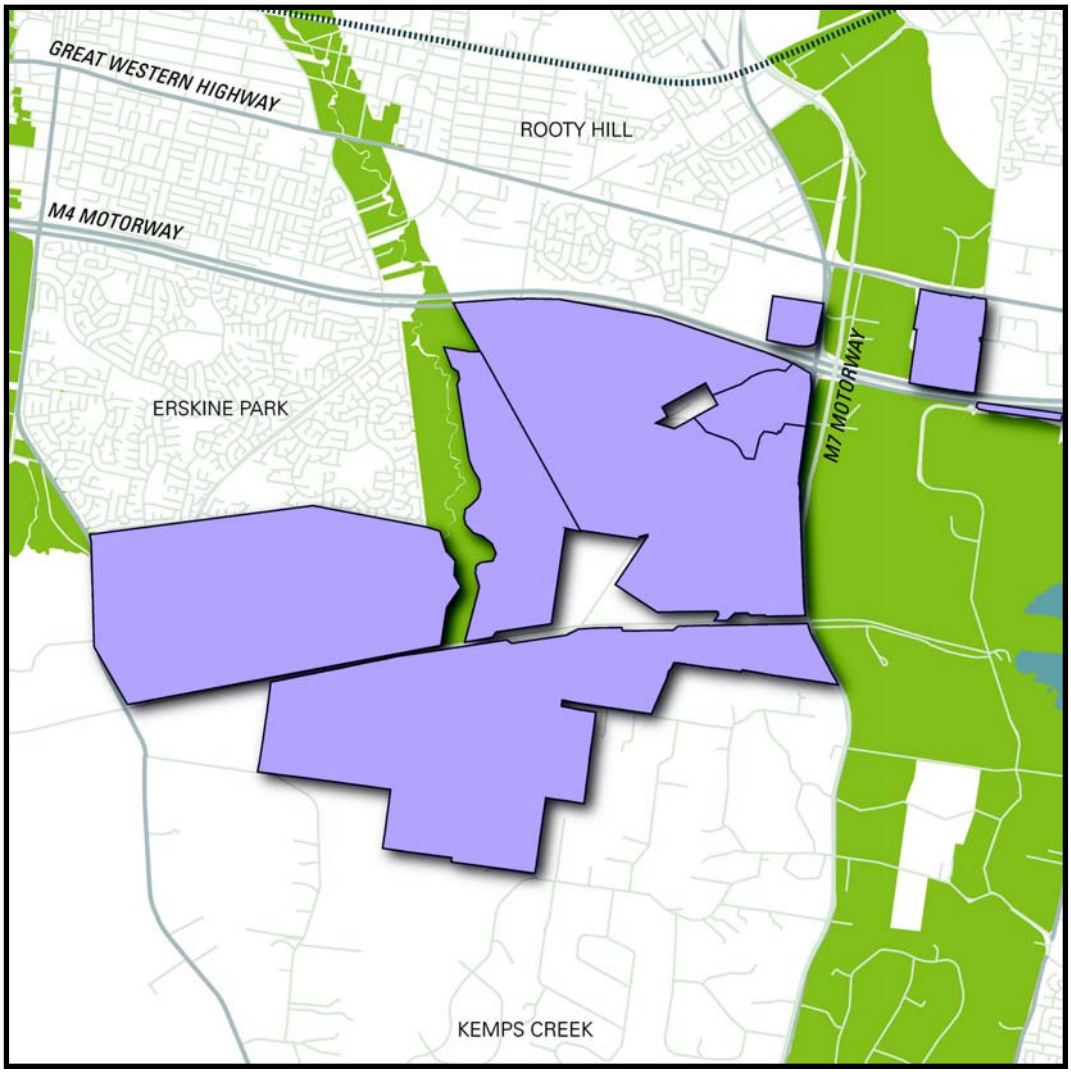
Western Sydney Employment Hub
Proposed Erskine Park Link Road Network

Working Paper No 2
Traffic Study

May 2007



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Western Sydney Employment Hub - Proposed Erskine Park Link Road Network Traffic Study

RTA

Prepared for

Roads and Traffic Authority

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Executive Summary

Maunsell have been commissioned by the Roads and Traffic Authority (RTA) to prepare a comprehensive traffic model report to analyse the proposed Erskine Park Link Road (EPLR) network for the Western Sydney Employment Hub (the Hub). Specifically Maunsell have been requested to review the RTA strategic EMME/2 traffic modelling, including model refinement in the study area and to assess the appropriateness of the model for assessing the impacts of the development. Maunsell also reviewed various stakeholder modelling reports and prepared a summary of the key assumptions, modelling techniques and conclusions.

On 5 December 2005, the Government released the Sydney Metropolitan Strategy. This strategy includes the creation of the Western Sydney Employment Hub (the Hub) **(Figure 1.1)**. The Hub includes ten precincts between Erskine Park & Greystanes. The four north-west precincts comprises the land between M7, Mamre Road/Erskine Park Road, M4 and Sydney water pipeline, hereafter known as North West Precincts (NWP). One precinct south of the Sydney water pipeline is identified for future land release, hereafter known as South West Precincts (SWP). **Figure 1.2** displays the location of the NWP and SWP.

In order to define the road network required within the NWP, strategic traffic modelling was undertaken by the RTA to identify the traffic demand for the NWP and the traffic that would access SWP through NWP. Several options were tested to identify a preferred network.

The RTA 2004/05 base year and 2006 M7 response models were assessed to examine the modelling methodology and the ability of the model to replicate existing traffic conditions in the vicinity of the Hub. Overall, Maunsell consider the RTA strategic model as a suitable and robust basis for assessing the traffic impacts of the Hub development.

The proposed road network would be used to seek concept plan approval from the Department of Planning under Part 3A of the EP&A Act. Subsequent to the concept plan approval, further analysis would be undertaken during project approval stage to refine the road network requirements.

The future year 2016 modelling was reviewed, with a particular focus on the local area assumptions including details of land use, trip generation, trip distribution and road network improvements.

The detailed assumptions with regards to the proposed land use developments are based on information provided by and discussions with, Blacktown City Council, Penrith City Council, Fairfield Council and the Department of Planning. In summary, with the additional roads in SWP, the EPLR Network will service a total developed area of 1,285 hectares by 2016; with the potential to provide employment for approximately 30,000 people and connects with the SWP.

The RTA adopted an average trip generation rate of 15 trips/hectare/hour, per assumed developed hectare of industrial land and 22.5 trips/hectare/2hours. These rates were applied to both the morning and evening peak periods for the Hub. The rates were derived by the RTA based on data from a number of sources, including a Transport Management and Accessibility Plan (TMAP) prepared by Sinclair Knight Merz for the Huntingwood precinct and several Development Applications (DA) submitted for employment areas in Erskine Park and other locations in the Penrith Local Government Area (LGA).

The split of the total generated trips is approximately 19% productions and 81% attractions (in the morning peak) based on trip generation data from the nearby industrial areas of Minchinbury, Huntingwood and Wetherill Park. This split, which reflects the commuter nature of travel during the peak periods, is considered appropriate

Assumptions regarding the trip distribution of generated traffic to/from the development areas are based on existing model proportions for the local industrial zones of Wetherill Park, Huntingwood and Minchinbury. The RTA assumed an identical distribution for all sites within the development area. Maunsell assessed the appropriateness of the trip distribution assumptions using data from the 2001 Journey to Work (JTW). The proportions adopted by the RTA are reasonably similar to the average distributions in the three adjacent industrial zones, which suggest that overall it is an appropriate trip distribution for the Hub.

In order to define the road network within the NWP of the Hub, the RTA developed a preferred network from the assessment of alternative internal and external road link options for a fully developed NWP and SWP development.

Stakeholders' input was considered by the RTA in developing the required road network and integrated where appropriate.

It was concluded that of the options evaluated, a road network similar to Option B1 or B8 is likely to provide the optimal traffic outcome, based on the multiple external connections that will facilitate an even distribution of trips across the main internal access links to the NWP and SWP developments.

The RTA preferred Option B1 and B8 includes the following road network features:

- A northern east-west route ('Erskine Park Link Road' as an extension of Lenore Lane) linking Erskine Park Road to the Old Wallgrove Road interchange with Wallgrove Road and the M7;
- A southern east-west route ('southern route' commencing south of Bakers Lane to the west) linking Mamre Road with Wallgrove Road and M7;
- Eastern and western north-south connections (Old Wallgrove Road and "N-S Link" respectively) linking both the north and south east-west link roads;
- A northern access road to Archbold Road connecting the area to the M4 (at a new interchange with east facing ramps only) and the Great Western Highway; and
- The road links would encompass a 40 metre wide corridor to construct 4 lane divided carriageways. The corridor would be wider at the intersections.

Based on the road networks (Option B1 or B8) that are required for both NWP and SWP, the road network Option C for NWP was defined and which forms a part of the RTA's preferred options (i.e Option B1 or B8). The network required for NWP (Option C) is referred to as the EPLR network and includes the following road network features:

- A northern east-west route ('Erskine Park Link Road' as an extension of Lenore Lane) linking Erskine Park Road to the Old Wallgrove Road interchange with Wallgrove Road and the M7;
- Eastern and western north-south connections (Old Wallgrove Road and "N-S Link" respectively) linking the northern east-west route to the SWP and a future southern road network;
- A northern access road to Archbold Road connecting the area to the M4 (at a new interchange; east facing ramps only) and the Great Western Highway; and
- The road links would encompass a 40 metre wide corridor to construct 4 lane divided carriageways. The corridor would be wider at the intersections.

There will be additional internal access roads that would be required to suit the development needs of the area.

As a result, Option C is defined as Erskine Park Link Road (EPLR) network that will be required to service the NWP of the Hub, with connections to SWP, which is designed to accommodate additional traffic that will eventually be generated from the SWP in conjunction with the remainder of the road network that would be required for the release of the land in the SWP (i.e completion of Option B1 or B8). Therefore Option C has been selected for the Concept Plan approval.

Analysis of the fully developed NWP and SWP modelling results was undertaken by comparing forecast traffic volumes with (based on the Option B1 & B8) and without the proposed NWP & SWP development. The difference highlights that the proposed development will significantly increase traffic flows on the surrounding road network for both the AM and PM peak 2 hour periods. Traffic flows on the M7 would increase by approximately 65~70% southbound in the AM peak and 60~62% northbound in the PM peak; which equates to approximately 1,500 vehicles per hour in both peaks.

Furthermore, a substantial increase in AM and PM peak traffic volumes are forecast on local links, including Wallgrove, Mamre and Erskine Park Roads. During the AM peak, additional traffic volumes will range from 38~49% (700 veh/2h) northbound on Wallgrove Road to 366~380% (2,400 veh/2h) southbound on Erskine Park Road. Similar increases are forecast in the PM peak, ranging from 48% (1,250 veh/2hr) northbound on Wallgrove Road to 330~351% (2,200 veh/2h) northbound on Erskine Park Road.

A summary of the NWP modelling results was also undertaken by comparing forecast traffic volumes with (Option C) and without the proposed NWP and SWP development. The difference highlights that the proposed NWP development will increase traffic flows on the surrounding road network for both the AM and PM peak 2 hour periods. Traffic flows on the M7 would increase by approximately 24% southbound in the AM peak and 47% northbound in the PM peak; which equates to approximately 500 and 900 vehicles per hour respectively.

Furthermore, an increase in AM and PM peak traffic volumes are forecast on local links, including Wallgrove, Mamre and Erskine Park Roads. During the AM peak, increase in traffic volumes will range from an average of 25% (550 veh/2h) in both directions on Wallgrove Road to 247% (1,550 veh/2h) southbound on Erskine Park Road. Similar increases are forecast in the PM peak, ranging from 20% (400 veh/2hr) northbound on Wallgrove Road to 243% (1,500 veh/2h) northbound on Erskine Park Road.

Based on the modelling analysis, a list of external roads that require upgrading to accommodate the traffic demand generated from NWP and SWP of the Hub development, has been identified.

A detailed intersection assessment of the road network's ability to cope with the resultant increase in traffic as a result of the NWP development will form the focus of the subsequent approval stage. During project approval stage microsimulation modelling could be undertaken to determine intersection requirements of the EPRL Network.

1.0 Introduction

1.1 Background

1.1.1 Previous Announcements

In May 2004, the then Premier of New South Wales, announced that land would be rezoned under the provisions of State Environmental Planning Policy number 59 (SEPP 59) to enable a road to be built that would link the existing Erskine Park Employment Area (EPEA) and the Westlink M7. A preferred option by Penrith City Council envisaged that the proposed road would be a higher order route linking the EPEA in the Penrith Local Government Area (LGA) at its western end, through the SEPP 59 employment lands in Blacktown LGA at its eastern end, to Wallgrove Road and the Westlink M7 Motorway via Old Wallgrove Road - a distance of approximately 7 kilometres.

On 5 December 2005, the Government released the Sydney Metropolitan Strategy. This strategy includes the creation of the Western Sydney Employment Hub (the Hub) **(Figure 1.1)**. The Hub includes ten precincts between Erskine Park & Greystanes. The four north-west precincts comprises the land between M7, Mamre Road/Erskine Park Road, M4 and Sydney water pipeline, hereafter known as North West Precincts (NWP). One precinct south of the Sydney water pipeline is identified for future land release, hereafter known as South West Precincts (SWP). **Figure 1.2** displays the location of the NWP and SWP.

1.1.2 Previous Proposals

In the past, various stakeholders have undertaken traffic studies, including strategic modelling and the development of road network proposals to serve various development scenarios in the vicinity of the EPEA and Eastern Creek SEPP59 Lands. Maunsell has reviewed various stakeholder traffic reports and an overview of each is included in **Section 5** of this report.

1.1.3 RTA's Involvement

Since 2004, the Roads and Traffic Authority (RTA) has provided advice to the Department of Planning (DoP) with respect to traffic impacts resulting from developing land in the vicinity of the Hub. Following the establishment of the Hub as part of the Sydney Metropolitan Strategy, the RTA became the proponent for the Concept Plan for a network of roads that would service the development of the NWP and connects with SWP.

The road network proposal was gazetted as a Major Project under Part 3A of the EP&A Act on 9 June 2006, known as the Erskine Park Link Road (EPLR) network in the Western Sydney Employment Hub to provide access to the NWP and connects with SWP.

The RTA as the proponent for the proposed EPLR network has analysed the previous proposals and developed a concept plan to address the traffic requirements for the NWP.

1.1.4 RTA's Road Network Option

After considering various road proposals, in March 2006, the RTA engaged Maunsell to undertake constraints mapping and to develop a road network within the NWP. The proposed road network would then be used to seek concept plan approval from the Department of Planning under Part 3A of the EP&A Act. Subsequent to the Concept Plan approval, further analysis would be undertaken during the project approval stage to refine the road network requirements. A separate Concept Plan and Environmental Assessment would be undertaken for the SWP.

In the development of the EPLR network for the NWP, the RTA has taken into consideration the future land development and the road network required for the SWP. The EPLR has been design to meet the demand of NWP and the additional traffic expected from the SWP.

Figure 1.2 displays the preferred RTA road network for the NWP, identified as Option C. The option features the following routes:

Proposed Road Network for the NWP:

- An east-west route ('Erskine Park Link Road' as an extension of Lenore Lane) linking Erskine Park Road to the Old Wallgrove Road interchange with Wallgrove Road and the M7;
- Eastern and western north-south link roads (Old Wallgrove Road and "N-S link respectively) connecting the Erskine Park Link Road to a future SWP road network; and
- A northern access road to Archbold Road connecting the area to the M4 (at a new interchange; east facing ramps only) and the Great Western Highway.

The road links would encompass a 40 metre wide corridor to construct 4 lane divided carriageways. The corridor would be wider at the intersections and additional internal access roads that would be required to suit the development needs of the area.

The RTA has also evaluated various network options with alternative internal and external road links for both NWP and SWP, which is designed to accommodate additional traffic generated from the area south of the Sydney water supply pipeline. The additional road network required to service the SWP would includes:

- A southern east-west route ('Southern Route' commencing south of Bakers Lane to the west) linking Mamre Road with Wallgrove Road and M7; and
- Eastern and western north-south connections (Old Wallgrove Road and "N-S Link" respectively) linking both the north and south east-west link roads from NWP.

1.2 Scope of the Report

Maunsell have been commissioned by the RTA to prepare a comprehensive traffic model report to analyse the proposed EPLR network associated with the NWP of the Hub. Specifically Maunsell have been requested to review the RTA strategic EMME/2 traffic modelling, including model refinement in the study area and to assess the appropriateness of the model for assessing the impacts of the developments.

The main objectives of the review are as follows:

- Review strategic traffic modelling prepared by the RTA;
- Review traffic analysis reports and stakeholders reports; and
- Prepare a comprehensive traffic report on findings for the Concept Plan.

1.3 Report Overview

The strategic model review is documented in the following five sections:

- **Section 2** provides details of the background to the strategic modelling, including an overview of the TPDC model and how this was developed to create the RTA base year network.
- **Section 3** reviews the assumptions, methodology, and results of the future year modelling, undertaken by the RTA to assess the impacts of the development.
- **Section 4** reports the results of the various modelling scenarios.
- **Section 5** reviews the stakeholder reports and summarises the adopted assumptions and methodology.
- **Section 6** provides a summary of the key findings and conclusions of the report.

Figure 1.1: Western Sydney Employment Hub – Development Precincts

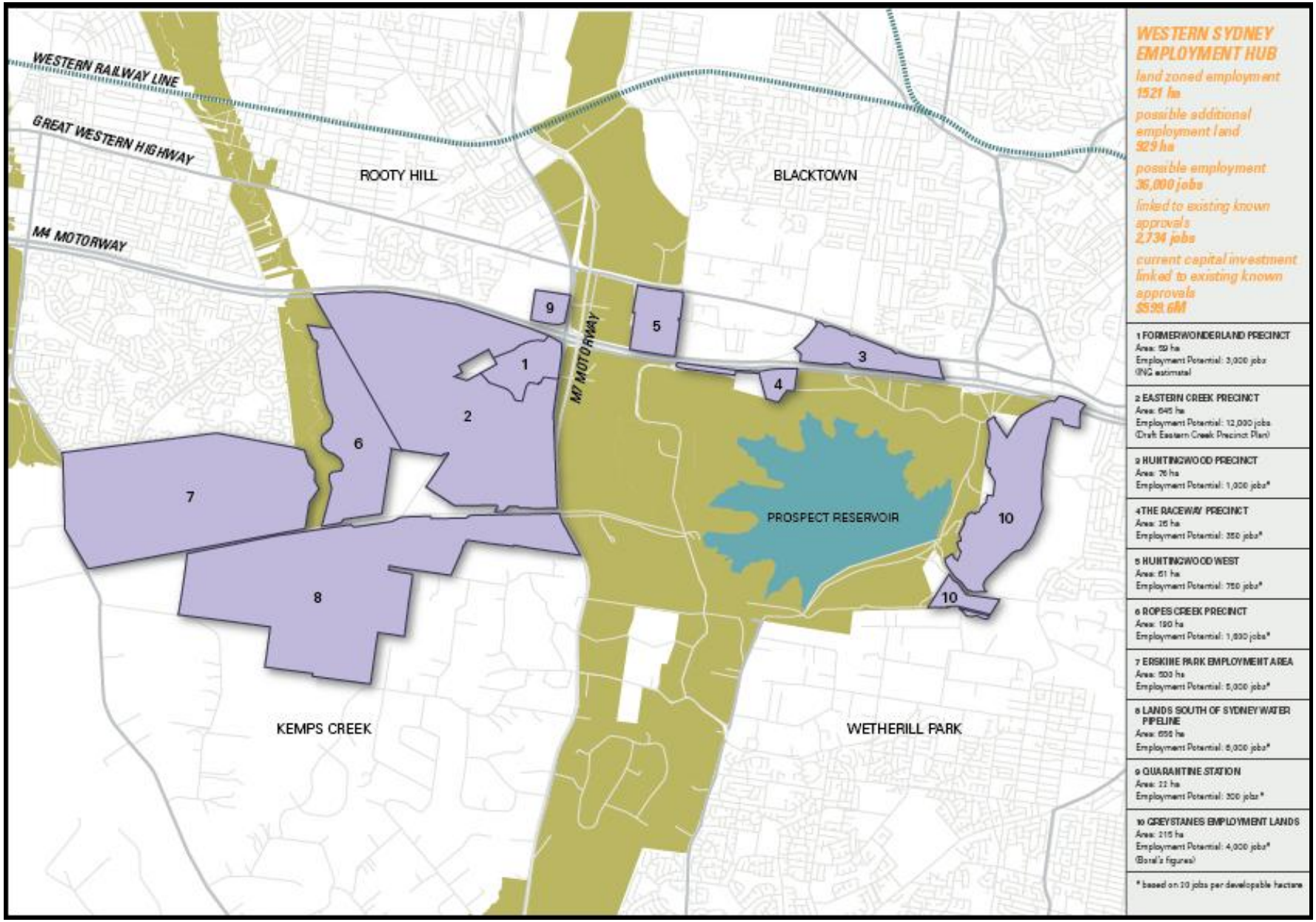
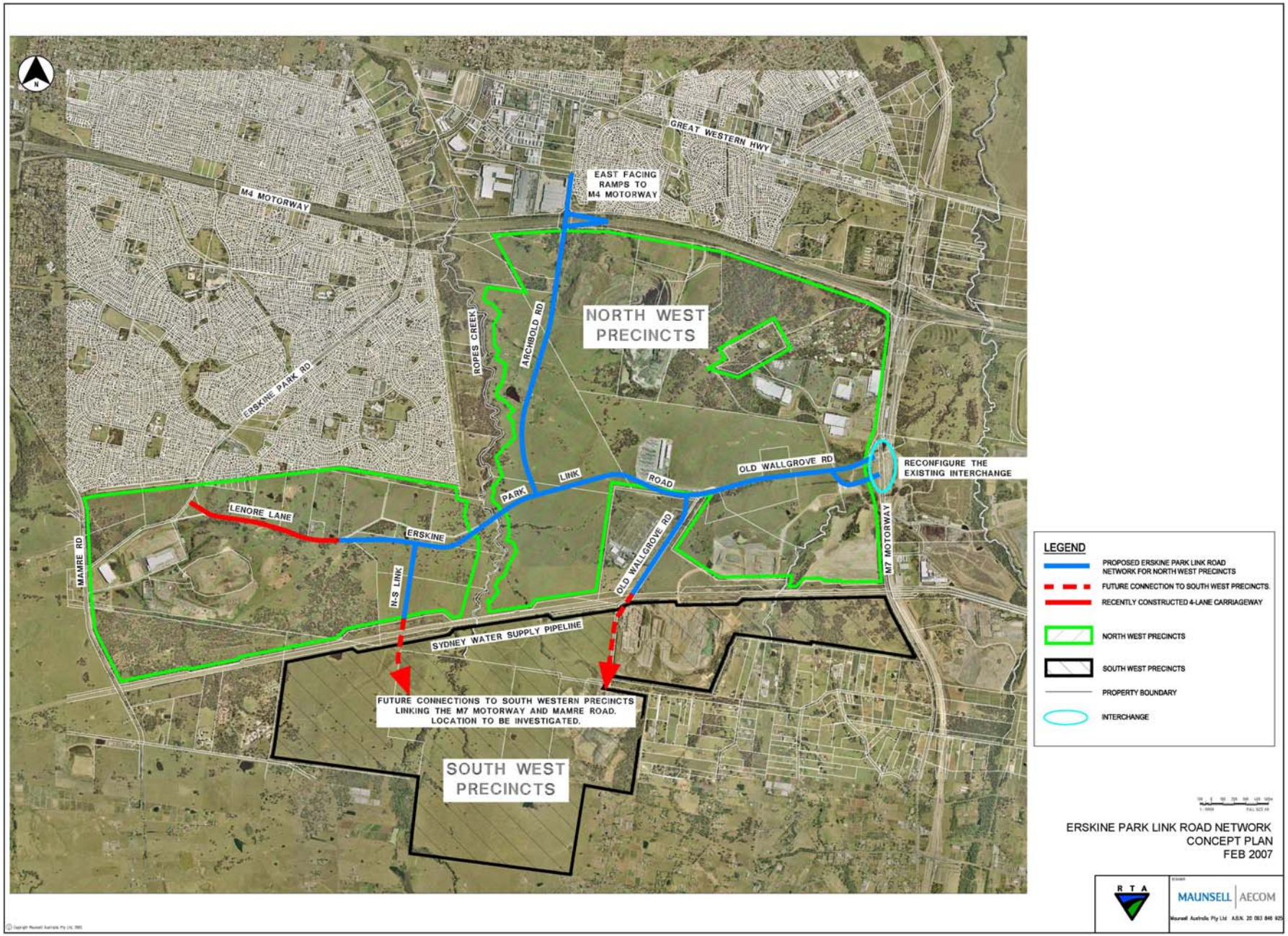


Figure 1.2: Western Sydney Employment Hub - Proposed Erskine Park Link Road Network (Option C)



2.0 Strategic Modelling

2.1 TPDC Strategic Model

The RTA strategic model has its origin in the Transport and Population Data Centre's (TPDC) Sydney Strategic Travel Model (STM). The STM model (from which the RTA strategic model is developed) is based on Version 2000 v1 (October 2000) land use forecasts.

The model encompasses approximately 900 origin and destination zones that describe travel demand across the network based on data derived from the Australian Bureau of Statistics (ABS) census Journey to Work (JTW) and TPDC Household Travel Surveys (HTS). The model is implemented in the EMME/2 transport planning platform.

The TPDC STM is effectively a standard four-stage transport model (i.e. trip generation, trip distribution, mode choice and assignment). The STM model estimates demand (Origin/Destination trip tables) based on approved Department of Planning (DoP) land use forecasts; specifically population, employment, housing, major trip generating developments and car ownership levels. The TPDC model highway network is based on assumptions provided by the RTA and is progressively updated to include future highway schemes.

TPDC presently undertake a limited adjustment and validation process of the STM model and typically provide model data to third-party users (e.g. the RTA or consultants) for further development and detailed calibration for use on detailed highway studies.

2.2 RTA Strategic Model

2.2.1 Model Overview

The RTA strategic model is a link-based model reflecting all-vehicle traffic demand for the average AM and PM peak 2 hours for a typical weekday. The original base year for model calibration is 2002 and has been updated to reflect traffic conditions on the Sydney road network in 2004/2005. The RTA has included an additional model year of 2006 to assess the model response to the opening of the M7 motorway.

Future year models are developed from the calibrated base year model to incorporate assumptions regarding future year highway schemes and future year land use and demand assumptions. For the purpose of assessing the Erskine Park Link Road (EPLR) network proposal, a future year model for 2016 has been developed.

2.2.2 Network

The base network in the RTA strategic model represents the Sydney road network in 2004/05. The RTA model has been used extensively for major highway schemes in Sydney in recent years and as a result the model network has progressively been updated to incorporate recent changes to the Sydney road network.

The model link network is defined based on a road hierarchy classification, as described below:

- Zone centroid connector - (a special link which does not physically exist but is used in modelling as zone loading points for the travel demand);
- Local/Collector road - e.g. Ferrers Road, Eastern Creek; Banks Drive, Erskine Park;
- Secondary arterial - e.g. Mamre Road, Erskine Park Road;
- Primary arterial - e.g. Wallgrove Road;
- Highway - e.g. Great Western Highway; and
- Freeway and motorways - e.g. M4 and M7 motorways.

Characteristics (capacity, speed etc) for each link in the model network are coded based on the classification of the link in the road hierarchy.

The 2016 future year strategic network has been developed based on the RTA's assumptions regarding the extent and timing, of anticipated and programmed network enhancements.

2.2.3 Zone System

In order to represent travel data at a local geographic level, the traffic model is divided into travel zones, which represent reasonably homogenous areas generally delineated by physical features such as roads, railways and rivers. The RTA model zone system is based on the TPDC Tz96 travel zone system in which zones are sub-divisions of Statistical Local Areas (SLAs) and comprises a number of Census Collection Districts (CCD).

The TPDC Tz96 zone system contains some large zones in terms of geographical and future socio-demographic size (and hence the number of trips generated in each zone) and the RTA has therefore undertaken a process of refinement ("zone-splitting"), particularly in areas of major development (for example the North West and South West Growth Sectors). The disaggregation of large zones is an important step in the modelling process as it facilitates a more realistic and less "lumpy" loading of future demand across the model network.

For the purpose of the Hub development proposal further zone disaggregation was necessary to represent in more detail the proposed land use of the area. This is covered in detail in **Section 3.2.3**.

2.2.4 Demand

Trip matrices (or trip tables) form the basis of demand in the model and describe the number of trips travelling between origin and destination pairs of zones for a given time period, vehicle type and/or trip purpose.

Base Year Demand

In the RTA strategic model, AM peak and PM peak network-wide all-vehicle trip tables have been developed. The trip tables were originally sourced from TPDC's STM model (version STM 00v1), which represents car driver trips only (excluding car trips for access to public transport) for the year 2001.

During the calibration process the trip tables were adjusted to reflect 2004/05 traffic counts using a standard matrix estimation process based on the principles of maximum-likelihood theory. As a result, all-vehicle trip tables were developed for the 2004/05 base model, which account for the following:

- Commercial vehicles;
- Car access to public transport trips; and
- Growth from 2001 to 2004/05.

It is acknowledged that this approach to converting to an all-vehicle trip table is simplistic and takes no account of differing trip ends and trip distributions associated with commercial vehicle movements, nor does it reflect the impact heavy vehicles have on capacity in the way that modelling as Passenger Car Units (PCU) does. However given the context of the model application and the general lack of reliable commercial vehicle trip table data, this approach is considered reasonable.

Maunsell has undertaken a sensibility check on the adjustments made to the STM trip tables. **Table 2.1** shows the resultant trip table total from the matrix adjustment process.

Table 2.1: Trip Table Totals (AM peak 2 hours)

Trip Table	Total Trips	Diff
STM 2001 car driver trip table	991,097	
RTA all-vehicle 2004/05 trip table	1,102,078	(+11%)

An increase of 11% between the RTA (2004/05) all-vehicle trip table and the STM car driver trip table is considered reasonable. Analysis of TPDC land use data (May 2004) suggests a natural increase (based on population and employment growth) of approximately 4-5% between 2001 and 2004/05. This suggests that the remainder of the difference is explained by the conversion of the trip table to all-vehicle and the fine-tuning to traffic counts. An increase of 6-7% for these adjustments is considered reasonable.

Analysis has been undertaken to confirm that the matrix estimation process has not distorted the trip length distribution. Despite an increase in "intra-SLA" trips, the matrix adjustment process appears to have maintained the general trip length distribution of the STM matrices. The average trip length for both trip tables is 24.6 km.

Future Year Demand

TPDC future year trip tables are produced from the full 4 stage STM travel model with forecast population, employment and transport networks as key inputs. The RTA has developed future year all-vehicle trip tables by adjusting the STM trip tables to include the following:

- Modifications to the base year trip table as a result of model calibration; and
- Recent revisions to land use projections (particularly in the South-west (SW) and North-west (NW) (Sydney) Sector growth areas).

Further modifications are made to the network wide trip tables to include demand associated with the development area. Local assumptions regarding land use, trip generation and trip distribution are adopted to develop revised trip demand for each zone in the development area. The revised trip data (row and column cell values for each zone) are then superimposed into the network wide trip tables and included in the Fratar procedure. This process is covered in detail in **Section 3.2**.

Check on Future Demand

Maunsell has undertaken a sensibility check on the future year network wide trip tables (excluding development trips) to review assumptions regarding growth in future year demand.

Although the RTA does not maintain a definitive set of population and employment projections for use in their modelling, Maunsell considered it prudent to confirm that the growth assumed in the RTA trip tables is consistent with recent Government land use projections, particularly in the NW and SW Sector growth areas.

A "back-calculation" process using estimated TPDC trip rates, derived from the original (version 00v1) land use and associated STM trip ends, was used to produce implied RTA population and employment[1] based on the 2004/05 and 2016 RTA trip tables. **Table 2.2** shows the implied population and employment totals as back-calculated for the North West and South West regions[2] as well the Sydney wide totals. These are compared against the equivalent totals from the latest TPDC land use projections (TPDC, May 2004) as shown in **Table 2.3**.

[1] Population was used as a proxy for origins and employment as a proxy for destinations.

[2] NW region defined as the LGAs of Blacktown, Baulkham Hills, Penrith, Hawkesbury and SW region as the LGAs of Liverpool, Camden, Campbelltown and Fairfield.

Table 2.2: Summary of Implied "RTA" Land-use Projection

Sector	Population			Employment		
	2004	2016	Growth	2004	2016	Growth
North-West	669,220	796,060	19%	207,075	257,204	24%
South-West	559,754	786,844	41%	170,689	243,803	43%
Sydney Total	3,838,198	4,284,564	12%	1,850,846	2,007,071	8%

Table 2.3: Summary of TPDC Land-use Projections (May 2004)

Sector	Population			Employment		
	2004	2016	Growth	2004	2016	Growth
North-West	684,962	798,332	17%	229,114	283,094	24%
South-West	564,801	654,828	16%	180,969	219,523	21%
Sydney Total	3,887,529	4,336,665	12%	1,943,586	2,154,664	11%

The following observations are drawn from comparison of **Table 2.2** and **Table 2.3**:

- The Sydney wide totals for the TPDC and "implied" RTA are similar suggesting that the RTA's overall growth is reasonable and in line with expected land use projections for the Sydney metropolitan region.
- For the NW region, the population and employment totals are very similar with approximately 18% growth in population (2004 - 2016) for both RTA and TPDC, and 24% increase in employment indicating that the growth envisaged by the RTA for the NW region is in line with current TPDC expectations.
- For the SW region, there are significant differences between the TPDC and the implied RTA population and employment totals. Whereas the RTA forecast growth of over 40% (2004-2016) in the SW region, TPDC's growth is a more modest 16% for population and 21% for employment. Although confirmation of one set of projections over the other is out of the scope of this report, the RTA assumptions reflect recent advice from Growth Centres Commission & DoP Metro Strategy group regarding development of the SW sector.
- Of relevance to the EPLR network proposal, adopting the RTA assumptions would generate more trips on the network in the SW and nearby regions, and would likely lead to higher traffic levels on the M7 and Wallgrove Road.

2.2.5 Assignment Process

Assignment is the process whereby the trip matrices are loaded onto the network (via centroid connectors) and trips are distributed across the network to provide model flows on all links. The assignment process forms two basic functions:

- Building paths (or routes) between all pairs of origin and destination zones; and
- Assigning (or loading) trips from the matrix onto the network, using the previously calculated paths.

An iterative all-or-nothing path building process determines routing through the network whereby minimum costs of travel between origin and destination zones are calculated at each iteration.

Capacity restraint is adopted using an equilibrium loading process to create multiple paths and a balanced (converged) model in terms of assigned flows and travel costs between successive iterations of the assignment process. In the path building process cost of travel is determined by time only (plus toll costs) reflecting the fact that drivers in peak periods are usually concerned only with minimising time.

Travel time in the network is defined using link based, speed-flow curves which represent composite link and junction capacity and delay. Speed-flow curves describe the performance of the network link in terms of link traffic speed and time, reflecting the fact that speed reduces as a result of increased traffic and increased congestion on a link.

Toll costs are modelled using link-based penalties representing the cost of using the toll road by the application of an equivalent time penalty (assuming an average value of time) for using the tolled link. This equivalent time penalty is included in the generalised cost function in the path-building algorithm. The RTA has indicated that an average all-vehicle value of time of $30 per hour is required to replicate observed traffic volumes on Sydney toll roads. Although higher than standard RTA values of time, Maunsell considers this an appropriate value of time based on its extensive experience in toll road modelling.[3]

A limitation of the link-based approach is that it is difficult to model complex tolling systems such as the distance-based capped toll structure that is adopted on the M7. In order to overcome this limitation, the RTA have augmented the strategic model with a supporting spreadsheet application that has estimated toll cost parameters for the different sections of the motorway to allow M7 observed volumes to be replicated. The calibrated M7 toll parameters were adopted for future model runs.

Although it is a simplified approach for reflecting the driver response to toll costs, Maunsell recognises that given the context of the project this approach is suitable for the modelling of the traffic impacts of the Hub development. However given the close proximity of the M7 to the development area and its impact on the dynamics of the surrounding network it is imperative that the model generally replicates the traffic volumes on the M7. For this reason Maunsell has examined in detail the post M7 opening model run, included in **Section 2.2.7**.

2.2.6 Model Validation

In order to have confidence in the model as a basis for producing robust and reliable future year traffic forecasts, the base year model must ideally be able to demonstrate that it reasonably reflects existing traffic conditions across the road network, particularly on roads in the immediate vicinity of the Hub development area.

Generally traffic models are compared against contemporary traffic data relating to traffic volumes on relevant links on the network. Maunsell considered that it was necessary to undertake the validation in a two-step process:

- Consideration of the base year model (2004/05) by comparison of model-observed traffic volumes on key links and screenlines; and
- An assessment of the model response to the inclusion of the M7 motorway by comparison of modelled and observed traffic volumes on key M7 links. As the M7 has significantly altered the dynamics of travel in Western Sydney it is imperative that the traffic model reasonably reflects the post M7 conditions, particularly given the proximity of the motorway to the development areas.

For the validation tasks, data from the RTA traffic sites was adopted together with count data Maunsell has previously collected on behalf of the RTA as part of the traffic impact assessment of the construction of the M7. These data sources allowed a reasonable series of screenlines to be established.

[3] Maunsell extensive experience in toll road modelling indicates that other non-time based benefits affect the attractiveness of a toll road (eg improved travel time reliability, convenience, safety, electronic payment, lack of congestion). In a link-based approach these benefits can be represented by higher values of time.

Base Year Validation

In order to assess the robustness of the RTA Strategic model in the Western Sydney area a series of screenlines have been defined. These are shown in **Figure 2.1**. **Table 2.2** and **Table 2.3** summarise the observed and modelled total volumes across these screenlines. (A full comparison showing individual links crossing the screenlines is included in **Appendix A**).

Table 2.2 and **Table 2.3** show that the RTA model generally produces a good match against the traffic count data.

Table 2.2: AM peak Screenline Comparisons

Screenline	Direction	Observed Volumes	Modelled Volumes	%Diff
1	N	10,050	10,341	2.9%
1	S	6,860	6,793	-1.0%
2	N	9,911	9,401	-5.1%
2	S	5,299	5,291	-0.2%
3	N	14,420	13,431	-6.9%
3	S	9,206	7,898	-14.2%
4	E	13,319	13,657	2.5%
4	W	10,343	10,466	1.2%
5	N	15,034	15,095	0.4%
5	S	13,758	14,385	4.6%
6	N	22,596	21,921	-3.0%
6	S	33,795	36,333	7.5%
7	N	5,699	5,689	-0.2%
7	S	11,901	12,324	3.6%
8	E	22,914	21,866	-4.6%
8	W	11,760	11,576	-1.6%
9	E	15,372	15,389	0.1%
9	W	7,148	7,483	4.7%
10	E	8,646	8,401	-2.8%
10	W	5,572	5,117	-8.2%

Note: Volumes are 2 hour all-vehicle traffic flows

Table 2.2 shows that 19 out of the 20 screenlines are within 10% of the traffic counts, with 15 screenlines within 5% of the observed data. Only one screenline lies outside the +/- 10% range (screenline 3, Orphans Creek, south of the Erskine Park development area). This is likely caused by local loading issues on the dense residential network and Maunsell does not consider this significant within the context of the project.

Detailed analysis of the key links that surround the Hub development area[4] shows that, although there are differences between the observed and model traffic flows, the match is within limits for a strategic model.

[4] Mamre Road, Wallgrove Road and M4 Motorway

Figure 2.1: Screenline Locations

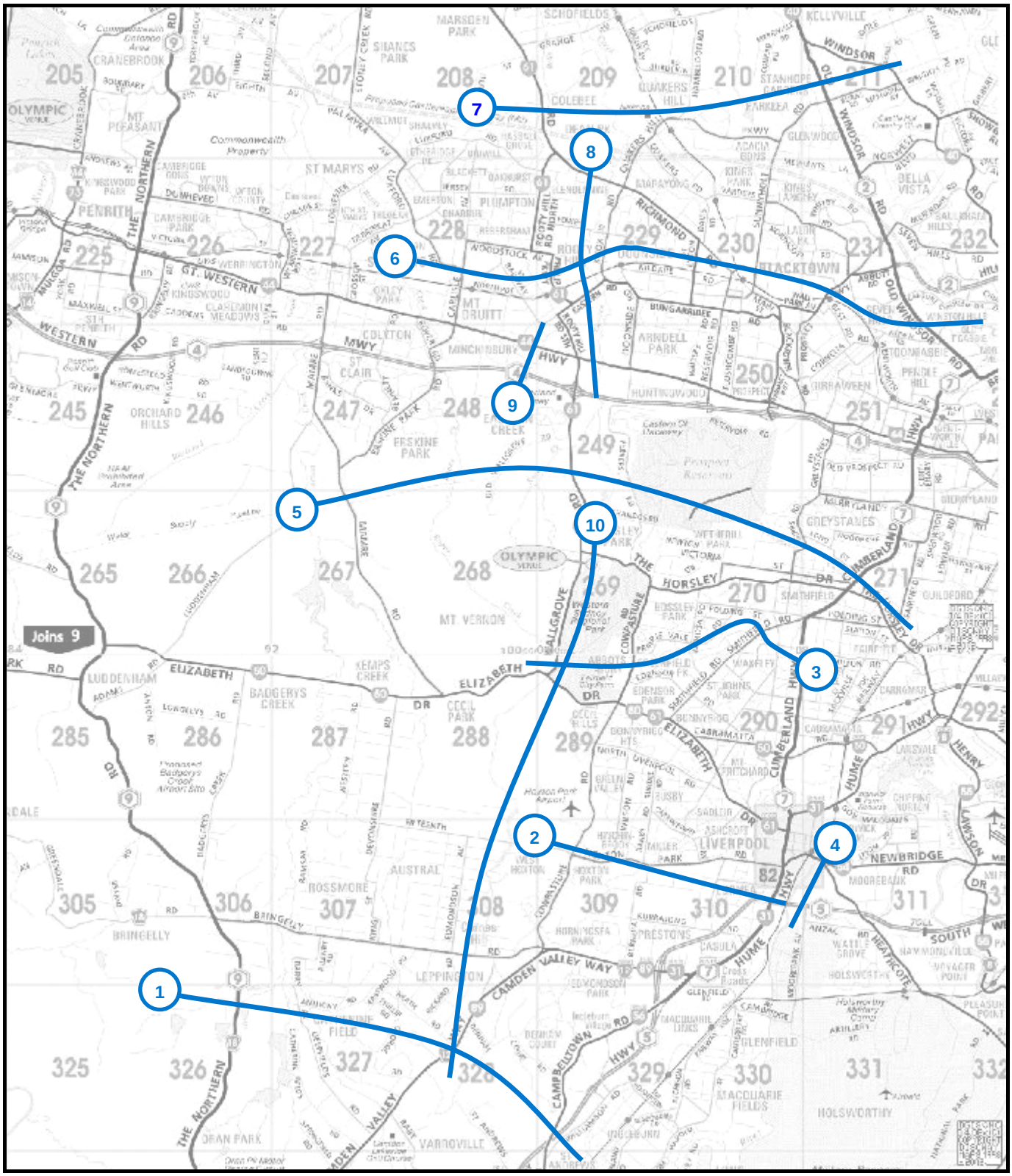


Table 2.3: PM peak Screenline Comparisons

Screenline	Direction	Observed Volumes	Modelled Volumes	%Diff
1	N	7,308	7,385	1.1%
1	S	11,752	11,914	1.4%
2	N	5,865	6,166	5.1%
2	S	8,877	9,272	4.4%
3	N	9,283	9,186	-1.0%
3	S	14,936	12,944	-13.3%
4	E	10,184	9,821	-3.6%
4	W	14,873	14,635	-1.6%
5	N	13,229	13,244	0.1%
5	S	14,983	14,602	-2.5%
6	N	34,543	34,073	-1.4%
6	S	27,891	27,358	-1.9%
7	N	11,338	11,298	-0.4%
7	S	6,762	6,709	-0.8%
8	E	12,843	12,625	-1.7%
8	W	24,097	21,660	-10.1%
9	E	8,230	7,372	-10.4%
9	W	15,196	14,154	-6.9%
10	E	6,235	5,731	-8%
10	W	8,680	8,696	0.2%

Note: Volumes are 2 hour all-vehicle traffic flows

Table 2.3 shows that 17 out of the 20 screenlines are within 10% of the traffic counts, with 14 screenlines within 5% of the observed data. Of the screenlines that lie outside the +/- 10% range only one raises concern (screenline 3, Orphans Creek, south of the Erskine Park development area). As with the AM peak, this is likely caused by local loading issues on the dense residential network and Maunsell does not consider this significant within the context of the project.

Detailed analysis of the key links that surround the Hub development area shows that, although there is some difference between the observed and model traffic flows, the match is within limits for a strategic model.

Root Mean Square Error (RMSE) is a parameter that is used to provide an assessment of the correlation between the observed and model flows for the whole data set. Typically a value of less than 30% is considered a reasonable goodness-of-fit. The following values of RMSE were calculated for the RTA strategic 2004/05 model:

- AM peak: 12.7%
- PM peak: 11.1%

The analysis has shown that both AM and PM peak models have generally achieved a satisfactory level of goodness-of-fit within the western Sydney region.

2.2.7 Post M7 Model Comparison

In addition to the 2004/05 calibrated network, the RTA developed a 2006 M7 response model that has allowed Maunsell to examine the impacts of the M7 motorway, with particular focus on the section adjacent to the study area, specifically the modelled flows on the M7 and Wallgrove Road.

Maunsell compared observed and modelled AM and PM peak link volumes for three key sections of the M7, between the intersections with Elizabeth Drive and the M4. The M7 count data is commercially sensitive and not provided in this report. However, the analysis of observed and modelled flows demonstrate that the RTA modelled 2006 link flows represent a good comparison with existing traffic volumes on the M7, as all sections are within 7%.

Table 2.4 and **Table 2.5** show the comparison of modelled and observed traffic volumes on Wallgrove Road before and after the opening of the M7.

Table 2.4: Wallgrove Rd Modelled v Observed Link Flows – AM peak

Location	Northbound			Southbound		
	Obs	Mod	% Diff	Obs	Mod	% Diff
2004/05 Base Year Model						
Wallgrove Rd at Water Supply Line	2,551	2,276	-11%	2,606	2,388	-8%
2006 M7 Response Model						
Wallgrove Rd at Water Supply Line	1,422	1,735	22%	2,070	2,121	2%

Analysis of Observed Volumes

- Northbound traffic volumes on Wallgrove Road have reduced by 44% since the opening of the M7.
- Southbound traffic volumes on Wallgrove Road have reduced by 21% since the opening of the M7.

Analysis of Modelled Volumes

- The 2004/05 modelled flows on Wallgrove Road are 11% and 8% lower than the corresponding observed values in the north and southbound directions.
- The 2006 modelled flows on Wallgrove Road are higher than observed by approximately 22% in the northbound and 2% in the southbound direction.

The 2006 model appears to be over-assigning trips in the northbound direction on Wallgrove Road. Although, the resultant M7 volumes are slightly lower than observed, there appears to be an over-estimation of modelled trips generated from areas south of Wallgrove Road. However it should be noted that the difference in modelled to observed flows equates to 150 veh/hr. This variance is not really significant in terms of infrastructure requirements.

The over assignment of traffic on Wallgrove Road (in the northbound direction) will need to be considered when undertaking the detailed traffic impact assessment as the high model flow may overestimate delay at the Hub-Wallgrove Road-M7 intersections. Alternatively, fine-tuning the model may improve the northbound flow on Wallgrove Road.

Table 2.5: Wallgrove Rd Modelled v Observed Link Flows – PM peak

Location	Northbound			Southbound		
	Obs	Mod	% Diff	Obs	Mod	% Diff
2004/05 Base Year Model						
Wallgrove Rd at Water Supply Line	2,627	2,676	2%	2,834	2,263	-20%
2006 M7 Response Model						
Wallgrove Rd at Water Supply Line	2,020	2,269	12%	1,610	1,767	10%

Analysis of Observed Volumes

- Northbound traffic volumes on Wallgrove Road have reduced by 23% since the opening of the M7.
- Southbound traffic volumes on Wallgrove Road have reduced by 43% since the opening of the M7.

Analysis of Modelled Volumes

- The 2004/05 modelled flows on Wallgrove Road are 2% higher and 20% lower than the corresponding observed values in the north and southbound directions respectively. The higher observed flow is possibly due to additional M7 construction traffic during the survey period.
- The 2006 modelled flows on Wallgrove Road are higher than observed by approximately 12% in the northbound and 10% in the southbound direction.

The 2006 model appears to be over-assigning trips in both directions of Wallgrove Road. This is counter balanced by lower model M7 volumes than observed. This suggests that although the total model flow across the two links matches the observed, there may be a slight discrepancy in route assignment. The traffic flow differences need to be accounted for when undertaking the detailed impact assessment as it may impact on the analysis of the operational efficiency of the Hub-Wallgrove Road-M7 intersection.

2.3 Summary

This section has reviewed the RTA strategic model by examining the process and methodology of the modelling with particular focus on its ability to replicate existing traffic conditions in the vicinity of the proposed the Hub development areas. The review has identified some aspects of the modelling that could be improved either by fine tuning of the model calibration or by adjusting the traffic flows prior to input to more detailed microsimulation modelling during the project approval stage.

However, Maunsell consider the RTA strategic model as a suitable and robust basis for development of a concept plan for assessing the traffic impacts of the proposed Hub development.

3.0 Modelling for North-west and South-west Precincts

3.1 Development Overview

3.1.1 Local Assumptions

This section details the incorporation of local assumptions regarding the NWP and SWP development areas into the wider RTA strategic network model. Consideration of the local area assumptions is essential for producing robust traffic volumes generated within the area and for determining their impacts on the surrounding road network. Specifically this section deals with assumptions relating to the following:

- Location, type and extent of proposed land use;
- Local road network (extent and type of road link);
- Trip generation; and
- Trip distribution and assignment onto the local and wider road network.

3.1.2 Background to Development

The NWP and SWP land use proposals comprise a large development area of approximately 1,285 developable hectares located within the Local Government Areas (LGA) of Penrith, Blacktown and Fairfield (**Figure 1.2**). The area is bounded by Erskine Park Road and Mamre Road to the west, the M7 to the east, M4 to the north and Bakers Lane to the south. The developments have the potential to provide employment for approximately 30,000 people.

The road network for development is structured in the following order:

Development of the North West Precincts (NWP):

- NWP consists of precincts 1, 2, 6& 7 of the Hub (**Figure 1.1.**);
- Development in the Eastern Creek area, including Stages 1 to 3 of the precincts identified in the State Environmental Planning Policy number 59 (SEPP 59) in addition to development at the Former Wonderland Site and a further area between the western edge of the existing SEPP 59 border and Ropes Creek precinct (Lot 4 and 5); and
- Erskine Park Employment Area between Mamre Road/Erskine Park Road and Ropes Creek/The Eastern Creek development area.

Development of the South West Precinct (SWP):

- SWP consists of precinct 8 of the Hub (**Figure 1.1.**);
- A large area identified for development in Fairfield LGA, south of the water supply line, adjacent to Burley Road and west of Wallgrove Road.

Figure 3.1 shows approximate location of the NWP and SWP within the development area. The area is expected to undergo rapid development with most areas fully developed by 2016, the year chosen for the future year traffic modelling.

3.2 Model Development

3.2.1 Land Use Proposals

The RTA based its detailed assumptions regarding the developments on information provided by Blacktown City Council, Penrith City Council and the Department of Planning (DoP). The total developable area of the NWP is assumed to be 825 hectares (include Eastern Creek precincts-433 hectares, Rope Creek precincts-80 hectares, former Wonderland precincts-35 hectares and Erskine Park Employment area-277 hectares) a further 460 hectares of developable area is proposed in SWP.

Therefore the total area that is assumed to be developed by 2016 is the sum of these five precincts, which equates to 1,285 hectares.

The RTA assumptions relating to the proposed developments, including location, amount of developed area and anticipated land use activity are indicated in **Table 3.1**. The majority of the land use is expected to be "general industrial", with some additional "distribution" activity at the Eastern Creek Precincts and steel works at the Erskine Park Employment area.

Figure 3.1: Approximate Location of SWP and NWP Development Areas

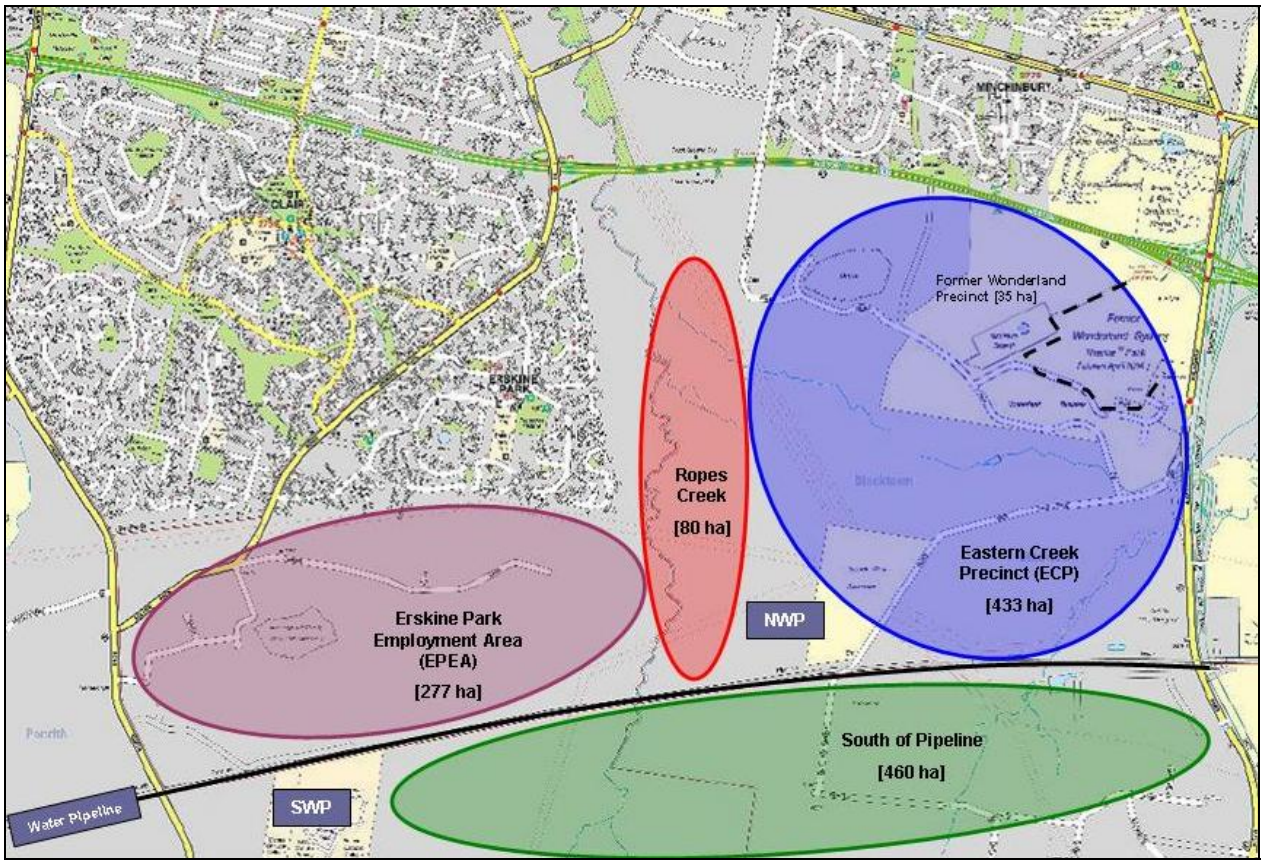


Table 3.1: Details of Proposed Developments: Model Assumptions

Development Sector	Location	Anticipated Land Use Type	Development Sector	Developed Area (ha) by 2016
Eastern Creek Precinct (ECP)	Eastern Creek Precinct South	General Industrial + distribution	NWP	305
	Eastern Creek Precinct North	General Industrial		78
	Eastern Creek Precinct East	General Industrial + distribution		50
Former Wonderland Precinct		General Industrial		35
Ropes Creek Precinct		General Industrial		80
Erskine Park Employment Area (EPEA)	Erskine Park Employment area (A)	General Industrial		17
	Erskine Park Employment area (B)	Steel Industry + General Industrial		77
	Erskine Park Employment area (C)	Steel Industry + General Industrial		183
Development south of the Sydney Water pipeline		General Industrial	SWP	460
Total				**1,285 ha**

3.2.2 Network

In addition to Sydney wide future year road upgrades (as discussed in **Section 2.2.2**) the following development related road changes (as displayed in **Figure 1.2**) for the RTA proposed Option C, have been included in the 2016 EMME/2 NWP model network:

- A northern east-west route ('Erskine Park Link Road' as an extension of Lenore Lane) linking Erskine Park Road to the Old Wallgrove Road interchange with Wallgrove Road and the M7;
- A northern access road to Archbold Road connecting the area to the M4 (at a new interchange; east facing ramps only) and the Great Western Highway; and
- Eastern and western north-south link roads.

The road links would encompass a 40 metre wide corridor to construct 4 lane divided carriageways. The corridor would be wider at the intersections and additional internal access roads that would be required to suit the development needs of the area.

As part of the SWP development of the Hub, a road network within SWP needs to be developed linking with the proposed EPLR network in NWP. The proposed EPLR network was tested to determine whether it will meet the traffic demand when the SWP development is completed.

The RTA has also tested various network scenarios to design for a fully developed NWP and SWP of the Hub, which includes the land release area south of the Sydney water supply pipeline. The road links for SWP would include:

- A southern east-west route ('Southern Route' commencing south of Bakers Lane to the west) linking Mamre Road with Wallgrove Road and M7; and
- Eastern and western north-south connections (Old Wallgrove Road and "N-S Link" respectively) linking both the north and south east-west link roads.

Details of the evaluation process to test various options are provided in **Section 4.2**.

3.2.3 Zone System

As described in **Section 2.2**, the Transport and Population Data Centre's (TPDC) Tz96 zone system contains some large zones in terms of geographical and socio-demographic size and the RTA has undertaken a process of "zone-splitting" in areas of major development. The disaggregation of large zones facilitates a more realistic and less "lumpy" loading of demand across the model network.

The proposed Hub development area is represented by 6 TPDC Tz96 travel zones, which is refined to 9 sub-divided zones in the RTA model. The correspondence between the RTA strategic model and TPDC travel zones is summarised in **Table 3.2**.

Figure 3.2 shows the location of each zone centroid connector for the subdivided travel zones, together with the assumed RTA internal road links and the access points to wider highway network.

3.2.4 Trip Generation

The RTA has adopted an average trip generation rate of 15 trips/hectare/hour, per assumed developed hectare of industrial land and 22.5 trips/hectare/2 hours, for the morning and evening peak periods for the Hub development area. These rates were derived by the RTA based on data from a number of sources, including a Transport Management and Accessibility Plan (TMAP) prepared by Sinclair Knight Merz (SKM) for the Huntingwood precinct and several Development Applications (DA) submitted for employment areas in Erskine Park and other locations in the Penrith Local Government Area (LGA).

Given that the RTA trip rate of 15 trips/hectare/hour is the result of collaborative experience of trip generation in the local area; Maunsell accepts that this is an appropriate average trip generation rate to adopt for the Hub precincts.

Table 3.2: RTA-TPDC Tz96 Zone Correspondence

Location	Developed Area (Ha) by 2016	TPDC Tz96	RTA Zone	LGA
Eastern Creek Precinct South	305	678	678	Blacktown
Eastern Creek Precinct East	50		306781	Blacktown
Former Wonderland Precinct	35	822	822	Blacktown
Eastern Creek Precinct North	78	823	823	Blacktown
Ropes Creek Precinct	80	739	739	Blacktown
Erskine Park Employment area A	17	741	307411	Penrith
Erskine Park Employment area B	77		307412	Penrith
Erskine Park Employment area C	183		307413	Penrith
Lands South of pipeline	460	821	821	Fairfield

Figure 3.2: Approximate Location of Development Areas with EMME/2 Zone Connections

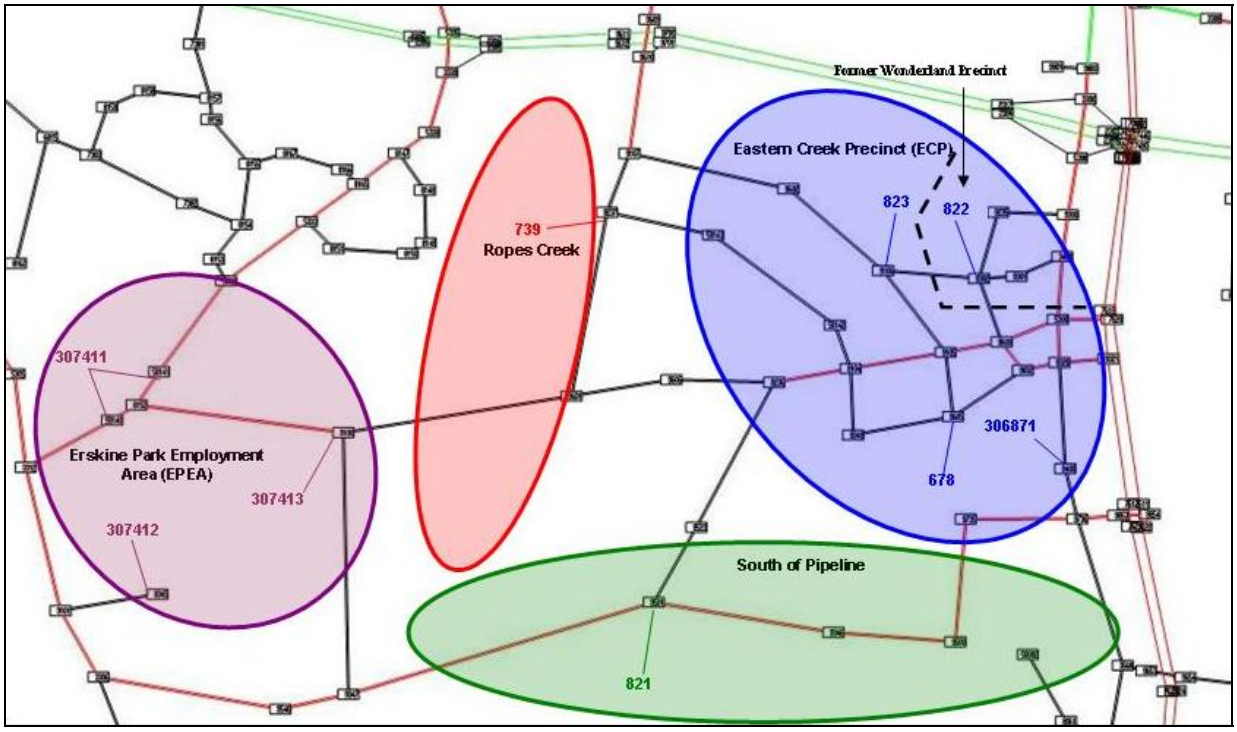


Table 3.3 provides the trip end estimates for the development zones adopted by the RTA based on the average trip rates of 15 trips/hectare/hour, per assumed developed hectare of industrial land and 22.5 trips/hectare/2 hours. The total number of trips generated by the development area is estimated to be 25,101 vehicles for each 2 hour peak period.

Note that for most precincts the trip generation of 15 trips/hectare/hour has been adopted. However, for the Eastern Creek East and South Precincts, where the land use is expected to be largely distribution and warehouse activity, a lower trip rate was adopted to reflect the lower employment density. For similar reasons, trip rates for the Erskine Park area are slightly lower than for Eastern Creek, reflecting lower employment density for the intended steel works.

The split of the total generated trips (in the morning peak period) is assumed to be approximately 19% productions and 81% attractions (based on trip data for the nearby industrial areas of Minchinbury, Huntingwood and Wetherill Park). This split, which reflects the commuter nature of travel during the peak periods, is considered appropriate.

3.2.5 Trip Distribution

Table 3.4 provides details of the RTA assumptions regarding the distribution of traffic generated by the development areas. This is based on the existing model trip distribution for the nearby industrial zones of Wetherill Park, Huntingwood and Minchinbury. The RTA has assumed an identical trip distribution for all sites within the development area.

Table 3.3: AM peak Trip End Distribution

Outbound		Inbound		
LGA	RTA Adopted	LGA	RTA Adopted	SKM
Blacktown	36%	Blacktown	27%	30%
Penrith	16%	Penrith	22%	10%
Fairfield	12%	Fairfield	11%	18%
Liverpool	10%	Liverpool	8%	4%
Campbelltown	4%	Parramatta	3%	7%
External zones	3%	Holroyd	3%	12%
Baulkham Hills	3%	External zones	3%	-
Parramatta	3%	Baulkham Hills	3%	4%
Holroyd	2%	Camden	3%	-
Camden	2%	Windsor/Hawkesbury	3%	-
Others	9%	Campbelltown	2%	-
		Others	11%	15%

Reasonableness of Trip Distribution

In order to assess the sensitivity of its trip distribution assumptions, the RTA has examined how an alternative trip distribution, as suggested by SKM as part of their modelling for the development, affects the assigned traffic volumes on the wider road network. The SKM trip distribution assumptions (for inbound only) are shown in **Table 3.4**. It can be clearly seen that the SKM trip distribution has a lower proportion from the west (Penrith) and a greater proportion from the east (Fairfield/Holroyd).

The implications of the different trip distributions are significant. The SKM trip table assignment has over 1,000 vehicles more using the eastern access roads to the area (from Wallgrove Road/M7) with a corresponding reduction of 1,000 vehicles on the western access roads (Mamre Road). Clearly the trip distribution that is adopted in the modelling will have implications for the assessment of the impact of the development on the wider road network; the SKM distribution having a greater impact on Wallgrove Road and M7 for example.

As the trip distribution assumptions appear to have consequences for the overall assessment of the impact of the development, Maunsell has attempted to assess the reasonableness of the RTA assumptions. Using data from the 2001 Journey to Work (JTW) obtained from the Australian Bureau of Statistics, Maunsell has examined the existing inbound trip distribution of commuter trips for each of the three nearby industrial zones of Wetherill Park, Huntingwood and Minchinbury. Maunsell has also compared the 2001 Census JTW with modelled figures from TPDC's 2001 Strategic Travel Model (STM). This comparison is shown in **Table 3.5** and **Table 3.6**.

Table 3.4 Trip Generation by Development Zone (AM peak Period)

Development Sector	Location	Developed by 2016 (Ha)	Access	RTA Zone	Trip Rate 1 hr	Trip Rate 2 hr	Directional Split		Trips In	Trips Out
Eastern Creek Precinct (ECP)	Eastern Creek Precinct South	305	Old Wallgrove Rd	678	8.3	12.5	80%	20%	3,036	763
	Eastern Creek Precinct North	78	Wonderland Dr	823	15.0	22.5	80%	20%	1,401	357
	Eastern Creek Precinct East	50	Wallgrove Rd	306781	9.6	14.3	80%	20%	571	146
Former Wonderland Precinct		35	Wonderland Dr	822	15.6	23.4	79%	21%	644	175
Ropes Creek Precinct		80	Archbold Rd	739	14.9	22.4	80%	20%	1,433	359
Erskine Park Employment Area (EPEA)	Erskine Park Employment area A	17	Erskine Park Rd	307411	14.9	22.4	80%	20%	306	77
	Erskine Park Employment area B	77	Mamre Rd	307412	14.9	22.3	78%	22%	1,341	369
	Erskine Park Employment area C	183	Lenore Lane	307413	14.5	21.8	80%	20%	3,177	805
Lands South of Sydney Water pipeline		460	Old Wallgrove Rd	821	14.7	22.0	83%	17%	8,436	1,705
Total		**1,285**			**13.0**	**19.5**	**81%**	**19%**	**20,345**	**4,756**
									25,101	

Note: “Trip rates” are expressed as a function of assumed developed area by 2016.

Table 3.5: RTA Adopted & STM01 Outbound Trip Distribution – Proposed Development Area

LGA	RTA	STM01 (vOct2000)			
		Wetherill Park	Huntingwood	Minchinbury	Average
Blacktown	36%	9%	41%	40%	30%
Penrith	16%	5%	15%	37%	19%
Fairfield	12%	42%	11%	3%	19%
Liverpool	10%	11%	5%	2%	6%
Campbelltown	4%	2%	1%	1%	1%
External	3%	1%	2%	2%	2%
Baulkham Hills	3%	2%	4%	2%	3%
Parramatta	3%	4%	4%	2%	3%
Holroyd	2%	7%	4%	2%	4%
Camden	2%	1%	1%	1%	1%
Hawkesbury	1%	1%	2%	3%	2%
Bankstown	1%	3%	1%	1%	2%
Ryde	1%	1%	1%	0%	1%
Wollondilly	1%	1%	1%	1%	1%
Concord	1%	0%	0%	0%	0%
Others	4%	9%	7%	4%	7%

Table 3.6: RTA Adopted, STM01 & JTW Inbound Trip Distribution – Proposed Development Area

LGA	RTA	STM01 (vOct2000)				JTW 2001			
		W'll Pk	H'wood	M'bury	Av	W'll Pk	H'wood	M'bury	Av
Blacktown	27%	11%	32%	36%	26%	14%	25%	25%	21%
Penrith	22%	8%	16%	34%	19%	11%	18%	32%	20%
Fairfield	11%	35%	8%	4%	16%	20%	6%	5%	10%
Liverpool	8%	11%	4%	2%	6%	12%	5%	6%	8%
Parramatta	3%	4%	5%	1%	3%	4%	6%	3%	4%
Holroyd	3%	6%	5%	2%	4%	5%	4%	3%	4%
External	3%	2%	5%	4%	4%	1%	2%	1%	1%
Baulkham Hills	3%	3%	5%	3%	4%	4%	6%	4%	5%
Camden	3%	2%	1%	1%	1%	3%	1%	2%	2%
Hawkesbury	3%	1%	3%	4%	3%	2%	3%	3%	3%
Campbelltown	2%	4%	2%	2%	3%	6%	2%	4%	4%
Auburn	1%	1%	1%	0%	1%	1%	1%	1%	1%
Bankstown	1%	3%	2%	1%	2%	3%	2%	1%	2%
Canterbury	1%	1%	1%	1%	1%	1%	1%	0%	1%
Strathfield	1%	0%	0%	0%	0%	0%	0%	0%	0%
Others	8%	9%	11%	6%	9%	14%	17%	9%	13%

The analysis shows that although the three zones examined are in relatively close proximity to each other, there are significant differences in the trip distributions implied by the JTW and STM trip data. The analysis clearly shows that the LGA in which the zone lies provides the greatest contribution to inbound trips; i.e. Wetherill Park has its largest contribution from Fairfield and Huntingwood has its largest number of trips from Blacktown. Minchinbury which is on the boundary between Penrith and Blacktown has a similar proportion of trips from each of those LGAs.

Table 3.5 and 3.6 also provide details of the RTA's estimated trip distribution, for comparison with observed figures extracted from the JTW and STM. The trip distribution has been estimated as the average of modelled trip distributions to and from employment areas at Huntingwood, Minchinbury and Wetherill Park, on the basis that these are the closest established employment areas to the new development areas.

As anticipated, the RTA adopted trip distributions are very similar to the **average** distributions obtained from the STM and JTW data for the aforementioned industrial zones. In consideration of the proximity to the proposed development areas, Maunsell accepts the RTA's reasoning to adopt the average trip distributions, which geographically reflects the proximity of all three established areas in equal proportions.

3.3 Summary

This section has reviewed the future year 2016 modelling, with a particular focus on the local area assumptions including details of land use, trip generation, trip distribution and road network improvements.

The detailed assumptions with regards to the proposed land use developments are based on information provided by and discussions with, Blacktown City Council, Penrith City Council, Fairfield Council and the Department of Planning (DoP). In summary, a total developable area for NWP and SWP (1,285 hectares) is proposed by 2016, with the potential to provide employment for approximately 20,000 people.

The RTA adopted an average trip generation rate of 15 trips/hectare/hour, per assumed developed hectare of industrial land and 22.5 trips/hectare/2hours. These rates were applied to both the morning and evening peak periods for the Hub development area. The rates were derived by the RTA based on data from a number of sources, including a TMAP prepared by Sinclair Knight Merz (SKM) for the Huntingwood precinct and several Development Applications (DA) submitted for employment areas in Erskine Park and other locations in the Penrith local government area.

The split of the total generated trips is approximately 19% productions and 81% attractions based on trip generation data from the nearby industrial areas of Minchinbury, Huntingwood and Wetherill Park.

Assumptions regarding the trip distribution of generated traffic to/from the development areas are based on existing model proportions for the local industrial zones of Wetherill Park, Huntingwood and Minchinbury. The RTA assumed an identical distribution for all sites within the development area. Maunsell assessed the appropriateness of the trip distribution assumptions using data from the 2001 Journey to Work (JTW). The proportions adopted by the RTA are reasonably similar to the average distributions in the three adjacent industrial zones, which suggest that it would be an appropriate trip distribution for the Hub development area.

This section has provided details of the future year traffic modelling that was undertaken by the RTA to develop various network scenarios based on alternative internal and external road links. The process involved modelling road network options for NWP for the worst case traffic generation scenario, which encompasses the fully developed NWP and SWP of the Hub.

4.0 Model Results

4.1 Introduction

In order to define the road network that will be required to service the North West Precinct (NWP) of the Western Sydney Employment Hub (the Hub), the RTA developed a preferred network from the assessment of alternative internal and external road link options for a fully developed NWP and South West Precinct (SWP); which is designed to accommodate additional traffic that will eventually be generated from the SWP.

The fully developed network assessment process formed the second of three modelling scenarios, as detailed below:

1. **Modelling Scenario A**

Assessment of Network Option A – road network without NWP and SWP development (no demand & no road network improvements).

2. **Modelling Scenario B**

Assessment of Network Options B to B8 – nine alternative internal and external road link designs for a fully developed NWP and SWP.

3. **Modelling Scenario C**

Assessment of Network Option C – the network required within the NWP with connections to SWP and is defined as the Erskine Park Link Road (EPLR) network. The design is based on the preferred road network (Option B1 or B8), identified in Modelling Scenario B.

Section 4.2 provides details of the various network options that were assessed, including a description of the alternative road network elements. A summary of the traffic impacts specific to each of the 2016 future year road network options and details of the preferred option(s) are also included.

The modelling results of the preferred RTA design options for Modelling Scenarios B and C are included in **Section 4.3** and **Section 4.4** respectively. The focus was to examine traffic impacts from the north-west and south-west precincts by comparing internal and external link volumes to a 2016 network without NWP and SWP development (Scenario A).

A list of external roads that require upgrading to meet the traffic demand that will be generated from the NWP and SWP, have been identified in **Section 4.5**.

4.2 Assessment of Alternative Future Year Road Modelling Options

4.2.1 Description of Modelling Scenario B Options

The RTA developed various network options based on alternative internal and external road links for a fully developed NWP and SWP, with the aim of designing for the worst case traffic scenario and developing the road network within NWP with connection to SWP. Details of the specific network feature for each option are listed in **Table 4.1** and the corresponding network description is highlighted in **Table 4.2** and **Figure 1.2** (Page 4).

Section 4.2.2 provides a summary of the traffic impacts specific to each of the 2016 future year road network scenarios and highlights the preferred network option(s), which were identified from the assessment.

Table 4.1: Description of Network Features for each of the 2016 Modelling Options

Network Feature	Scenario Network Options									
	B	B1**	B2	B3	B4	B5*	B6	B7	B8**	C***
Archbold Road	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
East Side Ramps	✓	✓		✓	✓	✓	✓	✓	✓	✓
West Side Ramps	✓									
Archbold Road Extension								✓		
Southern Route	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Southern Route Extension	✓	✓		✓		✓	✓	✓	✓	
Southern Route Interchange	✓	✓		✓		✓		✓	✓	
Direct Connection (Link 5)	✓	✓	✓		✓	✓	✓	✓	✓	✓
Erskine Park Link Road	✓	✓	✓	✓	✓	✓	✓		✓	✓
North South Link	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Old Wallgrove Road	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

* Option B5 does not include upgrade/widening of Mamre Rd/Erskine Pk Rd, north of the Southern Route

** Connection to M7 and Wallgrove Rd at different locations south of Sydney water pipeline – Option B1 is closer to Chandos Rd & Option B8 is at The Horsley Drive

*** Option C is same as Option B1 and B8 within NWP

Table 4.2: Description of each Network Feature

Network Feature	Description
Archbold Road	Extension from the M4 to Erskine Park Link Rd
East Side Ramps	At the interchange of M4 and Archbold Rd
West Side Ramps	At the interchange of M4 and Archbold Rd
Archbold Road Extension	From Erskine Park Link Rd to the Southern Route
Southern Route	From Mamre Rd to Old Wallgrove Rd, south of the water supply pipeline
Southern Route Extension	From Old Wallgrove Rd to Wallgrove Rd, south of the water supply pipeline
Southern Route Interchange	A Connection from the Southern Route Extension to the M7
Direct Connection (Link 5)	From Old Wallgrove Rd to the M7 northbound carriageway
Erskine Park Link Road	From Lenore La to Old Wallgrove Rd
North South Link	From Erskine Park Link Rd to the Southern Route
Old Wallgrove Road	From the Southern Route to Wallgrove Rd

4.2.2 Summary of the Traffic Impacts of Each Modelling Option

Appendix B displays the link volumes for each option at key locations internal and external to the Western Sydney Employment Hub (the Hub), for the AM and PM peak period respectively. A summary of the traffic impacts specific to each of the 2016 future year road network options and details of the preferred option(s) are included below:

Network Option B

Network Option B features the full network improvements, including west facing ramps at Archbold Road which allows direct access to/from the proposed development areas through the M4 via Archbold Road.

The additional trips to/from the M4 facilitated by the west facing ramps increases the traffic slightly on Archbold Road (+200 vehicles) in the peak direction. Correspondingly, there is a marginal reduction in peak direction traffic on Wallgrove Road.

In summary, the addition of west facing ramps to M4 at Archbold Road would not provide significant access benefit to the Hub.

Network Option B1

Network Option B1 features the full network improvements, but excludes the west facing ramps at Archbold Road. The option is similar to Option B8 with the only difference being the location of the connection with M7 south of the Sydney water pipeline. The Option B1 connection is at a location north of Chandos Road and Option B8 connection is at The Horsley Drive.

When comparing Option B1 with Option B3, the inclusion of the Direct Connection redistributes approximately 1,000 vehicles from Old Wallgrove Road and the Southern Route Extension in the AM peak and a similar figure from Old Wallgrove Road in the PM peak.

The network design has good connections to the internal and external road network providing a relatively even distribution of traffic across the main access links to the Hub development in the AM peak, including Erskine Park Link Road (2,732) from the west, Old Wallgrove Road (2,976) from the east and Archbold Road (3,199) from the north.

A similarly even distribution is also evident in the outbound direction during the PM peak, including Erskine Park Link Road (2,685) to the west, Old Wallgrove Road (2,696) to the east and Archbold Road (3,114) to the north.

Option B1 is designed to accommodate traffic that will be generated from a fully developed NWP and SWP. The internal road network provides multiple connections to the adjacent external links including 4 main intersections at Wallgrove Road (2 to the M7) and 1 to the M4, Erskine Park Road and Mamre Road.

It is suggested that of the options evaluated, a road network similar to Options B1 and B8 is likely to provide the optimal traffic outcome, based on the multiple external connections that will facilitate an even distribution of trips across the main internal access links to the NWP & SWP developments. With this in mind, the other network designs evaluated in this section will be compared to B1.

Network Option B2

Network Option B2 features the same network improvements as in Options B1 and B8, but excludes the direct access to/from M4 via Archbold Road and the Southern Route Extension link to the M7.

In the AM peak period, the exclusion of the M4 ramps reduces traffic on Archbold Rd by approximately 400 vehicles. There is a corresponding increase in traffic on Mamre Road, Wallgrove Road and M7.

Removal of the Southern Route Extension results in significant increases in westbound traffic on the Direct Connection (45%), Wonderland Drive (41%) and Old Wallgrove (13%). A notable increase in outbound direction flows on the Direct Connection (48%) and Old Wallgrove Road (46%) are also observed, as a result of re-routing of eastbound traffic from the Southern Route Extension. Eastbound movements accessing the proposed development sites from Lenore and Baker Lanes via Mamre Road have increased by 21% and 41% respectively, as a result of overall decreased capacity accessing to/from Wallgrove Road and the M7.

The notable increase in traffic (18%) on Erskine Park Road is based on the removal of Archbold Road ramps and redistribution due to the removal of the Southern Route Extension link to M7.

The results appear to be very similar for PM peak period, where the outbound movements to Wallgrove Road and the M7 decrease with a corresponding increase in westbound movements on Lenore Lane (27%) and Baker Lane (35%). Erskine Park Road is again affected with an increase of 24% in northbound direction.

Network Option B3

Network Option B3 features the same network improvements as in Options B1 and B8, but excludes the Direct Connection and hence eliminating the direct access to/from Wallgrove Road.

The removal of a Direct Connection to/from Wallgrove Road introduces additional pressures on other east-west roads into the proposed development areas during the AM peak period, particularly on Old Wallgrove Road (43%) and Wonderland Drive (42%). The outbound movement on Old Wallgrove Road is also increased substantially (103%) due to the re-routing of trips from the Direct Connection. Correspondingly, the northbound direction on Wallgrove Road between the Direct Connection and Old Wallgrove Road has increased substantially (90%).

In the PM peak period, outbound traffic on Old Wallgrove Road and Wonderland Drive are significantly increased by 39% and 64%, respectively. A 100% increase in the inbound direction on Old Wallgrove Road is also observed. Furthermore, there is a 100% increase in southbound traffic on Wallgrove Road between the Direct Connection and Old Wallgrove Road.

Network Option B4

Network Option B4 features the same network improvements as in Options B1 and B8, but excludes the Southern Route Extension link to M7 and Wallgrove Road.

Removal of the Southern Route Extension results in significant increases in westbound traffic on the Direct Connection (42%), Wonderland Drive (23%) and Old Wallgrove (10%). A notable increase in outbound direction flows on the Direct Connection (49%) and Old Wallgrove Road (45%) are also observed, as a result of re-routing of eastbound traffic from the Southern Route Extension. Eastbound movements accessing the proposed development sites from Lenore and Baker Lanes via Mamre Road have increased by 14% and 39% respectively, as a result of overall decreased capacity accessing to/from Wallgrove Road and the M7.

The notable increase in traffic (12%) on Erskine Park Road is probably due to the redistribution of traffic as a result of removing the Southern Route Extension link to M7 and Wallgrove Road.

The results appear to be very similar for PM peak period, where the outbound movements to Wallgrove Road and the M7 decrease with a corresponding increase in westbound movements on Lenore Lane (17%) and Baker Lane (33%). Erskine Park Road is again affected with an increase of 12% in northbound direction.

Network Option B5

The proposed road network for Option B5 is of a similar design to Options B1 and B8, however Mamre and Erskine Park Roads have only one lane in both directions.

The traffic on Mamre Road decreased as anticipated for both northbound (24%) and southbound (17%) directions. A corresponding increase in traffic is observed on access road links into the proposed development via the M7 and Wallgrove Road.

The situation is very similar in the PM peak period, with a reduction in traffic on Mamre Road in both directions, which results in increased traffic levels on other outbound link roads.

It is noted that the inbound traffic on Bakers Lane increases by 16% in the AM peak and correspondingly by 14% for the outbound direction during the PM peak period. This is possibly due to the redistribution of traffic from Erskine Park Road.

Network Option B6

The proposed road network for Option B6 is of a similar design to Options B1 and B8. The only difference in Option B6 is the exclusion of the Southern Route Extension link to the M7, but maintains the connection to Wallgrove Road.

The notable difference in modelling results between the two scenarios is the increase of northbound and southbound turning traffic at the Southern Route Extension/Wallgrove Road intersection, accessing the proposed development areas, in addition to a reduction in traffic on the M7 in the corresponding section. Redistribution of outbound traffic is also evident on Old Wallgrove Road (37% increase in traffic) from the Direct Connection (22% reduction in traffic) and the Southern Route Extension (10% reduction in traffic).

Network Option B7

Network Option B7 is different from Options B1 and B8, as indicated below:

- Removal of the Erskine Park Link Road between Lenore Lane and Old Wallgrove Road; and
- Extension of Archbold Road to the Southern Route.

The traffic on the Southern Route increased accordingly due to the removal of the competing link. Trips on the Direct Connection and Old Wallgrove Road decreased as a result of the reduction of east-west capacity and directness within the proposed development. This limits the overall accessibility to the development area from Wallgrove Road & M7, in both AM and PM peak periods.

Network Option B8

The location of the connection with M7 south of the pipeline is the only difference between Options B1 and B8. The M7 connection in Option B8 is further south than Option B1. The Option B1 connection is north of Chandos Road and Option B8 connection links to The Horsley Drive.

As Option B8 has a road network identical to Option B1, it would also provide the optimal traffic outcome, based on the multiple external connections that will facilitate an even distribution of trips across the main internal access links to the NWP and SWP developments.

4.2.3 Preferred Option

The preferred road network for the NWP and SWP development is similar to **Option B1 or B8**, as the design is likely to provide the optimal traffic outcome, based on the multiple external connections that will facilitate an even distribution of trips across the main internal access links of the developments.

As a result, **Option C** is defined as the Erskine Park Link Road (EPLR) network that will be required to service the NWP of the Hub, which is designed to connect with SWP to accommodate additional traffic that will eventually be generated from the SWP. Therefore the Option C has been selected as the preferred options for this concept plan approval.

4.3 Model Results – With and Without NWP & SWP Development

4.3.1 AM Peak

Figure 4.1 displays a comparison of the modelled AM peak 2 hour link flows for the following network options:

1. Option A: 2016 road network without NWP and SWP development (no demand and no road network improvements).
2. Option B1 & B8: 2016 RTA proposal for NWP and SWP (as described in **Section 3.2.2**).

The percentage difference included in **Figure 4.1** is the difference in traffic volumes for Option B1 and B8 against Option A and it clearly shows that the NWP and SWP development significantly increases traffic flows on the surrounding road network. A summary of the increase in traffic flows (Option B1 or B8) on the major internal and external roads are listed below:

- M7 approach to development — **+65~+69%** southbound traffic (+2,900~+3,100 vehicles) **+21~+44%** northbound traffic (+1,000~+2,000 vehicles)
- Wallgrove Road — **+33~+78%** southbound traffic (+500~+1,300 vehicles) **+38~+49%** northbound traffic (+500~+700 vehicles)
- M4 Motorway — **+19%** westbound (+1,200 vehicles)
- Mamre Road — **+179~+194%** southbound (+2,300~+2,500 vehicles)
- Erskine Park Road — **+366~+380%** southbound (+2,300~+2,400 vehicles)

In Option B1 and B8, the total number of inbound morning peak trips that enter the proposed development related road network at the main access roads are 18,372 and 18,743 vehicles/2 hrs respectively.

The split of traffic between these links as a proportion of total inbound flow is displayed in **Table 4.3**. The distribution of arrival trips to the development area is fairly evenly spread between the main access links (identified by the link number, which relates to **Figure 4.1**) including Erskine Park Link Road in the west and Archbold Road in the north.

Table 4.3: AM peak Inbound Trips

Link No.	Access Road	Inbound Trips B1 | B8	% of Total B1 | B8
1	Erskine Park Link Road	2,732 | 2,943	15% |16%
2	Archbold Road	3,199 | 3,073	17% | 16%
3	Wonderland Drive	976 | 987	5% | 5%
4	Old Wallgrove Road	2,976 | 2,877	16% | 15%
5	Direct Connection (Link 5)	2,414 | 2,173	13% | 12%
6	Southern Route Extension	3,241 | 3,950	19% | 21%
7	Southern Route	2,894 | 2,740	15% | 15%
Total		**18,432 | 18,743**	

4.3.2 PM Peak

Figure 4.2 displays a comparison of the modelled PM peak 2 hour link flows for the following network options:

1. Option A: 2016 road network without NWP and SWP development (no demand and no road network improvements).
2. Option B1 & B8: 2016 RTA proposal for NWP and SWP.

The percentage difference included in **Figure 4.2** is the difference in traffic volumes for Option B1 or B8 against Option A and it clearly shows that the NWP and SWP development significantly increases traffic flows on the surrounding road network. A summary of the increase in traffic flows (Option B1 or B8) on the major internal and external roads are listed below:

- M7 approach to development — **+60~+62%** northbound traffic (+2,700~+2,800 vehicles) **+12~+18%** southbound traffic (+600~+1,000 vehicles)
- Wallgrove Road — **+42~+48%** northbound traffic (+1,100~+1,250 vehicles)
- M4 Motorway — **+20~+21%** eastbound (+1,300~+1,400 vehicles)
- Mamre Road — **+175%~+176%** northbound (+2,350~+2,400 vehicles)
- Erskine Park Road — **+330~+351%** northbound (+2,050~+2,200 vehicles)

In Option B1 and B8, the total number of inbound morning peak trips that enter the proposed development related road network at the main access roads are 18,327 and 18,373 vehicles/2 hrs respectively.

The split of traffic between these links as a proportion of total outbound flow is displayed in **Table 4.4**. The distribution of departure trips from the development area is fairly evenly spread between the main access links (identified by the link number, which relates to **Figure 4.2**) including Erskine Park Link Road in the west and Archbold Road in the north.

Table 4.4: PM peak Outbound Trips

Link No.	Access Road	Outbound Trips B1 | B8	% of Total B1 | B8
1	Erskine Park Link Road	2,685 | 2,557	15% | 14%
2	Archbold Road	3,114 | 3,129	17% | 17%
3	Wonderland Drive	662 | 628	4% | 4%
4	Old Wallgrove Road	2,696 | 2,445	15% | 13%
5	Direct Connection (Link 5)	2,673 | 2,981	15% | 16%
6	Southern Route Extension	3,514 | 3,947	19% | 21%
7	Southern Route	2,983 | 2,686	16% | 15%
Total		**18,327 | 18,373**	

Figure 4.1: 2016 AM 2Hr Peak Link Volume Comparison for NWP & SWP | Options B1, B8 & A (Without Development)

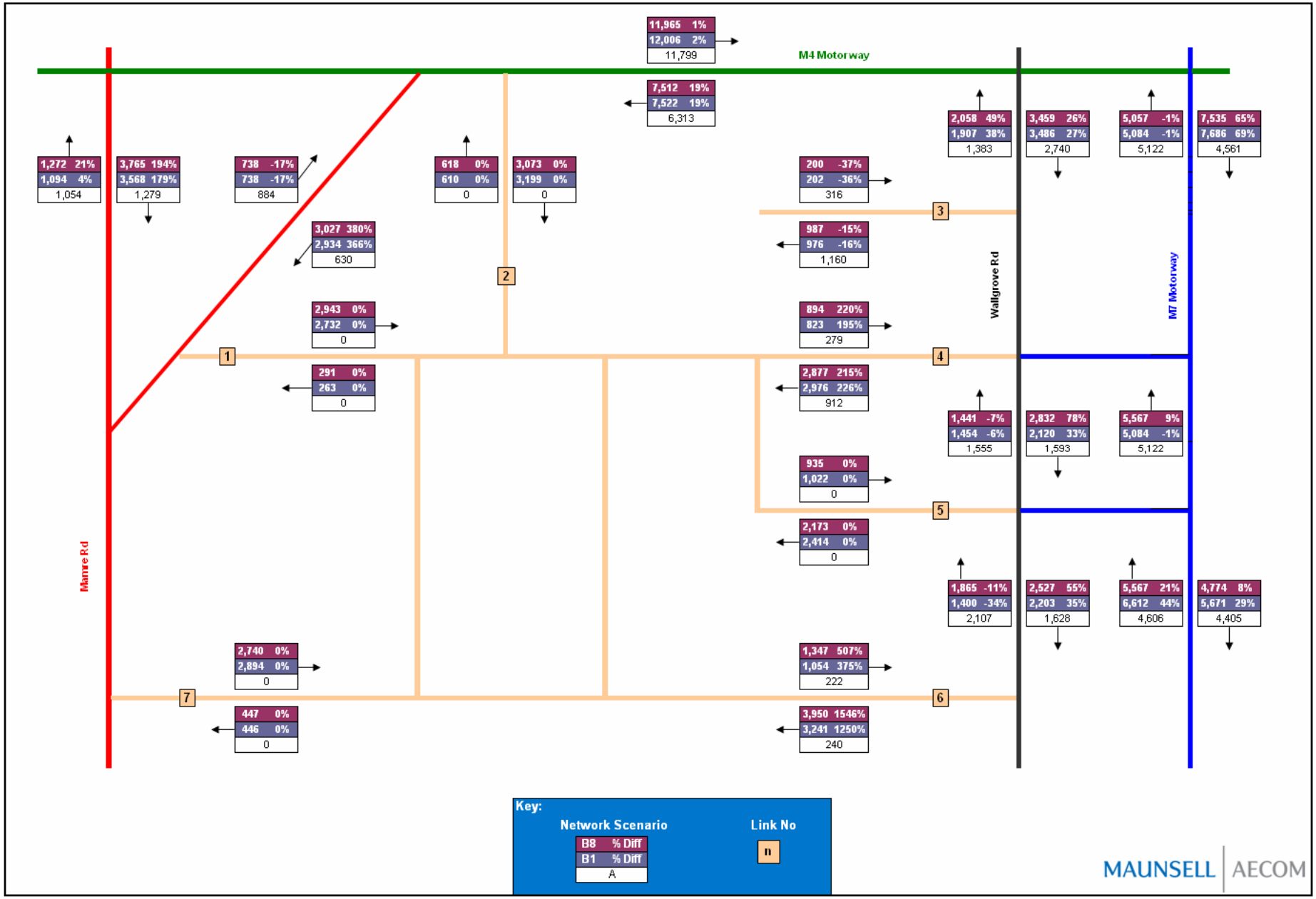
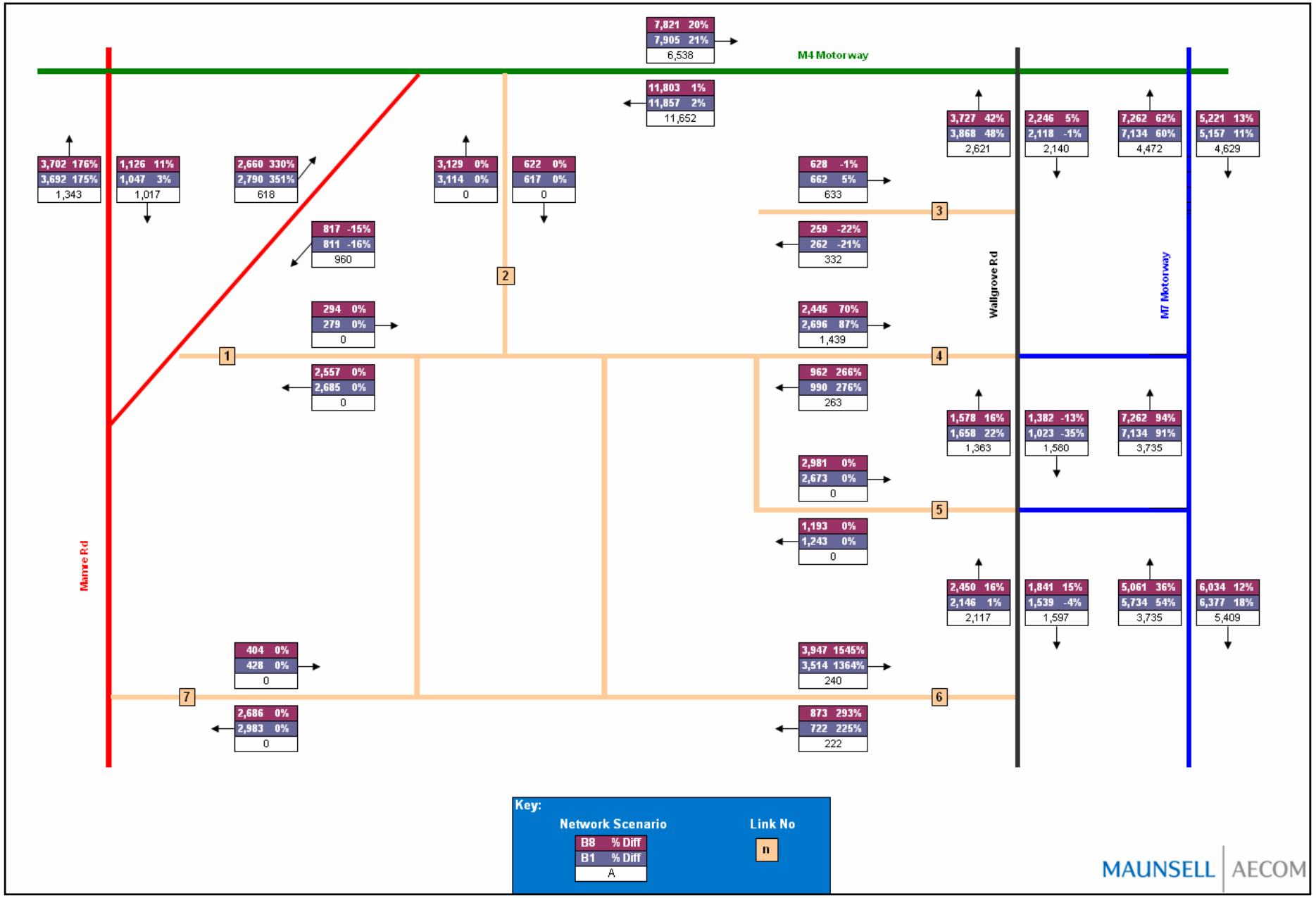


Figure 4.2: 2016 PM 2Hr Peak Link Volume Comparison for NWP & SWP | Options B1, B8 & A (Without Development)



4.4 Model Results – With and Without NWP Development

4.4.1 AM Peak

Figure 4.3 displays a comparison of the modelled AM peak 2 hour link flows for the following two network options:

1. Option A: 2016 road network without NWP and SWP development (no demand and no road network improvements).
2. Option C: 2016 RTA proposal for NWP (as described in **Section 3.2.2**).

The percentage difference included in **Figure 4.3** is the difference in traffic volumes between Option C and Option A and it clearly shows that the NWP development increases traffic flows on the surrounding road network. A summary of the increase in traffic flows on the major internal and external roads are listed below:

- M7 approach to development — **+24%** southbound traffic (+1,100 vehicles) **+26%** northbound traffic (+1,200 vehicles)
- Wallgrove Road — **+52%** southbound traffic (+800 vehicles) **+40%** northbound traffic (+550 vehicles)
- M4 Motorway — **+18%** westbound (+1,100 vehicles)
- Mamre Road — **+67%** southbound (+850 vehicles)
- Erskine Park Road — **+247%** southbound (+1,550 vehicles)

In Option C the total number of inbound morning peak trips that enter the proposed development related road network at the main access roads is 10,160 vehicles/2 hrs.

The split of traffic between these links as a proportion of total inbound flow is displayed in **Table 4.5**. The distribution of arrival trips to the development area is fairly evenly spread (with the exclusion of Wonderland Drive) between the main access links (identified by the link number, which relates to **Figure 4.3**) including Erskine Park Link Road in the west and Archbold Road in the north.

Table 4.5: AM peak Inbound Trips

Link No.	Access Road	Inbound Trips	% of Total
1	Erskine Park Link Road	2,796	28%
2	Archbold Road	2,386	23%
3	Wonderland Drive	935	9%
4	Old Wallgrove Road	1,724	17%
5	Direct Connection	2,319	23%
Total		**10,160**	

4.4.2 PM Peak

Figure 4.4 displays a comparison of the modelled PM peak 2 hour link flows for the following two network options:

1. Option A: 2016 road network without NWP and SWP development (no demand and no road network improvements).
2. Option C: 2016 RTA proposal for NWP.

The percentage difference included in **Figure 4.4** is the difference in traffic volumes between Option C and Option A and it clearly shows that the NWP development increases traffic flows on the surrounding road network. A summary of the increase in traffic flows on the major internal and external roads are listed below:

- M7 approach to development — **+47%** northbound traffic (+1,800 vehicles) **+11%** southbound traffic (+600 vehicles)
- Wallgrove Road — **-22%** to **+45%** southbound traffic (-350 to +700 vehicles) **+20%** northbound traffic (+400 vehicles)
-
- M4 Motorway — **+18%** eastbound (+1,100 vehicles)
- Mamre Road — **+54%** northbound (+700 vehicles)
- Erskine Park Road — **+243%** northbound (+1,500 vehicles)

In Option C the total number of outbound evening peak trips that exit the proposed development related road network at the main access roads is 10,066 vehicles/2 hrs.

The split of traffic between these links as proportion of total outbound flow is displayed in **Table 4.6**. The distribution of departure trips from the development area is fairly evenly spread (with the exclusion of Wonderland Drive) between the main access links (identified by the link number, which relates to **Figure 4.4**) including Erskine Park Link Road in the west and Direct Connection in the east.

Table 4.6: PM peak Outbound Trips

Link No.	Access Road	Outbound Trips	% of Total
1	Erskine Park Link Road	2,657	26%
2	Archbold Road	2,357	23%
3	Wonderland Drive	685	7%
4	Old Wallgrove Road	1,790	18%
5	Direct Connection	2,577	26%
Total		**10,066**	

Figure 4.3: 2016 AM 2Hr Peak Link Volume Comparison for NWP | Options C & A (Without NWP & SWP Development)

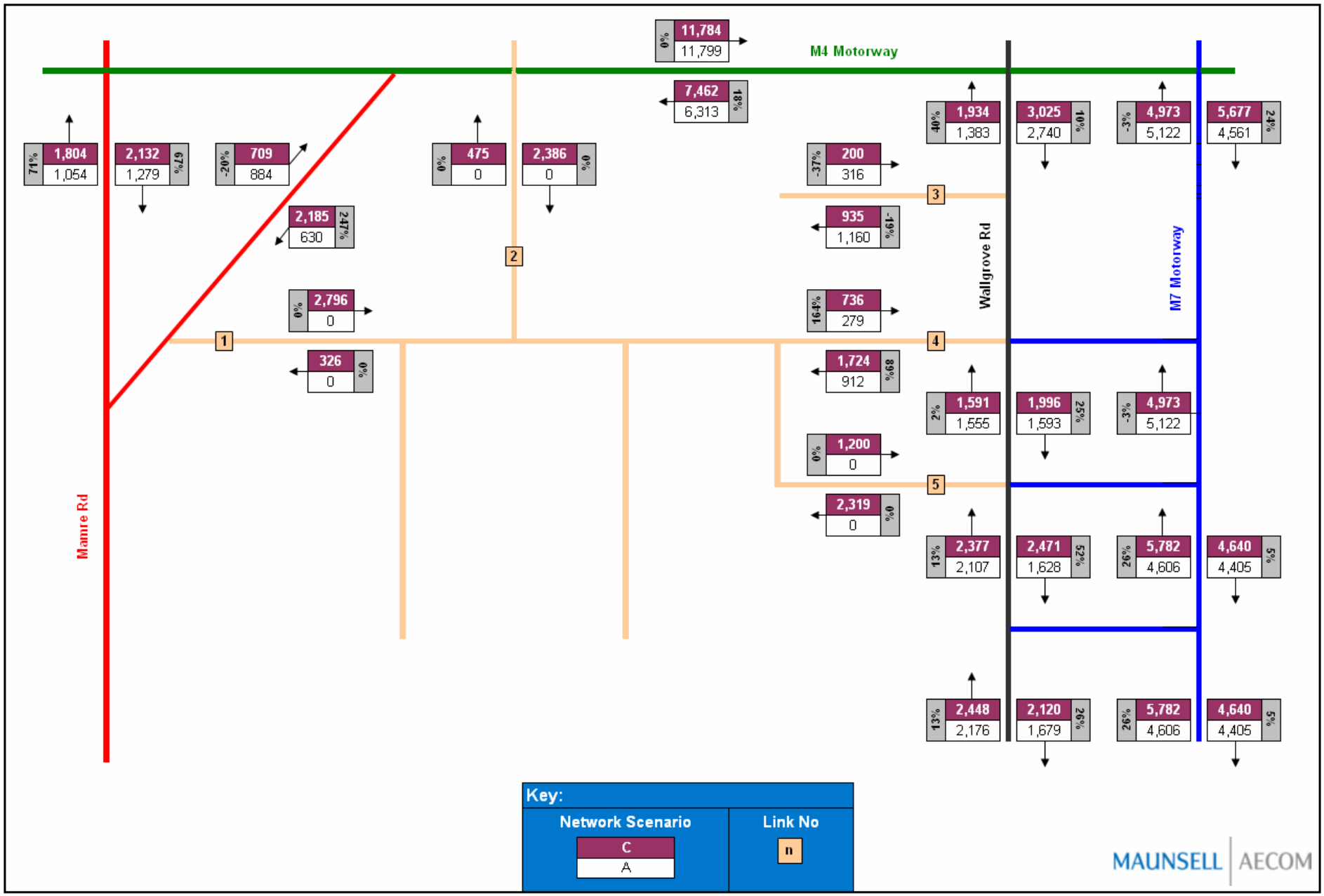
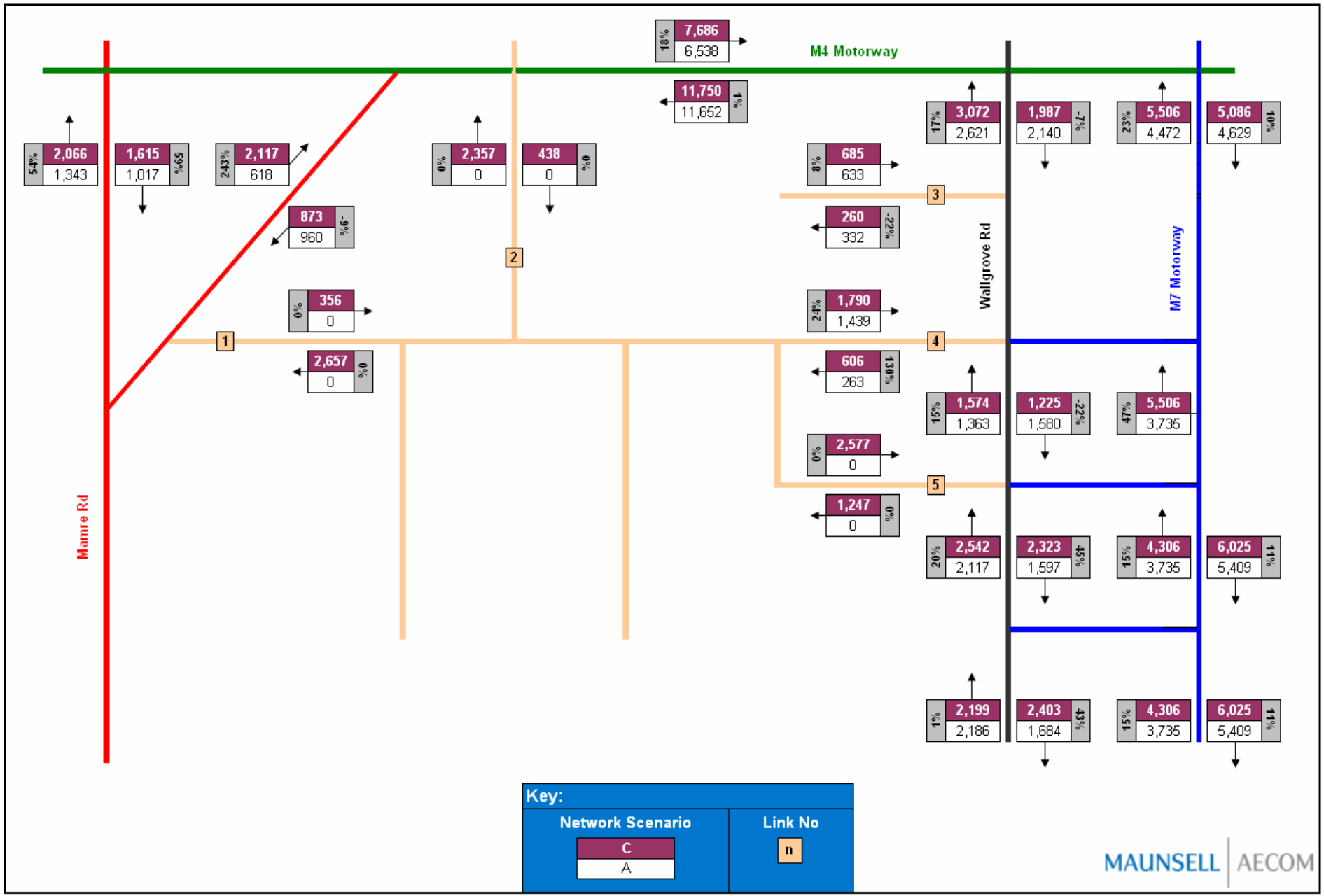


Figure 4.4: 2016 PM 2Hr Peak Link Volume Comparison for NWP| Options C & A (Without NWP & SWP Development)



4.5 Network Performance Measures

4.5.1 Volume-to-Capacity Ratios

The volume-to-capacity (V/C) ratio is a method of assessing congested conditions on road links between intersections. In summary, congested conditions are identified by V/C ratios greater than 1.0, bottlenecks have a value of 1.0, road sections operating close to capacity have a V/C ratio greater than 0.8, and acceptable conditions generally have a V/C ratio less than 0.8.

Tables 4.7 and **4.8** provide details of the modelled 2 hour 2016 inbound and outbound (peak directional) trips (B1) for the AM (07:00-09:00) and PM (16:00-18:00) peaks respectively. The resultant V/C ratios are also included for the following two road network designs:

- 2 Lane Road Network (1 lane in each direction)
- 4 Lane Divided Road Network (2 lanes in each direction)

Table 4.7: 2 Hour AM Peak Inbound Trips and V/C Ratios (2016)

Link No.	Access Road	Inbound Trips	V/C Ratios	
			2 Lane	4 Lane Divided
1	Erskine Park Link Road	2,732	1.37	0.68
2	Archbold Road	3,199	1.60	0.80
3	North South Link	909	0.46	0.23
4	Old Wallgrove Road	2,976	1.41	0.71
5	Direct Connection	2,414	1.14	0.57

Table 4.8: 2 Hour PM Peak Outbound Trips and V/C Ratios (2016)

Link No.	Access Road	Outbound Trips	V/C Ratios	
			2 Lane	4 Lane Divided
1	Erskine Park Link Road	2,685	1.34	0.68
2	Archbold Road	3,114	1.56	0.77
3	North South Link	772	0.39	0.19
4	Old Wallgrove Road	2,696	1.28	0.64
5	Direct Connection	2,673	1.27	0.63

The analysis demonstrates that for the 2 lane road design, the volume-to capacity ratios for all the roads (except the North South Link) are at unacceptable performance levels and the network would operate under heavily congested conditions. This is evident for both the AM and PM peak periods.

In the development of the preferred 4 lane divided road network for the North West Precincts (NWP), the RTA has taken into consideration the comparison of modelled volume-to-capacity ratios for the two designs, in addition to future land and road network developments required for the South West Precincts (SWP).

The volume-to-capacity ratios for the 4 lane divided road design are essentially half of the corresponding 2 lane values, which is a result of doubling the capacity of the road network. The V/C ratios for all access links are less than 0.8, reflecting acceptable un-congested conditions with spare capacity for additional traffic, at that date.

The North South Link could operate as a two lane road. However considering the high volume of heavy vehicle usage in the Hub, provision of vehicular access to the adjoining developments, emergency parking and the flexibility of allowing two, four lane North South Links across the Sydney water supply pipeline in the future, it was concluded that the North South Link would be designed as a four lane road. A sensitivity test was undertaken with a four lane EPLR network and concluded that there are no significant changes to the traffic pattern in the road network.

The EPLR network has been designed with a four lane corridor to accommodate the traffic demand generated by the NWP, with the provision of spare capacity for additional traffic expected from the SWP.

4.5.2 Intersection Analysis

During the project approval stage in addition to the above analysis of road link performance, detailed intersection assessment and micro simulation modelling will be undertaken by the proponents (e.g. relevant Councils or private developers) to ensure that intersections within and surrounding the EPLR network will be able to cope with the increase in traffic as a result of the NWP development. This intersection analysis will form the focus of the subsequent project approval stage.

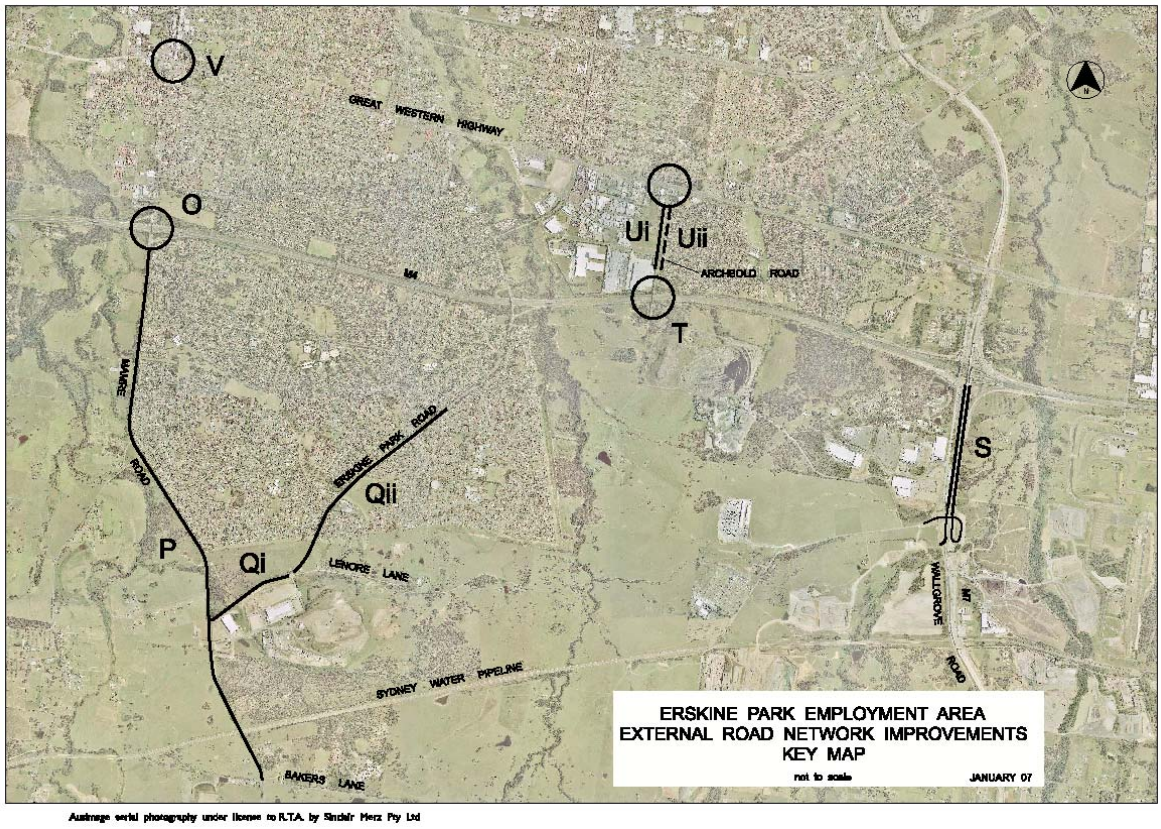
4.6 Improvements Required on the Adjoining Road Network

Based on the modelling analysis, it has been identified that the adjoining external road network needs to be improved to accommodate the traffic demand that will be generated from NWP and SWP of the Hub development. Details of the improvements are identified in **Table 4.9 and Figure 4.5**.

Table 4.9: External Road Network Improvements Required to Support the Proposal

No.	Description
External road improvements required for NWP	
O	Mamre Road – Bridge over M4 (Duplication & ramp upgrade)
Ui	Archbold Rd – Great Western Highway to M4 (Reconstruct to 2 lanes including intersection with GWH)
P	Mamre Road – M4 to Bakers Lane (Reconstruct Mamre Road to 4 lanes divided)
Qi	Erskine Park Road – Lenore Lane to Mamre Road (Complete construction to 4 lanes divided)
T	M4 – Archbold Rd west facing ramps
Uii	Archbold Rd – Great Western Highway to M4 (Reconstruct to 4 lanes)
Qii	Erskine Park Rd – Coonawarra Dr to Lenore Lane (Complete construction to 4 lanes divided)
V	Mamre Rd intersection with Great Western Highway
External road improvements required for SWP	
S	M7 – Additional 2 southbound lanes and 1 northbound lane between M4 & Old Wallgrove Rd, including the widening of access ramps to and from Wallgrove Road at Old Wallgrove Rd

Figure 4.5: Locations of External Road Network Improvements



4.7 Summary

This section provided an overview of the modelling process that was undertaken by the RTA to define the road network that will be required to service the NWP and connections to SWP of the Hub, by developing a preferred network from the assessment of alternative internal and external road link options for a fully developed NWP and SWP of the Hub.

A broad assessment of the various future year road network options identified the change in traffic volumes on the surrounding road network and compared traffic impacts with the preferred option. As envisaged, the traffic flow distributions of each scenario are a reflection of the road scheme modelled.

The preferred RTA option for both NWP and SWP development is a road network similar to **Option B1 or B8**, as the design is likely to provide the optimal traffic outcome, based on the multiple external connections that will facilitate an even distribution of trips across the main internal access links to the NWP & SWP developments.

The network Options C was derived from Option B1 and B8. Option C is same as Option B1 and B8 within NWP. As a result, **Option C** is defined as the EPLR network that will be required to service the NWP of the Hub, which is designed to accommodate additional traffic that will eventually be generated from the SWP. Therefore Option C has been selected for environmental assessment of the Concept Plan approval.

This section provided a summary of the fully developed Hub modelling results by comparing forecast traffic volumes with (based on the Option B1 & B8) and without the proposed NWP & SWP development. The difference highlights that the proposed development will significantly increase traffic flows on the surrounding road network for both the AM and PM peak 2 hour periods. Traffic flows on the M7 would increase by approximately 65~70% southbound in the AM peak and 60~62% northbound in the PM peak; which equates to approximately 1,500 vehicles per hour in both peaks.

Furthermore, a substantial increase in AM and PM peak traffic volumes are forecast on local links, including Wallgrove, Mamre and Erskine Park Road. During the AM peak, additional traffic volumes will range from 38~49% (500~700 veh/2h) northbound on Wallgrove Road to 366~380% (2,300~2,400 veh/2h) southbound on Erskine Park Road. Similar increases are forecast in the PM peak, ranging from 42~48% (1,100~1,250 veh/2hr) northbound on Wallgrove Road to 330~351% (2,050~2,200 veh/2h) northbound on Erskine Park Road.

A summary of the NWP modelling results was also included in this section by comparing forecast traffic volumes with (Option C) and without the proposed NWP and SWP development. The difference highlights that the proposed NWP development will increase traffic flows on the surrounding road network for both the AM and PM peak 2 hour periods. Traffic flows on the M7 would increase by approximately 24% southbound in the AM peak and 47% northbound in the PM peak; which equates to approximately 500 and 900 vehicles per hour respectively.

Furthermore, an increase in AM and PM peak traffic volumes are forecast on local links, including Wallgrove, Mamre and Erskine Park Road. During the AM peak, additional traffic volumes will range from an average of 25% (550 veh/2h) in both directions on Wallgrove Road to 247% (1,550 veh/2h) southbound on Erskine Park Road. Similar increases are forecast in the PM peak, ranging from 20% (400 veh/2hr) northbound on Wallgrove Road to 243% (1,500 veh/2h) northbound on Erskine Park Road.

Based on the modelling analysis, a list of external roads that require upgrading to accommodate the traffic demand generated from NWP and SWP of the Hub development, have been identified. However the improvement on the external roads do not form part of this concept plan approval.

5.0 Summary of Stakeholder Modelling Reports

Maunsell has reviewed a selection of reports for studies undertaken by individual stakeholders in the proposed development areas. A list of documents reviewed is provided in **Table 5.1**.

The initial strategy was to review the traffic modelling and assumptions detailed in the stakeholder reports, provide a summary and then compare with the RTA using a comparison matrix based approach. However, the consistency and level of data in each report varies and it is impossible to derive a common ground in which to develop a comparison matrix. As a result, Maunsell has undertaken a thorough review and detailed the key assumptions, modelling techniques and conclusions of each report, which were considered by the RTA in developing the required road network and integrated where appropriate.

Table 5.1: List of Maunsell Reviewed Stakeholder Reports

ID	Report	Source	Stakeholder	Release Date
A	Erskine Park Employment Area to M7	JBA	Jacfin Pty Ltd	Dec 2004 / Mar 2005
B	Supplementary Report Volume 3	JBA	Jacfin Pty Ltd	Feb 2006
C	Eastern Creek Business Park Stage 3 Precinct Plan	Blacktown City Council	Blacktown City Council	May 2004
D	Eastern Creek Precinct Plan - Transport Management & Accessibility Plan (TMAP)	SKM	Eastern Creek Landowners Group	Nov 2003
E	CSR Transport Assessment Report	TRAFFIX	CSR Limited	Apr 2004
F	TIA of Proposed Bulk Earthworks - Lot 5, Erskine Pk Employment Area	TRAFFIX	CSR Limited	Aug 2005
G	Proposed Coles Myer National Distribution Centre	SKM	Macquarie Goodman	Nov 2004
H	Proposed Coles Myer National Distribution Centre	Traffic Solutions	Coles Myer Ltd	Mar 2005
I	Proposed Coca Cola Distribution Facility	SKM	Macquarie Goodman	Dec 2004
J	Proposed Light Horse Business Centre	Masson/Wilson /Twiney	Joshua Farkash & Associates Pty Ltd	Apr 2006
K	Statement of Environmental Effects - Lysaght Sydney Manufacturing & Distribution Facility	SKM		Sep 2004
L	Statement of Environmental Effects - Paintline & Service Centre	SKM		Aug 2004

Report A - Erskine Park Employment Area to M7

The report was prepared by JBA with the assistance of independent traffic modelling, undertaken by Sinclair Knight Merz (SKM) and Hutcheson Transport Solutions (HTS). In addition, further traffic analysis was provided by Christopher Hallam & Associates (CHA).

The report reviews the impact of a single east-west Lenore Lane extension link, across Ropes Creek and onto Old Wallgrove Road and states that this new link will attract trips not only from the Erksine Park Employment Area, but also from Mamre Road to the M7. Furthermore, the modelling assesses the impact of the Lot 5 Ropes Creek State Environmental Planning Policy number 59 (SEPP 59) development, based on a development area of approximately 80 hectares.

The SKM and HTS 2016 modelling was based on the traffic model developed for the Western Sydney Orbital Environmental Impact Study (EIS), which was further refined to replicate the changes in traffic patterns in Western Sydney and highlight the resultant impact on peak hour trips.

Traffic generation provided in the RTA's *Guide to Traffic Generating Developments*, were developed through an aggregation of results from surveys at ten industrial and factory developments. The resultant employee density of 28 employees per hectare was developed. The analysis of aggregated generation figures resulted in 0.318 veh/hr/employee in the morning peak and 0.365 veh/hr/employee in the evening peak. This equates to traffic generation rates of 8.904 veh/hr/ha in the morning peak and 10.22 veh/hr/ha in the evening peak, averaging 9.56 veh/hr/ha.

A public transport planning reduction factor of 10% was applied to the SEPP59 area, as it was assumed that a Public Transport (PT) initiative programme would be developed. No reduction factor was applied to the Erskine Park industrial development, but was used in the generation analysis for other sites including Lot 11 Wallgrove Road.

Seven model scenarios were addressed in the report, which were based on different development areas, road network improvements (including a revised east-west route alignment) and trip generation rates.

The report concludes that in 2016 with full development at Eastern Creek, the Old Wallgrove Road & M7 interchange would be at capacity. The proposed Lenore Lane link road would only promote the value and development potential of the Erskine Park development.

Finally, the inclusion of Erskine Park industrial area and Lot 5 traffic to Old Wallgrove Road and the M7 interchange will have significant adverse impact on the capacity and delay at the intersection, which will affect accessibility to the Eastern Creek area.

Report B – Supplementary Report Volume 3

The supplementary report was prepared by JBA consultants in February 2006 and includes a review of the Metro Strategy, Western Sydney Employment Hub (the Hub) announcement and implications on the proposed link road to the M7.

The first section provides details of outstanding strategic traffic issues affecting the Hub. A summary of the existing position is included and suggests that the a new link road from Erskine Park, extending Lenore Lane to Old Wallgrove Road/M7 interchange, would increase congestion at the junction and have adverse traffic impacts for trips to/from the Erskine Park and Eastern Creek development areas.

Further sections discuss the identified traffic problems including: Erskine Park has no need for a third link road, the M7/Old Wallgrove interchange has no spare capacity during peak periods and that Blacktown City Council and Eastern Creek landowners oppose the Lenore Lane Link Road.

A solution to the above problems (and in response to an additional 400 hectares of developable area south of the water supply pipeline) is offered in the form of an east-west link road south of the water supply pipeline from Mamre Road to Wallgrove Road at the Southern Route Extension, including a proposed M7 interchange at the Southern Route Extension.

The main body of the report provides details of previous traffic studies and reviews the Metro Strategy and Hub development. In conclusion, the report compares the adverse impacts of the Lenore Lane Link Road and highlights the advantages of the preferred route to the south of the water pipeline.

The report includes appendices, which provide details of additional traffic modelling studies undertaken by consultants. Each study reviews the traffic implications of the proposed development area south of the water pipeline, based on the southern east-west link and the following traffic generation assumptions:

- Total developable area of 1290 hectares;
- Trip rates of 0.286 veh/hr/employee (AM peak) and 0.329 veh/hr/employee (PM peak); and
- Resultant trip totals of 12,600 vehicles per hour in the weekday morning peak hour and 14,500 vehicles per hour in the weekday afternoon peak hour.

Report C - Eastern Creek Business Park Stage 3 Precinct Plan

A total development of 690 hectares of land located at the M4 & M7 intersection (proposed by Blacktown City Council as part of the SEPP 59 Plan) was assessed in this study.

The network improvements proposed in this study area includes the intersections of Old Wallgrove/Wallgrove Road and Wallgrove/Austral Bricks Access Road South, as well as a bus only link at Archbold Road.

One of the key elements is the introduction of mode shift for the proposed development areas, which aim to achieve a 10% reduction in car share for home-based work trips in accordance with SEPP 59. Under the proposal, public buses will be provided to Eastern Creek with a plan to integrating Stage 1 and 2 developments to assist in increasing service frequencies. A new cycle path would also be integrated with Blacktown and M7 system to further encourage reduction of car trips generated from the proposed development area.

Report D - Eastern Creek Precinct Plan—Transport Management & Accessibility Plan (TMAP)

SKM undertook the study on behalf of the Eastern Creek Landowners Group using their NETANAL traffic model. Assumptions on regional and local networks, including those in other known development proposals in Western Sydney, were included in the modelling. The study assumed a total of 360 hectares of developed land in the precinct, under the scenarios of 20% of developable land taken up by 2006, 60% by 2011 and 100% by 2016, as well as the 2006 short term (20%) and 2016 long term (100%) occupancy scenarios .

The proposed network improvements includes upgrades at the intersections of M7/Wallgrove Road/Old Wallgrove Road, Wallgrove Road/Austral Brick Access Road South, Great Western Highway/Wallgrove Road and Wallgrove Road/M7 Ramp.

A set of road hierarchy is also recommended, which includes:

- 4-lane section on Wallgrove Road (0.65 km in length, 27 m in width);
- 4-lane section on Old Wallgrove Road (0.90 km in length, 25 m in width);
- a 7.5 km 4-lane undivided road 21 m in width;
- a 2.1 km 2-lane road 18 m in width;
- 2-lane section of bus only link on Archbold Road, with 10m in width; and
- 3 dual-lane roundabouts.

The trip generation rates for the proposed developments were adopted from the RTA’s guide to traffic generation (Oct 2002) derived for industrial/factory land use purposes, equating approximately 9 trips per hectare of developable area. In summary, the proposed development generates 3,205 trips (0.318 per employee) and 3,656 trips (0.362 trips per employee) in the AM and PM peak hour respectively, for an estimated total of 10,080 employees within the proposed development area. It is assumed that the inbound and outbound split is 85%/15% in the morning peak and 15%/85% in the evening peak periods.

The model adopted the existing model splits from Huntingwood Estate for the Eastern Creek precinct, revised with a 10% reduction in vehicle trip rates due to SEPP 59 transport initiatives, resulting in a total of 2,885 vehicle trips in the morning peak.

Report E - CSR Transport Assessment

The proposed developable area (with a mixed land use of warehousing, factory and freestanding office) is located east of Mamre Road about 3.5 km south of the M4, with a total 104.9 hectares of developable area, equivalent to approximately 50 hectares of industrial floor area, based on a Floor Space Ratio (FSR) of 0.48.

The proposed site would be divided into two precincts (eastern and western) with access to site via private roads located 200m south of the Erskine Park Road.

The proposed network improvements considered in the report includes the widening of:

- Mamre Road to two-lane/two-way between Crown Road Reserve and Luddenham Road;
- Erskine Park Road to two-lane/two-way between Mamre Road and Lenore Lane; and
- Lenore Lane between Erskine Park and Western Site access.

The study assumes a 60% development potential by 2011 and fully developed (further 40%) by 2016, where a total of 3,250 trips per hour (two-way) will be generated in the AM peak for both eastern and western sites. It is also assumed that 70% of trips would occur in the direction of peak flow.

The traffic model takes into consideration a 10% reduction in trip rates across the network due to a mode shift to public transport. The report also recommended further analysis in appropriateness of 10% reduction of trip rate applied to development sites.

Report F - Traffic Impact Assessment of Proposed Bulk Earthworks - Lot 5, Erskine Pk Employment Area

The proposed development area (33.4 hectares in total) is located to the east of Mamre Road, approximately 3.5 km south M4. Also included in the proposal is a new road connecting to a proposed facility designated as Road 1. For planning purposes a trip rate per link volume on Road 1 was assumed to be less than 800 vehicles per hour.

The study used the Penrith Council/RTA agreed trip rates (as well as distribution) adopted by the Coles Myer Development Application (DA) Report, which assumes:

- 10 trips/hectare for Lysaght/BlueScope/Walker & Strammit Sites; and
- 15 trips/hectare for the remaining of Erskine Park Employment Area, including the CSR MasterPlan site.

The combined impact of 640 vehicles in peak hour on Road 1 will be generated by the development, lower than the rate of 800 vehicles per hour designed for Road 1. Therefore, it is concluded by the report that the committed future road infrastructure will accommodate the trip generated by the developments.

No reference to public transport mode split assumptions has been documented in the report.

Report G - Proposed Coles Myer National Distribution Centre (SKM)

The proposed Coles Myer National Distribution Centre would occupy 20 hectares (out of the total of 63 hectares) of the Western Precinct, predominantly of light industrial purpose, including warehouses and office space. It would be connecting to the road network via the internal road system of the Western Precinct to Old Wallgrove Road and then to Wallgrove Road at the M7.

The network improvement considered in the report includes a proposed roundabout at Old Wallgrove Road/Road 21.

The proposed development assumed 0.43 hectares of office space and 6.6 hectares of warehouse/distribution purpose. A significant parking facility is proposed for 473 cars, 50 prime mover, 35 B-Double, 15 inbound and 9 outbound trucks.

The trip generation for site is based solely on previous experience from other similar facility (i.e. no trip rates had been specified for the study). However, it is found that the development would generate less traffic compared with results obtained from standard calculation method.

In summary, an estimated total of 1,940 vehicles per day would be generated from the site, with a significant portion of 45% Heavy Goods Vehicles (HGV).

No reference to public transport mode split assumption has been documented in the report.

Report H - Proposed Coles Myer National Distribution Centre (Traffic Solutions)

The site location of the proposed Coles Myer National Distribution Centre described in this report is different from the corresponding study conducted by SKM, with discrepancies in total area of development.

The proposed development includes 0.43 hectares of office space, 6.9 hectares of warehouse/distribution, and parking provided for 570 cars. A comparison trip rate of 0.5 trips per 100 m^2 is derived, based on a total of 349 AM peak trips on 69,806m^2.

In summary, a total of 1,914 trips (two-way) per day would be generated from the site, with similar heavy vehicle (45%) proportion obtained from corresponding SKM study.

No details on network improvements or public transport mode split assumption have been documented in the report.

Report I - Proposed Coca-Cola Distribution Facility

The proposed development is located in the Eastern Creek Precinct of the M7 business hub. The distribution facility would occupy 15 hectares (out of 32.3 hectares) of the precinct area. The facility would consist 3,000m^2 of office space and 46000m^2 of warehouse and distribution.

A new access road with a signalised intersection with Wallgrove Road has been proposed as part of network improvements.

In summary, a total of 2,171 daily trips would be generated from the distribution facility, with 296 and 158 trips in the AM and PM peak period, respectively. It is also estimated from the report that a total of 7,610 daily trips would be generated from the Eastern Creek Precinct, with 1,066 and 610 trips generated in the AM and PM peak periods respectively. The study assumes the inbound and outbound split of 80%/20% in the AM and 20%/80% in the PM peak period. A 50 % to/from via site access and 50% to/from via south access has also been specified for the study.

No reference to public transport mode split assumptions has been documented in the report.

Report J - Proposed Light Horse Business Centre

The proposed development is located on land connected to former Pioneer Quarry (near M4), occupies 96 hectares of land area. Two cases of land use scenarios had been assessed:

- Case 1: 60 hectares of business centre; and
- Case 2: 44.8 hectares of business centre with 14.2 hectares of material processing centre.

Masson/Wilson/Twiney (MWT) maintained the trip generation rate for the corresponding study conducted by Arup, by adjusting the total trip generation by factor of 0.81 to reflect a reduced total land development (74 hectares of development was assumed in Arup's study).

Commercial vehicle proportions of 3.5% in the AM and 4% in the PM peak period were used based on Table 3.4 of RTA "Guide to Traffic Generating Developments". It is also expected that the quarry filling would generate up to 40 two-way truck movements per hour.

The inbound/outbound split (in vehicle) of 85%/15% is assumed in the AM, with 15%/85% for the PM peak. In summary, an estimated total of 946 Passenger Car Units (PCU) would be generated in the AM, a corresponding total of 1,078 PCU vehicles for the PM peak in Case 1. Correspondingly, the estimated total of 850 and 949 PCU would be generated for the AM and PM peak in Case 2 respectively.

The report made reference to public transport that no trips travelling to/from proposed development site were made from the closest railway stations (Rooty Hill and Mount Druitt) or busway services (route 737, 738 & 772).

Report K - Statement of Environmental Effects - Lysaght Sydney Manufacturing & Distribution Facility

The proposed distribution facility would consist of a total building area of 3.12 hectares. SKM made reference to CSR Site TAR in their Netanal modelling. The network improvements considered in the study are as identified in the Erskine Park Employment Area DCP.

In summary, a total of 81 trips (two-way) in AM peak and a total of 37 trips in PM peak are generated from the proposed facility. No reference to public transport mode split assumptions has been documented in the report.

The report provides the trip distributions for destination locations, which shows:

- 55% to metropolitan north, south and east via M7;
- 27% to local north, south and west via Mamre Road and Erskine Park Road; and
- 18% to Newcastle and Wollongong via M7.

Report L - Statement of Environmental Effects – Paintline & Service Centre

The proposed distribution facility consists of 30,000m^2 in total area. It is assumed 60% development by 2011 and 100% by 2016.

The network improvements considered in the study include:

- Realignment and widening of Lenore Lane;
- Upgrading traffic signals at Erskine Park Road/Lenore Lane Intersection;
- Upgrading traffic signals at Erskine Park Road/Mamre Lane Intersection;
- Widening a section of Mamre Road and installation of traffic signal at completed western access road; and
- Construction of new link road between the M7 and Lenore Lane with cross-bridge over Ropes Creek.

In summary, a total of 64 trips (two-way) in AM peak and a total of 37 trips in PM peak are generated from the proposed facility. No reference to public transport mode split assumptions has been documented in the report.

6.0 Conclusion

Analysis of the calibrated base year network has demonstrated that the RTA EMME/2 model reasonably reflects existing traffic conditions across the road network, particularly in the immediate vicinity of the Western Sydney Employment Hub (the Hub) development area. The model has shown a good correlation between observed and modelled traffic flows across most analysed screenlines and the majority of network links, for both the AM and PM peak periods.

Significantly the 2006 M7 response model has been shown to reproduce a good correlation between observed and modelled link volumes on sections of the motorway adjacent to the development area. In addition, volumes on Wallgrove Road are a good match and slight variations are most likely due to M7 construction traffic during the survey period.

Maunsell consider that the calibrated RTA EMME/2 model is a suitable and robust basis for the assessment of traffic impacts generated from the proposed Hub development.

The modelling methodology identified the specific model developments that were required for the study area, with a particular focus on the local area assumptions including details of land use, trip generation, trip distribution and road network improvements. A review of the parameters used for each stage, showed that the RTA assumptions are appropriate for the purpose of this proposal.

In order to define the road network that will be required within the North West Precinct (NWP) of the Hub, the RTA developed a preferred network from the assessment of alternative internal and external road link options for a fully developed NWP and South West Precinct (SWP) development, which is designed to accommodate additional traffic that will eventually be generated from the SWP.

It was concluded that of the options evaluated, a road network similar to Option B1 or B8 is likely to provide the optimal traffic outcome, based on the multiple external connections that will facilitate an even distribution of trips across the main internal access links to the NWP & SWP developments.

Based on the road network (Option B1 or B8) that are required for both NWP and SWP, the Erskine Park Link Road (EPLR) network (Option C) for the NWP was defined.

Stakeholders input was considered by the RTA in developing the required road network and integrated where appropriate.

As a result, **Option C** is defined as the Erskine Park Link Road (EPLR) network that will be required to service the NWP of the Hub, which is designed to accommodate additional traffic that will eventually be generated from SWP. Therefore Option C has been selected for environmental assessment of the Concept Plan approval.

To identify the impacts on external road network, analysis of the fully developed NWP and SWP modelling results was undertaken by comparing forecast traffic volumes with (based on the Option B1 & B8) and without the proposed NWP & SWP development. The difference highlights that the proposed development will significantly increase traffic flows on the surrounding road network for both the AM and PM peak 2 hour periods. Traffic flows on the M7 would increase by approximately 65~70% southbound in the AM peak and 60~62% northbound in the PM peak, which equates to approximately 1,500 vehicles per hour in both peaks.

Furthermore, a substantial increase in AM and PM peak traffic volumes are forecast on local links, including Wallgrove, Mamre and Erskine Park Road. During the AM peak, additional traffic volumes will range from 38~49% (500~700 veh/2h) northbound on Wallgrove Road to 366~380% (2,300~2,400 veh/2h) southbound on Erskine Park Road. Similar increases are forecast in the PM peak, ranging

from 42~48% (1,100~1,250 veh/2hr) northbound on Wallgrove Road to 330~351% (2,050~2,200 veh/2h) northbound on Erskine Park Road.

A summary of the NWP modelling results was also undertaken by comparing forecast traffic volumes with (Option C) and without the proposed NWP development. The difference highlights that the proposed NWP development will increase traffic flows on the surrounding road network for both the AM and PM peak 2 hour periods. Traffic flows on the M7 would increase by approximately 24% southbound in the AM peak and 47% northbound in the PM peak, which equates to approximately 500 and 900 vehicles per hour respectively.

Furthermore, an increase in AM and PM peak traffic volumes are forecast on local links, including Wallgrove, Mamre and Erskine Park Road. During the AM peak, additional traffic volumes will range from an average of 25% (550 veh/2h) in both directions on Wallgrove Road to 247% (1,550 veh/2h) southbound on Erskine Park Road. Similar increases are forecast in the PM peak, ranging from 20% (400 veh/2hr) northbound on Wallgrove Road to 243% (1,500 veh/2h) northbound on Erskine Park Road.

Based on the modelling analysis, a list of external roads that require upgrading to accommodate the traffic demand generated from NWP and SWP of the Hub development, have been identified. However the upgrading of external roads do not form part of this Concept Plan approval.

A detailed intersection assessment of the EPLR network's ability to cope with the resultant increase in traffic as a result of the NWP development will form the focus of the subsequent project approval stage. During project approval stage microsimulation modelling could be undertaken to determine intersection requirements of the EPLR network.

Appendix A Base Year Screenline Traffic Volumes

2006 AM 2Hr Peak Screenline Traffic Volumes

Screenline		Location	Dir	North | East						Dir	South | West						Source
				Obs	Model	Diff	%Diff	GEH	%RMSE		Obs	Model	Diff	%Diff	GEH	%RMSE	
1	1.01	Northern Rd, S. of Carrington Rd	Northbound	1,055	1,194	139	13%	4.1		Southbound	1,362	1,245	-117	-9%	3.2		RTA Traffic Count Map
	1.02	Camden Valley Way, S. of Heath Rd	Northbound	2,716	2,656	-60	-2%	1.2		Southbound	1,160	1,182	22	2%	0.6		RTA Traffic Count Map
	1.03	Hume Hwy, S. of Brooks Rd	Northbound	6,279	6,491	212	3%	2.7		Southbound	4,338	4,366	28	1%	0.4		RTA Traffic Count Map
Total | GEH				10,050	10,341	291	3%	**2.9**	5.5%		6,860	6,793	-67	-1%	**0.8**	3.8%	
2	2.01	Cowpasture Rd, N. of Hoxton Park Rd	Northbound	2,050	2,038	-12	-1%	0.3		Southbound	1,300	1,323	23	2%	0.6		RTA Traffic Count Map
	2.02	Cumberland Highway, N. of Bringelly Rd	Northbound	7,861	7,363	-498	-6%	5.7		Southbound	3,999	3,968	-31	-1%	0.5		RTA Traffic Count Map
Total | GEH				9,911	9,401	-510	-5%	**5.2**	10.1%		5,299	5,291	-8	0%	**0.1**	1.5%	
3	3.01	Walgrove Rd, N. of Elizabeth Dr	Northbound	2,346	1,816	-530	-23%	11.6		Southbound	938	487	-451	-48%	16.9		65.013.N/S
	3.02	Cowpasture Rd, at Orphan School Crk	Northbound	2,762	3,201	439	16%	8.0		Southbound	1,694	1,559	-135	-8%	3.3		65.151.N/S
	3.03	Mimosa Rd, at Orphan School Crk	Northbound	1,154	1,000	-154	-13%	4.7		Southbound	858	1,297	439	51%	13.4		65.147.N/S
	3.04	Smithfield Rd, at Orphan School Crk	Northbound	1,798	1,799	1	0%	0.0		Southbound	1,310	894	-416	-32%	12.5		65.148.N/S
	3.05	Hamilton Rd, at Orphan School Crk	Northbound	1,392	982	-410	-29%	11.9		Southbound	614	426	-188	-31%	8.2		65.150.E/W
	3.06	King Rd, at Orphan School Crk	Northbound	1,364	931	-433	-32%	12.8		Southbound	896	320	-576	-64%	23.4		65.149.N/S
	3.07	Cumberland Highway, S. of Canley Vale Rd	Northbound	3,604	3,702	98	3%	1.6		Southbound	2,896	2,915	19	1%	0.4		RTA Traffic Count Map
Total | GEH				14,420	13,431	-989	-7%	**8.4**	18.4%		9,206	7,898	-1,308	-14%	**14.1**	30.3%	
4	4.01	Newbridge Rd, at Georges River	Eastbound	3,398	3,392	-6	0%	0.1		Westbound	3,388	3,592	204	6%	3.5		RTA Traffic Count Map
	4.02	South-Western Mwy, at Georges River	Eastbound	9,921	10,265	344	3%	3.4		Westbound	6,955	6,874	-81	-1%	1.0		RTA Traffic Count Map
Total | GEH				13,319	13,657	338	3%	**2.9**	5.2%		10,343	10,466	123	1%	**1.2**	4.2%	
5	5.01	Mamre Rd, at Water Supply Line	Northbound	1,100	1,291	191	17%	5.5		Southbound	1,706	2,116	410	24%	9.4		86.044.N/S
	5.02	Walgrove Rd, at Water Supply Line	Northbound	2,551	2,276	-275	-11%	5.6		Southbound	2,606	2,388	-218	-8%	4.4		RTA Traffic Count Map
	5.03	Ferrers Rd, at Water Supply Line	Northbound	1,448	1,363	-85	-6%	2.3		Southbound	1,884	1,774	-110	-6%	2.6		66.237.N/S
	5.04	Gipps Rd, S. of Long St	Northbound	2,098	2,110	12	1%	0.3		Southbound	2,180	2,313	133	6%	2.8		RTA Traffic Count Map
	5.05	Cumberland Hwy, S. of Long St	Northbound	5,553	5,640	87	2%	1.2		Southbound	4,106	4,202	96	2%	1.5		RTA Traffic Count Map
	5.06	Polding St Nth, at Prospect Creek	Northbound	2,284	2,415	131	6%	2.7		Southbound	1,276	1,592	316	25%	8.3		66.086.N/S
Total | GEH				15,034	15,095	61	0%	**0.5**	6.8%		13,758	14,385	627	5%	**5.3**	11.6%	
6	6.01	Carlisle Av, at Railway Overbridge	Northbound	2,664	2,226	-438	-16%	8.9		Southbound	2,158	1,974	-184	-9%	4.0		71.082.N/S
	6.02	Fracis Rd, N. of Railway Overbridge	Northbound	1,472	1,036	-436	-30%	12.3		Southbound	1,836	1,615	-221	-12%	5.3		71.046.N/S
	6.03	Philip Pky, N. of Railway Overpass	Northbound	774	1,059	285	37%	9.4		Southbound	1,440	1,933	493	34%	12.0		69.193.N/S
	6.04	Knox Rd, S. of Cross St	Northbound	1,716	1,878	162	9%	3.8		Southbound	3,024	3,275	251	8%	4.5		70.154.N/S
	6.05	Lancaster St, at Railway Crossing	Northbound	947	1,142	195	21%	6.0		Southbound	1,320	3,211	1,891	143%	39.7		RTA Traffic Count Map
	6.06	Balmoral St, at Railway Bridge	Northbound	1,549	1,676	127	8%	3.2		Southbound	2,076	2,404	328	16%	6.9		RTA Traffic Count Map
	6.07	Sunnyholt Rd, at Railway Br	Northbound	2,439	2,416	-23	-1%	0.5		Southbound	3,417	3,447	30	1%	0.5		RTA Traffic Count Map
	6.08	Prospect Hwy, at Railway Overbridge	Northbound	3,517	3,426	-91	-3%	1.5		Southbound	3,749	3,606	-143	-4%	2.4		RTA Traffic Count Map
	6.09	Station Rd at Girraween Crk	Northbound	2,062	1,386	-676	-33%	16.3		Southbound	1,936	1,858	-78	-4%	1.8		69.203.E/S
	6.10	Old Windsor Rd, N. of Hammers Rd	Northbound	3,470	3,582	112	3%	1.9		Southbound	6,724	6,763	39	1%	0.5		RTA Traffic Count Map
	6.11	Windsor Rd, N. of Hammers Rd	Northbound	1,986	2,094	108	5%	2.4		Southbound	6,115	6,247	132	2%	1.7		RTA Traffic Count Map
Total | GEH				22,596	21,921	-675	-3%	**4.5**	15.7%		33,795	36,333	2,538	8%	**13.6**	20.9%	
7	7.01	Richmond Rd, S. of Rooty Hill Rd	Northbound	1,540	1,571	31	2%	0.8		Southbound	2,449	2,596	147	6%	2.9		RTA Traffic Count Map
	7.02	Old Windsor Rd, S. of Balmoral Rd	Northbound	1,967	1,846	-121	-6%	2.8		Southbound	5,429	5,399	-30	-1%	0.4		RTA Traffic Count Map
	7.03	Windsor Rd, N. of Showground Rd	Northbound	2,192	2,272	80	4%	1.7		Southbound	4,023	4,329	306	8%	4.7		RTA Traffic Count Map
Total | GEH				5,699	5,689	-10	0%	**0.1**	5.5%		11,901	12,324	423	4%	**3.8**	6.1%	
8	8.01	Richmond Rd, W. of Knox Rd	Eastbound	2,816	2,786	-30	-1%	0.6		Westbound	2,020	1,755	-265	-13%	6.1		RTA Traffic Count Map
	8.02	Power St, W. of Knox Rd	Eastbound	2,733	2,551	-182	-7%	3.5		Westbound	1,235	1,270	35	3%	1.0		RTA Traffic Count Map
	8.03	Eastern Rd, W. of Knox Rd	Eastbound	2,409	2,063	-346	-14%	7.3		Westbound	1,209	1,079	-130	-11%	3.8		RTA Traffic Count Map
	8.04	Great Western Hwy, at Eastern Creek Br	Eastbound	3,956	4,125	169	4%	2.7		Westbound	1,296	1,240	-56	-4%	1.6		70.001.E/W
	8.05	Western Mwy, E. of Wallgrove Rd	Eastbound	11,000	10,341	-659	-6%	6.4		Westbound	6,000	6,232	232	4%	3.0		Maunsell Estimate
Total | GEH				22,914	21,866	-1,048	-5%	**7.0**	8.6%		11,760	11,576	-184	-2%	**1.7**	8.1%	
9	9.01	Great Western Hwy, W. of Beaconsfield Rd	Eastbound	3,826	4,919	1,093	29%	16.5		Westbound	1,476	1,770	294	20%	7.3		71.015.E/W
	9.02	Western Mwy, E. of Reservoir Rd	Eastbound	11,546	10,470	-1,076	-9%	10.3		Westbound	5,672	5,713	41	1%	0.5		71.165.E/W
Total | GEH				15,372	15,389	17	0%	**0.1**	20.0%		7,148	7,483	335	5%	**3.9**	8.3%	
10	10.01	Horsley Dr, E. of Wallgrove Rd	Eastbound	3,000	3,031	31	1%	0.6		Westbound	2,170	1,892	-278	-13%	6.2		RTA Traffic Count Map
	10.02	Elizabeth Dr, E. of Wallgrove Rd	Eastbound	2,070	1,818	-252	-12%	5.7		Westbound	1,592	1,475	-117	-7%	3.0		64.022.E/W
	10.03	Bringelly Rd, E. of Browns Rd	Eastbound	860	896	36	4%	1.2		Westbound	650	568	-82	-13%	3.3		85.092.E/W
	10.04	Camden Valley Way, S. of Heath Rd	Eastbound	2,716	2,656	-60	-2%	1.2		Westbound	1,160	1,182	22	2%	0.6		RTA Traffic Count Map
Total | GEH				8,646	8,401	-245	-3%	**2.7**	7.0%		5,572	5,117	-455	-8%	**6.2**	13.0%	
Total				**137,961**	**135,191**	**-2,770**	**-2%**	**7.5**	**11.6%**		**115,642**	**117,666**	**2,024**	**2%**	**5.9**	**14.3%**	

2006 PM 2Hr Peak Screenline Traffic Volumes

Screenline		Location	Dir	North | East						Dir	South | West						Source
				Obs	Model	Diff	%Diff	GEH	%RMSE		Obs	Model	Diff	%Diff	GEH	%RMSE	
1	1.01	Northern Rd, S. of Carrington Rd	Northbound	1,459	1,400	-59	-4%	1.6		Southbound	1,006	1,084	78	8%	2.4		RTA Traffic Count Map
	1.02	Camden Valley Way, S. of Heath Rd	Northbound	1,218	1,253	35	3%	1.0		Southbound	2,693	2,861	168	6%	3.2		RTA Traffic Count Map
	1.03	Hume Hwy, S. of Brooks Rd	Northbound	4,631	4,732	101	2%	1.5		Southbound	8,053	7,969	-84	-1%	0.9		RTA Traffic Count Map
Total | GEH				7,308	7,385	77	1%	**0.9**	3.5%		11,752	11,914	162	1%	**1.5**	3.7%	
2	2.01	Cowpasture Rd, N. of Hoxton Park Rd	Northbound	1,110	1,674	564	51%	15.1		Southbound	1,340	1,758	418	31%	10.6		RTA Traffic Count Map
	2.02	Cumberland Highway, N. of Bringelly Rd	Northbound	4,755	4,492	-263	-6%	3.9		Southbound	7,537	7,514	-23	0%	0.3		RTA Traffic Count Map
Total | GEH				5,865	6,166	301	5%	**3.9**	21.2%		8,877	9,272	395	4%	**4.1**	9.4%	
3	3.01	Walgrove Rd, N. of Elizabeth Dr	Northbound	1,134	802	-332	-29%	10.7		Southbound	2,248	1,717	-531	-24%	11.9		65.013.N/S
	3.02	Cowpasture Rd, at Orphan School Crk	Northbound	1,616	1,942	326	20%	7.7		Southbound	2,832	2,850	18	1%	0.3		65.151.N/S
	3.03	Mimosa Rd, at Orphan School Crk	Northbound	1,110	1,245	135	12%	3.9		Southbound	1,502	1,250	-252	-17%	6.8		65.147.N/S
	3.04	Smithfield Rd, at Orphan School Crk	Northbound	844	1,035	191	23%	6.2		Southbound	1,962	1,725	-237	-12%	5.5		65.148.N/S
	3.05	Hamilton Rd, at Orphan School Crk	Northbound	712	625	-87	-12%	3.4		Southbound	1,108	777	-331	-30%	10.8		65.150.E/W
	3.06	King Rd, at Orphan School Crk	Northbound	950	511	-439	-46%	16.2		Southbound	1,620	855	-765	-47%	21.7		65.149.N/S
	3.07	Cumberland Highway, S. of Canley Vale Rd	Northbound	2,917	3,026	109	4%	2.0		Southbound	3,664	3,770	106	3%	1.7		RTA Traffic Count Map
Total | GEH				9,283	9,186	-91	-1%	**1.0**	21.4%		14,936	12,944	-1,992	-13%	**16.9**	20.1%	
4	4.01	Newbridge Rd, at Georges River	Eastbound	3,308	3,073	-235	-7%	4.2		Westbound	3,815	3,962	147	4%	2.4		RTA Traffic Count Map
	4.02	South-Western Mwy, at Georges River	Eastbound	6,876	6,748	-128	-2%	1.6		Westbound	11,058	10,673	-385	-3%	3.7		RTA Traffic Count Map
Total | GEH				10,104	9,021	-363	-4%	**3.6**	5.3%		14,073	14,635	-230	-2%	**2.0**	5.5%	
5	5.01	Mamre Rd, at Water Supply Line	Northbound	1,234	1,038	-196	-16%	5.8		Southbound	862	1,120	258	30%	8.2		86.044.N/S
	5.02	Walgrove Rd, at Water Supply Line	Northbound	2,627	2,676	49	2%	1.0		Southbound	2,834	2,263	-571	-20%	11.3		RTA Traffic Count Map
	5.03	Ferrers Rd, at Water Supply Line	Northbound	1,940	1,696	-244	-13%	5.7		Southbound	1,426	1,344	-82	-6%	2.2		66.237.N/S
	5.04	Gipps Rd, S. of Long St	Northbound	2,090	2,183	93	4%	2.0		Southbound	2,195	2,301	106	5%	2.2		RTA Traffic Count Map
	5.05	Cumberland Hwy, S. of Long St	Northbound	4,148	3,931	-217	-5%	3.4		Southbound	5,500	5,224	-276	-5%	3.8		66.248.N/S
	5.06	Polding St Nth, at Prospect Creek	Northbound	1,190	1,720	530	45%	13.9		Southbound	2,166	2,350	184	8%	3.9		66.086.N/S
Total | GEH				13,229	13,244	-102	0%	**0.1**	13.4%		14,983	14,602	-381	-3%	**3.1**	12.9%	
6	6.01	Carlisle Av, at Railway Overbridge	Northbound	3,324	3,165	-159	-5%	2.8		Southbound	3,476	3,273	-203	-6%	3.5		71.082.N/S
	6.02	Fracis Rd, N. of Railway Overbridge	Northbound	2,490	1,802	-688	-28%	14.9		Southbound	1,888	1,382	-506	-27%	12.5		71.046.N/S
	6.03	Philip Pky, N. of Railway Overpass	Northbound	1,500	1,690	190	13%	4.8		Southbound	936	810	-126	-13%	4.3		69.193.N/S
	6.04	Knox Rd, S. of Cross St	Northbound	3,074	2,706	-368	-12%	6.8		Southbound	1,976	2,165	189	10%	4.2		70.154.N/S
	6.05	Lancaster St, at Railway Crossing	Northbound	1,825	2,506	681	37%	14.6		Southbound	1,064	1,552	488	46%	13.5		RTA Traffic Count Map
	6.06	Balmoral St, at Railway Bridge	Northbound	2,656	2,356	-300	-11%	6.0		Southbound	2,248	2,265	17	1%	0.4		RTA Traffic Count Map
	6.07	Sunnyholt Rd, at Railway Br	Northbound	3,174	3,215	41	1%	0.7		Southbound	3,229	3,220	-9	0%	0.2		RTA Traffic Count Map
	6.08	Prospect Hwy, at Railway Overbridge	Northbound	4,357	4,224	-133	-3%	2.0		Southbound	4,198	3,988	-210	-5%	3.3		RTA Traffic Count Map
	6.09	Station Rd at Girraween Crk	Northbound	1,910	1,860	-50	-3%	1.2		Southbound	1,802	1,483	-319	-18%	7.9		69.203.E/S
	6.10	Old Windsor Rd, N. of Hammers Rd	Northbound	5,510	5,706	196	4%	2.6		Southbound	4,080	4,013	-67	-2%	1.1		RTA Traffic Count Map
	6.11	Windsor Rd, N. of Hammers Rd	Northbound	4,723	4,843	120	3%	1.7		Southbound	2,994	3,207	213	7%	3.8		RTA Traffic Count Map
Total | GEH				34,543	34,073	15	-1%	**2.5**	11.5%		27,891	27,358	-533	-2%	**3.2**	11.0%	
7	7.01	Richmond Rd, S. of Rooty Hill Rd	Northbound	2,580	2,607	27	1%	0.5		Southbound	1,822	1,801	-21	-1%	0.5		RTA Traffic Count Map
	7.02	Old Windsor Rd, S. of Balmoral Rd	Northbound	4,775	4,521	-254	-5%	3.7		Southbound	2,475	2,406	-69	-3%	1.4		RTA Traffic Count Map
	7.03	Windsor Rd, N. of Showground Rd	Northbound	3,983	4,170	187	5%	2.9		Southbound	2,465	2,502	37	2%	0.7		RTA Traffic Count Map
Total | GEH				11,338	11,298	-40	0%	**0.4**	5.9%		6,762	6,709	-53	-1%	**0.6**	2.5%	
8	8.01	Richmond Rd, W. of Knox Rd	Eastbound	2,544	2,245	-299	-12%	6.1		Westbound	3,604	3,458	-146	-4%	2.5		RTA Traffic Count Map
	8.02	Power St, W. of Knox Rd	Eastbound	1,249	1,187	-62	-5%	1.8		Westbound	2,254	2,266	12	1%	0.3		RTA Traffic Count Map
	8.03	Eastern Rd, W. of Knox Rd	Eastbound	1,404	1,430	26	2%	0.7		Westbound	2,363	2,229	-134	-6%	2.8		RTA Traffic Count Map
	8.04	Great Western Hwy, at Eastern Creek Br	Eastbound	1,646	1,660	14	1%	0.3		Westbound	3,876	3,023	-853	-22%	14.5		70.001.E/W
	8.05	Western Mwy, E. of Wallgrove Rd	Eastbound	6,000	6,103	103	2%	1.3		Westbound	12,000	10,684	-1,316	-11%	12.4		Maunsell Estimate
Total | GEH				12,843	12,625	-218	-2%	**1.9**	6.3%		24,097	21,660	-2,437	-10%	**16.1**	16.4%	
9	9.01	Great Western Hwy, W. of Beaconsfield Rd	Northbound	2,558	1,921	-637	-25%	13.5		Southbound	3,744	3,404	-340	-9%	5.7		71.015.E/W
	9.02	Western Mwy, E. of Reservoir Rd	Northbound	5,672	5,451	-221	-4%	3.0		Southbound	11,452	10,750	-702	-6%	6.7		71.165.E/W
Total | GEH				8,230	7,372	-858	-10%	**9.7**	16.4%		15,196	14,154	-1,042	-7%	**8.6**	10.3%	
10	10.01	Horsley Dr, E. of Wallgrove Rd	Eastbound	2,501	2,047	-454	-18%	9.5		Westbound	2,965	3,225	260	9%	4.7		RTA Traffic Count Map
	10.02	Elizabeth Dr, E. of Wallgrove Rd	Eastbound	1,906	1,730	-176	-9%	4.1		Westbound	2,226	1,950	-276	-12%	6.0		64.022.E/W
	10.03	Bringelly Rd, E. of Browns Rd	Eastbound	610	701	91	15%	3.6		Westbound	796	660	-136	-17%	5.0		85.092.E/W
	10.04	Camden Valley Way, S. of Heath Rd	Eastbound	1,218	1,253	35	3%	1.0		Westbound	2,693	2,861	168	6%	3.2		RTA Traffic Count Map
Total | GEH				6,235	5,731	-504	-8%	**6.5**	18.4%		8,680	8,696	16	0%	**0.2**	11.6%	
Total				**119,058**	**116,901**	**-2,157**	**-2%**	**6.3**	**10.8%**		**148,047**	**141,944**	**-6,103**	**-4%**	**16.0**	**11.3%**	

Appendix B Network Scenarios – AM/PM Peak Link Flows

Network Options A, B – B8 & C: 2016 AM 2Hr Peak Link Flows

Location	North | Eastbound										South | Westbound									
	A	B	B1	B2	B3	B4	B5	B6	B7	B8	A	B	B1	B2	B3	B4	B5	B6	B7	B8
Mamre Rd	1,054	1,082	1,094	692	1,026	728	836	1,071	938	1,272	1,279	3,546	3,568	3,659	3,616	3,645	2,972	3,565	3,374	**3,765**
Erskine Pk Rd	884	712	738	699	751	687	743	739	**1,015**	738	630	2,925	2,934	**3,468**	2,963	3,275	2,865	3,007	3,230	3,027
Erskine Pk Link Rd	0	2,706	2,732	**3,314**	2,805	3,110	2,787	2,825	2,787	2,943	0	234	263	276	266	276	227	272	**418**	291
Southern Route	0	2,904	2,894	**3,986**	3,021	3,943	2,627	2,936	3,024	2,740	0	448	446	432	472	427	516	469	**589**	447
Archbold Rd	0	**663**	610	617	616	617	611	613	512	618	0	3,349	3,199	2,730	**3,368**	3,294	3,290	3,225	3,166	3,073
Wonderland Dr	**316**	181	202	216	202	201	201	202	203	200	1,160	948	976	1,381	**1,388**	1,200	983	979	1,023	987
Old Wallgrove Rd	279	826	823	1,199	**1,674**	1,196	826	1,130	733	894	912	2,746	2,976	3,366	**4,267**	3,267	2,694	3,042	2,740	2,877
Direct Connection (Link 5)	0	1,008	1,022	1,514	0	**1,523**	972	798	680	935	0	2,408	2,414	**3,489**	0	3,428	2,506	2,465	1,995	2,173
Southern Route Ext	222	1,073	1,054	0	1,101	0	1,057	950	1,123	**1,347**	240	3,355	3,241	0	3,494	0	3,535	2,974	3,534	**3,950**
Wallgrove Rd Nth	1,383	1,871	1,907	**2,248**	1,870	2,204	1,950	1,965	1,930	2,058	2,740	3,529	3,486	3,549	3,619	3,561	3,566	3,544	3,524	3,459
Nth Link 5	1,555	1,460	1,454	1,717	**2,767**	1,713	1,478	1,459	1,441	1,441	1,593	2,137	2,120	2,391	2,138	2,399	2,318	**2,915**	2,074	2,832
Sth Link 5	2,107	1,411	1,400	**2,422**	1,436	2,398	1,516	1,222	1,220	1,865	1,628	2,205	2,203	2,482	2,092	2,486	2,236	**2,703**	1,982	2,527
Wallgrove Rd Sth	2,176	2,807	2,806	2,474	2,880	2,448	2,929	3,011	2,862	1,952	1,679	2,309	2,305	2,110	2,152	2,111	**2,310**	2,043	2,288	2,189
M4	11,799	11,495	12,006	11,877	11,991	11,929	12,137	12,023	**12,302**	11,965	6,313	7,234	7,522	7,196	7,677	**8,037**	7,571	7,597	7,768	7,512
M7 Nth	5,122	5,103	5,084	5,200	5,187	**5,264**	5,120	5,062	4,959	5,057	4,561	7,509	7,686	7,595	7,361	7,295	7,916	7,512	7,499	7,535
M7 Sth Link 5	4,606	6,620	6,612	6,562	6,472	6,572	6,535	6,753	6,403	5,567	4,405	5,804	5,671	4,891	5,961	4,886	**6,043**	4,945	5,633	4,774
M7 Sth	4,606	6,921	6,925	6,562	6,754	6,572	6,828	6,753	6,895	5,567	4,405	4,689	4,675	4,891	4,809	4,886	4,773	**4,945**	4,624	4,774

Note: Orange fill highlights the maximum volume for each location.

Network Options A, B – B8 & C: 2016 PM 2Hr Peak Link Flows

Location	North | Eastbound										South | Westbound									
	A	B	B1	B2	B3	B4	B5	B6	B7	B8	A	B	B1	B2	B3	B4	B5	B6	B7	B8
Mamre Rd	1,343	3,673	3,692	3,762	**3,770**	3,750	3,105	3,765	3,424	3,702	1,017	1,037	1,047	663	1,041	676	897	1,033	892	1,126
Erskine Pk Rd	618	2,734	2,790	**3,458**	2,779	3,136	2,782	2,834	3,145	2,660	960	776	811	757	787	732	778	790	**1,080**	817
Erskine Pk Link Rd	0	257	279	282	265	279	278	282	**456**	294	0	2,626	2,685	**3,402**	2,760	3,146	2,848	2,806	2,752	2,557
Southern Route	0	426	428	402	478	396	486	460	**499**	404	0	2,977	2,983	**4,019**	3,037	3,972	2,694	3,046	3,063	2,686
Archbold Rd	0	**3,368**	3,114	2,691	3,263	3,183	3,120	3,064	3,055	3,129	0	**657**	617	588	620	596	616	619	521	622
Wonderland Dr	633	583	662	953	**1,084**	917	796	750	686	628	**332**	239	262	290	264	265	262	262	265	259
Old Wallgrove Rd	1,439	2,546	2,696	3,038	**3,735**	3,003	2,601	2,723	2,466	2,445	263	1,017	990	971	**1,977**	992	995	993	820	962
Direct Connection (Link 5)	0	2,732	2,673	**3,898**	0	3,851	2,734	2,744	2,499	2,981	0	1,210	1,243	1,784	0	**1,790**	1,219	1,177	728	1,193
Southern Route Ext	240	3,503	3,514	0	3,913	0	3,564	3,231	3,509	3,947	222	707	722	0	815	0	694	765	**960**	873
Wallgrove Rd Nth	2,621	3,716	3,868	3,996	**4,053**	3,912	3,913	3,714	3,779	3,727	2,140	2,079	2,118	**2,305**	2,155	2,220	2,131	2,123	2,099	2,246
Nth Link 5	1,363	1,756	1,658	1,501	2,177	1,480	1,632	**2,838**	1,608	1,578	1,580	1,022	1,023	1,325	**2,049**	1,273	1,030	1,934	1,006	1,382
Sth Link 5	2,117	2,140	2,146	2,390	2,070	2,385	2,177	1,619	1,991	**2,450**	1,597	1,550	1,539	**2,290**	1,274	2,242	1,553	936	1,387	1,841
Wallgrove Rd Sth	2,186	2,295	2,315	2,044	2,332	2,040	2,330	2,045	**2,339**	2,112	1,684	3,076	3,063	2,369	2,822	2,322	3,079	3,326	3,139	1,929
M4	6,538	7,544	7,905	7,460	8,017	**8,384**	7,823	7,973	8,134	7,821	11,652	11,282	11,857	11,799	11,955	11,905	12,024	11,861	**12,198**	11,803
M7 Nth	4,472	7,135	7,134	6,805	6,758	6,807	7,408	7,213	7,101	7,262	4,629	5,209	5,157	5,381	5,135	**5,487**	5,202	5,181	5,127	5,221
M7 Sth Link 5	3,735	5,756	5,734	4,766	**6,090**	4,810	5,871	4,719	5,328	5,061	5,409	6,369	6,377	**6,925**	6,582	6,924	6,368	6,691	6,287	6,034
M7 Sth	3,735	4,492	4,459	4,766	4,435	4,810	4,534	4,719	4,343	**5,061**	5,409	6,955	6,965	6,925	**7,164**	6,924	6,954	6,691	6,873	6,034

Note: Orange fill highlights the maximum volume for each location.