A key capacity issue is also the M5 East, which is the continuation of the motorway east of King Georges Road. The M5 East includes two four-kilometre long tunnels from Bexley to Arncliffe, with some steep grades (maximum 8.3 per cent) in each direction. These grades adversely affect the climbing performance of heavily laden trucks, of which there are many (up to 11 per cent of all traffic). Consequently, in the AM peak period, eastbound traffic on the M5 East regularly queues beyond King Georges Road causing delays to eastbound traffic on the M5 South West Motorway. Under such conditions, eastbound traffic queues have been observed west of Fairford Road.

The capacity of the parallel route to the M5 South Western Motorway is determined by the major intersections. A number of key intersections along the route operate in excess of capacity (Level of Service E) in one or both peak periods. The intersection of King Georges Road/Canterbury Road experiences the greatest level of delay, when compared to the other intersections, which occurs during the PM peak period. The intersection of Hume Highway/Hoxton Park Road/Macquarie Street also operates significantly in excess of capacity during both the AM and PM peak periods.

The capacity of principal roads crossing the M5 South Western Motorway is also dependent on their major intersections. The King Georges Road/Stoney Creek Road intersection has the highest average delay in both the AM and PM peak periods. A low level of service in the AM peak at the King Georges Road/Moorefields Avenue intersection is a result of queuing from the King Georges Road/M5 intersection.

Levels of service

For road links, level of service is a qualitative measure describing operational conditions within a traffic stream, and the perception of motorists and/or passengers. It considers factors such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience, and safety. For intersections, level of service is determined by reference to average vehicle delay. There are six levels of service, designated from A to F, with level of service A representing the best operating condition and level of service F the worst.

Level of service for AM eastbound traffic on the M5 South West Motorway ranges from E (between Camden Valley Way and Hume Highway) to C for most of the motorway including the sections between Henry Lawson Drive and King Georges Road. For PM westbound traffic, sections have a level of service of either C or B.

As noted above, the capacity of the parallel route is determined by the major intersections. A number operate in excess of capacity (level of services E) in one or both peak periods. The intersection of King Georges Road/Canterbury Road experiences the greatest level of delay, when compared to the other intersections. Delays are longest during the PM peak period.

The capacity of principal roads crossing the M5 South Western Motorway is also dependent on their major intersections. The King Georges Road/Stoney Creek Road intersection has the highest average delay in both the AM and PM peak periods. The King Georges Road/Moorefields Avenue intersection has a level of service F in the AM peak because of queuing from the King Georges Road/M5 intersection.

Travel speeds and times

Travel speeds and times were compared between the M5 South Western Motorway and parallel routes.

In the AM peak eastbound:

- The average AM peak eastbound speed on the M5 South Western Motorway ranges from 99 kilometres per hour in the section between Camden Valley Way and the Hume Highway, to 22 kilometres per hour in the section between Fairford Road and King Georges Road. The average over the whole length (Brooks Road to King Georges Road) is 49 kilometres per hour.
- The AM peak eastbound speeds on the parallel route (Campbelltown Road, Hume Highway, Newbridge Road, Milperra Road and Canterbury Road) are understandably lower than the motorway. They range from 56 kilometres per hour in the section from Brooks Road to Camden Valley Way, to 25 kilometres

per hour in the section from The River Road to Fairford Road. The average over the whole length is 36 kilometres per hour.

In the AM peak westbound:

- The average AM peak westbound speed on the M5 South West Motorway ranges from 93 kilometres per hour in the section between The River Road and Henry Lawson Drive, to 53 kilometres per hour in the section between King Georges Road and Fairford Road. The average over the whole length is 78 kilometres per hour.
- The AM peak westbound speeds on the parallel route range from 64 kilometres per hour in the section from the M5 (Liverpool) to Camden Valley Way, to 32 kilometres per hour in the section from Fairford Road to The River Road. The average over the whole length is 46 kilometres per hour.

In the PM peak westbound:

- The PM peak westbound speeds on the M5 South West Motorway range from 96 kilometres per hour in the section between Hume Highway and Camden Valley Way, to 33 kilometres per hour in the section between King Georges Road to Fairford Road. The average speed over the whole length is 56 kilometres per hour.
- The PM peak westbound speeds on the parallel route are slower, ranging from 53 kilometres per hour in the section between Camden Valley Way and Brooks Road, to 18 kilometres per hour in the section between Heathcote Road and the M5 (Liverpool). The average speed over the whole length is 38 kilometres per hour.

In the PM peak eastbound:

- The PM peak eastbound speeds on the motorway range from 100 kilometres per hour in the section between Moorebank Avenue and the Hammondville toll plaza, to 43 kilometres per hour in the section between The River Road and Fairford Road. The average speed over the whole length is 88 kilometres per hour.
- The PM peak eastbound speeds on the parallel route range from 57 kilometres per hour in the section between Brooks Road and Camden Valley Way, to 24 kilometres per hour in the section between M5 (Liverpool) and Heathcote Road. The average speed over the whole length is 43 kilometres per hour.

Road safety and crash history

Crash data for 2004–2008 has been analysed for both the M5 South West Motorway and the parallel route. This includes a graphical representation of crash locations over the period.

Between 2004–2008, some 1256 crashes occurred on the M5 South West Motorway between Camden Valley Way and King Georges Road. The number of crashes on this section of the motorway has fluctuated between 236 and 277 per year reaching a peak in 2006. The crash reduction in the two years since 2006 suggests road safety initiatives may have altered driver and pedestrian behaviour leading to fewer casualties. The most frequent crash type recorded was the less serious rear-end or nose/tail crash.

Over the same period, 1876 crashes occurred on the parallel route between Camden Valley Way and King Georges Road. The number of crashes on this section of the Hume Highway/Newbridge Road/Milperra Road/Canterbury Road has fluctuated between 338 and 400 per year, with the greatest number of crashes occurring in 2004.

The crash rate per 100 million vehicle kilometres travelled is much lower on the motorway than on the parallel route. Furthermore, it is also more consistent, varying from 37.2 to 49.5 (compared to the parallel route with a range 62.6 to 286.2).

8.1.3 Construction traffic and transport impacts

Construction traffic impacts have been assessed based on the construction program (about 24 months) and scope of works identified in Chapter 6.

On-motorway construction impacts

The existing number of operating traffic lanes on the M5 South West Motorway would be maintained during the daytime and peak periods to avoid traffic congestion impacts. If lane closures were required during non-peak periods, these would be the subject of a specific traffic assessment to establish the likely impacts of the lane closure.

Existing lane widths may need to be narrowed during construction, which would impact on lane capacity. A reduction in shoulder widths and associated posted speed reductions would also likely affect traffic capacity on the motorway, leading to increased travel times and some traffic diverting from the motorway to use alternative routes.

The 2011 strategic model was used to consider the potential impacts of construction of the project on the wider road network. For each section of the motorway where works are proposed, the model considered a reduced travel speed of 80 kilometres per hour and a link capacity of 95 per cent of normal operation. The model found that about five to 10 per cent of traffic on the motorway would divert to alternative parallel roads (mainly the Hume Highway and Canterbury Road) during peak hours, with the greatest rate of diversion (ie 10 per cent) during inter-peak hours.

The model shows a maximum seven per cent of traffic on the Hume Highway and Canterbury Road. It predicts the following impacts with regard to travel time and travel speed on the M5 South West Motorway during construction:

- An increase of about 14 per cent in travel time (additional two to three minutes) and a decrease in travel speed of about 13 per cent (minus 10 kilometres per hour) during inter-peak hours.
- An increase of about 10 per cent in travel time (additional two minutes) and a decrease in travel speed of about 10 per cent (minus seven kilometres per hour) during morning and evening peak hours.

Construction site compounds

Specific details regarding the size and location of construction site compounds are provided in Table 6.2. Anticipated construction traffic movements have been identified for each construction site compound based on its proposed use and are provided in Table 8.2.

Table 8.2 Average daily traffic trips by construction site compound

Compound	Proposed use	Proposed access	Average daily traffic movements[1]		Night time traffic movements	
			Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles
Moorebank Avenue (24-hour use)	Main office	From Moorebank Avenue	360	80	50	10
M5/Graham Avenue (1) (24-hour use)	Satellite office	From M5	60	20	10	15
M5/Graham Avenue (2)	Satellite office Materials laydown	From M5/Angelo Avenue	20	20	N/A	N/A
M5/Graham Avenue (3)	Satellite office Materials laydown	From M5/Angelo Avenue	20	20	N/A	N/A

Compound	Proposed use	Proposed access	Average daily traffic movements[1]		Night time traffic movements	
			Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles
Bransgrove Road (24-hour use)	Satellite office Materials laydown	From Bransgrove Road	40	40	10	10
Henry Lawson Drive	Satellite office Materials laydown	From Henry Lawson Drive	20	20	N/A	N/A
Beaconsfield Road (24-hour use)	Main office Materials laydown	From Marigold Street	180	80	10	10
Heathcote Road (north)	Materials laydown	From Heathcote Road	40	20	N/A	N/A

1. Average vehicle movements relates to round trips (ie one movement relates to a particular vehicle arriving at and departing from a particular construction site compound).

Table 8.2 shows that the majority of the sites would generate little more than one vehicle/truck per hour. In addition, all of the proposed construction site compounds are located in close proximity to the M5 South West Motorway and adjacent arterial routes. Therefore, even when construction traffic is required to utilise local roads, the impact would be generally limited to about 250–500 metres, at which point traffic would enter designated heavy vehicle routes.

Sites that would generate higher traffic levels such as those at Moorebank Avenue and Beaconsfield Road, would not have any significant impact on residential roads.

The direct access at each of the compound frontages would be provided with adequate sight distances having regard to the posted road speed. This would allow vehicles on the main road to see vehicles emerging from the compound and will allow sufficient spaces to slow down and stop if necessary. Similarly, it would allow vehicles waiting to leave the site adequate sight distance to see approaching vehicles and determine safe gaps in the traffic flow. Sites would generally employ a traffic controller to manage the vehicular traffic into and out of the site, as well as manage pedestrian flows across the access.

Construction of variable message signs

Construction traffic impacts as a result of variable message sign construction is discussed in section 10.7 of Appendix E. A number of variable message signs would be installed on the wider road network, generally on major roads leading to or from the M5 South West Motorway. Construction activities required to install variable message signs are identified in section 6.3.8, and generally comprises earthworks for footings, concreting associated with the footings and use of a crane to lift the sign into position.

Construction activities would be programmed so that works that do not affect traffic would be undertaken during the day. Works with the potential to affect traffic (potentially via lane closures or similar) would likely occur during the night in order to minimise interruption to road traffic. The night time construction activities would be of short duration (anticipated completion in about two nights) and would have a minor impact on traffic in the localised area.

Construction traffic routes and trip scheduling

Detailed site access arrangements would be developed for each construction site with the overarching objective of minimising traffic impacts on local streets and maximising the use of arterial roads. More specifically, the following would be considered in determining construction traffic routes:

- Preference for the motorway network, arterial roads and other higher order roads.
- Restrictions on size and load of vehicles for local roads.
- Location of sensitive areas especially schools, hospitals, places of worship, businesses.

- Hours of activity at sensitive sites.
- Access needs for residents, pedestrians, emergency services and buses.
- The impact of out-of-hours works on residential areas.
- Consultation with Traffic and Transport Liaison Group (see section 8.1.7), residents and sensitive communities.
- Relevant documents and standards, such as the *RTA Guide to Traffic Control at Worksites*, and Australian standards.

The delivery and collection of oversize plant and equipment, as well as materials required by the construction activities, would not occur during periods of high demand on the road network. This recognises that impeding traffic flow at these times, even for a relatively short period, would have large consequential effects on the broader road network. Impacts associated with oversize vehicles would be mitigated with advisory signage for regular users of the affected routes, detailing the proposed activities and likely disruptions that might be encountered.

Construction activities would be coordinated to ensure that peak levels of traffic generation do not coincide at two or more work sites that feed the same local routes.

De Meyrick Avenue underpass

The proposed scope of construction works at this location is discussed in section 6.3. These works would potentially require:

- Localised daily traffic diversions at De Meyrick Avenue for a period of up to six months and a reduction in motorway travel speeds in the vicinity of De Meyrick Avenue from 100 to 80 kilometres per hour.
- Potential closure of the motorway for up to 20 nights during bridge construction.

On a typical weekday the two-way traffic flow on De Meyrick Avenue at its intersection with the Hume Highway is 597 in the AM peak and 420 in the PM peak. However, site observations undertaken as part of the development of the traffic and transport technical paper (refer to Appendix E) indicate that traffic flow beneath the bridge is about 25 per cent of the AM and PM peak volumes (ie around 120 vehicles per hour in the peak period).

This reduction in vehicles using the De Meyrick Avenue underpass has been attributed to an increased use of Kurrajong Road, Old Kurrajong Road and Reserve Road, which are expected to experience traffic flow of about two vehicles per minute on average. These roads are capable of accommodating these traffic volumes over the anticipated six-month construction period.

The closure of the M5 Motorway over 20 nights would require redirection of vehicles onto the Hume Highway, which is considered achievable, especially as closures would likely occur at night-time and/or at other traditionally quiet periods.

Reduction of the M5 Motorway speed limit in the vicinity of De Meyrick Avenue to 80 kilometres per hour would decrease average traffic speeds, with the largest decreases likely to occur in free-flow situations (ie outside AM peaks, inter-peaks and PM peaks). In congested situations, the decrease would likely be smaller, therefore potential impacts and network effects would be minimal.

Construction workforce

It is anticipated that the workforce would average 300 workers, peaking at 500 for short periods of time. There would be limited if any parking availability for staff at construction site compounds and at motorway construction sites. Construction staff would be advised on suitable parking arrangements as part of the project induction process and would also be encouraged to car pool.

Workforce shuttle services, including services to and from public transport points, would be utilised to promote a reduction in general site vehicle movements and the number of staff using local roads for parking. Further detail regarding proposed management measures is provided in section 8.1.7.

8.1.4 Operational traffic and transport impacts

As a result of the project there are predicted to be increases in peak direction (AM eastbound and PM westbound) traffic volumes on the M5 South West Motorway between Camden Valley Way and King Georges Road. The modelling results show that traffic volumes at the Hammondville toll plaza would increase by between 23 and 29 per cent in the peak directions by 2026.

The results also show some traffic reduction on the parallel route (Hume Highway, Newbridge Road, Milperra Road and Canterbury Road). The M5 West widening project would not have a major impact on the M5 East.

The detail of the expected changes and their wider implications are considered below.

Changes to traffic volumes

The tables below present predicted traffic volumes, compared with the base case, on key sections of the M5 South West Motorway. The parallel route is also considered.

Table 8.3 Weekday AM period traffic forecasts (eastbound)

Year	Scenario	M5 South West Motorway			Parallel route		
		West of Hume Hwy	Hammondville toll plaza	West of King Georges Rd	Hume Hwy[1]	Newbridge Rd[2]	Canterbury Rd[3]
2009	Observed	-	3060	-	-	-	-
2016	Base	4020	3420	2610	3350	2940	1410
	Project	5200	3960	2780	3300	2790	1430
	Difference	1180	540	170	-50	-150	20
2026	Base	4470	4000	3240	3860	3370	1570
	Project	5840	4930	3300	3650	3030	1630
	Difference	1370	930	60	-210	-340	60

1 West of Terminus Street, 2 West of Henry Lawson Drive, 3 West of King Georges Road.

Table 8.4 Weekday PM period traffic forecasts (eastbound)

Year	Scenario	M5 South West Motorway			Parallel route		
		West of Hume Hwy	Hammondville toll plaza	West of King Georges Rd	Hume Hwy[1]	Newbridge Rd[2]	Canterbury Rd[3]
2009	Observed		3180				
2016	Base	3430	3690	3040	1780	2130	1280
	Project	3690	4170	3240	1590	1860	1280
	Difference	260	480	200	-190	-270	0
2026	Base	3590	3960	3300	1920	2500	1360
	Project	4270	4840	3730	1740	2050	1350
	Difference	680	880	430	-180	-450	-10

1 West of Terminus Street, 2 West of Henry Lawson Drive, 3 West of King Georges Road.

Table 8.5 Weekday PM period traffic forecasts (westbound)

Year	Scenario	M5 South West Motorway			Parallel route		
		West of Hume Hwy	Hammondville toll plaza	West of King Georges Rd	Hume Hwy[1]	Newbridge Rd[2]	Canterbury Rd[3]
2009	Observed		3040				
2016	Base	3380	3510	3230	2240	2200	1440
	Project	3720	3850	3340	2110	2040	1440
	Difference	340	340	110	-130	-160	0
2026	Base	3780	3930	3520	2430	2560	1510
	Project	4370	4620	3660	2210	2220	1530
	Difference	590	690	140	-220	-340	20

1 West of Terminus Street, 2 West of Henry Lawson Drive, 3 West of King Georges Road.

Table 8.6 Weekday AM period traffic forecasts (westbound)

Year	Scenario	M5 South West Motorway			Parallel route		
		West of Hume Hwy	Hammondville toll plaza	West of King Georges Rd	Hume Hwy	Newbridge Rd	Canterbury Rd
2009	Observed		3040				
2016	Base	4080	4090	3240	3300	3040	1790
	Project	5240	4970	3610	3070	2670	1800
	Difference	1160	880	370	-230	-370	10
2026	Base	4280	4530	3790	3610	3710	1960
	Project	5740	5840	4460	3430	3120	3030
	Difference	1460	1310	670	-180	-590	70

1 West of Terminus Street, 2 West of Henry Lawson Drive, 3 West of King Georges Road.

The above tables indicate that widening of the M5 South West Motorway would make the route more attractive to those vehicles that would otherwise use the parallel route. As a result, in 2026, traffic volumes on the parallel route would decrease on average by:

- 5.6 per cent in the AM peak eastbound direction.
- 11.1 per cent in the AM peak westbound direction.
- 8.3 per cent in the PM peak eastbound direction.
- 7.6 per cent in the PM peak westbound direction.

Significant increases in traffic volumes are expected on the M5 South West Motorway. This increase in traffic would decline as traffic moves from west to east. In the AM peak eastbound direction (2026) the percentage change in traffic volumes would decline from 31 per cent west of the Hume Highway, to 23 per cent at the toll plaza, and two per cent west of King Georges Road. Overall the project is expected to be successful in attracting traffic away from the alternative routes.

Changes to travel patterns

Overall, there is expected to be minimal change in the origins and destinations of traffic using the M5 South West Motorway. However, it is worth noting that without the M5 West widening project about 40 per cent of cars passing though the toll plaza in the peak direction (2026) would be expected to use the M5 East.

With the project, that proportion drops to about one-third, indicating that the additional traffic attracted to the improved motorway has more local destinations. Modelling indicates that a similar conclusion can be drawn for commercial traffic. This underlines the importance of the M5 West widening as a project that is justifiable in its own right.

Impacts on freight transport

Table 8.7 presents a summary of expected changes to commercial vehicle (truck) traffic volumes for the M5 South West Motorway and the parallel route.

Table 8.7 AADT forecasts (two-way total) – commercial vehicle (truck) traffic volumes

Year	Scenario	M5 – Hammondville toll plaza			Newbridge Road – West of Henry Lawson Drive		
		Total	Truck	% Truck	Total	Truck	% Truck
2016	Base	99,300	8100	8	68,700	7100	10
2016	Project	111,200	10,500	9	65,500	6500	10
2026	Base	113,700	9600	8	79,900	10,500	13
2026	Project	136,100	14,500	11	69,500	9300	13

Table 8.7 shows that the proportion of trucks is forecast to increase steadily on both the motorway and the parallel route – by three per cent in both cases when comparing the 2016 base case and 2026 project case. The actual truck volumes are forecast to increase by 79 per cent on the motorway and 31 per cent on the parallel route, demonstrating the attractiveness of the motorway to commercial vehicle operators, despite the toll payment.

Changes to travel speeds and travel times

The operation of the project is expected to result in an increase in vehicle kilometres travelled across the overall network. At the same time, vehicle hours travelled are expected to decline, indicating some improvement in journey times and a slight improvement in average travel speeds.

For the M5 corridor (including the M5 East), there is expected to be a similar trend, but the impacts observed along the M5 corridor are more pronounced. In 2026, the project is expected to result in:

- A 15 per cent increase in vehicle kilometres travelled in both the AM and PM peak periods (nine per cent in the inter-peak period).
- A six per cent reduction in vehicle hours travelled in both the AM and PM peak periods (four per cent in the inter-peak period).

The tables below present summary journey time information for the M5 South West Motorway and the parallel route.

Table 8.8 2016 AM peak average travel times

Scenario	Eastbound		Westbound	
	M5 SW Motorway	Parallel route	M5 SW Motorway	Parallel route
Base	21.8	37.7	20.3	31.1
Project	18.3	36.2	17.0	30.0
Per cent change	-16.1	-4.0	-16.3	-3.5

Table 8.9 2016 PM peak average travel times

Scenario	Eastbound		Westbound	
	M5 SW Motorway	Parallel route	M5 SW Motorway	Parallel route
Base	19.4	31.9	27.0	36.9
Project	17.5	31.1	20.5	3434.0
Per cent change	-9.8	-2.5	-24.1	-6.8

Table 8.10 2026 AM peak average travel times

Scenario	Eastbound		Westbound	
	M5 SW Motorway	Parallel route	M5 SW Motorway	Parallel route
Base	31.6	43.6	24.5	34.0
Project	24.5	40.7	18.9	31.8
Per cent change	-22.5	-6.7	-22.9	-6.5

Table 8.11 2026 PM peak average travel times

Scenario	Eastbound		Westbound	
	M5 SW Motorway	Parallel route	M5 SW Motorway	Parallel route
Base	24.7	34.8	36.6	43.0
Project	20.0	33.2	27.2	39.0
Per cent change	-19.0	-4.6	-25.7	-9.3

During the AM peak period, the travel time on the M5 South West Motorway eastbound between Camden Valley Way and King Georges Road is forecast to decrease from 22 to 18 minutes in 2016 and from 32 to 25 minutes in 2026. The AM eastbound travel time on the parallel route is forecast to decrease from 38 to 36 minutes in 2016, and from 44 to 41 minutes in 2026.

The M5 South West Motorway eastbound travel speed between Camden Valley Way and King Georges would increase from 56 kilometres per hour to 67 kilometres per hour in 2016, and from 39 kilometres per hour to 50 kilometres per hour in 2026.

Feeder and cross-routes

In terms of feeder and cross-routes, modelling suggests a mixture of increases and decreases in traffic volumes. Across all links and in both directions a slight decrease in traffic is forecast on the feeder routes (around one per cent in the AM peak), which demonstrates that the project is unlikely to have an adverse effect on these routes.

A number of routes on the northern side of the motorway, including Moorebank Avenue, Heathcote Road, Henry Lawson Drive and River Road, are expected to experience an increase in traffic volumes travelling northbound during the AM peak. This indicates that a proportion of the additional traffic using the motorway following the widening would exit the motorway in advance of the M5 East in order to reach their destinations.

The modelling also indicates that traffic would adapt to the improved efficiency of the M5 South West Motorway, by way of shifting traffic movements between feeder routes and incorporating the motorway within their route. For example, there is expected to be a reduction in trips on Heathcote Road southbound and a corresponding increase in trips on Fairford Road and King Georges Road south of the motorway. This suggests a preference to travel further on the motorway prior to travelling south.

In terms of percentage changes, Heathcote Road (north of the motorway, southbound direction) would experience some increases but this would be in the context of the absolute traffic volumes being relatively small.

Total traffic flows through the intersection of feeder routes with the M5 South West Motorway would remain relatively unchanged despite some variation in directional flow volumes.

Induced traffic and mode shift

The project has the potential to induce additional traffic to use the road network, some of which may be diverted from other travel modes. There are two sources of potential additional traffic:

- Mode shift – people switching from public transport to private car.
- New trips – newly created trip opportunities.

The modelling process accounts for and incorporates induced traffic, the basic principle being that the provision of increased network capacity will improve the utility of travel (travel time, congestion and speed) and result in additional trip making. Mode shift was estimated by comparing public transport and private vehicle trip generation using the Sydney Travel Model.

Modelling indicates that the M5 West widening project would result in an increase in private vehicle trips of between 0.1–0.3 per cent from South West Sydney areas including Bankstown, Fairfield, Liverpool, Campbelltown, and Camden. Some of this is attributable to mode shift from public transport, which is estimated to drop by 0.2–0.8 per cent, depending on year and time of day.

Road safety

The project is not expected to significantly alter the road safety environment of the M5 South West Motorway. Lower levels of congestion may result in a reduction in congestion related accidents. More specifically, the provision of additional lanes may improve merging opportunities for vehicles entering the motorway.

Impacts on public transport

The potential for a mode shift away from public transport has been noted above and is considered marginal.

The improved travel speeds on the M5 South West Motorway can be expected to attract some traffic away from the parallel route. In turn, the reduced demand on that route, coupled with its own improved travel speeds, should improve conditions for buses using that route or crossing that route. Strategic bus corridors 28, 25, 31 and 33 would realise the most direct benefits. It is anticipated that travel speeds on the parallel route would increase by 6.7 per cent in the AM peak eastbound direction in 2026 with a corresponding reduction in traffic volumes of 5.6 per cent.

Reduced demand and travel times on the parallel route present an opportunity to implement bus priority measures that exploit this increased capacity.

The possibility of including a bus lane on the M5 South West Motorway was discussed in Chapter 4. This option was not pursued because longer distance public transport travel demand is better served by rail in this part of Sydney while the arterial road network, rather than the motorway, gives bus services better access to local travel demand.

Impacts on pedestrians and cyclists

The proposed widening of the M5 South West Motorway is not predicted to have any significant impacts on the safety, amenity and access needs of pedestrians and cyclists.

The proposed configuration of the motorway would maintain existing levels of access for pedestrians across the corridor. Pedestrians are not currently permitted on the motorway and this would not change. During construction, a traffic controller would generally be available to assist pedestrian movement in the vicinity of construction site compounds.

Similarly, the proposed configuration of the motorway would maintain existing levels of access for bicycles along the corridor and across the corridor. Existing connections to the motorway are adequate for cyclists who are comfortable cycling in close proximity to high-speed traffic and high volumes of traffic. However, the RTA's position is that cycling on motorway shoulders is only appropriate for experienced riders, and that these shoulders cannot form part of the general bicycle network (RTA, 2005).

The local councils surrounding the motorway have their own bicycle plans that address the needs of non-regular cyclists and are focused on providing recreational cycling and access to town centres, public transport and education for other bicycle riders.

Elements of the project beyond the M5 corridor, such as variable message signs, would be positioned so as to not impede the movement of cyclists.

8.1.5 Bicycle network integration and enhancement

As part of the assessment process, consideration was given to opportunities for cycleway and pedestrian network integration as well as enhancement (refer to Appendix E).

Due to the limited number of bicycle and pedestrian facilities provided within the M5 South West Motorway corridor, opportunities for integration are limited.

However, a number of opportunities to enhance cycleway and pedestrian pathways in areas surrounding the M5 South West Motorway were identified. Some of these are included in the RTA's Bicycle Program and are either under construction or have funds allocated for their completion in the coming years. Others will be considered for inclusion in the program.

The RTA's Bicycle Program assists councils across NSW to plan, develop and fund the delivery of new cycleway infrastructure, and the upgrading of existing bicycle facilities. It assists with the implementation of the 2010 NSW Bike Plan. A program of actions identifying priorities for cycleway works in Liverpool, Bankstown and Canterbury are identified with necessary funding identified for the next 10 years. Projects within the Bicycle Program do not form part of the M5 West widening project and would be the subject of separate environmental assessment and approval processes.

Programmed improvements
Enhancement opportunities that are or will be progressed by the RTA are outlined below:

- There is an existing path for westbound cyclists exiting the M5 South West Motorway at the Hume Highway. Pedestrian access is currently restricted by signage and there are no linked facilities on the eastern end of the bridge. At its western end, the bridge links to a path looping back towards the rail line, which provides the potential for a link to the proposed shared path running along the rail line (see below). This link is funded and due to begin construction around July 2011.

- There is a proposed shared path along the rail line between Liverpool and Casula railway stations. This route is identified as a priority subregional route in the NSW Bike Plan. The route has funding and construction is due to begin in July 2011. It will provide an important off-road crossing of the M5 South West Motorway and could be also be linked to the abovementioned route which crosses the Georges River on the motorway bridge.
- There is a shared-use path along the southern side of Camden Valley Way between the M5 South West Motorway ramps. The RTA is funding this with construction occurring in 2010/11. The work includes the installation of bicycle crossing lights for each of the existing signalised crossings.
- There is a shared-use path along the north-eastern side of Heathcote Road from Newbridge Road, Moorebank to Nuwarra Road, Holsworthy.
- An upgrade of the existing path along the eastern side of Henry Lawson Drive between Kelso Park and Hermies Avenue was funded by the Australian Government in 2010.
- Bankstown Council has upgraded the pedestrian and bicycle access north of Hermies Avenue, Milperra with 2009–10 funding from the RTA.

8.1.6 Potential impacts of an M5 East expansion

While there is currently no commitment to proceed with an expansion of the M5 East and construction funding has not been allocated, options to increase the capacity of the M5 East are being considered. To understand the possible impact of an M5 East expansion on a widened M5 South West Motorway, additional modelling was undertaken. The assumptions underpinning the modelling are detailed at section 9.1 of the traffic and transport working paper (Appendix E).

The modelling indicates that with the M5 East expansion, increases in traffic on the motorway would be principally confined to the eastern section where the expansion occurs, with additional traffic entering and leaving at the Fairford Road and King Georges Road interchanges. Table 8.12 shows that increases in volumes further west at the Hammondville toll plaza are expected to be marginal.

Table 8.12 Hammondville toll plaza volumes – M5 West widening and M5 East expansion

Scenario[1]	Eastbound			Westbound		
	Project	With M5 East	% change	Project	With M5 East	% Change
2016 AM	3960	4010	1	4170	4150	0
2016 IP	2800	2790	0	2960	2930	-1
2016 PM	3850	3860	0	4970	4980	0
2026 PM	4930	4980	1	4840	4830	0
2026 IP	3680	3760	2	3950	3980	1
2026 PM	4620	4690	2	5840	5850	0

1. IP – inter peak

The longer distance trips covering the entire length of the M5 corridor, including the M5 South West Motorway, are substantially captive to the motorway due to the slower alternative routes. It is therefore not expected that increasing the capacity of the M5 East would attract a large number of long distance trips.

Additional details regarding the modelling analysis of the M5 East expansion are included at Chapter 9 of the traffic and transport working paper (Appendix E).

8.1.7 Management of impacts

Construction phase

The following measures would be undertaken to manage impacts on traffic and transport during construction:

- A traffic and transport liaison group would be established prior to commencement of construction. The traffic and transport liaison group would be consulted during preparation of the construction traffic management plan.
- A construction traffic management plan would be developed, approved, implemented and monitored as part of the project. The construction traffic management plan would focus on maintaining general traffic flow and providing appropriate site accesses and construction traffic routes. It would also specify:
  - Access routes and signage.
  - Hours of operation, including prohibitions on queuing outside sites prior to commencement of working hours.
  - Special control arrangements (such as warning signs or lights) at site accesses.
  - Road safety audit requirements.
  - Any localised improvements/adjustments to existing traffic management arrangements.
- Detailed site access arrangements would be developed for each construction site with the objective of minimising traffic impacts on local streets and maximising the use of arterial roads. Site access arrangements would be developed based on detailed investigation and analysis of road traffic conditions and consider the following:
  - Preference for the motorway network, arterial roads and other higher order roads.
  - Restrictions on size and load of vehicles for local roads.
  - Location of sensitive areas especially schools, hospitals, places of worship, businesses.
  - Hours of activity at sensitive sites.
  - Access needs for residents, pedestrians, emergency services and buses.
  - Impact of out-of-hours works on residential areas.
  - Consultation with Traffic and Transport Liaison Group, residents and sensitive communities.
  - Relevant documents and standards such as the RTA *Guide to Traffic Control at Worksites* and Australian standards.
- Existing motorway lane numbers would be maintained during the daytime and AM peak, inter-peak and PM peak periods. Where lane capacity is affected based on lane width, measures to minimise this impact, including adequate advanced warning signs, would be implemented where practicable.
- Shuttle vehicles would be utilised to transport construction staff between nominated parking locations, public transport points and the construction sites to promote public transport use and minimise construction vehicle movements at and between worksites.
- Where there is possible interaction between construction traffic and pedestrians (e.g. at worksites and construction site compound access points) traffic controllers would be employed to ensure safe passage.
- During the construction phase, access for bicycles along the motorway would be maintained, with the exception of times when work is being undertaken in the shoulder. This work would be limited and involve temporary diversions or stop/go conditions under traffic control.

8.2 Noise and vibration

Director General's requirements	Where addressed
Noise and vibration – the Environmental Assessment must address the noise impacts of the project during operation, consistent with the *Environmental Criteria for Road Traffic Noise* (EPA, 1999). The assessment must include specific consideration of impacts to receivers (dwellings, child care centres, educational establishments, hospitals, motels, nursing homes, or places of worship), as relevant and identify reasonable and feasible mitigation measures. The assessment must address construction noise and vibration impacts, consistent with the *Interim Construction Noise Guideline* (DECCW, 2009) and *Assessing Vibration: a technical guideline* (DEC, 2006).	Section 8.2.3, 8.2.3 and 8.2.4
The assessment must have regard to the nature of construction activities (including transport, tonal or impulsive noise-generating works and the removal of operational noise barriers, as relevant),	Section 8.2.3 Appendix F
the intensity and duration of noise and vibration impacts, the nature, sensitivity and impact to potentially affected receivers,	Section 8.2.3 Appendix F
the need to balance timely conclusion of noise and vibration-generating works with periods of receiver respite, and other factors that may influence the timing and duration of construction activities (such as traffic management).	Section 6.2, 8.2.1, 8.2.4
The assessment should present, as relevant, an indication of potential for works outside standard working hours, including predicted levels and exceedences, justification for the activity and	Section 8.2.1 Section 8.2.3
discussion of available mitigation and management measures.	Section 8.2.4

8.2.1 Assessment approach

This section presents an assessment of noise and vibration impacts identified for the project's construction and operation phases. A detailed Noise and Vibration working paper has been prepared and is provided at Appendix F. The construction phase assessment considers the proposed construction scope outlined in Chapter 6, including the indicative construction program discussed in section 6.2. The assessment has been carried out based on the following guidelines published by the NSW Department of Environment & Climate Change (DECCW) (or its predecessors):

- Interim Construction Noise Guideline (DECC 2009).
- Assessing Vibration: a technical guideline (DEC, 2006).
- Environmental Criteria for Road Traffic Noise (EPA, 1999).

The RTA's Environmental Noise Management Manual (RTA, 2001a) was used to assist in the implementation of the DECCW's Environmental Criteria for Road Traffic Noise.

An assessment of predicted noise for the project has been conducted in three parts: noise impacts during operation, noise impacts during construction, and impacts from construction vibration.

Operational road traffic noise assessment

Noise criteria

Under the Environmental Criteria for Road Traffic Noise, road developments are classified as either 'new road' or 'redevelopment of an existing road'. The M5 West widening project is classified as a redevelopment of an existing freeway/arterial road and the criteria set out in Table 8.13 therefore apply.

Table 8.13 Environmental criteria for operational road traffic noise – residences

Type of development	Noise level criterion (base criteria)		Where criteria are already exceeded (allowance criteria)
	Day (7am –10pm)	Night (10pm – 7am)	
Redevelopment of existing freeway/arterial road	$L_{Aeq, 15hr}$ 60 dBA	$L_{Aeq, 9hr}$ 55 dBA	In all cases, the redevelopment should be designed so as not to increase existing noise levels by more than 2 dB. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In many instances this may be achievable only through long-term strategies.

Where the base criteria are already exceeded, the RTA's Environmental Practice Note 24 'Noise assessment for acute levels of noise – redevelopment of existing roads' confirms the following:

'Application of all feasible and reasonable noise mitigation to aim to achieve the ECRTN noise criteria where, following a road redevelopment there is predicted to be a noticeable increase in road traffic noise, or road traffic noise levels are predicted to be acute.'

The RTA also has a Noise Abatement Program for existing roads where road traffic noise levels are very high and are considered excessive for noise-sensitive land uses. Noise affected sites are not currently given priority for noise treatment unless road traffic noise levels are at least 65 dBA (daytime – 7am to 10pm) or 60 dBA (night time – 10pm to 7am). These noise levels are termed acute noise levels.

In addition to residential receivers, a number of non-residential noise-sensitive receivers are located within the general project area. The road traffic noise criteria for these receivers (as per the Environmental Criteria for Road Traffic Noise) are provided in Table 8.14.

According to the Environmental Criteria for Road Traffic Noise, there are no universally accepted criteria governing the likelihood of sleep disturbance. The Environmental Criteria for Road Traffic Noise recommends that the assessment of sleep disturbance should include a consideration of the maximum noise level exceedances occurring during the night-time period and the emergence of these exceedances above the ambient noise level. The RTA's Environmental Noise Management Manual says that the assessment of sleep disturbance should include an examination of 'maximum noise events'. A 'maximum noise event' is defined as any single event where the L_{Amax} noise level exceeds 65 dBA and exceeds the $L_{Aeq,1hr}$ noise level by more than 15 dBA.

Table 8.14 Environmental criteria for operational road traffic noise – non-residential sensitive land uses

Type of development	Noise level criterion		Where criteria are already exceeded
	Day (7am – 10pm)	Night (10pm – 7am)	
Places of worship	$L_{Aeq, 1hr}$ 40 dBA (internal)	$L_{Aeq, 1hr}$ 40 dBA (internal)	To achieve internal noise criteria in the short term, the most practical mitigation measures are often related to building or facade treatments. Where existing levels of traffic noise exceed the criteria, all feasible and reasonable noise level control measures should be evaluated and applied. Where this has been done and internal and external criteria cannot be achieved, the proposed road should be designed so as not to increase existing traffic noise levels by more than 2 dB.
Hospital wards	$L_{Aeq, 1hr}$ 35 dBA (internal)	$L_{Aeq, 1hr}$ 35 dBA (internal)	
Existing school classrooms	$L_{Aeq, 1hr}$ 45 dBA (internal)	–	
Active recreation (eg golf courses)	Freeways and arterial roads $L_{Aeq, 15hr}$ 60dBA	–	

Due to the absence of definitive qualitative correlation between sleep disturbance and noise level, the Environmental Noise Management Manual says that the nominated noise levels and guidelines should not be taken to be criteria, but should be taken into consideration when prioritising noise mitigation measures to address general road traffic noise.

Methodology
The Environmental Criteria for Road Traffic Noise states that noise levels are to be assessed based on traffic volumes projected at the point in time 10 years after the opening of the project. The M5 West widening project is scheduled to open in 2013, so the future assessment year applicable to this project is 2023.

Detailed noise calculations have been carried out for three different scenarios:

- Existing scenario (Year 2009) – noise levels have been modelled to allow for validation of the noise model against noise survey results from 2009.
- Future existing scenario (Year 2013) – noise levels have been modelled with traffic forecast for 2013, but without the proposed widening.
- Future design scenario (Year 2023) – noise levels have been modelled with traffic forecast for 10 years after opening, with the proposed widening in place.

The future design scenario allows for natural growth in traffic volumes based on development affecting the region and also allows for the operation of the proposed M5 East expansion project. This ensures that the noise assessment represents the most conservative scenario for traffic figures.

Traffic volumes used to inform the noise model are outlined in more detail in section 8.2.1 of Appendix F, and examine the difference in approach for traffic and noise modelling based on traffic forecasts.

Section 8.2.3 of Appendix F indicates that typical noise reduction benefits associated with the introduction of an open-grade asphaltic concrete road surface would be about 2.5 dBA. The existing M5 South West Motorway is currently surfaced with open-grade asphaltic concrete. However, with degradation over time and lack of surface maintenance, the surface is likely to have become clogged and have a lower (or no) acoustic benefit. Although it is proposed to re-surface the existing main carriageways with open-grade asphaltic concrete, as a conservative measure any acoustic benefit associated with this surface type has not been incorporated into the noise model and the -2.5 dBA pavement correction for open-grade asphaltic concrete has been limited to new pavement areas even though the existing pavement would also be resurfaced. Based on this assessment methodology, the noise assessment is therefore considered to be conservative in its approach and results.

Construction noise assessment

The assessment of construction noise is considered in terms of noise from construction works within the road reserve, noise from construction site compounds, noise from construction traffic and access to construction site compounds and noise from construction of the operations management control system building and variable message signs.

For each of these distinct assessments, noise management levels have been set based either on results from background noise monitoring or relevant guidelines.

The overall assessment has been made by categorising the background noise levels within different 'noise catchments' along the corridor. This has been used to develop a rating background level and noise management level in accordance with the procedure outlined in the DECCW's Interim Construction Noise Guideline.

Construction hours

The noise guideline recommends that standard construction work hours should typically be as follows:

- Monday to Friday – 7.00am to 6.00pm.
- Saturday – 8.00am to 1.00pm.
- No work on Sundays or public holidays.

Due to the nature of the construction of the project, works would be required outside of standard hours to minimise the effects on traffic during the daytime peaks. Other factors that may influence the timing and duration of construction activities are identified in section 6.2 and where re-scheduling of works is required, consideration would be given to the need to balance the timely conclusion of noise and vibration-generating works with periods of receiver respite.

An assessment of the potential for exceedences of noise management levels at night is contained in section 8.2.3. A number of mitigation strategies to reduce construction noise at night are outlined in section 8.2.4.

Management levels

The assessment of construction noise has separated the construction activities that would occur within the road reserve from the noise impacts predicted to occur from the operation of construction site compounds. It has also separated the noise impacts predicted to occur as a result of construction traffic and access to the construction site compounds and works areas.

Table 8.15 Quantitative construction noise management levels at residences

Time of day	Management level $L_{Aeq\ (15\ min)}$	How to apply
Recommended standard hours: • Monday to Friday 7am to 6pm • Saturday 8am to 1pm • No work on Sundays or public holidays	Noise-affected (RBL[1] + 10 dBA)	The noise-affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise-affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise-affected (75 dBA)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.
Outside recommended standard hours	Noise-affected (RBL + 5 dBA)	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise-affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise-affected level, the proponent should negotiate with the community.

1. The rating background level (RBL) is a measure of background noise defined in the DECCW's Industrial Noise Policy. It is the median value of the assessed (measured) background noise level values for the full period background noise was measured. There is a rating background level for daytime, evening and night-time periods.

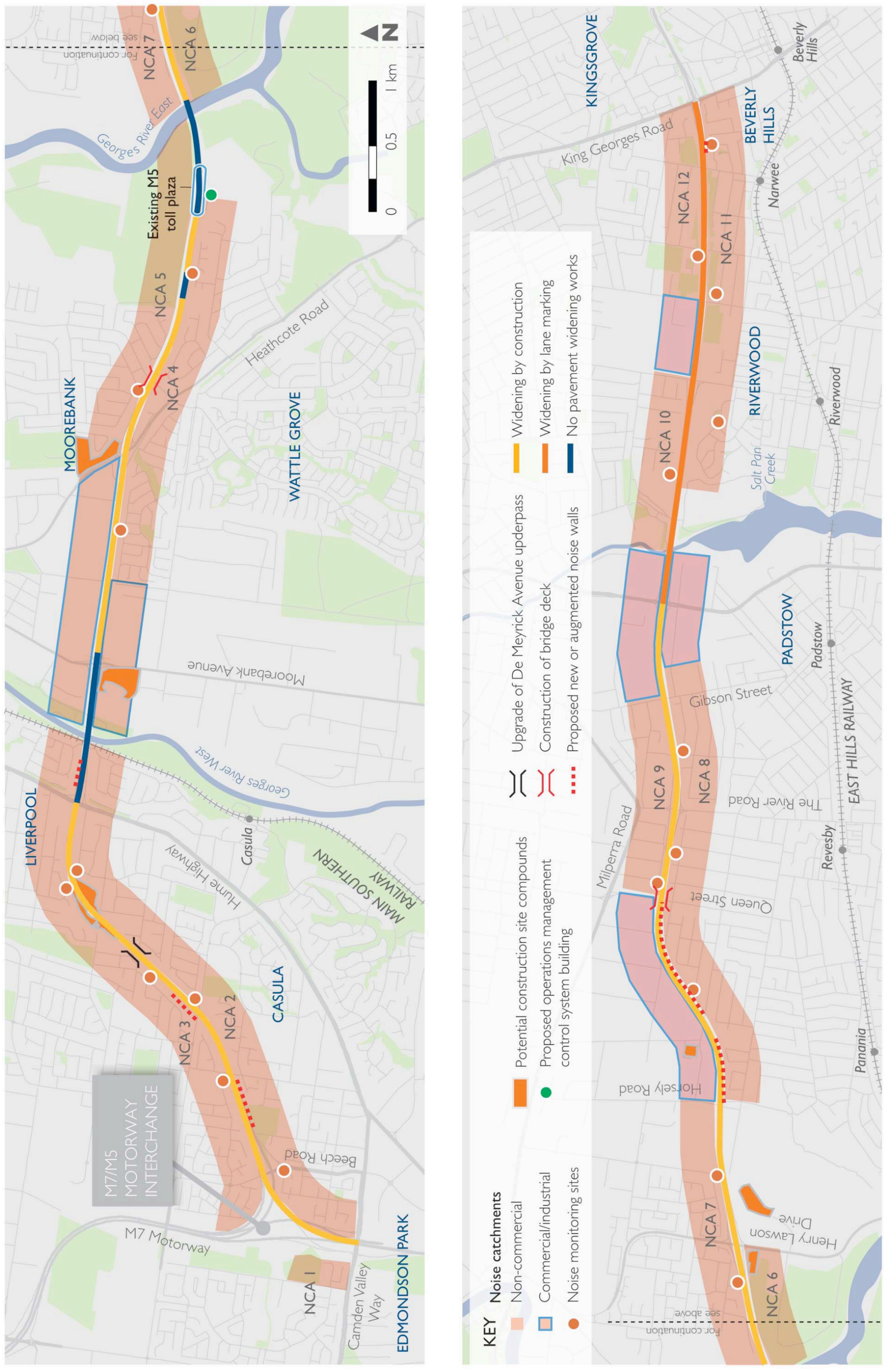
Noise catchment areas

Noise catchment areas for the assessment of both operational and construction noise impacts were developed based on factors including geographical location, level of noise exposure, and ambient noise at monitoring locations along the alignment (ambient noise levels were measured in 2009). The noise catchment areas are listed in Table 8.16 and shown in Figure 8.6.

Table 8.16 Noise catchment areas

Noise catchment area	Noise catchment code[1]	Description
1	CVW_M7_W	Camden Valley Way to M7 west of the M5 South West Motorway. This is a residential area and includes a sports oval to the north of the area.
2	CVW_HH_S	Camden Valley Way to east of Hume Highway intersection, on the southern side of the motorway. Mainly residential and includes Daruk Park, located some 100 metres from the motorway.
3	M7_HH_N	Westlink M7 to east of Hume Highway intersection, on the northern side of the motorway. Mainly residential and includes Preston Public School.
4	MA_HLD_S	West of Moorebank Avenue to the Hammondville Toll Plaza, south of the motorway. Residential area and includes Hammondville Public School.
5	HR_HLD_N	Heathcote Road to New Brighton Golf Club, north of motorway. Residential area and includes the Brighton Golf Club at the eastern end.
6[2]	HLD_S	West of Henry Lawson Drive, south of motorway. This catchment contains Blue Gum Zoo.
7	HLD_HR_N	West of Henry Lawson Drive to Horsely Road, north of motorway. This catchment is mainly residential and includes the University of Western Sydney at its eastern end.
8	HR_FR_S	Horsley Road to Fairford Road, south of motorway. This catchment is made up of residential receptors and also includes Panania North Public School.
9	QS_GA_N	From Queen Street to the west of The River Road, to Gibson Avenue, to the east of The River Road, north of the motorway. This catchment is mainly residential, but also includes Sir Joseph Banks Public School.
10	FR_BR_N	Area east of Fairford Road and west of Belmore Road, north of the motorway. This catchment is residential, broken by a pocket of industrial. Mclaughlin Oval is located on the western end.
11	BR_KGR_S	West of Belmore Road to King Georges Road, south of the motorway. This catchment is mainly residential and contains the active recreation area in Rotary Park.
12	BR_KGR_N	East of Belmore Road (Bonds Road) to King Georges Road, north of motorway. Mainly residential but also includes Wise Reserve at the western end.

1. The code comprises the initial letter of the two nearest crossing roads (generally confined to major roads) separated by an underscore, followed by 'N' or 'S' representing whether the catchment is north or south of the motorway. For example, CVW_M7_W means the area between Camden Valley Way and the M7 Motorway to the West of the M5 South West Motorway.
2. Noise catchment area six, around Blue Gum Farm Zoo and adjacent to Henry Lawson Drive in Milperra, is included for consistency of mapping. However, this business no longer operates and, as such, there are no receivers in the area, so it has been excluded from subsequent noise modelling.



Note: Project detail shown is indicative only, subject to detailed design

Figure 8.6 Noise catchments