Chapter 8
Transport and traffic

Contents

Contents i

8 Transport and traffic 8-1

8.1 Assessment approach 8-1

8.2 Existing environment 8-7

8.3 Potential impacts – construction 8-15

8.4 Potential impacts – operation 8-24

8.5 Environmental mitigation measures 8-34

List of tables

Table 8-1 Traffic modelling scenarios considered 8-2

Table 8-2 Intersection locations included in the construction and operational impact assessments 8-5

Table 8-3 Traffic volumes counted in 2018 8-12

Table 8-4 Level of service at existing intersections in the base year scenario (2018) 8-14

Table 8-5 Base year scenario average travel times and speeds in the study area 8-15

Table 8-6 Construction site vehicle access and volumes 8-16

Table 8-7 Forecast weekday peak hour traffic volumes at screenline locations with and without project construction 8-18

Table 8-8 Weekday peak hour network performance statistics between Blackheath and Little Hartley (with and without construction of the project) 8-19

Table 8-9 Forecast weekday peak hour level of service for existing and proposed intersections with and without construction of the project 8-21

Table 8-10 Daily weekday traffic volume estimates in 2030 and 2040 with and without the project 8-24

Table 8-11 Daily weekday heavy vehicle volume estimates in 2030 and 2040 with and without the project 8-26

Table 8-12 Weekday peak hour network performance statistics in the base year (2018) and with and without the project (2030 and 2040) 8-28

Table 8-13 Intersection performance during peak periods with and without the project in 2030 and 2040 8-32

Table 8-14 Transport and traffic performance outcomes 8-34

Table 8-15 Environmental mitigation measures – transport and traffic 8-35

List of figures

Figure 8-1 Summary of modelling approach and assessment scenarios 8-3

Figure 8-2 Study area, Operational Travel Model domain and screenline locations 8-4

Figure 8-3 Level of service criteria for intersections and mid-block (traffic flow) (Transport, 2013; Austroads, 2020) 8-7

Figure 8-4 Average weekday travel mode share for the Blue Mountains LGA 8-8
Figure 8-5 Existing and proposed public and active transport networks at Blackheath 8-11
Figure 8-6 Existing and proposed public and active transport networks between Soldiers Pinch and Little Hartley 8-11
Figure 8-7 Existing traffic volumes per day in 2018 west of Mount Victoria (count station: 6188) 8-13
Figure 8-8 Great Western Highway average weekday, weekend and public holiday hourly traffic volume profiles 8-13
Figure 8-9 Comparison of daily weekday traffic volumes (total vehicles) travelling through Blackheath and Mount Victoria townships with and without the project in 2030 and 2040 8-25
Figure 8-10 Comparison of daily weekday heavy vehicle volumes travelling through Blackheath and Mount Victoria townships with and without the project in 2030 and 2040 8-26
Figure 8-11 Peak hour average travel times and speed projections for the base year scenario (2018), and with and without the project in 2030 and 2040 8-30

8 Transport and traffic

This chapter summarises the transport and traffic assessment carried out for the upgrade of the Great Western Highway between Blackheath and Little Hartley (the project). The full assessment is provided in Appendix D (Technical report – Transport and traffic).

8.1 Assessment approach

The methodology for assessing potential transport and traffic impacts from the project included:

- analysis of road network performance statistics which included:
  - review of the existing road network (see Section 8.2.1 to Section 8.2.5) and development of an operational traffic model based on strategic traffic forecasting (see Section 8.1.1 for the modelling approach)
  - analysis of construction and operational impacts of the project under various modelled scenarios (see Sections 8.3 and 8.4)
- review of existing local road access and parking arrangements (see Section 8.2.1) and analysis of construction and operational changes to existing parking arrangements (see Section 8.3.1 and Section 8.4.1 respectively)
- review of existing public transport routes and services (see Section 8.2.2) and analysis of construction and operational impacts to public transport (see Section 8.3.2 and Section 8.4.2 respectively)
- review of the existing active transport network (see Section 8.2.3) and analysis of the construction and operational impacts to active transport (see Section 8.3.3 and Section 8.4.3 respectively)
- identification of suitable mitigation measures to manage potential impacts (see Section 8.5.2).

8.1.1 Road network modelling approach

Traffic modelling was carried out using available data to determine existing traffic conditions, and to make realistic predictions about future traffic conditions. This included estimating travel demand and traffic volumes for the project and the surrounding road network during construction and operation. The potential for additional traffic to be attracted to the Great Western Highway during operation of the project was also considered, and it was concluded that the project would be unlikely to generate new trips that would not have otherwise occurred (induced demand). Higher productivity vehicles that can transport larger freight volumes that are not permitted to use the existing Great Western Highway would be able to use the tunnel and are likely to result in increased freight transport efficiency.

Predictions about future traffic conditions were used to assess the performance of the road network both with and without the project, and to determine potential impacts during construction and operation. The traffic scenarios that were considered are detailed in Table 8-1.

The Operational Travel Model was designed to assess the cumulative impacts and benefits of the Great Western Highway Upgrade Program – Katoomba to Lithgow (Upgrade Program). The following assumptions were made in the Operational Travel Model:

- while the Katoomba to Blackheath Upgrade, Medlow Bath Upgrade and the Little Hartley to Lithgow Upgrade would be constructed and in operation by 2026, these have not been included in the ‘with project’ construction year scenario (2026) given the Operational Travel Model only assesses cumulative impacts and benefits associated with the entire Upgrade Program during operation

- all Upgrade Program components would be operational during the operational scenarios and have been included in the Operational Travel Model for 2030 and 2040.

Table 8-1 Traffic modelling scenarios considered

Year	Scenario	Project inclusion	Upgrade Program inclusion	Description
2018	Base year scenario[1]	Without	None	A base year model developed to replicate the existing traffic conditions on the Great Western Highway between Katoomba and Lithgow, including the model domain (within which the study area is contained) as shown in Figure 8-2. This scenario was used to extrapolate traffic demands in the future year scenarios.
2026	Construction year scenario	With	None	A construction year model based on the peak year construction activities for the project and traffic forecasts for 2026.
		Without	None	A model based on an unchanged existing road network (the existing Great Western Highway without project construction activities) and traffic forecasts for 2026.
2030	Operational year scenario (at project opening)	With	All Upgrade Program components[2]	An operational year model based on the additional road network provided by the project and traffic forecasts for 2030 (the year the project is open to traffic).
		Without	None	A model based on an unchanged existing road network (the existing Great Western Highway without the project) and traffic forecasts for 2030.
2040	Operational year scenario (10 years after opening)	With	All Upgrade Program components[2]	An operational year model based on the additional road network provided by the project and traffic forecasts for 2040 (ten years after the project is open to traffic).
		Without	None	A model based on an unchanged existing road network (the existing Great Western Highway without the project) and traffic forecasts for 2040.

Table notes:
1. 2018 was selected as the base year scenario given the impacts of the COVID-19 pandemic on travel patterns between 2020-2022.
2. Assumes the Katoomba to Blackheath Upgrade, the Medlow Bath Upgrade and the Little Hartley to Lithgow Upgrade are all operational by 2027, 2024 and 2026 respectively.

In summary, traffic modelling was developed using a four-tier system, which included:

- tier 1 – application of Transport's Regional Travel Model as a strategic modelling basis, and previous analysis completed using the Regional Travel Model to forecast growth in private vehicle travel for the Upgrade Program

- tier 2 – supplementing the existing Regional Travel Model with Transport's Strategic Freight Model and previous analysis completed using the Strategic Freight Model to develop future freight forecasts for the Upgrade Program
- tier 3 – operational traffic modelling using an Operational Travel Model for the project which used traffic demand inputs to analyse the traffic conditions that would likely occur with and without the project
- tier 4 – intersection modelling using the SIDRA intersection software to assess the performance of intersections with and without the project.

The Regional Travel Model is based on land use assumptions and forecast population growth for NSW and the ACT and is typically used to analyse transport network changes on regional passenger transport demands. The future freight forecasts extrapolate freight movements for future years by applying annual growth rates from the Strategic Freight Model.

The modelling approach and assessment scenarios are shown in Figure 8-1 and described in detail in Section 3 of Appendix D (Technical report – Transport and traffic). The Operational Travel Model domain includes the project, the broader Katoomba to Lithgow corridor, and Bells Line of Road, as shown in the inset to Figure 8-2. The study area applied to assessment of transport and traffic impacts from the project, including the area for SIDRA modelling, is also shown in the figure.

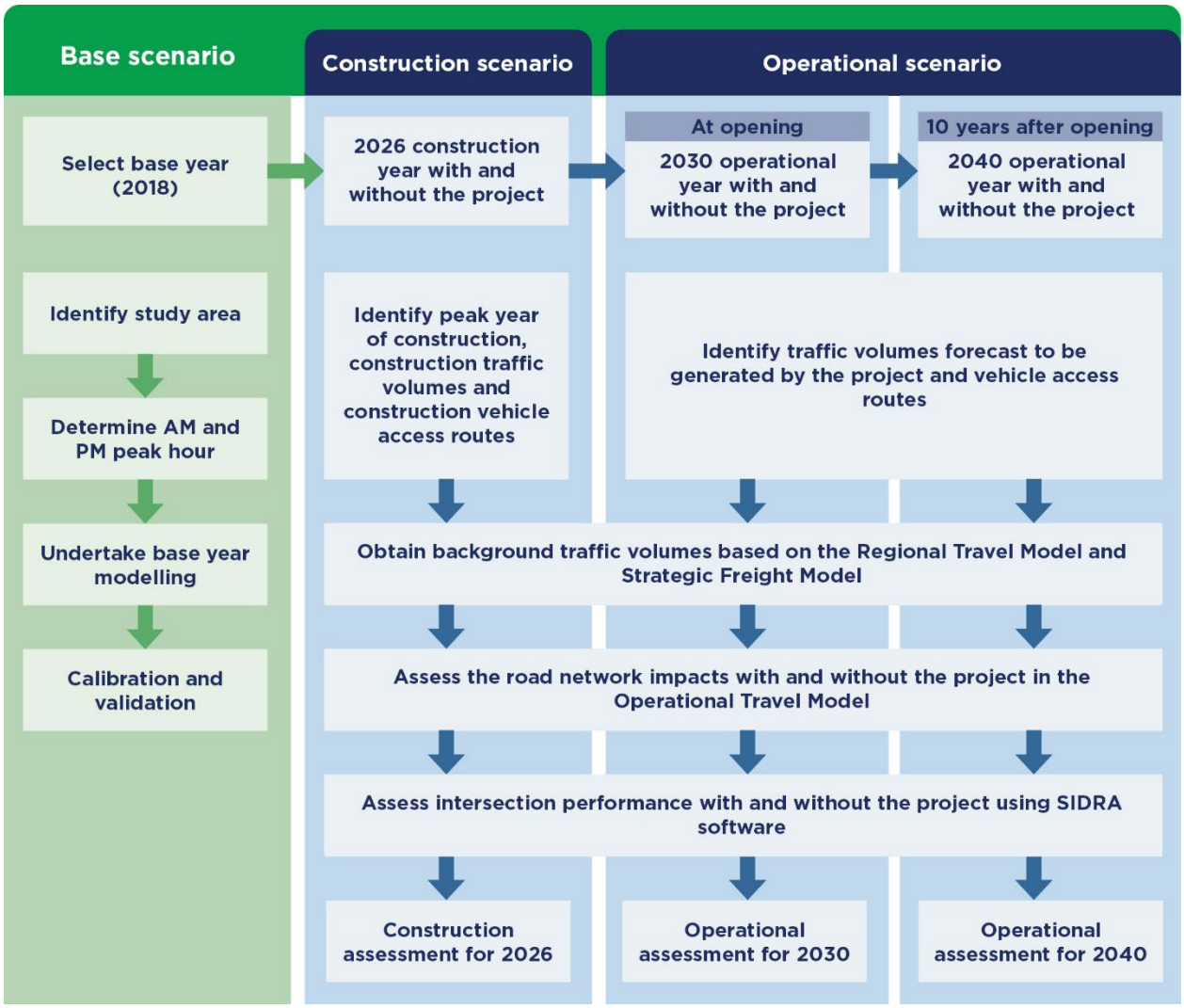

Figure 8-1 Summary of modelling approach and assessment scenarios

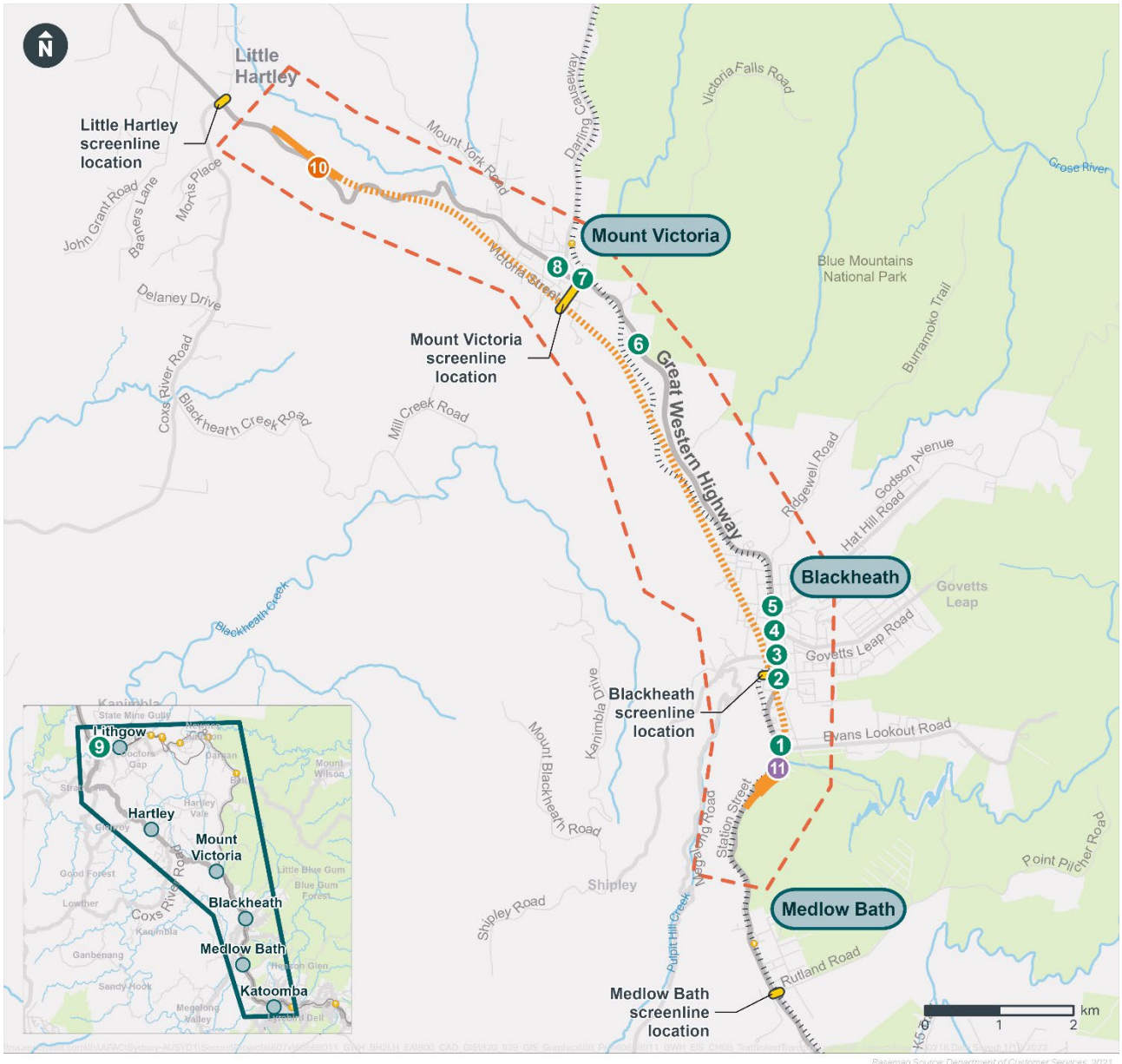

Figure 8-2 Study area, Operational Travel Model domain and screenline locations

The intersections listed in Table 8-2 were assessed for construction and operational traffic impacts. Most of the selected intersections are located within the study area and are anticipated to be most susceptible to traffic impacts due to the project. However, the Great Western Highway and Main Street and Caroline Avenue intersection (Intersection 9) is a signalised intersection located in Lithgow, to the west of the study area. This intersection has been included to assess the impacts of construction vehicles and spoil haulage to the west of the study area.

The traffic impact assessment carried out for the Little Hartley to Lithgow Upgrade (refer to Technical Working Paper – Traffic and transport (Jacobs and Arcadis, 2021) appended to the Review of Environmental Factors for that project) indicates that most other intersections along the Great Western Highway between the study area and Lithgow currently operate with spare capacity during the weekday AM and PM peak hours. The key exception is the intersection of the Great Western Highway, Coxs River Road and Ambermere Drive intersection which was identified in the traffic assessment for the Little Hartley to Lithgow Upgrade as operating near capacity in the PM peak hour. Based on current construction staging for the Upgrade Program, it is anticipated that this intersection would be upgraded to a grade separated intersection as part of the Little Hartley to Lithgow Upgrade prior to construction of the project[1]. This would address the existing capacity constraints at the intersection before the addition of project construction traffic.

Table 8-2 Intersection locations included in the construction and operational impact assessments

ID	Intersection	Signalling	Type
1	Great Western Highway and Evans Lookout Road, Blackheath	Unsignalised	Existing
2	Great Western Highway and Prince George Street, Blackheath	Unsignalised	Existing
3	Great Western Highway and Leichhardt Street, Blackheath	Unsignalised	Existing
4	Great Western Highway, Govetts Leap Road and Bundarra Street, Blackheath[1]	Signalised	Existing
5	Great Western Highway and Hat Hill Road, Blackheath	Unsignalised	Existing
6	Soldiers Pinch construction site intersection (to be used for access to the Soldiers Pinch construction site)	Unsignalised	Existing
7	Great Western Highway and Harley Avenue, Mount Victoria	Unsignalised	Existing
8	Great Western Highway and Station Street (Darling Causeway), Mount Victoria	Signalised	Existing
9	Great Western Highway and Caroline Avenue/ Main Street, Lithgow[2]	Signalised	Existing
10	Little Hartley construction site intersection (to be used for access to the Little Hartley construction site)	Unsignalised	New and temporary
11	New intersection at Blackheath[3] (to be used for access to the Blackheath ancillary facilities during operation)	Unsignalised	New and permanent

Table notes:
1. Intersection 4 performance considers the impacts of the adjacent level crossing
2. Intersection 9 is located outside the study area but is a major intersection located along the main construction haulage route and has therefore been analysed to assess potential construction impacts only
3. Intersection 11 would be a new intersection after the project is operational

[1] While it is anticipated that this intersection would be upgraded to a grade separated intersection as part of the Little Hartley to Lithgow Upgrade, this upgrade was not included in the 'with project' construction year scenario (2026) as part of the Operational Travel Model.

8.1.2 Assessment criteria

The assessment criteria used to evaluate the transport and traffic impacts of the project include:

- road network and intersection performance
- traffic volumes and patterns
- travel times
- road safety.

Assessment locations (shown in Figure 8-2) were used to evaluate these criteria under the scenarios described in Section 8.1.1 including:

- key intersections within the study area
- screenline locations to determine forecast traffic volumes at specific points in the modelled area
- travel route assessment locations to determine travel times and speeds between key travel locations.

For the project and the Operational Travel Model, the weekday AM peak hour was defined as between 8am and 9am, and the weekday PM peak hour was defined as between 3pm and 4pm. Although not used in the modelling, weekend peaks vary and are typically highest on a Saturday morning westbound and Sunday afternoon eastbound.

Common network performance indicators called levels of service (LoS) were also assessed. LoS is measured through a combination of parameters, such as total vehicle demand, kilometres travelled, average speed and time travelled. LoS indicators used for assessment of the project include:

- mid-block level analysis, showing travel time and travel speed changes to travel routes
- intersection level analysis, showing changes to the performance of intersections.

LoS is measured on a scale from A to F, with A representing optimal operating conditions and F representing worst operating conditions. When a road network performance falls to LoS D, investigations are generally initiated to determine if suitable remediation can be provided to improve the LoS rating. Further information about LoS ratings is provided in Figure 8-3.

During project development, design safety standards have been considered to avoid and minimise potential road safety impacts. To assess road safety, a qualitative assessment was conducted by analysing historical crash data and current traffic volumes, in conjunction with forecast changes in traffic volumes for the scenarios described in Section 8.1.1. The future benefits that the project would provide for road safety during operation were also considered in this assessment.

Intersection criteria			Mid-block criteria	
Average delay per vehicle (seconds per vehicle)	Traffic signals and roundabouts	Give way and stop sign		
Less than 14	Good operation	Good operation	LOS A	FREE FLOW Low volumes and no delays.
15 to 28	Good with acceptable delays and spare capacity	Good with acceptable delays and spare capacity	LOS B	STABLE FLOW Speeds restricted by travel conditions, minor delays.
29 to 42	Satisfactory	Satisfactory, but accident study required	LOS C	STABLE FLOW Speeds and manoeuvrability closely controlled because of higher volumes.
43 to 56	Near capacity	Near capacity, accident study required	LOS D	STABLE FLOW Speeds considerably affected by change in operation conditions. High density traffic restricts manoeuvrability; volume near capacity.
57 to 70	At capacity, at signals incidents will cause excessive delays	At capacity, requires other control mode	LOS E	UNSTABLE FLOW Low speeds; considerable delay; volume at or slightly over capacity.
Greater than 70	Extra capacity required	Extreme delay, major treatment required	LOS F	FORCED FLOW Very low speeds; volumes exceed capacity; long delays with stop-and-go traffic.

Figure 8-3 Level of service criteria for intersections and mid-block (traffic flow) (Transport, 2013; Austroads, 2020)

8.2 Existing environment

Ecological and heritage values associated with the Blue Mountains National Park and Greater Blue Mountains World Heritage Area, as well as topographical and engineering constraints have limited transport infrastructure development in the study area. In addition to a limited road and public transport network, the network also becomes congested during weekends, public holidays and event days and during emergencies such as flooding, bushfire, or vehicle crashes.

Figure 8-4 shows the weekday travel mode breakdown in the study area. The main travel mode is by private vehicle accounting for around 80 per cent of trips (as driver or passenger). The next most common mode is walking, followed by public transport use. On a typical weekday, travel in the Blue Mountains local government area (LGA) generally has a higher portion of travel for non-work related business, social/recreation and shopping when compared to the Sydney Greater Metropolitan Area (GMA)[2], and a lower proportion of travel for the purpose of commuting and education/childcare.

[2]as defined by the Australian Bureau of Statistics (ABS)

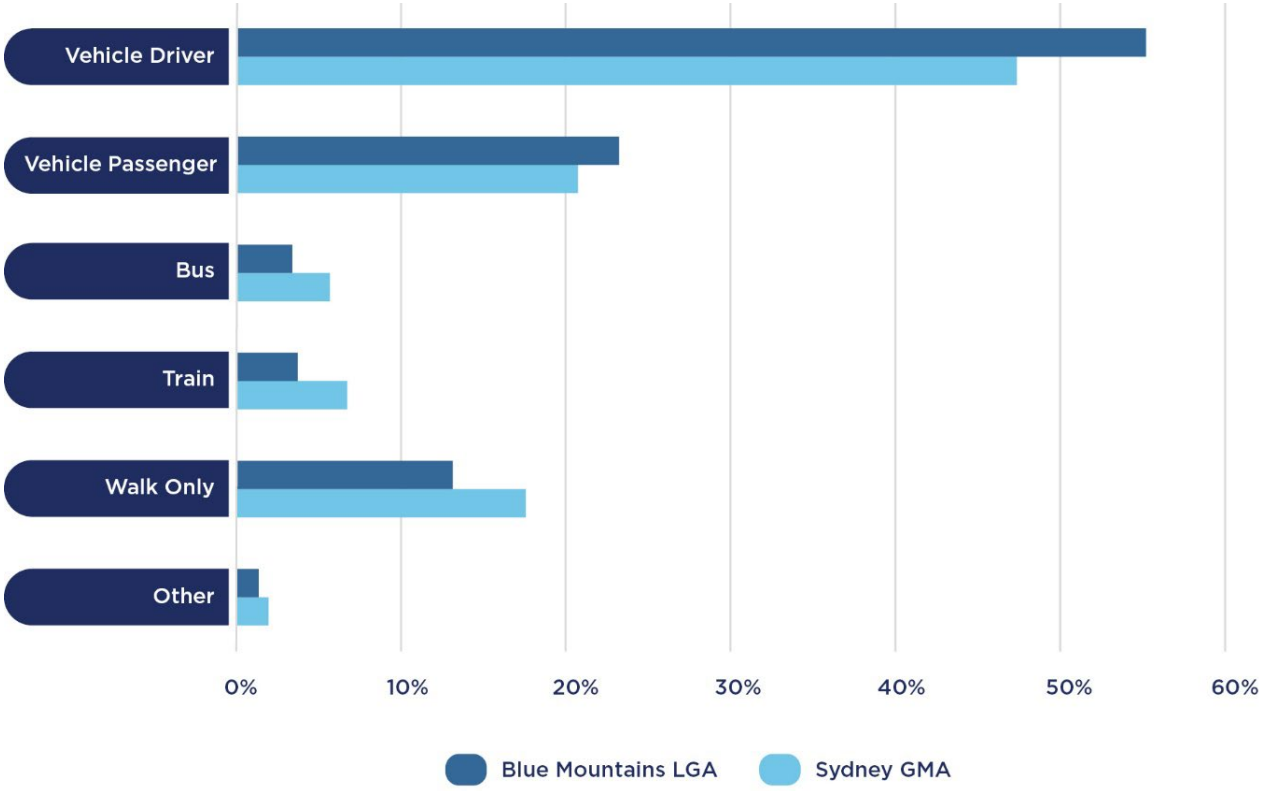

Figure 8-4 Average weekday travel mode share for the Blue Mountains LGA

8.2.1 Road network

The Great Western Highway is about 200 kilometres long and connects Bathurst, through the Central West and Orana regions, to Sydney. It spans the Great Dividing Range via the Blue Mountains. In the study area, the Great Western Highway is a generally undivided carriageway with one lane in each direction. Overtaking lanes and auxiliary lanes within the study area are limited. East of Katoomba, outside the study area, the Great Western Highway generally has two lanes in each direction.

The main functions of the Great Western Highway within the study area include:

- local access for residents of the adjacent townships and rural destinations located along the Great Western Highway
- major tourist route providing access to key destinations in the NSW Central West region
- major freight route accommodating vehicles up to 19 metres long carrying freight between Sydney and the Central West region.

Currently, the Great Western Highway typically has a posted speed limit of 60 kilometres per hour as it passes through townships and 80 kilometres per hour outside townships. Between Mount Victoria and Little Hartley, the 60 kilometre per hour posted speed limit continues for cars because of steep grades and a winding road alignment through Victoria Pass. Truck speeds are restricted to 40 kilometres per hour through this section.

The existing Great Western Highway has several sections with steep grades of more than 10 per cent, including Victoria Pass at 13 per cent. This is the steepest grade on any classified road or freight route in NSW.

Other components of the Upgrade Program have been approved and will deliver upgrades to the Great Western Highway, including:

- Medlow Bath Upgrade: upgrade and duplication of around 1.2 kilometres of the existing surface road corridor with intersection improvements and a new pedestrian bridge

- Katoomba to Blackheath Upgrade: upgrade, duplication and widening of around 5.8 kilometres the existing surface road corridor, with connections to the existing Great Western Highway east of Blackheath
- Little Hartley to Lithgow Upgrade: upgrade, duplication and widening of around 14 kilometres of the existing surface road corridor, with connections to the existing Great Western Highway at Little Hartley.

This approved infrastructure forms the baseline environment for the 2030 and 2040 'with project' scenarios in the transport and traffic assessment.

Crashes

Crashes on the Great Western Highway have increased over time. Between east of Blackheath and Little Hartley, 64 crashes have occurred between 2016 and 2020. Of these:

- one was a fatal crash
- 65 per cent resulted in an injury.

The following most common crash types occurred:

- nearly 35 per cent involved run-off road collisions, including nearly 30 per cent on bends
- nearly 35 per cent involved a rear-end collision
- nearly 20 per cent involved an intersection or opposing type crash, including nearly 15 per cent head-on collisions
- about five per cent of crashes involved a heavy vehicle.

Parking

On-street parking is generally provided along local roads within Blackheath and Mount Victoria, however on-street parking in Little Hartley is limited. There is an informal carpark used to access Berghofer's Pass at the base of Victoria Pass.

Within Blackheath and along the Great Western Highway, on-street parallel parking is provided on the eastbound side of the road between Evans Lookout Road and Hat Hill Road. Between Leichhardt Street and Gardiner Crescent, the on-street parking is time restricted to one hour. On-street parking is also provided on the westbound side of the Great Western Highway between Abbott Street and Murri Street and between the Station Street overbridge and Ridgewell Road.

One hour on-street parking is also provided along Govetts Leap Road between the Great Western Highway and Clanwilliam Street.

In Mount Victoria, on-street parking is generally provided along the eastbound side of the Great Western Highway between Harley Avenue and west of Mount York Road. Parking is permitted on the westbound side of the Great Western Highway in select locations in Mount Victoria.

On-street parking is not permitted along the Great Western Highway in Little Hartley. However, vehicles frequently park on a gravel area on the eastbound side of the Great Western Highway located at the bottom of Victoria Pass to gain access to Berghofer's Pass.

8.2.2 Public transport

Rail

The study area includes the Blue Mountains Line, which runs between Sydney and Lithgow / Bathurst via the Intercity Trains Network. The electrified rail line ends at Lithgow requiring most rail services to terminate at Lithgow or Mount Victoria. Within the study area, railway stations are provided at Blackheath and Mount Victoria as shown in Figure 8-5 and Figure 8-6. Commuter car parking is available at both stations, as well as bike lockers at Blackheath Station. Both stations have pedestrian facilities to enable crossing the Great Western Highway near the station. Rail patronage data shows that Blackheath Station has higher patronage than Mount Victoria Station.

The frequency of rail services on the Blue Mountains Line and within the study area includes:

- two express services in each direction between Sydney and Bathurst per day
- citybound services between 5:30am and 7:00am have a frequency of about 15 minutes at both stations, with an hourly service from 10am
- outbound services departing the Sydney CBD between 4:00pm and 6:30pm and stopping at both stations typically have a frequency of about 30 minutes, with an hourly service outside these times
- on weekends, one to two services typically stop at both stations per hour.

Bus services replace trains when the rail line is closed for maintenance works.

Bus services

The following bus services provided by Blue Mountains Transit operate near the project and service the Blue Mountains area:

- route 698 – Katoomba to Blackheath
- route 698V – Katoomba to Mount Victoria
- route 690K – Springwood to Katoomba (school bus)
- route 8710 – Wentworth Falls Public School to Blackheath (school bus).

Bus stops are located along the existing Great Western Highway, near Blackheath Station, and in Blackheath along Evans Lookout Road, Govetts Leap Road and Hat Hill Road. In Mount Victoria bus stops are located along the existing Great Western Highway, near Mount Victoria Station, on Victoria Street and on Mount York Road. No bus stops are provided in Little Hartley. Bus stops located close to the project are shown in Figure 8-5 and Figure 8-6.

8.2.3 Active transport

Pedestrian and cyclist facilities are limited near the Great Western Highway. Pedestrian infrastructure is generally limited to footpaths and a few signalised intersections in the Blackheath and Mount Victoria town centres.

There is a recreational trail used by hikers and cyclists that extends into the Soldiers Pinch construction footprint. Access to the trail is provided near the intersection of the Great Western Highway and Browntown Oval.

There are no footpaths or pedestrian crossings at Little Hartley. Active transport trails will be provided by the Katoomba to Blackheath Upgrade (near Blackheath) and the Little Hartley to Lithgow Upgrade (near Little Hartley) and will be completed prior to commencement of construction of the project. These trails are shown in Figure 8-5 and Figure 8-6.

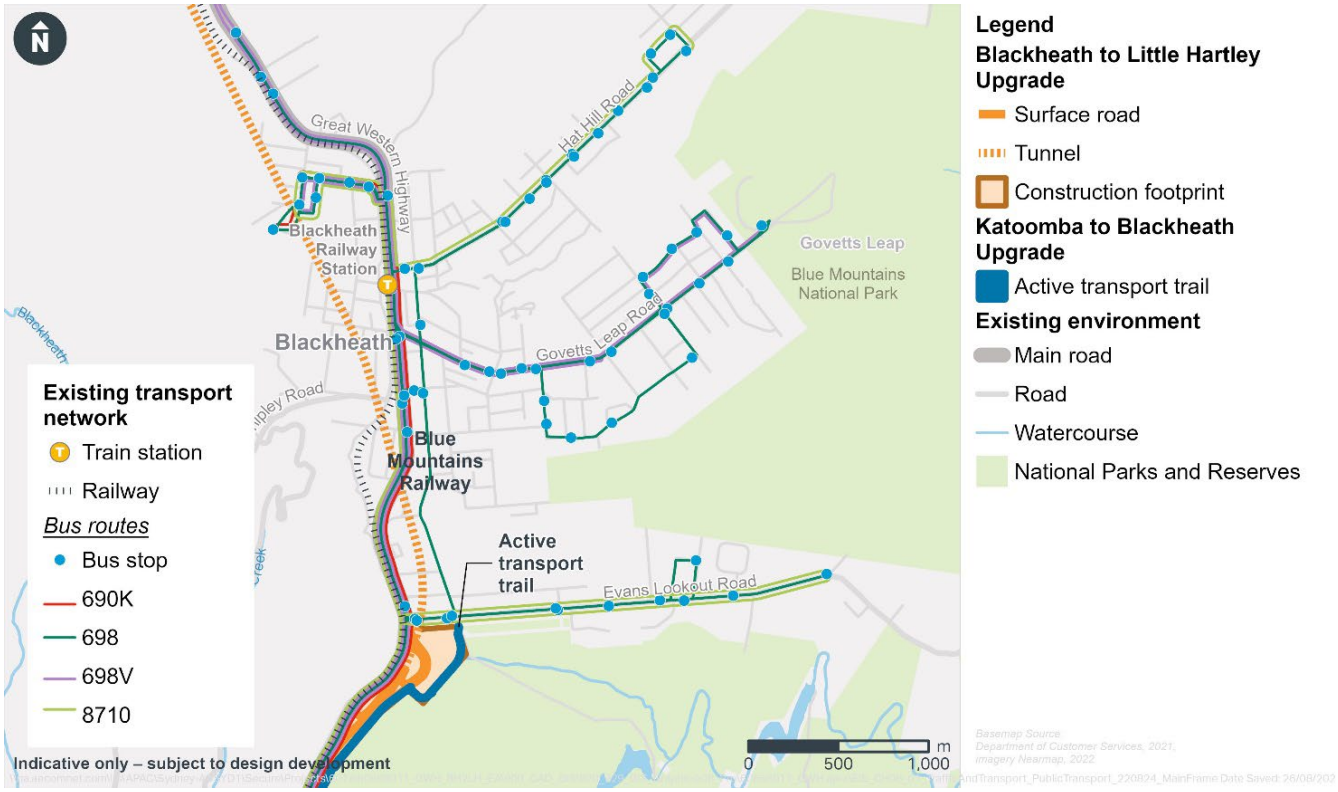

Figure 8-5 Existing and proposed public and active transport networks at Blackheath

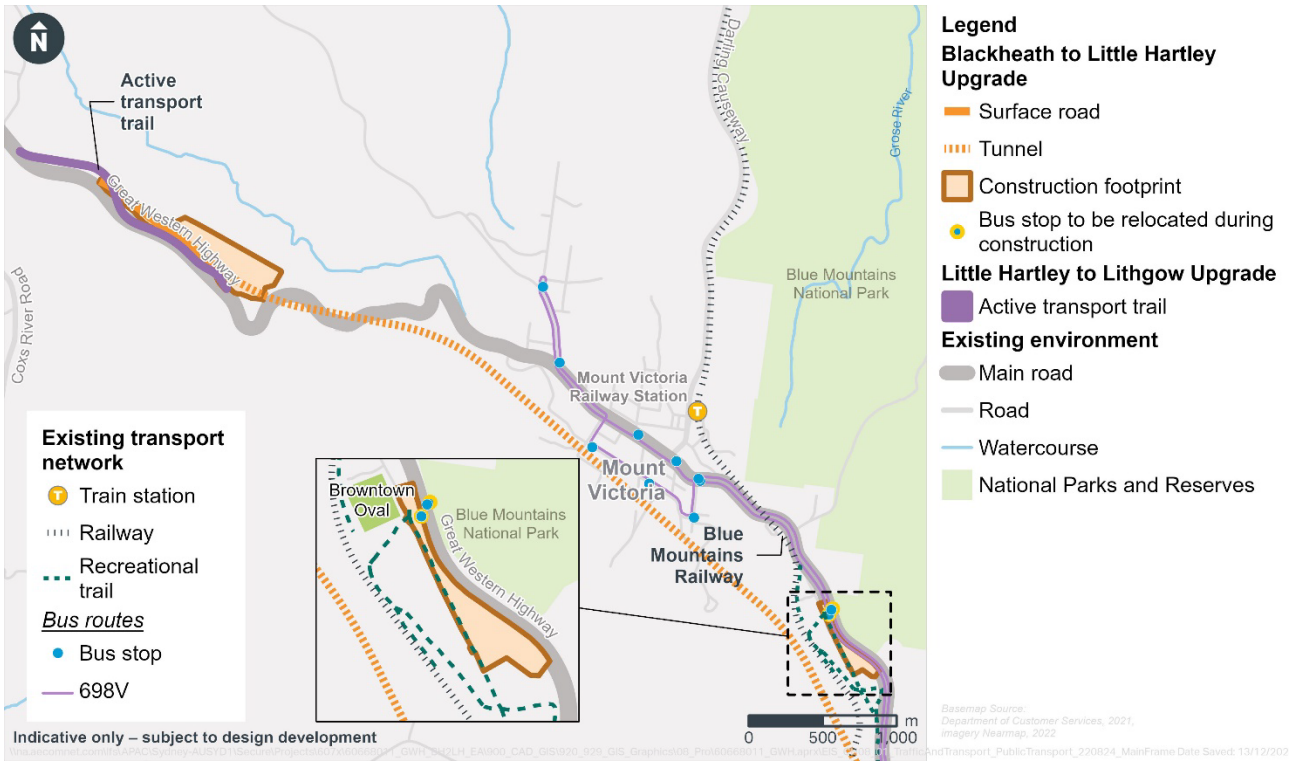

Figure 8-6 Existing and proposed public and active transport networks between Soldiers Pinch and Little Hartley

8.2.4 Traffic volumes and patterns

Hourly traffic volume data from counts conducted over 24-hours, seven days per week were used to estimate the weekday and weekend traffic volumes along the Great Western Highway and identify peak periods. The data shows that the road network is generally subject to higher weekend peaks than weekdays.

Table 8-3 presents the traffic volumes at traffic count locations in 2018:

- 800 metres north of Station Street and Railway Parade, Medlow Bath
- 450 metres south of Browntown Oval access, Blackheath
- 300 metres west of Mount York Road, Mount Victoria
- 500 metres east of Coxs River Road, Little Hartley.

Figure 8-7 shows typical weekday, weekend, and public holiday and special event traffic patterns, based on yearly traffic count data from 2018 from a count station just west of Mount Victoria[3].

Table 8-3 Traffic volumes counted in 2018

Location along the Great Western Highway	Two-way traffic volumes (vehicles per hour)		
	Weekday – AM peak	Weekday – PM peak	Sunday – peak hour
Railway Parade, Medlow Bath	1,260	1,490	1,910
Browntown Oval access, Mount Victoria	930	1,060	1,450
Mount York Road, Mount Victoria	780	880	1,300
Coxs River Road, Little Hartley	850	920	1,330
Average	**955**	**1,088**	**1,498**

Traffic count data from 2018 showed generally higher peaks of traffic on the weekends, as shown in Figure 8-8. These weekend peaks are generally around 700 vehicles in the early morning for Saturday westbound traffic, and around 900 vehicles between noon and early evening for Sunday eastbound traffic. These peaks could be indicative of recreational trips to or through the Blue Mountains from Greater Sydney at the start of the weekend (travelling westbound) and those returning to Greater Sydney at the end of the weekend (travelling eastbound). On weekdays there are two spikes of around 500 to 550 vehicles per direction associated with the weekday morning and afternoon peak periods at around 8am and 3pm, with a similar daily profile for eastbound and westbound traffic. This suggests that the Great Western Highway does not necessarily have peak directional flows.

For heavy vehicles, the traffic count data shows:

- during the weekday peak hour:
  - about 80 to 85 per cent of traffic is made up of light vehicles and light vehicles with trailers
  - about 15 to 20 per cent of the traffic count is made up of heavy vehicles (including rigid, articulated trucks such as semi-trailers and B-double vehicles)
- the highest proportions of heavy vehicles on a weekday occur late at night or in the early hours of the morning

[3] Statistics based on Transport's permanent count station 6188, Great Western Highway west of Mount Victoria

- over the weekday, the total heavy vehicle proportion of all traffic is about 20 per cent
- on a weekend, the total heavy vehicle proportion of all traffic is about five per cent.

While the Great Western Highway is used by through traffic to and from regions west of Lithgow, a large proportion of heavy vehicle traffic is generated between Katoomba and Lithgow, and accounts for around 30 per cent of road freight within the Blue Mountains.

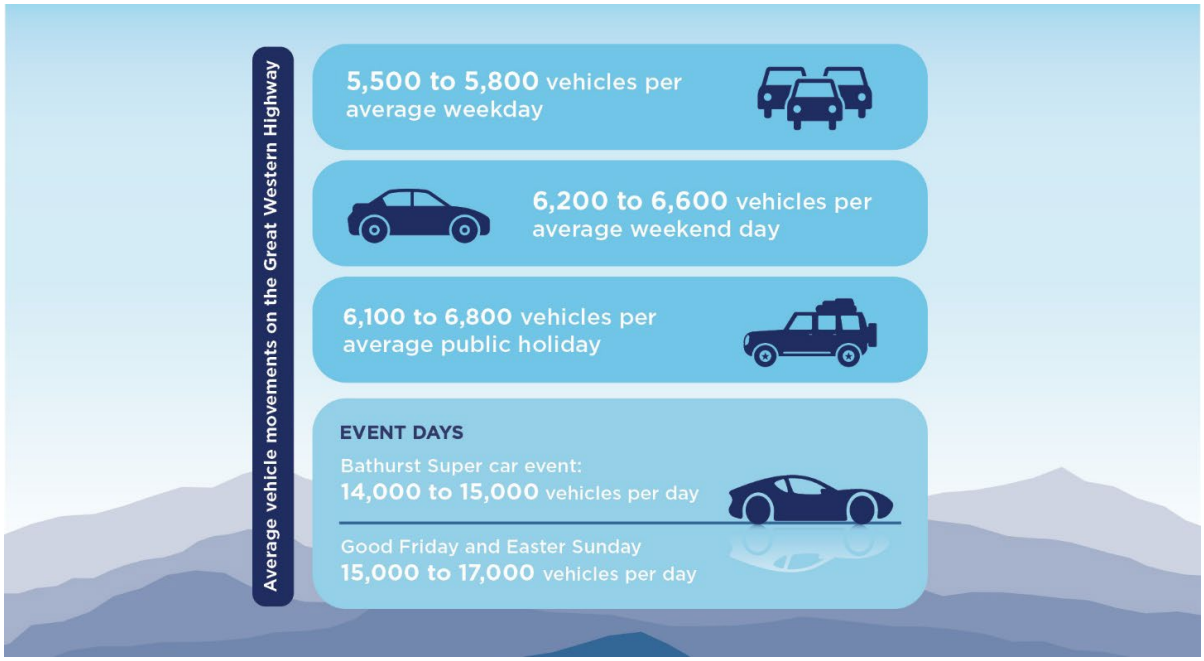

Figure 8-7 Existing traffic volumes per day in 2018 west of Mount Victoria (count station: 6188)

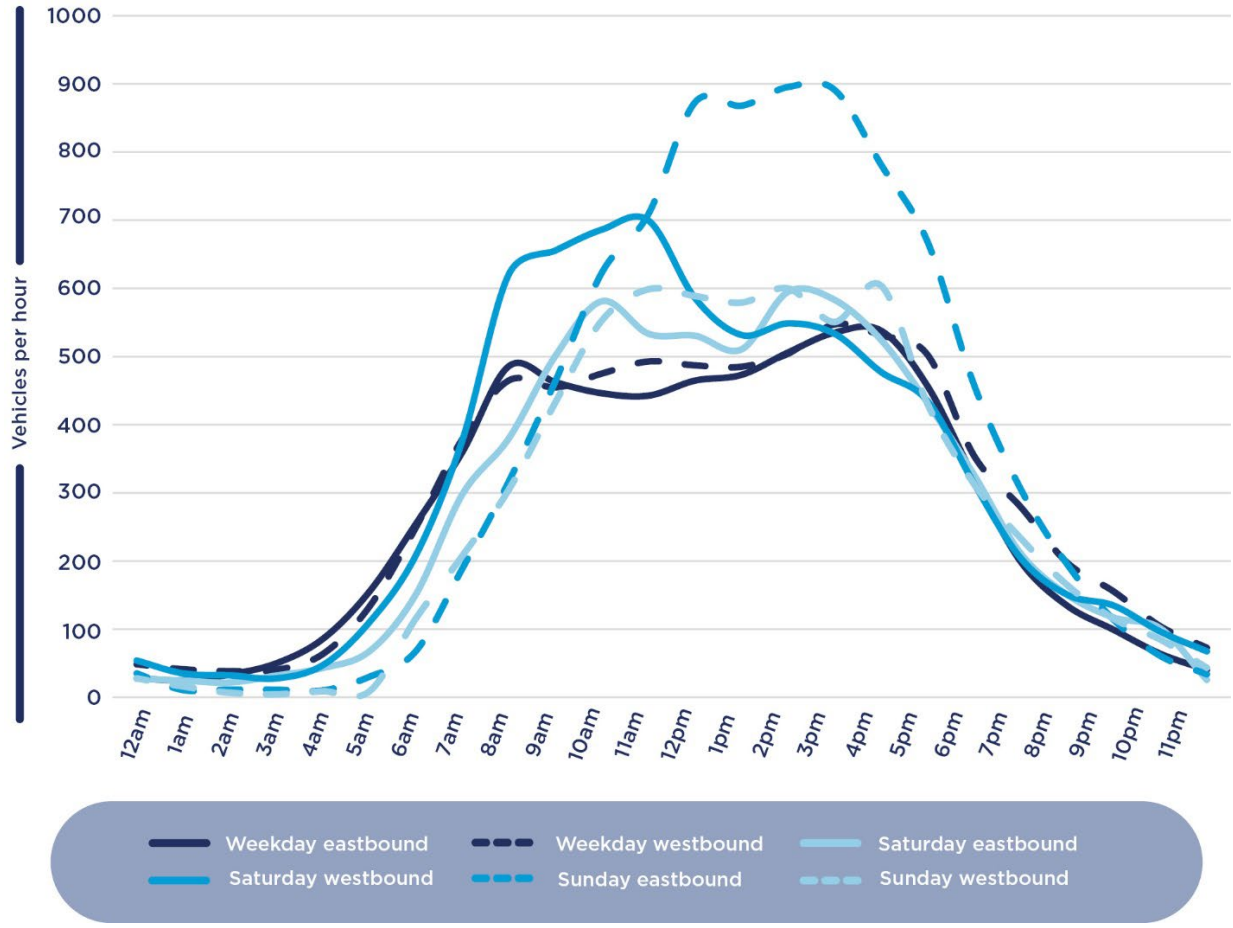

Figure 8-8 Great Western Highway average weekday, weekend and public holiday hourly traffic volume profiles

8.2.5 Road network performance

Network performance statistics

The road network performance statistics for all vehicles travelling through the study area was modelled for the 2018 base case scenario. The results show the following for weekday movements:

- vehicles travel through the model network with an average speed of around 55 kilometres per hour in the AM and PM peak periods
- the PM peak hour has a higher traffic demand than the AM peak hour (around 600 vehicles)
- both peak hours have similar total vehicles kilometres travelled and trip duration (PM peak hour is marginally higher)
- no unreleased vehicles were recorded (the number of vehicles unable to enter the study area due to congestion extending back into the study area's entry points), which suggests there is limited congestion on the road network.

Intersection performance

All existing intersections in the study area currently operate with an overall LoS C or better during the weekday AM and PM peak hour. The 2018 modelled intersection performance for the AM and PM peak hour is shown in Table 8-4. While not modelled, it is well known that lengthy delays and vehicle queuing frequently occurs on busy weekends and public holidays at the following intersections:

- local roads at the signalised intersections of the Great Western Highway
- Bundarra Street and Great Western Highway in Blackheath
- Govetts Leap Road and Great Western Highway in Blackheath
- Station Street and Great Western Highway in Mount Victoria.

Table 8-4 Level of service at existing intersections in the base year scenario (2018)

ID	Intersection	Intersection type	LoS	
			AM peak	PM peak
1	Great Western Highway/ Evans Lookout Road, Blackheath	Unsignalised	C	C
2	Great Western Highway/ Prince George Street, Blackheath	Unsignalised	B	B
3	Great Western Highway/ Leichhardt Street, Blackheath	Unsignalised	A	A
4	Great Western Highway/ Govetts Leap Road/ Bundarra Street, Blackheath[1]	Signalised	B	B
5	Great Western Highway/ Hat Hill Road, Blackheath	Unsignalised	A	A
6	Soldiers Pinch construction site intersection Blackheath[2]	Unsignalised	-	-
7	Great Western Highway/ Harley Avenue, Mount Victoria	Unsignalised	B	B

ID	Intersection	Intersection type	LoS	
			AM peak	PM peak
8	Great Western Highway/ Station Street (Darling Causeway), Mount Victoria	Signalised	A	A
9	Great Western Highway/ Caroline Avenue/Main Street, Lithgow[3]	Signalised	B	B

Table notes:
1. Intersection 4 performance considers the impacts of the adjacent level crossing
2. Intersection 6 is an existing intersection that would be used to access the Soldiers Pinch construction site. No existing traffic data is available and therefore this intersection has not been assessed in the existing environment
3. Intersection 9 is located outside the study area but is located along the proposed haulage route and has therefore been analysed to assess the project's construction impacts.

Travel times and speed

Travel time data for three key routes in the model domain was collected. The 2018 average AM and PM peak hour travel times and average speed for the three routes are summarised in Table 8-5. On peak days such as busy weekends and public holidays, vehicle times are substantially longer and vehicle speeds substantially lower than these averages.

When vehicles begin to queue eastbound at Mount Victoria during peak periods, Transport manages the traffic at the base of Victoria Pass in Little Hartley to prevent traffic congestion, breakdowns and start/stop movements up Victoria Pass, by:

- holding vehicles at the base of Victoria Pass in Little Hartley
- releasing vehicles in groups once there is enough storage capacity at the top of the Victoria Pass, allowing vehicles to travel up Victoria Pass in one smooth movement free from stopping.

Table 8-5 Base year scenario average travel times and speeds in the study area

Location	Average travel time (minutes)	Average travel speed (kilometres per hour)
Between Blackheath and Mount Victoria	7-8	50-55
Between east of Blackheath and Little Hartley	17-18	52-54
Between Katoomba and Lithgow	39-41	56-60

8.3 Potential impacts – construction

8.3.1 Road network performance

Construction vehicles and access

Temporary modifications to the existing road network such as construction site access arrangements, staged works and speed zone changes would be required during construction of the project. Construction vehicle access points and volumes at each construction site are outlined in Table 8-6. In this table, a vehicle entering a construction site constitutes one movement, and exiting the construction site would be another movement. Construction vehicle access points are shown in Figure 5-5 to Figure 5-7 in Chapter 5 (Construction).

Around 75 per cent of workers have been assumed to travel to the project construction sites from the east, travelling westbound to the construction sites and eastbound to return home. The remaining 25 per cent of construction workers have been assumed to travel to the project from the west, travelling eastbound to construction sites and westbound to return home.

Peak traffic generating activities, including spoil haulage and tunnel boring machine (TBM) segment deliveries would be scheduled to avoid peak days such as weekends, public holidays and major events such as the Bathurst Super Car event where possible. The Little Hartley construction site would have capacity to store spoil and tunnel segments for around three days to accommodate these peak periods.

While full road closures are not expected to be needed, the impacts of road closures would need to be assessed by the construction contractor(s) and measures to minimise and manage impacts would be identified in the Construction Transport and Access Management Plan (CTAMP).

Table 8-6 Construction site vehicle access and volumes[4]

Construction site	Maximum vehicle movements in and out				Access/egress points
	Per hour	Day time (6am-6pm)	Night time (6pm-6am)	Per day	
Blackheath	130	150 light vehicles and 160 heavy vehicles	120 light vehicles and 10 heavy vehicles	440 (270 light vehicles and 170 heavy vehicles)	• Great Western Highway around 950 metres southwest of Evans Lookout Road • intersection of Evans Lookout Road and Great Western Highway • intersection of Valley View Road and B5 Valley View Road Extension (light vehicle access/egress only).
Soldiers Point	105	120 light vehicles and 140 heavy vehicles	70 light vehicles and 65 heavy vehicles	395 (190 light vehicles and 205 heavy vehicles)	• intersection of Great Western Highway and Browntown Oval access road.
Little Hartley	905	1,230 light vehicles and 1,095 heavy vehicles	665 light vehicles and 335 heavy vehicles	3,325 (1,895 light vehicles and 1,430 heavy vehicles)	• Great Western Highway around 1.6 kilometres southeast of Coxs River Road • Great Western Highway around 750 metres southeast of Coxs River Road.

[4] Maximum hourly construction vehicle movements would occur at around 6am coinciding with worker shift changeover (outside the AM peak hours on the road network). During the road network peak hours, construction vehicle movements would be around 90 vehicle movements per hour

Traffic volumes and patterns

Outputs from the Operational Travel Model suggest that traffic along the Great Western Highway is anticipated to increase by 17 to 25 per cent between 2018 and 2026, without the project. The proportion of heavy vehicles along the Great Western Highway would remain relatively consistent between 2018 and 2026 and would constitute between 10 and 25 per cent of the weekday peak hour traffic volumes without the project.

As shown in Table 8-6, construction of the project is forecast to generate up to five per cent additional traffic compared to weekday peak hourly traffic volumes through Blackheath and Mount Victoria. At Little Hartley, construction traffic would increase traffic by up to 13 per cent of the weekday peak hourly traffic volume. The peak construction-related traffic volumes would occur during shift changeover at around 6am and between 5 and 7pm. As shown in Figure 8-8, average weekend traffic volumes along the Great Western Highway are typically much lower than weekday traffic volumes at 6am, but up to 20 per cent higher at 6pm.

Therefore, construction traffic is most likely to affect the performance of the Great Western Highway during the weekday AM peak and the weekend PM peak. Appropriate management measures would be developed and implemented through a CTAMP for the project.

The combination of reduced speed limits and additional construction traffic volumes would result in a minor increase to weekday peak hour travel times of about one minute for both directions along the Great Western Highway (between Katoomba and Lithgow). Potential construction traffic impacts on accessibility and connectivity to, businesses, town centres and schools is expected to be minimal (further discussed in Section 4.1.2 of Appendix P (Technical report – Economics and business) and Section 5.1 and Section 5.3 of Appendix O (Technical report – Social)).

Table 8-7 Forecast weekday peak hour traffic volumes at screenline locations with and without project construction

Screenline location	Peak hour	Base year scenario (2018) (vehicles/ hr)[1]	Construction year scenarios (2026)			
			Without project construction (vehicles/hr)	With project construction (vehicles/hr)	Overall change in traffic volumes (%)	With project construction (heavy vehicle %)
South of Medlow Bath	AM	1,330	1,540	1,570	2	16
	PM	1,440	1,810	1,810	0	16
Blackheath	AM	1,100	1,510	1,550	3	14
	PM	1,260	1,690	1,740	3	13
Mount Victoria	AM	990	1,190	1,210	2	17
	PM	1,040	1,340	1,360	1	16
Little Hartley	AM	860	960	1,050	9	29
	PM	890	1,050	1,190	13	22

Table notes:
1. The total heavy vehicle proportion of weekday traffic in 2018 was about 20 per cent

Network performance statistics and travel time

The additional construction traffic generated by the project would have a minor impact on the Great Western Highway network performance statistics. The combination of reduced speed limits and additional construction traffic volumes would result in a minor increase to weekday peak hour travel times through the study area of about one minute for both directions.

The modelled peak hour network performance between Blackheath and Little Hartley with and without construction is summarised in Table 8-8.

Table 8-8 Weekday peak hour network performance statistics between Blackheath and Little Hartley (with and without construction of the project)

Network performance statistic	Peak hour	Base year scenario (2018)	Construction year scenarios (2026)			
			Without project	With project	Change	Change (%)
All vehicles						
Total traffic demand (vehicles)	AM	4,350	4,825	4,931	106	2
	PM	4,961	5,384	5,493	109	3
Total kilometres travelled (kilometres)	AM	47,685	56,381	57,714	1,333	2
	PM	47,632	64,021	66,294	2,273	3
Total vehicle hours travelled (hours)	AM	864	1,047	1,091	44	4
	PM	871	1,177	1,247	70	6
Total vehicles arrived	AM	4,256	4,766	4,833	67	1
	PM	4,758	5,334	5,436	102	2
Total number of stops	AM	2,922	3,515	3,604	89	2
	PM	3,942	4,781	4,824	43	1
Average per vehicle in network						
Average vehicle kilometres travelled (kilometres)	AM	11	12	12	0	0
	PM	10	12	12	0	0
Average vehicle hours travelled (minutes)	AM	12	13	14	1	1
	PM	11	12	12	0	2
Average number of stops	AM	1	1	1	0	0
	PM	1	1	1	0	0
Average speed (kilometres per hour)	AM	55	54	53	-1	-2
	PM	55	54	53	-1	-2

Intersection performance

Forecast weekday peak hour levels of service (LoS) and average delays at existing and new intersections, with and without project construction, are summarised in Table 8-9. This data shows that:

- traffic growth between the base year (2018) and 2026 (without construction of the project) will lead to a deterioration in LoS at some existing intersections, namely:
  - Great Western Highway/ Evans Lookout Road, Blackheath – deterioration from LoS C to LoS F in both the AM and PM peak hours
  - Great Western Highway/ Govetts Leap Road/ Bundarra Street, Blackheath – deterioration from LoS B to LoS C in the PM peak hour
  - Great Western Highway/ Hat Hill Road, Blackheath – deterioration from LoS A to LoS C in the AM peak, and from LoS A to LoS D in the PM peak
- construction of the project would not materially affect average delays and would not affect the LoS at existing intersections, with the exception of a minor deterioration (from LoS C to LoS D) at the Great Western Highway/ Harley Avenue, Mount Victoria intersection in the PM peak hour
- the new, temporary intersection established to access the Little Hartley construction site, would operate at an acceptable LoS (LoS B during the AM peak hour, and LoS C during the PM peak hour)
- two intersections would operate at LoS F in the future, being the Great Western Highway/ Evans Lookout Road, Blackheath intersection and the Great Western Highway and Browntown Oval access intersection. Of these:
  - the Great Western Highway/ Evans Lookout Road, Blackheath intersection would operate at LoS F regardless of whether the project is constructed or not. This LoS F reflects delays to vehicles turning right from Evans Lookout Road to the Great Western Highway westbound
  - the LoS F forecast at the temporary intersection at the Great Western Highway/ Browntown Oval (access to the Soldiers Pinch construction site) would be restricted largely to construction vehicles turning right onto the Great Western Highway from the Soldiers Pinch construction site during weekday AM and PM peak hours. That is, the constraint at this intersection would affect mainly project construction traffic, rather than other road users.

Some intersections are predicted to perform better in the construction year scenarios (2026) than the base year scenario (2018). This is likely due to road network upgrades that have occurred since 2018, or that are planned to be completed prior to 2026, having been included in the Operational Travel Model (further described in Section 3.4.4 of Appendix D (Technical report – Transport and traffic)).

Access to public space and community facilities would not be directly affected during construction, however the above changes in anticipated level of service on the local road network may result in minor delays.

Access to Browntown Oval, which would remain open throughout the construction period, would be maintained via its existing intersection with the Great Western Highway. The project would include upgrade of the Great Western Highway / Browntown Oval access road to establish safe access to the Soldiers Pinch construction site. An increase in the number of heavy vehicles at the shared access point for the Soldiers Pinch construction site and Browntown Oval may impact on pedestrian and cyclist safety for those accessing the oval.

The oval includes a cricket pitch used for cricket matches and training in the summer months, and is used for archery practice on Sundays. The oval is also available for one-off events or seasonal bookings. Intersection improvements and/or traffic controllers could be used by the contractor to manage heavy vehicles turning in and out of the Soldiers Pinch construction footprint when the oval is in use. Mitigation measures would be confirmed during design development by the construction contractor(s).

Table 8-9 Forecast weekday peak hour level of service for existing and proposed intersections with and without construction of the project

ID	Intersection	Peak hour	Base year scenario (2018)	Construction year scenarios (2026)			
				Without construction		With construction	
			LoS	Average delay (seconds)	LoS	Average delay (seconds)	LoS
1	Great Western Highway/ Evans Lookout Road, Blackheath	AM	C	76	F	269	F
		PM	C	282	F	>300	F
2	Great Western Highway/ Prince George Street, Blackheath	AM	B	8	A	8	A
		PM	B	13	A	13	A
3	Great Western Highway/ Leichhardt Street, Blackheath	AM	A	8	A	8	A
		PM	A	12	A	12	A
4	Great Western Highway/ Govetts Leap Road/ Bundarra Street, Blackheath	AM	B	25	B	26	B
		PM	B	32	C	33	C
5	Great Western Highway/ Hat Hill Road, Blackheath	AM	A	29	C	30	C
		PM	A	45	D	49	D
6	Great Western Highway and Browntown Oval access intersection (Soldiers Pinch construction site)	AM	-	-	-	92	F
		PM	-	-	-	148	F
7	Great Western Highway/ Harley Avenue, Mount Victoria	AM	C	42	C	33	C
		PM	C	41	C	45	D
8	Great Western Highway/ Station Street (Darling Causeway), Mount Victoria	AM	A	9	A	8	A
		PM	A	5	A	5	A
9	Great Western Highway/ Caroline Avenue/ Main Street, Lithgow	AM	B	23	B	24	B
		PM	B	25	B	25	B
10	Little Hartley construction site intersection	AM	-	-	-	28	B
		PM	-	-	-	38	C

Public and road safety

The introduction of additional heavy vehicles onto the road network during construction has the potential to result in safety impacts to the public and other road users. This would be especially the case where there is an increased likelihood of interaction between heavy vehicles and other motorists, pedestrians and cyclists.

The design of the project (see Chapter 4 (Project description)) and construction planning (see Chapter 5 (Construction)) have sought to avoid or minimise the potential for road safety risks that may arise from project construction traffic. Importantly, the decision to construct the project tunnels with TBMs launched and spoil being hauled westward from the Little Hartley construction site means that:

- heavy vehicles hauling spoil from the Little Hartley construction site would not pass through Blackheath or Mount Victoria, avoiding interaction with pedestrians, cyclists and other vehicles in those areas
- heavy vehicles hauling spoil from the Little Hartley construction site would not need to use Victoria Pass, which frequently experiences heavy vehicle breakdowns due to steep grades.

Road safety risks from construction vehicles entering and exiting construction sites and increased heavy vehicle volumes using the Great Western Highway would be managed through the CTAMP.

Road safety is the main concern regarding transport and traffic related public safety issues, given the location of construction sites having limited interface with the public. Construction safety impacts on active transport are discussed in more detail in Section 8.3.3. The presence of construction sites and the construction workforce may result in changes to perceptions of public safety in an area, as discussed in Section 19.3 of Chapter 19 (Social impacts).

On-street parking impacts

On-street parking supply would generally be maintained during construction of the project.

On-site parking for workers would be provided at the project construction sites, as shown in Figure 5-5, Figure 5-6 and Figure 5-7 in Chapter 5 (Construction). This is likely to include parking for around 100 vehicles at Blackheath, around 70 vehicles at Soldiers Pinch and around 500 to 600 vehicles at Little Hartley[5]. Parking provided at each construction site would be sufficient for the associated worker demand, except for during worker shift changeover. Specific measures including staggering staff shift times to make parking available for incoming works and the use of carpooling or providing shuttle buses to workers will be investigated during detailed design to manage potential parking impacts during worker shift changeover. Further information about vehicle access and car parking during construction is provided in Section 5.10 of Appendix D (Technical report – Transport and traffic).

Nevertheless, construction workers may choose to use available on-street parking, particularly near the Blackheath construction site, which may impact the availability of on-street parking for nearby residents and visitors. A parking and access management plan would be developed as part of the CTAMP to minimise the impacts of potential worker on-street parking.

During construction, informal parking for around a 50-100 metre section of Evans Lookout Road near the Great Western Highway would be removed. This area accommodates space for up to five parked vehicles. This area would be required to facilitate heavy vehicles turning in and out of the Blackheath construction site at the intersection of Evans Lookout Road and the Great Western Highway.

[5] Worker parking and supply to be confirmed during detailed design.

Construction of the project is not expected to directly impact access to private property. In the vicinity of Little Hartley, revised property access arrangements and property access roads would be provided as part of the Little Hartley to Lithgow Upgrade This revised access would be maintained during construction of the project. Further details on parking and access arrangements, including development of a parking and access management plan as part of the CTAMP.

8.3.2 Public transport

Buses that travel along the Great Western Highway in the study area would be affected by the minor impacts to road network performance outlined in Section 8.3.1. These minor impacts would include slight reductions in the performance of some intersections and increased travel times during construction of the project. Modifications to existing bus stops or bus routes would not be required during construction of the project.

Rail services within the study area would not be affected by construction of the project. However, rail replacement bus services are periodically used in the study area to replace rail services during planned and unplanned works to the rail line. These services would be subject to the same minor impacts as the passenger and school bus services discussed above.

8.3.3 Active transport

Use of the Soldiers Pinch construction site would impact a recreational trail used by hikers and cyclists during construction (see Figure 8-6). If required, the trail would be temporarily diverted around the Soldiers Pinch construction footprint to avoid the conflict between construction vehicles and the public, which would marginally increase walking or cycling travelling time and distance. Access would be maintained during construction and therefore this temporary impact would be negligible.

The active transport trails to be provided as part of the Katoomba to Blackheath Upgrade and the Little Hartley to Lithgow Upgrade would be maintained during construction of the project. Where temporary modifications to existing pedestrian or cyclist infrastructure are required (such as at the Little Hartley construction site where construction vehicles would need to cross over the active transport trail), impacts would be managed under the CTAMP.

An increase in the number of heavy vehicles associated with construction may impact on pedestrian and cyclist safety near the project. This would be most prevalent around construction vehicle access points. There are also potential risks to pedestrian safety resulting from unauthorised access to construction areas. Removal of spoil westbound from the Little Hartley construction site would minimise potential impacts to pedestrian and cyclist safety, particularly in and around the Blackheath and Mount Victoria townships. Appropriate fencing and site security would be implemented at construction sites to minimise the risk of unauthorised access, in line with NSW workplace safety laws.

8.3.4 Emergency vehicle access

Emergency vehicles would potentially be subject to minor road network impacts such as increased traffic volumes, increased travel times and reduced intersection performance during construction of the project. Construction of the project may require temporary traffic modifications but would avoid full closures of the Great Western Highway. Therefore, emergency services access along the Great Western Highway would be maintained during the construction.

Access to the Sydney Drinking Water Catchment and Blue Mountains National Park at Blackheath via B6 Lake Medlow Trail (fire trail accessed via Valley View Road) would also be maintained during construction.

The CTAMP for the project would be developed in consultation with relevant emergency services, ensuring that procedures are in place to maintain safe, priority access for emergency vehicles through or around construction zones. In addition, local emergency services would be periodically updated on the staging and progress of construction works.

8.4 Potential impacts – operation

8.4.1 Road network performance

Light and heavy vehicle volumes and patterns

The project is forecast to attract additional traffic to the Great Western Highway to take advantage of the improved resilience, reduced travel time and increased road network capacity facilitated by the project. This additional traffic is forecast to be a combination of:

- travellers choosing more distant locations
- travellers switching travel modes
- travellers choosing to use the Great Western Highway instead of alternative routes (e.g. Bells Line of Road).

The project is not expected to generate new trips that would not have otherwise occurred (induced demand).

Weekday traffic volume estimates in both the eastbound and westbound direction are summarised in Table 8-10. The table compares traffic volumes without the project (i.e. traffic using the existing Great Western Highway only) for 2030 and 2040, and traffic volumes with the project (i.e. traffic using the existing Great Western Highway and project) for 2030 and 2040. These results show that there would be increases in traffic volumes on the Great Western Highway both with and without the project in both 2030 and 2040. However, the project would provide an additional two lanes in both eastbound and westbound directions that would support this additional traffic.

Table 8-10 Daily weekday traffic volume estimates in 2030 and 2040 with and without the project

Screenline location	Operational year scenario – total traffic volumes					
	2030			2040		
	Without the project	With the project	Change %	Without the project	With the project	Change %
Little Hartley (westbound)	6,090	6,870	13	6,500	8,730	34
Little Hartley (eastbound)	6,250	7,050	13	6,710	8,680	29
Mount Victoria (westbound)	7,270	7,900	9	7,770	9,810	26
Mount Victoria (eastbound)	7,620	8,180	7	8,150	9,960	22
Blackheath (westbound)	9,660	9,860	2	10,490	12,020	15
Blackheath (eastbound)	9,730	12,250	5	9,600	12,270	28
Medlow Bath (westbound)	9,730	10,250	5	10,470	12,480	19
Medlow Bath (eastbound)	10,490	10,970	5	10,550	12,980	23

Figure 8-9 compares the forecast weekday daily traffic volumes (total vehicles) passing through the Blackheath and Mount Victoria townships in 2030 and 2040, both with and without the project. With the project, weekday traffic volumes through the townships would be reduced by around 60 per cent in Blackheath and nearly 80 per cent in Mount Victoria. The large reduction in vehicle volumes along the existing Great Western Highway through Blackheath and Mount Victoria would noticeably improve the accessibility and amenity of these townships. Similarly, the expected traffic

through these townships in 2030 and 2040 on weekends and on public holidays would be reduced with the project through removal of most through traffic.

Without the project (in 2030 and 2040) average traffic volumes on the existing Great Western Highway through Blackheath and Mount Victoria could reach 25,000 and 20,000 vehicles per day on public holidays. With the project (in 2030 and 2040) modelling indicates that these traffic volumes would reduce substantially to 11,000 and 5,000 vehicles per day respectively. These volumes would be less than recorded vehicle volumes from 2018.

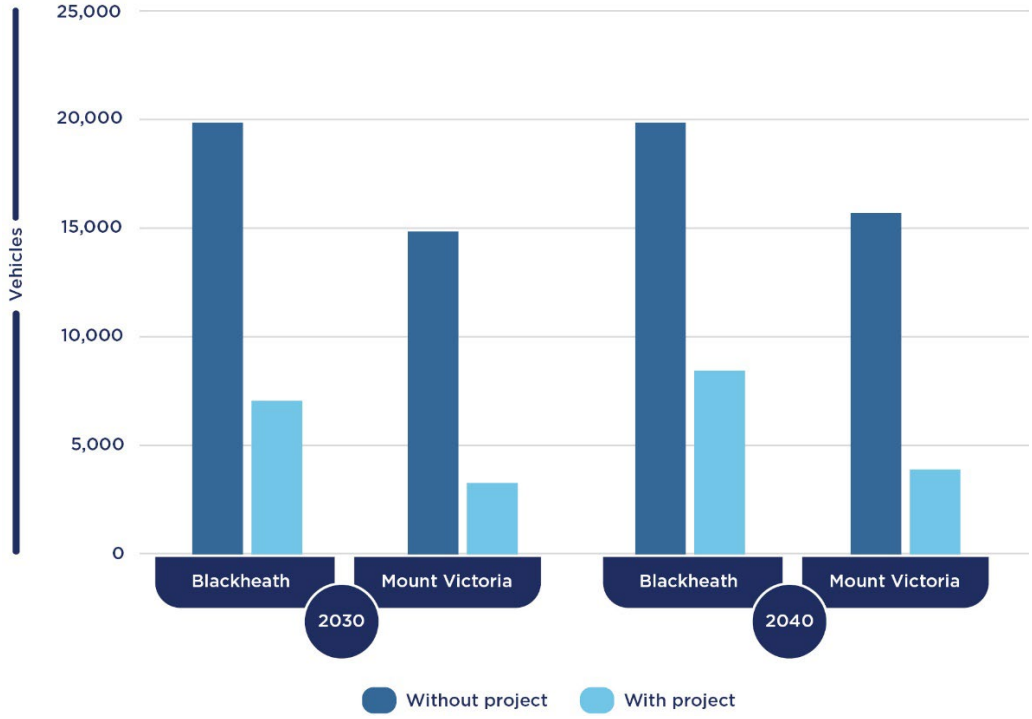

Figure 8-9 Comparison of daily weekday traffic volumes (total vehicles) travelling through Blackheath and Mount Victoria townships with and without the project in 2030 and 2040

Heavy vehicle volumes and patterns

Weekday eastbound and westbound heavy vehicle volumes are summarised in Table 8-11, including heavy vehicle volumes without the project (i.e. traffic using the existing Great Western Highway only) in 2030 and 2040, and heavy vehicle volumes with the project (i.e. traffic using the existing Great Western Highway and the project) in 2030 and 2040.

In 2030, the project would result in a slight increase in eastbound heavy vehicle volumes and a slight decrease in westbound heavy vehicle volumes when compared to the scenario without the project. In 2040, the project would result in a slight reduction in heavy vehicles travelling both eastbound and westbound when compared to the scenario without the project. This slight change in heavy vehicle volumes is due to the project providing a new connection for higher productivity freight vehicles longer than 20 metres between Blackheath and Little Hartley. Providing access to these higher efficiency vehicles would contribute to a total reduction in the current route for these vehicles by up to 100 kilometres between Sydney and Central West NSW (Transport for NSW, 2019).

Figure 8-10 compares the forecast weekday daily heavy vehicle volumes passing through the Blackheath and Mount Victoria townships in 2030 and 2040, both with and without the project. With the project, weekday heavy vehicle volumes through both townships would be reduced by around 80 to 85 per cent in 2030 and in 2040.

Table 8-11 Daily weekday heavy vehicle volume estimates in 2030 and 2040 with and without the project

Screenline location	Operational year scenario – heavy vehicle volumes					
	2030			2040		
	Without the project	With the project	Change (%)	Without the project	With the project	Change (%)
Little Hartley (westbound)	1,230	1,180	-4	1,370	1,300	-5
Little Hartley (eastbound)	1,170	1,190	2	1,300	1,270	-2
Mount Victoria (westbound)	1,370	1,300	-5	1,520	1,440	-5
Mount Victoria (eastbound)	1,340	1,380	3	1,490	1,490	0
Blackheath (westbound)	1,470	1,390	-5	1,670	1,580	-5
Blackheath (eastbound)	1,460	1,460	0	1,500	1,640	9
Medlow Bath (westbound)	1,570	1,470	-6	1,790	1,690	-6
Medlow Bath (eastbound)	1,680	1,680	0	1,770	1,820	3

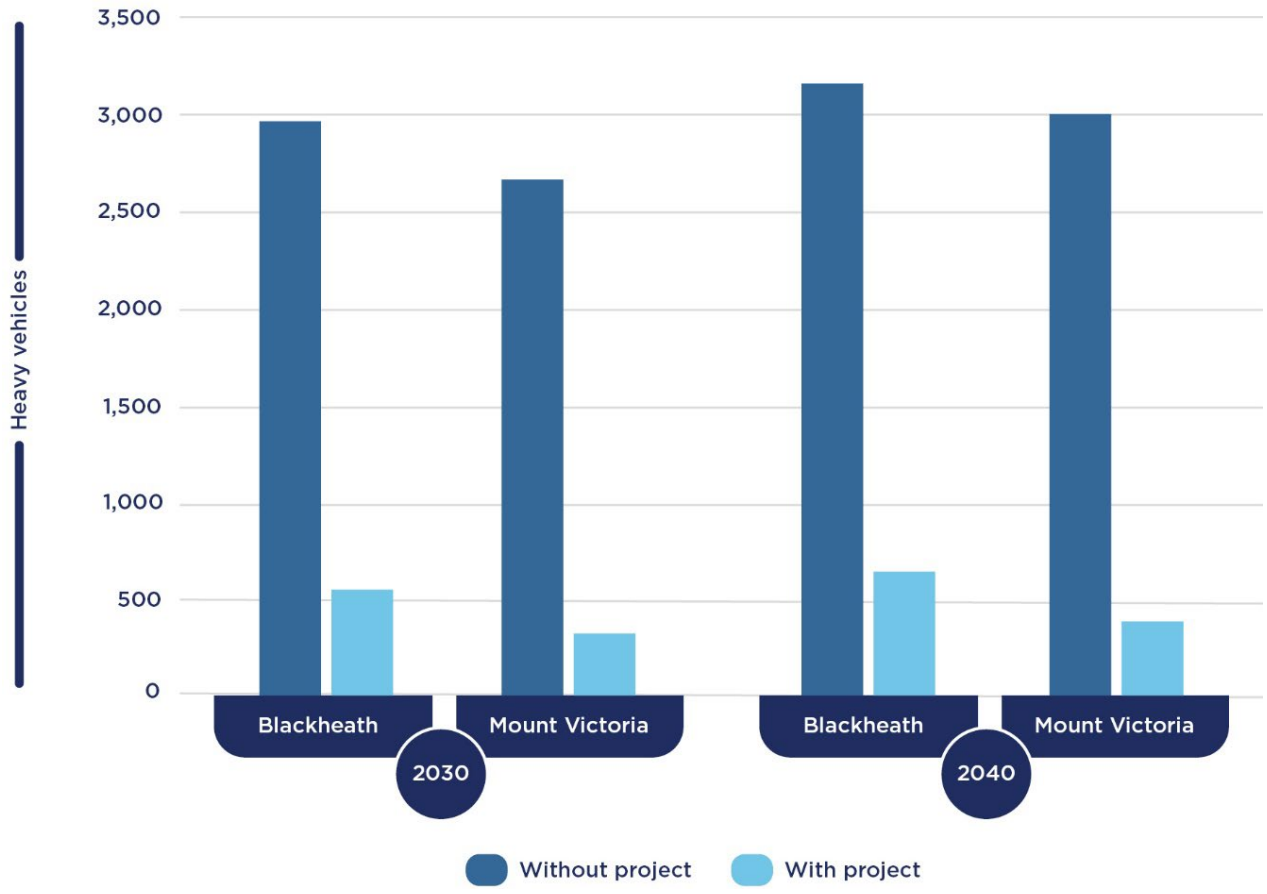

Figure 8-10 Comparison of daily weekday heavy vehicle volumes travelling through Blackheath and Mount Victoria townships with and without the project in 2030 and 2040

Network performance statistics and travel time

The modelled peak hour network performance between Blackheath and Little Hartley with and without the project in 2030 and 2040 is summarised in Table 8-12. A summary of peak hour travel times and speeds with and without the project in 2030 and 2040 are shown in Figure 8-11.

The project would provide the following traffic improvements between Blackheath and Little Hartley for the weekday AM and PM peak hours:

- average vehicle speeds would increase by up to 15 kilometres per hour with the project
- total vehicle hours travelled (VHT) would decrease by around 20 to 30 per cent during the weekday AM and PM peak hours
- total number of stops would decrease with the project
- between Medlow Bath and Hartley travel times would reduce from 23 and 24 minutes without the project in 2030 and 2040 respectively, to 14 minutes with the project (a reduction of around 40 per cent) providing substantial travel time savings for vehicles travelling through the study area
- between south of Blackheath and Little Hartley travel times would reduce from 18 and 19 minutes without the project in 2030 and 2040 respectively, to 10 minutes with the project (a reduction of around 45 per cent) providing substantial travel time savings for vehicles travelling through the study area
- between Leichhardt Street (Blackheath) and Station Street (Mount Victoria) via the existing Great Western Highway, travel times would reduce from eight and nine minutes without the project in 2030 and 2040 to seven minutes with the project
- in Blackheath and Medlow Bath local traffic would experience travel time savings of 15 to 40 per cent in 2030 and 2040 due to reduced traffic volumes using the existing Great Western Highway.

The project would also provide a connection for high productivity vehicles longer than 20 metres between Blackheath and Little Hartley, contributing to a total reduction in the current route for these vehicles by up to 100 kilometres between Sydney and the Central West region. Similar improvements to travel times are likely to occur on weekends and public holidays, due to the increased network capacity provided by the project. The Katoomba to Blackheath Upgrade and Little Hartley to Lithgow Upgrade would also accommodate high productivity vehicles longer than 20 metres.

Table 8-12 Weekday peak hour network performance statistics in the base year (2018) and with and without the project (2030 and 2040)

Network performance	Peak hour	Base year scenario (2018)	Operational year scenarios							
			2030				2040			
			Without project	With project	Change	Change (%)	Without project	With project	Change	Change (%)
All vehicles										
Total traffic demand (vehicles)	AM	4,350	4,913	4,905	-8	0	5,159	5,172	+13	0
	PM	4,961	5,596	5,569	-27	0	5,784	5,920	+136	2
Total vehicle kilometres travelled (kilometres)	AM	47,685	59,454	56,588	-2,865	5	61,677	61,639	-38	0
	PM	47,632	66,222	64,043	-2,179	3	67,469	73,887	+6,418	9
Total vehicle hours travelled (hours)	AM	864	1,104	867	-237	21	1,224	928	-296	24
	PM	871	1,224	985	-239	20	1,344	1,135	-209	16
Total vehicles arrived	AM	4,256	4,877	4,843	-34	1	5,110	5,027	-83	2
	PM	4,758	5,510	5,427	-83	2	5,704	5,887	+183	3
Total number of stops	AM	2,922	3,582	3,455	-127	4	4,087	3,775	-312	8
	PM	3,942	4,861	4,427	-434	9	5,669	5,090	-579	10
Average per vehicle in network										
Average vehicle kilometres travelled (kilometres)	AM	11	12	12	0	0	12	12	0	0
	PM	10	12	12	0	0	12	13	+1	8

Network performance	Peak hour	Base year scenario (2018)	Operational year scenarios							
			2030				2040			
			Without project	With project	Change	Change (%)	Without project	With project	Change	Change (%)
Average vehicle hours travelled (minutes)	AM	12	14	11	-3	21	14	11	-3	21
	PM	11	13	11	-2	15	14	12	-3	14
Average number of stops	AM	1	1	1	0	0	1	1	0	0
	PM	1	1	1	0	0	1	1	0	0
Average speed (kilometres per hour)	AM	55	54	65	+11	20	50	66	+16	32
	PM	55	54	65	+11	20	50	65	+15	30

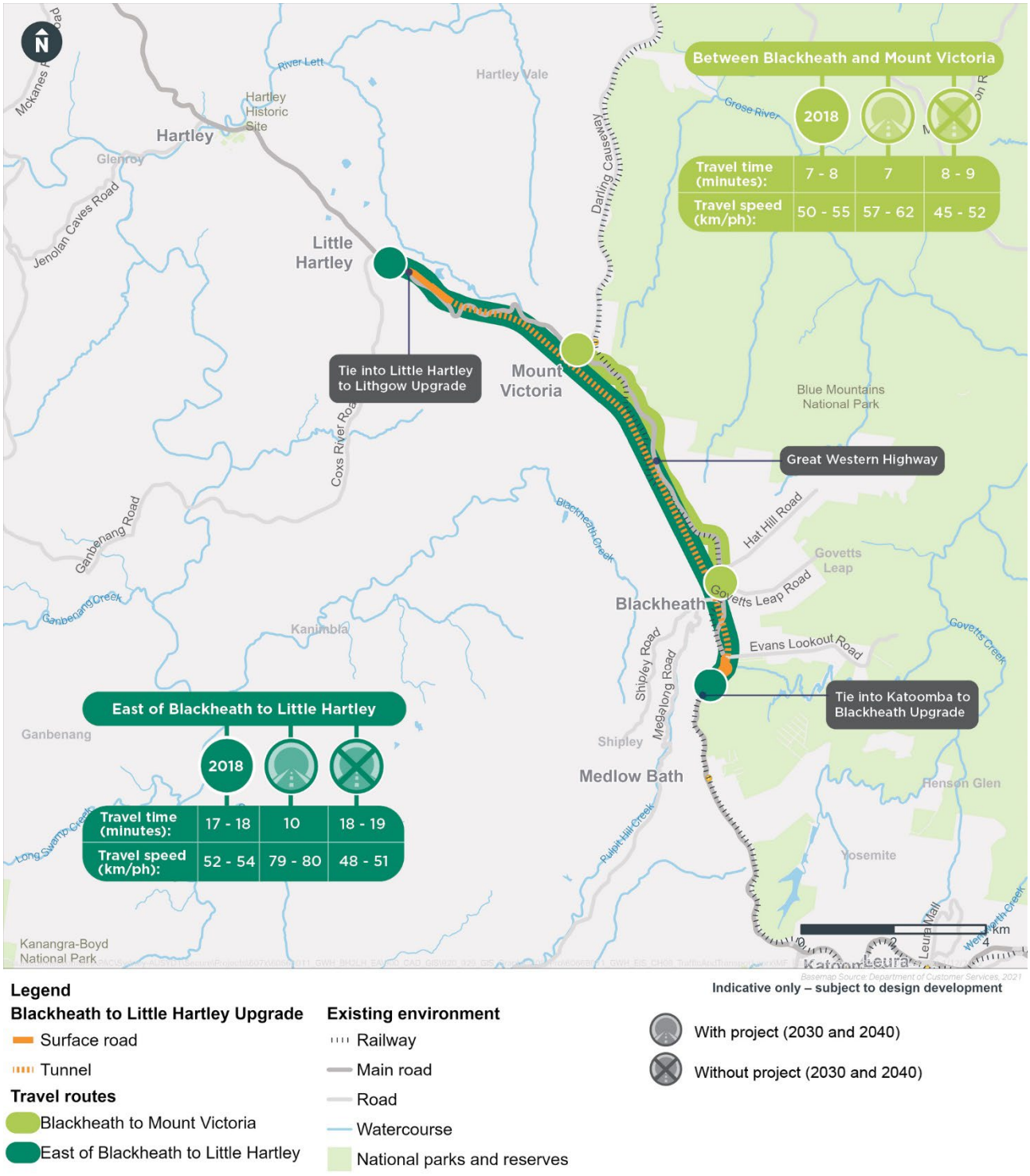

Figure 8-11 Peak hour average travel times and speed projections for the base year scenario (2018), and with and without the project in 2030 and 2040

Intersection performance

The modelled LoS for key intersections within the study area with and without the project for the 2030 and 2040 weekday AM and PM peak hours are summarised in Table 8-13. The model outputs indicate:

- with project in 2030 and 2040 all intersections would operate at LoS B or better
- with project in 2030 and 2040 there would be a substantial improvement in the performance of some intersections, particularly at:
  - Great Western Highway/ Evans Lookout Road, Blackheath – improvement from LoS F to LoS A in both the AM and PM peak hours in 2030 and 2040
  - Great Western Highway/ Govetts Leap Road/ Bundarra Street, Blackheath – improvement from LoS C to LoS B in the PM peak hour in 2030, and from LoS C to LoS B in both the AM and PM peak hours in 2040
  - Great Western Highway/ Hat Hill Road, Blackheath – improvement from LoS C in the AM peak hour and LoS E in the PM peak hour to LoS A in both the AM and PM peak hours in 2030 and 2040
  - Great Western Highway/ Harley Avenue, Mount Victoria – improvement from LoS C in the AM peak hour and LoS D in the PM peak hour to LoS A in both the AM and PM peak hours in 2030 and 2040
- intersection LoS would decline from 2018 to 2030 and 2040 without the project due to background traffic growth at the intersections listed above.

Table 8-13 Intersection performance during peak periods with and without the project in 2030 and 2040[6]

ID	Intersection	Intersection type	Peak hour	2030				2040			
				Without project		With project		Without project		With project	
				Average delay (seconds)	LoS	Average delay (seconds)	LoS	Average delay (seconds)	LoS	Average delay (seconds)	LoS
1	Great Western Highway and Evans Lookout Road, Blackheath	Unsignalised	AM	80	F	11	A	124	F	11	A
			PM	>300	F	13	A	>300	F	14	A
2	Great Western Highway and Prince George Street, Blackheath	Unsignalised	AM	8	A	5	A	9	A	5	A
			PM	14	A	6	A	14	A	7	A
3	Great Western Highway and Leichhardt Street, Blackheath	Unsignalised	AM	7	A	4	A	8	A	4	A
			PM	13	A	7	A	12	A	7	A
4	Great Western Highway, Govetts Leap Road and Bundarra Street, Blackheath	Signalised	AM	22	B	15	B	29	C	15	B
			PM	29	C	17	B	36	C	17	B
5	Great Western Highway and Hat Hill Road, Blackheath	Unsignalised	AM	32	C	7	A	40	C	8	A
			PM	68	E	8	A	70	E	8	A
7	Great Western Highway and Harley Avenue, Mount Victoria	Unsignalised	AM	33	C	9	A	36	C	9	A
			PM	49	D	9	A	49	D	9	A
8	Great Western Highway and Station Street (Darling Causeway), Mount Victoria	Signalised	AM	7	A	8	A	6	A	14	A
			PM	6	A	6	A	6	A	6	A
11	New intersection in Blackheath	Unsignalised	AM	-	-	7	A	-	-	7	A
			PM	-	-	8	A	-	-	8	A

[6] Intersections 6, 9 and 10 are not included in this discussion given they are only relevant to the construction assessment.

Heavy vehicle performance

The project would improve heavy vehicle performance by providing a consistent grade of around 1.75 per cent in the tunnel between Blackheath and Little Hartley and up to four per cent along the surface sections at Blackheath and Little Hartley. This compares to several existing sections of the Great Western Highway with steep grades of more than 10 per cent. It would also incorporate curves that are designed to be taken at higher speeds than curves on the existing Great Western Highway where advisory speed limits are as low as 45 kilometres per hour. The project would also have a positive impact on operational freight costs by reducing fuel consumption and the likelihood of breakdowns, as well as creating opportunities for increased freight efficiency via the use of larger freight vehicles in place of smaller freight vehicles.

Public and road safety

The project would result in the following road safety benefits:

- direct improvements to existing safety issues including:
  - separation of opposing traffic flows
  - wider lanes and improved sightlines
  - fewer intersections
  - reduced grades
  - separation of local and tourist traffic from through traffic (including heavy vehicles)
  - improved overtaking opportunities.
- improvements due to reduced traffic volumes and heavy vehicle traffic on the existing Great Western Highway resulting in:
  - substantially reduced local traffic through the Blue Mountains townships of Blackheath and Mount Victoria
  - improved safety and accessibility for pedestrians and cyclists using the existing road shoulder.

Investigations by Transport into the need for changed traffic signal phasing along the existing Great Western Highway in Blackheath and Mount Victoria may be considered after the project is completed, in consultation with the local councils and the local community.

8.4.2 Public transport

Existing public transport networks would be maintained with the project. The project does not include specific provision for additional public transport. However, buses would be permitted to use the tunnel which would result in travel time savings especially for longer trips. The project would also reduce congestion along the existing Great Western Highway which could result in improved travel times for local bus routes.

8.4.3 Active transport

The project does not include any specific provisions for active transport infrastructure, as pedestrians and cyclists would not be permitted to use the tunnel for safety reasons. Active transport trails to the east and west of the project provided as part of the Katoomba to Blackheath Upgrade and the Little Hartley to Lithgow Upgrade would not be impacted during operation of the project.

Reductions in traffic volumes on the existing Great Western Highway would improve the amenity and safety for active transport users.

Investigations are ongoing in consultation with local councils into opportunities to improve at-surface active transport infrastructure between Blackheath and Little Hartley. This infrastructure would be subject to separate assessments and approvals and may be delivered by others.

8.4.4 Parking and access

The project is not anticipated to impact property access, business access or on-street parking during operation.

New access roads would be provided by the Little Hartley to Lithgow Upgrade to maintain access around the project at Little Hartley. The Little Hartley to Lithgow Upgrade would also include formalisation of the existing informal Berghofer's Pass car park to improve the safety and amenity of the car park for visitors.

8.5 Environmental mitigation measures

8.5.1 Performance outcomes

Performance outcomes for the project in relation to transport and traffic are listed in Table 8-14 and identify measurable performance-based standards for environmental management.

Table 8-14 Transport and traffic performance outcomes

SEARs desired performance outcome	Project performance outcome	Timing
Network connectivity, safety and efficiency of the transport system in the vicinity of the project are managed to minimise impacts. The safety of transport system customers is maintained. Impacts on network capacity and the level of service are effectively managed. The safety of transport system customers is maintained. Impacts on network capacity and the level of service are effectively managed.	Avoid or minimise adverse impacts to the performance of the existing road network, including with respect to level of service, travel times and road safety.	Construction and operation
Works are compatible with existing infrastructure and future transport corridors.	Coordinate and deliver the project as part of the integrated package of works comprising the Upgrade Program.	Construction and operation

8.5.2 Mitigation measures

Mitigation measures to avoid, minimise or manage potential transport and traffic impacts as a result of the project are detailed in Table 8-15. A full list of environmental mitigation measures for the project is provided in Appendix R (Compilation of environmental mitigation measures).

Table 8-15 Environmental mitigation measures – transport and traffic

ID	Mitigation measure	Timing
TT1	A Construction Transport and Access Management Plan (CTAMP) will be prepared as part of the Construction Environmental Management Plan (CEMP) in consultation with the relevant local councils and emergency services. The CTAMP will include: • measures to minimise and manage construction traffic and road safety impacts on other road users, including pedestrians, cyclists and buses • planning to minimise the movement of construction heavy vehicles during the AM and PM peak hours, weekend peak hours and on peak weekends (such as the Bathurst Super Car event) and public holidays, where practicable • access management measures, including safety measures, for active transport interfaces with construction areas and construction sites • measures to provide safe and adequate access to residential premises and businesses during construction, particularly where construction activities affect existing property access arrangements • details of the types of temporary traffic management measures that would be required during construction, such as posted speed limit reductions, detours and full or partial road closures, and how these measures would be managed to minimise impacts on other road users • measures to periodically update local emergency services on the staging and progress of construction works, and to maintain safe adequate access for emergency services during the construction period • a framework for coordinating construction planning and traffic management with adjacent Great Western Highway upgrade projects to minimise potential cumulative construction traffic impacts.	Construction
TT2	Sufficient car parking spaces will be provided within the project construction sites to accommodate anticipated construction worker parking requirements. During detailed construction planning, opportunities to provide a shuttle bus or other initiatives to transfer construction workers from local hubs to construction sites will be investigated.	Design and construction
TT3	Opportunities to minimise the impacts of construction traffic on the level of service at the Great Western Highway/ Evans Lookout Road intersection and the Great Western Highway/ Browntown Oval intersection will be investigated during detailed construction planning.	Design and construction
TT4	The operational traffic performance of the project will be reviewed 12 months after commencement of operation. The review will aim to confirm the predicted positive effects of the project on the road network and, if relevant, identify adverse operational traffic impacts on road network performance. In the event that adverse operational traffic impacts on the road network are identified, opportunities to mitigate these impacts will be considered for implementation.	Operation