128 and 130-150 Bunnerong Road, Pagewood

Transport Impact Assessment Peer Review

80018011

Prepared for
Bayside City Council

23 October 2017

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

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Table of Contents

1 Introduction 1
1.1 Scope of works 1
1.2 Assumptions and exclusions 1
1.3 Reference documents 2
1.4 Report structure 2
2 Review of ARUP Transport Impact Assessment 3
3 Review of Arup Traffic Modelling 11
4 Summary 18

Tables

Table 2-1 Review of ARUP Transport Impact Assessment 3
Table 3-1 Review of ARUP Traffic Modelling 11

1 Introduction

Cardno has been commissioned to undertake an independent peer review of the Planning Proposal Transport Impact Assessment and Traffic Modelling Report currently being considered by Bayside Council. The Planning Proposal involves the rezoning of an 8.95ha industrial site for over 2,068 dwellings, approximately 1,000m2 of retail floor space, a 100 place child care centre, and community facility of up to 4,060m2.

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

> Planning Proposal Report for 128 and 130-150 Bunnerong Road , Pagewood, Urbis (April 2017);

> Transport Impact Assessment Report, 128 and 130-150 Bunnerong Road , Pagewood, Arup (Rev A, April 2017); and

> Traffic Modelling Report, Arup (issue April 2017).

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 Transport Impact Assessment and the Traffic Modelling Report (with associated AIMSUN model).

The documents have been reviewed to assess the:

> Car park, revision of parking rates reductions applied

> Public Transport accessibility and connectivity approach

  - Light Rail (Potential Network Extension)
  - Sydney Metro (Potential Network Extension)

> Assessment of the traffic and transport implications (two scenarios) with and without the extension of light rail.

> 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:

> Planning Proposal Report for 128 and 130-150 Bunnerong Road , Pagewood, Urbis (April 2017);

> Transport Impact Assessment Report, 128 and 130-150 Bunnerong Road , Pagewood, Arup (Rev A, April 2017);

> Traffic Modelling Report, Arup (issue April 2017);

> 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 Transport Impact Assessment Report, 128 and 130-150 Bunnerong Road, Pagewood, Arup (Rev A, April 2017):** A review of the Transport Impact Assessment of 128 and 130-150 Bunnerong Road , Pagewood including trip generation rates, travel patterns, public and active transport review and impacts to the road network.

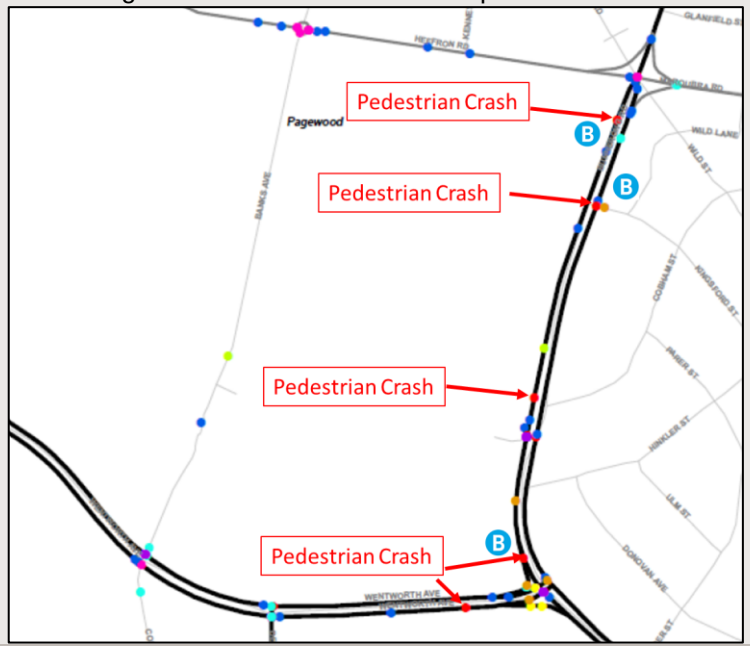
> **Section 3: Review of the Traffic Modelling Report, Arup (issue April 2017) and AIMSUN model:** A review of the AIMSUN model prepared for 128 and 130-150 Bunnerong Road, Pagewood, including model calibration, assumptions, inputs and set up.

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

2 Review of ARUP Transport Impact Assessment

Table 2-1 Review of ARUP Transport Impact Assessment

Section Reference	Review of ARUP Transport Impact Assessment Summary	Cardno Comment
2.3 Public Transport	The report documents that bus stops are located on Bunnerong Road near Heffron Road (northeast of the site) and at the Westfield Eastgardens bus terminal (southeast of the site).	No reference is made to the bus stops located midblock on Heffron Road between Banks Avenue and Bunnerong Road. This bus stop services routes 310 and X10. Whilst the same routes are services by bus stops located on Bunnerong Road, the stops on Heffron Road are likely to be used by commuters located in the north and eastern pockets of the development. This is particularly true for southbound services as the Heffron Road bus stop provides travel time savings as opposed to the Bunnerong Road bus stop by avoid the right turn at the Bunnerong Road/Heffron Road signalised intersection. The Transport Impact Assessment should make reference of this bus stop.
2.4.2 Walking	The Transport Impact Assessment mentions that there is ample pedestrian crossing opportunities in the area, with multiple signalised pedestrian crossing opportunities on Westfield Drive, Bunnerong Road and Maroubra Road.	Crossing opportunities from the development to the southbound bus stops are difficult in terms of direct route to and from the development; in particular for bus stops on both Heffron Road and Bunnerong Road. This may result in unsafe crossing movements or may result in residents and workers from the development being deterred from using bus services given the added walking distances required to cross. The Traffic Impact Assessment should note that future designs consider the safety of commuters crossing Heffron and Bunnerong Road to and from the development.
2.7 Crash Clusters	The Transport Impact Assessment notes that whilst there were no recognisable clusters for pedestrians, crash types were similarly 'emerging pedestrians' crash types surrounding the site. A review of Figure 11 of the document shows that these pedestrian crashes were located close to bus stops	Whilst potentially unrelated, the location of the pedestrian crashes along Bunnerong Road in relation to the bus stops could be alarming and concerning, especially as the Traffic Impact Assessment is considering bus travel as the preferred mode of travel choice with private vehicles.

Section Reference	Review of ARUP Transport Impact Assessment Summary	Cardno Comment
		As previously mentioned, the Transport Impact Assessment should note that future designs consider the safety of commuters crossing Bunnerong Road to and from the development. 
3.4 Previously Approved Intersection Upgrades		Cardno understand there are currently tender designed documents for the intersection of Page Street / Wentworth Avenue. The Arup Aimsun model layout provide slip lanes (as per the SMEC report) however the tender design documents do not include this arrangement. This discrepancy should be reviewed and modified accordingly. Furthermore, it is unclear whether the identified upgrades will be delivered by the opening stage of the development. It is relevant to note that the intersection of Baker Street / Wentworth Avenue has been identified as requiring upgrade to a signalised intersection. Botany Council's Section 94 Contributions Plan outlines the required funding to implement this upgrade.

Section Reference	Review of ARUP Transport Impact Assessment Summary	Cardno Comment
4.2 External Site Access	The Transport Impact Assessment identifies four external access arrangements to the proposed development, being: > Two current approved road accesses from Banks Avenue to the west of the site (unnamed); > The current Meriton Boulevard left in and left out access to Bunnerong Road; and > An all movement priority access to Heffron Road, north of the site.	Figure 19 of the Transport Impact Assessment identifies a single priority access point to Heffron Road, however Figure 17 and 18 identify two (2) access points onto Heffron Road. Clarification is sought with regard to the proposed access arrangement and detailed layouts of these intersections identifying any lost parking, kerb adjustments etc. Additionally, a turning warrant assessment should be provided to establish the need (or otherwise) for dedicated turning lanes along Heffron Road to facilitate safe and efficient turning.
5.1.1 Traffic Generation	The Transport Impact Assessment mentions that the trip generation rate was determined as a function of the mode share for the development by calculating the peak hour rations between the sites from the Technical Direction (TDT 2013/04a) and taking into consideration non-car mode share as 58% for the surveyed sites and 38% for the JTW data. The resulting trip generation rates are: • Weekday AM = 0.277 trips / unit • Weekday PM = 0.217 trips / unit • Weekday Noon = 0.246 trips / unit	For high density developments, the Technical Direction provided data for developments in St Leonards, Chatswood, Cronulla, Rockdale and Parramatta. Trip generation in the peak period vary from these sites between 0.07 to 0.32 trips per unit. These locations however have a train station located within close proximity which could result in a lower vehicle trip generation rate. As noted in Section 2.5 of the Transport Impact Assessment, JTW data indicates that inbound and outbound trips to the area are predominately made of car trips (62% and 57% respectively). Further information should be provided regarding the sites used as part from the Technical Direction and the travel similarities of the proposed developments to these developments. It is acknowledged that the adopted trip generation rates are generally consistent with the previous studies undertaken by Arup however the calculation / methodology is not clear where adjustments based on car mode share and factored Journey to Work rates are applied. Clarification is sought in regard to the methodology of the trip generation calculation, noting the discrepancy in existing journey to work patterns and the suggested modal shift (see further).
5.1.2 Forecast Mode Split	The Transport Impact Assessment provides average person per peak hour trips rates for high density residential developments	Further information is required to detail how the Transport Impact Assessment has come to the conclusion of the above average person

<table>
<tr><th>Section Reference</th><th>Review of ARUP Transport Impact Assessment Summary</th><th>Cardno Comment</th></tr>
<tr><td></td><td>based on Journey to Work and the RMS Technical Direction (TDT 2013/04a). These trip rates are provided as follows:

> Weekday AM: 0.725

> Weekday PM: 0.592

> Weekend Noon: 0.660

The Transport Impact Assessment, in Table 4, outlines the forecasted mode split by type of travel and the number of trips per peak period. The mode split in this table varies quite significantly to the travel pattern data provided in Section 2.5 of the document. The two datasets are shown below.

<table>
<tr><th>Mode</th><th>Inbound trips to work</th><th>Outbound trips to work</th></tr>
<tr><td>Train</td><td>4%</td><td>3%</td></tr>
<tr><td>Bus</td><td>11%</td><td>19%</td></tr>
<tr><td>Car</td><td>62%</td><td>57%</td></tr>
<tr><td>Walk</td><td>5%</td><td>6%</td></tr>
<tr><td>Other</td><td>3%</td><td>4%</td></tr>
<tr><td>Did Not Travel</td><td>15%</td><td>12%</td></tr>
<tr><td>Total %</td><td>100%</td><td>100%</td></tr>
<tr><td>Total Trips</td><td>4,466</td><td>3,622</td></tr>
</table>
Source: BTS, 2011

<table>
<tr><th rowspan="2">Mode</th><th colspan="2">AM Peak Hour</th><th colspan="2">PM Peak Hour</th><th colspan="2">Weekend Peak Hour</th></tr>
<tr><th>%</th><th>Number</th><th>%</th><th>Number</th><th>%</th><th>Number</th></tr>
<tr><td>Train</td><td>6%</td><td>71</td><td>5%</td><td>60</td><td>5%</td><td>66</td></tr>
<tr><td>Bus</td><td>37%</td><td>450</td><td>31%</td><td>377</td><td>34%</td><td>416</td></tr>
<tr><td>Car</td><td>38%</td><td>469</td><td>30%</td><td>367</td><td>34%</td><td>416</td></tr>
<tr><td>Walk</td><td>12%</td><td>142</td><td>10%</td><td>119</td><td>11%</td><td>131</td></tr>
<tr><td>Other</td><td>8%</td><td>95</td><td>6%</td><td>79</td><td>7%</td><td>88</td></tr>
<tr><td>Total</td><td>100%</td><td>1226</td><td>100%</td><td>1002</td><td>100%</td><td>1116</td></tr>
</table>
</td><td>trip rate per peak hour. The average person trip rate per peak hour, in particular for the PM peak, seems low.

Comparing the two tables, bus travel for the proposed development against the surrounding travel zones increases by approximately 20% whilst car trips drop by approximately 40%.

The Transport Impact Assessment should provide evidence to back the decision to increase use of bus services and the decrease in car trips. No suggestion has been made in the Transport Impact Assessment that suggests the shift in travel mode. In particular, reference should not be made to the extension of the Sydney Light Rail and the Sydney Metro West, which:

> Are unlikely to be extended; and

> If extended, are unlikely to be a preferred mode of travel given the distance and the lack of supporting public transport connection and parking at the destination.

The JTW dataset provided as part of the Section 2.5 of the document groups ferry/tram, other modes and modes not stated into the categorisation of “other”.

No information has been provided as to why the aforementioned travel modes have increased from 3-4% to 8-9%. Reference to the Sydney Light Rail should be avoided for the reasons mentioned above.

No evidence has been provided regarding the increase in walking trips for the proposed development.

The Transport Impact Assessment should provide information regarding to the increase in walking trips as the preferred mode of travel. No details have been provided regarding changing land use have been suggested to support growth in walking trips in the peak period.</td></tr>
<tr><td>5.2.1 Car Parking</td><td>The Transport Impact Assessment provides newly proposed parking rates that are recommended to be updated based on the Bayside</td><td>The proposed car parking rates are considered quite low for the location of the development. The recommendation to support mode shift to</td></tr>
</table>

Section Reference	Review of ARUP Transport Impact Assessment Summary	Cardno Comment

DCP and the rates approved as part of the developments Stage 1 masterplan. The proposed parking rates at generally 50% less than those outlined in the DCP and the masterplan. Details of the car parking rates are provided below.

Development type	Part 3A/9D BBDCP	Approved Stage 1 masterplan	Proposed rates
Residential flat buildings			
Studio / 1 bedroom apartments	1 space per apartment	1 space per apartment	0.5 space per apartment
2 bedroom apartments	2 spaces per apartment	1.5 space per apartment	1 spaces per apartment
3 bedroom apartments	2 spaces per apartment	2 space per apartment	1.5 spaces per apartment
Visitor parking	1 space per 5 apartments	1 space per 10 apartments	1 space per 10 apartments
Commercial / Retail / Infrastructure			
Shops	1 space per 25m^2	1 space per 40m^2	1 space per 40m^2
Childcare	1 space per 2 employees	1 space per 2 employees	1 space per 2 employees
	1 space per 5 children	1 space per 5 children	1 space per 5 children
	1 pick-up and set-down space per 20 children.	1 pick-up and set-down space per 20 children.	1 pick-up and set-down space per 20 children.

The Transport Impact Assessment reviewed 2011 Census data on car ownership for multi-dwellings in the surrounding suburbs (Botany, Pagewood, Hillsdale, Banksmeadow, Maroubra and Kingsford). These are rates are shown below.

Units (in area)	No. Units	No. Cars	Required Rate
One bedroom/studio	1245	895	**0.7189**
Two bedroom	5301	5376	**1.0141**
Three bedroom +	1940	2403	**1.2387**
Total	**8493**	**8685**	**1.0226**

public transport options is supported by this consultant however on this occasion, given the location and connection to public transport services, it is unlikely that is an opportunity to shift 50% of car parking needs.

The Transport Impact Assessment makes reference to the 2002 RTA Guide to Traffic Generating Developments, however comparing the parking rates to those in the Technical Direction (TDT 2013/04a) indicates that the proposed parking rates are too low.

The Technical Direction provides the number of units and parking spaces for high density developments in St Leonards, Chatswood, Parramatta, Pyrmont, Liberty Grove, Rockdale and Cronulla. The parking rates for these developments are generally 25-50% higher than those proposed for the development

Given the location of the development compared to public transport services and given the current Journey to Work data indicating that approximately 60% of inbound and outbound journeys are undertake by vehicles, it is unlikely that a reduction of car park rates will shift commuters to public transport; rather it is likely to push parking demands onto the external road network.

No information is provided on the type and location of these developments referred to in the Transport Impact Assessment review of Census data. Reference should be made to developments with similar characteristics and locality. Nevertheless, it has been successfully argued that analysis of Census data for the purpose of car parking provision is but one factor to consider. Referring to *Botany Development Pty Ltd v Council of the City of Botany Bay [NSW] NSWLEC 1073* where Commissioner Brown stated that *"census data is helpful in determining an appropriate parking however it should be the sole measure in determining whether a parking rate is appropriate in a certain area. In the absence of a more comprehensive parking survey, census data alone, in my view, is an insufficient reason to abandon the parking rate in DCP 2013 for the site" (*paragraph 76). Similarly, the same commentary was provided for *Turner Architects v City of Botany Bay Council [2016] NSWLEC 1186* where Commissioner O'Neill states "*In principle, actual demand for parking, as demonstrated by census data,*

Section Reference	Review of ARUP Transport Impact Assessment Summary	Cardno Comment
	The Transport Impact Assessment justifies the reduced proposed rates by noting the support of the development by good public transport networks both planned and under construction. The report notes that the potential Light Rail extension and potential Sydney Metro connection may be within walking distance of the site and will further encourage mode shift away from the cars, hence reducing the parking rates.	*is a fact that would generally inform Council's approach for formulating their policy in regard to parking requirements and consequently the next iteration of a development control plan which reflects that policy, and is not necessarily an appropriate justification for exercising flexibility in regard a standard set by a development control plan. This is because Council policy regarding parking requirements will inevitable be informed by many factors, of which the current or historic parking demand as demonstrated by census data is but one" (*paragraph 40). In view of the above, the justification for a significant variation to Council's DCP parking requirement and the parking rate adopted for the Stage 1 development is not supported based on the current application. The discussion of extending the Light Rail and Sydney Metro is not applicable to be used as support of a reduced car parking rate. The Transport Impact Assessment itself in Section 5.4.3 on page 27 notes that "given the distance (of the stop of the extended Light Rail route) from the site, there is still expected to be less walk-up of this mode compared to bus and people will likely drive to a commuter car park". Additionally the report in Section 5.4.4 on page 27 questions the uncertainty of the Sydney Metro indicating that "given the uncertainty of the project (Sydney Metro), no mode split to this mode have been assumed". It is suggested that the parking rates for the development be considered without considering the likelihood of an extension to the currently proposed Light Rail and Sydney Metro routes.
5.4.1 Bus Infrastructure	The Transport Impact Assessment indicates that an additional eight bus services during each of the peak hours is required to service the development approximately 334-399 commuters.	No confirmation or guarantees are provided that the eight additional bus services required to service the development will be provided. The Transport Impact Assessment should give consideration in the likelihood that the additional eight bus services are not added to the service. Without the additional bus services, residents are likely to shift towards private vehicle mode. There is no assessment of the existing bus stop capacities or survey data / documentation of bus capacities to support the expected increase

Section Reference	Review of ARUP Transport Impact Assessment Summary	Cardno Comment
		in demand. Nor is there any indication that discussions have been held with Transport for NSW with regard to gaining certainty in achieving the additional eight services required as suggest by the Transport Impact Assessment.
5.4.2 Sydney Light Rail & 5.4.3 Potential Light Rail Extension	The Transport Impact Assessment suggests that it is likely that future residents of the site will drive and park at the stop.	Parking along streets near future Light Rail stops are likely to be reconfigured to minimise park and ride. This is to ensure that the street parking is utilised by residents and short stay visits. Additionally, it is unlikely that commuter parking will be provided near the Light Rail stops. The Transport Impact Assessment should consider a shift to other forms of transport, including bus services and private vehicles.
6.1 Traffic Generation	Using the aforementioned trip generation rates, the Transport Impact Assessment has provided the proposed change to development traffic over a two hour peak period (shown in the table below).	It is unclear how the two hour traffic generation was established. The conversion factor of 1.6 is not supported by any justification or document reference. This factor needs to be further explained as based on previous experience with RMS, conversion of two hour volumes to a one hour volume is based on conversion of 0.55. To replicate a two hour volume based on a one hour value the inverse would hold true i.e. a conversion factor of 1.82, not 1.6. It is unclear how the warehouse traffic generation was derived for the two hour time period. This provides a significant reduction during both the weekday AM and PM period (397 trips). It is unclear if the reduction of 397 trips is based on actual survey demand during the AM and PM period or whether this is a theoretical calculation based on GFA. It is understood that the current operation of the site relates to the operations of Port Botany and as such, heavy vehicle movements and / or peak hour generation may occur outside of commuter peak hours that have been assessed.
6.2 Traffic Modelling Methodology	The Transport Impact Assessment outlines that the future years of 2021 and 2031 were agreed to with Roads and Maritime in December 2015. Furthermore, the report acknowledges that background growth as well as surrounding key approved	No evidence is provided to demonstrate if the adopted background growth rate has been accepted by RMS, or whether it is to be informed by a strategic model of the area which takes into account potential network and land use changes in 2021 and 2031.

Section Reference	Review of ARUP Transport Impact Assessment Summary	Cardno Comment
	developments have been incorporated into the model, including Bunnings, Orica Industrial and Masters.	Furthermore, it is unclear whether the adopted traffic generation for Bunnings, Orica Industrial and Masters has been taken from the respective traffic assessments of these applications. Table 20 of the Traffic Modelling Report identifies two hour traffic generation however the source of this information is not provided. The respective traffic impact assessments for these sites should be referenced and incorporated into the modelling. In addition to the Bunnings, Orica Industrial and Masters sites, Westfield Eastgardens have recently lodged an application for increased development. The Arup assessment does not take this into consideration (likely as a result of timing behind the Westfield submission). A corporative approach should be embarked upon in detailing cumulative traffic generation and resulting impacts for the area for both the BATA and Westfield sites.

3 Review of Arup Traffic Modelling

Table 3-1 Review of ARUP Traffic Modelling

Review of AUP Traffic Modelling Report Input Parameter / Model Reference	Cardno Commentary	Recommendation
The below review outlines whether an appropriate background image has been used to develop the model. It is critical that an appropriate background image is used for the model development to ensure that the correct road network and features of the road network are included in the model.		
A1 - Background image file	No background image file was provided for the model – refer item A2.	n/a
A2 - Scale of background	While no background image was provided, distance measurements within model corresponded within 2% to the measurements from online mapping imagery.	n/a
A3 - Background co-ordinate system	The background coordinate system has been set up with the correct longitude and latitude.	n/a
A4 - Seamless join of map tiles	N/A – refer item A1	n/a
A5 - Image legibility / resolution	N/A – refer item A1	n/a
The below review outlines whether the base model parameters and data used for the model development are accurate and reflect best practice.		
B1 - Car following parameters	No issues identified	n/a
B2 - Lane change parameters	No issues identified	n/a
B3 - Acceleration	No issues identified	n/a
B4 - Driver lane selection	No issues identified	n/a
B5 - Waiting time before diffusion	No issues identified	n/a
B6 - Speed profiles	No issues identified	n/a
B7 - Reduced speed areas	Traffic management measures have been implemented in the models to replicate the following real-line events / incidences: • Kerb-side lane closures on Wentworth Avenue (westbound) between Bunnerong Road / Denison Street to replicate when on-street parking is allowed	Reduction of the section of Heffron Road where Speed Change is implemented to account for the side island

Review of AUP Traffic Modelling Report Input Parameter / Model Reference	Cardno Commentary	Recommendation
	on this road. The traffic management measure implemented in the model to replicate this is considered appropriate. • School zone on Bunnerong Road (south of Wentworth Avenue). The traffic management measure implemented in the model to replicate the school zone is considered appropriate. • Zebra-crossings at various locations within the network. The traffic management measure implemented in the model to replicate the traffic delays caused by the zebra crossings is considered appropriate. Traffic calming items on Heffron Road. While the Speed Change implemented for the raised platform (near the intersection with Cowper Avenue) is considered appropriate, the section of Heffron Road where Speed Change implemented to account for the side island (east of Page Street) is considered too long. However, this isn't likely to have a material impact on the model results	
The below review outlines whether any issues have been identified with the model simulation parameters.		
C1 - Model simulation time periods (including warm-up and warm-down periods)	Modelled peak hours as follow: - 7.30AM to 9.30AM (Weekday) - 4.30PM to 6.30PM (Weekday) - 11.15AM to 1.15PM (Weekend) Each model includes a 30 minutes warm-up period	n/a
C2 - Model time steps	Time steps are 0.8 as per default	n/a
C3 - Random seeds	Industry standard random seed values have been utilised throughout the models.	n/a
C4 - Ensure left-side traffic rule has been applied	Left-side traffic rules have been correctly applied.	n/a
C5 - Model units for distance, speed and acceleration	International Standard (SI) units have been utilised in the model.	n/a

Review of AUP Traffic Modelling Report Input Parameter / Model Reference	Cardno Commentary	Recommendation
The below review outlines the findings of the review of the vehicle data parameters used for the model		
D1 – Vehicle types	Standard vehicles 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 haven't been included in the model (note: modelled trucks only have an average length of 8m and a maximum length of 10m).	Model documentation provided to include justification for not modelling larger trucks.
D2 – Vehicle characteristics and model distributions	Standard vehicles characteristics 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 to support the adopted vehicle profiles / distribution.	Model documentation to be updated to include justification for the adopted vehicle profiles / distribution.
D3 – Vehicle classifications	As the study area is adjacent to an operational container port, the model documentation should include additional data / justification to support the adopted vehicle profiles / distribution.	Model documentation to be updated to include justification for the adopted vehicle profiles / distribution.
D4 – Vehicle input flows	Traffic States have not been utilised in the model.	n/a
D5 – Vehicle demand matrix generation	The matrices have been generated for 15 minute intervals based on observed profiles.	n/a
The below review outlines the findings of the review of the link and centroid parameters used for the model.		
E1 - Lane widths	All lane widths in the model have been set to 3.00m. While it's unlikely that this is correct for all roads in the model, lane widths are only used for graphical purposes in model and have no impact on the model results.	n/a
E2 - Placement of lanes	Wentworth Avenue has been modelled with only 2 lanes in each direction between Page St and Bank Ave instead of 3 lanes in each direction. While this may have been intentionally implemented in the model to account for on-street parking, the model documentation does not describe	Model documentation to be updated to include justification for sections of Wentworth Avenue only having 2 lanes in each direction in the model.

Review of AUP Traffic Modelling Report Input Parameter / Model Reference	Cardno Commentary	Recommendation
	why this is the case (although there is a comment to state that this has been removed in the 2031 scenario).	Alternatively, model to be updated with correct number of lanes for Wentworth Avenue.
E3 - Placement of connectors	Connectors and zones have been placed at appropriate locations.	n/a
E4 - Link gradients	No gradients were used for this model. Best practice guidelines would suggest that link gradients should be coded in where significant gradients exist.	Update model documentation to justify the decision not to utilise link gradients / slopes in the model.
E5 - Lane change settings	Adopted lane change parameters considered appropriate.	n/a
E6 - Link/connection structure (roundabout approach)	No issues identified	n/a
The below review outlines the findings of the review into the priority behaviour parameters used for the model development.		
F1 - Placement of Priority Rules (priority intersections)	No incorrect priority rules have been identified in the models.	n/a
F2 - Placement of Priority Rules (roundabouts)	No incorrect priority rules have been identified in the models.	n/a
F3 - Headway and gaps	Standard values have been adopted in the models.	n/a
F4 - Blocking back / Yellow Boxes	No issues identified.	n/a
F5 - Pedestrian crossings	Pedestrian crossings at various locations within the network have been appropriately accounted for by the use of Section Incidences throughout the models.	n/a
The below review outlines the findings of the review into the vehicle routing dynamic assignment parameters used for the model development.		
G1 – Dynamic Assignment Parameters	Modelled as 50% static and 50% stochastic (50% static path is according to the shortest path found in static assignment) as explained in the traffic report	n/a
The below review outlines the findings of the review into the data used for the signalised intersections within the model.		

Review of AUP Traffic Modelling Report Input Parameter / Model Reference	Cardno Commentary	Recommendation
H1 – Signalised controlled intersections	The signalised intersections within the study area have been modelled appropriately with actuated traffic signal control in the models. It is noted that no SCATS (IDM) data was reviewed as part of this review.	n/a
H2 – Cycle times	Based on the documented Green Time Proportions, the cycle times adopted are considered appropriate.	n/a
H3 – Intergreen times	Intergreen times of 6 seconds have been utilised in the model. This value is considered appropriate and in line with standard practise.	n/a
H4 – Phase times	Based on the documented Green Time Proportions, the cycle times adopted are considered appropriate.	CBB to request phase data
H5 – Phase movements	No data available	SCATS maps and/or IDM data to be included in report appendix.
H6 – Priority behaviour within signalised intersection	Priority behaviour at signalised intersections have been set up correctly, with the exception of the left turn from Page Street (S) to Wentworth Avenue (W) in the future year models.	Priority marker to be included for the left turn from Page Street (S) to Wentworth Avenue (W) in the future year models.
H7 – Pedestrian behaviour at signalised pedestrian crossing	Pedestrian crossings at various locations within the network have been appropriately accounted for by the use of Section Incidences throughout the models.	n/a
H8 – Detector Locations	Detector have been included for actuated signalised intersections and located at appropriate locations.	n/a
The below review outlines the findings of the review into the public transport parameters used for the model development.		
I1 – Public transport routes	The relevant public transport lines have been implemented in the model.	n/a
I2 – Public transport stop locations	A bus stop is missing in each direction along Bunnerong Rd between Kingsford St and Maroubra Rd.	No action required as the impact is likely to be minimal
I3 – Public transport type/characteristics	Standard parameters have been adopted for the public transport vehicles	n/a

Review of AUP Traffic Modelling Report Input Parameter / Model Reference	Cardno Commentary	Recommendation
I4 – Service frequencies / start times	Spot-checks undertaken for the public transport plans show correct timetables have been adopted in the model.	n/a
I5 – Dwell times	A dwell time of 0 seconds has been used for all public transport timetables.	The dwell time adopted in the model is not considered realistic for all stops/routes. It is recommended that at least non-zero dwell time be adopted through the model. It would be desirable if timed PT stops could be accounted for in the model, especially if these are observed to impact on vehicle travel times.
The below review outlines the findings of the review into the model calibration.		
J1 – Turning counts	All existing scenarios were run and all scenarios exceeded the minimum model calibration requirements (note: no independent validation of the data included in the RDS was undertaken). It is noted that some minor variations were found in the modelled calibration results compared to the results included in the model documentation.	n/a
J2 – Link counts	No link count data was included in the model and not considered necessary due to the extent of the turning count data.	n/a
J3 – Screenline Traffic	No screenline / cordon calibration was undertaken and not considered necessary due to the extent of the turning count data	n/a
J4 – Check vehicle release	No issues identified relating to unreleased vehicles	n/a
The below outlines the findings of the review into the model validation.		
K1 – Journey time for general traffic	All existing scenarios were run in order to replicate the modelled travel times included in the model documentation. Minor variation was found in all travel times and with the exception of Route 2 for the AM scenario, was found to be within the tolerance limits.	Modelled travel times for Route 2 AM scenario to be reviewed / revised as necessary.

Review of AUP Traffic Modelling Report Input Parameter / Model Reference	Cardno Commentary	Recommendation
	For Route 2 in the AM scenario, the modelled travel times were not found to be within the 15% tolerance limits. The variation may be due to the model developers utilising Aimsun version 8.1.1 which is considered outdated (superseded in November 2015).	
K3 – Journey time for buses	Journey times have not been reported separately for buses. While desirable, this is not likely to have a material impact on the model results due to the relatively low proportion of buses within the study area.	n/a
K2 – Queue lengths	Journey travel time was adopted for validation, therefore queue lengths are not required for this instance	n/a
The following issues have also been noted as part of the model review		
	• The traffic growth methodology for the future year scenarios have been based on estimates and assumptions. However, to account for non-linear traffic growth issues (e.g. construction of external infrastructure), the traffic growth assumptions should have been sourced from a strategic transport model. If a strategic transport model does not exist for the study area, the traffic growth assumptions should have been discussed and agreed with the Council. • Section 9.3 of the Traffic Modelling Report (Year 2031) states that "*The Year 2031 models were becoming unstable under the future base models and were prone to lockups as such it was difficult to deduce meaningful results from the 2031 models*". However, Cardno notes the following: o Only "Do-Nothing" scenarios have been modelled based on the existing transport network. No attempts have been made to investigate whether mitigation measures could be implemented to address the issues identified (e.g. upgrades of intersections or optimisation of traffic signal operation). o A RMS memo was issued in July 2016 to provide 'interim suggested practice' for congested traffic models to avoid lock-ups and provide meaningful results. The model documentation does not provide evidence that any of the suggested methodologies were adopted or attempted.	

4 Summary

Cardno has been commissioned by Bayside Council to undertake an independent peer review of the Planning Proposal submitted for the British American Tobacco Australasia (BATA) site. Specifically, the Transport Impact Assessment and Traffic Modelling Report prepared by Arup and currently under consideration of Bayside Council. The Planning Proposal involves the rezoning of an 8.95ha industrial site for over 2,068 dwellings, approximately 1,000m^2 of retail floor space, a 100 place child care centre, and community facility of up to 4,060m^2.

As a result of the review, Cardno has identified a number of issues that require additional justification and information to support the findings of the Arup assessment and the Planning Proposal. In summary, the review has found:

i. Given the location of the development compared to public transport services, in combination with current Journey to Work data indicating that approximately 605 of inbound and outbound journeys are undertaken by vehicles, it is unlikely that a reduction in car parking rates will shift commutes to public transport, rather it is likely to push parking demands onto the external road network.

   The use of Census data for the purpose of determining car parking provision cannot be solely relied upon to justify a parking reduction. Council's DCP would take into consideration Census data as well as another of other factors to determine the appropriate car parking rate.

ii. There is no assessment of the existing bus stop capacities or survey data / documentation of bus capacities to support the expected increase in demand. Nor is there any indication that discussions have been held with Transport for NSW with regard to gaining certainty in achieving the additional eight services required as suggest by the Transport Impact Assessment

iii. It is unclear whether the identified upgrades will be delivered by the opening stage of the development.

   It is relevant to note that the intersection of Baker Street / Wentworth Avenue has been identified as requiring upgrade to a signalised intersection. Botany Council's Section 94 Contributions Plan outlines the required funding to implement this upgrade. For high density developments, the Technical Direction provided data for developments in St Leonards, Chatswood, Cronulla, Rockdale and Parramatta. Trip generation in the peak period vary from these sites between 0.07 to 0.32 trips per unit. These locations however have a train station located within close proximity which could result in a lower vehicle trip generation rate.

iv. As noted in Section 2.5 of the Transport Impact Assessment, JTW data indicates that inbound and outbound trips to the area are predominately made of car trips (62% and 57% respectively). Further information should be provided regarding the sites used as part from the Technical Direction and the travel similarities of the proposed developments to these developments.

   Clarification is sought in regard to the methodology of the trip generation calculation, noting the discrepancy in existing journey to work patterns and the suggested modal shift

v. Bus travel for the proposed development against the surrounding travel zones increases by approximately 20% whilst car trips drop by approximately 40%.

   The Transport Impact Assessment should provide evidence to back the decision to increase use of bus services and the decrease in car trips. No suggestion has been made in the Transport Impact Assessment that suggests the shift in travel mode. In particular, reference should not be made to the extension of the Sydney Light Rail and the Sydney Metro West, which:

   - Are unlikely to be extended; and
   - If extended, are unlikely to be a preferred mode of travel given the distance and the lack of supporting public transport connection and parking at the destination.

   The JTW dataset provided as part of the Section 2.5 of the document groups ferry/tram, other modes and modes not stated into the categorisation of "other". No information has been provided as to why

the aforementioned travel modes have increased from 3-4% to 8-9%. Reference to the Sydney Light Rail should be avoided for the reasons mentioned above.

No evidence has been provided regarding the increase in walking trips for the proposed development. The Transport Impact Assessment should provide information regarding to the increase in walking trips as the preferred mode of travel. No details have been provided regarding changing land use have been suggested to support growth in walking trips in the peak period

vi. The forecast traffic generation has been provided as a two hour volume based on a conversion factor of 1.6 for one hour trip generation rates. This conversion factor is not explained with supporting justification or referencing. This factor needs to be further explained as based on previous experience with RMS, conversion of two hour volumes to a one hour volume is based on conversion of 0.55. To replicate a two hour volume based on a one hour value the inverse would hold true i.e. a conversion factor of 1.82, not 1.6.

vii. The forecast traffic generation takes into consideration the existing warehouse us on the site, by reducing the overall traffic generation by 397 trips in the AM and PM peak (two hour peak flows). It is unclear how the warehouse traffic generation was derived for the two hour time period. This provides a significant reduction during both the weekday AM and PM period (397 trips).

It is unclear if the reduction of 397 trips is based on actual survey demand during the AM and PM period or whether this is a theoretical calculation based on GFA. It is understood that the current operation of the site relates to the operations of Port Botany and as such, heavy vehicle movements and / or peak hour generation may occur outside of commuter peak hours that have been assessed

viii. It is unclear whether the adopted traffic generation for Bunnings, Orica Industrial and Masters has been taken from the respective traffic assessments of these applications. Table 20 of the Traffic Modelling Report identifies two hour traffic generation however the source of this information is not provided. The respective traffic impact assessments for these sites should be referenced and incorporated into the modelling.

In addition to the Bunnings, Orica Industrial and Masters sites, Westfield Eastgardens have recently lodged an application for increased development. The Arup assessment does not take this into consideration (likely as a result of timing behind the Westfield submission). A corporative approach should be embarked upon in detailing cumulative traffic generation and resulting impacts for the area for both the BATA and Westfield sites.

ix. A detailed sample audit has been undertaken for the Bunnerong Road AIMSUN micro simulation models developed by Arup. This audit has detailed a number of concerns and potential areas of improvement.

Many of the items identified within the audit process are undesirable and would ideally be corrected, their presence is unlikely to affect the overall operation of the model on a network wide basis. Their presence will however affect the localised, detailed operation of the network in specific locations and could impact on the assessment of potential options. Nevertheless, the items raised above with regard to seeking clarification on trip generation rates, cumulative traffic impacts and forecast traffic generation need further justification that may impact the underpinning assumptions of the modelling which could significantly impact the reported results.