Randwick City Council
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Randwick City Council
Gateway Review Submission

Kingsford and Kensington Town Centres
Planning Proposal

5 March 2018

Contents

Attachments

Attachment A	Council Response to AJ+C Recommendations 18 October 2017
Attachment B	Conybeare Morrison Assessment of AJ+C Recommendations Report March 2018
Attachment C	EMM Anzac Parade Corridor Future Light Rail System Capacity Analysis Addendum Report 1 March 2018
Attachment D	ARUP Stage 2 Transport Modelling Report 18 May 2017

Executive Summary

- This submission supports Randwick City's request for a Gateway Review of the Gateway Determination issued for the Kingsford and Kensington Planning Proposal dated 12 December 2017.
- The Kensington and Kingsford Planning Proposal seeks to amend the Randwick Local Environmental Plan 2012, to introduce revised height and FSR controls to accommodate sustainable housing and employment growth, with local provisions to provide for affordable housing and essential community infrastructure.
- Council is requesting that the Gateway Determination be reconsidered, amended and re-issued. We contend that the conditions imposed have not been adequately substantiated, are unnecessary and will have far-reaching consequences on the liveability of the town centres and the amenity of surrounding residential areas.
- Council requests removal or amendment of the following Gateway Conditions for the reasons summarised below:

    1(a) The requirement for an additional 600 dwellings within the town centre boundary will result in adverse environmental impacts and thus the Gateway Condition should be removed.

    1(b) The requirement to increase the FSR associated with opportunity sites would result in adverse environmental impacts inconsistent with the urban design and accessibility objectives of the planning strategy and thus this Gateway Condition should be removed.

    1(c) The CIC is a legal, transparent and legitimate way for Council to fund community infrastructure to support growth and thus this Gateway Condition should be removed.

    2 This Gateway Condition should be removed as consultation with the Sydney Airport Corporation Limited, Department of Infrastructure, Regional Development and Cities and Air Services Authority regarding building heights and Transport for NSW and RMS regarding traffic modelling and road widening is underway and will be complete by the conclusion of this Gateway Review.

    3 As outlined in this justification, revisions to the planning proposal are not necessary, and thus the Gateway Condition requiring the Department to endorse the revised Planning Proposal should be removed.

    7 Given the unknown time to be taken by the Gateway Review process, the Gateway Condition should be amended so the timeframe for completion of the LEP is 12 months from the date the amended Gateway Determination is issued.

- This submission justifies our request to review the Gateway Determination to ensure that the Planning Proposal provides for the sustainable residential and economic growth of the town centres.

Introduction

- On 12 December 2017, the Department of Planning and Environment issued a Gateway Determination for the Planning Proposal for Kensington and Kingsford town centres (Department Ref: PP_2017_RANDW_001_00).
- The Planning Proposal seeks to amend the height and floor space ratio controls and introduce new local provisions for Kensington and Kingsford Town Centres,
- Council received a copy of the Gateway Determination on 13 December 2017.
- The Gateway Determination Review is in response to conditions 1(a)-(c), 2, 3 and 7 which have not been adequately substantiated and are inconsistent with Council's comprehensive evidence-based Planning Strategy for the town centres.
- On 22 January 2018, the Department granted an extension of time for the submission of Council's Gateway Review application to 5 March 2018.
- The Gateway requires a substantial increase in dwelling capacity for the town centres, which will have unacceptable environmental impacts.
- The Gateway determination also requires the removal of the proposed community infrastructure contribution clause which is a necessary, transparent and legal mechanism to provide essential infrastructure for the expected growth in the Kensington and Kingsford town centres.

Background

- In 2015, in response to site-specific planning proposals, Council began a review of the Kensington and Kingsford town centres, and in March 2016 Council adopted the Issues Paper for Kensington and Kingsford Town Centres.
- Council's comprehensive planning review of the Kensington and Kingsford town centres was informed by considerable background research and analysis, including:
    - Economic Needs Analysis by Macroplan Dimasi,
    - Kingsford Heritage Study by Colin Brady Heritage Consultant,
    - Urban Design Report by Conybeare Morrison,
    - Transport System Capacity Analysis by EMM Consulting
    - Traffic and Parking Study by ARUP,
    - Infrastructure Contribution Financial Feasibility Assessment by HillPDA,
    - Development Contributions Framework by Sam Haddad Consulting,
    - Liveability and walkability analysis by City Futures, UNSW; and
    - K2K International Urban Design Competition
- The K2K International Urban Design Competition run in 2016 sought innovative ideas from multi-disciplinary teams to support the future of the area and involved extensive community consultation to inform the competition brief and provide feedback on the competition entries to the judges.
- The Planning Strategy for Kensington and Kingsford Town Centres outlines the vision, strategies and implementation actions to guide the sustainable growth and development of the town centres over the next 15 years. The Planning Strategy utilised community feedback from the competition to inform the vision for the town centres, including the urban design approach and key local infrastructure.
- The comprehensive planning process has received three industry awards, including most recently the Planning Institute of Australia's Award for Excellence for its outstanding contribution to the creation of great places and communities.

Gateway Conditions Requested to be Removed or Amended

Dwelling Capacity

1(a) Identify additional opportunity sites in order to increase the dwelling capacity by a minimum of 600 dwellings within the planning proposal boundary currently zones B2 Local Centre Zone in the Kensington and Kingsford Town Centres

- Council's proposed built form controls have been established through careful 3D modelling and urban design specialist advice.
- An additional 600 dwellings in both town centres amounts to a 40% increase in additional dwelling capacity.
- The proposed increase in dwelling capacity will have significant adverse environmental impacts on the town centres and surrounding residential areas.
- Council has carefully considered the 'peer review' by Allen Jack and Cottier which recommended additional opportunity sites and increases to capacity of Council-identified opportunity sites (see Council response to AJ+C recommendations dated 18 October 2017 at Attachment A)
- Additional work by Conybeare Morrison has concluded that increased heights and densities are inappropriate and ill-considered (see Conybeare Morrison Assessment of Recommendations Report dated March 2018 at Attachment B).
- Transport network analysis by EMM has demonstrated that an additional 600 dwellings within the town centres will place greater demand on the public transport network and require additional buses in addition to the light rail to provide for the increased population (see EMM Report dated 1 March 2018 at Attachment C).
- Having considered the opportunities and constraints of each centre, Council's strategy provides for an optimal and well-considered distribution of dwelling growth.
- Work is underway to inform a local housing strategy for the entire LGA. A development capacity audit of the LGA has demonstrated that Council is well on track to meet the 2016-2021 dwelling growth target of 2,250 dwellings in the Revised Draft Eastern City District Plan.
- There is also sufficient development capacity outside of the existing town centres to contribute to any longer term housing targets for the District.
- These areas identified for future growth are adjacent to town centres and along key transport corridors and represent a more balanced approach in planning for additional dwelling growth across the LGA, while also providing for amenity.
- Future upzoning associated with a housing strategy will allow for an appropriate urban design transition to surrounding residential areas and provide for diverse housing stock within a walkable catchment of the town centres and transport.
- In 2018, Council will prepare a housing strategy as required by the district plan, which will provide for dwelling growth across the Local Government Area rather than burdening the town centres.
- Thus additional capacity for 600 dwellings in the Kensington and Kingsford town centres is unwarranted and excessive.
- Council has received verbal advice from the Department of Planning and Environment that they will support the 600 extra dwellings being provided within 400 metres of the light rail alignment, outside of the town centre boundary.
- **This Gateway requirement will result in adverse environmental impacts and should be removed.**

Opportunity Sites

1(b) specify appropriate heights and floor space ratios (FSRs) for the additional opportunity sites and specify FSR increases for sites where additional height (ie. additional 2 storeys) can be attained under design excellence provisions

- Increasing the dwelling capacity of the town centres by identifying additional opportunity sites is unnecessary and will have adverse environmental impacts, as detailed above and in Attachments A, B and C.
- Given the constraints of the opportunity sites, including access, setbacks, contributory buildings, tower floorplate controls and shadowing impact, 5:1 is an appropriate FSR for an 18 storey height limit.
- Any FSR above 5:1 for opportunity sites would be unachievable and inconsistent with the urban design and accessibility outcomes outlined in the planning strategy and key objective of maintaining suitable amenity to nearby residential areas.
- **The Gateway requirement to increase the FSR associated with opportunity sites would result in adverse environmental impacts and should be removed.**

Community Infrastructure Contribution

1(c) remove the proposed draft Community Infrastructure Contributions clause (Attachment C – Clause 6.14 Community Infrastructure height of buildings Kensington and Kingsford Town Centres) and amend to remove references throughout the proposal to a Community Infrastructure Clause

- Draft clause 6.14 has been developed to support and guide possible Voluntary Planning Agreements (VPAs) for the collection of certain community infrastructure for the expected growth in the Kensington and Kingsford town centres as outlined in the planning proposal.
- The draft clause provides a clear policy in an open and transparent way for specific VPAs which can be put forward at the discretion of a developer and then considered in the usual way by the Council.
- The draft clause complies with the fundamental principles of planning agreements as outlined in the Department's draft practice note for planning agreements dated November 2016 (copy attached).
- The draft clause is modelled on clause 6.14 '*Community Infrastructure floor space at Green Square*' in Sydney Local Environmental Plan 2012 (SLEP) which has been in operation since 2012 in its current form. The difference between the clauses is that the Green Square clause is for floor space ratio whereas Council's proposed clause is for height. Given that the Green Square clause (6.14) has been in operation for a number of years this provides further rigour to the Council's proposed draft clause 6.14 in terms of power and policy merit.
- A review of case law on clause 6.14 in Sydney Local Environmental Plan 2012 has shown that there is no case law which suggests that the clause is unlawful and/or beyond the LEP making power available under the Act.
- Legal advice determines that the assertion in the Gateway determination which indicates that the draft clause is beyond the LEP making power available under the Act is incorrect.
- Importantly, draft clause 6.14 is supported by a clear policy framework and evidence base including a comprehensive planning strategy which identifies the infrastructure needed to support growth; a feasibility assessment (which demonstrates that the community infrastructure contribution can be afforded); and community input undertaken as part of the K2K International Urban Design Competition.
- **The CIC is a legal, transparent and legitimate way for Council to fund community infrastructure to support growth and thus this Gateway condition should be removed.**

Consultation with public agencies

2. Prior to community consultation, initial consultation on the revised Planning Proposal is to be undertaken with the following public agencies:

- ***Sydney Airport Corporation Limited (SACL), Civil Aviation Safety Authority (CASA) and Air Services Australia (AsA) in relation to maximum building heights and to satisfy the requirements of Section 117 Direction 3.5 Development Near Licensed Aerodromes; and***
- ***Transport for NSW and Roads and Maritime Services in relation to the scope of detailed traffic modelling and potential future road corridor widening to support growth in the corridor.***

These public authorities are to be provided with a copy of the Planning Proposal and any relevant supporting material, and given at least 21 days to comment on the proposal.

- Council undertook consultation with SACL and the Department of Infrastructure, Regional Development and Cities (DIRDC) during the preparation of the draft Planning Strategy and all heights proposed in Kingsford are below the PANS-OPS obstacle clearance.
- Council submitted the required technical information to AsA and for approval (assessment number YSSY-MA-002), and AsA has indicated a timeframe for their response of approximately 6 weeks. It is expected consultation with AsA and will have been resolved by the date of the Planning and Assessment Commission meeting.
- CASA's response to Council's request for advice is that this planning proposal is a land use matter not within their jurisdiction but rather within the jurisdiction of DIRC.
- Council has been working closely with TfNSW and ALTRAC on carriageway widenings along Anzac Parade as part of the light rail project.
- TfNSW has been working with RMS as part of this process to ensure optimum lane widths and functionality of the road corridor is achieved.
- Widenings are proposed at a number of locations along the corridor, including the town centres.
- This process has been ongoing since 2014 and carriageway widths and resulting footpaths widths are now finalised and set. Kerb and guttering is now being constructed as part of the Light Rail contract works.
- Council's draft Planning Strategy has also responded to the reductions in footpath widths and the changed character of Anzac Parade through a number of design initiatives, most importantly building setbacks.
- Council has undertaken detailed traffic modelling using the TfNSW model, enhanced by ARUP, to test the traffic impacts of the planning proposal (see ARUP Stage 2 Traffic Modelling Report dated 18 May 2018 at Attachment D).
- A meeting between Council and TfNSW and RMS was scheduled for Tuesday 27 February, and was postponed at the request of TfNSW to Wednesday 14 March. This meeting will enable explanation of the traffic modelling and road widenings already occurred as part of the Light Rail and Council's Planning Strategy.
- Details on the process and outcome of the consultation will be forwarded to the Department of Planning and Environment as the consultation is completed.
- **Consultation with CASA is not required. Consultation with SACL, DIRDC, AsA, TfNSW and RMS has begun and will be complete before this Gateway Review is resolved and thus these Gateway requirements should be removed.**

Endorsement by Department

3. Prior to community consultation, the revised planning proposal is to be submitted to the Department of Planning and Environment for endorsement.

- **As outlined in this submission, revisions to the planning proposal are not necessary, and thus this requirement should be removed.**

Timeframe

7. The timeframe for completing the LEP is to be 12 months from the week following the date of the Gateway determination.

- Due to the Department's shut-down over the Christmas-New Year period, on 22 January 2018, the Department granted an extension of time for the submission of Council's Gateway Review application to 5 March 2018.
- Council cannot commit additional resources towards planning for the town centres until the formal Gateway Review process is completed.
- Once Council's application is submitted, the timing of the Gateway Review is outside of Council's control and therefore it is unreasonable to hold Council to a timeframe based on the Gateway Determination.
- **The Gateway Condition should be amended so the timeframe for the completion of the LEP is 12 months from the date the amended Gateway Determination is issued.**

Gateway Conditions Accepted

Affordable Housing

1(d) ***remove the proposed clause in the planning proposal for Affordable Housing and instead provide a statement of intent for the inclusion of a clause in a draft LEP for Affordable Housing (Attachment A - draft Affordable Housing Clause).***

1(e) ***include in the statement of intent for Affordable Housing a reference to:***

- ***i. determining an appropriate figure ($/m2) for the town centres, equivalent to the value of the properties; and***
- ***ii. providing more detail, including an example of how the contribution is calculated and further explanation of the "accountable total floor space".***

- **Noted and accepted.**

Community Consultation

4. ***Community consultation is required under sections 56(2)(c) and 57 of the Act as follows:***

- ***(a) the planning proposal must be made publicly available for a minimum of 28 days; and***
- ***(b) the relevant planning authority must comply with the notice requirements for public exhibition of planning proposals and the specifications for material that must be made publicly available along with planning proposals as identified in section 5.5.2 of A Guide to Preparing LEPs (NSW Department of Planning and Environment 2016).***

- **Noted and accepted. Council has resolved to exhibit the planning proposal for a minimum period of 6 weeks.**

Consultation with public authorities

5. ***Consultation is required with the following public authorities under section 56(2)(d) of the Act and/or to comply with the requirements of relevant section 117 Directions:***

- ***Commonwealth Department of Infrastructure and Regional Development***
- ***Sydney Airport Corporation;***
- ***Air Services Australia***
- ***Office of Environment and Heritage;***
- ***Heritage Office;***
- ***Transport for NSW;***
- ***Roads and Maritime Services;***
- ***Energy Australia;***
- ***Sydney Water***
- ***Family and Community Services - Housing NSW***
- ***Department of Education;***
- ***NSW Ministry of Health;***

- **Noted and accepted.**

Public Hearing

6. A public hearing is not required to be held into the matter by any person or body under section 56(2)(e) of the Act. This does not discharge Council from any obligation it may otherwise have to conduct a public hearing (for example, in response to a submission or if reclassifying land).

- **Noted and accepted.**

Conclusion

- Council has undertaken a comprehensive planning review, including an International Urban Design Competition, to guide the sustainable growth and development of Kensington and Kingsford town centres.
- This robust and evidence-based process has been recognised by a number of industry awards for its planning best practice and excellence.
- Conditions 1(a) and 1(b) requiring an increase in capacity by 600 dwellings and subsequent increase in the height and FSR of certain sites to accommodate the additional capacity are unsubstantiated and will result in unacceptable environmental impacts.
- Additional dwelling capacity in the town centres is unnecessary as Randwick City is on track to achieve its 5 year dwelling target and its existing planning approach for 40% of dwelling provision in town centres.
- Council has received verbal advice from the Department of Planning and Environment that they will support amending the Gateway Condition to provide the capacity for 600 additional dwellings outside the town centre boundary, within 400m of the light rail alignment.
- The community infrastructure charge is a necessary and legal mechanism to provide essential infrastructure within the Kensington and Kingsford town centres and Condition 1(c) requiring its deletion from the planning proposal should be removed from the Gateway Determination.
- Amendments to the planning proposal are unnecessary, and therefore Condition 3 requiring the Department to approve the revised planning proposal should be removed.
- Given the unknown time to be taken by the Gateway Review process, Condition 7 should be amended so the timeframe for completion of the LEP is 12 months from the date the amended Gateway Determination is issued.

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18 October 2017

Mr Steve Murray
Executive Director
Department of Planning & Environment
GPO Box 39
SYDNEY, NSW 2001

Dear Mr. Murray,

RE: Kingsford and Kensington Planning Proposal – AJ+C Urban Design Review

I write to you regarding the Review for DPE of the Randwick K2K Planning Strategy (the Review) by Allen Jack + Cottier (AJ+C) dated May 2017.

AJ+C were engaged by the Department of Planning and Environment to undertake a peer review of the Draft Planning Strategy Kensington and Kingsford Town Centres, proposed and lodged by Randwick City Council in January 2017. The scope of the Review included:

- Review/check constraints mapping
- Review and identify any further opportunity sites that may be appropriate for increased density controls
- Check/advise capacity/yields for any recommended opportunity sites

Thank you for providing Council an opportunity to respond to the Review by AJ+C. A detailed and thorough site by site analysis of the Review's recommendations is attached to this letter. The attached analysis demonstrates why the Review's recommendations are inappropriate and that Council's own investigations of the environmental, social and economic factors pertaining to the town centres supports the vision contain in the Planning Strategy and the development standards in the planning proposal.

If you require any further information, please contact me on 9093 6895 or alan.bright@randwick.nsw.gov.au.

Yours sincerely,

Alan Bright
Manager Strategic Planning

Analysis and Feedback on AJ+C Review

General Comments

Council undertook a comprehensive town centre review including social, economic and environmental considerations in the preparation of the Kensington and Kingsford Town Centre Planning Strategy. The Strategy was informed by considerable background research and analysis, including an economic needs analysis, a heritage study, an urban design report, transport system analysis and a traffic study; extensive community engagement; and an International K2K Urban Design Competition which sought innovative ideas from multi-disciplinary teams to support the future of the area. As a town centre review, dwelling capacity is just one of many issues to be considered.

As outlined in Council's Strategy, the urban design approach for the corridor takes a balanced view of future dwelling growth focussing on key nodes that respond to local character, transitional heights and improvements to local infrastructure and liveability for residents, businesses and visitors to the Centres. Having considered the opportunities and constraints of each centre, Council's strategy provides for an optimal and well-considered distribution of dwelling growth. Our reading of the AJ+C document indicates that it is not a peer review of Council's work, but something more akin to a consultant report for a housing study. The scope of works, as outlined in the executive summary, includes identifying further opportunity sites and advising on capacity/yields for any recommended opportunity site. As the consultant was required to look for opportunities for additional dwelling yield, it should be noted the report is not a peer review.

Reference to former UAP
Given that the State Government has effectively abandoned the Randwick UAP process, the rationale for referencing and comparing the Strategy to the former Randwick UAP is unclear. The UAP should not be considered any kind of benchmark for future planning strategies, in Kensington and Kingsford town centres, or elsewhere. The purpose of the Strategy is clearly outlined in Part A Overview of the Strategy, and we cannot see the relevance of the UAP to this process.

Dwelling capacity
A 'walkable catchment' analysis to identify opportunities for dwelling growth within walking distance of the light rail is, in theory, supported, and was a factor in the Strategy's node placement. As mentioned previously, our position that if the light rail has additional capacity, above what is provided for in the Strategy, then a better outcome would be for additional dwellings to be provided within the light rail corridor. A future housing study could investigate opportunities for future dwelling growth outside the B2 Local Centre Zone, within walking distance to the town centres and light rail stops. This approach would provide more diverse housing options to meet future needs of the community, and allow for a thorough planning and urban design analysis to accompany any additional capacity.

It is also noted there is no mention in the AJ+C report of the associated infrastructure impacts of the recommendations, or commentary on whether the existing and proposed (in the K2K strategy) infrastructure improvements/public benefits would be adequate to cope with the additional population generated by these recommendations.

The Strategy is consistent with State Government dwelling targets and population projections. Council is on track to provide the draft Central District Plan's 5-year target of 2,250 dwellings by

2021. The Strategy also outlines how Council plans to accommodate the State Government's 2014 projected dwelling demand of 15, 150 additional new dwellings by 2031. Increasing the dwelling capacity of the town centres would be inconsistent with Council's more balanced approach to planning for growth, which is to ensure an even and equitable distribution of housing delivery to meet future needs in areas which are best served by the infrastructure.

Speculative Planning Proposals

We are concerned about the speculative planning proposals and their supporting documentation being used to inform the AJ+C Review. Significant increases in the height and FSR of sites which were the subject of previous planning proposals, being 11-125 Anzac Parade and 112 Todman Avenue, Kensington, 137-145A Anzac Parade, Kensington and 391-397A Anzac Parade and 17 Bunnerong Road, Kingsford provides advantage to the owners of these sites and creates the perception that this is developer driven. Given these planning proposals, which were prepared to further private interests rather than the public interest, have all been recommended for refusal by the JRPP, we strongly believe they should not in any way be used to inform a Planning Strategy.

Furthermore, it should be noted that the planning proposals for 137-151 Anzac Parade, Kensington and 111-125 Anzac Parade and 112 Todman Avenue, Kensington haven't been determined by DPE, despite them being recommended for refusal by the JRPP some 10 months ago. As per Council's previous correspondence, the uncertainty created by this is of concern to Council.

Built form

The Strategy proposes detailed built form controls, having regard to:

- An appropriate bulk, scale and massing
- Relationship and response to surrounding development and public domain, including solar access considerations
- Environmental constraints including overshadowing and aircraft noise limitations
- Capacity to accommodate additional floor space to meet future demand (residential and commercial)
- Requirements of SEPP 65 and the Apartment Design Guide
- Economic feasibility including development yield and viability

Having regard to all the above, 3D modelling was utilised to test and refine urban design principles for the town centres, and identify heights and FSRs that were compatible with each other. The AJ+C Review proposes additional height and FSR without adequate justification for why specific sites have been chosen, without consideration of potential shadowing impacts, and without addressing bulk, visual impacts, heritage value or the transition with existing development within and adjacent to the centres.

Built form modelling for the Strategy demonstrates that additional residential and employment floor space can be accommodated within a mid-scale urban environment with some taller buildings clustered at strategic nodes to facilitate activation and the delivery of improved public domain. The taller building forms were proposed for 15/16 stories, with 17/18 stories permissible with design excellence. Council has tested the building heights proposed in the Strategy with respect to shadows, bulk and visual impact on Anzac Parade and the surrounding residential areas. The Review's proposed building heights of up to 25 stories have not been tested, and concern is raised over the shadowing impact, bulk and visual impact and transition to surrounding residential areas. Heights of up to 25 stories are wholly incompatible with the context and character of Kensington and Kingsford and are not supported.

We raise serious concern that increasing the maximum FSR, as recommended by AJ+C will add to the bulk, shadowing and visual impact of the buildings, resulting in greater impacts on surrounding residential areas. The FSRs recommended by the Review, of up to 6:1 are indicative of fringe CBD areas with greater levels of accessibility than Kensington and Kingsford, and are wholly incompatible with the context of Kensington or Kingsford. The FSRs proposed in the Strategy are chosen after detailed urban design review, including 3D modelling and constraints and opportunities modelling, and are considered the maximum appropriate FSRs for this location.

The proposed 850m^2 floor plate control for taller residential buildings, proposed in the Review, is likely to result in buildings with unacceptable bulk. The Urban Design Report by Conybeare Morrison recommends a maximum floor plate of 600m^2 for taller building forms as this will result in slender buildings with less visual impact, less bulk and faster-moving shadows. This will have a detrimental impact on the streetscape of Kensington and Kingsford town centres which already accommodate significant development of 7/8 stories and Council does not support any increase to the maximum floor plate.

Council's urban design analysis identified a four storey street wall as appropriate to achieve a cohesive streetscape consistent with existing development, reinforce a pedestrian scale and reduce the visual impact of building bulk within both town centres. A six storey street wall as proposed in the AJ+C review is not supported.

Council does not support the Review's recommendations for increases in height or FSR above what is outlined in the Planning Strategy, an increase in the maximum floor plate control or an increase in the street wall height. The following table provides block by block comments on the AJ+C recommendations, confirmed during recent ground investigations which included visual analysis and consideration of environmental impacts.

Detailed Comments

Site	RCC Strategy	AJ+C	Comment
		Kensington	
1, 2 & 3	54m (16 storeys) or 60m (18 storeys with design excellence) 5:1 FSR Max tower footprint 600m^2 4 storey street wall min 1:1 commercial FSR	Expanded/larger opportunity site 54m (16 storeys) or 60m (18 storeys with design excellence) 5:1 FSR or 5.5:1 FSR with design excellence Max tower footprint 850m^2 6 storey street wall min 1:1 commercial FSR	Expanding the extent of the opportunity sites to include additional sites will likely result in two tower forms on each corner, as opposed to the one tower form proposed under the Strategy. This will significantly increase the visual impact on the surrounding residential area. In addition, expanding the opportunity site to the south of the Todman Avenue intersection draws activity and emphasis away from the light rail stop which lies to the north of the intersection. In particular, expansion of opportunity site 2, to a maximum height to 18 storeys would be incompatible with the adjoining heritage item I114 Single storey terrace group at 1-27 Darling Street. The proposed 16-18 storeys would create a drastic height disparity, overwhelming the heritage items and providing an inappropriate transition. Increasing the maximum FSR on the site will add to the bulk and scale of the buildings, increasing visual impact and overshadowing, and will likely be unachievable while meeting the maximum building height and additional DCP controls such as setbacks and transition heights. The Strategy recommended a floor plate control of 600m^2 for taller building forms, and increasing the FSR and maximum floor plate controls will result in unacceptably bulky buildings. This will result in an undesirable transition to the existing surrounding development, overshadow the expansion of the public plaza at Addison Street to the south of the site, and have

			unacceptable impacts on the surrounding residential area. **The increase in maximum FSR and the expansion of the opportunity sites is not supported.** It is also noted that the expansion of opportunity site 1 was the subject of a previous planning proposal, and we strongly object to any developer-driven planning proposal informing the planning controls for a site.
	 Figure 1: Existing development at proposed extension to opportunity site 1	 Figure 2: 18 storeys at Site 2 would be an inappropriate transition to the heritage terraces at 1-27 Darling Street	 Figure 3: 18 storeys would be an inappropriate height adjacent to the low-rise residential character of Bowral Street
4	54m (16 storeys) or 60m (18 storeys with design excellence) 5:1 FSR Max tower footprint 600m^2 4 storey street wall min 1:1 commercial FSR	Expanded/larger opportunity site 66m (20 storeys) or 82m (25 storeys with design excellence) 6:1 FSR Max tower footprint 750m^2 6 storey street wall min 1:1 commercial FSR	It is unclear why this site was chosen for higher height and FSR over other corner sites of the Todman Avenue intersection. It is noted the proposed height in the Review is consistent with the planning proposal recommended for refusal by the JRPP, and we strongly object to any developer-driven planning proposal informing the planning controls for a site. Increasing the maximum FSR will add to the bulk of the building, increasing visual impact and overshadowing. The increased FSR will likely be unachievable while meeting additional DCP controls such as setbacks and transition heights. Given the current and

			future role of Kensington as a local centre, 18 storeys (with design excellence) is viewed as the maximum appropriate height for this location and **the increased height and FSR is not supported.**
5	Not included within K2K Strategy	Recommended for inclusion within town centre study area to further support potential cross-site links to Boronia Street and a more carefully considered transition in scale	This site is not included within the Planning Strategy boundary as adopted by Council, and therefore cannot be supported. This site may have potential and could be investigated as part of a future housing study which also addresses locational context and strategic merit, such as the relationship with existing lower scaled buildings, block/mass analysis, potential heritage significance, visual analysis and environmental considerations. **This site is outside the Strategy boundary and is not supported.**
Kingsford			
Kingsford Midtown			
1, 2 & 3	54m (16 storeys) or 60m (18 storeys with design excellence) 5:1 FSR Max tower footprint 600m^2 4 storey street wall min 1:1 commercial FSR	Expanded/larger opportunity site 54m (16 storeys) or 60m (18 storeys with design excellence) 5:1 FSR or 5.5:1 FSR with design excellence Max tower footprint 850m^2 6 storey street wall min 1:1 commercial FSR	Increasing the maximum FSR will add to the bulk and scale of the buildings, increasing visual impact and overshadowing, and will likely be unachievable while meeting the maximum building height and additional DCP controls such as setbacks and transition heights. The Strategy recommended a floor plate control of 600m^2 for taller building forms, and increasing the FSR and maximum floor plate controls will result in unacceptably bulky buildings. This will result in an undesirable transition to the existing surrounding development and have unacceptable shadowing and visual impacts on the surrounding residential area and on the heritage item O'Dea's corner (site 4). **The increase in maximum FSR is not supported.**
4	Heritage item - no changes to height or FSR	54m (16 storeys) or 60m (18 storeys with design excellence) 5:1 FSR or 5.5:1 FSR with design excellence Max tower footprint 850m^2	The site is constrained due to surrounding recent mixed use development and the heritage item, O'Dea's corner, on the site. Any increase in height and FSR would need to consider required setbacks in accordance with the Apartment Design Guide and

		6 storey street wall 1:1 min. non-resi FSR Careful design solutions required to address heritage characteristics	amenity impacts on the existing multi-storey development which wraps around the side and rear of the site. As part of the town centre review, Colin Brady Heritage Consultant was engaged to undertake a heritage review of Kingsford town centre. The review reaffirmed the heritage significance of O'Dea's corner as a well detailed example of Federation shop/residence development and for its association with Frank O'Dea – bookmaker, real estate developer and promoter of cultural activities in the foundation years of South Kensington (later renamed Kingsford). Due to the heritage significance of the site, no height or FSR increases were proposed in the strategy for this site. The proposed 16-18 storeys on this site is excessive, given the heritage value of O'Dea's Corner. 16-18 storey would be overwhelming in scale, would dominate the heritage fabric and component of the item, and cannot be supported. **The increase in height and FSR is not supported.**
	 Figure 4: Interface between site 1 and the low-medium density development across Houston lane	 Figure 5: The 8-storey mixed use development surrounding the heritage item at site 4	 Figure 6: Interface between site 4 and the adjoining mixed use development

Kingsford Junction			
5	31m (9 storeys) 4:1 FSR 4-storey street wall No min commercial	60m (18 storeys) or 66m (20 storeys with design excellence) 5.5:1 FSR or 6:1 FSR with design excellence Max tower footprint 850m^2 (or 750m^2 if 20 storeys) 6 storey street wall min 1:1 commercial FSR	The planning proposal specified a moderate increase in height along Anzac Parade to reinforce the urban 'spine' of the town centres, protecting lower scale residential neighbourhoods to the east and west and allowing scope for a transition in height. The higher building height is used to define the nodes, located at key light rail stops. The increased height on this site would draw visual emphasis away from the two identified southern gateway sites for the Kingsford town centre: the Triangle site and the Rainbow Street Market site (sites 7 & 8). The two identified gateway/opportunity sites at Kingsford Junction were identified predominantly for their proximity to the new light rail terminus. Due to the proposed intersection layout and functionality for Kingsford Junction, the northern parts of the town centre, including this site, will have more constrained pedestrian access to the terminus than the identified opportunity sites and this site is not suitable for an opportunity site. Kingsford Junction is constrained by airport and height limitations. Council officers met with representatives from Sydney Airport and the Commonwealth Department of Infrastructure and Regional Development in relation to the draft Strategy and airport restrictions were made clear. The proposed height in the strategy reflects the Commonwealth response, and will be subject to further scrutiny by the Commonwealth and Sydney Airport during the public consultation phase. As the population density of the area increases, protecting sun access to public spaces becomes increasingly important. The shadowing impact on Dacey Gardens needs to be carefully

			considered and tested using 3D modelling and detailed visual analysis. The increased height may also be incompatible with the heritage character of Dacey Gardens and the surrounding historic suburb of Daceyville, and a detailed heritage impact assessment should be part of any proposal to increase the height of this site. **The increased height and FSR are not supported.**
6	31m (9 storeys) 4:1 FSR 4-storey street wall	60m (18 storeys) or 66m (20 storeys with design excellence) 5.5:1 FSR or 6:1 FSR with design excellence Max tower footprint 850m^2 (or 750m^2 if 20 storeys) 6 storey street wall min 1:1 commercial FSR	The planning proposal specified a moderate increase in height along Anzac Parade to reinforce the urban 'spine' of the town centres, protecting lower scale residential neighbourhoods to the east and west and allowing scope for a transition in height. The higher building height is used to define the nodes, located at key light rail stops. The narrow width of Anzac Parade at this point, and the locational context of this site within a long block means 9-storeys provides a better relationship of scale to the rest of the block, and the rest of the Kingsford town centre. The 9-storey building height on this site also relates well in scale to the existing 9-storey development across the road at 532 Anzac Parade, Kingsford (Churchill's hotel development). The proposed 18-20 storeys on this site would draw visual emphasis away from the two identified southern gateway sites (sites 7 & 8). The two identified gateway/opportunity sites at Kingsford Junction were identified predominantly for their proximity to the new light rail terminus. Due to the proposed intersection layout and functionality for Kingsford Junction, the northern parts of the town centre, including this site, will have more constrained pedestrian access to the terminus than the identified opportunity sites and this site is not suitable for an opportunity site.

			As the population density of the area increases, protecting sun access to public spaces becomes increasingly important. The shadowing impact on Dacey Gardens (Heritage item I76 Dacey Garden Reserve and Substation and Daceyville Garden Suburb Heritage Conservation Area) needs to be carefully considered and tested using 3D modelling and detailed visual analysis. The increased height may also be incompatible with the heritage character of Dacey Gardens (Heritage item I76 Dacey Garden Reserve and Substation and Daceyville Garden Suburb Heritage Conservation Area), and a detailed heritage impact assessment should be part of any proposal to increase the height of this site. Kingsford Junction is constrained by airport and height limitations. Council officers met with representatives from Sydney Airport and the Commonwealth Department of Infrastructure and Regional Development in relation to the draft Strategy and airport restrictions were made clear. The proposed height in the strategy reflects the Commonwealth response, and will be subject to further scrutiny by the Commonwealth and Sydney Airport during the public consultation phase. **The increased height and FSR are not supported.**

	 Figure 7: Site 5 and 6 viewed from the western side of Anzac Parade, showing the narrow width of Anzac Parade	 Figure 8: Site 5, viewed from the western side of Anzac Parade	 Figure 9: Site 5, as viewed from Dacey Gardens
7	<u>Part of site:</u> 54m (15 storeys) or 60m (17 storeys with design excellence) 5:1 FSR Max tower footprint 600m^2 4 storey street wall min 1:1 commercial FSR <u>Part of site:</u> 31m (9 storeys) 4:1 FSR 4-storey street wall No min commercial	60m (18 storeys) or 66m (20 storeys with design excellence) 5.5:1 FSR or 6:1 FSR with design excellence Max tower footprint 850m^2 (or 750m^2 if 20 storeys) 6 storey street wall min 1:1 commercial FSR	Kingsford Junction is constrained by airport and height limitations. Council officers met with Sydney airport and the Commonwealth Department of Infrastructure and Regional Development in relation to the draft Strategy and airport restrictions were made clear. The proposed height in the strategy reflects the Commonwealth response, and will be subject to further scrutiny by the Commonwealth and Sydney Airport during the public consultation phase. The south eastern part of the site closer to Sturt Street is not appropriate for 18-20 storey heights. The residential area immediately to the south has a maximum building height of 9.5m and the proposed building height of 60-66m is at least 6 times that of the adjoining area. The proposed building height does not provide a sensitive transition and **the increase in building height across the site is not supported.**

			Increasing the maximum FSR will add to the bulk and scale of the buildings, increasing visual impact and overshadowing, and will likely be unachievable while meeting the maximum building height and additional DCP controls such as setbacks and transition heights. This will result in an undesirable transition to the existing surrounding development and have unacceptable impacts on the surrounding residential area. **The increase in maximum FSR is not supported.** It is also noted that this site was the subject of two previous planning proposals, and we strongly object to any developer-driven planning proposal informing the planning controls for a site.
8	<u>Part of site:</u> 54m (15 storeys) or 60m (17 storeys with design excellence) 5:1 FSR Max tower footprint 600m^2 4 storey street wall min 1:1 commercial FSR <u>Part of site:</u> 31m (9 storeys) 4:1 FSR 4-storey street wall No min commercial	60m (18 storeys) or 66m (20 storeys with design excellence) 5.5:1 FSR or 6:1 FSR with design excellence Max tower footprint 850m^2 (or 750m^2 if 20 storeys) 6 storey street wall min 1:1 commercial FSR Careful design solutions required to address heritage characteristics	Kingsford Junction is constrained by airport and height limitations. Council officers met with Sydney airport and the Commonwealth Department of Infrastructure and Regional Development in relation to the draft Strategy and airport restrictions were made clear. The proposed height in the strategy reflects the Commonwealth response, and will be subject to further scrutiny by the Commonwealth and Sydney Airport during the public consultation phase. The eastern part of the site is not appropriate for 18-20 storey heights. The area immediately to the east is zoned R2 low density residential and has a maximum building height of 9.5m and the proposed building height of 60-66m is at least 6 times that of the adjoining area. The proposed building height does not provide a sensitive transition and **the increase in building height across the site is not supported.** Increasing the maximum FSR will add to the bulk and scale of the buildings, increasing visual impact and overshadowing, and will likely be unachievable while meeting the maximum building

			height and additional DCP controls such as setbacks and transition heights. This will result in an undesirable transition to the existing surrounding development and have unacceptable impacts on the surrounding residential area. **The increase in maximum FSR is not supported.**

CM+

Kensington + Kingsford Town Centres

Assessment of Recommendations Report

March 2018

Content

Kensington Site 2 — 192-212 Anzac Parade
(Corner of Anzac Parade + Darling Street + Darling Lane)

Council Planning Proposal

- Proposed Height of Building of 9 storeys (31m)
- Floor Space Ratio 4:1
- Maximum floorplate 600m^2

AJ+C Review

- An increase in permitted building height from 9 storeys to 18 storeys, an increase in development density from FSR 4:1 to FSR 5.5:1 and an increase in floor plate size from 600m^2 to 850m^2 is proposed.

Background

- Heritage Item (I114) is identified in the RLEP as No. 1 to 27 Darling Street, to the east of the site, on the opposite side of Darling Lane - a row of single storey terraces.
- Contributory Items are identified in the RDCP at No. 208, 210 and 212 Anzac Parade, on the Anzac Parade and Darling Street corner – a two storey 'main Street' corner shop.
- The Kensington and Kingsford Town Centres Planning Strategy identified the appropriate built form for Kensington Town Centre as being a commercial/residential 'spine' of maximum nine (9) storeys along Anzac Parade, with a node comprised of taller apartment buildings, up to 18 storeys, on the corner sites, marking the intersection of Anzac Parade with Todman Avenue.

Location Plan


Heritage cottages in Darling Street, looking west towards Anzac Parade

Corner Anzac Parade and Darling Street

CM+ Commentary – Urban Design Issues

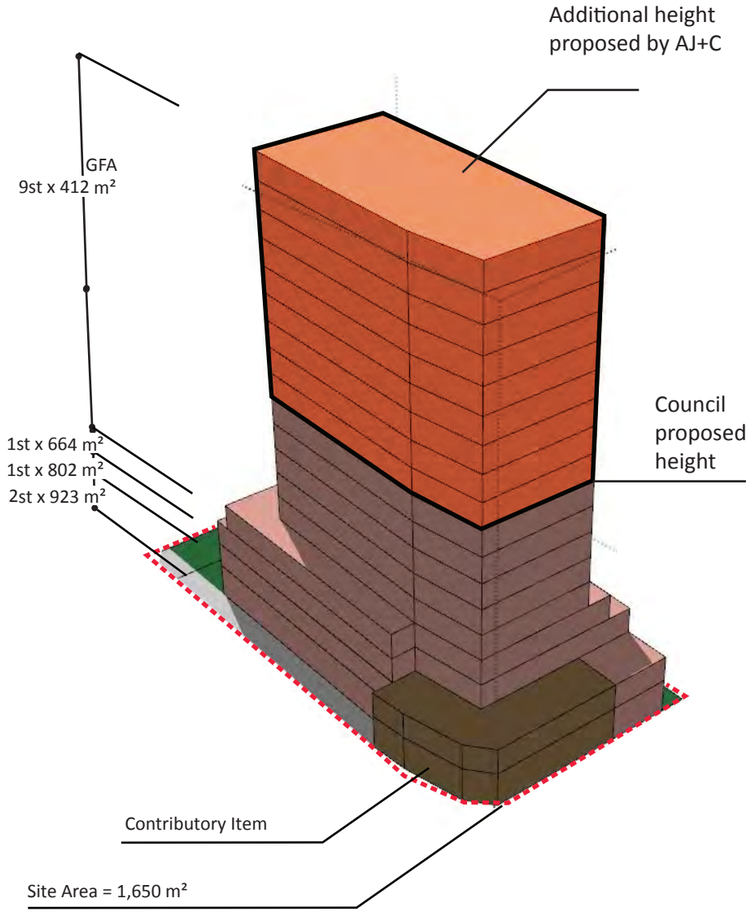
- The AJ+C proposal would establish a row of tower buildings at mostly the same height (predominantly 18 storeys) along both sides of Anzac Parade – in effect a 'wall' of tall buildings, of larger bulk and massing due to the larger footprint proposed.
- The urban design strategy of creating distinct nodes centred on the major intersections would be undermined. Instead a wall of tall and bulky buildings would emerge of inappropriate scale, which would overwhelm the public domain.
- The row of single storey heritage listed terrace houses situated to the east of the site, on the opposite side of Darling Lane, fronting Darling Street, would be impacted by a very tall tower building (18 storey) without any transition of height possible. This scale of development without any transition is inappropriate and does not respect the heritage value of the terrace houses.
- To respect the two storey corner Contributory Building (primarily the façade and parapet) any new development should be setback at least 5.5m, resulting in a restricted development envelope.
- The new tower would increase the overshadowing of Anzac Parade and Darling Street, impacting on streetscape amenity, particularly during the winter months.
- The contrast in height from one storey to eighteen storeys would likely create undesirable wind effects for pedestrians using the Anzac Parade and Darling Street footpaths and crossings.
- When ADG setback requirements and appropriate footpath widening setbacks (2.5m) and from the parapet (5.5m) of the corner Contributory Building are taken into consideration, the resultant tower footprint is restricted to 412m^2 GFA. This small floor area per level may not be viable to develop.

Floor plan of corner block Anzac Parade and Darling Street at 25 storeys

Drawing No: SK-101	Date	Issue
• issue for comments	02/02/2018	A
• incorporated councils comments	16/02/2018	B
• incorporated councils comments - Rev02	28/02/2018	C

Kensington Site 2

	CM+/RCC	AJ+C Proposed	AJ+C Actual
Total GFA	6,600 m²	9,075 m²	9,083 m²
Site Area	1,650 m²	1,650 m²	1,650 m²
Maximum FSR	4.0:1	5.5:1	5.5:1
Maximum HOB	9 storeys	18 storeys	18 storeys



Corner Block at Anzac Parade and Darling Street

Aerial View, Todman Avenue Intersection Node

Kensington Site 2

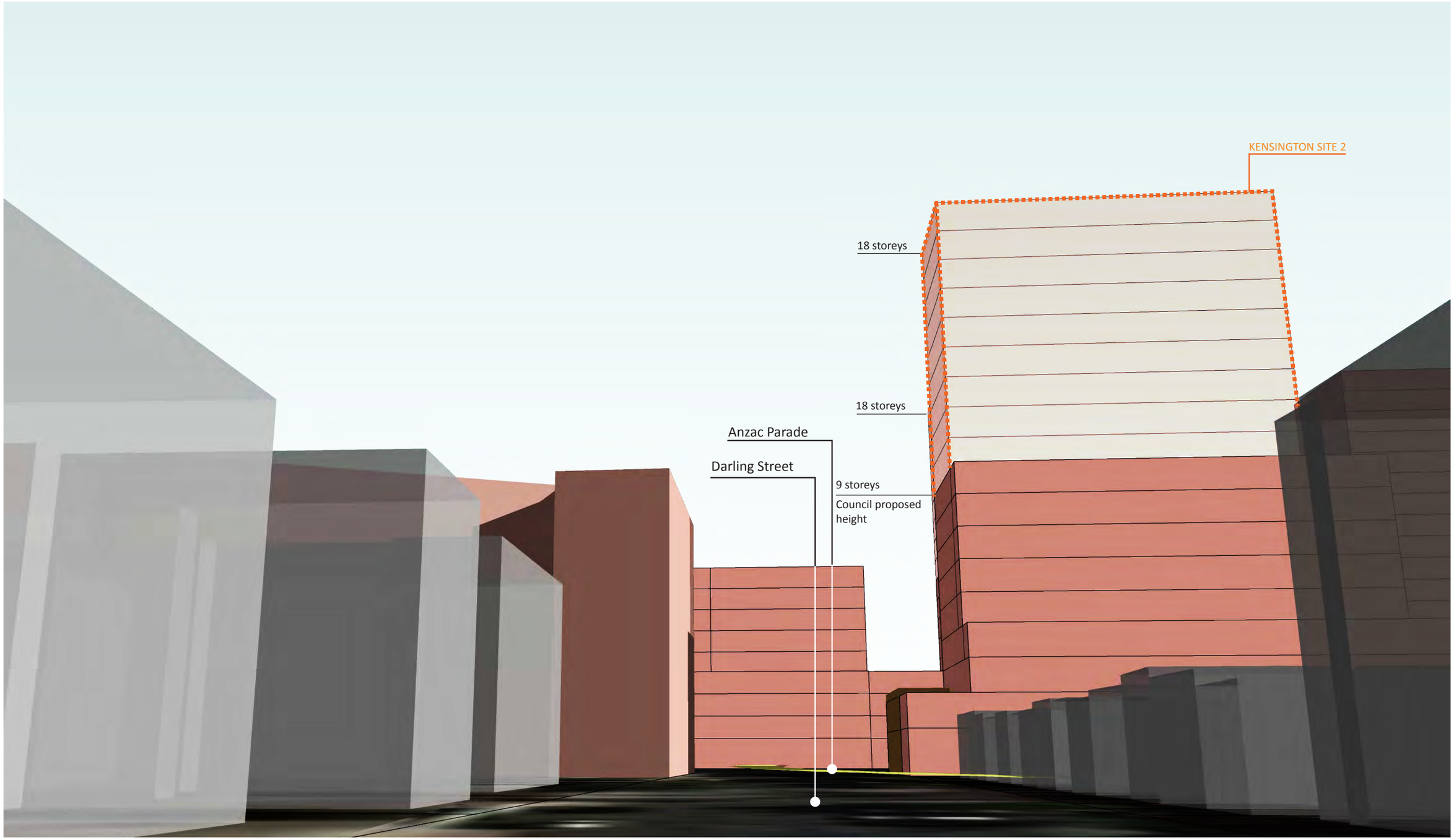
Mid-winter solstice at 11:00 am

Mid-winter solstice at 12:00

Mid-winter solstice at 13:00

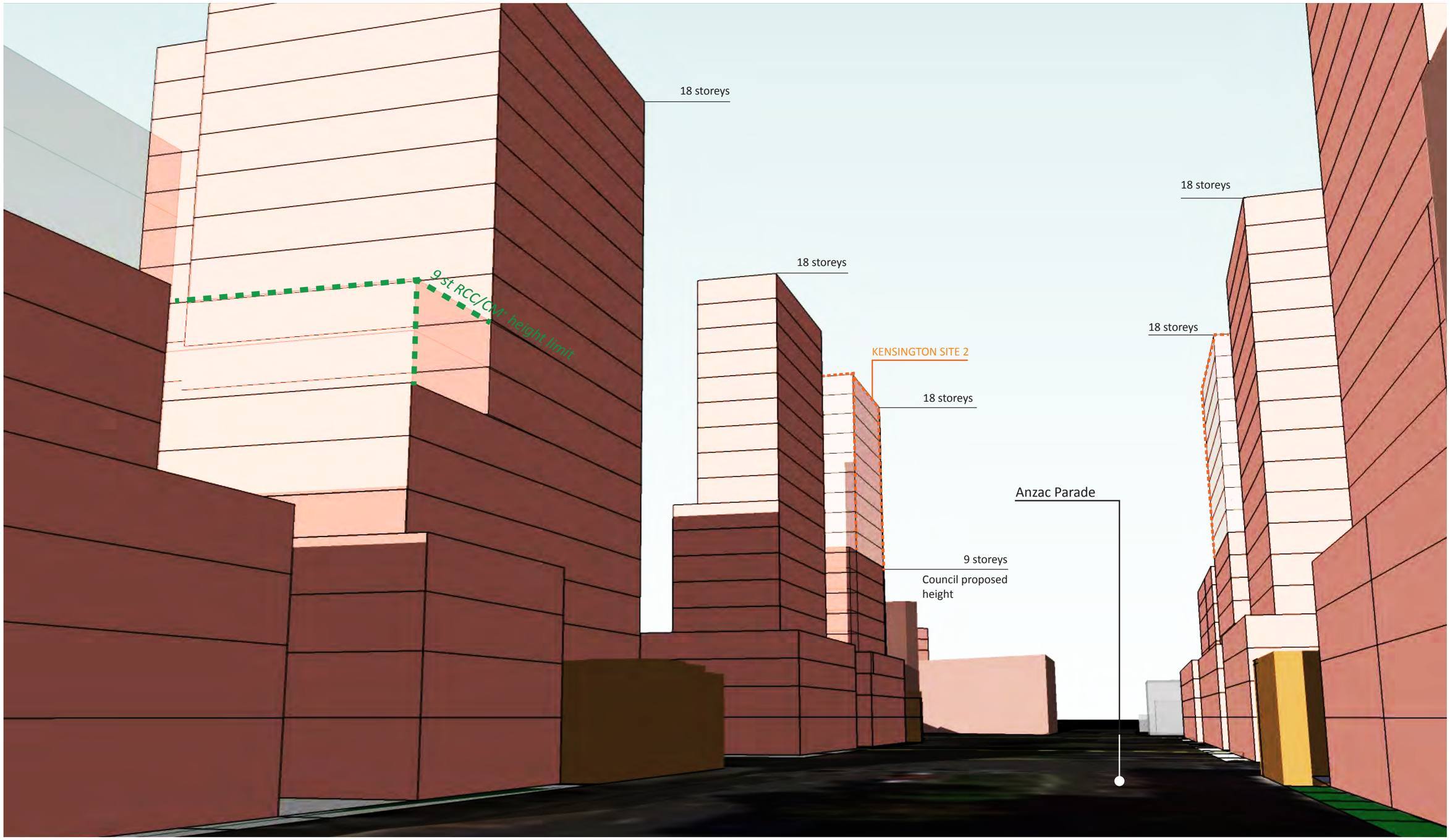
Mid-winter solstice at 14:00

Kensington Site 2



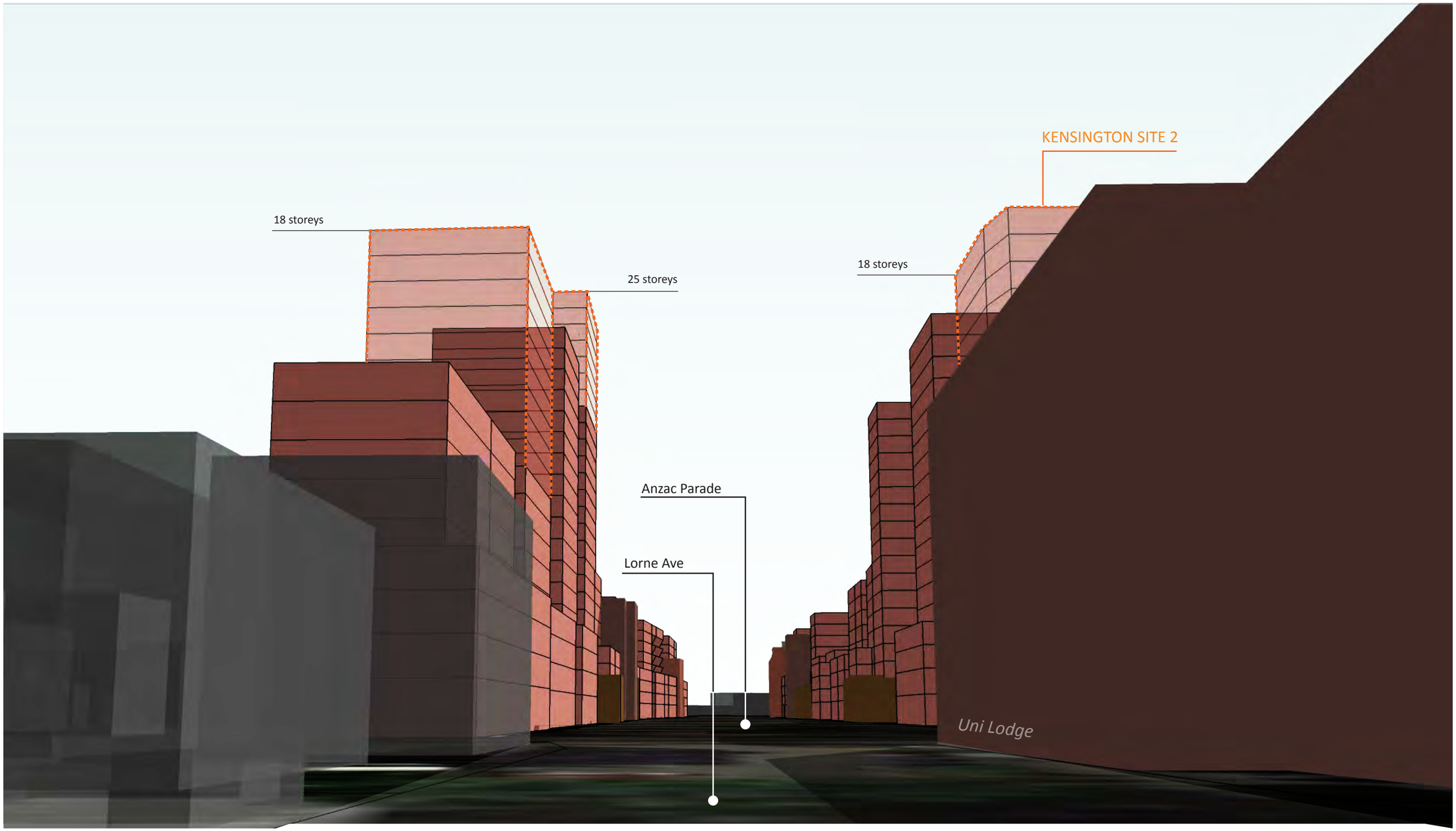
Impact analysis of the AJ+C recommendation - streetview - looking west on Darling Street - @ 18 storeys

Kensington Site 2



Impact analysis of the AJ+C recommendation - streetview - looking south on Anzac Parade - @ 18 storeys

Kensington Site 2



Impact analysis of the AJ+C recommendation - streetview - looking north on Lorne Avenue - @ 18 storeys and 25 storeys

Kingsford Site 4 – 424-436 Anzac Parade
(Corner of Anzac Parade + Middle Street (O'Deas Corner))

Council Planning Proposal

- Proposed Height of Building of 7 storeys (24m)
- Floor Space Ratio 4:1

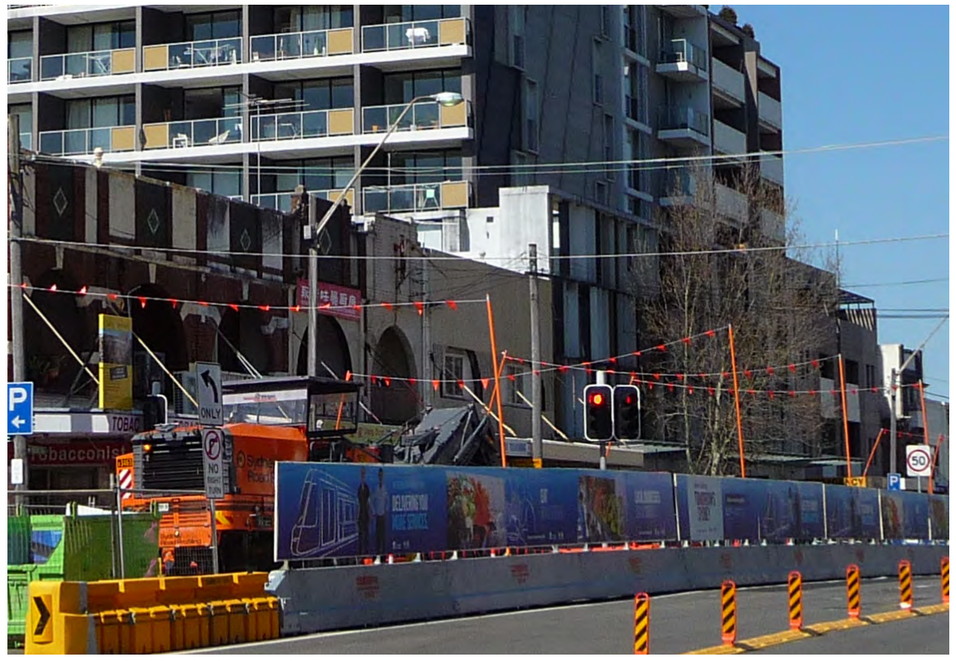
AJ+C Review

- An increase in permitted building height from 7 storeys to 18 storeys, an increase in development density from FSR 4:1 to FSR 5.5:1 and an increase in floor plate size from 600m^2 to 850m^2 is proposed.

Background

- Heritage Item (I152) identified in the RLEP at No. 424 to 436 Anzac Parade (O'Deas Corner) currently occupies the site.
- Contributory Item identified in the RDCP at No. 416 to 422 Anzac Parade, on the opposite Anzac Parade and Middle Street corner – the three storey Regent Hotel.
- The Kensington and Kingsford Town Centres Planning Strategy identified this site as being highly constrained due to the heritage status and recently constructed apartment building adjoining to the south with balconies and living areas facing north, overlooking the site. No height increases were proposed for this site in the strategy.

Location Plan



O'Deas corner building looking south east

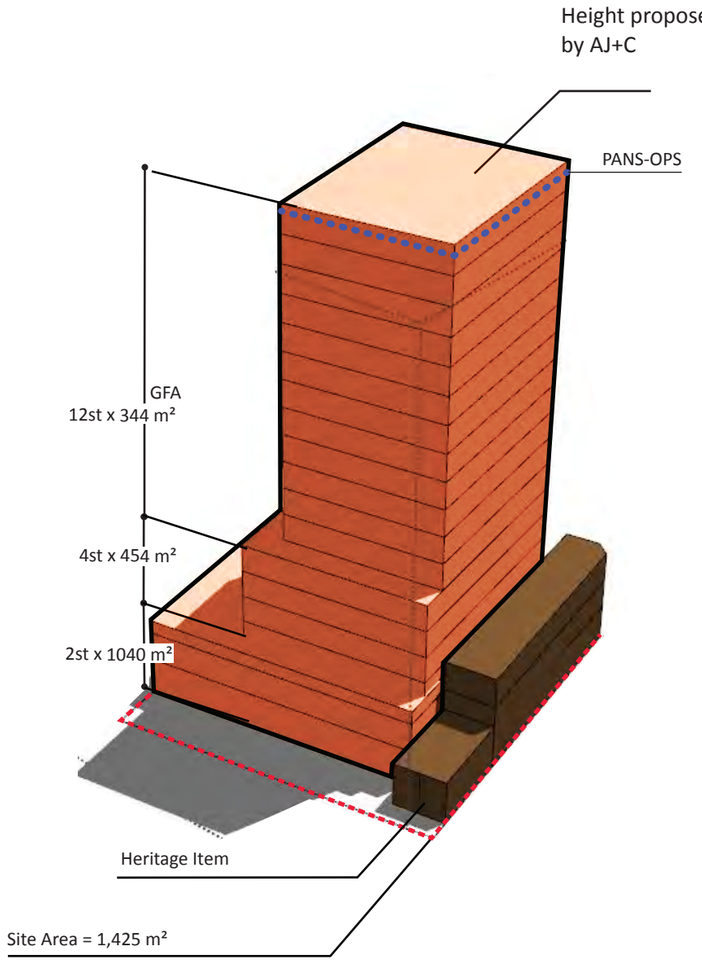
O'Deas corner building looking east

CM+ Commentary – Urban Design Issues

- The AJ+C proposal would establish a tower building on this highly constrained corner site, potentially undermining the cultural value of the O'Deas Corner heritage building.
- The Proposal recommends tower floor plates which are 40% larger than the Town Centres Planning Strategy (850m^2 rather than 600m^2). Bulky tower buildings may emerge, of inappropriate scale, which would overwhelm the public domain.
- It is important to respect the two storey corner Heritage Building (primarily the façade and parapet), and any new development should therefore be setback at least 5.5m from the parapet. The result would be a highly restricted development envelope for a tower building.
- The proposed new tower and increased floor plate size of the other three towers at the intersection would increase the overshadowing of Anzac Parade, particularly impacting on streetscape amenity during the winter months.
- The proposed tower would also significantly overshadow, half or more of the existing 'Cazzie Apartments' balconies and living spaces at 438 to 448 Anzac Parade which is situated at the south boundary, facing north, overlooking the site.
- When ADG setback requirements and appropriate setbacks (5.5m) from the parapet of the Heritage Building are taken into consideration, the resultant tower footprint is highly restricted to 344m^2 GFA. This small floor area per level is unlikely to be viable to develop.
- The proposed 18 storey height is not permitted, as Commonwealth Government height restrictions apply to preserve a safe flight path to and from Sydney Airport. The 'PANS-OPS' is an absolute upper limit which cannot be exceeded by any obstacle, including the tops of buildings, roofs, plant rooms, masts, signs, or even cranes during the construction phase.
- Once ADG floor-to-floor heights are calculated the maximum tower height possible is seventeen storeys (including freeboard level, plant rooms, roof forms, masts or the like). It assumes special construction techniques are used for the upper levels of the building, in lieu of a crane.

Floor plan of corner block Anzac Parade and Middle/Strachan Street at 18 storeys (including design excellence)

	CM+/RCC	AJ+C Proposed	AJ+C Actual
Total GFA	constraint	7,838 m²	6,550 m²
Site Area	1,425 m²	1,425 m²	1,425 m²
Maximum FSR	4.0:1	5.5:1	4.7:1
Maximum HOB	7 storeys	18 storeys	18 storeys



Corner Block at Anzac Parade and Middle Street

Aerial View, Anzac Parade and Middle/Strachan Street Intersection Node at 18 storeys (including design excellence)

Drawing No: SK-202	Date	Issue
• issue for comments	02/02/2018	A
• incorporated councils comments	16/02/2018	B
• incorporated councils comments - Rev02	28/02/2018	C

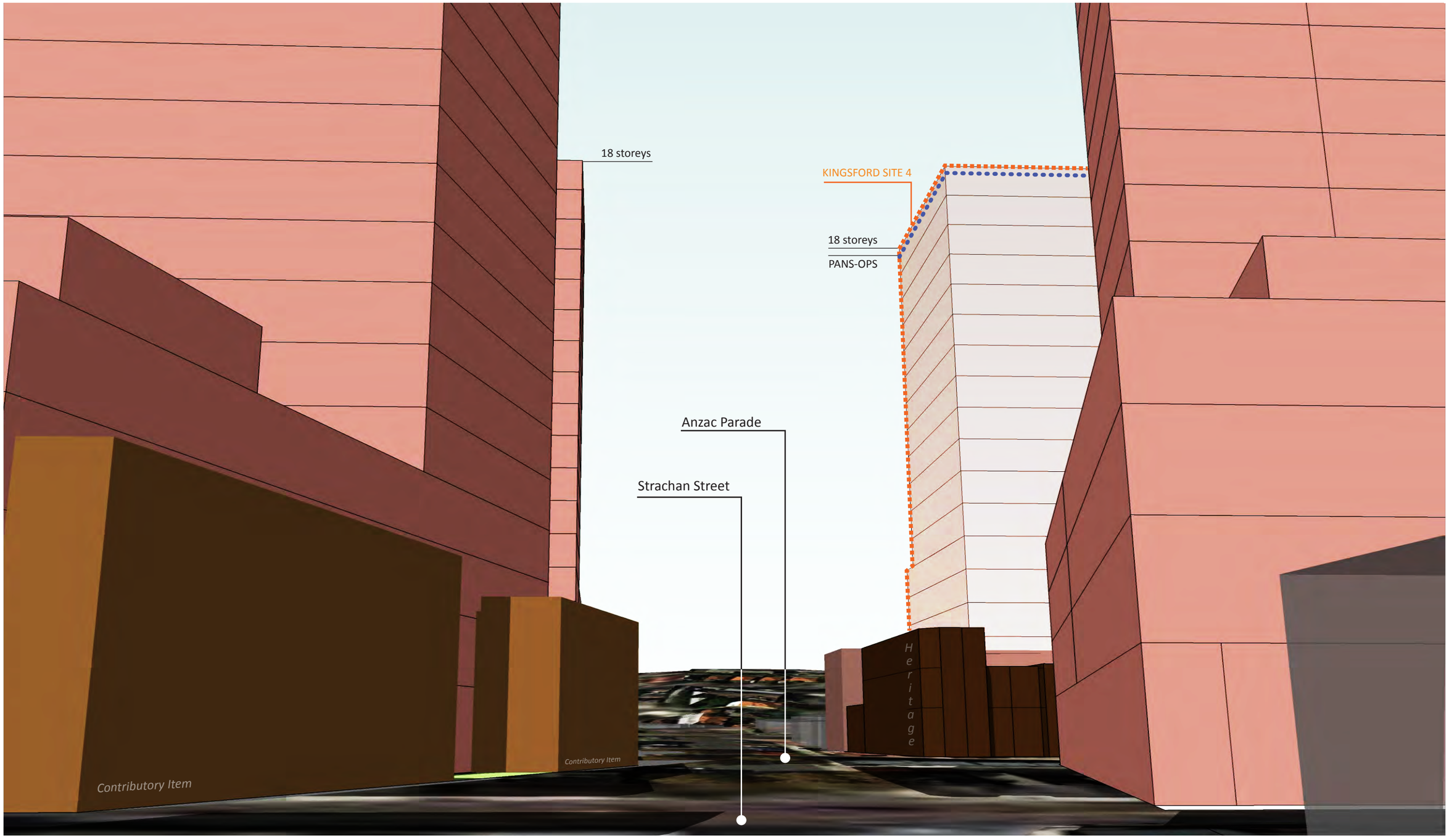
Kingsford Site 4

Mid-winter solstice at 11:00 am

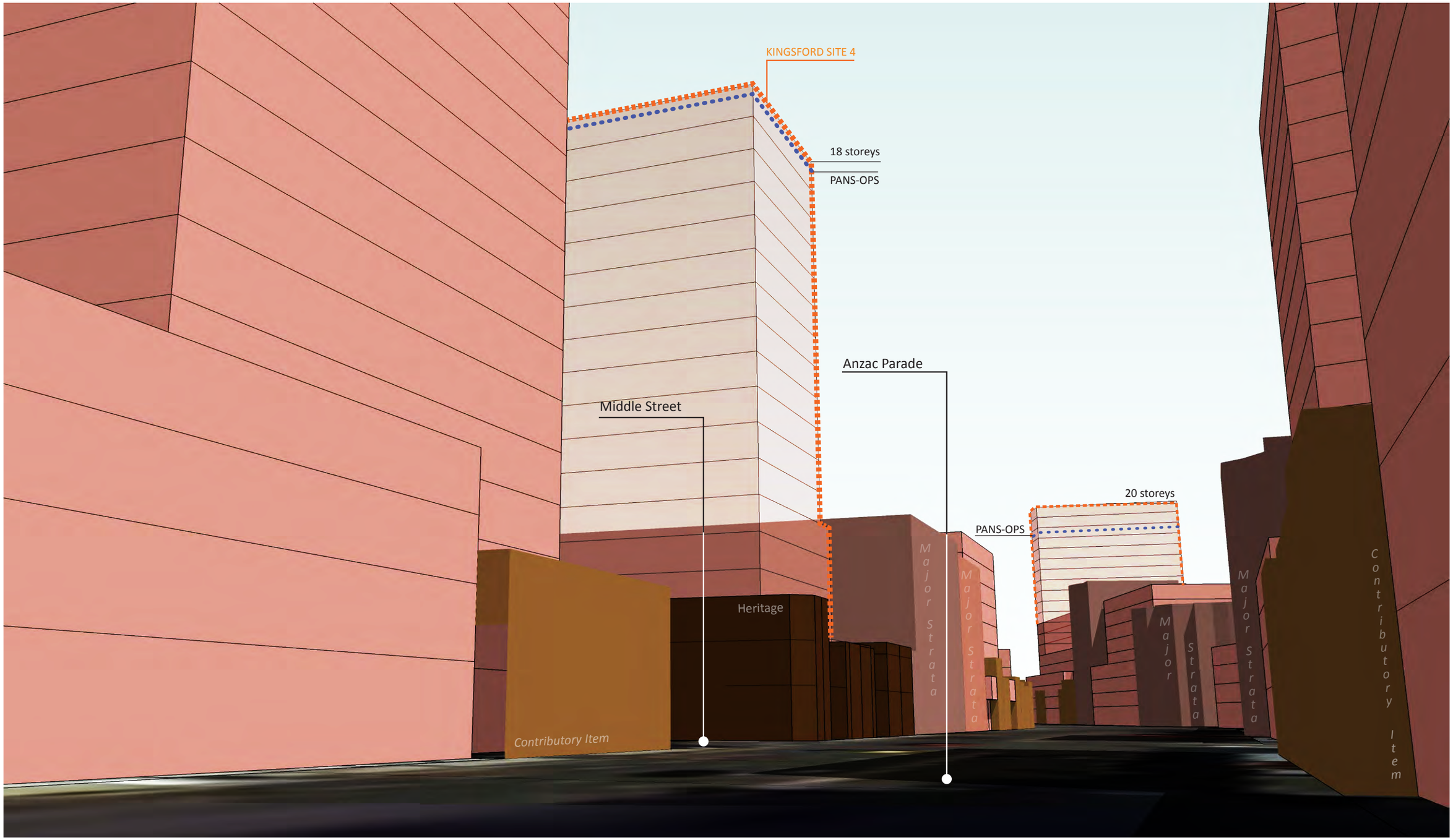
Mid-winter solstice at 12:00

Mid-winter solstice at 13:00

Mid-winter solstice at 14:00

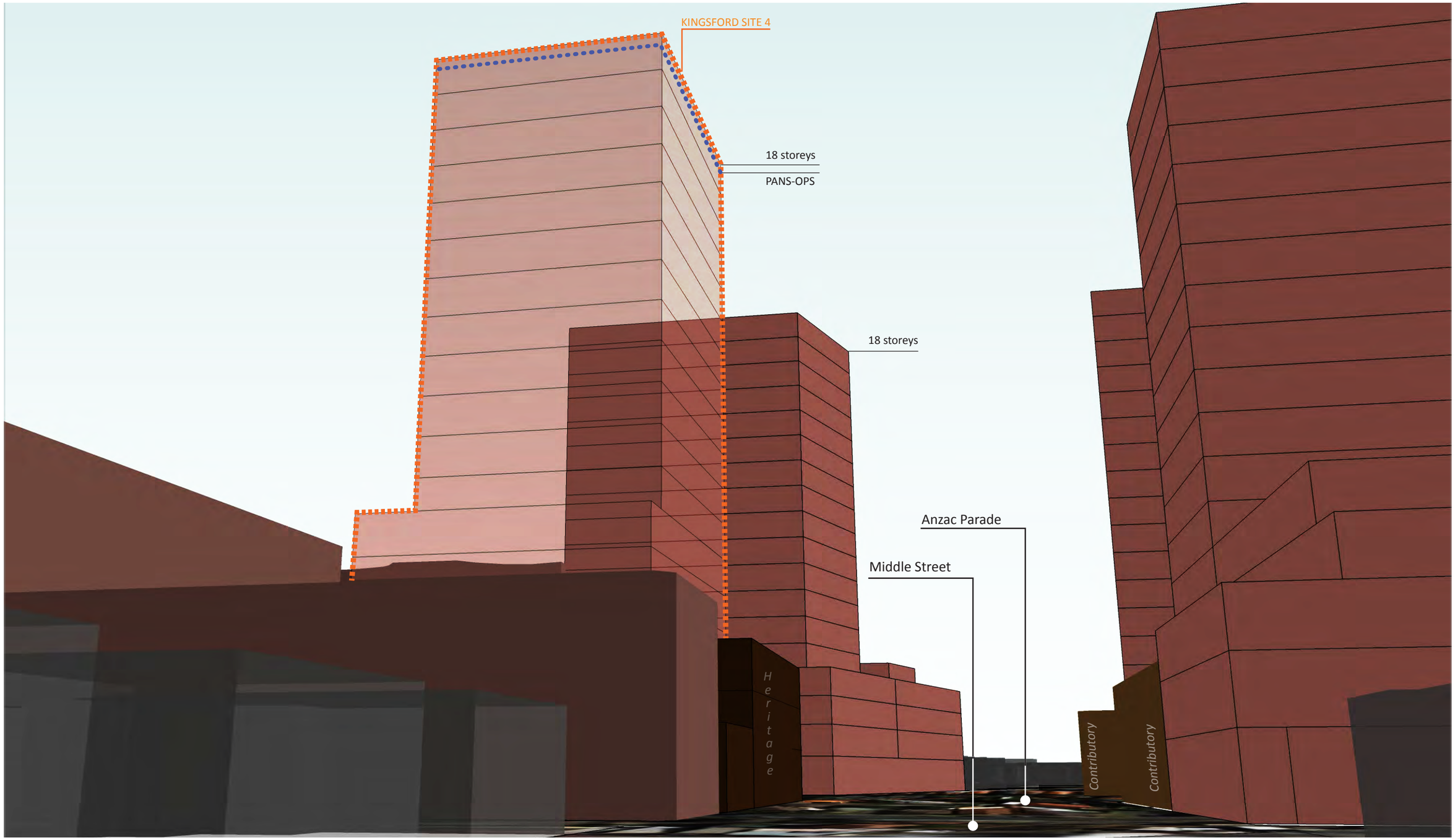


Impact analysis of the AJ+C recommendation - streetview - looking east on Strachan Street - constraint with heritage and 18 storeys proposed



Impact analysis of the AJ+C recommendation - streetview - looking south on Anzac Parade - constraint with heritage and 18 storeys proposed

Kingsford Site 4



Impact analysis of the AJ+C recommendation - streetview - looking west on Middle Street - constraint with heritage and 18 storeys proposed

Kingsford Site 5 – 375-389 Anzac Parade
(Corner of Anzac Parade + Gardeners Road)

Council Planning Proposal

- Proposed Height of Building of 9 storeys (31m)
- Floor Space Ratio 4:1
- Maximum floorplate 600m^2

AJ+C Review

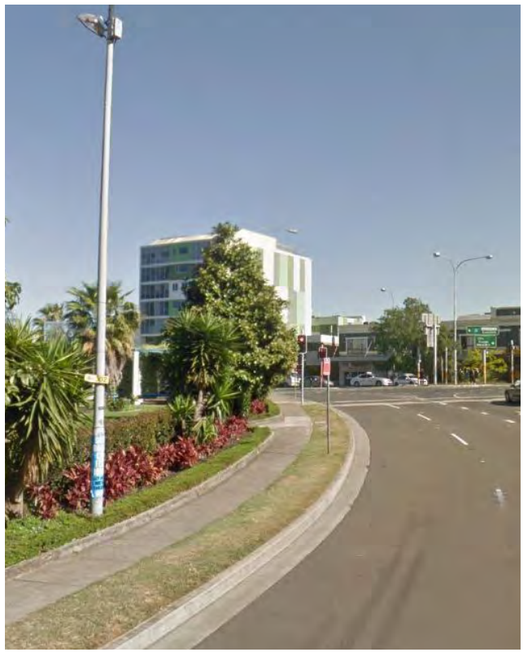
- An increase in permitted building height from 9 storeys to 20 storeys, an increase in development density from FSR 4:1 to FSR 6:1 and an increase in floor plate size from 600m^2 to 850m^2 is proposed.

Background

- Dacey Gardens is a Botany Bay LEP listed Heritage Landscape Item (I76) within Conservation Area (C1) and is situated south of the site, across Gardeners Road.
- Contributory Item identified in the RDCP at No. 385 to 387 Anzac Parade, on the Anzac Parade and Gardeners Road corner – the two storey Kydon Segal Building.
- The Kensington and Kingsford Town Centres Planning Strategy identified this site as suitable for a mid-rise (9 storey) building, to protect the park from overshadowing during winter, and from inappropriate scale and visual impacts on the heritage character of the park.

Location Plan

Kingsford Site 5 looking west


Kingsford Site 5 - view from Dacey Gardens

Kingsford Site 5 looking north

Drawing No: SK-100	Date	Issue
• issue for comments	02/02/2018	A
• incorporated councils comments	16/02/2018	B
• incorporated councils comments - Rev02	28/02/2018	C

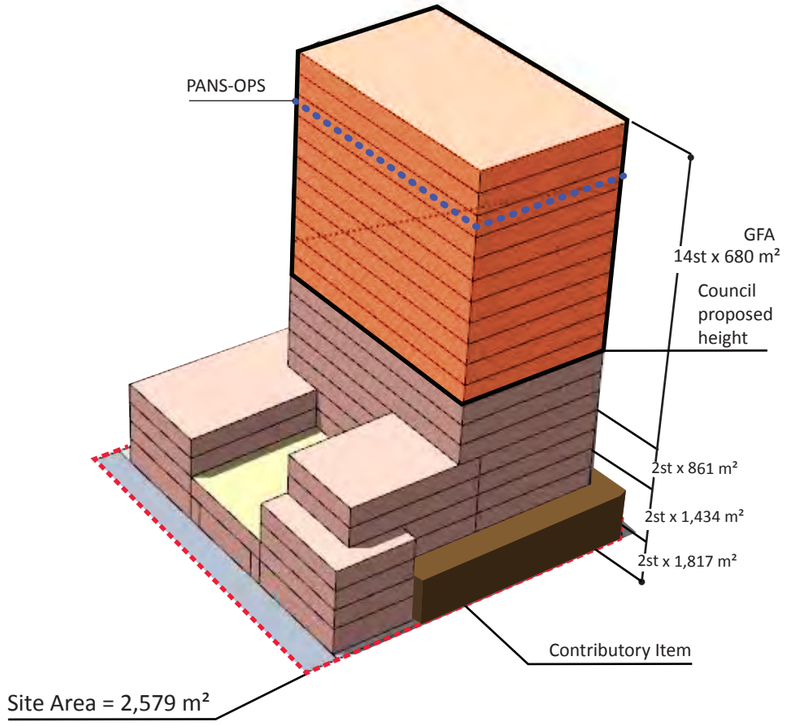
CM+ Commentary – Urban Design Issues

- The proposed 20 storey tower building on this site would overshadow Dacey Park in winter during the important lunchtime hours. The overshadowing would extend into the heart of the park's green spaces, impacting the amenity of lawn areas, seating areas and pathways through the park.
- It is important to respect the scale and character of the two storey corner Contributory Building, and any new development should therefore be setback at least 5.5m from the parapet to provide a transition in scale.
- The proposal recommends tower floor plates which are 40% larger than the RCC Urban Design Strategy (850m^2 rather than 600m^2). Bulky, squat and heavy looking tower buildings may emerge, which would be very visible from the green spaces of historic Dacey Park.
- The proposed 20 storey height is not permitted, as Commonwealth Government height restrictions apply to preserve a safe flight path to and from Sydney Airport. The 'PANS-OPS' is an absolute upper limit which cannot be exceeded by any obstacle, including the tops of buildings, roofs, plant rooms, masts, signs, or even cranes during the construction phase.
- Once ADG floor-to-floor heights are calculated the maximum tower height possible is seventeen storeys (including freeboard level, plant rooms, roof forms, masts or the like). It assumes special construction techniques are used for the upper levels of the building, in lieu of a crane.
- Even at seventeen storeys height, special permission from CASA is required, as the height exceeds the Object Limitation Surface (OLS). The OLS is just above 8 storeys in Kingsford. Any building or temporary structure, such as a construction crane, over a height of eight (8) storeys needs to be negotiated and approved by CASA and Kingsford Smith Airport.
- The exposed nature of a tall corner tower in this location would likely create undesirable wind effects for pedestrians using the Anzac Parade and Gardeners Road footpaths and crossings.
- The additional density proposed for this site, and the site to the north, would greatly increase traffic volumes and service vehicle movements (delivery trucks, garbage trucks, moving vans, etc). Direct access from Anzac Parade or Gardeners Road to this corner site would not be permitted by the RMS - rear lane access is the only option available.
- Housten Lane is a narrow one way laneway potentially serving a large number of commercial and residential properties. Congestion during peak periods is likely to occur, impacting on the viability of businesses and properties, and at the same time undermining the urban design strategy to promote laneway shared zones which are pedestrian 'friendly' and which provide an appropriate setting for Mews type residences.

Floor plan of corner block Anzac Parade and Gardeners Road at 20 storeys

Kingsford Site 5

	CM+/RCC	AJ+C Proposed	AJ+C Actual
Total GFA	10,316 m²	15,474 m²	13,665 m²
Site Area	2,579 m²	2,579 m²	2,579 m²
Maximum FSR	4.0:1	6.0:1	5.3:1
Maximum HOB	9 storeys	20 storeys	20 storeys



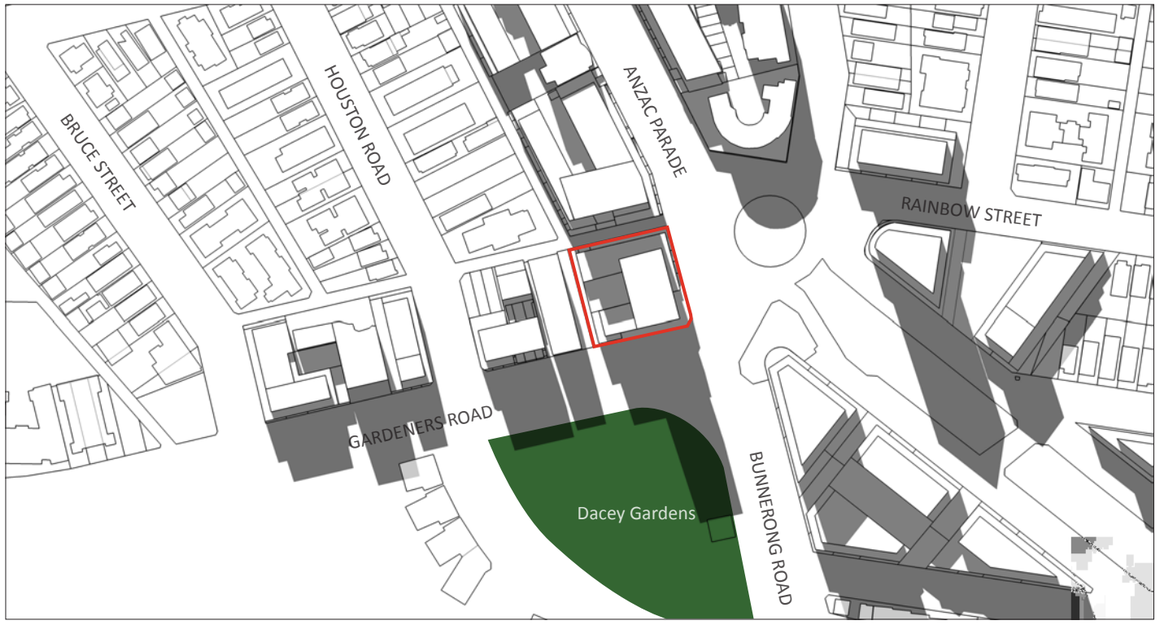
Aerial View, corner block Anzac Parade and Gardeners Road at 20 storeys

Drawing No: SK-301	Date	Issue
• issue for comments	02/02/2018	A
• incorporated councils comments	16/02/2018	B
• incorporated councils comments - Rev02	28/02/2018	C

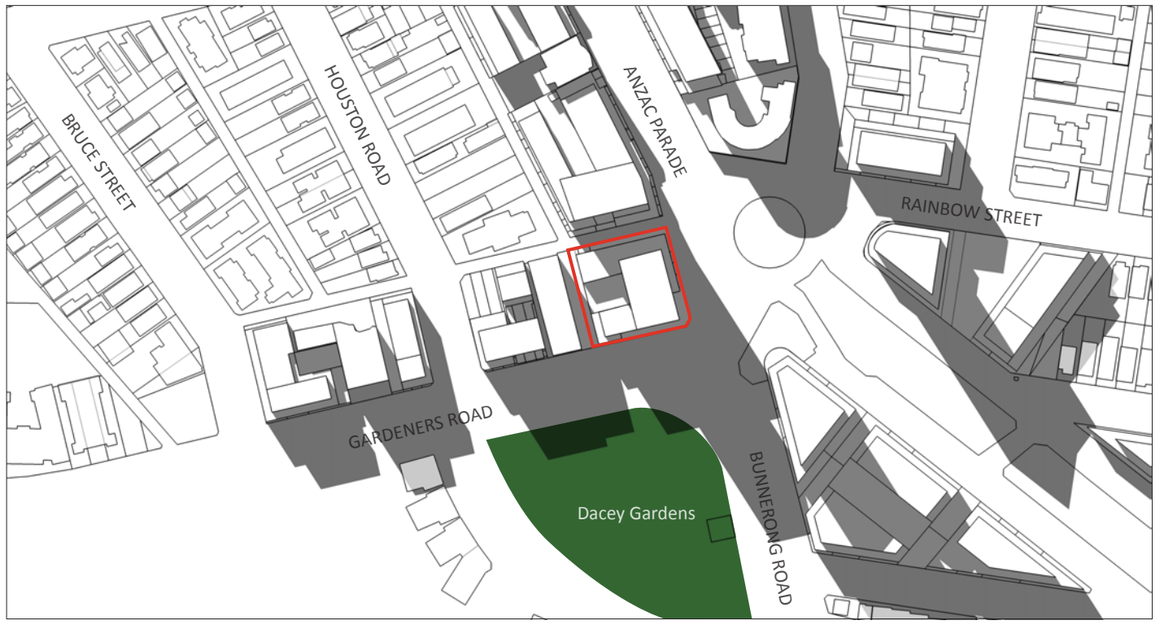
Kingsford Site 5

Mid-winter solstice at 11:00 am

Mid-winter solstice at 12:00

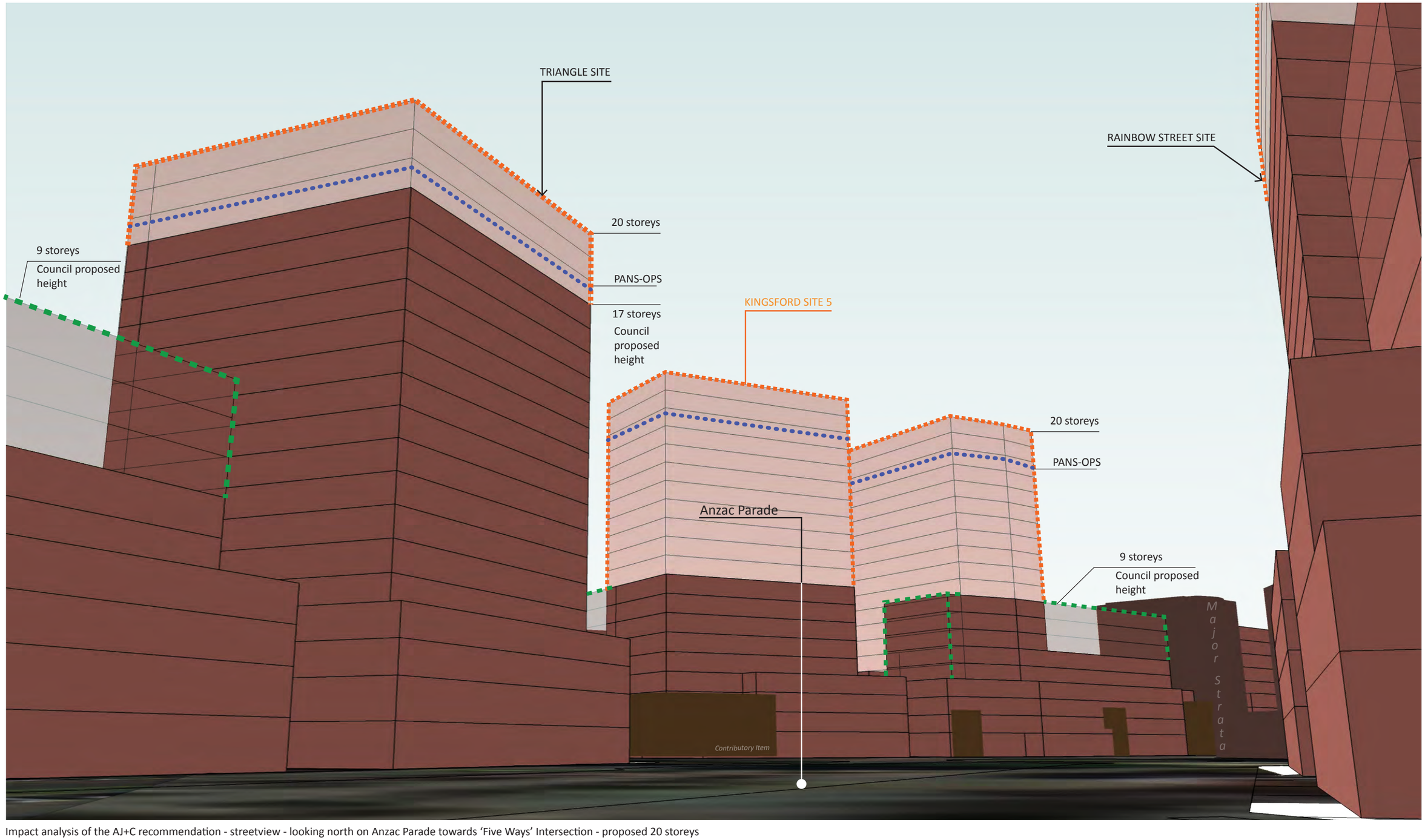


Mid-winter solstice at 13:00



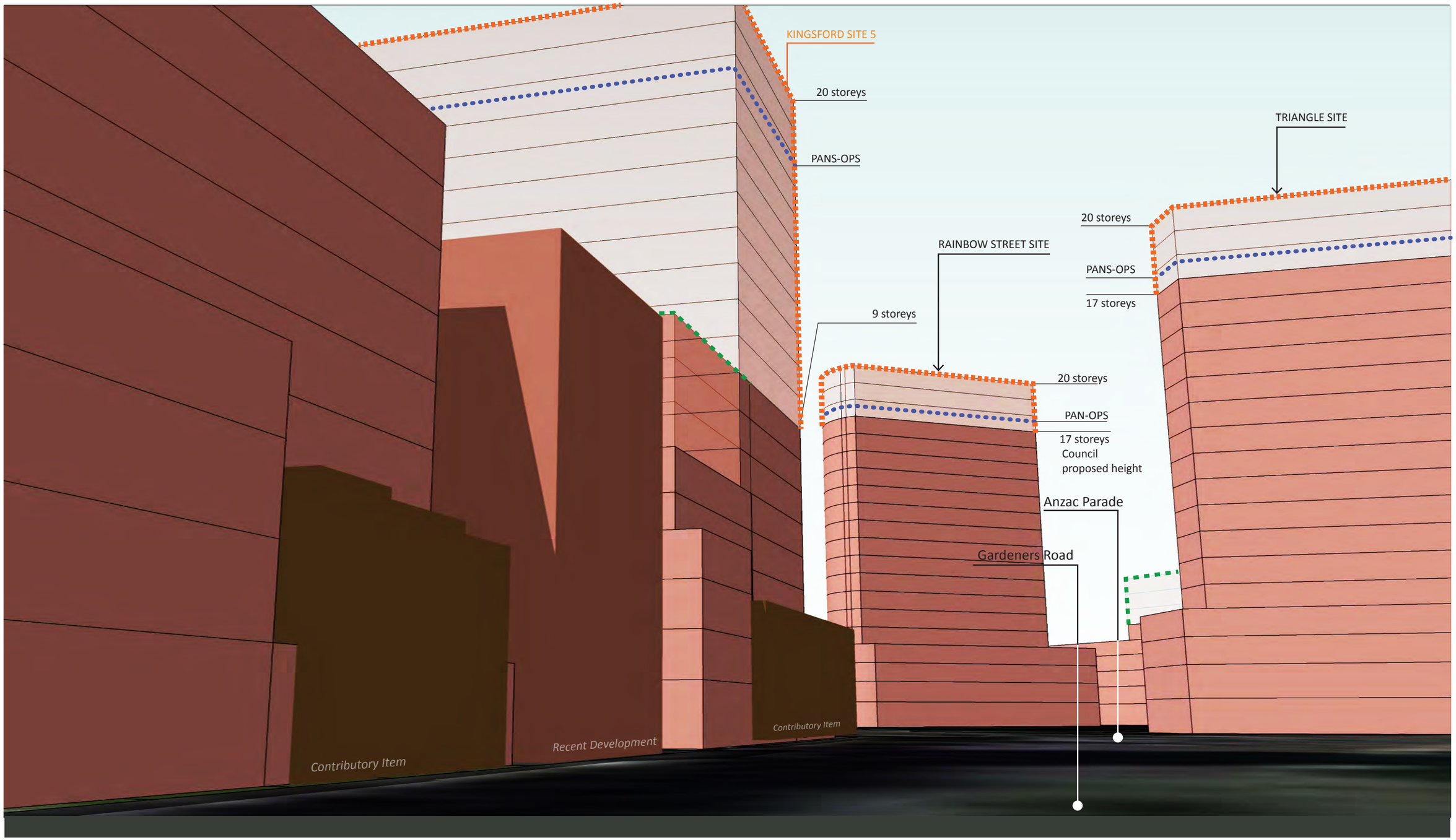
Mid-winter solstice at 14:00

Kingsford Site 5



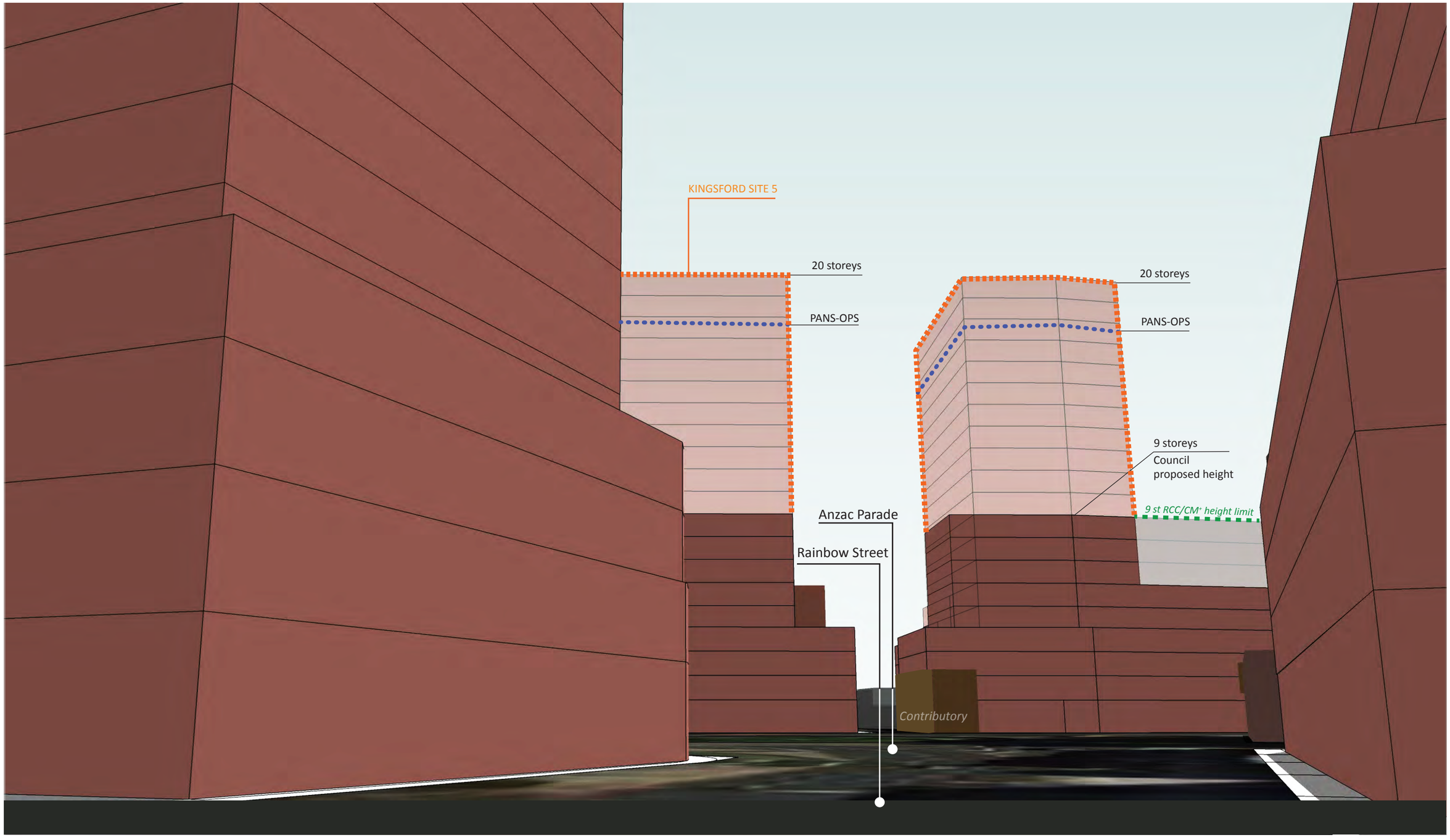
Impact analysis of the AJ+C recommendation - streetview - looking north on Anzac Parade towards 'Five Ways' Intersection - proposed 20 storeys

Kingsford Site 5



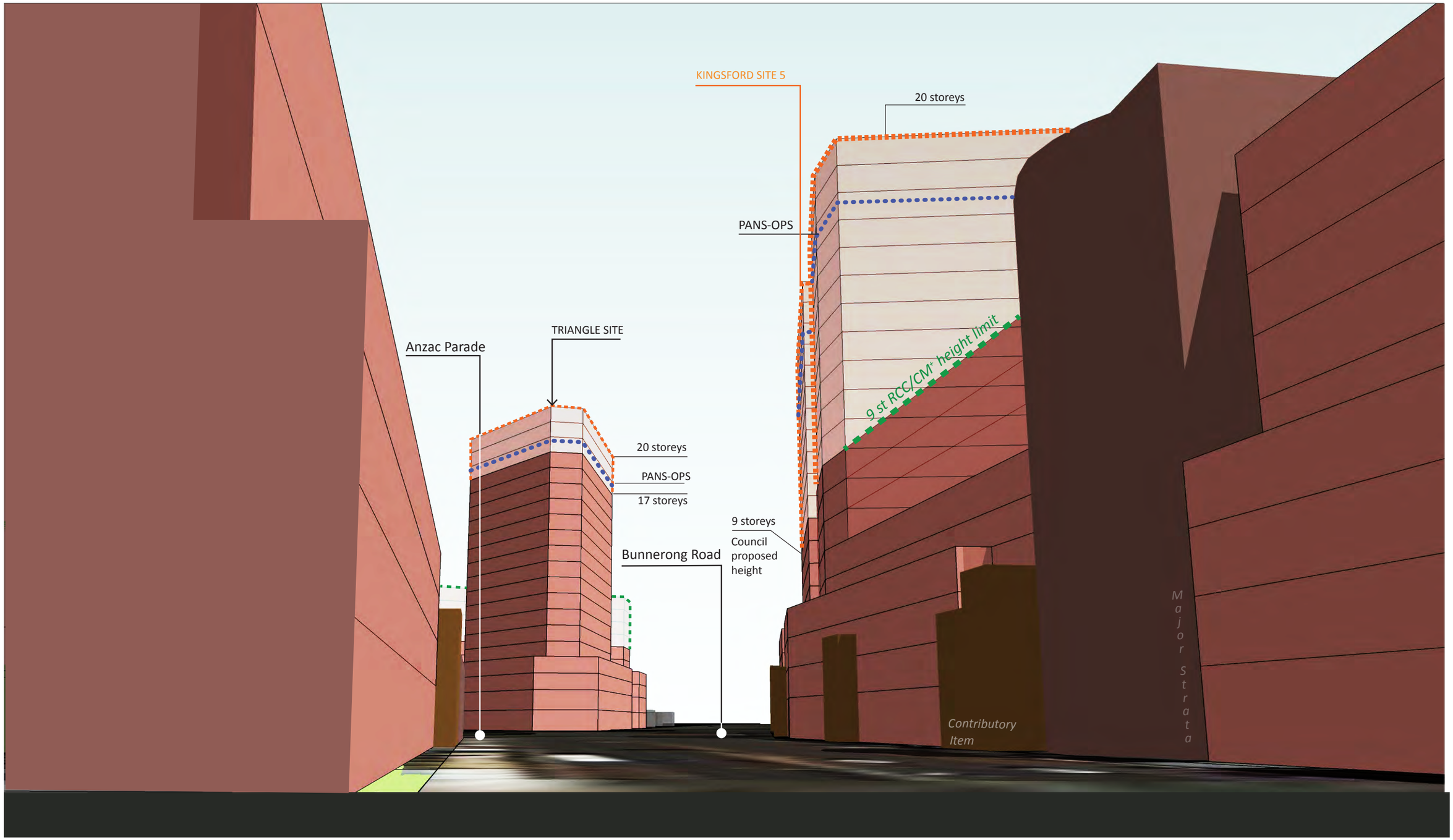
Impact analysis of the AJ+C recommendation - streetview - looking east on Gardeners Road towards Anzac Parade with Dacey Park on the right

Drawing No: SK-304	Date	Issue
• issue for comments	02/02/2018	A
• incorporated councils comments	16/02/2018	B
• incorporated councils comments - Rev02	28/02/2018	C



Impact analysis of the AJ+C recommendation - streetview - looking west on Rainbow Street - from 9 to proposed 20 storeys

Drawing No: SK-305	Date	Issue
• issue for comments	02/02/2018	A
• incorporated councils comments	16/02/2018	B
• incorporated councils comments - Rev02	28/02/2018	C



Impact analysis of the AJ+C recommendation - streetview - looking south on Anzac Parade to the proposed 20 storey buildings

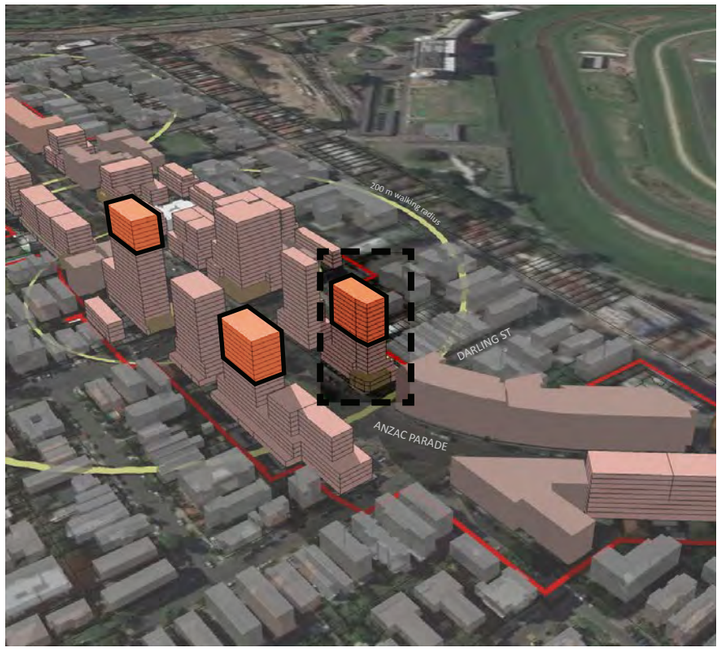
CM+ Conclusion

Conybeare Morrison (CM+) has completed an analysis of the AJ+C *Review For DP&E of the Randwick K2K Planning Strategy* (May 2017, Rev B FINAL), and we conclude that the Recommendations by AJ+C for additional tower buildings, additional building height and bulk, and for additional density (FSR) in the Kensington and Kingsford Town Centres are inappropriate due to the significant negative impacts which would result. In summary the AJ+C proposals would impact the:

- Heritage values of listed heritage buildings.
- Integrity of Contributory Buildings.
- Amenity of existing apartment residents.
- Human scale of the public domain.
- K+K town centres built form - the potential for a ‘wall of tall buildings’ to result.
- Tower proportion, resulting in large mass and bulk.
- Anzac Parade and side streets with overshadowing.
- Listed Heritage Landscape Item and Conservation Area - Dacey Gardens, with significant overshadowing.
- Sydney Airport flight paths (PANS-OPS).
- Viability of laneway shared zones and residential mews residences, due to increased traffic volumes and service vehicle movements.

Given the significant negative impacts which would result from these proposals, we strongly recommend that the proposed planning controls described in the original K2K Planning Strategy prepared and endorsed by Randwick City Council should not be modified and therefore should be supported for the purposes of public exhibition.

Kensington Site 2



Kingsford Site 4

Kingsford Site 5

Drawing No: SK-400	Date	Issue
• issue for comments	02/02/2018	A
• incorporated councils comments	16/02/2018	B
• incorporated councils comments - Rev02	28/02/2018	C

Anzac Parade corridor future Light Rail system capacity analysis

Addendum Report

Prepared for Randwick City Council | 2 March 2018

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Anzac Parade corridor future Light Rail system capacity analysis

Final

Report J180029RP1 | Prepared for Randwick City Council | 2 March 2018

Prepared by	**Tim Brooker**	Approved by	**Allan Young**
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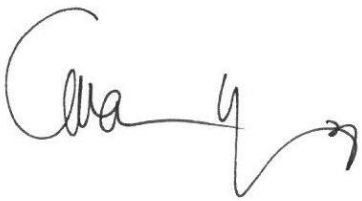
Signature		Signature	
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Version	Date	Prepared by	Reviewed by
V1	20 February 2018	Tim Brooker	Allan Young
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1 Introduction

This addendum report has been prepared by EMM Consulting Pty Limited (EMM) for Randwick City Council to review the capacity requirements for the future public transport commuter services in the Anzac Parade corridor.

This report is an addendum intended to be read in conjunction with the original report dated 20 January 2017. This review is in response to DPE's condition that a minimum of 600 additional dwellings be considered in Council's proposed amendment to the Randwick LEP 2012 (RLEP 2012) for the Kingsford and Kensington town centres. These 600 dwellings would be in addition to the 15,150 dwellings currently proposed by Council to be developed by 2031 within the Randwick local government area (LGA). Over this fifteen year future period, it will be important to maintain reasonable future peak hour passenger crowding levels for Anzac Parade public transport services to ensure that the Randwick LGA dwelling growth projections are achievable with minimum levels of car usage for future urban developments.

A base scenario and two future development scenarios are considered in this report:

- Scenario 1 – the base scenario for 2016, which has been updated from the 2011 Census Journey to Work Explorer data (Bureau of Transport Statistics). 2016 is used as this is consistent with the base for the population and employment projections used by Council.

- Scenario 2 – the 2016 base scenario plus the existing proposal by Council for the development of approximately 4,900 new dwellings within the Kensington to Kingsford (K2K) Anzac Parade corridor by 2031, as per the previous report. These would be part of the 15,150 new dwellings proposed for development within the Randwick LGA as a whole by 2031.

- Scenario 3 – the 2016 base scenario and existing proposal by Council plus an additional 600 dwellings required by DPE, coming to a total of 5,500 new dwellings within the K2K Anzac Parade corridor by 2031. These would be part of 15,750 new dwellings proposed for development within the Randwick LGA as a whole by 2031. This scenario is considered in addition to those in the previous report.

The future Light Rail capacity analysis in Chapter 2 calculates the future Light Rail passenger demand for the city-bound and out-bound directions through the Kingsford and Kensington town centre stops for scenarios 2 and 3. Further, the analysis calculates what continuing bus services will need to be retained travelling to and from the City via the Anzac Parade and Todman Avenue routes for either development scenario 2 or 3 to be achieved.

This addendum report also revises the public transport mode share assumptions in line with the ARUP Transport Assessment (28 November 2016) and Stage 2 Transport Modelling Report (18 May 2017). The higher public transport mode share during the peak hour recognises the transport-oriented nature of the new development, new residents attracted to the area by the light rail and the perceived reliability of the light rail as opposed to buses.

2 Future proposed change

2.1 Existing transport network

Detailed analysis of the existing transport network has been undertaken in the original report.

2.2 Dwelling growth projections

The historic dwellings growth distribution for the Randwick LGA is has now been superseded by a future growth forecast for the LGA for the 15 years from 2016 to 2031.

As outlined in Chapter 1, this report considers two future dwellings growth scenarios as shown below:

- Scenario 2 – a forecast of +15,150 dwellings within the LGA over the fifteen year period between 2016 and 2031 distributed between three generic areas: town centre zones, major sites/urban renewal areas and other 'infill' areas. The new dwellings would be split approximately 40%/30%/30% respectively between these areas:
  - 6,060 new dwellings in town centres including 4,900 in the K2K areas;
  - 4,545 new dwellings in major sites and/or identified urban renewal areas, and
  - 4,545 new dwellings built as infill developments within existing residential precincts.

- Scenario 3 – a forecast of +15,750 dwellings within the LGA over the same period, involving an additional 600 dwellings in the K2K areas:
  - 6,660 new dwellings in town centres including 5,500 in the K2K areas;
  - 4,545 new dwellings in major sites and/or identified urban renewal areas, and
  - 4,545 new dwellings built as infill developments within existing residential precincts.

The majority of the proposed 4,900 (scenario 2) or 5,500 (scenario 3) new K2K dwellings would be constructed within the Kingsford terminus and Kensington Light Rail stop catchments. The rest of the dwellings would be located within the catchment of the Strachan Street and Carlton Street stops. For the purposes of this report it is assumed that they would be distributed as below:

- Scenario 2 – approximately 1,800 new dwellings within the Kingsford terminus catchment and approximately 1,400 within the Todman Avenue stop catchment.

- Scenario 3 – the additional 600 dwellings would be split evenly between Kingsford and Kensington. Thus, there would be approximately 2,100 new dwellings within the Kingsford terminus catchment and approximately 1,700 within the Todman Avenue stop catchment.

For the purposes of future analysis of the Light Rail system passenger demand from all areas of the Randwick LGA, the following overall LGA distribution of the future predicted urban growth of between

+15,150 and +15,750 dwellings has been predicted by EMM to occur within the following Light Rail catchment areas:

- 35% of new dwellings within the Kensington and Kingsford (Anzac Parade) Light Rail catchment areas (37% for scenario 3);
- 32% of new dwellings within the Randwick, Clovelly, Coogee, Bundock Street and South Coogee (Randwick High Street) Light Rail catchment areas (31% for scenario 3);
- 24% of new dwellings within the Maroubra and other areas of Anzac Parade (south) Light Rail and bus feeder service catchment areas (23% for scenario 3); and
- 9% of new dwellings within the Matraville and other areas of Bunnerong Road (south) Light Rail and bus feeder service catchment areas (9% for scenario 3).

In addition to the predicted Randwick LGA dwelling growth generating further Light Rail passenger travel demand from the Bunnerong Road (south) catchment areas, there is significant additional passenger demand predicted from new dwellings constructed within the Pagewood, Hillsdale and Eastgardens localities within the adjoining Bayside LGA over the same fifteen year period from 2016 to 2031.

The future growth in the local employment based travel demand within the local employment centres adjacent to the Anzac Parade and Bunnerong Road routes through Randwick and the adjoining Bayside LGA is estimated to increase in line with general population growth at a rate of +1% annually. This increases the future Light Rail corridor peak hour travel demand growth in the counter peak direction (except for the future growth in the UNSW student travel movements which requires separate forecasting, as described in Section 3.1).

2.3 Future corridor travel demand

The total locally based future passenger demand for the Anzac Parade corridor (including the Light Rail and the remaining bus services which are continuing to operate) is summarised in Tables 2.1 and 2.2 for both future scenarios for the city-bound and out-bound directions, for the one hour morning and afternoon peak periods. In this analysis, there has been an increase of 20% assumed in the peak hour public transport travel mode share for the period between 2020 (the opening of the Light Rail) and 2031. As mentioned in Chapter 1, this assumption is supported by the transport-oriented nature of the new development, the new residents that would be attracted to the area by the Light Rail and the perceived reliability of the Light Rail as opposed to buses.

Table 2.1 Summary of scenario 2 Anzac Parade corridor peak hour Light Rail travel demand

Calculation of future corridor travel demand (north of Carlton Street)	AM peak hour city-bound	AM peak hour out-bound	PM peak hour city-bound	PM peak hour out-bound
2011 base year travel demand	3,410	1,071	918	2,923
2011 to 2016 growth adjustment **(Scenario 1)**	237	54	46	194
Total base year 2016 travel demand	**3,647**	**1,125**	**964**	**3,117**
+4,040 LGA dwellings growth from 2016	418	44	38	358
Total future year 2020 travel demand	**4,065**	**1,169**	**1002**	**3,475**
+15,150 LGA dwellings growth from 2016	1,722	182	156	1,476
Total future year 2031 travel demand	**5,787**	**1,351**	**1158**	**4,951**

Table 2.2 Summary of scenario 3 Anzac Parade corridor peak hour Light Rail travel demand

Calculation of future corridor travel demand (north of Carlton Street)	AM peak hour city-bound	AM peak hour out-bound	PM peak hour city-bound	PM peak hour out-bound
2011 base year travel demand	3,410	1,071	918	2,923
2011 to 2016 growth adjustment **(Scenario 1)**	237	54	46	194
Total base year 2016 travel demand	**3,647**	**1,125**	**964**	**3,117**
+4,200 LGA dwellings growth from 2016	443	44	38	380
Total future year 2020 travel demand	**4,090**	**1,169**	**1,002**	**3,497**
+15,750 LGA dwellings growth from 2016	1,806	182	156	1,548
Total future year 2031 travel demand	**5,896**	**1,351**	**1,158**	**5,045**

2.4 Future corridor requirements for bus and Light Rail services

The interim corridor analysis below in Tables 2.3 and 2.4, which is based on both year 2020 urban development scenarios for the first full year of operation of the Light Rail system, assumes the Light Rail system is operating at the TfNSW proposed initial frequency for the Anzac Parade route which is one tram every eight minutes (7.5 trams per hour) in each direction. This provides interim peak hour passenger capacity for the Light Rail system of 3,495 passengers per hour in each direction, based on 466 persons per tram.

The longer term analysis in Tables 2.3 and 2.4 is based on both year 2031 urban development scenarios for the corridor which assumes the future Light Rail system is operating at the TfNSW proposed maximum frequency for the Anzac Parade route with one tram every 6.5 minutes (9.23 trams per hour) in each direction. This would provide a future maximum peak hour capacity for the Light Rail system of 4,300 passengers per hour in each direction, based on the proposed design capacity of 466 persons per tram.

The future predicted year 2020 and year 2031 travel demand for the Light Rail system below shows that in both the interim and year 2031 situations, for both scenario 2 and 3, the overall future corridor travel demand will significantly exceed the respective capacity of the Light Rail system, such that a significant proportion of the existing corridor bus services would need to be retained, operating in addition to the Light Rail services.

The combined capacity for the future Anzac Parade corridor public transport system linking the K2K area to the Sydney CBD will depend on the proportion of the existing peak hour bus services (primarily express buses) which are to be retained.

In this regard, it will be desirable to maintain the current attractiveness of the K2K area public transport system by avoiding any major increase in the morning peak crowding levels. The adjusted base year corridor travel demand analysis for 2016, in Table 2.1, shows the existing corridor bus services carry 3,647 city-bound passengers per hour during the morning peak hour, which corresponds to an average one hour morning peak period crowding level of 76% for the combined 2016 total (Anzac Parade + Todman Avenue) bus capacity of 4,800 persons with 80 city-bound buses over a one hour period.

To avoid a significant deterioration in the future peak hour public transport 'level of service' for the Anzac Parade corridor (as measured by peak hour passenger crowding levels), it is recommended that the future average morning peak hour passenger crowding level for the route, north of Carlton Street, should not exceed 80%.

Considering scenario 2, for comparison purposes, with the interim (year 2020) and the longer term (year 2031) corridor public transport system operations, the required future number of bus services operating in addition to the Light Rail system are shown in Table 2.3, for a range of future one hour average morning peak period passenger crowding levels, either 80%, 90% or 100%.

Table 2.3 Future combined corridor operating capacity with bus and light rail services for scenario 2

Future system operations	Future one hour peak average crowding level	Required corridor hourly capacity	Light Rail system capacity	Residual bus system capacity	Number of buses per hour
Interim	80%	5,081	3,495	1,586	27
operations	90%	4,517	3,495	1,022	17
(year 2020)	100%	4,065	3,495	570	10
Long term	80%	7,234	4,300	2,934	49
operations	90%	6,430	4,300	2,130	36
(year 2031)	100%	5,787	4,300	1,487	25

The results of the corridor capacity and crowding 'level of service' calculations in Table 2.3 show that for the first year of the Light Rail system operations in 2020, with the proposed (scenario 2) Randwick LGA dwellings growth of +4,040 dwellings over the four year period from 2016 to 2020, approximately 27 of the existing 80 morning peak hour peak direction bus services will need to be maintained to provide the recommended maximum level of service (measured as an 80% one hour peak period average crowding level).

This would generally maintain the existing levels of passenger comfort for local commuters which were provided by the adjusted base year (2016) morning peak hour city-bound bus services where 80 buses per hour operated via the Anzac Parade and Todman Avenue routes to the Sydney CBD.

For the scenario 2 longer term Randwick LGA projected dwellings growth of +15,150 dwellings over a fifteen year period to 2031, well over half of the existing morning peak hour peak direction bus services (49 hourly bus services compared to 80 currently) will need to be maintained travelling through to the Sydney CBD.

This will also effectively maintain an equivalent level of passenger service and comfort in 2031 (measured in terms of the one hour morning peak period average crowding levels) to that which has historically been provided by current (year 2016) morning peak hour city-bound bus services travelling via the Anzac Parade and Todman Avenue routes.

Considering scenario 3 with the interim (year 2020) and the longer term (year 2031) corridor public transport system operations, the required future number of bus services operating in addition to the Light Rail system are shown in Table 2.4, for a range of future one hour average morning peak period passenger crowding levels, either 80%, 90% or 100%.

Table 2.4 Future combined corridor operating capacity with bus and light rail services for scenario 3

Future system operations	Future one hour peak average crowding level	Required corridor hourly capacity	Light Rail system capacity	Residual bus system capacity	Number of buses per hour
Interim	80%	5,113	3,495	1,618	27
operations	90%	4,544	3,495	1,049	18
(year 2020)	100%	4,090	3,495	595	10
Long term	80%	7,370	4,300	3,070	52
operations	90%	6,551	4,300	2,251	38
(year 2031)	100%	5,896	4,300	1,596	27

The results of the corridor capacity and crowding 'level of service' calculations in Table 2.4 show that for the first year of the Light Rail system operations in 2020, with the scenario 3 Randwick LGA dwellings growth of +4,200 dwellings over the four year period from 2016 to 2020, approximately 27 of the existing 80 morning peak hour peak direction bus services will need to be maintained to provide the recommended maximum level of service (measured as an 80% one hour peak period average crowding level).

This would generally maintain the existing levels of passenger comfort for local commuters which were provided by the adjusted base year (2016) morning peak hour city-bound bus services where 80 buses per hour operated via the Anzac Parade and Todman Avenue routes to the Sydney CBD.

For the scenario 3 longer term Randwick LGA projected dwellings growth of +15,750 dwellings over a fifteen year period to 2031, well over half of the existing morning peak hour peak direction bus services (52 hourly bus services compared to 80 currently) will need to be maintained travelling through to the Sydney CBD.

This will also effectively maintain an equivalent level of passenger service and comfort in 2031 (measured in terms of the one hour morning peak period average crowding levels) to that which has historically been provided by current (year 2016) morning peak hour city-bound bus services travelling via the Anzac Parade and Todman Avenue routes.

2.5 Future potential increase in tram service frequency

TfNSW has indicated in their submission to DPE that the tram frequency could increase in the future to a combined route (Anzac Parade and Alison Road) frequency of 20 trams per hour (10 trams per hour for each route). A total of 10 trams per hour along the Anzac Parade corridor would potentially increase the maximum tram capacity (licensed limit) to 4,660 passengers per hour. This would have an effective limit of 3728 based on a maximum of 80% crowding. However, this potential increase is not formally included in the project EIS and modification, and represents only a marginal improvement on the currently considered 9.23 trams per hour.

3 Additional factors considered

3.1 Effect of University of NSW student travel demand

Analysis of the effect of UNSW student travel has been considered in the original report.

The additional UNSW student travel movements, outlined in the original report, are potentially significant in terms of the overall corridor passenger crowding levels in the north-bound direction, between Kingsford and the University stop, although the additional student travel demand does not generally affect the morning peak hour corridor movements, north of Carlton Street.

The additional UNSW student travel demand over the Light Rail route north-bound between the Kingsford (Nine Ways) and the UNSW Light Rail stops could significantly increase the future corridor passenger movements and crowding levels (on both buses and Light Rail) during the one hour morning peak travel period. This requires that significant numbers of north-bound buses will still be retained in the Anzac Parade corridor travelling north of Kingsford, as is shown in Table 2.4, where up to 49 buses per hour in the longer term (year 2031) analysis scenario will be required to operate north of Kingsford in addition to the Anzac Parade corridor Light Rail services for scenario 2. Even more significantly, for scenario 3, up to 52 buses per hour in the longer term (year 2031) analysis scenario will be required to operate in addition to the Light Rail.

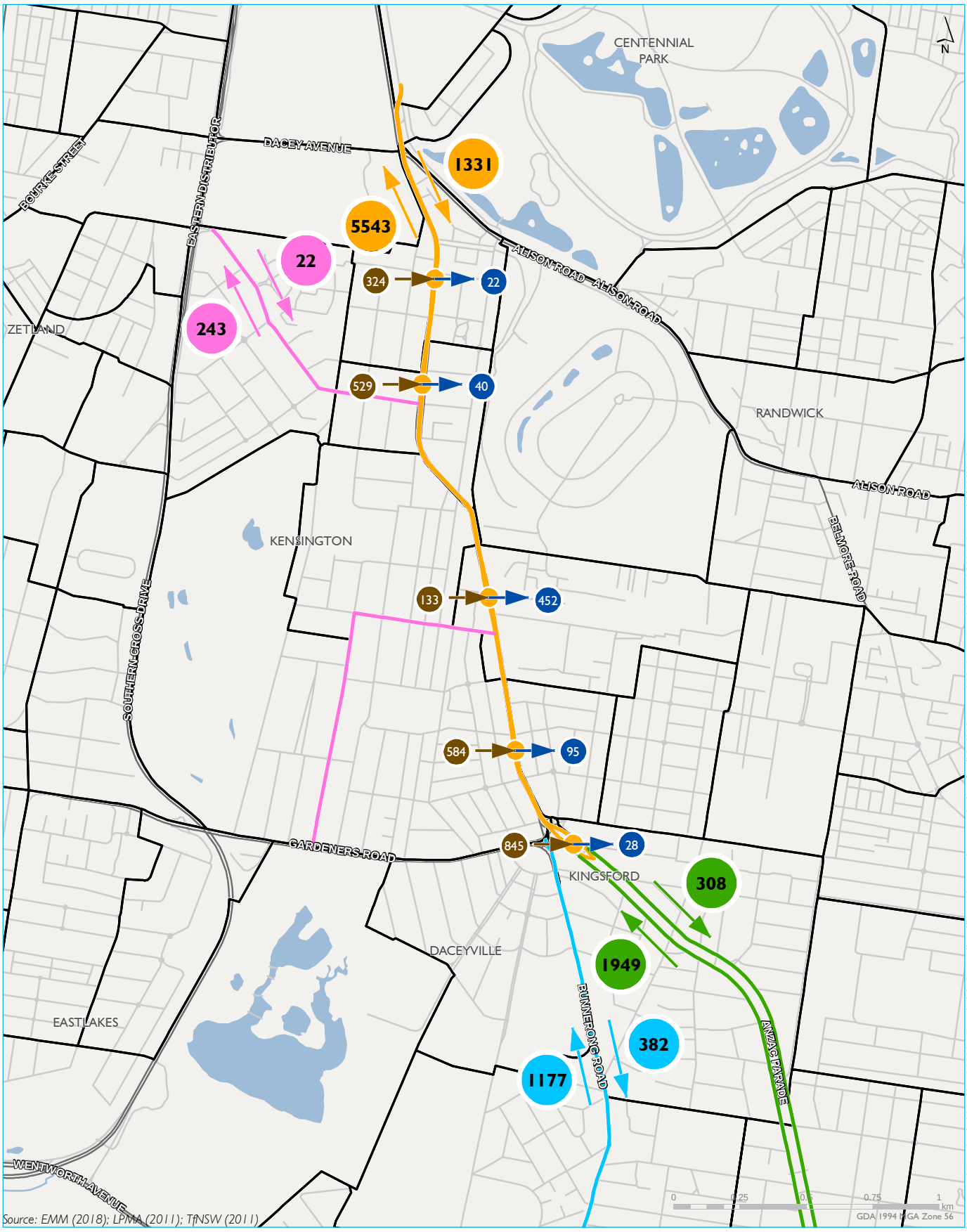
3.2 Capacity for future buses to continue travelling to the Sydney CBD

3.2.1 Peak hourly express bus services

It is understood from the December 2013 CSELR EIS and subsequent announcements that the NSW government is effectively committed to retaining existing express bus services from the Randwick area, in both the Alison Road and the Anzac Parade 'corridors' travelling through to the Sydney CBD.

In this context, it should be noted that the number of north-bound peak hourly express bus services travelling via the Anzac Parade route through Kingsford and Kensington has actually increased from approximately 15 buses per hour in 2011 to approximately 30 buses per hour in November 2016, based on the bus timetables for bus routes X92/4/6/7/9 and L94, for the one hour period 7.45 to 8.45 am at Carlton Street. (This period corresponds to the actual peak one hour morning arrival time of between 8.00 to 9.00 am for buses arriving at the Sydney CBD).

The City of Sydney Council is generally against buses coming into the Sydney CBD. If these existing express buses are retained, together with approximately eight buses per hour travelling on the route 303 via Todman Avenue to the Sydney CBD, the NSW government can relatively easily maintain up to 38 buses per hour travelling through the Kingsford and Kensington areas to the Sydney CBD in a one hour morning peak period. This would meet the interim (2020) future requirement which is identified by this study (Tables 2.3 and 2.4) for future Anzac Parade bus services to operate in addition to the Light Rail system. However, the retention of 38 buses would again be insufficient in the long term (2031) for both scenario 2 and 3.



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KEY (excludes UNSW student travel)

- Main road
- Local road
- Watercourse
- Waterbodies
- Light rail station
- Passenger alighting (count)
- Passenger boarding (count)
- Proposed light rail (count)
- Eastern - Day - Todman bus route (count)
- Bunnerong Road (count)
- Anzac Parade (count)

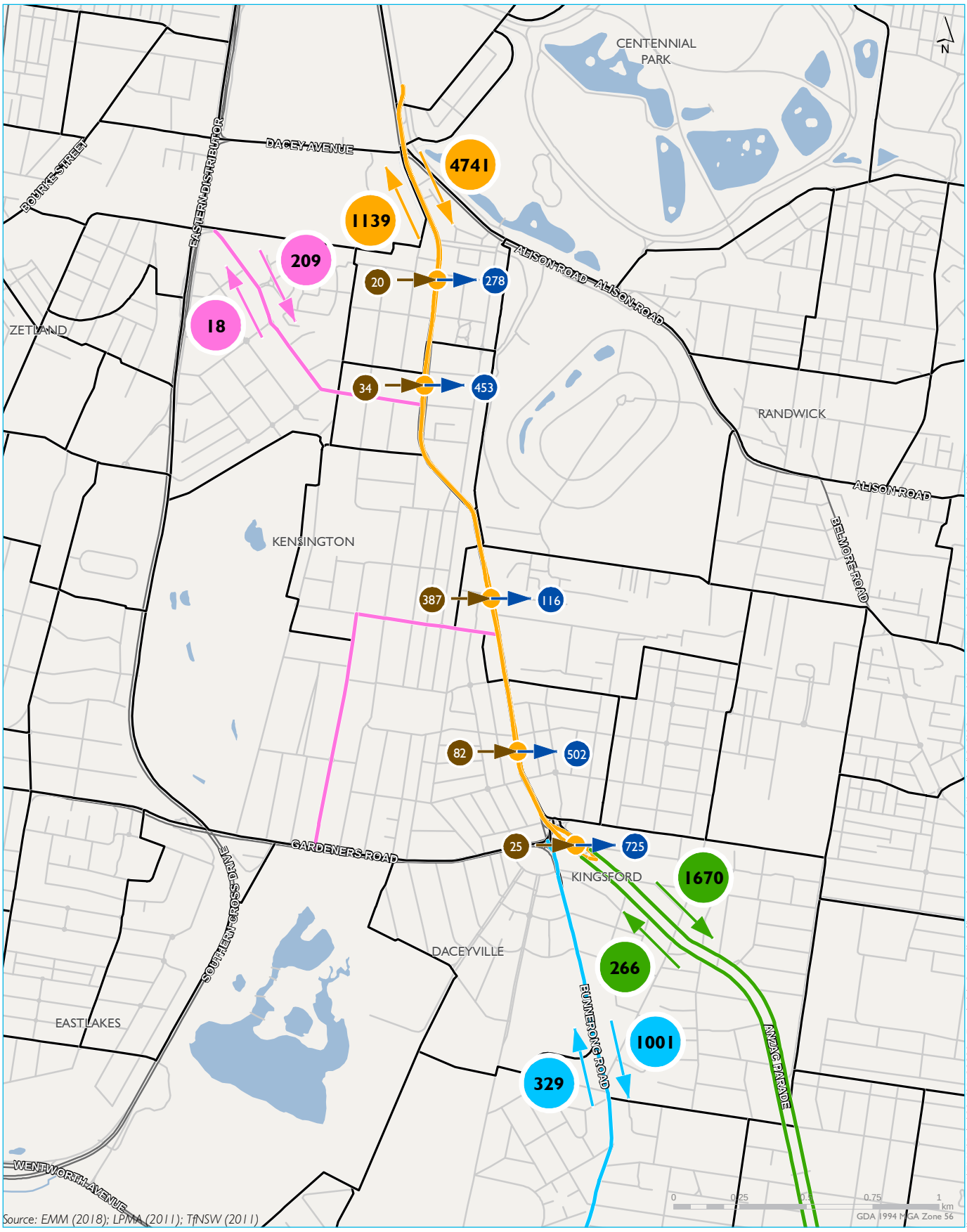
Future (2031) AM peak hour corridor public transport movements

Scenario 2

Randwick Light Rail

Figure 3.1

EMM



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KEY (excludes UNSW student travel)

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- Waterbodies
- Light rail station
- Passenger alighting (count)
- Passenger boarding (count)
- Proposed light rail (count)
- Eastern - Day - Todman bus route (count)
- Bunnerong Road (count)
- Anzac Parade (count)

Future (2031) PM peak hour corridor public transport movements

Scenario 2

Randwick Light Rail

Figure 4.2

EMM

3.3 Comparison with historic crowding levels for Sydney trains and buses

Another potential concern with the future Anzac Parade corridor Light Rail system is that the proposed Light Rail vehicle passenger capacity rates are significantly higher than the previously accepted Sydney public transport benchmark crowding levels for either heavy rail 'double deck train' or bus services.

An analysis of maximum passenger crowding rates has been undertaken in the original report. The proposed 66 m long Randwick Light Rail tram vehicles can have 466 persons/143 m^2 area available to passengers = 3.3 persons per m^2, which is about 25% higher than the average of the previously identified maximum crowding levels (which were defined as crush capacity) for either Sydney trains or buses.

Realistically, the maximum practical crowding level for the proposed 66 m long Randwick trams is probably about 80% of the maximum stated capacity of 466 persons and is about 380 persons per tram. Once an operating trams gets above this level of crowding (which is 2.65 persons per m^2), there is going to be a tendency for passengers to wait on the platform and hope the next tram is less crowded rather than try to force their way on.

This practical occupancy limit is recommended to support a public transport focus for future residential growth in Randwick LGA and encourage higher public transport use in preference to car travel by locally based commuters. It is also generally consistent with the currently observed one hour morning peak period passenger crowding levels, which are between 70% and 80% capacity, for the existing network of bus routes serving the Anzac Parade corridor within the Kensington and Kingsford areas.

Based on the survey of buses which was carried out from 7.45 to 8.45 am on Friday 11 November 2016 (Appendix B), approximately 85% of buses had five or fewer people standing. Moreover, of all the buses surveyed, only 8% of all passengers were standing. This suggests that passengers on the Anzac corridor route are currently unaccustomed to frequent standing on public transport. Trams have a total capacity of 466, with a seated capacity of 108 (only 23% of passengers will get seats on a full tram). There is seating for approximately 80% of passengers on a full bus. Therefore, the likelihood of standing during peak hour on a tram is much greater than on a bus. This may again cause fewer commuters to use the light rail rather than private vehicles or express buses.

4 Summary and conclusions

This addendum report has updated the original report and undertaken an overall review of the future Light Rail system capacity to determine the future ability of the additional public transport capacity along the Anzac Parade route to support future residential growth in the Randwick LGA (including the Kensington and Kingsford town centres and other areas further south towards Maroubra, Matraville and La Perouse). This addendum report increases projected public transport mode share to support Council's vision for reduced car usage and increased active transport and public transport usage in the corridor.

It is a significant concern that the proposed Light Rail system capacity will actually be lower than the capacity of the existing peak hour bus services which are currently using Anzac Parade and Todman Avenue and the future corridor public transport system will effectively be operating at full capacity from the commencement of operations in 2019. For scenario 2 – Council's original proposal of 4,900 new dwellings in the K2K area – this will require a significant number of existing peak hourly bus services (up to 49 buses per hour) to be retained if the system is to provide adequate public transport capacity for all the relevant areas of Randwick LGA in the future. For scenario 3 – DPE's requirement for at least 600 new dwellings in the K2K area in addition to Council's proposal – the necessary retention of peak hourly bus services becomes even greater (up to 52 buses per hour).

It might reasonably be anticipated that the City of Sydney will object to over 40 buses per hour continuing to travel through the Sydney CBD. As an alternative, increasing the capacity of the Light Rail with a higher frequency of services is an option which TfNSW is considering. However, the actual feasibility of this is unknown. Previously the proposed tram frequency was reduced by TfNSW due to concerns that intersections may be significantly affected.

4.1 Scenario 2

The currently proposed dwelling targets (scenario 2) for Randwick LGA and the K2K town centres are achievable, subject to the provision of adequate public transport capacity. A significant proportion of the existing corridor bus based public transport system will need to be retained for reasonable corridor morning peak hour average passenger crowding levels to be maintained, in both the interim year 2020 (first full year of the system operations) and the longer term year 2031.

In 2020, with approximately +4,040 additional dwellings forecast to be constructed in Randwick LGA and the peak hour Light Rail (tram) frequency at eight minutes, the future northbound corridor peak passenger loading (between Kingsford and the University stop) will exceed the Light Rail system capacity by nearly 2,000 passengers per hour. Up to 27 buses per hour will be required travelling north of Kingsford through to the Sydney CBD or other equivalent destinations in order to maintain the current levels of crowding.

In 2031, with +15,150 additional dwellings forecast to be constructed in Randwick LGA and the peak hour Light Rail (tram) frequency at 6.5 minutes, the future northbound corridor peak passenger loading (between Kingsford and the University stop) will exceed the Light Rail system capacity by nearly 3,200 passengers per hour. Up to 49 buses per hour will be required travelling north of Kingsford through to the Sydney CBD or other equivalent destinations in order to maintain the current levels of crowding.

4.2 Scenario 3

In addition to the Council's proposal (scenario 2), DPE has required that at least 600 additional dwellings be developed in the K2K area in the period between 2016 and 2031. In 2020, with approximately +4,200

additional dwellings forecast to be constructed in Randwick LGA and the peak hour Light Rail (tram) frequency at eight minutes, the future northbound corridor peak passenger loading (between Kingsford and the University stop) will exceed the Light Rail system capacity by nearly 2,000 passengers per hour, similar to scenario 2. Again, up to 27 buses per hour will be required travelling north of Kingsford through to the Sydney CBD or other equivalent destinations in order to maintain the current levels of crowding.

In 2031, with +15,750 additional dwellings forecast to be constructed in Randwick LGA and the peak hour Light Rail (tram) frequency at 6.5 minutes, the future northbound corridor peak passenger loading (between Kingsford and the University stop) will exceed the Light Rail system capacity by over 3,300 passengers per hour. Up to 52 buses per hour will be required travelling north of Kingsford through to the Sydney CBD or other equivalent destinations in order to maintain the current levels of crowding.

4.3 Future public transport system peak hour passenger crowding levels

If a significant proportion of existing bus services are not maintained concurrently with the Light Rail system operations, the likely consequence will be that the future peak hour passenger crowding levels on the Anzac Parade public transport system will significantly worsen in comparison to the current levels. This will adversely affect the attractiveness and use of public transport travel for existing users and new residents moving to the area.

This outcome would be inconsistent with the TfNSW objectives for providing an improved public transport system for the Anzac Parade route and the public transport focused travel objectives which underlie the draft Planning Strategy for Kensington and Kingsford town centres.

The predicted future morning peak hour travel demand north-bound within the corridor will be significantly influenced by locally based UNSW student travel movements between the Kingsford and University stops. Although the future overall average north-bound passenger crowding level for the future public transport system can be maintained at approximately 80% for the corridor north of Carlton Street, the localised future passenger crowding level would increase to approximately 90% between the Kingsford and University stops.

In the longer term beyond the year 2031, an extension to the Eastern Suburbs (Bondi Junction) heavy rail line would be required. That extension may be required earlier if a significant proportion of peak hour bus services travelling between the Sydney CBD and the Randwick LGA are not retained. The extension would extend either to Kingsford or Maroubra (or even as a loop via Mascot connecting back to the Illawarra line at Sydenham) to ensure adequate public transport capacity can be provided to all relevant areas of Randwick LGA in the future.

4.4 Future capacity constraint to development from the Light Rail system

Due to future constraints on the public transport system operating in the Anzac Parade corridor, it is recommended that future development for the K2K area of Randwick LGA not be above the +4,900 dwellings which has been proposed by Council.

Appendix A

Existing Randwick LGA bus routes map


For route information in this area, refer to Southern Region Guide.
Common Bus Route Along Dotted Line
Sydney
Railway Square
Lee St
Glebe
Eddy Avenue
Redfern
Redfern Railway Station
Surry Hills
Darlinghurst
Kings Cross
Bayswater Rd
Elizabeth Bay
Edgecliff
Edgecliff Railway Station
Paddington
Woollahra
Double Bay
Bellevue Hill
Bondi Junction
Bondi Junction Interchange
Moore Park
The Entertainment Quarter
Centennial Park
Waterloo
Newtown
Erskineville
Alexandria
St Peters
Marrickville Metro
Sydenham Street
Zetland
Randwick
UNSW High St
Kensington
UNSW Anzac Pde
Queens Park
Clovelly
Waverley
Rosebery
Kingsford
Daceyville
Coogee
South Coogee
North Coogee
Mascot
Eastlakes
Stamford Plaza Hotel
Airport
Botany
Botany Botany Rd
Pagewood
Maroubra Junction
Maroubra
Maroubra Beach
South Maroubra
Hillsdale
Banksmeadow
Banksmeadow Stephen Road
Matraville
Chifley
Malabar
Port Botany
Port Botany Bus Depot
Port Botany Military Rd
Phillip Bay
Little Bay
La Perouse
Eastgardens Westfield
Kingsford Gardeners Rd
Continues on Southern Region Guide
Sydenham & Wolli Creek
Eastern Region Bus Service Inset
Sydenham
Marrickville Rd
Continues on main map
Wolli Creek Railway Station
Marrickville South
Undercliffe
Tempe
Tempe Bus Depot
Princes Hwy
Airport Drive

Appendix B

Existing corridor bus calibration check

Summary of bus passenger calibration check count for Anzac Parade north of Carlton Street from 7.45 to 8.45 am on Friday 11 November 2016

Bus Loading	**Number of buses**	**Persons per bus**	**Total Persons**
Full plus 20 Standing	4	70	280
Full plus 15 Standing	5	65	325
Full plus 12 Standing	1	62	62
Full plus 10 Standing	1	60	60
Full plus 8 Standing	1	58	58
Full plus 5 Standing	13	55	715
Full plus 2 Standing	4	52	208
Full plus 1 Standing	1	51	51
Full to seated capacity	3	50	150
95% seats occupied	0	47	0
90%	4	45	180
85%	8	43	344
80%	7	40	280
75%	1	37	37
70%	1	35	35
65%	1	33	33
60%	4	30	120
55%	3	27	81
50%	2	25	50
45%	2	23	46
40%	3	20	60
35%	4	17	68
30%	2	15	30
25%	2	13	26
Total all observations	**77**		**3,266**

Appendix C

2011 Census Journey to work travel statistics for Randwick LGA

AUSTRALIAN BUREAU OF STATISTICS 2011 Census of Population and Housing
Randwick (C) (LGA16550) 36.3 sq Kms

List of tables
Find out more:
Method of Travel to Work
Sex

B46 METHOD OF TRAVEL TO WORK BY SEX

Count of employed persons aged 15 years and over

	Males	*Females*	*Persons*
One method:			
Train	164	156	320
Bus	5,703	7,259	12,962
Ferry	4	5	9
Tram (includes light rail)	0	5	5
Taxi	157	99	256
Car, as driver	15,799	12,096	27,895
Car, as passenger	938	1,678	2,616
Truck	384	12	396
Motorbike/scooter	630	125	755
Bicycle	963	248	1,211
Other	189	132	321
Walked only	1,721	2,154	3,875
Total one method	*26,652*	*23,969*	*50,621*
Two methods:			
Train and:			
Bus	1,012	966	1,978
Ferry	0	0	0
Tram (includes light rail)	3	3	6
Car, as driver	57	48	105
Car, as passenger	12	41	53
Other	12	3	15
Total	*1,096*	*1,061*	*2,157*
Bus and:			
Ferry	18	9	27
Tram (includes light rail)	14	19	33
Car, as driver	175	206	381
Car, as passenger	59	160	219
Other	104	78	182
Total	*370*	*472*	*842*
Other two methods	152	110	262
Total two methods	*1,618*	*1,643*	*3,261*
Three methods:			
Train and two other methods	106	97	203
Bus and two other methods (excludes train)	43	28	71
Other three methods	16	3	19
Total three methods	*165*	*128*	*293*
Worked at home	1,066	1,428	2,494
Did not go to work	2,074	3,530	5,604
Method of travel to work not stated	372	375	747
Total	**31,947**	**31,073**	**63,020**

This table is based on place of usual residence.

List of tables
Find out more:
Household Composition
Number of Persons Usually Resident

B30 HOUSEHOLD COMPOSITION BY NUMBER OF PERSONS USUALLY RESIDENT(a)

Count of occupied private dwellings(b)

	Family households	*Non-family households(c)*	*Total*
Number of persons usually resident:			
One	..	12,994	12,994
Two	13,104	2,942	16,046
Three	6,958	1,106	8,064
Four	6,602	427	7,029
Five	2,374	146	2,520
Six or more	845	65	910
Total	**29,883**	**17,680**	**47,563**

(a) Includes up to three residents who were temporarily absent on Census Night.
(b) Excludes 'Visitors only' and 'Other non-classifiable' households.
(c) Comprises 'Lone person' and 'Group households'.
.. Not applicable

List of tables
Find out more:
Sex

B01 SELECTED PERSON CHARACTERISTICS BY SEX (1 of 2)

Count of persons

	Males	*Females*	*Persons*
Total persons	63,367	65,622	128,989
Age groups:			
0-4 years	3,965	3,736	7,701
5-14 years	6,051	5,750	11,801
15-19 years	3,571	3,350	6,921
20-24 years	6,710	6,496	13,206
25-34 years	12,066	12,277	24,343
35-44 years	9,805	10,164	19,969
45-54 years	7,791	8,025	15,816
55-64 years	6,007	6,307	12,314
65-74 years	3,918	4,365	8,283
75-84 years	2,525	3,336	5,861
85 years and over	957	1,817	2,774
Counted on Census Night:			
At home	60,920	63,341	124,261
Elsewhere in Australia	2,447	2,282	4,729
Indigenous persons:			
Aboriginal	878	848	1,726
Torres Strait Islander	37	36	73
Both Aboriginal and Torres Strait Islander(a)	28	16	44
Total	*943*	*900*	*1,843*
Birthplace:			
Australia	34,298	35,265	69,563
Elsewhere(b)	24,032	25,613	49,645
Language spoken at home:			
English only	39,107	40,809	79,916
Other language(c)	18,278	20,484	38,762
Australian citizen	45,854	49,705	95,559

This table is based on place of usual residence unless otherwise stated.

(a) Applicable to persons who are of both Aboriginal and Torres Strait Islander origin.

(b) Includes 'Australian External Territories', 'Inadequately described', and 'At sea'.

(c) Includes 'Inadequately described' and 'Non-verbal, so described'.

(d) Comprises 'Pre-school', 'Infants/Primary' (including Government, Catholic, Other Non Government), 'Secondary' (including Government, Catholic, Other Non Government), 'Technical or Further Educational Institution (including TAFE Colleges)', and 'University or other Tertiary Institutions'. Excludes persons who did not state which type of educational institution they were attending.

(e) Applicable to persons aged 15 years and over.

(f) Data are based on place of enumeration.

(g) Includes 'Visitors only' and 'Other non-classifiable' households, 'Non-private dwellings' and 'Migratory, off-shore and shipping' SA1s.

Appendix D

AM and PM peak hour passenger boarding for 2011 and 2016 dwellings scenarios

AM Peak Period Light Rail Journey to work trips from Anzac Parade bus catchment analysis (2011 Census)

Zone	Description	Inbound trips towards CBD			* Corridor and Peak Hour Factor	Per Tram Passenger	Outbound Trips towards Randwick			* Corridor and Peak Hour Factor	Per Tram Passenger
		Total Trips	%Bus	Trips by Bus	0.35	Departures 2011	Total Trips	%Bus	Trips by Bus	0.35	Arrivals 2011
611	Carlton	1619	33	534	215	23	384	11	42	17	2
613	Todman (central)	1222	33	403	162	18	451	11	50	20	2
614 N	Todman (south)	347	27	94	38	4	232	12	28	11	1
614 S	UNSW (west)	347	27	94	38	4	232	12	28	11	1
615	UNSW (main campus)	463	29	134	54	6	6024	14	843	339	37
617	Strachan (west)	1491	28	417	168	18	776	13	101	41	4
618	Strachan (east)	665	33	219	88	10	599	14	84	34	4
420	Kingsford SW Daceyville	293	21	62	25	3	295	2	6	2	0
621	Kingsford SE	1242	26	323	130	14	246	5	12	5	1
620	Kingsford East	898	24	216	87	9	391	9	35	14	2
619	Kingsford NE	1413	33	466	188	20	12	14	2	1	0
612	Todman West 303 Bus	1401	21	294	118	13	494	8	40	16	2
616	Tunstall Street 303 Bus	735	28	206	83	9	16	13	2	1	0
637	Maroubra Anzac W	787	35	275	111	12	1532	14	214	86	9
636	Maroubra Anzac E	1671	35	585	235	26	383	14	54	22	2
638	Maroubra Storey Street	1167	20	233	94	10	346	8	28	11	1
642	Maroubra Fitzgerald NW	1220	29	354	142	15	789	10	79	32	3
643	Maroubra Fitzgerald NE	973	20	195	78	8	195	8	16	6	1
644	Maroubra Beach	1274	25	319	128	14	345	14	48	19	2
645	Heffron	762	24	183	74	8	19	5	1	0	0
646	Fitzgerald SE	762	24	183	74	8	168	5	8	3	0
647	Malabar north	1084	18	195	79	9	274	9	25	10	1
626	Malabar south	713	17	121	49	5	391	7	27	11	1
624 E	Beauchamp E	460	22	101	41	4	72	12	9	3	0
627 E	Franklin E	594	16	95	38	4	101	9	9	4	0
630	Long Bay	29	12	3	1	0	1252	4	50	20	2
631	Bilga Crescent	709	15	106	43	5	89	5	4	2	0
633	Little Bay	809	12	97	39	4	438	6	26	11	1
629 E	Chifley east	930	16	149	60	6	160	7	11	5	0
632 E	Phillip Bay east	500	11	55	22	2	99	10	10	4	0
640	Maroubra west	1758	22	387	156	17	563	10	56	23	2
624 W	Beauchamp W	460	22	101	41	4	72	12	9	3	0
627 W	Franklin W	594	16	95	38	4	101	9	9	4	0
629 W	Chifley west	930	16	149	60	6	160	7	11	5	0
632 W	Phillip Bay west	500	11	55	22	2	99	10	10	4	0
421	Pagewood north	532	16	85	34	4	130	0	0	0	0
423	Eastgardens	0	0	0	0	0	2955	17	502	202	22
424	Hillsdale north	1332	23	306	123	13	818	5	41	16	2
425	Hillsdale south	1448	22	319	128	14	152	5	8	3	0
625	Matraville north	693	18	125	50	5	1263	3	38	15	2
628	Matraville south	982	14	137	55	6	217	5	11	4	0
428	Botany Industrial north	3	0	0	0	0	730	2	15	6	1
429	Botany Industrial south	0	0	0	0	0	1961	3	59	24	3
Total Catchment Trips		35812		8471	3410	369	26026		2660	1071	116
Anzac Parade bus interchange						142					27
Bunnerong Road bus interchange						77					33
Todman route 303 bus trips						22					2
Total Walk Up Trips						129					54

Hourly Movements Northbound	Boardings	Total
Anzac Parade S	1308	
Bunnerong Road	708	2016
Nine Ways	429	2445
Strachan Street	256	2702
University	92	2793
Todman Ave	200	2993
Carlton Street	215	3208
Total Anzac Pde		3208
To CBD via Todman	201	
Total To CBD		3410

Hourly Movements Southbound	Boardings	total
Anzac Parade S	249	
Bunnerong Road	309	559
Nine Ways	22	581
Strachan Street	74	655
University	351	1006
Todman Ave	31	1037
Carlton Street	17	1054
Total Anzac Pde		1054
From CBD via Todma	17	
Total from CBD		1071

Zones in the local walk up catchment

Note * Includes additional 15% bus rail feeder trips. Corridor and Peak Hour Factors are 70% of public transport trips are in the CBD -Randwick Corridor and 50% of these occur in a 1 hour peak period (am peak)

PM Peak Period Light Rail Journey to work trips from Anzac Parade bus catchment analysis (2011 Census)

Zone	Description	Inbound trips towards CBD			* Corridor and Peak Hour Factor	Per Tram Passenger	Outbound Trips towards Randwick			* Corridor and Peak Hour Factor	Per Tram Passenger
		Total Trips	%Bus	Trips by Bus	0.3	Departures 2011	Total Trips	%Bus	Trips by Bus	0.3	Arrivals 2011
611	Carlton	384	11	42	15	2	1619	33	534	184	20
613	Todman (central)	451	11	50	17	2	1222	33	403	139	15
614 N	Todman (south)	232	12	28	10	1	347	27	94	32	4
614 S	UNSW (west)	232	12	28	10	1	347	27	94	32	4
615	UNSW (main campus)	6024	14	843	291	32	463	29	134	46	5
617	Strachan (west)	776	13	101	35	4	1491	28	417	144	16
618	Strachan (east)	599	14	84	29	3	665	33	219	76	8
420	Kingsford SW Daceyville	295	2	6	2	0	293	21	62	21	2
621	Kingsford SE	246	5	12	4	0	1242	26	323	111	12
620	Kingsford East	391	9	35	12	1	898	24	216	74	8
619	Kingsford NE	12	14	2	1	0	1413	33	466	161	17
612	Todman West 303 Bus	494	8	40	14	1	1401	21	294	102	11
616	Tunstall Street 303 Bus	16	13	2	1	0	735	28	206	71	8
637	Maroubra Anzac W	1532	14	214	74	8	787	35	275	95	10
636	Maroubra Anzac E	383	14	54	18	2	1671	35	585	202	22
638	Maroubra Storey Street	346	8	28	10	1	1167	20	233	81	9
642	Maroubra Fitzgerald NW	789	10	79	27	3	1220	29	354	122	13
643	Maroubra Fitzgerald NE	195	8	16	5	1	973	20	195	67	7
644	Maroubra Beach	345	14	48	17	2	1274	25	319	110	12
645	Heffron	19	5	1	0	0	762	24	183	63	7
646	Fitzgerald SE	168	5	8	3	0	762	24	183	63	7
647	Malabar north	274	9	25	9	1	1084	18	195	67	7
626	Malabar south	391	7	27	9	1	713	17	121	42	5
624 E	Beauchamp E	72	12	9	3	0	460	22	101	35	4
627 E	Franklin E	101	9	9	3	0	594	16	95	33	4
630	Long Bay	1252	4	50	17	2	29	12	3	1	0
631	Bilga Crescent	89	5	4	2	0	709	15	106	37	4
633	Little Bay	438	6	26	9	1	809	12	97	33	4
629 E	Chifley east	160	7	11	4	0	930	16	149	51	6
632 E	Phillip Bay east	99	10	10	3	0	500	11	55	19	2
640	Maroubra west	563	10	56	19	2	1758	22	387	133	14
624 W	Beauchamp W	72	12	9	3	0	460	22	101	35	4
627 W	Franklin W	101	9	9	3	0	594	16	95	33	4
629 W	Chifley west	160	7	11	4	0	930	16	149	51	6
632 W	Phillip Bay west	99	10	10	3	0	500	11	55	19	2
421	Pagewood north	130	0	0	0	0	532	16	85	29	3
423	Eastgardens	2955	17	502	173	19	0	0	0	0	0
424	Hillsdale north	818	5	41	14	2	1332	23	306	106	11
425	Hillsdale south	152	5	8	3	0	1448	22	319	110	12
625	Matraville north	1263	3	38	13	1	693	18	125	43	5
628	Matraville south	217	5	11	4	0	982	14	137	47	5
428	Botany Industrial north	730	2	15	5	1	3	0	0	0	0
429	Botany Industrial south	1961	3	59	20	2	0	0	0	0	0
Total Catchment Trips		26026		2660	918	99	35812		8471	2923	317
Anzac Parade bus interchange						23					121
Bunnerong Road bus interchange						29					66
Todman route 303 bus trips						2					19
Total Walk Up Trips						46					111

Hourly Movements Northbound	Boardings	Total
Anzac Parade S	214	
Bunnerong Road	265	479
Nine Ways	19	498
Strachan Street	64	562
University	301	862
Todman Ave	27	889
Carlton Street	15	903
Total Anzac Pde		903
To CBD via Todman	14	
Total To CBD		918

Hourly Movements Southbound	Boardings total	
Anzac Parade S	1121	
Bunnerong Road	607	1728
Nine Ways	368	2096
Strachan Street	220	2316
University	79	2394
Todman Ave	171	2566
Carlton Street	184	2750
Total Anzac Pde		2750
From CBD via Todma	173	
Total from CBD		2923

Note * Includes additional 15% bus rail feeder trips. Corridor and Peak Hour Factors are 70% of public transport trips are in the CBD -Randwick Corridor and 50% of these occur in a 1 hour peak period (am peak)

AM Peak Period Light Rail Journey to work trips (2011 to 2016 growth increment)

Zone	Description	Inbound trips towards CBD			* Corridor and Peak Hour Factor	Per Tram Passenger	Assume 5% Growth Outbound Trips towards Randwick			* Corridor and Peak Hour Factor	Per Tram Passenger
		Total Trips	%Bus	Trips by Bus	0.35	Departures 2011	Total Trips	%Bus	Trips by Bus	0.35	Arrivals 2011
611	Carlton	115	33	38	15	2	19	11	2	1	0
613	Todman (central)	115	33	38	15	2	23	11	2	1	0
614 N	Todman (south)	115	27	31	12	1	12	12	1	1	0
614 S	UNSW (west)	115	27	31	12	1	12	12	1	1	0
615	UNSW (main campus)			0	0	0	301	14	42	17	2
617	Strachan (west)	38	28	11	4	0	39	13	5	2	0
618	Strachan (east)	38	33	13	5	1	30	14	4	2	0
420	Kingsford SW Daceyville	38	21	8	3	0	15	2	0	0	0
621	Kingsford SE	38	26	10	4	0	12	5	1	0	0
620	Kingsford East	38	24	9	4	0	20	9	2	1	0
619	Kingsford NE	38	33	13	5	1	1	14	0	0	0
612	Todman West 303 Bus			0	0	0	25	8	2	1	0
616	Tunstall Street 303 Bus			0	0	0	1	13	0	0	0
637	Maroubra Anzac W	143	35	50	20	2	77	14	11	4	0
636	Maroubra Anzac E	143	35	50	20	2	19	14	3	1	0
638	Maroubra Storey Street	143	20	29	12	1	17	8	1	1	0
642	Maroubra Fitzgerald NW	143	29	41	17	2	39	10	4	2	0
643	Maroubra Fitzgerald NE	143	20	29	12	1	10	8	1	0	0
644	Maroubra Beach	143	25	36	14	2	17	14	2	1	0
645	Heffron			0	0	0	1	5	0	0	0
646	Fitzgerald SE			0	0	0	8	5	0	0	0
647	Malabar north			0	0	0	14	9	1	0	0
626	Malabar south	20	17	3	1	0	20	7	1	1	0
624 E	Beauchamp E			0	0	0	4	12	0	0	0
627 E	Franklin E			0	0	0	5	9	0	0	0
630	Long Bay			0	0	0	63	4	3	1	0
631	Bilga Crescent			0	0	0	4	5	0	0	0
633	Little Bay	666	12	80	32	3	22	6	1	1	0
629 E	Chifley east	14	16	2	1	0	8	7	1	0	0
632 E	Phillip Bay east	9	11	1	0	0	5	10	0	0	0
640	Maroubra west			0	0	0	28	10	3	1	0
624 W	Beauchamp W			0	0	0	4	12	0	0	0
627 W	Franklin W			0	0	0	5	9	0	0	0
629 W	Chifley west	14	16	2	1	0	8	7	1	0	0
632 W	Phillip Bay west	3	11	0	0	0	5	10	0	0	0
421	Pagewood north			0	0	0	7	0	0	0	0
423	Eastgardens			0	0	0	148	17	25	10	1
424	Hillsdale north	125	23	29	12	1	41	5	2	1	0
425	Hillsdale south			0	0	0	8	5	0	0	0
625	Matraville north	115	18	21	8	1	63	3	2	1	0
628	Matraville south	115	14	16	6	1	11	5	1	0	0
428	Botany Industrial north			0	0	0	37	2	1	0	0
429	Botany Industrial south			0	0	0	98	3	3	1	0
Total Catchment Trips		2627		590	237	26	1301		133	54	6
Anzac Parade bus interchange						14					1
Bunnerong Road bus interchange						3					2
Todman route 303 bus trips						0					0
Total Walk Up Trips						9					3

Hourly Movements Northbound	Boardings	Total
Anzac Parade S	129	
Bunnerong Road	27	157
Nine Ways	16	173
Strachan Street	9	182
University	12	194
Todman Ave	28	222
Carlton Street	15	237
Total Anzac Pde		237
To CBD via Todmar	0	
Total To CBD		237

Hourly Movements Southbound	Boardings total	
Anzac Parade S	12	
Bunnerong Road	15	28
Nine Ways	1	29
Strachan Street	4	33
University	18	50
Todman Ave	2	52
Carlton Street	1	53
Total Anzac Pde		53
From CBD via Todr	1	
Total from CBD		54

Zones in the local walk up catchment

Note * Includes additional 15% bus-rail feeder trips. Corridor and Peak Hour Factors are 70% of public transport trips are in the CBD -Randwick Corridor and 50% of these occur in a 1 hour peak period (am peak)

PM Peak Period Light Rail Journey to work trips (2011 to 2016 Growth Increment)

Zone		Description	Inbound trips towards CBD			* Corridor and Peak Hour Factor	Per Tram Passenger	Outbound Trips towards Randwick			* Corridor and Peak Hour Factor	Per Tram Passenger
			Total Trips	%Bus	Trips by Bus	0.3	Departures 2011	Total Trips	%Bus	Trips by Bus	0.3	Arrivals 2011
	611	Carlton	19	11	2	1	0	115	33	38	13	1
	613	Todman (central)	23	11	2	1	0	115	33	38	13	1
614 N		Todman (south)	12	12	1	0	0	115	27	31	11	1
614 S		UNSW (west)	12	12	1	0	0	115	27	31	11	1
	615	UNSW (main campus)	301	14	42	15	2			0	0	0
	617	Strachan (west)	39	13	5	2	0	38	28	11	4	0
	618	Strachan (east)	30	14	4	1	0	38	33	13	4	0
	420	Kingsford SW Daceyville	15	2	0	0	0	38	21	8	3	0
	621	Kingsford SE	12	5	1	0	0	38	26	10	3	0
	620	Kingsford East	20	9	2	1	0	38	24	9	3	0
	619	Kingsford NE	1	14	0	0	0	38	33	13	4	0
	612	Todman West 303 Bus	25	8	2	1	0			0	0	0
	616	Tunstall Street 303 Bus	1	13	0	0	0			0	0	0
	637	Maroubra Anzac W	77	14	11	4	0	143	35	50	17	2
	636	Maroubra Anzac E	19	14	3	1	0	143	35	50	17	2
	638	Maroubra Storey Street	17	8	1	0	0	143	20	29	10	1
	642	Maroubra Fitzgerald NW	39	10	4	1	0	143	29	41	14	2
	643	Maroubra Fitzgerald NE	10	8	1	0	0	143	20	29	10	1
	644	Maroubra Beach	17	14	2	1	0	143	25	36	12	1
	645	Heffron	1	5	0	0	0			0	0	0
	646	Fitzgerald SE	8	5	0	0	0			0	0	0
	647	Malabar north	14	9	1	0	0			0	0	0
	626	Malabar south	20	7	1	0	0	20	17	3	1	0
624 E		Beauchamp E	4	12	0	0	0			0	0	0
627 E		Franklin E	5	9	0	0	0			0	0	0
	630	Long Bay	63	4	3	1	0			0	0	0
	631	Bilga Crescent	4	5	0	0	0			0	0	0
	633	Little Bay	22	6	1	0	0	666	12	80	28	3
629 E		Chifley east	8	7	1	0	0	14	16	2	1	0
632 E		Phillip Bay east	5	10	0	0	0	9	11	1	0	0
	640	Maroubra west	28	10	3	1	0			0	0	0
624 W		Beauchamp W	4	12	0	0	0			0	0	0
627 W		Franklin W	5	9	0	0	0			0	0	0
629 W		Chifley west	8	7	1	0	0	14	16	2	1	0
632 W		Phillip Bay west	5	10	0	0	0	3	11	0	0	0
	421	Pagewood north	7	0	0	0	0			0	0	0
	423	Eastgardens	148	17	25	9	1			0	0	0
	424	Hillsdale north	41	5	2	1	0			0	0	0
	425	Hillsdale south	8	5	0	0	0			0	0	0
	625	Matraville north	63	3	2	1	0	115	18	21	7	1
	628	Matraville south	11	5	1	0	0	115	14	16	6	1
	428	Botany Industrial north	37	2	1	0	0			0	0	0
	429	Botany Industrial south	98	3	3	1	0			0	0	0
Total Catchment Trips			1301		133	46	5	2502		561	194	21
Anzac Parade bus interchange							1					12
Bunnerong Road bus interchange							1					1
Todman route 303 bus trips							0					0
Total Walk Up Trips							2					8

Hourly Movements Northbound	Boardings	Total
Anzac Parade S	11	
Bunnerong Road	13	24
Nine Ways	1	25
Strachan Street	3	28
University	15	43
Todman Ave	1	44
Carlton Street	1	45
Total Anzac Pde		45
To CBD via Todmai	1	
Total To CBD		46

Hourly Movements Southbound	Boardings total	
Anzac Parade S	111	
Bunnerong Road	14	124
Nine Ways	14	138
Strachan Street	8	146
University	11	157
Todman Ave	24	181
Carlton Street	13	194
Total Anzac Pde		194
From CBD via Todr	0	
Total from CBD		194

Note * Includes additional 15% bus-rail feeder trips. Corridor and Peak Hour Factors are 70% of public transport trips are in the CBD -Randwick Corridor and 50% of these occur in a 1 hour peak period (am peak)

Appendix E

AM and PM peak hour passenger boardings for scenario 2

AM Peak Period Light Rail Journey to work trips (Interim +4040 dwellings growth increment)

Zone		Description	Inbound trips towards CBD Total Trips	%Bus	Trips by Bus	* Corridor and Peak Hour Factor 0.35	Per Tram Passenger Departures 2020	Assume 15% Growth Outbound Trips towards Randwick Total Trips	%Bus	Trips by Bus	* Corridor and Peak Hour Factor 0.35	Per Tram Passenger Arrivals 2020
	611	Carlton	117	36	42	17	2	15	12	2	1	0
	613	Todman (central)	206	36	74	30	3	18	12	2	1	0
614 N		Todman (south)	206	30	62	25	3	9	13	1	0	0
614 S		UNSW (west)	45	30	13	5	1	9	13	1	0	0
	615	UNSW (main campus)	0	32	0	0	0	241	15	36	15	2
	617	Strachan (west)	215	31	67	27	3	31	14	4	2	0
	618	Strachan (east)	215	36	78	31	3	24	15	4	1	0
	420	Kingsford SW Daceyville	0	24	0	0	0	12	2	0	0	0
	621	Kingsford SE	197	29	57	23	2	10	6	1	0	0
	620	Kingsford East	197	27	53	21	2	16	10	2	1	0
	619	Kingsford NE	197	36	71	28	3	0	15	0	0	0
	612	Todman West 303 Bus	45	21	9	4	0	20	8	2	1	0
	616	Tunstall Street 303 Bus	45	28	12	5	1	1	13	0	0	0
	637	Maroubra Anzac W	94	35	33	13	1	61	14	9	3	0
	636	Maroubra Anzac E	94	35	33	13	1	15	14	2	1	0
	638	Maroubra Storey Street	45	20	9	4	0	14	8	1	0	0
	642	Maroubra Fitzgerald NW	45	29	13	5	1	32	10	3	1	0
	643	Maroubra Fitzgerald NE	45	20	9	4	0	8	8	1	0	0
	644	Maroubra Beach	45	25	11	4	0	14	14	2	1	0
	645	Heffron	45	24	11	4	0	1	5	0	0	0
	646	Fitzgerald SE	138	24	33	13	1	7	5	0	0	0
	647	Malabar north	138	18	25	10	1	11	9	1	0	0
	626	Malabar south	138	17	23	9	1	16	7	1	0	0
624 E		Beauchamp E	45	22	10	4	0	3	12	0	0	0
627 E		Franklin E	45	16	7	3	0	4	9	0	0	0
	630	Long Bay	0	12	0	0	0	50	4	2	1	0
	631	Bilga Crescent	45	15	7	3	0	4	5	0	0	0
	633	Little Bay	141	12	17	7	1	18	6	1	0	0
629 E		Chifley east	138	16	22	9	1	6	7	0	0	0
632 E		Phillip Bay east	45	11	5	2	0	4	10	0	0	0
	640	Maroubra west	45	22	10	4	0	23	10	2	1	0
624 W		Beauchamp W	45	22	10	4	0	3	12	0	0	0
627 W		Franklin W	45	16	7	3	0	4	9	0	0	0
629 W		Chifley west	138	16	22	9	1	6	7	0	0	0
632 W		Phillip Bay west	45	11	5	2	0	4	10	0	0	0
	421	Pagewood north	0	16	0	0	0	5	0	0	0	0
	423	Eastgardens	727	20	145	59	6	118	17	20	8	1
	424	Hillsdale north	0	23	0	0	0	33	5	2	1	0
	425	Hillsdale south	22	22	5	2	0	6	5	0	0	0
	625	Matraville north	45	18	8	3	0	51	3	2	1	0
	628	Matraville south	139	14	20	8	1	9	5	0	0	0
	428	Botany Industrial north	0	0	0	0	0	29	2	1	0	0
	429	Botany Industrial south	0	0	0	0	0	78	3	2	1	0
Total Catchment Trips			4214		1037	418	45	1041		110	44	5
Anzac Parade bus interchange							12					1
Bunnerong Road bus interchange							10					1
Todman route 303 bus trips							1					0
Total Walk Up Trips							23					2

Hourly Movements Northbound	Boardings	Total
Anzac Parade S	108	
Bunnerong Road	93	201
Nine Ways	73	274
Strachan Street	58	332
University	5	337
Todman Ave	55	392
Carlton Street	17	409
Total Anzac Pde		409
To CBD via Todman	9	
Total To CBD		418

Hourly Movements Southbound	Boardings total	
Anzac Parade S	10	
Bunnerong Road	12	22
Nine Ways	1	23
Strachan Street	3	27
University	15	42
Todman Ave	1	43
Carlton Street	1	44
Total Anzac Pde		44
From CBD via Todm	1	
Total from CBD		44

Zones in the local walk up catchment

Note * Includes +15% additional bus-rail feeder trips. Corridor and Peak Hour Factors are 70% of public transport trips are in the CBD -Randwick Corridor and 50% of these occur in a 1 hour peak period (am peak)

PM Peak Period Light Rail Journey to work trips (Interim +4040 dwellings growth increment)

Zone		Description	Inbound trips towards CBD Total Trips	%Bus	Trips by Bus	* Corridor and Peak Hour Factor 0.3	Per Tram Passenger Departures 2020	Outbound Trips towards Randwick Total Trips	%Bus	Trips by Bus	* Corridor and Peak Hour Factor 0.3	Per Tram Passenger Arrivals 2020
	611	Carlton	15	12	2	1	0	117	36	42	15	2
	613	Todman (central)	18	12	2	1	0	206	36	74	26	3
614 N		Todman (south)	9	13	1	0	0	206	30	62	21	2
614 S		UNSW (west)	9	13	1	0	0	45	30	13	5	0
	615	UNSW (main campus)	241	15	36	12	1	0	32	0	0	0
	617	Strachan (west)	31	14	4	1	0	215	31	67	23	2
	618	Strachan (east)	24	15	4	1	0	215	36	78	27	3
	420	Kingsford SW Daceyville	12	2	0	0	0	0	24	0	0	0
	621	Kingsford SE	10	6	1	0	0	197	29	57	20	2
	620	Kingsford East	16	10	2	1	0	197	27	53	18	2
	619	Kingsford NE	0	15	0	0	0	197	36	71	24	3
	612	Todman West 303 Bus	20	8	2	1	0	45	21	9	3	0
	616	Tunstall Street 303 Bus	1	13	0	0	0	45	28	12	4	0
	637	Maroubra Anzac W	61	14	9	3	0	94	35	33	11	1
	636	Maroubra Anzac E	15	14	2	1	0	94	35	33	11	1
	638	Maroubra Storey Street	14	8	1	0	0	45	20	9	3	0
	642	Maroubra Fitzgerald NW	32	10	3	1	0	45	29	13	4	0
	643	Maroubra Fitzgerald NE	8	8	1	0	0	45	20	9	3	0
	644	Maroubra Beach	14	14	2	1	0	45	25	11	4	0
	645	Heffron	1	5	0	0	0	45	24	11	4	0
	646	Fitzgerald SE	7	5	0	0	0	138	24	33	11	1
	647	Malabar north	11	9	1	0	0	138	18	25	9	1
	626	Malabar south	16	7	1	0	0	138	17	23	8	1
624 E		Beauchamp E	3	12	0	0	0	45	22	10	3	0
627 E		Franklin E	4	9	0	0	0	45	16	7	2	0
	630	Long Bay	50	4	2	1	0	0	12	0	0	0
	631	Bilga Crescent	4	5	0	0	0	45	15	7	2	0
	633	Little Bay	18	6	1	0	0	141	12	17	6	1
629 E		Chifley east	6	7	0	0	0	138	16	22	8	1
632 E		Phillip Bay east	4	10	0	0	0	45	11	5	2	0
	640	Maroubra west	23	10	2	1	0	45	22	10	3	0
624 W		Beauchamp W	3	12	0	0	0	45	22	10	3	0
627 W		Franklin W	4	9	0	0	0	45	16	7	2	0
629 W		Chifley west	6	7	0	0	0	138	16	22	8	1
632 W		Phillip Bay west	4	10	0	0	0	45	11	5	2	0
	421	Pagewood north	5	0	0	0	0	0	16	0	0	0
	423	Eastgardens	118	17	20	7	1	727	20	145	50	5
	424	Hillsdale north	33	5	2	1	0	0	23	0	0	0
	425	Hillsdale south	6	5	0	0	0	22	22	5	2	0
	625	Matraville north	51	3	2	1	0	45	18	8	3	0
	628	Matraville south	9	5	0	0	0	139	14	20	7	1
	428	Botany Industrial north	29	2	1	0	0	0	0	0	0	0
	429	Botany Industrial south	78	3	2	1	0	0	0	0	0	0
Total Catchment Trips			1041		110	38	4	4214		1037	358	39
Anzac Parade bus interchange							1					10
Bunnerong Road bus interchange							1					9
Todman route 303 bus trips							0					1
Total Walk Up Trips							2					19

Hourly Movements Northbound	Boardings	Total
Anzac Parade S	9	
Bunnerong Road	11	19
Nine Ways	1	20
Strachan Street	3	23
University	13	36
Todman Ave	1	37
Carlton Street	1	37
Total Anzac Pde		37
To CBD via Todman	1	
Total To CBD		38
Hourly Movements Southbound	Boardings total	
Anzac Parade S	92	
Bunnerong Road	80	172
Nine Ways	62	235
Strachan Street	50	284
University	5	289
Todman Ave	47	336
Carlton Street	15	350
Total Anzac Pde		350
From CBD via Todm	8	
Total from CBD		358

Note * Includes +15% bus-rail feeder trips. Corridor and Peak Hour Factors are 70% of public transport trips are in the CBD -Randwick Corridor and 50% of these occur in a 1 hour peak period (am peak)

AM Peak Period Light Rail Journey to work trips (Ultimate +15150 dwellings growth increment)

Zone	Description	Inbound trips towards CBD			* Corridor and Peak Hour Factor	Per Tram Passenger Departures 2031	Assume 15% Growth Outbound Trips towards Randwick			* Corridor and Peak Hour Factor	Per Tram Passenger Arrivals 2031
		Total Trips	%Bus	Trips by Bus	0.35		Total Trips	%Bus	Trips by Bus	0.35	
611	Carlton	440	43.2	190	77	8	58	14.4	8	3	0
613	Todman (central)	771	43.2	333	134	15	68	14.4	10	4	0
614 N	Todman (south)	771	36	278	112	12	35	15.6	5	2	0
614 S	UNSW (west)	167	36	60	24	3	35	15.6	5	2	0
615	UNSW (main campus)	0	38.4	0	0	0	904	18	163	65	7
617	Strachan (west)	808	37.2	301	121	13	116	16.8	20	8	1
618	Strachan (east)	808	43.2	349	140	15	90	18	16	7	1
420	Kingsford SW Daceyville	0	28.8	0	0	0	44	2.4	1	0	0
621	Kingsford SE	737	34.8	256	103	11	37	7.2	3	1	0
620	Kingsford East	737	32.4	239	96	10	59	12	7	3	0
619	Kingsford NE	737	43.2	318	128	14	2	18	0	0	0
612	Todman West 303 Bus	167	21	35	14	2	74	8	6	2	0
616	Tunstall Street 303 Bus	167	28	47	19	2	2	13	0	0	0
637	Maroubra Anzac W	354	35	124	50	5	230	14	32	13	1
636	Maroubra Anzac E	354	35	124	50	5	57	14	8	3	0
638	Maroubra Storey Street	167	20	33	13	1	52	8	4	2	0
642	Maroubra Fitzgerald NW	167	29	48	19	2	118	10	12	5	1
643	Maroubra Fitzgerald NE	167	20	33	13	1	29	8	2	1	0
644	Maroubra Beach	167	25	42	17	2	52	14	7	3	0
645	Heffron	167	24	40	16	2	3	5	0	0	0
646	Fitzgerald SE	517	24	124	50	5	25	5	1	1	0
647	Malabar north	517	18	93	37	4	41	9	4	1	0
626	Malabar south	517	17	88	35	4	59	7	4	2	0
624 E	Beauchamp E	167	22	37	15	2	11	12	1	1	0
627 E	Franklin E	167	16	27	11	1	15	9	1	1	0
630	Long Bay	0	12	0	0	0	188	4	8	3	0
631	Bilga Crescent	167	15	25	10	1	13	5	1	0	0
633	Little Bay	530	12	64	26	3	66	6	4	2	0
629 E	Chifley east	517	16	83	33	4	24	7	2	1	0
632 E	Phillip Bay east	167	11	18	7	1	15	10	1	1	0
640	Maroubra west	167	22	37	15	2	84	10	8	3	0
624 W	Beauchamp W	167	22	37	15	2	11	12	1	1	0
627 W	Franklin W	167	16	27	11	1	15	9	1	1	0
629 W	Chifley west	517	16	83	33	4	24	7	2	1	0
632 W	Phillip Bay west	167	11	18	7	1	15	10	1	1	0
421	Pagewood north	0	16	0	0	0	20	0	0	0	0
423	Eastgardens	2726	20	545	219	24	443	17	75	30	3
424	Hillsdale north	0	23	0	0	0	123	5	6	2	0
425	Hillsdale south	84	22	18	7	1	23	5	1	0	0
625	Matraville north	167	18	30	12	1	189	3	6	2	0
628	Matraville south	523	14	73	29	3	33	5	2	1	0
428	Botany Industrial north	0	0	0	0	0	110	2	2	1	0
429	Botany Industrial south	0	0	0	0	0	294	3	9	4	0
Total Catchment Trips		15804		4277	1722	187	3904		453	182	20
Anzac Parade bus interchange						44					4
Bunnerong Road bus interchange						38					5
Todman route 303 bus trips						4					0
Total Walk Up Trips						101					10

Hourly Movements Northbound	Boardings	Total
Anzac Parade S	404	
Bunnerong Road	349	753
Nine Ways	327	1081
Strachan Street	261	1342
University	24	1366
Todman Ave	246	1612
Carlton Street	77	1689
Total Anzac Pde		1689
To CBD via Todman	33	
Total To CBD		1722

Hourly Movements Southbound	Boardings total	
Anzac Parade S	37	
Bunnerong Road	46	84
Nine Ways	4	88
Strachan Street	14	103
University	68	170
Todman Ave	6	176
Carlton Street	3	180
Total Anzac Pde		180
From CBD via Todm	3	
Total from CBD		182

Zones in the local walk up catchment

Note * Includes +15% additional bus-rail feeder trips. Corridor and Peak Hour Factors are 70% of public transport trips are in the CBD -Randwick Corridor and 50% of these occur in a 1 hour peak period (am peak)

PM Peak Period Light Rail Journey to work trips (Ultimate +15150 dwellings growth increment)

Zone		Description	Inbound trips towards CBD			* Corridor and Peak Hour Factor	Per Tram Passenger Departures 2031	Outbound Trips towards Randwick			* Corridor and Peak Hour Factor	Per Tram Passenger Arrivals 2031
			Total Trips	%Bus	Trips by Bus	0.3		Total Trips	%Bus	Trips by Bus	0.3	
	611	Carlton	58	14.4	8	3	0	440	43.2	190	66	7
	613	Todman (central)	68	14.4	10	3	0	771	43.2	333	115	12
614 N		Todman (south)	35	15.6	5	2	0	771	36	278	96	10
614 S		UNSW (west)	35	15.6	5	2	0	167	36	60	21	2
	615	UNSW (main campus)	904	18	163	56	6	0	38.4	0	0	0
	617	Strachan (west)	116	16.8	20	7	1	808	37.2	301	104	11
	618	Strachan (east)	90	18	16	6	1	808	43.2	349	120	13
	420	Kingsford SW Daceyville	44	2.4	1	0	0	0	28.8	0	0	0
	621	Kingsford SE	37	7.2	3	1	0	737	34.8	256	88	10
	620	Kingsford East	59	12	7	2	0	737	32.4	239	82	9
	619	Kingsford NE	2	18	0	0	0	737	43.2	318	110	12
	612	Todman West 303 Bus	74	8	6	2	0	167	21	35	12	1
	616	Tunstall Street 303 Bus	2	13	0	0	0	167	28	47	16	2
	637	Maroubra Anzac W	230	14	32	11	1	354	35	124	43	5
	636	Maroubra Anzac E	57	14	8	3	0	354	35	124	43	5
	638	Maroubra Storey Street	52	8	4	1	0	167	20	33	12	1
	642	Maroubra Fitzgerald NW	118	10	12	4	0	167	29	48	17	2
	643	Maroubra Fitzgerald NE	29	8	2	1	0	167	20	33	12	1
	644	Maroubra Beach	52	14	7	2	0	167	25	42	14	2
	645	Heffron	3	5	0	0	0	167	24	40	14	1
	646	Fitzgerald SE	25	5	1	0	0	517	24	124	43	5
	647	Malabar north	41	9	4	1	0	517	18	93	32	3
	626	Malabar south	59	7	4	1	0	517	17	88	30	3
624 E		Beauchamp E	11	12	1	0	0	167	22	37	13	1
627 E		Franklin E	15	9	1	0	0	167	16	27	9	1
	630	Long Bay	188	4	8	3	0	0	12	0	0	0
	631	Bilga Crescent	13	5	1	0	0	167	15	25	9	1
	633	Little Bay	66	6	4	1	0	530	12	64	22	2
629 E		Chifley east	24	7	2	1	0	517	16	83	29	3
632 E		Phillip Bay east	15	10	1	1	0	167	11	18	6	1
	640	Maroubra west	84	10	8	3	0	167	22	37	13	1
624 W		Beauchamp W	11	12	1	0	0	167	22	37	13	1
627 W		Franklin W	15	9	1	0	0	167	16	27	9	1
629 W		Chifley west	24	7	2	1	0	517	16	83	29	3
632 W		Phillip Bay west	15	10	1	1	0	167	11	18	6	1
	421	Pagewood north	20	0	0	0	0	0	16	0	0	0
	423	Eastgardens	443	17	75	26	3	2726	20	545	188	20
	424	Hillsdale north	123	5	6	2	0	0	23	0	0	0
	425	Hillsdale south	23	5	1	0	0	84	22	18	6	1
	625	Matraville north	189	3	6	2	0	167	18	30	10	1
	628	Matraville south	33	5	2	1	0	523	14	73	25	3
	428	Botany Industrial north	110	2	2	1	0	0	0	0	0	0
	429	Botany Industrial south	294	3	9	3	0	0	0	0	0	0
Total Catchment Trips			3904		453	156	17	15804		4277	1476	160
Anzac Parade bus interchange							3					37
Bunnerong Road bus interchange							4					32
Todman route 303 bus trips							0					3
Total Walk Up Trips							9					87

Hourly Movements Northbound	Boardings	Total
Anzac Parade S	32	
Bunnerong Road	40	72
Nine Ways	4	76
Strachan Street	12	88
University	58	146
Todman Ave	5	151
Carlton Street	3	154
Total Anzac Pde		154
To CBD via Todman	2	
Total To CBD		156

Hourly Movements Southbound	Boardings total	
Anzac Parade S	346	
Bunnerong Road	300	646
Nine Ways	281	926
Strachan Street	224	1150
University	21	1171
Todman Ave	211	1382
Carlton Street	66	1447
Total Anzac Pde		1447
From CBD via Todm	28	
Total from CBD		1476

Note * Includes +15% bus-rail feeder trips. Corridor and Peak Hour Factors are 70% of public transport trips are in the CBD -Randwick Corridor and 50% of these occur in a 1 hour peak period (am peak)

Appendix F

AM and PM peak hour passenger boardings for scenario 3

AM Peak Period Light Rail Journey to work trips (Interim +4200 dwellings growth increment)

Zone	Description	Inbound trips towards CBD			* Corridor and Peak Hour Factor	Per Tram Passenger Departures 2020	Assume 4% Growth Outbound Trips towards Randwick			* Corridor and Peak Hour Factor	Per Tram Passenger Arrivals 2020
		Total Trips	%Bus	Trips by Bus	0.35		Total Trips	%Bus	Trips by Bus	0.35	
611	Carlton	162	36	58	24	3	15	12	2	1	0
613	Todman (central)	251	36	90	36	4	18	12	2	1	0
614 N	Todman (south)	206	30	62	25	3	9	13	1	0	0
614 S	UNSW (west)	45	30	13	5	1	9	13	1	0	0
615	UNSW (main campus)	0	32	0	0	0	241	15	36	15	2
617	Strachan (west)	248	31	77	31	3	31	14	4	2	0
618	Strachan (east)	248	36	89	36	4	24	15	4	1	0
420	Kingsford SW Daceyville	0	24	0	0	0	12	2	0	0	0
621	Kingsford SE	229	29	66	27	3	10	6	1	0	0
620	Kingsford East	197	27	53	21	2	16	10	2	1	0
619	Kingsford NE	197	36	71	28	3	0	15	0	0	0
612	Todman West 303 Bus	45	21	9	4	0	20	8	2	1	0
616	Tunstall Street 303 Bus	45	28	12	5	1	1	13	0	0	0
637	Maroubra Anzac W	94	35	33	13	1	61	14	9	3	0
636	Maroubra Anzac E	94	35	33	13	1	15	14	2	1	0
638	Maroubra Storey Street	45	20	9	4	0	14	8	1	0	0
642	Maroubra Fitzgerald NW	45	29	13	5	1	32	10	3	1	0
643	Maroubra Fitzgerald NE	45	20	9	4	0	8	8	1	0	0
644	Maroubra Beach	45	25	11	4	0	14	14	2	1	0
645	Heffron	45	24	11	4	0	1	5	0	0	0
646	Fitzgerald SE	138	24	33	13	1	7	5	0	0	0
647	Malabar north	138	18	25	10	1	11	9	1	0	0
626	Malabar south	138	17	23	9	1	16	7	1	0	0
624 E	Beauchamp E	45	22	10	4	0	3	12	0	0	0
627 E	Franklin E	45	16	7	3	0	4	9	0	0	0
630	Long Bay	0	12	0	0	0	50	4	2	1	0
631	Bilga Crescent	45	15	7	3	0	4	5	0	0	0
633	Little Bay	141	12	17	7	1	18	6	1	0	0
629 E	Chifley east	138	16	22	9	1	6	7	0	0	0
632 E	Phillip Bay east	45	11	5	2	0	4	10	0	0	0
640	Maroubra west	45	22	10	4	0	23	10	2	1	0
624 W	Beauchamp W	45	22	10	4	0	3	12	0	0	0
627 W	Franklin W	45	16	7	3	0	4	9	0	0	0
629 W	Chifley west	138	16	22	9	1	6	7	0	0	0
632 W	Phillip Bay west	45	11	5	2	0	4	10	0	0	0
421	Pagewood north	0	16	0	0	0	5	0	0	0	0
423	Eastgardens	727	20	145	59	6	118	17	20	8	1
424	Hillsdale north	0	23	0	0	0	33	5	2	1	0
425	Hillsdale south	22	22	5	2	0	6	5	0	0	0
625	Matraville north	45	18	8	3	0	51	3	2	1	0
628	Matraville south	139	14	20	8	1	9	5	0	0	0
428	Botany Industrial north	0	0	0	0	0	29	2	1	0	0
429	Botany Industrial south	0	0	0	0	0	78	3	2	1	0
Total Catchment Trips		4402		1101	443	48	1041		110	44	5
Anzac Parade bus interchange						12					1
Bunnerong Road bus interchange						10					1
Todman route 303 bus trips						1					0
Total Walk Up Trips						25					2

Hourly Movements Northbound	Boardings	Total
Anzac Parade S	108	
Bunnerong Road	93	201
Nine Ways	77	277
Strachan Street	67	344
University	5	350
Todman Ave	61	411
Carlton Street	24	434
Total Anzac Pde		434
To CBD via Todman	9	
Total To CBD		443

Hourly Movements Southbound	Boardings total	
Anzac Parade S	10	
Bunnerong Road	12	22
Nine Ways	1	23
Strachan Street	3	27
University	15	42
Todman Ave	1	43
Carlton Street	1	44
Total Anzac Pde		44
From CBD via Todm	1	
Total from CBD		44

Zones in the local walk up catchment

Note * Includes +15% additional bus-rail feeder trips. Corridor and Peak Hour Factors are 70% of public transport trips are in the CBD -Randwick Corridor and 50% of these occur in a 1 hour peak period (am peak)

PM Peak Period Light Rail Journey to work trips (Interim +4200 dwellings growth increment)

Zone		Description	Inbound trips towards CBD Total Trips	%Bus	Trips by Bus	* Corridor and Peak Hour Factor 0.3	Per Tram Passenger Departures 2020	Outbound Trips towards Randwick Total Trips	%Bus	Trips by Bus	* Corridor and Peak Hour Factor 0.3	Per Tram Passenger Arrivals 2020
	611	Carlton	15	12	2	1	0	162	36	58	20	2
	613	Todman (central)	18	12	2	1	0	251	36	90	31	3
614 N		Todman (south)	9	13	1	0	0	206	30	62	21	2
614 S		UNSW (west)	9	13	1	0	0	45	30	13	5	0
	615	UNSW (main campus)	241	15	36	12	1	0	32	0	0	0
	617	Strachan (west)	31	14	4	1	0	248	31	77	27	3
	618	Strachan (east)	24	15	4	1	0	248	36	89	31	3
	420	Kingsford SW Daceyville	12	2	0	0	0	0	24	0	0	0
	621	Kingsford SE	10	6	1	0	0	229	29	66	23	2
	620	Kingsford East	16	10	2	1	0	197	27	53	18	2
	619	Kingsford NE	0	15	0	0	0	197	36	71	24	3
	612	Todman West 303 Bus	20	8	2	1	0	45	21	9	3	0
	616	Tunstall Street 303 Bus	1	13	0	0	0	45	28	12	4	0
	637	Maroubra Anzac W	61	14	9	3	0	94	35	33	11	1
	636	Maroubra Anzac E	15	14	2	1	0	94	35	33	11	1
	638	Maroubra Storey Street	14	8	1	0	0	45	20	9	3	0
	642	Maroubra Fitzgerald NW	32	10	3	1	0	45	29	13	4	0
	643	Maroubra Fitzgerald NE	8	8	1	0	0	45	20	9	3	0
	644	Maroubra Beach	14	14	2	1	0	45	25	11	4	0
	645	Heffron	1	5	0	0	0	45	24	11	4	0
	646	Fitzgerald SE	7	5	0	0	0	138	24	33	11	1
	647	Malabar north	11	9	1	0	0	138	18	25	9	1
	626	Malabar south	16	7	1	0	0	138	17	23	8	1
624 E		Beauchamp E	3	12	0	0	0	45	22	10	3	0
627 E		Franklin E	4	9	0	0	0	45	16	7	2	0
	630	Long Bay	50	4	2	1	0	0	12	0	0	0
	631	Bilga Crescent	4	5	0	0	0	45	15	7	2	0
	633	Little Bay	18	6	1	0	0	141	12	17	6	1
629 E		Chifley east	6	7	0	0	0	138	16	22	8	1
632 E		Phillip Bay east	4	10	0	0	0	45	11	5	2	0
	640	Maroubra west	23	10	2	1	0	45	22	10	3	0
624 W		Beauchamp W	3	12	0	0	0	45	22	10	3	0
627 W		Franklin W	4	9	0	0	0	45	16	7	2	0
629 W		Chifley west	6	7	0	0	0	138	16	22	8	1
632 W		Phillip Bay west	4	10	0	0	0	45	11	5	2	0
	421	Pagewood north	5	0	0	0	0	0	16	0	0	0
	423	Eastgardens	118	17	20	7	1	727	20	145	50	5
	424	Hillsdale north	33	5	2	1	0	0	23	0	0	0
	425	Hillsdale south	6	5	0	0	0	22	22	5	2	0
	625	Matraville north	51	3	2	1	0	45	18	8	3	0
	628	Matraville south	9	5	0	0	0	139	14	20	7	1
	428	Botany Industrial north	29	2	1	0	0	0	0	0	0	0
	429	Botany Industrial south	78	3	2	1	0	0	0	0	0	0
Total Catchment Trips			1041		110	38	4	4402		1101	380	41
Anzac Parade bus interchange							1					10
Bunnerong Road bus interchange							1					9
Todman route 303 bus trips							0					1
Total Walk Up Trips							2					22

Hourly Movements Northbound	Boardings	Total
Anzac Parade S	9	
Bunnerong Road	11	19
Nine Ways	1	20
Strachan Street	3	23
University	13	36
Todman Ave	1	37
Carlton Street	1	37
Total Anzac Pde		37
To CBD via Todman	1	
Total To CBD		38

Hourly Movements Southbound	Boardings total	
Anzac Parade S	92	
Bunnerong Road	80	172
Nine Ways	66	238
Strachan Street	57	295
University	5	300
Todman Ave	52	352
Carlton Street	20	372
Total Anzac Pde		372
From CBD via Todm	8	
Total from CBD		380

Note * Includes +15% bus-rail feeder trips. Corridor and Peak Hour Factors are 70% of public transport trips are in the CBD -Randwick Corridor and 50% of these occur in a 1 hour peak period (am peak)

AM Peak Period Light Rail Journey to work trips (Ultimate +15750 dwellings growth increment)

Zone	Description	Inbound trips towards CBD			* Corridor and Peak Hour Factor	Per Tram Passenger	Assume 15% Growth Outbound Trips towards Randwick			* Corridor and Peak Hour Factor	Per Tram Passenger
		Total Trips	%Bus	Trips by Bus	0.35	Departures 2031	Total Trips	%Bus	Trips by Bus	0.35	Arrivals 2031
	611 Carlton	564	43.2	244	98	11	58	14.4	8	3	0
	613 Todman (central)	895	43.2	387	156	17	68	14.4	10	4	0
614 N	Todman (south)	771	36	278	112	12	35	15.6	5	2	0
614 S	UNSW (west)	167	36	60	24	3	35	15.6	5	2	0
	615 UNSW (main campus)	0	38.4	0	0	0	904	18	163	65	7
	617 Strachan (west)	897	37.2	334	134	15	116	16.8	20	8	1
	618 Strachan (east)	897	43.2	388	156	17	90	18	16	7	1
	420 Kingsford SW Daceyville	0	28.8	0	0	0	44	2.4	1	0	0
	621 Kingsford SE	827	34.8	288	116	13	37	7.2	3	1	0
	620 Kingsford East	737	32.4	239	96	10	59	12	7	3	0
	619 Kingsford NE	737	43.2	318	128	14	2	18	0	0	0
	612 Todman West 303 Bus	167	21	35	14	2	74	8	6	2	0
	616 Tunstall Street 303 Bus	167	28	47	19	2	2	13	0	0	0
	637 Maroubra Anzac W	354	35	124	50	5	230	14	32	13	1
	636 Maroubra Anzac E	354	35	124	50	5	57	14	8	3	0
	638 Maroubra Storey Street	167	20	33	13	1	52	8	4	2	0
	642 Maroubra Fitzgerald NW	167	29	48	19	2	118	10	12	5	1
	643 Maroubra Fitzgerald NE	167	20	33	13	1	29	8	2	1	0
	644 Maroubra Beach	167	25	42	17	2	52	14	7	3	0
	645 Heffron	167	24	40	16	2	3	5	0	0	0
	646 Fitzgerald SE	517	24	124	50	5	25	5	1	1	0
	647 Malabar north	517	18	93	37	4	41	9	4	1	0
	626 Malabar south	517	17	88	35	4	59	7	4	2	0
624 E	Beauchamp E	167	22	37	15	2	11	12	1	1	0
627 E	Franklin E	167	16	27	11	1	15	9	1	1	0
	630 Long Bay	0	12	0	0	0	188	4	8	3	0
	631 Bilga Crescent	167	15	25	10	1	13	5	1	0	0
	633 Little Bay	530	12	64	26	3	66	6	4	2	0
629 E	Chifley east	517	16	83	33	4	24	7	2	1	0
632 E	Phillip Bay east	167	11	18	7	1	15	10	1	1	0
	640 Maroubra west	167	22	37	15	2	84	10	8	3	0
624 W	Beauchamp W	167	22	37	15	2	11	12	1	1	0
627 W	Franklin W	167	16	27	11	1	15	9	1	1	0
629 W	Chifley west	517	16	83	33	4	24	7	2	1	0
632 W	Phillip Bay west	167	11	18	7	1	15	10	1	1	0
	421 Pagewood north	0	16	0	0	0	20	0	0	0	0
	423 Eastgardens	2726	20	545	219	24	443	17	75	30	3
	424 Hillsdale north	0	23	0	0	0	123	5	6	2	0
	425 Hillsdale south	84	22	18	7	1	23	5	1	0	0
	625 Matraville north	167	18	30	12	1	189	3	6	2	0
	628 Matraville south	523	14	73	29	3	33	5	2	1	0
	428 Botany Industrial north	0	0	0	0	0	110	2	2	1	0
	429 Botany Industrial south	0	0	0	0	0	294	3	9	4	0
Total Catchment Trips		16320		4487	1806	196	3904		453	182	20
Anzac Parade bus interchange						44					4
Bunnerong Road bus interchange						38					5
Todman route 303 bus trips						4					0
Total Walk Up Trips						111					10

Hourly Movements Northbound	Boardings	Total
Anzac Parade S	404	
Bunnerong Road	349	753
Nine Ways	340	1093
Strachan Street	290	1384
University	24	1408
Todman Ave	267	1675
Carlton Street	98	1773
Total Anzac Pde		1773
To CBD via Todman	33	
Total To CBD		1806

Hourly Movements Southbound	Boardings total	
Anzac Parade S	37	
Bunnerong Road	46	84
Nine Ways	4	88
Strachan Street	14	103
University	68	170
Todman Ave	6	176
Carlton Street	3	180
Total Anzac Pde		180
From CBD via Todm	3	
Total from CBD		182

Zones in the local walk up catchment

Note * Includes +15% additional bus-rail feeder trips. Corridor and Peak Hour Factors are 70% of public transport trips are in the CBD -Randwick Corridor and 50% of these occur in a 1 hour peak period (am peak)

PM Peak Period Light Rail Journey to work trips (Ultimate +15750 dwellings growth increment)

Zone		Description	Inbound trips towards CBD			* Corridor and Peak Hour Factor	Per Tram Passenger	Outbound Trips towards Randwick			* Corridor and Peak Hour Factor	Per Tram Passenger
			Total Trips	%Bus	Trips by Bus	0.3	Departures 2031	Total Trips	%Bus	Trips by Bus	0.3	Arrivals 2031
	611	Carlton	58	14.4	8	3	0	564	43.2	244	84	9
	613	Todman (central)	68	14.4	10	3	0	895	43.2	387	133	14
614 N		Todman (south)	35	15.6	5	2	0	771	36	278	96	10
614 S		UNSW (west)	35	15.6	5	2	0	167	36	60	21	2
	615	UNSW (main campus)	904	18	163	56	6	0	38.4	0	0	0
	617	Strachan (west)	116	16.8	20	7	1	897	37.2	334	115	12
	618	Strachan (east)	90	18	16	6	1	897	43.2	388	134	14
	420	Kingsford SW Daceyville	44	2.4	1	0	0	0	28.8	0	0	0
	621	Kingsford SE	37	7.2	3	1	0	827	34.8	288	99	11
	620	Kingsford East	59	12	7	2	0	737	32.4	239	82	9
	619	Kingsford NE	2	18	0	0	0	737	43.2	318	110	12
	612	Todman West 303 Bus	74	8	6	2	0	167	21	35	12	1
	616	Tunstall Street 303 Bus	2	13	0	0	0	167	28	47	16	2
	637	Maroubra Anzac W	230	14	32	11	1	354	35	124	43	5
	636	Maroubra Anzac E	57	14	8	3	0	354	35	124	43	5
	638	Maroubra Storey Street	52	8	4	1	0	167	20	33	12	1
	642	Maroubra Fitzgerald NW	118	10	12	4	0	167	29	48	17	2
	643	Maroubra Fitzgerald NE	29	8	2	1	0	167	20	33	12	1
	644	Maroubra Beach	52	14	7	2	0	167	25	42	14	2
	645	Heffron	3	5	0	0	0	167	24	40	14	1
	646	Fitzgerald SE	25	5	1	0	0	517	24	124	43	5
	647	Malabar north	41	9	4	1	0	517	18	93	32	3
	626	Malabar south	59	7	4	1	0	517	17	88	30	3
624 E		Beauchamp E	11	12	1	0	0	167	22	37	13	1
627 E		Franklin E	15	9	1	0	0	167	16	27	9	1
	630	Long Bay	188	4	8	3	0	0	12	0	0	0
	631	Bilga Crescent	13	5	1	0	0	167	15	25	9	1
	633	Little Bay	66	6	4	1	0	530	12	64	22	2
629 E		Chifley east	24	7	2	1	0	517	16	83	29	3
632 E		Phillip Bay east	15	10	1	1	0	167	11	18	6	1
	640	Maroubra west	84	10	8	3	0	167	22	37	13	1
624 W		Beauchamp W	11	12	1	0	0	167	22	37	13	1
627 W		Franklin W	15	9	1	0	0	167	16	27	9	1
629 W		Chifley west	24	7	2	1	0	517	16	83	29	3
632 W		Phillip Bay west	15	10	1	1	0	167	11	18	6	1
	421	Pagewood north	20	0	0	0	0	0	16	0	0	0
	423	Eastgardens	443	17	75	26	3	2726	20	545	188	20
	424	Hillsdale north	123	5	6	2	0	0	23	0	0	0
	425	Hillsdale south	23	5	1	0	0	84	22	18	6	1
	625	Matraville north	189	3	6	2	0	167	18	30	10	1
	628	Matraville south	33	5	2	1	0	523	14	73	25	3
	428	Botany Industrial north	110	2	2	1	0	0	0	0	0	0
	429	Botany Industrial south	294	3	9	3	0	0	0	0	0	0
Total Catchment Trips			3904		453	156	17	16320		4487	1548	168
Anzac Parade bus interchange							3					37
Bunnerong Road bus interchange							4					32
Todman route 303 bus trips							0					3
Total Walk Up Trips							9					95

Hourly Movements Northbound	Boardings	Total
Anzac Parade S	32	
Bunnerong Road	40	72
Nine Ways	4	76
Strachan Street	12	88
University	58	146
Todman Ave	5	151
Carlton Street	3	154
Total Anzac Pde		154
To CBD via Todman	2	
Total To CBD		156

Hourly Movements Southbound	Boardings total	
Anzac Parade S	346	
Bunnerong Road	300	646
Nine Ways	292	937
Strachan Street	249	1186
University	21	1207
Todman Ave	229	1436
Carlton Street	84	1520
Total Anzac Pde		1520
From CBD via Todm	28	
Total from CBD		1548

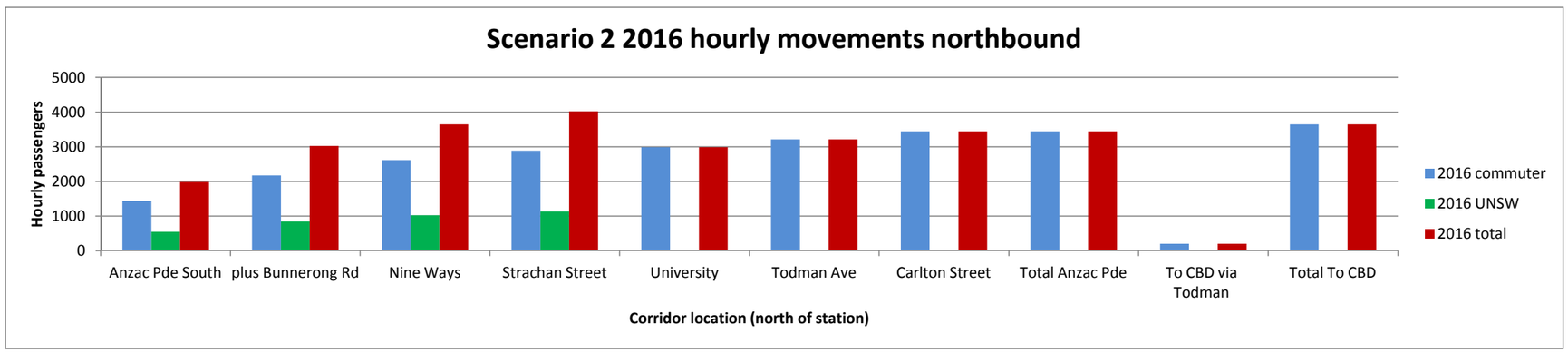
Note * Includes +15% bus-rail feeder trips. Corridor and Peak Hour Factors are 70% of public transport trips are in the CBD -Randwick Corridor and 50% of these occur in a 1 hour peak period (am peak)

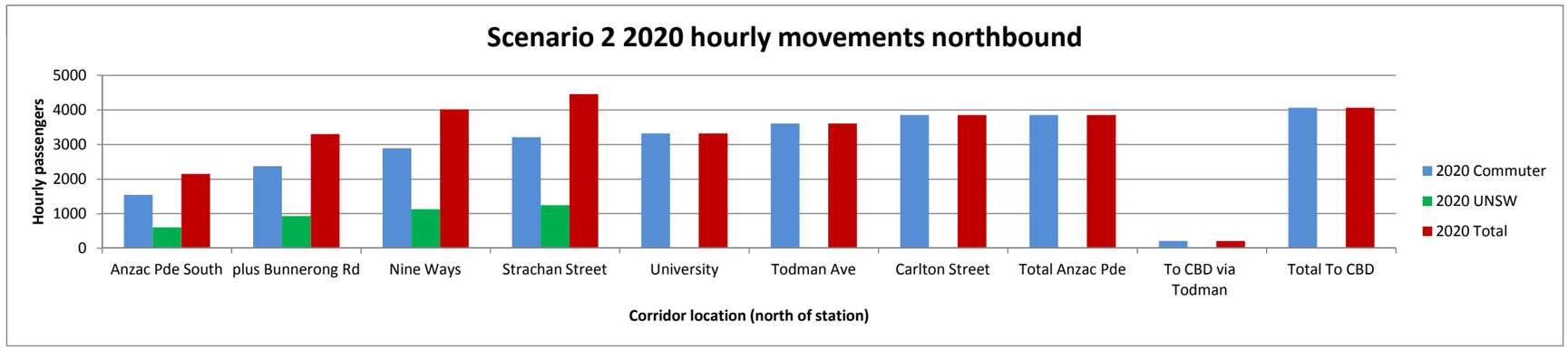
Appendix G

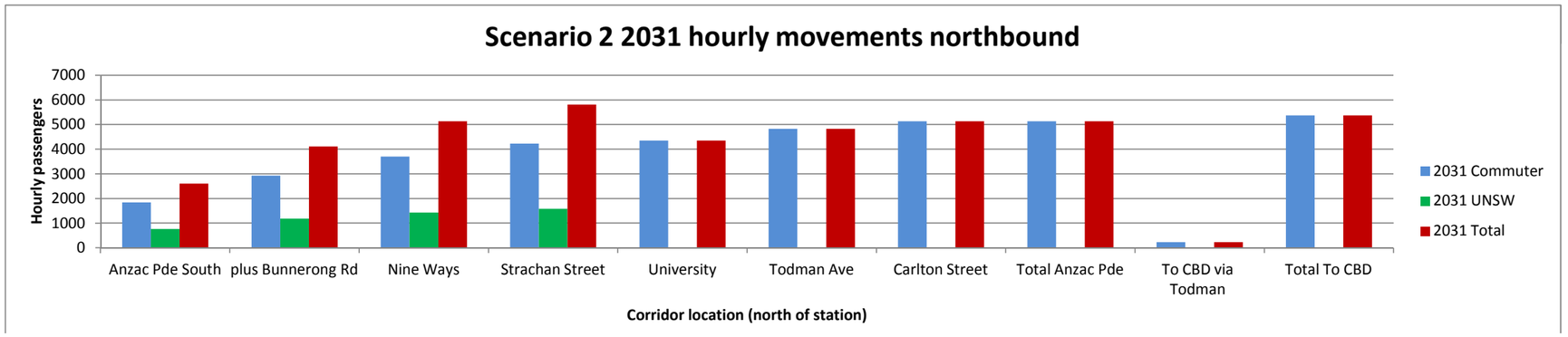
Summary tables of future corridor travel demand growth projections

Summary of Northbound Corridor Volumes Final Kingsford Route Option with PT travel mode share increase

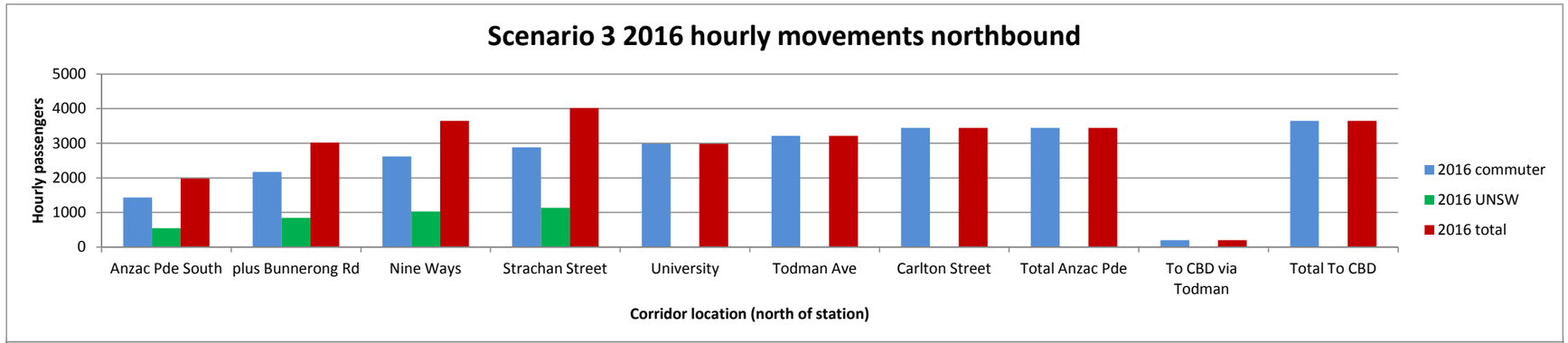
SCENARIO 2	Base	Growth to	Growth to	Growth to								
	2011	2016	2020	2031								
Hourly movements northbound					**2016 commut**	**2016 UNSV**	**2016 total**	**2020 Commu**	**2020 UNSV**	**2020 Total**	**2031 Commu**	**2031 UNSV**	**2031 Total**
Anzac Pde South	1308	129	108	404	1437	549	1986	1545	604	2149	1841	769	2610
plus Bunnerong Rd	2016	157	201	753	2173	847	3020	2374	932	3305	2926	1186	4112
Nine Ways	2445	173	274	1081	2618	1027	3645	2891	1130	4021	3698	1438	5136
Strachan Street	2702	182	332	1342	2883	1135	4018	3215	1249	4464	4226	1589	5815
University	2793	194	337	1366	2988		2988	3325		3325	4354		4354
Todman Ave	2993	222	392	1612	3215		3215	3607		3607	4828		4828
Carlton Street	3208	237	409	1689	3446		3446	3855		3855	5134		5134
Total Anzac Pde	3208	237	409	1689	3446		3446	3855		3855	5134		5134
To CBD via Todman	201	0	9	33	201		201	210		210	234		234
Total To CBD	3410	237	418	1722	3647		3647	4065		4065	5369		5369

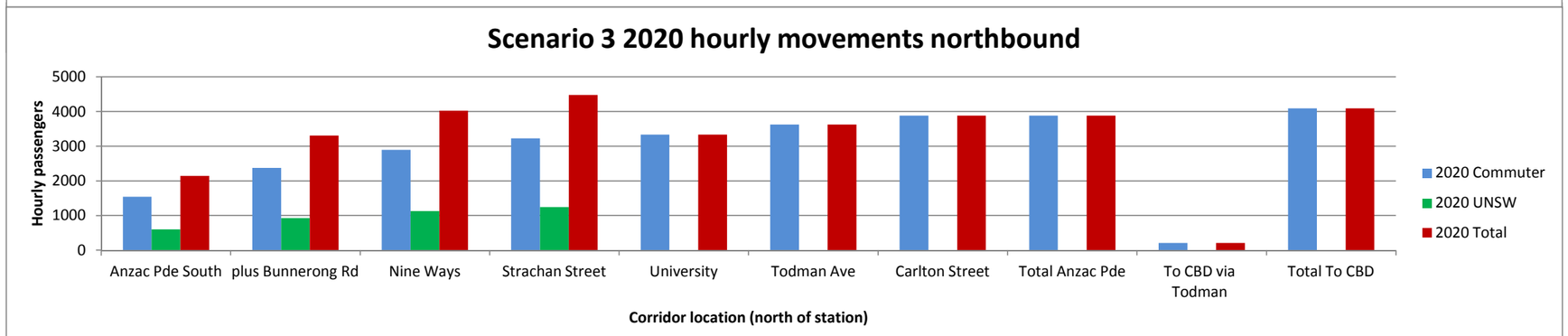


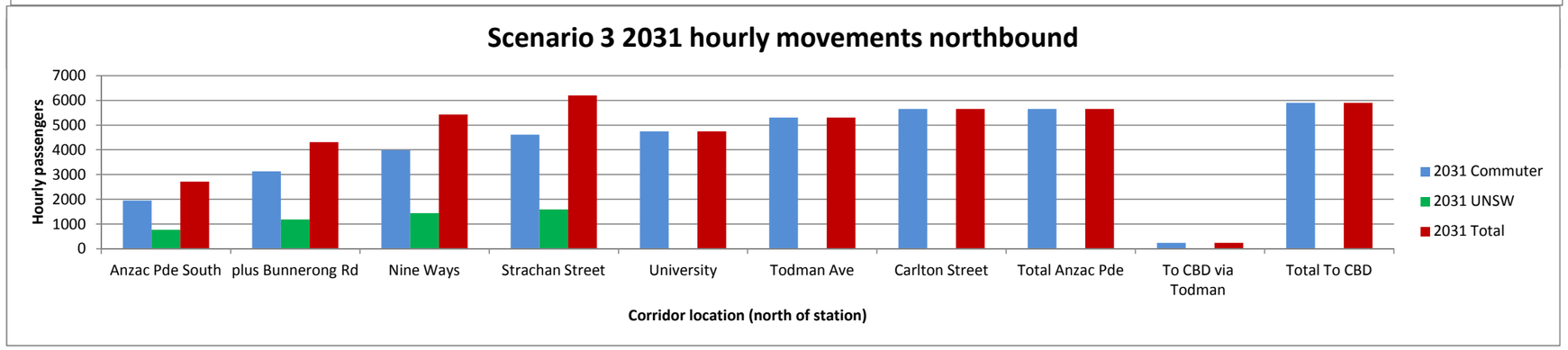




SCENARIO 3	Base	Growth to	Growth to	Growth to								
	2011	2016	2020	2031								
Hourly movements northbound					**2016 comn**	**2016 UNSV**	**2016 total**	**2020 Comn**	**2020 UNSV**	**2020 Total**	**2031 Comn**	**2031 UNSV**	**2031 Total**
Anzac Pde South	1308	129	108	404	1437	549	1986	1545	604	2149	1949	769	2717
plus Bunnerong Rd	2016	157	201	753	2173	847	3020	2374	932	3305	3127	1186	4313
Nine Ways	2445	173	277	1093	2618	1027	3645	2895	1130	4025	3988	1438	5426
Strachan Street	2702	182	344	1384	2883	1135	4018	3228	1249	4476	4611	1589	6200
University	2793	194	350	1408	2988		2988	3337		3337	4745		4745
Todman Ave	2993	222	411	1675	3215		3215	3626		3626	5301		5301
Carlton Street	3208	237	434	1773	3446		3446	3880		3880	5653		5653
Total Anzac Pde	3208	237	434	1773	3446		3446	3880		3880	5653		5653
To CBD via Todman	201	0	9	33	201		201	210		210	243		243
Total To CBD	3410	237	443	1806	3647		3647	4090		4090	5896		5896







Randwick City Council

Kensington and Kingsford Planning Strategy

Stage 2 Transport Modelling Report

Issue | 18 May 2017

Job number 252756

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Contents

1 Introduction

Randwick City Council appointed Conybeare Morrison International to advise on new planning controls for the Kingsford and Kensington town centres. The new planning controls will comprise a key aspect of a Planning Strategy to guide the coordinated growth and renewal of these town centres into the future.

Arup has provided Stage 1 Traffic and Transport Advice to inform the development of the planning controls and public realm improvements. This Stage 2 report investigates the impacts of the proposed changes in the Planning Strategy through traffic modelling. Specifically accounted for are the proposed dwelling growth and a number of road closures within each of the town centres, along with the addition of the CBD South East Light Rail through the area expected after 2019.

1.1 Proposed Changes and Methodology

As detailed in the Stage 1 Report, a variety of public domain changes are proposed that are likely to impact road network operation. Increases in residential dwellings and commercial floorspace are also proposed by the Planning Strategy, generating vehicle trips to be accommodated by the local road network. In summary, the proposed changes with bearing on traffic matters include:

- The closure of Meeks Street between Anzac Parade and Harbourne Lane;
- The closure of Duke St between Anzac Parade and Boronia Street;
- The closure of Bowral Street at Anzac Parade; and
- The addition of 2772 dwellings and 36,000m^2 commercial floorspace in Kingsford, expected to generate approximately 1022 trips in peak periods; and
- The addition of 1855 dwellings and 18,000m^2 commercial floorpsace in Kensington, expected to generate approximately 609 trips in peak periods.

These changes were imposed onto an appropriate existing future year model, namely the Sydney Light Rail SCATSIM Aimsun model (SLR model). Since the proposed changes are not large in scale, a subnetwork (known as the Kensington / Kingsford Subnetwork) was created within the SLR Aimsun model to more accurately investigate the impacts on the local area. The road network performance under simulation with and without the above changes was then compared to infer the traffic impacts of the changes.

2 Kensington / Kingsford Subnetwork

2.1 Methodology

The Sydney Light Rail SCATSIM Aimsun model, developed by GTA consultants, models the road network from North Sydney through the Sydney CBD to Kingsford under the CBD South East Light Rail (CSELR) and forms the basis of this investigation. The Sydney Light Rail model was itself developed from the Sydney Transit Model (STM), adding mesoscopic dynamic user equilibrium (DUE) simulation of the whole area to the strategic assessment of the CSELR project.

An appropriate subnetwork of the received model has been used to investigate the Kingsford / Kensington area specifically, for a variety of reasons:

- The proposed road closures are minor/ local in nature, and are unlikely to impact on a wider scale. Similarly, the floorspace uplifts are also not large enough to warrant employing the Sydney Light Rail model;
- The size of the Sydney Light Rail model means that large detours are possible and could potentially send vehicles on unrealistically long paths in response to minor changes;

An appropriate subnetwork (pictured in Figure 1) of the Sydney Light Rail model was extracted to investigate Kingsford/Kensington area specifically, ultimately using mesoscopic DUE as a simulation methodology. This process involved:

- A macro-static assignment run in the Sydney Light Rail model, generating a cordon O-D matrix for the subnetwork, containing all trips through the area for the four hour duration;
- A static assignment of the Kensington / Kingsford subnetwork, with the cordon matrix above, outputting static paths;
- A mesoscopic DUE of the Kensington / Kingsford subnetwork, using the static paths output above, was run;

However, the results of the full Sydney Light Rail SCATSIM mesoscopic DUE were received, and the outputs of the Kensington / Kingsford Subnetwork mesoscopic DUE were compared to ensure their validity. Further detail to these processes is offered below, along with comment on the convergence of the three assignments conducted above.

With a suitable future base model in place, the following was undertaken:

- Changes were made to reflect the proposed changes on the road network and a static assignment followed by a mesoscopic DUE were run on the Kensington / Kingsford subnetwork.
- The four-hour subnetwork models were converted to one-hour peak models, using traffic profiling from the original SLR model;
- The results of the unaltered Kensington / Kingsford Subnetwork (Do Nothing case) and the subnetwork with changes (Project case) were compared to infer the traffic impact of the road closures and generated trips.

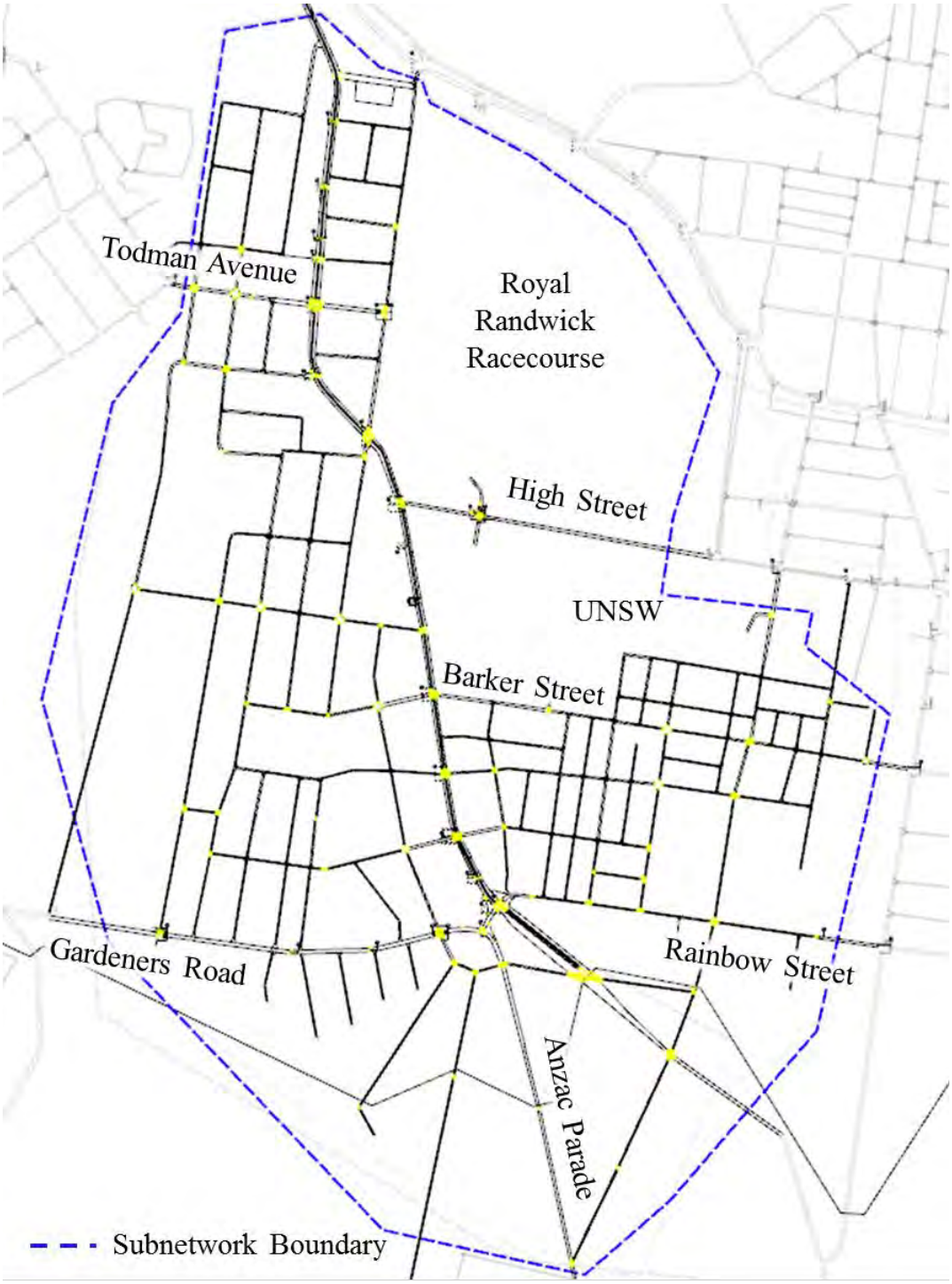

Figure 1: Kingsford / Kensington Subnetwork Extent

2.1.1 CBD Subnetwork: Macroscopic Static Assignment Convergence

The strategic models received were unaltered by Arup Pty Ltd and subsequently assumed to be sufficiently validated previously. Without the real data sets used to validate the original CSELR model, it was not possible to re-validate the results of each assignment run. However, the relative gap between iterations settled to the convergence criteria of 0.100% relative quickly:

- AM Peak: Converged to 0.99073% Relative Gap in 39 iterations;
- PM Peak: Converged to 0.90599% Relative Gap in 53 iterations.

This indicates that the static assignment process converged well and the cordon matrix generation was successful.

2.1.2 Kensington / Kingsford Subnetwork: Macroscopic Static Assignment Convergence

Similarly, the static assignment experiment conducted on theKensington / Kingsford Subnetwork with the traversal matrix converged successfully, specifically:

- AM Peak: Converged at 0.8936% Relative Gap on the 40th iteration;
- PM Peak: Converged at 0.9477% Relative Gap on the 44th iteration.

The paths of the final iterations for each peak were passed to the dynamic user equilibrium experiment as a starting point for that process.

2.1.3 K2K Town Centre Subnetwork: Mesoscopic DUE Simulation Convergence and Validation

The mesoscopic DUE of the subnetwork successfully converged to the following parameters:

- AM Peak: Converged to 5% Relative Gap in 54 iterations, surpassing the 10% relative gap undertaken on the corresponding meso-DUE on the full-scale model;
- PM Peak: Converged to 2% Relative Gap in 100 iterations, surpassing the 10% relative gap undertaken on the corresponding meso-DUE on the full-scale model.

These relative gap throughout the convergence process is shown in Figure 2 and Figure 3.

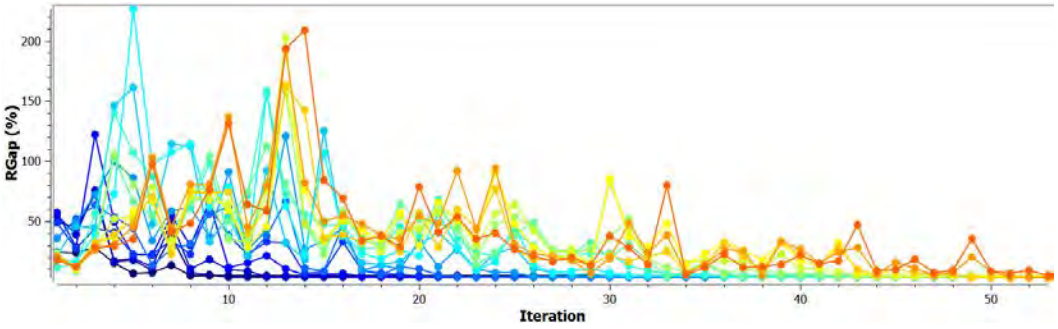

Figure 2: AM Subnetwork Meso-DUE Convergence (Relative Gap per Iteration)

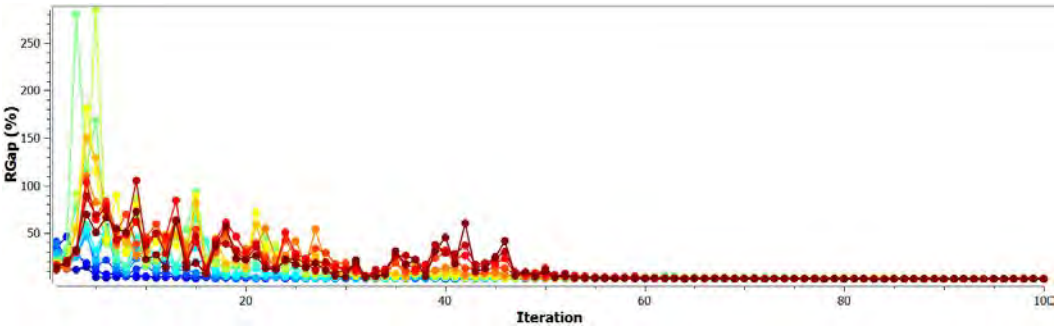

Figure 3: PM Subnetwork Meso-DUE Convergence (Relative Gap per Iteration)

3 Model Flow Comparison

Before modelling changes and drawing inference from the converged simulation, the mesoscopic DUE experiments on the Kensington / Kingsford subnetwork must first be proven to have produced flow results sufficiently similar to the original large model running the same meso-DUE process. The comparison was considered for:

- Average simulated section flows across the subnetwork; and
- Average simulated section flows along Anzac Parade; and

Details of these comparisons are provided below. However, it should also be noted that the simulations run on the subnetwork model consider a much smaller study area; this has allowed the subnetwork to achieve a convergence beyond the larger-scale simulation, but may also produce a variance between their flows.

3.1 Subnetwork Flow Comparison

The results of this comparison across the Kensington / Kingsford subnetwork are shown in Figure 4 and Figure 5 for the AM and PM peaks respectively.

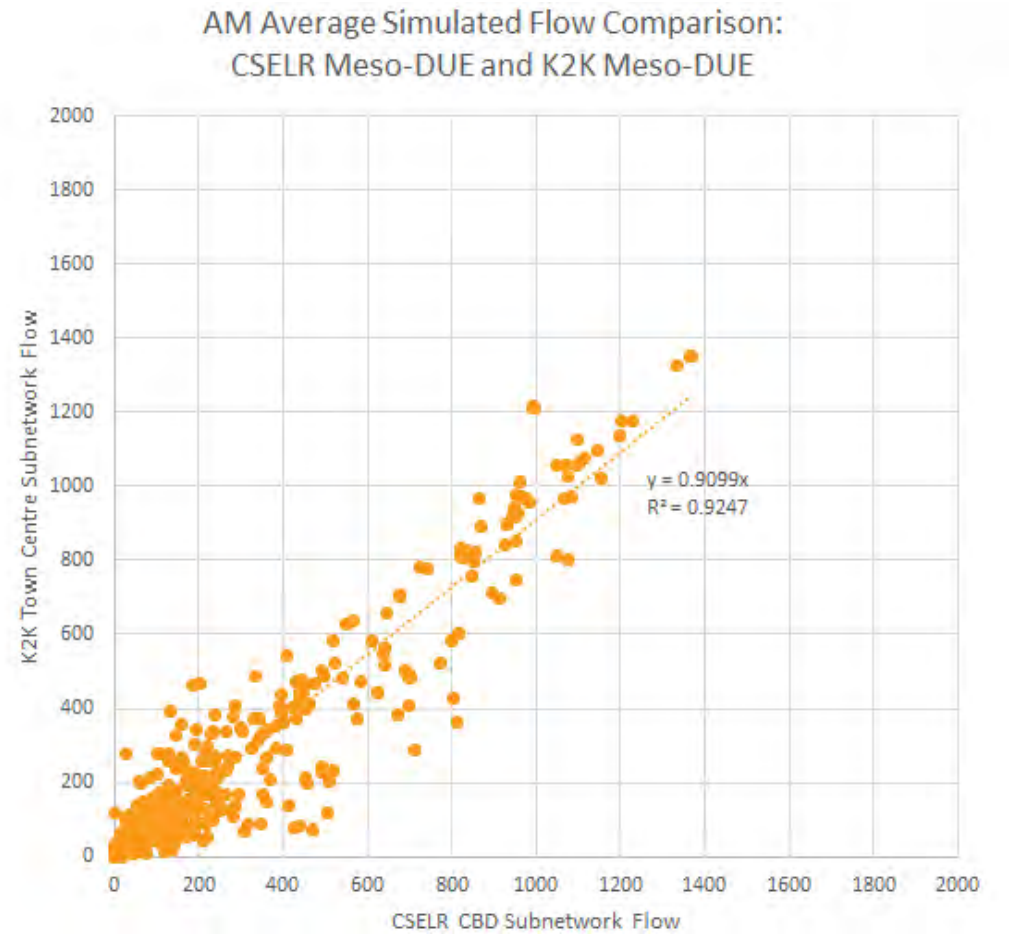

Figure 4: AM Simulated Flow Comparison: All of Subnetwork

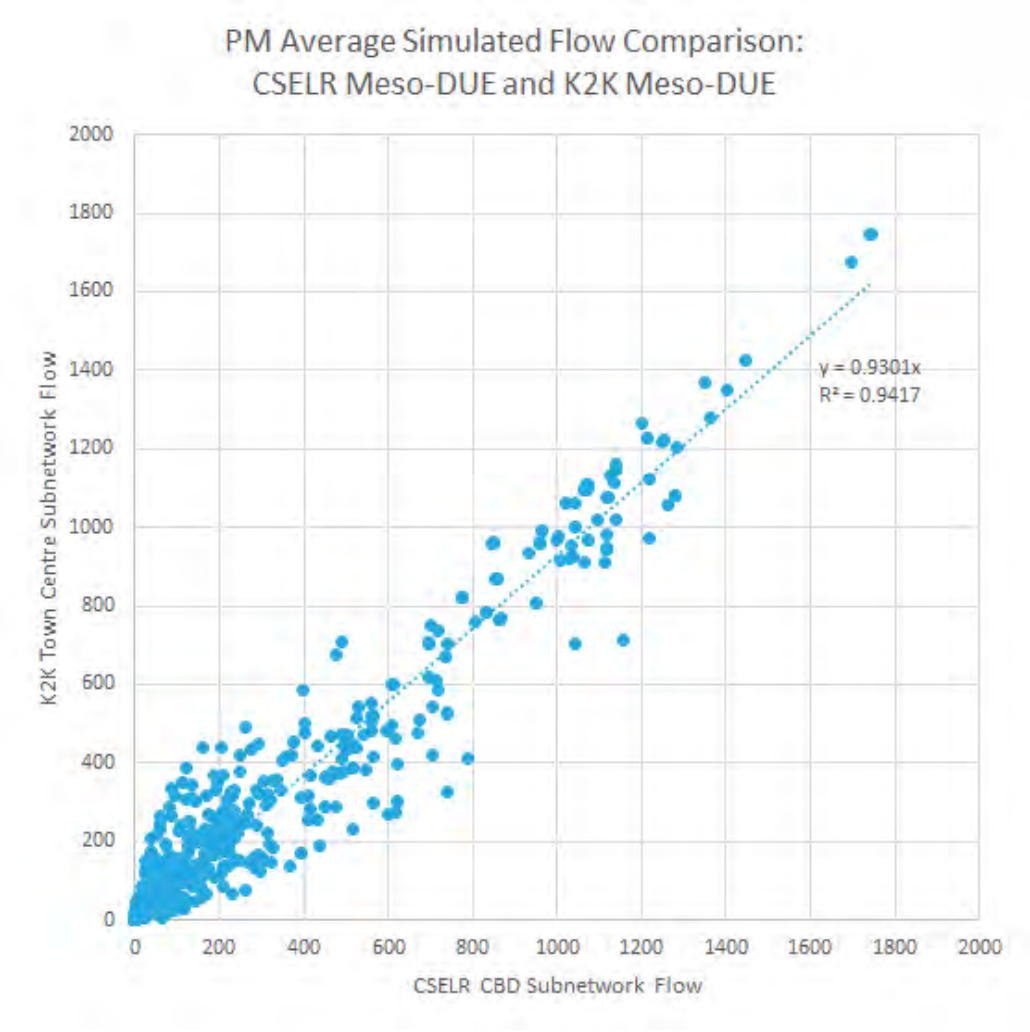

Figure 5: PM Simulated Flow Comparison: All of Subnetwork

As evidenced by the above graphs, specifically noting the R^2 of both peaks exceeds 0.9, and considering the looseness of the original CSELR simulation over such a large area, the flows simulated under a much smaller study area are considered to sufficiently resemble the flows estimated by the DUE over the larger area.

3.2 Anzac Parade Flow Comparison

Anzac Parade has been identified as of particular importance inferring to the validity of the modelling undertaken; it is the major arterial through the town centres and is directly adjacent to the proposed road closures. As a result, link flows along Anzac Parade were interrogated with further rigour, using the Geoffrey E. Havers Statistic (GEH) in conjunction with calibration criteria from the *RMS Modelling Guidelines*, namely:

- 100% of volumes to be below GEH 10; and
- 85% of volumes to be low GEH 5.

The GEH Statistic is essentially a measure of how different the observed and modelled flows are. However, it scales this difference based on the size of the

observed count allowing a comparison of "inaccuracy" between turning movements of different sizes. It is expressed as:

$$GEH = \sqrt{\frac{2(M-C)^2}{M+C}}$$

Where M is the modelled volume and C is the observed volume. The R^2 value is also an important measure for comparison between two sets and has been provided alongside the GEH comparison. The performance of each peak in relation to these GEH and R^2 criteria are shown in Table 1 and Table 2.

Table 1: Anzac Parade AM Flow Comparison Statistics

AM	**Northbound**	**Southbound**
GEH < 10	100%	100%
GEH < 5	95%	96%
Average GEH	1.5	1.7
R^2	0.602	0.93
Total turns	20	24

Table 2: Anzac Parade PM Flow Comparison Statistics

PM	**Northbound**	**Southbound**
GEH < 10	100%	100%
GEH < 5	95%	96%
Average GEH	2.83	2.38
R^2	0.77	0.7
Total turns	20	24

As evidenced by the above tables, the Anzac Parade corridor through the Kensington / Kingsford Subnetwork model calibrates well at a link volume level against the modelled volumes in the Sydney Light Rail SCATSIM model in 2021.

3.3 Comparison Summary

Overall, the Kensington / Kingsford Subnetwork appears to sufficiently resemble the flow patterns of the larger Sydney Light Rail it was derived from, and specifically can be considered to calibrate along Anzac Parade. The subnetwork is consequently considered to be fit for purpose, in light of the previously calibrated and validated Sydney Light Rail model and the lack of alterations made to the subnetwork. Beyond that, the subnetwork constrains the possibility of long detours as a reaction to relatively minor local road closures, while modelling in the full Sydney Light Rail model would still allow such unrealistic re-routing behaviour.

3.4 Peak Modelling Period Selection

Due to the likely traffic generation period of the new floorspaces, it was decided to model the subnetwork for only the peak hour instead of the full four hour duration of the Sydney Light Rail. Peak times and a factor to scale down the four-hour cordon matrix were drawn from hourly profiles within the Sydney Light Rail model, shown in Figure 6 and Figure 7.

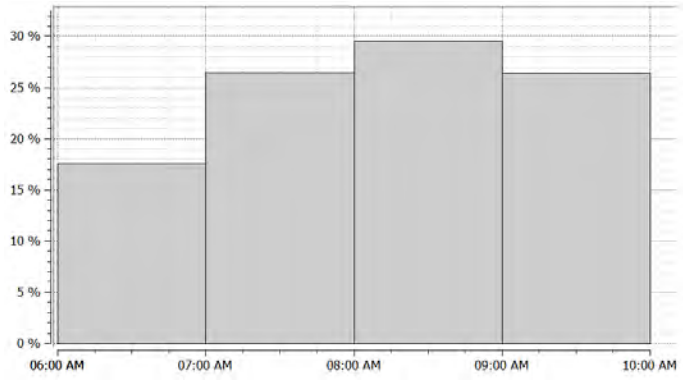

Figure 6: AM Hourly Traffic Profile in the Sydney Light Rail Model

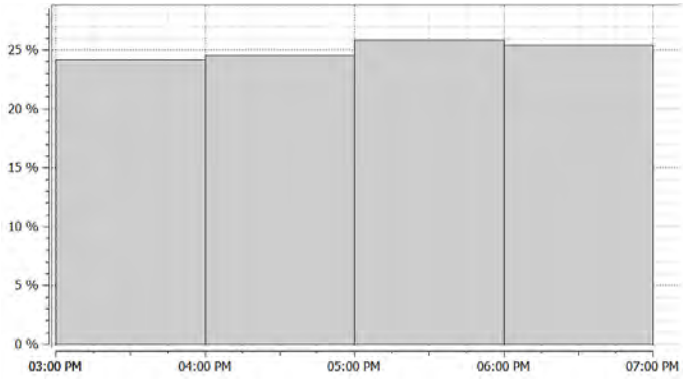

Figure 7: PM Hourly Traffic Profile in the Sydney Light Rail Model.

From this, the following peak times and factors were selected:

- AM Peak: 08:00 to 09:00, applying 29.54% of the 4-Hour O-D matrix; and
- PM Peak: 17:00 to 18:00, applying 25.88% of the 4-Hour O-D matrix.

These profiles represent the background traffic patterns, but are also likely to coincide with the peak generation time for the new floorspace. As a result, the modelled peak estimates the worst-case scenario.

4 Proposal Modelling

With a fit for purpose model as a basis, the proposed local road closures and floorspace uplifts were added to the model to test their impact. This involved a number of steps:

- Removal of the local roads to be closed and addition of new zones to generate new trips;
- Distribution of the traffic generated by new development (as in the Stage 1 Transport Assessment) based on Journey to Work 2011, on top of the future background traffic through the area as in the full Sydney Light Rail model;
- Running a static assignment on the Kensington / Kingsford subnetwork to anticipate changes in traffic patterns with these new trips and changes to the local road network. This generates initial paths to pass to the mesoscopic DUE simulation;
- Running the mesoscopic DUE simulation of the Kensington / Kingsford subnetwork to identify resultant traffic conditions; and
- Comparison the results of the mesoscopic DUE simulation to the unaltered Kensington / Kinsford 2021 Base model.

These processes are detailed below.

4.1 Proposed Road Network Changes

In order to factor in the proposed road closures, which would limit/eliminate access to and from Anzac Parade, three streets were removed from the project model. As above, these were:

- Meeks Street;
- Duke Street; and
- Bowral Street.

These changes are illustrated in Figure 8 and Figure 9.

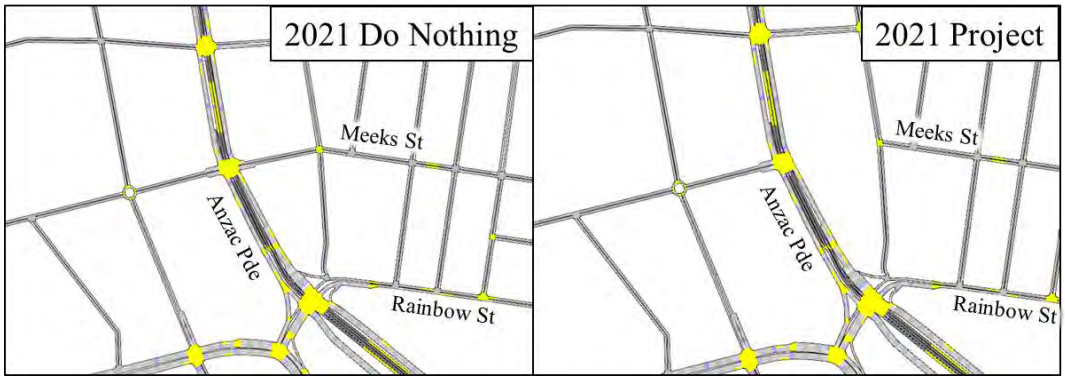

Figure 8: Meeks Street modelled road closure.

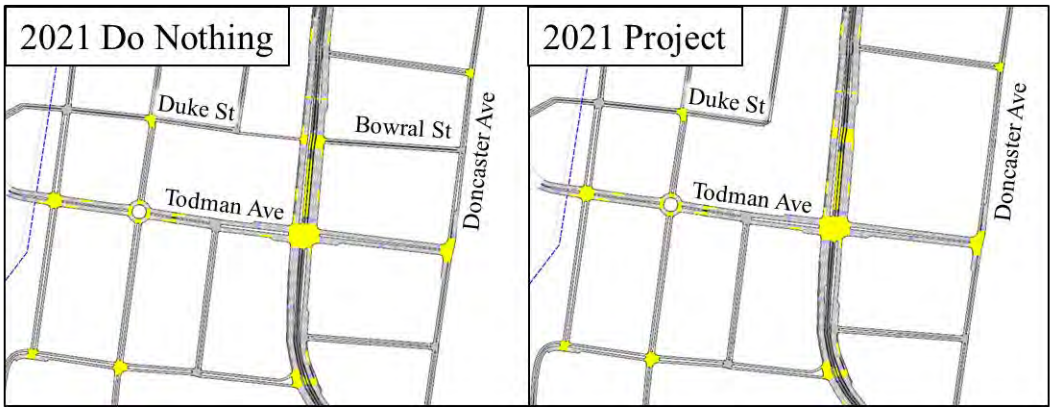

Figure 9: Bowral Street and Duke Street modelled road closure.

The proposed road closures do not actually involve the full removal of the road. The roads are proposed to remain intact for local access, while works would be undertaken to limit access to and from Anzac Parade. However, the overall Sydney Light Rail model releases vehicles onto nodes, not links, so removing the link in the Aimsun model is a valid way of modelling the reduced route choice. This modelling approach does not affect "local access" or the number of vehicles coming from the closed streets in the model.

4.2 Floorspace Uplifts

The additional dwellings and commercial floorspace afforded by the proposed Planning Strategy were applied as per the traffic generation levels and distribution undertaken in the Stage 1 Transport Assessment. Their trips were distributed to six major road routes from their expected origin based on the *Journey to Work 2011* (JTW 2011) and expected routing to-and-from the S3 Statistical Area listed in the *JTW*. The Place of Work and Place of Residence distributions are shown in Table 3 and Table 4.

Table 3: Place of Work of people living in Randwick – Kensington S3 Statistical Area. *Source: Journey to Work Survey, 2011.*

S3 Statistical Area	Trips	%
Eastern Suburbs – South	1207	58%
Botany	226	11%
Sydney Inner City	177	8%
Kogarah - Rockdale	116	6%
Eastern Suburbs – North	104	5%
Hurstville	80	4%
Canterbury	63	3%
Strathfield – Burwood – Ashfield	46	2%
Sutherland – Menai – Heathcote	39	2%
North Sydney – Mosman	33	2%

Major Route	%
Anzac Parade North	22.2%
Anzac Parade South	19.2%
High Street	6.1%
Rainbow Street	6.1%
Gardeners Road	21.9%
Bunnerong Road	24.6%

Table 4: Place of Residence of people working in Randwick – Kensington S3 Statistical Area. *Source: Journey to Work Survey, 2011.*

S3 Statistical Area	Trips	%
Sydney Inner	2338	43%
Eastern Suburbs – South	1574	29%
Eastern Suburbs – North	481	9%
Botany	465	9%
North Sydney – Mosman	204	4%
Chatswood – Lane Cove	143	3%
Ryde – Hunters Hill	94	2%
Marrickville – Sydenham – Petersham	62	1%
Strathfield – Burwood – Ashfield	62	1%

Major Route	%
Anzac Parade North	55.7%
Anzac Parade South	14.0%
High Street	2.2%
Rainbow Street	2.2%
Gardeners Road	16.2%
Bunnerong Road	9.7%

Using these two distributions from the Journey to Work, the trip distributions associated with the new floorspace and dwellings can be inferred. Specifically:

- **The Place of Work** relates to the **residential traffic distribution**. It tells us where people who live in this area are driving to and from for work. It informs the **AM destinations** and **PM origins** related to the **new residential dwellings**.
- **The Place of Residence** related to the commercial traffic distribution. It tells us where people who work in this area are driving from and to from home. It informs the **AM origins** and **PM destinations** related to the **new commercial floorspace**.

In addition to this assumed pattern from the *Journey to Work*, the following In and Out splits were assumed for each peak and land use:

- Trips generated by new commercial floorspace are assumed to attract 90% of trips in during the AM Peak, with 10% out, and vice-versa in the PM Peak.
- Trips generated by new residential dwellings are assumed to attract 20% of trips in during the AM Peak, with 80% out, and vice-versa in the PM Peak.

This produced the additional distributed trips to add into the O-D matrix. These trips are aggregated into Town Centre and to Major Route in Table 5 and Table 6 respectively.

Table 5: Total Trips Generated by Floorspace and Dwelling uplift – by Town Centre.

Town Centre	AM		PM	
	IN	OUT	IN	OUT
Kingsford	516	505	505	516
Kensington	281	335	335	281
Total	**796**	**839**	**839**	**796**

Table 6: Total Trips Generated by Floorspace and Dwelling uplift - by Major Route

Major Route	AM		PM	
	IN	OUT	IN	OUT
Anzac Pde North	241	445	445	241
Anzac Pde South	143	121	121	160
High St	41	21	21	43
Rainbow St	41	21	21	43
Gardeners Rd	163	140	140	183
Bunnerong Rd	167	91	91	179

4.3 Re-determining O-D Matrices and Paths

With the new trips in place and an altered road network, the previous static assignment of the subnetwork was not a valid starting point for the project meso-DUE simulation. A static assignment was run on the new project model to generate a valid set of static paths, which converged successfully:

- To 0.065% in 34 iterations for the AM Peak; and
- To 0.099% in 27 iterations for the PM Peak.

With the paths from this static assignment as a starting point, the meso-DUE was run on the project subnetwork model, converging to:

- 5% in 100 iterations for the AM Peak; and
- 2% in 100 iterations for the PM Peak.

5 Modelling Results

Following the establishment of both models and their convergence, the results of the Do Nothing and Project subnetworks were compared from the mesoscopic DUE simulation. The comparison is largely undertaken through:

- The simulated flows on links around the Anzac Parade Corridor;
- Similarly, the simulated delay time on links;
- The approach Level of Service (LoS) at selected intersections; and
- The overall intersection LoS of selected intersections.

To investigate the first two, screenshots of the Aimsun model showing flow and delay time within Kensington and Kingsford Town Centres are presented in Figure 10 through Figure 17, with commentary. Approach Level of Service and Intersection Level of Service were investigated for the following intersections within the Kensington:

- Anzac Parade / Boronia Street;
- Anzac Parade / Bowral Street / Duke Street;
- Anzac Parade / Todman Avenue;
- Anzac Parade / Addison Road; and
- Anzac Parade / Doncaster Avenue.

While the following intersections were investigated in the Kingsford Area:

- Anzac Parade / Barker Street;
- Anzac Parade / Middle Street / Strachan Street;
- Anzac Parade / Meeks Street / Borrodale Road; and
- Anzac Parade / Gardeners Road / Rainbow Street.

These levels of service are determined by the average delay time as shown in Table 7 (as per the *RMS Modelling Guidelines 2013, Table 14.3)*. The intersection Level of Service from the model is summarised in Table 8 with further detail in Appendix A and commentary below.

In short, looking at the intersection levels of service, it appears that the proposal generally has a small impact on intersection performance at this high level. Levels of service are mostly maintained while average delays worsen marginally, with the exception of:

- Anzac Parade / Todman Avenue during the AM Peak where it worsens from LoS E to LoS F, although the average delay difference is a matter of 11.2s;
- Anzac Parade / Barker Street during the AM Peak, where performance worsens from LoS C to LoS D, with an average delay difference of 9s.
- Anzac Parade / Meeks St / Borrodale St during the AM Peak, where it worsens from LoS B to LoS C, with an average delay difference of 4s.

Small deviations (whether they worsen or improve performance) at both the intersection level and the approach level are likely due to model variability and some traffic rerouting during the dynamic user equilibrium.

Table 7: Level of Service thresholds
Source: RMS Modelling Guidelines (2013), Table 14.3 pg. 199.

Level of Service	Average Delay Threshold
A	<14 seconds
B	<28 seconds
C	< 42 seconds
D	< 56 seconds
E	< 72 seconds
F	> 72 seconds

Table 8: Intersection Performance Summary (Level of Service)

Intersection	AM				PM			
	Do Nothing		Project		Do Nothing		Project	
Anzac Pde / Boronia St	0.7	A	1.2	A	0.9	A	1.2	A
Anzac Pde / Goodwood St	0.6	A	0.9	A	0.7	A	0.8	A
Anzac Pde / Ascot St	0.3	A	0.1	A	0.2	A	0.3	A
Anzac Pde / Bowral St	3.8	A	3.7	A	4.0	A	4.2	A
Anzac Pde / Todman Ave	65.8	E	77.0	F	45.5	D	47.4	D
Anzac Pde / Addison Rd	4.6	A	4.1	A	5.0	A	4.5	A
Anzac Pde / Doncaster Ave	14.1	B	15.3	B	14.1	B	15.4	B
Anzac Pde / Barker St	38.2	C	47.2	D	30.7	C	32.4	C
Anzac Pde / Middle St	22.0	B	24.9	B	16.9	B	20.5	B
Anzac Pde / Meeks St / Borrodale Rd	24.5	B	28.5	C	25.7	B	20.5	B
Anzac Pde / Gardeners Rd	15.2	B	14.2	B	15.3	B	14.2	B

5.1 Kingsford Town Centre Results Comparison

Kingsford: AM Peak

Figure 10: AM Flow Comparison, Kingsford Town Centre

The closure of Meeks Street causes rerouting away from Meeks Street and Borrodale Road, mostly onto Rainbow Street and Barker Street. Backstreets within Kingsford (such as Forsyth Street and Willis Street) also experience growth due to this, but their volumes remain low. Some rerouting occurs in the northeastern corner of Figure 10, although this is not substantial. The addition of 1020 vehicles from the proposed commercial floorspace and residential dwellings can also be seen in a marginal overall increase in flows.

Figure 11: AM Simulated Delay by Approach Comparison (Kingsford Town Centre)

There appears to be marginal impacts on delay time throughout the local Kingsford network, excepting:

- A worsening of delay time on the western Approach of Anzac Parade / Barker Street, moving the delay time from 56 seconds to 173.7 seconds and the approach Level of Service from LoS D to Los F;
- The eastern approach of Anzac Parade / Barker Street, moving from an average delay of 79.8 seconds (LoS F) to 115 seconds (LoS F);
- The western approach of Anzac Parade / Middle Street (Strachan Street), where delay has worsened from 78.2 seconds (LoS F) remaining LoS F at 79.4 seconds;
- The eastern approach of Anzac Parade / Middle Street, where delay has worsened from 37.3 seconds (LoS C) to 74.2 seconds (LoS F)
- The western approach of Anzac Parade / Meeks Street from 80.1 seconds (LoS F) to 109.1 seconds (LoS F),.

The majority of the Kingsford local road network at least one block back from Anzac Parade experiences minimal delay times, while delays along Anzac Parade remain satisfactory. The impacts of the rerouting and development under this analysis are experienced on the minor approaches onto Anzac Parade, likely due to the unchanged signals; there may be room in reality and in another analysis for more time to be afforded to these minor roads to improve their performance. The overall level of service for these intersections indicate that there may be a little rebalancing towards the minor roads available. Outside of signal adaptation, this congestion may also self-mitigate via drivers re-routing,or (desirably) mode-switching to the new light rail along the corridor.

Kingsford: PM Peak

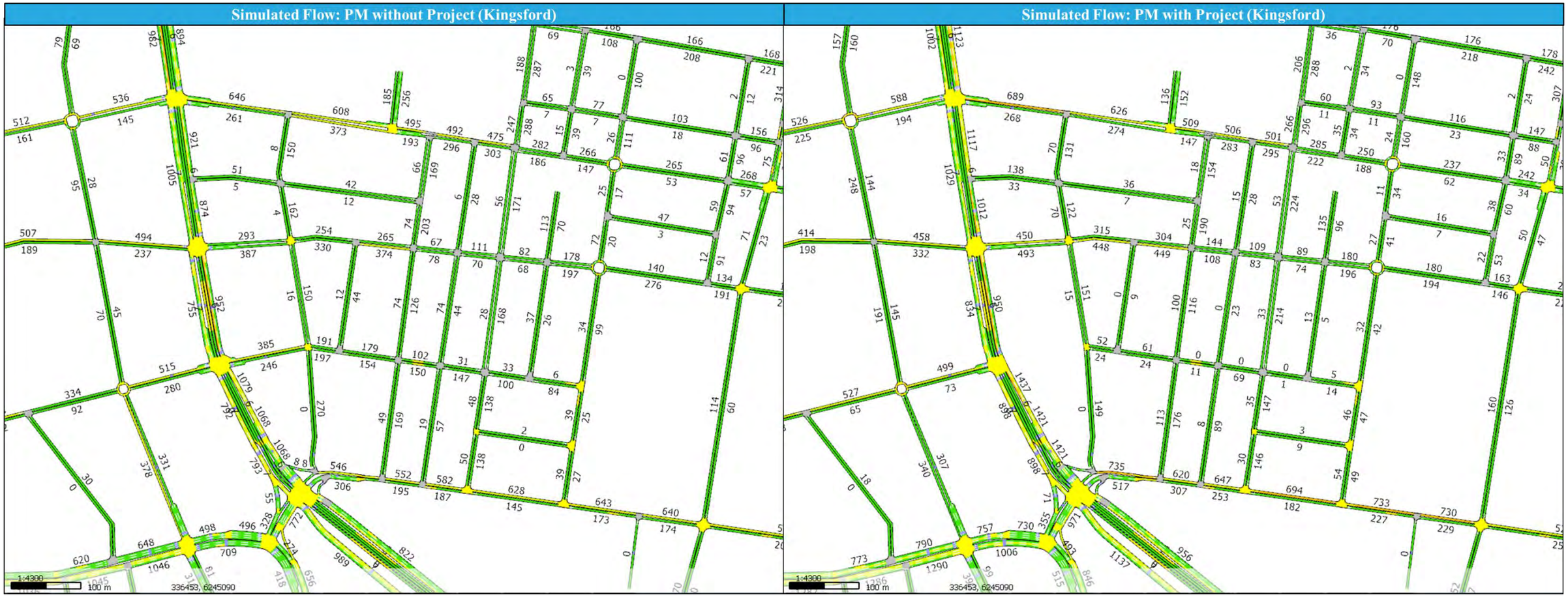

Figure 12: AM Simulation Flow Comparison (Kingsford Town Centre)

As in the AM Peak, flows on the remainder of Meeks Street drop (although Borrodale Road's volumes are almost maintained), while vehicles reroute to Barker Street, Middle Street, Strachan Street and Rainbow Street. Volumes change on Forsyth Street, Willis Street and in the northeastern corner of Figure 12, but remain small. Traffic from new floorspace is perceptible in some overall volume growth.

Figure 13: PM Simulated Delay Time Comparison (Kingsford Town Centre)

The PM model performs slightly better than the AM model in this area overall and at key locations. As in the AM, the road network performance is largely maintained, with some notable impacts:

- The eastern approach of Barker Street worsens from 46.6 seconds average delay (LoS C) to 78.4 seconds (LoS F);
- Middle Street eastern approach worsens from 31.8 seconds (LoS C) to 63.7 seconds (LoS E);
- Borrodale Road western approach improves from an average delay of 71.3 seconds (LoS E, almost F) to 51.8 seconds (LoS C, almost D).

Again, the local road network not immediately on Anzac Parade largely experiences little delay, with the levels of service along Anzac Parade maintained at satisfactory levels.

The projected large delays mean that congestion is expected on minor approaches to Anzac Parade, while travel along the corridor is not substantially impeded. This is likely due to the lack of change in signal timings and, as mentioned in the AM Peak assessment of Kingsford Town Centre, may be ameliorated by changed signal timings. This congestion may also self-mitigate via drivers re-routing on a larger scale, or (desirably) mode-switching to the new light rail along the corridor.

5.2 Kensington Town Centre Results Comparison

Kensington: AM Peak

With the closure of the Duke Street and Bowral Street at Anzac Parade, a small amount of re-routing occurs. However, Duke Street is a left-in one-way street, and Bowral Street is particularly minor, so detours are relatively small; according to the modelling, the volumes on Bowral Street relocate to Todman Avenue, Ascot Street and Goodwood Street.

The addition of 609 trips from the proposed commercial floorspace and residential dwellings (mostly onto Boronia Street, Doncaster Street and Addison Road) in conjunction with the small rerouting, produces notable flow increases at:

- The eastern approach of Anzac Parade / Todman Avenue;
- Doncaster Avenue, south of Todman Avenue;
- Kensington Road, either side of Todman Avenue;
- Certain sections of Roma Avenue and Cottenham Avenue; and
- Anzac Parade in general.

The other local roads maintain relatively low flows.

Figure 14: AM Simulated Flow Comparison (Kensington Town Centre)

In light of the above flow increases, the following notable changes or issues in performance are projected in the AM Peak:

- Anzac Parade / Todman Avenue overall performs at LoS E in the existing case, moving to LoS F under project conditions. Detailed changes in the approaches include:
  - The western approach changes little, maintaining poor performance well into LoS F;
  - The southern approach of Anzac worsens from Los E (64.9 seconds average delay) to LoS F (92.4 seconds)
  - The eastern approach of Todman Avenue worsens from 29.6 seconds (LoS C) to 38.8 seconds (Los C)
  - The northern approach worsens from 49.9 seconds (LoS D) to 57.9 seconds (LosS D)
- Not visible in Figure 15, but the Southern approach (Doncaster Avenue) of Anzac Parade / Doncaster Avenue worsens from 39.37 seconds (Los C) to 45.6 seconds (LoS D), although the intersection maintains Los B overall.

Most other changes in delay are negligible, or remain well within acceptable delays. Notably, most of Anzac Parade and local streets not directly adjacent continue to experience low delays. This includes the northern end of Doncaster Avenue, which experiences a small amount of overall growth.

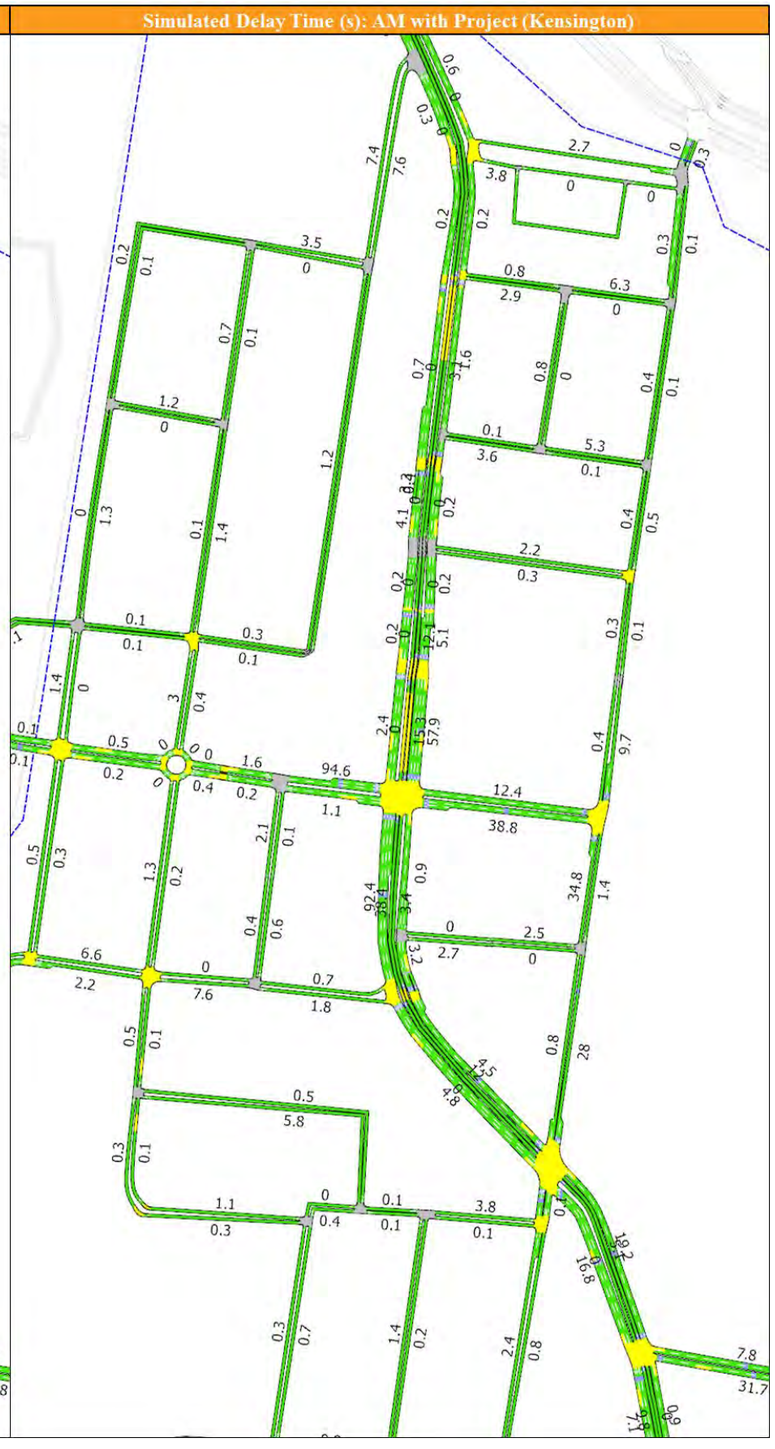

Figure 15: AM Simulated Delay Time Comparison (Kensington Town Centre)

Kensington: PM Peak

Flow growth patterns in the PM Peak are similar to those in the AM Peak, that is growth is projected on:

- The eastern approach of Anzac Parade / Todman Avenue;
- Doncaster Avenue, south of Todman Avenue;
- Kensington Road, either side of Todman Avenue;
- Certain sections of Roma Avenue and Cottenham Avenue; and
- Anzac Parade in general.

The increases on Doncaster Avenue and Anzac Parade are larger than in the AM Peak, however, the intersection remains at LoS B.

Figure 16: PM Simulated Flow Comparison (Kensington Town Centre)

The PM model performs slightly better than the AM Peak in the Do Nothing case, and delays projected by that case are quite reliably maintained or slightly worsened in the Project case. Although performance may not be ideal in the Do Nothing case (with various Los D approaches), it is to be expected on an urban corridor such as Anzac Parade. The impact of rerouting and development related traffic growth in the project case is considered minimal, as no approach worsens perceptibly and no approach reaches Los E or Los F. As previously, the local road network experiences little induced delay outside of Anzac Parade and Todman Avenue.

Figure 17: PM Simulated Delay Time Comparison (Kensington Town Centre)

5.3 Further Intersection Upgrades

Following the initial modelling, two intersection upgrades were considered, namely:

- At Anzac Parade / Todman Avenue: adding a short right turn lane to the western approach, allowing a dedicated through lane on that approach; and
- At Anzac Parade / Barker Street: adding a short through-and-left lane to the eastern approach, allowing a dedicated through lane on that approach.

The additional lanes and altered lane discipline of these approaches are shown in Figure 18 and Figure 19.

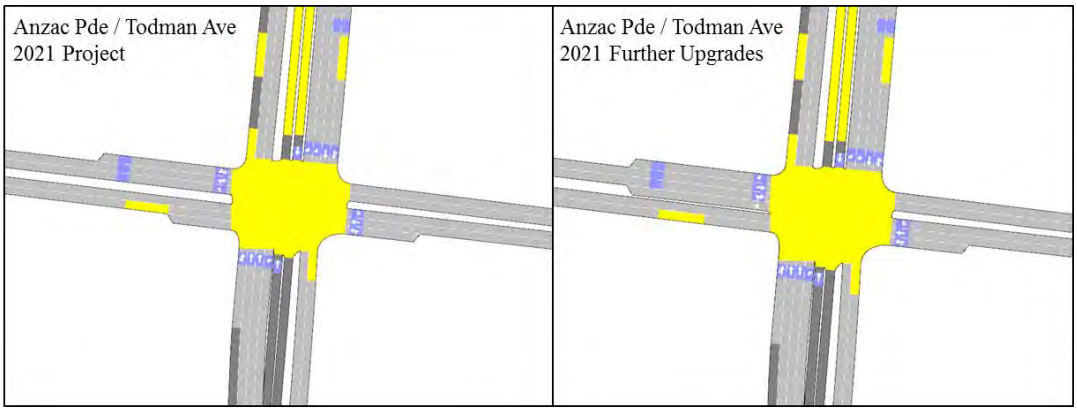

Figure 18: Anzac Parade / Todman Avenue Intersection Upgrade

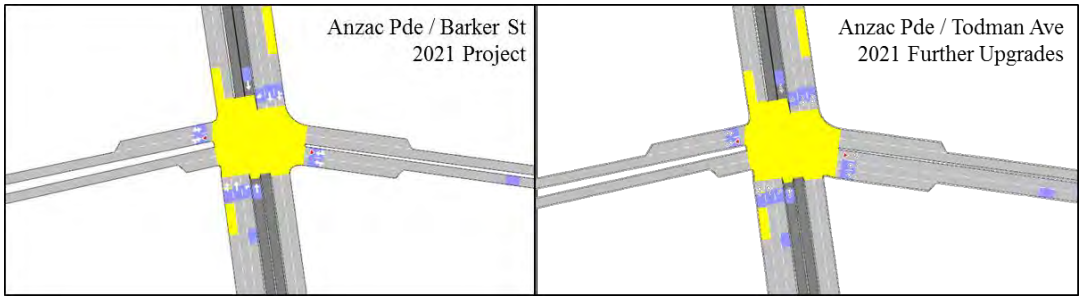

Figure 19: Anzac Parade / Barker Street Intersection Upgrade

These upgrades were modelled mesoscopically within the established subnetwork for comparison with the previous analysis, noting the following:

- Signal times were unchanged between the Project case and Further Upgrades;
- The static assignment was re-run for the Further Upgrades case, accounting for the expected change in route choice induced by the upgraded capacity.
    - This caused some re-routing between Barker Street and Middle Street; the performance of Anzac Pde / Middle St is also shown
    - Apparent “inconsistencies” in volumes between the two cases are likely due to the revised route choice.
- Short Lane lengths were assumed in light of existing short lane length and a minimised land-take:

  - The proposed right-turn bay at Anzac Parade / Todman Avenue was assumed to be the same length as the existing left turn bay there; and
  - The proposed left turn-bay at Anzac Parade / Barker Street is the same length as the existing left-turn bay.
- The mesoscopic simulaton has limitations in evaluating detailed geometry, especially in relation to queue stacking. As a result, the results do not infer on the required length of turn bays, or any other detailed geometry. These results are only intended to infer the benefit of added lanes and changed lane discipline.

Results of this comparison for the altered intersections are shown in Table 9.

Table 9: Further Intersection Upgrades Intersection Performance comparison.

Intersection	AM				PM			
	Project		Further Upgrades		Project		Further Upgrades	
	Delay (secs)	LoS	Delay (secs)	LoS	Delay (secs)	LoS	Delay (secs)	LoS
Anzac Pde / Todman Ave	77.0	F	67.3	E	47.4	D	45.7	D
Anzac Pde / Barker St	47.2	D	45.9	D	32.4	C	30.4	C
Anzac Pde / Middle St	24.9	B	23.3	B	20.5	B	17.4	B

At the overall intersection level, there are some decreases in average delay indicating marginally increased efficiency with the upgrades. The results presented for each approach are shown in Appendix B. The notable performance improvements in the AM include:

- The changes at Todman Avenue drop the average delay on the western and southern approaches from 92.4s and 94.6s to 73.3s and 78.2s respectively
- The western approach of Todman Avenue services an extra 200 vehicles (~800 vehicles in the project, ~1000 vehicles with further upgrade);
- The average delay on the other approaches of Todman Avenue remain approximately similar;
- The changes at Barker Street drop the average delay of the eastern approach from 173.7s to 104.5s. Although this remains LoS F, the performance;
- The average delay on the other approaches of Barker Street remain approximately similar.

In the PM the notable performance improvements include:

- The changes at Todman Avenue maginally drop the average delay on the western and southern approaches from 50.9s and 47.2s to 49s and 43.1s, respectively;
- The average delay on the other approaches of Todman Avenue remain approximately similar;
- The changes at Barker Street drop the average delay of the eastern approach from 78.4s (LoS F) to 44.4s (LoS D)
- The average delay on the other approaches of Barker Street remain approximately similar.

In both peak hours, the proposed further upgrades appear to improve the major movements on the western approach of Todman Avenue and eastern approach of Barker Street. This includes a reduction in average delay for those approaches and in some cases an increase in serviced traffic volumes. The end effect of those upgrades is slightly improved ease of access onto Anzac Parade along with a marginal gain in overall intersection efficiency.

6 Conclusion

The impact of the proposed road closures and new floorspace has been assessed and generally found to be acceptable at an intersection level, as the difference between Do Nothing and Project case is not large. The PM model generally presents acceptable results in both existing and project, with the exception of some side road approaches in Kingsford projected to experience LoS F and LoS E in the project case.

Existing performance in the AM model is substantially poorer than the PM, with various existing approaches experiencing LoS F and LoS E. This worsens marginally in the project case, with Anzac Parade / Todman Avenue and Anzac Parade / Barker Street moving to Los F and LoS D, respectively. More generally, the model indicates that some minor approaches at Anzac Parade intersections within Kingsford will operate poorly at LoS F, and gaining access to Anzac Parade may be difficult. The real response to this potential difficulty is (a desirable) mode-switch away to public transport including the new Light Rail running through the precinct, or more inventive re-routing through the precinct. Both of these outcomes might ameliorate the projected failures into “congested, but functional” territory.

Further assessment of two potential geometric upgrades at Anzac Parade / Todman Avenue and Anzac Parade / Barker Street indicated that some slight efficiencies could be gained at these two intersections overall. The benefits to individual minor approaches to Anzac Parade were more substantial, but continued to operate poorly.

There are various limitations to the assessment of the corridor under the current modelling methodology. No changes to signal phasing were incorporated in the project model; the overall intersection performance in most cases indicates that signal optimisation with the future intersection layouts (as currently planned and modelled in the SLR model) may be possible. It may be possible to more evenly balance signal timing between the co-ordination of the Anzac Parade corridor with the minor approaches, making the corridor more accessible from side-streets.

Appendix A

Modelling results for base + project cases

A1 AM Peak Base and Project Performance Comparison by Approach

Intersection Performance Comparison: AM													
Intersection	Approach	2021 Base						2021 Project					
		Volume	Delay Time	LoS	∑ Volume	Delay Time	LoS	Volume	Delay Time	Los	∑ Volume	Delay Time	LoS
Anzac Parade / Boronia St	N	892	0.3	A	2278	0.7	A	1167	0.6	A	2969	1.8	A
	SE	1022	0.3	A				1226	0.3	A			
	S	364	3.1	A				576	7.4	A			
	W	-	-					-	-				
Anzac Parade / Goodwood St	N	900	1.2	A	1994	0.6	A	1222	1.6	A	2551	0.9	A
	E	71	2.7	A				103	3.6	A			
	S	1023	0	A				1226	0.0	A			
	W												
Anzac Parade / Ascot St	N	897	0.3	A	1938	0.3	A	1194	0.2	A	2468	0.1	A
	E	18	0.9	A				48	0.3	A			
	S	1023	0.2	A				1226	0.0	A			
	W												
Anzac Parade / Bowral St / Duke St	N	855	4.9	A	2122	3.8	A	1172	5.1	A	2398	3.7	A
	E	169	0.4	A				-	-				
	S	1098	3.5	A				1226	2.4	A			
	W	-	-					-	-				
Anzac Parade / Todman Avenue	N	956	49.9	D	3064	65.8	E	1180	57.9	E	3497	77.0	F
	E	122	29.6	C				276	38.8	C			
	S	1165	64.9	E				1230	92.4	F			
	W	821	91	F				811	94.6	F			
Anzac Parade / Addison Road	N	1060	4.5	A	2562	4.6	A	1348	3.6	A	2900	4.1	A
	E	-	-					-	-				
	S	1378	5.1	A				1469	4.8	A			
	W	124	0.7	A				83	0.7	A			
Anzac Parade / Doncaster Avenue	N	104	26.2	B	2954	14.1	B	165	28.0	C	3520	15.3	B
	E	1311	16.1	B				1484	16.8	B			
	S	328	39.37	C				383	45.6	D			
	W	1211	4	A				1488	4.5	A			
Anzac Parade / Barker Street	N	594	25.6	B	2514	38.2	C	848	23.0	B	3086	47.2	D
	E	102	56	E				89	173.7	F			
	S	1291	25.6	B				1610	30.3	C			
	W	527	79.6	F				539	115.0	F			
Anzac Parade / Middle St	N	577	2.6	A	2497	22.0	B	798	2.7	A	3003	24.9	B
	E	187	37.3	C				348	74.8	F			
	S	1205	4.2	A				1324	3.3	A			
	W	528	78.2	F				533	79.4	F			
Anzac Parade / Meeks St	N	666	7.5	A	2413	24.5	B	749	10.2	A	2538	28.5	C
	E	171	29.4	C				-	-				
	S	1167	14	B				1359	13.1	A			
	W	409	80.1	F				430	109.1	F			
Anzac Parade / Gardeners Road	N	862	9.358399	A	2857	15.2	B	1164	6.9	A	3572	14.2	B
	E	182	27.8111	B				307	24.7	B			
	S	1447	13.3	A				1697	14.0	B			
	W	366	29.82721	C				404	28.4	C			

A2 PM Peak Base and Project Performance Comparison by Approach

Intersection Performance Comparison: PM													
Intersection	2021 Base							2021 Project					
	Approach	Volume	Delay Time	Los	∑ Volume	Delay Time	LoS	Volume	Delay Time	Los	∑ Volume	Delay Time	LoS
Anzac Parade / Boronia St	N	1269	0.8	A	2309	0.9	A	1727	1.2	A	3007	1.2	A
	SE	771	0.2	A				943	0.3	A			
	S	269	3.1	A				337	3.7	A			
	W	-	-					-	-				
Anzac Parade / Goodwood St	N	1079	1.2	A	1904	0.7	A	1446	1.3	A	2449	0.8	A
	E	54	1.1	A				60	3.2	A			
	S	771	0	A				943	0	A			
	W												
Anzac Parade / Ascot St	N	995	0.2	A	1766	0.2	A	1222	0.3	A	2190	0.3	A
	E	0	0	A				25	0.1	A			
	S	771	0.2	A				943	0.2	A			
	W												
Anzac Parade / Bowral St / Duke St	N	950	5.4	A	1962	4.0	A	1176	5.7	A	2119	4.2	A
	E	127	0.2	A				-	-				
	S	885	3	A				943	2.4	A			
	W	-	-					-	-				
Anzac Parade / Todman Avenue	N	1003	41.7	C	2024	45.5	D	1116	46.8	D	2380	47.4	D
	E	167	32.6	C				291	39	C			
	S	854	49.5	D				973	50.9	D			
	W	809	48.6	D				777	47.2	D			
Anzac Parade / Addison Road	N	1148	3.9	A	2558	5.0	A	1360	3.37	A	2768	4.5	A
	E	-	-					-	-				
	S	1410	6	A				1408	5.8	A			
	W	49	0.4	A				71	0.7	A			
Anzac Parade / Doncaster Avenue	N	210	31.2	C	1834	14.1	B	381	34.1	C	2093	15.4	B
	SE	1451	16.8	B				1438	17.4	B			
	S	173	37.08	C				274	30.16	C			
	NW	1249	5	A				1478	5.8	A			
Anzac Parade / Barker Street	N	894	27.2	B	2160	30.7	C	1123	27.5	B	2420	32.4	C
	E	261	46.6	D				268	78.4	F			
	S	1005	21.2	B				1029	22	B			
	W	536	46.8	D				588	39.1	C			
Anzac Parade / Middle St	N	874	3	A	2016	16.9	B	1012	2.7	A	2339	20.5	B
	E	387	31.8	C				493	63.7	E			
	S	755	3.1	A				834	2.3	A			
	W	494	50.9	D				458	46.7	D			
Anzac Parade / Meeks St	N	952	11.5	A	1990	25.7	B	950	13	A	1848	20.5	B
	E	246	29.3	C				-	-				
	S	792	12.1	A				898	11.1	A			
	W	515	71.3	F				499	51.8	D			
Anzac Parade / Gardeners Road	N	1068	9.441086	A	2362	15.3	B	1421	7.278213	A	3071	14.2	B
	E	305	31.72967	C				513	29.23345	C			
	S	989	12	A				1137	11.6	A			
	W	324	28.9638	C				351	28.28632	C			

Appendix B

Modelling results for further road upgrades

B1 AM Peak Project and Further Upgrades Performance Comparison by Approach

Intersection Performance Comparison: AM													
Intersection	Approach	2021 Project						2021 Project + Further Upgrades					
		Volume	Delay Time	Los	∑ Volume	Delay Time	LoS	Volume	Delay Time	Los	∑ Volume	Delay Time	LoS
Anzac Parade / Todman Avenue	N	1180	57.9	E	3497	77.0	F	1195	58.8	E	3612	67.3	E
	E	276	38.8	C				261	37.5	C			
	S	1230	92.4	F				1151	73.3	F			
	W	811	94.6	F				1005	78.2	F			
Anzac Parade / Barker Street	N	848	23.0	B	3086	47.2	D	849	23.0	B	3085	45.9	D
	E	89	173.7	F				247	104.5	F			
	S	1610	30.3	C				1477	29.2	C			
	W	539	115.0	F				512	103.8	F			
Anzac Parade / Middle St	N	798	2.7	A	3003	24.9	B	776	2.4	A	2900	23.3	B
	E	348	74.8	F				255	50.9	D			
	S	1324	3.3	A				1316	3.7	A			
	W	533	79.4	F				553	86.6	F			

B2 PM Peak Project and Further Upgrades Performance Comparison by Approach

Intersection Performance Comparison: PM													
Intersection	2021 Base	2021 Project						2021 Project + Council Upgrades					
	Approach	Volume	Delay Time	Los	∑ Volume	Delay Time	LoS	Volume	Delay Time	Los	∑ Volume	Delay Time	LoS
Anzac Parade / Todman Avenue	N	1116	46.8	D	2380	47.4	D	1155	46.8	D	2418	45.7	D
	E	291	39	C				296	38.9	C			
	S	973	50.9	D				967	49	D			
	W	777	47.2	D				882	43.1	D			
Anzac Parade / Barker Street	N	1123	27.5	B	2420	32.4	C	1148	27.7	B	2650	30.4	C
	E	268	78.4	F				435	44.4	D			
	S	1029	22	B				1067	21.4	B			
	W	588	39.1	C				497	44	D			
Anzac Parade / Middle St	N	1012	2.7	A	2339	20.5	B	1011	2.7	A	2263	17.4	B
	E	493	63.7	E				405	51.5	D			
	S	834	2.3	A				847	2.4	A			
	W	458	46.7	D				532	43.1	D			