

7.1 Traffic and transport

This chapter provides an assessment of potential traffic and transport impacts of the project, which was nominated in the Director-General's requirements (DGRs) as a key environmental issue for the project. It represents a summary of the *Traffic and Transport Technical Paper* (AECOM 2012), which was prepared for the project with consideration of the DGRs.

The technical paper is provided at **Appendix D**. The relevant extract from the DGRs is presented below.

Director-General's requirements	Where addressed
<i>Traffic and Transport – including but not limited to:</i>	
<i>Construction traffic impacts, including identification of construction routes and the nature of existing traffic on these routes, quantification of traffic volumes (including for spoil haulage), potential impacts to regional and local road network (including safety and level of service), and potential disruption to existing public transport services, access/service lanes to local properties.</i>	Section 7.1.3 Appendix D
<i>Operational traffic and transport impacts to the local and regional road network including:</i>	Section 7.1.3 Appendix D
<i>Changes to access arrangements/service lanes to local properties.</i>	Section 7.1.3 Appendix D
<i>Changes to local road connectivity and access and impacts on local traffic arrangements and local road capacity/safety from traffic rerouting and modified access to the upgraded highway, including direct impacts from the replacement of the existing highway that currently passes through Berry. The assessment must take into account potential interactions with local traffic associated with the residential sub-division at Huntingdale Park, Berry (including future growth) and any severance impacts on local connectivity within Berry as a result of the proposed route. Consideration must be given to potential impacts of changed traffic arrangements on local and/or school bus services, access for emergency services and garbage truck routes.</i>	Section 7.1.3 Appendix D
<i>Traffic capacity of the project and its ability to cater for predicted growth. Consideration should be given to what effect potential major land use changes in the locality may have to the traffic assessment outcomes</i>	Chapter 4 Section 7.1.1 Section 7.2.2 Section 7.1.3 Appendix D
<i>Opportunity for the provision of cycle way connections along the highway and to adjoining communities.</i>	Section 7.1.3 Section 7.6 Section 7.10 Appendix D

7.1.1 Methodology

A three stage traffic modelling and forecasting approach was used for the traffic impact assessment (refer to **Figure 7-1**). This approach established existing and future traffic conditions on the Princes Highway, the 'Sandtrack' and surrounding local roads and involved the use of:

- The TRACKS strategic transport model (the TRACKS model). This model provided current and future traffic demands and patterns both with and without the project. It factored in the influences of road network upgrades, population growth and employment growth in the local area and the wider region. It also provided the predicted split in traffic distribution between the Princes Highway and the 'Sandtrack', with and without the project (or other highway upgrades).
- Traffic forecasting spreadsheet modelling. This provided average daily traffic profiles within the vicinity of the project over time (such as peak hour volumes) using linear growth rates from the TRACKS model. In doing so, the spreadsheet re-forecast traffic volumes from the TRACKS model using traffic survey data from 2009 and 2011, so that the model results would be underpinned by the actual road network situation.
- Paramics micro simulation modelling. This focused on the operational performance of individual vehicle movements during key peak periods in the project area using traffic volumes from the forecasting spreadsheet.

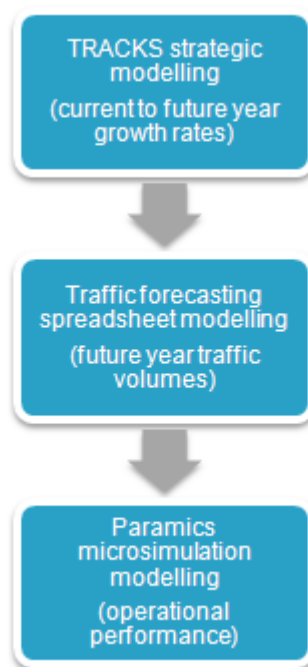


Figure 7-1 Overview of the three stage modelling approach

The Gerringong to Bomaderry sub-area TRACKS model was developed for the project using RMS' Illawarra regional TRACKS transport model. The TRACKS model factors in expected land use changes and proposed road network improvements in the region. This included:

- Upgrades to the Princes Highway between Gerringong and Bomaderry, including the project.
- Annual population growth for the Illawarra Region based on 2026 land use development projections. For the local area of the project, this included an additional 332 dwellings in Berry (which includes Huntingdale Park Estate) and 282 dwellings at Shoalhaven Heads. This equates to annual population growth rates of 2.4 per cent for Berry and 2.1 per cent for Shoalhaven Heads, resulting in traffic growth on key regional and local roads in the project area.
- Regional employment forecasts for 2026, including an additional 743 jobs in Gerringong and 915 jobs in Bomaderry.

The three stages of the modelling used local and regional traffic data to understand traffic volumes and patterns in and around Berry. This ensured that the models accurately replicated current operating conditions. Current and historic traffic data was used for the assessment, including:

- Traffic survey data collected in June 2011 to measure traffic volumes along Kangaroo Valley Road, Tannery Road and Woodhill Mountain Road.
- Traffic survey data collected for peak periods during the Easter and Anzac Day 2011 public holiday weekend. This included origin-destination surveys, intersection turning counts and midblock counts. Site visits and observations were carried out to collect additional information about the layout and operation of the road network.
- Traffic survey data collected in May/June 2009 and April/May 2011 to measure traffic volumes at other key locations on the Princes Highway and the 'Sandtrack'.
- Traffic count data from RMS' permanent site on the Princes Highway north of Rose Valley Road (located north of Gerringong) between 2008 and 2010.
- Origin-destination survey data collected at nine locations between Gerringong and Bomaderry along the Princes Highway, the 'Sandtrack' and Beach Road. Surveys were completed between 7am-9am and 2pm-6pm on Thursday 15 February 2007, and particularly focused on measuring the proportion of through traffic and traffic stopping in Berry.
- Origin-destination survey data, midblock counts and intersection turning counts collected on Victoria Street, Berry during May 2012, during both weekday and weekend peak conditions, to determine existing traffic patterns and volumes.

As the Princes Highway (in the project area) is in a rural area and is a major route for tourism with significant peak period traffic during school holidays, it is not necessarily appropriate to focus the traffic and transport assessment of existing and future conditions on typical weekday morning and evening peak periods. Therefore, further analysis of existing traffic patterns and volumes was carried out to identify the true periods of peak travel demand and found that these usually occurred on the first evening of a holiday period southbound and the last afternoon of a holiday period northbound during a Public Holiday weekend. These have been referred to as the 'holiday peak' periods.

The following time periods have been selected to report existing and future traffic flows:

- Annual Average Daily Traffic (AADT).
- Average one hour during a typical morning (AM) peak between 7am–11am.
- Average one hour during a typical evening (PM) peak between 3pm–7pm.
- Holiday peak hour southbound that reflects traffic patterns in the project area recorded on Thursday 21 April 2011.
- Holiday peak hour northbound that reflects traffic patterns in the project area recorded on Tuesday 26 April 2011.

To assess the operational performance of the project, the traffic assessment considered the following scenarios:

- The performance of the existing highway and intersections within Berry based on 2011 volumes, to represent the existing scenario.
- Three different scenarios based on 2037 traffic volumes to assess the highway performance. The first being without the project ('do nothing'), the second being with the project (only) and the third being the entire Princes Highway upgrade program between Mount Pleasant and Bomaderry (refer to **Table 7-1**). The year of 2037 was selected to represent the design year of the project (being 20 years after opening to traffic in 2017).
- Two different scenarios based on 2037 traffic volumes to assess the performance of key intersections within the local road network at Berry (including interchange ramps), the first being without the project ('do nothing') and the second being the complete Princes Highway upgrade program.

The 'Princes Highway upgrade program' scenario was selected for the purposes of the intersection performance assessment, instead of 'the project' scenario, as it is considered to be a more representative (or most likely) scenario. There are no changes to the local road network between the two scenarios, other than a minor increase in traffic volumes associated with the 'Princes Highway upgrade program'. As such, the 'Princes Highway upgrade program' scenario would represent the ultimate performance of the network in the long term.

The assessment scenarios, and the assumptions associated with each, are described further in **Table 7-1**.

To assess construction impacts of the project, assessments of the worst case and representative (or most-likely) scenarios were completed (as described in **Table 7-2**). The worst case scenario would be 'ameliorated' by the implementation of appropriate mitigation measures, as outlined at **section 7.1.4**. Both scenarios were assessed based on:

- Traffic volumes in 2017 (including construction traffic), which represents the last expected year of construction for the project.
- Gerringong upgrade being operational.
- The Berry bypass and the northern and southern interchanges not being operational, with all highway traffic continuing to travel through Berry.
- An 80 kilometres per hour construction zone speed limit throughout the project area (at locations where the posted speed is currently 80 kilometres per hour).
- Delays due to passing constraints along the existing highway caused by construction zones.

Table 7-1 Operational assessment scenarios

Road network scenario	Measure	Assessment year	Assessment period	Assumptions
Do nothing	To assess the consequence of no highway upgrade.	2011 , representing the existing conditions of the project area. 2037 , representing the project design year.		<ul style="list-style-type: none"> No change to the existing regional and local road network, with traffic distribution patterns in and around Berry remaining roughly unchanged. Traffic would continue to grow at the current rate. A split of regional traffic between the Princes Highway and the 'Sandtrack' remaining unchanged, representing 55 per cent / 45 per cent north of Berry, and 60 per cent/40 per cent south of Berry.
The project	To assess the operational performance of the project (highway only).	2037 , representing the design year of the project.	<p>For the assessment of the impacts on the local road network within Berry, traffic volumes during the holiday peak northbound and southbound were selected to assess the performance of the intersections when traffic demand in the project area is at its greatest (being holiday peak periods).</p> <p>For the assessment of the highway performance (or midblock), the following time periods were assessed:</p> <ul style="list-style-type: none"> The AM and PM peak. The holiday peak hour northbound and southbound. 	<ul style="list-style-type: none"> The project and the Gerringong upgrade to the north of the project area would be completed by 2017. However, the Berry to Bomaderry upgrade proposal is not included in this scenario. Increase in traffic volumes on the Princes Highway above the current rate as a result of the transfer of traffic from the 'Sandtrack' to the Princes Highway at the completion of the project. This would result in a split of total traffic of around 81 per cent (Princes Highway) /19 per cent (the 'Sandtrack') at both locations in 2037. Changes to the local road network as a result of the project, being the removal of highway traffic within Berry, the operation of the northern and southern interchanges for Berry, and other minor road modifications that form part of the project.
The Princes Highway upgrade program	To assess the operational performance of the project, following the completion of all remaining highway upgrades.	2037 , representing the design year of the project.		<ul style="list-style-type: none"> Completion of the project and all remaining Princes Highway upgrades (being the Gerringong upgrade and Berry to Bomaderry upgrade proposal). Increase in traffic volumes on the Princes Highway above the current rate as a result of the transfer of traffic from the 'Sandtrack' to the Princes Highway. This would result in a split of total traffic of around 84 per cent (Princes Highway) /16 per cent (the 'Sandtrack') at both locations in 2037, as a result of the combined benefits of all three upgrades between Gerringong and Bomaderry on highway travel times, road safety and network efficiency. Changes to the local road network as a result of the project, being the removal of highway traffic within Berry, the operation of the northern and southern interchanges for Berry, and other minor road modifications that form part of the project.

Table 7-2 Construction assessment scenarios

Scenario	Assessment period	Assumptions
Representative	2017 AM peak and PM peak	<ul style="list-style-type: none"> Existing highway layout (two-lane, two-way; no upgraded sections open to highway traffic). No transfer of traffic from the 'Sandtrack' to the Princes Highway. At least one construction zone on the Princes Highway both north and south of Berry. Temporary transfer of light vehicles from the Princes Highway to the 'Sandtrack', based on vehicles avoiding estimated delays associated with construction on the Princes Highway. It is expected that about three per cent of the combined traffic on both the Princes Highway and the 'Sandtrack' would divert to the 'Sandtrack' during construction. Construction traffic generated by material and equipment deliveries, earthworks haulage and construction personnel travelling on the Princes Highway.
Worst case	2017 holiday peak northbound and southbound peak	<ul style="list-style-type: none"> The completion and opening of some sections of the project, resulting in a transfer of traffic from the 'Sandtrack' to the Princes Highway. No construction traffic travelling on the Princes Highway (consistent with the RMS commitment that construction would not occur during the holiday peak). Existing highway layout (two-lane, two-way) on some sections of the Princes Highway north and south of Berry; a combination of upgraded and non-upgraded highway conditions throughout the project area. At least one construction zone on the Princes Highway both north and south of Berry.

Further information on the methodology, inputs and assumptions can be found in the *Traffic and Transport Technical Paper* at **Appendix D**.

7.1.2 Existing environment

Regional and local road network

The Princes Highway is the main north-south regional road corridor between Sydney, the Illawarra and through the NSW south coast to Victoria. Within the project area, the highway serves as a:

- Commuter route between Sydney, Wollongong and Nowra.
- Local route for residents travelling within Berry and between Berry and surrounding towns and rural residences.
- Major tourist route for key destinations including Berry, Nowra and the NSW south coast.
- Freight and bus route, particularly for the NSW south coast and far South Coast.

In the project area, the Princes Highway is a two lane single carriageway between Toolijooa Road and Schofields Lane, with two short overtaking lanes for southbound traffic only. The existing highway does not meet current road design safety and traffic efficiency requirements, as discussed in **Chapter 2**.

The project commences at the junction of the existing highway and Toolijooa Road. Toolijooa Road is a local road which eventually provides a connection to Beach Road and Crooked River Road. This road only carries small volumes of traffic (less than 500 vehicles per day), and is primarily used by traffic accessing properties to the east of the highway.

From Toolijooa Road, the highway passes through the Foxground bends, passing Foxground Road and Broughton village. This section of the highway is winding, and there are steep grades, sharp bends and limited overtaking opportunities. Vehicles at the intersection of the highway with Foxground Road can turn either left or right onto or from the highway. Foxground Road is a local road that provides sole access to the highway for rural and rural-residential properties located along Foxground Road, Free Selectors Road and Hoddles Road. Rural properties along the highway have uncontrolled direct accesses to the highway, and are able to turn either left or right onto or from the highway.

After passing through the Foxground bends, the Princes Highway crosses the Broughton Creek floodplain and crosses Broughton Creek once. The highway then travels through the undulating landscape until reaching Berry. There are several at-grade junctions with local roads, including Austral Park Road and Tindalls Lane. These local roads only serve to provide connections to the highway for properties located alongside these roads. Vehicles can turn either left or right to or from the highway from these intersections or from private accesses.

Within Berry, the Princes Highway carries both highway and local traffic through the town centre (refer to **Figure 7-2**). The highway follows Queen Street within Berry between Tannery Road and Kangaroo Valley Road. These two roads, as well as Prince Alfred Street, provide access to local and regional areas with:

- Prince Alfred Street and Tannery Road providing connections between Berry and destinations located along the coastline, such as Shoalhaven Heads and Seven Mile Beach. Tannery Road has an annual average daily traffic (AADT) of 1680 vehicles, of which five per cent consists of heavy vehicles.
- Kangaroo Valley Road providing a connection to Kangaroo Valley, Moss Vale, the Hume Highway and beyond. Kangaroo Valley Road has an AADT of 1485 vehicles, of which five per cent consists of heavy vehicles.

The Princes Highway (Queen Street) also has numerous intersections with local roads within Berry. These intersections, in particular the Alexandra Street and Queen Street intersection, provide access to residences, businesses and other facilities located within Berry, such as retail, car parking, tourist accommodation, community facilities and recreational areas.

Parallel carparking is provided along Queen Street. This can contribute to congestion as traffic slows down or stops to enable cars to park or parked cars to merge back into the traffic flow. A pedestrian island, located between Prince Alfred Street and Alexandra Street, provides the only refuge for pedestrians crossing Queen Street.

Woodhill Mountain Road provides access to properties and communities directly north of Berry. This includes Broughton and Broughton Vale. It also provides an alternative access to Berry and the Princes Highway from Woodhill and Wattamolla. Woodhill Mountain Road has an AADT of 970 vehicles, of which six per cent consists of heavy vehicles.

North Street provides an alternative route to Queen Street between Kangaroo Valley Road and Woodhill Mountain Road to the north of Berry. However, only a small proportion of through traffic currently uses this route to avoid congestion. Rawlings Lane connects to North Street, and provides property access to properties immediately north of Berry.

Victoria Street, which runs parallel to Queen Street, provides an immediate connection to the Princes Highway, south of the Kangaroo Valley Road intersection with Queen Street. This carries a small volume of traffic, with about 200 vehicles currently turning at the Victoria Street and the Princes Highway intersection during AM and PM peak periods.

Huntingdale Park Road connects to Kangaroo Valley Road, and provides the sole access to the Huntingdale Park Estate development.

South of Berry, the existing highway travels along the floodplain on a fairly straight alignment and remains a two lane single carriageway. It has at-grade junctions with Hitchcocks Lane and Schofields Lane, where vehicles can turn left or right. These local roads only serve to provide connections to the highway for properties located alongside these roads. As such, these roads carry only small volumes of traffic. Properties also have direct and uncontrolled access to and from the highway.

Beyond the immediate vicinity of the highway the 'Sandtrack' offers an alternative route for light vehicles between Gerringong and Bomaderry and comprises Fern Street, Crooked River Road, Gerroa Road and Bolong Road (refer to **Figure 7-2**). The 'Sandtrack' enables motorists to bypass the project area, avoiding the winding, hilly sections of the Princes Highway and general highway traffic congestion. It also intersects with local roads and provides an important connection to property and businesses within the project area and beyond. It has a five tonne load limit for heavy vehicles.



Figure 7-2 Transport network in project area

Source: LPMA, 2011

Travel speeds and travel times

The Princes Highway within the project area has a variable posted speed limit ranging from:

- 80 kilometres per hour on the section north of the existing Broughton Creek crossing, through the Foxground bends.
- 90 kilometres per hour on the section between the Broughton Creek crossing to the north of Berry.
- 50 kilometres per hour through Berry.
- 100 kilometres per hour south of Berry.

The 'Sandtrack' has a posted speed limit of 90 or 100 kilometres per hour for much of its length. Fern Street is used to travel from the 'Sandtrack' into Gerringong and has a posted speed limit of 50 kilometres per hour.

The Princes Highway currently has an average travel time of around 14-15 minutes between Toolijooa Road and Schofields Lane. The 'Sandtrack' is shorter in length and operates at a higher average speed, with travel taking less than eight minutes on average between Dooley Road and Shoalhaven Heads Road. The slower Princes Highway time is due to the Foxground bends, and varying and lower posted speed limits and delays when travelling through Berry. However, when comparing the highway and the 'Sandtrack' between Gerringong and Bomaderry, the routes are comparable in both length and travel time (about 30 minutes).

Within Berry, there is a posted speed limit of 50 kilometres per hour. Woodhill Mountain Road and Kangaroo Valley Road both have a posted speed limit of 50 kilometres per hour in the vicinity of Berry. Outside of Berry, the posted speed limit on Woodhill Mountain Road and Kangaroo Valley Road increases to 80 kilometres per hour and 60 kilometres per hour respectively.

Annual traffic growth

The closest permanent automatic traffic count site to the project area is on the Princes Highway, near Rose Valley Road, which is north of Gerringong. At this location, the AADT was 21,300 vehicles in 2010 (refer to **Table 7-3**). The average annual growth is 3.2 per cent, or 400 vehicles per year. Although this location is outside the project area, it is indicative of the continuous level of traffic growth along the Princes Highway.

Table 7-3 AADT traffic growth summary (1990–2010)

Location: Site 7.800: Princes Highway, north of Rose Valley Road			
Year	AADT	Growth rate	
		Period	Average annual growth (%)
1990	12,944	-	-
1994	14,791	1990 – 1994	3.6
1997	15,711	1994 – 1997	2.1
2000	17,753	1997 – 2000	4.3
2002	18,960	2000 – 2002	3.4
2004	19,371	2002 – 2004	1.1
2006	18,731	2004 – 2006	-1.7
2008	19,675	2006 – 2008	2.5
2010	21,300	2008 – 2010	4.1
-	-	1990 – 2010	3.2

(Source: AECOM, based on NSW Roads and Maritime Services Southern Region Traffic Survey Data)

Traffic patterns, including seasonality

Table 7-4 provides daily and peak period traffic volumes, which are based on survey data collected in May/June 2009 and April/May 2011 at key locations on the Princes Highway and the 'Sandtrack'.

The survey results indicate that:

- There is a loss of around 2450 vehicles per day to Gerringong and villages adjacent or near to the highway between Berry and Gerringong via local roads.
- The split of traffic between the highway and the 'Sandtrack' represents a 55 per cent and 45 per cent split respectively.
- There is a higher proportion of traffic arriving and departing Berry to and from the south, compared to traffic originating/departing from the north.
- Heavy vehicles represent eight per cent of the AADT north of Gerringong, increasing to around 12 per cent and 13 per cent of the AADT to the south and north of Berry respectively.
- Heavy vehicles on the 'Sandtrack' represent three to four per cent of the AADT due to the five tonne vehicle load limit on that road.
- Only a small proportion of vehicles travelling to, from and within the project area use the regional roads surveyed. For example, the AADT of Kangaroo Valley Road (1,485 vehicles) is the equivalent of around 12 per cent of AADT on the highway near Kangaroo Valley Road.

Table 7-4 Daily and peak period traffic volume summary (2009-2011)

Location	Year	AM peak (veh/h)	PM peak (veh/h)	Two-way traffic flows		AADT	
				Holiday peak nrbound peak (veh/h)	Holiday peak sthbound peak (veh/h)	Flow (veh/day)	% heavy veh
Princes Highway, north of Rose Valley Road	2010	1525	1800	2470	2680	21,300	8
Princes Highway, north of Tannery Road	2011	730	875	1185	1275	10,755	13
Tannery Road, east of Pulman Street	2011	130	165	125	95	1680	5
Woodhill Mt. Road, north of North Street	2011	80	100	90	110	970	6
Prince Alfred Street, south of Queen Street	2011	-	-	155	220	-	-
Kangaroo Valley Road, north of North Street	2011	115	140	155	140	1485	5
Victoria Street, east of Princes Highway	2012	215	190	170	245	2170	4
Princes Highway, south of Victoria Street	2011	930	1090	1250	1475	13,400	12
'Sandtrack', south of Belinda Street	2009	620	760	1010	1100	8700	3
'Sandtrack', south of Beach Road	2009	450	590	770	840	6650	4

(Source: AECOM, based on NSW Roads and Maritime Services Southern Region Traffic Survey Data)
Veh/h = Vehicles per hour

The seasonal variations, weekly and daily peak periods of traffic volumes within the project area reflect the rural nature of the area and the function of the highway as a major tourist route.

The traffic count site near Rose Valley Road shows that traffic flows are highest during major holiday periods, including the school holidays at Christmas, Easter, and Labour Day in October. At this location, daily traffic volumes during Christmas holidays peaked at over 26,000 vehicles or 20 per cent more vehicles compared to the AADT.

In an average week, the Princes Highway experiences a significant increase in southbound traffic on Friday afternoons and Saturday mornings, and northbound traffic on Sunday afternoons due to recreational weekend travel to and from the south coast from Sydney and Wollongong. This would increase the likelihood of congestion and delays during weekend peak hours compared to the AM and PM peaks through the week.

On an average day, the Princes Highway and the 'Sandtrack' experience a steady traffic increase throughout the day, peaking at around 3-4pm before decreasing in the early evening. This early peak suggests a significant level of after school pickup and associated social and commercial activity in the area during and after school pickups.

Within Berry, traffic in the town centre is at its highest during holiday and other recreational peak periods. To understand local traffic behaviours and to determine the percentage of vehicles that do not stop in Berry, traffic surveys were undertaken in 2007 and 2011. In 2011, the surveys were undertaken during the Easter and ANZAC long weekends to determine traffic behaviour during the holiday peak period, and included origin-destination surveys.

These surveys found that non-stopping through traffic contributes around 80 per cent of total traffic travelling through Berry on the Princes Highway on a typical weekday. During the holiday peak periods, traffic volumes are higher and travel patterns vary. As a result, through traffic fluctuates considerably between 50 and 75 per cent of total traffic.

The 2011 survey highlighted the heavy congestion and delays experienced on the road network within Berry during the busiest peak periods (refer to **Table 7-5**). For example average travelling time on the Princes Highway (northbound) between the Victoria Street intersection and the Tannery Road intersection was around 15 minutes during the northbound holiday peak period. This increased to 20-22 minutes for the 85th percentile. The 85th percentile represents the time 85 per cent of motorists took to travel through Berry and is used to distinguish between stopping and non-stopping traffic.

Table 7-5 Princes Highway travel times through Berry (holiday peak periods)

Origin	Destination	Direction	Minimum (mm:ss)	Average (mm:ss)	85 th percentile (mm:ss)
Northbound holiday peak period					
Princes Highway, north of Tannery Road	Princes Highway, south of Victoria Street	Southbound	02:24	08:31	06:00-06:30
Princes Highway, south of Victoria Street	Princes Highway, north of Tannery Road	Northbound	03:02	14:44	20:00-22:00
Southbound holiday peak period					
Princes Highway, north of Tannery Road	Princes Highway, south of Victoria Street	Southbound	02:48	06:08	05:30-06:00
Princes Highway, south of Victoria Street	Princes Highway, north of Tannery Road	Northbound	02:40	05:44	04:00-04:30

mm:ss – minute minute:second second

Current network performance

Level of service (LoS) is a qualitative measure describing operational conditions within a traffic stream. The desirable maximum capacity of each road section is determined from the 'Guide to Traffic Management, Part 3: Traffic Studies and Analysis' (AUSTROADS, 2009). It is generally described in terms of service measures such as the following:

- Speed and travel time.
- Freedom to manoeuvre.
- Traffic interruptions.
- Comfort and convenience.
- Road safety.

A description of the LoS scale for highway flows and intersection performance is provided in **Table 7-6** and **Table 7-7** respectively.

Table 7-6 LoS for highway flows

LoS	Description
A	A condition of free flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high, and the general level of comfort and convenience provided is excellent.
B	In the zone of stable flow where drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is a little less than with LoS A.
C	Also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.
D	Close to the limit of stable flow and approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems.
E	Traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause breakdown.
F	In the zone of forced flow, where the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs, and queuing and delays result.

Table 7-7 LoS criteria for intersections

LoS	Average delay/vehicle (seconds/vehicle)	Traffic signals roundabout	Give way stop signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents would cause excessive delays	At capacity; requires other control mode
F	>70	Roundabouts require other control mode	At capacity; requires other control mode

Source: 'Guide to Traffic Generating Developments' (RTA 2002)

The Princes Highway both north and south of Berry currently operates at LoS D in both the morning and afternoon peak periods at the locations specified in **Table 7-8**, while the 'Sandtrack' currently operates at LoS C (refer to **Table 7-8**). During holiday peak periods, the operational performance of the Princes Highway deteriorates to an unacceptable LoS E at most locations and the 'Sandtrack' operates at LoS D.

By 2037, the Princes Highway would operate at an unacceptable LoS E or LoS F for all peak periods in the absence of the project, should traffic continue to grow at current rates (refer to **Table 7-9**). This would result in the breakdown of traffic flow and major delays. The 'Sandtrack' would be expected to deteriorate to LoS D during the typical AM and PM peak, and LoS E during the highest holiday (southbound) peak period.

Key intersections in and around Berry currently have sufficient capacity to accommodate the high levels of demand associated with holiday peak period traffic (refer to **Table 7-10**). The intersections of Queen Street and Kangaroo Valley Road, Queen Street and Albert Street, and the Princes Highway and Tannery Road have three approach roads, with only small levels of traffic demand from their minor approaches. With little conflicting traffic demand, these intersections operate with minimal delay at LoS A.

As traffic volumes increase on Queen Street (Princes Highway), conflicting traffic demands of through and local traffic within Berry would result in longer delays and decreased LoS by 2037 (refer to **Table 7-11**). There would also be fewer gaps in the traffic flow, creating significant delays to vehicles attempting to turn onto or cross Queen Street. This would cause the performance of some major intersections of Queen Street, such as Kangaroo Valley Road, Alexandra Street, Prince Alfred Street and Tannery Road to deteriorate during peak periods, with significant average delays by 2037.

Longer delays would also have implications on the performance of the local road network in Berry where queuing traffic blocks adjacent intersections. If the road network remains unchanged and highway traffic is not removed from Berry, it is expected that local roads and intersections would be unable to accommodate the forecast increase in traffic volumes.

Table 7-8 2011 Highway (midblock) LoS summary (current situation)

Location	AM peak hour (veh/h)		PM peak hour (veh/h)		Holiday peak northbound (veh/h)		Holiday peak southbound (veh/h)	
	2-way volume	LoS	2-way volume	LoS	2-way volume	LoS	2-way volume	LoS
Princes Highway: Toolijooa Road – Tannery Road	730	D	875	D	1187	D	1275	E
Princes Highway: Victoria Street – South of Schofields Lane	927	D	1090	D	1248	E	1477	E
'Sandtrack': Dooley Road – Shoalhaven Heads Road	681	C	814	C	977	D	1144	D

Table 7-9 2037 Highway (midblock) LoS summary ('Do nothing' scenario)

Location	AM peak hour (veh/h)		PM peak hour (veh/h)		Holiday peak northbound (veh/h)		Holiday peak southbound (veh/h)	
	2-way volume	LoS	2-way volume	LoS	2-way volume	LoS	2-way volume	LoS
Princes Highway: Toolijooa Road – Tannery Road	1381	E	1658	E	2172	F	2372	F
Princes Highway: Victoria Street – South of Schofields Lane	1749	E	2062	E	2286	F	2714	F
'Sandtrack': Dooley Road – Shoalhaven Heads Road	1108	D	1324	D	1539	D	1789	E

Table 7-10 2011 intersection LoS summary (current situation)

Intersection / approach road	Holiday peak northbound			Holiday peak southbound		
	Approach volume (veh/h)	Average delay (second)	LoS	Approach volume (veh/h)	Average delay (second)	LoS
Princes Highway / Victoria Street						
Princes Highway northbound	893	0.0	A	542	0.0	A
Victoria Street westbound	51	0.0	A	158	0.5	A
Princes Highway southbound	280	0.0	A	776	0.0	A
Total	1224	0.0	A	1476	0.1	A
Queen Street (Princes Highway)/Kangaroo Valley Road						
Queen Street eastbound	751	0.0	A	457	0.0	A
Kangaroo Valley Road	92	3.7	A	97	3.0	A
Queen Street westbound	353	0.1	A	846	0.0	A
Total	1196	0.3	A	1400	0.2	A
Queen Street (Princes Highway)/Alexandra Street						
Queen Street eastbound	819	0.0	A	543	0.0	A
Alexandra Street southbound	79	12.5	A	118	22.2	B
Queen Street westbound	318	0.1	A	812	0.0	A
Alexandra Street northbound	92	8.6	A	65	16.8	B
Total	1308	1.4	A	1538	2.4	A
Queen Street (Princes Highway)/Prince Alfred Street						
Queen Street eastbound	816	0.0	A	517	0.1	A
Queen Street westbound	329	1.6	A	797	2.3	A
Prince Alfred Street northbound	151	9.2	A	139	22.7	B
Total	1296	1.5	A	1453	3.5	A
Queen Street (Princes Highway)/Albert Street						
Queen Street eastbound	859	4.1	A	528	4.1	A
Albert Street	58	2.6	A	62	1.4	A
Queen Street westbound	367	2.7	A	865	2.4	A
Total	1284	3.6	A	1455	3.0	A
Princes Highway/Tannery Road						
Princes Highway eastbound	914	1.5	A	550	1.9	A
Princes Highway westbound	292	1.1	A	790	1.1	A
Tannery Road	66	1.2	A	79	2.4	A
Total	1272	1.4	A	1419	1.5	A

Table 7-11 2037 intersection LoS summary ('Do nothing' scenario)

Intersection / approach road	Holiday peak northbound			Holiday peak hour southbound		
	Approach volume (veh/h)	Average delay (seconds)	LoS	Approach volume (veh/h)	Average delay (seconds)	LoS
Princes Highway / Victoria Street						
Princes Highway northbound	1681	0.0	A	870	94.7	A
Victoria Street westbound	83	0.2	A	173	3.9	A
Princes Highway southbound	486	0.0	A	918	0.0	A
Total	2250	0.0	A	1961	42.4	D
Queen Street (Princes Highway) / Kangaroo Valley Road						
Queen Street eastbound	1469	0.2	A	733	104.4	F
Kangaroo Valley Road	270	276	F	106	773.9	F
Queen Street westbound	663	19.5	B	1056	15.4	B
Total	2402	36.5	C	1895	92.3	F
Queen Street (Princes Highway) / Alexandra Street						
Queen Street eastbound	1637	0.6	A	789	86.2	F
Alexandra Street southbound	130	276	F	106	426.6	F
Queen Street westbound	634	1.0	A	1011	3.3	A
Alexandra Street northbound	136	329	F	98	438.9	F
Total	2537	32.4	C	2004	79.6	F
Queen Street (Princes Highway) / Prince Alfred Street						
Queen Street eastbound	1589	2.0	A	766	90.2	F
Queen Street westbound	659	3.9	A	1002	5.3	A
Prince Alfred Street northbound	222	197	F	156	296.9	F
Total	2470	20.0	B	1924	62.7	E
Queen Street (Princes Highway) / Albert Street						
Queen Street eastbound	1595	4.6	A	766	72.6	F
Albert Street	83	20.5	B	42	137.7	F
Queen Street westbound	855	16.8	B	1100	41.6	C
Total	2533	8.9	A	1908	56.2	E
Princes Highway / Tannery Road						
Princes Highway northbound	1656	4.0	A	776	72.7	F
Princes Highway southbound	583	1.2	A	996	25.6	B
Tannery Road	166	5.4	A	81	696.7	F
Total	2405	3.4	A	1853	74.7	F

Road safety

The current fatality rate for the project area is around 0.8 per 100 million vehicle kilometres travelled (MVKT). The NSW average fatality rate is 0.6 per 100 MVKT (for the 12-month period ending in June 2012). The project area therefore has over 30 per cent more fatalities per kilometre travelled than the NSW average. An analysis of crash statistics collected by RMS between 1 July 2003 and 30 September 2010 found that this section of the highway performs relatively poorly, with 118 recorded crashes during this period, of which 61 resulted in personal injury and three involved fatalities.

In addition, the 'Sandtrack' has a high fatality rate of 0.7 per 100 MVKT, again higher than the NSW average. Five fatal and 81 injury crashes occurred on the 'Sandtrack' between 1 July 2003 and 30 September 2010.

The frequency of crashes on the highway and the 'Sandtrack' would be expected to increase should the network remain unchanged.

Modes of travel

Private vehicles are the predominant mode of transport in the Shoalhaven and Kiama local government areas (LGAs), representing around 85 per cent of total trips on a weekday. Berry is about two and a half hours drive from Sydney, and it typically takes an additional 15 minutes to drive further south to Bomaderry. Private vehicles are the main transport mode because public transport services are limited both within and to the project area.

In terms of public transport, bus and rail account for fewer than five per cent of total trips on a weekday in the Shoalhaven and Kiama LGAs. Berry and the surrounding area are serviced by:

- The South Coast railway line, with Berry station located at Railway Street.
- Shoal Bus, a private bus operator providing two local services, and two school bus services.
- Premier Motor Service, a private bus operator providing regional/interstate services and school bus services.

The South Coast Railway Line provides connections to Sydney, Wollongong, Dapto, Kiama, Gerringong, Berry and North Nowra/Bomaderry. There are no direct services to Sydney and passengers are required to change at Wollongong, Dapto or Kiama. Daily passenger demand at Berry is low, with only 140 passengers entering or exiting the station during a typical 24 hour period.

Local and regional bus and coach services utilise the Princes Highway and local road network within Berry (refer to **Table 7-12**). However, the number of routes and frequency of services available are limited. This has resulted in fewer bus passengers when compared to other forms of travel, with bus passengers representing two to four per cent of the average weekday travel demand from the Shoalhaven and Kiama LGAs.

Patronage figures for school services between Gerringong, Berry and Bomaderry suggest around 20 students typically use these services on a daily basis during the school term.

Table 7-12 Description of bus routes within the project area

Route	Frequency	Comments
Shoal Bus		
A regular service travels from Werri Beach to Berry via the 'Sandtrack' and Beach Road; and then on to Bomaderry and Nowra via the Princes Highway (Route 705).	A minimum service of twice per day, with an additional two 'Shoal Shopper' services on Tuesday and Friday.	Express service travelling between Gerringong and Nowra typically takes 30-45 minutes, while all stop services can take over an hour.
A regular service operates between Berry (Queen Street and Station Road) and Shoalhaven Heads via Prince Alfred Street and Coolangatta Road (Route SB).	Two services operate on a typical weekday during morning and afternoon school pickup hours, with one on Saturdays.	On a typical weekday, the travel time for this route is around 30 minutes in the morning and 15 minutes in the afternoon.
School-specific services: A school service starts in Gerringong, travels down the 'Sandtrack', before it travels to Berry via Beach Road; and then to Bomaderry via the Princes Highway. A school service starts in Foxground and travels along the Princes Highway through Berry to Nowra.	Morning pick-up and afternoon drop-off periods.	The Foxground – Nowra service has informal rural pick-up and drop-off locations along the Princes Highway where children reside, as well as at numerous intersections between the Princes Highway and local roads in the project area.
Premier Motor Service		
Daily services operate in each direction, linking Sydney and Melbourne via Kiama, Gerringong and Nowra.	Two daily Princes Highway bus services in each direction.	-
A school service that operates between Bomaderry and Toolijooa Road along the Princes Highway.	Morning pick-up and afternoon drop-off periods.	-

Road shoulders and verges provide the only means for pedestrians or cyclists to travel along the Princes Highway. This and the speed of traffic combined with significant travel distances between neighbouring towns (ie Gerringong, Bomaderry and Berry), result in very low pedestrian and cyclist flows.

Footpaths are provided in Berry between Woodhill Mountain Road and Kangaroo Valley Road to service local shops and businesses on Queen Street. Residential streets in the town have one-sided, partial or no footpaths.

There are currently no cycle-specific facilities along the Princes Highway in the project area. In the surrounding region, an off-road cycle route links Gerringong and Gerroa along Fern Street and a six kilometre coastal walking track links Kiama and Gerringong.

There are no formal cycle specific facilities in Berry but Shoalhaven Council promotes various cycle routes to and from Berry utilising the Princes Highway and other local and regional roads (for example Berry to Seven Mile Beach via the Princes Highway, Tannery Road and Beach Road, and Berry to Kangaroo Valley via Berry Mountain).

A proposed 1400 kilometre coastal cycleway stretching from the Queensland border, through NSW to the Victorian border includes a section within the study area that follows the route of the 'Sandtrack'. This connects to the Berry to Seven Mile Beach route described above. It is largely funded by RMS and implemented by local government, and has already resulted in over 330 kilometres of the route being constructed or committed, in the form of shared pedestrian/cycle paths or on-road cycle lanes along local streets. There are opportunities for Shoalhaven and Kiama Councils to apply for grants to improve the route for cyclists.

Garbage truck services operate along North Street and Rawlings Lane, Berry on Thursdays. These services are operated by Shoalhaven City Council.

Police and fire brigade services also operate within Berry. The police station is located at 56 Victoria Street, Berry and the fire station is located at 26 Prince Alfred Street, Berry.

7.1.3 Assessment of potential impacts

Construction impacts

Construction activities would disrupt highway, regional and local flows, leading to travel time delays and decreased network performance as discussed in this section.

Construction routes

The project construction would create an increase in construction vehicles travelling to, from, and within the project area on the existing Princes Highway and local roads. This would include additional traffic demand generated by:

- Construction workers travelling to and from worksites.
- Delivery of heavy vehicles, machinery and other equipment required for highway construction.
- Delivery of construction materials including cement, aggregates and pre-fabricated structures.
- Movement of spoil haulage generated by earthworks, including the transfer of spoil to stockpile sites and/or removal from the project area.

Construction traffic would use the cleared project footprint where possible, to transport materials within the project area. This would occur either adjacent to the highway or via a haul route as appropriate.

It is anticipated that a large proportion of construction-related traffic would travel to and from the project area from Kiama, Port Kembla and Wollongong. North of the project, the Gerringong upgrade of the Princes Highway is proposed to be completed, providing a divided carriageway with two lanes in each direction (Gerringong upgrade) prior to construction of the current project. The main construction route would include the existing highway north of Gerringong and the upgraded section of highway between Gerringong and the project. This would provide sufficient capacity for construction-related vehicles to travel to and from work sites safely and efficiently.

Wherever practicable, the new sections of highway that are to be constructed away from the existing highway (referred to as offline construction) would be completed first, with the aim of removing construction-related vehicles from the existing highway. This would minimise traffic impacts along the construction route. Construction traffic entry and exit points would be minimised and controlled and the use of the existing highway would be restricted at peak hours, especially during holiday periods. This would also maintain traffic flow along the construction route.

During construction of the bypass at Berry, construction vehicles would be present in the northern end of Berry to source and transport material to/from the project footprint to the proposed stockpile site and compound/office adjacent to Woodhill Mountain Road and also to the compound/office south of North Street, accessed via Kangaroo Valley Road. All other compound stockpile sites and construction compounds/offices would be accessed directly from the existing highway or would involve additional travel for short distances on local roads after turning off the highway (eg Toolijooa Road).

Construction traffic

The ultimate volume of traffic generated by the project would be dependent on the construction methods adopted by the selected contractor, location of material suppliers, final material and spoil volumes, location and size of stockpile sites and use of haulage roads. These construction methods and subsequent detailed forecasts of traffic volumes and trip patterns would be developed from the final detailed design. However, based on assumptions on construction material estimates and staffing requirements, it has been estimated that around:

- 45,000 heavy vehicles would be generated during construction (or 90,000 vehicle movements) across the three year construction period. This would equate to an average of around 53 heavy vehicles per day, or 106 heavy vehicle movements per day.
- 65 light vehicles per day (or 130 movements per day) would be generated by construction workers. This is based on an assumed average of two construction personnel per vehicle.

Earthworks haulage and the delivery of dry bulk materials are expected to generate the vast majority of heavy vehicle movements (refer to **Table 7-13**).

Table 7-13 Construction traffic estimates

Estimated construction traffic generation – heavy vehicles:					
Source	Estimated volume of materials for haulage (average, per km)	Estimated volume of materials for haulage (total)	Vehicle capacity (average)	Estimated vehicle generation	
				Total	Daily (average)
Earthworks	-	1,000,000 m ³	30 m ³	33,333	39
Dry bulk materials	28,450 m ³	330,000 m ³	30 m ³	11,000	13
Reinforcing steel	460 tonnes	5320 tonnes	10 tonnes	532	1
Pre-fabricated units	18 units	205 units	1 unit	205	<1
Total – heavy vehicles	-	-	-	45,000	53

Impacts on regional roads, local roads and property access

Construction traffic would also generate noise, air quality and amenity impacts, particularly when heavy vehicles travel through Berry. However, it is not expected that the increase in traffic would reduce road safety, provided that adequate traffic management measures are employed.

It is RMS' goal to maintain an 80 kilometres per hour construction speed zone (where normal posted speeds equal or exceed this limit), which would minimise traffic delays. However, delays for traffic using the Princes Highway would be expected during construction periods for sections of the project where the existing highway would be upgraded (referred to as online construction). Delays would also be expected when tying new work in with the existing highway. For example disruptions and delays to local and highway traffic would be experienced during construction due to the narrowing of lanes and temporary speed reductions. There would also be delays to local traffic when other local or private roads are being bridged or tied in with the project. Large sections of the project completed offline would minimise the impacts to traffic efficiency on the current road network. This would include sections at Toolijooa Ridge, Broughton Creek and the Berry bypass.

Local roads outside of Berry that would potentially experience delays during construction include roads directly linked to, or serviced by, the new grade-separated interchanges at Toolijooa Road, Austral Park Road, and Tindalls Lane. Residents in the Foxground and Broughton Village areas who would use the new interchanges at Toolijooa Road and Austral Park Road would experience some closures and detours while construction is underway. Residents accessing properties along sections of the proposed upgraded highway may also experience delays and traffic management measures would maintain access while construction work is underway.

Within Berry, temporary delays would occur where:

- Proposed interchanges tie into the Berry bypass, including the upgrade and modification of existing intersections (for example the intersections of Kangaroo Valley Road with Queen Street and Huntingdale Park Road).
- Local road works are proposed (for example, the Woodhill Mountain Road roundabout).
- Temporary and/or permanent severance of local road connections are proposed, specifically Victoria Street, North Street, Rawlings Lane and Kangaroo Valley Road.

It is likely that roads directly linked to, or serviced by the new grade-separated interchanges would experience some closures and detours. In particular, the construction of the new Kangaroo Valley Road overpass at the southern interchange to Berry would require a temporary road closure. Kangaroo Valley Road is the key local road connection used by newer residential areas of Berry to access the highway and the retail and recreational areas of Berry. During this time, it is possible that traffic would be diverted along North Street and as a result, the Kangaroo Valley Road bridge would need to be operational before construction could commence on the bypass section that severs North Street, unless alternative arrangements for access are arranged.

North Street and Rawlings Lane properties would require access modifications, and bus routes and garbage routes would be impacted as a result of the permanent severance of North Street. These are discussed further within the operational impacts section.

It is estimated that about three per cent of total through traffic travelling between Gerringong and Bomaderry would shift from the highway to the 'Sandtrack', temporarily increasing traffic volumes on the 'Sandtrack', particularly during holiday peak periods. The impact of this increase in traffic on the performance of the 'Sandtrack' is discussed further within the LoS assessment below.

Toolijooa Road is a local road that currently carries very low traffic volumes (less than 500 vehicles per day), with the majority of vehicles using it to access properties along its length between the Princes Highway and Beach Road. It could potentially offer an alternative route during construction for vehicles attempting to avoid traffic delays resulting from construction activity, as the intersection between Toolijooa Road and the Princes Highway is located at the boundary of the project area to the east. However, it is anticipated that Toolijooa Road would continue to be mainly used by local residents during construction, given it is:

- Signposted as a local road with a posted speed limit of 60 kilometres per hour.
- Of a lower standard than the Princes Highway and the 'Sandtrack', with lower quality road surfaces including an unsealed section, narrow lanes, and a poor alignment.

The use of local roads by heavy vehicles associated with construction would be limited to where these roads provide access to construction ancillary sites, or where local road modifications are proposed. Two construction ancillary sites are located off the Princes Highway which would require travel along local roads, namely the site located off Woodhill Mountain Road and the site located adjacent to North Street (and accessed via Kangaroo Valley Road).

The existing AADT on Woodhill Mountain Road and Kangaroo Valley Road is 970 and 1485 vehicles respectively. Based on the most-likely construction scenario and assuming a maximum of 50 heavy vehicles per day, the impacts on both local roads is likely to be between a three per cent and five per cent increase on existing traffic volumes. Although the presence of heavy vehicles close to the town would be a temporary inconvenience to the community during construction of the bypass, the additional trucks would have a negligible impact on the operational performance of both roads with minimal delay and congestion. This is due to the low volume of daily and peak period local traffic flows that currently travel on Woodhill Mountain Road and Kangaroo Valley Road, the close proximity of the stockpile/compound sites and direct access to the Princes Highway to transport residual material to other sites/locations external to the town.

Public transport and emergency services

There would be potential for disruptions to existing public transport bus services due to construction of the project. Existing bus services pick up and set down at informal stops along the highway at driveways and intersections. Permanent or temporary closures of local access points as well as construction activities along the outer edge of the highway, would limit the areas along the highway where buses would be able to stop safely.

There would be potential delays to response times for emergency services. Delays due to construction activities, queuing traffic and reduced speed limits may disrupt emergency services. Procedures to minimise the impacts to emergency services during construction would be incorporated into the construction environmental management plan (CEMP) (refer to **Section 7.1.4**).

Impacts on network performance (LoS)

To assess the impacts of construction work on the LoS of the highway and key intersections within Berry, the following representative and worst case scenarios have been assessed, as follows (refer **Appendix D**):

- Representative or the 'most likely' scenario, indicative of construction traffic increasing volumes on the Princes Highway on a typical day, with a proportion of traffic transferring to the 'Sandtrack' to avoid construction works.
- A worst case scenario for the opening year (2017), representing the assessment of the road network during a holiday peak with the expected transfer of 'Sandtrack' traffic predicted following the completion of the Princes Highway upgrade program.

The worst case scenario would be ameliorated by the implementation of appropriate mitigation measures, as outlined at **section 7.1.4**. During the representative scenario, the construction traffic is estimated to consist of:

- 65 light vehicles used by construction workers during AM and PM peak hours.
- 10 heavy vehicles during AM and PM peak hours, based on the assumption that heavy vehicles would follow a more even distribution throughout a typical day compared to construction workers.

When compared to the total traffic on the Princes Highway, construction traffic is expected to contribute around seven per cent of total traffic during these peak periods. As an example, during a typical 2017 AM peak hour on the Princes Highway east of Tannery Road, total traffic is expected to reach around 1031 vehicles, including an estimated 75 construction vehicles.

Highway and 'Sandtrack' performance

Based on 2017 traffic volumes, the highway is expected to operate at a LoS E without the introduction of construction traffic north and south of Berry. This would not change with the addition of construction traffic (refer to **Table 7-14**). However, travel speeds would marginally decrease as a result of construction traffic. Average travel speeds on the Princes Highway would be around 50-60 kilometres per hour, with passing constrained by traffic management measures through construction zones. Current levels of road safety are not expected to decrease with the introduction of appropriate traffic management measures.

The 'Sandtrack' is expected to continue at LoS C during the typical AM and PM peak hours during the representative scenario up to and including the final year of construction, despite the predicted increase in light vehicles using this route to avoid construction delays. This relatively small increase in traffic is not expected to decrease the safety of this route. RMS would not utilise the 'Sandtrack' as a diversion route and would not seek the removal of the existing five tonne limit on the 'Sandtrack'. However, a three per cent transfer of traffic to the 'Sandtrack' has been factored into the assessment to account for motorist behaviour. The relatively small increase in traffic is not expected to decrease the safety of the 'Sandtrack'.

Table 7-14 2017 midblock LoS summary (representative construction scenario)

Location	AM peak hour (veh/h)		PM peak hour (veh/h)	
	2-way volume	LoS	2-way volume	LoS
Princes Highway: Toolijooa Road – Tannery Road	972	E	1150	E
Princes Highway: Victoria Street – South of Schofields Lane	1,160	E	1348	E
'Sandtrack': Dooley Road – Shoalhaven Heads Road	728	C	870	C

For the worst case scenario, two key assumptions have been made:

- Completed portions of the project have been opened to traffic, resulting in the transfer of traffic from the 'Sandtrack' to the highway. The transfer represents the predicted split of traffic once the Princes Highway upgrade program is complete.
- No construction work would be undertaken during holiday peak periods and as such, no construction vehicles would be travelling during this period. This reflects the RMS commitment to manage the project to avoid construction work during these times so that disruption to highway flows during holiday peak periods would be minimised.

Despite the removal of construction vehicles from the road network, the modelled 'worst case' scenario reflects the likely period of the poorest performance of the road network. This is a result of the combination of the holiday peak traffic volumes, a three per cent transfer of traffic from the 'Sandtrack' and the impact of traffic management measures through construction zones (such as speed restrictions and passing constraints).

The results of the worst case scenario analysis indicate that the highway would operate at LoS E during both the holiday peak northbound and southbound scenarios (refer to **Table 7-15**). Average travel speeds would drop to 50 kilometres per hour or less. This is attributed to the increase in traffic, speed restrictions and the prevention of overtaking in construction zones. Despite this reduction in performance, the LoS E indicates that the highway would have the capacity to accommodate the worst-case traffic volumes during construction.

On the 'Sandtrack', the LoS would remain relatively unchanged despite the reduction in traffic, with a LoS C during holiday northbound peak and LoS D during the busier holiday southbound peak.

Table 7-15 2017 midblock LoS summary (worst-case construction scenario)

Location	Holiday peak northbound (veh/h)		Holiday peak southbound (veh/h)	
	2-way volume	LoS	2-way volume	LoS
Princes Highway: Toolijooa Road – Tannery Road	1666	E	1793	E
Princes Highway: Victoria Street – South of Schofields Lane	1674	E	1967	E
"Sandtrack": Dooley Road – Shoalhaven Heads Road	792	C	924	D

Berry road network performance

The main factors influencing the performance of the road network and intersections in Berry during construction include the diversion of traffic during road closures and natural traffic growth.

Construction would not include any major works within the centre of Berry. The construction of the new Kangaroo Valley Road interchange would be the most substantial modification to the town's road network. This would require the temporary closure of Kangaroo Valley Road, with an alternative route made available via North Street.

The majority of works in the vicinity of Berry would be constructed offline with minimal traffic impacts. However it is likely there would be some adverse effects during the tie in of offline sections to online sections. These occurrences would only last for short periods.

To assess the impacts of construction on the local road network, the same worst case and representative scenarios were modelled. However, it was assumed for both scenarios that the road network within Berry had not been upgraded and that the Berry bypass was not operational (that is, traffic continued to travel through Berry).

During the representative scenario, the local network would be expected to accommodate the forecast traffic with minimal delay (refer to **Table 7-16**). Only the intersection approaches from Alexandra Street and Prince Alfred Street would be expected to drop to LoS B during the typical 2017 AM and PM peaks, with a maximum average delay of around 24 seconds.

During the worst case scenario, the Berry road network would continue to operate at acceptable performance levels during 2017 holiday peak periods as the majority of intersection approach roads would continue to operate at LoS A (refer to **Table 7-17**). However, the increase in traffic demand on Queen Street (due to overall higher traffic volumes experienced during this period) would result in further delays for some of the minor intersection approach roads, notably at Alexandra Street and Prince Alfred Street.

With the majority of traffic demand on the Queen Street approach roads (priority through movements), vehicles using the minor approach roads would find gaps in traffic less frequent and subsequently incur additional delays. The holiday peak southbound period modelling scenario indicates that vehicles travelling southbound on Alexandra Street would experience an average delay of about 90 seconds, resulting in LoS F. In addition, vehicles travelling on the Prince Alfred Street northbound approach would experience an average delay of 65 seconds. All other intersection approach roads in Berry would operate at LoS C or better.

In summary, due to the offline construction of the Berry bypass, the local road network and Berry intersections would still perform adequately during the worst-case construction scenario without the provision of additional temporary traffic management measures.

Table 7-16 2017 intersection LoS summary (representative construction scenario)

Intersection / approach road	AM Peak hour			PM Peak hour		
	Approach volume (veh/h)	Average delay (seconds)	LoS	Approach volume (veh/h)	Average delay (seconds)	LoS
Princes Highway / Victoria Street						
Total	1207	0.0	A	1329	0.0	A
Queen Street (Princes Highway)/Kangaroo Valley Road						
Total	1465	0.8	A	1672	1.0	A
Queen Street (Princes Highway)/Alexandra Street						
Queen Street eastbound	714	0.2	A	750	0.0	A
Alexandra Street southbound	48	19.1	B	98	23.6	B
Queen Street westbound	620	0.2	A	684	0.1	A
Alexandra Street northbound	33	10.6	A	52	13.9	A
Total	1415	1.1	A	1584	2.0	A
Queen Street (Princes Highway)/Prince Alfred Street						
Queen Street eastbound	612	0.2	A	682	0.2	A
Queen Street westbound	650	2.4	A	622	2.1	A
Prince Alfred Street northbound	137	13.4	A	210	17.6	B
Total	1399	2.5	A	1514	3.4	A
Queen Street (Princes Highway)/Albert Street						
Total	1294	3.4	A	1315	3.2	A
Princes Highway/Tannery Road						
Total	1234	2.0	A	1325	1.6	A

Performance of the intersection shows total movements only where all turning movements perform at LoS A in the worst case and representative scenarios. Refer to the Traffic and Transport Technical Paper at **Appendix D for more detail.*

Table 7-17 2017 intersection LoS summary (worst-case construction scenario)

Intersection / approach road	Holiday peak northbound			Holiday peak southbound		
	Approach volume (veh/h)	Average delay (seconds)	LoS	Approach volume (veh/h)	Average delay (seconds)	LoS
Princes Highway / Victoria Street						
Total	1626	0.0	A	1898	0.3	A
Queen Street (Princes Highway)/Kangaroo Valley Road*						
Total	1806	6.0	A	2015	1.3	A
Queen Street (Princes Highway)/Alexandra Street						
Queen Street eastbound	1178	0.0	A	796	0.3	A
Alexandra Street southbound	76	40.2	C	142	90.3	F
Queen Street westbound	445	0.0	A	1040	0.3	A
Alexandra Street northbound	119	21.7	B	93	41.5	C
Total	1818	3.1	A	2071	8.3	A
Queen Street (Princes Highway)/Prince Alfred Street						
Queen Street eastbound	1163	0.3	A	772	3.6	A
Queen Street westbound	447	2.2	A	1054	3.0	A
Prince Alfred Street northbound	198	23.2	B	214	65.2	E
Total	1808	3.3	A	2040	9.8	A
Queen Street (Princes Highway)/Albert Street*						
Total	1725	4.2	A	1944	3.8	A
Princes Highway/Tannery Road*						
Total	1696	1.6	A	1933	2.2	A

**Performance of the intersection is provided for total movements only where all turning movements perform at LoS A. Refer to the Traffic and Transport Technical Paper at Appendix D for more detail.*

Operational impacts

In comparison to the existing highway, the project would deliver a shortened route, reducing the length of the highway by around 1.5 kilometres between Toolijooa Road and Schofields Lane. The project would also deliver higher safe travel speeds, with the average travel speed increasing from around 52 kilometres per hour (in 2006) to around 98 kilometres per hour (in 2026). It would bypass the Foxground bends and remove conflicts between local and through traffic movements within Berry.

The project would result in an estimated seven minute reduction in travel time for vehicles travelling on the Princes Highway between Toolijooa Road and Schofields Lane.

In the project area the existing Princes Highway is longer, and has an average travel time close to double that of the equivalent 'Sandtrack' route to the south. Following opening, the project would create a shorter travel time on the Princes Highway than the 'Sandtrack' in the project area. It is estimated that average travel times along the 'Sandtrack' would remain roughly constant at around 7.5 minutes. The significant travel time savings on the Princes Highway created by the project are anticipated to result in a large volume of traffic transferring from the 'Sandtrack' in favour of the upgraded highway following construction. Similar upgrades to the north and south of the project area are likely to improve travel times further on the Princes Highway within the traffic impact footprint, adding to the proportion of overall traffic using the highway rather than the alternative 'Sandtrack' route.

As described in **Section 7.1.1**, the performance of the project and the 'Sandtrack' has been assessed against the 'do nothing' scenario using the 'the project' and 'the Princes Highway upgrade program' scenarios at the year of opening (2017) and year of design (2037). The result of the modelling indicates that the upgraded highway would operate at LoS A or LoS B throughout the project area during typical morning and afternoon peak periods for both the 'the project' and 'the Princes Highway upgrade program' scenarios (refer to **Table 7-18** and **Table 7-19**).

During the busiest northbound and southbound holiday peak periods, the highway would operate at LoS C or better. The project would provide two lanes in each direction and would increase the safe operating speed of the Princes Highway in the project area. This would be an improvement to the current LoS, with the highway predicted to operate at a LoS F during these peak periods by 2037, if the project was not constructed. In addition, the median strip and safety barrier would enable the directional flows on the highway to operate independently, so a heavy flow of traffic resulting in a decrease in the LoS in one direction would not reduce the LoS in the other (unlike existing conditions).

The 'Sandtrack' is expected to operate at LoS C during all peak periods in 2037 as traffic is anticipated to reduce from current levels due to the significant proportion of vehicles expected to transfer to the Princes Highway following its upgrade. This reduction in traffic would improve the 'Sandtrack' safety and efficiency, which would enhance the driver experience of this scenic coastal route.

In summary, the Princes Highway in the project area would perform at an acceptable LoS during peak hours in 2037 in both scenarios.

However, while the LoS is expected to improve within the project area, the increase in traffic on the Princes Highway following the upgrade could put pressure on unimproved sections of the highway to the south. For example, the section between Schofields Lane and Cambewarra Road (being the Berry to Bomaderry upgrade) would still be awaiting upgrade and would likely experience additional traffic growth as a result of motorists switching from the 'Sandtrack'.

Table 7-18 2037 midblock LoS summary ('The project' scenario)

Location	Direction	AM peak hour (veh/h)		PM peak hour (veh/h)		Holiday peak northbound (veh/h)		Holiday peak southbound (veh/h)	
		2-way volume	LoS	2-way volume	LoS	2-way volume	LoS	2-way volume	LoS
Princes Highway: Toolijooa Road – Berry east interchange	Northbound	1050	A	1420	B	2295	C	1298	B
	Southbound	1114	B	1228	B	795	A	2036	C
Princes Highway: Berry bypass	Northbound	990	A	1233	B	1894	C	1031	B
	Southbound	989	A	1086	A	575	A	1691	C
Princes Highway: Kangaroo Valley Road interchange – South of Schofields Lane	Northbound	1123	B	1399	B	2179	C	1299	B
	Southbound	1110	B	1260	B	742	A	2103	C
"Sandtrack": Dooley Road – Shoalhaven Heads Road	Two-way	532	C	627	C	660	C	774	C

Veh/h = vehicles per hour

Table 7-19 2037 midblock LoS summary ('The Princes Highway upgrade program' scenario)

Location	Direction	AM peak hour (veh/h)		PM peak hour (veh/h)		Holiday peak northbound (veh/h)		Holiday peak southbound (veh/h)	
		2-way volume	LoS	2-way volume	LoS	2-way volume	LoS	2-way volume	LoS
Princes Highway: Toolijooa Road – Berry east interchange	Northbound	1096	B	1481	B	2419	C	1366	B
	Southbound	1162	B	1280	B	838	A	2146	C
Princes Highway: Berry bypass	Northbound	1043	A	1299	B	2007	C	1092	B
	Southbound	1041	B	1142	B	611	A	1791	C
Princes Highway: Kangaroo Valley Road interchange – South of Schofields Lane	Northbound	1211	B	1509	B	2297	C	1369	B
	Southbound	1198	B	1359	B	782	A	2215	C
“Sandtrack”: Dooley Road – Shoalhaven Heads Road	Two-way	353	C	416	C	428	C	501	C

Veh/h = vehicles per hour

Intersection LoS

The project proposes grade separated interchanges at the northern and southern ends of Berry. At the northern end, an interchange would be provided for vehicles to join the highway in the northbound direction and exit the highway in the southbound direction. These ramps would connect to the existing Princes Highway.

At the southern end of town, a full grade separated interchange would be provided at Kangaroo Valley Road, providing on-ramps and off-ramps to and from the highway both northbound and southbound. The construction of this interchange would include two new roundabouts on Kangaroo Valley Road to the southeast and northwest of the bypass, at the approximate locations of the existing priority intersections of Kangaroo Valley Road and Huntingdale Park Road, and Queen Street (Princes Highway) and Kangaroo Valley Road respectively. In addition, a new road connection and roundabout would be constructed to the northeast of Kangaroo Valley Road, linking the northbound off-ramps and on-ramps and Rawlings Lane to Kangaroo Valley Road.

The results of the 'Princes Highway upgrade program' scenario for the 2037 holiday peak period for both the northbound and southbound movements at key intersections in Berry is provided in **Table 7-20**. At the southern interchange for Berry the three new roundabouts would operate at LoS A, with minimal delays.

It is estimated that during the busiest northbound holiday peak period, traffic exiting the highway via the northbound off-ramp would reach 585 vehicles per hour, with the majority of this traffic travelling on to the Kangaroo Valley Road and Huntingdale Park Road intersection. Overall traffic modelling indicates that the proposed arrangement of intersections at the southern interchange would operate efficiently, with very little delay to traffic on all approaches during both modelled peak periods.

The project would not result in changes to the layout or operation of local intersections in the centre or to the east of Berry, with the exception of the Queen Street and Woodhill Mountain Road intersection which would be reconfigured as a roundabout. While the project would remove major through movements within Berry, traffic demand generated by the town and its local surroundings would continue to grow. This would result in a considerable increase in the proportion of demand generated by the minor approach roads at the intersections listed in **Table 7-20**.

Despite the growth in locally generated traffic there would be an overall reduction in traffic on Queen Street, leading to an improvement in LoS and reduced delays. All intersections and approaches to Queen Street would operate at LoS A (with the exception of Alexandra Street southbound, which would operate at LoS B) and experience minimal congestion or delay. This is attributed to the project (specifically the bypass of Berry), which would remove large volumes of through-traffic from the centre of town.

The project would sever the current North Street road link between Rawlings Lane and Edward Street. North Street is an alternative route to the Princes Highway between Kangaroo Valley Road and Woodhill Mountain Road to the north of Berry. Although only a small proportion of through traffic currently uses this route, the construction of the Berry bypass would require vehicles to use either the bypass or Queen Street as an alternative to North Street.

In addition, the proposed project design currently includes a closure of Victoria Street at its western end, where it currently connects to the existing Princes Highway. This would result in a change in the volume and distribution of traffic on local roads; particularly along and between Victoria Street and Queen Street. The traffic impacts of potential options for the treatment of the western end of Victoria Street are discussed in detail in the *Traffic and Transport Technical Paper* (AECOM, 2012) which is provided at Appendix D of this environmental assessment.

Table 7-20 2037 intersection LoS summary ('the Princes Highway upgrade program' scenario)

Intersection / approach road	Holiday peak northbound			Holiday peak southbound		
	Approach volume (veh/h)	Average delay (seconds)	LoS	Approach volume (veh/h)	Average delay (seconds)	LoS
Kangaroo Valley Road / Huntingdale Park Road						
Huntingdale Park Road	252	0.5	A	244	0.5	A
Kangaroo Valley Rd southbound	141	0.9	A	164	0.9	A
New road connection westbound	603	0.9	A	547	1.1	A
Kangaroo Valley Road northbound	379	0.7	A	259	0.7	A
Total	1375	0.8	A	1214	0.9	A
Northbound highway ramps / Rawlings Lane						
Rawlings Lane	33	0.2	A	18	0.4	A
Northbound off-ramp	585	1.3	A	541	1.8	A
New road connection eastbound	172	0.3	A	141	0.3	A
Total	790	1.0	A	700	1.5	A
Kangaroo Valley Road / Queen Street						
Kangaroo Valley Road	790	0.9	A	664	0.7	A
Southbound off-ramp	166	6.1	A	135	2.4	A
Queen Street	501	0.9	A	701	1.0	A
Total	1457	1.5	A	1500	1.0	A
Queen Street / Alexandra Street						
Total	1402	2.2	A	1309	4.6	A
Queen Street / Prince Alfred Street						
Total	1126	1.4	A	1158	1.1	A
Queen Street / Albert Street						
Total	992	0.3	A	1058	0.1	A
Old Princes Highway / Tannery Road						
Total	924	0.2	A	1014	0.5	A

* Performance of the intersection is provided for total movements only where all turning movements perform at LoS A. Refer to the Traffic and Transport Technical Paper at Appendix D for more detail.

Performance of the southern interchange for Berry

Shoalhaven City Council requested that an additional northbound off-ramp be provided as part of the project to cater for future traffic growth. Or as an alternative, suggest that the project design allow for future construction of an additional northbound off-ramp.

The performance of the southern interchange was considered as part of the 2037 'Princes Highway upgrade program' scenario. This assessment demonstrated that the project was able to accommodate the predicted traffic volumes during the northbound holiday peak with minimal delay and a LoS A.

Additional sensitivity modelling was undertaken to determine the volume of traffic that would cause a reduction in the performance of this interchange to an unacceptable LoS and at what year this would occur. This modelling indicated that road network performance would deteriorate to LoS F by around 2070, based on forecast traffic growth rates. The project design would have sufficient operating capacity to adequately accommodate traffic volumes much higher than those predicted in the 2037 design year. As a result a second northbound off-ramp in Berry is not required to accommodate projected traffic volumes.

The only feasible connection for a second northbound off-ramp would be at Woodhill Mountain Road. However, environmental constraints and unfavourable geological conditions would result in adverse impacts to the current environment during construction and operation. As the project would provide sufficient network capacity to accommodate predicted traffic volumes and mitigate other environmental impacts, a second northbound off-ramp has not been provided as part of this project.

Despite this, the concept design does not preclude the future addition of a second northbound off-ramp for Berry at Woodhill Mountain Road should it be warranted in the future. The construction of this facility would be subject to a separate environmental assessment.

Property access

Local roads and accesses in rural areas would be restricted to left-in and left-out movements due to a central median and safety barrier fencing. Low daily volumes of traffic, which would previously have turned right from, or into a minor road or private property, would be required to travel to the nearest u-turn facility to make a safe right turn to proceed in the desired direction.

This would provide substantial improvements in road safety, including the elimination of traffic performing right turns to and from minor roads across fast-moving two-way traffic. Existing crash data shows that over 20 per cent of crashes in the project area occurred either at intersections or between vehicles travelling in opposite directions.

Access would be restricted to the following key sections of the project (refer to **Figure 4-15**, **Figure 4-16** and **Figure 4-17**):

- Tindalls Lane to Austral Park Road.
- Berry (north) interchange to Tindalls Lane.
- Schofield's Lane to Berry (south) interchange.

The maximum additional travel time resulting from left-in left-out only movements would be around three minutes. This would be for traffic wishing to enter or depart from properties located between or close to the Berry (north) and Tindalls Lane interchanges. Vehicles would be required to travel to these interchanges and complete a u-turn to travel in the desired direction.

Access to properties within Berry would be affected by the project and would be provided with an alternative means of access. Properties to the north of North Street, which currently gain access to the local road network via Rawlings Lane, would be provided with a link via a new road connection to Kangaroo Valley Road (refer to **Figure 4-3**). A u-turn facility would be provided at Rawlings Lane for garbage services or other heavy vehicles to use. All local properties to the west of the bypass travelling to and from Kangaroo Valley Road would do so via Queen Street.

The severance of North Street would also directly impact access for two properties and would impact local services (for example, garbage collection services). Access to the two North Street properties would be provided via a driveway connection to the proposed cul-de-sac located at the eastern end of North Street, or through an extension of George Street.

Garbage trucks servicing properties on North Street would encounter a cul-de-sac on the eastern side of the bypass or a dedicated u-turn facility on the western side of the bypass. To address this, the design of the cul-de-sac and u-turn facility includes turning provisions on the residual sections of North Street. Travel to North Street (west) and Rawlings Lane would be via Kangaroo Valley Road. For North Street (east), travel would be via Queen Street and Edward Street. School bus services which currently pick up and drop off children along North Street would also use the turning facilities and alternative route.

Victoria Street

Victoria Street currently intersects the Princes Highway at the southern extent of Berry adjacent to Mark Radium Park allowing all turning movements between the two roads. Under the project, various treatments could occur at this intersection. All options would change the volume and distribution of traffic on local roads, particularly along and between Victoria Street and Queen Street.

The project team identified and assessed three design options that could be incorporated at this intersection. The three options are:

- **Option 1** – Victoria Street closed and a one-way southbound on ramp.
- **Option 2** – Victoria Street open and a one-way southbound on ramp.
- **Option 3** – Victoria Street open and a two-way southbound on ramp.

Figures displaying these three options have been provided in **Section 3.6.6**. **Section 3.6.6** also presents a summary of the different impacts associated with each option, including the potential impacts on Mark Radium Park. A summary of the traffic impacts associated with each option is provided below.

In order to assess the local road traffic impacts of the three options identified, RMS and Shoalhaven City Council commissioned a number of traffic surveys which were undertaken during April and May 2012. These surveys measured the traffic volumes and patterns on Victoria Street and other key adjacent local roads within Berry.

The AADT on Victoria Street is currently highest at the western end, near the Princes Highway intersection with around 2200 vehicles per day in comparison to around 1200 vehicles per day at the eastern end between Prince Alfred Street and Alexandra Street. Traffic on key north-south roads between these two locations on Victoria Street peaks at 750 vehicles per day on Albany Street, with an average AADT of around 350-450 vehicles on the other roads, such as George Street, Edward Street, Alexandria Street and Prince Alfred Street.

Existing turning volumes at the Princes Highway and Victoria Street intersection were recorded to gain an understanding of the amount of traffic that would be re-distributed to other local roads, which would vary depending on the option selected. The movement from Victoria Street to the Princes Highway southbound was the most heavily trafficked at around 1100 vehicles per day. The opposite movement from the Princes Highway northbound into Victoria Street had a similar level of daily traffic with an AADT of 925 vehicles.

Modelling undertaken to forecast travels levels in 2037 showed that for all three Victoria Street design options, the four local north-south roads between George Street and Alexandra Street would be expected to experience the largest increase in daily traffic volumes, ranging between 107 per cent and 185 per cent over the next 25 years. These figures appear relatively high, however the AADT would be around or less than 2000 vehicles per day in 2037, which equates to:

- Approximately 100 vehicles per hour in each direction during the busiest 100 southbound peak period, or less than two vehicles per minute.
- The existing daily traffic volumes on Victoria Street near Mark Radium Park.

Option 1 would re-distribute the largest amount of traffic from Victoria Street to other local roads, resulting in a 35 per cent increase on George Street, Edward Street, Albany Street and Alexandra Street when compared to the other two options. However, option 1 would also remove 2000 vehicles per day from the western end of Victoria Street and there would be a 45 per cent reduction at the eastern end of Victoria Street.

Table 7-21 provides a summary of both the positive and negative traffic related impacts for the three Victoria Street design options. A detailed assessment of these options is provided in **Section 7.2.7** of the *Traffic and Transport Technical Paper* provided at **Appendix D**.

Table 7-21 Summary of traffic impacts for the Victoria Street design options

Victoria Street options	Positive impacts	Negative impacts
Option 1	<ul style="list-style-type: none"> • In 2037, daily traffic volumes on Queen Street would be around 50 per cent less than today. • Around 2000 vehicles would be removed from the western end of Victoria Street. • Traffic volumes on the eastern end of Victoria Street would decrease by around 45 per cent in 2037 when compared to the other options. • All local roads would perform at LoS A or LoS B in 2037, with only Queen Street operating at LoS C. • Least impact and land-take of Mark Radium Park and the closure of Victoria Street would allow for safer pedestrian connectivity to the park. • A turning circle at the eastern end of Victoria Street (adjacent to Mark Radium Park) would be provided that could be used as a u-turn for larger vehicles (buses, garbage trucks etc.) 	<ul style="list-style-type: none"> • In 2037, daily traffic volumes on local north-south are predicted to be three times greater when compared to existing levels. • Largest impacts on the local road network due to additional traffic volumes (around 35 per cent more than the other two options) on the north-south roads between Victoria Street and Queen Street. • Additional travel time to/from residential areas along and adjacent to Victoria Street to/from the south.

Victoria Street options	Positive impacts	Negative impacts
Option 2	<ul style="list-style-type: none"> In 2037, daily traffic volumes on Queen Street would be around 60 per cent less than today. Traffic volumes on the local north-south roads between Victoria Street and Queen Street would decrease by around 35 per cent in 2037 when compared to option 1. Most of the existing traffic movements and patterns on the local road network would be maintained, including direct access from Victoria Street to the Princes Highway southbound. All local roads would perform at LoS A or LoS B in 2037. 	<ul style="list-style-type: none"> In 2037, daily traffic volumes on local north-south are predicted to double when compared to existing levels. Additional travel time to residential areas along and adjacent to Victoria Street from the south. Potential safety issues due to slow moving traffic turning left from Victoria Street merging with vehicles accelerating on the southbound on ramp.
Option 3	<ul style="list-style-type: none"> In 2037, daily traffic volumes on Queen Street would be around 60 per cent less than today. Traffic volumes on the local north-south roads between Victoria Street and Queen Street would decrease by around 35 per cent in 2037 when compared to option 1. The majority of existing traffic movements and patterns on the local road network would be maintained, including direct access from Victoria Street to the Princes Highway southbound. All local roads would perform at LoS A or LoS B in 2037. A roundabout at the Victoria Street and southbound on ramp intersection would be provided that could be used as a u-turn for larger vehicles (buses, garbage trucks etc.). 	<ul style="list-style-type: none"> In 2037, daily traffic volumes on local north-south are predicted to double when compared to existing levels. Only 45 vehicles per day would travel northbound on Queen St (the southbound on ramp) between the Victoria Street and Kangaroo Valley Road intersections. This low volume of traffic shows that the two-way ramp option would provide a negligible benefit when compared to the other two options – particularly option 2. Additional travel time to residential areas along and adjacent to Victoria Street from the south.

For all options, predicted traffic volumes would not significantly change the residential nature of the local road network in Berry, particularly as the AADT on Queen Street in 2037 is expected to be at least 50 per cent less than existing daily traffic volumes.

For the purpose of the environmental assessment, Option 1 is the current preferred option. Nonetheless, RMS is able to deliver any of the Victoria Street design options through the project.

RMS will continue discussions and encourage feedback and submissions through the environmental assessment display period. Traffic impacts along with other environmental impacts will contribute to the selection of a final solution for Victoria Street.

Traffic crashes

The project would significantly reduce the frequency and severity of crashes in the project area. This would both increase the level of road safety to highway users and reduce the cost attributable to crashes.

A traffic crash analysis was undertaken using RMS' 'Crash Reduction Guide' and data from 1 July 2003 to 30 September 2010. The following crash reductions along the highway between Toolijooa Road and Schofields Lane were predicted as a result of the project (refer to **Table 7-22**):

- 100 per cent reduction in crashes at intersections and between vehicles travelling in opposing directions.
- 74 per cent reduction in off-path crashes on curves.
- 50 per cent reduction in crash frequency between vehicles travelling in the same direction.
- 64 per cent total reduction in crashes in the project area.

Upgrades of existing heavy vehicle rest areas north and south of the project area are currently being planned and are proposed by RMS within the scope of other projects. These upgrades would also be likely to reduce the occurrence of fatigue related crashes.

In addition to the road safety improvements on the Princes Highway, by drawing traffic from the 'Sandtrack', the project would be expected to further reduce the overall frequency of crashes within the project area. It is estimated that without the project, annual vehicle kilometres travelled on the 'Sandtrack' between Gerringong and Bomaderry would increase from around 90 MVKT to 160 MVKT by 2037. This would be expected to increase crash occurrences by a similar proportion. However, with the project, in 2037 vehicle kilometres travelled on the 'Sandtrack' between Gerringong and Bomaderry would be expected to decrease to 53 MVKT, or 57 per cent, resulting in a directly proportional drop in crash occurrences.

Table 7-22 Existing and proposed crash statistics (1 July 2003 – 30 September 2010))

Scenario	Accident type (from DCA code)*							Total
	Length of road (km)	Intersection - adjacent approaches	Vehicles from opposing direction	Vehicles from the same direction	Off path, on straight	Off path, on curve	Other	
Existing conditions	12.6	6	14	24	13	46	10	118
Proposed conditions	11.3	1	0	12	12	12	5	42
% Crash reduction	-	83	100	50	8	74	50	64

* DCA (definitions for coding accidents) – A system of categorising crashes based on the movement of the vehicle/s prior to the collision.

Emergency access

The introduction of median fencing would mean that emergency access would be restricted, potentially leading to delays in emergency service responses to traffic incidents. The project would include emergency u-turn facilities which provide an opportunity for emergency service vehicles to execute a u-turn manoeuvre on the highway rather than travelling to the next grade-separated interchange. In addition, a lay-by area with an emergency telephone would be incorporated within this facility.

U-turn facilities on the highway for public use are not proposed on the basis that the frequency of grade-separated interchanges minimises the need for a dedicated at-grade public u-turn facility. Two u-turn facilities are provided off the highway; one on a section of the residual highway just north of the Austral Park Road interchange, and the other at Mullers Lane south of Berry.

In the case of a significant traffic incident that blocks all lanes, emergency u-turn facilities would be used to redirect traffic to contra flow under emergency services control. The continuous median safety barrier would be 'dropped' at key locations when a facility is needed.

The 'Sandtrack' would also be maintained as an alternative route during major incidents, as currently identified in the RMS incident management plan for the area.

Public transport, pedestrians and cyclists

There are several bus routes that use some portion of the Princes Highway within the project area (refer to **Section 7.1.2**). As a result, it is expected that:

- Bus travel times would be improved as the project would enable higher safe travel speeds on the Princes Highway, while intersection delays in Berry would reduce as a result of fewer vehicles travelling through the town. A reduction of traffic on the 'Sandtrack' would also benefit travel times for buses using this alternative route.
- Service delays caused by traffic incidents and congestion would reduce as the project would decrease the frequency of traffic crashes. The provision of two lanes per direction on the Princes Highway would substantially ease congestion and improve the LoS during peak times.
- Travel to and from bus stops by car, walking and cycling would be quicker in Berry as there would be less traffic throughout the town.
- Reduced traffic volumes would improve air quality, decrease noise levels, enhance pedestrian safety and improved amenity for bus users waiting at stops within Berry and on the 'Sandtrack'.

School bus services that currently stop at informal locations, such as local roads or property accesses, would be discouraged with two dedicated bus stops provided, at Toolijooa Road and Tindalls Lane. This would remove the risk of accidents caused by buses speeding up and slowing down in high-speed traffic, but would inconvenience users required to travel to and from other existing bus stop locations. However, this must be considered in the context of the safety benefits from consolidating stopping locations along the Princes Highway and reduced travel time.

The severance of North Street would affect school services in Berry. However, the project would provide turning facilities in newly created cul-de-sacs, and buses would use the alternative Queen Street route. The negative impacts would be limited to a small amount of additional travel time for these services.

Impacts to rail services would not be expected and travel time to and from Berry railway station for passengers travelling by car, bus, walking, or cycling would be reduced due to a decrease in traffic and associated delays in Berry.

For cyclists and pedestrians within the project area, there would be reduced delays at intersections in Berry due to a reduction of traffic in the town.

Cyclist safety and amenity within Berry and on the 'Sandtrack' is expected to improve due to lower traffic volumes, which would reduce the potential for crashes. For sections of the project outside Berry, the 2.5 metre shoulder on the highway would allow greater separation between bicycles and pedestrians and high speed traffic.

Within Berry, the addition of two roundabouts on Kangaroo Valley Road to the west of the town was identified as a concern by the community, potentially reducing amenity for pedestrians and cyclists. This would include pedestrians and cyclists re-routed from North Street following its severance by the Berry bypass. However contemporary guidelines relating to road design, indicate that there is no evidence to suggest that roundabouts are less safe for pedestrians and cyclists than other forms of intersection control.

Pedestrian and cyclist arrangements would be provided to ensure that safe access is maintained (refer to **Section 7.1.4** and **Section 7.6**). Residual impacts would remain where the proposed median along the highway would require pedestrians and cyclists that wish to cross the highway to travel to the proposed interchanges.

A number of design responses have also been incorporated into the current design of the project to minimise the negative impacts on pedestrian and cyclists along the project and at key local road modifications. This includes:

- Provisions for cyclists in accordance with the RMS NSW Bicycle Guidelines and Austroads Cycling Aspects of Austroads Guides at all interchanges and intersections constructed as part of the project.
- A wider bridge design at Kangaroo Valley Road bridge (around 21 metres wide) to provide generous shared paths on both sides of Kangaroo Valley Road, minimising the amenity impacts on pedestrians and cyclists at this location.
- Line marked shoulders to be provided at 'squeeze points' for pedestrians and cyclists (such as bridges and roundabouts).
- Off-road pedestrian and cyclist path along the south of the bypass to mitigate the closure of North Street, providing connectivity between Kangaroo Valley Road and North Street.

7.1.4 Environmental management measures

Mitigation and management measures would be implemented to avoid, minimise or manage impacts to traffic and transport. These mitigation and management measures are identified in **Table 7-23** and have been incorporated in the draft statement of commitments in **Chapter 10**.

Table 7-23 Management and mitigation measures

Potential impacts	Mitigation and management measures
Construction	
Travel delays due to construction traffic and works	<p>Prepare and implement a detailed traffic management plan (TMP) as part of the CEMP. The TMP is to include appropriate guidelines and procedures required to ensure the continuous, safe and efficient movement of construction and non-construction traffic in and around the project area (including the 'Sandtrack') during construction. The TMP would be submitted in stages to reflect the progress of the work and would detail:</p> <ul style="list-style-type: none"> • Signage requirements. • Lane possession and approval process during periods of online construction. • Traffic control devices such as temporary signals. • A local and regional communications strategy. • Strategies to identify and respond to any changes in road safety (including the 'Sandtrack') as a result of highway construction works.

Potential impacts	Mitigation and management measures
	<p>Where feasible, construct offline sections of the project first to provide travel routes for construction vehicles off the Princes Highway where feasible (Toolijooa Road to Austral Park Road and the Berry bridge to Kangaroo Valley Road). Implement a queue length management strategy to minimise delays to traffic on the Princes Highway.</p> <p>Where feasible, program deliveries of materials along the existing road network outside of holiday peak periods.</p> <p>Use the cleared footprint adjacent to the Princes Highway along the section to be duplicated for construction traffic where feasible to minimise use of the existing road network by construction traffic.</p> <p>Design the works to minimise the number of construction site entry and exit points and provide traffic control to avoid traffic conflicts and minimise delays.</p> <p>Make provision for emergency services vehicles to pass through construction zones and update the local emergency services on the staging and progress of works that would affect their movement.</p>
Travel delays due to temporary road closures	Provide timely, accurate, relevant and accessible information about changed traffic arrangements and potential delays to road users and local communities with provision for feedback through a complaints line during construction.
Operation	
Lack of safe access for pedestrians and cyclists at the southern interchange	Monitor the performance of the southern interchange roundabouts within the first four weeks after opening and develop any remedial actions necessary to ensure continued safe access for pedestrians and cyclists.
Reduced traffic efficiency at key access points to and from Berry and at local roads does not meet the project objectives	<p>Monitor traffic on the Princes Highway and key local roads in Berry, particularly during peak periods, six months and 12 months after opening the project to monitor the performance of the network and ensure it is performing as expected. The results would also be used to inform the operational noise monitoring for the project.</p> <p>Investigate and implement any remedial action if required.</p>
Increased traffic on Princes Highway south of Berry	Provide a temporary tie-in where the project finishes, enabling southbound highway traffic to merge safely from two lanes into one. This would remain in operation from the opening of the current project until the completion of the proposed Berry to Bomaderry upgrade.