Holcim Dunloe Sands Quarry

Dunloe Sands Quarry Access/ Pottsville Road Intersection

Response to Road Safety Audit

March 2018

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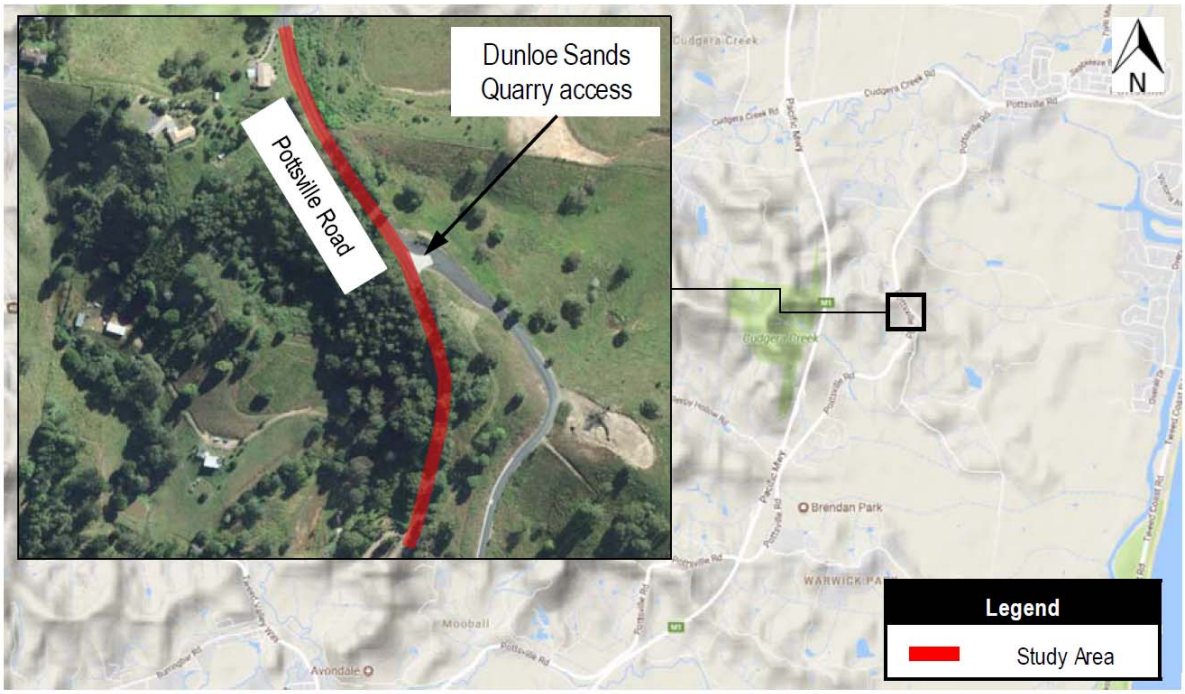
1. Introduction

The purpose of this document is to address the following significant issues raised in the Road Safety Audit conducted by Bitzios (refer Appendix A) on section of Pottsville Road, which is relevant to the existing Dunloe Quarry access road/ Pottsville Road intersection (refer Figure 1).

- Item 1.4 and Item 1.5 – Safe Intersection Sight Distance and Stopping Sight Distance
- Item 1.16 to 1.19 and Item 1.22 – Unprotected hazards in clearzone (embankment, trees) on inside of curve (eastern and western side of Pottsville Road)

The Road Safety Audit report is comprised of 23 items and the items listed above are considered significant and should be prioritised in GHD's coordination with RMS.



Source: Google Maps & SIX Maps

Figure 1: Extent of study area on Pottsville Road (excerpt from the RSA report)

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The opinions, conclusions and any recommendations in this report are based on information obtained in the Road Safety Audit Report and site observations.

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1.1 Assumptions and Limitations

The recommendations made in this report are based on information received from Bitzios and the site inspection conducted by GHD on the 14th of February 2018.

1. Information are all based on site observations and google map aerial view. No survey or as-built information is available to assess the vertical alignment of the roads involved.
2. Location and approximate size of trees are all based on site observations. Type of existing trees are not included in the available information.
3. The subject stretch of Pottsville Road has a posted speed of 80 km/hr.

2. Sight Distance Assessment

2.1 RSA Reference

Item 1.4 and Item 1.5 – Safe Intersection Sight Distance and Stopping Sight Distance

2.2 Stopping Sight Distance (SSD)

Stopping sight distance with absolute minimum and desirable minimum design parameters are summarised in Table 1 below. The road safety audit, assumed a grade of 7% for this section of Pottsville Road. This grade is adopted in SSD with grade corrections.

Trucks were analysed using operating speed/ posted speed.

For each SSD scenario, comments are provided if removal of trees is required to achieve an unobstructed sight line.

Table 1 – Required SSD

Design Vehicle	Design Speed	Rt (sec)	d	SSD (base)	SSD (downhill)	SSD (uphill)
Posted Speed 80 km/hr (existing condition)						
Absolute minimum design parameters						
Cars	90 km/hr	1.5	0.46	107	129	93
Trucks	80 km/hr	1.5	0.29	120	148 (remove minor trees)	103
Desirable minimum design parameters						
Cars	90 km/hr	2.0	0.36	139	161 (remove minor trees)	125 (remove major trees)
Trucks	80 km/hr	2.0	0.29	131	159	114
Posted Speed 60 km/hr (proposed speed reduction)						
Absolute minimum design parameters						
Cars	70 km/hr	1.5	0.46	71	84	62
Trucks	60 km/hr	1.5	0.29	74	90	65
Desirable minimum design parameters						
Cars	70 km/hr	2.0	0.36	92	105	83
Trucks	60 km/hr	2.0	0.29	82	98	73

Higher SSD adopted for two dimensional SISD check

2.3 Safe Intersection Sight Distance (SISD)

Safe intersection sight distance with absolute minimum and desirable minimum design parameters are summarised in Table 2 below. The road safety audit, assumed a grade of 7% for this section of Pottsville Road. This grade is adopted in SISD with grade corrections.

The available SISD as per site observation are:

- Downhill (south bound) – 177m
- Uphill (north bound) – 146m

For each SISD, comments are provided if removal of trees is required to achieve an unobstructed sight line.

Table 2 – Required SISD

Design Vehicle	Design Speed	Rt (sec)	d	SISD (base)	SISD (downhill)	SISD (uphill)
Posted Speed 80 km/hr (existing condition)						
Absolute minimum design parameters						
Cars	90 km/hr	1.5	0.362	201	223 (remove major trees)	187 (remove major trees)
Desirable minimum design parameters						
Cars	90 km/hr	2.0	0.362	214	236 (remove major trees)	200 (remove major trees)
Posted Speed 60 km/hr (proposed speed reduction)						
Absolute minimum design parameters						
Cars	70 km/hr	1.5	0.362	141	154	132
Desirable minimum design parameters						
Cars	70 km/hr	2.0	0.362	151	164	142

2.4 Sight distance assessment

2.4.1 SSD

As shown above in Section 2.2 the SSD values impact on existing trees, it is recommended to adopt and satisfy the absolute minimum design parameters by removing few minor trees (≤ 100mm diameter) on the inside of the curve of Pottsville Road (eastern side).

Figure 2: Preliminary SSD check showing absolute minimum design parameters (red lines)

2.4.2 SISD

Based on the absolute and desirable SISD values in Section 2.3, the initial solution to achieve an unobstructed sigh line is to remove the obstruction (i.e. clear existing trees) within the influence of the required SISD. However, clearing of trees in the area is not considered a preferred option at this stage due to a number of environmental implications (i.e. koala habitat area, cutting of trees would cause erosion on existing steep batters). Thereby, this report aims to propose the following options to address the SISD issues raised in the RSA report **without cutting the existing trees**.

Figure 3: Preliminary SISD check showing absolute (red lines) and preferred (yellow lines) minimum design parameters

Option 1: Proposed speed reduction on Pottsville Road (road section 250m on each side of Dunloe Quarry access)

Based on the SISD values and their impact on existing trees (refer Section 2.3), it is proposed to adopt and satisfy the desirable SISD minimum design parameters with a design speed of 70 km/hr (posted speed 60 km/hr) and avoid the removal of major trees on both uphill and downhill SSDs. This proposal will not warrant the need for minor tree clearing in the SSD assessment (refer Section 2.4.1).

Option 2: Maintain the posted speed in consideration of the crash history and AADT on Pottsville Road

The initial discussion between Greg Sciffer of RMS and GHD is that the clearing of trees or reduction of speed limit in the area is not to be considered as the only option/s for the assessment of RSA result. The level of risk should also be determined to validate the need for treatment with respect to the actual road conditions and history of road crashes (i.e. Is there a warrant to address the limited sight distance?). As discussed, there are other solutions that can be used to increase the level of driver's awareness and to stress the presence of the subject intersection which are discussed in this option.

The following factors are being considered for the viability of this alternative treatment:

- Risk is considered low due to the low traffic volume and no recorded crash history. Refer to the following sections of the road safety audit:
    - Section 2.2 of the RSA Report – AADT (bi-directional) 1517 veh/day
    - Section 2.3 of the RSA Report – no recorded crash history in proximity to the study area.
- Drivers of vehicles (i.e. quarry trucks, service vehicles) coming in and out of the Dunloe Quarry access are all subject to Holcim's safety training and regular safety review which includes the road safety requirements in the quarry access intersection and along Pottsville Road.
- The following road improvement works will be recommended:
    - Install signage as per recommendation in Table 3.1 (Item 1.4 and Item 1.5) of the RSA report (W2-9 Side Road Intersection on a curve plus W8-5)

W2-9(L)

W8-5

- Apply new and clear pavement linemarkings (i.e. no overtaking barrier lines, edge lines, auxiliary lane continuity line)
- Apply new road edge guide posts (REGP)
- Apply retroreflective raised pavement markers (RRPM)
- Improve the visibility of the intersection (i.e. extend the concrete pavement across the Quarry Access road section at the intersection, provide a raised median on Quarry Access Road at the intersection)
- Review of existing auxiliary lane at the southbound direction (refer Item 1.12 in the RSA report)

3. Clear Zone

3.1 RSA Reference

Item 1.16 to 1.19 and Item 1.22 – Unprotected hazards in clearzone (embankment, trees) on inside of curve (eastern and western side of Pottsville Road)

3.2 Required clear zone

The following design parameters were used with Table C.1 of Appendix C RTS Method in Austroads Part 6 to determine the required clear zone distance at Pottsville Road:

- Design Speed – 90 km/hr
- Road horizontal curve radius – R270m
- All fill and cut slopes are non-traversable (i.e. 1:1 or steeper)

The clear zone requirements with the above design parameters are as follows.

- 11.3m from the edge of road on curved alignment
- 7.5m from the edge of road on straight alignment

3.3 Site observations

Existing hazards such as existing trees with significant trunk diameter (i.e. 300mm to 600mm) and steep embankment slope (as steep as 1:1 with existing trees) are located within the clearzone (refer Figure 4 and Figure 5). Some of these hazards have 2m offset from the edge of road.

The western side of Pottsville Road, at the southern side of the Quarry Access road, has no sealed shoulder. The eastern side of Pottsville Road has sealed shoulder but a significant length of the shoulder at the northern side of the Quarry Access road is only 0.5m wide with concrete kerb immediately next to a steep batter.

Figure 4: Example of existing trees within the clear zone

Figure 5: Example of existing 0.5m shoulder (with concrete kerb) next to a steep batter

3.4 Clear Zone Assessment

The RSA report has recommended the installation of safety barriers to protect the vehicles from the identified hazards (refer Section 3.3).

Where a shoulder is not available, a 1m wide shoulder will be proposed before the barrier location.

It should be noted that the proposed safety barriers on the inside of the curve on both sides of Pottsville Road would become an obstruction to the SSD and SISD sight lines. Addressing the potential SSD problem with the safety barrier would require a shoulder widening on a steep batter slope and removal of trees. The repercussion of the installation of safety barriers would increase the cost of installation and environmental risks, which would not warrant the need for

safety barriers in the standard RISC analysis. In lieu of this, the following option can be considered.

Option 1: Consider the low risk condition (no recorded crash history) on Pottsville Road

The initial discussion between Greg Sciffer of RMS and GHD is that the clearing of trees or reduction of speed limit in the area is not to be considered as the only option/s for the assessment of RSA result. The level of risk should also be determined to validate the need for treatment with respect to the actual road conditions and history of road crashes (i.e. Is there a warrant to address the limited clear zone along Pottsville Road?). As discussed, there are other solutions that can be used to increase the level of driver's awareness and direct the drivers within the defined road lanes (i.e. clear linemarkings, REGP) which are discussed in this option.

The following factors are being considered for the viability of this alternative treatment:

- Risk is considered low due to the low traffic volume and no recorded crash history. Refer to the following sections of the road safety audit:
    - Section 2.2 of the RSA Report – AADT (bi-directional) 1517 veh/day
    - Section 2.3 of the RSA Report – no recorded crash history in proximity to the study area.
- Drivers of vehicles (i.e. quarry trucks, service vehicles) coming in and out of the Dunloe Quarry access are all subject to Holcim's safety training and regular safety review which includes the road safety requirements in the quarry access intersection and along Pottsville Road.
- The following road improvement works will be recommended to direct drivers (particularly around curves) and preventing run-off-road crashes:
    - Apply new and clear pavement linemarkings (i.e. no overtaking barrier lines, edge lines, auxiliary lane continuity line).
    - Consider audio-tactile edge lines
    - Apply new road edge guide posts (REGP)
    - Apply retroreflective raised pavement markers (RRPM)
    - Install relevant signages such as W1-3 on approaches to bend and D4-6 (chevron alignment markers).

D4-6

W1-3(L)

Appendices

Appendix A – Road Safety Audit Report

DUNLOE SANDS QUARRY POTTSVILLE
ROAD SAFETY AUDIT

FOR

GHD

Gold Coast
Suite 26, 58 Riverwalk Avenue
Robina QLD 4226
P: (07) 5562 5377
W: www.bitziosconsulting.com.au

Brisbane
Level 2, 428 Upper Edward Street
Spring Hill QLD 4000
P: (07) 3831 4442
E: admin@bitziosconsulting.com.au

Sydney
Studio 203, 3 Gladstone Street
Newtown NSW 2042
P: (02) 9557 6202

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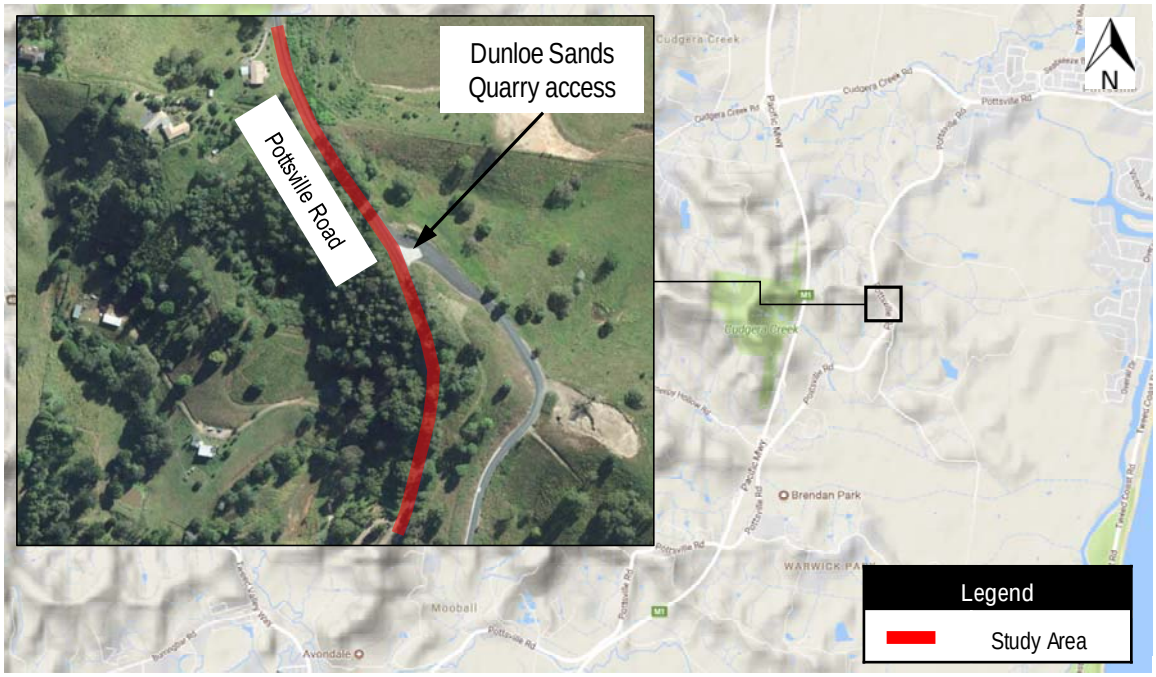
1. INTRODUCTION

1.1 BACKGROUND

Bitzios Consulting has been engaged by GHD to undertake an existing conditions road safety audit of the Dunloe Sands Quarry access to Pottsville Road in Sleepy Hollow, NSW. Given the access form and size, the quarry access is considered to form an intersection with Pottsville Road and is not a typical driveway crossover.

The study area extends approximately 250m to the north and 250m to the south of the Dunloe Sands Quarry access. The study area is presented in Figure 1.1.



Source: Google Maps & SIX Maps

Figure 1.1: Extent of Study Area on Pottsville Road

1.2 CONTEXTUAL INFORMATION

GHD recently completed a traffic assessment for a modification to the Dunloe Sands Quarry. The Roads and Maritime Services (RMS) have subsequently requested the following:

- *"It is recommended that the Consent Authority require an independent Road Safety Audit (RSA) of the existing intersection prepared in accordance with Part 6 of the Austroads Guide to Road Safety. An addendum to the TIA should be prepared to address the findings of the RSA and where appropriate, proposed mitigation measures to address any road safety impacts arising from the proposed modification."*

1.3 SCOPE

The scope of works for the road safety audit includes the following:

- review of crash data for the corridor to identify existing safety issues;
- review of available existing information (e.g. count data) relevant to the road corridor;
- undertake an existing conditions road safety audit consistent with the procedures outlined within the Austroads Guide to Road Safety;
- identify and prioritise recommendations for treatments / improvements to address the road safety issues and historical crashes identified within the study corridor; and
- prepare an inventory of issues and treatments.

1.4 LIMITATION AND INTERPRETATION OF AUDIT RESULTS

Actions have been suggested for each of the issues primarily as a guide for the personnel responsible for selecting and implementing remedial measures. It is not intended to imply that the suggested actions are the only possible actions.

Furthermore, while the scope items listed above presents a range of items that were reviewed as part of the audit process, only the issues identified as presenting a safety risk have been raised and commented upon within this report.

The road safety audit is limited to the section of Pottsville Road located within the study area, as detailed in Section 1.1.

1.5 OBJECTIVES

The objectives of the road safety audit are:

- to identify potential safety problems for road users and others affected by the existing conditions of the road; and
- to ensure that measures to eliminate or reduce the problems are considered fully.

The benefits of conducting road safety audits are that the:

- likelihood of crashes on the road network can be reduced; and
- severity of crashes can be reduced.

The aim of the road safety audit is:

"to identify any existing safety deficiencies of design, layout and road furniture which are not consistent with the road's function or use. There should be consistency of standards such that the road users' perception of local conditions assists safe behaviour."

1.6 METHODOLOGY

The road safety audit was carried out consistent with the procedures set out in the Austroads Guide to Road Safety. Items reviewed as part of the road safety audit included (but were not limited to) the following:

- road alignment (horizontal and vertical) and cross-section;
- intersection geometry;
- intersection sight distances (including sight distance to any intersection control signs);
- sign and pavement markings;
- roadside objects and hazards;
- driver sight distances along the corridor; and
- available crash details along the study corridor.

1.7 AUDIT TEAM

The road safety audit was carried out by an audit team comprising of:

- Praveen Bollavaram – Accredited Lead Road Safety Auditor; and
- Julius Walden-Goodlet – Traffic Engineer.

1.8 INFORMATION SOURCES

Information sources for the road safety audit included:

- site inspections;
- available crash history data obtained from Transport for NSW (NSW Centre for Road Safety);
- available traffic volume data obtained from Tweed Shire Council;
- AS1742 MUTCD;

- *Austroads Guide to Road Design*; and
- *Austroads Guide to Road Safety*.

1.9 SITE INSPECTIONS

Both day time and night time site inspections were carried out on Wednesday 4th September 2017 from 3:00PM to 5:00PM and 6:00Pm to 6:30PM to gain an appreciation of the existing road conditions and terrain for the purpose of identifying deficiencies along the existing corridor that need to be addressed.

2. ROAD CONDITIONS AND DATA REVIEW

2.1 POTTSVILLE ROAD

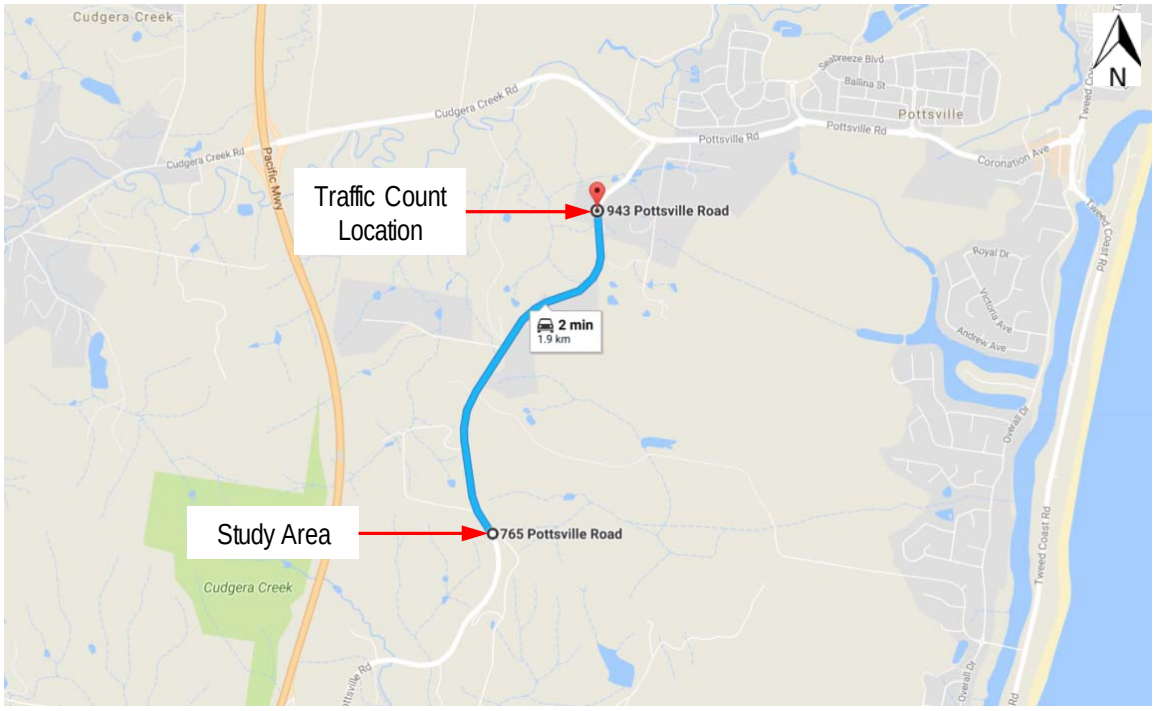
Pottsville Road is a rural road located between Cudgera Creek Road and Tweed Valley Way. Pottsville Road provides residential access, is a connecting road between two key rural roads and services a number of agricultural and industrial facilities. The section of Pottsville Road within the study area is a two-lane, two-way carriageway. The subject site / study area is the intersection of the Dunloe Sands Quarry access road and Pottsville Road, which is located on a curve and has a posted speed of 80km/h.

2.2 TRAFFIC VOLUMES

Traffic data was obtained from Tweed Shire Council for Pottsville Road. The traffic count location is at No. 943 Pottsville Road, which is approximately 1.9km north of the Dunloe Sands Quarry access. The traffic data is presented in Table 2.1. The traffic count location with respect, to the study area is shown in Figure 2.1.

Table 2.1: Pottsville Road AADT

Location	Date	AADT (Bi-Directional)
Pottsville Road – at No 943	17/05/2017	1517 veh/day



Source: Google Maps

Figure 2.1: Traffic Count Location with Respect to Study Area

2.3 CRASH HISTORY

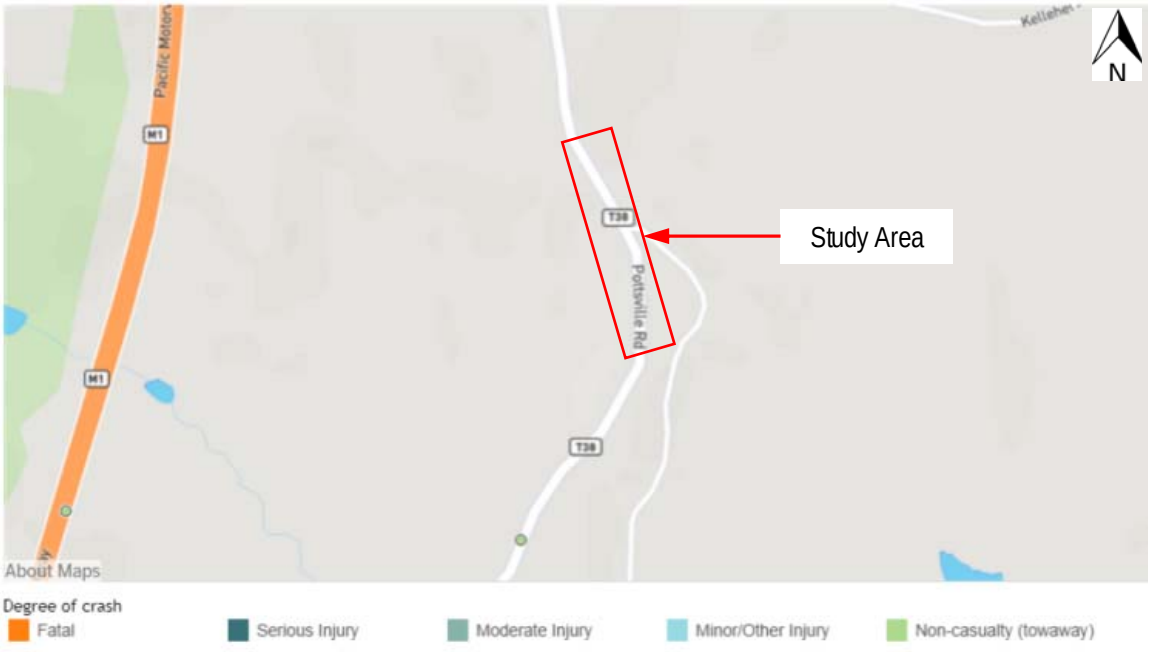
2.3.1 Reported Crashes

Crash data was obtained from Transport for NSW (NSW Centre for Road Safety). Available crash data includes a record of the following crash types:

- Fatal;
- Serious Injury;
- Moderate Injury;

- Minor/Other Injury; and
- Non-casualty (towaway) Crashes.

The available data is available for the 5-year period from 2012 to 2016. Figure 2.2 shows a map of crashes in the study area and immediate surrounds. As demonstrated, during the period that crash data is available for, no crashes were recorded in proximity to the study area. The nearest crash was approximately 800m to the south of the Dunloe Sands Quarry access. The single crash occurred in 2012 and was a non-casualty (towaway) crash. The crash was an off bend into object crash (RUM Code 85).



Source: Transport for NSW (NSW Centre for Road Safety)

Figure 2.2: Pottsville Road Crash History

As demonstrated in Figure 2.2, there is no significant crash history or trend of crashes recorded within the study area.

3. AUDIT FINDINGS

The safety issues, suggested treatments and prioritisation for the study area are detailed in Table 3.2. The location of each issue is summarised in Figure 3.1.

A ranking for each recommendation has been included to prioritise the issues in order of importance in relation to vehicular, cyclist and pedestrian safety using the following range:

- Priority A: Indicates highest priority for action from a safety view point. These are recommendations that will have the highest impact on reducing the probability or severity of a possible incident;
- Priority B: Indicates that action is needed from a safety point of view;
- Priority C: Indicates that the action is desirable from a safety point of view; and
- Priority D: For all other actions.

Table 3.1: Existing Conditions Road Safety Audit – Findings and Suggested Treatments

Item	Priority	Issue	Illustration	Suggested Treatment(s)
1.1	C	Line marking on westbound approach to the intersection is faded		Provide new line marking on the approach to the intersection
1.2	B	Unprotected drop / steep fall on edge of access road. Absence of delineation to assist drivers under night conditions.		Approach provides access to an internal roadway and is a low speed environment. As a minimum the edge of road should be delineated (provision of guide posts, line marking, RRPMs etc.). Ultimately it is recommended to protect the drop-off with guardrail.

Item	Priority	Issue	Illustration	Suggested Treatment(s)
1.3	C	Stop sign does not comply with the standard requirements of a stop sign as stipulated in AS1742. The stop sign is also not retroflective and therefore is not clearly visible at night.		Replace existing sign with Stop Sign (R1-1) compliant with AS1742. The new sign should be installed in accordance with the orientation and height requirements of AS1742.2
1.4	A	The Safe Intersection Sight Distance (SISD) to the north was measured to be approximately 205m. The available sight distance to the north does not comply with the Safe Intersection Sight Distance (SISD) of 236m stipulated in Austroads Guide to Road Design Part 4A. Sight distance to the north is obscured by vegetation on the inside of the curve on Pottsville Road (eastern side). The SISD requirement was based on a 2.0 second reaction time and design speed of 90km/h (posted speed 80km/h) which warrants an SISD of 214m. On site the average grade of Pottstville Road was measured to be approximately 7% through the intersection (downgrade for vehicles approaching from the north). On this basis an additional 22m SISD is required for grade correction (interpolated based on correction factors for 6% and 8%). The total SISD requirement is therefore 236m.		Vegetation removal / vegetation trimming along Pottsville Road to the north of the subject intersection, along the eastern extent of the road to maximise the available sight distances. Provision of signage on the major road (Pottsville Road) on approach to the intersection to provide additional warning to drivers. Signage may include Side Road Intersection on a Curve (W2-9(R)) and xx m sign (W8-5). Example signage is shown below. 

Item	Priority	Issue	Illustration	Suggested Treatment(s)
1.5	A	The Safe Intersection Sight Distance (SISD) to the south was measured to be approximately 135m. The available sight distance to the south does not comply with SISD requirement of 203m. The Stopping Sight Distance (SSD) to the south was measured to be approximately 115m. The available sight distance to the north does not comply with SISD requirement of 138m. Sight distance is obscured by vegetation on the inside of the curve on Pottsville Road (western side). The SISD requirement was based on a 2.0 second reaction time and design speed of 90km/h (posted speed 80km/h) which warrants an SISD of 214m. On site the average grade of Pottstville Road was measured to be approximately 7% through the intersection (upgrade for vehicles approaching from the south). On this basis a reduction of 11m SISD is permitted for grade correction (interpolated based on correction factors for 6% and 8%). The total SISD requirement is therefore 203m. The SSD requirement was based on the requirement for trucks with a reaction time of 2.0 seconds and design speed of 90km/h which warrants an SSD of 160m. A reduction of 22m was applied for grade correction.		Vegetation removal / vegetation trimming along Pottsville Road to the south of the subject intersection, along the western extent of the road to maximise sight distances. Consider relocating the existing stop bar (to the east of its current location) to improve sight distance. Minor relocation of the stop bar (to the east) may result in some sight distance improvements. Provision of signage on the major road (Pottsville Road) on approach to the intersection to provide additional warning to drivers. Signage may include Side Road Intersection on a Curve (W2-9(L)) and xx m sign (W8-5). Example signage is shown below. 

Item	Priority	Issue	Illustration	Suggested Treatment(s)
1.6	C	Westbound approach to intersection includes differing pavement surfaces (both bitumen and concrete) and is confusing for motorists navigating the intersection and trying to identify the intersection configuration (especially for vehicles approaching from the south and turning right into the access road). The concrete sections also make line marking difficult for motorists to see		Provide a consistent pavement finish for the approach to the intersection (i.e. all bitumen seal or all concrete)
1.7	C	Absence of Unidirectional hazard marker (D4-2-3)		Install Unidirectional hazard marker (D4-2-3) on Pottsville Road the opposite westbound approach to the intersection

Item	Priority	Issue	Illustration	Suggested Treatment(s)
1.8	B	Uneven road surface / damaged road / poor pavement conditions / minor pavement failure / pavement bleeding through intersection and on both approaches resulting in reduced skid resistance and unpredictable surface conditions	  	Re-surface damaged sections of road through the intersection and on approaches to the intersection

Item	Priority	Issue	Illustration	Suggested Treatment(s)
			 	

Item	Priority	Issue	Illustration	Suggested Treatment(s)
				
1.9	A	Absence of sealed shoulder on inside of curve (western side of Pottsville Road).		Provide a minimum 1m sealed shoulder in accordance with Austroads requirements for rural roads with an AADT between 1000-3000 veh/day
1.10	A	The unsealed shoulder on the western side of the intersection is slightly raised above traffic lane and may result in surface water drainage issues / water pooling		Grade shoulder. Shoulder crossfall should be marginally greater than the crossfall of the adjacent traffic lane (i.e. increase of 1%). Consideration to be given to Item 1.9.

Item	Priority	Issue	Illustration	Suggested Treatment(s)
				
1.11	C	No edgeline provided on western side of Pottsville Road and is inconsistent with adjacent sections of where edgelines have been provided on both sides	 	Provide edgeline. Consideration to be given to Item 1.9 (i.e. shoulder widening) prior to edgeline provision

Item	Priority	Issue	Illustration	Suggested Treatment(s)
1.12	C	Informal AUL provided		Formalise AUL including provision of lane marking and pavement arrows in accordance with AS1742
1.13	B	No RRPMs installed - poor delineation at night		Install RRPMs through intersection and on approaches
1.14	A	Poor delineation / no delineation - absence of guide posts particularly on the left-hand side when travelling north		Improve delineation by providing guideposts at a spacing consistent with minimum standard requirements (AS1742)

Item	Priority	Issue	Illustration	Suggested Treatment(s)
				
1.15	A	Damaged / broken guideposts throughout study area	 	Replace all damaged / broken guideposts

Item	Priority	Issue	Illustration	Suggested Treatment(s)
			  	

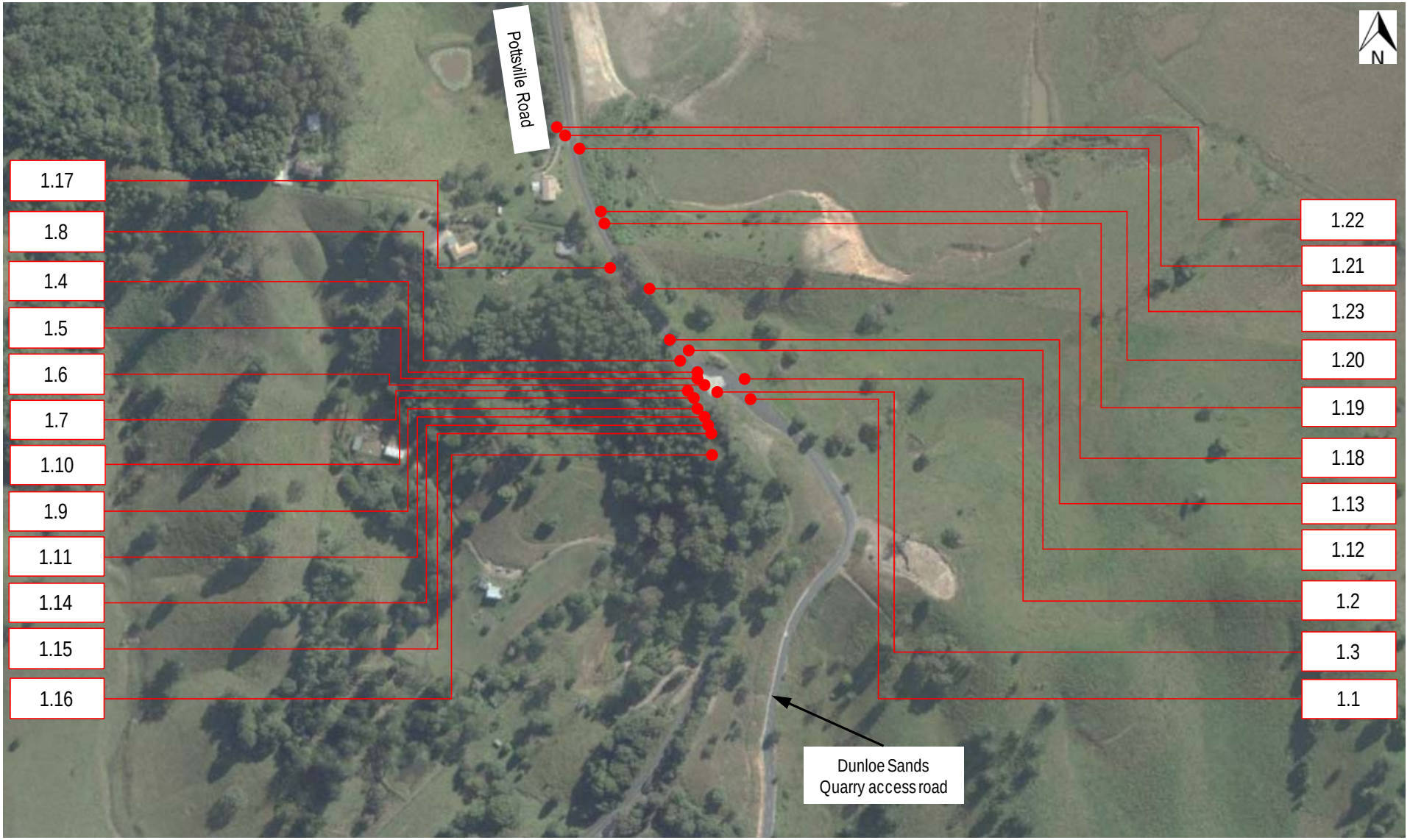
Item	Priority	Issue	Illustration	Suggested Treatment(s)
1.16	A	Unprotected hazards in clearzone (embankment, trees) on inside of curve (western side of Pottsville Road)	  	Protect hazards with guardrail

Item	Priority	Issue	Illustration	Suggested Treatment(s)
			 	
1.17	A	Unprotected hazards in clearzone (large rocks, tree) on western side of Pottsville Road		Remove rocks and tree (or retain tree and protect with guardrail).

Item	Priority	Issue	Illustration	Suggested Treatment(s)
1.18	A	Unprotected hazards in clearzone (embankment, trees) on eastern side of Pottsville Road		Install guardrail along this section of road to protect hazards
1.19	A	Unprotected hazards in clearzone (embankment, trees) on eastern side of Pottsville Road	 	Protect hazards with guardrail

Item	Priority	Issue	Illustration	Suggested Treatment(s)
				
1.20	A	Possible surface water drainage issues / water pooling on eastern side on Pottsville Road due to kerb design and crossfall		Drainage to be investigated further. Treatment will depend on findings however may include upgrades to kerb / provision of culverts (or other design feature to remove excess water from road edge)

Item	Priority	Issue	Illustration	Suggested Treatment(s)
1.21	A	Loose gravel on road from adjacent driveway		Remove any loose gravel
1.22	A	Unprotected hazards in clearzone (embankment, trees) on western side of Pottsville Road		Protect hazards with guardrail (extend existing guardrail)
1.23	D	Non-compliant Koala warning sign		Replace with Koala (Symbolic) (W5-47)



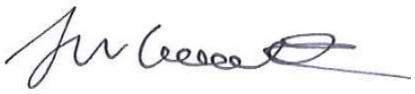
Source: SIX Maps

Figure 3.1: Indicative Item Locations

4. CONCLUDING STATEMENT

Bitzios Consulting Pty Ltd makes every endeavour to fully exercise its duty of care to its clients and all road users in any recommendations from being engaged to conduct a road safety audit report. Bitzios Consulting Pty Ltd, in making recommendations, is fully aware and wishes you to be fully aware that there can be a number of different factors that cause road crashes. Whilst Bitzios Consulting Pty Ltd makes every endeavour to make recommendations to enhance road safety by addressing foreseeable risks, those recommendations cannot completely eliminate the risk of crashes.

Praveen Bollavaram, Bitzios Consulting, Lead Road Safety Auditor



Julius Walden-Goodlet, Bitzios Consulting, Audit Team Member / Traffic Engineer

https://projects.ghd.com/oc/Sydney/holcimdunloesandmodi/Delivery/Documents/Holcim Report_05032018.docx

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
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