

Appendix A

Urban design, landscape and visual impact assessment

Sydney Harbour Bridge Southern Cycleway

Urban Design, Landscape Character and Visual
Impact Assessment

Prepared by Tract Consultants
For Roads and Maritime Services

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Executive Summary

Roads and Maritime Services is tasked with developing and delivering the Sydney Harbour Bridge Southern Cycleway. This project forms part of the NSW State Government's strategic cycleway network identified in the Sydney City Centre Access Strategy.

The removal of the Sydney Harbour Bridge (SHB) tollgates by Roads and Maritime Services, and the resultant realignment of traffic lanes on the Bradfield Highway has freed up road space providing the opportunity to investigate rationalisation of space within the Bradfield Highway and introduce a separated cycleway provision alongside Observatory Hill.

The proposal provides for the provision of a dedicated bi-directional cycleway from Kent St cycleway to Sydney Harbour Bridge cycleway, with effective width of 3.0 metres for cyclist and minimum 1.5metres for pedestrians. The works involve the removal of the existing footbridge crossing the Cahill Expressway, including approach ramps and replacement with cycle and pedestrian bridge and approach loop ramp as part of the overall cycleway enhancement.

Tract Consultants Pty Ltd has been commissioned by Roads and Maritime Services to provide an Urban Design, Landscape Character and Visual Impact Assessment of the proposed alignment of the cycleway between Kent Street and the southern end of the Sydney Harbour Bridge Cycleway on the surrounding environment.

The site is at the north-western end of the Central Business District of Sydney and forms an important connection between the northern and southern parts of Sydney. The land use zoning adjoining the site varies with zoning including Metropolitan Centre, Infrastructure and Public Recreation. The proposed cycleway is consistent with the functioning and requirements of these zonings.

The location of the site in one of the oldest parts of the city sees a number of heritage items adjoining the route. This includes the National Heritage and State listed Sydney Harbour Bridge; State listed Millers and Dawes Point, National Trust Centre- S.H. Ervin Gallery , Sydney Observatory, Sydney Observatory and locally listed Observatory Park, Bureau of Meteorology, and Fort Street Primary School, all of which need to be considered in the shaping the path and its connections.

Landform has been identified as a critical constraint on the alignment, with a number of areas where natural grade exceed accessible grades and are constrained by their interfaces. The alignment requires both cutting and elevating of the path in a number of locations in order to achieve appropriate grades and geometry to meet the intent of the standards.

In developing the design response the following key objectives have been developed in association with the northern approach design in order to achieve consistency. The Cycleway is to:

1. Provide a safe experience for all user groups including cyclists, pedestrians and motorists.
2. Be integrated with the adjoining heritage precinct and buildings.
3. Be integrated with adjoining broader active transport network.
4. Minimise impacts to the broader transport network both during construction and operation.

Located between Kent Street and Argyle Street, the proposal provides for a continuous uninterrupted segregated pedestrian and cycleway facility aimed at enhancing usability and safety of users and adjacent uses. Key to the achievement of these objectives is an enhanced geometry, both vertical and horizontal, that achieves grades which are compliant or as a minimum consistent with the objective of the standards and guidelines, within the physical constraints of the site.

The alignment has been broken into two sections:

- The southern approach - between Kent and the northern abutment of the Cahill Expressway Bridge is composed of three elements.
- The northern approach – The northern abutment of the Cahill Expressway Bridge to the southern terminus of the Harbour Bridge Cycleway

Within each zone there are a number of key interventions.

The southern approach includes the elevated loop and Cahill Expressway Bridge –designed as an integral element to achieve a 1:20 grade and appropriate clearance to the Cahill Expressway, these have adopted a structural profile which presents a slim leading edge and provides an overall sense of lightness. In

developing the preferred design a number of options were reviewed and assessed prior to the selection of the preferred form. Critical issues which the bridge form addresses includes

- The aesthetics of the proposed structure including:
 - Physical limitations such as:
 - Depth of Structure and span
 - Flexibility of form
 - Legislative constraints
 - Heritage constraints and considerations
- Constructability - taking consideration of space available for assembly, transport constraints, and the limitations of working over an active road corridor.
- Cost – In particular value offered by the variation of the form

The northern approach requires the construction of a number of retaining walls – firstly to support the cycleway above the merge lanes of the Cahill Expressway, secondly to retain the Bradfield Highway where land has been cut out from the highway and reappropriated back to the park to enable a smooth even profile of the path. The latter element requires careful consideration of its form so that it complements the existing retaining wall and does not detract from the overall monolithic form of the Bradfield Highways retaining structures.

In reviewing the proposal both a Landscape Character Assessment and Visual Impact Assessment were undertaken.

The Landscape Character Assessment identified four character zones within the precinct through which the path passes. Two locations, Observatory Hill and the S.H. Ervin Gallery environs have been assessed as of moderate to high impact in relation to character. This reflects the heritage values of the spaces and the potential impacts which may be posed by the introduction of new or enlarged structures within the context. Care needs to be focused on how the scale of change is managed and the resolution of the design to integrate it within the adjoining context in order to minimise impacts.

A visual impact assessment was undertaken on the proposed design to assess the level of change proposed and its impact on the environment and those who live and work adjacent to or pass through the proposed works. The assessment reviewed six sites in relation to the proposal of these sites two were assessed as Moderate to High. These include the frontage of the S.H. Ervin Gallery when viewed from the carpark and the northern section of the route on approach to the Harbour Bridge.

Both locations reflect a viewer that is sensitive to change due to the history of the site or vegetated nature of the site and so setting is important. In both instances planting could be used to further moderate the impact of the proposed changes on the viewer. Further refinement of this will be undertaken as part of the design development of the proposal.

Mitigation measures identified seek to achieve a design outcome which has a high visual quality and its own identity separate to the Bradfield Highway and Sydney Harbour Bridge. A number of strategies are outlined. These focus on minimising increase in paving, providing structures which are light, transparent and minimise the overall visual impact through carefully considered structural design and detailing, and retaining the landscape setting of the corridor.

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1 INTRODUCTION

1.1 Background

Roads and Maritime Services proposes to construct a dedicated cycleway connecting Kent Street cycleway and the Sydney Harbour Bridge (SHB) cycleway. This project forms part of the NSW State Government's strategic cycleway network identified in the Sydney City Centre Access Strategy, (2013).

The removal of the Sydney Harbour Bridge (SHB) tollgates by Roads and Maritime Services (RMS), and the resultant realignment of traffic lanes on the Bradfield Highway has freed up road space providing the opportunity to investigate rationalisation of space within the Bradfield Highway and introduce a separated cycleway provision alongside Observatory Hill.

The City of Sydney undertook a feasibility and concept study for the Harbour Village North (HVN) Cycleway Link in 2015. This investigated a bidirectional separated cycleway connecting the dedicated cycleway on the Sydney Harbour Bridge to the Kent Street cycleway. Key principles for the proposed bi-directional separated facility have been established and a concept design has been prepared. The urban design objectives for the proposal are:

- Improve safety for all users, including cyclists, pedestrians and road vehicles.
- Enhance quality of facilities for cyclists provided through the width and alignment of the cycleway,
- Provide separation between cyclists and pedestrians and vehicles wherever feasible,
- Integrate the cycle facility with the existing built environment with full consideration to park setting of Observatory Hill, Harbour Bridge retaining walls, heritage considerations of the Millers Point and Dawes Point Village precinct, school precinct, and the National Trust Centre/S.H. Ervin Gallery..

1.2 Proposal Description

The proposal is for the provision of a dedicated cycleway as part of the strategy to enhance connection of the Harbour Bridge Cycleway with the broader city network. The proposal consists of the following:

- Provision of a dedicated bi-directional cycleway from Kent St cycleway to Sydney Harbour Bridge cycleway, with effective width of 3.0 metres. Upgrade of the existing pedestrian footpath from Kent St to Fort Street Public School, with width varying from 1.5 to 2.2metres. Cyclists and pedestrians will be separated through delineation and contrasting surface treatments.
- Provision of a 1.8 metres wide pedestrian footpath from Fort Street Public School to Watson Road.
- Removal of existing footbridge crossing the Cahill Expressway, including approach ramps. This bridge was constructed in 1958 and is within the curtilage of the State Heritage Register of 'Millers Point and Dawes Point Village Precinct'. The existing footbridge will be replaced with a new cyclist and pedestrian bridge crossing the Cahill Expressway with a new alignment and an effective combined cycleway and footpath width of 4.5 metres.
- Removal of existing pedestrian and cyclist ramp on the southern approach to the Cahill Expressway footbridge. This will be replaced with a new spiral ramp for cyclists and pedestrians with an improved gradient and an effective combined cycleway and footpath width of 4.5 metres.
- Removal of a 60 metres section of existing concrete retaining wall adjacent to the Incident Response Area to accommodate the proposed cycleway alignment.
- Construction of a 62 metres section of new concrete retaining wall with a maximum height of 4.5 metres between the proposed cycleway alignment and the Incident Response Area.
- Modification of the merge treatment between Kent Street and Clarence Street on-ramps from general lane change to a zipper merge.
- Reconfiguration of existing fitness area in Observatory Hill to accommodate proposed cycleway alignment

- Ancillary works for construction including construction compounds
- Utility relocations, including water, sewer mains, telecommunication, electricity and gas services.

1.3 Purpose of Report

Tract Consultants Pty Ltd has been commissioned by Roads and Maritime Services to provide an assessment of the urban design, landscape character, and visual impact assessment of the proposed cycleway linking the Sydney Harbour Bridge Cycleway south to the Kent Street Cycleway.

As part of this process a review of the design was undertaken and recommendations made as to its integration within the overall context of the site. This assessment and recommendations will form part of the Review of Environmental Factors (REF) submission for the approval of the works.

2 CONTEXT

2.1 Location

The site consists of the southern approach to the Sydney Harbour Bridge cycleway and its connection to Kent Street to the south. It is located at the northern limits of the Central Business District (CBD), within the heritage precinct of The Rocks and Millers Point. The location provides a dramatic context for the proposed cycleway and will enhance north-south cycle access.



Figure 1 – Regional Context
(Source: OneMap)

The proposal is located to the side of the southern approaches of the Sydney Harbour Bridge and extends from the southern pylon of the Harbour Bridge through to Kent Street. It is bounded to the west by the Observatory Hill Park, Sydney Observatory, Fort Street Public School, and the National Trust Centre/ S.H. Ervin Gallery. To the east it is defined by the Bradfield Highway.

Roads and Maritime is also investigating options to provide step-free access for cyclists on the northern end of the SHB Cycleway to enhance accessibility for people of various ages and cycling abilities.



Figure 2 – Local Context
(Source: OneMap)

2.2 Land Use and Built Form

The zoning of an area influences the overall scale and nature of its built form. Adjoining the site are a number of differing zonings including:

- Metropolitan Centre (B8),
- Infrastructure (SP2),
- Public Recreation (RE1), and
- General Residential (R1) located to the west and north of the study area. This use is separated from the site by the level change between the Observatory Hill precinct and the residential precincts.



Figure 3 – Land use Zoning (based on Sydney LEP, 2012)

(Source: OneMap)

2.2.1 Metropolitan Centre

The objectives of the Metropolitan Centre zoning are to:

- *“Recognise and provide for the pre-eminent role of business, office, retail, and entertainment and tourist premises in Australia’s participation in the global economy.*
- *Provide opportunities for an intensity of land uses commensurate with Sydney’s global status.*
- *Permit a diversity of compatible **land uses** characteristic of Sydney’s global status and that **serve the workforce, visitors and wider community.***
- ***Encourage the use of alternatives to private motor vehicles, such as public transport, walking or cycling.***
- *Promote uses with active street frontages on main streets and on streets in which buildings are used primarily (at street level) for the purposes of retail premises”.*

Sydney LEP, 2012

Within the study area the apartment building located at the southern extent of the site on the corner of Kent Street and the bridge approaches is covered by this zoning and has a defined height limit of 110m. Also covered under this zoning are the National Trust Centre/ S.H. Ervin Gallery, the Fort Street Public School and the Sydney Observatory. This diversity of use is indicative of the broad range of uses permitted by the code.



Figure 4 – The edge of the CBD to the south of the proposal forms a strong vertical change in character

As a result of the diversity of use permitted and the past uses of the site there are distinct variations in the built form. Typically the scale of the built form is between one and three storeys. The National Trust Centre/S.H. Ervin Gallery site has a rich history and presents a formal painted heritage façade to the Bradfield Highway frontage.

The school site has a number of differing brick buildings which form a distinct compound of development.

Similarly a number of buildings make up the Observatory compound; the built form presents a sandstone façade which emphasises its age and provides a level of visual prominence.

A strong focus within the precinct is the provision of entertainment and tourist activities which are serviced by the National Trust Centre/S.H. Ervin Gallery and Sydney Observatory alike. Also evident within the space and reliant on the spaces provided by the adjoining land uses is the presence of the existing cycleway route. The existing cycling provision requires cyclists, pedestrians and motorists to mix and poses risks to both the cycleway user and pedestrian alike. A continuation and strengthening of this function is consistent with the encouragement of alternative transport modes.

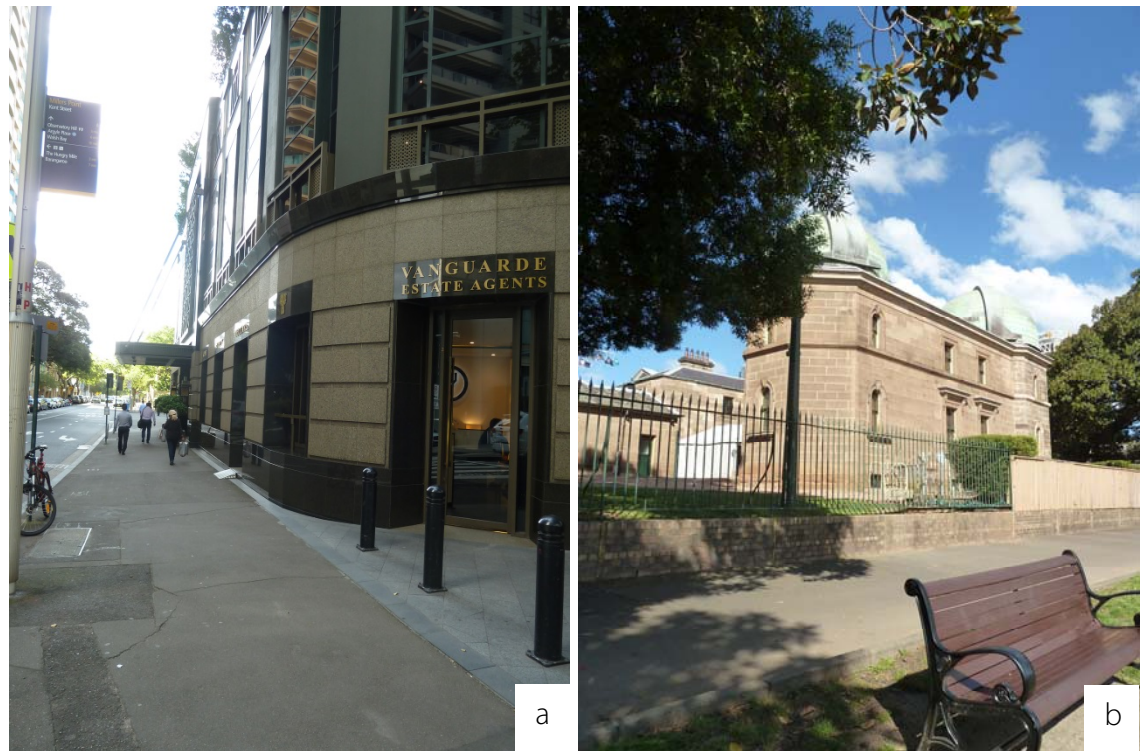


Figure 5 – a) Shop fronts at street level, Kent Street; b) Tourist destination – Sydney Observatory

2.2.2 Public Recreation (R1)

The objective of this zone is to:

- *“Enable land to be used for public open space or recreational purposes.*
- ***Provide a range of recreational settings and activities and compatible land uses.***
- *Protect and enhance the natural environment for recreational purposes.*
- ***Provide links between open space areas.***
- *Retain and promote access by members of the public to areas in the public domain including recreation facilities and waterways and other natural features”.*

Sydney LEP, 2012



Figure 6 – Observatory Hill Park

Observatory Hill Park is used in a way which fulfils all of the above functions. It consists of predominantly an open grassy knoll, with the occasional shelter structure. It is actively used for passive recreation overlooking the harbour; celebrations including weddings; fitness activities including boot camp etc; and as a link to the facilities adjoining or within the open space as well as providing physical connections to Kent Street, through Watson Road and the Agar Steps.



Figure 7 – Exercise area and Facilities within Observatory Hill Park

2.2.3 Infrastructure (SP2)

This zoning defines the actual alignment of the Sydney Harbour Bridge, the Bradfield Highway and its approach from the Cahill Expressway. The objectives of the use are to

- *“Provide for infrastructure and related uses.*
- *Prevent development that is not compatible with or that may detract from the provision of infrastructure”.*

Sydney LEP, 2012



Figure 8 – Bradfield Highway and its approach to the Sydney Harbour Bridge

Design Considerations

The proposal is consistent with the objectives of all three planning zones. The proposal achieves this compliance through the promotion of both alternative commuter connections, as well as the fulfilment of a recreational use.

2.3 Heritage

2.3.1 Introduction

The study area sits both within and surrounding several heritage items, including those of National, State and Local significance and includes both conservation areas and built forms be they buildings, bridges etc.

The study area forms part of Millers Point, several conservation listings apply to this area as a whole, recognising the high level of significance and value this area offers both in a state wide and local context.

Individual properties within this conservation area are listed on the Local and State Registers; there are numerous individual listings, particularly under the Sydney Local Environmental Plan 2012. These form part

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2.3.2 Sydney Harbour Bridge

National Listing

Sydney Harbour Bridge is an integral component of the Sydney Harbour vista and represents one of the most recognisable and iconic images in the world. It is a cultural landmark recognised by the nation and represents a highly significant place in Australia's cultural history.

A small section of the northern end of the study area falls within the curtilage of the Sydney Harbour Bridge, which is listed under the Environmental Protection & Biodiversity Conservation (EPBC) Act 1999, on the National Heritage List as of 2007 and is a State Heritage Item under the NSW Heritage Act 1977.

Design Considerations

The proposal needs to consider its impacts so as to not affect this status. The Sydney Harbour Bridge Conservation Management Plan, 2007: p94, key management objectives to conserve the integrity of the bridge, including that:

"Ongoing management of the bridge should provide for:

- *retention of the fundamental cultural heritage values and attributes of the bridge;*
- *conservation (including ongoing maintenance) of significant elements;*
- *enhanced opportunities for presentation and interpretation of the bridge and its history for*
- *public appreciation; and*
- *continued and enhanced linkage with associated elements adjacent to the bridge, including Bradfield Park and Plaza, Dawes Point and other foreshore areas within the view lines of the bridge (via interpretation, related activities, transport routes etc)."*

The Sydney Harbour Bridge Conservation Management Plan, 2007

The potential impacts of the proposal are considered as part of the heritage impact assessment.

State Listing

In addition to its National Listing, the Sydney Harbour Bridge is on the State Heritage List, (Listing no. 00781), under the State Heritage Act 1977. Similar considerations need to be applied as stated above, to ensure the physical structure is maintained and the views and vistas to the bridge are not adversely affected by the proposal of the cycleway.



Figure 10 – Sydney Harbour Bridge view looking north from Observatory Hill

2.3.3 Millers and Dawes Point

State Heritage Register (under Heritage Act, 1977)

The area of Millers & Dawes Point Village is listed as a State Conservation Area, its listing states:

"Millers Point & Dawes Point Village Precinct is of state significance for its ability to demonstrate, in its physical forms, historical layering, documentary and archaeological records and social composition, the development of colonial and postcolonial settlement in Sydney and New South Wales."

The area has evolved in response to both the physical characteristics of its location and the broader historical and social patterns that have shaped the development of NSW. Evidence of this is apparent in the remnants of colonial-era development, and the Post-colonial development which primarily characterise the area now.

Of particular importance for the proposal is the significance of its aesthetic qualities,

"its landmark qualities as a terraced sandstone peninsula providing an eastern 'wall' to the inner harbour and supporting the fortress like southern approaches to the Sydney Harbour Bridge; for its aesthetic distinctiveness as a walking scale, low rise, village like harbour side district with its central 'green' in Argyle Place, and its vistas and glimpses of the harbour along its streets and over rooftops."

Design Considerations

Consideration needs to be given to ensure the proposals for the cycleway are fitting in terms of scale with the surrounding structures, that key views and vista are not obscured by any of the proposed features and that the materials chosen are complementary to those present on and around the site. It is deemed important that the choice of materials does not attempt to imitate what is present but is complementary and makes clear that this intervention is another layer in the evolving development of the area.

Local Listing - Millers Point Conservation Area (C35) listed as of State significance under Part 2 Schedule 5 of the Sydney Local Environmental Plan (LEP) 2012.

The Conservation Area listing provides the following statement of significance explaining the importance of this area as,

"an integrated port town developed between the 1810s and the 1930s and little changed since then; considered remarkable for its completeness and intactness. Its components include deep-sea wharves and associated infrastructure, bond and free stores, roadways and access ways, public housing built for port workers, former private merchant housing, hotels and shops, schools, churches, post office and community facilities."



Figure 11 – Millers Point Buildings and its relationship to the site

2.3.4 Individual Heritage Listings

Within the Conservation Area of Millers Point there are a number of Heritage Items under Part 1 Schedule 5 of the LEP that the study area sits within close proximity to and /or falls within, the listings with most significance to this proposal are as follows:

The study area sits, intersects with, is adjacent to, or within close proximity to the following:

- *National Trust Centre, including buildings and their interiors, retaining walls and grounds – Item no. 1876, listed as of Local Significance*

- Bureau of Meteorology, including interior – Item no 1936, listed as of Local Significance
- Observatory Park, including Boer War Memorial, Bandstand, fences and landscaping, Item no. 1935, listed as of Local Significance
- Sydney Observatory group including buildings and their interiors and grounds, Item no. 1934, listed as of State Significance
- Fort Street Public School site including buildings and their interiors, Item no. 1938, listed as of Local Significance
- Millers Point Messenger's Cottage for Sydney Observatory, Item no. 1937, Listed as of Local Significance

National Trust Centre

National Trust Centre, including buildings and their interiors, retaining walls and grounds – Item no. 1876, listed as of Local Significance. The statement of significance states:

"The National Trust Centre is of state historical significance providing evidence of the Military Precinct located between Dawes Point and the Wynyard Barracks c1815 to c1850 of which the former Military Hospital; the first and earliest purpose built hospital building associated with the colony, was an integral part. It is of aesthetic significance in providing an example of the spread of architectural taste and standard building forms during the first half of the nineteenth century by the Royal Engineers and subsequently the Colonial Architect and architects designing public schools including John Watts, Mortimer Lewis and Henry Robertson.

Occupying a prominent elevated position on Observatory Hill, the National Trust Centre is an important visual marker for the area and has a strong visual and contextual relationship to the Observatory, Upper Fort Street and views towards the Harbour Bridge, which will form key considerations in the proposals for this scheme. The original building structure of the main National Trust Building has been modified throughout its life, originally designed in the Old Colonial Georgian style and later modified to Victorian Mannerist, it is now the finest largely intact example of this architecture style in the city.

The building is significant both physically for its historical and aesthetic assets and socially through its association with public functions since its construction.

The proposed cycleway runs adjacent to the main street frontage of the building and utilises space within the grounds to make the transition to cross the Cahill Expressway. Key consideration needs to be given to maintaining direct pedestrian access across the cycleway to the steps leading to the building frontage; and to not obscure the presence of the building from the street.

In addition to the physical structure of the building there are aspects of the grounds which form part of the listing; The National Trust Centre developed a Conservation Management Plan - Identification Plan in February 2000, which identifies these significant elements. Three Moreton Bay Fig trees located within the grounds, in proximity to the proposed cycleway are identified as being replacement plantings of trees planted c.1867, whilst not original they have been listed as being of high significance as reinstatements of the original trees. The location of these will need to be carefully considered when designing the cycleway.

Materiality of the proposed cycleway intervention is also a consideration in relationship to the National Trust Centre. Existing concrete retaining walls of the ramp and bridge structure will be removed as part of the proposal, and replacement of these should feel an integral part of the context. It is considered important that this proposal sits quietly with its surroundings, utilising simple and refined forms and detailing.



Figure 12 – National Trust Centre/S.H. Ervin Gallery



Figure 13 – S.H. Ervin Gallery from driveway entrance

Observatory Park & Sydney Observatory

Observatory Park, including Boer War Memorial, Bandstand, fences and landscaping, Item no. 1935, listed as Local Significance

The park forms a major component in the character of the Observatory Hill precinct. Its elevated position provides panoramic views to the north, west and south. The buildings that sit within are separately listed under Item no. 1934 (Sydney Observatory group including buildings and their interiors and grounds) are significant for their continued use for astronomical research as well as the aesthetic and historical qualities that reflect the European culture and influence at the time of construction.

The park consists of an open grassland space with mature trees, including specimens of Moreton Bay Figs, sandstone and iron palisade fences, Boer War Memorial and bandstand.

The placement of the proposed cycleway on the eastern side of Upper Fort Street does not alter the integrity of the park itself. The land to the eastern side originally formed part of the park; however it has

been altered from its original form by the construction and expansion of the Sydney Harbour Bridge/Bradfield Highway approach. The proposal explores the potential to reclaim land in this area, which is envisaged as a positive heritage benefit. A key consideration are the views from the Park to the Sydney Harbour Bridge and the approach structures, the proposals should seek to integrate with these sympathetically and not dominate or obscure the existing views.



Figure 14 – a) Panoramic view over inner harbour from Observatory Hill; b) Rotunda; c) Boer War Memorial

Other Listings

Bureau of Meteorology, including interior – Item no 1936, listed as Local Significance. The Bureau of Meteorology Building, built 1922, is significant as one of the first purpose built building for Meteorology in NSW. In terms of aesthetic significance its austere structure reflects the economic constraints of the mid-war period.

Fort Street Public School site, including buildings and their interiors, fig trees, and grounds, listing number 1938.

The proposed cycleway runs adjacent to these listings on the route of the existing cycling provisions and includes the replacement of the existing footbridge over the Cahill Expressway. Consideration needs to be given to the visual impact of the new structure to ensure key views and vistas are not obscured; the placement of the route needs to be carefully considered against the location of the existing fig trees.

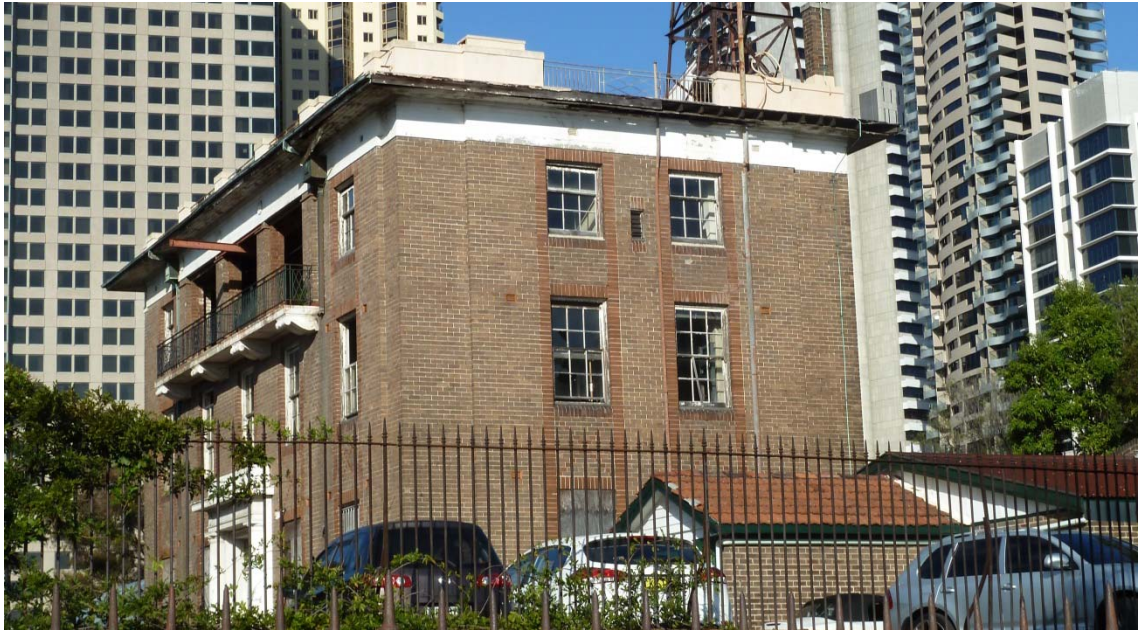


Figure 15 – Bureau of Meteorology building

Sydney Observatory



Figure 16 – Sydney Observatory

Design Considerations

Heritage elements both define and provide character along the proposed route. The proposal needs to respect these elements and be responsive to the Conservation Management Plans of both the Sydney Harbour Bridge and National Trust Centre. Views of the harbour, the Sydney Harbour Bridge (including approaches), S.H. Ervin Gallery all need to be carefully considered in terms of potential impacts.

Cycleway

The Sydney Harbour Bridge forms part of a broader cycleway network connecting to networks within both North Sydney and Sydney providing a critical link for cyclist between the CBD and further to the south and the North Shore.

A number of connections exist within the city including a combination of on road cycleways and dedicated cycleways segregated from traffic.

The existing Sydney Harbour Bridge provides a dedicated cycleway route however its geometry, both horizontal and vertical, make it an awkward route for many to use particularly at its end terminations, both north and south, where it joins the existing pedestrian/road network. The proposal seeks to enhance this accessibility by providing a dedicated cycleway with improved gradients and sightlines to encourage greater usage. Its connection to the south meets a number of well-defined cycle routes developed by the City of Sydney including both the Kent Street and Castlereagh Street Cycleways.

Within the Millers Point / Rocks Precinct on road cycleways are adopted reflecting the lower traffic volumes and speeds within the precinct. This system provides good connectivity throughout the area and to the emerging Barangaroo Precinct.

Pedestrian connections

Generally the topography in this precinct is relatively steep and does not encourage broad pedestrian usage. To enhance and encourage better usage a number of linkages exist which minimise distance.

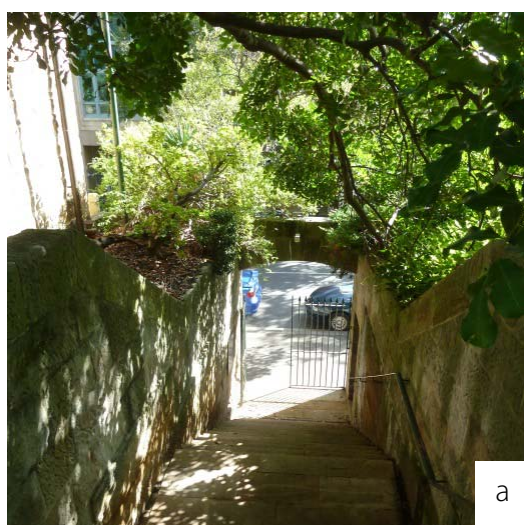
This includes:

- The linkage through the Harbour bridge abutment between Cumberland Street and Upper Fort Street
- A connection to the Cahill Expressway walkway through Cumberland Street
- The connection created by the linkage between Sydney Harbour Bridge Cycleway and Kent Street
- A linkage between Kent Street and Observatory Hill Park via steps from the western edge of the park
- A future connection proposed by the Barangaroo Development Authority from High Street into Barangaroo in the form of the proposed Sydney Steps.

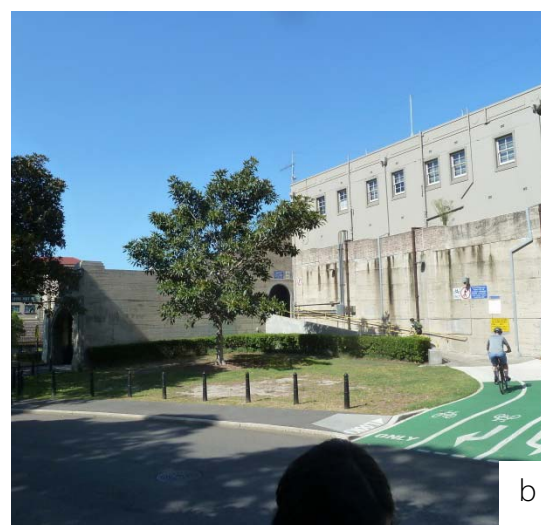
All assist in enhancing access for tourists and locals alike to this tourism focused section of the city. The proposal seeks to enhance the cyclist and pedestrian connection from the southern end of the Sydney Harbour Bridge to Kent Street by providing for pedestrians and cyclists alike.

Design Considerations

The proposal should enhance accessibility and useability for cyclists. The proposal should also consider pedestrian accessibility, usability and safety with clear delineation to provide a safe facility for pedestrians and cyclists.



a



b

Figure 18 – a) Link from Kent Street through to Observatory Hill Harbour Bridge

b) Delineation of cycle route off Sydney

2.5 Vegetation

Observatory Hill Park is the main green space within the corridor, with incidental landscape in front of the S.H. Ervin Gallery and some streetscape plantings at the commencement of the Bradfield Highway.

Observatory Hill Park is characterised by predominantly trees in grass. In this instance the trees are Moreton Bay Figs (*Ficus macrophylla*) which are located around the Sydney Observatory. In addition to these a number of other plantings have occurred over time.

Along Upper Fort Street Jacaranda, (*Jacaranda mimosifolia*) trees have been planted. In association with the outdoor fitness area Jelly Palms (*Butia Capitata*) have been planted within garden beds by the City of Sydney.

The overall feel and character of the parkland is that of a green cultural landscape setting, an oasis within the city.

S.H Ervin Gallery has undertaken a number of recent plantings of Moreton Bay Figs (*Ficus macrophylla*) along the frontage of the gallery. A mature and well managed olive hedge (*Olea Halis europea*) defines the physical edge of the property before the cut face of the Bradfield Highway boundary is reached.



Figure 19 – (a) Moreton Bay Figs form the dominant canopy tree within Observatory Park; (b) Young Jacarandas line Upper Fort Street.

Design Considerations

Retention of parkland setting character and the use of plantings associated with the various periods of development in the area should be considered in the planting design.

2.6 Landform

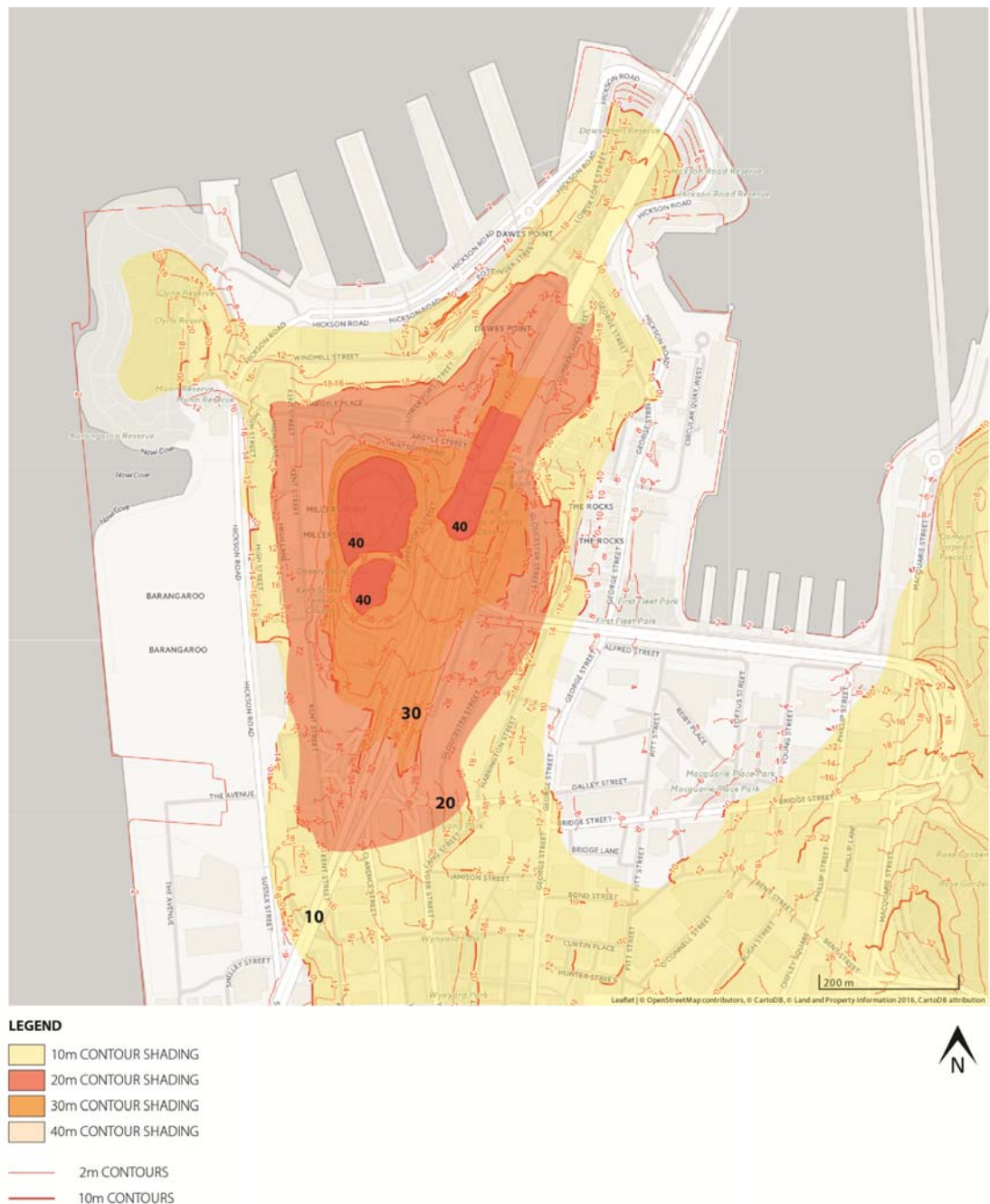
The landform of the site is located on a ridge at one of the highest points within the precinct with only the main body of Observatory Hill and the Sydney Observatory located higher.

The alignment of the proposed cycleway rises and falls in response to the topography of the site and its adjoining structures. The proposed alignment rises from a low point of 24 metres at Kent Street at a grade of approx. 1V:15H which mirrors the grades of the Bradfield Highway on ramp. A steeper section rises up and over the Cahill Expressway to a high point of 38 metres before the slope falls to the north towards the Sydney Harbour Bridge Cycleway.

This crested profile is not reflected in the alignment of the Bradfield Highway and the approaches to the Sydney Harbour Bridge which continue their gradual rise from Kent Street. Retaining walls separate the Bradfield Highway from the adjoining ground along Upper Fort Street.

Design Considerations

Landform forms is a significant constraint on the alignment and achieving a comfortable and accessible grade. Utilisation of both cuttings and raised elements, be they on elevated paths or bridges, are required to achieve a satisfactory alignment. These elements need to work with the forms of the adjoining structures if they are to integrate seamlessly with the existing forms.



2.7 Geology

The geology, like much of Sydney's eastern suburbs and CBD is derived of Hawkesbury Sandstone. The material is reflected in the heritage buildings of the Sydney Observatory and the cuttings of the Cahill Expressway loop. This stone provides a stable and robust base on which the proposal will bear.

The exposure of the stone both above ground and as part of the building fabric should be considered in the selection of the final materials of the proposal. Sandstone has formed a key component of many of the constructed elements within the precinct.

Also worthy of consideration in relation to geology is the significant volume of granite used in the construction of the Sydney Harbour Bridge piers and pylons. This light grey granite was sourced from Moruya on the south coast.



Figure 21 – Sandstone cutting to western edge of the Bradfield Highway

3 URBAN DESIGN OBJECTIVES AND PRINCIPLES

The development of this proposal is happening concurrently with that of the northern cycleway access ramp at Milsons Point. In order to achieve a consistent and co-ordinated approach the principles have been developed and co-ordinated between the two projects and are defined below.

3.1 Urban and Landscape Design Objectives and Principles

Development of the proposal is done in accordance with the following urban design principles and objectives:

1. Provide a safe experience for all user groups including cyclists, pedestrians and motorists.
 2. Be integrated with the adjoining heritage precinct and buildings.
 3. Be integrated with adjoining broader active transport network.
 4. Minimise impacts to the broader transport network both during construction and operation.
1. **Cycleway is to provide a safe experience for all user groups including cyclists, pedestrians and motorists.**
 - Provide where possible a consistent approach to the segregation of cyclists, pedestrians and vehicles along the length of the route.
 - Provide a safe and clear route for pedestrians to the western side of the cycle route, furthest away from the traffic of the Harbour Bridge.
 - Delineate clearly between cycle route and pedestrian environment to discourage pedestrians from using the cycleway.
 - Provide visual connections between cyclists and pedestrians to passively control speed and reinforce safe interface points.
 - Strive to meet applicable standards for the design of the facility, including spatial (width and clearance requirements) and geometry (both vertical and horizontal – eg. gradient requirements).
 - Ensure access and wayfinding is logical and intuitive, minimise unnecessary and sharp changes in alignment and maximise visibility and clear sight lines.
 - Improve the pedestrian environment on Upper Fort Street to provide safe pedestrian environments and clear crossing points.
 - Retain access requirements for RMS incident response vehicles from the Bradfield Highway to Upper Fort Street.
 2. **Cycleway is to be integrated with the adjoining heritage precinct and buildings.**
 - Ensure that the cycleway is sympathetic to the current uses and heritage elements of the surrounding area.
 - Limit the physical alteration to the heritage fabric of the area.
 - Limit where possible the loss of existing trees and vegetation where deemed an integral element of the existing landscape character.
 - Maximise the opportunity to both improve and expand useable public spaces, that will support a range of uses.
 - Avoid the creation of unusable spaces that could lead to antisocial behaviours.
 - Respect and retain the key landscape values of Observatory Hill Park whilst maximising the integration of the new cycle way and pedestrian routes.

- Retain important public views to and from surrounding heritage features including the Sydney Harbour Bridge, National Trust Centre and Observatory Hill Park to ensure the proposal does not adversely impact them, both during the day and night.
- Design the bridge and ramp structures to complement the surrounding heritage structures and ensure that the heritage elements remain the dominant features. Scale and form of the structure should be complementary to the surrounding structures and their curtilage. Careful consideration of materials and lighting treatments should reinforce this.
- The design of the structure should be light weight incorporating low key refined and elegant detailing which complement but not mimic their surroundings.
- Integration of the new cycleway and pedestrian routes within a landscape setting, maximising areas of soft planting and making use of planting buffers to segregate areas of pedestrian / cycle / vehicle zones where possible over hard boundaries.

3. Cycleway to be integrated with adjoining broader network.

- Ensure appropriate physical and visual connections are made to the surrounding cycle network and new connections are identified.
- Seamless transitions between the existing cycle network and the proposed cycleway that does not require cyclists to dismount or stop.
- Geometry, both vertical and horizontal should provide a safe, enjoyable and smooth journey which minimises grades where possible to encourage the broad usage of the cycleway network.

4. Minimise impacts to the broader transport network both during construction and operation

- Cycleway is to consider constructability as a key element of its design.
- The use of prefabricated elements including bridge and ramps structures should be considered to limit disruption to the existing cycleway, pedestrian and road network.
- Design the structures to limit impact on both the adjoining road and rail network operations.
- Structure is to be designed to maximise design life and minimise maintenance requirements. Design should adopt durable construction techniques and materials.
- Design should be responsive to future needs.

4 CONCEPT DESIGN

4.1 Design Parameters

The design parameters for the cycleway reflect both the design parameters for bike paths but also for pedestrian paths due to the requirement to provide both pedestrian and cycle access throughout the precinct.

4.1.1 Bike path

The following key parameters define the desired performance standards of the cycle route and are defined in Austroads Part 6A (2017).

Effective Path Width:	- 3.0m desirable minimum
Offset from obstructions etc. :	- 0.5m Minimum 1.0m desirable
Grades:	- 3% desirable maximum although steeper accepted
Length of uphill gradient at 5%:	- 110m acceptable
Geometry:	- Minimum radius of horizontal curve 10m at 20km/h
Path format:	- Separated with clear delineation of use through signage, line marking and surface treatments where applicable

4.1.2 Pedestrian path

The design of pedestrian paths is defined by Australian Standard 1428 Design for access and mobility.

Path Width:	- 1.5m minimum for wheelchair access - Desirable 2.0m width for two way separated paths
Grades:	- <1:14
Distance between landings:	<9m

4.2 Concept Design - Introduction

The proposal can be broken into a number of elements. Each element needs to meet a number of differing performance criteria yet achieve a consistent and integrated feel to the proposal. It also needs to consider the character and feel of the Sydney Harbour Bridge and the northern cycleway access ramp currently in development.

The design has been developed from the original Harbour Village North Cycleway Feasibility and Concept Design Report, 8 December 2015, Group GSA. As part of this process a number of options and solutions have been reviewed which have resulted in a proposal that is primarily at grade except for an elevated loop bridge across the Cahill Expressway.

The key components of the proposal are:

- The Southern Section including:
 - The separated cyclist and pedestrian path from Kent Street
 - Elevated (bridge) structures comprising:
 1. The Southern Approach Ramp (Elevated Loop)
 2. The Cahill Expressway Bridge
- The Northern Section

Within both sections retaining structures are required to ensure grades and geometry requirements are achieved

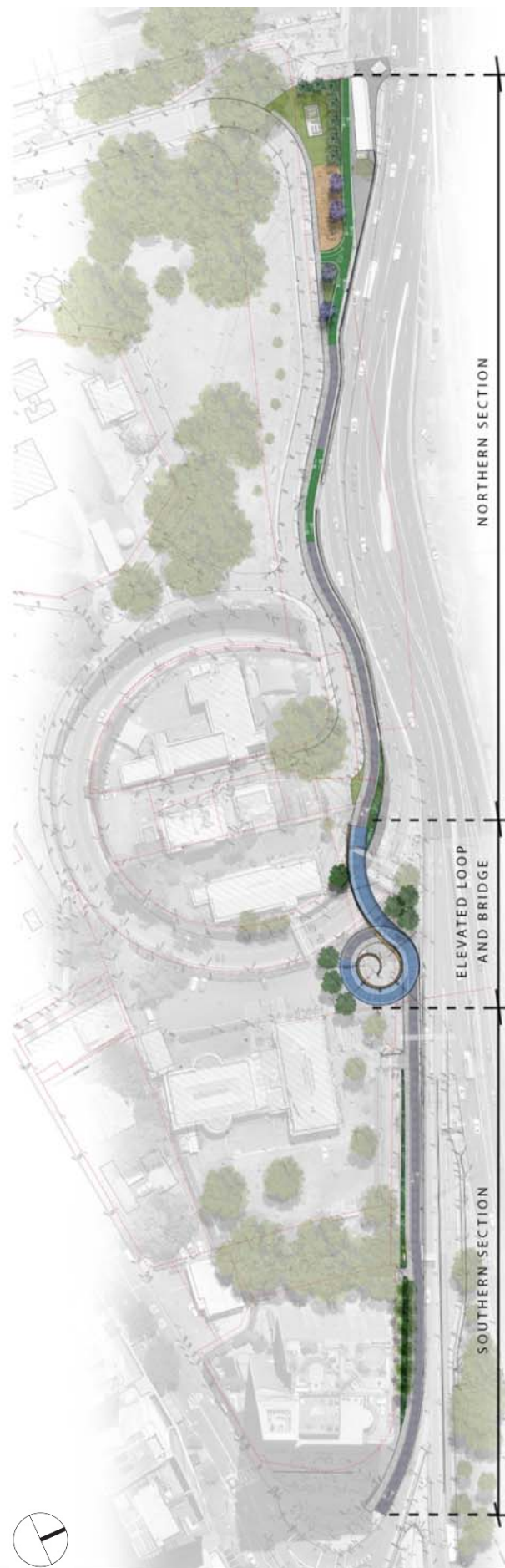


Figure 22 – Illustrative Masterplan

4.3 Proposal

Located between Kent Street and Argyle Street, the proposal provides for a continuous uninterrupted segregated cycleway and pedestrian facility aimed at enhancing usability and safety of users and adjacent uses. Key to the achievement of these objectives is an enhanced geometry, both vertical and horizontal, that achieves grades which are compliant or as a minimum consistent with the objective of the standards and guidelines, within the physical constraints of the site.

4.3.1 The Southern Approach

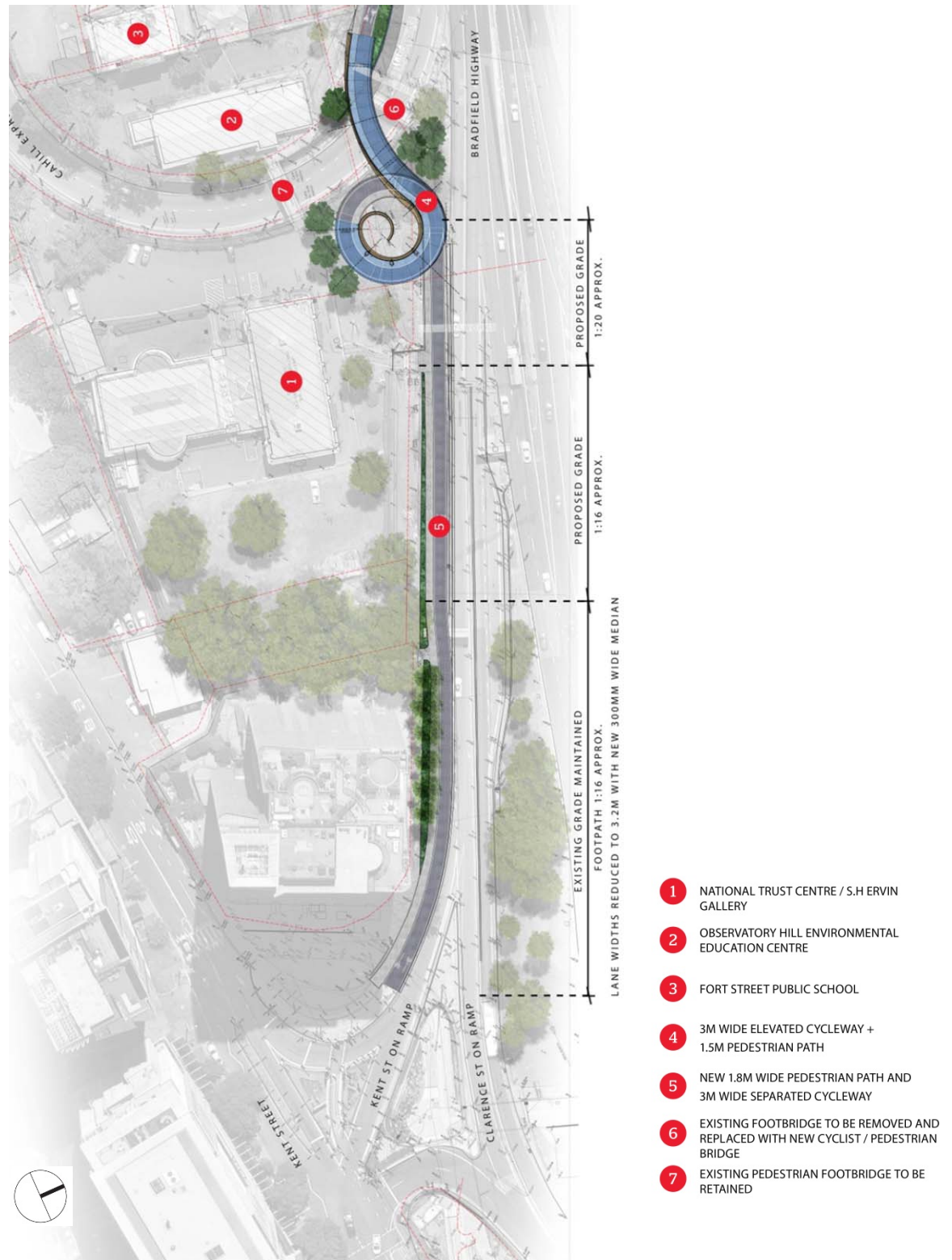


Figure 23 –The Southern Approach

The Southern Section runs from its connection with the Kent Street Cycleway through to the northern side of the Cahill Expressway Bridge, including the elevated loop and Cahill Expressway Bridge.

The Southern Section path consists of improvements to the footpath verge including realignment of kerb lines and widening to enable the construction of the separated path. The grades through this section are steep and are generally not compliant with disability access standards. Grades along the proposed cyclist and pedestrian paths will be adjusted to achieve a more consistent grade of between 1v:16h and 1v:20h. This requires the construction of a small retaining wall behind the kerb at the frontage of the National Trust Centre/S.H. Ervin Gallery. The proposed wall reaches approximately 1m in height, less than the height of the existing approach ramp retaining wall.

This wall sees a reduction of two in the number of stairs into the S.H. Ervin Gallery as well as a reduced scale in the sandstone cut beyond. The trees within the existing nature strip (3 no.) would be removed and replaced with a garden bed along the base of the cutting.

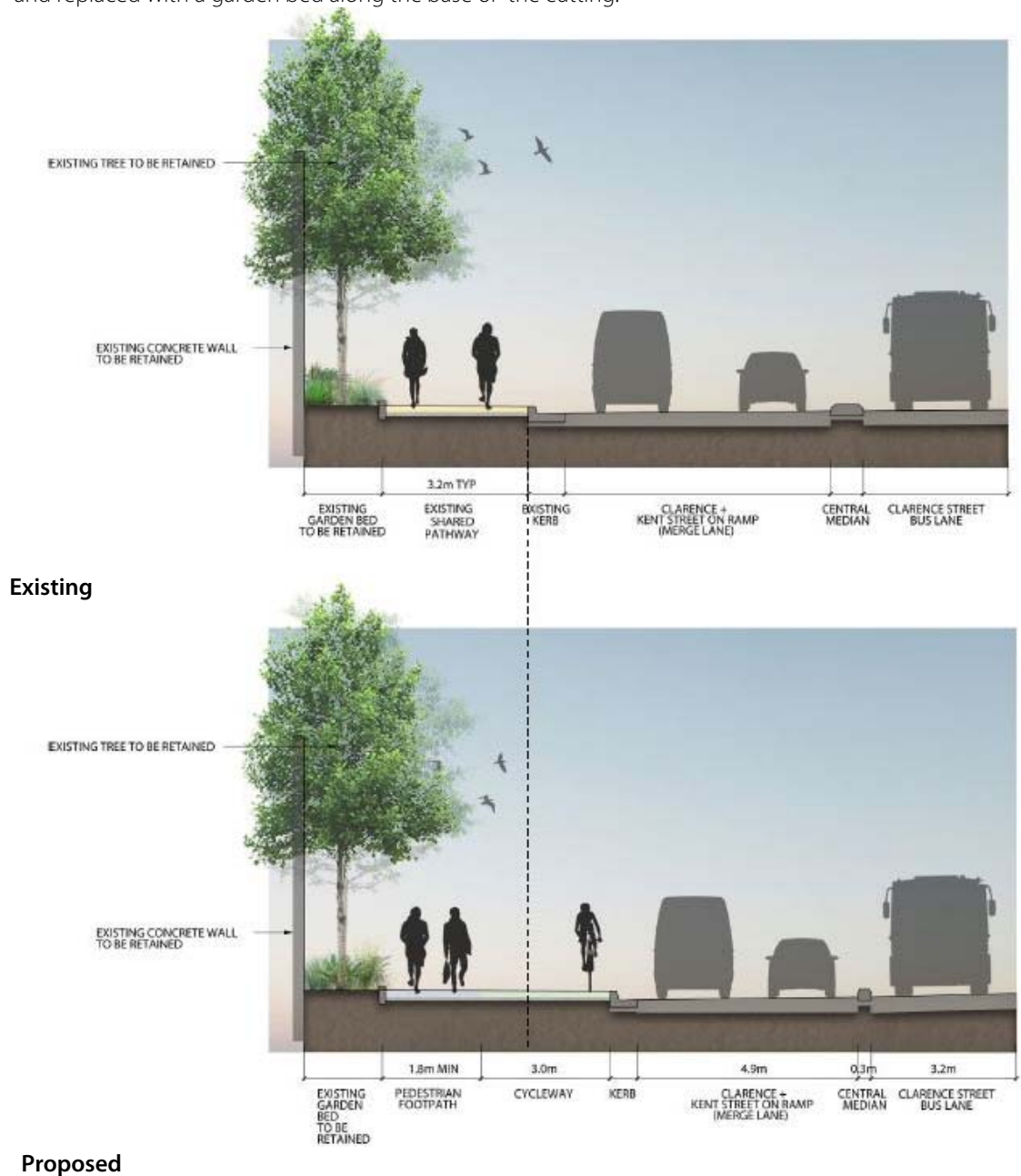
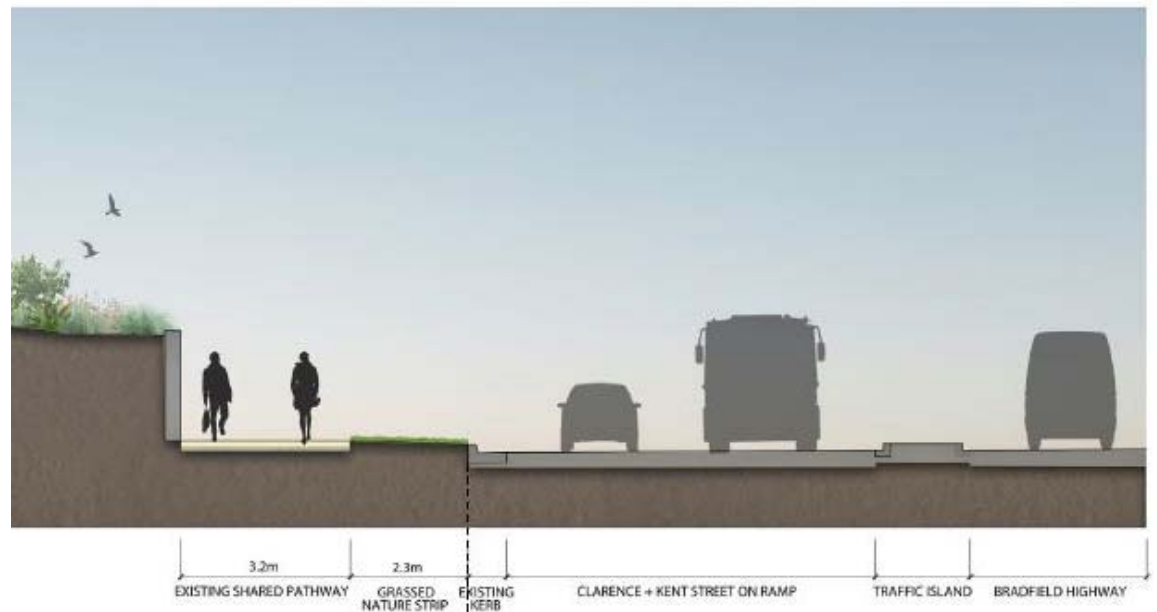
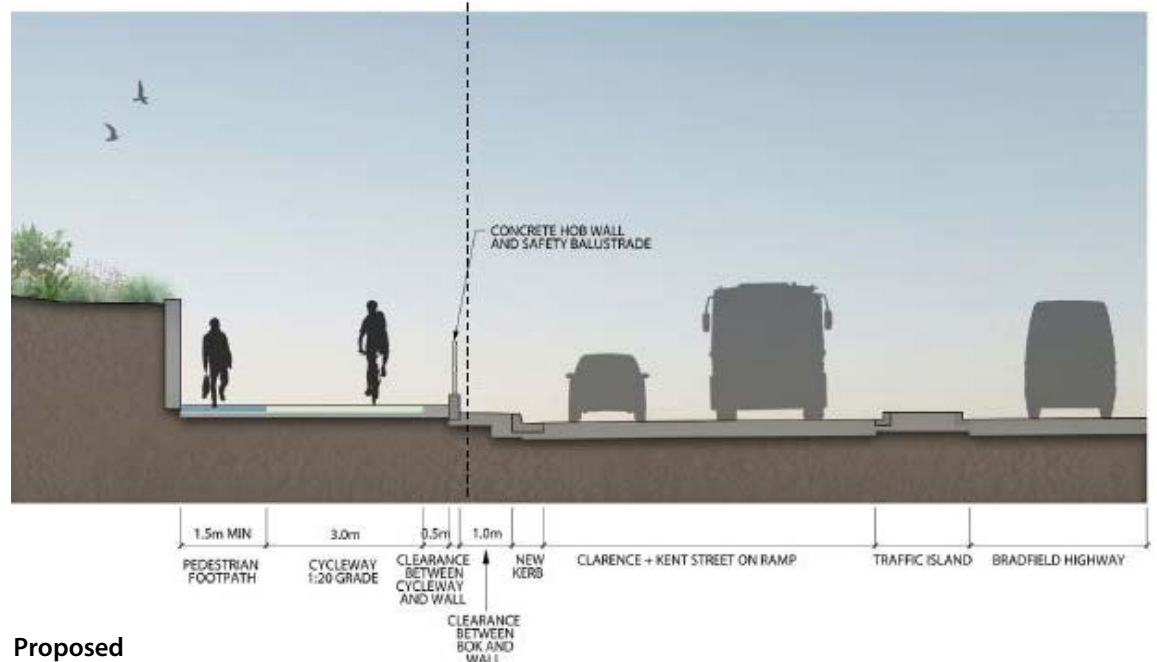


Figure 24 – The Southern Section– Section one



Existing



Proposed

Figure 25 – The Southern Section - Section2

The Elevated Loop

North of the National Trust Centre/S.H. Ervin Gallery stairs the path transitions into an 'elevated loop'. This is the approach structure to the Cahill Expressway Bridge introduced to achieve grades and geometry for the cyclist path consistent with Austroads Guide to Road Design Part 6A (2007). The key elements are a path which spirals around and over itself to connect to the Cahill Expressway Bridge. Its grade is approximately 1v:20h.

The design of this is envisioned as a ribbon in the landscape, with the depth of structure minimised and transparency of balustrades and throw-screens maximised to minimise impacts on its surrounds. The footprint of the loop has been kept clear of the frontage of the National Trust Centre/S.H. Ervin Gallery when viewed square on. The design has removed the walling which currently interrupts the flow of the eye beyond the existing cyclist and pedestrian ramp. The lower ramp follows the grade of the existing ground for approximately half its length until it rises from the land and is supported above the underlying path before it connects to the Cahill Expressway Bridge.

The construction of the ramp impacts a number of trees resulting in their removal. It is proposed that a review of the landscape response to the front of the S.H. Ervin Gallery be undertaken to better integrate the path and the gallery and enable both elements to be appreciated, within a new landscape setting which is responsive to the past yet reflects the proposed new use.

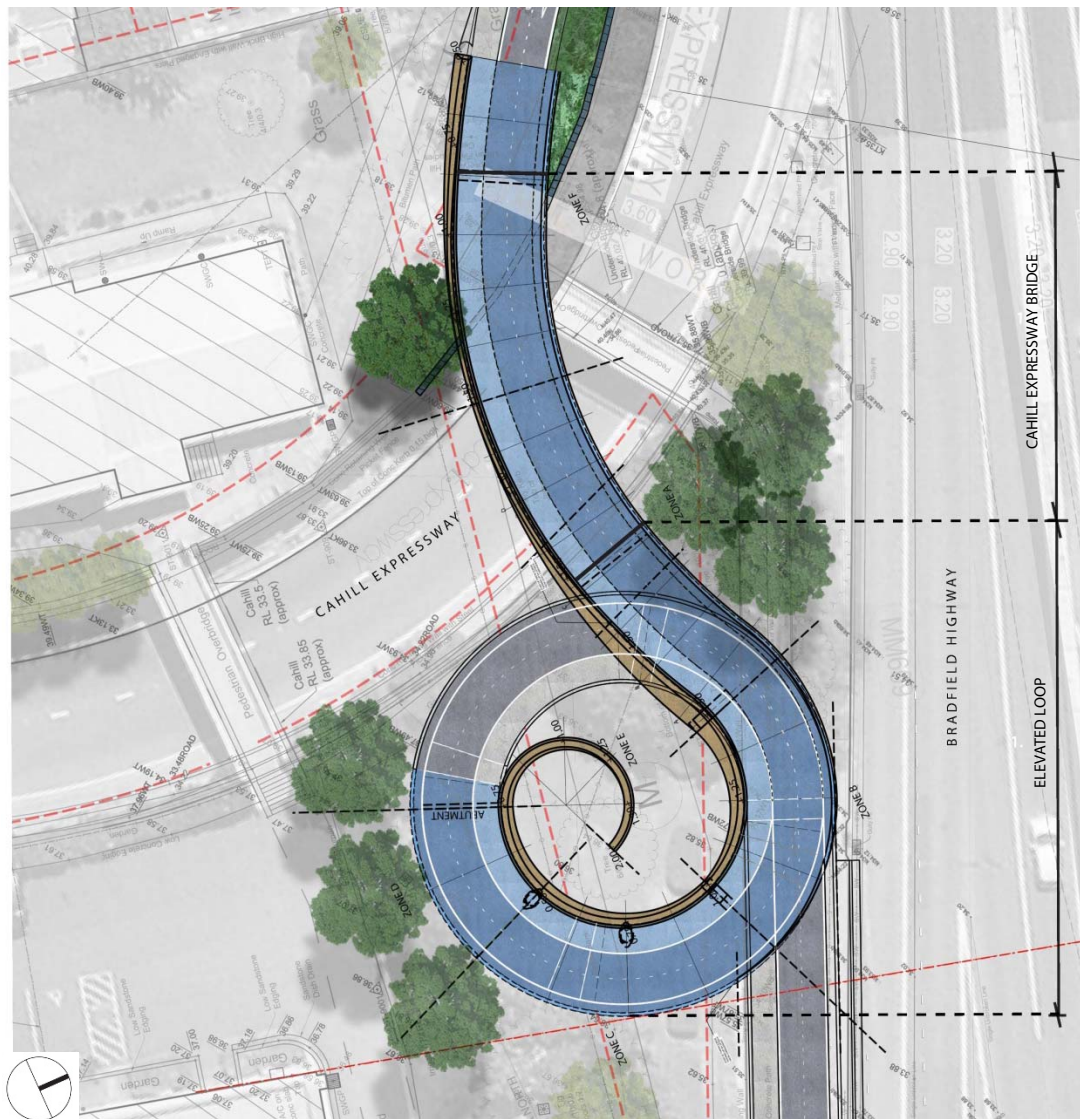


Figure 26 – Elevated Loop and Cahill Expressway Bridge

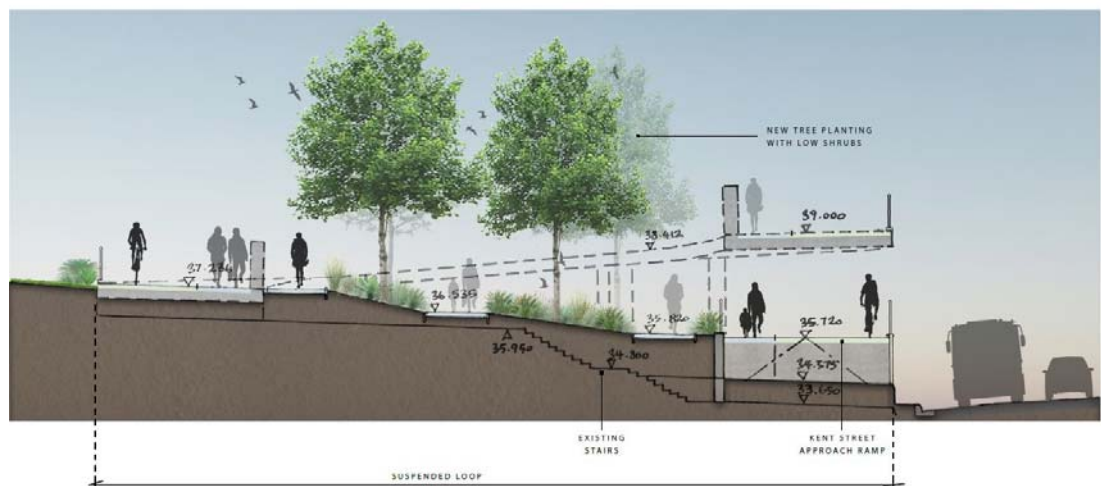


Figure 27 – Elevated Loop – Section



Figure 28 – Elevated Loop viewed when looking north from Bradfield Highway

The Cahill Expressway Bridge

The existing bridge features steep gradients, poor sight lines at the approaches, inadequate vertical clearance above the Cahill Expressway and does not meet current design standards. The proposed bridge adopts a curved alignment set to the west of the existing bridge providing greater visibility and better geometry for its users on approach to the ramp. This alignment reduces the dominances of the structures compared to the existing ramp and bridge which are set further forward, closer to the edge of the Bradfield Highway. A key element in the development of the design for the bridge structure is to achieve a slender leading edge for all bridges and their approaches. In doing so a sense of lightness to the structure is maintained. The design of the Cahill Expressway Bridge has been developed to present a slim deck profile to minimise the mass and visibility of the structure.

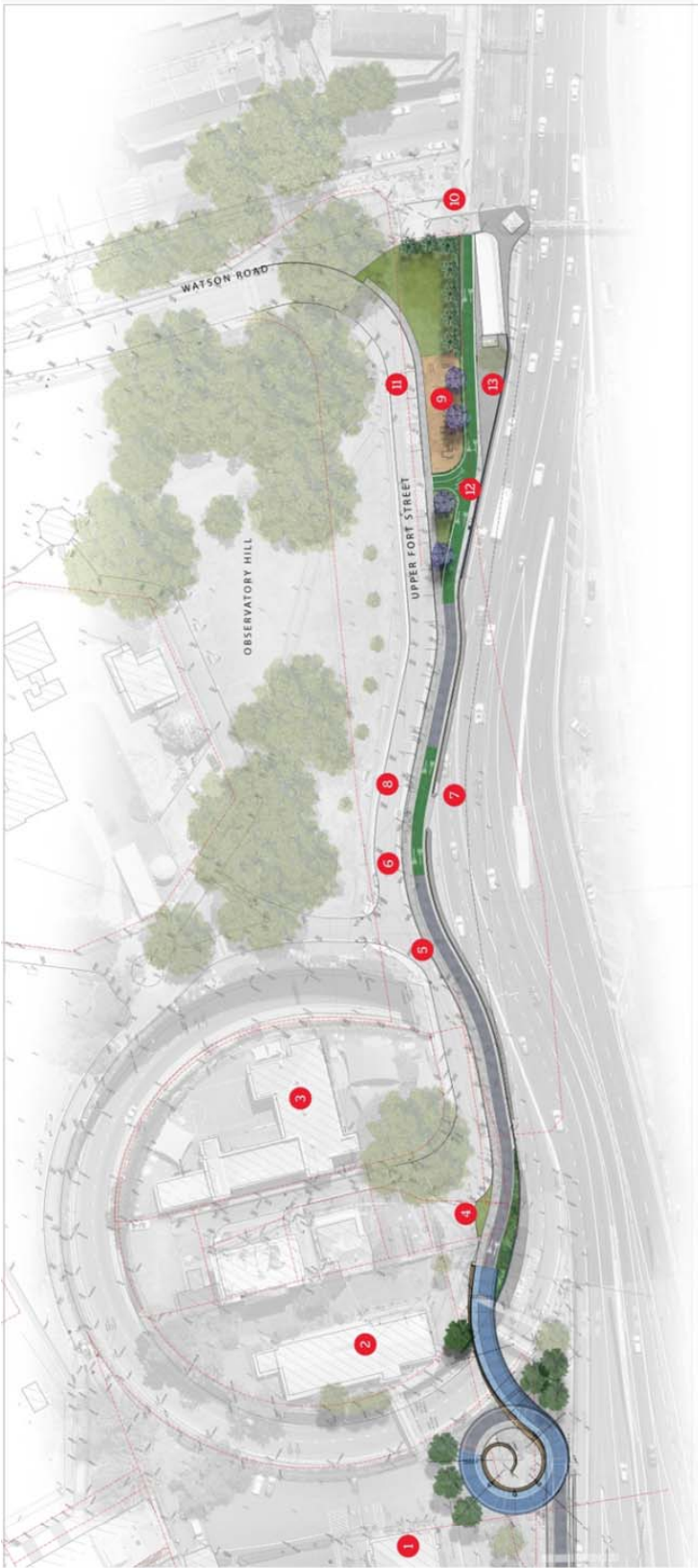


Figure 29 Proposed Cahill Expressway Bridge viewed when looking south from Bradfield Highway

4.3.2 The Northern Section

The northern section extends from the Cahill Expressway Bridge to the north to the Sydney Harbour Bridge Cycleway portal. The design of this alignment adopts a number of strategies to ensure impacts are minimised.

The alignment is adjacent to the Bradfield Highway as it moves north the path utilises some of the additional space created on the Bradfield Highway as a result of realignment of the existing traffic lanes under the SHB Southern Toll Plaza Precinct Upgrade project. This sees a rationalisation of the Incident Response Area (IRA) as the proposed cycleway occupies the edge of this space.



- 1 NATIONAL TRUST CENTRE / S.H. ERVIN GALLERY
- 2 OBSERVATORY HILL ENVIRONMENTAL EDUCATION CENTRE
- 3 FORT STREET PRIMARY SCHOOL
- 4 PEDESTRIAN CONNECTION TO SCHOOL
- 5 UPPER FORT STREET ALIGNMENT RETAINED
- 6 NEW PEDESTRIAN CROSSING TO CONNECT TO WESTERN FOOTPATH
- 7 SLIDING BOOM GATE RELOCATED FORWARD TO ALLOW FOR CYCLEWAY ALIGNMENT. EMERGENCY INCIDENT RESPONSE AREA
- 8 WARNING + CYCLEWAY SAFETY SIGNS AT BOOM GATE INTERSECTION
- 9 EXISTING FITNESS AREA RECONFIGURED TO SUIT
- 10 RAMP CONNECTION TO EXISTING ARCH ENTRY TO SYDNEY HARBOUR BRIDGE
- 11 EXISTING ROAD + PARKING RETAINED
- 12 SECTION OF EXISTING RETAINING WALL REMOVED TO ALLOW CYCLEWAY ALIGNMENT
- 13 RAIL TUNNEL EMERGENCY EXIT DOOR. PATH ALIGNMENT TO MEET DOOR COVER. TO RETAIN ACCESS. WARNING SIGNAGE LIGHTING TO BE PROVIDED.

Figure 30 – The Northern Section



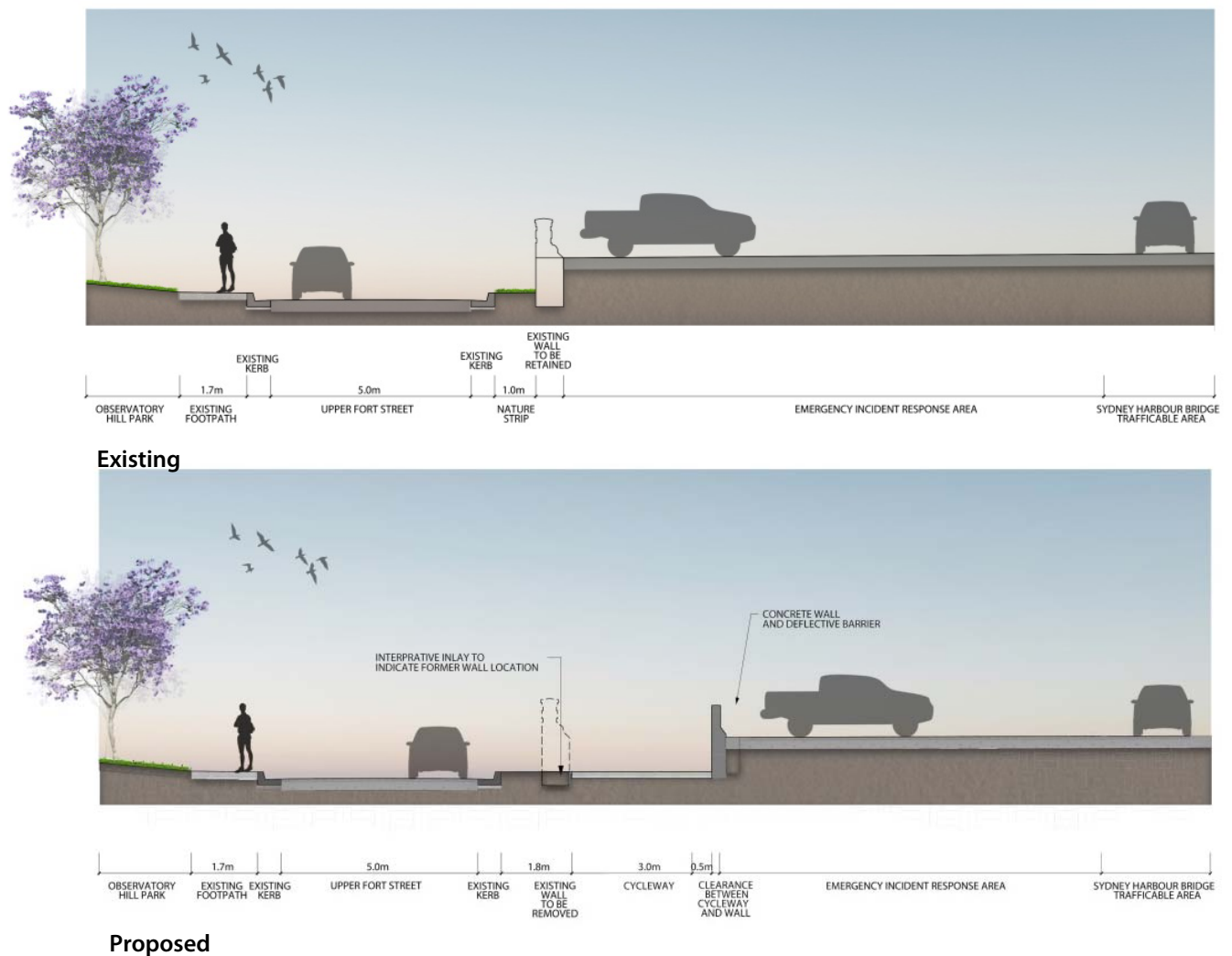


Figure 31 – The Northern Section– Section

Heading north beyond this point the path will be constructed at grade in order to achieve a safe, smooth and accessible alignment. Works would involve the modification and removal of part of the retaining walls to this edge of the Bradfield Highway between the access gate to Upper Fort Street and the structured park fitness facility. Modifications will be required to the fitness centre to accommodate the proposed alignment. Upper Fort Street is proposed to remain unmodified by the proposal, except for the addition of a pedestrian path behind the eastern kerb to allow free and easy access to/from the adjoining parked cars.

4.4 Bridge Precedents

In developing the proposed concept for the Cahill Expressway Bridge and elevated loop a number of precedent projects and bridge forms were reviewed in order to develop the best approach for the proposals development.

An important consideration is not only the bridge crossing the Cahill Expressway but also how the path is connected to the bridge. The two elements need to be considered as a whole but may vary in detail of potential structural form.

Key to the review and selection of a preferred bridge form are a number of design parameters which need to be considered. These are:

- The aesthetics of the proposed structure including:
 - Physical limitations such as:
 - Depth of Structure and span
 - Flexibility of form
 - Legislative (Planning) constraints:
 - Heritage constraints and considerations
- Constructability - taking consideration of space available for assembly, transport constraints, and the limitations of working over and adjacent to an active road corridor.
- Cost – A cost effective solution which is responsive to the context.



Figure 32 –a)Odense-Bicycle-Bridge (source: GPA and Lars R. Mortensen) b)Art Gallery NSW; c) Art Gallery NSW; d) Falcon Street Bridge; e) Cykelslangen – Copenhagen (Photo by Dissing+Weitling)

As part of the review process a number of bridge forms which utilise differing construction techniques were considered and their suitability assessed in order to arrive at the preferred bridge form. From these inspirational forms a number of structural options were reviewed and considered in relation to the design.

4.4.1 Option 1 – Standard RMS pedestrian bridge Arch with Truss bridge

Roads and Maritime Services have developed a standard pedestrian bridge form to provide a cost effective system to the delivery of pedestrian bridges within metropolitan Sydney. The bridge is a steel arch and truss design with post and tie beams supporting a roof structure. This solution provides a structural form suited for spans between 20 and 40 metres and provides an elegant gateway type structure.

Its form however limits the potential response to the space, and is limited by being a pedestrian only bridge with insufficient width to meet the design parameters.

Table 1 – Standard Roads and Maritime Pedestrian Bridge – Steel Arch

Advantages	Disadvantages
Allows minimal deck depth as a result of structure enclosing the bridge	Relatively heavy structure compromises visual outcome
	Arch form while similar to the adjacent Harbour Bridge detracts from it
Capacity to achieve long spans	Limited to a straight alignment
	Standard is not designed as separated cycleway and pedestrian path and is typically 3m in width
	Scale of structure will influence road transport and craneage
Simple design with standardised steel sections – off the shelf	
Prefabricated offsite	
Enables the incorporation of a roof element and safety screens integral with structure	
Economical design	



Figure 33 – Beecroft Road Bridge

4.4.2 Option 2a – Steel Box truss

A traditional engineering structure in which the depth of the superstructure of the bridge is load bearing. This structure is composed of connected elements typically linked in triangular forms. The form of the structure is relatively open minimising the overall mass of the structure.

Two types of box trusses:

- The steel box truss: Is a truss with pin-jointed truss. It is a structure made up from separated components by connecting them together at pinned joints, usually to form a series of triangles.
- Vierendeel truss: is characterised by the absence of diagonal members but form rectangular openings, and it is a frame with fixed joints that are capable of transferring and resisting shear and bending moments. Visually this is potentially a lighter structure.

Like the previous option the form is inflexible and not designed for shared facilities typically.

Table 2a – Steel Box Truss

Positives	Negatives
Allows minimal deck depth as a result of structure enclosing the bridge	Relatively heavy structure compromises visual outcome
Capacity to achieve long spans.	Limited to a straight alignment
	Scale of structure will influence road transport and craneage
Simple design with standardised steel sections – off the shelf	
Prefabricated offsite	
Enables the incorporation of a roof element and safety screens integral with structure	
Economic design	



Figure 34 – Typical truss bridges- Sunnyhot Road (Source: Street View), and Eastern Distributor

4.4.3 Option 2b – Group GSA Concept – Open Truss

This option is a variation on the truss theme in which the truss is not closed at the top. The depth of the sides, in particular the balustrading is used to achieve the structure required to support the path. While providing a shallower and more open structure it is still reliant on having a straight form which limits the potential to ease grades and be sympathetic to the context.

Table 2b – Steel Open Truss

Positives	Negatives
Allows minimal deck depth as a result of structure enclosing the bridge	Relatively heavy structure compromises visual outcome and limits finesse of balustrading
Capacity to achieve long spans.	Limited to a straight alignment
	Scale of structure will influence road transport and craneage
Prefabricated offsite	
Simple design with standardised steel sections – off the shelf	
Economic design	

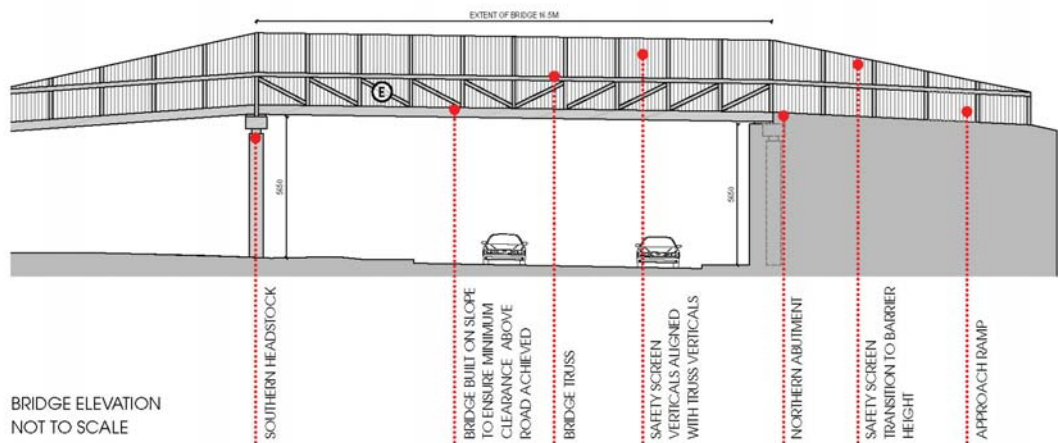


Figure 35 – GSA Concept – Open Truss (Group GSA, 2016)

4.4.4 Option 3 - T Beam or Concrete Box Girder

A standardised concrete girder form used in the construction of a variety of bridges. These elements are typically straight and rely on depth to meet the structural span of the bridge. The deck is supported by the girder and caps it off. In pedestrian bridges this element is normally the dominant element of the bridge.

The requirement to minimise the depth of the structure in order to optimise the grades of the path, limits the viability of this bridge form.

- The T-Beam is a prestressed concrete beam.
- A pre-stressed Box girder, as shown, forms an enclosed forms and is hollow in the centre



Table 3 –T Girder or Concrete Box Girder

Positives	Negatives
	Relatively heavy and deep sub-structure compromises visual outcome, grading of path
Prefabricated offsite	Limited to a straight alignment to gain cost benefits
	Scale of structure will influence road transport and crane age
	This option will impact and diminish effective clearance between the road and underside of bridge
Enables the incorporation of comparatively light handrails/ safety screens as bespoke elements	



Figure 36 – Pedestrian Bridge on Epping Road (Source: StreetView)

4.4.5 Option 4 - Steel Box Girder

The steel box girder is a beam which sits beneath the bridge deck. Its form can be varied but in its simplest form, it is constructed in a 'I' form. Its metal fabrication enables more flexibility in geometry and so a curved alignment is readily achieved.

Similar to the concrete box girder this usually can be constructed in two forms:

- A steel box girder: Consists of a principal structural element composed of one or more closed cells, constructed with flat steel plates acting in bending.



- I section girder: A girder is a support beam and normally support secondary beams. Girders often have an I-beam cross section composed welded of two load-bearing flanges separated by a stabilizing web.



Like Super T and concrete box girder this structural form primarily sits below the path and consequently requires additional clearance to achieve the operational requirements for the bridge.

Table 4 – Steel Box Girder

Positives	Negatives
	Relatively heavy and deep sub-structure compromises visual outcome , grading of path
Prefabricated offsite	Scale of structure will influence road transport and crane age
High torsional stiffness and strength, enables the use of box girders in horizontally curved bridges;	
Enables the incorporation of comparatively light handrails/ safety screens as bespoke elements	
Improved durability	
Clean lines of a closed box girder provide better appearance for footbridges where the visual impact counts	



Figure 37 – Falcon Street – Pedestrian Bridge

4.4.6 Option 5 - Cable Stay

A cable stay bridge has one or more towers to support the bridge deck. The cables run from the tower directly to the deck. Cable stay bridges can facilitate long spans.

Bridge decking structure can be constructed in a variety of forms and materials. This includes concrete structure or steel frame structure with a slim profile.

Limitation of the cable stay relate to the width of the proposed deck and the consequent scale of the central mast to support as a single pole. Multiples masters are also possible but increase the potential conflicts of the new bridge,

Table 5 – Cable Stay Bridge

Positives	Negatives
Slim deck profile	Highly visual element often of sculptural form could impact adjoining heritage
	Reliant on insitu works requiring work over the Cahill Expressway
Allows for off-site fabrication. The structural decking can be constructed in sections and craned over the road while the cables are connected.	
Enables the incorporation of comparatively light handrails/ safety screens as bespoke elements.	
Long span can be achieved.	



Figure 38 – Pomeroy Street Pedestrian Bridge, M4, Sydney (Source: Flickr by Peter Miller)

4.4.7 Option 6 - Architectural Feature Bridge – Steel beam with Cantilever

The proposal is a hybrid form: a diaphragm plated structure in L-shape (box section) with cantilever beams. This solution while bespoke in form involves the development of a structure specifically to meet the constructability and clearance constraints of the site .

Table 6 – Architectural Feature Bridge – Steel beam with Cantilever

Positives	Negatives
Flexibility in form enables development of a solution to meet the specific constraints of the proposal	Bespoke design will increase construction costs
Depth of structure can be visually minimised	
Structure can be broken into elements enabling flexibility in transport	
Prefabricated off-site	
Bespoke design meeting structural and architectural aspirations	
Lighter structure using steel frame	
Architectural pleasing and suitable with the significant prominent precinct	
Structural depth incorporated with the balustrade/protection screen	
Provide a constant grade and smooth transition between the bridge and the approaches	



Figure 39 – Jarrold Bridge, Norwich - Cantilevered Span (Source: Ramboll Group)



Figure 40 – (a), (b), (c) - Jarrold Bridge, Norwich (Source: SH Structures)

4.5 Approaches

In addition to the main bridge span the approach to this bridge will form a critical element.

4.5.1 The Elevated loop- The Southern Approach

The Elevated loop needs to consider its relationship to:

- the Cahill Expressway Bridge
- The **National Trust Centre**/S.H. Ervin Gallery
- The Bradfield Highway

These elements potentially impose heritage limitations but are also key visual elements within the corridor which need to be considered in the projects development.

Key requirements are:

- lightness,
- transparency
- simplicity of form
- compatibility with the proposed Cahill Expressway Bridge – including complementary forms, materials and detailing

In adopting these requirements a calm, subtle installation that it is subservient to the context will be achieved.

The following images depict the design intent, which illustrate the structural form and context of the site.



Figure 41 – Kadriorg Park Tallin Estonia (Source:: inhabit.com; and Reio Avaste)

4.6 Bridge Design Principles

As the design of the bridge(s) is resolved further the following principles should be adopted and refined to ensure the best fit of the proposal

Bridge Elements- Super Structure

- Be simple and elegant structure
- Present a slim leading edge to the Bradfield Highway
- Provide openness to the structure for both the user and viewer
- Present as a ribbon in the landscape with clear flooring form

-Soffit-

- Be designed as an integral element of structure
- Present a smooth uncluttered profile
- Conceal Services – recess services so that they finish flush

Bridge Elements- Piers

- Consider the design of piers in relation to visual dominance from key views
- Limit number of piers to structural minimum and manipulate
- Review and form to limit visuals maps

Bridge Element- materials

- Materials should be selected for their robustness and durability, considering their tendency to patina with age
- Express the inherent material of the structure and minimise use of claddings and additional finishes.

Bridge Element-Lighting

Lighting should be an integral part of the design rather than an attachment

- Ensure compliance with standards
- Integrate with vertical structural elements such as safety screen where possible
- Minimise light spill due to proximity of the Observatory

Bridge Element- Balustrade and Safety screens

Design should be integral with the overall structural character

- Be open
- Transparent
- Robust and durable
- Define the space
- Meet standards

The following images provide a sense of space and transparency. The angled profile of the safety screen and rail provide a sense of invitation and welcomeness, to what is otherwise a tall barrier system that could be oppressive and restrictive.



Figure 42 – Anzac Bridge Cycleway a) with safety screens; b) Balustrade only

4.6.1 Other Structural elements

While the bridge deck and its substructure form a dominant element of the Cahill Expressway Bridge and the elevated loop, other structural elements play an important role in the overall character and expression of the structure and consequently its impact on the surrounds. This includes retaining walls which support the path or the adjoining land within the corridor.

Walls

Retaining walls are required in a number of locations including:

- The southern section across the frontage of the S.H. Ervin Gallery
- The northern section in front of the Fort Street Public School; and
- The Bradfield Highway interface to the north

The design response needs to be responsive to the context. The response need to relate to the scale of the wall and what it connects to. Care is needed to modulate the design and composition in order that its scale and dominance is reduced.

The Southern Section

The wall to the front of the National Trust Centre/S.H. Ervin Gallery needs to relate to both the elevated loop and the heritage context of the Gallery. Its scale and height mean that its overall impact is limited.

The Northern Section – Fort Street Public School Frontage

This wall abuts the Bradfield Highway and ties in to the Cahill Expressway retaining wall as it wraps around into the approach to the Harbour Bridge. Its scale varies and construction needs will play a key role in its development. The wall needs to address both impacts from the adjoining road as well as address services which are fixed to the existing wall to be concealed by the new.

The Northern Section – Bradfield Highway Retaining wall

The proposal requires the realignment of the existing retaining wall to the Bradfield Highway. This retaining wall presents a monolithic structural edge to the Observatory Hill Park grounds, and forms part of the overall setting of the Harbour Bridge. The proposal will see a 60 metre section of the wall reconstructed approximately four metres eastward of its present alignment. Reconstruction will need to complement the structure in terms of its overall form and character, in order that the overall monolithic scale of the wall is maintained.

4.6.2 Separated pedestrian/cycleway

The configuration of the pedestrian /cycleway is being developed to provide a safe and efficient alternative transport system. The alignment has been reviewed both vertically and horizontally to provide the best fit within the constraints of the sites topography and existing elements.

The proposed cycleway features 3 metres effective width with clearance zones provided beyond in accordance with standards. Its configuration along its length varies as the pedestrian path is coupled and then uncoupled (as you move north) in order to minimise conflicts and achieve the most effective form.

From Kent St through to just beyond the Incidence Response Area boom gate access point the path provides a separated facility in which the two modes are separated by delineation and contrasting surface treatments. North of this point the proposed cycleway is physically separated.

The pedestrian path is provided as a minimum 1.5 metre width.

4.7 Materials

The design of all the elements needs to provide a sense of belonging and continuity to the overall setting of the works. The design has been informed by its context and the functionality of the proposal.

4.7.1 Paths

The pavement of the path network is to be developed consistent with the City of Sydney standards - Sydney Streets – A Design Guide - CoS Public Domain Standards. The section from Kent Street to the National Trust Centre/S.H. Ervin Gallery is presently paved in bitumen and is anticipated that this would be adopted as part of the redevelopment. The continuation of the urban granite treatment of the city streets is considered inconsistent with this environmental context. This treatment would be continued within Observatory Park matching in to the existing character and materials of the park.

The cycleway would be delineated by line marking and surface treatment to clearly define the two modes.

4.7.2 Walls

A number of retaining walls are identified as being required along the project length. All relate to the interface between the adjoining highway and the path alignment. The scale of the walls varies and so it is considered that the detailing and design of these elements will also need to respond to these changes.

Support to the elevated loop southern approach

This wall is a small scale wall of around one metre in height. Its proposed treatment would consist of precast concrete panels. This would enable the achievement of a high quality of finish and rapid installation minimising disruption to traffic and path users.

Northern approach to Cahill Expressway

A section of the path on approach to the Cahill Expressway straddles the existing retaining wall supporting Upper Fort Street and requires the construction of a new wall to the east of the existing. This wall needs to meet the safety requirements of a wall within an expressway environment. Its base will incorporate the profile of a Type 'F' barrier. Like the preceding wall it is anticipated that this wall would also be a precast profile enabling quick installation while achieving a high quality finish.

Bradfield Highway replacement retaining wall

The replacement of a section of retaining wall to the Bradfield Highway needs to be approached carefully as it forms part of the overall setting and context of the Sydney Harbour Bridge. Critical issues amongst this are that it needs to continue the overall monolithic profile of the wall which forms the edge to the Observatory Park.

Construction constraints dictate that a piled wall profile will need to be adopted. This will then need to be faced to achieve a profile and finish which complements the existing. The transition between old and new wall will occur at one of the vertical joints of the existing wall to enable the integration of the new works with the old. Construction could be either a precast panel system or insitu block work with a rendered face.

The design of the parapet to the wall needs to achieve safety standards for the adjoining road environment.

4.7.3 Bridge and bridge elements

The design of the bridge has in part determined its materiality. The proposed structure is to be of steel construction for both the elevated loop and the Cahill Expressway. The use of steel enables the prefabrication of elements, a large clear span, assists with transportation, and enables the profile of the structure to be minimised.

Further refinement of the bridge design and the finish of materials will take place during the detail design phase. The following considerations need to be evaluated in the final finish selection:

- Integral with structure rather than applied as a cladding
- Durability of finish and implications for overall structural durability
- Maintainability – ie the frequency of inputs required to ensure durability and ability to undertake standard maintenance activities
- Visibility – relates to the fit of the overall finish of the structure within its context. Elements to consider include:
 - colour and whether it patinas with age
 - Reflectivity

The images below depict metal finishes one of which is integral with the material and the other applied. They illustrate a warmth and permanence and change with time which an applied finish generally does not achieve.

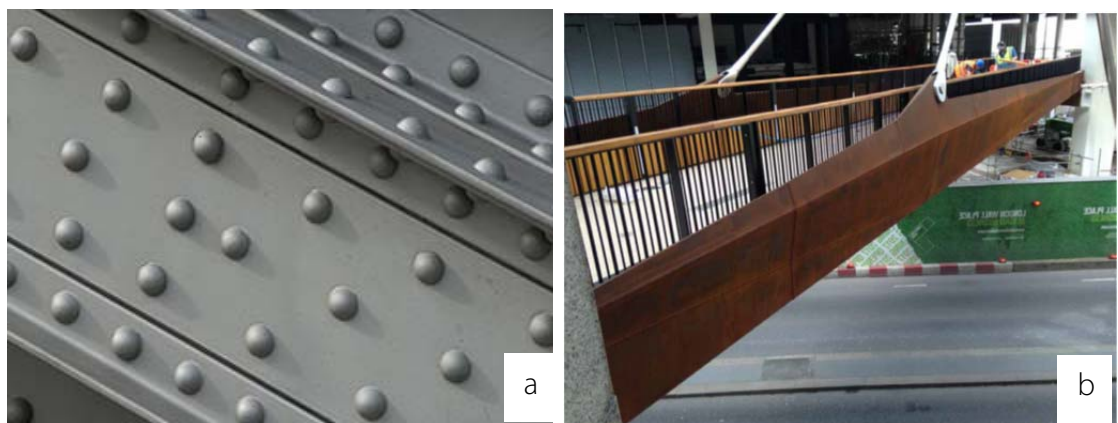


Figure 43 – a) Painted Micaceous Iron Oxide Finish (Source: sabreautonomous.com.au) b) Weathering steel bridge City Walk London (Source: Make Architects)

Balustrades and safety screens

Balustrade and safety screen design needs to be as light and transparent as possible. This will provide a sense of openness for both viewer and user of the path alike, and will reduce the overall perception of the mass of the structure.

The current design allows for safety screen at the at-grade level of the loop profile as well as the elevated section of the loop and across the bridge due to the paths elevated proximity to the adjoining roadway.

Details of required anti-throw screens, including their location and extent, will be further investigated during detail design. Opportunities to review this are being assessed on a risk basis to determine need. In order to address the extent of safety screen opportunities to vary the aperture of the mesh are being considered. This will further lighten the structure when viewed from the adjoining road and properties.

Integration of lighting within the support structures is also being considered to reduce the number of vertical elements within the view.



Figure 44 – a) stainless steel mesh with variable aperture b) stainless steel mesh screen on bridge (Source: Tensile ,2017)

5 ASSESSMENT METHODOLOGY

5.1 Landscape Character and Impact Assessment

This section of the report considers the visual impact and effect of the proposal on the landscape character of the study area.

The Roads and Maritime Visual Impact and Environmental Impact Assessment Guidance Note: Guidelines for landscape character and visual impact assessment, 2013 sets out the two main purposes of landscape character and visual impact assessment:

“To inform the development of the preferred route and concept design so that the proposal can avoid and minimise impacts up front.

To inform the Roads and Maritimes managers, other agencies and the community about the landscape character and visual impact of the proposal and what mitigation strategies would be implemented.”

And defines visual impact assessment and landscape character assessment as follows:

“Landscape character assessment - the assessment of impact on the aggregate of an area’s built, natural and cultural character or sense of place are equally important and visual assessment - the impact on views.

Landscape Character and Visual assessment are equally important. Landscape character assessment helps determine the overall impact of a project on an area’s character and sense of place. Visual impact assessment helps define the day to day visual effects of a project on people’s view.

This dual assessment will help differentiate options, improve route alignment decisions and improve design outcomes.”

5.2 Landscape Character Assessment

To assess landscape character the local context of the site is broken up into a number of units to assist in understanding the local context and the implications of the proposal. These include defining the landscape character zones (zones of similar spatial or character properties), and the analysis of changes to these zones as a result of the proposed bridge.

Landscape character is defined as:

“The combined quality of built, natural and cultural aspects that make up an area and provide its unique sense of place.”

(EIA No.4 Guidelines, 2013).

The proposal is assessed in terms of its impacts on these character zones and the impact ranked in terms of sensitivity to change. This assessment differs from a visual assessment in that it assesses the overall impact of a proposal on an area’s character and sense of place.

5.3 Visual Impact Assessment

Visibility

The view fields of a road/ cycleway corridor or object are composed of static receptors i.e. those that adjoin the corridor and mobile receptors include those that travel along the corridor. The impacts of the two groups are unique in that the time and frequency of the exposure differ. The extent to which views can be obtained is referred to as the view catchment.

Static Receptors

Static receptors occur within the visual catchment of the route and its structures i.e. they are points, which have a view of or can be viewed from. The visual envelope of the proposal is visually defined by both the topography and vegetation, which adjoins the proposal.

Mobile Receptors

Mobile receptors are the users of the cycle corridor and the adjoining streets and pathways; in this instance the vehicles which use the Harbour Bridge and Upper Fort Street, and pedestrians that travel either along the route or use the adjoining spaces such as the pathway through Observatory Hill Park. Their experience of the space is short term.

5.4 Landscape Character and Visual Assessment Matrix

Landscape character and visual assessment are equally important. Landscape character assessment helps determine the overall impact of a proposal on an area's character and sense of place including all built, natural and cultural aspects, covering towns, countryside and all shades between. Visual impact assessment helps define the day to day visual effects of a proposal on people's views.

To quantify these impacts it is important to assess two qualities in relation to landscape character or view point. These are: Sensitivity and Magnitude

"Sensitivity refers to the qualities of an area, the type number and type of receivers and how sensitive the existing character of the setting is to the proposed change. For example a pristine natural environment will be more sensitive to change than a built up industrial area.

Magnitude refers to the nature of the project. For example a large interchange would have a very different impact on landscape character than a localised road widening in the same area."

(EIA No.4 Guidelines, 2013).

As part of the assessment, Roads and Maritime, has adopted a matrix which combines sensitivity rankings with magnitude to determine the proposal's overall impact. This has been used to inform the Landscape Character and Visual Impact Assessment. Refer Table 1.

Table 7 – Landscape Character and Visual Impact Assessment Matrix

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High Impact	High - Moderate	Moderate	Negligible
	Moderate	High - Moderate	Moderate	Moderate - low	Negligible
	Low	Moderate	Moderate - low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

LANDSCAPE CHARACTER AND VISUAL ASSESSMENT

Landscape Character Assessment

The study area has been broken down into a number of character zones reflecting areas of specific qualities which are distinguishable from the neighbouring zone. Four character zones have been identified.

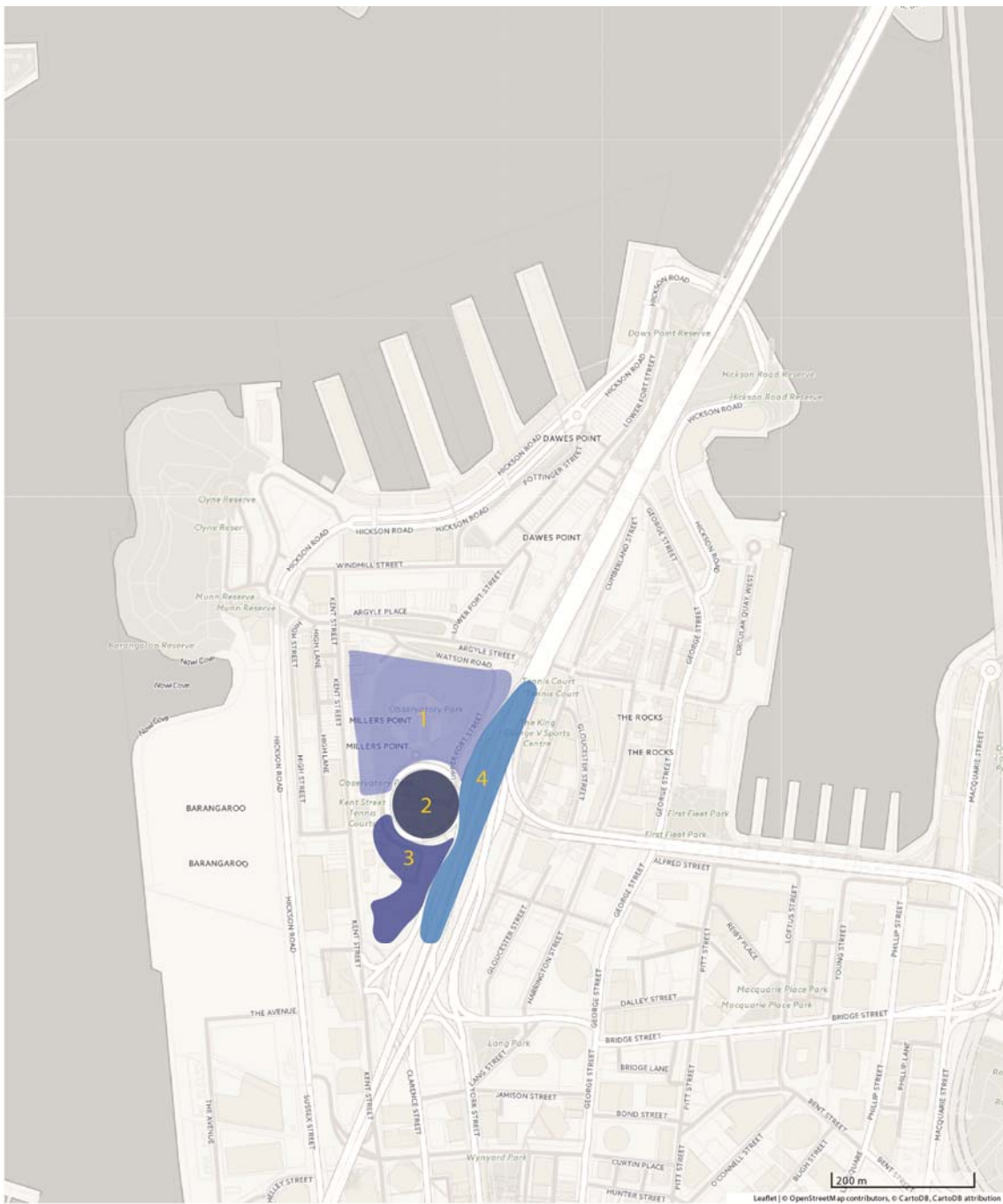


Figure 45 –Character Zones

6.1.1 Character Zone 1 – Observatory Hill Park

The Observatory Hill Park - Character Zone 1 is defined by the Parklands. It extends from the connection to the existing Harbour Bridge Cycleway (northern edge) and extends to the Cahill Expressway at the high point within the corridor. While dominated by the parklands there are other elements which add to or contribute to the overall character. The character zone has consequently been broken into two subgroups. The first and delineating element of the zone, as already discussed is the Observatory Hill Park. This provides an overall sense of green.

Key elements to the space are:

- A ground plain predominantly of grass which rises to a highpoint to the west and extends to the eastern edge of the zone which is delineated by a concrete retaining wall that provides a vertical change between the adjoining character zones.
- Substantial fig trees which form a strong canopy to the west
- The observatory compound defined by a wooden and sandstone fence line and the sandstone buildings beyond.



Figure 46 – Character Zone 1 – Looking over Observatory Hill Park towards Barangaroo

The other element is Upper Fort Street, a two-way, two-lane local road, which passes through the eastern edge of the space and has parking associated with it. Upper Fort Street interrupts the overall flow of the landscape and movement of pedestrians within the space.

Sensitivity – The precinct has a number of heritage buildings and is itself a local heritage item. The landscape nature of its setting and its accessibility for public use make it sensitive to changes and so its sensitivity is considered to be high.

Magnitude – The proposal sees the path proposed to follow the existing grade. This requires alterations to the retaining structure of the Bradfield Highway and its approaches to the Harbour Bridge. The proposed wall moves eastward freeing more open space. Its construction would match or complement the existing wall both in scale and detail. The magnitude of these changes is considered to be moderate, due to their restriction to the edge of the precinct and the fact they replace the removed element with a similar element.

6.1.2 Character Zone 2 – Fort Street Public School

The second zone of the study area is the location of the Fort Street Public School and its environs defined by the cutting of the Cahill Expressway. The defining elements of this zone are the sandstone walls of the Cahill Expressway cutting, and the cluster of brick buildings associated with the school compound. All fall within a fenced compound. The built form is occasionally broken by landscape elements including a substantial fig tree and small scale garden beds. To the west the precinct has views over the inner harbour including Darling Harbour, White Bay and further to the west.



Figure 47 – Character Zone 2 – Fort Street Public School

Sensitivity – The precinct has a number of heritage buildings but is located in a relative hard and utilitarian context. The sensitivity to change is considered low.

Magnitude – The proposal largely replicates the existing path access with limited changes in alignment and elevation. The magnitude of change is considered low.

6.1.3 Character Zone 3 – National Trust Centre/S.H. Ervin Gallery

The third precinct of the study area runs from the southern side of the Cahill Expressway extends across the frontage of the national Trust Centre/S.H. Ervin Gallery to its connection with the Kent Street separated cycleway. This precinct is largely defined by the green space to the forecourt of the National Trust Centre/S.H. Ervin Gallery. The setting of the National Trust Centre/S.H. Ervin Gallery is composed of individual fig trees, an olive hedge, and grassland, with the heritage buildings set beyond to the west. This space provides a green backdrop to the Bradfield Highway and Harbour Bridges approaches.

At the southern extremity the built form of 168 Kent Street forms the termination of the precinct and its connection to the CBD.

Figure 48 – Character Zone 3 – View of Landscape Front of the National Trust Centre/S.H. Ervin Gallery

Sensitivity – The precinct is largely a greenspace with a heritage building backdrop. The heritage nature of the space provides a higher level of sensitivity to the space and so sensitivity is considered to be high.

Magnitude – The precinct already accommodates a path as part of its address. The proposal encroaches further into the greenspace dividing the space physically and visually. The magnitude of these changes is considered moderate, with the view from and to the National Trust Centre/S.H. Ervin Gallery building maintained when viewed square on.

6.1.4 Character Zone 4 - Bradfield Highway and Harbour Bridge Approaches

The fourth zone of the study area runs for the full extent of the proposal on its southern boundary and incorporates all elements of the Harbour Bridge approaches including the Bradfield Highway, Western Distributor, on and off ramps from the adjoining street network, and incident response area. It is dominated by road infrastructure and in particular the expanse of pavement. Its edges are defined by barriers or cuttings which delineate the extent of infrastructure.

Figure 49 – Character Zone 4- View of the proposal of Bradfield Highway to Sydney Harbour Bridge

The northern terminus of the precinct is the Harbour Bridge and its pylons.

Sensitivity – the built hard edge and infrastructure focus of this precinct and the scale of the space it forms in relation to the proposal has seen its sensitivity assessed as low.

Magnitude – The proposal is largely consistent with the scale of pathway which already adjoins the precinct. Its impact on the overall character of the Harbour Bridge approaches is consistent in its language and complements the function of this infrastructure precinct, its impact is considered low.

6.2 Landscape Character Impact Assessment Summary

The following table provides a summary of the likely impacts on the character of the area through which the proposal passes. Two locations have been assessed as of moderate to high impact on character. This reflects the heritage values of the spaces and the potential impacts which may be posed by the introduction of new or enlarged structures within the context. Care needs to be focused on how the scale of change is managed and the resolution of the design to integrate it within the adjoining context in order to minimise impacts.

Table 8 – Summary of landscape character assessment

Character Zone	Sensitivity	Magnitude	Impact
Zone1	High	Moderate	Moderate to High
Zone 2	Low	Low	Low
Zone 3	High	Moderate	Moderate to High
Zone 4	Low	Low	Low

6.3 Visual Impact Assessment

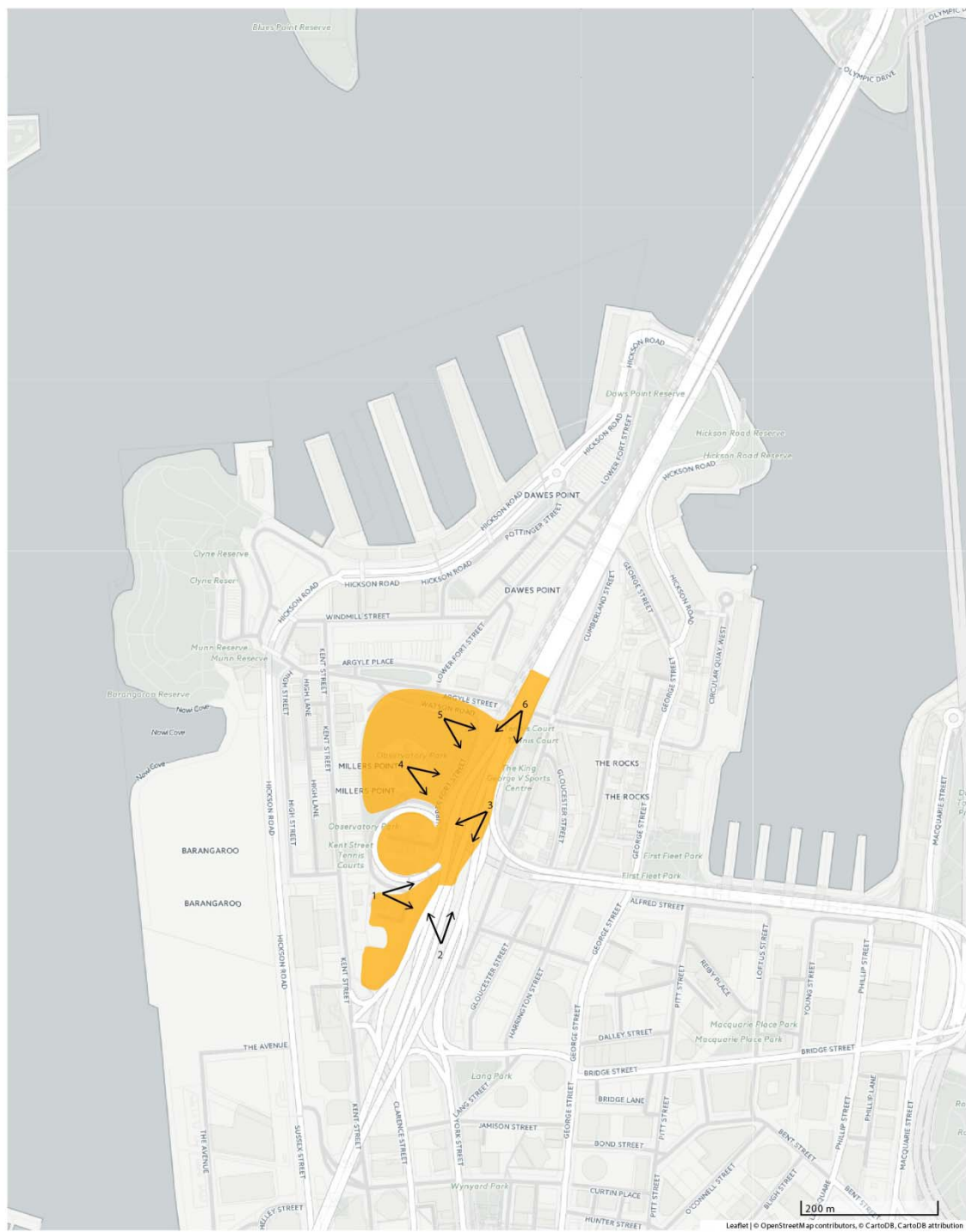
The potential visual impact of the proposed cycle route has been assessed in relation to a number of key viewpoints and/or group of viewpoints. It is based on the existing land use pattern and development adjoining the proposals location.

The assessment method comprises of:

- Defining the scale of the proposal
- Identification of key visual envelopes, viewpoints and groups of viewpoints from which the proposal is visible
- Assessment of the level of impact on the proposed viewpoints from the proposal.

6.3.1 Visual Envelop Mapping

A detailed field and desktop assessment of the alignment was carried out to determine the area from where the proposal is visible as defined in the Visual Envelope Map, (Figure 43). The proposal's visibility is influenced primarily by land use, vegetation and topography. Site assessment of the proposal reveals this will primarily be visible from the approaches to Sydney Harbour Bridge, the corridor itself and the adjoining properties namely, The National Trust Building, Fort Street Public School, the Sydney Observatory and Observatory Hill Park.



- LEGEND**
- | | | | |
|---|-----------------------------------|---------------------------------|--------------------|
| 1 ↗ CARPARK - SH ERVIN GALLERY | 3 ↘ BRADFIELD HIGHWAY SOUTH BOUND | 5 ↗ UPPER FORT STREET TO BRIDGE | ■ VISUAL CATCHMENT |
| 2 ↖ WESTERN DISTRIBUTOR - HEADING NORTH | 4 ↘ OBSERVATORY TO BRIDGE | 6 ↘ BRIDGE SOUTH BOUND | |

Figure 50 – Visual envelope and key view points

6.3.2 Key Viewpoints (Vpt)

View Point 1 – View from the car park of S.H. Ervin Gallery looking east.

This view establishes the relationship of the SH Ervin and the proposal. Presently the view of the existing bridge and ramp are interrupted by the vegetation within the grounds of the Gallery. Despite the presence of vegetation the built elements of both the ramp and bridge are evident and contribute to the termination of the view from here. The proposal will see the clearance of some of this vegetation and the introduction of an elevated ramped structure which rises from near the fig in the foreground.



Figure 51 – Existing View from the car park of S.H. Ervin Gallery looking east.



Figure 52 – Potential View from the car park of S.H. Ervin Gallery looking east indicating trees removed and approximate alignment

Sensitivity: National Trust Centre/S.H. Ervin Gallery as a heritage site has a high level of sensitivity to change. This sensitivity however is moderated by its existing context. High rise buildings east of the Bradfield Highway dominate the backdrop. The existing ramp limits the flow of the landform and landscape and creates an abrupt stop to the space. The sensitivity of the view to change is considered moderate.

Magnitude: The magnitude of change proposed as part of the proposal introduces a new built element within the foreground. This element rises as it moves into the mid-ground of the view. Its impact is

dependent on the solidity of the structure and landscape response. The magnitude of change is considered high.

View Point 2 – North bound from the intersection of the Western Distributor and Bradfield Highway looking North West toward the National Trust Centre/S.H. Ervin Gallery and proposed elevated loop and bridge.

This view is looking northwest across the highway to the National Trust Centre/S.H. Ervin Gallery and ramp beyond. Visibility of the gallery is reduced by the planting of fig trees between the highway and the building. The ramp is a dominant element but is visible clear of the elevation of the National Trust Centre/S.H. Ervin Gallery.



Figure 53 – View Point 2 – North bound from the intersection of the Western Distributor and Bradfield Highway (Existing)



Figure 54 – View Point 2 – North bound from the intersection of the Western Distributor and Bradfield Highway (Proposed)

Sensitivity: The view is from the Bradfield Highway and so is a view experienced by the transient motorist. Its sensitivity is influenced by the length of time of exposure and the elements within the view. Typically the view is experienced quickly with limited time to focus on the elements within the view. Sensitivity is considered to be low.

Magnitude: The proposal will see the thinning of trees in the background and introduction of a new structure replacing the existing ramp and bridge. The distance from view and the nature of existing uses sees this considered to be of low impact.

View Point 3 – South bound from the Bradfield Highway (former Toll Plaza) looking south west towards the National Trust Centre/S.H. Ervin Gallery and proposed elevated loop and bridge.

This view is that of the south bound motorist as they pass through the area formerly occupied by the toll plaza. This reveals the largely concealed National Trust centre/ S.H. Ervin Gallery and the prominence that the existing ramp and structure have in relation to this building.

Figure 55 – View Point 3– South bound from the Bradfield Highway (former Toll Plaza) looking south west

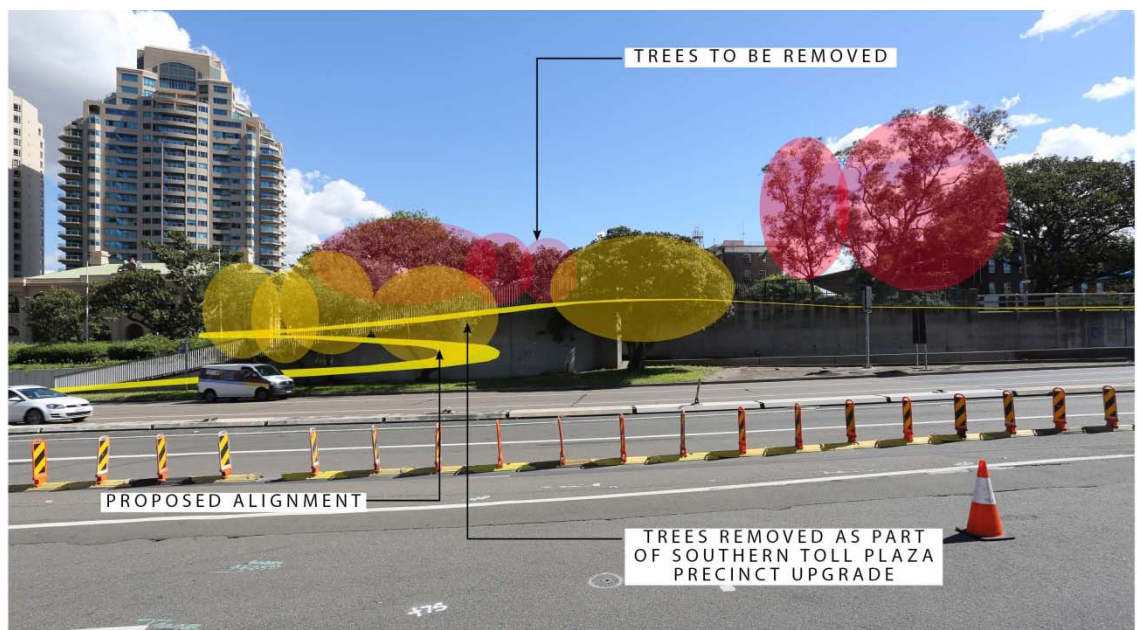


Figure 56 – View Point 3– South bound from the Bradfield Highway (former Toll Plaza) looking south west at view with changes highlighted

Sensitivity: Similar to the previous view it is one experienced by the motorist and so of rapid and short exposure. The presence of both significant built form behind the gallery and the presence of the ramp to the front and the obstruction this has to the setting of the National Trust Centre/S.H. Ervin Gallery have seen this view considered to be of low sensitivity.

Magnitude: The proposal is for a lighter and more open ramp reducing significantly the scale of the retaining wall but introducing an elevated structure. As part of these works the vegetation visible within the foreground will be removed (five trees have been cleared as part of the SHB Southern Toll Plaza Precinct Upgrade project). The scale of these changes is considered moderate. This reflects the proximity of the view to the proposal and the changes in visual character which are likely to occur with the proposal.

View Point 4– View from Observatory Park looking east towards the Bradfield Highway

The view is from the south eastern end of the Sydney Observatory compound looking east towards the Bradfield Highway. The foreground is dominated by the grassland of Observatory Hill Park, with the Bradfield Highway dominating mid-ground view.



Figure 57 – View Point 4 – View from the lower Observatory Park looking north – east towards the Bradfield Highway



Figure 58 – View Point 4 – View from the lower Observatory Park looking north – east towards the Bradfield Highway with impacts highlighted.

Sensitivity: The presence of the Bradfield highway takes away from the otherwise relaxing nature of the setting. The proposal is at the interface between this heavy infrastructure and the park and so sensitivity has been assessed as low.

Magnitude: The proposal introduces a new path which encroaches into the Bradfield Highway. As a structure at the same grade as the park it provides the sense of additional space being added to the park and removed from the road corridor. Its impact is low.

View Point 5– View from Watson Road looking east towards the Bradfield Highway and its concrete retaining wall.

The view is from the intersection of Watson Road and Upper Fort Street as they rise out of the Argyle Cut. It provides the first view of the Bradfield Highway retaining wall and its relationship with the Observatory Hill Park Precinct.



Figure 59 – View Point 5– View from Watson Road looking east towards the Bradfield Highway with impacts highlighted.



Figure 60 – View Point 5– View from Watson Road looking east towards the Bradfield Highway

Sensitivity: The view is experienced by a range of differing users associated with Observatory Hill Park and how it is used and the street's role as an arrival space. The view towards the Bradfield Highway is largely uninterrupted with the exception of planting to the front. The overall character is a restful green space on the edge of the city, it has been identified and listed of heritage significance and so its sensitivity is considered high.

Magnitude:

The vegetated screening of the Bradfield Highway is to be removed which is considered to result in a high impact. This impact however will partially be offset by the transplanting of most of this vegetation which will moderate this impact. Its overall impact is considered to be moderate.

View Point 6 – South bound from the Bradfield Highway looking south west across the incident response area towards National Trust Centre/ S.H. Ervin Gallery and proposed elevated loop and bridge.

This view is that of the south bound motorist as they pass through the area formerly occupied by the toll plaza opposite the incident response area. It is similar to that of pedestrians on the Cahill Expressway pedestrian pathway. The view reveals the National Trust Centre/S.H. Ervin Gallery is concealed by vegetation and the existing bridge structure, with the towers of the CBD beyond dominant within the view.

The view also reveals the nature of the interface between Upper Fort Street and the Bradfield Highway with a plain reinforced concrete retaining wall with a timber rail fence fixed to the top and the Fort Street Public School beyond.



Figure 61 – View Point 6– South bound from the Bradfield Highway looking south west across the incident response area



Figure 62 – View Point 6– South bound from the Bradfield Highway looking south west across the incident response areas and the proposal

Sensitivity: Similar to the previous highway views this is one experienced by the motorist (and to a lesser extent pedestrians) and so is largely a rapid view of short exposure. The National Trust Centre/ S.H. Ervin Gallery is located in the background with a backdrop of significant built-form behind and the presence of the Cahill Expressway Bridge to the front. The latter and vegetation associated with it completely obstruct the view of the National Trust Centre/ S.H. Ervin Gallery.

Fort Street Public School is visible from the alignment however its presence is moderated by vegetation and its perimeter fence. A clear edge to the highway corridor is provided by the retaining wall above which Upper Fort Street and the school sit. Overall the sensitivity of the view is considered low.

Magnitude: The proposed alignment will see both changes in the bridge structure and retaining wall adjoining the incidence response area. These elements within the scale of the setting are relatively minor and the impact is considered to be low.

6.3.3 Visual Impact Assessment Summary

The following table summarises the visual impacts of the proposal. These impacts are typically low to moderate.

Two locations however have been assessed as Moderate to High. These include the frontage of the National Trust Centre/S.H. Ervin Gallery when viewed from the carpark and the northern section of the route on approach to the Harbour Bridge. Both locations reflect a viewer that is sensitive to change due to the history of the site or vegetated nature of the site. In both instances planting could be used to further moderate the impact of the proposed changes to the viewer. Further refinement of this will be undertaken as part of the design development of the proposal.

The overall visual impact is considered to be low-moderate.

Table 9 – Summary of landscape character assessment

Viewpoint	Sensitivity	Magnitude	Impact
View point 1	Moderate	High	Moderate to High
View point 2	Low	Low	Low
View point 3	Low	Moderate	Low to Moderate
View point 4	Low	Low	Low
View point5	High	Moderate	Moderate to High
View point 6	Low	Low	Low

7 MITIGATION STRATEGIES

7.1 Mitigation incorporated into Concept Design

The integration of the engineering and performance objectives with urban design objectives for the elevated loop and Cahill Expressway Bridge aims to achieve a design outcome which has a high visual quality and its own identity separate to the Bradfield Highway and Sydney Harbour Bridge.

In order to achieve this, a range of mitigation measures have been incorporated into the project as the concept has been developed. These measures combine to develop a solution that seeks to protect and enhance the existing visual character of the area along the SHB Cycleway.

Table 10 – Mitigation Measures Incorporated into Concept Design

Project element	Mitigation Measure
Path from Kent St to front of National Trust Centre/S.H. Ervin Gallery	<ul style="list-style-type: none"> – Retention of vegetation to frontage of 168 Kent Street through changes in kerb alignment. – Retention of extent of paved area, rather than increasing, by redistribution of available road space.
Path in front of National Trust Centre/S.H. Ervin Gallery	<ul style="list-style-type: none"> – Introduction of small retaining wall reduces the: <ul style="list-style-type: none"> – Overall scale of existing cutting – Number of stairs to National Trust Centre/S.H. Ervin Gallery – Scale of the existing concrete retaining wall from adjacent path
Elevated Loop	<ul style="list-style-type: none"> – Opens up views from the Bradfield Highway by: <ul style="list-style-type: none"> – Reduction in height of retaining wall supporting path – Integration of new path alignment with existing grades for as long as possible. – Bridge design presents a thin leading edge to the elevated loop minimising its visual mass – Use of mesh balustrade and safety screens to maximise transparency of structure. Further refinement in extent of safety screens should be undertaken to further enhance outcome – Pier design – the number and scale of piers has been minimised in order to maintain an open character. – Pier form design has been responsive to the structural loads and visual prominence of the site in order to minimise scale of pier – Pier form beyond the path alignment has been simplified and moved in from the edge of the structure in order to reduce scale and simplify structure in order to lighten the overall structure
Cahill Expressway Bridge	<ul style="list-style-type: none"> – The adoption of a curved profile alignment for the bridge pushes the structure west – minimising its visual height and presence in relation to the Bradfield Highway – Bridge design presents a thin leading edge minimising its visual mass.

Project element	Mitigation Measure
Northern Section	<ul style="list-style-type: none"> – Adopts the general alignment of Upper Fort Street minimising scale of structures. – Path alignment is kept to the eastern edge of the open space in order to minimise fragmentation of the space – Use of space east of the present edge of the Bradfield Highway maintains open space area and reduces road footprint. – At grade profile limits need for vertical elements associated with bike path including rails and balustrades. – Removal of portion of Bradfield Highway retaining wall is offset by the construction of a complementary and similar scale of wall 4.0m further east – Opportunities for interpretation of the former wall alignment are to be explored as part of the design development.

7.2 Mitigation measures to be incorporated into the detailed design.

The following measures should continue to be adopted as part of the design development process.

- Development of the detail design will be in accordance with Roads and Maritimes' urban design policy 'Beyond the Pavement', including urban design guidelines - bridge aesthetics, and landscape guide.
- Detail design to be the result of an integrated engineering and urban design process.
- The urban design objectives and principles contained in this report will underpin and guide detailed design development.
- The urban design concept described in this report will form the basis for development of the detailed design.

7.3 Mitigation during Construction

The following mitigation measures would be implemented during construction:

- The extent of all construction activity including temporary works would be limited and defined in contractual documents in order to protect the area during construction.
- Construction facilities should be contained within the construction works zone boundary and occupy the minimum area practicable for their intended use or remote from site.
- Provide suitable barriers to screen views from adjacent areas during construction.
- Once construction is complete, or progressively throughout the works where possible, return disturbed areas to a level equivalent to their pre-construction state.
- Keep pollution and dust emissions to a minimum and monitor throughout the project construction period.
- Divert or re-route footpaths that would be affected by construction activities.
- Existing trees to be retained within construction facilities areas would be identified protected and maintained.
- Temporary lighting should be screened or diverted to reduce unnecessary light spill.
- Heritage items should be protected, as identified in the Statement of Heritage Impact.

8 CONCLUSION

The proposal has been assessed in terms of its impact on landscape character and visual impact.

The assessment reveals a low to moderate impact. Areas of greatest sensitivity have been identified as the National Trust Centre/S.H. Ervin Gallery and Observatory Hill Park.

National Trust Centre/S.H. Ervin Gallery has been identified as an existing, heavily constrained context, which is capable of accommodating the proposal if handled carefully and with a light and delicate touch.

Observatory Hill Park, too, has been identified as being able to accommodate the proposal provided the sense of 'green' (vegetation) is not removed from its **eastern** edge as a result of the proposal. The reinstatement of palms and other trees in association with the outdoor fitness areas will be critical to achieving this.

The design responds to both of these concerns and has addressed them through a carefully considered and light bridge structure. Revisions to the Observatory Hill Park take advantage of the proposal's alignment and enable the reconfiguration of the outdoor fitness area to achieve the green edge which screens the Bradfield Highway.

The proposal represents the integrated response to a number of projects which have occurred in or around the Bradfield Highway, primarily the Southern Harbour Bridge Southern Toll Plaza Precinct Upgrade. Through its various design elements it achieves an alignment which enhances access and safety for pedestrians and cyclists alike.

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