4 THE PROJECT

4.1 PROJECT OVERVIEW

This chapter provides an outline of the engineering components of the project as illustrated in Figure 4.1, the design standards and criteria used in the development of the engineering concept design. The replacement bridge project would comprise (as described in Windsor Bridge Replacement, Environmental Impact Statement, Chapter 5 - Description of the Project, SKM, July 2012) the following:

- Construction of a replacement bridge over the Hawkesbury River at Windsor, around 35 metres downstream of the existing Windsor bridge.
- Reconstruction and upgrading of existing intersections and bridge approach roads to accommodate the replacement bridge, including:
  - ¬ Removal of the existing roundabout and installation of traffic signals at the intersection of George and Bridge Streets.
  - ¬ Construction of a new dual lane roundabout at the intersection of Freemans Reach Road, Wilberforce Road, northern bridge approach road and the access road to Macquarie Park. All roads serviced by the new roundabout would require minor realignments.
  - ¬ Realignment of the southern and northern bridge approach roads. The new southern bridge approach road would generally follow the alignment of Old Bridge Street along the eastern side of Thompson Square. The northern bridge approach road would be a new road connecting the bridge to the new dual lane roundabout.
- Construction of a shared pedestrian/cycle pathway for access to and across the replacement bridge.
- Removal of the existing bridge approach roads and then backfilling, rehabilitating and landscaping these areas.
- Demolition of the existing Windsor Bridge including piers and abutments.
- Landscaping works within Thompson Square parkland and adjacent to the northern intersection of Bridge Street, Wilberforce Road, Freemans Reach Road and the access road to Macquarie Park.
- Redevelopment of part of The Terrace to provide continuous access along the southern bank of the river and under the replacement bridge to Windsor Wharf.
- Construction of scour protection works on the southern and northern banks and around three bridge piers.
- Construction of a permanent water quality basin to capture and treat stormwater runoff from the bridge and northern intersection prior to stormwater being discharged to the Hawkesbury River.
- Architectural treatments for noise mitigation, as required, where feasible and reasonable and in agreement with affected property owners.

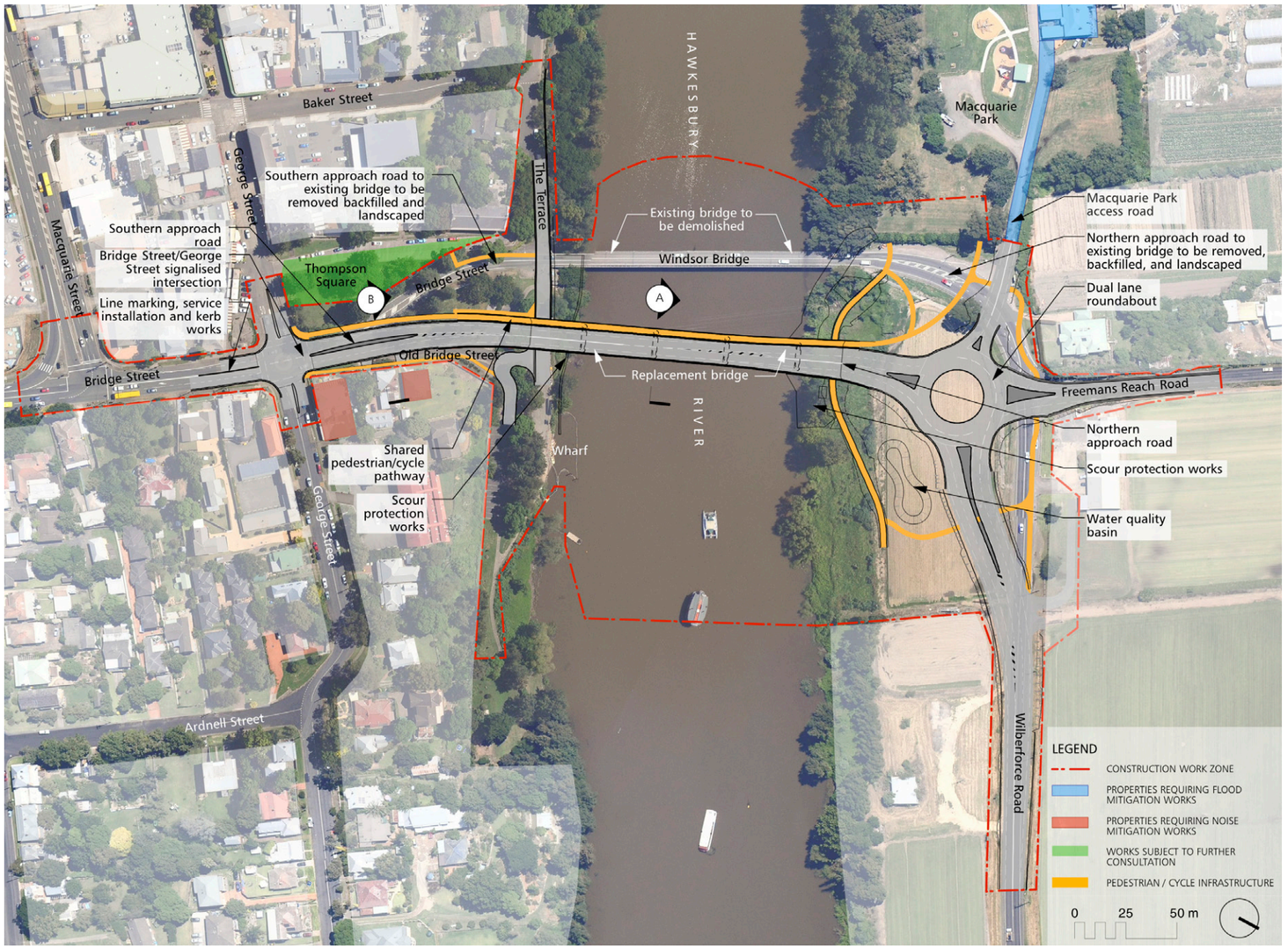

Figure 4.1: Scope of engineering works in the context of existing conditions.

4.2 OPTIONS CONSIDERED

A number of options were examined by the engineering designers. They were developed in an effort to further reduce environmental impacts and to more closely fit with the project objectives, and, particular, the following criteria:

- Maximise the open space within Thompson Square;
- Minimise visual impacts by reducing the elevation (level) of the road carriageway through Thompson Square with respect to existing ground levels and adjacent properties;
- Improve the bridge flood immunity; and
- Allow the existing roundabout at the intersection of Bridge Street and George Street to be upgraded to traffic signals in the future (if required) without the need to realign the road through Thompson Square.

Four horizontal alignment options were developed. The objective of the horizontal alignment options was to assess different bridge alignments across the Hawkesbury River. Five vertical alignment options were developed. The objective of the vertical alignment options was to assess different vertical elevations of the road and bridge. Six options combining both horizontal and vertical alignment options were considered. For more detail on the options consider, refer to Windsor Bridge Replacement - Concept Design & EIS, Volume 1 - 80% Concept Design report, SKM, July 2012.

The resulting preferred option maximises the open space within Thompson Square while permitting the intersection of Bridge Street and George Street to be upgraded to traffic signals. The preferred option improves the flood immunity while recognising that Freemans Reach Road and Wilberforce Road would be inundated in a 1 in 5 year ARI flood event before the bridge would be submerged. Furthermore, the preferred option minimises visual impacts by reducing the elevation (level) of the road carriageway through Thompson Square and at the intersection of Freemans Reach Road and Wilberforce Road to the extent possible.

4.3 PROPOSED WORKS

ROAD DESIGN PARAMETERS

The road works component of the project has been designed in accordance with Austroads - Guide to Road Design. The engineering design parameters for the road works component are summarised:

- Horizontal Alignment:
  - ¬ Design speed - 50km/h;
  - ¬ Curve radius - 150 metres minimum.
- Vertical Alignment:
  - ¬ Design speed - 50km/h;
  - ¬ Grade - maximum 8.4 per cent.
- Stopping Sight Distance:
  - ¬ Reaction time - 1.5 second;
  - ¬ Horizontal - 45 metres;
  - ¬ Vertical - 39 metres.
- Lanes:
  - ¬ Traffic lane width - 2 lanes 3.5 metres wide;
  - ¬ Road shoulder width - 2 metres both sides;
  - ¬ Crossfall - maximum 3.0 per cent.
- Southern Approach Road:
  - ¬ Minimise disturbance of Thompson Square;
  - ¬ Lower the road level as much as possible through Thompson Square;
  - ¬ Maintain left in/ left out access for the two properties at 6 and 8 Old Bridge Road.
- Northern Approach Road:
  - ¬ Maintain access to Macquarie Park;
  - ¬ Avoid impacts on the local heritage listed building 'Bridgeview';
  - ¬ Improve traffic flow and safety at the Freemans Reach Road, Wilberforce Road and northern bridge approach road intersection.

BRIDGE ENGINEERING DESIGN PARAMETERS

The project has been designed in accordance with the Australian Standard for Bridge Design (AS 5100). It meets the design criteria for Bridge Classification Type II, earthquake design category BEDC-1, and the additional engineering criteria presented below:

Bridge type:

- Incrementally launched bridge:
  - ¬ Length - 159.2m;
  - ¬ Width - 15.24m;
  - ¬ Crossfall - maximum 1.5%;
  - ¬ Span 1 - 28 metres;
  - ¬ Spans 2, 3 and 4 - 35 metres; and
  - ¬ Span 5 - 23.5 metres.
- Horizontal Alignment:
  - ¬ Design speed - 50 km/h.
- Vertical Alignment:
  - ¬ Design speed - 50 km/h;
  - ¬ Grade - maximum 1.35%.
- Lanes:
  - ¬ Road carriageway width - maximum 11m;
  - ¬ Lane width - 3.5m;
  - ¬ Shoulder width - 2.0m;
  - ¬ Shared path (western side) - 3.0m;
- Clearance:
  - ¬ Road clearance at The Terrace - minimum 3.6m;
  - ¬ Proposed navigational clearance - minimum 7.5m at MHWS.

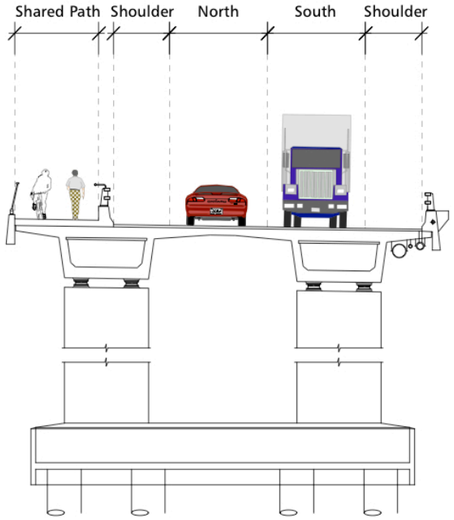

Figure 4.2: Typical cross section of the replacement bridge (two lane bridge).

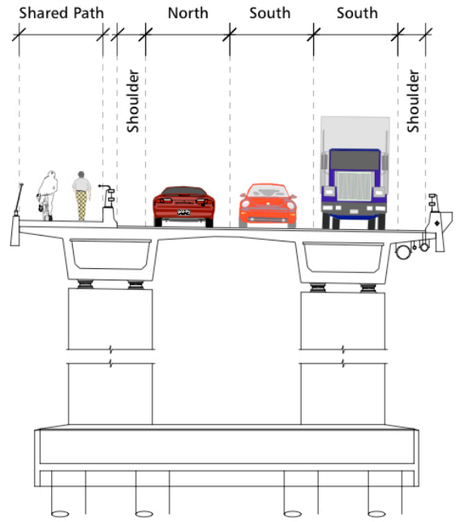

Figure 4.3: Typical cross section of the replacement bridge (future three lane configuration).

CROSS SECTION A

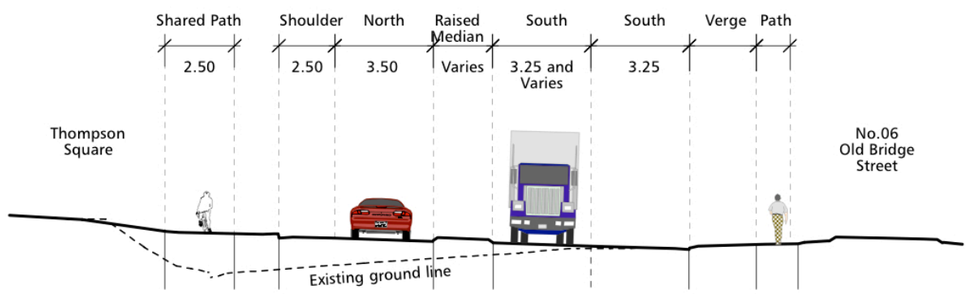

Figure 4.4: Typical cross section through southern approach road at Thompson Square.

CROSS SECTION B

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5 URBAN DESIGN, BRIDGE AND LANDSCAPE STRATEGY

5.1 INTRODUCTION

Urban design and landscape objectives and principles have been prepared for this project to guide the concept design to ensure that the bridge and approach roads are physically, visually and operationally integrated with the surrounding environment.

These objectives and principles take into account the desired future landscape and urban design character for the area as set out in Hawkesbury City Council's *Plan of Management for the Windsor Foreshore Parks Incorporating the Great River Walk*. They also reference the key urban design aspects of RMS's. *Beyond the Pavement* urban design policy and associated guidelines. Furthermore the objectives and principles are based on an understanding of the existing landscape and urban values of the area and the landscape and urban design issues that affect, or are affected by, the bridge and approach roads.

The project wide landscape and urban design principles as presented on the following page, have been further broken down into three distinct parts to address the unique characteristics and attributes of the following areas of the project.

5.2 URBAN DESIGN OBJECTIVES AND PRINCIPLES

The following project objectives and principles have been devised to guide the development of the concept design outcome for the project and these are;

Objective 1: Develop an integrated concept design that fits sensitively with the existing qualities and characteristics of Windsor and its Hawkesbury River setting.

Design principles:

- Maintain the landmark qualities of a bridge crossing at Windsor.
- Minimise the physical footprint and scale of the bridge, approach roads and associate intersections.
- Ensure the design and character of the bridge and associated roadworks are well integrated with the adjoining built areas, open space, historic and natural settings, rather than being a dominant feature.
- Minimise negative physical impacts on parklands, open space, the river and other foreshore areas adjacent to the bridge.
- Design all road and bridge elements carefully to integrate and coordinate with adjoining elements and structures. Materials and details to be robust, low maintenance and suitable for its purpose and place.
- Minimise the intrusion of road-related elements (fencing and water quality control measures) on the local landscape.
- Consolidate residual land parcels to retain sufficient public open space for future river front activities.

Objective 2: Enhance the existing amenity, visual character and cultural landscapes of Thompson Square and Windsor.

Design principles:

- Not precluding Council's future plans, which are yet to be determined.
- Redevelop any residual road space as parkland to be integrated within Thompson Square.
- Maximise opportunities to enhance the connection between Thompson Square and the commercial area around the intersection of George Street and Bridge Street.
- Enhance views of Thompson Square and its buildings to and from the bridge and approach roads on both sides of the river.
- Retain, and where possible improve, views to important landmarks in particular the Hawkesbury River, Thompson Square and the historic buildings around Thompson Square.
- Protect and interpret the heritage values of Thompson Square and Windsor in general.
- Maximise the available open space in Thompson Square by minimising the road corridor footprint and returning unused road areas back to open space land.
- Identify the most appropriate uses for Thompson Square in order to define its form and character.
- Enhance the access opportunities for all users around and through Thompson Square.

Objective 3: Maintain the integrity of cultural and historic buildings, structures, elements and spaces of Windsor.

Design principles:

- Maintain the physical and visual integrity of State-significant items including historical buildings, public spaces and their curtilage, particularly in Thompson Square.
- Preserve the integrity of heritage items and areas of cultural importance to the local community.
- Minimise the impact on historical archaeological sites, particularly those associated with Thompson Square.
- Enhance the setting of Thompson Square and its buildings.
- Minimise the impact on Aboriginal heritage sites and their associated heritage values.
- Minimise or avoid alterations to heritage items, except where the removal of intrusive elements would have a positive impact on their heritage significance.

Objective 4: Improve connectivity for vehicles, pedestrians and cyclists.

Design principles:

- Provide safe, direct and obvious connections between the bridge and approach roads with the local road network in Windsor.
- Enhance opportunities to define the northern intersection as an entry to Windsor.
- Provide generous and direct cycle and pedestrian connections across the bridge and enhance the existing pedestrian and cycle networks along the approach roads.
- Consider opportunities for public transport throughout the project.
- Maintain and enhance connections to the existing river edge and adjoining open space network.
- Provide safe pedestrian, cycle and vehicle access to Macquarie Park.

5.3 BRIDGE DESIGN OBJECTIVES AND PRINCIPLES FOR SITING AND CHARACTER

Specific architectural principles, to supplement the RMS Bridge Aesthetics Design Guidelines are set out on the following pages. The first part looks at urban siting and character. The second part looks in detail at individual bridge elements.

OBJECTIVES AND PRINCIPLES FOR SITING AND CHARACTER

A PLACEMENT AND SITING

<u>Objective 1:</u> Design a bridge and approaches that are well sited and considered in relationship to the Hawkesbury River's landscape setting, the township of Windsor, the banks, parks and approach roads.

Design principles:

- Give the new bridge a simple linear geometry so that it continues to be expressed as a calm, succinct form in the landscape.
- Clearly articulate the experience of crossing the bridge from the experience of approaching the bridge.
- Ensure that the eastern bridge approach accords as closely as possible to the historic Bridge Street alignment.
- Ensure that the vertical alignment through the historically important Thompson Square is as close as possible to existing ground levels.

B CHARACTER

<u>Objective 2:</u> Design the new bridge in alignment, gradient and its constituent elements so that is has a dignified and confident presence.

Design principles:

- Ensure the new bridge has a robust structural character.
- Give strong consideration to the landscape treatment and urban presence of both the bridge and its approaches.
- In keeping with the existing bridge character, design the new bridge to have an understated, rather than overly expressive character.

Figure 5.1: Straight alignment respects the street geometry and maximises the footprint of a consolidated Thompson Square.

Plate 5.1: The existing bridge has a strong, low horizontal presence, with no vertical elements above the deck. This keeps views from Thompson Square very open.

Plate 5.2: The existing bridge has a very calm, succinct form in the landscape - and sits recessively in district views and outlooks.

OBJECTIVES AND PRINCIPLES FOR BRIDGE ELEMENTS

A BRIDGE ELEMENTS - DECK

<u>Objective 3:</u> The deck of the bridge should be expressed as an uncluttered horizontal plane spanning the Hawkesbury River.

Design principles:

- Design the longitudinal grades of the new deck to mirror, as closely as possible, the horizontal plane of the Hawkesbury River for the component of the bridge that spans between the abutments.
- Reduce the width of the deck as much as possible, to minimise its bulk as viewed and experienced from Thompson Square, the Terrace and from more distant viewpoints along the river.
- Raise the pedestrian/cycle path slightly above road pavement level, to improve safety for pedestrians/cyclists.
- Minimise the bulk of the bridge as viewed from Thompson Square by locating required Traffic barriers between the traffic lane and the shared path.
- Use the design of the pedestrian handrail on the outer edge of the bridge to allow a finer scale/edge treatment to be developed on the Thompson Square side of the bridge.
- Ensure that the pedestrian rail on the outer edge is collapsible during flood events in accordance with established and tested RMS design solutions.

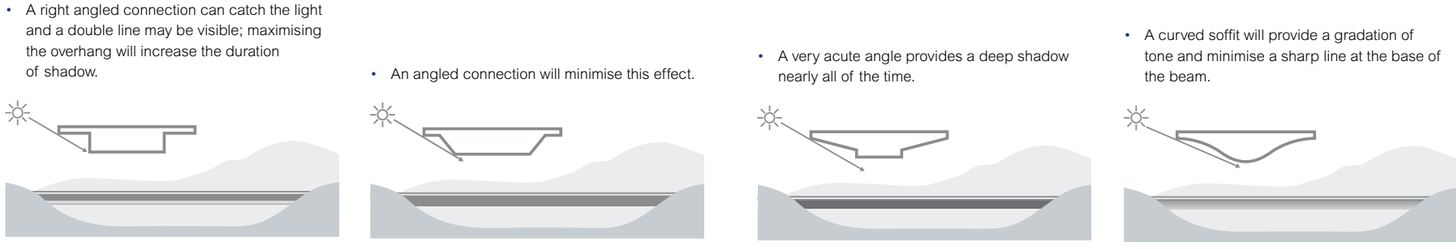


Figure 5.2: Excerpts from the RMS Bridge Aesthetics Design Guidelines.

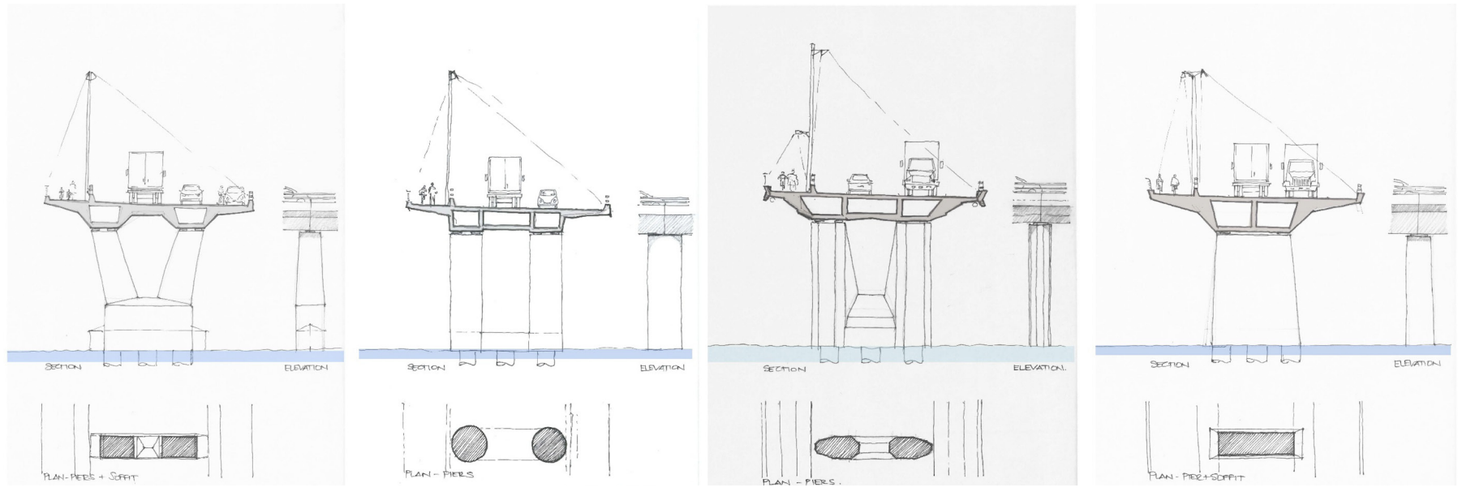


Figure 5.3: Developing options investigating the appropriate profiles for the Windsor bridge.

B BRIDGE ELEMENTS - DECK SOFFIT

<u>Objective 4:</u> The deck soffit should be designed, treated and finished as an important facade, due to its high visibility from the public domain.

Design principles:

- Give the deck soffit a modelled architectural expression, rather than expressing it as a generic flat plane.
- Fully integrate the bridge's edge detail with the soffit design.
- Conceal services wherever possible - if unavoidable, recess services into the deck soffit so that they site flush with the finished surface, or set away from the edge of the soffit so that they are always in shadow.
- Ensure that the transition of the soffit to the abutment is fully resolved in three dimensions.
- Give consideration to the treatment of the soffit surface in terms of reflection, light and shadow.

Plate 5.3: Bridge soffit that catches glancing afternoon light and frames particular landscape panoramas.

Plate 5.4: Bridge soffit that is structurally expressive and highly modelled.

C BRIDGE ELEMENTS - PIERS

<u>Objective 5:</u> The piers should express, through their structure, the forces that are transferred from deck to the foundations.

Design principles:

- Design piers for compliance with structural minima, to minimise their bulk.
- Design piers with a paired leg expression that is slender. i.e. the proportion of their vertical height to width should be controlled such that the piers appear fine, rather than squat.
- Consider the design of the piers in relation to their dominant visual presence from Thompson Square and the river foreshores.
- Ensure that the pile caps are recessive and integrated with the pier design.
- Consider the view through the pier structure from the Terrace and Wilberforce as a particular experience and articulate it accordingly.
- Use the placement, material character and any finish of the piers to discourage vandalism and graffiti

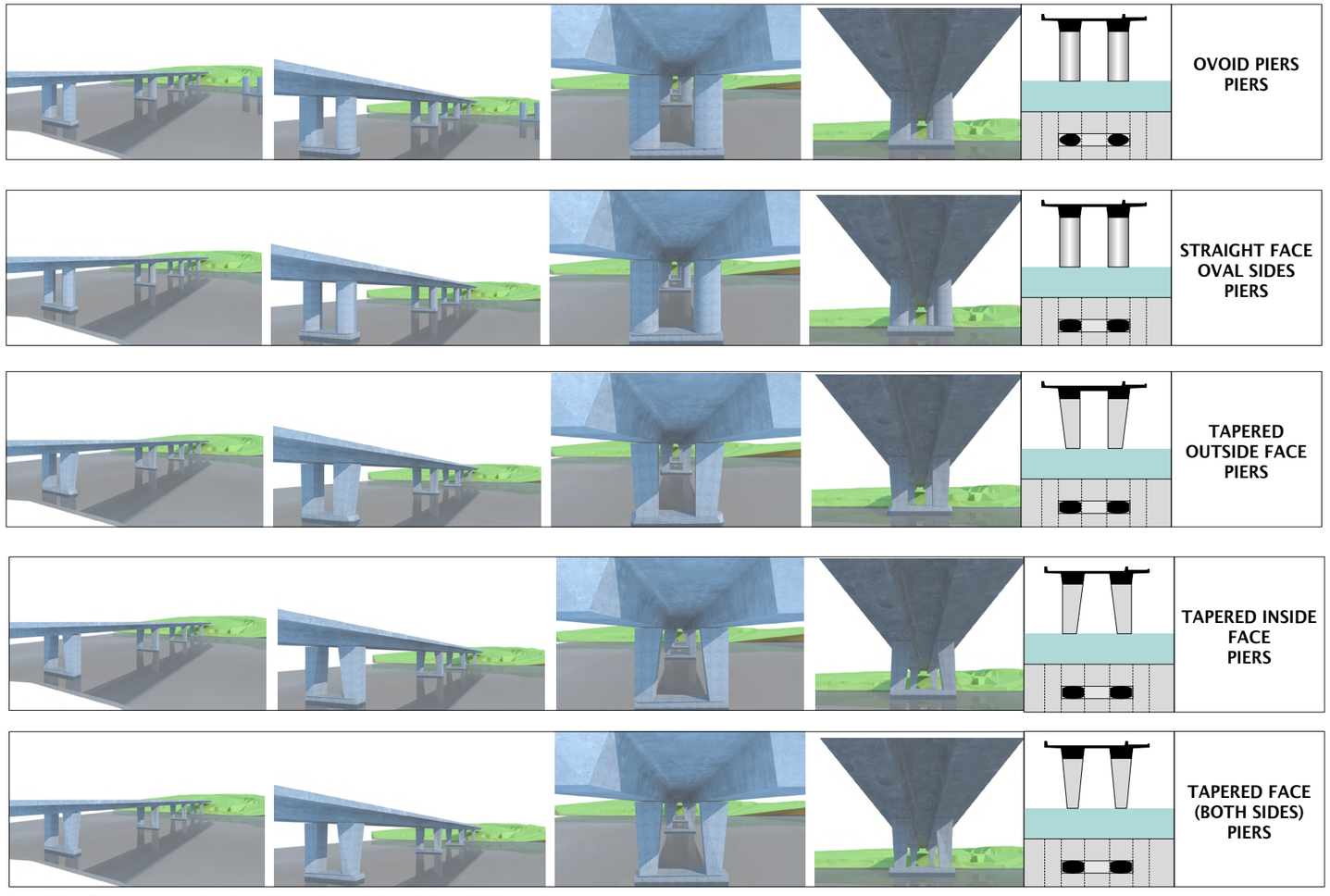


Figure 5.4: Diagrams comparing the weight, scale, proximity and form of different pier types.

D BRIDGE ELEMENTS - ABUTMENTS

<u>Objective 6:</u> The abutments should seamlessly resolve the transition from elevated deck to the ground plane, and be fully considered as a three dimensional design.

Design principles:

- Provide consistency in the architectural language between the piers and the abutments.
- Consider the abutment walls as an integral part of Thompson Square, defining the open space.
- Design the abutment walls as vertical walls to maximise usable space in Thompson Square and minimise land take.
- Form the abutment walls of robust masonry elements to complement existing walls in Thompson Square.
- Consider opportunities to interpret flooding and flood levels in the design of the abutment walls.

VERTICAL MASONRY (SOLID) ABUTMENT WALLS

- Minimal land take in Thompson Square.
- Allows for access along edge of park to The Terrace.
- Consistent with existing character walls in Thompson Square.
- Strongly defines proposed amphitheatre.
- Opening of sightlines around walls to be considered.

SPILL THROUGH ABUTMENT WITH MASONRY (SOLID) SURFACES UNDER BRIDGE AND GRASSED EMBANKMENTS TO SIDES. 1:1, 1.5:1 AND 2:1 GRADES SHOWN

- Allows for views through the abutment.
- Possible disincentive to graffiti.
- Access to Terrace through park, not Bridge Street edge.
- More land take in Thompson Square.
- Potential for furtive spaces to be considered.
- Constrains position of bridge abutment.

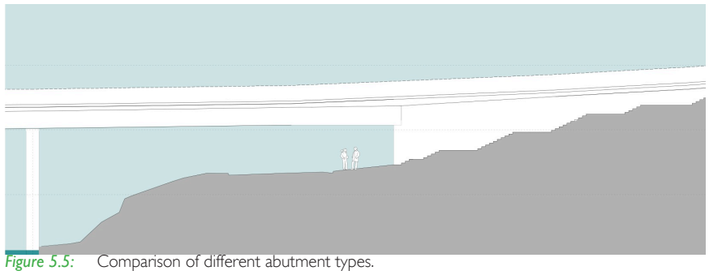


Figure 5.5: Comparison of different abutment types.

Plate 5.5: Existing walls in Thompson Square - reinforced concrete wall to cutting.

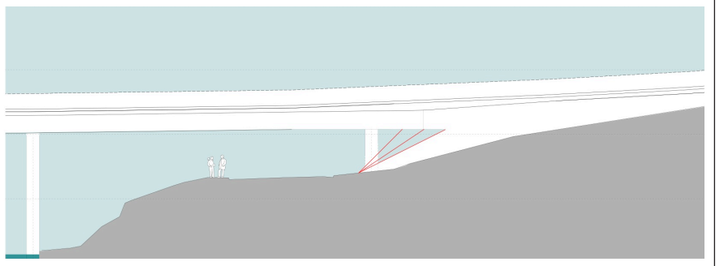


Plate 5.6: Existing walls in Thompson Square - sandstone and brick walls of the Doctor's House.

E BRIDGE ELEMENTS - MATERIALS

<u>Objective 7:</u> All materials should be selected for their robustness and durability, considering their tendencies to develop a patina as they age.

Design principles:

- Select materials that are robust and durable.
- Express the inherent material of the bridge construction, and minimise the use of cladding.
- Where special finishes are desired, consider them as an integral component of the construction method, rather than an applied finish.

F BRIDGE ELEMENTS - LIGHTING

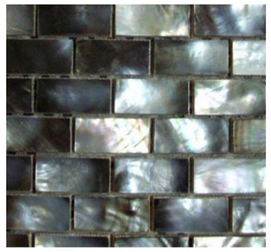
<u>Objective 8:</u> Lighting should be an integral part of the design, rather than an unrelated attachment.

Design principles:

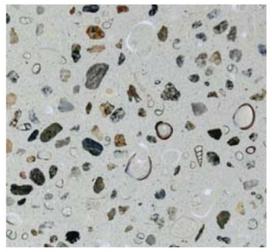
- Ensure that lighting levels comply with statutory requirements for each use - vehicular, pedestrian and cycle.
- Use integrated, linear, low level strip lighting wherever possible.
- Minimise the use of vertical pole elements that are susceptible to damage in flood and compete with the horizontal plane of the deck.
- Select low energy use sources wherever possible, with appropriate IP ratings that anticipate inundation.
- The provision of lighting should be sympathetic to the heritage conservation quality of Thompson Square.

Rough stone

Mother of pearl aggregate



Tiled surfaces



Shell aggregate

Brick

Sandstone

Figure 5.6: Early exploration of possible materials for abutments and/or cladding elements.

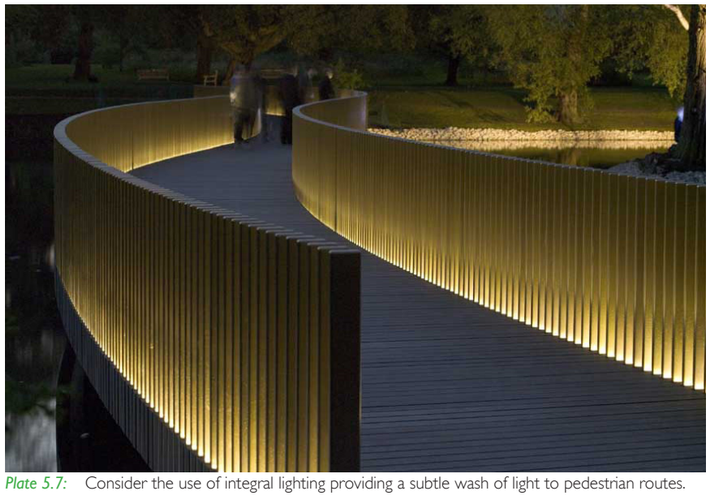


Plate 5.7: Consider the use of integral lighting providing a subtle wash of light to pedestrian routes.

Plate 5.8: Consider the effect and impact of lighting and reflection at an urban scale.