LINDEMAN GREAT BARRIER REEF RESORT PROJECT

ENVIRONMENTAL IMPACT STATEMENT

APPENDIX W - ROAD IMPACT ANALYSIS

Addendum: *This EIS was initially prepared assuming that the safe harbour was to be part of the Lindeman Great Barrier Reef Resort Project. With the commencement of the Great Barrier Reef Marine Park Authority's (GBRMPA) Dredging Coral Reef Habitat Policy (2016), further impacts on Great Barrier Reef coral reef habitats from yet more bleaching, and the recent impacts from Tropical Cyclone Debbie, the proponent no longer seeks assessment and approval to construct a safe harbour at Lindeman Island. Instead the proponent seeks assessment and approval for upgrades to the existing jetty and additional moorings in sheltered locations around the island to enable the resort's marine craft to obtain safe shelter under a range of wind and wave conditions. Accordingly, remaining references to, and images of, a safe harbour on various figures and maps in the EIS are no longer current.*

Road Impact Assessment

Lindeman Island EIS

HRP15078

Prepared for
White Horse Australia

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Cardno
Shaping the Future

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Contact Information

Cardno (Qld) Pty Ltd
ABN 57 051 074 992

Level 11 Green Square North Tower
515 St Paul's Terrace
Locked Bag 4006
Fortitude Valley Qld 4006

Telephone: 07 3369 9822
Facsimile: 07 3369 9722
International: +61 7 3369 9822

transportqld@cardno.com.au
www.cardno.com.au

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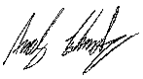
01	09 Feb 2016	Draft Issue	AXS		ASJ	

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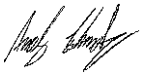
01	Draft for Comment	ASJ		09 Feb 2016

Executive Summary

Cardno (Qld) Pty Ltd (Cardno) has been commissioned by White Horse Australia Lindeman Pty Ltd (White Horse) to complete a Road Impact Assessment as part of the Environmental Impact Statement for the Lindeman Island Great Barrier Reef Resort.

White Horse proposes to redevelop Lindeman Island to include a spa and resort, with ancillary uses such as an airstrip and marina. The RIA considers the road impacts on the state-controlled road network associated with the Project. This pertains mainly to the construction activities and the impact on the mainland road system.

In accordance with the Guidelines for Assessment of Road Impacts of Developments (GARID), the assessment has been prepared as specified in the Terms of Reference (ToR). The road impact assessment includes a scoping assessment to determine the spatial extent of the subsequent pavement impact assessment.

It is acknowledged the information regarding assumptions associated with the project activities, particularly the construction activities, are subject to a certain level of uncertainty and may not currently provide a completely accurate representation due to the uncertainties of unknowns including the supply of materials and mode of transport. One important impact of this is that without more certainty around specific vehicle trips, a pavement impact assessment will not provide a meaningful outcome.

The project activities relate to the construction and operations of the project. For each stage, the impact on the road network will be attributed to workers arriving and departing from the port at Shute Harbour as well as project deliveries being transported to and from the port for shipping to the island. Future discussions will need to be undertaken to finalise the logistics arrangement for deliveries, as transporting deliveries by barge from the various shipping ports has been suggested as an option, pending further economic analysis. At this stage, however, all deliveries have been assumed to be transported by the road network.

The state controlled road network which has been assessed as part of the RIA includes Proserpine-Shute Harbour Road and sections of the Bruce Highway north and south of Proserpine. Upgrades planned for the network do not relate to increasing capacity and hence have not been considered as part of the assessment.

The scoping assessment to determine the traffic impacts on the road network have been based on the logistics assumptions received by Cardno from the project team. Where information was missing, Cardno has taken due care to ensure reasonable assumptions have been adopted. Preliminary results from the assessment have indicated that the entire length of Proserpine-Shute Harbour Road will need to be assessed further as part of the pavement impact assessment. The assessment has highlighted that the Bruce Highway did not trigger the 5% thresholds for further assessment based on the current estimates of traffic.

Until such time that assumptions regarding vehicle movements can be defined with more certainty, a pavement impact assessment should be delayed due to the potential variability of the outputs.

Table of Contents

Tables

Figures

Appendices

1 Introduction

1.1 Report Context

Cardno (Qld) Pty Ltd (Cardno) has been commissioned by White Horse Australia Lindeman Pty Ltd (White Horse) to complete a Road Impact Assessment (RIA) as part of the Environmental Impact Statement for the Lindeman Island Great Barrier Reef Resort.

White Horse proposes to redevelop Lindeman Island to include a spa and resort, with ancillary uses such as an airstrip and marina. The RIA considers the road impacts on the state-controlled road network associated with the Project. This pertains mainly to the construction activities and the impact on the mainland road system.

In accordance with the Terms of Reference (ToR) issued by the Office of the Co-ordinator General, this RIA details the potential impacts associated with the project and outlines the measures proposed to avoid, minimise or mitigate the impacts. Maintaining the safety and efficiency of the road network is the underlying objective for the RIA.

1.2 Report Structure

Table 1-1 summarises the report structure while the report appendices are summarised in Table 1-2.

Table 1-1 Report Structure

Section		Description
1	Introduction	Summarises the report context and structure
2	Assessment Overview	Outlines the assessment structure and parameters
3	Project Overview	Describes the project location and broad project parameters
4	Existing Road Conditions	Describes the study area and existing traffic volumes
5	Project Activities	Describes the assumptions associated with the project activities
6	Project Transport Task and Traffic Demands	Outlines the methodology and calculations for estimating the project related traffic
7	Road Improvements and Mitigations	Outlines the recommended mitigation measures
8	Environmental Issues	Describes other issues including parking requirements
9	Conclusion	Summarises the assessment and findings

Table 1-2 Report Appendices

Appendix		Description
A	Glossary	Definitions for acronyms and abbreviations used throughout the report

1.3 Limitations

Cardno has undertaken the RIA in accordance with the usual care and thoroughness of the engineering profession. The assessment is based on accepted traffic engineering practices and standards applicable at the time.

The adopted assessment methodology and sources of information utilised by Cardno are outlined in the RIA. Cardno has made no independent verification of the supplied project information or existing road condition data beyond the agreed scope of works. Within the extent of the assessment scope no indications were found however that the supplied project information or existing road condition data relied upon was inaccurate.

It is noted that the information regarding assumptions associated with the project activities, particularly the construction activities, were not deemed to provide a completely accurate representation due to the uncertainties surrounding the scale of materials and how these will be transported to site. One important impact of this is that without the ability to estimate specific vehicle trips, accurate pavement impact assessment results are unlikely. Until such time that assumptions regarding vehicle movements can be defined with more certainty, a pavement impact assessment is not considered to be worthwhile due to the potential variability of the outputs.

The assessment was undertaken between March 2015 and February 2016 and is based upon the road conditions encountered and the project information available at the time. Cardno disclaims responsibility for any changes to project planning or road conditions that may occur after completion of the assessment.

1.4 References

In preparation of this RIA, the following resources have been referenced:

> Department of State Development, *Terms of Reference for an Environmental Impact Statement: Lindeman Great Barrier Reef Resort Project*, July 2015
> Department of Transport and Main Roads, *Guidelines for Assessment of Road Impacts of Developments*, March 2006
> Department of Transport and Main Roads, *Queensland Transport and Roads Investment Program 2015-16 to 2018-19*, 2015
> Department of Transport and Main Roads, *Multi-combination Route in Queensland – Proserpine Regions*, 5 November 2007

2 Assessment Overview

2.1 Assessment Approach

The Guidelines for Assessment of Road Impacts of Developments (GARID), published by the Department of Transport and Main Roads (TMR), sets out the framework for traffic assessments, including road impact assessments and pavement impact assessments. The general structure for preparing RIAs is as follows:

1. Development profile
2. Future traffic volumes
3. Scope of assessment and criteria adopted
4. Impact assessment and determination of impact mitigation measures
5. Determination of development conditions or developer contribution required

2.1.1 Development Profile

The proposed development is described in section 3 of the RIA. This section outlines the project location and broad study area in terms of the road network.

2.1.2 Future Traffic Volumes

The determination of future baseline traffic volumes is based on existing traffic data with a general growth trend applied. In this case, the growth factor has been derived from historical AADT data. The inclusion of external traffic generators on the road network has not been assessed in this case.

2.1.3 Scope of Assessment and Criteria Adopted

GARID clearly sets out the thresholds for determining the spatial extent of the assessment, based upon the proportionate impact of the development traffic on existing roads. This is expanded on in section 2.2.

2.1.4 Impact Assessment and Determination of Impact Mitigation Measures

The estimation of development traffic has been derived from the underlying project assumptions such as the workforce numbers and construction deliveries. The impact of these trips is assessed in comparison to the baseline traffic through link analysis and intersection analysis. Where the road network is shown to be compromised due to the development, appropriate mitigation measures will be proposed.

2.1.5 Determination of Development Conditions or Developer Contribution Required

Where mitigation measures are determined to be necessary, appropriate contributions towards the state government will need to be agreed upon. Discussion of this matter will not be covered in this RIA.

2.2 Spatial Scope

In accordance with GARID, the threshold for determining whether traffic impacts need to be assessed is defined as traffic generated by the development that equals or exceeds 5% of the existing AADT on the road section, intersection movements or turning movements (Criteria 3).

Similarly for heavy vehicle movements, the development traffic along haul routes need to be assessed where the development traffic equals or exceeds 5% of the existing ESAs (Criteria 4).

2.3 Reference to Terms of Reference Items

Table 2-1 summarises the transport related ToR items and the sections of the report which address these items.

Table 2-1 Lindeman EIS ToR Checklist

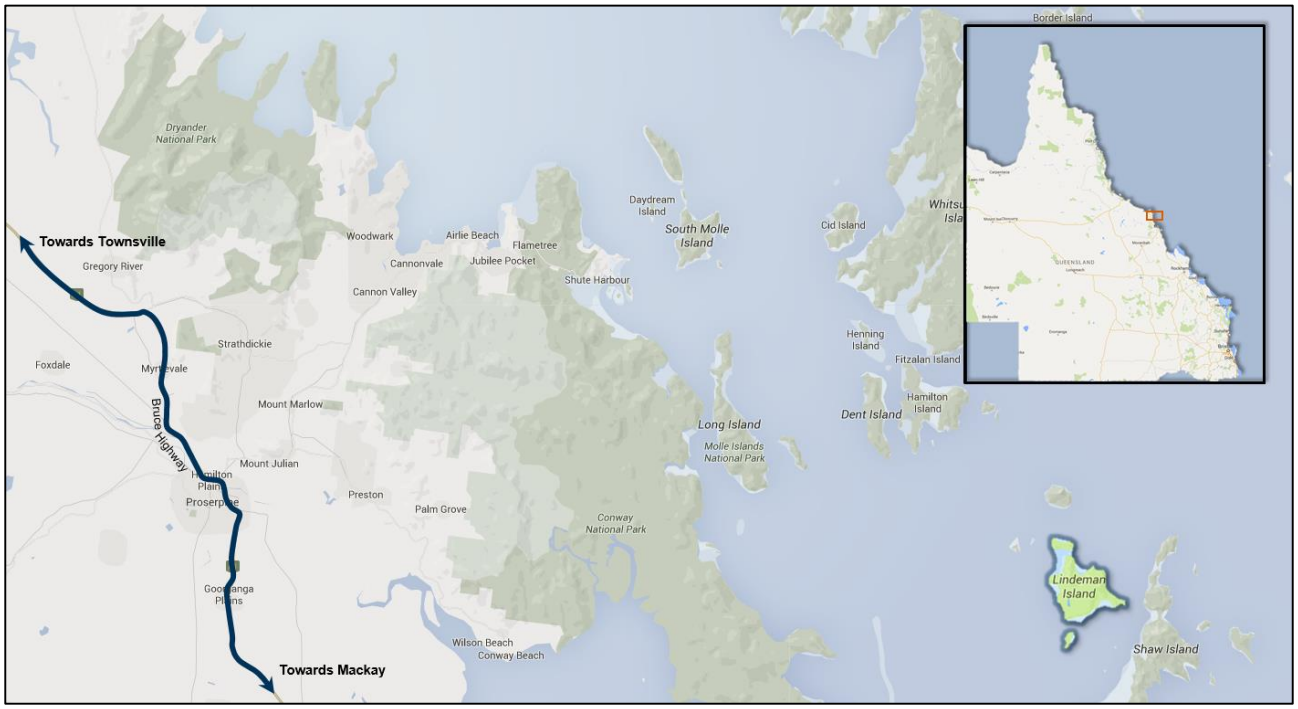
ToR Transport Item		Section of Report
13.45.	Include a clear summary of the total transport task for the project, including workforce, inputs and outputs during the construction and operational phases	Executive Summary
13.46.	Present the transport assessment in separate sections for each project-affected mode (road, rail, air and sea) as appropriate for each phase of the project.	This report relates to the road transport task
13.47.	Provide sufficient information to allow an assessment of how existing transport infrastructure will be affected by project transport at the local and regional level (for example, airports, local roads and state-controlled roads).	Section 6, referring to road network only
13.48.	Include details of the adopted assessment methodology for impacts on roads within the road impact assessment report in accordance with the Guidelines for Assessment of Road Impacts of Development.	Section 6
13.49.	Discuss and recommend how identified impacts will be mitigated. Mitigation strategies and are to be prepared in close consultation with relevant transport authorities (including local government).	Section 7

3 Project Overview

3.1 Project Description

The project is located on Lindeman Island, part of the Whitsunday Islands at the Great Barrier Reef. With respect to the closest mainland port, Shute Harbour, the island is situated approximately 32 kilometres south-east of the port. In terms of larger towns, the island is approximately 48km east of Proserpine and 78km north of Mackay. Figure 3-1 provides an illustration of the site location.

Figure 3-1 Project Location



Source: Google maps, www.maps.google.com.au

The project involves the construction and operation of the resort and ancillary uses, which is anticipated to attract tourism from overseas and nationally. The resort will comprise visitor accommodation, recreation and leisure sites as well as accommodating staff on-site. Further information regarding the project description is provided in the main EIS report.

The logistics of the project anticipate that the majority of deliveries and staff movements will originate on the mainland with connection to the island gained by barge or ferry from Shute Harbour. The extent of the associated trips is understood to include Townsville in the north and Rockhampton in the south. In order to reduce the impact on the road network, shipping options have been considered with potential ports including Townsville, Mackay, Cairns and Brisbane.

With the exception of access from the origin ports and depots, where the haul routes may include the local road network, the majority of the routes will use state controlled roads.

The baseline assumptions from which the traffic assessment was based upon are outlined in Table 3-1.

Table 3-1 Project Description

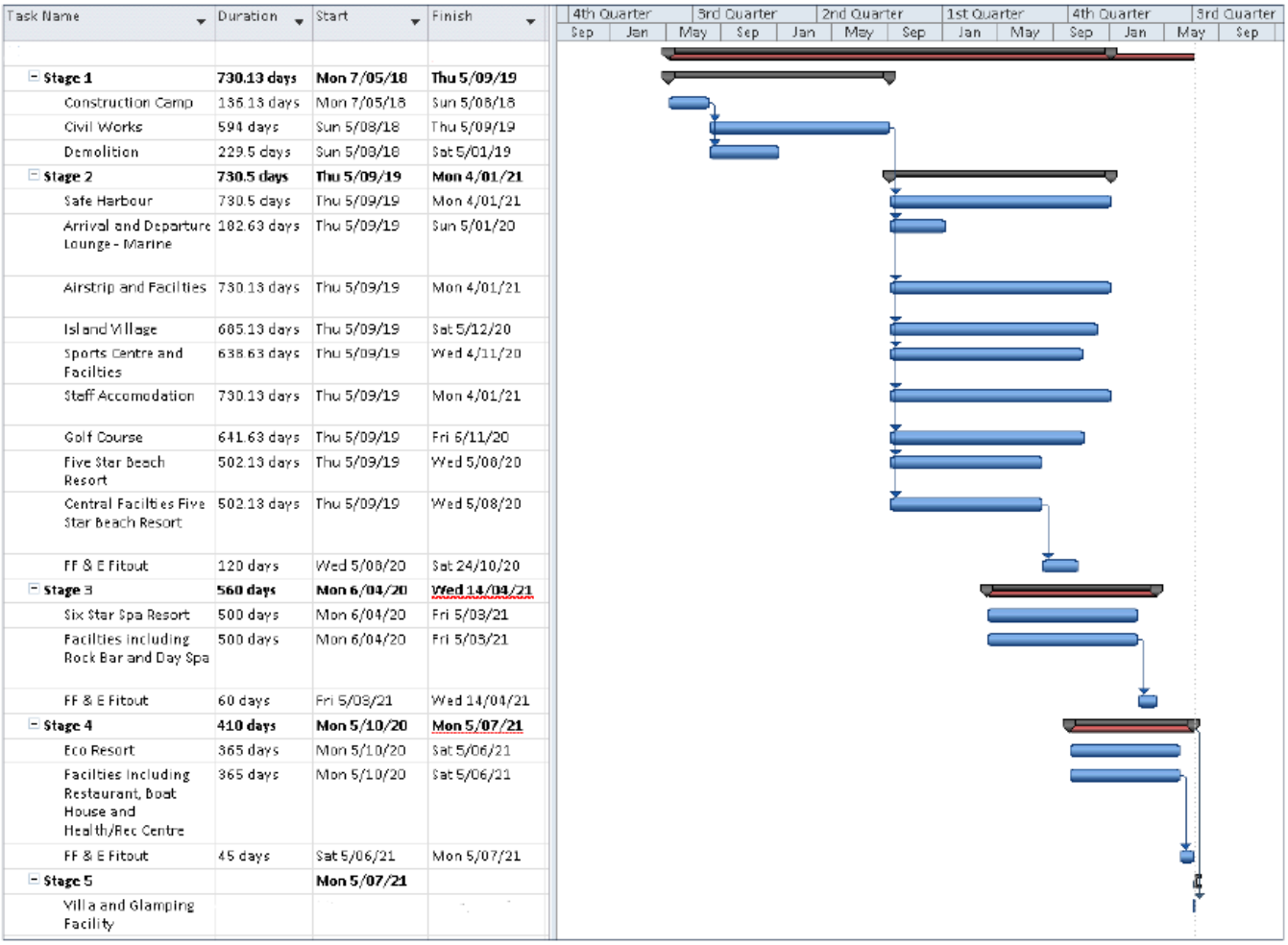
Item	Description
Workforce	
Construction workforce	300 workers
Operations workforce	300 workers
Deliveries	
Concrete	180,991 m^3
Steel	20,019 tonnes
Gravel and fill	18,379 m^3
Waste	21,939 m^3

3.2 Project Schedule

Timing for the construction of the project has been provided as a preliminary timeline. This is shown on Figure 3-2. The construction period would involve a period of approximately three years commencing mid-2018. The Beach Resort is due for completion mid-2020, Spa Resort early 2021, Eco Resort in mid-2021, and the remaining facilities progressively completed through 2021. The resorts will be opened at the same time in mid to late 2021.

A preliminary analysis of the proposed timeline has indicated that the peak construction period will occur in late 2018. This is based on a constant delivery schedule throughout the life of the proposed construction period. Nominal vehicle capacities have been adopted to estimate the number of vehicle movements per day.

Figure 3-2 Construction Staging Timeline - Preliminary

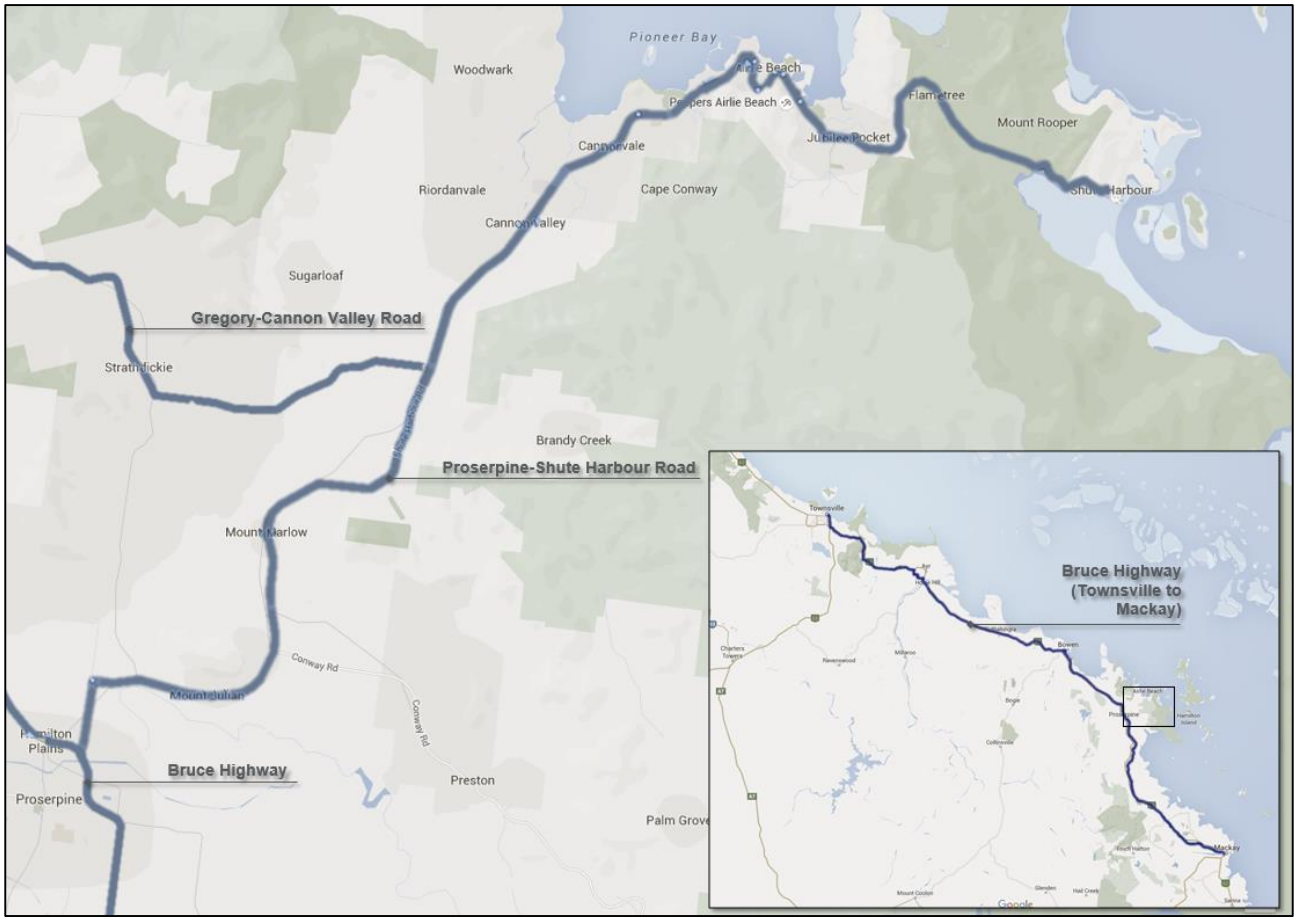


4 Existing Road Conditions

4.1 Road Infrastructure

The study area largely falls within the Mackay Whitsunday District of the Department of Transport and Main Roads. Figure 4-1 illustrates the state controlled road network associated with the project.

Figure 4-1 State Controlled Road Network



Source: Google maps, www.maps.google.com.au

Table 4-1 summarises the key characteristics of the key roads. The average AADT values from the 2014 traffic census have been included to provide a general indication of the demand on each road.

Table 4-1 State Controlled Roads

Road ID	State Controlled Road	Section	Average 2014 AADT
10J	Bruce Highway (Proserpine to Bowen)	Proserpine to Bowen	5,700 vpd
10H	Bruce Highway (Mackay to Proserpine)	Mackay (north of Bucasia turnoff) to Proserpine	6,150 vpd
851	Proserpine-Shute Harbour Road	Proserpine to Shute Harbour	8,700 vpd
8501	Gregory-Cannon Valley Road	Bruce Highway to Proserpine-Shute Harbour Road	2,400 vpd

Source: Queensland Government, 2014Traffic Census Data

4.2 Baseline Traffic Volumes

With regards to the baseline traffic, TMR data for Proserpine-Shute Harbour Road has been sourced. The most recent data provided was from 2014, for all count sites along the road between the Bruce Highway at Proserpine and Shute Harbour. The average annual growth rate from 2007 to 2014 was adopted for each site, to estimate the baseline traffic at the peak construction period (2018). Table 4-2 summarises the baseline traffic volumes.

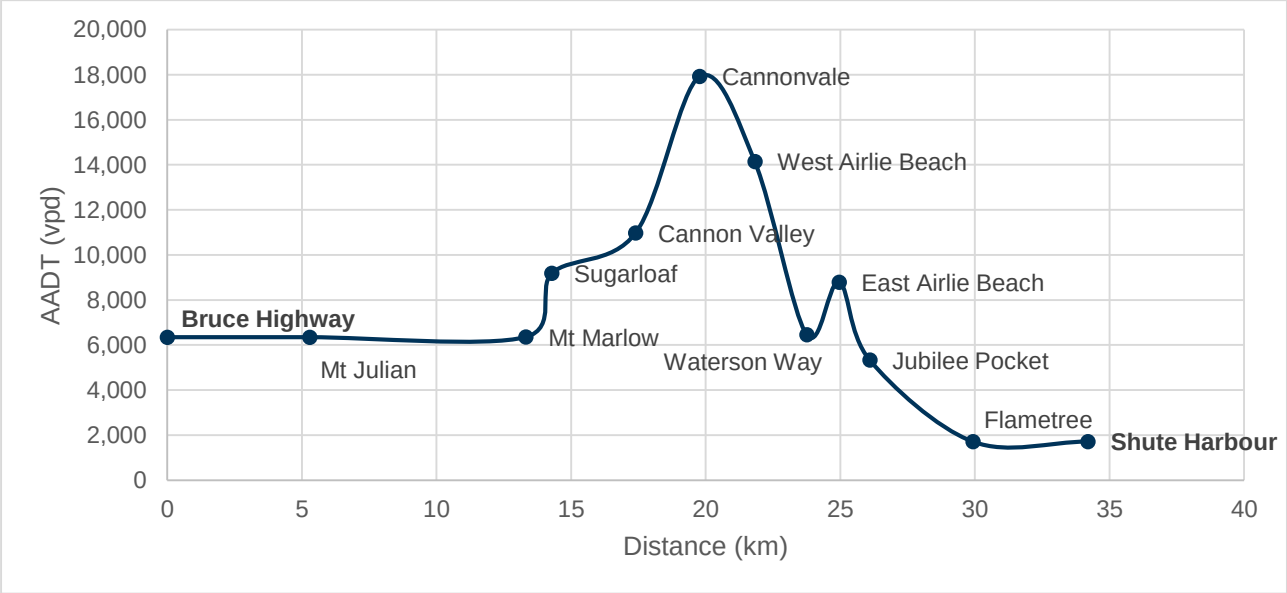
Table 4-2 Baseline Traffic Estimation

Count Site	Location	2014 AADT	Average Annual Growth Rate	2018 AADT
82888	Mt Julian	6,351 vpd	2%	6,807 vpd
83048	Mt Marlow	6,357 vpd	2%	6,921 vpd
80021	Sugarloaf	9,184 vpd	1%	9,483 vpd
83222	Cannon Valley	10,976 vpd	2%	11,748 vpd
83114	Cannonvale	17,925 vpd	2%	19,490 vpd
80178	West Airlie Beach	14,141 vpd	0%	14,141 vpd
83229	Waterson Way	6,462 vpd	-^	6,462 vpd
80177	East Airlie Beach	8,791 vpd	1%	9,084 vpd
80181	Jubilee Pocket	5,337 vpd	0%	5,337 vpd
82848	Flametree	1,715 vpd	0%	1,715 vpd

Source: Queensland Government, 2014Traffic Census Data; Note ^ No historical data for this site

The 2014 data are illustrated graphically on Figure 4-2, which plots the AADT against the distance along Proserpine-Shute Harbour Road.

Figure 4-2 2014 AADT – Proserpine-Shute Harbour Road



The majority of traffic is generated around Cannonvale, which is the largest commercial and retail centre in the area. Traffic volumes near Shute Harbour are significantly lower than along the rest of the road, indicating that this section will be more sensitive to additional traffic loads.

4.3 Planned Upgrades

In terms of road upgrades, the Department of Transport and Main Roads publication, Queensland Transport and Roads Investment Program 2015-16 to 2018-19 (QTRIP), identifies the proposed upgrades and funding allocated for the state road network. Table 4-3 summarises the upgrades within the study area, which is to be read alongside Figure 4-3 which illustrates the location of these upgrades.

Table 4-3 Planned Upgrades

ID	Road		Section/Location	Planned Upgrade	Timing
A	10J	Bruce Highway	Dingo Creek and Emu Creek	Construct overtaking lanes	2017-2019
B	10J	Bruce Highway	North of Gregory-Cannon Valley Road	Construct overtaking lanes	2017-2019
C	10J	Bruce Highway	Proserpine-Shute Harbour Road to Gregory-Cannon Valley Road	Treat hazards close to the road	2015-2016
D	10H	Bruce Highway	Goorganga Plains	Undertake transport project planning	2015-2016
E	10H	Bruce Highway	South of O'Connell River	Construct overtaking lanes	2016-2017
F	10H	Bruce Highway	Kitty Creek and Careys Creek	Construct overtaking lanes	2015-2016
G	851	Proserpine-Shute Harbour Road	William Murray Drive	Improve intersection	2015-2016
H	851	Proserpine-Shute Harbour Road	Entire length	Continue planning for upgrading of flood immunity hotspots	2015-2016

Source: Department of Transport and Main Roads, Queensland Transport and Roads Investment Program 2015-16 to 2018-19

As shown, the majority of upgrades relate to constructing overtaking lanes along the Bruce Highway. It is also noted that a significant project is the hydraulics analysis study along the length of Proserpine-Shute Harbour Road, given the importance of this road as the gateway to the tourism region.

Figure 4-3 Road Upgrades

Source: Google maps, www.maps.google.com.au

5 Project Activities

The traffic generating activities associated with the project can be classified under two stages, the construction stage and the operations stage. The construction stage will generate the majority of trips, with the bulk of deliveries being made by road. Additionally, the trips have been categorised be either workforce trips or delivery trips. The following sections describe the workforce and delivery arrangements, as advised by the project team.

5.1 Workforce

In terms of workforce, staff will be locally sourced with some fly-in fly-out for the construction stage. During the operations, it is anticipated that all staff will be from the local area.

Staff will be accommodated on the island and therefore, there will not be two trips associated with each employee. It is assumed that the roster will be staggered, with weekly changeovers for fly-in fly-out employees and daily changeovers for local staff. Therefore, there will be both in and out trips, however only a portion of the staff will be travelling each day.

Staff will be driven to Shute Harbour to board the ferry to Lindeman Island. Mode of travel to and from Shute Harbour will range from car, as either driver or passenger, or by charter bus. It is noted that those driving themselves to Shute Harbour will require parking.

5.2 Deliveries

The schedule for deliveries is not finalised, however due care has been taken to prepare the most reasonable assessment for the RIA. The number of vehicle trips has been based on the assumption that deliveries will be constantly arriving each day throughout the construction period.

A variety of heavy vehicles has been assumed to be used, including the following:

- 6 tonne capacity Aggi trucks
- 24 tonne capacity semi trailer
- 30 tonne capacity truck and dog

The multi-combination routes defined by TMR indicate that 25m B-doubles are only permitted on Proserpine-Shute Harbour Road between the Bruce Highway and William Murray Drive. As the project deliveries will require access beyond William Murray Drive, the maximum commercial vehicle size has been capped at a 30 tonne truck and dog.

It is noted that while Aggi trucks have been included in the assessment, the time taken to be transported from the concrete manufacturing plant to Shute Harbour and then on a barge to Lindeman Island would be too long for the concrete to remain manageable. Hence, the project will include an on-site concrete batching plant on the island. As such, the deliveries of concrete are assumed to constitute the dry materials arriving by semi trailer.

6 Project Transport Task and Traffic Demands

This section outlines the calculations for estimating the trips associated with the project activities. It has been categorised into the following subsections:

- Construction workforce trips
- Construction delivery trips
- Operations workforce trips
- Operations delivery trips

6.1 Construction Workforce

Table 6-1 outlines the assumptions and calculations for the estimation of traffic associated with the construction workforce trips, that is, those trips for workers arriving and leaving the island during the construction of the resort redevelopment.

Table 6-1 Construction Workforce Assumptions

Component	Assumption
Peak workforce (total workers employed at peak construction period, note this is not assumed to be total workers on site an any given time)	300 workers employed
From local areas (e.g. Airlie Beach, Proserpine, Cannonvale)	70% = 210 workers
From regional areas (fly in, fly out)	30% = 90 workers
Local workers:	
Roster	5 days on, 2 days off
Proportion staying on island / commuting everyday	80% / 20%
Frequency of rosters for workers staying on island	Daily changeover
Workers staying on island changing over per day	210 * 80% / 7 days of changeover = 24 workers
Workers commuting everyday	210 * 20% = 42 workers
Total workers changing over each day	66 workers
Proportion of local workers residing in the local area (Airlie Beach, Proserpine, Cannonvale)	50%
Proportion of local workers residing in the wider area (Mackay, Townsville)	50%
Proportion of workers from wider area originating south / north of Airlie Beach	70% / 30%
Proportion of local workers driving themselves to Shute Harbour / being dropped off	30% / 70%
Workers (local area) driving themselves / being dropped off	10 / 23
Proportion of local workers from wider area driving themselves to Shute Harbour / taking charter bus	10% / 90%
Workers (wider area) driving themselves / taking charter bus	3 / 30
Occupancy for bus	12 people
Number of charter buses per day	30 workers / 12 people per bus = 3 buses
FIFO workers:	
Roster	3 weeks on / 1 week off
Frequency of rosters for workers	Weekly changeover
Proportion of workers flying into Proserpine / Hamilton Island	100% / 0%
Workers changing over per changeover	90 / 4 changeovers = 23 workers
Proportion of workers taking bus	100%

Component	Assumption
Occupancy for bus	12 people
Number of buses per changeover	23 workers / 12 people per bus = 2 buses
All workers:	
Arriving by car	36 workers
Arriving by bus	30 workers
Number of car trips	36 trips in / 23 trips out
Number of bus trips	5 buses in / 5 buses out

As shown, in terms of daily one way trips (i.e. workers arriving or workers leaving) a total of 59 light vehicle trips and 10 bus trips have been estimated.

As discussed in section 4.2, the existing traffic volumes were based on historical count data received from TMR. Table 6-2 summarises the baseline traffic volumes.

Table 6-2 Baseline Traffic Estimation

Count Site	Location	2014 AADT	Average Annual Growth Rate	2018 AADT
82888	Mt Julian	6,351 vpd	2%	6,807 vpd
83048	Mt Marlow	6,357 vpd	2%	6,921 vpd
80021	Sugarloaf	9,184 vpd	1%	9,483 vpd
83222	Cannon Valley	10,976 vpd	2%	11,748 vpd
83114	Cannonvale	17,925 vpd	2%	19,490 vpd
80178	West Airlie Beach	14,141 vpd	0%	14,141 vpd
83229	Waterson Way	6,462 vpd	1%^	6,462 vpd
80177	East Airlie Beach	8,791 vpd	1%	9,084 vpd
80181	Jubilee Pocket	5,337 vpd	0%	5,337 vpd
82848	Flametree	1,715 vpd	0%	1,715 vpd

Note ^ No historical data to estimate traffic growth at this site, therefore growth rate taken as average of other sites

Daily trips has been assumed to be double the trips calculated for the directional changeover, representing both arriving workers and departing workers. Table 6-3 presents the proportionate impact of the daily workforce trips to the 2018 baseline traffic.

Table 6-3 Construction Workforce Traffic Impact

Count Site	Location	2018 AADT	Daily Trips	Proportionate Impact
82888	Mt Julian	6,807 vpd	50 vpd	1%
83048	Mt Marlow	6,921 vpd	50 vpd	1%
80021	Sugarloaf	9,483 vpd	56 vpd	1%
83222	Cannon Valley	11,748 vpd	56 vpd	0%
83114	Cannonvale	19,490 vpd	112 vpd	1%
80178	West Airlie Beach	14,141 vpd	121 vpd	1%
83229	Waterson Way	6,738 vpd	121 vpd	2%
80177	East Airlie Beach	9,084 vpd	121 vpd	1%
80181	Jubilee Pocket	5,337 vpd	139 vpd	3%
82848	Flametree	1,715 vpd	139 vpd	8%

As shown, a significant impact (in terms of a 5% trigger as defined by TMR in GARID), is shown to be estimated for the eastern section of Proserpine-Shute Harbour Road, represented by count site 82848. This scoping assessment provides an indication of the area of investigation for the pavement impact assessment.

6.2 Construction Deliveries

A review of the construction program and materials required has been undertaken by the client to estimate the quantity of heavy vehicles required to deliver supplies to the harbour for shipping to the island.

As a result of this, the total quantities for the defined materials were reduced as per Table 6-4.

Table 6-4 Construction Materials Assumptions

Component	Total
Concrete	180,991 m^3
Steel	20,019 tonnes
Gravel and fill	18,379 m^3
Waste	21,939 m^3

With these yields, the estimated traffic demands were calculated as outlined in Table 6-5. It is noted that the rate of construction was assumed to occur constantly over the allotted construction periods. Additionally, all deliveries have been assumed to arrive by truck at Shute Harbour with a barge taking the goods to the island.

It is acknowledged that the likely logistic constraint for the deliveries will be the barge deliveries. For example, if there are only two barges scheduled per day, with a capacity to carry 10 trucks of freight, then the daily delivery limit would need to be capped at 20 trucks per day. Currently no information has been provided with regards to the schedule for barge deliveries or the capacity for the barge, however understanding the proposed arrangement will provide assistance in estimating the accurate level of traffic demands.

Table 6-5 Construction Delivery Assumptions

Component	Assumption
Peak construction period (estimated as maximum monthly materials from total materials averaged over construction duration for each stage of works)	Nov / Dec 2018
Assumed all deliveries arrive by truck to Shute Harbour then depart via same route	
Assumed all deliveries offload onto a barge at Shute Harbour	
Concrete (quantity per month)	6,841 m^3
Steel (quantity per month)	794 tonnes
Gravel and fill (quantity per month)	698 m^3
Construction materials (cabling, ducting, pipe etc.) (quantity per month) (ratio assumed from previous EIS calculations)	Assumed 20% of concrete quantity = 6,841 m^3 * 20% = 1,368 tonnes
Average number of days per month	30 days
Approximate conversion for m^3 to tonnes (aggregate, gravel)	2.1 tonnes = 1 m^3
Concrete (quantity per day)	228 m^3 = 479 tonnes
Steel (quantity per day)	26 tonnes
Gravel and fill (quantity per day)	23 m^3 = 49 tonnes
Construction materials (quantity per day)	46 tonnes
Waste (quantity per day) assumed as 10% of total materials, as per assumptions	60 tonnes
Total materials and waste	660 tonnes

Component	Assumption
Other supplies:	
Food per person per day	1.5 kg
Workers on site at any one time	300 workers * 5 days on / 7 days = 215 workers
Food required per day	215 workers * 1.5 kg = 323 kg
Frequency of food deliveries	Weekly
Quantity of food required per shipment	323 kg * 7 days = 2,258 kg
Fuel requirement per year (metric assumed from previous EIS calculations)	18,500 kL
Average fuel required per day	18,500 kL / 365 days = 50.7 kL
Conversion from kL to tonnes	50.7 kL * 832 kg/m^3 / 1000kg = 42 tonnes per day
Truck capacities:	
Aggi truck	6 tonnes
Semi trailer	22 tonnes
Truck and dog	30 tonnes
Number of trucks per day:	
Concrete using Semi trailer	22 trucks
Steel using Semi trailer	2 trucks
Gravel and fill using Truck and dog	2 trucks
Construction materials using Semi trailer	3 trucks
Waste using Semi trailer	3 trucks
Food using Semi trailer	1 truck
Fuel using Semi trailer	2 trucks
Total daily trucks (one way)	**35 trucks per day**
Assumed hours of operation for trucks on the road network	12 hours per day
Average number of trucks per hour	**3 trucks per hour**

As shown, during the peak construction period, the daily traffic demand has initially been estimated at 35 trucks per day. This refers to one way traffic, representing 70 truck trips in total per day. Table 6-6 summarises the proportionate impact in terms of heavy vehicle trips on the baseline volumes. The 2018 volumes have been estimated using the annual growth rates reported in Table 6-2, which have been applied to the 2014 heavy vehicle traffic.

As shown, assuming that all deliveries travel along the entire length of Proserpine-Shute Harbour Road, the proposed construction traffic will have a significant impact along all segments of the road (i.e. greater than 5% on baseline traffic).

Table 6-6 Construction Deliveries Traffic Impact – Heavy Vehicle Trips

Count Site	Location	2018 Baseline HV	Daily Trips	Proportionate Impact
82888	Mt Julian	480 vpd	70 vpd	15%
83048	Mt Marlow	610 vpd	70 vpd	11%
80021	Sugarloaf	604 vpd	70 vpd	12%
83222	Cannon Valley	747 vpd	70 vpd	9%
83114	Cannonvale	967 vpd	70 vpd	7%
80178	West Airlie Beach	620 vpd	70 vpd	11%
83229	Waterson Way	438 vpd	70 vpd	16%
80177	East Airlie Beach	438 vpd	70 vpd	16%
80181	Jubilee Pocket	306 vpd	70 vpd	23%
82848	Flametree	186 vpd	70 vpd	38%

Given the relatively high impact estimated for Proserpine-Shute Harbour Road, the impact on the Bruce Highway was investigated to understand whether the scope of the pavement impact assessment will need to be widened. Table 6-7 reports the estimated impact of the heavy vehicles. It has been assumed that 50% of deliveries originate from the north and 50% from the south.

A nominal 2% growth rate has been applied to the 2014 volumes.

Table 6-7 Construction Deliveries Traffic Impact – Heavy Vehicle Trips - Bruce Highway

Count Site	Location	2014 Baseline HV	2018 Baseline HV	Daily Trips	Proportionate Impact
82717	Bruce Highway north of Gregory-Cannon Valley Road	702 vpd	759 vpd	35 vpd	4.6%
80010	Bruce Highway south of Proserpine-Shute Harbour Road	764 vpd	825 vpd	35 vpd	4.2%

As shown, the impact on the Bruce Highway is estimated to be marginally less than 5%. However, it is noted that this is a preliminary assessment and that the detailed assessment will likely yield a greater impact as with consideration of the directional loading and equivalent standard axles (ESAs), the impact will be intensified.

With this in mind, it is acknowledged that the Bruce Highway is part of the National Land Transport Network which receives funding from the Federal government. This indicates that there is an expectation for these roads to serve as strategic links and thus will carry greater traffic volumes and cope with greater increases in AADT and ESAs. Therefore, responsibility for any potential upgrades to the Bruce Highway should not fall solely on the developer should the pavement impact assessment indicate that the impact of the development will be significant and require works or a contribution.

6.3 Operations Workforce

Table 6-8 outlines the assumptions and calculations for the estimation of traffic associated with the operational workforce trips, that is, those trips for workers arriving and leaving the island for work.

Table 6-8 Operations Workforce Assumptions

Component	Assumption
Peak workforce	300 workers
From local areas (e.g. Airlie Beach, Proserpine, Cannonvale)	100% = 300 workers
From regional areas (fly in, fly out) Note: assumptions register mentions possibly 5% regional workers however this has been disregarded by subsequent items in the assumptions register	0% = 0 workers
Local workers:	
Roster	5 days on, 2 days off
Proportion staying on island / commuting everyday	100% / 0%
Frequency of rosters for workers staying on island	Daily changeover
Workers staying on island changing over per day	300 / 7 days of changeover = 43 workers
Workers commuting everyday	0 workers
Total workers changing over each day	43 workers
Proportion of local workers residing in the local area (Airlie Beach, Proserpine, Cannonvale)	50%
Proportion of local workers residing in the wider area (Mackay, Townsville)	50%
Proportion of workers from wider area originating south / north of Airlie Beach	70% / 30%
Proportion of local workers driving themselves to Shute Harbour / being dropped off	30% / 70%
Workers (local area) driving themselves / being dropped off	6 / 15
Proportion of local workers from wider area driving themselves to Shute Harbour / taking charter bus	10% / 90%
Workers (wider area) driving themselves / taking charter bus	2 / 19
Occupancy for bus	12 people
Number of charter buses per day	To/from south: 14 workers / 12 people per bus = 2 buses To/from north: 6 workers / 12 people per bus = 1 bus Total = 3 buses per direction
All workers:	
Arriving by car	24 workers
Arriving by bus	19 workers
Number of car trips	24 trips in / 15 trips out
Number of bus trips	3 buses in / 3 buses out

As shown, in terms of daily one way trips (i.e. workers arriving or workers leaving) a total of 39 light vehicle trips and 6 bus trips have been estimated.

For the purpose of undertaking the traffic assessment, operations are assumed to begin in 2020. The baseline traffic at 2020 has been estimated based on the growth rates outlined in Table 6-2. Table 6-9 summarises the proportionate impact estimated.

Table 6-9 Operations Workforce Traffic Impact

Count Site	Location	2020 Baseline AADT	Daily Trips	Proportionate Impact
82888	Mt Julian	7,035	20 vpd	0%
83048	Mt Marlow	7,203	20 vpd	0%
80021	Sugarloaf	9,633	25 vpd	0%
83222	Cannon Valley	12,134	25 vpd	0%
83114	Cannonvale	20,272	66 vpd	0%
80178	West Airlie Beach	14,141	77 vpd	1%
83229	Waterson Way	6,876	77 vpd	1%
80177	East Airlie Beach	9,230	77 vpd	1%
80181	Jubilee Pocket	5,337	89 vpd	2%
82848	Flametree	1,715	89 vpd	5%

As shown, a significant impact (in terms of a 5% trigger as defined by TMR in GARID), is shown to be estimated for the eastern section of Proserpine-Shute Harbour Road, represented by count site 82848.

6.4 Operations Deliveries

With regards to the deliveries during the operations of the development, the assumptions provided only refer to barge deliveries. Without further advice such as the barge capacity and delivery schedule, the number of delivery trips will be difficult to estimate. Table 6-10 summarises the information provided.

Table 6-10 Operations Delivery Assumptions

Component	Assumption
Water	1 barge per week
Food	1 barge per week
Waste	1 barge per week
Fuel	1 barge per week, perhaps monthly depending on usage

6.5 Summary of Initial Traffic Assessment

Table 6-11 summarises the initial traffic demand estimations.

Table 6-11 Operations Delivery Assumptions

Stage	Daily Trips
Construction Workforce (300 people)	59 light vehicle trips 10 bus trips
Construction Deliveries	70 heavy vehicles trips
Operations Workforce (300 people)	39 light vehicle trips 6 bus trips
Operations Deliveries	Not estimated

Figure 6-1 illustrates the relationship between development traffic and background traffic for the construction workforce trips.

Figure 6-1 Construction Workforce Trips – Proportionate Impact

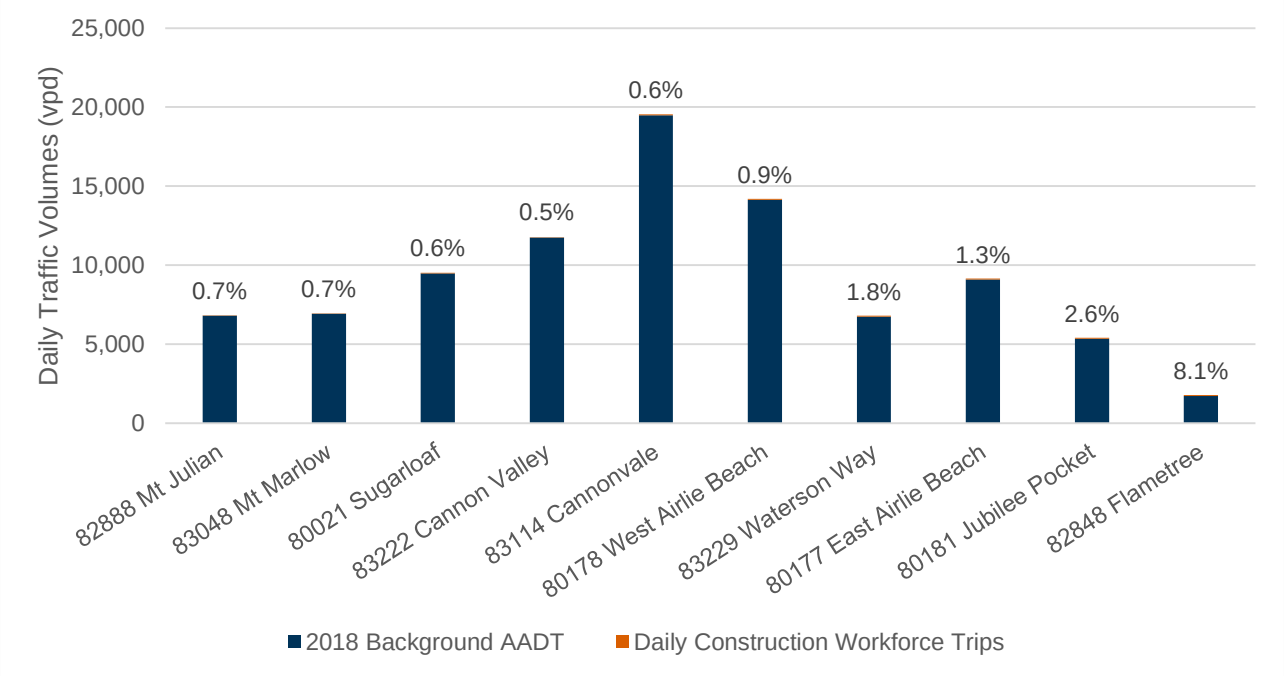


Figure 6-2 illustrates the relationship between development heavy vehicle traffic and background heavy vehicle traffic for the construction stage.

Figure 6-2 Construction Delivery Trips – Proportionate Impact (Heavy Vehicles)

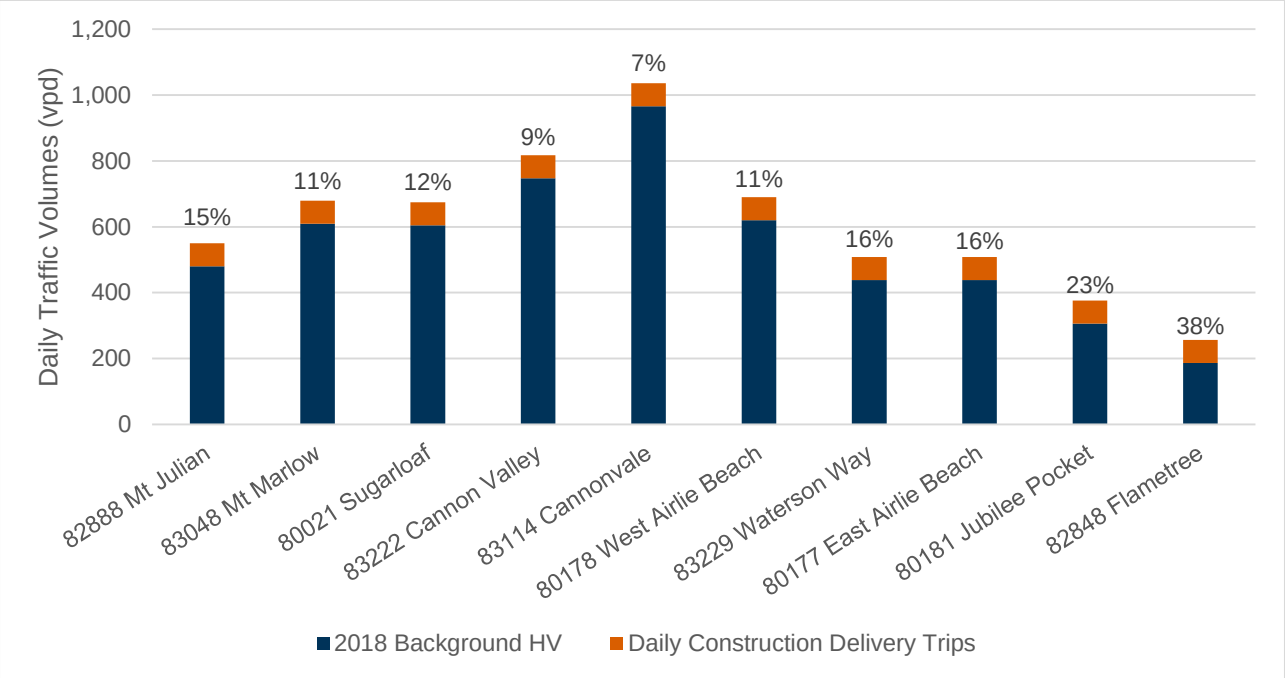


Figure 6-3 illustrates the relationship between development traffic and background traffic for the operations workforce trips.

Figure 6-3 Operations Workforce Trips – Proportionate Impact

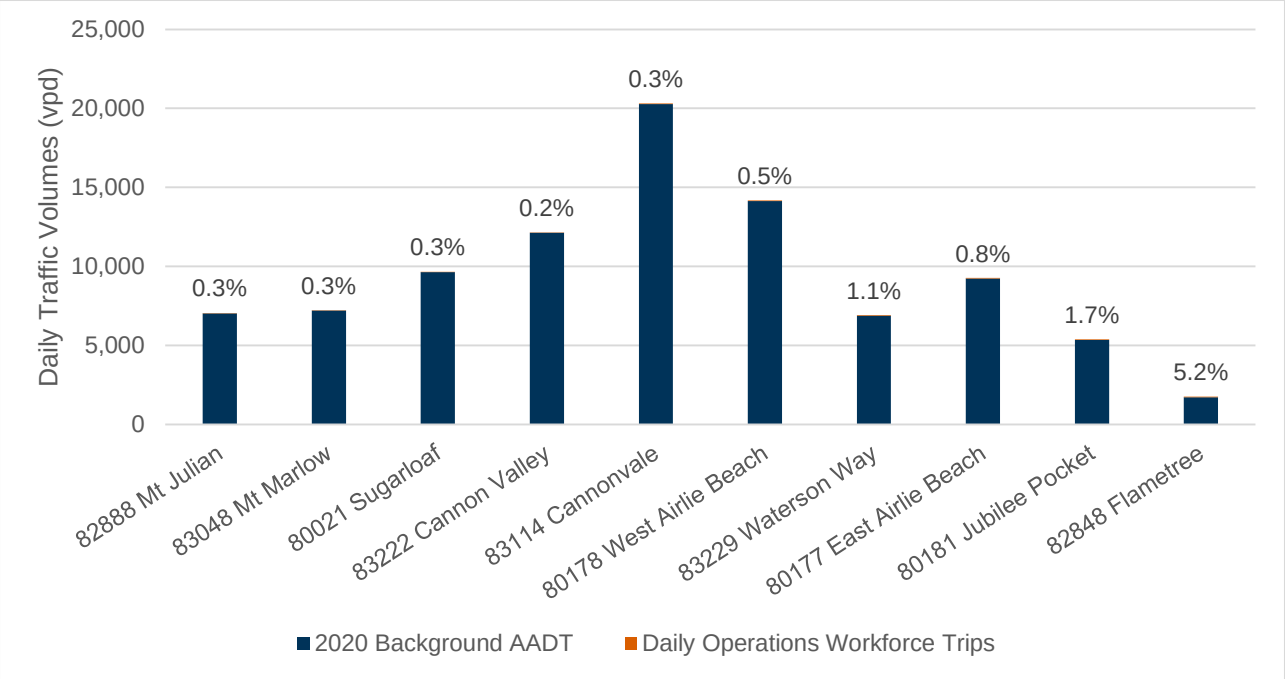


Table 6-12 summarises the scoping assessment results, highlighting those results indicating the 5% threshold has been triggered (equal to or greater than 5%). It indicates that the construction deliveries will impact along the entire length of Proserpine-Shute Harbour Road. With regards to workforce trips, a significant impact will be generated for the section between Flametree and Shute Harbour.

Table 6-12 Proportionate Impact of Project Traffic – Proserpine-Shute Harbour Road

Count Site	Location	Construction (Peak at 2018)		Operations (2020)	
		Workforce	Deliveries (HV)	Workforce	Deliveries
82888	Mt Julian	1%	15%	0%	-
83048	Mt Marlow	1%	11%	0%	-
80021	Sugarloaf	1%	12%	0%	-
83222	Cannon Valley	0%	9%	0%	-
83114	Cannonvale	1%	7%	0%	-
80178	West Airlie Beach	1%	11%	1%	-
83229	Waterson Way	2%	16%	1%	-
80177	East Airlie Beach	1%	16%	1%	-
80181	Jubilee Pocket	3%	23%	2%	-
82848	Flametree	8%	38%	5%	-

7 Road Improvements and Mitigations

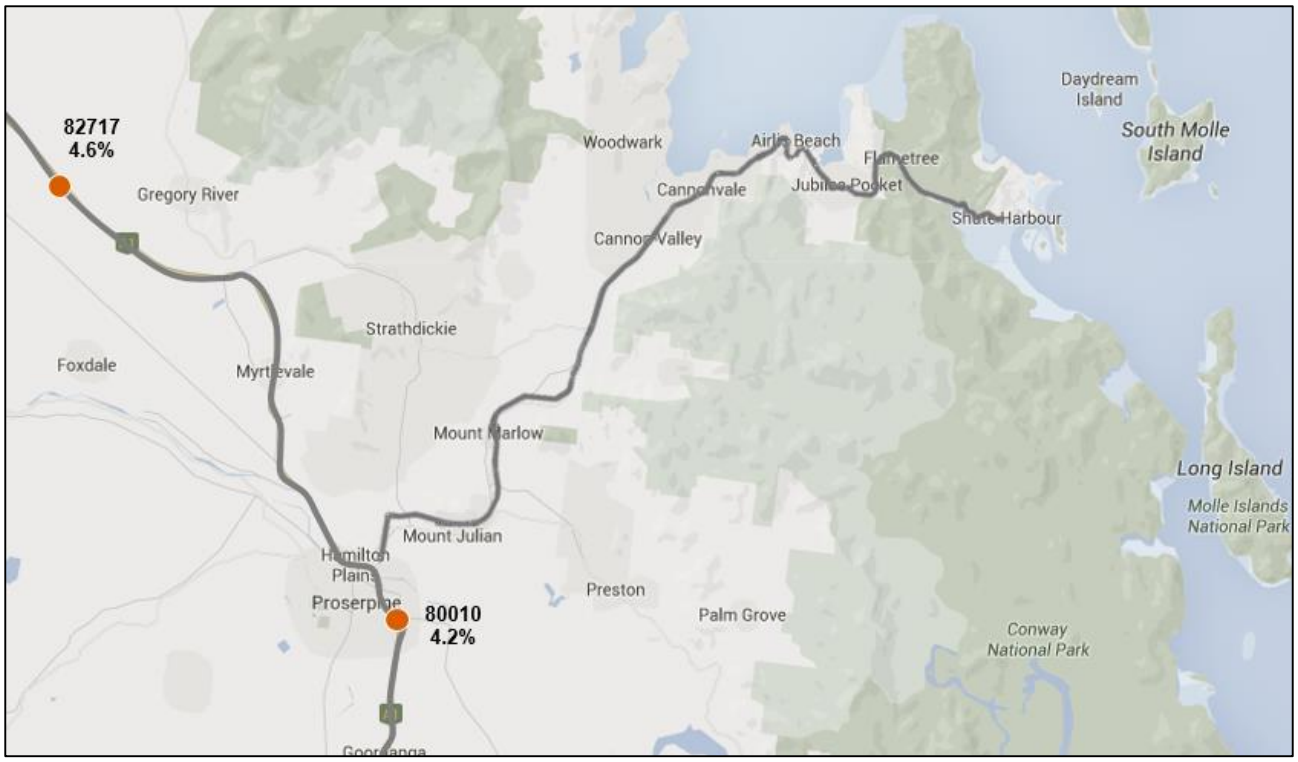
As outlined in section 6, the construction traffic will have a significant impact on the study road network, particularly the heavy vehicle impact. Figure 7-1 illustrates the count site locations along Proserpine-Shute Harbour Road alongside the proportionate impact from heavy vehicles due to construction activities.

Figure 7-1 Count Site Locations and HV Impact – Proserpine-Shute Harbour Road

Source: Google maps, www.maps.google.com.au

With regards to the Bruce Highway, the proportionate impact of the heavy vehicles is shown on Figure 7-2.

Figure 7-2 Count Site Locations and HV Impact – Bruce Highway



Source: Google maps, www.maps.google.com.au

As discussed in section 1.3, until such time that assumptions regarding vehicle movements can be defined with more certainty, a pavement impact assessment should be delayed due to the potential variability of the outputs. It is proposed that the coordinator general should condition that a scoping assessment and potentially a pavement impact assessment be undertaken once these items have more certainty.

8 Environmental Issues

8.1 Parking Requirements

The parking requirements which affect the state controlled road network has been determined from those workers who drive themselves to Shute Harbour. The calculations outlined in section 6 indicate that during construction, 13 workers drive themselves to/from Shute Harbour for each shift. Assuming a worst case scenario where workers leaving the island must wait for the next shift to arrive at the island before departing, this requires space for 26 vehicles parking on the mainland.

Likewise for the operations, 8 workers have been calculated to drive themselves per shift, therefore space for 16 vehicles will be required on the mainland.

Parking is already provided at Shute Harbour, however this is on a pay by the hour/day basis. Whether parking fees will be paid for by employees or the employer will be determined at a later stage. If the latter, an option to negotiate parking permits for employees could be investigated.

9 Conclusion

Cardno (Qld) Pty Ltd (Cardno) has been commissioned by White Horse Australia Lindeman Pty Ltd (White Horse) to complete a Road Impact Assessment as part of the Environmental Impact Statement for the Lindeman Island Great Barrier Reef Resort.

White Horse proposes to redevelop Lindeman Island to include a spa and resort, with ancillary uses such as an airstrip and marina. The RIA considers the road impacts on the state-controlled road network associated with the Project. This pertains mainly to the construction activities and the impact on the mainland road system.

The assessment has been carried out in accordance with the Guidelines for Assessment of Road Impacts of Developments, which is the overarching document for road impact assessments. The project activities have been categorised into four stages:

> Construction workforce trips
> Construction delivery trips
> Operations workforce trips
> Operations delivery trips

A scoping assessment for the state controlled road network has determined that the project will have significant traffic impacts on the state controlled road network and further assessment will be required. Table 9-1 summarises the proportionate impacts calculated at each site along Proserpine-Shute Harbour Road. It is noted that the operations deliveries have not been estimated due to a lack of information with regards to the anticipated operations.

Table 9-1 Proportionate Impact of Project Traffic – Proserpine-Shute Harbour Road

Count Site	Location	Construction (Peak at 2018)		Operations (2020)	
		Workforce	Deliveries (HV)	Workforce	Deliveries
82888	Mt Julian	1%	15%	0%	-
83048	Mt Marlow	1%	11%	0%	-
80021	Sugarloaf	1%	12%	0%	-
83222	Cannon Valley	0%	9%	0%	-
83114	Cannonvale	1%	7%	1%	-
80178	West Airlie Beach	1%	11%	1%	-
83229	Waterson Way	2%	16%	2%	-
80177	East Airlie Beach	1%	16%	1%	-
80181	Jubilee Pocket	3%	23%	3%	-
82848	Flametree	8%	38%	8%	-

As shown, with respect to workforce trips, a significant impact will be generated for the section between Flametree and Shute Harbour. In terms of delivery trips, relating to heavy vehicles, the entire length of Proserpine-Shute Harbour Road will need to be assessed, as all sections exceed the 5% threshold. At this stage, however, where uncertainty remains around the project assumptions, a pavement impact assessment is not considered to be worthwhile due to the potential variability of the outputs.

Table 9-2 summarises the proportionate impact calculated for the Bruce Highway. This is based on preliminary figures and should only be used as an indication of the project activities.

Table 9-2 Construction Deliveries Traffic Impact – Heavy Vehicle Trips - Bruce Highway

Count Site	Location	Proportionate Impact
82717	Bruce Highway north of Gregory-Cannon Valley Road	4.6%
80010	Bruce Highway south of Proserpine-Shute Harbour Road	4.2%

Until the assumptions regarding the project activities can be finalised, a pavement impact assessment should be delayed due to the potential variability of the outputs.

APPENDIX A
GLOSSARY

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Glossary

Acronym/Abbreviation	Definition
AADT	Annual average daily traffic
Aggi truck	Concrete mixing truck with 6 tonne load capacity
Cardno	Cardno (Qld) Pty Ltd
EIS	Environmental Impact Statement
FIFO	Fly-in fly-out
GARID	Guidelines for Assessment of Road Impacts of Developments
QTRIP	Queensland Transport and Roads Investment Program
RIA	Road Impact Assessment
TMR	Department of Transport and Main Roads
ToR	Terms of Reference
Truck and dog	Rigid truck with a trailer attached with 30 tonne load capacity
Semi trailer	Heavy vehicle with some of the load imposed on the prime mover with 24 tonne load capacity
White Horse	White Horse Australia Lindeman Pty Ltd