KUR-World

Transport

Chapter 13.0

Environmental Impact Statement

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

Abbreviations used in this chapter are as follows:

Table 13.0: Definition of key technical terms used in this chapter

Term	Definition
Annual Average Daily Traffic (AADT)	The total volume of vehicle traffic for a highway or read for a year and then divided by 365 days.
Audio Tactile Line Marking (ATLM)	Small white bumps adjacent to line markings that alert motorists through both sound and vibration when they are veering out of their lane and into oncoming traffic or the edge of the road.
Average Travel Speed (ATS)	The average travel speed for vehicles to over a road segment.
Auxiliary Right Turn Treatment (AUR)	Shared through and right turn lane and additional through-lane for overtaking vehicles.
Basic Left Turn Treatment (BAL)	Shared left-turn and through lane with minor widening of the shoulder.
Basic Right Turn Treatment (BAR)	Shared through and right-turn lane with minor widening of the shoulder.
Chainage (Ch)	The measurement of a horizontal or curvi-linear path between two points on the road network.
Channelised Right Turn Treatment (CHR)	Additional short right-turn only lane separated from through traffic by painted chevrons and/or traffic islands.
Degree of Saturation (DoS)	The ratio of demand flow to capacity.
Equivalent Risk Units (ERU)	The measure of exposure to risk per 10^8 vehicle kilometres travelled as per MUTCD Part 4.
Heavy Vehicle (HV)	A vehicle that has a gross vehicle mass or aggregate trailer mass greater than 4.5 tonnes.
Level of Service (LoS)	A qualitative measure used to relate the quality of traffic service based on performance measures like speed and density.
Passenger Car Equivalent (PCE)	The impact that a mode of transport has on traffic variables such as headway, speed and density, compared to a single car.
Percent Time Spent Following (PTSF)	The average percent of total travel time that vehicles must travel in platoons behind slower vehicles due to inability to pass on a two-lane highway.
Percent at Free Flow Speed (PFFS)	The ability of vehicles to travel at or near the posted speed limit.
Vehicle Kilometres Travelled (VKT)	The number of vehicles multiplied by the distance travelled.
Variable Speed Limit (VSL)	A speed limits that can change based on road, traffic, and weather conditions.

13.0 TRANSPORT

13.1 Introduction

The proposed KUR-World development is expected to generate additional traffic movements on the transport network during both the construction and operational phases of the project. The objectives of the following traffic impact assessment are to:

- maintain the safety and efficiency of all affected transport modes for the project workforce and other transport system users
- avoid or mitigate impacts on the condition of transport infrastructure
- ensure any required works are compatible with existing infrastructure and future transport corridors.

The assessment objectives seek to address the impacts of the traffic generated by the proposed construction and operation of KUR-World which may include:

- increased risk of road accidents due to a higher level of traffic on the roads
- increased delays caused by insufficient capacity at intersections and along road links.

The following sections considered the baseline traffic conditions in the areas surrounding KUR-World and the impact of construction and operation of the development on the surrounding transport network.

The study area for the traffic study has been determined based on the likely extent of impact, and includes key intersections and roads in the vicinity of the development that are likely to experience impacts.

Consultation has been undertaken with the Department of Transport and Main Roads (DTMR) and Mareeba Shire Council (MSC). General discussions were had with both DTMR and MSC regarding the overall project and approach to mitigation measures. Consultation was undertaken on:

- Consultation with DTMR (on 30 May 2017) and MSC (on 1 June 2017) was undertaken to give both agencies a general overview of the project.
- Further consultation with MSC was conducted on 19 July 2017 and 6 September 2017 regarding the masterplan and adoption of Far North Queensland Region of Councils (FNQROC) design guidelines for the local road network.
- DTMR were provided with a general update and preliminary indication of the traffic impact of the development on 11 September 2017.
- Consultation with DTMR and MSC discussing the overall traffic demand and strategies for mitigation was undertaken on 19 October 2017.

13.2 Methodology and assumptions

13.2.1 Methodology

The assessment of the transportation impacts of the construction and operation of KUR-World was completed in accordance with the Terms of Reference requirements to use the Guidelines for the Assessment of Road Impact of Development (GARID)[1], using an eight-step process:

1) The critical design years for analysis were determined (refer to Section 13.2.4)
2) The existing traffic environment was established to perform the assessment. This included an assessment of existing link capacity using the Highway Capacity Manual and intersection capacity using SIDRA Intersection software (refer to Section 13.3)
3) The level of background traffic in the study area in the design years was determined (refer to Section 13.4.1)
4) The likely volume and distribution of the traffic generated by the construction and operation of the development in the design years was estimated (refer to Section 13.4.2)
5) The impact of the construction and operation of the development on the surrounding transport network was assessed to confirm the study extents (refer to Section 13.5)
6) The operation of the road links and intersections within the study area were assessed to determine whether they can accommodate the additional traffic generated by the construction and operation of the development. This included a review of the predicted road link and intersection operation parameters to determine whether the impact is significant and an assessment of the impact of the development on other transport services (refer to Section 13.6)
7) The on-site parking required to support the development was estimated based on the various uses (refer to Section 13.6.10)
8) The mitigation measures for both the construction and operation phases were nominated (refer to Section 13.7).

Due to the proposed development containing a unique combination of uses with varied traffic impacts, this traffic impact study has utilised first principals traffic estimation techniques to establish the total generation of each use. The traffic generation of each use was based and analysed considering a 'typical week' for each use individually before combining all uses together to assess the overall impact of the proposed development. Benchmarking of similar developments has also occurred through the manual surveying of similar development types in the region. This coupled with the analysis taken from the findings in the Social and Economics chapter (Chapter 11) including associated assessment around employment numbers for construction, operation and visitors were used to inform traffic generations. In particular, the estimates around employment numbers and where these staff originate from.

13.2.2 Assumptions and technical limitations

During the transport impact assessment process, the following assumptions have been made:

- the proposed development will be fully operation in 2027
- there are no other significant developments being constructed in the area
- there are no significant planned upgrades to the local transport network that increase capacity.

[1] The GARID was replaced by the Guide to Traffic Impact Assessment (GTIA) in July 2017. GARID was the defined assessment method as per the Terms of Reference. The TOR (October 2016) was also issued prior to the commencement of the GTIA

In addition to the general assumptions and technical limitations described above, a number of assumptions were made to inform the determination of traffic generation, and the assessment of potential impacts. These assumptions are described further in Section 13.4.2.

13.2.3 Legislation and policy

The policy and legislative framework relevant to the assessment of traffic impacts is summarised in Table 13-1.

Table 13-1: Relevant legislation and policy

Policy/Legislation	Relevance
Guidelines for Assessment of Road Impacts of Development (GARID) (DTMR, 2006)	Provides guidance to assess the road impacts of development proposals. In accordance with the EIS Terms of Reference, this guideline has been the primary document that has informed the assessment of traffic impacts.
Austroads Guide to Road Design	Provides guidance and standards for any new or upgraded road works. This document was used to determine the requirement for turning treatment improvements
Austroads Guide to Traffic Management	Provides guidance and standards for the assessment of traffic impacts. This document was used to determine the geographical scope of traffic assessment and was used in conjunction with GARID.
Highway Capacity Manual (TRB, 2016)	Provides guidance on the measurement of highway capacity in order to determine the level of impact generated by a development. This document was used to determine the capacity of roads in the region.
Far North Queensland Regional Organisation of Councils (FNQROC) Design Guidelines 2014	Provides design guidelines and standards for Mareeba Shire Council infrastructure including roads. This document was used to determine the requirement for upgrades to MSC Roads.

13.2.4 Design year

The traffic impact of developments is conducted at certain design years to ensure that assessments are carried out for peak conditions where impacts may be their greatest. Developments such as KUR-World, which involve a number of stages and have a relatively high level of traffic in both the construction and operational phases, are assessed in a number of design years:

- Design year during the construction phase: The year of peak traffic generation during construction. If the level of construction traffic is assumed constant during the construction phase, the design year is the expected final year of construction. However due to the staged construction of KUR-World, the construction phase traffic will overlap with the operational phase traffic. Therefore, the design year of the construction phase is expected to occur in 2026 during the construction of Stage 3 of KUR-World with Stage 2 fully operational at this time.
- Design year during the operational phase: This is taken as the first year of operation of each stage of the KUR-World development. Therefore, operational design years will be taken as 2018, 2021, 2024 and 2027.
- Design horizon of the operational phase; this is taken as ten (10) years from the first year of full operation of the development. The expected design horizon year is 2037.

13.3 Existing conditions

13.3.1 Local road network overview

The study area has been defined based on the likely extent of impact, with roads outside the study area expected to experience a negligible level of impact. The study area includes three key roads and four key intersections in the vicinity of the development that are likely to be impacted by the proposed development. These roads include:

- Kennedy Highway
- Rob Veivers Drive / Barang Street
- Myola Road
- Barnwell Road.

These intersections include:

- Kennedy Highway / Myola Road / Rob Veivers Drive
- Kennedy Highway / Greenhills Road
- Myola Road / Kuranda Heights Road
- Myola Road / Barnwell Road.

These roads are illustrated below in Figure 13-1: Roads within study area. (Source: Google), while the characteristics of each road is discussed in the following sections. At this stage no impact on Warril Drive is anticipated, therefore Warril Drive has been excluded from the study area.

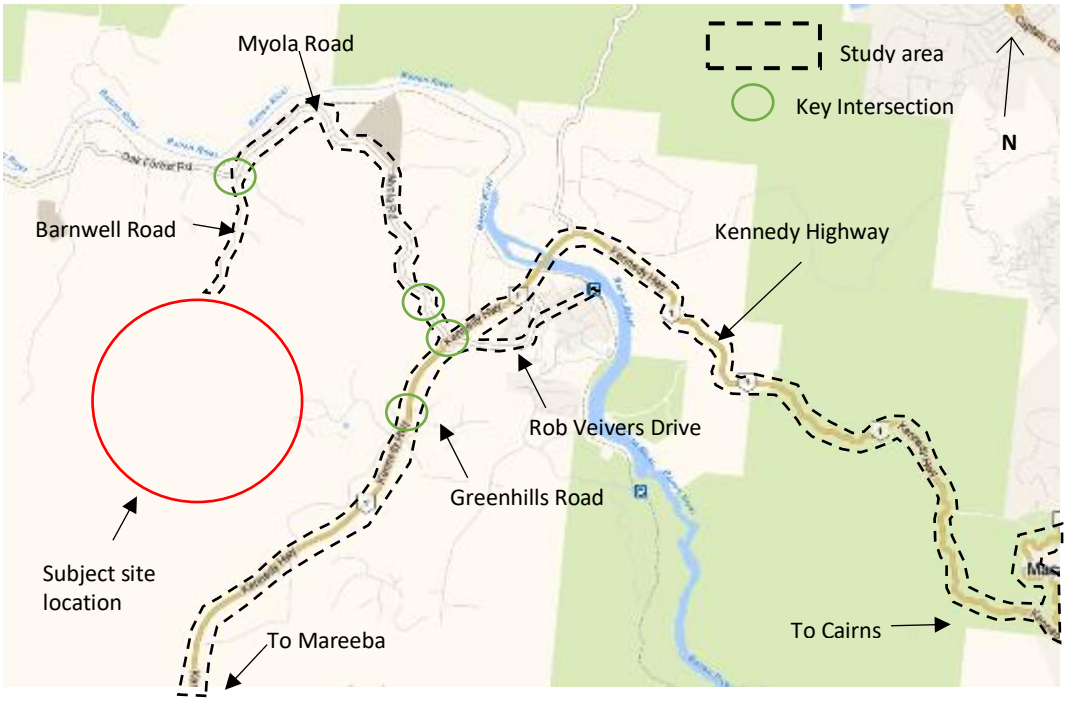


Figure 13-1: Roads within study area. (Source: Google)

13.3.2 Kennedy Highway

The Kennedy Highway is a two lane, undivided state controlled road (Department of Transport and Main Roads) running from Smithfield in Cairns to the start of the Gulf Development Road in the west. The Kennedy Highway is a major freight route. The study area encompasses the Kennedy Highway from Chainage 0.0km to approximate Chainage 17.0km. Within the study area, the width of the through traffic

lanes is generally 3.5m wide, with localised widening and narrowing occurring. The shoulder width is variable and constrained largely by the topography. The speed limit within the study area ranges between 60km/h and 80km/h. Multi-combination vehicles (Road Trains. B-Doubles) are not permitted to access the Kennedy Highway in the study area.

13.3.2.1 Kuranda Range section

The Kuranda Range Section is an 11km section of the Kennedy Highway that traverses the Macalister Range between Smithfield and Kuranda; it is the primary access road from the Cairns Airport to the project site. It features steep grades and tight bends, which lead to lower operational speeds and a lower capacity. This section features a 60km/h speed limit, limited property accesses and a number of overtaking and slow vehicle lanes.

13.3.2.2 Intersections

The Kennedy Highway/Myola Road/Rob Veivers Drive intersection is a signalised intersection featuring raised median channelisation. Left turn slip lanes are provided on all approaches and right turn lanes are provided on the eastern and western approaches. The right turn lanes are both 80 metres in length. There are cycle lanes on the eastern and western approaches and pedestrian crossings on the northern and western approaches. The layout of this intersection is illustrated below in Figure 13-2.

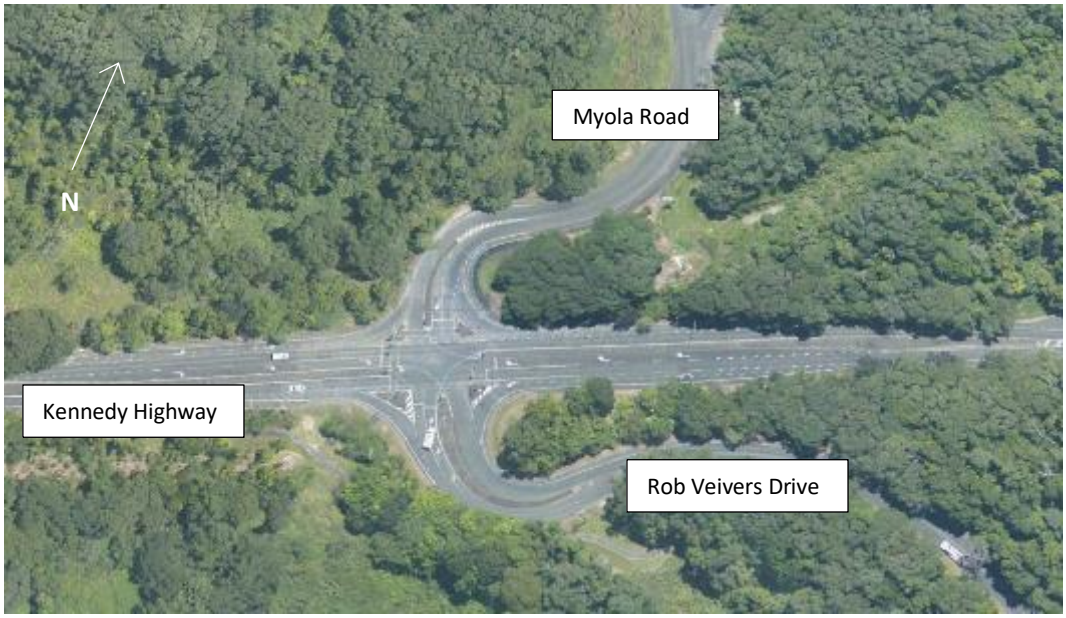


Figure 13-2: Layout of Kennedy Highway / Myola Road / Rob Veivers Drive intersection (Source: Google)

The Kennedy Highway/Greenhills intersection is a priority controlled T-intersection, with vehicles on Greenhills Road giving way to those on the Kennedy Highway. A left turn slip lane is provided on the eastern approach. An auxiliary right turn lane as described in Austroads Guide to Road Design has been provided on the western approach. The length of the left turn slip lane is 120m (including deceleration length) while the auxiliary widening is approximately 200m. The layout of the intersection is illustrated below in Figure 13-3.

Figure 13-3: Layout of Kennedy Highway / Greenhills Road intersection (Source: Google)

13.3.3 Rob Veivers Drive / Barang Street

Rob Veivers Drive is a sealed, two lane, undivided road providing access from the Kennedy Highway to the Kuranda Township and Kuranda Station. Rob Veivers Drive is controlled by Mareeba Shire Council (MSC) and is classified as a 'Collector Road'. The posted speed limit is the Urban Default for a majority of the section. The road is generally urban in nature with 3.5m wide traffic lanes and varying shoulder width with on-street parking in sporadic locations.

Barang Street provides a link between Rob Veivers Drive and Kuranda Station. Barang Street is a sealed, two lane, undivided road and is controlled by Mareeba Shire Council (MSC). It is classified as a 'Collector Road'. The posted speed limit is the Urban Default while the road is urban in nature with 3.5m wide traffic lanes and varying shoulder width with vast on-street parking.

13.3.4 Myola Road

Myola Road is a sealed, two lane, undivided road linking the locality of Myola to the Kennedy Highway. Myola Road is controlled by Mareeba Shire Council (MSC) and is classified as a 'Major Rural Road'. The posted speed limit is 60km/h along the entire section of Myola Road in the study area, there is however a 600m long 40km/h School Zone along the frontage of the Kuranda District State College. Within the study area, the horizontal and vertical alignment is constrained, while the traffic lanes are typically 3.5m wide with varying shoulder widths. The road shoulder is sporadically utilised as a bi-direction shared path for pedestrians and cyclists.

Myola Road intersects four lower order roads (including Kuranda Heights Road and Barnwell Road) and provides direct access to a number of residential properties. The intersection of Myola Road / Kuranda Heights Road is a priority controlled Y-intersection, with vehicles on Kuranda Heights Road giving way to those on Myola Road. No slip or right turn lanes are provided and the sight distance to the north of Kuranda Heights Road is limited due to a crest, warning signage advising drivers of the upcoming intersection is installed. The layout of this intersection is illustrated below in Figure 13-4.

Figure 13-4: Layout of Myola Road / Kuranda Heights Road intersection. (Source: Google)

The intersection of Myola Road/Barnwell Road is a priority controlled T-intersection, with vehicles on Barnwell Road giving way to those on Myola Road. No slip lanes or right turn lanes are provided. The layout of this intersection is illustrated below in Figure 13-5.

Figure 13-5: Layout of Myola Road / Barnwell Road intersection (Source: Google)

13.3.5 Barnwell Road

Barnwell Road is a partial sealed, undivided road linking the project site to Myola Road. Barnwell Road is controlled by Mareeba Shire Council and is classified as a 'Minor Rural Road' with its primary purpose being private property access. There is currently no posted speed limit, however due to horizontal and vertical alignment the operating speed is assumed to below (less than 50km/h). Barnwell Road is sealed for a

length of approximately 700m, for which the typical width is 5.0m. The remaining 400m of the road is sealed with a typical width of 4.5m.

Barnwell Road forms the current primary vehicle access to the project site.

13.3.6 Traffic volumes

Traffic volume data for the Kennedy Highway, Myola Road and Barnwell Road was obtained from Austraffic, DTMR and MSC respectively. A summary of the volumes, detailing the survey date, Annual Average Daily Traffic (AADT) and Heavy Vehicle (HV) percentage is provided below in Table 13-2.

Table 13-2: Existing traffic volumes on impacted roads

Road	Count Site	Site Reference	Year	AADT (vpd)	HV %	Source
Kennedy Highway	N/A	240m North of Greenhills Road	2017	8109	11.8	Austraffic
	110005	500m West of Captain Cook Highway	2016	9008	7.98	DTMR
	111606	Davies Creek	2016	5985	10.24	DTMR
Rob Veivers Drive	N/A	Intersection of Kennedy Highway	2017	4224[2]	4.75	Austraffic
Myola Road	N/A	Chainage 0.33km	2016	2389	4.5	MSC
	N/A	Chainage 1.81km	2011	1914	4.2	MSC
	N/A	Chainage 3.87km	2009	1386	5.8	MSC
Barnwell Road	N/A	300m South of Kingfisher Dr	2017	69	4.6	Austraffic

13.3.7 Road authority network planning

In order to identify the proposed future road related projects DTMR's Far North Queensland Transport and Roads Investment Program (QTRIP) 2016-17 to 2019-20 (Queensland Government, 2016) document and the Mareeba Shire Council Trunk Infrastructure Plan was reviewed to determine the projects that fall within the Study Area and may be used by traffic associated with the project. The projects detailed in the QTRIP and MSC Trunk Infrastructure Plan that fall within the Study Area are:

- Kennedy Highway (Cairns – Mareeba), Widen & Seal 1.70-2.10km – $900,000 - 2016-17
- Kennedy Highway (Cairns – Mareeba), Widen & Seal 8.01-8.20km – $1,406,000 - 2016-17
- Kennedy Highway (Cairns – Mareeba), Widen Pavement 8.00-10.00km – $3,004,000 - 2017-18
- Myola Road, Construct to new-sealed two lane standard 3.20-4.30km – $750,000 – 2016-2017.

The locations of these projects are illustrated in

Figure 13-6. The total value of these works is approximately $4.2 million. These works are primarily pavement and safety works and are unlikely to significantly improve the operational capacity of the affected roads; therefore, they have not been specifically considered when assessing the potential impacts of the proposed development.

[2] 14 Hour traffic volume

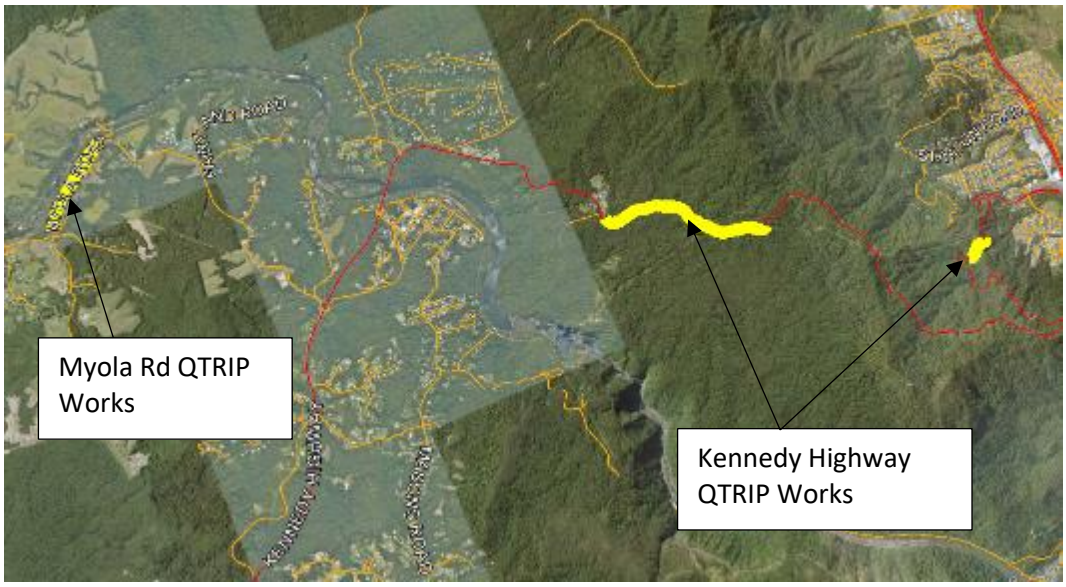


Figure 13-6: Location of QTRIP works that are within the study area.

13.3.8 Restricted vehicle routes

Within the study area, there are no gazetted multi-combination routes.

13.3.9 Link and intersection capacity

The capacity of the links and intersections identified in Section 13.2.4 were assessed using the volumes obtained from a traffic survey conducted by Austraffic on 10 May 2017 at the following intersections:

- Kennedy Highway / Myola Road / Rob Veivers Drive
- Kennedy Highway / Greenhills Road
- Myola Road / Barnwell Road.

The raw data is attached in Appendix 13A and Appendix 13B.

13.3.9.1 Link capacity

The link capacities of the existing roads were assessed using the methodology from the Highway Capacity Manual (HCM 2016) for assessing two-lane highways as all affected roads operate at a reduced capacity due to the reduced opportunities for passing slow vehicles. The link capacity of these roads are affected by the number of passing opportunities available and is a function of:

- the free flow speed of the road
- the volume of traffic in the opposing direction
- the design of the road (including lane width, shoulder width etcetera)
- the alignment of the road and the terrain in the region.

A summary of the link level of service (LoS) for current traffic volumes and the parameters used in the link capacity assessments are provided in Table 13-3 and Table 13-14 respectively.

Due to the urban nature of Rob Veivers Drive and the interrupted flow due to closely spaced intersections, the link capacity has been taken conservatively as 800 vehicles per hour in each direction based on the Cairns Strategic Transport Model. The current 2017 link level of service is therefore LoS A/B based on the surveyed traffic volumes.

Table 13-3: Link Capacity Assessment of the Kennedy Highway

Parameter	Kennedy Highway (Ch0.0-11.0km)	Kennedy Highway (Ch11.0-14.0km)
Class	Class II (Secondary Route)	Class II (Secondary Route)
Lane Width	3.75m	3.5m
Shoulder Width	0.75m	1m
Number of Access Points	1 per km	4 per km
Peak Hour Factor	0.85	0.85
Grade	Varies (5%+)	Level
Heavy Vehicle Percentage	5%	5%
Percent No-passing Zones	80%	80%
Percent Time Following	60-65%	60-65%
Link Level of Service	LOS C (both directions)	LOS C (both directions)

Table 13-4: Link Capacity Assessment of Myola Road and Barnwell Road

Parameter	Myola Road	Barnwell Road
Class	Class III (Local Road)	Class III (Local Road)
Lane Width	3.5m	2.5m
Shoulder Width	0.5m	0m
Number of Access Points	12 per km	10 per km
Peak Hour Factor	0.85	0.85
Grade	Varies (Rolling)	Varies (Rolling)
Heavy Vehicle Percentage	5%	5%
Percent No-passing Zones	40%	100%
Percent of Free Flow Speed	91%	92%
Link Level of Service	LOS B (both directions)	LOS A (both directions)

The hourly link capacities and the modelled Level of Service of these road segments were also extracted from the Cairns Strategic Transport Model (CSTM) for comparison. The hourly capacities and 2014 LoS can be seen in Table 13-5. It indicated that the HCM analysis is likely conservative when compared to the CSTM level of services even when accounting for the expected growth from 2014 to 2017.

Table 13-5: Hourly link capacity of affected roads from CSTM

Link	Hourly Capacity	Modelled Level of Service
Kennedy Highway (Ch0.0-11.0km)	1100 vehicles per hour (vph) in each direction	LoS A (both directions)

Link	Hourly Capacity	Modelled Level of Service
Kennedy Highway (Ch11.0-18.0km)	1600 vph in each direction	LoS A (both directions)
Rob Veivers Drive	800 vph in each direction	LoS A/B
Myola Road	600 vph in each direction	LoS A (both directions)
Barnwell Road	Not Modelled	Not Modelled

13.3.9.2 Intersection capacity

As shown in Figure 13-1: Roads within study area. (Source: Google), there are four intersections that are predicted to be affected by the traffic generated by the construction or operation of the development:

- Kennedy Highway / Myola Road / Rob Veivers Drive
- Kennedy Highway / Greenhills Road
- Myola Road / Kuranda Heights Road
- Myola Road / Barnwell Road.

The current operation of these intersections (2017) was assessed using SIDRA Intersection software. Three key performance parameters were assessed:

- Degree of Saturation (DoS) (%) – This is the ratio of demand flow to capacity. For priority controlled intersection the acceptable limit of operation is reached when the degree of saturation exceeds 80 per cent. For signalised intersections, the acceptable limit of operation is reached when the degree of saturation exceeds 90 per cent.
- Average Delay (sec) – The average delay per vehicle in seconds incurred by vehicles over the modelled time period.
- 95th Percentile Queue – A queue length measured in metres of which only five percent of queues are equal to or greater than.

The average delay is the key determinant in the overall LoS of the intersection. The LoS benchmarks are seen in Table 13-6 for which the intersections will be assessed.

Table 13-6: Level of Service for un-signalised and signalised intersections

Level of Service	Average delay per vehicle in seconds (s)	
	Un-signalised Intersections	Signalised Intersections
A	$d \leq 10$	$d \leq 10$
B	$10 < d \leq 15$	$10 < d \leq 20$
C	$15 < d \leq 25$	$20 < d \leq 35$
D	$25 < d \leq 35$	$35 < d \leq 55$
E	$35 < d \leq 50$	$55 < d \leq 80$
F	$50 < d$	$80 < d$

13.3.9.2.1 *Assumptions*

The following assumptions have been incorporated into the SIDRA Intersection analysis:

- Traffic volumes have incorporated demand volumes obtained from traffic counts carried out in 2017 for all intersections (except Myola Road/Kuranda Heights Road).
- The traffic volumes at the Myola Road/ Kuranda Heights Road intersection have been estimated based on the surveyed through volumes on Myola Road and the estimated traffic demand of Kuranda Heights Road.
- The lane lengths and widths were measured using Google Earth aerial imagery, approach grades are assumed to be 0%.
- SIDRA default value of 95% has been used as the peak flow factor for all intersection models.
- SIDRA default values for follow up headways and critical gap acceptance have remained unchanged.
- Heavy Vehicle volumes have been assumed to be consistent with the surveyed traffic volumes.
- SIDRA default value of Base Saturation Flow remains unchanged.

13.3.9.2.2 *Kennedy Highway / Myola Road / Rob Veivers Drive*

The Kennedy Highway/Myola Road/Rob Veivers Drive intersection is currently a signalised intersection with left turn slip lanes provided on every approach. Right turn lanes of varying lengths are also provided on all approaches. An indicative layout of the intersection is shown in Figure 13-7.

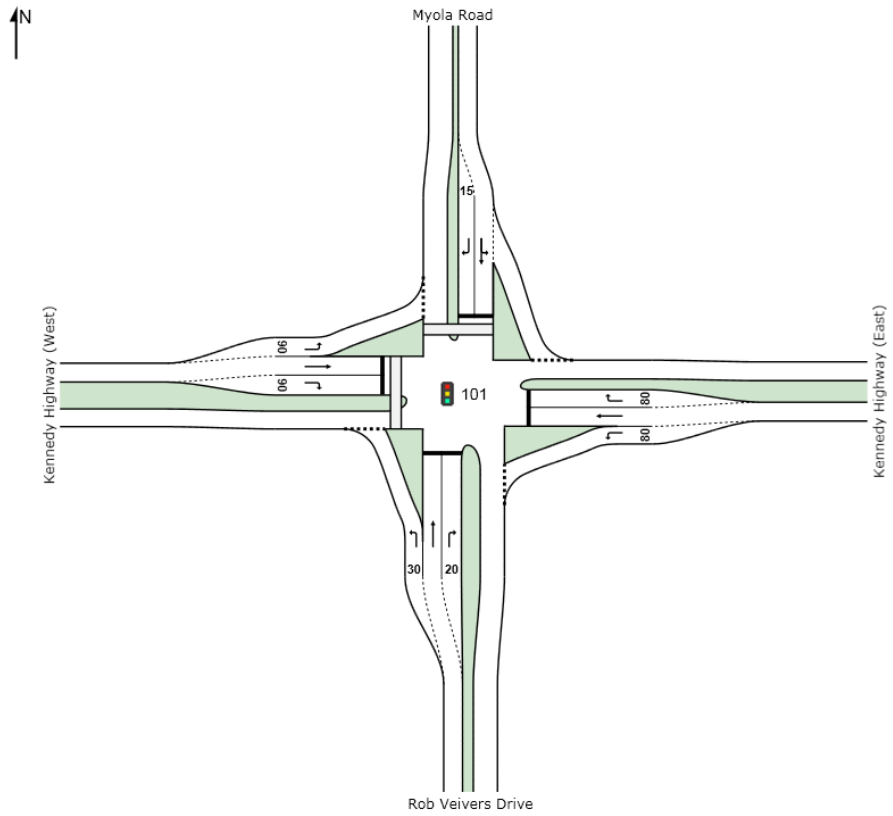


Figure 13-7: Kennedy Highway / Myola Road / Rob Veivers Drive intersection layout

The results of the SIDRA assessments for 2017 is presented in Table 13-7.

Table 13-7: Kennedy Highway / Myola Road / Rob Veivers Drive intersection assessment results for 2017.

Approach	Movement	Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM
Rob Veivers Drive	Left	3.5	6.3	7.3	8.1	1.7	3.8
	Through	21.2	20.8	27.4	26.3	9.7	10.5
	Right	20.0	60.4	33.0	34.3	8.7	32.4
Kennedy Highway (East)	Left	8.1	7.2	8.9	8.8	3.6	3.4
	Through	36.6	55.3	19.1	22.1	35.3	53.4
	Right	14.2	13.1	18.4	18.7	7.4	7.1
Myola Road	Left	36.1	28.1	16.8	15.8	14.3	13.6
	Through	36.1	28.1	11.2	10.1	14.3	13.6
	Right	24.4	28.7	34.5	34.8	9.2	10.9
Kennedy Highway (West)	Left	5.4	3.3	8.4	8.3	2.52	1.3
	Through	52.6	48.0	20.1	20.6	52.9	45.9
	Right	16.0	8.9	17.9	18.9	9.5	4.5
Intersection		**52.6**	**60.4**	**18.0**	**20.2**	**52.9**	**53.4**

The above results indicate that the intersection has sufficient capacity to accommodate the existing traffic volumes. The overall intersection LoS is LoS B for AM peak volumes and LoS C for PM peak volumes. The analysis shows that estimated traffic flows do not trigger a need for any geometrical upgrades to this intersection to cater for base flows.

13.3.9.2.3 *Kennedy Highway / Greenhills Road*

The Kennedy Highway/Greenhills Road intersection is currently a priority controlled intersection with a left turn slip lane and auxiliary right turn lane on the Kennedy Highway. An indicative layout of the intersection is shown in Figure 13-8

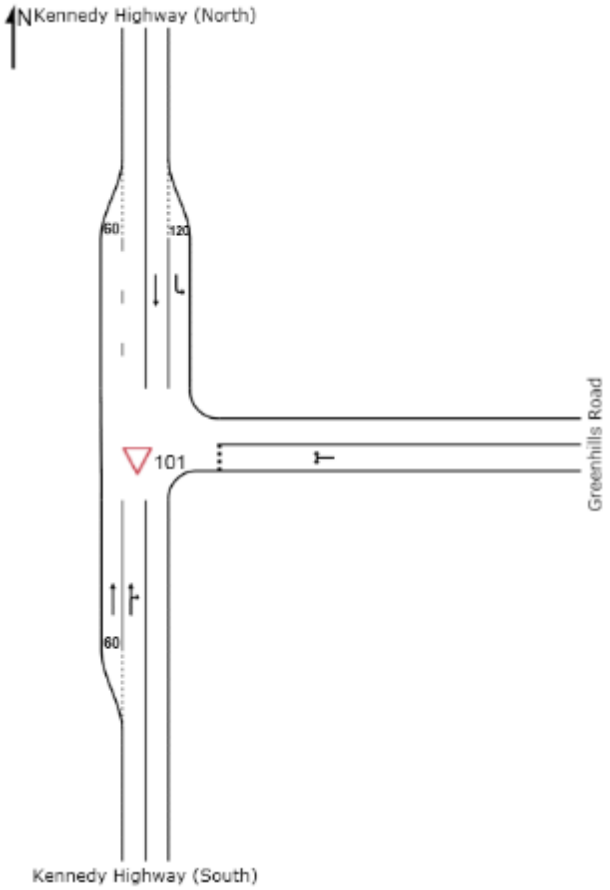


Figure 13-8: Kennedy Highway / Greenhills Road intersection layout.

The results of the SIDRA assessments for 2017 is presented in Table 13-8.

Table 13-8: Kennedy Highway / Greenhills Road intersection assessment results for 2017

Approach	Movement	Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM
Kennedy Highway (South)	Through	17.1	12.4	0.0	0.1	0.1	0.5
	Right	17.1	12.4	9.6	8.8	0.1	0.5
Greenhills Road	Left	5.4	3.3	7.5	8.3	1.4	0.9
	Right	5.4	3.3	13.4	14.3	1.4	0.9
Kennedy Highway (North)	Left	0.5	1.1	4.7	5.6	0.0	0.0
	Through	14.4	21.0	0.0	0.0	0.0	0.0
Intersection		**17.1**	**21.0**	**0.5**	**0.5**	**1.4**	**0.9**

The above results indicate that the intersection currently operates within acceptable limits. The warrants for a major road right turn treatment were assessed in accordance with Austroads Guide to Road Design

Part 4 and it was found that the 2017 turning volumes do not warrant the use of a Channelised Right Turn treatment (CHR).

13.3.9.2.4 *Myola Road / Kuranda Heights Road*

The Myola Road / Kuranda Heights Road intersection is a priority controlled Y-intersection with no turn lanes. An indicative layout of the intersection is illustrated in Figure 13-9

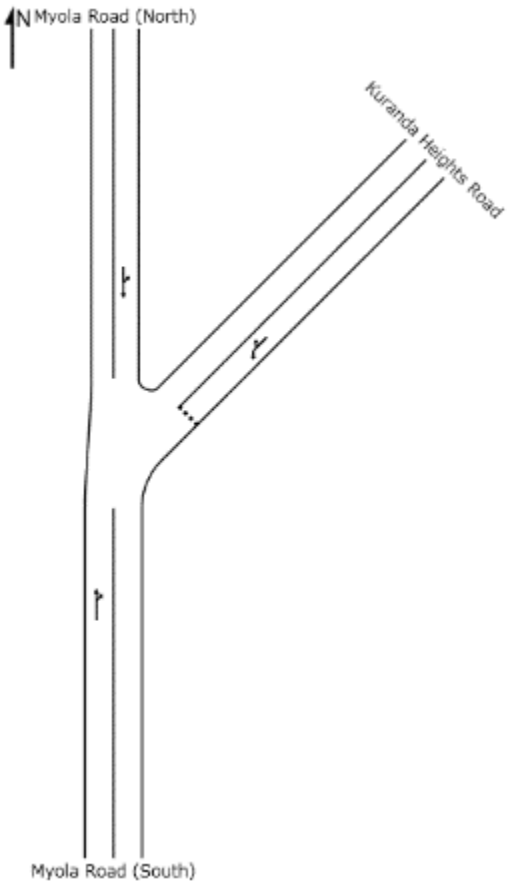


Figure 13-9: Myola Road / Kuranda Heights Road intersection layout.

The results of the SIDRA assessments for 2017 is presented in Table 13-9.

Table 13-9: Myola Road / Kuranda Heights Road intersection assessment results for 2017

Approach	Movement	Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM
Myola Road (South)	Through	5.4	7.3	0.0	0.0	0.3	0.3
	Right	5.4	7.3	5.0	4.9	0.3	0.3
Kuranda Heights Road	Left	1.1	0.9	5.5	5.4	0.3	0.2
	Right	1.1	0.9	7.1	7.2	0.3	0.2
	Left	6.7	5.8	6.5	6.5	0.0	0.0

Myola Road (North)	Through	6.7	5.8	0.0	0.0	0.0	0.0
Intersection		**6.7**	**7.3**	**0.5**	**0.5**	**0.3**	**0.3**

The above results indicate that the intersection currently operates with an acceptable level of service (LoS A).

13.3.9.2.5 *Myola Road / Barnwell Road*

The Myola Road / Barnwell Road intersection is a priority controlled intersection with no turn lanes. An indicative layout of the intersection is illustrated in Figure 13-10.

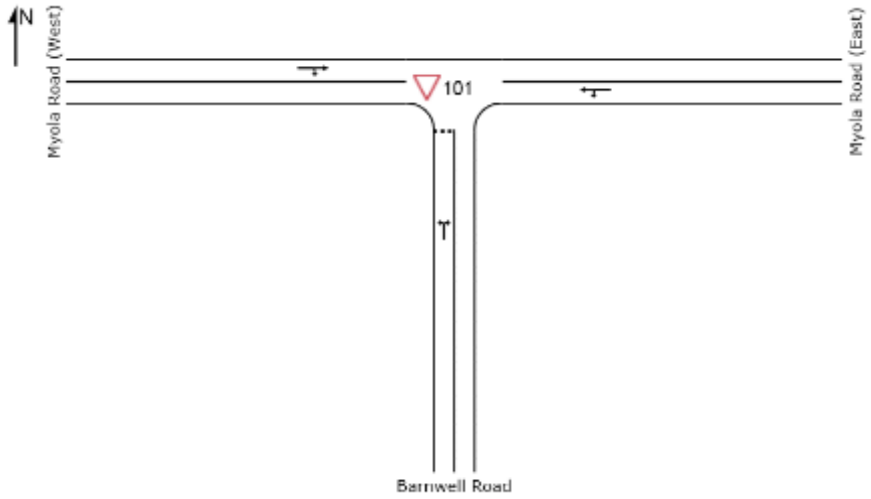


Figure 13-10: Myola Road / Barnwell Road intersection layout

The results of the SIDRA assessments for 2017 is presented in Table 13-10.

Table 13-10: Myola Road / Barnwell Road intersection assessment results for 2017

Approach	Movement	Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM
Myola Road (West)	Through	6.6	5.5	0.0	0.0	0.1	0.1
	Right	6.6	5.5	5.8	5.8	0.1	0.1
Barnwell Road	Left	0.1	0.5	6.4	6.6	0.3	0.2
	Right	0.1	0.5	6.6	6.9	0.3	0.2
Myola Road (East)	Left	6.6	6.3	5.7	5.7	0.0	0.0
	Through	6.6	6.3	0.0	0.0	0.0	0.0
Intersection		**6.6**	**6.3**	**0.5**	**0.4**	**0.3**	**0.2**

The above results indicate that the intersection currently operates with an acceptable level of service (LoS A).

13.3.10 Crash analysis

Crash analysis has been undertaken for the key roads in the study area. Road safety is usually treated as part of a risk management process according to the Austroads Guide to Road Safety. This involves determining:

- the relevant risk factors in a given situation
- which factors can be effectively manipulated
- which countermeasures will produce the desired outcomes.

The baseline traffic report considers the first element of the risk management process. It is important to recognise that the road safety risk factors include those from the road environment, road user (human) factors as well as vehicle factors.

The purpose of this assessment is to understand the current risk factors along the route that is most likely to carry traffic associated with the development during the construction and operational phases.

An assessment of the crash history for the study area was undertaken. This included the Kennedy Highway (including Kuranda Range section), Myola Road and Barnwell Road and the intersections along the route.

13.3.10.1 Survey data

Raw crash data for the subject roads was obtained through a request from DTMR. The crash data obtained is attached in Appendix 13C, with details of each crash including location, crash severity and crash type. The review considered the most recent five years (2012-2016) of available crash data as this is considered to give an indication of the current risk.

Maps showing the location of recorded crashes are presented in Figure 13-11 to Figure 13-15. The recorded crashes according to crash type for the Kennedy Highway, the intersection of the Kennedy Highway/Myola Road/Rob Veivers Drive and Myola Road are also summarised in Table 13-11, Table 13-12 and Table 13-13 respectively. There have been no crashes on Barnwell Road recorded in the most recent five-year period.

Table 13-11: Total crashes on the Kennedy Highway within the study area during the five-year period between 2012 and 2016

Crash Type	DCA Code[3]	Frequency
Hit Pedestrian (Playing, Working, Lying or Standing on Carriageway)	004	2
Head On	201	37
Vehicles from Opposing Directions (U-Turn)	207	1
Rear End (Vehicles in Same Lane)	301	10
Rear End (Vehicle Turning Right)	303	1
Side Swipe	305	2
Vehicle Leaving Driveway	406	1
On Path (Other)	600	2
Hit Temporary Object on Carriageway	607	3
Off Path on Straight (Left Off into Object)	703	2

[3] The DCA (Definition Code of Accident) Code is a reference to the type of accident. A full list of the DCA Codes are in Appendix 13D.

Crash Type	DCA Code[3]	Frequency
Off Path on Straight (Right Off into Object)	704	1
Off Path on Curve (Other)	800	3
Off Path on Curve (Right Bend)	801	3
Off Path on Curve (Left Bend)	802	2
Off Path on Curve (Right Bend into Object)	803	11
Off Path on Curve (Left Bend into Object)	804	11
Out of Control on Carriageway	805	13
Miscellaneous	900	1
Total		106

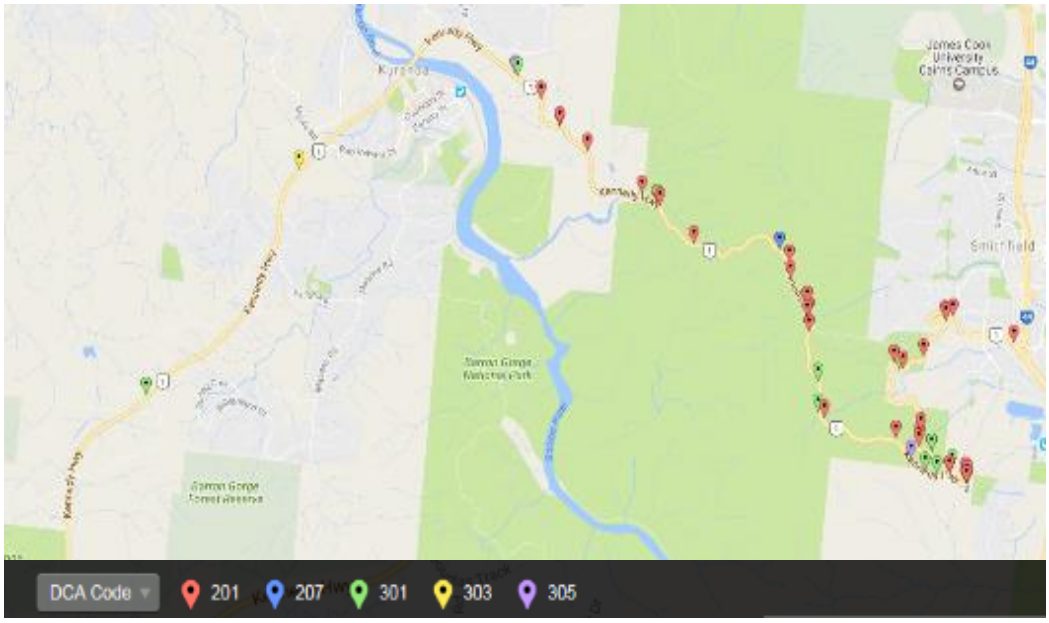


Figure 13-11: Kennedy Highway Dual Vehicle Crashes 2012-2016

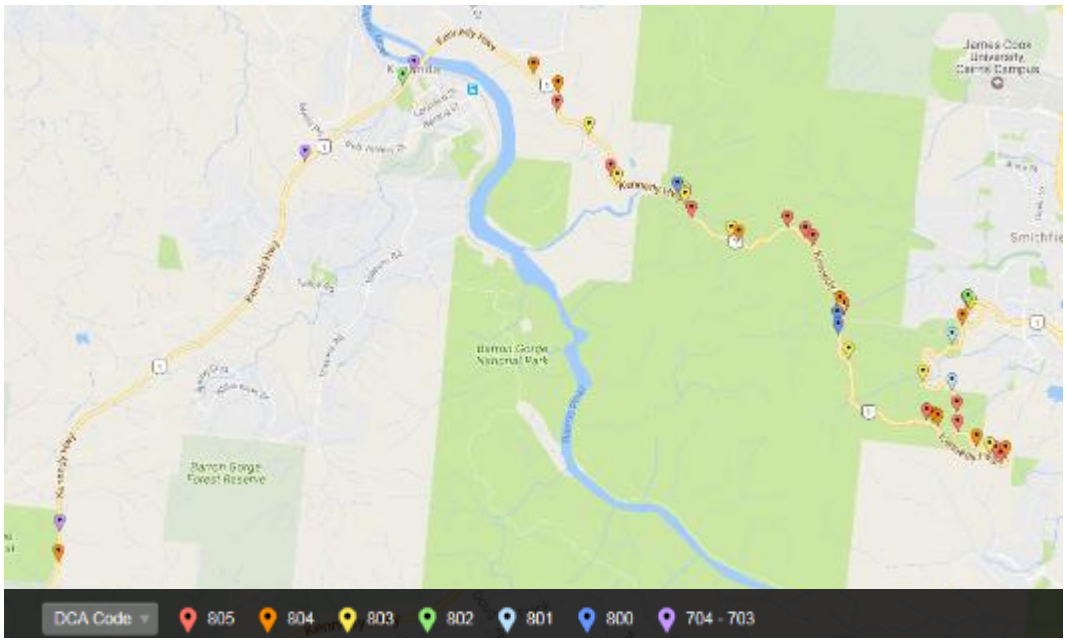


Figure 13-12: Kennedy Highway Single Vehicle Crashes 2012-2016

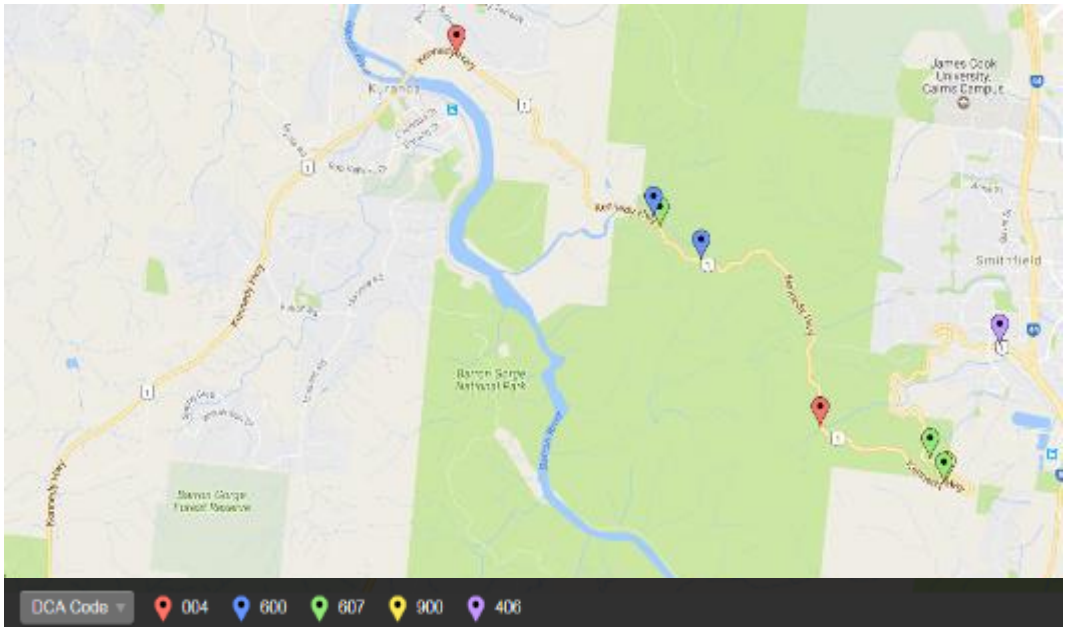


Figure 13-13: Kennedy Highway Miscellaneous Crashes 2012-2016

Table 13-12: Crashes at the intersection of Kennedy Highway/Myola Road/Rob Veivers Drive

Crash Type	DCA Code	Frequency
Intersection Adjacent Approach (Thru-Thru)	101	1
Opposing Direction (Thru-Right)	202	5
Rear End (Vehicle Turning Left)	302	1

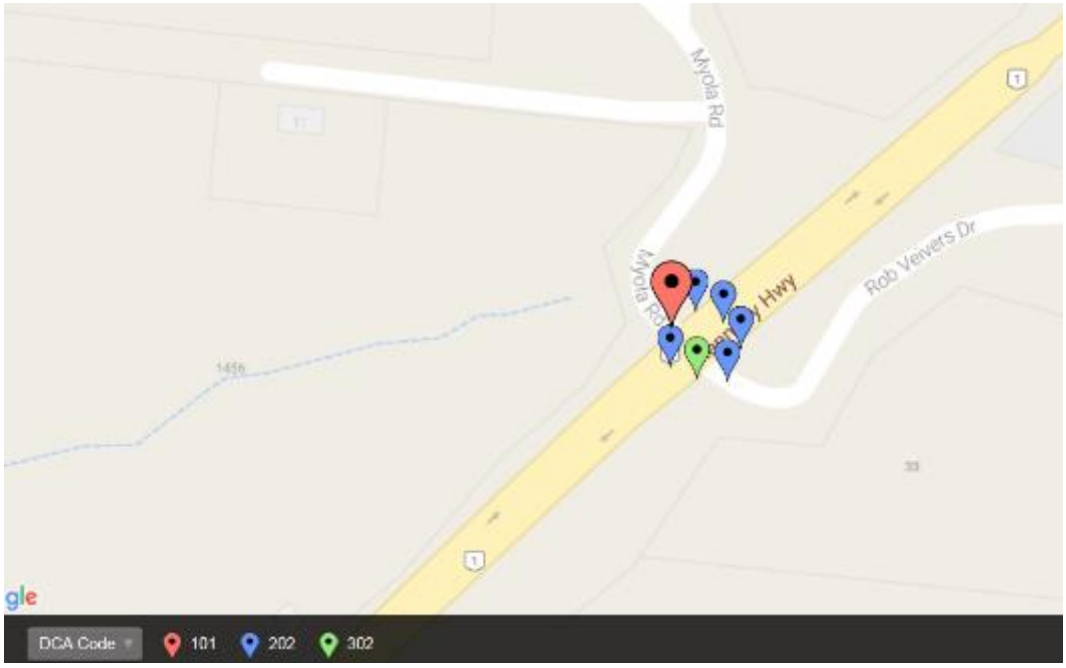


Figure 13-14: Crashes at intersection of Kennedy Highway/Myola Road/Rob Veivers Drive

Table 13-13: Crashes on Myola Road

Crash Type	DCA Code	Frequency
Off Path on Curve (Right Bend into Object)	803	1
Off Path on Curve (Left Bend into Object)	804	1

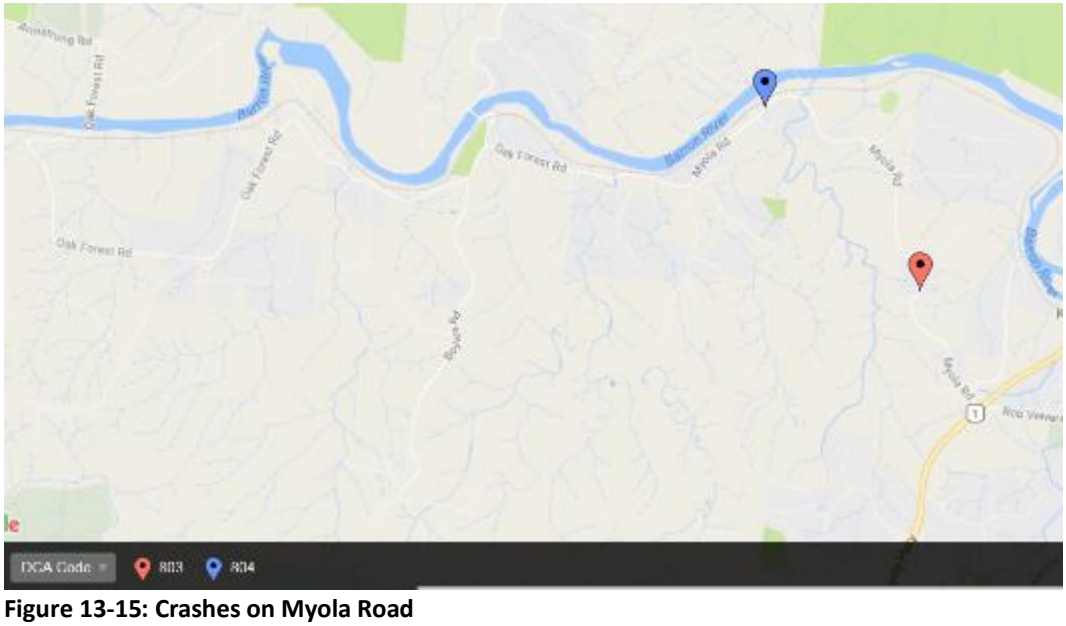


Figure 13-15: Crashes on Myola Road

13.3.10.2 Link crash rates

The actual crash rate is considered the most appropriate manner of measuring road crashes in terms of exposure to risk. The actual crash rate is determined using the formula from *DTMR Manual of Uniform Traffic Control Devices (MUTCD) Part 4: Speed Control Appendix E* and compared to the average and critical crash rates for similar roads.

$$R = \frac{\sum_{t=1}^{20} C_t * A_t}{M} * 10^4$$

Where:

R = actual casualty crash rate, expressed in terms of equivalent risk unit (ERU) per 108 vehicle kilometres travelled (VKT);

t = DCA (Definitions for Coding Accidents) Code Group

At = Average number of crashes in the DCA Code Group 't' per year

Ct = Crash risk score of a crash in DCA Code Group 't'

M = SxYx365 = Measure of crash exposure in 108 VKT using the formula

S = Length of road segment (km)

Y = Annual Average Daily Traffic.

The actual crash was determined for:

- Kennedy Highway between Chainages 0.0km – 11.0km
- Kennedy Highway between Chainages 11.0km – 18.0km
- Myola Road
- Barnwell Road.

The Casualty Crash Rate was determined in accordance with the convention described in the MUTCD:

- low casualty crash rate – Less than the average casualty crash rate
- medium casualty crash rate – between average and critical casualty crash rate
- high casualty crash rate – greater than or equal to the critical casualty crash rate.

The calculated casualty crash rates are summarised in Table 13-14. Intersection crash rates were calculated separately and can be seen in Section 13.3.10.3.

Table 13-14: Casualty Crash Rates for all links affected by proposed development.

Road	Calculated Casualty Crash Rate (ERU per 108 VKT)	Average Casualty Crash Rate[4] (ERU per 108 VKT)	Critical Casualty Crash Rate[5] (ERU per 108 VKT)	Casualty Crash Rate
Kennedy Highway (0-11.0km, Low Speed)	1903.9	1593.2	1681.5	High
Kennedy Highway (11.0-18.0km, High Speed)	1723.8	1138.0	1171.6	High
Myola Road	586.2	2394.0	2477.5	Low
Barnwell Road	0 (No Crashes Recorded)	597.5	693.6	Low

13.3.10.2.1 *Kennedy Highway*

The calculated crash rate for the Kennedy Highway was above the critical casualty crash rate (for both the high and low speed environments) indicating that the road has a high casualty crash rate. The high crash rate suggests that the road design or maintenance practices may have been a factor in the crashes due to the above average crash rate. There are a number of crash clusters including those illustrated in Figure 13-16 and Figure 13-17. The predominant crash type is a Head On (approximately 30% of total crashes) followed by various single vehicle loss of control crashes.

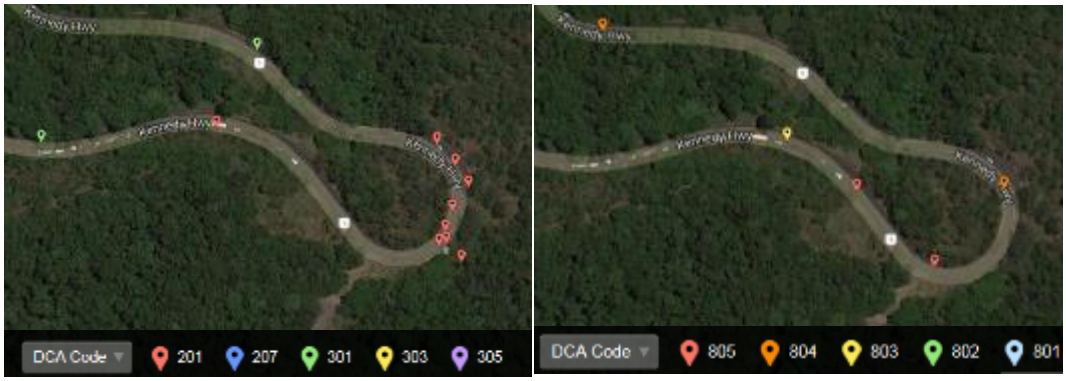


Figure 13-16: Crash Cluster at approximate Ch 4.0km on the Kennedy Highway, featuring approximately 16 crashes in close proximity.

[4] Assumed Rural Environment
[5] Assumed Rural Environment

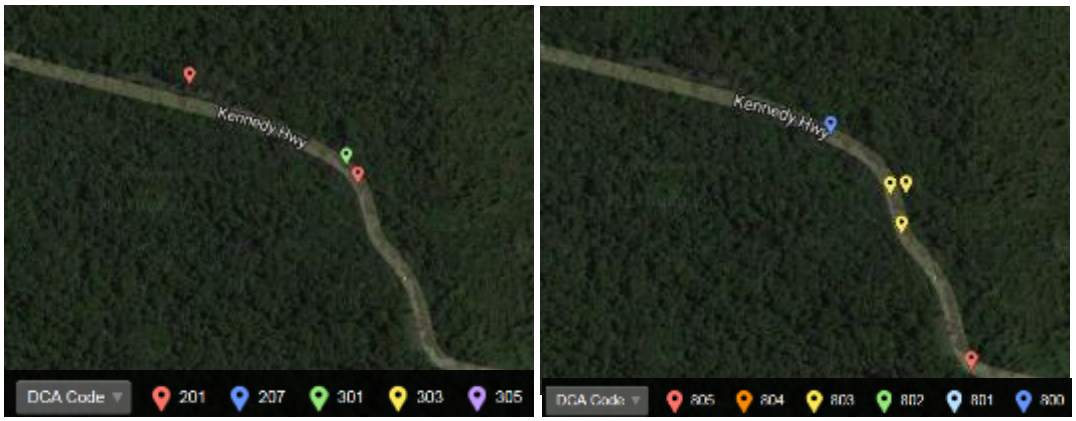


Figure 13-17: Crash cluster at approximate Ch 9.0km on the Kennedy Highway, featuring approximately 6 crashes in close proximity.

13.3.10.2.2 *Myola Road / Barnwell Road*

The calculated crash rates for Myola and Barnwell Roads were lower than the average and critical crash rate and therefore have a low casualty crash rate. The crash data showed no discernible patterns or crash clusters, as there were few accidents overall. Therefore, there is little evidence to suggest that any of the crashes on these roads were caused by road design or poor maintenance of the road.

13.3.10.3 Intersection crash rates

Intersection crash rates are calculated in terms of crashes per 10 million vehicles entering (10M VE) and provide an average crash rate for that location that can be compared against the Queensland average for similar intersection types. The intersection crash rates were calculated in accordance with the Austroads guides and presented in Table 13-15 below.

Table 13-15: Intersection Crash Rates for all affected intersections.

Intersection	Daily Vehicles Entering (AADT)	Number of Crashes (over set period)	Calculated Crash Rate (per 10M VE)	Average Crash Rate[6] (per 10M VE)	Relative Risk
Kennedy Highway / Myola Road / Rob Veivers Drive	12332	7	3.88	2.32	1.67
Kennedy Highway / Greenhills Road[7]	11443	0	N/A	1.69	N/A
Myola Road / Kuranda Heights Road	3048	0	N/A	1.69	N/A
Myola Road / Barnwell Road	597	0	N/A	1.69	N/A

The crash rate of the Kennedy Highway / Myola Road / Rob Veivers Drive intersection is above the Queensland Average for Rural Signalised Intersections. The predominant crash type at this intersection is Opposing Direction Thur-Right (DCA 202) crashes indicating the use of filtered turns at this intersection may

[6] Assumed Rural Environment

[7] No crashes were recorded at the Kennedy Hwy/Greenhills Rd, Myola Rd/Kuranda Heights Rd and Myola Rd/Barnwell Rd.

not be suitable. The crash rates of all other intersections were unable to be assessed as there were no crashes recorded at these intersections. It has been assumed that the crash rate of these intersections is average.

13.3.11 Public transport

The impact of the project on public transport services has been considered. The project has the potential to affect the following services:

- Public Bus Services
- School Bus Services
- Kuranda Skyrail
- Kuranda Scenic Rail.

13.3.11.1 Public bus services

The public bus services operating within the study area are summarised in Table 13-16. The public bus services operating in the study area are limited to the Kennedy Highway and roads within the Kuranda Village as seen in Figure 13-18, due to the already high vehicle volumes on the Kennedy Highway the impact the proposed development will have on the existing services is likely limited.

Table 13-16: Public bus services operating in the study area.

Bus Operator	Route	Frequency
Trans North	Cairns – Kuranda – Cairns	Five times daily
Trans North	Cairns – Mareeba – Atherton – Mareeba – Cairns	Three times daily
Johns Kuranda Bus	Kuranda – Cairns – Kuranda	Three times daily

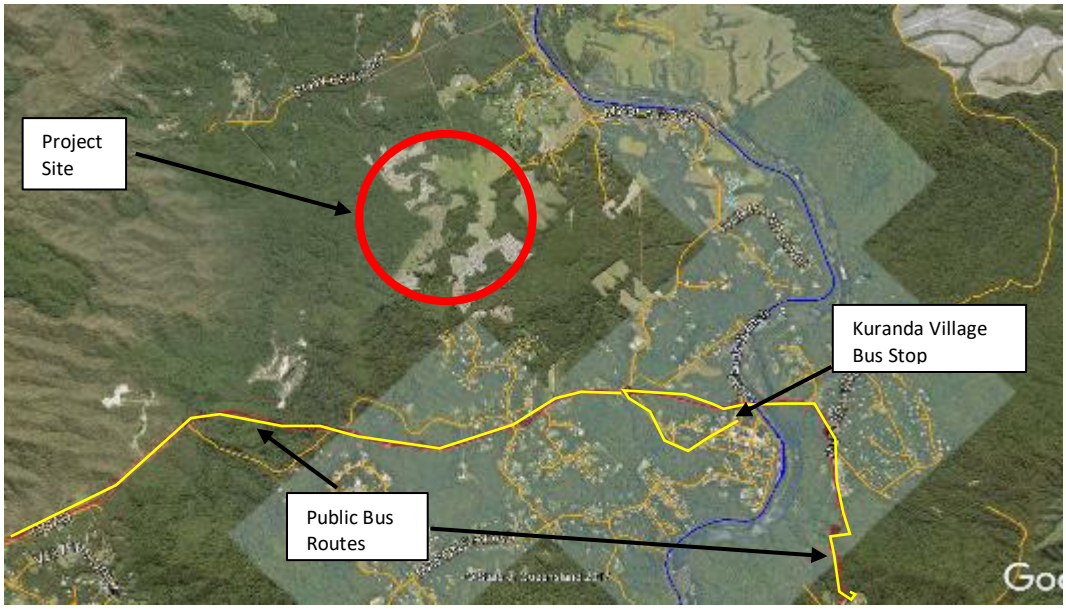


Figure 13-18: Public Bus Routes within the Study Area

13.3.11.2 School bus services

School bus services operating in the study area are summarised in Table 13-17. School buses currently service Kuranda District State College and the Cairns Hinterland Steiner School, operating on both the

Kennedy Highway and Myola Road. It is anticipated that school bus services will operate outside the peak traffic flows associated with this project, therefore the project is not anticipated to significantly affect the safety or operation of these services.

Table 13-17: School bus services operating in the study area

School	Origin/Destination	Roads Travelled
Kuranda District State College	Kuranda Town Centre	Kennedy Highway (between Town Centre and Myola Road), Myola Road
	Myola	Myola Road
	Kuranda Range	Kennedy Highway (between top of Kuranda Range and Myola Road), Myola Road
	Koah/Speewah	Kennedy Highway (between Koah and Myola Road), Myola Road
Cairns Hinterland Steiner School	Cairns	Kennedy Highway (between Smithfield and Myola Rd), Myola Road
	Smithfield	Kennedy Highway (between Smithfield and Myola Rd), Myola Road
	Mareeba	Kennedy Highway (between Mareeba and Myola Rd), Myola Road

13.3.11.3 Kuranda Skyrail

The Kuranda Skyrail Rainforest Cableway is a gondola spanning 7.5km from the Smithfield terminal (15 minutes north of Cairns) to Kuranda Station, located within the Kuranda Village Centre (seen in Figure 13-19). There are two mid stations (Red Peak and Barron Falls) that feature tourist attractions (Rainforest Boardwalk, Interpretation Centre, lookouts etc) with the total journey taking approximately 32 minutes, excluding time spent at the mid stations.

There are 114 gondolas, of which 103 are regular gondolas that can seat up to six persons, while the remaining 11 are Diamond View gondolas that can seat a maximum of five persons. Luggage is not currently permitted on the cableway.

Based on the 32 minute one-way trip time, the Kuranda Skyrail has an approximate uphill lift capacity of 354 persons per hour. With the current open hours of 9am to 5.15pm, with the last one-way journey departing at 3.30pm, the Skyrail has an approximate daily uphill capacity of 2,300 persons per day. The current occupancy rate is as yet unknown[8]. It is anticipated that guests will make use of this facility for transport to the resort and therefore Skyrail operations will be affected by the proposed development. However, passenger data is required to adequately assess the impacts.

[8] Passenger data has been requested from the Skyrail operator.

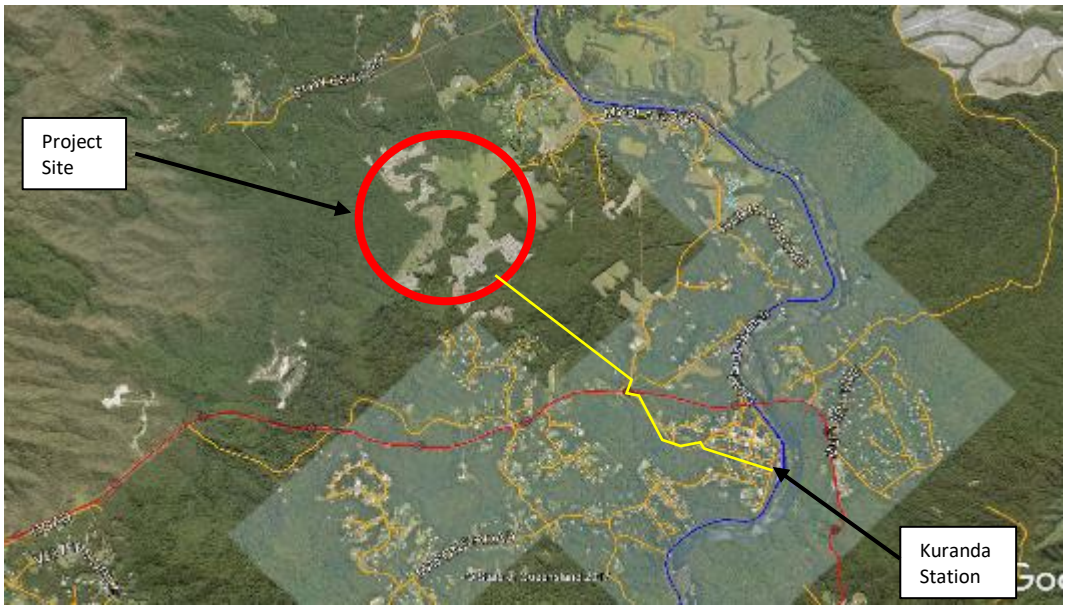


Figure 13-19: Likely route buses could travel between Kuranda Station and Project Site

13.3.11.4 Kuranda Scenic Rail

The Kuranda Scenic Railway is a heritage listed railway line built in the 1910's. The railway is now a tourist attraction with tourist trains currently using the section of railway line. It takes approximately one hour and 45 minutes to complete the journey form Cairns Central Station to Kuranda Station. The operating times for the tourist rail are:

- two return trips daily (Departs Cairns 8.30 and 9.30 am, Departs Kuranda 2.00 and 3.30pm).

The Kuranda Scenic Railway has a total capacity of up to 550 passengers per journey. Luggage space is limited to items that can be stored under the seat (25cm height). Due to the infrequent rail service and the conflicts with airport arrival and departure times it is unlikely that a large volume of KUR-World overnight guests will be able to utilise the Cairns-Kuranda rail line for transport to the resort, therefore it is anticipated that patronage will mainly be associated with Unique Day Guests.

13.3.12 Air traffic

The project site is approximately 16km (as the crow flies) from the Cairns International Airport while the nearest alternate public airfield is the Mareeba Airstrip (approximately 32km as the crow flies). Helicopters are not typically used for access to the existing property. There are various types of helicopter based at the Cairns International Airport, ranging from small two person helicopters through to transport style aircraft with up to 19 seats. Any development related flights will be closely linked to the arrival and departure schedule of airlines servicing the Cairns International Airport. There is assumed to be sufficient capacity to accommodate the air traffic demands KUR-World will likely generate.

13.4 Traffic generation of proposed development

In assessing the traffic impact of the construction and operation phases of the development, it is important to separate the effects of background traffic and the construction and operational traffic to assess the relative impact of each. Background traffic refers to the traffic that will be present in the absence of the development.

13.4.1 Future background traffic

The level of background traffic at the given design years was calculated as the sum of the following:

surveyed traffic volumes

an allowance for traffic growth to account for other development in the area.

This sub-section summarises the process for determining the background traffic volumes within the study area:

Section 13.4.1.1 presents the relevant surveyed traffic volumes

Section 13.4.1.2 summaries the results of the traffic growth rate calculation

Section 13.4.1.3 presents the predicted background traffic volumes.

13.4.1.1 Surveyed traffic volumes

Traffic volume surveys were conducted at relevant intersections and road links to determine the existing traffic conditions in the area. In addition to those traffic volumes, historical traffic volumes for the Kennedy Highway and Myola Road were obtained from DTMR and MSC for comparison. The data from these surveys is attached in Appendix 13A and Appendix 13B.

13.4.1.2 Determination of traffic growth

The future level of background traffic was predicted by applying a growth factor to the surveyed traffic volumes. For the purpose of this traffic assessment, the growth rate of traffic within the study area was determined from a comparison of the historical traffic growth rate and forecast traffic volumes in CSTM on roads within the study area.

The historical growth rates based on historical traffic survey data for roads within the study area ranged between -3.25% and 7.5% per annum for an average of 1.6% per annum while growth rates within the CSTM ranged between 1.8-2.2% per annum. These growth rates are provided in Appendix 13E. The average growth rate assumed for this project was therefore assumed to be two (2) percent per annum, providing a realistic estimate of the future traffic volumes considering the historical and forecast growth rates and accounting for any expected development in the area.

13.4.1.3 Estimation of future background traffic volumes

The background traffic volumes at the design years (2018, 2021, 2024 and 2027, the opening years of each stage and 2037, the 10-year design horizon) were estimated using the surveyed traffic volumes (conducted in 2017) and the assumed growth rate. These volumes are summarised Appendix 13F.

13.4.2 KUR-World traffic generation

The traffic generated by the construction and operational phases were estimated using predicted usage, guest and staff numbers as outlined in the Social and Economic chapter (Chapter 11, section 11.3) for the operational and construction phases. These are summarised in Section 13.4.2.1. To ensure a conservative estimate of the overall traffic generation of the development, no ‘discounts’ in the overall traffic generation have been applied for linked trips. This assumption assumes that all trips associated with the development will be new trips, in reality the development will generate a number of drop in trips which are considered

to be trips that are already part of the existing traffic flows on the network. Drop in trips for large shopping centre developments can be up to 37% of total trips associated with the development as per GARID.

13.4.2.1 Usage, guest and staff assumptions

13.4.2.1.1 *Construction phases*

The following staffing and traffic operation data and assumptions for the construction phases pf KUR-World have been used in the formulation of estimated traffic generated by the development during the construction phase. Overall employment figures and workforce origins for the construction were provided by Cummings Economics (as seen in Chapter 11 and the Cummings Economic Impact Assessment in Appendix 8B) for each stage of construction. The assumptions include:

- Construction will occur on five days of the week, Monday to Friday, and shifts are expected to be from 6.30am to 3pm. Construction is assumed to occur 50 weeks per year accounting for scheduled holidays.
- The construction workforce varies across all construction stages. The construction workforce has three key origins/destinations, Cairns, Kuranda and the Tablelands. Workers who currently live in Kuranda and are currently working in Cairns, however take up employment at KUR-World have been included as a reduction in the traffic volume to Cairns from Kuranda due to no longer making this journey. This is based on the assumptions made in Chapter 11.
- 30% of the Cairns based construction workforce, 100% of the Kuranda based construction workforce and 60% of the Tableland based construction workforce are expected to drive private vehicles to the site each day. The average occupancy of these vehicles is 1.2 persons per vehicle. The remaining workforce (70% Cairns and 40% Tablelands) will utilise shuttles provided by KUR-World with an occupancy of 35 persons per shuttle. A Construction Traffic Management Plan will be developed detailing the proposed locations for Park and Ride facilities and the methods for enforcement/monitoring of shuttle use for the construction workforce to ensure these benchmarks are met. On-site parking availability for the construction workforce will be intentionally limited to ensure compliance with the park and ride operational requirements during all stages of construction.
- It has been assumed that 5% (accounting for 10% of the workforce) of the construction workforce will travel in the AM peak period (the observed AM Peak was 7.45 – 8.45 AM), while 35% (accounting for 70% of the workforce) will leave during the PM peak period (the observed PM Peak was 2.30 – 3.30 PM) due to the anticipated timing of shifts as described above.
- Total construction estimated material loads have been provided by Thirkell Consulting. The construction materials report is provided in Appendix 13T. It is assumed for the purpose of this assessment that deliveries will happen consistently on a day to day basis for the duration of the construction period. This assumption has been made to assess the average daily traffic impact of the construction phase. The origin/destination of materials and typical delivery vehicle assumptions are drawn from the Thirkell Report and outlined below in Table 13-18.
- It has been assumed that between 10- 15% of the total construction material deliveries will occur during the peak periods, based on consistent deliveries throughout the day. It has been assumed that 70% of AM peak hour trips are arrivals and 70% of PM peak hour trips are departures from the site.
- Construction phase data has not been provided for Stage 1A, the traffic volumes associated with construction only are not considered to be significant without the addition of operational phase traffic.

Detailed construction phase traffic generation for each stage is provided in Appendix 13J.

Table 13-18: Construction material origin/destination and typical delivery vehicle data. Origin/destination data has been sourced from the Thirkell Consulting Construction Materials Report. All delivery vehicles have been assumed to represent the equivalent of three passenger cars in accordance with Main Road WA Table 4.5.1 of Supplement to Austroads Guide to Road Design Part 3.

Material	Origin/Destination	Typical Delivery Vehicle	Delivery Vehicle Capacity
Concrete	Tablelands	Four Axle Truck	$7m^3$
Steel Reinforcement	Cairns	Six Axle Truck	20 tonnes
Timber	Tablelands	Six Axle Truck	20 tonnes
Gravel	Tablelands	Six Axle Truck	$15m^3$
Road Pavement	Tablelands	Six Axle Truck	$15m^3$
Steel	Tablelands	Six Axle Truck	20 tonnes
Glazing	Cairns	Four Axle Truck	5 tonnes
Roof Sheeting	Cairns	Six Axle Truck	20 tonnes
Construction Water Supply	Myola	Six Axle Truck	20kL
Construction Wastewater	Kuranda	Six Axle Truck	20kL

13.4.2.1.2 *Operational phase details*

The following operational stage assumptions and patronage data has been formulated based on the business plan developed for the resort.

Stage 1A

The following usage, guests and staff numbers have been provided for the initial Stage 1A:

- Approximately 21 Lifestyle Lots will be constructed with 20% of the lots to be owner-occupied while the remaining 80% will be tourist accommodation.
- A 'Glamping Experience' will provide 15 rooms for tourist accommodation.
- The initial stages of the KUR-World Farm Theme Park and other day use elements will attract an average of 650 Unique Day guests per day.
- Approximately 224 staff will work at KUR-World during Stage 1A. 41 of these staff will have previously lived in Kuranda but worked in Cairns.
- Access to KUR-World in Stage 1A will be via Barnwell Road only.

Stage 1B

The following usage, guests and staff numbers have been provided for Stage 1B in addition to the usages established in Stage 1A:

- Business and Leisure Hotel initially providing approximately 60 rooms for tourist accommodation.
- An additional 56 Lifestyle Lots will be constructed with 20% of the lots to be owner-occupied while the remaining 80% will be tourist accommodation. Bringing the total Lifestyle Lot numbers to 77.
- Farmstay Accommodation providing 110 beds primarily for large school group usage.
- A 350 bed Rainforest Education Centre is to be provided catering primarily to large school groups.

- An additional 10 rooms are to be provided as part of the 'Glamping Experience' bring the total to 25 rooms.
- Approximately 39 Premium Villas will be constructed with 20% of the lots to be owner-occupied with the remaining 80% will be tourist accommodation.
- Further stages of the KUR-World Farm Theme Park and other day use elements will attract an average of 1090 unique day guests per day during Stage 1B. An increase of 440 Unique Day Guests on Stage 1A.
- Approximately 633 staff will work at KUR-World during Stage 1B. 114 of these staff will live in Kuranda and have previously worked in Cairns therefore reducing the number of trips to Cairns for these staff members.
- Access to KUR-World in Stage 1B will be via a new road link intersecting Myola Road opposite Kuranda Heights Road.

Stage 2

The following usage, guests and staff numbers have been provided for Stage 2 in addition to the usages established in Stage 1A&B:

- Business and Leisure Hotel will be further expanded, providing an additional 210 rooms for tourist accommodation. This will bring the total rooms within the Leisure Hotel to 270.
- A further 193 [154][9] Premium Villa will be constructed with 20% of the villas to be owner-occupied will the remaining 80% will be tourist accommodation.
- Approximately 60 Premium Villa Units for tourist accommodation.
- A 12-hole Golf Course open to the public attracting an estimated 100 Unique Day Guests per day.
- Further stages of theme park activities attracting an additional 45 Unique Day Guests and an expansion of the retail facilities attracting an additional 55 Unique Day Guests per day.
- An additional 244 staff for Stage 2 activities. 44 of these staff will live in Kuranda and have previously worked in Cairns therefore reducing the number of trips to Cairns for these staff members.

Stage 3

The following usage, guests and staff numbers have been provided for Stage 3 in addition to the usages established in Stage 1A&B and Stage 2:

- A Five Star Resort providing approximately 200 rooms for tourist accommodation.
- A further 93 Premium Villas will be constructed with 20% of the villas to be owner-occupied will the remaining 80% will be tourist accommodation. The total number of Premium Villas will therefore be 325 [286].
- KUR-World Campus providing 300 student accommodation rooms and teaching facilities for a further 300 day students.
- A Health and Wellbeing Retreat providing approximately 60 overnight rooms and attracting 5 Unique Day Guests per day.

[9] Note that at the time of assessment of Traffic Impacts, an additional 34 Premium Villas were assessed as part of this analysis i.e. a total of 325 versus the 286 now proposed as part of KUR-World. This is in part offset by an assumed maximum of 20% owner occupied Premium Villas for the purposes of the Traffic Impact Assessment, versus the 30% now anticipated as part of KUR-World. Notwithstanding, in respect to Premium Villas the Traffic Impact Assessment assesses a more intensive Premium Villa option than that now proposed.

- An additional 486 staff for Stage 3 activities. 88 of these staff will live in Kuranda and have previously worked in Cairns therefore reducing the number of trips to Cairns for these staff members.

13.4.2.1.3 *General operational stage traffic generation assumptions*

In addition to the above data, the following assumptions were made in order to complete the traffic assessment:

- The traffic generation for each use has been formulated using first principles[10] and is supported by surveys of similar uses within the Far North Queensland region.
- The origin/destination splits are based on the anticipated user profile for each use for which a detailed weekly profile has been developed for each development use. The key origin/destinations are:
  - Cairns and surrounds with access to the resort via the Kuranda Range and Skyrail/Scenic Rail
  - Kuranda with access to the resort via local roads
  - Wider Tablelands with access to the resort via the Kennedy Highway (Kuranda to Mareeba)
- Kuranda based traffic is considered to originate from the Kuranda Village on Rob Veivers Drive as this provides the worst-case scenario. In reality the traffic generated by the KUR-World will be spread across the local road network minimising the impact of the resort
- 60% of overnight guests will access the KUR-World via Private Coach. This assumption is consistent with tourism data for the Cairns region which shows that in total (i.e. international and domestic tourists), 60% of tourists utilise a form of group transport (80% of international tourists (the target market) to the region utilise group transport such as private coach). This estimate of the mode split is considered to be a conservative estimate.
- 20% of overnight guests utilising private coach for transport and originating in Cairns have been assumed to utilise with the Skyrail or Kuranda Scenic Rail in combination with a Private Coach transfer to the resort. The use of these services will be included within accommodation packages sold to guests. Therefore, it is assumed that only 12% of overnight guest's trips will utilize Skyrail or Kuranda Scenic Rail, with the majority of passengers utilising these services Unique Day Guests.
- 90% of Unique Day Guests will access KUR-World via Private Coach. 40% of these guests originating in Cairns will utilise with the Skyrail or Kuranda Scenic Rail in combination with a Private Coach transfer to the resort. The total percentage of day guests arriving via private coach is based on surveys and patronage data from similar nearby uses such as Rainforest Station and is consistent with tourism data showing international tourists heavy reliance on group transport (80% of international Far North Queensland tourists utilise group transport).
- Private Vehicle occupancy is to vary dependent on use. Private Vehicle occupancy for Unique Day Guests is assumed to be 3.0 persons per vehicle (assumed to consist of a small to medium sized family). Private vehicle occupancy for overnight guests are aligned with expected room occupancy (i.e. a two-person room will utilise an occupancy of 2.0 persons per vehicle). Private Vehicle occupancy for staff is assumed to be 1.5 persons per vehicle.
- Private Coach occupancy is assumed to be 35.0 passengers per vehicle. The capacity of coaches is assumed to be 50 passengers per vehicle. Therefore, coaches have been assumed to operate at 70% capacity.

[10] The first principles method of estimating traffic generation makes assumptions about the development, its users and their behaviour to formulate the traffic generation. It is typically used in circumstances where similar types of development do not exist and it is not possible to compare traffic generation.

- 20% of Kuranda based staff and 40% of Cairns based staff are expected to utilise private coach to travel to and from KUR-World. This will be achieved through reduced parking available to staff and through employment contracts. Additional private coach trips will be utilised for staff transport.
- The peak hour traffic generation is assumed to be a proportional rate of the standard peak hour figures, where suitable traffic generation rates are available. Details provided in Table 13-19.
- Service vehicles are assumed to contribute at least an additional 4% of the traffic generation of each use. Additional service vehicle trips have been accommodated within the traffic generation of each use through the rounding up of the uses daily traffic generation rate.
- Park and Ride sites for staff use are to be identified at Smithfield and Mareeba to accommodate the transport of operational and construction staff to and from the resort. These sites are to be located close to the start of the Kennedy Highway providing easy access for proposed shuttle services and ensure staff are not required to divert travel significantly.
- It has been assumed that new residents in Kuranda will utilise the existing land stock within the area and that no new developments will be required to accommodate new residents. Therefore, the traffic generated by these new residents are accounted for in the background growth rate applied to base traffic volumes.

Additional assumptions for each specific use and the assumed typical weekly profile are provided in the usage profiles in Appendix 13G. A technical note detailing how the traffic generation for each use was developed is presented in Appendix 13H, while survey data of comparable uses[11] to support the general assumptions made are presented in Appendix 13I.

Table 13-19: Peak Hour Factors and peak travel directions for key development uses.

KUR-World Element	Peak Hour Percentage	AM Travel Direction (Resort Bound/Out Bound)	PM Travel Direction (Resort Bound/Out Bound)	Basis for Assumptions
Overnight Accommodation	13%	40/60	40/60	Based on Thala Beach Survey and Standard Peak Hour Factor
Owner Occupied Residences	10%	20/80	80/20	Based on Standard Peak Hour Factor
Unique Day Guests	15%	75/25	15/85	Based on Theme Park (Movie World) and Rainforest Station Surveys
Resort Staff	25%	70/30	35/65	First Principals Estimates
Golf Course	8%			First Principals Estimates
KUR-World Campus Residents	10%	70/30	10/90	Based on Standard Peak Hour Factor
KUR-World Campus Day Students	20%	25/75	75/25	Based on Tertiary Travel Survey
Health and Wellbeing Centre	15%	90/10	30/70	First Principals Estimates

[11] Manual traffic count surveys were conducted at Rainforest Station and Thala Beach Lodge to assess unique day guest and overnight guest mode choice.

13.4.2.2 Traffic generation summary

Based on the data and assumptions presented in Section 13.4.2.1, the volume of traffic generated by the development in the operational phases of all stages of development was calculated. A summary of the overall traffic generation of the development by stage is provided in Figure 13-20 through Figure 13-22 respectively**.** The volume of traffic generated by KUR-World in the morning and evening peak periods during each operational stage are presented in Figure 13-23 through Figure 13-26 respectively, while the breakdowns of each stage are provided in Appendix 13K. The volume of construction traffic generated by KUR-World in the morning and evening peak periods for each stage are presented in Figure 13-27 through Figure 13-29 respectively.

Use	Daily Traffic Generation	Number		Average Persons	Private Vehicle Occupancy	Private Coach		Origin/Destination: Cairns Private Vehicle (Trips)	Cairns Private Coach/ HV	Cairns Skyrail/Scenic Rail (Persons)	Kuranda Private Vehicle (Trips)	Kuranda Private Coach/ HV	Wider Tablelands Private Vehicle (Trips)	Wider Tablelands Private Coach/ HV	Local Roads Private Vehicle (Trips)	Local Roads Private Coach/ HV
Stage One																
Farmstay Accomodation	2	110	Beds		2.5	35.00	Direction Splits	9.0%	36.0%		10.0%	40.0%	1.0%	4.0%		
							Traffic Generated	7.9	2.3		8.8	2.5	0.9	0.3		
Leisure Hotel	2.5	60	Rooms	3.0	3.0	35.0	Direction Splits	20.0%	24.0%	6.0%	10.0%	15.0%	10.0%	15.0%		
							Traffic Generated	30.0	3.1	27.3	15.0	1.9	15.0	1.9		
Lifestyle Lots Tourist Accommodation	3	61	Dwellings	3.0	3.0	35.0	Direction Splits	30.0%	16.0%	4.0%	20.0%	20.0%	5.0%	5.0%		
							Traffic Generated	54.9	2.5	22.0	36.6	3.1	9.2	0.8		
Owner Occupied Lifestyle Lots	8.5	16	Dwellings			35.0	Direction Splits	31.0%	17.2%		17.2%		6.9%		27.6%	
							Traffic Generated	42.2	0.67		23.4		9.4		37.5	
Rainforest Education Centre	1.5	350	Beds		2.5	35.0	Direction Splits	9.0%	36.0%		10.0%	40.0%	1.0%	4.0%		
							Traffic Generated	18.9	5.4		21	6	2.1	0.6		
Glamping Experience	2.5	25	Rooms	2.5	2.5	35.0	Direction Splits	20.0%	24.0%	6.0%	10.0%	15.0%	10.0%	15.0%		
							Traffic Generated	12.5	1.1	9.4	6.3	0.7	6.3	0.7		
Unique Day Guests	2	1090	Guests		3.0	35.0	Direction Splits	9.4%	50.9%	33.9%	0.3%	2.6%	0.3%	2.6%		
							Traffic Generated	68.5	31.7	740.0	2.1	1.6	2.1	1.6		
Premium Villas	3	31	Dwellings	3.0	3.0	35.0	Direction Splits	17.8%	21.3%	5.3%	13.3%	20.0%	8.9%	13.3%		
							Traffic Generated	16.5	1.7	14.9	12.4	1.6	8.3	1.1		
Premium Villas Owner Occupied	8.5	8	Dwellings			35.00	Direction Splits	31.0%	17.2%		17.2%	0%	6.9%	0%	27.6%	0%
							Traffic Generated	21.1	0.33		11.7	0.0	4.7	0.0	18.8	0
Cairns Staff	1.5	188	Employees		1.5	35.0	Direction Splits	56.5%	37.7%	0.0%	0.0%	0.0%	0.0%	0.0%		
							Traffic Generated	106.2	3.0	0.0	0.0	0.0	0.0	0.0		
Kuranda Staff	1.5	283	Employees		1.5	35.0	Direction Splits	0.0%	0.0%	0.0%	74.0%	18.5%	0.0%	0.0%		
							Traffic Generated	0.0	0.0	0.0	209.5	2.2	0.0	0.0		
Kuranda Staff (Cairns Reduction)	1.5	114	Employees		1.5	35.0	Direction Splits	N/A	N/A							
							Traffic Generated	-91.2	-1.0							
Wider Tableland Staff	1.5	162	Employees		1.5	35.0	Direction Splits	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%		
							Traffic Generated	0.0	0.0	0.0	0.0	0.0	162.0	0.0		
Construction Traffic							Traffic Generated	7.8	3.9		70.8	0.0	60.0	19.9		
Total Stage One								295	55	813	418	20	280	27	56	0
Increase on Background Traffic Volumes						Year	2021	9567	4.8%		4692	11.6%	6473	5.6%	2650	2.1%

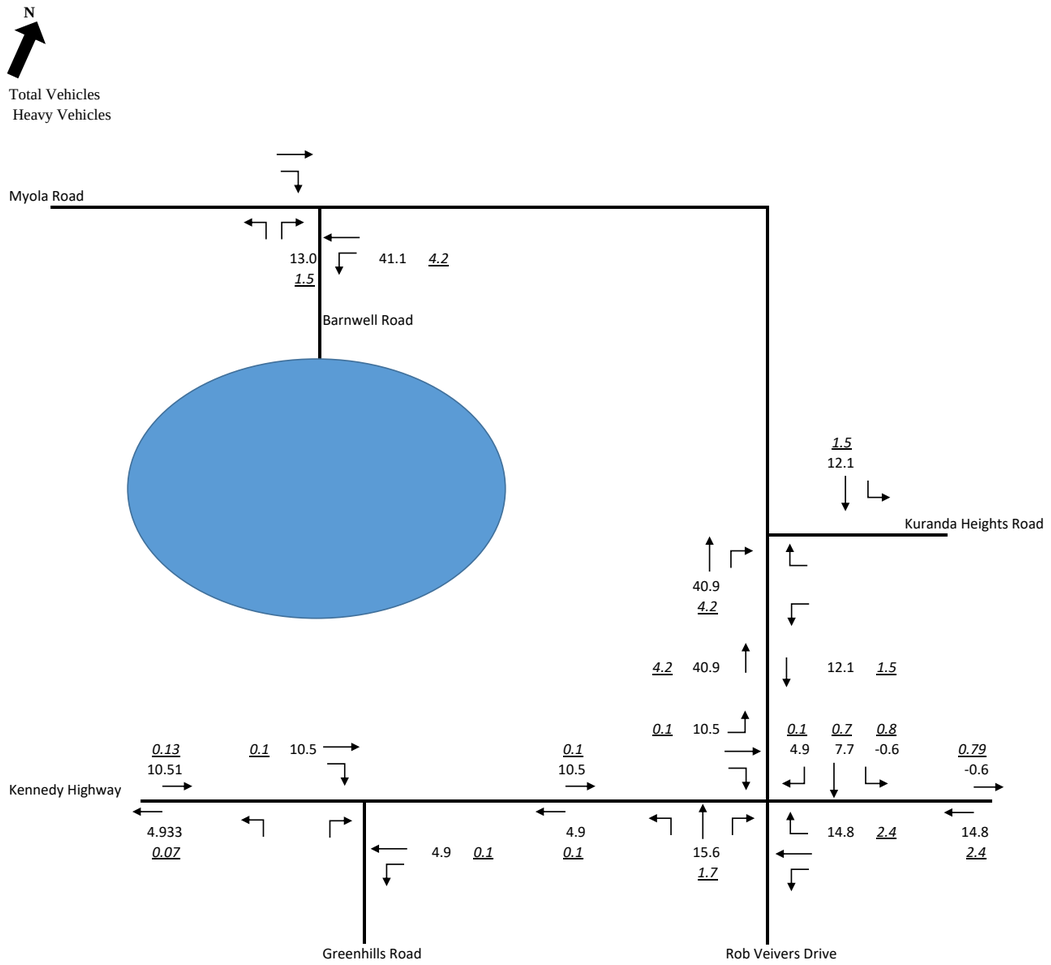
Figure 13-20: Summary of the Stage One daily traffic generation of KUR-World.

Use	Daily Traffic Generation	Number		Average Persons	Private Vehicle Occupancy	Private Coach		Origin/Destination: Cairns Private Vehicle (Trips)	Cairns Private Coach/ HV	Cairns Skyrail/Scenic Rail (Persons)	Kuranda Private Vehicle (Trips)	Kuranda Private Coach/ HV	Wider Tablelands Private Vehicle (Trips)	Wider Tablelands Private Coach/ HV	Local Roads Private Vehicle (Trips)	Local Roads Private Coach/ HV
Stage Two																
Leisure Hotel	2.5	210	Rooms	3.0	3.0	35.0	Direction Splits	20.0%	24.0%	6.0%	10.0%	15.0%	10.0%	15.0%		
							Traffic Generated	105.0	10.9	95.4	52.5	6.8	52.5	6.8		
Golf Course	2	100	Persons		1.5	35.0	Direction Splits	51%	0%	0%	21%	0%	27%	0%		
							Traffic Generated	68.6	0.0	0.0	28.6	0.0	36.2	0.0		
Premium Villas	3	162	Dwellings	3.0	3.0	35.0	Direction Splits	17.8%	21.3%	5.3%	13.3%	20.0%	8.9%	13.3%		
							Traffic Generated	86.4	8.9	77.8	64.8	8.3	43.2	5.6		
Premium Villas Owner Occupied	8.5	30	Dwellings			35.00	Direction Splits	31.0%	17.2%		17.2%	0%	6.9%	0%	27.6%	0%
							Traffic Generated	79.1	1.26		44.0	0.0	17.6	0.0	70.3	0
Premium Villa Units	2.5	60	Units	3.0	3.0	35.0	Direction Splits	20.0%	24.0%	6.0%	10.0%	15.0%	10.0%	15.0%		
							Traffic Generated	30.0	3.1	27.0	15.0	1.9	15.0	1.9		
Function/Retail/Dining Unique Guests	2	55	Guests		2.5	35.0	Direction Splits	41%	0%	0%	30%	0%	29%	0%		
							Traffic Generated	18.2	0.0	0.0	13.2	0.0	12.6	0.0		
Unique Day Guest	2	45	Guests		3.0	35.0	Direction Splits	9.4%	50.9%	33.9%	0.3%	2.6%	0.3%	2.6%		
							Traffic Generated	2.8	1.3	30.5	0.1	0.1	0.1	0.1		
Cairns Staff	1.5	73	Employees		1.5	35.0	Direction Splits	56.5%	37.7%	0.0%	0.0%	0.0%	0.0%	0.0%		
							Traffic Generated	41.2	1.2	0.0	0.0	0.0	0.0	0.0		
Kuranda Staff	1.5	109	Employees		1.5	35.0	Direction Splits	0.0%	0.0%	0.0%	74.0%	18.5%	0.0%	0.0%		
							Traffic Generated	0.0	0.0	0.0	80.7	0.9	0.0	0.0		
Kuranda Staff (Cairns Reduction)	1.5	44	Employees		1.5	35.0	Direction Splits	N/A	N/A							
							Traffic Generated	-35.2	-0.4							
Wider Tableland Staff	1.5	62	Employees		1.5	35.0	Direction Splits	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%		
							Traffic Generated	0.0	0.0	0.0	0.0	0.0	62.0	0.0		
Construction Traffic							Traffic Generated	11.3	2.5		70.8	0.00	75.0	2.9		
Total Stage Two								408	29	231	370	18	314	17	70	0
Total Stage One								288	51	813	347	20	220	7	56	0
Total Stage One and Two								695	80		716	38	534	24	127	0
Increase on Background Traffic Volumes (Stage One and Two)						Year	2024	10152	9.2%	1044.2	4980	18.5%	6869	8.8%	2812	4.5%

Figure 13-21: Summary of the Stage Two daily traffic generation of KUR-World.

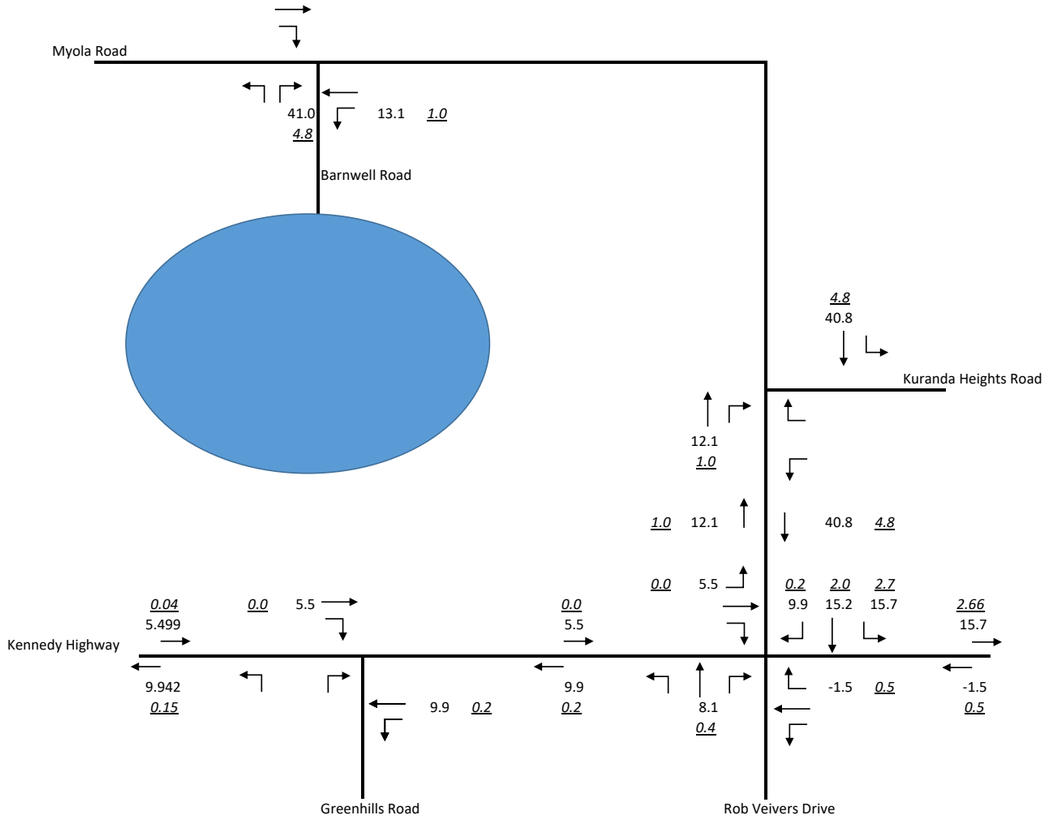
Use	Daily Traffic Generation	Number		Average Persons	Private Vehicle Occupancy	Private Coach		Origin/Destination: Cairns Private Vehicle (Trips)	Cairns Private Coach/ HV	Cairns Skyrail/Scenic Rail (Persons)	Kuranda Private Vehicle (Trips)	Kuranda Private Coach/ HV	Wider Tablelands Private Vehicle (Trips)	Wider Tablelands Private Coach/ HV	Local Roads Private Vehicle (Trips)	Local Roads Private Coach/ HV
Stage Three																
							Direction Splits	20.0%	24.0%	6.0%	10.0%	15.0%	10.0%	15.0%		
Five Star Resort	2.5	200	Rooms	1.8	1.8	35.0	Traffic Generated	100.0	6.2	54.0	50.0	3.9	50.0	3.9		
KUR Campus Student							Direction Splits	20%	40.0%		20.0%	20.0%	0%	0%		
Accommodation	2.5	300	Rooms	1.0	1.8	35.0	Traffic Generated	83.3	8.6		83.3	4.3	0.0	0.0		
KUR Campus Day							Direction Splits	13.5%	40.5%		4.1%	12.2%	7.4%	22.3%		
Students	1.2	300	Students		1.8	35.0	Traffic Generated	27.0	4.2		8.1	1.3	14.9	2.3		
Health and							Direction Splits	48.0%	12.0%	0.0%	16.0%	4.0%	16.0%	4.0%		
Wellbeing Retreat	2	5	Persons		2.5	35.00	Traffic Generated	1.9	0.0	0.0	0.6	0.0	0.6	0.0		
Health and							Direction Splits	31.1%	47%	0%	9%	13%	0%	0%		
Wellbeing Retreat	1.5	60	Rooms	1.3	1.3	35.0	Traffic Generated	28.0	1.6	0.0	8.0	0.4	0.0	0.0		
							Direction Splits	17.8%	21.3%	5.3%	13.3%	20.0%	8.9%	13.3%		
Premium Villas	3	75	Dwellings	3.0	3.0	35.0	Traffic Generated	40.0	4.1	36.0	30.0	3.9	20.0	2.6		
Premium Villas							Direction Splits	31.0%	17.2%		17.2%	0%	6.9%	0%	27.6%	0%
Owner Occupied	8.5	18	Dwellings			35.00	Traffic Generated	47.5	0.75		26.4	0.0	10.6	0.0	42.2	0
							Direction Splits	56.5%	37.7%	0.0%	0.0%	0.0%	0.0%	0.0%		
Cairns Staff	1.5	145	Employees		1.5	35.0	Traffic Generated	81.9	2.3	0.0	0.0	0.0	0.0	0.0		
							Direction Splits	0.0%	0.0%	0.0%	74.0%	18.5%	0.0%	0.0%		
Kuranda Staff	1.5	217	Employees		1.5	35.0	Traffic Generated	0.0	0.0	0.0	160.6	1.7	0.0	0.0		
Kuranda Staff (Cairns							Direction Splits	N/A	N/A							
Reduction)	1.5	88	Employees		1.5	35.0	Traffic Generated	-70.4	-0.8							
Wider Tableland							Direction Splits	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%		
Staff	1.5	124	Employees		1.5	35.0	Traffic Generated	0.0	0.0	0.0	0.0	0.0	124.0	0.0		
Total Stage Three								339	27	90	367	15	220	9	42	0
Total Stage One and Two								684	77	1044	646	38	459	21	127	0
Total Stage One, Two and Three								1023	104		1013	53	679	30	169	0
Increase on Background Traffic Volumes (Stage One, Two and Three)						Year	2027	10774	12.4%	1134.2	5284	24.0%	7290	10.5%	2984	5.7%

Figure 13-22: Summary of the Stage Three daily traffic generation of KUR-World.



253251-00 KUR-World Eco Resort

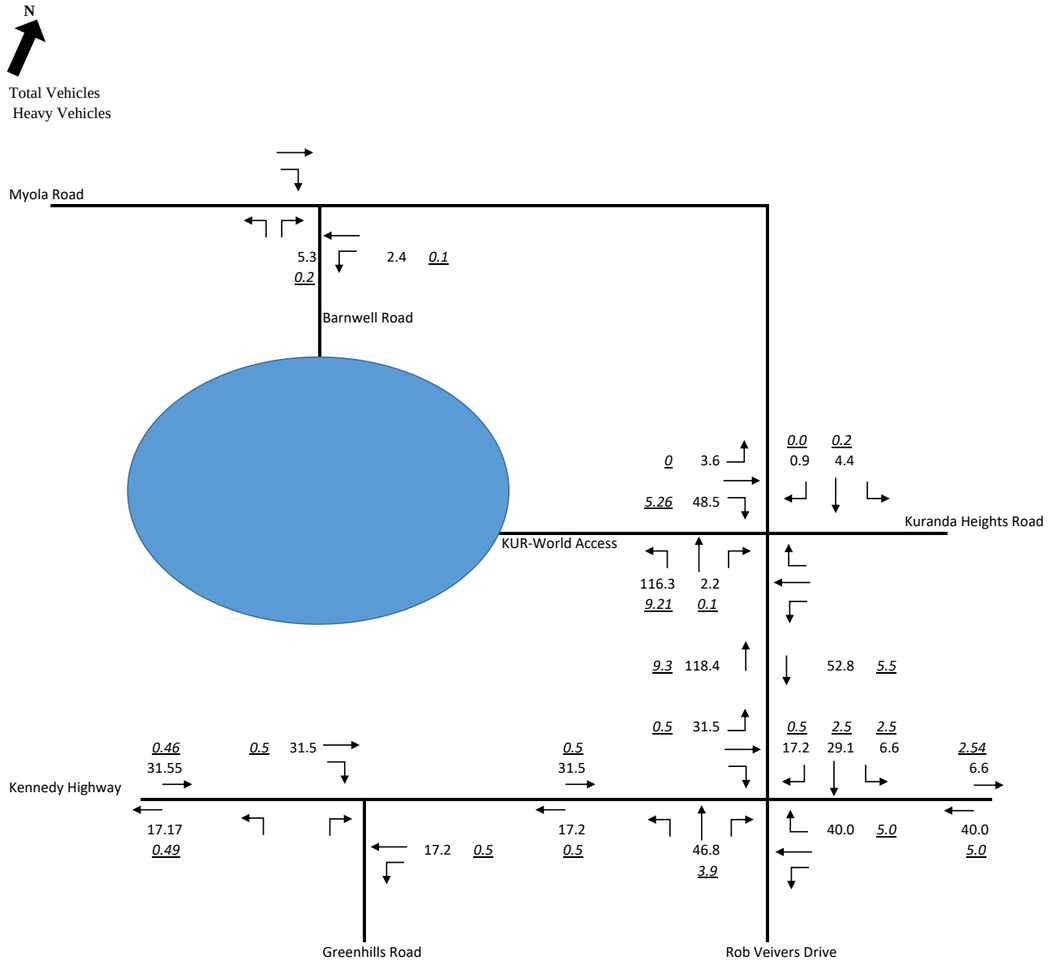
Figure B1: Stage 1A AM Peak Traffic Volumes



253251-00 KUR-World Eco Resort

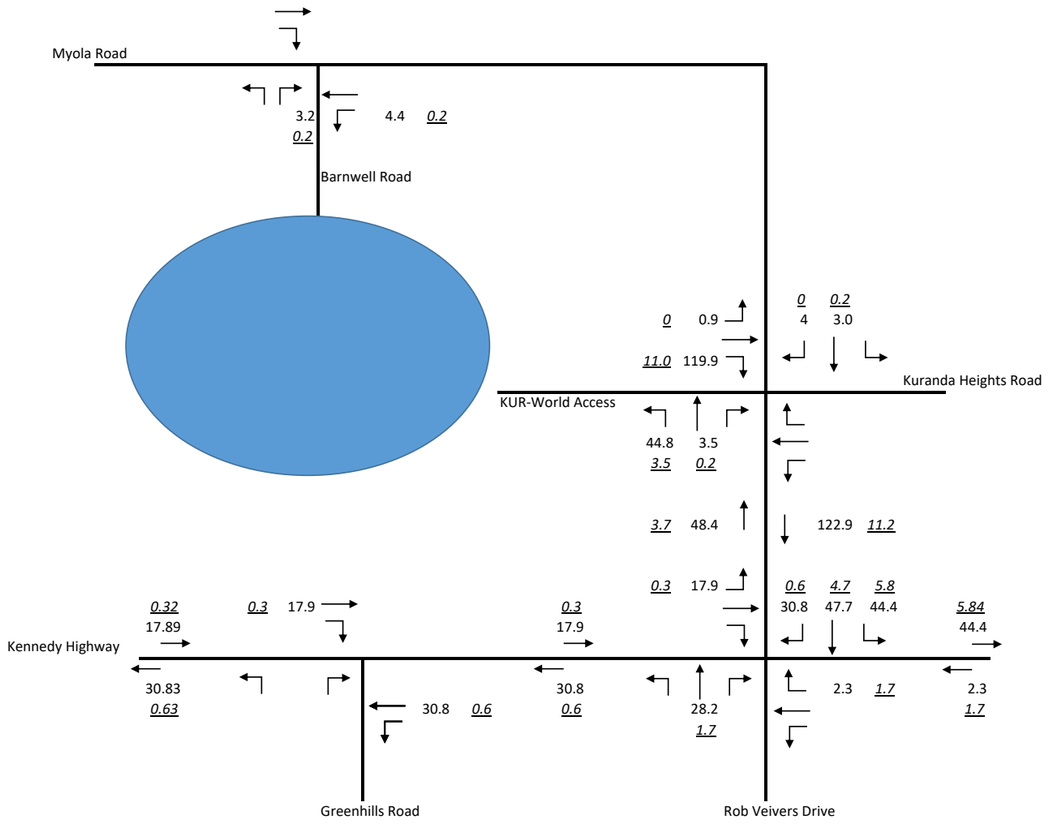
Figure B2: Stage 1A PM Peak Traffic Volumes

Figure 13-23: Stage 1A operational traffic volumes for the AM and PM peak periods.



253251-00 KUR-World Eco Resort

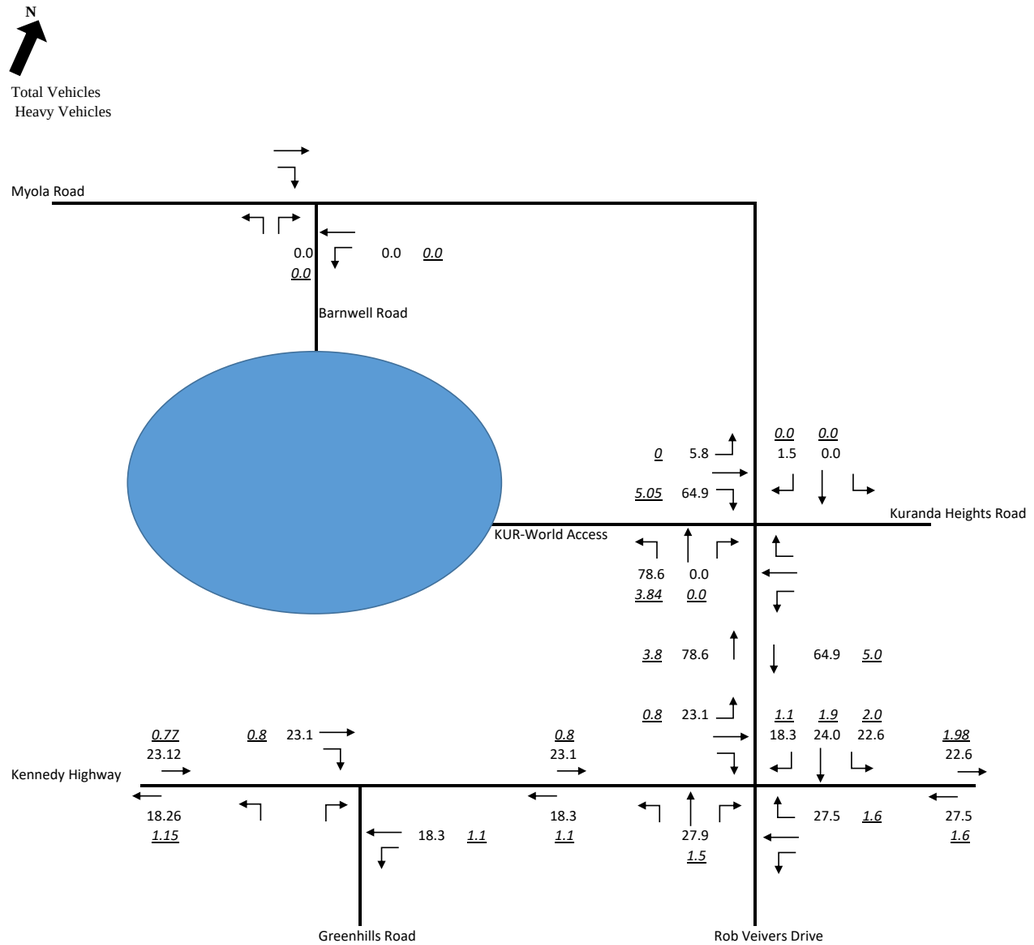
Figure B3: Stage 1 AM Peak Traffic Volumes-Main Access from Myola Road



253251-00 KUR-World Eco Resort

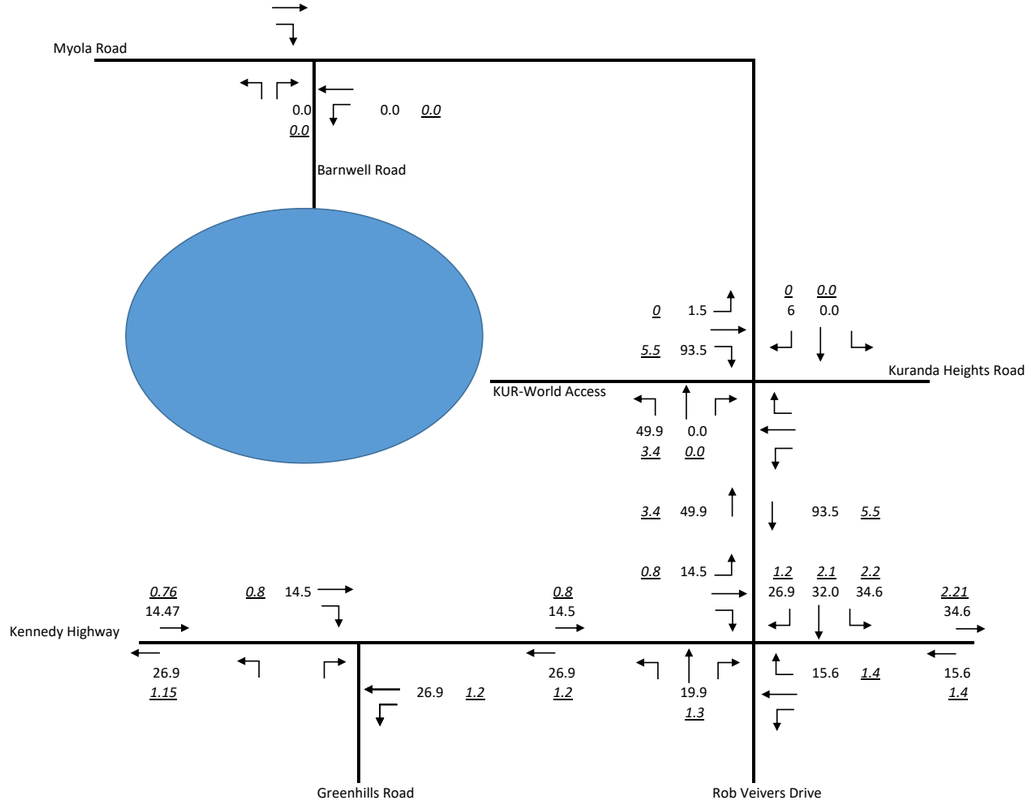
Figure B4: Stage 1 PM Peak Traffic Volumes-Main Access from Myola Road

Figure 13-24: Stage 1 operational traffic volumes for the AM and PM peak periods.



253251-00 KUR-World Eco Resort

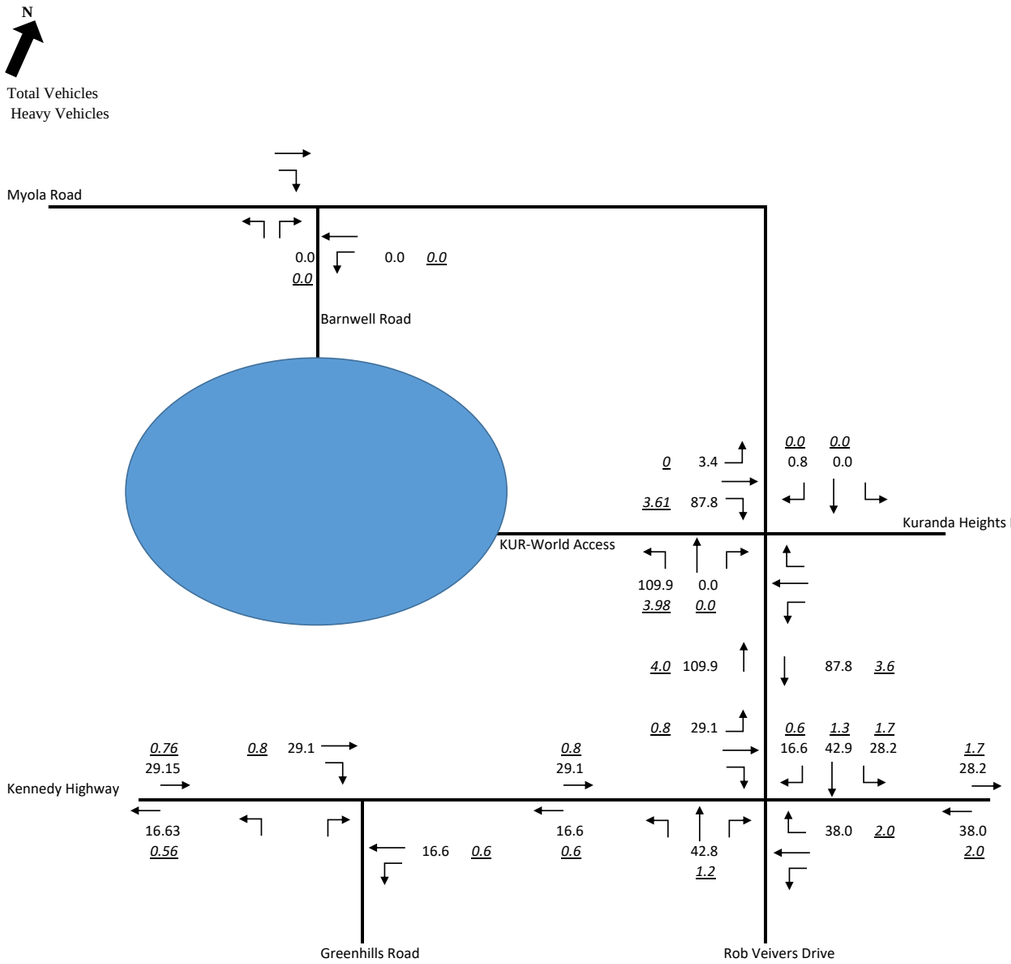
Figure B7: Stage 2 AM Peak Traffic Volumes-Main Access from Myola Road



253251-00 KUR-World Eco Resort

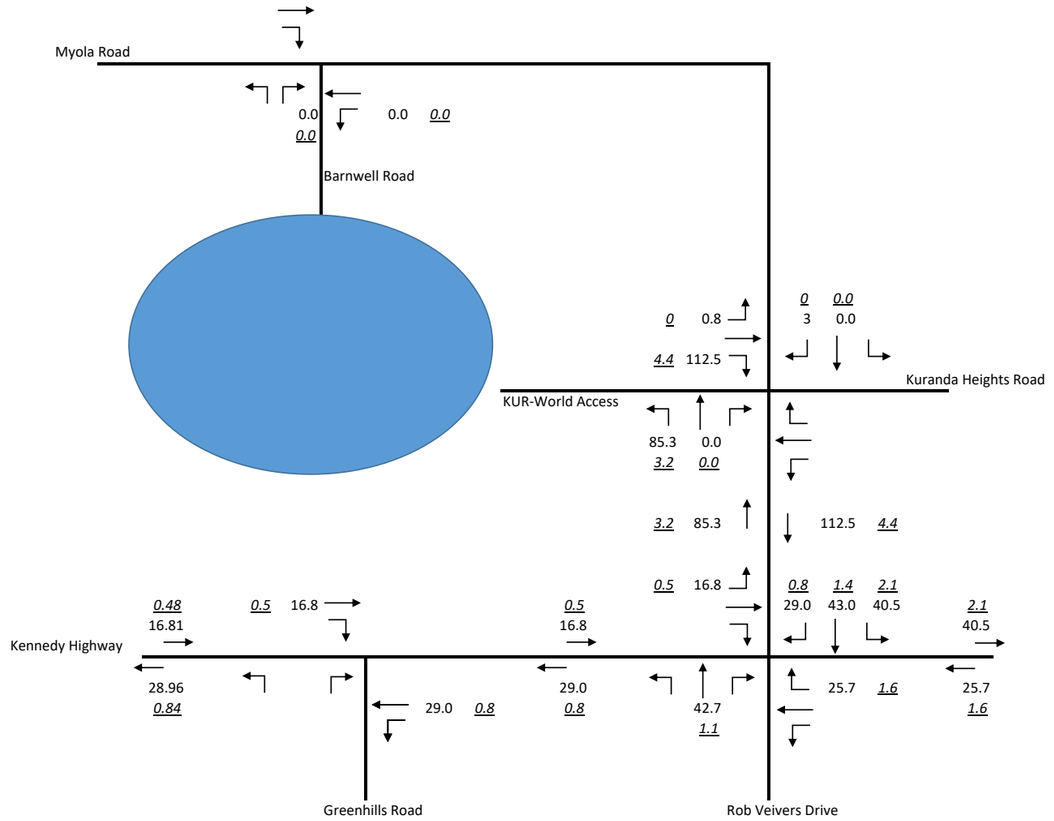
Figure B8: Stage 2 PM Peak Traffic Volumes-Main Access from Myola Road

Figure 13-25: Stage 2 operational traffic volumes for the AM and PM peak periods.



253251-00 KUR-World Eco Resort

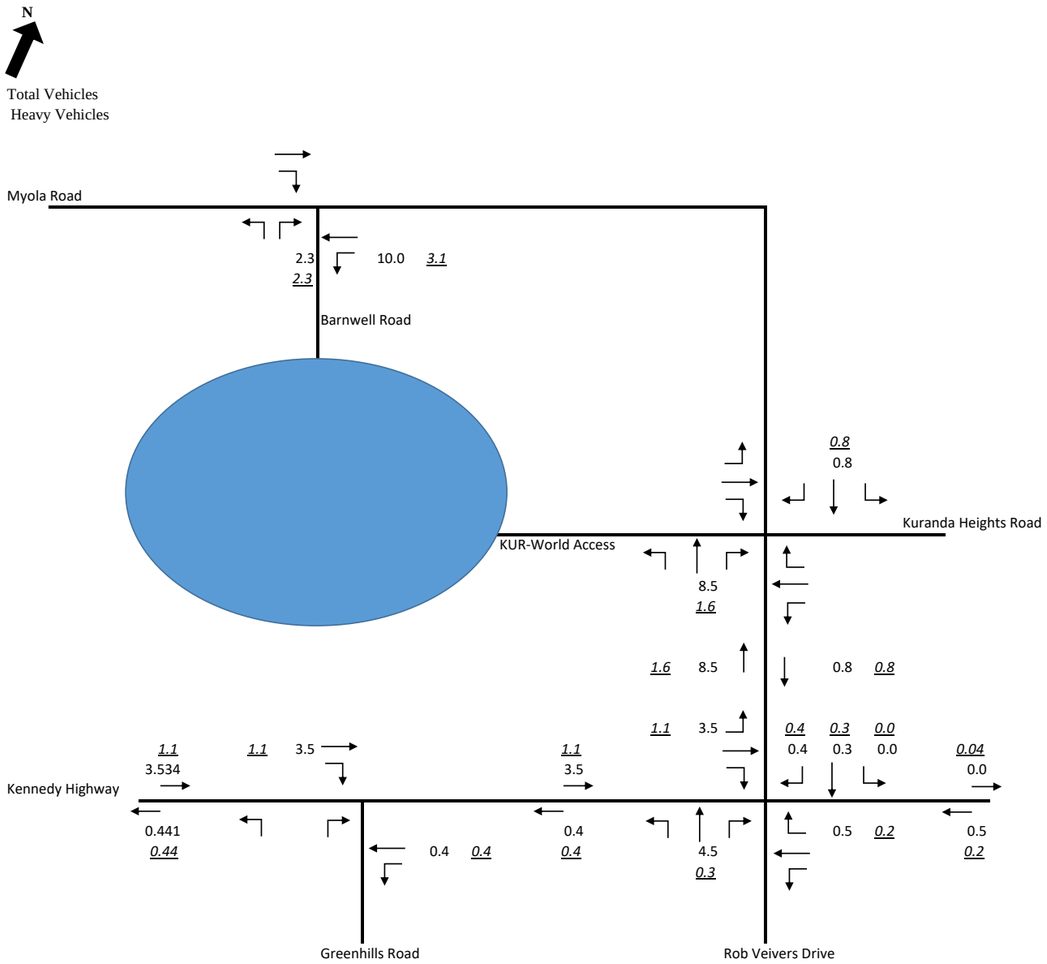
Figure B11: Stage 3 AM Peak Traffic Volumes-Main Access from Myola Road



253251-00 KUR-World Eco Resort

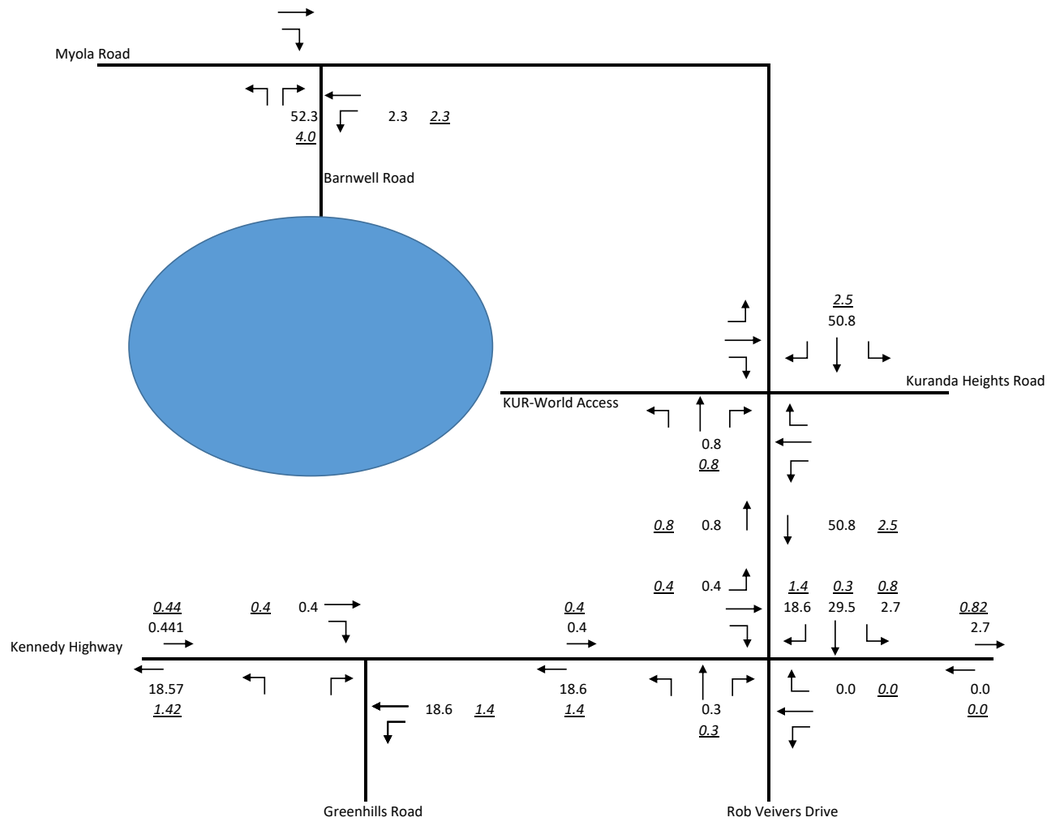
Figure B12: Stage 3 PM Peak Traffic Volumes-Main Access from Myola Road

Figure 13-26: Stage 3 operational traffic volumes for the AM and PM peak periods.



253251-00 KUR-World Eco Resort

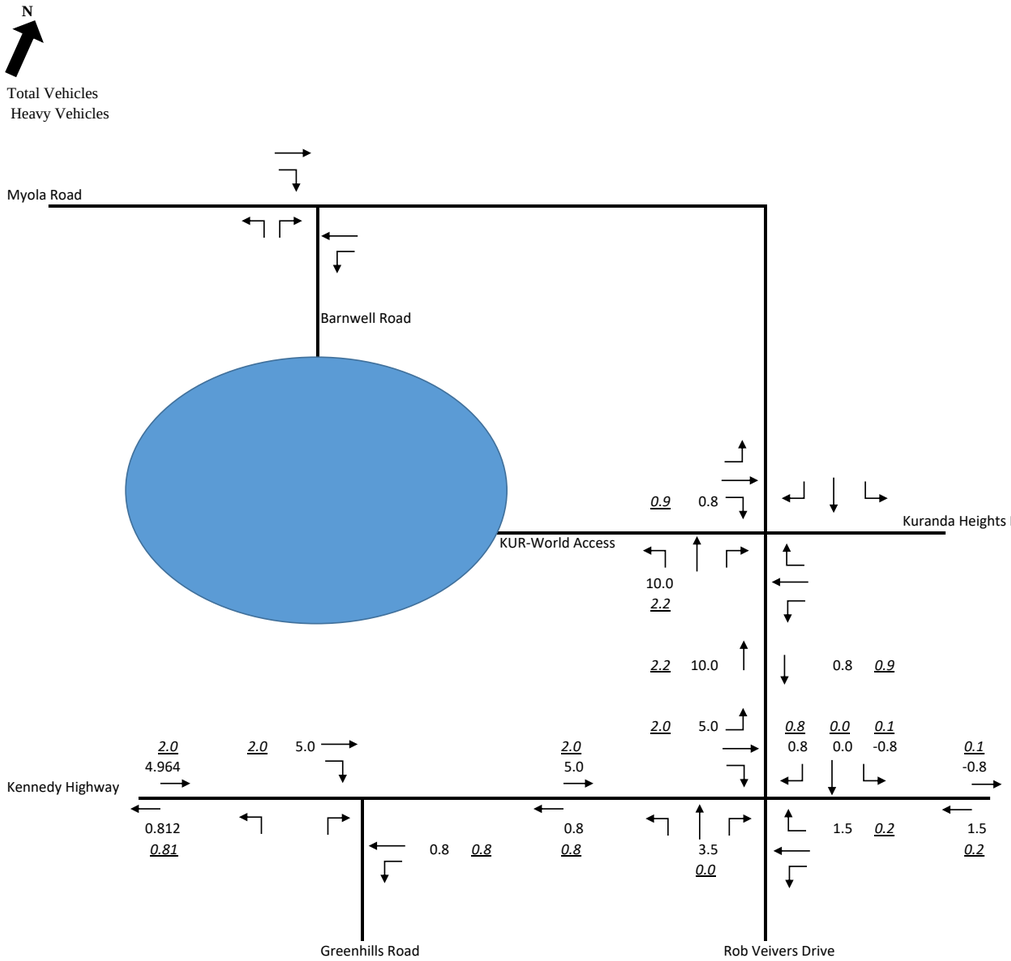
Figure B17: Stage 1 AM Constuction Traffic



253251-00 KUR-World Eco Resort

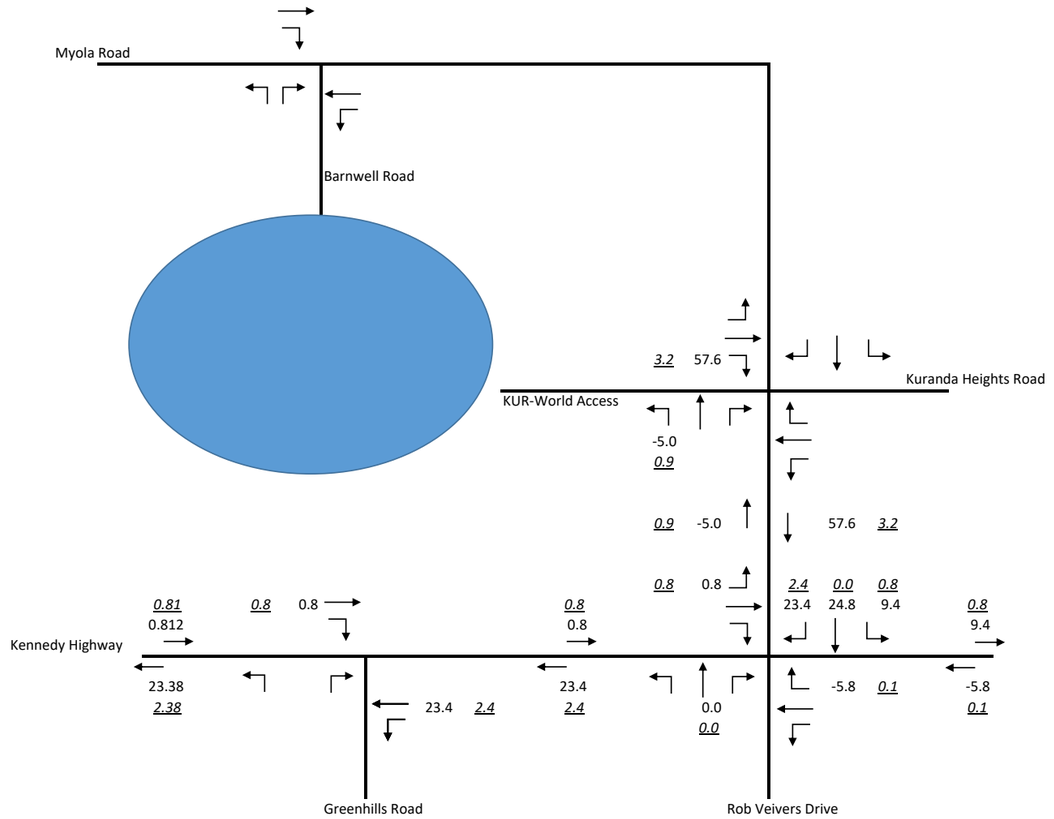
Figure B18: Stage 1 PM Constuction Traffic

Figure 13-27: Stage 1 construction traffic volumes for the AM and PM peak periods.



253251-00 KUR-World Eco Resort

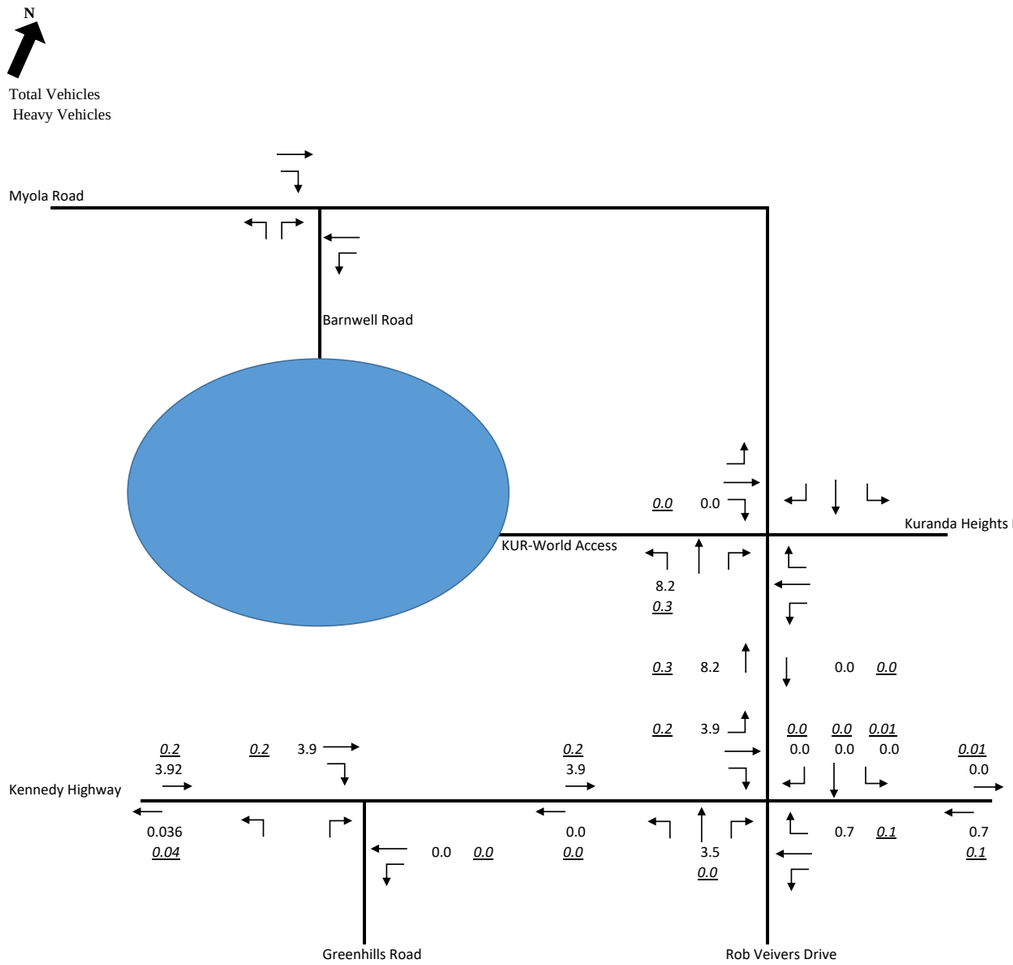
Figure B19: Stage 2 AM Constuction Traffic



253251-00 KUR-World Eco Resort

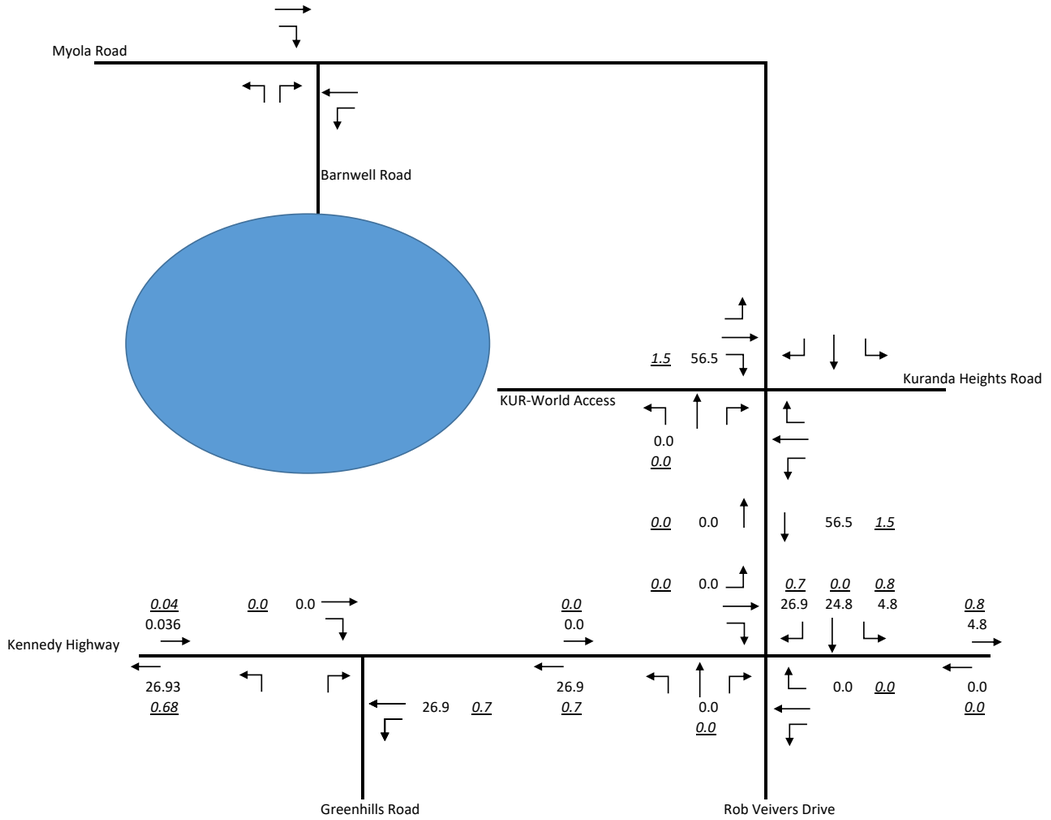
Figure B20: Stage 2 PM Constuction Traffic

Figure 13-28: Stage 2 construction traffic volumes for the AM and PM peak periods.



253251-00 KUR-World Eco Resort

Figure B21: Stage 3 AM Constuction Traffic



253251-00 KUR-World Eco Resort

Figure B22: Stage 3 PM Constuction Traffic

Figure 13-29: Stage 3 construction traffic volumes for the AM and PM peak periods.

13.4.2.3 Daily traffic volumes

The daily traffic volumes on the key links in the study area were calculated for the design years. A summary of the daily traffic volumes for with and without development scenarios for each key link in each design years is presented in Table 13-20 through Table 13-24. A map of the impacted road links is presented in Figure 13-30.

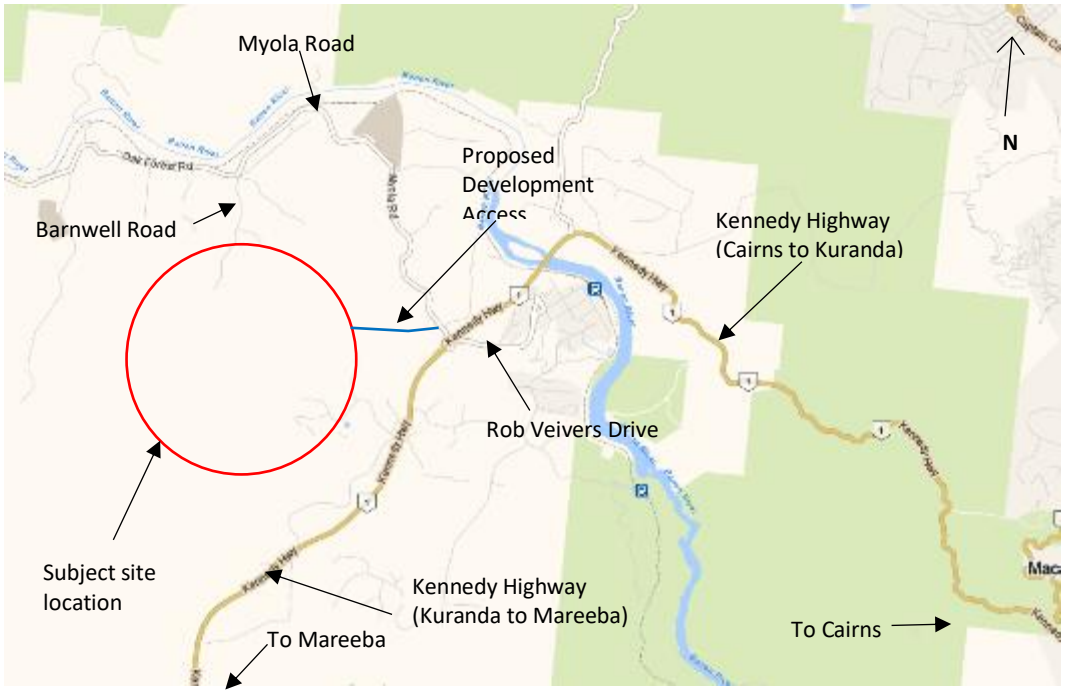


Figure 13-30: Map showing key links within the study area.

Table 13-20: Summary of AADT increases on the Kennedy Highway (to Cairns) for each stage of development due to KUR-World operational traffic.

Stage	Year	Base Traffic Volume (AADT)	Private Vehicle	Heavy Vehicles [12]	Passenger Car Equivalents[13]	With Development (AADT)	Percentage Increase
Stage 1A	2018	9015	86	25	160	9175	1.8%
Stage 1	2021	9567	295	55	460	10026	4.8%
Stage 2	2024	10152	698	80	937	11089	9.2%
Stage 3	2027	10774	1026	104	1338	12112	12.4%
2037 Design Horizon	2037	13133	1026	104	1338	14471	10.2%

[12] Heavy Vehicles include Private Shuttles and heavy vehicles associated with construction activities and development servicing.

[13] A Passenger Car Equivalent (PCE) of 3.0 has been taken for Private Coaches/HVs in accordance with Main Road WA Table 4.5.1 of Supplement to Austroads Guide to Road Design Part 3. This figure is based upon research from the National Road Transport Commission and accounts for vehicles classes 6 (Thee Axle Articulated) to 9 (Six Axle Articulated). Three Axle buses are traditionally Class 4 with a PCE of two.

Table 13-21: Summary of AADT increases on the Kennedy Highway (to Mareeba) for each stage of development due to KUR-World operational traffic.

Stage	Year	Base Traffic Volumes (AADT)	Private Vehicle	Heavy Vehicles	Passenger Car Equivalents	With Development (AADT)	Percentage Increase
Stage 1A	2018	6100	116	17	168	6268	2.8%
Stage 1	2021	6473	280	27	360	6834	5.6%
Stage 2	2024	6869	655	28	739	7609	10.8%
Stage 3	2027	7290	800	34	902	8192	12.4%
2037 Design Horizon	2037	8886	800	34	902	9788	10.1%

Table 13-22: Summary of AADT increases on Rob Veivers Drive for each stage of development due to KUR-World operational traffic.

Stage	Year	Base Traffic Volumes (AADT)	Private Vehicle	Heavy Vehicles	Passenger Car Equivalents	With Development (AADT)	Percentage Increase
Stage 1A	2018	4422	179	22	245	4667	5.5%
Stage 1	2021	4692	418	43	546	5239	11.6%
Stage 2	2024	4980	718	68	921	5900	18.5%
Stage 3	2027	5284	1014	86	1271	6555	24.0%
2037 Design Horizon	2037	6442	1014	86	1271	7712	19.7%

Table 13-23: Summary of AADT increases on Myola Road for each stage of development due to KUR-World operational traffic.

Stage	Year	Base Traffic Volumes (AADT)	Private Vehicle	Heavy Vehicles	Passenger Car Equivalents	With Development (AADT)	Percentage Increase
Stage 1A	2018	2497	394	94	675	3172	27.0%
Stage 1	2021	2650	63	3	71	2721	2.7%
Stage 2	2024	2812	63	3	71	2883	2.5%
Stage 3	2027	2984	63	3	71	3055	2.4%
2037 Design Horizon	2037	3638	63	3	71	3709	2.0%

Table 13-24: Summary of AADT increases on Barnwell Road for each stage of development due to KUR-World operational traffic.

Stage	Year	Base Traffic Volumes (AADT)	Private Vehicle	Heavy Vehicles	Passenger Car Equivalents	With Development (AADT)	Percentage Increase

Stage 1A	2018	72	394	94	675	747	940.5%
Stage 1	2021	76	63	3	71	148	93.7%
Stage 2	2024	81	63	3	71	152	88.3%
Stage 3	2027	86	63	3	71	157	83.2%
2037 Design Horizon	2037	105	63	3	71	176	68.3%

13.4.2.3.1 *Kennedy Highway (Kuranda Range section) traffic volumes*

Based on the data and assumptions presented in Section 13.4.2.1, the daily volume of traffic on the Kuranda Range for the with and without development scenarios was calculated based on the assumed peak hour traffic generation to determine any changes to the traffic peaks. As can be seen in Figure 13-31 there are no changes to the timing of traffic peaks, with development traffic expected to increase the traffic volumes within the existing peak periods, and not changing the timing of the peak periods on the Kuranda Range. As the expected peak hour traffic generation of the development is anticipated to be consistent across all affected road links and with similar peak hours, the development is not expected to alter the occurrence of the peak periods on any affected road links. Peak hour heavy vehicle percentages do not significantly change, with the biggest increase in the 2027 peak hour being a 0.5% increase in heavy vehicle percentage (5.6% to 6.1%) while maximum heavy vehicle percentages remain at approximately 9%.

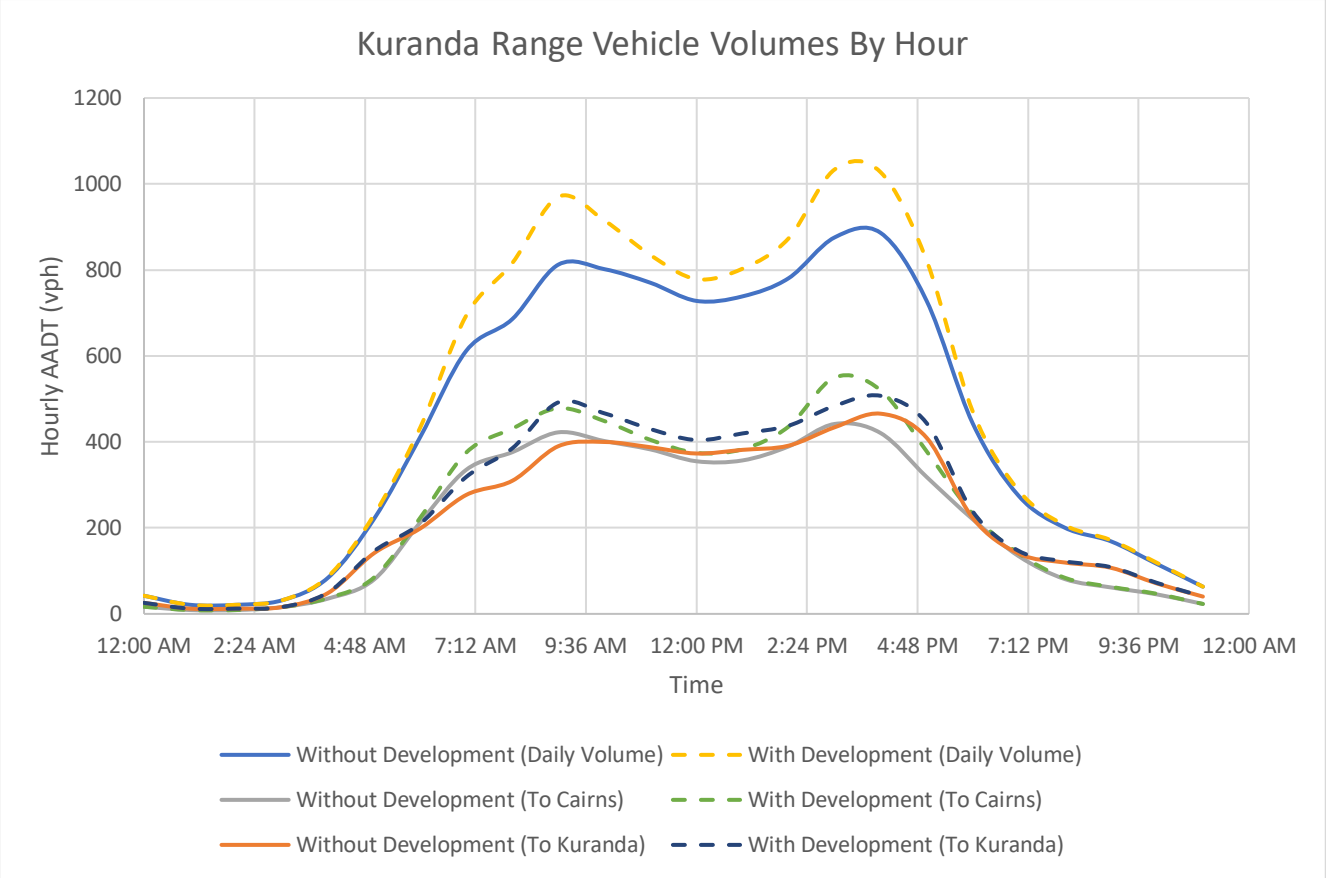


Figure 13-31: 2027 Kuranda Range Road hourly vehicle volumes with and without development.

13.4.3 Internal road operation and ownership

Ownership of internal roads and their proposed management is described in Chapter 6 Land Use. Roads internal to the development are to be designed in accordance with the relevant MUTCD and Austroads Guidelines and the FNQROC Development Manual. Internal roads have been designed to reduce operational speeds and are based on three typical cross sections suitable for the expected traffic volumes:

- Type 1 Road – An arterial type road with a typical cross section consisting of two 3.5m traffic lanes, centre median (where possible) and 1.5m bike lanes.
- Type 2 Road – A collector type road with a typical road width of 7.5m.
- Type 3 Road – An access street type road with a typical road width varying between 5.5m and 6.5m.

Footpaths are to be provided in accordance with FNQROC requirements.

13.5 Confirmation of study area extents

An assessment of the impact of the operational traffic within the study area was completed. The Guidelines for Assessment of Road Impacts of Development (DTMR, 2006) (GARID) suggest that a traffic assessment should be completed where the amount of additional traffic generated by a development exceeds five percent of existing volumes as this constitutes a significant road impact.

A comparison of the additional traffic generated by the operation of the development to the background traffic at each intersection was made to determine whether the development generated traffic is greater than five percent of the background traffic. The summary of this assessment is presented in Table 13-25 for the Stage 3 operation of the development.

Table 13-25: Summary of intersection traffic increases due to full operation of KUR-World.

Intersection	Percentage increase in traffic caused by Stage Three of development		Stage at which 5% increase in background traffic is exceeded
	Morning peak hour	Evening peak hour	
Kennedy Highway / Myola Road / Rob Veivers Drive	41%	38%	Stage 1B (2021)
Kennedy Highway / Greenhills Road	16%	16%	Stage 1B (2021)
Myola Road / Kuranda Heights Road	123%	137%	Stage 1A (2018)
Myola Road / Barnwell Road	3% (24% in Stage 1A)	2% (27% in Stage 1A)	Stage 1A (2018)
Captain Cook Highway / Kennedy Highway / Mount Millman Drive	6%	6%	Stage 2 (2024)

The results above indicate that the study area extents described in Section 13.3.1 are generally appropriate as the relative increase in traffic volumes due to the construction and operation of KUR-World rapidly decrease towards the study area extents with significant increase in background traffic on the Captain Cook Highway.

It is also noted that Strategic Modelling has also been undertaken with the CSTM to determine the extent of impact of the proposed development. A technical note detailing the modelling process and the results is presented in Appendix 13L. The modelling undertaken generally supports the assessment of study extents with traffic volume increases above 5% limited to the Kennedy Highway only. Due to lack of definition within the model the impact on local roads with Kuranda is not presented. However, the traffic associated with guest transport is only likely to be significant on Barnwell Road, Myola Road and Rob Veivers Drive;

therefore, all impacts within the Kuranda area are assumed to be limited to these roads. Non-guest traffic such as resort staff are likely to utilise various roads within the Kuranda area however the volumes generated aren't considered significant.

13.6 Assessment of potential impacts

The design traffic volumes for the morning and evening peak periods used on the traffic assessment were calculated by combining the data presented in Section 13.4.1 (existing traffic) and Section 13.4.2 (development construction and operational traffic). The resulting volumes are summarised below in Figure 13-32 to Figure 13-36. The types of impacts assessed include:

The impact of development traffic on the intersections. This was assessed using SIDRA Intersection software (refer Section 13.6.1), as well as turn treatment warrants based on the Austroads guidelines.

The impact of development traffic on road links. This was assessed using guidance from the Highway Capacity Manual (HCM) 6th Edition (2016) (refer Section 13.6.2).

The impact of development traffic on road safety. This was assessed based on existing crash data and the expected increase (refer Section 13.6.3).

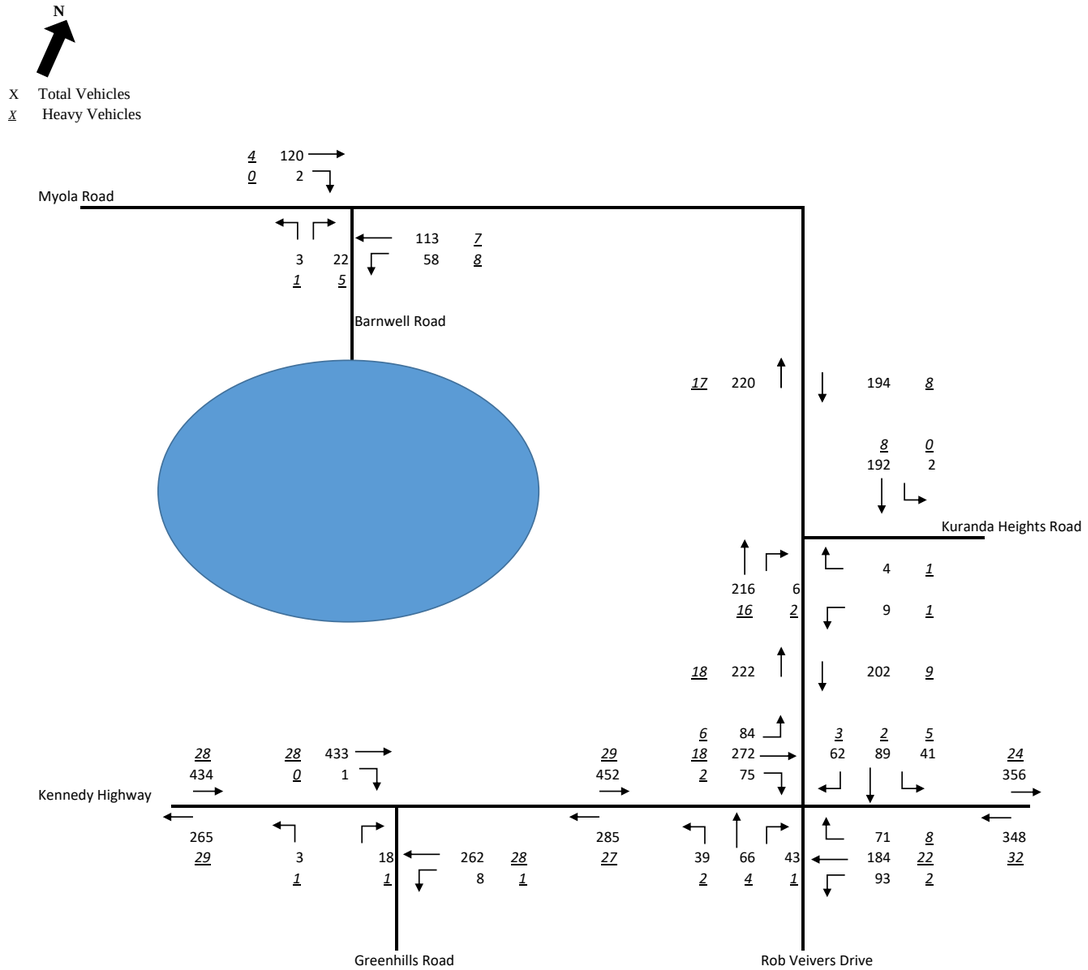
The impact of development traffic on Road Pavement (refer Section 13.6.4).

The impact of the development on Skyrail and Kuranda Scenic Rail (refer Section0).

The impact of development traffic on Public Transport in Kuranda (refer Section13.6.7).

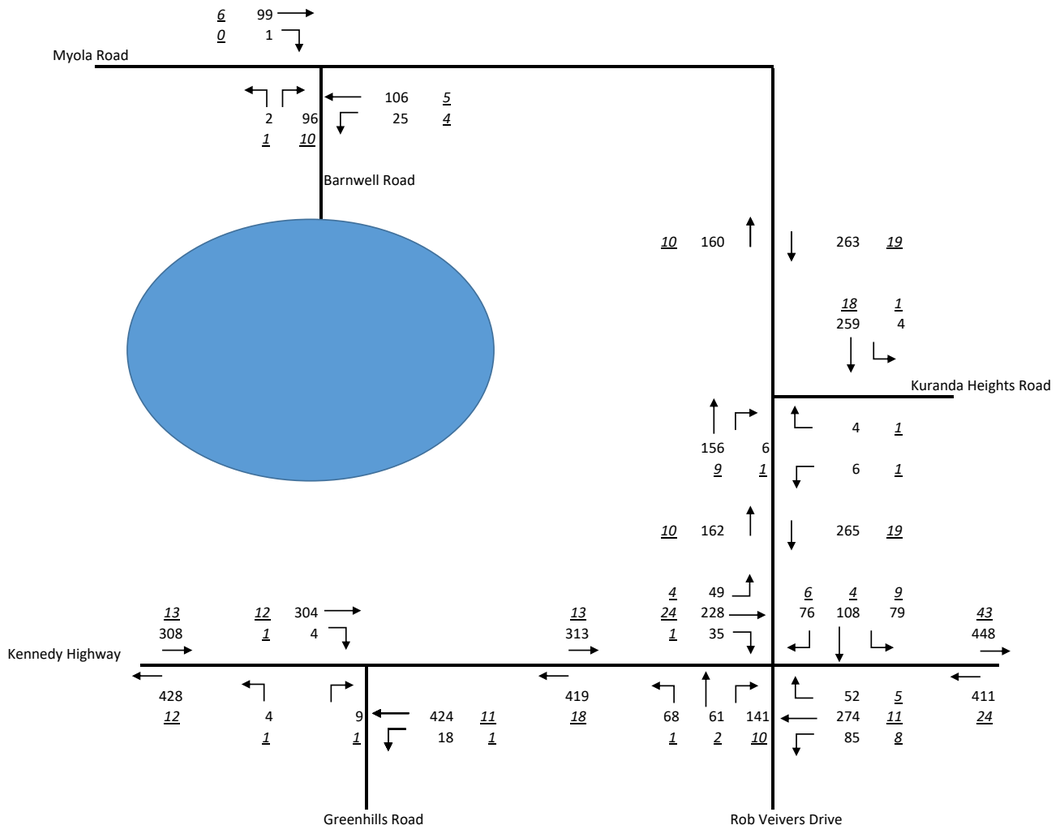
The impact the development on Air Transport (refer Section 13.6.8).

For each of the above impact types, the need for mitigation has been considered and proposed mitigation described where relevant. Mitigation is also summarised in Section 13.7.



253251-00 KUR-World Eco Resort

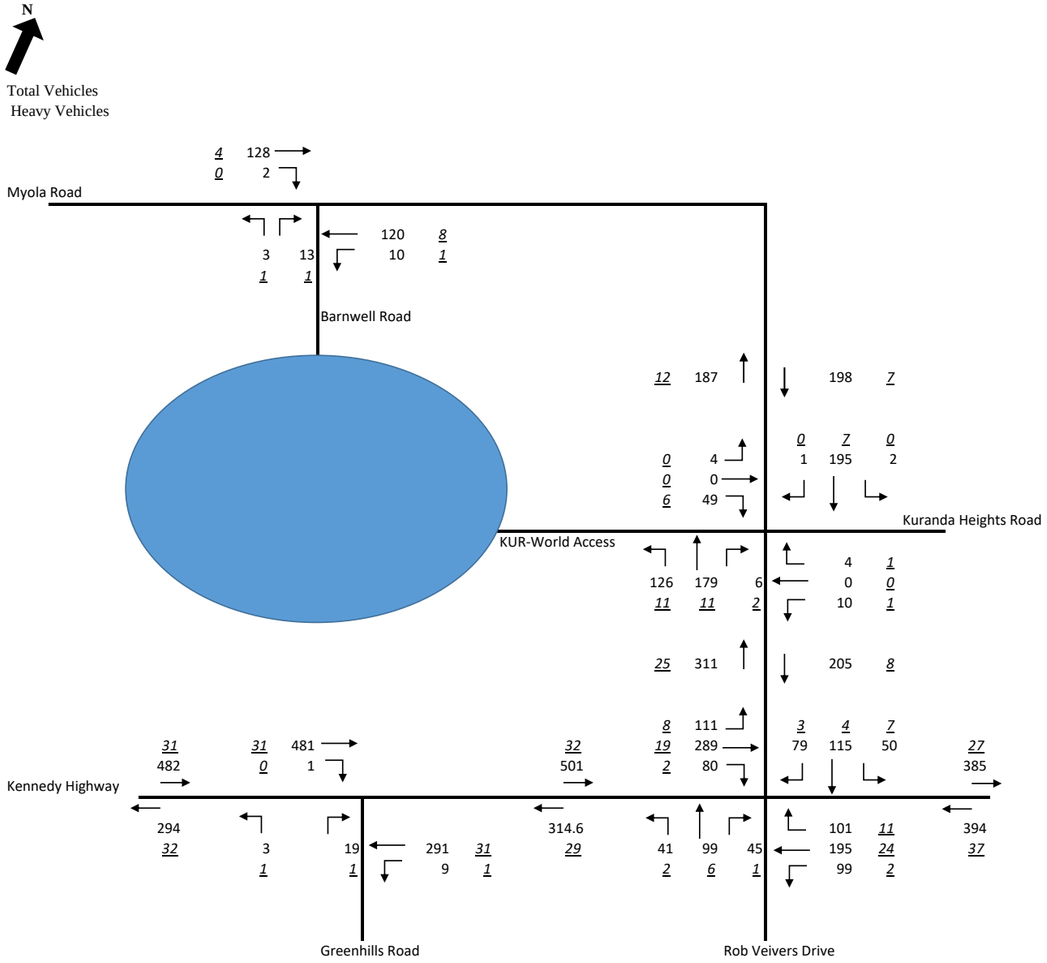
Figure C1: 2018 AM Stage 1A , Stage 1 CT & Existing Traffic Volumes



253251-00 KUR-World Eco Resort

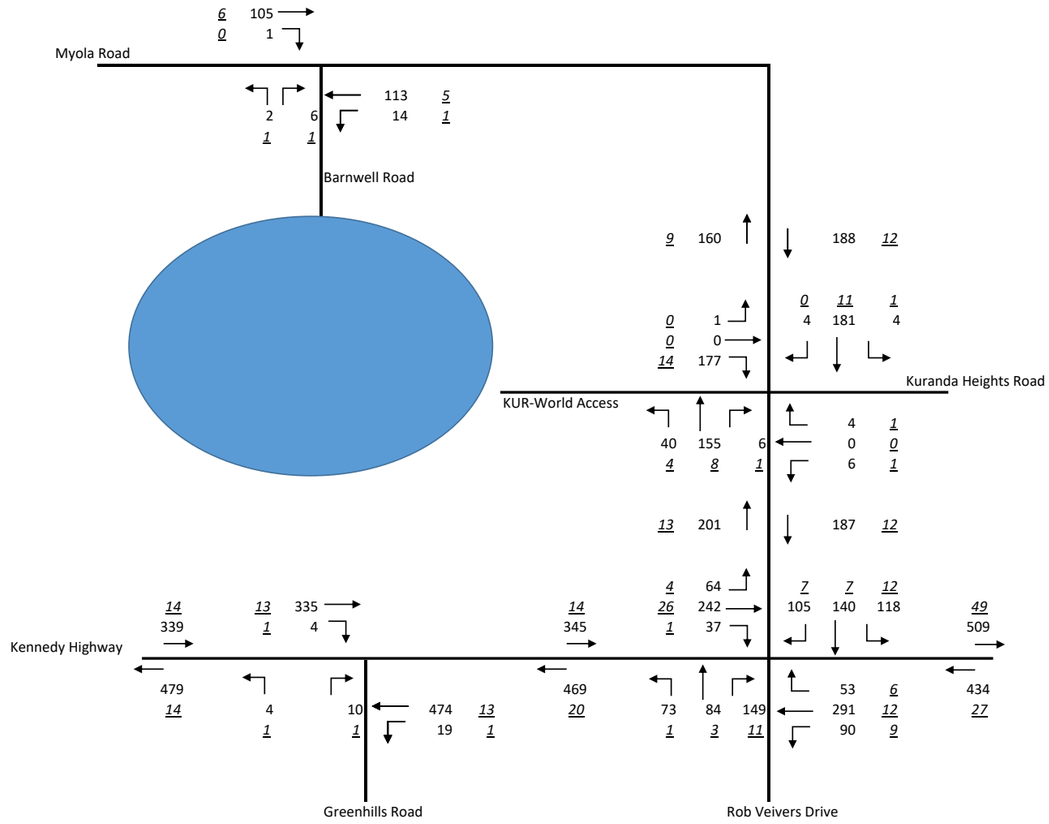
Figure C2: 2018 PM Stage 1A, Stage 1 CT & Existing Traffic Volumes

Figure 13-32: Forecast traffic volumes for Stage 1A operation and Stage 1 construction including 2018 base traffic volumes.



253251-00 KUR-World Eco Resort

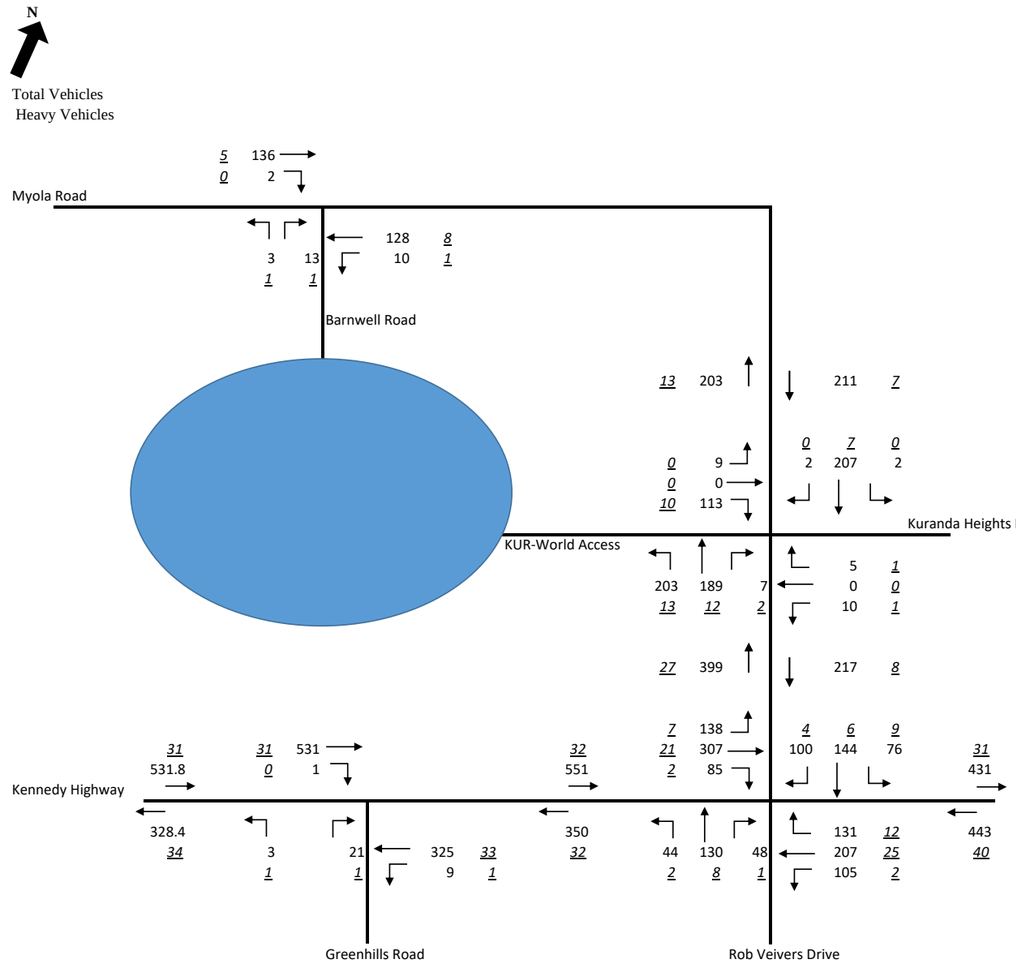
Figure C3: 2021 AM Stage 1, Stage 2 CT & Existing Traffic Volumes - Main Access from Myola Road



253251-00 KUR-World Eco Resort

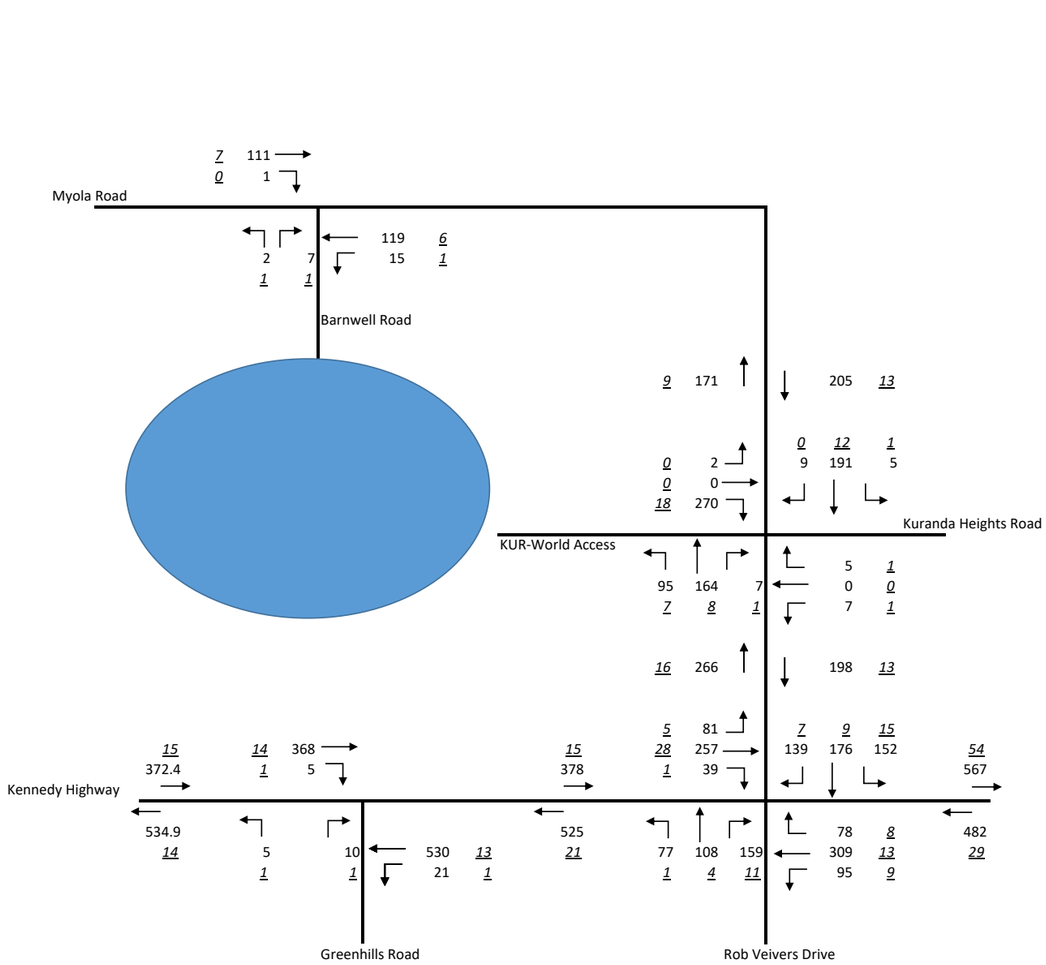
Figure C4: 2021 PM Stage 1, Stage 2 CT & Existing Traffic Volumes - Main Access from Myola Road

Figure 13-33: Forecast traffic volumes for Stage 1 operation and Stage 2 construction including 2021 base traffic volumes.



253251-00 KUR-World Eco Resort

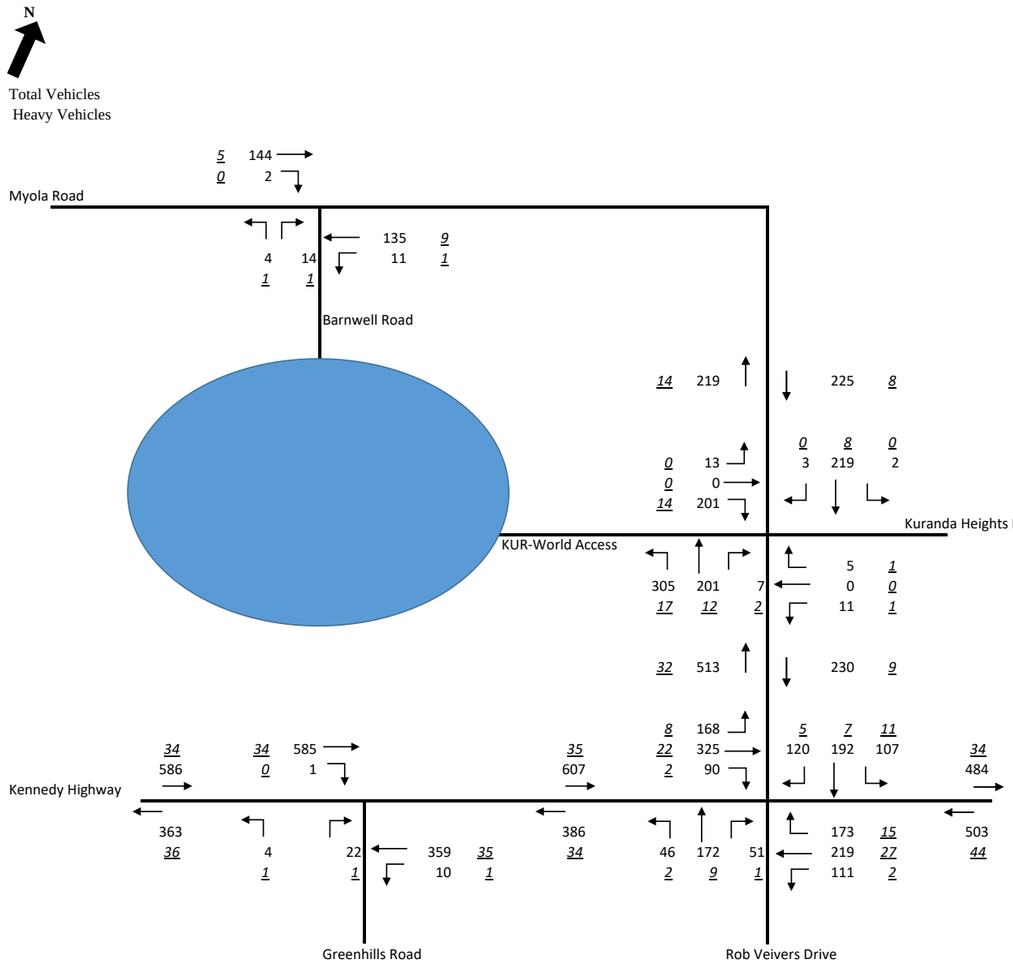
Figure C7: 2024 AM Stage 1&2, Stage 3 CT & Existing Traffic Volumes - Main Access from Myola Road



253251-00 KUR-World Eco Resort

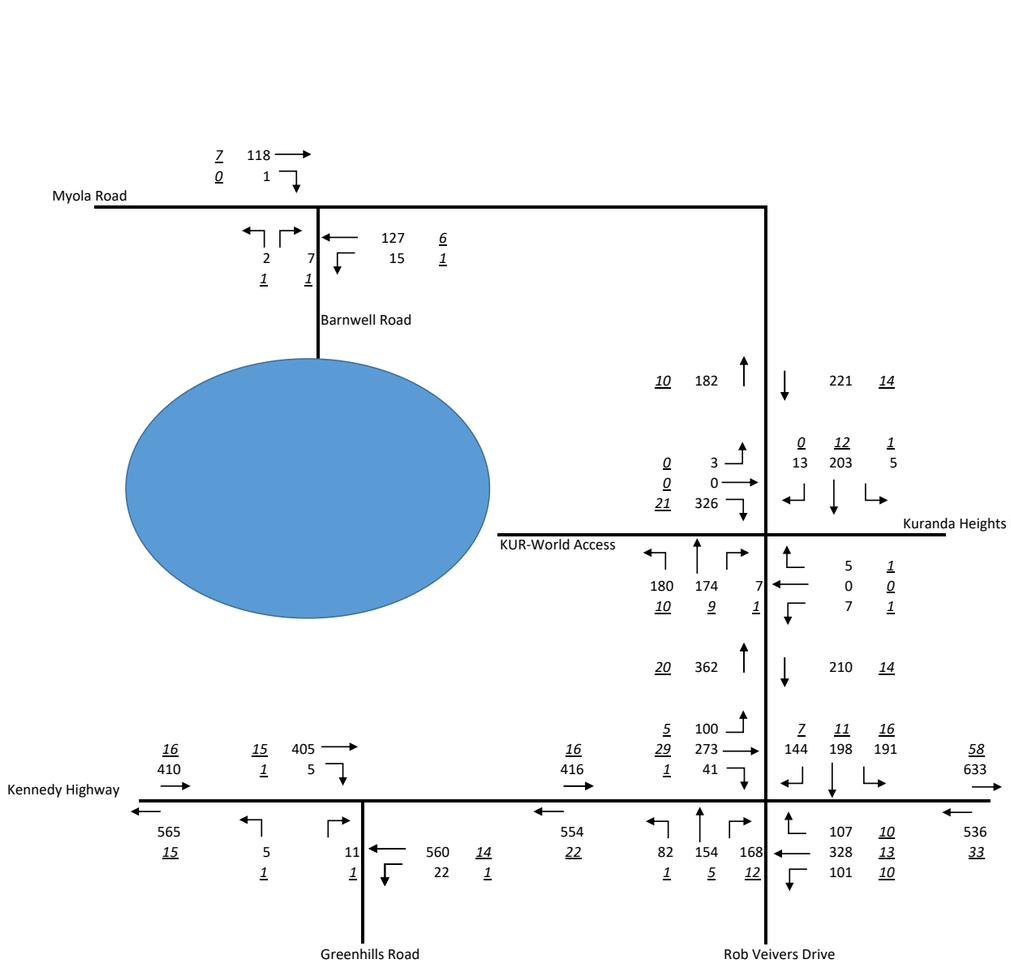
Figure C8: 2024 PM Stage 1&2, Stage 3 CT & Existing Traffic Volumes - Main Access from Myola Road

Figure 13-34: Forecast traffic volumes for Stages 1 & 2 operation and Stage 3 construction including 2024 base traffic volumes.



253251-00 KUR-World Eco Resort

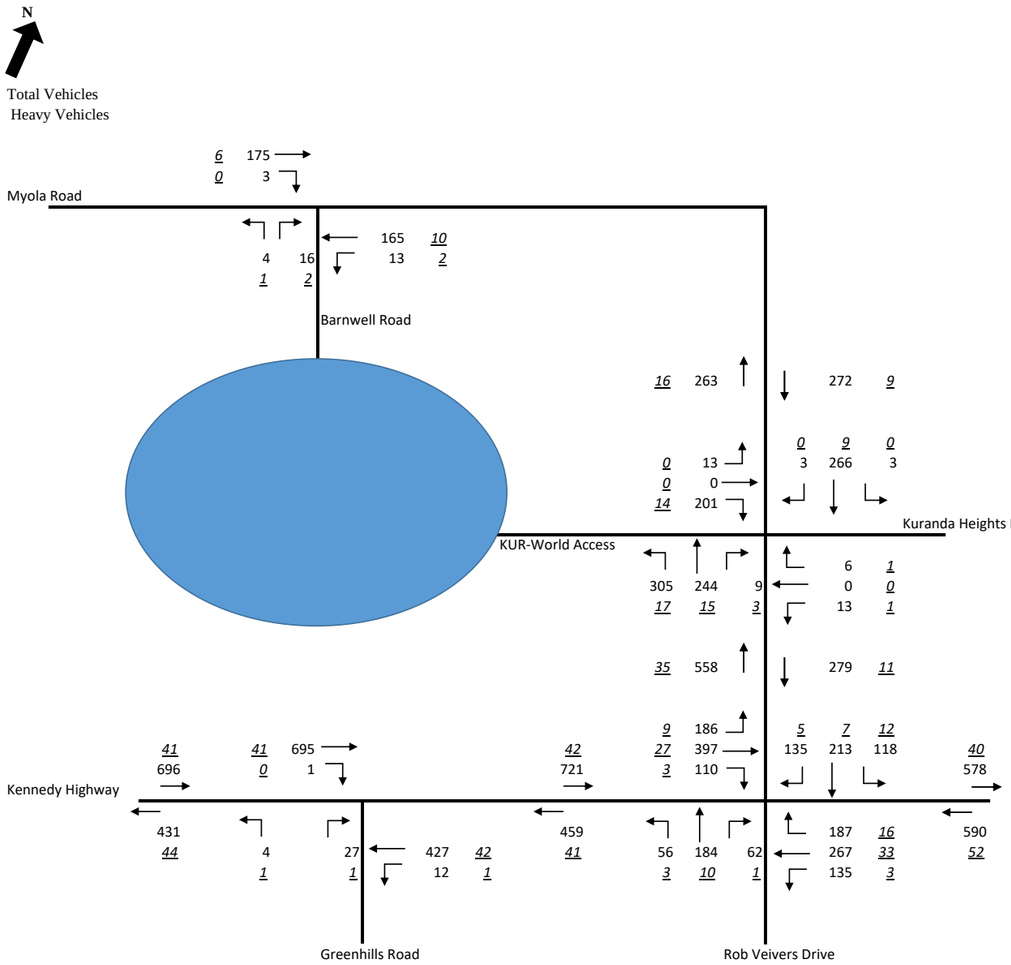
Figure C11: 2027 AM Stage 1&2&3 & Existing Traffic Volumes - Main Access from Myola Road



253251-00 KUR-World Eco Resort

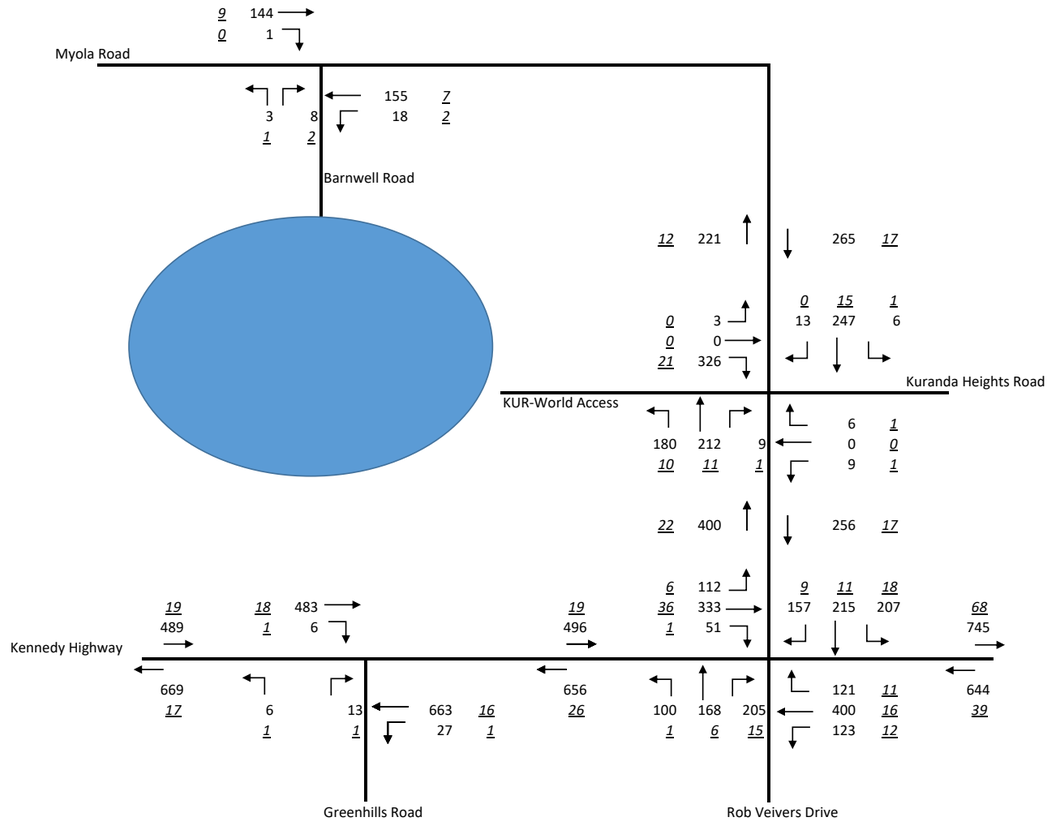
Figure C12: 2027 PM Stage 1&2&3 & Existing Traffic Volumes - Main Access from Myola Road

Figure 13-35: Forecast traffic volumes for Stages 1, 2 & 3 operation including 2027 base traffic volumes.



253251-00 KUR-World Eco Resort

Figure C15: 2037 AM Ultimate Stage Existing Traffic Volumes - Main Access from Myola Road



253251-00 KUR-World Eco Resort

Figure C16: 2037 PM Ultimate Stage Existing Traffic Volumes - Main Access from Myola Road

Figure 13-36: Forecast traffic volumes for Stages 1, 2 & 3 operation including 2037 base traffic volumes

13.6.1 Intersection assessment

Five key intersections within the study area were assessed using SIDRA Intersection software:

Kennedy Highway / Myola Road / Rob Veivers Drive

Myola Road / Kuranda Heights Road / Development Access

Myola Road / Barnwell Road

Kennedy Highway / Greenhills Road

Captain Cook Highway / Kennedy Highway / Mount Milman Drive.

The operation of these intersections was assessed based on the existing intersection layouts (the proposed roundabout layout was used for assessment of the Myola Road / Kuranda Heights Road / Development Access from Stage Two onwards). Similar to the baseline intersection capacity calculation, three key performance measures were assessed:

Degree of Saturation (%) – This is the ratio of demand flow to capacity. For priority controlled intersections the acceptable limit of operation is reached when the degree of saturation exceeds 80%. For roundabouts, the acceptable limit of operation is reached when the degree of saturation exceeds 85%. For signalised intersections, the acceptable limit of operation is reached when the degree of saturation exceeds 90%.

Average Delay (sec) – The average delay per vehicle in seconds incurred by vehicles over the modelled time period.

95th Percentile Queue – A queue length measured in metres of which only five percent of queues are equal to or greater than.

The average delay is the key determinant in the overall Level of Service of the intersection. The Level of Service benchmarks are seen in Table 13-26 for which the intersections will be assessed. SIDRA Movement Summaries are provided in Appendix 13M. which provide detailed intersection level of service summaries and overall intersection level of service.

Table 13-26: Level of Service for un-signalised, roundabouts and signalised intersections

Level of Service	Average delay per vehicle in seconds (s)		
	Un-signalised Intersections	Roundabouts	Signalised Intersections
A	d ≤ 10	d ≤ 10	d ≤ 10
B	10 < d ≤ 15	10 ≤ d ≤ 20	10 < d ≤ 20
C	15 < d ≤ 25	20 ≤ d ≤ 35	20 < d ≤ 35
D	25 < d ≤ 35	35 ≤ d ≤ 55	35 < d ≤ 55
E	35 < d ≤ 50	55 ≤ d ≤ 70	55 < d ≤ 80
F	50 < d	70 < d	80 < d

13.6.1.1 Kennedy Highway / Myola Road / Rob Veivers Drive

The Kennedy Highway/Myola Road/Rob Veivers Drive intersection is currently a signalised intersection with left turn slip lanes provided on every approach. Right turn lanes of varying lengths are also provided on all approaches. An indicative layout of the intersection is shown in Figure 13-37.

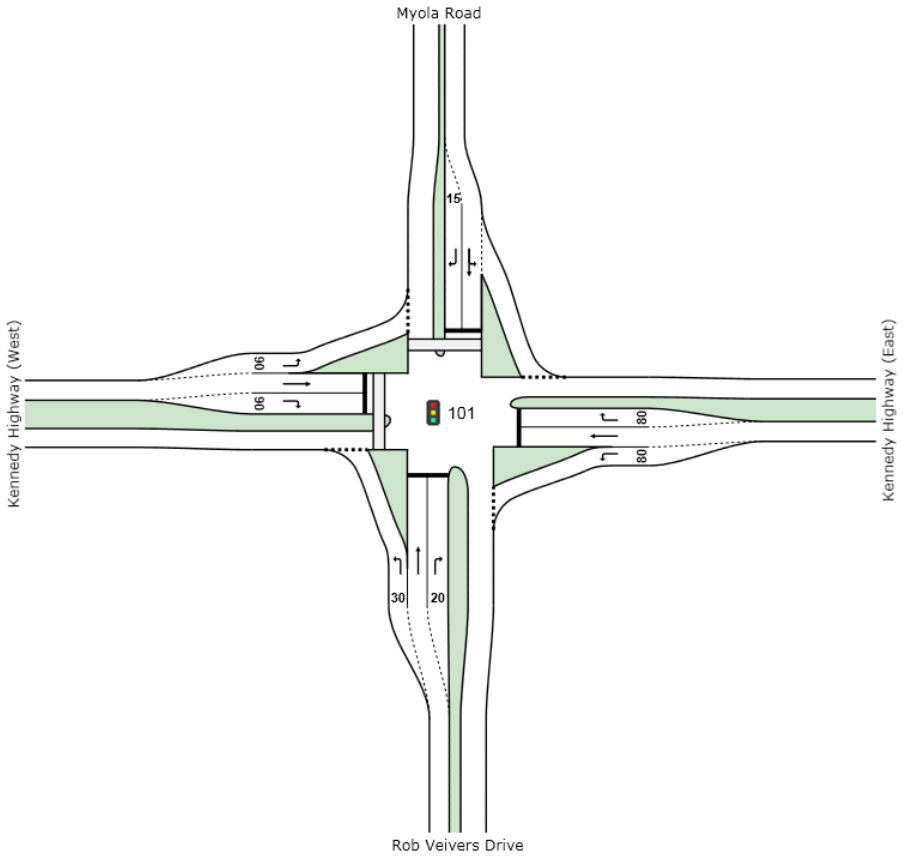


Figure 13-37: Kennedy Highway / Myola Road / Rob Veivers Drive intersection layout

The results of the SIDRA assessment for each design year are presented in Table 13-27 to Table 13-31.

Table 13-27: Kennedy Highway / Myola Road / Rob Veivers Drive intersection assessment results for 2018 with and without Stage 1A.

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Rob Veivers Drive	Left	3.6	6.5	7.6	8.1	1.9	3.9	3.6	6.6	7.6	8.4	1.9	4.1
	Through	21.7	21.5	27.5	26.3	9.9	10.9	31.4	25	27.9	26.5	14.7	12.8
	Right	20.8	61.7	33.1	34.5	9.1	33.2	20.8	61.7	33.1	34.5	9.1	33.2
Kennedy Highway (East)	Left	8.2	7.4	8.9	8.8	3.7	3.5	8.2	7.6	8.9	9.0	3.6	3.5
	Through	37.4	56.3	19.1	21.1	36.1	54.6	37.4	60.1	19.1	22.2	36.1	56
	Right	14.6	13.5	18.4	18.7	7.5	7.3	18.7	14.0	18.6	19.4	9.9	7.5
Myola Road	Left	37.7	28.5	18.1	15.8	14.6	13.8	41.1	46.1	18.6	17.3	15.3	24.3
	Through	37.7	28.5	12.4	10.1	14.6	13.8	41.1	46.1	12.9	11.5	15.3	24.3
	Right	34.5	29.3	35.0	34.8	13.2	11.1	36.9	39.6	35.1	34.1	14.1	17.5

Kennedy Highway (West)	Left	5.5	3.4	8.4	8.3	2.2	1.3	6.7	3.9	8.5	8.4	3	1.5
	Through	53.5	48.9	20.2	20.7	54.1	47.0	53.5	52.1	20.2	21.7	54.1	48
	Right	16.4	9.1	18.1	18.8	9.7	4.2	16.4	9.6	18.1	19.5	9.7	4.7
Intersection		**53.5**	**61.7**	**18.5**	**20.3**	**54.1**	**54.6**	**53.5**	**61.7**	**18.7**	**20.8**	**54.1**	**56.0**

Table 13-28: Kennedy Highway / Myola Road / Rob Veivers Drive intersection assessment results for 2021 with and without Stage 1.

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Rob Veivers Drive	Left	3.8	7.1	7.6	8.4	2.0	4.5	3.9	7.4	7.8	9	2.2	5
	Through	23.0	22.7	27.5	26.4	10.6	11.6	47.1	34.4	28.6	27	22.6	18
	Right	21.8	65.3	33.1	34.9	9.5	35.6	21.8	65.3	33.1	34.9	9.5	35.6
Kennedy Highway (East)	Left	8.3	77.4	8.7	8.4	4.0	3.1	8.5	7.8	8.9	9	4.4	4.2
	Through	39.7	59.9	19.3	21.4	38.7	58.7	39.7	68.4	19.3	24.4	38.7	63.5
	Right	16	14.5	18.9	19.2	8.1	7.7	27.3	15.6	19.4	20.6	14.4	8
Myola Road	Left	4.0	6.4	8.1	9.1	2.6	4.7	4.9	11.7	8.2	9.3	3.2	9.3
	Through	46.3	36.5	29.6	29.3	19.1	14.9	62.8	63.4	30.8	28.7	27	32.2
	Right	36.8	31	35.1	34.9	14.1	11.8	46.7	47.5	35.5	33.4	18.1	23.8
Kennedy Highway (West)	Left	5.8	3.5	8.4	8.3	2.4	1.4	9.2	5.1	9.1	8.5	5	2.3
	Through	56.8	51.9	20.4	20.9	58.1	50.2	56.8	59.3	20.4	23	58.1	52.9
	Right	17.8	9.9	18.1	19.1	10.3	4.8	17.8	11	18.1	20.4	10.3	5.1
Intersection		**56.8**	**65.3**	**19.5**	**22.7**	**58.1**	**58.7**	**62.8**	**68.4**	**20.2**	**22.6**	**58.1**	**63.5**

Table 13-29: Kennedy Highway / Myola Road / Rob Veivers Drive intersection assessment results for 2024 with and without Stage 1 &2 and Stage 3 construction traffic.

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Rob Veivers Drive	Left	4.1	7.6	7.6	8.4	2.1	4.7	4.3	8.2	8.1	9.8	2.5	5.9
	Through	24.4	24.3	27.6	26.5	11.2	12.4	41.9	50.6	29.7	28.8	30.7	24.2
	Right	23.2	69.5	33.2	35.6	10.2	38.5	23.2	79.8	33.2	38.9	10.2	41.0

Kennedy Highway (East)	Left	9.5	8.3	9.1	8.8	4.6	4.0	9.6	8.8	9.3	9.2	4.2	4.0
	Through	42.1	63.6	19.4	21.9	41.4	63.6	47.7	78.3	21.4	28.0	43.6	73.7
	Right	17.4	16.1	18.8	19.1	8.6	8.3	40.1	25.1	21.1	21.7	20.0	12.4
Myola Road	Left	42.9	31.7	18.5	15.8	17.7	16.7	57.9	62.8	22.5	20.6	29.8	46.6
	Through	42.9	31.7	12.8	10.1	17.7	16.7	57.9	62.8	16.7	14.8	29.8	46.6
	Right	37.7	33.1	35.1	35.0	14.4	12.7	44.4	72.0	33.2	33.7	22.0	31.9
Kennedy Highway (West)	Left	6.2	3.8	8.4	8.3	2.5	1.5	11.6	6.5	9.1	8.9	6.8	3.5
	Through	60.5	55.1	20.7	21.1	62.7	54.0	68.5	67.9	23.7	25.2	67.9	60.0
	Right	19.2	10.8	18.2	19.1	11.0	5.0	21.1	12.7	19.7	21.4	11.7	5.5
Intersection		**60.5**	**69.5**	**18.8**	**20.7**	**62.7**	**63.6**	**68.5**	**79.8**	**20.9**	**23.8**	**67.9**	**73.7**

Table 13-30: Kennedy Highway / Myola Road / Rob Veivers Drive intersection assessment results for 2027 with and without Stage 1, 2 & 3.

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Rob Veivers Drive	Left	4.4	8.1	7.8	8.7	2.5	5.4	4.6	9.0	8.4	10.2	2.8	6.6
	Through	25.8	22.7	27.6	25.3	11.9	12.7	83.3	72.0	34.4	31.2	44.6	36.8
	Right	24.6	66.1	33.2	34.1	10.8	39.6	24.6	89.3	33.2	44.5	10.8	47.6
Kennedy Highway (East)	Left	10	8.8	9.1	8.8	4.8	4.2	10.7	8.8	9.7	8.8	4.9	4.3
	Through	44.6	71.9	19.6	24.4	44.2	72.6	58.3	89.9	23.7	37.1	49.0	92.2
	Right	19.1	18.2	19.1	20.0	9.1	9.0	61.3	37.0	23.7	22.7	29.2	17.5
Myola Road	Left	45.2	34.4	18.9	16.4	19.6	18.5	66.7	67.3	24.8	11.2	46.8	57.3
	Through	45.2	34.4	13.2	10.7	19.6	18.5	66.7	67.3	19.1	15.5	46.8	57.3
	Right	40	34.9	35.2	35.1	15.3	13.4	42.7	72.5	31.2	32.9	25.4	32.5
Kennedy Highway (West)	Left	6.6	4	8.4	8.5	2.7	1.8	14.7	8.3	10.1	9.4	10.5	5.2
	Through	64	62.4	21.1	22.6	67.6	59.8	83.7	78	30.8	28.8	84.3	69.1
	Right	20.7	12.3	18.4	20.1	11.7	5.5	25.3	14.7	21.2	22.5	13.2	6.0
Intersection		**64**	**71.9**	**19.0**	**21.5**	**67.6**	**72.6**	**83.7**	**89.9**	**23.7**	**26.6**	**84.3**	**92.2**

Table 13-31: Kennedy Highway / Myola Road / Rob Veivers Drive intersection assessment results for 2037 with and without Stage 1,2 & 3.

Approach	Movement	Without Development	With Development

		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Rob Veivers Drive	Left	5.6	10.6	8.4	10.2	3.5	8.2	5.7	11.9	9.4	14.4	4.8	18.5
	Through	31.6	27.7	27.9	25.6	14.7	15.7	87.4	88.6	51.0	75.7	70.0	98.3
	Right	29.8	86.3	33.5	40.9	13.3	55.7	26.1	98.6	44.6	114.4	17.1	151.7
Kennedy Highway (East)	Left	13.0	9.9	10.0	8.2	7.1	3.2	13.3	10.0	10.9	9.2	9.4	10.4
	Through	54.4	87.7	20.3	33	55.8	107.8	63.0	99.3	33.4	105.1	75.8	296.4
	Right	26.4	24.9	20.3	20.8	11.2	11.1	66.4	65.7	30.8	53.0	37.8	53.7
Myola Road	Left	55.1	41.7	23.3	18.1	26.3	26.7	79.0	72.0	39.3	40.4	13.2	152.0
	Through	55.1	41.7	17.6	12.4	26.3	26.7	79.0	72.0	33.6	34.7	72.3	152.0
	Right	49	42.8	35.6	35.4	19	16.6	91.8	99.8	63.7	123.0	37.7	113.8
Kennedy Highway (West)	Left	8.1	4.9	8.5	8.5	3.8	2.2	15.6	8.5	10.8	10.2	14.9	11.4
	Through	78.2	76.2	25.2	25.9	94.1	81.2	90.6	93.9	50.2	85.2	132.5	232.6
	Right	27.6	17.4	18.9	21.2	14.6	6.8	29.8	36.4	26.7	52.4	19.5	20.7
Intersection		**78.2**	**87.7**	**20.9**	**25.4**	**94.1**	**107.8**	**91.8**	**99.8**	**36.1**	**70.5**	**132.5**	**232.6**

The above results show that the intersection will operate at an acceptable level in the without development case to 2037. The addition of development traffic increases the delay and DoS in all years. The intersection will operate within the acceptable limits to 2027, however the DoS (reaches a maximum of 99.8%, acceptable limit of operation is 90%) and LoS (reaches a maximum of 70.5 sec, acceptable limit of operation is 35 sec) exceed the acceptable limits in 2037 therefore requiring mitigation measures to ensure the intersection can operate within the acceptable limits over the projects design horizon.

The following upgrades to the intersection are proposed:

increase the right and left turn storage bay lengths on Myola Road to 25m and 30m respectively

increase the right turn storage bay length on Rob Veivers Drive to 30m.

The proposed upgraded layout can be seen in Figure 13-38 with the SIDRA analysis of the 2037 scenario demonstrating the acceptable operation of this intersection in 2037 provided in Table 13-32. The DoS and LoS are within acceptable limits for both the morning and evening peak periods with the addition of the development traffic. The expected queue lengths are not anticipated to affect the proposed Myola Road / Kuranda Heights Road roundabout. These upgrades are to be completed prior to the completion of Stage 3 construction.

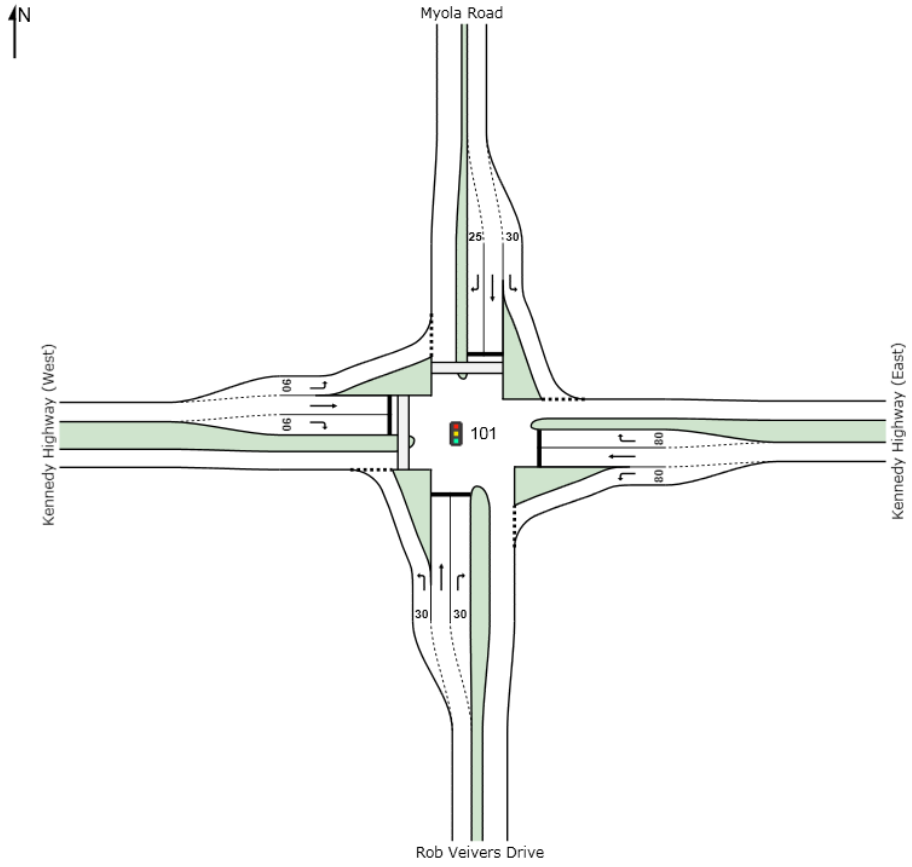


Figure 13-38: Upgrades to intersection of Kennedy Highway / Myola Road / Rob Veivers Drive to ensure intersection operates within acceptable limits over the design horizon.

Table 13-32: Kennedy Highway / Myola Road / Rob Veivers Drive intersection assessment results for 2037 with proposed upgrades to ensure acceptable operation over the design horizon.

Approach	Movement	With Development with Upgrades					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM
Rob Veivers Drive	Left	5.8	11.5	9.2	11.5	4.4	10.2
	Through	79.2	64.3	37.0	32.7	53.2	44.0
	Right	27.1	84.8	36.8	44.9	15	63.1
Kennedy Highway (East)	Left	12.3	10.8	10	9.5	8.9	7.5
	Through	56.8	85.3	24.3	34.4	65.8	117.7
	Right	71.0	43.3	27.1	24.7	36.8	22.2
Myola Road	Left	12.4	23.6	10.2	12.4	11.4	25.3
	Through	75.4	79.6	33.0	34.6	57.1	60.3

Approach	Movement	With Development with Upgrades					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM
	Right	46.5	54.9	35.1	35.6	33.1	39.8
Kennedy Highway (West)	Left	16.3	9.3	10.5	9.7	13.3	6.8
	Through	81.6	74	31.1	28.4	113.1	91.1
	Right	31.5	19.3	22.7	24.2	18.3	8.3
Intersection		**81.6**	**85.3**	**25.5**	**27.9**	**113.1**	**117.7**

13.6.1.2 Myola Road / Kuranda Heights Road

The Myola Road / Kuranda Heights Road intersection is currently a priority controlled Y-intersection with no turn lanes. An indicative layout of the intersection is illustrated in Figure 13-39. KUR-World proposes to upgrade this intersection in 2021 to a roundabout to provide the main access to the resort from Stage 1B onwards to mitigate the impact of the development. An indicative layout of the proposed intersection is illustrated in Figure 13-40.

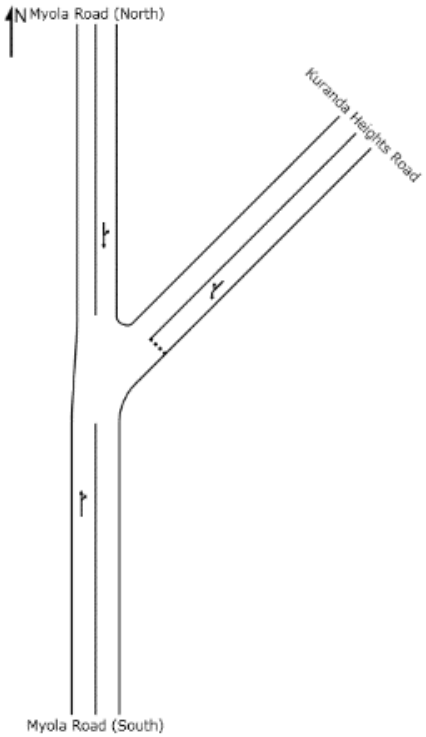


Figure 13-39: Myola Road / Kuranda Heights Road pre-development intersection layout.

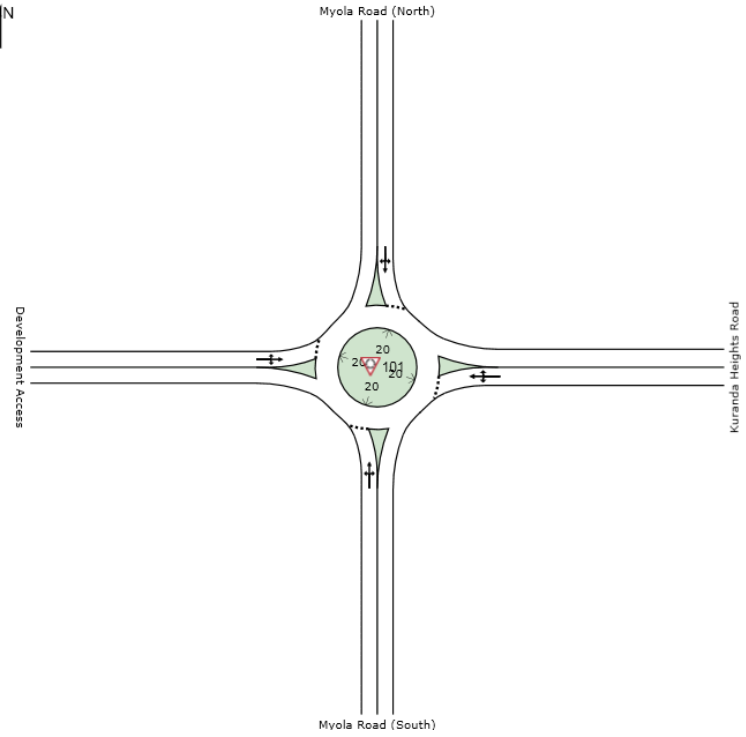


Figure 13-40: Proposed Myola Road / Kuranda Heights Road / Development Access intersection from Stage 1B (2021) onwards.

The results of the SIDRA assessment for each design year is presented in Table 13-33 to Table 13-37.

Table 13-33: Myola Road / Kuranda Heights Road / Development Access intersection assessment results for 2018 with and without Stage 1A.

Approach	Movement	Without Development[14]						With Development[15]					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Myola Road (South)	Left	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Through	9.3	8.0	0.0	0.0	0.5	0.4	12.1	8.8	0.0	0.1	0.5	0.4
	Right	9.3	8.0	5.8	5.4	0.5	0.4	12.1	8.8	5.9	5.9	0.5	0.4
Development Access (East)	Left	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Through	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Right	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Myola Road (North)	Left	9.7	9.3	6.5	6.8	0.0	0.0	10.4	14.4	6.5	6.8	0.0	0.0
	Through	9.7	9.3	0.0	0.0	0.0	0.0	10.4	14.4	0.0	0.0	0.0	0.0
	Right	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

[14] Assumes Priority Control
[15] Assumes Priority Control

Kuranda Heights Road	Left	1.3	1.0	5.8	5.8	0.4	0.3	1.3	1.1	5.8	6.3	0.4	0.3
	Through	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Right	1.3	1.0	8.3	8.1	0.4	0.3	1.3	1.1	8.8	8.9	0.4	0.3
Intersection		**9.7**	**9.3**	**0.4**	**0.4**	**0.5**	**0.4**	**12.1**	**14.4**	**0.3**	**0.3**	**0.5**	**0.4**

Table 13-34: Myola Road / Kuranda Heights Road / Development Access intersection assessment results for 2021 with and without Stage 1.

Approach	Movement	Without Development[16]						With Development[17]					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Myola Road (South)	Left	N/A	N/A	N/A	N/A	N/A	N/A	19.7	13.1	4.0	4.0	9.7	5.8
	Through	9.9	8.6	0.1	0.1	0.5	0.4	19.7	13.1	4.2	4.2	9.7	5.8
	Right	9.9	8.6	5.8	5.7	0.5	0.4	19.7	13.1	9.1	9.0	9.7	5.8
Development Access (East)	Left	N/A	N/A	N/A	N/A	N/A	N/A	1.5	1.2	5.1	5.9	0.5	0.5
	Through	N/A	N/A	N/A	N/A	N/A	N/A	1.5	1.2	5.1	5.7	0.5	0.5
	Right	N/A	N/A	N/A	N/A	N/A	N/A	1.5	1.2	10.3	11.0	0.5	0.5
Myola Road (North)	Left	10.3	9.9	6.5	6.8	0.0	0.0	15.4	18.2	4.2	5.6	6.8	8.2
	Through	10.3	9.9	0.0	0.0	0.0	0.0	15.4	18.2	4.5	5.4	6.8	8.2
	Right	N/A	N/A	N/A	N/A	N/A	N/A	15.4	18.2	9.1	9.9	6.8	8.2
Kuranda Heights Road	Left	1.4	1.0	5.8	5.9	0.4	0.3	5.2	16.4	4.9	4.9	2.0	6.9
	Through	N/A	N/A	N/A	N/A	N/A	N/A	5.2	16.4	5.1	5.1	2.0	6.9
	Right	1.4	1.0	8.4	8.2	0.4	0.3	5.2	16.4	10.0	9.9	2.0	6.9
Intersection		**10.3**	**9.9**	**0.4**	**0.4**	**0.5**	**0.4**	**19.7**	**18.2**	**4.9**	**6.5**	**9.7**	**8.2**

Table 13-35: Myola Road / Kuranda Heights Road / Development Access intersection assessment results for 2024 with and without Stage 1 & 2.

Approach	Movement	Without Development[18]						With Development[19]					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Myola Road (South)	Left	N/A	N/A	N/A	N/A	N/A	N/A	25.2	17.5	3.9	4.0	13.2	8.2
	Through	11.2	9.6	0.1	0.1	0.5	0.5	25.2	17.5	4.2	4.2	13.2	8.2

[16] Assumes Priority Control
[17] Assumes Roundabout
[18] Assumes Priority Control
[19] Assumes Roundabout

	Right	11.2	9.6	5.9	5.5	0.5	0.5	25.2	17.5	9.1	9.0	13.2	8.2
Development Access (East)	Left	N/A	N/A	N/A	N/A	N/A	N/A	1.7	1.6	5.5	6.5	0.6	0.6
	Through	N/A	N/A	N/A	N/A	N/A	N/A	1.7	1.6	5.5	6.3	0.6	0.6
	Right	N/A	N/A	N/A	N/A	N/A	N/A	1.7	1.6	10.6	11.5	0.6	0.6
Myola Road (North)	Left	11.6	11.2	6.5	6.7	0.0	0.0	18.3	21.7	4.6	6.3	8.2	10.0
	Through	11.6	11.2	0.0	0.0	0.0	0.0	18.3	21.7	4.9	6.1	8.2	10.0
	Right	N/A	N/A	N/A	N/A	N/A	N/A	18.3	21.7	9.5	10.6	8.2	10.0
Kuranda Heights Road	Left	1.6	1.2	5.9	5.9	0.4	0.4	11.7	24.7	5.0	5.0	4.8	11.2
	Through	N/A	N/A	N/A	N/A	N/A	N/A	11.7	24.7	5.3	5.3	4.8	11.2
	Right	1.6	1.2	8.6	8.4	0.4	0.4	11.7	24.7	10.1	10.0	4.8	11.2
Intersection		**11.6**	**11.2**	**0.4**	**0.4**	**0.5**	**0.5**	**25.2**	**24.7**	**5.4**	**7.0**	**13.2**	**11.2**

Table 13-36: Myola Road / Kuranda Heights Road / Development Access intersection assessment results for 2027 with and without Stage 1, 2 & 3.

Approach	Movement	Without Development[20]						With Development[21]					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Myola Road (South)	Left	N/A	N/A	N/A	N/A	N/A	N/A	32.3	24	3.9	4	18.6	12.4
	Through	10.5	9.0	0.1	0.1	0.5	0.5	32.3	24	4.2	4.2	18.6	12.4
	Right	10.5	9.0	5.8	5.5	0.5	0.5	32.3	24	9.1	9	18.6	12.4
Development Access (East)	Left	N/A	N/A	N/A	N/A	N/A	N/A	1.9	1.7	6.1	7	0.8	0.7
	Through	N/A	N/A	N/A	N/A	N/A	N/A	1.9	1.7	6.1	6.8	0.8	0.7
	Right	N/A	N/A	N/A	N/A	N/A	N/A	1.9	1.7	11.3	12.1	0.8	0.7
Myola Road (North)	Left	10.9	10.5	6.5	6.7	0.0	0.0	21.9	24.8	5.3	6.9	10	11.7
	Through	10.9	10.5	0.0	0.0	0.0	0.0	21.9	24.8	5.6	6.7	10	11.7
	Right	N/A	N/A	N/A	N/A	N/A	N/A	21.9	24.8	10.2	11.1	10	11.7
Kuranda Heights Road	Left	1.5	1.2	5.9	5.9	0.4	0.3	20.9	30.4	5.2	5.1	9.1	14.6
	Through	N/A	N/A	N/A	N/A	N/A	N/A	20.9	30.4	5.5	5.4	9.1	14.6
	Right	1.5	1.2	8.5	8.2	0.4	0.3	20.9	30.4	10.3	10.2	9.1	14.6
Intersection		**10.9**	**10.5**	**0.4**	**0.4**	**0.5**	**0.5**	**32.3**	**30.4**	**5.8**	**7.0**	**18.6**	**14.6**

[20] Assumes Priority Control

[21] Assumes Roundabout

Table 13-37: Myola Road / Kuranda Heights Road / Development Access intersection assessment results for 2037 with and without Stage 1, 2 & 3.

Approach	Movement	Without Development[22]						With Development[23]					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Myola Road (South)	Left	N/A	N/A	N/A	N/A	N/A	N/A	34.2	26.6	3.9	4	20.2	14.1
	Through	13.7	11.7	0.1	0.1	0.8	0.6	34.2	26.6	4.2	4.3	20.2	14.1
	Right	13.7	11.7	6.4	5.7	0.8	0.6	34.2	26.6	9.2	9	20.2	14.1
Development Access (East)	Left	N/A	N/A	N/A	N/A	N/A	N/A	2.3	2.1	6.4	7.3	0.9	0.9
	Through	N/A	N/A	N/A	N/A	N/A	N/A	2.3	2.1	6.4	7.2	0.9	0.9
	Right	N/A	N/A	N/A	N/A	N/A	N/A	2.3	2.1	11.5	12.4	0.9	0.9
Myola Road (North)	Left	14.1	13.6	6.5	6.7	0.0	0.0	26.6	30.1	5.4	6.9	12.7	14.9
	Through	14.1	13.9	0.0	0.0	0.0	0.0	26.6	30.1	5.7	6.8	12.7	14.9
	Right	N/A	N/A	N/A	N/A	N/A	N/A	26.6	30.1	10.3	11.2	12.7	14.9
Kuranda Heights Road	Left	2.1	1.7	6.1	6.1	0.6	0.5	21.5	31.9	5.4	5.5	9.4	15.4
	Through	N/A	N/A	N/A	N/A	N/A	N/A	21.5	31.9	5.7	5.7	9.4	15.4
	Right	2.1	1.7	9.2	8.8	0.6	0.5	21.5	31.9	10.5	10.5	9.4	15.4
Intersection		**14.1**	**13.6**	**0.4**	**0.5**	**0.8**	**0.6**	**34.2**	**31.9**	**5.9**	**7.1**	**20.2**	**15.4**

The above results show that the proposed roundabout intersection (providing access to the development) will operate within the acceptable limits over the design horizon. The intersection has an overall LoS A for all design years and the DoS is well within acceptable limits. The expected queue lengths are not anticipated to impact the operation of the nearby Kennedy Highway / Myola Road / Rob Veivers Drive intersection. The roundabout intersection is required to be completed prior to the completion of Stage 1B construction in 2021.

13.6.1.3 Myola Road / Barnwell Road

The Myola Road / Barnwell Road intersection is a priority controlled intersection with no turn lanes. An indicative layout of the intersection is illustrated in Figure 13-41.

[22] Assumes Priority Control
[23] Assumes Roundabout

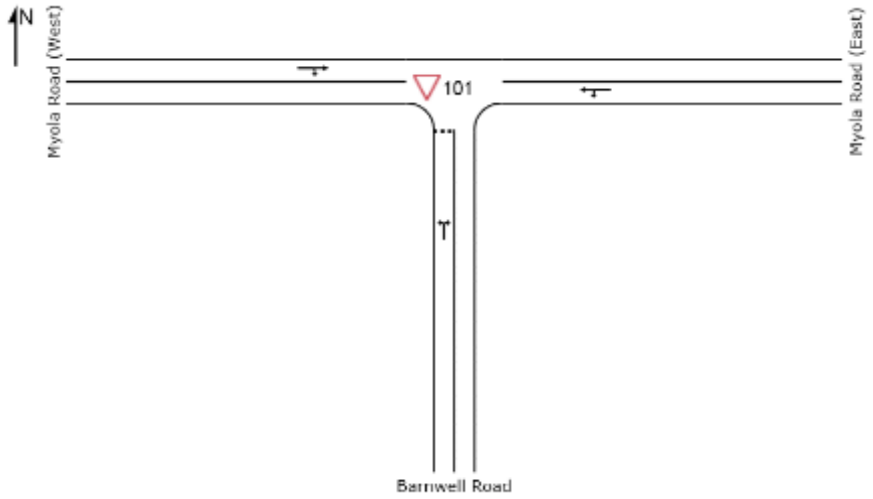


Figure 13-41: Myola Road / Barnwell Road intersection layout

The results of the SIDRA assessment for each design year is presented in Table 13-38 to

Table 13-42.

Table 13-38: Myola Road / Barnwell Road intersection assessment results for 2018 with and without Stage 1A.

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Barnwell Road	Left	1.0	0.5	6.4	6.6	0.3	0.2	2.9	10.4	6.4	6.7	0.8	2.7
	Right	1.0	0.5	6.6	6.9	0.3	0.2	2.9	10.4	7.0	6.6	0.8	2.7
Myola Road (East)	Left	6.7	6.4	5.7	5.7	0.0	0.0	9.9	7.4	5.7	5.7	0.0	0.0
	Through	6.7	6.4	0.0	0.0	0.0	0.0	9.9	7.4	0.0	0.0	0.0	0.0
Myola Road (west)	Through	6.7	5.6	0.0	0.0	0.1	0.1	6.7	5.6	0.0	0.0	0.1	0.1
	Right	6.7	5.6	5.9	5.8	0.1	0.1	6.7	5.6	6.0	5.9	0.1	0.1
Intersection		**6.7**	**6.4**	**0.5**	**0.4**	**0.3**	**0.1**	**9.9**	**10.4**	**1.6**	**2.4**	**0.8**	**2.7**

Table 13-39: Myola Road / Barnwell Road intersection assessment results for 2021 with and without Stage 1.

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Barnwell Road	Left	1.2	0.5	6.4	6.6	0.3	0.2	1.7	0.9	6.4	6.6	0.4	0.2

	Right	1.2	0.5	6.7	7.0	0.3	0.2	1.7	0.9	6.6	6.6	0.4	0.2
Myola Road (East)	Left	7.2	6.8	5.7	5.7	0.0	0.0	7.3	7.0	5.7	5.6	0.0	0.0
	Through	7.2	6.8	0.0	0.0	0.0	0.0	7.3	7.0	0.0	0.0	0.0	0.0
Myola Road (west)	Through	7.1	5.9	0.0	0.0	0.1	0.1	7.1	5.9	0.0	0.0	0.1	0.1
	Right	7.1	5.9	5.9	5.9	0.1	0.1	7.1	5.9	5.9	5.9	0.1	0.1
Intersection		**7.2**	**6.8**	**0.5**	**0.4**	**0.3**	**0.2**	**7.3**	**7.0**	**0.6**	**0.6**	**0.4**	**0.2**

Table 13-40: Myola Road / Barnwell Road intersection assessment results for 2024 with and without Stage 1 & 2.

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Barnwell Road	Left	1.2	0.6	6.5	6.7	0.3	0.2	1.7	1.0	6.5	6.7	0.4	0.3
	Right	1.2	0.6	6.8	7.0	0.3	0.2	1.7	1.0	6.7	6.6	0.4	0.3
Myola Road (East)	Left	7.6	7.2	5.7	5.7	0.0	0.0	7.7	7.4	5.7	5.6	0.0	0.0
	Through	7.6	7.2	0.0	0.0	0.0	0.0	7.7	7.4	0.0	0.0	0.0	0.0
Myola Road (west)	Through	7.6	6.2	0.0	0.0	0.1	0.1	7.6	6.2	0.0	0.0	0.1	0.1
	Right	7.6	6.2	5.9	5.9	0.1	0.1	7.6	6.2	5.9	5.9	0.1	0.1
Intersection		**7.6**	**7.2**	**0.5**	**0.4**	**0.3**	**0.2**	**7.7**	**7.4**	**0.6**	**0.6**	**0.4**	**0.3**

Table 13-41: Myola Road / Barnwell Road intersection assessment results for 2027 with and without Stage 1, 2 & 3.

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Barnwell Road	Left	1.4	0.7	6.4	6.7	0.4	0.2	1.9	1	6.4	6.7	0.5	0.3
	Right	1.4	0.7	6.8	6.9	0.4	0.2	1.9	1	6.7	6.7	0.5	0.3
Myola Road (East)	Left	8.1	7.7	5.7	5.7	0.0	0.0	8.2	7.9	5.7	5.6	0	0
	Through	8.1	7.7	0.0	0.0	0.0	0.0	8.2	7.9	0	0	0	0
Myola Road (west)	Through	8.0	6.6	0.0	0.0	0.1	0.1	8	6.6	0	0	0.1	0.1
	Right	8.0	6.6	5.9	5.9	0.1	0.1	8	6.6	6	5.9	0.1	0.1
Intersection		**8.1**	**7.7**	**0.5**	**0.4**	**0.4**	**0.2**	**8.2**	**7.9**	**0.6**	**0.6**	**0.5**	**0.3**

Table 13-42: Myola Road / Barnwell Road intersection assessment results for 2037 with and without Stage 1, 2 & 3.

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Barnwell Road	Left	1.6	0.8	6.5	6.6	0.4	0.2	2.3	1.3	6.5	6.6	0.6	0.4
	Right	1.6	0.8	7.1	7.3	0.4	0.2	2.3	1.3	7.2	7.3	0.6	0.4
Myola Road (East)	Left	9.8	9.3	5.7	5.6	0.0	0.0	10	9.6	5.7	5.7	0	0
	Through	9.8	9.3	0.0	0.0	0.0	0.0	10	9.6	0	0	0	0
Myola Road (west)	Through	9.8	8.1	0.0	0.0	0.2	0.1	9.8	8.1	0	0	0.2	0.1
	Right	9.8	8.1	6.1	6.0	0.2	0.1	9.8	8.1	6.1	6.1	0.2	0.1
Intersection		**9.8**	**9.3**	**0.5**	**0.4**	**0.4**	**0.2**	**10**	**9.6**	**0.6**	**0.6**	**0.6**	**0.4**

The above results show that the intersection will operate within acceptable limits across all design years with the addition of the development traffic.

In addition to the capacity assessment, an assessment of the existing right and left turn treatments from Myola Road to Barnwell Road was completed based on the guidelines presented in the Austroads Guide to Road Design Part 4 (2017). This assessment was conducted on Stage 1A and Stage 3 traffic volumes only as they represent the worst case scenario for this intersection. A summary of the assessment results is presented in Figure 13-42. As can be seen only Basic Right (BAR) and Basic Left (BAL) turn treatments are needed at this location to accommodate estimated the development traffic volumes therefore no upgrades are necessary.

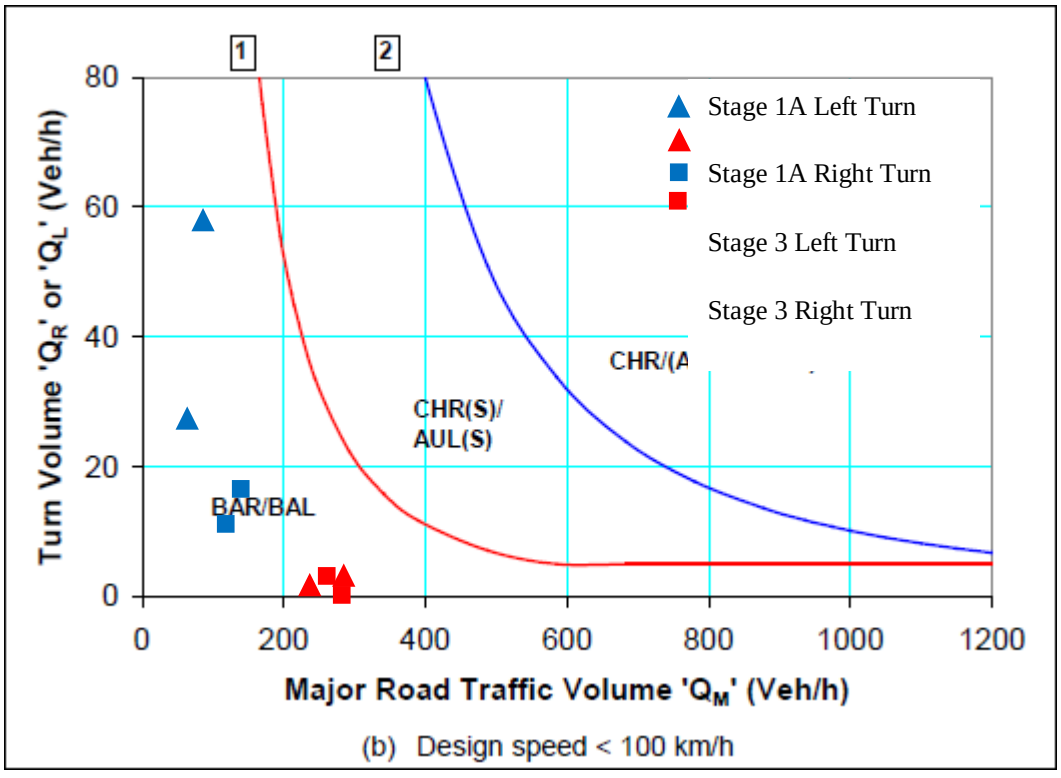


Figure 13-42: Turn warrant assessment of the Myola Road / Barnwell Road intersection

13.6.1.4 Kennedy Highway / Greenhills Road

The Kennedy Highway/Greenhills Road intersection is currently a priority controlled intersection with a left turn slip lane and auxiliary right turn lane on the Kennedy Highway. An indicative layout of the intersection is shown in Figure 13-43.

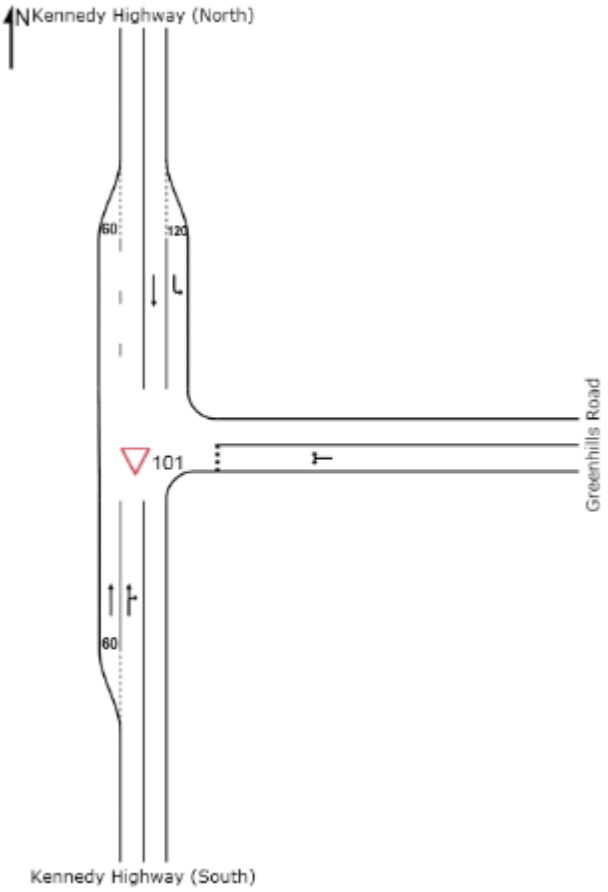


Figure 13-43: Kennedy Highway / Greenhills Road intersection layout

The results of the SIDRA assessment for each design year is presented in Table 13-43 to

Table 13-47.

Table 13-43: Kennedy Highway / Greenhills Road intersection assessment results for 2018 with and without Stage 1A.

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Kennedy Highway (South)	Through	17.5	12.6	0.0	0.1	0.1	0.5	18	12.9	0.0	0.1	0.1	0.5
	Right	17.5	12.6	7.0	8.9	0.1	0.5	18	12.9	7.0	9.3	0.1	0.5
	Left	5.5	3.4	7.6	8.3	1.5	0.9	5.7	3.6	7.6	8.6	1.5	1.0

Greenhills Road	Right	5.5	3.4	13.6	14.9	1.5	0.9	5.7	3.6	14.0	15.5	1.5	1.0
Kennedy Highway (North)	Left	0.5	1.1	5.7	5.6	0.0	0.0	0.5	1.1	5.7	5.6	0.0	0.0
	Through	14.7	21.5	0.0	0.0	0.0	0.0	15	23.0	0.0	0.0	0.0	0.0
Intersection		**17.5**	**21.5**	**0.5**	**0.5**	**1.5**	**0.9**	**18**	**23.0**	**0.5**	**0.5**	**1.5**	**1.0**

Table 13-44: Kennedy Highway / Greenhills Road intersection assessment results for 2021 with and without Stage 1

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Kennedy Highway (South)	Through	18.5	13.4	0.0	0.1	0.1	0.5	20.0	14.2	0.0	0.1	0.1	0.6
	Right	18.5	13.4	7.1	9.2	0.1	0.5	20.0	14.2	7.3	10.0	0.1	0.6
Greenhills Road	Left	6.2	4.0	7.7	8.6	1.6	1.1	6.9	4.6	7.8	9.1	1.8	1.2
	Right	6.2	4.0	14.5	15.5	1.6	1.1	6.9	4.6	15.9	17.7	1.8	1.2
Kennedy Highway (North)	Left	0.6	1.1	5.7	5.6	0.0	0.0	0.6	1.1	5.7	5.6	0.0	0.0
	Through	15.6	22.8	0.0	0.0	0.0	0.0	16.6	25.8	0.0	0.0	0.0	0.0
Intersection		**18.5**	**22.8**	**0.5**	**0.5**	**1.6**	**1.1**	**20.0**	**25.8**	**0.5**	**0.5**	**1.8**	**1.2**

Table 13-45: Kennedy Highway / Greenhills Road intersection assessment results for 2024 with and without Stage 1 & 2

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Kennedy Highway (South)	Through	19.7	14.3	0.0	0.1	0.1	0.7	22.0	15.7	0.0	0.2	0.1	0.8
	Right	19.7	14.3	7.3	9.3	0.1	0.7	22.0	15.7	7.6	10.6	0.1	0.8
Greenhills Road	Left	7.4	4.5	7.8	8.6	1.9	1.2	8.7	5.6	8.2	9.6	2.2	1.4
	Right	7.4	4.5	15.5	16.8	1.9	1.2	8.7	5.6	18.1	20.8	2.2	1.4
Kennedy Highway (North)	Left	0.6	1.2	5.7	5.6	0.0	0.0	0.6	1.2	5.7	5.6	0.0	0.0
	Through	16.5	24.2	0.0	0.0	0.0	0.0	18.5	28.8	0.0	0.0	0.0	0.0
Intersection		**19.7**	**24.2**	**0.5**	**0.5**	**1.9**	**1.2**	**22.0**	**28.8**	**0.5**	**0.5**	**2.2**	**1.4**

Table 13-46: Kennedy Highway / Greenhills Road intersection assessment results for 2027 with and without Stage 1,2 & 3

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Kennedy Highway (South)	Through	20.9	15.1	0.0	0.1	0.1	0.7	24.3	17.3	0	0.2	0.1	0.9
	Right	20.9	15.1	7.5	9.7	0.1	0.7	24.3	17.3	8	11.1	0.1	0.9
Greenhills Road	Left	8.5	5.2	7.7	8.9	2.2	1.4	11	6.9	8.2	9.9	2.7	1.7
	Right	8.5	5.2	16.8	18.1	2.2	1.4	11	6.9	21.1	23.4	2.7	1.7
Kennedy Highway (North)	Left	0.6	1.3	5.7	5.6	0.0	0.0	0.6	1.3	5.7	5.6	0	0
	Through	17.5	25.7	0.0	0.0	0.0	0.0	20.5	30.4	0	0	0	0
Intersection		**20.9**	**25.7**	**0.6**	**0.5**	**2.2**	**1.4**	**24.3**	**30.4**	**0.6**	**0.6**	**2.7**	**1.7**

Table 13-47: Kennedy Highway / Greenhills Road intersection assessment results for 2027 with and without Stage 1,2 & 3

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Kennedy Highway (South)	Through	25.4	18.5	0.0	0.2	0.1	1.1	28.8	20.7	0	0.3	0.1	1.4
	Right	25.4	18.5	8.2	11.3	0.1	1.1	28.8	20.7	9	13.2	0.1	1.4
Greenhills Road	Left	14.4	8.8	8.4	10.0	3.5	2.1	19.1	12	9.6	11.3	4.6	2.8
	Right	14.4	8.8	22.7	25.2	3.5	2.1	19.1	12	29.9	33.5	4.6	2.8
Kennedy Highway (North)	Left	0.7	1.6	5.6	5.6	0.0	0.0	0.7	1.6	5.6	5.6	0	0
	Through	21.4	31.3	0.0	0.0	0.0	0.0	24.3	36.1	0	0	0	0
Intersection		**25.4**	**31.3**	**0.7**	**0.7**	**3.5**	**2.1**	**28.8**	**36.1**	**0.8**	**0.7**	**4.6**	**2.8**

The above results show that the intersection will operate within acceptable limits across all design years with the addition of the development traffic requiring no mitigation measures to address capacity.

In addition to the capacity assessment, an assessment of the existing right turn treatment from the Kennedy Highway to Greenhills Road was completed based on the guidelines presented in the Austroads Guide to Road Design Part 4 (2017). This assessment was conducted on the Stage 2 traffic volumes as they

represent the trigger for the installation of a Channelised Right Turn (Short) (CHR (S)) treatment at this location. The intersection currently features an Auxiliary Right Turn (AUR) treatment, however the assessment results presented in Figure 13-44 show that the traffic volumes warrant the use of a CHR(S) in the 2024 with and without development scenarios. Therefore a CHR(S) is to be installed for safety reasons to provide protection to turning vehicles prior to the completion of Stage 2, noting that the intersection capacity will not be affected.

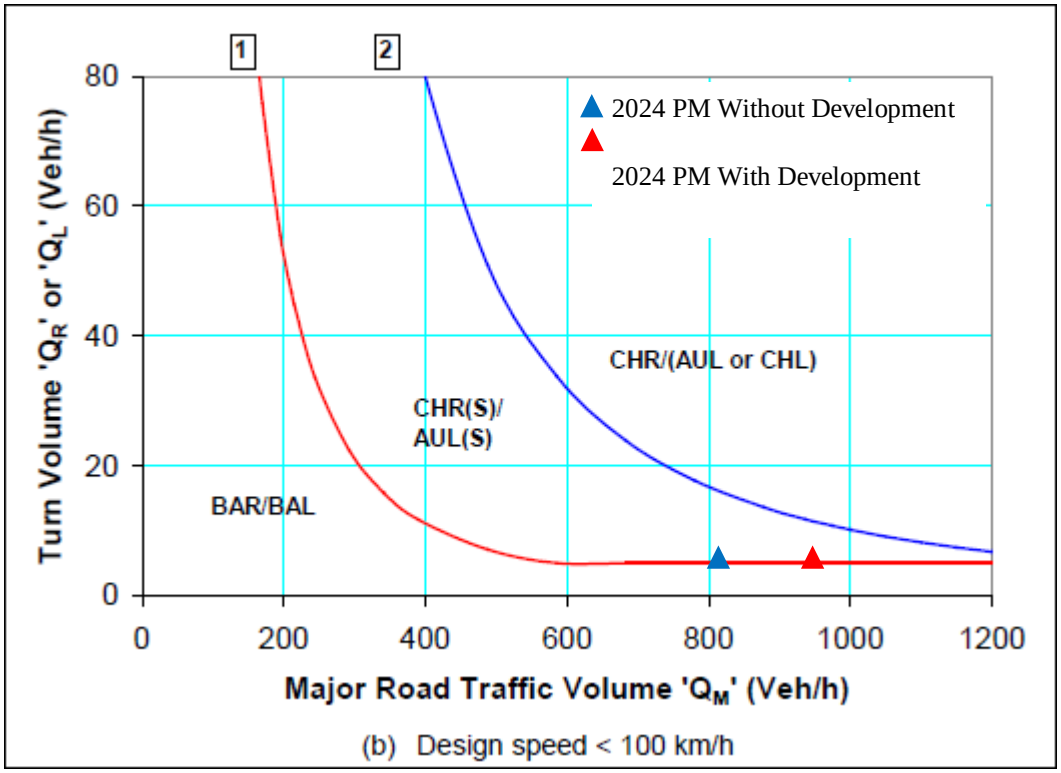


Figure 13-44: Turn warrant assessment of the Kennedy Highway / Greenhills Road intersection

13.6.1.5 Captain Cook Highway / Kennedy Highway / Mount Milman Drive

The Captain Cook Highway / Kennedy Highway / Mount Milman Driver intersection is a two-lane roundabout. An indicative layout of the intersection is seen below in Figure 13-45. The intersection currently features heavy congestion in both the morning and evening peak periods; however, the soon to be constructed Smithfield Bypass (due for completion in 2021) is anticipated to significantly ease congestion at this location. Analysis has been carried out for Stage Two (2024) onwards as the traffic volume generated by the development is expected to increase beyond 5% of background traffic upon completion of Stage Two.

Due to the construction of the bypass the traffic volumes at this location are anticipated to change significantly. Therefore, background traffic volumes for the analysis have been obtained from the 2021 CSTM with a growth rate applied to determine 2024, 2027 and 2037 traffic volumes as the CSTM takes into account the construction of the Smithfield Bypass. A summary of the traffic volumes used in the SIDRA assessment are in Appendix 13N.

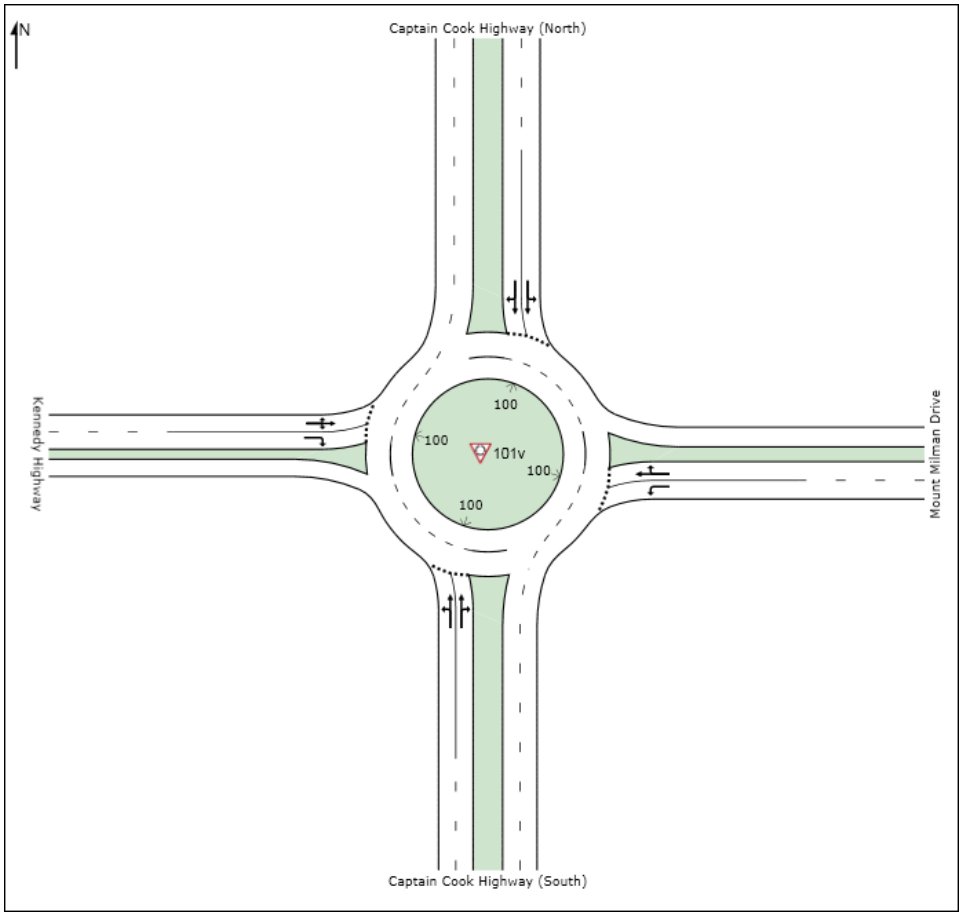


Figure 13-45: Captain Cook Highway / Kennedy Highway / Mount Milman Drive intersection layout

Table 13-48: Captain Cook Highway / Kennedy Highway / Mount Milman Drive intersection assessment results for 2024 with and without Stage 1 & 2.

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Captain Cook Highway (South)	Left	30	43.9	1.8	1.9	14.7	26.2	30.1	43.9	1.8	1.9	14.8	26.3
	Through	30	43.9	2.3	2.3	14.7	26.2	30.1	43.9	2.3	2.3	14.8	26.3
	Right	30	43.9	9.4	9.5	14	25.7	30.1	43.9	9.4	9.5	14.0	25.7
Mount Milman Drive (East)	Left	1.9	5	5.7	3.6	1	1.8	1.9	5.0	5.7	3.6	1.0	1.8
	Through	0.2	1.1	5.5	4.1	0.1	0.3	0.2	1.1	5.5	4.1	0.1	0.3
	Right	0.2	1.1	12.6	11.2	0.1	0.3	0.2	1.1	12.6	11.2	0.1	0.3
Captain Cook Highway (North)	Left	47.7	28.4	3.6	2.7	22.5	11.1	47.7	28.4	3.6	2.7	22.5	11.2
	Through	47.7	28.4	4.5	3.4	22.5	11.1	47.7	28.4	4.5	3.4	22.5	11.2
	Right	47.7	28.4	12.1	10.7	21.3	10.4	47.7	28.4	12.1	10.7	21.3	10.4

Kennedy Highway	Left	30.2	24.5	3.5	4.1	11.6	9.9	30.2	24.6	3.5	4.1	11.7	10.0
	Through	30.2	24.5	4	4.5	11.6	9.9	30.2	24.6	4.0	4.5	11.7	10.0
	Right	30.2	24.5	11.5	12.3	11.6	9.9	30.2	24.6	11.5	12.3	11.7	10.0
Intersection		**47.7**	**43.9**	**5.3**	**4.2**	**22.5**	**26.2**	**47.7**	**43.9**	**5.3**	**4.2**	**22.5**	**26.3**

Table 13-49: Captain Cook Highway / Kennedy Highway / Mount Milman Drive intersection assessment results for 2027 with and without Stage 1, 2 & 3.

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Captain Cook Highway (South)	Left	31.9	46.6	1.8	1.9	16.1	29.2	35.2	48.1	1.8	1.9	18.6	31.3
	Through	31.9	46.6	2.3	2.3	16.1	29.2	35.2	48.1	2.3	2.3	18.6	31.3
	Right	31.9	46.6	9.4	9.5	15.4	28.6	35.2	48.1	9.4	9.5	17.8	30.5
Mount Milman Drive (East)	Left	2.2	5.5	6.2	3.8	1.2	2.1	2.3	5.7	6.6	4.1	1.3	2.3
	Through	0.2	1.1	6.1	4.2	0.1	0.3	0.2	1.1	6.5	4.4	0.1	0.4
	Right	0.2	1.1	13.2	11.3	0.1	0.3	0.2	1.1	13.6	11.5	0.1	0.4
Captain Cook Highway (North)	Left	51.7	30.6	3.9	2.8	26.2	12.3	53.5	32.7	4.2	3	28.3	13.5
	Through	51.7	30.6	4.9	3.5	26.2	12.3	53.5	32.7	5.2	3.8	28.3	13.5
	Right	51.7	30.6	12.5	10.8	24.5	11.4	53.5	32.7	12.9	11.2	26.1	12.4
Kennedy Highway	Left	32.5	26.6	3.6	4.3	12.8	11	35.5	32.9	3.8	4.5	14.8	14.3
	Through	32.5	26.6	4.2	4.7	12.8	11	35.5	32.9	4.4	4.9	14.8	14.3
	Right	32.5	26.6	11.6	12.5	12.8	11	35.5	32.9	11.8	12.8	14.8	14.3
Intersection		**51.7**	**46.6**	**5.4**	**4.2**	**26.2**	**29.2**	**53.5**	**48.1**	**5.6**	**4.7**	**28.3**	**31.3**

Table 13-50: Captain Cook Highway / Kennedy Highway / Mount Milman Drive intersection assessment results for 2037 with and without Stage 1, 2 & 3.

Approach	Movement	Without Development						With Development					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Captain Cook Highway (South)	Left	38.9	56.9	1.8	1.9	22.1	43.3	42.2	58.4	1.8	1.9	25.3	46.6
	Through	38.9	56.9	2.3	2.3	22.1	43.3	42.2	58.4	2.3	2.4	25.3	46.6
	Right	38.9	56.9	9.4	9.6	21.1	42.9	42.2	58.4	9.4	9.6	24.1	46.1
	Left	3.6	7.5	9.6	4.4	2.4	3.2	3.8	8.1	10.6	5	2.6	3.6
	Through	0.3	1.3	9.5	4.7	0.2	0.5	0.3	1.3	10.4	5.3	0.2	0.6

Mount Milman Drive (East)	Right	0.3	1.3	16.6	11.8	0.2	0.5	0.3	1.3	17.5	12.4	0.2	0.6
Captain Cook Highway (North)	Left	69.1	39.8	5.7	3	47.1	17.5	71.9	42.7	6.3	3.3	51.7	19.6
	Through	69.1	39.8	7	3.8	47.1	17.5	71.9	42.7	7.7	4.2	51.7	19.6
	Right	69.1	39.8	15	11.2	42.2	16	71.9	42.7	15.8	11.8	45.6	18.2
Kennedy Highway	Left	41.7	35.6	4.2	5.3	17.8	16.4	45.2	42.8	4.6	5.9	21.4	22.1
	Through	41.7	35.6	4.7	5.7	17.8	16.4	45.2	42.8	5.2	6.3	21.4	22.1
	Right	41.7	35.6	12.5	13.8	17.8	16.4	45.2	42.8	13	14.6	21.4	22.1
Intersection		**69.1**	**56.9**	**6.5**	**4.6**	**47.1**	**43.3**	**71.9**	**58.4**	**6.8**	**5.1**	**51.7**	**46.6**

The above results indicate that the intersection will operate within the acceptable limits in both the with and without development scenario with a maximum DoS of 71.9% in the 2037AM with development scenario. No further mitigation measures are required at this intersection.

13.6.2 Road link assessment

The capacity of the road links within the study area were assessed using the guidelines from the HCM2010. The key road links assessed within the study area are:

Kennedy Highway (Kuranda to Cairns)

Kennedy Highway (Kuranda to Mareeba)

Rob Veivers Drive

Myola Road

Barnwell Road.

Three key performance measures of road link LoS were assessed:

- Percent Time Spent Following (PTSF) (%) – The PTSF is the average percent of total travel time that vehicles must travel in platoons behind slower vehicles due to the inability to pass on a two-lane highway. The PTSF is the key performance measure of Class One and Two Highways in accordance with the HCM.
- Percent At Free Flow Speed (PFFS) (%) – The PFFS represents the ability of vehicles to travel at or near the posted speed limit. It is the primary measure of LoS for Class Three Highways.
- Average Travel Speed (ATS) (km/h) – ATS reflects mobility on a two-lane highway and is the segments length divided by the average travel time for vehicles to traverse the segment.

The overall LoS for the road links are determined in accordance with the relevant performance measures for each highway class. The LoS benchmarks are summarised in Table 13-51.

Table 13-51: Level of Service benchmarks for Class One, Two and Three Highways.

Level of Service	Class One Highways[24]		Class Two Highways	Class Three Highways
	PTSF (%)	ATS (km/h)	PTSF (%)	PFFS (%)
A	≤35	>88	≤40	>91.7
B	>35 – 50	>80 – 88	>40 – 55	>83.3 – 91.7
C	>50 – 65	>72 – 80	>55 – 70	>75 – 83.3

[24] For Class One Highways, LoS is determined by the worse of ATS and PTSF based LoS.

D	>65 – 80	>64 –72	>70 – 85	>66.7 –75
E	>80	<64	>85	<66.7

In accordance with the methodology in Chapter 15 of the HCM2010:

- The Kennedy Highway (Cairns to Kuranda) was assessed as a Class Two two-way two-lane highway (in two segments, Ch0.0-0.11 and Ch11.0 – 14.0).
- The Kennedy Highway (Kuranda to Mareeba) was assessed as a Class One two-way two-lane highway.
- Myola Road and Barnwell Road were assessed as Class Three two-way two-lane highways.

As Rob Veivers Drive is an urban road, featuring interrupted vehicle flows and no overtaking it was assessed based on lane capacity of 800 vph per lane.

The traffic generation of the development has been developed to estimate the number of heavy vehicles including buses generated by the development. The HCM assessment of road link capacity takes into account the impact these vehicles have on the traffic flow and capacity. Results of the HCM assessments are provided in Appendix 13U.

13.6.2.1 Kennedy Highway (Cairns to Kuranda)

The capacity of the Kennedy Highway between Kuranda and Cairns was assessed as two segments of a Class Two two-lane Highway in accordance with the guidelines in Chapter 15 of the HCM2016 due to difference in speed zone and terrain type.

13.6.2.1.1 *Kennedy Highway (Ch0.0km – 11.0km)*

This segment of the Kennedy Highway was assessed using the following assumptions:

- Section was assessed as a specific upgrade/downgrade (as the gradient is estimated to be in excess of 6.5% in both directions).
- The typical lane and shoulder width is 3.75m and 0.75m respectively.
- The percentage of no passing zones was assumed to be 80%.
- The access point density was taken as 1.0 accesses per kilometre.

The results of the capacity assessments are seen in Figure 13-46 and Figure 13-47 and are based on the PTSF. The assessment is directionally based, with reference to Cairns Bound (CB) and Kuranda Bound (KB) directions. The assessment shows that this section of the Kennedy Highway has sufficient capacity to accommodate the AM Peak without development traffic volumes to 2037 in both directions, with the PTSF reaching a maximum of 69.6% (LoS D is 70%).
The addition of the development traffic causes the AM Peak LoS to increase from LoS C to LoS D in 2027 for Cairns bound vehicles and in 2032 for Kuranda bound vehicles, reaching a maximum PTSF of 73% for Cairns bound traffic, 3.1% worse than the without development scenario.

The assessment showed that this section of the Kennedy Highway will operate at LoS D in the PM Peak in both directions within the design horizon with only forecast background traffic growth (i.e. LoS D will be reached without the addition of development traffic), with Cairns bound traffic reaching LoS D in approximately 2028 (maximum PTSF of 74.3%) and Kuranda bound traffic reaching LoS D in 2031 (maximum PTSF of 73.1%) without development traffic.

The addition of the development traffic causes the PM peak Cairns bound traffic to reach LoS D at the completion of Stage One construction in 2021, while the PM peak Kuranda bound traffic will reach LoS D in approximately 2028. The PM Peak reaches a maximum PTSF of 79.3% (increase of 4.8%) in 2037 for Cairns bound traffic and 74.5% for Kuranda bound traffic (increase of 1.4%).

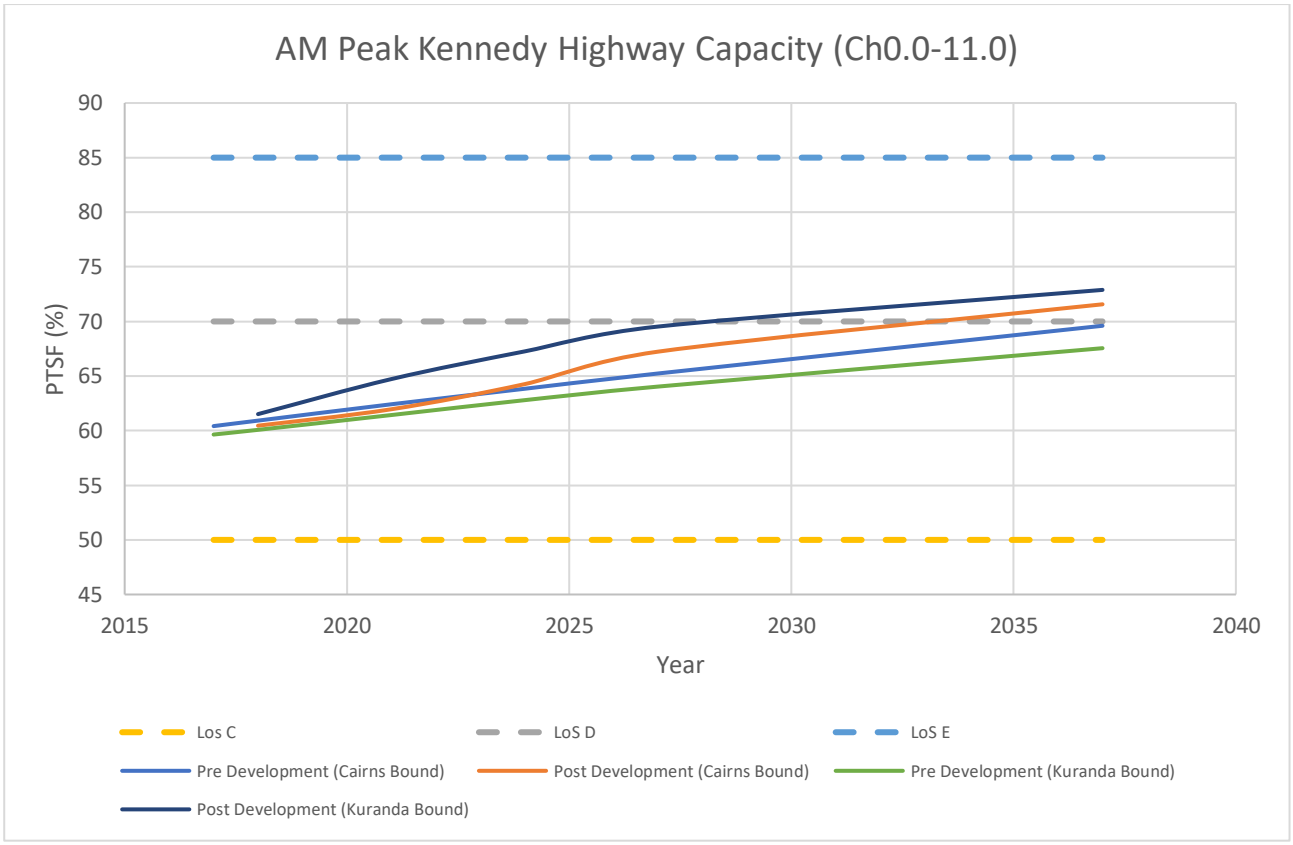


Figure 13-46: Kennedy Highway (Cairns to Kuranda) AM Peak capacity assessment.

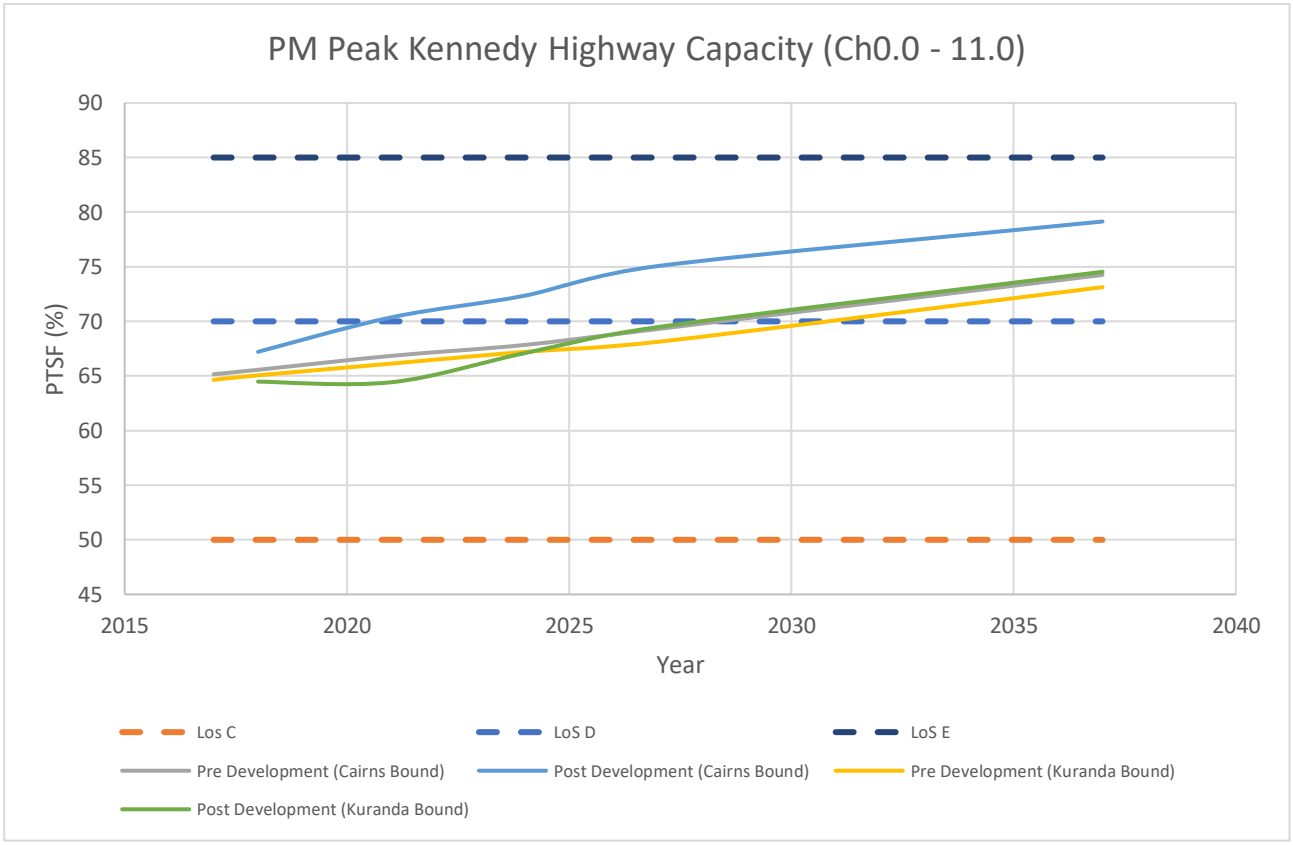


Figure 13-47: Kennedy Highway (Cairns to Kuranda) PM Peak capacity assessment.

It is also noted that there is an initial improvement in the level of service during Stage One operation/Stage Two construction in the AM Cairns bound and PM Kuranda bound directions due to a reduction the number of trips. This is due to a change in employment related trip origin/destination during the initial operation and construction of the resort by Kuranda residents to be employed at the resort.

13.6.2.1.2 *Kennedy Highway (Ch11.0km – 14.0km)*

This segment of the Kennedy Highway was assessed using the following assumptions:

- Section was assessed as a rolling highway.
- The typical lane and shoulder width is 3.5m and 1.0m respectively.
- The percentage of no passing zones was assumed to be 80%.
- The access point density was taken as 4.0 accesses per kilometre.

The results of the capacity assessments are seen in Figure 13-48 and Figure 13-49 and are based on the PTSF. The assessment is directionally based, Cairns bound and Kuranda bound, and shows that this section of the Kennedy Highway has sufficient capacity to accommodate the AM Peak without development traffic volumes in both directions to 2037 with Cairns bound traffic reaching a maximum PTSF of 69.9%.

The addition of the development traffic causes the level of service to increase from LoS C to LoS D in 2027 for Kuranda bound vehicles and in 2032 for Cairns bound vehicles. Cairns bound traffic on this section reaches a maximum PTSF of 72.1% (an increase of 2.2%), while Kuranda bound traffic reaches a maximum PTSF of 72.8% (an increase of 5.3%).

The assessment showed that this section of Kennedy Highway will operate at LoS D in the PM Peak within the design horizon with only forecast traffic growth, with Cairns bound traffic reaching LoS D in approximately 2028 and a maximum PTSF of 74.5% and Kuranda bound traffic reaching LoS D in 2031 and a maximum PTSF of 73.0%.

The addition of development traffic causes the PM peak Cairns bound traffic to reach LoS D at the completion of Stage One construction in 2021 (compared to 2028 without development traffic), while the PM peak Kuranda bound traffic will reach LoS D in approximately 2028 (compared to 2031 without development traffic). The PM Peak reaches a maximum PTSF of 79.6% (increase of 5.0%) in 2037 for Cairns bound traffic and 74.5% for Kuranda bound traffic (increase of 1.5%).

It is also noted that there is an initial improvement in the level of service during Stage One operation/Stage Two construction in the AM Cairns bound and PM Kuranda bound directions due to a reduction the number of trips. This is due to a change in employment related trip origin/destination during the initial operation and construction of the resort by Kuranda residents to be employed at the resort.

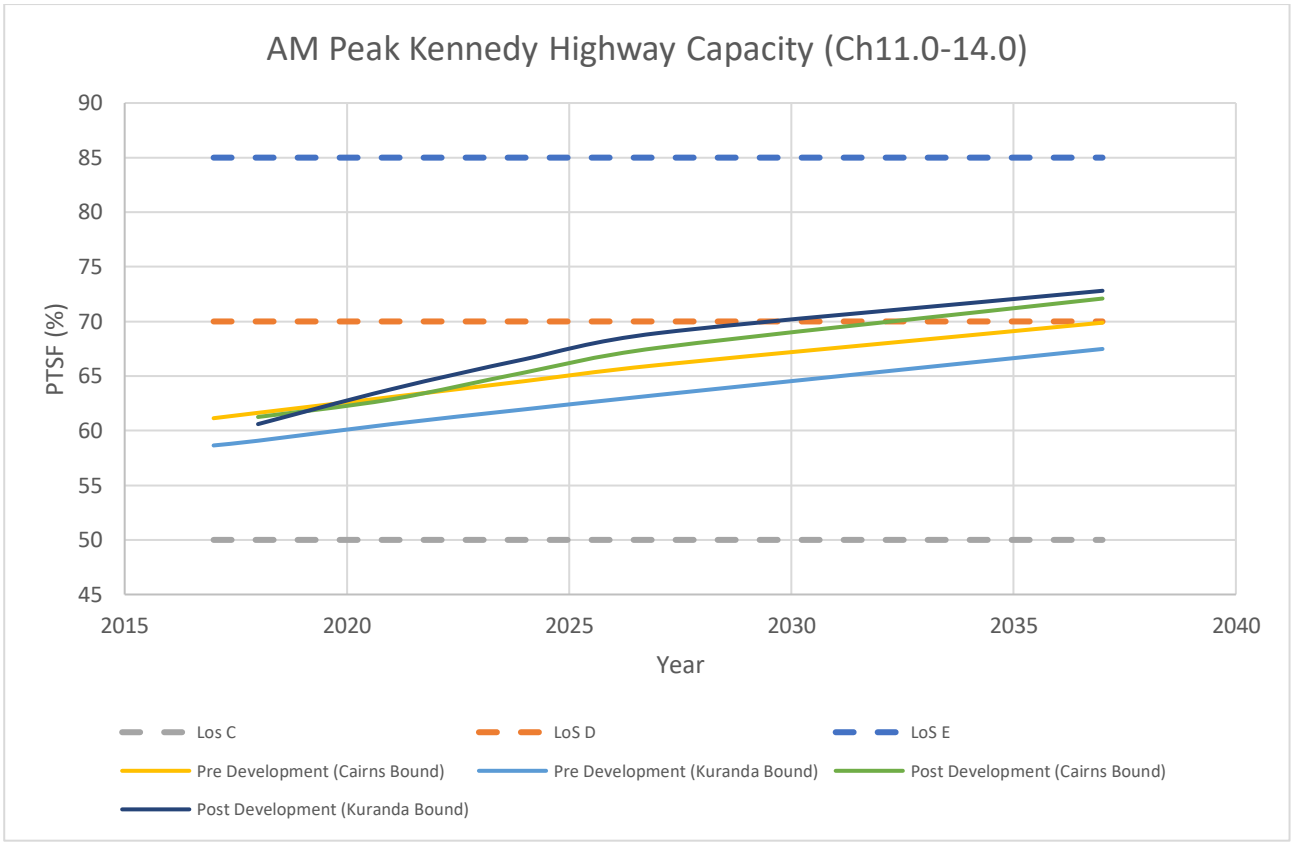


Figure 13-48: Kennedy Highway (Cairns to Kuranda) AM Peak capacity assessment.

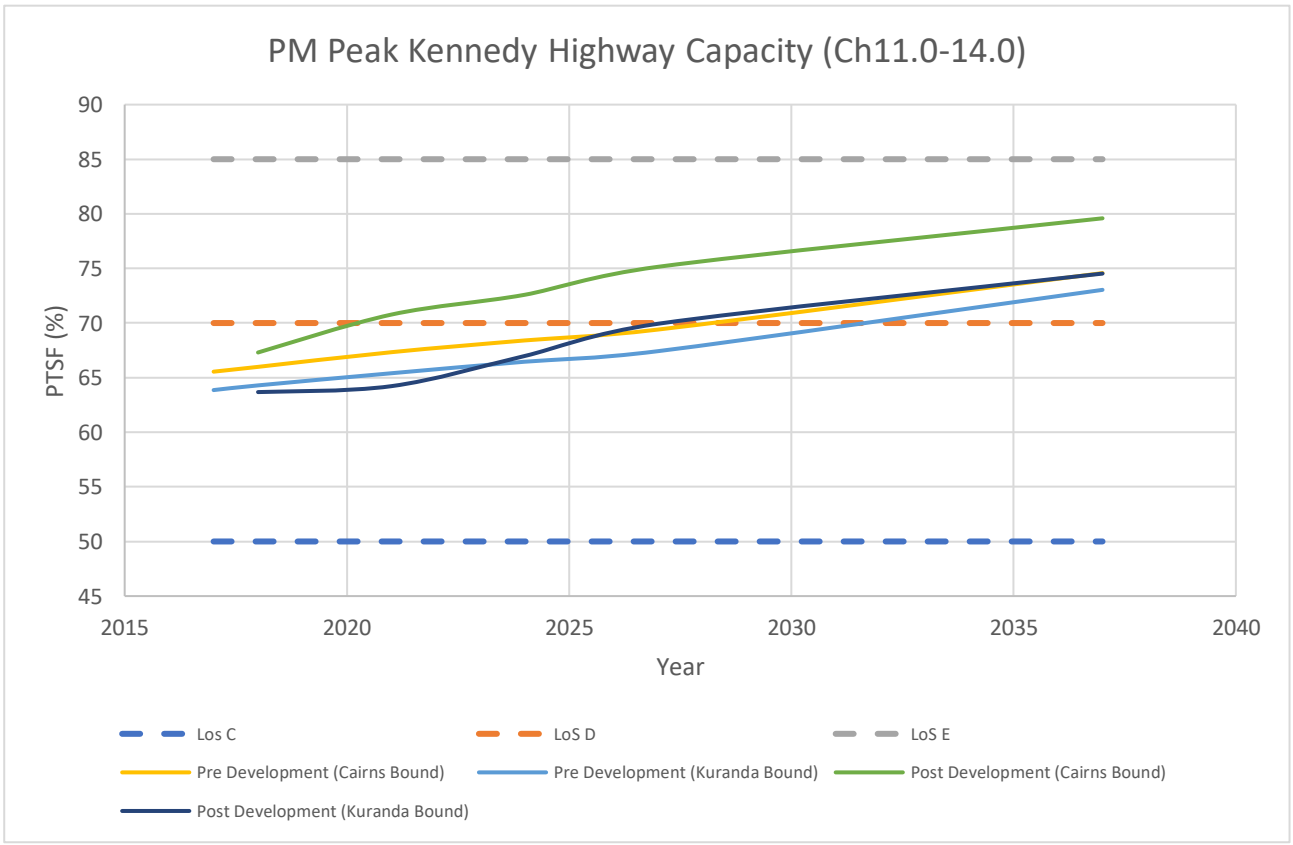


Figure 13-49: Kennedy Highway (Cairns to Kuranda) PM Peak capacity assessment.

13.6.2.1.3 *Kennedy Highway (Cairns to Kuranda) mitigation measures*

Mitigation measures to address the capacity constraints on this section of the Kennedy Highway are limited due to the extreme environmental and topographical constraints. As this section of road will operate with LoS D in the with and without the development scenarios in the design horizon, any mitigation measures proposed, will need to be provided with or without the development. Mitigation measures that have been investigated by DTMR to address capacity are believed to include:

increasing the number of overtaking opportunities

upgrading the Kennedy Highway (Kuranda Range Section) to four-lanes.

Providing additional overtaking lanes within the existing alignment is unlikely to significantly improve capacity and return the level of service to LoS C. Upgrading to four-lanes is likely to address the capacity issues and significantly improve the level of service, however it is seen as unviable on an environmental and economic basis.

It is not known how DTMR plans to address the capacity constraints of this section of the Kennedy Highway given the economic and environmental constraints faced on this section of the Kennedy Highway.

While not typically a measure of the level of service for Class Two Highways, the ATS provides an indication of the average speed of vehicles on a section of two-way two-lane highway dependent on the directional traffic volume.

Table 13-52 shows the impact of the addition of development traffic to forecast traffic volumes in 2037 when the level of service reaches LoS D for both pre and post development conditions in the PM Peak. The table illustrates that the average travel speed will decrease from between 1.2 to 3.4 km/h over this section of the Kennedy Highway. Average travel times along this section are therefore anticipated to increase by between 30 seconds to 1.3 minutes with the addition of development traffic as seen in Table 13-53.

The overall increase in travel time is expected to increase between 2.8% to 7.3% with the addition of development traffic. The larger increases in travel time occur in the AM peak period where the level of service increases from LoS C to LoS D with the addition of development traffic however, the PTSF does not increase significantly (an average increase in PTSF of 3.5%).

In addition, the decreases in ATS due to the development (when comparing to the without development scenario) are less than the anticipated decreases in ATS due to forecast traffic growth only (2017 to 2037) as seen in Table 13-54.

As the current PTSF of this section is high in the without development scenario, minor changes to PTSF such as those caused by the development are unlikely to be noticed by drivers. Therefore, it is recommended that the ATS be taken into consideration when assessing the capacity of this section of the Kennedy Highway.

With only marginal increases in PTSF with the addition of development traffic, and minor decreases in ATS, it has been assumed that that LoS D is likely a suitable level of service for this section of the Kennedy Highway when considering the constraints of potential mitigation measures. Therefore, it is recommended that LoS D is accepted as a suitable level of service, with this level of service considered acceptable no mitigation measures to improve link capacity are required. Mitigation measures to address road safety and crash frequency are proposed in Section 13.6.2.1.

Table 13-52: Change in Average Travel Speed on the Kennedy Highway (Cairns to Kuranda) due to the addition of development traffic to the forecast 2037 traffic volumes.

Section	Direction	AM Pre-Dev (km/h)	AM Post-Dev (km/h)	Change in ATS (km/h)	PM Pre-Dev (km/h)	PM Post-Dev (km/h)	Change in ATS (km/h)

Kennedy Highway (Ch 0.0 – 11.0km)	Cairns Bound	44.7 (LoS C)	41.3 (LoS D)	-3.4	43.6 (LoS D)	42.1 (LoS D)	-1.5
	Kuranda Bound	42.9 (LoS C)	39.7 (LoS D)	-3.2	42.5 (LoS D)	41.3 (LoS D)	-1.2
Kennedy Highway (Ch 11.0 – 14.0km)	Cairns Bound	71.6 (LoS C)	69.9 (LoS D)	-1.8	69.2 (LoS D)	67.3 (LoS D)	-1.9
	Kuranda Bound	71.8 (LoS C)	69.8 (LoS D)	-2.0	69.4 (LoS D)	67.7 (LoS D)	-1.8

Table 13-53: Travel time increases on the Kuranda Range (Ch0.0-14.0) for the 2037 pre and post development scenarios in the AM and PM peak.

Route	Pre-Development Travel Time (mins)	Post-Development Travel Time Increase (mins)	Percentage Travel Time Increase (%)
To Cairns (AM Peak)	17.3	1.25	7.3%
To Kuranda (AM Peak)	17.9	1.31	7.3%
To Cairns (PM Peak)	17.7	0.64	3.6%
To Kuranda (PM Peak)	18.1	0.51	2.8%

Table 13-54: Expected change in ATS with forecast traffic growth from 2017 to 2037.

Section	Direction	Peak Period	2017 without Development ATS	2037 without Development ATS	Change in ATS (km/h)
Kennedy Highway (Ch 0.0 – 11.0km)	Cairns Bound	AM	48.2	44.7	-3.5
		PM	47.8	43.6	-4.2
	Kuranda Bound	AM	45.0	42.9	-2.1
		PM	45.1	42.5	-2.6
Kennedy Highway (Ch 11.0 – 14.0km)	Cairns Bound	AM	74.7	71.6	-3.1
		PM	73.4	69.2	-4.2
	Kuranda Bound	AM	74.8	71.8	-3
		PM	73.5	69.4	-4.1

13.6.2.2 Kennedy Highway (Kuranda to Mareeba)

The capacity of the Kennedy Highway between Kuranda and Mareeba (from Ch. 20.0km –Ch. 42.0km) was assessed as a Class One Two-lane Highway in accordance with the guidelines in Chapter 15 of the HCM2016. This segment was assessed as a rolling highway with a typical lane and shoulder width of 3.7m and 1.0m respectively. The percentage of no passing was assumed to be 40% and the access point density was taken as 3.2 per km.

The results of the capacity assessments are seen in Figure 13-50 and Figure 13-51 and are based on the PTSF. The assessment is directionally based, Mareeba Bound (MB) and Kuranda Bound (KB) and shows that the Kennedy Highway has capacity to accommodate all future peak traffic volumes without the PTSF exceeding the desired LoS C except the Mareeba Bound 2037 PM Peak Post Development traffic which reaches LoS D in 2033. It should also be note that the analysis showed that there was limited change to the Average Travel Speed (ATS) across all years with the ATS remaining at LoS A.

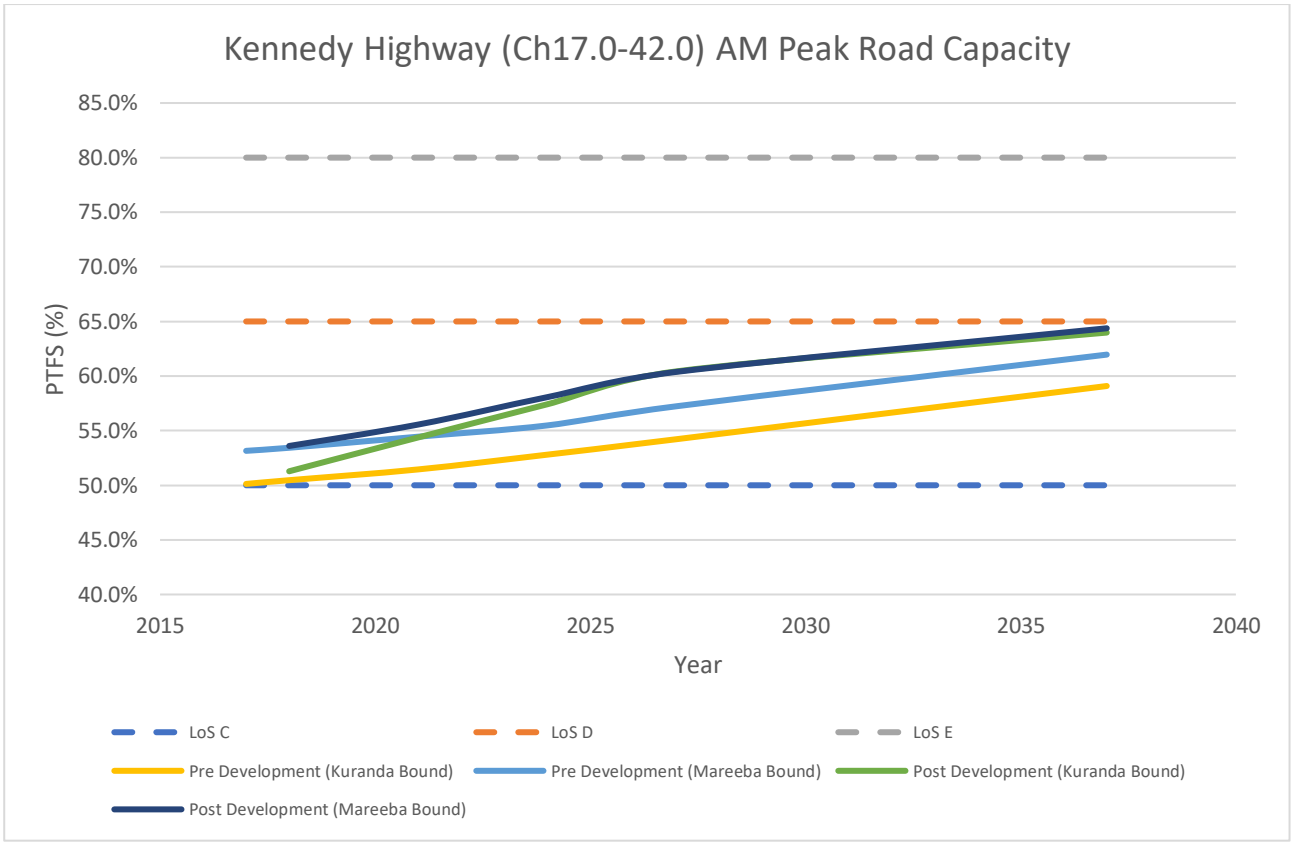


Figure 13-50: Kennedy Highway (Kuranda to Mareeba) AM Peak Capacity Assessment

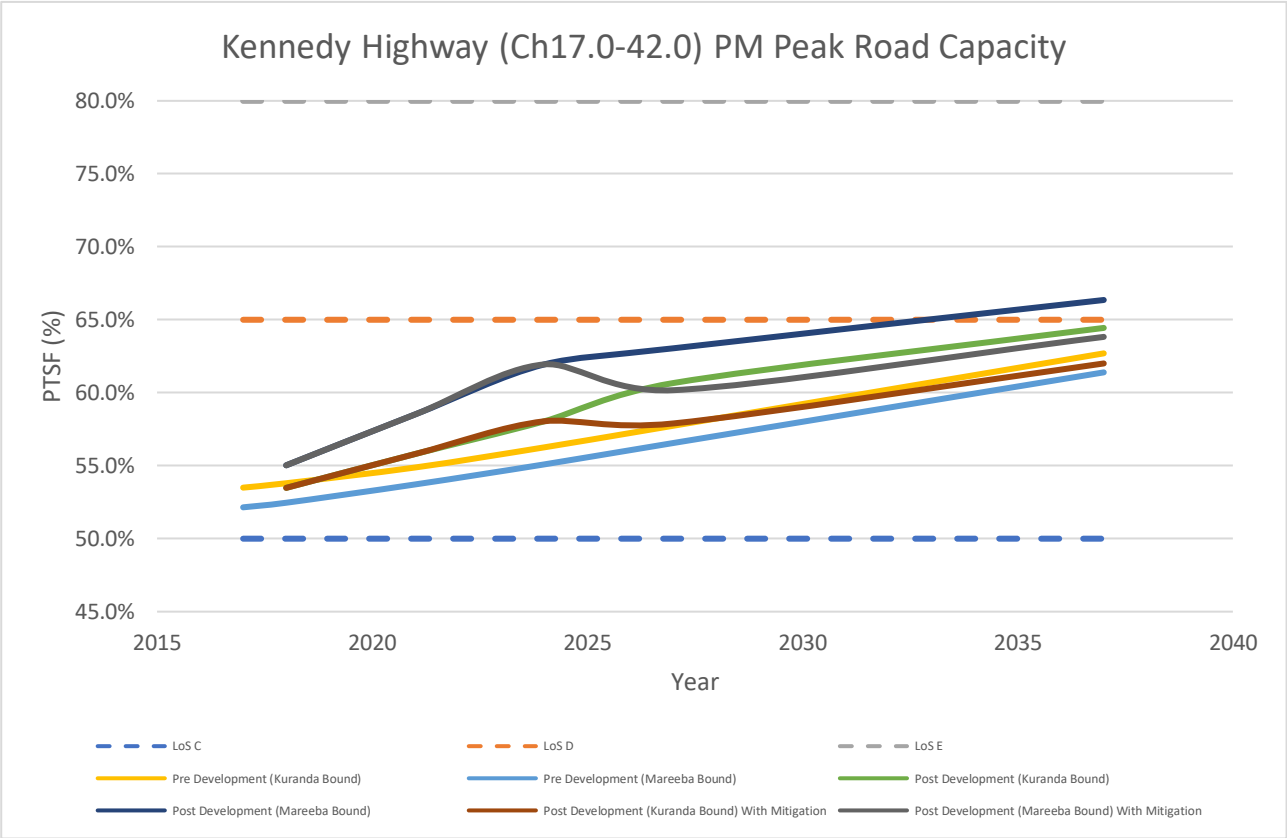


Figure 13-51: Kennedy Highway (Kuranda to Mareeba) PM Peak Capacity Assessment

13.6.2.2.1 *Kennedy Highway (Kuranda to Mareeba) mitigation measures*

To improve the 2037 Mareeba Bound PM Post Development traffic, an additional overtaking lane is to be provided to increase the overtaking opportunities prior to the completion of the Stage 3 of the development to improve the level of service. It is anticipated that with an additional overtaking opportunity the LoS will remain at LoS C as seen in Figure 13-51**.** The most suitable location for the overtaking lane is to be determined in consultation with DTMR.

13.6.2.3 Rob Veivers Drive

As Rob Veivers Drive typically has interrupted flow characteristics due to the number of urban intersection along the link and no expectation of overtaking, the capacity of the road has been determined based on a single lane capacity model. The lane capacity of Rob Veivers Drive has been conservatively assumed to be 800 vehicles per hour per lane. This is generally in line with what has been assumed in the Cairns Strategic Transport Model. The assessment is directionally based, Site Bound (SB) and Kuranda Bound (KB), the results of the assessment can be seen in Figure 13-52 and Figure 13-53. The assessment indicates that Rob Veivers Road has sufficient capacity to accommodate the future with and without development traffic volumes with at least LoS C maintained for all design years. Therefore, no mitigation measures to address capacity at this location are required.

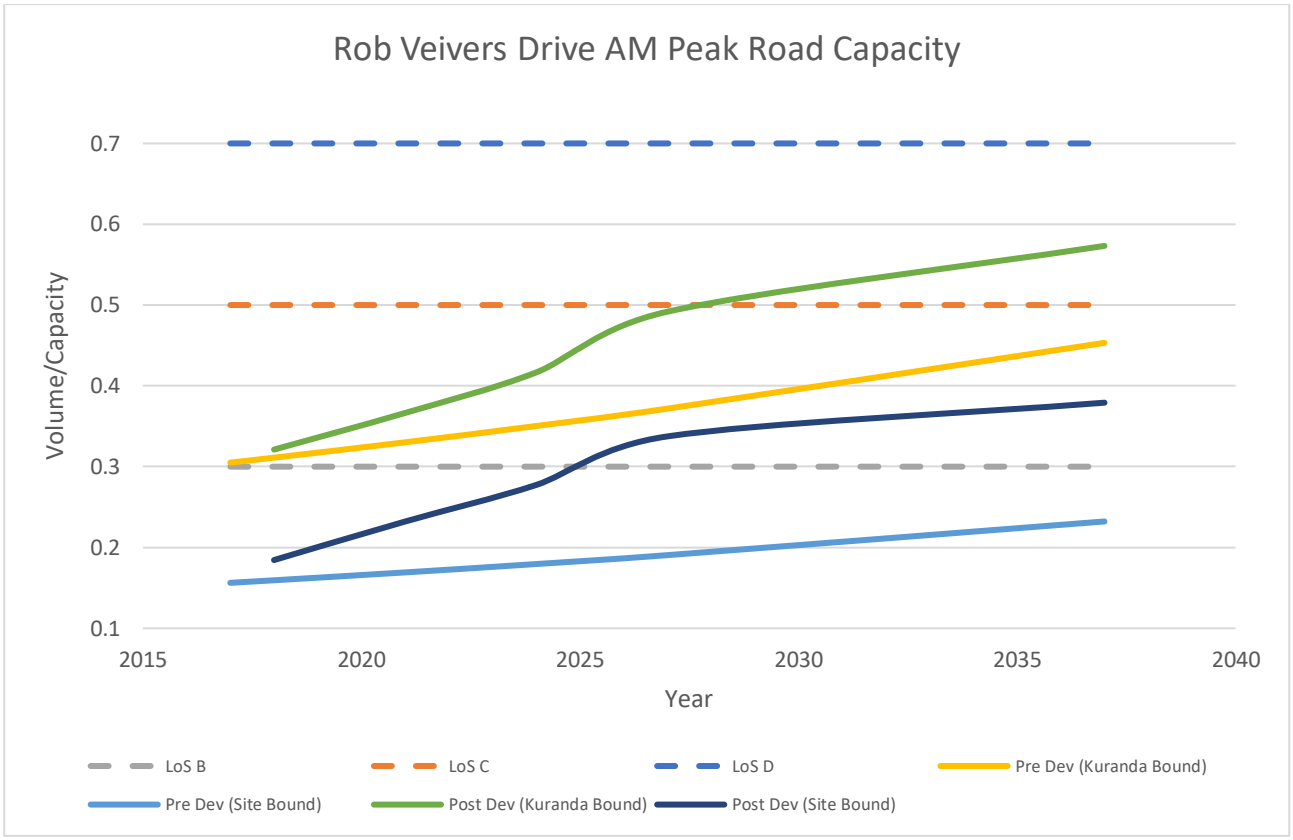


Figure 13-52: Rob Veivers Drive AM Peak capacity assessment.

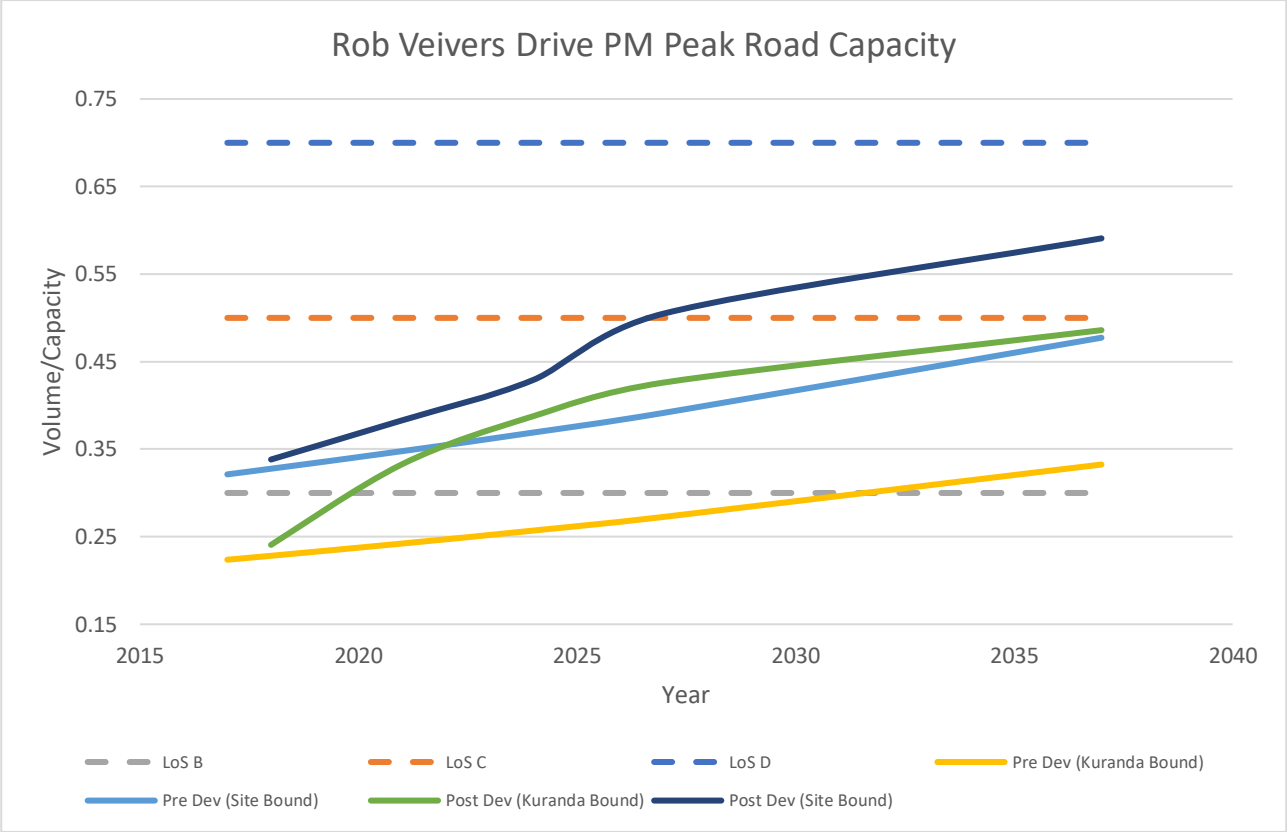


Figure 13-53: Rob Veivers Drive PM Peak capacity assessment.

13.6.2.4 Myola Road

The capacity of Myola Road was assessed as a Class Three Two-lane Highway in accordance with the guidelines in Chapter 15 of the HCM2016. This segment was assessed as a rolling highway with a typical lane and shoulder width of 3.5m and 0.5m respectively. The percentage of no passing was assumed to be 60% and the access point density was taken as 12 per km.

The results of the capacity assessment can be seen in Figure 13-54 and Figure 13-55 and is based on the PFFS. The assessments are directionally based, Site Bound (SB) and Kuranda Bound (KB) and indicates that Myola Road has sufficient capacity to accommodate the future with and without development traffic volumes with LoS C maintained for all design years. Therefore, no mitigation measures to address capacity are required for Myola Road.

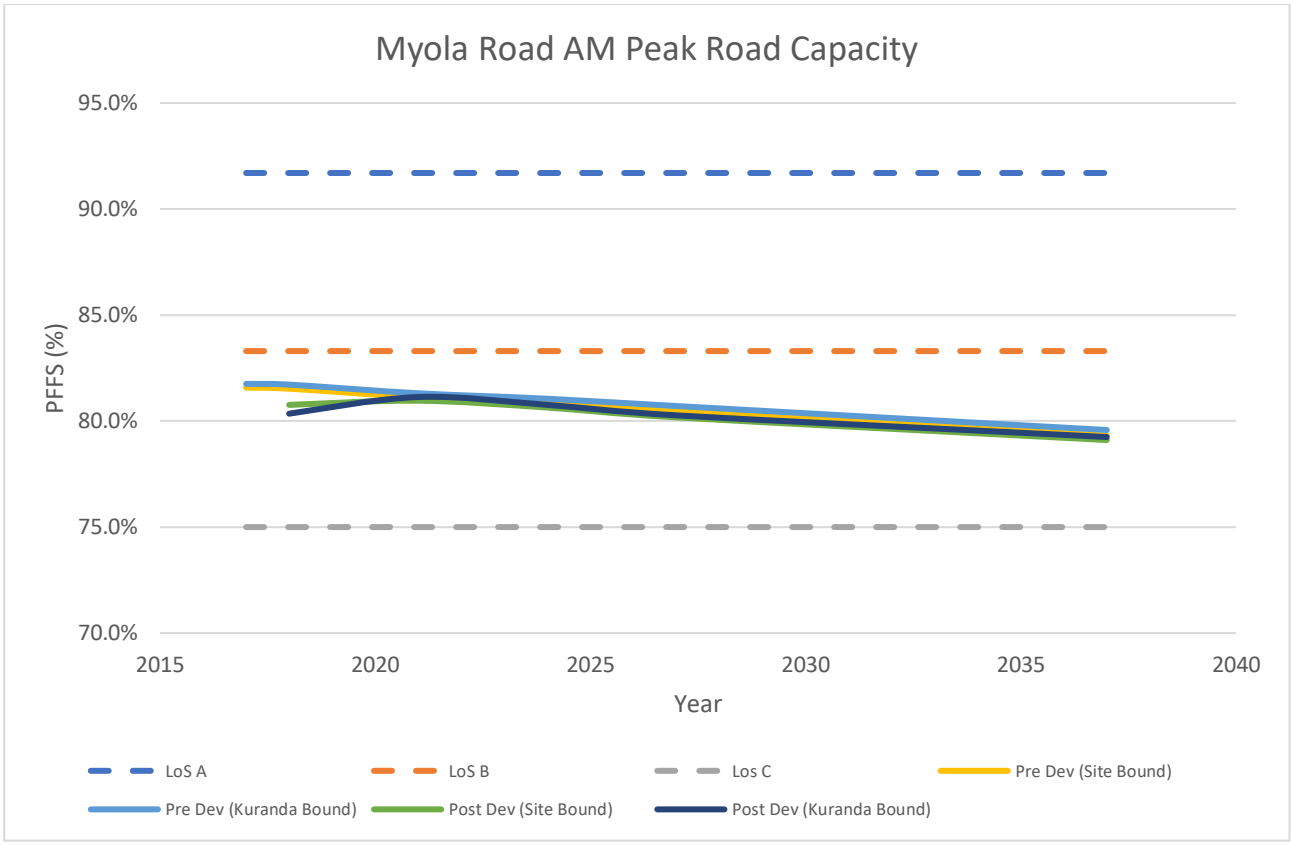


Figure 13-54: Myola Road AM Peak capacity assessment

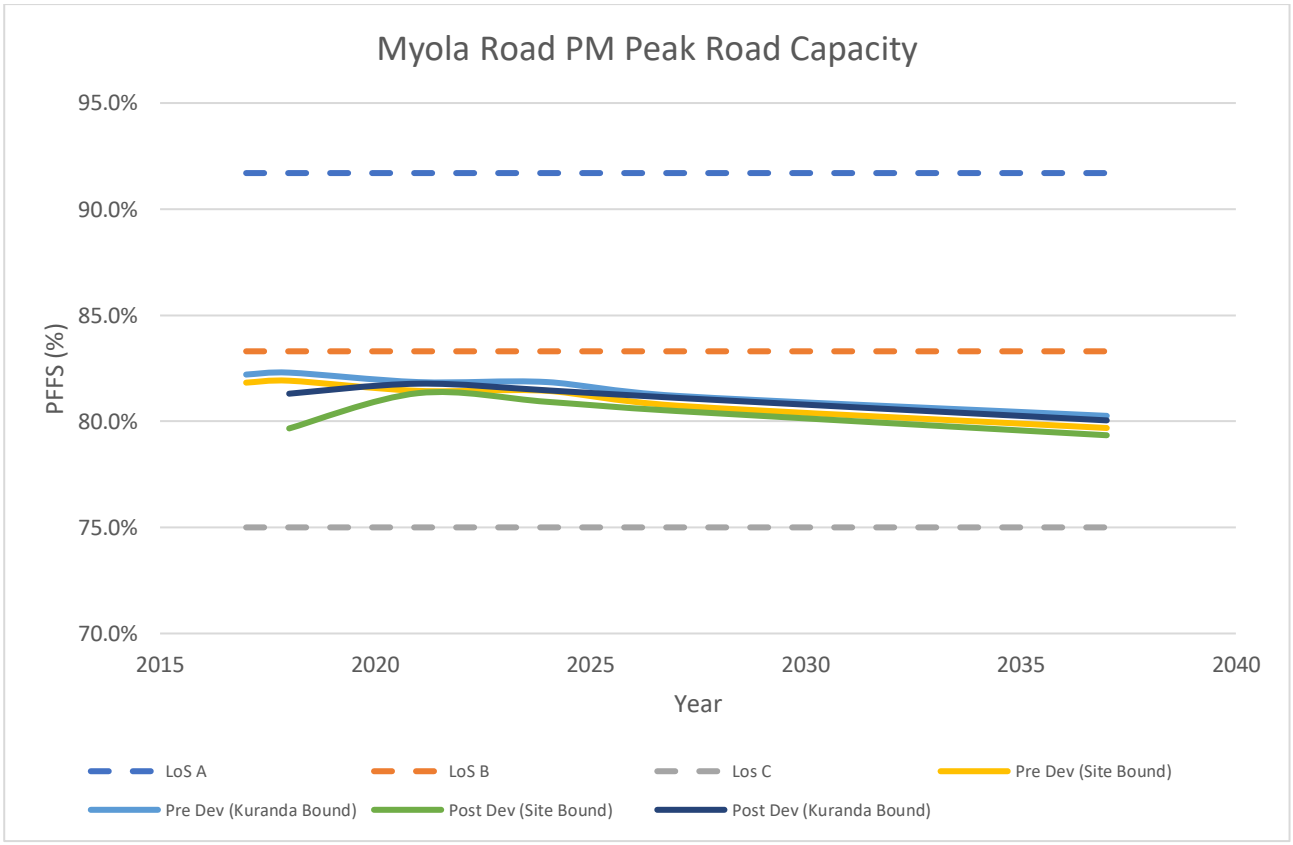


Figure 13-55: Myola Road PM Peak capacity assessment.

13.6.2.5 Barnwell Road

The capacity of Barnwell Road was assessed as a Class Three Two-lane Highway in accordance with the guidelines in Chapter 15 of the HCM2016. This segment was assessed as a rolling highway with a typical lane and shoulder width of 2.5m and 0.0m respectively. The percentage of no passing was assumed to be 100% and the access point density was taken as 10 per km.

The results of the capacity assessment can be seen in Figure 13-56: Barnwell Road AM Peak capacity assessment.

Figure 13-57 and is based on the PFFS. The assessment is directionally based, Site Bound (SB) and Kuranda Bound (KB) and indicates that Barnwell Road has sufficient capacity to accommodate the future with and without development traffic volume with LoS A/B maintained for all design years. It is proposed that Barnwell Road be widened to meet FNQROC standards however, this is not anticipated to affect the capacity assessment.

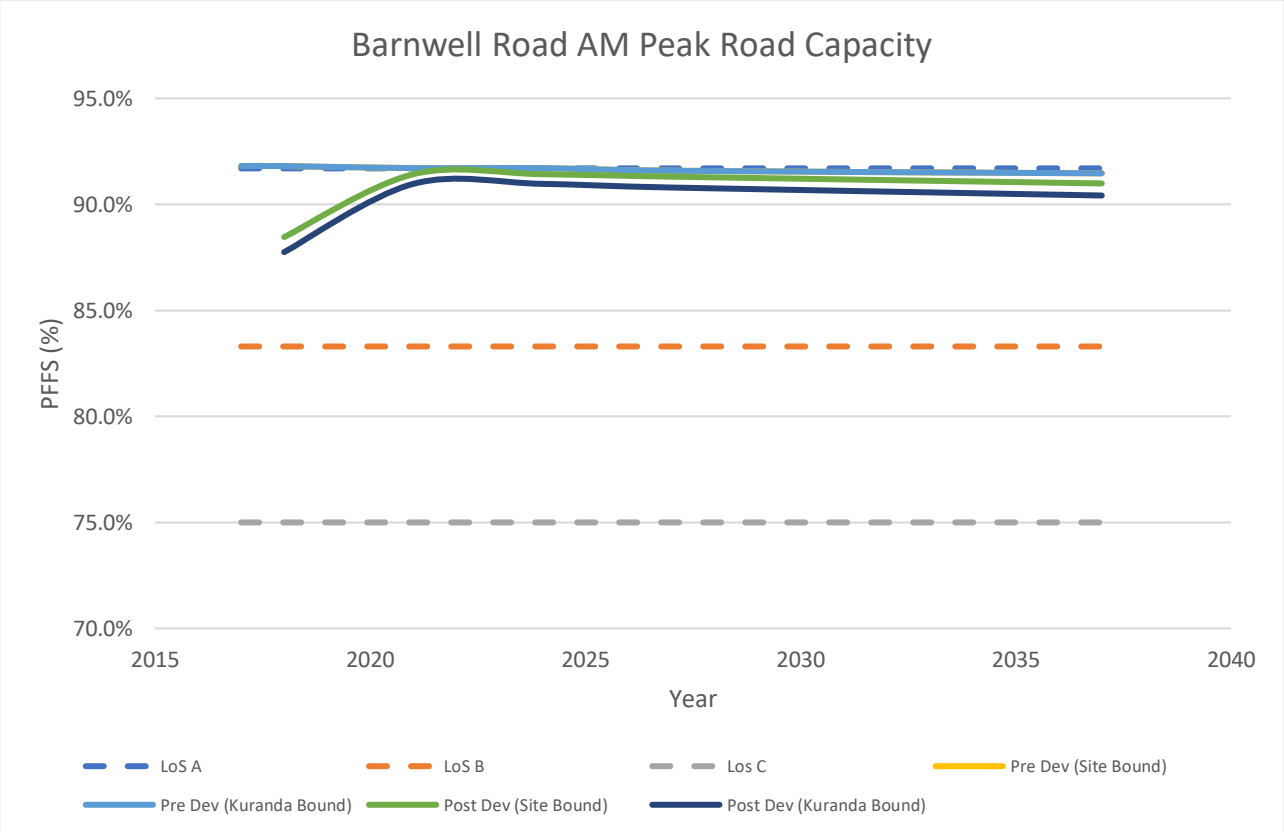


Figure 13-56: Barnwell Road AM Peak capacity assessment.

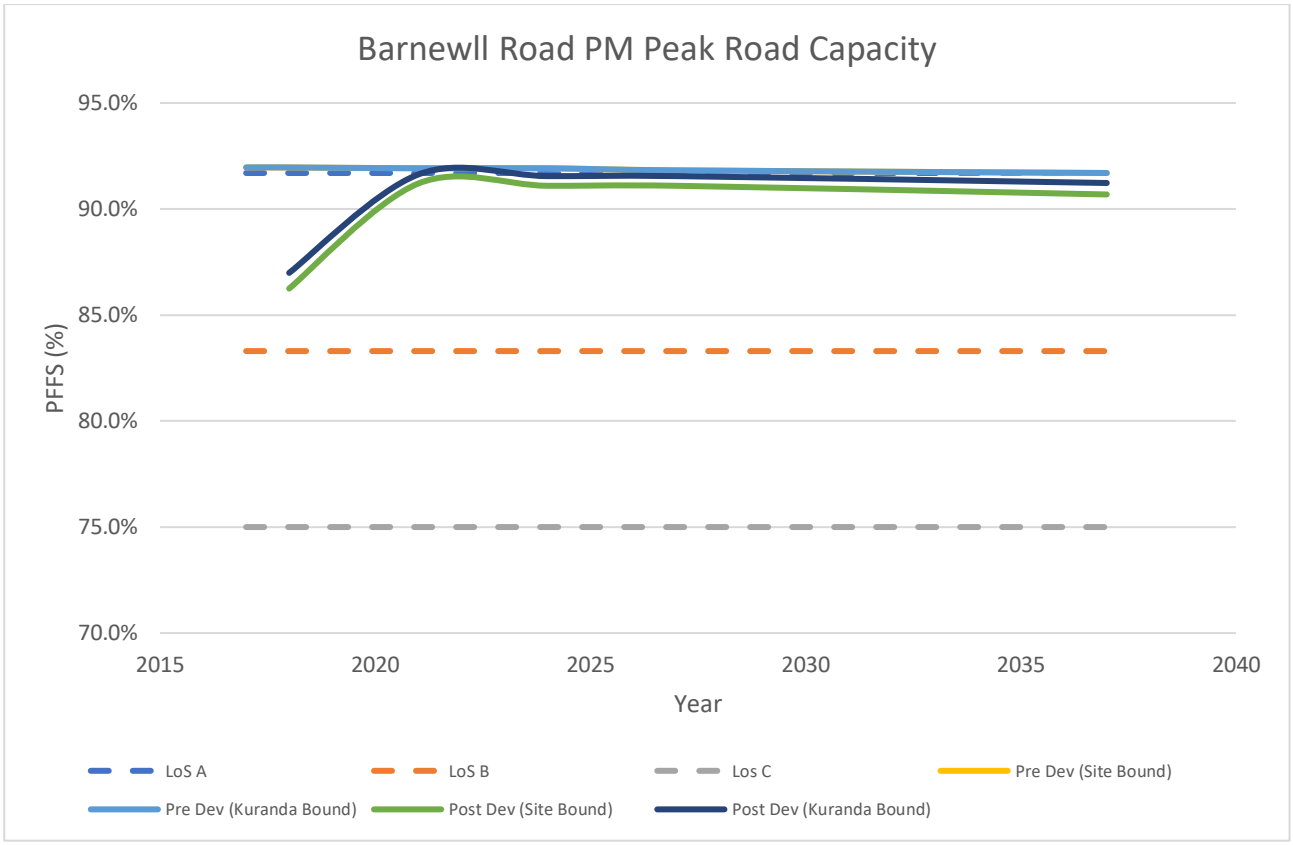


Figure 13-57: Barnwell Road AM Peak capacity assessment

13.6.3 Road safety impacts

The increase in traffic volumes due to the KUR-World development has the potential to increase the frequency crashes. Therefore, an assessment has been carried out on the potential impact of the KUR-World development on the frequency of crashes on the Kennedy Highway as the calculated crash rate was considered above average for this road. For this assessment, the Kennedy Highway was assessed in three sections based on the speed limit[25]:

Kennedy Highway from Ch 0.0 to Ch 11.0 (60km/h)

Kennedy Highway from Ch 11.0 to Ch 17.0 (80km/h)

Kennedy Highway from Ch 17.0 to Ch 42.0 (100km/h).

The crash assessment was based on injury crash data from 2012 – 2016. Maps showing the locations of the crashes can be seen in Appendix 13O. Additional assessment on the Kennedy Highway / Myola Road / Rob Veivers Drive intersection and MSC roads have also been undertaken.

13.6.3.1 Kennedy Highway Ch0.0 to Ch 11.0

This segment of the Kennedy Highway features a 60km/h speed limit with a recorded 89 injury crashes between 2012-2016. The calculated crash rate for this section was therefore 51.2 crashes per 100 Million Vehicle Kilometres Travelled (VKT). Table 13-55 present the expected number of crashes in 2027 based on the existing crash rate for the with and without development scenarios. As can be seen in the table the development is expected to increase the number of crashes by 14 over a five-year period.

[25] The assessment was broken down into speed environments as mitigation measures have different levels of effectiveness based on vehicle speeds

Table 13-55: Kennedy Highway (Ch 0.0 to Ch 11.0) expected number of crashes in 2027

Scenario	2027 Without Development	2027 With Development	2027 With Development & Mitigation
Crash Rate (per 100M VKT)	51.2	51.2	43.6
AADT	10,774	12,140	12,140
Expected Number of Crashes	110.7	124.7	106.3

13.6.3.1.1 *Kennedy Highway Ch0.0 to Ch11.0 - Mitigation measures*

As the crash rate is expected to increase, mitigation measure to reduce the number of crashes have been investigated. KUR-World proposes to finance the development of a Variable Speed Limit (VSL) system with DTMR along this (and the Ch 11.0-17.0) section of the Kennedy Highway that will reduce the speed limit when adverse conditions impact this section of road. It is proposed that:

- The speed limit will be reduced by up to 20km/h during periods of rain or other adverse conditions or emergencies.
- The speed limit will be reduced by up to 10km/h when the road surface is wet but not raining or other adverse conditions or emergencies.

Based on the existing crash types eligible for a reduction based on the proposed implementation of the VSL scheme and crash reduction factors[26] associated with speed reductions it is expected that there would be a 14.7% reduction in the number of crashes along this section. A 14.7% reduction in the number of crashes will reduce the expected number of crashes in the with development scenario to 106.3 over a five-year period, lower than the without development scenario. The estimation of crash reduction is seen in Appendix 13P.

It is noted that travel time increases along this section with the proposed 10km/h and 20km/h reductions are of a potential concern. It is estimated that the travel time will increase[27] by 2.6 (14% increase) and 7 (37% increase) minutes respectively. The reduction in the number of crashes during adverse conditions will reduce the total number of road closures which provides additional benefits and significant offset to the increased travel time. It is not expected that the VSL system (and the reduced speed limits) will have a significant impact on the capacity and LoS of the Kennedy Highway

These mitigation measures should be introduced prior to the KUR-World development increasing traffic on this section by 5% or more. Therefore, it is recommended that the VSL system be implemented prior to the opening of Stage 2 of the KUR-World development in 2024.

13.6.3.2 Kennedy Highway Ch11.0 to Ch 17.0

This segment of the Kennedy Highway features an 80km/h speed limit with a recorded 17 injury crashes between 2012-2016. The calculated crash rate for this section was therefore 17.9 crashes per 100 M VKT. Table 13-55 present the expected number of crashes in 2027 based on the existing crash rate for the with and without development scenarios. As can be seen in the table the development is expected to increase the number of crashes by 2.7 over a five-year period.

[26] Crash Reduction Factors have been sourced from DTMR. Crash Reduction Factors can be seen in Appendix 13Q.

[27] Based on an estimated average speed of 5km/h less than the posted speed limit.

Table 13-56: Kennedy Highway (Ch 11.0 to Ch 17.0) expected number of crashes in 2027

Scenario	2027 Without Development	2027 With Development	2027 With Development & Mitigation
Crash Rate (per 100M VKT)	17.9	17.9	15.9
AADT	10,774	12,140	12,140
Expected Number of Crashes	21.1	23.8	21.2

13.6.3.2.1 *Kennedy Highway Ch11.0 to Ch17.0 - Mitigation measures*

As the crash rate is expected in increase, mitigation measure to reduce the number of crashes have been investigated. KUR-World proposes to finance the development of a VSL system with DTMR along this (and the Ch 0.0-10.0) section of the Kennedy Highway that will reduce the speed limit when adverse conditions impact this section of road. It is proposed that:

The speed limit will be reduced by up to 20km/h during periods of rain or other adverse conditions or emergencies.

The speed limit will be reduced by up to 10km/h when the road surface is wet but not raining or other adverse conditions or emergencies.

Based on the existing crash types eligible for a reduction based on the proposed implementation of the VSL scheme and the crash reduction factors associated with speed reductions it is expected that there would be a 11.2% reduction in the number of crashes along this section. An 11.2% reduction in the number of crashes will reduce the expected number of crashes in the with development scenario to 21.2 over a five-year period, slightly higher than the without development scenario (21.1, 0.1 increase) however this is offset by the reduction in crashes in the 60km/h segment (overall reduction of 4.3 crashes over 5 years). The estimation of crash reduction is seen in Appendix 13P.

13.6.3.2.2 *Variable speed limit*

The proposed variable speed limit systems aim is to regulate drivers speed during adverse weather conditions or other periods where a reduced speed limit may be appropriate (during emergencies, on approach to congestion etc). It is proposed that the VSL system will be designed in accordance with the relevant DTMR and Austroads guidelines and that the development of the system will be in conjunction with DTMR.

The proposed system will include the provision of VSL signs at the required spacing (between 1km and 3.0km depending on speed zone) and rely on weather sensors/detector stations and monitoring to modify the speed limit in situations of adverse atmospheric conditions/ emergency situations etc. Speed limits appropriate for the conditions are to be developed along with the conditions of implementation. The proposed VSL system will be installed in a similar arrangement to that seen in Figure 13-58 and is proposed to be pole-mounted at the required spacing with supplementary default static speed signs as required.

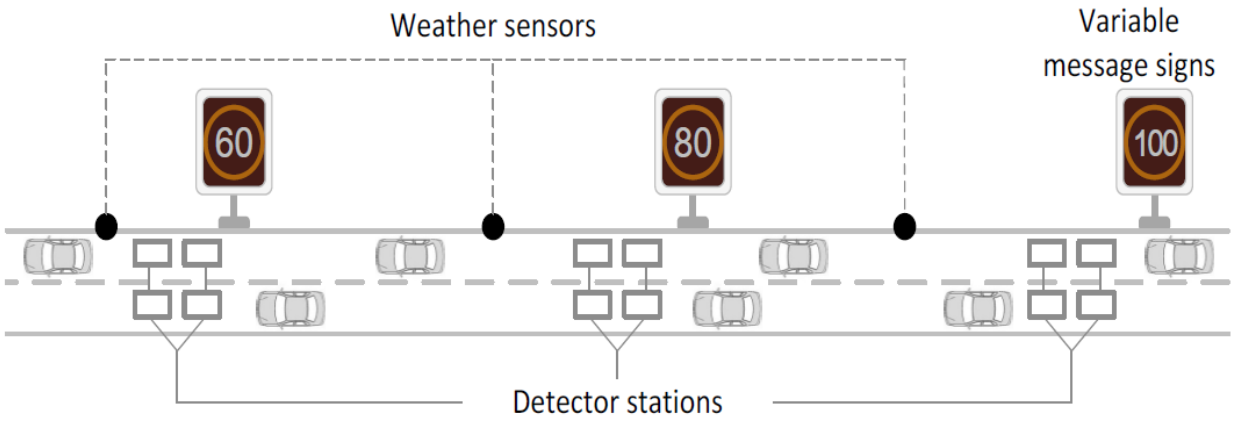


Figure 13-58: Potential configuration of the proposed VSL system using weather sensors to regulate the speed limit. (Source: Lee and Chung, 2011)

13.6.3.3 Kennedy Highway Ch17.0 to Ch 42.0

This segment of the Kennedy Highway features a 100km/h speed limit with a recorded 39 injury crashes between 2012-2016. The calculated crash rate for this section was therefore 14.6 crashes per 100 M VKT. Table 13-57 present the expected number of crashes in 2027 based on the existing crash rate for the with and without development scenarios. As can be seen in the table the development is expected to increase the number of crashes by 5.9 over a five-year period.

Table 13-57: Kennedy Highway (Ch 17.0 to Ch 42.0) expected number of crashes in 2027

Scenario	2027 Without Development	2027 With Development	2027 With Development & Mitigation
Crash Rate (per 100M VKT)	14.6	14.6	12.9
AADT	7,290	8,181	8,181
Expected Number of Crashes	48.5	54.4	48.0

13.6.3.3.1 *Kennedy Highway Ch17.0 to Ch42.0 - Mitigation measures*

As the crash rate is expected in increase, mitigation measure to reduce the number of crashes have been investigated. KUR-World proposes to:

- provide Audio Tactile Centreline Marking on 50%[28] of the Kennedy Highway
- provide additional Wire Rope Barrier (up to 8.75 km of wire rope barrier where needed, to be targeted to reduce crashes)
- improve Warning/Guide Signage along the Kennedy Highway.

Based on the existing crash types eligible for a reduction based on the proposed measures and the associated crash reduction factors it is expected that there would be a 11.7% reduction in the number of crashes along this section. An 11.7% reduction in the number of crashes will reduce the expected number of crashes in the with development scenario to 48.0 over a five year period, lower than the without development scenario. The estimation of crash reduction is seen in Appendix 13P.

[28] It is estimated that 15% of the Kennedy Highway (Kuranda to Mareeba) has ATLM and that an estimated 50-60% remains eligible for ATLM when considering the exclusions around residential properties.

13.6.3.4 Mareeba Shire Council roads

The Mareeba Shire Council roads to be impacted by the KUR-World development, including Rob Veivers Drive, Myola Road and Barnwell Road, all have below average crash rates, indicating that there is no adverse risk for drivers on these road, therefore no specific mitigation measures are required to address previous crashes. However, a detailed assessment such as a Road Safety Audit (RSA) of these roads is recommended to be undertaken prior to development traffic exceeding 5% of the existing traffic volumes to identify any safety issues. Any safety issues identified in the RSA should be addressed in coordination with Mareeba Shire Council.

13.6.3.5 Kennedy Highway / Myola Road / Rob Veivers Drive intersection

The Kennedy Highway / Myola Road / Rob Veivers Drive intersection has an above average crash rate (refer Section 13.3.10.3) with seven injury crashes occurring at this location between 2012-2016. Five of the seven crashes at this location were Thru-Right (DCA Code 202) type crashes from the Kennedy Highway, indicating that this location may not be suitable for the continued use of filtered right turns.

Due to the increase in traffic due to the development, it is anticipated that the crash rate will increase. Therefore, the ban of filtered right-turns to reduce the crash rate has been investigated at this location. Table 13-58 presents the 2037 With Development traffic volumes for the Kennedy Highway / Myola Road / Rob Veivers Drive intersection with the upgrades required to address intersection capacity (as detailed in Section 13.6.1.1) and a ban on filtered right turns from the Kennedy Highway.

As can be seen from Table 13-58, LoS C is maintained while the DoS is increased when compared to the filtered right turns allowed scenario, it is however still within acceptable limits for a signalised intersection. The ban on filtered right turns has a crash reduction factor of 80% for Thru-Right crashes, which will reduce the intersection crash rate by 57%. It is therefore recommended that a ban on filtered right turns be implemented when providing the capacity upgrades required prior to the opening of Stage 3.

Table 13-58: Kennedy Highway / Myola Road / Rob Veivers Drive intersection assessment results for 2037 with proposed upgrades and ban on filtered right turns to reduce Thru-Right crashes at this location.

Approach	Movement	With Development with Upgrades					
		Degree of Saturation (%)		Average Delay (s)		95th Percentile Queue (m)	
		AM	PM	AM	PM	AM	PM
Rob Veivers Drive	Left	5.8	11.4	9.2	11.5	4.4	10.1
	Through	89.1	64.3	43.5	32.7	58.5	44.0
	Right	30.5	84.8	38.0	44.9	15.4	63.1
Kennedy Highway (East)	Left	11.6	10.6	10.1	9.7	9.5	8.1
	Through	56.8	80.8	24.3	30.5	65.8	109.9
	Right	87.5	85.2	49.3	49.5	60.3	38.5
Myola Road	Left	12.2	23.8	10.6	12.4	11.9	25.4
	Through	83.0	87.8	37.0	40.8	61.1	66.3
	Right	50.8	59.9	36.2	37.1	33.8	41.0

Kennedy Highway (West)	Left	16.9	9.5	11.2	10.1	15.7	7.7
	Through	86.1	70.2	35.3	26.4	121.5	87.3
	Right	54.5	33.5	40.8	42.0	28.6	13.2
Intersection		**89.1**	**87.8**	**30.5**	**29.4**	**121.5**	**109.9**

13.6.4 Pavement impacts

KUR-World is anticipated to increase the number of heavy vehicles on the affected roads during construction and operation of the resort. Heavy vehicles will be predominately 50 seater buses during the operation of the resort and six-axle trucks during the construction phase. This is consistent with the current heavy vehicle composition of the area.

A visual inspection of the pavement on the Kennedy Highway appeared to indicate that the pavement is in good condition. Table 13-59 and Table 13-60 present the anticipated increase in heavy vehicles on the Kennedy Highway from Cairns to Kuranda and Kuranda to Mareeba respectively. It can be seen that there is a maximum increase in heavy vehicle traffic of 8.2% on the Kennedy Highway from Cairns to Kuranda and a maximum increase of 4.0% on the Kennedy Highway from Kuranda to Mareeba.

With only limited increases in heavy vehicle traffic on the Kennedy Highway (Kuranda to Mareeba) it is not anticipated that KUR-World will have a significant impact on the pavement condition, therefore not requiring any further mitigation measures. As the HV increase exceeds 5% on the Kennedy Highway (Cairns to Kuranda), a detailed pavement impact assessment is required to be completed prior to the completion of Stage Two Construction.

Table 13-59: Increase in Heavy Vehicles on the Kennedy Highway (Cairns to Kuranda) due to construction and operation of the resort.

Year	Without Development AADT	Surveyed Heavy Vehicle %	Total Heavy Vehicles (veh)	HV Increase due to Development (veh)	% Increase in Heavy Vehicles on Road
2018	9015	11.80%	1064	21	2.0%
2021	9567	11.80%	1129	55	4.8%
2024	10152	11.80%	1198	80	6.6%
2027	10774	11.80%	1271	104	8.2%
2037	13133	11.80%	1550	104	6.7%

Table 13-60: Increase in Heavy Vehicles on the Kennedy Highway (Kuranda to Mareeba) due to construction and operation of the resort.

Year	Without Development AADT	Surveyed Heavy Vehicle %	Total Heavy Vehicles (veh)	HV Increase due to Development (veh)	% Increase in Heavy Vehicles on Road
2018	6100	10.24%	625	2	0.3%
2021	6473	10.24%	663	27	4.0%
2024	6869	10.24%	703	24	3.4%
2027	7290	10.24%	746	30	4.0%
2037	8886	10.24%	910	30	3.3%

13.6.5 Kuranda Scenic Rail and Kuranda Skyrail

Due to the operations of both Kuranda Scenic Rail and Kuranda Skyrail being commercial in confidence, passenger data suitable for use in the assessment of the operational capacity cannot be obtained. Through discussions with operators of both services and recent observations of passenger occupancy it is not anticipated that either Kuranda Scenic Rail or Kuranda Skyrail will have issues with accommodating the additional passenger demand associated with KUR-World. It is noted that:

- Not all trips associated with KUR-World on these modes will be new trips as existing Kuranda Scenic Rail and Sky Rail guests are likely to visit KUR-World while in Kuranda.
- The project team has had verbal confirmation of Sky Rail's ability to accommodate the development through a combination of increased operating times and capacity improvements achieved through the use of higher occupancy gondolas and extended trading hours if required. Therefore, it is assumed that the Sky Rail has ability to accommodate the expected 400 return trips per day associated with KUR-World.
- The current passenger occupancy rate of the Kuranda Scenic Rail is unknown, although through conversations with the service manager and observation of train operations over a number of weeks, it is not anticipated that the accommodation of up to an additional 141 passengers per journey (282 return trips per day) will be a significant issue based on the current 550 passenger capacity of the Scenic Rail trains.
- The total number of new return trips per day for each service is detailed in Table 13-61 noting that to accommodate the development:
- 141 return trips per train is equal to 26% of the total capacity of the train based on current capacity. The operator has also indicated that additional carriages can be added to increase capacity if the demand requires.
- Skyrail operators have indicated that they have capacity to extend services. The required 48 additional return trips can be accommodated by extending operating hours by approximately 90 minutes in the morning and evening, therefore providing an additional 48 return trips if the Skyrail is operating at or near capacity under existing conditions, which is not believed to be the case.

Therefore, it is assumed that the Kuranda Scenic Rail and Skyrail have sufficient existing capacity to accommodate the KUR-World development or at least have the ability to increase capacity to meet demand should it be required. An agreement will need to be reached with both service operators confirming their ability to provide transport to the resort for resort guests.

Table 13-61: Anticipated new trips on Kuranda Scenic Rail and Skyrail due to KUR-World development.

Stage	Total New Trips	Total Return Trips	Total Additional Return Skyrail Trips (No. Gondolas)	Total Return Scenic Rail Trips (Persons per Train)
Stage 1 A	453	227	19	57
Stage 1	811	406	34	102
Stage 2	218	109	10	28
Stage 3	84	42	4	11
Total[29]	**1113**	**557**	**48**	**141**

[29] Stage 1 includes Stage 1A totals, therefore Stage 1A has not been included in the total.

13.6.5.1 Overnight guest interface with Scenic Rail/Skyrail and Airport

It has been assumed that a small portion (equivalent to 12% of overnight guest trips) will utilise the Kuranda Scenic Rail and Skyrail to access the resort. Due to the limited frequency and timing of trips on the Scenic Rail (departures from Cairns at 8.30 and 9.30 AM and from Kuranda at 2.00 and 3.30pm) the arrival and departure window for guests to arrive and utilise these transport modes is limited. However, it is noted that, while travel times are subject to change, typically:

- Direct International flights from mainland China to Cairns land between 6.30AM and 8.30AM, which would enable overnight guests to arrive via to the resort via the Scenic Rail or Skyrail;
- Guests travelling via domestic connection can arrive throughout the day and utilise either the Scenic Rail or Skyrail depending on arrival time;
- There are two main departure times for flights direct from Cairns to mainland China:
  - For flights departing between 8:00AM to 9:00AM, accounting for the required check-in time it is likely guests will choose to stay the night in Cairns prior to departure. Therefore, guests can utilise the Skyrail or Scenic Rail to depart to Cairns the day before departure and are generally not limited in their departure time.
  - For flights departing between 1:30PM to 3:00PM guests are able to utilise the Skyrail for transport to Cairns International Airport prior to departure.
- Cairns is also not typically the first or final destination for target clientele, with many opting to continue travelling within or have already travelled throughout Australia for which the Skyrail and Scenic Rail offer many connection options for domestic flight.

Given the small proportion of overnight guest trips utilising Scenic Rail and Skyrail and the typically arrival and departure times it is not anticipated that the connection between the airport and these transport modes will limit usage. Yearly summary schedules of Cairns International Terminal arrivals and departures have been provided in Appendix 13R with flights arriving/departing from mainland China highlighted.

13.6.6 Pedestrian impacts

The KUR-World development is not anticipated to have any impact on pedestrian transport infrastructure surrounding the site. KUR-World proposes to have an internal pedestrian network, however it is not anticipated that connection will be made to the external pedestrian network. It is not anticipated that there will be any pedestrians (guests or staff) accessing the site due to its location.

13.6.7 Public transport impacts

The KUR-World development is not anticipated to have an impact on the limited public transport services in the Kuranda area. KUR-World proposes to develop a shuttle service to provide transport for resort guests and staff (as described in Section 13.6.7.1), therefore not relying on existing public transport services.

It is not anticipated that there will be an impact on the School Bus services on Myola Road or the Kennedy Highway due to the operation of the resort as traffic increases on Myola Road are limited while mitigation measures are proposed for the Kennedy Highway. Any impacts to public transport on the Kennedy Highway are likely to be related to increases in average travel time, however these are unlikely to be significant when compared to the delays experienced by these services due to intersection delay in Cairns.

Should demand exist, KUR-World could accommodate the general public on the provided shuttle services, potentially improving public transport services in the area.

13.6.7.1 KUR-World shuttle service

KUR-World proposes to operate a number of shuttles between the subject site and Cairns to transport guests and resort staff as well as services between the site and Kuranda and the Wider Tablelands.

Based on the traffic generation of the resort, it is estimated that there will be 100 shuttle trips between the resort and Cairns daily (50 return trips) once KUR-World is fully operational in 2027. Preliminary shuttle schedules have been developed to cater for all users including staff and resort guests.

The preliminary shuttle schedules for the resorts full operation and Stage One operation are presented in Figure 13-59 and Figure 13-60 respectively. The shuttle schedule has been based on the assumption that shuttles are at 70% capacity and therefore have additional capacity throughout the day to cater for variations in demand. Operating hours are extended to cater for staff movements and outside hour's guest travel and can be revised as necessary to cater for demand. With the anticipated spare capacity, should demand exist, KUR-World can open shuttles to the public for transport between Cairns and Kuranda.

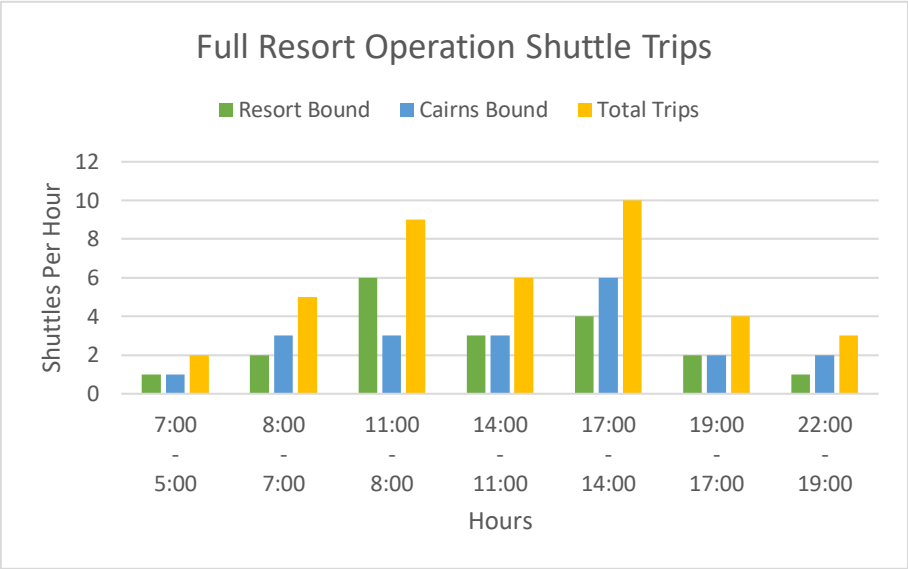


Figure 13-59: Preliminary shuttle schedule during full operation of the resort.

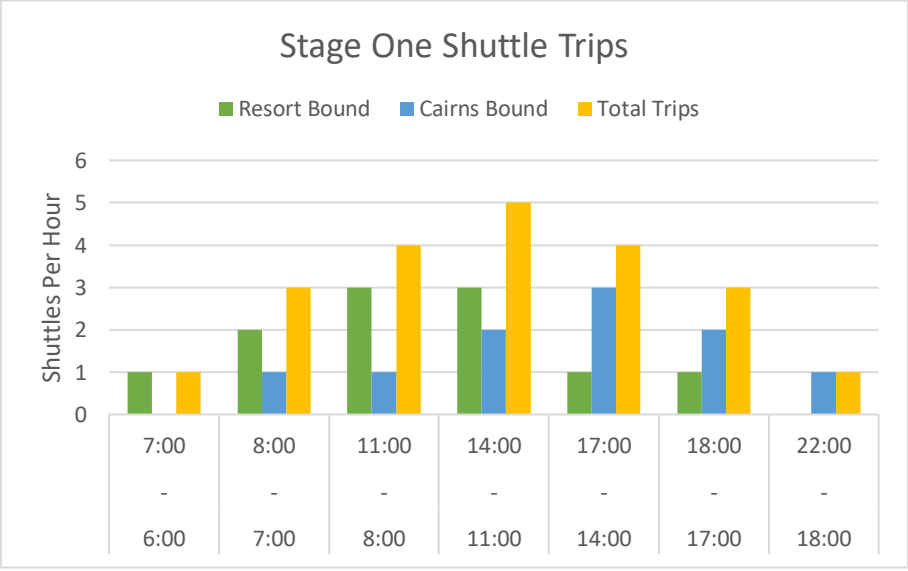


Figure 13-60: Preliminary shuttle schedule for Stage 1 operation of the resort.

13.6.8 Air transport impacts

REHBEIN Airport Consulting undertook an assessment focused on the servicing of the proposed KUR-World Resort via helicopter to and from Cairns International Airport and Mareeba aerodrome and additional scenic flights to Moore Reef and included the identification of expected aircraft types, passenger loads and service frequency, the determination of flightpaths and consideration of potential noise sensitive areas; and the impacts on Cairns International Airport operations including analysis of existing airspace constraints and compliance with air traffic and flight planning procedures.

The assessment concluded that the proposed additional flight operations are unlikely to have significant impacts. No change is required to existing airspace architecture, procedures to accommodate the proposed routes and associated operations. The full Air Traffic report prepared by REHBEIN detailing the impact of development on air traffic is attached in Appendix 13S.

13.6.8.1 Aircraft types and frequency

Helicopters likely to be utilised to service KUR World are expected to be sourced from local Cairns helicopter operators. Typically, helicopters likely to service the desired routes would be 6-seat turbine-powered "air taxi" style helicopters such as Aerospatiale AS350-B "Squirrel" or Bell B206 "Jetranger". Consideration of medical and rescue helicopters currently servicing North Queensland was also included in the assessment. Up to 10 flights per day are estimated as being adequate to service the resort's helicopter transfer requirements. Helicopter flight schedules are anticipated to be closely linked to domestic aircraft arrivals and would therefore be concentrated into daily 3 to 4 hour blocks covering morning and afternoon timeframes.

13.6.8.2 Flightpaths

Helicopter routes to service KUR-World were developed in consultation with Cairns International Airport Air Traffic Control (ATC) and consideration of the relevant flight rules, existing airspace procedures, terrain, performance characteristics typical of the anticipated types and a preference to minimise noise impacts on residential areas.

13.6.8.3 Impacts on Existing Airspace and Traffic Management

A flight thread analysis was undertaken for each of the proposed routes to assess their viability and identify any potential impacts on existing traffic and airspace management. No adverse impacts where identified. The proposed KUR World helicopter routes were assessed against the published Australian Noise Exposure Forecast (ANEF) contours for Cairns Airport. The outcome of the assessment indicated that departure and approach tracks are likely to be captured within the existing noise contours and the increased flight frequency would have been considered in the development of future aircraft volume forecasts.

Existing ATC and fly neighbourly procedures provide further protection of the community from exposure to unnecessary aircraft noise and the Cairns Airport Environmental Consultative Committee (AECC) provides a mechanism to address environmental issues.

13.6.9 Permanent road closures

There are no plans to close roads that are currently open to general traffic, therefore there will be no impact due to road closures caused by KUR-World. Details of any proposed permanent closures to existing road reserves within the project site are detailed in Chapter 6 - Land Use.

13.6.10 Parking

13.6.10.1 Car parking during construction

Car parking during construction will fluctuate depending on the construction stage at the time. It is anticipated that the maximum on-site parking demand for construction activities will occur in Stage 3 with an anticipated demand of 80 parks per day. It is anticipated that land will be available on site across all stages to provide the required car parking during construction.

13.6.10.2 Car parking during operation

Car parking during operation will gradually increase from Stage 1A onwards. Parking rates have been developed based on the expected usage of the various elements within KUR-World. These are generally based on the number of rooms and the expected number of private vehicle trips per day. The rates adopted and the total number of parks required during operation is shown in Table 13-62. Car parking will be provided at the site, as the various uses are developed in accordance with the proposed rates. In Summary:

- Individual Dwellings will have at least one (1) car park within the individual land parcel.
- Tourist Accommodation will generally have 0.4 car parks per room/unit. This is in line with the expected private vehicle usage of 40%.
- Parking rates for the various day uses are anticipated to be 70% of the total private vehicle trips per day accounting for staggered arrival and departure times.
- Parking rates for staff are anticipated to be 50% of the total private vehicle trips per day accounting for staggered arrival and departure times due to shift change over. Specific staff parking areas will be provided on site to limit staff usage of private vehicles.
- It is estimated that 365 car parks will be freely available to use by the general public which includes Staff and Unique Day Guests.

Table 13-62: Proposed Car Parking Rates for the operational phases of KUR-World

Land Use	Quantity		Parking Rate		Total Required Parks	Locations of Parks
Lifestyle Lots Queensland Lots	77	Dwellings	1	per Dwelling	77	Individual Lots
Farmstay Accommodation	110	Beds	0.05	per bed	6	On-Site
Rainforest Education Centre	350	Beds	0.05	per bed	18	On-Site
Glamping Experience	25	Rooms	0.4	per Room	10	On-Site
Premium Villas	286	Dwellings	1	per Dwelling	324	Individual Lots
Business Leisure Hotel	270	Rooms	0.4	per Room	108	On-Site
Golf Course	67	Private Vehicle Trips Per Day	70%	of Private Vehicle Trips	47	On-Site
Premium Villa Units	60	Per Unit	0.4	Per Unit	24	On-Site
Five Star Resort	200	Rooms	0.4	per Room	80	On-Site
KUR-Campus Accommodation	300	Per Room	0.2	per Room	60	On-Site

KUR-Campus Day Students	25	Private Vehicle Trips Per Day	70%	of Private Vehicle Trips	18	On-Site
Health and Wellbeing Retreat	60	Rooms	0.4	per Room	24	On-Site
Various Retail	24	Private Vehicle Trips Per Day	70%	of Private Vehicle Trips	17	On-Site
Unique Day Guests	39	Private Vehicle Trips Per Day	70%	of Private Vehicle Trips	28	On-Site
Staff	514	Private Vehicle Trips Per Day	50%	of Private Vehicle Trips	257	Various Locations

13.7 Summary of mitigation measures

Numerous mitigation measures are proposed as part of the project works to address the transport impacts of the development. The mitigation measures have been developed using valid engineering methods in accordance with Austroads and DTMR guidelines. It is intended that these mitigation measures will be further refined in close consultation with the relevant stakeholders to ensure the impacts of the resort are mitigated. These mitigation measures are detailed in the following sub-sections.

13.7.1 Mitigation measures for intersections

- Extensions to the turn lanes at the Kennedy Highway / Myola Road / Rob Veivers Drive intersection to ensure the intersection operates within the acceptable limits over the design horizon. Right and left turn storage bay lengths on Myola Road are to be extended to 25m and 30m respectively, with the right turn storage bay on Rob Veivers Drive to be extended to 30m. This is to be completed prior to the completion of Stage 3 construction and comply with DTMR and Austroads Standards. (Refer Section 13.6.1.1)
- Upgrade of the Myola Road / Kuranda Heights Road intersection to a roundabout to accommodate the additional leg of the intersection as a development access and ensure the intersection operates within acceptable limits across the design horizon. This is to be completed prior to the completion of Stage 1B construction and comply with MSC and Austroads Standards. (Refer Section 13.6.1.2)
- Provide a Channelised Right Turn Treatment at the Kennedy Highway / Greenhills Road intersection to provide right turn vehicle storage. This is to be completed prior to the completion of Stage 2 construction and comply with DTMR and Austroads Standards. (Refer Section 13.6.1.4)

13.7.2 Mitigation measures for road links

- An additional overtaking lane is to be provided on the Kennedy Highway (Kuranda to Mareeba) for Mareeba bound traffic to improve capacity on this section. This is to be completed prior to the completion of Stage 3 construction and comply with DTMR and Austroads Standards. The suitable location is to be determined in conjunction with DTMR. (Refer Section 13.6.2.2.1)
- Barnwell Road is to be upgraded to a sealed standard in accordance with FNQROC standards prior to the completion of Stage 1A construction. (Refer Section 13.6.2.5)

13.7.3 Road safety mitigation measures

- It is proposed to develop (in conjunction with DTMR) and install a Variable Speed Limit (VSL) on the Kennedy Highway (Cairns to Kuranda) to reduce the expected number of crashes to pre-development levels prior to the completion of Stage 2 construction. The VSL proposes to reduce the speed limit by 10 or 20km/h dependent on road conditions. It is expected that there will be a reduction in the

number of pre-development crashes of 4.3 crashes over five years with the addition of development traffic and the VSL. (Refer Sections 13.6.3.1.1 & 13.6.3.2.1)

- To reduce the expected crash rate on the Kennedy Highway (Kuranda to Mareeba) to pre-development levels with the addition of development traffic it is proposed to: (Refer Section 13.6.3.3.1)
  - Provide Audio Tactile Centre Line Markings (ATLM) to 50% of the Kennedy Highway from Kuranda to Mareeba to reduce run off road and head on crash frequency. It is estimated that only 15% of the Kennedy Highway currently has ATLM.
  - Provide approximately 8.75 km of additional wire rope barrier on the Kennedy Highway in various locations on the road shoulder. This is proposed to reduce run-off road and loss of control crashes.
  - Provide additional warning and guide signage on the Kennedy Highway in various locations to reduce rear end crashes. The location and type are to be determined in accordance with DTMR.
- Filtered right turns are to be banned at the Kennedy Highway / Myola Road / Rob Veivers Drive intersection to improve safety at this location. This should be completed in conjunction with the capacity upgrades required at this location. (Refer Section 13.6.3.5)
- Road Safety Audits of Barnwell Road, Myola Road and Rob Verviers Drive are to be completed and required mitigation measures (to be determined in coordination with MSC) implemented prior to development traffic volumes exceeding 5% of the base traffic volumes on these roads. (Refer Section 13.6.3.4)

13.7.4 Various mitigation measures

A detailed Pavement Impact Assessment is required to be completed on the Kennedy Highway (Cairns to Kuranda) to determine pavement impacts of the development prior to the completion of Stage Two Construction. (Refer Section 13.6.4)

An agreement is to be reached between Skyrail and Scenic Rail operators confirming their ability to provide transport to KUR-World for resort guests. (Refer Section 0)

Sufficient on-site car parking is to be provided to accommodate the expected operational and (allowed on-site) construction traffic. It is estimated that 365 car parks will be required to be available to the public at the completion of Stage 3 construction. (Refer Section 13.6.10)

Staff Park and Ride facilities and shuttle service between facilities and KUR-World are to be provided at Smithfield and Mareeba for use by construction and operational staff to reduce traffic volumes on the Kennedy Highway. Approximately 170 car parking spaces will need to be provided at Smithfield with approximately 50 car parking spaces to be provided at Mareeba. The exact location of these facilities are to be determined and to be provided prior to undertaking Stage 1B construction (to be provided in stages to meet demand). Conditions of employment for both operational and construction staff should include the use of the shuttle service.

A Construction Traffic Management Plan will be required prior to the commencement of construction to detail access to the site including the requirements for the use of Park and Ride Shuttles for Cairns and Tableland based workers. Appropriate data collection, review and enforcement of the Park and Ride Shuttles will be required to be detailed in the Construction Traffic Management Plan.

13.8 Conclusion

The proposed KUR-World development is expected to generate additional traffic on the surrounding network. The objectives of the traffic impact assessment was to:

- maintain the safety and efficiency of all affected transport modes for the project workforce and other transport system users
- avoid or mitigate impacts on the condition of transport infrastructure
- ensure any required works are compatible with existing infrastructure and future transport corridors.

In order to minimise the identified impacts of the resort such as:

increased delays due to insufficient capacity at intersections or on road links within the study area

reduced safety due to increased chance of conflict between vehicles.

An assessment of the predicted traffic impacts of the construction and operations phases was undertaken, in accordance with the *Guidelines for Assessment of Road Impacts of Development (DTMR, 2006)*, which considered the contribution of both background traffic volumes and the development generated traffic volumes in each stage of the development and over the ten-year design horizon. A key basis for the findings in this study were the estimations identified in the Social and Economic chapter (Chapter 11) and the Cummings Economic Impact Assessment (Appendix 8B).

The results of the traffic assessment showed that the surrounding road network generally had sufficient capacity to accommodate the future traffic volumes with various upgrades/mitigation required to reduce the impacts on road link and intersection capacity and ensure the development traffic volumes can be accommodated. The proposed mitigation measures are as detailed in Section 13.6.1.

The Level of Service on the Kennedy Highway (Cairns to Kuranda) is anticipated to reach LoS D in both the with and without development scenarios. The addition of the development traffic results in LoS D being reached on this section of the Kennedy Highway between four and seven years earlier than in the without development scenario. The increases in overall travel time due to the addition of the development traffic are anticipated to be minimal. As mitigation measures to address the capacity constraints on this section of the Kennedy Highway are economically and environmentally unviable as discussed in Section 13.6.2.1.3, no mitigation measures to improve capacity of the Kennedy Highway are proposed. Various mitigation measures to improve safety and reduce the frequency of road closures (through intelligent transport systems that respond to prevalent conditions) on this road are however proposed in addition to management techniques/mitigation measures to reduce the traffic generated by the development including Park and Ride sites for operational and construction staff. These sites are to are to be identified and begin operation prior to the commencement of construction of Stage 1B to reduce the traffic volumes generated by the development.

Proposed road safety upgrades as detailed in Section 13.6.3 and have been developed to reduce the likelihood of accidents on the Kennedy Highway to address the expected increase in crash frequency due to development traffic. The proposed measures will require agreement from relevant agencies on the suitability and the rollout of mitigation measures.

Up to 10 flights per day are expected to service the resort's helicopter transfer requirement with adequate capacity at the Cairns Airport no adverse air transport impacts are anticipated. Public transport is not anticipated to be impacted by the development as limited services currently exist. The project has potential to improve public transport in Kuranda should demand within the community exist to utilise the proposed shuttles. Pedestrian numbers on the existing transport network will not increase and no adverse pedestrian impacts are anticipated. It is also anticipated that the pavement on the Kennedy Highway has sufficient capacity to accommodate the increase in heavy vehicles due to the development. An agreement is required

be reached between Skyrail and Scenic Rail operators to provide the assumed transport of resort guests to KUR-World. A summary of all the proposed mitigation measures is presented in Section 13.7.

13.9 References

Austroads. (2015). *Guide to Road Safety Part 8: Treatment of Crash Locations (2015 Edition)*. 6 November 2015. [Online]. Available from: https://www.onlinepublications.austroads.com.au/items/AGRS08-15. [Accessed: 4 October 2017].

Austroads. (2016). *Guide to Road Design Part 3: Geometric Design (2016 Edition).* 28 September 2016. [Online]. Available from: https://www.onlinepublications.austroads.com.au/items/AGRD03-16. [Accessed: 15 September 2017].

Austroads. (2017). *Guide to Road Design Part 4: Intersection and Crossings – General (2017 Edition).* 7 June 2017. [Online]. Available from: https://www.onlinepublications.austroads.com.au/items/AGRD04-17. [Accessed:15 September 2017].

Austroads. (2013). *Guide to Traffic Management Pat 3: Traffic Studies and Analysis (2013 Edition).* 10 April 2013. [Online]. Available from: https://www.onlinepublications.austroads.com.au/items/AGTM03-13. [Accessed: 23 February 2017].

Department of Transport and Main Roads, Queensland Government. (2017). *Queensland Manual of Uniform Traffic Control Devices Part 4: Speed controls.* November 2017. [Online]. Available from: https://www.tmr.qld.gov.au/-/media/busind/techstdpubs/Traffic-management/Manual-of-Uniform-Traffic-Control-Devices/MUTCD-Pt-4-May-17.pdf?la=en. [Accessed: 17 March 2017].

Far North Queensland Regional Organisation of Councils (FNQROC). (2017). *FNQROC Development Manual Design Manual D1 Road Geometry.* Version No. 03/17. [Online]. Available from: http://www.fnqroc.qld.gov.au/files/media/original/004/0e6/f7a/616/D1-Road-Geometry---Operational-Works-Design-Manual-03-17--Issue-7.pdf. [Accessed: 14 September 2017].

Jiang, R., Chung, E & Lee, J. (2011). *Variable Speed Limits: Conceptual Design for Queensland Practice.* Brisbane: Smart Transport Research centre, Faculty of Built Environment and Engineering Queensland University of Technology.

Queensland Government Department of Main Roads. (2006). *Guidelines for Assessment of Road Impacts of Development.* [Online]. 1 April 2006. Available from: https://www.tmr.qld.gov.au/-/media/busind/techstdpubs/Road-planning-and-design/Guidelines-to-Traffic-Impact-Assessment/GARID_Guidelines_200406.pdf?la=en. [Accessed: 22 February 2017].

Queensland Government. (2016). *Queensland Transport and Roads Investment Program 2016-17 to 2019-20.* 14 June 2016 [Online]. Available from: https://publications.qld.gov.au/dataset/queensland-transport-and-roads-investment-program-qtrip-2016-17-to-2019-20/resource/0bdc9bf5-88d7-4a36-b917-5435ed135e3d. [Accessed: 6 March 2017].

Queensland Government. (2017). *Road crash locations: Data on the location of crashes within Queensland.* 7 November 2017. [Online]. Available from: https://data.qld.gov.au/dataset/crash-data-from-queensland-roads/resource/e88943c0-5968-4972-a15f-38e120d72ec0. [Accessed: 7 August 2017].

The National Academies of Sciences, Engineering and Medicine: Transportation Research Board. (2016). *Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis.* USA: Transportation Research Board.