

Charing Cross Streetscape Upgrade

Review of Environmental Factors

Prepared for: Waverley Council

26 October 2023



I certify that I have reviewed and endorsed the contents of this REF document and, to the best of my knowledge, it is in accordance with the EP&A Act, the EP&A Regulation and the Guidelines approved under clause 170 of the EP&A Regulation, and the information it contains is neither false nor misleading”..



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26th October 2023

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Executive summary

Purpose

This REF summarises the assessment of the potential environmental impacts of the Charing Cross Streetscape Upgrade proposal. Council (as the determining authority) will consider the findings of the REF as part of the determination process.

The existing site

The Charing Cross Village Centre is located within the Waverley LGA. It is about seven kilometres from the Sydney Central Business District (CBD) and 800 metres southeast of Bondi Junction, the closest transport centre.

The site at which the proposal will be undertaken ('the site') is located within the village centre, centred around the six-way intersection of Bronte Road, Carrington Road and Victoria Street. It is located along a section of Bronte Road between Church Street and its intersection with Albion Street. The proposal site also includes a section of Victoria Street and Carrington Road, near the intersection with Bronte Road.

The proposal site is located wholly within public land, within the road reserve for Bronte Road, Victoria Street and Carrington Road, and adjoining by land zoned E1 Local Centre under the Waverley LEP 2012.

Charing Cross is a key southern village centre within Waverley, located along a strip of Bronte Road connecting the eastern beaches, Bondi Junction, Centennial Park and the City. The centre has a diverse range of local shops and services that support the daily needs of residents, workers and visitors who frequent the area. The centre has a major "high street" character, supporting the local commercial strip as well as a major transport route, including servicing up to six different bus routes.

The centre is contained within the Charing Cross Heritage Conservation Area, reflecting the high heritage significance of many buildings and their past function and character.

Challenges

Some key challenges identified by the concept design process included:

- At present the public domain is not particularly well defined, blurring into the adjacent residential areas.
- High through traffic volumes conflict with the centralised commercial nature of the space which impacts local traffic movements causing significant congestion.
- The main street along this part of Bronte Road has a poor sense of arrival.
- Pedestrian safety and convenience for active and public transport modes could be enhanced.

Objectives

The Waverley Village Centres Strategy (2020) identified a vision for the desired future character of Charing Cross Village Centre:

The desired future character of Charing Cross is local, community-minded, historical and safe.

Charing Cross is safely and easily accessible by foot, cycle, and public transport.

The centre is leafy, buzzing and has a range of goods and services to support the local community in day-to-day living.

The strategy also outlines four priority objectives for the renewal of the Charing Cross Village centre. These were identified through a process of community consultation and refinement led by Waverley Council and included the following (refer to section 3.1.1 of this REF for detailed outline of objectives):

- People, Place and Prosperity
- Environment
- Access
- Built form

Design Options

The upgrade options for the Charing Cross Village were developed in the preliminary concept stage of the proposal, all aiming to meet the overall proposal objectives.

These options were further explored with Council at workshop on 12 November 2020.

Option 1 – Basic Upgrade: including trees within the existing footpaths where feasible, upgrade of footpaths and undergrounding of existing overhead power lines.

Option 2 – Green Streets: Constructing kerb buildouts throughout the precinct to accommodate trees between parking spaces, upgrade of pavements and undergrounding of existing overhead power lines.

Option 3 – Extended Public Realm: widening of the existing footpaths by approximately 600 mm to provide additional space for trees and pedestrian movement, upgrading of footpath pavements and undergrounding of existing overhead power lines.

After review of the Options Assessment Report and discussions with Council at the Options Presentation, Council selected Option 3 as their preferred design solution. This concept was then subject to a process of review and refinement.

Key features

The key features of the agreed refined proposal include:

- roadworks, including widening of footpaths and narrowing traffic to improve public amenity and access
- upgraded landscaping, including new street trees
- upgraded street furniture, including new multipoles and upgraded lighting
- new pedestrian crossing
- utility works, including undergrounding of overhead powerlines and improved stormwater infrastructure.

Construction approach

Construction activities are proposed to be split into several phases based on construction activities and expertise / likely sub contractor responsibilities:

- Phase A Power telecoms and Lighting
- Phase B Public Domain Construction Works
- Phase C Planting and finishing works
- Phase D Road re-sheeting works

Council's required construction approach for the main public domain works will be that the works are carried in physical zones that focusses on the general completion of a section of street so that disturbance to any given shop frontage is not drawn out over a longer time frame.

The works will be planned and managed under an approved Construction Environmental Management Plan (CEMP), and a Communications Strategy for managing forward planning and information to the public and businesses.

A detailed series of mitigation strategies is outlined in this REF to be addressed in the ongoing design of the centre and in its construction implementation and management.

Conclusion

This REF considers the potential environmental impacts of the proposal to construct the Charing Cross Streetscape Upgrade. It has been prepared by Environmental Partnership on behalf of Council in accordance with the relevant provisions of the Environmental Planning and Assessment Act 1979 and the Environmental Planning and Assessment Regulation 2021.

In conclusion the proposed activity is not likely to unduly affect the environment, provided the safeguards identified in this report are properly implemented. Therefore, an Environmental Impact Statement (EIS) is not required

Acronyms and Abbreviations Abbreviation	Term
AHIMS	Aboriginal Heritage Information Management System
BC Act	<i>Biodiversity Conservation Act 2016</i>
CBD	Central Business District
CEMP	Construction Environmental Management Plan
CLM Act	<i>Contaminated Land Management Amendment Act 1997 as amended 2008</i>
DCP	Development Control Plan
DPE	Department of Planning and Environment
EPA	NSW Environmental Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPL	Environment protection licence
HCA	Heritage Conservation Area
Transport and Infrastructure SEPP	<i>State Environmental Planning Policy (Transport and Infrastructure) 2021</i>
ISO	International Organization for Standardization
LED	Light emitting diode
LEP	Waverley Local Environmental Plan 2012
LGA	Local Government Area
Heritage NSW	Heritage New South Wales (Office of the Heritage Council of New South Wales, previously also known as the NSW Heritage office, the Heritage Branch, the Heritage Division of the Office of Environment and Heritage—OEH)
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
REF	Review of Environmental Factors
SEPPs	State Environmental Planning Policies
SoHI	Statement of Heritage Impact
SWMP	Soil and Water Management Plan
Waverley DCP	Waverley Development Control Plan 2012
WARR Act	<i>Waste Avoidance and Resource Recovery Act 2001.</i>

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1.0 Introduction

1.1 Overview and background

The Charing Cross Village Centre is located around the intersection of Bronte Road, Victoria Road and Carrington Road in Waverley, which is located in the Waverley local government area (LGA).

Waverley Council (Council) is committing to the objectives and visions defined by the *Our Liveable Places Centres Strategy 2020 – 2036* (Waverley Council, 2020a) ('the Centres Strategy'). The Centres Strategy provides policy recommendations for local and neighbourhood centres within the Waverley LGA, recognising the important role that Waverley's local centres play in providing equitable access to essential services. The strategy provides a shared community vision for the future of the centres to 2036.

As part of the Centres Strategy, Council and the local community identified the following vision for Charing Cross:

- The desired future character of Charing Cross is local, community-minded, historical and safe.
- Charing Cross is safely and easily accessible by foot, cycle, and public transport.
- The centre is leafy, buzzing and has a range of goods and services to support the local community in day-to-day living.

Consistent with this vision and the place-based objectives identified by the Centres Strategy, Council is proposing an upgrade to the streetscape at Charing Cross (the proposal). The proposal will improve the visual amenity and support the heritage character of the area, while improving safety and accessibility for pedestrians and active transport.

Environmental Partnership (NSW) Pty Ltd has been engaged to review and refine as necessary a previous design concept, to assess the potential environmental impacts of the updated proposal and prepare a Review of Environmental Factors (REF) in accordance with Part 5, Division 5.5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.2 Proposed activity

1.2.1 Key features

The key features of the proposed activity include:

- Footpath upgrades including widening of pedestrian areas, additional mid-block pedestrian crossing, and upgrading of southern crossing.
- Roadworks including narrowing vehicle travel lanes, upgraded stormwater drainage and road surfaces.
- Undergrounding of power and telecoms to facilitate tree planting and enhance character.
- Additional street tree planting and new street furniture to improve public amenity and placemaking and encourage people to stay longer in village main street.
- New multi function street lighting poles to reduce clutter of street elements and enhance character.
- Upgrade of Carrington Road signalised intersection to improve pedestrian convenience and enhance public domain amenity.
- Provision of new street furniture including seating and bins along Bronte Road and Victoria Road
- Installing an historic sandstone water trough and metal pump on the pavement within the study area along with modest interpretive signage"
- Providing 3 general interpretation signs within the streetscape and one First Nations focussed interpretive sign

Further information about the proposal and its design features are provided in section 4.1.

1.2.2 Location

The Charing Cross Village Centre is located within the Waverley LGA. It is approximately six kilometres from the Sydney Central Business District (CBD) and 900 metres southeast of Bondi Junction, the closest transport centre. The site at which the proposal would be undertaken ('the site') is located within the village centre, centred around the six-way intersection of Bronte Road, Carrington Road and Victoria Street. It is located along a section of Bronte Road between Oxford Street and Macpherson Street. The proposal site also includes a section of Victoria Street and Carrington Road, near the intersection with Bronte Road (see Figure 1 below). The proposal site is located wholly within public land, within the road reserve for Bronte Road, Victoria Street and Carrington Road. (refer adjoining land tenure - Figure 2 following page)



Figure 1 Location of the proposal

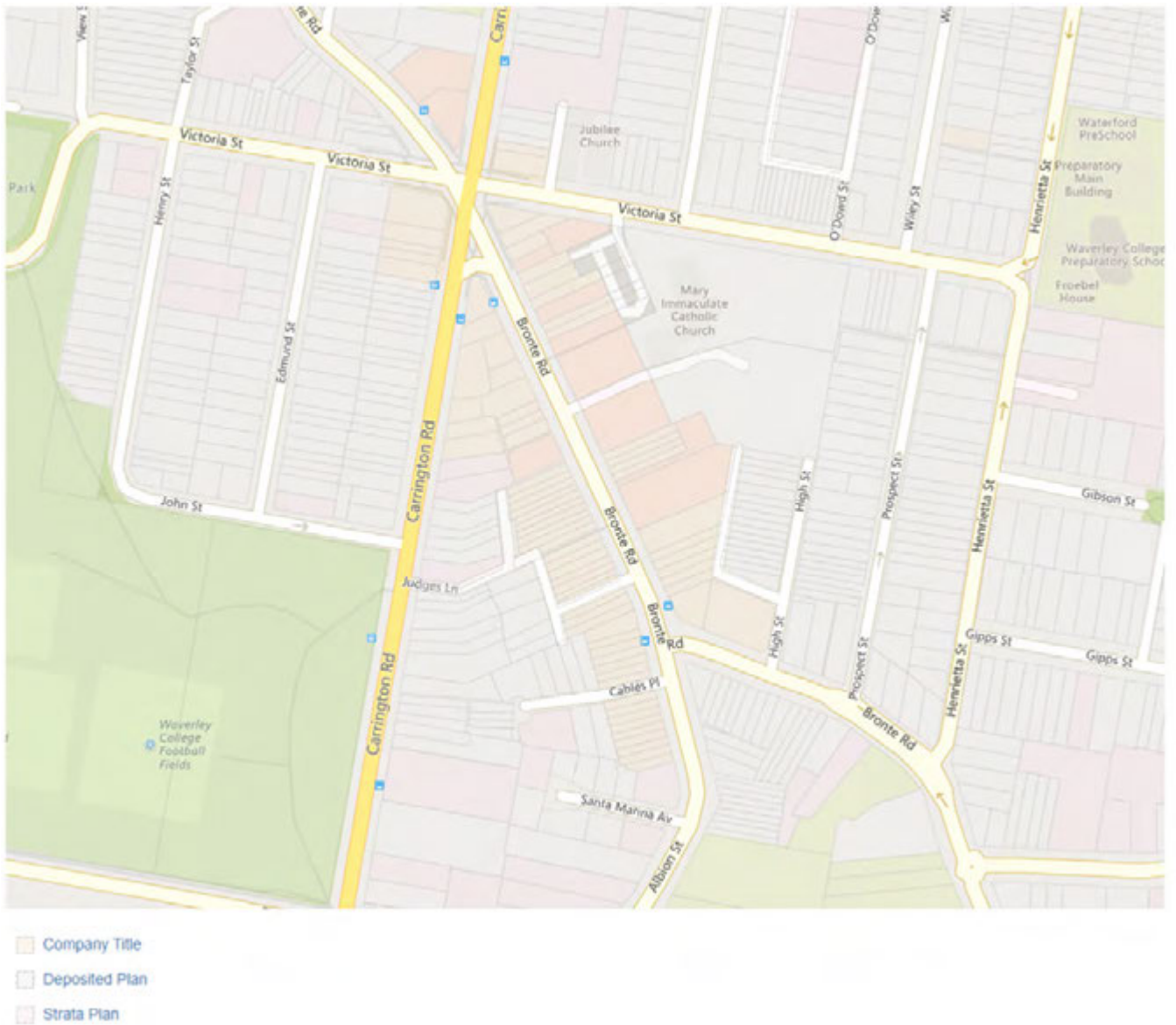


Figure 2 Land tenure in the project area

1.3 Scope and structure of the REF

1.3.1 Scope and purpose of the REF

The proposal is permissible without development consent and is subject to the approval and assessment requirements of Part 5, Division 5.1 of the EP&A Act. For an activity subject to Part 5 of the EP&A Act, section 5.5 of the Act imposes a duty on a determining authority to 'examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity'. Determining authorities make a determination about whether a proposal can proceed, and on what basis. The determining authority is Waverley Council

The purpose of this REF is to summarise the results of the environmental impact assessment for the proposal and provide information about the proposal as an input to the determination process. Council (as the determining authority) will consider the findings of the REF as part of the determination process.

In summary, the REF will assist Council to undertake the following:

- determine whether the proposal should be approved considering all matters affecting or likely to affect the environment (in accordance with section 5.5 of the EP&A Act)
- determine whether the proposal is likely to have a significant effect on the environment or significantly affect threatened species, populations or ecological communities or their habitats
- develop appropriate conditions (based on the mitigation measures within the REF) to be attached to any approval granted.

Clause 171 of the Environmental Planning and Assessment Regulation 2021 (the EP&A Regulation) lists, for the purposes of Part 5 of the EP&A Act, the factors to be taken into account when considering the likely impact of an activity on the environment. 0 of this REF considers the potential impacts of the proposal against these factors.

1.3.2 Methodology

Preparation of the REF has been undertaken over two phases. An initial concept was prepared by a consultancy team, for Council over 2020-2021. A preliminary REF was prepared based on the original concept. The original concept has been subject to review and refinement over May / June 2023, and a subsequent review and finalisation of this version of the REF has also been carried out.

Overall preparation of the REF has involved the following tasks:

- receiving relevant information from Council and the design team.
- site visits, including a site visit and proposal review by a heritage specialist (Artefact Heritage).
- review of consultation information provided by Council.
- undertaking specialist heritage, traffic and transport, and noise and vibration assessments.
- a qualitative desktop assessment of other potential environmental and social impacts, including reviews of existing information and database searches.
- identifying mitigation measures to manage the impacts identified.
- addressing the requirements of Part 5 of the EP&A Act and Clause 171 of the EP&A Regulation.

The REF has been prepared in consultation with relevant stakeholders, including the design team (Environmental Partnership and its collaborative team members), Council, and other relevant technical advisors and Government and Infrastructure agencies. It is noted that although the REF team has consulted with members of the design team to prepare the REF, design personnel have not influenced the methodology or outcomes of the environmental impact assessment process in any way.

1.3.3 Structure of the REF

The structure and content of the REF is summarised in Table 1.

Table 1 *Structure and content of the REF*

Section 1 – Introduction	Provides introductory and background information to the proposal and REF.
Section 2 – Statutory framework	Provides an overview of the statutory requirements for the proposal, including the requirements of relevant environmental planning instruments and legislation.
Section 3 – Strategic context and options considered	Includes background information on why the proposal is needed, its objectives, and the options considered as part of design development.
Section 4 – Description of the proposal	Provides a description of the proposal's key design features and an indicative construction methodology.
Section 5 – Community and stakeholder consultation	Summarises the consultation process undertaken by Council and the key issues raised.
Section 6 – Environmental impact assessment	Describes the key features of the existing environment, assesses the potential environmental impacts of the proposal, and provides measures to mitigate the potential impacts identified.
Section 7 – Environmental management and mitigation	Describes the approach to environmental management, including an outline of the requirements for the proposal's environmental management plan, and a summary of the mitigation measures identified by the REF.
Section 8 – Conclusion	Provides concluding information.
Section 9 – References	Outlines key references used in the preparation of the REF
Section 10 – Appendices	Attachments to the REF

1.3.4 Definitions used

For the purposes of this REF, the following definitions have been applied:

- The 'proposal' refers to the construction and operation of the upgraded Charing Cross Streetscape Upgrade
- The 'site' refers to the site on Bronte Road, Victoria Road and Carrington Road where the proposed streetscape upgrade would be constructed and operated
- The 'study area' consists of public land in the vicinity of, and including, the proposal site. The study area is the wider area surrounding the proposal site, including land that has the potential to be indirectly impacted by the proposal (for example, as a result of any noise impacts).

Other terms are defined in the glossary at the beginning of the REF.

2.0 Statutory framework

This section describes the key approval and assessment requirements for the proposal in accordance with the EP&A Act.

2.1 Approval and assessment requirements under the Environmental Planning and Assessment Act 1979

As outlined in this REF in accordance with *State Environmental Planning Policy (Transport and Infrastructure) 2021* (Transport and Infrastructure SEPP) the proposal is permissible without development consent. As a result, it is subject to the assessment and approval requirements of Part 5 of the EP&A Act. The proposal is not State significant infrastructure and is therefore subject to the requirements of Division 5.1 of the EP&A Act.

Section 5.1 defines a determining authority as '*a Minister or public authority and, in relation to any activity, means the Minister or public authority by or on whose behalf the activity is or is to be carried out or any Minister or public authority whose approval is required in order to enable the activity to be carried out*'. Waverley Council is the determining authority of the proposal.

For Division 5.1 activities, section 5.5(1) of the EP&A Act imposes a duty on a determining authority to '*...examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity*.' This REF has been prepared to satisfy the Waverley Council's obligations as the determining authority under Division 5.1.

Section 5.6 of the EP&A Act provides that the regulations may make provision for or with respect to the exercise by a prescribed determining authority of its functions under section 5.5. Part 8 of the EP&A Regulation 2021 applies to environmental assessment under Part 5 of the EP&A Act. Clause 171 in Part 8 defines the factors to be considered to the likely impact of an activity on the environment. A summary of the results of the assessment of the proposal in accordance with the Clause 171 factors is provided in Appendix A of the REF.

2.2 Environmental planning instruments

The environmental planning instruments that are relevant/potentially relevant to the approval and assessment of the proposal are considered below.

2.2.1 Waverley Local Environmental Plan 2012

The *Waverley Local Environmental Plan 2012* (the Waverley LEP) applies to the proposal site. Land on which the site is located is zoned E1 Local Centre (refer Figure 2 Land Zoning) for which it identifies the following objectives:

- To provide a range of retail, business and community uses that serve the needs of people who live in, work in or visit the area.
- To encourage investment in local commercial development that generates employment opportunities and economic growth.
- To enable residential development that contributes to a vibrant and active local centre and is consistent with the Council's strategic planning for residential development in the area.
- To encourage business, retail, community and other non-residential land uses on the ground floor of buildings.
- To strengthen the viability of Waverley's existing business centres as places of vitality for investment, employment and cultural activity.
- To maximise public transport patronage and encourage walking and cycling.
- To encourage the provision of affordable housing.
- To provide for a range of other uses, including light industrial, that serve the surrounding neighbourhood without impacting on the amenity of the adjoining uses.
- To ensure development is of a height and scale that achieves the desired future character of the neighbourhood.

- To promote employment growth by giving preference to commercial development over residential development.
- To provide active ground floor uses to create vibrant centres.

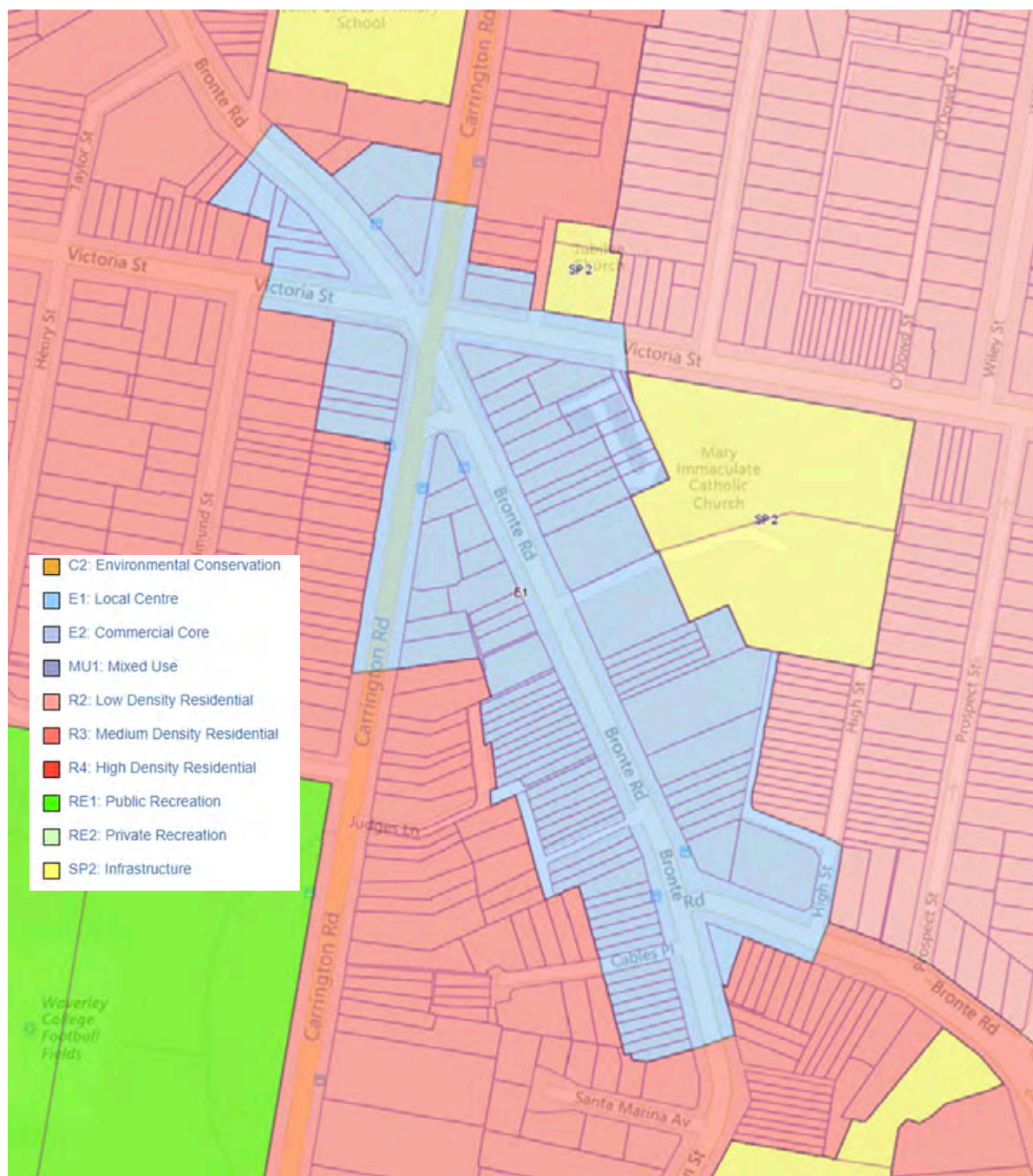


Figure 3 Land zoning – Waverley LEP 2012

Roads, and any other development not specified in items 2 (permitted without consent) and 4 (prohibited) are permitted with consent in the E1 zone. As a result, the proposal is permitted with consent under the LEP. Note that the Waverley LEP also provides that '*...this Plan does not restrict or prohibit, or enable the restriction or prohibition of, the carrying out of any development, by or on behalf of a public authority, that is permitted to be carried out with or without development consent, or that is exempt development, under State Environmental Planning Policy (Transport and Infrastructure) 2021*'.

However as outlined in the project Statement of Heritage Impact (SOHI) prepared by Artefact (September 2023) the subject site is located within the Charing Cross Heritage Conservation Area (HCA), which is listed as an item of local heritage significance (Waverley LEP # C7).

The site is also in close proximity to a further five local heritage items (within 64 metres of the HCA). One adjacent place and one nearby place are listed on the State Heritage Register: Mary Immaculate Church at 2280-282 Bronte Road and 45 Victoria Street (adjacent) and Charing Cross House at 11 Victoria Street (62m west).

Heritage items listed on the Waverley LEP are managed in accordance with the provisions of its Section 5.10, Heritage Conservation. Under Clause 5 of this section of the WLEP it is stated that:

The consent authority may, before granting consent to any development:

- (a) on land on which a heritage item is located, or*
- (b) on land that is within a heritage conservation area, or*
- (c) on land that is within the vicinity of land referred to in paragraph (a) or (b),*

require a heritage management document to be prepared that assesses the extent to which the carrying out of the proposed development would affect the heritage significance of the heritage item or heritage conservation area concerned.

The SOHI assessed the proposal as having no adverse physical impacts on the Charing Cross Heritage Conservation area, nor on the nine heritage places and 25 contributory places adjoining the study area nor on the five heritage items located nearby, but recommended a series of mitigation measures as outlined in this REF (section 6.3.3).

2.2.2 Waverley Development Control Plan 2012

Waverley Council requires development to comply with the guidelines set out in its Development Control Plan (Waverley DCP). The SOHI assessed the proposed works against the additional recommendations made within the Waverley Heritage Inventory Form for the Charing Cross Heritage Conservation Area (HCA) (Appendix B). The DCP guidelines were addressed throughout the heritage assessment and the recommendations incorporated into the design and into the mitigation measures outlined in the REF (section 6.3.3).

2.2.3 State environmental planning policies (SEPPs)

State Environmental Planning Policy (Transport and Infrastructure) 2021

State Environmental Planning Policy (Transport and Infrastructure) 2021 (Transport and Infrastructure SEPP) clarifies the consent arrangements for infrastructure projects. According to clause 2.7 'if there is an inconsistency between this Policy and any other environmental planning instrument, whether made before or after the commencement of this policy, this policy prevails to the extent of the inconsistency'.

Division 17, subdivision 1 of Transport and Infrastructure SEPP applies to roads and road infrastructure facilities.

Clause 2.109(1) of Transport and Infrastructure SEPP provides that 'Development for the purpose of a road or road infrastructure facilities may be carried out by or on behalf of a public authority without consent on any land. The majority of the streetscape upgrade works proposed involve works to and around roads and changes to road infrastructure. Relevantly, Clause 2.109(3)(c) provide that road infrastructure facilities include 'alterations or additions to an existing road (such as widening, narrowing, duplication or reconstruction of lanes, changing the alignment or strengthening of the road)'. The main works proposed as part of the proposal involve alterations and additions to existing roads, including narrowing and reconstruction of lanes.

Some of the proposed works (such as landscaping, installation of street furniture and utility works) meet the definitions of exempt development under Clause 2.113(1). However, in accordance with Clause 2.20(2)(e) of Transport and Infrastructure SEPP, to be classified as exempt development, development that is '*...likely to affect a State or local heritage item or a heritage conservation area, must involve no more than minimal impact on the heritage significance of the item or area*'.

As the proposal has the potential to affect State and local heritage items located along Bronte Road, and is a local heritage conservation area, to consider the upgrade works as a complete package, the proposal is considered to be defined as a whole as 'road infrastructure works', subject to the assessment requirements of Division 5.2 of the EP&A Act.

Clauses 2.10 to 2.14 of Transport and Infrastructure SEPP outline the requirements for consultation with councils and other public authorities for infrastructure development carried out by or on behalf of a public authority. As described in Table 2 the proposal does not trigger any additional consultation requirements, and therefore consultation with other public authorities is not required under the Transport and Infrastructure SEPP. However, relevant agencies have been, and will continue to be, consulted in relation to the proposal. Further details of the consultation process are provided in section 5 of this REF.

Table 2 *Infrastructure SEPP consultation requirements*

Transport and Infrastructure SEPP Clause	Requirements	Relevance to the proposal
2.10 Consultation with councils – development with impacts on council related infrastructure and services	<p>(1) This section applies to development carried out by or on behalf of a public authority that this Chapter provides may be carried out without consent if, in the opinion of the public authority, the development—</p> <p>(a) will have a substantial impact on stormwater management services provided by a council, or</p> <p>(b) is likely to generate traffic to an extent that will strain the capacity of the road system in a local government area, or</p> <p>(c) involves connection to, and a substantial impact on the capacity of, any part of a sewerage system owned by a council, or</p> <p>(d) involves connection to, and use of a substantial volume of water from, any part of a water supply system owned by a council, or</p> <p>(e) involves the installation of a temporary structure on, or the enclosing of, a public place that is under a council's management or control that is likely to cause a disruption to pedestrian or vehicular traffic that is not minor or inconsequential, or</p> <p>(f) involves excavation that is not minor or inconsequential of the surface of, or a footpath adjacent to, a road for which a council is the roads authority under the Roads Act 1993 (if the public authority that is carrying out the development, or on whose behalf it is being carried out, is not responsible for the maintenance of the road or footpath).</p> <p>(2) A public authority, or a person acting on behalf of a public authority, must not carry out development to which this section applies unless the authority or the person has—</p> <p>(a) given written notice of the intention to carry out the development (together with a scope of works) to the council for the area in which the land is located, and</p> <p>(b) taken into consideration any response to the notice that is received from the council within 21 days after the notice is given.</p>	<p>The proposal will involve minor impacts to Council assets, minor to moderate levels of excavation and minor to moderate disruption to pedestrian and vehicular traffic.</p> <p>The Proposal will result in the loss of 6 on street parking spaces to Bronte Road (subject to approval of signalised intersection proposals)</p>
2.11 Consultation with councils – development with impacts on local heritage	<p>(1) This section applies to development carried out by or on behalf of a public authority if the development—</p> <p>(a) is likely to affect the heritage significance of a local heritage item, or of a heritage conservation area, that is not also a State heritage item, in a</p>	<p>The proposal is located within the Charing Cross Heritage Conservation Area, and adjacent to several items of local and state heritage significance. A Statement of Heritage Impact Assessment (SOHI - Appendix C) completed for the proposal determined that the impacts would be minor/inconsequential. A copy of the SOHI has been provided to council for review and comment.</p>

Transport and Infrastructure SEPP Clause	Requirements	Relevance to the proposal
	<p>way that is more than minor or inconsequential, and</p> <p>(b) is development that this Chapter provides may be carried out without consent.</p> <p>(2) A public authority, or a person acting on behalf of a public authority, must not carry out development to which this section applies unless the authority or the person has—</p> <p>(a) had an assessment of the impact prepared, and</p> <p>(b) given written notice of the intention to carry out the development, with a copy of the assessment and a scope of works, to the council for the area in which the heritage item or heritage conservation area (or the relevant part of such an area) is located, and</p> <p>(c) taken into consideration any response to the notice that is received from the council within 21 days after the notice is given.</p>	
2.12 Consultation with councils – development with impacts on flood liable land	<p>(1) In this section, flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in accordance with the principles set out in the manual entitled Floodplain Development Manual: the management of flood liable land published by the New South Wales Government and as in force from time to time.</p> <p>(2) A public authority, or a person acting on behalf of a public authority, must not carry out, on flood liable land, development that this Chapter provides may be carried out without consent and that will change flood patterns other than to a minor extent unless the authority or person has—</p> <p>(a) given written notice of the intention to carry out the development (together with a scope of works) to the council for the area in which the land is located, and</p> <p>(b) taken into consideration any response to the notice that is received from the council within 21 days after the notice is given.</p>	<p>The proposal will not involve development on flood liable land.</p> <p>Drainage design for the street and footways has taken into account existing overland flow patterns and has been designed to accommodate these accordingly</p>
2.13 Consultation with State Emergency Service— development with impacts on flood liable land	<p>(1) A public authority, or a person acting on behalf of a public authority, must not carry out development on flood liable land that may be carried out without development consent under a relevant provision unless the authority or person has—</p> <p>(a) given written notice of the intention to carry out the development (together with a scope of works) to the State Emergency Service, and</p> <p>(b) taken into consideration any response to the notice that is received from the State Emergency Service within 21 days after the notice is given.</p> <p>(2) Any of the following provisions in Part 2.3 is a relevant provision—</p> <p>(a) Division 1 (Air transport facilities),</p>	<p>The proposal will not involve development on flood liable land.</p> <p>Drainage design for the street and footways has taken into account existing overland flow patterns and has been designed to accommodate these accordingly</p>

Transport and Infrastructure SEPP Clause	Requirements	Relevance to the proposal
	<ul style="list-style-type: none"> (b) Division 2 (Correctional centres and correctional complexes), (c) Division 6 (Emergency services facilities and bush fire hazard reduction), (d) Division 10 (Health services facilities), (e) Division 14 (Public administration buildings and buildings of the Crown), (f) Division 15 (Railways), (g) Division 16 (Research and monitoring stations), (h) Division 17 (Roads and traffic), (i) Division 20 (Stormwater management systems). (3) This section does not apply in relation to the carrying out of minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance. (4) In this section, flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in accordance with the principles set out in the manual entitled Floodplain Development Manual: the management of flood liable land published by the New South Wales Government and as in force from time to time. 	
2.14 Consultation with councils—development with impacts on certain land within the coastal zone	<ul style="list-style-type: none"> (1) This section applies to development on land that is within a coastal vulnerability area and is inconsistent with a certified coastal management program that applies to that land. (2) A public authority, or a person acting on behalf of a public authority, must not carry out development to which this section applies, which this Chapter provides may be carried out without development consent, unless the authority or person has— <ul style="list-style-type: none"> (a) given written notice of the intention to carry out the development to the council for the local government area in which the land is located, and (b) taken into consideration any response to the notice that is received from the council within 21 days after the notice is given. (3) In this section— <ul style="list-style-type: none"> certified coastal management program has the same meaning as in State Environmental Planning Policy (Coastal Management) 2018. coastal vulnerability area has the same meaning as in the Coastal Management Act 2016. 	The proposal will not involve development land within the coastal zone
2.15 Consultation with public authorities other than councils	<ul style="list-style-type: none"> (1) A public authority, or a person acting on behalf of a public authority, must not carry out specified development that this Chapter provides may be carried out without consent unless the authority or person has— <ul style="list-style-type: none"> (a) given written notice of the intention to carry out the development (together with a scope of 	No consultation with public authorities other than Council is required for the proposal.

Transport and Infrastructure SEPP Clause	Requirements	Relevance to the proposal
	<p>works) to the specified authority in relation to the development, and</p> <p>(b) taken into consideration any response to the notice that is received from that authority within 21 days after the notice is given.</p> <p>(2) For the purposes of subsection (1), the following development is specified development and the following authorities are specified authorities in relation to that development—</p> <p>(a) development adjacent to land reserved under the National Parks and Wildlife Act 1974 or to land acquired under Part 11 of that Act—the Office of Environment and Heritage,</p> <p>(b) development on land in Zone C1 National Parks and Nature Reserves or in a land use zone that is equivalent to that zone, other than land reserved under the National Parks and Wildlife Act 1974—the Office of Environment and Heritage,</p> <p>(c) development comprising a fixed or floating structure in or over navigable waters—Transport for NSW,</p> <p>(d) development that may increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map—the Director of the Observatory,</p> <p>—</p>	

State Environmental Planning Policy (Planning Systems) 2021

Section 5.12(2) of the EP&A Act provides that a State environmental Planning Policy may declare any development, or any class or description of development, to be State significant infrastructure.

The Planning Systems SEPP provides definitions of State significant infrastructure. The proposal is not considered to meet any of the definitions of State significant infrastructure provided in the SEPP.

2.3 Other legislative considerations

2.3.1 NSW legislation

Other environmental legislation that is directly relevant to the approval and/or assessment of the proposal is considered in Table 3.

Table 3 Other relevant NSW legislation

Act	Potential approval/assessment requirement	Relevance to the proposal
Biodiversity Conservation Act 2016 (BC Act)	The BC Act provides for the listing of threatened species (Schedule 1) and communities (Schedule 2), establishes a framework to avoid, minimise and offset the impacts of proposed development.	Threatened biota recorded or likely to occur in the study area is discussed in section 6.8.1. The proposal would not have a significant impact on threatened biota listed under the BC Act.
Contaminated Land Management Act 1997 (CLM Act)	The CLM Act establishes a process for investigating and (where appropriate) remediating land that the EPA considers to be contaminated significantly enough to require regulation.	There is no known contamination present on the proposed project site. If finds are made during the course of the works these will be investigated and addressed in accordance with the requirements of the CLM Act.
Heritage Act 1977	<p>Approval under section 57(1) for works to a place, building, work, relic, moveable object, precinct, or land listed on the State Heritage Register. The form of the application for approval is specified by section 60.</p> <p>An excavation permit is required under sections 139(1) and (2) to disturb or excavate any land containing or likely to contain a relic. The form of the application for a permit is specified by section 140.</p>	<p>The proposal is not located within the curtilage of a State heritage listed item and does not involve works as defined by clause 57(1). The works would not disturb or excavate any land containing or likely to contain a relic. As a result, approval under section 57(1) or an excavation permit is not required.</p> <p>However, the proposal site is located adjacent Mary Immaculate Church, which is listed on the State Heritage Register. The potential impacts on this item have been assessed (see section 6.3 and 0) and measures are provided to minimise any potential impacts.</p>
Roads Act 1993	Approval under section 138 for works in, on or over a public road.	<p>Clause 5(1) of Schedule 2 provides that a public authority is not required to obtain a roads authority's consent for the exercise of the authority's functions in, on or over an unclassified road.</p> <p>As the proposal involves works to public roads, approval under section 138 of the Roads Act will be required from Council.</p>
National Parks and Wildlife Act 1974	An Aboriginal heritage impact permit under section 90 in relation to a specified Aboriginal object, Aboriginal place, land, activity or person or specified types or classes of Aboriginal objects, Aboriginal places, land, activities or persons.	An AHIMS search was undertaken on the 6 th October 2023. There are no listed Aboriginal heritage items or places located on or in the immediate vicinity of the proposal site. As a result of the existing levels of site disturbance and development, there is a low likelihood that unknown items of Aboriginal heritage significance would be present.

Act	Potential approval/assessment requirement	Relevance to the proposal
Protection of the Environment Operations Act 1997 (POEO Act)	An environment protection licence (EPL) is required for scheduled activities (refer Schedule 1 of (POEO Act) for premises based and Schedule 2 for not premises based) or scheduled development work (development designed to enable scheduled activities to take place on a premises).	The proposal is not considered to be a scheduled activity or development work, and an EPL is not required for construction or operation.
Waste Avoidance and Resource Recovery Act 2001. (WARR Act)	The objectives of the WARR Act are to encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ecologically sustainable development and to ensure that resource management options are considered against a hierarchy of the following order: 1. avoidance of unnecessary resource consumption 2. resource recovery (including reuse, reprocessing, recycling and energy recovery), disposal. 3. To provide for the continual reduction in waste generation.	The design and specification of the project works and their ongoing construction will be undertaken in consideration of the WARR Act

2.3.2 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) protected matters tool was searched on 25 March 2021 for a 0.5 kilometre radius around the proposal site. The results of the search are summarised in Table 4. As no impacts are predicted, an approval under the EPBC Act would not be required.

Table 4 EPBC Act protected matters and their relevance to the proposal

EPBC Act protected matter	Matter located within search radius	Comments
World Heritage Property	None	The proposal will not impact on any World Heritage properties.
National Heritage Places	None	The proposal will not impact on any National Heritage properties.
Wetlands of international significance (Ramsar sites)	None	The proposal will not impact on any wetlands.
Threatened ecological communities	3 threatened ecological communities	The proposal will not impact on any threatened ecological communities.
Threatened species	36 threatened species	The proposal is located within a highly disturbed and developed urban area with limited vegetation (native or otherwise) that would provide habitat for threatened and migratory species.
Listed migratory species	18 migratory species	The proposal will not impact on any migratory species. The proposal will improve the opportunity for species to migrate with increased trees and plantings
Nuclear actions	None	The proposal does not involve a nuclear action.
Commonwealth Marine Areas	None	No Commonwealth marine areas are located within the search radius.

EPBC Act protected matter	Matter located within search radius	Comments
Great Barrier Reef Marine Park	None	The Great Barrier Reef Marine Park is outside the search radius.
Commonwealth land	No Commonwealth properties	The proposal will not directly or indirectly impact on the Commonwealth land.
A water resource, in relation to coal seam gas development and large coal mining development	Not relevant	Not relevant.

2.4 Other relevant policies and requirements

Waverley Development Control Plan 2012

The Waverley Development Control Plan (Waverley DCP) supports the controls outlined in the Waverley LEP with more specific planning and design guidelines including built form controls, parking, biodiversity and tree preservation, signage, heritage conservation and safety. The Waverley DCP provides guidelines for new residential development as well as residential alterations and extensions. It also details general controls for commercial developments and identifies areas where more specific guidelines apply, such as the Bondi Junction centre, the Bondi beachfront area and the local villages.

Section 3.1.3 of Part E of the Waverley DCP includes specific guidelines for Charing Cross including village character objectives. The proposal aligns with the village character objectives, in particular:

- to minimise ‘visual clutter’ through control of peripheral building elements.
- to maintain Bronte Road as the primary streetscape in the centre with lanes and side passages as secondary frontages.
- to encourage the conservation of historic architectural details and reconstruction of missing or degraded elements.

The proposal will declutter the streetscape by undergrounding overhead electrical and telecommunications cables. It will also increase the usability of the Charing Cross streetscape for pedestrians and village visitors. Heritage buildings will be complimented by new pavements and tree planting along with interpretation elements conveying the heritage importance of the area.

The proposal has regard for all other applicable sections of the DCP such as:

B1 Waste
 B2 Ecologically Sustainable Development
 B3 Landscaping, Biodiversity and Vegetation Preservation
 B5 Water Management
 B6 Accessibility and Adaptability
 B7 Transport
 B8 Heritage
 B9 Safety
 B10 Public Art
 B11 Design Excellence
 B13 Excavation
 B15 Public Domain
 B17 Social Impact Assessment

2.5 Summary of approval requirements

The proposal does not require development consent and it is subject to assessment and determination under Part 5, Division 5.1 of the EP&A Act. No additional approvals are required.

3.0 Strategic context and options considered

3.1 Strategic context

3.1.1 Need for the proposal

The proposal is justified by several strategic documents, ranging from short to long term commitments from Council and the public domain policy framework of the NSW Government. These include:

Table 5 Summary of Council strategies and related project considerations

COUNCIL STRATEGIES	PROJECT CONSIDERATIONS
<p>Our Liveable Places Centres Strategy 2020-2036</p> <p>The Our Liveable Places Centres Strategy 2020-2036 (2020) outlines a vision for the Charing Cross Village Centre:</p> <p><i>The desired future character of Charing Cross is local, community-minded, historical and safe.</i></p> <p><i>Charing Cross is safely and easily accessible by foot, cycle, and public transport.</i></p> <p><i>The centre is leafy, buzzing and has a range of goods and services to support the local community in day-to-day living.</i></p> <p>The strategy also outlines four priority objectives for the renewal of the Charing Cross Village centre. These were identified through a process of community consultation and refinement led by Waverley Council and included:</p> <p>People, Place and Prosperity</p> <ul style="list-style-type: none"> - To promote Charing Cross as a destination rather than a thoroughfare, where people visit, stay and enjoy. - To improve the visibility of local indigenous culture and heritage - To promote a diversity of uses, independent businesses and retail offerings catering to local needs. - To provide places for the arts, entertainment and culture <p>Environment</p> <ul style="list-style-type: none"> - To maintain a clean environment, with waste disposal managed discreetly and efficiently. - To increase urban greening where appropriate <p>Access</p> <ul style="list-style-type: none"> - To promote a high level of pedestrian activity and connectivity within and from the centre to Bondi Junction, Queens Park and Bronte Beach. - To ensure the balanced and shared use of the public domain between pedestrian movements, landscaping, outdoor dining and vehicle access and parking. - To ensure a comfortable public realm, with functional and well-designed furniture, landscaping and signage. - To ensure that the centre provides universal access to all users <p>Built form</p> <ul style="list-style-type: none"> - To maintain a prevailing and consistent streetscape, comprising distinctive and well-maintained low-rise Victorian, Federation and Inter-war buildings and shopfronts, reflective of the historical evolution of Waverley's oldest commercial centre. - To protect the setting of and views to landmark buildings, including the Bell Towers at St Marys Immaculate Church, that are visible across the LGA aided by the centre's ridgeline topography. 	<p>The project provides a key vehicle to realise this vision and the detailed objectives within the village centre through the design strategies implemented:</p> <ul style="list-style-type: none"> - footway widenings, - additional / improved pedestrian crossing facilities, - greening of the centre and - improved quality of public domain materials and finishes.

COUNCIL STRATEGIES	PROJECT CONSIDERATIONS
People movement places transport plan 2017	
<p>The plan seeks to:</p> <ul style="list-style-type: none"> - Increase transport choices for residents and visitors - Improve accessibility to centres and across the LGA and region - Manage demands to use resources more efficiently - Reduce car travel overall and as a percentage of mode share <p>The plan prioritises travel modes in the following order</p> <ul style="list-style-type: none"> - Pedestrians - Bicycles - Public Transport - Service vehicles and shared mobility - Private vehicles <p>The plan identifies a series of priority projects of which 9. Charing Cross is one – The key actions are outlined following:</p> <ul style="list-style-type: none"> 62 Prioritise public transport, walking + cycling on Bronte Rd 63 Direct through-traffic away from Bronte Rd to Carrington Rd as arterial road 64 Provide traffic calming, landscaping 65 Revise intersection of Carrington Rd/ Bronte Rd for preferred transport priorities + improved safety for all road users 	<p>The proposal seeks to address key actions to some degree through the proposed works:</p> <ul style="list-style-type: none"> - Improving pedestrian space amenity and safety through widened footways and improved crossings - Calming traffic speeds through the visual reduction of the road corridor - Enhancing facilities for cycle users (bike stands) - Enhancing facilities at bus stops
Sustainable visitation strategy 2024	
<p>This Strategy represents a framework to guide the management of tourism in Waverley over the next five years. The plan has the following objectives:</p> <ul style="list-style-type: none"> - Develop a sustainable approach to visitation management that protects and maintains Waverley's environment, culture and heritage • Integrate tourism effectively within the community and mitigate negative impacts on local amenity. • Grow Waverley's share of higher yielding visitor markets. • Support tourism product which generates a sustainable commercial return <p>The plan identifies works such as enhancing local hubs and upgrading streetscapes in particular around Bondi but also in local hubs</p>	<p>The proposal will enhance Charing Cross as a local pedestrian focussed village hub, and promote public transport and EV use</p>
Creative lighting strategy 2018	
<p>The Waverley Creative Lighting Strategy has been developed in response to the Council vision to create “a memorable application of light that integrates social gathering, public health and safety, sustainability and economic vitality into the urban environment.</p>	<p>The proposal supports and implements the strategy directions and guidelines as applicable to the project and site</p>
Waverley Local Strategic Planning Statement 2020-2036	
<p>The plan identifies 4 principles for change and evolution in Waverly LGA:</p> <ul style="list-style-type: none"> - Infrastructure and collaboration - Liveability - Productivity - Sustainability 	<p>The proposal supports the LSPS across all of the principles in particular “liveability” in the enhancement of one of Waverley's important Village Centres</p>
Waverley Tree Management Policy 2022	
<p>The objectives of the Tree Management Policy are to</p> <ul style="list-style-type: none"> - Prioritise maintaining and protecting the existing tree population - Manage trees strategically to maximise the benefits trees can provide. - Increase Waverley tree canopy cover and manage species diversity and maturity, size, - quality and quantity of Waverley's canopy cover - Identify and protect trees in terms of heritage, cultural, social, and ecological criteria 	<p>The proposal supports the Tree Management Policy through the planting of over 50 additional canopy trees to the streetscape of Bronte Road</p>

COUNCIL STRATEGIES	PROJECT CONSIDERATIONS
<ul style="list-style-type: none"> - Communicate the economic, environmental, and financial benefit of trees to the community, staff and developers 	
Waverley Community engagement Strategy 2021	
<p>The objectives of this policy are to:</p> <ul style="list-style-type: none"> - set a principles-based framework for external community engagement across Council - position Council as a trusted organisation in touch with community needs. 	<p>Engagement for the concept design phase was undertaken with regard for the requirements of the engagement policy.</p> <p>Ongoing liaison with the local community and business through the construction process will likewise reflect the requirements of the policy for well planned pro active liaison and communication</p>
Draft Waverley Electric Vehicles Strategy 2023	
<p>Waverley Council launched the first EV infrastructure strategy for the eastern suburbs region. The numbers of electric vehicles (EVs) on local roads are rapidly increasing as more affordable models enter the market and Federal and State Government provide incentives to lower the purchase cost of new EVs. Currently, the eastern suburbs is home to over 2,000 EVs, with this number set to double year on year. The growing demand for these cleaner, more efficient vehicles has led to greater demands for publicly available EV charging infrastructure. This is especially the case in the eastern suburbs which is a hotspot for EV uptake and where more than 60% of residents live in multi-unit dwellings or rent.</p> <p>While most EV charging occurs at home or work, a significant portion of dwellings lack off-street parking, so public charging stations will serve as their primary charging method.</p>	<p>The proposal integrates provision of EV charges points across longer term parking. These are provided in several forms:</p> <ul style="list-style-type: none"> - Integrated within Multi-function street lighting poles (MFP's) - As stand alone EV chargers providing fast – rapid charge capacity
STATE STRATEGIES	PROJECT CONTEXT
Better Placed, Government Architect of NSW	
<p>Better Placed is an integrated design policy for the built environment in NSW. It considers an approach to ensure good design delivers architecture, public places and environments will be places people want to inhabit now and those we make for the future. Better Placed provides a framework to support and develop tools for better design outcomes through locally based policies and initiatives.</p> <p>Framework Focus:</p> <ul style="list-style-type: none"> - Creating Better Places - Enhancing Design Quality - Emphasises the Importance of Design 	<p>The project reflects the Better Placed principles in the following ways:</p> <ul style="list-style-type: none"> - fitting the heritage and community context of the village - providing better function for pedestrian movement and public transport - enhancing opportunities for community interaction and street life - enhancing the street environment to encourage people to visit the village and to stay longer - providing improved safety and security - providing improved quality and character of environment <p>The project can provide an exemplar of the for Waverley Village centre upgrades</p>
Movement and Place, Government Architect of NSW & Transport for NSW	
<p>Movement and Place is a collaborative policy developed by Government Architect NSW and Transport for NSW.</p> <p>Movement and Place creates a shared language and approach to help all stakeholders achieve better place outcomes. Through a practitioner's guide, toolkit and governance structure, it seeks consideration of place when developing our transport systems, through collaborative working between the community, movement and place practitioners.</p> <p>Framework Focus:</p> <ul style="list-style-type: none"> - Acknowledging Streets as Public Space - Aligning Movement Functions with Places 	<p>The project reflects the principles of the guidelines through:</p> <ul style="list-style-type: none"> - Maximisation of pedestrian movement spaces - Enhancing pedestrian movement and safety across the road and at side streets - Enhancing the quality of the street environment

3.2 Consultation required under State Environment Planning Policy (Transport and Infrastructure) 2021

As noted in section 0, Clauses 2.10 to 2.15 of the Transport & Infrastructure SEPP outlines the requirements for consultation with councils and other public authorities for infrastructure development carried out by or on behalf of a public authority that meets the requirements under these clauses. As can be seen in Section 2.2.3 and Appendix B of this REF the proposal triggers consultation with the following public authorities under the Transport and Infrastructure SEPP:

- Council in relation to the presence of local heritage items, the project site's location within a heritage conservation area and whether potential impacts to the heritage significance of the item / area are more than *minor or inconsequential*.

Discussions with Councils heritage specialists identified the following requirements for ongoing design (refer 4.1 Description of the proposal for further explanation):

- Careful consideration of proposed street tree species and locations to avoid adverse impacts on the viewing and understanding of heritage building facades.
- Streetscape materials and finishes selected to complement heritage architectural fabric.
- Interpretive signage and other elements carefully curated to complement heritage architectural fabric

No further consultation to meet legislative requirements have been identified.

General consultation within Council has however been undertaken during the course of the project including the following internal stakeholders:

- Council Heritage Team
- Council Infrastructure Team
- Council Sustainability Team

A number of internal meetings were facilitated by Council with their Heritage Team during development of the proposal. The potential for impacts to heritage values within the vicinity of the proposal site were reviewed during these meetings and measures to avoid and minimise impacts were identified. These are discussed further in 6.3 Heritage.

3.3 Existing conditions

Charing Cross is a key southern village centre within Waverley, located along a strip of Bronte Road connecting the eastern beaches, Bondi Junction, Centennial Park and the City. The centre has a diverse range of local shops and services that support the daily needs of residents, workers and visitors who frequent the area. The centre has a village "high street" character, supporting the local commercial strip as well as a major transport route, including servicing up to six different bus routes. The centre continues to fulfill a valuable social role and meeting place for local residents and for children attending and travelling to surrounding schools. The diverse local population also includes aged housing.

The centre is contained within the Charing Cross Heritage Conservation Area. It is typified by near- intact rows of two storey Federation and Victorian terraces, interspersed with some examples of two storey Interwar and Art Deco apartments. Important views of historic buildings, include those of the St Mary's Catholic Church and associated buildings (a listed State Heritage group), viewed across the community centre at 280-282 Bronte Road. These buildings of historic character are all of masonry construction, many with painted plaster render and highly decorative finishes. The buildings are mixed-use and maintain a consistent retail ground floor with residential upper storeys and also support awnings over the entire pavement width. Narrow passages between terraced groups give access to the rear of properties and laneways.

Some key challenges identified by the concept design process included:

- Appreciation of the high heritage quality of the building stock of the area is compromised by intrusive suspended power and telecommunication lines.
- The public domain setting is generally run down and does not contribute to the character of the village

- The village centre is not particularly well defined, blurring into the adjacent residential areas.
- The main street has a poor sense of arrival,
- Pedestrian safety and convenience for active and public transport modes are not ideal and could be enhanced
- High through traffic volumes conflict with the main street commercial role of the street which can impact local traffic movements and cause significant congestion.
- The signalised intersection at Bronte Road / Carrington Road / Victoria Street is complicated for vehicle movements and has poor pedestrian comfort and ease of use



Site image: Carrington Road viewed north at Victoria Street at the signalised intersection



Site image: Bronte road (left) and Carrington Road viewed south at the signalised intersection



Site image: *Crossing and footway pavements make access difficult and don't contribute to a quality unified character*



Site image: *2 existing Blueberry Ash specimens will be removed to facilitate the footpath widening*



Site image: *The lane crossing at Cables Lane does not reflect pedestrian priority – potential for continuous footpath*



Site image: *The existing zebra crossing to the south of the project area is proposed to be upgraded to a raised crossing to enhance ease of use and further calm vehicle traffic*

3.4 Objectives of the proposal

Council's Our Liveable Places Centres Strategy (2020) outlines four place based objectives for the renewal of the Charing Cross Village Centre. These were identified through a process of community consultation and refinement led by Waverley Council and included:

- People, Place and Prosperity.
- Environment.
- Access.
- Built form.

Refer to section 3.1.1 of this REF for a detailed description of these objectives.

The ongoing refinement of the concept proposals also identified the need to address the following specific objectives in realising the public domain project:

- Minimise loss of parking.
- Minimise disruptions caused by construction works on the local centre.

3.5 Design development and options considered

3.5.1 Design process

Preparation of the Concept Design has been undertaken over two phases. An initial concept was prepared by a consultancy team, for Council over 2020-2021. The original concept has been subject to review and refinement over May / June 2023, and a subsequent review and finalisation of this version of the REF has also been carried out. A summary description of the concept for the proposal is provided in Section 4 of this REF, while further illustration is provided in the Concept Design Plans provided at Appendix F.

3.5.2 Options development

A summary of the main options considered as part of the development of the proposal is provided below. In addition to the streetscape elements, Council also engaged GHD to undertake cycleway, stormwater drainage and traffic assessments to confirm the feasibility of the streetscape options.

The 'do nothing' option

The 'do nothing' option involves not undertaking the proposal. Under this option, no streetscape upgrades would be undertaken. This option is not considered to be acceptable, as it would result in Council not being able to meet the project objectives.

Option 1: Basic Upgrade

The first option develops provided a basic upgrade to the Charing Cross streetscape, and includes new tree planting within the existing footpaths. Option 1 offers the following:

- No changes to kerb alignment and no loss of parking.
- Installation of smaller columnar trees in existing pavement (where possible).
- Replacement of paving with new and consistent treatment.

The basic upgrade would also need to address the following challenges:

- Existing and new underground services in pavement would need to be coordinated against the soil volume and root requirements for new trees.
- New trees could only be accommodated where awnings were absent or reduced.
- Limited opportunities to accommodate outdoor dining, or meaningful public furniture/seating due to existing footpath width.

The Basic upgrade would not meet the following project objectives:

- Encourage and facilitate a high level of pedestrian activity
- Improving pedestrian safety
- Improving potential for outdoor dining

Option 2: Green Streets

The second option considers kerb buildouts along the existing kerb alignment to enable new tree planting throughout the precinct. Option 2 offers the following:

- Minor changes to kerb alignment to allow for kerb buildouts
- Opportunity to install consistent boulevard of canopy shade trees in kerb extensions with understory planting to offer more extensive greening of street.

This option would require coordination of the following challenges:

- Some loss of parking due to localised kerb buildouts for planting
- Opportunities to accommodate outdoor dining, or meaningful public furniture/seating nodes still limited due to existing footpath width.

Option 3: Extended Public Realm

The third option to upgrade the Charing Cross streetscape considers the widening of the existing footpaths by up to 1.0m generally to provide additional space for trees and pedestrian movement. Option 2 offers significant opportunities for the improvement of the streetscape, including:

- extending the public realm on both sides of Bronte Road and creating opportunities for outdoor dining, seating nodes and consistent planting of larger shade trees

The main challenges for Option 3 are construction costs and duration, as the extent of works included are significantly greater than Option 1 or Option 2.

Footpath Pavement options

As part of the options assessment different footpath pavement options to be used for the Streetscape Upgrade were considered. These were the Red Brick Paver and Concrete Unit Paver included in the Council Public Domain Technical Manual 2019 (Waverley Council, 2020b) and a sandy concrete paver referencing neighbouring beachside suburbs.

Evaluation of alternatives and preferred option

The upgrade options were further explored with Council at a workshop on 12 November 2020.

Option 1 – Basic Upgrade: including trees within the existing footpaths where feasible, upgrade of footpaths and undergrounding of existing overhead power lines.

Option 2 – Green Streets: Constructing kerb buildouts throughout the precinct to accommodate trees between parking spaces, upgrade of pavements and undergrounding of existing overhead power lines.

Option 3 – Extended Public Realm: widening of the existing footpaths by approximately 600 mm to provide additional space for trees and pedestrian movement, upgrading of footpath pavements and undergrounding of existing overhead power lines.

After review of the Options Assessment Report and discussions with Council at the Options Presentation, Council selected Option 3 as their preferred design solution for further development. The refined concept design is described further in section 4 of this REF.

4.0 Description of the proposal

4.1 Design features

The refined concept proposal includes upgrades to the Charing Cross village centre streetscape to improve the visual amenity and enhance the heritage character of the area, while improving safety and accessibility for active transport. As described in section 1.2.1, the key features of the proposal include:

- Roadworks, including widening of footpaths and narrowing traffic to improve public amenity and access
- Upgraded landscaping, including new street trees and street gardens
- Upgraded street furniture, including new multi-function poles and upgraded lighting
- New pedestrian crossing and upgrades to existing to improve pedestrian movement and traffic flow
- Utility works, including undergrounding of overhead powerlines and improved stormwater infrastructure.

Further information on these features is provided in the following sections. The proposed works are also illustrated in the Concept Plan provided at Appendix F. An overview of the concept proposals is provided at Figure 4, Masterplan Arrangement on page 31.

4.1.1 Road upgrades and parking

Swept path analysis has been undertaken to intersections to determine minimum lane widths required and to facilitate the widening of footpaths, including:

- Long Rigid Bus, Articulated Bus and Small Rigid Vehicles to Signalised Crossing.
- Medium Rigid Vehicle to Bronte Road /Albion Street intersection.

Improvements and upgrades to traffic and pedestrian function addressed in this proposal includes:

- i. Traffic lane widths at Bronte Road within the project site will be reduced to maximum of 3.2 metres to enable widening of footpaths and reduced crossing distances, and to encourage reduced traffic speeds while catering for bus movement.
- ii. Traffic lane widths at western arm of Victoria Street within the project site will be reduced to maximum of 3.2 metres to enable widening of footpath and reduced crossing distance. Integration of existing road shoulder lanes with the traffic lanes will also contribute to the footpath widening.
- iii. Reconfigured widths of traffic lane and parking at eastern arm of Victoria Street within the project site to enable widening of footpath and reduced crossing distance.
- iv. Left turn lane from Bronte Road to Carrington Road (north of The Robin Hood Hotel) will be removed and converted to footpath.
- v. Refuge crossing to the Bronte Road /Albion Street intersection will be maintained but traffic lane widths to Bronte Road East will be reduced to the minimum requirement to enable widening of the footpath and reduced crossing distance.
- vi. Parking lane width is proposed generally to be 2.4m in general to enhance safety and improve traffic flow. Parking length will be as advised by Council as no linemarking is required to parking lanes.
- vii. Existing asphalt outside of the signalised intersection of Bronte Road and Victoria Street is to be milled and re-sheeted with new asphalt, and new line markings and signage will be provided in reworked areas.

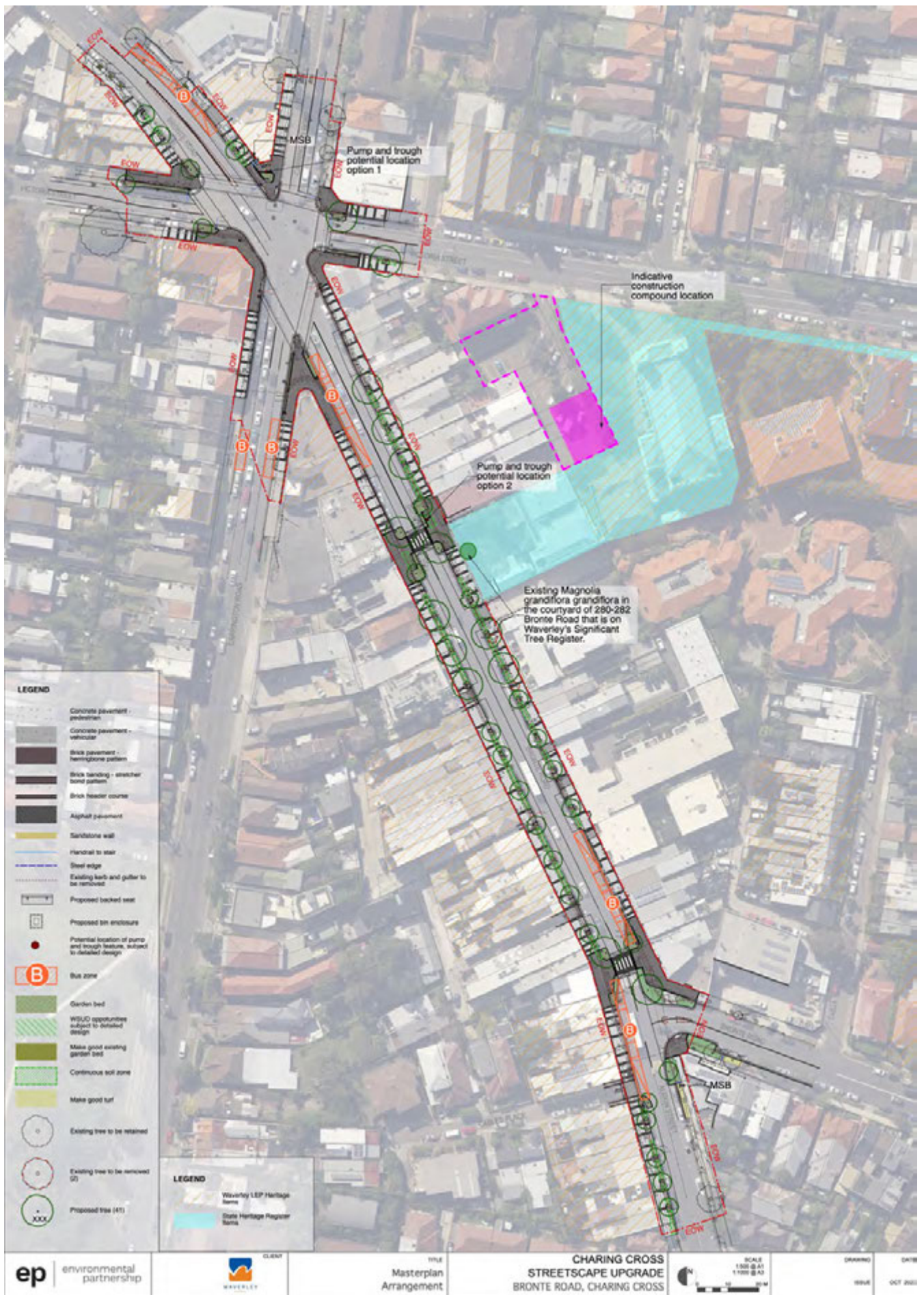


Figure 4 Masterplan arrangement



Figure 5 *Illustrative photomontage of street at new mid block crossing – before (above) and after (below) proposed activity*

4.1.2 Services utility and drainage works

Existing overhead powerlines within the Charing Cross Village will be relocated underground, replacing the poles with green pillars to service shopfronts. New multi-function poles (MFP) will also be installed to replace existing street lighting poles. Energy Australia only owns and maintains its standard Energy Australia lighting infrastructure. As such the new MFP network will be owned and maintained by Council. At the signalised intersection at Carrington Road the signals will be consolidated onto the MFP poles creating a neater and simpler visual environment.

Existing stormwater infrastructure will be selectively upgraded and new infrastructure installed to address the streetscape modifications. Kerb inlet pits will be installed at the footpath widenings to capture kerbside drainage and awning downpipe connections will be upgraded where necessary.

A passive irrigation system and Water Sensitive Urban Design for street tree pits and gardens where applicable will be implemented drawing water from the street and filtering water before it gets into the broader stormwater drainage system.

4.1.3 Widening and upgrade of the footpath

Footpath width is to be extended by up to 1.0 metres to allow for tree planting and improved pedestrian amenity. The kerb will be realigned and reconstructed for all footpath widening sections and all existing signage will be relocated as required to suit the new kerb alignment. Existing paving will be replaced with continuous high-quality pavement finished including honed concrete and clay brick feature bands as accent pavement. Further kerb build outs and footpath extensions will be provided to crossings where possible to reduce crossing distance and increase pedestrian safety.

4.1.4 New raised crossings

One new raised mid block pedestrian crossing will be installed and one existing on grade pedestrian crossing will be upgraded to a raised pedestrian crossing. The existing crossing is located near the intersection of Albion Street and Bronte Road. The new crossing is proposed adjacent to 280 Bronte Road. The installation of these crossings will provide traffic calming and pedestrian priority one of the core aims of the project. The no-stopping / parking zones either side of the crossings will enable further footpath widening enhancing opportunities for street furniture and street gardens.

A raised platform is also proposed to the Cables Place / Albion Street intersection to provide continuous footpath movement for pedestrians and improve pedestrian priority.

4.1.5 Street trees and understorey plantings

Two existing planted trees will be replaced by street trees of several species that will line the kerbs providing 41 additional trees within the street. Dwarf Lemon Scented Gum (*Corymbia citriodora* 'scentuous') is proposed to heritage building façades. This planting will contribute to the 'greening' of the street but it's open canopies will minimise the visual screening impact to the heritage building façade. Japanese Zelkova (*Zelkova serrata* 'Green Vase') is proposed to non-heritage building façades. This species will provide seasonal colour and solar access during Winter to the main street. A feature tree will be placed at a key location along Bronte Road to punctuate the other plantings and as a marker terminating some key view lines. The proposed species is Illawarra Flame Tree (*Brachychiton acerifolius*). Understorey street gardens are proposed to the street tree pits and in beds adjacent to pedestrian crossings.

Tree pits will be installed throughout the proposal site, and downpipes and gutter flow will be directed to the pits where applicable, which will assist to infiltrate stormwater.

There is a Magnolia grandiflora in the courtyard of 280-282 Bronte Road that is on Waverley's Significant Tree Register. It is outside the scope of the work to be undertaken under this project scope. However construction management will ensure that the curtilage to this tree is full protected and managed in accordance with qualified Arborist advice (Refer to Appendix E).

4.1.6 Street furniture works

Benches will be installed at a maximum of 60 metre intervals on either side of the street and will be positioned at least 0.8 metres from the kerb of the road. Bin enclosures will also be provided at regular intervals through the precinct and will be located 1.2 metres from signalised corners to prevent congestion. Bike hoops will be installed to the Multi Function Poles or where practical and in the vicinity of bus stops to allow travellers to transfer easily from bus to bike.

4.1.7 Pump and Trough

A historic water trough and pump that have been conserved by Council and are believed to be originally from the Waverley area will be integrated to the site with interpretive signage to illustrate the past function of the trough and pump and other related aspects of local history. The function of the trough will be adapted to a planter bed and the pump is proposed to be a drinking water bottle refill station. Both items will be carefully conserved and repaired to be made workable and appropriately secured as per conservation specialists' recommendations.

Figure 6 below shows the existing trough and pump items in their current locations.



Figure 6 *Images of historic trough and water pump items*

4.2 Construction

4.2.1 Methodology

The demolition and construction methodology will be established by the appointed Contractor in response to a detailed series of construction management and environmental management measures that will be identified in the tender. A Construction Environmental Management Plan (CEMP) will be prepared by the appointed Contractor that will define procedures for construction and environmental management

Key Components of the works

The key components of the implementation of the proposal involve the following:

- Site establishment and mobilisation.
- Excavation of trenches and undergrounding of power and telecoms and laying of new private power circuit for street and pedestrian lighting.
- Demolition of existing pavement and structures.
- Removal of street trees and planter boxes.
- Construction of new footpaths, including earthworks, drainage works pavements, kerbs, and public domain finishes (pavements, planting and furniture).
- Site reinstatement including landscaping, tree re-planting etc.
- Plant establishment period (watering and general maintenance).

Phasing of the works

The above components can be split into several phases based on construction activities and expertise / likely sub contractor responsibilities:

Phase A Power telecoms and Lighting.

Phase B Public Domain Construction Works.

Phase C Planting and finishing works.

Phase D Road re-sheeting works.

Phase A – Power Telecommunications and Lighting

Council's preferred construction approach is that the works are carried out in physical zones that focus on the general completion of one section of the project area at a time so that disturbance to any given shop frontage is not drawn out over a longer time frame. This will include for power, telecommunications and lighting:

- Excavation of trenches and undergrounding of power and telecoms and laying of new private power circuit for street and pedestrian lighting.
- Temporary surface to be replaced to maintain access to shopfronts kerbside parking and bus stops.
- Council estimates approximately 10-15m completed per day – equating to 44 work days (approximately 8 weeks) over the 334m long project area.

Phase B Public Domain Construction Works

As above Council's preferred construction approach for the primary public domain works is that the works are carried out in physical zones that focus on the general completion of one section of the project area at a time so that disturbance to any given shop frontage is not drawn out over a longer time frame. This will include for public domain:

- Demolition of existing pavement and structures.
- Removal of existing trees (2 trees in poor condition) and existing planter boxes.
- Construction of new footpaths, including earthworks, drainage works pavements, kerbs, and excavation and soils works (excluding planting) to tree pits and gardens and installation of furniture.
- Preparation and construction of raised crossing structures to the two crossing locations.

- Council estimates that approximately 80-90m sections are able to be completed over 4 weeks – equating to 8 stages (4 stages per side) over the 334m long project area.

Phase C Planting and finishing works

Phase C will involve the installation of plant material in the completed construction works stages as they become available. As such the planting works will be carried out concurrently with construction works in separate stages of the project area. It is noted however that the impact of planting works on footpath access is minimal – largely requiring the loss temporary loss of some kerbside parking for delivery and planting of plants.

Phase D Road re-sheeting works

Phase D will focus on the final trimming and re-establishment of the road surface to Bronte Road and the surrounding affected streets.

4.2.2 Construction timeframe, hours and duration

The demolition works will occur during the recommended standard hours for construction work as outlined in the Draft Construction Noise Guideline (NSW EPA, 2020) which are:

- Monday to Friday 7:00 am to 6:00 pm.
- Saturday 8:00 am to 1:00 pm.
- No works on Sundays or Public Holidays.

Nightworks

Some nightworks will be required for upgrades to the Charing Cross Village Centre. The need for night works will be sought to be reduced through ongoing liaison with services authorities. The permitting of night works by Council will be subject to all applicable noise management requirements, and would be notified ahead of time with appropriate notice to residents and business owners. Noise and vibration monitoring would be carried out in accordance with standards.

Construction period

Works related to undergrounding of power and telecommunications (Phase A works) are anticipated to commence in December 2023, subject to approvals, funding and contractor availability. Phase B works comprising the main civil and public domain works are anticipated to commence in May 2024.

Works will be staged along the proposal alignment and proposed Phase B works are anticipated to be completed within an 12 month period.

4.2.3 Workforce

It is estimated that a workforce of up to approximately 25-40 personnel will be required during the construction phase.

4.2.4 Plant and equipment

Plant and equipment likely to be used during the works may include, but is not limited to, the following:

- 10 tonne tipper trucks for bringing in and removal of material.
- Flatbed trucks for bringing in and removal of equipment.
- Tractor-loader-backhoe or small excavator.
- Concrete trucks.
- Plate compactors and 10 tonne pneumatic roller.
- Handheld power tools, such as pavement saw, concrete breaker, concrete poker (vibrator).
- Steel grinders/cutters.
- Generators (diesel).

It is estimated that up to approximately 4 heavy vehicles and 4 light vehicles will need to access the site each day during the construction period.

4.2.5 Access and heavy vehicle routes

Access to the project site is via the existing road network surrounding the proposal, with access available at both the eastern and western ends of the proposal site.

4.2.6 Construction compound

Potential compound locations have been identified for the proposal (refer Figure 4). A compound will be located in the existing Council carpark, accessed via Victoria Street. An additional compound will be located in a Council owned building located along Bronte Road. The proposed compound configuration will be determined by the appointed contractor.

4.2.7 Environmental management during works

A Construction Environmental Management Plan (CEMP) will be prepared for the works by the appointed Head Contractor that will define procedures for construction and environmental management. The CEMP will document the mechanisms for achieving compliance with the commitments made in this REF, the general and special conditions of contract, and all relevant Australian Standards, codes of practice, and Council policies.

4.2.8 Communications strategy

The Head Contractor will be required to establish and maintain a Communications Strategy to be approved by Council. The aim of the strategy is that residents and business stakeholders are fully aware of the project process, when their day to day activities will be interrupted, and if there are any necessary changes to those plans.

Council will maintain an online platform accessible by QR code posted around the site, that provides real time information of the construction process, upcoming activities and temporary changes to access, and provides contact details for information and complaints.

Temporary access changes within the construction site will be notified to the community and businesses prior to the event and then clearly signed and manned by traffic wardens on the day.

5.0 Community and stakeholder consultation

This section summarises the consultation activities that have informed the proposal to date and those which would be ongoing through to proposal completion.

5.1 Community consultation

5.1.1 Consultation undertaken during preparation of the Our Liveable Places Centres Strategy

An extensive community engagement program was undertaken in the development of the Our Liveable Places Centres Strategy in 2019-2020. This included an online survey platform which had 231 participants and a community workshop program involving 71 participants.

The consultation identified a series of overall themes to inform development of the Centres Strategy as well as specific ideas for each of the 19 centres. General themes for aspirations were identified and included:

- Village centres that are community focussed local and safe.
- Vibrant villages after dark.
- More greenery and trees (but not at the expense of parking).
- Heritage character and the look and feel of streets is protected.
- Each villages retains its sense of place.

Specific values and outcomes related to Charing Cross included:

- Retain the smaller local feel of the centre.
- Environmental sustainability.
- Conservation of character buildings and effective maintenance.
- Provide greenery.
- Ease of access by public transport.
- Safe movement for pedestrians.
- Improved street furniture.

5.1.2 Consultation during development of the concept design

During development of the proposal design, Council undertook consultation with the local community, including residents, and other key stakeholders such as property owners and occupants in the centre. This included:

- Ongoing internal communications with Council.
- Development of the following communications for residents, property owners and property managers:
 - two proposal newsletters;
 - notification letter; and
 - property adjustment forms.

Details of this process are provided on the following page.

Method	Overview	Date	Response
Have Your Say website	Council's Have Your Say Waverley website had a dedicated page for this project: haveyoursay.waverley.nsw.gov.au/Charingcross	Mar 20 – May 21	2000 visits to the page 1600 aware visitors 12 new registrations
Notification letters	Dropped to 1044 residents and businesses within the Charing Cross Village Centre. Had trackable QR code.	19 April 21	34 scans of the QR code.
Media release	Distributed at the beginning of the project	19 April 21	1 article
Mayor's column	Mayor's column in the Wentworth Courier	12 May 21	N/A
Social media posts (Facebook)	Post 1: Directed people to the HYS Page	23 April 21	1691 people reached 312 engagements Most people spoke about the businesses and 'empty shops,' were supportive of the project
	Post 2: Promoted the HYS Days	29 April 21	736 people reached 35 engagements
	Post 3: Promoted the community information session	2 May 21	392 people reached 14 engagements
	Post 4: Last chance to participate	12 May 21	585 people reached 152 engagements Two of the four commenters said they thought the project was great.
Social media posts (Instagram)	Post 1: Directed people to the HYS Page	23 April 21	1432 views 148 likes Most people were supportive of the project, highlighting the inclusion of trees as a positive.
	Post 2: Listed the key features of the project and directed people to join the community information session	2 May 21	218 likes Most comments focused on traffic and congestion. Not many people felt the project will solve any of these issues.
	Post 3: Directed people to HYS page	12 May 21	43 likes A few comment regarding the Bondi Junction cycleway
	Post 4-7: Instagram story saying last chance to provide feedback. These posts were posted at the same time in sequential order		2387 views
Business drop-in	Council Officers visited all retail shops in the project area. Handed out flyers with direct link to HYS page	21 April 21	N/A
Precinct meeting	Online meeting with Charing Cross Precinct	28 April 21	8 attendees
(3) Have Your Say stalls	Council Officers intercepted users of the Charing Cross	30 April – 2 May 21	87 respondents
Online survey	The survey was made of two core questions and a number of supplementary ones	21 April – 19 May 21	200 respondents
Waverley Weekly newsletter	Explained the project and directed people to the HYS page	29 April 21	270 clicks
		6 May 21	17 clicks
		13 May 21	12 clicks
Engagement newsletter	Enews sent to all those who registered for updates for the project and to HYS Waverley.	22 April 21	30 recipients 11 clicks
		30 April 21	5413 recipients
Posters, fact sheets and flyers	QR code included on posters and fact sheets handed out at HYS days	21 April – 19 May 21	32 Clicks

5.1.3 Consultation during development of the REF

During preparation of the Preliminary REF, the following consultation activities were facilitated by Council:

- Ongoing internal communications with Council.
- Development of the following communication collateral in a combination of both online and hard copy formats:
 - notification letters to residents and business owners;
 - media releases;
 - advertisements;
 - signage;
 - web banner; and
 - i-visual.
- Email contact with stakeholders (businesses, precinct, schools).
- Proposal site walk through with business owners and residents.
- Meetings with precincts.
- Establishment of a dedicated 'Have your say' webpage that provides an overview of the proposal, Q&A, online survey, proposal timeline and an opportunity for viewers to stay informed and subscribe to proposal updates.
- Online Zoom session on 'Have your say day' that would provide an opportunity for the community to provide feedback on the proposal.

5.1.4 Key issues raised during consultation

The following table summarises conclusions identified by Council from the concept exhibition process

Key feature	Next step	Comment
Charing Cross village centre will become 40km/h	Supported	Some people wanted 30km/h, some were concerned about the effect on congestion; overall the 40km/h was supported.
Slip lane to be removed and signalised	Supported	—
Raised pedestrian crossings	Investigate	There was overall support for this, however concerns were raised about: the location, pinch points for cyclists and the impact on congestion. Should consider moving further down Bronte Road.
A change in parking arrangements to allow for a safer crossing	Investigate	As above: Should consider moving the pedestrian crossing further down Bronte Road to mid-block.
Powerlines will be moved underground	Supported	—
Council is proposing new trees and a range of garden beds and plantings	Investigate	While trees and garden beds were generally supported, they should not block heritage facades and should not be allergenic like Plane trees. Hanging baskets should be investigated.
New multipoles and upgraded lighting	Investigate	Look for historically sympathetic options.
Historical features highlighted throughout the design.	Investigate	The community would like to see more details on how this will work. Some suggestions included – plaques, and aesthetic materials like pavers matching the old.
Widening and upgrading footpaths	Supported	Community supported widening of footpaths to facilitate introduction of trees and potential for on-street seating without impacting parking.
New street furniture	Supported	—

Need to incorporate into the next design	Comment
Safety improvements at intersection of Carrington Road, Bronte Road and Victoria Street.	This was the most common comment and needs to be addressed in the next stage of the design.
More information about Albion Street / Bronte Road upgrades.	It was not clear in this consultation how the proposed concept improved safety of all transport modes. It should be noted that the design included the following: <ul style="list-style-type: none"> • Both kerbs were brought in so there was a shorter crossing for pedestrians. • Raising the pedestrian crossing across Bronte Road and the speed changing to 40km/h means cars will approach slower, giving vehicles coming out of Bronte Road the

5.1.5 Ongoing consultation

Consultation with key stakeholders including Transport for NSW, Charing Cross Precinct and the local businesses will continue through the procurement and construction stages of the project.

Consultation with the community and business stakeholders would be ongoing in the lead up to construction, and during construction of the proposal.

This would include online updates via Waverley Weekly and 'Have your say' E-news and a letter box drop to notify local residents of future proposal site visits. Contact details for Council's Community Relations Representative would also be provided during this time.

It is proposed that access to live construction, pedestrian and traffic management information will be available during the duration of construction accessible by QR code by phone device.

The construction contract will require that the Head Contractor provide a comprehensive process of traffic and pedestrian management that includes extensive forward planning notification and liaison with residents and businesses.

6.0 Environmental impact assessment

6.1 Overview

A scoping exercise has been completed for the proposal. The scoping exercise has considered the potential environmental impacts of the proposal to identify those environmental factors requiring environmental impact assessment within this REF. The key issues identified were heritage, traffic, visual, noise and vibration and social. Mitigation measures have been provided in section 7.0.

6.2 Land use and properties

6.2.1 Existing environment

The proposal site is an existing Neighbourhood Centre providing a range of main street business and services and providing key public transport (up to six different bus routes) and local vehicular traffic routes. The Carrington Road signalised intersection in the north is a complex traffic and pedestrian environment. The kerbside the Bronte road features several bus zones, loading zones and time restricted weekday parking (30min and 1hr).

Adjoining land uses include some residential accommodation mostly located above commercial businesses.

Land uses immediately surrounding/adjoining the proposal site include:

- low and medium density residential housing;
- mixed use including a range of shops, cafes and convenient stores;
- Australia Post Office Waverley;
- Robinhood and Charing Cross Hotel;
- Charingfield Aged Care Community;
- Mary Immaculate Catholic Church;
- Jubilee Church; and
- Waverley Council carpark.

Land uses in the broader area include:

- Recreational uses - Queens Park is about 150 metres west of the proposal site, and Bronte Beach and park is located about 1.5 kilometres to the east of the proposal site.
- Education uses - St Charles' Primary School (about 70 metres north), St Catherine's School (about 200 metres south), Waverley Public School (about 300 metres north-west), Waverley College (about 250 metres north-east), Waverley Junior College (about 250 metres east), Gingerbread Kindergarten (about 400 metres north-west) and Waterford Pre-School (about 300 metres east). The centre plays a vital role for local residents and children attending and travelling to these surrounding schools.

6.2.1.1 Utilities and services

The site has existing overhead power and telecommunications utilities mounted to timber poles, while water and gas services are located along the majority of the footpaths.

The intersection signal box at Carrington Road is located to the north side of Victoria Street

6.2.2 Impact assessment

Construction

There will be a controlled degree of impact to day to day uses in the project area during the works. In order to underground power and upgrade services, trenching and other excavation will be required. Construction will seek to aggregate services works to avoid multiple phases of trenching and services works.

Construction works would be undertaken in a staged manner whereby sections of the road and existing pedestrian facilities would be upgraded, confining the works area and extent of construction impacts experienced at any one time. Pedestrian access would be maintained throughout the construction of the proposal and temporary detours would be provided where required. Property access along the proposal site during staged construction may be restricted during certain times of the day. The impacts on property access will be short term, and alternative access will be provided if possible. In summary there will be some disruption to day to day activities in the centre during construction as is normal for implementation of upgrades to a main street public domain.

Operation

Following completion of the proposed works, general impacts to land use would be limited and consistent with the existing and prior uses of the proposal site as a main street road corridor with public transport. The proposal would significantly improve the pedestrian amenity and attractiveness of the main street thereby encouraging longer stays and potentially enhanced business conditions.

The new mid block crossing to the north section of Bronte Road will increase pedestrian accessibility and safety and the vibrancy of streetlife and related retail activity. The proposal will facilitate a significant increase in greening through street trees street gardens and hanging planters to multi function poles.

However the provision of the new mid block crossing with incorporation of required no standing zones will result in the loss of 37.2 lineal metres of kerbside space (6 on street spaces) to Bronte Road, and the upgrading of the southern crossing, the loss of 3.2 lineal metres of kerbside space (1 on street space). To the north-western side of Victoria Street a further 4.5 lineal metres of kerbside space (1 on street space) will be lost to accommodate changes to facilitate the Victoria Street shared cycle / traffic lane. The outcome is a total loss of 44.9 lineal metres of kerbside space (8 on street spaces)

Design refinement has identified potential to compensate these losses with an additional 2 spaces integrated to the street (1 to the western side of Albion Street, and 1 to the south western side of Victoria Street) resulting in an overall loss of 6 spaces. There may also be limited opportunities to compensate for these lost spaces with greater efficiency to the layout of off street parking behind the Charing Cross commercial precinct off Victoria Street, and through greater efficiency (encouraging more effective parking) to generic street parking in neighbouring streets.

6.2.3 Mitigation measures

Construction

The following mitigation measures would be implemented to minimise impacts during construction:

- Access will generally be maintained (including through temporary measures as required) to residences and businesses during the course of the works including:
 - a. Through coordination with the head contractor, access to businesses during each business's opening hours, will be maintained during the course of the works
 - b. Through coordination with the head contractor, residential access will maintained during the course of the works
- Residents and businesses within 200 m of the proposal will be notified of the works by direct communication prior to commencement. Signage will also be provided near the site to notify of any closures and alternate access.
- The necessary staging of works and rerouting of vehicular and / or pedestrian access will be notified in advance along with alternative access.
- Where trenching and excavation has been carried out or pavement sub-bases are under construction temporary access by way of non-slip walkways will be provided by the construction contractor and managed on site through signage and personnel in high activity periods.
- All work equipment and materials will be contained within the designated boundaries of the work site.
- Construction vehicles and on site personnel will be limited to those needed for the proposed work, with all excess equipment moved off-site to reduce visual impacts.
- All communications and complaints will be assessed and a response, corrective and/or preventative action implemented (as necessary).

Operation

Generally the completed works will result in an improved pedestrian environment for locals and visitors and an enhanced setting for main street activities including on street trading (outdoor seating). Tree and garden planting will enhance the character and identity of Charing Cross.

As above the loss of 6 on street parking spaces as a result of the improved pedestrian crossing amenity and safety is offset against these benefits. Opportunities to provide additional off street parking to supplement on street parking will be pursued by Council with adjoining land holders as redevelopment occurs in the future.

6.3 Heritage

6.3.1 Existing Environment

Non-Aboriginal heritage

The proposal site is located within the *Charing Cross Heritage Conservation Area* (HCA) (Item No. C7) which is listed under schedule 5 of the Waverley LEP. A number of local and State listed heritage items are located within close proximity to the project site. Due to the heritage significance of the proposal site and surrounding study area, a Statement of Heritage Impact (SoHI) was prepared by Artefact Heritage dated 4th September 2023 in accordance with the NSW Heritage Act 1977. The SoHI is included in this REF at 0.

Table 6 Local and state significant heritage items listed in the WLEP 2012

Item name	Heritage item number	Distance from proposal site
Late Victorian commercial residential building	I411	Adjacent to the proposal
Inter-war Art Deco style hotel, Charing Cross Hotel	I412	Adjacent to the proposal
Evansdale	I413	Approximately 42 metres southwest
Late 19th Century commercial/residential terraces (Deluca)	I442	Adjacent to the proposal
Late 19th Century commercial/residential terraces	I443	Adjacent to the proposal
1940s commercial style building, Robin Hood Hotel	I453	Adjacent to the proposal
Inter-war Free Classical public building (former Waverley Post Office)	I454	Adjacent to the proposal
Victorian style commercial terrace houses	I455	Adjacent to the proposal
Late nineteenth century commercial terrace	I456	Adjacent to the proposal
Uniting Church and Hall	I494	Adjacent to the proposal
Mary Immaculate Church	I495 (State Heritage Register item 00625)	Adjacent to the proposal
Charing Cross (House)	I429 (State Heritage Register item 00449)	Approximately 62 metres southwest
Late Victorian Villa	I457	Approximately 64 metres east
1920s Inter War Bungalow	I469	Approximately 48 metres northeast

The SOHI identified that the HCA maintains a two-storey character, with highly intact Federation and Victorian terraces, interspersed with two storey Interwar and Art Deco apartments. State heritage listed St Mary's Catholic Church and associated buildings are viewed across the community centre, while the high heritage visual quality of the buildings in this area are comprised by the intrusive suspended power lines and cluttered footpaths. Streetscape fronts are generally well maintained, however conduit and plumbing services within a majority of the street frontages are intrusive to the heritage values of the streetscape.

Archaeological heritage

The current road alignment is similar to the original road constructed in the 1830's as part of early settlement, although it is possible that subsequent road widening works may have covered areas originally containing stone cottages that once lined the street verge. The potential that current road corridors or footpaths contain footages or structures is low. The proposal site also has the potential to contain evidence of early road construction, including former surface treatments, kerbs guttering and services. These remains are likely to be heavily truncated through later ground disturbance, road widening, the installation of services and construction works.

Aboriginal heritage

A basic search of the Aboriginal Heritage Information Management System (AHIMS) was undertaken on 25 March 2021 covering a 200-metre radius around the proposal. The search did not identify any sites within the proposed buffer. The visual inspection undertaken on 16 March 2021 of the proposal site indicated that the proposed works would be undertaken entirely on land that is previously disturbed.

6.3.2 Impact assessment

Non-Aboriginal heritage

The SoHI concluded that the proposal would not result in any physical or visual impacts to the heritage significance of the HCA and surrounding buildings. There is the potential for some construction activities, including the removal and replacement of existing paving and excavation for new services and planting to result in inadvertent impacts to the facade of heritage listed buildings adjoining the proposal site. Although the potential for archaeological remains within the proposal site is low, there is the potential that these ground disturbing works could damage an item of significance. Mitigation measures to minimise construction impacts on heritage buildings and archaeological remains are provided in Section 6.3.3.

Recommendations regarding the conservation of the heritage significance of the streetscape, including conservation of original fabric, awnings and facade work have been provided in Appendix C, and have informed the placement and species selection of street trees to maintain visual connections to the heritage facades.

Council wishes to adaptively re-use within the Charing Cross public domain a heritage trough and water pump understood to be authentic remnants of street furniture from the locality (currently being held on Waverley Council property). The SoHI notes that these may be considered 'moveable heritage', and should be heritage assessed to establish their provenance and determine their level of significance, which would then inform the design of conservation works required to repair them and relocate them for adaptive re-use as street furniture within the study area. Refer to 6.3.3 Mitigation Measures for further detail.

In summary the SOHI concludes that construction of the proposal would result in a positive heritage outcome improving the visual amenity of the precinct.

Aboriginal heritage

The proposal site has been previously significantly disturbed and the potential impacts on Aboriginal heritage during operation of the proposal are not expected. An unexpected finds protocol is proposed to address residual risk to Aboriginal heritage.

6.3.3 Mitigation measures

The following mitigation measures would be implemented to minimise impacts during design and construction: The Detailed heritage recommendations that have informed detailed design are available in the SoHI at Appendix C of this REF.

Non-Aboriginal heritage

During Design

- Apply the SOHI recommendations of a native high canopied tree species that will maintain filtered views through to heritage facades.

- Arrange trees at a generous spacing to maintain filtered views through to heritage facades.
- Use materials and finishes to the public domain that are simple and robust and complement the heritage character of the precinct (eg asphalt concrete and brick).
- Provide interpretation of the heritage significance of the precinct including a variety of mediums.
- The historic water trough and pump are understood to be authentic remnants of street furniture from the locality, currently being held on Waverley Council property, and may be considered 'moveable heritage'. These elements should be heritage assessed to establish their provenance and determine their level of significance, which would then inform the design of conservation works required to repair them and relocate them for adaptive re-use as street furniture within the study area. If they are determined to be significant moveable heritage, the works required to use them and install as proposed should be undertaken with expert heritage supervision, including careful consideration of security measures to reduce the likelihood of graffiti and vandalism (such as CCTV)

During construction

- A heritage induction should be presented to workers by an expert Heritage Consultant before commencement of construction. All relevant construction staff, contractors and subcontractors must be made aware of their statutory obligations for heritage under the NSW *Heritage Act 1977* and best practice as outlined in *The Burra Charter* (Australia ICOMOS 2013) and HNSW guidelines to ensure no archaeological remains or heritage fabric are impacted during the proposed works without appropriate mitigation measures in place. The induction should include the values of the place, avoidance procedures and outline any relevant 'Unexpected Archaeological Finds' protocols
- an 'Unexpected Archaeological Finds' protocol should be developed for all excavation works. If unexpected archaeological finds are encountered during the excavation, works must cease immediately, and a suitably qualified archaeologist be contacted to assess the find and recommend next steps. Should unexpected historical archaeological 'relics' be identified the NSW Heritage Council should be notified under s146 of the Heritage Act 1977. Additional assessment, management and/or approvals from Heritage NSW may be required before significant 'relics' can be impacted
- Where works are proposed that would abut the facades of buildings that are heritage listed or considered contributory buildings within the HCA (for example, the removal and replacement of existing paving), it is recommended that these works be conducted with special care to avoid possible damage to heritage fabric—possibly being undertaken by hand rather than with heavy machinery.

Aboriginal heritage

- Cease work if an item (or suspected item) of non-Aboriginal heritage is discovered during the work, and inform the site supervisor who will advise Council. Works affecting Aboriginal 'objects' on the site must not continue until Heritage, Department of Premier and Cabinet has been informed in accordance with Section 89A of the National Parks and Wildlife Act 1974 (as amended). Aboriginal 'objects' must be managed in accordance with the National Parks and Wildlife Act 1974.
- All workers / contractors will be informed of their obligations under the NPW Act, namely that it is illegal to disturb, damage, destroy a relic without the prior approval of the NSW Government.

6.4 Traffic, transport and access

This section provides an assessment of the potential traffic and transport impacts associated with construction and operation of the proposal.

6.4.1 Assessment approach and methodology

A traffic impact assessment (prepared by GHD and dated 19th November 2020) was undertaken as part of the Concept Design proposal. This study involved:

- Site inspection and traffic counts
- Traffic modelling for design options
- A traffic study to review the performance of the existing intersections in the nearby area, as well as assess the existing traffic and transport conditions, crash statistics and pedestrian safety at the Charing Cross Village

A further traffic report building on the earlier work was undertaken by TTW in October 2023. This report involved:

- Review of signalised intersection crossings and traffic configuration including additional traffic modelling
- Review of non signalised pedestrian crossings
- Review of parking and bus zones
- Swept path analysis

6.4.2 Existing environment

Road network

The road network in the vicinity of the proposal site is described below. The proposal site is along Bronte Road and includes a six-way intersection at Bronte Road, Victoria Street and Carrington Road and the intersection of Bronte Road with Albion Street south of the proposal site. Access to the indicative compound location is via Victoria Street.

Traffic generators located in the vicinity of the proposal site include Bondi Junction and the local schools including St Charles' Primary School, St Catherine's School, Waverley Public School, Waverley College, Waverley Junior College, Gingerbread Kindergarten and Waterford Pre-School.

Bronte Road

Bronte Road is a sub-arterial road (regional road), which provides a local link to Bondi Junction to the north and Bronte Beach Park to the southwest. The carriageway is divided by a double solid line and is a two-way, two-lane road with parallel parking on both sides. It has a default urban speed limit of 50 km/h except for where it is 40 km/h at a school zone.

Victoria Street

Victoria Street functions as a collector road, which runs in east west direction connecting Henrietta Street in its east and Queens Park Road and York Road to its west. It is a two-way road with one traffic lane in each direction divided by raised median and double solid lines. It has a default urban speed limit of 50 km/h.

Carrington Road

Carrington Road is an arterial road (state road), which provides connection to Council Street and Bondi Road to its north and Coogee Bay Road to its south. It mostly has one traffic lane in each direction divided by double solid line. It has a default urban speed limit of 50 km/h except for where it is 40 km/h at a school zone.

Albion Street

Albion Street functions as a collector road, which runs in a north south direction connecting Bronte Road to the north and Carrington Road to the south. It is a two-way road with one traffic lane in each direction divided by double solid lines (faded). It has a default urban speed limit of 50 km/h except for where it is 40 km/h at a school zone.

Macpherson Street

Macpherson Street functions as a sub-arterial (regional) road, which runs in east west direction connecting Darley Road and Carrington Road to the west and Bronte Road to the east, towards Bronte Beach. It is a two-way road with one traffic lane in each direction divided by double solid lines (faded). It has a default urban speed limit of 50 km/h except for where it is 40 km/h at a school zone.

Leichardt Street

Leichardt Street functions as a sub-arterial (regional) road, which runs in a north south direction connecting Bronte Road to the north and Macpherson Street to the south, becoming a local road to the south of Macpherson Street towards Varna Street. It is a two-way road with one traffic lane in each direction divided by double solid lines (faded). It has a default urban speed limit of 50 km/h except for where it is 40 km/h at a school zone.

Parking

Parking within the proposal site is provided by on-street parallel parking bays along both sides of Bronte Road. The parking restrictions vary along the proposal site ranging from 15 minutes to 1 hour on weekdays and Saturdays.

In the vicinity of the proposal site, parking along Bronte Road is available in both directions and time restricted. On-street parking on either side of Carrington Road, Victoria Street and Albion Street is available on both sides of the road with 30 minute to two hour time restrictions.

Pedestrian access

An existing 3.6 metre footpath from property boundary to kerb line is provided on both sides of Bronte Road. Signal controlled pedestrian crossings are provided at the six-way intersection at Bronte Road, Victoria Street and Carrington Road. Pedestrian connectivity at this intersection is poor due to the complexity of the intersection and its six approaches to the intersection resulting in delays for pedestrians crossing several roads. Transport for NSW's Walking Space guide suggests that main street footpaths should ideally range from 4.5 metres (3.2 metres pedestrian clear zone) to 5.4 metres (3.9 metres pedestrian clear zone) for higher activity. As such opportunities to widen the available footpath space are important from a functional and safety perspective.

The zebra crossing for the slip lane from Bronte Road onto Carrington Road increases pedestrian crossing distance for the intersection. A zebra crossing is also located at the southern end of Bronte Road, just north of the intersection with Albion Street, a distance of 245 metres. Ideally for a main street situation TfNSW Gehl and other references suggest crossings would ideally be closer to 100m apart.

Cycle access

The concept design process undertaken across 2020-2021 examined the feasibility of integration of cycle provisions to Bronte Road. This review assessed that provision of cycle facilities was not feasible while addressing the other project goals of improved pedestrian safety and movement and greening of the centre due to the finite space available within the road reserve.

Potential ongoing conflicts with vehicular traffic and parking function were also identified as constraints to providing formal cycle facilities.

Public transport

There are currently several bus services operating in the vicinity of the study area, and seven of these are associated with bus stops within the proposal site. These are summarised in Table 6

Most of these services run regularly on weekdays and about one to two services per hour on weekends.

Bondi Junction train station is about 1 kilometre north west of the proposal site. Bondi Junction station is serviced by Sydney Trains T4 Eastern Suburbs and Illawarra train line.

Table 7 *Bus services in the vicinity of the project study area*

Route	Coverage
314	Bondi Junction to Coogee via Randwick Junction
316	Bondi Junction to Eastgardens via Randwick Junction
317	Bondi Junction to Eastgardens via Randwick Junction & Beauchamp Rd
348	Bondi Junction to Wolli Creek
353	Bondi Junction to Eastgardens
379	Bronte to North Bondi
400	Sydney Airport to Bondi Junction via Eastgardens

6.4.3 Impact assessment

6.4.3.1 Construction

Generally speaking construction activities will affect:

The footpath and related pedestrian access along the street, to shopfronts and to public transport

Kerbside space – through construction of kerbs and gutters, drainage and construction vehicle standing

The carriageway – through trenching for installation of services and for road re-sheeting

As noted in section 4.2, Council's required construction approach for the main public domain works will be that the works are carried in physical zones that focusses on the general completion of a section of street so that disturbance to any given frontage is not drawn out over a longer time frame.

In addition, a key focus on construction management will be in forward planning and liaison with the affected community and business owners. Early notification of periods of disturbance or other impact will be provided, and clear communication maintained during works.

Traffic generation

Construction would generate heavy vehicle movements associated with the transportation of construction machinery, equipment, and materials to and from the proposal site. Light vehicle movements would be associated with employees and smaller deliveries.

Construction vehicle movements would result in a temporary increase in traffic along the road network most significantly during concrete pours, which could result in about 16 movements per day. The estimated worst-case scenario for truck movements during peak periods would be about four vehicle trips per hour comprising two in and two out movements. This work offers some potential for nightworks to mitigate traffic impact.

Construction works disturbance of traffic

Construction works within the carriageway will also create disturbance to traffic. The key disturbances through construction works would include:

- During services trenching and services crossing works. Full closure of the carriageway may be required for some crossing works – and this would be sequenced to occur in lower traffic timeframes

- During road trimming and re-sheeting – the Contractor will be requested to maintain at least one side of the carriageway open. Again this work offers some potential for nightworks to mitigate traffic impact

Construction vehicle access

Construction vehicular access will be focussed on Bronte Road generally approaching from the western end via Carrington Road southbound or Bronte Road eastbound. It will be necessary to temporarily close 2-4 parking spaces at different locations intermittently during the construction works for materials and construction access. As outlined in section 4.2 the works are proposed to be sequenced within a series of zones along the street so that impacts to any given section of street are not prolonged

Pedestrian access to shopfronts and public transport

The construction contract will generally maintain access to shopfronts and existing bus services and existing bus stops. Temporary access panels will be laid to areas under construction to maintain access to these facilities. Where there is a need to temporarily modify stopping areas, this will be approved with State Transit, and implemented and managed in accordance with their requirements.

6.4.3.2 Operationally

The project implements the following elements generally focussed on improving the pedestrian environment and safety. The Civil and Traffic Engineering Assessment by TTW Engineers provided at Appendix D outlines these in further detail:

- New mid block raised crossing and upgraded southern crossing (upgraded to raised)
- Continuous footpath provided across Cables Place junction with Bronte Road
- Upgrades and modifications at signalised intersection with Carrington Road and Victoria Street:
 - o Removal of westbound slip lane from Bronte Road to Carrington Road southbound to facilitate improved pedestrian movement space and safety at crossing
 - o Localised footpath widenings to Victoria Street on all 4 corners at the signalised intersection to facilitate reduced pedestrian crossing distance

The new mid block crossing and upgraded southern crossing will act to slow traffic speeds which can provide an improved main street environment with marginally reduced traffic noise and fumes, in addition to the pedestrian benefits stated above.

TTW undertook SIDRA modelling in October 2023 in order to assess the impacts of the proposed Charing Cross Streetscape Upgrade Works on vehicular and pedestrian traffic and the operation of the surrounding road network. These investigations indicated the following:

- The Level of Service (LOS) for all intersections in the model with the introduction of the Streetscape Upgrade works is projected to remain the same, when compared to the Base network results.
- The operation of the intersection of Bronte Road, Carrington Road and Victoria Street with the introduction of the Streetscape Upgrade works is projected to improve during all peak hours, as the degree of saturation, average delay and 95th percentile queue length is projected to decrease, when compared to the Base network results.
- The operation of the remaining intersections with the introduction of Streetscape Upgrade works is projected to remain the same or be altered by a negligible amount, when compared to the Base network results.

6.4.4 Mitigation measures

Construction planning and management

Section 4.2 outlined the construction approach proposed by Council and to which the Contractor must address their construction planning and management. This will focus on a phased approach whereby works are focussed in a physical zone, under the following overall phases:

Phase A Power telecoms and Lighting

Phase B Public Domain Construction Works

Phase C Planting and finishing works

Phase D Road re-sheeting works

Councils required construction approach for the main public domain works will be that the works are carried in physical zones that focusses on the general completion of a section of street so that disturbance to any given shop frontage is not drawn out over a longer time frame.

Construction

The following mitigation measures would be implemented by the Head Contractor to minimise traffic impacts during construction:

- Residents and businesses within 200 m of the proposal will be notified of the works prior to commencement. Signage will also be provided near the site to notify of any closures and alternate access.
- The necessary staging of works and re-routing of vehicular and / or pedestrian access will be notified in advance along with alternative access
- All work equipment and materials will be contained within the designated boundaries of the work site.
- Construction vehicles and on site personnel will be limited to those needed for the proposed work, with all excess equipment moved off-site to reduce traffic impacts.
- All communications and complaints will be assessed and a response, corrective and/or preventative action implemented (as necessary).

Operation

Generally, the completed works will result in an improved street environment for local residents, business owners and visitors. Tree and garden planting and will enhance the character and identity of Charing Cross, and in combination with footpath widenings, act to encourage slower traffic speeds. Improved pedestrian crossing facilities will enhance connectivity between east and west sides of Bronte Road and result in increased pedestrian safety.

The loss of 6 on street car parking spaces as a result of the northern mid-block pedestrian crossing and southern crossings is offset against these benefits. Opportunities to provide additional off-street parking to supplement on street parking will be pursued by Council with adjoining land holders as redevelopment occurs in the future.

6.5 Visual amenity (including trees)

6.5.1 Existing environment

The Waverley Development Control Plan 2022 describes Charing Cross as having “high street” character with a two-storey character encompassing near-complete rows of highly intact Federation terraces (with continuous lateral pitched roofs) and Victorian terraces (with ornate parapet), interspersed with some examples of two storey Interwar and Art Deco apartments.

Heritage buildings in the site area provide high visual amenity. Many of the Charing Cross buildings have:

- Painted plaster featuring highly decorative finishes.
- Largely intact, original shop fronts or original entry configuration.

- A variety of visually pleasing colours (although where adjoining buildings have been painted the same colour this amenity is diminished) (Council, 2012).

The proposal site forms part of the Charing Cross to Bronte history walk and provides viewpoints of heritage items including the former Bank of NSW Waverley Branch (189 Bronte Road), the former post office (234 Bronte Road), Charing Cross Hotel and Robin Hood Hotel (Urban Design + Heritage Team, 2020).

The site area also includes views of historic buildings outside the site, including St Mary's Immaculate Catholic Church and associated buildings (a listed State Heritage group) and the Uniting Church and Hall (Refer SoHI Appendix C)

The Waverley Development Control Plan 2022 also states, *"Appreciation of the high heritage quality of the building stock of this area is compromised by intrusive suspended power lines and the placement above the line of awnings of other built elements such as advertising structures and air conditioning units"* (Council, 2012).

6.5.2 Impact assessment

The proposed works would see the removal of intrusive modern elements that have visually cluttered the streetscape and impacted upon view lines to the first-floor facades of heritage items, particularly along the main streetscape of Bronte Road. (SOHI Artefact, 2023).

The existing paving, which has failed over time would be removed and replaced with appropriate mix of honed concrete and brick paving. The new paving would extend across both sides of Bronte Road while also demarcating the end of the "village" streetscape on Carrington Road, Victoria and Albion Streets, resulting in an interpretive response of the village centre within the Heritage Conservation Area. (SOHI Artefact, 2023).

The proposed removal and replacement of modern fabric (paving, street furniture, kerbs and guttering) with similar, like-for-like fabric would not result in any adverse indirect visual impacts. The proposed new parking spots along Victoria Street would generally not result in any additional visual impacts, as the area currently comprises of parallel parking zones and impacted views to the heritage items in the area would be temporary.

The introduction of new soft landscape within the streetscape would generally not result in any adverse indirect visual heritage impacts to the Heritage Conservation Area. (SOHI Artefact, 2023).

Overall, the SoHI notes that the proposed replacement of modern fabric and removal of overhead wiring is considered to be a positive and sympathetic enhancement of the streetscape, retaining the village atmosphere through upgrades to street furniture, paving and infrastructure within the area.

6.5.3 Mitigation measures

The design has applied the SOHI recommendations of a native high canopied tree species at a generous spacing that will maintain filtered views through to heritage facades but maintain the visual presence of the facades to the streetscape.

The following mitigation measures would be implemented to minimise impacts during construction:

- Take all practical measures to ensure construction equipment, stockpiles, and other visible elements are located away from key views to or from the sensitive visual receivers identified in this assessment. Should such equipment or stockpiles be located in a visually prominent location for any reasonable period of time, incorporate screening measures and practices to ensure sites are kept tidy. Refer to section 4.2.6 and Figure 4 Masterplan Arrangement of this REF for indicative location of construction compound.
- Ensure final design and materiality of services components such as poles, signage and lighting contribute positively to the heritage context of the park.

6.6 Noise and vibration

6.6.1 Existing environment

The Charing Cross Village Centre project is located within an active mixed use area. Sensitive receivers include a mix of residential and commercial premises. These receivers will be affected by noise and vibration during construction works.

In general the existing noise environment of the study area is dominated by road traffic noise and commercial activities along Bronte Road. It is likely that background level of noise for the day period is higher than that of the evening and night period due to the high intensity of morning peak hour traffic and pedestrian activity.

6.6.2 Impact assessment

Works will be carried out during standard hours where possible. However, given the nature of the project, some right-time works may be required. This is due to a need to maintain the operational integrity of the road and pedestrian network.

The Interim Construction Noise Guideline (ICNG), (DECC, 2009), outlines noise assessment criteria and provides suitable mitigation measures to reduce noise and vibration impacts. The ICNG specifies a noise management level for residential receivers of background levels +10 dB(A) during standard work hours (Monday to Friday 7am to 6pm and Saturday 8am to 1pm). Outside of these hours, it recommends only +5dB(A). The ICNG accepts that some works undertaken on public infrastructure, such as road works, may need to be carried out outside of standard hours.

Given the close proximity of the proposal to multiple sensitive receivers, it is likely that the ICNG's recommended noise management levels will be exceeded during the day and night.

6.6.3 Mitigation measures

It is recommended the following core mitigation measures be used to reduce noise and vibration impacts:

- An Acoustic Consultant is to undertake a Noise and Vibration Assessment prior to works commencing and conclusions outlined in the final CEMP
- A Construction Noise and Vibration Management Plan is to be prepared and implemented as part of the CEMP. The plan is to generally follow the approach in the ICNG.
- All sensitive receivers likely to be affected will be notified at least 5 working days prior to the start of any works associated with the activity that may have an adverse noise or vibration impact.
- Works are to be carried out during normal work hours (i.e., 7am to 6pm Monday to Friday; 8am to 1pm Saturdays; no work on Sunday or public holidays). Works outside these times will be carried out in accordance with the management and mitigation measures detailed within the Construction Noise and Vibration Management Plan .
- Undertake building dilapidation surveys on all buildings located within a buffer zone as defined by the construction Construction Noise and Vibration Management Plan (prepared as part of the CEMP) prior to major project construction activities with the potential to cause property damage
- Establish and maintain safe working distances from structures when performing vibration intensive works.

The following supporting mitigation measures are also recommended as outlined in the Draft Construction Noise Guideline 2021 (EPA):

- Train workers and contractors on the best practice use of equipment and work methods in order to minimise noise.
- Ensure workers and contractors are aware of the noise management requirements in any consents, approvals or licences, for example through site inductions and 'toolbox talks' and by providing a summary of relevant project requirements for quick reference (such as on a noticeboard).

- Include appropriate clauses and conditions within employment contracts, subcontractor agreements and work method statements that require all workers and contractors to observe (noise management) directions from the site manager.
- Periodically check the site, nearby residences and other sensitive land uses to proactively identify noise issues and feasible and reasonable mitigation.
- Avoid the use of radios, stereos, open two-way radios and public address systems outdoors where they are likely to be audible at sensitive receivers beyond the site boundary.
- Avoid shouting, talking loudly, slamming vehicle doors or making any other unnecessary noise.
- Inform truck drivers of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices, such as minimising use of engine brakes and avoiding engine idling.
- Avoid the use of equipment that generates impulsive, tonal or irregular noise.
- Minimise or avoid the need for reversing or movement alarms. Advice is provided in Appendix E of the Draft guidelines)
- Avoid unnecessary dropping of materials from a height and metal-to-metal contact on equipment.
- Avoid mobile equipment clustering near residences and other sensitive land uses.

The following work practices also recommended as outlined in the Draft Construction Noise Guideline 2021. These are relevant at all times, but have particular relevance for managing noise when work is scheduled outside the recommended standard hours:

- Where appropriate, consider prefabricating items off site.
- Where appropriate, consider the use of 'quiet' communication methods, such as personal radio headsets.
- Where practicable, restrict deliveries to the daytime. Where deliveries must be made during the evening or night-time (or on weekends or public holidays), schedule vehicle movements to avoid residential streets, if possible.
- Offer periods of respite to the community where unavoidable maximum noise level events are anticipated. In some circumstances, offers of alternative accommodation or temporary relocation may be appropriate (refer section 5 of Draft Construction Noise Guideline).
- Ensure procedures are in place to address noise at unattended sites, for example unattended equipment operating over 24 hours and security alarms. The use of guard dogs is discouraged where worksites are adjacent to residential areas.

Consultation and notification

The contractor must also have regard for the guidance provided for consultation and notification of the residential and business community as outlined in Appendix C2 of the Draft Construction Noise Guideline

6.7 Socio-economic

6.7.1 Existing environment

The proposal site is located within Charing Cross, the mixed-used Village Centre for the suburb of Waverley. Profile ID notes that Waverley suburb in 2022 had a population of 4,218, which is a density 6968 persons per square metre around 50% of the density of neighbouring Bondi suburb. The suburb has primarily low and medium residential land use with several schools, parks, churches, and businesses.

The proposal site is an important transport route with bus routes connecting the village with surrounding areas and land uses. According to the *Our Liveable Places Centres Strategy (Adopted December 2020)* the community want Charing Cross to become a destination rather than a throughfare, “where people visit, stay and enjoy”. The community envisioned the area as having more emphasis on the village’s heritage, more greenery and a balance between pedestrian use and parking to allow it to function as a commercial precinct, as intended.

6.7.2 Impact assessment

Construction

During construction issues such as air quality, dust, traffic and access, land use, noise, vibration, and visual amenity have the potential to impact the local community and road users.

These issues have been outlined and assessed in other sections of this report, as follows:

- Noise and vibration (refer section 6.6)
- Visual impacts (refer section 6.5)
- Traffic and access (refer section 6.4)
- Air quality (refer section 6.8.3)

During construction, businesses along Bronte Road will experience access disruption due to closed sections of the road or delivery and removal of materials. Arrangements will be made with owners and business operators to provide alternative delivery and access requirements as required to minimise inconvenience during this period.

Traffic and access issues during construction, as discussed in section 6.4 have the potential to result in minor impacts to the community through increased travel times during construction. It is expected that increased travel times would occur during construction in response to changes in access and connectivity. Reduced speed limits around construction sites would also have the potential to result in increased travel time for road users. Increased travel times would also be experienced by pedestrians on alternate routes provided during closure and construction of footpaths.

The Council carpark adjacent to the Mary Immaculate Catholic Church has been identified as a potential compound site for use during the construction phase of the proposal. This site would be temporarily unavailable to Council workers for parking during the construction period. This impact would be temporary and short term as the compound site would be reinstated to its original condition and use following completion of construction.

The compound site is in close proximity to sensitive receivers at the Mary Immaculate Catholic Church, the Charingfield Aged Care Community and residencies along Victoria Road. A minor increase in noise would potentially occur as a result of construction activities at these compound sites. The compound site would temporarily impact the visual and acoustic amenity for the nearby sensitive receivers.

The increased presence of heavy vehicles entering and exiting the compound sites may contribute to traffic congestion from vehicles turning in and out of the sites. Dust would potentially occur as a result of the construction vehicle and machinery movement at the compound site. Mitigation measures as outlined in section 6.7.3 aim to address this impact as sensitive receivers are in close proximity to the site.

Operational

The proposed works will result in a greatly enhanced street environment and create an improved sense of place for Charing Cross with greater pedestrian comfort, eye level interest and improved experiences for locals and visitors. All aspects of the proposal are in line with best practice that focuses on improving a place to encourage street and community life and generate economic activity.

At the heart of the project are several fundamental goals related to socio-economic health:

- a. Making Charing Cross a more appealing place to visit
- b. Providing an environment that encourages people to stay longer
- c. Providing greater ease of connectivity between the north and south sides of the street that make it easier for people to visit multiple businesses on a visit

These goals are realised through the design by a number of key strategies:

Arrival experience

- The proposed improvements to the entry points to Bronte Road will highlight arrival to Charing Cross, emphasise its enhanced role as a “people place”, and build the sense of place and character that will encourage a greater awareness of and desire to visit the centre.

Sense of place

- As noted in the SOHI (refer appendix C) the proposal will improve the heritage presentation of the streetscape through the removal of overhead power and telecommunications lines and provision of sensitively designed tree and garden plantings.
- Additional greening through tree and garden planting will improve summer shading, framing of important views and facades, and create a greener presence on the street, enhancing the character and identity of Charing Cross.
- Interpretive elements including signage and artworks will provide background to the history and identity of Charing Cross, and will complement the other improvements

Pedestrian space, connections and amenity

- Widening of the footpaths will facilitate more comfortable and higher volumes of foot traffic, create space for fixed street furniture, enable greater opportunities for on street trading (café seating), and facilitate street tree and street garden greening of the street making it a more pleasant place to be year round.
- Increased foot traffic and encouragement of longer “stays” in the centre should have positive impacts for businesses within Charing Cross and support the community goals for having Charing Cross as a “destination” rather than merely a thoroughfare.
- Introduction of a mid-block crossing will improve pedestrian comfort and accessibility and reduce traffic speeds through Bronte Road. At slower speeds vehicles emit less noise and fumes which will enhance the pedestrian environment and encourage on street trading and longer stays in the centre.

Comfort

- New pavements through the centre will greatly improve the visual character of the place but also make it more comfortable for pedestrians
- The introduction of seating and gathering areas at the mid-block and upgraded south crossing will encourage community to linger longer in the centre and assist and encourage visitors to frequent local businesses

In the context of the above improvements that will significantly contribute to the long term socio-economic health of Charing Cross Village Centre and increase pedestrian safety and comfort, 6 on street parking spaces will be lost to facilitate the proposed new mid-block crossing and upgrading of the southern pedestrian crossing.

In addition to the above benefits, this minor loss of parking to the centre should also be considered in the context of the density of population to adjoining neighbourhoods and the potential for this local community to walk or cycle to the Charing Cross main street.

Council will pursue opportunities to provide additional off-street parking to supplement on street parking as redevelopment occurs in the future.

6.7.3 Mitigation measures

The following mitigation measures would be implemented to socio-economic minimise impacts .

6.7.3.1 Construction

As outlined in section 4.2 the works are proposed to be split into several phases based on construction activities and expertise / likely sub-contractor responsibilities:

Phase A Power telecoms and Lighting

Phase B Public Domain Construction Works

Phase C Planting and finishing works

Phase D Road re-sheeting works

Council's required construction approach for the main public domain works will be that the works are carried in physical zones that focusses on the general completion of a section of street so that disturbance to any given shop frontage is not drawn out over a longer time frame.

Access will generally be maintained (including through temporary measures as required) to residences and businesses during the course of the works including:

- a. Through coordination with the head contractor, access to businesses during each business's opening hours, will be maintained during the course of the works
- b. Through coordination with the head contractor, residential access will maintained during the course of the works

A further strategy that will be subject to planning and implementation by the construction contractor will be tailoring higher impact construction works to after 11/12pm after the peak activity period for the main street has subsided. This could mean machinery focussed activities, and noise generating activities are more focussed in the afternoon period where possible

The demolition works will occur during the recommended standard hours for construction work as outlined in the Draft Construction Noise Guideline (NSW EPA, 2020).

Some nightworks will be required for streetscape upgrades to the Charing Cross Village Centre. This may include Phase A - Power Telecommunications and Lighting, and Phase B Civil and Public Domain Construction Works. The allowing of night works by Council will be subject to all applicable noise management requirements, and would be notified ahead of time to residents and business owners. Noise and vibration monitoring would be carried out in accordance with standards.

The contractor will be required to establish and maintain a communications strategy to be approved by Council. The aim of the strategy is that residents and business stakeholders are fully aware of the project process, including when their activities will be interrupted, and if there are any necessary changes to those plans.

Further, Council will maintain an online platform accessible by QR code posted around the site, that provides real time information of the construction process, upcoming activities and temporary changes to access, and provides contact details for information and complaints.

Temporary access changes during construction will be notified to the community and businesses prior to the event and then clearly signed and manned by traffic wardens on the day.

The following day to day mitigation measures would also be implemented to minimise socio-economic impacts during construction:

- Residents and businesses within 200 m of the proposal will be notified of the works prior to commencement. Signage will also be provided near the site to notify of any closures and alternate access.
- The necessary staging of works and re routing of vehicular and / or pedestrian access will be notified in advance along with alternative access
- Construction vehicles and on site personnel will be limited to those needed for the proposed work, with all excess equipment moved off-site to reduce traffic impacts.

- Construction management of air and water quality and noise during the works will be implemented and monitored in accordance with an approved Construction Environmental Management Plan (CEMP) as noted in 6.8.2
- Construction activities will be phased and sequenced to enable maintenance of as close to normal access as possible during the course of the proposed works.
- Temporary access panels with non-slip surfaces will be provided over works areas during business hours as required

All communications and complaints will be assessed and a response, corrective and/or preventative action implemented (as necessary).

6.8 Other issues

6.8.1 Biodiversity

6.8.1.1 Existing environment

The proposal is located within a highly urbanised and modified landscape. There is no native vegetation present within the proposal site. Two street trees planted within the proposal site have been identified as Blueberry Ash (*Elaeocarpus reticulatus* Smith). The mature trees are in moderate health and display stress symptoms which is evident in the distorted growth and bark. The proposal site also contains several planter boxes located along the edge of the footpath, which are planted with shrubs and perennials that appear to be African Lily (*Philodendron* cultivar)

Previous surveys and Council biodiversity plans and maps were reviewed to analyse conservation value of the proposal site. These documents indicated the site is of low conservation value (AMBS, 2011; Total Earth Care Pty Ltd, 2014; Hirschfeld, 2015; Council 2018).

The Waverley Flora Survey Report 2020 undertaken by Sydney Bush Generation Company for Council identified remnant vegetation stands are located at Bondi, North Bondi, Dover Heights, Queens Park, Tamarama, Vaucluse and Waverley Cemetery Bronte within the LGA:

A search of the Protected Matters search tool on the National Department of Climate Change, Energy, the Environment and Water website (October 2023) as part of the REF preparation identified the potential for the following in the vicinity of the project area:

- Migratory bird species	18
- Threatened ecological communities	5
- Threatened species	47

6.8.1.2 Impact assessment

The proposal would require the removal of two planted trees from the formed garden beds located along the northern footpath. Several detachable planter boxes will also need to be relocated or removed from along both sides of the footpath. The proposed removal of the two planted trees and planter boxes for the widening of the footpath would have a negligible impact on native flora and fauna within the locality. The vegetation that would be impacted by the proposal does not provide any significant fauna habitats. The proposed vegetation clearing/disturbance would be unlikely to affect the persistence of any local populations of native fauna.

There is a Magnolia grandiflora in the courtyard of 280-282 Bronte Road that is on Waverley's Significant Tree Register (Refer to figure 4 following page). No works are proposed within the courtyard and the existing wall between the tree and the paved footpath will be retained. While it is outside the scope of the work to be undertaken under this project scope, construction management must ensure that the curtilage to this tree is fully protected and managed in accordance with qualified Arborist statement provided by Council's Arborist (refer Appendix E).

The proposed replanting of additional street trees would have a positive impact on the proposal site by providing potential fauna habitat and improving the ecological value of the area. In total 41 new street trees are proposed to be planted as part of the proposal of which 64% are Australian native species. In addition street garden areas at the two pedestrian crossings and under street trees will provide additional greening and cooling of the centre.

In relation to potential impacts on migratory bird species, threatened ecological communities and threatened species in the vicinity of the site, it is noted that the proposed project does not change the ongoing long term use and function of the site. During construction potential impacts related to noise, vibration, dust and water quality will be subject to management under the project CEMP and are not considered to be additional threats to these species and communities. The provision of additional tree canopy and understorey garden planting will provide a positive impact in terms of increasing habitat values for general fauna in the area



Figure 7 *Location of existing Magnolia specimen to be protected and conserved and image of existing conditions*

6.8.1.3 Mitigation measures

The following mitigation measures would be implemented to minimise impacts on biodiversity during construction:

- Vegetation removal will be limited to the two street trees (in poor condition) and planter boxes located along the footpaths within the proposal site.
- Tree removal will be carried out according to the guidelines outlined in Safe Work Australia (2016) and in accordance with the Waverley Council Street Tree Masterplan (Waverley Council 2008) and the Waverley Council Tree Management Policy (Waverley 2019)
- Ensure the adjoining pavement and related works adjacent to existing *Magnolia grandiflora* in the courtyard of 280-282 Bronte Road that is on Waverley's Significant Tree Register maintain the design extent of works and provide tree protection and works management measures in accordance with AS-4970-2007 Protection of Trees on Development sites.
- *Magnolia grandiflora* in the courtyard of 280-282 Bronte Road is on Waverley's Significant Tree Register. It is outside the scope of the work to be undertaken under this project scope. However construction management must ensure that the curtilage to this tree is full protected and managed in accordance with qualified Arborist advise. Refer key requirements below and Appendix E of this REF for detailed requirements:
 - The existing raised garden bed wall will act as a protection for the Structural Root Zone (SRZ). All work outside the SRZ and in between the TPZ will require hand excavation to avoid damaging any tree roots. No mechanical excavation is to be undertaken
 - All pavers in the between the SRZ and TPZ are to be removed by hand to avoid damaging any tree roots. No mechanical excavation of pavers is to be undertaken.
 - If any tree roots are exposed during any approved works, then roots smaller than 30mm are to be pruned as per the specifications below. **Any roots greater than 30mm are to be assessed by a qualified arborist before any pruning is undertaken.**
 - If tree roots are required to be removed for the purposes of constructing the approved works, **they shall be cut cleanly by hand, by an experienced Arborist/Horticulturist (with a minimum level 5 Horticulture Certificate or Tree Surgery Certificate).**
 - It is the consulting arborist's responsibility to determine if such root pruning is suitable. If there are any concerns regarding this process, then Waverley Council's Tree Management Officer is to be contacted to make final determination.
 - If the *Magnolia grandiflora* requires pruning, then permission must be gained from the owner of the tree, and an application to Prune or Remove Trees on Private Property is then to be submitted to Council for processing.
- The CEMP and construction plans would clearly document the location and full extent of the vegetation disturbance required. These areas would be clearly marked to avoid disturbance to adjacent retained vegetation, and exclusion fencing would be installed around trees to be retained.
- Weed control mitigation and management strategies would be documented and implemented in accordance with the *Noxious Weeds Act 1993*. This would include procedures to reduce the spread of weeds via vehicles and machinery, such as visual inspection of vehicles prior to exit from site to ensure they are clear of plant material.
- Weeds would be managed and disposed of in accordance with the requirements of the *Noxious Weeds Act 1993* and/or the *Weeds of National Significance Weed Management Guide*.

6.8.2 Soils and water quality

6.8.2.1 Existing environment

Topography, geology and soils

The proposal site is relatively flat and is located within two soil landscapes. The north end of the site belongs to the Newport soil landscape unit, which comprise gently undulating plains to rolling rises of Holocene sands mantling other soil materials or bedrock.

The south end of the site near the Bronte Road and Albion Street intersection belongs to the Hawkesbury landscape unit (DPIE 2020).

The Sydney 1:100,000 Geological Map (sheet 9130) shows the proposal site lithology as underlain by quaternary sediments including medium to fine-grained “marine” sand with podosols (Herbert 1983).

Contamination

A search of the EPA Contaminated Land Record website undertaken for Waverley LGA on 10th October 2023 indicated no notices have been issued for the site area under the *Contaminated Land Management Amendment Act 2008* (CLM Act).

A search of the List of NSW Contaminated Sites Notified to the EPA on 9th October 2023 indicated that no notifications of contaminated land have been received by the EPA in the immediate vicinity of the proposal site through Queens Park and Bronte

The closest notification land is at 33-37 Carrington Road Randwick about 500 metres from the Bronte Road and Albion Street intersection. Other sites notified to the EPA near the site include:

- 1-15 Oxford Street Bondi Junction, about 1 kilometre from the Carrington Road, Victoria Road and Bronte Road intersection
- 51 Bondi Road Bondi, about 1 kilometre from the Carrington Road, Victoria Road and Bronte Road intersection
- 185 Bondi Road Bondi, about 1.2 kilometres from the Carrington Road, Victoria Road and Bronte Road intersection.

Several other sites are located at locations through Randwick between 2.4km to 3km from the proposed activity site

Drainage and watercourses

The nearest surface water receptors are a series of ponds within Centennial Park, with the nearest being Musgrave Pond, approximately 1.1 kilometres west of the Bronte Road and Albion Street intersection. Bronte Beach/Nelson Bay is located approximately 1.3 kilometres to the east of the Bronte Road and Albion Street intersection.

The proposal site is not identified as being located on flood prone land. Stormwater is managed through downpipes and gutter drainage.

6.8.2.2 Impact assessment

The proposal involves ground disturbing works including excavation and vegetation removal to upgrade the existing footpath. These works would largely be confined to a surface scrape. Therefore, it is not expected that the groundwater table would be reached as part of the construction works, and dewatering would not be required.

Surface water runoff will generally remain as per current conditions, with the existing stormwater networks remaining in place. Appropriate sediment and erosion control measures will be implemented prior to the commencement of works to reduce potential impacts of sediment laden runoff.

Some sections of aged stormwater pipework will be upgraded and where necessary to implement the works the stormwater system extended. Existing downpipe outfalls will be maintained.

As part of the proposal it is proposed to integrate several raingarden beds to planted areas at the low point of the site in the south of the project area. This will assist with improving water quality for a proportion of the street runoff, and will provide passive irrigation to trees and low level planting in those beds

6.8.2.3 Mitigation measures

Construction

The following mitigation measures would be implemented to minimise impacts during construction:

- Erosion and sedimentation controls would be installed and maintained in accordance with *Managing Urban Stormwater – Soils and Construction* (the Blue Book). Controls would be established before work begins and would be maintained in effective working order for the duration of the works, until the site is restored.
- Overland flow paths will be kept free and open
- Existing stormwater infrastructure will be regularly inspected during construction to ensure free of debris
- Property stormwater outlets will maintained during construction
- The area of ground disturbance, including movement of vehicles and plant, would be minimised.
- Silt socks would be installed in down-gradient locations from excavations, especially at drain inlets, along gutters, etc.
- On-site storage of spoil/other eroding materials in stockpiles would be minimised. Any stockpiles would be bunded and appropriately covered, or used as soon as possible following stockpiling, to minimise the potential for offsite migration.
- Road surfaces would be kept free of spoil/other eroding materials. If spoil is tracked onto roads/paths, it would be removed prior to the work crew leaving the site.
- Excavation would not take place during or after heavy rain when doing so is likely to cause soil erosion and soil structural damage. Personnel would monitor weather conditions and suspend the proposed works in the event of heavy rainfall.
- Disturbed areas would be restored as close as practicable to pre-works condition, and in accordance with the Blue Book.
- Excavated areas would be backfilled and tamped to a stable surface as soon as practicable.
- Any fill sourced off site for backfill and restoration would be clean fill suited to the existing soil composition at excavation.
- Erosion and sedimentation controls would be removed after construction is complete, including removing any trapped sediment in drainage lines.
- The volume of fuels or chemicals brought to site would be limited and contained/bunded within vehicles and plant on site.
- Refuelling would not be carried out on site.
- Vehicles and plant would be checked regularly for leaks.
- All vehicles carrying waste materials capable of discharging free liquid would be watertight to prevent leakage and would be checked before they leave the site.
- Solid or liquid waste (e.g. sediment-laden water) would not be discharged to gutters, stormwater inlets/drainage lines or watercourses.
- Uncontrolled discharge of water into the surrounding environment would not be permitted.
- A functioning 'spill kit' would be kept on site at all times for clean-up of accidental chemical/fuel spills. The 'spill kit' will be stored in an appropriate location that is quickly and easily accessible from all areas of the work site.
- An unexpected finds Protocol will form part of the CEMP to deal with finds of unexpected contaminated materials.
- Cease work in the immediate vicinity of any areas of suspected contamination that are identified prior to or during work. Ensure that these areas are not disturbed and are cordoned off as a safety risk.
- Vehicle and machinery movement will be confined to designated roads, tracks, pathways and work areas. Designated lay-down areas will be selected to minimise erosion or vegetation damage.

- Cease work during heavy rainfall events when there is a risk of sediment loss off-site or ground disturbance due to water logged conditions.
- Ensure equipment, plant and materials are placed in designated areas where they are least likely to cause erosion.
- Check machinery daily for oil, fuel or other liquid leaks
- An incident emergency spill plan would be developed and incorporated into the construction environmental management plan. The plan would include measures to avoid and manage spillages of fuels, chemicals, and fluids onto any surfaces and an emergency response procedure
- Should a fuel spill occur during construction, the emergency response plan will be implemented, and the Council contacted. The EPA would also be notified as per Part 5.7 of the POEO Act.
- The refuelling of plant and maintenance of machinery would be undertaken offsite or in impervious bunded areas in the compound area.
- A Soil and Water Management Plan (SWMP) would be prepared and implemented as part of the CEMP. The SWMP would identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks would be addressed during construction.
- Disturbed areas will be stabilised during maintenance works, where necessary and revegetation where appropriate will be undertaken after works are complete.
- Any damage from construction to the ground surface will be restored to preconstruction condition on completion of works.

Operationally

The Civil and Traffic Engineering Assessment by TTW Engineers provided at Appendix D noted that flood modelling assessment was undertaken by BMT in 2020 which illustrated the extent of flooding during events from 1EY up to 1% AEP. The results were able to demonstrate that the existing stormwater infrastructure has insufficient capacity to drain minor and major flood events. It was found that in 5% AEP event flooding in Bronte Road is expected to reach a depth of 450mm. During the 1% AEP event, flood depths reach 550mm in Bronte Road. Refer to Figure 12 for 1% AEP flood extents.

TTW note that the BMT report explores potential upgrade options including upgrading the downstream system to Carrington Road and further option to provide a surcharge pipe into Queens Park. It was found that for both options an upgraded system was able to assist with minor flood events but offered little to negligible assistance for major flood events given the potential economic cost and increased hazard to downstream developments.

As such, the design intent for the public domain upgrades is to ensure that flood impacts are not worsened by the proposed works. Upgrades to the Bronte Road stormwater infrastructure and the inclusion of passive irrigation and raingardens will be able offer some assistance for the capture and retention of minor flooding events.

Raised crossings where specified have been designed with a 75mm high profile. Primarily this is to allow buses and heavy vehicles to cross over the raised pavement without crossing, however it also offers overland flow paths to continue travelling downstream within the carriageway without overtopping the 150mm barrier kerbs.

TTW also note that although a stormwater quality assessment is not required in accordance with Council's DCP, opportunities for passive irrigation and raingarden have been nominated through the concept stormwater design which will be able to assistance with the water quality being discharged to the Council system. These proposals have been modelled in MUSIC and results indicated an improvement to water quality leaving the site as a result of these improvements.

6.8.3 Air Quality

6.8.3.1 Existing environment

The proposal site is zoned Local Centre (E1) and is adjoined by medium density residential to the west and Low density residential and SP2 (infrastructure – Church Grounds) to the east.

There are potential sensitive receivers adjacent to the site each as outlined following – these should be confirmed through development of the CEMP.

Businesses	Doors and windows to commercial premises to the street frontages adjoining the works site (Bronte Road, Carrington Road, Victoria Street, Albion Street) and proposed construction compound area (located in the existing Council carpark, accessed via Victoria Street)
Residences	Doors and windows to residential premises to the street frontages adjoining the works site, and to adjoining streets (eg Victoria Street and Carrington Road)
Mary Immaculate Catholic Church	Doors and windows to Church building adjacent proposed construction compound area (located in the existing Council carpark, accessed via Victoria Street) and to Works at Victoria Street/ Carrington Road intersection
Jubilee Church	Doors and windows to Church building adjacent Works at Victoria Street/ Carrington Road intersection and at access to construction compound off Victoria Street
Charingfield Aged Care	Doors and windows to aged housing located off Bronte Road but not immediately adjoining the works area

6.8.3.2 Potential impacts

The proposal has the potential to impact on air quality during construction through the generation of dust and odours during land disturbance and construction. Air quality impacts during construction include emissions from construction vehicles, machinery and equipment being operated at the site.

Dust and odours from construction have the potential to impact the amenity of the surrounding commercial residential and community facilities.

When completed the streetscape will improve air quality for the site and immediately adjoining areas by suppressing dust and turbulence and reducing summer heat loadings through the significant increase of tree canopy.

6.8.3.3 Mitigation measures

The following general mitigation measures would be implemented to minimise air quality impacts during construction:

- Erosion and dust controls would be installed and maintained through the project works area and construction compound in accordance with the approved CEMP for the proposal including watering down during earthworks and subgrade works.
- Regular dust monitoring will be undertaken in accordance with the approved CEMP for the proposal.
- When weather reports predict periods of high winds stockpiles and other major areas of uncovered earth or materials shall be appropriately covered and or watered down.

Other required mitigation measures will include:

- Sheeting of vehicles transporting earthworks materials to or from site.
- Wheel washing of site vehicles.
- Locating haul routes away from off-site sensitive properties, with regular watering, particularly during dry conditions (wet suppression of dust).

- Limiting site vehicle speeds on unpaved surfaces.
- Locating aggregate stocking areas away from sensitive properties.
- Minimising drop heights of material.
- Bulking of wastes to minimise transportation and handling requirements.

Measures to minimise plant exhaust emissions should also be employed during the construction phase such as:

- Ensuring, where possible, all Non-Road Mobile Machinery (NRMM) use ultra-low sulphur diesel.
- Placing onsite operating plant far from sensitive properties as practicable.
- Ensuring vehicles and operating plant engines are not idling unnecessarily.
- Maintaining all vehicles and plant and regularly servicing according to manufacturers' recommendations.

6.8.4 Waste management

6.8.4.1 Existing environment

The project site is a highly developed village main street environment. The project site currently is served by Council bins for visitors to Charing Cross for disposal of day to day waste. Refer to Figure 6 following page for locations of existing public rubbish bins.

6.8.4.2 Potential impacts

The construction work will produce waste such as such as miscellaneous waste associated with packaging and transport of materials and equipment, various other manufactured items forming part of works, and offcuts from materials and the like.

These materials will be disposed of offsite at an appropriate licenced waste facility as applicable. Excess materials that can be recycled will be used on other sites or otherwise adaptively re-used. There will be no disposal of construction related rubbish allowable in the public bins through the town centre.

If it is necessary to decommission existing public bins during the construction works these will be temporarily replaced, while the provision of new bins to Village Centre will be implemented through the construction works. Siting of new bins will be in accordance with Council's Waste and Recycling policies and procedures and the Occupational Health and safety requirements for their effective maintenance.

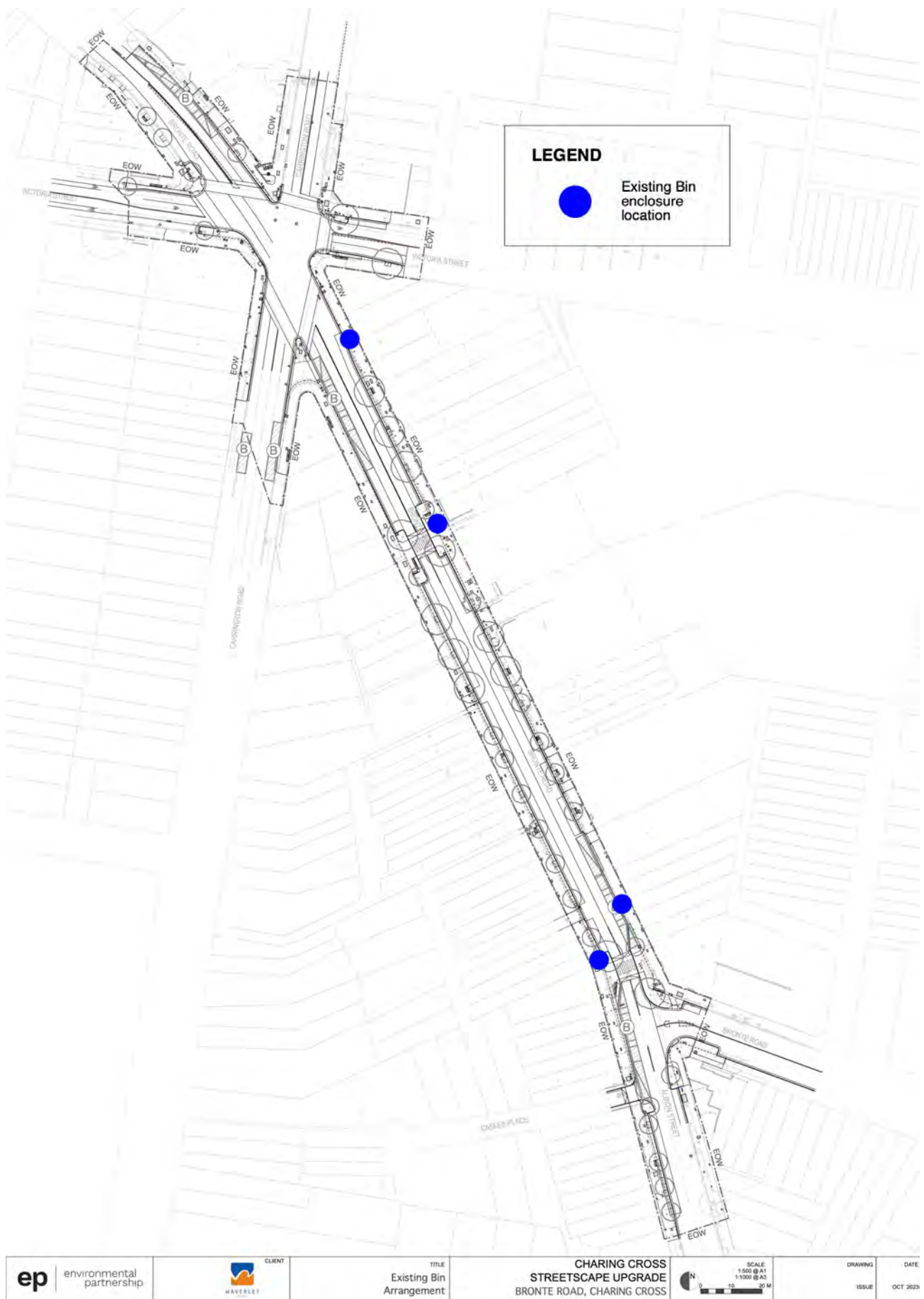


Figure 8 Existing Council bin locations to Charing Cross Village Centre

6.8.4.3 Mitigation measures

- All construction waste handling, transport and disposal would be in accordance with the requirements of the *Protection of the Environment Operations Act 1997* and the EPA's Waste Classification Guidelines. Any waste spoil to be disposed off site would be classified in accordance with the *Waste Classification Guidelines – Part 1: Classifying waste* (EPA, 2014) and disposed of at a location licenced to accept the type of waste.
- If any previously unidentified contamination (e.g. asbestos, discoloured soil, strong chemical or petrol odours, refuse or leachate) is discovered during construction works, works would cease immediately, and advice would be sought from a suitably qualified environmental consultant. Areas would be cordoned off where they pose a safety risk.
- Public bins will not be used for construction related waste during construction works
- Existing bins needing to be temporarily decommissioned during construction works will be temporarily replaced
- New bin locations shall be approved by Councils Waste and Recycling Officers

6.8.5 Cumulative impacts

6.8.5.1 Existing environment

A desktop search of the Waverley area was conducted on 6th October 2023 on the NSW Department of Planning Major Projects register. A further search was undertaken on Waverley Councils Development Tracker portal. This background informed assessment of potential for any cumulative impacts that may result from multiple proposals within the project area.

6.8.5.2 Potential impacts

No projects identified as Charing Cross are currently registered on the Major Projects Register or Councils DA Tracker.

Multiple ongoing projects in the area may have the potential to impact on traffic and transport flow.

6.8.5.3 Mitigation measures

- Continue to monitor potential for other construction works in the area that may need to be considered in ongoing construction traffic management.

Environmental management and mitigation

7.1 Environmental management plans

7.1.1 Construction

The management system would provide the framework for implementing the environmental management measures documented in this REF, and any conditions of other approvals, licences or permits.

A CEMP would be prepared for the proposal. The CEMP would provide a centralised mechanism through which all potential environmental impacts would be managed. The CEMP would document mechanisms for achieving compliance with the commitments made in this REF, the conditions of approval and other relevant statutory approvals. The plan would address (at a minimum) the following elements:

- water and soil management
- noise and vibration management
- air quality management
- traffic and transport management
- heritage management
- waste management
- community and stakeholder communication.

The plan would be prepared by the Head Contractor for the proposed activity and implemented prior to construction works. Implementation and compliance with the CEMP would be monitored by Council for the duration of construction. One of the minimum requirements in terms of the tender for the contractor/s is that they have an environmental management plan capable of meeting the requirements of ISO 14001. The CEMP will include relevant mitigation measures for the proposed activity.

7.2 Summary of mitigation measures

The REF has identified a range of potential environmental impacts as a result of the proposed activity. This section provides a summary of the measures proposed in the preceding sections to mitigate and manage these potential impacts. This summary should be read in conjunction with the specific impact assessment mitigation measure outlines

The mitigation measures may be revised as required. The final mitigation measures will guide subsequent phases of the proposed activity. The contractor selected to undertake the works will be required to undertake all works in accordance with these measures, the conditions of approval and any other relevant statutory approvals.

Table 8 Summary of mitigation measures

Aspect	Mitigation Measures
Land use and property	<ul style="list-style-type: none">• Access will generally be maintained (including through temporary measures as required) to residences and businesses during the course of the works including:<ul style="list-style-type: none">a. Through coordination with the head contractor, access to businesses during each business's opening hours, will be maintained during the course of the worksb. Through coordination with the head contractor, residential access will be maintained during the course of the works
	<ul style="list-style-type: none">• Residents and businesses within 200 m of the proposal will be notified of the works by direct communication prior to commencement. Signage will also be provided near the site to notify of any closures and alternate access.

Aspect	Mitigation Measures
	<ul style="list-style-type: none"> • The necessary staging of works and re routing of vehicular and / or pedestrian access will be notified by direct contact with those affected in advance along with provision of alternative access. • Where trenching and excavation has been carried out or pavement subbases are under construction temporary access by way of non slip walkways will be provided by the construction contractor and managed on site through signage and personnel in high activity periods. • All work equipment and materials will be contained within the designated boundaries of the work site. • Construction vehicles and on site personnel will be limited to those needed for the proposed work, with all excess equipment moved off-site to reduce visual impacts. • All communications and complaints will be assessed and a response, corrective and/or preventative action implemented (as necessary).
Non-Aboriginal heritage	<p>During Design.</p> <ul style="list-style-type: none"> • Apply the SOHI recommendations of a native high canopied tree species that will maintain filtered views through to heritage facades. • Arrange trees at a generous spacing to maintain filtered views through to heritage facades. • Use materials and finishes to the public domain that are simple and robust and complement the heritage character of the precinct (eg asphalt concrete and brick). • Provide interpretation of the heritage significance of the precinct including a variety of mediums. • The historic water trough and pump are understood to be authentic remnants of street furniture from the locality, currently being held on Waverley Council property, and may be considered 'moveable heritage'. These elements should be heritage assessed to establish their provenance and determine their level of significance, which would then inform the design of conservation works required to repair them and relocate them for adaptive re-use as street furniture within the study area. If they are determined to be significant moveable heritage, the works required to use them and install as proposed should be undertaken with expert heritage supervision, including careful consideration of security measures to reduce the likelihood of graffiti and vandalism (such as CCTV). <p>During construction</p> <ul style="list-style-type: none"> • A heritage induction should be presented to workers by an expert Heritage Consultant before commencement of construction. All relevant construction staff, contractors and subcontractors must be made aware of their statutory obligations for heritage under the NSW <i>Heritage Act 1977</i> and best practice as outlined in <i>The Burra Charter</i> (Australia ICOMOS 2013) and HNSW guidelines to ensure no archaeological remains or heritage fabric are impacted during the proposed works without appropriate mitigation measures in place. The induction should include the values of the place, avoidance procedures and outline any relevant 'Unexpected Archaeological Finds' protocols.

Aspect	Mitigation Measures
	<ul style="list-style-type: none"> an 'Unexpected Archaeological Finds' protocol should be developed for all excavation works. If unexpected archaeological finds are encountered during the excavation, works must cease immediately, and a suitably qualified archaeologist be contacted to assess the find and recommend next steps. Should unexpected historical archaeological 'relics' be identified the NSW Heritage Council should be notified under s146 of the Heritage Act 1977. Additional assessment, management and/or approvals from Heritage NSW may be required before significant 'relics' can be impacted.
	<ul style="list-style-type: none"> Where works are proposed that would abut the facades of buildings that are heritage listed or considered contributory buildings within the HCA (for example, the removal and replacement of existing paving), it is recommended that these works be conducted with special care to avoid possible damage to heritage fabric—possibly being undertaken by hand rather than with heavy machinery.
Aboriginal heritage	<ul style="list-style-type: none"> Cease work if an item (or suspected item) of non-Aboriginal heritage is discovered during the work, and inform the site supervisor who will advise Council. Works affecting Aboriginal 'objects' on the site must not continue until Heritage, Department of Premier and Cabinet has been informed in accordance with Section 89A of the National Parks and Wildlife Act 1974 (as amended). Aboriginal 'objects' must be managed in accordance with the National Parks and Wildlife Act 1974
	<ul style="list-style-type: none"> All workers / contractors will be informed of their obligations under the NPW Act, namely that it is illegal to disturb, damage, destroy a relic without the prior approval of the Director-General of the Environment and Heritage Group within DPE.
Traffic, transport and access	Construction
	<ul style="list-style-type: none"> The construction approach will focus on a phased approach whereby works are focussed in a physical zone, under the following overall phases: <ul style="list-style-type: none"> Phase A Power telecoms and Lighting; Phase B Public Domain Construction Works; Phase C Planting and finishing works; and Phase D Road re-sheeting works.
	<ul style="list-style-type: none"> As noted for Landuse and Property – all residents and businesses within 200 m of the proposal will be notified of the works prior to commencement. Signage will also be provided near the site to notify of any closures and alternate access.
	<ul style="list-style-type: none"> The necessary staging of works and re routing of vehicular and / or pedestrian access will be notified in advance along with alternative access.
	<ul style="list-style-type: none"> All work equipment and materials will be contained within the designated boundaries of the work site.
	<ul style="list-style-type: none"> Construction vehicles and on site personnel will be limited to those needed for the proposed work, with all excess equipment moved off-site to reduce traffic impacts.
	<ul style="list-style-type: none"> All communications and complaints will be assessed and a response, corrective and/or preventative action implemented (as necessary).

Aspect	Mitigation Measures
Visual amenity	<ul style="list-style-type: none"> • Take all practical measures to ensure construction equipment, stockpiles, and other visible elements are located away from key views to or from the sensitive visual receivers identified in the SoHI prepared by Artefact Heritage 4 September 2023 (Appendix C). Should such equipment or stockpiles be located in a visually prominent location for any reasonable period of time, incorporate screening measures and practices to ensure sites are kept tidy.
	<ul style="list-style-type: none"> • Ensure design and materiality of services components such as poles, signage and lighting contribute positively to the site.
Noise and vibration	<ul style="list-style-type: none"> • A construction noise and vibration management plan is to be prepared and implemented as part of the CEMP. The plan is to generally follow the approach in the interim Construction Noise Guideline (ICNG), (DECC, 2009).
	<ul style="list-style-type: none"> • All sensitive receivers likely to be affected will be notified at least 5 working days prior to the start of any works associated with the activity that may have an adverse noise or vibration impact.
	<ul style="list-style-type: none"> • Works are to be carried out during normal work hours (i.e., 7am to 6pm Monday to Friday; 8am to 1pm Saturdays; no work on Sunday or public holidays). Works outside these times will be carried out in accordance with the management and mitigation measures detailed within the noise and vibration management plan.
	<ul style="list-style-type: none"> • Establish and maintain safe working distances from structures when performing vibration intensive works.
	<ul style="list-style-type: none"> • Undertake building dilapidation surveys on all buildings located within the buffer zone prior to major project construction activities with the potential to cause property damage.
	<p>The following supporting mitigation measures are also recommended as outlined in the Draft Construction Noise Guideline 2020 (EPA):</p> <ul style="list-style-type: none"> • Train workers and contractors on the best practice use of equipment and work methods in order to minimise noise. • Ensure workers and contractors are aware of the noise management requirements in any consents, approvals or licences, for example through site inductions and 'toolbox talks' and by providing a summary of relevant project requirements for quick reference (such as on a noticeboard). • Include appropriate clauses and conditions within employment contracts, subcontractor agreements and work method statements that require all workers and contractors to observe (noise management) directions from the site manager. • Periodically check the site, nearby residences and other sensitive land uses to proactively identify noise issues and feasible and reasonable mitigation. • Avoid the use of radios, stereos, open two-way radios and public address systems outdoors where they are likely to be audible at sensitive receivers beyond the site boundary. • Avoid shouting, talking loudly, slamming vehicle doors or making any other unnecessary noise. • Inform truck drivers of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices, such as minimising use of engine brakes and avoiding engine idling. • Avoid the use of equipment that generates impulsive, tonal or irregular noise. • Minimise or avoid the need for reversing or movement alarms. Advice is provided in Appendix E of the Draft guidelines).

Aspect	Mitigation Measures
	<ul style="list-style-type: none"> • Avoid unnecessary dropping of materials from a height and metal-to-metal contact on equipment. • Avoid mobile equipment clustering near residences and other sensitive land uses.
	<p>The following work practices also recommended as outlined in the Draft Construction Noise Guideline. These are relevant at all times, but have particular relevance for managing noise when work is scheduled outside the recommended standard hours:</p> <ul style="list-style-type: none"> • Where appropriate, consider prefabricating items off site. • Where appropriate, consider the use of 'quiet' communication methods, such as personal radio headsets. • Where practicable, restrict deliveries to the daytime. Where deliveries must be made during the evening or night-time (or on weekends or public holidays), schedule vehicle movements to avoid residential streets, if possible. • Offer periods of respite to the community where unavoidable maximum noise level events are anticipated. In some circumstances, offers of alternative accommodation or temporary relocation may be appropriate (refer section 5 of Draft Construction Noise Guideline). • Ensure procedures are in place to address noise at unattended sites, for example unattended equipment operating over 24 hours and security alarms. The use of guard dogs is discouraged where worksites are adjacent to residential areas
	<p>Consultation and notification</p> <ul style="list-style-type: none"> • The contractor must also have regard for the guidance provided for consultation and notification of the residential and business community as outlined in Appendix C2 of the Draft Construction Noise Guideline.
Socio-economic issues	<ul style="list-style-type: none"> • The construction approach will be that the works are carried in physical zones that focus on the general completion of a section of street so that disturbance to any given shop frontage is not drawn out over a longer time frame. • Access will generally be maintained (including through temporary measures as required) to residences and businesses during the course of the works including: <ol style="list-style-type: none"> a. Through coordination with the head contractor, access to businesses during each business's opening hours, will be maintained during the course of the works b. Through coordination with the head contractor, residential access will be maintained during the course of the works • The demolition works will occur during the recommended standard hours for construction work as outlined in the Draft Construction Noise Guideline (NSW EPA, 2020). • Some nightworks will be required for upgrades to the village centre. This may include Phase A Power telecoms and Lighting, and Phase B Public Domain Construction Works. The allowing of night works by Council will be subject to all applicable noise management requirements, and would be notified ahead of time to residents and business owners. Noise and vibration monitoring would be carried out in accordance with standards. • The contractor will be required to establish and maintain a communications strategy to be approved by Council. The aim of the strategy is that residents and business stakeholders are fully aware of the project process, when their

Aspect	Mitigation Measures
	<p>days to day activities will be interrupted, and if there are any necessary changes to those plans.</p>
	<ul style="list-style-type: none"> • Council will maintain an online platform accessible by QR code posted around the site, that provides real time information of the construction process, upcoming activities and temporary changes to access, and provides contact details for information and complaints.
	<ul style="list-style-type: none"> • Temporary access changes will be notified to the community and businesses and businesses prior to the event and then clearly signed and manned by traffic wardens on the day.
	<ul style="list-style-type: none"> • Residents and businesses within 200 m of the proposal will be notified of the works prior to commencement. Signage will also be provided near the site to notify of any closures and alternate access.
	<ul style="list-style-type: none"> • The necessary staging of works and re routing of vehicular and / or pedestrian access will be notified in advance along with alternative access.
	<ul style="list-style-type: none"> • Construction vehicles and on site personnel will be limited to those needed for the proposed work, with all excess equipment moved off-site to reduce traffic impacts.
	<ul style="list-style-type: none"> • Construction management of air and water quality and noise during the works will be implemented and monitored in accordance with an approved Construction Environmental Management Plan (CEMP) as noted in 6.8.2.
	<ul style="list-style-type: none"> • Construction activities will be phased and sequenced to enable maintenance of as close to normal access as possible during the course of the works.
	<ul style="list-style-type: none"> • Temporary access panels with non-slip surfaces will be provided over works areas during business hours as required. • All communications and complaints will be assessed and a response, corrective and/or preventative action implemented (as necessary).
Other issues	
Biodiversity	<ul style="list-style-type: none"> • Vegetation removal will be limited to the two street trees and planter boxes located along the footpaths within the proposal site
	<ul style="list-style-type: none"> • Tree removal will be carried out in accordance with to the guidelines outlined in Safe Work Australia (2016) and in accordance with the Waverley Council Street Tree Masterplan (Waverley Council 2008) and the Waverley Council Tree Management Policy (Waverley Council 2019)
	<ul style="list-style-type: none"> • The Magnolia grandiflora in the courtyard of 280-282 Bronte Road is on Waverley's Significant Tree Register. It is outside the scope of the work to be undertaken under this project scope. However construction management must ensure that the curtilage to this tree is full protected and managed in accordance with qualified Arborist advise. Refer key requirements below and Appendix E of this REF for detailed requirements: <ul style="list-style-type: none"> - The existing raised garden bed wall will act as a protection for the Structural Root Zone (SRZ). All work outside the SRZ and in between the TPZ will require hand excavation to avoid damaging any tree roots. No mechanical excavation is to be undertaken.

Aspect	Mitigation Measures
	<ul style="list-style-type: none"> - All pavers in the between the SRZ and TPZ are to be removed by hand to avoid damaging any tree roots. No mechanical excavation of pavers is to be undertaken. - If any tree roots are exposed during any approved works, then roots smaller than 30mm are to be pruned as per the specifications below. <u>Any roots greater than 30mm are to be assessed by a qualified arborist before any pruning is undertaken.</u> - If tree roots are required to be removed for the purposes of constructing the approved works, <u>they shall be cut cleanly by hand, by an experienced Arborist/Horticulturist (with a minimum level 5 Horticulture Certificate or Tree Surgery Certificate).</u> - It is the consulting arborist's responsibility to determine if such root pruning is suitable. If there are any concerns regarding this process, then Waverley Council's Tree Management Officer is to be contacted to make final determination. - If the Magnolia grandiflora requires pruning, then permission must be gained from the owner of the tree, and an application to Prune or Remove Trees on Private Property is then to be submitted to Council for processing. <ul style="list-style-type: none"> • The CEMP and construction plans would clearly document the location and full extent of the vegetation disturbance required. These areas would be clearly marked to avoid disturbance to adjacent retained vegetation, and exclusion fencing would be installed around trees to be retained. • Weed control mitigation and management strategies would be documented and implemented in accordance with the <i>Noxious Weeds Act 1993</i>. This would include procedures to reduce the spread of weeds via vehicles and machinery, such as visual inspection of vehicles prior to exit from site to ensure they are clear of plant material. • Weeds would be managed and disposed of in accordance with the requirements of the <i>Noxious Weeds Act 1993</i> and/or the <i>Weeds of National Significance Weed Management Guide</i>.
Soils and water quality	<ul style="list-style-type: none"> • Erosion and sedimentation controls would be installed and maintained in accordance with <i>Managing Urban Stormwater – Soils and Construction</i> (the Blue Book). Controls would be established before work begins and would be maintained in effective working order for the duration of the works, until the site is restored. • The area of ground disturbance, including movement of vehicles and plant, would be minimised. • Overland flow paths will be kept free and open • Existing stormwater infrastructure will be regularly inspected during construction to ensure free of debris • Property stormwater outlets will maintained during construction • Silt socks would be installed in down-gradient locations from excavations, especially at drain inlets, along gutters, etc. • On-site storage of spoil/other eroding materials in stockpiles would be minimised. Any stockpiles would be bunded and appropriately covered, or used as soon as possible following stockpiling, to minimise the potential for offsite migration. • Road surfaces would be kept free of spoil/other eroding materials. If spoil is tracked onto roads/paths, it would be removed prior to the work crew leaving the site.

Aspect	Mitigation Measures
	<ul style="list-style-type: none"> Excavation would not take place during or after heavy rain when doing so is likely to cause soil erosion and soil structural damage. Personnel would monitor weather conditions and suspend the proposed works in the event of heavy rainfall. Disturbed areas would be restored as close as practicable to pre-works condition, and in accordance with the Blue Book. Excavated areas would be backfilled and tamped to a stable surface as soon as practicable. Any fill sourced off site for backfill and restoration would be clean fill suited to the existing soil composition at excavation. Erosion and sedimentation controls would be removed after construction is complete, including removing any trapped sediment in drainage lines. The volume of fuels or chemicals brought to site would be limited and contained/bunded within vehicles and plant on site. Refuelling would not be carried out on site. Vehicles and plant would be checked regularly for leaks. All vehicles carrying waste materials capable of discharging free liquid would be watertight to prevent leakage and would be checked before they leave the site. Solid or liquid waste (e.g. sediment-laden water) would not be discharged to gutters, stormwater inlets/drainage lines or watercourses. Uncontrolled discharge of water into the surrounding environment would not be permitted. A functioning 'spill kit' would be kept on site at all times for clean-up of accidental chemical/fuel spills. The 'spill kit' will be stored in an appropriate location that is quickly and easily accessible from all areas of the work site. An unexpected finds Protocol will form part of the CEMP to deal with finds of unexpected contaminated materials. Cease work in the immediate vicinity of any areas of suspected contamination that are identified prior to or during work. Ensure that these areas are not disturbed and are cordoned off as a safety risk. Vehicle and machinery movement will be confined to designated roads, tracks, pathways and work areas. Designated lay-down areas will be selected to minimise erosion or vegetation damage. Cease work during heavy rainfall events when there is a risk of sediment loss off-site or ground disturbance due to water logged conditions. Ensure equipment, plant and materials are placed in designated areas where they are least likely to cause erosion. Check machinery daily for oil, fuel or other liquid leaks An incident emergency spill plan would be developed and incorporated into the construction environmental management plan. The plan would include measures to avoid and manage spillages of fuels, chemicals, and fluids onto any surfaces and an emergency response procedure Should a fuel spill occur during construction, the emergency response plan will be implemented, and the Council contacted. The EPA would also be notified as per Part 5.7 of the POEO Act

Aspect	Mitigation Measures
	<ul style="list-style-type: none"> • The refuelling of plant and maintenance of machinery would be undertaken offsite or in impervious bunded areas in the compound area. • A Soil and Water Management Plan (SWMP) would be prepared and implemented as part of the CEMP. The SWMP would identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks would be addressed during construction. • Disturbed areas will be stabilised during maintenance works, and where necessary revegetation would be undertaken after works are complete. • Any damage from construction to the ground surface will be restored to preconstruction condition on completion of works.
Air quality	<p>Generally the following overall mitigation measures will be implemented:</p> <ul style="list-style-type: none"> • Erosion and dust controls would be installed and maintained in accordance with the approved CEMP for the proposal including watering down during earthworks and subgrade works. • Regular dust monitoring will be undertaken in accordance with the approved CEMP for the proposal. • When weather reports predict periods of high winds stockpiles and other major areas of uncovered earth or materials shall be appropriately covered and or watered down.
	<p>Other required mitigation measures to be implemented as required will include:</p> <ul style="list-style-type: none"> • Sheeting of vehicles transporting earthworks materials to or from site. • Wheel washing of site vehicles. • Locating haul routes away from off-site sensitive properties, with regular watering, particularly during dry conditions (wet suppression of dust). • Limiting site vehicle speeds on unpaved surfaces. • Locating aggregate stocking areas away from sensitive properties. • Minimising drop heights of material. • Bulking of wastes to minimise transportation and handling requirements.
	<p>Measures to minimise plant exhaust emissions should also be employed during the construction phase such as:</p> <ul style="list-style-type: none"> • Ensuring, where possible, all Non-Road Mobile Machinery (NRMM) use ultra-low sulphur diesel. • Placing onsite operating plant far from sensitive properties as practicable. • Ensuring vehicles and operating plant engines are not idling unnecessarily. • Maintaining all vehicles and plant and regularly servicing according to manufacturers' recommendations.
Waste management and resource use	<ul style="list-style-type: none"> • All waste handling, transport and disposal would be in accordance with the requirements of the <i>Protection of the Environment Operations Act 1997</i> and the EPA's Waste Classification Guidelines. Any waste spoil to be disposed off site would be classified in accordance with the <i>Waste Classification Guidelines – Part 1: Classifying waste</i> (EPA, 2014) and disposed of at a location licenced to accept the type of waste. • If any previously unidentified contamination (e.g. asbestos, discoloured soil, strong chemical or petrol odours, refuse or leachate) is discovered during works, works would cease immediately, and advice would be sought from a suitably qualified environmental consultant. Areas would be cordoned off where they pose a safety risk.

Aspect	Mitigation Measures
	<ul style="list-style-type: none"> Public bins will not be used for construction related waste during construction works.
	<ul style="list-style-type: none"> Existing bins needing to be temporarily decommissioned during construction works will be temporarily replaced.
	<ul style="list-style-type: none"> New bin locations shall be approved by Councils Waste and Recycling Officers.
Cumulative impacts	<ul style="list-style-type: none"> Continue to monitor potential for other construction works in the area that may need to be considered in ongoing construction traffic management.

8.0 Conclusion

This REF considers the potential environmental impacts of the proposed activity to construct the Charing Cross streetscape upgrade. It has been prepared by Environmental Partnership on behalf of Council to assist with determination of the proposal under Part 5 of the Environmental Planning and Assessment Act.

In conclusion the proposed activity is not likely to unduly affect the environment, provided the safeguards identified in this report are properly implemented. Therefore, an Environmental Impact Statement (EIS) is not required.

9.0 References

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- Waverley Council 2020a, *Our Liveable Places Centres Strategy 2020 – 2036*.
- Waverley Council 2020b, *Public Domain Technical Manual Revision G*.
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10.0. Appendix

Appendix A

Clause 171 factors and ecologically sustainable development considerations under the EP&A Regulation 2021

Table A.1 **Clause 228 considerations**

Clause 171 factor	Summary of results	Potential impact
(a) Any environmental impact on a community	The proposal has the potential to result in amenity related impacts in the vicinity of the works. These impacts would be managed through the implementation of the proposal environmental management plan. No long-term environmental impacts are predicted.	Short-term – minor negative Long-term – none
(b) Any transformation of a locality	The proposal would be in a mixed-use zone. It would not result in the transformation of this locality.	None
(c) Any environmental impact on the ecosystems of the locality	The proposal would require the removal of two trees. No environmental impact on the ecosystems is anticipated.	Minor
(d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality	The proposal would require the removal of two trees.	Minor
(e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations	The proposal would benefit local historical buildings and conservation areas by highlighted heritage items. The proposal would not result in any negative impact on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value.	None
(f) Any impact on the habitat of protected fauna (within the meaning of the <i>Biodiversity Conservation Act 2016</i>)	No impacts on protected fauna within the meaning of the <i>Biodiversity Conservation Act 2016</i> are predicted.	None
(g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air	The proposal would not endanger any species of plant, animal or other form of life.	None
(h) Any long-term effects on the environment	Other than the additional of new trees and landscaping, the proposal would not have any long-term impacts on the environment.	None
(i) Any degradation of the quality of the environment	The proposal has the potential to result in minor impacts to environmental quality during the construction period. These impacts would be managed through the implementation of mitigation measures. No long-term impacts to the quality of the environment are predicted.	Short-term - minor negative Long-term - none
(j) Any risk to the safety of the environment	The construction of the proposal is not considered to result in any risk to the safety of the environment. Safety in the vicinity of the proposal would be managed by the contractor/s.	None
(k) Any reduction in the range of beneficial uses of the environment	The proposal would not result in any reduction in the range of beneficial uses of the environment.	None
(l) Any pollution of the environment	The proposal had the potential to result in minor air quality impacts during construction. These impacts would be managed through the implementation of the CEMP. Operation of the proposal would not produce any emissions and no long-term pollution impacts are predicted.	Short-term - minor negative Long-term – none
(m) Any environmental problems associated with the disposal of waste	Waste created during the works period would be removed from site and recycled where possible.	None
(n) Any increased demands on resources (natural or otherwise) that are, or are likely to become in short supply	The proposal would not increase the demand on any resources that are or are likely to become in short supply.	None

Clause 171 factor	Summary of results	Potential impact
(o) Any cumulative environmental effect with other existing or likely future activities	No significant cumulative impacts were identified as a result of the interaction of the proposal with other projects.	None
(p) any impact on coastal processes and coastal hazards, including those under projected climate change conditions	The proposal would not impact on coastal processes and coastal hazards.	None
(q) applicable local strategic planning statements, regional strategic plans or district strategic plans under the Act, Division 3.1	No contraventions by the proposal of applicable local strategic planning statements, regional strategic plans or district strategic plans were identified.	None
(r) other relevant environmental factors.	No significant environmental impacts were identified as a result of the construction and ongoing operation of the proposal.	None

Table A.2 ESD considerations under the EP&A Act

Principle	Definition	Comment
Precautionary principle	This principle states that ‘if there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation’.	<p>A range of environmental assessments have been undertaken during the preparation of this REF to ensure that the potential environmental impacts can be understood with a high degree of certainty. There are not considered to be any threats of serious or irreversible environmental damage.</p> <p>The proposal has evolved to avoid environmental impact where possible and mitigation measures would be implemented to minimise impacts. No mitigation measures have been deferred due to a lack of scientific certainty. The proposal is therefore considered to be consistent with the precautionary principle.</p>
Intergenerational equity	The principle states, ‘the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations’. In other words, we should ensure that future generations do not inherit a degraded environment.	The proposal site has been previously disturbed during previous uses, and development of the Charing Cross village centre. The proposal would not result in any impacts that are likely to impact on the health, diversity or productivity of the environment for future generations. The proposal would benefit future generations through highlighting heritage items through the village centre and through introducing new landscaping.
Conservation of biological diversity and ecological integrity	This principle states that the ‘diversity of genes, species, populations and communities, as well as the ecosystems and habitats to which they belong, must be maintained and improved to ensure their survival’.	The study area is located in a modified urban environment. No potential impacts to biological diversity and ecological integrity were identified.
Improved valuation, pricing and incentive mechanisms	This principle requires that ‘costs to the environment should be factored into the economic costs of a project’.	<p>The cost of environmental resources includes the costs incurred to protect the environment. The mitigation measures imposed to minimise the adverse impacts of this proposal would result in economic costs to the construction and operation of the proposal. This indicates the valuation of environmental resources has been assigned.</p> <p>The proposal has been designed to minimise adverse impacts on the environment by confining work to a defined area and implementing appropriate mitigation measures when impacts are expected.</p>

Appendix B

Transport and Infrastructure SEPP consultation requirements

Table B1 Council related infrastructure or services

Issue	Potential impact	Yes/No	If 'yes' consult with	Transport and Infrastructure SEPP 2021 Clause
Stormwater	Is the work likely to have a <i>substantial</i> impact on the stormwater management services which are provided by council?	No	Waverley Council	cl. 2.10(1)(a)
Traffic	Is the work likely to generate traffic to an extent that will <i>strain</i> the capacity of the existing road system in a local government area?	No	Waverley Council	cl. 2.10(1)(b)
Sewerage system	Will the work involve connection to a council owned sewerage system? If so, will this connection have a <i>substantial</i> impact on the capacity of any part of the system?	No	Waverley Council	cl. 2.10(1)(c)
Water usage	Would the work involve connection to a council owned water supply system? If so, would this require the use of a <i>substantial</i> volume of water?	No	Waverley Council	cl. 2.10(1)(d)
Temporary structures	Would the work involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, would this cause more than a <i>minor</i> or <i>inconsequential</i> disruption to pedestrian or vehicular flow?	No	Waverley Council	cl. 2.10(1)(e)
Road & footpath excavation	Would the work involve more than <i>minor</i> or <i>inconsequential</i> excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	Yes	Waverley Council	cl. 2.10(1)(f)
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the work? If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than <i>minor</i> or <i>inconsequential</i> ?	Yes	Waverley Council	cl. 2.11(1)

Table B2 Flood liable land

Issue	Potential impact	Yes/No	If 'yes' consult with	Transport and Infrastructure SEPP 2021 Clause
Flood liable land	Is the work located on flood liable land? If so, would the work change flood patterns to more than a <i>minor</i> extent?	No	Waverley Council	cl. 2.12
Flood liable land	Is the work located on flood liable land? (to any extent). If so, does the work comprise more than minor alterations or additions to, or the demolition of, a building, emergency	No	State Emergency Services	cl. 2.13

Issue	Potential impact	Yes/No	If 'yes' consult with	Transport and Infrastructure SEPP 2021 Clause
	work or routine maintenance			

Note: Flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in accordance with the principles set out in the manual entitled *Floodplain Development Manual: the management of flood liable land* published by the New South Wales Government.

Table B3 Public authorities other than councils

Issue	Potential impact	Yes/No	If 'yes' consult with	T&ISEPP clause
National parks and reserves	Is the work adjacent to a national park or nature reserve, or other area reserved under the <i>National Parks and Wildlife Act 1974</i> , or on land acquired under that Act?	No	Office of Environment and Heritage	T&ISEPP cl. 2.15(2)(a)
National parks and reserves	Is the work on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	No	Office of Environment and Heritage	T&ISEPP cl. 2.15(2)(b)
Bush fire prone land	Is the work for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?	No	Rural Fire Service	T&ISEPP cl. 2.16
Artificial light	Would the work increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map? (Note: the dark sky region is within 200 kilometres of the Siding Spring Observatory)	No	Director of the Siding Spring Observatory	T&ISEPP 2.15(2)(d)
Defence communications buffer land	Is the work on buffer land around the defence communications facility near Morundah? (Note: refer to Defence Communications Facility Buffer Map referred to in clause 5.15 of Lockhardt LEP 2012, Narrandera LEP 2013 and Urana LEP 2011.	No	Secretary of the Commonwealth Department of Defence	T&ISEPP cl. 2.15(2)(e)
Mine subsidence land	Is the work on land in a mine subsidence district within the meaning of the <i>Mine Subsidence Compensation Act 1961</i> ?	No	Mine Subsidence Board	T&ISEPP cl. 2.15(2)(f)

Appendix C

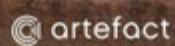
Statement of Heritage Impact

Charing Cross Streetscape Upgrade

Statement of Heritage Impact

Report to Environmental Partnership

September 2023



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EXECUTIVE SUMMARY

Charing Cross is a key southern village centre within Waverley, located along a strip of Bronte Road connecting Bronte Beach, Bondi Junction, Centennial Park and the city. Artefact Heritage have been engaged by Environmental Partnership to revise the 2022 Statement of Heritage Impact (SOHI) to accommodate new works planned for incorporation into the Charing Cross Streetscape Upgrade. This report will assist the project design for the proposed upgrade and advise on any possible heritage impacts associated with the plans.

The first version of this report, commissioned by GHD, was finalised in November 2022 but changes to the project administration, proposed works and interpretation require that the SOHI be revised in August 2023. The scope of proposed works in late 2022 included: replacing footpath paving, undergrounding intrusive overhead wiring for electricity and telecommunications, introducing new soft landscape along the streetscape, installing flush new kerbs and gutters, replacing drainage piping, replacing existing features with two new raised pedestrian islands and adding interpretative features. In 2023 the scope of works has been revised to also include: replacing traditional timber utility poles with 'smart poles', refining the designs for kerb realignment and pavement patterning and installing an historic sandstone water trough and metal pump on the pavement within the study area.

Whereas the original 2022 version of this report included a section on interpretation for the project, in this version that analysis has been separated out into a stand-alone report on Heritage Interpretation Planning, also prepared by Artefact. This SOHI thus contains minimal comment on interpretation issues.

Findings

The study area is located within the Charing Cross Heritage Conservation Area (HCA), which is listed as an item of local heritage significance (Waverley Local Environmental Plan 2012 # C7).

Charing Cross HCA is locally significant for its historic, aesthetic and social values. The HCA also has representative value due to the cohesiveness of its built form and structural function, and is rare for its mix of village and ecclesiastic architecture. The study area is adjacent to nine properties listed as local heritage items on the Waverley LEP 2012 and 25 properties which fit the relevant definition of 'contributory items' (being more than 50 years old—see Appendix 1). The study area is also in close proximity to a further five local heritage items (within 64 metres of the HCA). One adjacent place and one nearby place are listed on the State Heritage Register: Mary Immaculate Church at 2280-282 Bronte Road and 45 Victoria Street (adjacent) and Charing Cross House at 11 Victoria Street (62m west).

The proposal is assessed as having no adverse physical impacts on the Charing Cross Heritage Conservation area, nor on the nine heritage places and 25 contributory places adjoining the study area nor on the five heritage items located nearby. The proposal has potential for a minor adverse physical impact on the historic water trough and pump themselves if they are not conserved appropriately in the course of being adaptively re-used as street furniture. There is also potential for minor adverse visual impacts if the trough and pump are positioned in a way which could obscure views to architectural elements of adjacent heritage places or significant views of streetscapes or if proposed street trees were to mature in ways that obscure significant views of streetscapes. The proposal would have no adverse physical or visual heritage impacts on nearby heritage places. Overall, the proposed replacement of modern fabric and removal of overhead wiring is considered to be a positive and sympathetic enhancement of the streetscape, retaining the village atmosphere through upgrades to street furniture, paving and infrastructure within the area.

Due to the close proximity of the works to the facades of some heritage buildings, there is potential for the works to result in inadvertent impacts during and after construction—for example while replacing existing paving, or resulting from the growth of new vegetation. Recommendations to address risks to heritage fabric, heritage appearances and archaeology are made in Section 9 of this report. Also because the works would include extensive (although presumably shallow) excavation, Section 9 includes recommendations to address and mitigate archaeological risks.

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LIST OF ABBREVIATIONS

Artefact	Artefact Heritage Services Pty Ltd
<i>Burra Charter</i>	<i>Burra Charter: The Australian ICOMOS Charter for Places of Cultural Significance</i> (2013) guide to caring for heritage places in Australia, available online from Australia ICOMOS
CMP	Conservation Management Plan
DCP	Development Control Plan (a Council guideline for development which accompanies and elaborates on the Council's Local Environmental Plan)
DP	Deposited Plan
EP	Environmental Partnership
Heritage NSW	Heritage New South Wales (Office of the Heritage Council of New South Wales, previously also known as the NSW Heritage office, the Heritage Branch, the Heritage Division of the Office of Environment and Heritage—OEH)
ICOMOS	International Council of Monuments and Sites (the peak international organisation for heritage professionals)
km	Kilometre
LALC	Local Aboriginal Land Council
LGA	Local Government Area
LEP	Local Environmental Plan (made by local government Councils)
NSW	New South Wales
S170	Section 170 of the NSW <i>Heritage Act 1977</i> which requires government agencies to keep a Heritage & Conservation Register of places they own and manage
SHI	State Heritage Inventory (Heritage NSW's response to requirement to keep a publicly accessible list of all statutory-listed heritage places under <i>NSW Heritage Act 1977</i>)
SHR	State Heritage Register
SOHI	Statement of Heritage Impact
WDCP	Waverley Development Control Plan 2012
WLEP	Waverley Local Environmental Plan, 2012

1.0 INTRODUCTION

1.1 Project background

Artefact Heritage have been engaged by Environmental Partnership (EP) to provide a Statement of Heritage Impact (SOHI) for the Charing Cross Streetscape Upgrade. This report has been commissioned to assist the project design for the proposed upgrade. The first version of this report, commissioned by GHD, was finalised in November 2022 but changes to the project administration, proposed works and interpretation require that the SOHI be revised in August 2023. Whereas the original, 2022 version of this report included comment on Heritage Interpretation Planning for the project, in this version of the report that analysis has been separated out into a stand-alone report, also prepared by Artefact.

Charing Cross is a key southern village centre within Waverley, located along a strip of Bronte Road connecting Bronte Beach, Bondi Junction, Centennial Park and the City (illustrated in Figures 19-54). The centre has a diverse range of local shops and services that support the daily needs of residents, workers and visitors who frequent the area. The centre has a 'high street' character, supporting the local commercial strip as well as being a major transport route, including servicing up to six different bus routes. The centre continues to fulfil a valuable social role and meeting place for residents and for children attending and travelling to surrounding schools. The diverse local population also includes aged housing within the centre.

The study area is contained within an existing Heritage Conservation Area (HCA), reflecting its heritage significance. The area maintains a two-storey character, with near complete rows of highly intact Federation and Victorian terraces, interspersed with some examples of two storey Interwar and Art Deco apartments. Important views of historic buildings include St Mary's Catholic Church and associated buildings (a listed State Heritage listed item) viewed across the community centre at 280–282 Bronte Road. Appreciation of the heritage quality of the building stock of this area is compromised by intrusive suspended power lines.

These buildings of historic character are all of masonry construction, many with painted plaster render and highly decorative finishes. The buildings are mixed-use and maintain a consistent retail ground floor with residential upper storeys. Support awnings extend across the entire pavement width. Narrow passages between terrace groups give access to the rear of properties and laneways.

At present the public domain is not particularly well defined, blurring into the adjacent residential areas. High through traffic volumes conflict with the centralised commercial nature of the space which impacts local traffic movements causing significant congestion.

The Charing Cross Streetscape Upgrade (the project) proposes a streetscape upgrade to the commercial precinct of Charing Cross to enhance the sense of arrival, including improved pedestrian safety and convenience for active and public transport modes.

1.2 Project location

Charing Cross is situated approximately 7 km east of the Sydney CBD and 800m southeast of Bondi Junction. It is located on high ground between Bronte Beach and Centennial Park. The study area (Figure 1) is located with the Charing Cross HCA and comprises of the streets and roadways that stem off from the arterial thoroughfare, Bronte Road. It pertains to approximately 400m of Bronte Road, including slight deviations into crossroads (Victoria and Albion Streets and Carrington Road); the study area is located between the intersection of Carrington Road, Bronte Road and Victoria Street and runs down just past the intersection of Bronte Road and Albion Street.

Figure 1: Study Area (Charing Cross)



1.3 Proposed works

This assessment has been prepared based on concept designs which were issued in February 2021 and July 2023. The initial 2021 plans discussed in the 2022 SOHI were:

- GHD, 2021. “Waverley Council Charing Cross Streetscape Upgrade 12521936-G001-2 and C001, C011-22, C031” concept design drawings dated up until 14/4/21 (Appendix 1).

The original works proposed:

- Removing intrusive overhead wiring for telephone/ electrical lines by repositioning them underground. This requires further detailed design but is planned to be done at the same time that pavements are replaced.
- Replacing underground piping and drainage, subject to development of the detailed design.
- Installing flush new kerbs and gutters.
- Upgrading one existing pedestrian crossing and installing one new pedestrian crossing with crossings.
- Replacing footpath paving throughout the study area in a way which distinguishes it from surrounding residential areas.
- Introducing new soft landscaping by planting new trees and shrubs.
- Replacing and upgrading street furniture (such as seating).
- Introducing interpretive signage to explain historical aspects of the area (discussed in Artefact’s separate Heritage Interpretation Planning report).

In August 2023, conceptual changes updating the original plans were prepared by Environmental Partnerships and are analysed in this updated SOHI. Appended to this report, these revised plans at the 50% Detailed Design stage:

- Environmental Partnership, 6 July 2023. “Charing Cross Streetscape Upgrade Project Issue 2” for Waverley Council (see Appendix 2).

EP’s proposed changes to the proposal are analysed in this revised SOHI and constitute:

- Installing an historic sandstone water trough and metal pump on the pavement within the study area along with modest interpretive signage.
- Replacing telephone/ electrical poles with smart poles capable of providing for lighting, baskets of flowering plants and bicycle security.
- Reducing the density of tree planting in front of heritage buildings and finalising the species of both trees and shrubs to be used.
- Refining the design of the pavement and kerb realignment—for example, slightly expanding the pavement around the Robin Hood Hotel corner and around pedestrian crossings.
- Replacing the previously proposed two-sided interpretation panels with one-sided panels.
- Finalising options for the design of the pavement surface detailing in brick and concrete.

1.4 Authorship

This report was prepared in 2022 by Sophie Barbera (Heritage Consultant) and Alexandra Gaffikin (Senior Heritage Consultant). Jenny Winnett (Principal) and Carolyn MacLulich (Principal) provided management input and review. The 2023 version of this report was prepared by Bronwyn Hanna (Senior Heritage Consultant) with Josh Symons (Principal) providing management input and review.

1.5 Methodology

1.5.1 Heritage significance assessment

Determining the significance of heritage items or a potential archaeological resource is undertaken by utilising a system of assessment centred on the *Burra Charter* of Australia International Council on Monuments and Sites (ICOMOS). The principles of the charter are relevant to the assessment, conservation and management of sites and relics. The approach to the assessment of heritage significance is outlined through legislation in the NSW *Heritage Act 1977* and guidelines issued by Heritage NSW implemented through the *NSW Heritage Manual* and the *Archaeological Assessment Guidelines*.¹

1.5.2 Archaeological assessment

The assessment of historical archaeological potential is based on the identification of former land uses and evaluating whether subsequent actions (either natural or human) may have impacted on archaeological evidence for these former land uses.

Knowledge of previous archaeological investigations, understanding of the types of archaeological remains likely to be associated with various land uses and phases of development, and the results of site inspection are also taken into consideration when evaluating the potential of an area to contain archaeological remains.

This report does not comment on Aboriginal archaeological potential.

1.5.3 Assessment of heritage impact

This Statement of Heritage Impact has been prepared using *Guidelines for preparing a statement of heritage impact* (Heritage NSW, 2023A). Specific terminology and corresponding definitions are used in this assessment to consistently identify the magnitude of the project's physical or visual impacts on heritage items. The terminology and definitions are based on those contained in guidelines produced by ICOMOS².

¹ NSW Heritage Office 1996; 25–27

² Including the document *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties*, ICOMOS, January 2011.

2.0 STATUTORY CONTEXT

2.1 NSW Heritage Act 1977

The NSW *Heritage Act 1977* (Heritage Act) is the primary piece of State legislation affording protection to heritage items (natural and cultural) in NSW. Under the Heritage Act, 'items of environmental heritage' include places, buildings, works, relics, moveable objects and precincts identified as significant. Significance is based on historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic values. State significant items can be listed on the NSW SHR and are given automatic protection under the Heritage Act against any activities that may damage an item or affect its heritage significance. The Heritage Act also protects 'relics', which can include archaeological material, features and deposits.

2.1.1 State Heritage Register

Established under Section 22 of the Heritage Act, the SHR is a list of places and objects of particular importance to the people of NSW, including archaeological sites. The SHR is administered by Heritage NSW, DPC and includes a diverse range of over 1,500 items in private and public ownership. To be listed, an item must be deemed to be of heritage significance for the whole of NSW.

To carry out activities within the curtilage of an SHR-listed item, approval must be gained from the Heritage Council through a Section 60 permit. In some circumstances, under Section 57(2) of the Heritage Act, a Section 60 permit may not be required if works meet the conditions for exemption (Heritage NSW, 2009B). This typically includes works that are minor in nature and with no or minimal impact on the heritage significance of the SHR-listed item.

2.1.2 Relics Provisions

The Heritage Act also provides protection for 'relics', which includes archaeological material or deposits. According to Section 139 (Division 9: Section 139, 140–146):

- (1) *A person must not disturb or excavate any land knowingly or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, damaged or destroyed unless the disturbance is carried out in accordance with an excavation permit.*
- (2) *A person must not disturb or excavate any land on which the person has discovered or exposed a relic except in accordance with an excavation permit.*
- (3) *This section does not apply to a relic that is subject to an interim heritage order made by the Minister or a listing on the State Heritage Register.*
- (4) *The Heritage Council may by order published in the Gazette create exceptions to this section, either unconditionally or subject to conditions, in respect of any of the following:*
 - a. *Any relic of a specified kind or description,*
 - b. *Any disturbance of excavation of a specified kind or description,*
 - c. *Any disturbance or excavation of land in a specified location or having specified features or attributes,*

- d. *Any disturbance or excavation of land in respect of which an archaeological assessment approved by the Heritage Council indicates that there is little likelihood of there being any relics in the land.*

Section 4 (1) of the Heritage Act (as amended in 2009) defines a relic as:

...any deposit, artefact, object or material evidence that relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and is of State or local heritage significance.

A relic has been further defined as:

Relevant case law and the general principles of statutory interpretation strongly indicate that a 'relic' is properly regarded as an object or chattel. A relic can, in some circumstances, become part of the land be regarded as a fixture (a chattel that becomes permanently affixed to land) (Heritage NSW, 2009A).

Excavation permits are issued by the Heritage Council of NSW, or its Delegate, under Section 140 of the Heritage Act for relics not listed on the SHR or under Section 60 for relics listed on the SHR. An application for an excavation permit must be supported by an Archaeological Research Design and Archaeological Assessment prepared in accordance with the Heritage Council of NSW archaeological guidelines. Minor works that will have a minimal impact on archaeological relics may be granted an exception under Section 139 (4) or an exemption under Section 57 (2) of the Heritage Act.

2.1.3 Archaeological 'works' versus 'relics'

The Heritage Act provides protection for archaeological remains through the operation of the 'relics' provisions. The primary aim of an archaeological significance assessment is to identify whether an archaeological resource, deposit, site or feature is of cultural value and therefore, considered to be a 'relic'. Historical archaeological sites typically contain a range of different elements as vestiges and remnants of the past. Such sites will include 'relics' of significance in the form of deposits, artefacts, objects and usually also other material evidence from demolished buildings, works or former structures which provide evidence of prior occupations but may not be 'relics' (Heritage NSW, 2009A).

The Heritage Act places 'works' in a separate category to archaeological 'relics'. 'Works' are typically remnants of infrastructure that are considered to be items of environmental heritage but are not associated with artefact bearing material. Impacts to a 'work' do not require approval from the NSW Heritage Council or its delegate.

2.2 Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the framework for cultural heritage values to be formally assessed in the land use planning and development consent process. The EP&A Act requires that environmental impacts are considered prior to land development; this includes impacts on cultural heritage items and places as well as archaeological sites and deposits. The Proposal is subject to assessment under Part 5 of the EP&A Act.

The EP&A Act also requires that local governments prepare planning instruments (such as Local Environmental Plans [LEPs] and Development Control Plans [DCPs]) in accordance with the EP&A Act to provide guidance on the level of environmental assessment required. The current project location falls within the boundaries of the Waverley Council LGA. Schedule 5 of the Waverley LEP 2012 includes a list of items/sites of heritage significance within the Waverley Council LGA.

2.2.1 Waverley Local Environmental Plan 2012 (WLEP)

Heritage items listed on the Waverley LEP 2012 (WLEP) are managed in accordance with the provisions of its Section 5.10 Heritage Conservation. Under Clause 5 of this section of the WLEP:

The consent authority may, before granting consent to any development:

(a) on land on which a heritage item is located, or

(b) on land that is within a heritage conservation area, or

(c) on land that is within the vicinity of land referred to in paragraph (a) or (b),

require a heritage management document to be prepared that assesses the extent to which the carrying out of the proposed development would affect the heritage significance of the heritage item or heritage conservation area concerned.

2.2.2 Waverley Development Control Plan

The Waverley DCP 2012 is a supporting document that compliments the provisions contained within the WLEP 2012 and provides specific design suggestions for sympathetic development on, or in the vicinity of, items listed on Schedule 5 of the WLEP 2012.

Part B (B9) and Part E (E3) of the DCP 2012 provides considerations for sympathetic development in the vicinity of a heritage listed item or Heritage Conservation Area (HCA). These considerations include ensuring that the character, bulk, scale and height of new development does not unreasonably overshadow a nearby heritage item, that colouring and texture of new materials of a new development is sympathetic to a heritage item, and that views of a heritage item should not be obscured from the point of view of areas of public domain.

2.3 Heritage registers search

Statutory registers provide legal protection for heritage items. In NSW, the Heritage Act and the EP&A Act provide for heritage listings. The SHR, the Section 170 Heritage & Conservation Registers and the environmental heritage schedules of LEPs are statutory listings. Places on the World, National and Commonwealth Heritage Lists are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

A search of all relevant registers was undertaken on 30 November 2022. The results are displayed below in Table 1. A map of the curtilages of the relevant heritage items is provided in Figure 2.

In addition, a summary of contributory buildings which bound the study area have been included in an appendix (Section 11.0 of this report). Although not individually listed items, the Waverley DCP 2012 notes that all contributory buildings within HCAs should be retained and protected from adverse impacts.

Table 1: Statutory heritage register search results for study area, adjacent and nearby

Item	Address	Significance	Listing	Place ID (Item No.)	Distance from study Area
Charing Cross Heritage Conservation Area		Local	WLEP 2012 National Trust Register	LEP Item No.C7	Within
Mary Immaculate Church	45 Victoria Street/ 280–282 Bronte Road	Local and State	WLEP 2012 State Heritage Register National Trust Register	LEP Item No. I495 SHR No. 00625	Adjacent to the study area
Late Victorian commercial residential building	189–199 Bronte Road	Local	WLEP 2012	LEP Item No. I411	Adjacent to the study area
Inter-war Art Deco style hotel, Charing Cross Hotel	81–85 Carrington Road	Local	WLEP 2012	LEP item No. I412	Adjacent to the study area
Late 19th Century commercial/residential terraces (Deluca)	3–13 Albion Street	Local	WLEP 2012	LEP Item No. I442	Adjacent to the study area
Late 19th Century commercial/residential terraces	15–30 Albion Street	Local	WLEP 2012	LEP Item No. I443	Adjacent to the study area
1940s commercial style building, Robin Hood Hotel	203–209 Bronte Road	Local	WLEP 2012	LEP Item No. I453	Adjacent to the study area
Inter-war Free Classical public building (former Waverley Post Office)	234 Bronte Road	Local	WLEP 2012	LEP Item No. I454	Adjacent to the study area
Victorian style commercial terrace houses	252–254 Bronte Road	Local	WLEP 2012	LEP Item No. I455	Adjacent to the study area
Late nineteenth century commercial terrace	245–277 Bronte Road	Local	WLEP 2012	LEP Item No. I456	Adjacent to the study area
Uniting Church and Hall	28–30 Victoria Street	Local	WLEP 2012	LEP Item No. I494	Approximately 17m east
Evansdale	105 Carrington Road	Local	WLEP 2012	LEP Item No. I413	Approximately 42m southwest
Charing Cross (House)	11 Victoria Street	Local and State	WLEP 2012 State Heritage Register	LEP Item No. I429 SHR No. 00449	Approximately 62m southwest
Late Victorian Villa	348 Bronte Road	Local	WLEP 2012	LEP Item No. I457	Approximately 64m east
1920s Inter War Bungalow	50 Carrington Road	Local	WLEP 2012	LEP Item No. I469	Approximately 48m northeast

Figure 2: Location of listed heritage items adjacent and nearby the study area



Figure 3: Waverley LEP 2012 Heritage map including most of the study area which is located within the Charing Cross Heritage Conservation area (C7) (HER001 extract)



Figure 4: Waverley LEP 2012 Heritage Map showing area adjacent to the north of the study area (Waverley Council, HER001A extract)



Figure 5: Waverley LEP 2012 Heritage Map showing area adjacent to the east of the study area (Waverley Council, HER004B extract)



3.0 HISTORICAL CONTEXT

This section of the report provides a background history of the area. The information shown here is not intended to be used as text for any interpretive elements, but rather to give some contextual historical background to the study area.

3.1 History of Waverley

3.1.1 Aboriginal History of the Waverley Area

Many Aboriginal people, like other Indigenous or First Nations people around the world, say they have been living on Country for 'time immemorial' – that they have always been here and their origins lie in the creation of the land and animals. Over the last few decades, archaeologists' knowledge of deep human time in Australia has expanded from just a few thousand years in the 1950s, to 25,000 years in the 1960s, then 40,000 years, to now around 60,000 years or more.³

Archaeological evidence of Aboriginal people living in the Sydney region from Shaw's Creek west of the Dyarubbin (Nepean) River is dated at around 14,000 years ago and numerous other sites in the area have been dated at around 15,000 ago. While Cranebrook Terrace, near Penrith in Western Sydney, has been dated to 41,700 years and a site near Parramatta at 30,000 years old, there is growing consensus among archaeologists and historians that people have lived across the Sydney region from around 50,000 years ago.⁴

Prior to colonisation, Aboriginal people in the relatively resource rich Sydney region lived in extended family groups estimated at around 30 to 50 people. These groups were associated with certain territories or places that gave clan members particular social and economic rights and obligations. Each of the estimated 30 clans in the Sydney region had a name often associated with a place or resource such as the Cabro (Gabra) gal (people) at modern day Cabramatta. Clan groups moved around a defined area in response to changing seasons and the availability of food and other resources. European observers mistakenly took this as a nomadic lifestyle, when in fact they moved around a 'limited and deeply known' area. There were also forms of more sedentary agriculture and aquaculture, and villages such as those described by early colonial diarists at Kamay-Botany Bay and later accounts of '70 huts' at Bent's Basin on the Nepean River west of Sydney.⁵

The Gadi people, or Gadigal, lived on the south side of the harbour along the shores between South Head and Gomora (to later be called Darling Harbour). They were the first people displaced by the colonists at Warrane – what was later called Sydney Cove. The colonists had arrived with pre-conceptions about Aboriginal society, often believing it to be static and unchangeable, unable to adapt to colonisation, and highly territorial. However the network of social, ceremonial and family relations that existed among clans right across the Sydney region and beyond meant that in fact, the Sydney people were highly mobile and adaptable. At any one time, people from various clan groups could be living in another group's Country, people could have family networks over great distances and a clan group might have several different languages spoken. This adaptability, based in a strong central core of the clan's heartland, was to shape how Aboriginal people survived the decimation of disease and the massive impact of colonisation.⁶

The European colonisation of Australia began with the establishment of a colony at Sydney Cove by Captain Arthur Phillip in January 1788 on Gadigal Country. The location of Captain Arthur Phillip's landing site was on the southern shore of Sydney Cove (Thorp, 1995: 33). Many of the documented early interactions between the British and the Gadigal People were amicable. Watkin Tench, Captain

³ Karskens, 2009: 25.

⁴ Attenbrow, 2010: 18-20; Nanson, Young & Stockton, 1987: 77; Jo McDonald, 2005, Cultural Heritage Management: 4, 87-94;

⁵ Gapps, 2010: 26-60; Attenbrow, 2010: 78; Karskens, 2009: 36; Gammage, 2012: 281-304.

⁶ Irish, *Hidden in Plain View*, pp. 16-17

of the Marines with the First Fleet, documented his first meeting with the Gadigal People, when he and a landing party visited the south shore of Port Jackson. Tench noted that they were greeted by a dozen Aboriginal people, with the landing party and the Aboriginal people cautiously approaching each other before observing one another and exchanging items (Tench, 1789: 54-58).

British colonisation had a profound effect on the Aboriginal population of the Sydney region. In the early days of the colony Aboriginal people were disenfranchised from their land as the British claimed areas for settlement and agriculture. The colonists, often at the expense of the local Aboriginal groups, also claimed resources such as grasses, timber, fishing grounds and water sources.

Despite the impacts to the Aboriginal community following British colonisation, Aboriginal community connections to the area and culture are strong and ongoing.

3.1.2 Early exploration of the region and land grants

Exploration of the region began soon after European occupation. Early settlers might have seen the beaches, swamps and sandy scrubland as ‘something of a peculiar loneliness,’⁷ however, the land would soon attract timber-getters, as well as the military, who established themselves at South Head.⁸ With the completion of the South Head lighthouse in 1811, the area developed as the penal colony grew.⁹

Early land grants in Waverley were made in the early years of the nineteenth century. William Roberts received 200 acres [81 hectares] of land in January 1810.¹⁰ This parcel of land included Bondi Beach and was given in part as recognition of his services during the construction of South Head Road. Roberts would use the land as cattle pastures until his death in 1819.¹¹ The land would remain within the family until the 1850s, when the property was subdivided and advertised for sale. Surveyor General Mitchell noted the importance of the access to the beach and resumed the beach-front location.¹²



Figure 6: 1841 Map of the surrounding area.
Approximate location of the study area highlighted in red.
(Source: SLNSW. FL3712260.)

⁷ Webber, Daniel. *Bondi Stories*. Createspace

⁸ Dowd, B. T. (Bernard Thomas) & Foster, William (1959). *The history of the Waverley Municipal District*. Waverley Municipal Council, Waverley, N.S.W

⁹ Faro, Clive (1998). 'To the lighthouse! The South Head Road and place-making in early New South Wales'. In *Journal of the Royal Australian Historical Society*. 84 (2), 109.

¹⁰ Waverley Council. *Bondi Beach Urban Conservation Area*. Heritage Inventory Sheet.

¹¹ Family Notices (1819, September 18, p4). *The Sydney Gazette and New South Wales Advertiser*. Retrieved April 13, 2020.

¹² Ford, Caroline M (2014). *Sydney beaches: a history*. NewSouth Publishing, Coogee, N.S.W.

Two additional land grants in Waverley were made to John Hurd (an employee of Roberts) in 1809 and Barnett Levy in the 1830s (Figure 6).¹³ New regulations in 1831 forced a new system of acquisition by purchase, although promissory grants within smaller areas of the Waverley district remained honoured. Notable new landowners within the area included Henry Bond, Francis Knight and Hercules Watt, all of whom ran tannery yards on their properties that required space and access to water. The sale of land for private ownership would not boom until the late 1830s.



Figure 7: Bronte House sketched c 1856. (Source: SLNSW. FL13003011.)

The NSW Colonial Architect William Mortimer Lewis purchased 42 acres [17 hectares] of land at Bronte (now encompassing Bronte House, Figure 7),¹⁴ Smaller land sales of three to ten acres [1-4 hectares] were steadily processed, yet permanent settlement in these areas was confined to areas around Tea Gardens (now Bondi Junction) and Charing Cross.¹⁵ The economic depression of the 1840s slowed development in the area for a number of years—apart from local Chinese residents who were more successful in their agricultural endeavours in this coastal environment, and who established market gardens within the Waverley area.¹⁶ Livestock farming in the district was also viable, with ready markets for milk and dairy in Sydney town.¹⁷

Waverley and its surrounding suburbs formed an isolated pocket in the east that was removed from the established settlement of Sydney. The people were loyal to their local area and formed village communities with close ties to their neighbourhoods, which often led to political, if not physical, fights within Sydney Municipality.¹⁸ Transport modes to the area improved over time with horse bus routes and a tram line established during the 1860s to 1880s. By the 1870s, there were community focal points the Tea Gardens Hotel and the Robin Hood Hotel at Charing Cross. There were also local butchers, green grocers and fruiterers, in addition to a hay and corn store and a blacksmith; bootmakers and a watchmaker.

In the 1880s, the Charing Cross settlement expanded with commercial interests and residential development, bringing the suburbanisation of the area into the twentieth century (Figure 8). Waverley would enjoy further popularity in the early years of the 20th century, particularly as a destination spot

¹³ Bergman, G. F. J. 'Levey, Barnett (1798–1837)', *Australian Dictionary of Biography*, National Centre of Biography, Australian National University.

¹⁴ 'Bronte House' *The Sydney Morning Herald* (April 6, 1948, p. 2). Retrieved April 13, 2020.

¹⁵ *ibid*

¹⁶ 'Waverley Municipality'. *Empire* (3 May, 1860, p2). Retrieved April 13, 2020.

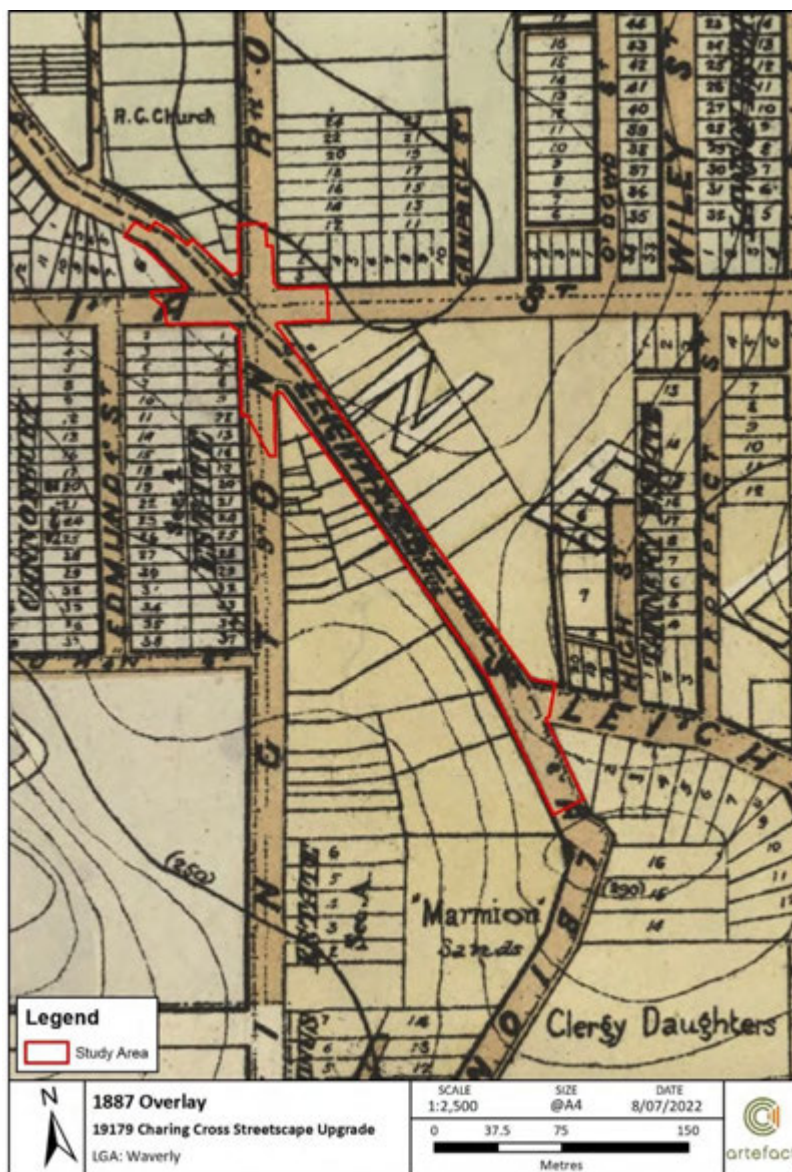
¹⁷ Waverley Council. 2007. *Waverley Heritage Policy*.

¹⁸ 'The Federal Fight'. *The Australian Star* (30 April 1898, p. 5). Retrieved April 13, 2020.

for leisure activities at Wonderland City in Tamarama;¹⁹ Bronte Beach's baths and park, and the crowd-pleasing Bondi Beach.

During the inter-war years, the Municipality of Waverley underwent a wave of residential flat, bungalow and duplex development. Sydney's seaside suburbs of Bondi and Manly were inundated with new residential flat buildings of various architectural styles; although some local residents rallied against the development of 'unsightly blocks of flats which obliterated views and caused property prices to plummet'.²⁰ Although these buildings were not popular with local communities, there was little land left for subdivision by the late 1920s. Post war, Sydney ushered in further redevelopments of the area (Figure 9), culminating in the landmark development of Bondi Junction Mall in 1979 and the opening of the eastern suburbs railway line that same year. This opened up the suburb to outsiders like never before.

Figure 8: The expanding development of Waverley, c 1887. Plan of the borough of Waverley. Study area highlighted in red. (Source: Pollitzer, S & Gibbs, Shallard & Co.)



¹⁹ 'Tamarama Beach'. *The Daily Telegraph* (18 March 1907, p.9). Retrieved April 13, 2020.

²⁰ Thompson, Ruth (1986). *Sydney's flats, a social and political history*. PhD Thesis Macquarie University, 1986, p.45

Figure 9: c1950s aerial of Charing Cross and Waverley. Study area outlined in red. (Source: SLNSW. IE8822860)



3.2 Charing Cross history

The following information has been extracted from the Charing Cross heritage inventory held by Waverley Council, unless otherwise referenced.²¹

3.2.1 Initial Land Grants

Following the formation of Old South Head Road in 1811, Bronte Road evolved as a route south to Coogee Bay and Governor Macquarie's watchtower at La Perouse. The HCA and study area is located in areas originally within the purchase grants of William Manners Clarke (1837), Lewis Gordon, (1838) and Samuel Peak, (1839). Gordon's lands (Figure 11) were substantially transferred to J Vickery between 1839 and 1858. Subdivisions of these early grant lands resulted in a small service village on the road to Coogee and La Perouse.

3.2.2 Naming of the Village: Maddens Corner

John Madden also purchased lands from Lewis Gordon at the intersection of what was Coogee Road and later Carrington Road. Madden erected three stone cottages on the lands. Madden and his son John Madden Jnr. were signatories to the establishment of Waverley Municipal Council in 1859. The village was originally referred to as Maddens Corner and retained its local identity until Madden's house was purchased and demolished c.1919.

Maddens Corner was renamed by the inaugural Waverley Council as Charing Cross in 1859.

²¹ Waverley Council. (No date). *Charing Cross Urban Conservation Area*. Heritage Inventory Sheet.

3.2.3 Expansion of Charing Cross after 1859

By 1854, the area accommodated small stores, smithies and hotels serving local market gardeners, dairymen and travellers to Coogee. The village expanded with the 1866 establishment of Vickery's Glenrock Tannery on the eastern side of Charing Cross. By 1868 the tannery and leather goods factory employed over 140 men producing 1200 pairs of boots a week. The Vickery family also constructed Glenrock Terrace, a row of sandstone workers' cottages, remaining in High Street, Charing Cross, south of the former tannery site. Vickery's tannery closed on 8 Nov 1881 with the land subdivided as the Tannery Estate.

In the 1890s, existing stone quarries expanded to supply city construction. Bronte Road was also known as Leichhardt Street during this period (Figure 12). Quarry workers had erected small stone cottages about streets to the eastern side of Charing Cross as early as the 1850s. During that time, two hotels, Newlands (1857) later the Charing Cross and the Robin Hood (1859) commenced trade in Vickery Street (now Carrington Road). Both were substantial premises erected in stone and served to further strengthen the focal point of Maddens Corner /Charing Cross by the 1860s. William Newland (1807–1883), builder, proprietor of Newlands Hotel, and councillor from 1859–1860 opened the hotel to the first meeting of Waverley Council. Construction of a three storey Norman Style Friary commenced here. Later population growth would see the erection of the Renaissance-style Mary Immaculate Church, which opened in 1913 on the eastern side of this land.

In 1883, local Waverley poet and candle maker Alfred Allen published a book of poetry, including a short poem titled 'Waverley (a retrospect)'.²² The poem has been detailed below and recounts his youth in the area, having arrived in Sydney in 1844 as a child of Irish parents.²³ Alfred would be elected as a member for Paddington in 1887 but his later bids for Waverley were unsuccessful.²⁴

Waverley (a retrospect)

*Here memory reckons one by one
My early years of joy and mirth ;
For here my brightest dreams had birth
Ere life's stern battle had begun.*

*Here are the rocks where once my feet
With lightness skipped from crag to crag ;
The sandy beach and moss-bound flag
Where still the breakers wildly beat.*

*Here are the hills of heath and rose —
They rudely line the rugged shore,
And o'er them white-plumed sea birds soar,
Waiting their victims to depose.*

*In boyhood's sunny hours I've played
Among these rocks and time-worn caves,
And breasted oft the rolling waves,
And knelt with those I've loved, and prayed.*

Here, borne on fancy far above

²² Allen, Alfred. 1883. *Australian Verse Drift Poems*. Sydney. F.Cunninghame and Co.

²³G. P. Walsh, 'Allen, Alfred (1839–1917)', *Australian Dictionary of Biography*.

²⁴ Ibid.

*The callings of this lower state,
We've sojourned till the hours were late
To measure the Eternal love.*

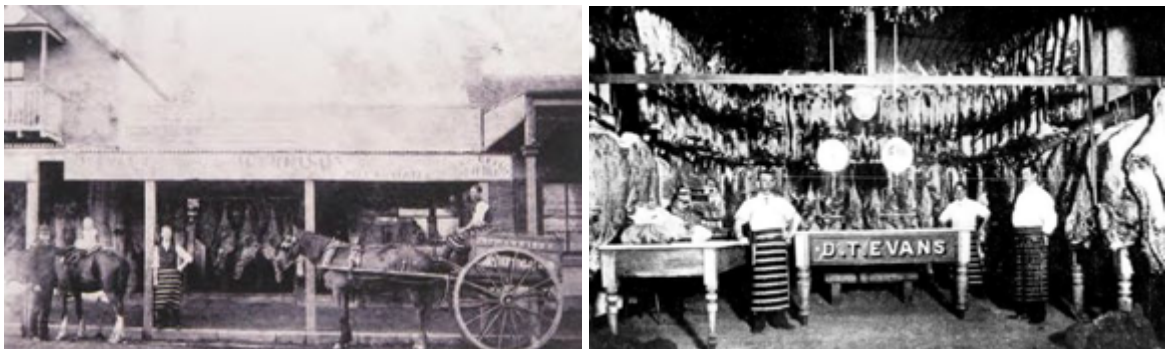
*Before the dawn we've sought the grove,
To watch the early peep of day.
To see the waves with sunbeams play,
Before the clouds began to rove.*

*These rocks and hills with sheltered glen,
And curling waves with solemn moan.
Oft taught my spirit whence to roam,
And drew me from the haunts of men.*

*These rugged hills unaltered sleep, —
If any change, I fail to see ;
Whatever change, it is in me, —
I see none in the changeless deep.*

*There is no spot on earth to me
More dear, where richer charms abound,
Than here, and in the hills around
The rock-lined glens of Waverley.*

Figure 10: Early butcher shop, located at what is now 256–258 Bronte Road. Left: Harrison Butchers, c1885 (Source: Waverley Image Gallery.101391). Right: D.T Evans Butchers, c1906²⁵



Opposite Mary Immaculate Church, the Presbyterian Church having conducted its first service in the Odd Fellows Hall in Church Street on Jan. 17, 1885, proceeded to lay the foundation stone of a church in November 1885. The initial church was superseded in February 1898 by a much larger Gothic style sandstone building, the Grahame Memorial Church named in honour of benefactor Mrs W Grahame. These institutions defined the northern and southern limits of Charing Cross from the irregular strip of retail and residential undertakings extending along Cowper Street [now Bronte Road] to the Tea Gardens [now Bondi Junction] and along McPherson Street to the southeast.

²⁵ 'Enterprise at Waverley'. *The Sydney Mail and New South Wales Advertiser* (26 September 1906, p.807). Retrieved February 25, 2021.

Figure 11: 1859 map of the area, showing landowners. Study area highlighted in red. (Source: SLNSW. FL3679646.)

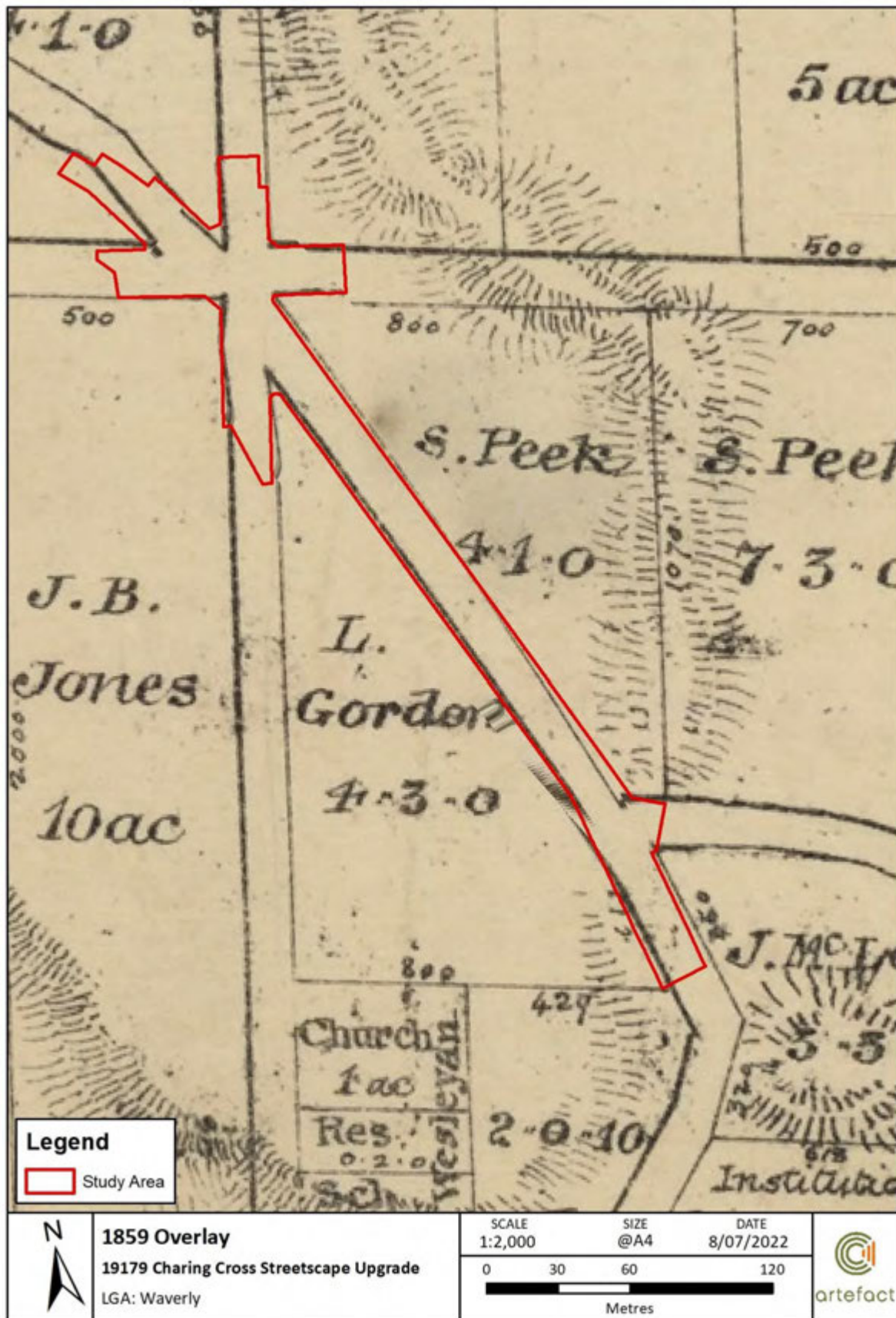
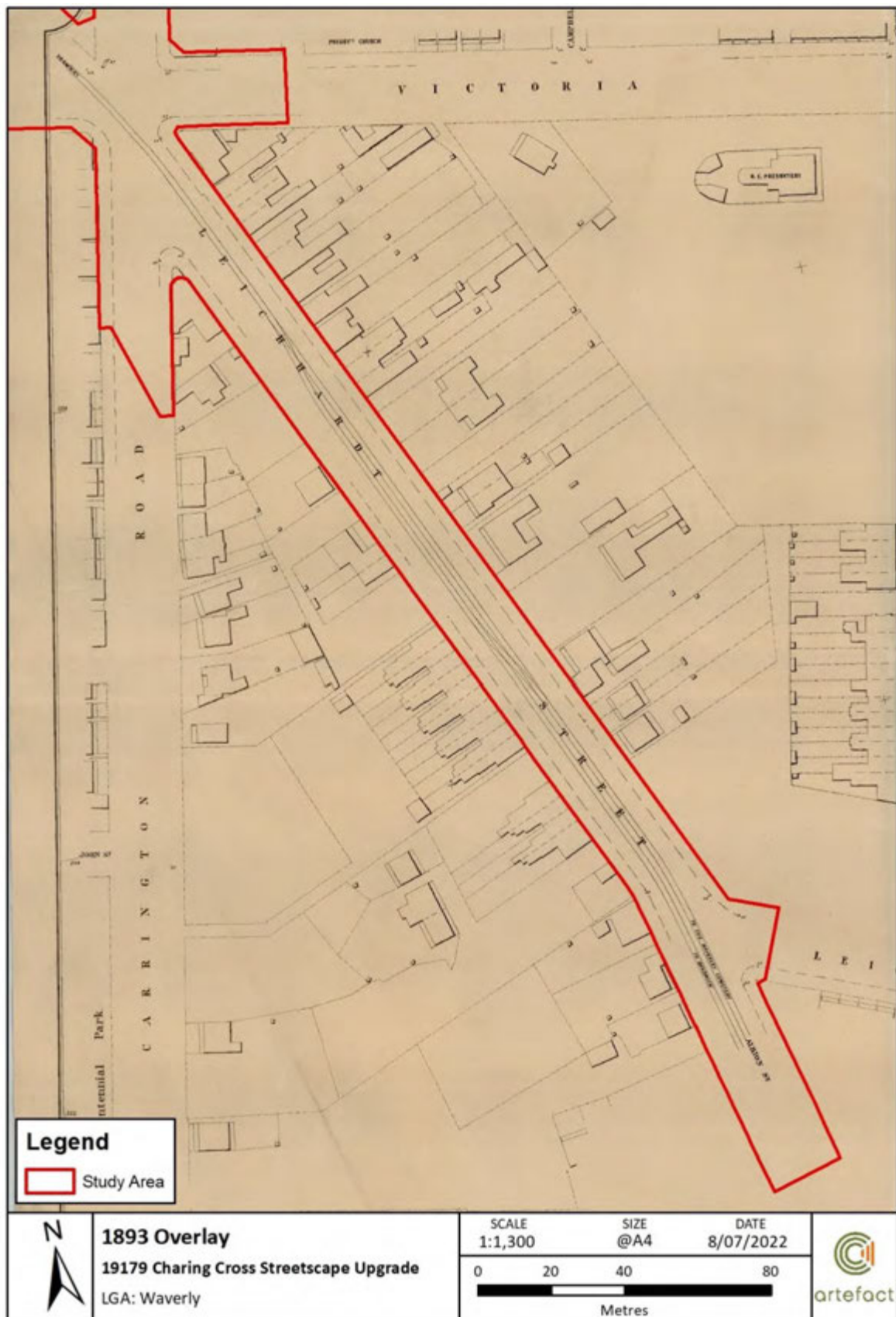


Figure 12: Charing Cross c.1890s. Note Bronte Road called Leichhardt Street at that time. The majority of these building have been demolished and rebuilt in the late 1890s to early 20th century. Study area highlighted in red. (Source: SLNSW. Metropolitan Sheet 14)



3.2.4 Consolidation of the Village

The subdivision of Samuel Peaks 'Sea View' Estate in 1863, bounded by Victoria, Henrietta and High Street, established the current lot patterns to the eastern side of Charring Cross. Further substantial subdivision and development occurred from the 1870s onwards with horse drawn omnibus services to the city and tram services linking Charing Cross with the Tea Gardens (now Bondi Junction) in April 1881. The tram line was continued through to Randwick by 1887. A water trough appears in an early 1890 illustration (Figure 14), which appears to be the same design as a water trough removed from the site in the 1960s. That trough was donated by local resident Amelia Hall and her family and is now located in Lithgow.²⁶

The continuing growth and consolidation of the village resulted in a streetscape of two storey retail frontages, with living spaces above, opening onto post supported verandas (Figure 13 to Figure 15). Initially of late Victorian Style these continued to be erected in Federation styles through the early 20th century. Electrification of the tramway between Bondi Junction and Waverley in October 1902 accelerated the development of Charring Cross. In the process much of the early Victorian streetscape was replaced by Federation styled shops, with high parapeted frontages replacing the hip-roofed verandah forms of the 19th century.

In 1889 Waverley Volunteer Fire Brigade first occupied a building in Carrington Road at Charing Cross. Following the September 1912 opening of an 'unofficial' post office in Carrington Road, commitment was made to establish a formal post office. Around the time of the First World War, the Australian Government acquired the house of pioneer John Madden at the intersection of Carrington and Bronte Roads. The house was demolished and site cleared by 1919 and a new post office erected by 1923. The architect, John Smith Murdoch, was also designing the 'temporary' parliament house in Canberra, Australia's new national capital. When opened, the new post office was designated as 'Charing Cross' but in 1940 it was renamed 'Waverley'. In the early 1920s, the 're-making'²⁷ of Bronte Road was undertaken, although it is not known where the works were undertaken. It is possible that they were in the vicinity of Madden's Corner.

The demands of commerce supported the establishment of bank buildings at Charing Cross. In 1888 the Bank of NSW opened at the corner of Victoria Street and Carrington Road. In 1919 the Australian Bank of Commerce opened at 240 Bronte Road, before merging with the Bank of NSW in 1931. In 1920 the Government Savings Bank purchased land from the Seaview Estate erecting a bank and residence near the intersection of Bronte Road and Albion Streets. The building remained in use after merger with the Commonwealth Bank in 1931.

²⁶ Waverley Council. Heritage Assets. *Miss Amelia's Horse Troughs*. Published by Waverley Library from sources in the Local History Collection, 2009.

²⁷ 'Bronte Road'. *Evening News* (23 February 1922, p.3), p. 3. Retrieved April 22, 2020.



Figure 13:
Charing Cross,
1884, facing
down
Carrington
Road towards
Queen's Park.
The original
Robin Hood
Hotel to the
centre left of
frame (Source:
*OUR ARTIST
AT
WAVERLEY.*
(1884, August
2). Illustrated
Sydney News
(NSW: 1881–
1894), p. 9)

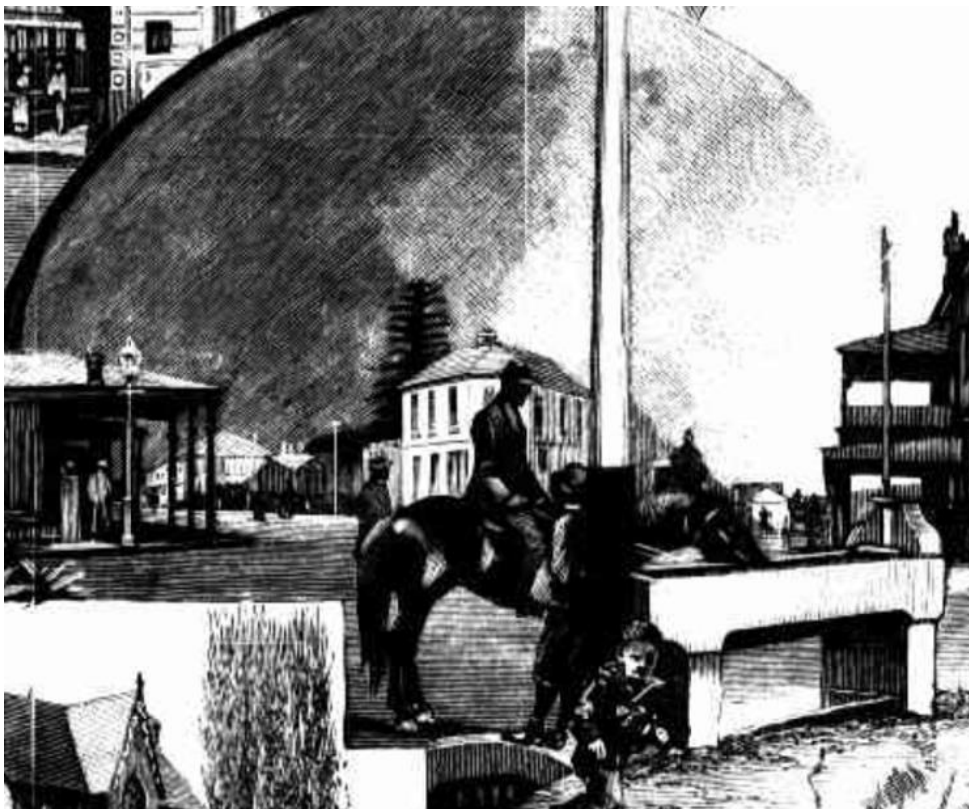


Figure 14:
Charing Cross,
c1890. Note
water pump
and trough to
the foreground
(Source:
*PICTURESQUE
NEW SOUTH
WALES—IN
AND AROUND
WAVERLEY.*
(1890, July 12).
The Sydney
Mail and New
South Wales
Advertiser
(NSW: 1871–
1912), p. 88)

Figure 15: Charing Cross, c 1890s. The original Robin Hood Hotel is to the middle of the image (Source: SLNSW. FL3326643)



Inter War development at Charing Cross included the Functionalist Style Robin Hood Hotel, dramatically situated at the acute intersection of Carrington and Bronte Roads (Figure 16), also the Art Deco-styled Charring Cross Hotel (Figure 18), the Commonwealth Bank, and the prominent twin towers of Mary Immaculate Church, which were completed in 1929–30.

In 1910 omnibus operator John Bunyan built an open-air picture show on his former stables site at the corner of Bronte Road and High Street. After 1924, the theatre was converted to Bronte Stadium a by promoter Pat O'Conner, and continued operating until 1936. It reverted to a cinema, The Bronte Hoyts by 1945, and closed in 1957. The site is now occupied by an equipment hire company at its new address, 340 Bronte Road and borders the southern end of the study area.

By the outbreak of World War 2 residential flat buildings had replaced earlier buildings in peripheral sites about Charing Cross, including a distinctive setting of Inter War planning forming Santa Marina Avenue south of Charring Cross.

The 1940s saw substantial freestanding Victorian residences still extant in Charring Cross, including Minnamurra and another large residence with secondary shopfronts constructed to the eastern side of Bronte Road. By World War 2, most buildings from the formative 1840–50s had been replaced. The tracks of the Bronte tram line were removed in the 1960s, altering the roadway for the influx of new motor vehicles along Bronte Road.²⁸

Many modifications have been made within the study area since the 1950s, including the introduction of residential flat buildings to the east and west of Bronte Road and the introduction of the intrusive Legion Club building to the south of the Robin Hood Hotel.

²⁸ 'Campaign to save trams'. *The Sydney Morning Herald*, 17 January 1960.

Figure 16: (L to R) Robin Hood Hotel between 1920 and 1938. Robin Hood Hotel, c 1938 after redevelopment. Illustrating this early development of the streetscape (insert to right) (Source: Tooth's Yellow Cards²⁹)



²⁹ Australian National University. Noel Butlin Archives. *Robin Hood Hotel*. Tooth's Yellow Cards.

Figure 17: View south along Bronte Road towards Albion Street, 1930 (Source: Waverley Image Gallery, 101392)



Figure 18: Charing Cross Hotel. Left: 1925 image of the building (Source: Waverley Image Gallery, 101222). Right: Charing Cross Hotel, c1930s. Note streetscape insert to right (Source: Tooth's Yellow Cards³⁰)



³⁰ Australian National University. Noel Butlin Archives. *Charing Cross Hotel*. Tooth's Yellow Cards. N60–YC–137

4.0 SITE INSPECTION

4.1 Introduction

A site inspection was conducted on 9 April 2020 by Sophie Barbera (Heritage Consultant) from Artefact Heritage (see Figures 19-54). The aim of the site inspection was to inspect the area of proposed impacts, inform a preliminary assessment of archaeological potential, and to identify heritage items and heritage significant fabric at the station and in the vicinity that may be affected by the Proposal. The inspection was undertaken on foot and a photographic record was made.

4.2 Site context and setting

Bronte Road runs southeast from Ebley Street at Bondi Junction to the intersection of Leichardt Street in Bronte. Here Bronte Road turns sharply east towards Bronte beach. The study area's built forms are predominately made up of one to two storey shop-top developments, with larger developments (Legions Club) sited to the western side of the streetscape. Photographic evidence documented in Section 2.0 illustrates modifications that many buildings have undergone since the late 1890s. It is evident that many of the original contributory features of the streetscape have been removed or modified, streetscape furnishings (lamp-posts) and balconies in particular. Some buildings within the street appear to be infill developments dating from the 1970s through to the present day. Additionally, some buildings along the streetscape have retained early features including pressed metal ceilings and original shop front facades.

The study area also includes the main intersection of Charing Cross (Victoria Street, Carrington Road and Bronte Road), sited in its north, and the smaller intersection of Bronte Road and Albion Street in its south. Small laneways extend from the east and west of the streetscape and offer visual connections to the rear of the allotments. Street parking is available along all streets. As detailed below, early sandstone kerbing has been replaced by modern concrete kerbing. Footpaths expand along both sides of the street and are generally comprised of brickwork, with some asphalt and concreted areas around the frontages of the two hotels and contributory buildings within the northern portion of the study area. Street furnishings include planter boxes and seating; these are later installations and do not have heritage significance. Street lighting includes overhanging streetlights placed along the street. Telephone and electrical poles and overhead wiring are evident along the streetscape.

Figure 19: Facing north of Bronte Road from intersection of Albion Street



Figure 20: Facing north along Bronte Road towards Charing Cross intersection



Figure 21: Facing north along Bronte Road towards Charing Cross intersection



Figure 22: Facing west from Victoria Street towards Charing Cross intersection



Figure 23: Facing west of current asphalt and concrete paving along Victoria Street



Figure 24: Facing south of concrete paving along Carrington Road



Figure 25: Some original contributory fabric (pressed metal ceilings) along Bronte Road



Figure 26: Early laneway along Bronte Road



4.3 Heritage Items in the vicinity of the study area

As outlined in Section 2.3, there are nine locally listed heritage properties which bound the curtilage of the study area, while a further five heritage items are located within the visual catchment of the development. The following section provides a brief description of each heritage place and its location

in the vicinity of the study area. The descriptions have been obtained from their State Heritage inventory (SHI) listings and from the Waverley Heritage Policy.

4.3.1 Heritage items located adjacent to the study area

4.3.1.1 189–199 Bronte Road—Late Victorian commercial residential building (WLEP #I411)³¹

The item comprises two, two-storey commercial buildings located at the intersection of Bronte Road and Victoria Street, offering a splayed façade to the corner. Both buildings feature shopfronts downstairs which have been substantially altered. The façades above the awnings on both streets appear to be relatively intact, with no. 195–199 featuring a prominent parapet with stucco detailing. The ground floor fenestration has been intrusively modified over time.

Figure 27: View towards locally listed heritage item, 189–199 Bronte Road, from Charing Cross intersection



Figure 28: View along Bronte Road from 189–199 Bronte Road



4.3.1.2 Charing Cross Hotel, 81–85 Carrington Road—Inter-war Art Deco style hotel, (WLEP #I412)³²

The building is a good example of an Art Deco style hotel located on a landmark corner site. The building features elaborate rendered decoration above the awning. The building, located at the intersection of Carrington and Bronte Roads, presents a splayed façade towards the intersection. The hipped roof is broken up between large parapets, while the first-floor façade features recessed balconies. The ground floor façade has been modified by the introduction of modern fenestration.

³¹ 'Item', 185–199 Bronte Road, HNSW SHI listing for WLEP #I411, accessed 18 February 2021.

³² 'Charing Cross Hotel', 81–85 Carrington Road, HNSW SHI listing for WLEP #I412, accessed 18 February 2021.

Figure 29: Charing Cross Hotel viewed from Victoria Street



Figure 30: Charing Cross Hotel viewed from the intersection of Bronte Road and Victoria Street



4.3.1.3 Robin Hood Hotel, 203-209 Bronte Road—1940s commercial style building (WLEP item #I453)³³

The building is a 1940s commercial building located at the intersection of Bronte and Carrington Roads. The building features a rounded corner facing the intersection and features an awning and a large parapet. It has Art Deco characteristics, including ocean liner detailing and original tiling featured along the ground floor façade. Many original external features appear to be intact.

Figure 31: Robin Hood Hotel façade viewed from Carrington Road



Figure 32: Robin Hood Hotel viewed from Bronte Road



4.3.1.4 245–277 Bronte Road—Late 19th century commercial terrace (WLEP item #I456)

The mixed terrace at 254 Bronte Road, Charing Cross, is designed in the Victorian Italianate style and retains a consistent street frontage. The terrace was built in 1887, integrating six shopfronts within the consistent form of mixed terraces. The terraces step down Bronte Road and are constructed of rendered masonry, with original finishes painted over. The pitched roof is of corrugated iron with detailed brick chimney stacks and round headed raised party walls separating each pair of buildings. A raised pediment at the centre of the group carries raised lettering identifying the terrace as 'Head's Building 1887'. Arcaded windows and moulded render detailing including ornate brackets beneath the shallow eave articulate the first floor elevation. The suspended awning is of later construction resulting from a 1920s Council directive requiring removal of existing post-supported balconies. Beneath the awning, contemporary ongoing alteration has removed much original detailing from the ground floor shop frontages.³⁴

³³ 'Robin Hood Hotel', HNSW SHI listing for WLEP #I456, accessed 18 February 2021.

³⁴ Waverley Council (Ines Meyer and Colin Brady). 2007. *Waverley Heritage Policy*, Waverley Council.

Figure 33: Facades along Bronte Road towards 245–277 Bronte Road



Figure 34: View along Bronte Road towards 245–277 Bronte Road



4.3.1.5 3–13 Albion Street—Late 19th Century commercial/residential terraces (Deluca) (WLEP item #I442)³⁵

The buildings are located towards the southern end of the study area, near the intersection of Albion Street and Bronte Road and bounding Cables Place to the south. The buildings display a good example of a late nineteenth century row of shops with shop top residences above. The building remains reasonably intact above the expanding awning. The building facades have been painted over time and the interior shopfronts have been altered. The original parapet remains intact as do the parapet finials.

Figure 35: View south towards 3–13 Albion Street



Figure 36: View west towards 3–13 Albion Street



4.3.1.6 15–31 Albion Street—Late 19th Century commercial/residential terraces (WLEP item #I443)³⁶

Located to the south of Cables Place on the western side of Bronte Road, the building bounds the southern part of the study area. The buildings at 15–31 Albion Street consist of a row of late nineteenth century two storey shop top developments. The buildings have been intrusively modified over time with alteration to the façade, fenestration and awning. Most of the original detailing has been lost. The original parapet has been retained.

³⁵ 'Late 19th century commercial /residential terrace [3–13 Albion Street]', HNSW SHI listing for WLEP #I442, accessed 18 February 2021.

³⁶ 'Late 19th century commercial /residential terraces [15–31 Albion Street]', HNSW SHI listing for WLEP #I443, accessed 18 February 2021.

Figure 37: View south towards 15–31 Albion Street



Figure 38: View south towards 15–31 Albion Street from Bronte Road



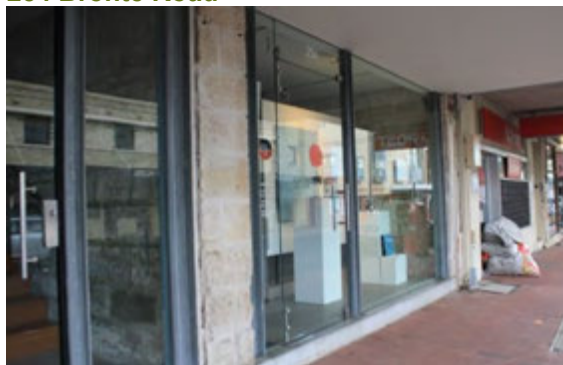
4.3.1.7 252–254 Bronte Road—Victorian style commercial terrace houses (WLEP item #I455)³⁷

The building features a stone facade with a gabled frontage to the street with iron roof. No. 252 is potentially a former laneway or right-of-way which was filled in by a narrow shop. Number 254 is a two-storey shop with residence above. Plain bargeboard and single sandstone chimney to south side, exposed rough sandstone on north elevation. A cantilevered balcony has recently been restored in a sympathetic design. The building has recently been renovated.

Figure 39: View towards 252–254 Bronte Road



Figure 40: View towards front façade of 252–254 Bronte Road



4.3.1.8 234 Bronte Road—Inter-war Free Classical public building (WLEP item #I454)³⁸

The building is a good 1920s Classical Revival style public building. The building is located at the corner of Bronte and Carrington Roads. The corner location of the building provides a splayed corner entry to the building. The building is a single storey with a parapet. The building is a single storey with a parapet. The entry portico has been fully rendered and features Tuscan columns and entablature.

³⁷ Perumal Murphy Pty Ltd. 1990. *Waverley heritage study*, Waverley Municipal Council.

³⁸ Perumal Murphy, 1990.

Figure 41: View from Bronte Road towards 234 Bronte Road



Figure 42: View from Victoria Street towards 234 Bronte Road



4.3.2 Heritage Items located within the visual buffer of the study area

4.3.2.1 *Mary Immaculate Church, 45 Victoria Street/ 280–282 Bronte Road (WLEP Item #I495/ SHR #00625)*³⁹

Mary Immaculate Church (45 Victoria Street) contains a group of buildings including the large cathedral with Classical Revival façade to lower part of building. The Cathedral is located nearby, about 57 metres east of the study area. The building features a clerestory level, with its two imposing bell towers, which appear to be in a different style. The entrance is formed by large, pedimented portico with four, imposing Ionic columns. Ionic pilasters continue around to the sides. Niches are located at the front with statues. The towers are square with horizontal rendered bands. The modern buildings adjoining the structure are reasonably sympathetic. :⁴⁰

The Mary Immaculate Church buildings located at 280–282 Bronte Road are sited to the north of Bronte Road and adjacent to the study area. The large Victorian Italianate residence at 280 Bronte Road, Waverley is constructed in painted render with a gable roof form now attached to a large hip roofed addition. The wide gable roofed frontage is set well forward and is symmetrically detailed with fretwork bargeboards. The gable is also constructed with moulded render to the gable vents, window heads and sills. Windows are of tripartite form having narrow side openings flanking a conventional centre opening. Windows are of timber framed double hung sash type with centre mullions to the main openings. Later additions to 280 Bronte Road are of sympathetic form set back from the main frontage and of rendered masonry with broad hip roof and timber balustrades to open verandahs. Window openings are of deep proportions with timber framed French doors and window frames. Contemporary landscaping occupies the former yard in the front of the building. :⁴¹

The narrow Victorian vernacular cottage at 282 Bronte Road, Waverley, combines elements of Victorian stylistic movements notably the Victorian Italianate and Victorian Gothic. The former residence now in use as a cafe is a rare remnant of the residential forms originally combined with early shopfronts to form the core of Charing Cross. A steep pitched gable roof clad in corrugated metal retains fretwork detailing to barge boards set forward of lined stucco clad masonry. An open skillion roofed verandah to the street frontage shows evidence of a previous reversed curve profile set between raised blade walls with rounded render capping and moulded render brackets. Iron filigree is employed as a frieze to the underside of the stop chamfered verandah beam. A single window opening to the street frontage retains a double hung timber sash window whilst an adjacent

³⁹ 'Mary Immaculate Church', HNSW SHI listing for SHR entry, accessed 18 February 2021.

⁴⁰ Waverley Council, 2007.

⁴¹ Waverley Council, 2007.

contemporary glazed door marks the location of the former entry. Internally, the former residence has been extensively altered. :⁴²

Figure 43: View from Victoria Street towards heritage item



Figure 44: View towards rear curtilage of the heritage item along Bronte Road



4.3.2.2 28–30 Victoria Street—Uniting Church and Hall (WLEP 2012 item #I494)⁴³

The building is located to the east of the Charing Cross intersection of Carrington and Bronte Roads and Victoria Street, and opposite Mary Immaculate Church. The building features a stone church in the ecclesiastical Gothic style. It has a gabled parapet to the facade with a belltower to one side. Rusticated stonework with smooth and carved stone have been used for decorative features. The building features lancet windows and Gothic pointed arches to all openings. The façade features a three-pointed main feature window in stained glass to the streetscape. Notable elements include pilastered columns, buttresses, fleches, pediment and cornices. The building has undergone little alteration except for limited painting of stone. The building is bordered by a fence in matching style. The hall beside is a simple gabled structure with a modern brick front added. Original gable features include decorative barge boards.

Figure 45: View from Victoria Street towards heritage item (Source: GoogleMaps)



Figure 46: View towards the Uniting Church and Hall from study area (Source: Googlemaps)



4.3.2.3 105 Carrington Road—Evansdale (WLEP 2012 Item #I413)⁴⁴

The building is located to the south side of Carrington Road and south of the Charing Cross intersection. The building features an impressive, two storey, Late Victorian house. The structure is in good condition with little modification. The building features a gabled roof form with slate roofing. A double verandah spans the whole front with wing walls. Original features include cast iron columns

⁴² Waverley Council, 2007.

⁴³ 'Late 19th century stone church, Graham memorial Church [28–30 Victoria Street]', HNSW SHI listing for WLEP # I494, accessed 18 February 2021.

⁴⁴ 'Victorian terrace style house [105 Carrington Road]', HNSW SHI listing for WLEP # I413, accessed 18 February 2021.

and lacework decoration. Of special note is the carriage entry into the rear yard. Other notable elements and features include excellent windows and door downstairs, with elaborate stucco mouldings, four French doors along the front façade and front palisade fence and gates.

Figure 47: View from Carrington Road towards heritage item (Source: GoogleMaps)



Figure 48: View towards front façade from study area (Source: GoogleMaps)



4.3.2.4 11 Victoria Street—Charing Cross (House) (WLEP 2012 item # I429, SHR item # 449)⁴⁵

The building is situated along the southern side of Victoria Street. The structure is a stone two storey building with symmetrical façade. It features a simple gabled form, repeated at the rear. New cusped barge boards have been introduced to the side gables. The building features the original slate roof. The double verandah is an authentic reconstruction. A skillion roof is supported by simple timber posts with moulded capitals. Double hung windows feature either side of main door. Three french doors are located along the first floor façade.

Figure 49: View from Victoria Street towards heritage item (Source: GoogleMaps)



Figure 50: View towards study area from heritage item (Source: GoogleMaps)



4.3.2.5 348 Bronte Road—Victorian Style Residence (WLEP 2012 item #I458)⁴⁶

The building is located to the east of the intersection of Albion Street and Bronte Road along the northern side of the streetscape. The building is a good example of a two storey, Late Victorian Villa. It features an L-shaped plan with canted bay to the front projection. A small porch with bullnosed balcony is located above the entrance porch. The building is indicative of transition to Federation period and retains its original tessellated tile pathway.

⁴⁵ 'Old stone building [11 Victoria Street]', HNSW SHI listing for WLEP # I429, accessed 18 February 2021.

⁴⁶ 'Late Victorian Villa [348 Bronte Road]', HNSW SHI listing for WLEP #I458, accessed 18 February 2021.

Figure 51: View from Victoria Street towards heritage item (Source: GoogleMaps)



Figure 52: View towards study area from heritage item (Source: GoogleMaps)



4.3.2.6 50 Carrington Road—1920s Inter War Bungalow (WLEP 2012 item # I469)⁴⁷

The building is located north of the study area to the eastern side of Carrington Road. The building is a very good example of an Inter-War Bungalow. The structure is mostly intact and features a double gable with verandah across the front facade. The building is recessed on same side as smaller gable. Dark brick with raised foundation of rusticated stone. Original contributory features include leadlight, casement windows and period French doors.

Figure 53: View from Carrington Road towards heritage item (Source: GoogleMaps)



Figure 54: View towards study area from heritage item (Source: Googlemaps)



⁴⁷ '1920s interwar bungalow [50 Carrington Road], HNSW SHI listing for WLEP #I469, accessed 18 February 2021.

5.0 SIGNIFICANCE ASSESSMENT

5.1 Assessment of significance for Charing Cross HCA

The methodology used in this SOHI is consistent with *Statements of Heritage Impact* and *Assessing Heritage Significance* published by Heritage New South Wales, and has been prepared in accordance with the principles contained in the *Burra Charter: The Australian ICOMOS Charter for Places of Cultural Significance* (2013).

The heritage significance assessment criteria required by the Heritage Council of NSW are as follows:

Table 2: NSW heritage assessment criteria (Heritage NSW, 2023A)

Criteria	Description
A–Historical Significance	An item is important in the course or pattern of the local area’s cultural or natural history.
B–Associative Significance	An item has strong or special associations with the life or works of a person, or group of persons, of importance in the local area’s cultural or natural history.
C–Aesthetic or Technical Significance	An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in the local area.
D–Social Significance	An item has strong or special association with a particular community or cultural group in the local area for social, cultural or spiritual reasons.
E–Research Potential	An item has potential to yield information that will contribute to an understanding of the local area’s cultural or natural history.
F–Rarity	An item possesses uncommon, rare or endangered aspects of the local area’s cultural or natural history.
G–Representativeness	An item is important in demonstrating the principal characteristics of a class of NSW’s cultural or natural places of cultural or natural environments (or the cultural or natural history of the local area).

The assessment of significance in Table 3 quotes the Waverley Council Heritage Inventory sheet for the Charing Cross Heritage Conservation Area.⁴⁸

Table 3: Significance assessment for the Charing Cross Heritage Conservation Area

Criterion	Explanation
A–Historical Significance	<p><i>The area records the pattern of early 19th Century purchase grants which provided the basis for the later grid street pattern of Charing Cross.</i></p> <p><i>The Conservation Area was an early small bustling town containing industry, cottages, small retail stores and hotels.</i></p> <p>Charing Cross Heritage Conservation Area has local significance under this criterion</p>

⁴⁸ Waverley Council Heritage Inventory Sheet, no date. ‘Charing Cross Heritage Conservation Area’.

Criterion	Explanation
B–Associative Significance	<p><i>The area has historical association with initial speculative absentee land owners William Manners Clarke-conveyancer, Lewis Gordon government surveyor, Samuel Peak-Sydney retailer. J. Vickery being land entrepreneurs of the mid-19th Century. Vickery established a tannery in the area and provided housing for workers during the 1860s. The area has close historic association with early 1840s resident John Madden-stonemason and provider of the initial location name Maddens Corner.</i></p> <p><i>Maddens family were also associated with other Waverley pioneering families the Fitzgeralds and Teeveys.</i></p> <p>Charing Cross Heritage Conservation Area has local significance under this criterion</p>
C–Aesthetic or Technical Significance	<p><i>The area retains significance as a demonstration of the forms, streetscapes and social relationship of industry, worker housing and commerce in the early years of Waverley Municipality. The scale, forms and history of the remaining worker cottages, terraces, shops and hotels provide a notable demonstration of the Municipality's social history.</i></p> <p>Charing Cross Heritage Conservation Area has local significance under this criterion</p>
D–Social Significance	<p><i>The area retains significance as a demonstration of the forms, streetscapes and social relationship of industry, worker housing and commerce in the early years of Waverley Municipality. The scale, forms and history of the remaining worker cottages, terraces, shops and hotels provide a notable demonstration of the Municipality's social history.</i></p> <p>Charing Cross Heritage Conservation Area has local significance under this criterion</p>
E–Research Potential	<p><i>The area records the forms of construction and detail employed in retail buildings within outer villages and later commuter suburbs of the Sydney Region during the 19th and early 20th Centuries. Former manufacturing sites retain archaeological potential as does the site of John Madden's early cottages, school house and churches.</i></p> <p>Charing Cross Heritage Conservation Area has local significance under this criterion</p>
F–Rarity	<p><i>The area contains rare examples of village structures of the mid-19th Century together with rare examples of ecclesiastic architecture notably the Renaissance Styled Mary Immaculate Church with its murals by Italian artist Professor Cesare Vagarini.</i></p> <p>Charing Cross Heritage Conservation Area has local significance under this criterion</p>
G–Representativeness	<p><i>The area has representative value as a cohesive example of the built form styles and functions of structures comprising an early outer village of the Colonia Sydney later consolidating as a transport based suburban centre of Waverley Municipality.</i></p> <p>Charing Cross Heritage Conservation Area has local significance under this criterion</p>

5.2 Statement of significance

Charing Cross Heritage Conservation Area is of local heritage significance.

The following statement of significance quotes the Waverley Council Heritage Inventory Sheet for Charing Cross Heritage Conservation Area.⁴⁹

The streetscape retains notable 19th and early 20th buildings of both state and local heritage significance. The high integrity of built form in the area records the historic evolution of a place from an early village east of Sydney. The layered fabric dominated by Federation Style buildings indicates a streetscape generated by tram

⁴⁹ Waverley Council Heritage Inventory Sheet, no date. 'Charing Cross Heritage Conservation Area'.

transport beginning in the 1880s. The slowing of growth in Post World War 2 ensured the preservation of Waverley's earliest history.

5.3 Locally listed heritage items

In addition to the Charing Cross Heritage Conservation Area, a number of properties are listed on the Waverley Council LEP 2012 as items of local significance are located within the vicinity of the study area. Statements of significance for these items have been quotes from the SHI WLEP entries for each item and are provided in Table 4 below.

Table 4: Statements of significance for nearby local heritage listed items

Item	Statement of significance
Inter-war Art Deco style hotel, Charing Cross Hotel (WLEP item No. I412) ⁵⁰	Good example of an Inter-War, Art Deco style hotel. Unaltered except for rendering. Property also has historic interest as the site of the area's first hotel. In continuous use as a hotel since 1857. Local significance.
Late 19th Century commercial/residential terraces (Deluca) (WLEP Item No. I442) ⁵¹	Good row of late nineteenth century commercial/residential terraces, with reasonably intact, above awning façade. Good streetscape with Nos. 15–31. Local significance.
Late 19th Century commercial/residential terraces (WLEP Item No. I443) ⁵²	Good row of late nineteenth century commercial/residential terraces. Good streetscape, with Nos. 3–13, despite alterations. Local significance.
1940s commercial style building, Robin Hood Hotel (WLEP Item No. I453) ⁵³	First Robin Hood Hotel established close by in Carrington Road in 1859. A second building was built on the present site c. 1880, replacing an old shop. It continued to trade as the Oxford Hotel until its licence was transferred to the Duke of Gloucester Hotel, in North Randwick, in the 1930s. Then became the new Robin Hood Hotel. Underwent a major rebuilding following the Second World War.
Inter-war Free Classical public building (former Waverley Post Office) (WLEP Item No. I454) ⁵⁴	Fine example of an Inter-War Free classical public building. Major streetscape contribution on this historic six-way intersection. Complements hotel building on adjoining corners. Local significance.
Victorian style commercial terrace houses (WLEP Item No. I455) ⁵⁵	No Statement of Significance could be obtained for the item. It is noted that the item was listed as a contributory element within the HCA in 2008 and not an individually listed item.

⁵⁰ 'Charing Cross Hotel' HNSW SHI listing for WLEP # I412, accessed 18 February 2021.

⁵¹ 'Deluca' HNSW SHI listing for WLEP # I442, accessed 18 February 2021.

⁵² 'Terraces', HNSW SHI listing for WLEP # I443, accessed 18 February 2021.

⁵³ 'Robin Hood Hotel', HNSW SHI listing for WLEP # I453, accessed 18 February 2021.

⁵⁴ 'Inter-war Free Classical public building', HNSW SHI listing for WLEP # I454, accessed 18 February 2021.

⁵⁵ 'Victorian style commercial terrace houses', HNSW SHI listing for WLEP # I455, accessed 18 February 2021.

Item	Statement of significance
Late nineteenth century commercial terrace (WLEP Item No. I456) ⁵⁶	One of the best surviving, late nineteenth century, commercial terraces in the Waverley Council area, at least from a streetscape point of view. Despite some alteration, the above awning façade remains essentially intact. Nos. 245–263 is a good example of a long and consistent row. Local significance.
Uniting Church and Hall (WLEP Item No. I494) ⁵⁷	Outstanding late nineteenth century stone church, with earlier building still standing beside. Church is essentially intact and features some fine stone detailing. Older building, now the hall, has suffered from alterations and additions but retains considerable historical interest. Fabric may also be reasonably intact behind modern addition. Both buildings of considerable social and historical interest. Church is a key element in the historic townscape around Charing Cross. Local significance.
Mary Immaculate Church (WLEP Item No. I495, SHR No. 00625) ⁵⁸	Landmark church building. Important element in the historic Charing Cross townscape. Façade is considered a fine example of a 1920s Academic Classical remodelling. (Recorded in Identifying Australian Architecture as an illustrative example of the style). An example of the work of noted architects, Sheerin and Hennessy. Local, historical and social interest, particularly to the local Catholic community. The Mary Immaculate Group is of State significance. It includes the buildings known as Mary Immaculate and St Charles Borromeo Church, the former Parish House and Minnamurra Cottage.
Evansdale (WLEP Item No. I413) ⁵⁹	Very good example of a Victorian terrace style house, with most of its original fabric intact. Of special note for its carriageway entry, now rare. Important individual element in the Charing Cross townscape for over 115 years. Local significance.
Charing Cross (House) (WLEP Item No. I429, SHR No. 449) ⁶⁰	There are a number of stone houses in Isabella Street, Blenheim and Birrell Streets. Dowd considers that they may date back to the 1850s as he is taking much of his information (without acknowledgement) from the 1924 articles by Major Johnston, who had access to older informants, this date is probably substantially correct. All of these houses have archaeological potential, particularly in areas of backyards, wells and privies in which household refuse was discarded. This is a rather grander house than the ones mentioned above, even though it too is in an area of light industry. Like the houses in the other streets, it is made of fine stone and has chimney pots which may well be original. It is two storeyed and fully symmetrical with three French windows on the upper storey, opening on to the verandah.
Late Victorian Villa (WLEP Item No. I457) ⁶¹	Good example of a Late Victorian villa. Many were built in the Charing Cross area but few survive in such good condition. Local significance.
1920s Inter War Bungalow (WLEP Item No. I469) ⁶²	Interesting variation on the standard 1920s Bungalow. Essentially intact and well maintained. Local significance.

⁵⁶ 'Late nineteenth century commercial terrace', HNSW SHI listing for WLEP # I456, accessed 18 February 2021.

⁵⁷ 'Uniting Church and Hall', HNSW SHI listing for WLEP # I494, accessed 18 February 2021.

⁵⁸ 'Mary Immaculate Church', HNSW SHI listing for WLEP # I495, accessed 18 February 2021.

⁵⁹ 'Victorian terrace style house [105 Carrington Road]', HNSW SHI listing for WLEP # I413, accessed 18 February 2021.

⁶⁰ 'Charing Cross [11 Victoria Street]', SHR #449; 'Old stone building [11 Victoria Street]', HNSW SHI listing for WLEP # I429, accessed 18 February 2021.

⁶¹ 'Late Victorian Villa [348 Bronte Road]', HNSW SHI listing for WLEP # I457, accessed 18 February 2021.

⁶² '1920s interwar bungalow [50 Carrington Road]', HNSW SHI listing for WLEP # I469, accessed 18 February 2021.

6.0 HISTORICAL ARCHAEOLOGICAL ASSESSMENT

6.1 Introduction

This section includes a preliminary discussion of the study area's potential to contain significant historical archaeological resources. This is based on the results of the site visit undertaken and the historical and cartographic documentation provided in Section 3.0.

Heritage items and a potential archaeological resource should be managed in terms of significance. Determining heritage and archaeological significance is undertaken by utilising a system of assessment centred on the *Burra Charter* (Australia ICOMOS 2013). The principles of the charter are relevant to the assessment, conservation and management of sites and relics. The assessment of heritage significance is outlined through legislation in the *Heritage Act 1977* and implemented through the *NSW Heritage Manual, the Archaeological Assessment Guidelines* (1996)⁶³ and *Assessing Significance for Historical Archaeological Sites and 'Relics'* (2009).⁶⁴

6.1.1 Protection of 'relics'

The NSW Heritage Act provides additional protection for archaeological remains through the operation of the 'relics' provisions. The primary aim of an archaeological significance assessment is to identify whether an archaeological resource, deposit, site or feature is of cultural value and therefore, considered to be a 'relic'.⁶⁵ Historical archaeological sites typically contain a range of different elements as vestiges and remnants of the past. Such sites will include 'relics' of significance in the form of deposits, artefacts, objects and usually also other material evidence from demolished buildings, works or former structures which provide evidence of prior occupations but may not be 'relics'.⁶⁶

6.2 Land use summary

European occupation of the study area has been divided into three general phases of historical activity, which are summarised below:

- Phase 1 (1800s – 1830s)—European settlement in the Waverley Area
- Phase 2 (1830s – 1880s)—Development of Charing Cross village
- Phase 3 (1880s – 1950s)—Changing streetscape of Charing Cross
- Phase 4 (1950s–present)—Modern Charing Cross.

6.3 Assessment of archaeological potential

The identified levels of archaeological potential referred to in this assessment are based on the following definitions:

Table 5: Grades of archaeological potential

⁶³ Heritage NSW (then NSW Heritage Office), 1996. *NSW Heritage Manual, the Archaeological Assessment Guidelines*, p. 25-27.

⁶⁴ Heritage NSW (then NSW Heritage Office), 2009. *Assessing Significance for Historical Archaeological Sites and 'Relics'*.

⁶⁵ Heritage NSW, 2009A, p. 4.

⁶⁶ Heritage NSW, 2009A, p. 7.

Grading	Justification
Nil	No evidence of historical development or use, or where previous impacts such as deep basement structures would have removed all archaeological potential
Low	Research indicates little or low intensity historical development, or where there have been substantial previous impacts, disturbance and truncation in locations where some archaeological remains such as deep subsurface features may survive
Moderate	Analysis demonstrates known historical development and some previous impacts, but it is likely that archaeological remains survive with some localised truncation and disturbance
High	Evidence of multiple phases of historical development and structures with minimal or localised 20 th century development impacts, and it is likely the archaeological resource would be largely intact

6.3.1 Phase 1: European Settlement

The settlement of the Waverley area was intrinsically linked to the construction of the South Head Road and development of the South Head Lighthouse (outside the study area).

The first land grants within the study area were assigned in the 1830s and were utilised for grazing and agriculture. No dwellings appear to have been constructed within the study area during this time, however stone cottages were present by the 1840s surrounding Maddens Corner (now Charing Cross). Although the present-day road alignment is similar to the original, it is possible that subsequent road widening works may have resumed areas originally containing these early cottages. There is therefore low potential that current road corridors or footpaths contain truncated footings associated with the frontages of former structures.

The study area also has the potential to contain evidence of early road construction, including former surface treatments, kerbs and guttering and services. These remains are likely to be heavily truncated through later ground disturbance, road widening, the installation of services and construction works.

Overall, this assessment has identified that the potential for the study area to contain an intact archaeological resource associated with phase 1 is low.

6.3.2 Phase 2: Development of Charing Cross village

By the 1850s, the immediate area accommodated small stores, smithies and hotels serving local market gardeners, dairymen and travellers to Coogee. In the 1860s, new industrial businesses were established along the streetscape and within the surrounding allotments.

A plan dating to c.1890 (Figure 12) indicates that the frontages of buildings on Victoria Street at the intersection with Carrington and Bronte Roads originally extended slightly further into the road corridor than the current property boundary, likely due to road widening. The study area therefore has low potential to contain archaeological evidence of these buildings. Archaeological remains may include truncated footings and postholes representing the frontages of structures aligned with the former Victoria Street road corridor and/or deeper subsurface structural features that may have been located below building frontages such as basements.

Further substantial subdivision and development occurred from the 1870s, including the introduction of horse drawn omnibus services and later the development of the tram line in the 1880s.

The study area has the potential to contain evidence of road construction during this period, including former surface treatments, kerbs and guttering and services, as well as evidence of the former tram line in the form of buried rails and bedding material.

These remains are likely to be heavily truncated through later ground disturbance, road widening, the installation of services and construction works. This assessment has identified that the potential for the study area to contain intact archaeological remains associated with phase 2 is low.

6.3.3 Phase 3: Changing streetscape of Charing Cross

The electrification of the tramway between Bondi Junction and Waverley in October 1902 accelerated the development of Charing Cross. In the process, much of the early Victorian Streetscape was replaced by Federation Styled shops, high parapeted frontages replacing the hip roofed verandah forms of the 19th Century. The Commonwealth Government acquired and demolished the house of pioneer John Madden at the intersection of Carrington and Bronte Roads.

Evidence of earlier phases of road construction may survive within the study area. This may include evidence of early road surfaces, built up areas, road paving (stone, ballast) evidence of drainage and kerbing, and evidence of the former tramway in the form of remnant rail and associated services. These remains are likely to be truncated through later ground disturbance, road widening, the installation of services and construction works.

This assessment has identified that the potential for the study area to contain intact archaeological remains associated with phase 3 is low.

6.3.4 Phase 4: Modern Charing Cross

Several modifications have been made within the study area since the 1950s, including the introduction of residential flat buildings to the east and west of Bronte Road and the introduction of the intrusive legion club building to the south of the Robin Hood Hotel.

Structural modifications made during this period are largely still extant and above ground and are not classified as archaeological items.

As such, the potential for recovering archaeological remains relating to this historical phase is considered **nil**.

6.3.5 Summary of potential archaeological remains within the study area

Table 6 provides an overview of potential for archaeological material to be located within and near to the study area.

Table 6. Potential archaeological remains within the study area

Phase	Potential archaeological remains	Archaeological potential
Phase 1 (1800s –1830s) —European settlement in the Waverley Area	Former shop and residence frontages within footpaths and road corridor Evidence of early road construction, including former surface treatments, kerbs and guttering and services	Low

Phase	Potential archaeological remains	Archaeological potential
Phase 2 (1830s –1880s) —Development of Charing Cross village	Former shop and residence frontages within footpaths and road corridor Evidence of early road construction, including former surface treatments, kerbs and guttering and services, as well as evidence of the former tram line in the form of buried rails and bedding material	Low
Phase 3 (1880s –1950s) —Changing streetscape of Charing Cross	Evidence of early road and tram construction, including buried rails, former surface treatments, kerbs and guttering and services	Low
Phase 4 (1950s– present)—Modern Charing Cross	Not archaeological/extant	Nil

6.4 Assessment of archaeological significance

An assessment of the significance of potential archaeological remains is assessed below in Table 7.

Table 7. Assessment of Archaeological Significance against the NSW Heritage Act criteria

Criterion	Discussion
A) Historical	<p>Intact and <i>in situ</i> archaeological remains associated with Phase 2 residential and commercial development have the potential to contribute to our understanding of the early development of Waverley. Archaeological remains may include foundations and postholes identifying the location of earlier structures fronting road corridors prior to road widening works in the early 20th century.</p> <p>Dependent on the integrity and date of remains of this type, there is some potential they would reach the local significance threshold.</p> <p>However, it is considered unlikely that archaeological remains would be considerably intact or associated with an artefactual resource with the potential to provide insight into the life-ways of former inhabitants. The potential archaeological resource may reach the threshold of local significance under this criterion.</p> <p>Archaeological evidence of earlier utilities, road and/or tram infrastructure, whilst demonstrative of the historical development of Waverley, are unlikely to reach the local significance threshold under this criterion. Better preserved and/or extant examples of remains of this type exist elsewhere.</p>
B) Associative	<p>The study area during Phase 1 was a part of land grants and estates owned by particular individuals of historical importance in the local area, such as John Madden. Any connection of artefacts or works dating to this period to significant personnel or events would be tenuous.</p> <p>The potential archaeological resource may reach the threshold of local significance under this criterion.</p>
C) Aesthetic or Technical	<p>Potential archaeological remains associated with 19th century commercial or residential premises are unlikely to demonstrate any uncommon architectural styles or technical achievements. In addition, remains of this type are not expected to be considerably intact due to considerable modification of the road corridors and footpaths through excavation for utility installation.</p>

Criterion	Discussion
	<p>Although it is recognised that exposed <i>in situ</i> archaeological remains may have distinctive/attractive visual qualities, only rarely are these considered 'important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW'. The anticipated archaeological resource is unlikely to demonstrate particularly significant aesthetic characteristics or a high degree of creative or technical achievement compared to other examples.</p> <p>The archaeological resource is unlikely to reach the threshold of local significance under this criterion.</p>
D) Social	<p>As no public consultation has been undertaken it is difficult to state conclusively whether the potential archaeological resource may have strong or special associations with a particular person, group, or cultural group in the local area. While it is acknowledged that there is generally a strong positive view of heritage in the Waverley area, it seems unlikely that the archaeological remains uncovered would have a strong association with a particular cultural group.</p> <p>The potential archaeological resource is unlikely to reach the threshold of local significance under this criterion.</p>
E) Research Potential	<p>The study area has been assessed as having low potential to contain footings and/or postholes originally associated with buildings fronting Victoria Road prior to widening. Typically, artefact bearing deposits are located in the rear yards of 19th century properties, and it is unlikely <i>in situ</i> artefactual remains would be identified within the study area. Furthermore, the ongoing disturbance of the road corridors in the vicinity of Charing Cross suggests that it is unlikely sensitive artefact bearing occupation deposits (i.e. underfloor deposits) would survive intact.</p> <p>Other potential remains, including evidence of former road and tram infrastructure, are unlikely to hold research potential unless artefact-bearing deposits are present.</p> <p>Archaeological remains are unlikely to be associated with a substantial artefactual resource or be substantially intact. Remains are unlikely to be considered 'relics' as defined by the <i>Heritage Act 1977</i>.</p>
F) Rarity	<p>The potential archaeological resource, including truncated sandstone or brick footings and evidence of earlier utilities, road and/or tram infrastructure are unlikely to reach the local significance threshold under this criterion. Better preserved and/or extant examples of remains of this type exist elsewhere.</p> <p>The potential archaeological resource is unlikely to reach the threshold of local significance under this criterion.</p>
G) Representativeness	<p>It is anticipated that the potential archaeological resource would be representative of Victorian-era construction methods. However, there are likely to be examples of these features within Waverley and wider areas which better demonstrate the principal characteristics of these site-types. Remains of this type are typical, and it is unlikely that the study area contains important examples of these types of remains.</p> <p>The potential archaeological resource is unlikely to reach the threshold of local significance under this criterion.</p>

6.4.1 Statement of archaeological significance

The study area has generally low potential to contain an archaeological resource. The remains are likely to consist of the truncated frontages of late 19th century residences and shopfronts as well as evidence of former utilities and road and tram infrastructure. Remains of this type are not typically associated with a significant artefactual resource and have limited ability to contribute to current research agendas.

Should archaeological remains be identified and be found to be unexpectedly intact, these may reach the local significance threshold through the association with the historical development of Maddens Corner and Charing Cross.

Overall, these remains are unlikely to be considered 'relics' as defined by the relics provision of the *NSW Heritage Act 1977*.

6.5 Summary of archaeological potential and significance

A summary of the archaeological potential and significance of archaeological remains in and near the study area is provided in Table 8.

Table 8: Summary of potential and significance of archaeological remains

Phase	Potential archaeological remains	Archaeological potential	Archaeological significance
Phase 1 (1800s – 1830s)—European settlement in the Waverley Area	Former shop and residence frontages within footpaths and road corridor	Low	Local (if substantially intact)
	Evidence of early road construction, including former surface treatments, kerbs and guttering and services		Nil
Phase 2 (1830s – 1880s)—Development of Charing Cross village	Former shop and residence frontages within footpaths and road corridor	Low	Local (if substantially intact)
	Evidence of early road construction, including former surface treatments, kerbs and guttering and services, as well as evidence of the former tram line in the form of buried rails and bedding material		Nil
Phase 3 (1880s – 1950s)—Changing streetscape of Charing Cross	Former shop and residence frontages within footpaths and road corridor	Low	Local (if substantially intact)
	Evidence of early road and rail construction, including buried rail, former surface treatments, kerbs and guttering and services		Nil
Phase 4 (1950s–present)—Modern Charing Cross	Not archaeological/extant	Nil	n/a

7.0 PROPOSED WORKS

7.1 Overview of works

7.1.1 Original works proposed in February 2021

The original works were outlined in 2021 in:

- GHD, 2021. “Waverley Council Charing Cross Streetscape Upgrade 12521936-G001-2 and C001, C011-22, C031” concept design drawings dated up until 14/4/21 (Appendix 1).

The revisions to the original plans proposed in 2021 include streetscape upgrades and modifications and are presented in:

- Environmental Partnership, 6 July 2023. “Charing Cross Streetscape Upgrade Project Issue 2” for Waverley Council (Appendix 2).

These revisions are at the 50% Detailed Design stage. They propose:

- Removing intrusive overhead wiring for telephone/ electrical lines by repositioning them underground. This requires further detailed design but is planned to be done at the same time that pavements are replaced.
- Replacing underground piping and drainage, subject to development of the detailed design.
- Installing flush new kerbs and gutters.
- Upgrading one existing pedestrian crossing and installing one new pedestrian crossing with crossings.
- Replacing footpath paving throughout the study area in a way which distinguishes it from surrounding residential areas.
- Introducing new soft landscaping by planting new tree and shrub species.
- Replacing and upgrading street furniture (such as seating).
- Introducing interpretive signage to explain historical aspects of the area (discussed in Artefact’s separate Heritage Interpretation Planning report).

7.1.2 Additional works and amendments, proposed in July 2023:

The revised works are outlined in Environmental Partnership, 6 July 2023. ‘Charing Cross Streetscape Upgrade Project’, PDF outline of design proposal commissioned by Waverley Council.

The revised works amend some aspects of the previous proposed works, and offer several aspects of new works designed to improve the streetscape of the Charing Cross Village in Waverley:

- Replacing telephone/ electrical poles with smart poles capable of providing for lighting, baskets of flowering plants and bicycle security.
- Reducing the density of tree planting in front of heritage buildings and finalising the species of both trees and shrubs to be used.

- Refining the design of the pavement and kerb realignment— for example, slightly expanding the pavement around the Robin Hood Hotel corner and around pedestrian crossings.
- Replacing the previously proposed two-sided interpretation panels with one-sided panels.
- Finalising options for the design of the pavement surface detailing in brick and concrete.
- Restoring an historic sandstone water trough and metal pump on the pavement within the study area along with modest interpretive signage. It is planned to plant the trough with small-growth foliage and repair the pump into working order and link it into the water supply system for use by the public as a bottle refill station. Three options are proposed for the positioning of the trough and pump (see Figure 53). The three locations under consideration are:
 - Location option 1 : Outside 234 Bronte Rd (corner of Bronte & Carrington).
 - Location option 2 : Outside 280 Bronte Rd.
 - Location option 3: Outside 328 Bronte Rd (corner of Bronte & Albion).

Note: Artefact has not inspected the trough and pump, which are understood to be authentic remnants of street furniture from the locality, currently being held on Waverley Council property. As such, the trough and pump may be considered 'moveable heritage'.

Figure 55: Overview of arrangement plan for Study Area (Source: EP, July 2023)



Figure 56: Three options proposed for the location of the restored historic trough and pump
(Source: EP, 2023, Drawing 3870)

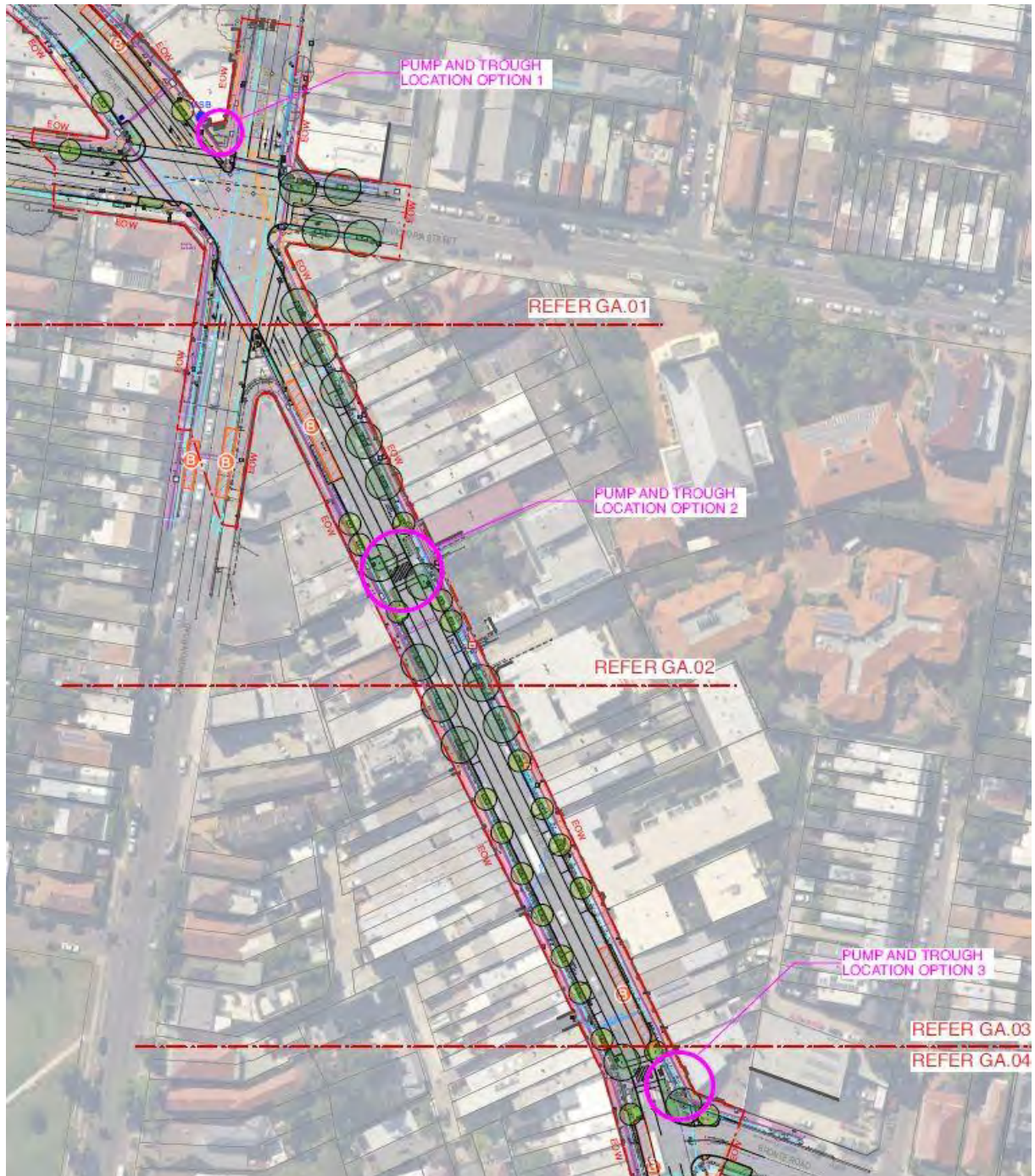


Figure 57: Design for pedestrian crossings (Source: EP, 2023)

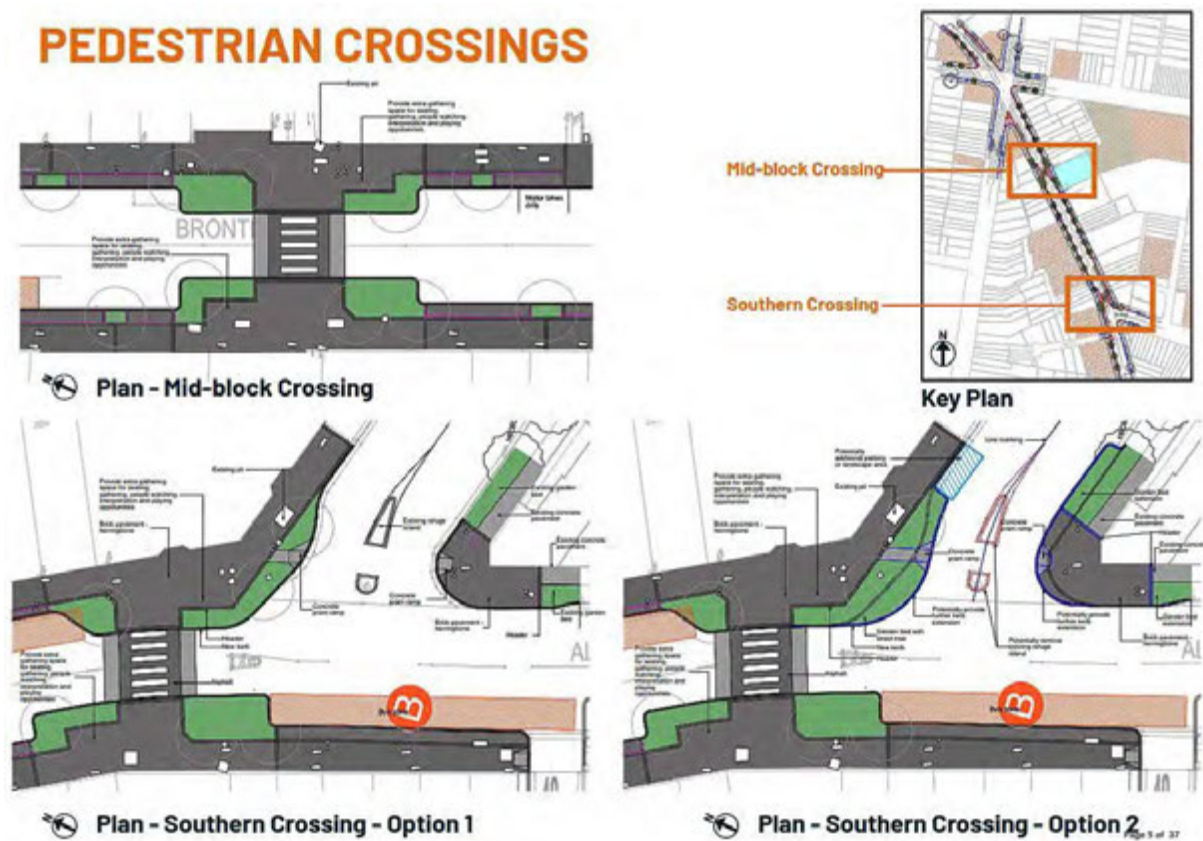


Figure 58: Some of the pavement pattern options under consideration (Source: EP, 2023)

PAVEMENT OPTIONS

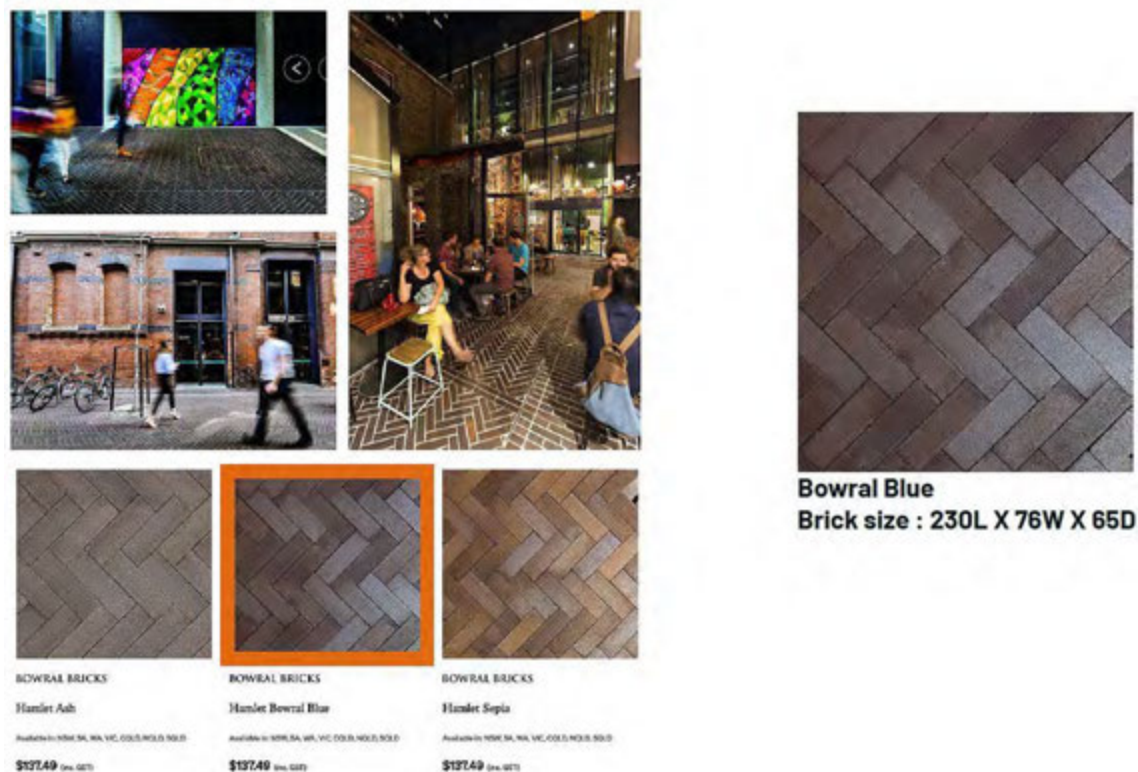


Figure 59: Tree species proposed by EP: *Corymbia citriodora* ‘scentuous’ (Dwarf Lemon Scented Gum) and *Zelkova serrata* ‘Green Vase’ (Green Vase Japanese Elm). (Source: EP, 2023)

TREE SPECIES





Category	Botanic Name/ Common Name	Size (H/W)	Form/Shape	Image
Evergreen to heritage facade	<i>Corymbia citriodora</i> ‘scentuous’ (Dwarf Lemon Scented Gum)	12H x 6W		
Deciduous to non-heritage facade	<i>Zelkova serrata</i> ‘Green Vase’ (Green Vase Japanese Elm)	14H x 10W		

Figure 60: Some of the shrub plantings proposed by EP (Source: EP, 2023)

STREET GARDEN PLANTING PALETTE

UNDERSTORY SELECTION PRINCIPLES:

- Provide consistent boulevard of canopy shade trees in kerb extensions with under-story planting to offer extensive green (Charing Cross Streetscape Upgrade Options Assessment Report by GHD)
- Provide street gardens to reflect coastal and heritage village characters through richness of colours and textures, and mix of native and exotic plants
- Plantings species that are drought tolerant, low maintenance and well-suited to coastal climate.



Figure 61: Options for the corner treatment of pavement (Source: EP, 2023)

INTERPRETATION ELEMENTS

INTERPRETIVE BANDING



Figure 62: Proposed “smart pole” for urban lighting to replace timber utility poles. (Source: EP, 2023)

LIGHTINGS

MULTI-FUNCTION POLE OPTION 1B

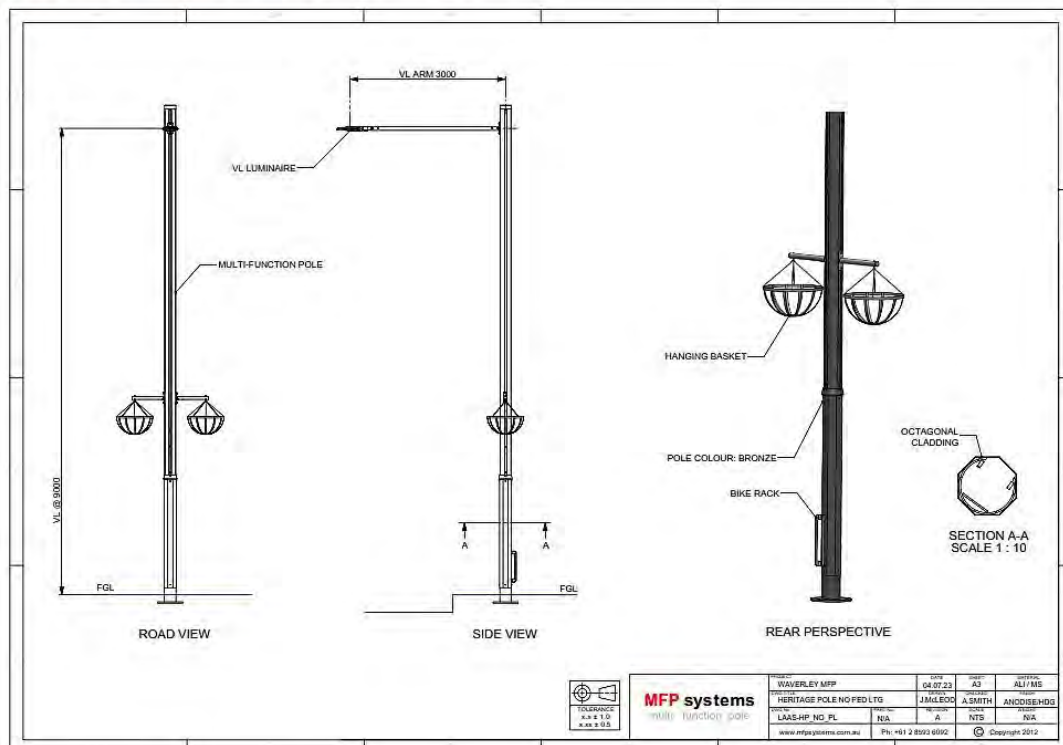


Figure 63: Mock up image of smart poles installed in urban streetscape (Source: EP)

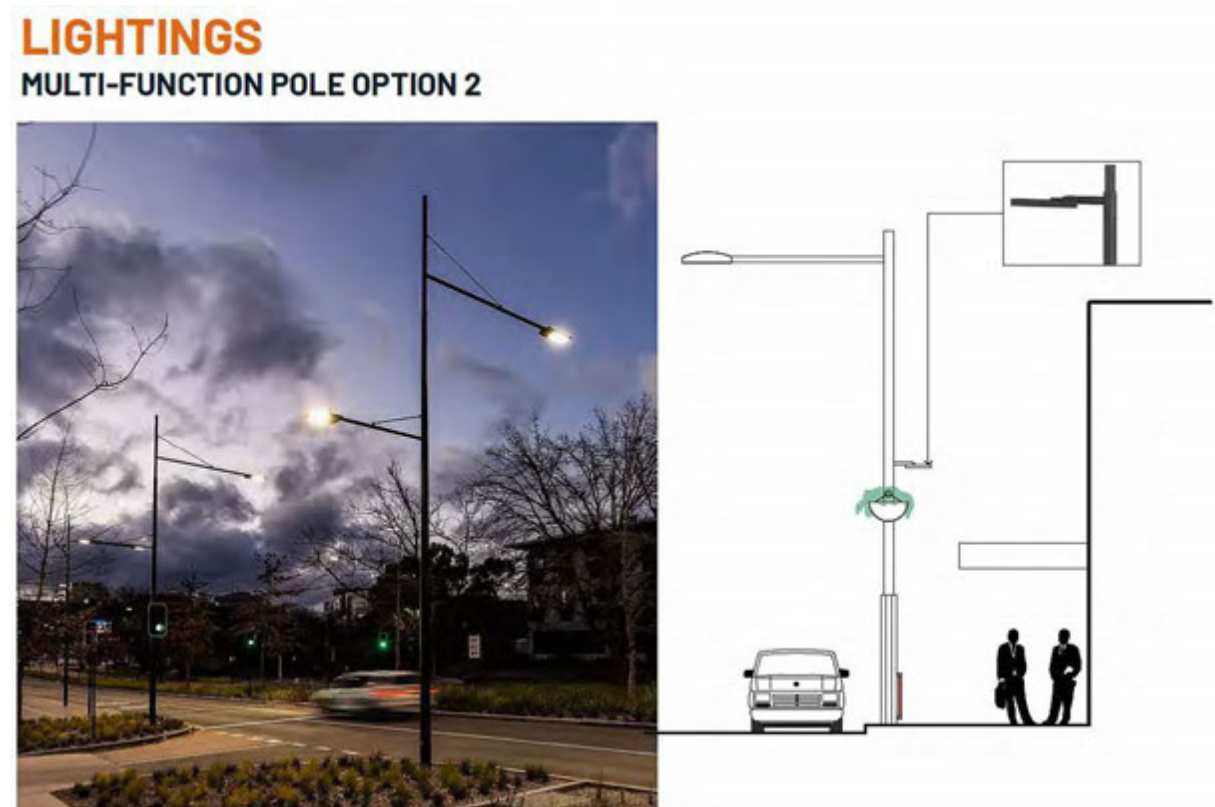


Figure 64: Proposed design and arrangement of street furniture and heritage panels (Source: EP, 2023)

FURNITURE AND FURNITURE ARRANGEMENT

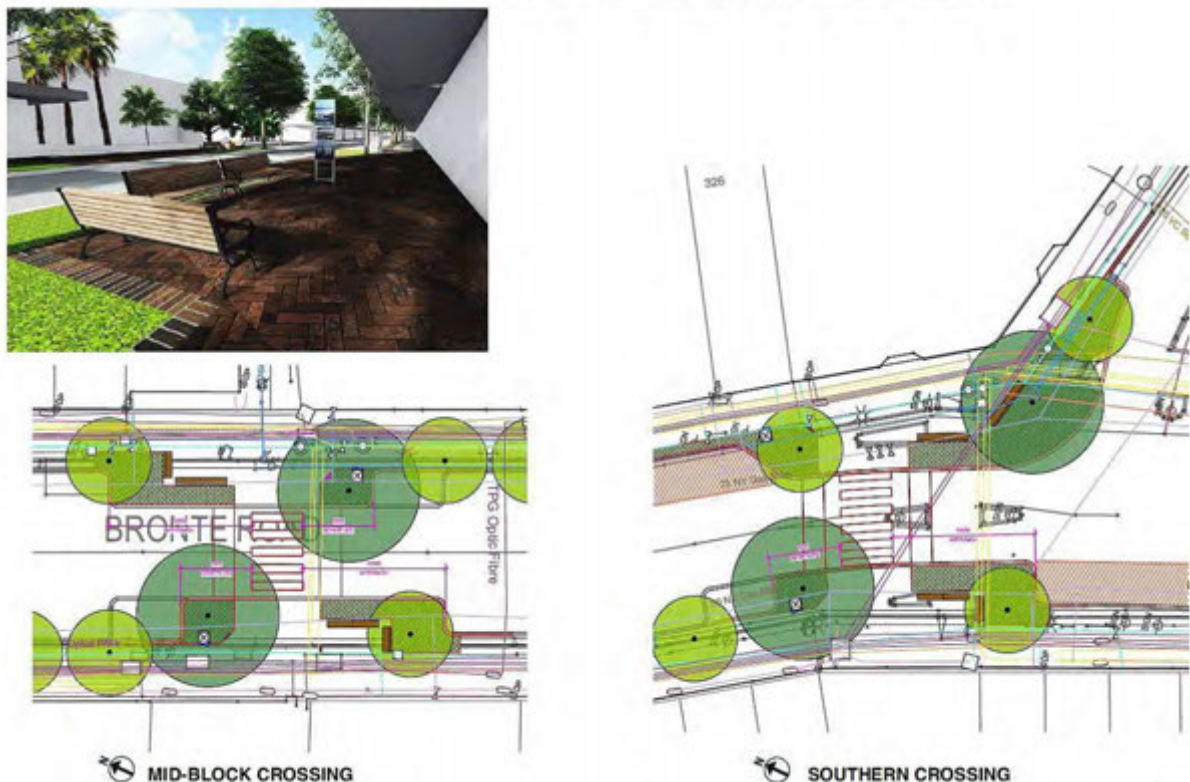


Figure 65: Recent photos of the historic metal pump proposed for installation on the pavement within the study area (Source: Woollahra Council via EP)



Figure 66: Photo of a sandstone horse trough similar to the historic trough proposed for placement with a functioning historic pump within the study area (Source: EP)



Figure 67: BEFORE: View of study area facing north along Bronte Road towards Charing Cross intersection (Source: Artefact)



Figure 68: AFTER Photomontage of study area, Bronte Road looking south towards Albion Street after completion of proposed works (Source: GHD & Woolahra Council, 2021)



8.0 HERITAGE IMPACT ASSESSMENT

8.1 Introduction

The objective of a SOHI is to evaluate and explain how the proposed development, rehabilitation or land use change will affect the heritage value of the site and/or place. A SOHI should also address how the heritage significance of the place can be conserved or maintained, and preferably enhanced by the proposed works. This section offers Artefact's assessment of likely heritage impacts arising from the proposed works, both positive and adverse, using guidelines for heritage analysis developed by Waverley Council in its DCP and by the Heritage Council of NSW and ICOMOS.

8.2 Methodology

In order to consistently identify the impact of the proposed works, the terminology contained in the following table is used throughout this report. The terminology and definitions are based on those contained in guidelines produced by the International Council on Monuments and Sites (ICOMOS)⁶⁷ and the Heritage Council of NSW⁶⁸ and are shown in Tables 9 and 10.

Table 9: Terminology for heritage impact types

Impact	Definition
Physical	Impacts resulting from works located within or outside the curtilage boundaries of the heritage item, caused by removing or altering the item or fabric of heritage significance.
Visual / other	Impact to views, vistas, setting and curtilage of the heritage item resulting from proposed works inside or outside the curtilage boundaries of the heritage item.
Potential	Impacts resulting from increased noise, vibrations and construction works located within or outside the curtilage boundaries of the heritage item.

Table 10: Terminology for assessing the magnitude of heritage impact.

Grading	Definition
Major adverse	Actions that would have a severe, long-term and possibly irreversible impact on a heritage item. Actions in this category would include partial or complete demolition of a heritage item or addition of new structures in its vicinity that destroy the visual setting of the item. These actions cannot be fully mitigated.
Moderate adverse	Actions that would have an adverse impact on a heritage item. Actions in this category would include removal of an important part of a heritage item's setting or temporary removal of significant elements or fabric. The impact of these actions could be reduced through appropriate mitigation measures.
Minor adverse	Actions that would have a minor adverse impact on a heritage item. This may be the result of the action affecting only a small part of the place or a distant/small part of the setting of a heritage place. The action may also be temporary and/or reversible.
Negligible	Actions that are so minor that the heritage impact is considered negligible.

⁶⁷ Including the document Guidance on Heritage Impact Assessments for Cultural World Heritage Properties, ICOMOS, January 2011.

⁶⁸ <https://www.environment.nsw.gov.au/resources/heritagebranch/heritage/material-threshold-policy.pdf>

Grading	Definition
Neutral/ Nil	Actions that would have no heritage impact.
Minor positive	Actions that would bring a minor benefit to a heritage item, such as an improvement in the item's visual setting.
Moderate positive	Actions that would bring a moderate benefit to a heritage item, such as removal of intrusive elements or fabric or a substantial improvement to the item's visual setting.
Major positive	Actions that would bring a major benefit to a heritage item, such as reconstruction of significant fabric, removal of substantial intrusive elements/fabric or reinstatement of an item's visual setting or curtilage.

8.3 Waverley Development Control Plan 2012

Waverley Council requires development to comply with the guidelines set out in its Development Control Plan (WDCP 2012). The pertinent sections for Heritage Items and Heritage Conservation Areas of the WDCP 2012 are listed below. The proposed works have also been assessed against the additional recommendations made within the Waverley Heritage Inventory Form for the Charing Cross Heritage Conservation Area (HCA) (Appendix B). The DCP guidelines are addressed throughout the heritage assessment below.

Heritage NSW considerations

The Heritage NSW guidelines (Heritage NSW, 2023A, 2023B) pose a series of questions as prompts to aid in the consideration of impacts resulting from the proposal. The guidelines most relevant to the current proposal are addressed below in Table 11.

Table 11: NSW Heritage's considerations for major additions to a heritage item

Heritage Consideration	Discussion
Minor partial demolition	
<ul style="list-style-type: none"> Is partial demolition essential for the heritage item to function? Are important features of the item affected by the partial demolition (eg fireplaces in buildings)? Is partial demolition sympathetic to the heritage significance of the item (eg creating large square openings in internal walls rather than removing the wall altogether)? If partial demolition is a result of the condition of the fabric, is it certain that the fabric cannot be repaired? 	Most of the proposed elements within the study area to be removed are modern elements such as concrete paving and overhead wiring which have no heritage significance and are intrusive to the HCA. No elements of recognised heritage significance would be impacted by the proposed works. Where works may inadvertently impact upon heritage fabric (for example, the removal and replacement of paving adjoining heritage building facades), recommendations have been provided in Section 9.0 of this report to mitigate any adverse heritage impacts.
Minor additions	
<ul style="list-style-type: none"> How will the impact of the addition on the heritage significance of the item be reduced? 	New fabric to be introduced would mainly replace existing, non-significant fabric with better quality fabric. Where new elements have been

Heritage Consideration	Discussion
<ul style="list-style-type: none"> Can the additions be located within the existing structure? If no, why not? Will the additions visually dominate the heritage item? Are the additions sited on any known, or potentially significant archaeological deposits? If so, have alternative locations for the additions been considered? Are the additions sympathetic to the heritage item? In what way (eg form, proportions, design)? 	<p>proposed (for example, soft landscaping along streetscape), recommendations have been provided in Section 9.0 to help mitigate the potential visual impacts. It is recommended that the installation of a heritage trough and pump on the street will require 1) careful conservation works so they are not damaged by the adaptive re-use into street furniture; 2) careful positioning so as to not obscure architectural details of nearby heritage buildings or significance view-lines and 3) security measures to protect their integrity (for example, CCTV).</p> <p>As outlined in Section 6.4.1, this report has assessed that there is low potential for archaeological deposits within the study area. However, recommendations to manage any unexpected finds are provided in Section 9.0 of this report.</p> <p>The proposed replacement of modern elements and the introduction of soft landscaping within the study area are considered sympathetic enhancements to the streetscape, retaining and enhancing the village atmosphere through upgrades to street furniture, paving, and amenities within the area.</p>

New Services

<ul style="list-style-type: none"> How will the impact of the new services on the heritage significance of the item be reduced? Do any of the existing services have heritage significance? In what way? Will the services be affected by the new work? Has the advice of a heritage consultant been sought? Will the consultant's advice be implemented? Will any known or potential archaeological deposits (underground and under floor) be affected by the proposed new services? 	<p>Existing services are proposed to be removed and replaced. The existing services reconstructed in modern fabric with no heritage significance. As outlined in Section 6.4.1, this report has assessed that there is low potential for archaeological deposits within the study area. However, recommendations to manage any unexpected finds are provided in Section 9.0.</p>
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New landscape works and features

<ul style="list-style-type: none"> How has the impact of the new work on the heritage significance of the existing landscape been minimised? Has evidence (archival and physical) of previous landscape work been investigated? Are previous works being reinstated? Has the advice of a consultant skilled in the conservation of heritage landscapes been sought? If so, have their recommendations been implemented? 	<p>New soft landscaping elements would be sited alongside the resurfaced pavement.</p> <p>Historically, the main streetscape within the study area (Bronte Road) has not included plantings. The new shrubs are not assessed as having any potential for impacts but the new trees have some potential to result in a minor adverse visual impacts if they grow in such a way as to obscure heritage obscuring view-lines. The potential for this is being carefully managed. The possible heritage impacts should be weighed against the enhancement of the public domain enabled by the new landscaping, which is in keeping with the visual aesthetic of surrounding streetscapes (which feature plantings along council verges).</p>
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Heritage Consideration	Discussion
<ul style="list-style-type: none"> Are any known or potential archaeological deposits affected by the landscape works? If so, what alternatives have been considered? How does the work impact on views to, and from, adjacent heritage items? 	<p>The tree species have been finalised and appear to be heritage-sympathetic. Further recommendations have been made in Section 9.0 to mitigate potential inadvertent issues, including the possibility that the plants might grow to obscure views of the heritage buildings over time, so that significant view lines may be retained.</p>

New development adjacent to a heritage item

<ul style="list-style-type: none"> How is the impact of the new development on the heritage significance of the item or area to be minimised? Why is the new development required to be adjacent to a heritage item? How does the curtilage allowed around the heritage item contribute to the retention of its heritage significance? How does the new development affect views to, and from, the heritage item? What has been done to minimise negative effects? Is the development sited on any known, or potentially significant archaeological deposits? If so, have alternative sites been considered? Why were they rejected? Is the new development sympathetic to the heritage item? In what way (e.g. form, siting, proportions, design)? Will the additions visually dominate the heritage item? How has this been minimised? Will the public, and users of the item, still be able to view and appreciate its significance 	<p>The proposed works are minimal in design, with much of the work focussing on the replacement of existing, modern fabric in better quality materials to enhance the public domain. The proposed works have been assessed as resulting in no adverse physical impacts and potential for minor adverse visual impacts to adjacent heritage building resulting from the growth of trees. Further recommendations have been provided in Section 9.0 to mitigate any inadvertent impacts to heritage fabric and view lines during and after the works have been completed.</p> <p>The new works are viewed as a sympathetic and recessive response to the significance of the area while also updating and enhancing the existing public domain of Charing Cross. The new works would not dominate or overshadow the existing significance of the HCA, the study area or the heritage items located within the vicinity.</p>
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8.4 HNSW suggested approach to Statement of Heritage Impact

A statement of heritage impact has been prepared according to Heritage NSW guidelines (2023A, 2023B) in Table 12 below.

Table 12: Statement of heritage impact for the proposed works responding to HNSW guideline

Development	Discussion
What aspects of the Proposal respect or enhance the heritage significance of the study area?	<p>The proposed works would see the removal of modern elements (such as telephone wires) that visually clutter the view lines within the HCA and particularly along the main village shopping area of Bronte Road. New works including the removal and replacement of existing modern fabric (such as pavements, gutters and kerbs, street furniture) would result in any no adverse heritage impacts and moderate positive heritage impacts. The introduction of soft landscaping along the streetscape of the study area is carefully designed to enhance the public domain of the area while retaining the existing views to heritage listed items but retains potential for a minor adverse heritage impact on view-lines.</p>

Development	Discussion
	This report assesses the study area as having a generally low potential to contain a significant archaeological resource. The proposed excavation works are typically shallow and/or localised and are unlikely to impact archaeological remains.
What aspects of the Proposal could have a detrimental impact on the heritage significance of the study area?	<p>Although the proposed works are assessed as having mainly positive physical and visual impacts, the proximity of new works to surrounding heritage items means there is potential for inadvertent or accidental impacts to occur <i>during</i> the proposed works—for example, removal and replacement of paving could damage the facades of heritage items—and <i>after</i>—for example, maturing trees could impact views towards heritage items. As such, recommendations have been provided in Section 9.0 to mitigate the potential outcome of these issues</p> <p>There is also potential for the new leafy ambience (resulting from the planting of new street trees and shrubs) to change the historic appearance of the place.</p>
Have more sympathetic options been considered and discounted?	The proposal is assessed as a sympathetic response to the heritage significance of the Charing Cross HCA, to the nine heritage items that are adjacent to the study area and to the five heritage items located nearby.

8.5 Statement of Heritage Impact

The proposed works in the Charing Cross Streetscape Upgrade seek to upgrade recently built features and elements within the study area as explained below. It is proposed to:

- Excavate all the pavements of the study area in order to upgrade underground utilities, services and drainage, to renew footpaths and kerbing, to improve street seating and interpretive signage and to remove intrusive overhead wiring and design careful patterning of the replacement pavement to refer to nearby heritage and help mark the village shopping locality.
- Remove the traditional timber utility poles (made partly redundant by the undergrounding of electricity and telecommunication wiring) and replace them with contemporary metal poles for street lighting.
- Plant new street trees and shrubs along all the streetscapes in the study area in order to enhance the urban amenity of Charing Cross.
- Installing an historic sandstone water trough and metal pump on the pavement within the study area (Figures 56 and 65), including connecting the pump to the water mains so that it provides water for use by the public as a bottle filling station. The trough and pump are understood to be historical remnants of 19th century technology which would have been in place in the locality, currently being held at Council depots. They are not understood to be heritage listed although they may have some heritage significance. They will require careful conservation works so they are not damaged, and careful positioning so that they do not obscure views of architectural details or street vistas, and careful security to ensure they retain their integrity.

8.5.1 Physical impacts

No significant heritage place or element within the study area or Charing Cross HCA would be removed or injured by these works and thus no adverse physical impacts are envisaged for any identified heritage fabric. The proposed replacement of recent fabric (paving, street furniture, kerbs and guttering) with new fabric would not result in any adverse physical or visual impacts. The proposed installation of new interpretation panels along the streetscapes, if carefully designed and positioned, would not result in any adverse physical or visual impacts. The planting of new street trees along the streetscapes of the study area has been carefully designed to avoid the potential to interfere physically with shop awnings as they mature.

The installation of two elements of moveable heritage—an historic sandstone water trough and historic metal pump—on the pavement within the study area has minor potential for adverse physical impact on the historic elements themselves if they are assessed to be ‘moveable heritage’. If found to be significant elements of heritage in themselves, the conservation works required to relocate them, repair them and adapt them to the proposed new use as street furniture should happen under the supervision of a heritage expert. Furthermore, being installed in an open public place opens potential for the two elements to be graffitied or otherwise vandalised. Artefact recommends that this part of the proposal be advanced along with careful planning for their security (for example, CCTV), and with heritage input into the design of the installation.

Artefact assesses the proposed works overall as likely to result in a physical moderate positive impact to the Charing Cross HCA by substantially improving its public infrastructure and amenity, and envisages one minor adverse physical impact (and then only to the moveable heritage, not the HCA).

8.5.2 Visual impacts

The proposed works would see the removal of overhead wiring, an intrusive modern element that has long visually cluttered the streetscape and impacted upon view lines to the first-floor facades of heritage items, particularly along the main streetscape of Bronte Road. This will result in a moderate positive visual heritage outcome.

The planting of new street trees along the streetscapes of the study area has been carefully designed to reduce the likelihood of them obscuring view-lines towards heritage buildings. Nonetheless the proposal to plant street trees in an area which has never had them before is likely to result in a minor adverse visual impact on the heritage significance of the area and of individual heritage properties (compare the historical and contemporary streetscape against the mock-up of the proposed view in Figures 67 and 68). Waverly Council may weigh this adverse impact against the physical and visual advantages provided by trees in the provision of shade, coolness and urban amenity.

Three different locations are under consideration for the installation of the history pump and water trough (see Figure 56). Artefact has not made a site inspection to consider the possible visual impacts of each of the three options. It is possible they will have no have no visual heritage impact if the pair of historical elements is installed carefully so that they do not obscure views towards architectural details of heritage places or significant views of streetscapes.

Artefact assesses the proposed works overall as likely to result in a moderate positive visual heritage impact to the Charing Cross HCA by substantially improving its appearance and amenity, and envisages one minor adverse visual impact.

8.5.3 Potential for archaeological impacts

These proposed works will require excavation of all the pavements in the study area. As noted in the Historical Archaeology analysis in Section 6, there is low potential for significant archaeological remains to be impacted by these works. No excavation is proposed to abut or adjoin the heritage buildings. To prevent potential impacts, recommendations are provided in Section 9.

8.5.4 Heritage impacts to adjacent heritage listed items

There are nine heritage listed items adjacent to the study area, 25 contributory items adjacent to the study area and five heritage items that are located within the visual catchment of the proposed works.

The proposal as assessed as having no adverse physical or visual impacts on any of the heritage places or contributory items adjacent to the study area, nor on the five heritage items located nearby.

8.5.5 Summary of heritage impacts to Charing Cross HCA

In the current concept stage of the proposal, the proposed works in the Charing Cross Streetscape Upgrade are assessed as likely to result in moderate positive heritage enhancement of the Charing Cross HCA. They are considered to have neutral or no heritage impacts on nearby heritage places. Artefact also considers there is potential for one minor physical adverse impact (to moveable heritage) and two minor adverse visual impacts (arising from the introduction of street trees, and inappropriate positioning of the trough and pump).

The new works would not dominate or overshadow the existing significance of the HCA, the study area or the heritage items located within or nearby the vicinity. The proposed removal of overhead wiring is considered to be a positive and sympathetic enhancement of the streetscape and the upgrading of pavements, street furniture and other infrastructure within the area should result in the retention and enhancement of the village atmosphere. The new works are a sympathetic and recessive response to the heritage character of the HCA while updating and enhancing its public domain.

Recommendations have been made in Section 9 to help when developing detailed design of the upgrade works. These recommendations should help mitigate any possible heritage impacts to the significant fabric and appearances of the HCA and adjacent and nearby heritage properties.

9.0 CONCLUSION AND RECOMMENDATIONS

9.1 Conclusions

Charing Cross Heritage Conservation Area is listed on the following register as an item of local heritage significance:

- 'Charing Cross Heritage Conservation Area', Waverley Local Environmental Plan (WLEP 2012) 2012, Item No.C7.

Charing Cross is locally significant due to its historic, aesthetic and social values. The HCA also has representative value due to cohesiveness of its built form and structural function and is rare due to a mix of village and ecclesiastic architecture.

The study area has been assessed as having low potential to contain an archaeological resource associated with the 19th century development of Waverley. It is considered unlikely that the archaeological resource will be substantially intact and is unlikely to reach the local significance threshold. It is unlikely that potential archaeological remains would be considered to be 'relics' as defined by the Heritage Act.

Charing Cross HCA is located adjacent to nine properties listed as local heritage items on the WLEP 2012. There are also 25 adjacent properties which fit its definition of 'contributory items' (being more than 50 years old—see Appendix A). The HCA is also in close proximity to a further five local heritage items (within 64 metres of the HCA). One adjacent place and one nearby place are also listed on the State Heritage Register: Mary Immaculate Church at 2280-282 Bronte Road and 45 Victoria Street (adjacent) and Charing Cross House at 11 Victoria Street (62m west).

- The proposal is assessed as having no adverse physical impacts on the Charing Cross Heritage Conservation area, nor on the nine heritage places and 25 contributory places adjoining the study area nor on the five heritage items located nearby. The proposal has potential for a minor adverse physical impact on the historic water trough and pump themselves if they are not conserved appropriately in the course of being adaptively re-used as street furniture. There is also potential for minor adverse visual impacts if the trough and pump are positioned in a way which could obscure views to architectural elements of adjacent heritage places or significant views of streetscapes or if proposed street trees were to mature in ways that obscure significant views of streetscapes. The proposal would have no adverse physical or visual heritage impacts on nearby heritage places. Overall, the proposed replacement of modern fabric and removal of overhead wiring is considered to be a positive and sympathetic enhancement of the streetscape, retaining the village atmosphere through upgrades to street furniture, paving and infrastructure within the area.

Due to the close proximity of the works to the facades of some heritage buildings, there is potential for the works to result in inadvertent impacts during and after construction—for example while replacing existing paving or resulting from the growth of new vegetation. Heritage recommendations are given in Section 9 to avoid accidental impacts during construction.

The current concept design package requires further elaboration during detailed design stages. The following recommendations have been provided to assist in the development of sympathetic heritage design measures to be implemented during the detailed design stage.

9.2 Recommendations

- A heritage induction should be presented to workers before commencement of construction. All relevant construction staff, contractors and subcontractors must be made aware of their statutory obligations for heritage under the NSW *Heritage Act 1977* and best practice as outlined in *The Burra Charter* (Australia ICOMOS 2013) and HNSW guidelines to ensure no archaeological remains or heritage fabric are impacted during the proposed works without appropriate mitigation measures in place. The induction should include the values of the place, avoidance procedures and outline any relevant 'Unexpected Archaeological Finds' protocols.
- If one does not already exist, an 'Unexpected Archaeological Finds' protocol should be developed for all excavation works. If unexpected archaeological finds are encountered during the excavation, works must cease immediately, and a suitably qualified archaeologist be contacted to assess the find and recommend next steps. Should unexpected historical archaeological 'relics' be identified the NSW Heritage Council should be notified under s146 of the Heritage Act 1977. Additional assessment, management and/or approvals from Heritage NSW may be required before significant 'relics' can be impacted.
- There are a number of buildings that bound the curtilage of the study area that are heritage listed or considered contributory buildings within the HCA. Where works are proposed that would abut the facades of these buildings (for example, the removal and replacement of existing paving), it is recommended that these works be conducted with special care to avoid possible damage to heritage fabric—possibly being undertaken by hand rather than with heavy machinery.
- The historic water trough and pump are understood to be authentic remnants of street furniture from the locality, currently being held on Waverley Council property, and may be considered 'moveable heritage'. These elements should be heritage assessed to establish their provenance and determine their level of significance, which would then inform the design of conservation works required to repair them and relocate them for adaptive re-use as street furniture within the study area. If they are determined to be significant moveable heritage, the works required to use them and install as proposed should be undertaken with expert heritage supervision, including careful consideration of security measures to reduce the likelihood of graffiti and vandalism (such as CCTV).

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11.0 APPENDICES

APPENDIX 1 ORIGINAL PLANS FOR THE WORKS BY GHD IN 2021

GHD, 2021. "Waverley Council Charing Cross Streetscape Upgrade 12521936-G001-2 and C001, C011-22, C031" concept design drawings dated up until 14/4/21

APPENDIX 2 REVISED PLANS FOR THE WORKS BY EP IN 2023

Environmental Partnership, 6 July 2023. "Charing Cross Streetscape Upgrade Project Issue 2" package presented to Waverley Council.

APPENDIX 3 CHARING CROSS HERITAGE CONSERVATION AREA— CONTRIBUTORY ITEMS

Charing Cross HCA notes that any building over 50 years would be eligible to be considered as a contributory item within the HCA. The following items were identified within the study area as structures older than 50 years which be impacted by the proposed upgrade to the streetscape. The following descriptions have been adapted from previous heritage studies.⁶⁹

11.1.1 238–242 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Late Victorian	Single Building	Two storey shops with residences above with single storey shop attached.	Victorian Italianate	Contributes

Physical Description

Rendered and painted. Bracketed eaves, moulded windowsill extended as string course, and pilaster mouldings flanking first floor windows. Weatherboard applied finish on west elevation. Shop front substantially altered.



⁶⁹ Perumal Murphy Pty Ltd for Waverley Municipal Council. Heritage Study. 1990.

11.1.2 244–250 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Early 20 th Century	Group of buildings	Single storey pair of shops	Edwardian	Contributes

Physical Description

Rendered and painted. Label course below parapet string course. Glazed shopfronts with recessed door to nos. 248 and 250.

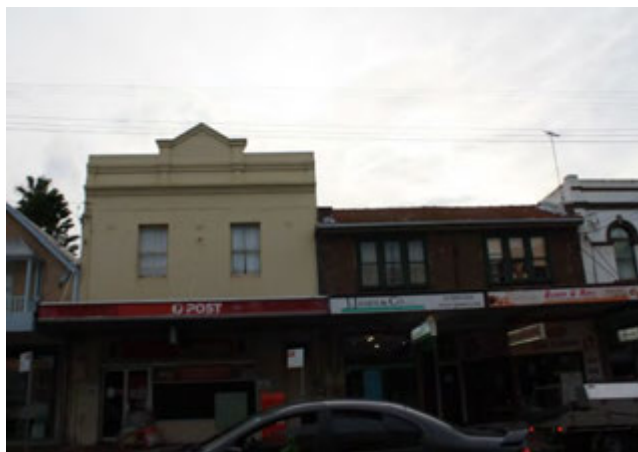


11.1.3 256–258 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Late Victorian	Single Building	Two storey shop with residence above.	Late Victorian Commercial/ Neo-classical.	Contributes

Physical Description

Rendered and painted. Moulded entablature and pilaster details. Evidence of balcony canopy above first floor windows. Ground floor shopfront substantially altered.



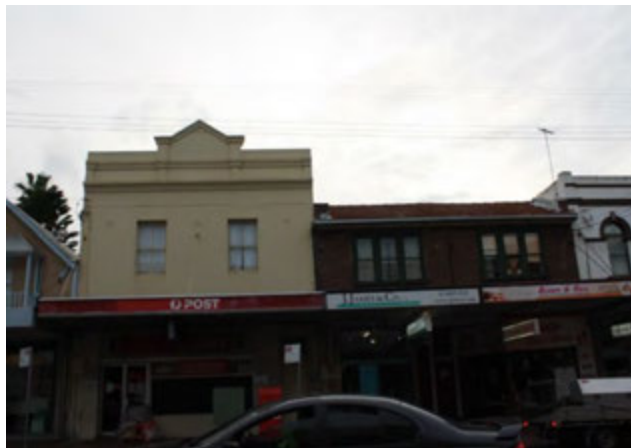
11.1.4 260–264 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
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Early 20 th Century	Single Building	Pair of two storey shops with residences above.	Federation	Contributes
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Physical Description

Face brick first floor; painted brick and tile ground floor. Upper part of shopfront joinery is original, as is central doorway entrance to residence above.



11.1.5 266 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
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Late Victorian	Single Building	Single storey shop with former residence (façade only extant) above.	Victorian Italianate	Contributes
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Physical Description

Rendered and painted. String courses, arches with keystones and fluted pilasters. Air-conditioning unit above awning. Shop front substantially altered and first floor behind facade removed.



11.1.6 268–270 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Early 20 th Century	Single Building	Two storey shops with residences above.	Federation	Contributes

Physical Description

Rendered and painted. Elaborate parapet decoration including pilasters, ball finials and date (1903) on central pediment. Original shopfronts have been altered slightly.



11.1.7 272–274 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Late Victorian	Group of buildings	Pair of two storey shops with residences above.	Late Victorian Commercial/ Neo-classical.	Contributes

Physical Description

Rendered and painted. Hood mouldings with label course over. Two covered vents to no. 272 above awning façade, and original shop front with brass glazing bars, recessed entrance door and kickboards. No. 274 shop front substantially altered. No 274 has rendered pediment on parapet and air conditioning units installed to front façade.



11.1.8 276–278 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
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Late 20 th Century	Single building	Three storey building with shops on ground floor and residences above.	Twentieth century modern	Neutral
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Physical Description

Vertical division in two bays and concrete awning to front and side (south) facades. Recessed balconies on first and second floors with face brick balustrades, ornamental timber bards, cement planter boxes, accessed by aluminium framed sliding doors.



11.1.9 280–282 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
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Late 20 th Century	Group of buildings	Two storey former residence (no. 280) and single storey former residence now used as a café (no. 282)	Reproduction Victorian Italianate	Contributes
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Physical Description

Fretwork bargeboards, moulded render to gable vents, window heads and sills. Later additions set back from the main frontage with timber balustrades to open verandahs.



11.1.10 284–294 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Late 20 th Century	Single Building	Two storey row of shops with residences above.	Late Twentieth century contextual modern	Neutral

Physical Description

Contextual façade detailing. Recessed balconies to first floor with window styled openings and accessed by set of glazed doors. New shop fronts to ground floors in the form of Victorian shopfronts. Individual building element on north end (no. 284) with imitation rustication, and recessed corner balcony to front and side (north) facades.



11.1.11 296–302 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Early 20 th Century	Group of buildings	Two storey row of shops with residences above.	Federation period commercial building	Contributes

Physical Description

Painted brickwork. Original shop fronts with brass glazing bars and recessed entrance doors to nos. 296 and 298.



11.1.12 304–306 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Late 20 th Century	Single Building	Two storey shop with residences above.	Modern contextual	Neutral

Physical Description

Rendered brick building with parapet and string course



11.1.13 308 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Early 20 th Century	Single Building	Two storey shop and through-vehicle access with residences above.	Federation	Contributes

Physical Description

Rendered brickwork with doric verandah columns and string course with brick dentils. Rendered panels on parapet for signage. Original shopfront although areas of modification are evident.



11.1.14 310–312 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Early 20 th Century	Single Building	Two storey shops with residences above.	Federation	Neutral

Physical Description

Decorative rendered parapet. Ground floor shop fronts are sympathetic in form and detailing.



11.1.15 314 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Late 20 th Century	Single Building	Two storey shops with residences above.	Modern infill with Federation details	Neutral

Physical Description

Engaged pilasters and horizontal string courses.



11.1.16 16–326 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Early 20 th Century	Group of buildings	Two storey row of shops with residences above.	Federation	Key Element

Physical Description

Central pair (nos 320 & 322) have raised parapets and form the centre-piece of the group. Moulded and gauged semi-circular brick arched verandahs with rendered key stone, accessed by two French doors, infilled except no. 324, which remains intact. Modern signs attached to parapet of no. 318 and projecting sign to no. 324. Original shop fronts on no. 318 and 324, including brass glazing bars, recessed door entry and kick plates, other shop fronts substantially altered. This is an architecturally distinctive group of buildings with one intact example from which to restore the others.



11.1.17 330 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Early 20 th Century	Group of buildings	One and two storey bank building	Art Deco	Contributes

Physical Description

Rendered brick building. Characteristic Art Deco vertical fin features on pilasters. Awning and shop fronts substantially altered.



11.1.18 1 Albion Street

Construction Period	Type of item	Form	Style	Streetscape Contribution
Late Victorian	Single Building	Two storey shop with residence above.	Victorian Italianate	Contributes

Physical Description

Moulded rendered parapet with central anthemion motif. First floor balcony with carved timber posts, a cast iron lacework balustrade and concave corrugated iron roof accessed by three French doors. Shop front substantially altered.



11.1.19 285 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Early-20 th Century	Single Building	Two storey rendered commercial building with Residences behind (Bronte Road Frontage) and above	Edwardian style	Neutral

Physical Description

Roughcast rendered panel course and fluted pilasters in parapet. Once had a wrap-around awning. The two-storey verandah to Bronte Road elevation is of original configuration with bullnosed roof but timber balustrades have been replaced. New timber fold-back window openings to ground floor to Bronte Road and Albion Street.



11.1.20 279–283 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Early-20 th Century	Group of buildings	Two storey row of three (shops with residences above).	Federation	Contributes

Physical Description

Originally face brickwork, however, this remains only on no. 283. Painted brickwork to no. 279. Painted rendered walls to no. 281. Engaged pilasters, gauged brickwork string courses and semi-circular verandah openings to above awning facade. 1930s style ground floor shopfronts to nos 279 and 283. Original French doors with highlights and side lights to no. 279. New French door and sidelights to no. 283, aluminium door and window ensemble to no. 281.



11.1.21 231 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Mid-20 th Century	Single Building	Single storey shop	Mid-20 th Century	Neutral

Physical Description

Rendered and painted brick façade. Modern shopfront and signs attached to above awning facade.



11.1.22 229 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution

Early 20 th Century	Single Building	Pair of two storey buildings (shops with residences above)	Federation	Contributes
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Physical Description

Original shop fronts with central recessed 15 panel-glazed door. Rendered and painted brickwork sill above and below first floor windows. Lead-light to first floor south windows removed.



11.1.23 94 Carrington Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Early 20 th Century	Single Building	Two storey row of shops with residences above	20 th century Classical Revival	Contributes

Physical Description

Face brickwork and cement render above awning. Double sash hung windows. Cement rendered string course Shop fronts to nos. 275 and 277 generally intact with recessed entrance door. Shopfront to no. 273 substantially altered. Judging from historic photograph, the rendered pediment seems to have been added later.



11.1.24 221–211 Bronte Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Late 20 th Century	Single Building	Three storey commercial building	Late 20 th century	Detracts

Physical Description

Rendered blank façade featuring aluminium cladding and slate façade at ground level.



11.1.25 78–82 Carrington Road

Construction Period	Type of item	Form	Style	Streetscape Contribution
Mid-20 th Century	Single Building	Single storey building but equivalent to two storeys in height	Contemporary minimalist	Neutral

Physical Description

Brick building with parapet. Aluminium framed fenestration.



APPENDIX 4 HERITAGE INVENTORY SHEET RECOMMENDATIONS BY WAVERLEY COUNCIL

Recommendations

1. All existing construction prior to 1950 in the Conservation Area should be considered contributory to the Conservation Area.
2. Contributory buildings and their original features should be retained, any unsympathetic elements should be removed and original features restored.
3. Neutral buildings may be replaced or altered, so that the property is made compatible with the significance of the area.
4. Intrusive buildings should be replaced or altered so that the property is made compatible with the significance of the area.
5. The pattern of two storey shop fronts with street awnings should be retained.
6. Where documentary evidence exists first floor post supported or cantilevered balconies should be reinstated to street frontages.
7. Historic building forms should remain clearly identifiable within any redevelopment and or extension of existing structures.
8. The original built form should remain as the dominant aspect of any new works to contributory buildings.
9. Original shopfronts including openings and related detailing and signage locations should be retained and restored in any works to existing Contributory Buildings.
10. The pattern of small service lanes and walkways should remain
11. Original external finishes should be retained and reinstated. Original face brick and sandstone walls and fences should not be rendered and/or painted. Slate and terra cotta tiling to roofs should be maintained and matched in new works to the core building.
12. Sandstone retaining walls and boundary walls should be retained and repaired.
13. A heritage impact report should be prepared for proposed work to all contributory elements in the Conservation Area and to sites adjacent to or in the visual curtilage of contributory fabric.



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Appendix D

Traffic Assessment Reporting

- D1 Civil and Traffic Engineering Assessment by TTW Engineers
October 2023
- D2 Traffic Assessment by GHD Engineers
November 2020

Preliminary Civil and Traffic Engineering Assessment

Charing Cross Streetscape Upgrade

Prepared for Environmental Partnership / 25 October 2023

231268 CAAA TAAA

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1.0 Introduction

TTW have been engaged by Environmental Partnership on behalf of Waverly Council to undertake the design development of the Charing Cross Streetscape Upgrade.

In general the upgrade includes but not limited to;

- Upgrade of the Bronte/Carrington/Victoria six-way intersection, including pedestrian and footpath grade improvements, vehicle turning restrictions and kerb extensions
- Upgrade of the public domain along Bronte Road including new pavement, footpath widening, tree planting and street furniture
- Installation of new mid-block raised pedestrian crossing along Bronte Road
- Upgrade of existing pedestrian crossing to raised pedestrian crossing on Bronte Road near Albion Street intersection
- Upgrade intersection of Cables Place and Bronte Road with a continuous footpath treatment
- Upgrade pedestrian crossing at Bronte Road (East) and Albion Street intersection
- Upgrades to Council stormwater drainage and water sensitive urban design opportunities

This assessment report has been prepared to outline the methodology and analysis undertaken in preparing the developed design. The findings of this assessment is based on the current Draft 50% Detailed Design, as well as available information and correspondence undertaken at the time of writing. A full detailed design assessment will be undertaken as design development continues.

2.3 Review of Concept Documentation

Below is an outline of the proposed deviations from the original concept in which TTW have to date have address or are continuing to develop;

- The geometry of the left slip lane removal has been revised in order to retain the existing crossing island. This is due to the presence of utility pits which are costly or impractical to relocate.
- The orientation of four of the pedestrian crossings at the signalised intersection are considered to be non-compliant by TfNSW as a result of the acute angles formed by the existing road alignments.
- Some bus turning movements have since changed since the original GHD report was prepared.

Additionally, a review of the electronic SIDRA files prepared at concept stage by GHD has been undertaken for the preparation of the submission to Council's Traffic Committee and TfNSW. The following items have been noted as features of the concept SIDRA modelling that are viewed as incorrect, and have been corrected as described for the SIDRA model prepared by TTW for TfNSW:

- Pedestrian crossing distances for all signalised intersections were set to 'Program' as opposed to input manually. All pedestrian crossing distances have been input so that crossing distances can be accurately represented.
- GHD had not obtained SCATS data for the preparation of the model at concept stage. Therefore, Optimum Cycle Time had been selected for the phasing and timing of the model. SCATS data has not been obtained by TTW; therefore, a Network User Given Cycle Time has been input into the model.
- The modelling of the intersection of Bronte Road, Carrington Road and Victoria Street undertaken at concept stage had represented the existing left turn slip lane between Bronte Road (south) and Carrington Road (South) as a signalised slip lane. This is not correct as the slip lane operates unsignalised and vehicles can undertake left turn movements between Bronte Road (south) and Carrington Road (south) at any time with care (essentially under 'Give Way' conditions); the submission for TfNSW has modelled the slip lane accordingly.
- Discrepancies within the GHD model were noted with respect to the lengths of kerb-side short lanes available for traffic flow at various times throughout the day. For example, in the concept stage GHD model sections of 'No Parking' restrictions have been counted as available lanes for traffic. The TTW model has indicated the length of the short lanes being only instances where prevailing bus zones or 'No Stopping' restrictions apply within the kerb-side lane on approach and departure to and from the intersection during each peak hour.
- Pedestrian volume data was not input into the model at concept stage; therefore, all pedestrian crossing volumes were set to 'default'. Pedestrian volumes have now been input into the model, being based on observations of pedestrian volumes within the subject area, undertaken by Council officers.
- No bunching had been input into the model to accurately reflect the impact of nearby signalised intersections resulting in the propensity of vehicles arriving at the subject intersections in platoons. Appropriate levels of bunching have been input into the model based on observations of the operation of the road network.
- Pedestrian refuges at roundabouts were modelled as staged crossings. As pedestrians do not have right of way at pedestrian refuges, the model prepared by TTW does not represent the refuges as staged pedestrian crossings.
- Instances were noted where applicable speed limits (particularly school zone speed limits) were not accurately reflected in the GHD model. The model prepared for TfNSW includes the appropriate speed limits input dependent on the peak hour being represented and the applicable speed limit at that time.'

2.4 Design Vehicles

Each possible turning and through movement is to be assessed using the respective largest expected design vehicle. The Traffic Study prepared by GHD had identified the bus turning movements at the time however since this study, some bus turning movements have changed. The below image outlines the current expected turning paths for articulated buses and coaches (14.5m length)

For all other turning movements between major and minor streets, a Small Rigid Vehicle (SRV) has been used for assessment. It is recommended that prior to submission of the detailed design, up-to-date traffic observations are carried out to confirm the correct design vehicle has been allowed for.



Figure 2 - Sydney Buses turning movement through intersection

2.5 Swept Path Analysis

Refer to Figure 3, Figure 4, Figure 4 and Figure 5 for swept path analysis of articulated bus, 14.5m coach and SRV respectively. Plans have been provided in Appendix A.

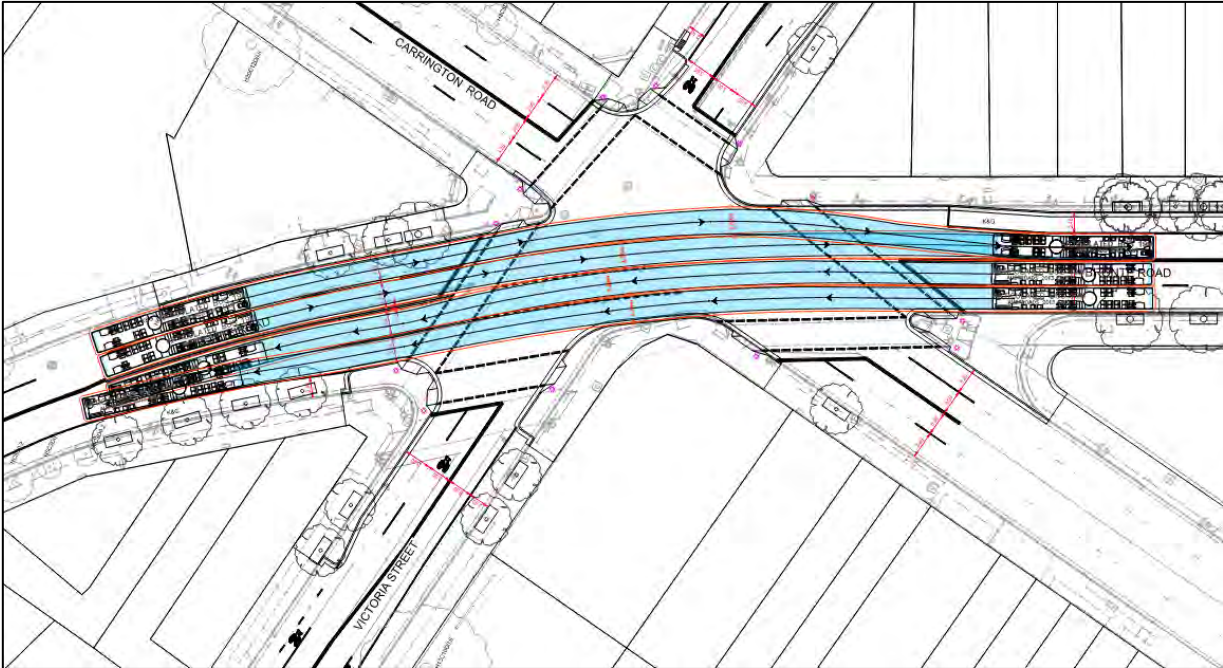


Figure 3 – Swept path analysis - Articulated bus

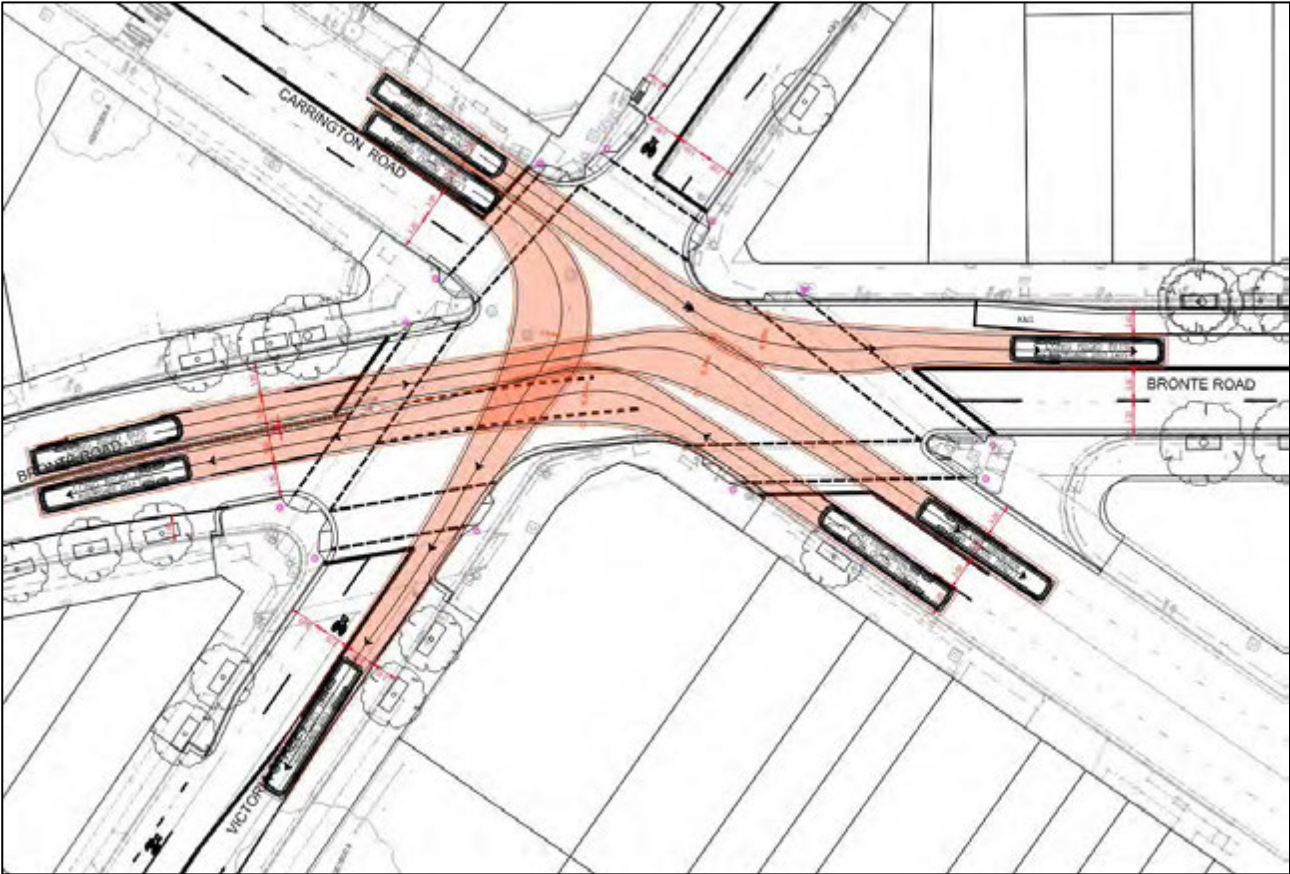


Figure 4 - Swept Path Analysis - 14.5m Coach



Figure 5 - Swept Path Analysis - SRV

2.6 Pedestrian Crossings at Signalised Intersection

The existing pedestrian crossings and kerb ramps are non-complaint as per the extract from RMS Traffic Signal Design Appendix D. Due to the unusual arrangement of approach and departure roads, providing compliant crossings would be difficult within the given constraints and would likely result in other safety or functionality issues.

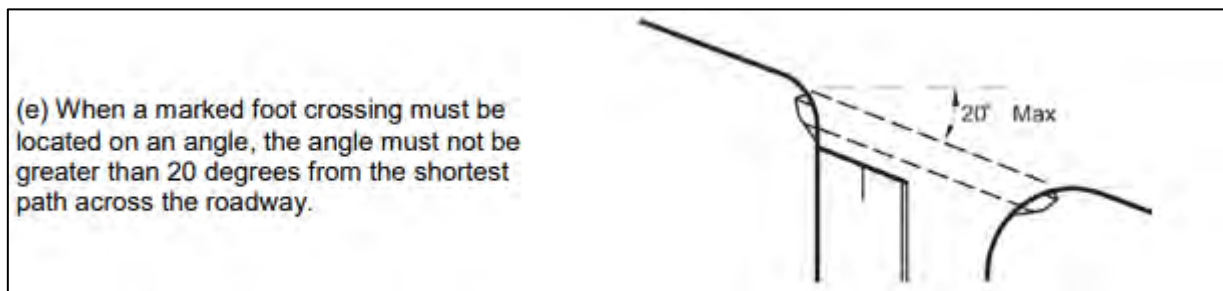
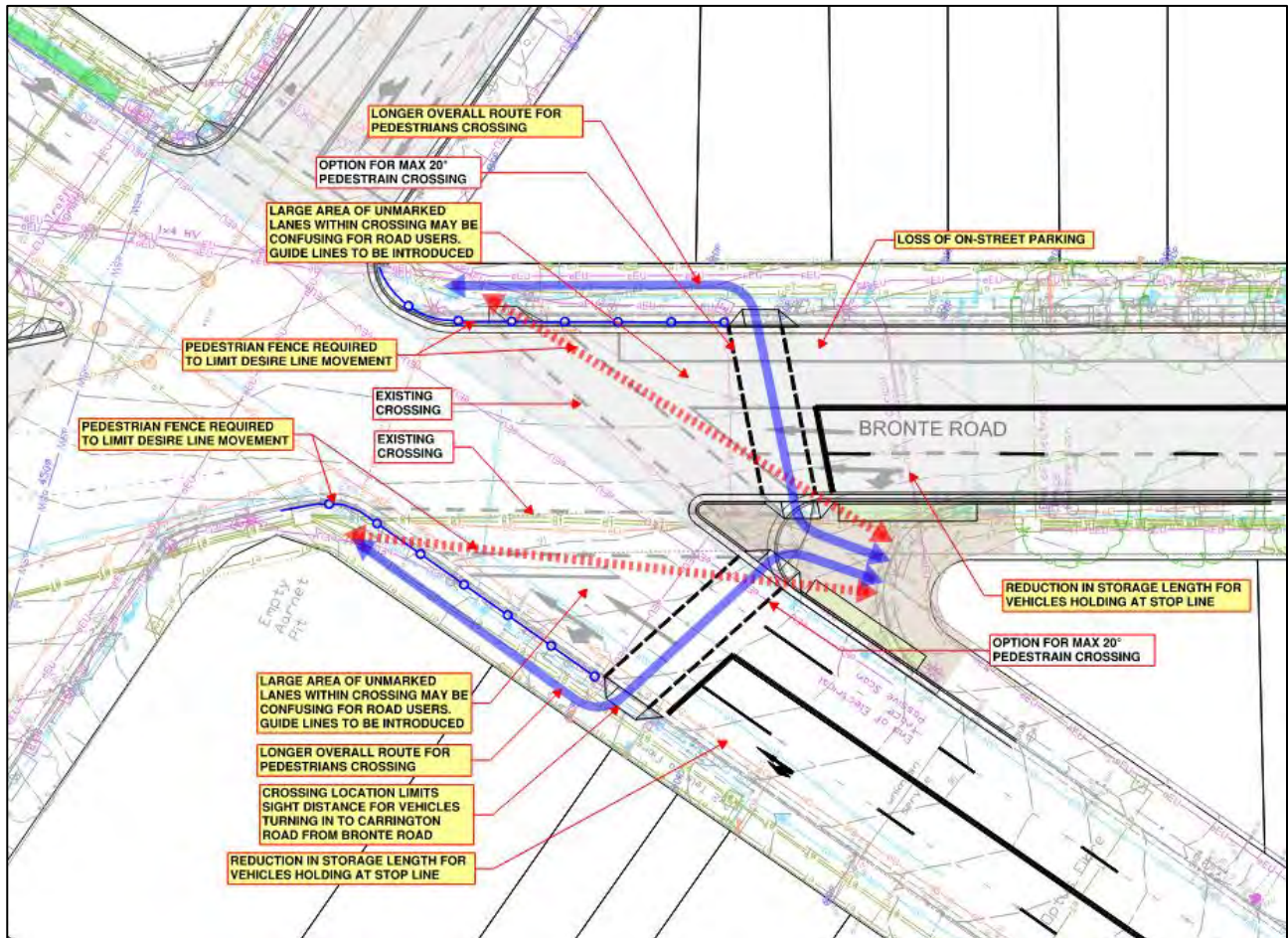


Figure 6 - Extract from RMS Traffic Signal Design Appendix D

Options were explored to provide perpendicular or maximum 20° angled pedestrian crossings on Bronte Road, Carrington Road and Victoria Street. However, several safety and functionality issues were identified as demonstrated by the figure below.



In order to proceed with the design development it is recommended that the sharp angled pedestrian crossings as retained. To proceed on this basis confirmation of the deviation from the design requirements is required from TfNSW.

The below figure shows how the intersection design has been developed based on the recommendations outlined in this report such as swept path analysis and pedestrian facilities. The drawing plan has been provided in Appendix A.

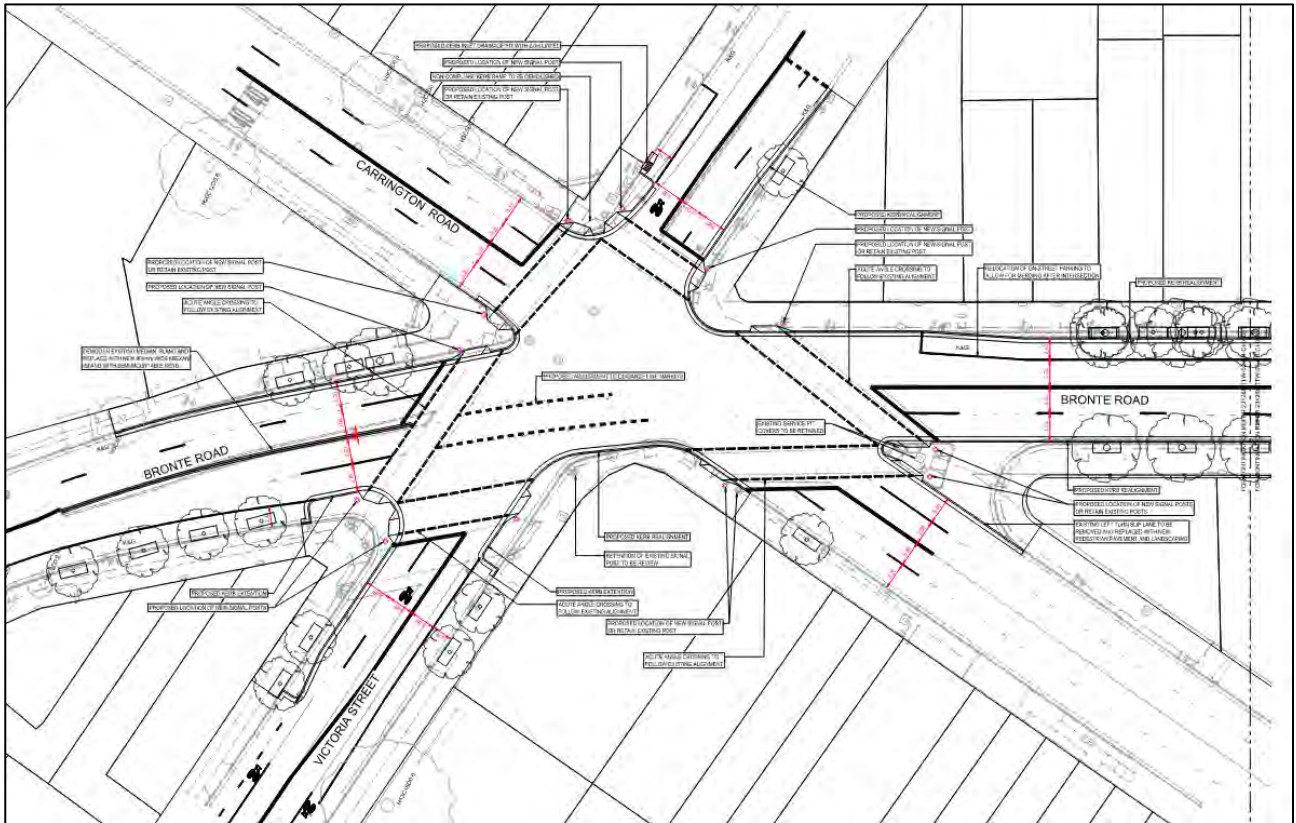


Figure 7 – Developed concept design

SIDRA modelling has been undertaken in order to assess the impacts of the proposed Charing Cross Streetscape Upgrade Works on vehicular and pedestrian traffic and the operation of the surrounding road network.

- A Base model, representing the application of 2030 traffic volumes to the subject intersection network if no changes are made to the existing layout and infrastructure.
- A Proposed model, which applies the 2030 traffic volumes to the proposed Charing Cross Streetscape Upgrade design works as presented within Appendix A of this report.

The results of the SIDRA analysis indicate the following:

- The LOS for all intersections in the model with the introduction of the Streetscape Upgrade works is projected to remain the same, when compared to the Base network results.
- The operation of the intersection of Bronte Road, Carrington Road and Victoria Street with the introduction of the Streetscape Upgrade works is projected to improve during all peak hours, as the

- degree of saturation, average delay and 95th percentile queue length is projected to decrease, when compared to the Base network results.
- The operation of the remaining intersections with the introduction of Streetscape Upgrade works is projected to remain the same or be altered by a negligible amount, when compared to the Base network results.

According to above, the Streetscape Upgrade works are anticipated to result in minor impacts to the operation of the surrounding road network, when compared to the Base operation of the network (if no changes are made) with respect to vehicular traffic. The proposed Streetscape Upgrade works are however projected to improve pedestrian amenity, connectivity and safety of the precinct.

3.0 Bronte Road Design

Bronte Road is proposed to be upgraded to improve the public domain between for the section between the intersections of Carrington Road and Albion Street. The scope of improvements along this section of Bronte Road include:

- Upgrading of road geometry, including kerb alignments
- Installation of additional mid-block raised pedestrian crossing facility
- Upgrading of existing southern pedestrian crossing facility to raised crossing
- Provision of continuous footpath treatment at Cables Place
- Upgrades to existing stormwater drainage infrastructure
- Provision of water quality control basins in vicinity of Bronte Road East

The proposed upgraded road profile for Bronte Road includes:

- 3.2m wide trafficable lanes in both directions
- 2.4m wide parking lanes both sides.
- Kerb and gutter on both sides.
- 4.4m wide footpath with planting on both sides.

Crossfalls along the existing road vary. Existing carriageway crossfalls typically range between 1% to 6%. Existing footpath crossfalls range from 0% to 6%, with some areas grading away from the road.

The design levels of the road are intended to be largely in keeping with the existing road profile. The design crossfalls for the road carriageway will be typically between 2-5%, similar to existing crossfalls. The design footpath levels are to be flattened to a maximum of 2.5% fall towards the road where possible. This has been achieved by raising or lowering the kerb level in some areas. Some footpaths may need to retain larger crossfalls where kerb levels could not be practically adjusted. The design levels also intend to minimise the potential impacts to the flood conveyance and stormwater drainage conditions on Bronte Road. Levels at the road reserve boundaries are to be retained as per existing conditions.

4.0 Stormwater Quantity

The current council stormwater assets under Bronte Road and Judges Lane do not have the capacity to adequately discharge flow from major storm events. The stormwater assets are proposed to be upsized from commonly Ø300 to Ø375, to assist in discharging stormwater flows as well as assist in reducing flooding impacts. The impacts of the upgraded stormwater assets were modelled in DRAINS and the pre-development model was compared with the post-development model.

The DRAINS model indicated that the upgraded stormwater assets resulted in reduced overall overland flow by allowing more flow to exit the site within the stormwater pipes, as opposed to the existing scenario which had more flow leaving the site via overland flow.

The pre-development and post-development model results for 1% AEP and 5% AEP are shown in Table 3 which were extracted from the DRAINS model from the figures below.

Table 1 - Pre Dev vs Post Dev Overland Flow Comparison

DRAINS Results	1% AEP		5% AEP	
	Pre Development	Post Development	Pre Development	Post Development
Overland Flow (L/s)	913	746	583	398
Total Overland and Piped Flow (L/s)	1,596	1,449	1,303	1,092

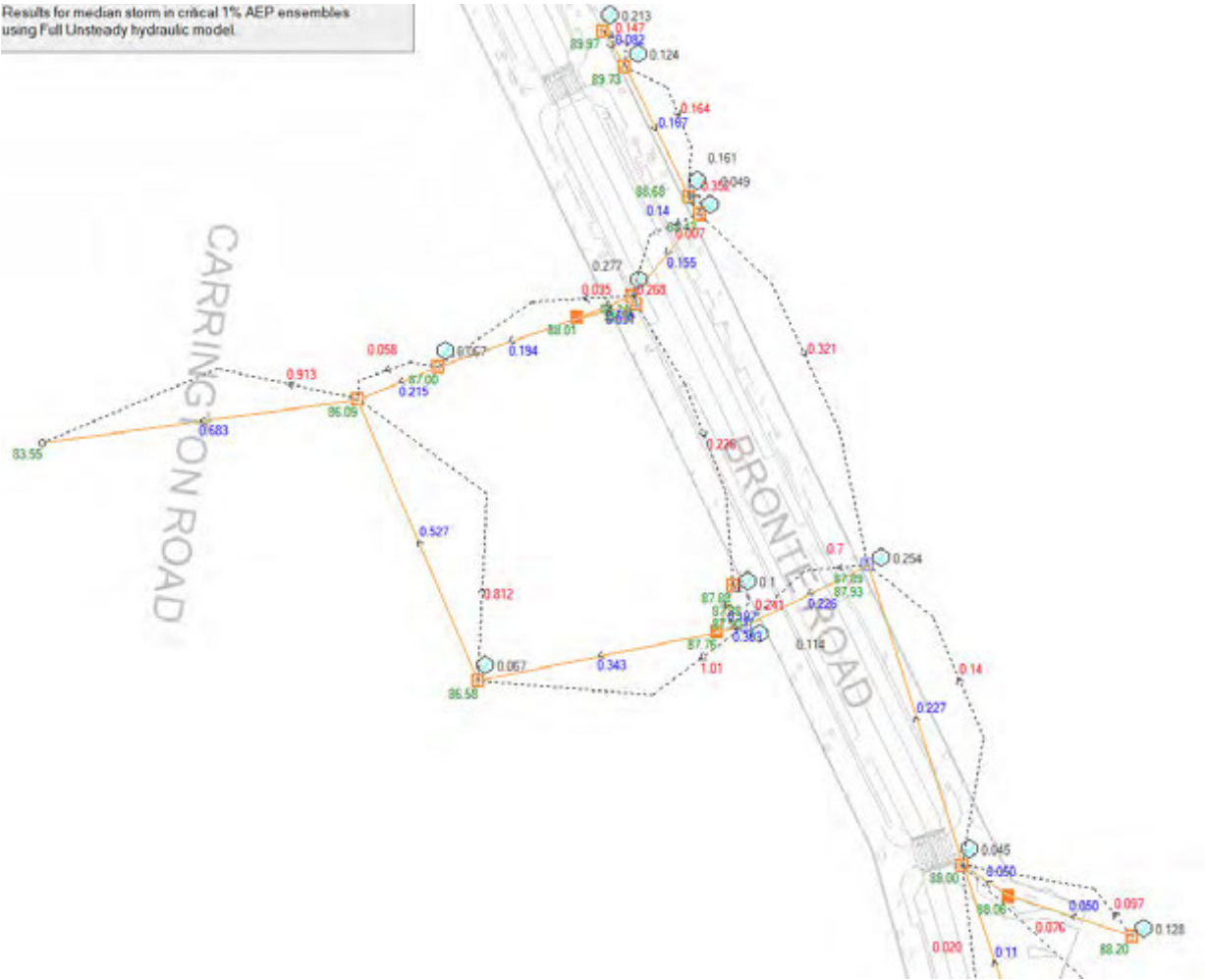


Figure 8 - 1% AEP Pre Development DRAINS Model

Results for median storm in critical 1% AEP ensembles
using Full Unsteady hydraulic model.

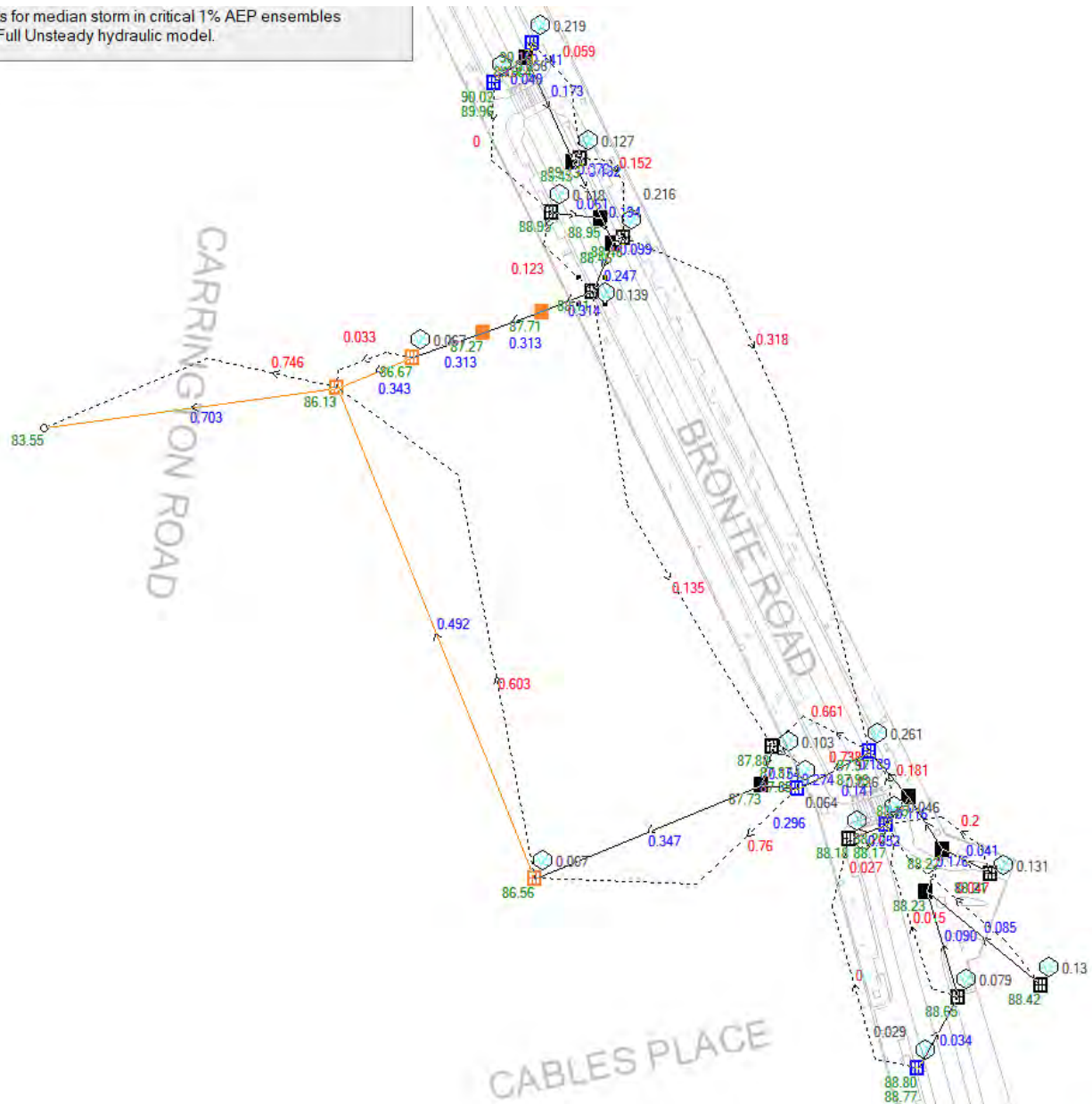


Figure 9 - 1% AEP Post Development DRAINS Model

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Figure 10 - 5% AEP Pre Development DRAINS Model

Results for median storm in critical 5% AEP ensembles using Full Unsteady hydraulic model:

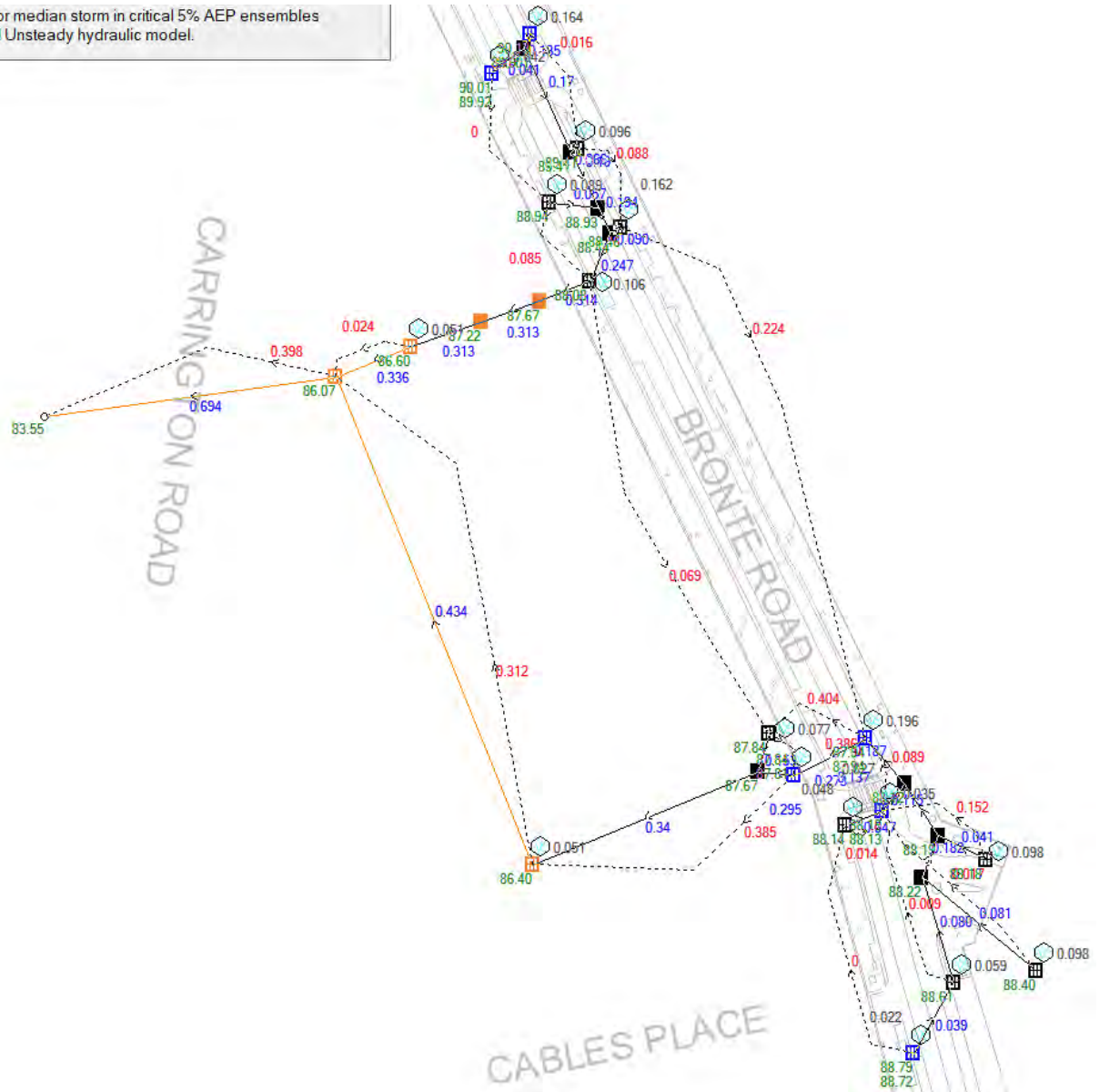


Figure 11 - 5% AEP Post Development DRAINS Model

5.0 Flood Impact

A flood modelling assessment was undertaken by BMT in 2020 which illustrated the extent of flooding during events from 1EY up to 1% AEP. The results were able to demonstrate that the existing stormwater infrastructure has insufficient capacity to drain minor and major flood events. It was found that in 5% AEP event flooding in Bronte Road is expected to reach a depth of 450mm. During the 1% AEP event, flood depths reach 550mm in Bronte Road. Refer to Figure 12 for 1% AEP flood extents.

The BMT report explores potential upgrade options including upgrading the downstream system to Carrington Road and further option to provide a surcharge pipe into Queens Park. It was found that for both options an upgraded system was able to assist with minor flood events but offered little to negligible assistance for major flood events given the potential economic cost and increased hazard to downstream developments.

As such, the design intent for the public domain upgrades is to ensure that flood impacts are not worsened by the proposed works. Upgrades to the Bronte Road stormwater infrastructure and the inclusion of passive irrigation and raingardens will be able offer some assistance for the capture and retention of minor flooding events.

Raised crossings where specified have been designed with a 75mm high profile. Primarily this is to allow buses and heavy vehicles to cross over the raised pavement without crossing, however it also offers overland flow paths to continue travelling downstream within the carriageway without overtopping the 150mm barrier kerbs.

As the design develops it is recommended that a new flood modelling assessment is undertaken to ensure the proposed works does not impact surrounding or downstream developments.

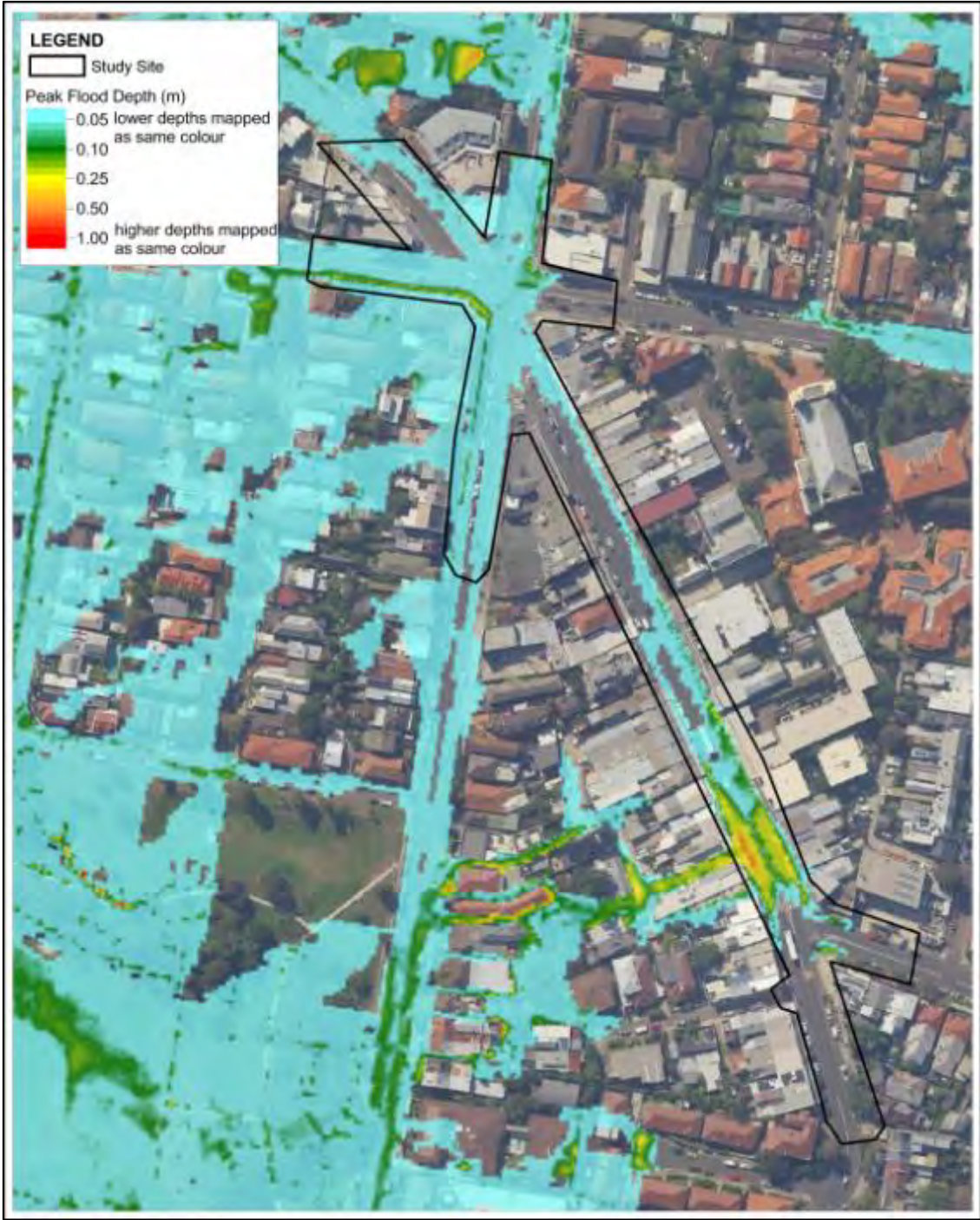


Figure 12 - 1% AEP Flood Extent (BMT, 2020)

6.0 Water Quality

A stormwater quality assessment is not required in accordance with Council's DCP. However opportunities for passive irrigation and raingarden have been nominated which will be able to assistance with the water quality being discharged to the Council system. Refer to Figure 17 for Waverley Council typical raingarden arrangement and filter media specifications. The reduction targets from Council's DCP have been provided in order to estimate the effectiveness of the raingardens. To that end, a conceptual stormwater treatment train has been formulated and been modelled in MUSIC.

For water quality control measures, all applicable developments must achieve a minimum of:

- a) 90% reduction in the post development mean annual load of total gross pollutants (greater than 5 mm)
- b) 80% reduction in the post development mean annual load of total suspended solids (SS)
- c) 55% reduction in the post development mean annual load of total phosphorus (TP)
- d) 40% reduction in the post development mean annual load of total nitrogen (TN)

Designers implementing WSUD should use the Model for Urban Stormwater Improvement Conceptualisation and refer to documents including *Using MUSIC in Sydney Drinking Water Catchment* (published by WaterNSW, Parramatta, June 2019). Council's preference is the use of green

Figure 13 - Stormwater quality targets (Section 9, Waverley Water management Technical Manual 2021, pg. 47)

The effectiveness of these bio retention basin measures is summarised in Table 2 below:

Table 2 - MUSIC modelling results compared against Council's target reduction goals (not required to meet)

Water Quality	Gross Pollutants (GP)	Total Suspended Solids (TSS)	Total Phosphorus (TP)	Total Nitrogen (TN)
Target Reduction (Not required to meet)	90	80	55	40
Modelled Reduction	100	75.1	47.6	41.6

An excerpt from the MUSIC model is presented below as Figure 14:

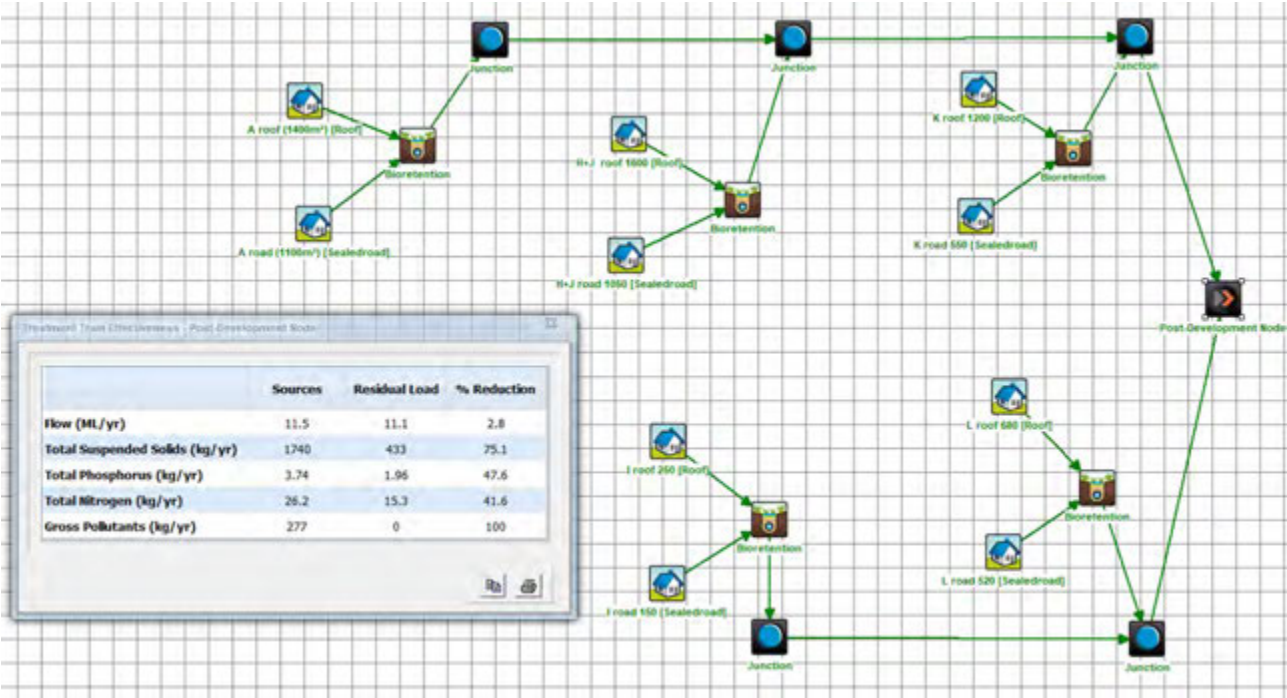


Figure 14 - Preliminary MUSIC model excerpt

Potential raingarden locations have been shown in Figure 15 and Figure 16.

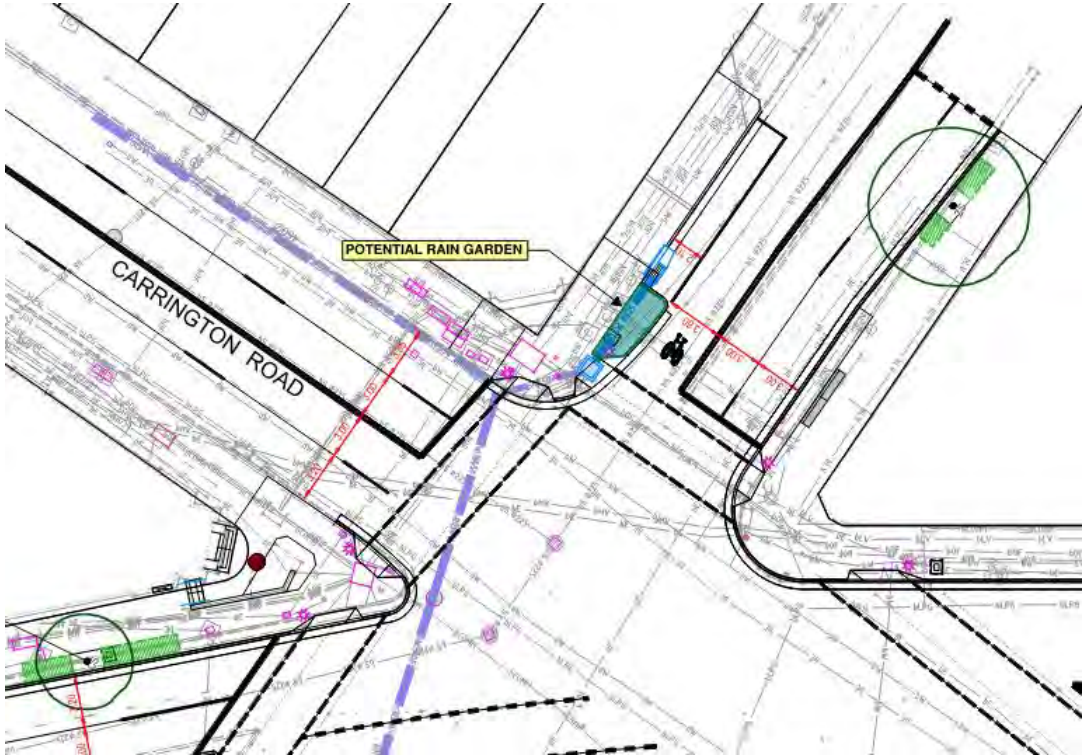


Figure 15 - Charing Cross Bioretention basin location

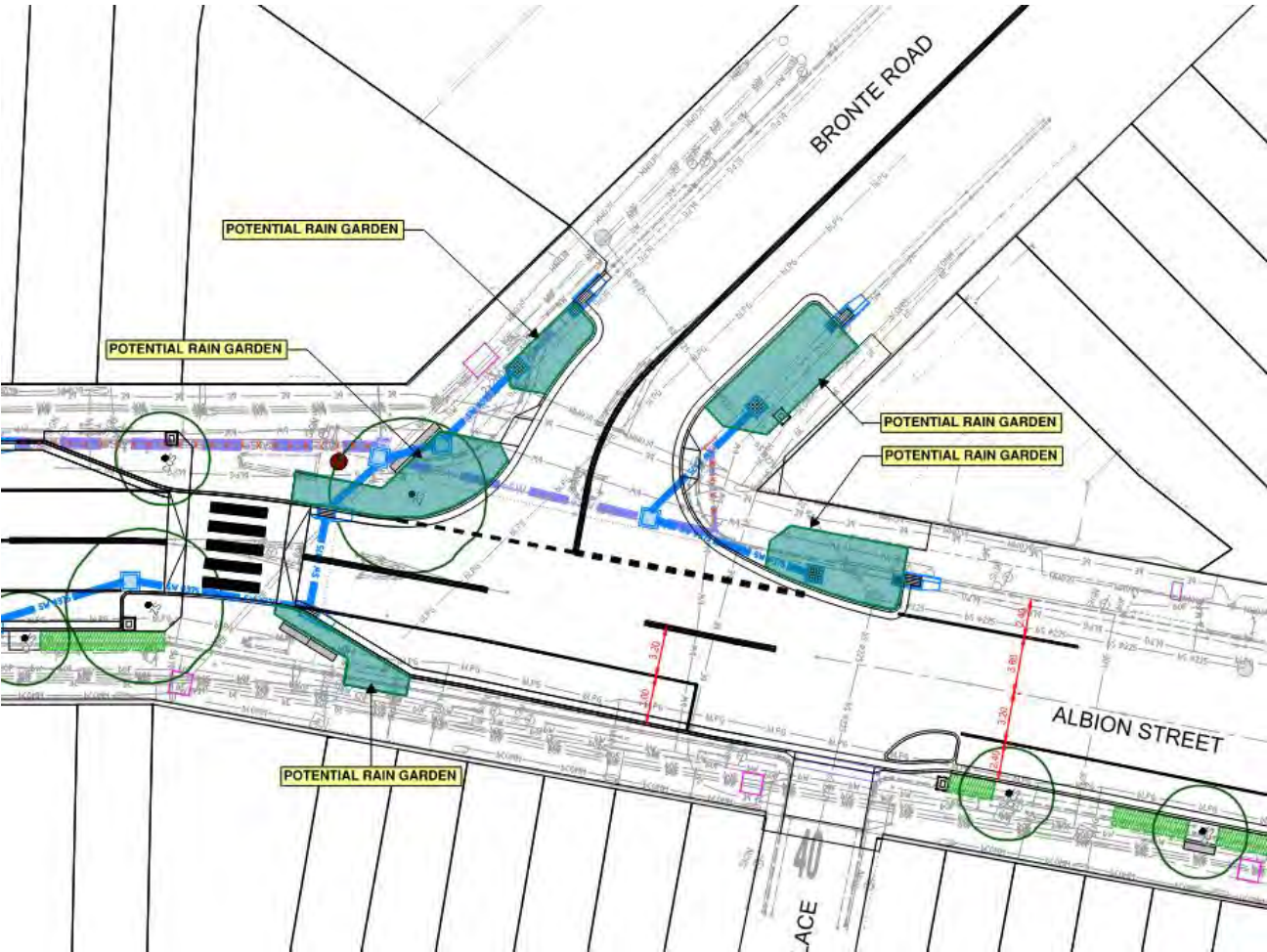


Figure 16 - Albion Street, Bronte Road bioretention basins location

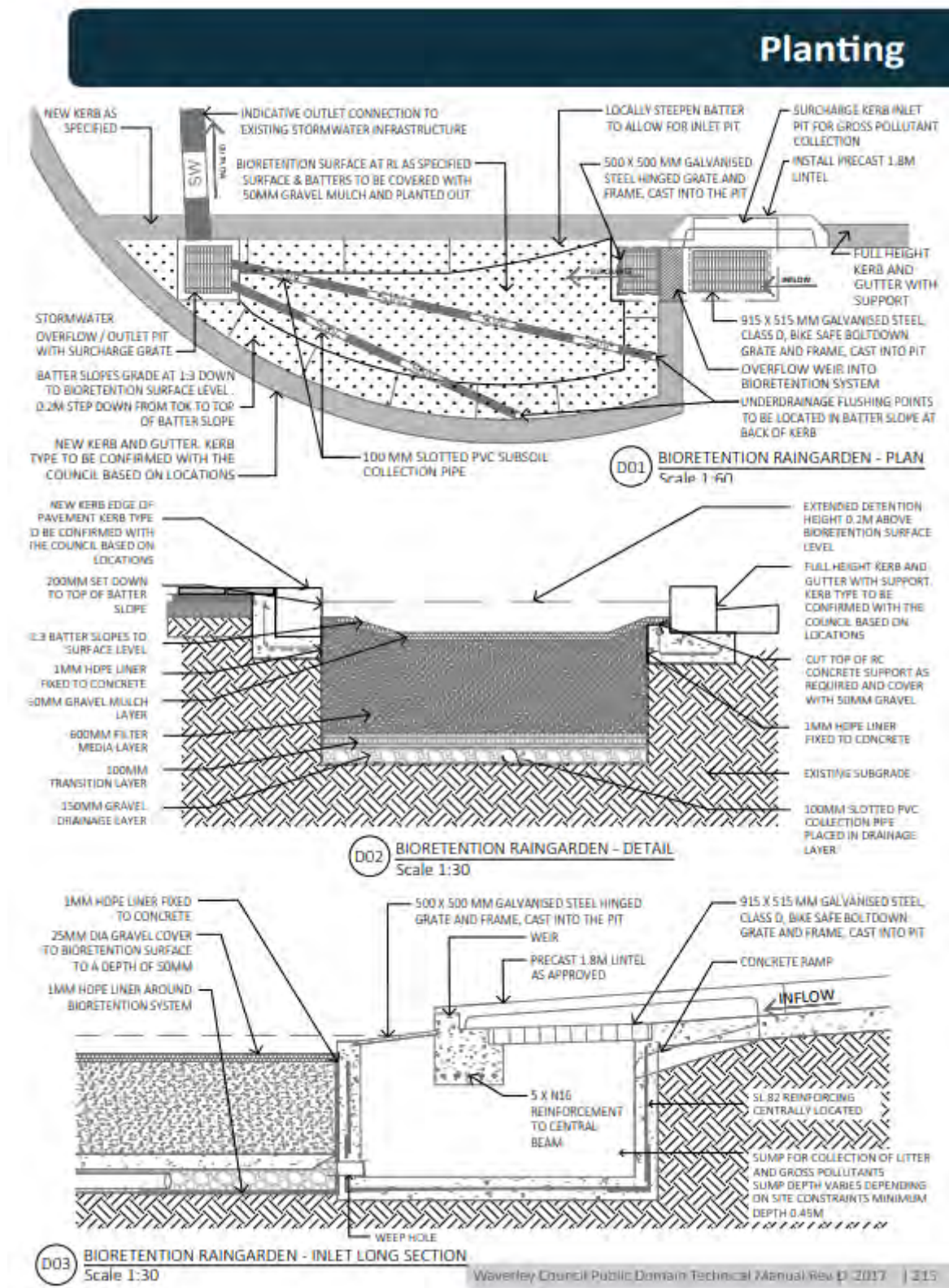


Figure 17 - Typical Raingarden Arrangement (Waverley Council Public Domain Technical Manual, 2017)

7.0 On-Street Parking

7.1 Parking Layout

The current on street parking layout has been based on AS2890.5 which requires 2.0-2.3m wide parallel spaces. The parking bay lengths vary dependent whether vehicles are obstructed at the ends of the bays or not. Longitudinal broken or unbroken line marking will be provided to define the width of the available parking bays, however traverse markings delineating individual lengths of parking bays will not be provided in accordance with Waverly Council's requirements.

7.2 Bus Layover

The lengths of bus draw-in, set down and draw-out areas have been based on the NSW Government State Transit Bus Infrastructure Guide. Table 1 details the draw in and out lengths that have been assumed, noting that a standard bus has been allowed for based on site inspection.

Swept paths have been analysed at bus draw out areas where kerb blisters extend into the required draw out length to confirm they provide sufficient manoeuvring length.

Table 3 - Bus Stop Specifications, Transit Bus Infrastructure Guide

Bus Stop Dimension (m)	Standard	Long Rigid	Articulated
Length of Bus	12.5	14.5	18.0
Minimum draw-out length	6.0	6.5	8.0
Minimum draw-in length	11.5	14.0	14.0
Bus Zone length for one bus	30.0	35.0	40.0

8.0 Conclusion

The design of the Charing Cross Streetscape Upgrade has been developed in accordance with all relevant standards and guidelines. Design development will continue as further investigations and correspondence between design consultants, Council, TfNSW and stakeholders is undertaken. The stormwater asset upgrades lowered the expected overflow and flood levels as modelled in Section 4.0: Stormwater Quantity.

Prepared by
TTW (NSW) PTY LTD

Authorised By
TTW (NSW) PTY LTD

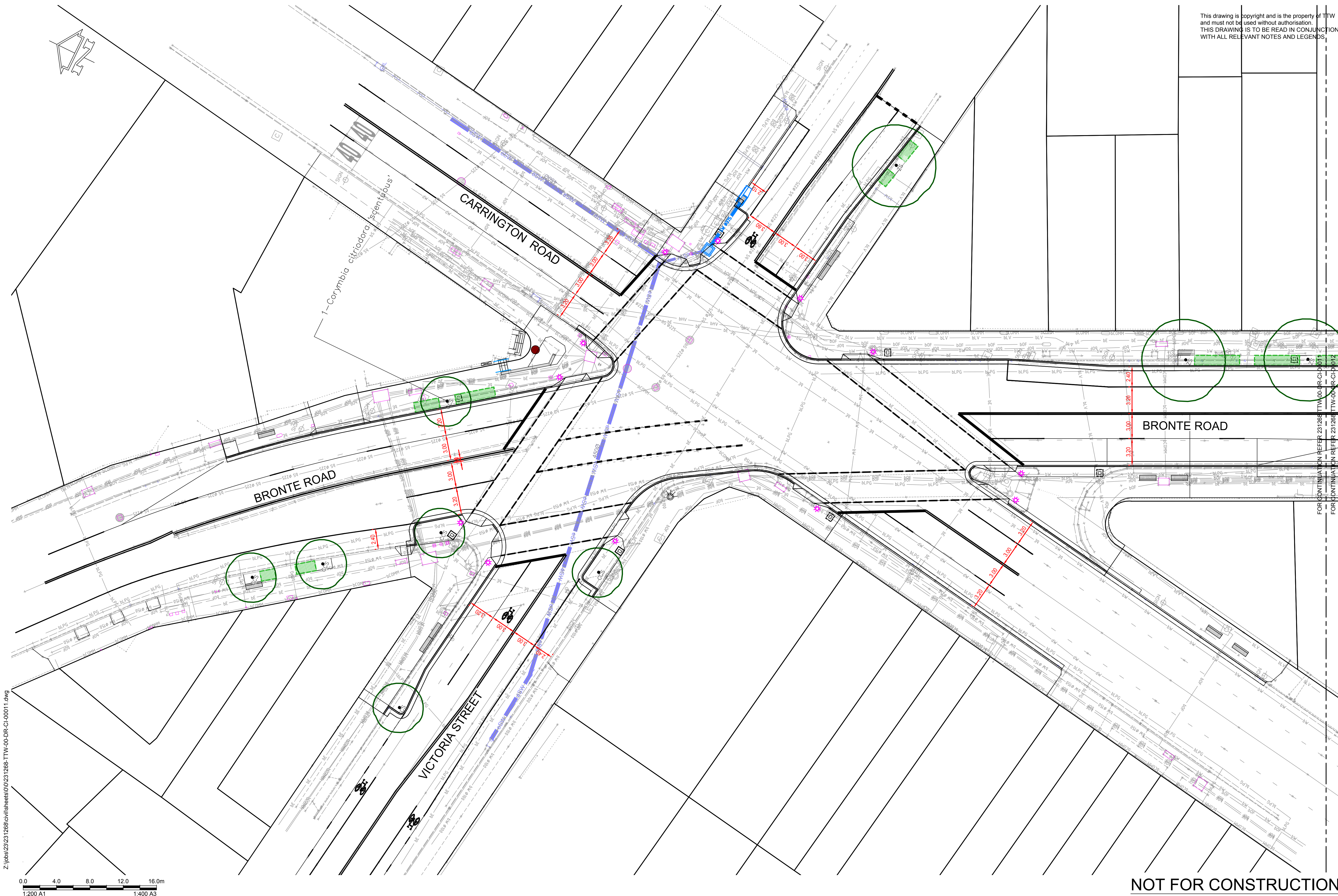
DUNCAN MARSHALL
Associate (Civil)

TIM MOORE
NSW Civil Manager

Appendix A

Civil Drawings

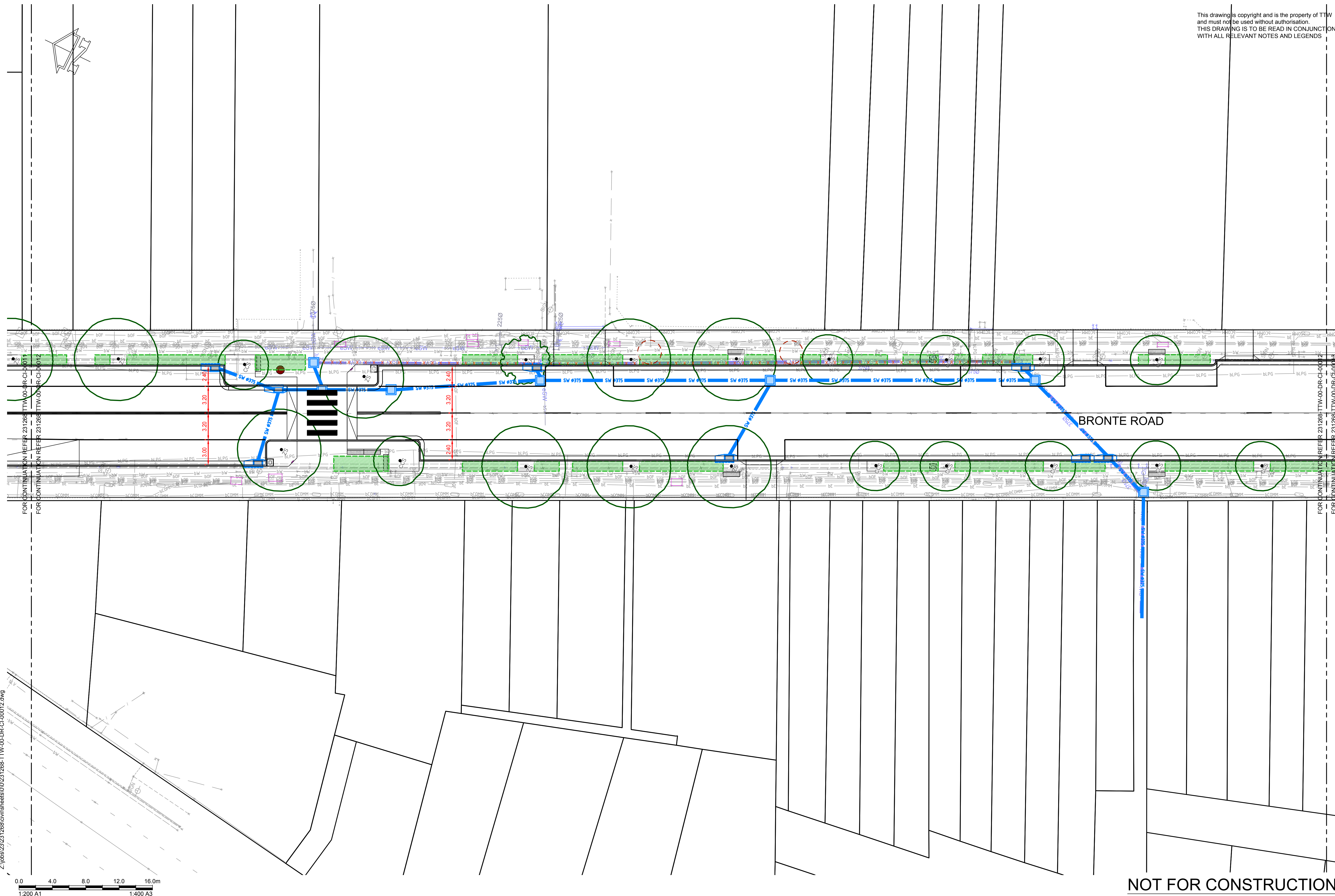
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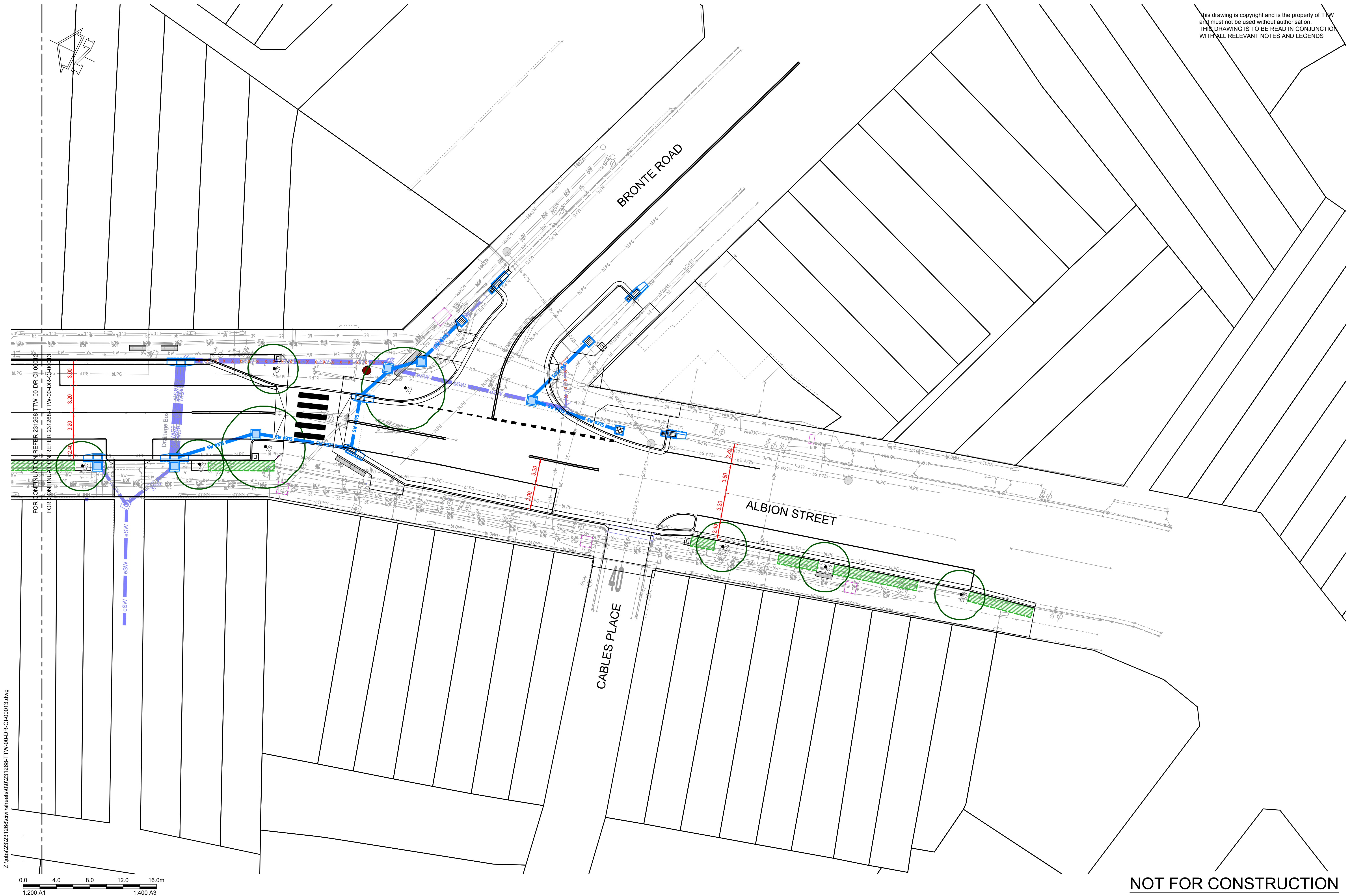
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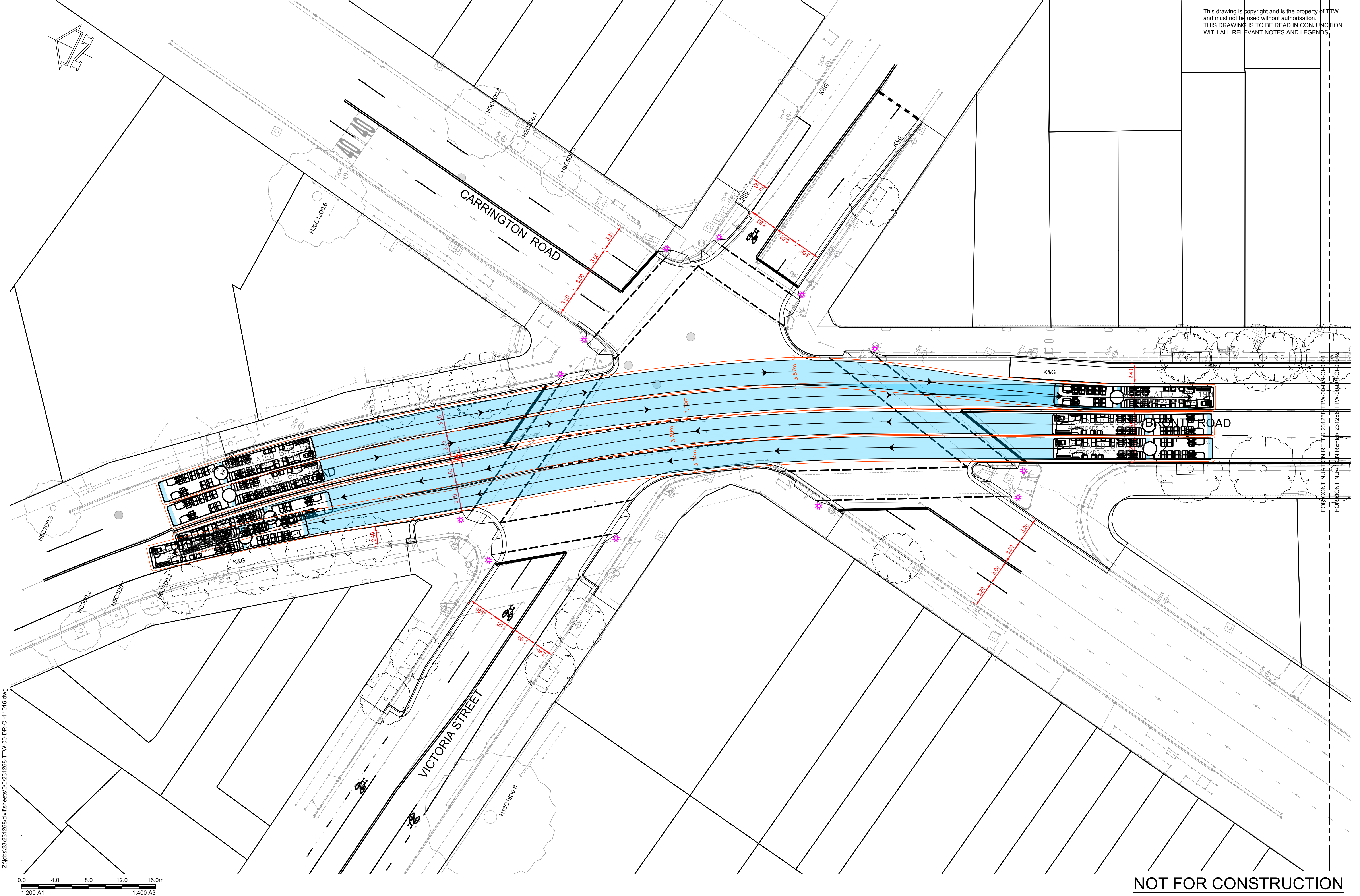
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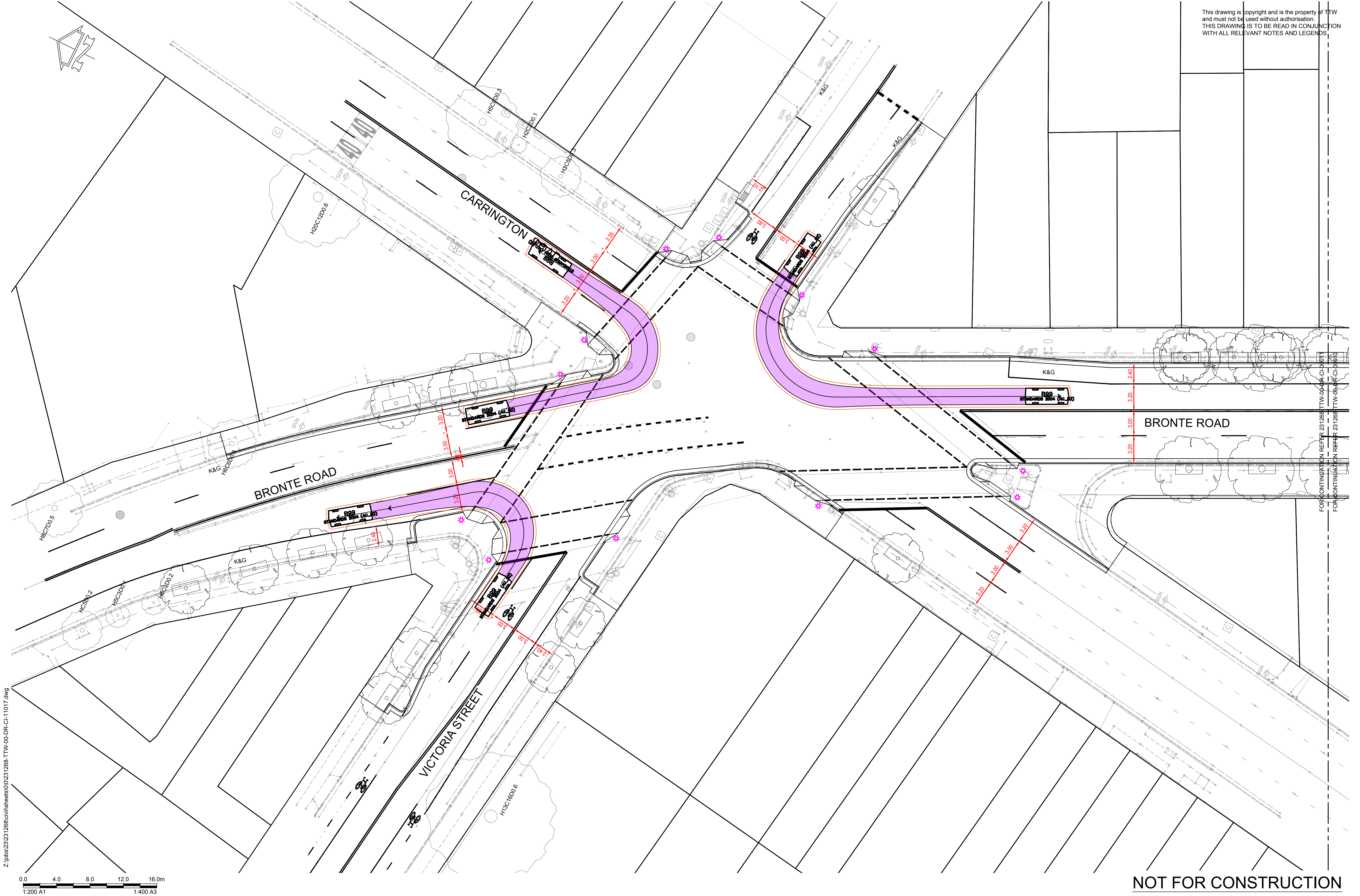
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Engineer:

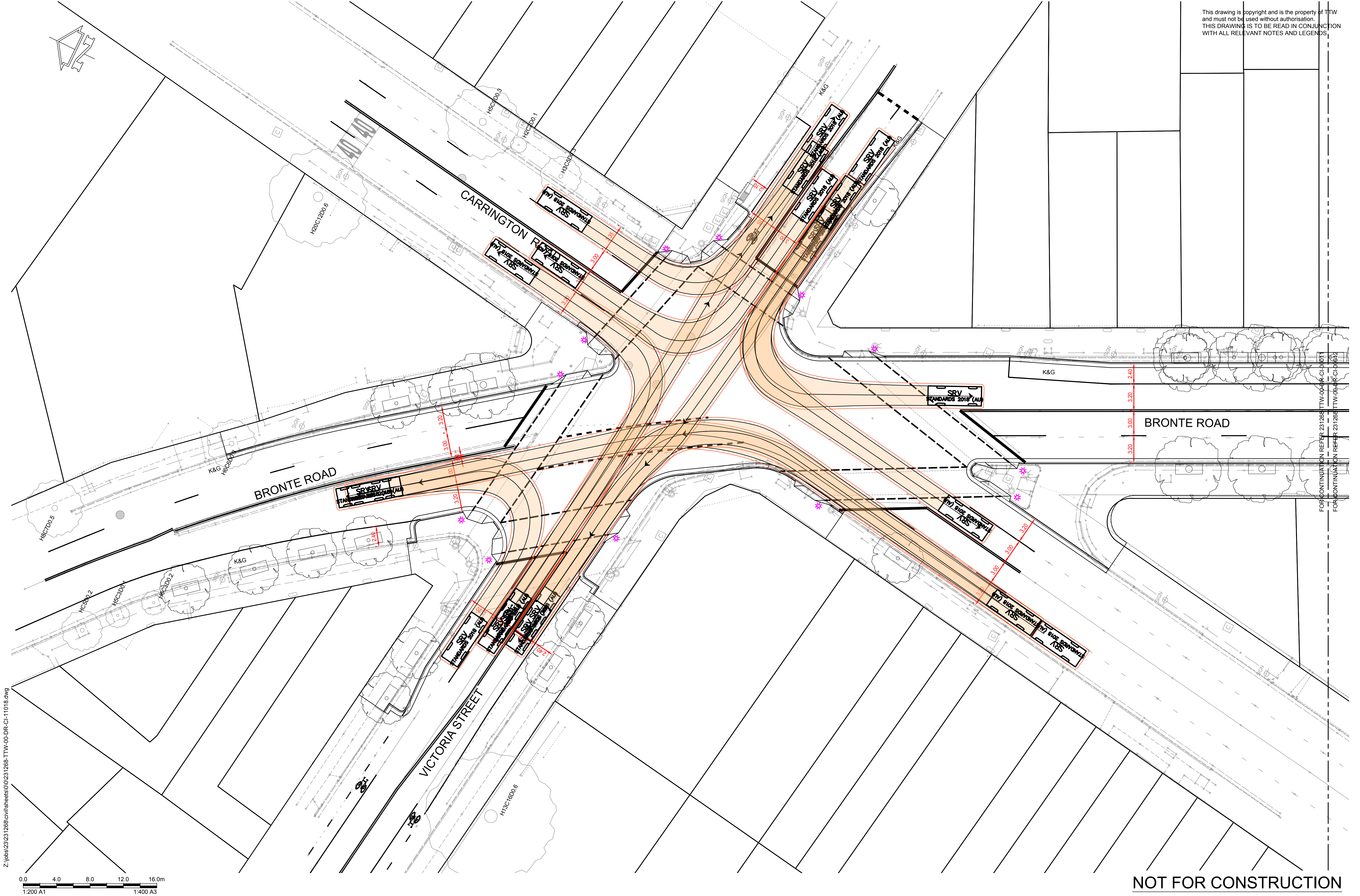
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CHARING CROSS STREETSCAPE UPGRADE

Drawing Title:
VEHICLE TURNING PATHS B99 PASSENGER VEHICLE

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Drawn
AS
Designed
DM
Approved

Project No	Originator	Zone	Type	Role	Sheet No.	Rev
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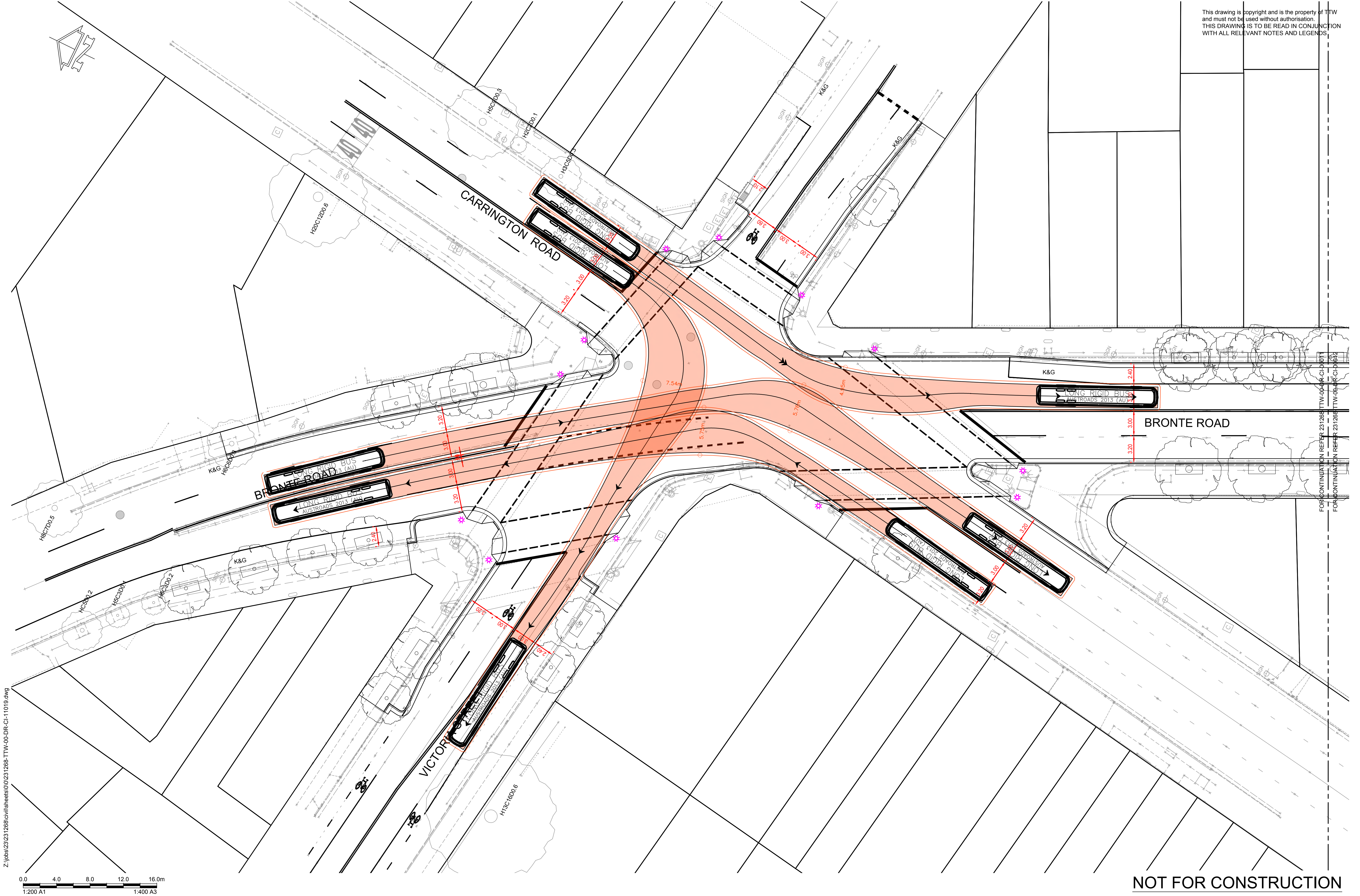


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Engineer:

Project:
CHARING CROSS
STREETSCAPE UPGRADE

Drawing Title:
VEHICLE TURNING PATHS
LONG RIGID BUS (14.5m)

Scale at A1	Drawn	Designed	Approved
AS	AS	DM	
Project No	Originator	Zone	Type
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Appendix B

Traffic Modelling Assessment

Traffic Modelling Assessment

Charing Cross Streetscape Upgrade

Prepared for Environmental Partnership / 25 October 2023

231268 CAAA TAAA

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1.0 Introduction

TTW have been engaged by Environmental Partnership on behalf of Waverley Council to undertake a modelling assessment to determine the impacts of the proposed design works associated with the Charing Cross Streetscape Upgrade.

In general, the Streetscape Upgrade works include, but are not limited to, the following:

- Upgrade of the Bronte Road, Carrington Road and Victoria Street six-approach intersection, including the removal of the left turn slip lane between Bronte Road and Carrington Road
- Implementation of kerb extensions and the realignment of signalised pedestrian crossings in order to improve pedestrian amenity and accessibility
- Upgrade of the public domain areas along Bronte Road including new pavement, footpath widening, tree planting and street furniture
- Installation of new raised mid-block pedestrian crossings across Bronte Road
- Upgrade to Council stormwater drainage and water sensitive urban design opportunities

This report has been prepared to present the modelling assessment that has been undertaken to project the impact of the proposed works, incorporating the following in the SIDRA analysis:

- The redistribution of traffic associated with the proposed removal of the left turn slip lane and the associated prohibition of left turn traffic movements from Bronte Road (south) to Carrington Road (south)
- Adjusted traffic volumes, where required based on the above mentioned trip redistribution, throughout the six intersections included in the network
- The intersection layouts to align with the revised design, including adjusted lane widths, pedestrian crossing distances and median arrangements

A summary of the findings of the SIDRA network modelling analysis has been provided, describing the performance of a 'Base'^[1] and 'Proposed' network model during the weekday AM, PM and Saturday peak hours.

1.1 References

This report has been prepared in consultation with the Charing Cross Streetscape Upgrade Traffic Study dated 19 November 2020 and accompanying electronic SIDRA files, both prepared by GHD.

[1]: Base model has been adapted from the GHD model as reported on in their Charing Cross Streetscape Upgrade Traffic Study dated 19 November 2020

2.0 Existing Conditions

The SIDRA analysis has included the following six intersections in a network arrangement, being the intersections surrounding and included in the Charing Cross Street Upgrade works:

- Bronte Road, Carrington Road and Victoria Street (signalised)
- Carrington Road, Darley Road and Macpherson Street (signalised)
- Macpherson Street and Albion Street (unsignalised roundabout)
- Albion Street and Bronte Road (unsignalised)
- Bronte Road and Leichhardt Street (unsignalised roundabout)
- Leichhardt Street and Macpherson Street (unsignalised roundabout)

Figure 1 below is an aerial image of the above existing intersections in order to demonstrate their spatial relationship.

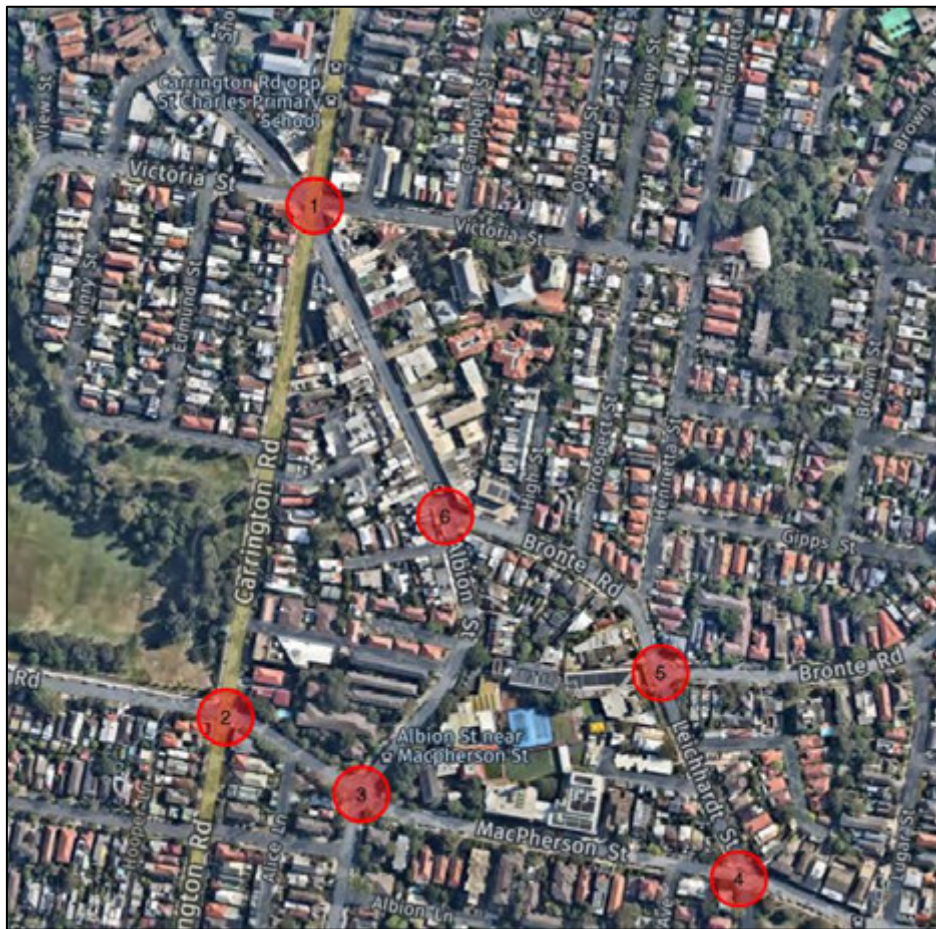


Figure 1 – Aerial Image of Intersection Network, source: Nearmap image dated 3/10/2023

Whilst the SIDRA assessment includes the above-mentioned intersections, the majority of the Streetscape Upgrade design works are associated with the signalised intersection of Bronte Road, Carrington Road and Victoria Street and within Bronte Road (to the south of Victoria Street).

The existing layout of the intersection of Bronte Road, Carrington Road and Victoria Street includes six two-way approaches with signalised pedestrian crossings provided on each approach. The length of the kerb-side lanes on approach to and departure from the intersection depend on the time of day due to the varying sections of 'No Stopping' and 'No Parking' restrictions that apply during the morning peak periods, the afternoon peak periods and on weekends (this has been reflected in the prepared SIDRA analysis). The intersection provides an existing left-turn slip lane between Bronte Road (south) and Carrington Road (south), facilitating filtering left turn movements between Bronte Road (south) and Carrington Road (south) at any time with care.

An aerial image of the existing signalised intersection of Bronte Road, Carrington Road and Victoria Street is provided as Figure 2.



Figure 2 – Aerial Image of Intersection of Bronte Road, Carrington Road and Victoria Street, source: Nearmap image dated 3/10/2023

The intersection currently provides right turn restrictions on the Victoria Street (west), Carrington Road (south), Bronte Road (south) and Carrington Road (north) depending on the time of day.

Figure 3 is taken from the Charing Cross Streetscape Upgrade Traffic Study prepared by GHD, demonstrating the turning restrictions that apply at the intersection of Bronte Road, Carrington Road and Victoria Street at any given time.

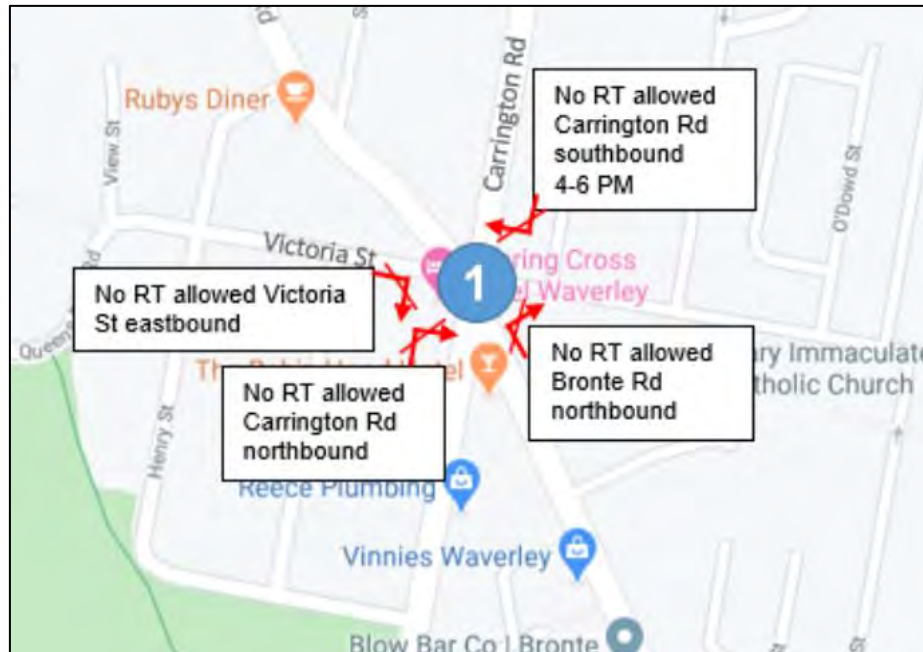


Figure 3 - Turning Restrictions at the Intersection of Bronte Rd, Carrington Rd and Victoria St, source: GHD

Bronte Road, to the south of Victoria Street, currently provides an approximately 12.8m wide pavement facilitating one through lane of traffic in each direction in conjunction to parallel parking permitted along both kerb alignments (the extent of which varying dependent on the time and day). Pedestrian footpaths are provided along both sides of Bronte Road. An existing marked pedestrian crossing is provided across Bronte Road to the north of Albion Street.

An aerial image of a section of Bronte Road, between Victoria Street and Albion Street, is provided as Figure 4.



Figure 4 - Aerial Image of Bronte Road, source: Nearmap image dated 3/10/2023

3.0 Proposed Works

A detailed design plan for the upgrade works associated with the intersection of Bronte Road, Carrington Road and Victoria Street has been developed by TTW, based primarily on the recommendations provided in the Charing Cross Streetscape Upgrade Traffic Study prepared by GHD. The recommendations relevant to the intersection include:

- Removal of the left turn slip lane from Bronte Road (south) into Carrington Road (south)
- Kerb extensions for improved pedestrian crossing facility, notably providing a kerb extension at the Victoria Street (east departure)
- Realignment of pedestrian crossings at Bronte Road and Carrington Road to reduce road crossing length

The proposed intersection design, incorporating the above recommendations is shown below as Figure 5.

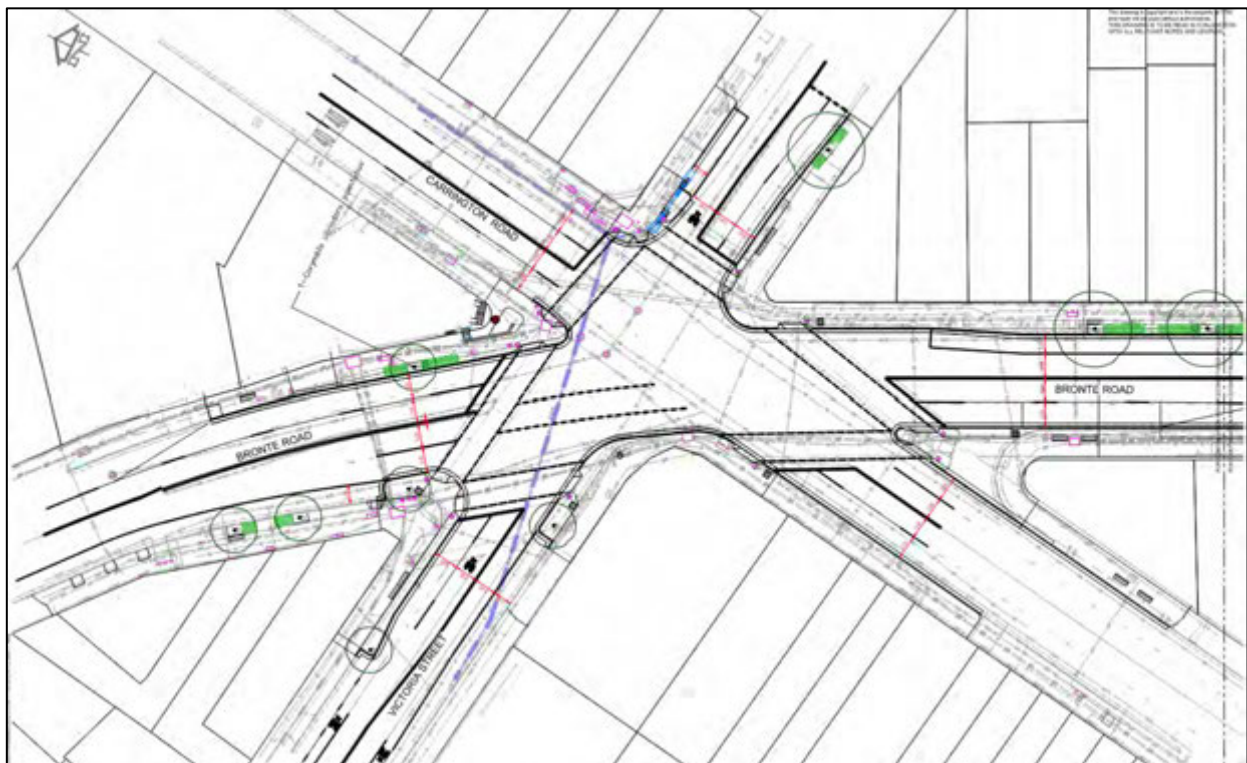


Figure 5 – Proposed Intersection Design, prepared by TTW

The Charing Cross Streetscape Upgrade Traffic Study also provided recommendations with respect to pedestrian infrastructure and public domain to improve pedestrian amenity and connectivity, these recommendations include the following:

- Introduce a new raised mid-block pedestrian crossing across Bronte Road near the pedestrian laneway
- Upgrade the existing pedestrian crossing across Bronte Road to the north of Albion Street to provide a raised crossing
- Introduce a 40m/h high pedestrian activity speed limit within Bronte Road in between the two above mentioned recommended raised pedestrian crossings
- Provide marked parallel parking lanes on both sides of Bronte Road where parking restrictions do not exist

Figures 6 and 7 overleaf indicate the detailed design plans for the public domain works that have been proposed within Bronte Road in accordance with the above GHD recommendations.

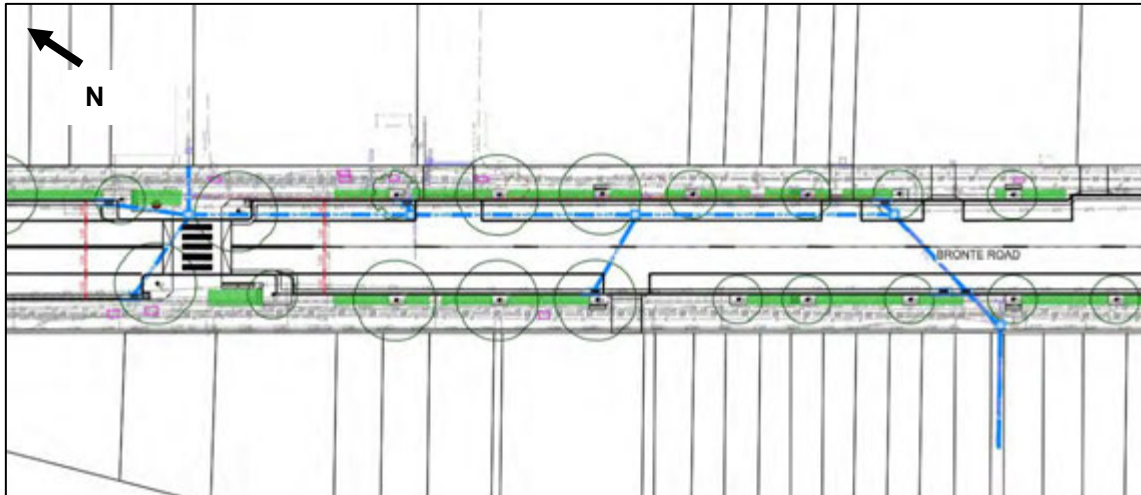


Figure 6 - Proposed Bronte Road Public Domain Works plans, prepared by TTW

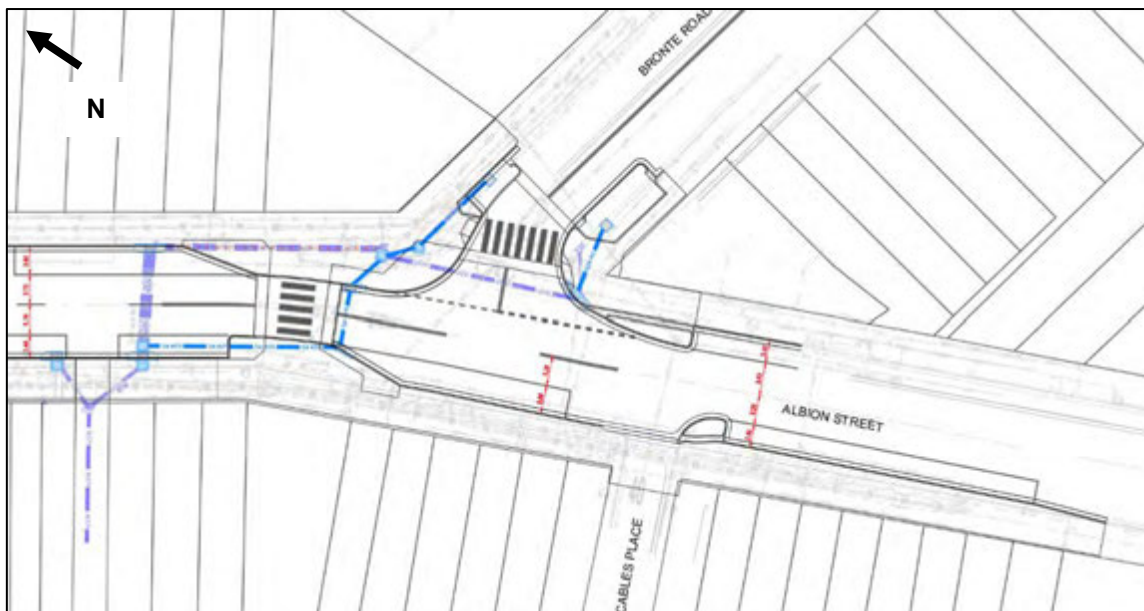


Figure 7 - Proposed Bronte Road Public Domain Works plans, prepared by TTW

Figures 6 and 7 indicate that two new pedestrian crossings are to be provided, being one raised mid-block crossing across Bronte Road and one across Bronte Road to the east of Albion Street. The existing pedestrian crossing across Bronte Road to the north of Albion Street is proposed to be upgraded to a raised pedestrian crossing.

4.0 SIDRA Modelling

4.1 Assumptions

The SIDRA analysis includes, and has been based upon the following information and assumptions:

- Two network models have been prepared. A Base model has been prepared, representing the application of 2030 traffic volumes to the subject intersection network if no changes are made to the existing layout and infrastructure. A Proposed model has been prepared, which applies the 2030 traffic volumes to the proposed Charing Cross Streetscape Upgrade design works as presented within Section 4.0 of this report.
- Both models utilise the traffic volume data as presented within the GHD Charing Cross Streetscape Upgrade Traffic Study, being based upon traffic surveys that occurred on the 22nd and 25th of July 2020.
- The following peak hours were determined from the 2020 traffic volume surveys mentioned above:
 - AM Peak: 7:45 – 8:45am;
 - PM Peak: 4:45 – 5:45pm; and
 - SAT Peak: 12:15 – 1:15pm.
- In order to achieve a 2030 traffic scenario, a total 5% growth rate has applied to all turning movements, in accordance with the methodology used in the GHD report and models.
- The network models utilise a Network User Given Cycle Time, as existing SCATs data for the intersections has not been obtained.
- Pedestrian volumes have been input into the model which have been based upon observations undertaken in the area for the purposes of the Streetscape Upgrade project.
- The above mentioned 5% total growth factor has also been applied to the existing observed pedestrian volumes in order to project the approximate 2030 pedestrian volumes.
- Therefore, the following pedestrian volumes have been input into the Base and Proposed models on all approaches to the intersection of Bronte Road, Carrington Road and Victoria Street as well as all other pedestrian crossings (existing and proposed) within the road network:
 - AM Peak: 158 ped/h;
 - PM Peak: 105 ped/h;
 - SAT Peak: 105 ped/h.

4.2 Base Model

4.2.1 Intersection Layout

A 2030 Base model has been prepared in order to capture the operation of the road network if no changes are made to the existing layout or infrastructure of the network.

Figures 8 – 10 overleaf indicate the existing layout of the intersection of Bronte Road, Carrington Road and Victoria Street during the AM, PM and Saturday peak hours as modelled in SIDRA, as the majority of the proposed design alterations are associated with this intersection.

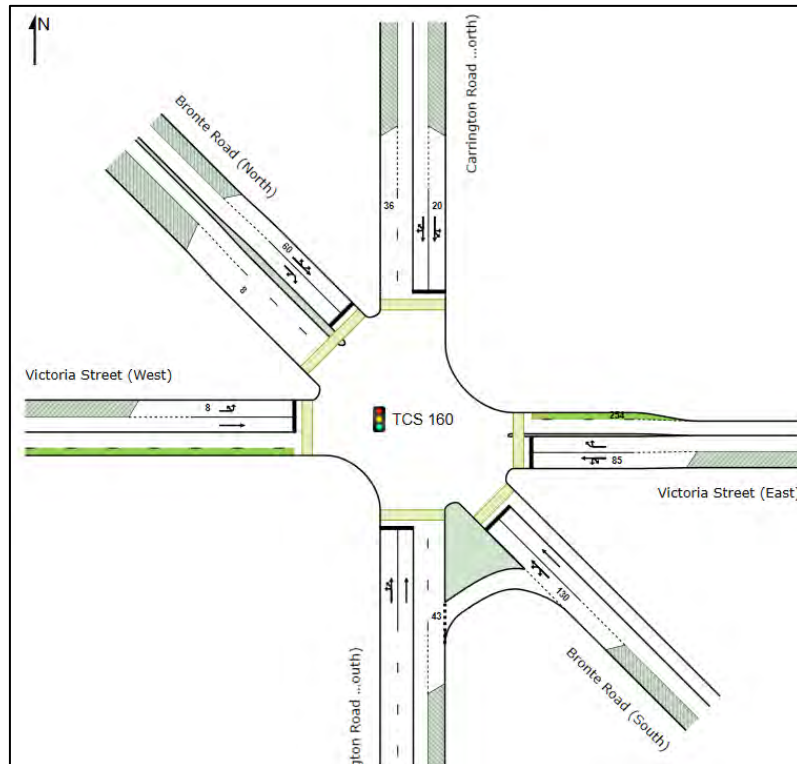


Figure 8 - AM Peak Base Intersection Layout

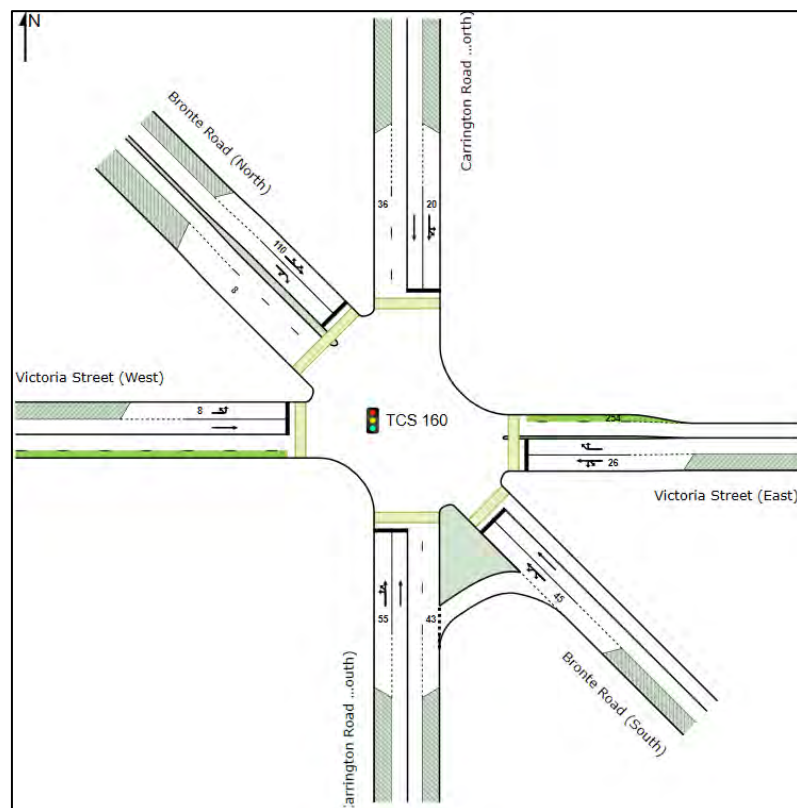


Figure 9 - PM Peak Base Intersection Layout

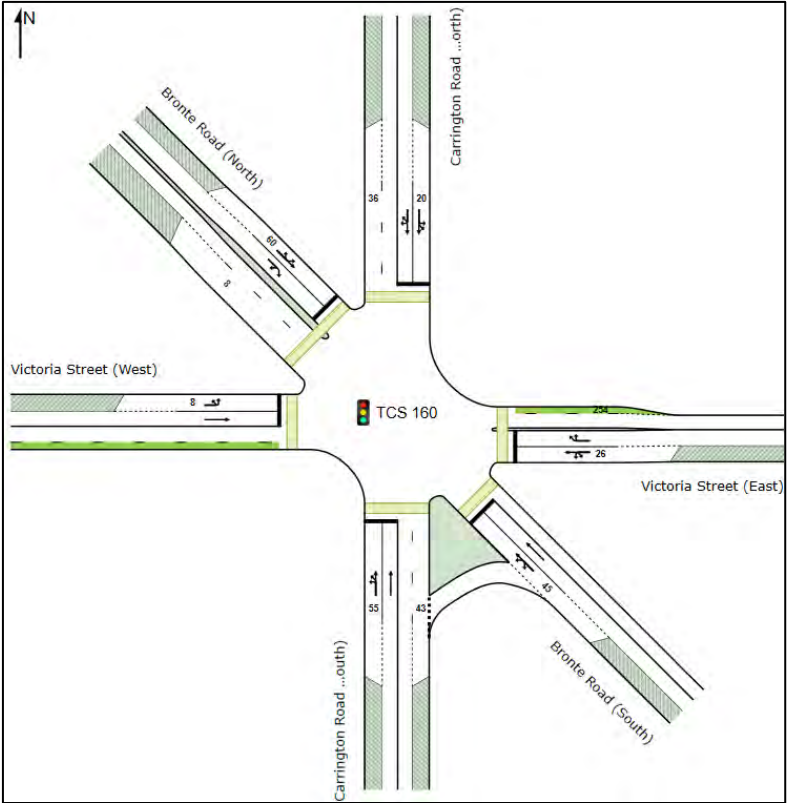


Figure 10 - SAT Peak Base Intersection Layout

4.2.2 Intersection Performance

Table 1 overleaf summarises the operation and performance of the Base network model. Further detailed SIDRA results are included in Appendix A.

Table 1: Base Network Intersection Performance

Data for unsignalised intersections is taken from the movement with the worst delay

LOS = Level of Service

	AM Peak (7:45 – 8:45am)				PM Peak (4:45 – 5:45pm)				SAT Peak (12:15 – 1:15pm)			
Intersection	Degree of Sat.	Average Delay (sec)	95% Queue Length (veh)	LOS	Degree of Sat.	Average Delay (sec)	95% Queue Length (veh)	LOS	Degree of Sat.	Average Delay (sec)	95% Queue Length (veh)	LOS
Bronte / Carrington / Victoria	1.117	105.4	74.8	F	1.292	138.3	83.3	F	1.296	140.6	79.1	F
Carrington / Macpherson	1.400	183.8	69.2	F	1.134	136.8	56.5	F	1.087	105.5	48.6	F
Albion / Macpherson	1.146	149.9	70.1	F	0.710	14.9	6.8	B	0.882	25.1	16.9	B
Macpherson / Leichhardt	0.896	33.3	18.7	C	0.945	33.6	28.8	C	0.943	32.9	28.7	C
Bronte / Leichhardt	0.600	10.8	6.1	A	0.712	15.6	7.6	B	0.708	17.5	7.5	B
Bronte / Albion	0.835	27.8	6.3	B	0.458	17.6	3.9	B	0.534	19.4	6.2	B

The results in Table 1, in conjunction to the SIDRA Movement Summaries provided in Appendix A, indicate the following with respect to the operation of the Base 2030 network:

- The intersections of Bronte Road, Carrington Road and Victoria Street, and Carrington Road and Macpherson Street are projected to operate with a LOS 'F' during the morning, afternoon and Saturday peak hours if no changes occur to the road network.
- The Saturday peak hour experiences the greatest delay at the intersection of Bronte Road, Carrington Road and Victoria Street. It is estimated that this may be attributed to the layout of the intersection during the Saturday peak period allowing for the greatest amount of parking in the kerb-side lanes as opposed to vehicle queueing space on approach and departure to and from the intersection.

4.3 Proposed Model

4.3.1 Intersection Layout

A 2030 Proposed model has been prepared in order to determine the operation of the road network incorporating the proposed Streetscape Upgrade design alterations as presented in Section 3.0.

Figures 11 – 13 below and overleaf indicate the proposed layout of the intersection of Bronte Road, Carrington Road and Victoria Street during each peak period as modelled in SIDRA, as the majority of the proposed design alterations are associated with this intersection.

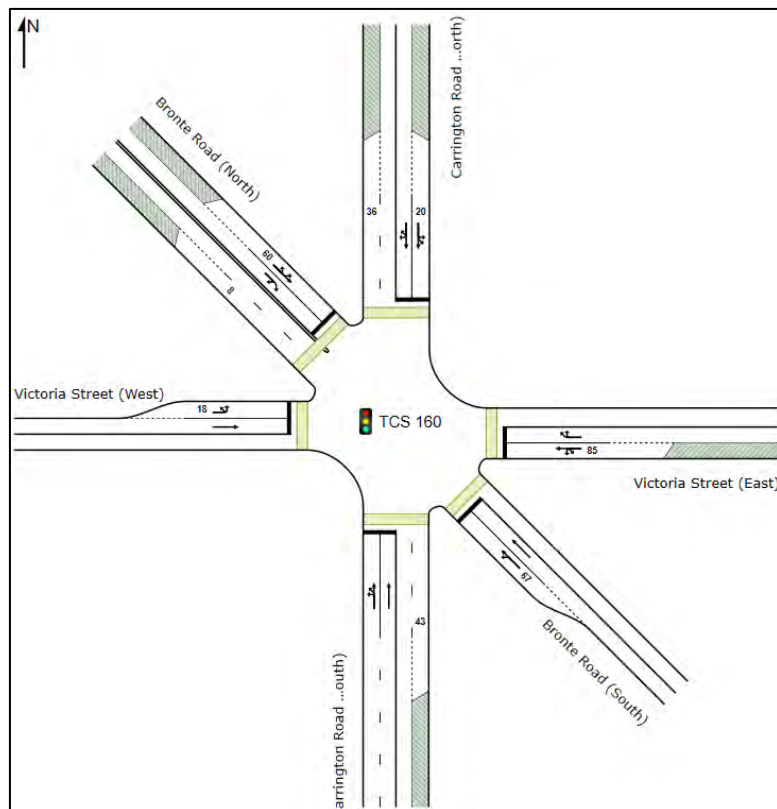


Figure 11 - AM Peak Proposed Intersection Layout

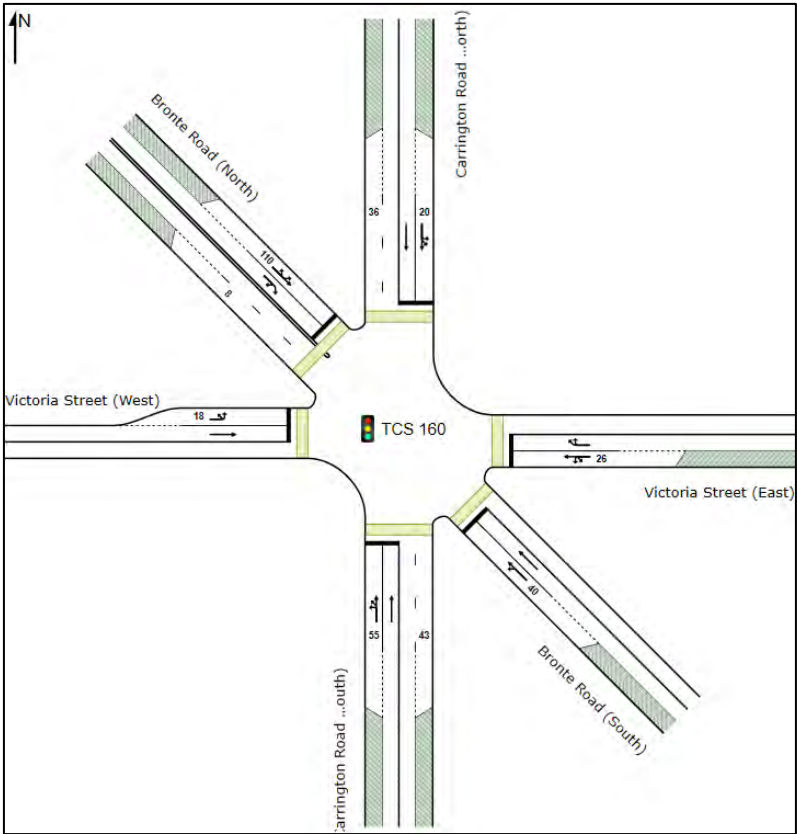


Figure 12 - PM Peak Proposed Intersection Layout

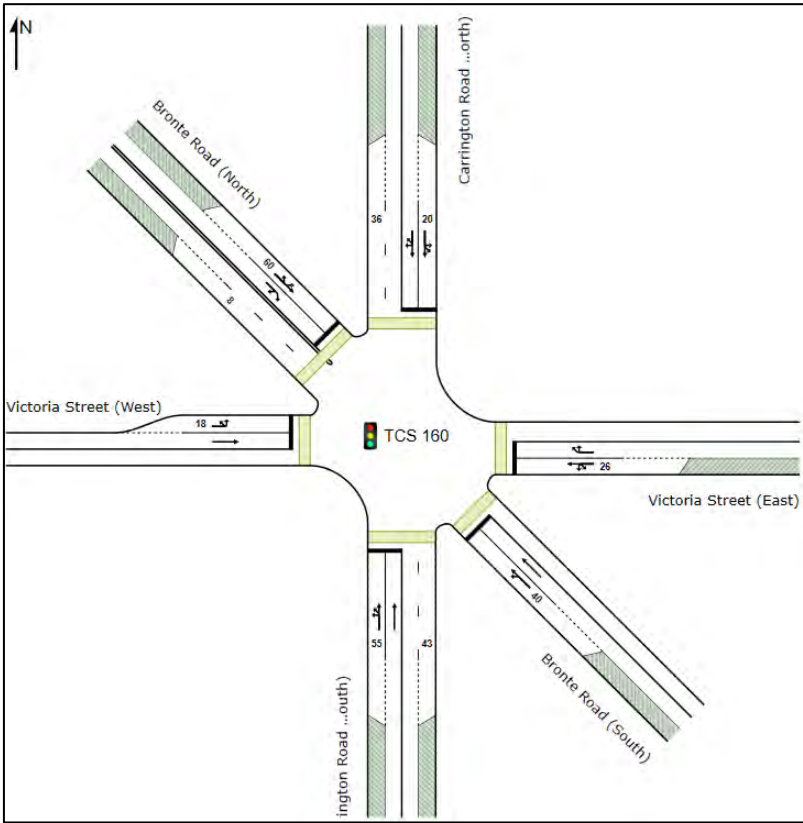


Figure 13 - SAT Peak Proposed Intersection Layout

4.3.2 Trip Redistribution

The layout of the intersection of Bronte Road, Carrington Road and Victoria Street with the introduction of the Streetscape Upgrade works involves the removal of the left turn slip lane from Bronte Road (south) to Carrington Road (south). With the removal of the slip lane, the left turn from Bronte Road (south) to Carrington Road (south) is accordingly prohibited. Therefore, the existing left turn movements between Bronte Road (south) and Carrington Road (south) are required to be redistributed throughout the rest of the road network.

The volume of trips required to be redistributed in each peak hour are as follows:

- AM peak – 22 trips
- PM peak – 24 trips
- SAT peak – 40 trips

The Traffic Study prepared by GHD assumed that vehicles currently turning left between Bronte Road (south) and Carrington Road (south) are most likely to undertake a left turn from Bronte Road (south) to Victoria Street, a left turn to Edmund Street, a left turn to John Street and thence a right or left turn to Carrington Road once this movement is prohibited. Once travelling north or southbound on Carrington Road, it has been assumed that the redistributed volumes are assigned based upon the existing traffic movements within the rest of the road network, particularly the existing turning volumes at the northern approach of the intersection of Carrington Road, Darley Road and Macpherson Street. Accordingly, the morning, afternoon and Saturday peak hour trip distributions have been assigned as shown in Figure 14 below.



Figure 14 - Redistributed Traffic, prepared by TTW adopted from Nearmap

4.3.3 Intersection Performance

Table 2 overleaf displays the operation and performance of the Proposed network model, as well as the Base model results for ease of comparison between the two models. Further detailed SIDRA results are included in Appendix A.

Table 2: Network Intersection Performance (Proposed and Base)

Data for unsignalised intersections is taken from the movement with the worst delay

Intersection	Model	AM Peak (7:45am – 8:45am)				PM Peak (4:45pm – 5:45pm)				SAT Peak (12:15pm – 1:15pm)			
		Degree of Sat.	Average Delay (sec)	95% Queue Length (veh)	LOS	Degree of Sat.	Average Delay (sec)	95% Queue Length (veh)	LOS	Degree of Sat.	Average Delay (sec)	95% Queue Length (veh)	LOS
Bronte / Carrington / Victoria	Base	1.117	105.4	74.8	F	1.292	138.3	83.3	F	1.296	140.6	79.1	F
	Proposed	1.090	101.5	71.0	F	1.272	136.0	81.4	F	1.155	122.5	62.2	F
Carrington / Macpherson	Base	1.400	183.8	69.2	F	1.134	136.8	56.5	F	1.087	105.5	48.6	F
	Proposed	1.155	150.3	60.5	F	1.168	146.1	60.3	F	1.128	128.8	60.8	F
Albion / Macpherson	Base	1.146	149.9	70.1	F	0.710	14.9	6.8	B	0.882	25.1	16.9	B
	Proposed	1.147	150.5	70.3	F	0.709	14.9	6.8	B	0.894	26.2	17.7	B
Macpherson / Leichhardt	Base	0.896	33.3	18.7	C	0.945	33.6	28.8	C	0.943	32.9	28.7	C
	Proposed	0.893	33.0	18.5	C	0.941	32.6	28.1	C	0.941	32.4	28.3	C
Bronte / Leichhardt	Base	0.600	10.8	6.1	A	0.712	15.6	7.6	B	0.708	17.5	7.5	B
	Proposed	0.603	10.8	6.2	A	0.713	15.5	7.6	B	0.696	17.1	7.2	B
Bronte / Albion	Base	0.835	27.8	6.3	B	0.458	17.6	3.9	B	0.534	19.4	6.2	B
	Proposed	0.786	25.8	5.9	B	0.454	17.5	3.9	B	0.614	20.2	6.7	B

The results in Table 2, in conjunction to the SIDRA Movement Summaries provided in Appendix A, indicate the following with respect to the projected operation of the Proposed 2030 network, in relation to the operation of the Base network:

- The LOS for all intersections with the introduction of the Streetscape Upgrade works is projected to remain the same, when compared to the Base network results.
- The operation of the intersection of Bronte Road, Carrington Road and Victoria Street with the introduction of the Streetscape Upgrade works is projected to improve during all peak hours, as the degree of saturation, average delay and 95th percentile queue length is projected to decrease, when compared to the Base network results.
- The operation of the remaining intersections with the introduction of Streetscape Upgrade works is projected to remain the same or be altered by a negligible amount, when compared to the Base network results.

5.0 Summary of Results and Impacts

5.1 Traffic Impacts

Table 2 indicates that the overall operation of the subject road network is not projected to be altered to any measurable extent. To this end, the LOS of each intersection is projected to remain the same in the Base and Proposed models.

The result of the SIDRA modelling also indicates that the Streetscape Upgrade works involving design alterations to the intersection of Bronte Road, Carrington Road and Victoria Street, are projected to improve the operation of this intersection during all peak hours.

Notwithstanding, it is acknowledged that the intersections incur long queues throughout the precinct during the identified peak hours, particularly at the following intersections:

- Bronte Road, Carrington Road and Victoria Street
- Carrington Road and Macpherson Road
- Bronte Road and Albion Street

Whilst the proposed works are projected to decrease queue lengths in some instances, it considered that reducing queue lengths could further be remedied by imposing additional 'No Stopping' restrictions during peak hours on the approaches to these intersections.

5.2 Pedestrian Impacts

As outlined in Section 4.0 of this report, the Charing Cross Streetscape Upgrade include works largely aimed at improving the amenity, safety and connectivity for pedestrians travelling along Bronte Road and at the intersection of Bronte Road, Carrington Road and Victoria Street.

As a result of the Streetscape Upgrade Design, the pedestrian crossing distances at multiple approaches at the intersection of Bronte Road, Carrington Road and have been reduced, thereby decreasing the time required for pedestrians to cross the intersection and improving the safety of the crossing. Table 3 below indicates the crossing distances of the existing and proposed intersection.

Table 3: Pedestrian Crossing Distance Impacts

Approach	Existing Crossing Distance (m)	Streetscape Upgrade Design Crossing Distance (m)
Bronte Rd (north)	25	18
Bronte Rd (south)	20	20
Carrington Rd (north)	12.5	12.5
Carrington Rd (south)	21	21
Victoria St (east)	13	10
Victoria St (west)	19	14

As shown in Table 3, the proposed design results in a reduced pedestrian crossing distance for the Bronte Road (north) approach and both Victoria Street approaches, by up to 7m.

In addition to the above reported reduction in crossing distances at the intersection of Bronte Road, Carrington Road and Victoria Street, the pedestrian storage capacity between the Bronte Road (South) and Carrington Road (south) has been significantly increased through the removal of the slip lane, further improving the amenity and safety of pedestrians at the intersection.

Further, it is envisioned that, whilst they have little impact on the operation of the road network with respect to vehicular traffic, the introduction of the raised pedestrian crossings, including the mid-block crossing across Bronte Road and the additional pedestrian crossings provided at the junction of Bronte Road and Albion Street, will significantly improve pedestrian connectivity between both sides of Bronte Road and therefore promote pedestrian safety and amenity throughout the precinct.

6.0 Conclusion

This report has been prepared in order to provide an assessment of the impacts of the proposed Charing Cross Streetscape Upgrade Works on the vehicular and pedestrian traffic and the operation of the surrounding road network through SIDRA analysis.

The results of the SIDRA analysis indicate that the intersection of Bronte Road, Carrington Road and Victoria Street is projected to experience reductions in the degree of saturation, average delay and 95th percentile queue lengths during all peak periods, suggesting minor improvements to operation with the upgrade works incorporated. The proposed Streetscape Upgrade works are however projected to improve pedestrian amenity, connectivity and safety of the precinct. Therefore, the Streetscape Upgrade works are anticipated to result in minor impacts to the operation of the surrounding road network, when compared to the Base operation of the network (if no changes are made).

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Appendix A

SIDRA MOVEMENT SUMMARIES

MOVEMENT SUMMARY

 Site: TCS 160 [Carrington Rd & Bronte Rd & Victoria St - AM
(Site Folder: AM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101
[2030_AM_Scenario
0_Carrington Rd between
Bronte Rd & Macpherson St -
(120 cycle time) (Network
Folder: General)]

AM peak - existing

Site Category: Future Conditions 1

Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 120 seconds (Network User-Given Cycle Time)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]	[Total HV]											
			veh/h	%	veh/h	%	v/c	sec		[Veh. veh	Dist]				km/h
South: Carrington Road (South)															
1	L2	All MCs	29	3.6	25	3.6	0.342	29.2	LOS C	8.1	56.6	0.63	0.68	0.63	30.3
1a	L1	All MCs	229	3.7	196	3.7	0.342	26.3	LOS B	8.1	56.6	0.63	0.68	0.63	35.2
2	T1	All MCs	904	2.8	770	2.8	* 1.117	127.3	LOS F	74.8	535.6	0.99	1.63	1.83	15.6
Approach			1163	3.0	991	3.0	1.117	104.9	LOS F	74.8	535.6	0.91	1.41	1.56	17.9
SouthEast: Bronte Road (South)															
21b	L3	All MCs	23	0.0	22	0.0	0.223	27.7	LOS B	3.4	24.2	0.87	0.81	0.87	15.2
21a	L1	All MCs	55	0.0	53	0.0	0.223	50.8	LOS D	3.4	24.2	0.87	0.81	0.87	20.8
22	T1	All MCs	405	12.2	393	12.4	* 1.114	172.8	LOS F	40.8	314.1	1.00	1.72	2.04	11.8
Approach			483	10.2	468	10.4	1.114	152.0	LOS F	40.8	314.1	0.98	1.57	1.85	12.3
East: Victoria Street (East)															
4b	L3	All MCs	61	0.0	61	0.0	0.883	68.1	LOS E	20.0	139.0	1.00	1.01	1.22	13.6
4	L2	All MCs	123	1.7	123	1.7	0.883	64.4	LOS E	20.0	139.0	1.00	1.01	1.22	13.6
5	T1	All MCs	126	0.0	126	0.0	* 0.883	58.5	LOS E	20.0	139.0	1.00	1.01	1.22	18.4
6a	R1	All MCs	37	2.9	37	2.9	0.745	66.2	LOS E	6.3	44.7	1.00	0.91	1.19	23.2
6	R2	All MCs	63	1.7	63	1.7	0.745	65.7	LOS E	6.3	44.7	1.00	0.91	1.19	21.5
Approach			411	1.0	411	1.0	0.883	63.5	LOS E	20.0	139.0	1.00	0.99	1.21	17.6
North: Carrington Road (North)															
7	L2	All MCs	9	11.1	9	11.1	0.502	73.6	LOS F	7.3	54.2	0.83	0.76	0.83	28.8
7a	L1	All MCs	151	8.4	151	8.4	0.502	69.0	LOS E	7.3	54.2	0.83	0.76	0.83	22.7
8	T1	All MCs	468	3.4	468	3.4	1.055	159.8	LOS F	45.3	324.2	1.00	1.56	1.76	9.6
9	R2	All MCs	6	0.0	6	0.0	1.055	221.8	LOS F	45.3	324.2	1.00	1.56	1.76	12.6
9b	R3	All MCs	1	0.0	1	0.0	1.055	222.6	LOS F	45.3	324.2	1.00	1.56	1.76	16.7
Approach			636	4.6	636	4.6	1.055	137.8	LOS F	45.3	324.2	0.96	1.36	1.53	9.1
NorthWest: Bronte Road (North)															
27b	L3	All MCs	57	0.0	57	0.0	0.789	68.5	LOS E	21.5	162.3	0.98	0.91	1.06	28.5
27a	L1	All MCs	20	5.3	20	5.3	0.789	60.3	LOS E	21.5	162.3	0.98	0.91	1.06	27.3
28	T1	All MCs	300	14.4	300	14.4	0.789	56.9	LOS E	21.5	162.3	0.98	0.91	1.06	21.8
29a	R1	All MCs	114	3.7	114	3.7	0.743	77.4	LOS F	7.1	50.8	1.00	0.96	1.15	17.8
29b	R3	All MCs	4	0.0	4	0.0	* 0.743	79.6	LOS F	7.1	50.8	1.00	0.96	1.15	21.1
Approach			495	9.8	495	9.8	0.789	63.2	LOS E	21.5	162.3	0.99	0.92	1.08	19.4
West: Victoria Street (West)															
10b	L3	All MCs	27	0.0	27	0.0	0.584	91.9	LOS F	10.0	70.6	0.96	0.81	0.96	23.7
10	L2	All MCs	159	0.7	159	0.7	0.584	88.3	LOS F	10.0	70.6	0.96	0.81	0.96	22.1
11	T1	All MCs	25	0.0	25	0.0	0.066	76.3	LOS F	1.2	8.4	0.84	0.61	0.84	23.4
Approach			212	0.5	212	0.5	0.584	87.3	LOS F	10.0	70.6	0.94	0.79	0.94	16.5

All Vehicles	3399	4.9	3211	5.2	1.117	105.4	LOS F	74.8	535.6	0.96	1.25	1.44	14.9
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Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance											
Mov ID	Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	sec		[Ped ped	Dist] m			sec	m	m/sec
South: Carrington Road (South)											
P1	Full	166	54.5	LOS E	0.5	0.5	0.96	0.96	69.9	20.0	0.29
SouthEast: Bronte Road (South)											
P5	Full	166	54.5	LOS E	0.5	0.5	0.96	0.96	69.9	20.0	0.29
East: Victoria Street (East)											
P2	Full	166	54.5	LOS E	0.5	0.5	0.96	0.96	69.9	20.0	0.29
North: Carrington Road (North)											
P3	Full	166	54.5	LOS E	0.5	0.5	0.96	0.96	69.9	20.0	0.29
NorthWest: Bronte Road (North)											
P7	Full	166	54.5	LOS E	0.5	0.5	0.96	0.96	69.9	20.0	0.29
West: Victoria Street (West)											
P4	Full	166	54.5	LOS E	0.5	0.5	0.96	0.96	69.9	20.0	0.29
All Pedestrians		998	54.5	LOS E	0.5	0.5	0.96	0.96	69.9	20.0	0.29

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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Project: P:\2023\2312\231268\Reports\TTW\Traffic\Modelling\231025 - Charing Cross SIDRA Files\231012 Charing Cross - Base (2030).sip9

Pedestrian Movement Performance											
Mov ID	Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	sec		[Ped	Dist]			sec	m	m/sec
South: Carrington Road (South)											

P1 Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
East: Machpherson Street										
P2 Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
North: Carrington Road (North)										
P3 Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
West: Darley Road										
P4 Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
All Pedestrians	211	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 Site: Site 3 [Albion St & Macpherson St - AM (Site Folder: AM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

■ Network: N101
[2030_AM_Scenario
0_Carrington Rd between
Bronte Rd & Macpherson St -
(120 cycle time) (Network
Folder: General)]

AM peak - existing
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]		[Total HV]					[Veh. veh	Dist]				
			veh/h	%	veh/h	%	v/c	sec			m				km/h
South: Albion Street															
1	L2	All MCs	52	2.0	52	2.0	0.964	37.6	LOS C	24.5	180.9	1.00	1.78	2.67	19.1
2	T1	All MCs	355	11.0	355	11.0	0.964	38.2	LOS C	24.5	180.9	1.00	1.78	2.67	19.1
3	R2	All MCs	226	2.8	226	2.8	0.964	41.0	LOS C	24.5	180.9	1.00	1.78	2.67	19.1
3u	U	All MCs	2	0.0	2	0.0	0.964	42.3	LOS C	24.5	180.9	1.00	1.78	2.67	26.6
Approach			635	7.3	635	7.3	0.964	39.1	LOS C	24.5	180.9	1.00	1.78	2.67	19.1
East: Macpherson Street (East)															
4	L2	All MCs	241	1.7	239	1.7	1.146	145.2	LOS F	70.1	492.6	1.00	4.40	7.50	11.8
5	T1	All MCs	356	0.6	353	0.6	1.146	145.0	LOS F	70.1	492.6	1.00	4.40	7.50	6.8
6	R2	All MCs	109	11.5	109	11.6	1.146	149.1	LOS F	70.1	492.6	1.00	4.40	7.50	6.8
6u	U	All MCs	32	0.0	31	0.0	1.146	149.9	LOS F	70.1	492.6	1.00	4.40	7.50	6.8
Approach			738	2.6	732	2.6	1.146	145.9	LOS F	70.1	492.6	1.00	4.40	7.50	8.6
North: Albion Street (North)															
7	L2	All MCs	61	19.0	61	19.0	0.532	7.0	LOS A	4.9	37.3	0.63	0.69	0.70	35.6
8	T1	All MCs	266	12.3	265	12.3	0.532	6.5	LOS A	4.9	37.3	0.63	0.69	0.70	41.2
9	R2	All MCs	75	2.8	74	2.8	0.532	9.7	LOS A	4.9	37.3	0.63	0.69	0.70	35.6
9u	U	All MCs	19	0.0	19	0.0	0.532	11.2	LOS A	4.9	37.3	0.63	0.69	0.70	35.6
Approach			421	11.0	419	11.0	0.532	7.4	LOS A	4.9	37.3	0.63	0.69	0.70	39.9
West: Macpherson Street (West)															
10	L2	All MCs	81	1.3	69	1.3	0.531	12.1	LOS A	3.8	27.3	0.77	0.94	0.92	21.0
11	T1	All MCs	219	2.9	187	3.0	0.531	12.2	LOS A	3.8	27.3	0.77	0.94	0.92	21.0
12	R2	All MCs	34	0.0	29	0.0	0.531	15.3	LOS B	3.8	27.3	0.77	0.94	0.92	34.2
12u	U	All MCs	6	0.0	5	0.0	0.531	16.9	LOS B	3.8	27.3	0.77	0.94	0.92	21.0
Approach			340	2.2	290	2.2	0.531	12.6	LOS A	3.8	27.3	0.77	0.94	0.92	23.5
All Vehicles			2134	5.6	2076	5.7	1.146	66.7	LOS E	70.1	492.6	0.89	2.36	3.73	14.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akcelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

 Site: 4 [Macpherson St & Leichhardt St - AM (Site Folder: AM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

■ Network: N101
[2030_AM_Scenario
0_Carrington Rd between
Bronte Rd & Macpherson St -
(120 cycle time) (Network
Folder: General)]

AM peak - existing
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back	Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]		[Total HV]					[Veh. veh	Dist]				km/h
			veh/h	%	veh/h	%	v/c	sec			m				
South: Leichhardt Street (South)															
1	L2	All MCs	54	0.0	54	0.0	0.571	24.2	LOS B	5.2	36.5	1.00	1.03	1.38	22.3
2	T1	All MCs	149	1.4	149	1.4	0.571	24.3	LOS B	5.2	36.5	1.00	1.03	1.38	22.3
3	R2	All MCs	6	0.0	6	0.0	0.571	27.0	LOS B	5.2	36.5	1.00	1.03	1.38	33.8
3u	U	All MCs	1	0.0	1	0.0	0.571	28.4	LOS B	5.2	36.5	1.00	1.03	1.38	29.4
Approach			211	1.0	211	1.0	0.571	24.3	LOS B	5.2	36.5	1.00	1.03	1.38	22.9
East: Macpherson Street (East)															
4	L2	All MCs	4	0.0	4	0.0	0.896	27.6	LOS B	18.7	132.3	1.00	1.39	2.00	32.2
5	T1	All MCs	304	4.8	304	4.8	0.896	27.9	LOS B	18.7	132.3	1.00	1.39	2.00	28.1
6	R2	All MCs	277	3.4	277	3.4	0.896	30.7	LOS C	18.7	132.3	1.00	1.39	2.00	28.1
6u	U	All MCs	11	20.0	11	20.0	0.896	33.3	LOS C	18.7	132.3	1.00	1.39	2.00	34.9
Approach			596	4.4	596	4.4	0.896	29.3	LOS C	18.7	132.3	1.00	1.39	2.00	28.3
North: Leichhardt Street (North)															
7	L2	All MCs	325	3.6	324	3.6	0.822	14.0	LOS A	14.4	102.3	1.00	0.89	1.35	37.0
8	T1	All MCs	49	0.0	49	0.0	0.822	13.6	LOS A	14.4	102.3	1.00	0.89	1.35	32.6
9	R2	All MCs	317	1.3	315	1.3	0.822	16.6	LOS B	14.4	102.3	1.00	0.89	1.35	22.8
9u	U	All MCs	26	4.0	26	4.0	0.822	18.2	LOS B	14.4	102.3	1.00	0.89	1.35	22.8
Approach			718	2.3	714	2.4	0.822	15.3	LOS B	14.4	102.3	1.00	0.89	1.35	32.6
West: Macpherson Street (West)															
10	L2	All MCs	251	3.8	234	4.0	0.728	16.1	LOS B	9.6	69.4	0.99	0.98	1.41	28.9
11	T1	All MCs	227	6.0	212	6.2	0.728	16.2	LOS B	9.6	69.4	0.99	0.98	1.41	38.3
12	R2	All MCs	7	0.0	7	0.0	0.728	18.7	LOS B	9.6	69.4	0.99	0.98	1.41	34.3
12u	U	All MCs	57	1.9	53	1.8	0.728	20.2	LOS B	9.6	69.4	0.99	0.98	1.41	28.9
Approach			542	4.5	505	4.6	0.728	16.6	LOS B	9.6	69.4	0.99	0.98	1.41	34.5
All Vehicles			2066	3.4	2026	3.4	0.896	20.7	LOS B	18.7	132.3	1.00	1.07	1.56	30.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

 Site: Site 5 [Bronte Rd & Leichhardt St - AM (Site Folder: AM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

■ Network: N101
[2030_AM_Scenario
0_Carrington Rd between
Bronte Rd & Macpherson St -
(120 cycle time) (Network
Folder: General)]

AM peak - existing
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back	Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
South: Leichhardt Street (South)															
2	T1	All MCs	185	2.3	181	2.3	0.600	4.2	LOS A	6.1	43.6	0.59	0.55	0.59	28.3
3	R2	All MCs	487	3.0	476	3.1	0.600	6.8	LOS A	6.1	43.6	0.59	0.55	0.59	33.5
3u	U	All MCs	49	2.1	48	2.2	0.600	7.9	LOS A	6.1	43.6	0.59	0.55	0.59	28.3
Approach			722	2.8	705	2.8	0.600	6.2	LOS A	6.1	43.6	0.59	0.55	0.59	32.6
East: Bronte Road (East)															
4	L2	All MCs	518	2.0	518	2.0	0.585	5.2	LOS A	4.8	34.1	0.60	0.58	0.60	32.8
6	R2	All MCs	112	0.0	112	0.0	0.585	6.9	LOS A	4.8	34.1	0.60	0.58	0.60	32.8
6u	U	All MCs	15	0.0	15	0.0	0.585	8.0	LOS A	4.8	34.1	0.60	0.58	0.60	37.8
Approach			644	1.6	644	1.6	0.585	5.6	LOS A	4.8	34.1	0.60	0.58	0.60	33.0
North: Bronte Road (North)															
7	L2	All MCs	143	3.7	140	3.7	0.412	8.0	LOS A	2.8	19.9	0.77	0.70	0.78	33.5
8	T1	All MCs	151	3.5	147	3.5	0.412	7.2	LOS A	2.8	19.9	0.77	0.70	0.78	29.1
9u	U	All MCs	7	0.0	7	0.0	0.412	10.8	LOS A	2.8	19.9	0.77	0.70	0.78	29.1
Approach			301	3.5	295	3.5	0.412	7.7	LOS A	2.8	19.9	0.77	0.70	0.78	31.9
All Vehicles			1667	2.5	1644	2.5	0.600	6.2	LOS A	6.1	43.6	0.63	0.59	0.63	32.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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Project: P:\2023\2312\231268\Reports\TTW\Traffic\Modelling\231025 - Charing Cross SIDRA Files\231012 Charing Cross - Base (2030).sip9

MOVEMENT SUMMARY

▼ Site: Site 6 [Bronte Rd & Albion St - AM (Site Folder: AM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

■ Network: N101
[2030_AM_Scenario
0_Carrington Rd between
Bronte Rd & Macpherson St -
(120 cycle time) (Network
Folder: General)]

AM peak - existing
Site Category: Future Conditions 1
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]		[Total HV]					[Veh. veh	Dist]				km/h
			veh/h	%	veh/h	%	v/c	sec			m				
South: Albion Street (South)															
2	T1	All MCs	340	15.8	324	16.1	0.593	6.8	LOS A	6.3	47.6	0.65	0.71	1.15	33.1
3	R2	All MCs	213	1.0	202	1.0	0.593	12.7	LOS A	6.3	47.6	0.65	0.71	1.15	33.1
Approach			553	10.1	526	10.3	0.593	9.1	NA	6.3	47.6	0.65	0.71	1.15	33.1
East: Bronte Road (East)															
4	L2	All MCs	108	4.9	107	4.9	0.835	15.7	LOS B	5.9	41.9	0.95	1.39	2.27	20.9
6	R2	All MCs	167	1.3	165	1.3	0.835	27.8	LOS B	5.9	41.9	0.95	1.39	2.27	20.9
Approach			276	2.7	272	2.7	0.835	23.1	LOS B	5.9	41.9	0.95	1.39	2.27	20.9
North: Albion Street (North)															
7	L2	All MCs	221	5.2	221	5.2	0.360	4.7	LOS A	0.0	0.0	0.00	0.23	0.00	44.9
8	T1	All MCs	301	14.3	301	14.3	0.360	0.1	LOS A	0.0	0.0	0.00	0.23	0.00	44.9
Approach			522	10.5	522	10.5	0.360	2.0	NA	0.0	0.0	0.00	0.23	0.00	44.9
All Vehicles			1351	8.7	1320	8.9	0.835	9.2	NA	6.3	47.6	0.46	0.66	0.92	33.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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Project: P:\2023\2312\231268\Reports\TTW\Traffic\Modelling\231025 - Charing Cross SIDRA Files\231012 Charing Cross - Base (2030).sip9

MOVEMENT SUMMARY

 Site: TCS 160 [Carrington Rd & Bronte Rd & Victoria St - PM
(Site Folder: PM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101
[2030_PM_Base_Carrington Rd
between Bronte Rd &
Macpherson St - Import
(Network Folder: General)]

PM peak - existing

Site Category: Future Conditions 1

Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 120 seconds (Network User-Given Cycle Time)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Carrington Road (South)															
1	L2	All MCs	27	0.0	25	0.0	0.300	50.2	LOS D	7.1	49.8	0.67	0.70	0.67	29.0
1a	L1	All MCs	185	1.7	168	1.6	0.300	46.9	LOS D	7.1	49.8	0.67	0.70	0.67	34.0
2	T1	All MCs	573	0.7	519	0.8	0.953	74.8	LOS F	35.5	250.1	0.99	1.10	1.28	25.3
Approach			785	0.9	711	0.9	0.953	67.4	LOS E	35.5	250.1	0.90	0.99	1.11	23.3
SouthEast: Bronte Road (South)															
21b	L3	All MCs	25	0.0	25	0.0	0.174	35.2	LOS C	2.3	16.4	0.87	0.72	0.87	19.4
21a	L1	All MCs	26	0.0	26	0.0	0.174	52.2	LOS D	2.3	16.4	0.87	0.72	0.87	25.2
22	T1	All MCs	273	10.8	268	11.0	* 0.868	74.6	LOS F	16.6	126.2	0.99	1.03	1.23	23.4
Approach			324	9.1	318	9.3	0.868	69.7	LOS E	16.6	126.2	0.97	0.98	1.17	20.7
East: Victoria Street (East)															
4b	L3	All MCs	101	0.0	101	0.0	0.905	100.6	LOS F	16.6	116.1	1.00	1.05	1.34	12.1
4	L2	All MCs	99	0.0	99	0.0	0.905	97.0	LOS F	16.6	116.1	1.00	1.05	1.34	12.1
5	T1	All MCs	42	0.0	42	0.0	* 0.905	90.9	LOS F	16.6	116.1	1.00	1.05	1.34	16.7
6a	R1	All MCs	33	0.0	33	0.0	0.322	78.0	LOS F	3.5	24.2	0.93	0.76	0.93	25.7
6	R2	All MCs	32	0.0	32	0.0	0.322	78.7	LOS F	3.5	24.2	0.93	0.76	0.93	24.0
Approach			306	0.0	306	0.0	0.905	93.4	LOS F	16.6	116.1	0.98	0.99	1.26	12.6
North: Carrington Road (North)															
7	L2	All MCs	11	0.0	11	0.0	1.125	227.4	LOS F	36.7	257.7	1.00	1.66	2.16	10.6
7a	L1	All MCs	313	0.7	313	0.7	1.125	221.8	LOS F	36.7	257.7	1.00	1.66	2.16	6.8
8	T1	All MCs	578	1.6	578	1.6	* 1.292	352.3	LOS F	83.3	590.2	1.00	2.40	2.82	4.3
Approach			901	1.3	901	1.3	1.292	305.6	LOS F	83.3	590.2	1.00	2.14	2.58	4.5
NorthWest: Bronte Road (North)															
27b	L3	All MCs	7	0.0	7	0.0	0.789	53.8	LOS D	25.2	187.0	0.98	0.90	1.03	29.4
27a	L1	All MCs	11	0.0	11	0.0	0.789	46.6	LOS D	25.2	187.0	0.98	0.90	1.03	28.1
28	T1	All MCs	435	8.7	435	8.7	0.789	43.2	LOS D	25.2	187.0	0.98	0.90	1.03	22.6
29a	R1	All MCs	205	1.5	205	1.5	0.919	77.4	LOS F	13.6	96.4	1.00	1.20	1.39	15.9
29b	R3	All MCs	2	0.0	2	0.0	* 0.919	79.7	LOS F	13.6	96.4	1.00	1.20	1.39	19.1
Approach			660	6.2	660	6.2	0.919	54.1	LOS D	25.2	187.0	0.99	0.99	1.14	20.2
West: Victoria Street (West)															
10b	L3	All MCs	14	0.0	14	0.0	0.319	76.3	LOS F	4.4	30.5	0.90	0.76	0.90	24.4
10	L2	All MCs	73	0.0	73	0.0	0.319	72.3	LOS F	4.4	30.5	0.90	0.76	0.90	22.8
11	T1	All MCs	49	0.0	49	0.0	0.180	65.6	LOS E	2.4	16.9	0.87	0.66	0.87	23.0
Approach			136	0.0	136	0.0	0.319	70.3	LOS E	4.4	30.5	0.89	0.72	0.89	18.4
All Vehicles			3113	2.9	3033	2.9	1.292	138.3	LOS F	83.3	590.2	0.96	1.32	1.57	11.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)


Pedestrian Movement Performance											
Mov ID	Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	sec		[Ped	Dist]			sec	m	m/sec
South: Carrington Road (South)											
P1	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
SouthEast: Bronte Road (South)											
P5	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
East: Victoria Street (East)											
P2	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
North: Carrington Road (North)											
P3	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
NorthWest: Bronte Road (North)											
P7	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
West: Victoria Street (West)											
P4	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
All Pedestrians		663	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 Site: TCS 1650 [Carrington Rd & Macpherson St - PM (Site Folder: PM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101
[2030_PM_Base_Carrington Rd
between Bronte Rd &
Macpherson St - Import
(Network Folder: General)]

PM peak - existing

Site Category: Future Conditions 1

Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 120 seconds (Network User-Given Cycle Time)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%				[Veh. veh	Dist] m				km/h
South: Carrington Road (South)															
1	L2	All MCs	71	0.0	71	0.0	0.262	76.1	LOS F	5.9	41.6	0.83	0.72	0.83	29.4
2	T1	All MCs	567	1.1	567	1.1	* 1.134	205.2	LOS F	56.5	398.1	0.98	1.72	1.99	6.0
Approach			638	1.0	638	1.0	1.134	191.0	LOS F	56.5	398.1	0.97	1.61	1.86	6.3
East: Machpherson Street															
4	L2	All MCs	13	0.0	12	0.0	0.660	67.6	LOS E	17.3	122.5	0.94	0.81	0.94	21.0
5	T1	All MCs	326	1.9	322	2.0	0.660	59.4	LOS E	17.3	122.5	0.94	0.81	0.94	26.1
6	R2	All MCs	33	0.0	32	0.0	0.318	84.5	LOS F	1.9	13.4	0.99	0.73	0.99	5.7
Approach			372	1.7	366	1.7	0.660	61.9	LOS E	17.3	122.5	0.94	0.80	0.94	20.0
North: Carrington Road (North)															
7	L2	All MCs	48	2.2	42	2.0	0.233	40.3	LOS C	5.7	40.2	0.39	0.39	0.39	37.9
8	T1	All MCs	675	1.2	583	1.2	1.127	114.5	LOS F	55.4	390.4	0.76	1.05	1.35	17.1
9	R2	All MCs	232	1.4	200	1.4	* 1.127	178.9	LOS F	55.4	390.4	1.00	1.49	1.98	14.4
Approach			955	1.3	824	1.3	1.127	126.3	LOS F	55.4	390.4	0.80	1.13	1.46	14.1
West: Darley Road															
10	L2	All MCs	182	0.6	182	0.6	0.221	44.6	LOS D	6.5	44.4	0.62	0.71	0.62	30.4
11	T1	All MCs	335	0.9	335	0.9	* 1.104	183.3	LOS F	37.8	266.6	0.99	1.65	1.99	9.2
12	R2	All MCs	36	0.0	36	0.0	1.104	214.7	LOS F	37.8	266.6	1.00	1.68	2.03	13.0
Approach			553	0.8	553	0.8	1.104	139.6	LOS F	37.8	266.6	0.87	1.34	1.54	10.8
All Vehicles			2517	1.2	2381	1.2	1.134	136.8	LOS F	56.5	398.1	0.88	1.26	1.51	11.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance											
Mov ID	Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	sec		[Ped ped	Dist] m			sec	m	m/sec
South: Carrington Road (South)											
P1	Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29

East: Machpherson Street											
P2	Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
North: Carrington Road (North)											
P3	Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
West: Darley Road											
P4	Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
All Pedestrians		211	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

 Site: Site 3 [Albion St & Macpherson St - PM (Site Folder: PM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101
[2030_PM_Base_Carrington Rd
between Bronte Rd &
Macpherson St - Import
(Network Folder: General)]

PM peak - existing
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back	Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
South: Albion Street															
1	L2	All MCs	46	0.0	46	0.0	0.650	9.4	LOS A	6.8	49.2	0.86	0.79	1.03	34.2
2	T1	All MCs	239	11.0	239	11.0	0.650	9.8	LOS A	6.8	49.2	0.86	0.79	1.03	34.2
3	R2	All MCs	254	0.4	254	0.4	0.650	12.7	LOS A	6.8	49.2	0.86	0.79	1.03	34.2
3u	U	All MCs	3	0.0	3	0.0	0.650	14.2	LOS A	6.8	49.2	0.86	0.79	1.03	39.0
Approach			542	5.0	542	5.0	0.650	11.2	LOS A	6.8	49.2	0.86	0.79	1.03	34.3
East: Macpherson Street (East)															
4	L2	All MCs	200	0.5	198	0.5	0.710	10.2	LOS A	6.3	45.4	0.79	0.90	1.03	39.3
5	T1	All MCs	259	2.8	257	2.9	0.710	10.2	LOS A	6.3	45.4	0.79	0.90	1.03	34.1
6	R2	All MCs	74	11.4	73	11.5	0.710	13.9	LOS A	6.3	45.4	0.79	0.90	1.03	34.1
6u	U	All MCs	9	0.0	9	0.0	0.710	14.9	LOS B	6.3	45.4	0.79	0.90	1.03	34.1
Approach			542	3.1	538	3.1	0.710	10.8	LOS A	6.3	45.4	0.79	0.90	1.03	36.7
North: Albion Street (North)															
7	L2	All MCs	88	8.3	85	8.6	0.579	8.0	LOS A	4.3	31.2	0.70	0.74	0.81	34.8
8	T1	All MCs	392	7.3	377	7.5	0.579	7.6	LOS A	4.3	31.2	0.70	0.74	0.81	40.8
9	R2	All MCs	51	0.0	49	0.0	0.579	10.8	LOS A	4.3	31.2	0.70	0.74	0.81	34.8
9u	U	All MCs	5	0.0	5	0.0	0.579	12.4	LOS A	4.3	31.2	0.70	0.74	0.81	34.8
Approach			536	6.7	516	6.9	0.579	8.0	LOS A	4.3	31.2	0.70	0.74	0.81	39.9
West: Macpherson Street (West)															
10	L2	All MCs	51	0.0	45	0.0	0.497	9.3	LOS A	3.5	24.3	0.67	0.82	0.75	24.0
11	T1	All MCs	263	1.2	237	1.2	0.497	9.3	LOS A	3.5	24.3	0.67	0.82	0.75	24.0
12	R2	All MCs	59	1.8	53	1.7	0.497	12.8	LOS A	3.5	24.3	0.67	0.82	0.75	36.2
12u	U	All MCs	8	0.0	8	0.0	0.497	14.2	LOS A	3.5	24.3	0.67	0.82	0.75	24.0
Approach			381	1.1	344	1.1	0.497	10.0	LOS A	3.5	24.3	0.67	0.82	0.75	27.6
All Vehicles			2001	4.2	1939	4.3	0.710	10.0	LOS A	6.8	49.2	0.77	0.81	0.92	36.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

 Site: Site 4 [Macpherson St & Leichhardt St - PM (Site Folder: PM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101
[2030_PM_Base_Carrington Rd
between Bronte Rd &
Macpherson St - Import
(Network Folder: General)]

PM peak - existing
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
South: Leichhardt Street (South)															
1	L2	All MCs	26	0.0	26	0.0	0.197	13.0	LOS A	1.4	9.6	0.92	0.80	0.92	30.0
2	T1	All MCs	53	0.0	53	0.0	0.197	12.9	LOS A	1.4	9.6	0.92	0.80	0.92	30.0
3	R2	All MCs	2	0.0	2	0.0	0.197	15.8	LOS B	1.4	9.6	0.92	0.80	0.92	39.2
3u	U	All MCs	1	0.0	1	0.0	0.197	17.2	LOS B	1.4	9.6	0.92	0.80	0.92	35.6
Approach			82	0.0	82	0.0	0.197	13.0	LOS A	1.4	9.6	0.92	0.80	0.92	30.6
East: Macpherson Street (East)															
4	L2	All MCs	13	16.7	13	16.7	0.770	14.3	LOS A	12.2	87.5	1.00	0.88	1.32	38.3
5	T1	All MCs	272	6.6	272	6.6	0.770	13.6	LOS A	12.2	87.5	1.00	0.88	1.32	35.6
6	R2	All MCs	353	0.9	353	0.9	0.770	16.3	LOS B	12.2	87.5	1.00	0.88	1.32	35.6
6u	U	All MCs	13	0.0	13	0.0	0.770	17.6	LOS B	12.2	87.5	1.00	0.88	1.32	40.4
Approach			649	3.6	649	3.6	0.770	15.2	LOS B	12.2	87.5	1.00	0.88	1.32	35.8
North: Leichhardt Street (North)															
7	L2	All MCs	523	2.2	516	2.2	0.945	29.6	LOS C	28.8	202.9	1.00	1.43	2.11	30.1
8	T1	All MCs	68	0.0	67	0.0	0.945	29.3	LOS C	28.8	202.9	1.00	1.43	2.11	24.7
9	R2	All MCs	223	0.0	220	0.0	0.945	32.2	LOS C	28.8	202.9	1.00	1.43	2.11	14.7
9u	U	All MCs	9	0.0	9	0.0	0.945	33.6	LOS C	28.8	202.9	1.00	1.43	2.11	14.7
Approach			824	1.4	813	1.4	0.945	30.3	LOS C	28.8	202.9	1.00	1.43	2.11	27.0
West: Macpherson Street (West)															
10	L2	All MCs	272	0.4	259	0.4	0.797	17.8	LOS B	13.0	91.9	1.00	1.06	1.52	27.9
11	T1	All MCs	314	3.7	299	3.8	0.797	17.9	LOS B	13.0	91.9	1.00	1.06	1.52	37.6
12	R2	All MCs	13	0.0	12	0.0	0.797	20.6	LOS B	13.0	91.9	1.00	1.06	1.52	33.5
12u	U	All MCs	23	0.0	22	0.0	0.797	22.0	LOS B	13.0	91.9	1.00	1.06	1.52	27.9
Approach			621	2.0	592	2.1	0.797	18.0	LOS B	13.0	91.9	1.00	1.06	1.52	34.4
All Vehicles			2177	2.2	2136	2.2	0.945	21.7	LOS B	28.8	202.9	1.00	1.14	1.66	31.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

 Site: Site 5 [Bronte Rd & Leichhardt St - PM (Site Folder: PM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

■ Network: N101
[2030_PM_Base_Carrington Rd
between Bronte Rd &
Macpherson St - Import
(Network Folder: General)]

PM peak - existing
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
South: Leichhardt Street (South)															
2	T1	All MCs	128	0.0	126	0.0	0.545	4.9	LOS A	5.5	38.8	0.51	0.56	0.51	31.3
3	R2	All MCs	546	0.8	536	0.8	0.545	7.5	LOS A	5.5	38.8	0.51	0.56	0.51	38.5
3u	U	All MCs	13	0.0	12	0.0	0.545	8.8	LOS A	5.5	38.8	0.51	0.56	0.51	31.3
Approach			687	0.6	674	0.6	0.545	7.0	LOS A	5.5	38.8	0.51	0.56	0.51	37.8
East: Bronte Road (East)															
4	L2	All MCs	528	1.6	528	1.6	0.712	9.1	LOS A	7.6	53.4	0.84	0.72	0.97	35.0
6	R2	All MCs	86	1.2	86	1.2	0.712	11.0	LOS A	7.6	53.4	0.84	0.72	0.97	35.0
6u	U	All MCs	9	0.0	9	0.0	0.712	12.2	LOS A	7.6	53.4	0.84	0.72	0.97	39.2
Approach			624	1.5	624	1.5	0.712	9.4	LOS A	7.6	53.4	0.84	0.72	0.97	35.1
North: Bronte Road (North)															
7	L2	All MCs	135	0.8	129	0.8	0.618	12.3	LOS A	5.5	38.3	0.88	0.87	1.12	36.3
8	T1	All MCs	288	1.1	277	1.1	0.618	11.7	LOS A	5.5	38.3	0.88	0.87	1.12	28.9
9u	U	All MCs	8	0.0	8	0.0	0.618	15.6	LOS B	5.5	38.3	0.88	0.87	1.12	28.9
Approach			432	1.0	415	1.0	0.618	12.0	LOS A	5.5	38.3	0.88	0.87	1.12	32.2
All Vehicles			1743	1.0	1713	1.0	0.712	9.1	LOS A	7.6	53.4	0.72	0.69	0.82	35.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: Site 6 [Bronte Rd & Albion St - PM (Site Folder: PM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Network: N101
[2030_PM_Base_Carrington Rd
between Bronte Rd &
Macpherson St - Import
(Network Folder: General)]

PM peak - existing
Site Category: Future Conditions 1
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				
South: Albion Street (South)															
2	T1	All MCs	225	15.0	222	15.2	0.408	9.0	LOS A	3.9	29.1	0.67	0.75	0.95	30.6
3	R2	All MCs	131	0.0	128	0.0	0.408	15.3	LOS B	3.9	29.1	0.67	0.75	0.95	30.6
Approach			356	9.5	350	9.6	0.408	11.3	NA	3.9	29.1	0.67	0.75	0.95	30.6
East: Bronte Road (East)															
4	L2	All MCs	82	0.0	81	0.0	0.458	9.8	LOS A	2.5	17.2	0.72	0.97	1.07	26.6
6	R2	All MCs	131	0.8	129	0.8	0.458	17.6	LOS B	2.5	17.2	0.72	0.97	1.07	26.6
Approach			213	0.5	210	0.5	0.458	14.6	LOS B	2.5	17.2	0.72	0.97	1.07	26.6
North: Albion Street (North)															
7	L2	All MCs	406	0.8	389	0.8	0.423	4.6	LOS A	0.0	0.0	0.00	0.26	0.00	44.4
8	T1	All MCs	444	8.3	427	8.6	0.423	0.1	LOS A	0.0	0.0	0.00	0.26	0.00	44.4
Approach			851	4.7	816	4.9	0.423	2.3	NA	0.0	0.0	0.00	0.26	0.00	44.4
All Vehicles			1419	5.3	1376	5.4	0.458	6.4	NA	3.9	29.1	0.28	0.49	0.40	36.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

 Site: TCS 160 [Carrington Rd & Bronte Rd & Victoria St - SAT
(Site Folder: SAT - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

■ ■ Network: N101
[2030_Sat_Scenario
0_Carrington Rd between
Bronte Rd & Macpherson St -
Import (Network Folder:
General)]

SAT peak - existing

Site Category: Future Conditions 1

Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 120 seconds (Network User-Given Cycle Time)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]	[Total HV]											
			veh/h	%	veh/h	%	v/c	sec		[Veh. veh	Dist]				
										veh	m			km/h	
South: Carrington Road (South)															
1	L2	All MCs	33	0.0	32	0.0	0.422	48.5	LOS D	9.9	69.1	0.69	0.72	0.69	28.9
1a	L1	All MCs	231	0.9	225	0.9	0.422	45.3	LOS D	9.9	69.1	0.69	0.72	0.69	34.0
2	T1	All MCs	506	1.9	495	1.9	1.015	92.1	LOS F	39.6	280.4	1.00	1.31	1.44	21.6
Approach			769	1.5	752	1.5	1.015	76.2	LOS F	39.6	280.4	0.89	1.11	1.18	21.8
SouthEast: Bronte Road (South)															
21b	L3	All MCs	42	0.0	42	0.0	0.220	41.1	LOS C	3.8	26.8	0.78	0.70	0.78	21.2
21a	L1	All MCs	19	0.0	19	0.0	0.220	54.9	LOS D	3.8	26.8	0.78	0.70	0.78	27.0
22	T1	All MCs	364	6.9	361	7.0	* 1.102	172.2	LOS F	33.0	241.8	0.98	1.53	1.89	13.1
Approach			425	5.9	422	6.0	1.102	154.0	LOS F	33.0	241.8	0.95	1.41	1.73	12.1
East: Victoria Street (East)															
4b	L3	All MCs	84	0.0	84	0.0	0.921	104.6	LOS F	17.8	123.8	1.00	1.07	1.38	11.7
4	L2	All MCs	133	0.8	133	0.8	0.921	100.8	LOS F	17.8	123.8	1.00	1.07	1.38	11.7
5	T1	All MCs	35	0.0	35	0.0	* 0.921	94.9	LOS F	17.8	123.8	1.00	1.07	1.38	16.2
6a	R1	All MCs	28	0.0	28	0.0	0.352	80.1	LOS F	3.9	27.1	0.93	0.77	0.93	25.6
6	R2	All MCs	43	0.0	43	0.0	0.352	78.8	LOS F	3.9	27.1	0.93	0.77	0.93	23.9
Approach			323	0.3	323	0.3	0.921	96.4	LOS F	17.8	123.8	0.99	1.01	1.28	12.3
North: Carrington Road (North)															
7	L2	All MCs	9	0.0	9	0.0	0.932	118.5	LOS F	17.6	123.2	1.00	1.14	1.46	19.6
7a	L1	All MCs	222	0.5	222	0.5	0.932	113.0	LOS F	17.6	123.2	1.00	1.14	1.46	13.8
8	T1	All MCs	539	0.8	539	0.8	* 1.296	360.0	LOS F	79.1	555.8	1.00	2.40	2.84	4.3
9	R2	All MCs	4	25.0	4	25.0	1.296	413.4	LOS F	79.1	555.8	1.00	2.40	2.84	5.8
9b	R3	All MCs	2	0.0	2	0.0	1.296	414.0	LOS F	79.1	555.8	1.00	2.40	2.84	8.3
Approach			777	0.8	777	0.8	1.296	286.8	LOS F	79.1	555.8	1.00	2.03	2.43	4.8
NorthWest: Bronte Road (North)															
27b	L3	All MCs	7	0.0	7	0.0	0.746	62.1	LOS E	22.3	163.6	0.95	0.85	0.97	30.4
27a	L1	All MCs	14	0.0	14	0.0	0.746	55.0	LOS D	22.3	163.6	0.95	0.85	0.97	29.2
28	T1	All MCs	400	6.8	400	6.8	0.746	51.6	LOS D	22.3	163.6	0.95	0.85	0.97	23.7
29a	R1	All MCs	144	2.2	144	2.2	0.582	70.7	LOS F	8.3	58.4	0.98	0.93	0.98	19.1
29b	R3	All MCs	4	25.0	4	25.0	* 0.582	73.1	LOS F	8.3	58.4	0.98	0.93	0.98	22.4
Approach			569	5.5	569	5.5	0.746	56.8	LOS E	22.3	163.6	0.96	0.87	0.97	19.7
West: Victoria Street (West)															
10b	L3	All MCs	26	8.0	26	8.0	0.306	75.3	LOS F	3.9	28.0	0.90	0.76	0.90	24.2
10	L2	All MCs	49	2.1	49	2.1	0.306	71.1	LOS F	3.9	28.0	0.90	0.76	0.90	22.6
11	T1	All MCs	48	0.0	48	0.0	0.169	64.1	LOS E	2.4	16.5	0.86	0.66	0.86	23.0
Approach			124	2.5	124	2.5	0.306	69.2	LOS E	3.9	28.0	0.89	0.72	0.89	18.7

All Vehicles	2988	2.6	2967	2.7	1.296	140.6	LOS F	79.1	555.8	0.95	1.32	1.55	11.5
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Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance											
Mov ID	Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	sec		[Ped ped	Dist] m			sec	m	m/sec
South: Carrington Road (South)											
P1	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
SouthEast: Bronte Road (South)											
P5	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
East: Victoria Street (East)											
P2	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
North: Carrington Road (North)											
P3	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
NorthWest: Bronte Road (North)											
P7	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
West: Victoria Street (West)											
P4	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
All Pedestrians		663	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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Pedestrian Movement Performance											
Mov ID	Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	sec		[Ped	Dist]			sec	m	m/sec
South: Carrington Road (South)											

P1	Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
East: Machpherson Street											
P2	Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
North: Carrington Road (North)											
P3	Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
West: Darley Road											
P4	Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
All Pedestrians		211	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

 Site: Site 3 [Albion St & Macpherson St - SAT (Site Folder: SAT - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

■ ■ Network: N101
[2030_Sat_Scenario
0_Carrington Rd between
Bronte Rd & Macpherson St -
Import (Network Folder:
General)]

SAT peak - existing
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]	[Total HV]	[Total HV]	[Total HV]	v/c	sec		[Veh. veh	Dist]				km/h
South: Albion Street															
1	L2	All MCs	55	0.0	55	0.0	0.882	20.2	LOS B	16.9	120.9	1.00	1.25	1.77	26.3
2	T1	All MCs	320	6.6	320	6.6	0.882	20.6	LOS B	16.9	120.9	1.00	1.25	1.77	26.3
3	R2	All MCs	301	0.7	301	0.7	0.882	23.6	LOS B	16.9	120.9	1.00	1.25	1.77	26.3
3u	U	All MCs	8	0.0	8	0.0	0.882	25.1	LOS B	16.9	120.9	1.00	1.25	1.77	33.1
Approach			684	3.4	684	3.4	0.882	21.9	LOS B	16.9	120.9	1.00	1.25	1.77	26.4
East: Macpherson Street (East)															
4	L2	All MCs	218	1.4	218	1.5	0.836	11.7	LOS A	9.1	64.8	0.90	0.98	1.24	38.4
5	T1	All MCs	312	3.0	311	3.0	0.836	11.7	LOS A	9.1	64.8	0.90	0.98	1.24	32.7
6	R2	All MCs	81	7.8	81	7.8	0.836	15.3	LOS B	9.1	64.8	0.90	0.98	1.24	32.7
6u	U	All MCs	2	0.0	2	0.0	0.836	16.4	LOS B	9.1	64.8	0.90	0.98	1.24	32.7
Approach			613	3.1	612	3.1	0.836	12.2	LOS A	9.1	64.8	0.90	0.98	1.24	35.4
North: Albion Street (North)															
7	L2	All MCs	67	14.1	67	14.1	0.520	7.5	LOS A	3.4	24.6	0.69	0.72	0.77	35.5
8	T1	All MCs	314	5.4	313	5.4	0.520	7.0	LOS A	3.4	24.6	0.69	0.72	0.77	41.3
9	R2	All MCs	45	0.0	45	0.0	0.520	10.3	LOS A	3.4	24.6	0.69	0.72	0.77	35.5
9u	U	All MCs	9	0.0	9	0.0	0.520	11.8	LOS A	3.4	24.6	0.69	0.72	0.77	35.5
Approach			436	6.0	435	6.0	0.520	7.5	LOS A	3.4	24.6	0.69	0.72	0.77	40.3
West: Macpherson Street (West)															
10	L2	All MCs	62	0.0	58	0.0	0.580	12.6	LOS A	4.6	31.8	0.79	0.96	0.97	20.6
11	T1	All MCs	256	2.1	239	2.1	0.580	12.7	LOS A	4.6	31.8	0.79	0.96	0.97	20.6
12	R2	All MCs	20	0.0	19	0.0	0.580	15.9	LOS B	4.6	31.8	0.79	0.96	0.97	33.9
12u	U	All MCs	7	0.0	7	0.0	0.580	17.5	LOS B	4.6	31.8	0.79	0.96	0.97	20.6
Approach			345	1.5	323	1.5	0.580	13.0	LOS A	4.6	31.8	0.79	0.96	0.97	22.1
All Vehicles			2078	3.5	2054	3.6	0.882	14.6	LOS B	16.9	120.9	0.87	1.01	1.27	31.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

 Site: Site 4 [Macpherson St & Leichhardt St - SAT (Site Folder: SAT - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

■ Network: N101
[2030_Sat_Scenario
0_Carrington Rd between
Bronte Rd & Macpherson St -
Import (Network Folder:
General)]

SAT peak - existing
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]		[Total HV]					[Veh. veh	Dist]				km/h
			veh/h	%	veh/h	%	v/c	sec			m				
South: Leichhardt Street (South)															
1	L2	All MCs	28	0.0	28	0.0	0.247	15.9	LOS B	1.8	12.3	0.97	0.83	0.97	27.3
2	T1	All MCs	42	0.0	42	0.0	0.247	15.8	LOS B	1.8	12.3	0.97	0.83	0.97	27.3
3	R2	All MCs	12	0.0	12	0.0	0.247	18.7	LOS B	1.8	12.3	0.97	0.83	0.97	37.5
3u	U	All MCs	1	0.0	1	0.0	0.247	20.1	LOS B	1.8	12.3	0.97	0.83	0.97	33.6
Approach			83	0.0	83	0.0	0.247	16.3	LOS B	1.8	12.3	0.97	0.83	0.97	29.9
East: Macpherson Street (East)															
4	L2	All MCs	9	0.0	9	0.0	0.891	21.9	LOS B	21.4	152.6	1.00	1.19	1.72	34.4
5	T1	All MCs	312	4.4	312	4.4	0.891	22.0	LOS B	21.4	152.6	1.00	1.19	1.72	30.7
6	R2	All MCs	408	2.3	408	2.3	0.891	24.8	LOS B	21.4	152.6	1.00	1.19	1.72	30.7
6u	U	All MCs	21	0.0	21	0.0	0.891	26.1	LOS B	21.4	152.6	1.00	1.19	1.72	37.0
Approach			751	3.1	751	3.1	0.891	23.6	LOS B	21.4	152.6	1.00	1.19	1.72	31.0
North: Leichhardt Street (North)															
7	L2	All MCs	506	1.2	506	1.2	0.943	28.8	LOS C	28.7	201.8	1.00	1.41	2.08	30.3
8	T1	All MCs	44	0.0	44	0.0	0.943	28.5	LOS C	28.7	201.8	1.00	1.41	2.08	25.0
9	R2	All MCs	273	1.5	272	1.5	0.943	31.6	LOS C	28.7	201.8	1.00	1.41	2.08	14.9
9u	U	All MCs	2	0.0	2	0.0	0.943	32.9	LOS C	28.7	201.8	1.00	1.41	2.08	14.9
Approach			825	1.3	824	1.3	0.943	29.7	LOS C	28.7	201.8	1.00	1.41	2.08	26.8
West: Macpherson Street (West)															
10	L2	All MCs	307	1.4	299	1.4	0.888	28.4	LOS B	18.9	134.4	1.00	1.40	2.01	22.1
11	T1	All MCs	296	3.2	288	3.3	0.888	28.5	LOS B	18.9	134.4	1.00	1.40	2.01	33.1
12	R2	All MCs	14	0.0	13	0.0	0.888	31.1	LOS C	18.9	134.4	1.00	1.40	2.01	28.6
12u	U	All MCs	5	0.0	5	0.0	0.888	32.5	LOS C	18.9	134.4	1.00	1.40	2.01	22.1
Approach			622	2.2	605	2.2	0.888	28.5	LOS C	18.9	134.4	1.00	1.40	2.01	28.9
All Vehicles			2281	2.1	2263	2.1	0.943	26.9	LOS B	28.7	201.8	1.00	1.31	1.90	28.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

 Site: Site 5 [Bronte Rd & Leichhardt St - SAT (Site Folder: SAT - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

■ ■ Network: N101
[2030_Sat_Scenario
0_Carrington Rd between
Bronte Rd & Macpherson St -
Import (Network Folder:
General)]

SAT peak - existing
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
South: Leichhardt Street (South)															
2	T1	All MCs	151	0.7	149	0.7	0.617	5.0	LOS A	6.9	49.1	0.57	0.55	0.57	31.1
3	R2	All MCs	623	2.0	616	2.0	0.617	7.7	LOS A	6.9	49.1	0.57	0.55	0.57	38.4
3u	U	All MCs	1	0.0	1	0.0	0.617	8.9	LOS A	6.9	49.1	0.57	0.55	0.57	31.1
Approach			775	1.8	766	1.8	0.617	7.2	LOS A	6.9	49.1	0.57	0.55	0.57	37.6
East: Bronte Road (East)															
4	L2	All MCs	573	1.3	573	1.3	0.708	7.8	LOS A	7.5	53.3	0.79	0.65	0.86	36.5
6	R2	All MCs	77	1.4	77	1.4	0.708	9.7	LOS A	7.5	53.3	0.79	0.65	0.86	36.5
6u	U	All MCs	18	0.0	18	0.0	0.708	11.0	LOS A	7.5	53.3	0.79	0.65	0.86	40.2
Approach			667	1.3	667	1.3	0.708	8.1	LOS A	7.5	53.3	0.79	0.65	0.86	36.6
North: Bronte Road (North)															
7	L2	All MCs	169	0.6	169	0.6	0.643	14.3	LOS A	6.0	42.0	0.93	0.93	1.24	34.9
8	T1	All MCs	220	1.4	219	1.4	0.643	13.7	LOS A	6.0	42.0	0.93	0.93	1.24	26.9
9u	U	All MCs	9	0.0	9	0.0	0.643	17.5	LOS B	6.0	42.0	0.93	0.93	1.24	26.9
Approach			399	1.1	398	1.1	0.643	14.0	LOS A	6.0	42.0	0.93	0.93	1.24	31.4
All Vehicles			1841	1.4	1831	1.4	0.708	9.0	LOS A	7.5	53.3	0.73	0.67	0.82	35.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

▼ Site: Site 6 [Bronte Rd & Albion St - SAT (Site Folder: SAT - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

■ Network: N101
[2030_Sat_Scenario
0_Carrington Rd between
Bronte Rd & Macpherson St -
Import (Network Folder:
General)]

SAT peak - existing
Site Category: Future Conditions 1
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
South: Albion Street (South)															
2	T1	All MCs	284	8.9	282	9.0	0.516	9.7	LOS A	6.2	45.0	0.69	0.80	1.21	29.9
3	R2	All MCs	185	1.7	184	1.7	0.516	15.8	LOS B	6.2	45.0	0.69	0.80	1.21	29.9
Approach			469	6.1	465	6.1	0.516	12.1	NA	6.2	45.0	0.69	0.80	1.21	29.9
East: Bronte Road (East)															
4	L2	All MCs	46	2.3	46	2.3	0.534	10.7	LOS A	2.9	20.3	0.78	1.06	1.26	24.3
6	R2	All MCs	164	0.6	163	0.6	0.534	19.4	LOS B	2.9	20.3	0.78	1.06	1.26	24.3
Approach			211	1.0	209	1.0	0.534	17.5	LOS B	2.9	20.3	0.78	1.06	1.26	24.3
North: Albion Street (North)															
7	L2	All MCs	333	0.6	333	0.6	0.372	4.6	LOS A	0.0	0.0	0.00	0.25	0.00	44.7
8	T1	All MCs	391	6.7	391	6.7	0.372	0.1	LOS A	0.0	0.0	0.00	0.25	0.00	44.7
Approach			723	3.9	723	3.9	0.372	2.2	NA	0.0	0.0	0.00	0.25	0.00	44.7
All Vehicles			1403	4.2	1398	4.2	0.534	7.8	NA	6.2	45.0	0.35	0.55	0.59	35.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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Project: P:\2023\2312\231268\Reports\TTW\Traffic\Modelling\231025 - Charing Cross SIDRA Files\231012 Charing Cross - Base (2030).sip9

MOVEMENT SUMMARY

 Site: TCS 160 [Carrington Rd & Bronte Rd & Victoria St - AM
(Site Folder: AM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101 [2030_AM
Network (Network Folder:
General)]

AM Peak - Proposed

Site Category: Future Conditions 1

Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 120 seconds (Network User-Given Cycle Time)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]		[Total HV]					[Veh. veh	Dist]				km/h
			veh/h	%	veh/h	%	v/c	sec			m				
South: Carrington Road (South)															
1	L2	All MCs	29	3.6	25	3.6	0.326	25.6	LOS B	7.2	50.1	0.57	0.66	0.57	31.6
1a	L1	All MCs	229	3.7	198	3.7	0.326	23.3	LOS B	7.2	50.1	0.57	0.66	0.57	36.3
2	T1	All MCs	904	2.8	780	2.8	* 1.090	99.7	LOS F	71.0	508.7	0.99	1.52	1.68	18.3
Approach			1163	3.0	1004	3.0	1.090	82.7	LOS F	71.0	508.7	0.90	1.33	1.43	20.7
SouthEast: Bronte Road (South)															
21a	L1	All MCs	78	0.0	76	0.0	0.217	61.4	LOS E	4.2	29.5	0.87	0.74	0.87	14.7
22	T1	All MCs	405	12.2	394	12.3	* 1.085	164.8	LOS F	15.9	122.4	1.00	1.62	1.90	10.8
Approach			483	10.2	469	10.4	1.085	148.1	LOS F	15.9	122.4	0.98	1.48	1.74	10.1
East: Victoria Street (East)															
4b	L3	All MCs	61	0.0	61	0.0	1.074	150.8	LOS F	29.6	206.1	1.00	1.43	1.88	6.9
4	L2	All MCs	123	1.7	123	1.7	1.074	146.9	LOS F	29.6	206.1	1.00	1.43	1.88	6.9
5	T1	All MCs	126	0.0	126	0.0	* 1.074	141.0	LOS F	29.6	206.1	1.00	1.43	1.88	10.0
6a	R1	All MCs	37	2.9	37	2.9	0.951	89.9	LOS F	7.5	53.4	1.00	1.12	1.63	19.4
6	R2	All MCs	63	1.7	63	1.7	0.951	89.2	LOS F	7.5	53.4	1.00	1.12	1.63	18.0
Approach			411	1.0	411	1.0	1.074	131.7	LOS F	29.6	206.1	1.00	1.35	1.82	10.4
North: Carrington Road (North)															
7	L2	All MCs	9	11.1	9	11.1	0.469	70.7	LOS F	7.0	52.5	0.80	0.75	0.80	29.4
7a	L1	All MCs	151	8.4	151	8.4	0.469	66.2	LOS E	7.0	52.5	0.80	0.75	0.80	23.3
8	T1	All MCs	468	3.4	468	3.4	1.014	132.3	LOS F	41.8	299.2	1.00	1.42	1.58	11.5
9	R2	All MCs	6	0.0	6	0.0	1.014	198.1	LOS F	41.8	299.2	1.00	1.42	1.58	14.8
9b	R3	All MCs	1	0.0	1	0.0	1.014	198.8	LOS F	41.8	299.2	1.00	1.42	1.58	19.3
Approach			636	4.6	636	4.6	1.014	116.5	LOS F	41.8	299.2	0.95	1.25	1.39	10.3
NorthWest: Bronte Road (North)															
27b	L3	All MCs	57	0.0	57	0.0	0.735	62.5	LOS E	20.1	152.0	0.96	0.85	0.98	29.7
27a	L1	All MCs	20	5.3	20	5.3	0.735	54.4	LOS D	20.1	152.0	0.96	0.85	0.98	28.5
28	T1	All MCs	300	14.4	300	14.4	0.735	50.9	LOS D	20.1	152.0	0.96	0.85	0.98	23.0
29a	R1	All MCs	114	3.7	114	3.7	0.750	76.2	LOS F	7.1	50.9	1.00	0.96	1.15	17.7
29b	R3	All MCs	4	0.0	4	0.0	* 0.750	78.4	LOS F	7.1	50.9	1.00	0.96	1.15	21.0
Approach			495	9.8	495	9.8	0.750	58.5	LOS E	20.1	152.0	0.97	0.88	1.02	20.3
West: Victoria Street (West)															
10b	L3	All MCs	27	0.0	27	0.0	0.690	89.1	LOS F	10.7	75.2	0.99	0.84	1.04	22.6
10	L2	All MCs	159	0.7	159	0.7	0.690	85.5	LOS F	10.7	75.2	0.99	0.84	1.04	20.9
11	T1	All MCs	25	0.0	25	0.0	0.079	71.9	LOS F	1.3	8.8	0.88	0.64	0.88	22.2
Approach			212	0.5	212	0.5	0.690	84.3	LOS F	10.7	75.2	0.98	0.82	1.02	16.9
All Vehicles			3399	4.9	3226	5.2	1.090	101.5	LOS F	71.0	508.7	0.95	1.24	1.43	14.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.
 Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
 Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
 Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
 Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance											
Mov ID	Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	sec		[Ped	Dist]			sec	m	m/sec
South: Carrington Road (South)											
P1	Full	166	54.5	LOS E	0.5	0.5	0.96	0.96	69.9	20.0	0.29
SouthEast: Bronte Road (South)											
P5	Full	166	54.5	LOS E	0.5	0.5	0.96	0.96	69.9	20.0	0.29
East: Victoria Street (East)											
P2	Full	166	54.5	LOS E	0.5	0.5	0.96	0.96	69.9	20.0	0.29
North: Carrington Road (North)											
P3	Full	166	54.5	LOS E	0.5	0.5	0.96	0.96	69.9	20.0	0.29
NorthWest: Bronte Road (North)											
P7	Full	166	54.5	LOS E	0.5	0.5	0.96	0.96	69.9	20.0	0.29
West: Victoria Street (West)											
P4	Full	166	54.5	LOS E	0.5	0.5	0.96	0.96	69.9	20.0	0.29
All Pedestrians		998	54.5	LOS E	0.5	0.5	0.96	0.96	69.9	20.0	0.29

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
 Pedestrian movement LOS values are based on average delay per pedestrian movement.
 Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Pedestrian Movement Performance											
Mov ID	Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	sec		[Ped ped	Dist] m			sec	m	m/sec
South: Carrington Road (South)											
P1	Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
East: Machpherson Street											

P2 Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
North: Carrington Road (North)										
P3 Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
West: Darley Road										
P4 Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
All Pedestrians	211	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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Project: P:\2023\2312\231268\Reports\TTW\Traffic\Modelling\231010 Charing Cross - Proposed Design (2030).sip9

MOVEMENT SUMMARY

 Site: Site 3 [Albion St & Macpherson St - AM (Site Folder: AM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101 [2030_AM Network (Network Folder: General)]

AM Peak - proposed
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]		[Total HV]					[Veh. veh	Dist]				km/h
			veh/h	%	veh/h	%	v/c	sec			m				
South: Albion Street															
1	L2	All MCs	52	2.0	52	2.0	0.963	37.5	LOS C	24.4	180.4	1.00	1.77	2.66	19.1
2	T1	All MCs	355	11.0	355	11.0	0.963	38.1	LOS C	24.4	180.4	1.00	1.77	2.66	19.1
3	R2	All MCs	226	2.8	226	2.8	0.963	40.9	LOS C	24.4	180.4	1.00	1.77	2.66	19.1
3u	U	All MCs	2	0.0	2	0.0	0.963	42.2	LOS C	24.4	180.4	1.00	1.77	2.66	26.6
Approach			635	7.3	635	7.3	0.963	39.0	LOS C	24.4	180.4	1.00	1.77	2.66	19.2
East: Macpherson Street (East)															
4	L2	All MCs	241	1.7	239	1.7	1.147	145.8	LOS F	70.3	494.1	1.00	4.41	7.52	11.8
5	T1	All MCs	356	0.6	353	0.6	1.147	145.6	LOS F	70.3	494.1	1.00	4.41	7.52	6.8
6	R2	All MCs	109	11.5	109	11.6	1.147	149.6	LOS F	70.3	494.1	1.00	4.41	7.52	6.8
6u	U	All MCs	32	0.0	31	0.0	1.147	150.5	LOS F	70.3	494.1	1.00	4.41	7.52	6.8
Approach			738	2.6	732	2.6	1.147	146.5	LOS F	70.3	494.1	1.00	4.41	7.52	8.6
North: Albion Street (North)															
7	L2	All MCs	61	19.0	61	19.1	0.534	7.1	LOS A	3.8	28.7	0.64	0.70	0.71	35.5
8	T1	All MCs	266	12.3	264	12.3	0.534	6.6	LOS A	3.8	28.7	0.64	0.70	0.71	41.2
9	R2	All MCs	75	2.8	74	2.8	0.534	9.8	LOS A	3.8	28.7	0.64	0.70	0.71	35.5
9u	U	All MCs	19	0.0	19	0.0	0.534	11.3	LOS A	3.8	28.7	0.64	0.70	0.71	35.5
Approach			421	11.0	418	11.1	0.534	7.5	LOS A	3.8	28.7	0.64	0.70	0.71	39.9
West: Macpherson Street (West)															
10	L2	All MCs	81	1.3	72	1.3	0.557	12.6	LOS A	4.2	29.6	0.78	0.96	0.95	20.5
11	T1	All MCs	220	2.9	196	2.9	0.557	12.7	LOS A	4.2	29.6	0.78	0.96	0.95	20.5
12	R2	All MCs	34	0.0	30	0.0	0.557	15.8	LOS B	4.2	29.6	0.78	0.96	0.95	33.8
12u	U	All MCs	6	0.0	6	0.0	0.557	17.4	LOS B	4.2	29.6	0.78	0.96	0.95	20.5
Approach			341	2.2	304	2.2	0.557	13.0	LOS A	4.2	29.6	0.78	0.96	0.95	23.0
All Vehicles			2135	5.6	2089	5.7	1.147	66.6	LOS E	70.3	494.1	0.90	2.36	3.72	14.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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Project: P:\2023\2312\231268\Reports\TTW\Traffic\Modelling\231010 Charing Cross - Proposed Design (2030).sip9

MOVEMENT SUMMARY

 Site: 4 [Macpherson St & Leichhardt St - AM (Site Folder: AM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101 [2030_AM Network (Network Folder: General)]

AM Peak - proposed
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]		[Total HV]					[Veh. veh	Dist]				km/h
			veh/h	%	veh/h	%	v/c	sec			m				
South: Leichhardt Street (South)															
1	L2	All MCs	54	0.0	54	0.0	0.571	24.2	LOS B	5.2	36.5	1.00	1.03	1.38	22.3
2	T1	All MCs	149	1.4	149	1.4	0.571	24.3	LOS B	5.2	36.5	1.00	1.03	1.38	22.3
3	R2	All MCs	6	0.0	6	0.0	0.571	27.0	LOS B	5.2	36.5	1.00	1.03	1.38	33.8
3u	U	All MCs	1	0.0	1	0.0	0.571	28.4	LOS B	5.2	36.5	1.00	1.03	1.38	29.4
Approach			211	1.0	211	1.0	0.571	24.4	LOS B	5.2	36.5	1.00	1.03	1.38	22.9
East: Macpherson Street (East)															
4	L2	All MCs	4	0.0	4	0.0	0.893	27.4	LOS B	18.5	131.1	1.00	1.38	1.98	32.3
5	T1	All MCs	304	4.8	304	4.8	0.893	27.6	LOS B	18.5	131.1	1.00	1.38	1.98	28.2
6	R2	All MCs	277	3.4	277	3.4	0.893	30.4	LOS C	18.5	131.1	1.00	1.38	1.98	28.2
6u	U	All MCs	11	20.0	11	20.0	0.893	33.0	LOS C	18.5	131.1	1.00	1.38	1.98	35.0
Approach			596	4.4	596	4.4	0.893	29.0	LOS C	18.5	131.1	1.00	1.38	1.98	28.5
North: Leichhardt Street (North)															
7	L2	All MCs	325	3.6	323	3.6	0.826	14.3	LOS A	14.7	104.1	1.00	0.91	1.36	36.8
8	T1	All MCs	49	0.0	49	0.0	0.826	14.0	LOS A	14.7	104.1	1.00	0.91	1.36	32.4
9	R2	All MCs	317	1.3	315	1.3	0.826	17.0	LOS B	14.7	104.1	1.00	0.91	1.36	22.5
9u	U	All MCs	26	4.0	26	4.0	0.826	18.5	LOS B	14.7	104.1	1.00	0.91	1.36	22.5
Approach			718	2.3	713	2.4	0.826	15.6	LOS B	14.7	104.1	1.00	0.91	1.36	32.4
West: Macpherson Street (West)															
10	L2	All MCs	251	3.8	237	3.9	0.741	16.7	LOS B	10.0	72.8	1.00	1.00	1.44	28.5
11	T1	All MCs	228	6.0	217	6.1	0.741	16.7	LOS B	10.0	72.8	1.00	1.00	1.44	38.0
12	R2	All MCs	7	0.0	7	0.0	0.741	19.2	LOS B	10.0	72.8	1.00	1.00	1.44	34.0
12u	U	All MCs	57	1.9	54	1.9	0.741	20.8	LOS B	10.0	72.8	1.00	1.00	1.44	28.5
Approach			543	4.5	515	4.6	0.741	17.2	LOS B	10.0	72.8	1.00	1.00	1.44	34.1
All Vehicles			2067	3.4	2034	3.4	0.893	20.8	LOS B	18.5	131.1	1.00	1.08	1.57	30.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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Project: P:\2023\2312\231268\Reports\TTW\Traffic\Modelling\231010 Charing Cross - Proposed Design (2030).sip9

MOVEMENT SUMMARY

 Site: Site 5 [Bronte Rd & Leichhardt St - AM (Site Folder: AM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101 [2030_AM
Network (Network Folder:
General)]

AM Peak - proposed
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]		[Total HV]					[Veh. veh	Dist]				
			veh/h	%	veh/h	%	v/c	sec			m				km/h
South: Leichhardt Street (South)															
2	T1	All MCs	185	2.3	182	2.3	0.603	4.2	LOS A	6.2	44.0	0.60	0.55	0.60	28.3
3	R2	All MCs	487	3.0	478	3.1	0.603	6.8	LOS A	6.2	44.0	0.60	0.55	0.60	33.5
3u	U	All MCs	49	2.1	49	2.2	0.603	7.9	LOS A	6.2	44.0	0.60	0.55	0.60	28.3
Approach			722	2.8	709	2.8	0.603	6.2	LOS A	6.2	44.0	0.60	0.55	0.60	32.6
East: Bronte Road (East)															
4	L2	All MCs	518	2.0	518	2.0	0.585	5.2	LOS A	4.8	34.1	0.60	0.58	0.60	32.8
6	R2	All MCs	112	0.0	112	0.0	0.585	6.9	LOS A	4.8	34.1	0.60	0.58	0.60	32.8
6u	U	All MCs	15	0.0	15	0.0	0.585	8.0	LOS A	4.8	34.1	0.60	0.58	0.60	37.8
Approach			644	1.6	644	1.6	0.585	5.6	LOS A	4.8	34.1	0.60	0.58	0.60	33.0
North: Bronte Road (North)															
7	L2	All MCs	143	3.7	140	3.7	0.413	8.0	LOS A	2.8	20.0	0.77	0.71	0.78	33.5
8	T1	All MCs	151	3.5	147	3.5	0.413	7.3	LOS A	2.8	20.0	0.77	0.71	0.78	29.0
9u	U	All MCs	7	0.0	7	0.0	0.413	10.8	LOS A	2.8	20.0	0.77	0.71	0.78	29.0
Approach			301	3.5	294	3.6	0.413	7.7	LOS A	2.8	20.0	0.77	0.71	0.78	31.9
All Vehicles			1667	2.5	1647	2.5	0.603	6.2	LOS A	6.2	44.0	0.63	0.59	0.63	32.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: Site 6 [Bronte Rd & Albion St - AM (Site Folder: AM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Network: N101 [2030_AM
Network (Network Folder:
General)]

AM Peak - Proposed
Site Category: Future Conditions 1
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]		[Total HV]					[Veh. veh	Dist]				
			veh/h	%	veh/h	%	v/c	sec			m				km/h
South: Albion Street (South)															
2	T1	All MCs	340	15.8	326	16.0	0.565	7.5	LOS A	5.9	45.1	0.62	0.74	1.05	32.7
3	R2	All MCs	213	1.0	203	1.0	0.565	12.3	LOS A	5.9	45.1	0.62	0.74	1.05	32.7
Approach			553	10.1	529	10.2	0.565	9.3	NA	5.9	45.1	0.62	0.74	1.05	32.7
East: Bronte Road (East)															
4	L2	All MCs	108	4.9	107	4.9	0.786	14.1	LOS A	5.4	38.2	0.91	1.27	2.00	21.8
6	R2	All MCs	167	1.3	165	1.3	0.786	25.8	LOS B	5.4	38.2	0.91	1.27	2.00	21.8
Approach			276	2.7	273	2.7	0.786	21.2	LOS B	5.4	38.2	0.91	1.27	2.00	21.8
North: Albion Street (North)															
7	L2	All MCs	221	5.2	220	5.3	0.373	3.5	LOS A	0.0	0.0	0.00	0.19	0.00	36.0
8	T1	All MCs	301	14.3	299	14.4	0.373	0.1	LOS A	0.0	0.0	0.00	0.19	0.00	36.0
Approach			522	10.5	519	10.5	0.373	1.5	NA	0.0	0.0	0.00	0.19	0.00	36.0
All Vehicles			1351	8.7	1321	8.9	0.786	8.7	NA	5.9	45.1	0.44	0.64	0.84	30.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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Project: P:\2023\2312\231268\Reports\TTW\Traffic\Modelling\231010 Charing Cross - Proposed Design (2030).sip9

MOVEMENT SUMMARY

 Site: TCS 160 [Carrington Rd & Bronte Rd & Victoria St - PM
(Site Folder: PM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101 [2030_PM
Network (Network Folder:
General)]

PM Peak - Proposed

Site Category: Future Conditions 1

Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 120 seconds (Network User-Given Cycle Time)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]		[Total HV]					[Veh. veh	Dist]				km/h
			veh/h	%	veh/h	%	v/c	sec			m				
South: Carrington Road (South)															
1	L2	All MCs	27	0.0	25	0.0	0.282	43.5	LOS D	6.5	45.9	0.62	0.69	0.62	30.1
1a	L1	All MCs	185	1.7	168	1.6	0.282	40.5	LOS C	6.5	45.9	0.62	0.69	0.62	35.0
2	T1	All MCs	573	0.7	519	0.8	0.879	52.4	LOS D	29.2	205.3	0.92	0.91	1.04	30.2
Approach			785	0.9	712	0.9	0.879	49.3	LOS D	29.2	205.3	0.84	0.85	0.93	27.1
SouthEast: Bronte Road (South)															
21a	L1	All MCs	52	0.0	51	0.0	0.177	66.9	LOS E	3.0	20.9	0.89	0.72	0.89	14.0
22	T1	All MCs	273	10.8	268	11.0	* 0.885	81.3	LOS F	16.1	122.4	1.00	1.06	1.27	19.7
Approach			324	9.1	319	9.3	0.885	79.0	LOS F	16.1	122.4	0.98	1.01	1.21	16.1
East: Victoria Street (East)															
4b	L3	All MCs	101	0.0	101	0.0	1.094	197.7	LOS F	24.5	171.8	1.00	1.44	2.04	6.1
4	L2	All MCs	99	0.0	99	0.0	1.094	193.9	LOS F	24.5	171.8	1.00	1.44	2.04	6.1
5	T1	All MCs	42	0.0	42	0.0	* 1.094	187.8	LOS F	24.5	171.8	1.00	1.44	2.04	8.9
6a	R1	All MCs	33	0.0	33	0.0	0.369	83.9	LOS F	3.6	25.0	0.95	0.76	0.95	25.0
6	R2	All MCs	32	0.0	32	0.0	0.369	84.5	LOS F	3.6	25.0	0.95	0.76	0.95	23.3
Approach			306	0.0	306	0.0	1.094	171.3	LOS F	24.5	171.8	0.99	1.30	1.81	7.8
North: Carrington Road (North)															
7	L2	All MCs	11	0.0	11	0.0	1.101	206.1	LOS F	35.3	247.8	1.00	1.59	2.05	11.5
7a	L1	All MCs	313	0.7	313	0.7	1.101	200.5	LOS F	35.3	247.8	1.00	1.59	2.05	7.4
8	T1	All MCs	578	1.6	578	1.6	* 1.272	332.1	LOS F	81.4	576.9	1.00	2.35	2.74	4.5
Approach			901	1.3	901	1.3	1.272	285.0	LOS F	81.4	576.9	1.00	2.08	2.49	4.8
NorthWest: Bronte Road (North)															
27b	L3	All MCs	7	0.0	7	0.0	0.772	52.0	LOS D	24.6	182.8	0.97	0.88	1.00	29.8
27a	L1	All MCs	11	0.0	11	0.0	0.772	44.9	LOS D	24.6	182.8	0.97	0.88	1.00	28.6
28	T1	All MCs	435	8.7	435	8.7	0.772	41.4	LOS C	24.6	182.8	0.97	0.88	1.00	23.1
29a	R1	All MCs	205	1.5	205	1.5	0.951	85.1	LOS F	14.4	101.5	1.00	1.25	1.49	14.9
29b	R3	All MCs	2	0.0	2	0.0	* 0.951	87.2	LOS F	14.4	101.5	1.00	1.25	1.49	18.0
Approach			660	6.2	660	6.2	0.951	55.3	LOS D	24.6	182.8	0.98	0.99	1.16	19.9
West: Victoria Street (West)															
10b	L3	All MCs	14	0.0	14	0.0	0.299	57.3	LOS E	4.5	31.6	0.92	0.77	0.92	23.6
10	L2	All MCs	73	0.0	73	0.0	0.299	53.2	LOS D	4.5	31.6	0.92	0.77	0.92	22.0
11	T1	All MCs	53	0.0	53	0.0	0.158	46.4	LOS D	2.7	17.9	0.89	0.68	0.89	22.0
Approach			139	0.0	139	0.0	0.299	51.0	LOS D	4.5	31.6	0.91	0.73	0.91	22.2
All Vehicles			3116	2.9	3036	2.9	1.272	136.0	LOS F	81.4	576.9	0.95	1.30	1.56	11.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance											
Mov ID	Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	sec		[Ped ped	Dist] m			sec	m	m/sec
South: Carrington Road (South)											
P1	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
SouthEast: Bronte Road (South)											
P5	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
East: Victoria Street (East)											
P2	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
North: Carrington Road (North)											
P3	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
NorthWest: Bronte Road (North)											
P7	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
West: Victoria Street (West)											
P4	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
All Pedestrians		663	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Pedestrian Movement Performance											
Mov ID	Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	sec		[Ped ped	Dist] m			sec	m	m/sec
South: Carrington Road (South)											
P1	Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
East: Machpherson Street											

P2 Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
North: Carrington Road (North)										
P3 Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
West: Darley Road										
P4 Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
All Pedestrians	211	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

 Site: Site 3 [Albion St & Macpherson St - PM (Site Folder: PM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101 [2030_PM Network (Network Folder: General)]

PM Peak - proposed
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]		[Total HV]					[Veh. veh	Dist]				km/h
			veh/h	%	veh/h	%	v/c	sec			m				
South: Albion Street															
1	L2	All MCs	46	0.0	46	0.0	0.650	9.3	LOS A	6.8	49.2	0.86	0.79	1.03	34.2
2	T1	All MCs	239	11.0	239	11.0	0.650	9.8	LOS A	6.8	49.2	0.86	0.79	1.03	34.2
3	R2	All MCs	254	0.4	254	0.4	0.650	12.7	LOS A	6.8	49.2	0.86	0.79	1.03	34.2
3u	U	All MCs	3	0.0	3	0.0	0.650	14.2	LOS A	6.8	49.2	0.86	0.79	1.03	39.0
Approach			542	5.0	542	5.0	0.650	11.1	LOS A	6.8	49.2	0.86	0.79	1.03	34.3
East: Macpherson Street (East)															
4	L2	All MCs	200	0.5	198	0.5	0.709	10.1	LOS A	6.3	45.0	0.79	0.90	1.02	39.4
5	T1	All MCs	259	2.8	257	2.9	0.709	10.1	LOS A	6.3	45.0	0.79	0.90	1.02	34.2
6	R2	All MCs	74	11.4	73	11.5	0.709	13.9	LOS A	6.3	45.0	0.79	0.90	1.02	34.2
6u	U	All MCs	9	0.0	9	0.0	0.709	14.9	LOS B	6.3	45.0	0.79	0.90	1.02	34.2
Approach			542	3.1	537	3.1	0.709	10.7	LOS A	6.3	45.0	0.79	0.90	1.02	36.8
North: Albion Street (North)															
7	L2	All MCs	88	8.3	85	8.6	0.575	7.8	LOS A	4.2	30.7	0.69	0.73	0.80	35.0
8	T1	All MCs	392	7.3	377	7.5	0.575	7.5	LOS A	4.2	30.7	0.69	0.73	0.80	40.9
9	R2	All MCs	51	0.0	48	0.0	0.575	10.7	LOS A	4.2	30.7	0.69	0.73	0.80	35.0
9u	U	All MCs	5	0.0	5	0.0	0.575	12.2	LOS A	4.2	30.7	0.69	0.73	0.80	35.0
Approach			536	6.7	516	6.9	0.575	7.9	LOS A	4.2	30.7	0.69	0.73	0.80	40.0
West: Macpherson Street (West)															
10	L2	All MCs	51	0.0	44	0.0	0.483	9.1	LOS A	3.3	23.1	0.67	0.81	0.73	24.3
11	T1	All MCs	264	1.2	231	1.2	0.483	9.2	LOS A	3.3	23.1	0.67	0.81	0.73	24.3
12	R2	All MCs	59	1.8	52	1.7	0.483	12.6	LOS A	3.3	23.1	0.67	0.81	0.73	36.4
12u	U	All MCs	8	0.0	7	0.0	0.483	14.0	LOS A	3.3	23.1	0.67	0.81	0.73	24.3
Approach			382	1.1	334	1.1	0.483	9.8	LOS A	3.3	23.1	0.67	0.81	0.73	27.8
All Vehicles			2002	4.2	1929	4.4	0.709	9.9	LOS A	6.8	49.2	0.76	0.81	0.91	36.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

 Site: Site 4 [Macpherson St & Leichhardt St - PM (Site Folder: PM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101 [2030_PM Network (Network Folder: General)]

PM Peak - proposed
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]		[Total HV]					[Veh. veh	Dist]				km/h
			veh/h	%	veh/h	%	v/c	sec			m				
South: Leichhardt Street (South)															
1	L2	All MCs	26	0.0	26	0.0	0.197	13.0	LOS A	1.4	9.6	0.92	0.80	0.92	30.0
2	T1	All MCs	53	0.0	53	0.0	0.197	12.9	LOS A	1.4	9.6	0.92	0.80	0.92	30.0
3	R2	All MCs	2	0.0	2	0.0	0.197	15.8	LOS B	1.4	9.6	0.92	0.80	0.92	39.2
3u	U	All MCs	1	0.0	1	0.0	0.197	17.2	LOS B	1.4	9.6	0.92	0.80	0.92	35.6
Approach			82	0.0	82	0.0	0.197	13.0	LOS A	1.4	9.6	0.92	0.80	0.92	30.6
East: Macpherson Street (East)															
4	L2	All MCs	13	16.7	13	16.7	0.770	14.2	LOS A	12.2	87.4	1.00	0.87	1.31	38.3
5	T1	All MCs	272	6.6	272	6.6	0.770	13.6	LOS A	12.2	87.4	1.00	0.87	1.31	35.6
6	R2	All MCs	353	0.9	353	0.9	0.770	16.3	LOS B	12.2	87.4	1.00	0.87	1.31	35.6
6u	U	All MCs	13	0.0	13	0.0	0.770	17.6	LOS B	12.2	87.4	1.00	0.87	1.31	40.4
Approach			649	3.6	649	3.6	0.770	15.1	LOS B	12.2	87.4	1.00	0.87	1.31	35.9
North: Leichhardt Street (North)															
7	L2	All MCs	523	2.2	516	2.2	0.941	28.6	LOS C	28.1	198.0	1.00	1.40	2.06	30.5
8	T1	All MCs	68	0.0	67	0.0	0.941	28.2	LOS B	28.1	198.0	1.00	1.40	2.06	25.1
9	R2	All MCs	223	0.0	220	0.0	0.941	31.2	LOS C	28.1	198.0	1.00	1.40	2.06	15.1
9u	U	All MCs	9	0.0	9	0.0	0.941	32.6	LOS C	28.1	198.0	1.00	1.40	2.06	15.1
Approach			824	1.4	812	1.4	0.941	29.3	LOS C	28.1	198.0	1.00	1.40	2.06	27.4
West: Macpherson Street (West)															
10	L2	All MCs	272	0.4	255	0.4	0.790	17.3	LOS B	12.6	89.0	1.00	1.05	1.49	28.2
11	T1	All MCs	315	3.7	297	3.8	0.790	17.4	LOS B	12.6	89.0	1.00	1.05	1.49	37.8
12	R2	All MCs	13	0.0	12	0.0	0.790	20.1	LOS B	12.6	89.0	1.00	1.05	1.49	33.7
12u	U	All MCs	23	0.0	22	0.0	0.790	21.5	LOS B	12.6	89.0	1.00	1.05	1.49	28.2
Approach			622	2.0	586	2.1	0.790	17.6	LOS B	12.6	89.0	1.00	1.05	1.49	34.6
All Vehicles			2178	2.2	2130	2.2	0.941	21.1	LOS B	28.1	198.0	1.00	1.12	1.63	31.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

 Site: Site 5 [Bronte Rd & Leichhardt St - PM (Site Folder: PM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101 [2030_PM Network (Network Folder: General)]

PM Peak - proposed
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]		[Total HV]					[Veh. veh	Dist]				km/h
			veh/h	%	veh/h	%	v/c	sec			m				
South: Leichhardt Street (South)															
2	T1	All MCs	128	0.0	125	0.0	0.543	4.9	LOS A	5.5	38.5	0.51	0.56	0.51	31.3
3	R2	All MCs	546	0.8	533	0.8	0.543	7.5	LOS A	5.5	38.5	0.51	0.56	0.51	38.6
3u	U	All MCs	13	0.0	12	0.0	0.543	8.8	LOS A	5.5	38.5	0.51	0.56	0.51	31.3
Approach			687	0.6	671	0.6	0.543	7.0	LOS A	5.5	38.5	0.51	0.56	0.51	37.8
East: Bronte Road (East)															
4	L2	All MCs	528	1.6	528	1.6	0.713	9.1	LOS A	7.6	53.6	0.84	0.72	0.97	35.0
6	R2	All MCs	86	1.2	86	1.2	0.713	11.0	LOS A	7.6	53.6	0.84	0.72	0.97	35.0
6u	U	All MCs	9	0.0	9	0.0	0.713	12.2	LOS A	7.6	53.6	0.84	0.72	0.97	39.2
Approach			624	1.5	624	1.5	0.713	9.4	LOS A	7.6	53.6	0.84	0.72	0.97	35.1
North: Bronte Road (North)															
7	L2	All MCs	135	0.8	129	0.8	0.617	12.3	LOS A	5.4	38.1	0.88	0.86	1.11	36.3
8	T1	All MCs	288	1.1	277	1.1	0.617	11.7	LOS A	5.4	38.1	0.88	0.86	1.11	28.9
9u	U	All MCs	8	0.0	8	0.0	0.617	15.5	LOS B	5.4	38.1	0.88	0.86	1.11	28.9
Approach			432	1.0	414	1.0	0.617	11.9	LOS A	5.4	38.1	0.88	0.86	1.11	32.3
All Vehicles			1743	1.0	1710	1.0	0.713	9.1	LOS A	7.6	53.6	0.72	0.69	0.82	35.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: Site 6 [Bronte Rd & Albion St - PM (Site Folder: PM - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Network: N101 [2030_PM
Network (Network Folder:
General)]

PM Peak - proposed
Site Category: Future Conditions 1
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]		[Total HV]					[Veh. veh	Dist]				
			veh/h	%	veh/h	%	v/c	sec			m			km/h	
South: Albion Street (South)															
2	T1	All MCs	225	15.0	221	15.2	0.412	10.1	LOS A	3.9	28.9	0.65	0.80	0.95	29.7
3	R2	All MCs	131	0.0	128	0.0	0.412	15.4	LOS B	3.9	28.9	0.65	0.80	0.95	29.7
Approach			356	9.5	349	9.7	0.412	12.0	NA	3.9	28.9	0.65	0.80	0.95	29.7
East: Bronte Road (East)															
4	L2	All MCs	82	0.0	81	0.0	0.454	9.7	LOS A	2.5	17.0	0.72	0.97	1.06	26.5
6	R2	All MCs	131	0.8	129	0.8	0.454	17.5	LOS B	2.5	17.0	0.72	0.97	1.06	26.5
Approach			213	0.5	209	0.5	0.454	14.5	LOS A	2.5	17.0	0.72	0.97	1.06	26.5
North: Albion Street (North)															
7	L2	All MCs	406	0.8	388	0.8	0.439	3.5	LOS A	0.0	0.0	0.00	0.22	0.00	35.6
8	T1	All MCs	444	8.3	425	8.6	0.439	0.1	LOS A	0.0	0.0	0.00	0.22	0.00	35.6
Approach			851	4.7	813	4.9	0.439	1.7	NA	0.0	0.0	0.00	0.22	0.00	35.6
All Vehicles			1419	5.3	1371	5.4	0.454	6.3	NA	3.9	28.9	0.28	0.48	0.40	31.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

 Site: TCS 160 [Carrington Rd & Bronte Rd & Victoria St - SAT
(Site Folder: SAT - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101 [2030_SAT
Network (Network Folder:
General)]

SAT Peak - proposed

Site Category: Future Conditions 1

Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 120 seconds (Network User-Given Cycle Time)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back	Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]		[Total HV]					[Veh. veh	Dist]				km/h
			veh/h	%	veh/h	%	v/c	sec			m				
South: Carrington Road (South)															
1	L2	All MCs	33	0.0	30	0.0	0.366	41.4	LOS C	9.0	62.5	0.66	0.71	0.66	29.5
1a	L1	All MCs	231	0.9	214	1.0	0.366	38.5	LOS C	9.0	62.5	0.66	0.71	0.66	34.5
2	T1	All MCs	506	1.9	469	1.9	0.836	44.5	LOS D	24.1	170.8	0.88	0.84	0.96	31.6
Approach			769	1.5	713	1.5	0.836	42.5	LOS D	24.1	170.8	0.81	0.80	0.86	28.9
SouthEast: Bronte Road (South)															
21a	L1	All MCs	61	0.0	60	0.0	0.231	75.8	LOS F	3.7	28.4	0.90	0.74	0.90	13.8
22	T1	All MCs	364	6.9	359	7.0	* 1.155	229.8	LOS F	17.0	122.4	1.00	1.76	2.21	8.4
Approach			425	5.9	419	6.0	1.155	207.7	LOS F	17.0	122.4	0.98	1.62	2.02	7.7
East: Victoria Street (East)															
4b	L3	All MCs	84	0.0	84	0.0	1.117	216.4	LOS F	26.8	187.1	1.00	1.48	2.13	5.5
4	L2	All MCs	133	0.8	133	0.8	1.117	212.5	LOS F	26.8	187.1	1.00	1.48	2.13	5.5
5	T1	All MCs	35	0.0	35	0.0	* 1.117	206.6	LOS F	26.8	187.1	1.00	1.48	2.13	8.2
6a	R1	All MCs	28	0.0	28	0.0	0.405	84.6	LOS F	4.0	27.9	0.95	0.77	0.95	25.0
6	R2	All MCs	43	0.0	43	0.0	0.405	84.2	LOS F	4.0	27.9	0.95	0.77	0.95	23.3
Approach			323	0.3	323	0.3	1.117	184.5	LOS F	26.8	187.1	0.99	1.32	1.87	7.2
North: Carrington Road (North)															
7	L2	All MCs	9	0.0	9	0.0	0.822	89.3	LOS F	14.1	98.6	0.97	0.95	1.17	24.5
7a	L1	All MCs	222	0.5	222	0.5	0.822	84.2	LOS F	14.1	98.6	0.97	0.95	1.17	18.2
8	T1	All MCs	539	0.8	539	0.8	* 1.143	224.9	LOS F	62.2	436.9	1.00	1.88	2.16	6.7
9	R2	All MCs	4	25.0	4	25.0	1.143	267.3	LOS F	62.2	436.9	1.00	1.88	2.16	9.0
9b	R3	All MCs	2	0.0	2	0.0	1.143	267.9	LOS F	62.2	436.9	1.00	1.88	2.16	12.4
Approach			777	0.8	777	0.8	1.143	183.4	LOS F	62.2	436.9	0.99	1.60	1.86	7.1
NorthWest: Bronte Road (North)															
27b	L3	All MCs	7	0.0	7	0.0	0.749	62.4	LOS E	22.4	164.3	0.95	0.85	0.98	30.3
27a	L1	All MCs	14	0.0	14	0.0	0.749	55.4	LOS D	22.4	164.3	0.95	0.85	0.98	29.1
28	T1	All MCs	400	6.8	400	6.8	0.749	51.9	LOS D	22.4	164.3	0.95	0.85	0.98	23.6
29a	R1	All MCs	144	2.2	144	2.2	0.589	70.8	LOS F	8.3	58.4	0.98	0.93	0.98	19.0
29b	R3	All MCs	4	25.0	4	25.0	* 0.589	73.1	LOS F	8.3	58.4	0.98	0.93	0.98	22.3
Approach			569	5.5	569	5.5	0.749	57.1	LOS E	22.4	164.3	0.96	0.87	0.98	19.6
West: Victoria Street (West)															
10b	L3	All MCs	26	8.0	26	8.0	0.291	57.8	LOS E	4.0	29.0	0.92	0.76	0.92	23.4
10	L2	All MCs	49	2.1	49	2.1	0.291	53.3	LOS D	4.0	29.0	0.92	0.76	0.92	21.7
11	T1	All MCs	48	0.0	48	0.0	0.151	46.4	LOS D	2.4	17.1	0.89	0.67	0.89	22.0
Approach			124	2.5	124	2.5	0.291	51.6	LOS D	4.0	29.0	0.91	0.73	0.91	22.2
All Vehicles			2988	2.6	2926	2.7	1.155	122.5	LOS F	62.2	436.9	0.94	1.20	1.43	12.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance											
Mov ID	Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	sec		[Ped	Dist]			sec	m	m/sec
South: Carrington Road (South)											
P1	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
SouthEast: Bronte Road (South)											
P5	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
East: Victoria Street (East)											
P2	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
North: Carrington Road (North)											
P3	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
NorthWest: Bronte Road (North)											
P7	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
West: Victoria Street (West)											
P4	Full	111	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29
All Pedestrians		663	54.4	LOS E	0.4	0.4	0.95	0.95	69.8	20.0	0.29

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Pedestrian Movement Performance											
Mov ID	Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	sec		[Ped ped	Dist] m			sec	m	m/sec
South: Carrington Road (South)											
P1	Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
East: Machpherson Street											

P2 Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
North: Carrington Road (North)										
P3 Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
West: Darley Road										
P4 Full	53	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29
All Pedestrians	211	54.3	LOS E	0.2	0.2	0.95	0.95	69.7	20.0	0.29

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

 Site: Site 3 [Albion St & Macpherson St - SAT (Site Folder: SAT - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101 [2030_SAT Network (Network Folder: General)]

SAT Peak - proposed
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed	
			[Total HV]		[Total HV]					[Veh. veh	Dist]				km/h
			veh/h	%	veh/h	%	v/c	sec			m				
South: Albion Street															
1	L2	All MCs	55	0.0	55	0.0	0.894	21.3	LOS B	17.7	126.6	1.00	1.29	1.83	25.7
2	T1	All MCs	320	6.6	320	6.6	0.894	21.7	LOS B	17.7	126.6	1.00	1.29	1.83	25.7
3	R2	All MCs	301	0.7	301	0.7	0.894	24.7	LOS B	17.7	126.6	1.00	1.29	1.83	25.7
3u	U	All MCs	8	0.0	8	0.0	0.894	26.2	LOS B	17.7	126.6	1.00	1.29	1.83	32.5
Approach			684	3.4	684	3.4	0.894	23.0	LOS B	17.7	126.6	1.00	1.29	1.83	25.8
East: Macpherson Street (East)															
4	L2	All MCs	218	1.4	217	1.5	0.869	12.9	LOS A	10.0	71.8	0.94	1.03	1.36	37.6
5	T1	All MCs	312	3.0	311	3.0	0.869	12.8	LOS A	10.0	71.8	0.94	1.03	1.36	31.6
6	R2	All MCs	81	7.8	81	7.8	0.869	16.5	LOS B	10.0	71.8	0.94	1.03	1.36	31.6
6u	U	All MCs	2	0.0	2	0.0	0.869	17.6	LOS B	10.0	71.8	0.94	1.03	1.36	31.6
Approach			613	3.1	612	3.1	0.869	13.4	LOS A	10.0	71.8	0.94	1.03	1.36	34.5
North: Albion Street (North)															
7	L2	All MCs	67	14.1	67	14.2	0.519	7.5	LOS A	3.3	24.3	0.69	0.72	0.77	35.5
8	T1	All MCs	314	5.4	310	5.4	0.519	7.0	LOS A	3.3	24.3	0.69	0.72	0.77	41.3
9	R2	All MCs	45	0.0	45	0.0	0.519	10.2	LOS A	3.3	24.3	0.69	0.72	0.77	35.5
9u	U	All MCs	9	0.0	9	0.0	0.519	11.8	LOS A	3.3	24.3	0.69	0.72	0.77	35.5
Approach			436	6.0	431	6.1	0.519	7.5	LOS A	3.3	24.3	0.69	0.72	0.77	40.3
West: Macpherson Street (West)															
10	L2	All MCs	62	0.0	57	0.0	0.575	12.5	LOS A	4.5	31.2	0.79	0.96	0.96	20.7
11	T1	All MCs	258	2.0	237	2.0	0.575	12.6	LOS A	4.5	31.2	0.79	0.96	0.96	20.7
12	R2	All MCs	20	0.0	18	0.0	0.575	15.8	LOS B	4.5	31.2	0.79	0.96	0.96	34.0
12u	U	All MCs	7	0.0	7	0.0	0.575	17.4	LOS B	4.5	31.2	0.79	0.96	0.96	20.7
Approach			347	1.5	319	1.5	0.575	12.9	LOS A	4.5	31.2	0.79	0.96	0.96	22.2
All Vehicles			2080	3.5	2046	3.6	0.894	15.3	LOS B	17.7	126.6	0.88	1.04	1.33	31.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

 Site: Site 4 [Macpherson St & Leichhardt St - SAT (Site Folder: SAT - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101 [2030_SAT Network (Network Folder: General)]

SAT Peak - proposed
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]		[Total HV]					[Veh. veh	Dist]				km/h
			veh/h	%	veh/h	%	v/c	sec			m				
South: Leichhardt Street (South)															
1	L2	All MCs	28	0.0	28	0.0	0.247	15.9	LOS B	1.8	12.3	0.97	0.83	0.97	27.3
2	T1	All MCs	42	0.0	42	0.0	0.247	15.8	LOS B	1.8	12.3	0.97	0.83	0.97	27.3
3	R2	All MCs	12	0.0	12	0.0	0.247	18.7	LOS B	1.8	12.3	0.97	0.83	0.97	37.5
3u	U	All MCs	1	0.0	1	0.0	0.247	20.1	LOS B	1.8	12.3	0.97	0.83	0.97	33.6
Approach			83	0.0	83	0.0	0.247	16.3	LOS B	1.8	12.3	0.97	0.83	0.97	29.9
East: Macpherson Street (East)															
4	L2	All MCs	9	0.0	9	0.0	0.890	21.7	LOS B	21.3	151.8	1.00	1.19	1.71	34.4
5	T1	All MCs	312	4.4	312	4.4	0.890	21.9	LOS B	21.3	151.8	1.00	1.19	1.71	30.8
6	R2	All MCs	408	2.3	408	2.3	0.890	24.7	LOS B	21.3	151.8	1.00	1.19	1.71	30.8
6u	U	All MCs	21	0.0	21	0.0	0.890	25.9	LOS B	21.3	151.8	1.00	1.19	1.71	37.1
Approach			751	3.1	751	3.1	0.890	23.5	LOS B	21.3	151.8	1.00	1.19	1.71	31.1
North: Leichhardt Street (North)															
7	L2	All MCs	506	1.2	505	1.3	0.941	28.3	LOS B	28.3	198.8	1.00	1.39	2.05	30.5
8	T1	All MCs	44	0.0	44	0.0	0.941	28.0	LOS B	28.3	198.8	1.00	1.39	2.05	25.2
9	R2	All MCs	273	1.5	272	1.5	0.941	31.1	LOS C	28.3	198.8	1.00	1.39	2.05	15.1
9u	U	All MCs	2	0.0	2	0.0	0.941	32.4	LOS C	28.3	198.8	1.00	1.39	2.05	15.1
Approach			825	1.3	823	1.3	0.941	29.2	LOS C	28.3	198.8	1.00	1.39	2.05	27.0
West: Macpherson Street (West)															
10	L2	All MCs	307	1.4	297	1.4	0.884	27.9	LOS B	18.6	131.9	1.00	1.38	1.99	22.3
11	T1	All MCs	298	3.2	288	3.2	0.884	27.9	LOS B	18.6	131.9	1.00	1.38	1.99	33.3
12	R2	All MCs	14	0.0	13	0.0	0.884	30.6	LOS C	18.6	131.9	1.00	1.38	1.99	28.8
12u	U	All MCs	5	0.0	5	0.0	0.884	32.0	LOS C	18.6	131.9	1.00	1.38	1.99	22.3
Approach			624	2.2	603	2.2	0.884	28.0	LOS B	18.6	131.9	1.00	1.38	1.99	29.2
All Vehicles			2283	2.1	2259	2.1	0.941	26.5	LOS B	28.3	198.8	1.00	1.30	1.88	29.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

 Site: Site 5 [Bronte Rd & Leichhardt St - SAT (Site Folder: SAT - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

 Network: N101 [2030_SAT Network (Network Folder: General)]

SAT Peak - proposed
Site Category: Future Conditions 1
Roundabout

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]		[Total HV]					[Veh. veh	Dist]				km/h
			veh/h	%	veh/h	%	v/c	sec			m				
South: Leichhardt Street (South)															
2	T1	All MCs	151	0.7	148	0.7	0.615	5.0	LOS A	6.9	48.6	0.56	0.55	0.56	31.1
3	R2	All MCs	623	2.0	615	2.0	0.615	7.7	LOS A	6.9	48.6	0.56	0.55	0.56	38.4
3u	U	All MCs	1	0.0	1	0.0	0.615	8.9	LOS A	6.9	48.6	0.56	0.55	0.56	31.1
Approach			775	1.8	764	1.8	0.615	7.1	LOS A	6.9	48.6	0.56	0.55	0.56	37.7
East: Bronte Road (East)															
4	L2	All MCs	573	1.3	573	1.3	0.696	7.6	LOS A	7.2	51.2	0.77	0.64	0.83	36.7
6	R2	All MCs	77	1.4	77	1.4	0.696	9.5	LOS A	7.2	51.2	0.77	0.64	0.83	36.7
6u	U	All MCs	18	0.0	18	0.0	0.696	10.7	LOS A	7.2	51.2	0.77	0.64	0.83	40.3
Approach			667	1.3	667	1.3	0.696	7.9	LOS A	7.2	51.2	0.77	0.64	0.83	36.9
North: Bronte Road (North)															
7	L2	All MCs	169	0.6	167	0.6	0.629	13.9	LOS A	5.8	40.4	0.92	0.92	1.21	35.1
8	T1	All MCs	220	1.4	217	1.5	0.629	13.3	LOS A	5.8	40.4	0.92	0.92	1.21	27.3
9u	U	All MCs	9	0.0	9	0.0	0.629	17.1	LOS B	5.8	40.4	0.92	0.92	1.21	27.3
Approach			399	1.1	394	1.1	0.629	13.7	LOS A	5.8	40.4	0.92	0.92	1.21	31.7
All Vehicles			1841	1.4	1825	1.4	0.696	8.8	LOS A	7.2	51.2	0.72	0.66	0.80	36.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: Site 6 [Bronte Rd & Albion St - SAT (Site Folder: SAT - 2030)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Network: N101 [2030_SAT
Network (Network Folder:
General)]

SAT Peak - proposed
Site Category: Future Conditions 1
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]		[Total HV]					[Veh. veh	Dist]				
			veh/h	%	veh/h	%	v/c	sec			m				km/h
South: Albion Street (South)															
2	T1	All MCs	284	8.9	281	9.0	0.586	11.8	LOS A	6.7	48.7	0.70	0.88	1.37	28.1
3	R2	All MCs	185	1.7	183	1.7	0.586	16.8	LOS B	6.7	48.7	0.70	0.88	1.37	28.1
Approach			469	6.1	464	6.1	0.586	13.8	NA	6.7	48.7	0.70	0.88	1.37	28.1
East: Bronte Road (East)															
4	L2	All MCs	46	2.3	46	2.2	0.614	11.2	LOS A	3.0	21.3	0.80	1.11	1.38	23.6
6	R2	All MCs	164	0.6	163	0.6	0.614	20.2	LOS B	3.0	21.3	0.80	1.11	1.38	23.6
Approach			211	1.0	209	1.0	0.614	18.3	LOS B	3.0	21.3	0.80	1.11	1.38	23.6
North: Albion Street (North)															
7	L2	All MCs	333	0.6	328	0.6	0.383	3.4	LOS A	0.0	0.0	0.00	0.21	0.00	35.8
8	T1	All MCs	391	6.7	386	6.8	0.383	0.1	LOS A	0.0	0.0	0.00	0.21	0.00	35.8
Approach			723	3.9	714	4.0	0.383	1.6	NA	0.0	0.0	0.00	0.21	0.00	35.8
All Vehicles			1403	4.2	1387	4.2	0.614	8.2	NA	6.7	48.7	0.36	0.57	0.67	29.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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Waverley Council

Charing Cross Streetscape Upgrade Traffic Study

19 November 2020

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Appendices

Appendix A – SIDRA Model Calibration Analysis

Appendix B – Traffic Redistribution Assumptions – Victoria Street / Bronte Road / Carrington Road

Appendix C - Traffic Redistribution Assumptions – Bronte Road / Albion Street

1. Introduction

1.1 Background

Waverley Council are proposing streetscape upgrades to the Charing Cross Village Centre, which is primarily located along Bronte Road between the Carrington Road / Bronte Road / Victoria Road intersection and the Bronte Road Albion Street intersection. The centre has a diverse range of local shops and services that support the daily needs of local residents, workers and visitors. The centre is also a transport route, with bus routes along Bronte Road.

1.1.1 Project objectives

The Charing Cross streetscape project is intended to upgrade the commercial precinct of Charing Cross to enhance the sense of arrival, including improved safety and convenience for active and public transport modes. The location of Charing Cross Village Centre is shown in Figure 1-1.

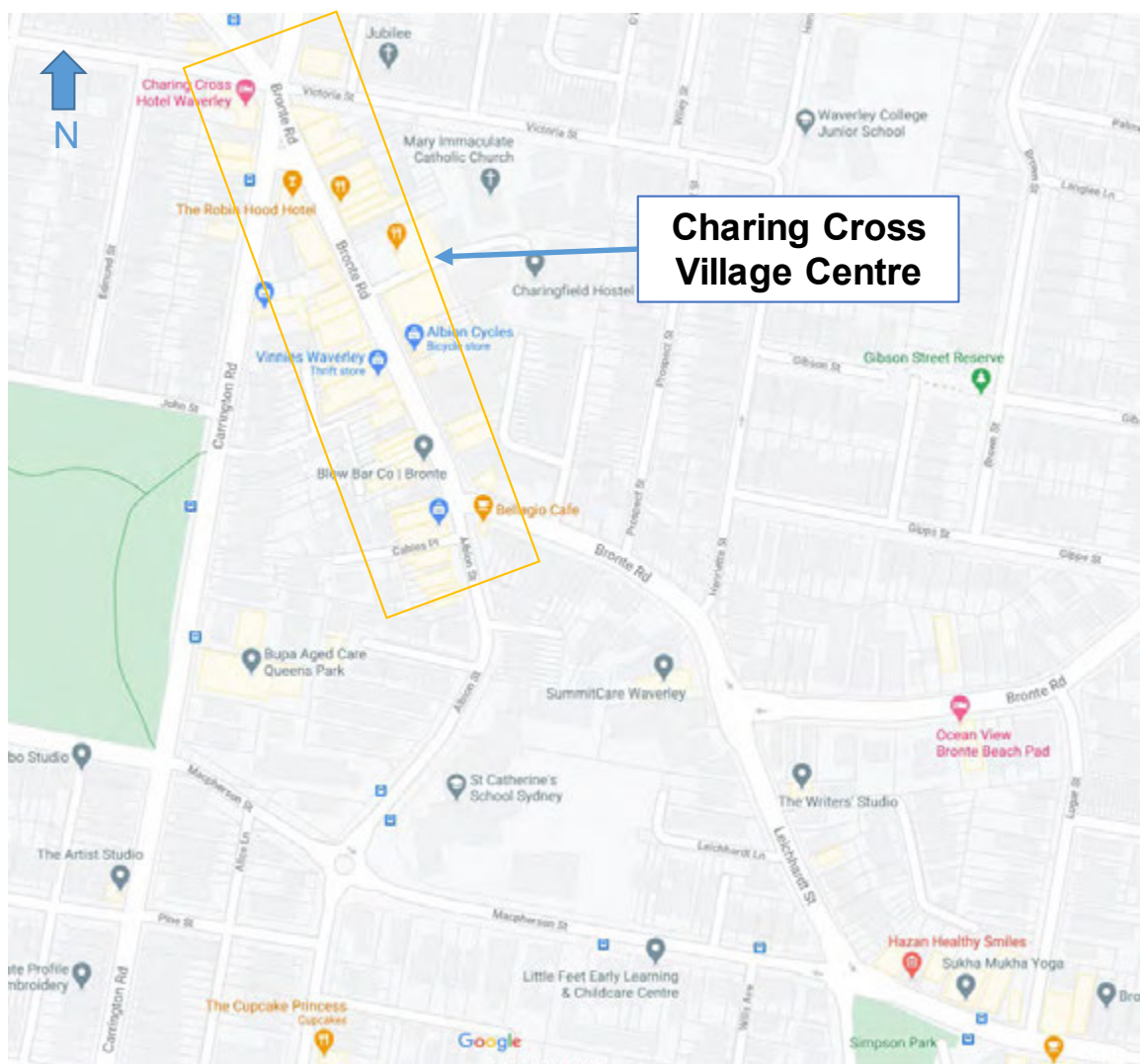


Figure 1-1 Charing Cross Village location

Source: Google Maps (2020), modified by GHD

1.2 Purpose of this report

This Traffic Study provides a review of the existing and future road and transport conditions in the vicinity of Charing Cross Village Centre, including traffic volumes and crash data. The intent is to inform future planning for the proposed Charing Cross Streetscape project.

1.3 Study assumptions and limitations

The preparation of this study was limited by the following:

- No assessment of the proposed streetscape upgrade has been undertaken, as the proposed works have not been confirmed to date. However, this traffic study will help inform the development of the streetscape upgrade project for Charing Cross.
- A site visit undertaken during the AM and PM peak periods in July 2020 on the same day as the weekday intersection traffic surveys. No site visit was undertaken during the Saturday Peak.
- Traffic count surveys (as listed in Table 3-10), including:
 - Seven-day Automatic Tube Counts (ATCs) undertaken in July 2020;
 - Weekday AM peak, weekday PM peak and Saturday intersection turning count surveys undertaken in July 2020;
 - Historical 2019 ATC and intersection traffic count data provided by Matrix Traffic and Transport Pty. Ltd; and
 - Historical 2019 intersection traffic counts for the Carrington Road / Bronte Road / Victoria Street intersection, provided by TfNSW.
- SIDRA 8 traffic modelling has been undertaken for key intersections in the study area, which have been calibrated base on
 - Queue length survey data (for the Carrington Road / Bronte Road / Victoria Street intersection and the Carrington Road / Darley Road / Macpherson Street intersection);
 - Google typical traffic operations; and
 - Observations from the site inspection.
- The greater of the 2019 and 2020 intersection count data traffic volumes has been used for the SIDRA traffic modelling analysis, as agreed with Council and TfNSW. Analysis of the traffic count data identified that the 2020 traffic data was higher for all intersections.
- A future state base model was developed for 2030, allowing ten-year future growth. The future base traffic model was developed utilising an assumed growth rate of 0.5 percent per annum for the Carrington Road / Bronte Road corridor (Randwick to Bondi) as sensitivity test. It is noted that minimal development is planned in the study area and that road network is already congested in the peak hours. This indicates that there is not expected to be significant traffic grown in the network during peak periods.
- No parking surveys or pedestrian surveys were undertaken. The study broadly assesses parking and pedestrian demand based on the site visits

1.4 Report structure

The remaining sections of this report are structured as follows:

- **Section 2 – Method:** describes the steps undertaken in the assessment and the assessment criteria.
- **Section 3 – Existing conditions:** provides a review of existing road features, adjacent developments, traffic volumes and crash data.
- **Section 4 – Future intersection options analysis:** provides a summary of SIDRA intersection analysis for a number of potential intersection upgrade options.
- **Section 5 – Summary and recommendations:** provides a summary of the key findings of this study and outlines recommendations for Council to consider to address key issues.

2. Method

This Section outlines the method and evaluation criteria used in the assessment of the project.

2.1 Method of assessment

This Traffic Study has been undertaken with reference to the *Guide to Traffic Generating Development* (Roads and Maritime 2002). While not mandatory, the Guide provides a process and methodology to undertake the Traffic Study. The traffic operation assessment process outlined in the guide identifies the operating characteristics which need to be compared with agreed performance criteria.

The Guide states that existing daily traffic volumes on roads adjacent to a proposed development should be compared with estimated daily traffic volumes. This enables the functions of roads in the overall hierarchy of roads to be reviewed in the context of the proposed development.

The assessment criteria adopted for this report is outlined in the following Sections.

2.1.1 Intersection assessment criteria

The performance of the existing road network is largely dependent on the operating performance of key intersections, which are critical capacity control points on the road network. The SIDRA 8 intersection modelling software was used to assess the proposed peak hour operating performance of intersections on the surrounding road network.

The criteria for evaluating the operational performance of intersections is provided by the *Guide to Traffic Generating Developments* (Roads and Maritime Services, 2002) and reproduced in Table 2-1. The criteria for evaluating the operational performance of intersections is based on a qualitative measure (i.e. Level of Services), which is applied to each band of average vehicle delay.

Table 2-1 Level of services criteria for intersections

Level of Services	Average Delay per Vehicle (seconds/veh)	Traffic Signals, Roundabouts	Give Way & Stop Signs
A	< 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control modes	At capacity, requires other control mode
F	> 70	Over Capacity Unstable operation	Over Capacity Unstable operation

Source: *Guide to Traffic Generating Developments* (Roads and Maritime Services 2002)

2.1.2 Midblock assessment criteria

Table 2-2 (from the *Roads and Maritime Guide to Traffic Generating Developments*) summaries the Level of Service mid-block capacities for urban roads.

Table 2-2 Urban road mid-block capacities

Level of Service	One Lane veh/h	Two Lanes veh/h
A	200	900
B	380	1,400
C	600	1,800
D	900	2,200
E	1,400	2,800

Source: *Guide to Traffic Generating Developments (Roads and Maritime Services 2002)*

3. Existing conditions

3.1 Existing road network characteristics

This Section provides an understanding of the existing road network surrounding the Charing Cross Village Centre.

3.1.1 Road hierarchy

Roads within NSW are categorised in the following two ways:

- By classification (ownership)
- By the function that they perform.

Road Classification

Roads are classified (as defined by the *Roads Act 1993*) based on their importance to the movement of people and goods within NSW (as a primary means of communication).

The classification of a road allows Transport for NSW (TfNSW) to exercise authority of all or part of the road. Classified roads include Main Roads, State Highways, Tourist Roads, Secondary Roads, Tollways, Freeways and Transitways.

For management purposes, Roads and Maritime has three administrative classes of roads. These are:

- **State Roads** – Major arterial links throughout NSW and within major urban areas. They are the principal traffic carrying roads and fully controlled by Roads and Maritime with maintenance fully funded by Roads and Maritime. State Roads include all Tollways, Freeways and Transitways; and all or part of a Main Road, Tourist Road or State Highway.
- **Regional Roads** – Roads of secondary importance between State Roads and Local Roads which, together with State Roads provide the main connections to and between smaller towns and perform a sub arterial function in major urban areas. Regional roads are the responsibility of councils for maintenance funding, though Roads and Maritime funds some maintenance based on traffic and infrastructure. Traffic management on Regional Roads is controlled under delegation by local government. Regional Roads maybe all or part of a Main Road, Secondary Road, Tourist Road or State Highway; or other roads as determined by Roads and Maritime.
- **Local Roads** – The remainder of roads are council controlled roads. Local Roads are the responsibility of councils for maintenance funding. Roads and Maritime may fund some maintenance and improvements based on specific programs (e.g. urban bus routes, road safety programs). Traffic management on Local Roads is controlled under the delegation by local government.

Functional Hierarchy

Functional road classification involves the relative balance of the mobility and access functions.

TfNSW define four levels in a typical functional road hierarchy, ranking from high mobility and low accessibility, to high accessibility and low mobility. These road classes are:

- **Arterial Roads** – generally controlled by Roads and Maritime, typically no limit in flow and designed to carry vehicles long distance between regional centres.
- **Sub-Arterial Roads** – can be managed by either Roads and Maritime or local council. Typically, their operating capacity ranges between 10,000 and 20,000 vehicles per day, and their aim is to

carry traffic between specific areas in a sub region, or provide connectivity from arterial road routes (regional links).

- **Collector Roads** – provide connectivity between local roads and the arterial road network and typically carry between 2,000 and 10,000 vehicles per day.
- **Local Roads** – provide direct access to properties and the collector road system and typically carry between 500 and 4,000 vehicles per day.

3.1.2 Bronte Road

Bronte Road is a sub-arterial road (regional road), which connects Bondi Junction to the north to Bronte Park / Beach to the southwest. It runs approximately northwest to southeast between Oxford Street and Macpherson Street.

Bronte Road has the following key features outlined in Table 3-1 and shown in Figure 3-1 to Figure 3-3.

Table 3-1 Bronte Road key features

Feature	Description
Carriageway	Two-way road with one lane in each direction divided by double solid line (BB line).
Parking	On-street parking bays are provided on both sides of the road. At Bronte Road southeast of Victoria Street the following parking facilities are provided: <ul style="list-style-type: none"> • 30 minutes parking (various time restrictions) • 60 minutes parking (various time restrictions) • 15 minute parking (various time restrictions) At northwest of Victoria Street it includes the following: <ul style="list-style-type: none"> • 30 minute parking (various time restrictions) • Disabled parking
Speed Limit	50 km/h default urban speed limit 40 km/h at school zone
Pedestrian Facilities	Footpaths are available along both sides of the road. Signal controlled pedestrian crossings are provided at Victoria Street and Bronte Road signalised intersection. A zebra crossing is provided at Bronte Road, located to the north of the intersection with Albion Street. It is noted that pedestrian connectivity at the Carrington Road / Victoria Street / Bronte Road intersection is poor due to the current intersection configuration, with six approaches to the intersection. In particular, pedestrians walking along the southern side of Victoria Road are required to cross at two long pedestrian crossings, which can result in delays for pedestrians walking along this alignment.
Bicycle Facilities	U-rail bike parking facilities are provided on footpaths. A right-turning facility is provided on Bronte Road northbound at the intersection with Henrietta Street.
Public Transport	Bus stops are located on either side of Bronte Road, with bus routes: 314, 316, 317, 348, 353 and 379 operating from these stops.



Figure 3-1 Bronte Road south of Victoria Street, viewed northwards from Albion Street intersection



Figure 3-2 Bronte Road north of Victoria Street, viewed northwards from Victoria Street



Figure 3-3 Bronte Road at Henrietta Street intersection, viewed southwards

3.1.3 Carrington Road

Carrington Road is an arterial road (state road), which provides connection to Council Street and Bondi Road to its north and Coogee Bay Road to its south. The road consists of two traffic lanes with one lane in each direction.

Carrington Road has the following key features outlined in Table 3-2 and shown in Figure 3-4 and Figure 3-5.

Table 3-2 Carrington Road key features

Feature	Description
Carriageway	Generally one traffic lane in each direction divided by double solid line. Parking lanes are provided on either sides of the road.
Parking	On-street parking available.
Speed Limit	50 km/h sign posted. 40 km/h at school zone
Pedestrian Facilities	Footpaths are provided on both sides of the road. Signal pedestrian crossings are provided at signalised intersections.
Bicycle Facilities	No dedicated facilities
Public Transport	Bus stops are located on both sides of the road at Carrington Road south of Victoria street with bus route 313 operating at these bus stops. Bus stops at Carrington Road north of Victoria Street is located on eastern side of the road with route 400 operating at these stops.



Figure 3-4 Carrington Road south of Victoria Street, viewed southwards



Figure 3-5 Carrington Road north of Victoria Street, viewed northwards

3.1.4 Victoria Street

Victoria Street functions as a collector road, which runs in east west direction connecting Henrietta Street in its east and Queens Park Road and York Road to its west.

Victoria Street has the following key features outlined in Table 3-3 and shown in Figure 3-6 and Figure 3-7.

Table 3-3 Victoria Street key features

Feature	Description
Carriageway	Two-way road with one traffic lane in each direction divided by raised median and double solid lines. Dedicated parking lanes provided on both sides of the road.
Parking	Parking facilities are provided with the following time restrictions: <ul style="list-style-type: none"> • 2 hour parking • 1 hour parking • 30 minutes parking
Speed Limit	50 km/h (default urban)
Pedestrian Facilities	Signal pedestrian crossing at Victoria Street and Carrington Road intersection. A wombat pedestrian crossing is provided at Henrietta Street intersection.
Bicycle Facilities	Dedicated on-street cycle lanes are provided on both sides of the road.
Public Transport	No public transport services operate along Victoria Street. However bus stops are available at Queens Park Road with 357 bus stop operating at this bus stop.



Figure 3-6 Victoria Street west of Carrington Road, viewed westwards



Figure 3-7 Victoria Street east of Carrington Road, viewed eastwards

3.1.5 Macpherson Street

Macpherson Street functions as a sub-arterial (regional) road, which runs in east west direction connecting Darley Road and Carrington Road to the west and Bronte Road to the east, towards Bronte Beach.

Macpherson Street has the following key features outlined in Table 3-4 and shown in Figure 3-8 and Figure 3-9.

Table 3-4 Macpherson Street key features

Feature	Description
Carriageway	Two-way road with one traffic lane in each direction divided by double solid lines (faded). Dedicated parking lanes provided on both sides of the road.
Parking	Parking facilities are provided with the following time restrictions: <ul style="list-style-type: none"> • Unrestricted parking available • 10 minute parking • Kiss & Ride zone 8:00AM to 9:15AM and 2:45PM to 4:15PM
Speed Limit	50 km/h (default urban), 40km/h during school zone hours
Pedestrian Facilities	Signal pedestrian crossing at Carrington Road intersection. A wombat pedestrian crossing is provided at St Catherine's School.
Bicycle Facilities	Marked on-street cycle route shared with general traffic lane between Albion Street and Leichardt Street. Dedicated cycle lane on Macpherson Street west of Leichardt Street in the westbound direction. No dedicated cycle facilities west of Albion Street.
Public Transport	Bus stops are located on the north and south sides of Macpherson Street between Albion Street and Leichardt Street, servicing route 379.



Figure 3-8 Macpherson Street east of Albion Street, viewed westwards



Figure 3-9 Macpherson Street at Carrington Road intersection, viewed eastwards

3.1.6 Albion Street

Albion Street functions as a collector road, which runs in a north south direction connecting Bronte Road to the north and Carrington Road to the south.

Albion Street has the following key features outlined in Table 3-5 and shown in Figure 3-10.

Table 3-5 Albion Street key features

Feature	Description
Carriageway	Two-way road with one traffic lane in each direction divided by double solid lines (faded). Dedicated parking lanes provided on both sides of the road.
Parking	Parking facilities are provided with the following time restrictions:

Feature	Description
	<ul style="list-style-type: none"> • 2 hour parking • 30 minute parking • Unrestricted parking available
Speed Limit	50 km/h (default urban), 40km/h during school zone hours
Pedestrian Facilities	Signalised pedestrian crossing at St Catherine's School.
Bicycle Facilities	No dedicated cycling facilities.
Public Transport	Bus stops are located on the east and west sides of Albion Street outside St Catherine's School, servicing routes 314,316, 317, 348, 353, 379, 400 and 400N.



Figure 3-10 Albion Street at Macpherson Street intersection, viewed northwards

3.1.7 Leichardt Street

Leichardt Street functions as a sub-arterial (regional) road, which runs in a north south direction connecting Bronte Road to the north and Macpherson Street to the south, becoming a local road to the south of Macpherson Street towards Varna Street.

Leichardt Street has the following key features outlined in Table 3-6 and shown in Figure 3-11.

Table 3-6 Leichardt Street key features

Feature	Description
Carriageway	Two-way road with one traffic lane in each direction divided by double solid lines (faded). Dedicated parking lanes provided on both sides of the road.
Parking	Parking facilities are provided with the following time restrictions: <ul style="list-style-type: none"> • No parking 7:45AM to 9:00AM and 2:30PM to 4:00PM on school days on the northbound side.
Speed Limit	50 km/h (default urban), 40km/h during school zone hours.
Pedestrian Facilities	Wombat pedestrian crossing adjacent Lugar Brae Avenue.

Feature	Description
Bicycle Facilities	Marked on-street cycle route shared with general traffic lane in both directions.
Public Transport	Bus stops are located on the east and west sides of Leichardt Street, servicing routes 360.



Figure 3-11 Leichardt Street south of Bronte Road, viewed northwards

3.2 Crash data review

A review of crash data provided from the Transport for NSW Centre for Road Safety website has been undertaken. The five-year period (2014-2018) crash data summary is given for the following road sections:

- Victoria Street / Bronte Road
- Carrington Road, between Victoria Street and Macpherson Street
- Carrington Road / Macpherson Street
- Bronte Road, between Victoria Street and Macpherson Street
- Bronte Road, between Victoria Street and Birrell Street
- Macpherson Street / Albion Road

Figure 3-12 to Figure 3-17 show the locations of recorded crashes.

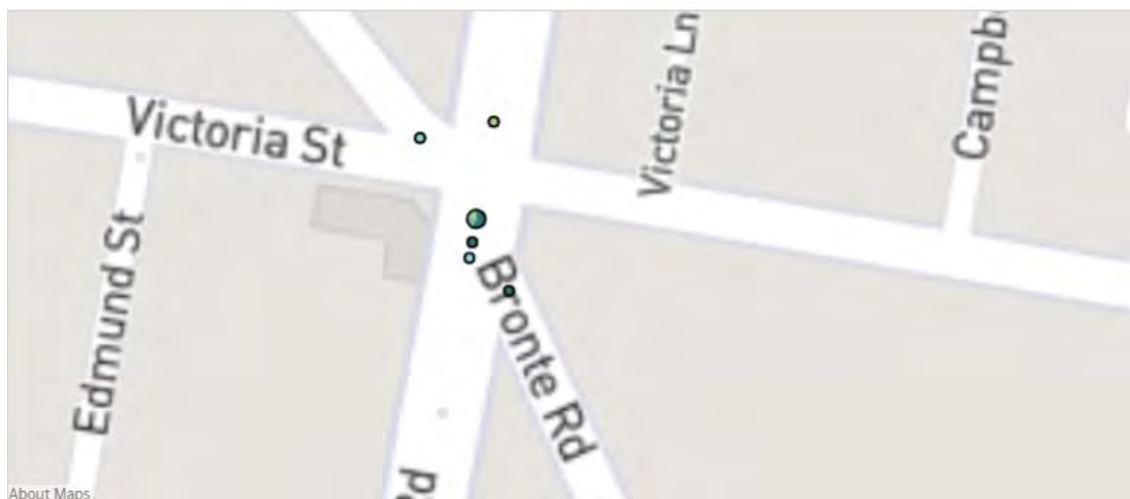


Figure 3-12 Crash locations (2014-2018) – Victoria Street / Bronte Road / Carrington Road intersection

Source: Transport for NSW Centre for Road Safety

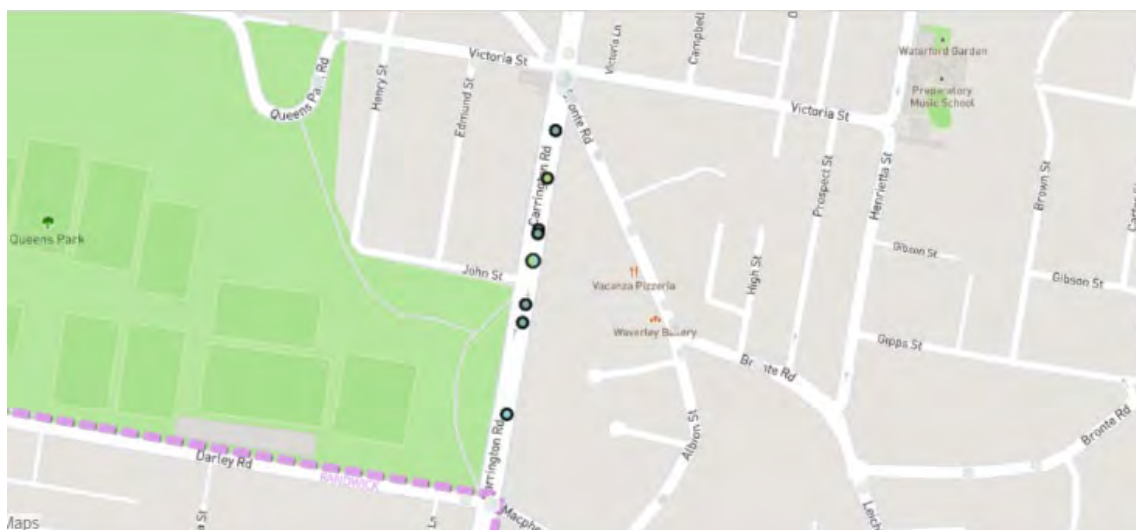


Figure 3-13 Crash locations (2014-2018) – Carrington Road between Victoria Road and Macpherson Street

Source: Transport for NSW Centre for Road Safety

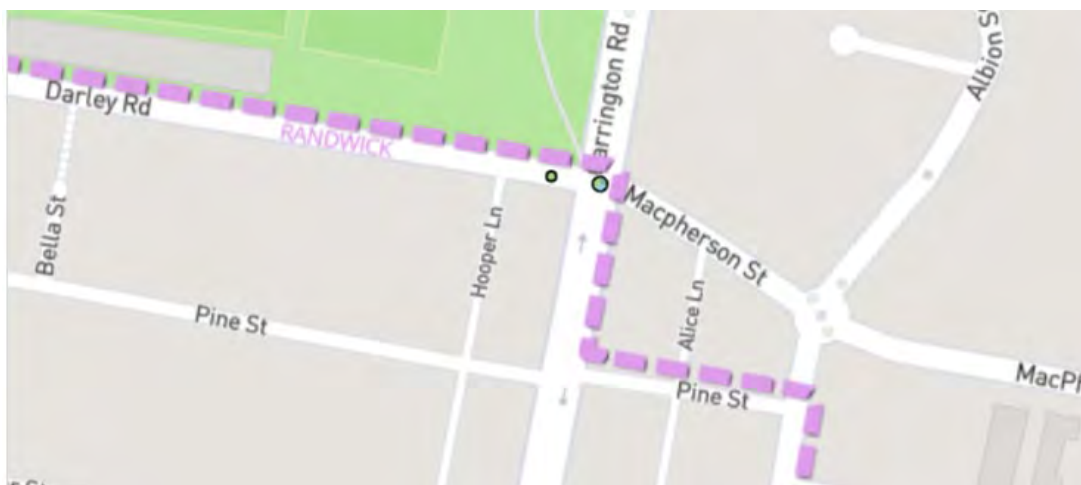


Figure 3-14 Crash locations (2014-2018) – Carrington Road / Macpherson Street / Darley Road intersection

Source: Transport for NSW Centre for Road Safety

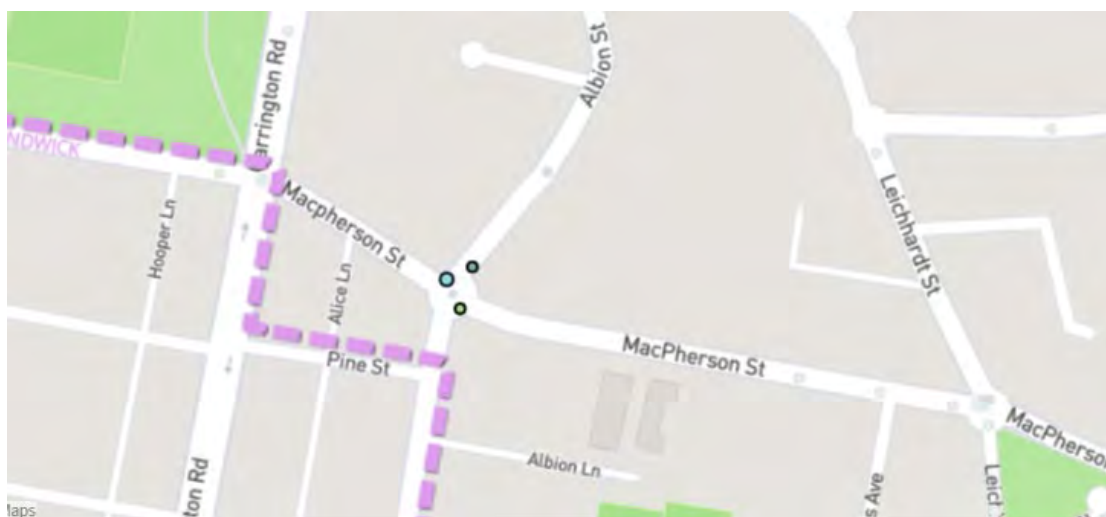


Figure 3-15 Crash locations (2014-2018) – Macpherson Street / Albion Street intersection

Source: Transport for NSW Centre for Road Safety

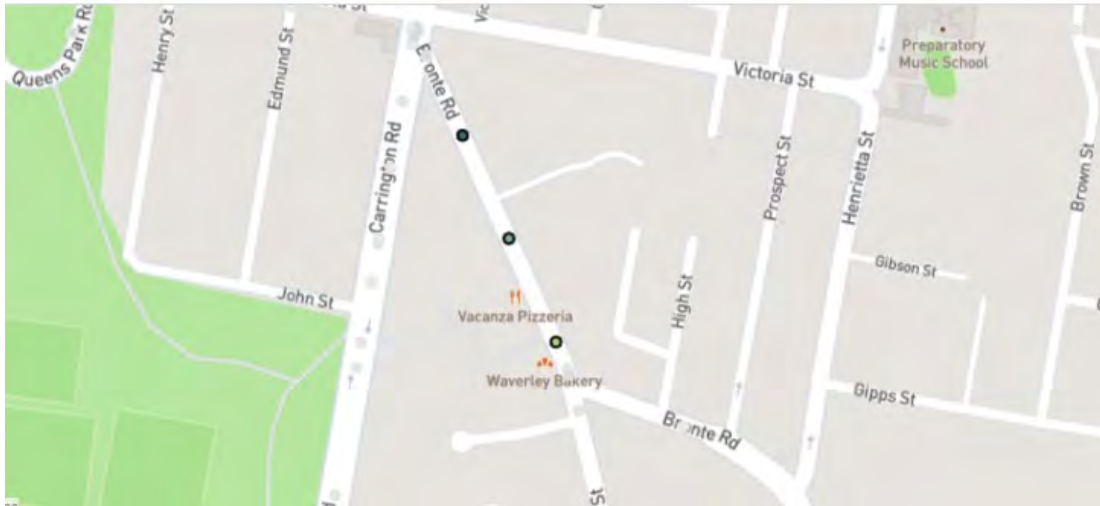


Figure 3-16 Crash locations (2014-2018) – Bronte Road between Victoria Street and Albion Street

Source: Transport for NSW Centre for Road Safety

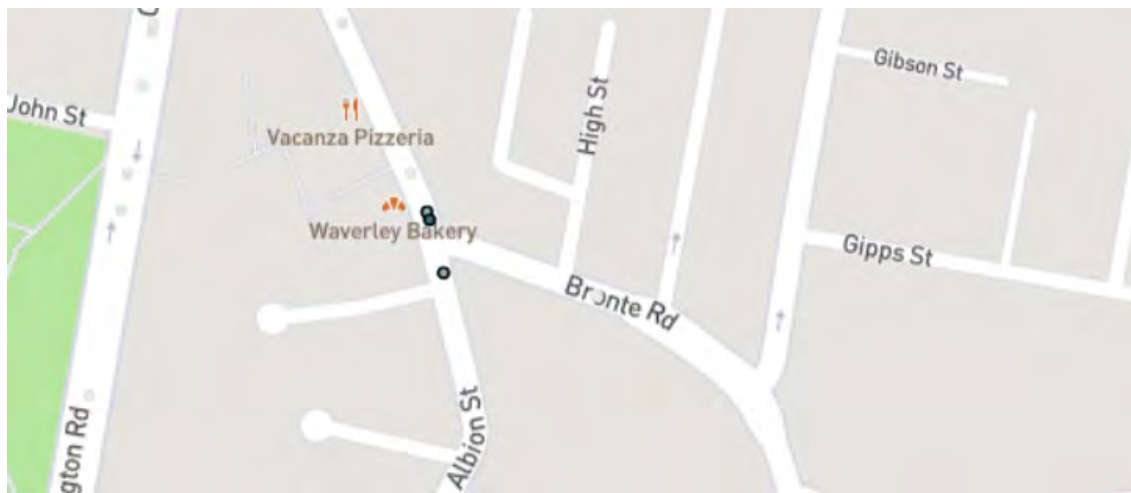


Figure 3-17 Crash locations (2014-2018) – Bronte Road / Albion Street intersection

Source: Transport for NSW Centre for Road Safety

A summary of the crash types by road section, is provided in Table 3-7. Analysis of these data indicates the following:

- Pedestrian crashes were the highest at the Carrington Road / Victoria Street / Bronte Road intersection. These crashes have resulted in eight injuries including four serious injuries. The intersection pedestrian crashes could be due to lack of adequate sight distances for vehicles entering Victoria Street and Bronte Street.
- Crashes involving vehicles travelling in the same direction were the highest along Carrington Road, between Victoria Street and Macpherson Street. The contributing factors could be associated with poor driver observation, particularly under congested traffic conditions.

Table 3-7 Summary of crash types by location (2014-2018)

Location	Predominant crash type (number of crashes)	Number of crashes			
		Fatal	Injured	Not injured	Total
Victoria Street / Bronte Road	Pedestrians (5) Vehicles from same direction (4) Vehicles from opposite direction (1)	0	8	2	10
Carrington Road - between Victoria Street and Macpherson Street	Vehicles from same direction (5) Off path, on straight (2) On path (1) Manoeuvring (1)	0	6	3	9
Carrington Road / Macpherson Street	Vehicles from same direction (2) Vehicles from opposing direction (2)	0	2	2	4
Bronte Road - Between Victoria Street Albion Street	Pedestrian far side (1) Vehicles same direction - rear end (1) Off path, on straight - left off carriageway into object, parked vehicle (1)	0	2	1	3
Bronte Road / Albion Street	vehicle on path - vehicle open door (1) Off path, on straight left - left off carriageway into object, parked vehicle (1) Pedestrian far side (1)	0	3	0	3
Bronte Road - Between Victoria Street and Birrell Street	Pedestrians (1) Vehicles from same direction (1) Vehicles from opposite direction (1) Vehicles from adjacent direction (1) Others (3)	0	5	2	7
Macpherson Street / Albion Road	Vehicles from adjacent direction (2) Vehicles from same direction (1) Off path, on curve or turning (1)	0	3	1	4

3.3 St Catherine's School drop-off and pick-up

A review of the St Catherine's School drop-off and pick-up has been undertaken. Figure 3-18 shows the location of the existing drop-off and pick-up facilities.

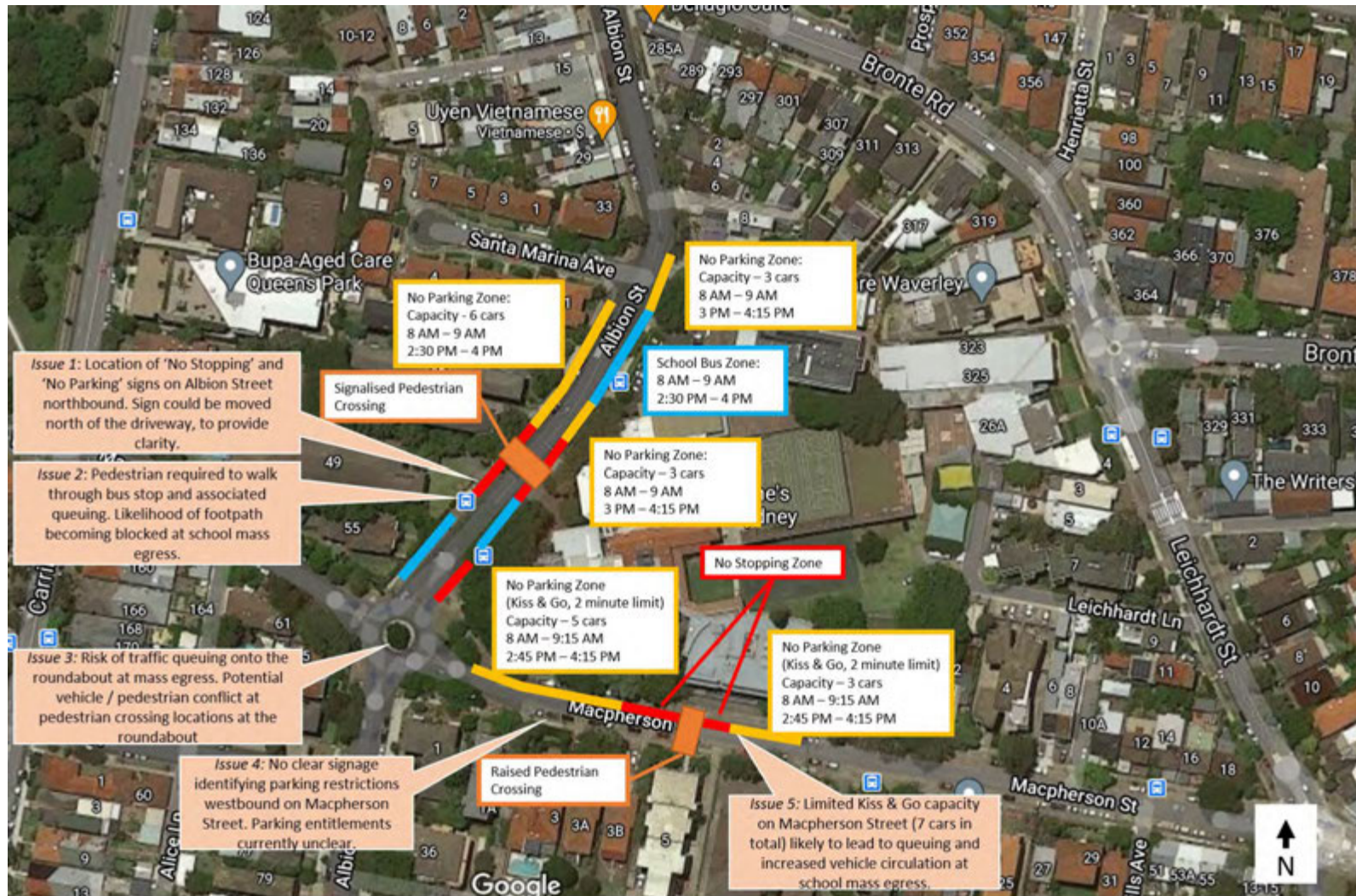


Figure 3-18 St Catherine's School drop-off and pick-up

Source: Google Maps (2020), modified by GHD

The review of drop-off and pick-up facilities at St Catherine's School has been undertaken, which is summarised in Table 3-8.

Table 3-8 Review of St Catherine's School drop-off and pick-up facilities

Issue number	Issue description	Recommendation
1	Location of 'No Stopping' and 'No Parking' signs on Albion Street northbound (see Figure 3-19). Sign could be moved north of the driveway, to provide clarity.	Consider the relocation of 'No Stopping' and 'No Parking' signs to north of the driveway.
2	Pedestrians required to walk through bus stop and associated queuing. Likelihood of footpath becoming blocked at school mass egress (see Figure 3-20) Pedestrian footpath width at the rear of the bus stop is currently one metre only – this may pose issues for wheelchair users, parents prams etc. Bus stop ID: 202419 and 202428	Consider the reconfiguration of bus stops on Albion Street to allow safe pedestrian movement during peak egress times to deconflict bus queues with pedestrian through-movements.
3	Risk of traffic queuing onto the roundabout. Potential vehicle / pedestrian conflict at pedestrian crossing locations at the roundabout: Southern arm – non-standard pedestrian refuge (see Figure 3-21) Eastern arm - no pedestrian refuge Western arm – no pedestrian refuge	Investigate upgrade of pedestrian crossing facilities at Macpherson Street / Albion Street roundabout, including installation of pedestrian refuge islands to improve pedestrian access and safety.
4	No clear signage identifying parking restrictions westbound on Macpherson Street. Parking entitlements are currently unclear.	Installation of appropriate signage to support parking entitlements.
5	Use of non-standard 'Kiss & Go Signage' at Macpherson Street (see Figure 3-19)	Installation of appropriate 'R9-303' signage to support formal school pick-up and drop-off operations (see Figure 3-19) Note, R9-303 (School Drop-off & Pick-up Zone) plate can only be used in accordance with "Roads and Maritime Services Procedure 141P - Procedure for a 'Drop-off & Pick-up' initiative around schools
6	Limited Kiss & Go capacity on Macpherson Street (seven cars in total) likely to lead to queuing and increased vehicle circulation at school mass egress.	Review of available 'Kiss & Go' locations serving the school. Consider use of westbound parking lanes, adjacent to the existing school drop-off / pick up' locations to provide additional capacity and minimise requirements for vehicle circulation on Macpherson Street and Albion Street.

Figure 3-19 shows the existing location of the 'No Parking' and 'No Stopping' signs on Albion Street.



Figure 3-19 'No parking' and 'No Stopping' signs south of the driveway on Albion Street, viewed northwards (Issue 1)

Figure 3-20 shows the northbound and southbound bus shelters at Albion Street, which can restrict through-movements for pedestrians and bus stop queuing conflicts.



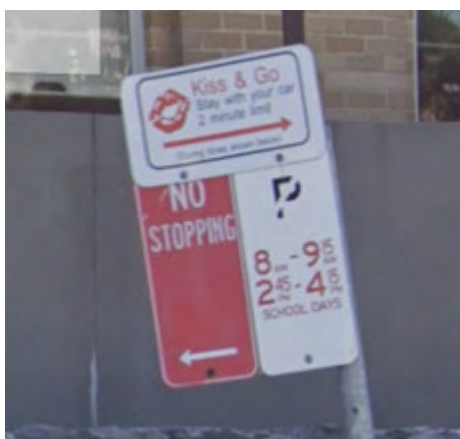
Figure 3-20 Bus stops on Albion Street, viewed northwards (Issue 2)

Figure 3-21 shows the existing non-standard pedestrian crossing facilities at the Albion Street / Macpherson Street roundabout south approach.



Figure 3-21 Non-standard pedestrian crossing at Albion Street (Issue 3)

Figure 3-22 shows the existing non-standard 'Kiss & Go' signage at Macpherson Street and the recommended TfNSW standard 'School Drop-off Pick-up Zone' signage.



Existing non-standard 'kiss and Go' Signage at Macpherson Street (Issue 5)



TfNSW standard 'School Drop-off and Pick-up Zone' signage (Issue 5)

Figure 3-22 Non-standard signage at Macpherson Street (Issue 5)

3.4 Public and active transport

In reviewing the site and its accessibility to public transport opportunity, reference was made to the *NSW Planning Guidelines for Walking and Cycling (2004)*. This document outlines a recommended walkable distance of 400 m to 800 m to public transport and other local amenities or a 1.5 km bicycle riding distance. Details of the accessibility to public transport, walking and bicycle riding access is provided in the following sections.

3.4.1 Bus services

Bus services operating roads in the vicinity of the project study area summarised in Table 3-9. The bus routes are shown in Figure 3-23.

Table 3-9 Bus services

Route	Number of bus services per hour	Coverage
313	Weekday : 2 services per hour Saturday: 2 services per hour Sunday: 2 services per hour	Bondi Junction to Coogee via Carrington Rd
	Weekday : 2 services per hour Saturday: 2 services per hour Sunday: 2 services per hour	Coogee to Bondi Junction via Carrington Rd
314	Weekday: 2 services per hour Saturday: 2 services per hour Sunday: 1 services per hour	Bondi Junction to Coogee via Randwick Junction
	Weekday: 2 services per hour Saturday: 2 services per hour Sunday: 1 services per hour	Coogee to Bondi Junction via Randwick Junction
316	Weekday: 2 services per hour Saturday: 2 services per hour Sunday: 1 service per hour	Bondi Junction to Eastgardens via Randwick Junction
	Weekday: 2 services per hour Saturday: 2 services per hour Sunday: 1 services per hour	Eastgardens to Bondi Junction via Randwick Junction
317	Weekday: 2 services per hour Saturday: 2 services per hour Sunday: 1 service per hour	Bondi Junction to Eastgardens via Randwick Junction & Beauchamp Rd
	Weekday: 2 services per hour Saturday: 2 services per hour Sunday: 1 service per hour	Eastgardens to Bondi Junction via Randwick Junction & Beauchamp Rd
348	Weekday: 2 services per hour 3 services during AM and PM peak hours Saturday: 2 services per hour Sunday: 2 services per hour	Bondi Junction to Wolli Creek
	Weekday: 2 services per hour 4 services during AM peak hour Saturday: 2 services per hour Sunday: 2 services per hour	Wolli Creek to Bondi Junction
353	Weekday: 2 services per hour AM and PM peak: 3-4 services Saturday: 2 services per hour Sunday: 2 services per hour	Bondi Junction to Eastgardens
	Weekday: 2 services per hour 3-5 services per hour during AM and PM peak hours Saturday: 2 services per hour Sunday: 2 services per hour	Eastgardens to Bondi Junction
379	Weekday: 6 services per hour AM and PM peak: 6-9 services per hour Saturday: 6 services per hour Sunday: 3-6 services per hour	Bronte to North Bondi
	Weekday: 6 services per hour Saturday: 6 services per hour Sunday: 6 services per hour	North Bondi to Bronte
400	Weekday: 9 services per hour Saturday: 6 services per hour Sunday: 6 services per hour	Sydney Airport to Bondi Junction via Eastgardens
	Weekday: 9 services per hour Saturday: 6 services per hour	Bondi Junction to Sydney Airport via Eastgardens

Route	Number of bus services per hour	Coverage
	Sunday: 6 services per hour	

Source: Transport NSW (data obtained on 16 June 2020)

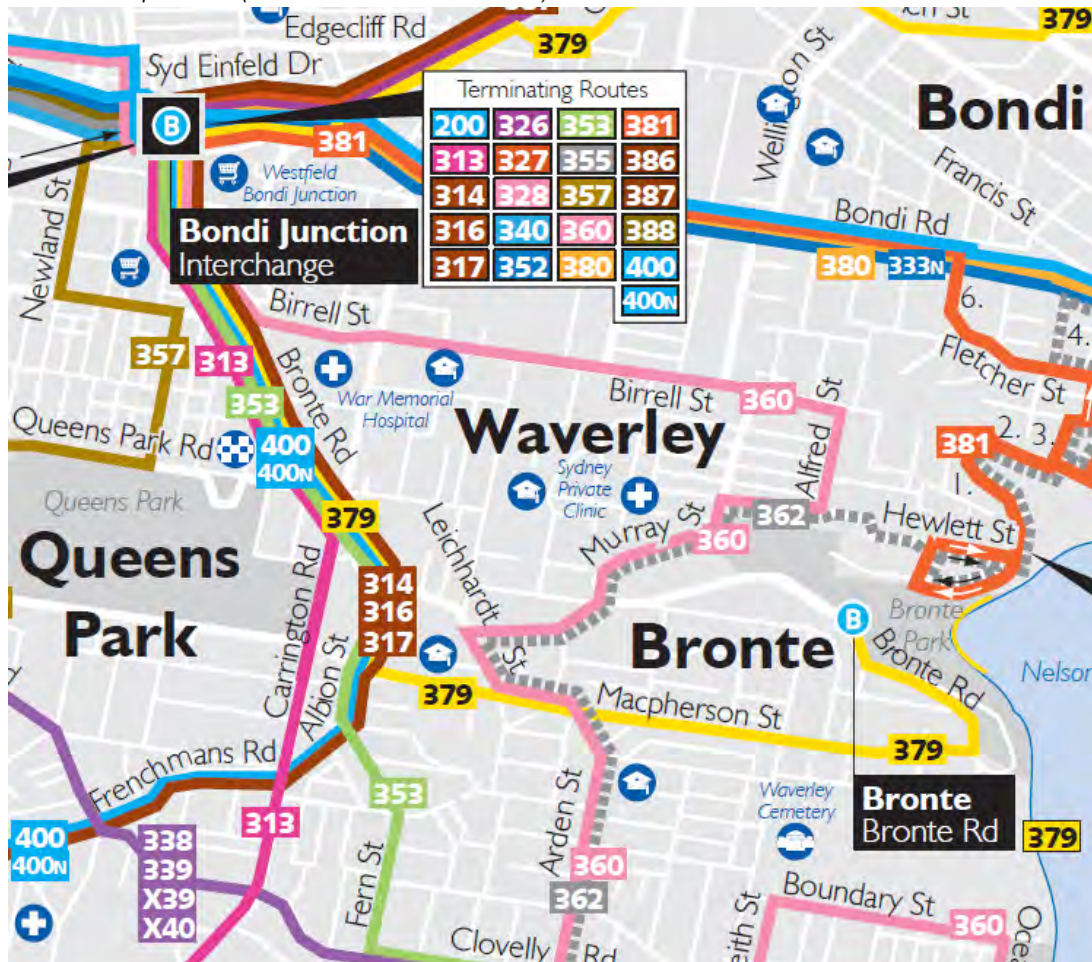


Figure 3-23 Eastern Suburbs bus network map

Source: Transport for NSW website

3.4.2 Bicycle riding

The bicycle network in the study area is shown at Figure 3-24, which is an extract from the *TfNSW Cycleway Finder* website. An on-road bicycle route (low difficulty) is provided along Victoria Street, which passes in an east-west alignment through the Bronte Road / Carrington Road / Victoria Street intersection. There are additional routes using Leichardt Street and Macpherson Street.

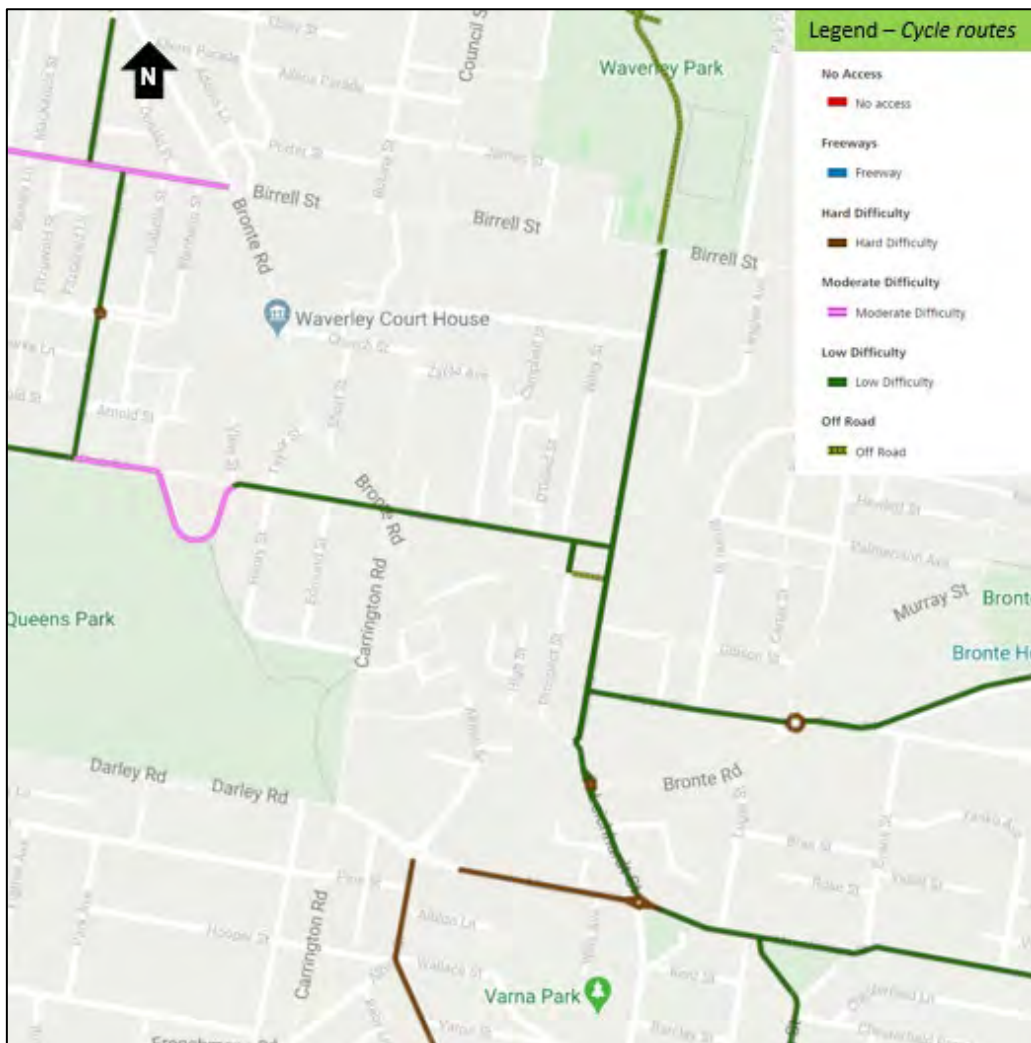


Figure 3-24 Existing bicycle network

Source: http://www.rms.nsw.gov.au/maps/cycleway_finder

Figure 3-25 is an extract from the Strava global heat map, which is a map generated by aggregated public cycling activities over the past two years. The figure demonstrates that Carrington Road, Bronte Road and Macpherson Street have a high level of cyclist traffic compared with other roads in the area. This indicates that despite the limited cycling infrastructure on these roads, they are popular routes for cycling.

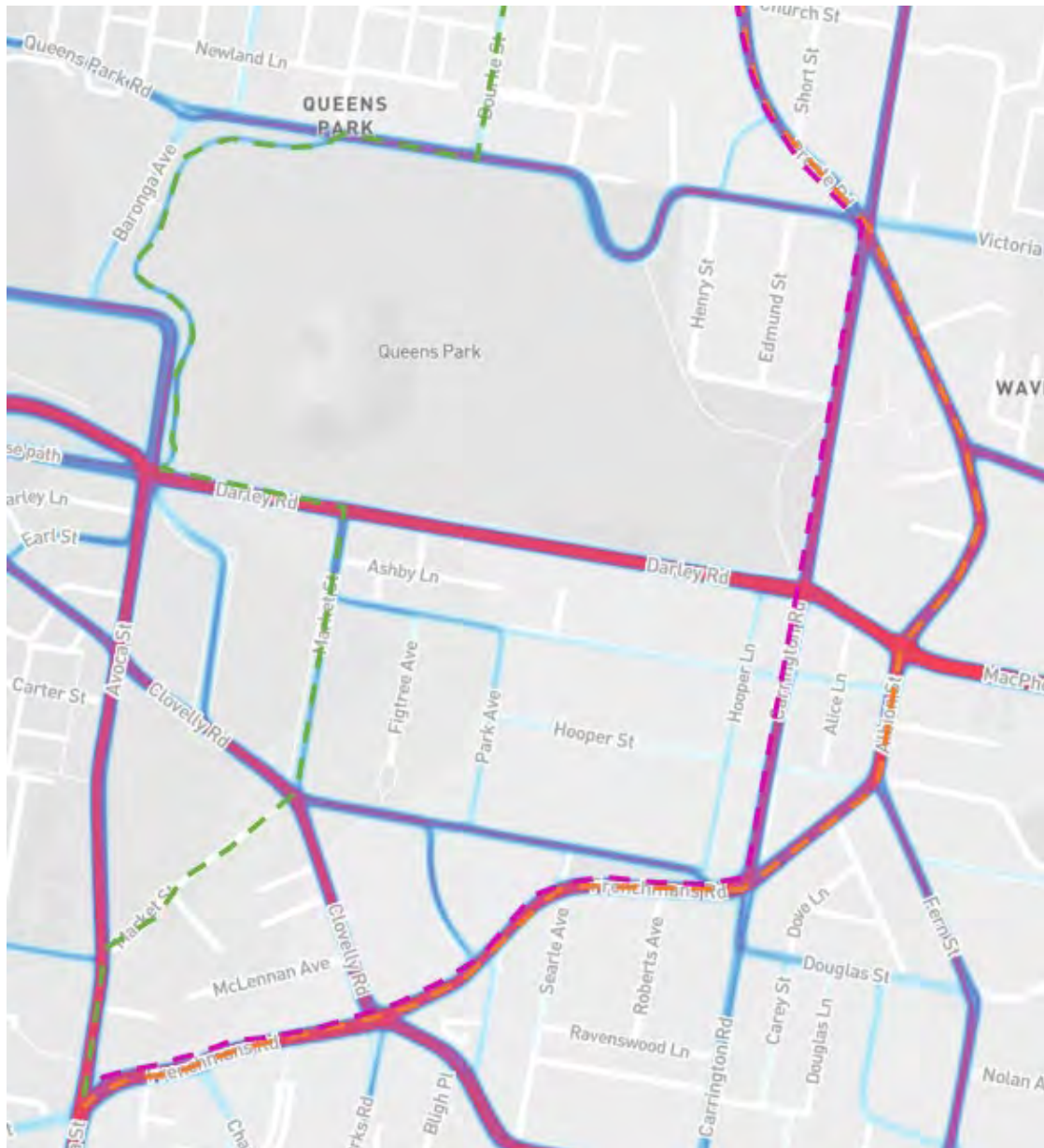


Figure 3-25 Strava Heat Map

Source: STRAVA (2020)

3.5 Traffic volumes

GHD commissioned Matrix Traffic and Transport Data Pty. Ltd. to undertake Automatic Tube Counts (ATC), intersection counts and queue length surveys in July 2020 for the roads and intersections in this study area. Additionally, in order to validate the suitability of this 2020 data under the current COVID-19 social distancing restrictions, additional traffic data from 2019 was provided by Matrix Traffic and Transport Data Pty. Ltd and by TfNSW.

Table 3-10 provides a summary of the survey data available for the purposes of this study from 2019 and 2020.

Table 3-10 Summary of available survey data – 2019 and 2020

Survey	2019	2020
Intersection surveys: Weekday	<p>28 June and Thursday 4 July 6AM to 7PM:</p> <ul style="list-style-type: none"> • Bronte Road / Carrington Road / Victoria Street <p>11 April between 7-9AM and 4-6PM:</p> <ul style="list-style-type: none"> • Bronte Road / Leichardt Street • Bronte Road / Albion Street 	<p>Wednesday 22 July between 7:30-11:30AM and between 3-7PM:</p> <ul style="list-style-type: none"> • Bronte Road / Carrington Road / Victoria Street • Carrington Road /Darley Road / Macpherson Street • Macpherson Street / Albion Street • Macpherson Street / Leichardt Street • Bronte Road / Leichardt Street • Bronte Road / Albion Street
Intersection surveys: Weekend	<p>12 April 6AM to 7PM:</p> <ul style="list-style-type: none"> • Bronte Road / Carrington Road / Victoria Street 	<p>Saturday 25 July between 11am and 2pm:</p> <ul style="list-style-type: none"> • Bronte Road / Carrington Road / Victoria Street • Carrington Road /Darley Road / Macpherson Street • Macpherson Street / Albion Street • Macpherson Street / Leichardt Street • Bronte Road / Leichardt Street • Bronte Road / Albion Street
Queue Length surveys	None	<p>AM, PM and Saturday peak periods:</p> <ul style="list-style-type: none"> • Bronte Road / Carrington Road / Victoria Street • Carrington Road /Darley Road / Macpherson Street
7-day “tube” Automatic Traffic Counts (ATCs)	<p>6-20 April 2019:</p> <ul style="list-style-type: none"> • Bronte Road (south of Albion Street) • Albion Street • Leichardt Street • Macpherson Street (east of Albion Street) 	<p>22-28 July 2020:</p> <ul style="list-style-type: none"> • Bronte Road (south of Victoria Street) • Albion Street • Leichardt Street • Macpherson Street (east of Carrington Road)
IDM (SCATS) Data from TfNSW	None	<p>Wednesday 22 July:</p> <ul style="list-style-type: none"> • Bronte Road / Carrington Road / Victoria Street • Carrington Road /Darley Road / Macpherson Street

3.5.1 Intersection traffic counts

GHD commissioned Matrix Traffic and Transport Data Pty. Ltd. to undertake intersection counts at six intersections, as shown in Figure 3-26 during the following periods:

- Wednesday 22 July 7:30AM - 11:30AM and between 3-7PM; and
- Saturday 25 July 11AM – 2PM.

The survey conducted for the traffic network indicates that:

- The weekday morning peak traffic volume peak occurs between 7:45 AM to 8:45 AM,
- The weekday afternoon peak traffic volume peak occurs between 4:45 PM to 5:45 PM; and
- The Saturday peak traffic volume peak occurs between 12:15 PM to 1:15 PM

Figure 3-26 also shows the current turn restrictions at the intersections in the study area network.



Figure 3-26 2020 intersection traffic survey locations and turn restrictions

Source: Google Maps 2020 (modified by GHD)

It is noted that the 2020 traffic surveys were undertaken during a time where traffic operations were potentially impacted by the COVID-19 pandemic. Due to these circumstances, the data collected in 2020 has been compared to historical data collected in 2019 in order to confirm the suitability of the 2020 traffic surveys for the purposes of undertaking intersection traffic modelling.

GHD has been provided with historical intersection count data from 2019, for intersections 1, 5 and 6 shown in Figure 3-26, including:

- Intersection 1: on weekdays between Friday 28 June and Thursday 4 July 6AM to 7PM: and
- Intersections 5 and 6: on Thursday 11 April between 7-9AM and between 4-6PM.

For comparative purposes, GHD has used historical intersection count data for a Wednesday for these three sites to maintain consistency with the 2020 count days.

3.5.2 Comparison of 2019 and 2020 intersection count data

A comparison of the 2019 and 2020 intersection count data is shown Figure 3-27, Figure 3-28 and Figure 3-29 for the weekday AM, weekday PM and Saturday peak hours respectively (noting that Saturday data is only available for 2020). Analysis of the data indicates that the 2020 traffic volumes were higher at all locations and in each peak period. This indicates that using the intersection count data from 2020 would provide a more conservative analysis of the intersection operations and therefore should be used for the SIDRA modelling.

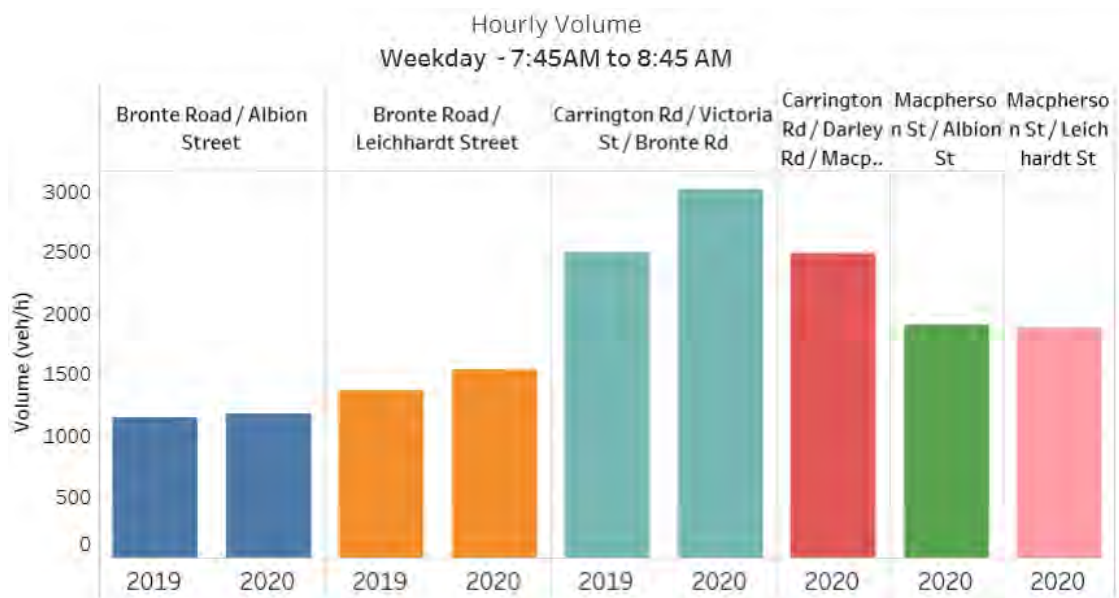


Figure 3-27 AM Peak hourly volume by intersection - 2019 vs. 2020

Source: <https://public.tableau.com/profile/mingjie6118#!/vizhome/CharingCross-TrafficAnalysis/Summary?publish=yes>

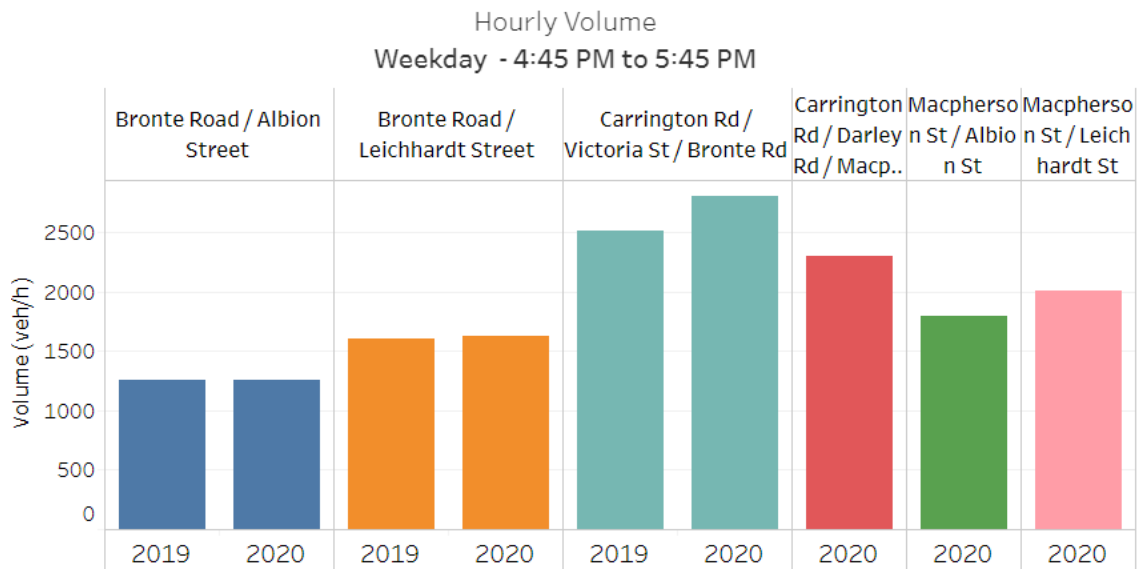


Figure 3-28 PM Peak hourly volume by intersection - 2019 vs. 2020

Source: <https://public.tableau.com/profile/mingjie6118#!/vizhome/CharingCross-TrafficAnalysis/Summary?publish=yes>

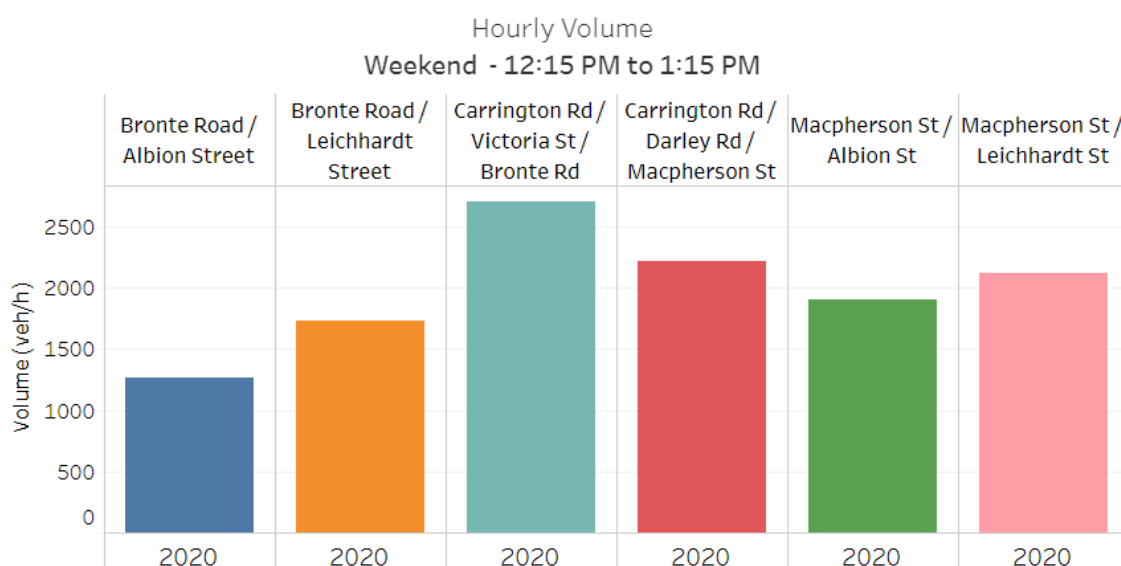


Figure 3-29 Saturday Peak hourly volume by intersection - 2020

Source: <https://public.tableau.com/profile/mingjie6118#!/vizhome/CharingCross-TrafficAnalysis/Summary?publish=yes>

Heavy Vehicles

A summary of the proportion of heavy vehicles for each road in the study area is provided in Table 3-11. Higher observed proportions of heavy vehicles is noted at Albion Street between Bronte Road and Macpherson Street, and Bronte Road to the north of Albion Street. This is expected to be associated with the volume of buses along these segments and lower traffic volumes compared with other roads such as Carrington Road.

Table 3-11 Peak hour surveyed traffic volumes and heavy vehicle proportions (2020)

Road	Location	Direction	AM Peak		PM Peak		Saturday	
			Total vehicles	% heavy vehicles	Total vehicles	Percent heavy vehicles	Total vehicles	% heavy vehicles
Carrington Road	South of Victoria St	NB	1,096	3	712	1	700	2
		SB	741	3	877	1	850	1
	North of Victoria St	NB	1125	2	624	1	554	2
		SB	603	5	830	1	714	1
Bronte Road	East of Carrington Road	NWB	459	10	308	9	405	6
		SEB	496	11	496	11	687	4
	West of Carrington Road	NWB	654	9	471	7	609	5
		SEB	470	10	618	6	535	6
	East of Albion Street	NWB	262	3	262	3	200	1
		SEB	286	4	410	1	379	1
Victoria Street	East of Carrington Road	EB	52	4	67	0	68	0
		WB	390	1	291	0	307	0

Road	Location	Direction	AM Peak		PM Peak		Saturday	
			Total vehicles	% heavy vehicles	Total vehicles	Percent heavy vehicles	Total vehicles	% heavy vehicles
Macpherson Street	West of Albion Street	EB	627	3	362	1	328	2
		WB	453	1	353	2	393	2
	East of Albion Street	EB	830	5	590	2	591	2
		WB	701	3	515	3	582	3
Albion Street	North of Macpherson Street	NB	525	10	525	10	446	6
		SB	400	11	509	7	414	6
Leichardt Street	North of Macpherson Street	NB	686	3	653	1	736	2
		SB	682	2	783	1	784	1

Note, buses are also included in the proportion of Heavy vehicles

3.5.3 Midblock traffic counts

A seven day Automatic Tube Count (ATC) was undertaken for the locations shown in Figure 3-30 between Wednesday 22 and Tuesday 28 July 2020, including at

1. Bronte Road (south of Victoria Street)
2. Albion Street (south of Bronte Road)
3. Leichardt Street
4. Macpherson Street (east of Carrington Road)

Additionally, historical ATC data was sourced from April 2019, collected for two weeks between Saturday 6 and Friday 20 April 2019, at the following locations:

1. Bronte Road (south of Albion Street)
2. Albion Street (south of Bronte Road)
3. Leichardt Street
4. Macpherson Street (east of Albion Street)

The locations of these historical tube counts differ slightly from the 2020 counts commissioned by GHD for this study, notably at Bronte Road and Macpherson Street.



Figure 3-30 2019 and 2020 ATC survey locations

Source: Google Maps 2020 (modified by GHD)

Vehicle Speeds

Table 3-12 provides a summary of the 85th percentile vehicle speeds from the 2020 ATCs, which indicates that the vehicle speeds are generally within the posted speed limit for each street, with the exception of Bronte Road (southbound).

Table 3-12 Automatic Traffic Count 2020 vehicle speed summary (weekday and weekend)

Location	Direction	Speed limit (km/h)	Weekday	Weekend
			85th percentile speed (km/h)	85th percentile speed (km/h)
ATC 1 – Bronte Road	Northbound	50	48.7	49.6
	Southbound		52.5	53.0
ATC 2 – Albion Street	Northbound	50	45.2	45.2
	Southbound		48.7	49.3
ATC 3 – Leichardt Street	Northbound	50	37.1	36.1
	Southbound		36.1	35.0
ATC 4 – Macpherson Street	Eastbound	50	42.7	42.1
	Westbound		40.8	40.3

Source: Matrix Traffic & Transport Data (modified by GHD)

2019 vs 2020 Traffic Count Analysis – weekday

A comparison of the average weekday daily volumes from the 2019 and 2020 ATCs is provided in Figure 3-31, which indicates that:

- Average daily volumes observed at Albion Street and Leichardt Street are similar, with slightly less traffic volumes observed on Leichardt Street in the 2020 survey.
- The 2020 ATC at Bronte Road was conducted between Albion Street and Victoria Street, whereas the 2019 ATC data was collected between Prospect Street and Henrietta Street. A higher traffic count can be expected for the 2020, as the location of the count is where Albion Street and Bronte Road (south of Albion Street) merge together.
- The 2020 daily traffic count at Macpherson Street is lower in 2020 than in 2019, although the ATCs were not undertaken at the same location.

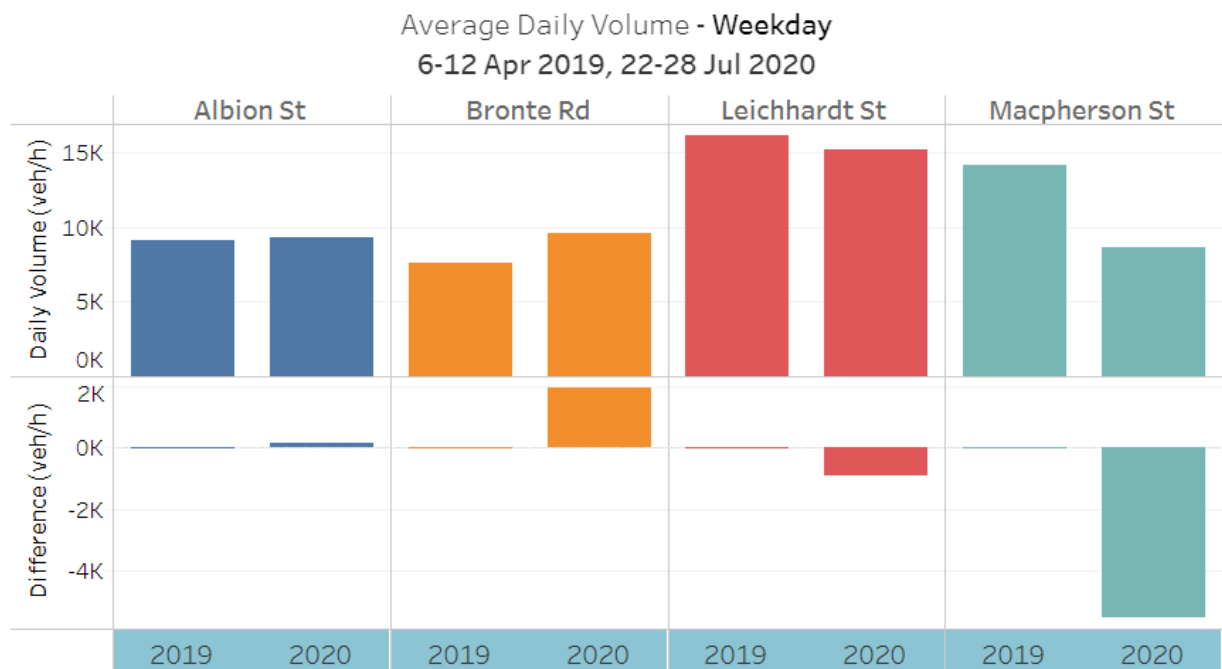


Figure 3-31 ATC average weekday daily traffic volumes (all day) - 2019 vs. 2020

Source: <https://public.tableau.com/profile/mingjie6118#!/vizhome/CharingCross-TrafficAnalysis/Summary?publish=yes>

A comparison of the 2019 and 2020 weekday daily traffic profile for Albion Street is provided in Figure 3-32, which indicates that the daily traffic operations are quite comparable for the pre and post COVID-19 traffic operations.

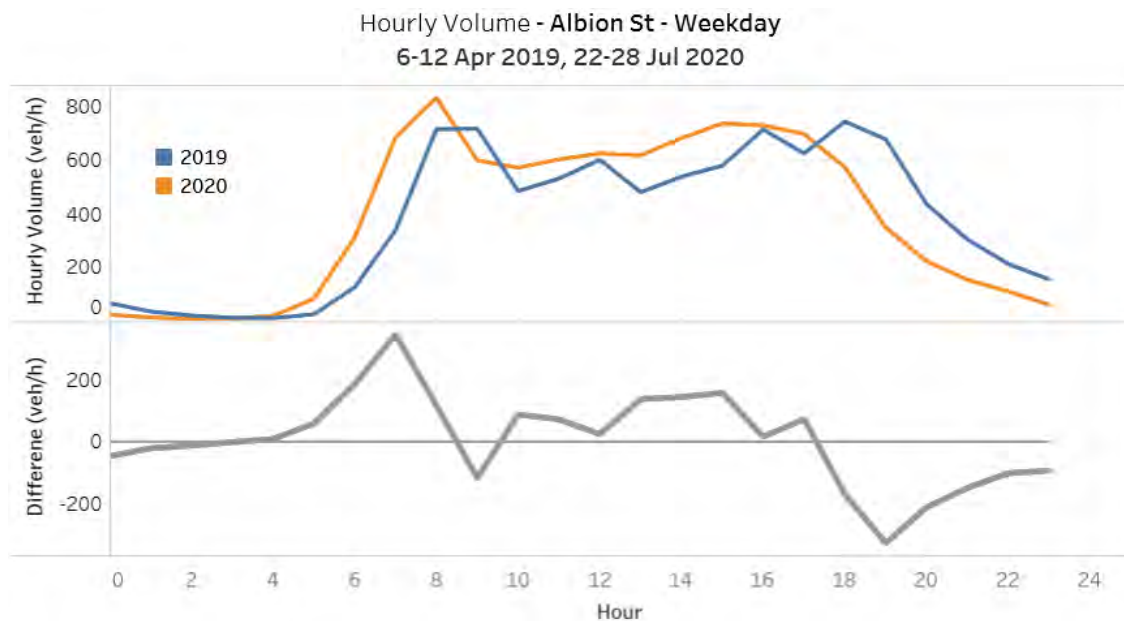


Figure 3-32 Albion Street average weekday traffic profile - 2019 vs. 2020

A comparison of the 2019 and 2020 weekday daily traffic profile for Macpherson Street is shown at Figure 3-33. Although there are notable differences in the traffic profiles, it is noted that 2020 ATC location was between Carrington Road and Albion Street, whereas the 2019 ATC was collected between Albion Street and Wills Avenue.

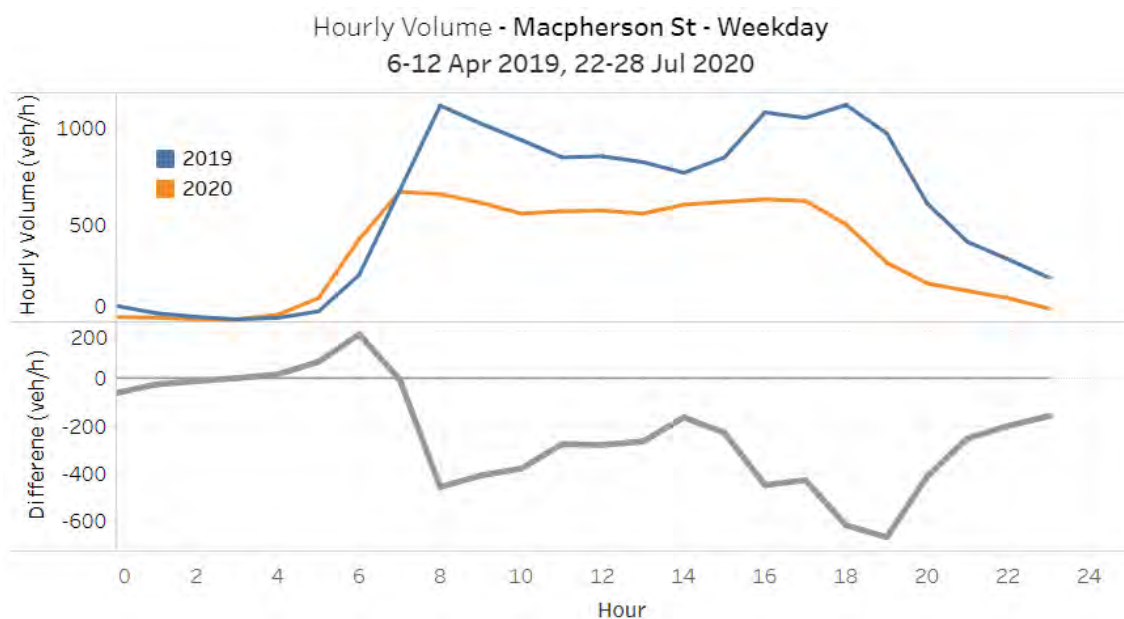


Figure 3-33 Macpherson Street average weekday traffic profile - 2019 vs. 2020

Source: <https://public.tableau.com/profile/mingjie6118#!/vizhome/CharingCross-TrafficAnalysis/Summary?publish=yes>

An analysis between the weekday AM and PM peak hour traffic counts has therefore been undertaken using the 2019 and 2020 intersection counts and ATCs, which is summarised in Table 3-13. Analysis of this data indicate that the 2020 volumes are generally higher than observed in the 2019 ATC surveys. This provides justification to use the 2020 intersection count data for SIDRA modelling purposes.

Table 3-13 Macpherson Street - Comparison ATC and intersection counts

Time	Direction	Between Carrington Road and Albion Street	Between Albion Street and Willis Street (Leichardt Street)				
		ATC (2020)	Intersection Count (2020)	% increase from 2019	ATC (2019)	Intersection Count (2020)	% increase from 2019
AM Peak (8:00 AM)	Eastbound	250	323	29%	614	515	-16%
	Westbound	408	453	11%	330	701	112%
	2-way	658	776	18%	944	1,216	29%
PM Peak (5:00 AM)	Eastbound	315	362	15%	462	590	28%
	Westbound	298	353	18%	571	515	-10%
	2-way	613	715	17%	1,033	1,105	7%
Saturday (1:00 PM)	Eastbound	306	328	7%	519	591	14%
	Westbound	343	393	15%	600	582	-3%
	2-way	649	721	11%	1119	1,173	5%

Source: Matrix Traffic & Transport Data (modified by GHD)

2019 vs 2020 Traffic Count Analysis – weekend

A comparison of the weekend daily volumes from the 2019 and 2020 ATCs is provided in Figure 3-34, which indicates that:

- Traffic volumes at Albion Street and Bronte Road were higher in 2020.
- Traffic volumes along Macpherson Street are lower in 2020 than in 2019, as shown in Figure 3-36. However, it is noted that the 2019 count was undertaken on a warm (30°C) day in April, compared with the winter count in July 2020. Lower volumes are therefore expected for the 2020 count, with reduced traffic related to outdoor activities such as beach-going, as Macpherson Street is a primary access route to nearby beaches.
- Similarly, on Leichardt Street (see Figure 3-35) is potentially impacted by the difference in weather / seasons, with 2020 traffic volumes observed to be lower than in 2019.

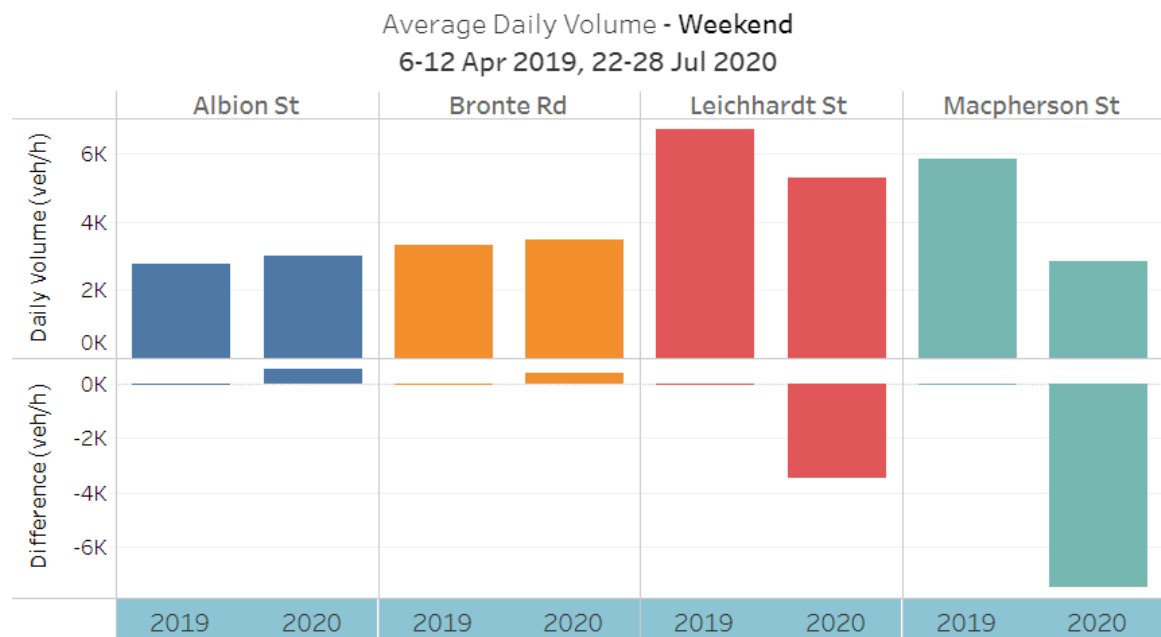


Figure 3-34 Saturday daily volume - 2019 vs. 2020

Source: <https://public.tableau.com/profile/mingjie6118#!/vizhome/CharingCross-TrafficAnalysis/Summary?publish=yes>

The weekend traffic profile for 2019 and 2020 at Leichardt Street is shown at Figure 3-35. Overall, the traffic profile is comparable, with slightly higher traffic volumes in 2019, which could be associated with traffic demand for Bronte Beach in the warmer survey period in 2019. A late afternoon peak is noted for the 2019 counts, which could potentially be associated with returning traffic from nearby beaches.

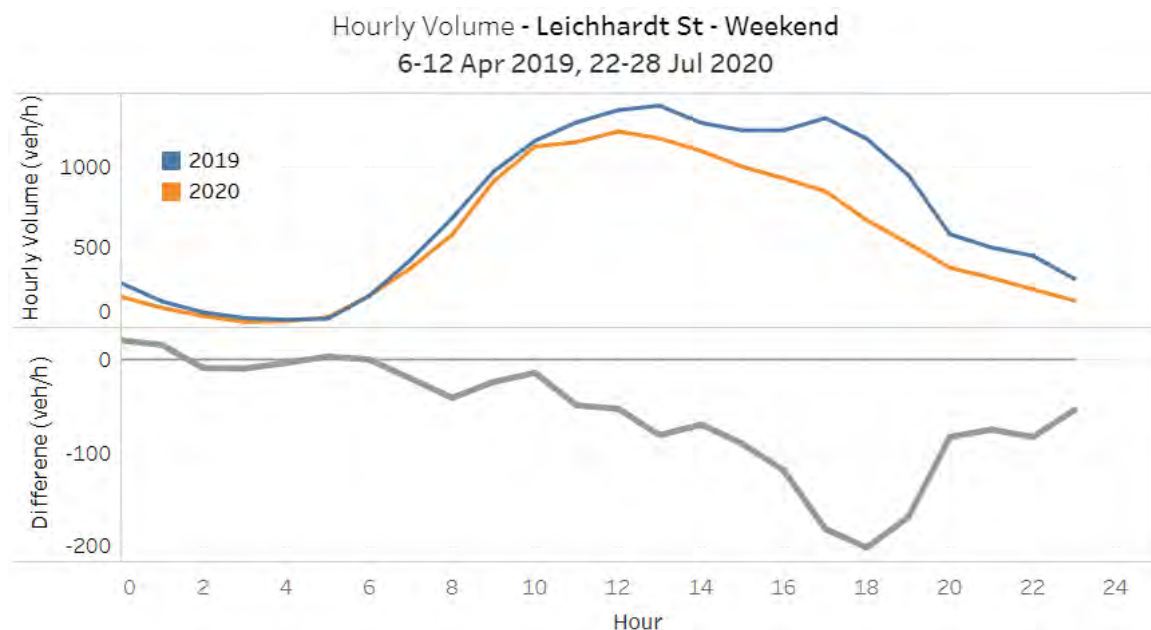


Figure 3-35 Leichardt Street Saturday traffic profile - 2019 vs. 2020

Source: <https://public.tableau.com/profile/mingjie6118#!/vizhome/CharingCross-TrafficAnalysis/Summary?publish=yes>

The weekend traffic profile for 2019 and 2020 at Leichardt Street is shown at Figure 3-35. Again, the difference in traffic could be associated with traffic demand for Bronte Beach in the warmer survey period in 2019. Additionally, the count locations were located in different places on the street, with the 2019 count to the east of Albion Street and the 2020 count to the west of Albion Street.

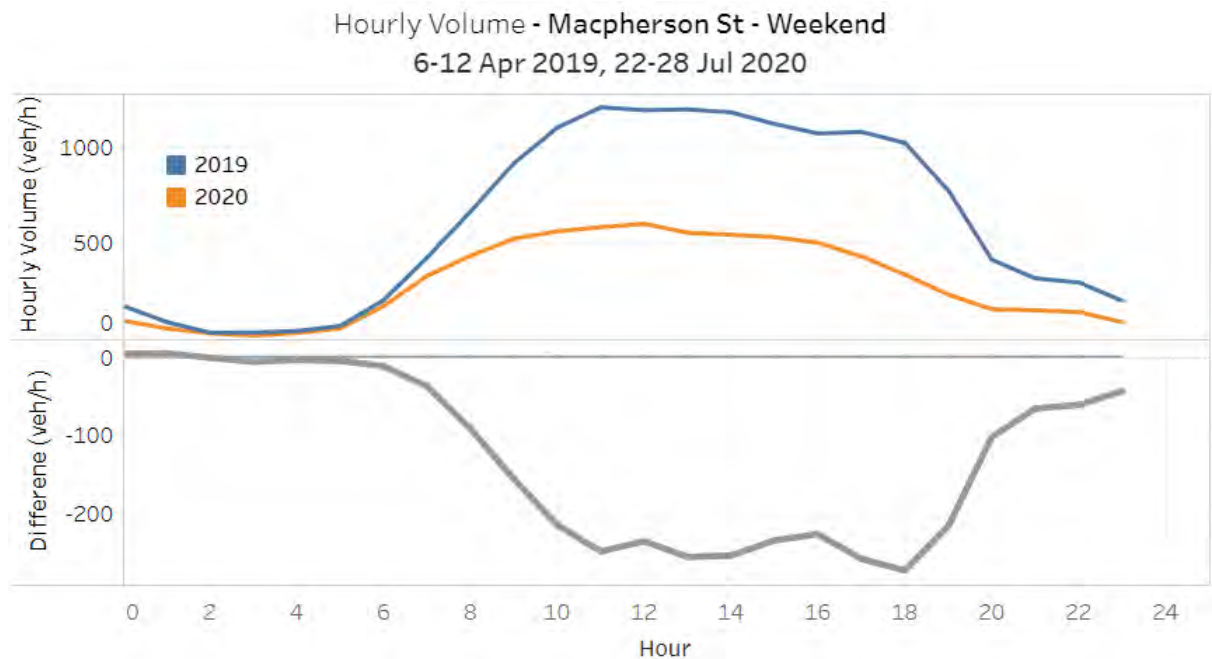


Figure 3-36 Macpherson Street Saturday traffic profile - 2019 vs. 2020

Source: <https://public.tableau.com/profile/mingjie6118#!/vizhome/CharingCross-TrafficAnalysis/Summary?publish=yes>

2019 vs 2020 traffic data analysis summary

A summary of the comparison between the 2019 vs 2020 traffic data is as follows:

- ATC counts:
 - For all sites combined, the weekday profiles are generally comparable, with a slight change in observed peak hour periods (ie. slightly later in the AM peak and earlier in the PM peak)
 - Albion Street and Leichardt Street have very comparable traffic profiles
 - The counts at Bronte Road were not undertaken in the exact same location, with the 2020 counts undertaken to the south of Victoria Street. Higher traffic is expected south of Victoria Street (which was identified for the 2020 count), as traffic splits further to the south at Albion Street and Bronte Road. As such, the 2020 count at Bronte Road are considered reasonable and comparable to the pre COVID scenario.
 - The counts at Macpherson Street were not undertaken in the exact same location, with the 2019 counts located to the east of Albion Street and the 2020 counts located to the west of Albion Street. However, a comparison with the ATC data and weekday and weekend peak hour data from the intersection counts indicate that the 2020 peak hour volumes were generally higher in 2020.
 - Higher volumes were noted on a weekend at Macpherson Street and Leichardt Street, which could be associated increased travel demand to access Bronte Beach, with the 2019 counts undertaken in April (on a 30°C day) and the 2020 undertaken in July.
- Intersection counts:
 - The three comparable intersection counts generally have higher peak hour traffic volumes in the weekday AM and PM peaks, which could be a result of increased school drop / off pick up activity by car and a general switch to private vehicle use from public transport.
 - Counts at the Bronte Road / Carrington Road / Victoria Street are notably higher in 2020

- Bronte Road / Leichardt Street and Bronte Road / Albion Street intersection are slightly higher in 2020, although are considered to be comparable

As agreed with Council and TfNSW, the greater of the 2019 and 2020 intersection count data traffic volumes has been used for the SIDRA traffic modelling analysis. Analysis of the traffic count data identified that the 2020 traffic data was generally higher for all intersections.

3.5.4 Queue lengths

Queue length surveys have been undertaken for intersections 1 and 2, shown in Figure 3-26. These surveys were carried out on

- Wednesday 22 July 2020 between 7:30AM - 11:30AM and between 3-7PM; and
- Saturday 25 July between 11AM and 2PM.

The data provided the queue lengths in the form of the number of vehicles queued in each approach lane at regular intervals during the survey times. The number of queueing vehicles has been converted into overall queue lengths using a nominal length of seven metres for light vehicles and 13 metres for heavy vehicle.

1. Carrington Road / Bronte Road / Victoria Street

A summary of the queue length surveys at the Carrington Road / Bronte Road / Victoria Street intersection is provided in Table 3-14.

Table 3-14 Intersection 1 Carrington Road / Bronte Road / Victoria Street Queue Data

Road	Approach	Weekday AM Peak 95th percentile length (m)	Weekday PM Peak 95th percentile length (m)	Saturday Peak 95th percentile length (m)
Carrington Road	South	309	233	299
Bronte Road	Southeast	160	158	199
Victoria Street	East	99	105	105
Carrington Road	North	139	127	155
Bronte Road	Northwest	152	184	155
Victoria Street	West	42	42	36

2. Carrington Road / Macpherson Street / Darley Road

A summary of the queue length surveys at the Carrington Road / Macpherson Street / Darley Road intersection is provided in Table 3-15.

Table 3-15 Intersection 2 Carrington Road / Darley Road / Macpherson Street Queue Data

Road	Approach	Weekday AM Peak 95th percentile length (m)	Weekday PM Peak 95th percentile length (m)	Saturday Peak 95th percentile length (m)
Carrington Road	South	16	20	22
Macpherson Street	East	14	14	14
Carrington Road	North	18	20	20
Darley Road	West	12	29	17

3.6 Mid-block capacity analysis

In accordance with the mid-block capacity criteria Table 2-2, the mid-block level of service for roads for the roads in the vicinity of Charing Cross are summarised in Table 3-16.

Table 3-16 Mid-block review of roads within the vicinity of Charing Cross

Road	Location	Direction	Number of Lanes	Mid-block volume (AM Peak)*	Mid-block volume (PM Peak)*	Mid-block volume (Saturday Peak)*	LOS [^]
Carrington Road	South of Victoria St	NB	2 (1 lane on Sat)	1,090	742	726	D
		SB	1	730	900	870	D
Bronte Road	East of Carrington Road	NWB	1	455	303	398	C
		SEB	1	490	798	679	D
Victoria Street	East of Carrington Road	EB	1	49	67	68	A
		WB	1	384	291	304	C
Macpherson Street	West of Albion Street	EB	1	320	355	319	B
		WB	1	431	351	393	C
Albion Street	North of Macpherson Street	NB	1	522	329	437	C
		SB	1	390	501	411	C
Leichardt Street	North of Macpherson Street	NB	1	677	649	729	D
		SB	1	676	778	776	D

*average vehicles per hour

[^] LoS = Level of Service

The traffic survey outputs and data indicate that the roads in the vicinity of the Charing Cross study area currently operate within the acceptable limits of their mid-block capacities with Level of service not greater than LoS D (desirable maximum).

3.7 Existing Intersection capacity analysis

The intersection modelling has been undertaken based on the following assumption, as agreed with Council and TfNSW:

- The greater of the 2019 and 2020 intersection count data traffic volumes has been used for the SIDRA traffic modelling analysis.
- Analysis of the traffic count data identified that the 2020 traffic data was higher for all location.

The base 2020 traffic models were developed using the AM and PM peak hour survey data results. Existing traffic flows at key intersections were analysed using SIDRA 8 to obtain the current operation of the key intersections. The results of the SIDRA analysis are shown in Table 3-17 for the weekday AM peak, weekday PM peak and Saturday peak periods.

A summary of the SIDRA queue length calibration, based on observed queue lengths at each intersection, is provided at Appendix A.

Table 3-17 Base 2020 intersection operations

Location		AM Peak				PM Peak				Saturday Peak			
		Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh
1	Carrington Road / Bronte Road / Victoria Street	1.07	57	LOS E	44	0.94	50	LOS D	32	0.95	51	LOS D	37
2	Carrington Road / Macpherson Street / Darley Road	0.93	42	LOS C	25	1.28	92	LOS F	55	1.15	99	LOS F	53
3	Albion Street / Macpherson Street	1.09	108	LOS F	57	0.77	17	LOS B	8	0.93	30	LOS C	13
4	Macpherson Street / Leichhardt Street	0.93	43	LOS D	22	0.94	33	LOS C	29	0.96	38	LOS C	33
5	Bronte Road / Leichhardt Street	0.61	12	LOS A	6	0.65	16	LOS B	6	0.68	17	LOS B	6
6	Bronte Road / Albion Street	0.74	25	LOS B	6	0.47	18	LOS B	3	0.49	19	LOS B	3

Notes:

- The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.
- The level of service for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.
- The degree of saturation is defined as the ratio of the arrival flow (demand) to the capacity of each approach.
- Average delay is given in seconds per vehicle.

Analysis of the SIDRA modelling results in Table 3-17 can be summarised by the following:

- Carrington Road / Bronte Road / Victoria Street intersection operates at capacity (LoS E) in the weekday AM peak and at near capacity during the Saturday Peak hour (LoS D).
- Carrington Road / Macpherson Street Darley Road intersection operates over capacity during the weekday PM peak and Saturday peak hour at LoS F.
- Albion Street / Macpherson Street operates over capacity during the weekday AM peak hour, at LoS F.
- The other intersections analysed in the road network currently have an acceptable Level of Service (i.e. better than Level of Service E) during the weekday morning and weekday evening and weekend peak periods.
- Overall, the results indicates that the road network in the vicinity of the site is currently operating at capacity with significant delays on approaches to Carrington Road.

4. Future intersection option analysis

This section of the report considers the future operation of the Charing Cross traffic network, including SIDRA intersection modelling of a number of potential intersection upgrades to support the proposed Streetscape upgrade at Bronte Road.

4.1 Background traffic growth - 2030

For the purposes of a sensitivity test of potential traffic growth in the study area, SIDRA intersection modelling has been undertaken for the future horizon year 2030, allowing ten-year future growth, based on the following assumption:

- An annual linear growth rate of 0.5 percent per annum applied to movements along Carrington Road and Bronte Road (north of Carrington Road).
- This growth rate, of five percent in total to the ten-year period, was applied to the movements shown in Figure 4-1.

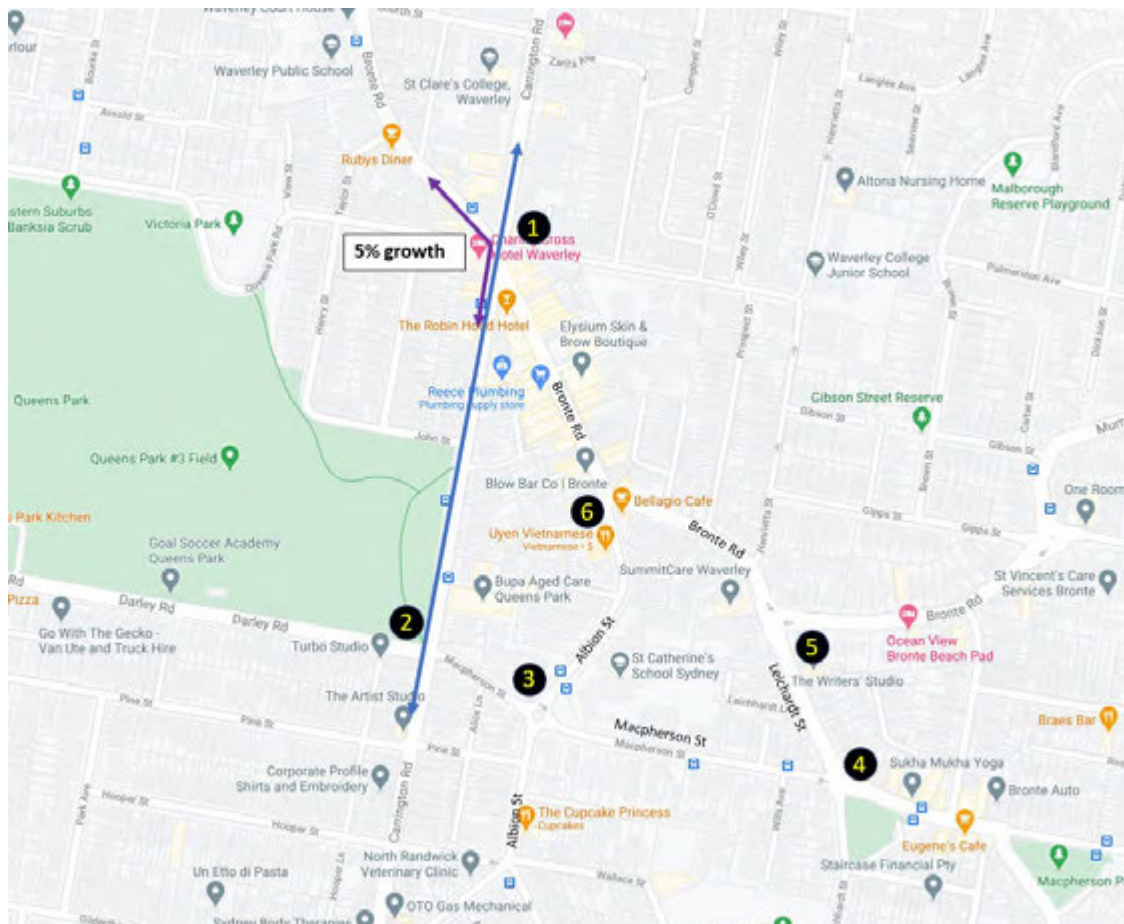


Figure 4-1 Future background traffic growth – 2020 to 2030

Source: Google Maps (2020), modified by GHD

4.2 Future intersection layout options

A number of potential intersection upgrade options have been tested to support the proposed streetscape upgrade for Charing Cross, including at the following intersections:

- Victoria Street / Bronte Road / Carrington Road
- Bronte Road and Albion Street
- Carrington Road / Macpherson Street / Darley Road.

The following sections provide a summary of the potential intersection upgrade options tested in the SIDRA 8 traffic network model.

4.2.1 Victoria Street / Bronte Road / Carrington Road intersection

The following options have been assessed for the Victoria Street / Bronte Road / Carrington Road intersection for the 2030 future horizon year:

- Option 1 - no change
- Option 2 – Victoria Street closed eastbound, as shown at Figure 4-2:
 - Close the eastbound traffic lanes on Victoria Street (east and west sides); and
 - Remove the slip lane at Bronte Road south-east.

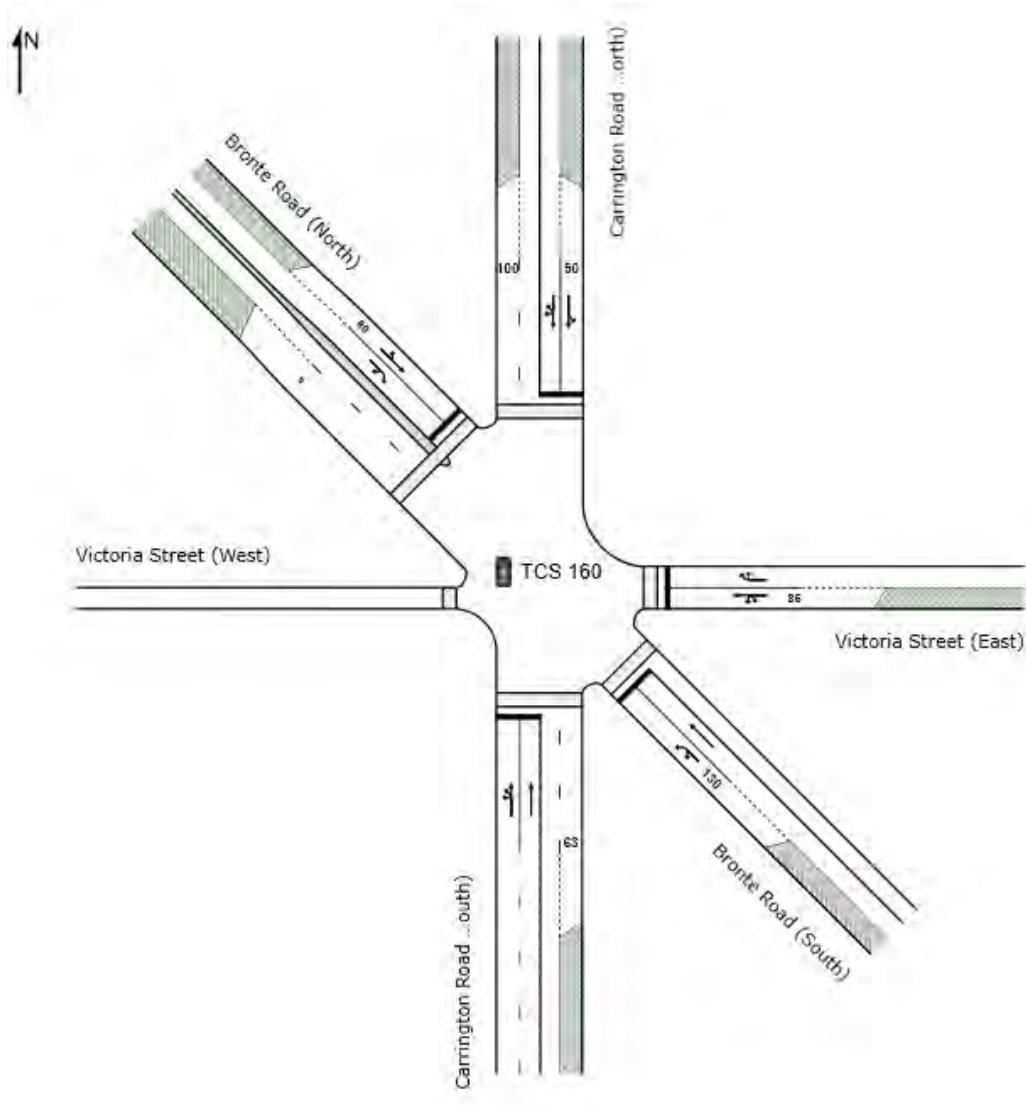


Figure 4-2 Carrington Road / Bronte Road / Carrington Road intersection – Option 2 Layout

Source: SIDRA 8, note the above layout is for the AM peak period

- Option 3 - Victoria Street Closed two-way (west side) and eastbound (east side), shown in Figure 4-3:
 - Victoria Street closed two-way (west side) and eastbound (east side); and
 - Remove the slip lane at Bronte Road south-east.

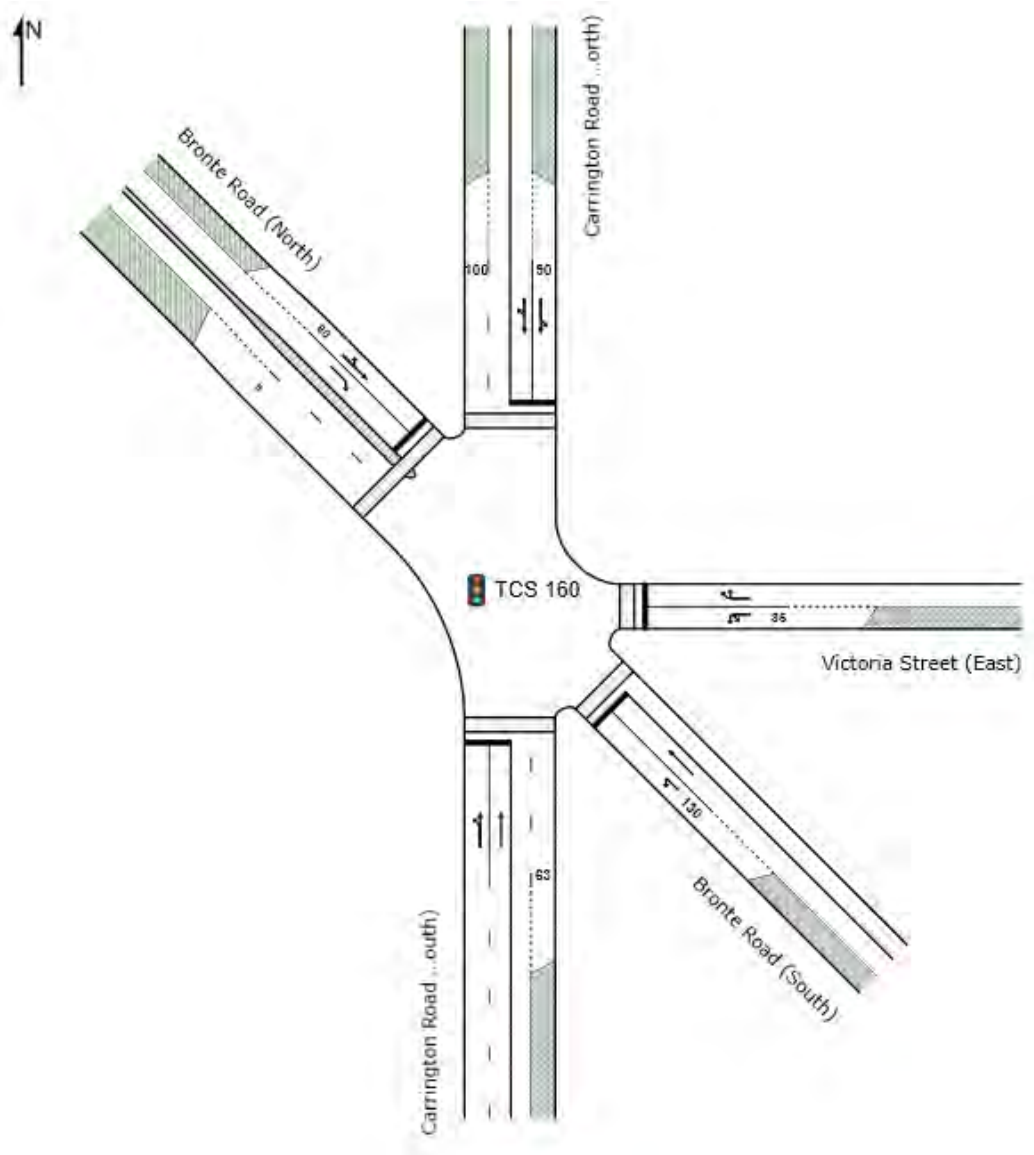


Figure 4-3 Carrington Road / Bronte Road / Carrington Road intersection – Option 3 Layout

Source: SIDRA 8, note the above layout is for the AM peak period

The proposed lane closures for proposed upgrades will result in traffic using alternative routes in the surrounding area. The assumed traffic redistribution for AM, PM and Saturday peak periods is shown in Appendix B.

4.2.2 Carrington Road / Macpherson Street / Darley Road intersection

The following options have been assessed for the Victoria Street Bronte Road / Carrington Road intersection for the 2030 future horizon year:

- Option 1 – no change
- Option 2 – extend the existing right turn bay at the Macpherson Street approach to 65 metres, as shown at Figure 4-4.

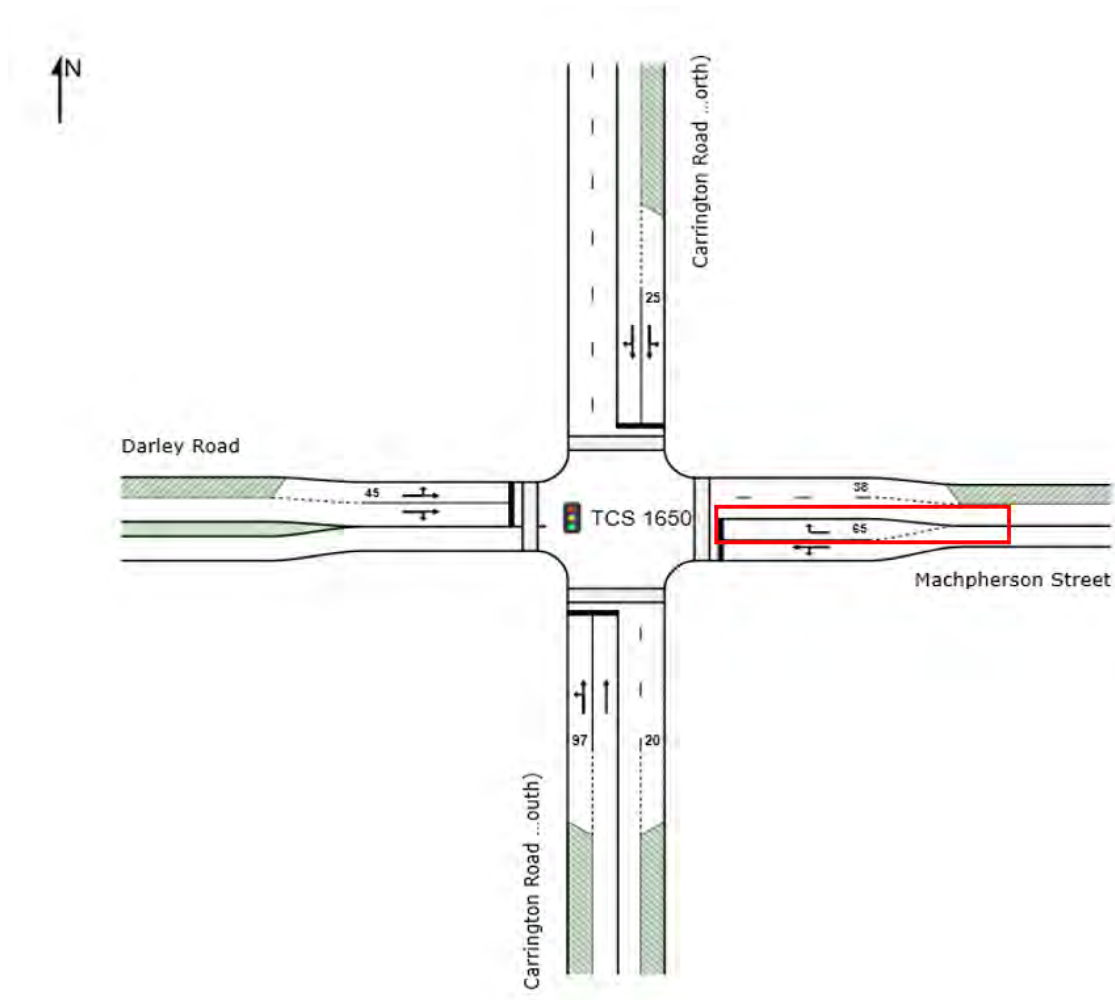


Figure 4-4 Carrington Road / Macpherson Street / Darley Road intersection – Option 2 Layout

Source: SIDRA 8, note the above layout is for the AM peak period

4.2.3 Bronte Road / Albion Street intersection

The following options have been assessed for the Bronte Road / Albion Street intersection for the 2030 future horizon year:

- Option 1 – no change
- Option 2 – left in left out only, as shown at Figure 4-5.

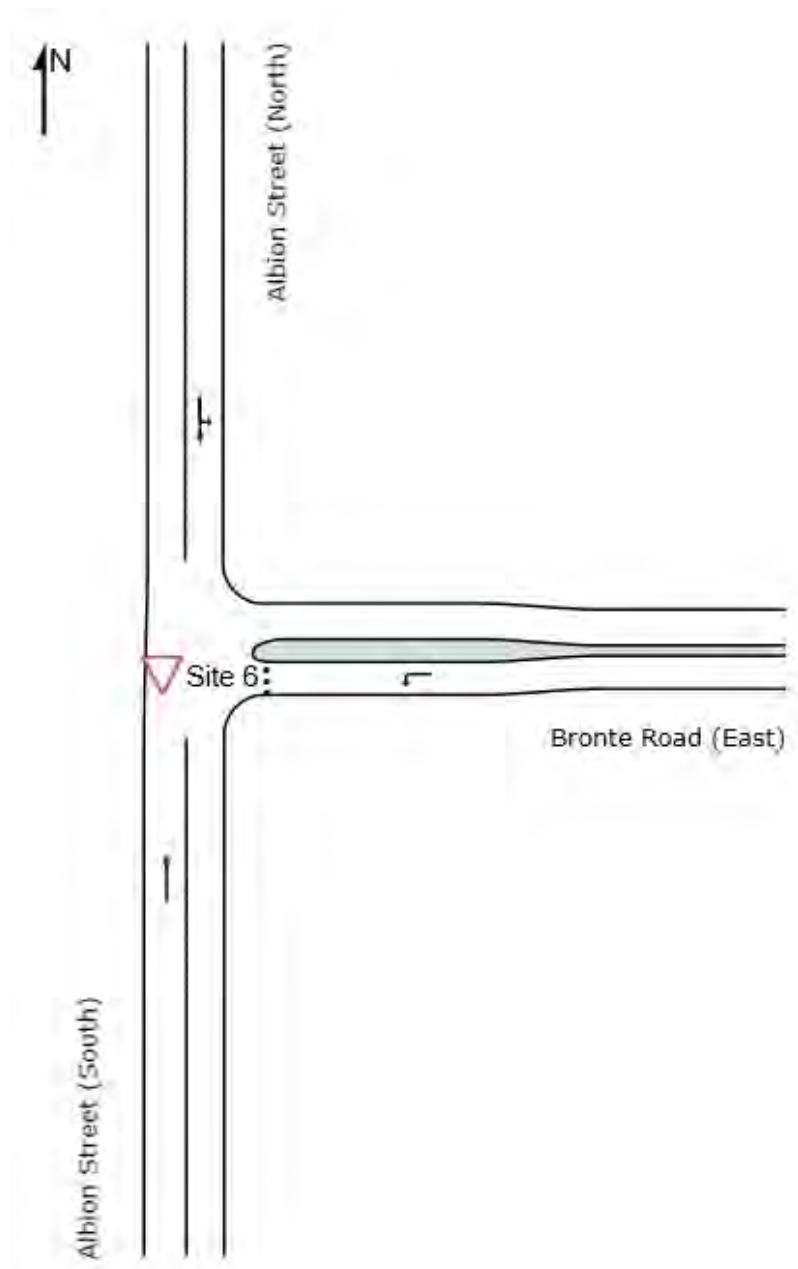


Figure 4-5 Bronte Road / Albion Street intersection – Option 2 Layout

Source: SIDRA 8

The proposed upgrades will result in traffic using alternative routes in the surrounding area. The assumed traffic redistribution, based on observed traffic turning proportions, for AM, PM and Saturday peak periods is shown in Appendix C.

4.2.4 Scenarios for future year SIDRA modelling assessment

A number of traffic network upgrade scenarios have been tested using SIDRA, based on the intersection upgrades described in Sections 4.2.1 to 4.2.3. The network scenarios are identified in Table 4-1.

Table 4-1 SIDRA network modelling scenarios – future horizon year 2030

Scenario (2030)	Carrington Road / Bronte Road / Victoria Street intersection			Carrington Road / Macpherson Street / Darley Road intersection		Bronte Road / Albion Street intersection	
	Option 1 (No change)	Option 2	Option 3	Option 1 (No change)	Option 2	Option 1 (No change)	Option 2
Scenario 0	✓			✓		✓	
Scenario 1		✓		✓		✓	
Scenario 2			✓	✓		✓	
Scenario 3	✓				✓	✓	
Scenario 4		✓			✓	✓	
Scenario 5			✓		✓	✓	
Scenario 6	✓			✓			✓
Scenario 7		✓		✓			✓
Scenario 8			✓	✓			✓
Scenario 9	✓				✓		✓
Scenario 10		✓			✓		✓
Scenario 11			✓		✓		✓

Note: The green cells in the above table identify options which would involve an intersection upgrade

4.3 SIDRA results – future horizon year 2030

The following sections provide a summary of the SIDRA network modelling results for the scenarios identified in Table 4-1.

4.3.1 Scenario 0 – 2030 existing intersection layouts

The SIDRA modelling results for Scenario 0 for the weekday AM, PM and Saturday peak periods are summarised in . Comparing the results of the existing (2020) intersection performance (refer to section 3.7) against the Scenario 0 indicates the following:

- Carrington Road / Bronte Road / Victoria Street intersection: the LoS is reduced from LoS E to LoS F during AM peak and from LoS D to LoS E during Saturday peak.
- Bronte Road / Macpherson Street / Darley Road intersection: the performance is reduced to from LoS C to LoS D during AM peak and remains at LoS F during the PM peak and Saturday peak, with higher average delays than in 2020.
- Albion Street / Macpherson Street intersection: is expected to operate over capacity with LoS F during AM peak, with higher average delays than in 2020.

Table 4-2 Scenario 0: No change (2030)

Location		AM Peak				PM Peak				Saturday Peak			
		Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh
1	Carrington Road / Bronte Road / Victoria Street	1.08	73	LOS F	68	0.86	43	LOS D	27	0.99	56	LOS E	43
2	Carrington Road / Macpherson Street / Darley Road	0.97	53	LOS D	34	1.10	102	LOS F	48	1.17	113	LOS F	62
3	Albion Street / Macpherson Street	1.11	122	LOS F	63	0.66	14	LOS A	6	0.96	32	LOS C	16
4	Macpherson Street / Leichhardt Street	0.94	44	LOS D	23	0.89	25	LOS B	22	0.88	32	LOS C	19
5	Bronte Road / Leichhardt Street	0.61	12	LOS A	6	0.56	14	LOS A	5	0.64	18	LOS B	6
6	Bronte Road / Albion Street	0.70	23	LOS B	6	0.42	16	LOS B	2	0.52	19	LOS C	3

Notes:

- The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.
- The level of service for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.
- The degree of saturation is defined as the ratio of the arrival flow (demand) to the capacity of each approach.
- Average delay is given in seconds per vehicle.

4.3.2 Scenario 1

The SIDRA modelling results for Scenario 1 for the weekday AM, PM and Saturday peak periods are summarised in . A comparison of the results against the “do nothing” (2030) intersection performance (Scenario 0) indicates the following:

- Carrington Road / Bronte Road / Victoria Street: similar to Scenario 0, the intersection is expected to operate over capacity at LoS F, during AM peak and at LoS E during Saturday Peak.
- Carrington Road / Macpherson Street / Darley Road: reduced to LoS F from LoS D (in Scenario 0) during AM peak and remains over capacity during PM and Saturday peaks, with higher average delays.
- Albion Street / Macpherson Street: similar to Scenario 0, expected to operate over capacity during AM peak at LoS F, although with slightly reduced average delays.

Table 4-3 Scenario 1: Bronte Road / Carrington Street / Victoria Street (Option 2) + Carrington Road / Darley Road / Macpherson Street (Option 1) + Bronte Road / Albion Street (Option 1)

Location		AM Peak				PM Peak				Saturday Peak			
		Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh
1	Carrington Road / Bronte Road / Victoria Street	1.04	78	LOS F	79	0.88	46	LOS D	19	0.98	56	LOS E	42
2	Carrington Road / Macpherson Street / Darley Road	1.24	78	LOS F	51	1.20	136	LOS F	36	1.17	113	LOS F	62
3	Albion Street / Macpherson Street	1.09	107	LOS F	57	0.74	16	LOS B	3	0.96	32	LOS C	16
4	Macpherson Street / Leichhardt Street	0.93	41	LOS C	22	0.95	36	LOS D	13	0.88	32	LOS C	18
5	Bronte Road / Leichhardt Street	0.61	12	LOS A	6	0.66	17	LOS B	2	0.64	17	LOS B	6
6	Bronte Road / Albion Street	0.73	24	LOS B	6	0.47	18	LOS C	1	0.52	19	LOS C	3

Notes:

- The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.
- The level of service for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.
- The degree of saturation is defined as the ratio of the arrival flow (demand) to the capacity of each approach.
- Average delay is given in seconds per vehicle.

4.3.3 Scenario 2

The SIDRA modelling results for Scenario 2 for the weekday AM, PM and Saturday peak periods are summarised in . A comparison of the results against the “do nothing” (2030) intersection performance (Scenario 0) indicates the following:

- Carrington Road / Bronte Road / Victoria Street: remains over capacity at LoS F during AM peak, with slightly higher average delays. Reduced from LoS E (Scenario 0) to LoS D during Saturday peak.
- Carrington Road / Macpherson Street / Darley Road: reduced to over capacity with LoS F from LoS D in Scenario 0 during AM peak. Remains over capacity during PM and Saturday peaks at LoS F, with increased average delays.
- Albion Street / Macpherson Street: similar to Scenario 0, remains over capacity with LoS F during AM peak.

Table 4-4 Scenario 2: Bronte Road / Carrington Street / Victoria Street (Option 3) + Carrington Road / Darley Road / Macpherson Street (Option 1) + Bronte Road / Albion Street (Option 1)

Location		AM Peak				PM Peak				Saturday Peak			
		Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh
1	Carrington Road / Bronte Road / Victoria Street	1.08	78	LOS F	79	0.88	44	LOS D	18	0.94	49	LOS D	37
2	Carrington Road / Macpherson Street / Darley Road	1.23	77	LOS F	51	1.20	136	LOS F	36	1.17	114	LOS F	62
3	Albion Street / Macpherson Street	1.09	111	LOS F	58	0.74	16	LOS B	3	0.96	32	LOS C	16
4	Macpherson Street / Leichhardt Street	0.93	42	LOS C	22	0.95	36	LOS D	13	0.88	32	LOS C	18
5	Bronte Road / Leichhardt Street	0.61	12	LOS A	6	0.66	17	LOS B	2	0.64	17	LOS B	6
6	Bronte Road / Albion Street	0.85	32	LOS C	7	0.47	18	LOS C	1	0.52	19	LOS C	3

Notes:

- The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.
- The level of service for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.
- The degree of saturation is defined as the ratio of the arrival flow (demand) to the capacity of each approach.
- Average delay is given in seconds per vehicle.

4.3.4 Scenario 3

The SIDRA modelling results for Scenario 3 for the weekday AM, PM and Saturday peak periods are summarised in . A comparison of the results against the “do nothing” (2030) intersection performance (Scenario 0) indicates the following:

- Carrington Road / Bronte Road / Victoria Street: similar to Scenario 0, remains over capacity at LoS F during AM peak and LoS E during Saturday peak.
- Carrington Road / Macpherson Street / Darley Road: reduced to at capacity with LoS E from LoS D in Scenario 0 during AM peak. Expected to operate over capacity during PM and Saturday peaks at LoS F, with delays similar to Scenario 0.
- Albion Street / Macpherson Street: similar to Scenario 0, expect to operate over capacity at LoS F during AM peak.

Table 4-5 Scenario 3: Bronte Road / Carrington Street / Victoria Street (Option 1) + Carrington Road / Darley Road / Macpherson Street (Option 2) + Bronte Road / Albion Street (Option 1)

Location		AM Peak				PM Peak				Saturday Peak			
		Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh
1	Carrington Road / Bronte Road / Victoria Street	1.08	74	LOS F	69	0.92	49	LOS D	20	0.99	56	LOS E	43
2	Carrington Road / Macpherson Street / Darley Road	0.99	61	LOS E	38	1.19	133	LOS F	37	1.17	112	LOS F	62
3	Albion Street / Macpherson Street	1.08	99	LOS F	53	0.74	16	LOS B	3	0.89	27	LOS C	17
4	Macpherson Street / Leichhardt Street	0.86	31	LOS C	17	0.95	36	LOS D	13	0.88	32	LOS C	19
5	Bronte Road / Leichhardt Street	0.61	13	LOS A	6	0.66	17	LOS B	2	0.64	18	LOS B	6
6	Bronte Road / Albion Street	0.72	24	LOS B	6	0.47	18	LOS C	1	0.52	19	LOS C	3

Notes:

- The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.
- The level of service for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.
- The degree of saturation is defined as the ratio of the arrival flow (demand) to the capacity of each approach.
- Average delay is given in seconds per vehicle.

4.3.5 Scenario 4

The SIDRA modelling results for Scenario 4 for the weekday AM, PM and Saturday peak periods are summarised in . A comparison of the results against the “do nothing” (2030) intersection performance (Scenario 0) indicates the following:

- Carrington Road / Bronte Road / Victoria Street: similar to scenario 0, expected to operate over capacity at LoS F during AM peak and at LoS E during Saturday Peak.
- Carrington Road / Macpherson Street / Darley Road: reduced to over capacity at LoS F from LoS D in Scenario 0 during AM peak. Remains over capacity during PM and Saturday peaks at LoS F.
- Albion Street / Macpherson Street: similar to Scenario 0, expected to operate over capacity at LoS F during AM peak.

Table 4-6 Scenario 4: Bronte Road / Carrington Street / Victoria Street (Option 2) + Carrington Road / Darley Road / Macpherson Street (Option 2) + Bronte Road / Albion Street (Option 1)

Location		AM Peak				PM Peak				Saturday Peak			
		Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh
1	Carrington Road / Bronte Road / Victoria Street	1.11	82	LOS F	77	0.89	47	LOS D	19	0.98	56	LOS E	42
2	Carrington Road / Macpherson Street / Darley Road	1.18	73	LOS F	47	1.20	136	LOS F	36	1.17	113	LOS F	62
3	Albion Street / Macpherson Street	1.07	92	LOS F	50	0.73	16	LOS B	3	0.89	27	LOS C	17
4	Macpherson Street / Leichhardt Street	0.91	37	LOS C	20	0.95	36	LOS D	13	0.88	32	LOS C	18
5	Bronte Road / Leichhardt Street	0.61	12	LOS A	6	0.66	17	LOS B	2	0.64	17	LOS B	6
6	Bronte Road / Albion Street	0.81	29	LOS C	6	0.47	18	LOS C	1	0.52	19	LOS C	3

Notes:

- The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.
- The level of service for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.
- The degree of saturation is defined as the ratio of the arrival flow (demand) to the capacity of each approach.
- Average delay is given in seconds per vehicle.

4.3.6 Scenario 5

The SIDRA modelling results for Scenario 5 for the weekday AM, PM and Saturday peak periods are summarised in . A comparison of the results against the “do nothing” (2030) intersection performance (Scenario 0) indicates the following:

- Carrington Road / Bronte Road / Victoria Street: similar to Scenario 0, expected to over capacity at LoS F during the AM peak.
- Carrington Road / Macpherson Street / Darley Road: reduced to over capacity at LoS F from to LoS D in Scenario 0 during AM peak. Remains over capacity during PM and Saturday peaks at LoS F.
- Albion Street / Macpherson Street: similar to Scenario 0, expected to over capacity at LoS F during AM peak.

Table 4-7 Scenario 5: Bronte Road / Carrington Street / Victoria Street (Option 3) + Carrington Road / Darley Road / Macpherson Street (Option 2) + Bronte Road / Albion Street (Option 1)

Location		AM Peak				PM Peak				Saturday Peak			
		Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh
1	Carrington Road / Bronte Road / Victoria Street	1.08	78	LOS F	79	0.88	46	LOS D	31	0.94	49	LOS D	37
2	Carrington Road / Macpherson Street / Darley Road	1.24	76	LOS F	51	1.20	136	LOS F	58	1.17	113	LOS F	62
3	Albion Street / Macpherson Street	1.07	94	LOS F	51	0.73	16	LOS B	7	0.89	27	LOS C	17
4	Macpherson Street / Leichhardt Street	0.92	39	LOS C	21	0.95	36	LOS D	31	0.88	32	LOS C	18
5	Bronte Road / Leichhardt Street	0.61	12	LOS A	6	0.66	17	LOS B	6	0.64	17	LOS B	6
6	Bronte Road / Albion Street	0.85	32	LOS C	7	0.47	18	LOS C	3	0.52	19	LOS C	3

Notes:

- The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.
- The level of service for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.
- The degree of saturation is defined as the ratio of the arrival flow (demand) to the capacity of each approach.
- Average delay is given in seconds per vehicle.

4.3.7 Scenario 6

The SIDRA modelling results for Scenario 6 for the weekday AM, PM and Saturday peak periods are summarised in . A comparison of the results against the “do nothing” (2030) intersection performance (Scenario 0) indicates the following:

- Carrington Road / Bronte Road / Victoria Street: similar to Scenario 0, expected to over capacity at LoS F during AM peak. Remains at LoS E during the Saturday peak.
- Carrington Road / Macpherson Street / Darley Road: reduced to over capacity at LoS F from LoS D in Scenario 0 during the AM peak. Remained at LoS F during the PM peak and Saturday peak.
- Albion Street / Macpherson Street: similar to Scenario 0, expected to operate over capacity with LoS F during AM peak although with higher delays. Reduced to LoS F from LoS C (Scenario 0) during Saturday peak.
- Macpherson Street / Leichhardt Street: performance expected to be reduced to LoS F from LoS D in Scenario 0 during AM peak. Reduced to LoS F from LoS C (Scenario 0) during Saturday peak. This is due to ban right turn movement at Bronte Road, which results in additional traffic on Macpherson Street.

Table 4-8 Scenario 6: Bronte Road / Carrington Street / Victoria Street (Option 1) + Carrington Road / Darley Road / Macpherson Street (Option 1) + Bronte Road / Albion Street (Option 2)

Location		AM Peak				PM Peak				Saturday Peak			
		Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh
1	Carrington Road / Bronte Road / Victoria Street	1.15	91	LOS F	77	0.95	54	LOS D	35	1.03	71	LOS E	47
2	Carrington Road / Macpherson Street / Darley Road	1.54	84	LOS F	42	1.19	137	LOS F	60	1.22	111	LOS F	58
3	Albion Street / Macpherson Street	1.31	298	LOS F	106	0.93	31	LOS C	16	1.11	123	LOS F	63
4	Macpherson Street / Leichhardt Street	1.33	322	LOS F	107	0.99	53	LOS D	41	1.05	84	LOS F	53
5	Bronte Road / Leichhardt Street	0.77	15	LOS B	10	0.69	20	LOS B	5	0.56	18	LOS B	4
6	Bronte Road / Albion Street	0.29	6	LOS A	1	0.11	7	LOS A	0	0.06	7	LOS A	0

Notes:

- The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.
- The level of service for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.
- The degree of saturation is defined as the ratio of the arrival flow (demand) to the capacity of each approach.
- Average delay is given in seconds per vehicle.

4.3.8 Scenario 7

The SIDRA modelling results for Scenario 7 for the weekday AM, PM and Saturday peak periods are summarised in . A comparison of the results against the “do nothing” (2030) intersection performance (Scenario 0) indicates the following:

- Carrington Road / Bronte Road / Victoria Street: similar to Scenario 0, expected to be over capacity at LoS F, during AM peak and at LoS E during the Saturday Peak
- Carrington Road / Macpherson Street / Darley Road: reduced to over capacity at LoS F from LoS D in Scenario 0 during AM peak. Remains at LoS F during PM peak and Saturday peak.
- Albion Street / Macpherson Street: similar to Scenario 0, expected to operate over capacity at LoS F during AM peak. Reduced to LoS F from LoS C in Scenario 0 during the Saturday peak.
- Macpherson Street / Leichhardt Street: performance reduced to LoS F from LoS D in Scenario 0 during AM peak and reduced to LoS E from LoS C in Scenario 0 during Saturday peak.

Table 4-9 Scenario 7: Bronte Road / Carrington Street / Victoria Street (Option 2) + Carrington Road / Darley Road / Macpherson Street (Option 1) + Bronte Road / Albion Street (Option 2)

Location		AM Peak				PM Peak				Saturday Peak			
		Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh
1	Carrington Road / Bronte Road / Victoria Street	1.12	96	LOS F	88	0.94	52	LOS D	33	1.04	77	LOS E	50
2	Carrington Road / Macpherson Street / Darley Road	2.66	145	LOS F	61	1.20	137	LOS F	58	1.23	109	LOS F	58
3	Albion Street / Macpherson Street	1.31	299	LOS F	106	0.93	29	LOS C	16	1.10	118	LOS F	61
4	Macpherson Street / Leichhardt Street	1.33	324	LOS F	107	0.96	37	LOS D	32	1.02	69	LOS E	45
5	Bronte Road / Leichhardt Street	0.77	15	LOS B	10	0.60	17	LOS B	5	0.56	18	LOS B	4
6	Bronte Road / Albion Street	0.28	6	LOS A	1	0.11	7	LOS A	0	0.06	7	LOS A	2

Notes:

- The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.
- The level of service for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.
- The degree of saturation is defined as the ratio of the arrival flow (demand) to the capacity of each approach.
- Average delay is given in seconds per vehicle.

4.3.9 Scenario 8

The SIDRA modelling results for Scenario 8 for the weekday AM, PM and Saturday peak periods are summarised in . A comparison of the results against the “do nothing” (2030) intersection performance (Scenario 0) indicates the following:

- Carrington Road / Bronte Road / Victoria Street: Similar to Scenario 0, expected to operate over capacity at LoS F during AM peak and at LoS E during Saturday peak.
- Carrington Road / Macpherson Street / Darley Road: reduced to over capacity with LoS F from LoS D in Scenario 0 during AM peak. Remains at LoS F during PM and Saturday peaks.
- Albion Street / Macpherson Street: similar to Scenario 0, over capacity with LoS F during AM although with increased delays. Reduced from LoS C (Scenario 0) to LoS F during Saturday peak.
- Macpherson Street / Leichhardt Street: performance expected to reduce to LoS F from LoS D in Scenario 0 during AM peak. reduced to LoS F from LoS C (Scenario 0) during the Saturday peak

Table 4-10 Scenario 8: Bronte Road / Carrington Street / Victoria Street (Option 3) + Carrington Road / Darley Road / Macpherson Street (Option 1) + Bronte Road / Albion Street (Option 2)

Location		AM Peak				PM Peak				Saturday Peak			
		Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh
1	Carrington Road / Bronte Road / Victoria Street	1.09	85	LOS F	80	0.91	50	LOS D	20	1.01	65	LOS E	44
2	Carrington Road / Macpherson Street / Darley Road	2.97	137	LOS F	50	1.20	137	LOS F	36	1.23	115	LOS F	58
3	Albion Street / Macpherson Street	1.31	301	LOS F	106	0.92	29	LOS C	6	1.11	125	LOS F	64
4	Macpherson Street / Leichhardt Street	1.33	322	LOS F	107	0.96	37	LOS D	13	1.05	85	LOS F	53
5	Bronte Road / Leichhardt Street	0.77	15	LOS B	10	0.60	17	LOS B	2	0.56	18	LOS B	4
6	Bronte Road / Albion Street	0.33	7	LOS A	1	0.11	7	LOS A	0	0.06	7	LOS A	0

Notes:

- The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.
- The level of service for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.
- The degree of saturation is defined as the ratio of the arrival flow (demand) to the capacity of each approach.
- Average delay is given in seconds per vehicle.

4.3.10 Scenario 9

The SIDRA modelling results for Scenario 9 are summarised in Table 4-11. A comparison of the results against the “do nothing” (2030) intersection performance (Scenario 0) indicates the following:

- Carrington Road / Bronte Road / Victoria Street: similar to Scenario 0, over capacity at LoS F during AM peak and at LoS E during Saturday peak.
- Carrington Road / Macpherson Street / Darley Road: reduced to over capacity at LoS F from LoS D in Scenario 0 during AM peak. Remains at LoS F during PM peak and Saturday peak.
- Albion Street / Macpherson Street: similar to Scenario 0, over capacity with LoS F during AM peak. Reduced from LoS C in Scenario 0 to LoS F during Saturday peak.
- Macpherson Street / Leichhardt Street: performance reduced to LoS F from LoS D (Scenario 0) during the AM peak.

Table 4-11 Scenario 9 Bronte Road / Carrington Street / Victoria Street (Option 1) + Carrington Road / Darley Road / Macpherson Street (Option 2) + Bronte Road / Albion Street (Option 2)

Location		AM Peak				PM Peak				Saturday Peak			
		Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh
1	Carrington Road / Bronte Road / Victoria Street	1.15	90	LOS F	75	0.95	53	LOS D	33	1.03	72	LOS E	47
2	Carrington Road / Macpherson Street / Darley Road	1.63	79	LOS F	37	1.19	133	LOS F	60	1.29	116	LOS F	58
3	Albion Street / Macpherson Street	1.29	283	LOS F	106	0.91	27	LOS B	15	1.08	98	LOS F	53
4	Macpherson Street / Leichhardt Street	1.23	237	LOS F	86	0.96	37	LOS C	32	0.97	42	LOS D	35
5	Bronte Road / Leichhardt Street	0.76	15	LOS B	10	0.60	17	LOS B	5	0.53	17	LOS B	4
6	Bronte Road / Albion Street	0.3	6	LOS A	1	0.11	7	LOS A	0	0.06	7	LOS A	0

Notes:

- The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.
- The level of service for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.
- The degree of saturation is defined as the ratio of the arrival flow (demand) to the capacity of each approach.
- Average delay is given in seconds per vehicle.

4.3.11 Scenario 10

The SIDRA modelling results for Scenario 10 for the weekday AM, PM and Saturday peak periods summarised in . A comparison of the results against the “do nothing” (2030) intersection performance (Scenario 0) indicates the following:

- Carrington Road / Bronte Road / Victoria Street: Similar to Scenario 0, expected to operate over capacity at LoS F during AM peak and at LoS E during Saturday peak.
- Carrington Road / Macpherson Street / Darley Road: reduced to over capacity at LoS F from LoS D in Scenario 0 during AM peak. Remained at LoS F during PM peak and Saturday peak.
- Albion Street / Macpherson Street: reduced to over capacity at LoS F during the AM peak, and reduced to LoS E from LoS C (Scenario 0) during Saturday peak.
- Macpherson Street / Leichhardt Street: performance reduced to LoS F during AM peak from LoS D (Scenario 0).

Table 4-12 Scenario 10: Bronte Road / Carrington Street / Victoria Street (Option 2) + Carrington Road / Darley Road / Macpherson Street (Option 2) + Bronte Road / Albion Street (Option 2)

Location		AM Peak				PM Peak				Saturday Peak			
		Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh
1	Carrington Road / Bronte Road / Victoria Street	1.27	125	LOS F	88	0.94	52	LOS D	20	1.04	77	LOS E	50
2	Carrington Road / Macpherson Street / Darley Road	1.08	102	LOS F	50	1.20	136	LOS F	36	1.28	113	LOS F	58
3	Albion Street / Macpherson Street	1.32	311	LOS F	106	0.90	25	LOS C	6	1.03	76	LOS E	41
4	Macpherson Street / Leichhardt Street	1.33	323	LOS F	107	0.96	37	LOS D	13	0.96	38	LOS D	32
5	Bronte Road / Leichhardt Street	0.76	15	LOS B	10	0.60	17	LOS B	2	0.53	17	LOS B	4
6	Bronte Road / Albion Street	0.34	6	LOS A	1	0.11	7	LOS A	0	0.06	7	LOS A	2

Notes:

- The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.
- The level of service for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.
- The degree of saturation is defined as the ratio of the arrival flow (demand) to the capacity of each approach.
- Average delay is given in seconds per vehicle.

4.3.12 Scenario 11

The SIDRA modelling results for Scenario 11 for the weekday AM, PM and Saturday peak periods is summarised in . A comparison of the results against the “do nothing” (2030) intersection performance (Scenario 0) indicates the following:

- Carrington Road / Bronte Road / Victoria Street: Similar to Scenario 0, expected to operate over capacity at LoS F during AM peak and at LoS E during Saturday peak.
- Carrington Road / Macpherson Street / Darley Road: reduced to over capacity with LoS F from LoS D in Scenario 0 during the AM peak. Remains at LoS F during the PM peak and Saturday peak.
- Albion Street / Macpherson Street: similar to Scenario 0, expected to operate over capacity at LoS F during the AM peak. Reduced from LoS C in Scenario 0 to LoS F during the Saturday peak.
- Macpherson Street / Leichhardt Street: performance reduced to LoS F from LoS D in Scenario 0 during AM peak.

Table 4-13 Scenario 11: Bronte Road / Carrington Street / Victoria Street (Option 3) + Carrington Road / Darley Road / Macpherson Street (Option 2) + Bronte Road / Albion Street (Option 2)

Location		AM Peak				PM Peak				Saturday Peak			
		Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh	Deg.Sat v/c	Average Delay sec	Level of Service	95% Back of Queue veh
1	Carrington Road / Bronte Road / Victoria Street	1.11	92	LOS F	84	0.95	49	LOS D	20	1.03	62	LOS E	39
2	Carrington Road / Macpherson Street / Darley Road	3.25	149	LOS F	54	1.20	136	LOS F	39	1.30	119	LOS F	58
3	Albion Street / Macpherson Street	1.32	302	LOS F	106	0.89	25	LOS C	6	1.08	101	LOS F	54
4	Macpherson Street / Leichhardt Street	1.33	323	LOS F	107	0.96	37	LOS D	13	0.97	40	LOS D	33
5	Bronte Road / Leichhardt Street	0.77	15	LOS B	10	0.76	9	LOS A	3	0.53	17	LOS B	4
6	Bronte Road / Albion Street	0.33	7	LOS A	1	0.11	7	LOS A	0	0.06	7	LOS A	0

Notes:

- The average delay for priority-controlled intersections is selected from the movement on the approach with the highest average delay.
- The level of service for priority-controlled intersections is based on the highest average delay per vehicle for the most critical movement.
- The degree of saturation is defined as the ratio of the arrival flow (demand) to the capacity of each approach.
- Average delay is given in seconds per vehicle.

4.3.13 SIDRA modelling summary

A number of intersection upgrade option scenarios have been tested for the Charing Cross Road network using SIDRA, including for the Carrington Road / Bronte Road / Victoria Street intersection, Bronte Road / Albion Street intersection and the Carrington Road / Macpherson Street / Darley Road intersection. Potential upgrades to these intersection have been considered in order to improve the pedestrian environment as part of the Bronte Road Streetscape Upgrade project, which includes reviewing opportunities to potentially divert traffic from Bronte Road to Carrington as identified in Council's People, Movement Places Strategy.

Analyses of the SIDRA modelling indicates the following:

- Closing the eastbound traffic lanes on Victoria Street will result in traffic being diverted to Carrington Road, via Darley Road. This additional northbound traffic on Carrington Road would result in increased delays at the Carrington Road / Bronte Road / Victoria Street intersection and at the Carrington Road / Macpherson Street / Darley Road intersection.
- Banning the right turns at the Bronte Road / Albion Street intersection would redirect traffic along Macpherson Street and Carrington Road. This redistribution of traffic is expected to result in increased delays at the Macpherson Street / Albion Road intersection and also at the Carrington Road / Macpherson Street / Darley Road intersection and the Carrington Road / Bronte Road / Victoria Street intersection.

Based on the above, the proposed traffic network scenarios tested for this study are not recommended. However, the following arrangements should be considered for further analysis to improve safety and amenity for pedestrians:

4.4 Potential upgrades for further consideration

Carrington Road / Bronte Road / Victoria Street intersection

The crash data review indicates that pedestrian crashes were the highest at the Carrington Road / Victoria Street / Bronte Road intersection, with ten crashes over a five-year period. These crashes have resulted in eight injuries, including four serious injuries.

It is recommended that Council consider the following safety improvements at the Carrington Road / Bronte Road / Victoria Street intersection:

- Remove the left turn slip lane from Bronte Road (south eastern approach) to Carrington Road (south) and widen the existing pedestrian storage area, as shown at . The following is noted for this proposed arrangement:
 - This arrangement would increase the waiting area for pedestrians at the crossings and provide opportunities to improve amenity.
 - Vehicles currently turning left from Bronte Road (south eastern approach) into to Carrington Road (south) would be required to travel via Victoria Street, Edmund Street and John Street. The impacts of this traffic diversion are expected to be minimal, given the low number of vehicles that currently turning left at this location, based on the 2020 traffic count data.
- Provide a kerb buildout on the northern side of the Victoria Street (east) approach. The following is noted for this proposed arrangement:
 - This improvement is expected to result in negligible impacts to the operation of the Carrington Road / Bronte Road / Victoria Street intersection. The kerb buildout would provide a buffer between the footpath and traffic lane.

- Consider opportunities to realign the existing pedestrian crossings at the Victoria Street (west), Carrington Road (south) and Bronte Road (south east) approaches. The following is noted for this proposed arrangement:
 - This improvement would reduce the crossing distances for pedestrians (when crossing the road). However, measures such as pedestrian fencing and / or landscaping would be required to prevent pedestrians crossing at the existing crossing locations.
 - This arrangement would result in increased overall walking distances for pedestrians, resulting in potentially longer crossing times for some pedestrian movements at the intersection.
 - Council will need to undertake intersection modelling analysis and an intersection safety review to confirm the feasibility of realigning the pedestrian crossings.
 - Around four parking spaces would be removed on Bronte Road to accommodate the realigned pedestrian crossing, including the existing loading zone located on the eastern side of Bronte Road, which operates between 8.30 AM – 4 PM Monday to Saturday.
 - It is recommended that Council undertake a detailed traffic study to assess the feasibility for realigning the existing pedestrian crossings.



Figure 4-6 Potential improvements to the Victoria Street / Carrington Road / Bronte Road intersection

Source: Nearmap (2020), modified by Waverley Council

Bronte Road

The mid-block traffic count data for Bronte Road indicates that the 85th percentile speeds in the southbound direction currently exceed the 50 km/h speed limit.

To improve pedestrian access and amenity along Bronte Road, it is recommended that Council undertake a study to assess the feasibility of implementing a High Pedestrian Activity Area (HPAA) along Bronte Road, with a reduced speed limit from 50 km/h to 40 km/h.

Additionally, or as part of the HPAA feasibility study, Council should consider the following opportunities to improve the pedestrian environment along Bronte Road, as illustrated in Figure 4-7:

- Introduce a raised pedestrian crossing (wombat crossing), with planted islands on the approach and departure sides of the crossing at Bronte Road located near the pedestrian laneway to the Council car park. The following is noted for this proposed arrangement:
 - A traffic study will be required to assess if a pedestrian crossing at this location will meet the TfNSW pedestrian crossing warrants. Pedestrian count data will be needed for this analysis.
 - This proposal would result in a loss of some on-street parking along Bronte Road (around six spaces).
- Upgrade the existing pedestrian crossing located to the north of Albion Street to provide a raised pedestrian crossing (wombat crossing), with planted islands on the approach and departure sides of the crossing.
- Introduce a 40 km/h speed limit between the two above-mentioned raised pedestrian crossings on Bronte Road, which would form a gateway treatment to the HPAA.
- Line mark the parking lanes on both sides of Bronte Road where parking restrictions do not exist. Traffic lane along Bronte Road should be no more than 3.2 metres wide, which is wide enough to accommodate buses. The following is noted for this proposed arrangement:
 - The line marking could result in reduced vehicle speeds on Bronte Road, by narrowing the trafficable road width.
 - The line marking is expected to improve parking operations by providing wide parking bays that are easier for vehicles to access, and will improve pedestrian access to the driver's side of a vehicle.



Figure 4-7 Proposed pedestrian crossing upgrades at Bronte Road between Victoria Street and Albion Street

Source: Nearmap (2020), modified by GHD

5. Conclusions and recommendations

5.1 Overview

Waverley Council are proposing streetscape upgrades to Charing Cross Village Centre, which is primarily located along Bronte Road between the Carrington Road / Bronte Road / Victoria Road intersection and the Bronte Road Albion Street intersection.

This Traffic Study provides a review of the existing road and transport conditions in the vicinity of Charing Cross Village Centre, including traffic volumes and crash data. The intent is to inform future planning for the proposed Charing Cross Streetscape project.

5.2 Key findings

The key findings of this study are as follows:

5.2.1 Existing conditions

- Pedestrian environment:
 - Footpaths are available along both sides of each road in the study area.
 - Signal controlled pedestrian crossings are provided at Victoria Street / Carrington Road / Bronte Road intersection and the Darley Road / Carrington Road / Mapherson Street intersection.
 - A zebra crossing is provided at Bronte Road, to the north of the intersection with Albion Street, with a zebra crossing also provided at both Mapherson Street and Leichardt Street.
 - Pedestrian connectivity at the Carrington Road / Victoria Street / Bronte Road intersection is currently poor to the current intersection configuration, with six approaches to the intersection. In particular, pedestrians walking along the southern side of Victoria Road are required to cross at two long pedestrian crossings, which can result in delays for pedestrians walking along this alignment.
- The bicycle network in the study area includes an on-road bicycle route (low difficulty) is provided along Victoria Street, which passes in an east-west alignment through the Bronte Road / Carrington Road / Victoria Street intersection.
- A review of five-year crash statistics identified that:
 - Pedestrian crashes were the highest at the Carrington Road / Victoria Street / Bronte Road intersection. These crashes have resulted in eight injuries including four serious injuries. The intersection pedestrian crashes could be due to lack of adequate sight distances for vehicles entering Victoria Street and Bronte Street.
 - Crashes involving vehicles travelling in the same direction were the highest along Carrington Road, between Victoria Street and Macpherson Street. The contributing factors could be associated with poor driver observation, particularly under congested traffic conditions.
 - No crashes involving bicycle riders were recorded.
- Analysis of 2020 traffic count surveys identified that:
 - The weekday morning peak traffic volume peak occurs between 7:45 AM to 8:45 AM,
 - The weekday afternoon peak traffic volume peak occurs between 4:45 PM to 5:45 PM; and
 - The Saturday peak traffic volume peak occurs between 12:15 PM to 1:15 PM.

- The roads in the vicinity of the facility currently operate within the acceptable limits of their mid-block capacities.
- SIDRA 8 intersection analysis of intersections in the study area indicates the following:
 - Carrington Road / Bronte Road / Victoria Street intersection operates over capacity in the weekday AM peak (LoS F) and at capacity during the Saturday Peak hour (LoS E).
 - Carrington Road / Macpherson Street / Darley Road intersection operates over capacity during the weekday PM peak and Saturday peak hour at LoS F.
 - Albion Street / Macpherson Street operates over capacity during the weekday AM peak hour, at LoS F.
 - The other intersections analysed in the road network currently have an acceptable Level of Service (i.e. better than Level of Service E) during the weekday morning and weekday evening and weekend peak periods.
 - Overall, the results indicate that the road network in the vicinity of the site is currently operating at capacity with significant delays on approaches to Carrington Road.

5.2.2 Future conditions – intersection analysis (2030)

Intersection options

The following intersection layout options have been assessed using the SIDRA 8 network modelling for the 2030 horizon year:

- Victoria Street / Bronte Road / Carrington Road intersection:
 - Option 1 - no change
 - Option 2 - close the eastbound traffic lanes on Victoria Street (east and west sides) and Remove the slip lane at Bronte Road south-east.
 - Option 3 - Victoria Street closed two-way (west side) and eastbound (east side) and remove the slip lane at Bronte Road south-east.
- Carrington Road / Macpherson Street / Darley Road intersection:
 - Option 1 – no change
 - Option 2 – extend the existing right turn bay at the Macpherson Street approach to 65 metres.
- Option 2 Bronte Road and Albion Street intersection:
 - Option 1 – no change
 - Option 2 – left in left out only.

SIDRA network modelling results summary

A number of intersection upgrade option scenarios have been tested for the Charing Cross Road network using SIDRA, including for the Carrington Road / Bronte Road / Victoria Street intersection, Bronte Road / Albion Street intersection and the Carrington Road / Macpherson Street / Darley Road intersection. Potential upgrades to these intersection have been considered in order to improve the pedestrian environment as part of the Bronte Road Streetscape Upgrade project, which includes reviewing opportunities to potentially divert traffic from Bronte Road to Carrington as identified in Council's People, Movement Places Strategy.

Analyses of the SIDRA modelling indicates the following:

- Closing the eastbound traffic lanes on Victoria Street will result in traffic being diverted to Carrington Road, via Darley Road. This additional northbound traffic on Carrington Road is expected to result in increased delays at the Carrington Road / Bronte Road / Victoria Street intersection and at the Carrington Road / Macpherson Street / Darley Road intersection.
- Banning the right turns at the Bronte Road / Albion Street intersection would redirect traffic along Macpherson Street and Carrington Road. This redistribution of traffic is expected to result in increased delays at the Macpherson Street / Albion Road intersection and also at the Carrington Road / Macpherson Street / Darley Road intersection and the Carrington Road / Bronte Road / Victoria Street intersection.

Based on the above, the proposed traffic network scenarios tested for this study are not recommended. However, the following arrangements should be considered for further analysis to improve safety and amenity for pedestrians:

5.3 Recommendations

Carrington Road / Bronte Road / Victoria Street intersection

The crash data review indicates that pedestrian crashes were the highest at the Carrington Road / Victoria Street / Bronte Road intersection, with ten crashes over a five-year period. These crashes have resulted in eight injuries, including four serious injuries.

It is recommended that Council consider the following safety improvements at the Carrington Road / Bronte Road / Victoria Street intersection:

- Remove the left turn slip lane from Bronte Road (south eastern approach) to Carrington Road (south) and widen the existing pedestrian storage area, as shown at . The following is noted for this proposed arrangement:
 - This arrangement would increase the waiting area for the pedestrians at the crossings and provide opportunities to improve amenity.
 - Vehicles currently turning left from Bronte Road (south eastern approach) into to Carrington Road (south) would be required to travel via Victoria Street, Edmund Street and John Street. The impacts of this traffic diversion are expected to be minimal, given the low number of vehicles that currently turning left at this location, based on the 2020 traffic count data.
- Provide a kerb buildout on the northern side of the Victoria Street (east) approach. The following is noted for this proposed arrangement:
 - This improvement is expected to result in negligible impacts to the operation of the Carrington Road / Bronte Road / Victoria Street intersection.
- Consider opportunities to realign the existing pedestrian crossings at the Victoria Street (west), Carrington Road (south) and Bronte Road (south east) approaches. The following is noted for this proposed arrangement:
 - This improvement would reduce the crossing distances for pedestrians (when crossing the road). However, measures such as pedestrian fencing and / or landscaping would be required to prevent pedestrians crossing at the existing crossing locations.
 - This arrangement would result in increased overall walking distances for pedestrians, resulting in potentially longer crossing times for some pedestrian movements at the intersection.
 - Council will need to undertake intersection modelling analysis and an intersection safety review to confirm the feasibility of realigning the pedestrian crossings.

- Around four parking spaces would be removed on Bronte Road to accommodate the realigned pedestrian crossing, including the existing loading zone located on the eastern side of Bronte Road, which operates between 8.30 AM – 4 PM Monday to Saturday.
- It is recommended that Council undertake a detailed traffic study to assess the feasibility for realigning the existing pedestrian crossings.

Bronte Road

The mid-block traffic count data for Bronte Road indicates that the 85th percentile speeds in the southbound direction currently exceed the 50 km/h speed limit.

To improve pedestrian access and amenity along Bronte Road, it is recommended that Council undertake a study to assess the feasibility of implementing a High Pedestrian Activity Area (HPAA) along Bronte Road, with a reduced speed limit from 50 km/h to 40 km/h.

Additionally, or as part of the HPAA feasibility study, Council should consider the following opportunities to improve the pedestrian environment along Bronte Road :

- Introduce a raised pedestrian crossing (wombat crossing), with planted islands on the approach and departure sides of the crossing, at Bronte Road located near the pedestrian laneway to the Council car park. The following is noted for this proposed arrangement:
 - A traffic study will be required to assess if a pedestrian crossing at this location will meet the TfNSW pedestrian crossing warrants. Pedestrian count data will be needed for this analysis.
 - This proposal would result in a loss of some on-street parking along Bronte Road (around six spaces).
- Upgrade the existing pedestrian crossing located to the north of Albion Street to provide a raised pedestrian crossing (wombat crossing), with planted islands on the approach and departure sides of the crossing.
- Introduce a 40 km/h speed limit between the above mentioned two raised pedestrian crossings on Bronte Road, which would form a gateway treatment to the HPAA.
- Line mark the parking lanes on both sides of Bronte Road, where parking restrictions do not exist. Traffic lane along Bronte Road should be no more than 3.2 metres wide, which is wide enough to accommodate buses. The following is noted for this proposed arrangement:
 - The line marking could result in reduced vehicle speeds on Bronte Road, by narrowing the trafficable road width.
 - The line marking is expected to improve parking operations by providing wide parking bays that are easier for vehicles to access, and also allow more room for on the people to access the driver's side of a vehicle.

St Catherine's School drop-off and pick-up facilities

The review of drop-off and pick-up facilities at St Catherine's School has been undertaken, which is summarised in Table 5-1.

Table 5-1 Review of St Catherine's School drop-off and pick-up facilities

Issue number	Issue description	Recommendation
1	Location of 'No Stopping' and 'No Parking' signs on Albion Street northbound (see Figure 3-19). Sign could be moved north of the driveway, to provide clarity.	Consider the relocation of 'No Stopping' and 'No Parking' signs to north of the driveway.
2	Pedestrians required to walk through bus stop and associated queuing. Likelihood of footpath becoming blocked at school mass egress (see Figure 3-20) Pedestrian footpath width at the rear of the bus stop is currently one metre only – this may pose issues for wheelchair users, parents prams etc. Bus stop ID: 202419 and 202428	Consider the reconfiguration of bus stops on Albion Street to allow safe pedestrian movement during peak egress times to deconflict bus queues with pedestrian through-movements.
3	Risk of traffic queuing onto the roundabout. Potential vehicle / pedestrian conflict at pedestrian crossing locations at the roundabout: Southern arm – non-standard pedestrian refuge (see Figure 3-21) Eastern arm - no pedestrian refuge Western arm – no pedestrian refuge	Investigate upgrade of pedestrian crossing facilities at Macpherson Street / Albion Street roundabout, including installation of pedestrian refuge islands to improve pedestrian access and safety.
4	No clear signage identifying parking restrictions westbound on Macpherson Street. Parking entitlements are currently unclear.	Installation of appropriate signage to support parking entitlements.
5	Use of non-standard 'Kiss & Go Signage' at Macpherson Street (see Figure 3-19)	Installation of appropriate 'R9-303' signage to support formal school pick-up and drop-off operations (see Figure 3-19) Note, R9-303 (School Drop-off & Pick-up Zone) plate can only be used in accordance with "Roads and Maritime Services Procedure 141P - Procedure for a 'Drop-off & Pick-up' initiative around schools
6	Limited Kiss & Go capacity on Macpherson Street (seven cars in total) likely to lead to queuing and increased vehicle circulation at school mass egress.	Review of available 'Kiss & Go' locations serving the school. Consider use of westbound parking lanes, adjacent to the existing school drop-off / pick up' locations to provide additional capacity and minimise requirements for vehicle circulation on Macpherson Street and Albion Street.

Appendices

Appendix A – SIDRA Model Calibration Analysis

Intersection Queue calibration

To ensure the reliability of the results, the outputs from the SIDRA models were compared against another data sets, including queue length surveys, site observations and Google traffic data. A queue length model calibration was carried out, which compares the surveyed queues (in vehicles) at each intersection against the SIDRA output queues.

Table 5-2 provides a comparison with the surveyed queues against SIDRA output queues for the weekday peak hours, with Table 5-3 providing a queue length comparison for the Saturday peak hour. Analysis of the data indicates that the majority of approaches modelled are within an acceptable range of the surveyed queues. However, queue differences (greater than five vehicles) are noted for some approaches which have significant observed queue lengths. These differences may be explained by the following:

- Difficulties in capture an accurate queue lengths associated with limitations of video queue surveys.
- SIDRA queue lengths increasing exponentially when the intersection approaching capacity

It should also be noted that queue surveys at unsignalised intersections were noted from GHD's site visit, which observed traffic queuing for a period of around 15 minutes only, which may not have captured full extend of queueing conditions. Actual queue lengths during peak hours may therefore exceed the observed traffic conditions.

Table 5-2 Weekday AM and PM peak queue comparison (vehicles)

Location		AM Peak Queue (veh)			PM Peak Queue (veh)		
		Survey	SIDRA (95th %)	Difference	Survey	SIDRA (95th %)	Difference
1	South (Carrington Street)	48	44	4	36	27	9
	Southeast (Bronte Road)	29	41	12	21	18	3
	East (Victoria Street)	18	26	8	15	16	1
	North (Carrington Street)	22	21	1	18	25	7
	Northwest (Bronte Road)	27	24	3	25	31	6
	West (Victoria Street)	14	10	4	6	5	1
2	South (Carrington Street)	20	25	5	20	10	10
	East (Macpherson Street)	14	24	10	14	19	5
	North (Carrington Street)	22	24	2	22	45	23
	West (Darley Road)	23	22	1	29	55	26
3*	South (Albion St)	13	28	15	8	7	1
	East (Macpherson St)	13	57	44	4	8	4
	North (Albion St)	8	3	5	8	4	4
	West (Macpherson St)	8	5	3	7	3	4
4*	South (Leichardt St)	1	5	4	1	1	0
	East (Macpherson St)	13	22	9	3	13	10
	North (Leichardt St)	7	17	10	9	29	20
	West (Macpherson St)	3	12	9	4	10	6
5*	South (Leichardt St)	3	6	3	1	5	4
	East (Bronte Rd)	8	5	3	5	7	2
	North (Bronte Rd)	1	3	2	4	6	2

Location		AM Peak Queue (veh)			PM Peak Queue (veh)		
		Survey	SIDRA (95th %)	Difference	Survey	SIDRA (95th %)	Difference
6*	South (Albion St)	1	6	5	1	4	3
	East (Bronte Rd)	11	5	6	1	3	2
	North (Bronte Rd)	3	0	3	24	0	24

Note: Queue Survey and SIDRA outputs measured in vehicles (veh)

**Surveys at unsignalised sites were taken for a period of around 15 minutes only.*

Table 5-3 Saturday peak queue comparison (vehicles)

Intersection		Saturday Peak Queue (veh)		
		Survey	SIDRA (95th %)	difference
1	South (Carrington Street)	42	22	20
	Southeast (Bronte Road)	29	24	5
	East (Victoria Street)	18	19	1
	North (Carrington Street)	22	37	15
	Northwest (Bronte Road)	22	21	1
	West (Victoria Street)	7	4	3
2	South (Carrington Street)	24	53	29
	East (Macpherson Street)	14	23	9
	North (Carrington Street)	21	45	24
	West (Darley Road)	19	36	17

Note: Queue Survey and SIDRA outputs measured in vehicles (veh)

Appendix B – Traffic Redistribution Assumptions – Victoria Street / Bronte Road / Carrington Road

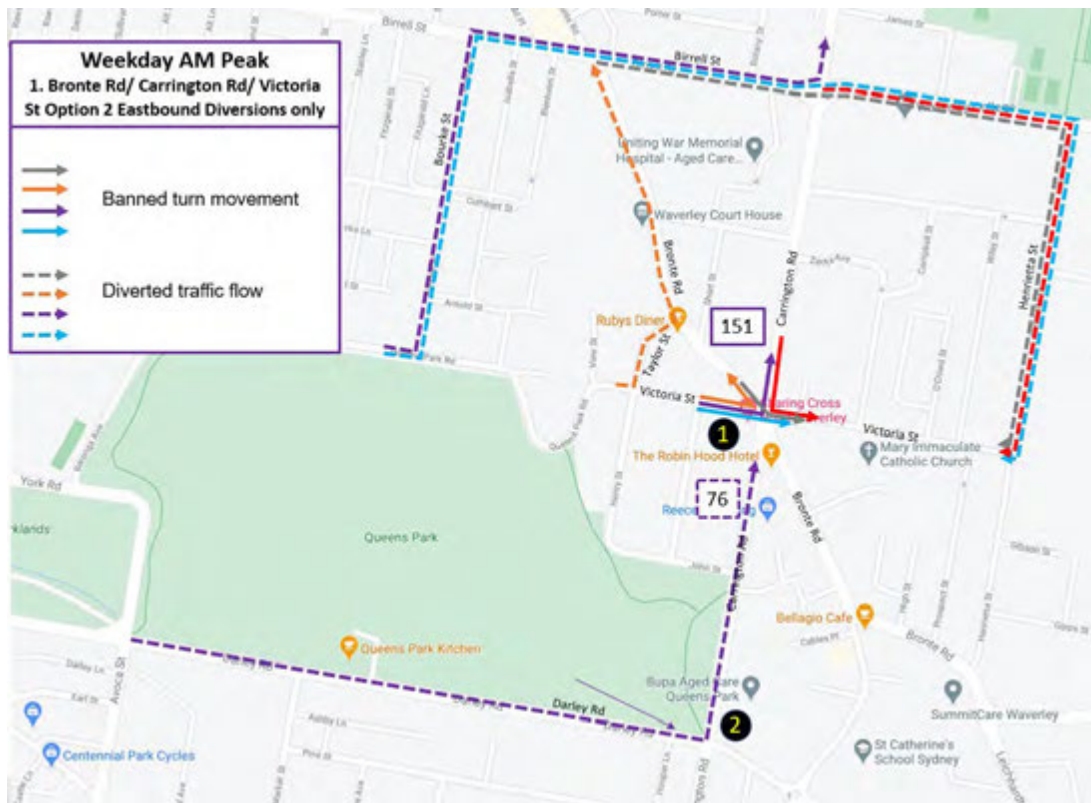


Figure 5-1 Option 2 Bronte Road / Carrington Road / Victoria Street
 Eastbound traffic diversion – AM Peak

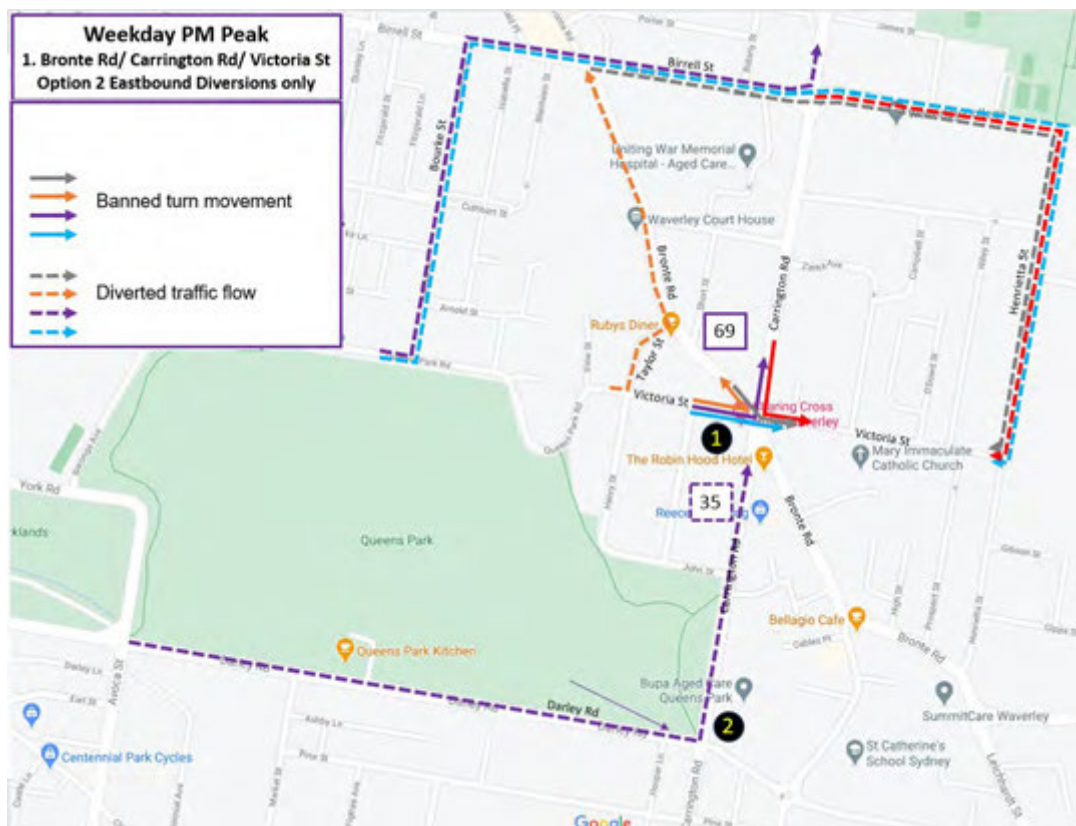


Figure 5-2 Option 2 Bronte Road / Carrington Road / Victoria Street
 Eastbound traffic diversion - PM Peak

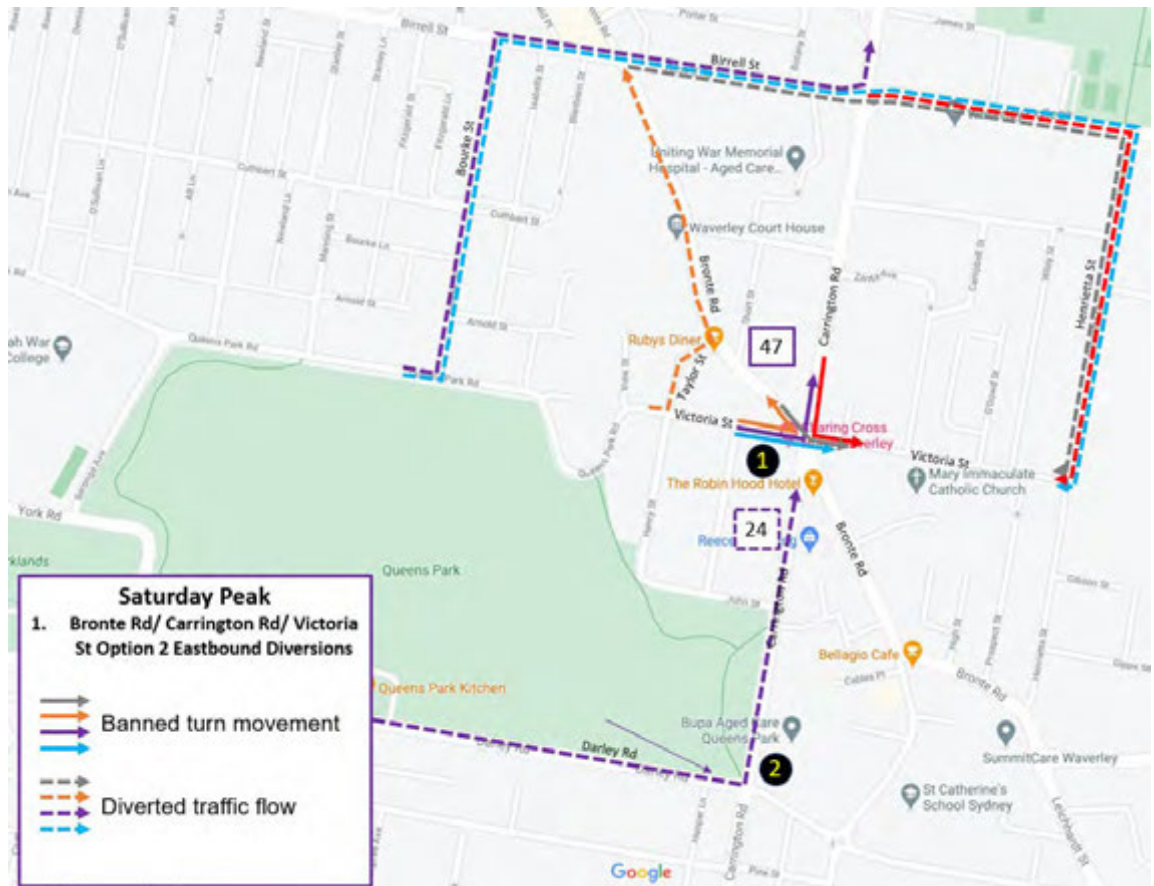


Figure 5-3 Option 2 Bronte Road / Carrington Road / Victoria Street
 Eastbound traffic diversion - Saturday Peak

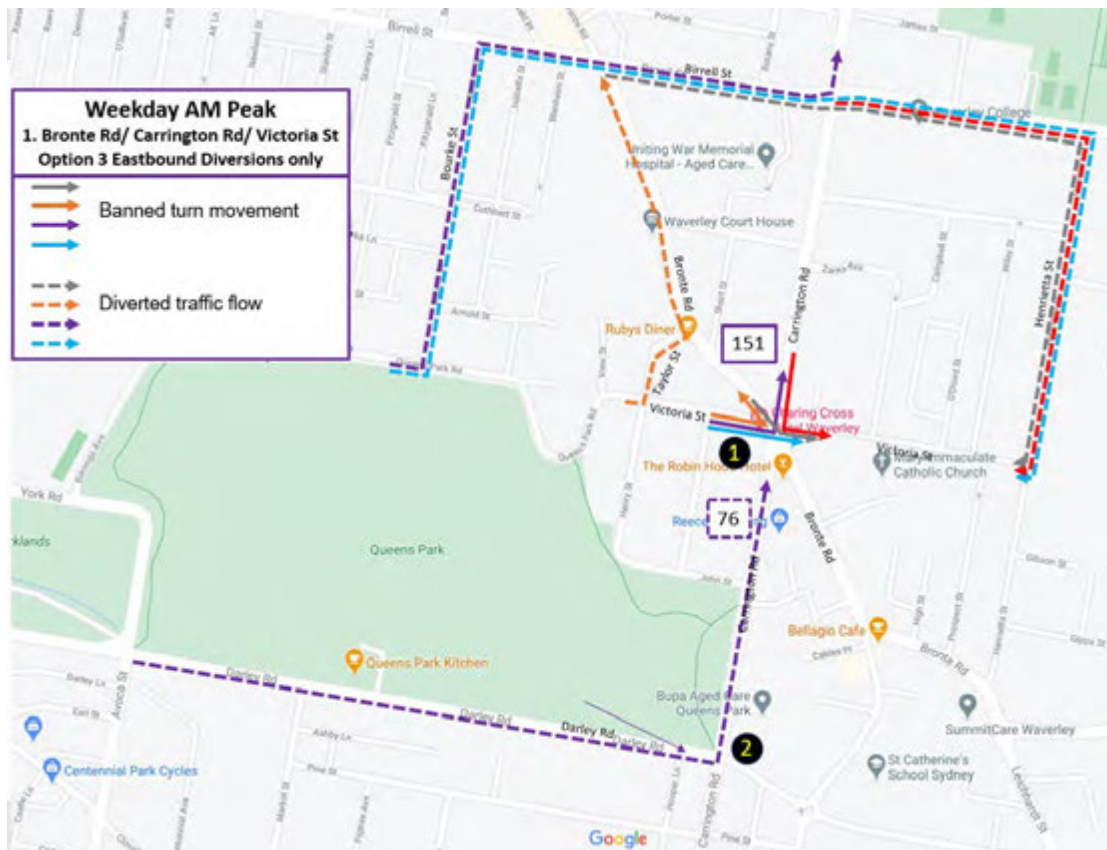


Figure 5-4 Option 3 Bronte Road / Carrington Road / Victoria Street
 Eastbound traffic diversion - AM Peak



Figure 5-5 Option 3 AM Peak - Bronte Road / Carrington Road / Victoria Street
 Westbound traffic diversion – AM Peak



Figure 5-6 Option 3 PM Peak - Bronte Road / Carrington Road / Victoria Street
 Eastbound traffic diversion – PM Peak



Figure 5-7 Option 3 Bronte Road / Carrington Road / Victoria Street
 Westbound traffic diversion - PM Peak

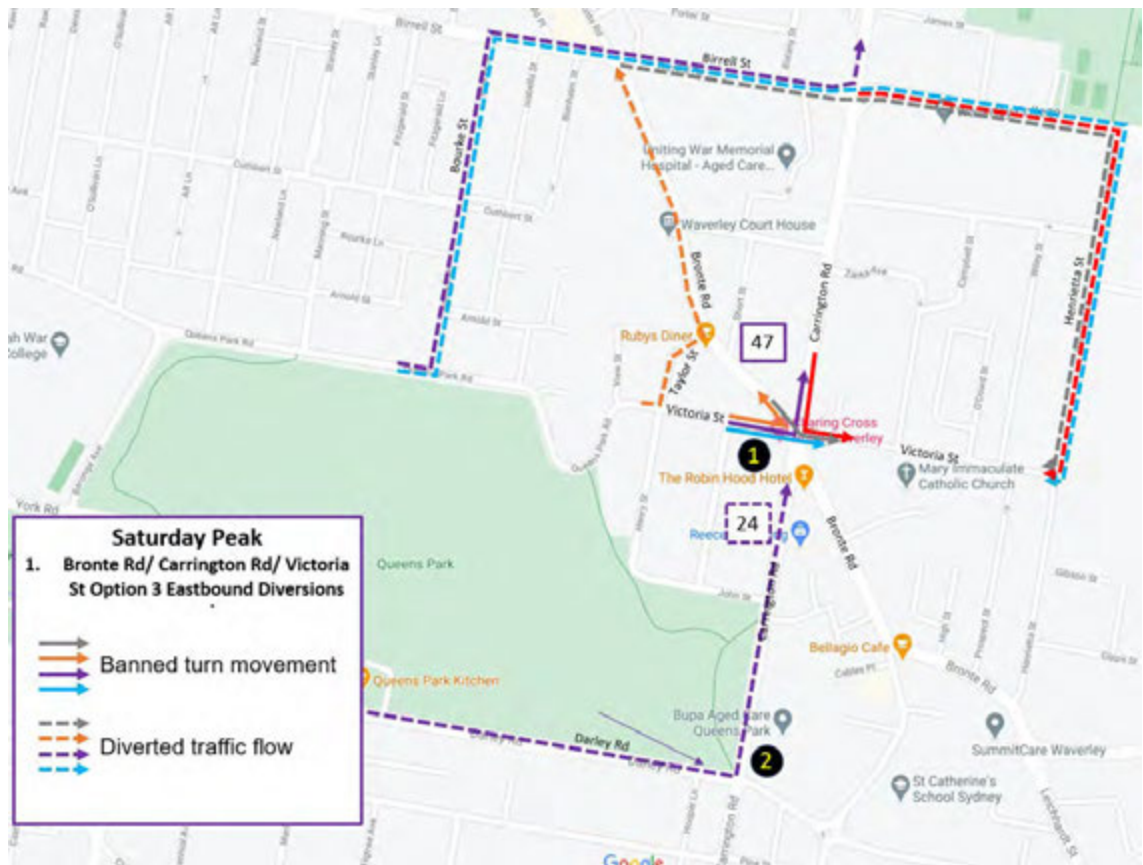


Figure 5-8 Option 3 Bronte Road / Carrington Road / Victoria Street Eastbound traffic diversion – Saturday Peak



Figure 5-9 Option 3 Bronte Road / Carrington Road / Victoria Street Westbound traffic diversion – Saturday Peak

Appendix C - Traffic Redistribution Assumptions – Bronte Road / Albion Street



Figure 5-10 Option 2 Bronte Road / Albion Street traffic diversion eastbound - AM peak

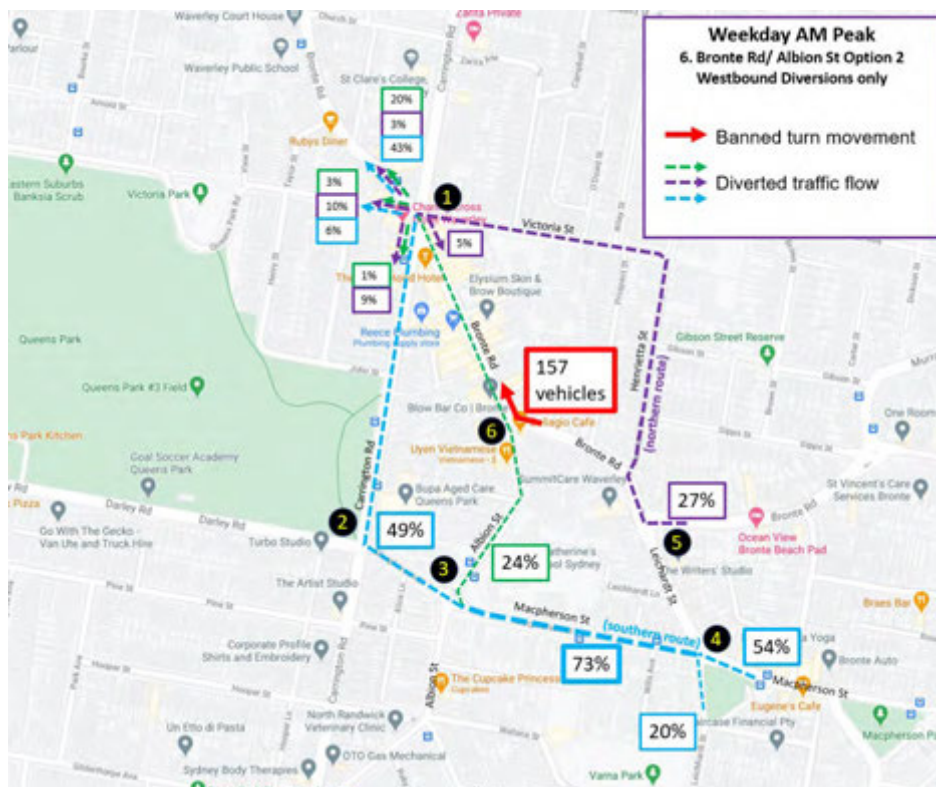


Figure 5-11 Option 2 Bronte Road / Albion Street traffic diversion Westbound – AM peak

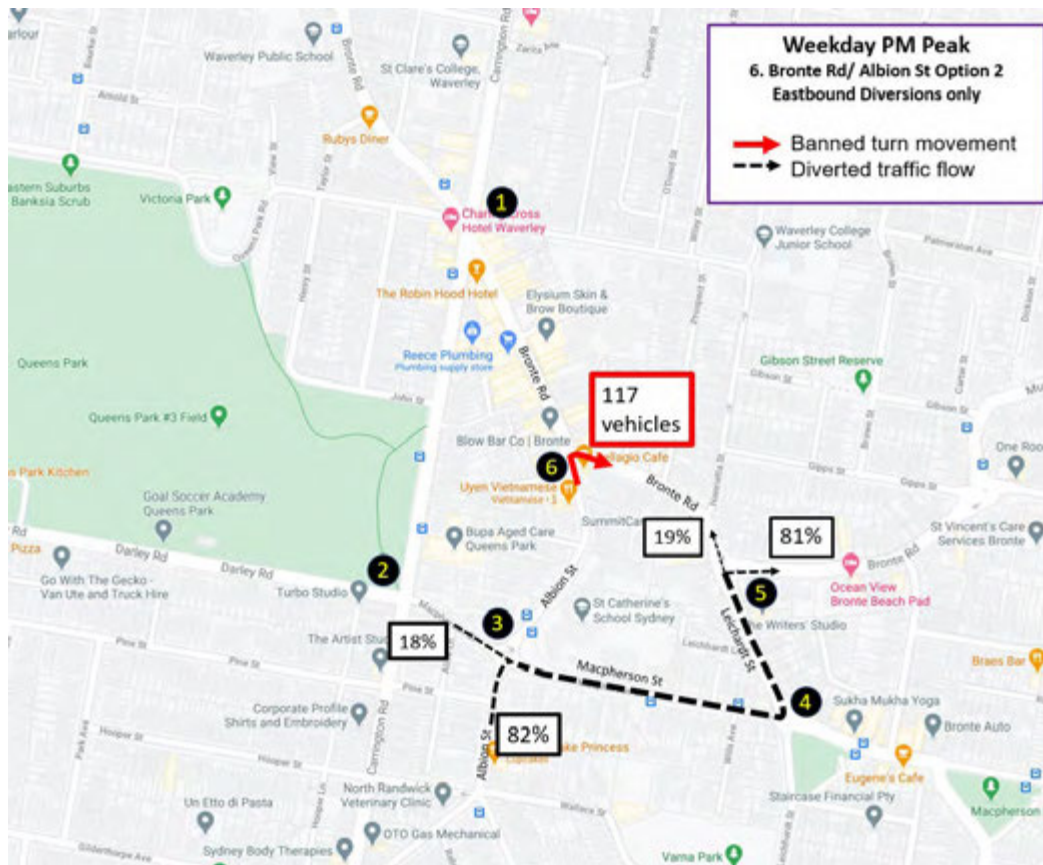


Figure 5-12 Option 2 Bronte Road / Albion Street traffic diversion eastbound – PM peak



Figure 5-13 Option 2 Bronte Road / Albion Street traffic diversion westbound – PM peak

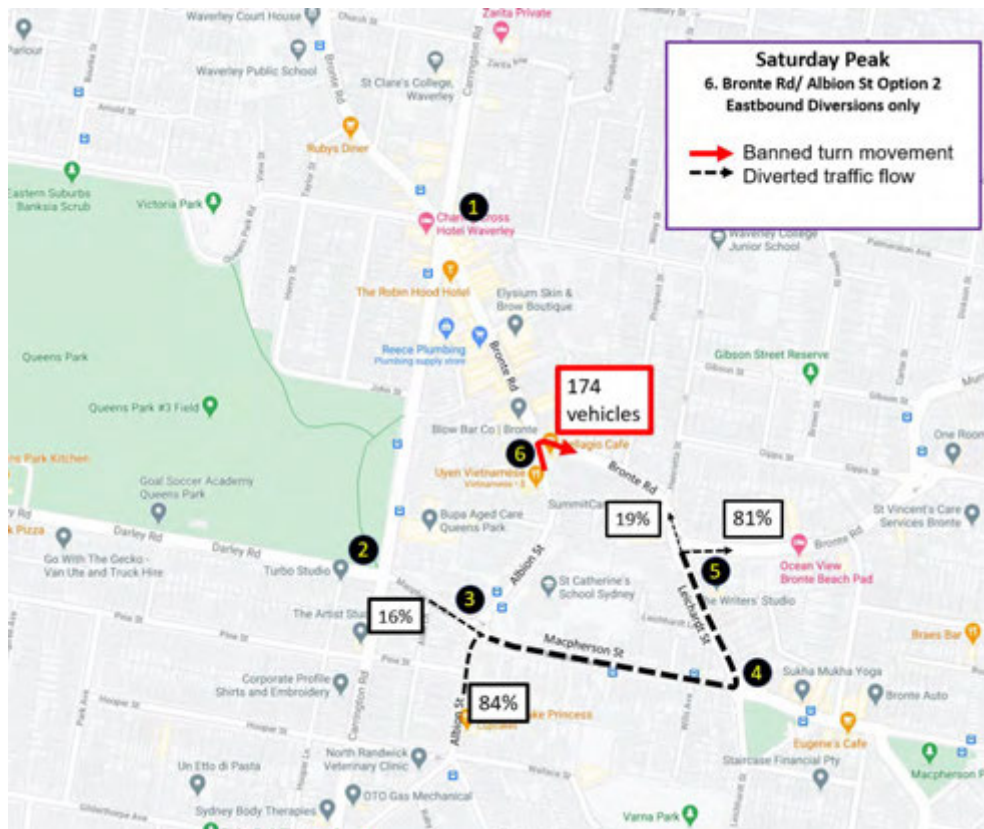


Figure 5-14 Option 2 Bronte Road / Albion Street traffic diversion eastbound – Saturday Peak

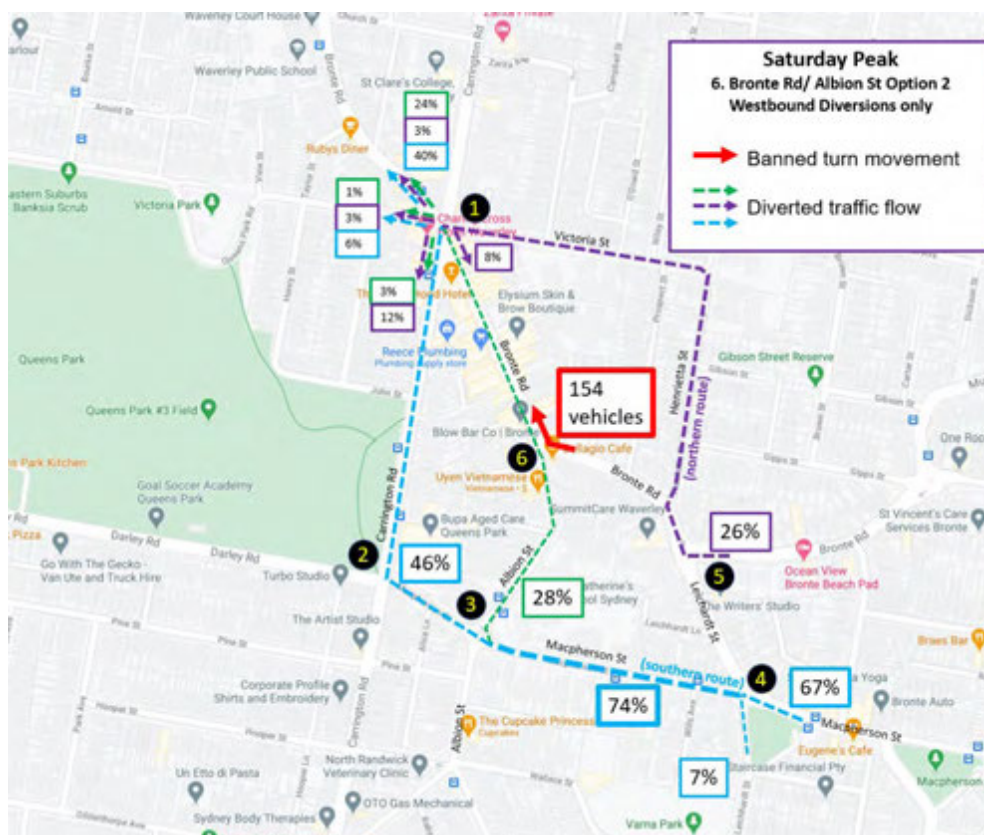


Figure 5-15 Option 2 Bronte Road / Albion Street traffic diversion westbound – Saturday Peak

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[85/https://projectsportal.ghd.com/sites/pp15_04/charingcrossstreetsc/ProjectDocs/12521936_Charing Cross_Traffic Study Report Options Draft FINAL.docx](https://projectsportal.ghd.com/sites/pp15_04/charingcrossstreetsc/ProjectDocs/12521936_Charing%20Cross_Traffic%20Study%20Report%20Options%20Draft%20FINAL.docx)

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
1	E Mia / O Peel	C Platts	On file			18/11/2020

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Appendix E

Magnolia grandiflora –

280 Bronte Rd Charing Cross



Our ref: D23/111405

11 October 2023

Re:

**Tree Protection Measures – Magnolia Grandiflora – 280 Bronte Road
Elaeocarpus Reticulatus Tree Removal – 284 – 294 Bronte Road**

To Whom It May Concern,

I write to you as a qualified arborist that represents Waverley Council for the recommended protection measures of the Magnolia grandiflora situated at 280 Bronte Road, which is included on Waverley Councils Significant Tree Register, that should be incorporated into the Environmental Management Plan for the construction of the Charing Cross Streetscape Upgrade.

This letter also contains analysis and assessment of the proposed removal of two Elaeocarpus reticulatus trees situated between 284 – 294 Bronte Road.

The classification of the TPZ and SRZ respectively has been determined using the following criteria:

Tree Protection Zone (TPZ):

The Tree Protection Zone (TPZ) is a radial distance measured from the centre of the trunk of the tree. These have been calculated in accordance with AS 4970-2009 (Protection of Trees on Development Sites).

The intention of the TPZ is to ensure protection of the root system and canopy from the potential damage from construction works and ensure the long-term health and stability of each tree to be retained. Incursions to the root zone may occur due to excavations, changes in ground levels, (either lowering or raising the grade), trenching or other forms of soil disturbance such as ripping, grading or inverting the soil profile. Such works may cause damage or loss of part of the root system, leading to an adverse impact on the tree.

Structural Root Zone (SRZ):

The Structural Root Zone (SRZ) provides the bulk of mechanical support and anchorage for a tree. This is also a radial distance measured from the centre of the trunk.

The SRZ has been calculated in accordance with AS 4970-2009 (Protection of Trees on Development Sites).

Incursions within the SRZ are not recommended as they are likely to result in the severance of woody roots which may compromise the stability of the tree or lead to its decline and demise.

Magnolia grandiflora (TPZ):

Diameter (cm) of stem measured at 1.4m above ground.

1. Trunk dimensions = 82cm.
2. TPZ radius (m) = 9.8m.

Magnolia grandiflora (SRZ):

Diameter (cm) measured immediately above the root buttress.

1. Immediately above the root buttress dimensions = 82cm.
2. SRZ radius (m) = 3m

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The recommendations are as follows;

Tree Protection:

Precautions shall be taken when working near trees to ensure their retention, including the following:

- (a) Do not store harmful or bulk materials or spoil under or near trees;
- (b) Prevent damage to bark and root system;
- (c) Do not use mechanical methods to excavate within root zones;
- (d) Do not add or remove topsoil from under the drip line;
- (e) Do not compact ground under the drip line;
- (f) Do not mix or dispose of liquids within the drip line of the tree; and
- (g) All trees marked for retention must have a protective fence/guard placed around a nominated perimeter.

General comments:

The Magnolia grandiflora is in a raised garden bed structure at the front of 280 Bronte Road. As the location of the tree is near a public thoroughfare and surrounding infrastructure, it would be improbable to impose the full extent of the TPZ. It is understood most of the work will be to the west of the tree (on the public thoroughfare) and therefore tree protection conditions will concentrate on that specific area. However, basic tree protection measures will be in place for the remaining areas. For the purpose on minimizing impact to the tree, a set of conditions has been set out as follows:

- The existing raised garden bed wall will act as a protection for the Structural Root Zone (SRZ). All work outside the SRZ and in between the TPZ will require hand excavation to avoid damaging any tree roots. No mechanical excavation is to be undertaken.
- All pavers in the between the SRZ and TPZ are to be removed by hand to avoid damaging any tree roots. No mechanical excavation of pavers is to be undertaken.
- If any tree roots are exposed during any approved works, then roots smaller than 30mm are to be pruned as per the specifications below. Any roots greater than 30mm are to be assessed by a qualified arborist before any pruning is undertaken.
- If tree roots are required to be removed for the purposes of constructing the approved works, they shall be cut cleanly by hand, by an experienced Arborist/Horticulturist (with a minimum level 5 Horticulture Certificate or Tree Surgery Certificate).
- It is the consulting arborist's responsibility to determine if such root pruning is suitable. If there are any concerns regarding this process, then Waverley Council's Tree Management Officer is to be contacted to make final determination.
- If the Magnolia grandiflora requires pruning, then permission must be gained from the owner of the tree, and an application to Prune or Remove Trees on Private Property is then to be submitted to Council for processing.

Contact us

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WAVERLEY COUNCIL

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Elaeocarpus reticulatus Removal:

The two *Elaeocarpus reticulatus* (Blueberry Ash) located on the pathway outside 284-294 Bronte Road Waverley/Charing Cross are mature specimens with fair health and structure and a useful life expectancy of 9-20 years.

The tree locations and current heights are 5 metres and has seen branches come into conflict with the awning above and pushing tree growth out onto the roadway. This has created the potential for branches to be struck by trucks and eventually failing.

The trees are not located in Council's Biodiversity corridors, provide little amenity, and is rated as having low retention values. Council's Tree Management considers the trees to be unsuitable and unsustainable in their current locations and are supportive of their removal and replacement with a more suitable species.

Best regards,

A handwritten signature in blue ink, appearing to read 'David Petrie'.

David Petrie

Technical Officer, Trees, Waverley Council

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