Homebush Bay Pedestrian and Cycle Bridge

A proposal to implement an important infrastructure need at Homebush Bay West

by Billbergia Pty Ltd in consultation with Auburn Council, SOPA, DIPNR and the Waterways Authority

Introduction

A 400 metre long pedestrian and bicycle bridge is being proposed across Homebush Bay by Billbergia Pty Ltd, a development company with land at Homebush Bay West.

The bridge has been identified in State and local plans and will link the two large emerging communities at Rhodes and Homebush Bay West in order to provide better access for future residents to share mass transit, employment, retail and community services and regional recreational facilities.

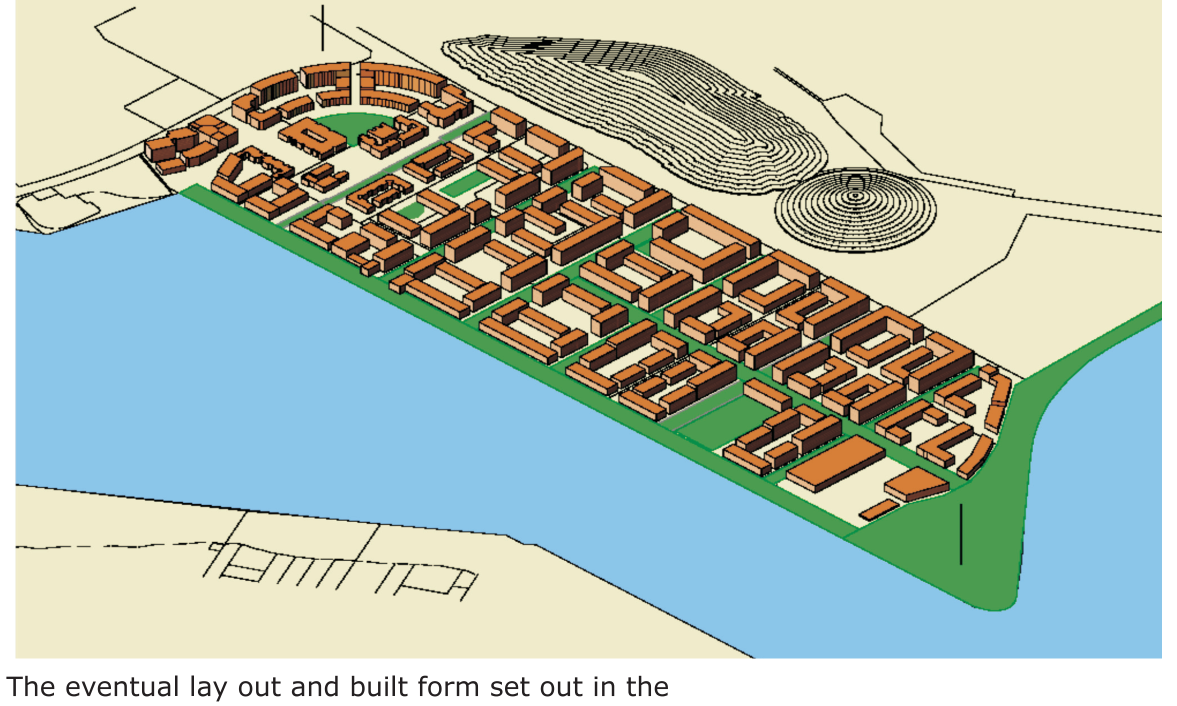
Subject to the agreement of both State and local governments, it can be mostly privately financed in return for modest and sensible development concessions.

Auburn Council is now being asked if it will, in principle,:

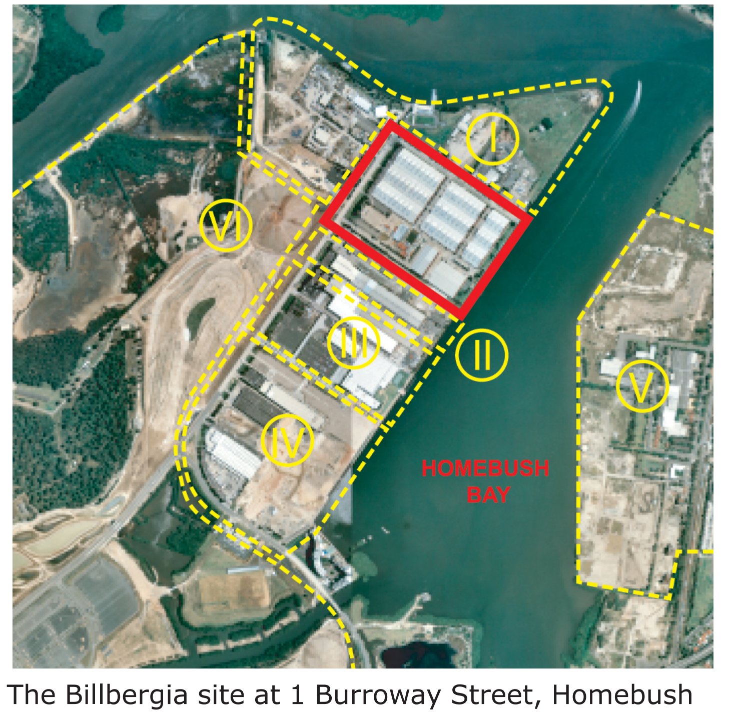
- Support the bridge concept; and

- Accept ownership of the bridge once completed.

This report provides a description of the project and the proposed bridge design arrived at in consultation with officers of Auburn Council, DIPNR, SOPA, Sydney Waterways and two separate design review panels. The report also outlines the background to the project, its benefits and costs, and the process required to make it happen.



The eventual lay out and built form set out in the Homebush Bay West Development Control Plan



The Billbergia site at 1 Burroway Street, Homebush Bay West (shown in red) in relation to other development areas adjoining and at Rhodes.

The Story So Far

A significant redevelopment is occurring at Homebush Bay West on the former reclaimed industrial lands.

The DCP for the area envisages “an attractive, appropriate, high amenity and high quality environment for residents, workers and visitors” and seeks to “integrate new development in the private and public domains with its wider context”.

The DCP also acknowledges, however, that it is “isolated .... by its water and parkland edges” and “is not well linked to existing services, neighbourhoods or public transport infrastructure”. The Bay is also a barrier to joining the cycle networks through the Olympic Park lands with the regional cycle routes that cross Parramatta River.

A bridge was first identified during the planning for the Rhodes Peninsula when the first residential development was also occurring at Homebush Bay West. Most recently, the bridge was identified in the State government’s “Sharing Sydney Harbour Access Plan” and the Homebush Bay West DCP.

Billbergia recognised the potential community and commercial benefits of the bridge. Accordingly, it provided funds to DIPNR for a study of the bridge concept, which in turn supported the concept and recommended the current proposed alignment.

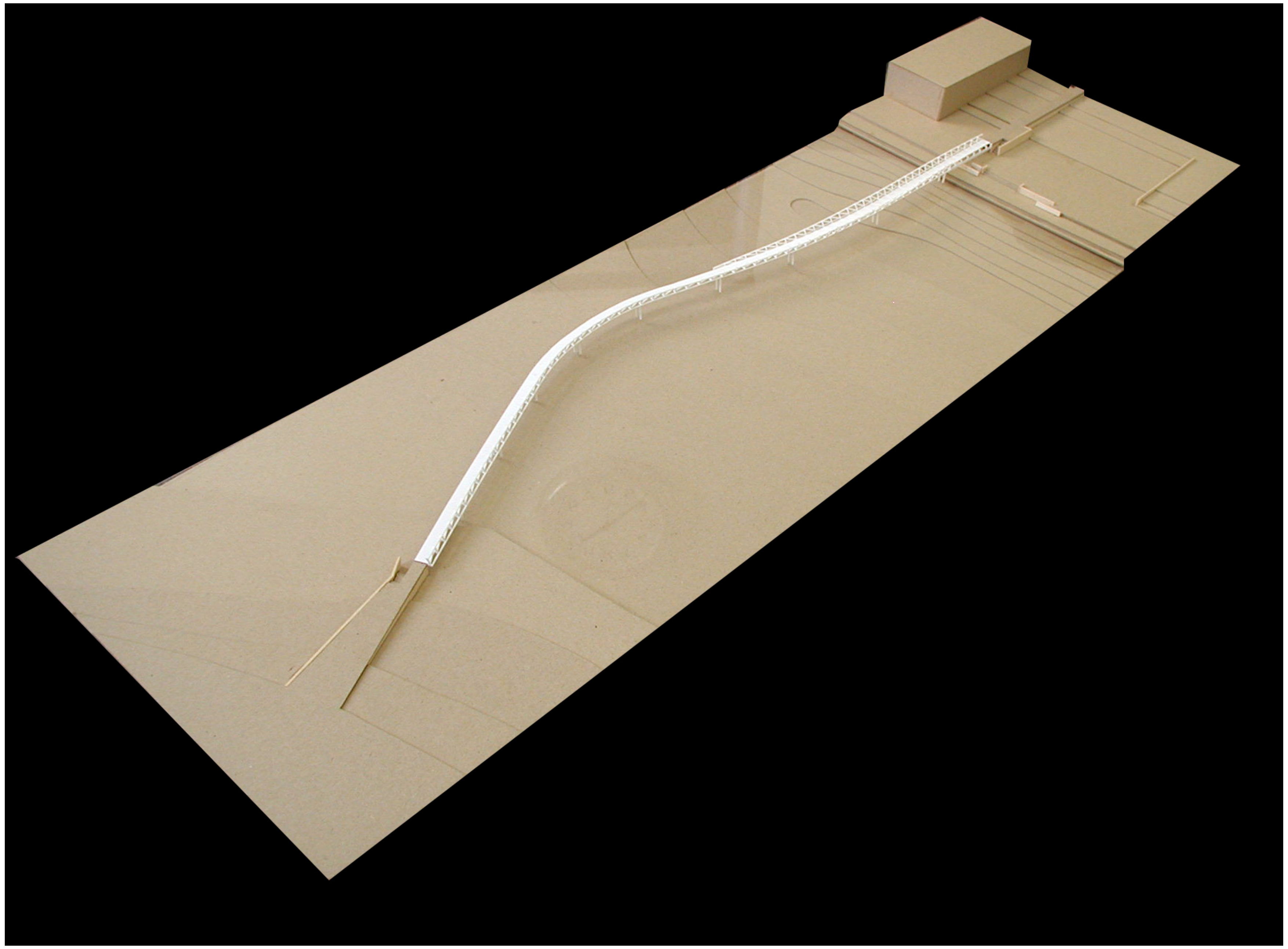
Since that time, Billbergia undertook further investigations in liaison with authorities to test the bridge feasibility including compatibility with the decontamination of Rhodes. This resulted in officers of DIPNR, SOPA and Auburn Council agreeing to a process to finalise a bridge design and establish mechanisms for ownership, funding and implementation. A working party chaired by SOPA which also includes the Waterways Authority and Billbergia has now met on six occasions.

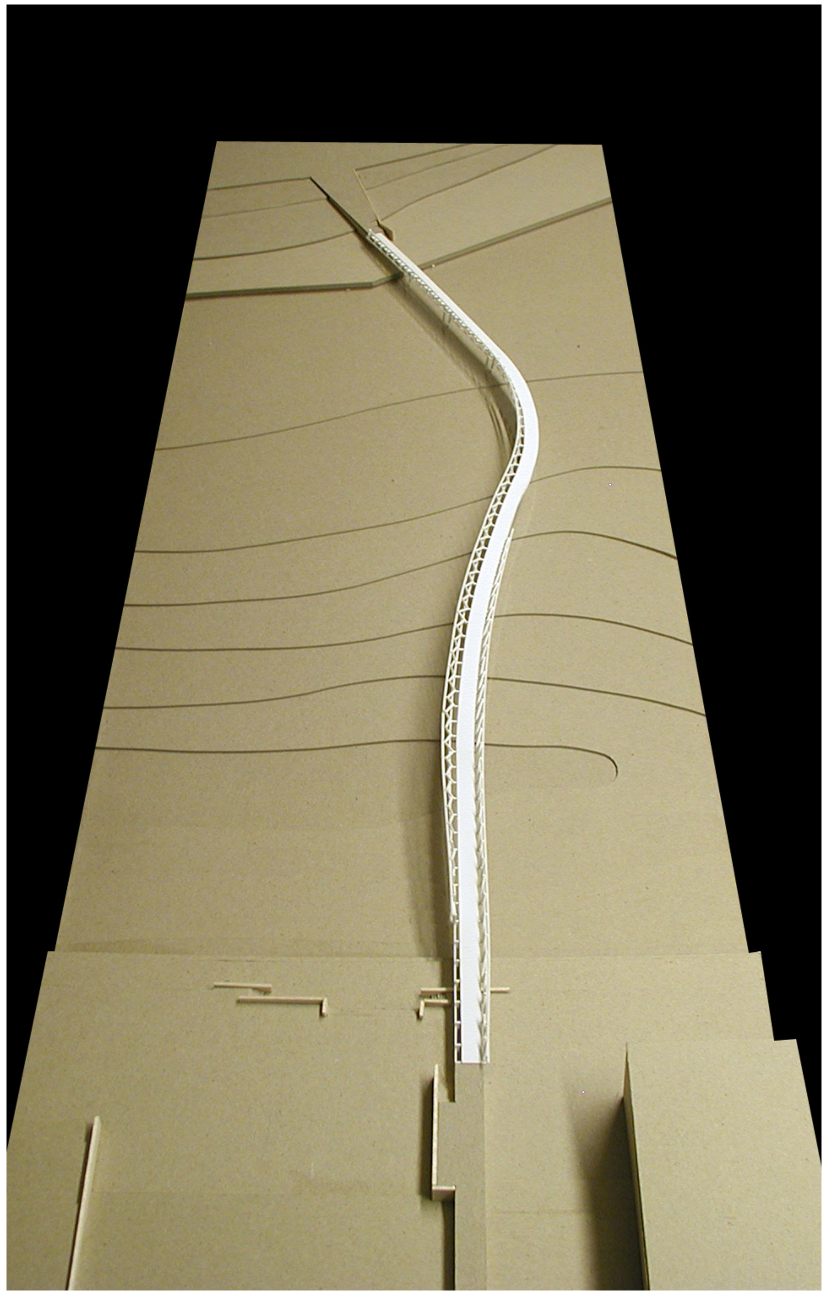
Bridge Concept Design

the bridge in future context

perspective view from Homebush Bay West looking north

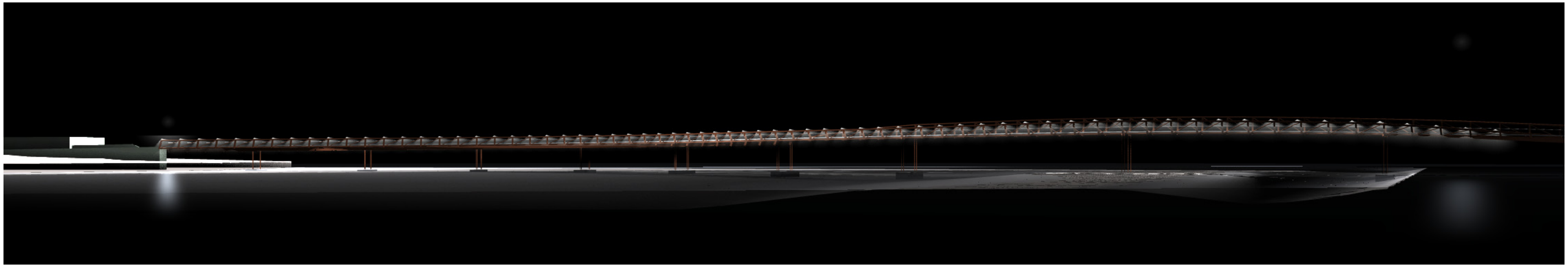
Bridge Concept Design





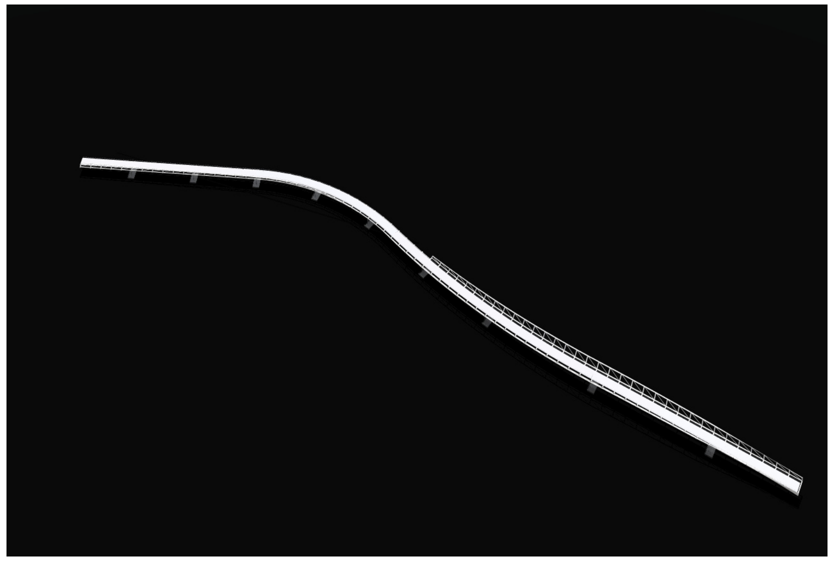
model views

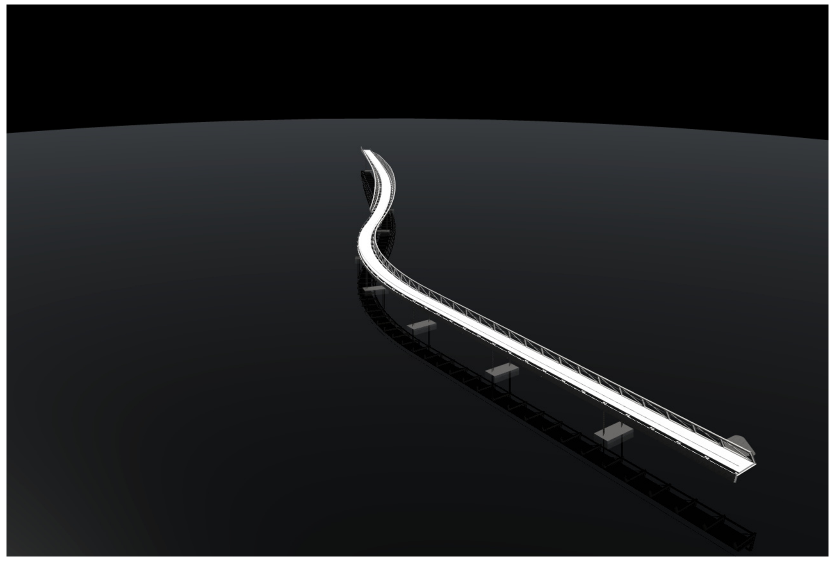
< view from south east

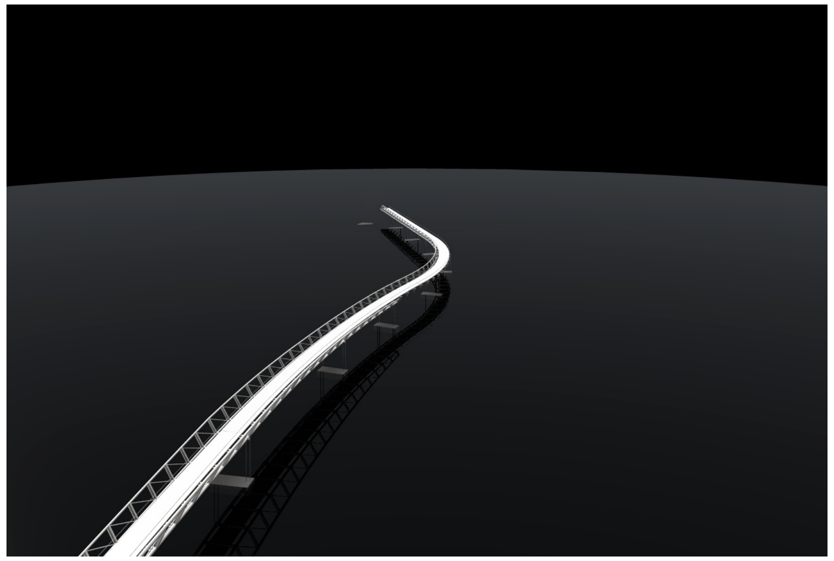


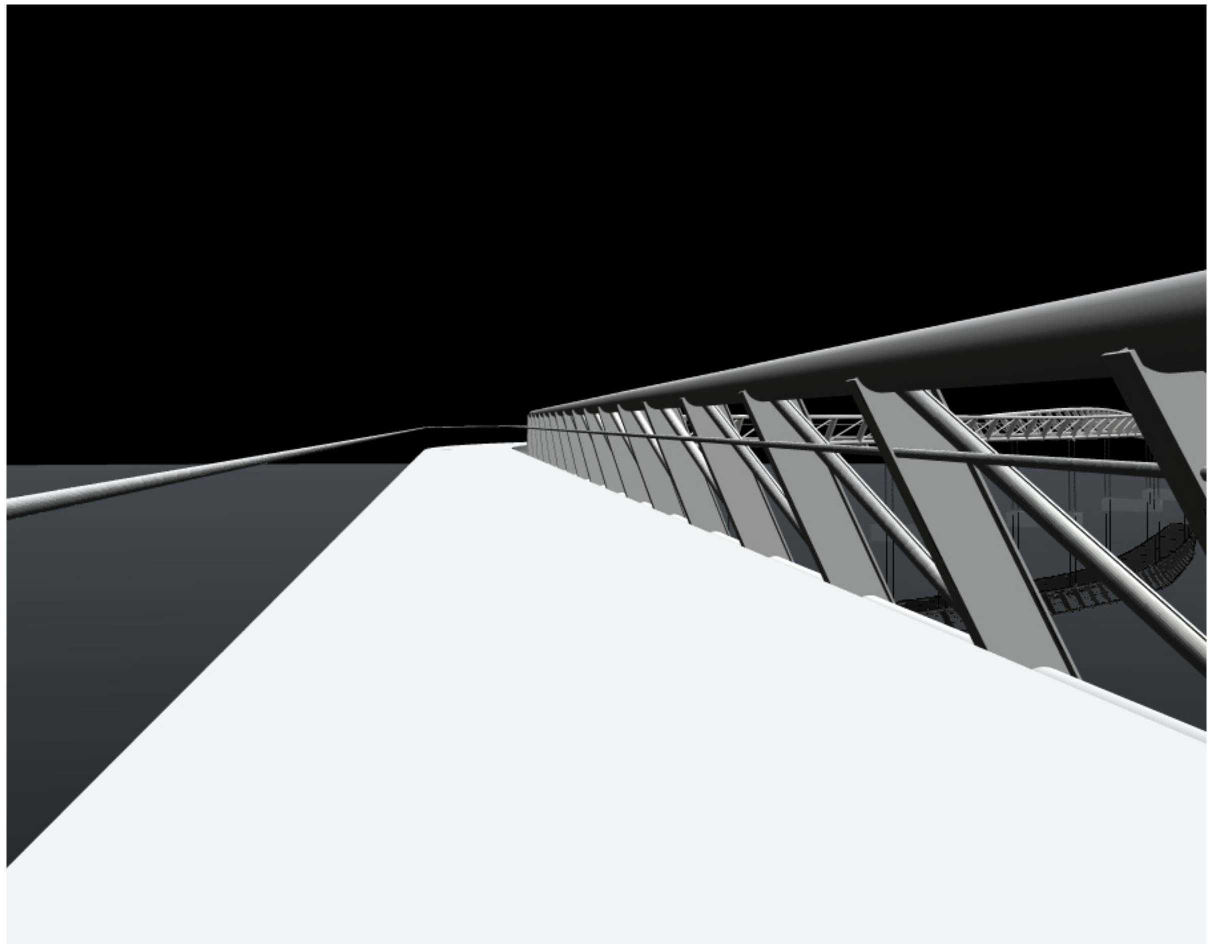
simulation of night view

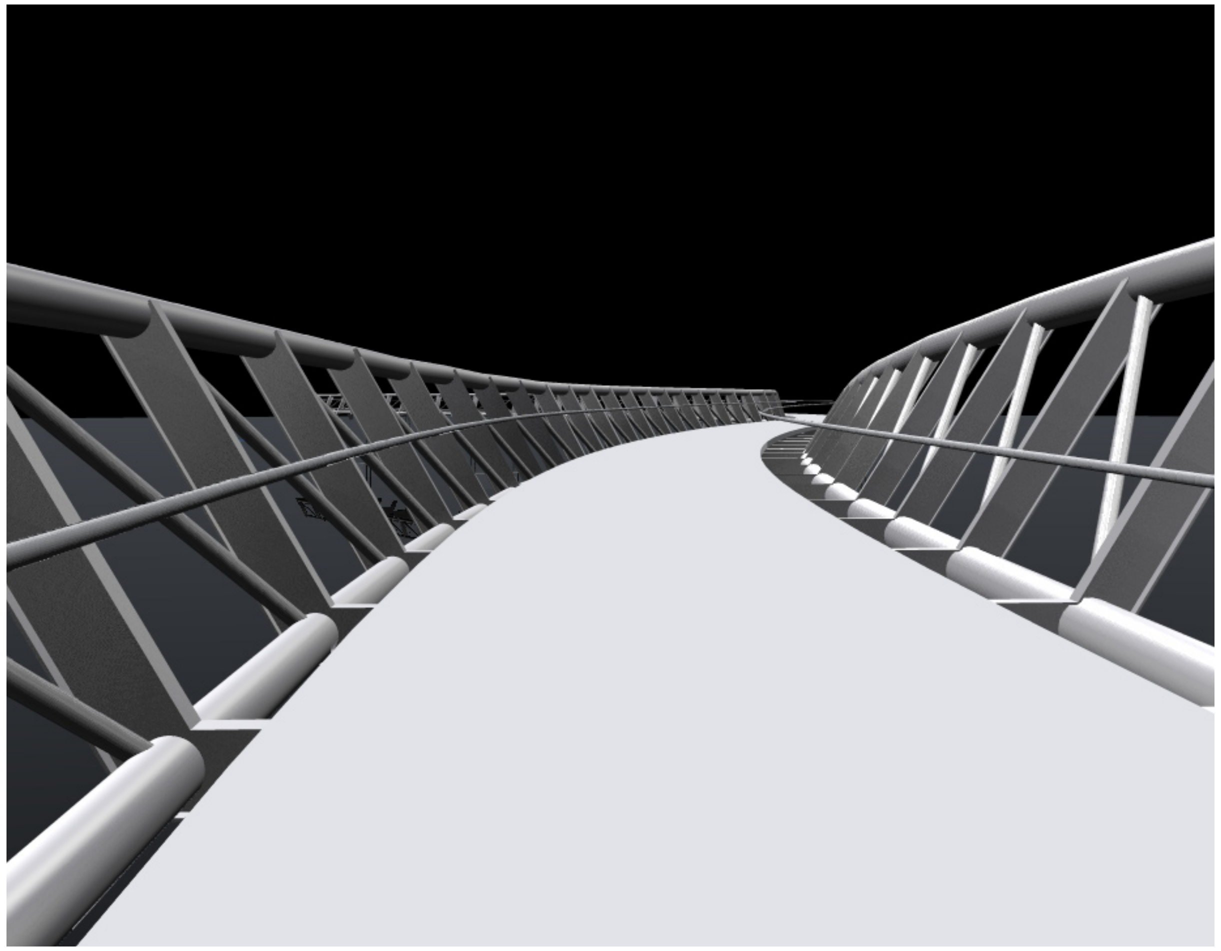
Bridge Concept Design





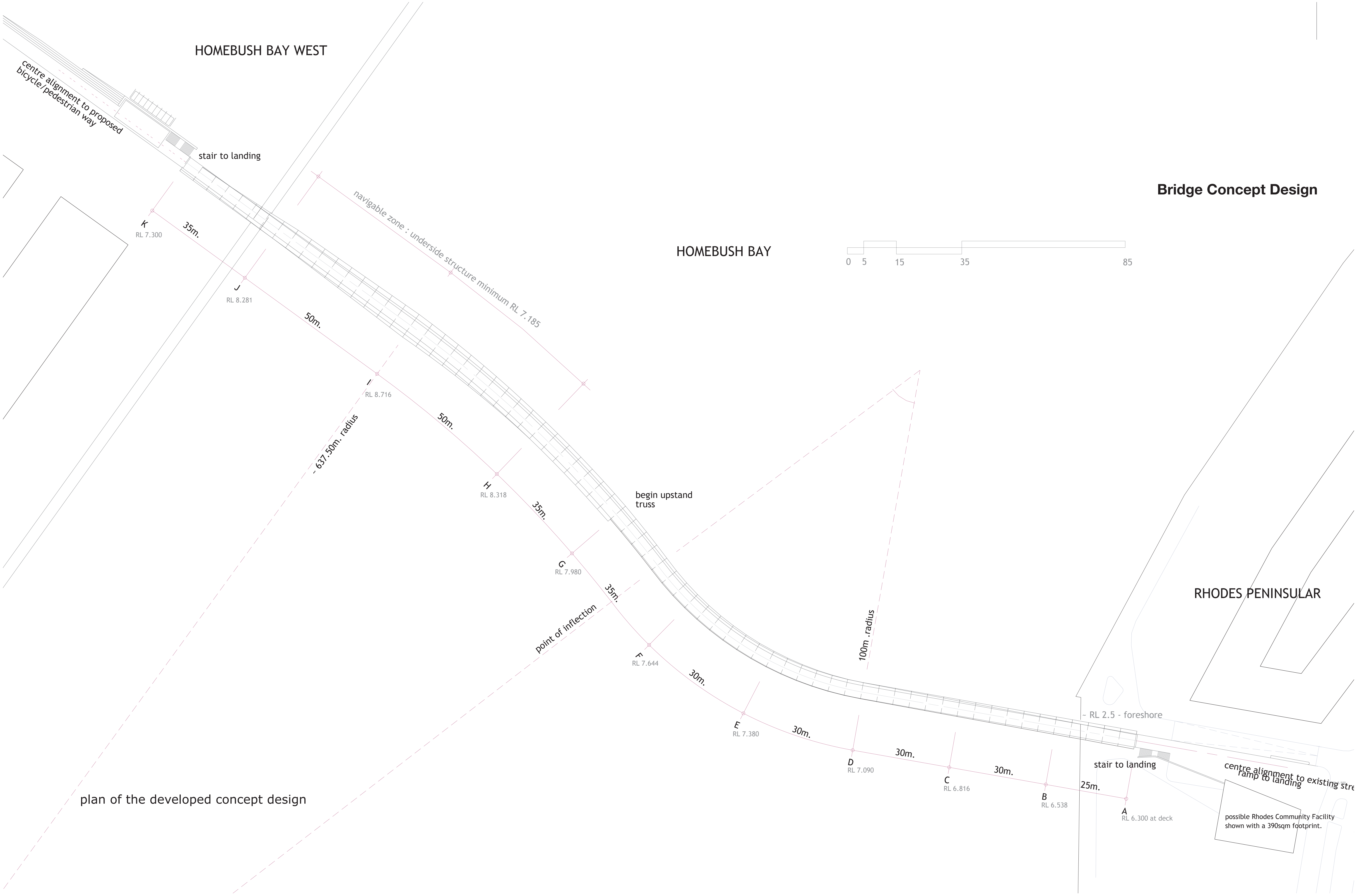






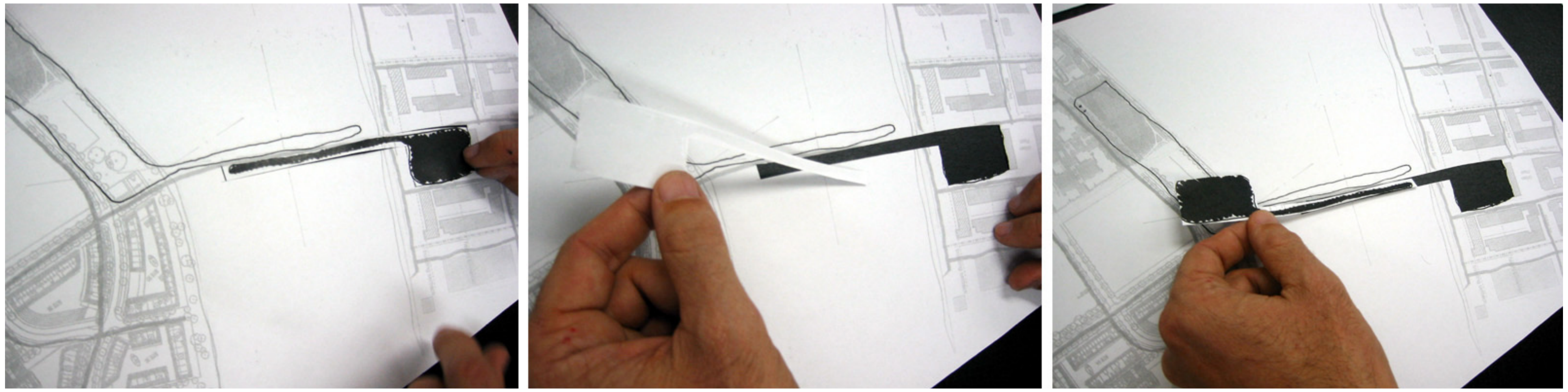
top: various snapshots of the bridge digital model
bottom: views on bridge from east and west ends

Bridge Concept Design



plan of the developed concept design

images showing the exaggerated horizontality of the bay. A broadness drawn out by the possible 'line' of the bridge.



a mapping of two potential communities/open space to one another creates a half twist asymmetry which offer clues to a reading of the bridge.

Concept

The design team identified two primary conditions which have informed the design. Conditions which call emphatically on the nature of the bay and the areas transformation from redundant industrial landscapes to integrated city quarters.

Firstly the scale of the Bay induces a horizontal panorama that impresses not only when viewed from north and east looking west but also when being viewed in reverse towards the more undulating Rhodes and Meadowbank peninsulas. To accentuate and even underline this phenomena, the bridge should avoid using more vertically oriented structures and emphasise the continuity of itself and the Bay.

Redevelopment at Homebush Bay West and the Rhodes Peninsula strongly represent the transitions inherent in urban consolidation where higher residential densities suggest a subsequent higher standard of public open space. In both cases, the new developments at the eastern and western landings of the proposed bridge include substantial urban parks which will serve the new communities. These parks are bisected by the bridge axis in an asymmetrical fashion whereby the bridge becomes a sinuous element that mediates this asymmetry and unites the open space network. This diagram can then inform a number of conceptual diagrams.

an emphasis of the horizon stems from an analysis of the bay demonstrating the nature of urban and vegetated edges
with the majority of views of the bridge originating from within the immediate surrounds of the bay rather than from afar

1km - 1.8km Isochrones from Rhodes Station
1km = approximately 12.5 minutes walk time
1.8km = approximately 22.5 minutes walk time

Isochrones from Rhodes Station
source: PBAI

Networks

The benefits of the pedestrian / bicycle bridge include:

- Access for future residents of Homebush Bay West to the community at Rhodes, its rail station and regional bus routes as well as the Rhodes shopping centre.

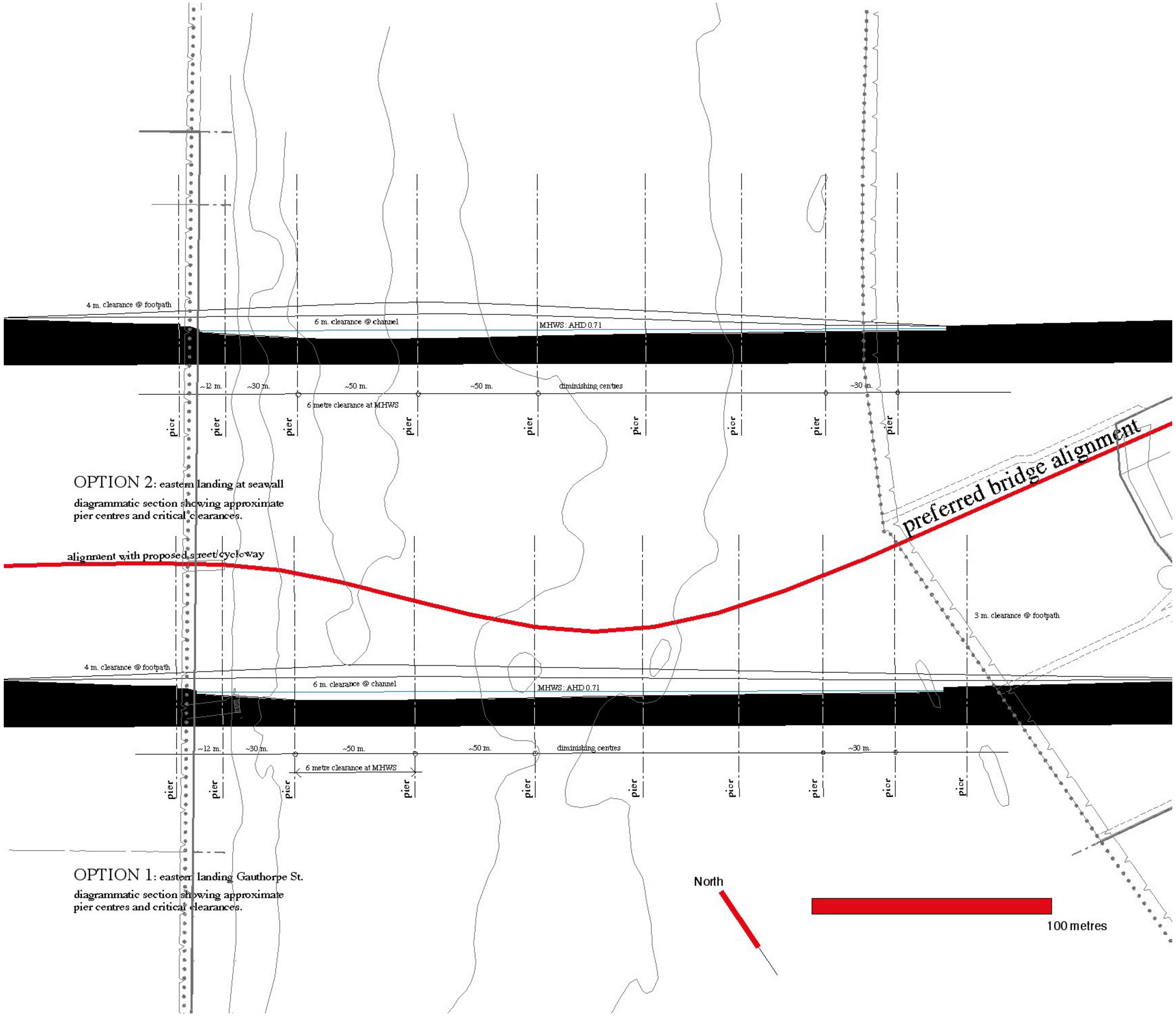
- Reduced pressure on car access to and from the Homebush Bay area with an estimate of over 600 pedestrian movements on the bridge during the peak commuting hours.

- Access for the future residents of Rhodes to a range of regional recreational facilities at Homebush Bay including the proposed maritime and boat storage facilities at Wentworth Point, the Sydney Olympic Park and the Millennium Park.

- Linking of two regional bike routes while completing a recreational walking and bike trail around Homebush Bay (similar to that of Iron Cove).

- Allowing for water, sewage and electricity connections across the Bay thereby avoiding disturbing contaminated sediments in the Bay.

The map at left shows how most of the residents of Homebush Bay West will be within a 20 to 25 minute walk from Rhodes rail station with a bridge (and much less by bike). In turn, peak hour trains arriving every 15 minutes at Rhodes will deliver residents to Town Hall station in 20 minutes. In comparison, driving a car from Homebush Bay west to Rhodes will take almost 20 minutes and even longer with peak hour road congestion.



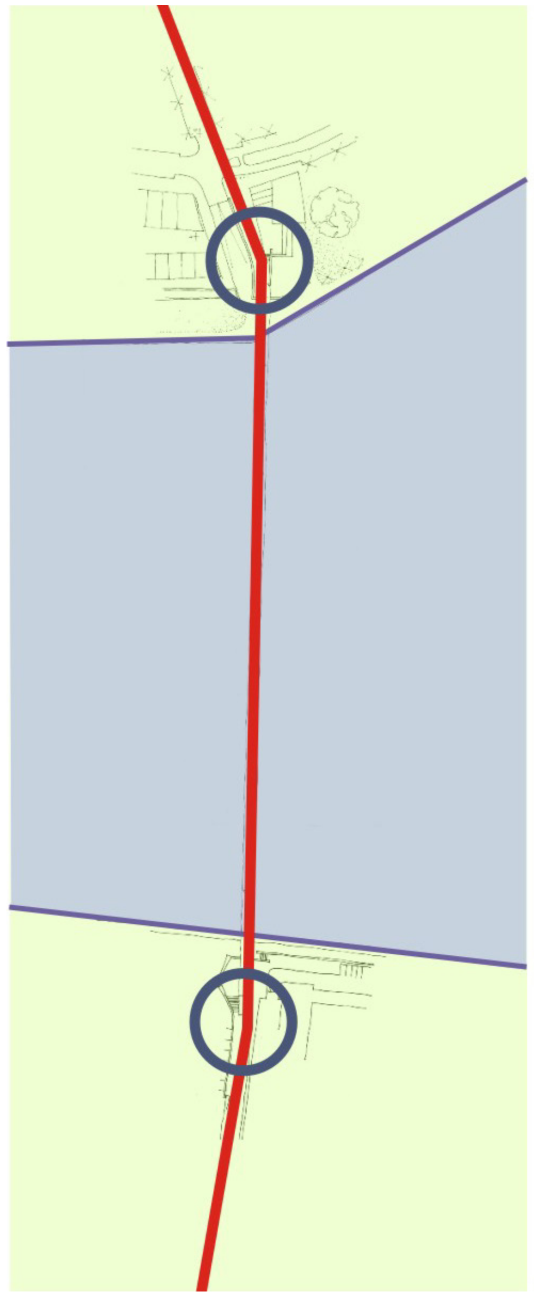
plan / section showing required clearances from the bay

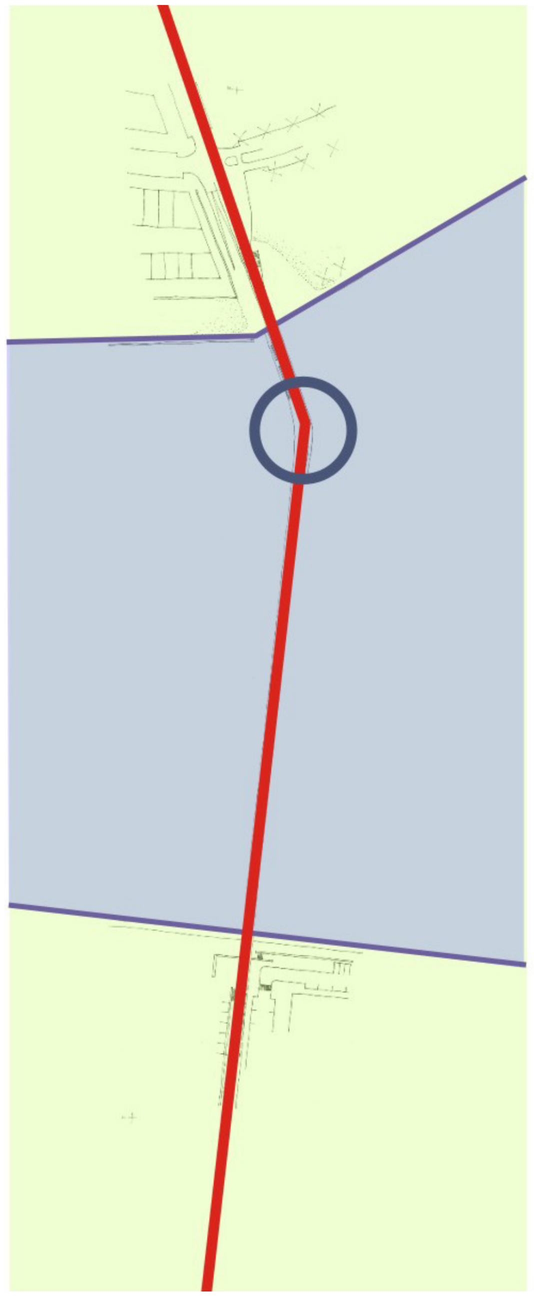
Use

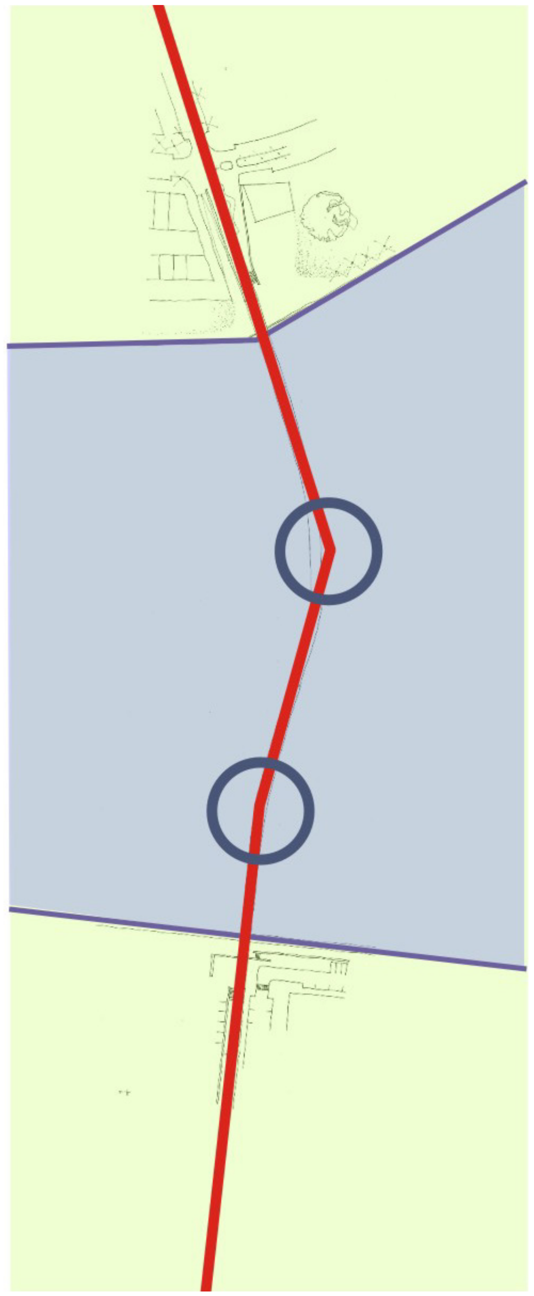
The bridge proposal facilitates a variety of uses including recreation, commuting, and water based activities. Waterways NSW has asked for two 50 metre clear spans with a clearance above the mean high water level of 6.5 metres (RL 7.185). This 'navigable zone' occurs towards the western side where the existing channel is located. Otherwise the Bay is extremely shallow. The bridge design accommodates this requirement rendering visible not only the aquatic use of the bridge but also the underlying geological structure of the bay.

The ARUP feasibility study recommended a design width of 3.5 metres in accordance with Ausroads guides for traffic engineering practice. The proposal allows for a minimum of 4 metres to take account of the exceptional length of the bridge while enhancing its utility.

The pedestrian and cycle usage of the bridge is considered utmost from the transport infrastructure perspective. To this end it is critical that the connections at both landings are integrated with the existing and proposed street network as seamless as possible. The proposal therefore suggests near level entry/exit ramps providing the longest possible entry and exit vistas to and from the bridge. The resulting elevated pathway at both banks also facilitates an uninterrupted passage of (mostly recreational) pedestrians and cyclists along the waterfront path ways kept safe from cycle movements crossing the Bay.


straight or skewed option


dog-leg option


segmented option

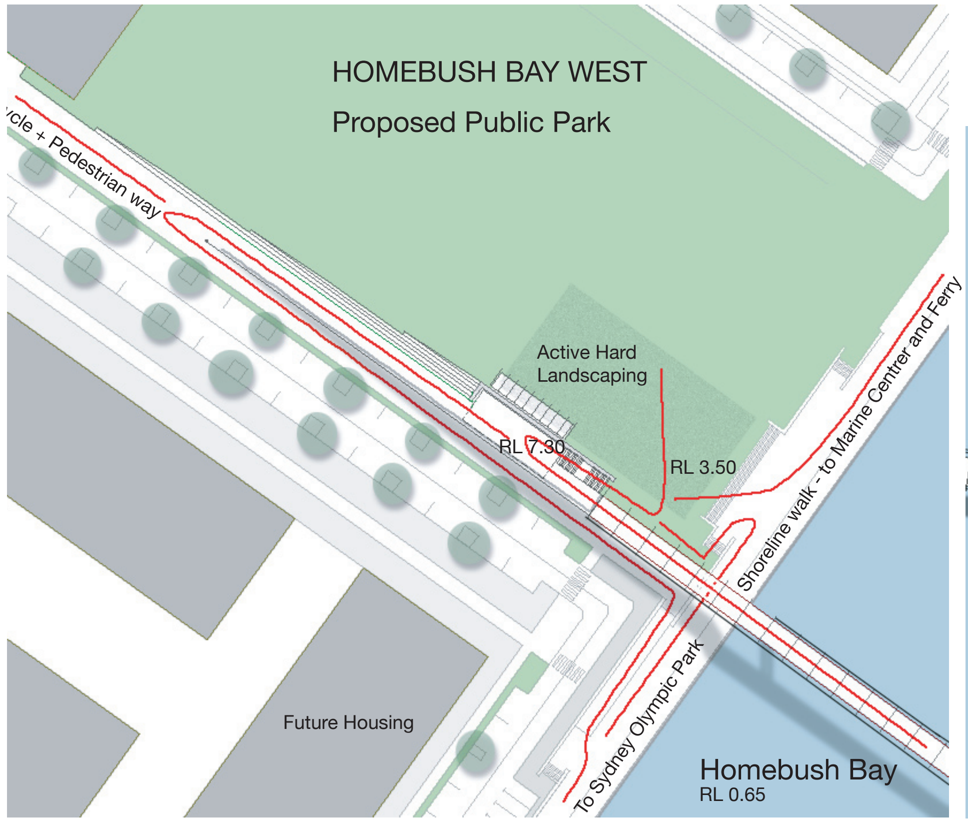
Alignment

Three specific alignment strategies were investigated.

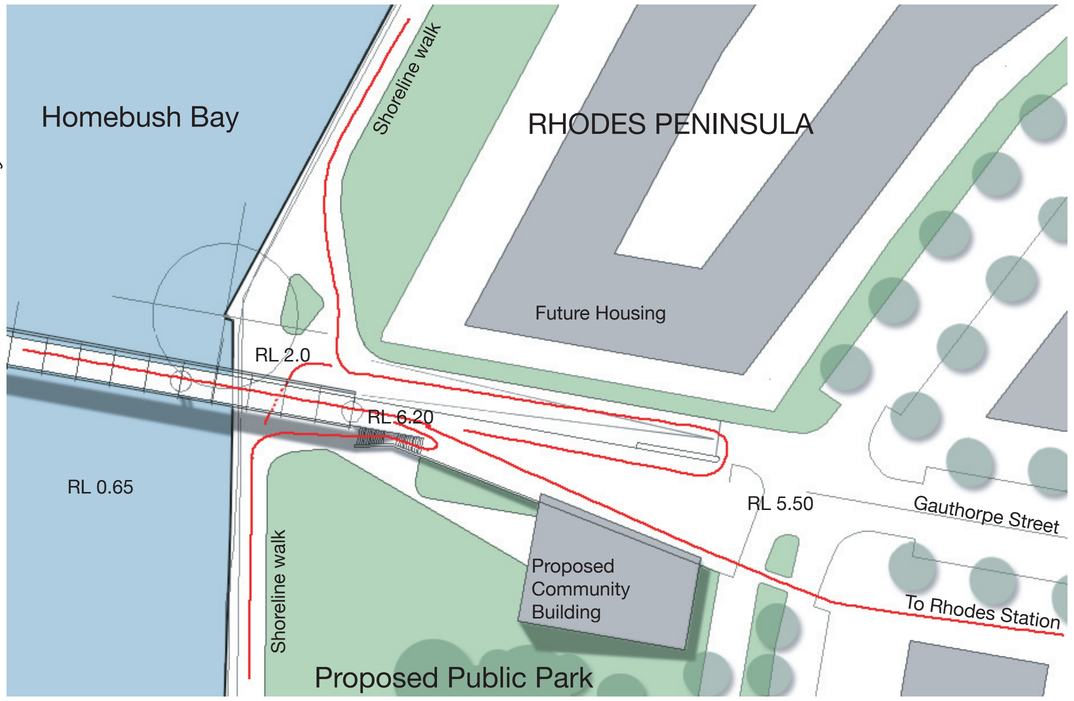
The first, a traditional bridge span using the shortest possible distance was discarded as it fails to directly integrate with the adjoining street alignments, a major factor in encouraging use.

The second alignment suggests a straight extension of both street axes to a junction that provides direct visual connections into the bridge from both street alignments. This was not adopted because it inhibits visual access to the bridge landings due to the vertical profile of the bridge path way necessary to attain required height clearances.

The third and adopted alignment uses a segmented alignment developed into a long s-curve which facilitates long views along the bridge towards landings and increases perceived safety through surveillance. It also maximises views into and out of the street network by extending the Gauthorpe Street vista.



Western Landing : Homebush Bay West



Eastern Landing : Rhodes

Landings

Critical to the seamless integration of the bridge is the arrangement of the landings. The efficiency of these transitions is fundamental in how pedestrian use can be encouraged. It is considered important in pedestrian/ cycle bridge design that the carriageway continues as close to grade as possible into the street network and that the bridge makes direct, comfortable connections.

On the western bank, an elevated entry to the bridge is unavoidable as the required water clearances prohibit a landing at the bank (approx. RL 2.5m). The development at Homebush Bay West proposes an elevated topography to allow for underground carparks above the water level. This follows that the elevated arrival of the bridge can continue almost level until meeting the new ground level. A stair as indicated on the adjacent plan allows direct access to the waterfront being more desirable for recreational users.

An elevated landing is also proposed on the eastern shoreline (Rhodes) on the advice of pedestrain experts as it provides a near level way onto Gauthorpe Street. This is preferred to an arrival at the bank in a park setting which would also require an unecessary descent and accent. The resulting grade separation of bridge to waterfront also removes potential conflicts of speeding cyclists and recreational pedestrians at the shoreline. A set of stairs links pedestrians more directly to the waterfront.

Both landings suggest solutions that incorporate the lay of the land so that no suspended ramps would be necessary.

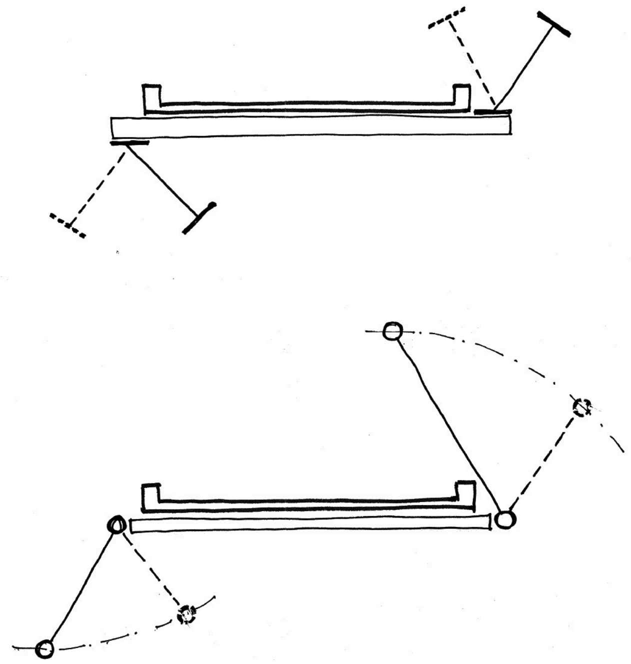
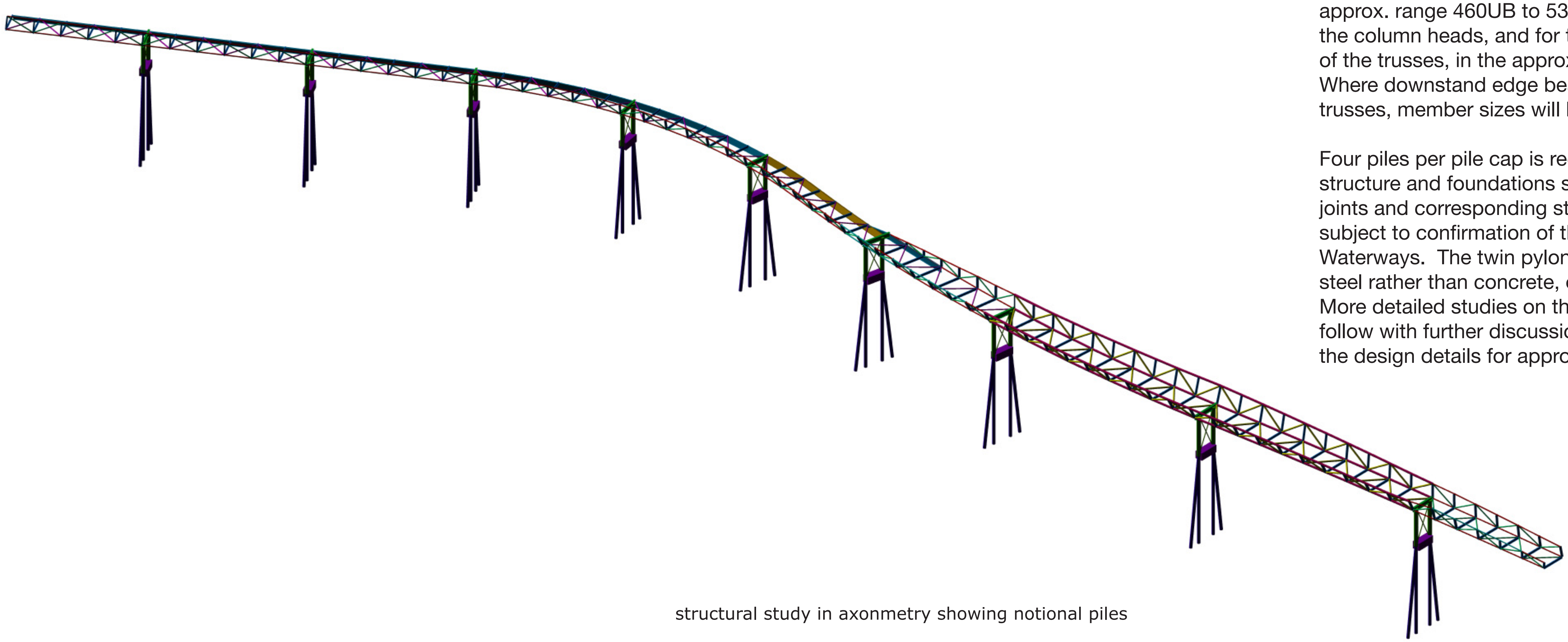


diagram showing development potential asymmetry solution



structural study in axonometry showing notional piles

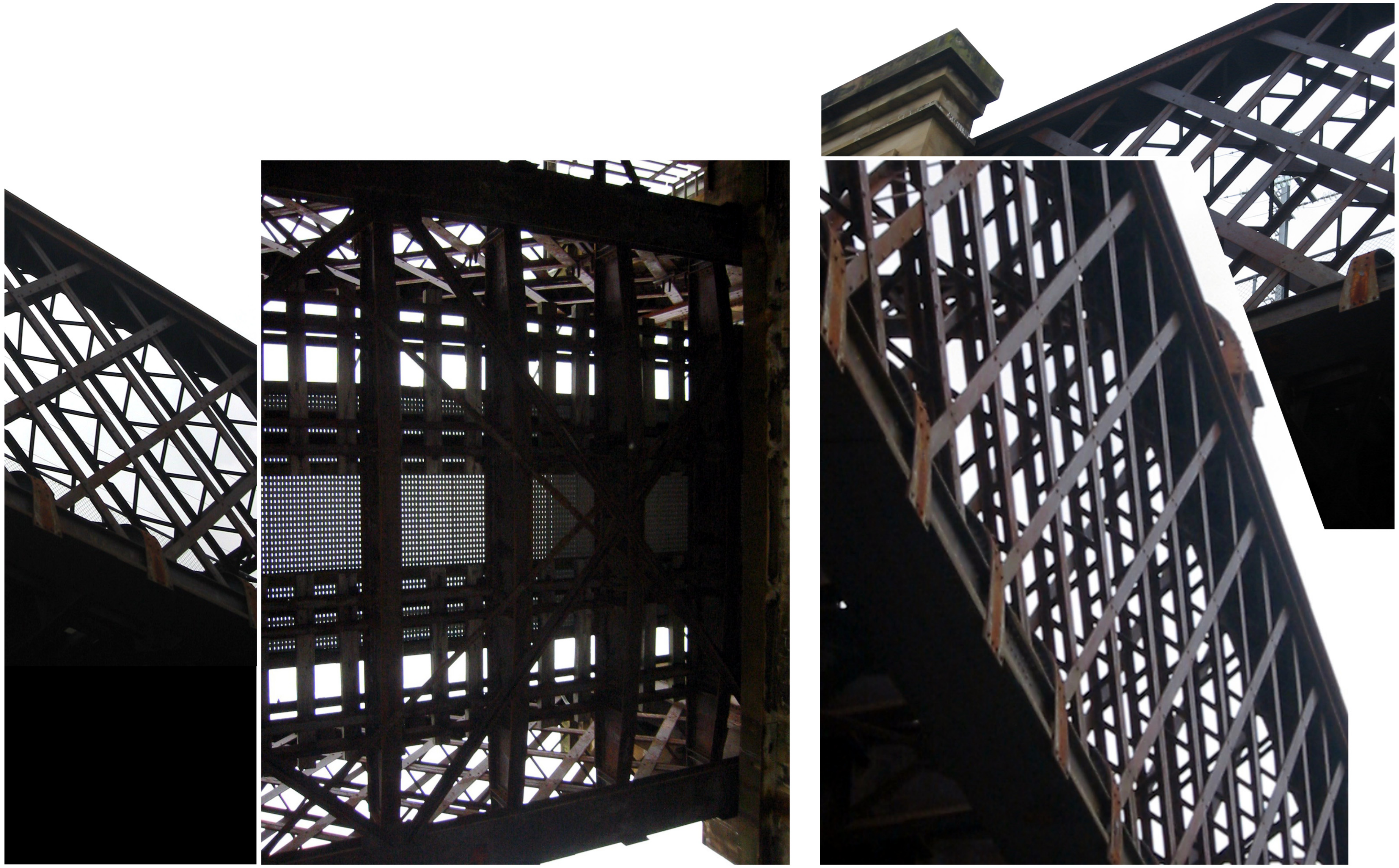
Structure

The working party and design review panels showed a clear preference for a structural solution that was legible and elegant. In keeping with the conceptual intent, a number of asymmetrical solutions were explored which also emphasised a continuous structure. Precedence in Sydney Harbour, including the adjacent John Whitton Bridge, also suggested a trussed steel solution.

The provision of both up and down-stand portions of the structure provide opportunities for a minimum walk way height where critical clearances are required as well as visual variation along the length of the bridge which measures, landing to landing, some 352 metres.

A preliminary structural analysis has been completed allowing for effects like top chord stability, curvatures in plan and elevation and truss twist. Member sizes for the lateral (N-S) frames supporting the deck will be in the approx. range 460UB to 530UB, with up to 900WB at the column heads, and for the top and bottom chords of the trusses, in the approx. range 219CHS to 508CHS. Where downstand edge beams are used instead of the trusses, member sizes will be about 1200 deep PWG.

Four piles per pile cap is recommended for pier support structure and foundations so as to facilitate expansion joints and corresponding stability requirements subject to confirmation of the pile cap impact needs of Waterways. The twin pylons above pile cap level may be steel rather than concrete, or a combination of the two. More detailed studies on these elements will logically follow with further discussions with Waterways in refining the design details for approvals.



details of the nearby John Whitton Bridge

Durability

A steel structure not only belongs to a family of bridges used in Sydney Harbour and the Parramatta River but is lighter and cheaper to construct. Steel in a marine environment, however, raises questions of maintenance and life-cycle costs and while there is no direct comparison to be made between life-cycle and construction costs, current steel coating technologies suggest the alleviation of concern regarding maintenance of a steel structure.

The bridge deck would be fabricated in large parts, blast cleaned and shop coated. After installation, the connections and any repairs will require re-blast cleaning and coating to the same specification.

Possible coatings include:
• Zinc rich epoxy primer of 75 microns plus 2 coats each of 125 microns epoxy MIO plus a polyurethane finish
• 400 microns glass flake epoxy plus a polyurethane finish
• 400 microns glass flake vinyl ester

Expected maintenance periods on the paintwork:
• 20 years - to rejuvenate the appearance of coating - (spot repainting of visible areas)
• 35 years - to rectify corrosion breakthrough - (full repainting)

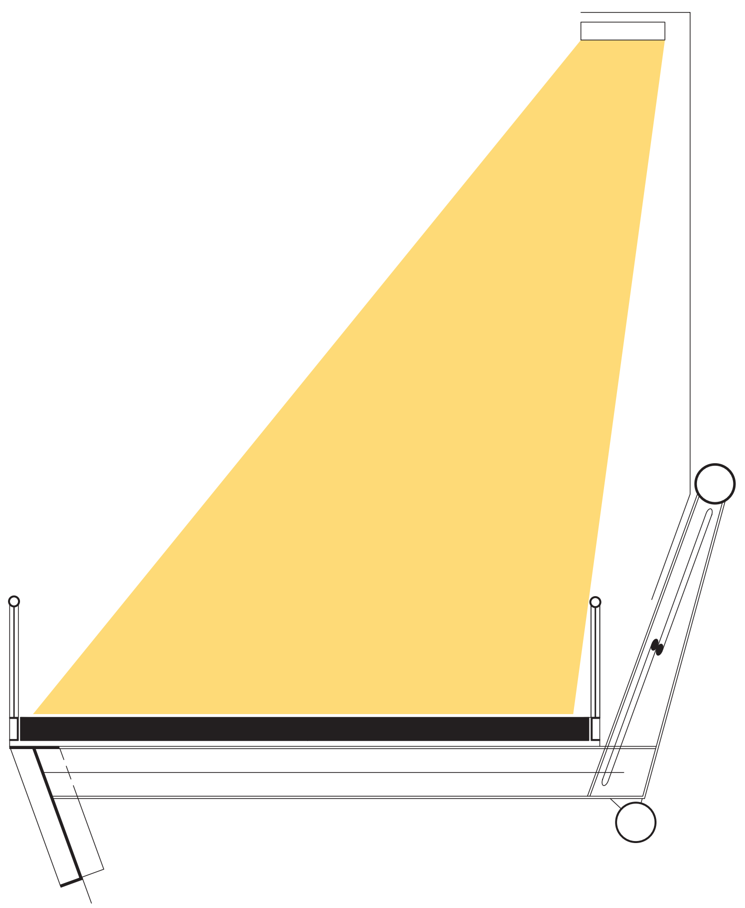
Maintenance can be expected to be minimal for pylons and pile caps in reinforced concrete with appropriate concrete specification, covers and workmanship to suit a 100 years design life. If the pylons are steel, re-coating will be required as for the bridge deck.

The piles are proposed as steel tubes with corrosion allowance in wall thickness, probably with NS-PAC coating from about 2m below the mudline to the pile cap connection and possibly Denso jackets just below the pile cap connections. With appropriate specification, corrosion allowance and workmanship to suit a 100 years design life, maintenance should be minimised. Most likely maintenance would be repairs to the NS-PAC coating and replacement of the Denso jackets at the top parts of the piles.

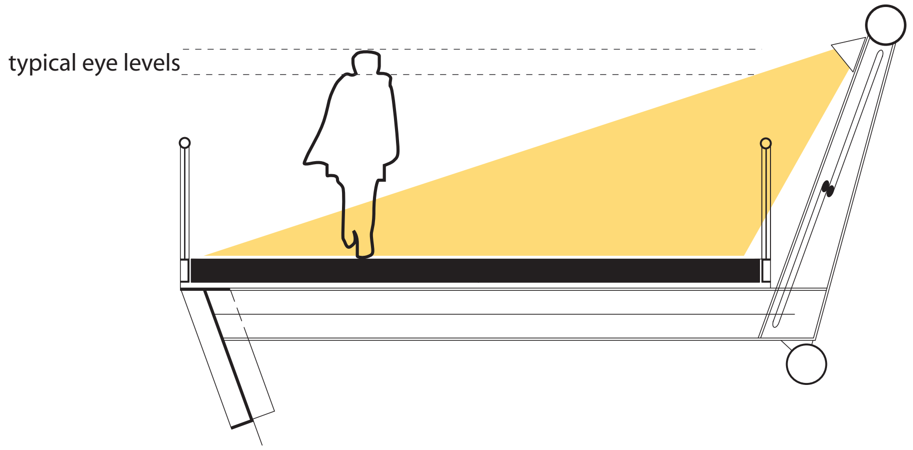
Lighting

The illumination of the bridge should facilitate the safe crossing of the bridge in twilight and night conditions.

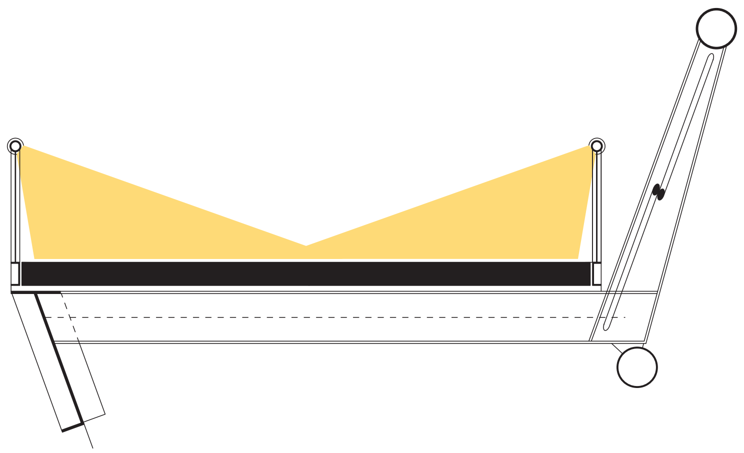
Although professional lighting engineering design has not been carried out to date, three primary options have been considered. All three consider the bridge as a pathway or concourse with higher illumination levels being used at both landings.



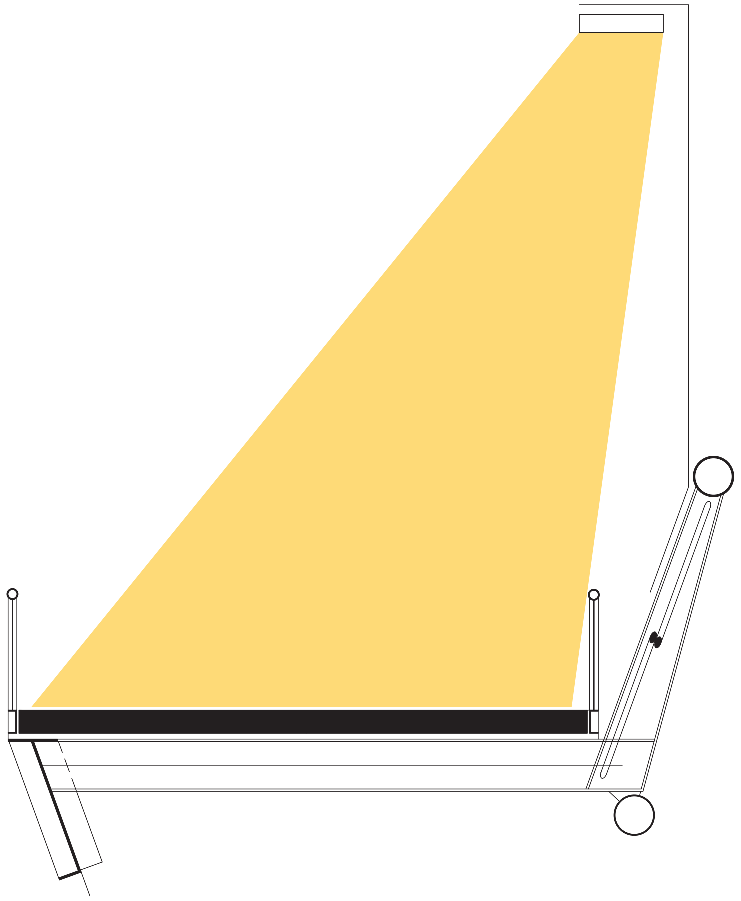
Option 1 : Street type lighting



Option 2 : Frame supported floor washing

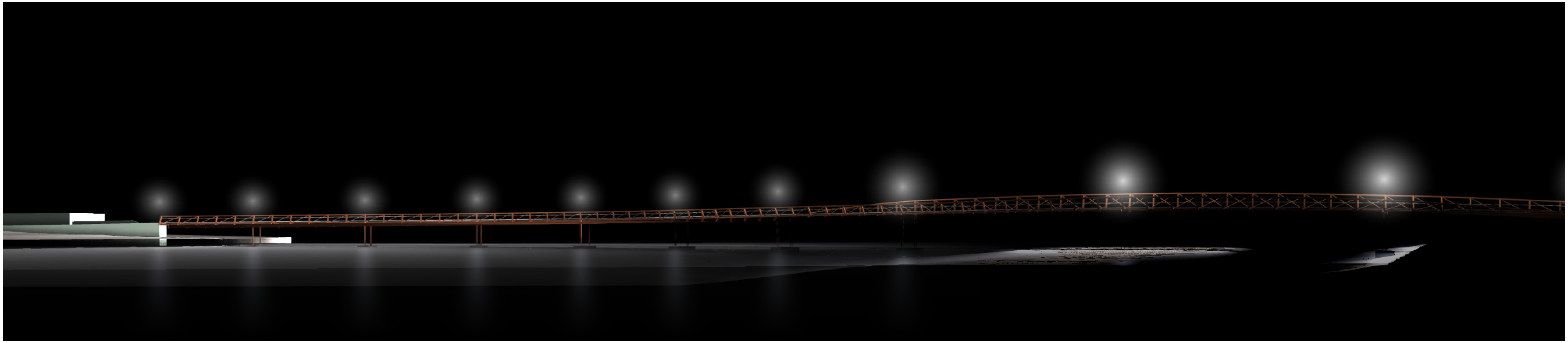


Option 3 : Handrail continuous floor washing

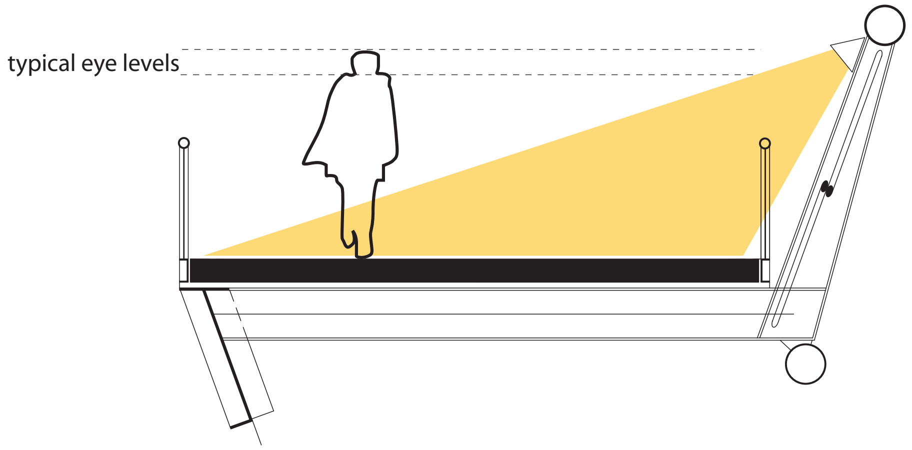


Option 1.

Street/Park type lighting positioned in line with pier centres on columns attached to structural frame. This option potentially suggests the simplest and cheapest solution with the disadvantage of creating an interruption to the otherwise uninterrupted horizontal silhouette of the bridge. This solution also provides less than ideal viewing conditions away from the bridge.



simulation of option 1



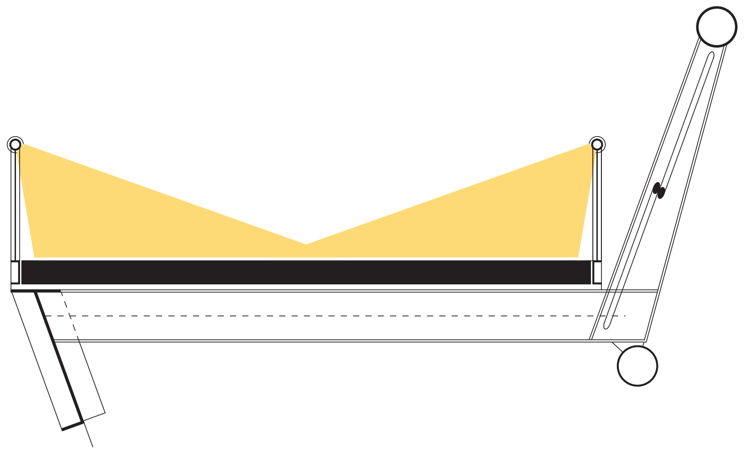
Option 2 : Frame supported floor washing

Option 2.

A variation to bollard type lighting whereby each up-stand frame (5 metre centre) receives a light fitting and washes the pathway asymmetrically. This solution is consistent with the structural concept and would not only facilitate safe crossing but provide a strong nocturnal image of the bridge. Some potential visual comfort issues arise but should be manageable through the careful planning of the cut-off angles.

simulation of option 2

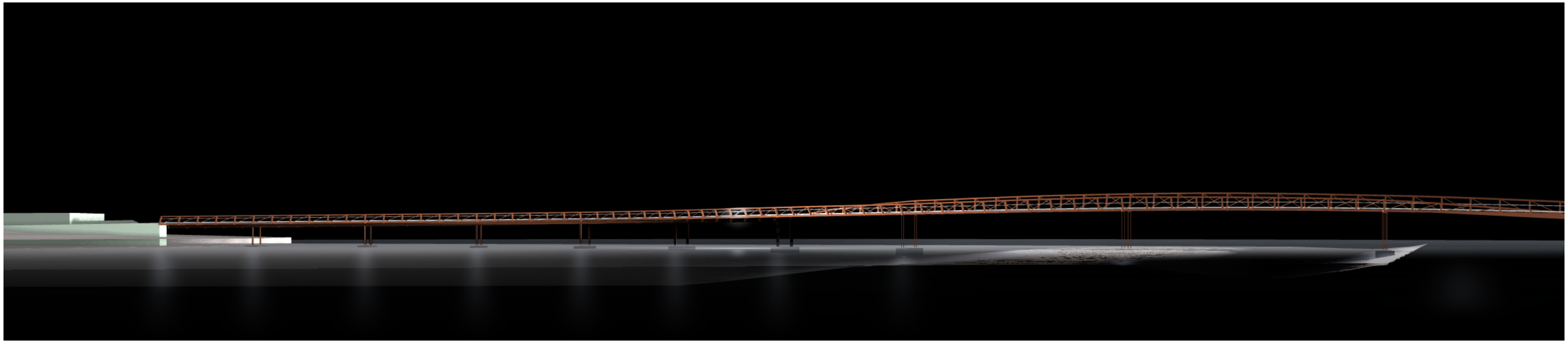
handrail lighting detail



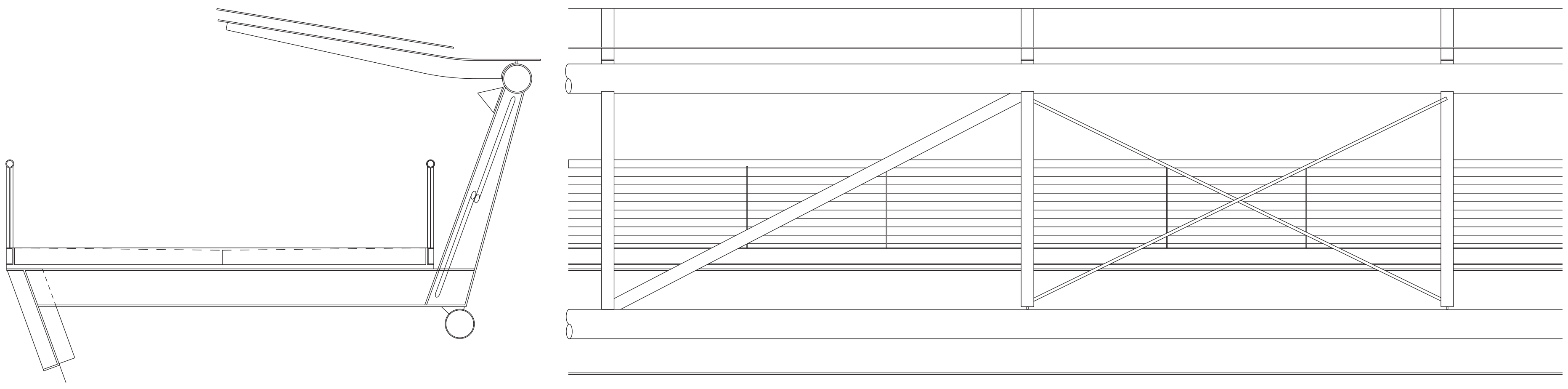
Option 3 : Handrail continuous floor washing

Option 3.

Strip lighting in handrails is the preferred lighting system for many European pedestrian bridges and was considered desirable by the working party but is also potentially the most expensive option. Advantages include a high degree of visual comfort due to the indirect illumination of the deck surface, an increased visibility outwards from the bridge and a lesser impact on night views across the Bay.



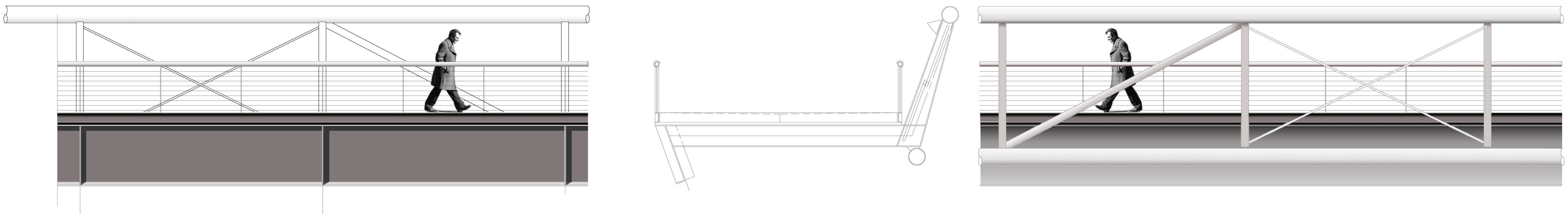
simulation of option 3



upstand truss arrangement allows for development or retro fitting of occasional sun shading

Shading

The exceptional length of the bridge poses some comfort issues regarding solar radiation through the summer months. Although well exposed to the influence of cooling breezes, some shading could be considered to provide occasional relief. The covering of the entire bridge was considered unnecessary and therefore shading should be considered as periodic refuges. The logical locations for shade reflief is the zone with up-stand trusses on both sides of the pathway as this would remove the need for further structures allowing a simple infill solution.



elevation + section showing relative scale of the bridge and alternate bracing solutions

Costs, Funding and Making It Happen

The cost of the proposed bridge has been estimated at $16 million with an expectation that it will be cost effectively designed and built to a high but practical standard.

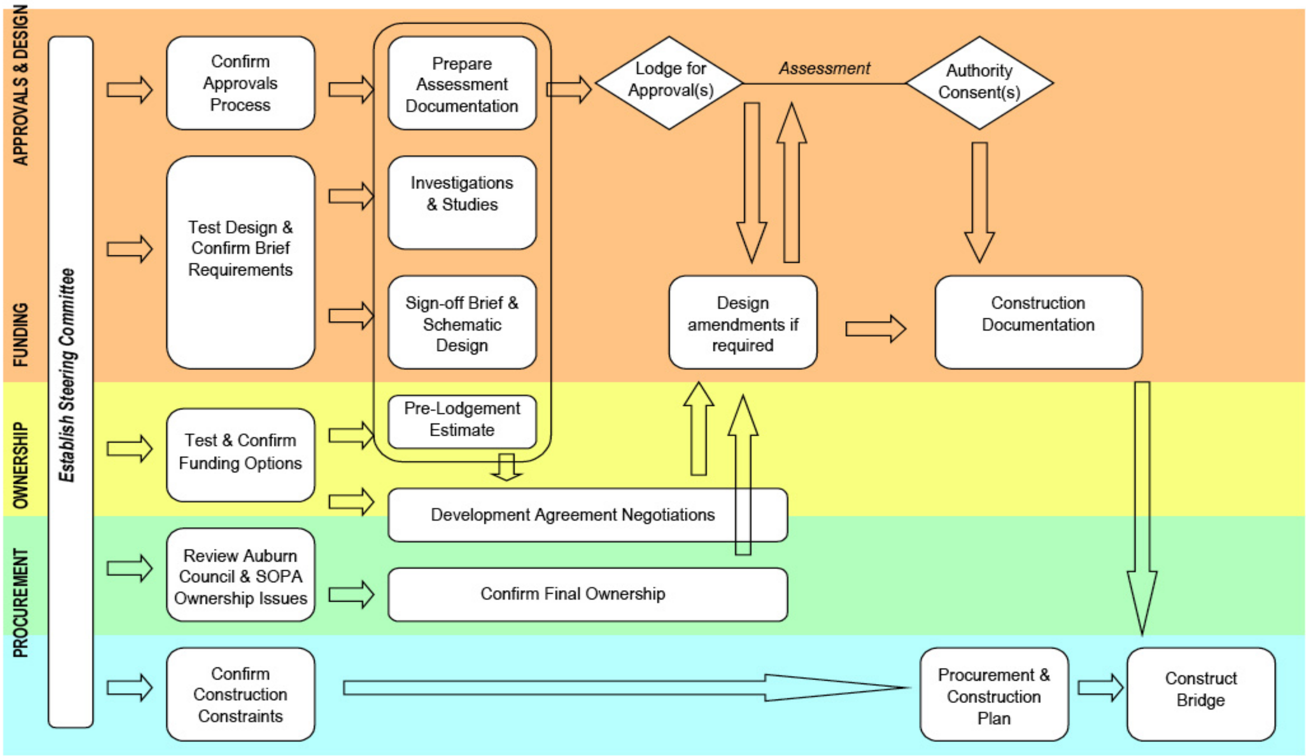
SOPA appointed project managers, APP, is currently examining the means of funding in consultation with Auburn Council officers and other stakeholders. Currently, small contributions are available from public sector sources but the majority of funds will derive from Billbergia in return for a modest increase in development potential on its site as well as redirecting excess section 94 contributions.

A preliminary estimate of maintenance costs to Council suggest that this could be provided by a small rates levy from Homebush Bay West properties given that its residents will be the major beneficiary of the bridge.

Making the bridge happen requires coordination across a number of Government and private stakeholders. The project managers have set out the process to ensure all stakeholder requirements can be addressed.

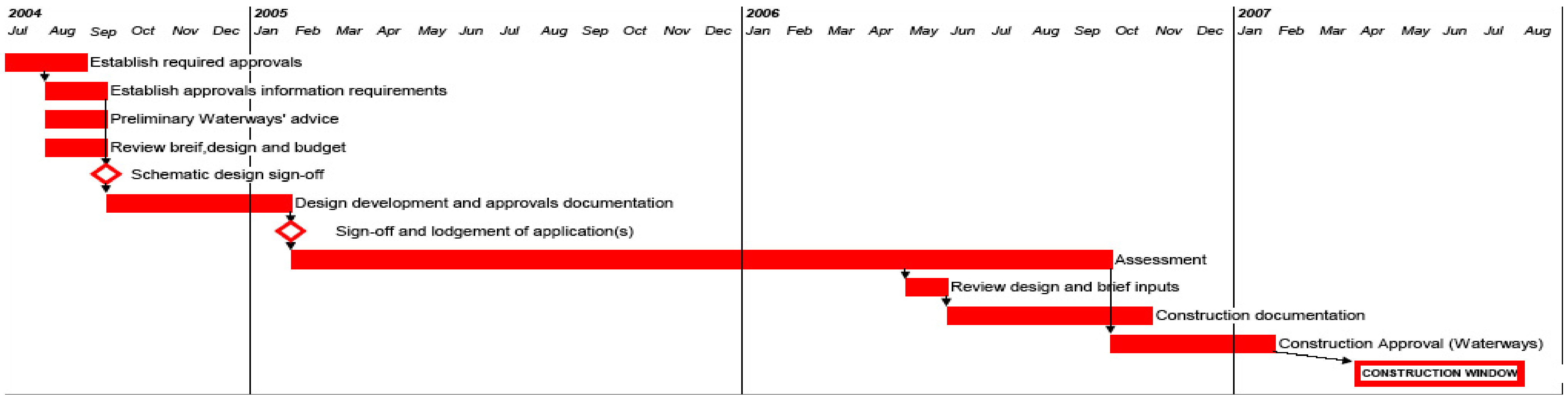
Billbergia is currently funding consultants for the bridge design at its own risk. The design team has consulted with the working party to arrive at a design with Government agency support to form a basis of a development agreement between the relevant authorities and Billbergia.

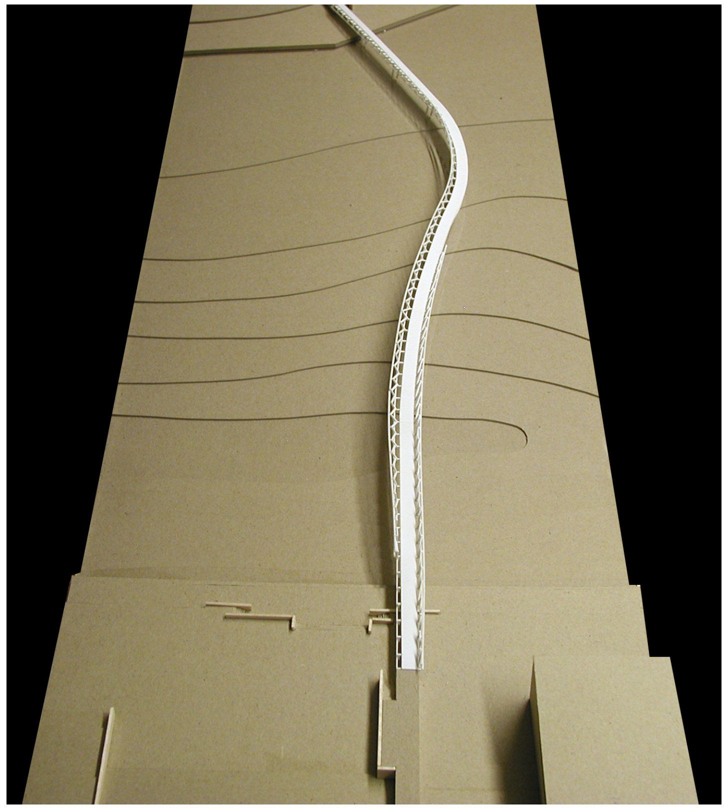
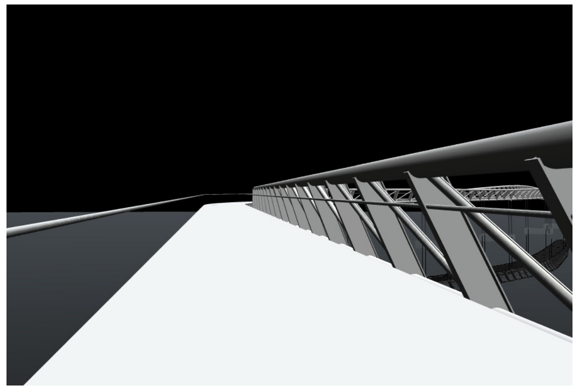
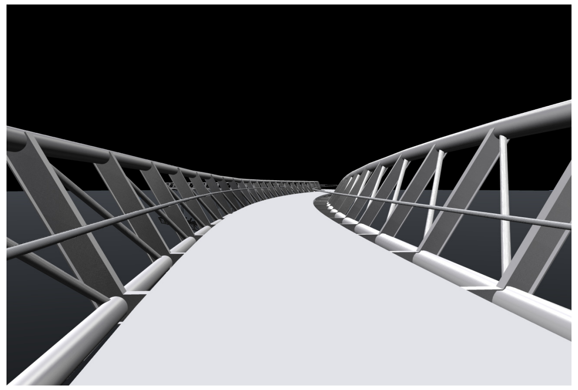
Putting the bridge in place as early as possible will mean that new residents are more likely to adopt environmentally friendly transport habits from the time of their arrival. The timetable for the bridge design, approvals and construction however is largely determined by the decontamination program for the former Union Carbide site at Rhodes and the eastern shore of the Bay.



Left: Process prepared by APP for SOPA on behalf of the working party.

Below: Proposed timetable prepared by APP for SOPA on behalf of the working party.




model views

Next Steps

The benefits, costs, alignments and technical requirements for building the bridge have been confirmed and a concept design for building the bridge is now complete.

Both Government agencies and Billbergia cannot reasonably expend more effort and money on technical studies for the bridge until it has in-principle support for the concept by Council and an eventual owner for the bridge is secured.

Accordingly, the next steps include:

- Adoption in principle of the pedestrian and cycle bridge concept by Auburn Council.
- Acceptance in principle of ownership of the bridge by Auburn Council.
- Agreement on direct and indirect sources to finance construction of the bridge.
- Detailed investigations and design for land owners, planning and construction approvals.

Timing for the next steps is critical in order to coordinate with the remediation process for the former Union Carbide site and Bay.

Accordingly, Auburn Council's consideration of the project and its timely agreement in principle will ensure a great opportunity to realise a strategic piece of local infrastructure without significant cost to government.

Appendix 1

Project Team

APP	t. +61 (0)2 9963 9909	project manager
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ARUP	t. +61 (0)2 9320 9320	structural engineer
Rider Hunt	t. +61 (0)2 9922 2277	quantity surveyor
Intelligent Space Partnership (UK)	t. +44 (0)20 7739 9729	pedestrian consultant
PBAI	t. +61 (0)2 9460 2444	transport planner
Patterson Britton	t. + 61 (0)2 9957 1619	environmental engineer