Figure 9-1 – Link Volume Difference Plot (2026 AM Peak Average Hour) – Test Case vs Base Case

Compared to Base Case there are significant traffic increases on both M5 West and M5 East after including the two upgrade projects. The forecasts show that in 2026, the peak direction traffic volumes at M5 West (Hammondville Toll Plaza) and M5 East (West of Marsh Street) would increase by 25 – 29% and 39 – 54% respectively. Where there is little or no increase shown in the results, this is generally the counter peak direction which was operating with spare capacity prior to the Test Case and accordingly had captured all users wanting to use the motorway.

It is noted that the relief is greater to the east due mainly to the quantum increase in capacity i.e. doubling of lane capacity in each direction.

To evaluate the net impact of the M5 East duplication, a comparison is made between the Project Case (M5 West widening) and the Test Case (M5 West Widening plus M5 East Duplication). The results are detailed in Table 9-3 and Table 9-4 and the traffic volumes changes illustrated in Figure 9-2.

Table 9-3 M5 Hammondville Toll Plaza Volume – Test Case vs Project Case

Scenario	Eastbound				Westbound			
	Project	Test	Diff	% Diff	Project	Test	Diff	% Diff
2016 AM	3,960	4,010	50	1%	4,170	4,150	-20	0%
2016 IP	2,800	2,790	-10	0%	2,960	2,930	-30	-1%
2016 PM	3,850	3,860	10	0%	4,970	4,980	10	0%
2026 AM	4,930	4,980	50	1%	4,840	4,830	-10	0%
2026 IP	3,680	3,760	80	2%	3,950	3,980	30	1%
2026 PM	4,620	4,690	70	2%	5,840	5,850	10	0%

Table 9-4 M5 West of Marsh Street Volume – Test Case vs Project Case

Scenario	Eastbound				Westbound			
	Project	Test	Diff	% Diff	Project	Test	Diff	% Diff
2016 AM	3,520	4,670	1,150	33%	3,290	3,290	0	0%
2016 IP	2,910	3,100	190	7%	3,080	2,920	-160	-5%
2016 PM	2,950	3,200	250	8%	3,290	3,770	480	15%
2026 AM	3,480	5,400	1,920	55%	3,230	3,460	230	7%
2026 IP	3,020	3,810	790	26%	3,220	3,810	590	18%
2026 PM	3,000	3,600	600	20%	3,500	4,890	1,390	40%

Figure 9-2 – Link Volume Difference Plot (2026 AM Peak Average Hour) – Test Case vs Project Case

In the Test Case, the additional traffic to the motorway is principally confined to the eastern section where the duplication occurs. The modelling results show that in 2026, the peak direction traffic volumes at M5 East (West of Marsh Street) would increase by 40 – 55% respectively. Additional traffic would access the M5 East through Fairford Road and King Georges Road interchanges. This is illustrated in Figure 9-3 which shows origins and destinations of the additional users of M5 East.

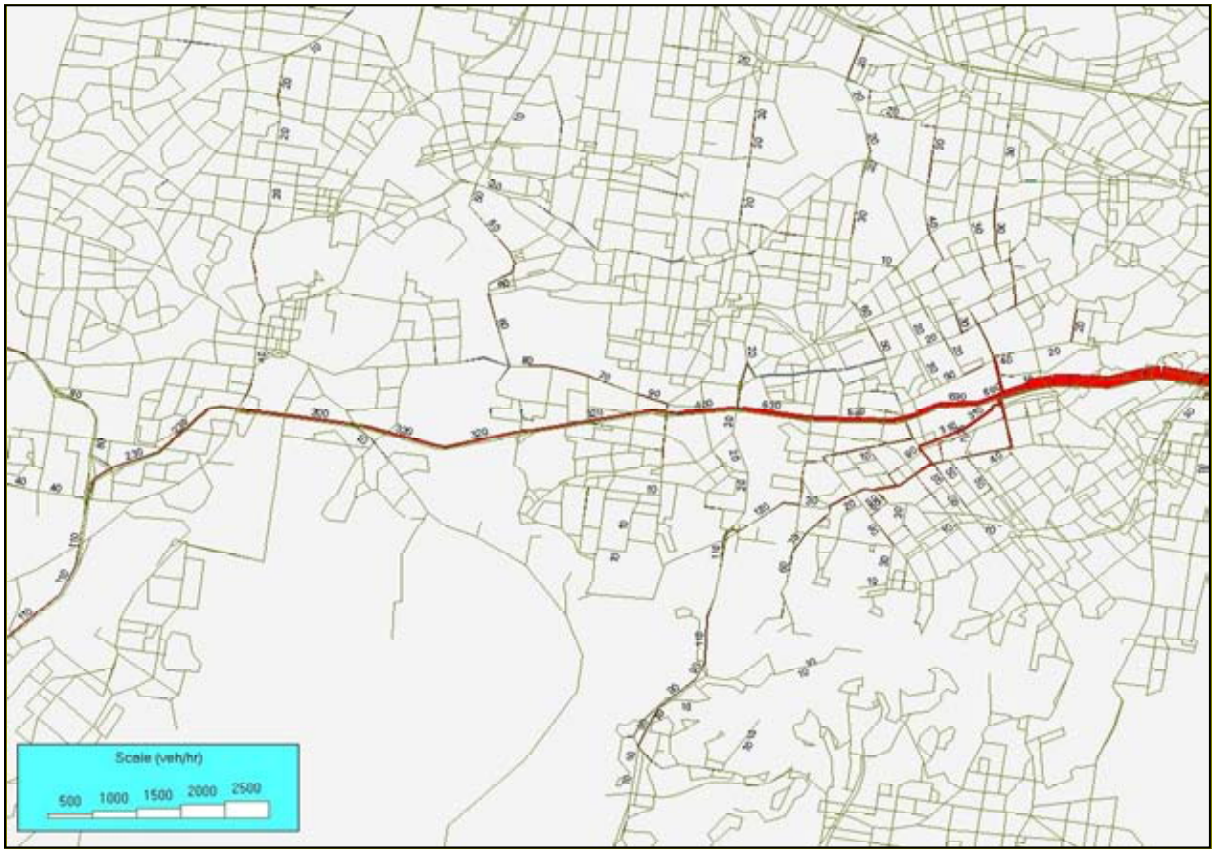


Figure 9-3 – Additional M5 East Users with M5 East Duplication (2026 AM Peak Average Hour)

This analysis may not seem intuitive as there may be an expectation that M5 East Duplication should draw a larger proportion of the additional traffic along the entire system. However the nature of the test case shows:

- While the M5 East doubles in lane capacity, going from two lanes in each direction to four, the M5 west of King Georges Road is three lanes in each direction. This provides the M5 East with additional capacity that would need to be drawn to/from from King Georges Road and Kingsgrove Road if M5 East were to run near capacity.
- Longer distance trips travelling the entire length of the corridor are substantially captive to the motorway due to the much slower alternate routes. Hence widening the eastern section would only attract few additional long distance trips. Long distance users are captive to the motorway despite the fact that there would be high

levels of congestion without the M5 East duplication. The congestion merely diverts the short length trips.

9.4 Summary

The M5 West widening and M5 East duplication are reasonably independent projects, both having significant benefits in their own right.

The M5 East duplication would slightly enhance the benefits of the M5 West widening, with small increases in through traffic; The M5 West Widening Project relieves the Alternative Route (Newbridge/Milperra/Canterbury Road) while the M5 East duplication picks up additional trips moving between King Georges Road and the Airport/Port Botany.

Longer distance trips which are captive to the motorway and currently experience congestion and delay, would benefit from improved travel times and less congestion delays during peak period.

10 Construction Impacts

10.1 Introduction

This section presents the assessment of impacts during scheme construction.

The proposed construction plan is detailed in the M5 West Widening EA Design Input Update dated April 2010 produced by Interlink.

10.2 Construction Activity

The principle adopted is that, wherever possible, the existing number of lanes will be maintained throughout construction. There is likely to be an 80km/h construction speed limit in operation for the duration of the works.

With regard to the works, in principle, there are three main construction treatments, these being:

- King Georges Road to Fairford Road (westbound) - the existing carriageway in this section of the motorway is of adequate width to provide additional lanes. Works would include mill and resheet of the existing carriageways, construction of a central safety barrier, pier protection for existing overbridges, line marking to suit the new lanes configuration and OMCS works.
- Fairford Road to Camden Valley Way - in the areas where widening into the median is being undertaken, the civil engineering works involve the removal of vegetation from the central median, modifications to the drainage system, construction of new pavements for the additional traffic lanes and the construction of a central safety barrier and pier protection for existing overbridges. Where bridge works are required they would include piling, construction of concrete structures, installation of precast concrete planks, demolition of existing parapets, construction of approach slabs and installation of bridge joint.
- Upgrading of the DeMeyrick Road Bridge

The works will also include:

- Localised widening works at around 9 locations identified where sections of the route totalling 5km will require widening on the outside of one or both sides of the motorway
- OMCS trunk cabling and variable message signing
- Sedimentation ponds
- Noise barriers, and
- Control building construction.

10.3 Staging of Works

In general, the works would be broken up into two distinct types, the side works and the central median works. Along the majority of the motorway route, both central median and side works are to be carried out during the course of the widening. The approach is to only work in one section at any one time, such that when side works are being performed in one section, no central median works would be performed in that section and vice versa.

At any one time along the entire 22km motorway route, it is anticipated that there would be four to six construction work sections; two to three in the median and two to three at the motorway edge. Each work section would be approximately 4-5 km in length and it is expected that approximately 10 km of central median works and 10km of side works would be under construction.

It is the intention is to undertake the construction works in a number of packages across the following construction periods namely:

Table 10-1 Staging of Works

Section	Duration (months)
King Georges Road to Belmore Rd	6
Belmore Rd to Fairford Rd	7
Fairford Rd to The River Rd	11
The River Rd to Henry Lawson Dr	27
Henry Lawson Dr to East of Toll Plaza Area	7
Toll Plaza Area	3
West of Toll Plaza Area to Heathcote Rd	9
Heathcote Rd to East of Moorebank Ave	10
East of Moorebank Ave to East of Hume Hwy	4
East of Hume Hwy to Camden Valley Way	16

10.4 Works with Safety and Congestion Issues

The M5 South West Motorway is one of the busiest roads in Sydney, carrying over 90,000 vehicles per day. Constructing the project under traffic is a complex task which would involve lane closures and even full carriageway closures for asphalting works.

Closing lanes during peak periods would result in significant traffic disruption at the worksite and along the entire motorway. In addition, congestion on the M5 South West Motorway increases the risk of traffic incidents and often has a flow on effect of causing congestion on the orbital network, increasing the risk of secondary incidents across the motorway network. It is therefore considered appropriate to undertake primarily night works given the large number of people that would be affected by daytime traffic disruption.

Working on busy roads such as the M5 South West Motorway can pose safety risks to both construction personnel and the users of the roads if appropriate measures are not put in place. Construction works associated with roads often require temporary modification to existing lane alignments and other traffic control measures which are different to the usual conditions experienced by road users at these locations.

Temporary arrangements increase the potential for traffic incidents that could affect the safety of construction personnel and other the road users. As such, certain activities are proposed at night-time to address these safety concerns. Some of these works involve short-term activities such as making appropriate changes to the lane alignment and other intersection features. Other short term activities include the installation of safety

barriers to provide adequate work clearance for construction personnel and safety for road users. Safety barriers also enable works to be undertaken during the daytime that would otherwise need to be undertaken at night.

In addition, some construction activities must be undertaken over a specified time period to achieve design parameters. Such works including bridge deck pours connecting existing bridges to new bridges, asphalt overlay works and lean mix concrete pours. These works cannot be interrupted without compromising quality.

10.5 Working Hours

In general the standard working hours on site would be between 7 am and 6 pm from Monday to Friday and between 8 am and 1 pm on Saturdays. While the majority of the Project could be constructed during these standard construction hours, a number of construction activities would need to be undertaken at night.

These night works are required for a number of reasons including safety, design and quality considerations and to avoid substantial traffic delays. The likely night time operations for the Project include:

- Any works requiring lane closures
- Removal of existing traffic barriers and installation of temporary and permanent traffic barriers.
- Removal of existing line marking and new line marking.
- Removal of existing static signage and installation of new signs.
- Road re-surfacing of the existing open grade asphalt pavement.
- Ramp tie in works.
- Some bridge works including piling for abutments, construction of piers, and installation of structures such as girders and concrete deck works and drainage works.
- Some concreting works.
- Some OMCS works including trenching which requires lane closures and lifting the sign into place.
- Use of some construction site compounds.
- The delivery of plant and materials which is required outside these hours as requested by Police or other authorities for safety reasons.

- Any works which do not cause noise emissions to be audible at any sensitive receptor.
- Emergency work to avoid the loss of lives, property and/or to prevent environmental harm.

The Interlink report summarises the night time /day time tasks follow.

Table 10-2 Breakdown of Day Time / Night Time Works

Daytime Operations	Night Time Operations
Bridge works – day time	Saw Cutting
Clearing and grubbing	Traffic control
Concrete works	Removal of existing linemarking
Drainage works	Linemarking
Earthworks	Temporary safety barriers
Landscaping and vegetation	Concrete works
Noise walls construction	Paving
OMCS works	Mill and resheet
Pavement construction	Signs installation
Sedimentation basins works	Bridge works – night time
	Removal of wire rope barrier

The proposed works would result in changes in traffic flows which would be experienced in a number of ways:

- Additional traffic generated by the construction sites or work compounds. Construction traffic is the most consistent impact of those listed above. The management of the traffic generated by the construction work sites is discussed in detail below.
- Temporary closure of existing roads. Any necessary closures would be supported by a full construction traffic management plan which would need to be approved formally by RTA.
- Temporary diversion of existing traffic from the construction of the Project works. Any necessary temporary diversions would need to be supported by a full construction traffic management plan which would need to be approved formally by RTA.
- Preparation for the temporary measures

10.6 Construction Site Compounds

As the widening works would be constructed under traffic, there would be limited opportunities to locate construction site compounds on the motorway. It would be necessary to establish compounds at locations as close as possible to the motorway corridor. Such compounds would provide support to work sites and uses would comprise the following:

- Offices including meeting rooms, reception and general administration area, amenity, first aid facilities and parking areas.
- Materials lay-down including storage of plant, equipment and tools and material storage areas including stockpiling.
- Site compound fencing and a hardstand for buildings and car parking.
- Access to construction compounds would be via the motorway and the arterial road network where possible to minimise impacts on local roads.

The proposed compound locations are discussed in more detail below. The tables include descriptions of the sites, the likely main access route into the compound and the volume of daytime and night time traffic that might be generated. The subsequent tables then undertake a brief assessment of the impact of this generated traffic.

Table 10-3 Construction Site Compound Details

Compound	Location	Approx size (m^2)	Proposed use	Proposed Local Street Route to access motorway/arterial roads	Average daily traffic movements*		Night Time Traffic Movements	
					Light	Heavy	Light	Heavy
Moorebank Ave (24 hour use)	Near 175-209 Moorebank Ave, Moorebank	46,750	Main office	Access directly from Moorebank avenue	180	40	50	10
M5/Graham Ave – 1 (24 hour use)	Near 59-79 Graham Ave, Casula	17,930	Satellite office,	Access from M5 motorway	30	10	10	15
M5/Graham Ave - 2	Near 81 Graham Ave, Casula	6,170	Satellite office Materials laydown	Access from either Graham Ave, Liverpool St or possibly M5 motorway	10	10	N/A	N/A
M5/Graham Ave - 3	Near 85A Graham Ave, Lurnea	10,900	Satellite office, Materials laydown	Access from Graham avenue	10	10	N/A	N/A
Bransgrove Road (24 hour use)	Bransgrove Rd, Panania	29,940	Satellite office, Materials laydown	Access from Henry Lawson Drive into Bransgrove Rd	20	20	10	10
Henry Lawson drive	Near 450 Henry Lawson Dr, Milperra	12,000	Satellite office, Materials laydown	Access from Henry Lawson Drive and possibly from M5 motorway on ramp	10	10	N/A	N/A
Beaconsfield Road (24 hour use)	Near 68 Marigold St, Milperra	3,000	Main office Materials laydown	Access via either Milperra Rd or Beaconsfield rd into Marigold St	90	40	10	10
North side of Heathcote road	Corner of M5 on ramp and Heathcote Rd, Moorebank	3,000	Materials laydown	Access/egress from South bound Heathcote Rd. Possible egress on to M5 on ramp	20	10	N/A	N/A

*Note: Average vehicle movements relates to round trips (i.e. one movement relates to a particular vehicle arriving at and departing from a particular site compound.

Details about the location of each of the sites are provided in Table 10-4 and Table 10-5.

Table 10-4 Location of Proposed Construction Compounds (1 of 2)

Name	Location	Map	Impact
Moorebank Ave (24 hour use)	Near 175-209 Moorebank Ave, Moorebank		This will be the busiest of all of the worksites. Access will be achieved directly from Moorebank Avenue. Daytime traffic will peak at around 15 light vehicle traffic movements per hour and there may be 3 heavy vehicles. At night there might be 4 light vehicles per hour and there may be 1 heavy vehicle.
M5/Graham Ave – 1 (24 hour use)	Near 59-79 Graham Ave, Casula		Access will be achieved from the M5 motorway and Graham Avenue. Daytime traffic will peak at around 2-3 light vehicle movements per hour and there may be 1 heavy vehicle per hour. At night there might be 1 light vehicle per hour and there may be 1 heavy vehicle per hour.
M5/Graham Ave - 2	Near 81 Graham Ave, Casula		Access will be achieved either from Graham Ave, Liverpool St or possibly the M5 Motorway Daytime traffic will peak at around 1 light vehicle movement per hour and there may be 1 heavy vehicle per hour. This is not a 24 hour a day site so there will be no vehicles overnight.
M5/Graham Ave - 3	Near 85A Graham Ave, Lurnea		Access will be achieved from Graham Avenue Daytime traffic will peak at around 1 light vehicle movement per hour and there may be 1 heavy vehicle per hour. At night there might be 1 light vehicle per hour and there may be 1 heavy vehicle per hour.
Heathcote Road	Near 152 Heathcote Rd, Hammondville		Access will be achieved from Heathcote Road directly into the compound with possible access from Anzac Rd Daytime traffic will peak at around 1/2 light vehicles movement per hour and there may be 1 heavy vehicle per hour. This is not a 24 hour a day site so there will be no vehicles overnight. At night there might be 1 light vehicle per hour and there may be 1 heavy vehicle per hour.
Bransgrove Road (24 hour use)	Bransgrove Rd, Panania		Access will be achieved from Henry Lawson Drive into Bransgrove Rd. Daytime traffic will peak at around 1/2 light vehicle movements per hour and there may be 1 heavy vehicle per hour. At night there might be 1 light vehicle per hour and there may be 1 heavy vehicle per hour.

Table 10-5 Location of Proposed Construction Compounds (2 of 2)

Name	Location	Map	Impact
Bransgrove Road (24 hour use)	Bransgrove Rd, Panania		Access will be achieved from Henry Lawson Drive into Bransgrove Rd. Daytime traffic will peak at around 1/2 light vehicle movements per hour and there may be 1 heavy vehicle per hour. At night there might be 1 light vehicle per hour and there may be 1 heavy vehicle per hour.
Henry Lawson Drive	Near 450 Henry Lawson Dr, Milperra		Access will be achieved from Henry Lawson Drive and possibly by use of the M5 motorway on ramp Daytime traffic will peak at around 1 light vehicle movement per hour and there may be 1 heavy vehicle per hour. This is not a 24 hour a day site so there will be no vehicles overnight.
Beaconsfield Road (24 hour use)	Near 68 Marigold St, Milperra		Access will be achieved via either Milperra Rd or Beaconsfield Rd and then by Marigold St. Daytime traffic will peak at around 6 light vehicle movements per hour and there may be 3/4 heavy vehicle movements per hour. At night there might be 1 light vehicle per hour and there may be 1 heavy vehicle per hour.
North side of Heathcote road	Cnr M5 on ramp and Heathcote Rd, Moorebank		The Access/egress from Southbound Heathcote Rd. There is potential for an egress onto the M5 on ramp Daytime traffic will peak at around 1/2 light vehicle movements per hour and there may be 1 heavy vehicle per hour. This is not a 24 hour a day site so there will be no

10.6.1 Access to Compounds & Associated Traffic Impacts

Table 10-3 numerically assesses the traffic impact generated by the proposed compounds on the adjacent roads. As can be seen, the majority of the sites would generate little more than one vehicle/truck per hour which is not significant. In addition, all of the proposed construction compounds are located in close proximity to the M5 corridor and adjacent arterial routes. As such, even when construction traffic is required to utilise local roads, the impact is low and the extent of the impact is generally limited to approximately 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 both achieve access without any significant impact on residential roads. The construction traffic management plan should however highlight measures to minimise any impacts such as reduced speed, limiting use of compression braking etc.

The direct access at each of the compound frontages will be provided with adequate sight distances relating to the posted road speed. This will allow vehicles on the main road to see vehicles emerging from the compound and will allow ample room to slow down and stop if necessary. Similarly, it will allow vehicles waiting to emerge from the site access, adequate sight distance to see approaching vehicles and determine acceptable gaps for them to enter the main road traffic.

Sites would generally employ a traffic controller at the site access who can not only manage the vehicular traffic into and out of the site but could also manage pedestrian flows across the access to minimise pedestrian vehicle conflict.

10.6.2 Planning of Access Points and Haul Routes

Construction vehicle routes to and from compounds and worksites will be developed in the context of minimising impacts on local streets and maximising use of arterial roads. The approach for development of the routes is to 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;

- Avoiding sensitive communities especially schools, hospitals, places of worship, businesses;
- Hours of operation of the sensitive communities;
- Access needs for residents, pedestrians, emergency services and buses;
- Out of hours impact on residential areas;
- Consultation with a Traffic and Transport Liaison Group (TTLG), residents and sensitive communities; and
- Guidance from relevant documents and standards such as the Guide to Traffic Control at Worksites (RTA) and Australian Standards.

The construction activities should be coordinated to ensure that peak levels of traffic generation do not coincide at two or more work sites which feed the same local routes. If this were to occur, then there would need to be some compensatory reduction in construction traffic generation from other work sites (also feeding the same route) below the average anticipated levels.

As stated earlier, all of the proposed construction compounds are located in close proximity to the M5 corridor and adjacent arterial routes.

10.6.3 Special Vehicles

The delivery and collection of oversize plant and equipment, as well as materials required by the construction activities would be undertaken under existing permit arrangements. It is important that this activity does not occur during periods of high demand on the road network, as a blockage, even for a relatively short period, of strategic roads in the area would have large knock-on effects within Sydney's road network.

Depending on the delivery or collection site and its proximity to housing, this type of activity should occur overnight at the weekend and / or during holiday periods. Impacts associated with oversize vehicles should be mitigated with advanced (i.e. in time) advisory signage for regular users of the affected routes, detailing the proposed activities and likely disruptions that might be encountered.

Deliveries to site compounds should have minimal impact due to the low volumes experienced during the permissible hours.

10.6.4 Heavy Vehicle Condition

To ensure that contractors do not overload haul trucks and that the trucks are in a roadworthy condition would be a priority. This will avoid heavy vehicles travelling unnecessarily slowly when travelling up some any long grades in the area and thus causing queues, as other heavy vehicles are forced to overtake them.

10.6.5 Construction Traffic Management Plan

For all proposed construction sites, a detailed design of appropriate site access arrangements would be produced. This would cover: location and prevailing traffic conditions, geometry (including widths, turning paths and sight distances to and from the access, traffic management devices, advanced warning signage and other requirements.

For all proposed access routes, an investigation and analysis of road and traffic conditions would be prepared. This would cover pertinent characteristics such as:

- traffic volumes
- geometry of proposed route
- existing traffic management, and
- adjoining land uses.

The investigation and analyses would provide an input to the preparation of any Construction Traffic Management Plan (CTMP) for the proposal.

10.7 Traffic Impact from Temporary Closures

The underlying approach to construction of the proposed works will be to minimise impacts on traffic capacity in so far as lane numbers must be maintained during the daytime and particularly through peak periods. Where lane capacity is impaired due to narrowing then, where possible, measures will be introduced to minimise this impact. These would include providing adequate advanced warning signage, erection of appropriate barriers between traffic lanes and work sites to provide drivers with a sense

of security and certainty, and potentially addressing existing factors that may reduce traffic capacity.

Mitigation will be achieved through a combination of minimising road closures and allowing staged construction, whilst maintaining the current number of traffic lanes particularly during the busier periods. The dispersed nature of the work sites would support this approach which will minimize the local impacts on traffic operation

As stated previously, the projected volume of construction traffic would be small relative to existing levels of traffic. Therefore, the impacts on road network operation would be more likely to be due to activity in close proximity to traffic lanes distracting drivers, thereby reducing capacity. The distraction of the works would be addressed through appropriate screening of works.

Where road shoulders would be used to accommodate re-aligned traffic lanes, there is a risk of extended delays as a result of incidents, such as breakdowns or accidents. Therefore, a higher level of road patrol services should be provided in the area during the construction period, to ensure rapid response and clearance times.

At the proposed worksites, impacts would be minimised through the appropriate design and implementation of site accesses and construction traffic route selection. At several of the potential work sites, limits on the hours of access are proposed which will minimize impacts on adjoining properties and on the road network.

If lane closures are required during non-peak periods, these will be the subject of a traffic assessment to establish the traffic impacts of lane closure.

A reduction in shoulder widths may result in incidents which would in turn impact on traffic capacity. To mitigate this potential impact, additional road patrol resources should be allocated to the general construction area, at least during peak periods. These can then respond more quickly to incidents and hence reduce their potential impact on the road network's performance.

A number of VMS's will be installed outside the M5 motorway corridor, generally on major roads leading to or from the Motorway. This work comprises earthworks for

footings (an excavator, backhoe or similar), concreting associated with the footings (a concrete truck) and use of a crane to lift the VMS into position. Work is likely to occur during the night in order to minimise interruption to road traffic. The construction is however of short duration and is expected to be completed in approximately two nights at any site.

10.8 Diversionary Impacts

Traffic diversion and change in travel times and speeds were examined using the 2011 strategic model.

To model the impacts of a reduced speed limit and narrowing lanes, motorway sections proposed to be widened were coded with reduced travel speed of 80km/h and 95% of their original link capacity. The model shows approximately 5 to 10% of traffic on the M5 South West Motorway would be diverted to alternative parallel roads during peak hours in such conditions, with the greatest rate of diversion (i.e. 10%) observed during inter-peak hours.

The Hume Highway and Canterbury Road are the key alternative roads used by diverted traffic where a maximum of 7% increase in modelled traffic was observed. Across all time periods, the model shows an increase in travel time and decrease in speed on the motorway. Approximately 14% increase (+2 to 3 minutes) in travel time and 13% decrease (-10 km/h) in travel speed can be observed during inter-peak hours while 10% increase (+ 2 minutes) in travel time and 10% decrease (-7km/h) in travel speed can be observed during morning and evening peak hours.

10.9 DeMeyrick Bridge Upgrade

These works would potentially require:

- Localised daily traffic diversions at De Meyrick Ave for a period of up to 6 months and a reduction in motorway travel speeds in the vicinity of De Meyrick Avenue from 100km/hr to 80km/hr
- 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 (i.e. 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 km/h would decrease average traffic speeds, with the largest decreases likely to occur in free-flow situations (i.e. outside AM peaks, inter-peaks and PM peaks). In congested situations, the decrease would likely be smaller and therefore potential impacts and network effects would be minimal.

10.10 Other Impacts

10.10.1 Impacts on Bus Operations

During construction, buses will be inconvenienced in the same way as general traffic. However, as there are no bus stops along the motorway corridor, there will be little physical disruption to bus facilities.

10.10.2 Impacts on Cyclists

During the construction phase, access for bicycles along the motorway will be maintained, with the exception of times when work is being undertaken in the shoulder. This work will be limited in nature and involve temporary diversions or stop/go conditions under traffic control.

10.10.3 Impacts upon Pedestrians

Pedestrian access at the various under/overpasses will not be affected during construction.

Where there is possible interaction between construction traffic and pedestrians (e.g. at worksite / compound access points) traffic controllers will be employed to ensure that adequate protection is given.

10.11 Construction Traffic Management

10.11.1 Construction Traffic Management Plan (CTMP)

A CTMP will be prepared for the proposed construction activities. The CTMP would have regard to maintaining general traffic flow and providing appropriate site accesses and routes for construction traffic. Each stage and reconfiguration of general traffic lanes would be considered and included in this detailed document.

The CTMP would specify:

- Access routes and signage;
- Hours of operation, including prohibitions on queuing outside sites prior to commencement of working hours;
- Vehicle types to be used in the various operations;
- Special control arrangements (such as warning signage or lights) at site accesses;

- Load covering;
- Vehicle cleaning on exit from site;
- Road cleaning programme;
- Road safety audit of plan; and
- Localised improvements/adjustments to traffic management devices and arrangements.

A process of site induction for contractors and drivers would be mandatory. This would cover general safety procedures as well as the details of the CTMP applicable both to the package of work and the location of the relevant sites. Monitoring of compliance with the plan would use surveys and sample checks of traffic movements. A hotline would be established for members of the public to raise concerns with regard to construction traffic activity.

Construction activities should be co-ordinated to ensure that peak traffic generation by work sites which feed onto the same route do not coincide, and if they do, that there is a compensatory decrease in traffic generation by other sites feeding onto these routes.

The condition of contractors' vehicles and their compliance with load limits would be monitored to ensure that haul vehicles do not travel unnecessarily slowly when loaded. Oversize vehicle access should be restricted to periods of low traffic demands.

10.11.2 Workforce Travel

Construction staff would have limited parking available at the compounds and worksites. The workforce would be advised on suitable parking arrangements as part of the compulsory project induction. Staff would be encouraged to car pool.

It is expected that a proportion of the workforce would use public transport to commute to and from the work sites. Public transport and a reduction in general site vehicle movements could be promoted via the use of shuttle services from designated points collecting personnel and transporting them to site. Shuttle buses and public transport would minimise the number of staff using local roads for parking. Information will be prepared for each of the sites showing how workers can use bus and train services to reach the various worksites.

Such shuttle vehicles could operate at the beginning and end of each shift to get the workforce to and from the worksites. An on-demand service could then operate during the shift. The collection and delivery points for the shuttle service would vary as activities and worksites change during the length and time of the Project.

11 Summary and Conclusion

This report has examined the traffic and transport impacts of the proposed M5 West Widening Project.

The assessment has shown that the M5 South West Motorway is of strategic significance being the key route between central Sydney and the south-western suburbs connecting to the F5 Freeway, the M5 East and the Westlink M7.

Traffic Forecasts have been produced using the Strategic Metropolitan Traffic Model (SMTM)[19]. Models were developed for the future years 2016 and 2026, for the AM, PM and Inter peak periods.

Future year travel demand matrices were provided by the Bureau of Transport Statistics and as such the models represent the government's forecast of future land use development in Sydney. The traffic forecasts also take into account the effects of induced demand.

Results of the traffic modelling indicate an average annual growth rate on the M5 South West Motorway of 1.0% for car and 2.6% - 2.8% for truck, between 2006 and 2026.

The findings of this assessment are as follows:

- Traffic volumes at Hammondville Toll Plaza are forecast to increase by 23 – 29% in the peak directions in 2026.
- During the morning peak period, the travel time on M5 South West Motorway eastbound between Camden Valley Way and King Georges Road is forecast to improve from 32 to 25 minutes in 2026 with the completion of the Project, when compared with the business as usual (Base Case) situation.
- The AM eastbound travel time on the Alternative Route will reduce from 44 to 41 minutes in 2026 as a result of the M5 West Widening Project.

[19] The SMTM is a model developed by Halcrow for assessment of RTA's major road infrastructure proposals. It is a model that has been continually developed and validated against major road improvements as they come into effect.

- Existing and forecast freight movements will experience improved travel conditions as a results of the Project, which is a primary strategic objective of the corridor.
- Strategic Bus Corridors will benefit from faster travel times on the Alternative Route and improved conditions at some intersections with the M5 South West Motorway.
- Traffic reductions on the Alternative Route and the general surrounding network are expected to provide opportunities for road based public transport.
- Conditions for pedestrians and cyclists remain unchanged and unaffected.

Overall this assessment has shown that the M5 West Widening Project will improve journey times for users of the M5 South West Motorway and the Alternative Route, improving conditions for both strategic motorway and local traffic. It provides a necessary increase in capacity required to accommodate projected growth in travel demand up to 2026 and offers a significant improvement in travel conditions when compared to the Base Case, do nothing, scenario.

Appendix A Level of Service Definition

A.1 Road Link Levels of Service

The different levels of service can generally be described as follows:

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

Volume capacity ratios were used to determine the mid-block level of service.

Table A- 1 Level of Service Definition (Mind-Block)

Level of Service	Maximum Volume Capacity Ratio (V/C)	
	Freeway[1]	Multi-Lane Highway[2]
A	0.3	0.26
B	0.48	0.41
C	0.7	0.59
D	0.9	0.81
E	1.00	1.00
F	>1.00	>1.00

1 Highway Capacity Manual Exhibit 23-2 LOS Criteria for Basic Freeway (Based on Free Flow Speed of 100km/h)
2 Highway Capacity Manual Exhibit 21-2 LOS Criteria for Multilane Highways (Based on Free Flow Speed of 70km/h)

A.2 Intersection Levels of Service

Levels of Service at these intersections have been determined according to the RTA Guide to Traffic Generating Developments (2002), as illustrated in the table below:

Table A- 2 Level of Service Definition (Intersection)

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	<14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	>70	Extra capacity required	Extreme delay, traffic signals or other major treatment required

*Adapted from RTA Guide to Traffic Generating Developments (2002).

Appendix B Model Development Details

Appendix B describes the traffic model used for the M5 West widening study, the forecasting methodology and the key inputs to the traffic forecasting process.

B.1 Base Model

The model used for this study is a strategic traffic model named Sydney Metropolitan Traffic Model (SMTM). It is implemented in the EMME transport planning software. The traffic model is a vehicle assignment model covering the entire Greater Metropolitan Area (GMA) using vehicle demands obtained from the Bureau of Transport Statistics' (BTS) Sydney Strategic Travel Model (STM). The base model was developed for the year 2006 and validated to observed 2006 data. Future year models were developed using demand forecasts provided by BTS. Key attributes of the model are:

- It runs 3 periods, namely morning (AM) peak, inter peak (IP) and evening (PM) peak;
- It was validated to 2006 conditions and has forecasts available for 2011, 2016, 2021 and 2026.

B.1.1 Zone System

The number of traffic zones in the traffic model is 2722. The zone system in this version of the model was based on the STM TZ06 zoning system with the following modifications:

- Disaggregation (Redefinition) of zones at the airport to reflect different terminals and car parks at the airport;
- An extra traffic zone was added to Arncliffe to represent future year Cooks Cove development.

B.1.2 Model Network

The 2006 model networks cover the Greater Metropolitan Area (GMA) of NSW which include the following areas:

- Sydney Metropolitan Area
- Blue Mountains
- Newcastle
- Gosford-Wyong
- Wollongong
- Nowra-Bomaderry
- Illawarra

The coverage of the model is indicated in Figure B- 1and Figure B- 2.

B.1.3 2006 Demands

Two sets of 2006 trip demands were provided by BTS in June 2009:

- 24 hour car driver trip tables by trip purpose
- truck matrices by period

The car driver trips were based on 2006 land use and journey to work (JTW) data. The truck matrices were based on the forecasts produced from the Sydney Freight Movement Model (FMM).

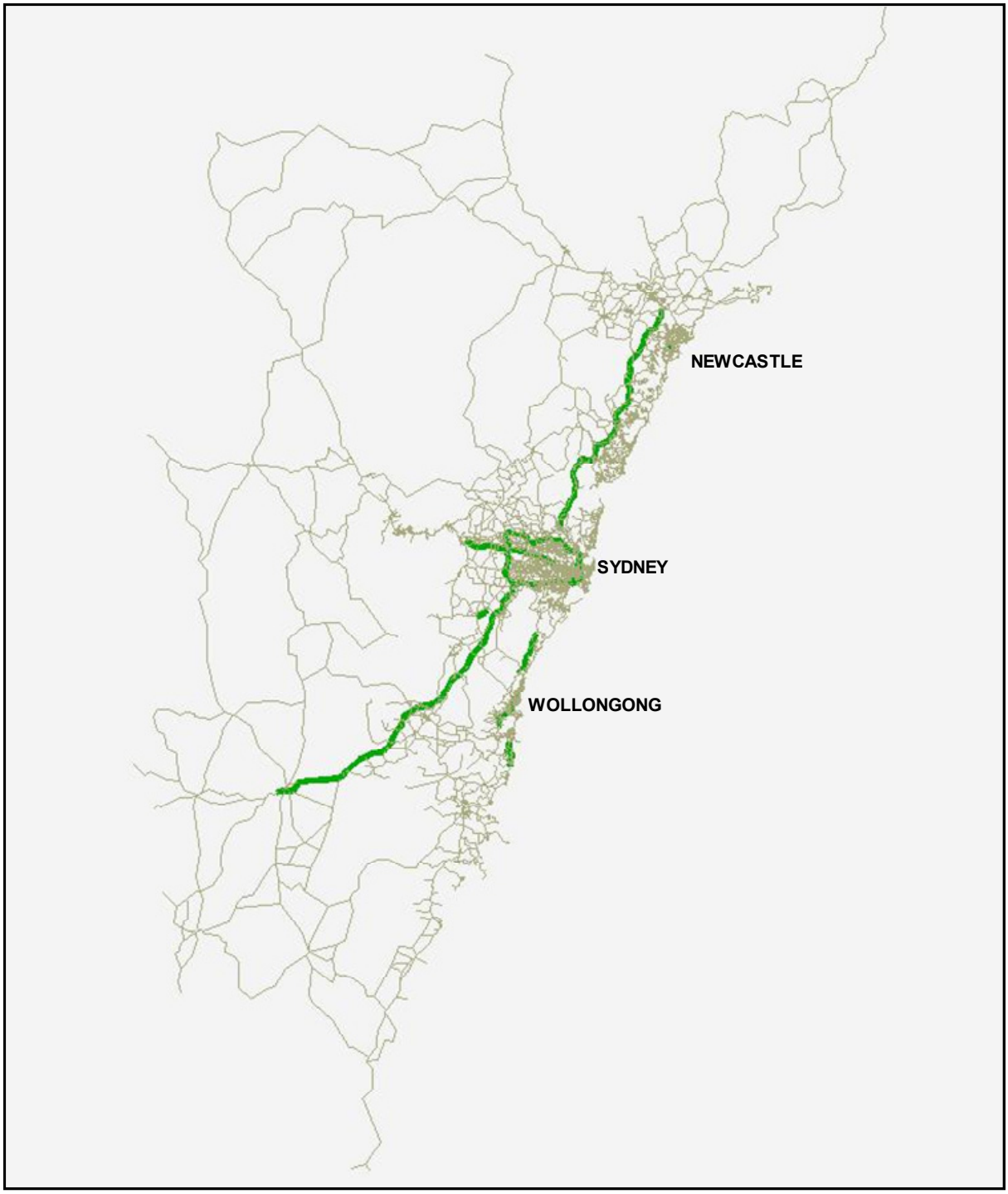


Figure B- 1 Sydney Metropolitan Traffic Model Coverage

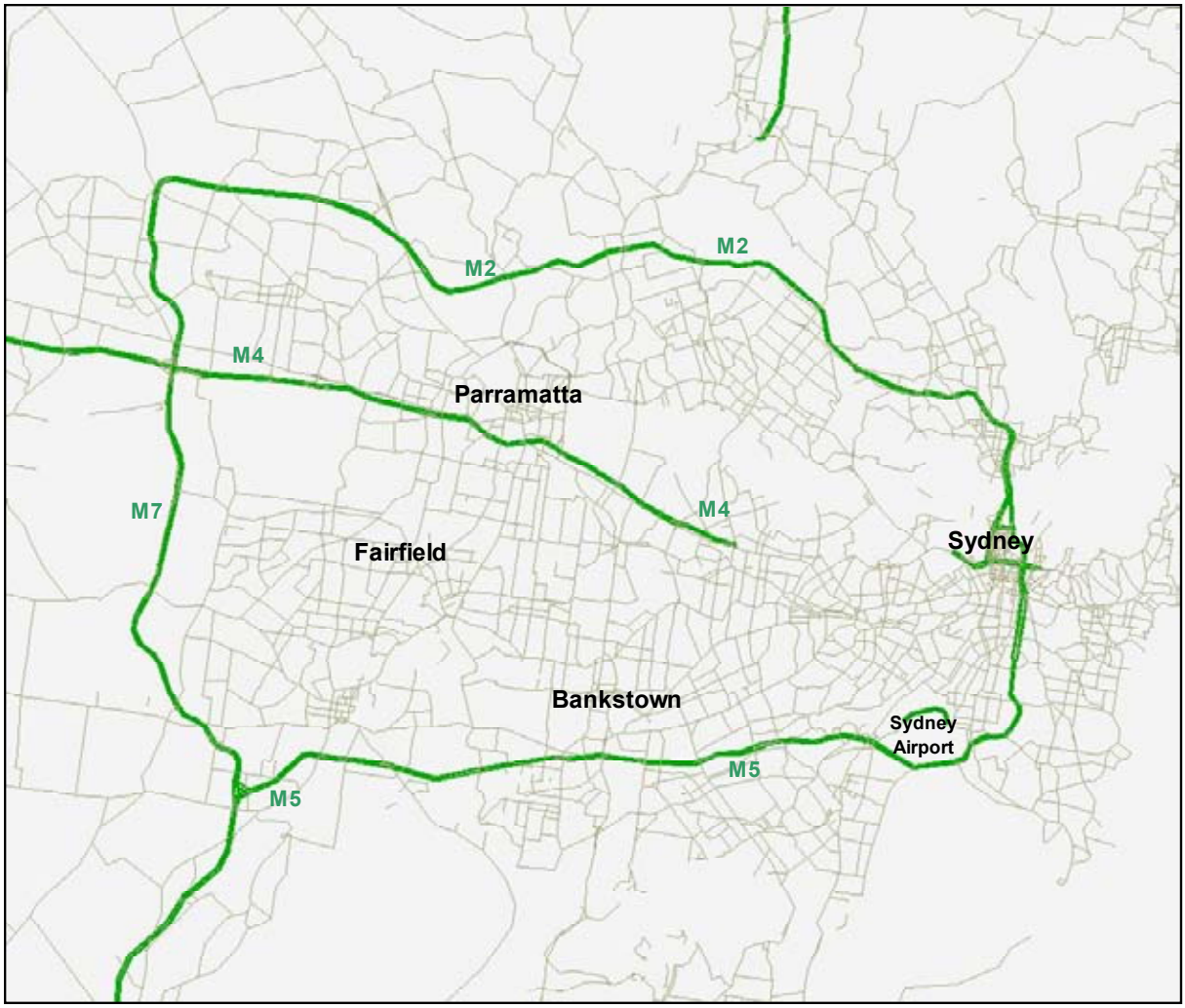


Figure B- 2 Sydney Metropolitan Traffic Model Coverage

B.1.4 Time Period Factors

Time period factors were applied to convert the 24 hour car driver demands into AM peak, Inter peak and PM peak demands. These factors determined 2 hour AM Peak, 3 hour PM Peak and 6 hour Inter Peak matrices. These matrices were then converted to a 1 hour average peak period matrices. The time period factors are listed in

Table B- 1.

Table B- 1 SMTM Peak Factors for Car Driver

Purpose		AM	IP	PM
Work	From	0.454	0.194	0.035
	To	0.013	0.132	0.455
Other	From	0.143	0.420	0.171
	To	0.059	0.378	0.260

B.1.5 Airport Trip Generation

It was identified that the STM model underestimated airport trip generation. Therefore airport trip production and attractions were reviewed and updated. The revised airport trip generation and distributions were based on Airport Master Plan study.

B.2 Traffic Model Improvements

At the beginning of the study, the traffic model was reviewed as to it appropriateness, robustness and accuracy for the purpose of this study. The review confirmed that:

- The model is in a continuing state of development;
- The model has an appropriately detailed coverage of the strategic road network across Sydney region.

The traffic model was deemed to provide a well established base for developing traffic forecast for this project. Some aspects of the model required additional refinements to build a study that meets the demand for the M5 South West Motorway Environmental Assessment.

The following improvements have been made to the traffic model to create a project traffic model:

- Reviewed and adjusted speeds and capacities on M5 and the alternative routes for reasonableness within the context of the zone and network detail being used;
- Reviewed 2006 validation on the links relevant to this study;
- Updated model validation to include link validation at all sections of M5.

B.2.1 Matrix Adjustment

To provide a final refinement of the trip tables and to meet the validation targets, a level of matrix adjustment was applied to compare the model against observed counts provided by RTA. The effect of the estimation and the procedure for applying the changes to forecast year models is outline below.

The change in total trips in each time period due to the adjustment factors is shown in Table B- 2 below.

Table B- 2 Change in Trip Adjustment

Trip Matrix	Before Estimation		After Estimation		Change	
	Car	Truck	Car	Truck	Car	Truck
AM	726,036	21,740	734,036	20,473	1.1%	-5.8%
IP	548,618	26,338	557,527	23,271	1.6%	-11.6%
PM	814,336	18,623	815,083	16,164	0.1%	-13.2%

B.3 Model Validation

B.3.1 Validation Approach

The model validation process involved comparisons of the predicted model output against observed data for year 2006. The following outputs were compared:

- Screenline volumes
- Individual link volumes along M5 corridor

B.3.2 Screenline Validation

Of primary importance is the project traffic model represents traffic flows accurately at an aggregate level from region to region across designated screenlines. The screenlines used in the validation are shown in Figure B- 3.

A generally accepted target criteria is that modelled traffic volumes across most screenlines are with 10% of observed traffic volumes with a GEH of less than 5%.

Table B- 3 and

Table B- 4 summarise the validation statistics for the base year model. Scatter plots of modelled versus observed screenline totals are shown in Figure B- 4 to Figure B- 6 and scatter plots of modelled versus observed individual link flows are shown in Figure B- 7 to Figure B- 9. It can be seen that the traffic model shows that the modelled traffic flows across most screenlines are within the target criteria. The key root mean square error (RMSE) and R^2 targets are met which is a good measure for a strategic model and would be a good basis for project specific models.

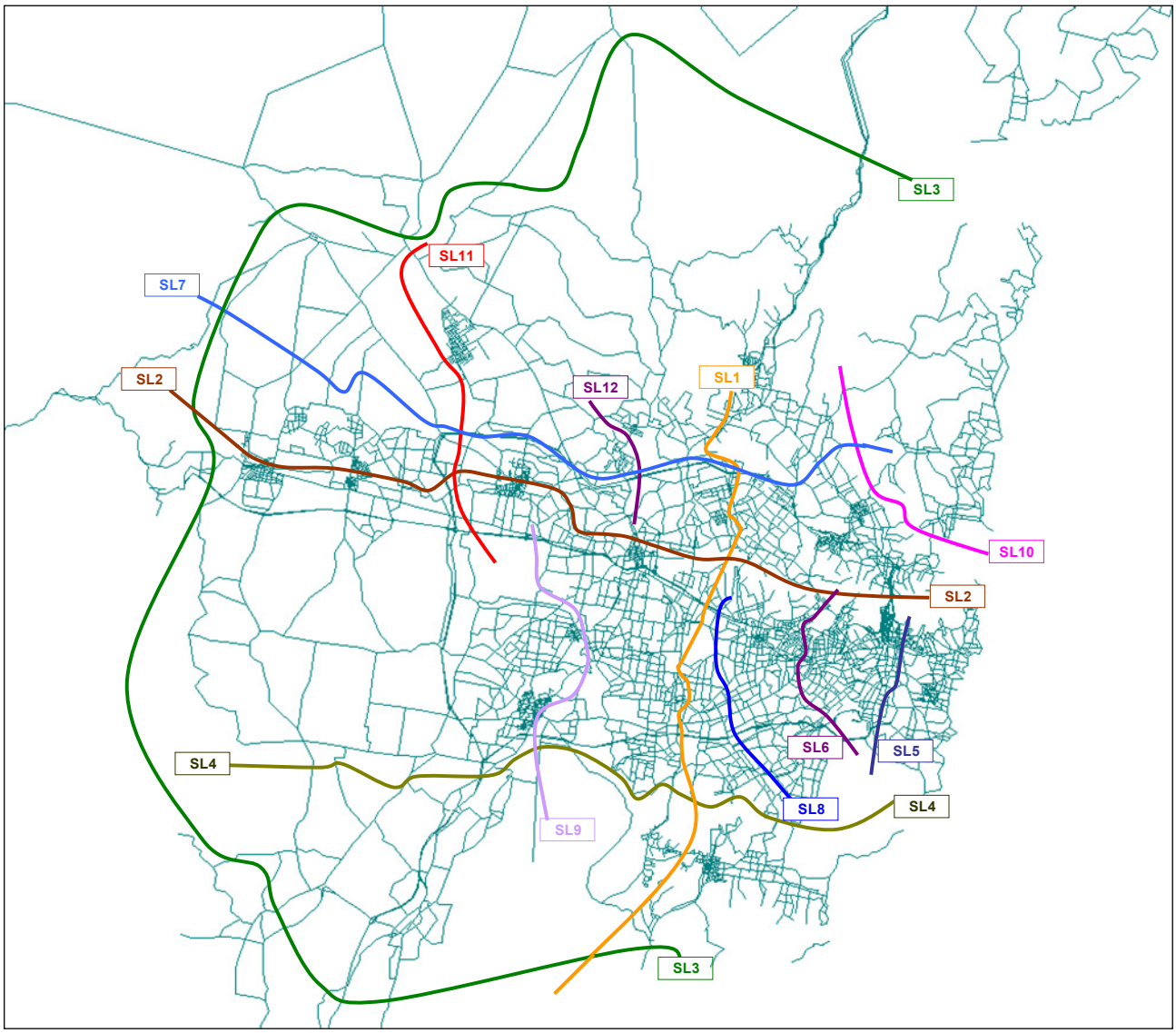


Figure B- 3 Screenline Locations

Table B- 3 Validation Results for Total Vehicles

Target	AM		IP		PM	
	Before	**After**	**Before**	**After**	**Before**	**After**
Actual GEH Percentage (Screenline)						
GEH <5	25%	100%	54%	100%	33%	100%
Actual GEH Percentage (Individual Link)						
60% <5	40%	87%	47%	91%	41%	89%
95% <10	70%	98%	75%	99%	67%	98%
100% <20	96%	100%	94%	100%	94%	100%
R^2 (>0.85)	0.9072	0.9729	0.8513	0.9792	0.8447	0.9663
RMSE (<30%)	28%	10%	32%	12%	33%	9%
Percentage of Links <20% diff	77%	95%	72%	93%	75%	95%

Table B- 4 Validation Results for Trucks

Target	AM		IP		PM	
	Before	**After**	**Before**	**After**	**PM**	**After**
Actual GEH Percentage (Individual Link)						
60% <5	61%	74%	55%	91%	58%	77%
95% <10	86%	97%	82%	100%	87%	94%
100% <20	99%	100%	99%	100%	99%	100%
Actual GEH Percentage (Screenline)						
GEH <5	15%	100%	10%	100%	30%	90%

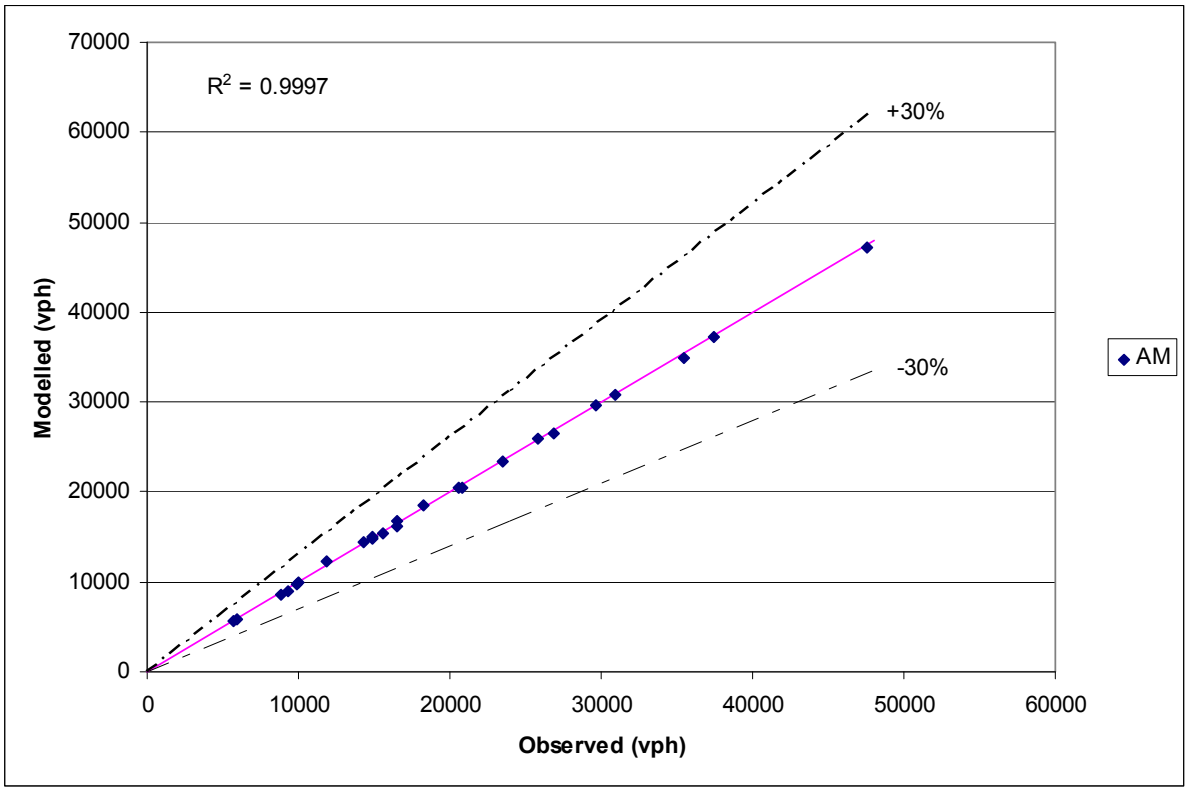


Figure B- 4 Scatter Plot of Observed versus Screenline Total Flows (AM)

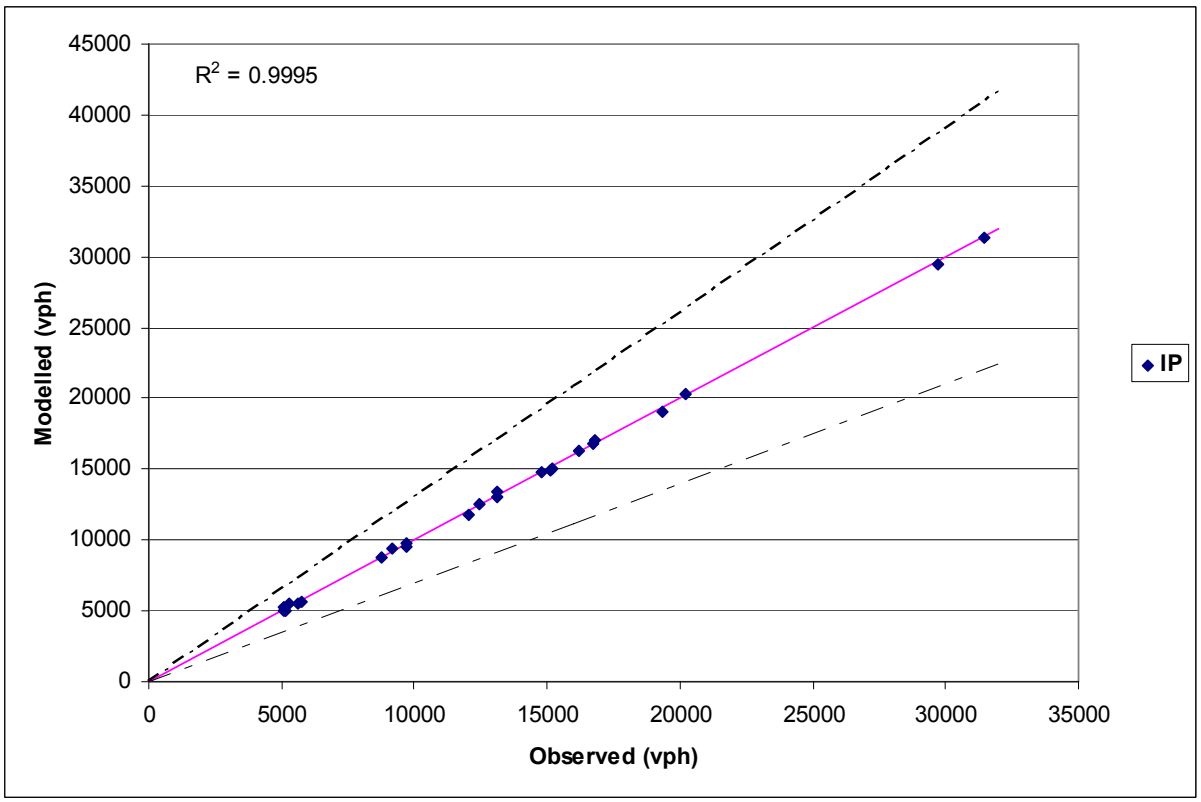


Figure B- 5 Scatter Plot of Observed versus Screenline Total Flows (IP)

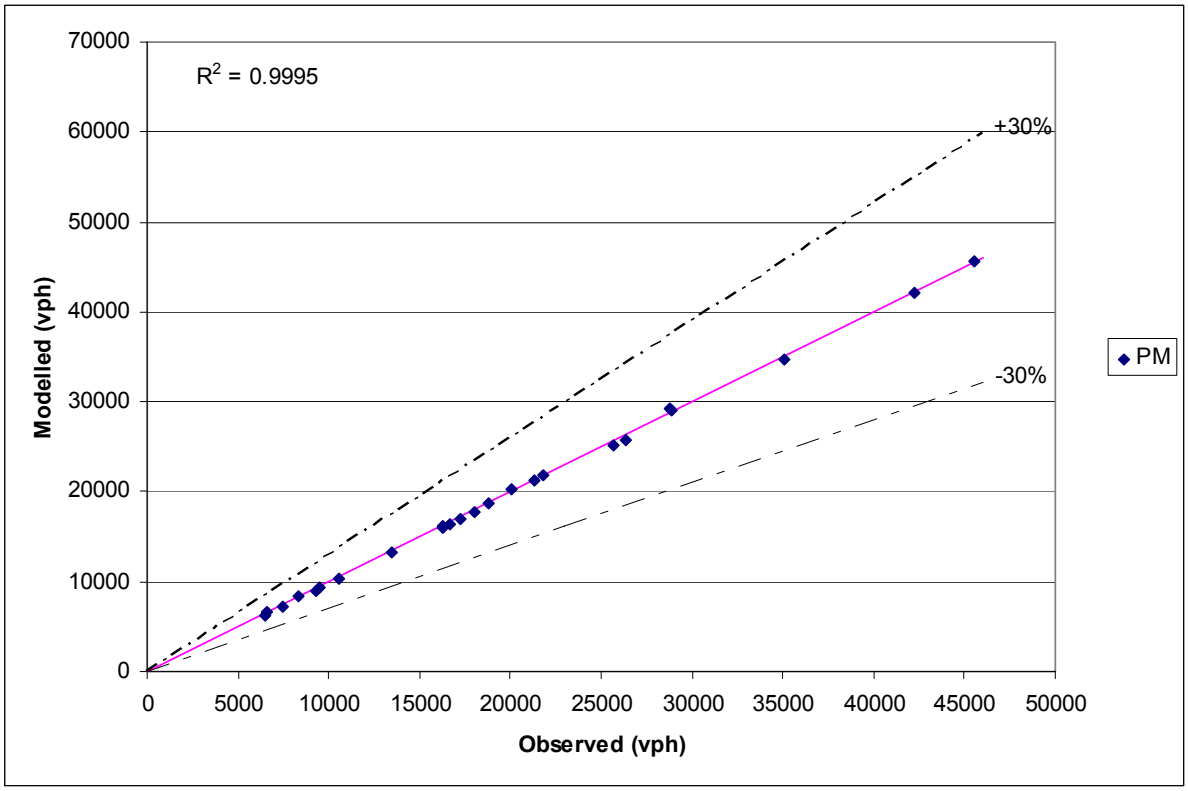


Figure B- 6 Scatter Plot of Observed versus Screenline Total Flows (PM)

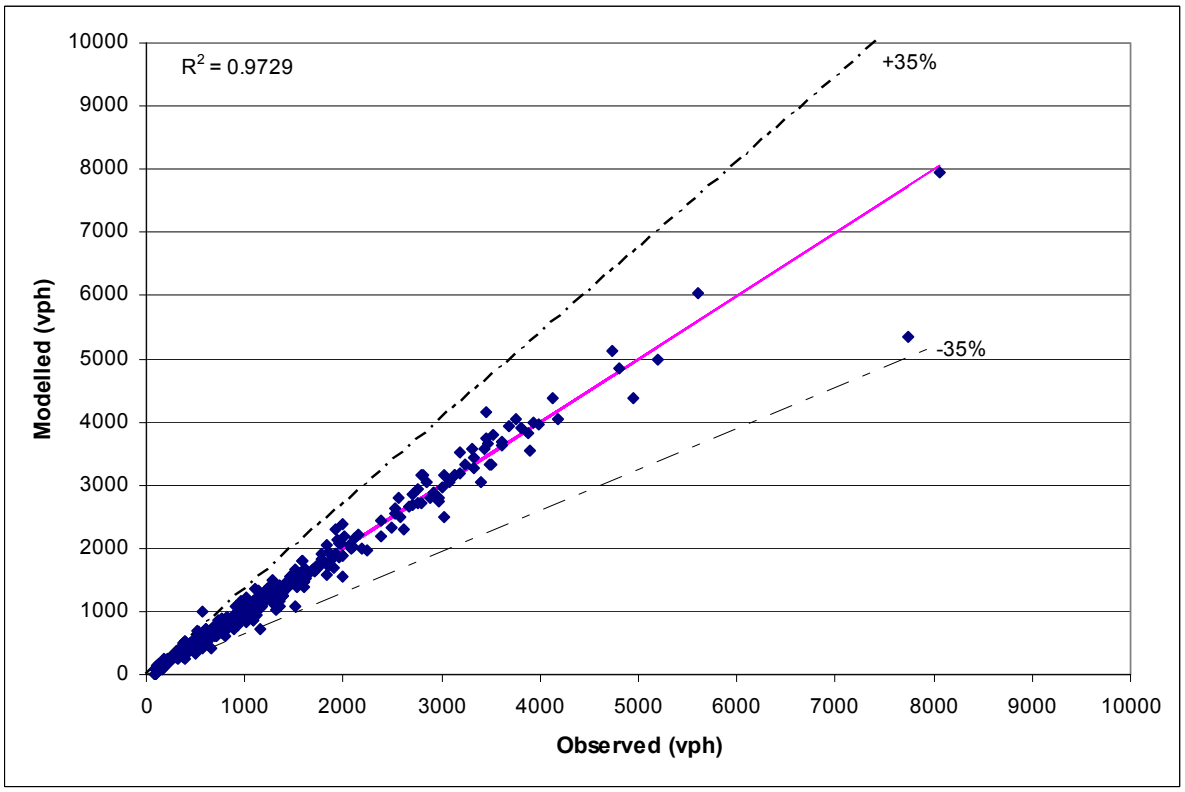


Figure B- 7 Scatter Plot of Observed versus Individual Link Flows (AM)

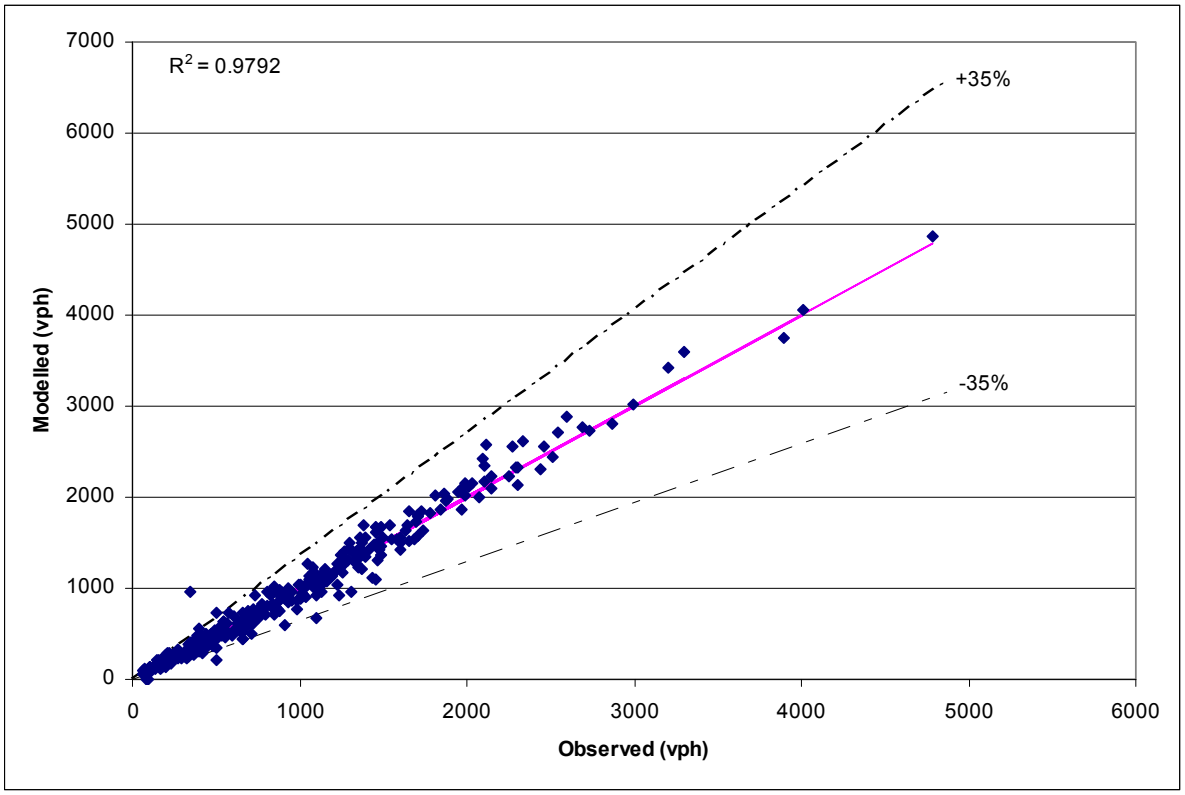


Figure B- 8 Scatter Plot of Observed versus Individual Link Flows (IP)

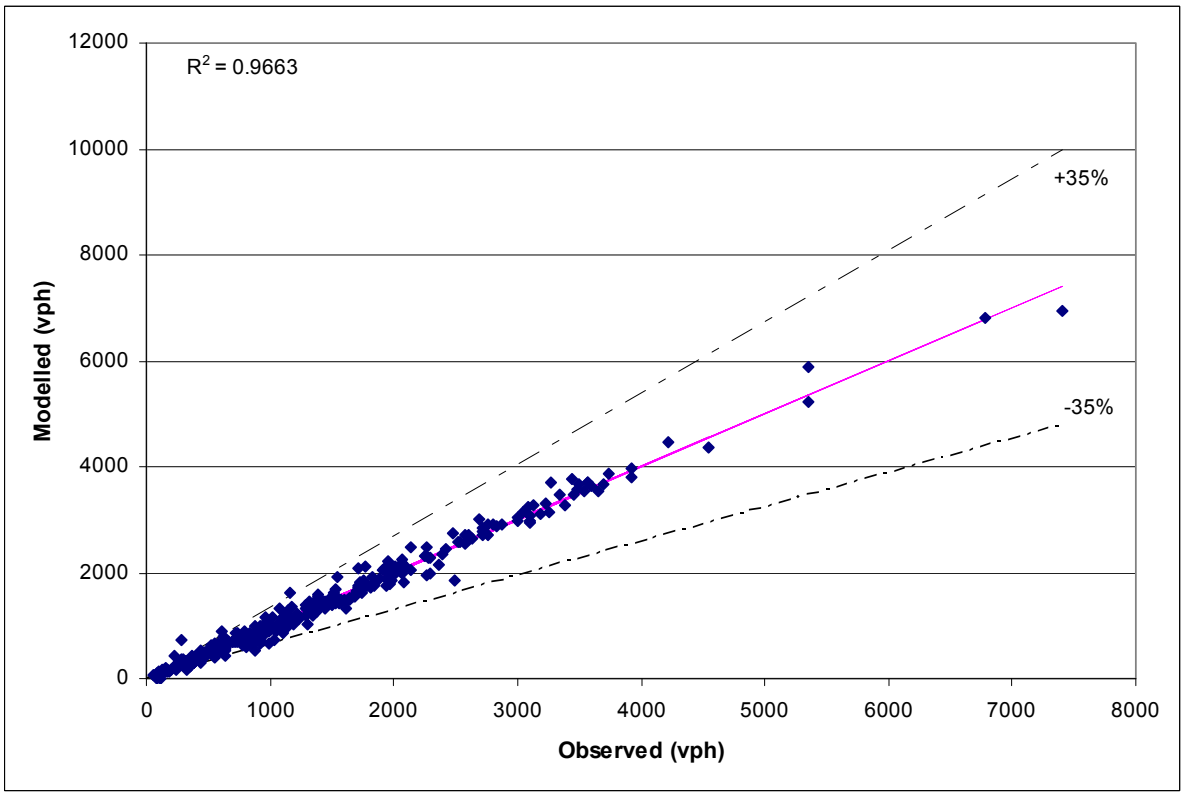


Figure B- 9 Scatter Plot of Observed versus Individual Link Flows (PM)

B.3.3 M5 South West Motorway Individual Link Validation

M5 traffic count data was provided by RTA in 2009. The data covers traffic count information on the motorway mainlines and the ramps along the M5 corridor between Camden Valley Way and Marsh Street. The modelled traffic volumes along M5 corridor were checked against the observed data and the results show that all sections along M5 have achieved GEH of less than 5% which indicate that the model is suitable for the purpose of the M5 West Traffic Study. The M5 link validation results are summarised in Table B- 5 to Table B- 7.

Table B- 5 M5 Link Validation (AM Peak)

	Eastbound (Average 0700 – 0900)					Westbound (Average 0700 – 0900)				
Description	**Observed**	**Modelled**	**Diff**	**% Diff**	**GEH**	**Observed**	**Modelled**	**Diff**	**% Diff**	**GEH**
M5, West of Hume Hwy	3572	3693	122	3%	2	2862	2935	73	3%	1
M5, West of Moorebank	4798	4861	63	1%	1	3878	3834	-44	-1%	1
M5, West of Heathcote Rd	3632	3632	0	0%	0	3713	3644	-69	-2%	1
Hammondville Toll Plaza	3050	3022	-28	-1%	1	3258	3168	-90	-3%	2
M5, West of River Rd	2633	2670	37	1%	1	3334	3233	-101	-3%	2
M5, West of Fairford Rd	2638	2696	58	2%	1	3394	3315	-79	-2%	1
M5, West of Belmore	2526	2543	17	1%	0	3008	2973	-35	-1%	1
M5, West of KGR	2310	2282	-28	-1%	1	2610	2590	-20	-1%	0
M5, West of Kingsgrove Rd	2665	2653	-12	0%	0	3233	3327	94	3%	2
M5, West of Marsh St	3102	3128	26	1%	0	2897	2917	20	1%	0
Hume Hwy East Facing Ramps	1227	1172	-55	-4%	2	1016	899	-117	-12%	4
Moorebank Ave West Facing Ramps	1455	1546	91	6%	2	539	548	9	2%	0
Moorebank Ave East Facing Ramps	289	315	26	9%	2	374	357	-17	-4%	1
Heathcote Rd West Facing Ramps	932	991	59	6%	2	973	972	-1	0%	0
Heathcote Rd East Facing Ramps	350	381	31	9%	2	518	497	-21	-4%	1
Henry Lawson Dr West Facing Ramps	623	539	-84	-13%	3	312	278	-34	-11%	2
Henry Lawson Dr East Facing Ramps	206	186	-20	-9%	1	388	342	-46	-12%	2
The River Rd West Facing Ramps	212	243	31	15%	2	281	260	-21	-8%	1
The River Rd East Facing Ramps	217	269	52	24%	3	341	342	1	0%	0
Fairford Rd West Facing Ramps	414	449	35	8%	2	718	616	-102	-14%	4
Fairford Rd East Facing Ramps	302	295	-7	-2%	0	332	273	-59	-18%	3
Belmore Rd West Facing Ramps	216	261	45	21%	3	398	384	-14	-4%	1
King Georges Rd West Facing Ramps	520	578	58	11%	2	486	493	7	2%	0
King Georges Rd East Facing Ramps	875	949	74	8%	2	1109	1231	122	11%	4
Kingsgrove Rd East Facing Ramps	992	972	-20	-2%	1	483	509	26	5%	1
Bexley Rd West Facing Ramps	150	159	9	6%	1	819	918	99	12%	3
Princes Hwy West Facing Ramp	405	337	-68	-17%	4					
Marsh St West Facing Ramps	983	1098	115	12%	4	1073	1119	46	4%	1
Marsh St East Facing Ramps	728	793	65	9%	2	441	392	-49	-11%	2

Table B- 6 M5 Link Validation (Inter Peak)

	Eastbound (Average 1100 – 1300)					Westbound (Average 1100 – 1300)				
Description	**Observed**	**Modelled**	**Diff**	**% Diff**	**GEH**	**Observed**	**Modelled**	**Diff**	**% Diff**	**GEH**
M5, West of Hume Hwy	2159	2003	-156	-7%	3	2085	2023	-62	-3%	1
M5, West of Moorebank	2867	2809	-58	-2%	1	2729	2739	10	0%	0
M5, West of Heathcote Rd	2410	2396	-13	-1%	0	2299	2373	74	3%	2
Hammondville Toll Plaza	2184	2168	-16	-1%	0	2102	2160	58	3%	1
M5, West of River Rd	2323	2247	-75	-3%	2	2234	2246	12	1%	0
M5, West of Fairford Rd	2421	2316	-105	-4%	2	2329	2324	-5	0%	0
M5, West of Belmore	2435	2314	-121	-5%	2	2250	2238	-11	-1%	0
M5, West of KGR	2278	2162	-116	-5%	2	2097	2066	-31	-1%	1
M5, West of Kingsgrove Rd	2994	3024	30	1%	1	2688	2770	83	3%	2
M5, West of Marsh St	2449	2550	100	4%	2	2574	2675	101	4%	2
Hume Hwy East Facing Ramps	708	807	99	14%	4	644	716	72	11%	3
Moorebank Ave West Facing Ramps	660	624	-36	-5%	1	618	531	-87	-14%	4
Moorebank Ave East Facing Ramps	203	211	8	4%	1	188	164	-23	-12%	2
Heathcote Rd West Facing Ramps	527	535	8	2%	0	468	505	37	8%	2
Heathcote Rd East Facing Ramps	301	307	5	2%	0	271	292	21	8%	1
Henry Lawson Dr West Facing Ramps	207	211	3	2%	0	193	218	25	13%	2
Henry Lawson Dr East Facing Ramps	346	290	-56	-16%	3	325	304	-21	-6%	1
The River Rd West Facing Ramps	135	127	-8	-6%	1	123	128	5	4%	0
The River Rd East Facing Ramps	233	196	-37	-16%	3	218	206	-11	-5%	1
Fairford Rd West Facing Ramps	374	362	-12	-3%	1	417	400	-16	-4%	1
Fairford Rd East Facing Ramps	388	360	-28	-7%	1	338	315	-23	-7%	1
Belmore Rd West Facing Ramps	158	152	-5	-3%	0	152	172	20	13%	2
King Georges Rd West Facing Ramps	498	461	-37	-7%	2	527	522	-4	-1%	0
King Georges Rd East Facing Ramps	1214	1324	110	9%	3	1117	1226	110	10%	3
Kingsgrove Rd East Facing Ramps	411	445	33	8%	2	339	367	27	8%	1
Bexley Rd West Facing Ramps	436	398	-38	-9%	2	453	462	9	2%	0
Princes Hwy West Facing Ramp	520	522	2	0%	0					
Marsh St West Facing Ramps	809	869	60	7%	2	1080	1124	44	4%	1
Marsh St East Facing Ramps	383	408	25	6%	1	379	366	-13	-3%	1

Table B- 7 M5 Link Validation (PM Peak)

	Eastbound (Average 1500 – 1800)					Westbound (Average 1500 – 1800)				
Description	**Observed**	**Modelled**	**Diff**	**% Diff**	**GEH**	**Observed**	**Modelled**	**Diff**	**% Diff**	**GEH**
M5, West of Hume Hwy	2918	2923	5	0%	0	3898	3759	-139	-4%	2
M5, West of Moorebank	3929	3969	39	1%	1	5348	5236	-112	-2%	2
M5, West of Heathcote Rd	3483	3452	-31	-1%	1	4319	4193	-125	-3%	2
Hammondville Toll Plaza	3125	3057	-68	-2%	1	3787	3743	-44	-1%	1
M5, West of River Rd	3317	3221	-95	-3%	2	3629	3634	5	0%	0
M5, West of Fairford Rd	3484	3387	-97	-3%	2	3612	3637	25	1%	0
M5, West of Belmore	3390	3262	-128	-4%	2	3255	3141	-114	-3%	2
M5, West of KGR	3066	2930	-135	-4%	2	2952	2862	-90	-3%	2
M5, West of Kingsgrove Rd	3594	3632	37	1%	1	3458	3467	9	0%	0
M5, West of Marsh St	2770	2693	-78	-3%	1	2940	2825	-115	-4%	2
Hume Hwy East Facing Ramps	1011	1046	35	3%	1	1450	1478	29	2%	1
Moorebank Ave West Facing Ramps	688	733	46	7%	2	1391	1419	28	2%	1
Moorebank Ave East Facing Ramps	241	217	-25	-10%	2	362	375	13	4%	1
Heathcote Rd West Facing Ramps	889	852	-37	-4%	1	965	938	-27	-3%	1
Heathcote Rd East Facing Ramps	531	457	-74	-14%	3	433	488	55	13%	3
Henry Lawson Dr West Facing Ramps	255	244	-11	-4%	1	438	353	-85	-19%	4
Henry Lawson Dr East Facing Ramps	446	409	-38	-8%	2	280	244	-36	-13%	2
The River Rd West Facing Ramps	182	187	5	3%	0	246	266	21	8%	1
The River Rd East Facing Ramps	350	353	3	1%	0	229	269	41	18%	3
Fairford Rd West Facing Ramps	552	523	-29	-5%	1	717	803	86	12%	3
Fairford Rd East Facing Ramps	458	398	-60	-13%	3	360	306	-54	-15%	3
Belmore Rd West Facing Ramps	324	332	7	2%	0	303	279	-23	-8%	1
King Georges Rd West Facing Ramps	716	653	-63	-9%	2	697	730	33	5%	1
King Georges Rd East Facing Ramps	1245	1355	110	9%	3	1203	1335	132	11%	4
Kingsgrove Rd East Facing Ramps	473	429	-44	-9%	2	445	426	-19	-4%	1
Bexley Rd West Facing Ramps	782	882	100	13%	3	964	1068	104	11%	3
Princes Hwy West Facing Ramp	515	487	-28	-5%	1					
Marsh St West Facing Ramps	779	786	7	1%	0	970	1008	38	4%	1
Marsh St East Facing Ramps	323	323	0	0%	0	470	562	92	20%	4

B.4 Forecasting

B.4.1 Land Use Forecasts

June/July 2009 version of the population and employment forecasts were provided by BTS in September 2009. This land use data was the basis of the future year traffic demand forecasts.

B.4.2 Future Networks

The assumed timing of the strategic road network upgrades was based on the future year road network improvement list provided by Road and Traffic Authority (RTA) in August. The project listing provides information on road projects to be completed in 2011, 2016, 2021, 2026, 2031 and 2036. The key projects are shown in Table B- 8.

Table B- 8 Key Road Projects for Future Year

Project	Project Description
F5 Upgrade	6 lanes from Raby Road to Narellan Road
M4 Toll Removal	February 2010
Inner West Busway	Tidal flow, bus lanes and duplication of Iron Cove Bridge, Victoria Road
M2	Widen from Windsor Road to Delhi Road
M5 Widening	Widening Camden Valley Way to King Georges Road
M4 Extension	Completion of works from Strathfield to Airport/Port, including QANTAS Drive and O'Riordan St Intersection and M4 8-laning from North Strathfield to Church Street
F3 to M2	New link between F3 and M2
M4	8 lanes from Church Street to Mamre Road
F6	4 Lanes from Loftus to St Peters, with connection to M4 Extension
M2	Extension from Macquarie Park via Gladesville Bridge to M4 East at White Bay

B.4.3 Toll Locations

In the future year models, it is assumed that tolls are placed on:

- Sydney Harbour Bridge and Tunnel

- Cross City Tunnel
- Eastern Distributor
- Lane Cove Tunnel and Military Road
- Hills M2
- M5 South-West Motorway
- Westlink M7
- M4 East (2026)
- M2-F3 (2026)

B.4.4 Predicted Traffic Growth

The 2006 and future year all vehicle demands and truck demands by period were provided by BTS in October 2009. These matrices were based on 2006 land use data, June/July 2009 version of the population and employment forecasts, and FMM forecasts.

The all vehicle demands were split into car and truck demands based on the truck demand forecasts. The matrix adjustment factors developed from the base year matrix estimation were then applied to the future year car and truck demands prior to the final assignment.

The predicted traffic demands in years 2006, 2011, 2016, 2021 and 2026 are shown in Table B- 9 and the percentage growth of the predicted traffic demands are shown in Table B- 10.

Table B- 9 Predicted Traffic Demands

Trip Matrix	AM		IP		PM	
	Car	Truck	Car	Truck	Car	Truck
2006	734,036	20,473	557,527	23,271	815,083	16,164
2011	781,041	23,021	591,977	26,266	865,365	18,339
2016	826,531	26,413	623,095	30,505	913,393	21,205
2021	858,096	30,164	648,277	35,196	948,213	24,370
2026	893,953	34,226	675,004	40,268	989,678	27,803

Table B- 10 Percentage Growth of Predicted Traffic Demands

Trip Matrix	AM		IP		PM	
	Car	Truck	Car	Truck	Car	Truck
2006 - 2011	6.4%	12.4%	6.2%	12.9%	6.2%	13.5%
2011 – 2016	5.8%	14.7%	5.3%	16.1%	5.6%	15.6%
2016 – 2021	3.8%	14.2%	4.0%	15.4%	3.8%	14.9%
2021 - 2026	4.2%	13.5%	4.1%	14.4%	4.4%	14.1%

This equates to an average annual growth between 2006 and 2026 of 1.0% for car and 2.6% - 2.8% for truck.

B.5 Annualisation Factors

Factors were determined to estimate annual flow and revenues from the weekday peak-period traffic models. Annualisation factors were revised from the previous traffic model based on analysis of available continuous count data and the factors are presented in Table B- 11 below.

Table B- 11 Daily Flow Aggregation Factors

Conversion	Car	Truck
Aggregated Peak Flows* to 5-Day Average	5.29	5.23
5-Day Average to 7-Day Average	0.94980	0.75384

* Aggregated Peak Flow = (AM peak 1 hr) + (Inter-peak 1 hr)+(PM peak 1 hr)

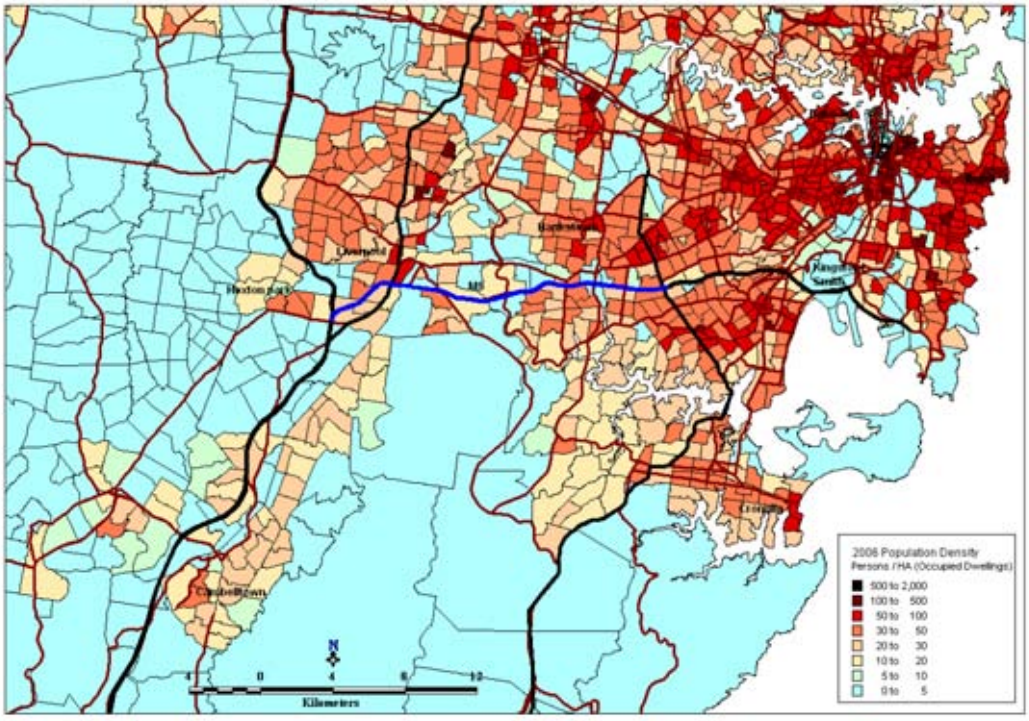
Subsequently the Annual Average Daily Traffic (AADT) was estimated as follows:

$$AADT_{Car} = 5.29 \times (AM + IP \times PM) \times 0.94980$$

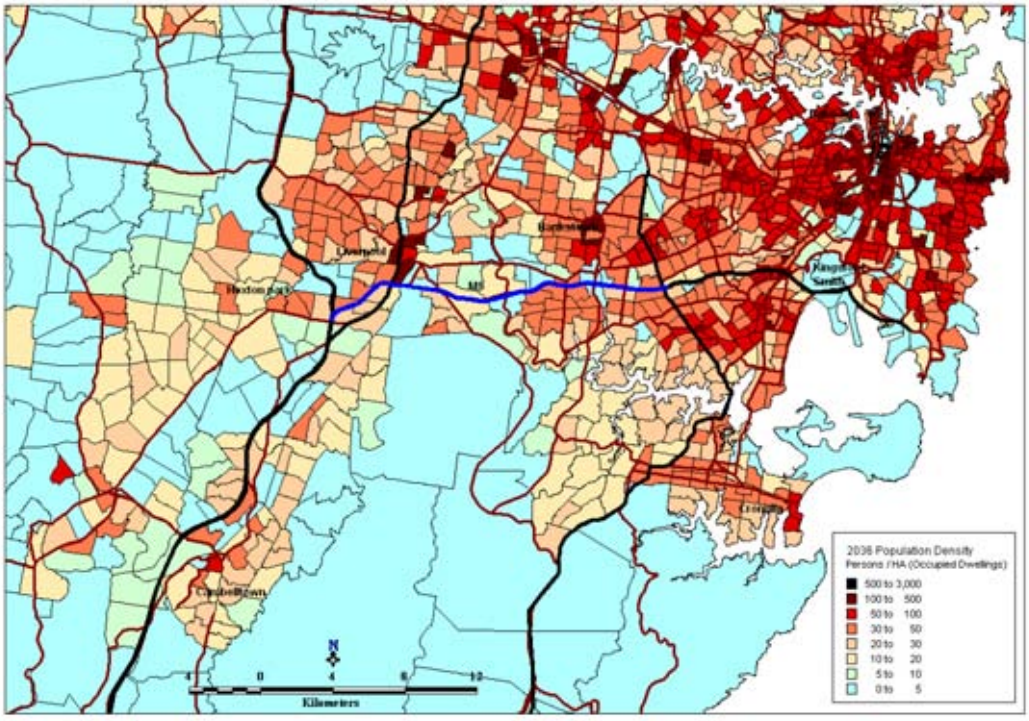
$$AADT_{Truck} = 5.23 \times (AM + IP + PM) \times 0.75384$$

Appendix C Land Use Density Graphs

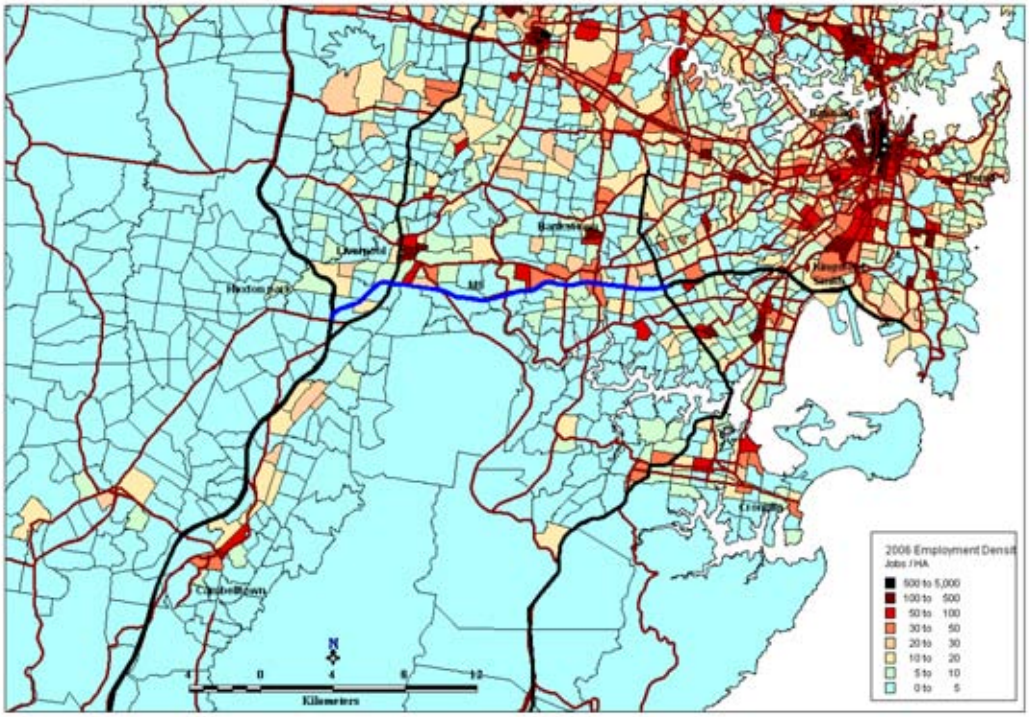
C.1 2006 Population Density



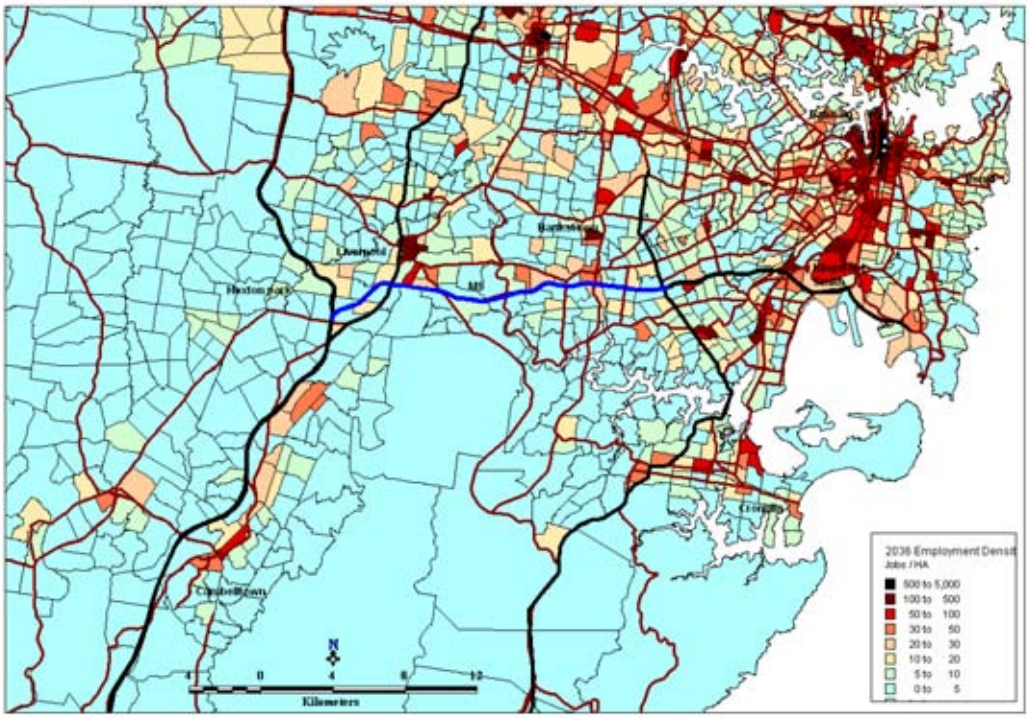
C.2 2036 Population Density



C.3 2006 Employment Density



C.4 2036 Employment Density



Introduction

GTA Consultants has been commissioned by the RTA to identify opportunities to integrate the M5 West Motorway with existing or proposed shared path and on-road bicycle and pedestrian networks in the vicinity of the Motorway.

A desktop review of the existing and proposed networks in the vicinity of the M5 Motorway west of King Georges Road was undertaken. A site inspection was also undertaken to determine the status and quality of each route. Each route was evaluated using criteria such as status, quality, importance, usage, user types and opportunities for integration with the M5 West. A range of recommendations has been developed to improve the integration of the M5 West with the surrounding bicycle and pedestrian networks, including both existing and proposed infrastructure.

It is noted that the Director General's Requirements specify the need for "integration" of cycling (and walking) facilities with the M5 West project. However, there are safety concerns associated with encouraging some groups of cyclists along the existing motorway cycling facilities. These facilities generally consist of the motorway shoulders, which are unsuitable for family groups and unfamiliar recreational riders.

It is further noted that there are limited opportunities to "integrate" new cycling and walking facilities with the M5 given that there are limited existing facilities along the motorway.

However, while opportunities to "integrate" are limited, there are numerous opportunities to "enhance" the surrounding networks, which focus on implementation of bicycle and pedestrian facilities across the M5 West and facilities further afield, typically based on existing Council and State Government bike plans. In particular, many of the interchanges of the M5 West with the surface road network provide good pedestrian and bicycle access to the local street network, railway stations, town centres, etc.

Bicycle and Pedestrian Infrastructure in M5 West Corridor

In the area surrounding the M5 West there are a number of key bicycle and pedestrian routes. The new NSW Bike Plan includes a number of prioritised links, which build on the existing cycle network. When considering potential connections from the M5 West to the surrounding cycle network, priority should be given to these routes and associated connections. Particular attention should be given to river crossing points and motorway crossing points, which are major barriers to cyclists.

As a key location, a subregional bike network has been developed for Liverpool being one of three Regional River Cities. The Liverpool subregional bicycle network features a number of priority links, including:

- Liverpool to Casula on the western side of the Georges River
- Liverpool to Chipping Norton along Newbridge Road
- Liverpool to Holsworthy via Heathcote Road
- Liverpool to Moorebank via Moorebank Road.

These routes provide a number of key north-south and east-west links at the western end of the M5 West Corridor.

Recommendations

Based on the evaluation of the existing and proposed routes in the vicinity of the M5 West, the following recommendations have been developed which would improve the integration of the M5 West into the local shared path and on-road bicycle and pedestrian network. Refer to Attachment 1 for the evaluation of all routes assessed.

Opportunities for Integration

Due to the limited number of bicycle and pedestrian facilities explicitly provided in the existing M5 West corridor, there is only one location that affords an "integration" opportunity:

River Crossing Points

- R1: A pedestrian and cycle crossing on the western arm of the Georges River could be provided. There is an existing path for westbound cyclists exiting the M5 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 toward the rail line, which provides the potential for a link to the proposed shared path running along the rail line. It is understood this link is funded and due to begin construction around July 2011.

Opportunities for Enhancement

The main opportunities for the provision of bicycle and pedestrian facilities in and around the M5 West corridor consist of "enhancements", including:

River Crossing Points

- R2: The existing boardwalk facilities at Salt Pan Creek should be widened to provide sufficient space to accommodate cyclists. The boardwalk links to other shared path facilities and incorporates a crossing of Salt Pan Creek on the northern side of the M5. The current boardwalk is approximately 1.2-1.5m wide, which is insufficient for cyclists to pass.

Motorway Crossing Points

- M1: A shared path along the Hume Highway is proposed (see M4). The Hume Highway is a significant crossing point over the M5 south of the start of the M7. Bicycle crossing facilities could be provided at this intersection to link with the shared path along Maxwells Creek and leading to the M7 cycleway.
- M2: Cycle and pedestrian links at the M5/M7 interchange should be maintained. The M7 cycleway is a major piece of cycle infrastructure and linkage to it should be encouraged.
- M3: The Beech Road Bridge over the M5 features wide verges of more than 3m suitable for use as a shared path. This narrows on the southern side of the bridge, but may have adequate width to accommodate a shared path. However there are no pedestrian or cycle facilities leading to the bridge from the north. The route is a major crossing of the M5 and the path could link to facilities on Kurrajong Road to the north and proposed facilities on the Hume Highway to the south.
- M4: The Liverpool Bike Plan features a proposed off-road shared path along the Hume Highway. Small sections of the route exist. However, the remainder of the route could be constructed to provide a valuable link between the several major crossings of the M5, as well as other cycleways.
- M5: Heathcote Road is a key crossing of the M5. The route also links proposed off-road paths through Ernie Smith Reserve, along Heathcote Road and through Anzac Creek.

- M6: The shared path along Henry Lawson Drive could be upgraded. The existing off-road facility is in poor condition from Kelso Park through the M5 underpass. This route is a significant crossing of the M5 and links to nearby off-road facilities in Deepwater Regional Park and Kelso Park to the south and on-road facilities along the East Hills rail line.
- M7: A proposed on-road path along Horsley Road is included in the Bankstown Bike Plan. If constructed it would provide an additional M5 crossing point.
- M8: The River Road is a major road and significant crossing of the M5. It carries high traffic volumes which discourage on-road cycling. An off-road route could link the area from north of the M5 south to the East Hills Rail Line.
- M9: A marked on-road cycle route could be installed on Mackenzie Street which would provide improved bicycle accessibility of the M5 pedestrian bridge overpass. The route does not currently exist, but is proposed as an on-road path in the Bankstown Bike Plan. The route is generally wide with low vehicular traffic and provides a link from Canterbury Road to on-road facilities along the East Hills rail line.
- M10: Fairford Road is a major road and significant crossing of the M5. It carries high traffic volumes which discourage on-road cycling. An off-road route could link the area from north of the M5 south to the East Hills Rail Line. However, an off-road route would need to extend north to Canterbury Road and south to Iberia Street as there is little other surrounding cycle infrastructure.
- M11: Bicycle crossing facilities at King Georges Road at the M5 overpass could be provided, including bicycle lanterns at the signalised pedestrian crossing. This would link the existing off-road shared paths running parallel to the M5 on both sides. This facility extends largely uninterrupted from Bexley Road in the east to Salt Pan Creek Reserve to the west.

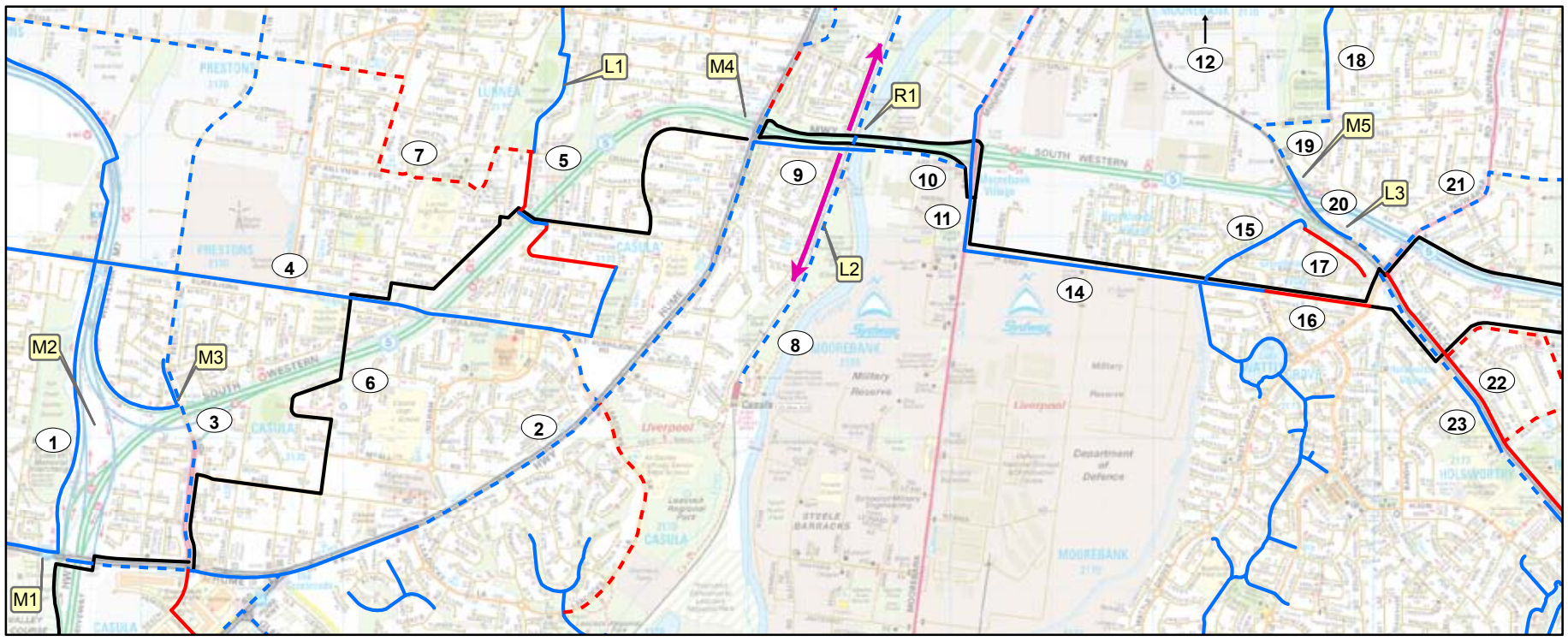
Links to Major Regional Cycleways and Other Surrounding Infrastructure

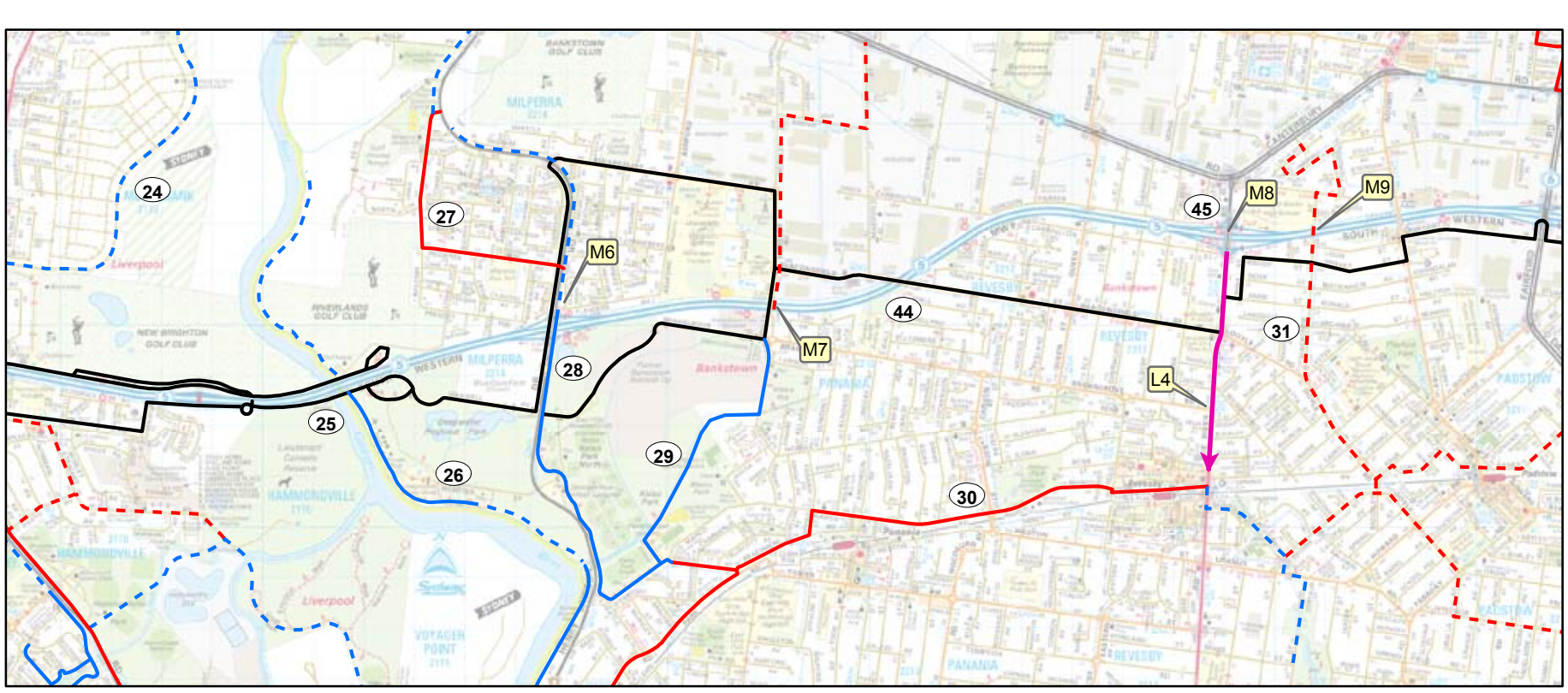
- L1: An off-road shared path runs along Brickmakers Creek through Amalfi Memorial Park. The route has some on-road sections which could be shifted off-road to provide a more continuous route. The route links an off-road route along Hoxton Park Road to the north and an off-road path on Kurrajong Road and proposed facilities on the Hume Highway to the south. Facilities at the underpass under the M5 could be upgraded. There is a wide verge on one side only that is adequate for a shared path. However, paths narrow on each side to 1.2-1.5m which is inadequate for a shared path. Signposting could also be improved.
- L2: There is a proposed shared path along the rail line between Liverpool and Casula Stations. This route is featured as a priority subregional route in the NSW Bike Plan. It is understood that the route has funding and that construction is due to begin in July 2011. The route will provide an important off-road crossing of the M5. The route could also be linked to a proposed route which crosses the Georges River on the M5 Bridge.
- L3: Heathcote Road and Nuwarra Road provide crossing points for the M5 and link with existing shared path facilities on Anzac Road. Presently there are no facilities on Nuwarra Road. An off-road path is proposed as part of the Liverpool Bike Plan. There is sufficient room for a shared path along Nuwarra Road and through the M5 underpass. This route should be prioritised.
- L4: The River Road is a major crossing of the M5. The crossing links the area north of the M5 with facilities to the south, including the East Hills rail line at Revesby Station. Facilities at the M5 crossing and along The River Road could be enhanced to improve access to this line.
- L5: The M5 crossing at Belmore Road provides a link from north of the M5 to Riverwood Station on the East Hills line. Crossing facilities could be enhanced, and the proposed off-road facilities on Belmore Road extended towards Riverwood Station.

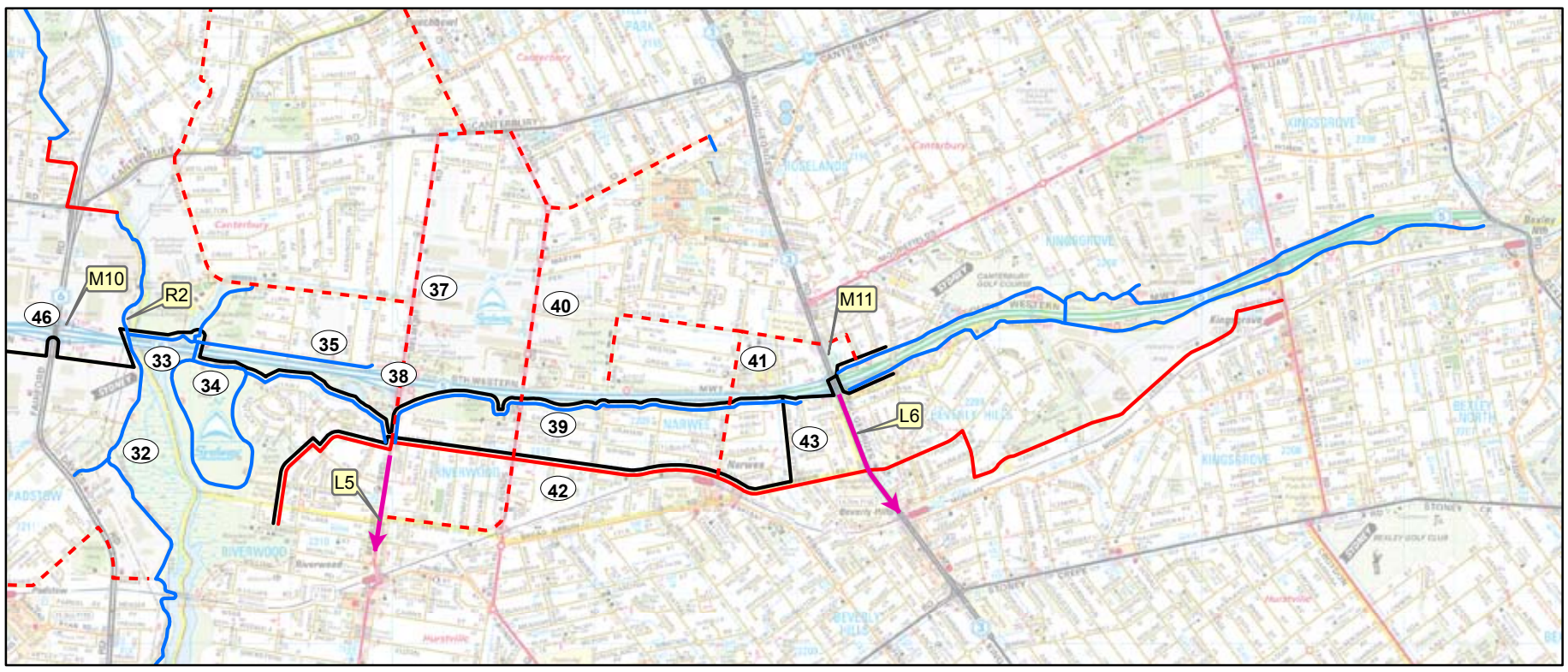
- L6: King Georges Road is a key crossing of the M5 and provides a link to Beverly Hills Station on the East Hills line. Improving crossing facilities and integration with surrounding paths could provide a useful link to Beverly Hills Station.

Other Considerations

- Bicycle and pedestrian related signs and markings are generally poor across the routes, particularly towards the eastern section of the M5. Better signposting of routes could be provided to help identify on-road routes and shared paths.
- Improved directional signage could be provided on cycle routes, in particular to identify M5 crossing points.
- On-road facilities should have marked lanes where possible to improve separation from vehicular traffic.
- Overpasses at on/off-ramp locations feature pedestrian signals. Bicycle lanterns could be added at these locations and shared paths extended beyond these crossing points to improve accessibility for cyclists.







Legend

- On-Road, Existing
- On-Road, Proposed
- Shared Path, Existing
- Shared Path, Proposed
- Interlink Road Proposed Routes
- Critical Links to Rail Stations

Issue	Date	By	Chkd	Appd
P1	07-06-10	BL	CW	DVD

Client

Roads and Traffic Authority

Job Title

M5 West Widening
- Cyclist Route Planning

Drawing Title

Bicycle Routes Map

Metres

0 380 760 1,520

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Scale at A3

1:32,000

Drawing Status

Preliminary

Job No	Drawing No	Issue
IS12410	001	P1

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Works Scale	
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			Route Evaluation								Works		
Route Number	*Route Description*	*Route Photo*	*Network importance*	*M5 Relevance*	*Status of Route*	*Route Type*	*Route Condition*	*Route Usage*	*User Type*	*Opportunities or constraints for integration*	*Works Type*	*Works Scale*	*Benefits/ Drawbacks*
1	Off road M7 link		High	link	Existing	Shared Path	Shared Path is in generally good condition and well signposted. Hume Highway overpass: · All crossings signalised · M7 bike path to north · Footpath to east only, on north side only	Pending	Pedestrian Recreational Commuter	Ensure integration with and access to the surrounding network is maintained during the period of construction.	Improve pavement markings and directional signage	1	· Increases accessibility and navigability · Increases driver awareness of cyclists · Low cost
2	Hume Hwy		High	Parallel	Existing/Proposed	Shared Path	There is an existing 3m wide concrete shared path between Beech Road and York Street which is in good condition. There is currently no path between Beech Road and the entrances to the M5/M7. The existing path seems to be recently constructed and there is construction work in progress. M5 crossing (North): · No crossing of the Highway on the northern approach · All other crossings signalised or zebra · Standard footpaths on all approaches	Pending	Pedestrian Recreational	Opportunity to provide an alternative route along the M5 corridor.	Provide pavement markings and directional signage	4	· Provides an alternate route · Increases accessibility · Wide nature strip for shared path · Path next to a major arterial road
3	Beech Road		High	Cross	Proposed	Shared Path	No current on-road facilities observed during the site visit. There are currently shared path facilities on the eastern side just south of the Kurrajong intersection and on the western side, north of the M5 crossing. There is no footpath leading up to the M5 crossing from the north.	Pending	Pedestrian Recreational	The creation of a shared path facility would link the Kurrajong Road shared path with the Hume Highway shared path. This would provide a key cross link between the two paths as Beech Road is one of only two direct links, the other being Box Road. This facility would link partially constructed shared paths within the Beech Road Corridor.	Shared path construction and associated signage.	3	· Provides for an additional direct M5 crossing at a location without on/off ramps · No direct access to the M5 · Links into existing shared path network
4	Kurrajong Road		Medium	Cross	Existing	Shared Path	New 3m wide shared path on the northern side of Kurrajong Road crossing to the southern side near the Wonga Road intersection.	Pending	Pedestrian Recreational Commuter	Kurrajong Road crosses the M5 but does not connect with it. There would be concerns with providing an extra connection with the M5 as it would provide easier access for recreational riders to ride along the M5 Corridor. Access across the M5 needs to be maintained as Kurrajong Road provides important local access.	Widen existing shared path in narrow sections.	3/4	· Increases cyclist accessibility · Reduced cyclist pedestrian conflicts · Improves links to M7 cycleway
5	Amalfi Memorial Park to Kurrajong Rd		Medium	cross	Existing	Shared Path/On-road	Approximately 2.5m wide shared path facility crossing under the M5 on the southern side of De Meyrick Avenue and continues within Amalfi Memorial Park. This is a concrete path in good condition. Either side of the M5 underpass are on-road routes. These have no pavement markings but do have directional signage.	Pending	Pedestrian Recreational	This is an existing link between Amalfi Memorial Park and Kurrajong Road. It provides a key crossing of the M5. There is the possibility of upgrading the current on-road facilities to bring them up to standard and direct bikes toward the crossing.	Enhance existing on road sections with pavement markings and install directional signage.	1	· Increases navigability · Increases driver awareness of cyclists · Low cost
6	Box Road Pedestrian Crossing		Low	Cross	Existing	Shared Path	Existing pedestrian bridge over M5 links to nearby footpaths and roads. There is no current marking or signage.	Pending	Pedestrian Recreational	This overbridge is an important local link across the M5. It provides direct access to Prestons Public school for residents living south of the M5. This link must be kept open during the construction period.	Modify existing pedestrian bridge to be used as a shared path. Construct shared paths on both sides of the crossing.	2	· Provides safe pedestrian and cyclist crossing · Allows safe crossing of the M5 by local school children · Links into surrounding local roads

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7	Jedda Ave/Hillview Pde		Low	Link	Proposed	On road	No facilities present during site visit.	Pending	Recreational	This is a local facility that would direct cyclist toward main routes.	Provide pavement markings and directional signage	1	· Increases navigability · Increases driver awareness of cyclists · Low cost
8	Liverpool/Casula Rail Link		High	Cross	Proposed	Shared Path	No facilities present during site visit.	Pending	Pedestrian Recreational Commuter	This link will provide a key link south of Liverpool. The NSW Government has included it in the NSW Bike Plan as a high priority link. Funding for this project will be available in the 2010/2011 financial year. Existing facilities could link into this new route. The route could easily be linked to a crossing of the Georges River on the M5, and provide a link between Liverpool and Casula railway stations.	Shared path construction and associated signage.	5	· New commuter route into Liverpool · New M5 crossing point · Links to Liverpool and Casula railway stations · High cost
9	M5 Parallel off road		High	Parallel	Existing	Shared Path	Existing 2m wide footpath are on the southern side of the M5 bridge crossing the Georges river. Pedestrian and bicycle access from the west and bicycle only access from the east. Current path leads to a dead end for pedestrians.	Pending	Pedestrian Recreational Commuter	The current off road facility would require minor upgrades to provide convenient access across the Georges River and link to Moorebank Avenue	Undertake minor path maintenance and install warning/directional Signage	1	· Increases accessibility between Hume Highway and Moorebank Avenue · Limited works required due to existing facilities
10	M5 Parallel off road		High	Parallel	Proposed	Shared Path	No facilities present during site visit. Pedestrian desire lines in the area with dirt track next to M5 on-ramp.	Pending	Pedestrian Recreational Commuter	The linking of Moorebank Avenue with the existing Georges River crossing would enable the creation of an additional pedestrian and bicycle crossing of Georges River. As the bridge crossing has already been constructed only the construction of a shared path is needed to link existing facilities. A new crossing of Moorebank Avenue would be needed to link with existing shared paths on the eastern side of Moorebank Avenue.	Shared path construction and associated signage.	3	· Increases accessibility between Hume Highway and Moorebank Avenue · Additional river crossing · Relatively low cost due to existing bridge facilities
11	Moorebank Av (South)		High	Cross	Existing	Shared Path	Existing concrete shared path on the eastern side of Moorebank Avenue. Path is approximately 2m wide. There is a wide footpath at the M5 crossing and a zebra crossing. There are no bicycle crossing facilities. · No crossing facilities down west side of Moorebank Avenue · No footpath on south west approach · Limited footpaths to north	Pending	Pedestrian Recreational Commuter	This route links the M5 crossing with the Anzac Road shared path. The current condition of the route is good and the route is well constructed and only minor works on the intersections are needed.	Install bicycle Lanterns on pedestrian crossings and mark as shared paths. Install new crossing of Moorebank Avenue and install new pedestrian crossings to replace existing zebra crossings.	3	· Increases accessibility for cyclists and pedestrians · Possible Increases motorist delay due to additional crossing · High cost due to intersection modifications
12	Moorebank Av (North)		Medium	Cross	Proposed	Shared Path	Existing narrow 1-1.2 wide footpath on the eastern side of the road north of the M5 crossing. The footpath is currently overgrown and is intermittent along Moorebank Avenue.	Pending	Pedestrian Recreational Commuter	Footpath facilities could be provided north of the M5 on Moorebank avenue. There is currently a lack of any consistent footpath along the route. This section of Moorebank Road is marked as high priority in the NSW Bike plan and will be looked at in 2011 for possible construction. It is important that there is good connectivity between this route and the M5 crossing.	Shared path construction and associated signage.	3	· Wide existing nature strip, suitable for shared path · Requires crossing provision, difficulties associated with high traffic volume

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13	Newbridge Rd		High	Parallel	Proposed	Shared Path	Currently there is a footpath approximately 1.2m wide either side of Newbridge Road.	Pending	Pedestrian Recreational Commuter	Newbridge Road is a road of state importance and is heavily used by motor vehicles. It is the most direct route parallel to the M5 corridor and is continues all the way to the centre of Sydney. Newbridge Road is marked as high priority in the NSW Bike Plan.	Shared path construction and associated signage.	5	· Difficulties due to large number of vehicular crossings · High cost · Limited available space in footpath area · Would link to Liverpool Town Centre
14	Anzac Rd shared path		Medium	Parallel	Existing	Shared Path	2.5m wide bitumen shared path in reasonable condition. Cracking has developed and the path has started to become uneven. The path crosses Anzac Road twice.	Pending	Pedestrian Recreational Commuter	This route is an important parallel route to the M5. With the extension of the Georges River crossing it would form a route to link Liverpool and Casula with Wattle Grove.	Remedial work to repair uneven surfaces and cracking. Installation of directional signage.	2	· Improves accessibility and navigability · Limited works required to improve path quality
15	Anzac Creek Shared Path		Medium	Cross	Existing	Shared Path	2.5m wide concrete shared path. Concrete has started to rise and fall leading to level differential in slabs and has allowed over growth. Links into Anzac Road shared path.	Pending	Pedestrian Recreational	The Anzac Creek shared path links the Anzac Road shared path with the Heathcote Road/M5 interchange. It provides easy access for pedestrians and cyclists. With minor maintenance work this path could provide a parallel path to the M5.	Undertake minor path maintenance. Installation of directional signage.	1	· Improves accessibility and navigability · Limited works required to improve path quality
16	Anzac Rd on road		Medium	Parallel	Existing	On road	No facilities present during site visit. Unsealed shoulder which is unsuitable for bikes.	Pending	Pedestrian Recreational Commuter	The ending of the shared path facilities before Heathcote road takes away a convenient access point path for pedestrians and cyclists. The Anzac Road Shared path could be continued until Heathcote Road to allow access to the proposed Heathcote Road shared path.	Shared path construction and associated signage.	2	· Provides link to Heathcote Road · Wide verge/shoulder area, suitable for shared path · Existing verge/shoulder unsealed
17	Bridges Av		Low	Parallel	Existing	On road	No facilities present during site visit.	Pending	Recreational	This is a local access route between Anzac Creek shared path and Nuwarra Road. Pedestrians and cyclists should be encouraged to use the Heathcote Road shared path to free up local streets.	Provide pavement markings and directional signage.	1	· Improves accessibility and navigability · Improves on road safety · Low cost
18	Ernie Smith Reserve Shared Path		Low	Link	Existing	Shared Path	Good quality 2.5m concrete shared path. No signage or line marking present.	Pending	Pedestrian Recreational	This route provides for local access south to the M5. Currently the path ends at the southern end of Ernie Smith Reserve and forces pedestrians and cyclist to use the edge of the road to gain access to Heathcote Road.	Improve directional signage.	1	· Improves accessibility and navigability · Low cost

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19	Ernie Smith Reserve Connection		Medium	Link	Proposed	Shared Path	Current 1.4m wide footpath which is unsuitable for bicycle use.	Pending	Pedestrian Recreational	This path provides a critical link north through Ernie Smith Reserve to Newbridge Road. There is currently no footpath linking these two facilities.	Shared path construction and associated signage.	2	· Provides missing link north to Newbridge Road · Wide verge area suitable for shared path
20	Heathcote Rd, M5 crossing		High	Cross	Existing	Shared Path	Narrow/steep approach from the south with dangerous pedestrian zebra crossing due to poor visibility of the footpath. Wide footpath on bridge. No signage or bicycle lanterns. · Pedestrian crossings on east side only, signalised and zebra · Paths on east side only, off Heathcote road either side of intersection	Pending	Pedestrian Recreational Commuter	This route is a key crossing of the M5. The route also links proposed off-road paths through Ernie Smith Reserve, along Heathcote Road and through Anzac Creek.	Remove Zebra crossing on westbound off ramp and install signals. Provide bicycle lanterns on crossings.	3	· Increases cyclist and pedestrian accessibility across M5 for cyclists and pedestrians · Possible delay to motorists due to changes to intersection phasing · High cost due to intersection modifications
21	Nuwarra Rd		High	Cross	Proposed	Shared Path	No existing bicycle facilities. 1.2m wide footpath on each side of the Road. Wide nature strip on the eastern side of road is suitable for 3m wide shared path.	Pending	Pedestrian Recreational	The current underpass of the M5 is narrow and Nuwarra Road is a busy connector road to Newbridge Road. The provision of safe pedestrian and cyclist facilities off-road is desirable. The construction of a shared path on the eastern side of Nuwarra Road would allow for safe access across the M5 Corridor.	Shared path construction and associated signage.	2	· Wide nature strip suitable for shared path construction · Provides additional M5 crossing, with no on/off ramp crossings · Provides cycle link between Wattle Grove and Moorebank
22	Heathcote Rd		Medium	Parallel	Existing	On road	Narrow kerbside bike lanes both sides of Heathcote Road. Lanes approximately 1m wide. North of M5 crossing is a proposed shared path linking to Newbridge Road	Pending	Pedestrian Recreational Commuter	The current on-road facility could be upgraded to provide a safer environment for users. Attention should be given to the proposed shared path as it provides better connections with the surrounding network.	Provide additional signage and pavement markings.	1	· Improves accessibility and navigability · Improves on road safety · Low cost
23	Heathcote Rd Shared Path		High	Parallel	Existing/Proposed	Shared Path	Current completed section of shared path is a 2.5m wide concrete path. No signage or pavement markings are present.	Pending	Recreational Commuter	The Heathcote Road shared path would provide an important alternative to the current on-road facilities. It could enable better connectivity with other shared paths in the area and allow recreational users a safer place to ride.	Shared path construction and associated signage. Install bicycle lanterns on pedestrian crossings	3	· Improves accessibility and navigability · Safer and more accessible alternative to on-road path
24	Newbridge Rd to Nuwarra Rd		Medium	Link	Proposed	Shared Path	No facilities present during site visit.	Pending	Pedestrian Recreational	The development of this shared path would link the proposed Governor Macquarie Drive shared path with the Nuwarra Road shared path. It would relocate pedestrians and cyclists travelling along Nuwarra Road. This path should only be built once the new residential area is constructed due to safety concerns for users at night.	Shared path construction and associated signage.	3	· Additional link between the M5 and Newbridge Road · Could be developed as part of the adjoining development · Medium cost · The path would run along the back of properties which could create anti social problems

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25	Georges River Crossing		Medium	Parallel	Proposed	Shared Path	No facilities present during site visit.	Pending	Pedestrian Recreational	The development of an additional crossing of the Georges River could dramatically increase the accessibility of the area for pedestrians and cyclists. The two closest crossings are Newbridge Road in the North and Voyager Point Pedestrian Bridge in the south. The crossing could become an important parallel route for the M5. Concerns about safety of users after dark would need to be addressed due to the remote location.	Construct shared path on the western side of the Georges River and construct shared river crossing.	5	· Additional river crossing · Could link to existing and proposed routes · High cost · Unpopulated areas either side of Georges River
26	Deepwater regional Park Shared Path		Low	Link	Existing	Shared Path	2.5m asphalt shared path with no line marking or pavement markings. Shared path signage at start of path. Path is in good condition with minimal cracking.	Pending	Pedestrian Recreational	Deepwater Regional Park shared path is an important recreational route in the Bankstown area. It would provide a long stretch of shared path without intersecting roads. Due to the isolated nature of the path there are concerns about safety after dark and with sections of the path no passive surveillance.	Shared path construction and associated signage.	3	· Provides a link to the proposed crossing of the Georges River crossing · Creates a crossing under the M5 linking to the north. · Path travels through bush where there is no passive surveillance
27	Raleigh Rd/Pozieres Av		Low	Link	Existing/Proposed	On road	On-road mixed traffic facilities linking to shared path in the north, low traffic volumes with a wide road reserve. Bicycle stencils and signage along route with green paving intersection treatments.	Pending	Recreational	This route is designed to provide and alternative route to Henry Lawson Drive for local cyclists as well as better linkage with the local suburb. The provision of facilities at each end may encourage more use.	Provide additional directional signage and pavement markings	1	· Improves accessibility and navigability · Improves on road safety · Low cost
28	Henry Lawson Dr		Medium	Cross	Existing	Shared Path	Near M5, poor quality asphalt path with obstructions. Path has been severely eroded near the M5 overpass. At M5 overpass: · Crossings on east side only · Mixture of signalised and zebra crossings · Path on east side only, poor quality south of overpass New path of west side of Henry Lawson Drive. Good condition, 2.5m wide asphalt path, ends abruptly.	Pending	Pedestrian Recreational	The upgrading of the shared path facilities would provide increased amenity for pedestrians and cyclists between Milperra and East Hills. Henry Lawson Drive is a heavily used road and the provision of safe pedestrian facilities is necessary. The path would also link Milperra residents with Kelso Park recreational facilities.	Shared path construction and associated signage.	3	· Linkage between M5 and East Hills rail line and adjacent cycle facilities · Improves accessibility and navigability
29	Kelso Park Shared Path		Low	Parallel	Existing	Shared Path	Good quality 2.5m asphalt shared path.	Pending	Pedestrian Recreational	Kelso Park shared path connects the M5 to East Hills to the south. The placement of directional signage would make the path more visible to pedestrians and cyclists.	Provide additional directional Signage	1	· Improves accessibility and navigability · Low cost
30	East Hills rail line cycle path		Medium	Parallel	Existing	On road	A mixture of on-road and shared path facilities. Shared path and bicycle signs are present along route. Mixed traffic conditions further away from Revesby Station.	Pending	Pedestrian Recreational Commuter	This on-road facility is a major parallel facility that could be considered for connection to the M5 network. Currently the only connection is through the Kelso Park shared path.	Enhance existing on-road facilities and upgrade to separated bike lanes where appropriate	1	· Improves accessibility and navigability · Improves on-road safety · Low cost

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31	Mackenzie St		Medium	Cross	Proposed	On road	Currently no facilities. Wide streets with the potential to develop bicycle facilities. Pedestrian bridge over the M5 with devices to obstruct bicycle movement.	Pending	Pedestrian Recreational Commuter	The Mackenzie Street Pedestrian crossing bridge is the only crossing in the area to provide safe and easy crossing of the M5 for pedestrians and cyclists. Mackenzie street is a local road and is well suited as a local bicycle route.	On road Bike Lanes/Mixed Traffic. Line/pavement markings and warning/directional signage	2	· Improves cycle accessibility and navigability · Improves on road safety · Low cost
32	Stuart St reserve		High	Cross	Existing	Shared Path	2.5m wide concrete path with no markings. Narrow boardwalks across creek where bike riders need to dismount.	Pending	Pedestrian Recreational	The only alternative to using the boardwalk/shared path network to the west of Salt Pan Creek is to use Fairford Road. Many pedestrians and recreational cyclists would find this intimidating. Enabling cyclists to ride on the boardwalk system may encourage increased use of the facilities and increase local access.	Widen existing boardwalk to 3m and provide directional signage	3	· Improves cycle accessibility to river crossing · Improves navigability
33	Salt Pan Creek crossing		High	Parallel	Existing	Shared Path	Bridges across Salt Pan Creek are narrow and it would be difficult for two bikes to pass. Boardwalks are marked no riding areas where riders need to dismount.	Pending	Pedestrian Recreational	There are only two other crossing of the Salt Pan Creek in the vicinity of the M5. They are Canterbury Road in the north and a railway crossing in the south. The provision of a full shared path could allow easy crossing of the creek.	Widen existing boardwalk to 3m and provide directional signage	3	· Improves cycle accessibility of river crossing · Improves navigability
34	Salt Pan Creek reserve		High	Cross	Existing	Shared Path	Wide concrete paths near Riverwood Community centre in good condition. Paths closer to Salt Pan Creek often unsealed.	Pending	Pedestrian Recreational	It may be possible to construct a shared path linking Salt Pan Creek Reserve with the crossing of Salt Pan Creek to the north of the M5. This route is within the NSW Bike Plan.	Shared path construction and associated signage.	2	· Improves cycle accessibility to river crossing · Improves navigability
35	M5 Shared Path, North		Medium	Parallel	Existing	Shared Path	A 1.2m wide footpath has been installed along the length of this route. Conflicts are possible between pedestrians and cyclists when passing each other.	Pending	Pedestrian Recreational	The upgrading of the shared path facilities could provide for an alternative connection between the Belmore Road crossings and Salt Pan Creek.	Shared path construction and associated signage.	3	· Integration of M5 crossing points at Salt Pan Creek and Belmore Road · Safer, more accessible parallel route to M5
36	Moxon Rd/Wiggs Rd		Low	Parallel	Proposed	On road	Wide road with no line markings. Speeding vehicles were observed on-site. No formed kerb on the northern side of the street closer to Belmore Street.	Pending	Pedestrian Recreational Commuter	This route provides local access to the Belmore Road and Salt Pan Creek M5 crossings. Due to the road width traffic calming devices could be installed to reduce the speed of traffic along Wiggs Road.	On road bike lanes, line/pavement markings and warning/directional signage. Traffic calming devices	2	· Integration of M5 crossing points at Salt Pan Creek and Belmore Road and links towards Bankstown Line Rail · Wide roads have sufficient space for on road cycle facilities

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37	Belmore Rd		Medium	Cross	Proposed	On road	1.5m footpath on both sides of road with no markings. No signage to denote shared path. North of M5 there are marked bicycle lanes on both sides of the street with bike stencils	Pending	Pedestrian Recreational Commuter	The upgrading of the shared path facilities would create a link between Hannans Roads and the shared paths at the M5 Crossing.	Widening of existing footpath to 2.5m	2	· Links Canterbury to south of the M5 · Links existing on and off road facilities south of the M5
38	Belmore Road M5 crossing		High	Cross	Existing	Shared Path	Wide concrete path on both sides of crossing. No signage or bicycle lanterns. · No crossing on Belmore Road southern approach · All other crossings are signalised · Footpaths from all corners · Shared path parallel to M5 from north west corner	Pending	Pedestrian Recreational Commuter	The Belmore Road crossing is the last main road crossing before the Salt Pan Creek. It provides direct connections north to Canterbury Road and south to Riverwood Railway station. The crossing is also the crossing point of three shared path routes, two to the west and one to the east. The only crossing of Belmore Road is to the north of the M5 on-ramp. This means pedestrians and cyclists need to travel further to cross.	Install bicycle Lanterns on pedestrian crossings and mark as shared paths	2	· Improves cycle accessibility and navigability · Improves cyclist safety
39	M5 Shared Path, South		High	Parallel	Existing	Shared Path	Varied width (1.5-3m) asphalt path in generally good condition. Some minor cracking in path surface.	Pending	Pedestrian Recreational	The M5 shared path provides pedestrian and recreational access along the M5 corridor. Links could be made with crossing streets such as Bonds Road and Penshurst Road and directional signage be provided to inform users of associated routes.	Remedial work to repair uneven surfaces and cracking. Installation of signage.	1	· Improves cycle accessibility and navigability
40	Bonds Rd		Medium	Cross	Proposed	On road	Wide Road with good potential for on-road treatments. High volume with significant heavy vehicle usage.	Pending	Pedestrian Recreational Commuter	Upgrading this route could provide connections with the Hannans Road on-road route and the M5 shared paths. Bonds Road continues north to Canterbury Road and provides close links to Roselands shopping centre. Due to the wide carriageway, the installation of bicycle lanes would require only minor works	On road bike lanes, line marking, warning and directional signage. Intersection treatments.	2	· Additional M5 crossing · Improves cycle accessibility and navigability · Wide road, space for bike lanes
41	Penshurst Rd		Low	Cross	Proposed	On road	Marked shoulder area, generally with parking. Linkages with shared paths at M5 underpass.	Pending	Pedestrian Recreational Commuter	Upgrading this route could provide connections with the Hannans Road on-road route and the M5 shared paths. Penshurst Road is the closest crossing of the M5 to the King Georges Road interchange.	Enhance existing on road treatments with additional line marking and directional signage.	1	· Improves cycle accessibility and navigability · Improves cyclist on road safety
42	Hannans Rd		Medium	Parallel	Existing	On road	Marked bike lane between parking and travel lanes with bike logos. No intersection treatments.	Pending	Pedestrian Recreational Commuter	Existing facilities are currently well integrated into M5 crossings. Directional signage could be provided to direct pedestrians and cyclists towards M5 crossing locations. Hannans Road has been identified to be developed as an alternative parallel on road cycle route to the M5.	Signalised intersection treatments and roundabout treatments.	2	· Improves cycle accessibility and navigability · Improves cyclist on road safety

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43	Broad Arrow Rd		Medium	Parallel	Existing	On road	No markings or signage.	Pending	Pedestrian Recreational Commuter	Broad Arrow Road is the last link between Hannans Road and King Georges Road. This link runs in front of a local school and could provide easy access for school children. Closer to the intersection of King Georges Road the traffic volume becomes higher in peak periods. This would be unsuitable for on-road bicycle facilities and a shared path would be more appropriate.	On Road bike lanes, Line marking, warning and directional signage. Signalised intersection treatments for on road paths	2	· Improves cycle accessibility and navigability · Improves cyclist on road safety
44	Beaconsfield Street M5 crossing		Low	Cross	Proposed	Shared Path	No facilities present during site visit.	Pending	Pedestrian Recreational Commuter	Beaconsfield Street would provide an M5 crossing uninterrupted by on/off-ramps. Beaconsfield Street also links The River Road with the proposed off-road path on Horsley Road.	Shared path construction and associated signage.	2	· Additional M5 crossing · Improves cycle accessibility and navigability · Improves cyclist on road safety
45	The River Road M5 crossing		Medium	Cross	Proposed	Shared Path	· No crossing of The River Road on southern approach · Eastern slip lanes have zebra crossings · All other crossings have pedestrian signals · Standard, narrow footpaths to the north and south on east and west sides	Pending	Pedestrian Recreational Commuter	The River Road is a major road and significant crossing of the M5. Its high traffic volumes would discourage on-road cycling. Pedestrian and cycle crossings may cause delays. An off-road route could link the area from north of the M5 south to the East Hills Rail Line.	Remove zebra crossings on slip lanes and install signalised crossings. Install bicycle lanterns. Upgrade existing footpaths to 2.5m to provide for shared paths.	3	· Additional M5 crossing · Improves cycle accessibility and navigability · Improves cyclist safety · Possible Increases motorist delay due to additional crossing · High cost due to intersection modifications
46	Fairford Road M5 crossing		Medium	Cross	Proposed	Shared Path	· No crossing of Fairford Road on northern approach · Left turn slip lanes onto M5 have zebra crossings · All other crossings have pedestrian signals · Standard, narrow footpath from the north eastern corner only. No paths from other accesses.	Pending	Pedestrian Recreational Commuter	Fairford Road is a major road and significant crossing of the M5. Its high traffic volumes would prevent on road cycling. Pedestrian and cycle crossings may cause delays. An off-road route could link the area from north of the M5 south to the East Hills Rail Line. However, an off-road route would need to extend north to Canterbury Road and south to Iberia Street as there is little other surrounding cycle infrastructure.	Install bicycle lanterns on pedestrian crossings and mark as shared path. Construct shared paths on all four approaches to the M5 crossing	4	· Additional M5 crossing · Improves cycle accessibility and navigability · Improves cyclist safety · Possible Increases motorist delay due to additional crossing · High cost due to intersection modifications
47	King Georges Road M5 Crossing		High	Cross	Existing	Shared Path	· No crossing of King Georges Road on northern approach · All other crossings have pedestrian signals · Footpaths on all approaches · Shared paths are located on both side of the M5, east of King Georges Road	Pending	Pedestrian Recreational Commuter	King Georges Road provides a significant crossing point of the M5 and links a number of key off-road cycle routes. High traffic volumes and multi-leg crossings cause delays in crossing. There is no cycle infrastructure through the intersection, though shared paths run east from King Georges Road.	Bicycle lanterns could be provided at crossings and shared paths extended through the intersections	2	· Improves cycle accessibility · Improves cyclist safety