Memorandum

To:	Rob Johnston	**At:**	Scentre Group
From:	Chris Lawlor Tim Sullivan	**At:**	SLR Consulting Australia Pty Ltd
Date:	28 February 2019	**Ref:**	620.12132-M03-v1.1 Revised Planning Proposal Transport Review 20190228.docx
Subject:	Westfield Eastgardens Revised Planning Proposal Review of Transport Matters		

1 Introduction

1.1 Context

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Scentre Limited (Scentre Group) to undertake transport modelling and provide traffic engineering advice in relation to the proposed expansion of Westfield Eastgardens, located at 152 Bunnerong Road, Eastgardens.

This memorandum has been prepared to assess the consistency of a revised Planning Proposal for Westfield Eastgardens with transport modelling previously undertaken by SLR, including the validity of traffic generation and distribution assumptions and proposed road network capacity improvements. The document also provides a high level review of the relevant transport matters associated with the revised Planning Proposal.

Concept plans for the revised Planning Proposal are included at Attachment A.

1.2 Background

SLR has previously undertaken AIMSUN microsimulation modelling to assess the external traffic impacts of an expansion of Westfield Eastgardens consisting of the following incremental increase in floor area:

- 27,500sq.m of retail lettable floor area;
- 25,000sq.m of commercial (office) lettable floor area.

In addition to the Westfield Eastgardens expansion, the AIMSUN modelling also assessed the external traffic impacts of development within the adjacent precinct, including the Meriton development (Stages 1 and 2).

A peer review of the SLR AIMSUN modelling and associated reporting was conducted by external traffic consultant Cardno on behalf of Bayside Council. After several model revisions, the SLR AIMSUN modelling was accepted by Bayside Council as being appropriate.

For context, the most recent and relevant documentation pertaining to the SLR AIMSUN modelling assessment is included at Attachment B:

1. *Westfield Eastgardens Expansion: SLR Response to Cardno Modelling Peer Review Comments* dated 2 October 2018 prepared by SLR ('Document 1');
2. *Westfield Eastgardens: Transport Impact Assessment Peer Review* dated 15 June 2018 prepared by Cardno ('Document 2', attached to Document 1);
3. *AIMSUN Future Year and Development Options Traffic Assessment* dated 24 July 2018 prepared by SLR ('Document 3', attached to Document 1).

Further to the above, it is understood that the development scheme and supporting transport assessments for the adjacent Meriton development (Stage 2) have been revised since the AIMSUN modelling was undertaken by SLR. To ensure consistency between the latest Meriton development and the SLR AIMSUN modelling, SLR carried out a review of the latest publically available reporting prepared by ARUP (*128 and 130-150 Bunnerong Road, Pagewood: Transport Impact Assessment* dated 21 November, 2018). This document (referred to herein as the 'Meriton TIA') is available at: https://haveyoursay.bayside.nsw.gov.au/planning-proposal-128-and-130-150-bunnerong-road-eastgardens-bata-site/documents.

2 Revised Planning Proposal Summary

Based on the concept plans included at Attachment A and advice provided by Scentre Group, the land uses and floor areas associated with the revised Planning Proposal are compared to the previously assessed Planning Proposal and existing shopping centre yield in Table 1 below.

Table 1 Westfield Eastgardens Planning Proposal Summary

Land Use	Existing Yield	Previously Assessed		Revised Planning Proposal	
		Incremental Increase	Total	Incremental Increase	Total
Commercial (office)	5,000sq.m	*+25,000sq.m*	30,000sq.m	*+30,500sq.m*	35,500sq.m
Retail (shopping centre)	79,400sq.m	*+27,500sq.m*	106,900sq.m	*+27,500sq.m*	106,900sq.m
Total	**84,400sq.m**	***+52,500sq.m***	**136,900sq.m**	***+58,000sq.m***	**142,400sq.m**

As indicated in Table 1, the increase in retail floor area associated with the revised Planning Proposal is consistent with that previously modelled by SLR as per Document 3 included at Attachment B (referred to herein as the 'SLR Modelling Options Report'). The commercial floor area now proposed has increased by 5,500sq.m from that previously assessed by SLR. This increase in commercial floor area has been proposed to accommodate the urban design scheme developed by Architectus.

The implications of the additional 5,500sq.m commercial use yield and any design changes associated with the revised Planning Proposal are assessed in the subsequent sections of this document.

3 Review of Consistency with Previous SLR Modelling Assumptions

3.1 Traffic Demand

The traffic demand potential for the revised Planning Proposal yield was calculated consistent with the assumptions detailed in Section 3.4 of the SLR Modelling Option Report. The traffic demand estimated for the revised Planning Proposal yield is compared to that estimated for the previously assessed Planning Proposal yield in Table 2 below.

Table 2 Revised Westfield Eastgardens Traffic Demand Estimate (Incremental Increase)

Land Use	Yield	Thursday PM (TPM)			Saturday Midday (SAT)		
		Total	In	Out	Total	In	Out
Previous planning proposal							
Commercial	25,000sq.m	300vph	60vph	240vph	150vph	75vph	75vph
Retail	27,500sq.m	700vph	350vph	350vph	843vph	422vph	422vph
Total	**52,500sq.m**	**1,000vph**	**410vph**	**590vph**	**993vph**	**497vph**	**497vph**
Revised Planning Proposal							
Commercial	30,500sq.m	366vph	73vph	293vph	183vph	92vph	92vph
Retail	27,500sq.m	700vph	350vph	350vph	843vph	422vph	422vph
Total	**58,000sq.m**	**1,066vph**	**423vph**	**643vph**	**1,026vph**	**513vph**	**513vph**
Difference	*+5,500sq.m (Commercial)*	*+66vph*	*+13vph*	*+53vph*	*+33vph*	*+17vph*	*+17vph*

Table 2 indicates that, adopting the previous traffic demand assumptions as per the SLR Modelling Option Report, the revised development would generate an additional 66 trips during the Thursday PM (TPM) peak period, and an additional 33 trips during the Saturday midday (SAT) peak period.

The 66 additional TPM trips and 33 additional SAT trips are equivalent to around one additional vehicle per minute (TPM) and one additional vehicle every two minutes (SAT) over the respective peak hour periods. In the context of the traffic volumes currently experienced on the road network surrounding Westfield Eastgardens, this trip demand increase is not considered significant enough to change the findings of the previous traffic assessment. These additional trips will also be dispersed across a number of access/egress points and external intersections.

Further to the above, as per the Cardno comment (*'3.4.2 Cumulative Traffic Demand'*) in *Table 2-1* of the Peer Review (i.e. Document 2 at Attachment B), the retail traffic demand rates adopted by SLR are conservative when compared with typically adopted RMS retail trip generation rates (i.e. *Guide to Traffic Generating Developments: Updated traffic surveys*, 2013). As a sensitivity test, the increase in traffic demand calculated using RMS trip rates (i.e. for 'Shopping Centre' use with a floor area of >70,000sq.m) is presented in Table 3 and is compared with the adopted SLR retail traffic demand estimate.

Table 3 Sensitivity Test: RMS Retail Traffic Demand versus SLR Retail Traffic Demand Estimate

Component	TPM	SAT
Total retail floor area	*84,400sq.m + 27,500sq.m = 111,900sq.m*	
RMS traffic generation rate	*3.1vph per 100sq.m*	*3.6vph per 100sq.m*
RMS total retail traffic demand *(111,900sq.m)*	3,469vph	4,028vph
Minus existing 85th %ile traffic demand *(84,400sq.m)*	3,368vph	4,055vph
RMS incremental retail traffic demand *(+27,500sq.m)*	**+101vph**	**-27vph**
SLR incremental retail traffic demand (+27,500sq.m)	+700vph	+843vph
Difference (SLR incremental – RMS incremental)	*+599vph*	*+870vph*

Based on the above, sufficient conservatism has been adopted in estimating the previous development traffic demands, as detailed in the SLR Modelling Options Report, to cater for the traffic likely to be generated by the additional 5,500sq.m of commercial floor area associated with the revised Planning Proposal, and therefore no additional AIMSUN modelling is considered to be warranted to support the revised Planning Proposal.

Travel demand measures to be implemented as part of the revised Planning Proposal (which will assist in limiting private vehicle trips to the expanded centre) are discussed in Sections 4 and 5 of this document.

3.2 AIMSUN Model Site Access Coding and Traffic Distribution

SLR carried out a high level review of the concept plans prepared for the revised Westfield Eastgardens Planning Proposal (included at Attachment A) to determine consistency with the previous AIMSUN model, particularly with regard to the coding of site accesses, and the adopted distribution of trips between the various site accesses. The following is noted in relation to the review:

- New development traffic was previously assigned to site access/egress locations based upon the number of car parking spaces available through each access, and the relative convenience of each site access in consideration of the trip distribution to/from the external trade catchment;
- The number of car parking spaces available through each access (i.e. considering the interconnectivity between different car parking areas and levels) as indicated on the concept plans prepared for the revised Planning Proposal was compared to that indicated on the previous concept plans used to inform the coding of the AIMSUN model for the 'With Development' (i.e. Westfield) scenarios. Although the number of car parking spaces provided on each proposed car parking level has now changed, the interconnectivity between the various site accesses, car parking areas and levels is reasonably consistent with that previously modelled, and therefore the distribution of new trips to the proposed site accesses is not anticipated to materially change. The design and locations of proposed site accesses indicated on the revised concept plans are generally consistent with that previously modelled. It is noted that the access to a service area and two egresses for car parking areas on Wentworth Avenue (eastbound) between Denison Street and Bunnerong Road differ slightly from that previously modelled. These access/egress locations will likely require a further level of assessment in the future; however, this is mainly design related as opposed to operational impact (i.e. given the low anticipated traffic volumes at these access locations). Importantly, none of these design adjustments are anticipated to impact upon the previous assessment of external intersections.

Based on the above, the previous coding of the SLR AIMSUN model remains sufficiently consistent with the revised Planning Proposal concept plans for the AIMSUN modelling to remain valid.

3.3 Review of Latest Meriton Proposal

As detailed in Section 1.2, the development scheme and supporting transport assessments for the adjacent Meriton development (Stage 2) have been revised since the AIMSUN modelling was undertaken by SLR. In order to determine the consistency of the current Meriton proposal with that modelled by SLR, the latest publically available Meriton TIA was reviewed.

3.3.1 Traffic Demand

Whilst the Meriton TIA does not detail the specific development yields now proposed, two hour traffic demand estimates for the proposal are provided. To allow a like-for-like comparison the Arup traffic demand estimates (two hour) and those modelled by SLR (one hour), the two hour traffic demand detailed in *Table 8* (Change to development traffic) of the Meriton TIA was converted to a peak hour traffic demand using the factors detailed in *Table 4* (Traffic Demand Profile) of the *Traffic Modelling Report* attached to the Meriton TIA.

Reflective of the above, the ARUP and SLR modelled traffic demands are compared in table 4 below.

Table 4 Meriton Traffic Demand Comparison

Modelled Traffic Demand	TPM	SAT
Arup 2 hour demand	1,622 + 245 = 1,867vehicles/2hrs	1,185 + 705 = 1,890 vehicles/2hrs
Arup peak hour demand	0.52 X 1,867 = 971vph	0.48 X 1,890 = 907vph
SLR peak hour demand	1,117vph	1,223vph
Difference	*+146vph*	*+316vph*

Table 4 indicates that the traffic demand estimates previously adopted by SLR for the AIMSUN modelling of the Meriton development were sufficiently conservative to cater for the revised Meriton development yield.

3.3.2 AIMSUN Model Network Coding

The coding of the AIMSUN model network adopted by SLR for the Meriton development was compared to the revised layout modelled by Arup as documented in the Meriton TIA. It is noted that the AIMSUN model networks developed by SLR and Arup are generally consistent; however, as a result of recent changes to the Arup modelling, there are a number of differences which are outlined in Table 5. Commentary is also provided regarding the potential impact of the differences on the modelled network.

Table 5 Meriton AIMSUN Model Network Comparison

Element	Differences	Commentary on Impacts
External Intersections/Upgrades		
Wentworth Avenue/Page Street intersection	• SLR has modelled a proposed intersection upgrade layout (shown on Figure 1) based on plans provided by Bayside Council; • Arup has modelled an upgraded intersection layout (shown on Figure 1) with additional left turn slip lanes on the south-eastern Wentworth Avenue and south-western Page Street approaches. These slip lanes will result in extensive property impacts.	The SLR modelled intersection layout was shown to provide an adequate Levels of Service (i.e. LOS C or better for all assessed scenarios and peak periods as per Section 4.4 of the SLR Modelling Options report), with sufficient spare capacity to cater for any moderate increases in traffic arising from the updated Meriton and Westfield planning proposals.
Meriton Site Accesses		
Bunnerong Road/Meriton Boulevard	• SLR has modelled a left in/left out/right in signalised intersection (shown on Figure 2) based on previous Arup reporting; • Arup has now modelled a left in/left out only priority intersection at this location (shown on Figure 2).	The impact of removing the signalised intersection from the model is that travel times/delays along Bunnerong Road will improve over that previously modelled by SLR. This improvement in travel time will occur across all scenarios, and will therefore not materially impact on the results previously reported by SLR. In consideration of the conservative traffic demand assumptions adopted by SLR, the impact of this change is expected to be minimal. At a high level, the removal of the right turn movement into Meriton Boulevard from Bunnerong Road will likely redistribute a number of trips (i.e. associated with the Meriton development) through the following intersections: 1. Bunnerong Road/Maroubra Road/Heffron Road intersection; 2. Heffron Road/Banks Road intersection. Based on a review of path assignment data from the AIMSUN model, the number of trips anticipated to be redistributed between movements at the above intersection is presented on Figure 3. As detailed in Section 4.4 of the SLR Modelling Options Report, both intersections 1 and 2 are anticipated to operate at a Level of Service of B or higher for all assessed scenarios and peak periods, and hence the redistributed Meriton traffic demands will readily be accommodated by the remaining capacity of each intersection. On this basis, no additional modelling is considered to be warranted.

Element	Differences	Commentary on Impacts
Other site accesses	• In addition to the single Bunnerong Road site access detailed above, SLR has modelled a number of Meriton site accesses (shown on Figure 2), including accesses to Heffron Road, Banks Avenue, and Westfield Drive as per the previous Arup reporting; • Arup has now modelled the single Bunnerong Road site access and a single all movements' access to Banks Avenue (shown on Figure 2).	The impacts of the removing the Meriton site accesses would mainly be confined internally within the site (i.e. given the reduction in access locations, queues of exiting vehicles would likely be longer). It will be the responsibility of Meriton and their traffic consultant to ensure that traffic impacts internal to their site can be adequately managed with the new access configuration. It is also expected that the reduction in site accesses would concentrate Meriton traffic around the Heffron Avenue/Banks Avenue intersection and Banks Avenue/Meriton Site Access intersections, which may increase queuing and delays for certain movements over that assessed by SLR. Given that the access changes are unlikely to have a significant impact on vehicle route choice in the model, and also in consideration of the conservative traffic demand assumptions adopted by SLR, the impacts of this change on the wider model network are expected to be minimal, and therefore no additional modelling is considered to be warranted.

Figure 1 Comparison of Wentworth Avenue/Page Street Intersection Layout

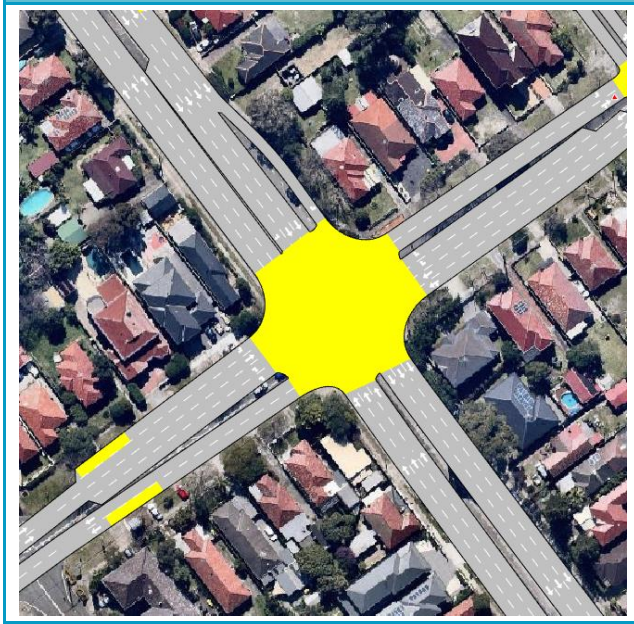
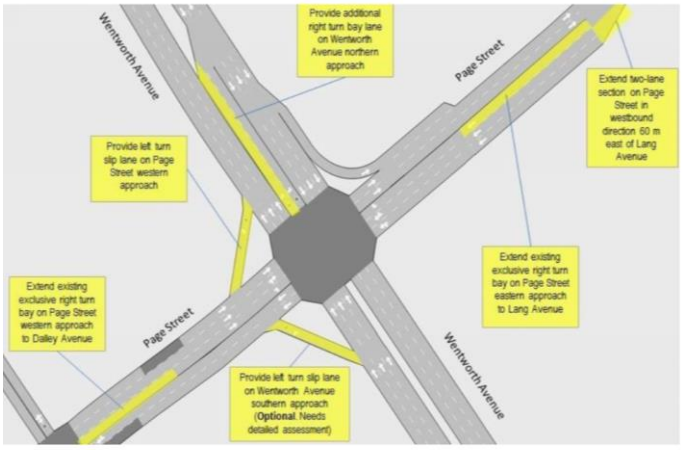
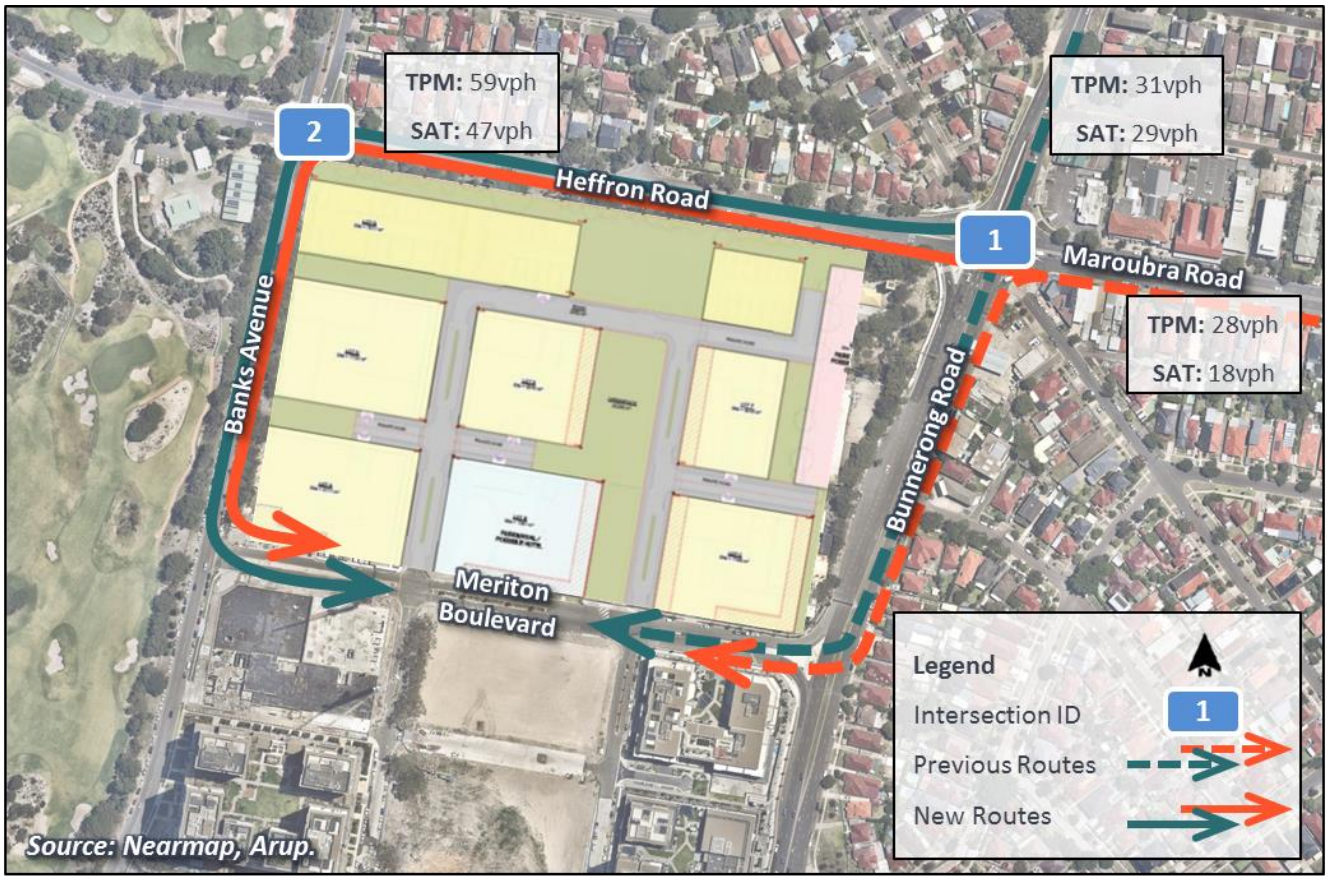
SLR Modelled Layout	Arup Modelled Layout
	 Figure 16: Upgrade to Page Street and Wentworth Avenue

Figure 2 Comparison of Meriton Development Layout

SLR Modelled Layout	Arup Modelled Layout
	

Figure 3 Meriton Development Traffic Redistribution



Based on the above analysis, SLR considers that the recent changes to the Meriton development do not require additional modelling at this stage. The previous SLR modelling is still considered valid for determining the external traffic impacts of the revised Westfield Eastgardens Planning Proposal.

3.4 External Intersection Upgrades

Given that the previous SLR modelling is still considered appropriate for determining the external traffic impacts of the revised Westfield Eastgardens Planning Proposal, the proposed external intersection upgrade works detailed in the SLR Modelling Options Report also remain valid. For ease of reference, the previously proposed external intersection upgrades are summarised in Table 6 below.

Table 6 Westfield Eastgardens Planning Proposal - External Intersection Upgrades Summary

Intersection	Proposed Upgrading Works
Wentworth Avenue/Banks Avenue/Corish Circuit Intersection	• Additional Banks Avenue northern approach auxiliary left turn lane; • Additional Wentworth Avenue eastern approach auxiliary right turn lane.
Wentworth Avenue/Denison Street/Westfield Access Intersection	• Additional Westfield Access northern approach auxiliary left turn/through lane; • New Westfield Access northern approach entry lane; • Additional Wentworth Avenue western approach auxiliary right turn lane; • New Wentworth Avenue eastern approach auxiliary right turn lane.
Wentworth Avenue/Bunnerong Road Intersection	• Additional Bunnerong Road northern approach auxiliary right turn lane.
Bunnerong Road/Westfield Drive Intersection	• Additional Bunnerong Road northern approach auxiliary right turn lane; • Reconfiguration and optimisation of the Westfield Drive approach lane arrangements.

4 Car Parking Provision

As noted in the transport reviews prepared to accompany previous Planning Proposal submissions for Westfield Eastgardens, car parking provision, access, servicing and internal circulation are matters that will be addressed in detail as part of a future Development Application.

At a high level, the following is noted in relation to the car parking provision likely to be delivered as part of the future development of the site:

- Additional retail car parking will be provided at a rate which aligns with the forecast trip generation across the expanded centre. The car parking rate for the expanded centre is expected to be lower than the car parking rate of the existing centre on the basis of the following:
    - Controlled car parking and parking guidance has recently been installed across Westfield Eastgardens and has significantly improved the availability of car parking spaces to retail customers through the removal of non-retail car parking (e.g. commuter car parking for the bus interchange, employees of adjacent sites, and even airport parking), and though the relocation of staff car parking (i.e. through the provision of 'nested' staff parking areas) to previously underutilised rooftop car parking areas;
    - The additional retail floor area will target retail categories that are complementary to existing trips to the centre (i.e. due to the increased retail offer, a visitor to the centre will be able to carry out multiple additional tasks in the same trip), and new categories that are likely to attract trips at different times of the day (e.g. restaurants that attract visitors in the evenings outside of peak car parking demand periods);
    - The retail demand generated by the large future residential catchment located in close walking proximity (i.e. the 3,800+ residential dwellings proposed as part of the adjacent Meriton development) that will generate minimal car parking demand;
    - The improved appeal of travelling to the centre by public transport, to be achieved by the proposed improvements to the capacity and experience of the Westfield Eastgardens bus interchange, which is encouraged by the pricing mechanism of controlled car parking which has now been implemented across the site.
- Commercial office car parking will be provided based on the likely private vehicle mode share of the target tenancy mix, and also in consideration of the temporal variation in car parking demand between the retail use and office use (i.e. whereby office uses can be assumed to have limited car parking demands on weekday evenings, and on weekends when retail uses typically experience a higher car parking demand).

Further analysis will be undertaken at a Development Application stage to provide rigour around the ultimately adopted car parking provision. A review of the sustainable transport opportunities available to further support a reduced car parking provision for the Planning Proposal is provided below.

5 Sustainable Transport Opportunities

5.1 Overview

The Planning Proposal presents a significant opportunity to improve travel by sustainable transport modes to Westfield Eastgardens and the surrounding area, as envisaged by a number of key strategic transport/planning documents, including the following:

- *Future Transport Strategy 2056*, Transport for NSW, March 2018 ('Future Transport 2056');
- *Eastern City District Plan*, Greater Sydney Commission, March 2018 ('Eastern City District Plan').

Future Transport Strategy 2056 is a state-wide transport planning strategy describing the key challenges and opportunities for providing the mobility required to facilitate the significant population growth anticipated to occur across Greater Sydney and Regional NSW over the next 40 year period. The *Eastern City District Plan* provides a more detailed roadmap to achieving the nominated 'Planning Priorities', each of which has specific 'Objectives', 'Actions' and 'Responsibilities'.

Both *Future Transport 2056* and the *Eastern District Plan* have identified linkages between the existing Sydney CBD, the Eastgardens - Maroubra Junction Strategic Centre, and other Centres as key strategic growth corridors for multiple modes of transport. Of particular relevance to the subject site, in response to Planning Priority E11 (*'Growing investment, business opportunities and jobs in strategic centres'*) of the *Eastern City District Plan,* a number of actions are identified in relation to Eastgardens-Maroubra Junction. *Action 48* of the *Eastern City District Plan* is reproduced in Table 7 below.

Table 7 Action 48 of the Eastern City District Plan

Actions	Responsibility
Strengthen Eastgardens-Maroubra Junction through approaches that: a. Protect capacity for job targets and a diverse mix of uses to strengthen and reinforce the economic role of the centre; b. Extend and investigate additional economic activities to connect Eastgardens and Maroubra Junction and complement the existing activities; c. Leverage future public transport connections in the south east and west of the District; d. Encourage provision of affordable housing to support the nearby health and education facilities and employment lands; e. Promote place making initiatives to improve the quality and supply of public spaces, promote walking and cycling connections and integrate with the Green Grid; f. Improve public transport connections, and walking and cycling between Eastgardens-Maroubra Junction and Randwick.	Bayside Council, Randwick City Council, other planning authorities and State agencies

Source: Eastern City District Plan

As described in Table 7, there are a number of transport related actions, with a particular emphasis on improving sustainable transport connections to, from and within Eastgardens-Maroubra Junction, including improvements to public transport, walking and cycling.

A high level review of the sustainable transport opportunities available for Westfield Eastgardens with reference to the aforementioned key transport planning strategies is provided below.

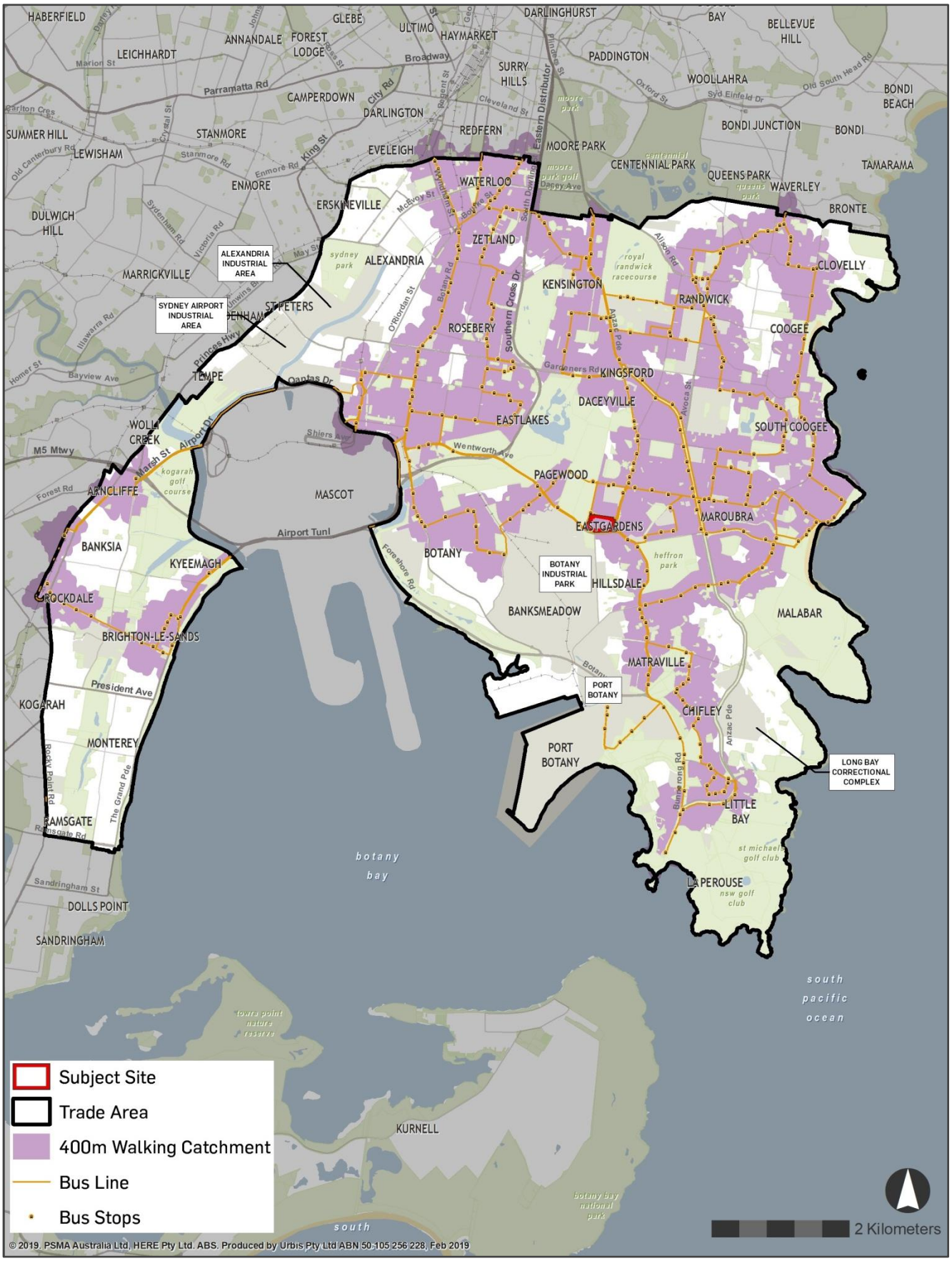
5.2 Existing Public Transport Services

Due primarily to the bus interchange located within the site, Westfield Eastgardens has excellent existing access to public transport. Details of existing bus routes servicing the subject site are provided in Table 8 below, whilst the proportion of the Westfield Eastgardens trade area catchment located within 400m walking distance of an existing bus route is mapped on Figure 4 overleaf, which has been prepared by Urbis.

Table 8 Existing Public Transport Services (Bus)

Route	Description	Service Frequency
301	Eastgardens – City Circular Quay Via Mascot	30 minutes (both directions)
302	Eastgardens – City Circular Quay Via Kingsford	Hourly (both directions)
310	Eastgardens – Central Railway Square via Botany Rd	20 minutes (both directions)
316	Eastgardens – Bondi Junction via Randwick Junction	20 minutes (both directions)
317	Eastgardens – Bondi Junction via Randwick Junction & Beauchamp Rd	30 minutes (both directions)
353	Eastgardens – Bondi Junction	30 minutes (both directions)
391	La Perouse or Port Botany – Central Railway Square	30 minutes (both directions)
392	Little Bay – City Circular Quay via Eastgardens & Prince Henry Hospital	30 minutes (both directions)
400	Burwood – Bondi Junction via Eastgardens (Limited Stops)	30 minutes (both directions)
410	Bondi Junction – Rockdale	15 minutes during AM and PM peak periods (both directions)
X10	Eastgardens – Central Railway Square (Express Service)	15 minutes during AM and PM peak periods (operates in peak direction only)
X92	Little Bay – City Museum (Express Service)	

Figure 4 Existing Public Transport Catchment within the Westfield Eastgardens Trade Area



5.3 Future Public Transport Opportunities

As identified in *Future Transport 2056* and the *Eastern City District Plan*, there is a need for additional public transport connectivity to the Eastgardens-Maroubra Junction Strategic Centre. The Westfield Eastgardens Planning Proposal, which adds retail and commercial density above a bus interchange, is aligned with a number of actions recommended by the *Eastern City District Plan,* including:

- Action 48 (c), which calls to strengthen Eastgardens-Maroubra Junction through approaches that leverage future public transport connections in the southeast and west of the District; and
- Action 48 (f), by improving public transport connections between Eastgardens-Maroubra Junction and Randwick.

Further to the above, Scentre Group participated in engagement for *Future Transport 2056*, and have made formal submissions to Transport for NSW, recommending that future mass transit is routed through Eastgardens.

A number of planned projects also have the potential to increase the public transport accessibility of Westfield Eastgardens and Eastgardens-Maroubra Junction as follows:

- The Sydney Light Rail project will include a station at Kingsford, located around 2.2km to the north of the subject site. Whilst 2.2km is not considered to be an 'easily walkable' distance, the Meriton TIA includes commentary around Meriton having preliminary discussions with the State to extend the light rail line further to the south towards the Meriton site (i.e. and also the subject site). This would further increase the accessibility of the subject site by public transport;
- Other planned large scale public transport project such as the Sydney Metro West may in the longer term provide heavy rail access to the Eastgardens-Maroubra Strategic Centre, and provide the potential for an increased public transport catchment for the site through the interchange of modes/services at other locations.

5.4 Westfield Eastgardens Bus Interchange Improvements

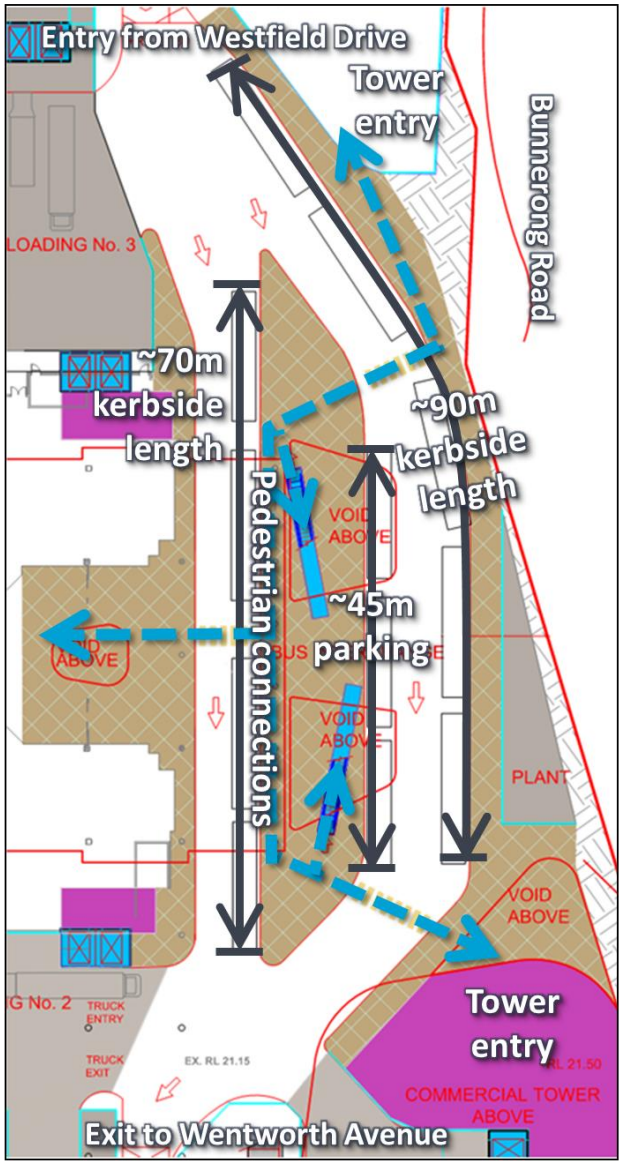
As indicated on the concept plans prepared for the revised Planning Proposal, a number of significant improvements are proposed for the existing bus interchange facilities located within the site and on the Bunnerong Road frontage of the site. These improvements are aligned with Actions 48(c) and 48(f) of the *Eastern City District Plan,* facilitating greater public transport connectivity between Eastgardens-Maroubra Junction, Randwick, and other key destinations.

The key improvements to the bus interchange facility, as indicated on the concept plans, are described as follows:

- Additional bus stop capacity and accommodation of larger design vehicles;
- Enhanced bus waiting areas, pedestrian amenity and security;
- Improved pedestrian connections with the shopping centre and new vertical transport to the proposed commercial towers;
- Additional parking and improved facilities for bus drivers on a rest break.

An overview of the existing and proposed bus interchanges is presented on Figure 5 overleaf.

Figure 5 Proposed Bus Interchange Improvements

Existing Bus Interchange	Proposed Bus Interchange
	

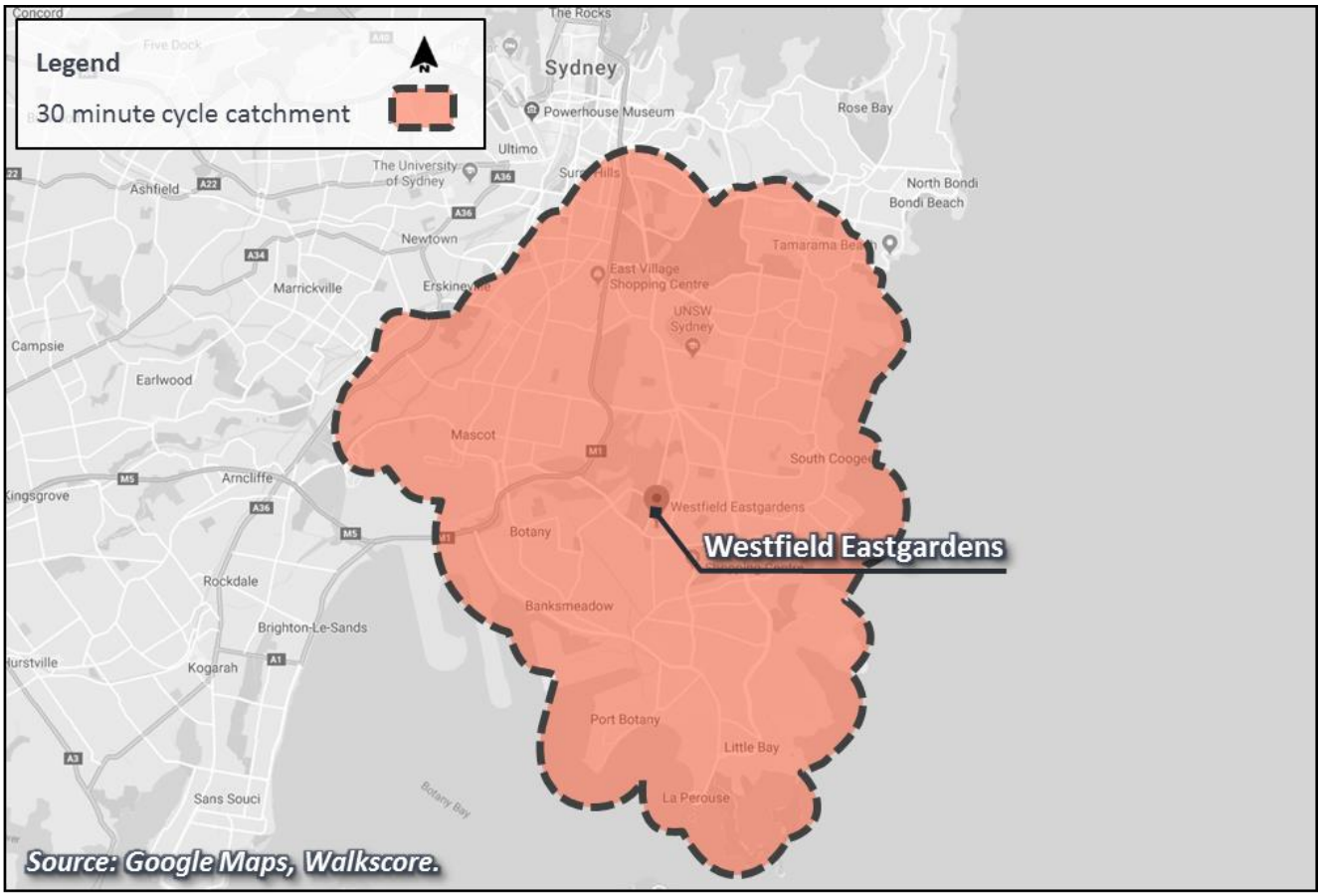
The bus interchange improvements will encourage the use of public transport services to access the subject site, and in turn reduce the reliance on private vehicle travel (and demand for car parking) for employment-based uses. Scentre Group will continue to liaise with Transport for NSW to progress the current conceptual design of the bus interchange.

5.5 Active Transport Provisions

The concept scheme prepared for the revised Planning Proposal includes provision for bicycle parking and end-of-trip facilities below the commercial towers. The provision of high quality bicycle parking and end-of-trip facilities will encourage employees of the commercial component to cycle to work, also reducing demand for car parking. This addresses Actions 48(e) and 48(f) of the *Eastern City District Plan* in promoting cycling, in particular, between Eastgardens-Maroubra Junction and Randwick.

Figure 6 below illustrates that there is a substantial area (including Randwick) located within a 30 minute cycle trip of Westfield Eastgardens, indicating that cycling is a highly feasible transport option for retail customers and employees of the future commercial uses located on the subject site.

Figure 6 Westfield Eastgardens 30 Minute Cycle Catchment



6 Summary

SLR has been commissioned by Scentre Group to undertake transport modelling and provide traffic engineering advice in relation to the revised Planning Proposal for Westfield Eastgardens.

Based on the above analysis, the following is concluded in relation to the revised Planning Proposal:

- The external traffic impacts of the additional 5,500sq.m of commercial floor area and recent changes to the adjacent Meriton development have been assessed as unlikely to make a material difference to the findings of the previous AIMSUN modelling undertaken by SLR. Therefore, the proposed external intersection upgrade works, as detailed in the SLR Modelling Options Report, also remain valid.
- The Planning Proposal presents a significant opportunity to improve travel by sustainable transport modes to Eastgardens-Maroubra Junction and the surrounding area, which aligns with strategic transport/planning documents including *Future Transport 2056* and the Eastern *City District Plan.*

Attachment A

Concept Plans

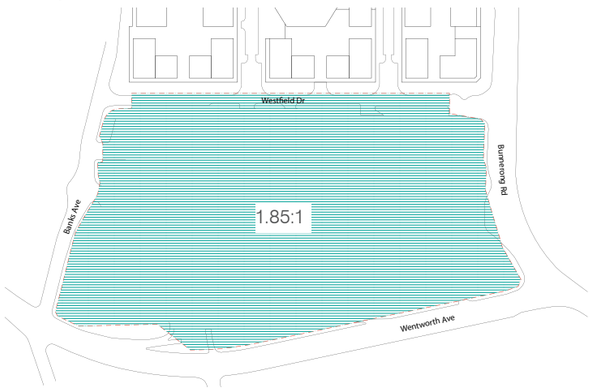
The Master Plan

Indicative Area Schedule

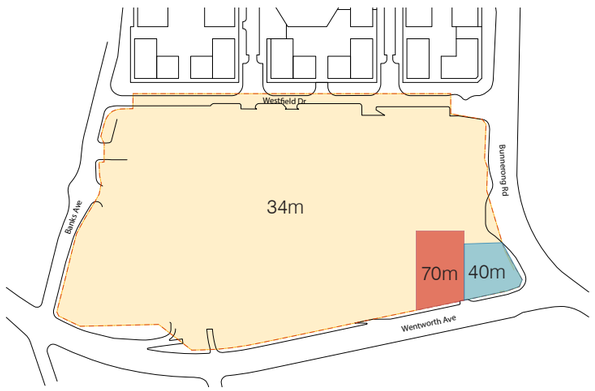
Description	Tower	Floorplate (GLA)	Incremental GFA	Efficiency	Incremental GLA
Retail					
Incremental retail	n/a	n/a	37,500	n/a	27,500
Commecial					
14 commercial storeys above retail mall	Tower A	~1,250sqm	20,000	90%	17,900
8 + part 2 commercial storeys above basement	Tower B	~1,000sqm	11,500	85%	9,800
Enlarged floorplate of existing 4 commercial storeys above retail mall	Tower C	~1,600sqm	3,300	85%	2,800
Sub-total incremental commercial			34,800		30,500
Total incremental scheme			72,300		58,000

FSR calculation	
Existing GFA	99,400
Incremental GFA	72,300
Completion GFA	171,700
Site area	92,900
Completion FSR	1.85

Proposed LEP amendments

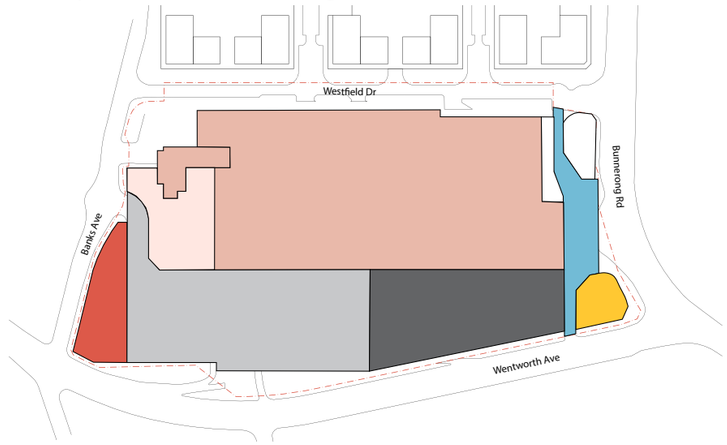


Proposed FSR

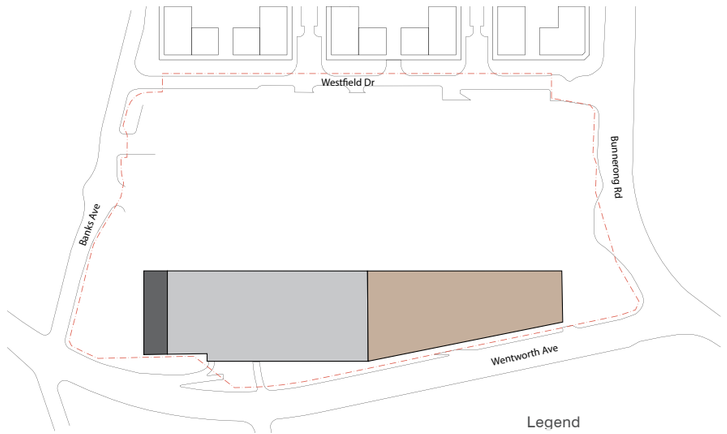


Proposed Height of Buildings

Proposed Block Diagrams



Level 1 Block Diagram

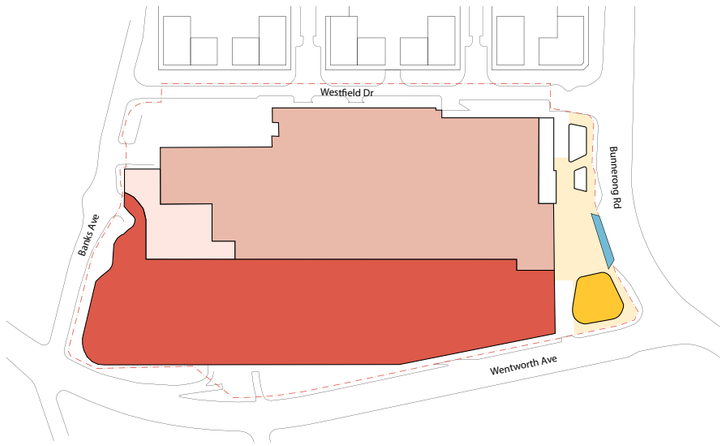


Level 1M Block Diagram

Legend

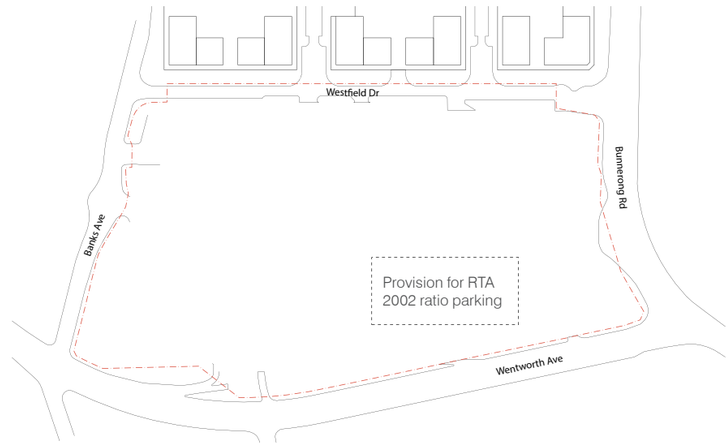
- Existing retail
- Reconfigured retail
- New retail
- Existing carpark
- Existing carpark reconfigured
- New carpark
- New commercial
- Reconfigured commercial
- Proposed rooftop garden/urban farm
- Bus terminus
- Publicly accessible landscaped area
- Provision for RTA 2002 ratio parking
- Future built form area (within site)

The Master Plan



Level 2 Block Diagram

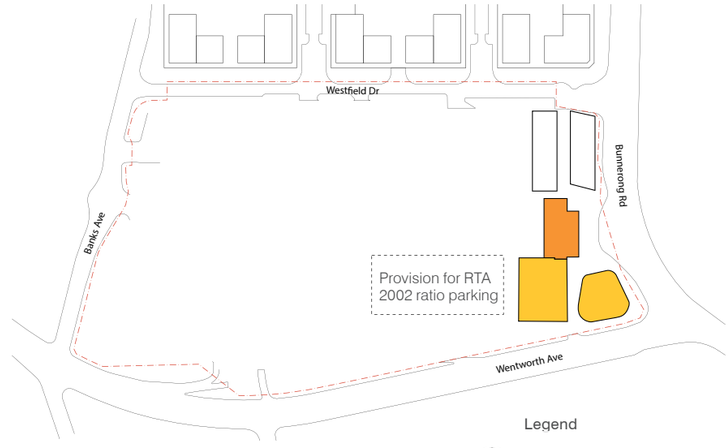
Level 3M Block Diagram



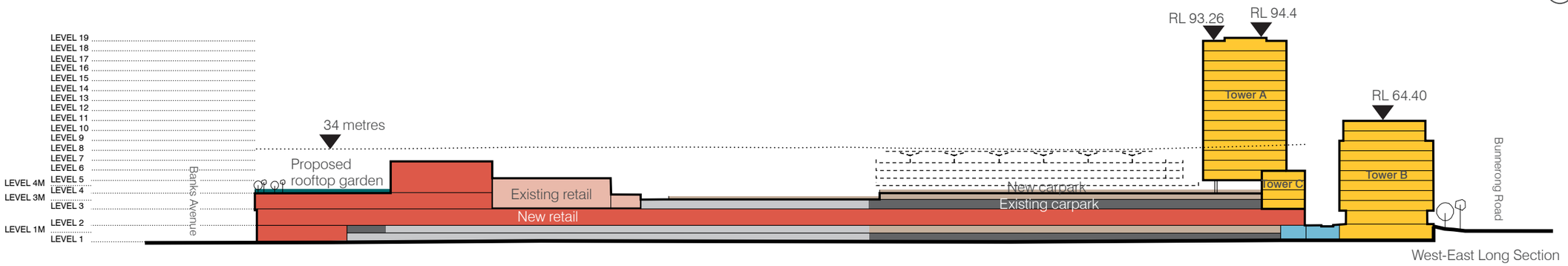
Level 4M Block Diagram

Level 3 Block Diagram

Level 4 Block Diagram



Level 5 Block Diagram



West-East Long Section

Legend

- Existing retail
- Reconfigured retail
- New retail
- Existing carpark
- Existing carpark reconfigured
- New carpark
- New commercial
- Reconfigured commercial
- Proposed rooftop garden/urban farm
- Bus terminus
- Publicly accessible landscaped area
- Provision for RTA 2002 ratio parking
- Future built form area (within site)

Attachment B

AIMSUN Modelling Documentation

2 October 2018

620.12132-L01-v0.3 Eastgardens Modelling Peer Review Response 20181002.docx

Scentre Group
85 Castlereigh Street
Sydney NSW 2000

Attention: Robert Johnston

Dear Robert

Westfield Eastgardens Expansion
SLR Response to Cardno Modelling Peer Review Comments

1 Context

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Scentre Group Pty Ltd (Scentre Group) to undertake transport modelling in relation to the proposed expansion of Westfield Eastgardens, located at 152 Bunnerong Road, Eastgardens.

This letter has been prepared to respond to issues raised in a peer review of the AIMSUN microsimulation modelling carried out by SLR in relation to the subject Eastgardens Planning Proposal. The peer review, carried out by Cardno on behalf of Bayside City Council, is documented in *Westfield Eastgardens: Transport Impact Assessment Peer Review* dated 15 June 2018 - attached.

Table 1 herein summarises the SLR responses to the Cardno peer review. To ensure a comprehensive response, the AIMSUN modelling previously assessed and reported by SLR in March 2018 has been re-run and reporting updated in considering the peer review comments.

The results of the updated AIMSUN modelling are documented in the updated SLR report *Westfield Eastgardens Development Modelling Options Assessment* dated 24 July, 2018 (referred to as 'Modelling Options Assessment' herein) - attached. The scope and form of this updated modelling report is consistent with that which formed part of the Planning Proposal. Only the model results are updated to make account of the Cardno peer review matters.

2 Items Raised in 'Review of SLR Traffic Impact Assessment'

Table 1 Responses to Items Raised in 'Review of SLR Traffic Impact Assessment'

Section Reference	Summary	Cardno Comment	SLR Response
3.3.1.3 Traffic Profiles	The column headings for "Thursday PM Model" and "Saturday Midday Model" appear to provide the trip distribution during the 2 hour period.	The time periods provided in the table 6 appear to be incorrect. This appears to be a typographical error and is unlikely to impact the conclusions made by the report.	This was a typographical error and has been corrected in the updated Modelling Options Assessment report.

Section Reference	Summary	Cardno Comment	SLR Response
3.3.2.2 Further changes to the '2031 Base + Meriton' Model	The report identifies that further changes to the 2031 base model have been made in order to alleviate congestion, including removal of parking along Wentworth Avenue approach to the Wentworth Avenue/Page Street intersection	As this adjustment is on the Base model, it is likely the implementation of removing parking is an issue for Council/RMS to investigate based on the SLR report findings.	The issue of future on-street parking will be discussed with Council as the application progresses and confirmation will be sought regarding this assumption which forms part of the Base and Future model scenarios.
3.4.2 Cumulative Traffic Demand	The trip generation rates adopted for Commercial floor space are based on the RMS Technical Direction which provides updated trip rates for the RMS Guide. The SLR assessment has assessed weekend (Saturday) traffic generation at 50% of the weekday peak hour.	The trip generation rate adopted is based on commercial office use. The proposed office yield (25,000m2) is significant in size. Accordingly, if the end user is identified as being retail or a higher trading use then the trip rate should be adjusted accordingly to reflect what would likely be a higher traffic generation rate. As the application is a Planning Proposal and the end user is yet to be defined, the application should be required to revisit its traffic and transport assessment in the event that land the land use / end user changes.	The trip generation rates and development yields were adopted by SLR based on information presented by Scentre Group prior to lodging the Planning Proposal. It is understood that these assumptions accurately reflect the development proposal and hence no further action is warranted.
3.4.3.6 Incremental Retail Traffic Generation	The methodology described to formulate the decay curve analysis is stated as being based on technical standards and guidelines published by relevant authorities and industry organisations.	Cardno does not object to the use of the decay curve methodology, however the resulting decay curve for Westfield Eastgardens should be compared to the cited documents to ensure the resulting curve (and trip rate adopted) is consistent with other survey information. Based on the updated RMS survey information, the RMS incremental trip rates based on floor area appears to be lower than the rates adopted by SLR. Therefore, the trip rate adopted by SLR appears to be conservative however a similar graphical presentation of Westfield Eastgardens curve will demonstrate any anomalies.	Noted. The adopted traffic generation curve is higher than that presented in RMS guidance. The higher curve is conservative and is based on a calibrated base scenario. Ultimately, the SLR assumption is conservative as it results in a higher incremental traffic demand resulting from the proposed expansion, hence no further justifications or actions are warranted.

Section Reference	Summary	Cardno Comment	SLR Response
	The adopted traffic direction split is presented in Table 11 of the SLR assessment. The direction split for retail is 50% inbound and 50% outbound during both the weekday and weekend peaks	A comparison to the survey information would be a more reliable source of directional split. The adopting of 50% inbound and 50% outbound is generally accepted by the traffic industry however as there is available data to identify the directional split this would be a more reliable source to base the assumption on.	The traffic survey evidence indicates an in/out split approximating 50%/50%. This directional split assumption for retail uses is widely accepted in industry practice, hence no further justifications or actions are warranted.
3.4.3.7 Resultant Westfield Eastgardens Demand Summary	A 19% "drop-in trips" has been adopted by the assessment, applicable to the retail trip generation only.	It is unclear how 19% for "drop-in trips", also referred to as "passing trade". The RMS Guide suggests rates of up to 25% may be applied, based on a site by site basis. Therefore the 19% assumption may not be incorrect, however it is unclear how it as determined.	SLR has adopted the 19% from table F1 of the Guidelines for Assessment of the Road Impacts of Development (available at: https://www.tmr.qld.gov.au/-/media/busind/techstdpubs/Road-planning-and-design/Guidelines-to-Traffic-Impact-Assessment/GARID_Guidelines_200406.pdf?la=en) The 19% relates to 'undiverted drop-in' trips for shopping centres greater than 20,000sq.m. This is a conservative assumption and lower than that suggested by Cardno, hence no further justifications or actions are warranted.

Section Reference	Summary	Cardno Comment	SLR Response
3.4.4.1 Proposed Intersection Upgrades	The SLR assessment identifies four intersections that require upgrades to offset impacts associated with the Planning Proposal. The intersections include: • Wentworth Avenue/Banks Avenue/ ornish Circuit; • Wentworth Avenue/ Denison Street/Site Access; • Wentworth Avenue/ Bunnerong Road; • Bunnerong Road/ Westfield Drive.	The report acknowledges that civil concepts for these upgrades are yet to be developed/finalised and accordingly, the impact to existing road alignment, existing property boundaries etc is not defined. The screenshots provided by the Aimsun model depicted the proposed upgrades being contained within the existing road reserve however it is unlikely this will be the case. The upgrades identified will need to be further discussed with Council and RMS. In the event that the suite of upgrades is modified, then the traffic assessment will require an update accordingly. Any upgrades attributed to the Planning Proposal should be appropriately conditioned prior to commencement of any works within the Westfield Eastgardens site.	Noted. It is understood the Scentre Group have engaged a civil engineering consultant to prepare functional layouts for the subject intersections. Should the design process reveal that the proposed intersection footprints cannot be appropriately accommodated, it would be reasonable that discussions with the City and RMS were held to confirm if supplementary the AIMSUN modelling was necessary. Until such time, no further actions are considered to be warranted.

3 Items Raised in 'Review of SLR Traffic Modelling'

Table 2 Responses to Items Raised in 'Review of SLR Traffic Modelling – Base Model Development'

Input Parameter	Latest Cardno Comment	SLR Response
D1 – Vehicle Types	Cardno's review requested justification as to why larger heavy vehicles where not used in version 1 of the base model but not necessarily requesting a change in vehicle size to occur. Whilst SLR have now adopted to change the size of trucks within the microsimulation model, other parameters such as acceleration profile would similarly need to change for larger vehicles as this can in turn impact queuing. Cardno requests SLR to review their approach to modelling of large trucks and advise of the impact. Additionally, Section 3.2.1 should clearly state what changes have been made to vehicle types which differ to the default settings.	SLR adjusted the maximum and median size of trucks within model, as requested, to reflect the B-Double vehicles that were observed using the Wentworth Avenue/Denison Street intersection on both aerial imagery and a site inspection. During the site inspection, larger B-Double design vehicles were not observed to cause any additional delays (i.e. due to acceleration) compared with Articulated Vehicle and Heavy Rigid Vehicles, both of which are accommodated within the default AIMSUN settings. As such, it is considered appropriate to adjust the design vehicle size for heavy vehicles within the model, however not the vehicle performance profile. Furthermore, given that the model shows a high degree of calibration for heavy vehicles at the Wentworth Avenue/Denison Street intersection (see response to 'K1' below). No further changes are considered to be warranted.

Input Parameter	Latest Cardno Comment	SLR Response
J1 – Number of seed runs	The updated reporting does not calculate the number of model runs required rather adopts Cardno's previous review. However, as parameters have been changed for base model version 2, the number of model runs similarly may have changed. The correct calculation to determine number of seeds to determine the stability of the model is calculated as per the RMS Modelling Guide. Based on the updated reporting, both the Weekday PM and Saturday have been identified to contain outliers. Whilst outliers occur, it should be investigated as to why they are happening and if they can be avoided via changes in the model. Additionally commentary is required for these outliers and the impact on the modelling results. For example in model run 2 of the PM peak vehicles turning right from Heffron Road into Bunnerong Road are seen to queue into the one lane section causing excess build-up of traffic behind. This in turn causes a queue to back up into the roundabout at Heffron Road / Banks Avenue causing a gridlock within the roundabout which does not get resolved. Due to this, the confidence of whether this can happen in the future models is at question and is recommended to be resolved in the base model. For the weekend peak the section incidents along Wentworth Avenue blocks buses from accessing the bus stop which in turn causes excess queuing.	Based upon the previous Cardno request, SLR increased the number of model runs from five to seven, which is beyond the five runs typically specified in the RMS modelling guidelines. The stability statistics reported by SLR show one outlier in each modelled scenario. This would likely be the case if additional model runs were added. The issues affecting model stability mentioned by Cardno are unlikely to impact modelling of future scenarios given the following: • The Heffron Road/Banks Avenue roundabout is a signalised intersection in all future scenarios and hence will not cause the network to lock up due to demand variance produced by the different random seeds (roundabouts in microsimulation models are inherently unstable and prone to lock-up when at capacity); • The section incident along Wentworth Avenue has been adjusted to be clear of the bus stop, and hence will no longer cause congestion in future modelling scenarios. The model stability figures provided at Appendix A of the amended Modelling Options Assessment report demonstrate appropriate model stability. Based on the above, no further actions are considered to be warranted.

Input Parameter	Latest Cardno Comment	SLR Response
K1 – Turning counts	Based on past experience with RMS, they have requested that results be presented to show calibration statistics for light and heavy vehicles separately. This is also indicated in the RMS Modelling Guidelines: "Generally RMS requires demand to be calibrated for each one hour period within the model and for each major vehicle type." This quote is from Section 11.5.2 of the Modelling Guidelines.	To demonstrate the existing calibration of the model with regard to heavy vehicle movements, the calibration of turning movements at the following intersections along Wentworth Avenue (i.e. where heavy vehicle movements were observed to be the greatest) was assessed: • Wentworth Ave/Page St; • Wentworth Ave/Denison St/Westfield access; • Wentworth Ave/Bunnerong Rd. The results presented at in Table 3 and Table 4 for the PM peak period and Saturday peak period below demonstrate that all turning movements have a GEH of less than 5, and accordingly, show a high level of calibration. Given that movements with the highest heavy vehicle volumes are calibrated in the Base model, this provides a reasonable level of certainty that heavy vehicle movements are not statistically significant (i.e. and will not impact on the operation of the model), and therefore no further actions are considered to be warranted.

Table 3 PM Peak Hour Heavy Vehicle Calibration Check

Intersection	Approach	Movement	Object ID	Observed	Modelled	GEH
Wentworth Ave/Page St	N	L	1856	0	8	4.1
		T	1857	4	3	0.5
		R	1855	3	6	1.5
	E	L	1860	0	5	3.3
		T	1858	87	74	1.4
	S	L	1849	3	2	0.6
		T	1850	8	0	3.8
		R	1851	1	2	0.8
	W	L	1847	5	5	0.1
		T	1853	70	70	0.0
		R	1854	10	6	1.5
Wentworth Ave/Denison St/Westfield Access	N	L	1701	0	0	0.0
		T	1702	0	0	0.0
		R	1700	0	0	0.0
	E	L	1704	4	7	1.2
		T	1703	14	29	3.2
	S	L	1696	61	48	1.8
		R	1697	6	5	0.5
	W	L	2769	3	4	0.4
		T	1698	21	19	0.5
		R	1699	43	49	0.9
Wentworth Ave/Bunnerong Rd	N	T	1690	16	17	0.3
		R	1691	2	13	4.1
	S	L	2827	16	22	1.3
		T	1687	20	8	3.3
	W	L	1682	44	35	1.4
		R	1688	27	34	1.2

Table 4 SAT Peak Hour Heavy Vehicle Calibration Check

Intersection	Approach	Movement	Object ID	Observed	Modelled	GEH
Wentworth Ave/Page St	N	L	1856	0	4	2.8
		T	1857	3	0	2.4
		R	1855	1	1	0.0
	E	L	1860	2	3	0.6
		T	1858	56	38	2.6
	S	L	1849	2	4	1.2
		T	1850	3	1	1.4
		R	1851	2	1	0.8
	W	L	1847	2	4	1.2
		T	1853	52	50	0.3
		R	1854	3	1	1.4
Wentworth Ave/Denison St/Westfield Access	N	L	1701	0	0	0.0
		T	1702	0	0	0.0
		R	1700	0	0	0.0
	E	L	1704	3	5	1.0
		T	1703	25	10	3.6
	S	L	1696	26	22	0.8
		R	1697	6	9	1.1
	W	L	2769	0	8	4.0
		T	1698	15	14	0.3
		R	1699	36	28	1.4
Wentworth Ave/Bunnerong Rd	N	T	1690	7	11	1.3
		R	1691	12	8	1.3
	S	L	2827	16	7	2.7
		T	1687	23	15	1.8
	W	L	1682	30	15	3.2
		R	1688	18	14	1.0

4 Items Raised in 'Future Option Modelling'

Table 5 Responses to Items Raised in 'Future Option Modelling'

Section Reference	Cardno Comment	SLR Response
3.1.2 Meriton Boulevard Configuration	The Arup assessment submitted for Meriton Stage 2 considered the intersection of Meriton Boulevarde/Bunnerong Road under two arrangements. The agreed intersection arrangement is not defined and as such there is likely to be uncertainty around this intersection until Meriton formalise their application post gateway. The SLR assessment adopts the intersection arrangement permitting right turn movements into Meriton Boulevarde, which appeared to have better results based on the Arup assessment. In the event that Meriton Boulevarde is configured differently then this would need to be reflected in the traffic modelling.	The arrangement of the Bunnerong Rd/Meriton Boulevard signalised intersection was prepared based on the best information available at the time, noting that the various transport assessments prepared for the Meriton development were inconsistent with regards to the various upgrades proposed. Until such time as a specific intersection layout is approved and conditioned for the Bunnerong Rd/Meriton Boulevard intersection, the layout modelled by SLR is considered to be appropriate, representing a conservative scenario.
3.1.3 Node 2801 – Altitude Mismatch	Section altitudes do not match at node 2801, thus creating a 5.7m "drop" at the node as shown in Figure 32. This mismatch is considered to be minor and is likely to be rectified for further analysis if the application is to proceed post Gateway.	This error has been corrected in all model scenarios. All scenarios have been rerun and the updated results are presented in the amended Modelling Options Assessment report.
3.1.4 Virtual Queues on Section 1277 at End of Peak Hour	At the end of the main simulation period for the 2031 TPM Base + Meriton + Westfield scenario (i.e. at 5:30) there is a virtual queue of approximately 150 vehicles on Section 1277 (refer Figure 3-2), which would not have been accounted for in the reported delays. This is only observed to occur in the TPM scenario, not the SAT scenario.	At the same point (i.e. 5:30PM) in the '2031 TPM Base + Meriton' scenario, there is a virtual queue of 150 vehicles on Section 1277. Furthermore, there is a virtual queue of around 100 vehicles present in the '2031 TPM Base' scenario on Section 1277, and on Section 23311 (Page Street southwestern approach), a virtual queue of around 240 vehicles is present at the end of the peak hour period (this is due to the constrained existing intersection form, which is upgraded in the '+ Meriton' scenario). Based on the above, the virtual queue issues are present across all scenarios at the Wentworth Avenue/Page Street intersection, and hence the reported delays are considered to show the relative incremental impact of each model scenario, and are not biased in favour of the Westfield development. Accordingly, no further action is considered to be warranted.

Section Reference	Cardno Comment	SLR Response
3.1.5 Public Transport	The 2031 models do not assume any changes to the existing Public Transport services. It is expected that any changes to the model relating to public transport will have minimal impact to the conclusions identified in the SLR report.	This is the case for all modelled 2031 scenarios, and hence the impacts are relative across all scenarios. Therefore, no further actions are considered to be warranted.
3.1.6 Meriton Development Demand (2031 Base only)	For the zones associated with the Meriton site (i.e. zones 108 and 109), there are 28 trips in the "2017 TPM Adjusted" scenario and 77 trips in the "2017 SAT Adjusted" scenario. In the 2031 Base scenarios, these trips appear to have been removed without any explanation provided. Similarly, the reintroduction of trips associated with these zones is unlikely to change the conclusions identified in the SLR report	The demand for these centroids was inadvertently removed in the 2031 Base scenarios. This has been corrected and the models rerun. The updated results are presented in the amended Modelling Options Assessment report.
3.1.7 Westfield Zones	It is unclear what methodology has been adopted to distribute the incremental traffic across the Westfield zones. Clarification is required on whether changes to car park accesses and distribution of the additional car park bays proposed as part of the expansion have been accounted for.	New development traffic has been assigned to site access/egress locations based upon the number of car parking spaces and relative convenience of each site in consideration of the distribution to the external trade catchment. Should the design of the internal car parking and/or access arrangements change significantly, it may be reasonable to review these assumptions. No change is warranted at this time.
3.1.8 Network Wide Results	Spot checks confirm the reported results in Tables 15 and 16. However, it is noted that due to the model structure, the reported results also include the network statistics from both the warm-up and cool-down periods. Minor comment: the last row in Tables 15 and 16 is titled "Total vehicles in matrix". However, this appears to refer to the "Input Count" from the replication Output Summary, which is the total amount of vehicles that were "read in" to the model. While the "Input Count" is based on the Traffic Demand, they are not necessarily similar.	The information presented in Table 15 and Table 16 is meant to provide a broad, high level snapshot of model statistics. They are not used to evaluate or determine the location and scale of possible scenario impacts. As such, it is considered appropriate to provide statistics from the entire 2 hour modelled period in this instance. With regard to the 'total vehicles in matrix', this has been changed to 'input count' in the amended Modelling Options Assessment report.

Section Reference	Cardno Comment	SLR Response
3.1.9 External Travel Route Travel Times	Spot checks confirm that the reported results in Table 17 and 18 can be replicated in the supplied models. However, as shown in it appears that the reported travel times include both the warm-up and cool-down periods where there is less demand in the network. If these time periods are excluded, the model travel times will likely differ. Example provided in Figure 3-5 for Route 1 Eastbound the 2031 Base TPM + Meriton + Westfield scenario where the reported travel time is 215 sec. However, is the warm-up and cool-down periods are excluded, the modelled travel time increases to approximately 245 sec.	The travel time observations collected by others and agreed for use with the City and Cardno are for a 2 hour period across all scenarios, hence the results presented demonstrate the relative travel time impacts of each scenario. Nevertheless, the travel times have been revised to reflect the peak hour period only and are presented in the amended Modelling Options Assessment report. It is important to note that this has not materially altered the findings or conclusions of the prior report and that no changes to the previously recommended engineering upgrades are warranted.
3.1.10 Intersection Results Operations Delay	It is unclear how the intersection delays in Tables 19 and 20 have been calculated as no sub-paths have been set up in the models for these intersections. It has therefore not been possible to confirm the reported results in these tables.	Intersection delays have been exported from the MINODE table in the results database, which provides the average approach delay for each node. Given that this is the AIMSUN default for measuring intersection delay, it is considered appropriate for use in reporting. Importantly, this approach is used consistently across all scenarios, hence, the incremental impact and determination of no nett worsening is possible. It is noted that intersection delays had previously been calculated for the 2 hour modelled period, however, these have now been updated to reflect the peak hour only and are presented in the amended Modelling Options Assessment report.

Should you have any queries in relation to this response, please do not hesitate to contact the undersigned.

CHRIS LAWLOR
Associate - Transport Advisory

KRIS STONE
Principal Consultant – Transport Advisory

Attachment A

Cardno Peer Review Comments

Westfield Eastgardens

Transport Impact Assessment Peer Review

80018011

Prepared for
Bayside City Council

15 June 2018

Cardno
Shaping the Future

Contact Information

Cardno NSW/ACT Pty Ltd
Cardno NSW/ACT Pty Ltd
95 001 145 035

Level 9 - The Forum
203 Pacific Highway
St Leonards 2065
Australia

www.cardno.com
Phone +61 2 9496 7700
Fax +61 2 9496 7748

Document Information

Prepared for	Bayside City Council
Project Name	Transport Impact Assessment Peer Review
File Reference	80018011 Westfield Peer Review v2.docx
Job Reference	80018011
Date	15 June 2018
Version Number	2

Document History

Version	Date	Description of Revision	Prepared by:	Reviewed by:
1	6/06/2018	Daft	Jackie Liang / Andreas Wang	Hayden Calvey
2	15/06/2018	Final		Hayden Calvey

Table of Contents

Tables

1 Introduction

Cardno has been commissioned to undertake an independent peer review of the Planning Proposal submitted for Westfield Eastgardens currently being considered by Bayside Council. Cardno understands that the current Planning Proposal requests modification to current controls that is likely to yield an additional 52,500m^2 Gross Leasable Area (GLA).

The follow documents have been reviewed as part of this peer review:

> Aimsun Future Year and Development Options Traffic Assessment, SLR (March 2018)

Cardno has reviewed these documents to ensure it meets the typical objectives of a transport assessment, and provide the findings and recommendations for further study or clarification. The objectives of the aforementioned documents are to investigate the proposed development with regard to the following:

> Identify the traffic and transport impact of the proposed development;

> Identify the number of trips and likely travel modes associated with the proposed land uses;

> Assess the impact the development will have on the capacity of the road system, in particular on intersections;

> Accessibility to public transport and other transport modes.

> Review the number of off-street parking spaces required to support the development; and

> Identify measures to limit the impact the development will make on the transport network.

1.1 Scope of works

The objective of this report is to prepare a technical report presenting the findings from the peer review of the Future Year and Development Options Assessment (with associated AIMSUN model).

The documents have been reviewed to assess the:

> Assessment of the traffic and transport implications

> Cumulative traffic and parking impacts

> Review of modelling methodology and model parameters

1.2 Assumptions and exclusions

The following assumptions and exclusions were made whilst undertaking this peer review:

> Additional traffic surveys would not be conducted; and

> Site visits were not required.

1.3 Reference documents

The following documents were reference as part of this peer review:

> Aimsun Future Year and Development Options Traffic Assessment, SLR (March 2018)

> Eastgardens Planning Proposal Traffic Review, CBHK (16 March 2018)

> Westfield Eastgardens Aimsun Base Model Development Report, SLR (19 February 2018)

> Westfield Eastgardens Aimsun Microsimulation Modelling – Peer Review Responses, SLR (19 February 2018)

> RMS Guide to Traffic Generating Developments (2002); and

> Technical Direction TDT 2013/04a – Guide to Traffic Generating Developments Update.

1.4 Report structure

This report has been divided into three sections, detailed below:

> **Section 1: Introduction:** An introduction to this document, including report structure, scope of works and reference documents.

> **Section 2: Review of Aimsun Future Year and Development Options Traffic Assessment, SLR (March 2018):** A review of the Future Year and Development Options assessment including trip generation rates, travel patterns, public and active transport review and impacts to the road network. This report also incorporates the Base Model Development Report, SLR (19 February 2018).

> **Section 3: Review of SLR Traffic Modelling Files (received 2 May 2018):** A review of the Aimsun modelling prepared for Westfield Eastgardens, including model assumptions and set up.

> **Section 4: Summary of findings and conclusion:** An overall summary of the review and key items raised that require further assessment.

2 Review of SLR Traffic Impact Assessment

Table 2-1 Review of SLR Traffic Impact Assessment

Section Reference	Review of SLR Traffic Impact Assessment Summary	Cardno Comment
3.3.1.3 Traffic Profiles	The column headings for “Thursday PM Model” and “Saturday Midday Model” appear to provide the trip distribution during the 2 hour period	The time periods provided in the table 6 appear to be incorrect. This appears to be a typographical error and is unlikely to impact the conclusions made by the report.
3.3.2.2 Further changes to the ‘2031 Base + Meriton’ Model	The report identifies that further changes to the 2031 base model have been made in order to alleviate congestion, including removal of parking along Wentworth Avenue approach to the Wentworth Avenue / Page Street intersection	As this adjustment is on the Base model, it is likely the implementation of removing parking is an issue for Council / RMS to investigate based on the SLR report findings.
3.4.2 Cumulative Traffic Demand	The trip generation rates adopted for Commercial floor space are based on the RMS Technical Direction which provides updated trip rates for the RMS Guide. The SLR assessment has assessed weekend (Saturday) traffic generation at 50% of the weekday peak hour.	The trip generation rate adopted is based on commercial office use. The proposed office yield (25,000m^2) is significant in size. Accordingly, if the end user is identified as being retail or a higher trading use then the trip rate should be adjusted accordingly to reflect what would likely be a higher traffic generation rate. As the application is a Planning Proposal and the end user is yet to be defined, the application should be required to revisit its traffic and transport assessment in the event that land the land use / end user changes.
3.4.3.6 Incremental Retail Traffic Generation	The methodology described to formulate the decay curve analysis is stated as being based on technical standards and guidelines published by relevant authorities and industry organisations.	Cardno does not object to the use of the decay curve methodology, however the resulting decay curve for Wesftfield Eastgarden should be compared to the cited documents to ensure the resulting curve (and trip rate adopted) is consistent with other survey information. Based on the updated RMS survey information, the RMS incremental trip rates based on floor area appears to be lower than the rates adopted by SLR. Therefore, the trip rate adopted by SLR appears to be conservative however a similar graphical presentation of Westfield Eastgardens curve will demonstrate any anomalies.

Section Reference	Review of SLR Traffic Impact Assessment Summary	Cardno Comment
	The adopted traffic direction split is presented in Table 11 of the SLR assessment. The direction split for retail is 50% inbound and 50% outbound during both the weekday and weekend peaks	A comparison to the survey information would be a more reliable source of directional split. The adopting of 50% inbound and 50% outbound is generally accepted by the traffic industry however as there is available data to identify the directional split this would be a more reliable source to base the assumption on.
3.4.3.7 Resultant Westfield Eastgardens Demand Summary	A 19% "drop-in trips" has been adopted by the assessment, applicable to the retail trip generation only.	It is unclear how 19% for "drop-in trips", also referred to as "passing trade". The RMS Guide suggests rates of up to 25% may be applied, based on a site by site basis. Therefore the 19% assumption may not be incorrect, however it is unclear how it was determined.
3.4.4.1 Proposed Intersection Upgrades	The SLR assessment identifies four intersections that require upgrades to offset impacts associated with the Planning Proposal. The intersections include: > Wentworth Avenue / Banks Avenue / Cornish Circuit > Wentworth Avenue / Denison Street / Site Access > Wentworth Avenue / Bunnerong Road > Bunnerong Road / Westfield Drive	The report acknowledges that civil concepts for these upgrades are yet to be developed / finalised and accordingly, the impact to existing road alignment, existing property boundaries etc is not defined. The screenshots provided by the Aimsun model depicted the proposed upgrades being contained within the existing road reserve however it is unlikely this will be the case. The upgrades identified will need to be further discussed with Council and RMS. In the event that the suite of upgrades is modified, then the traffic assessment will require an update accordingly. Any upgrades attributed to the Planning Proposal should be appropriately conditioned prior to commencement of any works within the Westfield Eastgardens site.

3 Review of SLR Traffic Modelling

Cardno has provided a review of the SLR Base model, to which responses have been provided by SLR in the memorandum 19 February 2018. Following the responses and an updated base model, Cardno provided the following additional comments.

Table 3-1 Review of SLR Base Model Development

Input Parameter / Model Reference	Cardno Review (Base Model 1)	Cardno Recommendation (Base Model 1)	SLR Response	Cardno Review (Base Model 2)
D1 – Vehicle types	Standard vehicle types have been utilised in the model. As the study area is adjacent to an operational container port, the model documentation should include additional data / justification of why larger trucks have not been included in the model.	Model documentation provided to include justification for not modelling larger trucks.	The maximum and median size of trucks within the model has been adjusted	Cardno's review requested justification as to why larger heavy vehicles where not used in version 1 of the base model but not necessarily requesting a change in vehicle size to occur. Whilst SLR have now adopted to change the size of trucks within the microsimulation model, other parameters such as acceleration profile would similarly need to change for larger vehicles as this can in turn impact queuing. Cardno requests SLR to review their approach to modelling of large trucks and advise of the impact. Additionally, Section 3.2.1 should clearly state what changes have been made to vehicle types which differ to the default settings.
J1 – Number of seed runs	5 seed runs have been presented, which is the industry standard minimum. However, based on the indicated total travel times a	Determine the number of appropriate runs required for the model to present stability.	This is not a usual requirement; nevertheless, the number of model runs has been expanded to 7 seeds.	The updated reporting does not calculate the number of model runs required rather adopts Cardno's previous review. However, as parameters have

Input Parameter / Model Reference	Cardno Review (Base Model 1)	Cardno Recommendation (Base Model 1)	SLR Response	Cardno Review (Base Model 2)
	statistical analysis shows that the PM peak would require 7 runs to determine stability (this is an iterative process and would require to be redone after 7 runs to confirm number of runs required and so forth)		The updated Model Development report includes details regarding this expanded modelling procedure.	been changed for base model version 2, the number of model runs similarly may have changed. The correct calculation to determine number of seeds to determine the stability of the model is calculated as per the RMS Modelling Guide. Based on the updated reporting, both the Weekday PM and Saturday have been identified to contain outliers. Whilst outliers occur, it should be investigated as to why they are happening and if they can be avoided via changes in the model. Additionally commentary is required for these outliers and the impact on the modelling results. For example in model run 2 of the PM peak vehicles turning right from Heffron Road into Bunnerong Road are seen to queue into the one lane section causing excess build-up of traffic behind. This in turn causes a queue to back up into the roundabout at Heffron Road / Banks Avenue causing a gridlock within the roundabout which does not get resolved. Due to this, the confidence of whether this can happen in the future models is at question and is recommended to be resolved in the base model.

Input Parameter / Model Reference	Cardno Review (Base Model 1)	Cardno Recommendation (Base Model 1)	SLR Response	Cardno Review (Base Model 2)
				For the weekend peak the section incidents along Wentworth Avenue blocks buses from accessing the bus stop which in turn causes excess queuing.
K1 – Turning counts	Calibration exceeds the minimum model calibration requirements for all vehicles for turn counts. However, RMS Modelling Guidelines indicates that demand should be calibrated for each major vehicle type (which in this case would be light and heavy vehicles).	Report light and heavy vehicle calibration statistics separately.	SLR has reviewed Section 11.5.2 of the RMS Guidelines (Guideline criteria: traffic volumes) – no reference is made to the calibration of turn count and section flows by vehicle type. It is suggested that the number of trucks is low in the context of the entire modelling volume and that the overall calibration/validation is of sufficient quality that it is reasonable with respect to trucks. Furthermore, this is not a typical requirement that has been encountered previously by SLR on a modelling project. Accordingly, no change to the modelling is deemed necessary.	Based on past experience with RMS, they have requested that results be presented to show calibration statistics for light and heavy vehicles separately. This is also indicated in the RMS Modelling Guidelines: *"Generally RMS requires demand to be calibrated for each one hour period within the model and for each major vehicle type.*" This quote is from Section 11.5.2 of the Modelling Guidelines

Further to above comments, the review of the Future Option modelling is provided in following sections.

3.1.2 Meriton Boulevarde Configuration

The Arup assessment submitted for Meriton Stage 2 considered the intersection of Meriton Boulevarde / Bunnerong Road under two arrangements. The agreed intersection arrangement is not defined and as such there is likely to be uncertainty around this intersection until Meriton formalise their application post gateway.

The SLR assessment adopts the intersection arrangement permitting right turn movements into Meriton Boulevarde, which appeared to have better results based on the Arup assessment. In the event that Meriton Boulevarde is configured differently then this would need to be reflected in the traffic modelling.

3.1.3 Node 2801 – Altitude Mismatch

Section altitudes do not match at node 2801, thus creating a 5.7m “drop” at the node as shown in **Figure 3-2**. This mismatch is considered to be minor and is likely to be rectified for further analysis if the application is to proceed post Gateway.

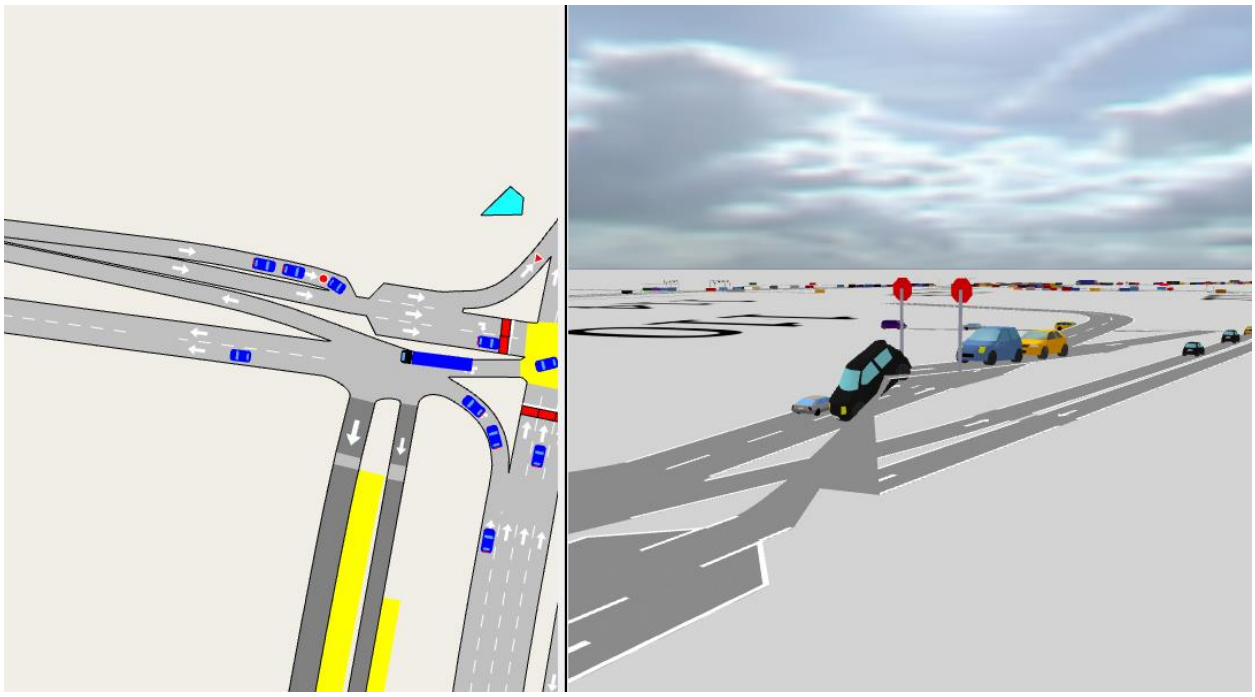


Figure 3-1 Mismatch of Section Altitudes at Node 2801

3.1.4 Virtual Queues on Section 1277 at End of Peak Hour

At the end of the main simulation period for the 2031 TPM Base + Meriton + Westfield scenario (i.e. at 5:30) there is a virtual queue of approximately 150 vehicles on Section 1277 (refer **Figure 3-2**), which would not have been accounted for in the reported delays. This is only observed to occur in the TPM scenario, not the SAT scenario.

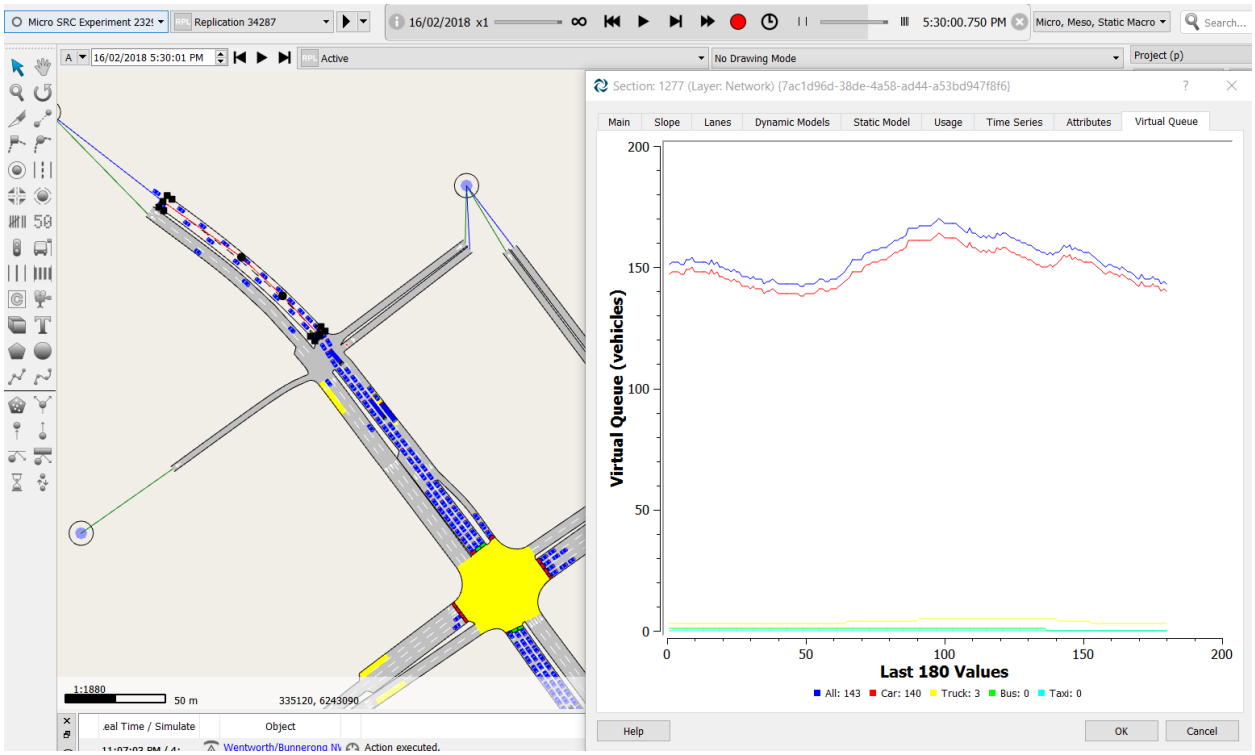


Figure 3-2 Virtual Queue for Section 1277 for 2031 TPM Base + Meriton + Westfield Scenario

3.1.5 Public Transport

The 2031 models do not assume any changes to the existing Public Transport services. It is expected that any changes to the model relating to public transport will have minimal impact to the conclusions identified in the SLR report.

3.1.6 Meriton Development Demand (2031 Base only)

For the zones associated with the Meriton site (i.e. zones 108 and 109), there are 28 trips in the "2017 TPM Adjusted" scenario and 77 trips in the "2017 SAT Adjusted" scenario. In the 2031 Base scenarios, these trips appear to have been removed without any explanation provided. Similarly, the reintroduction of trips associated with these zones is unlikely to change the conclusions identified in the SLR report

3.1.7 Westfield Zones

It is unclear what methodology has been adopted to distribute the incremental traffic across the Westfield zones. Clarification is required on whether changes to car park accesses and distribution of the additional car park bays proposed as part of the expansion have been accounted for.

3.1.8 Network Wide Results

Spot checks confirm the reported results in Tables 15 and 16. However, it is noted that due to the model structure, the reported results also include the network statistics from both the warm-up and cool-down periods.

Minor comment: the last row in Tables 15 and 16 is titled "Total vehicles in matrix". However, this appears to refer to the "Input Count" from the replication Output Summary, which is the total amount of vehicles that were "read in" to the model. While the "Input Count" is based on the Traffic Demand, they are not necessarily similar.

Example provided in **Figure 3-3** and **Figure 3-4** for the 2031 TPM Base + Meriton + Westfield scenario.

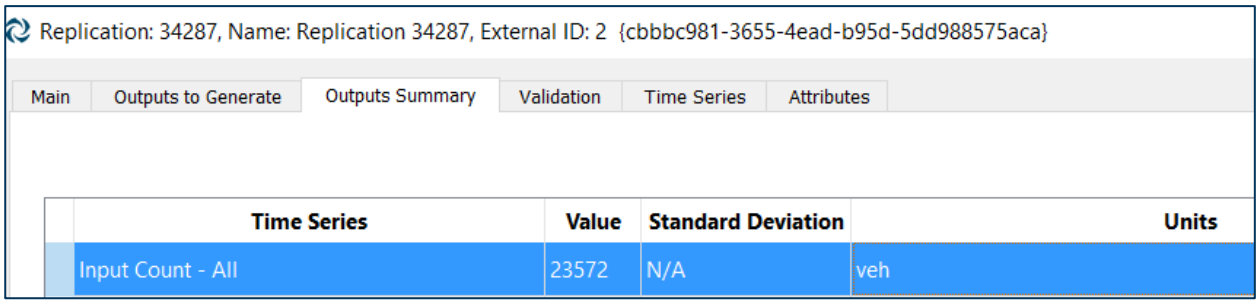


Figure 3-3 Input Count (from Output Summary) for 2031 TPM Base + Meriton + Westfield scenario

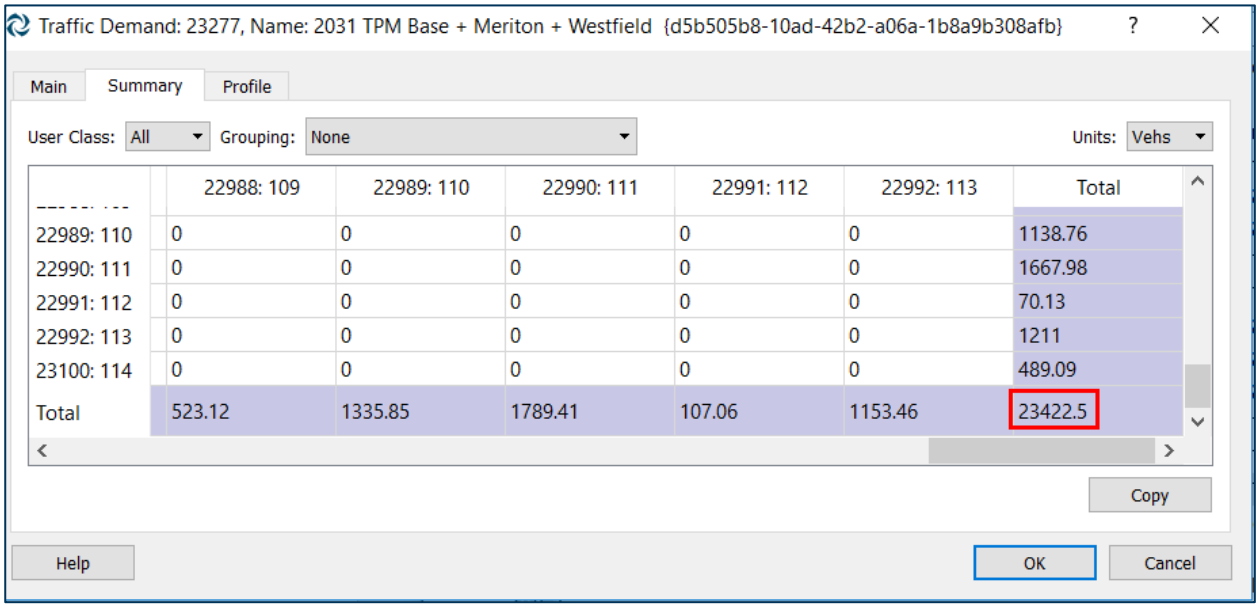


Figure 3-4 Matrix Total (from Traffic Demand) for 2031 TPM Base + Meriton + Westfield scenario

3.1.9 External Travel Route Travel Times

Spot checks confirm that the reported results in Table 17 and 18 can be replicated in the supplied models. However, as shown in it appears that the reported travel times include both the warm-up and cool-down periods where there is less demand in the network. If these time periods are excluded, the model travel times will likely differ. Example provided in **Figure 3-5** for Route 1 Eastbound the 2031 Base TPM + Meriton + Westfield scenario where the reported travel time is 215 sec. However, is the warm-up and cool-down periods are excluded, the modelled travel time increases to approximately 245 sec.

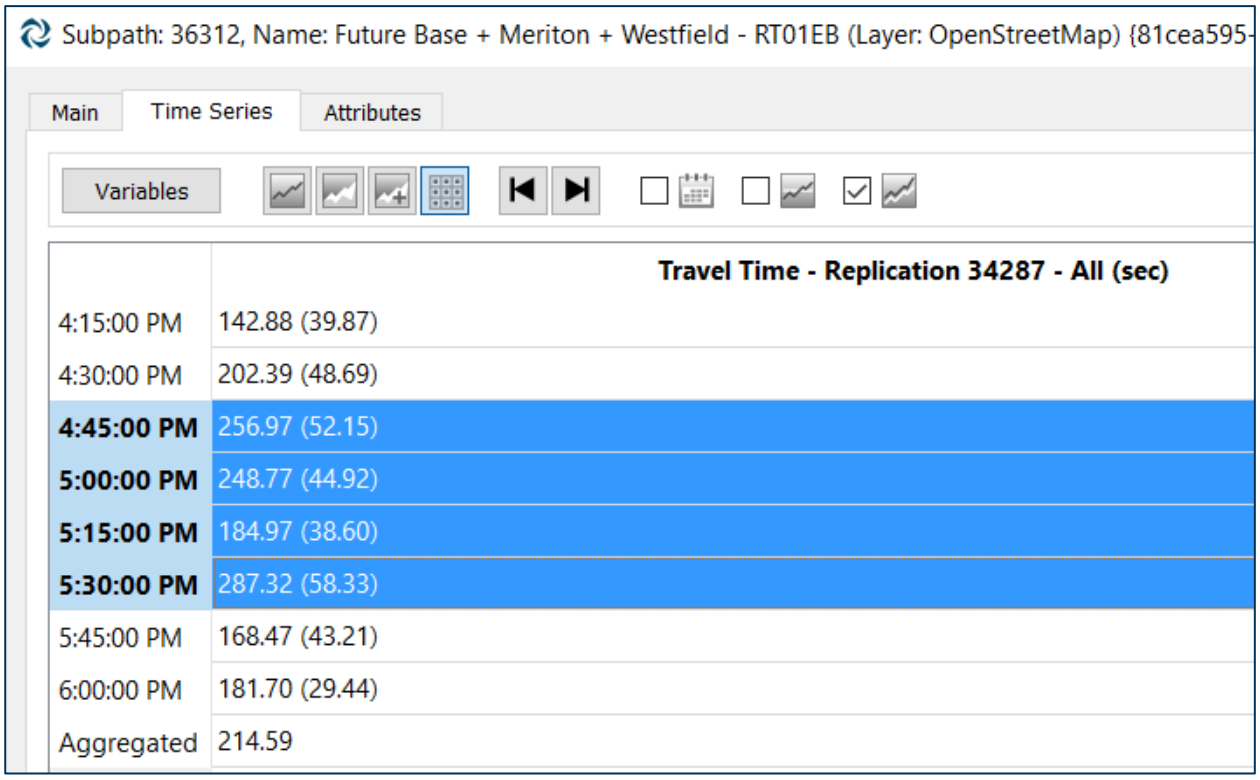


Figure 3-5 Modelled Travel Time Statistics for Route 1 Eastbound the 2031 Base TPM + Meriton + Westfield scenario

3.1.10 Intersection Results Operations Delay

It is unclear how the intersection delays in Tables 19 and 20 have been calculated as no sub-paths have been set up in the models for these intersections. It has therefore not been possible to confirm the reported results in these tables.

4 Summary

Cardno has been commissioned by Bayside Council to undertake an independent peer review of the Planning Proposal submitted for the Westfield Eastgardens site. Specifically, the Aimsun Future Year and Development Options Traffic Assessment prepared by SLR.

The Planning Proposal involves the request to the current planning controls to permit an additional 52,500m^2 GLA.

As a result of the review, Cardno has identified a number of items with regards to the modelling and reporting provided by SLR, as follows:

i. The assumptions behind future traffic generation and distribution, including the decay curve methodology, passing trade assumptions and inbound / outbound distribution should be further clarified. However, the resulting analysis adopted by SLR is not necessarily incorrect rather the request detailed previously are to seek clarity.

ii. Proposed upgrades within the surrounding road network appear to be significant and likely to result in property boundary adjustments. Given majority of the works are along classified roads, consultation with RMS will be necessary. Any upgrades required to offset the traffic and transport impacts of the planning proposal should be appropriately conditioned if the application is to proceed.

iii. Comments on the base model should be incorporated into further base analysis.

iv. Discrepancies between peak hour calibration and reporting which includes warm-up and cool-down periods should be clarified.

In summary, the overall modelling undertaken by SLR is considered to be appropriate for the pre-Gateway submission. The network improvements, which the Planning Proposal relies upon, should be agreed with relevant stakeholders and is considered necessary to support the development.

ATTACHMENT B

SLR Consulting's *Westfield Eastgardens Development Modelling Options Assessment dated 24 July, 2018*

AIMSUN FUTURE YEAR AND DEVELOPMENT OPTIONS TRAFFIC ASSESSMENT

Westfield Eastgardens
152 Bunnerong Road, Eastgardens

Prepared for:

Scentre Group Pty Ltd
85 Castlereigh Street
Sydney NSW 2000

SLR Ref: 620.12132-R02
Version No: v0.3
July 2018

PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Level 2, 15 Astor Terrace
Spring Hill QLD 4000 Australia
(PO Box 26 Spring Hill QLD 4004)
T: +61 7 3858 4800 F: +61 7 3858 4801
E: brisbane@slrconsulting.com www.slrconsulting.com

BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Scentre Group Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
620.12132-R02-v0.3	24 July 2018	Chris Lawlor	Kris Stone	Kris Stone
620.12132-R02-v0.2	16 March 2018	Chris Lawlor	Kris Stone	Kris Stone
620.12132-R02-v0.1	16 March 2018	Chris Lawlor	Kris Stone	Kris Stone

CONTENTS

CONTENTS

DOCUMENT REFERENCES

TABLES

CONTENTS

FIGURES

APPENDICES

1 Introduction

1.1 Overview

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Scentre Group Pty Ltd (Scentre Group) to undertake transport modelling in relation to the proposed expansion of Westfield Eastgardens, located at 152 Bunnerong Road, Eastgardens.

This report has been prepared to document the modelling and evaluation of traffic impacts and possible road network capacity improvements associated with the Westfield Eastgardens Planning Proposal submitted by Scentre Group. The AIMSUN modelling also incorporates incremental traffic demands and external road works associated with the Meriton Pagewood development, inclusive of the approved Stage 1 and proposed Stage 2.

This report (version 0.3) includes updated results based on the findings of a peer review completed by Cardno on behalf of the Bayside City Council *(Westfield Eastgardens Transport Impact Assessment Peer Review, 15 June 2018)*. The results summarised herein supersede those presented by SLR in reporting (version 0.2) dated 16 March 2018 which formed part of the Planning Proposal application.

1.2 Background

The following is a summary of the transport related background considered relevant to the Westfield Eastgardens expansion and the accompanying microsimulation modelling:

1) A Planning Justification report was prepared by Urbis in May 2017 in relation to the subject Westfield Eastgardens expansion. The Urbis report described the development vision, indicative land uses, yields and building height/form. Additionally, the report summarised a series of amendments to the Local Environmental Plan that would be necessary to facilitate the proposed redevelopment;

2) A Transport Review was prepared by Colston Budd Rogers & Kafes in May 2017 (Reference 10339/3) and formed part of Planning Justification Report. The review detailed a high level evaluation of the proposed expansion including a preliminary analysis of the projected traffic demand increases and potential road network capacity improvements. Whilst the Colston Budd Rogers & Kafes review did note the adjacent Meriton development (approved and proposed), it did not include an analysis of the cumulative impact of the development;

3) Arup prepared a Transport Impact Assessment in relation to the Meriton development located at 128 and 130-150 Bunnerong Road in April 2017 (Reference 237575 Revision A). The report detailed an assessment of the incremental traffic impacts arising from the 'Stage 2' expansion of the already approved 'Stage 1' Meriton Pagewood development. It isn't clear in the Arup reporting if the modelling considered the cumulative impact of both the Meriton and Westfield Eastgardens redevelopments;

4) During consultation throughout late 2017, Bayside Council identified a desire for a cumulative transport assessment considering both the Westfield Eastgardens and Meriton Pagewood developments;

5) Attempts were initially made by Scentre Group and SLR to utilise the Arup prepared modelling as the basis for the cumulative assessment of both redevelopments; however, the modelling tools weren't available;

6) Scentre Group resolved to develop new microsimulation modelling to inform an assessment of the cumulative impact attributable to development approved and proposed by Scentre Group and Meriton;

7) The modelling scope, key input variables and assumptions were agreed with representatives acting on behalf of Bayside Council in January 2018

8) The model build and findings were reviewed by Council and their consultant on two occasions in the period January-March, and it was confirmed that the calibrated Thursday and Saturday models prepared for the base year scenarios are reasonable and fit-for-purpose

9) At a meeting held 8 February 2018 involving representatives of Bayside Council, Cardno, NSW RMS, Scentre Group and SLR; it was advised that:

   a) The future peak hour growth rate for background traffic that would be used was 1% based on available survey information. It was requested of NSW RMS that this assumption was validated. At the time of preparing this report, no comments or responses have been received from NSW RMS

   b) The traffic generation assumptions for the subject Westfield Eastgardens redevelopment and also the Meriton Pagewood development were detailed. It was requested of all stakeholders that these assumption were validated. At the time of preparing this report, no comments or responses have been received from attending stakeholders

10) The calibrated model files and reporting provided to Bayside Council is understood to have been forwarded to NSW RMS for their preliminary review and comment in February 2018. At the time of preparing this report, no comments or responses have been received from NSW RMS.

11) Cardno, on behalf of Bayside City Council undertook a peer review of the SLR modelling and issued a matrix of issues/comments for consideration

12) SLR engaged by Cardno to understand the peer review comments and undertook updated modelling (where warranted) based on the Cardno comments. The results documented in this report make account of the peer review comments.

1.3 Report Purpose

This technical report has been prepared to document the microsimulation model development process for the following future year 2031 AIMSUN model scenarios:

1) 2031 Base Year = 2017 Calibrated Base Year with annual demand growth

2) 2031 Base Year + Meriton Pagewood (Stages 1 and 2)

3) 2031 Base Year + Meriton Pagewood + Westfield Eastgardens.

The purpose of the information detailed herein is to inform decisions regarding the road network impacts and proposed capacity improvements.

The majority of the model build process is detailed in the preceding SLR report *Westfield Eastgardens – AIMSUN Base Model Development Report* dated 19 February 2017. This report details the additional model development processes, inclusive of:

- Background growth approach
- Development traffic generation and trip assignment
- Nominated external road network upgrading
- Comparison of network and intersection traffic operations.

1.4 Report Structure

The remainder of this report is structured as follows:

- **Section 2:** Provides detailed of the modelled development including that approved/proposed by Meriton and Scentre Group
- **Section 3:** Details the process and assumptions employed in developing the 2031 Base and With Development (two scenarios) cumulative microsimulation models
- **Section 4:** Summarises the results of the 2031 and cumulative modelling process including details relating to possible capacity improvements that mitigate or offset impacts associated with the subject Westfield Eastgardens Planning Proposal
- **Section 5:** Provides a summary of the modelling process undertaken to date including recommendations.

1.5 References

The following reports and reference documents have been used in the production of the AIMSUN model and subsequent reports:

- *128 and 130-150 Bunnerong Road, Pagewood: Transport Impact Assessment* dated 7 April 2017 prepared by Arup;
- *128 Bunnerong Road, Pagewood: Traffic Modelling Report dated 7 April 2017* prepared by Arup; and
- *Traffic Modelling Guidelines* (New South Wales Roads & Maritime Service [RMS], 2013)
- *Guide to Traffic Generating Developments [NSW RMS], 2013*
- *Westfield Eastgardens – AIMSUN Base Model Development Report* [SLR Consulting], 19 February 2018.

1.6 Assumptions and Limitations

This report assumes the following:

- Any traffic data collected during the base model calibration and validation is accurate and reliable;
- Any traffic data used in the model calibration and validation process is representative of a typical weekday in the study area;
- Any previous model(s) and data inputs are accurate and reliable
- The traffic input assumptions detailed by SLR in the stakeholder meeting held 9 February.

2 Proposed Development

2.1 Westfield Eastgardens

The specifics of the proposed redevelopment are addressed in reports and analysis prepared by others. This advice relates only to microsimulation modelling and the evaluation of external traffic impacts and possible capacity improvements.

An indicative development is described in terms of the proposed land uses and their associated yields (in Gross Leasable Area [GLA]) in Table 1 below.

Table 1 Proposed Development

Land Use	Existing Situation Yield	Proposed Expansion	Post Expansion Yield
Commercial	84,401sq.m	25,000sq.m	136,901sq.m
Shopping Centre		27,500sq.m	
Total	**84,401sq.m**		**136,901sq.m**

2.2 Meriton Development

The following land uses and yields have been determined by SLR based on the information presented across the multitude of planning and traffic sources submitted in support of the Meriton Pagewood development. There were several discrepancies noted across many of the Pagewood consultant reports; however, the information summarised in Table 2 has been selected for the purposes of this modelling exercise.

These land uses and yields were introduced to Council, Cardno and NSW RMS representatives at the 9 February 2018 meeting where it was agreed that they representative a reasonable estimate.

Table 2 Proposed Meriton Development

Stage	Land Use	Yield
1	Child Care	300 placements (children)
	Residential (apartments)	1,856 apartments
	Retail	1,000sq.m GFA
2	Child Care	100 placements (children)
	Residential (apartments)	2,231 apartments
	Retail	5,000sq.m GFA
Total	**Child Care**	***400 placements (children)***
	Residential (apartments)	***4,087 apartments***
	Retail	***6,000sq.m GFA***

Should the Meriton Pagewood land uses and yields that are proposed and/or approved vary from that described above, it may necessitate a revision to the modelling and findings summarised later herein.

3 Future Network Development

3.1 Modelling Scenarios

The following scenarios were modelled using AIMSUN (microsimulation) for both the Thursday PM (TPM) and Saturday Midday (SAT) peak hour periods:

- 2031 base traffic;
- 2031 base plus Meriton development traffic;
- 2031 base plus Meriton plus Westfield development traffic.

3.2 Base Scenario

3.2.1 Demand Development

To develop the traffic demand matrices for the 2031 base scenario, growth was applied to background traffic traveling between external centroids. No growth was applied to residential catchments (these are already 'built out') or 'internal centroids (i.e. Meriton and Westfield sites).

It is noted that the Arup assessment conducted for the Meriton development assumed a 1% per annum growth rate based upon the best available RMS data. SLR attempted to engage with RMS on several occasions to discuss, however, to this stage, RMS have not provided any input.

In consideration of the current levels of congestion experienced at the Wentworth Avenue/Page Street and Bunnerong Road/Maroubra Road/Heffron Road intersections (especially the former), it would be difficult for new background traffic to enter the network (i.e. in the absence of any upgrades) due to the levels of congestion currently observed.

Reflective of the above, a linear growth rate of 1% per annum was applied to all external nodes. This is considered to be a conservative assumption and therefore to be appropriate.

3.2.2 Network Development

The calibrated base network from the 2017 base model was modified to consider:

- Intersection upgrade works committed to be undertaken by RMS;
- Minor signal phasing/timing adjustment, as would normally be undertaken by a road authority to accommodate arterial traffic flows.

3.2.2.1 Proposed Non-Development Related Intersection Upgrades

RMS provided SLR with plans for the proposed upgrade of the Wentworth Avenue/Baker Street intersection. It is understood that the upgrade, which will signalise the intersection, will occur within the next few years, and hence was coded into the base scenario AIMSUN network.

The existing layout and AIMSUM upgrade layout of the Wentworth Avenue/Baker Street intersection are shown on Figure 1 overleaf.

Figure 1 Existing and Proposed Layout: Wentworth Avenue/Baker Street Intersection

Existing Layout	AIMSUN Layout – RMS Upgrade
	

ID	Upgrade
1	Signalisation.
2	Extension of Wentworth Avenue western approach auxiliary right turn lane.

The following is noted in relation to further changes to the coding of the calibrated base model:

- No significant changes were made to signal phasing or timing within the base model;
- Public transport service frequencies were not adjusted from the 2017 base model;
- No other significant changes were made to the base model.

3.3 Base Plus Meriton Pagewood (Stages 1 and 2) Scenario

3.3.1 Demand Development

The traffic demand matrices for the ultimate Meriton development were created based upon the information provided in the Arup reporting for the development, and the assumed development yields documented in Table 2 of this report. It has been assumed that the development would be fully constructed and occupied by 2031. An overview of the assumptions used in developing the traffic demand for the '2031 Base + Meriton' scenario is provided below.

3.3.1.1 Traffic Demand

The projected incremental and resultant traffic demands generated to/from the Meriton Pagewood development was determined by SLR in accordance with information presented by Arup and/or that presented in industry guidelines like the NSW RMS *Guide to Traffic Generating Developments*. Table 3 summarises the key generation rates adopted for the component land uses.

Table 3 Meriton Development Trip Rates

Land Use	TPM	SAT
Child Care	0.7 trips per child	-
Residential (apartment)	0.217 trips per apartment	0.246 trips per apartment
Retail	12 trips per 100sq.m	16 trips per 100sq.m

Table 4 summarises the new traffic generation that SLR Consulting projects will be attributable to the Meriton Pagewood development inclusive of Stages 1 and 2. The calculations incorporate a series of reductions described as follows:

- Vehicle trip *credits* already generated by the existing site use;
- Internal cross-utilisation and drop-in trips associated with the child care and retail uses.

Table 4 Meriton Development Traffic Demand

Stage	Land Use	Yield	TPM Peak Hour (vph)			SAT Peak Hour (vph)		
			Total	In	Out	Total	In	Out
1	Child Care	300 placements	210	105	105	-	-	-
	Residential	1,856 units	403	282	121	457	228	228
	Retail	1,000sq.m GFA	120	60	60	160	80	80
	Subtotal		***733***	***447***	***286***	***617***	***308***	***308***
2	Child Care	100 placements	70	35	35	-	-	-
	Residential	2,231 units	484	339	145	549	274	274
	Retail	5,000sq.m GFA	600	300	300	800	400	400
	Subtotal		***1,154***	***674***	***480***	***1,349***	***674***	***674***
Total			***1,887***	***1,121***	***766***	***1,965***	***983***	***983***
Minus existing trips (from 2017 traffic surveys)			*-20*	*-1*	*-19*	*-22*	*-7*	*-15*
Minus retail internalisation discount (75%)			*-540*	*-270*	*-270*	*-720*	*-360*	*-360*
Minus childcare internalisation discount (75%)			*-210*	*-105*	*-105*	-	-	-
Final			***1,117***	***745***	***372***	***1,223***	***616***	***608***

3.3.1.2 Traffic Distribution

The traffic distribution adopted by SLR in modelling scenarios #2 and #3 is consistent with that specified by Arup in their traffic assessment dated 7 April 2017. The Arup assessment was based on the regional distribution of other dwelling and employment trips informed by strategic planning projects made by the State and Federal government. It is noted that there are minor discrepancies compared with the Arup reporting due to rounding errors.

The Arup assumptions that are retained by SLR are reproduced in Table 6 overleaf. The assumed distribution below accounts for the peak hour directionality (i.e. inbound/outbound split) of each of the uses.

Table 5 Meriton Development Traffic Distribution

Origin/Destination	Model Centroid	TPM		SAT	
		In	Out	In	Out
Wentworth Av (W)	1	35%	16%	25%	25%
Page St (S)	3	3%	3%	3%	3%
Denison St (S)	6	4%	2%	3%	3%
Bunnerong Rd (S)	7	12%	6%	9%	9%
Maroubra Rd (E)	12	4%	2%	3%	3%
Bunnerong Rd (N)	13	5%	2%	4%	4%
Banks Ave (N)	15	4%	2%	3%	3%
Total		**67%**	**33%**	**50%**	**50%**

3.3.1.3 Traffic Profiles

The 15 minute traffic demand proportions presented in Table 6 were used to develop the Meriton Pagewood demand profile for the peak hour period and the two hour modelled period.

Table 6 2 Hour Traffic Demand Profile

Thursday PM Model	% of peak hour demand	Saturday Midday Model	% of peak hour demand
4:00PM – 4:15PM	20%	11:15AM – 11:30AM	20%
4:15PM – 4:30PM	20%	11:30AM – 11:45AM	20%
4:30PM – 4:45PM	25%	11:45AM – 12:00PM	25%
4:45PM – 5:00PM	25%	12:00PM – 12:15PM	25%
5:00PM – 5:15PM	25%	12:15PM – 12:30PM	25%
5:15PM – 5:30PM	25%	12:30PM – 12:45PM	25%
5:30PM – 5:45PM	20%	12:45PM – 1:00PM	20%
5:45PM – 6:00PM	20%	1:00PM – 1:15PM	20%
Total	**180%**	**Total**	**180%**

The following vehicle fleet proportions were assumed for all new trips:

- Light vehicles: 98%;
- Heavy vehicles: 2%.

3.3.2 Network Development

SLR has reviewed the consultant reports and government planning documents with respect to the nominated road network upgrading that, to date, has been specified and approved (conditioned by Voluntary Planning Agreement). These capacity improvement works are detailed in Section 3.3.2.1.

Additionally, the modelled network for the '2031 Base + Meriton Pagewood' scenario was developed in consideration of the following:

- The proposed internal road network and new access locations to the proposed Meriton development, as documented within the Arup reporting;
- External intersection upgrades proposed as part of the development;
- Minor changes to signal phasing and timing.

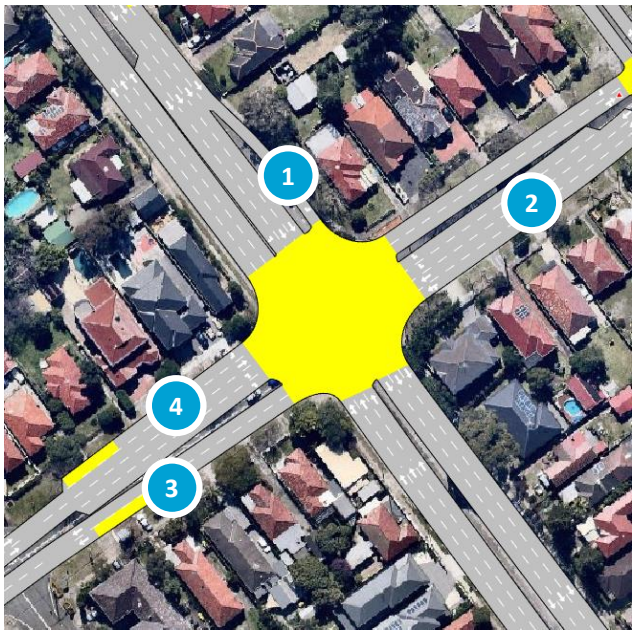
3.3.2.1 Proposed Intersection Upgrades

Wentworth Avenue/Page Street Intersection

RMS provided SLR with plans for the proposed upgrade of the Wentworth Avenue/Page Street intersection. It is understood that this upgrade will be funded by Meriton, and hence, the intersection improvements were coded into the '2031 Base + Meriton' scenario AIMSUN network. That is, these works will be delivered in combination with the assumed Stage 1 and Stage 2 Meriton Pagewood development.

The existing layout and AIMSUM upgrade layout of the Wentworth Avenue/Page Street intersection are shown on Figure 2 below.

Figure 2 Existing and Proposed Layout: Wentworth Avenue/Page Street Intersection

Existing Layout	AIMSUN Layout – RMS/Meriton Upgrade
	

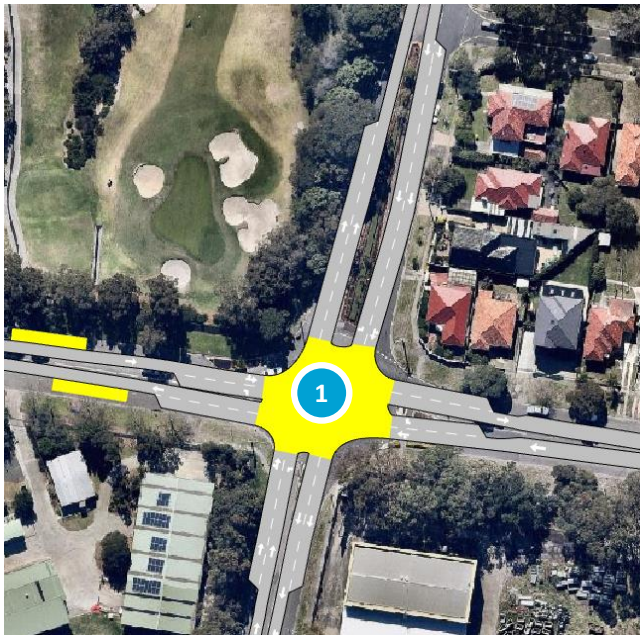
ID	Upgrade
1	Signalisation of Wentworth Avenue (Eastbound) approach left turn slip lane.
2	Extension of Page Street northern approach auxiliary right turn lane; Additional Page Street northern approach auxiliary right turn lane; Removal of on-street parking on Page Street northern approach (both sides) to Lang Avenue.
3	Removal of on-street parking on Page Street southern approach (southern side) to Dalley Avenue.
4	Additional Page Street southern approach auxiliary left turn lane; Additional Page Street southern approach auxiliary right turn lane (re-designation); Removal of on-street parking on Page Street southern approach (northern side) to Dalley Avenue.

Heffron Road/Banks Avenue Intersection

It is understood Meriton will also fund an upgrade of the Heffron Road/Banks Avenue roundabout to a signalised intersection form, and hence the upgraded intersection was coded into the '2031 Base + Meriton' scenario AIMSUN network. It is noted that the Arup assessment documented a slightly different intersection configuration. SLR initially used the Arup layout; however the intersection performance was sub-optimal. Reflective of the above, a new intersection layout, which can be accommodated within the proposed intersection footprint, was assessed by SLR.

The existing layout and AIMSUM upgrade (SLR amended) layout of the Heffron Road/Banks Avenue intersection are shown on Figure 3 below.

Figure 3 Existing and Proposed Layout: Heffron Road/Banks Avenue Intersection

Existing Layout	AIMSUN Layout – Meriton Upgrade
	

ID	Upgrade
1	Signalisation; New line marking on all approaches to create auxiliary turn lanes.

Bunnerong Road/Heffron Road/Maroubra Intersection

It is understood Meriton will also fund an upgrade of the Bunnerong Road/Heffron Road/Maroubra Road intersection, and hence the upgraded intersection was coded into the '2031 Base + Meriton' scenario AIMSUN network.

The existing layout and AIMSUM upgrade layout (as documented within the Arup reporting) of the Bunnerong Road/Heffron Road/Maroubra Road intersection are shown on Figure 4 below.

Figure 4 Existing and Proposed Layout: Bunnerong Road/Heffron Road/Maroubra Road Intersection

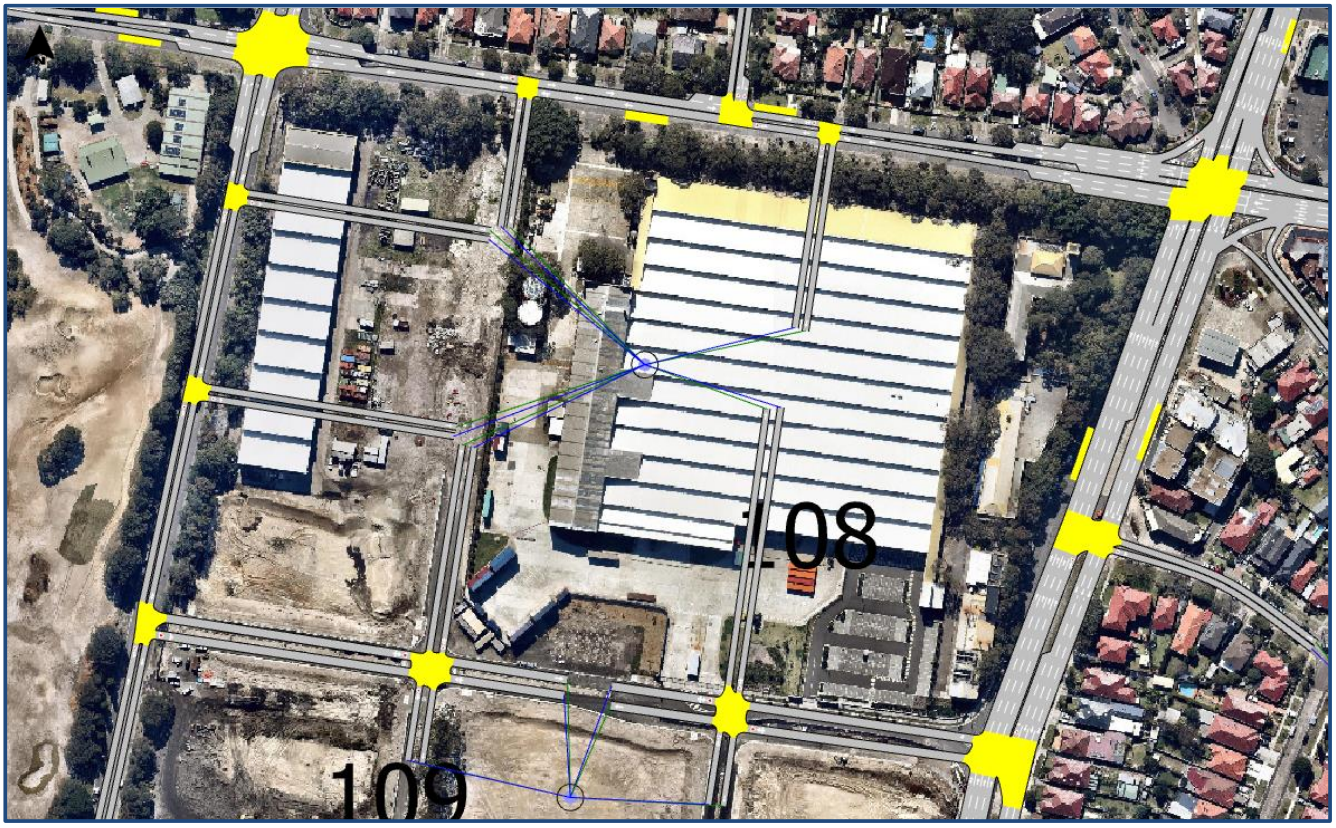
Existing Layout	AIMSUN Layout – Meriton Upgrade
	

ID	Upgrade
1	Extension and reconfiguration of the Heffron Road western approach left turn slip lane.
2	Additional Bunnerong Road northern approach auxiliary right turn lane; Extension of the Bunnerong Road northern approach auxiliary through lane.
3	Extension of the Bunnerong Road southern approach auxiliary lane; Additional Bunnerong Road southern approach auxiliary right turn lane.

3.3.2.2 Further Changes to the '2031 Base + Meriton' Model

The AIMSUN model network was coded to accommodate the road network and access locations proposed as part of the Meriton development, including signalisation of the Bunnerong Road/Meriton Boulevard intersection. The AIMSUN layout of the Meriton development is presented on Figure 5 below.

Figure 5 Meriton Development Layout



The following is noted in relation to further changes to the coding of the calibrated base model (i.e. in addition to those conducted in the 2031 Base model):

- Signal timing was adjusted at Wentworth Avenue/Page Street intersection to provide enhanced utilisation of the upgraded layout (it is noted that this was not an exhaustive exercise);
- On-street parking was removed for approximately 100m along both sides of the southern Wentworth Avenue approach to the Wentworth Avenue/Page Street intersection. This was carried out as the existing on-street parking was creating congestion in the models.

3.4 Base Plus Meriton Pagewood Plus Westfield Eastgardens Scenario

3.4.1 Demand Development

The traffic demand matrices for the subject development were created based assumed development yields documented in Table 1 of this report. An overview of the assumptions used in developing the traffic demand for the '2031 Base + Meriton + Westfield' scenario is provided overleaf.

3.4.2 Commercial Traffic Demand

The traffic demand for the commercial (office) component of the Westfield Eastgardens redevelopment proposed as part of the Planning Proposal was forecast based upon typical rates documented within the *Guide to Traffic Generating Developments* (RMS, 2002). Conservatively, it was assumed that commercial use would generate traffic demand during the Saturday midday peak hour peak period at 50% of the Thursday PM peak period. Reflective of the above, the traffic demand for the commercial component of the development is presented is Table 7 below.

Table 7 Commercial Traffic Demand Forecast

Land Use	Yield	Trip Rate	Thursday PM Trips	Saturday Midday Trips
Commercial	25,000sq.m GFA	**TPM:** 1.2 trips per 100sq.m; **SAT:** 0.6 trips per 100sq.m.	300vph	150vph

3.4.3 Retail Traffic Demand

The operational analysis of the incremental traffic demand generated by the proposed development requires a series of traffic engineering assumptions to be incorporated as part of the ongoing AIMSUN modelling:

- Confirmation of existing traffic demand and generation rate
- Determination of incremental traffic demand
- Evaluation of likely external traffic distribution.

These assumptions and procedural steps are summarised in the following sections of this report.

3.4.3.1 Existing Traffic Demand

SLR advocates the use of an existing and future site traffic demand representative of an 85th percentile design trading day. The percentile threshold aligns with the approach adopted for the determination of suitable car parking provisions. An 85th percentile approach ensures that demands are well catered for during the majority of the year while recognising that designing infrastructure for the worst case or peak event/s is not a reasonable or sustainable approach. The following four step process has been adopted:

- **Step 1:** Obtain traffic generation survey data to establish local traffic demands
- **Step 2:** Determine the surveyed day/s patronage, i.e. shopping demand comparable to a 12 month period
- **Step 3:** Determine the patronage demand for a representative 85th percentile trading day
- **Step 4:** Apply a scalar factor to increase or reduce the surveyed generation in line with the scalar difference between Step 1 and Step 2.

3.4.3.2 Step 1: Obtain Existing Traffic Generation Survey Data

SLR commissioned Trans Traffic Survey Pty Ltd (TTS) to undertake intersection video surveys on Thursday 7 December 2017 and Saturday 9 December 2017 for the following periods:

- Thursday PM: 16:00 – 19:00;
- Saturday Midday: 11:00 – 14:00.

From this information, it is possible to quantify the existing situation traffic generation on these two days of survey as summarised in Table 8.

Table 8 Westfield Eastgardens – Existing Traffic Demand Calibration

Peak Period	Surveyed Traffic Generation
Thursday PM	3,454vph
Saturday Midday	3,855vph

3.4.3.3 Step 2: Determine Survey Day Patronage

Westfield Centre Management provided annual door count patronage data in order to determine a representative 85th percentile trading day.

Figures 6 and 7 summarise the centre door count patronage data for the Westfield Eastgardens site for a 365 day period of Thursdays and Saturdays respectively throughout 2016/17. The only manipulation of this data is to remove commercially sensitive patronage numbers and recalibrate the Y-axis to a percentage scale of the maximum annual daily demand.

Figure 6 Thursday Door Count Data (2017)

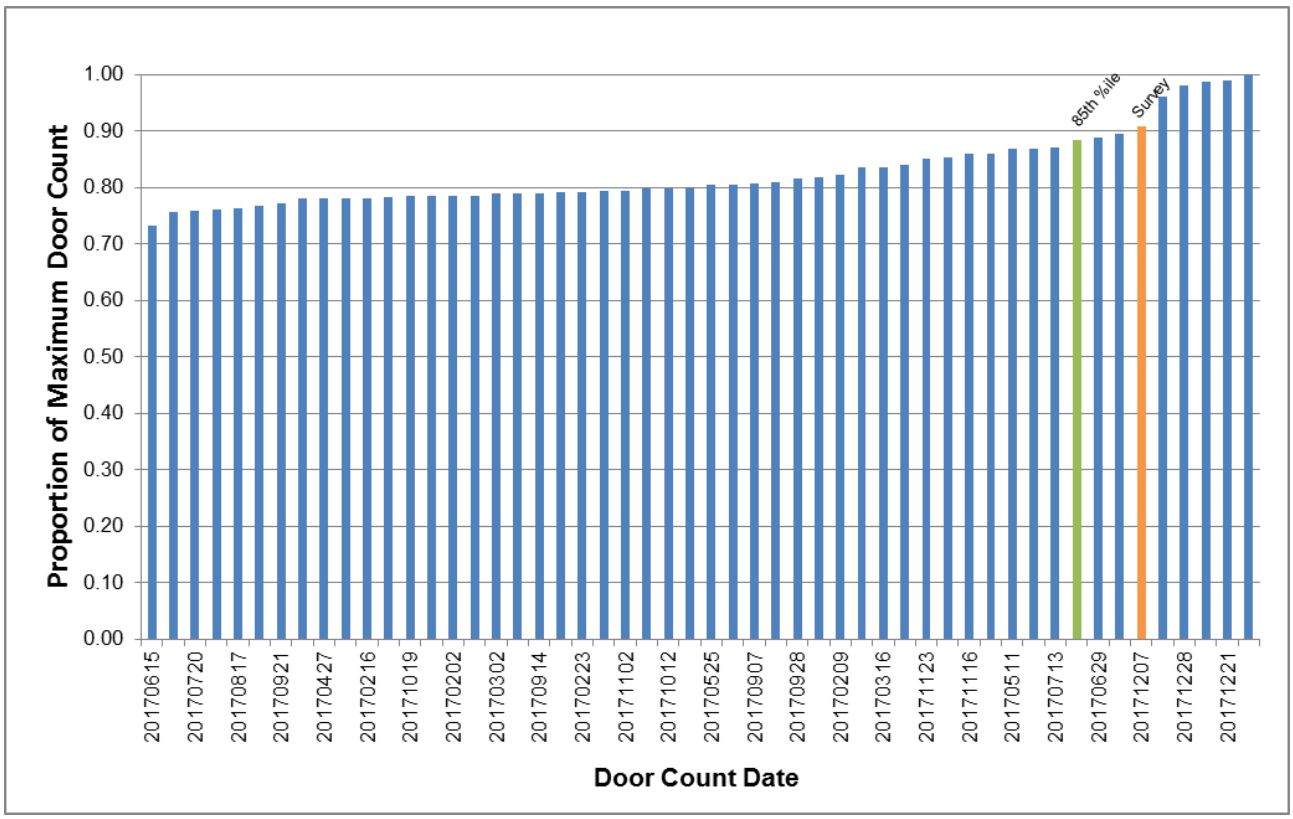


Figure 7 Saturday Door Count Data (2017)

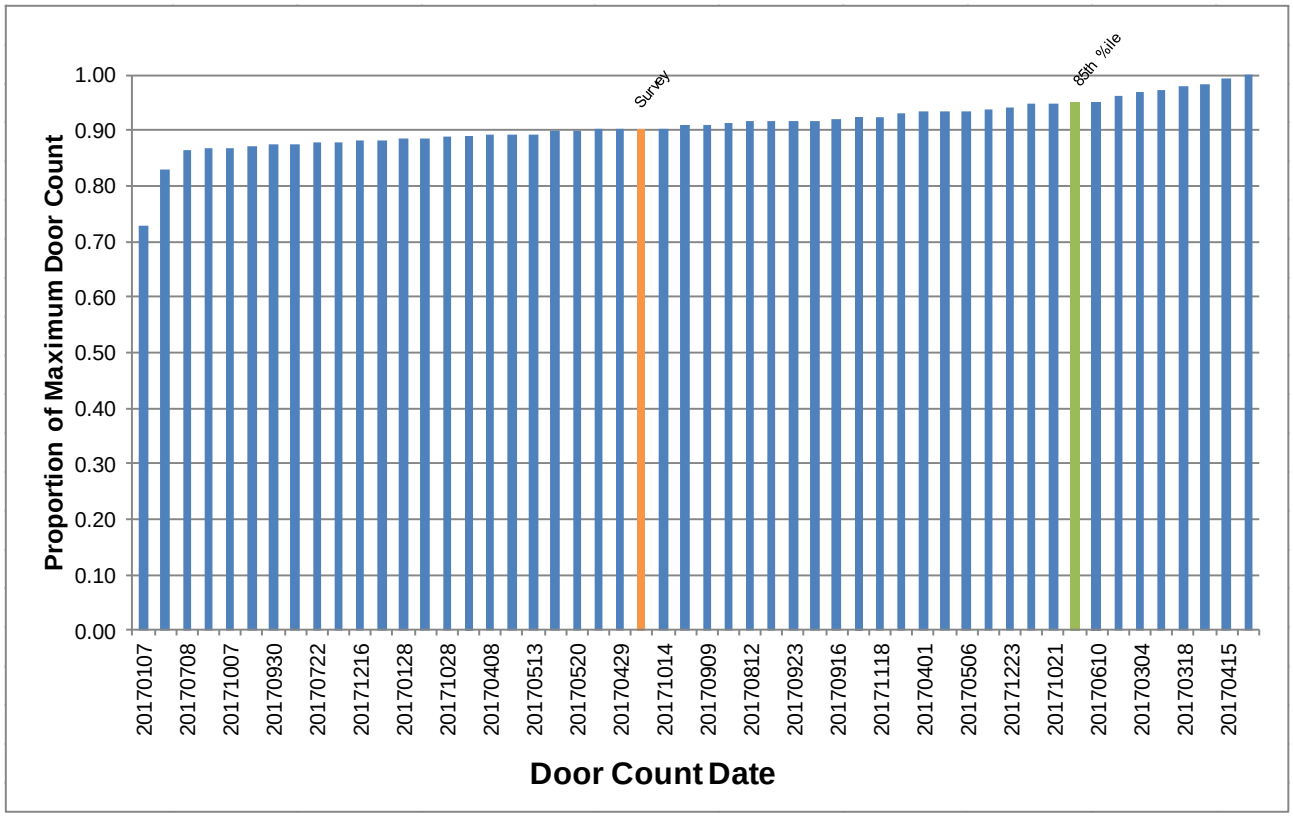


Figure 6 and 7 also denote a comparative view of the survey day patronage and that determined as the 85th percentile of Thursdays and Saturdays.

3.4.3.4 Step 3: Determine Percentile Trading Day Conversion Factor

From the Figure 6 and 7 data, it was established that the two survey days were high trading days as would be expected given they were conducted in the first major week of the 2017 December Christmas shopping period. It was established that the survey days were:

- Thursday 7th, 2017 was a 102.5% of the 85th percentile trading Thursday
- Saturday 9th, 2017 was 95% of the 85th percentile trading Saturday.

3.4.3.5 Step 4: Apply Patronage Scalar Factor to Survey Demand

Table 9 summarises the resultant, scaled 85th percentile Westfield Eastgardens traffic generation for both peak hour periods.

Table 9 Westfield Eastgardens – Existing Traffic Demand Calibration

Peak Period	Surveyed Traffic Generation	85th %ile Calibration Factor	85th %ile Traffic Generation
Thursday PM	3,454vph	0.975	**3,368vph**
Saturday Midday	3,855vph	1.052	**4,055vph**

3.4.3.6 Incremental Retail Traffic Generation

SLR advocates the use of the traffic generation decay forecasting method for large retail establishments including shopping centres. This approach is widely recognised by the traffic engineering industry and is referenced in the following guidelines:

- *Land Use Traffic Generation Guidelines*, March 1987 – Director General of Transport, South Australia;
- *Guide to Traffic Generating Developments Version 2.2*, October 2002 – Roads and Traffic Authority, New South Wales;
- *Guide to Traffic Generating Developments – Updated Traffic Surveys, TDT 2013/04a*, August 2013 – NSW RMS;
- *Trip Generation 7th edition*, 2003 – Institute of Transportation Engineers, Washington, USA.

The incremental retail traffic generation has been estimated in accordance with the widely accepted traffic generation decay curve for shopping centres larger than 30,000sq.m. The Figure 8 traffic generation *rate* curve and the Figure 9 traffic generation *total* curve are calibrated using the 85th percentile existing site generation rates documented in Section 3.4.3.5 of this report. This approach ensures that the decay curve is standardised as much as possible to account for local conditions.

Figure 8 Retail Traffic Demand Decay Curve – Trip Rate

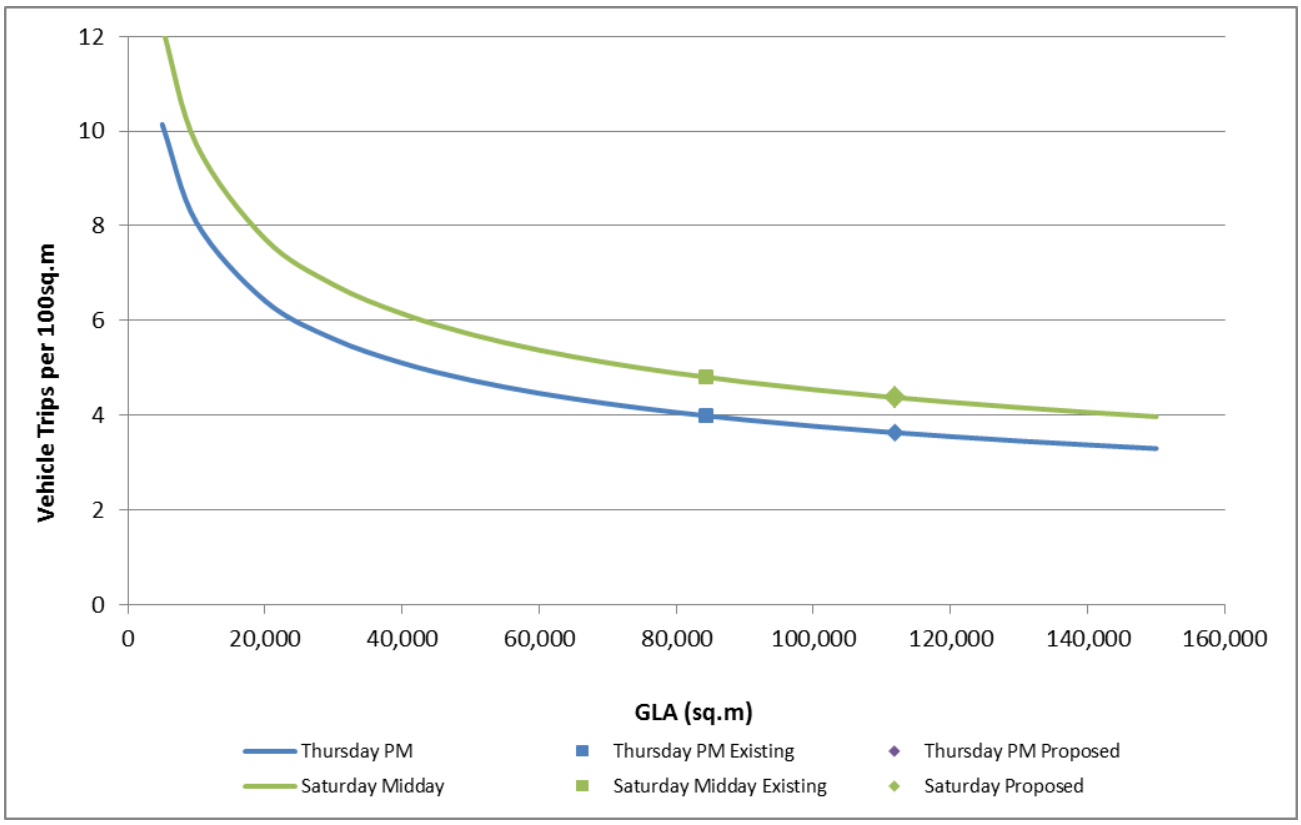


Figure 9 Retail Traffic Demand Decay Curve – Total Trips

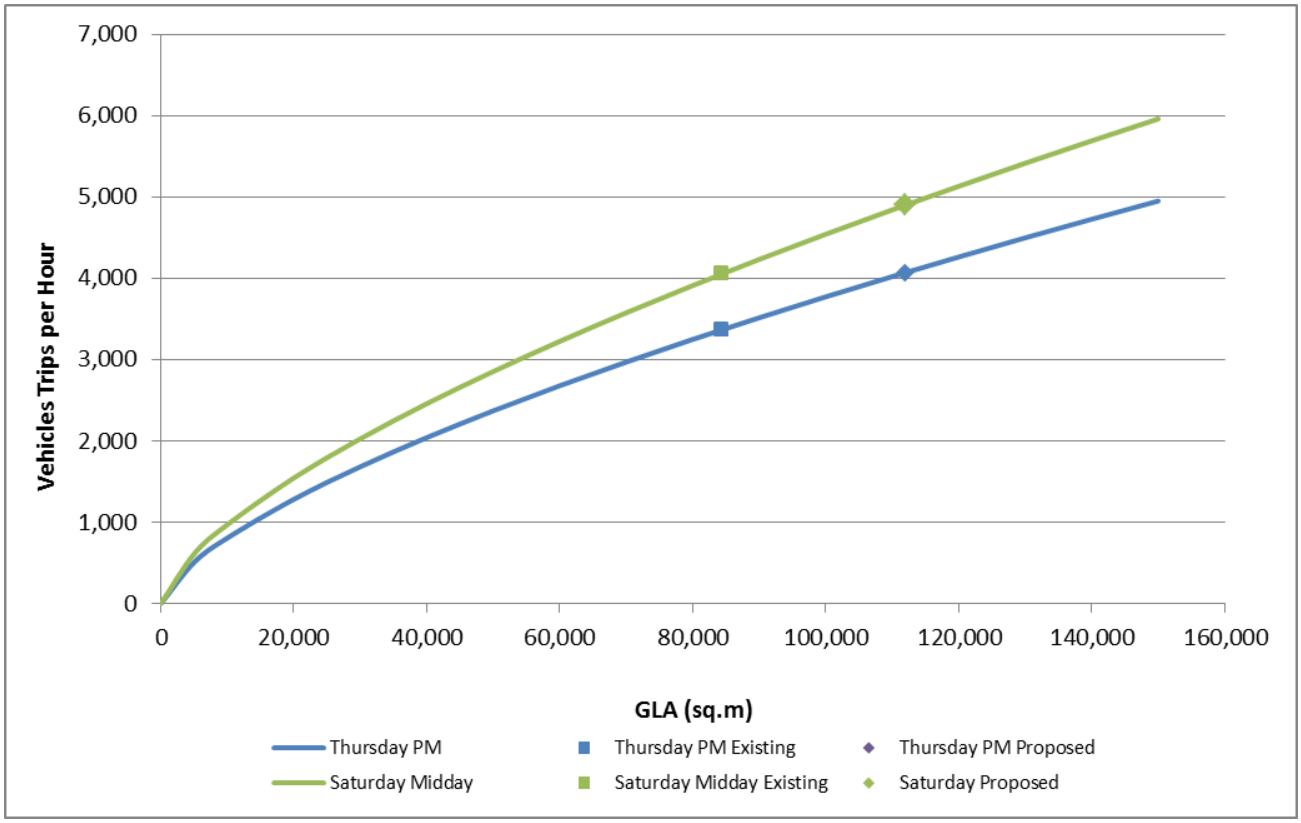


Table 10 summarises the results obtained from Figures 8 and 9.

Table 10 Westfield Eastgardens – Future Traffic Demand (Retail)

Scenario	Land Use	Yield (GLA)	TPM		SAT	
			Trip Rate	Trips	Trip Rate	Trips
Existing	Retail	84,401sq.m	3.99 per 100sq.m GLA	3,368	4.80 per 100sq.m GLA	4,055
Proposed		111,901sq.m	3.64 per 100sq.m GLA	4,068	4.38 per 100sq.m GLA	4,898
Incremental Increase			-	***+700vph***		***+843vph***

Table 11 summarises the assumptions adopted for the Westfield Eastgardens directional distribution.

Table 11 Westfield Development Directional Split Assumptions

Land Use	TPM		SAT	
	In	Out	In	Out
Commercial	20%	80%	50%	50%
Retail	50%	50%	50%	50%

3.4.3.7 Resultant Westfield Eastgardens Demand Summary

Table 12 summarises the resultant traffic demand increase associated with the cumulative retail and office components.

Table 12 Westfield Development Traffic Demand (Incremental Increase)

Land Use	Yield	TPM			SAT		
		Total	In	Out	Total	In	Out
Commercial	25,000sq.m GLA	300	60	240	150	75	75
Retail	27,500sq.m GLA	700	350	350	843	422	422
Total	***52,500sq.m GLA***	***1000***	***410***	***590***	***993***	***497***	***497***
Drop-in trips (19%)		*133*	*67*	*67*	*160*	*80*	*80*
New trips (81%)		*867*	*343*	*523*	*833*	*417*	*417*
Total		***1000***	***410***	***590***	***993***	***497***	***497***

The resultant traffic demand increase does not include any consideration for other cross-utilisation or temporal variations. It does make consideration for drop-in trips which is widely accepted practice. Only undiverted drop-in trips already travelling along the two main fronting roads are incorporated. Diverted drop-in trips are conservatively not incorporated and these trips are assumed as entirely new trips.

A 19% proportion has been adopted for drop-in trips travelling along Wentworth Avenue and Bunnerong Road. That is, 19% of the incremental traffic generated by the proposed expansion is assumed to already travel past the subject site. On commencement of the use, these existing trips will drop-in to the site, thereby generating new turning movements (in and out of site) but reducing through traffic. The drop-in trip reduction is only applied to the retail (shopping centre) component and not the commercial (office) use.

3.4.4 Network Development

The Base 2031 + Meriton Pagewood + Westfield Eastgardens traffic scenario was iteratively evaluated such that a suite of possible capacity upgrading works on the external road network could be devised such that the incremental effect of Westfield Eastgardens traffic could be offset, either across the network or at individual intersection locations.

This 'no nett worsening' approach was developed such that sufficient quantitative modelling and evidence could be presented that justified the scope and scale of the nominated improvements. From the three future year scenarios developed by SLR, it is possible to make the following comparisons of network and intersection traffic operations for both peak periods:

a. How does Meriton Pagewood Stage 1 and 2 development (inclusive of capacity improvements) increase/reduce congestion compared to the Base (No Development) scenario

b. How does the Westfield Eastgardens redevelopment (inclusive of capacity improvements) increase/reduce congestion compared to the Base + Meriton Pagewood development

c. How does the combined Meriton Pagewood and Westfield Eastgardens developments (inclusive of capacity improvements) increase/reduce congestion compared to the Base (No Development) scenario.

3.4.4.1 Proposed Intersection Upgrades

In association with the proposed Westfield Eastgardens Planning Proposal, the following capacity improvements have been investigated and are nominated for ongoing consideration and stakeholder discussion:

1. Wentworth Avenue/Banks Avenue/Cornish Circuit – additional turn lanes on the northern and eastern intersection approaches
2. Wentworth Avenue/Denison St/Site – additional turn lanes on eastern and western Wentworth Avenue approaches and reconfiguration of site egress to accommodate two-way traffic movement
3. Wentworth Avenue/Bunnerong Road – addition turn lane on the northern intersection approach
4. Bunnerong Road/Westfield Drive – additional turn lane on the northern intersection approach and improvements to the existing site approach/departure to increase queue storage and reduce weaving conflicts.

The four key intersection improvements are detailed in the following sections and screen shots from the model are included at Appendix C. Civil concepts for these works are still being resolved and may be available in due course during subsequent post-lodgement discussions with stakeholders.

Comparative operational results for the two layouts across the three use scenarios and two peak hour periods are reported in Section 4.

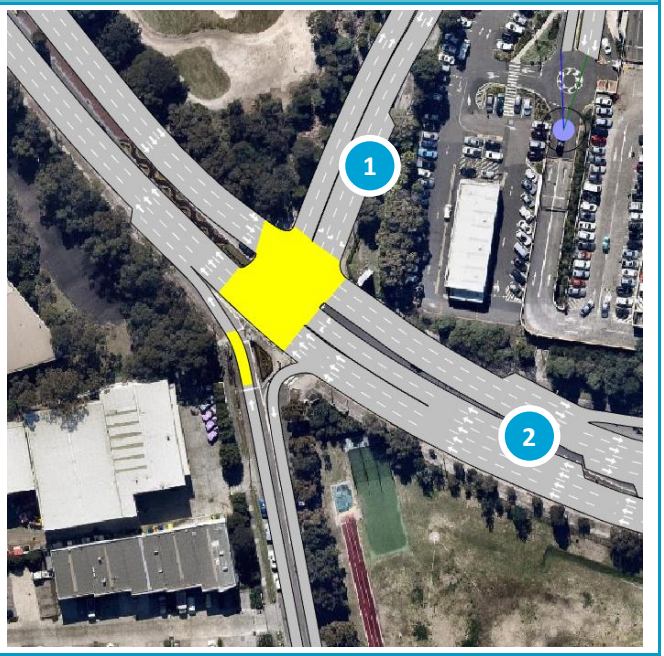
It is noted that these works are generally consistent with that described in the original traffic statement prepared by Colston Budd Rogers and Kafes Transport Review for Planning Proposal for Westfield Eastgardens, dated May 2017.

It is also noted that whilst these works have been assessed to date, it does not mean that these are the only solution that would be possible should, for any reason, these works be ultimately determined as not feasible or desired by any involved stakeholder. The upgrade type/scale represents only first position of a possible suite of solutions.

Wentworth Avenue/Banks Avenue/Cornish Circuit

Figure 10 illustrates the existing layout and upgraded AIMSUN modelled layout and summarises the proposed improvements to the northern and eastern intersection approaches.

Figure 10 Existing and Proposed Layout: Wentworth Avenue/Banks Avenue/Corish Circuit Intersection

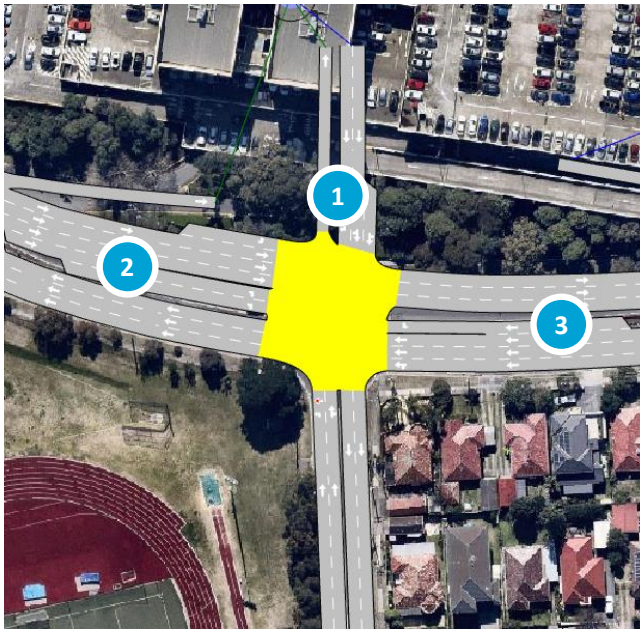
Existing Layout	AIMSUN Layout – Westfield Upgrade
	

ID	Upgrade
1	Additional Banks Avenue northern approach auxiliary left turn lane.
2	Additional Wentworth Avenue eastern approach auxiliary right turn lane.

Wentworth Avenue/Denison Street/Westfield Access

Figure 11 illustrates the existing layout and upgraded AIMSUN modelled layout and summarises the proposed improvements to the northern, eastern and western intersection approaches.

Figure 11 Existing and Proposed Layout: Wentworth Avenue/Denison Street/Westfield Access Intersection

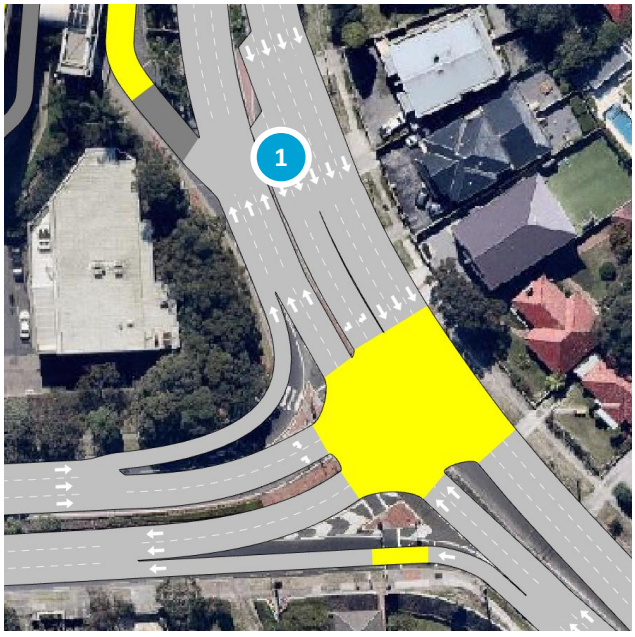
Existing Layout	AIMSUN Layout – Westfield Upgrade
	

ID	Upgrade
1	Additional Westfield Access northern approach auxiliary left turn/through lane. New Westfield Access northern approach entry lane.
2	Additional Wentworth Avenue western approach auxiliary right turn lane.
3	New Wentworth Avenue eastern approach auxiliary right turn lane.

Wentworth Avenue/Bunnerong Road

Figure 12 illustrates the existing layout and upgraded AIMSUN modelled layout and summarises the proposed improvements to the northern intersection approach.

Figure 12 Existing and Proposed Layout: Wentworth Avenue/Bunnerong Road Intersection

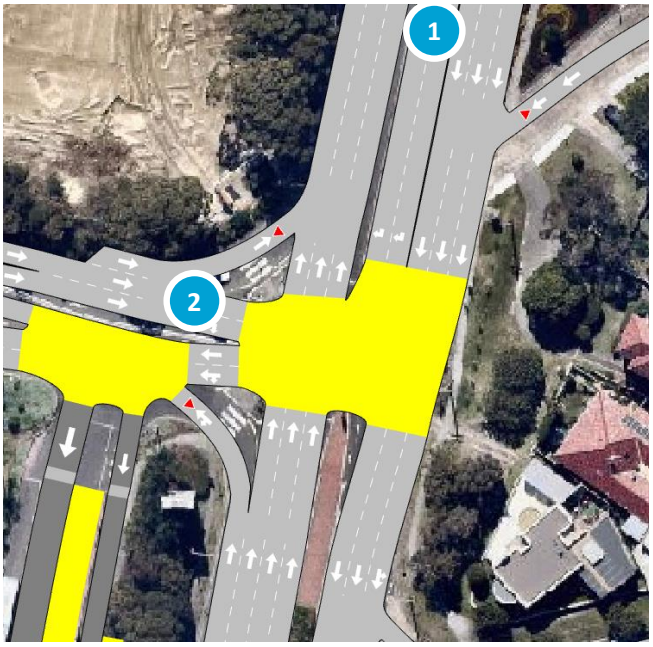
Existing Layout	AIMSUN Layout – Westfield Upgrade
	

ID	Upgrade
1	Additional Bunnerong Road northern approach auxiliary right turn lane.

Bunnerong Road/Westfield Drive

Figure 13 illustrates the existing layout and upgraded AIMSUN modelled layout and summarises the proposed improvements to the northern and western intersection approaches.

Figure 13 Existing and Proposed Layout: Bunnerong Road/Westfield Drive Intersection

Existing Layout	AIMSUN Layout – Westfield Upgrade
	

ID	Upgrade
1	Additional Bunnerong Road northern approach auxiliary right turn lane.
2	Reconfiguration and optimisation of the Westfield Drive approach lane arrangements.

3.4.4.2 Further Changes to the '2031 Base + Meriton' Model

The following is noted in relation to further changes to the coding of the calibrated base model (i.e. in addition to those conducted in the 2031 Base model):

- Signal timing was adjusted at a selection of intersections,
- Removal of some on-street parking on approach to some intersections.

These changes are considered reasonable and are not unlike those which would be expected to be implemented by Council and/or NSW RMS in due course by 2031 to ensure ongoing operation of the network. Furthermore, sufficiently stable results could not be extracted from the model without these minor revisions.

Most importantly, where minor revisions like those summarised above were made, they were similarly adopted in the other comparative land use scenarios such that direct comparison were possible.

4 Modelling Outputs and Results

4.1 Model Stability

Tables 13 and 14 summarise the model stability outputs for each of the three scenarios, for the Thursday and Saturday assessment periods respectively.

Table 13 Model Stability – 2031 Thursday PM Scenarios

Peak Period	Run	Seed	TPM 2031 Base		TPM 2031 Base + Meriton		TPM 2031 Base + Meriton + Westfield	
			Replication	Travel Time	Replication	Travel Time	Replication	Travel Time
TPM	1	560	**23296**	**1,139.44**	28926	1,163.32	34286	1,283.84
	2	28	23298	1,100.53	28927	1,152.25	34287	1,298.32
	3	7771	23299	1,114.27	28928	1,148.98	34288	1,265.56
	4	86524	23300	1,130.39	28929	1,206.14	**34289**	**1,292.76**
	5	2849	23301	1,184.12	28930	1,201.42	34290	1,270.88
	6	5321	23302	1,149.48	**28931**	**1,166.09**	34291	1,300.41
	7	137	23303	1,146.93	28932	1,194.70	34292	1,393.47
	Average	-	***23295***	***1137.88***	***28925***	***1,176.13***	***34285***	***1,296.40***
	Median	-	***23296***	***1,139.44***	***28931***	***1,166.09***	***34289***	***1,292.76***

Table 14 Model Stability – 2031 Saturday Midday Scenarios

Peak Period	Run	Seed	SAT 2031 Base		SAT 2031 Base + Meriton		SAT 2031 Base + Meriton + Westfield	
			Replication	Travel Time	Replication	Travel Time	Replication	Travel Time
SAT	1	560	28840	952.48	28909	1,141.66	30383	1,215.76
	2	28	28841	931.99	**28910**	**1,118.07**	30384	1,269.21
	3	7771	28842	953.38	28911	1,120.40	30385	1,184.63
	4	86524	28843	932.02	28912	1,106.33	30386	1,228.07
	5	2849	28844	1,000.57	28913	1,116.40	30387	1,279.99
	6	5321	28845	909.83	28914	1,112.95	**30388**	**1,229.59**
	7	137	**28846**	**948.06**	28915	1,149.92	30389	1,251.38
	Average	-	***28839***	***946.91***	***28908***	***1,123.68***	***30382***	***1,236.95***
	Median	-	***28846***	***948.06***	***28910***	***1,118.07***	***30388***	***1,229.59***

The Table 13 and 14 results indicate that the seven seeds are generally consistent with the selected median seed.

4.2 Network Wide Average Results Summary

Tables 15 and 16 summarise a selection of traffic performance parameters measured across the entire modelled network. These results are extracted from the median seed model run.

Table 15 Model Results Summary - 2031 Thursday PM (Median model runs)

Statistic	Base	Base + Meriton		Base + Meriton + Westfield		
		Result	Δ Base	Result	Δ Base	Δ Base + M
Replication	***23296***	***28931***		***34289***		
Vehicle kilometres travelled	23,718	26,461	11.6%	28,315	19.4%	7.0%
Vehicle hours travelled	1,139	1,166	2.3%	1,293	13.5%	10.9%
Average speed (km/h)	26.6	25.8	-2.8%	24.8	-6.9%	-4.2%
Stop time (sec/km)	118	90	-24.0%	94	-20.5%	4.5%
Waiting to enter (vehs)	269	5	-98.1%	1	-99.6%	-80.0%
Input Count	19,993	21,968	9.9%	23,760	18.8%	8.2%

The Table 15 results for the Thursday PM scenario can be interpreted as follows:

- As expected, VKT and VHT obviously increase post development of the Meriton and Westfield sites;
- The modelled capacity improvements delivered in combination with the Pagewood development:
  - Reduce the average Travel Speed compared to the Base;
  - Reduce the average Stop Time compared to the Base;
  - Reduce the number of vehicles waiting to enter the model.
- The modelled capacity improvements delivered in combination with the Westfield Eastgardens development:
  - Reduce the average Travel Speed compared to the Base and Base + Meriton scenarios *;
  - Reduce the average Stop Time compared to the Base;
  - Reduce the number of vehicles waiting to enter the model.

** It should be noted that the average travel speed output for both development scenarios is affected by vehicles moving slower through car park areas and low speed streets compared to the higher average posted speed limit that is modelled as part of the Base year scenario. Additional information pertaining to travel time along external routes that don't include this development delay is presented in Section 4.3.*

Table 16 Model Results Summary - 2031 Saturday Midday (Median model runs)

Statistic	Base	Base + Meriton		Base + Meriton + Westfield		
		Result	Δ Base	Result	Δ Base	Δ Base + M
Replication	***28846***	***28910***		***30388***		
Vehicle kilometres travelled	23,434	26,285	12.2%	27,779	18.5%	5.7%
Vehicle hours travelled	948	1,118	17.9%	1,230	29.7%	10.0%
Average speed (km/h)	29.0	27.0	-7.1%	25.5	-12.1%	-5.4%
Stop time (sec/km)	76	83	9.2%	95	24.9%	14.4%
Waiting to enter (vehs)	0	0	inf	0	inf	inf
Input Count	19,224	21,503	11.9%	23,018	19.7%	7.0%

The Table 16 results for the Thursday PM scenario can be interpreted as follows:

- As expected, VKT and VHT obviously increase post development of the Meriton and Westfield sites;
- The modelled capacity improvements delivered in combination with the Pagewood development:
  - Reduce the average Travel Speed compared to the Base;
  - Increase the average Stop Time compared to the Base;
  - No change in the number of vehicles waiting to enter the model.
- The modelled capacity improvements delivered in combination with the Westfield Eastgardens development:
  - Reduce the average Travel Speed compared to the Base and Base + Meriton scenarios *;
  - Increase the average Stop Time compared to the Base and Base + Meriton scenarios *;
  - No material change in the number of vehicles waiting to enter the model.

** It should be noted that the average travel speed reported for both development scenarios is affected by vehicles moving slower through car park areas and low speed streets compared to the higher average posted speed limit that is modelled as part of the Base year scenario. Additional information pertaining to travel time along external routes that don't include this development delay is presented in Section 4.3.*

When evaluated across the entirety of the modelled area, it is suggested that the modelled capacity improvements associated with both the Meriton Pagewood and Westfield Eastgardens sites sufficiently offset any incremental demand that they generation on the network.

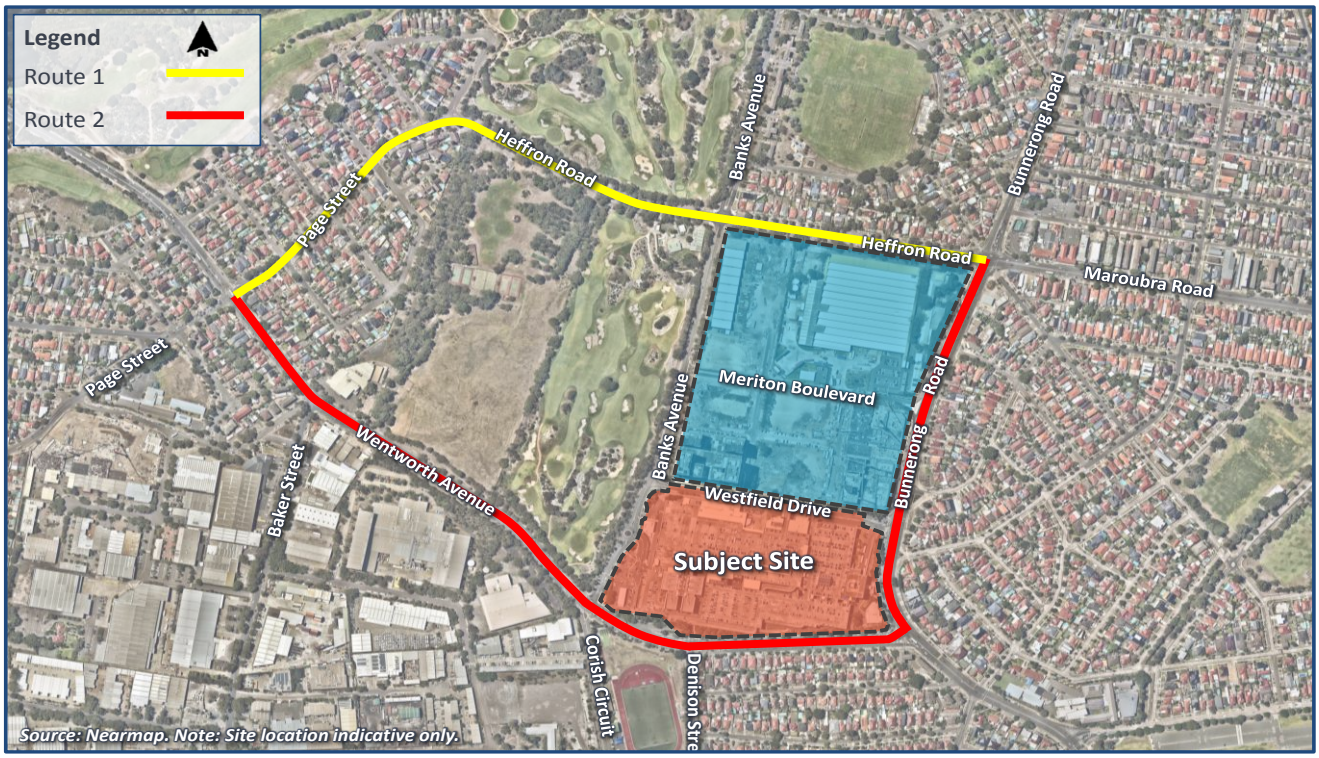
4.3 External Travel Route Travel Times

A supplementary review of travel speeds and travel time was completed so as to provide for a more complete view of development impacts associated with both the Meriton Pagewood and Westfield Eastgardens developments.

The approach is based on the external routes introduced previously in the 2017 Base year Model Development and Calibration reporting. Comparing travel times on these routes across the three use scenarios provide a more accurate representation of development impact and capacity upgrading benefit whilst excluding delays and lower travel speeds that occur in development car parks (Eastgardens) and lower order residential streets (Pagewood).

Figure 14 illustrates the two travel routes used for the travel time comparisons.

Figure 14 Travel Time Routes



Tables 17 and 18 summarised the comparative travel times output for each of the three use scenarios for the Thursday and Saturday peak hour assessment periods respectively. Figures 15 and 16 overleaf present this same information in a bar chart format.

Table 17 Travel Time Comparison (Seconds) - 2031 Thursday PM (Median model runs)

Route	Direction	Base	Base + Meriton		Base + Meriton + Westfield		
			Result	Δ Base	Result	Δ Base	Δ Base + M
Replication		***23296***	***28931***		***34289***		
Route 1	Eastbound	150	263	75%	339	126%	29%
	Westbound	308	212	-31%	169	-45%	-21%
Route 2	Eastbound	197	235	19%	249	26%	6%
	Westbound	368	207	-44%	279	-24%	35%

Table 18 Travel Time Comparison (Seconds) - 2031 Saturday Midday (Median model runs)

Route	Direction	Base	Base + Meriton		Base + Meriton + Westfield		
			Result	Δ Base	Result	Δ Base	Δ Base + M
Replication		***28846***	***28910***		***30388***		
Route 1	Eastbound	155	175	13%	224	45%	28%
	Westbound	152	316	108%	213	40%	-33%
Route 2	Eastbound	216	240	11%	262	21%	9%
	Westbound	357	313	-12%	277	-22%	-11%

Figure 15 2031 Thursday PM Model Scenarios – Travel Time Comparison

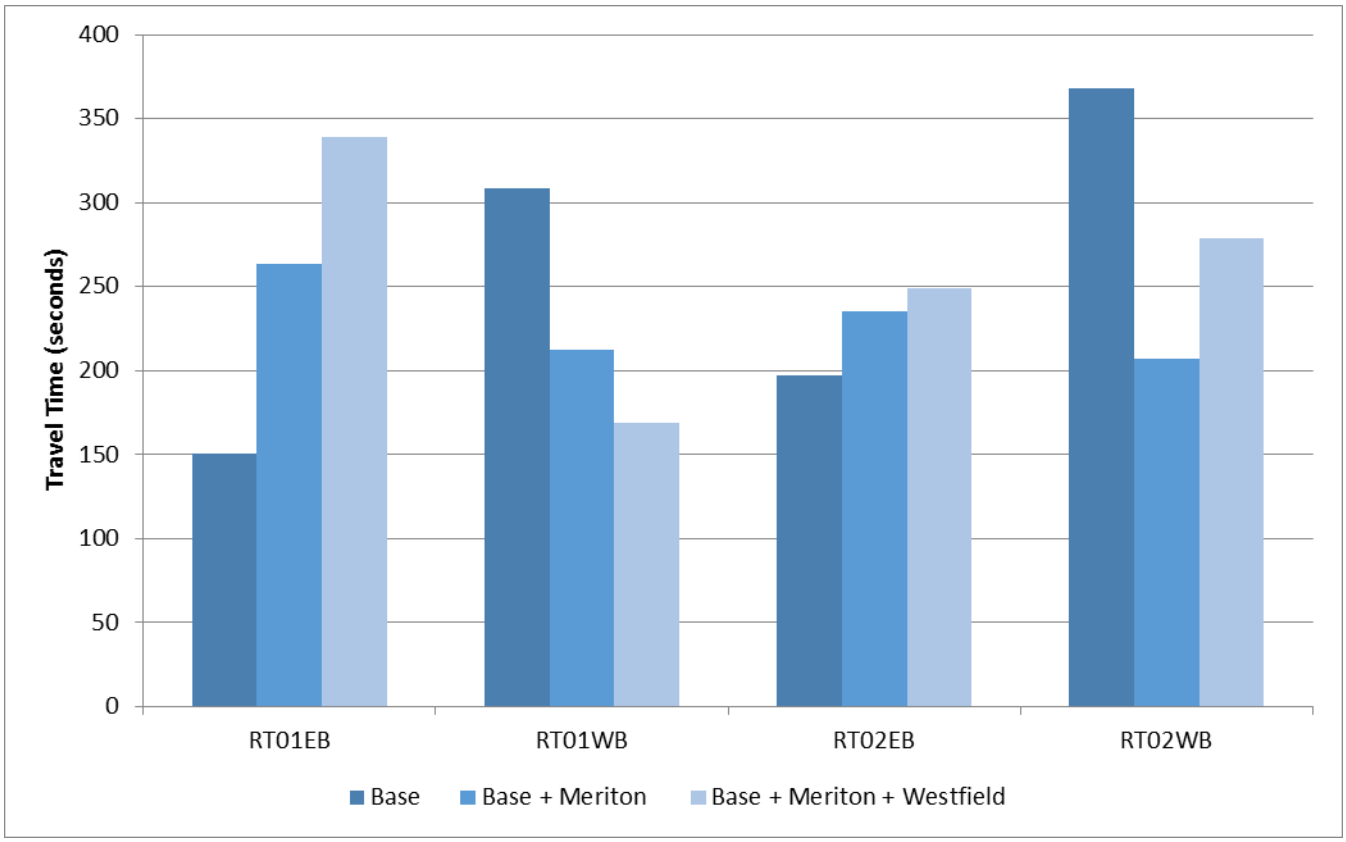
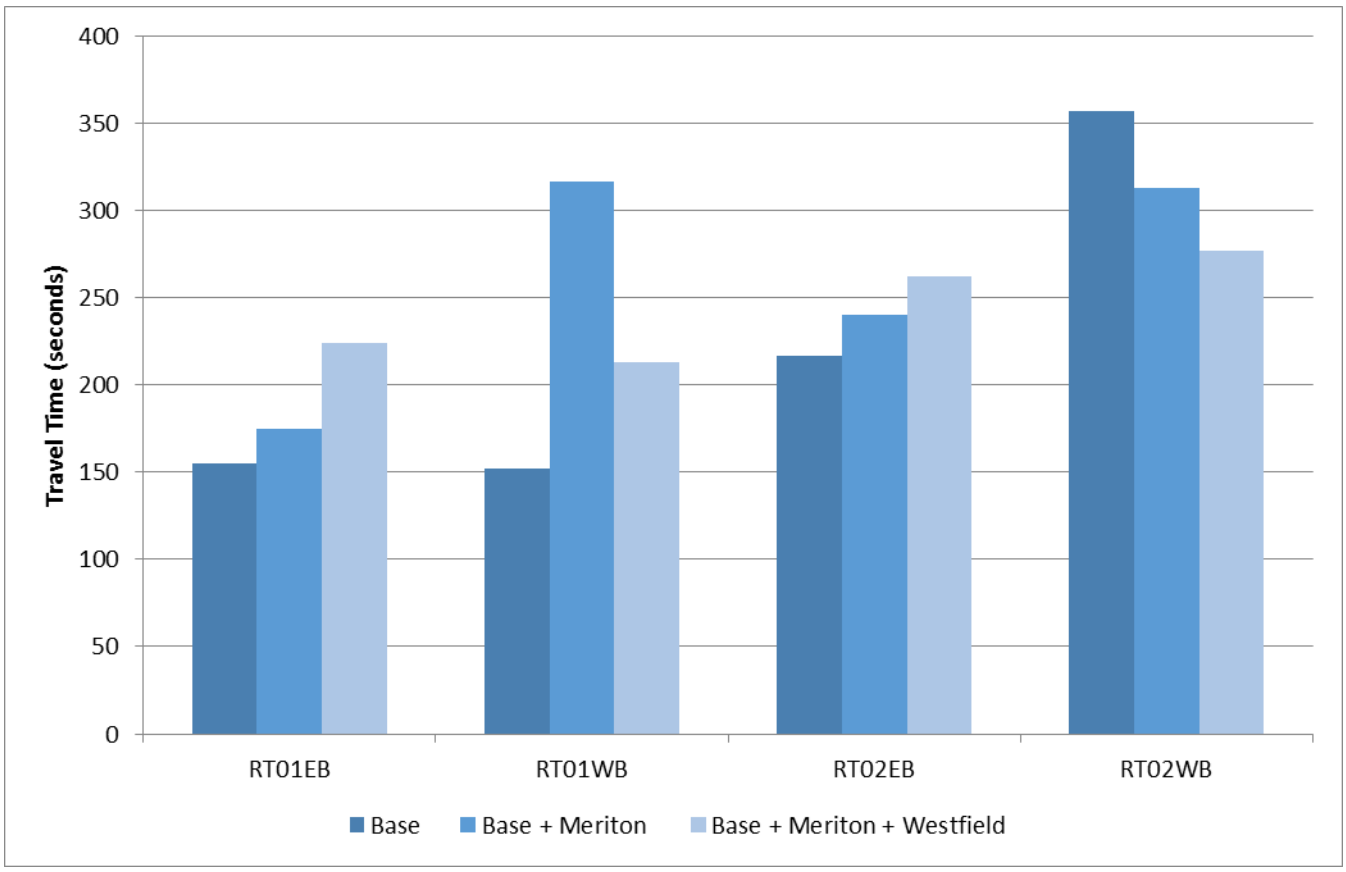


Figure 16 2031 SAT Model Scenarios – Travel Time Comparison



When evaluated across the external travel routes with consideration for both directions of travel and the relative demands, it is suggested that the modelled capacity improvements nominated in association with the Westfield Eastgardens development reasonably offset any additional network congestion that would otherwise arise from the subject redevelopment over-and-above that projected for the (planned) base scenario inclusive of the Meriton development.

4.4 Intersection Results Operations Delay

Tables 19 and 20 summarise a the average delay and Level of Service (LOS) traffic performance parameters extracted for each major intersection included in the modelled network. These results are extracted from the median seed model run.

Table 19 2031 Thursday PM Model Scenarios – Intersection Average Delay Comparison (Seconds)

ID	Intersection	Base		Base + Meriton		Base + Meriton + Westfield	
		Delay	LOS	Delay	LOS	Delay	LOS
1	Wentworth Avenue/Page Street	37	C	31	C	27	B
2	Wentworth Avenue/Baker Street	16	B	14	A	14	B
3	Wentworth Avenue/Banks Avenue/Cornish Circuit	43	D	43	D	47	D
4	Banks Avenue/Westfield Access (S)	1	A	1	A	2	A
5	Banks Avenue/Westfield Access (N)	2	A	2	A	3	A
6	Banks Avenue/Westfield Drive	20	B	17	B	15	B
7	Banks Avenue/Heffron Avenue	2	A	30	C	28	B
8	Wentworth Avenue/Dennison Street/Westfield Access	20	B	19	B	27	B
9	Wentworth Avenue/Westfield Access	2	A	2	A	2	A
10	Wentworth Avenue/Bus Egress	2	A	2	A	3	A
11	Wentworth Avenue/Bunnerong Road	34	C	26	B	23	B
12	Bunnerong Road/Westfield Drive	9	A	10	A	18	B
13	Bunnerong Road/Meriton Boulevard	0	A	5	A	8	A
14	Bunnerong Road/Maroubra Road/Heffron Road	24	B	26	B	25	B

The Table 19 results for the Thursday PM scenario can be interpreted as follows:

- The modelled capacity improvements delivered in combination with the Pagewood development:
  - Generally maintain similar levels of delay and LOS that would otherwise projected to occur as part of the Base scenario;
  - Delay and LOS is improved/degraded at individual locations, albeit the balance tends to equalise across all 14 locations *.
- The modelled capacity improvements delivered in combination with the Westfield Eastgardens development:
  - Generally maintain similar levels of delay and LOS that would otherwise projected to occur as part of the Base scenario and Base + Meriton scenario;
  - Delay and LOS is improved/degraded at individual locations, albeit the balance tends to equalise across all 14 locations *.

** As was the case for the network wide average Stop Time and Travel Speed, the development scenarios include additional delays experienced at the site egress to a higher proportion that is modelled in the base. These lesser intersection approach typically have less green time compared to the arterial phase present on the fronting road. Accordingly, when development traffic demand increases, so too does the average delay measured across the entire intersection.*

Table 20 2031 SAT Model Scenarios – Intersection Average Delay Comparison (Seconds)

ID	Intersection	Base		Base + Meriton		Base + Meriton + Westfield	
		Delay	LOS	Delay	LOS	Delay	LOS
1	Wentworth Avenue/Page Street	34	C	37	C	27	B
2	Wentworth Avenue/Baker Street	5	A	6	A	6	A
3	Wentworth Avenue/Banks Avenue/Cornish Circuit	47	D	39	C	46	D
4	Banks Avenue/Westfield Access (S)	2	A	3	A	2	A
5	Banks Avenue/Westfield Access (N)	3	A	4	A	2	A
6	Banks Avenue/Westfield Drive	19	B	11	A	11	A
7	Banks Avenue/Heffron Avenue	2	A	25	B	28	B
8	Wentworth Avenue/Dennison Street/Westfield Access	17	B	17	B	29	C
9	Wentworth Avenue/Westfield Access	1	A	1	A	2	A
10	Wentworth Avenue/Bus Egress	4	A	1	A	3	A
11	Wentworth Avenue/Bunnerong Road	32	C	29	C	23	B
12	Bunnerong Road/Westfield Drive	13	A	12	A	22	B
13	Bunnerong Road/Meriton Boulevard	0	A	11	A	9	A
14	Bunnerong Road/Maroubra Road/Heffron Road	27	B	26	B	26	B

The Table 20 results for the Saturday scenario can be interpreted as follows:

- The modelled capacity improvements delivered in combination with the Pagewood development:
  - Generally maintain similar levels of delay and LOS that would otherwise projected to occur as part of the Base scenario;
  - Delay and LOS is improved/degraded at individual locations, albeit the balance tends to equalise across all 14 locations *.
- The modelled capacity improvements delivered in combination with the Westfield Eastgardens development:
  - Generally maintain similar levels of delay and LOS that would otherwise projected to occur as part of the Base scenario and Base + Meriton scenario;
  - Delay and LOS is improved/degraded at individual locations, albeit the balance tends to equalise across all 14 locations *.

** As was the case for the network wide average Stop Time and Travel Speed, the development scenarios include additional delays experienced at the site egress to a higher proportion that is modelled in the base. These lesser intersection approach typically have less green time compared to the arterial phase present on the fronting road. Accordingly, when development traffic demand increases, so too does the average delay measured across the entire intersection.*

Based on the Table 19 and 20 results, it is suggested that the modelled capacity improvements nominated in association with the Westfield Eastgardens development reasonably offset any additional network congestion that would otherwise arise from the subject redevelopment over-and-above that projected for the (planned) base scenario inclusive of the Meriton development.

5 Summary and Conclusions

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Scentre Group Pty Ltd (Scentre Group) to undertake transport modelling in relation to the proposed expansion of Westfield Eastgardens, located at 152 Bunnerong Road, Eastgardens.

This report has been prepared to document the modelling and evaluation of traffic impacts and possible road network capacity improvements associated with the Westfield Eastgardens Planning Proposal submitted by Scentre Group. The AIMSUN modelling also incorporates incremental traffic demands and external road works associated with the Meriton Pagewood development, inclusive of the approved Stage 1 and proposed Stage 2.

The purpose of the information detailed herein is to inform decisions regarding the road network impacts and proposed capacity improvements.

This technical report has been prepared to document the microsimulation model development process for the following future year 2031 AIMSUN model scenarios:

1) 2031 Base Year = 2017 Calibrated Base Year with annual demand growth;
2) 2031 Base Year + Meriton Pagewood (Stages 1 and 2);
3) 2031 Base Year + Meriton Pagewood + Westfield Eastgardens.

The following key information is summarised and conclusions made:

- The modelling detailed herein is based on the 2017 Calibrated Base AIMSUN model that has been reviewed by Bayside Council and their consultants and deemed reasonable and fit-for-purpose;
- The key land use, traffic generation and background traffic growth assumptions relied upon herein have previously been reviewed by Council, Cardno and NSW RMS and no comment has been received since the 9 February 2018 meeting as to a contrary approach;
- The cumulative modelling incorporates SLR's understanding of the land use and yields approved and proposed as part of the Meriton Pagewood development inclusive of Stages 1 and 2. This understanding has been relayed to Council and NSW RMS and no comment or contrary information has been provided.
- The cumulative modelling of the subject Westfield Eastgardens Planning Proposal includes the following land uses and yields:
  - Commercial – incremental 25,000sq.m;
  - Shopping Centre (Retail) – incremental 27,500sq.m.
- A series of capacity upgrading works have been modelled and evaluated as reasonable and sufficient in offsetting any incremental traffic congestion that would otherwise result from the proposed Westfield Eastgardens Planning Proposal. The nominated works can be summarised as including:
  1. Wentworth Avenue/Banks Avenue/Cornish Circuit – additional turn lanes on the northern and eastern intersection approaches;
  2. Wentworth Avenue/Denison St/Site – additional turn lanes on eastern and western Wentworth Avenue approaches and reconfiguration of site egress to provide two-way traffic movement;
  3. Wentworth Avenue/Bunnerong Road – addition turn lane on the northern intersection approach;

4. Bunnerong Road/Westfield Drive – additional turn lane on the northern intersection approach and improvements to the existing site approach/departure to increase queue storage and reduce weaving conflicts.

- These capacity upgrades are nominated as an introductory position for the purposes of informing the Planning Proposal. It is noted that civil concepts for this works have not yet been refined and the location, nature and scale of the works could vary subject to ongoing stakeholder consultations.
- The nominated road capacity improvements have been deemed sufficient in offsetting the Westfield Eastgardens traffic impact, on balance, when evaluated as follows:
  - On a network wide scale across the entire modelled area;
  - At individual intersections;
  - That traffic performance subsequent to the redevelopment of Westfield Eastgardens (and inclusive of nominated capacity improvements) is comparable to, or better than that projected for the Base + Meriton Pagewood development scenario;
  - That traffic performance subsequent to the cumulative development of the Westfield Eastgardens and Meriton Pagewood sites (and inclusive of cumulative capacity improvements) is comparable to that projected for the Base 2031 (No Development) scenario.

APPENDIX A

Base Model Development Report

Not Included
No Change From That Presented in 16 March 2018 SLR Report

APPENDIX B

Model Stability Results

Updated From That Presented in 16 March 2018 SLR Report in Response to Cardno Peer Review Comments

Figure 17 2031 TPM Model Stability: Vehicles Inside Model – Base

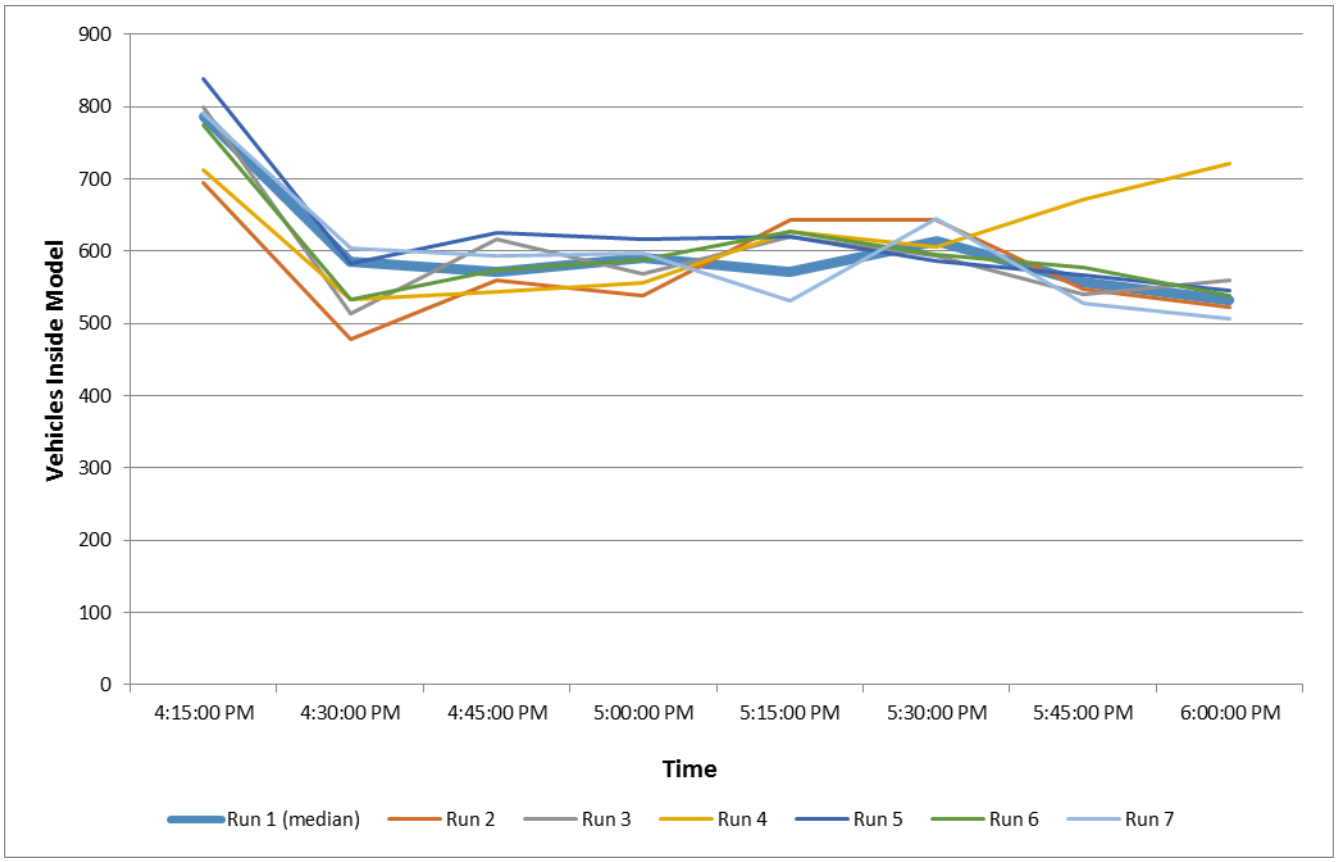


Figure 18 2031 TPM Model Stability: Vehicles Inside Model – Base + Meriton

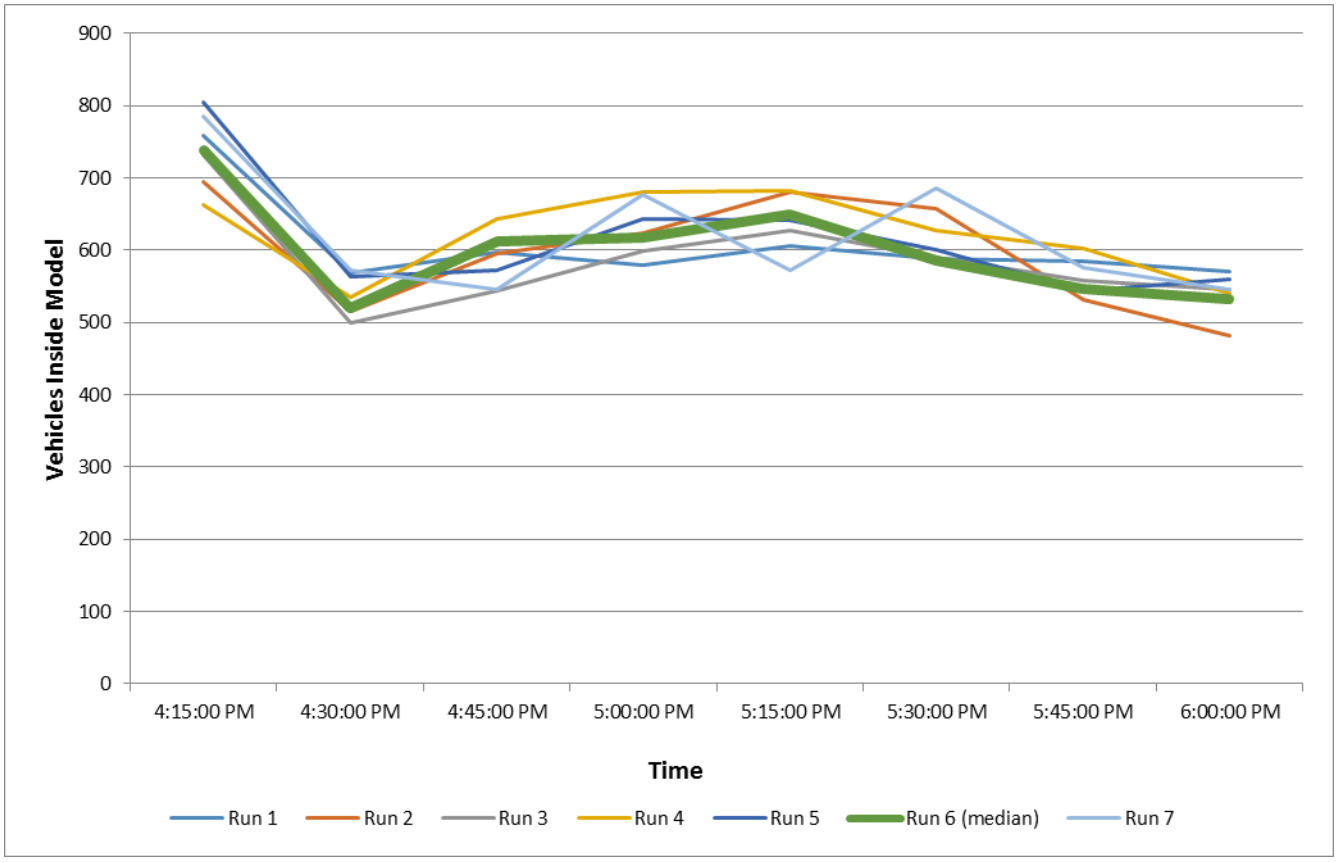


Figure 19 2031 TPM Model Stability: Vehicles Inside Model – Base + Meriton + Westfield

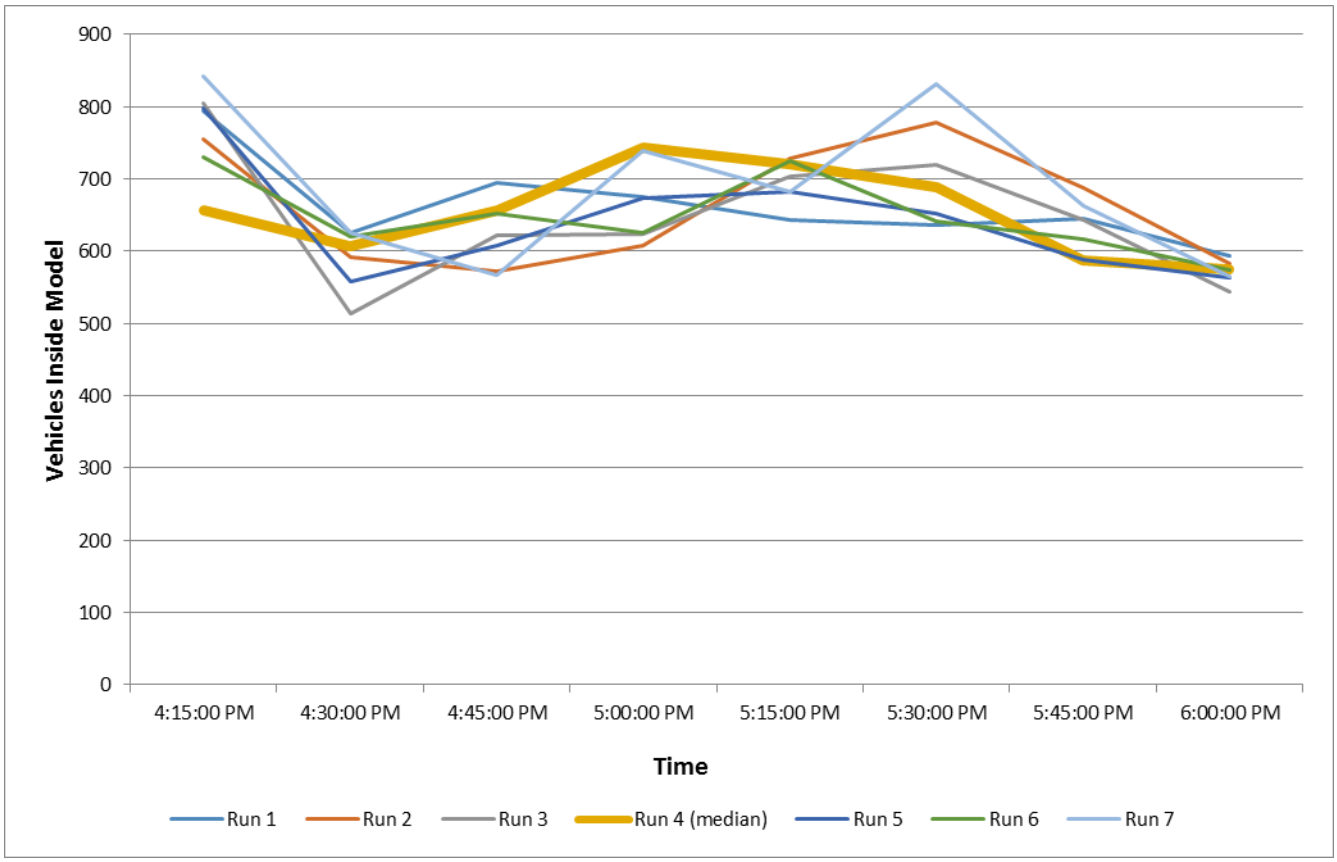


Figure 20 2031 SAT Model Stability: Vehicles Inside Model – Base

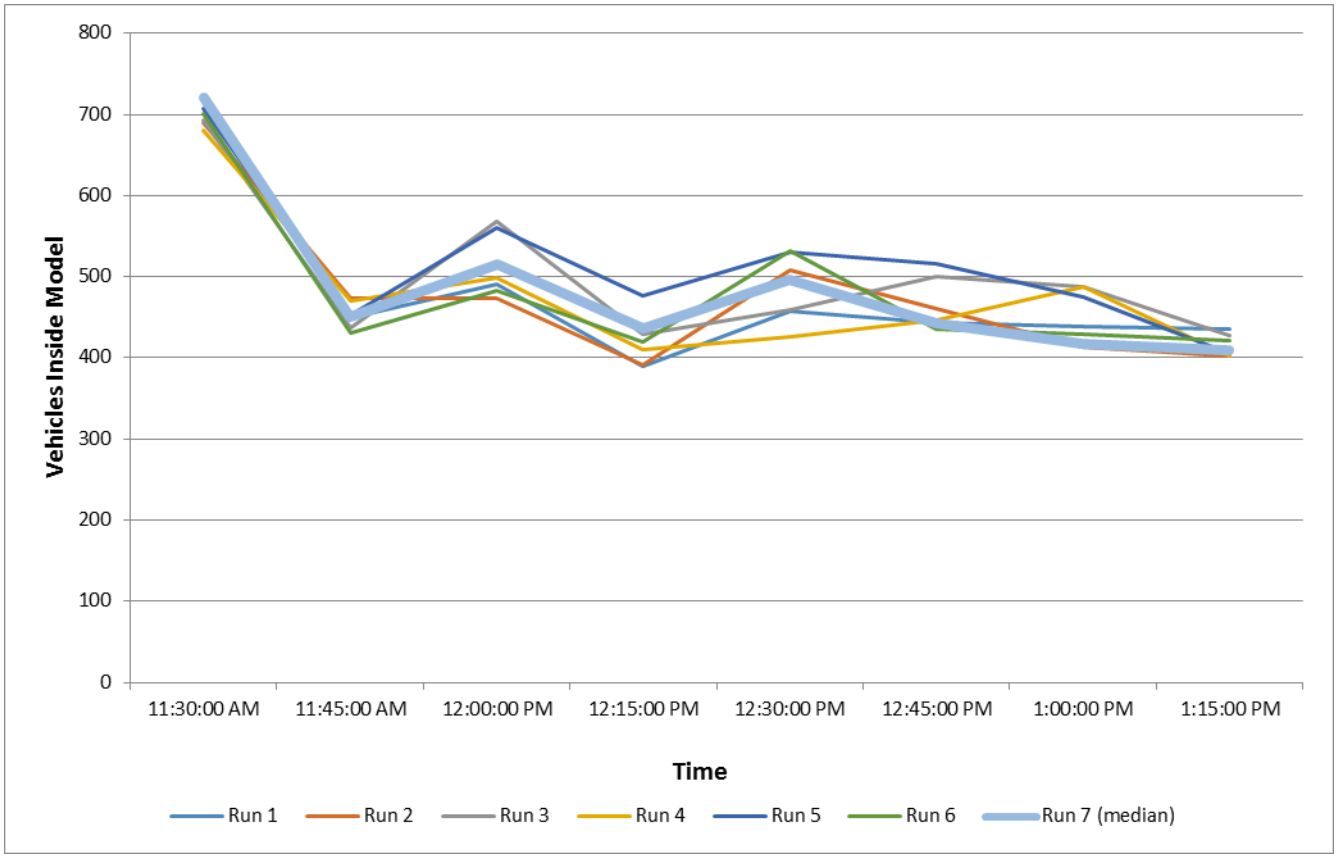


Figure 21 2031 SAT Model Stability: Vehicles Inside Model – Base + Meriton

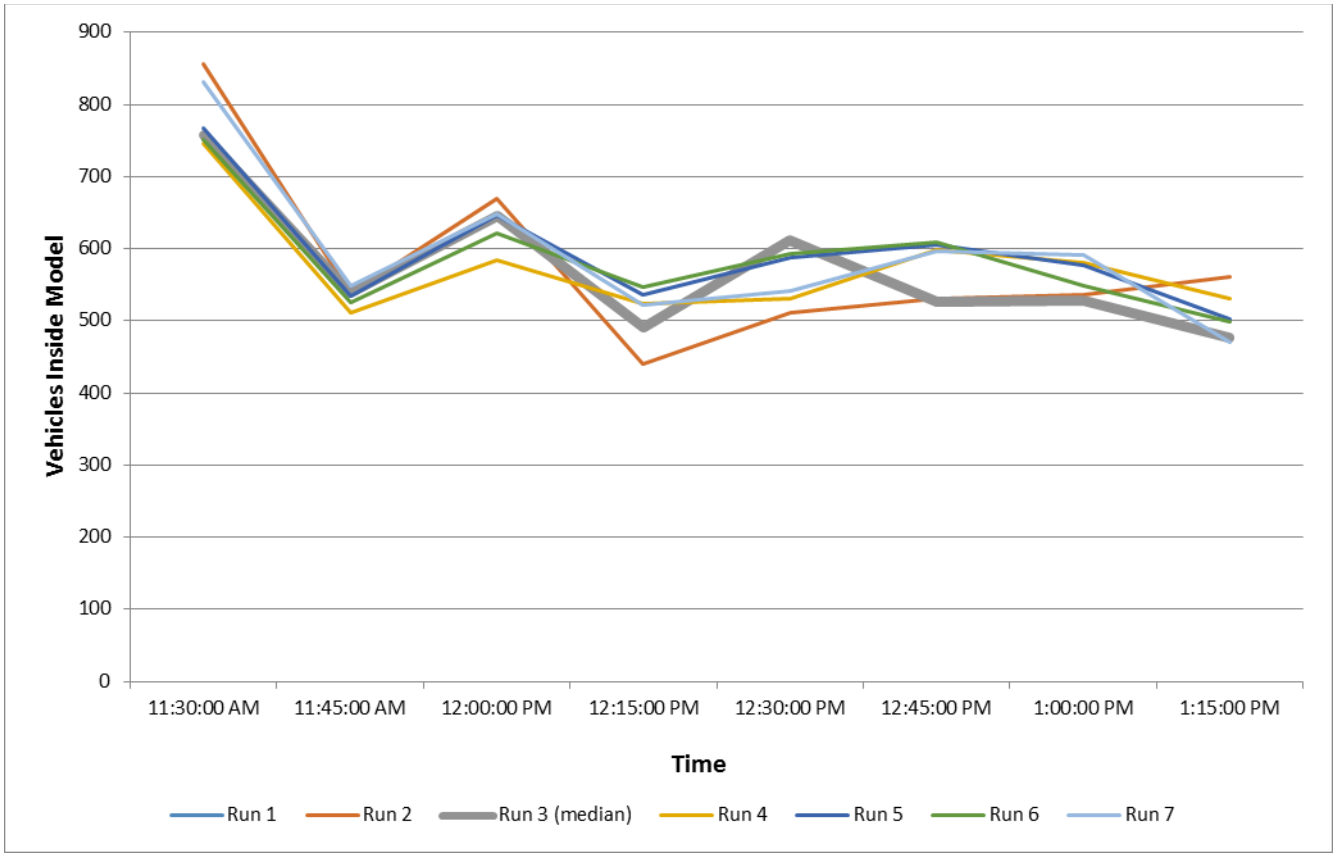
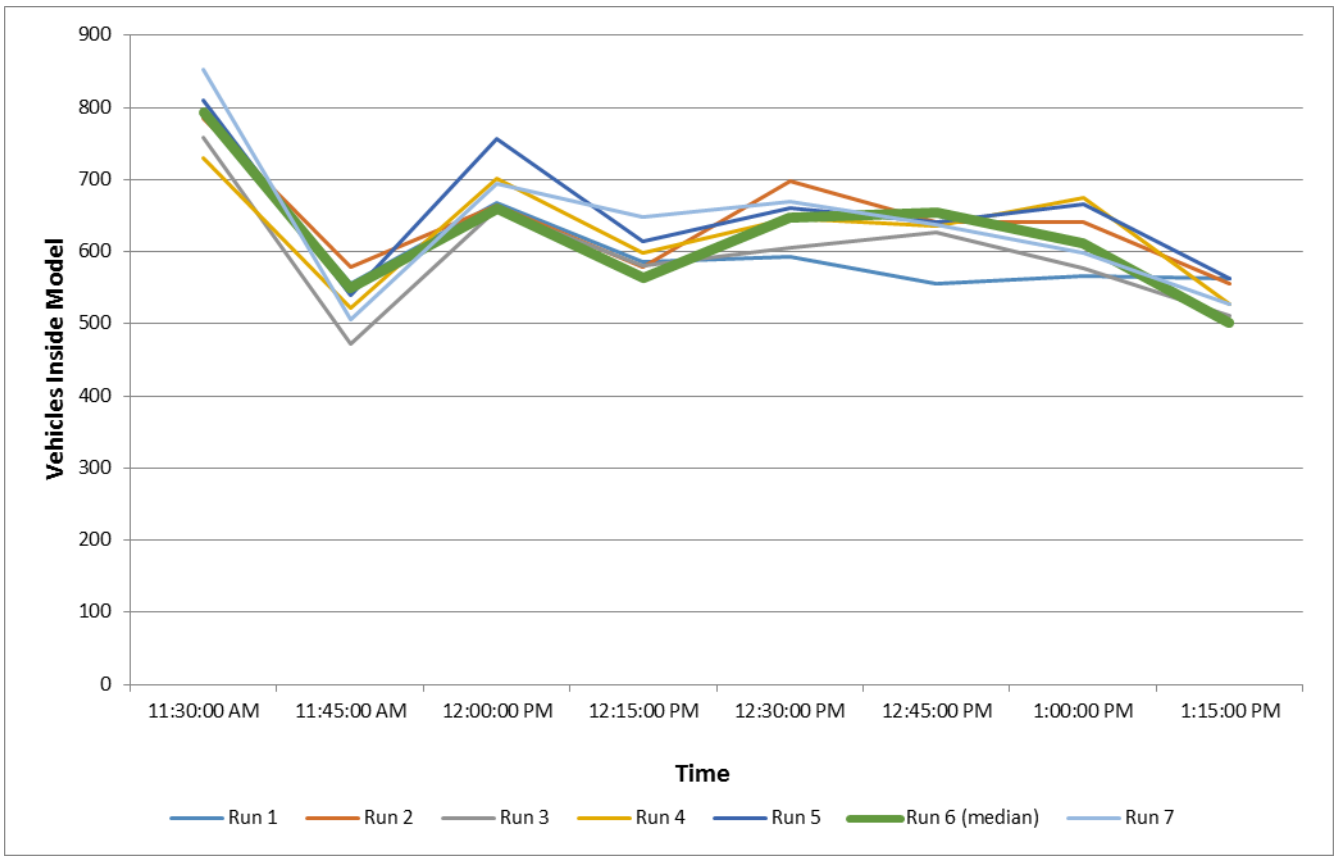


Figure 22 2031 SAT Model Stability: Vehicles Inside Model – Base + Meriton + Westfield



APPENDIX C

Modelled Road Network Capacity Upgrades (Westfield Eastgardens)

Not Included
No Change From That Presented in 16 March 2018 SLR Report

ASIA PACIFIC OFFICES

BRISBANE
Level 2, 15 Astor Terrace
Spring Hill QLD 4000
Australia
T: +61 7 3858 4800
F: +61 7 3858 4801

CANBERRA
GPO 410
Canberra ACT 2600
Australia
T: +61 2 6287 0800
F: +61 2 9427 8200

DARWIN
5 Foelsche Street
Darwin NT 0800
Australia
T: +61 8 8998 0100
F: +61 2 9427 8200

MACKAY
21 River Street
Mackay QLD 4740
Australia
T: +61 7 3181 3300

MELBOURNE
Suite 2, 2 Domville Avenue
Hawthorn VIC 3122
Australia
T: +61 3 9249 9400
F: +61 3 9249 9499

NEWCASTLE
10 Kings Road
New Lambton NSW 2305
Australia
T: +61 2 4037 3200
F: +61 2 4037 3201

PERTH
Ground Floor, 503 Murray Street
Perth WA 6000
Australia
T: +61 8 9422 5900
F: +61 8 9422 5901

ROCKHAMPTON
rockhampton@slrconsulting.com
M: +61 407 810 417

SYDNEY
2 Lincoln Street
Lane Cove NSW 2066
Australia
T: +61 2 9427 8100
F: +61 2 9427 8200

TAMWORTH
PO Box 11034
Tamworth NSW 2340
Australia
M: +61 408 474 248
F: +61 2 9427 8200

TOWNSVILLE
Level 1, 514 Sturt Street
Townsville QLD 4810
Australia
T: +61 7 4722 8000
F: +61 7 4722 8001

AUCKLAND
68 Beach Road
Auckland 1010
New Zealand
T: +64 27 441 7849

NELSON
5 Duncan Street
Port Nelson 7010
New Zealand
T: +64 274 898 628

NEW PLYMOUTH
Level 2, 10 Devon Street East
New Plymouth 4310
New Zealand
T: +64 0800 757 695