Table 24 Performance based on screenline points

Screenline	Location	Type	Inbound (Citybound)						Outbound					
			Lanes	AM Peak		PM Peak		Daily	Lanes	AM Peak		PM Peak		Daily
				Hourly Vehicle	LoS	Hourly Vehicle	LoS			Daily	Los	Hourly Vehicle	LoS	
1A	Norwest Boulevard East of Old Windsor Road	Arterial	2	1,200	F	1050	B	13,800	2	850	A	1,900	B	15,850
1B	Seven Hills Road East of Merindah Road	Arterial	1	1,250	B	900	B	11,000	1	900	B	1,150	B	11,100
1D	Abbott Road East of Old Windsor Road	Major Arterial	2	950	A	850	A	10,250	2	750	A	1,000	A	12,000
1E	Old Windsor Road North of Gibbon Road	Major Arterial	2	2,850	F	2,250	C	31,250	2	1950	C	2,600	C	29,900
1F	Powers Road East of Station Road	Sub-Arterial	2	700	C	450	B	6,150	2	400	B	550	B	5,200
1G	Station Road at Mc Coy Park	Sub-Arterial	1	1,000	C	1,000	B	11,600	1	1,000	C	950	B	11,900
2A	Castle Hill Road East of Old Northern Road	Major Arterial	2	1,800	C	1,800	D	22,450	2	1,900	C	2,050	C	23,500
2B	Renown Road East of Cook Street	Sub-Arterial	2	1,150	D	500	A	8,200	2	550	D	1,150	D	8,600
2D	James Ruse Road East of Windsor Road	Major Arterial	3	3,500	F	1,800	B	28,300	2	1,550	E	2,300	C	25,000

Screenline	Location	Type	Inbound (Citybound)						Outbound					
			Lanes	AM Peak		PM Peak		Daily	Lanes	AM Peak		PM Peak		Daily
				Hourly Vehicle	LoS	Hourly Vehicle	LoS			Daily	Los	Hourly Vehicle	LoS	
2E	Church Street South of Briens Road	Major Arterial	3	2,250	F	1,100	E	19,800	3	900	E	2,050	D	20,800
3A	The Comenarra Parkway East of Fox Valley Road	Sub-Arterial	1	500	D	950	C	7,650	1	900	C	450	D	6,650
3C	Epping Road West of Vimiera Road	Major Arterial	2	2,500	F	1,050	D	21,900	2	850	E	1,950	F	21,350
4A	Windsor Road North of M2 Motorway	Major Arterial	2	2,750	E	1,650	D	28,200	3	1,550	A	2,550	A	28,700
4B	Oakes Road North of M2 Motorway	Sub-Arterial	1	1,150	C	650	C	8,350	1	750	B	1,350	C	9,500
4C	Pennant Hills Road North of M2 Motorway	Major Arterial	3	3,550	F	2,400	D	38,350	3	2,150	B	3,200	D	38,700
4D	Kirkham Street at M2 Motorway	Collector	1	1,000	B	400	A	4,700	1	400	A	500	A	3,650
4E	Beecroft Road North of M2 Motorway	Major Arterial	2	2,100	C	950	B	17,800	2	850	B	1,600	B	17,750
4F	Ryde Road South of Lady Game Drive	Major Arterial	3	4,000	F	3,750	D	45,400	3	3,150	C	3,650	B	43,500

Intersection performance

The performance of intersections uses a LoS indicator. Grades A to F are once again used, so as to provide some tie-in with the link indicators and the LoS criteria specified by the RTA guidelines is shown in Table 25.

Two different traffic engineering software packages were used to estimate LoS for the intersections within the study area. The SCATES intersection analysis program has been used to assess the operation of closely spaced co-ordinated traffic signals, and SIDRA 3.2 has been used to assess isolated traffic signals.

Table 25 Intersection performance measures

Intersection Level of service (LoS)	Average Delay per vehicle (sec/veh) including geometric delay	Conditions for signalised intersections
A	0 – 14.5	Good operation
B	14.5 – 28.5	Acceptable delays and spare capacity
C	28.5 – 42.5	Satisfactory
D	42.5 – 56.5	Operating near capacity
E	56.5 – 70.5	At capacity
F	> 70.5	Extra capacity required

Source: NSW RTA Guide to Traffic Generating Development, Oct 2002.

Based on historical surveys and SCATES data, the intersection LoS performances are estimated for the locations shown in Table 26.

Table 26 Intersection performance levels

Intersection	LoS AM	LoS PM
Windsor Road – M2 Motorway ramps	B	B
Pennant Hills Road – M2 Motorway ramps	B	D
Christie Road – Talavera Road	C	A
Herring Road – Talavera Road	B	B
Lane Cove Road – M2 Motorway ramps	A	A
Herring Road – Waterloo Road	C	C
Khartoum Road – Talavera Road	B	B
Lane Cove Road – Talavera Road	B	F
Lane Cove Road – Waterloo Road	F	D
Lane Cove Road – Epping Road	E	F
Windsor Road – Cook Street	F	C
Herring Road – Epping Road	E	D

As Table 26 shows, some of the intersections surrounding the M2 Motorway have a LoS of D, E and F, which indicate they are operating near or at capacity.

During the AM peak the only intersections operating at LoS F are Lane Cove Road, Waterloo Road and Windsor Road to Cook Street. In the case of the former, this is due to high proportion of traffic turning from Lane Cove Road accessing Macquarie Park via Waterloo Road. The latter is due to high volumes into and out of Cook Road. In the PM peak the intersections of Lane Cove Road – Talavera Road and Lane Cove Road/Epping Road are operating at LoS F. Similarly to the intersection of Lane Cove Road – Waterloo Road during the morning peak, the poor performance of Lane Cove Road – Talavera Road during the evening peak is attributable to high volumes of traffic leaving the Macquarie Park area via Talavera Road. The performance of Lane Cove Road – Epping Road reflects intersection of two heavily trafficked major arterial roads in the network.

Travel speeds and travel times

Travel time surveys were conducted along the M2 Motorway and compared to an alternative route via parallel roads and is shown in Figure 21. Table 27 provides a summary of the travel time surveys along these routes.

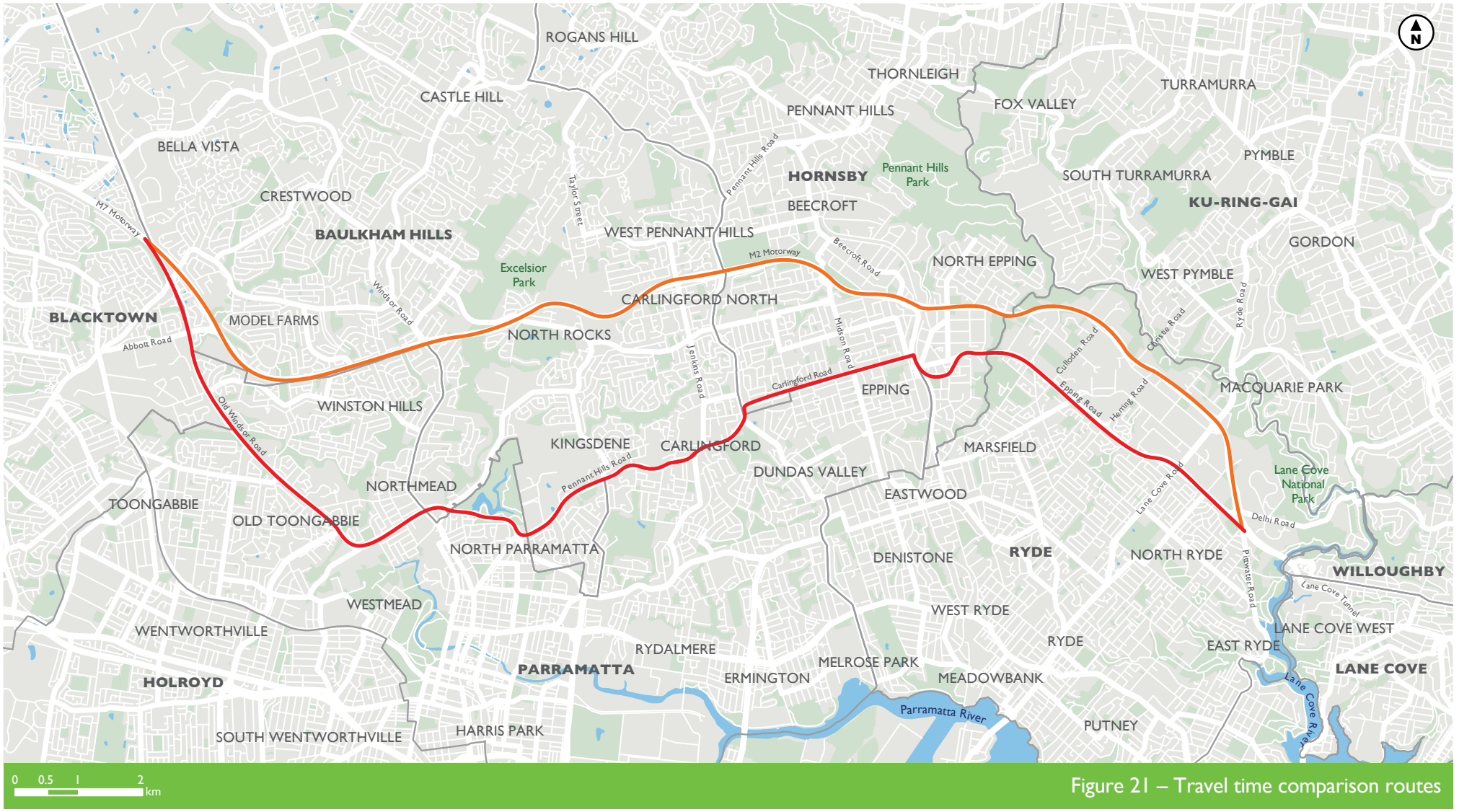


Figure 21 – Travel time comparison routes

- M2 Motorway
- Alternative route
- River / Waterway
- Park / Open space
- LGA boundary

Source: Transurban, 2010

Table 27 Existing travel times and speeds

Route	Direction	Travel time (minutes)	Average speed (kilometres per hour)
M2 Motorway	Eastbound	34	37
Alternative		45	30
M2 Motorway	Westbound	27	45
Alternative		46	29

Morning peak congestions on the M2 Motorway occur west of and at Norfolk Tunnel, average speeds in these sections can drop below 20 kilometres per hour and are the result of insufficient capacity to accommodate traffic entering M2 Motorway at Beecroft Road. The insufficient merge capacity at this location, coupled with conditions within the Norfolk Tunnel result in flow break down, leading to poor travel speeds and queuing which can extend to the M7 Motorway.

Whilst westbound travel times during the PM peak are relatively high compared to other times of the day, the congestion on both the M2 Motorway and the alternative local network is not as extreme as the AM peak. Average westbound speeds on the M2 Motorway during the PM peak are substantially higher than the eastbound speeds in the AM peak, interim westbound widening is likely to be a contributing factor to the relative difference in peak direction performance of the M2 Motorway.

Road safety

Analysis of incidents that occurred on the M2 Motorway in 2008 indicates that the annual accident rate on M2 Motorway is lower than the NSW state average. Refer to Table 28. This is likely to be attributable to safety benefits of motorways associated with grade separated interchanges and physical separation between opposing traffic streams.

Table 28 Accident rates comparison (2008)

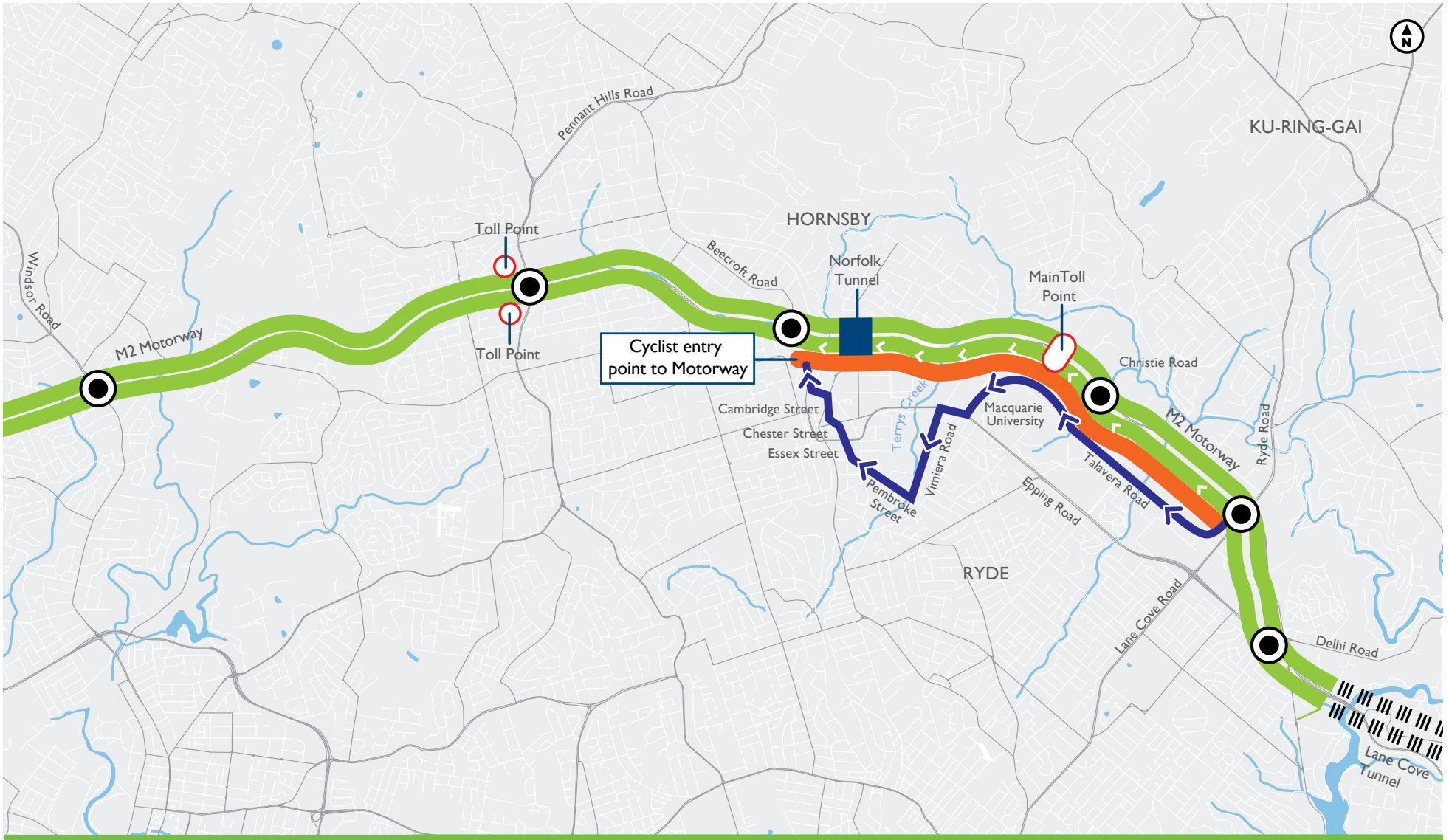
	NSW Overall*	M2 Motorway*
Fatal	0.5	0.0
Injury	28.5	6.7
Non Casualty (tow-away)	36.1	11.3
Total	65.1	18.0

Note: *accidents per 100 million VKT

The incidents that occurred on the M2 Motorway were generally adjacent to interchanges, decision point locations and the Norfolk Tunnel, where sun glare is an issue in the morning peak.

Cycle facilities

Originally, the road shoulders located along the M2 were designated as breakdown lanes and used by cyclists. However, the removal of the westbound shoulder between Lane Cove Road and Beecroft Lane, to allow for a third traffic lane, has detoured the cycle route via the local road system from North Ryde to Epping as shown in Figure 22.



Not to scale

Figure 22 - Existing cycle facilities adjacent to the M2 Motorway

Existing M2 Motorway
Alternate Bike Route
Removal of westbound shoulder
Interchange
Toll plaza

Source: Transurban, 2010

Pedestrian access

Existing pedestrian facilities on the M2 Motorway provide access between the bus stops, located along the median and kerbsides, and the adjacent local streets. Also located along the M2 Motorway are pedestrian overpasses and an underpass that allow safe pedestrian passage across the M2 Motorway. Section 7.3.2 and Table 12 indicated the pedestrian crossing points and changes during the construction period.

9.1.2 Impact assessment

Basis for assessing current and future traffic conditions in the M2 Motorway

Transurban's Strategic Traffic Model (TUSTM) was used to forecast traffic network volumes in the corridor, including on M2 Motorway, with and without the proposed M2 Upgrade project for years 2011 and 2021. Turning volume forecasts from TUSTM were also used to model intersection performance using the intersection analysis software packages SIDRA and SCATES.

TUSTM uses demand forecasts of vehicle trips between origins and destinations obtained from Transport Data Centre (TDC). These are assigned on a model of the Sydney road network using appropriate modules from the CUBE suite of transport planning software packages. Vehicle trips are assigned on the basis the lowest cost route. This cost takes into account travel time, toll cost and varies depending on the socio-economic characteristics of the trip purpose.

Refer to Technical Paper 1 for full description of TUSTM and assessment contained in this section.

Induced traffic

When the capacity of the road network is increased, traffic may occur that may not have otherwise resulted. This additional traffic can result from one or more of the following:

- Rerouting of traffic onto different roads to take advantage of travel time savings.
- Redistribution of trips so that some traffic switch to destinations that are now more easily accessed.
- Retiming of trips (particularly into peak times).
- Modal shifts from public transport to car driver.
- Additional trips that would otherwise not have been undertaken.
- Changes in the land use patterns to accommodate growth and in response to the improved accessibility resulting in additional trips.

These factors can result in an increase in vehicle kilometres of travel, known as 'induced traffic'.

The forecast of annual road network vehicle kilometres travelled (VKT) for the Sydney network has been modelled for 2011 and 2021 and is shown in Table 29 below. The modelling forecasts a slight reduction (less than 0.1 per cent) in the overall number of vehicle kilometres travelled on the Sydney road network as a result of the M2 Upgrade project in 2011 and 2021, while there would be a slight increase in vehicle kilometres travelled on the motorway itself (around 0.6 per cent). This net change on the network is considered to be marginal.

While there may be changes and increases in traffic numbers due to land use changes, population growth and/or changes in economic activity, it is noted that one of the project objectives include:

- Enhance the strategic road network in Sydney's north-west to support economic growth.
- To improve access to and accessibility between key residential, employment and educational precincts in Sydney's north-west.

The increased activity that M2 Motorway addresses is not considered to be a result of the project. Rather, the project addresses this need for an enhanced road network.

However, a new or substantially upgraded road can induce changes in trip patterns even when there is no growth in regional population or changes in economic activity. This can appear as induced traffic. Generally, changes to home and workplace trip patterns occur over several years after opening of the new or upgraded road whereas changes to shopping and recreational trip patterns can occur in a much shorter period. A key factor for induced trips is that improvements in travel times are experienced throughout the day, which, as an example, occurred upon opening of the M7 Motorway.

However, unlike the M7 Motorway and similar projects, the M2 Upgrade project is expected to provide only marginal improvements outside of peak periods and therefore provides much lower potential for induced trips at these times. More substantial travel time improvements are expected primarily during the morning and evening peak periods. While this provides potential to induce traffic at these peak times, it is expected to be low as there would also be similar improved travel time for buses on the M2 Motorway. Thus there would be no greater incentive for a mode shift. Further, while the east facing on-ramp at Christie Road and off-ramp at Herring Road would enhance accessibility to Macquarie Park, they are not likely to generate more than a marginal mode shift from rail (Epping to Chatswood Rail Link). This is because private vehicle travel to and from Macquarie Park and Sydney's Central Business Districts are most heavily influenced by parking costs and availability, and this is not going to change as a result of the M2 Upgrade project.

It should also be noted that proposed toll at the new access ramps, and increased toll upon opening, may act as a deterrent to discretionary travel, further reducing the potential for induced traffic.

On this basis, the project is not expected to unduly induce traffic.

Strategic level changes in road network performance

The predicted change in travel demands on the Sydney network is shown in Table 29. The likely change in hours travelled are shown in Table 30 and average vehicle speeds on the future network are shown by Table 31[3].

While the overall change in network vehicle kilometres travelled is small, there is an expected shift in travel from arterial and local roads (between 0.2 percent - 0.5 percent to travel on Motorways and 0.6 percent on the network). The majority of this predicted change would be within the M2 corridor, influenced by the project.

There would be an overall reduction in vehicle hours travelled (Table 30), with up to 8.3 percent reduction on motorways as a result of the project. Likewise, when travel speeds are compared with the base scenario, representing the M2 Motorway with no upgrades, (Table 31), the project improves overall travel speed performance.

Table 29 Forecast annual road network vehicle kilometres travelled

Facility	2011 base scenario*	2011 M2 with Upgrade*	Impact (percent)	2021 base scenario*	2021 M2 with Upgrade*	Impact (percent)
Motorway	8,697	8,749	0.6	9,862	9,924	0.6
Arterial	14,379	14,347	-0.2	16,407	16,368	-0.2
Local / Sub Arterial	7,302	7,280	-0.3	8,668	8,628	-0.5
Sydney Network	30,379	30,376	<-0.1	34,936	34,920	<-0.1

*Note: * million kilometres*

Table 30 Future annual road network vehicle hours travelled

Facility	2011 base scenario*	2011 M2 with Upgrade*	Impact (percent)	2021 base scenario*	2021 M2 with Upgrade*	Impact (percent)
Motorway	113.0	112.51	-0.4	156.89	143.82	-8.3
Arterial	351.0	348.55	-0.7	431.70	427.95	-0.9
Local / Sub Arterial	209.9	209.05	-0.4	276.62	274.30	-0.8
Sydney Network	673.8	670.10	-0.6	853.58	846.07	-0.9

*Note: * million hours*

[3] The annual figures below have been calculated using the following methodology:

- Average workday VKT and VHT summed from TUSTM four model periods – AM, IP, PM, NT
- Annual VKT and VHT converted using an annualisation factor of 325

Table 31 Future annual road network annual average vehicle speeds

Facility	2011 base scenario*	2011 M2 with Upgrade*	Impact (percent)	2021 base scenario*	2021 M2 with Upgrade*	Impact (percent)
Motorway	77.0	77.8	1.0	62.9	69.0	9.8
Arterial	41.0	41.2	0.5	38.0	38.2	0.6
Local / Sub Arterial	34.8	34.8	0.1	31.3	31.5	0.4
Sydney Network	45.1	45.3	0.5	40.9	41.3	0.8

*Note: * kilometres per hour*

Link Flows

The forecast change daily traffic flows for each section of the M2 Motorway is based on the modelling detailed in Technical Paper 1, and is summarised in Table 32. Generally, the forecasts indicate increased traffic volumes on the M2 Motorway. At 2021, the daily traffic flows increase in the order of 1,600 to 6,900 vehicles are indicated, the latter in the westbound section Lane Cove Road to Herring Road.

Table 32 Forecast M2 Motorway eastbound daily traffic volumes

From	To	Eastbound					
		2011 Base	2011 Up-grade	2011 Impact	2021 Base	2021 Up-grade	2021 Impact
Old Windsor Road	Windsor Road	31,800	33,950	2,150	37,550	40,050	2,500
Windsor Road	Pennant Hills Road	41,200	42,400	1,200	49,750	51,330	1,580
Pennant Hills Road	Beecroft Road	36,150	37,850	1,700	44,750	46,830	2,080
Beecroft Road	Christie Road	40,350	42,500	2,150	49,250	51,830	2,580
Christie Road	Lane Cove Road	36,250	40,150	3,900	42,900	47,810	4,910
Lane Cove Road	Delhi Road	26,950	30,750	3,800	32,500	37,310	4,810
Delhi Road	Epping Road	19,200	22,000	2,800	25,850	29,810	3,960

Table 33 Forecast M2 Motorway westbound daily traffic volumes

From	To	Westbound					
		2011 Base	2011 Up-grade	2011 Impact	2021 Base	2021 Up-grade	2021 Impact
Epping Road	Delhi Road	18,750	21,450	2,700	24,300	27,800	3,500
Delhi Road	Lane Cove Road	27,200	31,600	4,400	30,500	35,250	4,750
Lane Cove Road	Herring Road	36,150	42,350	6,200	40,200	47,100	6,900
Herring Road	Beecroft Road	40,800	44,500	3,700	47,250	50,920	3,670
Beecroft Road	Pennant Hills Road	37,750	41,850	4,100	43,600	47,720	4,120
Pennant Hills Road	Windsor Road	43,750	45,650	1,900	50,350	52,020	1,670
Windsor Road	Old Windsor Road	33,300	38,250	4,950	37,350	42,715	5,365

Further detail regarding traffic flows forecast during the AM and PM peak hours, is summarised in Table 34and Table 35. This is followed by LoS based on the M2 Motorway forecast traffic volumes summarised in Table 36 and Table 37.

Table 34 Forecast M2 Motorway eastbound peak hour traffic volumes

From	To	AM				PM			
		2011 Base	2011 Up-grade	2021 Base	2021 Up-grade	2011 Base	2011 Up-grade	2021 Base	2021 Up-grade
Old Windsor Road	Windsor Road	2,400	2,800	3,000	3,400	2,350	2,750	2,900	3,400
Windsor Road	Pennant Hills Road	3,350	3,830	4,200	4,800	2,950	3,270	3,700	4,150
Pennant Hills Road	Beecroft Road	3,600	4,430	4,350	5,400	2,250	2,620	2,900	3,450
Beecroft Road	Christie Road	4,450	5,380	5,250	6,400	2,450	2,870	3,150	3,750
Christie Road	Lane Cove Road	3,600	4,430	4,100	5,300	2,250	2,920	2,900	3,800
Lane Cove Road	Delhi Road	2,750	3,480	2,950	4,000	1,600	2,170	2,150	2,950
Delhi Road	Epping Road	1,900	2,430	1,900	2,800	1,200	1,670	1,800	2,500

Table 35 Forecast M2 Motorway westbound peak hour traffic volumes

From	To	AM				PM			
		2011 Base	2011 Up-grade	2021 Base	2021 Up-grade	2011 Base	2011 Up-grade	2021 Base	2021 Up-grade
Epping Road	Delhi Road	950	1,250	1,250	1,650	2,050	2,150	2,350	2,450
Delhi Road	Lane Cove Road	1,550	1,950	1,950	2,450	3,000	3,200	3,400	3,650
Lane Cove Road	Herring Road	2,150	2,650	2,900	3,550	3,900	4,350	4,400	5,000
Herring Road	Beecroft Road	2,350	2,500	3,150	3,400	4,750	5,170	5,350	6,000
Beecroft Road	Pennant Hills Road	2,200	2,400	2,950	3,250	4,300	4,670	4,700	5,100
Pennant Hills Road	Windsor Road	2,900	2,950	3,550	3,650	4,250	4,220	4,550	4,300
Windsor Road	Old Windsor Road	2,250	2,480	2,750	3,050	3,150	3,440	3,400	3,450

Table 36 Forecast M2 Motorway eastbound peak hour level of service scenarios

From	To	AM				PM			
		2011 Base	2011 Up-grade	2021 Base	2021 Up-grade	2011 Base	2011 Up-grade	2021 Base	2021 Up-grade
Old Windsor Road	Windsor Road	C	C	D	D	C	C	D	D
Windsor Road	Pennant Hills Road	D+	C	F+	D	C+	C	D+	C
Pennant Hills Road	Beecroft Road	D+	D	F+	D	C+	B	C+	C
Beecroft Road	Christie Road	F+	D+	F+	F+	C+	B+	D+	C+
Christie Road	Lane Cove Road	D	C+	E	D+	C	B+	D	C+
Lane Cove Road	Delhi Road	C	D	D	E	B	C	D	D
Delhi Road	Epping Road	B	C	B	C	B	B	C	C

Note to table: '+' indicates LoS based on constraints at on-ramp merge point.

Table 37 Forecast M2 Motorway westbound peak hour level of service scenarios

From	To	AM				PM			
		2011 Base	2011 Up-grade	2021 Base	2021 Up-grade	2011 Base	2011 Up-grade	2021 Base	2021 Upgrade
Epping Road	Delhi Road	A	B	B	C	C	C	D	D
Delhi Road	Lane Cove Road	B+	B+	B+	C+	C+	D+	D+	D+
Lane Cove Road	Herring Road	B+	B+	C+	C+	C+	D+	D+	D+
Herring Road	Beecroft Road	B+	B+	C+	B+	D+	D+	D+	D+
Beecroft Road	Pennant Hills Road	C	B	D	C	F	D	F	D
Pennant Hills Road	Windsor Road	C+	C+	D+	D+	F+	F+	F+	F+
Windsor Road	Old Windsor Road	C	C+	C	D+	D	D	D	D

Note to table: '+' indicates LoS based on constraints at on-ramp merge point.

Table 36 and Table 37 indicate that the project would improve the level of service on the M2 Motorway eastbound during the AM and PM peak between Windsor Road and Beecroft Road. The westbound level of service would also improve during the AM and PM peak between Beecroft Road and Pennant Hills Road.

The eastern end of the M2 Motorway is unlikely to experience improvements in level of service. The level of service during the AM peak for east bound motorists between Lane Cove Road and Epping Road would be adversely affected as a result of traffic growth and improved access to the M2 Motorway resulting from the M2 Upgrade project.

The assessment of the eastbound section between Beecroft Road and Christie Road is based on existing vehicle occupancy rates along the M2 Motorway and therefore may represent a conservative utilisation of the proposed T2 lane along this section. It is probable that the introduction of the T2 lane may potentially encourage car pooling and thus improve the LoS along this section. The assessment of the T2 lane would be further investigated using microsimulation during detailed design.

The LoS following the M2 Upgrade project are predicted to be generally no worse than LoS D by 2011. By 2021, only the afternoon peak westbound movement between Pennant Hills and Windsor Road would operate at LoS F. This would be the case with or without the M2 Upgrade project.

Heavy vehicles

The M2 Upgrade project would improve travel conditions for M2 Motorway commercial vehicles and would continue to provide high levels of service for trucks. The M2 Upgrade project would offer reduced travel times for commercial vehicles and thereby potentially reduce truck volumes, consequent truck noise and emission impacts on the local road network.

Public transport impact

The project would result in a number of benefits to bus services. The main benefits include:

- Reduced traffic congestion pinch points on the M2 resulting from increased capacity.
- Changes to bus access arrangements.

The provision of a T2 lane eastbound between Terrys Creek and Lane Cove Road would provide additional eastbound road capacity for both transit lane users and eastbound bus services along a section that currently experiences regular congestion during the AM Peak.

M2 Motorway buses, between Beecroft Road and Lane Cove Road, utilise the same lanes as general traffic. The widening of M2 Motorway within this section with an additional lane in each direction is expected to benefit both buses and private vehicles. This additional capacity would reduce traffic congestion for motorists and buses to provide improved bus travel times and reliability. The widening of the carriageways would also allow the speed limit to be restored to 100 kilometres per hour and potentially resolve queuing issues upstream.

The current delays experienced by buses entering the M2 Motorway, from Windsor Road, and accessing the median bus only lane would alleviated through the introduction of the additional eastbound lane. The additional lane would ease the congestion within the area and improve bus manoeuvrability between the Windsor Road on-ramp and the median bus only lane.

Bus travel times and reliability along the M2 Motorway would improve for services that exit to Macquarie Park as well as those that continue to the CBD. Services to the Macquarie Park area would benefit from widening of the Christie Road bridge and Talavera Road, as these upgrades would reduce delays currently experienced by buses exiting the M2 Motorway, crossing the Christie Road Bridge and accessing the Macquarie Bus interchange via Talavera Road. By increasing bus travel times and reliability, the M2 Upgrade project would support achieving NSW Government's mode share targets, as described above.

With the M2 Upgrade project, the forecast travel time saving for buses is approximately five minutes for eastbound services during the 2021 AM peak hour, which is important in that it is over a relatively short section of the M2 Motorway where travel time delay is currently experienced by bus users that this time saving would be realised. Removing this bottleneck would provide a free flow travel experience from end to end for bus users. Table 38 provides a summary of the bus travel times.

Table 38 Forecast bus travel times on M2 Motorway

Direction	2011 Base Travel Time[1]	2011 With Upgrade Travel Time[1]	2011 Travel Time Difference	2021 Base Travel Time[1]	2021 With Upgrade Travel Time[1]	2021 Travel Time Difference
AM Eastbound	16	12	-4	18	13	-5
AM Westbound	12	12	0	12	12	0
PM Eastbound	12	12	0	13	12	-1
PM Westbound	25	20	-5	26	22	-4

Note:1 – Travel time assumes no stopping

Given there were approximately 17,000 passengers using M2 Motorway bus services each workday in 2008, the annual travel time savings from the M2 Upgrade project for bus users would be in the order of 250,000 hours by the time the M2 Upgrade project is complete.

The existing two-way bus ramp near Beecroft Road was installed in anticipation of the potential demand of commuter transferring between the M2 Motorway buses and the heavy rail network at Epping Rail Station. However, historic patronage data shows that the number of people transferring from buses at Epping Railway station is small in comparison to the demand for direct city bound bus services along the M2 Motorway. Furthermore, with the opening of the Epping to Chatswood rail link, commuters have the ability to access Epping Railway Station via the heavy rail network from Macquarie Park.

The removal of the bus ramp between the M2 Motorway and Beecroft Road would require existing bus routes between the M2 Motorway and Epping Rail Station (611 and 740) to be re-routed.. In addition to the rail station, these services also provide connections to Macquarie University and the shopping centre. With the removal of the bus only ramps near Beecroft road, these bus routes would be re-routed via Christie Road, Talavera Road and Herring Road. Commuters using the bus routes 611 and 740 to access Macquarie Park would benefit from shorter travel times as a result of the using the Christie Road exit ramp.

The removal of the bus ramps would only require a change in the trip schedule for those commuters using bus routes 611 and 740 to access Epping or to connect with other services at Epping Railway Station. Those commuters departing Epping or connecting to other transport services to reach their final destination would have alternative options, such as catching alternate buses and trains. Some trips for those commuters currently using these bus routes are likely to result in longer travel times and or more transfers, while other trips are likely to result in fewer transfers and travel time savings.

As discussed in Section 9.1.1 passenger counts at Epping indicate there are approximately 70 passengers per day boarding and departing at Epping (source: DT&I). In addition, there are approximately 40 students from Epping Boys' High whose service could be re-routed.

Apart from bus routes 611 and 740, that access Epping via the Beecroft Road ramp, other existing public transport services provide connections to Epping Station and other stations on the Northern Railway Line from the north-western regions of Sydney.

Existing public transport options available to those users that would be required to change their trip schedule include:

- Utilising alternative bus services that travel between the north-west and Epping (refer to Table 23 for services with Epping as a destination).
- Utilising alternative bus services to Pennant Hills or Beecroft Station and catching a train to Epping (refer to Table 23 for services with these stations as their destination).
- Utilising potentially re-routed 611 or 740 bus services to Macquarie Centre and catching a train to Epping.

There would also be opportunities for operating new bus services that utilise the M2 Motorway with modified routes to access Epping if demand for these services was warranted.

Some of the existing 611 and 740 passengers that alight at Epping to connect to other Northern Railway Line stations would also be able to utilise alternative public transport services that exist, such as the North West T-Way and the Western Railway Line. Table 39 compares trip characteristics before and after removal of the bus ramps for users that would currently utilise the 611 and 740 services and alight at Epping.

Table 39 Bus routes 611 and 740 comparison with other public transport services

Example Trip	Route Details	
	Beecroft Bus Ramp	Alternative
Castle Hill (Showground Road) to Epping Station	2 buses (610x and 611) Total Walking distance: ~1.4km Travel time (door to door): 1 hour 4 minutes	2 buses (T70 and 633) and 1 train (Pennant Hills to Epping) Total Walking distance: ~200m walk Travel time (door to door): 59 minutes
North Rocks (Barclay Road) to Pennant Hills Station	1 bus (611) and 1 train (Epping to Pennant Hills) Total Walking distance: ~300m Travel time (door to door): 36 minutes	2 buses (610x and 553) and 1 train (Beecroft to Pennant Hills) Total Walking distance: ~500m walk Travel time (door to door): 44 minutes
Stanhope Gardens (Stanhope Parkway) to Rhodes Station	1 bus (740) and 1 train (Epping to Rhodes) Total Walking distance: 600m walk Travel time (door to door): 1hr 27 mins	1 bus (T74 - T-Way) and 2 trains (Blacktown to Strathfield, Strathfield to Rhodes) Total Walking distance: 500m walk Travel time (door to door): 1hr 10 mins
Baulkham Hills (Windsor Road) to Eastwood Station	2 buses (610x and 611) and 1 train Total Walking distance: 1200m walk Travel time (door to door): 53 mins	1 bus (630) and 1 train (Epping to Eastwood) Total Walking distance: 900m walk Travel time (door to door): 1hr 4 mins

There are also opportunities to develop new bus services that utilise the M2 Motorway as a consequence of the new Herring Road off-ramp, Christie on-ramp and Windsor Road on- and off-ramps. The additional capacity on the M2 Motorway would facilitate continued growth in bus use by improving bus travel times and service reliability. Improvements for buses would result from reducing delays at and on approach to existing pinch points where buses are not protected by bus lanes.

Mode share impact

Given that M2 Motorway bus services are at or near capacity during peak periods, it is assumed that increased bus services would be required along the M2 Motorway to meet the NSW Governments mode share targets. The additional capacity provided by the M2 Upgrade project and improved accessibility provided by the new ramps would facilitate continued growth in bus use by improving bus travel times and service reliability. This additional capacity and the potential for greater buses services along the M2 Motorway corridor is consistent with the NSW Government's target of increasing public transport to Sydney CBD and the Macquarie Park.

As part of the recent *Metropolitan Transport Plan*, $2.9 billion has been allocated extra buses for strategic corridors and local routes as well as for upgrading bus depots. Under the plan the NSW Government will purchase an additional 1,000 buses.[4]

The additional buses and funding as part of the *Metropolitan Transport Plan* and the integration of the ECRL services is expected to increase public transport mode share in the area.

The widening and subsequent improvement in travel times for private vehicles is not expected to significantly impact these mode share targets for the following reasons:

- The east facing on-ramp at Christie Road and off-ramp at Herring Road would enhance accessibility to Macquarie Park, however they are not likely to generate more than a marginal mode shift from rail (Epping to Chatswood Rail Link) as private vehicle travel to/from Macquarie Park and Sydney CBD is most heavily influenced by parking costs and availability, and this is not going to change as a result of the M2 Upgrade project.
- The proposed toll at the new access ramps, and increased toll upon opening, may act as a deterrent to discretionary travel, further reducing the potential for mode shift from public transport to car.
- The proposal would also result in bus travel time improvements that would offset any incentive to shift mode as a result of the improved traffic conditions for private vehicles.

Local road impact

Under existing conditions, midblock traffic volumes (traffic travelling on the M2 Motorway between interchanges) often exceed theoretical motorway lane capacities leading to congestion and increased travel times, particularly during peak periods. This also impacts on the surrounding arterial road network due to traffic seeking alternative routes. By providing additional lane capacity, the project would alleviate existing congestion along the M2 Motorway and provide relief for surrounding arterial routes.

The provision of new ramps at the Windsor Road interchange as well as at Christie Road and Herring Roads would result in the re-distribution of traffic in the vicinity of M2 Motorway. In particular, demand on roads leading to and from M2 Motorway entrances and exits are likely to increase with the proposed ramps. Figure 23 shows the resulting total daily traffic flow changes on the road network. Traffic volumes are expected to increase at the M2 Motorway access point to the M7 Motorway, Old Windsor Road, Windsor Road and Pennant Hills Road.

The local road network surrounding the M2 Motorway is likely to experience reduced traffic volumes, with lower traffic volumes indicated along Windsor Road, between Norwest Boulevard and M2

[4] Website: http://more.nsw.gov.au/news/all-buses-now-fitted-gps-linked-traffic-lights

Motorway, as well as Epping Road between Blaxland Road and Pittwater Road. This potential impact is illustrated in Figure 23 with total daily traffic volumes for the base and upgrade scenario summarised in Table 40.

A summary of peak hour 2011 and 2021 forecast traffic volumes is provided in Table 41 and Table 42 respectively, together with a level of service comparison of the 'Base 2021' against the 'M2 Upgrade Project 2021' for the screen lines previously identified.

The analysis indicates that the project is likely to reduce the traffic volumes on majority of the adjacent roads. However, traffic on the M7 Motorway east of Old Windsor Road, Abbot Road east of Old Windsor Road, Church Street south of Briens Road, Windsor Road north of the M2 Motorway and Renown Road east of Cook Street are likely to experience minor increases in demand (Table 43). However, general improvement can be seen in the LoS throughout the local network, including for the inbound direction. Improved LoS is identified at Windsor Road (4A) and several locations along Screen line 1 at Seven Hills Road, Powers Road and Station Road. Improved performance is also observed during the PM peak outbound along Screenline 2 on Castle Hill Road and James Ruse Drive.

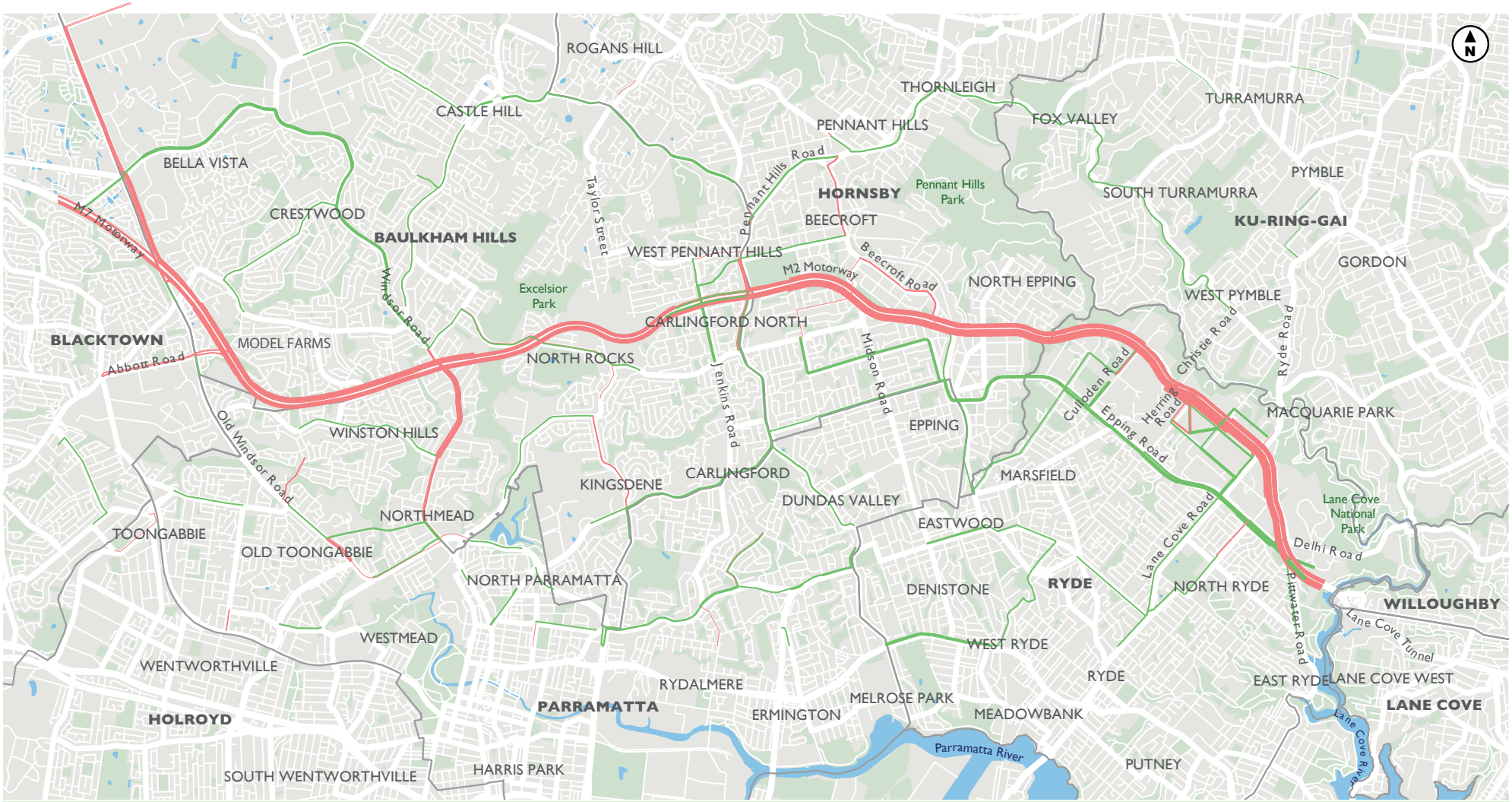
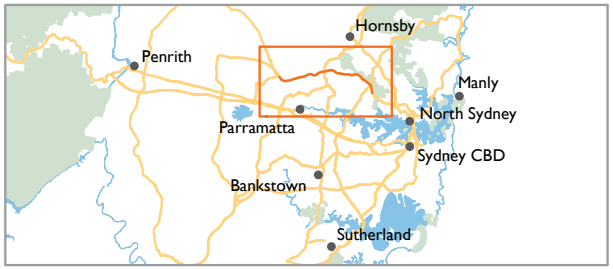


Figure 23 – Redistribution of traffic with M2 Upgrade

River / Waterway
Park / Open space
LGA boundary

DECREASE= -5000
DECREASE= -10000
INCREASE= 5000
INCREASE= 10000



Source: MapData, 2010

Table 40 Forecast local road traffic volumes (Daily)

SCL	Location	Type	Inbound (Citybound)				Outbound			
			2011 Base	2011 Upgrade	2021 Base	2021 Upgrade	2011 Base	2011 Upgrade	2021 Base	2021 Upgrade
1A	Norwest Boulevard East of Old Windsor Road	Arterial	14,400	14,000	16,500	16,000	16,750	16,450	20,150	19,800
1B	Seven Hills Road East of Merindah Road	Arterial	11,250	10,800	12,150	11,250	11,500	11,000	12,950	12,000
1D	Abbott Road East of Old Windsor Road	Major Arterial	11,050	11,700	14,350	15,200	12,000	13,050	14,000	17,350
1E	Old Windsor Road North of Gibbon Road	Major Arterial	33,400	31,600	41,800	39,450	31,800	31,300	39,150	38,550
1F	Powers Road East of Station Road	Sub-Arterial	6,400	6,300	7,200	7,100	5,300	5,200	5,750	5,650
1G	Station Road at Mc Coy Park	Sub-Arterial	11,750	11,500	12,200	11,800	12,100	11,850	12,700	12,400
2A	Castle Hill Road East of Old Northern Road	Major Arterial	23,800	23,250	28,950	28,350	24,900	24,700	30,250	29,650
2B	Renown Road East of Cook Street	Sub-Arterial	8,600	8,600	10,050	10,250	9,050	9,300	10,700	11,050
2D	James Ruse Road East of Windsor Road	Major Arterial	28,450	27,650	29,050	28,250	25,150	24,800	25,650	25,300
2E	Church Street South of Briens Road	Major Arterial	20,650	21,150	23,800	24,400	21,750	22,350	25,200	26,000
3A	The Comenarra Parkway East of Fox Valley Road	Sub-Arterial	7,750	7,700	8,050	7,700	6,650	6,450	6,700	6,500
3C	Epping Road West of Vimiera Road	Major Arterial	22,950	22,700	26,800	25,200	21,600	21,350	22,350	20,850
4A	Windsor Road North of M2	Major Arterial	29,050	32,450	32,100	35,950	29,350	32,700	31,750	35,950
4B	Oakes Road North of M2	Sub-Arterial	8,500	8,250	8,950	8,700	9,550	9,150	9,650	8,850
4C	Pennant Hills Road North of M2	Major Arterial	38,850	38,850	40,450	40,550	40,850	40,850	48,800	48,900
4D	Kirkham Street at M2	Collector	4,700	4,600	4,750	4,100	3,750	3,350	4,200	3,750
4E	Beecroft Road North of M2	Major Arterial	18,600	18,700	21,500	21,600	18,250	18,350	19,950	20,150
4F	Ryde Road South of Lady Game Drive	Major Arterial	46,900	46,500	52,150	51,700	46,050	45,650	55,750	55,300

Table 41 Forecast local road traffic volumes (2011)

SCL	Location	Type	Inbound (Citybound)				Outbound			
			AM Peak		PM Peak		AM Peak		PM Peak	
			2011 Base	2011 Upgrade	2011 Base	2011 Upgrade	2011 Base	2011 Upgrade	2011 Base	2011 Upgrade
1A	Norwest Boulevard east of Old Windsor Road	Arterial	1,250	1,200	1,150	1,100	1,000	1,000	2,050	2,000
1B	Seven Hills Road East of Merindah Road	Arterial	1,300	1,200	950	950	1,100	1,050	1,300	1,250
1D	Abbott Road East of Old Windsor Road	Major Arterial	1,000	1,050	950	1,000	850	900	1,300	1,350
1E	Old Windsor Road North of Gibbon Road	Major Arterial	3,200	3,050	2,450	2,300	2,000	1,900	2,800	2,550
1F	Powers Road East of Station Road	Sub-Arterial	750	700	500	500	400	400	600	550
1G	Station Road at Mc Coy Park	Sub-Arterial	1,050	1,000	1,050	1,050	1,050	1,000	950	950
2A	Castle Hill Road East of Old Northern Road	Major Arterial	1,950	1,800	2,000	2,000	1,950	1,950	2,350	2,350
2B	Renown Road East of Cook Street	Sub-Arterial	1,250	1,300	550	550	650	650	1,250	1,300
2D	James Ruse Road East of Windsor Road	Major Arterial	3,550	3,450	1,800	1,750	1,550	1,550	2,300	2,250
2E	Church Street South of Briens Road	Major Arterial	2,400	2,400	1,150	1,200	950	1,050	2,150	2,250
3A	The Comenarra Parkway East of Fox Valley Road	Sub-Arterial	550	550	950	950	950	950	550	550
3C	Epping Road West of Vimiera Road	Major Arterial	2,800	2,750	1,100	1,100	950	950	2,050	2,050
4A	Windsor Road North of M2	Major Arterial	3,000	3,350	1,800	2,000	1,550	1,750	2,550	2,750
4B	Oakes Road North of M2	Sub-Arterial	1,300	1,300	700	650	800	750	1,350	1,350
4C	Pennant Hills Road North of M2	Major Arterial	3,600	3,300	2,400	2,300	2,300	2,100	3,450	3,300
4D	Kirkham Street at M2	Collector	1,150	1,150	400	400	400	300	550	250
4E	Beecroft Road North of M2	Major Arterial	2,200	2,150	1,050	1,000	900	900	1,700	1,650
4F	Ryde Road South of Lady Game Drive	Major Arterial	4,100	4,100	3,950	3,900	3,300	3,300	4,000	3,950

Table 42 Forecast local road traffic volumes (2021)

SCL	Location	Type	Inbound (Citybound)				Outbound			
			AM Peak		PM Peak		AM Peak		PM Peak	
			2021 Base	2021 Upgrade	2021 Base	2021 Upgrade	2021 Base	2021 Upgrade	2021 Base	2021 Upgrade
1A	Norwest Boulevard East of Old Windsor Road	Arterial	1,400	1,350	1,350	1,300	1,350	1,350	2,400	2,350
1B	Seven Hills Road East of Merindah Road	Arterial	1,350	1,250	1,000	900	1,450	1,400	1,550	1,400
1D	Abbott Road East of Old Windsor Road	Major Arterial	1,400	1,450	1,400	1,500	1,200	1,300	1,550	1,600
1E	Old Windsor Road North of Gibbon Road	Major Arterial	3,850	3,650	2,800	2,600	2,100	2,000	3,250	3,000
1F	Powers Road East of Station Road	Sub-Arterial	850	750	550	550	450	450	650	550
1G	Station Road at Mc Coy Park	Sub-Arterial	1,100	1,050	1,100	1,050	1,100	1,050	1,000	1,000
2A	Castle Hill Road East of Old Northern Road	Major Arterial	2,200	1,950	2,400	2,350	2,000	1,850	2,900	2,900
2B	Renown Road East of Cook Street	Sub-Arterial	1,400	1,400	650	650	800	800	1,400	1,500
2D	James Ruse Road East of Windsor Road	Major Arterial	3,600	3,400	1,850	1,800	1,600	1,600	2,350	2,300
2E	Church Street South of Briens Road	Major Arterial	2,700	2,750	1,300	1,350	1,050	1,150	2,400	2,500
3A	The Comenarra Parkway East of Fox Valley Road	Sub-Arterial	650	600	950	900	1,050	950	700	650
3C	Epping Road West of Vimiera Road	Major Arterial	3,450	3,400	1,200	1,200	1,150	1,150	2,250	2,250
4A	Windsor Road North of M2	Major Arterial	3,450	3,850	2,050	2,300	1,550	1,850	2,600	2,800
4B	Oakes Road North of M2	Sub-Arterial	1,550	1,550	750	700	850	800	1,400	1,250
4C	Pennant Hills Road North of M2	Major Arterial	3,650	3,350	2,450	2,250	2,650	2,450	3,950	3,600
4D	Kirkham Street at M2	Collector	1,400	1,350	400	300	450	350	600	300
4E	Beecroft Road North of M2	Major Arterial	2,400	2,341	1,200	1,150	1,000	967	1,900	1,800
4F	Ryde Road South of Lady Game Drive	Major Arterial	4,300	4,290	4,300	4,250	3,600	3,592	4,700	4,650

Table 43 Forecast local road impact comparison

SCL	Location	Type	Inbound (Citybound)					Outbound				
			Hourly Capacity	AM Peak		PM Peak		Hourly Capacity	AM Peak		PM Peak	
				2021 Base LoS	2021 Upgrade LoS	2021 Base LoS	2021 Upgrade LoS		2021 Base LoS	2021 Upgrade LoS	2021 Base LoS	2021 Upgrade LoS
1A	Norwest Boulevard East of Old Windsor Road	Arterial	3,300	F	F	E	D	3,300	B	B	F	F
1B	Seven Hills Road East of Merindah Road	Arterial	1,650	E	B	C	B	1,650	F	F	F	F
1D	Abbott Road East of Old Windsor Road	Major Arterial	3,600	B	C	A	C	3,600	B	C	B	C
1E	Old Windsor Road North of Gibbon Road	Major Arterial	3,600	F	F	F	F	3,600	F	E	F	F
1F	Powers Road East of Station Road	Sub-Arterial	3,000	F	D	C	C	3,000	C	C	D	B
1G	Station Road at Mc Coy Park	Sub-Arterial	1,500	E	D	C	B	1,500	E	D	C	C
2A	Castle Hill Road East of Old Northern Road	Major Arterial	3,600	F	F	F	F	3,600	D	B	F	B
2B	Renown Road East of Cook Street	Sub-Arterial	3,000	F	F	A	A	3,000	F	F	F	F
2D	James Ruse Road East of Windsor Road	Major Arterial	5,400	F	F	C	B	3,600	F	F	E	C
2E	Church Street South of Briens Road	Major Arterial	5,400	F	F	F	F	5,400	F	F	F	F
3A	The Comenarra Parkway East of Fox Valley Road	Sub-Arterial	1,500	F	F	C	B	1,500	F	E	F	F
3C	Epping Road West of Vimiera Road	Major Arterial	3,600	F	F	F	F	3,600	F	F	F	F
4A	Windsor Road North of M2	Major Arterial	3,600	*F*	*D*	E	C	3,600	A	C	A	C
4B	Oakes Road North of M2	Sub-Arterial	1,500	F	F	F	E	1,500	E	C	D	B
4C	Pennant Hills Road North of M2	Major Arterial	5,400	F	F	E	B	5,400	F	E	F	F
4D	Kirkham Street at M2	Collector	1,000	F	F	A	A	1,000	A	A	A	A
4E	Beecroft Road North of M2	Major Arterial	3,600	F	F	B	B	3,600	B	B	F	F
4F	Ryde Road South of Lady Game Drive	Major Arterial	5,400	F	F	F	F	5,400	F	F	F	F

Intersection performance

As part of the M2 Upgrade project, the following modifications are proposed to mitigate the effects of additional traffic using the intersections of Windsor Road/M2 Motorway, Christie Road/M2 Motorway, Christie Road/Talavera Road and Herring Road/Talavera Road:

- Talavera Road Intersections
  - University Roundabout to Christie Road – (eastbound) increase from one to two lanes (starting just after roundabout), plus longer left turn lane, (westbound) increase from one to two lanes (merging just prior to roundabout). Parking to be removed in both directions.
  - Christie to Herring – (eastbound) same layout of two lanes and bus only right turn lane; (westbound) increase from two to three lanes westbound (one lane being a right turn lane to Christie Road).
  - Herring to Alma – (eastbound) same layout of two lanes plus one right turn lane; (westbound) increase from one to two through lanes, plus one additional right turn lane to M2 Motorway (from one to two lanes).
- Christie Road bridge
  - (Northbound) increase from one to two lanes, to accommodate a new right turn lane to the new ramp (with traffic control signals being provided); (southbound) increase from two to three lanes.
- Windsor Road Intersection
  - Oakland Ave to M2 Motorway – (southbound) existing layout of three lanes and left turn to M2 Motorway, plus two new right turn lanes to the new west-facing ramp; (northbound) same as existing layout of three lanes.
  - M2 Motorway to Woodlands Street – (southbound) same as existing layout of two lanes; (northbound) increase from two to three lanes for 175 metres to the south, plus one new left turn lane to the new west-facing ramp and one additional right turn lane to the M2 Motorway (increase from one to two lanes).

The additional ramps to and from the M2 Motorway, proposed as part of the M2 Upgrade project, would result in the redistribution of traffic as summarised above. The greatest impact arising from this would be on the intersection performance adjacent to the M2 Motorway access points.

Based on the above works, the intersection performance levels comparing with and without project works, for the intersections identified in Table 26 are summarised in Table 44.

Table 44 Forecast intersection performances

Intersection	2011 AM Base	2011 AM M2 Upgrade project	2011 PM Base	2011 PM M2 Upgrade project	2021 AM Base	2021 AM M2 Upgrade project	2021 PM Base	2021 PM M2 Upgrade project
Windsor Road – M2 Ramps	B	B	B	B	E	C	C	B
Pennant Hills Road – M2 Ramps	C	B	E	D	E	C	F	F
Christie Road – Talavera Road	F	C	A	A	F	F	A	A
Herring Road – Talavera Road	C	E	B	B	C	F	C	C
Lane Cove Road – M2 Ramps	A	A	A	A	D	D	A	A
Herring Road – Waterloo Road	D	D	C	C	F	F	D	E
Khartoum Road – Talavera Road	C	C	A	B	C	C	E	F
Lane Cove Road – Talavera Road	E	B	F	F	D	A	F	F
Lane Cove Road – Waterloo Road	F	D	E	D	F	F	F	E
Lane Cove Road – Epping Road	F	D	F	C	F	F	F	C
Windsor Road – Cook Road	F	F	D	D	F	F	F	F
Herring Road – Epping Road	E	E	D	D	F	F	E	E

The intersection performance levels summarised in Table 44 indicate that the performance of three intersections adjacent to the M2 Motorway access points; Herring Road – Talavera Road, Herring Road/Waterloo Road and Khartoum Road – Talavera Road, would decline with the M2 Upgrade project. These are indicated in bold in Table 44.

During the AM peak hour, delays at the intersection of Herring Road and Talavera Road are forecast to increase with the M2 Upgrade project works and result in the poorer LoS. However this intersection is located adjacent to the intersection of Christie Road and Talavera Road, and when the two intersections are examined together, there are material reductions in overall delay, as detailed in Technical Paper 1, during both 2011 and 2021.

Minor reductions in operation performance are forecast for the intersection of Khartoum Road and Talavera Road during the PM peak hours. However, potential improvements to the intersection performance may be permitted with modifications of the traffic signals.

Increased demand along the M2 Motorway is likely to result in traffic reduction along the competing parallel roads, this is evidenced by the improved intersection performances along the parallel corridor of Lane Cove Road.

Travel Time

Table 45 provides a summary of the theoretical travel times for the routes identified in Figure 21 for the scenarios representing without M2 Motorway upgrades (base) and with upgrades (M2 Upgrade project) for years 2011 and 2021.

Table 45 M2 Upgrade project travel time comparisons

Route	Direction	2011			2021		
		Base Travel Time (mins)	M2 Upgrade project Travel Time (mins)	Travel Time Difference (mins)	Base Travel Time (mins)	M2 Upgrade project Travel Time (mins)	Travel Time Difference (mins)
M2 Motorway	Westbound (PM Peak)	29	22	-7	36	30	-6
Alternative		48	45	-3	52	50	-2
M2 Motorway	Eastbound (AM Peak)	38	23	-15	50	31	-19
Alternative		59	52	-7	67	62	-5

Table 45 indicates that the project would result in travel time savings during both the AM and PM peak hours along both the M2 Motorway and the alternative route.

Additional entry and exit ramps at Windsor Road and Macquarie Park interchange would allow alternative faster travel routes via the M2 Motorway as indicated by the green lines in Figure 24, Figure 25 and Figure 26. It is forecast that the travel times between the west facing ramps at Windsor Road would reduce travel times between Old Windsor Road and Windsor Road by approximately four minutes during both AM and PM peak hours (Figure 24). Travel time benefits of the new east facing Herring Road off-ramp and Christie Road on-ramp is forecast to be three minutes in the AM peak northbound direction, and five minutes in the PM southbound direction, when compared to alternative routes (Figure 25and Figure 26).

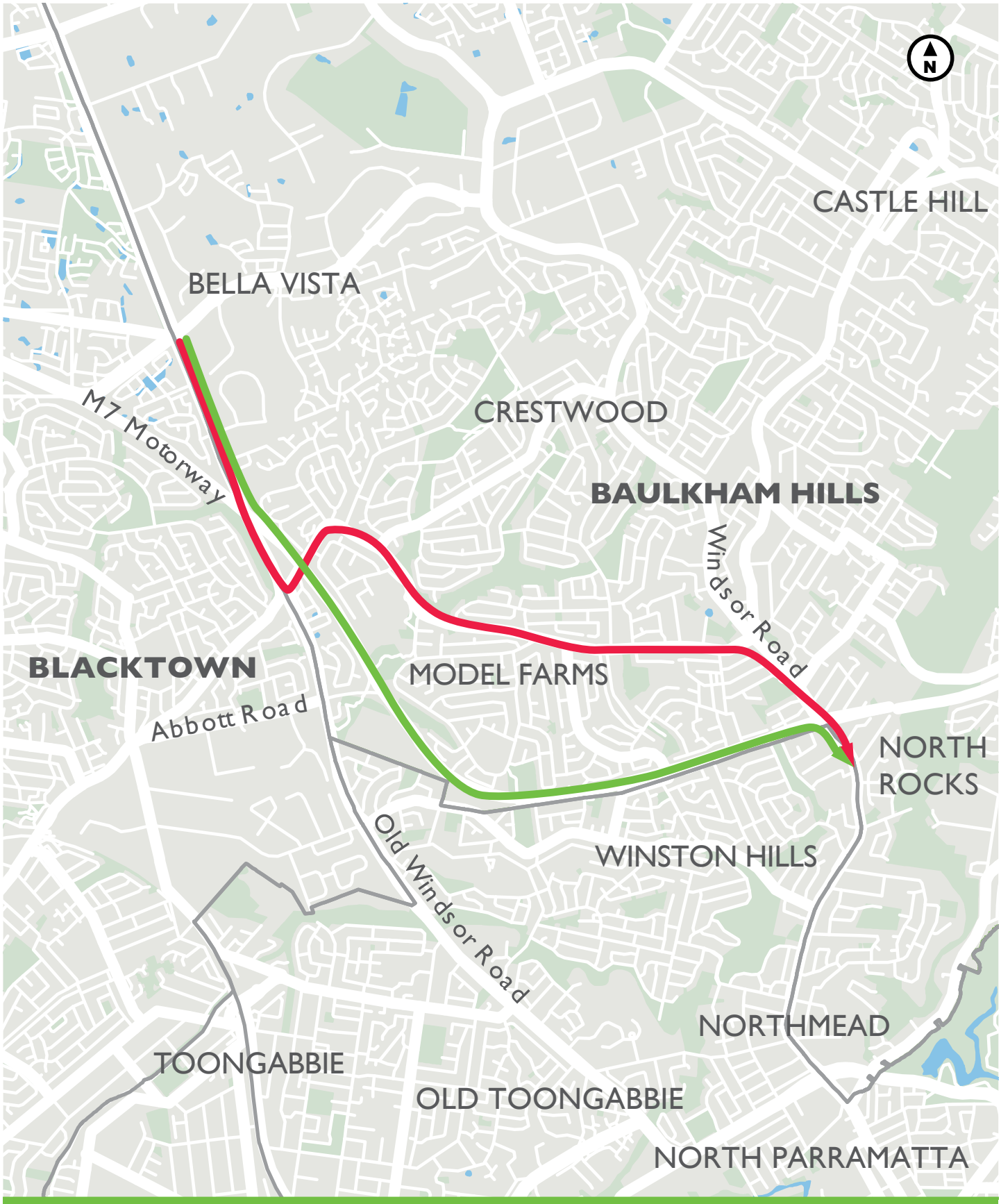


Figure 24 – Eastbound travel route – Norwest Boulevard and Windsor Road

Eastbound travel route

Eastbound travel route

River / Waterway

Park / Open space

LGA boundary

Source: Transurban, 2010

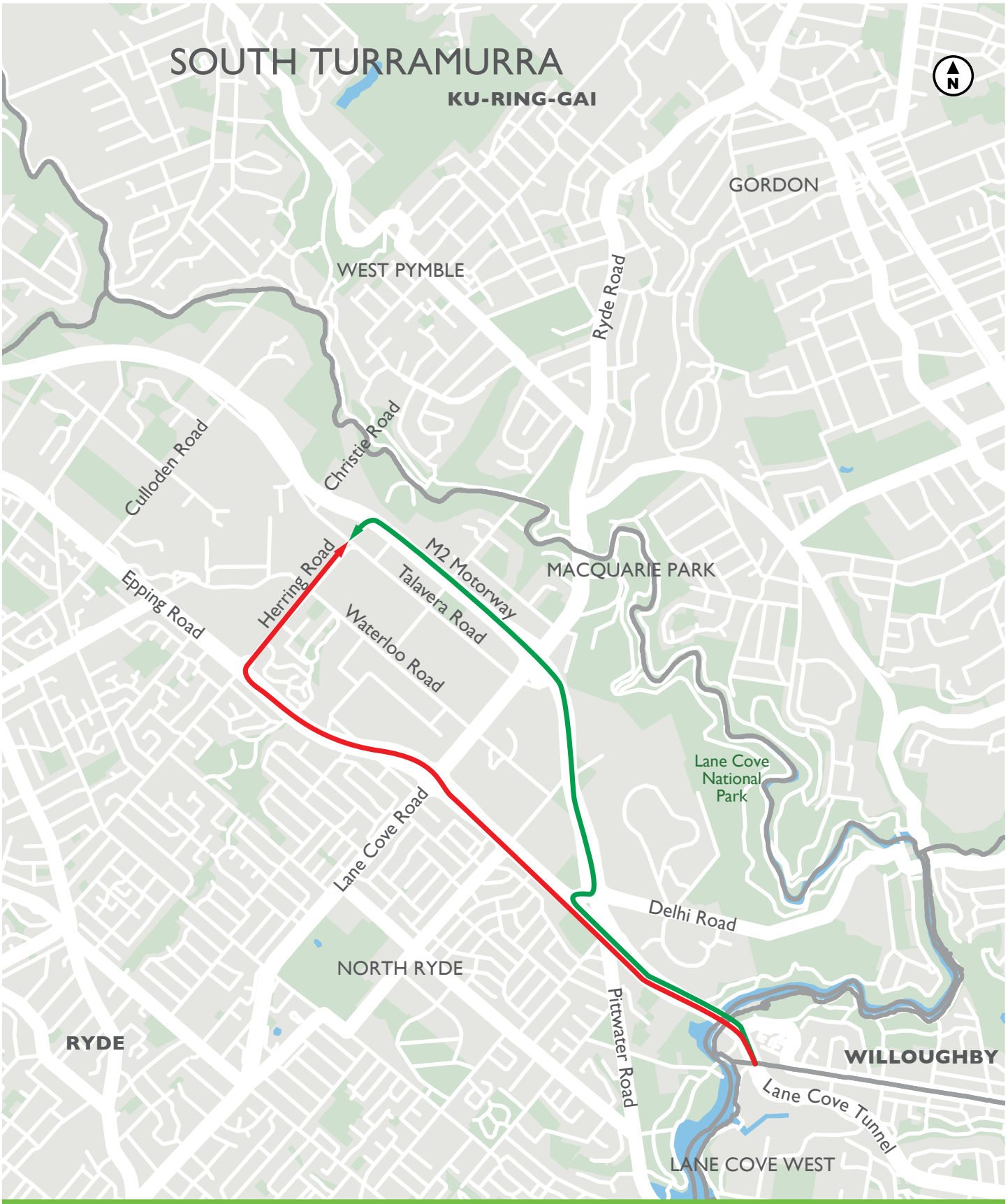


Figure 25 – Westbound travel route – Lane Cove and Macquarie Park

Westbound travel route

Westbound travel route

River / Waterway

Park / Open space

LGA boundary

Source: Transurban, 2010

Figure 26 – Eastbound travel route – Lane Cove and Macquarie Park

Eastbound travel route

Eastbound travel route

River / Waterway

Park / Open space

LGA boundary

Source: Transurban, 2010

New access

The additional ramps at Windsor Road (on- and off-ramps), Herring Road (off-ramp) and Christie Road (on-ramp) would improve accessibility to the M2 Motorway as well as the adjacent employment hubs. Table 46 summarises the forecast traffic volumes along the ramps during the peak hours.

Table 46 Forecast traffic volumes on Windsor Road and Herring/Christie Road ramps

Ramps	Direction	2011 AM Peak	2011 PM Peak	2011 Daily	2021 AM Peak	2021 PM Peak	2021 Daily
Windsor Road	Eastbound	420	230	3,800	450	250	4,120
Windsor Road	Westbound	230	420	3,800	250	450	4,120
Christie Road	Eastbound	150	300	2,320	200	350	2,680
Herring Road	Westbound	400	130	3,170	450	150	3,680

Traffic modelling of the additional ramps indicates that the majority of the trips would be local trips accessing the adjacent suburbs. Therefore, the additional ramps would reduce traffic on the nearby local road network.

Road safety

The M2 Upgrade project would alleviate congestion along the M2 Motorway and it is expected that congestion related accidents would reduce along the M2 Motorway. In particular, additional lanes along the M2 Motorway would improve merging opportunities for vehicles entering the M2 Motorway from existing on-ramps located at Windsor Road, Pennant Hills Road and Beecroft Road due to entering an added lane rather than merging into heavy traffic flows.

Sun glare issues during the AM peak hour for eastbound traffic mounts adjacent to the Norfolk Tunnel would remain. However, improved lighting within the tunnel, as part of the upgrade works, would improve visibility within the tunnel and would allow motorists to better adapt to lighting conditions whilst entering and leaving the tunnel.

Furthermore, reinstatement of road shoulders through the westbound Norfolk Tunnel would allow vehicles to use the breakdown lane and reduce the risk of secondary accidents.

Cycle facilities

The M2 Upgrade project would restore the road shoulder between Lane Cove Road and Beecroft Road, by removing the restriction for cyclists to detour between North Ryde and Epping, thus allowing cyclists to travel westbound on the M2 Motorway. Furthermore, the west facing Windsor Road and east facing Herring/Christie Road ramps would provide additional access points for cyclists.

Pedestrians

The additional on and off ramps proposed at the M2 Motorway interchanges would be signalised to control the competing vehicle movements. The signals would also cater for pedestrians by inclusion of pedestrian phases to provide safe crossing opportunities. In particular, pedestrian movements through the reconfigured Windsor Road and the Christie/Talavera Road interchanges would be the subject of detailed design.

Lane Cove Tunnel

The project is expected to increase traffic through this section in both directions and both peak periods. Of particular importance is the eastbound section during the AM peak, which already displays signs of congestion at the merge between Epping Road and the Lane cove Tunnel. The project is forecast to increase traffic through this section by up to 13 percent by 2021. However, despite this increase in peak hour volume, the merge performance of this section would remain satisfactory. This is due to reduced traffic volume on Epping Road improving the operation of this merge, and confirms the objective of the project to encourage longer distance travel along the M2 Motorway network (refer to Technical Paper 1).

M7 Motorway

During the AM peak there is currently congestion and poor travel speeds eastbound at the M7/M2 Motorway interface which is caused by a lack of downstream capacity on the M2 Motorway at Windsor Road and points further east. The additional eastbound lane between Windsor Road and Terrys Creek is predicted to resolve this issue by providing additional capacity and remove the merging conflict at Windsor and Pennant Hills Roads.

On opening of the M7 Motorway, there was a large uplift in traffic in the western section of the M2 Motorway. This demonstrated that the M7 Motorway route, the M2 Motorway to the off-ramp at Pennant Hills Road was attractive against the alternative 'cross-city' route of Cumberland Highway and Pennant Hills Road with no use of M2 Motorway. The widening of eastbound section of the M2 Motorway from Windsor Road to Pennant Hills Road would again improve the M7 Motorway / M2 Motorway LoS and further entice transfer of traffic off the non-motorway route, providing an uplift to M7 Motorway volumes.

The new west-facing ramps at Windsor Road provide new opportunity and accessibility between M2 Motorway and M7 Motorway and vice versa. Traffic at the new Windsor Road ramps, over and above that diverting from Pennant Hills Plaza, would be new traffic to the M2 for its short section and would be coming from either the M7 Motorway (estimated to 80 percent) or Abbott Road (estimated to be 20 percent). However not all of the new trips between M7 Motorway and new Windsor Road ramps would be new as some exit/entry points would be further away (for example, Sunnyholt Road, Norwest Boulevard).

9.1.3 Mitigation measures

Public transport

With the installation of additional ramps at the M2 Motorway, opportunities exist to re-route the bus services affected by the removal of the Beecroft Road bus ramp. These services, 611 and 740 may potentially be re-routed via the Christie Road and Herring Road ramps, for access between the M2 Motorway and the Macquarie University and Macquarie Shopping Centre, rather than Epping Station. Furthermore, a Transport Working Group has been established to allow stakeholders such as NSW Transport and Infrastructure, Hillsbus and Busways to work together at a greater level of detail in examining the M2 Upgrade project and construction issues.

With the ongoing development of the Macquarie Business Park, Hillsbus are also considering extending Route 611 into Macquarie Business Park. The potential re-routing and extended service is likely to be more attractive for workers in the area than the existing arrangement. Bus passengers accessing Epping Station would be required to utilise the Epping-Chatswood rail services to connect to the re-routed bus routes of 611and 740. Section 9.1.2 also discussed alternate public transport arrangements for those accessing Epping Station.

Cyclists

There would be beneficial impacts associated with restoring the westbound breakdown lanes between Lane Cove Road and Beecroft Road thereby reinstating the original cycle facility along the M2 Motorway.

Pedestrians

The additional on and off ramps proposed at the M2 Motorway would be signalised to control the competing vehicle movements. The signals would also cater for pedestrians by inclusion of pedestrian phases to provide safe crossing opportunities for the pedestrians. In particular, pedestrian movements through the reconfigured Windsor Road and the Christie/Talavera Road interchanges would be the subject of detailed design.