

# Sydney Harbour Bridge Northern Cycle Ramp

## Options Report

Roads and Maritime Services | November 2017





## Executive summary

Roads and Maritime Services (Roads and Maritime) is investigating options to provide step-free access for cyclists at the northern end of the Sydney Harbour Bridge Cycleway (the Cycleway). The Cycleway is identified as a strategic cycle route in *Sydney's Cycling Future, Cycling for everyday transport* (Transport for NSW, 2013) connecting the Sydney CBD and the Lower North Shore.

The Cycleway is located on the western side of the bridge. On average, around 2,000 cyclist trips are taken on the cycleway on weekdays, making it the most heavily used cycleway in the Sydney metropolitan area. At the northern end of the Cycleway, cyclists are required to stop, dismount and negotiate 55 steps at Burton Street. Studies have shown that these stairs are a key issue for many cyclists. For some, the steps are an inconvenience that affects their ability to use the existing cycle network, for others (such as those with less mobility or heavy electric or cargo bicycles) the current steps restrict their ability to use their bike for transport and recreation.

Since 2015, Roads and Maritime has been investigating the access issues at this location in detail. This has involved a detailed site analysis to identify constraints and values associated with both the immediately affected allocation and the broader locality, consultation with key stakeholders to support the site analysis and to inform identification and development of practicable options, and extensive investigation and testing of options that would address the identified performance criteria for improved access.

A range of alignment options have been identified and developed to varying degrees resulting in three options that have been subject to critical assessment through a Value Management (VM) process involving a diverse range of stakeholders. This identified the option comprising a ramp supported on columns parallel to the western bridge approach wall through Bradfield Park (Option 2) as the preferred option.

Stakeholders involved in the VM process also examined six structural form options and identified three for further investigation and development; these structural form options are compatible with the preferred alignment option.

Roads and Maritime now propose to further develop the project in the following ways:

- further investigation and development of the three structural form options in the context of the preferred option
- public exhibition of this Options Report (November 2017)
- public exhibition of the review of environmental factors for the Sydney Harbour Bridge Northern Cycle Ramp (late 2018).

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# 1. Introduction

## 1.1 Background to the project

Roads and Maritime Services (Roads and Maritime) is investigating options to provide step-free access for cyclists at the northern end of the Sydney Harbour Bridge Cycleway (the Cycleway). The Cycleway is identified as a strategic cycle route in *Sydney's Cycling Future, Cycling for everyday transport* (Transport for NSW, 2013) connecting the Sydney CBD and the Lower North Shore.

The Cycleway is located on the western side of the bridge. On average, around 2,000 cyclist trips are taken on the cycleway on weekdays, making it the most heavily used cycleway in the Sydney metropolitan area. Pedestrian access is prohibited on the Cycleway; a separate pedestrian footpath is available on the eastern side of the bridge. At the northern end of the Cycleway, cyclists are required to stop, dismount and negotiate 55 steps at Burton Street.

The *North Sydney Integrated Cycling Strategy* (GTA Consultants, 2014) notes that having to dismount and push bicycles up 55 steps to access the Cycleway is a key issue for many cyclists. For some, the steps are an inconvenience that affects their ability to use the existing cycle network, for others (such as those with less mobility or heavy electric or cargo bicycles) the current steps restrict their ability to use their bike for transport and recreation.

## 1.2 Study area

The general study area for the project is shown in Figure 1-1. This effectively covers the entire area of Bradfield Park on the western side of the Sydney Harbour Bridge.

At the southern approach to the Cycleway at Millers Point, Roads and Maritime has been tasked by Transport for NSW to develop and deliver a dedicated cycleway connection from the Cycleway to Kent Street Cycleway. This would remove the need for cyclists to share public roads and footpaths with pedestrians and motorists. The proposed upgrade would also improve grades and sight lines for cyclists and pedestrians. This proposal is currently in concept phase and the REF is planned to be publicly exhibited in late 2017.

There are currently no proposals to upgrade and/or change the cycle path on the main deck of the Sydney Harbour Bridge.

## 1.3 Site constraints

There are a number of constraints that have informed the options development. These are noted below and site analysis maps are provided in Appendix A. It has been assumed that the cycleway would remain on the western side of the bridge.

### 1.3.1 Heritage and land use

There are a number of historic heritage items within the study area including the following:

- Sydney Harbour Bridge and approach viaducts, arches and bays under Warringah Freeway – listed under North Sydney LEP, State Heritage Register and National Heritage List
- Milsons Point Railway Station Group – listed under North Sydney LEP, State heritage Register and Sydney Trains s170 Heritage and Conservation Register
- Bradfield Park (including northern section) – listed under North Sydney LEP
- Milsons Point (Fitzroy Street) Underbridge – Sydney Trains s170 Heritage and Conservation Register
- Milsons Point (Lavender Street) Railway Underbridge – Sydney Trains s170 Heritage and Conservation Register
- Sydney Opera House buffer zone – Sydney Harbour Catchment REP.

Importantly, it is not only the Sydney Harbour Bridge as a physical heritage item that is valued, but also views to the iconic structure from the surrounding area that are highly valued.

Bradfield Park comprises a number of different land uses including formal gardens at the northern end, public open space in the central section which is utilised for playing fields, and the Kirribilli Markets and more informal open space south of Fitzroy Street. The Bradfield Park Community Centre is located in the central section of Bradfield Park, immediately adjacent to the Cycleway stairs.

Consultation with North Sydney Council has indicated that the open space is highly valued by both the community and Council.

Burton Street, including the area underneath the viaduct, is used for paid, timed on-street parking.

### 1.3.2 Existing topography

The current northern access to the Cycleway comprises 55 steps from Burton Street (relative level (RL) 33.57 metres) up to the Harbour Bridge deck (RL 42.54 metres). This has an approximate 1:3 gradient which presents a challenge for some cyclists, particularly for heavier electric or cargo bikes.

The existing topography in the project study area is characterised by rising ground levels to the north of Burton Street, and falling ground levels to the south of Fitzroy Street. This is a key consideration in determining the optimal location where the proposed ramp would land.

### 1.3.3 Northern Rail Line

The Northern Rail Line is located on the western side of the Sydney Harbour Bridge, adjacent to the Cycleway. All options would need to consider safety implications for the rail line. Entry to the Milsons Point train station must remain unobstructed. Further consultation will be undertaken with Sydney Trains and TfNSW during the concept design phase to establish technical requirements.

## 1.4 Purpose of this document

This report has been prepared to summarise the options development process for the Sydney Harbour Bridge Northern Cycle Ramp, and to present the preferred strategic option to the community and stakeholders for comment.





**Figure 1-1 Study area location (Source: Spackman Mossop Michaels)**



## 2. Project need

### 2.1 Background

The NSW Government has indicated it would like to see a greater number and diversity of cyclists being able to access the Cycleway. Currently, at the northern approach to the Cycleway at Milsons Point, cyclists are required to stop, dismount and wheel their bicycles up/down the Burton Street stairs which features 55 steps at approximately 1:3 gradient. This impacts on cyclists' access to the Cycleway, in particular cyclists who have lower levels of experience and fitness. For some, the steps are an inconvenience that affects their ability to use the existing cycle network, for others (such as those with less mobility or heavy electric or cargo bicycles) affects their ability to use the existing cycle network.

Anecdotal reports and observations made by the project team also indicate that a number of cyclists ride down the smooth concrete strip which runs down the centre of the stairs at approximately 1:3 gradient. This presents a safety risk for cyclists, pedestrians and motorists at the conflict point at the bottom of the stairs.

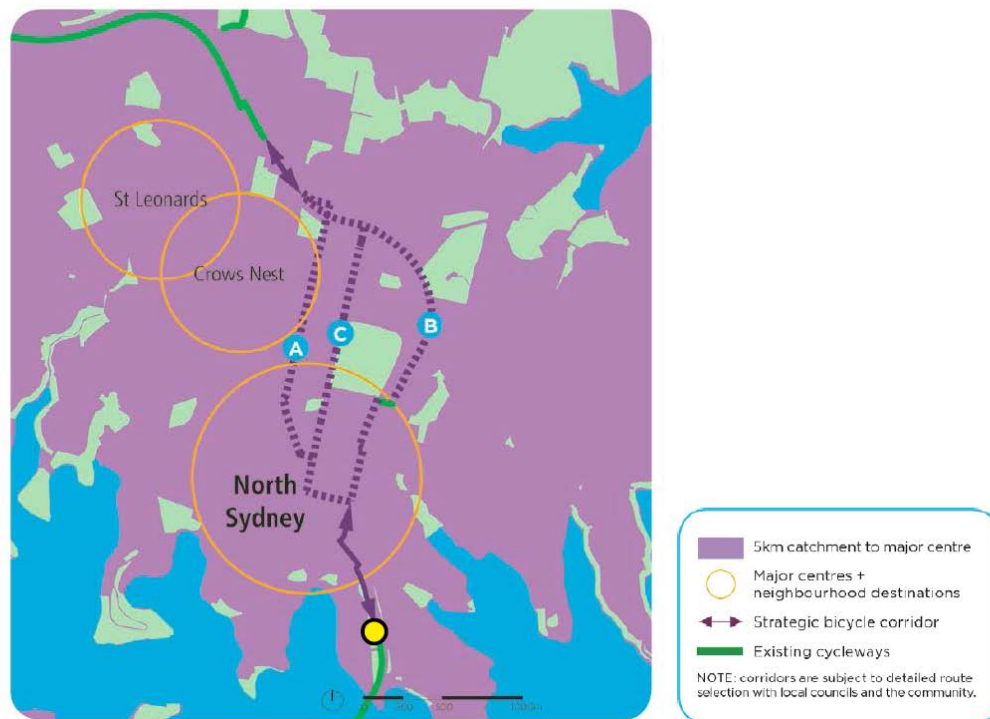
The following 'project drivers' underpinning the need for the Sydney Harbour Bridge Northern Cycle Ramp connection have been identified by key stakeholders:

- cyclists are required to stop, dismount and wheel their bicycles up and or down the Burton Street stairs which adds to journey time
- the steep gradient makes the task of carrying bicycles up and or down the stairs difficult for some cyclists
- the steps are an inconvenience for cyclists
- there are real safety concerns for cyclists, pedestrians and motorists at the conflict point at the bottom of the stairs
- stairs represent a capacity pinch point for cyclists, especially during peak hours and major events
- the stairs represent a barrier for some groups within the community and prevent some groups such as parents with child provisions attached to their bicycles from cycling across the bridge
- there is a lack of connectivity in the existing road cycleway network.

#### 2.1.1 Regional context

The northern end of the Cycleway will form an important link between the existing Cycleway and the future North Shore Link Cycleway (NSLC). The NSLC has been identified by the NSW Government as one of five priority bicycle routes in *Sydney's Cycling Future* (2013). The proposed NSLC will connect with the Cycleway and extend north towards the existing Naremburn Cycleway, thus addressing the missing link in the regional cycleway network (refer to Figure 2-1). TfNSW and Roads and Maritime are currently investigating feasibility of

route options. All options for the Sydney Harbour Bridge Northern Cycle Ramp discussed in this report would support the development of the NSLC.



**Figure 2-1 Strategic plan for the North Shore Link Cycleway (TfNSW, 2013, *Sydney's Cycling Future*)**

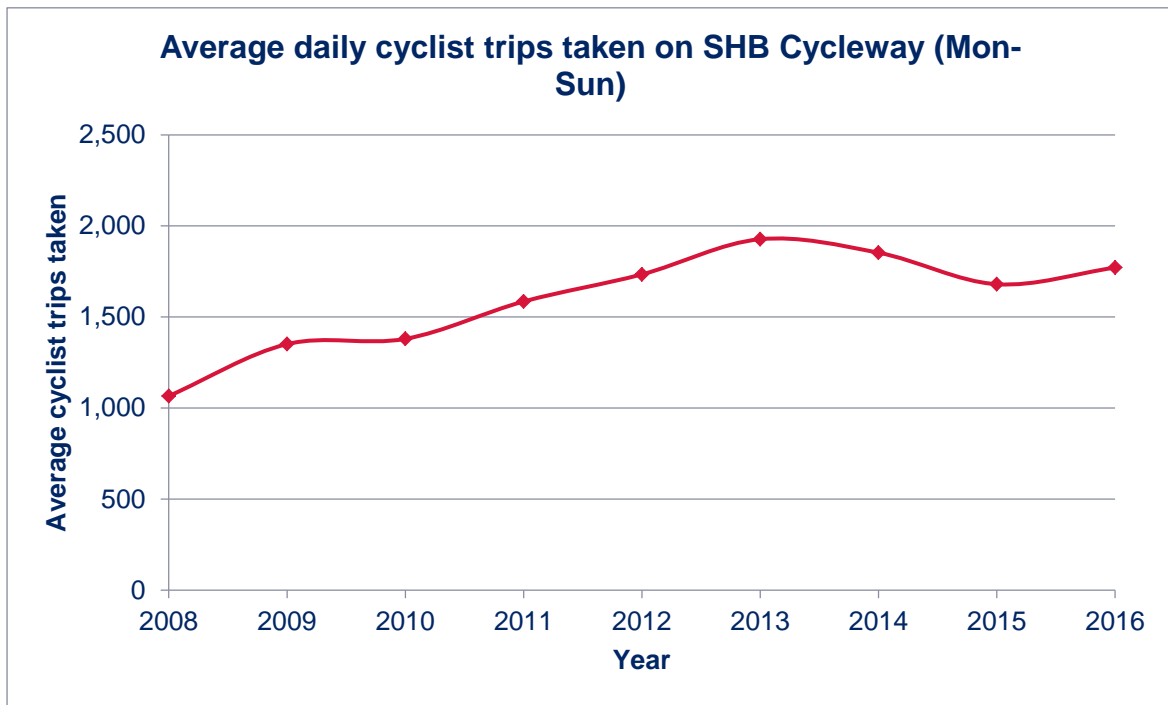
Providing step-free access at the northern end of the Cycleway would improve the efficiency on the north-south regional cycle route and encourage cycling participation in the Inner Sydney and North Shore Regional Bicycle Network.

### 2.1.2 Existing demand

*Sydney's Cycling Future* notes that since 2006 the number of people riding to work has increased by 50 per cent in metropolitan Sydney. Continuing to increase this mode share will ease pressure on the transport system. Surveys undertaken for *Sydney's Cycling Future* identified that 70 per cent of NSW residents would like to ride a bike more for everyday transport, and would do so if it was made safer and more convenient.

Cyclist trip data was collected from the Cycleway permanent counter located at the southern approach in Millers Point. Figure 2-2 shows the average number of cyclist trips taken from 2008 to 2016. The data shows that the Cycleway experienced significant growth from 2008; one major contributing factor may be the opening of the Naremburn Cycleway in 2007.

Future upgrades to the regional bicycle network in the Sydney CBD and Lower North Shore are expected to further contribute to the future demand along the Cycleway.



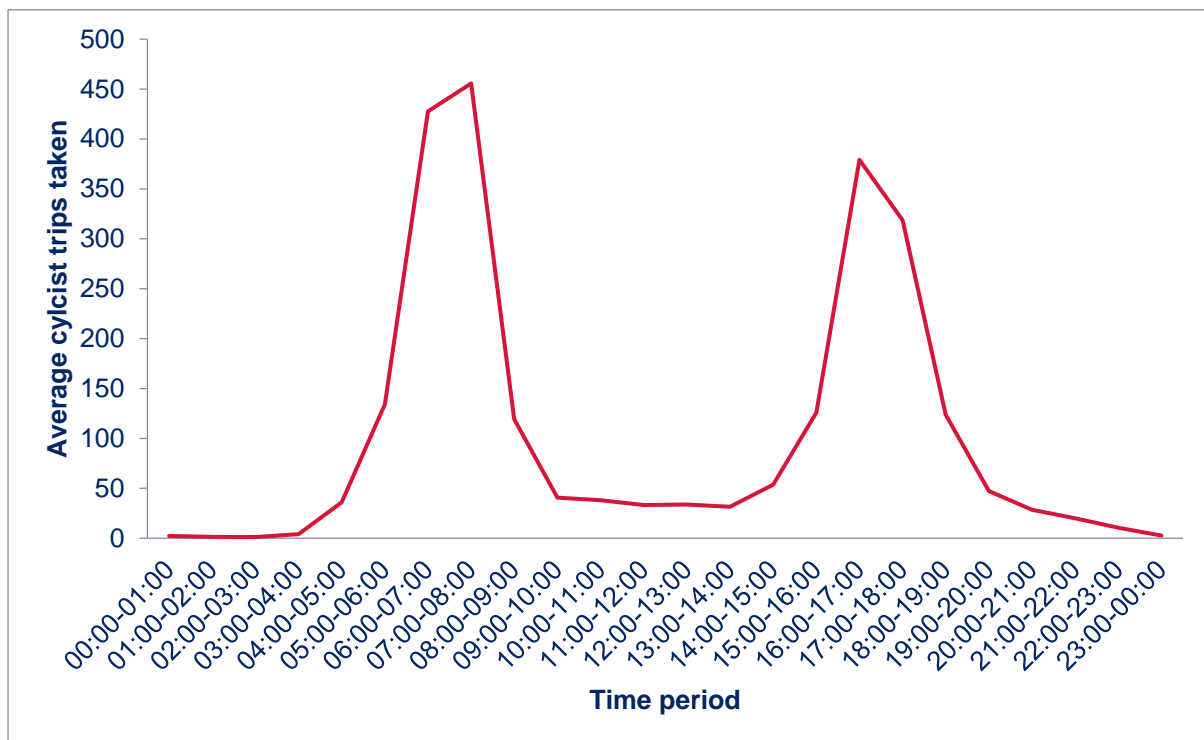
**Figure 2-2 Cyclist trip data collected from Sydney Harbour bridge permanent bicycle counter**

Cyclist intercept surveys undertaken at the northern end of the Cycleway in October 2009 found that 85.8 per cent of cyclists were male, and 14.2 per cent were female. The majority of cyclists were aged 30-49 (70.6 per cent) (SKM and Price Waterhouse Coopers, 2010).

This data suggests that certain groups such as female riders and children are underrepresented in cycling in North Sydney LGA.

The hourly profile of cyclist trips taken on the Cycleway was also captured for Tuesday-Thursday for the period of 11 November to 11 December 2014 (refer Figure 2-3). The data shows that peak demand is experienced from 6am-8am in the morning, and 4pm-6pm in the afternoon.

The data also shows that the maximum hourly volume experienced on the Cycleway during this period was 568 cyclist trips/hour in the AM (Tuesday 18 November 2014), and 473 cyclist trips/hour in the PM (Tuesday 11 November 2014).



**Figure 2-3** Average hourly profile of cyclist trips taken on Sydney Harbour Bridge Cycleway (Tuesday-Thursday, 11 November to 11 December 2014)

### 2.1.3 Sydney Harbour Bridge Cycleway southern connection

At the southern approach to the Cycleway at Millers Point, Roads and Maritime has been tasked by TfNSW to develop and deliver a dedicated cycleway connection from the Sydney Harbour Bridge Cycleway to the Kent Street Cycleway. This will alleviate the need for cyclists to share public roads and footpaths with pedestrians and motorists. The proposed upgrade will also improve grades and sight lines for cyclists and pedestrians. This proposal is currently in concept phase and the REF will be exhibited in late 2017.

## 2.2 Previous studies

A number of previous studies have been conducted to investigate options for the Cycleway, including:

- *Sydney Harbour Bridge Cycleway Feasibility* (NSW Public Works and Services, 1999) (prepared at the request of Roads and Traffic Authority).
- *Sydney Harbour Bridge Cycle Ramp Options Feasibility Study* (Government Architect's Office, 2012) (prepared at the request of Roads and Maritime Services). Refer to Appendix D

- *Evaluation of the costs and benefits to the community of financial investment in the Naremburn to Harbour Bridge Active Transport Corridor (Harbourlink)* (SKM and Price Waterhouse Coopers, 2010) (prepared at the request of North Sydney Council).

The options discussed in this report have drawn on the findings from these previous studies as well as developing new options.

In addition to these previous studies, Roads and Maritime also explored alternatives utilising an escalator or elevator to provide step-free access for cyclists. It was suggested by some stakeholders that these treatments could have a relatively smaller footprint than a cycle ramp and would potentially mitigate some impacts to heritage values and open space. A summary of the international case study options examined is provided in Appendix C. The findings of these studies were that outdoor escalators and lifts typically have high maintenance requirements and offer a low reliability of service due to the potential for shutdowns due to malfunctions. Consequently, based on these findings, escalators and lifts were not considered further for the options investigations.

## 2.3 Risks with the current situation

### 2.3.1 Access and efficiency

At the northern approach to the Cycleway at Milsons Point, cyclists are required to stop, dismount and wheel their bicycles up/down the Burton Street stairs which features 55 steps at approximately 1:3 gradient (refer Figure 2-4).<sup>1</sup> This impacts on cyclists' access to the Cycleway, in particular cyclists who have lower levels of experience and fitness. For some, the steps are an inconvenience that compromises the network, for others (such as those with less mobility or heavy electric or cargo bicycles) they are a serious limitation to their capacity to use cycling for transport and recreation.

Furthermore, an economic evaluation report for the 'HarbourLink' cycle route commissioned by North Sydney Council in 2010 assumes that the Burton Street stairs have a disutility equivalent to two minutes of travel time.

Providing step-free access would improve the efficiency on the north-south regional cycle route and encourage cycling participation in the Inner Sydney Regional Bicycle Network.

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<sup>1</sup> Photo 1: Szczepanski, Marcin (2007) "Cycleway queue" <https://flic.kr/p/3q/3qRFqz>, photo taken 16 October 2007, photo accessed 19 June 2017.

Photo 2: Rae, Peter (2007) "AM Peak hour on the cycle path on the Sydney Harbour Bridge" <http://bit.ly/2xu4J2y>, photo taken 25 September 2007, photo accessed 19 June 2017.



**Figure 2-4** Current situation at Burton Street stairs

### 2.3.2 Safety risk

Anecdotal reports and observations made by the project team also indicate that a number of cyclists ride down the smooth concrete strip which runs down the centre of the stairs at approximately 1:3 gradient (refer Figure 2-4). This presents a safety risk for cyclists, pedestrians and motorists at the conflict point at the bottom of the stairs.

### 2.3.3 Catering for future growth in cycling

Data collected from the Cycleway permanent bicycle counter indicate that from 2008 to 2016, cyclist volumes have increased by 66 per cent. Future upgrades to the regional bicycle network in the CBD and Lower North Shore will further contribute to the future demand along the Cycleway.

## 2.4 Project objectives

As described above, the project will form an important link between the existing Cycleway and the future North Shore Link Cycleway, one of five priority bicycle routes in *Sydney's Cycling Future* (2013).

The specific project objectives are to:

- improve access to the Sydney Harbour Bridge Cycleway
- improve efficiency on the Sydney Harbour Bridge Cycleway



- improve safety for cyclists, pedestrians and motorists
- support future growth in cyclists travelling between the Sydney CBD and the Lower North Shore
- provide a cycleway facility that sensitively fits in with the:
  - context of the location including the potential visibility of the structure
  - heritage values of the area
  - architectural qualities of the Sydney Harbour Bridge.

In fulfilling the above objectives, the project would also aim to:

- minimise impacts to the natural and built environment
- minimise impacts to the community
- deliver a cost-effective solution.

## 2.5 Design parameters

A number of design parameters were established (refer *Table 2-1*) to inform the options development, based on *Austroads – Guide to Road Design Part 6A: Paths for Walking and Cycling* (2017).

**Table 2-1**      **Design parameters**

Parameter	Description
Use of the proposed facility	Bicycle use only; pedestrians are not permitted to access the Cycleway on the western side of the bridge. A separate pedestrian path is provided on the eastern side of the bridge.
Minimum radii of horizontal curves	25 m without superelevation, 22 m with max. 4% superelevation.
Width of cycleway access ramp	1.5 m effective width (clear from barriers and edges) for each direction. 3.0 m minimum overall.  It is noted that the existing cycle path width on the bridge is 2.5 m.
Maximum gradient	For ease of uphill travel a maximum gradient of 3% without providing short flatter sections is desirable.  In cases where 3% cannot not be achieved, a maximum acceptable 5% gradient for a maximum length of 100 m with short flatter sections of min. 20 m long at regular intervals is required.  Steeper gradients are possible by proportionally shortening the length.

## 3. Strategic context

### 3.1 NSW Long Term Transport Master Plan

The *NSW Long Term Transport Master Plan* (Transport Master Plan) (Transport for NSW, 2012) establishes the framework to deliver an integrated, modern transport system by identifying NSW's transport actions and investment priorities over a 20 year period. Its objectives focus on improving liveability and supporting economic growth and productivity. These objectives are to be facilitated by the provision of a transport network which reduces journey times, improves connectivity, increases efficiency and provides services that support job growth in centres close to where people live.

The Transport Master Plan provides actions to improve the NSW transport system and sets out the following five key measures related to cycling:

- improved access to user-friendly bike trip information
- a long term NSW Cycling Investment Program to improve the planning, management and delivery of cycleway capital programs, supported by design solutions and standards to reflect customer needs
- a program to increase and improve bike parking at public transport interchanges
- a connected cycling network that targets investment in clearly defined cycleways within a five kilometre radius of major urban centres in the short term and 10 kilometre radius of centres in the longer term
- enhanced cycling routes in regional centres to increase the number of people who cycle.

The proposal is justified in its nature to provide better cycling infrastructure, as a part of the 'Unclogging the Sydney CBD' initiative. The Transport Master Plan acknowledges the increase in cyclists who use the Harbour Bridge and the growing rate of cycling within Sydney. Through the provision of infrastructure, a connected network of cycleways would improve safety and access for cyclists traveling in Sydney.

### 3.2 Sydney's Cycling Future

*Sydney's Cycling Future, Cycling for everyday transport* (Transport for NSW, 2013) aims to provide safe, convenient and enjoyable transport options for Sydney. This initiative supports the need to prioritise investment in state priority corridors to encourage more people to ride bicycles. The aims of *Sydney's Cycling Future* include:

- investing in separated cycleways and providing connected bicycle networks to major centres and transport interchanges
- promoting better use of the existing network



- engaging with partners across government, councils, developers and bicycle users.

The NSW Government has recognised the proposal area as a key route within the greater Sydney cycle network, and the need to provide better connectivity to the CBD in this area. The North Shore Link Cycleway (NSLC) has been identified as a priority cycleway to connect the Lower North Shore to the Sydney CBD. Provision of a new ramp at the northern end of the Sydney Harbour Bridge to provide a connection with the future NSLC would be consistent with the aims of *Sydney's Cycling Future*, providing a better, safer link that is attractive for a wider range of users.

### 3.3 North Sydney Integrated Cycling Strategy

North Sydney Council has developed the *North Sydney Integrated Cycling Strategy* (Integrated Cycling Strategy) to promote cycling as a sustainable transport option (GTA Consultants, 2013). The Integrated Cycling Strategy identifies the key issues within North Sydney and goals that can improve the overall cycling network.

The goals of the Integrated Cycling Strategy include:

- deliver an accessible, safe and connected cycle network by 2020
- make cycling an attractive choice for short trips within the LGA
- increase and diversify participation in cycling (people of all ages and abilities will view cycling as a safe, everyday transport option).

Primary issues with the existing network that were identified from consultation activities conducted by North Sydney Council included:

- the cycling network in the North Sydney LGA is disconnected and has significant gaps and difficult sections
- the steps to the Cycleway are a barrier to cycling
- current bicycle route signage is inconsistent and insufficient
- there are insufficient bicycle parking facilities to cope with current demand or to encourage more cycling.

The Strategy recognises that the 55 steps at the northern end to the Cycleway limit the accessibility of the network for a variety of users.

The Strategy also identifies that the northern end of the Cycleway will form a link between the cycleway and the following two priority routes in the region:

- Route 1: Sydney Harbour Bridge to Cammeray (also referred to as North Shore Link Cycleway)
- Route 3: Sydney Harbour Bridge to Neutral Bay. This route is currently being developed by North Sydney Council and construction is expected to commence in 2018.

The proposal seeks to mitigate the lack of connectivity and access through the provision of a new cycle ramp that removes the need for cyclists to negotiate the 55 steps at Burton Street.

The proposal would improve the connection from North Sydney to the Cycleway and would provide safe, easy access for a wider array of users than are currently catered for.

### 3.4 NSW Premier's Priorities

To set the agenda for the NSW Government over the coming years, State Priorities were developed in September 2015. These priorities were developed to achieve the following outcomes across NSW:

- grow the economy
- deliver infrastructure
- protect the vulnerable
- improve health, education and public services.

Twelve Premier's priorities and 18 State priorities were developed. Specific priorities related to this proposal include building infrastructure and improving road travel reliability; comment on these is provided below.

#### ***Building infrastructure***

Building infrastructure is a key priority for the NSW Government to respond to Sydney's growing population. This priority was developed with the incentive to maintain liveable communities that are well connected by reliable and efficient transport infrastructure.

The proposal aims to install a cycle ramp that meets current gradient and safety standards at the northern end of the Cycleway to improve connectivity and access through the provision of new infrastructure. The proposal is considered to be consistent with this priority.

#### ***Improving road travel reliability***

This priority was developed to improve existing road infrastructure, develop infrastructure to address capacity issues and encourage the use of public and active transport.

This proposal aims to encourage the use of active transport through the provision of a new cycle ramp. The proposal is considered to be consistent with this priority.

### 3.5 State Infrastructure Strategy 2012-2032 and 2014 update

A 20-year strategy was developed by Infrastructure NSW known as the *NSW State Infrastructure Strategy 2012-2032* (State Infrastructure Strategy). The purpose of the State Infrastructure Strategy is to enhance productivity and growth through the delivery of critical public infrastructure. The State Infrastructure Strategy focuses on the strategic investments and reforms that Infrastructure NSW has assessed as being likely to have most impact over the next 20 years. Recognised as a global city, Sydney has been identified as the key route to the success of NSW through use of the State Infrastructure Strategy. It identifies the need

to make Sydney an attractive urban environment, with world class transport networks in a heavily populated, geographically constrained area.

The proposal is consistent with the objectives of the State Infrastructure Strategy, as it addresses connectivity improvement issues that would meet the infrastructure needs within the study area.

### 3.6 A Plan for Growing Sydney

*A Plan for Growing Sydney* is the NSW Government's plan for the future of the Sydney Metropolitan Area over the 20 year period commencing in late 2014. It provides key directions and actions to guide Sydney's productivity, environmental management, and liveability, including the delivery of housing, employment, infrastructure and open space.

The Plan identifies the need to revitalise existing suburbs by providing more social infrastructure and improve transport functions in response to growth. The Plan also emphasises the need to provide joint capital works including cycle paths around Sydney Harbour. Through the provision of separated and safe active transport facilities, healthy built environments can encourage healthy communities.

The study area falls within the Global Sydney Region of the Plan. As a strategic centre, improving walking and cycling connections between Global Sydney Precincts and the surrounding area is a priority. Improving access through provision of a cycle ramp would support greater and more efficient connectivity.

### 3.7 Towards Our Greater Sydney 2056

In November 2016, the Greater Sydney Commission developed a draft amendment to update *A Plan for Growing Sydney* known as *Towards Our Greater Sydney 2056*. This was developed to provide a nexus between current and future regional plans, encompassing a 40-year vision. *Towards Our Greater Sydney 2056* focuses on productivity, liveability and sustainability. The proposal is consistent with these focus areas.

*Towards Our Greater Sydney 2056* is supported by District Plans (in draft form at the time of preparation of this report. Two of these, Central District and North District, are relevant to the proposal. Comment on these is provided as follows.

#### ***Draft Central District Plan***

The Draft Central District Plan encompasses nine LGAs within central Sydney, including the City of Sydney. The Plan identifies the need to improve the cycle network through the introduction of initiatives to reduce car ownership as a means of reducing traffic congestion. The northern approach of the Harbour Bridge has been confirmed as part of the Principal Bicycle Network Route. Better access to the northern and southern approaches has been identified as a key element in improving connectivity across the network. The proposal would support improved connectivity.

### ***Draft North District Plan***

North Sydney forms part of the North District, and is included in the Draft North District Plan. The Plan outlines the planning priorities for the District and the actions required in achieving them. One priority for the North District is the enhancement of walking and cycling connections from North Sydney to the Sydney CBD. The proposal would support achievement of this priority.

## 4. Consultation

The most recent round of consultation with key stakeholders commenced in 2015 and has continued throughout the strategic design development. These stakeholders include:

- Office of Environment and Heritage
- Department of the Environment and Energy
- North Sydney Council
- Sydney Trains (Heritage Group and External Interface)
- Bicycle user groups: Bicycle NSW, Bike North, Bicycle Network
- Roads and Maritime Asset Management
- Roads and Maritime Critical Infrastructure and Security
- TfNSW Active Transport Planning
- Roads and Maritime Network Sydney.

Key issues that have been raised include:

- impacts on the community facilities and open space in Bradfield Park
- connectivity with the existing and future cycle network
- preference for more direct alignments expressed by bicycle advocacy groups
- impacts on the heritage values of the area.

Feedback from the ongoing consultation with key stakeholders has informed the development of the options examined in this report, including investigations into alternative options such as lifts or elevators.

A Value Management (VM) workshop was held on 23 June 2017 with representatives in attendance from key stakeholders. Further details on the workshop are provided in Section 6.1.

## 5. Description of options

Mott MacDonald (civil and structural design), Spackman Mossop Michaels (urban design), and Tonkin Zulaikha Greer (architectural design) were engaged by Roads and Maritime to develop a range of options for a cycle ramp that would connect the northern end of the Cycleway (at the top of the steps) to the existing shared path on the eastern side of Alfred Street South.

Alignment options were considered first and then structural types were examined.

Seven alignment options were considered initially, however four of these did not meet the geometric requirements outlined in Section 2.5 and were therefore not considered further. The three alignment options that were developed further are listed below and described in further detail in Section 5.1:

- **Option 1:** Ramp starting at the top of the stairs and finishing in Bradfield Park North. The proposed ramp would be constructed within the existing stairwell, and would stay close to the existing approach wall. Maximum gradient of four per cent for 22.5 metres, total length would be about 210 metres
- **Option 2:** Similar to Option 1, however the proposed ramp would connect to the Cycleway by breaking through the existing parapet wall, avoiding impact on the stairs. Option 2 is further offset from the existing approach wall compared to Option 1. Maximum gradient of four per cent for 22.5 metres, total length would be about 210 metres
- **Option 3:** Spiral ramp starting from the bridge deck north of Fitzroy Street and finishing south of Burton Street. Maximum gradient of five per cent for 100 metres, total length would be about 290 metres.

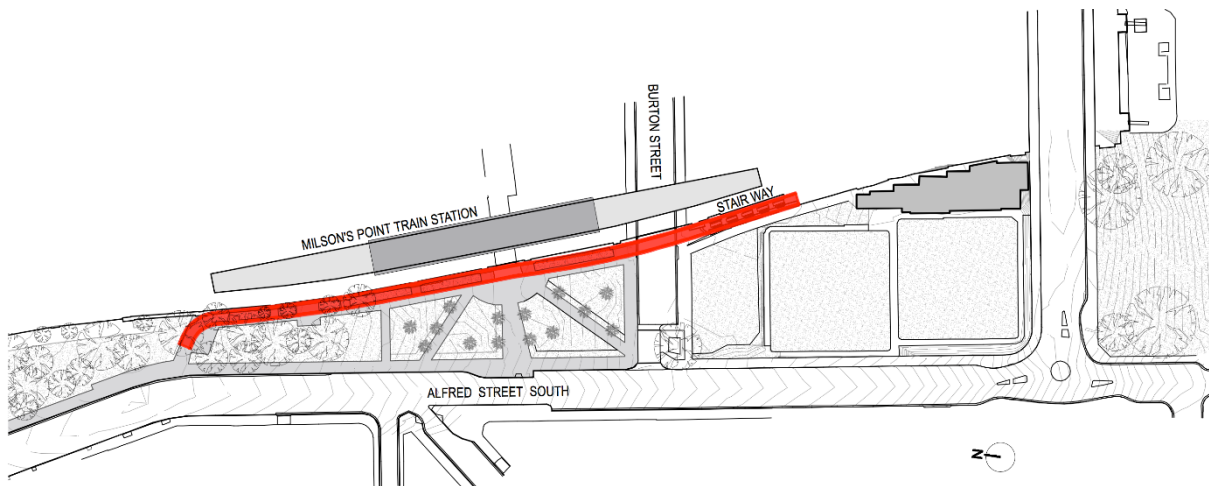
### 5.1 Alignment options

#### 5.1.1 Option 1

This would comprise a new cycle ramp from the top of the existing stairs and extending down to Bradfield Park, with the ramp supported on columns. The new ramp would commence at the top of the existing stairs and would continue over the full width of the stairwell (thereby making the existing stairs redundant). The general arrangement of this option is shown in Figure 5-1<sup>2</sup>. An indicative photomontage is provided in Appendix B, Figure B1.

---

<sup>2</sup> Design levels where shown on figures are subject to confirmation.



**Figure 5-1 Alignment Option 1 – Adjacent alignment abutting western bridge approach wall (Source: Spackman Mossop Michaels)**

The ramp would take cyclists from the bridge deck level (RL 42.500) across the Burton Street arch and the Milsons Point station entry, and then down to the existing park (RL 38.600). The ramp would stay at the level of the parapet until just north of the station entrance and only then would ramp down.

The principal advantages of this option are:

- very straight connection at the bridge with no chicane or intersection(s)
- avoids impact on bridge parapet
- when compared with Options 2 and 3, having the least amount of intrusion into the park.

The principal disadvantages of this option are:

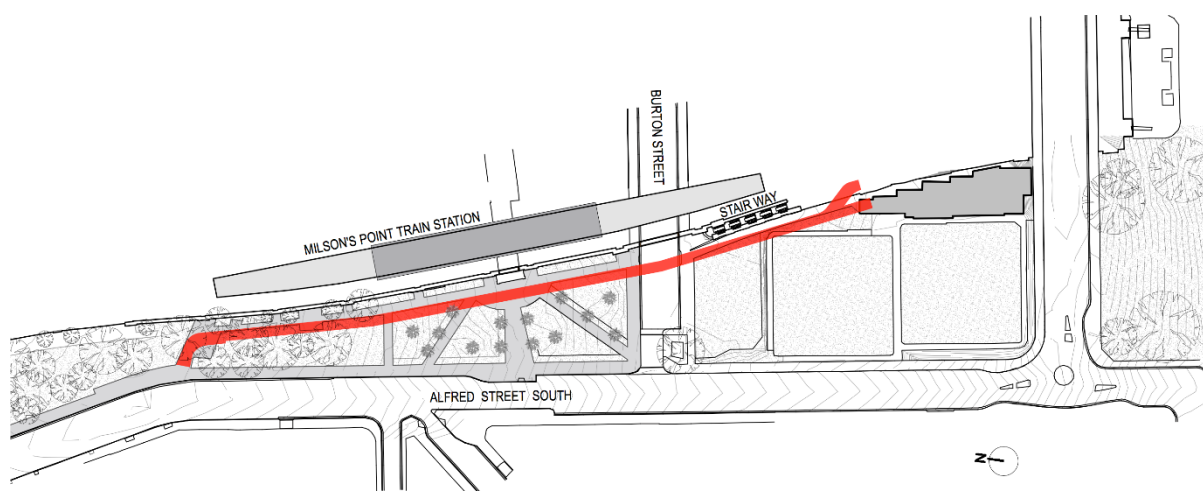
- would involve removal of the existing staircase; this would require provision of an alternative temporary access to the Cycleway during construction to minimise disruption to cyclists.
- the close proximity of the new ramp to the bridge approach wall (and railway line) may present some constructability issues such as working in close proximity to a live rail line
- impacts on plantings adjacent to the bridge approach wall at the northern end of the ramp
- piers for the cycle ramp would be located within the existing pedestrian footpath adjacent to the bridge approach wall; relocation of the pathway may be required
- loss of the direct connection to Burton Street; (about 20 per cent of cyclists using the stairs travel along Burton Street and would need to double back from the ramp landing)
- potential intrusion into the bridge footings (extent currently unknown)
- the rendered parapet façade would be masked by the new ramp



- the ramp would permanently overshadow the western entrance to Milsons Point Station and the western side of the Burton Street arch.

## 5.1.2 Option 2

This option would comprise a ramp supported on columns parallel to the western bridge approach wall through the park. As previously noted, this option is very similar to Option 1, the principal difference being the ramp would be offset from the bridge approach wall (refer Figure 5-2).



**Figure 5-2 Alignment Option 2 – Adjacent alignment offset from western bridge approach wall (Source: Spackman Mossop Michaels)**

The ramp would commence just to the south of the top of the existing stairs and would take cyclists from the bridge deck level (RL 42.500) down to the park (RL 38.600) running parallel to the bridge approach wall. The ramp would stay at the level of the parapet wall until north of the station entrance at which point it would then ramp down to the park level. With the exception of where the ramp meets the bridge approach wall, it would be supported on free standing columns generally positioned above the existing pedestrian path (within the park). The existing path would be required to be relocated where the height of the ramp drops below three metres at the northern end of the park.

The principal advantages of this option are:

- avoids impacting on the existing stairs, both during and post-construction
- avoids direct impact on the bridge approach wall and the associated heritage values
- the works would minimise permanent and/or irreversible physical alteration to the heritage fabric of the bridge and its approaches
- the separation distance from the railway infrastructure would avoid the need for throw screens and the visual impacts associated with these
- less impact on trees in the park than Option 1



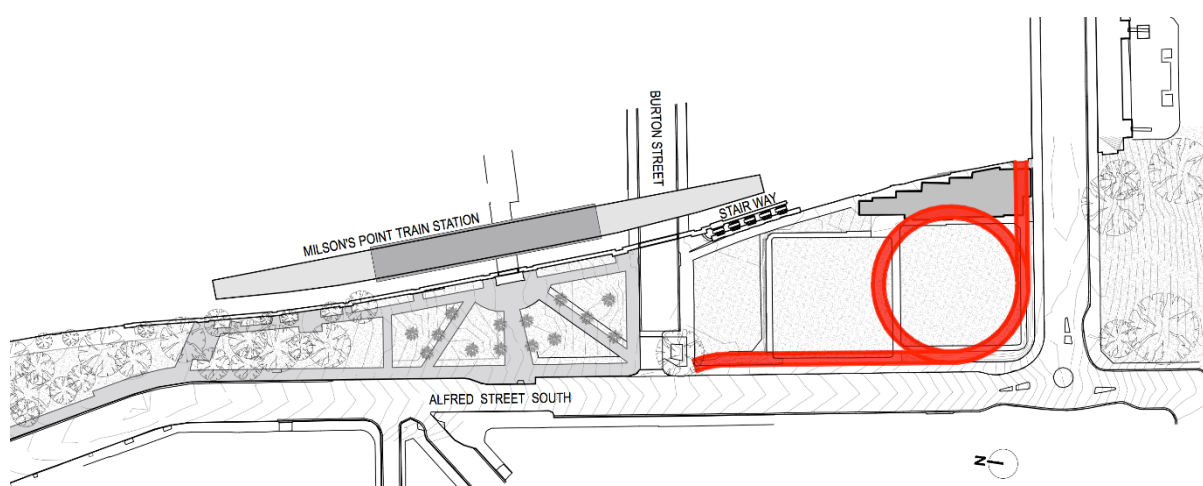
- would allow natural light to continue to fall onto the bridge approach wall, minimising shadowing, particularly at the western entrance to Milsons Point Station and the western side of the Burton Street arch
- continued exposure would allow a rate of weathering generally consistent with other sections of the bridge approach wall thereby maintaining a consistent appearance along the wall
- construction could occur largely offline allowing the existing stairs to remain open and minimising disruption to cyclists accessing the Cycleway.

The principal disadvantages of this option are:

- it would intrude further into the park than Option 1
- it would have a visual impact on the architectural geometry around the Milsons Point Station entrance, including the historic radial pattern
- requires a chicane at the bridge connection, which would impact on rider behaviour
- it would cut into the bridge parapet (similar to proposed lifts on the other side of the bridge).

### 5.1.3 Option 3

This option comprises a ramp connecting to the bridge at a point just north of Fitzroy Street that would take cyclists, via a full circle/loop down to a landing point near the corner of Burton Street and Alfred Street South (refer Figure 5-3). An indicative photomontage is provided in Appendix B, Figure B2.



**Figure 5-3 Alignment Option 3 – Separated alignment incorporating spiral ramp (Source: Spackman Mossop Michaels)**

The ramp would connect to the bridge at right angles requiring a 90 degree turn by cyclists transitioning to/from the bridge cycleway to the ramp. The section of ramp from the bridge would pass across the frontage of the Bradfield Park Community Centre before turning in a

full 360 degree loop to then ramp down to the landing point at the corner of Burton Street and Alfred Street South.

The loop section of the ramp would pass over part of the community centre and over both bowling greens.

The principal advantages of this option are:

- there would not be any impact on Milsons Point train station
- there would not be any impact on the open space north of Burton Street
- with the exception of where it would connect to the bridge, the ramp would be outside the Sydney Harbour Bridge state and national heritage curtilages
- provides a more logical connection to Route 3 (refer Section 2.1.2)
- allows retention of the existing stairs.

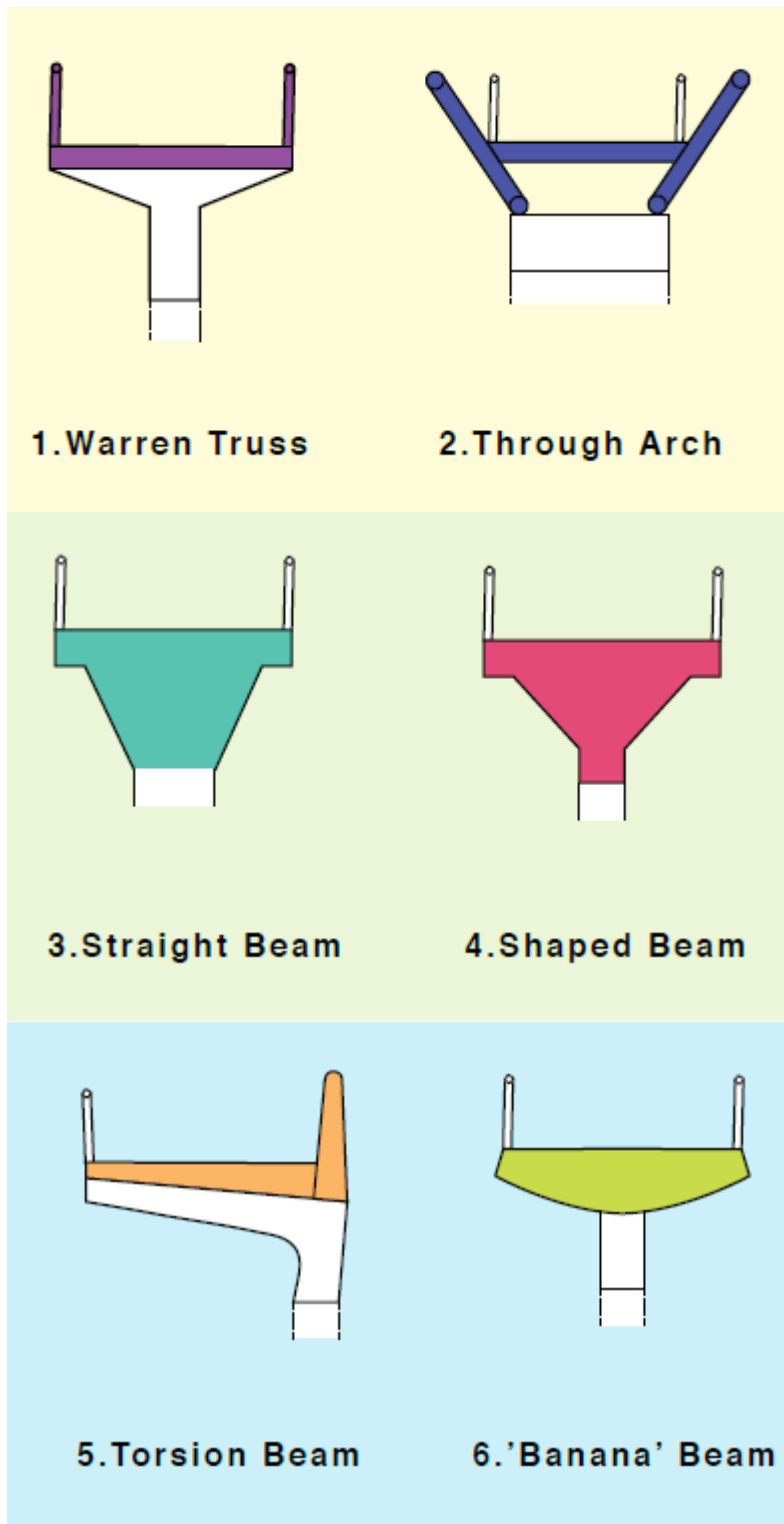
The principal disadvantages of this option are:

- introduction of a very prominent structure into the local landscape which would arguably have a major impact on a significant view to the harbour
- reduced utility of use of the public open spaces in Bradfield Park Central
- it would impact on the footpath on Alfred Street South with potential for conflicts between cyclists and pedestrians at the northern end of the ramp
- potential to impact on a significant fig tree at the corner of Burton Street and Alfred Street South
- creates a much longer travel distance for cyclists, which may be in conflict with the project objective of improving efficiency on the Cycleway
- disruption to Fitzroy Street during construction
- impedes the use and future redevelopment of Bradfield Park Central including the community centre site.

## 5.2 Structural form options

A range of structural form options were developed to facilitate better understanding of the potential visual impact of the structure. The cross sections of the structural form options are shown in Figure 5-4. Indicative photomontages of these structural options are provided in Appendix B.

All the structural options identified are compatible with alignment Options 1 and 2. Some options, such as the Warren Truss, are not fully compatible with Option 3, for example due to the incorporation of a full 360 degree loop within the ramp.



**Figure 5-4 Structural form options – cross sections**

### 5.3 ‘Do nothing’ option (base case)

The shortcomings of the existing Cycleway northern connection have been recognised for some time, dating back as early as 1999 as documented in the *Sydney Harbor Bridge Cycleway Feasibility Study* prepared by NSW Public Works and Services for the then Roads and Traffic Authority.

The ‘do nothing’ option would result in continuation of the identified shortcomings for cyclist access and amenity at the northern end of the Sydney Harbour Bridge, the principal ones being:

- the requirement for cyclists to dismount and climb up 55 steps to access the Cycleway at bridge level, with a consequent impact on amenity and travel times
- related to the above point, particular inconvenience for cyclists with reduced mobility or for cyclists with heavy electric or cargo bicycles
- safety issues associated with some cyclists using the central concrete strip to descend (without dismounting) to the Burton Street level.

From a broader transport planning strategy perspective, the ‘do nothing’ option would:

- not address the existing identified discontinuity in the strategic cycle network between the Sydney Harbour Bridge and the future North Shore Link Cycleway identified in *Sydney’s Cycling Future* (Transport for NSW, 2013)
- not address key issues identified in North Sydney Council’s Integrated Cycling Strategy regarding significant gaps and barriers to cycling within the North Sydney LGA network.

The ‘do nothing’ option would not deliver a satisfactory outcome both in regard to amenable access to and from the Cycleway and more broadly in terms of functionality of the wider cycle network. Reference to this option has been included in this report for the sake of completeness but no further consideration of it will be provided.

## 6. Evaluation of options

### 6.1 Value management / Options evaluation workshop

The Australian Centre for Value Management (ACVM) was engaged to facilitate and report on the value management (VM) workshop held on Friday, 23 June 2017.

The objectives of the workshop were to:

- develop an understanding of the project need and options development process undertaken to date
- evaluate the three alignment options
- select and recommend a preferred alignment option that would be progressed for further investigation and concept design
- recommend a shortlist of structural form options for further investigation.

Workshop participants undertook the following activities:

- identification of project-related 'givens' and features or characteristics of the project that were considered to be important
- agreeing to and weighting of the assessment criteria under four key categories
- undertake relative assessment criteria weighting based on a paired comparison assessment process
- identify the principal advantages and disadvantages of each option
- evaluate the relative performance of each option against the weighted criteria.

The assessments were then converted to a numerical score and compared to a strategic capital cost assessment.

This section provides an overview of the VM workshop process and outcomes. A fuller account is provided in the separate VM report *Sydney Harbour Bridge – Northern Cycleway Project* (Roads and Maritime Services, 2017).

### 6.2 Evaluation criteria for alignment options

The workshop participants agreed to employ a 'silo' or category approach for criteria selection and option assessment. The agreed categories/silos comprised:

- functionality (cyclist accessibility, efficiency, safety and amenity)
- heritage (fabric and visual impacts)
- environment (community, natural and built environment)

- constructability.

Prior to the workshop, draft criteria were identified and listed for discussion under the identified categories. Prior to accepting a criterion, participants were required to satisfy themselves that:

- the criterion was discrete, i.e. the intent had not been double counted
- the criterion would allow meaningful differentiation between options.

Capital cost estimates were separated from the criteria assessment, but introduced as separate information to guide further decision making.

The criteria identified and agreed to by participants under the respective categories are reproduced below.

### ***Functionality (cyclist accessibility, efficiency, safety and amenity)***

- provide a comfortable transition to the existing Cycleway that caters for people of various ages and cycling abilities
- avoid potential for conflict with pedestrians and cars
- provide an efficient alignment in terms of distance travelled and direction of travel for cyclists
- enable flexibility for future extensions to the cycle network
- safe alignment for users
- design an alignment that would minimise risks to critical infrastructure.

### ***Heritage (fabric and visual impacts)***

- minimise the adverse visual and physical impacts on the significance of Sydney Harbour Bridge
- minimise adverse visual and physical impacts on the significance of the Sydney Harbour Bridge approaches
- minimise the adverse visual and physical impacts on the significance of Bradfield Park
- minimise the adverse visual and physical impacts on the significance of Milsons Point station.

### ***Environment (community, natural and built environment)***

- maintain access for pedestrians, cyclists and vehicles for the study area
- retain the existing Bradfield Park Community Centre building
- avoid impacts on a range of recreational activities that occur within Bradfield Park and the local environment
- minimise the intrusion of new infrastructure into Bradfield Park.

### ***Constructability***

- maintain cycle access during construction
- limit disruption to all other public access through the area during construction
- maximise ease of construction and installation
- minimise the risk of damage to Sydney Harbour Bridge and other heritage items during construction.

Relative weighting of the evaluation criteria within each category was completed by participants using a paired comparison approach. This process involved assessing the relative importance of the respective criteria by comparing each criterion to every other criterion to determine which one is collectively viewed as being the most important. If the group was unable to differentiate between the two criteria under consideration they were given equal weighting.

## **6.3 Evaluation criteria for structural form options**

Separate to the consideration of the alignment, workshop participants were requested to identify assessment criteria for the structural options. These are listed as follows, grouped under built outcomes and constructability.

### ***Built outcomes***

- minimise visual and physical intrusion
- maximise user comfort and safety
- maximise potential to integrate utilitarian functions
- design the cycleway structure to be a contemporary design which does not mimic adjacent heritage items
- ensure that the heritage elements in the area have precedence and that the new structures do not visually dominate those elements.
- refined and elegant detailing
- materials are robust and durable
- minimises maintenance requirements.

### ***Constructability***

- standard construction methods and materials
- ease of construction and installation
- minimise the risk of damage to the Sydney Harbour Bridge and other heritage items during construction.

## **6.4 Summary of evaluation of options**

### 6.4.1 Alignment

Participants evaluated the options using the weighted assessment criteria in each of the four categories as discussed in Section 6.2. The options were judged on a qualitative basis of how well each alignment option met each category's assessment criteria on a scale of 5 (excellent) to 1 (low). Once the qualitative evaluation was completed, the evaluation was scored using the weightings of the criteria and a ranking was established for each option within that category.

A summary of the options rankings against the various assessment categories is provided in *Table 6-1*. Comparative information is also provided on the order of capital costs for the options. The order of capital costs for each option is relative to the lowest cost option (Options 1 and 2).

**Table 6-1** *Ranking of alignment options against evaluation criteria categories*

Option	Functionality	Heritage	Environment	Constructability	Cost
1	1	2	2	3	1
2	1	1	1	2	1
3	3	3	3	1	1.2

### 6.4.2 Structural form

The project team assessed the six structural form options with reference to the criteria identified in Section 6.3. The results of the assessment are summarised in *Table 6-2*. Options which meet the criterion are marked with a tick (✓).

**Table 6-2** *Summary of assessment of structural form options*

Assessment criterion	Warren Truss	Through Arch	Straight Beam	Shaped Beam	Torsion Beam	Banana Beam
<b>Built outcomes</b>						
Minimise visual and physical intrusion					✓	✓
Maximise user comfort and safety	✓	✓	✓	✓		
Maximise the potential to integrate utilitarian functions			✓	✓	✓	✓
Design the cycleway structure to be a contemporary design				✓	✓	✓



Assessment criterion	Warren Truss	Through Arch	Straight Beam	Shaped Beam	Torsion Beam	Banana Beam
which does not mimic adjacent heritage items						
Ensure that the heritage elements in the area have precedence and that the new structures do not visually dominate these elements					✓	✓
Refined and elegant detailing		✓			✓	✓
Materials are robust and durable	✓	✓	✓	✓	✓	✓
Minimises maintenance requirements			✓	✓	✓	✓
<b>Constructability</b>						
Standard construction methods and materials			✓	✓		✓
Ease of construction and installation			✓	✓	✓	✓
Minimise the risk of damage to the Sydney Harbour Bridge and other heritage items during construction	✓		✓	✓	✓	✓

## 7. Preferred option

### 7.1 Alignment

As a final review, workshop participants were requested to reflect on the analysis and their inherent knowledge of the options and, where possible, offer a recommendation as to which alignment option should be progressed for further development. The participants unanimously recommended that Option 2 be taken forward for further consideration.

Option 2 was identified as the preferred option on the following grounds:

- it offers the best value-for-money outcome based on the assessment criteria
- achieves the best outcomes on balance when assessed against the criteria
- would minimise disruption to the Cycleway during construction
- is the option that would have the most likely chance of gaining heritage and environmental approval.

The above recommendation is subject to:

- resolution of design issues that may arise during concept development
- ongoing consultation with Sydney Trains and key stakeholder agencies.

### 7.2 Structure

The outcome of the assessment of the structural options was a recommendation to progress the following options for further investigation and development:

- Shaped beam (Option 4)
- Torsion beam (Option 5)
- Banana beam (Option 6).

Indicative three dimensional forms for these three options are shown in the photomontages provided in Appendix B, Figures B7, B8 and B9.

It was suggested that there would be merit in presenting the three potential options to the Heritage Council for initial feedback. Roads and Maritime will liaise with the Office of Environment and Heritage to organise appropriate presentation.

## 8. Summary

The Sydney Harbour Bridge Cycleway is the most heavily used cycleway in the Sydney metropolitan area with on average some 2000 daily cyclist trips taken on weekdays. At the northern end of the Cycleway, cyclists are required to stop, dismount and negotiate 55 steps before continuing their journey. For some, the steps are an inconvenience that affects their ability to use the existing cycle network, for others (such as those with less mobility, or heavy electric or cargo bicycles) the current steps restrict their ability to use their bike for transport and recreation. These issues adversely affect cycling amenity and travel times.

The existing steps would not deliver a satisfactory outcome both in regards to amenable access to and from the Cycleway and more broadly in terms of functionality of the wider cycle network.

Since 2015, Roads and Maritime has been investigating the access issues at this location in detail. This has involved a detailed site analysis to identify constraints and values associated with both the immediately affected allocation and the broader locality, consultation with key stakeholders to support the site analysis and to inform identification and development of practicable options, and extensive investigation and testing of options that would address the identified performance criteria for improved access.

A range of alignment options have been identified and developed to varying degrees culminating in three options that have been subject to critical assessment through a Value Management (VM) process involving a diverse range of stakeholders. This identified the option comprising a ramp supported on columns parallel to the western bridge approach wall through Bradfield Park (Option 2) as the preferred option.

Stakeholders involved in the VM process have also examined six structural form options and identified three for further investigation and development; these structural form options are compatible with the preferred alignment option.

### ***Next steps***

Activities associated with further development of the project include the following:

- further investigation and development of the three structural form options in the context of the preferred option
- public exhibition of this Options Report (November 2017)
- public exhibition of the REF for the Sydney Harbour Bridge Northern Cycle Ramp (late 2018).

## 9. References

Austroroads (2017) *Guide to Road Design Part 6A: Paths for Walking and Cycling*

Government Architect's Office (2012) *Sydney Harbour Bridge Cycle Ramp Options Feasibility Study*, report prepared for Roads and Maritime Services, October 2012, Sydney.

Greater Sydney Commission (2014) *Towards Our Greater Sydney 2056* (A draft amendment to update A Plan for Growing Sydney), December 2014.

GTA consultants (2014) *North Sydney Integrated Cycling Strategy*, report prepared for North Sydney Council, June 2014, North Sydney.

Infrastructures NSW (2011) *NSW State Infrastructure Strategy 2012-2032*.

NSW Planning and Environment (2014) *A Plan for Growing Sydney*, report prepared for NSW Government, December 2014, Sydney.

NSW Public Works and Services (1999) *Sydney Harbour Bridge Cycleway Feasibility*, report prepared by Heritage Group, DPWS for Roads and Traffic Authority, March 1999, Sydney.

SKM and Price Waterhouse Coopers (2010) *Evaluation of the costs and benefits to the community of financial investment in the Naremburn to Harbour Bridge Active Transport Corridor (Harbourlink)*.

Transport for NSW (2012) *NSW Long Term Transport Master Plan*, report prepared for State of New South Wales, December 2013, Sydney.

Transport for NSW (2013) *Sydney's Cycling Future, Cycling for everyday transport*, report prepared for State of New South Wales, December 2013, Sydney.

## **Appendix A – Site analysis**

# Appendix A

## Site Constraints



# contents

1. Cycle network
2. Heritage setting
3. Heritage listings
4. Pedestrian and cycle access and circulation
5. Bradfield Park site analysis
6. Topography and levels





01

**Figure A1: Cycle Network**





**Figure A2: Heritage Setting**





Photo source:  
SIX Maps  
NSW Land and Property Information



#### North Sydney LEP 2013

##### Heritage Items

- 01 Sydney Harbour Bridge approach viaducts, arches and bays under Warringah Freeway
- 02 Milsons Point Railway Station group
- 03 Bradfield Park
- 04 Sydney Harbour Bridge north pylons
- 05 North Sydney Olympic Pool
- 06 Luna Park
- 07 Camden House
- 08 Lavender Bay Railway Line
- 09 Chinese Christian Church
- 10 Greenway Flats

#### State heritage significance

##### (01) Milsons Point Railway Station group – 1932

Includes platform, station building, station entrances, concourse, walls and abutments and Burton Street underbridge. Historical photographs from the station construction in 1932 indicate that the decorative awning for the Alfred Street station entrance is original.

##### Heritage listings:

- NSW State Heritage Register
- North Sydney LEP

#### National heritage significance

##### Sydney Harbour Bridge, approaches and viaducts (road and rail) – 1932

SHR curtilage shown. The approaches include Bradfield Park and Dawes Point Park.

##### Heritage listings:

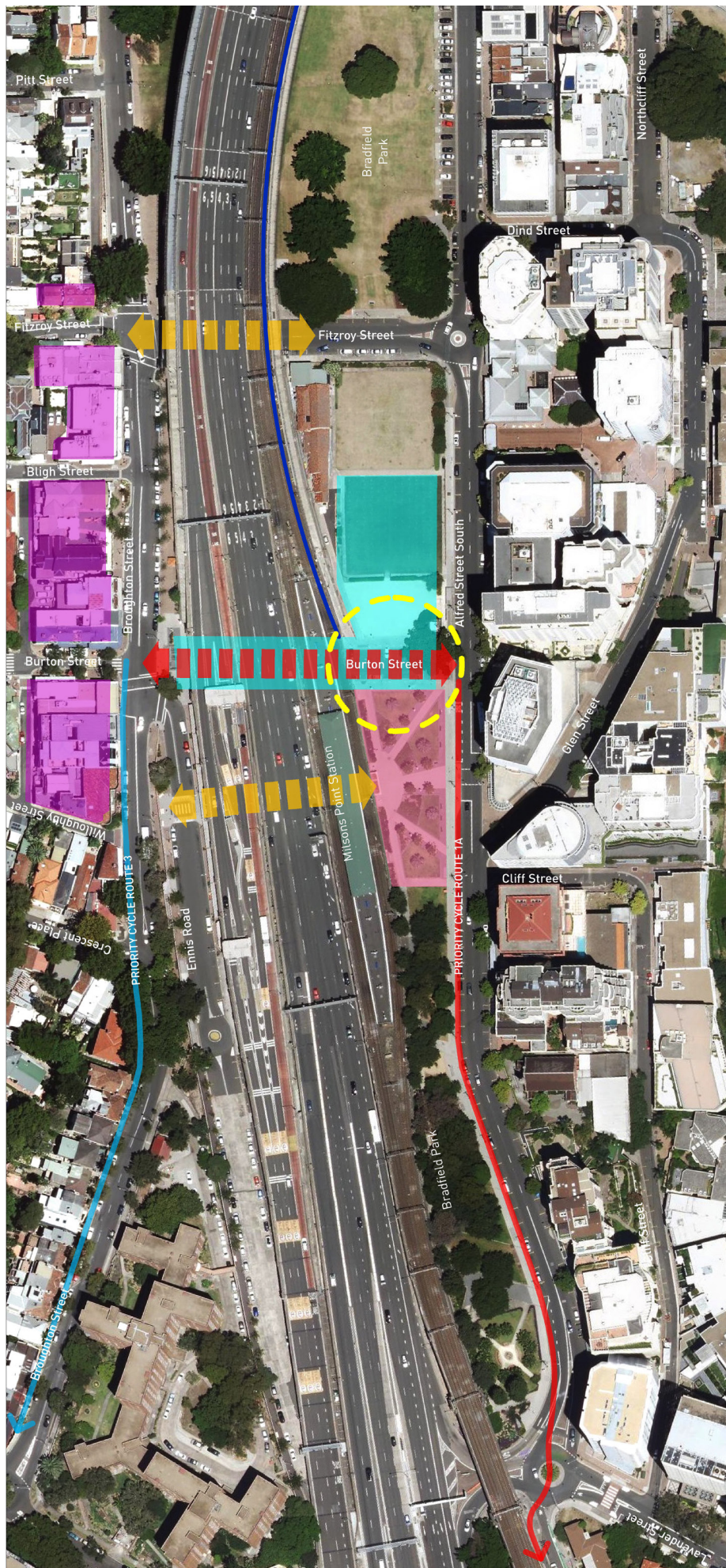
- National Heritage List
- NSW State Heritage Register
- North Sydney LEP

##### Non-statutory listings:

- National Trust of Australia register
- Register of the National Estate

**Figure A3: Heritage Listings**





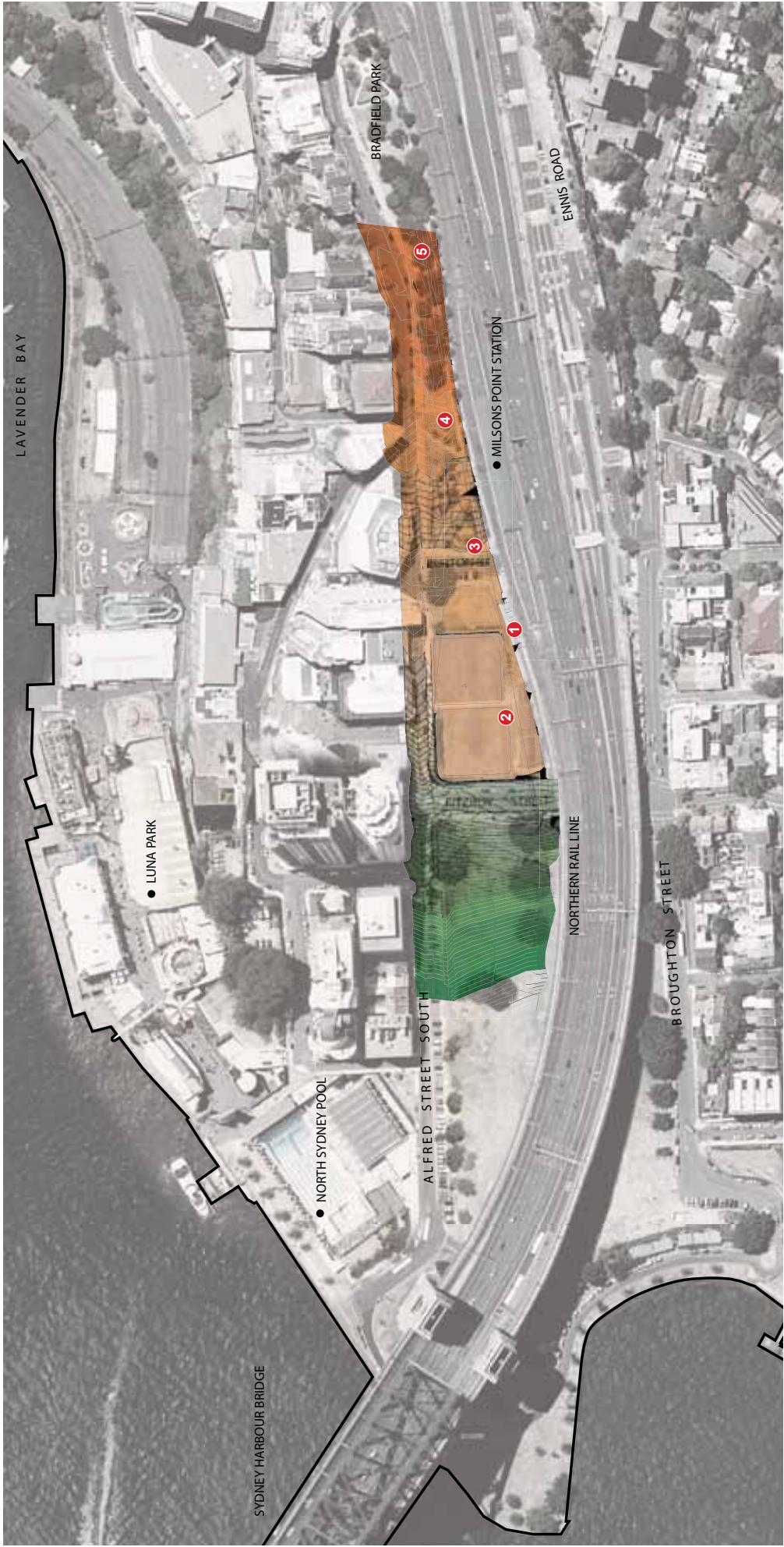
**Figure A4: Pedestrian and Cycle Access and Circulation**





**Figure A5: Bradfield Park Site Analysis**





⊕ NOT TO SCALE

KEY	HIGH ELEVATIONS	LOW ELEVATIONS

DESIRABLE GRADIENTS
(Based on Austroads Guide to Road Design)
<ul style="list-style-type: none"> <li>3% (1:33) for general cycleways</li> <li>2% (1:50) for lengths &gt;200m</li> <li>max 12% (1:8) for lengths &lt;8m</li> </ul>

LEVEL CHANGE
Level change varies from 11.5m to 4.3m depending on the option:-
1. Bridge deck (top of stairs): RL 42.54
2. Kirribilli Neighbourhood Centre: RL 32.00
3. Burton Street: RL 33.57
4. Bradfield Park North opposite Cliff Street: RL 37.20
5. Opposite the 'kink' in Alfred Street South: RL 38.80

**Figure A6: Topography and Levels** (source: Government Architect's Office 2012)





## **Appendix B – Preliminary strategic options**

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# Appendix B

Preliminary Strategic Options



# contents

1. Horizontal Options 1 and 2 - Station View from Alfred Street South
2. Horizontal Option 3 - View from Burton Street
3. Parallel View of Horizontal Option 2 - Bradfield Park North
4. Structural Option 1 Warren Truss - Station View from Alfred Street South
5. Structural Option 2 Through Arch - View from Bowling Green
6. Structural Option 3 Straight Beam - Station View from Alfred Street South
7. Structural Option 4 Shaped Beam - View from Bowling Green
8. Structural Option 5 Torsion Beam - View from Bowling Green
9. Structural Option 6 Banana Beam - View from Bowling Green



**Figure B1: Horizontal Options 1 and 2 - View from Alfred Street South**





**Figure B2: Horizontal Option 3 - View from Burton Street**





**Figure B3: Parallel View of Horizontal Option 2 - Bradfield Park North**



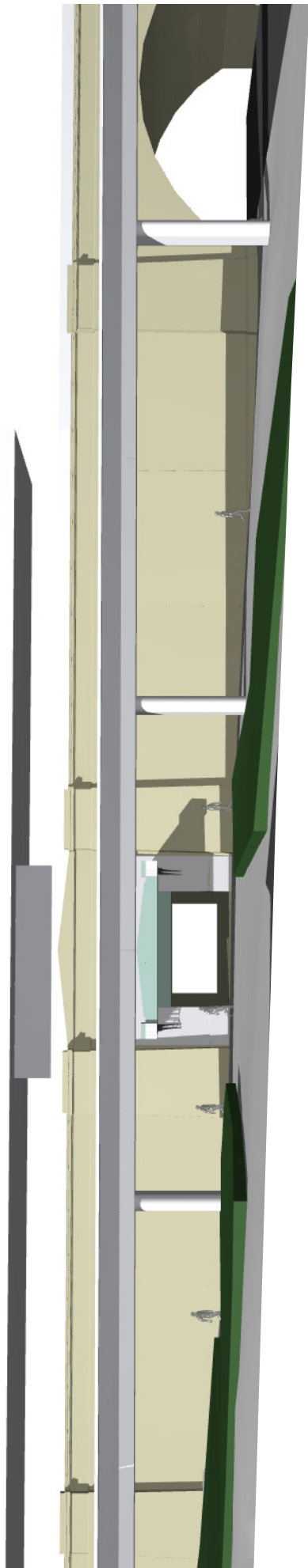


**Figure B4: Structural Option 1 Warren Truss - Station View from Alfred Street South**





**Figure B5: Structural Option 2 Through Arch - View from Bowling Green**



**Figure B6: Structural Option 3 Straight Beam - Station View from Alfred Street South**



**Figure B7: Structural Option 4 Shaped Beam - View from Bowling Green**





**Figure B8: Structural Option 5 Torsion Beam - View from Bowling Green**





**Figure B9: Structural Option 6 Banana Beam - View from Bowling Green**



## **Appendix C – Case studies for outdoor elevators/escalators**

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## Case studies for outdoor elevators/escalators

In addition to the linear infrastructure investigations, Roads and Maritime also explored built examples of where an escalator or elevator was used to provide step-free access for cyclist. This desktop investigation was prompted by feedback from some stakeholders who had suggested that these solutions may have a relatively smaller footprint than a cycle ramp and may mitigate impacts to heritage and public open space.

A brief overview of two potential alternative options is provided below.

### ***Nijmegen Cycle Bridge (Cyclist Access Escalators), Netherlands<sup>3</sup>***

*Description:* Outdoor escalators constructed to provide access to elevated cycleway. Completed in 2004.

*Issues cited:* Poor durability, high cost of maintenance, vandalism, poor reliability, noise, and wheels slipping during and after periods of rain. In 2009, 11 malfunctions were reported. In 2012, the authority responsible for the facility announced their intention to replace the escalators with stairs suitable to be used by cyclists. In this example, provision of an outdoor escalator for cyclists was not considered to be a cost-effective solution.



**Figure 1** (Out of use) escalator and stair access for cyclists to the Nijmegen Bridge, Netherlands

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<sup>3</sup> Bicycle Dutch (2013) "Nijmegen cycle bridge revisited"  
<https://bicycledutch.wordpress.com/2013/05/16/nijmegen-cycle-bridge-revisited/> viewed 03 November 2017.

### ***Paleisbrug (Palace Bridge) Access Lifts, 's-Hertogenbosch, Netherlands<sup>4</sup>***

**Description:** Inclined lift for pedestrian and cyclist access. Adjacent to the lift are stairs with grooves on the edges to allow cyclists to wheel their bicycles up/down.

**Potential issues:** A lift would not adequately accommodate the high volume of cyclists currently using the Sydney Harbour Bridge Cycleway. As discussed in Section 2.1.2, data collected in 2014 showed peak hourly demand during the AM and PM periods exceeded 550 and 450 cyclist trips, respectively. Queueing on the bridge deck is also a potential issue as cyclists would be waiting to use the lift at the top of the stairs. Reliability of lifts is also a potential issue.



**Figure 2** Lift access for cyclists and pedestrians to the Palace Bridge, Netherlands

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<sup>4</sup> Bicycle Dutch (2015) "First garden bridge in the Netherlands opened"  
<https://bicycledutch.wordpress.com/2015/06/16/first-garden-bridge-in-the-netherlands-opened/> viewed 03 November 2017.

# **Appendix D – Sydney Harbour Bridge Cycle Ramp Options Feasibility Study (2012)**

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Public Works  
Government Architect's Office

PREPARED FOR ROADS AND MARITIME SERVICES



# SYDNEY HARBOUR BRIDGE CYCLE RAMP

OPTIONS FEASIBILITY STUDY

MILSONS POINT

OCTOBER 2012



SYDNEY

HARBOUR

BRIDGE

CYCLE

RAMP

OPTIONS FEASIBILITY STUDY

MILSONS POINT

NOVEMBER 2012

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Issue/Revision	Author	Reviewed		Issued to	
		Name	Purpose		Date
C	GM/MK	B.Schaffer	FINAL	NG	20.11.2012
B					

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*Existing step access at Sydney Harbour Bridge*

# EXECUTIVE SUMMARY

The Sydney Harbour Bridge cycleway is one of the most well used cycleways in Sydney. There is currently at peak 497 cyclists per hour (over 8 people per minute). Currently the cycleway only has stair access to the Bridge at Milsons Point. Roads and Maritime Services (RMS) have engaged the NSW Government Architect’s Office (GAO) to explore options for well designed solution to this issue that will respect the heritage and urban design paramaters in addition to considering safe access and connectivity for cyclists.

Resolving this issue will inform the design of other cycle networks north of the Bridge, in particular connections through to Cammeray.

While cyclists are expected to dismount to use the stairs, as directed by existing signage, some have been observed riding down the steep ramp which is provided in the centre of the staircase for pushing bikes up and down. This creates hazardous conditions for both cyclists riding down the ramp and riders pushing their bikes up the stairs. It is also hazardous at the base of the stairs, where mounted riders can enter the road system at speed, and incidents of cyclists colliding with signs and signposts have been received and acknowledged. The requirement for cyclists to dismount and push a bike up or down the stairs can also be seen as a disruption to the cycle network and strategy.

This report has been prepared as an early feasibility study building on the 1999 Department of Public Works report. Its purpose is to ascertain whether any option for avoiding the steps have merit and whether further detailed studies should proceed.

This report investigates 5 options to provide accessible connections from Sydney Harbour Bridge to Milsons Point. These connections will service both commuter cyclists as well as recreational users.

### OPTION 1

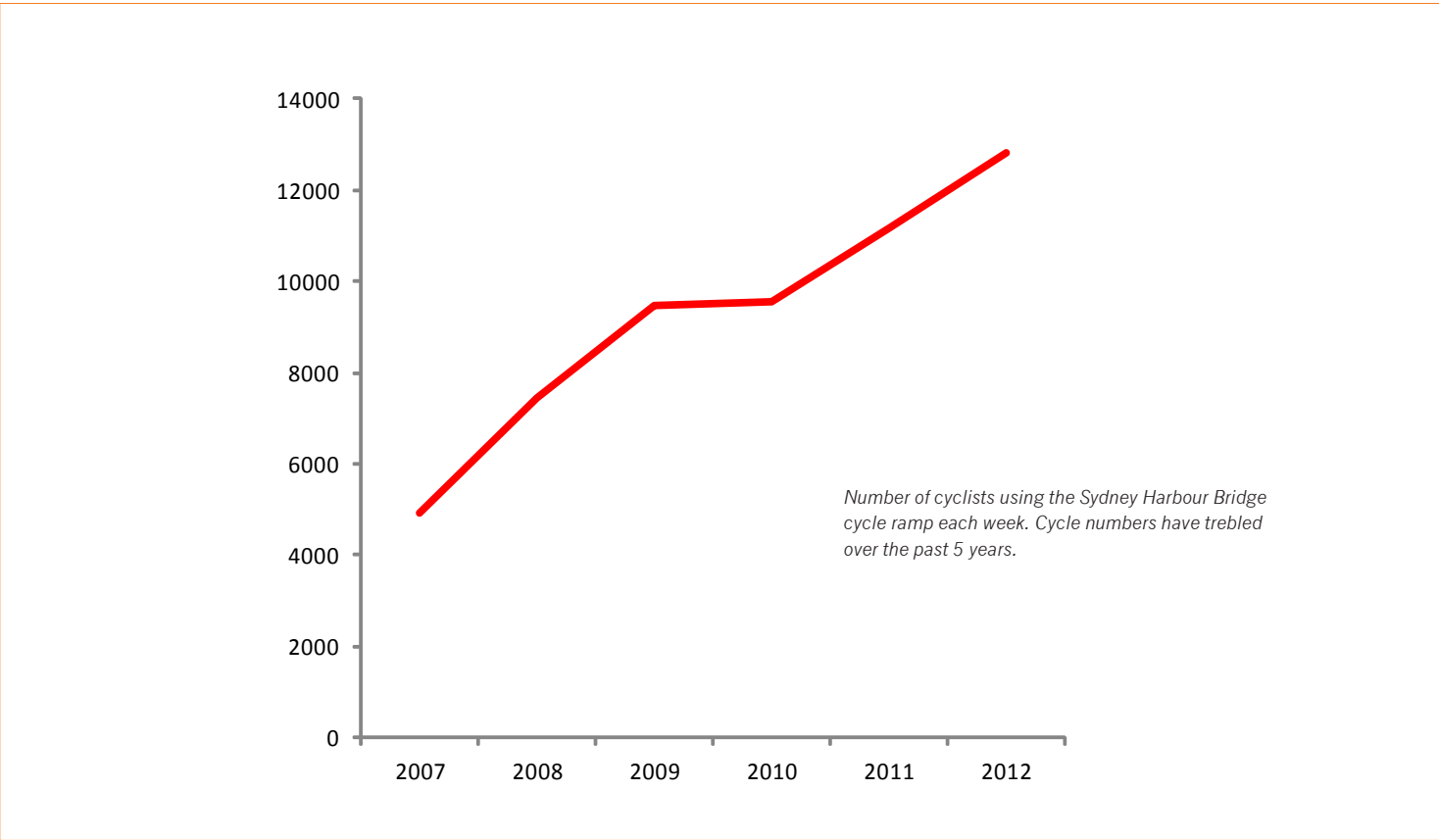
Cycle ramp from the SHB approach, North of the Fitzroy St arch, down to just south of Burton Street. Ramp is supported on free standing steel columns.

### OPTION 2

Cycle ramp from the SHB approaches, just north of the Fitzroy Street arch, down to just south of Burton Street. The ramp is supported on steel brackets cantilevered from the SHB approach walls.

### OPTION 3

Cycle ramp from south of the top of the existing SHB stairs to Bradfield Park North is supported on free standing steel columns it travels at the highest level over the Milsons Point Railway station entrance before ramping down.



### OPTION 4

Cycle ramp from top of existing SHB stairs (blocking stair access) to Bradfield Park North is supported on steel brackets cantilevered from the SHB approach walls. It travels at the higher level untill after it passes over Milsons Point station entrance before ramping down.

### OPTION 5

Cycle ramp regraded within existing SHB ramp and steps from the SHB approaches, north of the Fitzroy Street arch down to just south of Burton Street

These Five Options have been short listed from an initial list of 10 Options considered in the GAO Report in June 2012. The remaining 7 options were not pursued due to their failure to achieve good outcomes for cycleway improvement, heritage and visual impact and safety requirements. See Appendix A on page 49.





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1.

DESIGN

PRINCIPLES

The following principles were formulated for this the study. These principles were used to inform the development of the 3 current cycle ramp options:

- Respect heritage
- Innovative urban design and improved amenity
- Improve safe access and connectivity

RESPECT HERITAGE



The new cycle ramp should respect the heritage value of the Sydney Harbour Bridge and of Bradfield Park including:

- respect the integrity of the Sydney Harbour Bridge in its setting
- have minimal impact on aesthetic & technical heritage values
- have minimal impact on heritage fabric
- be as reversible as possible in accordance with the Australia ICOMOS Burra Charter 1999.
- have minimal heritage impact on Bradfield Park & the Milsons Point train station entry

INNOVATIVE URBAN DESIGN & IMPROVED AMENITY



Improve amenity and apply sound urban design principles including:

- minimise impact on Bradfield Park, e.g. integrate cycleway into circulation pattern
- respect current and future pedestrian and recreational use
- apply innovative design principles
- consider opportunities to integrate services for the park eg. lighting

IMPROVE SAFE ACCESS AND CONNECTIVITY



The cycle ramp should improve the connectivity between the Sydney Harbour Bridge, Bradfield Park and beyond including:

- connection with the North Sydney Cycle Network
- compliance where possible with Austroads Guide to Road Design Part 6A: (Pedestrian and Cyclist Paths)
- minimise conflicts between vehicles, cyclists and pedestrians
- address other safety & security concerns & deter vandalism



## 2.

# PRECEDENTS

The following aesthetic approach is in keeping with the 3 main principles for the design of the new cycle ramp:

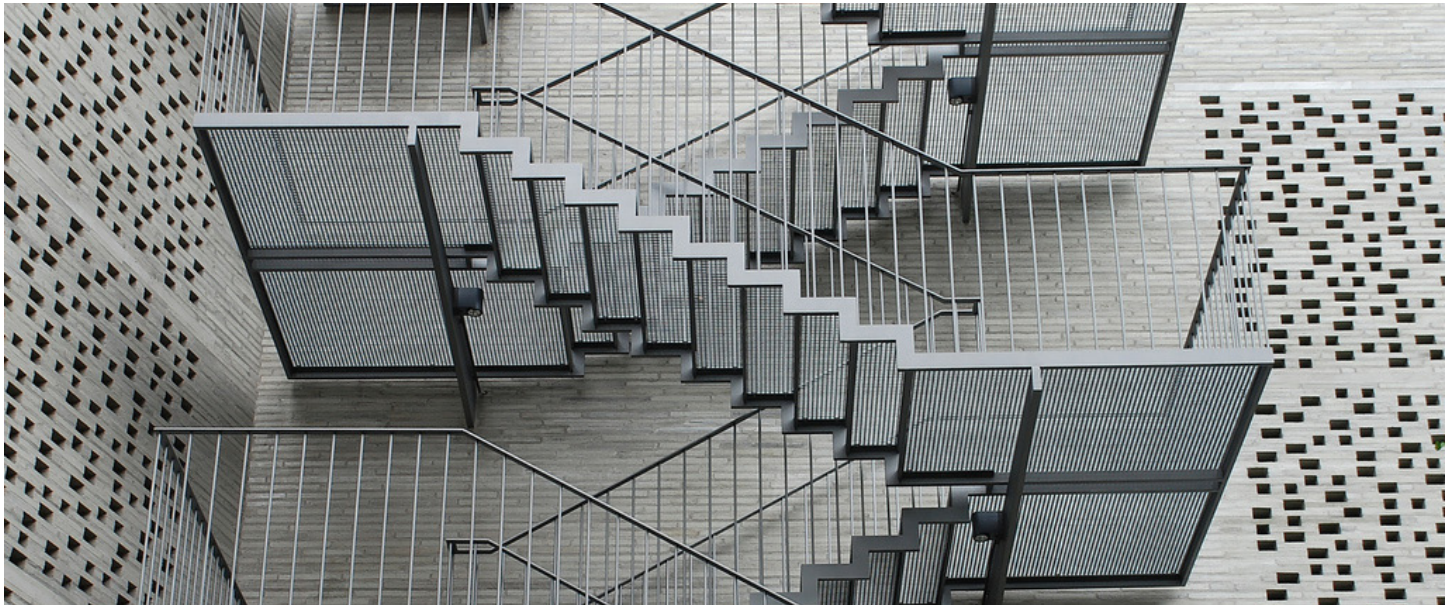
- Maximise transparency
- Lightweight structure
- Fine detailing
- Clean contemporary structural design

The images on this page illustrate precedents for such an approach.

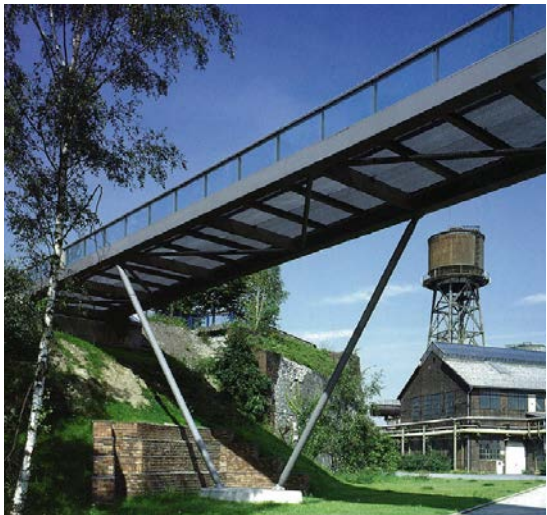
Fine detailing  
Walkway 14, ANZAC  
Bridge



Lightweight structure  
Brick Pit Ring, Sydney  
Olympic Park



Maximise transparency  
Kolumba Museum, Cologne



Open Bridge Deck  
Nordpol Bridge Westpark, Bochum,  
Germany

Clean contemporary  
structural design  
Cycle ramp extension,  
Cahill Freeway, Sydney



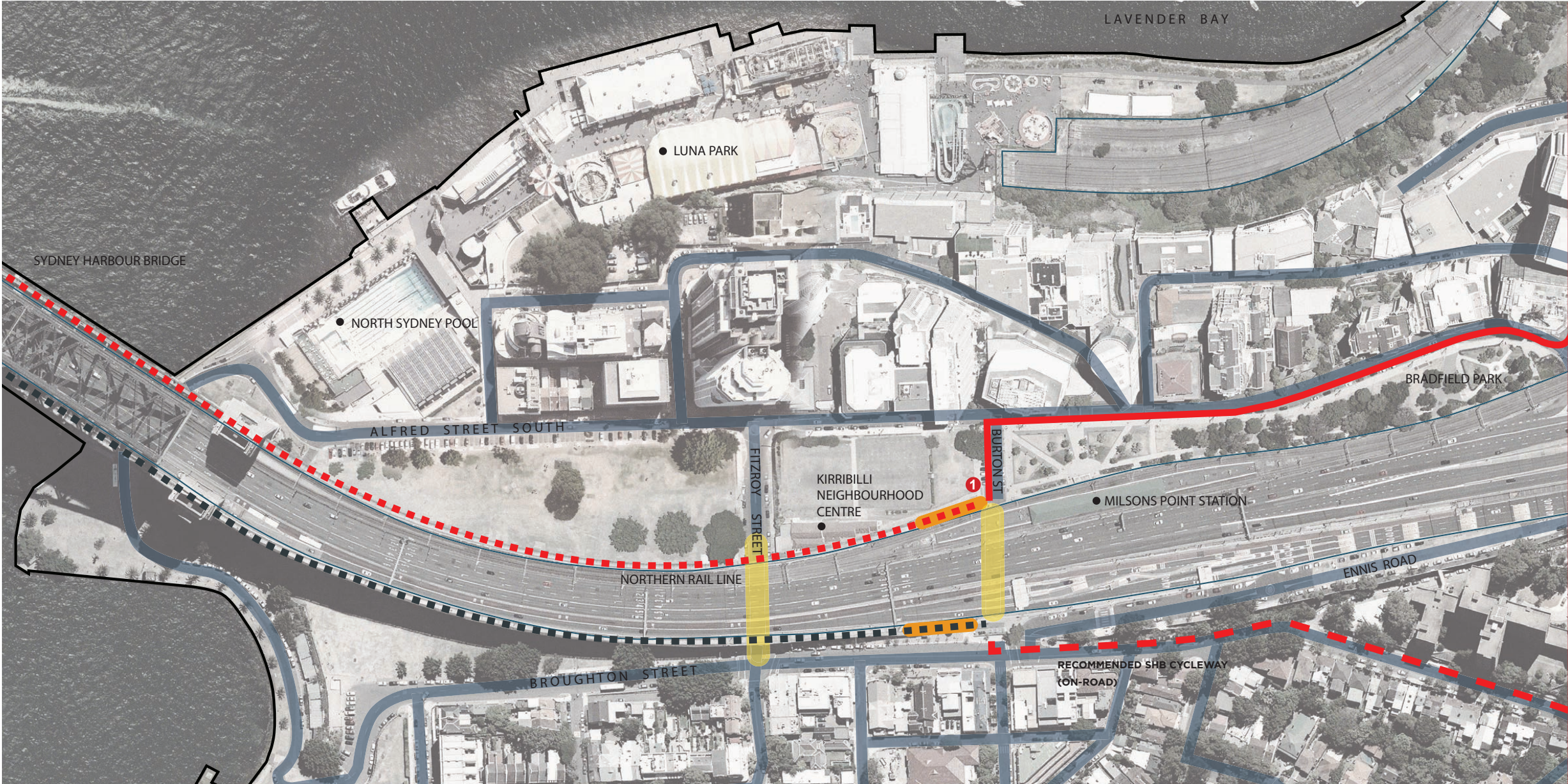


3.

SITE

ANALYSIS

ACCESS AND CIRCULATION



KEY

- SHB CYCLEWAY (OFF-ROAD)
- ON-ROAD CYCLEWAY
- SHB PEDESTRIAN WALK
- SHB TUNNELS
- VEHICULAR ACCESS (SHB EXCLUDED FOR LEGIBILITY)
- STAIR/RAMP ACCESS TO SHB

NOT TO SCALE



Cycle access to the SHB.  
Total of 55 steps

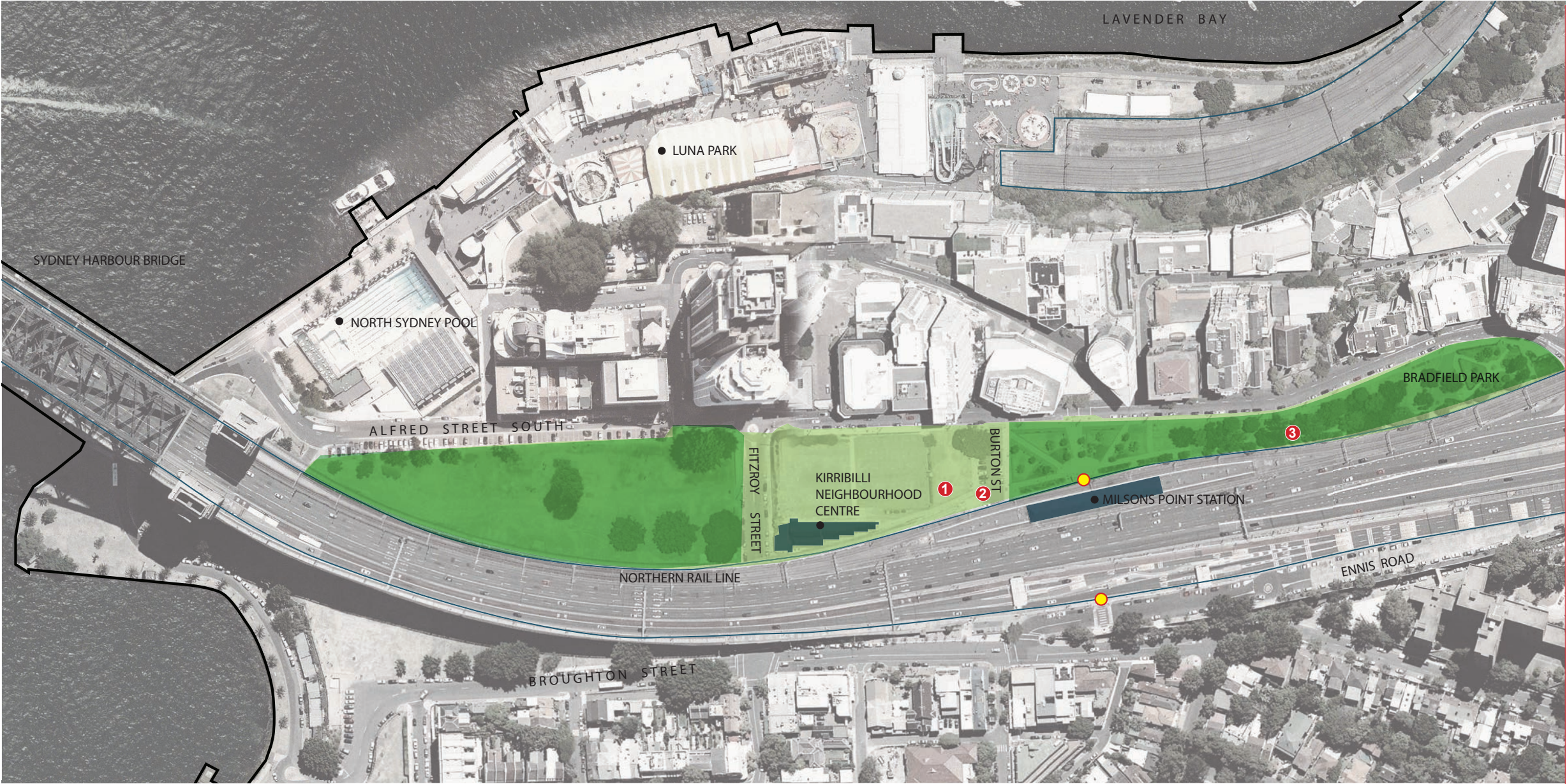


3.

SITE

ANALYSIS

LAND USE



KEY

PUBLIC OPEN SPACE

BRADFIELD PARK

COMMUNITY SERVICE CENTRE  
AND RAIL WAY STATION

STATION ENTRANCE



Art Fashion and Design Market in Bradfield Park/Kirribilli Neighbourhood Centre



Kirribilli Markets in the Burton Street Tunnel



Heritage Walk. View looking South towards Harbour

NOT TO SCALE

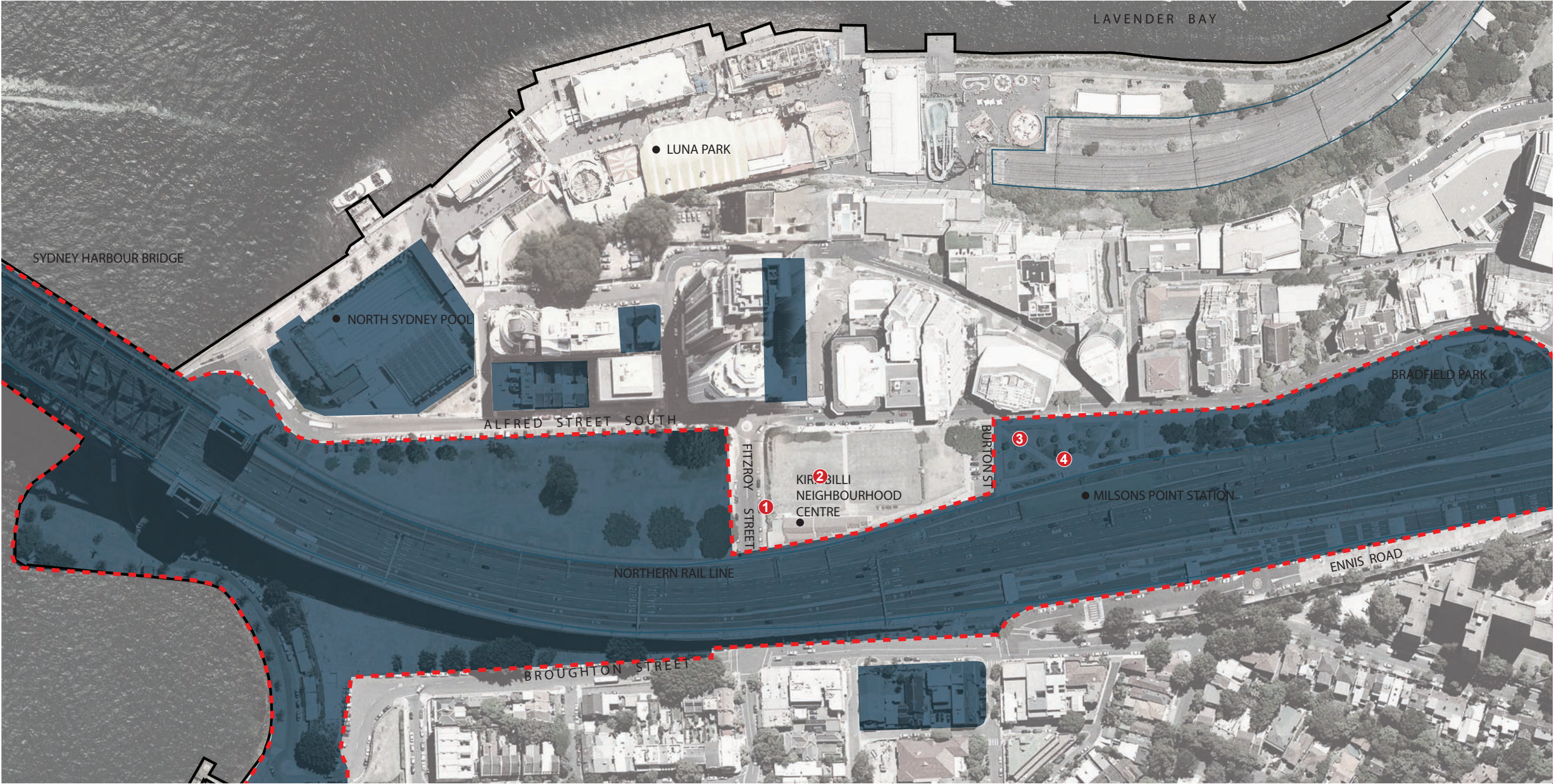


3.

SITE

ANALYSIS

HERITAGE MAPPING



KEY

- HERITAGE LISTED ITEM
- SHB AND APPROACHES:  
NATIONAL AND STATE  
HERITAGE LIST



Stair/Ramp access to Sydney Harbour Bridge



Sydney Harbour Bridge approach looking North towards Milsons Point



Sydney Harbour Bridge approach looking North



Station Entry

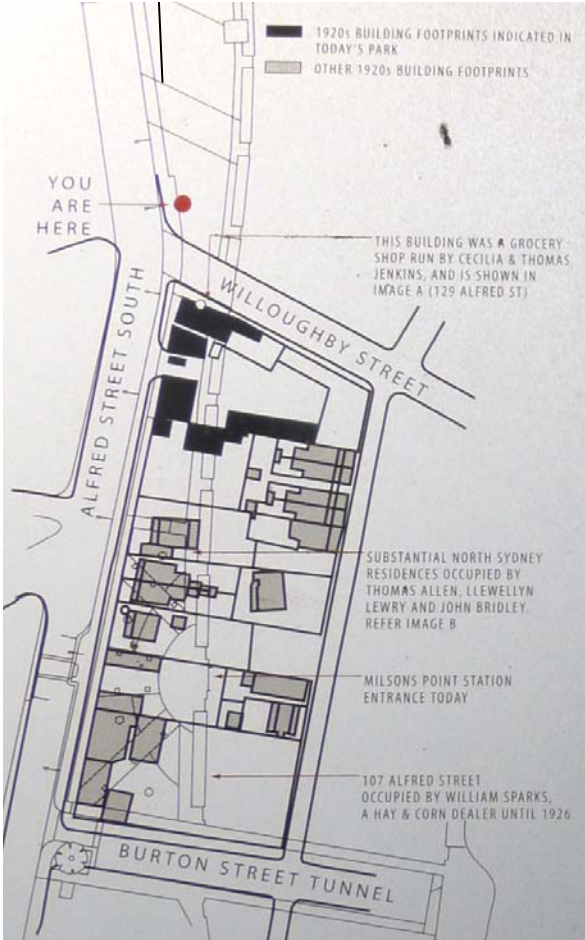
⊕ NOT TO SCALE



HERITAGE IMAGES



1943 Aerial of the site (Source LPMA)



This diagram is from the interpretive signage in Bradfield Park (Copyright North Sydney Council). The line of the Bridge constructed in 1942 has been highlighted in red on this image.



View through Bradfield Park with the Station entry in the background. Note the recent interpretive signage and mature palm plantings.



The former Willoughby Street and the footprints of the former buildings have been interpreted in the ground plain of Bradfield Park.



The entrance to Milsons Point Stage constructed as part of the Bridge works in 1942 has an elegant simplicity. Note the details such as the flanking wall lights and the central parapet feature above the awning.



The Burton Street Arch and the Station entrance with the platform awning above form an important heritage ensemble in the SHB approach walls.



The Bridge Stairs (now the cycle way access) also adds to the ensemble of heritage details for the SHB at Milson's Point.



The views from Alfred Park to the 'Bridge in Curve' are an important urban design feature of Bradfield Park. Note the Kirribilli Neighbourhood centre in the centre ground.



The Kirribilli neighbourhood centre is a former Bowling Club, now community open space used for recreation and market days. (Copyright North Sydney Council)



Looking up to Fitzroy Street Arch with the Kirribilli Neighbourhood Centre on the left.



View looking south down the cycleway from the top of the Cycle/Stairs. Security screens to the railway line will need to be extended for ramp option 2 and 4.



3.


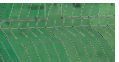
SITE

ANALYSIS

TOPOGRAPHY AND LEVELS



KEY

-  HIGH ELEVATIONS
-  LOW ELEVATIONS

LEVEL CHANGE

- Level change varies from 11.5m to 4.3m depending on the option:-
1. Bridge deck (top of stairs): RL 42.54
  2. Kirribilli Neighbourhood Centre: RL 32.00
  3. Burton Street: RL 33.57
  4. Bradfield Park North opposite Cliff Street: RL 37.20
  5. Opposite the 'kink' in Alfred Street South: RL 38.80

DESIRABLE GRADIENTS

- (Based on Austroads Guide to Road Design)
- 3% (1:33) for general cycleways
  - 2% (1:50) for lengths >200m
  - max 12% (1:8) for lengths <8m

 NOT TO SCALE

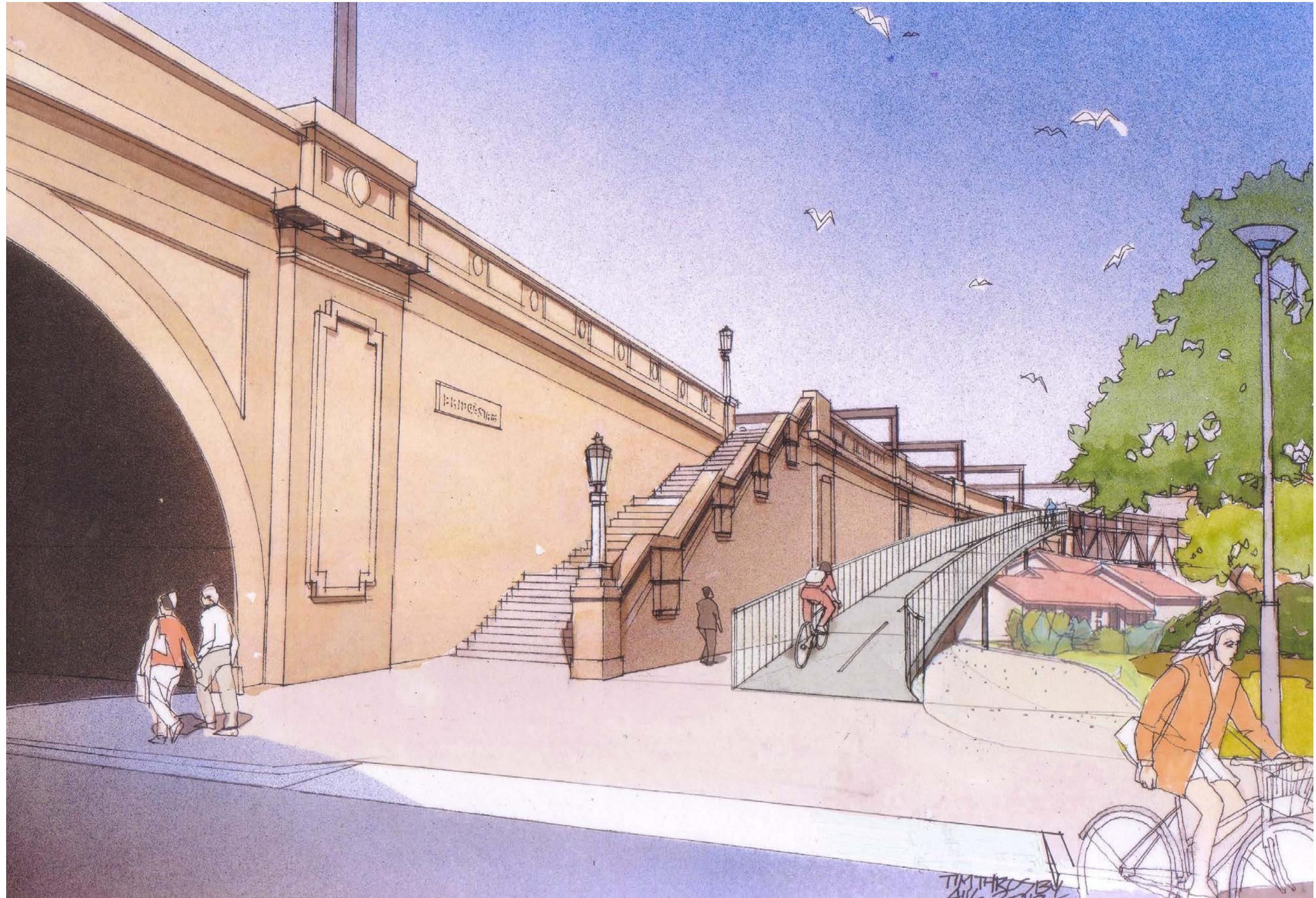


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## OPTION 1

NEW CYCLE RAMP SUPPORTED ON STEEL COLUMNS PARALLEL WITH THE SYDNEY HARBOUR BRIDGE APPROACHES COMMENCING NORTH OF THE FIZROY STREET ARCH AND ARRIVING SOUTH OF BURTON







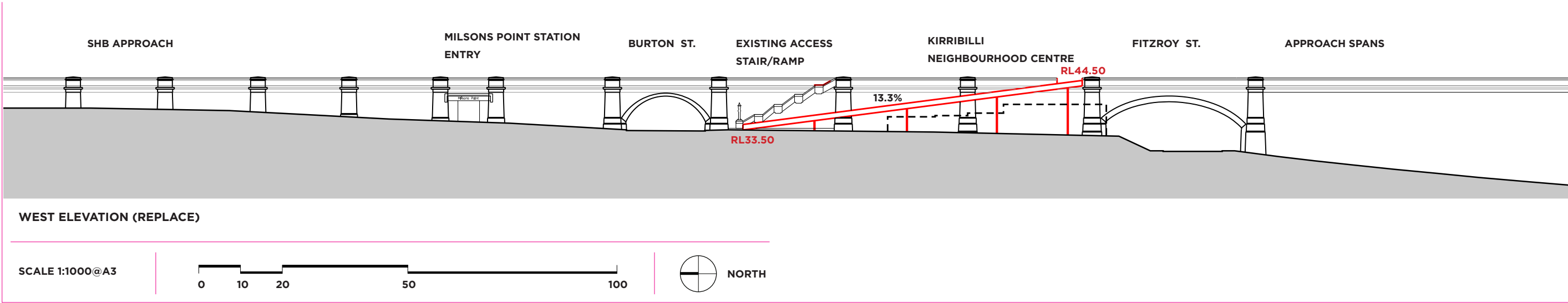
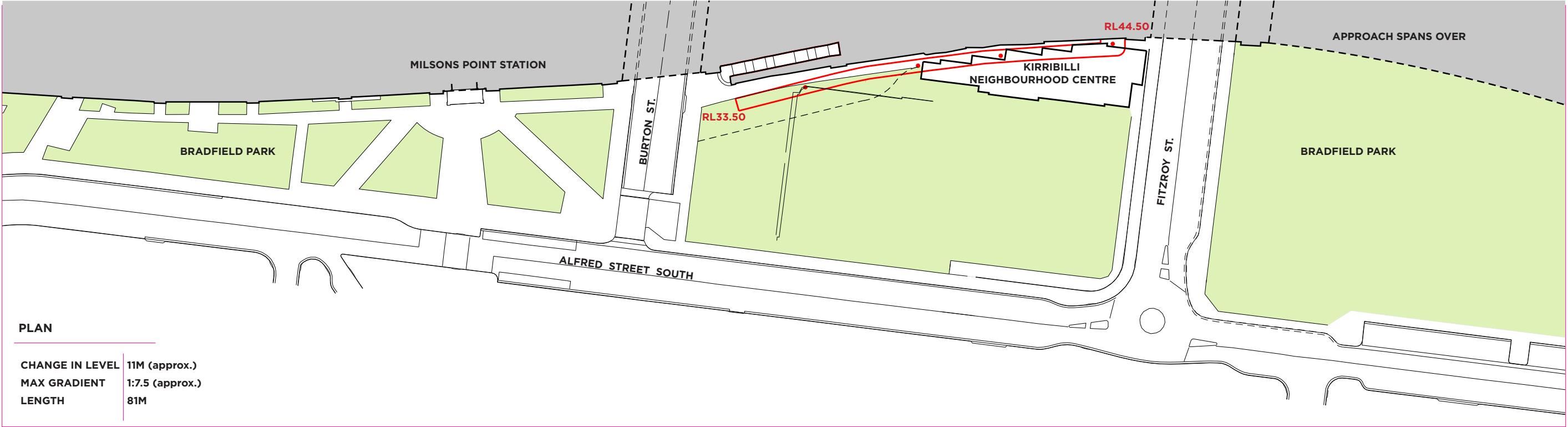


OPTION 1 DESCRIPTION

With a grade of 1:7.5 (13.3%) the cycle ramp takes cyclists from the bridge deck level (RL44.500) down to Burton Street (RL33.500). The steepness of ramp for this proposed option is outside the recommended grade 5% stated in Austroads. The existing steps are retained.

Except where it meets the Bridge approach wall, the ramp is supported on free standing steel columns positioned to avoid conflicts with the existing landscape and structures below. Ramp moves out to allow continuing use of the shared access road to the Kirribilli Neighbourhood Centre.

ESTIMATED COST \$8MILLION



4.

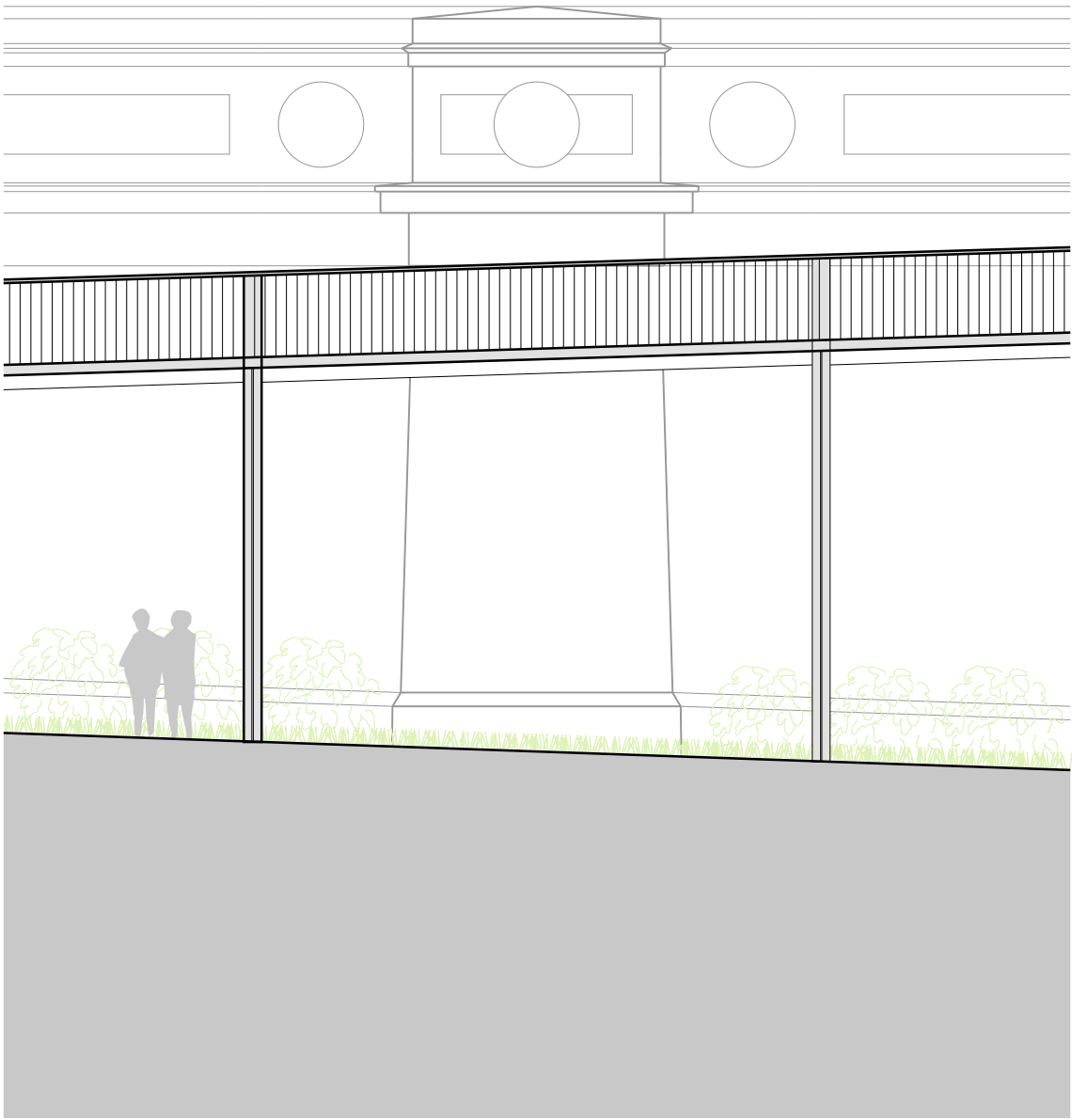
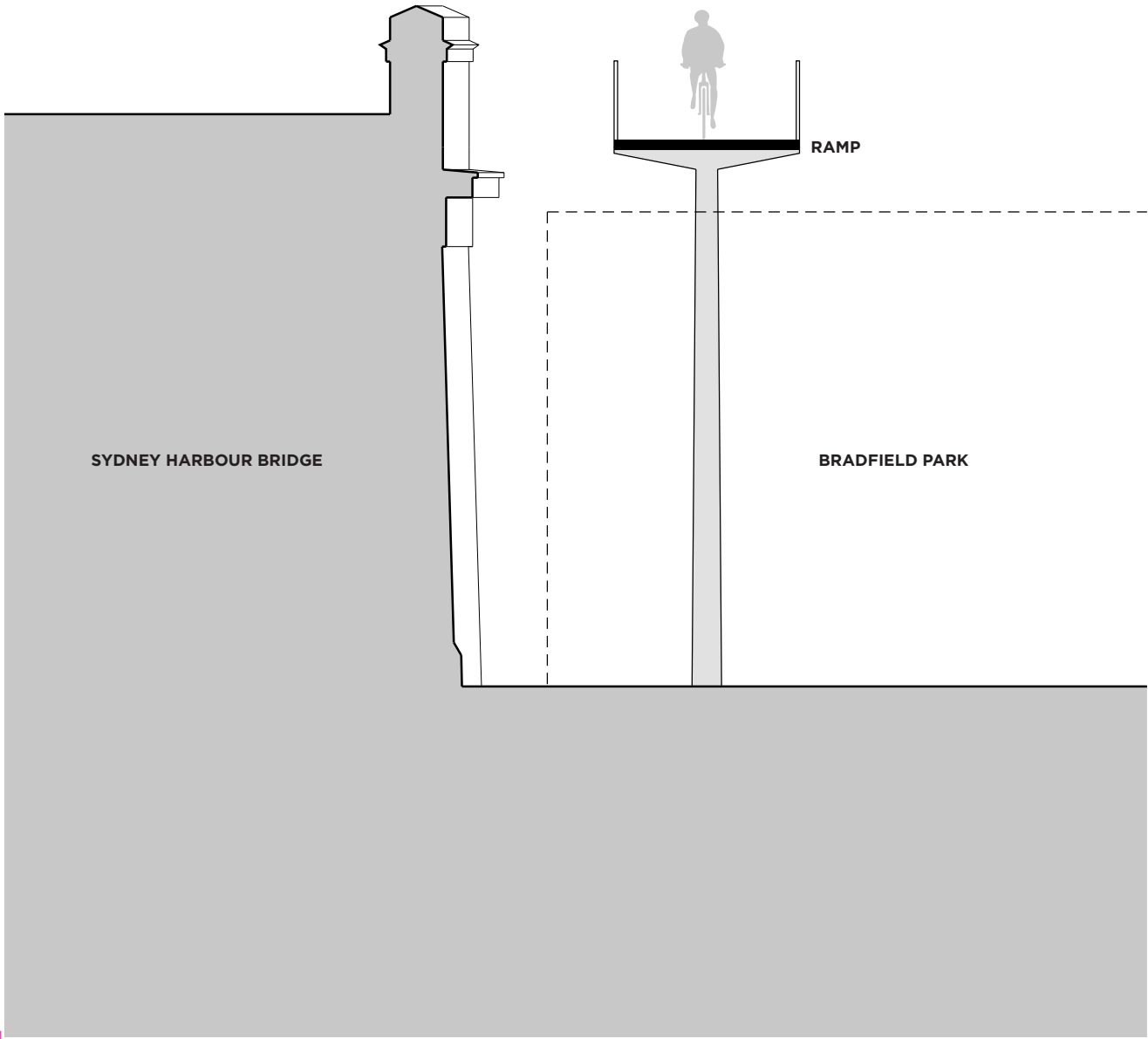
OPTION 1

SECTION

STAND ALONE CYCLE RAMP ON COLUMNS

DESCRIPTION

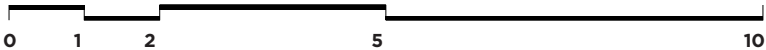
From bridge deck down to Burton St supported on free standing steel posts



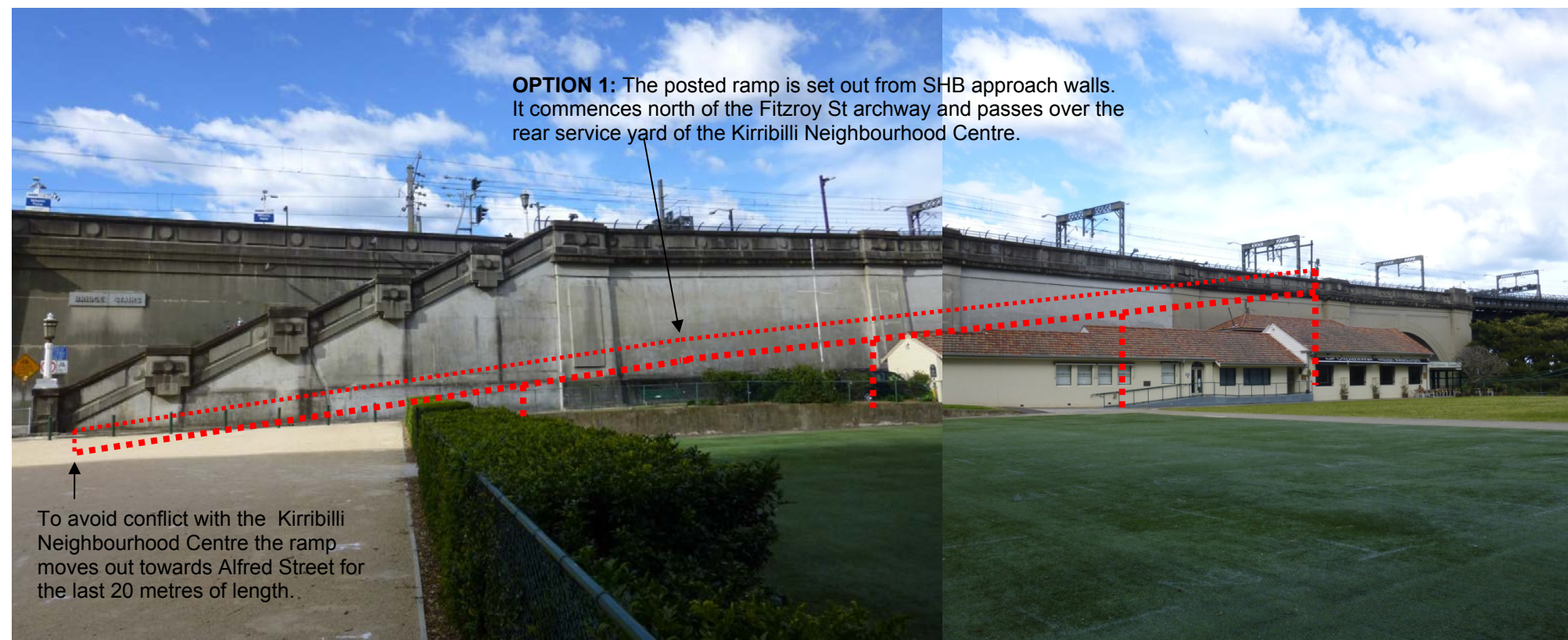
SECTION

ELEVATION

SCALE 1:100@A3







Option 1: Posted cycleway set out from the SHB approach walls viewed from Fitzroy Street. The break in the parapet to access the cycleway should be a suitable distance north of the Fitzroy Street archway to suit the parapet detailing

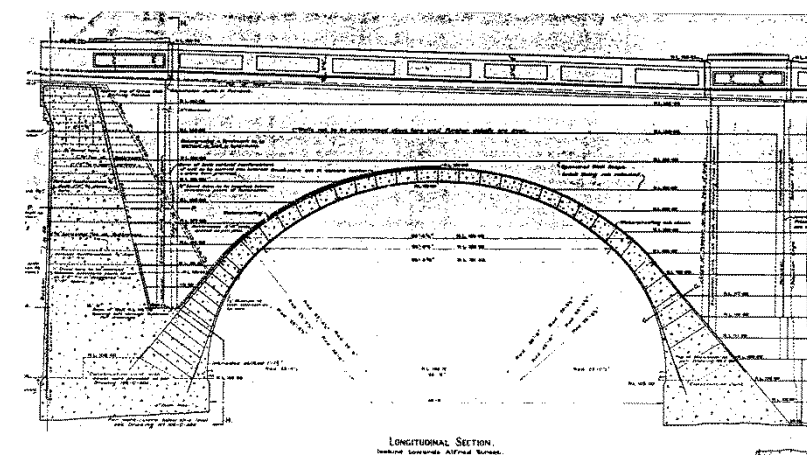


Fig. Cross Section through Fitzroy St Bridge.

Section through the Fitzroy Street Arch

OPTION 1	DATA			ACCESS / SAFETY / AMENITY ISSUES	FABRIC IMPACTS / BUILDABILITY (including heritage fabric impacts)	VISUAL IMPACTS (including aesthetic heritage impacts)
	CYCLEWAY WIDTH	GRADIENT	LENGTH			
Pt 6A AustRoads	2.5-4m	5%	No max.			
From bridge deck down to Burton st, supported on free standing steel posts.	No width restriction	13.3%	81m	<b>SHB / Cycleway</b> POSITIVE <ul style="list-style-type: none"> <li>Separation of ramp from SHB approach walls discourages attempts to apply graffiti or scale walls.</li> <li>Negates cycle/pedestrian/vehicle. conflicts that occur when ramp arrives at Burton St.</li> </ul>	<b>SHB / Cycleway</b> POSITIVE <ul style="list-style-type: none"> <li>Free standing solution has less impact along the length of rendered SHB approach walls.</li> <li>Cycleway can remain in use for most of construction period.</li> </ul>	<b>SHB / Cycleway</b> POSITIVE <ul style="list-style-type: none"> <li>Less visual / heritage conflicts with SHB approach walls and Burton Street Arch for closer views compared with Option 3 &amp; 4.</li> <li>It is a separate engineered structure.</li> </ul>
				NEGATIVE <ul style="list-style-type: none"> <li>Does not connect directly into the existing cycle route at Burton St. Possible cycle/pedestrian conflicts through Bradfield Park or cycle traffic conflicts if on Alfred Street South.</li> <li>New Structure imposed on park.</li> <li>Grade of ramp steep at 13.3%.</li> <li>Throw screen required.</li> <li>Safety / security concern with building over neighbourhood centre.</li> </ul>	NEGATIVE <ul style="list-style-type: none"> <li>Section of rendered balustrade removed at junction with SHB. This section may also require large cantilever brackets.</li> <li>Temporary closure to Kirribilli Neighbourhood Centre during construction.</li> </ul>	
				OTHER <ul style="list-style-type: none"> <li>Existing stairs can remain operational (subject to safety analysis).</li> <li>Station entry not impacted.</li> </ul>		
				<b>Station Entry</b> POSITIVE <ul style="list-style-type: none"> <li>Allows better lighting of entrance.</li> </ul>	<b>Station Entry</b> POSITIVE <ul style="list-style-type: none"> <li>Station entry not impacted.</li> </ul>	<b>Station Entry</b> POSITIVE <ul style="list-style-type: none"> <li>Does not impact on the Station Entry.</li> </ul>
				<b>Bradfield Park / Neighbourhood Centre</b> POSITIVE <ul style="list-style-type: none"> <li>Park lighting can be incorporated under ramp.</li> <li>Only minor impact on Bradfield Park.</li> <li>No impact on Neighbourhood Centre.</li> </ul>	<b>Bradfield Park / Neighbourhood Centre</b> POSITIVE <ul style="list-style-type: none"> <li>Minor impact on Neighbourhood Centre.</li> </ul>	<b>Bradfield Park / Neighbourhood Centre</b> POSITIVE <ul style="list-style-type: none"> <li>Visual impacts to Bridge from within Park have better resolution compared with Option 3 &amp; 4.</li> <li>Trees provide some screening to northern end of the ramp for more distant views.</li> </ul>
					NEGATIVE <ul style="list-style-type: none"> <li>Impacts on land belonging to North Sydney Council.</li> <li>Grassed areas and possibly some plantings in Park impacted on.</li> <li>Compulsory acquisition required .</li> <li>Difficult to construct over Neighbourhood centre.</li> </ul>	NEGATIVE <ul style="list-style-type: none"> <li>Creates some clutter in the Park.</li> <li>May impact Neighbourhood Centre.</li> </ul>
					OTHER <ul style="list-style-type: none"> <li>Possible archaeological issues for post positions in Bradfield Park North.</li> </ul>	



4.

## OPTION 2

NEW CYCLE RAMP ATTACHED TO THE BRIDGE APPROACHES  
COMMENCING FROM BRIDGE DECK DOWN TO BURTON ST, SUPPORTED  
ON CANTILEVERED BRACKETS FROM SHB APPROACH WALLS.



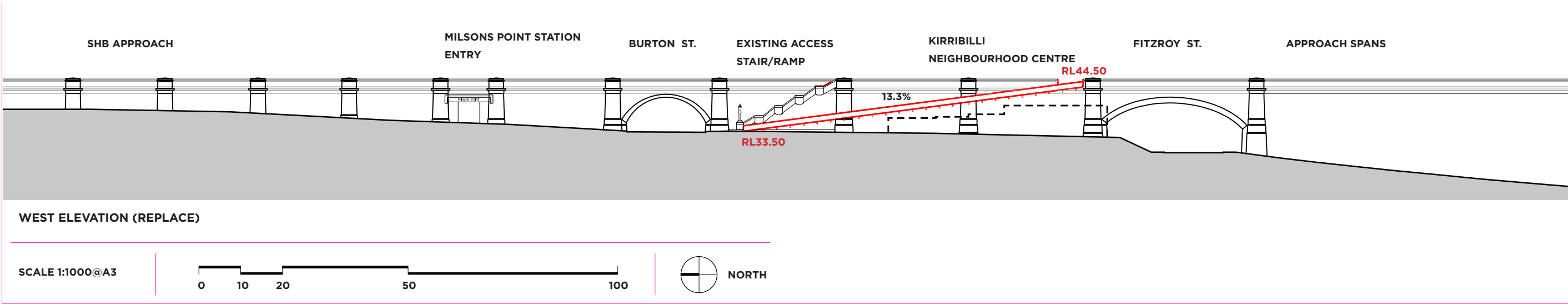
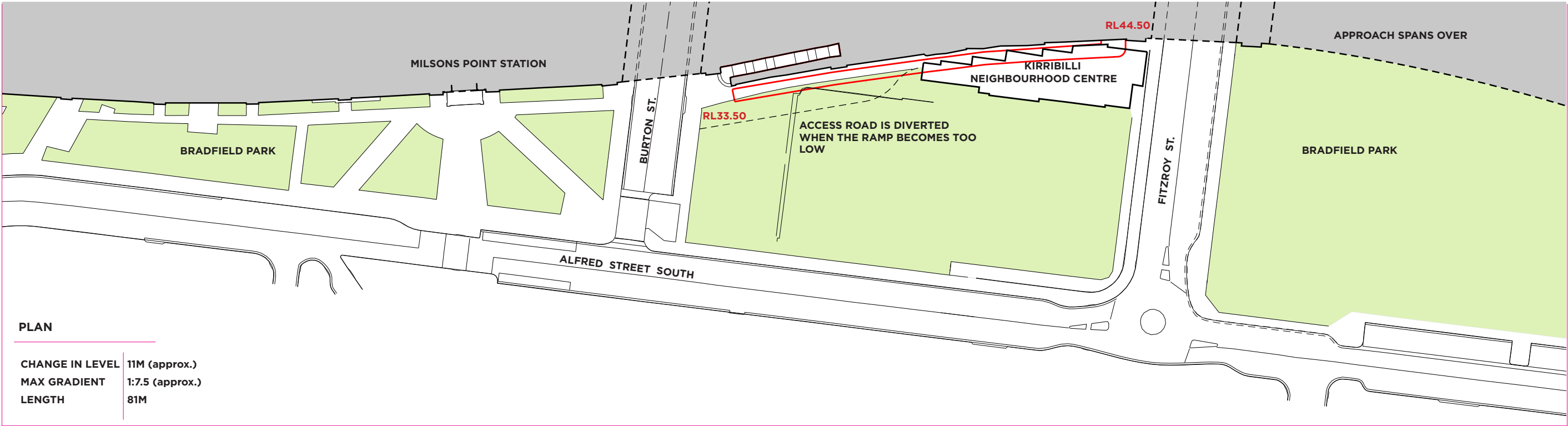


OPTION 2 DESCRIPTION

The cycle ramp takes cyclists from the bridge deck level (RL44.500) down to Burton Street (RL33.500) with a grade of 1:7.5 (13.3%). The steepness of ramp for this proposed option is outside the recommended grade 5% stated in Austroads. From bridge deck down to Burton St (over Fitzroy St) supported on cantilevered brackets from

SHB approach walls. The construction of the Northern Approaches of the SHB, south of Burton Street, (Mass Gravity retaining Wall with Backfill) make this option not feasible due to structural issues. Refer to the RMS Structural Drawings and Structural Feasibility Assessment on page 38.

Refer Option 1 Sketch, page 17 for illustration of cyclerramp ramp steepness.  
ESTIMATED COST \$10MILLION

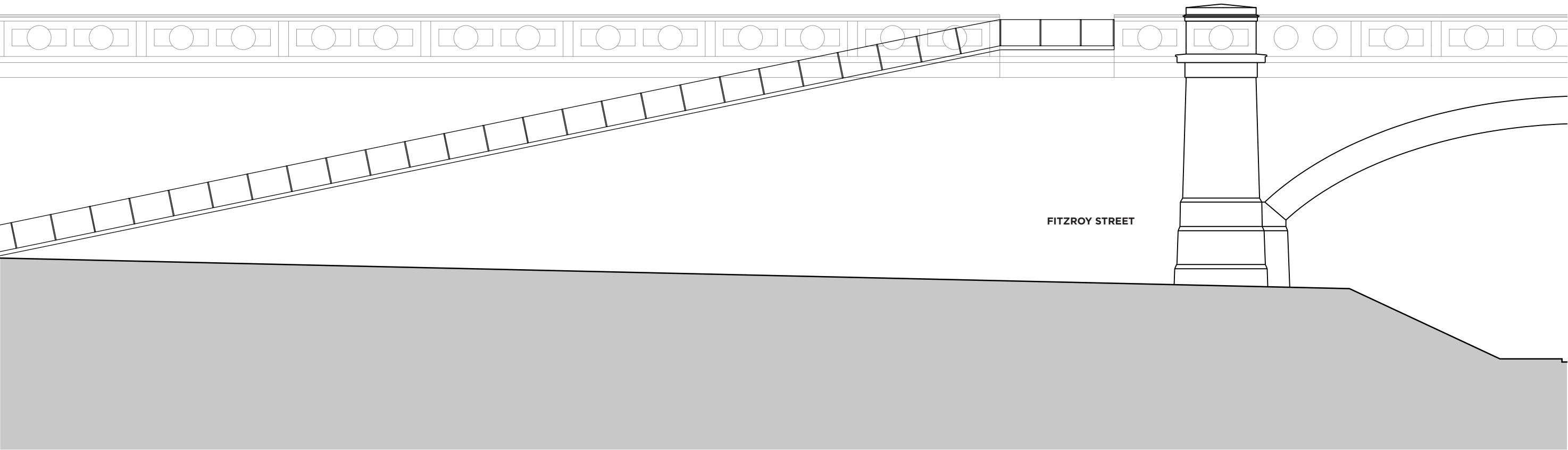




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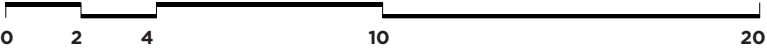
OPTION 2

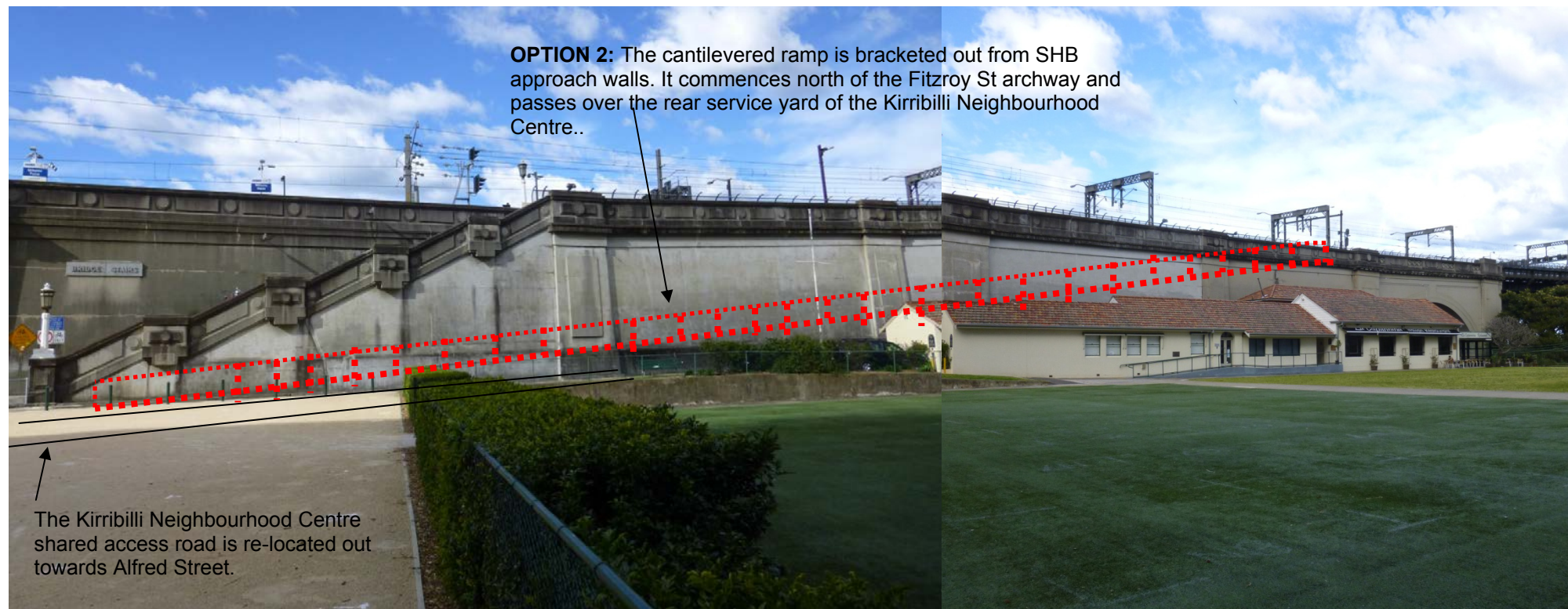
FROM BRIDGE DECK DOWN  
TO BURTON ST, SUPPORTED  
ON CANTILEVERED BRACKETS  
FROM SHB  
APPROACH WALLS.



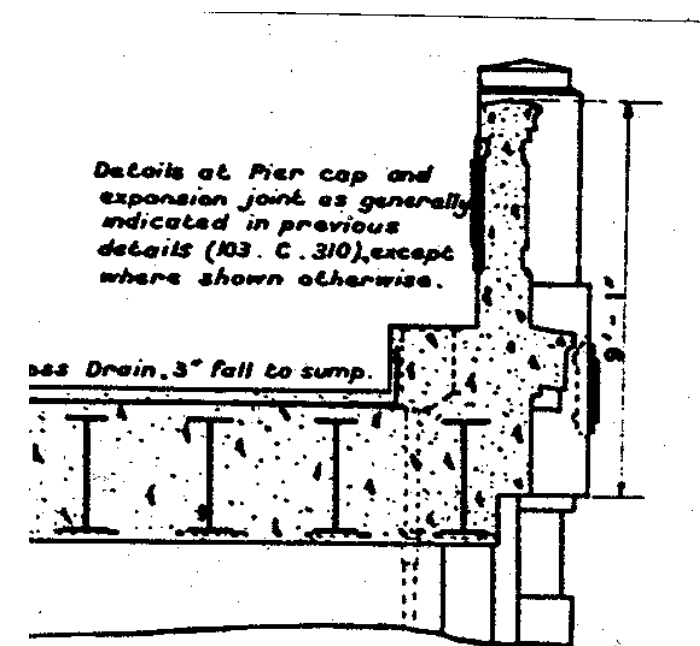
ELEVATION

SCALE 1:200@A3





Option 2: Cantilevered cycleway cantilevered out from the SHB approach walls viewed from Fitzroy Street. The Break in the parapet to access the cycleway should be a suitable distance north of the Fitzroy Street archway to suit the parapet detailing.



Section through the Parapet wall. The cantilver brackets need to allow for the cycleway to carry past the 'cornice' details of the pilasters.



OPTION 2	DATA			ACCESS / SAFETY / AMENITY ISSUES	FABRIC IMPACTS / BUILDABILITY (including heritage fabric impacts)	VISUAL IMPACTS (including aesthetic heritage impacts)
	CYCLEWAY WIDTH	GRADIENT	LENGTH			
Pt 6A AustRoads	2.5-4m	5%	No max.			
From bridge deck down to Burton st, supported on cantilevered brackets from SHB approach walls.	No width restriction	13.3%	81m	<b>SHB / Cycleway</b> POSITIVE <ul style="list-style-type: none"><li>Ramp ends at the existing cycle route at Burton Street.</li><li>Separation of ramp from SHB approach walls discourages attempts to apply graffiti or scale walls.</li><li>Negates cycle/pedestrian/vehicle conflicts that occur when ramp arrives at Burton Street.</li></ul>	<b>SHB / Cycleway</b> POSITIVE <ul style="list-style-type: none"><li>Cycleway can remain in use for most of the construction period.</li></ul>	<b>SHB / Cycleway</b> POSITIVE <ul style="list-style-type: none"><li>Less visual / heritage conflicts with SHB approach walls and Fitzroy Street Arch for closer views compared with Option 3 &amp; 4.</li></ul>
				NEGATIVE <ul style="list-style-type: none"><li>Does not connect directly into the existing cycle route at Burton St. Possible cycle/pedestrian conflicts through Bradfield Park or cycle traffic conflicts if on Alfred Street South.</li><li>New structure imposed on park.</li><li>Cycle / pedestrian / traffic conflict at Burton St needs resolution, particularly on Market Days.</li><li>Gradient is steep at 13.3%.</li><li>Throw screen required.</li></ul>	NEGATIVE <ul style="list-style-type: none"><li>Section of rendered balustrade removed at junction with SHB. Top section may also require large cantilever brackets.</li><li>Cantilever needs to be located at least 3m from the top of retaining wall.</li><li>Temporary closure to Kirribilli Neighbourhood Centre during construction.</li></ul>	
				OTHER <ul style="list-style-type: none"><li>Existing stairs can remain operational (subject to safety analysis).</li><li>Station entry not impacted.</li></ul>		
				<b>Station Entry</b> POSITIVE <ul style="list-style-type: none"><li>Allows better lighting of entrance.</li></ul>	<b>Station Entry</b> POSITIVE <ul style="list-style-type: none"><li>Station Entry not impacted on.</li></ul>	<b>Station Entry</b> POSITIVE <ul style="list-style-type: none"><li>Does not impact on the Station Entry.</li></ul>
				<b>Bradfield Park / Neighbourhood Centre</b> POSITIVE <ul style="list-style-type: none"><li>Only minor impact on Bradfield Park near Burton Street.</li><li>No impact to Neighbourhood Centre. Park lighting can be incorporated under ramp.</li></ul>	<b>Bradfield Park / Neighbourhood Centre</b> <b>POSITIVE</b> <ul style="list-style-type: none"><li>Minor impact on Bradfield Park near Burton Street.</li></ul>	<b>Bradfield Park / Neighbourhood Centre</b> POSITIVE <ul style="list-style-type: none"><li>Visual impacts to Bridge from within Park have better resolution compared with Option 3 &amp; 4.</li><li>Only minor impact on Bradfield Park near Burton Street.</li></ul>
				NEGATIVE <ul style="list-style-type: none"><li>Safety / security concerns with building over Neighbourhood Centre.</li></ul>	NEGATIVE <ul style="list-style-type: none"><li>Difficult to construct over Neighbourhood centre.</li><li>Strata acquisition required.</li></ul>	NEGATIVE <ul style="list-style-type: none"><li>May impact Neighbourhood centre.</li></ul>
					OTHER <ul style="list-style-type: none"><li>Possible archaeological issues for post positions in Bradfield Park North.</li></ul>	OTHER <ul style="list-style-type: none"><li>Additional plantings could help screen for more distant views.</li></ul>

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4.

## OPTION 3

NEW CYCLE RAMP SUPPORTED ON STEEL COLUMNS PARALLEL  
WITH THE SYDNEY HARBOUR BRIDGE APPROACHES THROUGH  
BRADFIELD PARK





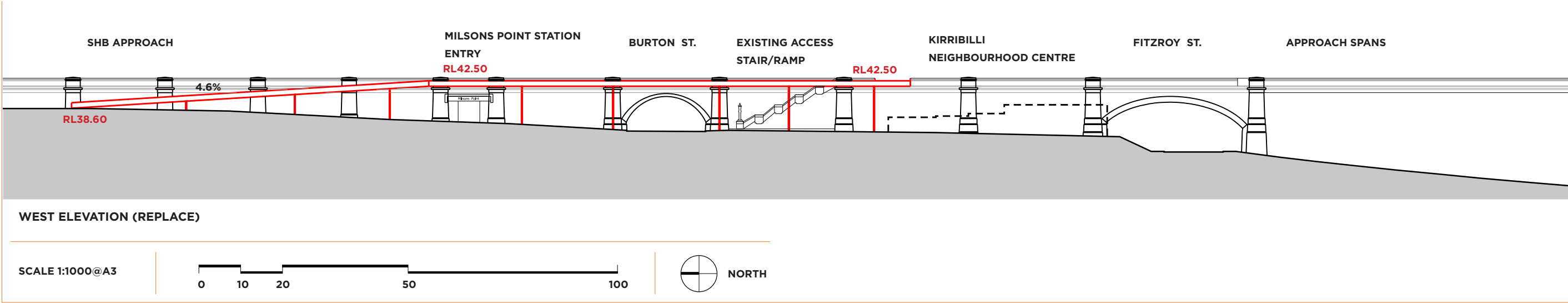
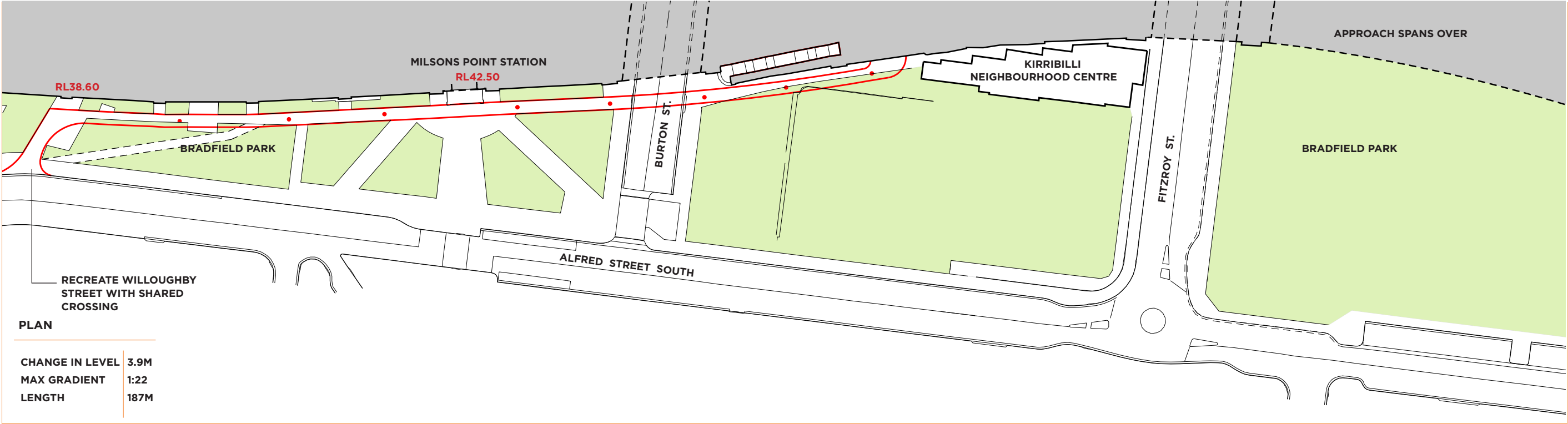
OPTION 3 DESCRIPTION

Ramp commences just to the south of the top of the existing stair and takes cyclists from the bridge deck level (RL42.50) down to Bradfield Park (RL38.60) running parallel to the Bridge approach wall. The ramp stays at

the level of the parapet wall until it is north of the station entrance and only then ramps down. Except where it meets the Bridge approach wall, the ramp is supported on free standing steel columns positioned to avoid conflicts with the existing landscape below. The ramp is aligned with the pedestrian path below.

The ramp arrives at a recreated Willoughby Street which becomes a dedicated cycle area. A new pedestrian path is required through Bradfield Park when the ramp is lower than 3m.

ESTIMATED COST \$10MILLION





4.

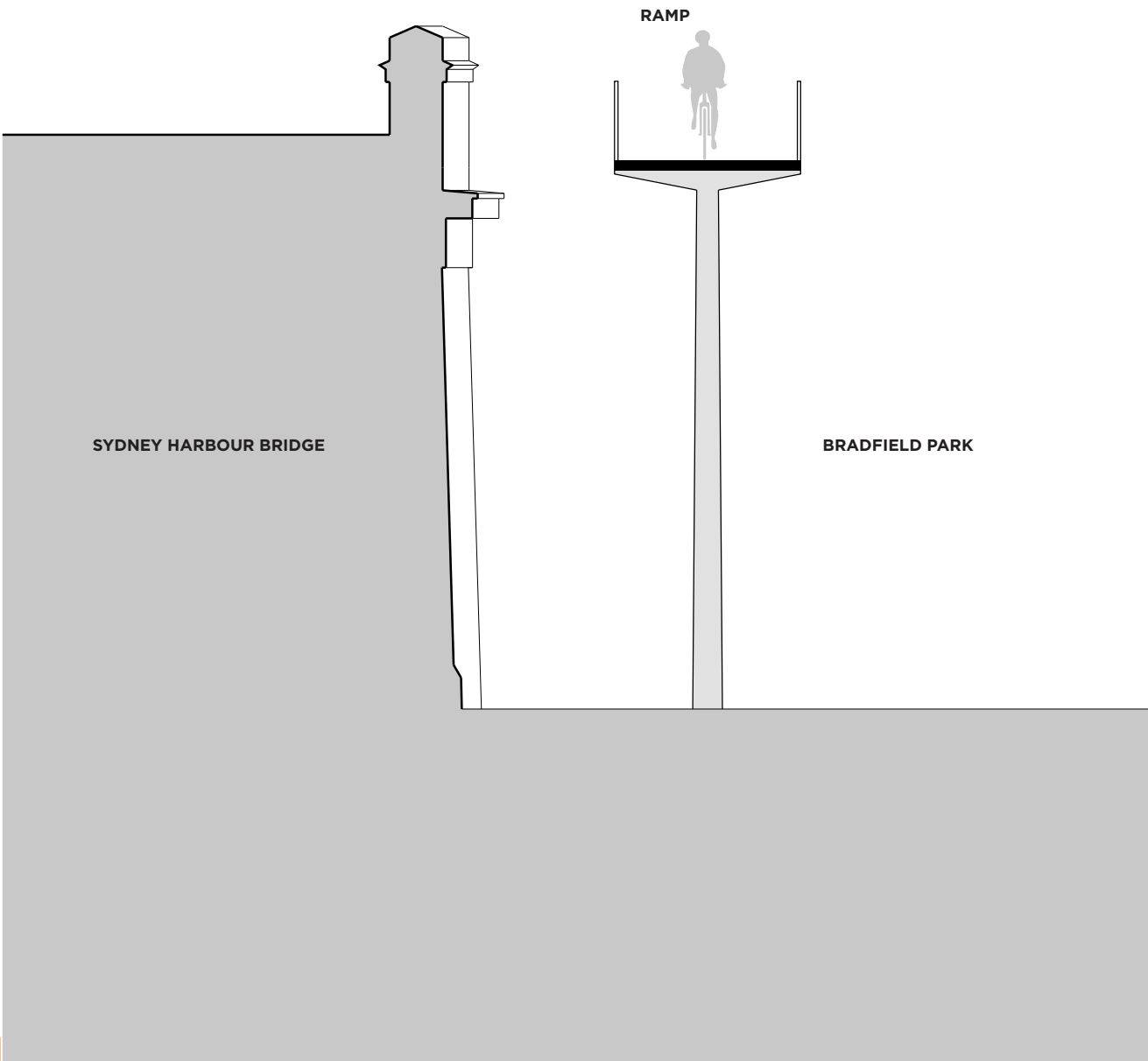
OPTION 3

SECTION

STAND ALONE CYCLE RAMP ON COLUMNS

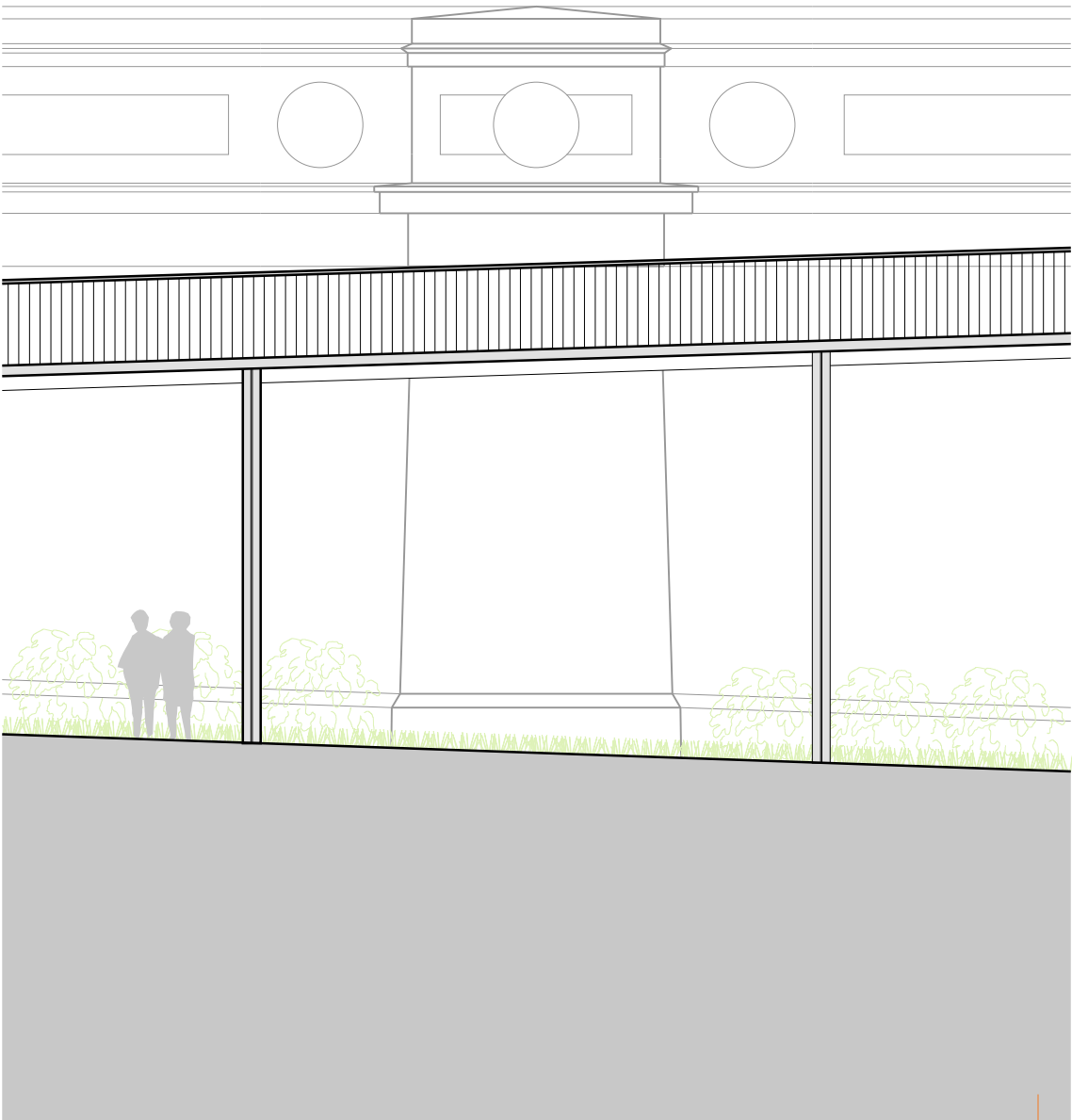
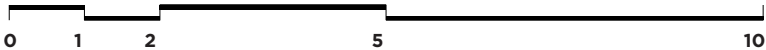
DESCRIPTION

Cycle ramp is supported by a series of columns and is completely independent of the bridge (except at connection point).



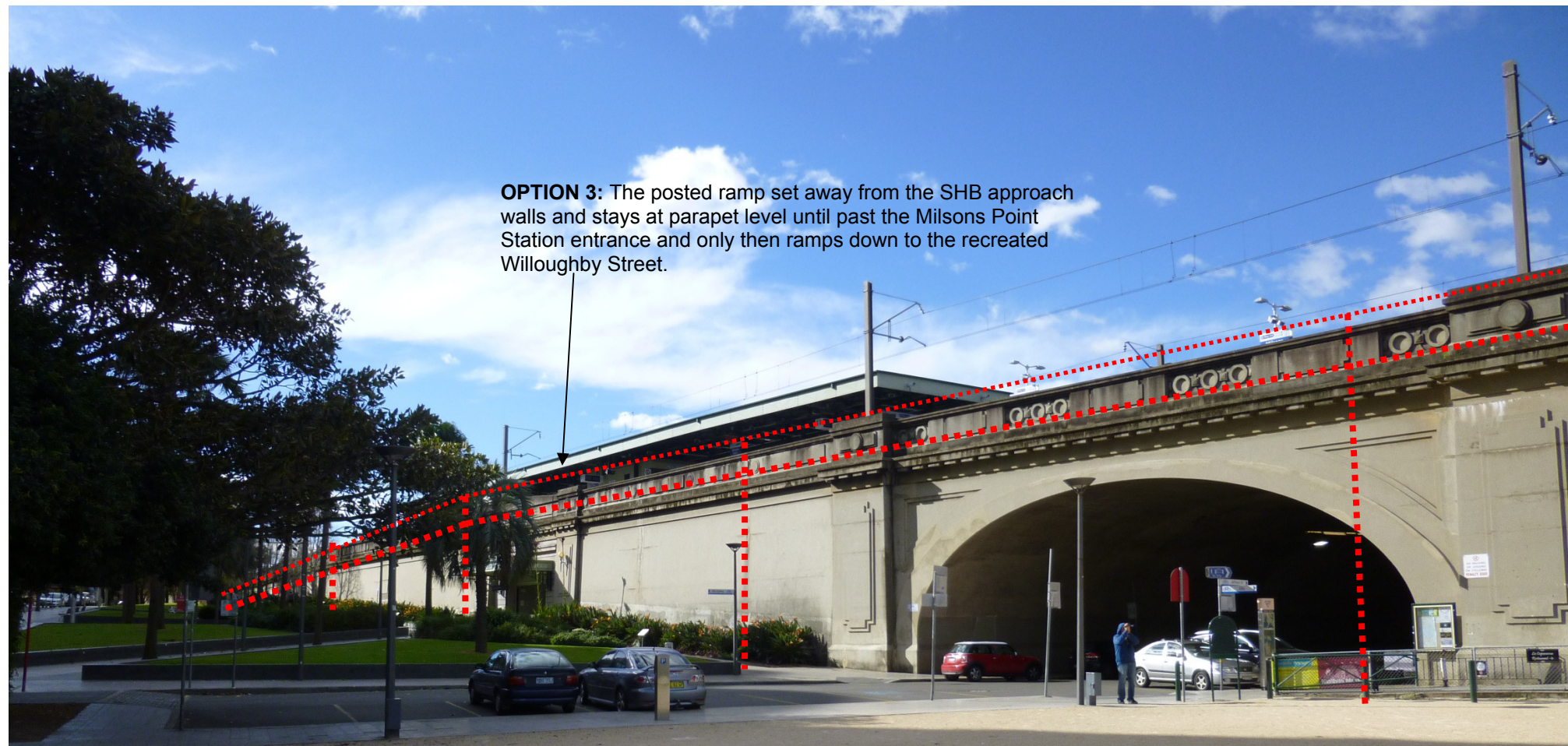
SECTION

SCALE 1:100@A3

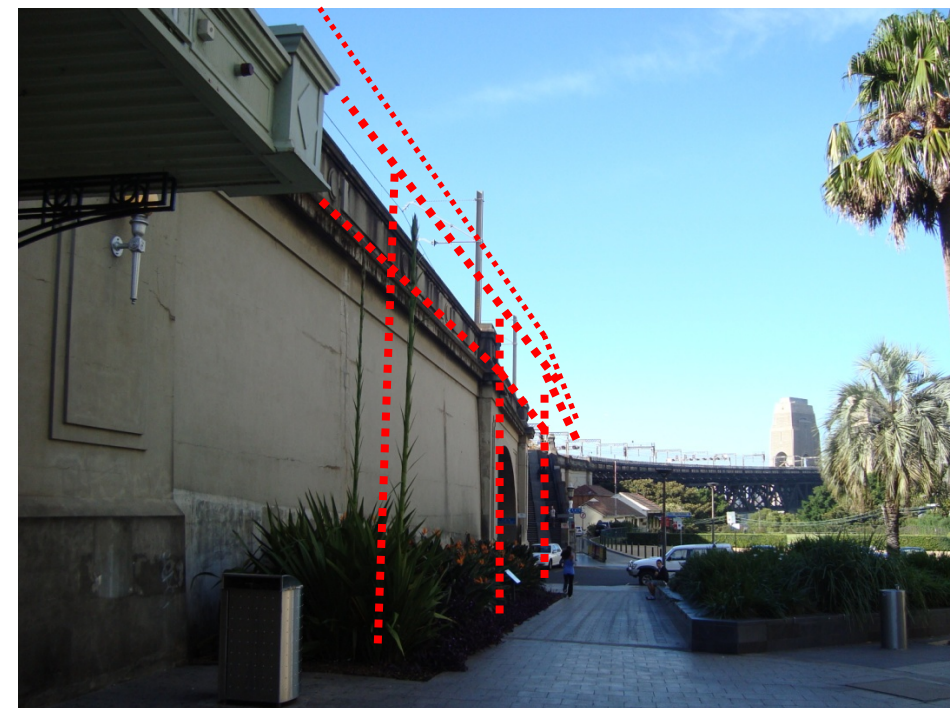


ELEVATION





Option 3: The posted ramp set away from the SHB approach walls and stays at parapet level until past the Milsons Point Station entrance and only then ramps down. Having the ramp horizontal (or parallel with the parapet) above the station entrance means that there is less visual disruption to the symmetrical presentation of the entrance.



Option 3: The posted ramp set away from the SHB approach walls would run approximately over the existing pathway with the support posts off-set in the garden bed. In this view having the ramp at a high level parallel to the parapet means that it has less visual disruption to this important view corridor through to the curving Bridge approach spans.



OPTION 3	DATA			ACCESS / SAFETY / AMENITY ISSUES	FABRIC IMPACTS / BUILDABILITY (including heritage fabric impacts)	VISUAL IMPACTS (including aesthetic heritage impacts)
	CYCLEWAY WIDTH	GRADIENT	LENGTH			
Pt 6A AustRoads	2.5-4m	5%	No max.			
Cycle ramp supported on steel columns parallel with the Sydney Harbour Bridge approaches through Bradfield Park	No width restriction	4.6%	187m	<b>SHB / Cycleway / Burton St</b> POSITIVE <ul style="list-style-type: none"><li>Separation of ramp from SHB approach walls discourages attempts to apply graffiti or scale walls.</li><li>Negates cycle/pedestrian/vehicle conflicts that occur when ramp arrives at Burton St.</li></ul>	<b>SHB / Cycleway / Burton St</b> POSITIVE <ul style="list-style-type: none"><li>Free standing solution has less impact along the length of rendered SHB approach walls.</li></ul>	<b>SHB / Cycleway / Burton St</b> POSITIVE <ul style="list-style-type: none"><li>Less visual / heritage conflicts with SHB approach walls and Burton Street Arch for closer views compared with Option 4.</li><li>It is a separate engineered structure.</li></ul>
				NEGATIVE <ul style="list-style-type: none"><li>Does not connect directly into the existing cycle route at Burton St. Possible cycle/pedestrian conflicts through Bradfield Park or cycle traffic conflicts if on Alfred Street South.</li><li>New Structure imposed on park.</li></ul>	NEGATIVE <ul style="list-style-type: none"><li>Section of rendered balustrade removed at junction with SHB. This section may also require large cantilever brackets.</li></ul>	
				OTHER <ul style="list-style-type: none"><li>Existing stairs can remain operational (subject to safety analysis).</li></ul>		
				<b>Station Entry</b> POSITIVE <ul style="list-style-type: none"><li>Allows better lighting of entrance.</li></ul>	<b>Station Entry</b> POSITIVE <ul style="list-style-type: none"><li>Ramp does not physically conflict with detail of Station Entry Canopy.</li></ul>	<b>Station Entry</b> POSITIVE <ul style="list-style-type: none"><li>Less visual / heritage conflict with the Milsons Pt Station entry from within Park compared with Option 4.</li></ul>
				<b>Bradfield Park / Neighbourhood Centre</b> POSITIVE <ul style="list-style-type: none"><li>Park lighting can be incorporated under ramp.</li><li>No impact on Neighbourhood Centre.</li></ul>	<b>Bradfield Park / Neighbourhood Centre</b> POSITIVE <ul style="list-style-type: none"><li>No impact on Neighbourhood Centre.</li></ul>	<b>Bradfield Park / Neighbourhood Centre</b> POSITIVE <ul style="list-style-type: none"><li>Trees provide some screening to northern end of the ramp for more distant views.</li><li>No impact on Neighbourhood Centre.</li></ul>
					NEGATIVE <ul style="list-style-type: none"><li>Impacts on land belonging to North Sydney Council.</li><li>Grassed areas and some plantings in Park impacted on.</li><li>Property aquisition.</li></ul>	NEGATIVE <ul style="list-style-type: none"><li>Creates clutter in the Park.</li></ul>

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4.

## OPTION 4

NEW CYCLE RAMP FROM TOP OF EXISTING STAIRS DOWN TO  
BRADFIELD PARK, SUPPORTED ON BRACKETS FROM BRIDGE  
APPROACH WALLS





OPTION 4 DESCRIPTION

Ramp commences at top of existing stair and continues over the full width of the stairwell (making the stairs redundant).

It is supported from the SHB approach walls by steel brackets. It takes cyclists from the bridge deck level (RL42.500) across above the Burton Street arch and the

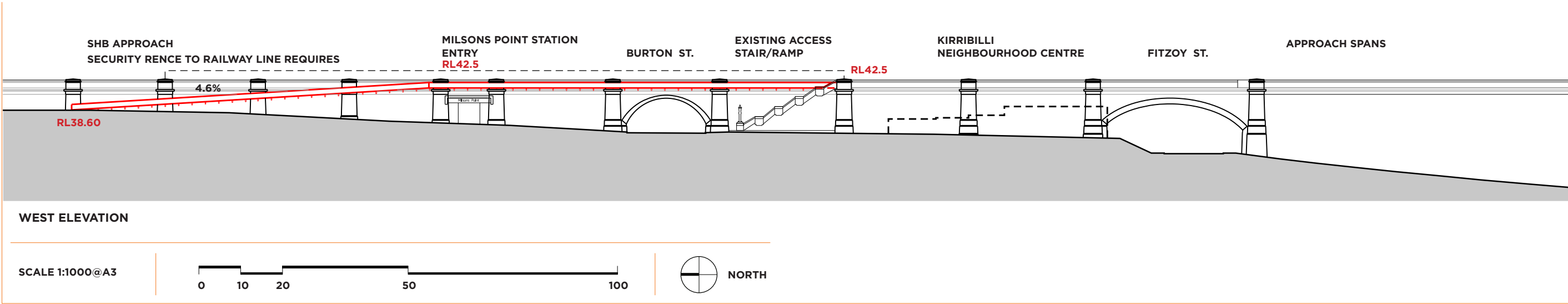
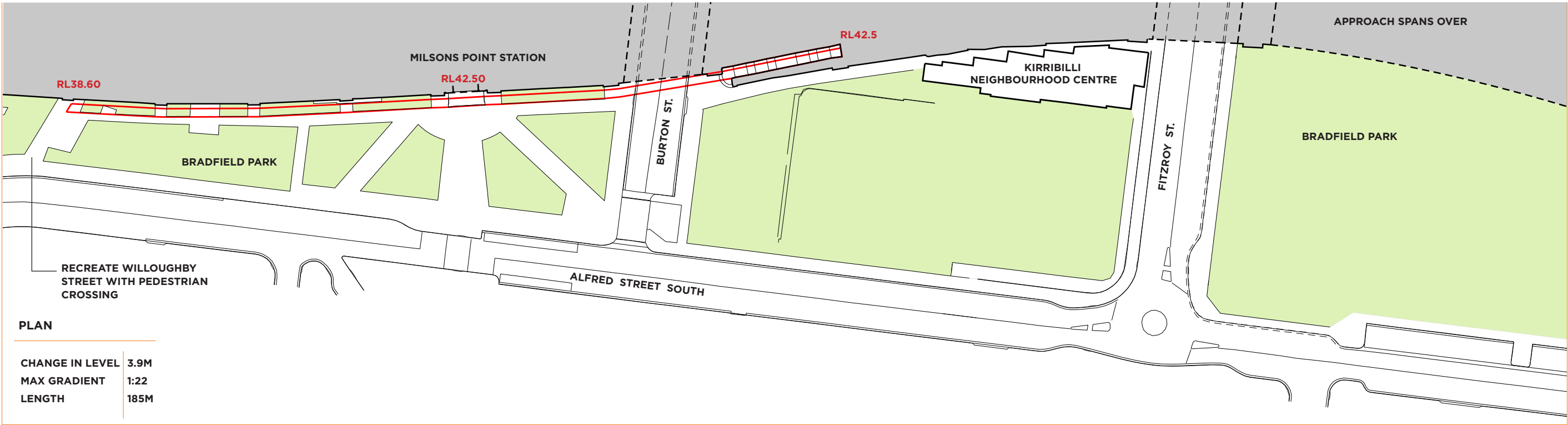
Milsons Point station entry then down to Bradfield Park (RL38.600).

The ramps stays at the level of the parapet until just north of the station entrance and only then ramps down.

The construction of the Northern Approaches of the SHB, (Mass Gravity retaining Wall with Backfill and Steel Beams

support on piers with external Masonry Walls) make this option not feasible due to structural issues. Refer to the RMS Structural Drawings and Structural Feasibility Assessment on page 38.

ESTIMATED COST \$8MILLION (BASED ON COLUMN OPTION 3)





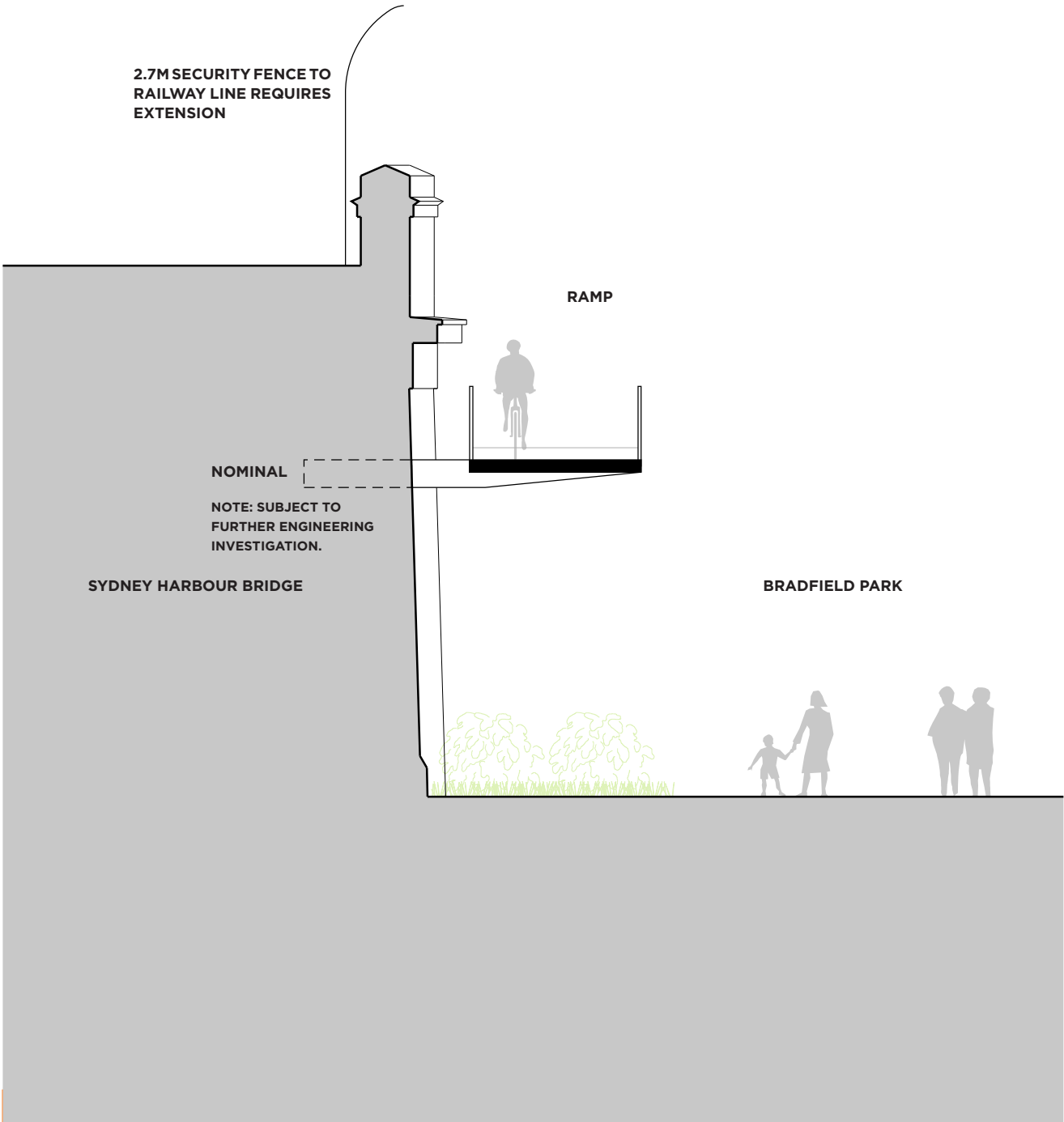
4.

OPTION 4

CANTILEVERED CYCLE RAMP

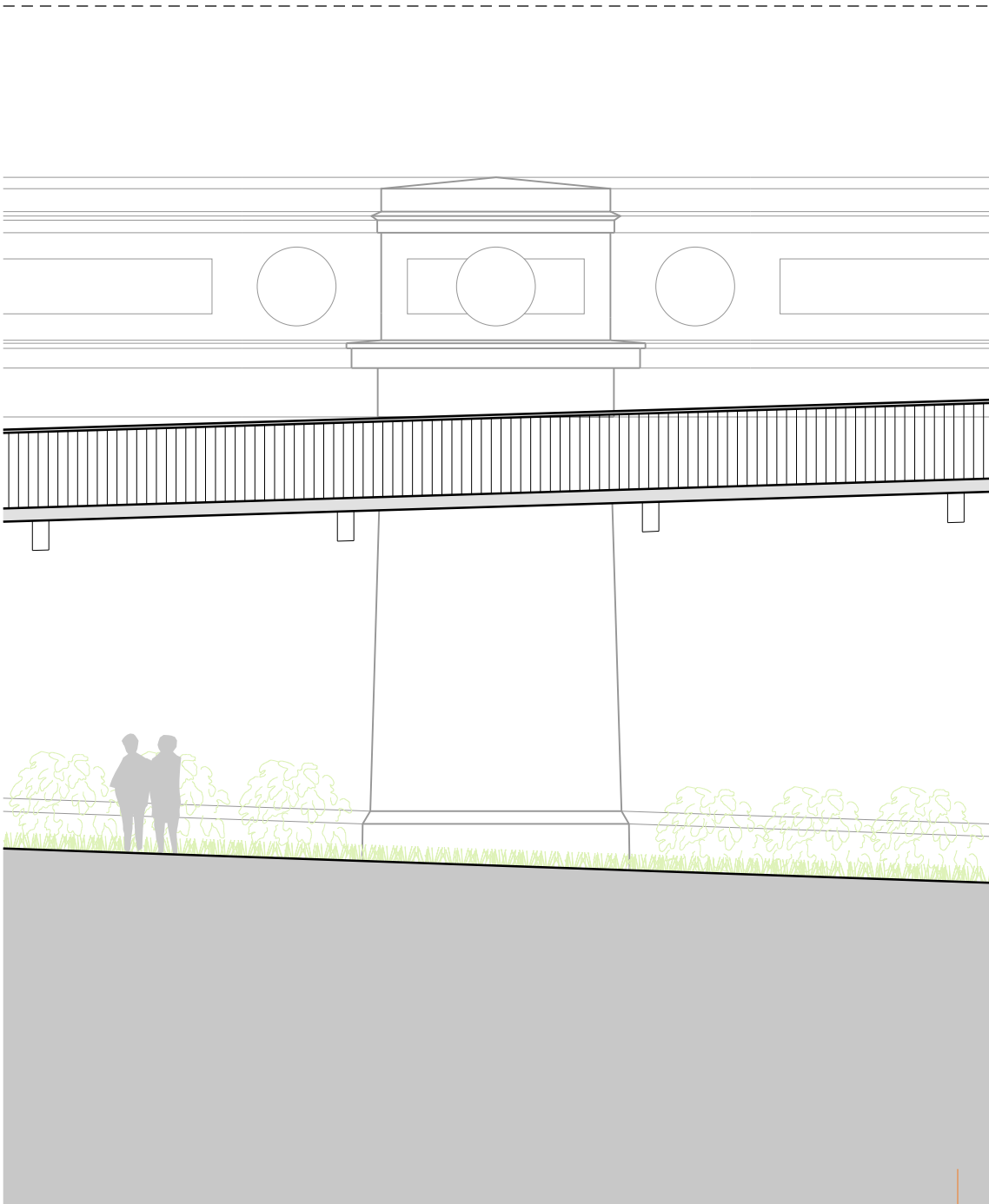
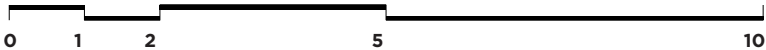
DESCRIPTION

From top of existing stairs down to Bradfield Park (over Burton St), supported on brackets from the SHB approach walls



SECTION

SCALE 1:100@A3



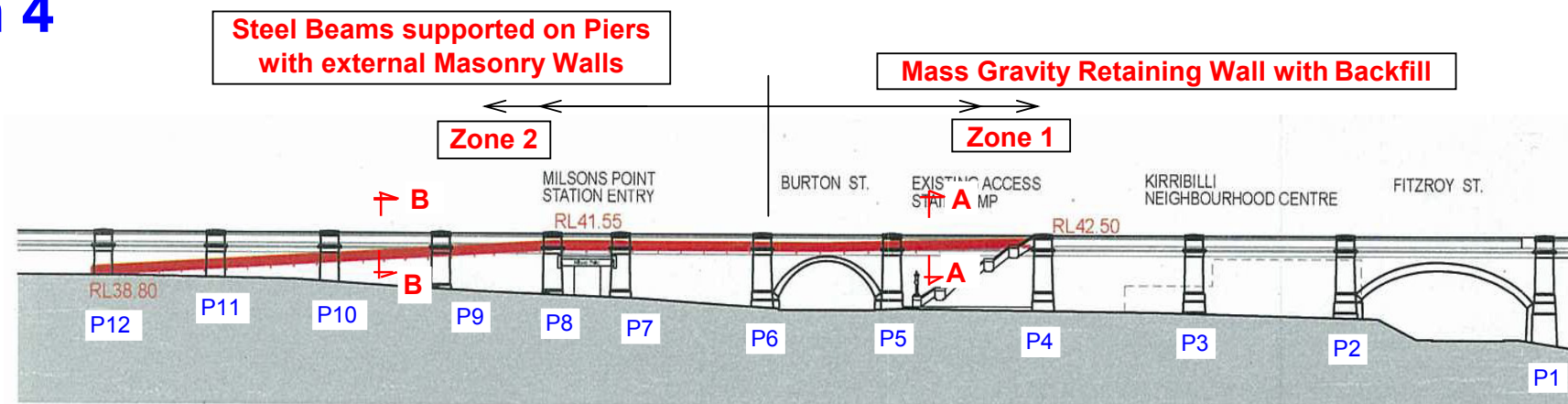
ELEVATION



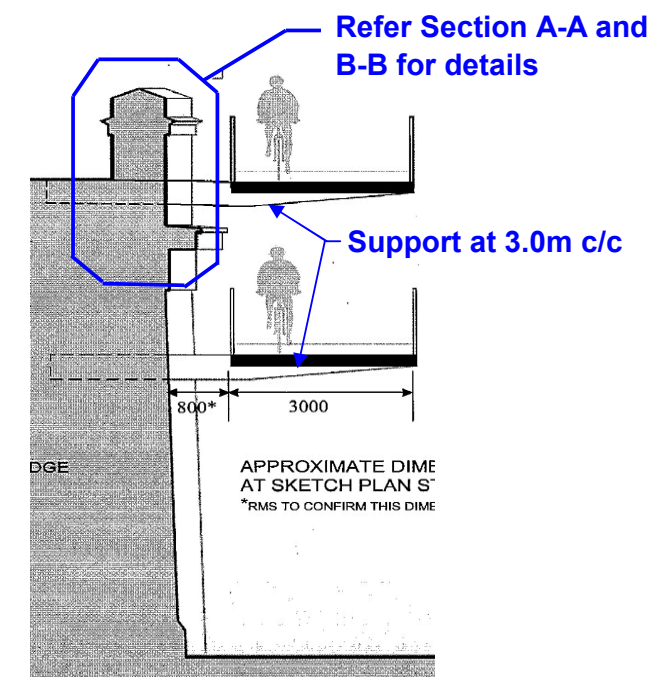


Project	Sydney Harbour Bridge-Northern Approach--New Cycle Ramp Proposal			Job ref
Part of Structure	Structural Feasibility Assessment			Calc sheet no. rev
Drawing Ref				Rev01
	Calc By	Date	Check by	
	YG	9/10/2012		

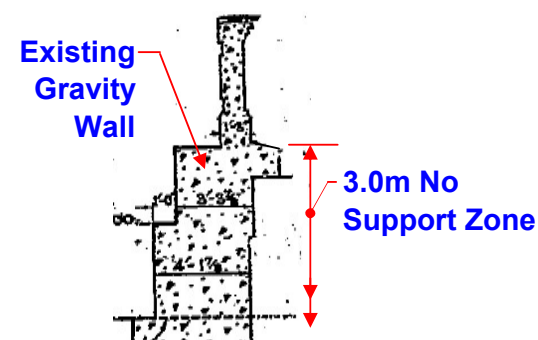
## Option 4



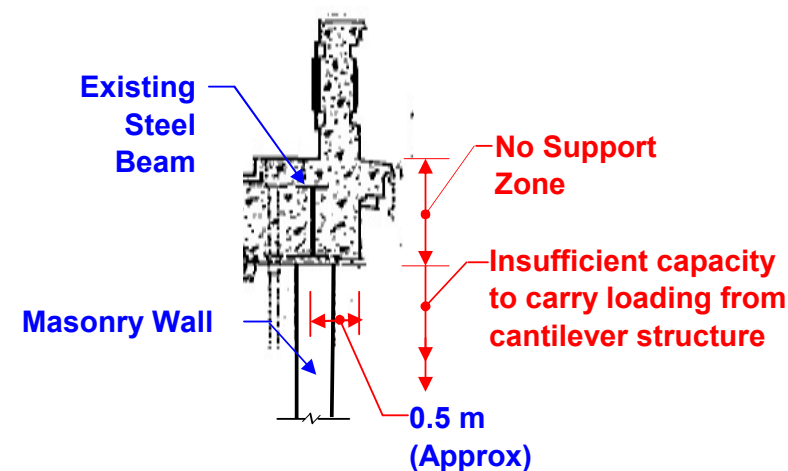
**Fig 1. Proposed Longitudinal Elevation**



**Fig 2. Proposed Cross Section**



**Section A-A**



**Section B-B**

### Description:

The new cycle ramp is proposed to be supported on the existing external walls of Sydney Harbour Bridge Northern Approach between P4 to P12 (refer Fig 1). The width of the cycle ramp is 3.0 meters and 0.8 meters offset from the wall (refer Fig 2). Spacing of the supports is approximately 3.0 meters centre to centre. Cycle ramps are formed by structural steel frames with Fibreglass Reinforced Plastic (FRP) deck.

The existing walls in the proposed area have two different types of structure - structural wall and non-structural wall indicated as gravity retaining wall (Zone 1, Fig 1) and a masonry wall (Zone 2, Fig 1) respectively.

### Structural Feasibility Assessment:

1. The new cycle ramp located at Zone 1 (refer Fig 1) is proposed to be supported on the gravity retaining wall between P4 to P6 and the proposed steel supports are intended to be inserted into the gravity wall approximately at road/rail level (refer Fig 2). To be able to achieve the fixed support for the cantilever structure, the existing gravity wall requires adequate capacity to balance the ultimate bending moment and shear forces from the proposed cantilever structure. As the result of engineering calculations for the position of the steel supports on the existing retaining wall, the distance from top of the retaining wall should not be less than 3.0 meters. (refer Section A-A)
2. For the cycle ramp located at Zone 2 (refer Fig 1), it is not feasible to insert the new steel support into the wall due to the existing longitudinal steel beams, which are approximate 0.5 meters from the external face of wall (see Section B-B). Therefore it does not have sufficient depth to embed the steel supports.
3. Based on the existing drawing, the masonry wall also does not have sufficient capacity to carry the additional loads as it is a non-structural wall.

### Conclusions:

The existing gravity retaining wall and masonry wall do not have the adequate capacity to carry the additional loads from the proposed cantilever structure. Therefore it is concluded that the proposed options 4 is not a feasible option.

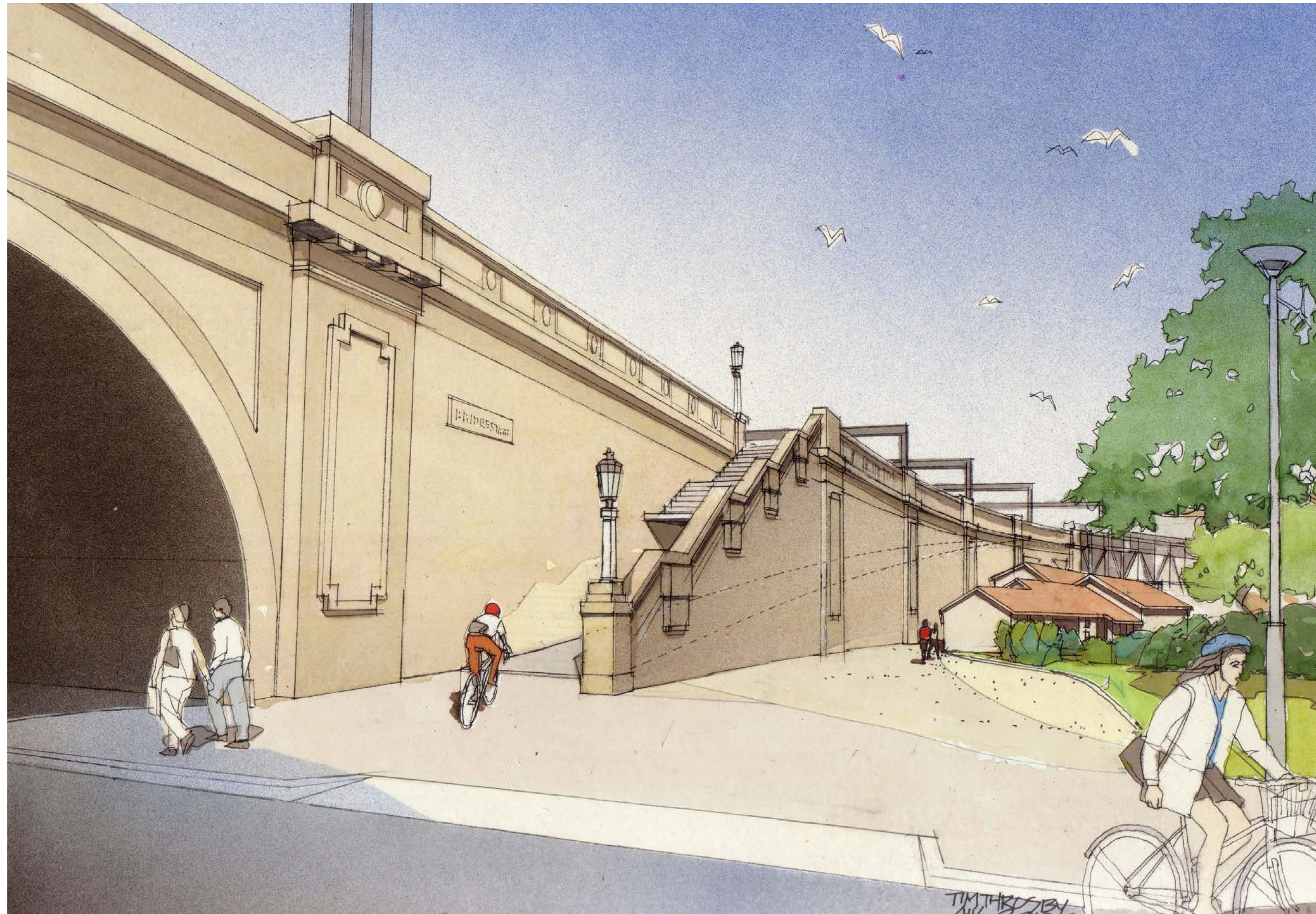
OPTION 4	DATA			ACCESS / SAFETY / AMENITY ISSUES	FABRIC IMPACTS / BUILDABILITY (including heritage fabric impacts)	VISUAL IMPACTS (including aesthetic heritage impacts)
	CYCLEWAY WIDTH	GRADIENT	LENGTH			
Pt 6A AustRoads	2.5-4m	5%	No max.			
From top of existing stairs down to Bradfield Park (over Burton st), supported on brackets from the SHB approach walls.	2.8m at SHB	4.6%	185m	<b>SHB / Cycleway / Burton St</b> POSITIVE <ul style="list-style-type: none"><li>Continues line of existing cycleway.</li><li>Negates cycle/pedestrian/vehicle conflicts that occur where the existing cycleway ramp arrives at Burton St.</li></ul>	<b>SHB / Cycleway / Burton St</b> POSITIVE <ul style="list-style-type: none"><li>Top of ramp above existing stair can be detailed to be ‘reversible’ (although stair closed to public). No SHB balustrade removed.</li></ul>	<b>SHB / Cycleway / Burton St</b> POSITIVE <ul style="list-style-type: none"><li>Top of ramp fits neatly into existing stairwell.</li></ul>
				NEGATIVE <ul style="list-style-type: none"><li>Does not connect directly into the existing cycle route at Burton St. Possible cycle/pedestrian conflicts through Bradfield Park or cycle traffic conflicts if route via Alfred Street South.</li><li>Existing stair made redundant – needs screening, potential for vandalism.</li><li>May encourage graffiti or scaling of SHB approach walls.</li></ul>	NEGATIVE <ul style="list-style-type: none"><li>Engineered ramp brackets attached to SHB approach walls may need to be substantial. This is a major intervention in the rendered façade.</li><li>Cycleway cannot be used during construction period. Temporary scaffold stair required.</li><li>Cantilever needs to be located 3m below retaining wall.</li></ul>	NEGATIVE <ul style="list-style-type: none"><li>Visual / heritage conflict with: cornice and pilaster rendered detail on Bridge approach and the Burton Street arch. Also ‘Bridge Stairs’ sign.</li></ul>
				OTHER <ul style="list-style-type: none"><li>Will need additional screening at top of ramp to provide security to railway corridor.</li></ul>	OTHER <ul style="list-style-type: none"><li>Brackets need to be positioned to avoid impacts on cornice and pilaster rendered detail.</li></ul>	
				<b>Station Entry</b> POSITIVE <ul style="list-style-type: none"><li>Reduced conflict.</li></ul>	<b>Station Entry</b> NEGATIVE <ul style="list-style-type: none"><li>Has to be positioned so the steel and copper awning to station entry is not impacted on.</li><li>Difficult to avoid impact on rendered detailing and lighting around station entry.</li></ul>	<b>Station Entry</b> NEGATIVE <ul style="list-style-type: none"><li>Visual / heritage conflict with and the Milsons Pt Station entry.</li><li>Obscures rendered detailing and light brackets around entry.</li></ul>
				NEGATIVE <ul style="list-style-type: none"><li>Security issue of being able to access Station Entry awning from cycleway.</li></ul>		
				<b>Bradfield Park / Neighbourhood Centre</b> POSITIVE <ul style="list-style-type: none"><li>Park lighting can be incorporated under ramp.</li><li>No impact on Neighbourhood Centre.</li></ul>	<b>Bradfield Park / Neighbourhood Centre</b> POSITIVE <ul style="list-style-type: none"><li>No impact on Neighbourhood Centre.</li></ul>	<b>Bradfield Park / Neighbourhood Centre</b> POSITIVE <ul style="list-style-type: none"><li>Trees provide some screening to northern end of the ramp.</li><li>No impact on Neighbourhood Centre.</li></ul>
				NEGATIVE <ul style="list-style-type: none"><li>At lower end cycleway takes up existing pedestrian path adjacent to the SHB Approach walls in Park requiring re-design of Park (loss of grassed area).</li></ul>		
					NEGATIVE <ul style="list-style-type: none"><li>Path, grassed areas and possibly some plantings in Park impacted on.</li><li>Property acquisition.</li></ul>	NEGATIVE <ul style="list-style-type: none"><li>1940s park design may be disrupted.</li></ul>



4.

## OPTION 5

CYCLE RAMP REGRADED WITHIN EXISTING CYCLEWAY AND STAIR-  
WELL ARRIVING AT BURTON STREET



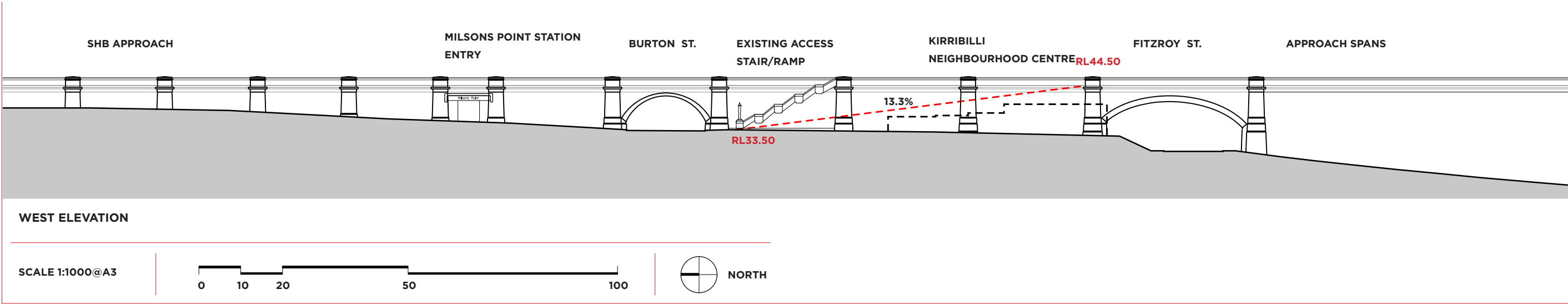
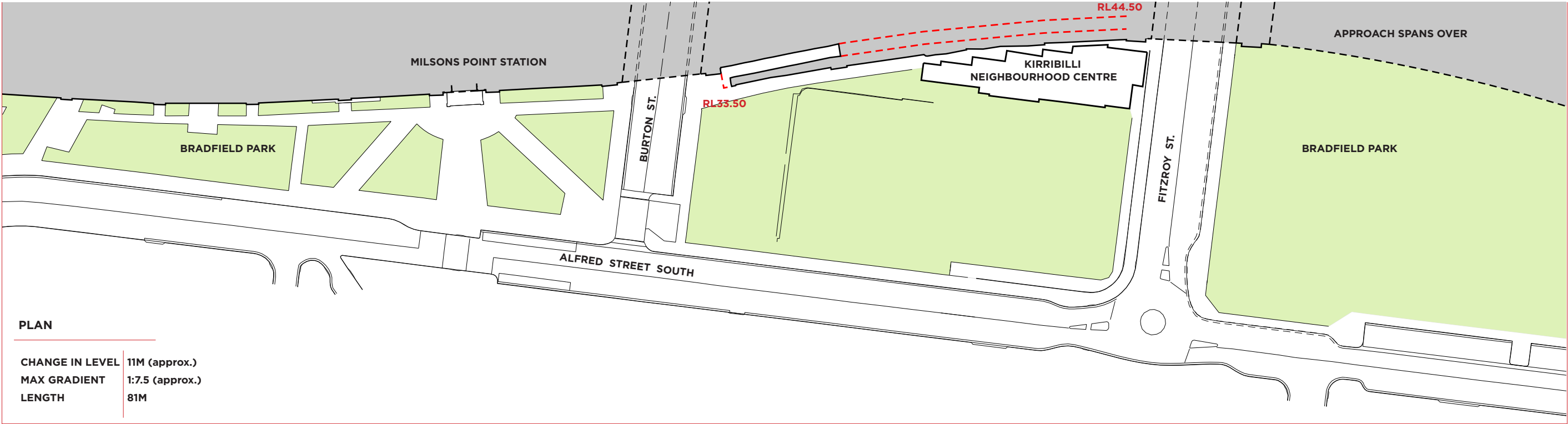


OPTION 5 DESCRIPTION

With a constant grade of 1:7.5 (13.3%) the cycle ramp takes cyclists from the bridge deck level (RL44.500) down to Burton Street (RL33.500).

While the construction is technically possible this option is not feasible due to the impact and closure of railway operation during the construction of a new retaining wall. Refer to the RMS Structural Drawings and Structural Feasibility Assessment on page 43.

ESTIMATED COST \$97MILLION



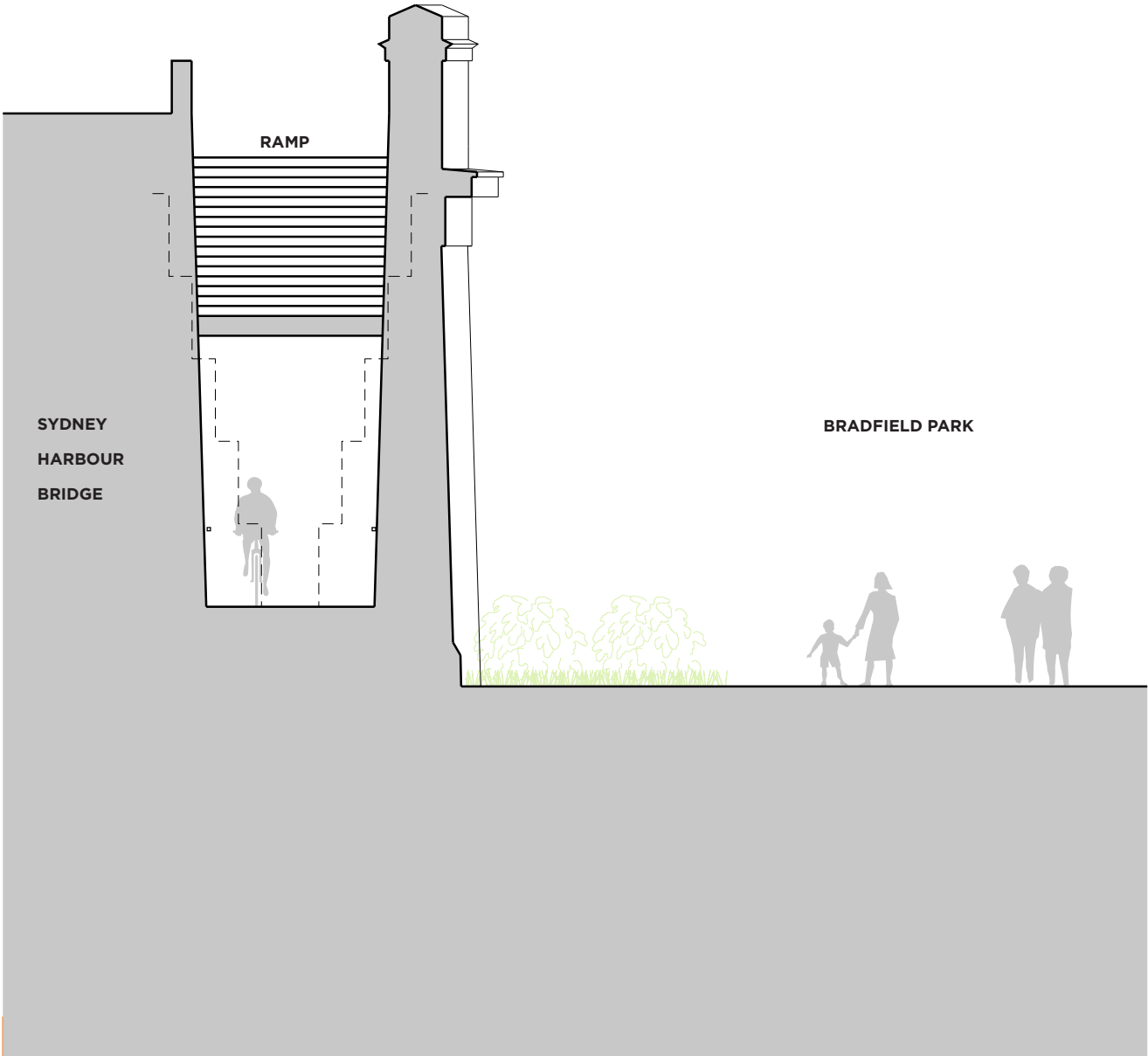


4.

OPTION 5

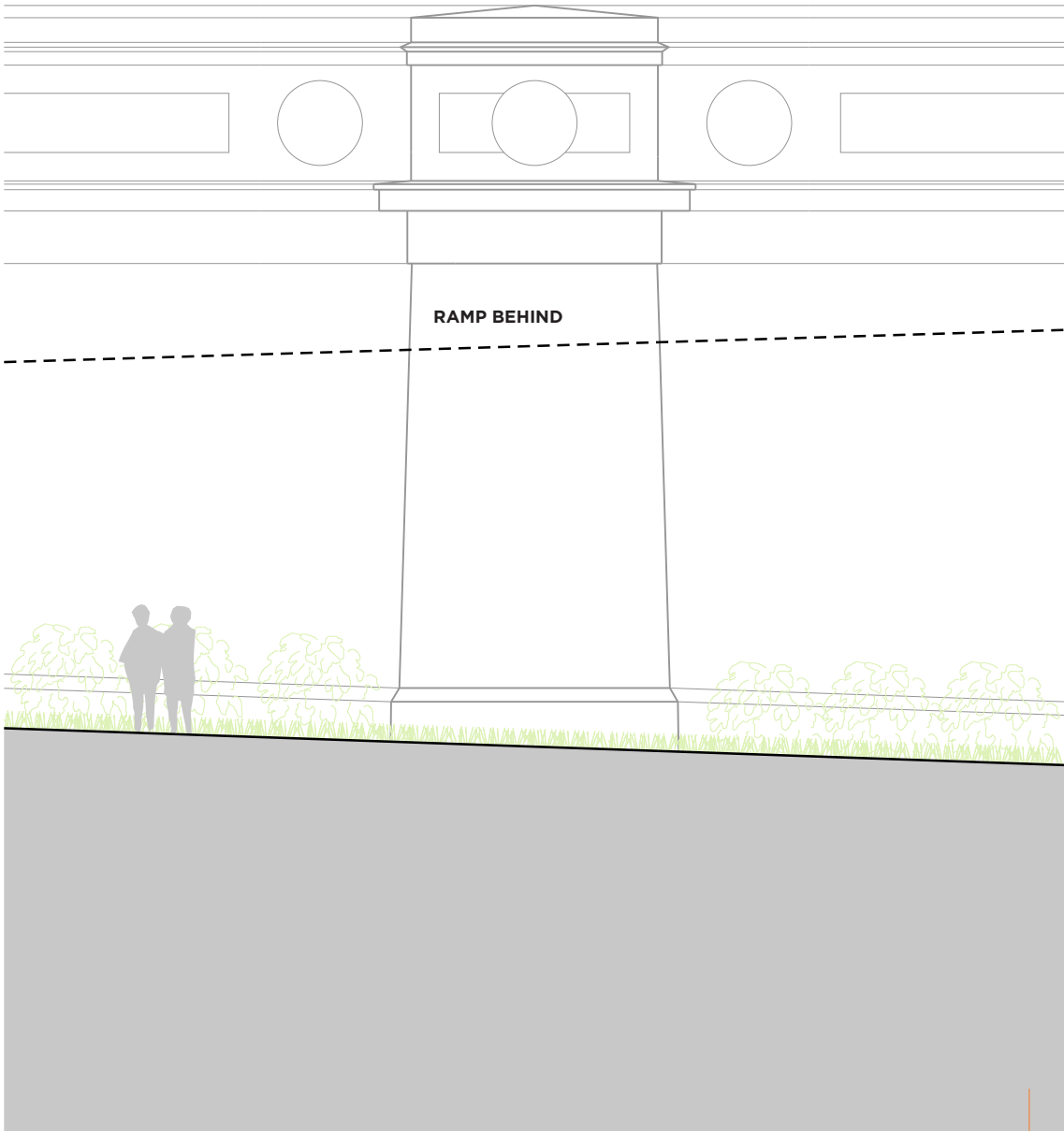
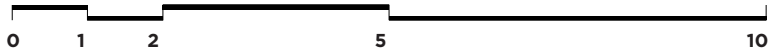
SECTION

CYCLE RAMP REGRADED WITHIN  
EXISTING CYCLEWAY AND STAIRWELL  
ARRIVING AT BURTON STREET



SECTION

SCALE 1:100@A3



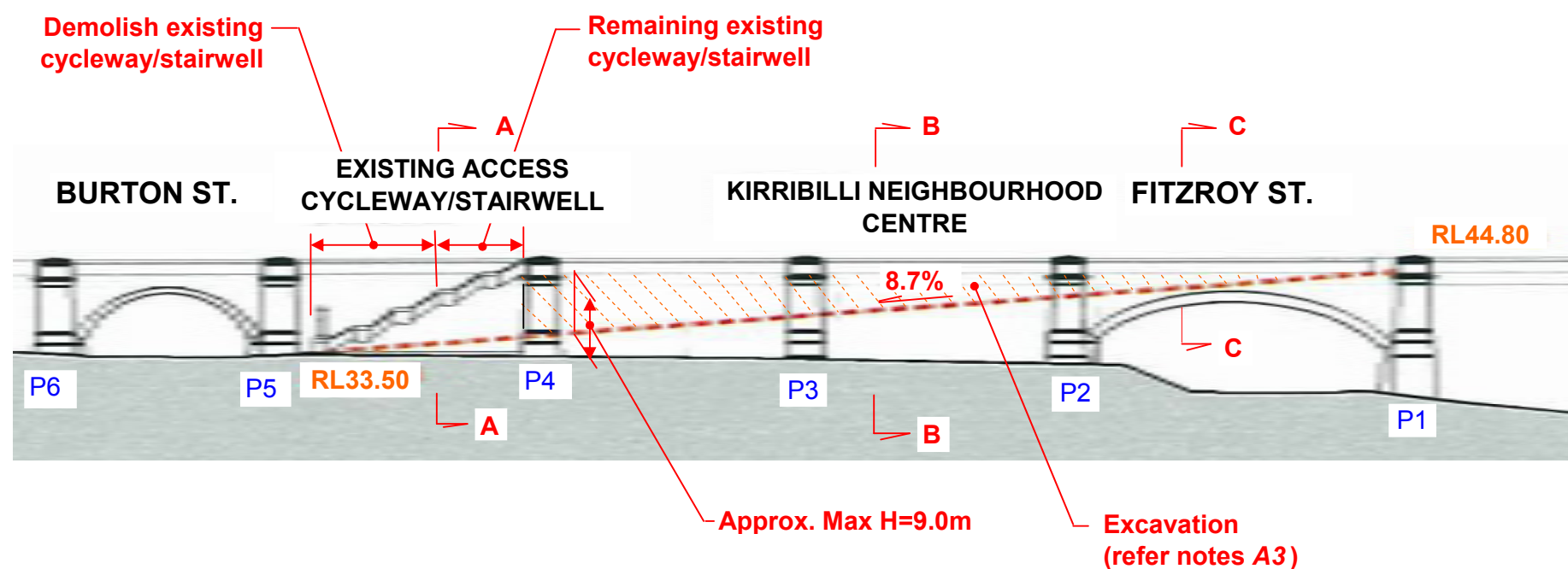
ELEVATION

Project	Sydney Harbour Bridge-Northern Approach--New Cycle Ramp Proposal			Job ref
Part of Structure	Structural Feasibility Assessment			sheet no. Rev01
Drawing Ref		By	Date	Check by
		YG	9/10/2012	

## Option 5– Sheet 1 of 3


### Description

1. The new cycle ramp is proposed to be regraded within the existing cycleway and stairwell, and takes cyclist from the bridge deck level (RL 44.880) down to Burton Street (RL33.500).
2. The width of the proposed cycle ramp remains the same as the existing cycleway and stairwell with a constant grade of 1:11.5 (8.7%).
3. The existing cycleway and stairwell between P4 and P5 are supported on gravity walls (refer Section A-A) and cycleway at road/ railway level (RL44.8) between P1 to P4 is on the backfill, which is retained by the gravity wall. (refer Section B-B)



**Fig 1. ELEVATION**



 <b>Transport</b> Roads & Maritime Services	Project	Sydney Harbour Bridge-Northern Approach--New Cycle Ramp Proposal			Job ref		
	Part of Structure	Structural Feasibility Assessment			sheet no. Rev01		
	Drawing Ref				By	Date	Check by
					YG	9/10/2012	

Option 5– Sheet 2 of 3

Construction Sequence:

- A1 Rail closure is required prior to construction of the new retaining walls.

A2 Construct a new retaining wall R1 from road/railway level socketed into the rock.

(refer Fig 2 and Section B-B)

A3 Excavate behind the wall R1 to the proposed new cycle ramp level and cut the existing retaining wall to a vertical line to provide a space for the new cycle ramp.

(refer Section B-B)
- A4 Temporary remove railway tracks-T2 (between P1 and P2) for the construction of the new gravity retaining on top of arch underpass.

A5 Construct a temporary retaining wall over the existing arch underpass prior to excavate.

A6 Excavate to the top of arch underpass, drill the dowel bars into the concrete arch (refer Section C-C) then construct the new gravity retaining wall R2.

Backfill and re-install railway tracks.
- A7 Backfill behind wall R2 to the proposed new cycle ramp level and cut the existing retaining wall to a vertical line to provide a space for new cycle ramp. (refer Section C-C)

A8 Remove existing gravity wall ER1 for the new cycle ramp access (refer Fig 2) and cut the existing external retaining wall to a vertical line. (refer Section A-A).

A9 Remove existing stairs. (refer Fig 2)

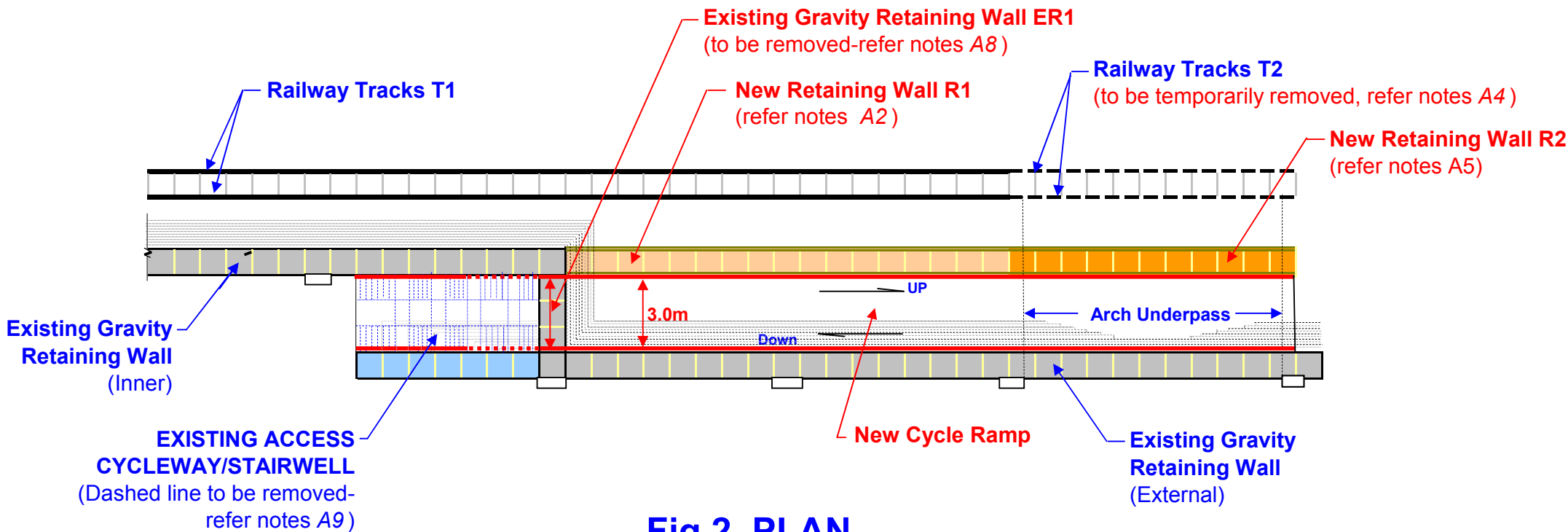



Fig 2. PLAN

 <b>Transport</b> Roads & Maritime Services	Project	Sydney Harbour Bridge-Northern Approach--New Cycle Ramp Proposal			Job ref					
	Part of Structure	Structural Feasibility Assessment			sheet no.    Rev01					
	Drawing Ref				<table><tr><td>By</td><td>Date</td><td>Check by</td></tr><tr><td>YG</td><td>9/10/2012</td><td></td></tr></table>	By	Date	Check by	YG	9/10/2012
By	Date	Check by								
YG	9/10/2012									

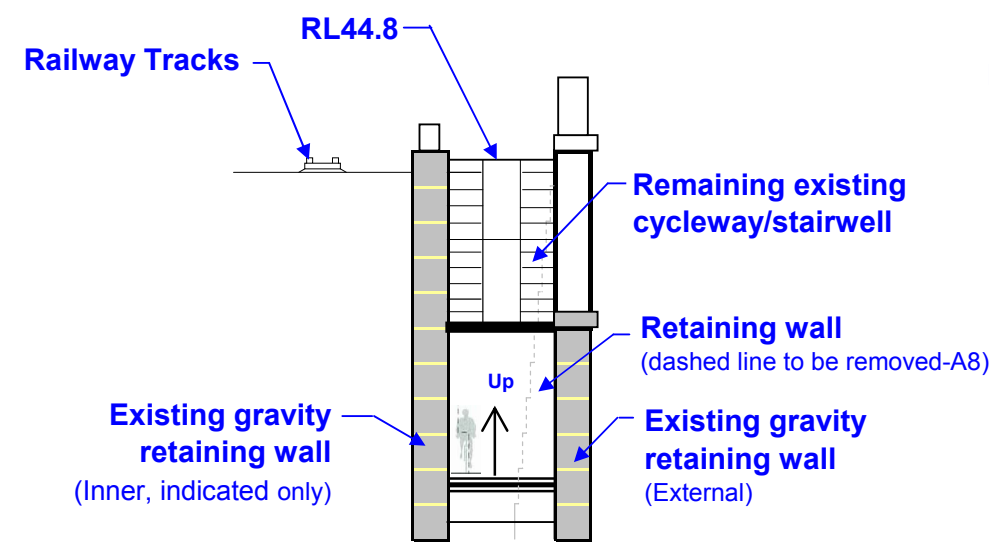
Option 5– Sheet 3 of 3

Structural Feasibility Assessment:

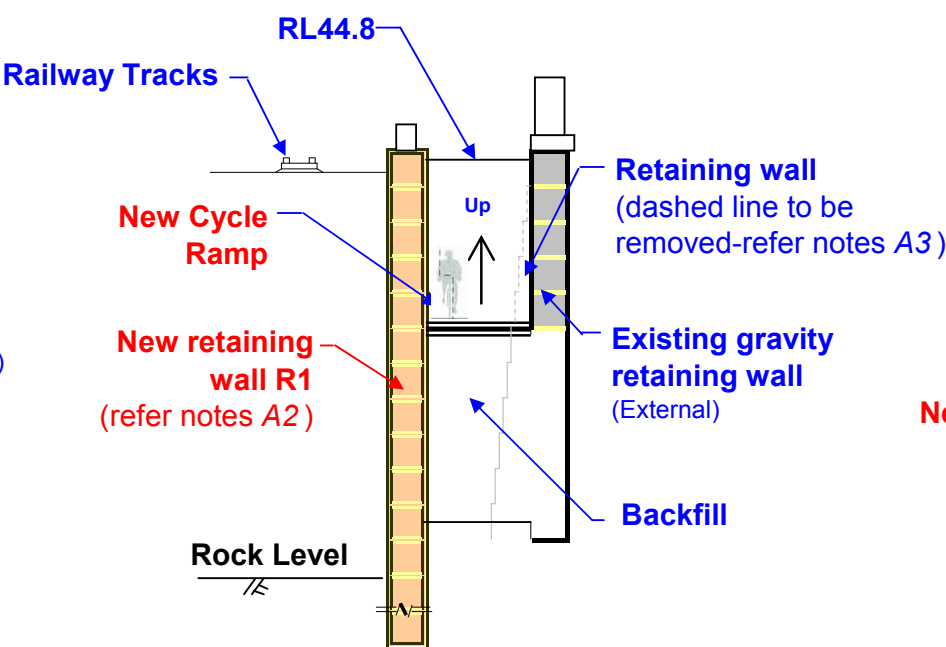
- B1 Significant impact to railway operation due to the vibration and relocation of tracks for the construction of the new wall R1 and R2 respectively.
- B2 Stability of the existing external wall after cutting to a vertical line, requires strengthening if the free standing is more than 2m height.

Conclusions:

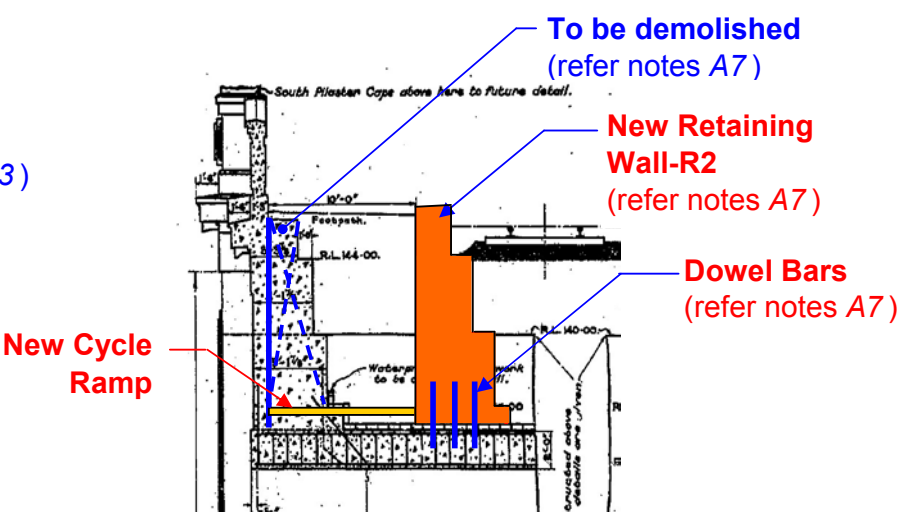
Option 5 appears to be feasible for structural and technical aspect, however it would not be practically feasible to construct due to cost and disruption to the railway operations.



Section A-A



Section B-B



Section C-C



OPTION 5	DATA			ACCESS / SAFETY / AMENITY ISSUES	FABRIC IMPACTS / BUILDABILITY (including heritage fabric impacts)	VISUAL IMPACTS (including aesthetic heritage impacts)
	CYCLEWAY WIDTH	GRADIENT	LENGTH			
Pt 6A AustRoads	2.5-4m	5%	No max.			
Ramp excavated behind the SHB approach wall within the same alignment of the existing stair (Part of existing cycleway and stair demolished)	2.8m Limited by existing stair-well width.			<b>SHB / Cycleway</b> POSITIVE <ul style="list-style-type: none"><li>Continues line of existing cycleway.</li><li>Ramp ends at the existing cycle route at Burton Street.</li></ul>	<b>SHB / Cycleway</b> POSITIVE <ul style="list-style-type: none"><li>No impact on external detailing of SHB approach walls and their detail.</li></ul>	<b>SHB / Cycleway</b> POSITIVE <ul style="list-style-type: none"><li>Very little impact on views to SHB.</li></ul>
				NEGATIVE <ul style="list-style-type: none"><li>Gradient is steep at 13.3%.</li><li>Much of the ramp will be dark and will require lighting.</li><li>Security risk due to lack of public surveillance, particularly at night.</li></ul>	NEGATIVE <ul style="list-style-type: none"><li>Requires removal of at least 50% of the concrete treads and risers of SHB stairs.</li><li>Cycleway cannot continue in use during construction. Temporary scaffold stair required.</li><li>New internal retaining wall required.</li><li>Rail closure required during construction.</li></ul>	
					OTHER <ul style="list-style-type: none"><li>Requires further investigation of ability to excavate behind SHB approach wall and stabilise it. May be very difficult to construct and engineer.</li></ul>	
				<b>Station Entry</b> POSITIVE <ul style="list-style-type: none"><li>Does not impact on the Station Entry.</li></ul>	<b>Station Entry</b> POSITIVE <ul style="list-style-type: none"><li>Does not impact on the Station Entry.</li></ul>	<b>Station Entry</b> POSITIVE <ul style="list-style-type: none"><li>Does not impact on the Station Entry.</li></ul>
				<b>Bradfield Park / Neighbourhood Centre</b> POSITIVE <ul style="list-style-type: none"><li>Does not change current status for Bradfield Park and Neighbourhood Centre.</li></ul>	<b>Bradfield Park / Neighbourhood Centre</b> POSITIVE <ul style="list-style-type: none"><li>Does not change current status for Bradfield Park and Neighbourhood Centre.</li><li>No aquisition required.</li></ul>	<b>Bradfield Park / Neighbourhood Centre</b> POSITIVE <ul style="list-style-type: none"><li>Does not change current status for Bradfield Park and Neighbourhood Centre.</li></ul>

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5.

CONCLUSION

Each cycle ramp option is slightly different in terms of its impact on the access, heritage, physical and visual amenity of Sydney Harbour Bridge, Bradfield Park and its surrounds. There are impacts associated with this project, particularly in relation to the heritage and visual quality of the area. To address these issues, a sensitive high quality design will be needed.

There are customer benefits in regards to removing the use of the existing 55 steps which includes improving the safety requirements and journey times. The existing cycle access limits the age and type of bicycles that can be used due to the existing steps, as cyclist are required to haul their bikes up and down the steep steps. The benefits of the proposed cycle ramp options permits all cyclist to utilise the cycle ramp. This will encourage more cyclist who were reluctant to use the cycle way. In addition the propose ramp connects the SHB cycle access onto the connecting streets which inturn improves accessibility.

While all the options seek to optimise the width of the cycleway, the width is limited to the maximum available on the Sydney Harbour Bridge.

In addition when considering the proposed grade for the new ramp, it should be remembered that the surrounding topography presents less than optimal grades for cyclists.

Option 1 has the more positive outcomes. However the more detailed design of the posted structure and the potential conflict with the Kirribilli Neighbourhood Centre requires resolution. In addition with exceeding the max grade of 5%.outlined in the Ausroad guidelines.

For the remaining options – Option 3 is also freestanding away from the SHB ‘approaches’ are more favourable in heritage and aesthetic terms than those bracketed from the walls (Options 2 and 4). This is because the bracketed options will obscure the cornice and balustrade detail of the SHB Approaches they will also require significant fabric interventions. These attributes are of importance to the National, State and local heritage values of the Bridge. The 2007 RMS Conservation Management Plan (page 51) notes:

*The consistent detail treatment of the components that make up the approaches (ie arched and flat topped voids utilised as tenancies, retaining walls, balustrades, steps, lighting) is of a high quality and makes a major contribution to the streetscapes of Milsons Point and The Rocks/Millers Point. [1]*

In addition Policy 13 in the 2007 CMP states:

*13.3 Views of the original form of the rendered masonry approaches should be maintained and not obscured.*

NEXT STEPS

Should the project proceed the following steps are recommended:

preferred option. Note an archaeological assessment may also be required.

1. This report should be circulated to stakeholders for comment.

2. Further investigate the feasibility of Option 1. Progress concept design (including engineering input) to enable further assessment against criteria.

3. Consult with North Sydney Council re the potential conflicts of Option 1 with the Kirribilli Neighbourhood Centre.

4. Prepare a preliminary heritage impact assessment (HIA) and further visual assessment (in accordance with RMS guidelines) for the

5. Consult with the relevant Commonwealth, State and local heritage authorities explaining the preferred option.

6. Prepare business case and obtain funding approval.

7. Community Consultation

8. Prepare final REF/SEE and HIA for the preferred option

9. Once approvals are obtained proceed to tender documentation.

6.

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**APPENDIX A**

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PHASE 1 REPORT - ANALYSIS AND 10 OPTION SUDY





# SYDNEY HARBOUR BRIDGE CYCLE RAMP MILSONS POINT

PREPARED FOR ROADS AND MARITIME SERVICES



Transport  
Roads & Maritime  
Services

29 JUNE 2012

A NUMBER OF DESIGN OPTIONS HAVE BEEN INVESTIGATED

DESIGN OPTIONS

OPTION 1	Long ramp, attached to SHB Approaches to bradfield park
OPTION 2	Ramp, attached to SHB approaches to burton street
OPTION 3	Ramp with existing ramp and step access way to Burton street
OPTION 4	Medium ramp, attached to SHB Approaches to bradfield park
OPTION 5	Lift from Burton st to SHB deck
OPTION 6	Spiral ramp to Burton street
OPTION 7	Ramp, detached from SHB to Bradfield Park
OPTION 8	Ramp, detached from SHB to Bradfield Park
OPTION 9	Switchback ramp to Burton street
OPTION 10	Ramp and step arrangements within existing ramp and step access way



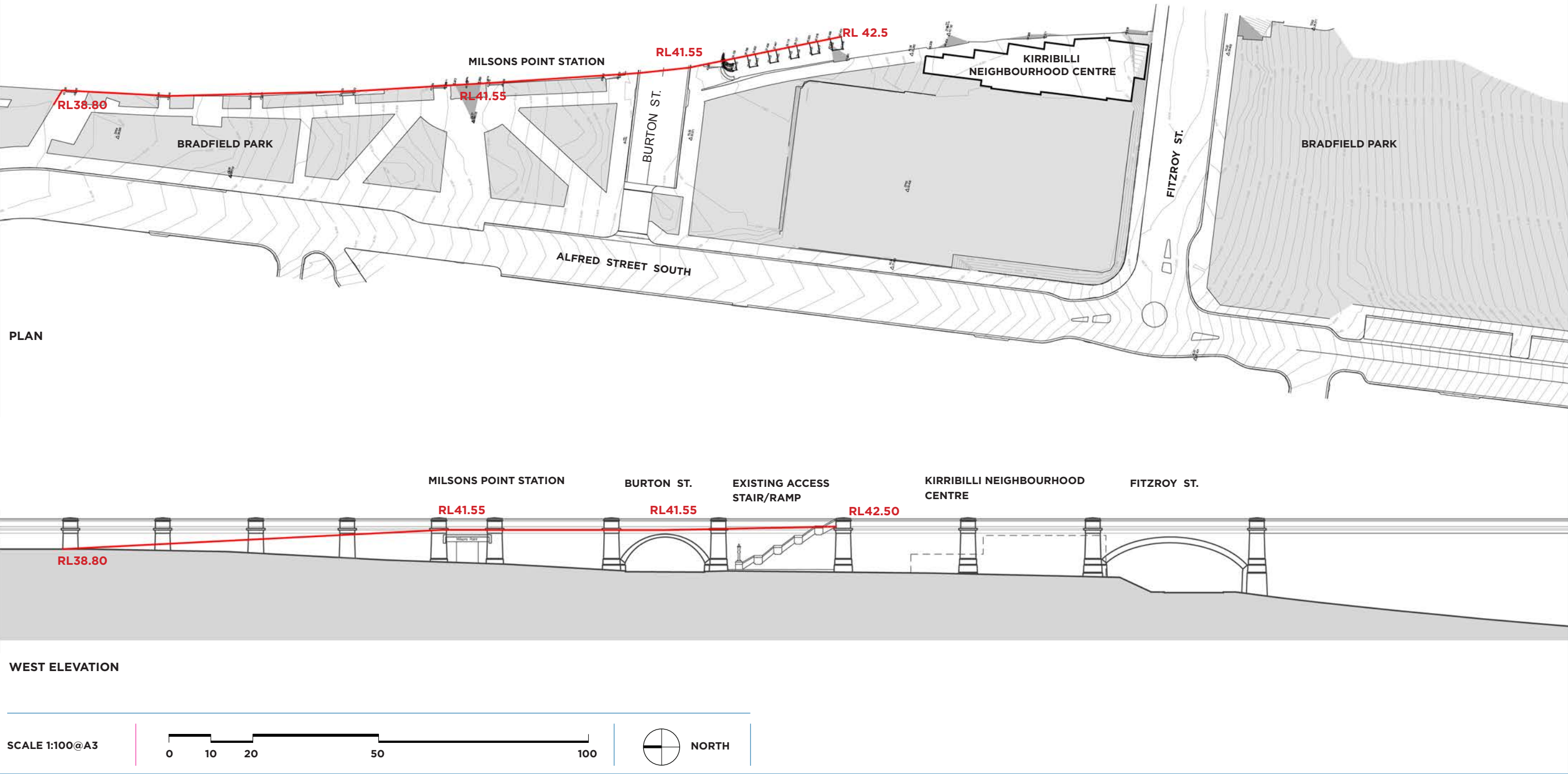
# DESIGN

## OPTION 1

LONG RAMP, ATTACHED TO  
SHB APPROACHES TO  
BRADFIELD PARK

CHANGE IN LEVEL FROM	5.3M (approx.)
MAX GRADIENT	1:35 (approx.)
LENGTH	185M

Long Ramp attached to SHB approaches takes cyclists from the bridge deck level (RL42.500) across the Burton Street and Milsons Point Station Entries then down to Bradfield Park (RL38.800).



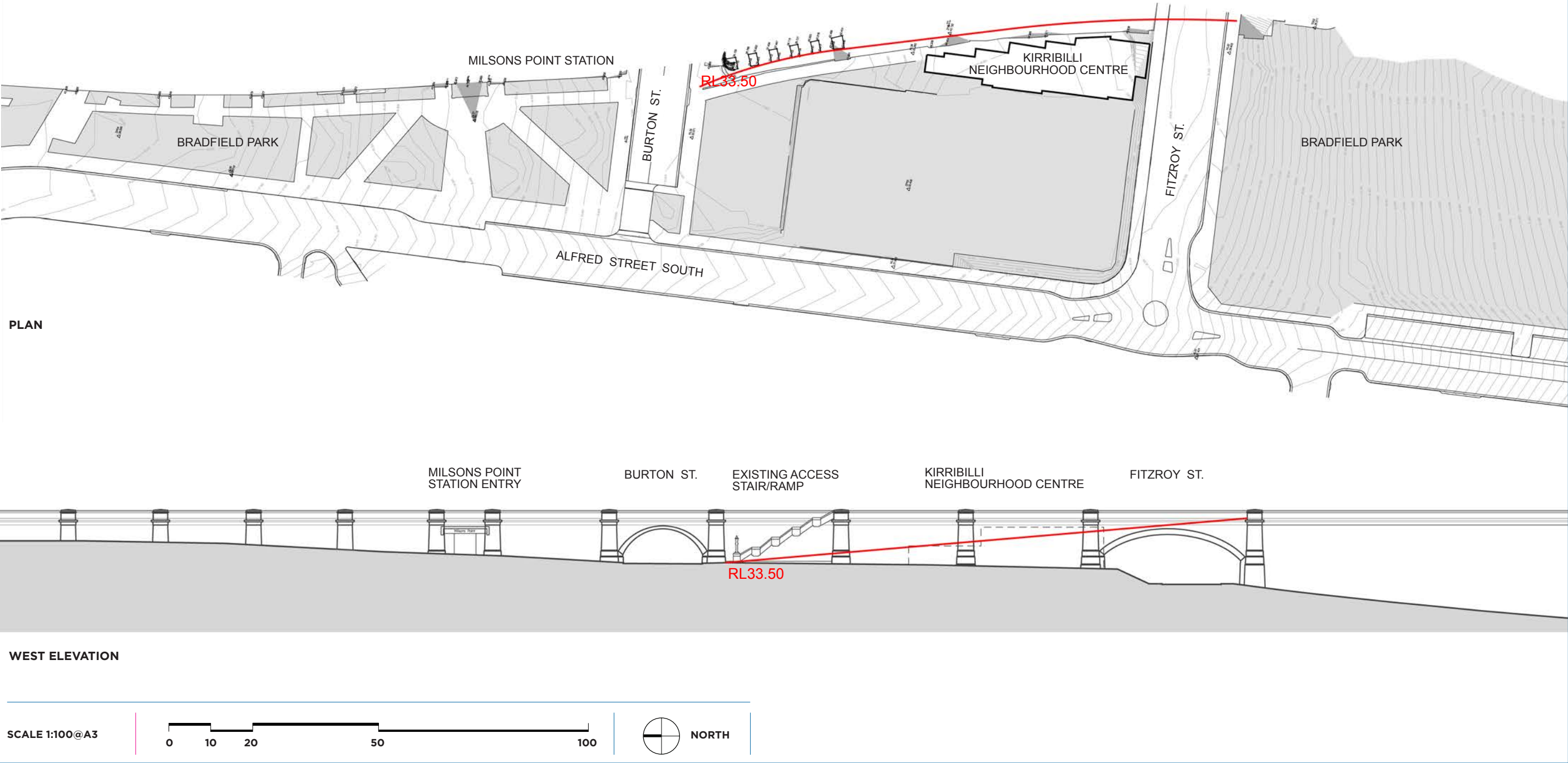
DESIGN

OPTION 2

RAMP ATTACHED TO SHB  
APPROACHES TO BURTON STREET

CHANGE IN LEVEL	11.6M (APPROX.)
MAX GRADIENT	1:11.6 (APPROX.)
LENGTH	130M

With a constant grade of 11.6 (8.6%) the Ramp takes cyclists from the bridge deck level (RL44.800) down to Burton Street (RL33.500).





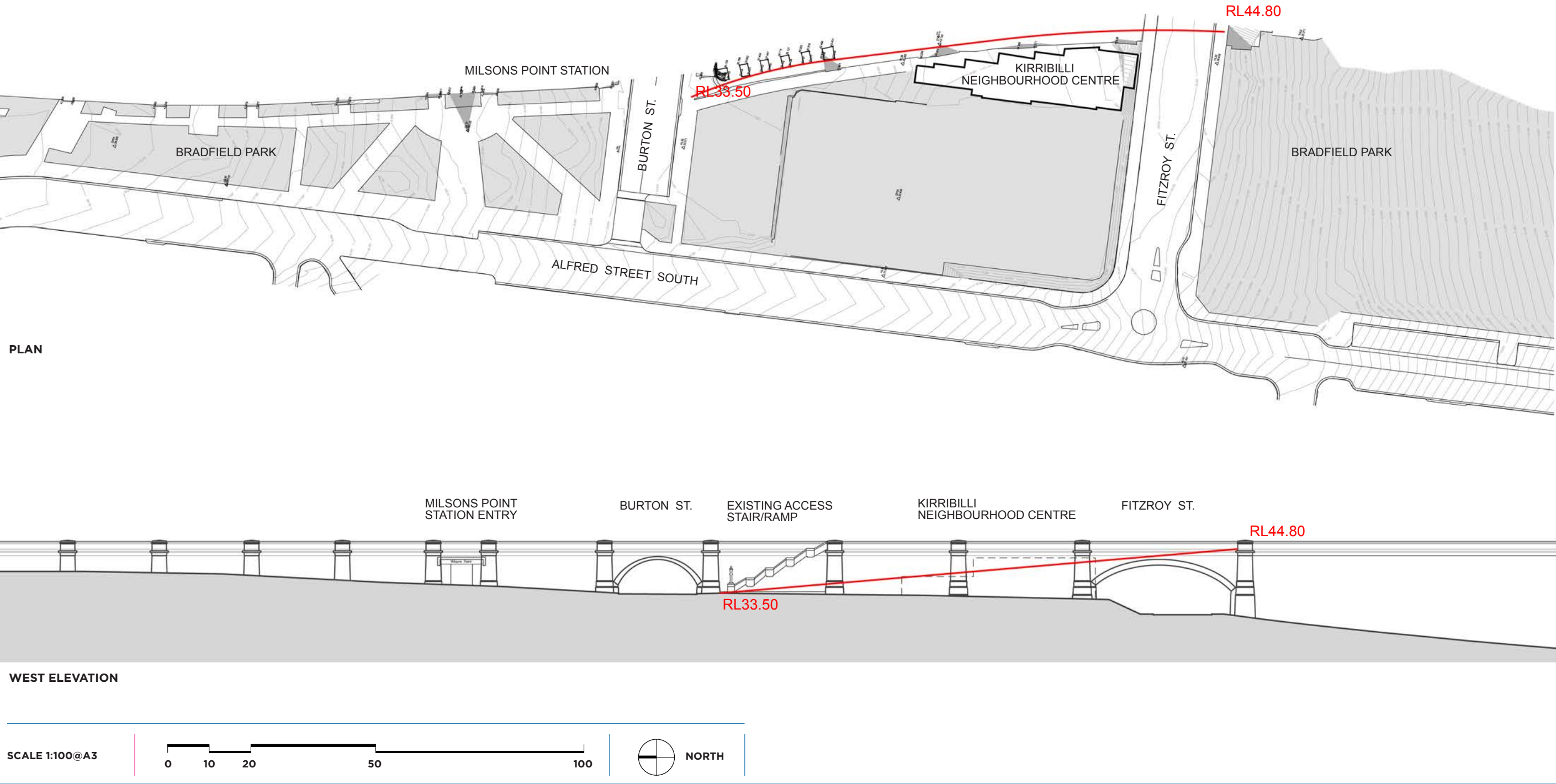
DESIGN

OPTION 3

RAMP WITHIN EXISTING RAMP  
AND STEP ACCESS WAY TO  
BURTON STREET

CHANGE IN LEVEL	11.6M (APPROX.)
MAX GRADIENT	1:11.6 (APPROX.)
LENGTH	130M

With a constant grade of 11.6 (8.6%) the Ramp takes cyclists from the bridge deck level (RL44.800) down to Burton Street (RL33.500).



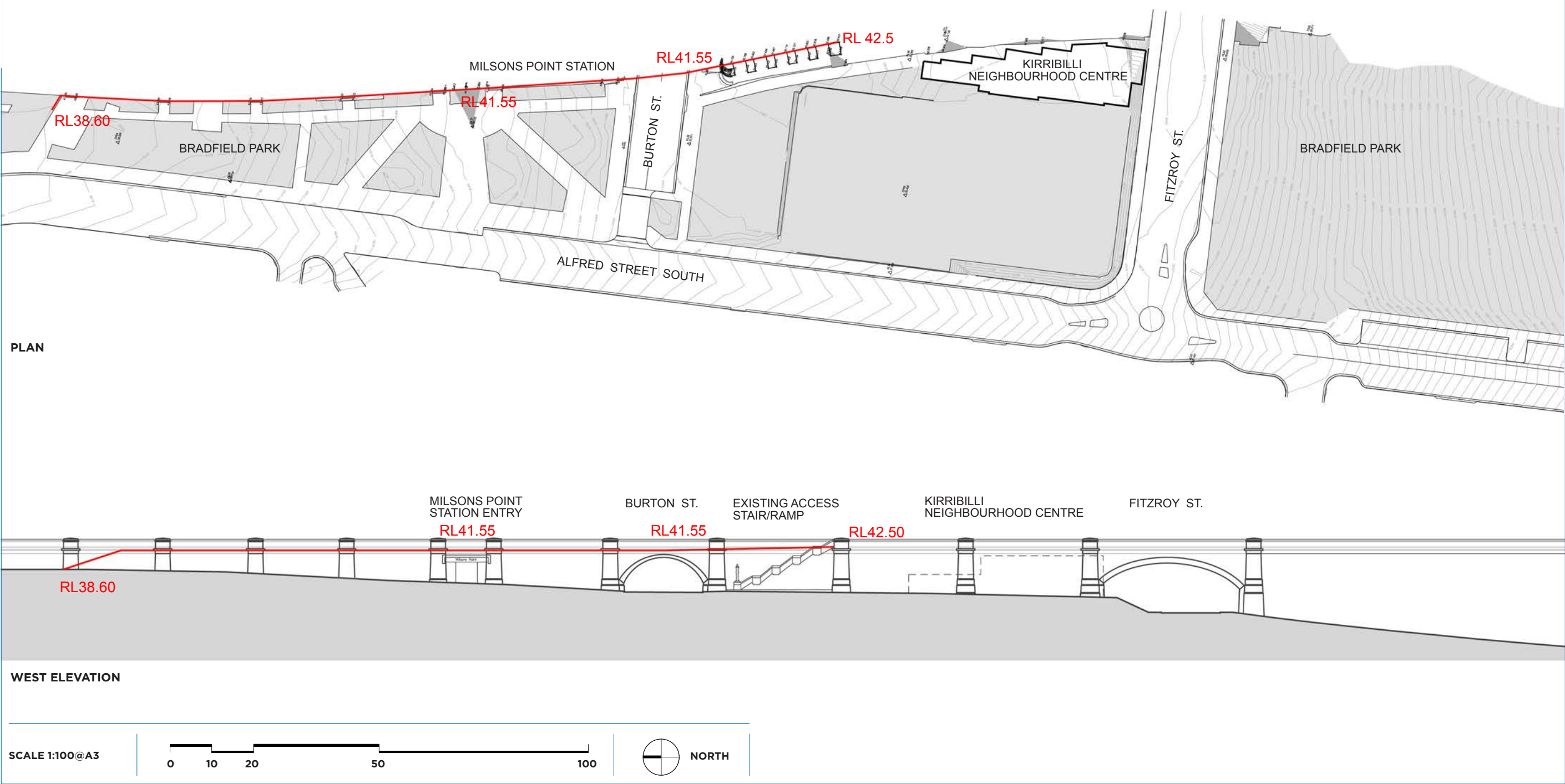
DESIGN

OPTION 4

MEDIUM RAMP, ATTACHED TO  
SHB APPROACHES TO BRADFIELD  
PARK

CHANGE IN LEVEL FROM	5.3M
MAX GRADIENT	1:8
LENGTH	185M

Medium Ramp attached to SHB approaches takes cyclists from the bridge deck level (RL42.500) across the Burton Street and Milsons Point Station Entries then down to Bradfield Park (RL37.200).





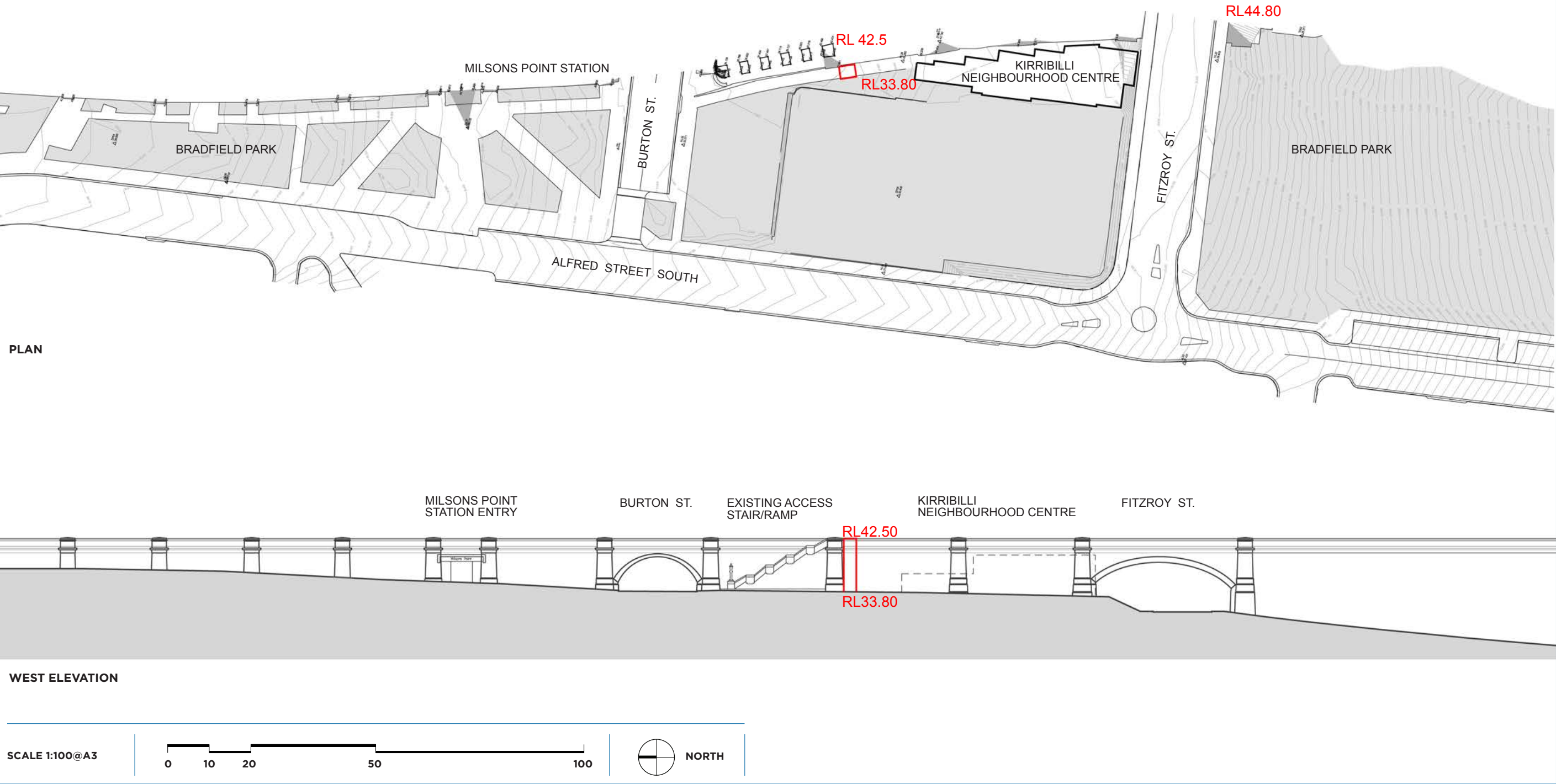
DESIGN

OPTION 5

LIFT FROM BURTON ST TO  
SHB DECK

CHANGE IN LEVEL FROM	8.7M
MAX GRADIENT	NA
LENGTH	NA

Lift takes cyclists from the bridge deck level (RL42.500) down to Burton Street (RL33.800). Queuing and waiting times, especially during peak hours are a potential issue



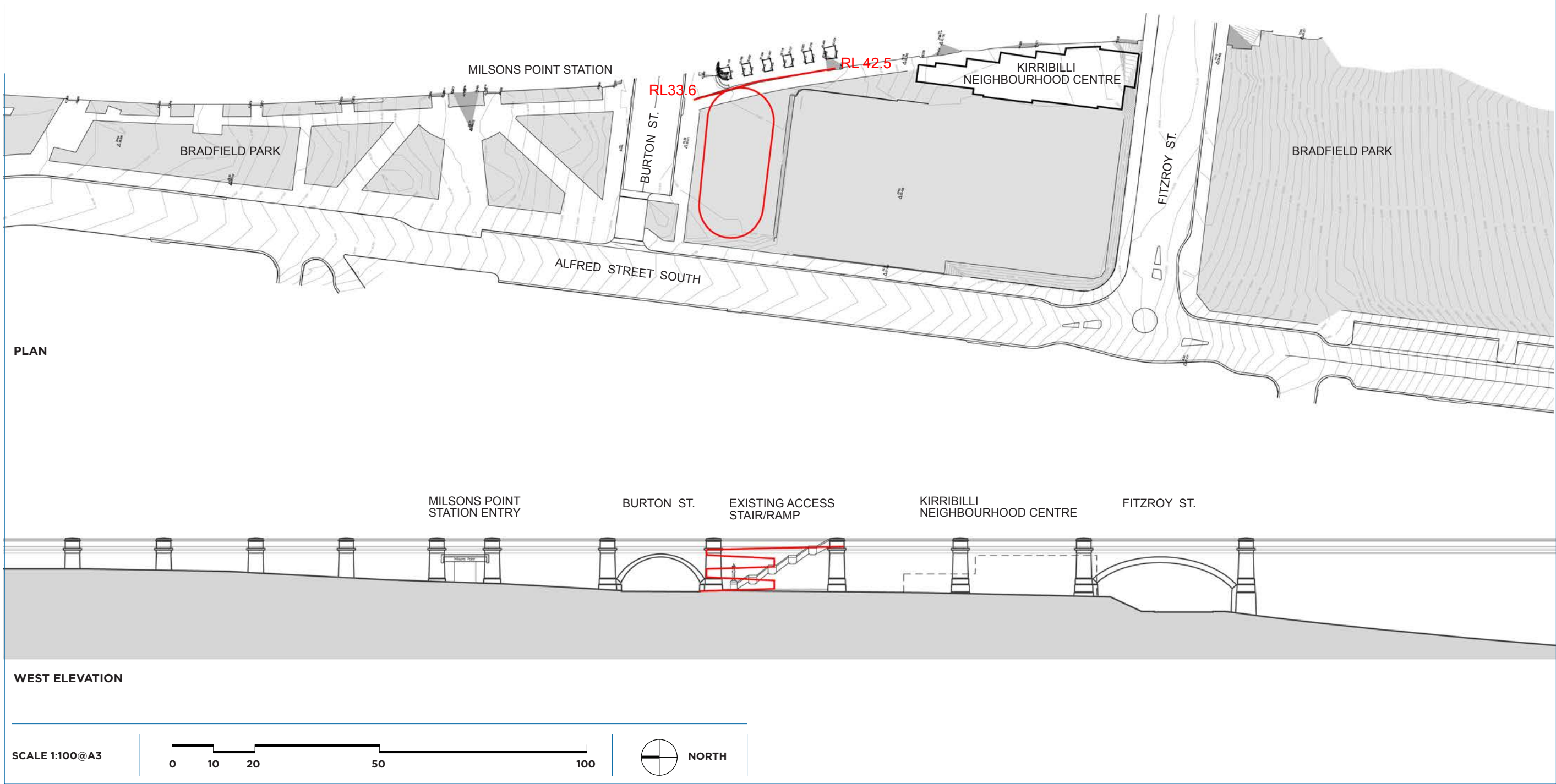
# DESIGN

## OPTION 6

### SPIRAL RAMP TO BURTON STREET

CHANGE IN LEVEL FROM	8.9M
MAX GRADIENT	1:38
LENGTH	296M

With a constant grade of 1:38 (>3%) the Spiral Ramp takes cyclists from the bridge deck level (RL42.500) down to the existing kerb ramp at Burton Street (RL33.600).





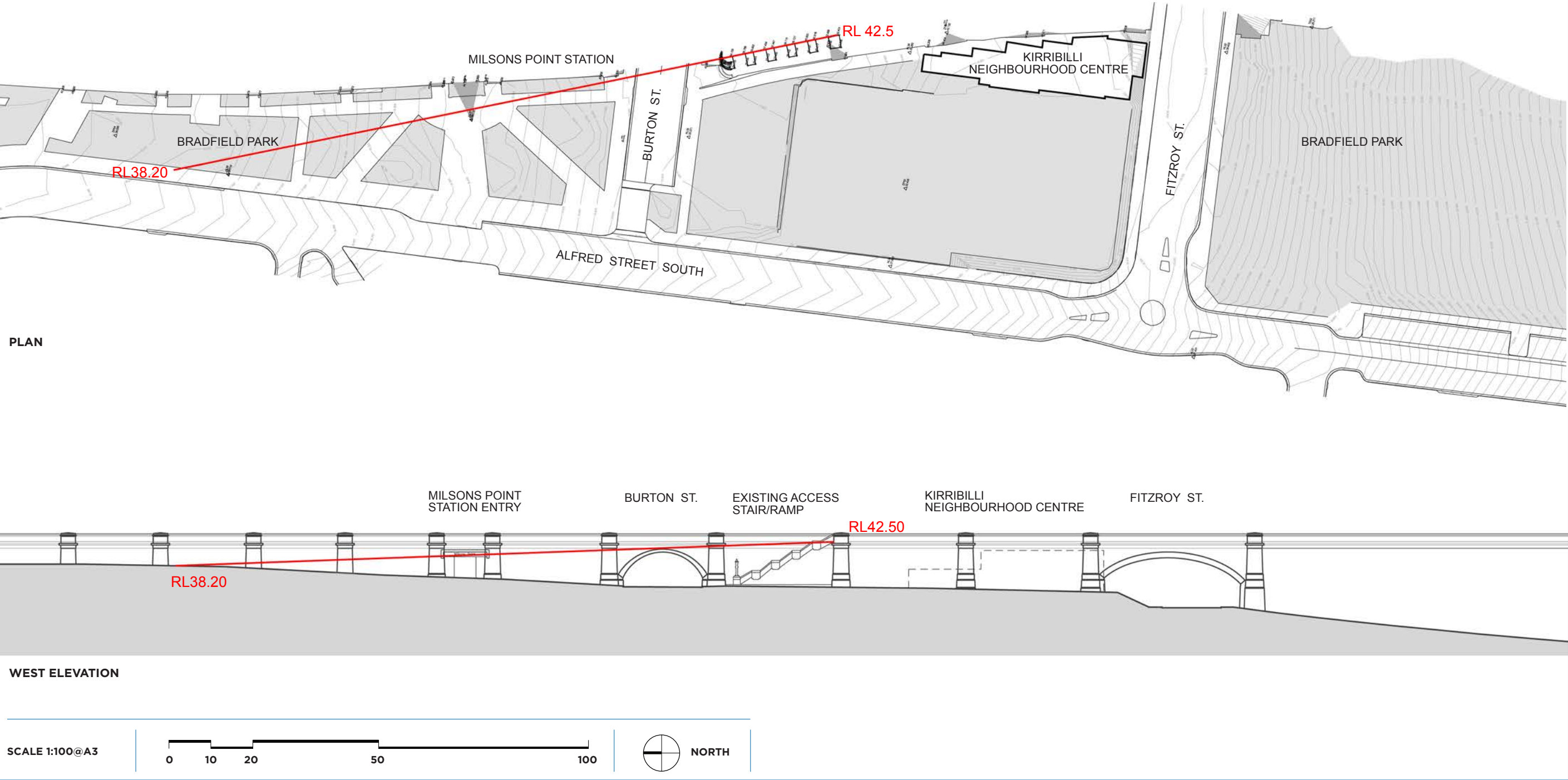
DESIGN

OPTION 7

RAMP, DETACHED FROM SHB  
TO BRADFIELD PARK

CHANGE IN LEVEL FROM	4.3M
MAX GRADIENT	1:37
LENGTH	160M

Ramp takes cyclists from the bridge deck level (RL42.500) across the Burton Street and Milsons Point Station Entries then down to Bradfield Park/Alfred Street South footpath (RL38.200).



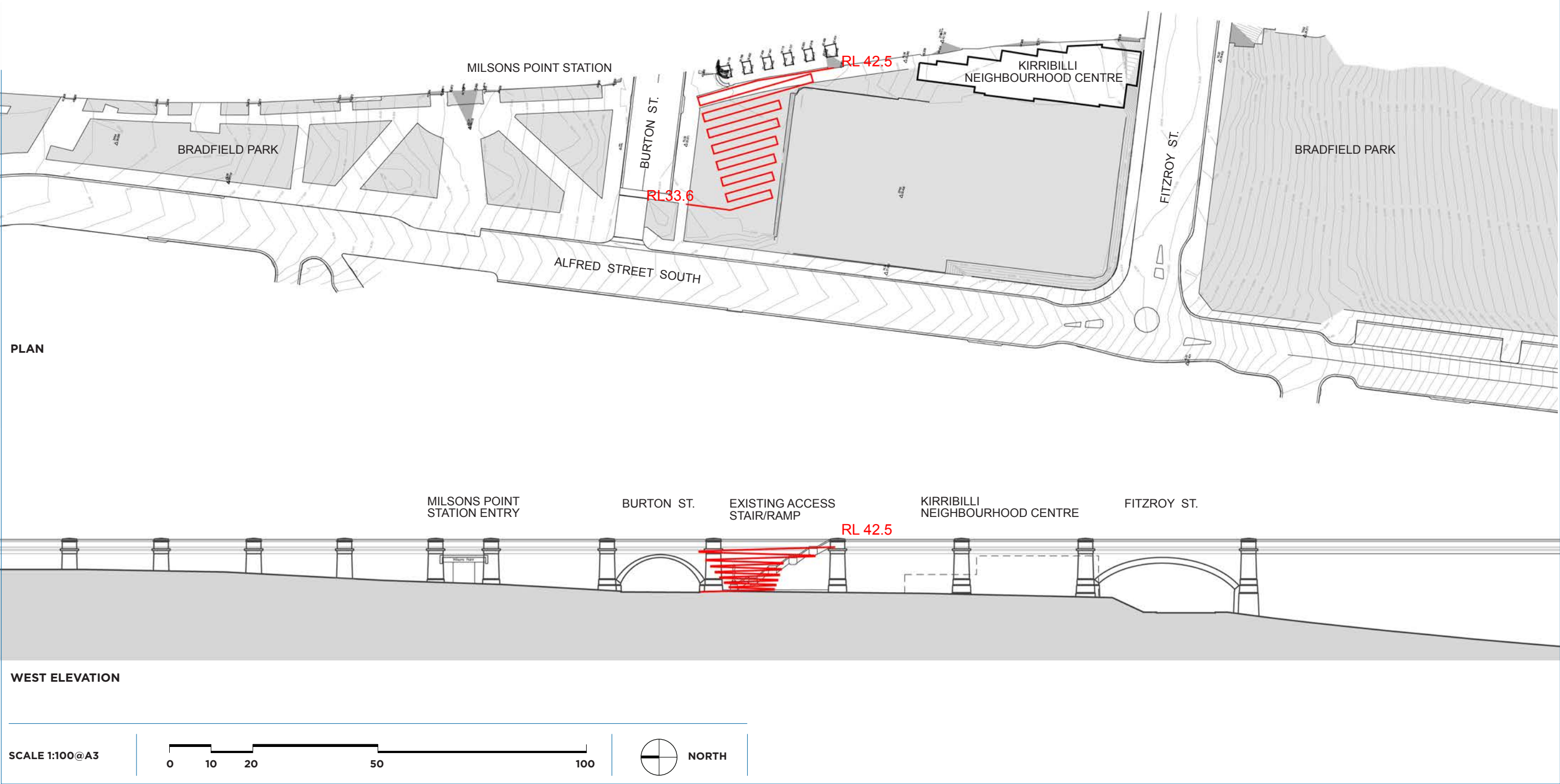
DESIGN

OPTION 8

SWITCHBACK RAMP TO BURTON STREET

CHANGE IN LEVEL FROM	8.9M
MAX GRADIENT	1:33
LENGTH	296M

With a constant grade of 1:33 (3%) the Switchback Ramp takes cyclists from the bridge deck level (RL42.500) down to Burton Street in close proximity to Alfred Street South (RL33.600). The Switchback takes up the majority of the open space to the north of the Kirribilli Neighbourhood Centre



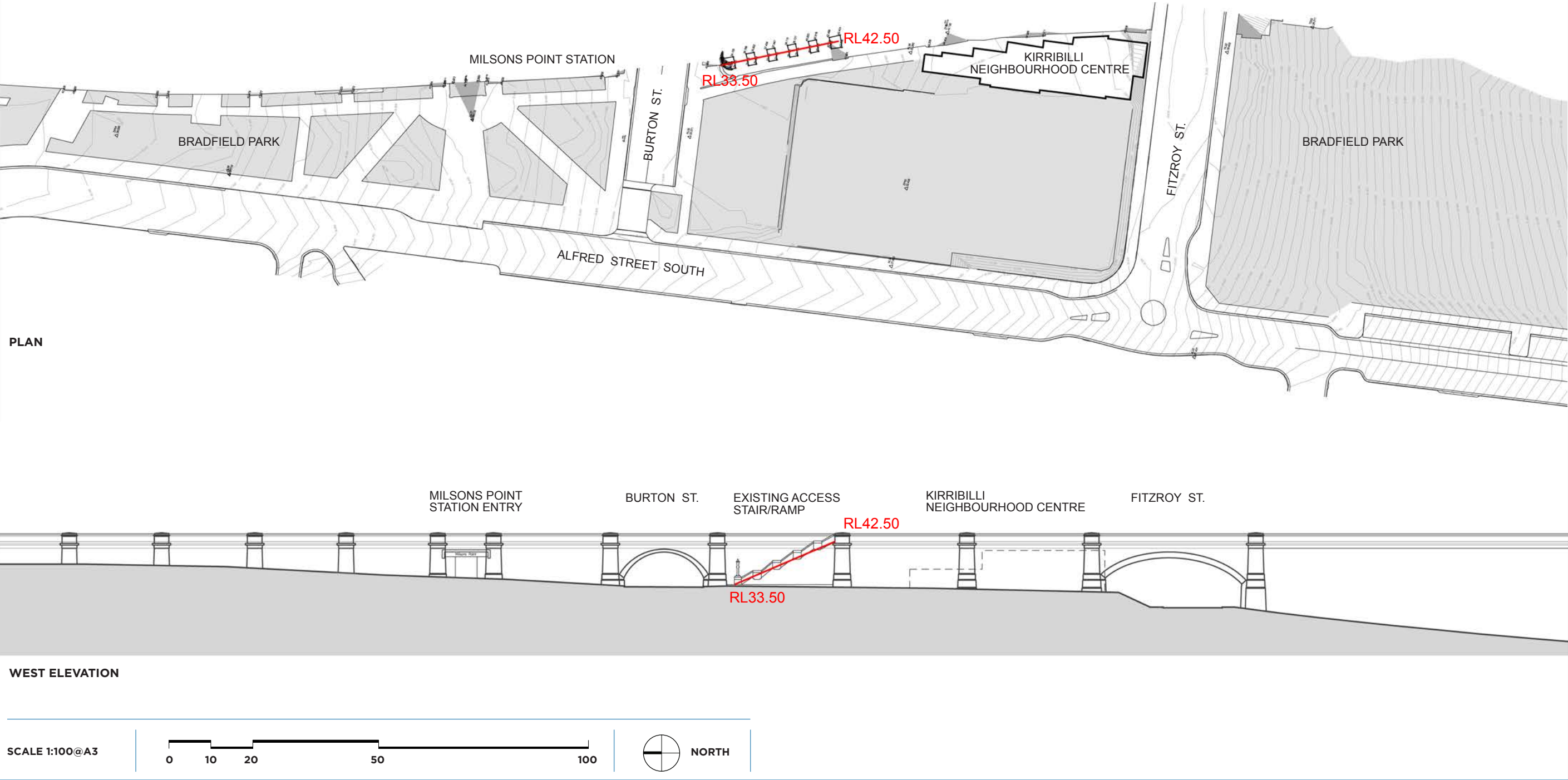


# DESIGN

## OPTION 9 & 10

RAMP AND STEP ARRANGEMENTS WITHIN EXISTING RAMP AND STEP ACCESS WAY

CHANGE IN LEVEL FROM	9M
MAX GRADIENT	1:4
LENGTH	35M
Option 8 Widen ramp, retain single set of steps.	
Option 9 Widen ramp to full width of existing access way	



DESIGN  
MATRIX

CYCLEWAY RAMP  
OPTIONS

MATRIX KEY

Y YES

N NO

LOW IMPACT

MEDIUM IMPACT

HIGH IMPACT

NOTE:  
All options to be designed  
and developed in  
accordance with the CMP  
Policies

DESIGN OPTIONS		FEASIBILITY		PHYSICAL IMPACTS TO PARK AND URBAN SETTING			HERITAGE IMPACT		CIRCULATION			VISUAL AMENITY		ACCESS AND SAFETY			
		Compliance with part 6A (Pedestrian and Cyclist Paths)	Compatibility with the North Sydney Cycle Network	Bradfield Park	SHB approaches	Station entry	Heritage Impact	Heritage Fabric	Entrance to Burton Street tunnel	Entrance to Fitzroy Street tunnel	Entrance Milsons Point Station	Bradfield Park setting	Sydney Harbour Bridge	Ease of access for cyclists	Pedestrian Cycle conflicts	Safety	
1	Long Ramp attached to the Sydney Harbour Bridge approaches to Bradfield Park	Y	Y														
2	Ramp attached to the Sydney Harbour Bridge approaches to Burton Street	Y	Y														
3	Ramp within existing ramp and step access way to burton street	Y	Y														
4	Medium Ramp attached to the Sydney Harbour Bridge approaches to Bradfield Park	Y	Y														
5	Lift to service cyclists from Burton Street to SHB Cycle way	N	N														
6	'Spiral' Ramp to Burton Street	Y	Y														
7	Ramp detached from the Sydney Harbour Bridge approaches to Bradfield Park	Y	N														
8	Switchback Ramp to Burton Street	Y	Y														
9	Step/Ramp/Step envelope replaced with Ramp/Ramp/ Step arrangement	N	Y														
10	Step/Ramp/Step envelope replaced with ramp only arrangement	N	Y														





[rms.nsw.gov.au](http://rms.nsw.gov.au)



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