

Date 30/08/2019
To Rachel Perry
From Herman Joubert, Wendy Hu
Copy to Westley Owers
Subject Kings Hill REF Construction Route Assessment

1 INTRODUCTION

1.1 Purpose of Technical Note

The purpose of this technical note is to determine whether the construction haulage route options considered for the construction of the Pacific Highway Interchange and Kings Hill Stormwater Channel Review of Environmental Factors (REF) would be appropriate for the transport of materials, equipment and workforce.

The viability of five different route options will be determined through an in depth swept path analyses, high level capacity assessment, intersection and road link layout and geometry assessment as well as a safety evaluation. This assessment quantifies any impacts of the proposed transport movements and identifies potential actions to mitigate these impacts.

The route options evaluated as part of this route assessment consist of:

- **Route Option 1:** Utilising the existing spillway to travel between each side of Pacific Highway as illustrated in Figure 2-1.
- **Route Option 2:** Vehicles would exit southbound onto the Pacific Highway from AP-07 and travel approximately 1.6 km before turning right towards AP-01 by making use of the existing right-hand turn lane. This option allows vehicles to travel from the eastern side of the Pacific Highway to the western side. This route option is illustrated in Figure 2-2.
- **Route Option 3:** Vehicles would exit southbound onto the Pacific Highway from AP-02 and travel approximately 3.5 km south to the Richardson Road exit. Vehicles would then perform a U-turn movement at the roundabout to travel back along the Pacific Highway northbound carriageway. After another 3.5km, vehicles would then use the left turn auxiliary lane to turn left at AP-01. This option allows vehicles to travel from the eastern side of the Pacific Highway to the western side. This route option is illustrated in Figure 2-3.
- **Route Option 4:** Under this option vehicles would turn left from AP-01 and travel northbound along the Pacific Highway for approximately 4 km where vehicles would conduct a U-turn movement at the existing U-turn bay at Ringwood Road to continue travelling southbound. Vehicles would then turn left at AP-07 or AP-02. This option allows vehicles to travel from the western side of the Pacific Highway to the eastern side. This route option is illustrated in Figure 2-4.
- **Route Option 5:** Vehicles would exit southbound onto the Pacific Highway from AP-08 and travel southbound for approximately 1.5 km to AP-07, or 3.2 km to AP-02, where they would then make a left turn into the access. This option allows vehicles to travel from the western side of the Pacific Highway to the eastern side. This route option is illustrated in Figure 2-5.

1.2 Construction Generated Traffic

It is understood that the 14-month construction period of the Pacific Highway Interchange would generate up to 10,200 trips. The average number of trips per working day would be about 35 two-way trips. These trips would be generated by the workforce, materials haulage, and deliveries to the proposal. Construction deliveries would be timed to occur outside peak traffic periods when feasible and reasonable, to minimise impacts on the road network. These vehicle trips would make use of the route options evaluated in this technical memo.

1.3 Aim and Objectives

The aim of this construction route assessment is to evaluate the route options and to identify areas of key constraint and advise on mitigation measures and upgrade work to allow for the viable transport of workforce, material and equipment. More specifically, the assessment aims to:

- Identify key constraint areas along the route
- Conduct a high-level swept path analysis at pinch point/ constraint areas in order to determine potential conflicts
- Evaluate the conflict points and quantify the mitigation works potentially required to resolve constraints
- Identify required upgrade works to ensure safe design standards and adequate construction vehicle manoeuvrability
- Conduct a high-level evaluation on road link capacity of each route option
- Conduct a high-level design standard assessment of the accesses (sight distance and layout configuration of intersections and links).

1.4 Assumptions and Limitations

This desktop assessment has been based on readily available information, with limited consultation with regulatory departments, bodies or other stakeholders undertaken in the production of this construction route analysis.

1.4.1 Transport Design Vehicle

The largest design vehicle to be used to transport the construction material has not been defined in terms of their dimensions. For the purpose of this assessment it is therefore assumed that a 19-metre "Prime mover with Semi-Trailer" is used to conduct the vehicle swept path analyses. Autodesk's program AutoCAD and its Vehicle Tracking software have been used to produce the swept paths and to determine what the impacts would be in terms of vehicle manoeuvrability through various intersections along the assumed transport route options. As no vehicle dimensions are available at this stage of the project, a vehicle has been selected from the Vehicle Tracking library ("Prime mover with Semi-Trailer"). This vehicle has been utilised as the design vehicle for the vehicle swept path assessment.

Figure 1-1 illustrates the profile view dimensions of the truck used in the desktop study, with example turning paths for the truck. A 20 km/h design speed has been selected for all turn paths to be undertaken at intersections of interest. The turn paths are also representative of ideal conditions, using full pavement widths and do not allow for driver error. It should be noted that the design vehicle might change, should specific design vehicle configuration information be provided.

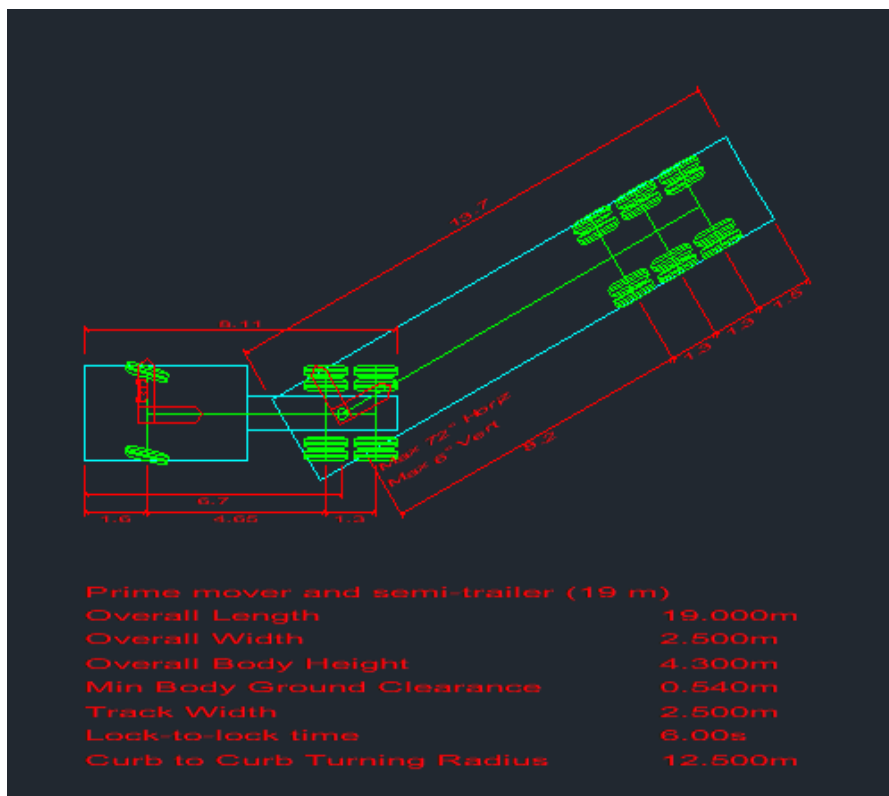


Figure 1-1 Transport design vehicle

Figure 1-2 illustrates the vehicle turn path of the transport design vehicle.

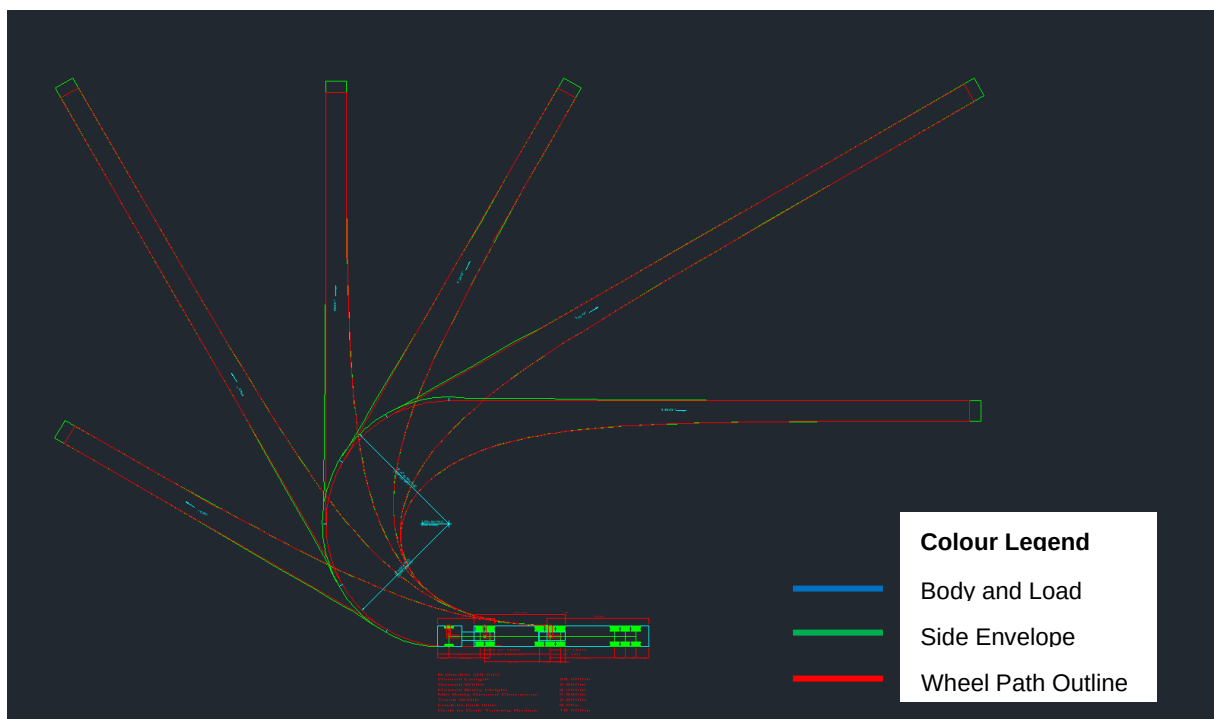


Figure 1-2 Transport design vehicle turn path

The preferred contractor responsible for the actual transport, when selected, is deemed to be responsible for undertaking further route assessment of the route options using their selected design vehicle. This assessment has been completed as a high-level route assessment to identify possible obstructions and likely mitigation requirements; however, the contractor is responsible for undertaking the assessment at a more detailed level prior to the commencement of the proposed transport operations.

1.4.2 Limitations

The route assessment does however not take the following into account:

- Pavement impact analysis due to the transport of construction material
- Any degree of impact to structures such as but not limited to bridges, culverts, kerbs etc.
- The route assessment does not analyse or take into account the existing vertical geometry
- The route assessment does not take into account any operating licenses if required
- The route assessment does not include a road safety audit
- The route assessment is based on an assumed design vehicle for the purpose of conducting swept path analysis
- Traffic counts were not conducted for the purpose of this assessment. It was considered appropriate to adopt traffic volumes along Pacific Highway from the *Pacific Highway Interchange at Kings Hill – Updated Traffic Modelling Report, November 2014* prepared by Hyder Consulting Pty Ltd
- The study was conducted based on a desktop assessment only.

2 DESKTOP STUDY

2.1 Study Area – Route Options

As mentioned in Section 1.1, there are five transport options considered for transporting the construction material, equipment and workforce. The study area consists of the road network contained within the five route options, which are shown from Figure 2-1 to Figure 2-5.

Route Option 1 is illustrated in Figure 2-1.

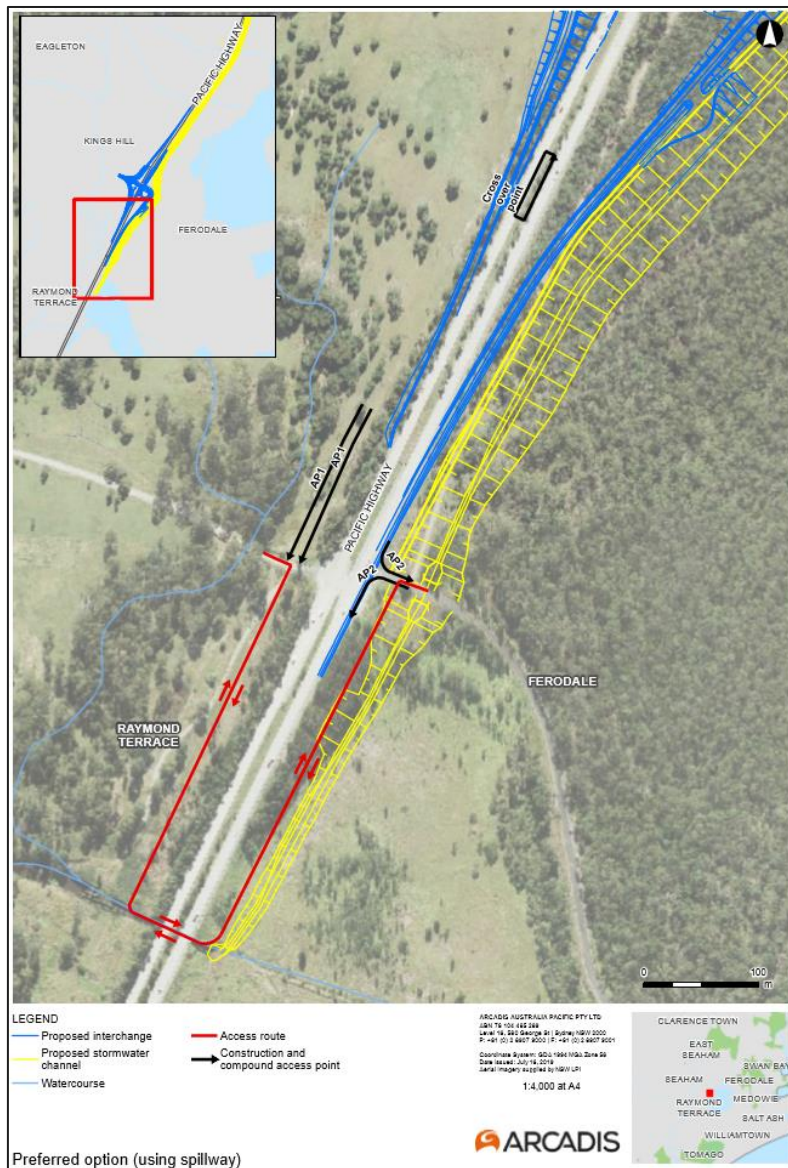


Figure 2-1 Route Option 1

Route Option 1 consists of utilising the existing spillway to travel between either side of the Pacific Highway. It is assumed that adequate height clearance of the spillway exists to allow for the passing of construction vehicles.

Route Option 2 is illustrated in Figure 2-2.



Figure 2-2 Route Option 2

Within Route Option 2, vehicles would exit southbound onto Pacific Highway from AP-07 and travel approximately 1.6 kilometres before turning right towards AP-01 by making use of the existing right-turn lane. This option allows vehicles to travel from the eastern side of the Pacific Highway to the western side.

Route Option 3 is illustrated in Figure 2-3



Figure 2-3 Route Option 3

Within Route Option 3, vehicles would exit southbound onto the Pacific Highway from AP-02 and travel approximately 3.5 km south to the Richardson Road exit. Vehicles would then perform a U-turn movement at the roundabout to travel back along the Pacific Highway northbound carriageway. Vehicles would then after 3.5 km use the left turn auxiliary lane to turn left at AP-01. This option allows vehicles to travel from the eastern side of the Pacific Highway to the western side.

Route Option 4 is illustrated in Figure 2-4

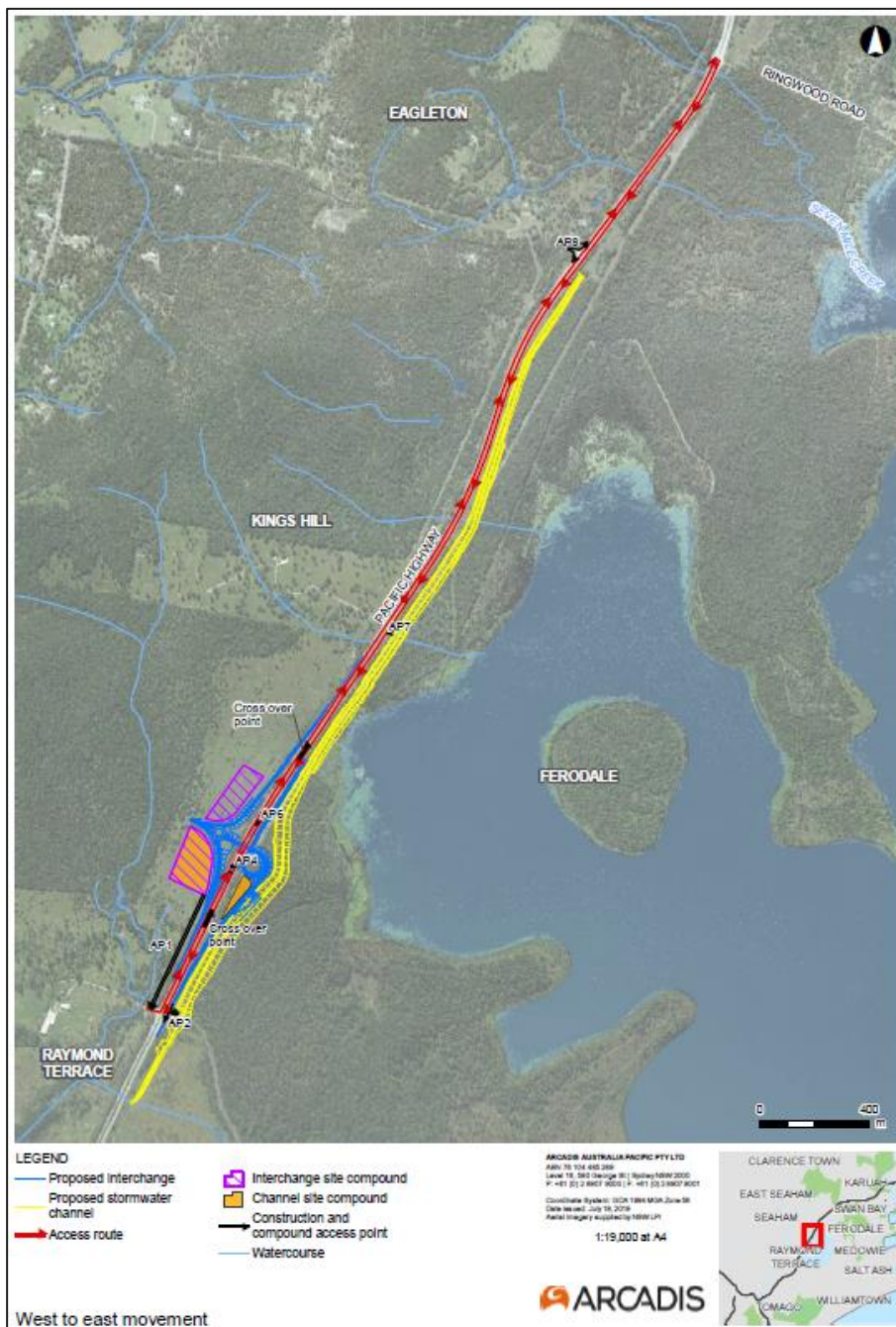


Figure 2-4 Route Option 4

Under Route Option 4, vehicles would turn left from AP-01 and travel northbound along the Pacific Highway for approximately 4 km, where vehicles would conduct a U-turn movement at the existing U-turn bay at Ringwood Road in order to travel in the southbound direction. Vehicles would then turn left to exit the Pacific Highway at AP-07 or AP-02. This option allows vehicles to travel from the western side of the Pacific Highway to the eastern side.

Route Option 5 is illustrated in Figure 2-5.

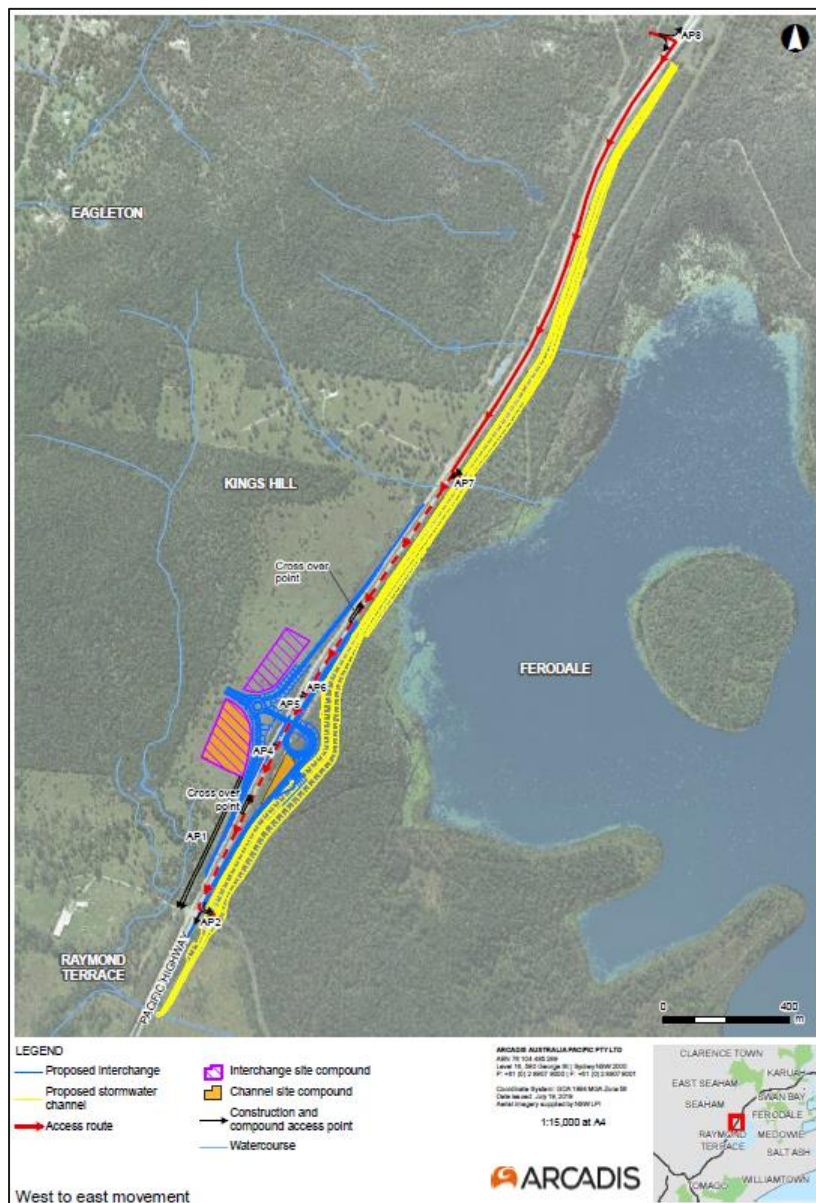


Figure 2-5 Route Option 5

Under Route Option 5, vehicles would exit southbound onto the Pacific Highway from AP-08 and travel southbound for approximately 1.5 km to AP-07, or 3.2 km to AP-02, where they would then make a right turn. This option allows vehicles to travel from the western side of the Pacific Highway to the eastern side.

2.2 Key Pinch Points

The desktop evaluation identified the pinch points in Table 2-1, which were assessed by means of a swept path analysis. The pinch points are illustrated in Figure 2-11 to Figure 2-15 in Section 2.6 of this technical memo. These key pinch point locations were selected if they satisfied at least one of the following criteria:

1. A major intersection or interchange
2. A particularly sharp bend or change in direction in the road. These are areas identified during the desktop study, however not all horizontal geometry of the route was assessed.

Table 2-1 Pinch point locations

ID	Street 1	Street 2	Approx. Lat.	Approx. Long.	Type
Route Option 1					
1	AP-01 access road	Gravel track	32°43'32.97"S	151°47'7.61"E	Constrained width
2	Spillway	-	-	-	Constrained width
3	AP-02 access road	Connection to spillway	32°43'33.41"S	151°47'11.06"E	Intersection
Route Option 2					
1	Pacific Highway	AP-07 access road	32°42'49.17"S	151°47'41.46"E	Intersection
2	Pacific Highway	AP-01 access road	32°43'32.97"S	151°47'7.61"E	Constrained width
Route Option 3					
1	Pacific Highway	AP-02 access road	32°43'33.70"S	151°47'9.51"E	Intersection
2	Pacific Highway	Richardson Road	32°45'19.29"S	151°45'56.32"E	Roundabout
3	Pacific Highway	AP-01 access road	32°43'32.97"S	151°47'7.61"E	Constrained width
Route Option 4					
1	Pacific Highway	AP-01 access road	32°43'32.97"S	151°47'7.61"E	Constrained width
2	Pacific Highway	Ringwood Road	32°41'41.44"S	151°48'29.12"E	U-turn
3	Pacific Highway	AP-07 access road	32°42'49.17"S	151°47'41.46"E	Intersection
4	Pacific Highway	AP-02 access road	32°43'32.77"S	151°47'10.52"E	Intersection
Route Option 5					
1	Pacific Highway	AP-08 access road	32°42'3.79"S	151°48'8.14"E	Intersection
2	Pacific Highway	AP-07 access road	32°42'49.17"S	151°47'41.46"E	Intersection
3	Pacific Highway	AP-02 access road	32°43'32.77"S	151°47'10.52"E	Intersection

2.2.1 Swept Path Analysis Process

The following systematic approach was used to conduct the swept path analyses:

3. Vehicle Tracking in AutoCAD 2019 was used as the preferred software suite
4. Aerial imagery of the pinch point areas was uploaded to provide a scaled background view of existing conditions and road alignment
5. Specific focus was given to each pinch point, and the design vehicle was placed on the background imagery in relation to the road alignment with an acceptable vehicle trajectory
6. The swept path movement was performed using the AutoDrive function whilst steering the vehicle through the pinch point area, taking into consideration both front and rear steering axles. The travel pathway through the pinch point was based on the most realistic scenario given the constraints of the physical environment
7. An iterative process was followed for each pinch point, where focus was given to obtain the best optimum alignment between the front and rear axles whilst taking into consideration the swept path
8. Each swept path was reinvestigated to ensure vehicle movements are smoothed out
9. The combination of the swept path analysis and confirmation of the specific conflict points were used to determine the extent of the conflict areas.

2.3 High Level Road Link Capacity Assessment

A high-level planning analysis assessment of the road link capacity along the Pacific Highway has been undertaken based on each route option and direction of travel. The capacity analysis has been undertaken in order to quantify the impact construction traffic would have on the operational performance and remaining capacity of the Pacific Highway. The capacity analysis was also used in assessing the viability of each route option. The capacity analysis is based on the analysis criteria adopted from *Austroads Guide to Traffic Engineering Practice – Part 2: Roadway Capacity, 1988*. The analysis criteria for determining road link level of service (LoS) is provided in Table 2-2.

Table 2-2 Multi-lane highway analysis criteria

LoS	Percent Trucks				
	0	5	10	15	20
Level Terrain					
A	700	700	650	650	600
B	1100	1050	1000	1000	1000
C	1400	1350	1300	1250	1250
D	1750	1700	1650	1600	1550
E	2000	1950	1850	1800	1750
Rolling Terrain					
A	700	600	550	500	500
B	1100	950	850	800	700
C	1400	1200	1100	1000	900
D	1750	1500	1350	1250	1100
E	2000	1750	1550	1450	1250
Mountainous Terrain					
A	700	500	400	350	300
B	1100	800	650	550	450
C	1400	1050	850	700	600
D	1750	1300	1050	850	750
E	2000	1500	1200	1000	850

Source: Austroads Guide to Traffic Engineering Practice – Part 2: Roadway Capacity, 1988

The analysis criteria are based on a service flow rate per lane (vehicles/hour) on multi-lane highways for planning applications, assuming a design speed of 100 km/h under level terrain conditions. Projected future year 2020 traffic volumes on the Pacific Highway were estimated based on previous traffic modelling assumptions documented in *Pacific Highway Interchange at Kings Hill, Updated Traffic Modelling Report* (Hyder Consulting Pty Ltd, 2014). The traffic modelling was performed for the 2036 condition, based on the assumption of background growth rate being about two per cent per annum. Projected future year 2020 volumes were estimated from this report. It is assumed that three construction vehicles would travel along the Pacific Highway in each direction during both peak periods, in addition to the background traffic. Table 2-3 shows the projected future year 2020 traffic volumes on the Pacific Highway for both morning and afternoon peak periods.

Table 2-3 projected future year 2020 traffic volumes on the Pacific Highway

Volumes	AM peak			PM peak		
	NB	SB	Two-way	NB	SB	Two-way
Total volumes (background traffic)	333	1061	1394	1061	462	1523
Volumes per lane (background traffic)	167	530	-	530	231	-
Volumes per lane (with construction traffic)	170	533	-	533	234	-

The roadway capacity was assessed based on traffic volumes per lane. The analysis results are shown in Table 2-4.

Table 2-4 Projected future year 2020 roadway capacity level of service on the Pacific Highway

Peak period	Pacific Highway LoS	
	NB	SB
AM peak	A	A
PM peak	A	A

Overall, the road link capacity assessment indicates that the Pacific Highway would perform at LoS A during both morning and afternoon peak periods, for vehicles travelling in both northbound and southbound directions. It was found that the expected increase due to construction traffic during the peak hours would not impact on capacity and operational performance of the Pacific Highway.

2.4 High Level Design Standard Assessment of Accesses

A high-level design standard assessment was conducted at the accesses along each route option. The assessment of the accesses is based on the *Austroads Guide to road Design – Part 4A: Unsignalised and Signalised Intersections, October 2010*. The design standard assessment was conducted to evaluate:

- Existing and required safe sight distances to accommodate the construction vehicles
- High-level assessment of impact to intersection and road link geometry and lane configuration
- Possible impact to pedestrians, cyclists and motorcycles.

2.4.1 Sight Distance Assessment

2.4.1.1 Safe Intersection Sight Distance

Safe Intersection Sight Distance (SISD) is the minimum sight distance which should be available along the major road at any intersection. An evaluation of the available SISD was done for the proposed compound access locations. The SISD assessment was based on the provisions of *Austrroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections* (AGRD). The existing longitudinal grade (vertical alignment) of the major road was measured in google earth along each of the compound accesses.

SISD was measured as indicated in Figure 2-6 for each compound area access:

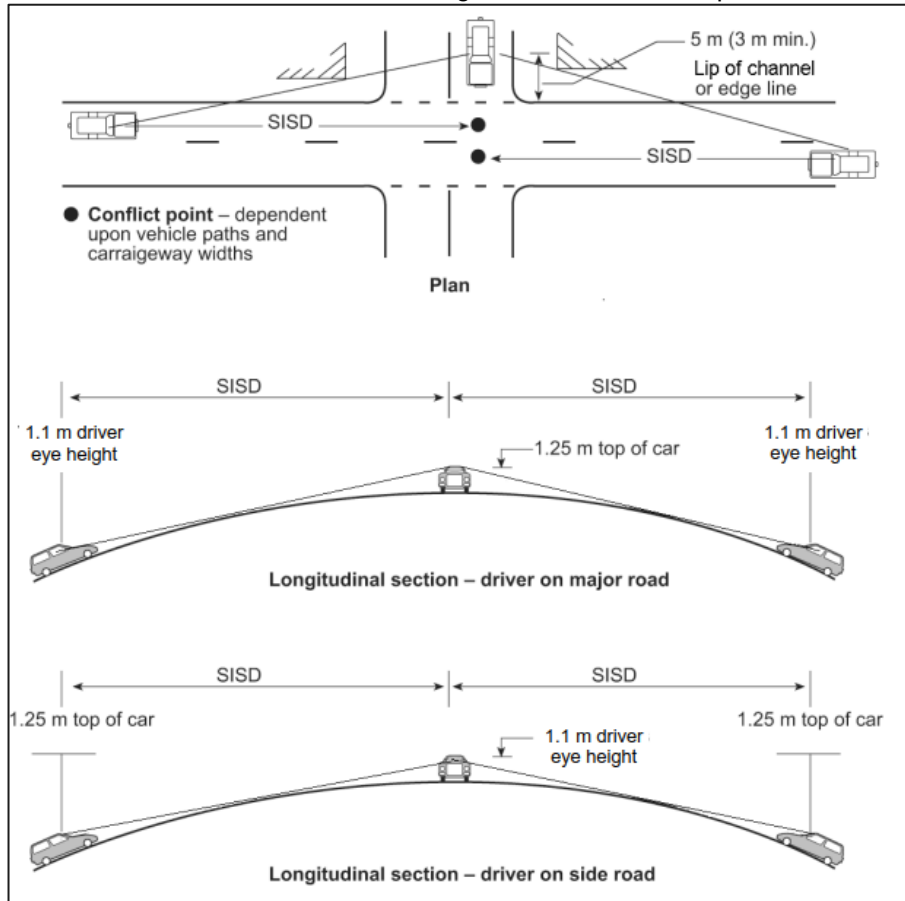


Figure 2-6 Concept of SISD

Visibility of the site accesses are perceived to be available for both directions of travel. The required SISD was determined based on the following equation:

$$SISD = \frac{DT \times V}{3.6} + \frac{V^2}{254 (d + 0.01 \times a)}$$

Where:

SISD = safe intersection sight distance (m)

DT = decision time (sec) = observation time (3 sec) + reaction time (sec) – refer to AGRD Part 3 (Austrroads 2016b) for a guide to values

V = operating (85th percentile) speed (km/h)

d = coefficient of deceleration – refer to Table 3.3 and AGRD Part 3 for a guide to values

a = longitudinal grade in % (in direction of travel: positive for uphill grade, negative for downhill grade) which should be available.

Table 2-5 shows the safe intersection sight distances calculated for each of the four accesses.

Table 2-5 Compound access SISD requirements from major road

Road	Parameter	Direction of Travel	
		Northbound	Southbound
Pacific Highway near AP-01	Ot	3	3
	Rt	2.5	2.5
	Dt	5.5	5.5
	V	110	110
	d	0.29	0.29
	a	0	-0.59
	SISD Required (m)	332	336
Pacific Highway near AP-02	Ot	3	3
	Rt	2.5	2.5
	Dt	5.5	5.5
	V	110	110
	D	0.29	0.29
	a	0	-0.59
	SISD Required (m)	332	336
Pacific Highway near AP-07	Ot	3	3
	Rt	2.5	2.5
	Dt	5.5	5.5
	V	110	110
	d	0.29	0.29
	a	-0.67	-0.71
	SISD Required (m)	336	336
Pacific Highway near AP-08	Ot	3	3
	Rt	2.5	2.5
	Dt	5.5	5.5
	V	110	110
	d	0.29	0.29
	a	1.15	0.80
	SISD Required (m)	326	328

It was found that the existing available SISD at all four accesses are greater than the minimum required distances for both directions of travel at each of the compound areas.

2.4.1.2 Minimum Gap Sight Distance

The assessed SISD and existing intersection sight distances were compared against the Minimum Gap Sight Distance (MGSD) for each of the accesses. The MGSD is calculated based on the observation angle to approaching traffic and critical gap acceptance values adopted by drivers undertaking typical manoeuvres at the intersections. The MGSD is defined by the *Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections* (Austroads, 2010) as the minimum distance in metres required for the driver of a vehicle entering the major flow to see a vehicle in the conflicting streams, in order to safely commence the desired manoeuvre.

Figure 2-7 and Figure 2-8 show the MGSD for left turning and right turning traffic respectively as the distance labelled 'D'.

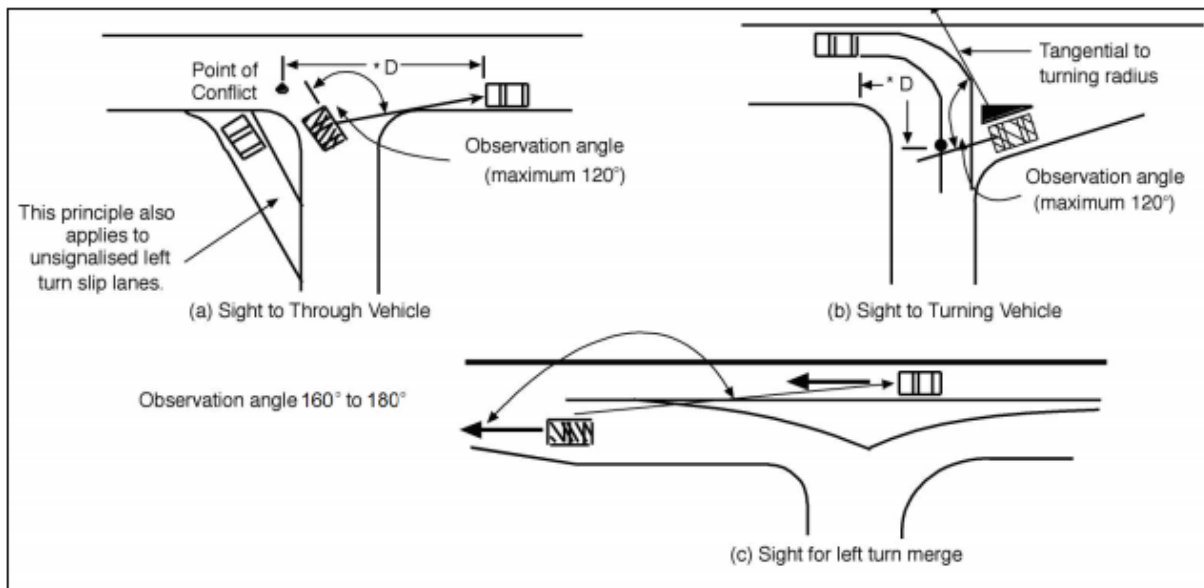


Figure 2-7 Sight distance requirements and angles for traffic turning left

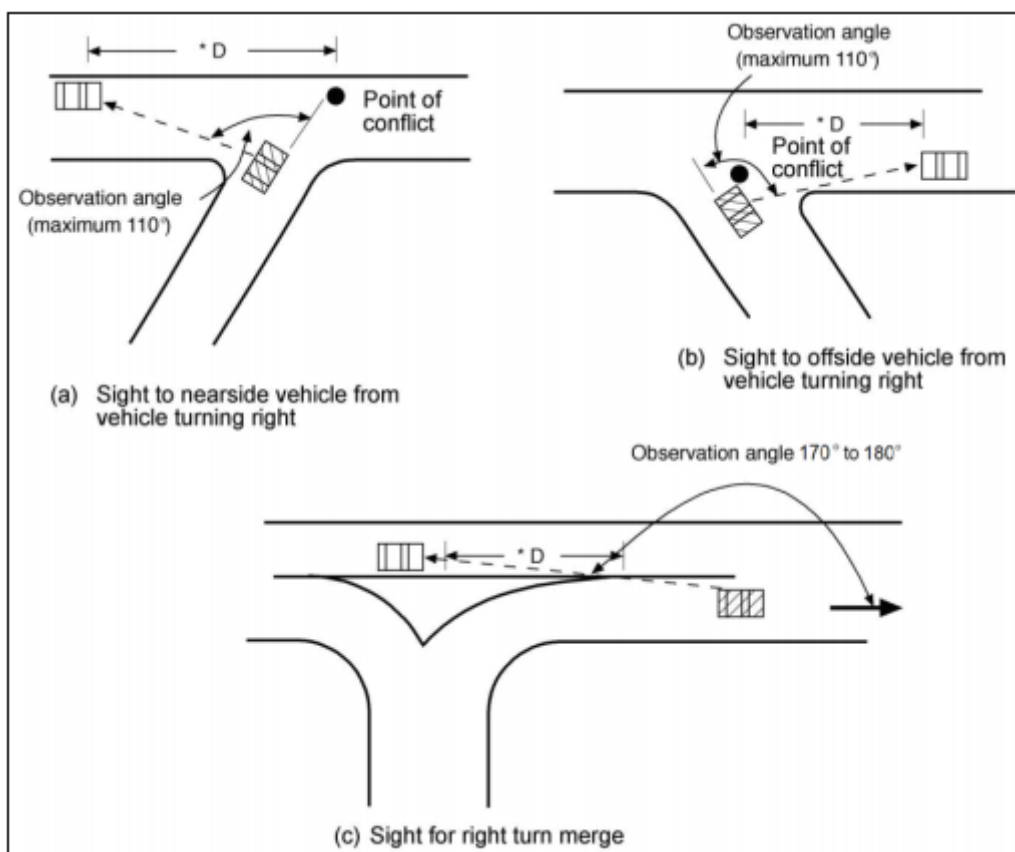


Figure 2-8 Sight distance requirements and angles for traffic turning right

The MGSD varies depending on vehicle approach speeds and critical gap acceptance times, as shown in Table 2-6.

Table 2-6 Minimum gap sight distances ('D' in metres) for various speeds

Critical gap acceptance time (ta) (secs)	85th percentile speed of approaching vehicle (km/h)										
	10	20	30	40	50	60	70	80	90	100	110
4	11	22	33	44	55	67	78	89	100	111	122
5	14	28	42	55	69	83	97	111	125	139	153
6	17	33	50	67	83	100	117	133	150	167	183
7	19	39	58	78	97	117	136	155	175	194	214
8	22	44	67	89	111	133	155	178	200	222	244
9	25	50	75	100	125	150	175	200	225	250	275
10	28	56	83	111	139	167	194	222	250	278	305

Comparison of the most conservative estimate of MGSD for the Pacific Highway would be about 305 metres, for vehicles travelling at 85th percentile speeds of 110 km/h, and with a critical gap acceptance time of 10 seconds. For all four accesses assessed, the existing sight distances at all approaches exceed the 305 metre MGSD requirement, therefore no sight distance issues are expected at any of the accesses.

2.4.1.3 Approach Sight Distance

Approach Sight Distance (ASD) is calculated the same as for SISD:

$$ASD = \frac{RT \times V}{3.6} + \frac{V^2}{254 (d + 0.01 \times a)}$$

where

ASD = approach sight distance (m)

RT = reaction time (sec); refer to *Austrroads Guide to Road Design Part 3: Geometric Design* (Austrroads, 2016) for guidance on values

V = operating (85th percentile) speed (km/h)

d = coefficient of deceleration; refer to *Austrroads Guide to Road Design Part 3: Geometric Design* (Austrroads, 2016) for guidance on values

a = longitudinal grade in % (in direction of travel: positive for uphill grade, negative or downhill grade)

Figure 2-9 illustrates the concept of ASD.

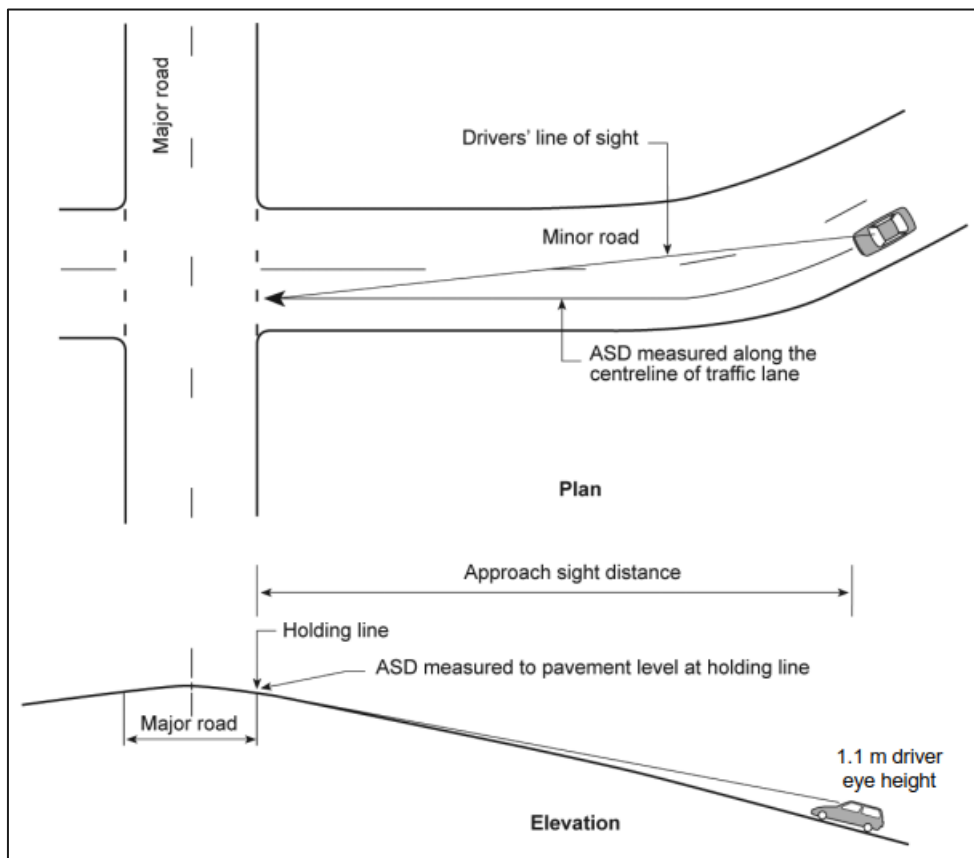


Figure 2-9 Concept of Approach Sight Distance (ASD)

The various sight distance requirements for trucks should be driver eye height of 2.4 metres to pavement level at the stop or holding line (zero metres). Approach sight distances for trucks are numerically the same as the SISD values for trucks provided in *Austrroads Guide to Road Design Part 3: Geometric Design* (Austrroads, 2016). The same sight distance requirements were calculated as for SISD.

SISD requirements for vehicles travelling from the proposed compound access points into the major flow were assessed and summarised in Table 2-7, where the SISD for the approach from each access to the Pacific Highway was recorded.

Table 2-7 Compound access SISD requirements

Road	Parameter	Direction of Travel
		Towards the Pacific Highway
AP-01 access road	Ot	3
	Rt	2
	Dt	5
	V	50
	d	0.29
	a	4
	SISD Required (m)	99
AP-02 access road	Ot	3
	Rt	2
	Dt	5
	V	50
	D	0.29
	a	1.503
	SISD Required (m)	102
AP-07 access road	Ot	3
	Rt	2
	Dt	5
	V	50
	d	0.29
	a	2
	SISD Required (m)	101
AP-08 access road	Ot	3
	Rt	2
	Dt	5
	V	80
	d	0.29
	a	-1.429
	SISD Required (m)	203

While existing sight distances could not be assessed due to accesses being located along minor roads, private roads and proposed new accesses with no data available, these minimum SISD requirements may be used to inform the future construction of vehicle compound access points.

However, due to road alignment and gradient, it is expected that the existing ASD is more than the required minimum distances and that the proposed accesses would maintain safe sight distance standards.

2.5 Restricted Access Vehicle Routes

Due to the limited information available regarding expected construction vehicle configurations, it is considered that approval may be required from Roads and Maritime Services (Roads and Maritime) through a permit application or notice, when roads to be used for construction transport purposes are to be serviced by vehicles that are classified Restricted Access Vehicles (RAVs). Examples of RAVs include:

- B-doubles and road trains
- Vehicle combinations longer than 19 metres
- Vehicles higher than 4.3 metres
- Combinations carrying large indivisible oversize or over mass (OSOM) loads
- Performance-Based Standards (PBS) vehicles (i.e. vehicles that have been designed, tested and approved in accordance with the PBS scheme).

Should vehicle configurations be used for the transport of construction material and equipment that comply with the prescribed mass and dimension limits do not require a notice or permit to operate on the road network. These vehicles are classified as General Access Vehicles (GAV). These vehicles have general access to the road network unless the road is sign-posted otherwise. The following prescribed dimensions apply to all GAV:

- Width limit of 2.5 metres excluding rear vision mirrors, signalling devices, side-mounted lamps and reflectors, anti-skid devices on wheels, central tyre inflation systems, tyre pressure gauges, and permanently fixed webbing-assembly-type devices.
- Height limit of 4.3 metres
- Overall length limit of 19 metres (with the exception of B-doubles which are classified as a Class 2 Restricted Access Vehicle).

It was found that the Pacific Highway currently provides access to GML vehicles consisting of 19-meter B-doubles (over 50 tonnes), as well as 4.6-metre high vehicles. The NSW Higher Mass Limit (HML) and RAV map is shown in Figure 2-10. It should be noted that the *NSW Route Assessment Guide for Restricted Access Vehicles, 30 October 2012* should be complied with.



Figure 2-10 Restricted access vehicle map

Source: <https://www.rms.nsw.gov.au/business-industry/heavy-vehicles/maps/restricted-access-vehicles-map/map/index.html> (accessed 26 August 2019).

Based on the heavy vehicle access provisions indicated in Figure 2-10, a notice or permit to operate on the road network would not be required, should the construction vehicles account for GAVs.

2.6 Analysis Results

This section of the report provides the findings of the vehicle swept path, link capacity and design standard analysis that was conducted for each of the route options. An analysis result sheet was produced for all the identified pinch points along each route option, and provides detailed information including:

- Pinch point under evaluation
- A pinch point location map
- Names of intersecting streets
- The aspect of conflict
- Geo-referenced longitude and latitude coordinates
- Imagery portraying the vehicle swept path results
- Google earth street view images indicating possible conflicts (if any)
- Road link capacity analysis results
- Design standard assessment results (sight distance assessment and lane configuration and access layout requirements)
- Descriptions of expected conflicts, possible mitigations, road safety risks, impact on community and managing road user inconvenience.

2.6.1 Route Option 1 analysis

Route Option 1 proposes the use of the existing spillway to travel between AP-01 and AP-02 and bypass the Pacific Highway. Three pinch points were identified along this route option and are shown in Figure 2-11.

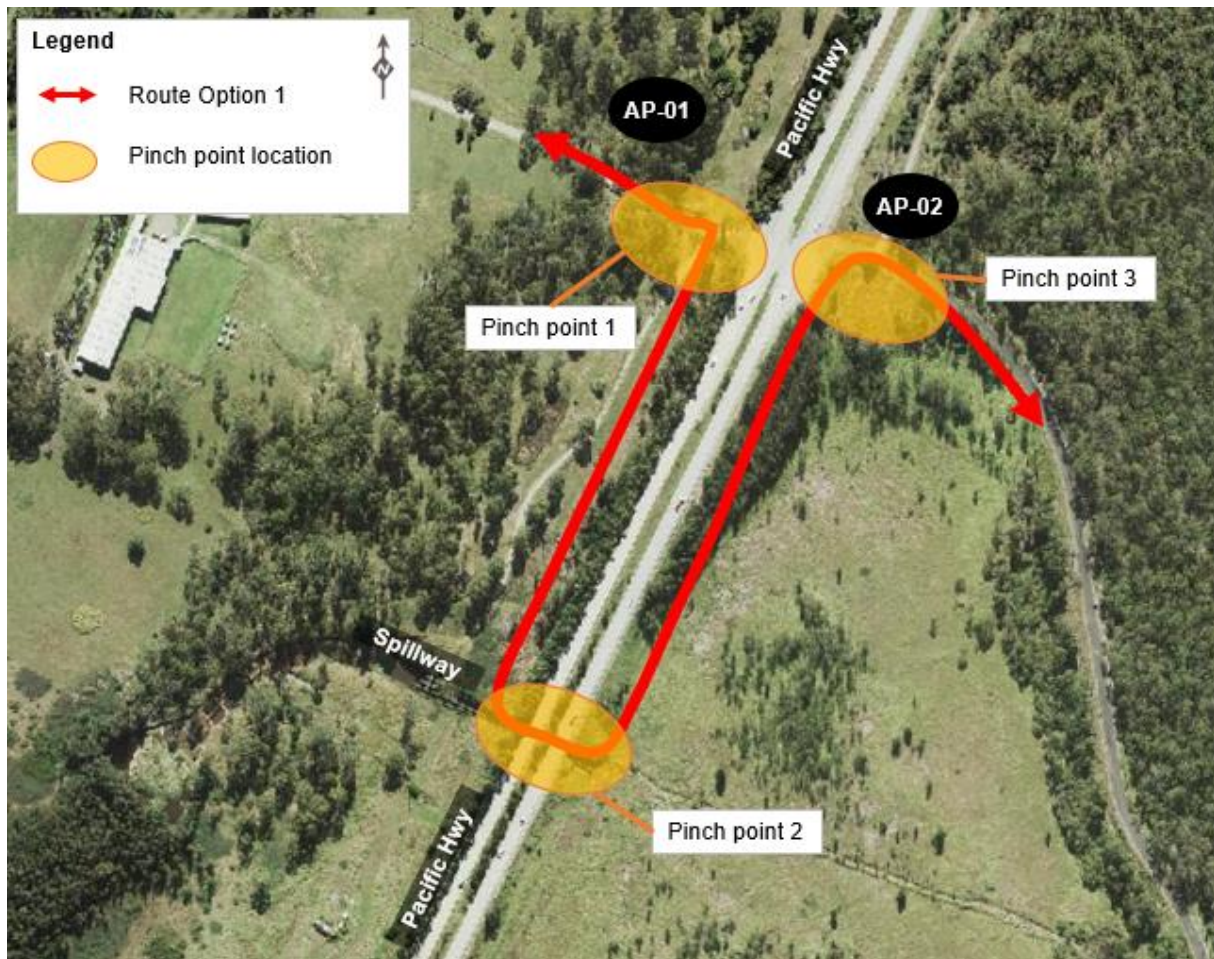
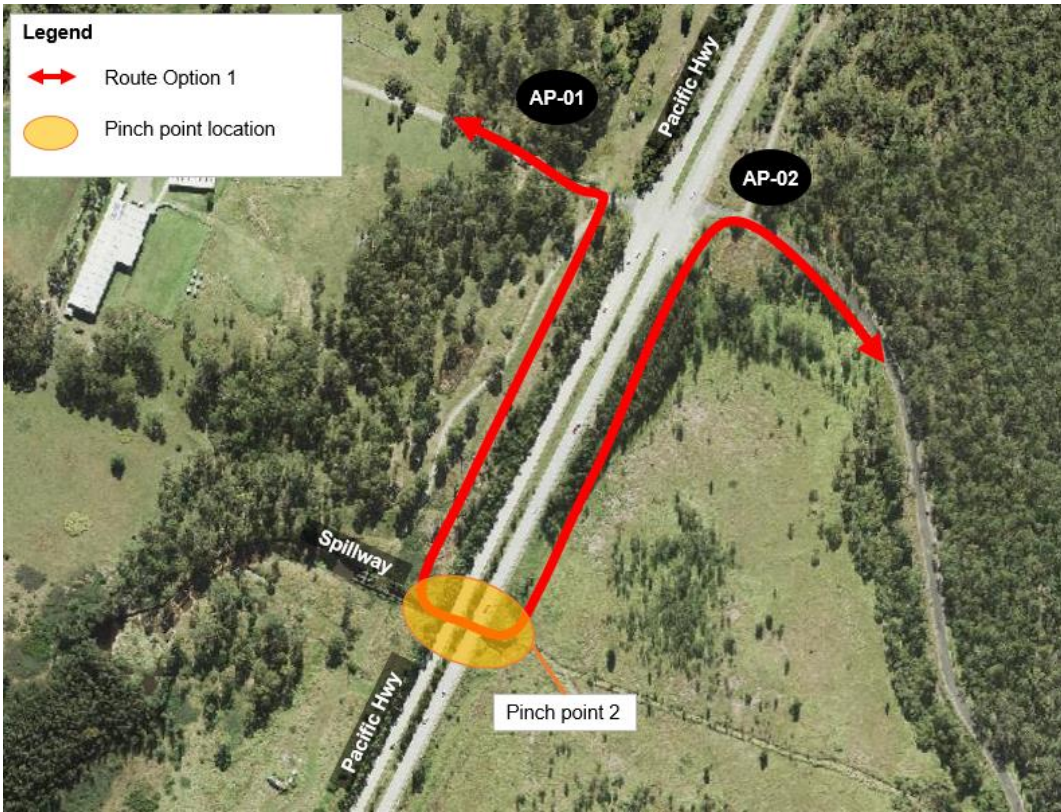


Figure 2-11 Pinch point locations along Route Option 1

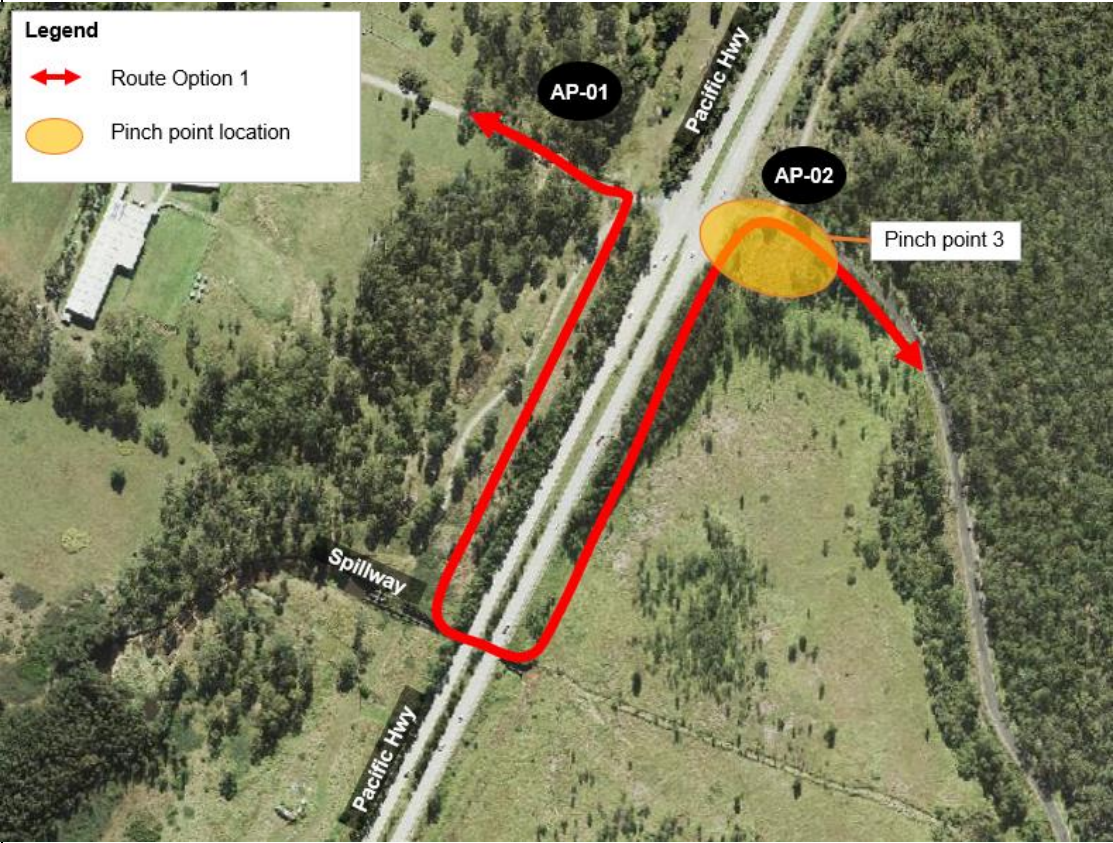
2.6.1.1 Route option 1 - Pinch point 1 results

Pinch Point ID	Street 1	Street 2	Approx. Lat.	Approx. Long.	Aspect of Conflict
R1-PP1	AP-01 access road	Gravel Track	32°43'32.97"S	151°47'7.61"E	Constrained Width
Locality		Swept Path Analysis		Envisaged Conflict	
Legend ↔ Route Option 1 Pinch point location 		No swept path conducted. Construction route traverses along an unformed gravel track.		The proposed route at this pinch point would intersect with an existing gravel road leading to existing farm steads and the proposed AP-01. Possible conflict would occur between heavy vehicles turning to and from the proposed transport route and traffic along the existing gravel road. There is a width constraint of approximately 6m along the existing gravel road to AP-01. There is no conflict with the Pacific Highway expected in this route option.	
				Sight Distance Evaluation	
				No impact expected. Design standards pertaining to sight distance requirements are not applicable to informal and unformed road conditions.	
				Lane Configuration and Access Layout Evaluation	
				No impact expected. Design standards pertaining to layout requirements are not applicable to informal and unformed road conditions. Traffic volumes are also expected to be low, with no turn lane treatment requirements.	
				Road Link Capacity Evaluation	
Intersection Photos (Sourced from Google Street View)				Possible Mitigation	
No photos available at given location.				The provision of a temporary gravel road with adequate width to accommodate for bi-directional flow of heavy vehicles would be required. Signage would be required indicating heavy vehicles turning at the intersection.	
Road Safety Considerations		Impacts on Community		Managing Road-User Inconvenience	
The provision of a temporary gravel road with adequate width to accommodate for bi-directional flow of heavy vehicles would be required. It is anticipated that a low speed environment is present with no impact to road safety. A temporary intersection with the AP-01 access road would be required to accommodate for bi-directional heavy vehicle turn paths. Signage would be required to indicate heavy vehicles turning at the intersection. There is no queueing impact expected to occur between the intersection with the Pacific Highway and the informal intersection between the access road to the laydown area (AP-01) and the informal gravel track to be used for Route Option 1. The spacing between the two intersections is approximately 40 metres apart, which is considered sufficient to accommodate for queueing vehicles. There is currently no street lighting available, which may affect night-time safety, and impact driving visibility in adverse weather conditions.		No impact is expected to other road users. Heavy vehicle noise may impact the immediate surroundings. It is assumed that relatively low traffic volumes occur due to the rural and informal nature of the existing gravel road to AP-01.		Inform the local community of trip plans, construction activities and durations. This should appropriately be documented in a Traffic Management Plan. Use temporary lighting where required or avoid night-time driving where visibility is constrained.	

2.6.1.3 Route option 1 - Pinch point 2 results

Pinch Point ID	Street 1	Street 2	Approx. Lat.	Approx. Long.	Aspect of Conflict		
R1-PP2	Spillway		32°43'43.07"S	151°47'2.76"E	Constrained Width		
Locality		Swept Path Analysis		Envisaged Conflict			
Legend ↔ Route Option 1 Pinch point location 		No swept path conducted. Construction route traverses along an unformed gravel track.		Possible conflict would occur between heavy vehicles travelling bi-directionally through the spillway where a width constraint of approximately 5.8 metres is evident. There is no conflict with the Pacific Highway expected with this route option.			
				Sight Distance Evaluation			
				No impact expected. Design standards pertaining to sight distance requirements are not applicable to informal and unformed road conditions.			
				Lane Configuration and Access Layout Evaluation			
				No impact expected. Design standards pertaining to layout requirements are not applicable to informal and unformed road conditions.			
				Road Link Capacity Evaluation			
				No impact expected where there is no conflict with the Pacific Highway.			
Intersection Photos (Sourced from Google Street View)				Possible Mitigation			
No photos available at given location.				Heavy vehicles should travel through the spillway separately per direction eliminating opposing movements in order to avoid possible conflict. It is advised that signage be provided at the entrances to the spillway to warn opposing construction vehicles to wait for oncoming vehicles before travelling through the spillway. Consider alternative transport options in the event the spillway is flooded through the implementation of a transport and trip management plan. Inform emergency services of the proposed transport route option in case such services are dispatched to a possible incident located in the spillway.			
Road Safety Considerations		Impacts on Community		Managing Road-User Inconvenience			
Possible conflict may occur between heavy vehicles needing to traverse through the spillway in opposite directions where a constrained width is evident. Flooding of the spillway may exacerbate safety risks where vehicles might become stationary in the spillway, in addition to floodwater risks. There is currently no street lighting available, which may affect night-time safety and impact driving visibility in adverse weather conditions.		No impact is expected to other road users through the spillway. Heavy vehicle noise may impact the immediate surroundings.		Inform the local community of trip plans, construction activities and durations. This should appropriately be documented in a Traffic Management Plan. Use temporary lighting where required or avoid night-time driving where visibility is constrained.			

2.6.1.4 Route option 1 - Pinch point 3 results

Pinch Point ID	Street 1	Street 2	Approx. Lat.	Approx. Long.	Aspect of Conflict
R1-PP3	AP-02 access road	Spillway	32°43'33.41"S	151°47'11.06"E	Intersection
Locality		Swept Path Analysis		Envisaged Conflict	
Legend ↔ Route Option 1 Pinch point location 		No swept path conducted. Construction route traverses along a proposed unformed track.		The proposed route at this pinch point would intersect with an existing paved road leading to Grahamstown Lake, which is access controlled and considered to be used only by maintenance vehicles. There is currently no existing road or track along the proposed route to accommodate for the heavy vehicles. The implementation of a temporary road would be required in addition to the clearing of existing vegetation. There is no conflict with the Pacific Highway expected with this route option.	
				Sight Distance Evaluation	
				No impact expected. Design standards pertaining to sight distance requirements are not applicable to informal and unformed road conditions.	
				Lane Configuration and Access Layout Evaluation	
				No impact expected. Design standards pertaining to layout requirements are not applicable to informal and unformed road conditions. Traffic volumes are also expected to be low, with no turn lane treatment requirements.	
				Road Link Capacity Evaluation	
Intersection Photos (Sourced from Google Street View)				No impact expected where there is no conflict with Pacific Highway.	
				Possible Mitigation	
No photos available at given location.				The proposed route travelled in Option 1 would require the clearing of vegetation as well as the provision of a temporary gravel track with an adequate width to accommodate for bi-directional flow of heavy vehicles.	
Road Safety Considerations		Impacts on Community		Managing Road-User Inconvenience	
The provision of a temporary gravel road with adequate width to accommodate for bi-directional flow of heavy vehicles would be required. It is anticipated that a low speed environment is present with no adverse impact to road safety. A temporary intersection with the AP-02 access road would be required to accommodate for bi-directional heavy vehicle turn paths. Signage would be required to indicate heavy vehicles turning at the intersection. There is no queueing impact expected to occur between the intersection with Pacific Highway and the informal intersection between the access road to the laydown area (AP-02) and the informal gravel track to be used for Route Option 1. There is sufficient storage space available between the two intersections to accommodate for queueing vehicles. There is currently no street lighting available, which may affect night-time safety, and impact driving visibility in adverse weather conditions.		No impact is expected to other road users. Heavy vehicle noise may impact the immediate surroundings. It is assumed that relatively low traffic volumes would occur due to the rural and informal nature of the existing road to Grahamstown Lake.		Inform the local community of trip plans, construction activities and durations. This should appropriately be documented in a Traffic Management Plan. Use temporary lighting where required or avoid night-time driving where visibility is constrained.	

2.6.2 Route Option 2 analysis

Route Option 2 provides a connection from AP-07 east of the Pacific Highway, and AP-01 west of the Pacific Highway. Vehicles would exit AP-07 southbound and travel for about 1.6 km before utilising the existing right turn lane to enter AP-01. Two pinch points were identified along this route option, shown in Figure 2-12.

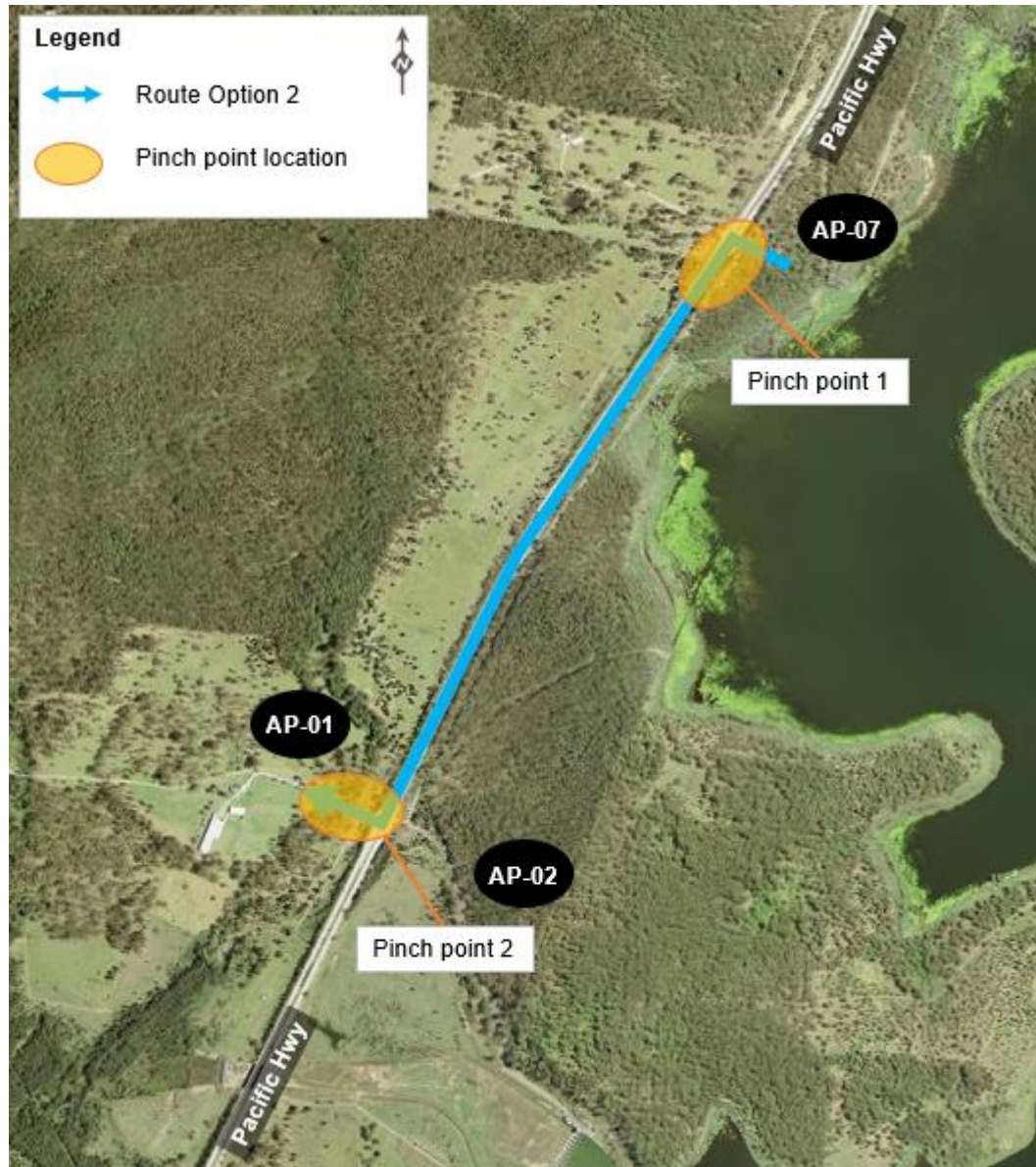
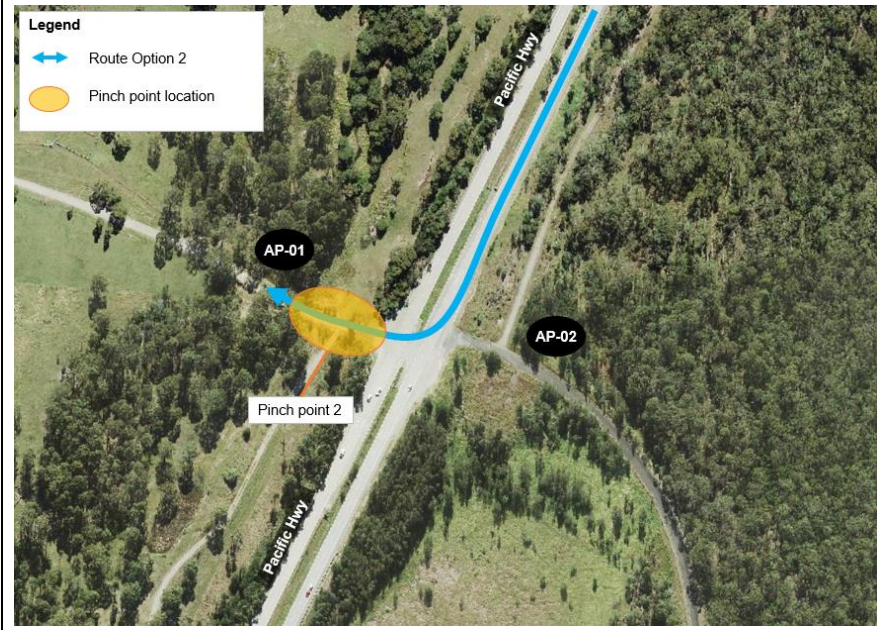


Figure 2-12 Pinch point locations along Route Option 2

2.6.2.1 Route option 2 - Pinch point 1 results

Pinch Point ID	Street 1	Street 2	Approx. Lat.	Approx. Long.	Aspect of Conflict
R2-PP1	Pacific Highway	AP-07 access road	32°42'49.17"S	151°47'41.46"E	Intersection
Locality		Swept Path Analysis		Envisaged Conflict	
				There is no conflict envisaged for the swept path movement from AP-07 onto the Pacific Highway. The design vehicle is expected to be able to turn left onto the Pacific Highway (two lanes southbound) without any impacts to roadside infrastructure, as identified by the swept path analysis. The existing access layout does not provide for an acceleration lane on the Pacific Highway for vehicles turning from the proposed access. This may create conflict between heavy vehicles turning from the AP-07 access road and through vehicles travelling southbound on the Pacific Highway, introducing safety issues resulting from a high-speed differential. Upgrade of the AP-07 access road is also required to provide sufficient roadway width to accommodate bi-directional flow of heavy vehicles.	
Sight Distance Evaluation					
The existing longitudinal grade along the Pacific Highway near AP-07 is such that the proposed access point would be located in a sag, where both northbound and southbound traffic travel towards the point on a downhill slope. Travelling from the north, the longitudinal grade is -0.71%, and travelling from the south, the longitudinal grade is -0.67%. On both approaches, this results in a SISD requirement of 336 metres. The existing sight distances on both approaches to the intersection are considered sufficient to meet SISD requirements.					
Lane Configuration and Access Layout Evaluation					
The existing access layout does not provide for a left turn acceleration lane from the proposed access. It is proposed to upgrade or formalise the access in accordance with the requirements of <i>Austroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections Manual</i>, including a sufficient acceleration lane length to accommodate for heavy vehicle left turn movements and allow for safe acceleration to a tolerant and safe speed differential. The layout geometry should also be determined as per the <i>Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections Manual</i>.					
Intersection Photos (Sourced from Google Street View)				Road Link Capacity Evaluation	
				Road link capacity analysis of level terrain under the conservative assumption of 20% heavy vehicles volumes indicate that the Pacific Highway would operate at level of service A in the southbound direction during both AM and PM peak periods. It is expected that the additional 3 heavy vehicles per hour generated by construction traffic would have no impact on existing road link capacity and operational performance.	
Possible Mitigation					
It is proposed to upgrade or formalise the access in accordance with the requirements of <i>Austroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections Manual</i> through the provision of a sufficient acceleration lane length.					
Road Safety Considerations		Impacts on Community		Managing Road-User Inconvenience	
Slow moving vehicles transporting construction material would give way to the priority through movement when turning from the minor road onto the Pacific Highway, a major north-south movement corridor. High volumes of vehicles are serviced by the Pacific Highway daily, travelling at the high posted speed of 110 km/h. This may create hazardous situations for heavy vehicles merging onto the Pacific Highway where no acceleration lanes are provided. There is currently no street lighting available, which may affect night-time safety and impact driving visibility in adverse weather conditions.		The Pacific Highway is a major north-south movement corridor servicing local and through traffic passing through Raymond Terrace. Heavy vehicle noise may impact the immediate surroundings during the construction and operation of the AP-07 access.		Inform the local community (in particular, those who would use the adjacent private access road) of trip plans, construction activities and durations. This should appropriately be documented in a Traffic Management Plan. Travel outside of background traffic peak times and use temporary lighting where required or avoid night-time driving where visibility is constrained.	

2.6.2.2 Route option 2 - Pinch point 2 results

Pinch Point ID	Street 1	Street 2	Approx. Lat.	Approx. Long.	Aspect of Conflict
R2-PP1	Pacific Highway	AP-01 access road	32°43'32.97"S	151°47'7.61"E	Constrained Width
Locality		Swept Path Analysis		Envisaged Conflict	
				Potential conflict exists for bi-directional traffic travelling on the AP-01 access road due to the narrow road width of about 6 metres. This issue is compounded upon by the low fencing present on either side of the AP-01 access road. Vehicle swept path analysis indicates that none of the road signage and infrastructure (identified in intersection photos) would be impacted other than the access road fencing.	
				Sight Distance Evaluation	
				The existing longitudinal grade along the Pacific Highway near AP-01 is such that southbound traffic on the Pacific Highway would travel along a downhill slope of about -0.59% until reaching the AP-01 access road. South of the access, the gradient reduces to a relatively flat gradient of about 0%. The resulting SISD requirement is about 336 metres for southbound traffic and 332 metres for northbound traffic. The existing sight distances on both approaches to the intersection are considered sufficient to meet SISD requirements.	
				Lane Configuration and Access Layout Evaluation	
				The intersection currently has a right turn auxiliary (deceleration) lane of sufficient length to accommodate for heavy vehicle right turn movements and the associated turn path into AP-01 from Pacific Highway. The existing right turn short lane is about 85 metres long. Widening of the AP-01 access road should be taken into account, which would require the upgrade of existing bell mouths and any other setting out details. The layout geometry should also be determined as per the <i>Austrroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections Manual</i>.	
				Road Link Capacity Evaluation	
				Road link capacity analysis of level terrain under the conservative assumption of 20% heavy vehicles volumes indicate that the Pacific Highway would operate at level of service A in the southbound direction during both AM and PM peak periods. It is expected that the additional 3 heavy vehicles per hour generated by construction traffic would have no impact on existing road link capacity and operational performance.	
				Possible Mitigation	
				It is proposed to widen the existing gravel road to allow for bi-directional flow of heavy vehicles and to allow for right turn movements from Pacific Highway to be unimpeded. Other mitigation measures should also include the removal of sections of fencing along the AP-01 access road. Heavy vehicle turning signs should also be provided at the intersection in order to warn transient traffic, who would be unfamiliar with local conditions and construction activities.	
				Managing Road-User Inconvenience	
Road Safety Considerations		Impacts on Community		Managing Road-User Inconvenience	
Slow moving vehicles transporting construction material would perform a right turn movement across two lanes of opposing traffic along the Pacific Highway. Potential conflict may occur between high speed through movement vehicles along the Pacific Highway and right turning construction vehicles where high risk gaps are taken. There is currently no street lighting available, which may affect night-time safety, and impact driving visibility in adverse weather conditions.		The Pacific Highway is a major north-south movement corridor servicing local and through traffic passing through Raymond Terrace. Pacific Highway experiences relatively high peak hour traffic volumes. The AP-01 access road is shared by vehicles travelling to the RDA NSW building. It also provides a direct east-west connection between the Pacific Highway and the Raymond Terrace Resource Recovery Park. It is assumed that relatively low traffic volumes occur due to the rural and informal nature of the existing gravel road.		Inform the local community (in particular RDA NSW and the Raymond Terrace Resource Recovery Park) of trip plans, construction activities and durations. This should appropriately be documented in a Traffic Management Plan. Use temporary lighting where required or avoid night-time driving where visibility is constrained. Conduct driver safety training and put in place safety control measures to avoid high risk gaps taken by drivers to cross high-speed opposing traffic. This should be provided in a Safety Management Plan.	

2.6.3 Route Option 3 analysis

Route Option 3 provides a connection from AP-02, east of the Pacific Highway to AP-01, west of the Pacific Highway. The route option proposes the vehicles existing AP-02 turn left and travel about 3.5 km southbound where they would perform a U-turn manoeuvre at the Richardson Road roundabout. The vehicles would then travel 3.5 km northbound and use the left turn auxiliary lane to enter AP-01. Three pinch points were identified along this route option, as shown in Figure 2-13.

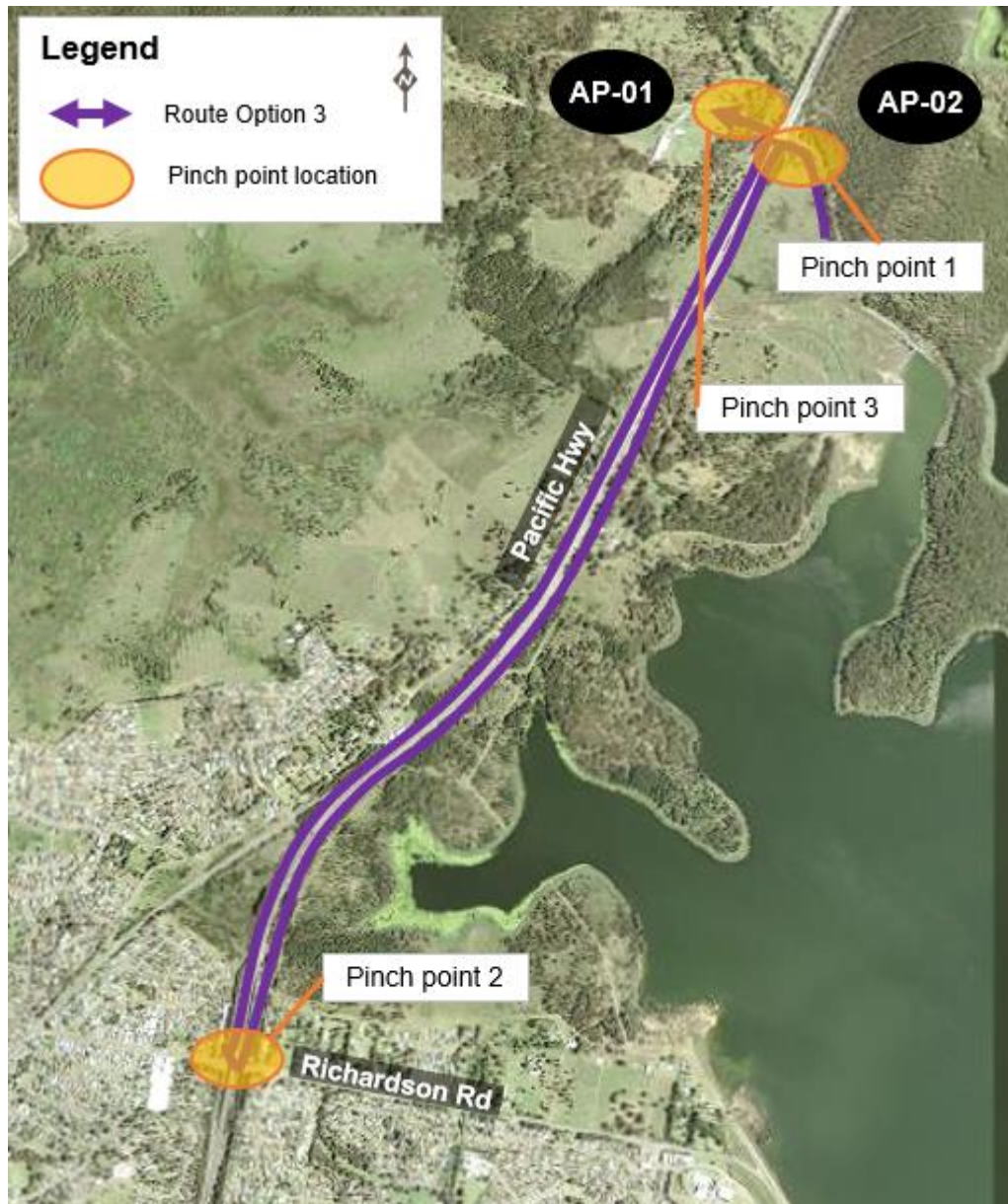
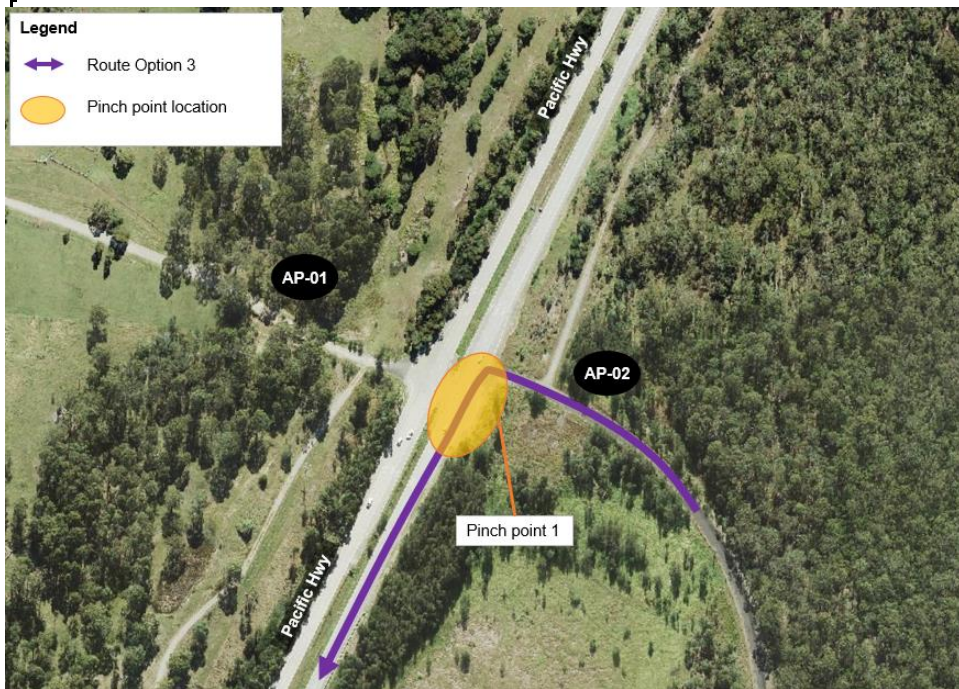
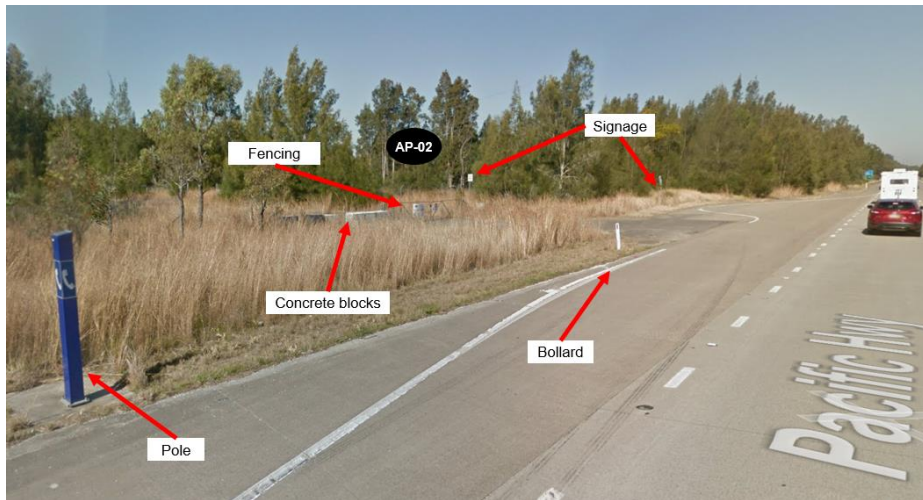


Figure 2-13 Pinch point locations along Route Option 3

2.6.3.1 Route option 3 - Pinch point 1 results

Pinch Point ID	Street 1	Street 2	Approx. Lat.	Approx. Long.	Aspect of Conflict
R3-PP1	Pacific Highway	AP-02 access road	32°43'33.70"S	151°47'9.51"E	Intersection
Locality		Swept Path Analysis		Envisaged Conflict	
Legend ↔ Route Option 3 Pinch point location 				Potential conflict exists for construction vehicles performing a left turn movement from the AP-02 access onto the Pacific Highway, travelling southbound. The existing access layout does not provide for a left turn acceleration lane from the proposed access, which may create conflict between heavy vehicles entering the major flow and through vehicles travelling at high speeds, due to the high-speed differential. The swept path analysis shows that the construction vehicles would not impact any roadside infrastructure (identified in the intersection photos). Sight Distance Evaluation The existing longitudinal grade along the Pacific Highway near AP-02 is such that southbound traffic on the Pacific Highway would travel along a downhill slope of about -0.59% until reaching the AP-02 access road. South of the access, the gradient reduces to a relatively flat gradient of about 0%. The resulting SISD requirement is about 336 metres for southbound traffic and 332 metres for northbound traffic. The existing sight distances on both approaches to the intersection are considered sufficient to meet SISD requirements. Lane Configuration and Access Layout Evaluation It is proposed to upgrade or formalise the access in accordance with the requirements of <i>Austrroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections Manual</i> with a sufficient acceleration lane length to accommodate heavy vehicle left turn movements and allow for safe acceleration to a tolerant and safe speed differential. The existing access layout does not provide for a left turn acceleration lane from the proposed access. Widening of the AP-07 access road should be taken into account, which would require upgrade of existing bell mouths and any other setting out details. The layout geometry should also be determined as per the <i>Austrroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections Manual</i>.	
Intersection Photos (Sourced from Google Street View)				Road Link Capacity Evaluation	
		Road link capacity analysis of level terrain under the conservative assumption of 20% heavy vehicles volumes indicate that the Pacific Highway would operate at level of service A in the southbound direction during both AM and PM peak periods. It is expected that the additional 3 heavy vehicles per hour generated by construction traffic would have no impact on existing road link capacity and operational performance.		Possible Mitigation It is proposed to upgrade or formalise the access in accordance with the requirements of <i>Austrroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections Manual</i> with a sufficient acceleration lane length. Heavy vehicle turning signs should also be provided at the intersection in order to warn transient traffic that would be unfamiliar with local conditions and construction activities. Upgrade of the AP-02 access road is required to provide sufficient roadway width to accommodate bi-directional flow of heavy vehicles.	
Road Safety Considerations		Impacts on Community		Managing Road-User Inconvenience	
Slow moving vehicles transporting construction material would give way to the priority through movement when turning from the minor road onto the Pacific Highway, a major north-south movement corridor. High volumes of vehicles are serviced by the Pacific Highway daily, travelling at the high posted speed of 110 km/h. This may create dangerous situations for heavy vehicles merging onto the Pacific Highway where no acceleration lanes are provided. There is currently no street lighting available, which may affect night-time safety, and impact driving visibility in adverse weather conditions.		The AP-02 access road is opposite the AP-01 access, shared by vehicles travelling to the RDA NSW building and the Raymond Terrace Resource Recovery Park. AP-02 is a private road providing controlled access to a Grahamstown Lake and is not open for public access. Very low traffic volumes are expected on these informal roads. The Pacific Highway is a major north-south movement corridor servicing local and through traffic passing through Raymond Terrace. Pacific Highway experiences relatively high peak hour traffic volumes.		Inform the local community (including RDA NSW and the Raymond Terrace Resource Recovery Park) of trip plans, construction activities and durations. This should appropriately be documented in a Traffic Management Plan. Travel outside of peak times, to avoid vehicular conflict. Use temporary lighting where required or avoid night-time driving where visibility is constrained.	

2.6.3.2 Route option 3 - Pinch point 2 results

Pinch Point ID	Street 1	Street 2	Approx. Lat.	Approx. Long.	Aspect of Conflict
R3-PP2	Pacific Highway	Richardson Road	32°45'19.29"S	151°45'56.32"E	Roundabout
Locality		Swept Path Analysis	Envisaged Conflict		
Legend ↔ Route Option 3 ● Pinch point location 			There is no conflict expected for this swept path U-turn movement from the Pacific Highway at the roundabout with Richardson Road. The construction vehicles are expected to be able to traverse around the roundabout without any impacts to roadside infrastructure. It is assumed that the vehicles will use the inner lane to perform the U-turn manoeuvre. The construction vehicles are expected travel underneath the Pacific Highway bridge; however, it is assumed that adequate height clearance exists. Sight Distance Evaluation No impact expected. Lane Configuration and Access Layout Evaluation No impact expected for this pinch point. Road Link Capacity Evaluation Road link capacity analysis of level terrain under the conservative assumption of 20% heavy vehicles volumes indicate that the Pacific Highway would operate at level of service A in the northbound and southbound directions during both AM and PM peak periods. It is expected that the additional 3 heavy vehicles per hour generated by construction traffic would have no impact on existing road link capacity and operational performance.		
Intersection Photos (Sourced from Google Street View)			Possible Mitigation		
			No mitigation required.		
Road Safety Considerations		Impacts on Community	Managing Road-User Inconvenience		
The proposed route involves slow moving vehicles transporting construction material performing a U-turn manoeuvre at a roundabout passing through the Raymond Terrace town centre. Pedestrian activity is expected to cross the road in this area, providing potential for conflict with construction vehicles using the roundabout.		The roundabout provides an interface between local and through traffic using the Pacific Highway. Pedestrian activity is expected in the area, and formal pedestrian footpaths are provided along all approaches to the roundabout.	Inform the local community of trip plans, construction activities and durations. This should appropriately be documented in a Traffic Management Plan. Travel outside of peak times.		

2.6.3.3 Route option 3 - Pinch point 3 results

Pinch Point ID	Street 1	Street 2	Approx. Lat.	Approx. Long.	Aspect of Conflict
R3-PP3	Pacific Highway	AP-01 access road	32°43'32.97"S	151°47'7.61"E	Constrained Width
Locality		Swept Path Analysis		Envisaged Conflict	
				Potential conflict exists for bi-directional traffic travelling on the AP-01 access road due to the narrow road width of about 6m. This issue is compounded upon by the low fencing on either side of the AP-01 access road.	
				Sight Distance Evaluation	
				The existing longitudinal grade along the Pacific Highway near AP-01 is such that southbound traffic on the Pacific Highway would travel along a downhill slope of about -0.59% until reaching the AP-01 access road. South of the access, the gradient reduces to a relatively flat gradient of about 0%. The resulting SISD requirement is about 336 metres for southbound traffic and 332 metres for northbound traffic. The existing sight distances on both approaches to the intersection are considered sufficient to meet SISD requirements.	
				Lane Configuration and Access Layout Evaluation	
				The intersection currently has a left turn auxiliary lane of about 35 meters in length to accommodate for the deceleration of heavy vehicles and to allow for the turn path from the Pacific Highway to the AP-01 access road. Widening of the AP-01 access road should be taken into account, which would require upgrade of existing bell mouths and any other setting out details. The layout geometry should also be determined as per the <i>Austrroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections Manual</i>.	
Intersection Photos (Sourced from Google Street View)				Road Link Capacity Evaluation	
				Road link capacity analysis of level terrain under the conservative assumption of 20% heavy vehicles volumes indicate that the Pacific Highway would operate at level of service A in the northbound direction during both AM and PM peak periods. It is expected that the additional 3 heavy vehicles per hour generated by construction traffic would have no impact on existing road link capacity and operational performance.	
				Possible Mitigation	
				It is proposed to widen the existing gravel road to allow for bi-directional flow of heavy vehicles, and to allow for right and left turn movements from Pacific Highway to be unimpeded. Heavy vehicle turning signs should also be provided at the intersection in order to warn transient traffic that would be unfamiliar with local conditions and construction activities.	
Road Safety Considerations		Impacts on Community		Managing Road-User Inconvenience	
Slow moving vehicles transporting construction material performing a left turn manoeuvre from the Pacific Highway into a minor access road conflicts with two lanes of northbound traffic, providing opportunity for conflict. There is currently no street lighting available, which may affect night-time safety, and impact driving visibility in adverse weather conditions.		The AP-01 access road is shared by vehicles travelling to the RDA NSW building. It also provides a direct east-west connection between the Pacific Highway and the Raymond Terrace Resource Recovery Park. Very low traffic volumes are expected on these informal roads. The Pacific Highway is a major north-south movement corridor servicing local and through traffic passing through Raymond Terrace. The Pacific Highway experiences relatively high peak hour traffic volumes.		Inform the local community (in particular RDA NSW and the Raymond Terrace Resource Recovery Park) of trip plans, construction activities and durations. This should appropriately be documented in a Traffic Management Plan. Travel outside of peak times to avoid vehicular conflict. Use temporary lighting where required or avoid night-time driving where visibility is constrained.	

2.6.4 Route Option 4 analysis

Route Option 4 provides a connection between AP-01, west of the Pacific Highway, to either AP-07 or AP-02, east of the Pacific Highway. The route option proposes that vehicles turn left out of AP-01, travelling northbound for about 4 km and performing a U-turn manoeuvre at the Ringwood Road U-turn bay. Vehicles would then travel southbound for about 2.4 km to AP-07, or 4 km to AP-02. Four pinch points were identified, as shown in Figure 2-14.

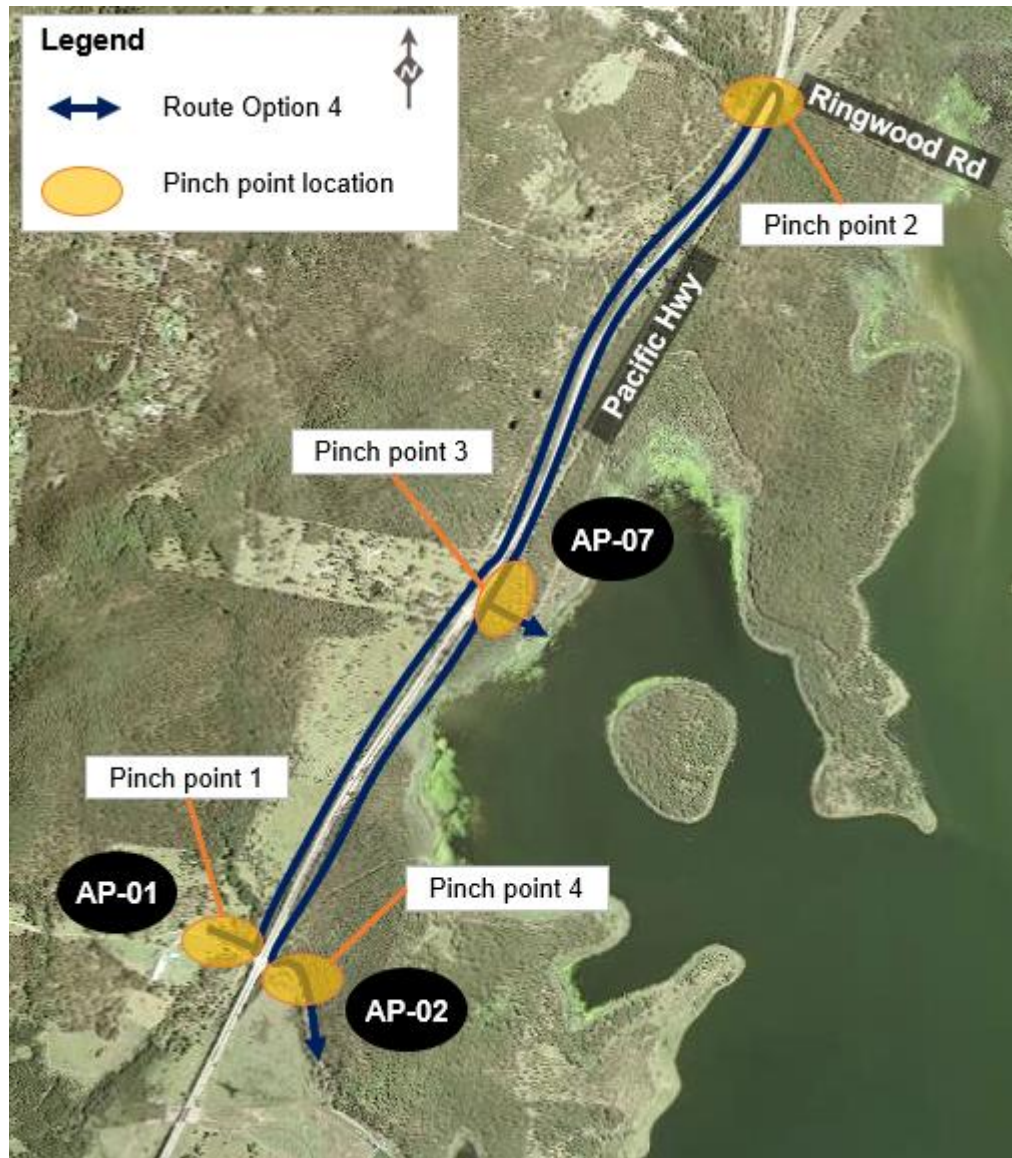


Figure 2-14 Pinch point locations along Route Option 4

2.6.4.1 Route option 4 - Pinch point 1 results

Pinch Point ID	Street 1	Street 2	Approx. Lat.	Approx. Long.	Aspect of Conflict
R4-PP1	Pacific Highway	AP-01 access road	32°43'32.97"S	151°47'7.61"E	Constrained Width
Locality		Swept Path Analysis	Envisaged Conflict		
			Potential conflict exists for bi-directional traffic travelling on the AP-01 access road, due to the narrow road width of about 6 metres. This issue is compounded upon by the low fencing present on either side of the AP-01 access road. Vehicle swept path analysis indicates that none of the road signage and infrastructure (identified in the intersection photos) will be impacted except for the access road fencing.		
			Sight Distance Evaluation		
			The existing longitudinal grade along the Pacific Highway near AP-01 is such that southbound traffic on the Pacific Highway would travel along a downhill slope of about -0.59% until reaching the AP-01 access road. South of the access, the gradient reduces to a relatively flat gradient of about 0%. The resulting SISD requirement is about 336 metres for southbound traffic and 332 metres for northbound traffic. The existing sight distances on both approaches to the intersection are considered sufficient to meet SISD requirements.		
			Lane Configuration and Access Layout Evaluation		
			The intersection currently has a right turn auxiliary (deceleration) lane of sufficient length to accommodate for heavy vehicle right turn movements and the associated turn path into AP-01 from the Pacific Highway. The existing right turn short lane is about 85 metres long. Widening of the AP-01 access road should be taken into account, which would require the upgrade of existing bell mouths and any other setting out details. The layout geometry should also be determined as per the <i>Austrroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections Manual</i>.		
Intersection Photos (Sourced from Google Street View)			Road Link Capacity Evaluation		
			Road link capacity analysis of level terrain under the conservative assumption of 20% heavy vehicles volumes indicate that the Pacific Highway would operate at level of service A in the southbound direction during both AM and PM peak periods. It is expected that the additional 3 heavy vehicles per hour generated by construction traffic would have no impact on existing road link capacity and operational performance.		
			Possible Mitigation		
			It is proposed to widen the existing gravel road to allow for bi-directional flow of heavy vehicles and to allow for right turn movements from Pacific Highway to be unimpeded. Other mitigation measures should also include the removal of sections of fencing along the AP-01 access road. Heavy vehicle turning signs should also be provided at the intersection in order to warn transient traffic that would be unfamiliar with local conditions and construction activities.		
Road Safety Considerations		Impacts on Community	Managing Road-User Inconvenience		
Slow moving vehicles transporting construction material would perform a right turn movement across two lanes of opposing traffic along the Pacific Highway. Potential conflict may occur between through movement vehicles travelling along the Pacific Highway at high speeds and right turn construction vehicles when high risk gaps are taken. There is currently no street lighting available, which may affect night-time safety, and impact driving visibility in adverse weather conditions.		The Pacific Highway is a major north-south movement corridor servicing local and through traffic passing through Raymond Terrace. Pacific Highway experiences relatively high peak hour traffic volumes. The AP-01 access road is shared by vehicles travelling to the RDA NSW building. It also provides a direct east-west connection between the Pacific Highway and the Raymond Terrace Resource Recovery Park. It is assumed that relatively low traffic volumes occur due to the rural and informal nature of the existing gravel road.	Inform the local community (in particular RDA NSW and the Raymond Terrace Resource Recovery Park) of trip plans, construction activities and durations. This should appropriately be documented in a Traffic Management Plan. Travel outside of peak times, avoid vehicular conflict. Use temporary lighting where required or avoid night-time driving where visibility is constrained. Conduct driver safety training and put in place safety control measures to avoid high risk gaps taken by drivers to cross high-speed opposing traffic. This should be provided in a Safety Management Plan.		

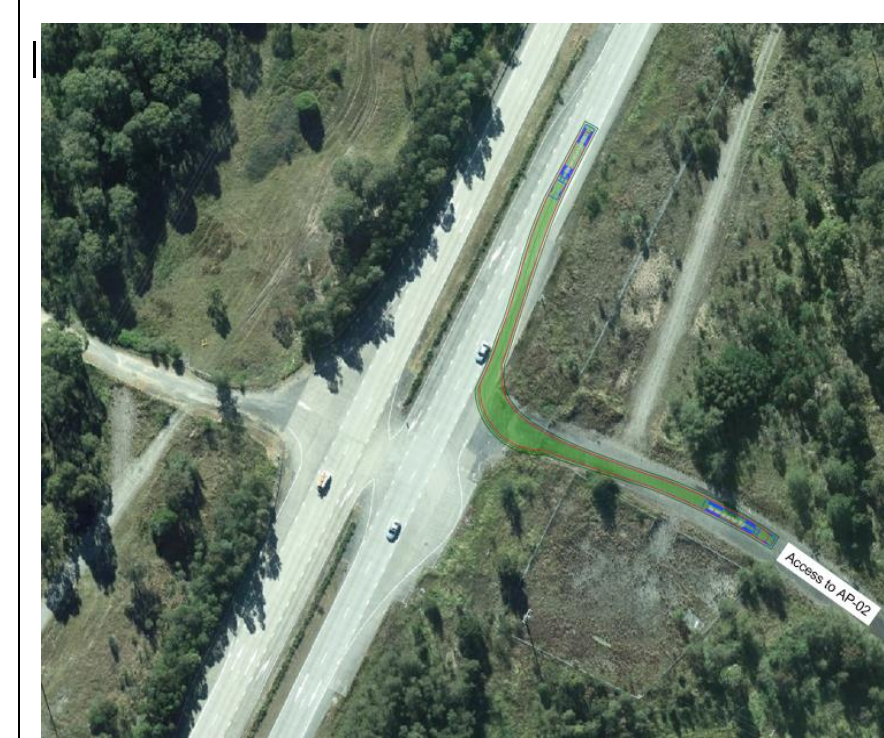
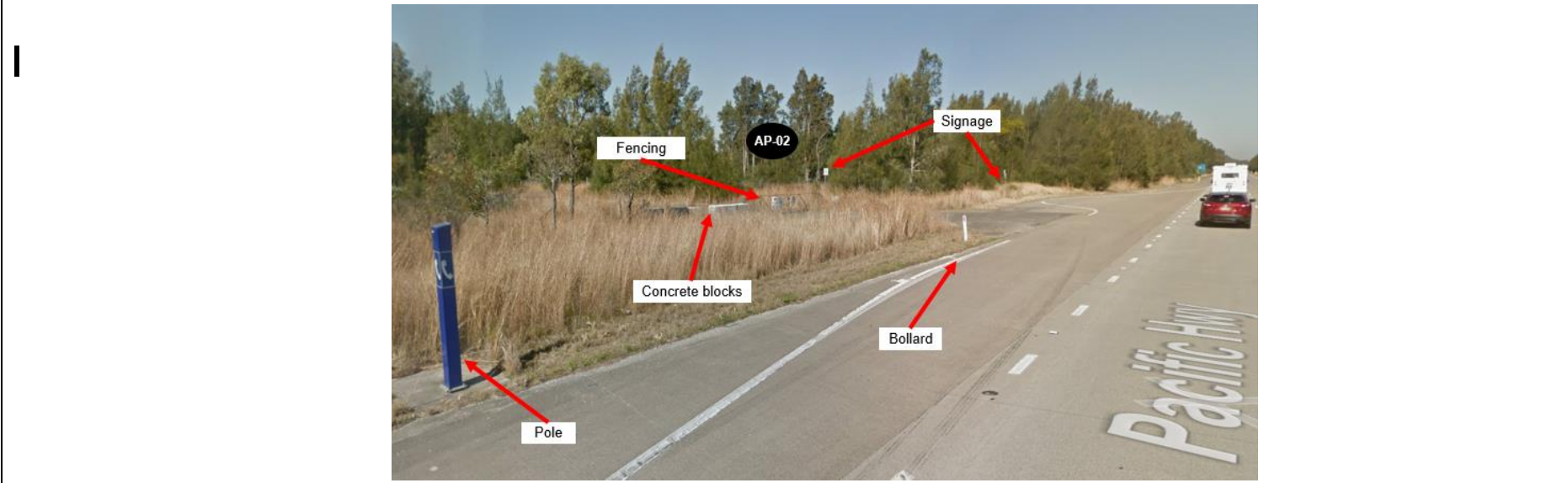
2.6.4.2 Route option 4 - Pinch point 2 results

Pinch Point ID	Street 1	Street 2	Approx. Lat.	Approx. Long.	Aspect of Conflict
R4-PP2	Pacific Highway	Ringwood Road	32°41'41.44"S	151°48'29.12"E	U-turn
Locality		Swept Path Analysis	Envisaged Conflict		
			The swept path U-turn movement from the Pacific Highway (northbound to southbound) at the intersection with Ringwood Road shows that turning construction vehicles are expected to cross three lanes of the Highway (two through lanes and one short lane). Safety issues are expected due to conflicting movement with the Pacific Highway, a major north-south movement corridor.		
			Sight Distance Evaluation The U-turn manoeuvre at Ringwood Road proposed for this route option requires the construction vehicles to cross three lanes (two through lanes and one short lane). Sight distance issues may be present at the intersection due to turning vehicles being unable to see and react to the behaviour of vehicles exiting Ringwood Road and oncoming vehicles on the Pacific Highway in the far side lane that might be behind other vehicles.		
			Lane Configuration and Access Layout Evaluation The existing intersection configuration requires that construction heavy vehicles cross three conflicting lanes when performing the proposed U-turn manoeuvre, posing potential safety issues.		
Intersection Photos (Sourced from Google Street View)  		Road Link Capacity Evaluation Road link capacity analysis of level terrain under the conservative assumption of 20% heavy vehicles volumes indicate that the Pacific Highway would operate at level of service A in the northbound and southbound directions during both AM and PM peak periods. It is expected that the additional 3 heavy vehicles per hour generated by construction traffic would have no impact on existing road link capacity and operational performance.			
		Possible Mitigation Safety issues for U-turn vehicles may be mitigated by widening the median to allow for a two-stage crossing. However, this option is likely to be costly, considering the implementation of the required median storage length requiring major works. A different turn point may be chosen at an intersection with better safety conditions. However, nearby intersections possess a similar geometrical footprint and lane configuration, therefore similar issues may persist. Alternatively, it is proposed that an alternative route option be considered.			
Road Safety Considerations		Impacts on Community		Managing Road-User Inconvenience	
Vehicles performing a U-turn would conflict with two lanes of southbound through traffic and one lane of left turning traffic at Ringwood Road, providing potential for conflict. There is currently no street lighting available, which may affect night time safety, and impact driving visibility in adverse weather conditions.		The Pacific Highway is a major north-south movement corridor servicing local and through traffic passing through Raymond Terrace. Ringwood Road is a minor road that provides an east-west connection for some local traffic between the Pacific Highway and Medowie, passing through an area with low density residential dwellings. However, Ringwood Road is an unformed gravel track, and is expected to service lower volumes than both Medowie Road (forming a connection to the Pacific Highway to the north of the assessed pinch point), and Richardson Road to the south (forming a connection with the Pacific Highway to the south via Raymond Terrace).		Inform the local community of trip plans, construction activities and durations. This should appropriately be documented in a Traffic Management Plan. Travel outside of peak times, perhaps in the evenings to avoid vehicular conflict. Use temporary lighting where required. Use temporary lighting where required or avoid night-time driving where visibility is constrained. Consider an alternative route option.	

2.6.4.3 Route option 4 - Pinch point 3 results

Pinch Point ID	Street 1	Street 2	Approx. Lat.	Approx. Long.	Aspect of Conflict
R4-PP3	Pacific Highway	AP-07 access road	32°42'49.17"S	151°47'41.46"E	Intersection
Locality		Swept Path Analysis		Envisaged Conflict	
				The swept path analysis indicates that potential conflict is envisaged with the existing signage and bollard north of the AP-07 access road when making the required turn path. All lateral movements and turn paths can be contained within the given lane configuration and existing left turn auxiliary lane. Upgrade of the AP-07 access road is required to provide sufficient roadway width to accommodate bi-directional flow of heavy vehicles.	
				Sight Distance Evaluation	
				The existing longitudinal grade along the Pacific Highway near AP-07 is such that the proposed access point would be located in a sag, where both northbound and southbound traffic travel towards the point on a downhill slope. Travelling from the north, the longitudinal grade is -0.71%, and travelling from the south, the longitudinal grade is -0.67%. On both approaches, this results in a SISD requirement of 336 metres. The existing sight distances on both approaches to the intersection are considered sufficient to meet SISD requirements.	
				Lane Configuration and Access Layout Evaluation	
				The intersection currently has a left turn auxiliary (deceleration) lane of sufficient length to accommodate for heavy vehicle right turn movements and associated turn path into AP-07 from the Pacific Highway. The existing left turn short lane is about 45 metres long. The layout geometry should also be determined as per the <i>Austrroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections Manual</i>.	
Intersection Photos (Sourced from Google Street View)				Road Link Capacity Evaluation	
				Road link capacity analysis of level terrain under the conservative assumption of 20% heavy vehicles volumes indicate that the Pacific Highway would operate at level of service A in the southbound direction during both AM and PM peak periods. It is expected that the additional 3 heavy vehicles per hour generated by construction traffic would have no impact on existing road link capacity and operational performance.	
				Possible Mitigation	
				Upgrade of the AP-07 access road is required to provide sufficient roadway width to accommodate bi-directional flow of heavy vehicles. Temporary removal of the existing signage and bollard north of the AP-07 access road would mitigate the potential for conflict.	
Road Safety Considerations		Impacts on Community		Managing Road-User Inconvenience	
Slow moving vehicles transporting construction material and turning from the Pacific Highway, with a posted speed limit of 110 km/h, into the AP-07 access road may pose potential for conflict. Decelerating heavy vehicles on Pacific Highway may create a safety risk to through vehicles travelling southbound along Pacific Highway. There is currently no street lighting available, which may affect night-time safety, and impact driving visibility in adverse weather conditions.		The Pacific Highway is a major north-south movement corridor servicing local and through traffic passing through Raymond Terrace. Heavy vehicle noise may impact the immediate surroundings during the construction and operation of the AP-07 access.		Inform the local community (in particular those who would use the adjacent private access road) of trip plans, construction activities and durations. This should appropriately be documented in a Traffic Management Plan. Use temporary lighting where required or avoid night time driving where visibility is constrained.	

2.6.4.4 Route option 4 - Pinch point 4 results

Pinch Point ID	Street 1	Street 2	Approx. Lat.	Approx. Long.	Aspect of Conflict
R4-PP4	Pacific Highway	AP-02 access road	32°43'32.77"S	151°47'10.52"E	Intersection
Locality		Swept Path Analysis		Envisaged Conflict	
				The swept path analysis indicates that potential conflict is envisaged with the existing bollard north of the AP-02 access road when making the required turn path. All lateral movements and turn paths can be contained within the given lane configuration and existing left turn auxiliary lane. The turn path indicates that heavy vehicles will take up most of the roadway width of the access road to AP-02 in order to complete the turn path. Upgrading of the left turn geometry would be required to accommodate for unimpeded bi-directional flow.	
		Sight Distance Evaluation		The existing longitudinal grade along the Pacific Highway near AP-02 is such that southbound traffic on the Pacific Highway would travel along a downhill slope of about -0.59% until reaching the AP-02 access road. South of the access, the gradient reduces to a relatively flat gradient of about 0%. The resulting SISD requirement is about 336 metres for southbound traffic and 332 metres for northbound traffic. The existing sight distances on both approaches to the intersection are considered sufficient to meet SISD requirements.	
		Lane Configuration and Access Layout Evaluation		The intersection currently has a left turn auxiliary (deceleration) lane of sufficient length to accommodate for heavy vehicle right turn movements and associated turn path into AP-02 from the Pacific Highway. The existing left turn short lane is about 20 metres long. Upgrading of the left turn geometry should be taken into account, which would require upgrade of existing bell mouths and any other setting out details. The layout geometry should also be determined as per the <i>Austrroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections Manual</i>.	
		Road Link Capacity Evaluation		Road link capacity analysis of level terrain under the conservative assumption of 20% heavy vehicles volumes indicate that the Pacific Highway would operate at level of service A in the southbound direction during both AM and PM peak periods. It is expected that the additional 3 heavy vehicles per hour generated by construction traffic would have no impact on existing road link capacity and operational performance.	
Road Safety Considerations		Impacts on Community		Possible Mitigation	
				Upgrade of the AP-02 access road is required to provide sufficient roadway width to accommodate bi-directional flow of heavy vehicles. Temporary removal of the existing bollard north of the AP-02 access road would mitigate the potential for conflict.	
Slow moving vehicles transporting construction material and turning from the Pacific Highway, with a posted speed limit of 110 km/h, into the AP-02 access road produces potential for conflict. Decelerating heavy vehicles on Pacific Highway may create a safety risk to through travelling vehicles along Pacific Highway. There is currently no street lighting available, which may affect night-time safety, and impact driving visibility in adverse weather conditions.		The Pacific Highway is a major north-south movement corridor servicing local and through traffic passing through Raymond Terrace. Heavy vehicle noise may impact the immediate surroundings.		Managing Road-User Inconvenience	
				Inform the local community (in particular RDA NSW and the Raymond Terrace Resource Recovery Park) of trip plans, construction activities and durations. This should appropriately be documented in a Traffic Management Plan. Travel outside of peak times. Use temporary lighting where required or avoid night-time driving where visibility is constrained.	

2.6.5 Route Option 5 analysis

Route Option 5 proposes a connection from AP-08, west of the Pacific Highway to either AP-07 or AP-02, east of the Pacific Highway. The route proposes that vehicles turn right at AP-08 and travel southbound along the Pacific Highway for about 1.5 km to AP-07, or 3.2 km to AP-02 before making a left turn into the accesses. Three pinch points were identified along this route, as shown in Figure 2-15.



Figure 2-15 Pinch point locations along Route Option 5

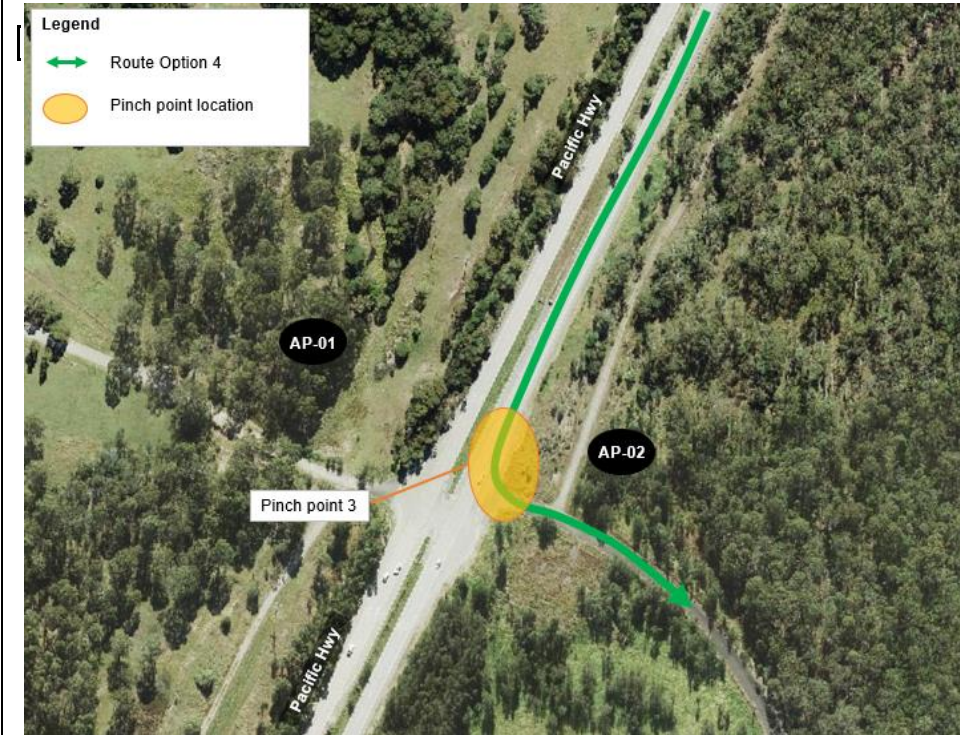
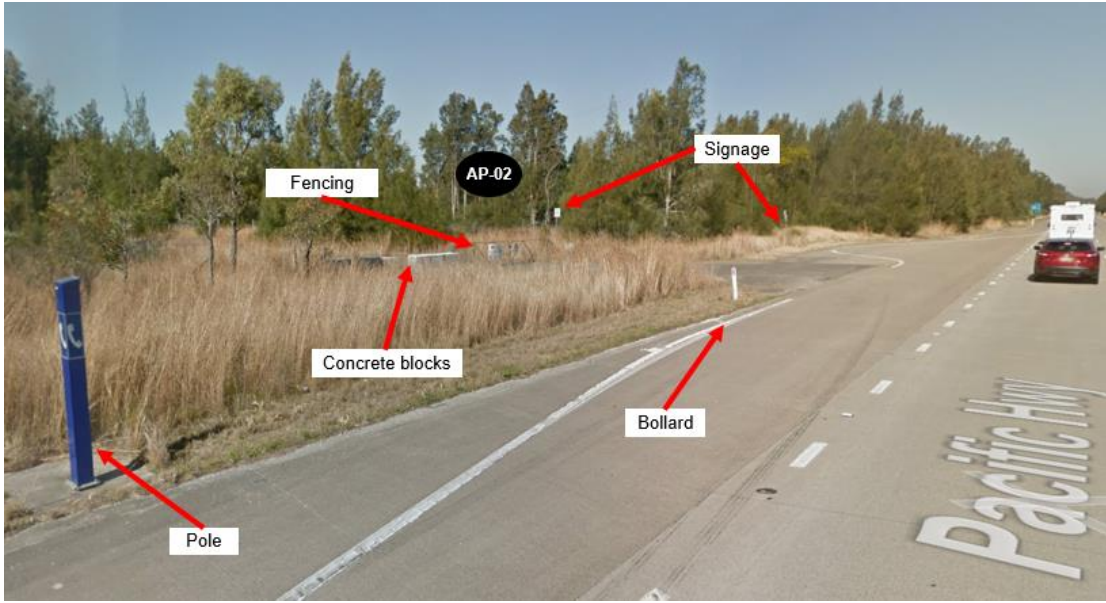
2.6.5.1 Route option 5 - Pinch point 1 results

Pinch Point ID	Street 1	Street 2	Approx. Lat.	Approx. Long.	Aspect of Conflict
R5-PP1	Pacific Highway	AP-08 access road	32°42'3.79"S	151°48'8.14"E	Intersection
Locality		Swept Path Analysis	Envisaged Conflict		
Legend → Route Option 5 Pinch point location 			There is no conflict envisaged for this swept path movement from AP-08 turning right onto the Pacific Highway. The design vehicle is expected to be able to turn right onto the Pacific Highway (three lanes southbound, merging into two downstream lanes) without any impacts to roadside infrastructure (as indicated in the intersection photos). All turn paths would be contained within the required lanes.		
			Sight Distance Evaluation The existing longitudinal grade along the Pacific Highway near AP-08 is such that the proposed access point would be located on a peak, where both northbound and southbound traffic travel towards the point on an uphill slope. Travelling from the north, the longitudinal grade is 0.80%, and travelling from the south, the longitudinal grade is 1.15%. The resulting SISD requirement is about 328 metres for southbound traffic and 326 metres for northbound traffic. The existing sight distances on both approaches to the intersection are sufficient to meet SISD requirements.		
			Lane Configuration and Access Layout Evaluation No impact expected. Adequate lane configuration (through the seagull treatment) is provided to minimise conflict with opposing movements.		
Intersection Photos (Sourced from Google Street View)  			Road Link Capacity Evaluation Road link capacity analysis of level terrain under the conservative assumption of 20% heavy vehicles volumes indicate that the Pacific Highway would operate at level of service A in the southbound direction during both AM and PM peak periods. It is expected that the additional 3 heavy vehicles per hour generated by construction traffic would have no impact on existing road link capacity and operational performance.		
			Possible Mitigation Heavy vehicle turning signs should also be provided at the intersection in order to warn transient traffic that would be unfamiliar with local conditions and construction activities.		
Road Safety Considerations		Impacts on Community	Managing Road-User Inconvenience		
Slow moving vehicles transporting construction material would be performing a right turn manoeuvre across two lanes of the Pacific Highway when entering the major flow. Potential conflict arises due to opposing vehicle movements occurring with the high volumes of vehicles serviced by the Pacific Highway, travelling at the high posted speed of 110 km/h. There is currently no street lighting available, which may affect night-time safety, and impact driving visibility in adverse weather conditions.		The Pacific Highway is a major north-south movement corridor servicing local and through traffic passing through Raymond Terrace. Six Mile Road is an unformed gravel track that provides an east-west connection between the Pacific Highway to the east and Newline Road to the west via Eagleton and is expected to service relatively low volumes of traffic.	Inform the local community of trip plans, construction activities and durations. This should appropriately be documented in a Traffic Management Plan. Travel outside of peak times. Use temporary lighting where required or avoid night time driving where visibility is constrained.		

2.6.5.2 Route option 5 - Pinch point 2 results

Pinch Point ID	Street 1	Street 2	Approx. Lat.	Approx. Long.	Aspect of Conflict
R5-PP2	Pacific Highway	AP-07 access road	32°42'49.17"S	151°47'41.46"E	Intersection
Locality		Swept Path Analysis	Envisaged Conflict		
Legend ↔ Route Option 5 Pinch point location 			The swept path analysis indicates that potential conflict is envisaged with the existing signage and bollard north of the AP-07 access road when making the required turn path. All lateral movements and turn paths can be contained within the given lane configuration and existing left turn auxiliary lane. Upgrade of the AP-07 access road is required to provide sufficient roadway width to accommodate bi-directional flow of heavy vehicles. Sight Distance Evaluation The existing longitudinal grade along the Pacific Highway near AP-07 is such that the proposed access point would be located in a small sag, where both northbound and southbound traffic travel towards the point on a downhill slope. Travelling from the north, the longitudinal grade is - 0.71%, and travelling from the south, the longitudinal grade is -0.67%. On both approaches, this results in a SISD requirement of 336 metres. The existing sight distances on both approaches to the intersection are considered sufficient to meet SISD requirements. Lane Configuration and Access Layout Evaluation The intersection currently has a left turn auxiliary (deceleration) lane of sufficient length to accommodate for heavy vehicle right turn movements and associated turn path into AP-07 from Pacific Highway. The existing left turn short lane is about 45 metres long. Widening of the AP-01 access road should be taken into account, which would require upgrade of existing bell mouths and any other setting out details. The layout geometry should also be determined as per the <i>Austrroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections Manual</i>.		
Intersection Photos (Sourced from Google Street View)			Road Link Capacity Evaluation		
			Road link capacity analysis of level terrain under the conservative assumption of 20% heavy vehicles volumes indicate that the Pacific Highway would operate at level of service A in the southbound direction during both AM and PM peak periods. It is expected that the additional 3 heavy vehicles per hour generated by construction traffic would have no impact on existing road link capacity and operational performance. Possible Mitigation Upgrade of the AP-07 access road is required to provide sufficient roadway width to accommodate bi-directional flow of heavy vehicles. Temporary removal of the existing signage and bollard north of the AP-07 access road would mitigate the potential for conflict.		
Road Safety Considerations		Impacts on Community	Managing Road-User Inconvenience		
Slow moving vehicles transporting construction material and turning from the Pacific Highway, with a posted speed limit of 110 km/h, into the AP-07 access road provide potential for conflict. Decelerating heavy vehicles on Pacific Highway may create a safety risk to through travelling vehicles along Pacific Highway. There is currently no street lighting available, which may affect night-time safety, and impact driving visibility in adverse weather conditions.		The Pacific Highway is a major north-south movement corridor servicing local and through traffic passing through Raymond Terrace. Heavy vehicle noise may impact the immediate surroundings during the construction and operation of the AP-07 access.	Inform the local community (in particular those who would use the adjacent private access road) of trip plans, construction activities and durations. This should appropriately be documented in a Traffic Management Plan. Use temporary lighting where required or avoid night-time driving where visibility is constrained.		

2.6.5.3 Route option 5 - Pinch point 3 results

Pinch Point ID	Street 1	Street 2	Approx. Lat.	Approx. Long.	Aspect of Conflict
R5-PP3	Pacific Highway	AP-02 access road	32°43'32.77"S	151°47'10.52"E	Intersection
Locality		Swept Path Analysis		Envisaged Conflict	
				The swept path analysis indicates that potential conflict is envisaged with the existing bollard north of the AP-02 access road when making the required turn path. All lateral movements and turn paths can be contained within the given lane configuration and existing left turn auxiliary lane. The turn path indicates that heavy vehicles will take up most of the roadway width of the access road to AP-02 in order to complete the turn path. Upgrading of the left turn geometry would be required to accommodate for unimpeded bi-directional flow.	
		Sight Distance Evaluation		The existing longitudinal grade along the Pacific Highway near AP-02 is such that southbound traffic on the Pacific Highway would travel along a downhill slope of about -0.59% until reaching the AP-02 access road. South of the access, the gradient reduces to a relatively flat gradient of about 0%. The resulting SISD requirement is about 336 metres for southbound traffic and 332 metres for northbound traffic. The existing sight distances on both approaches to the intersection are considered sufficient to meet SISD requirements.	
		Lane Configuration and Access Layout Evaluation		The intersection currently has a left turn auxiliary (deceleration) lane of sufficient length to accommodate for heavy vehicle right turn movements and associated turn path into AP-02 from the Pacific Highway. The existing left turn short lane is about 20 metres long. Upgrading of the left turn geometry should be taken into account, which would require upgrade of existing bell mouths and any other setting out details. The layout geometry should also be determined as per the <i>Austrroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections Manual</i>.	
		Road Link Capacity Evaluation		Road link capacity analysis of level terrain under the conservative assumption of 20% heavy vehicles volumes indicate that the Pacific Highway would operate at level of service A in the southbound direction during both AM and PM peak periods. It is expected that the additional 3 heavy vehicles per hour generated by construction traffic would have no impact on existing road link capacity and operational performance.	
Possible Mitigation				Upgrade of the AP-02 access road is required to provide sufficient roadway width to accommodate bi-directional flow of heavy vehicles. Temporary removal of the existing bollard north of the AP-02 access road would mitigate the potential for conflict.	
Road Safety Considerations		Impacts on Community		Managing Road-User Inconvenience	
Slow moving vehicles transporting construction material and turning from the Pacific Highway, with a posted speed limit of 110 km/h, into the AP-02 access road poses potential for conflict. Decelerating heavy vehicles on Pacific Highway may create a safety risk to through travelling vehicles along Pacific Highway. There is currently no street lighting available, which may affect night-time safety, and impact driving visibility in adverse weather conditions.		The Pacific Highway is a major north-south movement corridor servicing local and through traffic passing through Raymond Terrace. Heavy vehicle noise may impact the immediate surroundings.		Inform the local community (in particular RDA NSW and the Raymond Terrace Resource Recovery Park) of trip plans, construction activities and durations. This should appropriately be documented in a Traffic Management Plan. Travel outside of peak times. Use temporary lighting where required or avoid night-time driving where visibility is constrained.	

2.7 Consultation and Approvals

It is recommended that consultation with Roads and Maritime and the relevant local government agencies be undertaken during the Project development. Parallel to further route analysis studies, stakeholder consultation would need to be undertaken and Traffic Management Plans (TMPs) would be developed, detailing temporary and permanent traffic arrangements (if required) resulting from the Project. The TMPs would be developed in accordance with the *Traffic Control at Worksites* manual (Roads and Maritime, June 2010) by accredited personnel.

3 POTENTIAL IMPACTS SUMMARY

The swept path analyses indicate that there are several pinch points and conflict areas through which construction vehicles would have to traverse. Vehicle swept paths were conducted for a design vehicle as specified in Section 1.4.1 consisting of a 19-metre long “Prime mover with Semi-Trailer”. Some work would be required to formalise the laydown area accesses from a safety perspective at AP-01, AP-02, AP-07 and AP-08. Finding results are elaborated further in the following sub-sections. The route assessment findings are based on the following factors for each route option:

- Intersections and accesses
 - Pavement markings and signs
 - Speed environment
 - Intersection operation and acceleration/ deceleration lane
 - Auxiliary turn lanes/ lengths/ weaving
 - Heavy vehicle and bus turn paths
 - Utilities (hardware/ services)
 - Location of poles/ traffic signals
- Road links
 - Road width
 - Shoulder seal
 - Vertical/ horizontal alignment
 - Clearance to obstructions
 - Overtaking opportunities
- Pedestrians
 - Road crossing facilities
 - Footpaths
 - Disabled provision
 - Cyclists
 - Cycle lanes/ paths
 - Road crossing facilities
- Motorcyclists
 - Road surface
 - Barrier
 - Visibility at intersection.

3.1 Route Option 1 – Impact Analysis Findings

Safety Checklist	Pinch Point ID: Impact - Yes (Y), No (N)			Findings
	1	2	3	
Intersections and access				
Queueing	N	N	N	Pinch Point 1 - There is no queueing impact expected to occur between the intersection with Pacific Highway and the informal intersection between the access road to the laydown area (AP-01) and the informal gravel track to be used for Route Option 1. The spacing between the two intersections is approximately 40m apart which is considered sufficient to accommodate for queueing vehicles. Pinch Point 2 - There is no queueing impact expected along pinch point 2. Pinch Point 3 - There is no queueing impact expected to occur between the intersection with Pacific Highway and the informal intersection between the access road to the laydown area (AP-02) and the informal gravel track to be used for Route Option 1. There is sufficient stacking space available between the two intersections to accommodate for queueing vehicles.
Access Location and Sight Distance	N	N	N	Pinch Point 1, 2 and 3 - No impact expected. Design standards pertaining to sight distance requirements is not applicable to informal and unformed road conditions. It is assumed that given the low speed environment and straight and level terrain that adequate sight distance would prevail.
Pavement Markings & Signs	N	N	N	Pinch Point 1, 2 and 3 - No impact to pavement marking and signage expected.
Speed Environment	N	N	N	Pinch Point 1, 2 and 3 - There is no impact to the speed environment expected. Current conditions allow for a low speed environment.
Intersection Operation & Acc. / Dec. Lane	N	N	N	Pinch Point 1, 2 and 3 - Current conditions consist of unformed gravel track with no impact on intersection operations and or acceleration and deceleration lanes.
Auxiliary Turn Lanes / Lengths / Weaving	N	N	N	Pinch Point 1, 2 and 3 - No requirement for turn lanes based on warrant given low volumes of traffic are assumed.
Heavy Vehicle and Bus Turn paths	Y	Y	Y	Pinch Point 1, 2 and 3 - Given the informal nature of the roads and constrained road widths it is expected that opposing vehicle turn paths at the intersection locations will collide. It is proposed that the gravel roads be widened to provide sufficient width to accommodate opposing vehicle turn paths as well as along the links to accommodate for bi-directional flow. Pinch Point 2 - The spillway has an existing constrained width of 5.8m.
Utilities (Hardware / Services)	N	N	N	Pinch Point 1, 2 and 3 - It is assumed that there are no utilities evident at these pinch points to be impacted.
Location of Poles / Traffic Signals	N	N	N	Pinch Point 1, 2 and 3 - There are no traffic signals and or light poles evident at these pinch points to be impacted.
Road Links				
Road Width	Y	Y	Y	Pinch Point 1, 2 and 3 - Given the informal nature of the roads and constrained road widths it is expected that opposing vehicle turn paths at the intersection locations will collide. It is proposed that the gravel road links along Route Option 1 be widened to provide sufficient width to accommodate opposing vehicle turn paths at Pinch Point 1 and 3. Heavy vehicles should travel through the spillway at Pinch Point 2 separately per direction eliminating opposing movements in order to avoid possible conflict. It is advised that signage be provided at the entrances to the spillway to warn opposing construction vehicles to wait for oncoming vehicles before travelling through the spillway.
Capacity	N	N	N	Pinch Point 1, 2 and 3 - No impact to roadway capacity expected.
Shoulder Seals	N	N	N	Pinch Point 1, 2 and 3 - No impact on shoulder seals expected given the existing roads are unformed gravel track.
Vertical / Horizontal Alignment	N	N	N	Pinch Point 1, 2 and 3 - No impact expected. Design standards pertaining to horizontal / vertical alignment requirements is not applicable to informal and unformed road conditions.
Bridges and Approaches	N	N	N	Pinch Point 1, 2 and 3 - No impact on bridges and approaches expected.
Clearance to Obstructions	N	N	N	Pinch Point 2 - No impact on height restrictions expected. It is assumed that the spillway consists of sufficient height to allow for heavy vehicle movements without any impact.
Overtaking Opportunities	N	N	N	Pinch Point 1, 2 and 3 - Given the low speed and informal road environment, overtaking opportunities are not required.
Pedestrians				
Road Crossing Facilities	N	N	N	Pinch Point 1, 2 and 3 - No impact to road crossing facilities expected. There is no pedestrian activity or associated infrastructure available along the route option.
Footpaths	N	N	N	Pinch Point 1, 2 and 3 - No impact to footpaths expected. There is no pedestrian activity or associated infrastructure available along the route option.
Disabled Provision	N	N	N	Pinch Point 1, 2 and 3 - No impact to disabled facilities expected. There is no pedestrian activity or associated infrastructure available along the route option.
Cyclists				
Cycle Lanes / Paths	N	N	N	Pinch Point 1, 2 and 3 - No impact expected. There are no cycle lanes or cycle users evident along the route option.
Road Crossing Facilities	N	N	N	Pinch Point 1, 2 and 3 - No impact expected. There are no road crossing facilities or required use thereof evident along the route option.
Intersection Provision	N	N	N	Pinch Point 1, 2 and 3 - No impact expected. There are no intersections along the proposed route which accommodates cyclist provision.

Safety Checklist	Pinch Point ID: Impact - Yes (Y), No (N)			Findings
	1	2	3	
Motorcyclists				
Road Surface	N	N	N	Pinch Point 1, 2 and 3 - No impact expected. There are no motorcycles or users evident along the proposed route option given the existing road surface which is an unformed gravel track.
Warning of Hazards	N	N	N	Pinch Point 1, 2 and 3 - No impact expected.
Barrier	N	N	N	Pinch Point 1, 2 and 3 - No impact expected.
Visibility at Intersection	N	N	N	Pinch Point 1, 2 and 3 - No impact expected. There are no motorcycles users evident along the proposed route option

3.2 Route Option 2 – Impact Analysis Findings

Safety Checklist	Pinch Point ID: Impact - Yes (Y), No (N)		Findings
	1	2	
Intersections and access			
Queueing	N	N	Pinch Point 1 - There is no queueing impact expected to occur for the left turning vehicles exiting the AP-07 access onto the Pacific Highway southbound lanes. Pinch Point 2 - The storage capacity of the right turn short lane into the AP-01 access is about 85 metres long. It is not expected for queues to exceed this distance given the low volume peak hour construction traffic of 3 vehicles per hour.
Access Location and Sight Distance	N	N	Pinch Point 1 and 2 - The existing sight distances are sufficient to meet minimum SISD requirements
Pavement Markings & Signs	N	N	Pinch Point 1 and 2 - The vehicle turn path results indicate that the heavy vehicles would not collide with any road signs or pavement marking. All lateral movements and turn paths can be contained within the given lane configuration.
Speed Environment	Y	Y	Pinch Point 1 and 2 - Impact expected. Heavy vehicles would traverse along Pacific Highway with a posted speed limit of 110km/h. Greater speed differential between slow heavy vehicles and higher speed through traffic would increase safety risk.
Intersection Operation & Acc. / Dec. Lane	Y	N	Pinch Point 1 - The existing access layout does not provide for a left turn acceleration lane from the proposed access. Pinch Point 2 - An existing right turn deceleration lane is provided for right turning vehicles (about 85m)
Auxiliary Turn Lanes / Lengths / Weaving	N	N	Pinch Point 1 - No impact expected. No auxiliary turn lanes are considered necessary to accommodate for the left turning vehicles from the proposed access, given the low volume of expected construction traffic. Pinch Point 2 - An existing right turn auxiliary lane is provided for right turning vehicles (about 85m)
Heavy Vehicle and Bus Turn paths	N	N	Pinch Point 1 and 2 - Swept path analysis indicates that existing infrastructure would be sufficient to accommodate the turn path requirements of construction traffic.
Utilities (Hardware / Services)	N	N	Pinch Point 1, and 2 - It is assumed that there are no utilities evident at these pinch points to be impacted.
Location of Poles / Traffic Signals	N	Y	Pinch Point 1 and 2 - There are no traffic signals and or light poles evident at these pinch points to be impacted.
Road Links			
Road Width	N	Y	Pinch Point 1 - No impact to road width expected. Pinch Point 2 - Given the constrained road widths it is expected that current widths would not be enough to allow for bi-directional travel along the AP-01 access road. It is proposed that the gravel road link be widened to provide sufficient width to accommodate opposing vehicle turn paths
Capacity	N	N	Pinch Point 1 and 2 - No impact to roadway capacity expected.
Shoulder Seals	N	N	Pinch Point 1 and 2 - No impact to shoulder seals expected.
Vertical / Horizontal Alignment	Y	Y	Pinch Point 1 - It is proposed to formalise the AP-07 access road approach leg to the intersection. A left turn acceleration lane is also proposed to be provided. This would have an impact on horizontal alignment details. Pinch Point 2 - It is proposed to widen access road to AP-01 which might affect current horizontal alignment details.
Bridges and Approaches	N	N	Pinch Point 1 and 2 - No impact on bridges and approaches expected.
Clearance to Obstructions	N	N	Pinch Point 1 - No impact expected. Pinch Point 2 - Fencing along the access road to AP-01 is expected to be impacted by bi-directional heavy vehicle traffic. It is proposed to temporarily remove the fencing to allow for construction vehicle movements.
Overtaking / Passing Opportunities	Y	Y	Pinch Point 1 - No impact to overtaking opportunities expected. It is however proposed to formalise the AP-07 access road approach to allow for bi-directional flow of heavy vehicles. Pinch Point 2 - No impact to overtaking opportunities expected. It is however proposed to formalise the AP-01 access road approach to allow for bi-directional flow of heavy vehicles.
Pedestrians			
Road Crossing Facilities	N	N	Pinch Point 1 and 2 - No impact to road crossing facilities expected. There is no pedestrian activity or associated infrastructure available along the route option.
Footpaths	N	N	Pinch Point 1 and 2 - No impact to footpaths expected. There is no pedestrian activity or associated infrastructure available along the route option.
Disabled Provision	N	N	Pinch Point 1 and 2 - No impact to disabled facilities expected. There is no pedestrian activity or associated infrastructure available along the route option.
Cyclists			
Cycle Lanes / Paths	N	N	Pinch Point 1 and 2 - No impact expected. There are no cycle lanes or cycle users evident along the route option.
Road Crossing Facilities	N	N	Pinch Point 1 and 2 - No impact expected. There are no road crossing facilities or required use thereof evident along the route option.

Safety Checklist	Pinch Point ID: Impact - Yes (Y), No (N)		Findings
	1	2	
Intersection Provision	N	N	Pinch Point 1 and 2 - No impact expected. There are no intersections along the proposed route which accommodates cyclist provision.
Motorcyclists			
Road Surface	N	N	Pinch Point 1 and 2- No impact expected. There are no motorcycles or users evident along the proposed route option of AP-01 and AP-07 given the informal gravel tracks. Motorcyclist activity is evident along Pacific Highway; however, no impact is expected as Pacific Highway is a multi-lane paved road.
Warning of Hazards	N	N	Pinch Point 1 and 2 - No impact expected.
Barrier	N	N	Pinch Point 1 and 2 - No impact expected.
Visibility at Intersection	N	N	Pinch Point 1 and 2 - No impact expected. There are no motorcycles or users evident along the proposed route option of AP-01 and AP-07 given the informal gravel tracks. The visibility of the intersections (sight distances) are sufficient along Pacific Highway.

3.3 Route Option 3 – Impact Analysis Findings

Safety Checklist	Pinch Point ID: Impact - Yes (Y), No (N)			Findings
	1	2	3	
Intersections and access				
Queueing	N	N	N	Pinch Point 1 - There is no queueing impact expected to occur for the left turning vehicles exiting the AP-02 access onto the Pacific Highway southbound lanes. Pinch Point 2 - The existing queue capacity at the northern approach to the intersection is about 335m long. Additional construction vehicles are not expected to significantly impact the queueing at the intersection. Pinch Point 3 - Left turn short lane from the Pacific Highway towards AP-01 access road is about 35m long. Queues are not expected to exceed this storage capacity due to low construction vehicle volumes of about 3 vehicles per hour.
Access Location and Sight Distance	N	N	N	Pinch Points 1, 2 and 3 - Existing sight distance is sufficient to meet minimum SISD requirements.
Pavement Markings & Signs	N	N	N	Pinch Point 1, 2 and 3 - No impact to pavement marking and signage expected.
Speed Environment	Y	N	Y	Pinch Point 1 and 3 - Impact expected. Heavy vehicles would traverse along Pacific Highway with a posted speed limit of 110km/h. Greater speed differential between slow heavy vehicles and higher speed through traffic would increase safety risk. Pinch Point 2 - No impact expected at the roundabout.
Intersection Operation & Acc. / Dec. Lane	Y	N	N	Pinch Point 1 - Impact expected as there is no existing left turn acceleration lane. Pinch Point 2 - No acceleration/ deceleration lane required at the roundabout. No impact expected. Pinch Point 3 - Currently a short left turn lane with deceleration taper provided. No impact expected.
Auxiliary Turn Lanes / Lengths / Weaving	N	N	N	Pinch Point 1 - No requirement for turn lanes from AP-02 access road towards Pacific Highway from a warrant requirement given low volumes of turning construction traffic. Pinch Point 2 - No requirement for turn lanes due to the pinch point being a roundabout. Pinch Point 3 - Left turn axillary lane is provided from Pacific Highway to AP-01 access road and no impact is anticipated.
Heavy Vehicle and Bus Turn paths	N	N	N	Pinch Point 1, 2 and 3 - Swept path analysis indicates that existing infrastructure would be sufficient to serve additional construction traffic
Utilities (Hardware / Services)	N	N	N	Pinch Point 1, 2 and 3 - It is assumed that there are no utilities evident at these pinch points to be impacted.
Location of Poles / Traffic Signals	N	N	N	Pinch Point 1, 2 and 3 - No impact is expected to any existing roadside infrastructure
Road Links				
Road Width	Y	N	Y	Pinch Point 1 - Upgrade of the AP-02 access road is required to provide sufficient roadway width to accommodate bi-directional flow of heavy vehicles. Pinch Point 2 - No impact expected. Pinch Point 3 - Given the constrained road widths it is expected that current widths would not be enough to allow for bi-directional travel along the AP-01 access road. It is proposed to widen the existing gravel road to allow for bi-directional flow of heavy vehicles and to allow for right turn movements from Pacific Highway to be unimpeded.
Capacity	N	N	N	Pinch Point 1, 2 and 3 - No impact to roadway capacity expected.
Shoulder Seals	N	N	N	Pinch Point 1 and 2 - No impact on shoulder seals expected given swept path analysis. Pinch Point 3 - No impact on shoulder seals expected given the existing roads are unformed gravel track.
Vertical / Horizontal Alignment	Y	N	Y	Pinch Point 1 - It is proposed to widen access road to AP-02 which might affect current horizontal alignment details. Pinch Point 2 - No impact expected. Pinch point 3 - It is proposed to widen access road to AP-01 which might affect current horizontal alignment details.
Bridges and Approaches	N	N	N	Pinch Point 1, 2 and 3 - No impact on bridges and approaches expected. It is assumed that the bridge at Pinch Point 2 consist of sufficient vertical clearance.
Clearance to Obstructions	N	N	N	Pinch Point 1 and 3 - No impact on height restrictions expected. Pinch Point 2 - While construction vehicles are required to travel under the bridge, adequate clearance height is assumed as it is a 4.5m high vehicle route.
Overtaking Opportunities	N	N	N	Pinch Point 1 - The Pacific Highway is two lanes in each direction, providing sufficient overtaking opportunities. Pinch Point 2 - Overtaking opportunities are not required at the roundabout approach. Pinch Point 3 - Overtaking opportunities are not required for the left turn movement. Given the low speed and informal road environment of the AP-01 access road, overtaking opportunities are not required on the road.
Pedestrians				
Road Crossing Facilities	N	N	N	Pinch Point 2 - Located in the town centre with no formal road crossing facilities other than a pedestrian refuge on the Richardson Road west approach. Construction vehicles are not expected to impact the pedestrian refuge. Pinch Point 1 and 3 - No impact to road crossing facilities expected. There is no pedestrian activity or associated infrastructure available along the route option.

Safety Checklist	Pinch Point ID: Impact - Yes (Y), No (N)			Findings
	1	2	3	
Footpaths	N	N	N	Pinch Point 2 - Footpaths are provided at all approaches to the intersection. The construction vehicles are not expected to impact the footpaths. Pinch Point 1 and 3 - No impact to footpaths expected. There is no pedestrian activity or associated infrastructure available along the route option.
Disabled Provision	N	N	N	Pinch Point 2 - No impact to disabled facilities expected due to lack of existing infrastructure. Pinch Point 1 and 3 - No impact to disabled facilities expected. There is no pedestrian activity or associated infrastructure available along the route option.
Cyclists				
Cycle Lanes / Paths	N	N	N	Pinch Point 1 and 3 - No impact expected. There are no cycle lanes or cycle users evident along the route option. Pinch Point 2 - No impact expected. There are no cycle lanes evident along the route option.
Road Crossing Facilities	N	N	N	Pinch Point 1 and 3 - No impact expected. There are no road crossing facilities or required use thereof evident along the route option. Pinch Point 2 - No impact expected. There are no road crossing facilities evident along the route option.
Intersection Provision	N	N	N	Pinch Point 1, 2 and 3 - No impact expected. There are no intersections along the proposed route which accommodates cyclist provision.
Motorcyclists				
Road Surface	N	N	N	Pinch Point 1, 2 and 3 - No impact expected.
Warning of Hazards	N	N	N	Pinch Point 1, 2 and 3 - No impact expected.
Barrier	N	N	N	Pinch Point 1, 2 and 3 - No impact expected.
Visibility at Intersection	N	N	Y	Pinch Point 1 and 3 - No impact expected. There are no motorcycles users evident along the proposed route option Pinch Point 2 - Construction vehicles may encounter visibility issues when sharing a route with motorcyclists.

3.4 Route Option 4– Impact Analysis Findings

Safety Checklist	Pinch Point ID: Impact - Yes (Y), No (N)				Findings
	1	2	3	4	
Intersections and access					
Queueing	N	N	N	N	Pinch Point 1 -The storage capacity of the right turn short lane into the AP-01 access is about 85 metres long. It is not expected for queues to exceed this distance given the low volume peak hour construction traffic of 3 vehicles per hour. Pinch Point 2 - U-turn manoeuvre would be completed using the short right turn lane into Ringwood Road (about 80m). No queueing impact expected. Pinch Point 3 - About 45m of left turn short lane length would be provided to the new AP-07 access under current conditions, expected to be sufficient. Pinch Point 4 - Left turn short lane about 20m long for vehicles turning into AP-02, expected to be sufficient to accommodate for at least one vehicle of 19m in length.
Access Location and Sight Distance Distance	N	Y	N	N	Pinch Points 1, 3 and 4- Existing sight distance is sufficient to meet minimum SISD requirements. Pinch Points 2 - Sight distance issues may be present at the intersection due to turning vehicles being unable to see and react to the behaviour of vehicles exiting Ringwood Road, and oncoming vehicles on the Pacific Highway in the far side lane that might be behind other vehicles.
Pavement Markings & Signs	N	N	N	N	Pinch Point 1, 2, 3 and 4 - No impact to pavement marking and signage expected.
Speed Environment	Y	Y	Y	Y	Pinch Point 1 - An existing 35 metre deceleration is provided for right turning vehicles from the Pacific Highway into the AP-01 access road, however, impact is expected as heavy vehicles would traverse along Pacific Highway with a posted speed limit of 110km/h. Greater speed differential between slow heavy vehicles and higher speed through traffic would increase safety risk. Pinch Point 2 - Slow moving heavy vehicles would make a U-turn movement across three lanes of the Pacific Highway, with a posted speed limit of 110 km/h. This speed differential and conflict poses potential safety issues. Pinch Point 3 - An existing left turn short lane of about 45m long is provided into the proposed AP-07 access road. however, impact is expected as heavy vehicles would traverse along Pacific Highway with a posted speed limit of 110km/h. Greater speed differential between slow heavy vehicles and higher speed through traffic would increase safety risk. Pinch Point 4 - An existing left turn short lane of about 20m long is provided into the AP-02 access road. however, impact is expected as heavy vehicles would traverse along Pacific Highway with a posted speed limit of 110km/h. Greater speed differential between slow heavy vehicles and higher speed through traffic would increase safety risk.
Intersection Operation & Acc. / Dec. Lane	N	N	N	N	Pinch Point 1 - Existing 85m right turn short lane provided for deceleration. Pinch Point 2 - A right turn lane of about 85m long is provided for vehicles turning into Ringwood Road from the Pacific Highway. This can also be used for vehicles performing U-turn movements. Pinch Point 3 - About 45m of space can be used for a left turn short lane to the new proposed access for deceleration. Pinch Point 4 - Existing 20m right turn short lane provided for deceleration.
Auxiliary Turn Lanes / Lengths / Weaving	N	Y	N	N	Pinch Point 1, 3 and 4 - Turn lanes are provided and expected to be sufficient. Pinch Point 2 - Although a right turn auxiliary lane is provided to allow for a U-turn movement a wide vehicle turn path would be required to complete the turning manoeuvre. Safety issues for U-turn vehicles may be mitigated by widening the median to allow for a two-stage crossing. However, this option is likely to be costly considering the median storage length required, which would require major works
Heavy Vehicle and Bus Turn paths	N	Y	N	N	Pinch Point 1 - Swept path analysis indicates that existing layout would be sufficient to accommodate the turn path requirements of construction traffic, however, given the constrained road widths it is expected that opposing vehicle turn paths will collide at AP-01 access road. It is proposed that the gravel road be widened to provide sufficient width to accommodate opposing vehicle turn paths as well as along the links to accommodate for bi-directional flow. Pinch Point 2 - Vehicles performing a U-turn would traverse across three lanes of the Pacific Highway, including two lanes of southbound through traffic, posing potential safety issues. Pinch Point 3 - Swept path analysis indicates that existing layout would be sufficient to accommodate the turn path requirements of construction traffic, however, given the constrained road widths it is expected that opposing vehicle turn paths will collide at AP-07 access road. It is proposed that the gravel road be widened to provide sufficient width to accommodate opposing vehicle turn paths as well as along the links to accommodate for bi-directional flow. Pinch Point 4 - Swept path analysis indicates that existing layout would be sufficient to accommodate the turn path requirements of construction traffic, however, given the constrained road widths it is expected that opposing vehicle turn paths will collide at AP-02 access road. It is proposed that the gravel road be widened to provide sufficient width to accommodate opposing vehicle turn paths as well as along the links to accommodate for bi-directional flow.
Utilities (Hardware / Services)	N	N	N	N	Pinch Point 1, 2, 3 and 4 - It is assumed that there are no utilities evident at these pinch points to be impacted.
Location of Poles / Traffic Signals	N	N	N	N	Pinch Point 1, 2, 3 and 4 - No impact is expected to any existing roadside infrastructure
Road Links					

Safety Checklist	Pinch Point ID: Impact - Yes (Y), No (N)				Findings
	1	2	3	4	
Road Width	Y	Y	Y	Y	Pinch Point 1 - Given the constrained road widths it is expected that current widths would not be enough to allow for bi-directional travel along the AP-01 access road. It is proposed to widen the existing gravel road to allow for bi-directional flow of heavy vehicles and to allow for right turn movements from Pacific Highway to be unimpeded. Pinch Point 2 - Vehicles performing a U-turn would conflict with three lanes of the Pacific Highway, including two lanes of southbound through traffic, posing potential safety issues. Pinch Point 3 - Upgrade of the AP-07 access road is required to provide sufficient roadway width to accommodate bi-directional flow of heavy vehicles. Pinch Point 4 - Upgrade of the AP-02 access road is required to provide sufficient roadway width to accommodate bi-directional flow of heavy vehicles.
Capacity	N	N	N	N	Pinch Point 1, 2, 3 and 4 - No impact to roadway capacity expected.
Shoulder Seals	N	N	N	N	Pinch Point 1, 2, 3 and 4 - No impact on shoulder seals expected given swept path analysis.
Vertical / Horizontal Alignment	N	N	Y	Y	Pinch Point 1, 2 - No impact expected. Pinch Point 3 - It is proposed to formalise access road to AP-07 which might affect current horizontal alignment details. Pinch Point 4 - It is proposed to widen access road to AP-02 which might affect current horizontal alignment details.
Bridges and Approaches	N	N	N	N	Pinch Point 1, 2, 3 and 4 - No impact on bridges and approaches expected.
Clearance to Obstructions	Y	N	N	N	Pinch Point 2, 3 and 4 - No impact expected. Pinch Point 1 - Fencing along the access road to AP-01 is expected to be impacted by bi-directional heavy vehicle traffic. It is proposed to temporarily remove the fencing to allow for construction vehicle movements.
Overtaking Opportunities	N	N	N	N	Pinch Point 1 - Overtaking opportunities are not required for the right turn movement. Given the low speed and informal road environment of the AP-01 access road, overtaking opportunities are not required on the road. Pinch Point 2, 3 and 4 - The Pacific Highway is two lanes in each direction, providing sufficient overtaking opportunities.
Pedestrians					
Road Crossing Facilities	N	N	N	N	Pinch Point 1, 2, 3 and 4 - No impact to road crossing facilities expected. There is no pedestrian activity or associated infrastructure available along the route option.
Footpaths	N	N	N	N	Pinch Point 1, 2, 3 and 4 - No impact to footpaths expected. There is no pedestrian activity or associated infrastructure available along the route option.
Disabled Provision	N	N	N	N	Pinch Point 1, 2, 3 and 4 - No impact to disabled facilities expected. There is no pedestrian activity or associated infrastructure available along the route option.
Cyclists					
Cycle Lanes / Paths	N	N	N	N	Pinch Point 1, 2, 3 and 4 - No impact expected. There are no cycle lanes or cycle users evident along the route option.
Road Crossing Facilities	N	N	N	N	Pinch Point 1, 2, 3 and 4 - No impact expected. There are no road crossing facilities or required use thereof evident along the route option.
Intersection Provision	N	N	N	N	Pinch Point 1, 2, 3 and 4 - No impact expected. There are no intersections along the proposed route which accommodates cyclist provision.
Motorcyclists					
Road Surface	N	N	N	N	Pinch Point 1 - No impact expected. There are no motorcycles users evident along the proposed route option given the existing road surface which is an unformed gravel track. Pinch Point 2 - No impact expected. Pinch Point 3 and 4 - No impact expected. There are no motorcycle users expected along the proposed private accesses.
Warning of Hazards	N	N	N	N	Pinch Point 1, 2, 3 and 4 - No impact expected.
Barrier	N	N	N	N	Pinch Point 1, 2, 3 and 4 - No impact expected.
Visibility at Intersection	N	Y	N	N	Pinch Point 1, 3 and 4 - No impact expected. There are no motorcycles or users evident along the proposed route option. Pinch Point 2 - Construction vehicles may encounter visibility issues when sharing a route with motorcyclists.

3.5 Route Option 5– Impact Analysis Findings

Safety Checklist	Pinch Point ID: Impact - Yes (Y), No (N)			Findings
	1	2	3	
Intersections and access				
Queueing	N	N	N	Pinch Point 1 - No excessive queueing is expected along Six Mile Road Pinch Point 2 - About 45m of left turn short lane length would be provided to the new AP-07 access under current conditions, expected to be sufficient. Pinch Point 3 - Left turn short lane about 20m long for vehicles turning into AP-02, expected to be sufficient.
Access Location and Sight Distance	N	N	N	Pinch Points 1, 2 and 3 - Existing sight distance is sufficient to meet minimum SISD requirements.
Pavement Markings & Signs	N	N	N	Pinch Point 1,2 and 3 - No impact to pavement marking and signage expected.
Speed Environment	N	Y	Y	Pinch Point 1 - About 480m acceleration lane provided for right turning vehicles from Six Mile Road to the Pacific Highway. Pinch Point 2 - An existing left turn short lane of about 45m long is provided into the proposed AP-07 access road. however, impact is expected as heavy vehicles would traverse along Pacific Highway with a posted speed limit of 110km/h. Greater speed differential between slow heavy vehicles and higher speed through traffic would increase safety risk. Pinch Point 3 - An existing left turn short lane of about 20m long is provided into the AP-02 access road. however, impact is expected as heavy vehicles would traverse along Pacific Highway with a posted speed limit of 110km/h. Greater speed differential between slow heavy vehicles and higher speed through traffic would increase safety risk.
Intersection Operation & Acc. / Dec. Lane	N	N	N	Pinch Point 1 - About 480m acceleration lane provided for right turning vehicles from Six Mile Road to the Pacific Highway. Pinch Point 3 - Existing 45m left turn short lane with taper to allow for deceleration. Pinch Point 4 - Existing 20m right turn short lane with taper provided for deceleration.
Auxiliary Turn Lanes / Lengths / Weaving	N	N	N	Pinch Point 1, 2 and 3 - Turn lanes are provided and expected to be sufficient to meet construction traffic demands.
Heavy Vehicle and Bus Turn paths	N	N	N	Pinch Point 1 - Swept path analysis indicates that existing infrastructure would be sufficient to serve additional construction traffic Pinch Point 2 - Swept path analysis indicates that existing layout would be sufficient to accommodate the turn path requirements of construction traffic, however, given the constrained road widths it is expected that opposing vehicle turn paths will collide at AP-07 access road. It is proposed that the gravel road be widened to provide sufficient width to accommodate opposing vehicle turn paths as well as along the links to accommodate for bi-directional flow. Pinch Point 3 - Swept path analysis indicates that existing layout would be sufficient to accommodate the turn path requirements of construction traffic, however, given the constrained road widths it is expected that opposing vehicle turn paths will collide at AP-02 access road. It is proposed that the gravel road be widened to provide sufficient width to accommodate opposing vehicle turn paths as well as along the links to accommodate for bi-directional flow.
Utilities (Hardware / Services)	N	N	N	Pinch Point 1, 2 and 3 - It is assumed that there are no utilities evident at these pinch points to be impacted.
Location of Poles / Traffic Signals	N	N	N	Pinch Point 1, 2, and 3 - No impact is expected to any existing roadside infrastructure
Road Links				
Road Width	N	Y	Y	Pinch Point 1 - No impact expected. Pinch Point 2 - Upgrade of the AP-07 access road is required to provide sufficient roadway width to accommodate bi-directional flow of heavy vehicles. Pinch Point 3 - Upgrade of the AP-02 access road is required to provide sufficient roadway width to accommodate bi-directional flow of heavy vehicles.
Capacity	N	N	N	Pinch Point 1, 2 and 3 - No impact to roadway capacity expected.
Shoulder Seals	N	N	N	Pinch Point 1, 2 and 3 - No impact on shoulder seals expected given swept path analysis.
Vertical / Horizontal Alignment	N	N	N	Pinch Point 1, 2 and 3 - No impact expected.
Bridges and Approaches	N	N	N	Pinch Point 1, 2 and 3 - No impact on bridges and approaches expected.
Clearance to Obstructions	N	N	N	Pinch Point 1, 2 and 3 - No impact on height restrictions expected.
Overtaking Opportunities	N	N	N	Pinch Point 1, 2 and 3 - The Pacific Highway is two lanes in each direction, providing sufficient overtaking opportunities.
Pedestrians				
Road Crossing Facilities	N	N	N	Pinch Point 1, 2 and 3 - No impact to road crossing facilities expected. There is no pedestrian activity or associated infrastructure available along the route option.
Footpaths	N	N	N	Pinch Point 1, 2 and 3 - No impact to footpaths expected. There is no pedestrian activity or associated infrastructure available along the route option.
Disabled Provision	N	N	N	Pinch Point 1, 2 and 3 - No impact to disabled facilities expected. There is no pedestrian activity or associated infrastructure available along the route option.
Cyclists				
Cycle Lanes / Paths	N	N	N	Pinch Point 1, 2 and 3 - No impact expected. There are no cycle lanes or cycle users evident along the route option.
Road Crossing Facilities	N	N	N	Pinch Point 1, 2 and 3 - No impact expected. There are no road crossing facilities or required use thereof evident along the route option.

Safety Checklist	Pinch Point ID: Impact - Yes (Y), No (N)			Findings
	1	2	3	
Intersection Provision	N	N	N	Pinch Point 1, 2 and 3 - No impact expected. There are no intersections along the proposed route which accommodates cyclist provision.
Motorcyclists				
Road Surface	N	N	N	Pinch Point 1, 2 and 3 - No impact expected. There are no motorcycles or users expected to be travel along the private access roads.
Warning of Hazards	N	N	N	Pinch Point 1, 2 and 3 - No impact expected.
Barrier	N	N	N	Pinch Point 1, 2 and 3 - No impact expected.
Visibility at Intersection	N	N	N	Pinch Point 1, 2 and 3 - No impact expected.

3.6 Conclusions

From the analysis results, a route viability assessment score was derived based on the number of pinch point impacts relative to the total number of impact items assessed under each route option. The assessment results are summarised in Table 3-1.

Table 3-1 Route Viability Assessment Scoring

Route Options	East to West Movement		West to East Movement	
	Total Number of Items Impacted	Route Viability Score	Total Number of Items Impacted	Route Viability Score
Route Option 1 (Pinch Points 1, 2 and 3)	6	92%	6	92%
Route Option 2 (Pinch Points 1 and 2)	9	83%	-	-
Route Option 3 (Pinch Points 1, 2 and 3)	8	90%	-	-
Route Option 4 (Pinch Points 1, 2, 3 and 4)	-	-	15	86%
Route Option 5 (Pinch Points 1, 2 and 3)	-	-	4	95%

The following points can be noted from the route comparison summary:

- It is evident from the results that Route Option 1 would produce the least impact for construction vehicles travelling from the east to the west of Pacific Highway and vice versa, with a viability score of 92%
- Route Option 5 is considered the most viable option to travel from the west of Pacific Highway to the east, with a viability score of 95%
- Route Option 3 is considered the most viable option to travel from the east of Pacific Highway to the west with a viability score of 90%.

It is proposed that all recommendations and proposals made in this report be considered prior to the commencement of construction activities and transport of material, equipment and workforce. It should be noted that this assessment is based on the design vehicle specified in this technical memo and does not constitute the transport of any over dimension overmass loads or vehicle configurations different from what has been identified as the design vehicle in this report.