

4.2.4 *Traffic Composition*

Trucks (Class B traffic) passing the Hammondville Toll Plaza account for approximately 6% of the Average Annual Daily Traffic (AADT) and 8% of Average Weekday Traffic (AWT). However, Table 4-5 shows this varies, however by time of day, with trucks accounting for 7% of the tolled traffic in the AM peak period; between 4% and 6% in the PM peak period; and reaching 12% in the inter-peak period.

Table 4-5 Tolled Traffic Composition - 2009

Time Period	Direction	Class A	Class B
AM Peak	Eastbound	93%	7%
AM Peak	Westbound	93%	7%
PM Peak	Eastbound	96%	4%
PM Peak	Westbound	95%	5%
Inter Peak	Eastbound	88%	12%
Inter Peak	Westbound	86%	14%
AADT	Two Way	94%	6%

4.2.5 *Historical Growth*

The weekday traffic growth at M5 Hammondville Toll Plaza was 1.7% between 2006 and 2007, 1.5% between 2007 and 2008, and 0.8% between 2008 and 2009. Compared with the regional growth of 1 – 2%, the historical data shows traffic growth on the M5 motorway is consistent with overall traffic growth in the region.

The reduction in the percentage growth between 2007 and 2009 is a potential indication that the motorway is reaching its ultimate capacity, although this could also be in part due to changes in other demand influencing factors such as the recent economic downturn.

4.2.6 *Study Area Screenline Flows*

For the purposes of this study, five traffic screenlines have been defined across the study area, facilitating the assessment of aggregate traffic flows along particular cross-sections of the study area. Screenlines are often used in this manner to characterise the overall north-south or east-west movements through the study area.

The five screenlines are described in the following sections:

- **Screenline 1 – South West Screenline (N-S)**
The South West Screenline runs north-to-south crossing Elizabeth Drive, Moore Street, Memorial Avenue, Hoxton Park Road, Rose Street, Reilly Street, the M5 South West Motorway, De Meyrick Avenue, Kurrajong Road, Camden Valley Way and Campbelltown Road.
- **Screenline 2 – Main Toll Plaza Screenline (N-S)**
The Main Toll Plaza Screenline runs north-to-south between Newbridge Road and the M5 Hammondville Toll Plaza.
- **Screenline 3 – Bankstown Screenline (N-S)**
The Bankstown Screenline runs north-to-south crossing Liverpool Road, Greenacre Road, Rickard Road, Wattle Street, Stanley Street, Macauley Avenue, Canterbury Road and the M5 South West Motorway.
- **Screenline 4 – Eastern Screenline (N-S)**
The Eastern Screenline is located at the eastern end of the M5 West and runs north-to-south crossing Liverpool Canterbury Road, Roselands Avenue, Roselands Drive, Shorter Avenue, the M5 South West Motorway, Broad Arrow Road and Stoney Creek Road.
- **Screenline 5 – Northern Screenline (E-W)**
The Northern Screenline is located to the north of M5 South West Motorway. It runs east-to-west crossing King Georges Road, Belmore Road, Fairford Road, The River Road, Henry Lawson Drive, Heathcote Road, Moorebank Avenue, and the Hume Highway

The screenline locations are indicated in Figure 4-6.

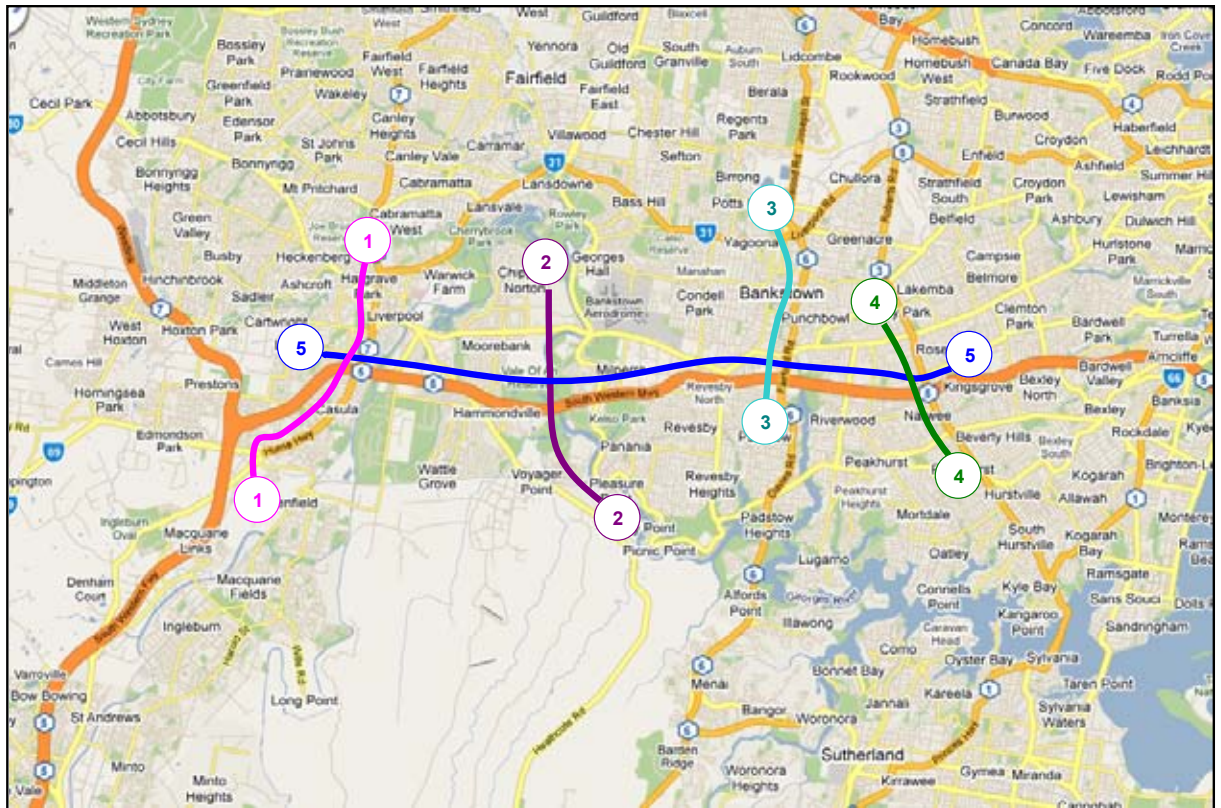


Figure 4-6 Screenline Locations

Table 4-6 summarises the observed screenline volumes.

Table 4-6 Screenline Volumes (Two-way Total, Observed)

Screenline	AM Peak (1 hour Average)	PM Peak (1 hour Average)
1	18,580 (35%)	20,390 (33%)
2	10,670 (58%)	11,490 (59%)
3	16,040 (40%)	17,900 (40%)
4	11,600 (47%)	13,590 (45%)
5	24,420	25,700

Note: % shown in () indicate percentage on M5

4.3 *Travel Speeds*

Travel time surveys were undertaken for the AM peak and PM peak period in April and May 2010 to determine typical travel speeds. The survey routes are described as follows:

- M5 South West Freeway and M5 South West Motorway between Brooks Road and King Georges Road
- Alternative Route between Brooks Road and King Georges Road through Campbelltown Road, Hume Highway, Newbridge Road, Milperra Road and Canterbury Road.

These travel time surveys were conducted during April/May 2010 for the AM and PM peak hours. Six survey runs were completed for each direction over a period of three days to determine the average travel speeds.

Travel speeds on M5 South West Motorway and the Alternative Route are shown in Figure 4-7 to Figure 4-12.

The results illustrate that a range of travel speeds are experienced along different sections of the motorway and the Alternative Route. Actual speeds are generally somewhat lower than the posted speed limited as a result of congestion, with the worst travel speeds being experienced in the AM peak eastbound direction east of Fairford Road.

4.3.1 *AM peak eastbound*

The average eastbound speed on the M5 South West Motorway ranges from 100 km/h in the section between Hume Highway and Moorebank Avenue, to 22 km/h in the section between Fairford Road and King Georges Road. The average speed over the whole length (Brooks Road to King Georges Road) is 49 km/h. See Figure 4-7 for more details.

Eastbound speeds on the Alternative Route (Campbelltown Road, Hume Highway, Newbridge Road, Milperra Road and Canterbury Road) are lower than the motorway. They range from 56 km/h in the section from Brooks Road to Camden Valley Way, to

25 km/h in the section from The River Road to Fairford Road. The average speed over the whole length is 36 km/h. See Figure 4-8 for more details.

4.3.2 *AM peak westbound*

The average westbound speed on the M5 South West Motorway ranges from 93 km/h in the section between The River Road and Henry Lawson Drive, to 53 km/h in the section between King Georges Road and Fairford Road. The average over the whole length is 78 km/h. See Figure 4-9 for more details.

Westbound speeds on the Alternative Route range from 64 km/h in the section from Camden Valley Way to Brooks Road, to 32 km/h in the section from Fairford Road to The River Road. The average over the whole length is 46 km/h. See Figure 4-10 for more details.

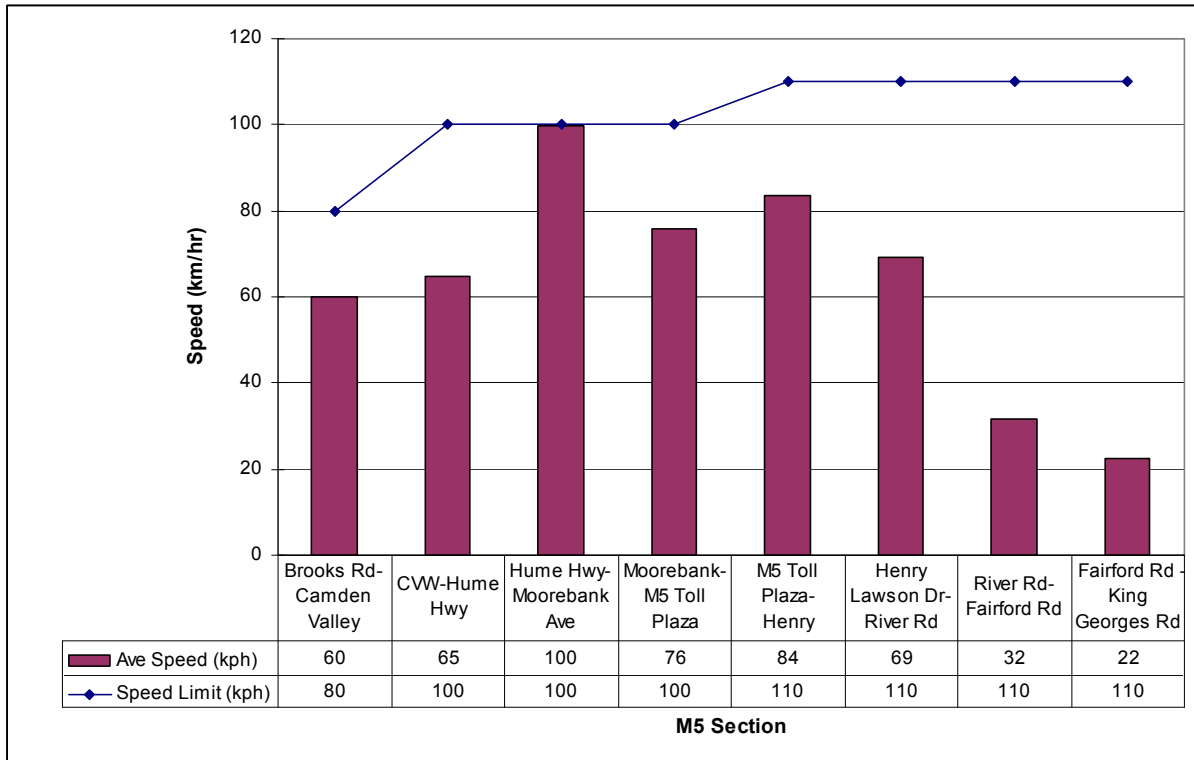


Figure 4-7 Travel Speeds - M5 South West Motorway AM Peak Eastbound

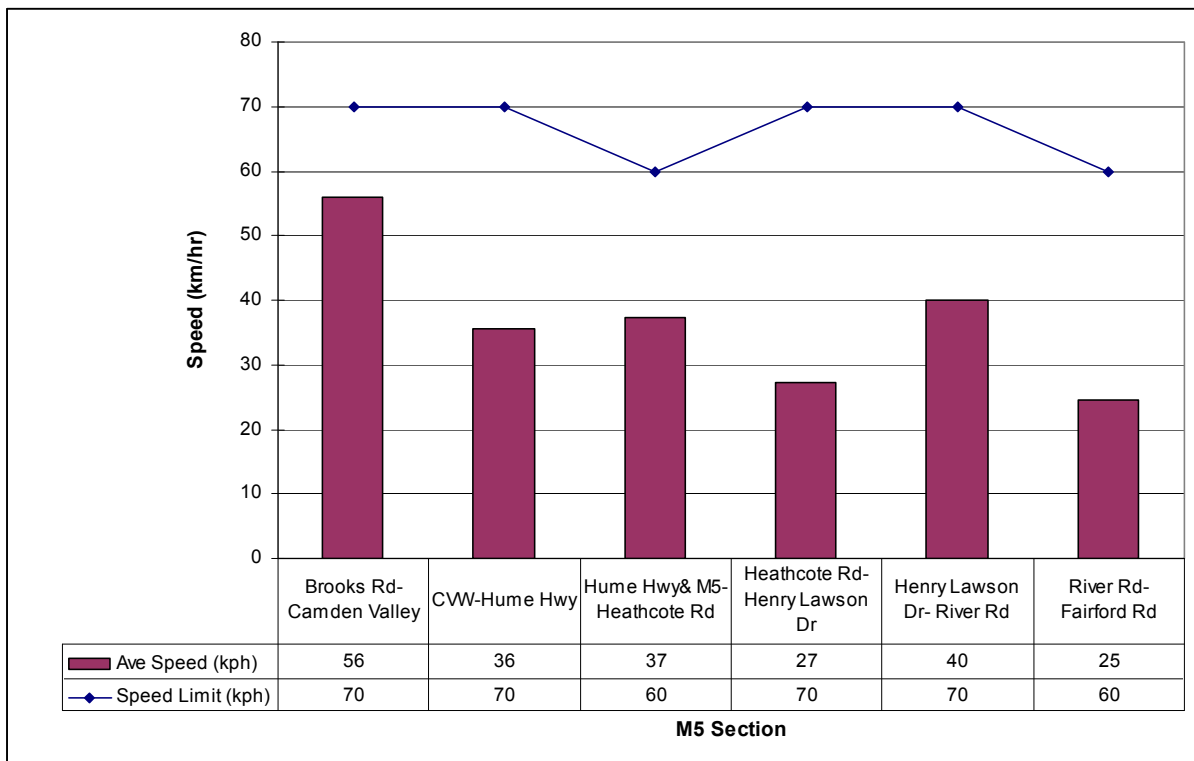


Figure 4-8 Travel Speeds - Alternative Route AM Peak Eastbound

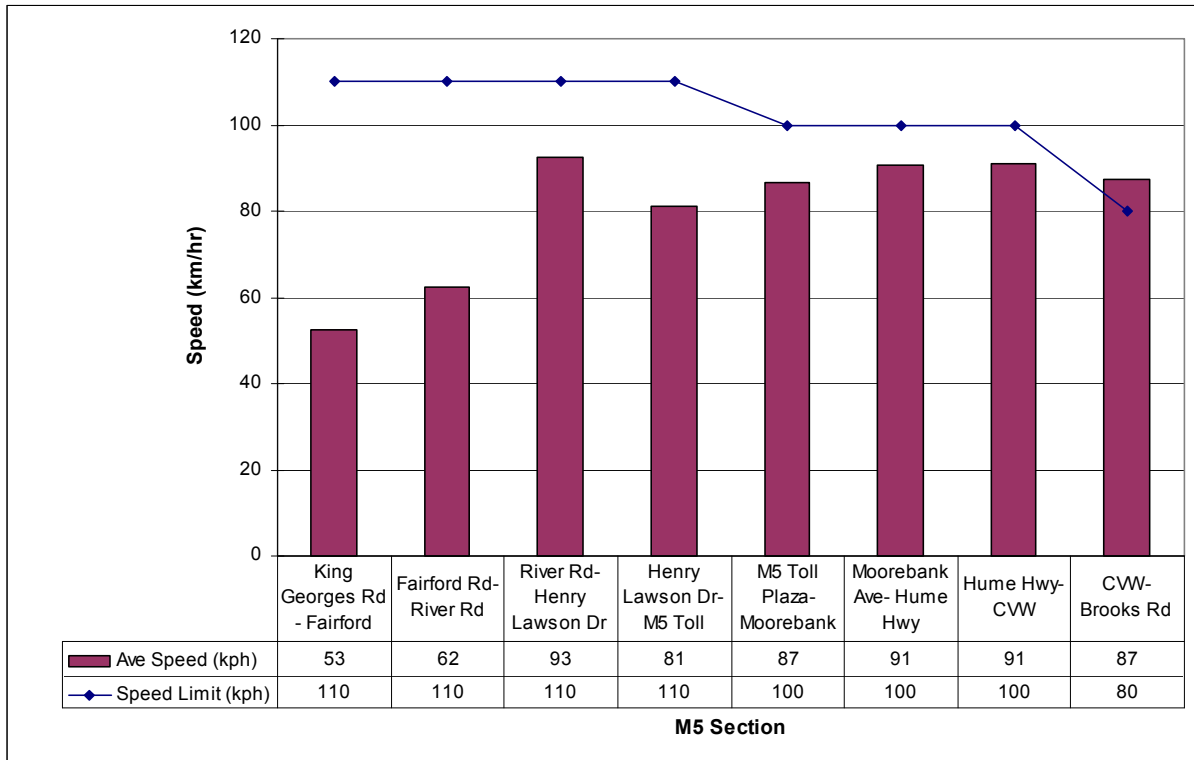


Figure 4-9 Travel Speeds - M5 South West Motorway AM Peak Westbound

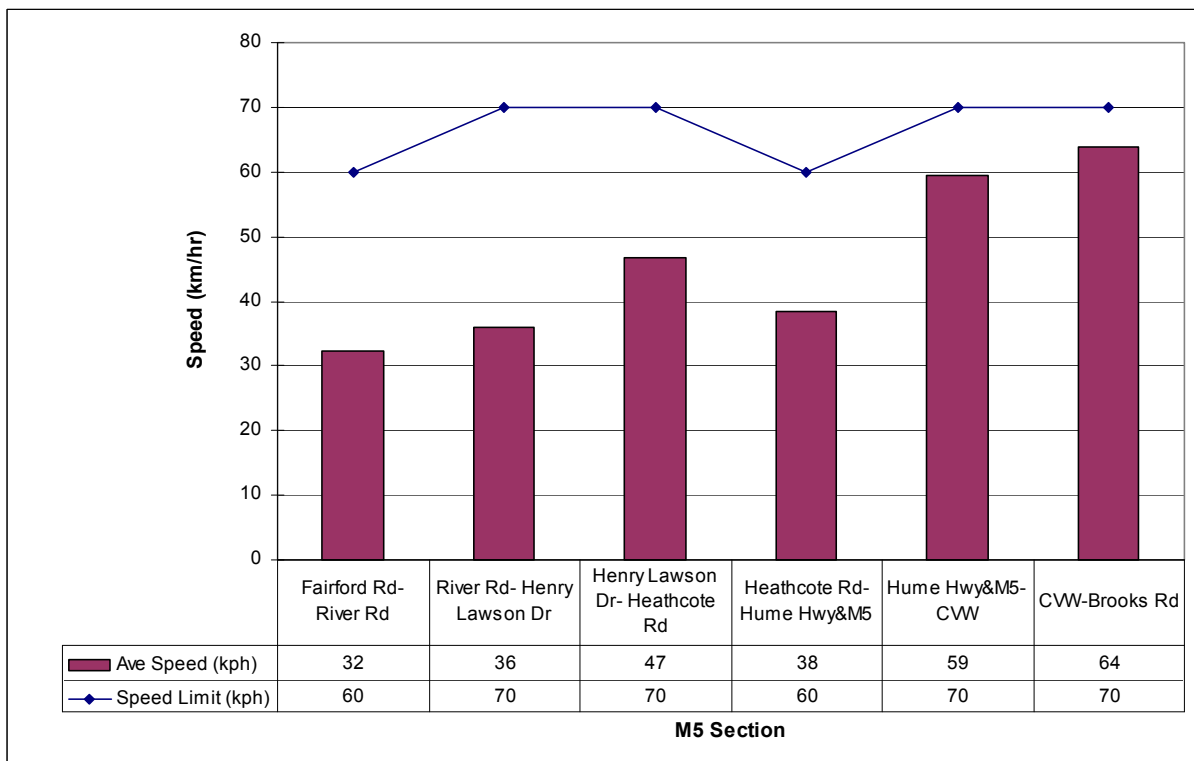


Figure 4-10 Travel Speeds - Alternative Route AM Peak Westbound

4.3.3 *PM peak eastbound*

In the counter-peak direction, eastbound speeds on the motorway range from 100 km/h in the section between Moorebank Road and the Hammondville toll plaza, to 43 km/h in the section between The River Road and Fairford Road. The average speed over the whole length was 88 km/h. See Figure 4-11 for more details.

On the Alternative Route, speeds range from 57 km/h in the section between Brooks Road and Camden Valley Way, to 24 km/h in the section between M5 (Liverpool) and Heathcote Road. The average speed over the whole length was 43 km/h. See Figure 4-12 for more details.

4.3.4 *PM peak westbound*

Westbound speeds on the M5 South West Motorway range from 96 km/h in the section between Hume Highway and Camden Valley Way, to 33 km/h in the section between King Georges Road and Fairford Road. The average speed over the whole length was 56 km/h. See Figure 4-13 for more details.

On the Alternative Route, speeds are much slower, ranging from 53 km/h in the section between Hume Highway and Camden Valley Way, to 18 km/h in the section between Heathcote Road and the M5 (Liverpool). The average speed over the whole length was 38 km/h. See Figure 4-14 for more details.

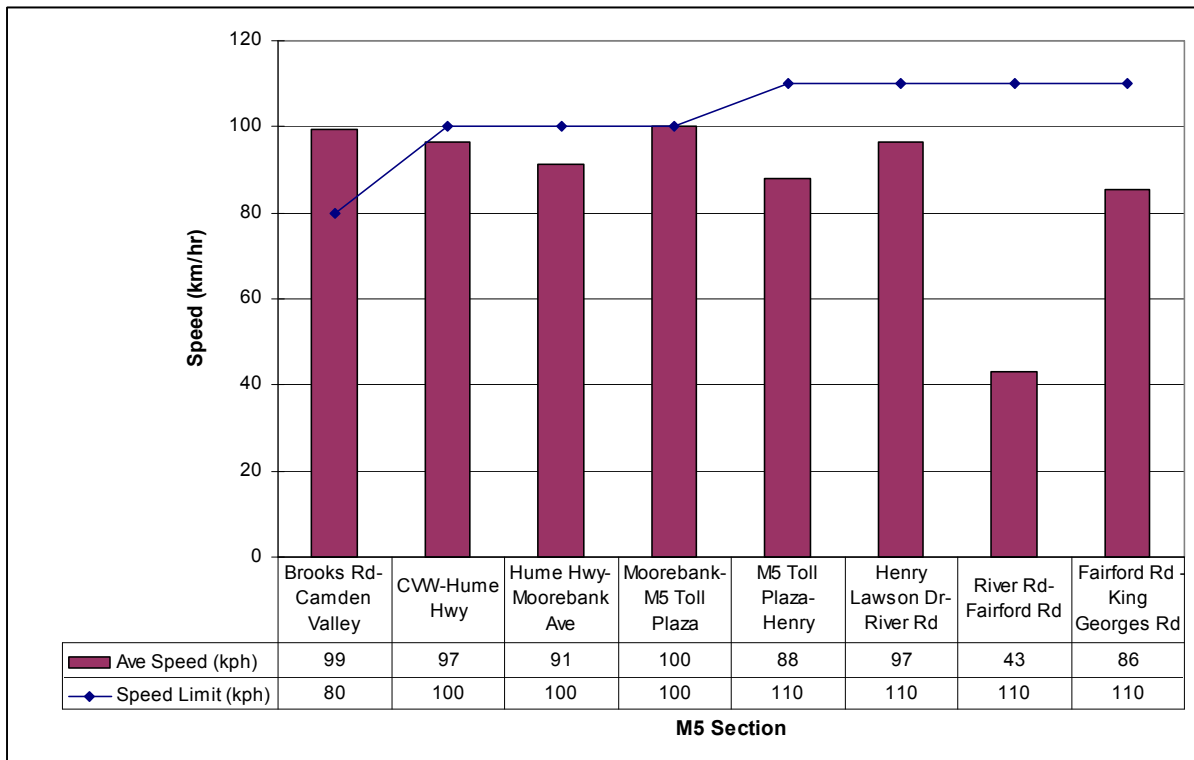


Figure 4-11 Travel Speeds - M5 South West Motorway PM Peak Eastbound

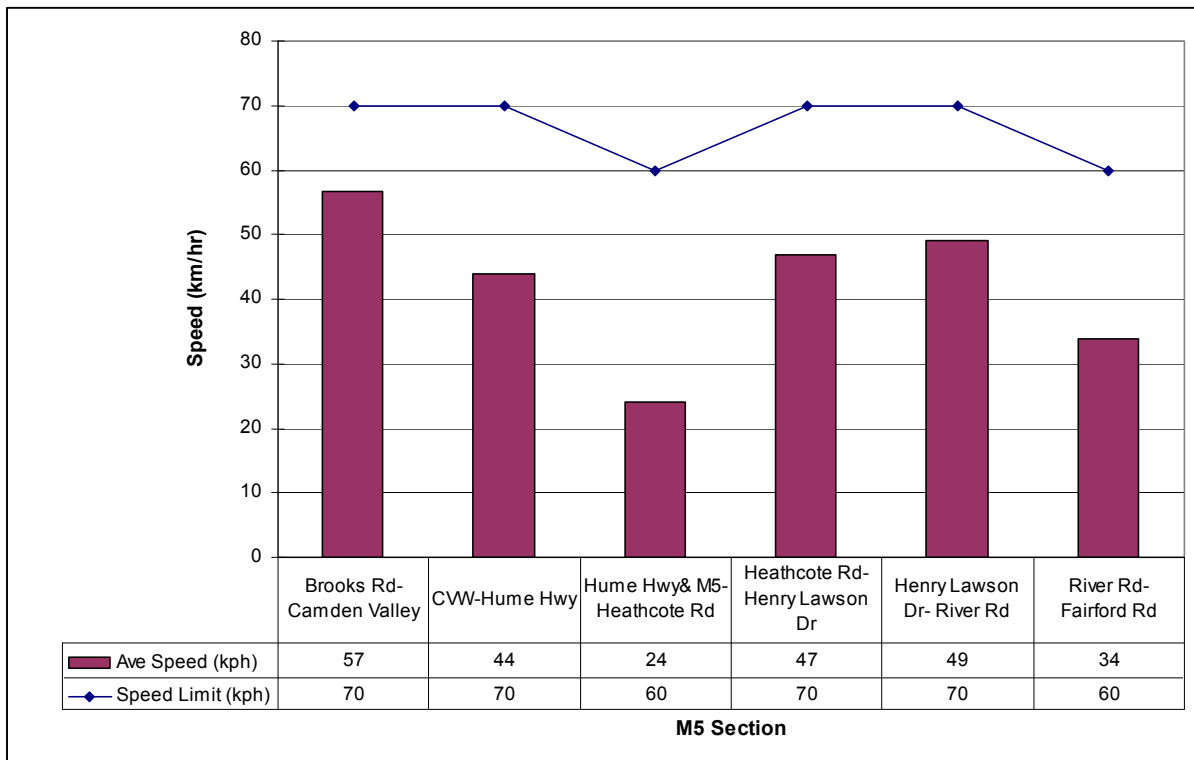


Figure 4-12 Travel Speeds - Alternative Route PM Peak Eastbound

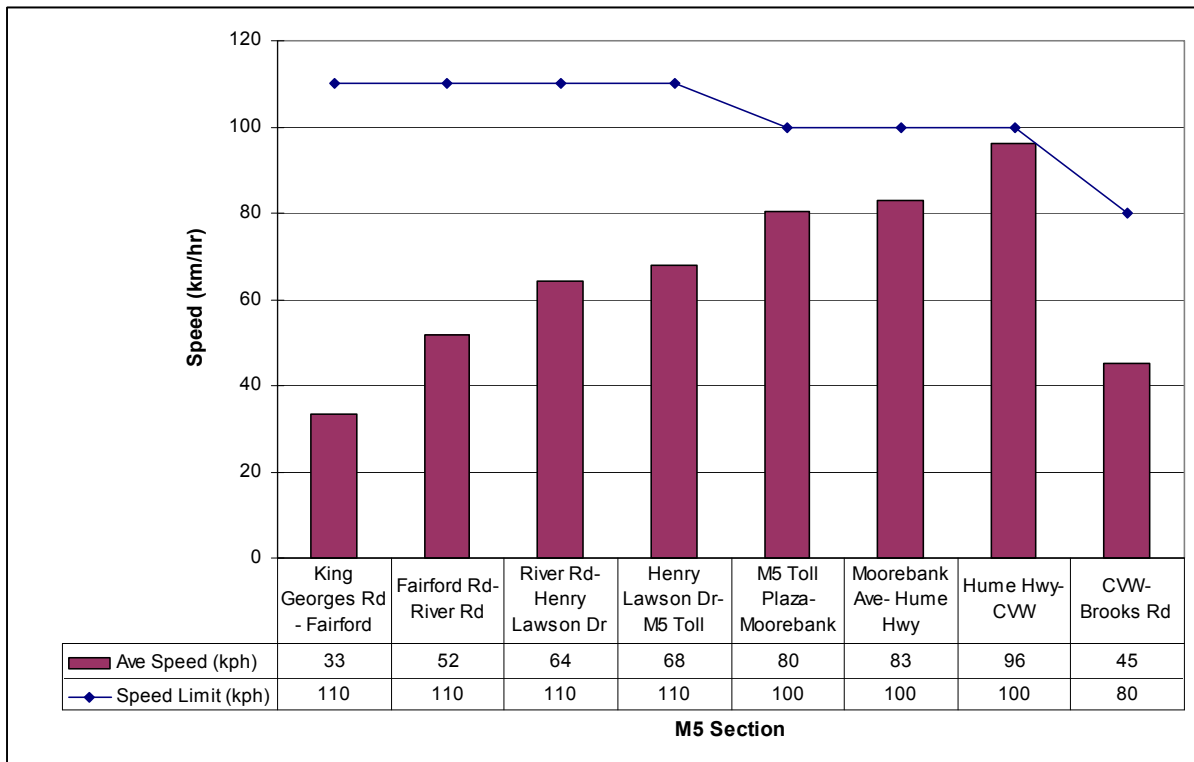


Figure 4-13 Travel Speed - M5 South West Motorway PM Peak Westbound

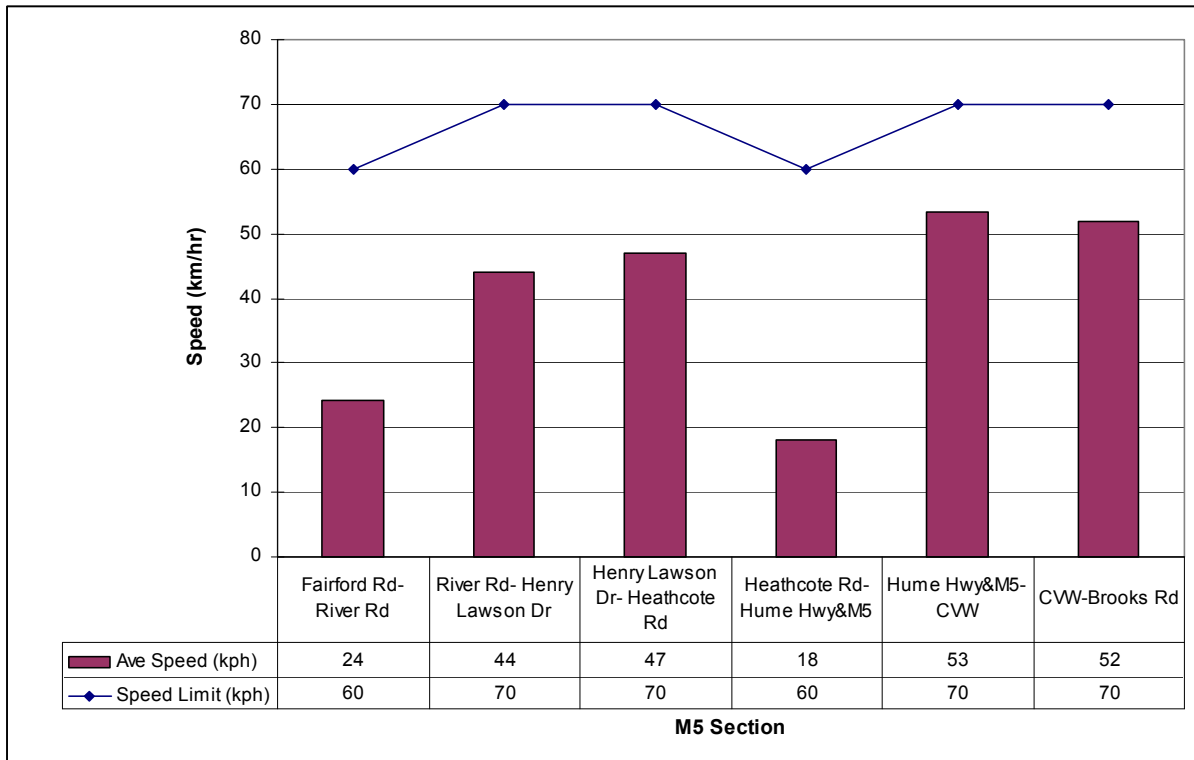


Figure 4-14 Travel Speed - Alternative Route PM Peak Westbound

4.4 *Definition of Levels of Service*

The Level of Service measures used in our assessment of road links and intersections are described below.

4.4.1 *Road Link Levels of Service*

Level of Service is defined as a qualitative measure describing operational conditions within a traffic stream, and the perception of motorists and/or passengers. A level of service definition generally describes these conditions in terms of factors such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience, and safety. There are six levels of service, designated from A to F, with Level of Service A representing the best operating condition and level of service F the worst.

The road link Levels of Service (LOS) used in this assessment are consistent with the LOS as defined in the Highways Capacity Manual. Full details are provided in **Appendix A**.

4.4.2 *Intersection Levels of Service*

Intersection Levels of Service have been computed based on the Level of Service measure defined by the NSW Roads and Traffic Authority in the RTA Guide to Traffic Generating Developments (2002). According to this measure, for traffic signals the average vehicle delay over all movements through the intersection should be taken, while for roundabouts and priority control intersections (with Stop and Give Way signs or those operating under the T-junction rule) the critical movement that defines the Level of Service should be that with the highest average vehicle delay.

Intersection LOS has been computed using the Paramics traffic micro-simulation model, which has been calibrated using 2010 count data. A summary of the overall approach to traffic modelling is provided in Section 5 and the full Paramics Calibration Report will be included in a subsequent revision of this report.

Using the Paramics model, it is only possible to measure average delay at an intersection at the level of individual approaches (being the sum of the average approach delay and the average acceleration delay) rather than movements; this measure has been modified slightly such that the delay reported for signalised intersections is the weighted average

delay of all approaches, and for roundabouts and priority intersections, it is the average delay of the worst approach.

4.5 Network Capacity and Levels of Service

4.5.1 Capacity of the M5 Motorway

The capacity of the M5 South West Motorway is determined by the number of lanes on the motorway and the capacity of ramps and signalised intersections at the interchanges. The motorway itself has two lanes in each direction, with the exception of the Hammondville Toll Plaza (five lanes in each direction – three cash lanes and two e-tag lanes), and the section from Moorebank Avenue to Hume Highway (four lanes in each direction, including extended on and off ramps).

A key capacity issue, however, is the M5 East which is the continuation of the motorway east of King Georges Road. The M5 East includes a long tunnel from Bexley to Arncliffe, with some steep grades (maximum 8.3%) in each direction. These grades adversely affect the climbing performance of heavily laden trucks, which can comprise up to 11% of all traffic. Consequently, in the AM peak period eastbound traffic on the M5 East regularly queues beyond King Georges Road and causes eastbound delays on the M5 South West Motorway. Under such conditions, eastbound traffic queues as far as Fairford Road.

In addition to the effects of grades in the M5 East tunnel, it is a widely documented phenomenon that vehicles entering a tunnel have a tendency to increase their headways as they enter the tunnel, due in part to the change in lighting. This increase in headway produces a shockwave effect that also contributes to extended delays. This phenomenon is observed on the eastbound entrance to the M5 East tunnel in the morning and evening peak periods.

For both these reasons, the M5 East tunnel is considered a capacity constraint for eastbound traffic on the M5 South West Motorway in the morning and evening peak periods.

4.5.2 Mid-block Levels of Service

Figure 4-7 summarises the mid-block levels of service along M5 and the alternative route. These values have been estimated assuming a maximum capacity of 2,200 passenger car units (PCU) per lane per hour for the motorway and 1,980 PCUs per lane per hour on the Alternative Route.

The mid-block LOS provides an indication of operating conditions along each of these sections of the motorway. However, the LOS has been estimated using the 2006 strategic model, which has been calibrated to observed traffic count data. These calculations reflect the observed flows and do not necessarily represent the actual demand (as opposed to flows) which is somewhat harder to measure.

The effect of the observed downstream congestion is that the observed or counted flow may be lower than unrealised demand during a particular time period as a result of flow breakdown. As a result, some vehicles will divert to alternative routes to avoid congestion while others will be delayed such that their trip is counted in the subsequent time period (known as peak spreading) or they will retime their trip altogether.

Table 4-7 Mid-Block Levels of Service (2006 Modelled Flows)

Location	AM		PM	
	V/C	LoS	V/C	LoS
M5 Motorway, EBD				
Between Camden Valley Way and Hume Highway	0.96	E	0.77	D
Between Hume Highway and Moorebank Avenue	0.62	C	0.51	C
Between Moorebank Avenue and Heathcote Road	0.61	C	0.57	C
Between Heathcote Road and Henry Lawson Drive	0.76	D	0.76	D
Between Henry Lawson Drive and The River Road	0.68	C	0.81	D
Between The River Road and Fairford Road	0.69	C	0.85	D
Between Fairford Road and Belmore Road	0.65	C	0.82	D
Between Belmore Road and King Georges Road	0.59	C	0.75	D
M5 Motorway, WBD				
Between King Georges Road and Belmore Road	0.67	C	0.75	D
Between Belmore Road and Fairford Road	0.76	D	0.82	D
Between Fairford Road and The River Road	0.84	D	0.94	E
Between The River Road and Henry Lawson Drive	0.81	D	0.93	E
Between Henry Lawson Drive and Heathcote Road	0.80	D	0.94	E
Between Heathcote Road and Moorebank Avenue	0.62	C	0.70	D

Location	AM		PM	
	V/C	LoS	V/C	LoS
Between Moorebank Avenue and Hume Highway	0.49	C	0.67	C
Between Hume Highway and Camden Valley Way	0.78	D	0.99	E
Alternative Routes				
Hume Highway, NBD - Between Campbelltown Road and Hoxton Park Road	0.49	C	0.36	B
Hume Highway, WBD - Between Hoxton Park Road and Campbelltown Road	0.27	B	0.43	C
Terminus Street, EBD - Between Hume Highway and Speed Street	0.55	C	0.41	C
Terminus Street, WBD - Between Speed Street and Hume Highway	0.31	B	0.37	B
Newbridge Road, EBD - Between Speed Street and Henry Lawson Drive	0.54	C	0.39	B
Newbridge Road, WBD - Between Henry Lawson Drive and Speed Street	0.48	C	0.50	C
Milperra Road, EBD - Between Henry Lawson Drive and The River Road	0.45	C	0.38	B
Milperra Road, WBD - Between The River Road and Henry Lawson Drive	0.37	B	0.43	C
Canterbury Road, EBD - Between The River Road and King Georges Road	0.61	D	0.65	D
Canterbury Road, WBD - Between King Georges Road and The River Road	0.48	C	0.61	D

The results for the M5 South West Motorway show that in 2010, the PM peak (westbound) performs at a poor Level of Service. However, during the morning peak (eastbound) the reported levels of service may appear to be better than might otherwise be expected. This is a function of the known capacity limitation in the east, which may in this instance, given the relatively slow speeds eastbound approaching the M5 East, result in fewer vehicles passing the count location. As a consequence lower observed traffic counts will be reported relative to demand.

Since the theoretical capacity of the road remains fixed, an artificially low count has the effect of making the operational conditions appear better than they are in reality.

The PM westbound direction does not have similar capacity constraints and as a result operates closer to capacity, experiencing LOS D and E along most sections. The results indicate that the M5 South West Motorway has limited capacity to absorb additional traffic growth going forward.

4.5.3 Intersection Levels of Service

The capacity of the Alternative Route to the M5 South West Motorway is determined by the major intersections. The Level of service for each intersection on the Alternate Route is shown in Table 4-8.

Table 4-8 Major Intersection Levels of Service (2009/2010 Modelled Flows)

Location	AM		PM	
	Av Delay	LoS	Av Delay	LoS
King Georges Road/M5	65	E	41	C
King Georges Road/Canterbury Road	69	E	116	F
Canterbury Road/Chapel Road South/Gibson Avenue	93	F	79	F
Canterbury Road/Milperra Road/The River Road	68	E	43	D
Milperra Road/Newbridge Road/Henry Lawson Drive	112	F	65	E
Newbridge Road/Governor Macquarie Drive	65	E	67	E
Newbridge Road/Nuwarra Road	59	E	61	E
Newbridge Road/Heathcote Road	44	D	40	C
Hume Highway/Hoxton Park Road/Macquarie Street	75	F	76	F
Hume Highway/M5 South West Motorway	17	B	22	B
Hume Highway/Campbelltown Road	17	B	21	B
Camden Valley Way/M5 South West Motorway	21	B	19	B

Table 4-8 shows that a number of key intersections operate poorly in one or both peak periods. The intersection of King Georges Road/Canterbury Road experiences the greatest level of delay, when compared to the other intersections, which occurs during the PM peak period.

The intersection of Hume Highway/Hoxton Park Road/Macquarie Street is found to operate in excess of capacity during both the AM and PM peak periods. The RTA is currently evaluating an upgrade the intersection as part of an RTA Pinch Point project. This will include the provision of an eastbound to northbound left turn lane from

Hoxton Park Road to Hume Highway. The impact of this change has not been evaluated as part of this Environmental Assessment.

The capacity of principal roads crossing the M5 South West Motorway is dependent on their major intersections. Apart from the intersections detailed in previous, the other intersections are shown in Table 4-9:

Table 4-9 Principal Route Intersection Levels of Service (2009/2010 Modelled Flows)

Location	AM		PM	
	Av Delay	LoS	Av Delay	LoS
King Georges Road/Stoney Creek Road	125	F	86	F
Stacey Street/ Stacey Street South	46	D	29	C
Stacey Street/Macauley Avenue	56	D	27	B
Heathcote Road/Nuwarra Road	96	F	56	D
Heathcote Road/Moorebank Avenue	82	F	58	E
Hume Highway/Elizabeth Drive	82	F	64	E
Campbelltown Road/Glenfield Avenue	43	D	30	C

It can be seen that the King Georges Road/Stoney Creek Road intersection has the highest average delay in both the AM and PM peak periods. This is due to the limited capacity for right turn movements at this intersection, particularly from Stoney Creek Road into King Georges Road. The intersection of Heathcote Road and Nuwarra Road operates at capacity in the morning peak period (LOS F), due to significant demand from the residential areas of Holsworthy and Moorebank accessing the M5 South West Motorway and Newbridge Road.

The intersection of the Hume Highway and Elizabeth Drive also operates at capacity (LOS F) in the morning peak period, due to the high volume of northbound traffic conflicting with eastbound traffic from Liverpool South and Hoxton Park accessing the Hume Highway and the M5 South West Motorway.

The intersection of Heathcote Road and Moorebank Avenue shows LOS F in the morning peak, however this largely reflects queuing from the intersection of Heathcote Road and Newbridge Road, which is currently operating at capacity due to the high

volumes accessing Liverpool from the M5 via Moorebank Avenue. This reported Level of Service at the intersection Heathcote Road and Moorebank Avenue is largely a secondary effect of downstream queuing, and does not accurately reflect the performance of this intersection in isolation.

4.6 *Road Safety and Crash History*

An analysis of historical crash data for both the M5 South West Motorway and the Alternative Route from 2004-2008 has been undertaken. This includes a graphical representation of crash locations over the period. Detailed 2009 data is not yet available for analysis as a number of cases are awaiting final review.

In the five year period (2004 – 2008) for which detailed analysis is available there were:

- 1256 crashes on the South West Motorway (M5) between Camden Valley Way and King Georges Road
- 1876 crashes on the Alternative Route (which will include for the purposes of this road safety assessment Hume Highway, Newbridge Road, Milperra Road and Canterbury Rd) between Camden Valley Way and King Georges Road

Crash statistics recorded by the RTA are confined to those crashes that conform to the national guidelines for reporting and classifying road vehicle crashes. The main criteria are:

- The crash was reported to the police
- The crash occurred on a road open to the public
- The crash involved at least one moving road vehicle
- The crash involved at least one person being killed or injured or at least one motor vehicle being towed away.

Minor crashes where drivers exchange details are not required to be recorded. Consequently such crashes may not feature in the crash data.

4.6.1 *Alternative Route*

Figure 4-15 shows that the number of crashes on this section of the Hume Highway/Newbridge Road/Milperra Road/Canterbury Road has fluctuated between 338 and 400 per year, with the greatest number of crashes occurring in 2004.

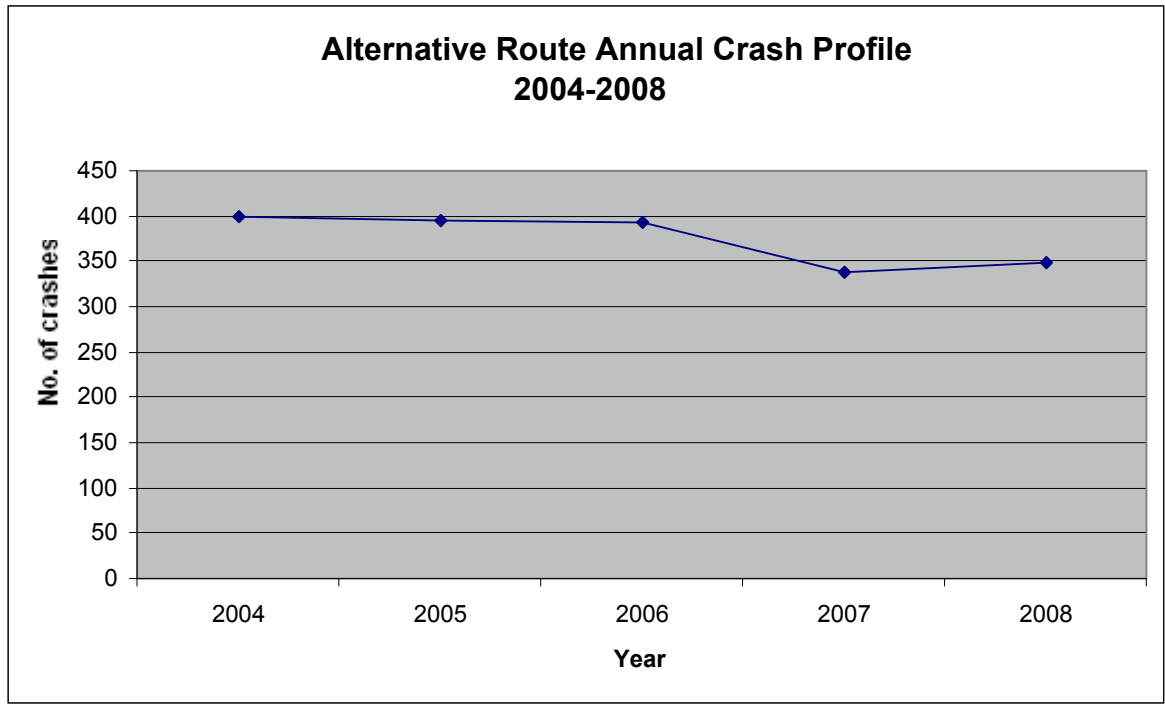


Figure 4-15 Annual Crash Profile 2004-2008 - Alternative Route

The crash reduction over the two years (2006-2008) suggests road safety initiatives (such as advertising campaigns) may have altered driver and pedestrian behaviour leading to fewer casualties.

An analysis of the crashes from 2004-2008 (which is the latest period for which full crash details are available) is summarised in Table 4-10. This table identifies the number of crashes by crash type groupings.

Table 4-10 Crash Summary 2004-2008 – Alternative Route

Crash Type	No. of Crashes	% of crashes
Intersection Adjacent approach	274	14.6
Head On	24	1.3
Opposing traffic, turning	259	13.8
U-Turn	15	0.8
Rear End	802	42.8
Lane Change	141	7.5
Parallel Lanes turning	50	2.7

Crash Type	No. of Crashes	% of crashes
Vehicles leaving driveway	33	1.8
Hit parked vehicles	12	0.6
Hit pedestrian	42	2.2
Off road – on straight	109	5.8
Off road – on curve	23	1.2
Other crash Type	92	4.9
TOTAL	1876	100.0

As the data show, rear end/nose to tail crashes is clearly the most common type on this section of the Alternative Route (43%). This type of crash is commonly the result of people driving too close to the vehicle in front, which is symptomatic of heavily congested roads.

The second most frequent crash type is intersection crashes – out of 1,876 crashes, some 1,229 (including rear end crashes) are within 10m of an intersection. The adjacent approaches or opposing traffic turning categories make up 29% of crashes. Around 13.6 % occurred when the road surface was wet (although only 9.9% in the rain) and 21.7% occurred in the dark. Some 7.6% involved a single vehicle. Heavy trucks were involved in 10.8% of all crashes and light trucks in 18.0% of all crashes.

The data has been analysed in more detail so that the road safety performance of each section of road can be observed and is shown in the table below. An additional column has been included which notes the amount of travel on each of the roads.

Table 4-11 Summary of Crash Rates per 100 million VKT (2004-2008) - Alternative Route

Section	Location	Section Length-One way (km)	Crashes 2004-2008	No. of crashes per km travelled	Travel 2006 (million VKT)	Crash Rate Crash per 100 million VKT
1	Camden Valley Way (from M7 on ramp)	1	113	57	12.44	181.7
2	Hume Highway	4.5	444	49	81.91	108.4
3	Terminus St	0.7	74	53	5.17	286.2
4	Newbridge Road	5.3	431	41	95.70	90.1
5	Milperra Road	3.7	211	29	67.45	62.6
6	Canterbury Road to King Georges Road	5.2	603	58	73.26	164.6
Total Crashes		20.4	1876	46	335.93	111.7

These rates can be compared to typical crash rates for different types of roads as issued in their NSW Speed Zoning Guidelines (November 2009).

Table 4-12 Typical Crash Rates per 100 million VKT

Development / Road Category	Typical Crash Rate (total crashes per 100 MVK)
Urban Freeway	50
Urban Divided Road (4 lanes or more)	165
Urban Undivided Road (4 lanes or more)	225
Urban Undivided Road (less than 4 lanes)	110
Rural Freeway	20
Rural Divided Road	33
Rural Undivided Road	35

Discretion is required in applying these rates to sections of the road where it is not possible to easily assign the road length to a particular category of road. There are also difficulties encountered in assigning crashes to particular roads at intersections. Nevertheless, the rates do provide an indication of the relative road safety performance of each section of the route.

4.6.2 M5 South West Motorway

Figure 4-16 shows that the number of crashes on this section of the M5 South West Motorway has fluctuated between 236 and 277 per year reaching a peak in 2006. The crash reduction over the two years from the 2006 peak suggests road safety initiatives,

such as speed reduction campaigns, may have altered driver behaviour leading to fewer casualties.

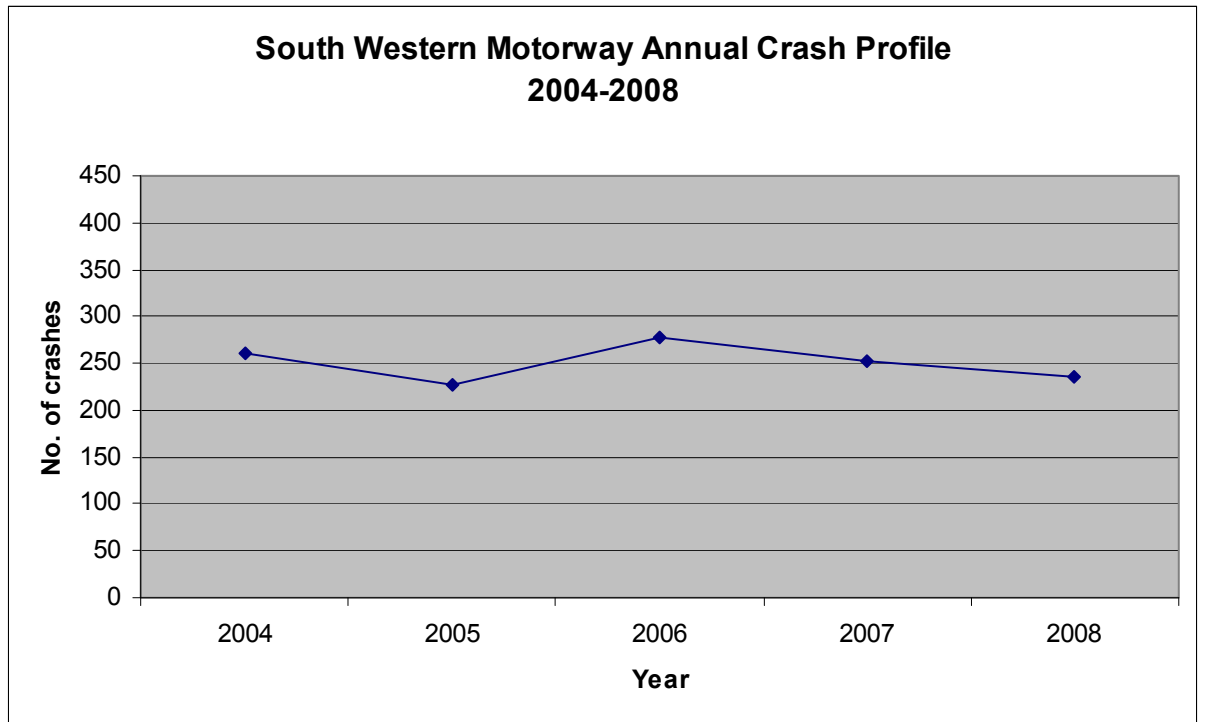


Figure 4-16 Annual Crash Profile 2004-2008 – M5 South West Motorway

An analysis of the crashes from 2004-2008 (which is the latest period for which full crash details are available) is summarised in Table 4-13. This table identifies the number of crashes by crash type groupings.

Table 4-13 Crash Summary (2004-2008) – M5 South West Motorway

Crash Type	No. of Crashes	% of crashes
Intersection Adjacent approaches	55	4.4
Head On	3	0.2
Opposing traffic, turning	40	3.2
U-Turn	3	0.2
Rear End	606	48.2
Lane Change	140	11.1
Parallel Lanes turning	9	0.7
Vehicles leaving driveway	0	0.0
Hit parked vehicles	5	0.4
Hit pedestrian	1	0.1
Hit animal	2	0.2
Hit obstruction on road	1	0.1
Off road – on straight	253	20.1
Off road – on curve	52	4.1
Other crash Type	86	6.8
TOTAL	1256	100.0

As the data show, rear end and lane change are clearly the most common type of all crashes on this section of the M5 South West Motorway (60%). This type of crash is commonly the result of people driving too close to the vehicle in front or where there is high incidence of lane changing. These types of accidents frequently occur during periods of congestion or adverse weather.

The second most frequent crash type is “off road on straight” crashes (20%) which are typically associated with excess speed, driver inattention and driver distraction.

Out of 1,256 crashes, only 312 (25%) occurred within 10m of an intersection.

Around 18 % occurred when the road surface was wet (although only 13.4% occurred in the rain) and 25.6% occurred in the dark. Some 24.8% involved a single vehicle. Heavy trucks were involved in 10.7% of all crashes and light trucks in 18.4% of all crashes.

The data has been analysed in more detail so that the road safety performance of each section of road can be seen and is shown in the table below. An additional column has been provided which summarises the amount of travel on each of the roads.

Table 4-14 Summary of Crash Rates per 100 million VKT (2004-2008) - M5 South West Motorway

Section	Location	Section Length-One way (km)	Crashes 2004-2008	No. of crashes per km travelled	Travel 2006 (million VKT)	Crash Rate Crash per 100 million VKT
1	North of Camden Valley Rd to West of Hume Hwy	4.4	233	26	125.37	37.2
2	East of Hume Hwy to West of West of Heathcote Rd	2.7	196	36	91.74	42.7
3	East of Heathcote Rd to West of Henry Lawson Dr	3.8	242	32	121.62	39.8
4	East of Henry Lawson Dr to West of Davies Rd	5	321	32	143.83	44.6
5	East of Davies Rd to West of King Georges Rd	3.8	264	35	106.56	49.5
Total Crashes		19.7	1256	32	589.12	42.6

These rates can be compared to typical crash rates for different types of roads as issued in their NSW Speed Zoning Guidelines (November 2009).

Table 4-15 Typical Crash Rates per 100 million VKT

Development / Road Category	Typical Crash Rate (total crashes per 100 MVK)
Urban Freeway	50
Urban Divided Road (4 lanes or more)	165
Urban Undivided Road (4 lanes or more)	225
Urban Undivided Road (less than 4 lanes)	110
Rural Freeway	20
Rural Divided Road	33
Rural Undivided Road	35

Whilst there are difficulties encountered in assigning crashes to particular roads at intersections, the rates do provide an indication of the relative road safety performance of each section of the motorway. In fact, it does show that the crash rates on the M5 South West Motorway are less than those experienced on a typical urban freeway.

It is clear that the crash rate per 100 million VKT is much lower on the motorway than on the Alternative Route. The crash rate is also more consistent along the length of the motorway, varying from 37.2 to 49.5 (whereas on the parallel Alternative Route it varies from 62.6 to 286.2).

4.7 Summary

Analysis of historical traffic data has shown continued traffic growth on the M5 South West Motorway. This has impacted on the current traffic conditions within the study area which are characterised as follows:

- M5 South West Motorway and the Alternative Route carry very high numbers of vehicles in the peak periods
- Reduced travel speeds on the M5 South West Motorway and on the Alternative Route, being significantly lower than posted speeds on some sections
- A relatively high proportion (8% AWT) of heavy vehicles on the M5 South West Motorway reflects its vital role as a local and strategic freight route
- Eastbound capacity in the AM peak period is constrained by the capacity of the M5 East freeway, with its two lane tunnel, relatively steep grades and high proportion of heavy trucks. Capacity on the Alternative Route is governed by the major intersections

Overall, traffic conditions during peak periods have deteriorated with many motorists experiencing congestion related delays. There is limited scope for future growth particularly during the peak periods without further decline in travel times.

5 Traffic Forecasting Process

5.1 *Introduction*

The assessment of the effects of the proposed widening of the M5 South West Motorway is dependant on reliable forecasts of future traffic levels for the situation with and without the Project. These forecasts are produced using an assignment traffic model of Sydney's road system. Such models in turn are reliant on accurate forecasts of future land use changes which influence changes in travel demand.

This section outlines the processes involved in the development of the traffic model and the preparation of future land use scenarios for forecasting.

5.2 *Traffic Modelling Approach*

The modelling approach adopted for this study employed the Strategic Metropolitan Traffic Model (SMTM)¹³, implemented in the EMME transport planning software platform. The traffic model is a vehicle assignment model covering the entire Greater Metropolitan Area (GMA) centred on vehicle demands obtained from the Bureau of Transport Statistics' (BTS) Sydney Strategic Travel Model (STM).

The model has 2,722 zones, based on the *TZ 2006* Travel Zone definitions as provided by the BTS, with two specific, localised refinements. These refinements were:

- the disaggregation (redefinition) of zones at Sydney's Kingsford Smith Airport to reflect different terminals and car parks at the airport; and,
- the addition of an extra traffic zone at Arncliffe to reflect the Cooks Cove development.

The SMTM contains separate models for the 3 core time periods, namely morning (AM) peak; inter peak (IP) and evening (PM) peak, and produces forecasts for 2011, 2016, 2021 and 2026.

¹³ 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.

A Paramics micro-simulation traffic model has also been developed to facilitate a more in-depth analysis of the major operational impacts of the Project. The micro-simulation model has been used to generate intersection performance statistics. Results of the Paramics micro-simulation modelling, including the model calibration report, will be provided in a subsequent revision of this report.

5.2.1 *Model Time Periods*

Model results are reported by day and time period. Peak period results are reported as typical weekday, average hour volumes for the following time periods:

- AM Peak – 7am to 9am
- Inter Peak – 11am to 1pm
- PM Peak – 3pm to 6pm

Daily traffic volumes are generally reported as Average Annual Daily Traffic (AADT), which is a measure of the total volumes of annual vehicle traffic divided by the number of days in the year. Modelled years used in this analysis are 2006, 2016 and 2026.

5.2.2 *Travel Demand*

The 2006 travel demand comprises 24 hour car driver trip matrices by trip purpose along with truck trip matrices by period. The car driver trip matrices are derived from 2006 land use and 'journey to work' (JTW) census data. The truck trip matrices are based on the forecasts produced from the Sydney Freight Movement Model (FMM) developed by BTS.

Future year travel demand matrices were also provided by BTS and as such the models represent the government's forecast of future land use development in Sydney.

5.2.3 *Road Network Assumptions – Supply Side*

The base network covers the Greater Metropolitan Area (GMA) of NSW, including the Sydney Metropolitan Area; the Blue Mountains; Newcastle; Gosford-Wyong; Wollongong; Nowra-Bomaderry; and the Illawarra.

The base network was provided by the RTA and subsequently refined and enhanced in the study area for the purpose of this project.

Future and proposed infrastructure developments detailed in Table 5-1 are included in the future year road networks (as agreed with RTA) to reflect the changes in supply.

Note: Only committed schemes are included in the future scenarios.

Table 5-1 Key Road Projects for Future Years

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 West widening	Widen from Camden Valley Way to King Georges Road (the Project)
M4 Extension	Completion of works from Strathfield to Airport/Port, with M4 upgrade works through to Church Street, Parramatta
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

Note: For this assessment, the base models do not include M5 South West Widening

5.2.4 Expansion Factors

As the models forecast three period traffic flows, there is a need to expand these estimates to obtain forecast Average Annual Daily Traffic (AADT) and Average Weekday Traffic flows (AWT). These factors have been developed based on analysis of the latest available continuous count data (2007 count data). The expansion factors applied in the modelling are presented in Table 5-2 below.

Table 5-2 Daily Flow Aggregation Factors

Model	Car	Truck
Aggregated Peak Flows* to 5-Day Average	5.29	5.23
5-Day to 7-Day Factor (AWT to AADT)	0.94980	0.75384

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

5.3 Model Calibration and Validation

Of primary importance is that the traffic model represents traffic flows accurately both at an aggregate and local level.

The SMTM has been calibrated and validated (against independent data sets) in accordance with industry best practice acceptance criteria. Full details of this process are provided in **Appendix B**.

The model validation process involved comparisons of the predicted model output against observed data for 2006, comparing both screenline volumes and individual link volumes along the M5 corridor. Figure 5-1 to Figure 5-3 summarise the results for the screenline flows.

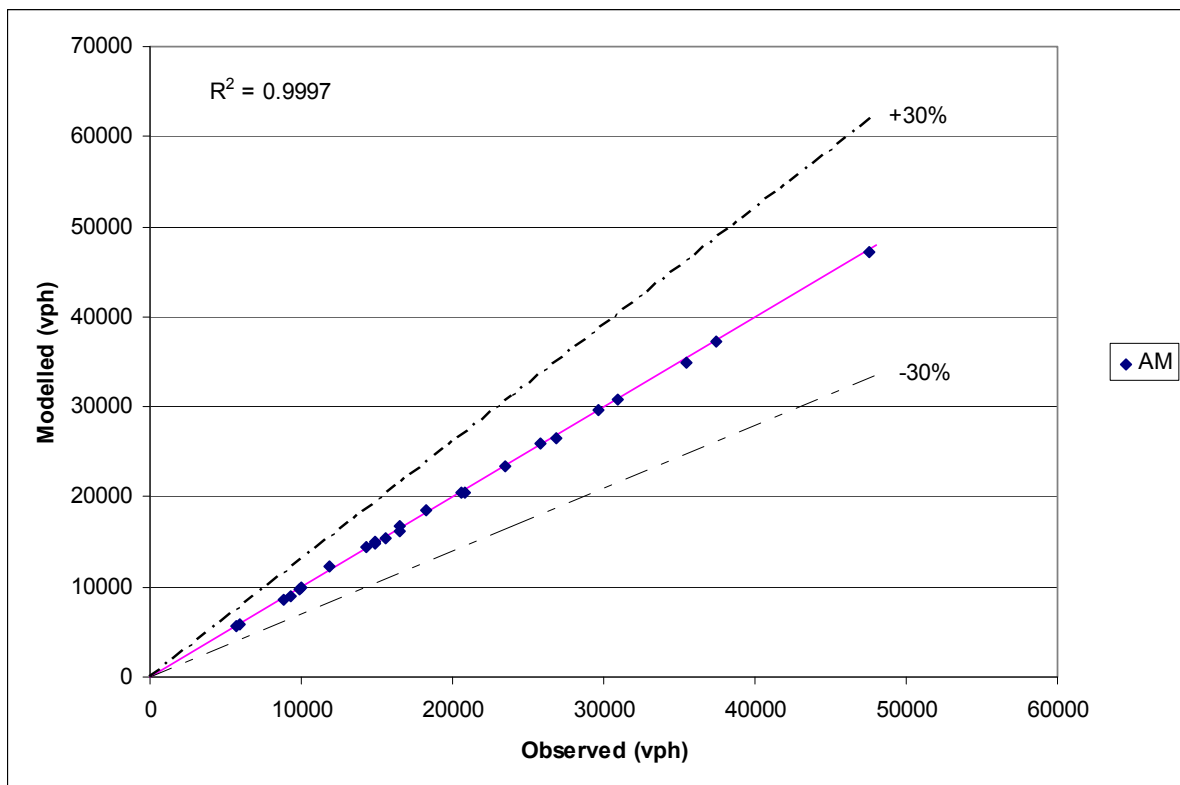


Figure 5-1 Scatter Plot of Observed versus Screenline Total Flows (AM)

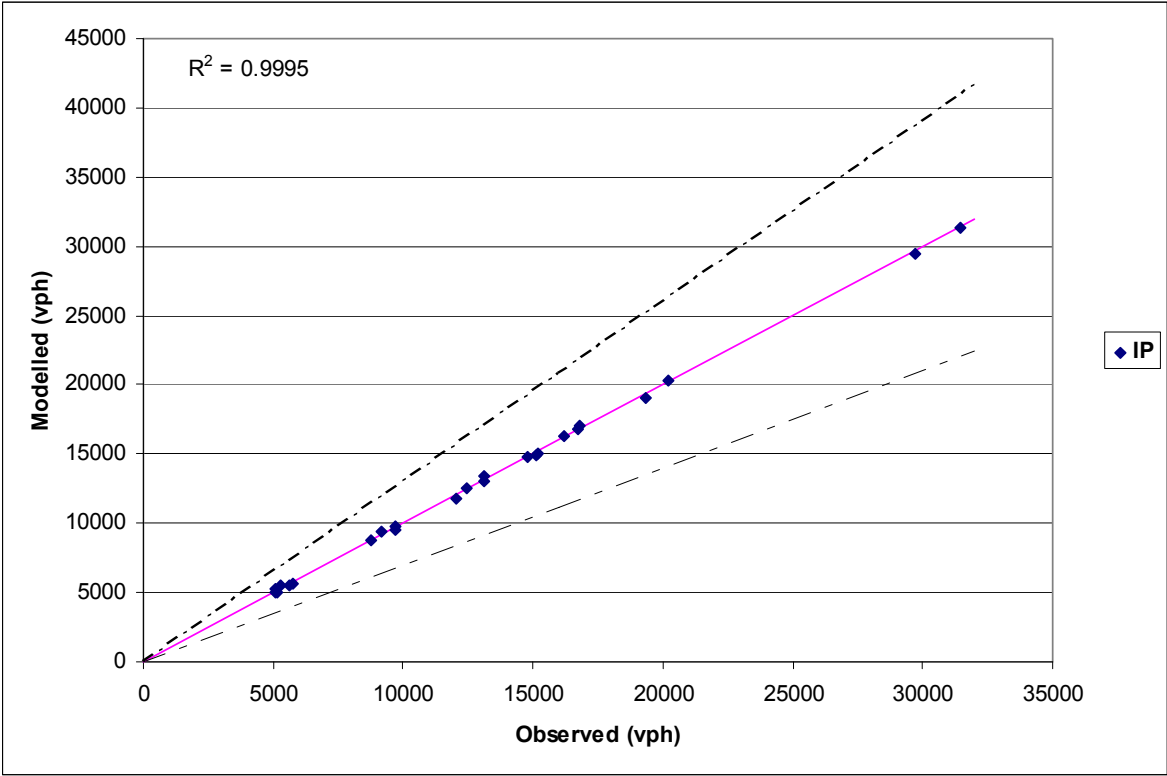


Figure 5-2 Scatter Plot of Observed versus Screenline Total Flows (IP)

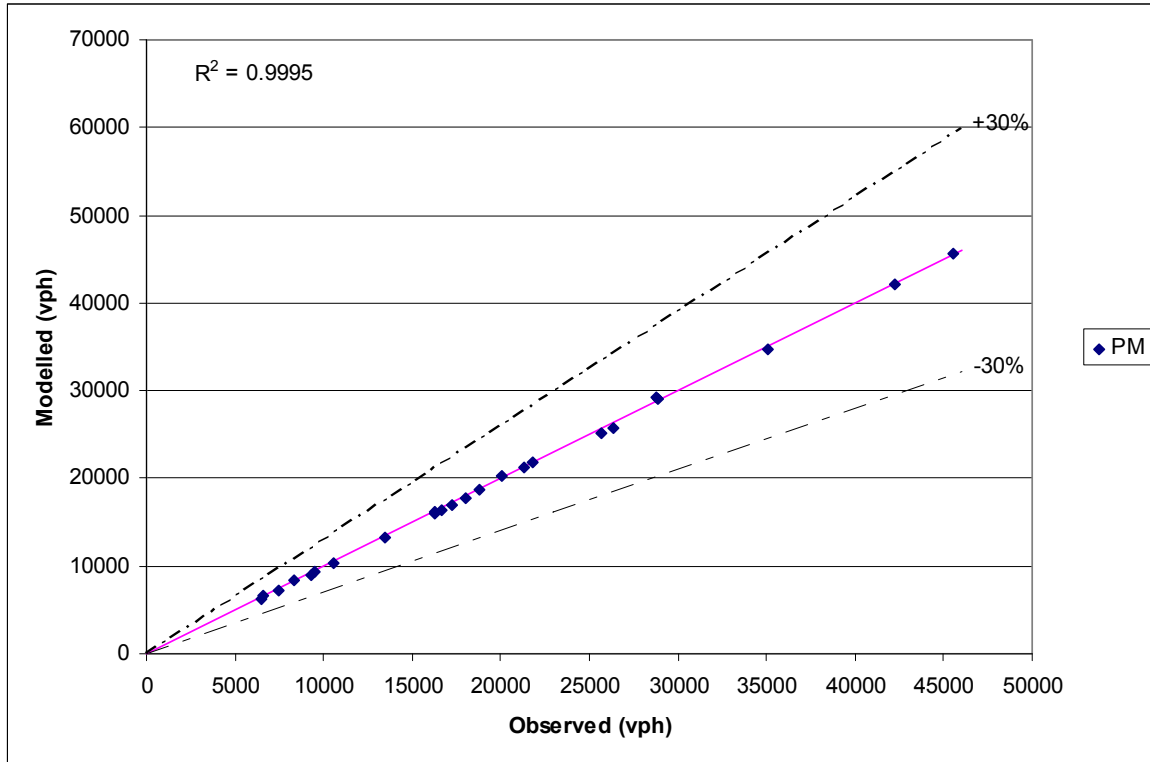


Figure 5-3 Scatter Plot of Observed versus Screenline Total Flows (PM)

The modelled traffic volumes along the M5 corridor were checked against the 2007 observed data and the results show that all sections of the M5 have achieved a GEH¹⁴ value of less than 5%.

The results of the process suggest that the model is a robust and sound basis for traffic forecasting.

5.4 Land Use Projections

Future travel demand on the road network is directly related to forecast growth in population and employment. Figure 5-4 and Figure 5-5 illustrate by traffic zone (TZ) the NSW Government forecasts for the spatial distribution of population and employment growth in the region (2006 and 2036 population and employment densities are provided in Appendix C). Growth areas are presented in Table 5-3 below by Statistical Local Area (SLA).

¹⁴ A calibration or validation statistical goodness of fit measure - Refer Appendix A for details.

As discussed in Section 1 under Project context and justification, the data presented in the figures highlight significant areas of population growth to the west of the M5 corridor and employment growth to the eastern seaboard. This population growth may, in turn lead to sustained growth in demand in the M5 corridor in both the short and medium term. Camden and Liverpool West are found to be major areas of high forecast population growth (and hence traffic generators) accounting for over 200,000 additional residents (increasing from 120,000 to 330,000). Two areas of significant forecast employment growth, attracting traffic, are seen to be Botany Bay and Rockdale local government areas.

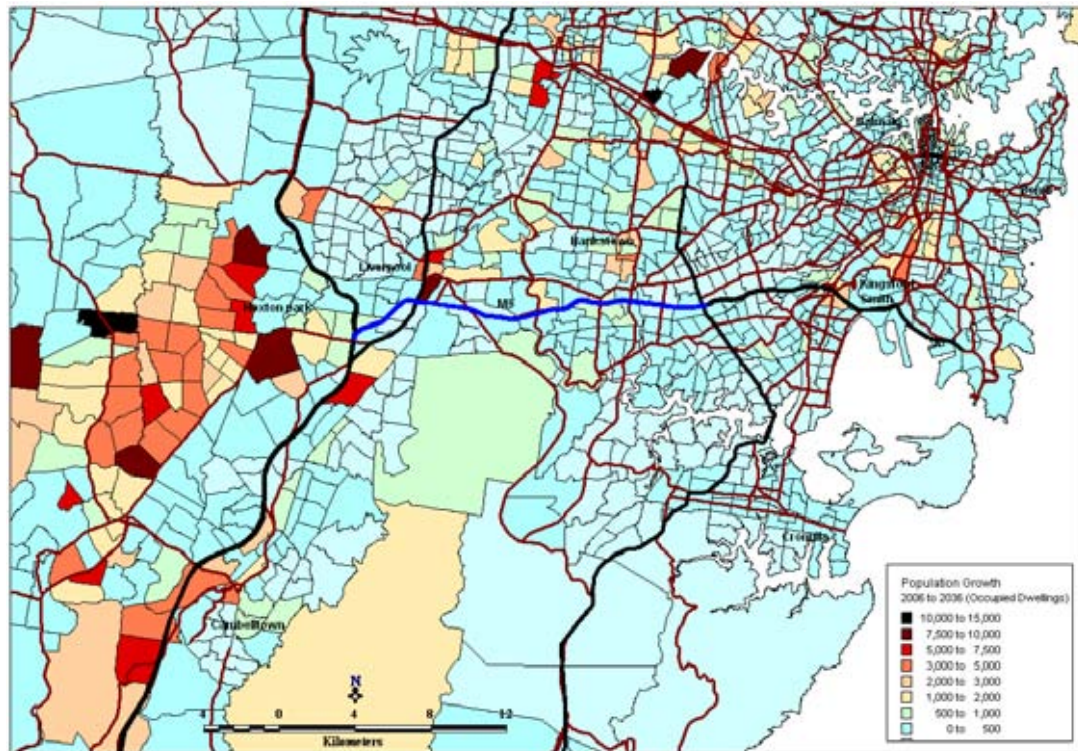


Figure 5-4 Forecast Population Growth Areas (2006 to 2036)

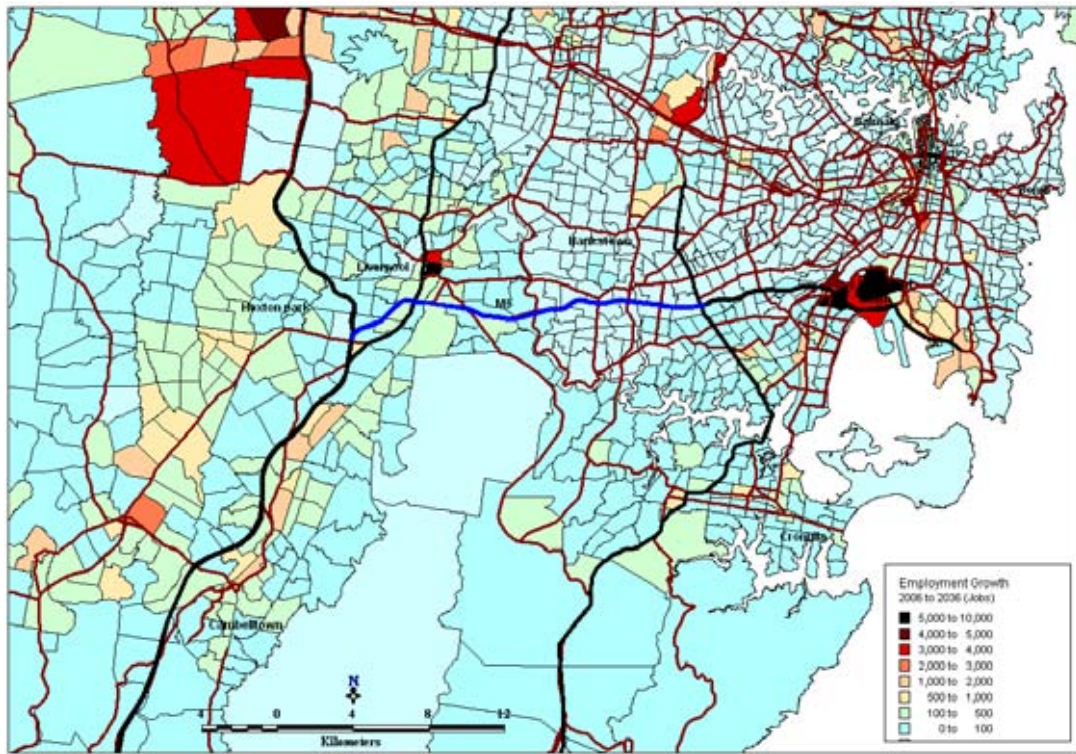


Figure 5-5 Forecast Employment Growth Areas (2006 to 2036)

The forecast population and employment growth figures are summarised in the table below and further details of key trip generating sites within the study area and its surrounds are provided in the following section.

Table 5-3 Forecast Population and Employment Growth

Statistical Sub-Division	Population (Occupied Dwellings)							Employment (Jobs)						
	2006	2016		2026		2036		2006	2016		2026		2036	
	No.	No.	% growth	No.	% growth	No.	% growth	No.	No.	% growth	No.	% growth	No.	% growth
Blacktown	277,503	310,857	12%	359,842	30%	413,042	49%	96,359	111,928	16%	128,764	34%	142,197	48%
Canterbury-Bankstown	308,866	323,358	5%	334,171	8%	341,850	11%	102,130	103,927	2%	96,865	-5%	92,064	-10%
Central Northern Sydney	419,671	458,060	9%	492,538	17%	519,830	24%	149,304	176,547	18%	196,098	31%	211,234	41%
Central Western Sydney	306,755	347,449	13%	384,500	25%	415,402	35%	198,682	210,460	6%	214,329	8%	212,009	7%
Eastern Suburbs	235,146	245,457	4%	247,053	5%	248,475	6%	86,689	87,251	1%	85,371	-2%	84,194	-3%
Fairfield – Liverpool	353,783	393,657	11%	427,251	21%	461,346	30%	117,483	133,442	14%	146,903	25%	153,619	31%
Fairfield - East	113,483	113,944	0%	113,924	0%	112,640	-1%	24,975	27,178	9%	28,392	14%	29,093	16%
Fairfield - West	72,079	72,238	0%	72,992	1%	72,963	1%	32,271	37,169	15%	41,044	27%	41,783	29%
Liverpool – East	98,117	110,046	12%	120,797	23%	130,059	33%	47,184	53,741	14%	59,659	26%	63,315	34%
Liverpool - West	70,104	97,430	39%	119,538	71%	145,684	108%	13,053	15,354	18%	17,808	36%	19,428	49%
Gosford-Wyong	299,420	336,450	12%	371,276	24%	404,301	35%	105,854	117,853	11%	129,285	22%	135,283	28%
Illawarra SD Bal	101,641	117,405	16%	131,213	29%	143,262	41%	32,149	37,531	17%	41,679	30%	44,006	37%
Inner Sydney	312,656	366,319	17%	390,805	25%	412,214	32%	539,828	575,900	7%	591,309	10%	599,641	11%
Inner Western Sydney	171,254	192,355	12%	203,286	19%	213,152	24%	79,089	82,775	5%	83,394	5%	83,927	6%
Lower Northern Sydney	293,565	307,080	5%	321,962	10%	334,670	14%	242,838	268,945	11%	278,847	15%	283,179	17%
Newcastle	505,010	544,816	8%	580,767	15%	608,470	20%	223,658	246,114	10%	266,870	19%	279,899	25%
Northern Beaches	230,261	237,575	3%	253,965	10%	267,743	16%	90,167	99,630	10%	104,206	16%	106,748	18%
Nowra-Bomaderry	31,367	34,698	11%	37,457	19%	39,667	26%	19,111	24,087	26%	27,516	44%	29,528	55%
Outer South Western Sydney	237,070	286,451	21%	363,873	53%	426,486	80%	75,512	89,065	18%	100,335	33%	110,353	46%
Camden	50,435	78,445	56%	134,057	166%	188,211	273%	17,633	25,141	43%	31,527	79%	36,691	108%
Campbelltown - North	76,120	83,081	9%	84,974	12%	84,734	11%	23,090	26,162	13%	29,324	27%	32,499	41%
Campbelltown - South	69,559	77,435	11%	91,905	32%	96,244	38%	23,764	26,249	10%	27,751	17%	29,380	24%
Wollondilly	40,955	47,490	16%	52,936	29%	57,298	40%	11,026	11,513	4%	11,733	6%	11,783	7%
Outer Western Sydney	308,599	333,697	8%	365,073	18%	380,806	23%	110,392	127,305	15%	138,333	25%	144,328	31%
St George-Sutherland	434,387	452,915	4%	448,721	3%	441,048	2%	138,029	153,202	11%	161,302	17%	166,508	21%
Wollongong	272,799	291,387	7%	308,211	13%	321,645	18%	106,690	117,033	10%	123,595	16%	127,594	20%
Grand Total	5.10m	5.58m	9%	6.02m	18%	6.39m	25%	2.51m	2.76m	10%	2.92m	16%	3.01m	20%

Source: Bureau of Transport Statistics June 2009

5.5 Key Development Sites

A summary of key development locations within the study area, and their situation in regards to the M5 South West Motorway, is provided below. This is focussed in particular on those sites that have been earmarked for sizeable future growth.

The list of sites is not exhaustive, but serves to illustrate how population and employment growth will be accommodated within the study area. The existence of such development sites within the study area strengthens the need to cater for increased travel demand, for which the M5 South West Motorway serves a key role.

(a) Sydney Airport

The Sydney Airport Masterplan forecasts that the passenger throughput of the airport will increase from 26.4 million in 2000/2001 to 68.3 million in 2023/24 (+160%).

The Masterplan forecasts that airport generated morning peak hour traffic would grow as shown in Table 5-4:

Table 5-4 Forecast Morning Peak Airport Traffic Generation (veh/hr)¹⁵

Year	Domestic Arrivals	Domestic Departures	International Arrivals	International Departures	Year	Total Arrivals	Total Departures	Total Two-Way
2003	1,785	1,939	2,204	2,353	2003	3,985	5,292	9,277
2024	3,794	3,660	4,662	4,607	2024	8,456	8,267	16,723

* Source: Sydney Airport Masterplan 2003/04 – 2023/24, SACL

Over the 20 (approximate) year analysis period the morning peak hour traffic generation of the airport is expected to grow by nearly 7,500 vehicle movements per hour.

The 2009 masterplan forecasts that freight handled by the airport is forecast to grow significantly over the next twenty or so years, with an increase of 33% in dedicated freight aircraft as illustrated in the table below.

¹⁵ The more recent Sydney Airport Masterplan 2009 provides an update on planning for the airport up to 2029. However, this does not reflect any major change in direction and it does not present any new information with regard to traffic data.

Dedicated freight aircraft accounts for approximately 20% of total freight movements to/from the airport, the remaining 80% being carried in the holds of passenger aircraft. Approximately 27% of freight handled by the airport is transhipped via domestic routes.

Table 5-5 Freight Demand Summary

Year	Domestic (tonnes)	International (tonnes)	Freight aircraft
2007			7,800
2029	167,000	910,000	10,400
Growth			2,600

* Source: Sydney Airport Masterplan 2009, SACL

This growth will continue to underline the importance of the strategic road-freight network used to transport a large proportion of this cargo to/from the airport.

(b) Port Botany

The Port Botany Environmental Impact Statement (2004) forecasts that container throughput, expressed as twenty foot equivalent units (TEUs), will increase as follows:

Table 5-6 Forecast Port Botany Container Growth (medium growth scenario)

Year	Million TEUs per annum
2006	1.25
2011	1.75
2016	2.5
2021	3.2

* Source: Port Botany Expansion Environmental Impact Statement, Sydney Ports Corporation 2004

Thus over the 15 year forecast period the number of containers handled at the port is expected to increase by about 2 million TEUs or by about 155%. At the same time the port's landside transport strategy seeks to increase the proportion of containers being handled by rail from about 20% to about 40%.

The Environmental Impact Statement for the Port Botany expansion forecasts that if, as a worst case, only 20% of containers were transported by rail then daily road container transport trips would increase as shown in Table 5-7.

Table 5-7 Forecast Port Botany Truck Movement Growth

Year	Daily (veh/day)	AM Peak (veh/hr)	PM Peak (veh/hr)
2002	2,913		
2006	3,797		
2011	3,746	256	118
2016	5,154	316	144
2021	6,273	376	234

Even with the rail mode carrying 40% of containers the number of truck trips generated in 2021 would be about 4,700 per day. Even under this high rail scenario, truck volumes are expected to nearly double over the next 15 years.

Road operations play an important role in the movement of freight to and from the port and its facilities. Port Botany has direct road access to the orbital network via Foreshore Road (the main port access road). There are also a number of roads that serve the port precinct; these roads are owned and managed by the RTA, City of Botany Bay, Randwick City Council and Sydney Ports Corporation.

With around 80 per cent of containers handled at Port Botany arriving and departing by road, Sydney Ports seeks to actively facilitate improvements in the performance of road operations for the benefit of all port users.

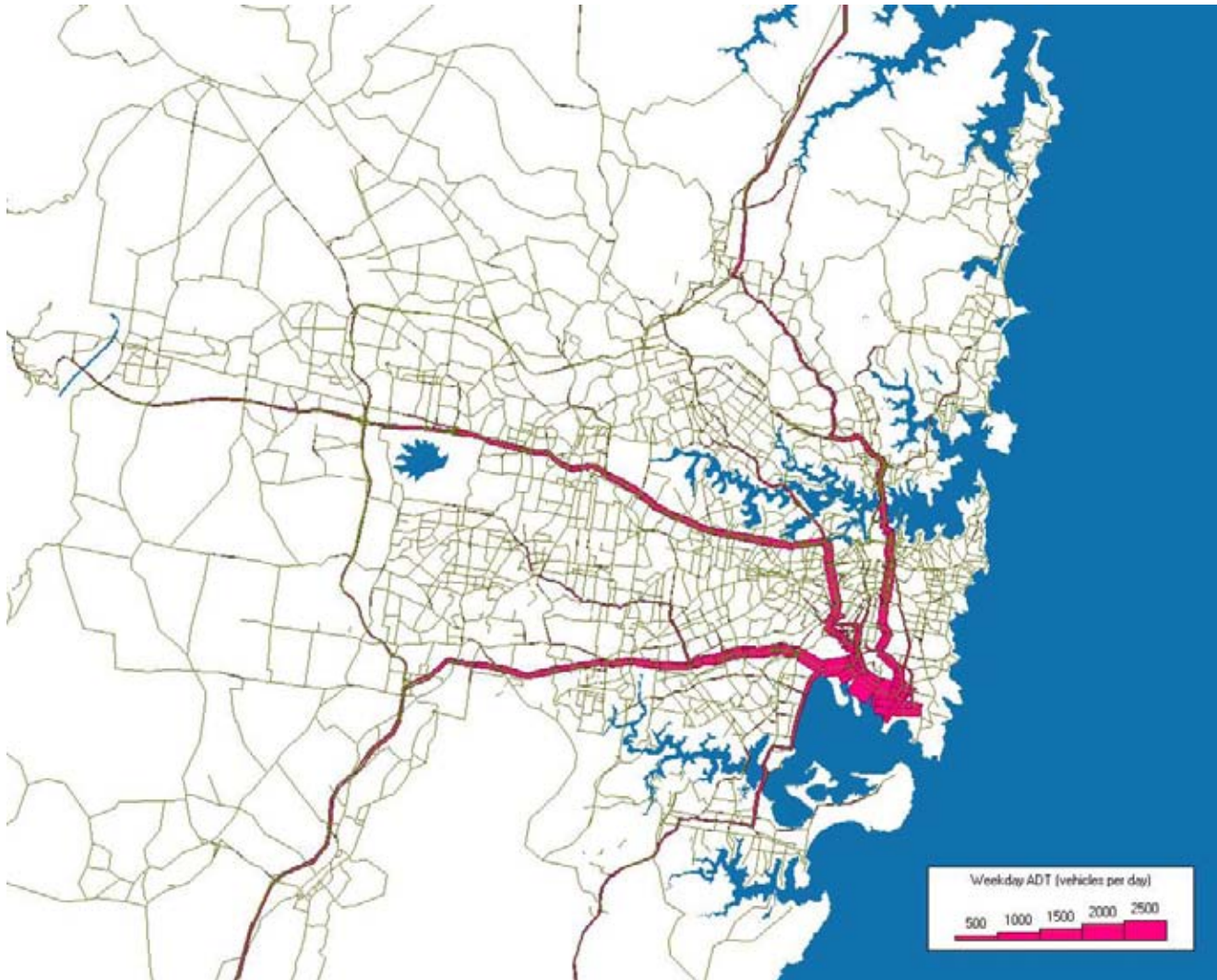
Rail operations are an increasingly vital component of the logistics network that can contribute to the more sustainable movement of freight to and from the port and its facilities. The NSW Government forecasts the rail mode share for Port Botany increasing from 20% in 2006 to 26% by 2031.

The M5 corridor is seen to be heavily influenced by the operations and growth at Port Botany. Analysis of the BTS road freight forecast movements to and from Port Botany as shown in Figure 5-6 and Figure 5-7 for 2006 and 2036 respectively show that truck movements to and from the port are dominated by usage of the M5 corridor both now and in the foreseeable future, with heavy vehicles almost doubling by 2026.



Source: Halcrow Sydney Metropolitan Traffic Model (SMTM)

Figure 5-6 Heavy Vehicle Trips from Port Botany – 2006 Average Weekday



Source: Halcrow Sydney Metropolitan Traffic Model (SMTM)

Figure 5-7 Heavy Vehicle Trips from Port Botany – 2026 Average Weekday

(c) *Moorebank*

Moorebank is situated to the east of Liverpool and features a mix of residential and industrial areas. The industrial area combines logistics and warehousing, manufacturing and heavy industry between Newbridge Road and Heathcote Road. Local and light industry predominates to the north of the M5 motorway.

The M5 South West Motorway links Moorebank east to the Sydney CBD and west to Campbelltown.

An intermodal terminal is currently proposed for land adjacent to the M5 South West Motorway on the southern side. This land is currently occupied by the Australian Army's School of Military Engineering. The Intermodal Terminal facility is planned to handle container traffic from interstate rail freight and Port Botany. Funding has been allocated to complete the detailed planning for the terminal, which will provide an integrated transport solution for the movement of freight to, from and within Sydney. Completion of the detailed design and approval of the terminal project is anticipated by mid-2012.

The Moorebank site has been selected given its proximity to key transport corridors including the Southern Sydney Freight Line, main interstate rail line, and the M5 and M7 motorways; as well as for its proximity to the industrial centres in Sydney's west and south west including Moorebank, Bankstown, Prestons and Ingleburn.

The impact of the intermodal terminal on the M5 South West Motorway heavy vehicle volumes will be assessed in detail as this proposal is developed. It is intended that the facility will encourage transport of cargo by rail freight but it will also alter the localised impact of freight movements.

Road access from this facility to the M5 South West Motorway is likely to be via Moorebank Avenue. It should be noted that the provision of an additional lane as part of the M5 West Widening Project does not preclude the future expansion of this site.

(d) Ingleburn

Ingleburn, situated within the Campbelltown LGA, is a substantial area comprising large factory and warehouse uses. There are a number of vacant factory unit blocks and further capacity to expand industry in the area by encouraging development of vacant land.

Currently, ramps at Brooks Road and Campbelltown Road provide good direct road access to and from the M5 South West Freeway. The site will also benefit from the completion of the Southern Sydney Freight line.

Approximately 10,000 people were employed in the Ingleburn industrial area in 2001¹⁶, and it is anticipated that this area will be developed further given its proximity to the proposed South West Growth Centre and its good road and rail linkages. To this end a former residential area near Ingleburn station is currently being redeveloped as a light industrial area.

Demand to/from Ingleburn is expected to increase around 45% between 2006 and 2026 according to BTS demand data. During the inter peak period truck movements make up around 40% of total demand. In absolute terms this is around 700 vehicle movements.

(e) Bankstown Airport / Milperra

The Bankstown Airport/Milperra area is identified as a Specialised Centre in the Metropolitan Strategy and as such contains infrastructure that performs a vital economic and employment role within the wider metropolitan context.

Milperra is an established industrial and residential centre located immediately to the north of the M5 South West Motorway. The industrial lands are bounded by Henry Lawson Drive in the west, Milperra Road in the north and River Road in the east.

The Milperra Employment Lands precinct forms part of a broader Employment Lands belt that also includes Revesby, Padstow North and Padstow South. These employment lands are used for a mix of transport and logistics as well as light manufacturing.

¹⁶ Sydney Metropolitan Strategy, South West Subregional Strategy, pp 31.

Bankstown Airport, also known as Sydney Metropolitan Airport, is located further to the west near the intersection of Milperra Road and Henry Lawson Drive. This area also includes a business park in the north-eastern corner of the site. The airport is used largely for charter flights and is not currently a significant commuter or freight facility.

The Bankstown Airport Preliminary Draft Masterplan 2010, released in September 2009 anticipates an additional 10,500 jobs to be created directly or indirectly in relation to the airport. The future development of the airport will increase the land-side transport task, and will affect Milperra Road and Henry Lawson Drive in particular.

(f) Chullora

Chullora is an industrial area comprising factories and warehousing. Access to the main industrial area to and from the M5 South West Motorway is primarily via Fairford Road / Stacey Street. Notably, Chullora houses a number of printing plants including Fairfax Printers and News Limited Printers.

Chullora is located within close proximity to the former Enfield marshalling yards. A dedicated rail freight line exists between Port Botany and Enfield / Chullora and a freight line extension to the south west exists from Chullora to Sefton Junction.

BTS travel zone demand indicates demand to/from this area of around 1300 vehicles in the AM peak period in 2006, comprising approximately 18% heavy vehicles. This increases to around 30% in the inter peak period.

(g) Enfield

The Intermodal Logistics Centre (ILC) at Enfield is a planned intermodal terminal facility that would service approximately a quarter Sydney's total intermodal freight demand. Approval was given for the development of the intermodal terminal at Enfield in 2007 and it is due to be completed in 2011.

The road and rail exchange will include an intermodal terminal, railway lines, warehouses and container storage areas and is located on the site of the former Enfield Marshalling Yards.

The site is bounded by the suburbs of Greenacre, Belfield, Belmore, South Strathfield, Strathfield and Chullora. The site is situated to the north of the M5 South West Motorway, and access to and from the M5 motorway is via King Georges Road and Roberts Road, at the intersection of Roberts Road with the Hume Highway. It is bounded by Punchbowl Road in the south and by the Hume Highway in the north.

Sydney Ports Corporation is a key proponent of this development, which will become part of an integrated network of existing and planned intermodal facilities in greater Sydney and is seen as integral to the efficient running of an expanded Port Botany.

(b) Liverpool and Bankstown Regional Centres

The regional City of Liverpool is a strategic centre located to the north of the M5 South West Motorway, accessed via the Hume Highway. It is a focused employment and commercial centre and comprises a mixture of retail and industrial developments, including the Westfield shopping centre and Liverpool Hospital.

As detailed in Table 3-1 in 2006 Liverpool generated/attracted around 37,300 freight vehicle movements. By 2026 this is forecast to increase by over 100% to 76,100, making it one of the highest freight trip growth rates anticipated for any one area within Sydney.

Bankstown City Centre lies to north of the M5 South West Motorway between Chapel Road South in the West and Stacey Street in the east. The central business district is centred on the train station. Bankstown is classified as a Major Centre in the Metropolitan Strategy with a workforce of around 10,000 people and will continue to service the local population providing employment and commercial opportunities.

(i) South West Growth Centre

The South West Growth Centre is located to the west of the M5 South West Motorway, close to the M7 intersection and falls within the boundaries of three local government areas - Liverpool, Camden and Campbelltown.

The site comprises 18 precincts, with capacity for around 110,000 new dwellings for 300,000 people and significant local employment. The successful development of this site hinges on the timely and adequate provision of necessary infrastructure, including transport.

Given its proximity to the M5 South West Motorway, the development of the South West Growth Centre could exacerbate congestion issues currently experienced on the motorway and surrounding network. The widening project will contribute to the additional transport capacity necessary to service the area, whilst maintaining acceptable journey times for other users.

5.6 *Induced Traffic Demand Modelling Process*

The primary response to changes to the highway network is route choice, which is modelled as standard within the EMME model through the assignment / reassignment process. The estimation of changes in traffic due to other responses (distribution, mode switching, generation, time of travel) is more generally known as variable demand modelling, with the four primary such responses being:

1. Trip frequency (or trip generation), i.e. more people moving into the catchment area due to greater accessibility brought about by the new infrastructure;
2. Trip distribution, i.e. network enhancements providing increased accessibility to jobs;
3. Modal choice (whereby the relative times and costs of making the trip by the alternative modes are increased, thus making the car a more attractive option and hence enticing people away from other modes and into their cars); and
4. Micro and macro travel-time choice, such that the reduction in congestion may result in drivers now being enticed to travel at a more desirable time rather than be driven to travel during periods of lesser congestion.

The basic principle is that the provision of increased network capacity will improve the attractiveness / utility of travel which will result in additional trip making (vehicles on the roads). Within the STM model, the trip generation and distribution functions are dependent upon the utility of travel (including travel time, congestion and speed), and as such will generate additional traffic, above and beyond traffic diverted from other modes. Worldwide, the standard transport modelling practices adopt this approach through the use of a process, referred to as four stage modelling, using industry standard software platforms such as EMME (as per the STM).

The modelling process used accounts for; and incorporates induced / generated traffic through the four stage modelling process within the Bureau of Transport Statistics' STM model runs. The widening of the M5 South West Motorway will increase capacity and reduce the cost of travel when compared to the base situation. Consequently, it is generally considered that an increase in demand would be expected over and above the Base Case for reasons outlined above.

More details of the results of the induced traffic impact are provided in Section 8.8.

6 Future Base Traffic Conditions

6.1 Introduction

This section outlines the Base Case traffic forecast for the study area derived using the traffic modelling approach described in Section 5. The traffic models have been used to forecast traffic volumes for the future years 2016 and 2026.

6.2 Future Network Assumptions

6.2.1 Future Network Upgrades

The assumed timing of the strategic road network upgrades was based on the future year road network improvement list agreed with the RTA in August 2009. The project listing provides information on road projects to be completed in future years. The key projects are shown in the table below.

Table 6-1 Key Road Projects for Future Year

Project	Project Description
F5 Upgrade	6 lanes from Raby Road to Narellan Road
M4 Toll Removal	Implemented 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
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 Freeway and M2 Motorway
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

The proposed M5 East duplication has not been included in the Base Case network. A more detailed analysis of the impact of this project has been undertaken separately and is reported in Section 9.

6.2.2 Toll Locations

In the future year models, tolls have been escalated from the current levels inline with CPI. For new motorway links, an assumed tolling value has been agreed with the RTA.

Assumed locations toll locations include:

- Sydney Harbour Bridge and Tunnel
- Cross City Tunnel
- Eastern Distributor
- Lane Cove Tunnel and Military Road
- Hills M2 (7% increase 2013)
- M5 South-West Motorway
- Westlink M7
- M4 East
- M2-F3

6.3 Business as Usual (Base Case) Traffic Growth

Future year models were developed based on land use, population and employment data outlined in Section 5 together with the network assumptions detailed above. The following sections report forecast traffic conditions arising out of the modelling process.

6.3.1 Network Wide Traffic Growth

Table 6-2 and Table 6-3 present a summary of traffic forecasts for the whole of the modelled Sydney metropolitan road network.

Table 6-2 Network Wide Modelled Traffic Demand

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 6-3 Network Wide Percentage Growth in Modelled Traffic Demand

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%

The growth figures summarised above indicate an average annual growth rate of 1.0% for car and 2.6% - 2.8% for truck, between 2006 and 2026. These growth rates are consistent with historical trends.

6.3.2 M5 South West Toll Plaza Traffic Growth

The AADT traffic growth at M5 Hammondville Toll Plaza is forecast to be 16% (1.5% per year) between 2006 and 2016, and 15% (1.4% per year) between 2016 and 2026.

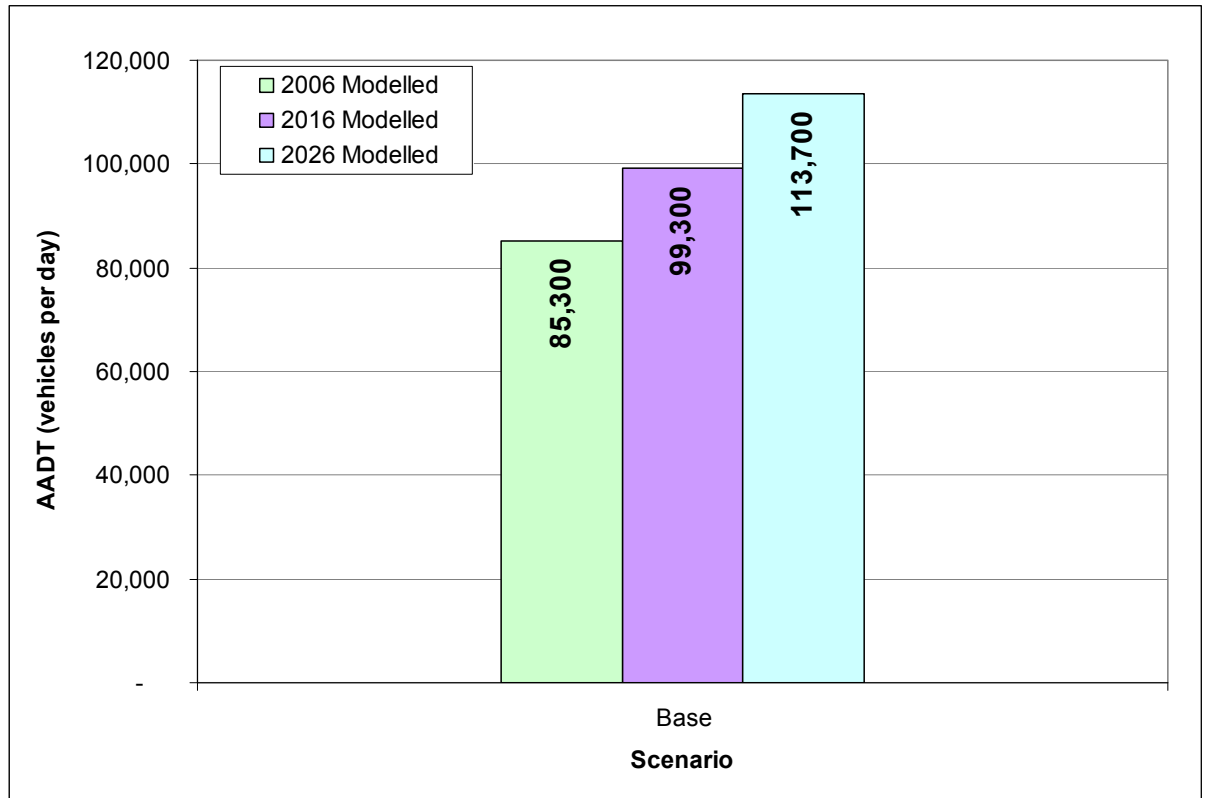


Figure 6-1 M5 Hammondville Toll Plaza AADT Forecast - Base Case

This forecast growth is slightly higher than the equivalent Sydney wide growth figures and reflects the likely distribution of employment and population forecasts. Allowing for the distribution of future land use projections, the level of traffic growth at this location is within normal bounds when compared to the Sydney-wide value. This suggests that there is little spare capacity on the motorway to take up additional traffic from other over capacity roads.

6.3.3 Screenlines

To obtain a more detailed understanding of the growth in traffic demand within the M5 South West Motorway study area, an assessment of screenline volumes has been undertaken. Figure 6-2 shows the location of the screenlines and Table 6-4 details the growth in screenline volumes between 2006 and 2016 and between 2016 and 2026.

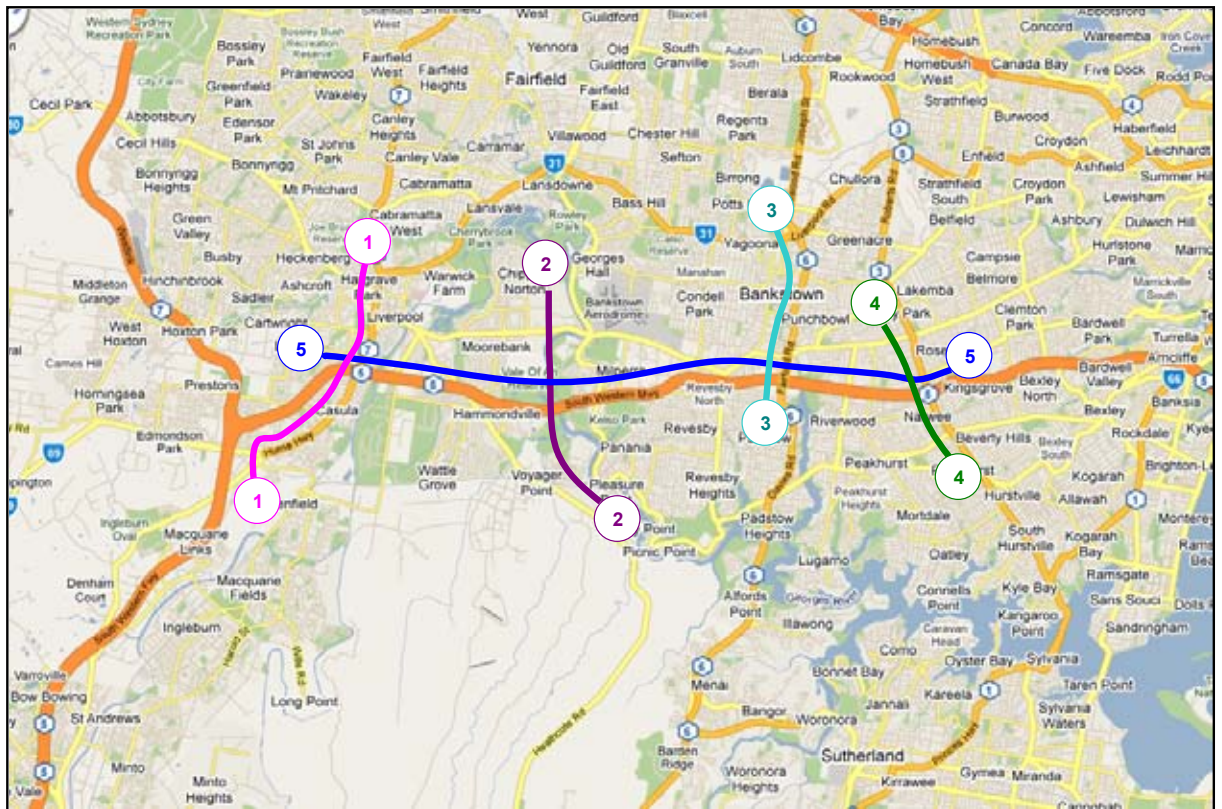


Figure 6-2 Screenline Locations

Table 6-4 Screenline AADT Growth (Two-Way)

Screenline	2006	2016	2006 – 2016 Growth	2026	2016 – 2026 Growth
1	251,900	294,300	42,400 (17%)	326,300	32,000 (11%)
2	149,100	168,000	18,800 (13%)	193,500	25,600 (15%)
3	220,300	243,000	22,700 (10%)	278,800	35,800 (15%)
4	185,600	202,200	16,600 (9%)	222,700	20,500 (10%)
5	317,700	340,100	22,400 (7%)	362,500	22,400 (7%)

Note: % shown in () indicate percentage growth

Figure 6-3 presents graphically the AADT growth for each screenline over the 10 year periods, 2006 to 2016 and 2016 to 2026.

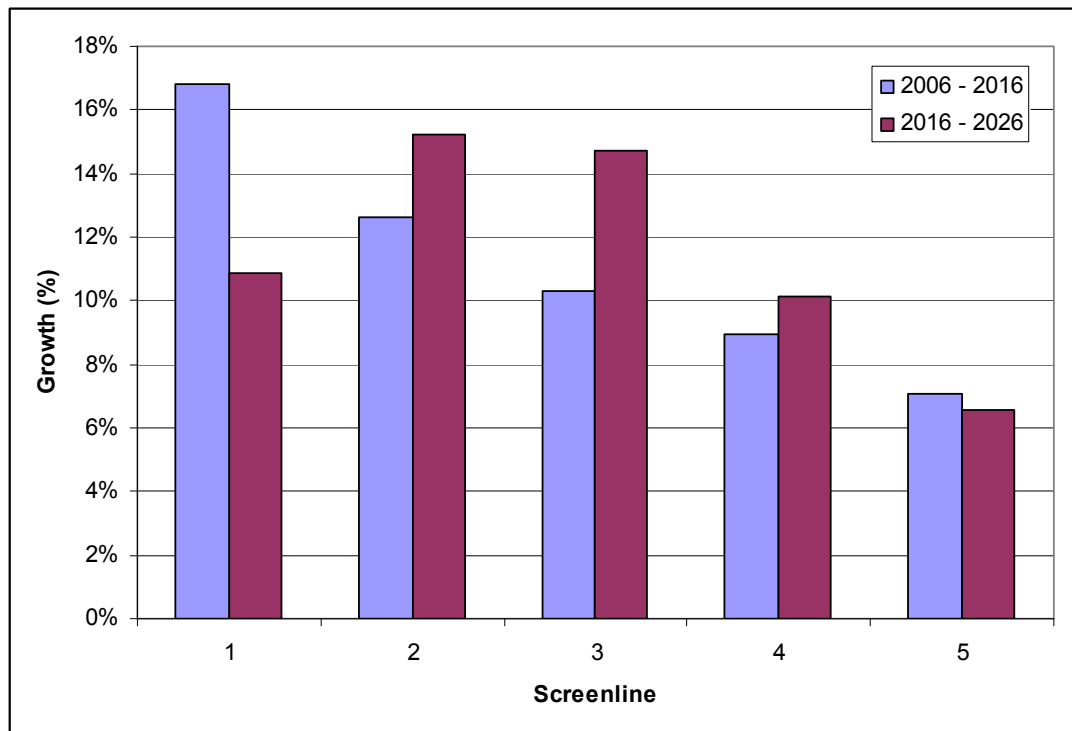


Figure 6-3 AADT Screenline Growth (2016 and 2026)

The comparative Sydney-wide growth rates based on data in Table 6-2 is 13% for 2006 to 2016 and 9% for 2016 to 2026. These growth rates are similar to the overall growth across all study area screenlines, which generally reflect projected land use growth within the corridor.

It is pertinent to note Screenline 5 which is a measure of the north-south movements is slightly lower than the global average.

6.3.4 Peak Period Traffic Forecasts

The AM and PM weekday peak period traffic forecast results are summarised in Table 6-5 and Table 6-6.

Table 6-5 Weekday AM Period Traffic Forecasts

Year	Scenario	M5 South West Motorway			Alternative Route		
		West of Hume Highway	Hammondville Toll Plaza	West of King Georges Road	Hume Highway ¹	Newbridge Road ²	Canterbury Road ³
AM Peak Eastbound							
2006	Existing	3,690	3,020	2,280	3,100	2,810	1,370
2016	Base	4,020	3,420	2,610	3,350	2,940	1,410
2026	Base	4,470	4,000	3,240	3,860	3,370	1,570
AM Peak Westbound							
2006	Existing	2,940	3,170	2,590	1,590	1,920	1,240
2016	Base	3,430	3,690	3,040	1,780	2,130	1,280
2026	Base	3,590	3,960	3,300	1,920	2,500	1,360

Note: 1 – West of Terminus St
 2 – West of Henry Lawson Drive
 3 – West of King Georges Rd

The results illustrate a growth in AM peak traffic of 12% (2009 to 2016) and 17% (2016 to 2026) at the Hammondville Toll Plaza. This compares with the 2016 to 2026 growth of 11% and 24% on the other two sections of the motorway (being west of Hume Highway and west of King George’s road respectively). Traffic growth on the Alternative Route averages 14% across Hume Highway, Newbridge Road and Canterbury Road.

Growth is forecast to be strong for both the motorway and the Alternative Route in the Base Case and is above the expected Sydney-wide average.