums grow within 3m of the highway between Port Lincoln and Coffin Bay. On one occasion, a hazard board had been placed in front of a gum which may draw attention to its presence but does not offer any form of protection from the tree. In these cases a barrier system would be a more appropriate form of protection.

5km west of Port Lincoln, Stobie Poles were found within 4m of the highway. Given the close proximity in the clear zone, barrier protection may be considered for these hazards.

W-beam barriers have been used in some locations to protect vegetation and drops on the outside of bends, as well as across a number of culverts.

The assessment recorded two rest areas between Port Lincoln and Elliston, excluding facilities provided in the towns along the highway. This equates to a rest stop every 80km and while this is likely to be suitable given the traffic volumes along this route, it would be beneficial to include a further rest stop along this road. These rest stops on the highway comprise of an unsealed layby with bins and sheltered seating provision.

#### **4.3.5 Recommendations**

RAA recommends the following treatments for the Flinders Highway between Port Lincoln and Elliston:

- Construct shoulders to a minimum of 1m throughout the highway
- Refresh line marking in problem areas
- Apply ATLM edge lines on bends
- Install RRPMS along centreline between Coffin Bay and Elliston
- Consider installation of advance warning flashers for rail crossings
- Correct overtaking marking north of Coffin Bay
- Unsealed shoulder rehabilitation
- Install barrier protection at key roadside hazards
- Consider provision of an additional rest stop between Port Lincoln and Elliston

### **4.4 Elliston to Streaky Bay**

This section of road is approximately 127km in length. The road is fairly straight in general with occasional bends. Small hills are also common, which sometimes affect the site distance for overtaking. This road includes one truck friendly rest stop approximately 37km from Elliston. The rest stop is a small sealed layby with a bin provided. The road was driven in a north westerly direction from Elliston to Streaky Bay and a trip meter to record hazards and features was started at the intersection of the Flinders Highway and Memorial Drive.

#### **4.4.1 Lane Widths and Lines**

The lane widths on the southern part of this road start at 3.3m lanes with no edge lines and a 2m unsealed shoulder. Further north (38km) the sealed surface does not change but edge lines are painted onto the road which provides 3m lane widths with 0.3m sealed shoulder and 2.0m unsealed shoulder. It was noted at some locations that the centreline was not painted directly in the centre of the road which caused one lane to be wider than the other. The line marking quality was good for the entire stretch of road.

#### **4.4.2 Signs and Delineation**

It was noted that hazard marker posts were used at 150m spacing in general and were increased in frequency on the bends. It was noted that there were some bends with roadside hazards that could have done with more frequently spaced posts. Also on some of the long straight sections the hazard marker posts were 3m to 400m spaced. RAA recommends keeping the spacing consistent at 150m on straights and only varying in frequency for bends and other roadside hazards.

#### **4.4.3 Pavement Condition**

The pavement condition was recorded as good on the southern part of the road and average to good on the northern section due to some deterioration in the ride quality caused by bumps on the surface, light rutting and bitumen bleeding. Generally the ride quality was smooth, with good texture and few bumps or undulations. There were a few instances where edge break in the road was observed, in many places repair work for this had already taken place, with only small patches that have recently broken out still needing repairs (48km from Streaky Bay).

Approximately 48km from Elliston the light coloured asphalt transitions into a different surface with darker colour. This brings a slight increase in bumpiness but still provides good texture. After 96.2km there is another change in asphalt to a similar colour with a smoother ride quality and very coarse texture. This change in asphalt brings a louder sound which detracts from the ride quality. At 101.5km another change in asphalt of a similar colour causes a bumpier ride with similar texture. It was noted that the pavement condition deteriorates while travelling through Port Kenny. There was also 2km of minor patching works on the surface at approximately 16km from Streaky Bay which detracts from the ride quality.

Approximately 27km from Streaky Bay, a number of large bumps on the edge of the pavement were observed which may have been caused by tree roots.

#### **4.4.4 Roadside Hazards**

The major roadside hazards for this section of road were trees, shrubs, and roadside drops of up to 3m. Roadside drops are very common along this road. Some drops were larger and steeper than others. Drops of more than 3m should be protected with W-beam barriers especially when situated on the outside of sharp bends. Currently unprotected drops of this magnitude were recorded at 18.1km, 25.8km, 30.8km, 37.3km and 95.9km from Elliston (trip meter was started at the intersection of Memorial Drive and the Flinders Highway). On the exit from Elliston, Stobie poles run alongside the eastern side of the road for a short distance which are a safety hazard and should be protected with hazard boards. There were some significant trees noted within 2.5m of the road seal at 27.8km which would also benefit from hazard board protection.

The trees and shrubs progressively became more significant and dense when travelling further north. An animal hazard is also present with the high number of kangaroos in the area and consequently, a high number of recorded hit animal crashes. A number of kangaroo warning signs were seen. On the day of the assessment a sheep was encountered on the road approximately 20km from Elliston. Further up at 24km a large number of sheep were seen outside of their paddock on the roadside which is also a threat to motorists.



**Figure 8 – Typical road environment with roadside drops and trees beyond**

#### **4.4.5 Recommendations**

RAA recommends the following improvements for the Flinders Highway between Elliston and Streaky Bay:

- Install ATLM along the entire length of road
- Install W-beam barriers for drops greater than 3m
- Install hazard board protection for Stobie poles and significant trees closer than 3m from the road
- Consistent application of hazard marker posts on straights and increased in frequency on bends
- Additional rest stops to accommodate drowsy drivers

#### **4.5 Streaky Bay to Ceduna**

This road is approximately 110km in length and was driven in a northerly direction from Streaky Bay to Ceduna. The trip meter was started at the intersection of Alfred Terrace and the Flinders Highway. It was noted that the start of this road has many bends, which causes overtaking in some locations to be challenging. The road then becomes quite straight after 20km. The road also has three rest areas, all with sheltered seating areas and bins provided. These areas also had sealed slip lanes for acceleration when entering and leaving the area. The trip was driven at 5pm and it was noted that this caused the trip to be uncomfortable to

drive because of the position of the sun which caused glare on the windshield and vision difficulties despite the use of internal sunvisors and sunglasses.

#### **4.5.1 Lane Widths and Lines**

On the first section of road between Streaky Bay and the intersection of the Streaky Bay Highway and the Flinders Highway, the line marking was showing some signs of wear. There was some edge break patching which was patched over the edge lines and still needed to be repainted. After the aforementioned intersection, the line markings were noted as good with little signs of wear. The lane widths don't vary much and stay between 3m and 3.1m for the entire stretch of this road, which is relatively narrow. This created an uneasy driving experience, particularly when passing heavy vehicles. Before the intersection of the Streaky Bay Highway and the Flinders Highway, the road has painted edge lines with a 0.3m sealed shoulder. These edge lines are not present on the road north of the intersection. The unsealed shoulder varies between 2m and 3m. It was noted that passing trucks that were travelling in the opposite direction was very uncomfortable due to the narrow lane widths.

#### **4.5.2 Signs and Delineation**

Hazard marker posts appeared to be in good condition and consistently spaced at 150m. On the bends and when roadside hazards were present, they were increased in frequency. Signage in the area was also in good condition. There was adequate warning of all crossroads and rest areas. There was also adequate advisory signage to display distances to destinations. It was noted that some of the small crests on the road were restricting vision to the point where oncoming cars were not visible while no overtaking restrictions were in place. It is recommended that the sight distance be reviewed and overtaking restrictions be applied so that motorists are only overtaking when it is safe to do so.

#### **4.5.3 Pavement Condition**

On the first section of road between Streaky Bay and the intersection of the Streaky Bay Highway and the Flinders Highway, the road is characterised by an average surface with evidence of rutting and bleeding, particularly on the passenger wheel path. There are many short sections of edge break which have been patched in the past, although not having any effect on the ride quality. After the intersection of the Flinders Highway and Streaky Bay Highway, the road surface improves and provides a good texture, good drainage properties and only a few bumps and undulations in the road with little to no signs of rutting or bleeding. There was still some evidence of edge break along the side of the road, which have also been repaired. Again this did not have any impact on the ride quality. Overall, the ride quality was quite good for the entire length of the road; however it was noticed that it became bumpier on the northern section of the road on the approach to Ceduna.

#### **4.5.4 Roadside Hazards**

Again, like the other sections of the Flinders Highway, the major roadside hazards were the shrubs, trees and significant roadside drops. For the entire stretch of this section of road, there were consistent drops of 1m on both sides of the road. Large drops of 3m to 5m were

also noted which should be protected with W-beam barriers. These drops were noted at: 50km and 64.9km from Streaky Bay (using the trip meter). There are some sections of road where the trees and shrubs become less dense and pose little threat to run-off road incidents. The shoulders at the time of assessment were noted to contain lots of loose material. There was also times where it was difficult to determine where the shoulder starts and if the shoulder was sealed or unsealed due to the position of the sun. This can be misleading and dangerous should a vehicle accidentally hit the loose material. It is highly recommended that the shoulder seal be widened along this section of road and edge lines be painted.

The combination of narrow lanes and shoulders with loose material was also noted to cause large pieces of the loose material on the shoulders to flick up, which would reduce with sealed shoulders and edge lines.



**Figure 9 – Typical road environment with roadside drops, trees beyond and lack of edge lines**

#### **4.5.5 Recommendations**

RAA recommends the following improvements for the Flinders Highway between Streaky Bay and Ceduna:

- Install W-beam barriers to protect from major roadside drops
- Shoulder widening for the section between the Streaky Bay Highway and Ceduna
- Edge lines refreshed and implemented where lacking
- Install ATLM along the entire length of road

## **5 Birdseye Highway**

### **5.1 Traffic Volumes**

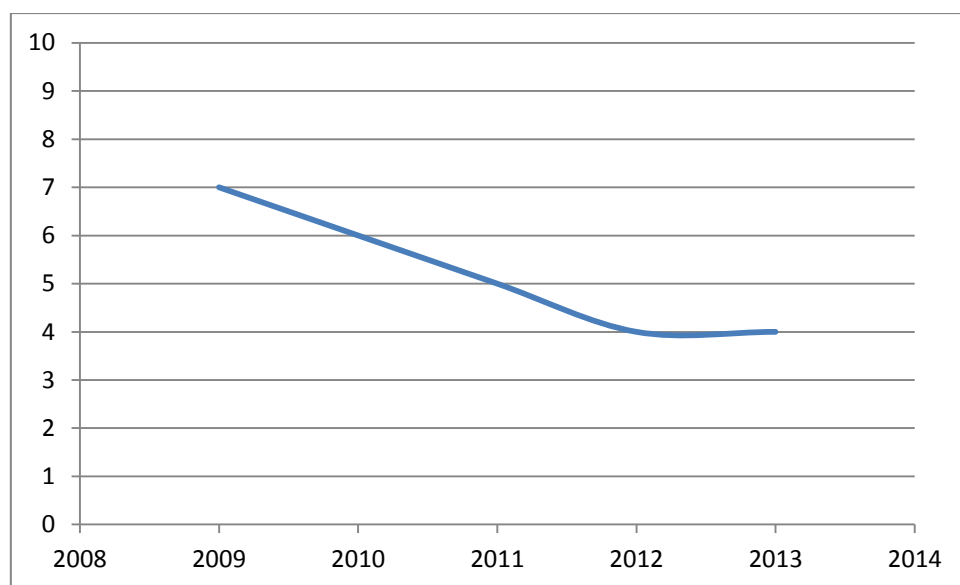
Traffic volumes along the Birdseye Highway average 336 vehicles per day, a 21% increase from 2009. Heavy vehicle volumes increased by 7% over the last 5 years and now represent 13.8% of the total traffic volume.

## 5.2 Crash History

Crashes along the Birdseye Highway have steadily been declining over the last five years. Crashes were the highest in 2009 with a total of seven crashes recorded but have since fallen to four crashes in 2013. The top three crash types that occur along the highway are:

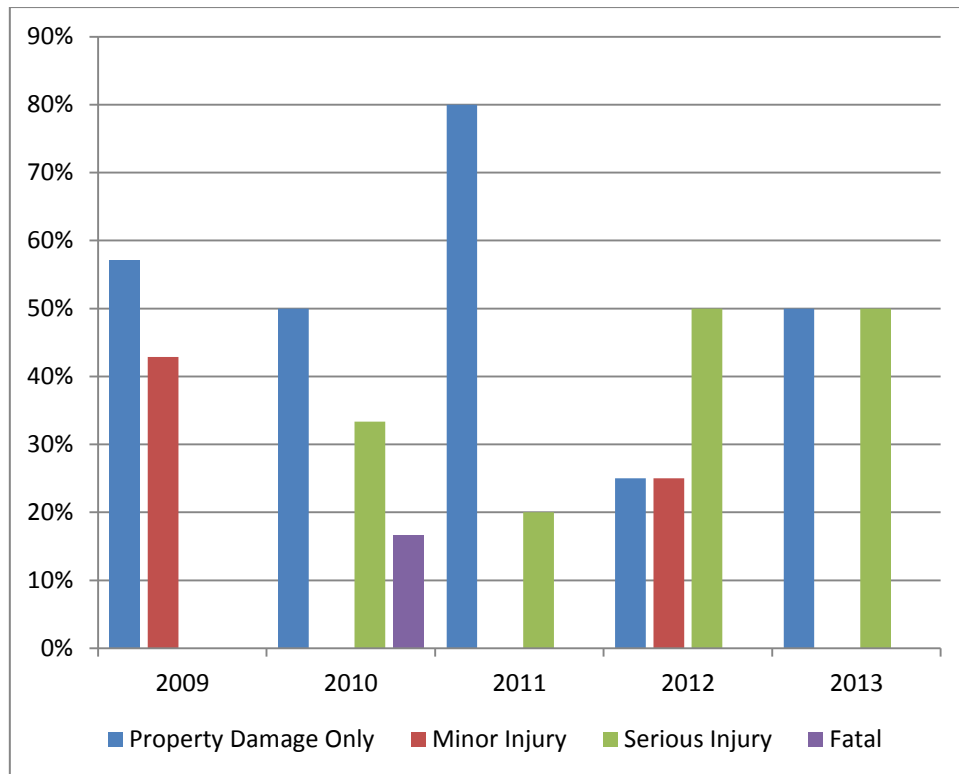
- 1) Animal collisions (8 crashes)
- 2) Vehicle rollovers (7 crashes)
- 3) Hit fixed objects (7 crashes)

Unfortunately, there are limited treatments to address animal collisions. Vegetation removal at the side of the road may assist but this is impractical over long distances. The best form of protection is to avoid driving at dawn or dusk. Where this is necessary, drivers should use headlights on high beam, when it is safe and legal to do so. Rollover and hit fixed object crash types are an indication that driver fatigue or inattention is prevalent and fatigue/inattention countermeasures such as audio tactile line marking or barrier protection to reduce the severity of a crash would be welcome improvements.



**Figure 10 - Crashes on Birdseye Highway, 2009-2013**

The majority of crashes along the Birdseye Highway tend to involve property damage only. During the five year monitoring period there were 14 property damage only crashes, four minor injury crashes, seven serious injury crashes and one fatal crash.



**Figure 11 – Crashes by Severity, 2009-2013**

**Table 5 - Cost of Crashes on Birdseye Highway (2014 Values), 2009-2013**

Crash Severity	Cost per Crash <sup>3</sup>	Number of crashes	Total Cost (2014 Values)
Property damage only	\$12,330	14	\$172,620
Minor injury	\$18,174	4	\$72,696
Serious injury	\$340,000	7	\$2,380,000
Fatal	\$7,200,000	1	\$7,200,000

The estimated economic cost of crashes along the Birdseye Highway between 2009 and 2013 is \$9,825,316. This figure includes losses to workplace and households as well as a number of medical, insurance, crash investigation, legal, and repair costs. The above table breaks down the cost of crashes in the last five years by severity.

### 5.3 Elliston to Lock

This road is 91.5km in length and was driven in a westerly direction from Lock to Elliston. The trip meter was started at the intersection of the Tod Highway and the Birdseye Highway. The road is generally characterised by short straight stretches of road with many bends with

<sup>3</sup> Property damage only and minor injury costs derived from 'Cost of Crashes in Australia 2006', BITRE Research Report 118; Figures amended to reflect 2014 values. Serious jury and fatal costs derived from AusRAP 2013 'Star Rating Australia's National Roads'. Note that the costs displayed are for each crash type and not for each casualty.



lots of small shrubs which restrict sight distance and cause overtaking to be difficult in some areas. The speed limit on this road is 100km/h for the first 55.3km. After this the speed limit changes to 110km/h where terrain is more open and the road is straight with better visibility.

### **5.3.1 Lane Widths and Lines**

The lane widths and line marking was quite inconsistent along this road. Along the first section of road the line marking is slightly faded but still providing a good delineation. There were no edge lines and a 3.6m lane in westerly direction and 3.3m easterly direction with a 2m unsealed shoulder on both sides. After 11.3km, edge of carriageway lines were added on the very outer edge of the road causing very little if at all, sealed shoulder. Some sections of the edge line were sealed over and not visible because of the edge break patching. After 12.8km, edge of carriageway lines were moved in from the edge of the road, which caused the lanes to become 3.3m with a 0.3m sealed shoulder, which is good because it helps to keep vehicles away from the edge of the seal, while still providing extra room if required. At 29.8km, the edge line appears to move closer to edge of seal again, only providing 200mm to 300mm sealed shoulder and approximately 3.2m lane width. The condition of the line marking improves to the west and provides a good contrast to the road surface. The lanes and line markings don't change again until Bramfield. At 58.3km the edge lines disappear for a short section of 400m and then return. After passing Bramfield, the edge lines disappear and the lane widths appeared to be between 3.4m and 3.5m in both directions.



**Figure 12 – Inconsistent edge line marking**

### **5.3.2 Signs and Delineation**

This road was noted to have good speed and distance signage that was clearly visible and well positioned. Hazard marker posts were of decent quality with good delineation of the road and increased on bends.

### **5.3.3 Pavement Condition**

The pavement condition was better on the eastern end of this road. Travelling west; it was noted that the pavement quality slowly deteriorates from good to average due to the increase in pavement defects such as bumps, patching and stripping. When setting off from Lock, the road is a light coloured surface with a smooth ride quality and reasonably coarse texture. There were very few bumps or undulations and no evidence of cracks, rutting, or bleeding. After 12.8km the road changes to a newer looking surface which brings also a good texture and ride quality and minimal defects. After 30km there are some sections of surface failure that have been patched in the past which detract from the ride quality significantly. From this point the ride quality is worse than prior with a few bumps and undulations. More patching was found at 57.1km which again detracts from the ride quality. There were some small sections of minor rutting on passenger side in this area also. At 74.1km the surface changed again with some added rutting and bleeding on the road surface for a few kilometres. After Bramfield the road showed some signs of stripping in the surface and was an average ride quality.

### **5.3.4 Roadside Hazards**

There are a number of roadside hazards for this section of road. There are power lines set back 5m to 8m from roadside on the right hand side for approximately 2km on the exit of Lock. Following this, there are significant patches of trees and bushes along with drainage ditches to the roadside past the unsealed shoulder, which are quite often more than 1m in depth. The significant trees are generally set back between 3m and 5m and line the road for approximately 70% of the entire journey. In places these trees are dangerously close to the road as close as 0.5m and 1m. These locations require trimming (7.9km, 36.5km, 43.3km, and 47.7km from start of trip meter).

A significant high pressure pipeline also runs alongside of the road, set back between 3m and 5m. This is a hazard for run-off road crashes for the first 30km of the journey before it leads away from the road.

Severe drops along both sides of the road are very common along this road. There are several large drops on the outside of bends which require W-beam barrier protection. These are located at 40.9km, 45.9km, 65km and 79.2km from the start of the trip meter.

Kangaroos are clearly an issue with this road, with 8 recorded hit animal crashes and 4 separate kangaroo warning signs found at 7.47km, 22.4km, 35km, and 61.5km from the start of the trip meter. The high presence of kangaroos and the large number of trees and shrubbery is a dangerous combination. As such, the 100km speed limit was deemed appropriate.

At 52.1km from the start of the trip meter; some local farm animals (sheep) had escaped from their paddock and were wandering near to the road which is also hazardous.

The photo below displays some of the roadside hazards encountered on the assessment. A large high pressure pipeline is on the left. A roadside drop of 1m is on the right, with large trees beyond.



**Figure 13 – Roadside hazards – High pressure pipeline (left) and edge drops with vegetation (right)**

### **5.3.5 Recommendations**

RAA recommends the following improvements for the Birdseye Highway between Elliston and Lock:

- Install barrier protection for steep roadside drops (especially on the outside of the bends)
- Bush and branch trimming where specified
- Paint edge lines on eastern and western ends to provide a lane width of 3.2m and a sealed shoulder of 0.3m

## **5.4 Lock to Cowell**

This road is 116km in length and was driven in an easterly direction from Lock to Cowell. The trip meter was started at the intersection of the Tod Highway and Birdseye Highway. The speed limit for this section of road is 110km/h.

### **5.4.1 Lane Widths and Lines**

Lane widths along the Birdseye Highway are between 3m and 3.2m with unsealed shoulders of between 2.3m and 2.7m.

East of Lock, the quality of the line marking was found to be very good. The line marking appeared to have been recently refreshed and retro reflection was noticeable in the daylight.

It is anticipated that this level of quality will quickly reduce as the line is coated in dust and dirt, but the lines will still offer a good contrast to the road.

Only a centreline is provided along the road due to the narrow lane widths. It is recommended however that the seal is increased to allow edge of carriageway lines at least on bends to improve night time delineation.

#### **5.4.2 Signs and Delineation**

The assessment noted a cross road intersection 32km west of Cowell that was not clearly visible on approach. It was also noted that a large volume of dirt has been carried onto the highway from the side roads suggesting that a lot of farm traffic turns at this intersection. It is therefore recommended that advance warning signage is provided for this intersection and that the road conditions are monitored. If a build-up of dirt on the road is constant, then signage to warn of potential skidding should be considered, particularly to cater for the wetter months.

There are a series of sharp bends with drops into creeks, 15km prior to Cowell. There is an absence through that section of Chevron Alignment Markers (CAMS), which would be highly recommended to increase night time delineation, particularly since many sections of the road do not have barrier protection.

#### **5.4.3 Pavement Condition**

To the east of the intersection with Peterson Road, the assessment noted severe bitumen bleeding under the wheel paths to a point where the surface appeared highly polished. This can present a hazard as skid resistance may be reduced and the pavement is likely to offer poor drainage performance, increasing the skid potential and the possibility of aquaplaning in wet weather. It is recommended that resurfacing is undertaken along this section to improve the pavement surface.

About 27km west of Cowell, the unsealed shoulders were noted as poor quality along some sections of the highway with both adverse cross falls and a lot of loose material across the surface. It is recommended that the shoulders are regraded and compacted along these sections to reduce the risk of loss of control of the vehicle if entering on to the shoulder at speed.

#### **5.4.4 Roadside Hazards**

To the east of Lock, drops of up to 4m were recorded along a straight on both sides of the road. Further drops of up to 5m were found to be unprotected about 14km west of Cowell. Despite the absence of protection at the locations identified, there are a number of creeks and culverts that the Birdseye Highway passes over which have been protected with W-beam barrier and RAA welcomes these infrastructure improvements.

The assessment noted a number of drops of up to 4m to 5m in the last 15km prior to Cowell. These occur where the road is windy, elevating the risk of run-off road crashes. While barrier protection is recommended for all drops through this section, it may also be appropriate to lower the speed limit to 100km/h. lowering the speed affords more time for the driver to react and would lower the risk of run-off road crashes.

Between Lock and Cowell, there was one rest stop identified, excluding rest facilities available in Rudall and Cleve. The rest area was an unsealed layby with bin and seating provision. Given the volumes of traffic on the Birdseye Highway between Lock and Cowell, one area is deemed to be sufficient but it could benefit from shaded seating facilities.

#### **5.4.5 Recommendations**

RAA recommends the following treatments for the Birdseye Highway between Lock and Cowell:

- Construct 500mm sealed shoulder on bends
- Install edge lines on bends
- Pavement rehabilitation to address poor texture
- Unsealed shoulder rehabilitation
- Install barrier protection for roadside hazards up to 15km west of Cowell
- Consider speed reduction to 100km/h for up to 15km west of Cowell

## **6 Tod Highway**

### **6.1 Traffic Volumes**

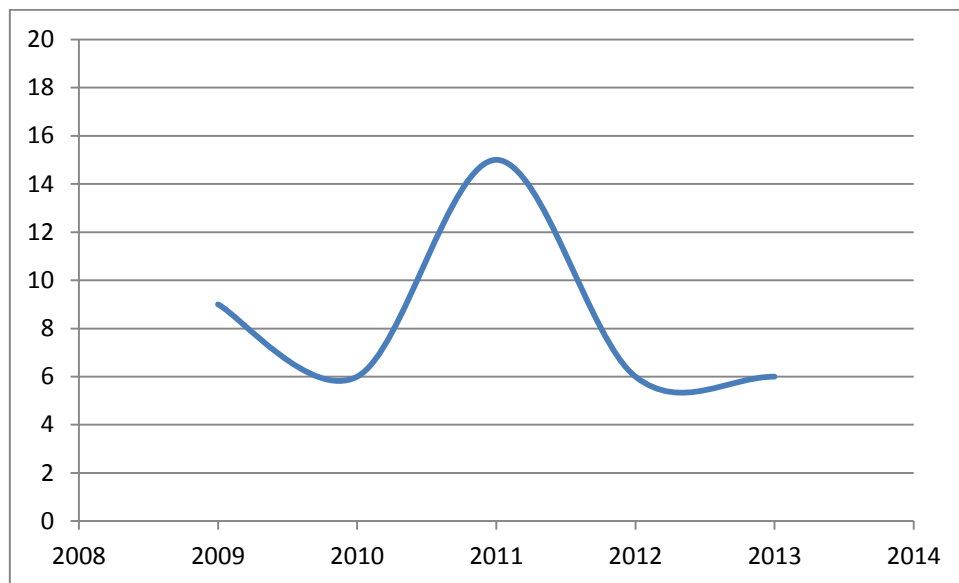
Over the last 5 years, there has been a 22.8% increase in traffic volume along the Tod Highway. The highway is currently used by an average of 422 vehicles per day, 27% of which are heavy vehicles. The heavy vehicle volume has increased by 76.6% over the last 5 years, a significant increase which reflects upon the growing agricultural industry in the region.

### **6.2 Crash History**

Crashes along the Birdseye Highway have varied over the last five years, with an average of about eight crashes per year. Reaching a peak of 15 crashes in 2011, crashes fell to 6 for both 2012 and 2013. The top three crash types that occur along the highway are:

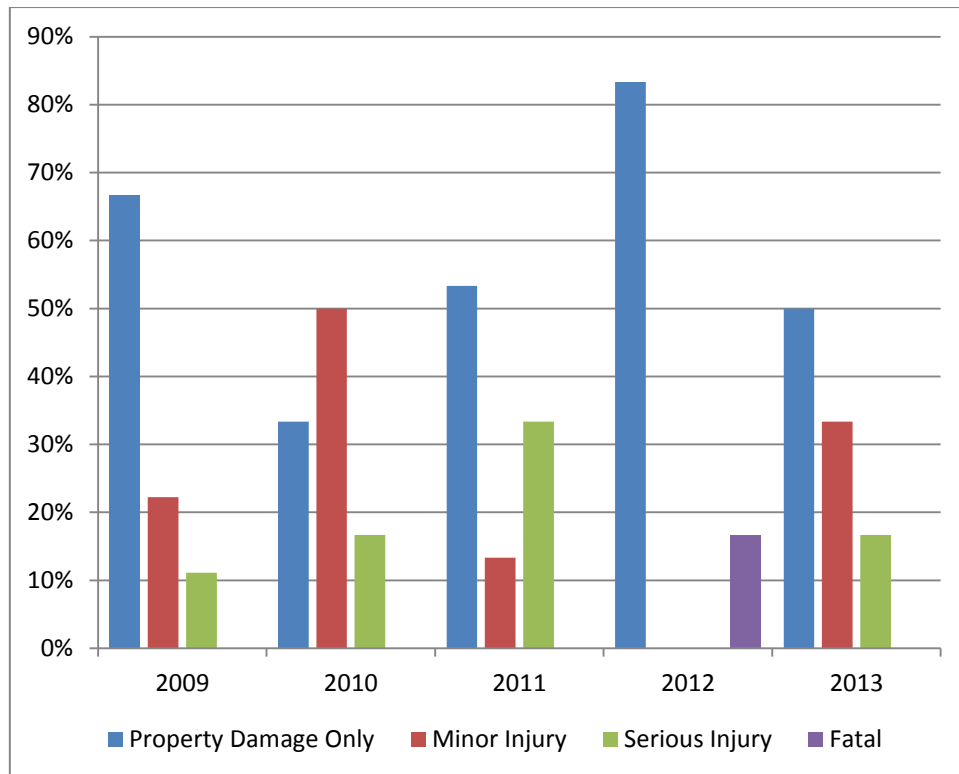
- 1) Hit fixed object (12 crashes)
- 2) Vehicle rollovers (11 crashes)
- 3) Animal collisions (5 crashes)

Hit fixed object and rollover crash types are an indication that driver fatigue or inattention is an issue along the highway and countermeasures such as audio tactile line marking or barrier protection, to reduce the severity of a crash, may be worthwhile improvements.



**Figure 14 - Crashes on Tod Highway, 2009-2013**

The majority of crashes along the Tod Highway tend to involve property damage only. During the five year monitoring period there were 24 property damage only crashes, nine minor injury crashes, eight serious injury crashes and one fatal crash.



**Figure 15 – Crashes by Severity, 2009-2013**

**Table 6 - Cost of Crashes on Tod Highway (2014 Values), 2009-2013**

Crash Severity	Cost per Crash <sup>4</sup>	Number of crashes	Total Cost (2014 Values)
Property damage only	\$12,330	24	\$295,920
Minor injury	\$18,174	9	\$163,566
Serious injury	\$340,000	8	\$2,720,000
Fatal	\$7,200,000	1	\$7,200,000

The estimated economic cost of crashes along the Tod Highway between 2009 and 2013 is \$10,379,486. This figure includes losses to workplace and households as well as a number of medical, insurance, crash investigation, legal, and repair costs. The above table breaks down the cost of crashes in the last five years by severity.

### 6.3 Kyancutta to Lock

This section of road is 54.4km in length and was driven in a southerly direction from Kyancutta to Lock. The speed limit is 110km/h and the trip meter was started at the intersection of the Tod highway and the Eyre Highway.

<sup>4</sup> Property damage only and minor injury costs derived from 'Cost of Crashes in Australia 2006', BITRE Research Report 118; Figures amended to reflect 2014 values. Serious jury and fatal costs derived from AusRAP 2013 'Star Rating Australia's National Roads'. Note that the costs displayed are for each crash type and not for each casualty.

### **6.3.1 Lane Widths and Lines**

Lane widths along the Tod Highway between Kyancutta and Lock were found to be between 3.1m and 3.2m. Unfortunately, a sealed shoulder has not been provided along this section and the unsealed shoulder width was approximately 2m wide. The assessment noted that the lanes felt narrow, particularly when passing heavy vehicles. The problem was magnified when heavy vehicles passed on the outside of bends and had a tendency to cut the corner and into the path of oncoming vehicles.

Since sealed shoulders have not been provided, edge of carriageway lines were also absent, although the quality of the centreline was good offering a solid line with good contrast to the pavement.

### **6.3.2 Signs and Delineation**

No significant issues were recorded in relation to signs or delineation. At the edge of the carriageway, seal extension would allow lining ATLM which is preferential, due to its effectiveness of prevention of run-off road crashes resulting from fatigue. In the absence of ATLM, RRPMS may be used throughout the highway or on bends to improve night time delineation of the road.

### **6.3.3 Pavement Condition**

Rutting was observed in some areas and particularly on bends where the defect had led to crumbling and edge break of the asphalt. This created edge drop in some instances, although the difference in height between the sealed and unsealed surfaces was not significant. It's encouraging to note that the roads authority have made attempts to repair edge break in many locations, although shoulder seal extension will reduce the frequency of edge break since vehicles are less likely to drive along the edge of the pavement surface.

Along the unsealed shoulders, a lot of loose material was observed. In some areas it was apparent that there were adverse cross falls over the unsealed shoulder. Given the narrow nature of the highway throughout this section, it is highly recommended that adverse cross falls are addressed by building up the shoulder to provide a gradual slope. It would be beneficial to regrade and compact the shoulders, reducing the volume of loose material and providing a safer surface to run on at high speed. This should provide the driver with more time to recover should they drift off the seal.

### **6.3.4 Roadside Hazards**

Eucalypts are found along most of the highway within 3m to 4m of the seal, but given the expanse of the vegetation, it is unrealistic to expect that it is protected throughout the highway. At a minimum, barrier protection should be considered on bends deemed to be of high risk for vehicle run-offs.

The assessment noted that approximately 30km south of Kyancutta there were a number of drops of up to 4m, with steep embankments at the side of the road. It is recommended that



these are protected with a barrier system to reduce the severity of a crash from vehicle rollovers if a vehicle departs the highway at these sections.

The assessment noted one rest stop which consisted of a layby with bin provision. It is recommended that seating is also provided to encourage motorists to stop. Given the distance between Kyancutta and Lock, one rest stop is thought to be sufficient to cater for rest breaks and reduce driver fatigue.

### **6.3.5 Recommendations**

RAA recommends the following treatments for the Tod Highway between Kyancutta and Lock:

- Construct sealed shoulders to a minimum of 400mm
- Pavement rehabilitation to address edge break/edge drop
- Unsealed shoulder rehabilitation
- Installation of seating at rest stop

## **6.4 Port Lincoln to Lock**

This section of road is 122km in length and was driven in a northerly direction from the Flinders Highway to Lock. The trip meter was started at the intersection of the Flinders Highway and the Tod Highway. The speed limit for this section of road is 110km/h.

### **6.4.1 Lane Widths and Lines**

Immediately north of the intersection with the Flinders Highway, the Tod Highway is noticeably wider with lane widths of around 3.1m but an addition of sealed shoulders of 700mm. About 7km north of the intersection however, the widths of the sealed shoulders drastically reduce to about 200mm, but increase in width back to 700mm to 1m further north along the highway. The wide sealed shoulders along this section of highway are welcomed as they provide ample room to move over and provide space when passing heavy vehicles, particularly on bends.

The quality of line marking along this section of highway was found to be in a poor condition, with lines noted to be fading along both the centreline and edge of carriageway lines from a point 33km north of the Flinders Highway to about 50km south of Lock, where the quality of the lining improves again, offering clearer line marking.

### **6.4.2 Signs and Delineation**

No significant issues were recorded in relation to signs or delineation. At the edge of the carriageway, seal extension would allow lining ATLM which is preferential, due to its effectiveness of prevention of run-off road crashes resulting from fatigue. In the absence of ATLM, RRPMS may be used throughout the highway or on bends to improve night time delineation of the road.

#### **6.4.3 Pavement Condition**

North of the intersection with the Flinders Highway, severe rutting was detected under the passenger wheel path, thought to be up to 30mm to 40mm deep. Bad edge break was also recorded along the highway, again with drops of up to 40mm between the sealed and unsealed surfaces.

Despite this, the ride quality along the highway was found to be smooth and the pavement offered a reasonably coarse texture to aid drainage and skid resistance.

Adverse cross falls were noted along some lengths of unsealed shoulder and it is recommended that as a low-cost solution, these should be built up and graded to reduce the risk of vehicles running off the road if drifting onto the unsealed shoulder.

20km south of Lock, ride quality reduces with ribbing in the pavement surface which causes vibration. Pavement failure was also noted as reducing ride quality. Some rutting was apparent along the transition of the seal extension and this was also causing bitumen to bleed through the surface.

#### **6.4.4 Roadside Hazards**

North of Wanilla, there's a slight bend which benefits from barrier protection. There are however many more bends along the route that are sharper or have roadside hazards on the outside of the bend, which highlights the inconsistency of the application of barriers and points to a reactive treatment. Barriers have however been used to protect culvert headwalls which is welcomed due to the potential damage culverts can cause to run-off-road vehicles.

Around 50km south of Lock, a large diameter high pressure water pipeline runs along the road within 5m of the carriageway. Protection of the infrastructure should be considered in the long term.

#### **6.4.5 Recommendations**

RAA recommends the following treatments for the Tod Highway between the Flinders Highway and Lock:

- Increase shoulder seal to match 700mm to 1m seal found throughout the highway
- Refresh line marking in problem areas
- Pavement rehabilitation to address edge break/edge drop
- Unsealed shoulder rehabilitation
- Installation of seating at rest stop
- Consider barrier protection for drops greater than 2m and significant roadside hazards

## 7 Bratten Way

### 7.1 Traffic Volumes

Traffic volumes along Bratten Way are approximately 336 vehicles per day, an increase of 23% over the last five years. The volume of heavy vehicles has doubled in the last five years and now accounts for about 21% of the total traffic volume.

### 7.2 Crash History

The volume of crashes on Bratten Way has remained reasonably low for the past five years. Averaging between one and two crashes per annum, there were no reported crashes in 2001, but a peak of three crashes in 2012. The top three crash types that occur along the highway are:

- 1) Hit fixed object (3 crashes)
- 2) Vehicle rollovers (2 crashes)
- 3) Right angle crash (1 crash)

Hit fixed object and rollover crash types are an indication that driver fatigue or inattention is an issue along the highway and countermeasures such as audio tactile line marking or barrier protection, to reduce the severity of a crash, may be worthwhile improvements.

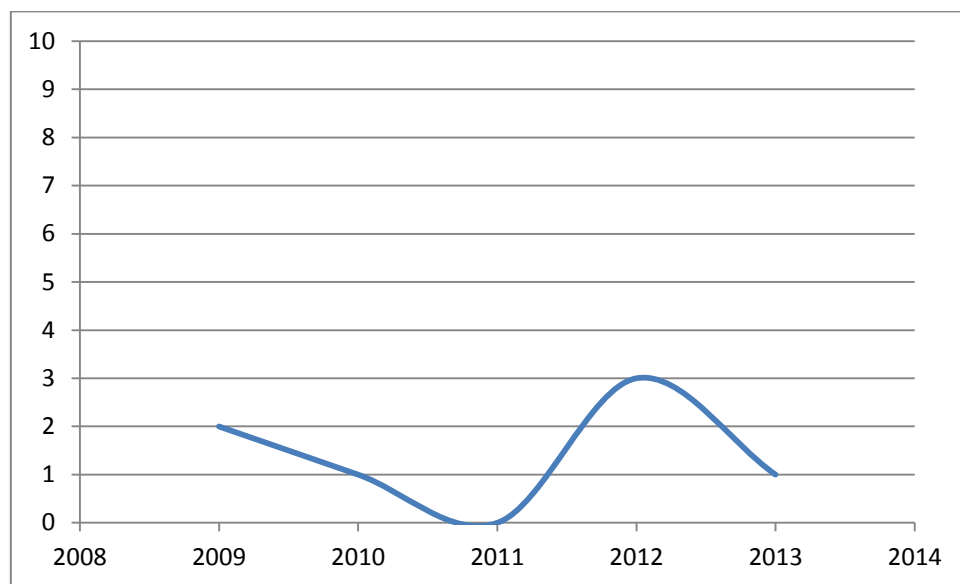
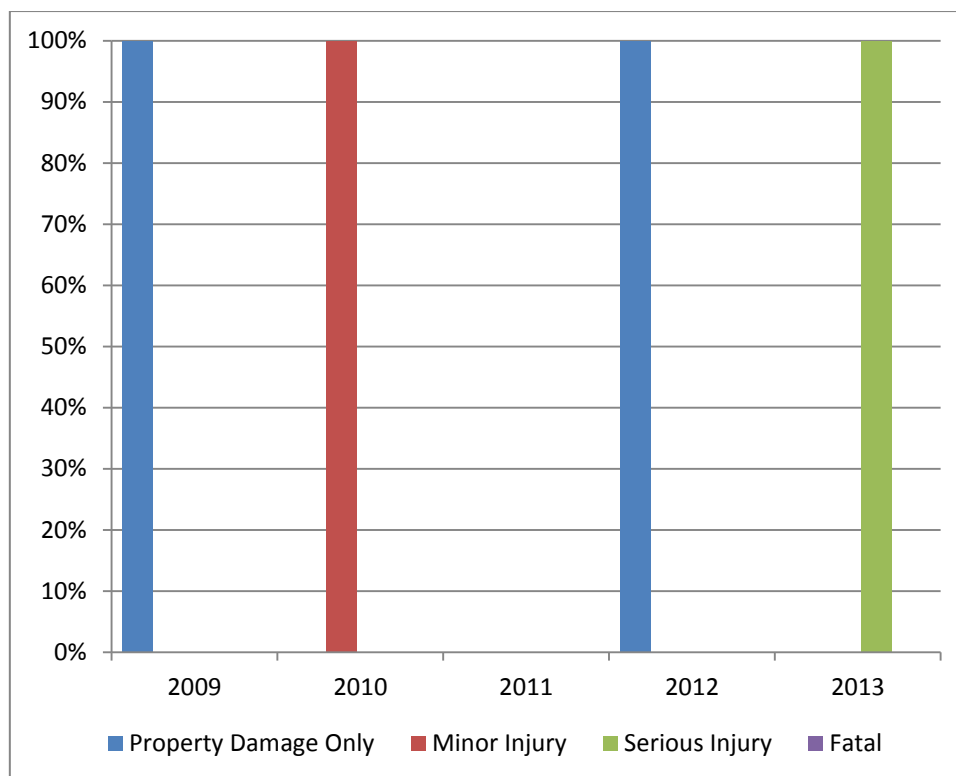


Figure 16 - Crashes on Bratten Way, 2009-2013

The majority of crashes along Bratten Way tend to involve property damage only. During the five year monitoring period, there have been five property damage only crashes, one minor injury crash, and one serious injury crash. No fatal crashes have occurred on Bratten Way during the past five years.



**Figure 17 – Crashes by Severity, 2009-2013**

**Table 7 - Cost of Crashes on Bratten Way (2014 Values), 2009-2013**

Crash Severity	Cost per Crash <sup>5</sup>	Number of crashes	Total Cost (2014 Values)
Property damage only	\$12,330	5	\$61,650
Minor injury	\$18,174	1	\$18,174
Serious injury	\$340,000	1	\$340,000
Fatal	\$7,200,000	0	-

The estimated economic cost of crashes along Bratten Way between 2009 and 2013 is \$10,379,486. This figure includes losses to workplace and households as well as a number of medical, insurance, crash investigation, legal, and repair costs. The above table breaks down the cost of crashes in the last five years by severity.

### 7.3 Tumby Bay to Cummins

This road is 37.6km in length. It was driven in an easterly direction from the Cummins to Tumby Bay. The trip meter was started on the intersection of the Tod Highway and Bratten Way. The speed limit for this road is 110km/h.

<sup>5</sup> Property damage only and minor injury costs derived from 'Cost of Crashes in Australia 2006', BITRE Research Report 118; Figures amended to reflect 2014 values. Serious injury and fatal costs derived from AusRAP 2013 'Star Rating Australia's National Roads'. Note that the costs displayed are for each crash type and not for each casualty.

### **7.3.1 Lane Widths and Lines**

On the outskirts of Cummins there were 3.3m lanes with edge lines providing 0.5m to 0.7m of sealed shoulder and between 1m and 2m unsealed shoulder. At 4.7km from the start of the trip meter, the sealed surface becomes narrower with 3.3m lanes and edge lines provided and little to no sealed shoulder. The unsealed shoulder at this location varies between 1m and 2m. After 11km the edge lines were faded and will require refreshing soon. The lane widths and lines do not change significantly following on from this.

### **7.3.2 Signs and Delineation**

On this section of road it was good to see advisory distance signage which informed the distance to Tumby Bay. There were also good quality hazard markers which were again spaced in 150m intervals and increased in frequency on the bends. The speed signage was in good condition and well placed. Another speed sign would be useful just as a reminder on the middle to eastern end. It was noted that because of the severe roadside hazards, 110km/h is inappropriate for this road and the speed limit should be changed to 100km/h.

### **7.3.3 Pavement Condition**

On the outskirts of Cummins the ride quality was quite bumpy and uncomfortable. Travelling further along there was some slight rutting on both passenger and driver side. The ride quality then improves with only a few bumps and undulations and slight rutting. Passing over a bridge which is less than 5km from Cummins, the surface was quite poor and going over the bumps jolt the car at speed. Between 5km and 6.7km from the start of the trip meter, there are sections of severe bleeding. After 6.7km the surface changes and improves somewhat with less bleeding. There however is more bleeding further up at 9km. The road surface changes at 10km. This new surface is much higher quality with only occasional longitudinal cracks. The ride quality and pavement conditions don't change significantly from here on in with only some minor patches of bleeding or edge break.

### **7.3.4 Roadside Hazards**

On the outskirts of Cummins there are steep roadside drops of up to 1.5m with medium to large trees set back another meter beyond. At 11.7km there is a bend to the left in the road which has a steep unprotected drop and significant trees beyond. A seal extension to provide sealed shoulders and ATLM would be advisable for this bend and others of similar nature. After 17km there are many significant trees lining the roadside, which are set back only 2m from the sealed surface and this section would again benefit from an extra sealed surface and ATLM. At 29km there are very large drops of up to 10m that are protected with W-beam barriers. In this area there are also smaller drops of 5m that are currently not protected. These should also be protected with barriers. In areas where these roadside hazards are not protected with W-beam barriers, the sealed shoulder should be extended and ATLM should be used to prevent run-off road crashes from occurring. The figure below shows a section of road with significant trees and large drops that are a hazard for run-off road crashes.



**Figure 18 – Significant vegetation with large drop (left)**

### **7.3.5 Recommendations**

RAA recommends the following improvements for Bratten Way from Cummins to Tumby Bay:

- Consider reducing speed limit to 100km/h
- Increase sealed shoulder by 500mm on each side for entire road (except in first 5km from Cummins)
- ATLM to help prevent run-off road crashes on sections of road with unprotected hazards
- Construct W-beam barriers to protect from significant drops and trees

## **7.4 Cummins to Flinders Highway (East-West)**

This road is 37.6km in length. It was driven in an easterly direction from the Flinders Highway to Cummins. The trip meter was started on the intersection between the Flinders Highway and Bratten Way. The speed limit for this road is 100km/h.

### **7.4.1 Lane Widths and Lines**

The lane widths start out at 3.3m in each direction with an edge line that provides a 0.3m sealed shoulder. This is combined with a 0.5m to 2.5m unsealed shoulder that often drops away and isn't useable which can also be hazardous for run-off road crashes. Line marking is good. At 11km from the start of the trip meter, the edge lines have been patched over and require repainting. At this location the line marking is also faded and will require refreshing soon. At 13.4km the line marking improves. Further east, at 31.9km the edge lines disappear, however the seal width is unchanged. At this location the centreline marking is faded and requires refreshing. Many sections of this road have been raised in order to clear the wetlands, as a result there is limited space available to increase the sealed shoulder or

unsealed shoulder space. As a result many sections along this road do not have sufficient shoulders to allow vehicles to stop and clear the carriageway if needed.

#### **7.4.2 Signs and Delineation**

Along this route, it was noted that hazard markers are in good condition and used in 150m spacing and increased in frequency on the bends. Speed limits are well signed, with a number of repeaters after major intersections. Chevron alignment markers were used well to delineate the major bends in the road and can be seen in the figure below. It was noted that there wasn't any distance advisory markers for Cummins. On entry of Cummins, on the intersection with the Tod Highway just prior to the rail crossing, the give way line is set back too far from the road and doesn't allow a good position for determining if safe to cross. This line should be moved further forward. The disused rail crossings still have faded give way signage and pavement markings which should also be removed.



**Figure 19 – Chevron Alignment Markers provide clear delineation on bends**

#### **7.4.3 Pavement Condition**

On the western end the pavement condition is fair to good with a smooth ride, coarse texture, and some patches of repair for sections of bleeding bitumen. On the intersection with Douglas Well Road and Ashman Road, the pavement is severely worn with aggregate loss, rutting and bleeding which is becoming polished. Following on from this intersection, there appears to be patches of severe rutting and bleeding on both sides of the road that has been patched, but only in the worst locations. There are many areas that still desperately require patching. At 13km from the start of the trip meter, there are some areas where the top layer of the sealed surface has stripped away and some of the previous road surface is showing. Edge break was recorded at 11km where it had been patched over the edge line. At 13.4km the surface changes from a dark to light surface. With the change in seal, the bleeding and rutting improves slightly however there are some sections of edge break for 5km which in some areas is crumbling as far as the edge line. At 18km the pavement changed to a slightly darker coloured surface which again had severe bleeding and rutting especially on the passenger side. Some severe pot holes which require patching



were recorded at 20.5km and 30.5km before they become large and damage vehicles. There was evidence of more repairs to the road at 31km which has attempted to patch over bleeding surfaces but still requires more work. The ride quality however is smooth with only a few bumps. After 31.9km, the road condition improves slightly until Cummins with much less rutting and bleeding with occasional patches to edge break.



**Figure 20 – Bitumen bleeding under wheel paths**

#### **7.4.4 Roadside Hazards**

The major hazards for the route are medium to large bushes and trees set back 3m to 5m. On the western side there are small to medium sized drainage ditches and drops of 0.5m to 1m which are common for the first 13.4km. After this, around Lake Malata there are major drops of 3m+ down to the water which are often protected with W-beam barriers. One of these drops was not yet protected at approximately 16km on the outside of a bend. This location would be highly recommended for additional W-beam barrier protection. After 20.5km there are more steep drops to the side of the road of up to 1.5m. In this location ATLM would be an additional feature to prevent vehicles from leaving the sealed surface. The shoulders are also at a steep cross fall in many locations which can be dangerous for run-off road incidents.

#### **7.4.5 Recommendations**

RAA recommends the following improvements for Bratten Way between Cummins and the Flinders Highway (east-west):

- Barrier protection of severe unprotected drops into water around Lake Malata area
- Consideration of ATLM for entire length to help prevent fatigue related run-off road crashes
- Patching of pot holes and severely bleeding surfaces
- Refreshing of line marking on eastern end
- Distance advisory markers for Cummins



## 8 Streaky Bay Highway

### 8.1 Traffic Volumes

Traffic has remained constant over the past five years, with 250 vehicles per day travelling along the highway. Over the same period, heavy vehicle volumes travelling along Streaky Bay Highway has increased by 40%. Heavy vehicles currently represent around 19.6% of the total traffic volume.

### 8.2 Crash History

Five out of the six recorded crashes are run-off road instances, with one right angle crash. The volume of crashes along the Streaky Bay Highway is very low. Between 2009 and 2010, there were no reportable crashes along the highway. Since 2011, there has been an average of between one and two crashes on the highway each year, 83% of which have been property damage only crashes. The crashes that have occurred along the highway are split between:

- 1) Hit fixed object/left road – out of control (2 crashes each)
- 2) Vehicle rollover/right angle (1 crash each)

Since the number of crashes along Streaky Bay Highway is low, it is difficult to identify a pattern in the type of crashes, but protection from significant hazards would be beneficial to minimise the severity of any crash that occurs.

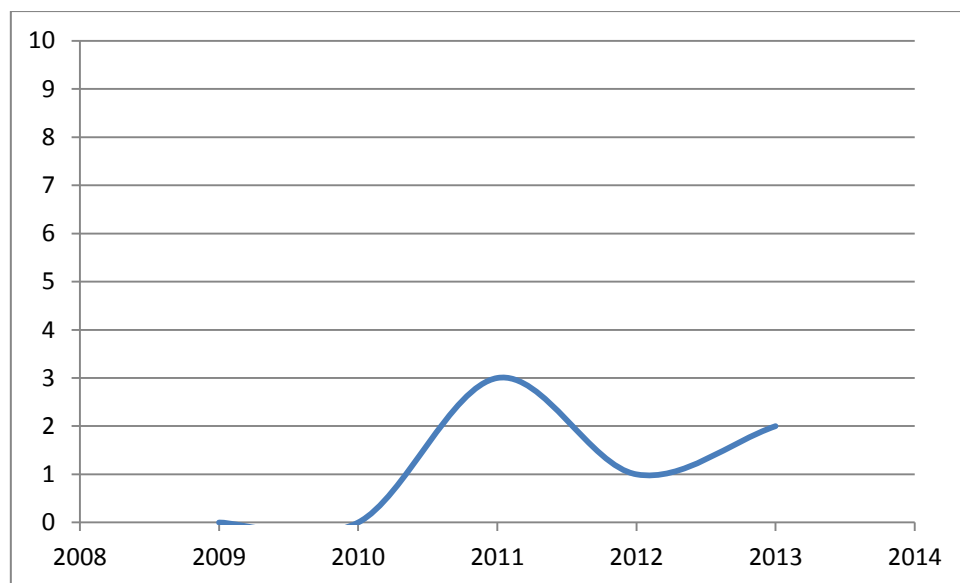
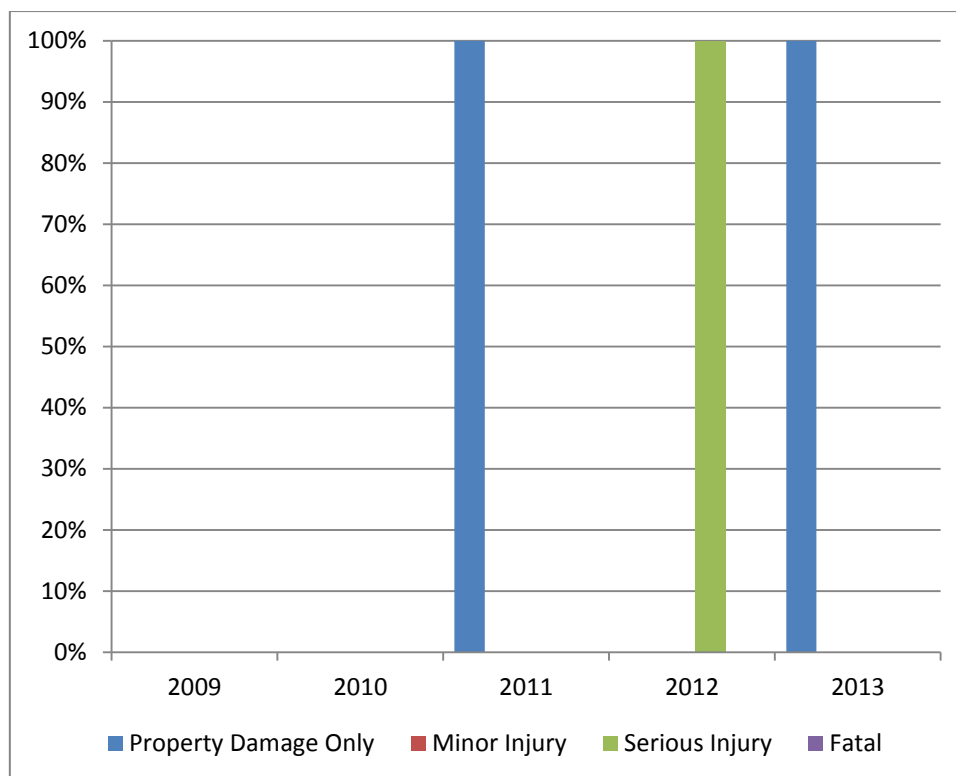


Figure 21 - Crashes on Streaky Bay Highway, 2009-2013

The majority of crashes along the Streaky Bay Highway have either involved property damage only (five crashes) or, on one occasion, a serious injury crash.



**Figure 22 – Crashes by Severity, 2009-2013**

**Table 8 - Cost of Crashes on Bratten Way (2014 Values), 2009-2013**

Crash Severity	Cost per Crash <sup>6</sup>	Number of crashes	Total Cost (2014 Values)
Property damage only	\$12,330	5	\$61,650
Minor injury	\$18,174	0	-
Serious injury	\$340,000	1	\$340,000
Fatal	\$7,200,000	0	-

The estimated economic cost of crashes along the Streaky Bay Highway between 2009 and 2013 is \$401,650. This figure includes losses to workplace and households as well as a number of medical, insurance, crash investigation, legal, and repair costs. The above table breaks down the cost of crashes in the last five years by severity.

<sup>6</sup> Property damage only and minor injury costs derived from 'Cost of Crashes in Australia 2006', BITRE Research Report 118; Figures amended to reflect 2014 values. Serious injury and fatal costs derived from AusRAP 2013 'Star Rating Australia's National Roads'. Note that the costs displayed are for each crash type and not for each casualty.

### **8.3 Streaky Bay to Poochera**

The road is fairly straight with a few bends and shallow hills. The road is 54.4km in length and was driven in an easterly direction from Streaky Bay to Poochera. The trip meter was started at the intersection of Alfred Terrace and Flinders Highway Streaky Bay. The speed limit is 110km/h.

#### **8.3.1 Lane Widths and Lines**

The lane widths along this section of road vary slightly between 3m to 3.2m. The centreline marking was good, with little signs of wear and providing a good contrast to the road. There were no edge lines or sealed shoulders on the straight sections of this road. The seal was extended by 1m on the outside of significant bends. In these locations an edge line was provided for the bend and approximately 30m past the bend on either side. When encountering wide vehicles travelling in the opposite direction, the lanes felt narrow. At the time of the assessment, only one heavy vehicle was encountered, however statistics from the Department of Planning Transport and Infrastructure show that approximately 49 heavy vehicles use this road per day. RAA recommends increasing the seal width by 300mm on both sides, and painting edge lines to enable vehicles more room for passing and to help prevent vehicles from running off the road.

#### **8.3.2 Signs and Delineation**

Hazard markers were in good condition and provided a clear delineation of the road. The markers were used at 150m intervals and were increased in frequency on bends especially on the outside. The signage was also in good condition and appeared to be well maintained. There was adequate warning of cross roads and distance advisory markers.

#### **8.3.3 Pavement Condition**

The general pavement condition for this road was quite good with only a few bumps and undulations. The texture quality was also coarse and provides a good skid resistance and drainage properties. There were no ruts or bleeding observed. At the time of assessment; many loose stones were noticed on the road, which were likely caused by the high winds at the time. It is also possible that vehicles are drifting off the side of the road onto the unsealed shoulder and kicking up the loose shoulder material. A council bob cat with sweeper was observed to be sweeping the material back off the road. Edge break was a common occurrence along this road, and was especially bad at 21.9km and 26.4km from the start of trip meter. The presence of edge break also suggests vehicles are running off the road due to the narrow lanes.

#### **8.3.4 Roadside Hazards**

It was noted that the unsealed shoulders contained an abundance of loose material. An advisory sign for soft shoulders at 25km was also observed. Beyond the soft shoulders, there are patches of dense shrubbery and medium to large trees. Foliage becomes denser,

and large trees are more common when closer to Poochera. Small drops of 0.5m to 1m on each side are common along the entire section of road. Kangaroo warning signs were also seen, although there were no recorded hit animal crashes for the last 5 years.

### **8.3.5 Recommendations**

RAA recommends the following improvements for the Streaky Bay Highway:

- Construct sealed shoulders of 0.3m for the entire road
- Paint edge lines

## **9 Kimba – Cleve Road**

This road is 69.6km in length and was driven in a southerly direction from Kimba to Cleve. The trip meter was started on the intersection of Old Cleve Road and Cleve Road. The speed limit is 110km/h.

### **9.1 Traffic Volumes**

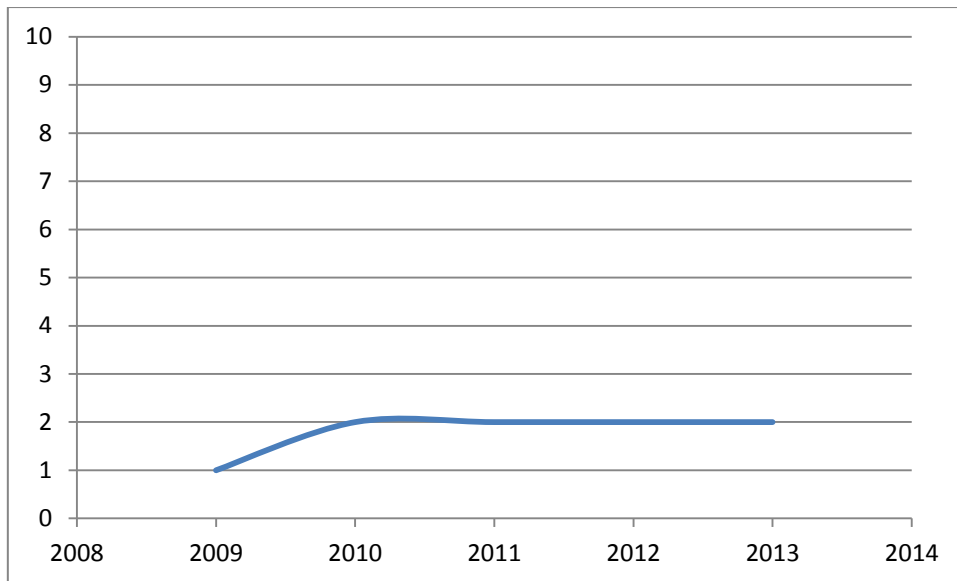
On average, 210 vehicles per day travel along the Kimba to Cleve Road. Heavy vehicles represent 13% of the total traffic volume. The total heavy vehicle traffic has increased by 22% over the last five years, while the total traffic volume has increased by approximately 34%.

### **9.2 Crash History**

The number of crashes has remained reasonably low over the past five years with two crashes typically occurring on the road each year. The most frequent crashes that occur along the road are:

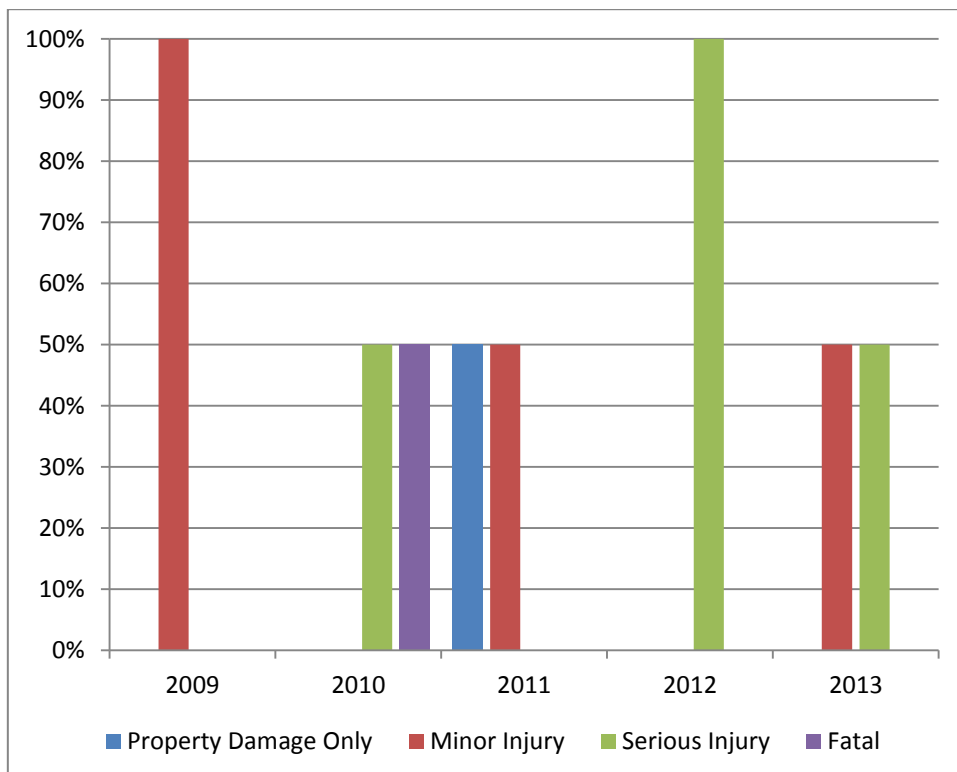
- 1) Hit fixed object (6 crashes)
- 2) Head-on, animal collisions, vehicle rollovers (1 crash each)

The number of hit fixed object crashes is an indication that driver fatigue or inattention is an issue along the highway and countermeasures such as ATLM or barrier protection, to reduce the severity of a crash, may be worthwhile improvements.



**Figure 23 - Crashes on Kimba to Cleve Road, 2009-2013**

The majority of crashes along the Kimba to Cleve Road have been serious or minor injury crashes. During the five year monitoring period there was a single property damage only crash, three minor injury crashes, four serious injury crashes and one fatal crash.



**Figure 24 – Crashes by Severity, 2009-2013**

**Table 9 - Cost of Crashes on Kimba to Cleve Road (2014 Values), 2009-2013**

<b>Crash Severity</b>	<b>Cost per Crash<sup>7</sup></b>	<b>Number of crashes</b>	<b>Total Cost (2014 Values)</b>
Property damage only	\$12,330	1	\$12,330
Minor injury	\$18,174	3	\$54,522
Serious injury	\$340,000	4	\$1,360,000
Fatal	\$7,200,000	1	\$7,200,000

The estimated economic cost of crashes along the Kimba to Cleve Road between 2009 and 2013 is \$8,626,852. This figure includes losses to workplace and households as well as a number of medical, insurance, crash investigation, legal, and repair costs. The above table breaks down the cost of crashes in the last five years by severity.

### **9.2.1 Lane Widths and Lines**

Lane widths along the Kimba to Cleve Road were found to be very narrow with widths of between 2.8m and 3.3m. The sealed shoulder varied between 300mm and 500mm and the unsealed shoulder was between 2.2m and 2.4m.

Approximately 3km north of Cleve, the road appeared narrower with approximately 3m shoulders and a very minimal shoulder seal, no greater than 100mm. South of Cleve, road widths were found to be 3m with a 300mm sealed shoulder and 2m unsealed shoulder.

Line marking was found to be good throughout most of the road, offering clear and reasonably bright lines that provided a good contrast to the road surface. While edge lines have been provided along the road, ATLM was not found to be present and the assessment noted on many occasions that it would be beneficial to provide this treatment, particularly on the outside of bends.

### **9.2.2 Signs and Delineation**

While the quality of the line marking was very good, the road lacked RRPMs. In the absence of ATLM, it would be beneficial to apply RRPMs to improve night time delineation and the treatment should be prioritised for high risk locations such as sharp bends.

The assessment also noted that in some areas the hazard marker posts installed at the edge of the road were either missing or badly damaged. It would be recommended that the roads authority undertake a review of the posts and replace where necessary to maintain clear low light and wet weather delineation.

<sup>7</sup> Property damage only and minor injury costs derived from 'Cost of Crashes in Australia 2006', BITRE Research Report 118; Figures amended to reflect 2014 values. Serious jury and fatal costs derived from AusRAP 2013 'Star Rating Australia's National Roads'. Note that the costs displayed are for each crash type and not for each casualty.

24km north of Cleve the assessment identified a sharp bend for which no advanced warning is provided. It is recommended that warning signs are installed with advisory speed plates and that CAMs are also installed around the bend. Further bends were noted that had barrier protection but could benefit from CAMs to improve night time delineation. Some bends did have CAMs installed but there did not appear to be consistent application of the markers throughout the route.

### **9.2.3 Pavement Condition**

Asphalt edge drop was recorded in a number of areas with an estimated drop of 40mm to 50mm between the sealed and unsealed surfaces. About 50km and again at 24km north of Cleve, the assessment noted a number of instances of rutting and pavement deformation that was leading to the asphalt breaking at the edge of the road. Patching has been undertaken in a number of areas and while not a safety risk, has reduced the ride quality along the road.

The unsealed shoulders were found to have adverse cross falls at a number of locations. This can present a hazard as any vehicle entering the shoulder at speed could potentially be pulled off to the side of the road. It's therefore recommended that the shoulders are built up at these locations and graded to provide a suitable cross fall for drainage while providing a safer running surface for vehicles.

### **9.2.4 Roadside Hazards**

Throughout the road, there are many areas with dense vegetation consisting of eucalypts and large shrubs within 2m to 5m of the seal.

The assessment noted the presence of a number of drainage ditches and rock swales at various locations along the road. They may be a hazard as they increase the probability of a vehicle rollover should the vehicle depart the highway. Of particular concern were those that were located at locations where the unsealed shoulder had severe cross fall or where the swale was located almost adjacent to the seal.

It is encouraging to note that barrier protection has been provided on many bends to protect from drops of over 2m, with steep embankments. There were however some drops noted of between 1.5m and 2m that did not have barrier protection and it is recommended that as a medium to long term strategy, these should also be protected due to the increased risk of rollovers in these areas.

### **9.2.5 Recommendations**

RAA recommends the following treatments for the Kimba to Cleve Road:

- Application of RRPMs or ATLM on bends
- Review and reinstate damaged or missing hazard marker posts
- Install bend warning signage
- Install CAMs on sharp bends

- Pavement rehabilitation (rut filling and edge repair)

## 10 Arno Bay Road

This road is 25 km in length and was driven in a southerly direction from Cleve to Arno Bay. The trip meter was started at the intersection of the Birdseye Highway and Arno Bay Road. The speed limit is 110km/h.

### 10.1 Traffic Volumes

Over the past five years, traffic volumes along Arno Bay Road have increased by almost 12%, while heavy vehicle volumes have increased by almost 67%. Currently, 380 vehicles per day travel along the road, 20% of which are heavy vehicles.

### 10.2 Crash History

Very few crashes occur on Arno Bay Road, the last reported crash occurred in 2010 and was a serious injury crash involving a vehicle hitting a fixed object at the side of the road. Prior to this, one other crash occurred in 2009 which involved a vehicle rollover, resulting in a fatality.

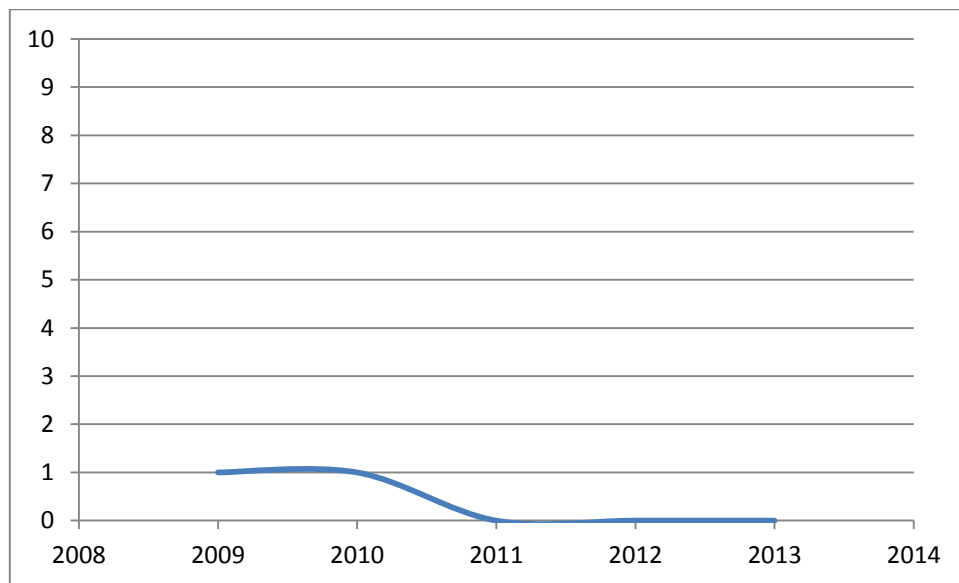


Figure 25 - Crashes on Arno Bay Road, 2009-2013



**Table 10 - Cost of Crashes on Kimba to Cleve Road (2014 Values), 2009-2013**

<b>Crash Severity</b>	<b>Cost per Crash<sup>8</sup></b>	<b>Number of crashes</b>	<b>Total Cost (2014 Values)</b>
Property damage only	\$12,330	0	-
Minor injury	\$18,174	0	-
Serious injury	\$340,000	1	\$340,000
Fatal	\$7,200,000	1	\$7,200,000

Despite the low number of crashes on Arno Bay Road, estimated economic cost between 2009 and 2013 has been \$7,540,000. This figure includes losses to workplace and households as well as a number of medical, insurance, crash investigation, legal, and repair costs. The above table breaks down the cost of crashes in the last five years by severity.

### **10.3 Lane Widths and Lines**

Lane widths along Arno Bay Road were found to be approximately 3m with a 300mm sealed shoulder and 2m unsealed shoulder. The lane widths were found to increase to 3.2m approaching Arno Bay. The quality of the lining was found to be good with edge and centrelines offering a reasonably bright line with good contrast to the road surface.

### **10.4 Signs and Delineation**

The assessment noted that on at least one occasion, cross road warning signs were provided on approach to a cross road which was located on a bend. The sign type used for this was not correct and it is recommended that the signs are replaced to show that the cross road occurs on the bend. Although the line marking is good, RRPMS have not been provided along this section and it is recommended that RRPMS are at least installed on the bends, to further enhance low light delineation. No speed signage is provided on approach to Arno Bay.

### **10.5 Pavement Condition**

South of Cleve, rutting on bends and bleeding in the pavement surface was observed. The assessment noted that the ride quality between Cleve and Arno Bay was generally rougher than the section between Kimba and Cleve. About 19km south of Cleve, there was a poor transition identified between the existing seal and the extension which appeared to create a rut along the side of the road and created a rough driving surface.

<sup>8</sup> Property damage only and minor injury costs derived from 'Cost of Crashes in Australia 2006', BITRE Research Report 118; Figures amended to reflect 2014 values. Serious jury and fatal costs derived from AusRAP 2013 'Star Rating Australia's National Roads'. Note that the costs displayed are for each crash type and not for each casualty.

## **10.6 Roadside Hazards**

About 4km north of Arno Bay, an arterial SA Water pipeline lies within 4m of the road. It is recommended that the pipeline is protected with a barrier system. Shortly after, Stobie Poles are also found within 4m of the road and protection should also be considered for these hazards.

## **10.7 Recommendations**

RAA recommends the following treatments for Arno Bay Road:

- Application of RRPMS or ATLM on bends
- Decrease hazard marker post spacing on bends
- Correct cross road warning signs
- Pavement rehabilitation
- Barrier protection for key roadside hazards
- Install speed signage as appropriate at the entry points into Arno Bay

# **11 Coffin Bay Road**

This road is 13.6km in length and was driven in both directions. The trip meter was started at the eastern end on the intersection of Coffin Bay Road and the Flinders Highway. The speed limit is 110km/h.

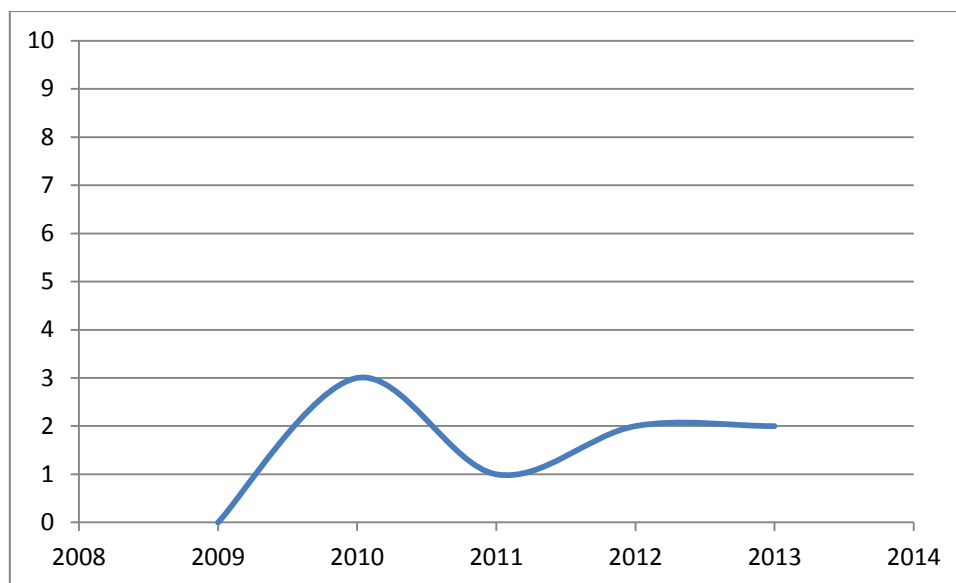
## **11.1 Crash History**

At the time of this report, traffic volume data for Coffin Bay Road was unavailable.

## **11.2 Crash History**

The number of crashes has remained low over the past five years, with an average of between one and two crashes per year. All crashes that have occurred have involved property damage only. The most frequent crashes that occur along the road are:

- 1) Animal collisions (3 crashes)
- 2) Hit fixed object (2 crashes)
- 3) Hit parked vehicle, rear end and vehicle rollovers (1 crash each)



**Figure 26 - Crashes on Coffin Bay Road, 2009-2013**

**Table 11 - Cost of Crashes on Kimba to Cleve Road (2014 Values), 2009-2013**

Crash Severity	Cost per Crash <sup>9</sup>	Number of crashes	Total Cost (2014 Values)
Property damage only	\$12,330	8	\$98,640
Minor injury	\$18,174	0	-
Serious injury	\$340,000	0	-
Fatal	\$7,200,000	0	-

The estimated economic cost of crashes along Coffin Bay Road between 2009 and 2013 is \$98,640. This figure includes losses to workplace and households as well as a number of medical, insurance, crash investigation, legal, and repair costs. The above table breaks down the cost of crashes in the last five years by severity.

### **11.3 Lane Widths and Lines**

Lane widths along Coffin Bay Road were found to be approximately 3.2m to 3.3m with up to a 1m sealed shoulder. It was encouraging to find that the lane widths and shoulder seal have been created with a seal extension at some point over the last few years.

### **11.4 Signs and Delineation**

The assessment did not identify any significant issues with signage and delineation. It was noted that on many bends, the hazard marker posts were closely spaced which should

<sup>9</sup> Property damage only and minor injury costs derived from 'Cost of Crashes in Australia 2006', BITRE Research Report 118; Figures amended to reflect 2014 values. Serious injury and fatal costs derived from AusRAP 2013 'Star Rating Australia's National Roads'. Note that the costs displayed are for each crash type and not for each casualty.

provide good low light and wet weather delineation. On some bends, it was felt that a longer lead into the bend of hazard posts could be provided.

### **11.5 Pavement Condition**

The pavement was found to be in good condition along Coffin Bay Road with only a few minor instances of asphalt edge break recorded.

### **11.6 Roadside Hazards**

RAA welcomes the hazard protection that has been installed along Coffin Bay Road. A number of bends with drops or other hazards on the outside of the bend had a W-beam barrier installed to protect vehicles and reduce run-off crashes.

A sharp drop down to the ocean which was unprotected was noted on one occasion and it is recommended that such drops, even on straight sections, be protected since the severity of a crash would be high.

### **11.7 Recommendations**

RAA recommends the following treatments for Arno Bay Road:

- Install additional marker posts on approach to bends
- Protect embankments leading to the ocean with a barrier system

## 12 Summary and Recommendations

RAA's 2014 regional road assessment of the Eyre Peninsula sought to review the driveability and infrastructure provided on both the Lincoln Highway and the other B-class roads that serve as key transport corridors, connecting the Peninsula. The assessment considered the level of safety built into the route and outlined a number of recommendations for safety improvements. Table 12 provides a summary of the recommendations for the roads on the Eyre Peninsula.

Key issues include the width of the shoulder seals which, combined, with narrow lane widths experienced on some roads, allowed little room when passing heavy vehicles. This is important since traffic volumes clearly show that the number of heavy vehicles is increasing on the Peninsula which is a result of the growing agricultural and mining industry. Many of the crashes that occur on the Peninsula involve hit fixed object or vehicle rollovers, indicating that driver fatigue and inattention is a growing problem. The extension of sealed shoulders, particularly in combination with audio tactile line marking, will afford drivers a greater opportunity to recover if their vehicle starts to drift from the road and consequently `will assist in lowering the number of crashes.

Barrier protection is another key recommendation. While crash barrier systems are widely used across the Peninsula, the assessment identified that there were inconsistencies in their use. Some low severity hazards have been protected by a barrier system while others, particularly steep embankments over five metres high have not. It may be that some of the barrier installation has been undertaken under a black spot style program, treating locations based on previous crash history. In the long term, mass action treatments have proven to be a more effective approach at addressing road safety infrastructure and it is hoped that funds permitting, this model may be adopted in the future.

Lastly pavement rehabilitation, particularly to address edge break and unsealed pavement rehabilitation were identified on numerous instances. Edge break is a particular problem since large drops between the sealed and unsealed surface can create difficulties in recovering the vehicle onto the seal if drifting onto the shoulder. Loose shoulder material and adverse cross falls is a significant hazard when hitting the shoulder at speed and could pull vehicles off the road or create the potential to cause rollovers.

The assessment noted the need for overtaking lanes to be constructed along the Lincoln Highway but particularly between Whyalla and Port Augusta. While there are a number of straight sections along the highway, the traffic volumes in both directions reduce the available overtaking opportunities. It is noted that Whyalla Council is now calling for overtaking lanes to be constructed to reduce crashes on this section of route. RAA has called for overtaking lanes since *Towards 2020* but acknowledges that this is a long term requirement. Roadway departures continue to be the highest crash type on the Lincoln Highway and countermeasures in the short to medium term should address preventing and minimising the severity of run-off road and rollover crashes.

**Table 12 – Summary of Recommendations**

		Road Geometry & Pavement				Signs				Linemarking			Delineation			Intersections		Hazard Protection		Rest Areas					
Highway	Section	Shoulder seal extension	Pavement rehabilitation	Unsealed shoulder rehabilitation	Drainage improvements	Construction of overtaking lanes	Review / Install intersection warning signage	Review / Install bend warning signage	Review / install speed signage	Speed reduction to 100km/h	Installation of distance signage	Refresh linemarking	Line marking corrections	Application of edge lines	Audio Tactile Line Marking (ATLM)	Additional hazard marker posts	Install Chevron Alignment Markers (CAMs) on bends	Raised Reflective Pavement Markers (RRPMs)	Intersection upgrades	Rail crossing upgrade	Barrier Protection	Vegetation trimming / removal	Explore installation of additional rest stops	Upgrade existing rest areas with seating	Upgrade existing key rest areas (shelter & LED lighting)
Lincoln Highway	Port Augusta to Whyalla	✓																							
	Whyalla to Cowell		✓	✓											✓										
	Cowell to Tumby Bay		✓		✓																				
	Tumby Bay to Port Lincoln	✓	✓			✓	✓												✓		✓				✓
Flinders Highway	Port Lincoln to Elliston	✓		✓									✓		✓ <sup>①</sup>						✓		✓		
	Elliston to Streaky Bay														✓	✓					✓		✓		
Tod Highway	Streaky Bay to Ceduna	✓	✓	✓								✓									✓				✓
	Kyancutta to Lock	✓	✓	✓								✓									✓			✓	
Birdseye Highway	Flinders Highway to Lock	✓	✓	✓										✓							✓				
	Elliston to Lock													✓ <sup>①</sup>							✓				
Bratten Way	Lock to Cowell	✓ <sup>①</sup>	✓							✓ <sup>②</sup>				✓ <sup>①</sup>							✓				
	Tumby Bay to Cummins	✓								✓					✓						✓				
Streaky Bay Highway	Cummins to Flinders Hwy		✓								✓				✓						✓				
	Streaky Bay to Poochera	✓												✓											
Cleve Road	Kimba to Cleve		✓					✓						✓ <sup>①</sup>		✓	✓	✓ <sup>①</sup>							
Arno Bay Road	Cleve to Arno Bay		✓				✓		✓					✓ <sup>①</sup>			✓	✓ <sup>①</sup>			✓				
Coffin Bay Road	Flinders Highway to Coffin Bay															✓ <sup>①</sup>					✓				

① Application of treatment should be prioritised on bends.

② At specific locations identified in report.

- ① Application of treatment should be prioritised on bends.  
 ② At specific locations identified in report.

The posted speeds on the Peninsula of 110km/h and 100km/h were generally found to be appropriate for the road conditions with two exceptions. It was felt that on the Birdseye Highway, between Lock and Cowell, the speed limit should be reduced from 110km/h to 100km/h for approximately 15km west of Cowell. This reduction should assist in reducing the crash risk and severity resulting from the series of bends with steep drops on either side of the road along that section of the highway. A reduction of 110km/h to 100km/h is also recommended for Bratten Way between Tumby Bay and Cummins due to the frequency and severity of roadside hazards.

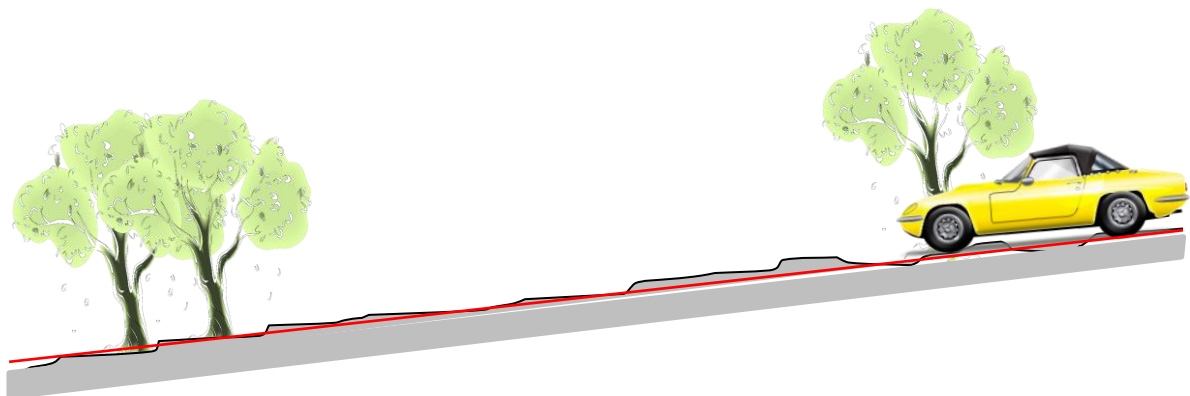
RAA acknowledges the limited funding options for the regional road network. At a time when it is a challenge to secure funding to upgrade the national highway network to a minimum 3-star safety rating, the opportunity to achieve such goals on the state and regional network appears bleak. RAA will continue to lobby the Federal Government for increased funding to the state to enable regional mass action treatments to be undertaken. Until then, treatments require careful selection to maximise the safety benefit and return on the infrastructure funding.

# Appendix A - Pavement Performance Factors

## Roughness

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

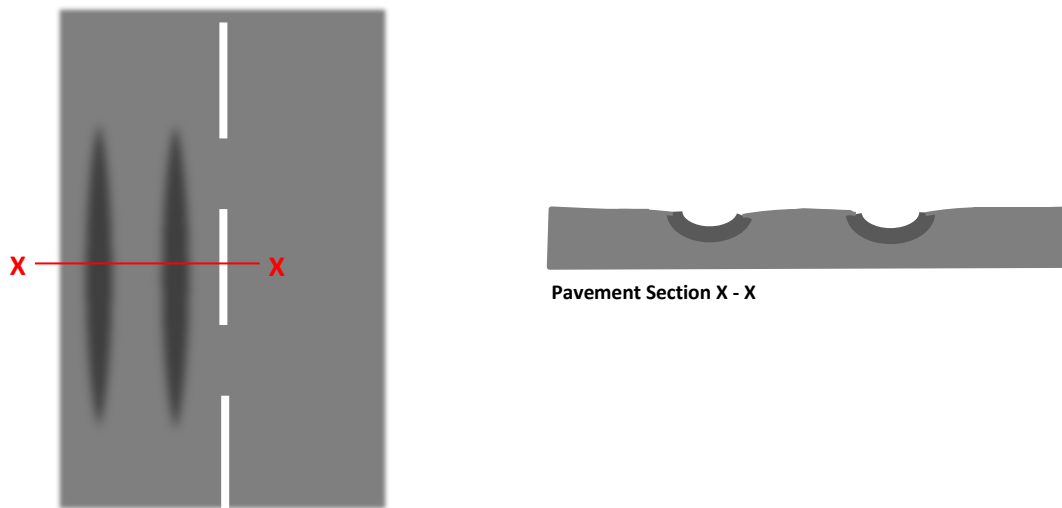
The roughness is not only important for the ride quality experienced by the motorist but prolonged vehicle exposure to a rough road may also increase wear, maintenance and fuel consumption.





## **Rutting**

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



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

## Texture

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

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

