Appendix D – Sydney Harbour Bridge Cycle Ramp Options Feasibility Study (2012)
Existing step access at Sydney Harbour Bridge
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 parameters 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 until 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.
## CONTENTS

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</tr>
<tr>
<td>PHASE 1 REPORT - ANALYSIS AND 10 OPTION STUDY (GAO JUNE 2012)</td>
<td>49</td>
</tr>
</tbody>
</table>
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
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.
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 RAILWAY STATION
- STATION ENTRANCE

ART FASHION AND DESIGN MARKET IN BRADFIELD PARK/KIRRIBILLY NEIGHBOURHOOD CENTRE

KIRRIBILLY MARKETS IN THE BURTON STREET TUNNEL

HERITAGE WALK, VIEW LOOKING SOUTH TOWARDS HARBOUR

1. SITE ANALYSIS LAND USE

NOT TO SCALE

Government Architect’s Office

Sydney Harbour Bridge Cycle Ramp OCTOBER 2012
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.

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 add to the ensemble of heritage details for the SHB at Milson’s Point.

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

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.

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

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

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.
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
4.

**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

[Diagram of the cycle ramp on columns, showing sections and elevations.]
**OPTION 1:** The posted ramp is set out from SHB approach walls. It commences north of the Fitzroy St archway and passes over the rear service yard of the Kirribilli Neighbourhood Centre.

To avoid conflict with the Kirribilli Neighbourhood Centre the ramp moves out towards Alfred Street for the last 20 metres of length.

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.

Section through the Fitzroy Street Arch
<table>
<thead>
<tr>
<th></th>
<th>DATA</th>
<th>ACCESS / SAFETY / AMENITY ISSUES</th>
<th>FABRIC IMPACTS / BUILDABILITY (Including heritage fabric impacts)</th>
<th>VISUAL IMPACTS (Including aesthetic heritage impacts)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPTION 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt 6A AustRoads</td>
<td>2.5-4m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From bridge deck down to Burton st, supported on free standing steel posts.</td>
<td>No width restriction</td>
<td><strong>SHB / Cycleway</strong></td>
<td><strong>SHB / Cycleway</strong></td>
<td><strong>SHB / Cycleway</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>POSITIVE</strong></td>
<td><strong>NEGATIVE</strong></td>
<td><strong>NEGATIVE</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>· Separation of ramp from SHB approach walls discourages attempts to apply graffiti or scale walls.</td>
<td>· Does not connect directly into the existing cycle route at Burton St.</td>
<td>· Section of rendered balustrade removed at junction with SHB. This section may also require large cantilever brackets.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· Negates cycle/pedestrian/vehicle. conflicts that occur when ramp arrives at Burton St.</td>
<td>· Possible cycle/pedestrian conflicts through Bradfield Park or cycle traffic conflicts if on Alfred Street South.</td>
<td>· Temporary closure to Kirribilli Neighbourhood Centre during construction.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· Does not connect directly into the existing cycle route at Burton St.</td>
<td>· New Structure imposed on park.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Grade of ramp steep at 13.3%.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Throw screen required.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Safety / security concern with building over neighbourhood centre.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>OTHER</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Existing stairs can remain operational (subject to safety analysis).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Station entry not impacted.</td>
<td></td>
</tr>
<tr>
<td>Station Entry</td>
<td><strong>POSITIVE</strong></td>
<td><strong>POSITIVE</strong></td>
<td><strong>NEGATIVE</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>· Allows better lighting of entrance.</td>
<td>· Park lighting can be incorporated under ramp.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Only minor impact on Bradfield Park.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· No impact on Neighbourhood Centre.</td>
<td></td>
</tr>
<tr>
<td>Bradfield Park / Neighbourhood Centre</td>
<td><strong>POSITIVE</strong></td>
<td><strong>POSITIVE</strong></td>
<td><strong>NEGATIVE</strong></td>
<td><strong>NEGATIVE</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>· Park lighting can be incorporated under ramp.</td>
<td>· Impacts on land belonging to North Sydney Council.</td>
<td>· Creates some clutter in the Park.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Only minor impact on Bradfield Park.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· No impact on Neighbourhood Centre.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>NEGATIVE</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Grassed areas and possibly some plantings in Park impacted on.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Compulsory acquisition required.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Difficult to construct over Neighbourhood centre.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>OTHER</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Possible archaeological issues for post positions in Bradfield Park North.</td>
<td></td>
</tr>
</tbody>
</table>
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 36.

Refer Option 1 Sketch, page 17 for illustration of cycleramp ramp steepness.

ESTIMATED COST $10MILLION
4.

OPTION 2

FROM BRIDGE DECK DOWN
TO BURTON ST, SUPPORTED
ON CANTILEVERED BRACKETS
FROM SHB
APPROACH WALLS.
OPTION 2: The cantilevered ramp is bracketed out from SHB approach walls. It commences north of the Fitzroy St archway and passes over the rear service yard of the Kirribilli Neighbourhood Centre.

The Kirribilli Neighbourhood Centre shared access road is re-located out towards Alfred Street.

Option 2: Cantilevered cycleway cantilivered 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**

<table>
<thead>
<tr>
<th>Data</th>
<th>Access / Safety / Amenity Issues</th>
<th>Fabric Impacts / Buildability (Including heritage fabric impacts)</th>
<th>Visual Impacts (Including aesthetic heritage impacts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt 6A AustRoads</td>
<td>Cycleway POSITIVE</td>
<td>SHB / Cycleway POSITIVE</td>
<td>SHB / Cycleway POSITIVE</td>
</tr>
<tr>
<td>Cycleway Width</td>
<td>2.5-4m</td>
<td>Ramp ends at the existing cycle route at Burton Street.</td>
<td>Cyleway can remain in use for most of the construction period.</td>
</tr>
<tr>
<td>Gradient</td>
<td>5%</td>
<td>Separation of ramp from SHB approach walls discourages attempts to apply graffiti or scale walls.</td>
<td>Cycle / pedestrian / traffic conflicts at Burton Street needs resolution, particularly on Market Days.</td>
</tr>
<tr>
<td>Length</td>
<td>No max.</td>
<td>Negates cycle/pedestrian/vehicle conflicts that occur when ramp arrives at Burton Street.</td>
<td>Gradient is steep at 13.3%.</td>
</tr>
<tr>
<td>SHB / Cycleway NEGATIVE</td>
<td>SHB / Cycleway NEGATIVE</td>
<td>- Does not connect directly into the existing cycle route at Burton St.</td>
<td>- Section of rendered balustrade removed at junction with SHB. Top section may also require large cantilever brackets.</td>
</tr>
<tr>
<td>- Possible cycle/pedestrian conflicts through Bradfield Park or cycle traffic conflicts if on Alfred Street South.</td>
<td>- Cantilever needs to be located at least 3m from the top of retaining wall.</td>
<td>- New structure imposed on park.</td>
<td>- Temporary closure to Kirribilli Neighbourhood Centre during construction.</td>
</tr>
<tr>
<td>- Cycle / pedestrian / traffic conflict at Burton St needs resolution, particularly on Market Days.</td>
<td>- Gradient is steep at 13.3%.</td>
<td>- Throw screen required.</td>
<td></td>
</tr>
<tr>
<td>OTHER</td>
<td>OTHER</td>
<td>- Existing stairs can remain operational (subject to safety analysis).</td>
<td>- Safety / security concerns with building over Neighbourhood Centre.</td>
</tr>
<tr>
<td>Station Entry POSITIVE</td>
<td>Station Entry NEGATIVE</td>
<td>Station Entry NEGATIVE</td>
<td>Station Entry NEGATIVE</td>
</tr>
<tr>
<td>- Allows better lighting of entrance.</td>
<td>- Station Entry not impacted.</td>
<td>- Does not impact on the Station Entry.</td>
<td>- May impact Neighbourhood centre.</td>
</tr>
<tr>
<td>Bradfield Park / Neighbourhood Centre POSITIVE</td>
<td>Bradfield Park / Neighbourhood Centre NEGATIVE</td>
<td>Bradfield Park / Neighbourhood Centre NEGATIVE</td>
<td>Bradfield Park / Neighbourhood Centre OTHER</td>
</tr>
<tr>
<td>- Only minor impact on Bradfield Park near Burton Street.</td>
<td>- Difficult to construct over Neighbourhood centre.</td>
<td>- Additional plantings could help screen for more distant views.</td>
<td>- Possible archaeological issues for post positions in Bradfield Park North.</td>
</tr>
<tr>
<td>- No impact to Neighbourhood Centre.</td>
<td>- Strata acquisition required.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Park lighting can be incorporated under ramp.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTHER</td>
<td>OTHER</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From bridge deck down to Burton st, supported on cantilevered brackets from SHB approach walls.
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).
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

<table>
<thead>
<tr>
<th>Data</th>
<th>Access / Safety / Amenity Issues</th>
<th>Fabric Impacts / Buildability</th>
<th>Visual Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycleway Width</td>
<td>SHB / Cycleway / Burton St</td>
<td>SHB / Cycleway / Burton St</td>
<td>SHB / Cycleway / Burton St</td>
</tr>
<tr>
<td>2.5-4m</td>
<td>POSITIVE</td>
<td>POSITIVE</td>
<td>POSITIVE</td>
</tr>
<tr>
<td>5%</td>
<td>NEGATIVE</td>
<td>NEGATIVE</td>
<td>NEGATIVE</td>
</tr>
<tr>
<td>No max.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cycle ramp supported on steel columns parallel with the Sydney Harbour Bridge approaches through Bradfield Park

<table>
<thead>
<tr>
<th>Width</th>
<th>Gradient</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>No width restriction</td>
<td>4.6%</td>
<td>187m</td>
</tr>
</tbody>
</table>

**SHB / Cycleway / Burton St**

- Separation of ramp from SHB approach walls discourages attempts to apply graffiti or scale walls.
- Negates cycle/pedestrian/vehicle conflicts that occur when ramp arrives at Burton St.

**NEGATIVE**

- 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.
- New structure imposed on park.

**OTHER**

- Existing stairs can remain operational (subject to safety analysis).

**Station Entry**

- Allows better lighting of entrance.

**Station Entry**

- Ramp does not physically conflict with detail of Station Entry Canopy.

**Station Entry**

- Less visual / heritage conflicts with Milsons Pt Station entry from within Park compared with Option 4.

**Bradfield Park / Neighbourhood Centre**

- Park lighting can be incorporated under ramp.
- No impact on Neighbourhood Centre.

**Bradfield Park / Neighbourhood Centre**

- No impact on Neighbourhood Centre.

**NEGATIVE**

- Impacts on land belonging to North Sydney Council.
- Grassed areas and some plantings in Park impacted on.
- Property acquisition.

**OTHER**

- Possible archaeological issues for post positions in Bradfield Park North.

**Bradfield Park / Neighbourhood Centre**

- Trees provide some screening to northern end of the ramp for more distant views.
- No impact on Neighbourhood Centre.

**NEGATIVE**

- Creates clutter in the Park.
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.
OPTION 4: The cantilevered ramp is bracketed out from SHB approach walls and stays at parapet level until past the Milsons Point Station entrance and only then ramps down to the recreated Willoughby Street.
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. 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 approximately 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.

2. 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

<table>
<thead>
<tr>
<th>DATA</th>
<th>ACCESS / SAFETY / AMENITY ISSUES</th>
<th>FABRIC IMPACTS / BUILDABILITY (including heritage fabric impacts)</th>
<th>VISUAL IMPACTS (including aesthetic heritage impacts)</th>
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<tbody>
<tr>
<td>Pt 6A AustRoads</td>
<td>CYCLEWAY WIDTH: 2.54m, GRADIENT: 5%, LENGTH: No max.</td>
<td>-----------------------------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>From top of existing stairs down to Bradfield Park (over Burton st), supported on brackets from the SHB approach walls.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SHB / Cycleway / Burton St</td>
<td>SHB / Cycleway / Burton St</td>
<td>SHB / Cycleway / Burton St</td>
</tr>
<tr>
<td></td>
<td>POSITIVE</td>
<td>POSITIVE</td>
<td>POSITIVE</td>
</tr>
<tr>
<td></td>
<td>Continues line of existing cycleway.</td>
<td>Top of ramp above existing stair can be detailed to be ‘reversible’ (although stair closed to public). No SHB balustrade removed.</td>
<td>Top of ramp fits neatly into existing stairwell.</td>
</tr>
<tr>
<td></td>
<td>Negates cycle/pedestrian/vehicle conflicts that occur where the existing cycleway ramp arrives at Burton St.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>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.</td>
<td>Engineered ramp brackets attached to SHB approach walls may need to be substantial. This is a major intervention in the rendered façade.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Existing stair made redundant – needs screening, potential for vandalism.</td>
<td>Cycleway cannot be used during construction period. Temporary scaffold stair required.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>May encourage graffiti or scaling of SHB approach walls.</td>
<td>Cantilever needs to be located 3m below retaining wall.</td>
<td></td>
</tr>
<tr>
<td>OTHER</td>
<td>Will need additional screening at top of ramp to provide security to railway corridor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Brackets need to be positioned to avoid impacts on cornice and pilaster rendered detail.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Station Entry</td>
<td>站台入口</td>
<td>NEGATIVE</td>
<td>NEGATIVE</td>
</tr>
<tr>
<td></td>
<td>POSITIVE</td>
<td>HAS to be positioned so the steel and copper awning to station entrance is not impacted on.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reduced conflict.</td>
<td>Difficult to avoid impact on rendered detailing and lighting around station entry.</td>
<td>Visual / heritage conflict with and the Milsons Pt Station entry.</td>
</tr>
<tr>
<td></td>
<td>NEGATIVE</td>
<td>Obscures rendered detailing and light brackets around entry.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Security issue of being able to access Station Entry awning from cycleway.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bradfield Park / Neighbourhood Centre</td>
<td>Bradfield Park / Neighbourhood Centre</td>
<td>Bradfield Park / Neighbourhood Centre</td>
<td></td>
</tr>
<tr>
<td></td>
<td>POSITIVE</td>
<td>POSITIVE</td>
<td>POSITIVE</td>
</tr>
<tr>
<td></td>
<td>Park lighting can be incorporated under ramp.</td>
<td>No impact on Neighbour Centre.</td>
<td>Trees provide some screening to northern end of the ramp.</td>
</tr>
<tr>
<td></td>
<td>No impact on Neighbourhood Centre.</td>
<td></td>
<td>No impact on Neighbourhood Centre.</td>
</tr>
<tr>
<td>NEGATIVE</td>
<td>At lower end cycleway takes up existing pedestrian path adjacent to the SHB Approach walls in Park requiring redesign of Park (loss of grassed area).</td>
<td>Path, grassed areas and possibly some plantings in Park impacted on.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Property acquisition.</td>
<td></td>
<td>1940s park design may be disrupted.</td>
</tr>
</tbody>
</table>
4.

OPTION 5

CYCLE RAMP REGRADED WITHIN EXISTING CYCLEWAY AND STAIRWELL 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 $97 MILLION
4. OPTION 5

SECTION

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

SECTION ELEVATION

SYDNEY HARBOUR BRIDGE

BRADFIELD PARK

SCALE 1:100@A3

RAMP BEHIND

ELEVATION
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
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 to 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 to Section B-B)

A4 Temporarily remove railway tracks-T2 (between P1 and P2) for the construction of the new gravity retaining wall 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 to 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 to Section C-C)

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

A9 Remove existing stairs. (refer to Fig 2)

Fig 2. PLAN
**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.
### OPTION 5

<table>
<thead>
<tr>
<th>DATA</th>
<th>ACCESS / SAFETY / AMENITY ISSUES</th>
<th>FABRIC IMPACTS / BUILDABILITY (Including heritage fabric impacts)</th>
<th>VISUAL IMPACTS (Including aesthetic heritage impacts)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pt 6A AustRoads</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ramp excavated behind the SHB approach wall within the same allignment of the existing stair (Part of existing cycleway and stair demolished)</strong></td>
<td><strong>SHB / Cycleway</strong></td>
<td><strong>SHB / Cycleway</strong></td>
<td><strong>SHB / Cycleway</strong></td>
</tr>
</tbody>
</table>
| 2.8m Limited by existing stair-well width. | POSITIVE  
- Continues line of existing cycleway.  
- Ramp ends at the existing cycle route at Burton Street. | POSITIVE  
- No impact on external detailing of SHB approach walls and their detail. | POSITIVE  
- Very little impact on views to SHB. |
| | NEGATIVE  
- Gradient is steep at 13.3%.  
- Much of the ramp will be dark and will require lighting.  
- Security risk due to lack of public surveillance, particularly at night. | NEGATIVE  
- Requires removal of at least 50% of the concrete treads and risers of SHB stairs.  
- Cycleway cannot continue in use during construction. Temporary scaffold stair required.  
- New internal retaining wall required.  
- Rail closure required during construction. | |
| | OTHER  
- Requires further investigation of ability to excavate behind SHB approach wall and stabilise it. May be very difficult to construct and engineer. | | |
| **Station Entry** | **Station Entry** | **Station Entry** | **Station Entry** |
| POSITIVE  
- Does not impact on the Station Entry. | POSITIVE  
- Does not impact on the Station Entry. | POSITIVE  
- Does not impact on the Station Entry. | |
| **Bradfield Park / Neighbourhood Centre** | **Bradfield Park / Neighbourhood Centre** | **Bradfield Park / Neighbourhood Centre** | **Bradfield Park / Neighbourhood Centre** |
| POSITIVE  
- Does not change current status for Bradfield Park and Neighbourhood Centre. | POSITIVE  
- Does not change current status for Bradfield Park and Neighbourhood Centre. | POSITIVE  
- Does not change current status for Bradfield Park and Neighbourhood Centre. | POSITIVE  
- Does not change current status for Bradfield Park and Neighbourhood Centre.  
- No acquisition required. |
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:

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

APPENDIX A

PHASE 1 REPORT - ANALYSIS AND OPTION STUDY
SYDNEY HARBOUR BRIDGE CYCLE RAMP MILSONS POINT

PREPARED FOR ROADS AND MARITIME SERVICES

29 JUNE 2012
### A NUMBER OF DESIGN OPTIONS HAVE BEEN INVESTIGATED

#### DESIGN OPTIONS

<table>
<thead>
<tr>
<th>OPTION</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPTION 1</td>
<td>Long ramp, attached to SHB Approaches to bradfield park</td>
</tr>
<tr>
<td>OPTION 2</td>
<td>Ramp, attached to SHB approaches to burton street</td>
</tr>
<tr>
<td>OPTION 3</td>
<td>Ramp with existing ramp and step access way to Burton street</td>
</tr>
<tr>
<td>OPTION 4</td>
<td>Medium ramp, attached to SHB Approaches to bradfield park</td>
</tr>
<tr>
<td>OPTION 5</td>
<td>Lift from Burton st to SHB deck</td>
</tr>
<tr>
<td>OPTION 6</td>
<td>Spiral ramp to Burton street</td>
</tr>
<tr>
<td>OPTION 7</td>
<td>Ramp, detached from SHB to Bradfield Park</td>
</tr>
<tr>
<td>OPTION 8</td>
<td>Ramp, detached from SHB to Bradfield Park</td>
</tr>
<tr>
<td>OPTION 9</td>
<td>Switchback ramp to Burton street</td>
</tr>
<tr>
<td>OPTION 10</td>
<td>Ramp and step arrangements within existing ramp and step access way</td>
</tr>
</tbody>
</table>
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).
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).
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).
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 4**

**Medium Ramp, Attached to SHB Approaches to Bradfield Park**

```
<table>
<thead>
<tr>
<th>CHANGE IN LEVEL FROM</th>
<th>5.3M</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX GRADIENT</td>
<td>1:8</td>
</tr>
<tr>
<td>LENGTH</td>
<td>185M</td>
</tr>
</tbody>
</table>
```

Medium Ramp attached to SHB approaches...
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.
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).
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).
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

Plan

- MILSONS POINT STATION
- BRADFIELD PARK
- FITZROY ST.
- BRADFIELD PARK
- MILSONS POINT STATION ENTRY
- ALFRED STREET SOUTH
- KIRRIBILLI NEIGHBOURHOOD CENTRE
- FITZROY ST.
- BURTON ST.
- EXISTING ACCESS STAIR/RAMP
- KIRRIBILLI NEIGHBOURHOOD CENTRE

Option 8: Widen ramp, retain single set of steps.
Option 9: Widen ramp to full width of existing access way.

<table>
<thead>
<tr>
<th>Change in Level From</th>
<th>Max Gradient</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>9M</td>
<td>1:4</td>
<td>35M</td>
</tr>
</tbody>
</table>

Scale: 1:1000 | A3

North

Plan Scale: 1:1000 | A3
# Design Matrix

## Cycleway Ramp Options

<table>
<thead>
<tr>
<th>Design Options</th>
<th>Feasibility</th>
<th>Physical Impacts to Park and Urban Setting</th>
<th>Heritage Impact</th>
<th>Circulation</th>
<th>Visual Amenity</th>
<th>Access and Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compliance with part 6A (Pedestrian and Cyclist Paths)</td>
<td>Compatibility with the North Sydney Cycle Network</td>
<td>Heritage Impact</td>
<td>Entrance to Burton Street</td>
<td>Entrance to Fitzroy Street</td>
<td>Entrance Milsons Point Station</td>
</tr>
<tr>
<td>1. Long Ramp attached to the Sydney Harbour Bridge approaches to Bradfield Park</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>2. Ramp attached to the Sydney Harbour Bridge approaches to Burton Street</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>3. Ramp within existing ramp and step access way to Burton Street</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>4. Medium Ramp attached to the Sydney Harbour Bridge approaches to Bradfield Park</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>5. Lift to service cyclists from Burton Street to SHB Cycle way</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>6. ‘Spiral’ Ramp to Burton Street</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>7. Ramp detached from the Sydney Harbour Bridge approaches to Bradfield Park</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>8. Switchback Ramp to Burton Street</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>9. Step/Ramp/Step envelope replaced with Ramp/Ramp/Step arrangement</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>10. Step/Ramp/Step envelope replaced with ramp only arrangement</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

**Note:**
All options to be designed and developed in accordance with the CMP Policies.