Your ref: D18/12394
Our Ref: SO18/03922

The Hon Robert Brown MLC
Committee Chair, Industry and Transport
Legislative Council
Parliament House
Macquarie Street
SYDNEY NSW 2000

Dear Mr Brown

Thank you for your correspondence about the Inquiry into the Windsor Bridge Replacement Project. The Transport cluster welcomes the opportunity to assist the Committee's inquiry.

As you are aware, Transport for NSW is undertaking a Request for Tender process for the Windsor Bridge Replacement Project. I expect the tender to be awarded by the end of May 2018.

A copy of the Final Business Case is enclosed. Due to the ongoing tender process, commercially confidential information has been redacted. The strictest level of confidentiality needs to be maintained in relation to this information until the tender is awarded, in order to safeguard commercial in confidence negotiations/interests and protect the public interest. The Transport cluster will provide this information to the Committee following conclusion of negotiations and the award of contract.

If you have any further questions, Mr Ian Young, Acting Principal Manager, Parliamentary Services, Customer Relations and Government Services at Transport for NSW, would be pleased to take your call on (02) 8202 3167 or 0476 809 501.

Yours sincerely

**Rodd Staples**
**Secretary**

Encl

Roads & Maritime

# Windsor Bridge Replacement

NSW Roads and Maritime Services
ABN 76 236 371 088

# Final Business Case

# Document Summary Information

| | |
|---|---|
| Objective Ref: | fA35679917 - https://edm.rta.nsw.gov.au/id:fA35679917 |
| Author: | Katie McNamara/Ngcebo Gwebu - Jacobs |
| Version: | 0.6 |
| Original Version Release Date: | October 2016 |
| Document Security | |

Template history

| Version | Amendment | Amendment Date | Amended by |
|---|---|---|---|
| Ver 1 | Specific Road project requirements added | 27 January 2014 | Martin Nichols |
| Ver 2 | Draft Federal requirements added | 13 February 2014 | Martin Nichols |
| Ver 3 | Draft reviewed and amended | 5 March 2014 | Rene Burkart |
| Ver 4 | Draft Federal requirements added | August 2014 | Sarah Jones |
| Ver 5 | Minor formatting | 5 November 2014 | Janine Leake |
| Ver 6 | Replacement of draft objective table in 3.1 with updated table from TfNSW Marta Bach | 19 November 2014 | Janine Leake |
| Ver 7 | Updated to incorporate Fed requirements | 25 November 2014 | Janine Leake |
| Ver 8 | Minor updates | 15 December 2014 | Janine Leake |
| Ver 9 | Overall review | 10 February 2014 | Janine Leake and Martin Nichols |
| Ver 10 | Minor updates | 20 May 2015 | Janine Leake |
| Ver 11 | Review of 2.5.3, 5.6, 5.8 and 5.9; 5.11 | 23 June 2015 | Martin Nichols, Janine Leake |

Project-specific document history

| Version | Amendment | Amendment Date | Amended by |
|---|---|---|---|
| Ver 0.1 | Initial indication of content | 22 April 2016 | |
| Ver 0.2 | Draft for RMS input | 17 May 2016 | |
| Ver 0.2 B | Draft for REM comment (with RMS initial inputs included) | 25 May 2016 | |

| | | | |
|---|---|---|---|
| Ver 0.3 | Draft for RMS (including Exec Summary and updated milestone dates) | 5 July 2016 | |
| Ver 0.4 | Final draft for RMS Review | 19 August 2016 | |
| Ver 0.5 | Final Document for RMS Approval | 07 October 2016 | |
| Ver 0.6 | Final Document for RMS Approval - Traffic, Economics and Cost Estimate inputs updated. | July 2017 | |
| Ver 0.7 | Final Updated after Gate 2 Assurance Review | November 2017 | *T Stephanou* |

# Purpose of this Document

This document is intended to meet the requirements of the NSW Government as follows:

- It is a Business Case for review under the NSW Infrastructure Investor Assurance Framework Process and to support submission to the TfNSW Finance and Investment Committee for release of State Government funds. This document represents the Business Case for Gates 2 and 3 (Business Case and Pre Tender Gates).

# Contents

# APPROVAL REQUEST FOR TfNSW PURPOSES

The signatures below endorse that all necessary areas have been consulted, the details of the investment as described in this document and supporting documents are accurate and requests the release of funds as per Section 3.1.2 to complete the next phase of this investment. The budget required in P50 outturn for the next stage is [redacted].

**Business Case Final**

| | |
|---|---|
| State Project Number / ID: | A/66737 |
| Project Title | Windsor Bridge Replacement |

**Estimated Cost ***

| | |
|---|---|
| **A.** Project Development Planning (up to detailed design, P50 out-turn $) | [redacted] |
| **B.** Project Implementation (detailed design and construction, P50 out –turn $) | [redacted] |
| **C.** Total Budget (P50, out-turn $) (Equals A + B) | [redacted] |
| Total Budget (P90) | [redacted] |
| Estimate for Announcement (P90, out-turn $) | [redacted] |

**Agreed major milestone dates***

| | |
|---|---|
| Final Business Case (Gate 2 & 3) approved | August 2017 |
| Complete Detailed Design | October 2017 |
| Invite Construction Tenders | December 2017 |
| Award Contract | April 2018 |
| Start construction | June 2018 |
| Open Stage to Traffic | June 2020 |
| Project Complete – Non Road component | June 2021 |

* Subject to agreement and funding

**Prepared by:**

| | |
|---|---|
| Graham Standen | |
| Senior Project Manager | |
| Date: 10th October 2016 | |

**Recommended by:**

| | |
|---|---|
| Ian Allan | |
| Principal Manager Program | |
| Date: 10 October 2016 | |

**Approved by Project Sponsor:**

| | |
|---|---|
| Chris Browne | |
| General Manager<br>Greater Sydney Program Office | |
| Date: 10 OCTOBER 2016 | |
| Telephone | |
| Facsimile | |
| Email | |
| Address | |

Approval to release any capital funding is via the Finance and Investment Committee (FIC). Approval to release any operating expense funding will require approval of the DDG of the relevant area(s).

**Primary Project Contact:**

| | |
|---|---|
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| Senior Project Manager, Greater Sydney Program Office | |
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# 1 EXECUTIVE SUMMARY

Roads and Maritime Services (RMS) is preparing to construct a new bridge over the Hawkesbury River at Windsor to replace the existing bridge which is in poor condition and beyond its useful life. Windsor Bridge connects the town of Windsor (to the south of the river) and is as an important regional link between Western Sydney, the Blue Mountains and the Hunter region.

The project has received environmental approval to proceed and this business case therefore seeks funding for the development and construction of the new Windsor Bridge from Government of [redacted] (outturn P50).

## 1.1 Need for the Investment

### 1.1.1 Project Background

The project is located at Windsor in the Hawkesbury local government area about 57 kilometres north-west of Sydney. Windsor is a major historic town, with European settlement dating back to the late 1700s. Today it is predominantly rural, although there is extensive and expanding urban development to the south and west of the town. The existing Windsor Bridge was opened in 1874 and is the oldest existing bridge across the Hawkesbury River. It provides an important local link for communities on each side of the river, as well as an important regional link between western Sydney, the Blue Mountains and the Hunter region. Around 21,600 vehicles use the bridge each day, with around eleven per cent of these being heavy vehicles.

Parts of the existing bridge are over 140 years old and are deteriorating as a result of age and heavy use. Elements of the bridge have deteriorated substantially and it is not practical to replace or repair these elements. The existing bridge and adjacent intersections no longer meet the demands of current peak hour traffic volumes or current road standards. The level of maintenance required to maintain adequate road safety is no longer cost effective and it is therefore regarded that the bridge has reached the end of its economic life.

In June 2008, in recognition of the condition of the existing bridge and the volume of traffic it carried, the New South Wales (NSW) Government announced funding for its replacement. Preliminary investigations of potential bridge replacement options along with stakeholder consultations were completed in 2012, followed by completion and public display of the Environmental Impact Statement (EIS) exhibition. The NSW Minister for Planning and Infrastructure's Conditions of Approval was provided in December 2013 but were then appealed at the NSW Land and Environmental Court on the grounds that it would impact on Thompson Square. This appeal was led by the Community Action Group for Windsor Bridge. However, in 2015 the appeal was denied and the court allowed the project to proceed.

### 1.1.2 Existing Problem

The primary reasons why a replacement river crossing at Windsor is required are:

- Deterioration in the condition of the existing bridge leading to possible load limits and eventual closure of the bridge
- The existing bridge and approach roads fail to meet current engineering and safety standards
- The existing bridge has lower flood immunity than the surrounding roads
- Traffic performance and capacity of the existing bridge and surrounding intersections is inadequate and the predicted growth in traffic using this river crossing indicates further deterioration in the levels of service. Heavy vehicles travelling in opposing directions currently

stop on the bridge approaches and give way to each due to narrow lane widths on the existing bridge. Furthermore, the local road network has a high crash rate.

### 1.1.3 Base Case

Without the bridge replacement, as proposed in this Business Case, the above problems would not be adequately addressed. The Base Case assumes that even without a bridge replacement, significant remedial works will be required to keep the bridge operational. This option would require the bridge to be closed and an alternative route to be temporarily implemented through Richmond and Freemans Reach at an additional distance of approximately 20km.

Even with significant remedial works, the bridge's structural condition will continue to deteriorate and require greater maintenance than a new bridge.

Furthermore, under the Base Case there would continue to be unacceptable traffic performance, high safety risks, poor amenity for cyclists and lower flood immunity. All these problems will be compounded by future growth in average daily traffic.

### 1.1.4 Objectives

The primary aim of the project is to provide a safe and reliable crossing of the Hawkesbury River at Windsor. The specific objectives for the project are as follows[1]:

- Replace the existing bridge which has reached the end of its economic life with a new bridge with a design life of 100 years
- Increase flood immunity of the bridge equivalent to the approach roads
- Support economic growth and productivity by providing a road with capacity LoS D or better for 2026 forecast traffic volumes
- Encourage active transport by providing appropriate facilities for cycling and walking
- Provide safe two-way traffic access for freight vehicles

  Reduce crash rates to be no greater than the stereotypical rates for a primary arterial road (A2 road classification).

Secondary objectives common to all Roads and Maritime projects are:

- Design and construction works are to be sympathetic with local heritage and the environment
- To be cost effective and an affordable outcome

### 1.1.5 Proposed Solution

The preferred option for the Windsor Bridge replacement project comprises:

- A new bridge 35 metres downstream of the existing Windsor Bridge
- Traffic capacity greater than the existing bridge, with a single northbound lane and two southbound lanes

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[1] *The objectives described here have been refined and as a result they differ slightly from those identified in the project's Environmental Impact Assessment (appendix 7).*

- New approach roads and intersections to connect the new bridge to the existing road network
- New traffic lights with pedestrian facilities at the intersection of Bridge Street and George Street
- A new dual lane roundabout at the intersection of Wilberforce Street and Freemans Reach Road
- Modifications to local roads and access arrangements, including changes to the Macquarie Park access road and reconnection of The Terrace
- Pedestrian and cyclist facilities, including a shared path connecting to and across the new bridge
- Removal and backfill of the existing bridge approach roads
- Removal of the existing bridge once the new bridge is operational
- Landscaping and urban design work, including within the Thompson Square parkland area and adjacent to the northern intersection of Wilberforce Road, Freemans Reach Road and the Macquarie Park access road.

### 1.1.6 Benefits

Replacing the Windsor Bridge and intersections surrounding will provide the following benefits:

- Upgrading an essential local and regional road link across the Hawkesbury River at Windsor
- Improved safety for motorists, pedestrians and cyclists
- Improved traffic performance including two-way heavy vehicle traffic flow on the bridge and increased travel speeds in the AM and PM peak periods.
- Improved traffic efficiency by installing traffic lights at the intersection of Bridge and George Streets and a new dual-lane roundabout at Freemans Reach Road and Wilberforce Road
- Flood immunity similar to surrounding roads would provide improved flood evacuation opportunities for floodplain areas north of Windsor and would provide access across the Hawkesbury River for a wider range of flood events
- Better access for pedestrians and cyclists including a three metre wide shared pedestrian and cycle path that connections to Thompson Square and surrounds
- Reduced road footprint within the Thompson Square heritage precinct
- A unified open space in Thompson Square increasing the usable area by more than 500 square metres with direct access to the river.

## 1.2 Proposed Strategy / Recommended Option(s)

### 1.2.1 Overall Project Cost

The P50 out-turn cost (including sunk or part costs) for the Windsor Bridge Replacement to achieve project completion in 2021 is [redacted]. This includes funding for project development and management, design, construction, contingencies, risk and escalation costs. The outturn project cost is shown in Table 1-1 below.

No federal funding will be sought as this is project is not part of a Federal Freight Route.

**Table 1-1 Project funding (P50 out-turn cost)**

| | Year 1, 2016/17 | Year 2, 2017/18 | Year 3, 2018/19 | Year 4, 2019/20 | Year 5, 2020/2021 | Year 6, 2021/2022 | Total |
|---|---|---|---|---|---|---|---|
| Project Costs (1) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Savings/Benefits(2) | - | - | - | - | - | - | - |
| Net cashflow (3) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Alternate funding(4) | - | - | - | - | - | - | - |
| State funding requirement (5) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Existing provisions (6) | - | - | - | - | - | - | - |
| Difference (7) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

***Notes***

1. Project Costs: Equals the sum of the all project related costs (P50 outturn) and contingency per the cashflow line in the Cost Plan and @risk modelling work undertaken (with escalation).
2. Nominal Savings / Benefits: Equals the sum of the proceeds from the sale of assets or delivery of cash benefits (savings in operational costs) during the life of the project.
3. Net cashflow: Sub-total equals (1) minus (2).
4. Alternate funding: No Federal funding is sort as this project is not eligible for Federal funding. It is a bridge replacement project for an internal local route.
5. State funding requirement: Sub-total equals (3) minus (4).
6. Existing provisions: Equals the existing unused provisions per most recent submission (e.g. TAM) to NSW Treasury.
7. Difference: Sub-total equals (5) minus (6). Indicates to Investment Programs changes being requested to capital budget.

### 1.2.2 Budget Request

The P50 Outturn Cost is [redacted].

### 1.2.3 Ongoing Operating and Maintenance Costs (whole of life)

It is expected the new bridge will require limited maintenance over the next thirty years. Total whole of life real operating and maintenance costs are estimated to be $ 2.3m (P50 cost, over 30 years of operations). This comprises annual planned/reactive maintenance and periodic inspections. The operating and maintenance costs of the current bridge years are estimated to be $4.5m[2] (over 30 years of operation). The project will therefore produce operating cost savings totalling $2.2m over 30 years.

### 1.2.4 Investigation of Private Funding

Procurement options for the project have been examined based on scope, cost, risks and market analysis. The viability of PPP delivery for the project has been examined based on the preliminary analysis of the key value for money drivers and is summarised as follows:

- Complex risk profile and opportunity for risk transfer – the risks of the project are considered typical and common to road projects of similar scale and nature. The project is unlikely to yield

[2] Maintenance cost estimates were based on RMS data.

additional benefits in transfer risks to the private sector through PPP delivery above the proposed design followed by construction (GC21) methodology.

- Whole-of-life costing – upon completion of the project, it is expected that road maintenance will be overseen by RMS (however outsourced to Downer Mouchel) as part of the regular road maintenance program of the State network. The project is unlikely to yield additional benefits of improved efficiency by the private sector managing whole-of-life cost.

- Innovation – the project scope is typical and common to most road upgrade projects. The project had undergone detailed value engineering and is unlikely to provide added benefits or incentives for the private sector to develop innovative solutions in meeting typical road operating services.

Based on the project scope, cost, risks and analysis of potential for PPP delivery and the NSW Government policy position, private financing for the project is not suitable.

### 1.2.5 Other Impacts

This project is not expected to generate traffic or change the distribution of existing traffic. All work to cope with changed conditions resulting from the new bridge is included in the scope of the project, most importantly the upgrade to northern and southern intersections.

## 1.3 Justification

### 1.3.1 Economic Appraisal

A Cost Benefit Analysis (CBA) was undertaken to assess the economic costs and benefits of the project. Table 1-2 below shows a summary of the CBA results. The economic viability of the project is reflected by a strong Benefit-Cost Ratio of 2.5 (assuming a 7% discount rate). Most of the project's benefits derive from travel time and vehicle operating cost savings.

**Table 1-2 CBA results**

| VARIABLE | 4% Discount Rate | 7% Discount Rate | 10% Discount Rate |
|---|---|---|---|
| ***COSTS*** | | | |
| *Capital Costs (P50)* | [redacted] | [redacted] | [redacted] |
| ***Total Discounted Costs (P50)*** | [redacted] | [redacted] | [redacted] |
| ***BENEFITS*** | | | |
| Travel time savings | $302.7 m | $173.2 m | 105.5 m |
| Vehicle Operating Cost Savings (travel distances) | $4.6 m | $2.8 m | $1.8 m |
| Vehicle Operating Cost Savings (number of stops) | $21.0 m | $12.4 m | $7.8 m |
| Externality Savings | $2.2 m | $1.3 m | $0.9 m |
| Crash Cost Savings | $3.9 m | $2.4 m | $1.6 m |
| Maintenance Savings | $0.9 m | $0.6 m | $0.4 m |
| Residual Value | $9.7 m | $3.6 m | $1.4 m |
| ***Total Discounted Benefits*** | $344.7 m | $196.2 m | $119.2 m |
| ***NPV*** | [redacted] | [redacted] | [redacted] |
| ***BCR*** | 4.1 | 2.5 | 1.6 |

A sensitivity analysis demonstrates that the viability of the project is resilient to changes in capital cost, operating cost and benefits.

### 1.3.2 Financial Appraisal

A financial appraisal is not required as the project does not require private sector capital nor does it impact on any tolling regimes.

## 1.4 Program / Project Management

RMS is the main road delivery agency in NSW and has delivered many road and bridge projects of this type in the past.

The project is being managed through the RMS Greater Sydney Project Office. The project team comprises of both development and delivery staff. The development team started the project but have since (early 2012) handed over leadership of the project to delivery staff. The project delivery team members have held regular internal multiple disciplinary (weekly) team meetings since October 2015 following the NSW Land and Environmental Court appeal and subsequent reversal, to ensure effective project management. The progress of the project will continue to be tracked during the monthly coordination meetings.

Section 5.1 summarises the executed and proposed milestones as of July 2017.

## 1.5 Project Partners

There are no project partners to assist the delivery and maintenance of the new Windsor Bridge.

## 1.6 Related Projects

The Windsor Bridge Replacement Project does not rely on or influence outcomes of other projects being planned or in construction.

# 2 NEED FOR THE INVESTMENT / REASON FOR EXPENDITURE

## 2.1 Current situation

### 2.1.1 Town of Windsor

The town of Windsor is located in the Hawkesbury local government area, 57 kilometres north-west of Sydney. The Windsor Bridge crosses the Hawkesbury River providing essential connectivity for communities either side of the river, and is an important regional link between Western Sydney, the Blue Mountains and the Hunter region. Whilst the area surrounding Windsor is predominantly rural, there is extensive and expanding urban development to the south and west of the town.

The location and regional context of the project is shown in Figure 2-1. The scope of this business case extends from the intersection of Bridge and Macquarie Streets in the south to the intersection of Freemans Reach and Wilberforce Roads in the north. Windsor is a historic town, with Aboriginal cultural heritage plus European settlement dating back to the late 1700s. The township contains numerous buildings and sites of heritage significance that create a specific character. Developing a solution that is sympathetic to the Aboriginal and cultural heritage within the project area is a key objective, particularly in the vicinity of Thompson Square.

**Figure 2-1 Project locality map**

### 2.1.2 Project Background

In June 2008, in recognition of the condition of the existing bridge, traffic demands and road safety, the NSW Government announced funding of $25 million for a bridge replacement project. Following this announcement, RMS began preliminary investigations of potential bridge replacement options in consultation with the local community and other stakeholders. Subsequently an Environmental Impact Statement (EIS) was completed and put on public exhibition through 2012 with the Minister providing Conditions of Approval in December 2013. Subsequently the Community Action for Windsor Bridge (CAWB) appealed to the NSW Land and Environmental Court on the grounds that the new bridge would impact Thompson Square. Built in 1811 by Governor Macquarie, Thompson Square is one of the oldest public village squares in Australia and is listed on the State Heritage Register. After further deliberation, in 2015 the appeal was denied and the court allowed the project to proceed.

A replacement river crossing at Windsor is required for the following reasons:

- Deterioration in the condition of the existing bridge leading to possible load limits and eventual closure of the bridge
- The existing bridge and approach roads fail to meet current engineering and safety standards
- The existing bridge has lower flood immunity than the surrounding roads
- Traffic performance and capacity of the existing bridge and surrounding intersections is inadequate and the predicted growth in traffic using this river crossing indicates further deterioration in the levels of service. Heavy vehicles travelling in opposing directions currently stop on the bridge approaches and give way to each due to narrow lane widths on the existing bridge. Furthermore, the local road network has a high crash rate.

### 2.1.3 Condition of the Existing Bridge

The original bridge was built on the current alignment in 1874. Some parts of the existing bridge are over 140 years old and have deteriorated as a result of age and heavy use. The level of maintenance required to maintain adequate road safety is also no longer cost effective and the existing bridge is therefore considered to have reached the end of its useful life. Furthermore, the bridge and adjacent intersections no longer meet the demands of current peak hour traffic volumes or current road standards.

Roughly 21,600 vehicles use the bridge each day, with around eleven per cent (11 %) of these being heavy vehicles. The nearest alternative bridge crossing of the Hawkesbury is located around 10 kilometres to the west at Richmond, requiring a road detour of around 20 kilometres to drive between the southern and northern sides of the river at Windsor.

The bridge is inspected regularly to identify maintenance requirements and to ensure its safety for use. Recent inspection reports are provided in Appendix 14 and have revealed ongoing and escalating maintenance issues. They have also shown that while it is suitable for current use, the overall condition of the bridge is rated as poor. As such, it would need extensive rehabilitation works to be used and maintained into the future. Figure 2-2 shows the current Windsor Bridge and Table 2-1 summarises the concerns relating to the condition of the bridge.

**Figure 2-2 Existing Windsor Bridge**

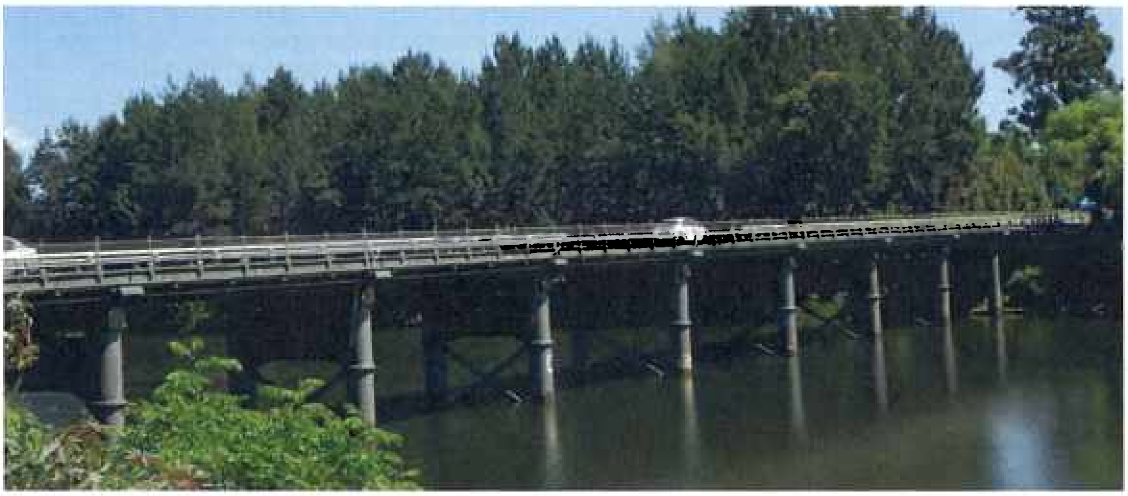


**Table 2-1 Bridge condition**

| BRIDGE COMPONENT | EXISTING CONDITION |
|---|---|
| Piers | Sections of the bridge below the water line are heavily corroded and substantial graphitisation of the cast iron has occurred on some piers. |
| | Horizontal cracking is present in the pier columns. Such cracks would be expected to have a serious impact on the overall serviceability of the bridge. |
| | Bracing between the older cast iron column sections on three piers are undergoing considerable corrosion at the water-line and may require replacement or repair. |
| Bridge Span | Between 2003 and 2007 there was 16% deterioration in the stiffness of at least one of the bridge spans. The stiffness of a span determines the load it is able to support. Therefore, to address this issue, load limits on the bridge may need to be implemented in the near future. |
| Bridge Deck | Concerns have been raised around spalling, cracking and corrosion relating to the deck slab, internal and external beams and deck joints. |

**Figure 2-3 Severe spalling, delamination and corrosion of existing bridge**

### 2.1.4 Engineering and Safety Standards

The aging bridge does not comply with a number of current engineering and road safety standards, leading to operational constraints. For example:

- The bridge deck at 6.1 metres wide is significantly less than the minimum requirements for a two-lane two-way bridge. Consequently this restricts the movement of heavy vehicles with some drivers electing to wait on one side of the bridge while an oncoming heavy vehicle passes. This results in traffic congestion and delays

- The standard and condition of the existing bridge necessitates that speeds for heavy vehicles are limited to 40 kilometres per hour (rather than 60 kph for general traffic). Continued deterioration of the bridge will require even more stringent speed and vehicle load limits to be introduced, further restricting commercial traffic

- The pedestrian path on the existing bridge is only one metre wide and is unsuitable for cyclists

- The traffic and pedestrian safety barriers on the existing bridge do not meet current design standards. This produces safety risks for pedestrians and motorists. In addition, there are no safe crossing locations for pedestrians at the George Street / Bridge Street intersection and across the northern approach road from the existing bridge pedestrian path to Macquarie Park

- The sight distances for vehicles at the George Street / Bridge Street intersection plus the Freemans Reach Road and Wilberforce Road intersection do not comply with current safety standards.

Figure 2-4 Heavy vehicles using existing narrow bridge

### 2.1.5 Flood Immunity

The existing bridge is lower than the 1 in 2 year flood event level, compared to the surrounding approach roads, which have a higher level of flood immunity. The existing bridge is around 1.4 metres lower than the low point on Wilberforce Road and 2.6 metres lower than the low point on Freemans Reach Road. Over the past 100 years, the existing bridge has been flooded on 59 occasions; while the approach roads have remained accessible in many of these events. More recent data shows that between 1987 and 2011 there have been eight events for which water levels were higher than the level of the existing bridge. The average duration of these events was 43 hours.

A new bridge with flood immunity similar to surrounding roads would improve flood evacuation opportunities for floodplain areas north of Windsor and would provide access across the Hawkesbury River for a wider range of flood events.

### 2.1.6 Traffic Constraints

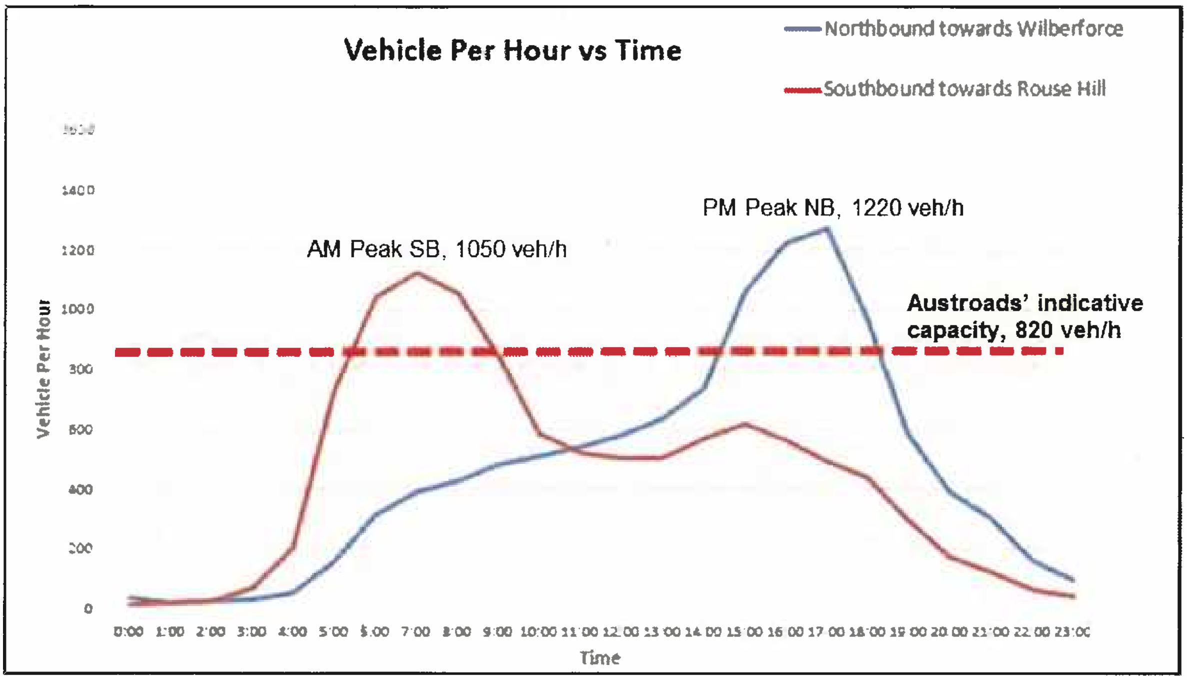
Traffic Surveys showed that in 2017 Windsor Bridge carried about 1,480 and 1,790 vehicles (two-way) per hour in the AM and PM peak hours respectively. The AM peak data suggests substantial traffic (about 71 per cent) in the southbound direction. Conversely, the PM peak data suggests substantial traffic (about 68 per cent) in the northbound direction. The current peak hour directional traffic distribution on Windsor Bridge suggests typical 'tidal flow' distribution.

The notional traffic capacity of the Windsor Bridge was estimated using Austroads' *Guide to Traffic Management Part 3: Traffic Studies and Analysis.* Figure 3-4 shows hourly traffic distribution for the average weekday on the existing Windsor Bridge.

The Austroads' Guideline has suggested an indicative (notional) capacity of 820 vehicles per hour per lane as bridge traffic capacity. The bridge capacity of 820 vehicles per hour takes into account posted speed reductions for heavy vehicles and upstream and downstream intersection capacity.

The capacity analysis in Figure 2-5 below suggests that current traffic on Windsor Bridge exceeds the saturation traffic levels in both the 2017 morning (AM) and afternoon (PM) peak periods. The existing condition analysis for the bridge also suggests the need for additional bridge capacity.

**Figure 2-5 Windsor Bridge Capacity Assessment**




The capacity of the section of Bridge Street and Wilberforce Road between Court Street and Freemans Reach Road is strongly influenced by the operation of Windsor Bridge and adjoining key intersections. The performance of an intersection is measured by the intersection average delay per vehicle, which in turns leads to a Level of Service (LOS) measure for the intersection.

Four intersections within the study area were analysed (using SIDRA, version 7 network) to determine the operating performance and Level of Service including:

• Wilberforce Road / Freemans Reach Road (sign controlled);

• Bridge Street / George Street (roundabout);

• Bridge Street / Macquarie Street (traffic signals); and

• Bridge Street / Court Street (sign controlled).

Table 2-2 below shows the existing 2017 Level of Service at the four analysed intersections. The table reflects shows poor levels of service on Wilberforce Road for both peak periods. This reflects the capacity constraints illustrated by Table 2-2.

Level of service (LoS) is reported in accordance with the Roads and Maritime guideline (*Traffic Modelling Guideline, Issue 1.0, RMS, February 2013*). It recommends that for priority intersections such as a roundabouts and sign controlled intersections, the Level of Service (LoS) value is determined by the critical movement with the highest delay. With these types of intersection controls (roundabout, Stop and Give way sign controls), some movements may experience high levels of delay while other movements may experience minimum delay. For a signalised intersection LoS criteria are related to the average intersection delay measured in seconds per vehicle.

**Table 2-2 Existing Level of Service in 2017**

| *Delay (s)* | *INTERSECTION* | *CONTROL* | *AM PEAK DELAY (S)* | *AM PEAK LOS* | *PM PEAK DELAY (S)* | *LOS* |
|---|---|---|---|---|---|---|
| I-1 | Wilberforce Road and Freemans Reach Road | Priority | 59 | E | 60 | E |
| I-2 | Bridge Street and George Street | Roundabout | 41 | C | 97 | F |
| I-3 | Bridge Street and Macquarie Street | Traffic Signals | 15 | B | 29 | C |
| I-4 | Bridge Street and Court Street | Priority | 37 | C | 22 | B |

The local road network in the vicinity of Windsor Bridge has insufficient capacity to provide an acceptable level of service in the future. The operational performance of the bridge is constrained on its entry and exit by the capacity at three key intersections; Bridge Street / Macquarie Street, Bridge Street / George Street and Wilberforce Road / Freemans Reach Road.

### 2.1.7 Existing crash risks

An additional traffic issue related to the local network is its high crash rate. RMS data of the period between July 2011 and December 2016 shows there was a total of 52 crashes. Twenty crashes (38 per cent) were associated with injuries, with 20 people injured. The remaining 32 crashes (62 per cent) were recorded as non-casualty related. No fatal crashes were recorded in this period.

Table 2-3 below summarises recorded crashes by road and location. Of all crashes reported, 41 crashes occurred at intersections, 8 crashes occurred on the undivided road sections, and 3 crashes occurred on the divided road sections.

**Table 2-3 Location of Crashes**

| Road | Total Number of Crashes Recorded | Intersection crash | Non-intersection |
|---|---|---|---|
| Bridge Street | 23 | 17 | 6 |
| George Street | 1 | 1 | 0 |
| Macquarie Street | 4 | 3 | 1 |
| Wilberforce Road | 24 | 20 | 4 |
| **TOTAL** | 52 | 41 | 11 |

Figure 2-6 illustrates the location of crashes from 1 July 2010 – 30 June 2015. The map conveys a similar message as Table 2-3 – the majority of crashes occur near the Wilberforce Rd/Freeman Reach Rd and Bridge St/George St intersections.

**Figure 2-6 Reported crashes by location (2010 – 2015)**


### 2.1.8 Risks with the Current Situation (the problem statement)

As the bridge continues to age, its structural condition will deteriorate further. This will lead to:

- Increasing maintenance costs. Currently RMS is spending $50,000 per annum on access and level 3 inspections for Windsor Bridge and up to $100,000 on intermediate repairs (e.g. concrete spalling) per annum. This cost has increased substantially over time and will continue to grow if the bridge is not replaced.

- More likely closure of the bridge when ongoing maintenance can no longer provide an adequate level of traffic safety. This will necessitate significant remedial works to keep the bridge operational as outlined in the base case. Bridge closure would result in the loss of an important crossing of the Hawkesbury River, with severe impacts on local and regional connectivity. Existing bridge users would need to use alternative river crossing points, resulting in increased travel times, adverse effects on the local economy of Windsor and increased congestion at the alternative crossing points.

Forecasted traffic increases for the area will lead to a further deterioration in the road network's operational performance. Growth rates of key roads have been derived from the RMS Strategic Traffic Forecasting Model. Table 2-4 shows that significant growth rates will be experienced.

**Table 2-4 Growth rates of key roads (2017 base)**

| ROAD | PER ANNUM GROWTH (%) | | |
|---|---|---|---|
| | 2017 - 2026 | 2026 - 2036 | 2016 – 2036 (AVERAGE) |
| AM Peak | | | |
| Bridge Street (Windsor Bridge) and Macquarie Street | 1.7% | 1.0% | 1.3% |
| George Street and Court Street | 0.5% | 0.5% | 0.5% |
| PM Peak | | | |
| Bridge Street (Windsor Bridge) and Macquarie Street | 1.7% | 1.1% | 1.4% |
| George Street and Court Street | 0.3% | 0.3% | 0.3% |

## 2.2 Project Objectives

The primary aim of the project is to provide a safe and reliable crossing of the Hawkesbury River at Windsor.

The specific objectives for the project are as follows[3]:

- Replace the existing bridge which has reached the end of its economic life with a new bridge with a design life of 100 years
- Increase flood immunity of the bridge equivalent to the approach roads
- Support economic growth and productivity by providing a road with capacity LoS D or better for 2026 forecast traffic volumes
- Encourage active transport by providing appropriate facilities for cycling and walking
- Provide safe two-way traffic access for freight vehicles
- Reduce crash rates to be no greater than the stereotypical rates for a primary arterial road (A2 road classification).

Secondary objectives common to all Roads and Maritime projects:

- Design and construction works are to be sympathetic with local heritage and the environment
- To be cost effective and an affordable outcome

[3] *The objectives described here have been refined and as a result they differ slightly from those identified in the project's Environmental Impact Assessment (Appendix 7).*

These objectives were used to inform the option assessment described in Section 2.3 (below). To guide this process, a series of performance criteria were developed under each objective as presented in Table 2-5.

**Table 2-5 Project objectives and performance criteria**

| PROJECT OBJECTIVE | PERFORMANCE CRITERIA |
|---|---|
| Replace the existing bridge which has reached the end of its economic life with a new bridge with a design life of 100 years. | • Meets the applicable design codes<br>• Achieves a road speed of 50kph[4]<br>• Ensures pedestrian safety |
| Increase flood immunity of the bridge equivalent to the approach roads. | • Provides a crossing that has a higher level of flood immunity than the existing bridge<br>• Provides a crossing with a flood immunity that is compatible with the surrounding approach roads |
| Support economic growth and productivity by providing a road with capacity LoS D or better for 2026 forecast traffic volumes. | • Minimise queue lengths / delays<br>• Improves performance of road network<br>• Improves load capacity of the crossing to meet current load standards |
| Encourage active transport by providing appropriate facilities for cycling and walking. | • Provides a pedestrian and cyclist connection to surrounding locations<br>• Minimises impacts on recreational spaces |
| Provide safe two-way traffic access for freight vehicles. | • Enables two heavy vehicles to pass on the bridge without waiting |
| Design and construction works are to be sympathetic with local heritage and the environment. | • Minimises impact on Aboriginal and non- Aboriginal heritage and conservation areas<br>• Protects the town's built heritage and its setting<br>• Minimises visual impact and impacts on the character of local area |
| To be cost effective and an affordable outcome. | • Provides a cost effective solution - capital cost<br>• Provides a cost effective solution - maintenance<br>• Provides a cost effective solution – return on investment<br>• Minimises the impact of construction in regards to length and timing |
| Reduce crash rates to be no greater than the stereotypical rates for a primary arterial road (A2 classification) | • Meets the applicable design codes<br>• Achieves a road speed of 50kph<br>• Ensures pedestrian safety |

Table 2-6 aligns the objectives of this project with the broader Long Term Transport Master Plan objectives.

[4] *The design speed was later reduced to 50kph to allow a reduction in the height of the bridge*

Table 2-6 Relevant RMS Road program objectives

| ALIGNMENT WITH THE LONG TERM TRANSPORT MASTER PLAN OBJECTIVES | ROAD PROGRAM OBJECTIVES | PROBLEM DEFINITION | | PROJECT OBJECTIVES | PERFORMANCE INDICATORS | | BENEFIT REALISATION |
|---|---|---|---|---|---|---|---|
| | | What is the current problem to be solved? If we do nothing, what are the future needs? | Does the proposed initiative (project) address these issues? | After considering the problem definition, list the specific project objectives for the project | Identify and provide baseline data (i.e. today, before project) used to identify the problem. | List and describe the performance objectives and intended outcomes (i.e. in the future post project implementation). | List specific performance indicators to measure the performance of the asset post-completion. |
| Improve safety and security | 1. Improve Road Safety (reduce fatalities and serious injuries). | Traffic at the intersection of Wilberforce Rd (Bridge St) / Freemans Reach Rd exceeds the capacity for a give way control, leading to crashes occurring when vehicles are approaching from adjacent roads. | The project scope will change the control at the intersection of Wilberforce Rd (Bridge St) / Freemans Reach Rd to a roundabout configuration which is appropriate for the current and anticipated level of traffic. | • Reduce crash rates to be no greater than the stereotypical rates for a primary arterial road. | • 20 of the 52 (38 %) reported crashes in the study area between 2011 and 2016 were recorded on a Wilberforce Road related intersection.<br>• The same data also showed that 62% of total crashes involved only property/vehicle damage. Injury related crashes constituted 38% of total crashes.<br>• The data indicates that there were no fatal crashes. | • Reduction in the frequency of crashes at the intersection of Wilberforce Rd (Bridge St) / Freemans Reach Rd.<br>• Reduction in the severity of crashes at the intersection of Wilberforce Rd (Bridge St) / Freemans Reach Rd. | 70% reduction in adjacent approach crashes by 2026. |
| Support economic growth and productivity | 2. Improve Freight Productivity (support freight and long distance travel important to the NSW economy) | Speed restrictions for heavy vehicles are currently imposed due to the structural weakness of the bridge. | • The design solution will:<br>• Increase the speed limit for heavy vehicles from 40 kph to 50 kph.<br>• Enable two heavy vehicles to pass on the bridge without waiting. | • Support economic growth and productivity by providing a road with capacity LoS D or better for 2026 forecast traffic volumes.<br>• Provide safe two-way traffic access for freight vehicles. | • 2,400 (11% of total traffic) heavy vehicles cross the Windsor Bridge each day but are limited to 40 kph compared to 60 kph for general traffic.<br>• Heavy vehicles are also subject to the congestion demonstrated by the poor level of service at certain intersections. | • Improved travel times for heavy vehicles through the removal of speed restrictions.<br>• Improved travel times for heavy vehicles through improved level of service at intersections. | Level of service at all intersections to be no worse than LoS 'B' at all intersections in 2026. |
| Improve liveability | 3. Improve traffic efficiency (address specific traffic congestion issues) | Traffic volumes through the Windsor township exceed the capacity at key intersections causing delays. | As well as replacing the Windsor Bridge, this proposal will re-model the adjoining road network; in particular the configuration of intersections which will improve traffic flow during peaks. | • Support economic growth and productivity by providing a road with capacity LoS D or better for 2026 forecast traffic volumes. | • Intersection of Wilberforce Rd (Bridge St) / Freemans Reach Rd is currently operating at LoS 'E'.<br>• By 2026 the Bridge St / George St intersection will be operating at LoS D in the AM peak period and F in the PM period on the current bridge. | • Improved travel times for vehicles travelling on the Windsor network.<br>• Reduced intersection delays. | Level of service at all intersections to be no worse than LoS 'B' at all intersections in 2026. |

| ALIGNMENT WITH THE LONG TERM TRANSPORT MASTER PLAN OBJECTIVES | ROAD PROGRAM OBJECTIVES | PROBLEM DEFINITION | | PROJECT OBJECTIVES | PERFORMANCE INDICATORS | | BENEFIT REALISATION |
|---|---|---|---|---|---|---|---|
| | | What is the current problem to be solved? If we do nothing, what are the future needs? | Does the proposed initiative (project) address these issues? | After considering the problem definition, list the specific project objectives for the project | Identify and provide baseline data (i.e. today, before project) used to identify the problem. | List and describe the performance objectives and intended outcomes (i.e. in the future post project implementation). | List specific performance indicators to measure the performance of the asset post-completion. |
| **Improve liveability** | **4.** Connect communities (particularly enhances network connectivity in the regions). | Frequent flood events require traffic needing to cross the Hawkesbury river at Windsor to take a 20km detour.<br><br>Currently there lacks specific lanes for pedestrians and cyclists. | The project will raise the height of the Windsor Bridge to be consistent with the adjoining road network.<br><br>In addition, the project will provide a pedestrian and cyclist shared path on the new bridge. | • Increase flood immunity of the bridge equivalent to the approach roads.<br>• Encourage active transport by providing appropriate facilities for cycling and walking. | • Over the past 100 years, the existing bridge is thought to have been flooded on 59 occasions.<br>• Between 1987 and 2011 there have been eight events for which water levels were higher than the level of the existing bridge. | Improve flood immunity from about a 1 in 2 year ARI flood event to approximately a 1 in 4 year ARI flood event. | Number of bridge closures due to flooding. |
| **Improve liveability** | **4.** Connect communities (particularly enhances network connectivity in the regions). | Pedestrians and cyclists are unable to cross the current bridge. | The project will provide a pedestrian and cyclist shared path along the bridge. | • Encourage active transport by providing appropriate facilities for cycling and walking. | There was no access for pedestrians on the current bridge. | • Consistent use of shared path by cyclists and pedestrians | Pedestrian and cyclist counts on the bridge. |
| **Support regional development** | **5.** Replace assets not economical to maintain (reduce costs by replacing infrastructure that is not economical to maintain). | The Windsor Bridge is now well beyond its original design life and requires regular inspections to ensure it is structurally safe to operate. While the bridge is suitable for current use, it would need extensive remedial works if it was to be used and maintained in a safe and acceptable condition into the future. | The proposal will provide both a new bridge and removal of the existing structure which would continue to pose a maintenance burden if it remained. | To be cost effective and an affordable outcome. | Frequency of closures to address maintenance requirements. | • Planned maintenance of 0.03% of capital development per annum.<br>• Reactive (unplanned) maintenance of 0.05% of capital development cost per annum.<br>• 0.5 inspections per annum (not associated with flood events). | Annual cost of maintenance and renewals is reduced from current levels and still achieves acceptable condition. |

## 2.3 Options Considered

Four alternative approaches were identified as strategic options for addressing the deteriorating condition of the existing Windsor Bridge, namely:

- Base case – Under the Base Case there would be remedial capital works to ensure that the bridge remains open to traffic. Under the base case, current suboptimal levels of services are maintained.[5] (The attached Options Report has identified that are more likely event would be that pending structural inadequacies would liokely cause the closure of the bridge and impose a minimum 20km detour to all traffic).

- Refurbishment of the existing bridge – This option involves temporarily closing the existing bridge and refurbishing elements of the bridge and approach roads to improve its current design standards (noting full design compliance is not achievable under this method).

- Bypass of Windsor – This alternative includes constructing one or more bridges and associated roads to bypass the town centre of Windsor.

- Replacement Bridge – This alternative includes constructing a replacement bridge either up or downstream of the existing bridge, with traffic still being able to access the town centre directly.

During the project development phase a total of 10 route options were identified and aligned to the three strategic options of refurbishment, bypass and replacement. As outlined in Table 2-8 below, these were then compared against the base case.

**Table 2-7 Project Options Considered – Long List**

| OPTION | STRATEGIC OPTION | DESCRIPTION |
|---|---|---|
| 1 | New Bridge | This option involves replacing the existing bridge with a new high-level bridge along the alignment of old bridge street, some 35 metres downstream of the existing bridge. |
| 2 | New Bridge | As for Option 1 (a new bridge along the alignment of Old Bridge Street) but a **low-level bridge** in contrast to the high level bridge of option 1. |
| 3 | New Bridge | Option 3 would replace the existing bridge with a **new bridge that primarily follows the existing alignment** of Bridge Street through Thompson Square, around 10 metres upstream of the existing bridge. This option would maintain the existing roundabout at George Street and the current alignment of Bridge Street. It would create a curved bridge that meets the existing alignment of Wilberforce Road. |
| 4 | New Bridge | Option 4 involves replacing the existing bridge with **a new bridge along the alignment of Baker Street**, Windsor. The new bridge would be around 70 metres upstream of the existing bridge and would connect Baker Street to existing roads in Macquarie Park on the northern bank of the Hawkesbury River. |
| 5 | New Bridge | Option 5 is similar to option 4 and involves replacing the existing bridge with a **new bridge along the alignment of Kable Street** Windsor. The new bridge would be around 170 metres upstream of the existing bridge and would connect to existing roads in Macquarie Park on the northern |

[5] *Traffic modelling for the Base Case takes the conservative approach, it assumes that the bridge would remain open*

| OPTION | STRATEGIC OPTION | DESCRIPTION |
|---|---|---|
| | | bank. |
| 6 | Bypass | Option 6 would involve replacing the existing bridge with a **new bridge around 400 metres downstream of the existing bridge**. Option 6 would include a new signalised T-intersection on Windsor Road north of Pitt Town Road, a bridge over South Creek, a 1.2 kilometre road parallel to Palmer Street and through Governor Phillip Park, a new bridge over the Hawkesbury River and a new T-intersection on Wilberforce Road. |
| 7 | New Bridge | Option 7 would involve replacing the existing bridge with **a new bridge at the end of Palmer Street**. Traffic would access Palmer Street and the new bridge via Court and North Streets. A new signalised intersection would be installed at the corner of Windsor Road and North/Court Street, establishing the southern approach route to the bridge and a new T-intersection would be installed where the bridge connects to Wilberforce Road. |
| 8 | Bypass | Option 8 would involve **replacing the existing bridge with a new bridge located at Pitt Town Bottoms** and connecting to Wilberforce, around six kilometres downstream of the existing bridge. There would be no bridge crossing of the Hawkesbury River at Windsor if this option was implemented. |
| 9 | Refurbishment | This option does not require the removal or the replacement of the existing bridge deck. The existing narrow lane widths on the current bridge are retained. Scope includes **replacing the bridge joints, concreting the bridge deck, installation of deck drainage and beams and add additional steel girders between the existing concrete beams**. The cast iron piers would require strengthening by concrete encasement. The existing bridge would be closed for three months to complete the refurbishment. |
| 10 | Refurbishment | Option 10 includes **the removal and replacement of the existing bridge deck and existing superstructure**. The rubble in the existing cast iron casings would be drilled out and replaced with a reinforced concrete infill to create permanently cased bored piles. The bridge superstructure would be refurbished to include a head stock, beams and decking that would accommodate a wider road platform. The existing bridge would be closed for twelve months during the refurbishment. |

The details, impacts and costs of each of the above options were presented to the community, other stakeholder groups and government agencies to obtain feedback. While RMS did not request that the community nominate a preferred option, many of the submissions identified one or more preferred options for the replacement bridge.

The three most preferred options were Options **1, 2 and 6**. However, many submissions were opposed to Options 1 and 2 because of their potential impact on Thompson Square and the heritage values and vistas of Windsor. Many submissions were opposed to Option 6 due to new amenity impacts on previously unaffected residential areas and the potential economic impacts of a bypass of the town centre.

### 2.3.1 Government Agency Workshop

Following the community information sessions, a government agency workshop was held to consider the issues and concerns relating to each option. The workshop was held in September 2009 and was attended by Hawkesbury City Council, the then NSW Maritime (now RMS), the Heritage Branch of the NSW Office of Environment and Heritage, and the Government Architects Office. The workshop participants identified project objectives, considered the positive and negative aspects of each option and identified opportunities to improve project outcomes, particularly in terms of visual amenity and urban design, heritage, traffic and impacts on the Windsor community. It is important to note that the project objectives used in this workshop were from the EIS. These objectives are phrased differently from the business case project objectives outlined in Section 2.2. Nonetheless, they promote the same outcomes.

**The workshop participants recommended that options 3, 4, 5, 7, 8, 9 and 10 not be considered further** as they did not meet one or more of the project objectives. They also recommended that further work on short-listed Option 1, 2 and 6 was required before a preferred option could be recommended. A comparison of each of the short-listed options against the project objectives and criteria is provided in Table 2-8. The analysis suggests that while each option has strengths and weaknesses, there is little to differentiate between the three short-listed options.

**Table 2-8 Options assessment against project objectives[6]**

| | Do Nothing | Option 1 | Option 2 | Option 6 |
|---|---|---|---|---|
| **To improve safety for motorists, pedestrians and cyclists** | | | | |
| Meets the various design codes | 0 | 2 | 2 | 2 |
| Meets a road speed of 60 km/h* | 0 | 2 | 2 | 2 |
| Ensures pedestrian safety | 1 | 2 | 2 | 2 |
| | | | | |
| **To improve traffic and transport efficiency** | | | | |
| Minimises queue length/delays | 0 | 2 | 2 | 4 |
| Improves performance of road network | 0 | 2 | 2 | 2 |
| Enables two heavy vehicles to pass on the bridge without waiting | 0 | 2 | 2 | 2 |
| Improves load capacity of the crossing to meet current load standards | 0 | 2 | 2 | 2 |
| | | | | |
| **To improve the level of flood immunity** | | | | |
| Provides a crossing that has a higher level of flood immunity than the existing bridge | 0 | 3 | 2 | 2 |
| Provides a crossing with a flood immunity that is compatible with the surrounding approach roads | 0 | 4 | 2 | 2 |
| | | | | |
| **To meet long term community needs** | | | | |
| Provides an efficient connection for local traffic | 2 | 3 | 3 | 2 |
| Provides an efficient connection for regional traffic | 1 | 2 | 2 | 4 |
| Provides a pedestrian and cyclist connection to surrounding locations | 3 | 3 | 3 | 2 |
| Minimises impacts on recreational spaces | 2 | 2 | 2 | 2 |
| Minimises impacts of noise | 3 | 3 | 3 | 1 |
| Minimises impacts to businesses and the shopping environment | 2 | 2 | 2 | 2 |
| Minimises impacts on property access | 4 | 2 | 2 | 4 |
| Minimises need for acquisition | 4 | 3 | 3 | 2 |
| Provides a 100 year life span for the bridge | 0 | 2 | 2 | 2 |
| | | | | |
| **To minimise the impact on heritage and the character of the local area** | | | | |
| Minimises impact on Aboriginal and non- Aboriginal heritage and conservation areas | 2 | 0 | 0 | 2 |
| Protects the town built heritage and its setting | 3 | 1 | 1 | 3 |
| Minimises visual impact and impacts on the character of local area | 3 | 1 | 1 | 2 |
| | | | | |
| **To be a cost effective and an affordable outcome** | | | | |
| Provides a cost effective solution - capital cost | 4 | 3 | 3 | 1 |
| Provides a cost effective solution - maintenance | 0 | 3 | 3 | 3 |
| Provides a cost effective solution - return on investment | 0 | 3 | 3 | 3 |
| Minimises the impact of construction in regards to length and timing | 2 | 3 | 3 | 3 |

While Option 1 was selected as the preferred option for the replacement bridge by RMS, it was recognised that there is significant opposition to this option within parts of the community and from the Heritage Council of NSW due to its potential impacts on the heritage values of Thompson Square and the heritage character of Windsor. To minimise these potential impacts and to develop urban design and land use outcomes that enhance the amenity and use of this historic precinct, RMS undertook further development of this option.

Following the EIS process, the direction to proceed with the Windsor Bridge replacement project was provided under the "Minister's Conditions of Approval" issued by the Department of Planning and

[6] *Scoring range of 0 to 4 whereby 0 reflects worst performance and 4 reflects best performance*

Infrastructure on 20 December 2013. The main impact of this approval on the design of the preferred option is:

- The lowering of the bridge deck by approximately one metre on the southern approach
- Review of the criteria for The Terrace including the access to the existing Windsor Wharf car parking area
- The landscaping of Thompson Square according to a Conservation Management Plan prepared for the project.

Subsequent to this decision, an appeal was launched in the Land and Environment Court by members of the community opposed to the proposal to demolish and replace the bridge on the grounds of expected impact on the Thompson Square, which is on the State heritage register. In November 2015 the Court found that the original basis to proceed was correct in law, and the appeal dismissed.[7] The project recommenced in late November 2015.

## 2.4 Proposed Strategy / Recommended Option Description and Scope of Works

Within the preferred alignment option, a number of 'sub-options' have been considered for the following major scope items:

- Configuration at the northern intersection (Bridge St / Wilberforce Rd / Freemans Reach Rd) and southern intersection (Bridge St / George St)
- Design of the bridge structure
- Design and environmental management measures to minimise the visual impact of the project and consider impact on Thompson Square.

### 2.4.1 Intersection Design

A number of different intersection types and lane configurations were assessed for existing and future traffic scenarios including:

- For the northern intersection:
  - Traffic lights
  - Single lane roundabout
  - Dual lane roundabout
- For the southern intersection (Bridge St / George St):
  - Maintain the existing roundabout
  - Traffic lights

Traffic modelling was undertaken to determine the best intersection configurations for the project. For the northern intersection (Bridge St / Wilberforce Road / Freemans Road) a dual lane roundabout was identified as the preferred intersection type. A dual lane roundabout requires a larger footprint than

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[7] *Land and Environment Court Citation - Community Action for Windsor Bridge Inc v NSW Roads and Maritime Services [2015] NSWLEC 167*

traffic lights, however it will be cheaper both to construct and maintain in the longer term. Traffic lights would provide a similar traffic outcome to a dual lane roundabout, however operating and maintaining traffic lights in the floodplain adjacent to the bridge was undesirable and costly given they would be subject to frequent immersion by floodwaters. It was determined that a single lane roundabout would not provide an acceptable level of service; especially for morning peak traffic from Wilberforce Road. The dual lane roundabout will act as a traffic calming device as motorists enter the 50 kilometres per hour zone, and also provide a visual entry point into the township of Windsor.

For the southern intersection (Bridge Street / George Street), traffic lights were identified as the preferred option, rather than maintaining the existing roundabout. Traffic lights will result in improved levels of service for traffic from all directions in both peak periods. The provision of a signalised intersection at the corner of Bridge and George streets also addresses the concern of pedestrian safety raised during community consultation. The existing roundabout has no designated pedestrian crossings of Bridge / Old Bridge Street at the intersection, making access across this intersection difficult and dangerous. With a signalised intersection, pedestrian crossing of the intersection would be catered for and made safer. This was considered an important outcome as most of the local hotel accommodation and Governor Phillip Park is located on the eastern side of Windsor and pedestrian traffic from this area is required to cross Bridge / Old Bridge Street for direct access to the Windsor town centre.

A further modification was investigated post-EIS-approval for this intersection post approval to further improve PM peak performance. It included a two-lane northbound exit from the intersection that merged back to one lane before the bridge. Whilst this was found to provide further benefit at negligible additional cost to PM Peak traffic, the modification was not adopted due to its non-compliance with the EIS and Minister's Conditions of Approval. The modification required further encroachment into Thompson Square. The current proposal enables this modification to be undertaken as future low-cost retrofit upgrade at a later date.

### 2.4.2 Bridge Design

A series of preliminary concept designs for the replacement bridge were developed to determine a preferred bridge type for the replacement bridge. Based on advice from the heritage architect and urban designers, it was considered desirable to have a straight (rather than curved) bridge option as perpendicular to the river banks as possible. This allowed consideration of a wide range of bridge types, including:

- Precast concrete plank
- Incrementally launched
- Cantilever
- Arch bridge
- Truss bridge
- Cable stayed bridge.

Bridge options were assessed against a range of criteria that covered design requirements such as ability to undergo frequent immersion by flood waters, visual appearance, construction impacts, other environmental risks and whole of life cost. Based on the combined outcomes of a Bridge Options Review Workshop and input from a community focus group, the incrementally launched option was found to be the preferred bridge structure option. Key factors in the selection of this bridge option included its:

- Lower visual impact and the ability to be architecturally enhanced
- A relatively small number of piers in comparison to some of the other options

- Ability to be constructed and launched from the northern bank, which would minimise construction impacts on Thompson Square.

### 2.4.3 Thompson Square

In selecting Option 1 as the preferred option for the bridge alignment, it was recognised that it would adversely impact the significance of the State Heritage Register-listed Thompson Square heritage conservation area and the overall historic vistas and values of Windsor. To minimise these potential impacts, substantial effort has been invested in developing appropriate design and environmental management measures to minimise the visual impact of the project. The impact of the project on Thompson Square is major contributing factor to the delays in the project being granted approval.

Locating the bridge and approach roads on the eastern side of the Thompson Square parkland provides opportunities to improve the size, amenity, appearance and use of the green space within Thompson Square. The approach road to the existing Windsor Bridge would be removed, the cutting backfilled and landscaped to provide additional green space and connect the two existing sections of the Thompson Square parkland. Uninterrupted pedestrian and cyclist access would be provided along The Terrace to the wharf. Access from the new pedestrian/cyclist path across the replacement bridge to the town centre would also be provided.

In response to the sensitivities surrounding the impact of the project on Thompson Square, an Urban Design consultant has been appointed as part of the team selected to provide the detailed design for the project. The design scope requires the utilisation of urban design principles that reflect the landscape and visual aspects of the area to ensure that the replacement bridge will fit sensitively into the built, natural and community environments; contribute to the accessibility and connectivity of people within regions and communities; and contribute to the overall quality of the public domain for the community and all road users.

### 2.4.4 Preferred Option

In summary, the preferred option for the Windsor Bridge replacement project comprises the following:

- A new bridge 35 metres downstream of the existing Windsor Bridge
- Increase traffic capacity of the bridge with a single northbound lane and two southbound lanes
- New approach roads and intersections to connect the new bridge to the existing road network
- New traffic lights with pedestrian facilities at the intersection of Bridge Street and George Street
- A new dual lane roundabout at the intersection of Wilberforce Street and Freemans Reach Road
- Modifications to local roads and access arrangements, including changes to the Macquarie Park access road and reconnection of The Terrace
- Pedestrian and cyclist facilities, including a shared path connecting to and across the new bridge
- Removal and backfill of the existing bridge approach roads
- Removal of the existing bridge once the new bridge is operational
- Landscaping and urban design work, including within the Thompson Square parkland area and adjacent to the northern intersection of Wilberforce Road, Freemans Reach Road and the Macquarie Park access road.

**Figure 2-7 Proposed Windsor Bridge Replacement Project**[8]

## 2.5 Customer Outcomes / Benefits of the Investment

Benefits from this investment link directly to the project objectives. Those which reflect improved outcomes for the customer are:

1) Improved **safety** for motorists, pedestrian and cyclists through:
   - Reconfigured intersections at the northern and southern approaches to the bridge that address a high crash rate area
   - Provision of a wide shared path providing dedicated space for pedestrians and cyclists to cross the river
2) Improved traffic and transport efficiency through:
   - Reduced queuing and delays
   - Greater bridge width to enable heavy vehicles to traverse the bridge without the need to wait for oncoming heavy vehicles to cross first

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[8] *Source : EIS (2012)*

3) Improve the **reliability** of the bridge being open for traffic through:

- Increased level of flood immunity
- Reduced frequency and impact of bridge closures for maintenance as the exiting bridge reaches the end of its useful life.

### 2.5.1 Corporate Plan Result Areas

The customer outcomes described above reflect key result areas as detailed in the Transport for New South Wales Corporate Plan. Two result areas are identified as 'primary' drivers for the project; these relate to the efficient and reliable movement of people and goods and acceptable standard of transport assets.

**Table 2-9 TfNSW Corporate Plan Result Areas**

| RESULT AREA | RESULT | WHAT IT MEANS | DRIVER |
|---|---|---|---|
| Customer | The customer is at the centre of everything we do. | To achieve this Result we need to ensure that the rest of our Results as well as the transport system itself are aligned to what our customers expect from transport. | Secondary |
| Travel | The door-to-door movement of people and goods is efficient and reliable. | Transport is about the reliable movement of people and goods from one location to another. This Result is about minimising travel time for as many people and goods as possible. We do this by providing infrastructure, operating services, and supporting the productive use of the transport system for both social and economic benefits. | Primary |
| Asset | Transport infrastructure meets acceptable standards. | Well maintained assets have implications for the safety, reliability and customer perceptions of the transport system. This Result relies on the management of the balance between the wear and tear associated with the use of assets and the ongoing effort to maintain them. We protect the condition and long-term value of assets, as well as determining the assets we need to meet future demand. | Primary |
| Accessibility | The accessibility of transport is aligned to the needs of the community and the economy. | This Result is about providing transport that is accessible to all users, when and where it is needed. This Result relates to every type of user, including customers who have higher mobility needs. It also relates to the location and frequency of transport services, to ensure that transport is aligned to current and proposed land use and travel patterns. | Not applicable |
| Environment | The impact of transport on the environment is minimised. | We promote a transport system that meets our present social and economic needs without compromising the quality of life of future generations. An important part of this is minimising the impact of transport on our natural environment now, and into the future. | Not applicable |
| Safety | The safety and security of the transport system is maximised. | This Result covers the safety of the road network, public transport and waterways. The Result is broader than just the safety of transport; it is also about the security of the transport system. | Secondary |

| RESULT AREA | RESULT | WHAT IT MEANS | DRIVER |
|---|---|---|---|
| Business | Effective governance is in place to deliver our Results. | This Result captures a range of outcomes that describe what we aim to achieve in terms of how we do business. This outcome drives good business practices relating to the transport cluster, its workforce, financial management and the safety of those working in transport. | Not applicable |

### 2.5.2 Relevant transport goals, strategies or policies

The Windsor Bridge project contributes to goals and objectives set out in a number of relevant state and local government strategies. Table 2-10 lists the strategies most relevant to this proposal and identifies the objectives, goals and initiatives that are supported by the Windsor Bridge replacement project.

**Table 2-10 Strategy alignment**

| STRATEGY | OVERVIEW | RELEVANT OBJECTIVE/GOALS |
|---|---|---|
| **NSW 2021 - A Plan to Make NSW No 1** | NSW 2021 is the NSW Government's 10-year strategic plan setting priorities for action and guiding resource allocation within the NSW budget. The plan includes strategies for returning quality services and renovating infrastructure, with goals and targets for improving transport and road safety. | • Improve the efficiency of the road network during peak times on Sydney's road corridors<br>• Improve road safety<br>• Increase expenditure on critical NSW infrastructure<br>• Improve the quality of urban and rural State roads |
| **A Plan for Growing Sydney** | A Plan for Growing Sydney, released in December 2014, is the NSW Government's plan for the future of the Sydney Metropolitan Area over the next 20 years. The Plan provides key directions and actions to guide Sydney's productivity, environmental management, and liveability – including the delivery of housing, employment, infrastructure and open space. | • Enhance linkages to regional NSW<br>• Protect and maintain the high social, economic and environmental value of the Hawkesbury-Nepean River (priority for the West Sub-region) |
| **NSW Long Term Transport Master Plan** | The NSW Long Term Transport Master Plan identifies the challenges that the transport system in NSW needs to address to support the State's economic and social performance over the next 20 years and identifies a planned and coordinated set of actions (reforms, service improvements and investments) to address those challenges. | Priorities for the north-west region:<br>• Connect communities<br>• Make our regional roads safer<br>• Move regional freight more efficiently |
| **First Things First – The State Infrastructure Strategy 2012 - 2032** | The Strategy assesses the current state of infrastructure in NSW and the need and strategic priorities for infrastructure for the next 20 years. Infrastructure NSW has applied a strategy evaluation method and an investment planning and prioritisation framework consisting of three criteria which are supported by the Windsor Bridge Project. | • Connectivity – The Windsor Bridge provides an important link between productive agricultural areas with the Sydney metropolitan region.<br>• A better life – The project will reduce delays and congestion to improve liveability.<br>• Resilience – The new bridge will be less prone to flooding than the existing crossing. |

| STRATEGY | OVERVIEW | RELEVANT OBJECTIVE/GOALS |
|---|---|---|
| **Hawkesbury Mobility Plan 2010** | The Bike Plan identifies regional and sub-regional cycle routes in the LGA and includes a sub-regional cycleway route from Windsor to Wilberforce which crosses the existing Windsor bridge.<br>The existing Windsor bridge was identified in the plan as a section of on-road cycleway as having inadequate lane and shoulder width for cyclists. It was also identified as a major constraint in improving the safety and continuity of the cycle ways to the north of the Hawkesbury River. | The project would enable a number of the recommendations of the Mobility Plan to be achieved through its improved pedestrian and cyclist facilities around Thompson Square, at the George Street and Bridge Street intersection and across the river. |

### 2.5.3 External requirements

The Windsor Bridge replacement project is subject to various state and federal legislative instruments as described in Table 2-11. Most notably, under the Environmental Planning and Assessment Act an Environmental Impact statement was required for this proposal. In December 2013, Roads and Maritime received approval to deliver the project under Part 5.1 of the Environmental Planning and Assessment Act 1979.

Approval was granted by the Minister for Planning subject to a number of conditions including:

- Preparation of a Strategic Conservation Management Plan to help RMS conserve and minimise impacts to Thompson Square and historical sites
- Preparation of an Interpretation Plan to outline procedures for interpreting heritage items
- Archival recording of historic sites
- An archaeological investigation program of Aboriginal and cultural heritage in the project area
- Preparation of an Urban Design and Landscape Plan for the project that is sympathetic to the heritage values and significance of the Thompson Square conservation area.

**Table 2-11 External Requirements**

| LEGISLATION OR POLICY | POSSIBLE COMMENTARY |
|---|---|
| **NSW Roads Act, 1993** | This Act provides the legislative basis for Roads and Maritime Services to undertake works on State Roads. |
| **Environmental Planning and Assessment Act, 1979** | The EP&A Act provides the statutory basis for planning and environmental assessment in NSW. The Minister for Planning and Infrastructure, statutory authorities and local councils are responsible for implementing the EP&A Act. The EP&A Act provides the framework for environmental planning and development approvals and includes provisions to ensure that the potential environmental impacts of a development are assessed and considered in the decision making process.<br>RMS formed the opinion that the Windsor Bridge replacement project is likely to significantly affect the environment and would require an environmental impact statement to be obtained and consequently the project is State significant infrastructure under Part 5.1.<br>Subsequently an Environmental Impact Statement (EIS) was completed and put on public exhibition through 2012 with the Minister providing Conditions of Approval in December 2013. Following an appeals process in 2015 the NSW Land and Environmental Court handed down its decision to allow the project to proceed. |
| **Commonwealth Environment Protection and Biodiversity Conservation Act, 1999** | Under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) proposed 'actions' that have the potential to significantly impact on matters of national environmental significance, the environment of Commonwealth land or that are being carried out by a Commonwealth agency must be referred to the Commonwealth Government. If the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities determines that a referred project is a 'controlled action' under the EPBC Act, the approval of that minister would be required for the project in addition to the NSW Minister for Planning and Infrastructure's approval.<br>Based on the results of the environmental investigations carried out for this EIS, it is considered that no matters of national environmental significance or areas of Commonwealth land are likely to be impacted by the project. Accordingly RMS decided that no referral is required at this stage. RMS notes that the project would impact on the Thompson Square Precinct (hereafter referred to as the Thompson Square Conservation Area), which includes parts of the project area. The Thompson Square Conservation Area has been nominated for inclusion on the National Heritage List. |
| **Other relevant legislation** | Approvals under other NSW legislation that may apply to the project include:<br>• An aquifer interference approval under the **Water Management Act 2000** if construction requires intersection of a groundwater source.<br>Other legislation that may apply to the project includes:<br>• **Land Acquisition (Just Terms Compensation) Act 1991** – applies to the compulsory acquisition of any land required for the project.<br>• **Crown Lands Act 1989** - applies to the acquisition of land reserved under this Act. A land status search undertaken in June 2012 confirmed there will be Crown land where at least partial acquisition would be required for the project.<br>• **Aboriginal Land Rights Act 1983** – there is an area of Crown land on the southern side of the project that at the time of the EIS was subject of an Aboriginal Land Claim made under this Act. This claim was investigated by the Crown Lands Division of the Department of Primary Industries and subsequently resolved.<br>• **Protection of the Environment Operations Act 1997** – applies to the prevention of pollution, appropriate disposal of waste and the need to notify the Environment Protection Authority (EPA) in the event of any incidents that cause or have the potential to cause environmental harm.<br>• **Contaminated Land Management Act 1997** – requires notification to the EPA in the event of discovering or causing contamination. |

| LEGISLATION OR POLICY | POSSIBLE COMMENTARY |
|---|---|
| **State Environmental Planning Policy (Infrastructure) , 2007** | The ISEPP aims to facilitate the effective delivery of infrastructure across the State. Clause 94 of ISEPP permits development generally for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority (RMS in the case of most of our projects) without consent. However, there may still requirements for consent where the land comprises:<br>• Land reserved under the National Parks and Wildlife Act 1974 (in very limited circumstances, see 94(1)(a) – (c); and/or<br>• Land the subject of State Environmental Planning Policy (SEPP) 14 – Coastal Wetlands; and/or<br>• Land subject to SEPP 26- Littoral Rainforests; and/or<br>• Land subject to SEPP (Major Projects) 2005.<br>Note also that where such development requires consent under either SEPP 14 – Coastal Wetlands; SEPP 26 – Littoral Rainforests or SEPP (Major Projects) 2005, then those SEPPs will prevail over the ISEPP and consent under Part 4 will be required (see clause 8, ISEPP). ]<br>Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. These consultation requirements would be determined as part of the environmental impact assessment phase for the proposed upgrade. |
| **State Environmental Planning Policy (State and Regional Development), 2011** | This is the instrument which places many of the road projects and other projects into the State Significant Infrastructure category for assessment and approval. |
| **Local Environmental Plans** | Local Environmental Plans may or may not permit RMS to carry out proposed works without the consent of Council but in most cases (with the exception of those outlined above), where the works are permissible without consent under the ISEPP, consent will not be required under the relevant Local Environmental Plan. |

# 3 FUNDING THE PROPOSED STRATEGY / RECOMMENDED OPTION

## 3.1 Proposed Funding

The proposed funding arrangements are detailed in the following sections. It is important note that in this document there are three types of capital costs (for both P50 and P90 cost levels) that will be quoted. They are defined as follows:

- Outturn costs - These costs include the base estimate, contingency and escalation. These are the nominal costs of the project
- Real costs - These costs only include the base estimate and contingency, expressed in in 2017 dollars
- Discounted costs – These are the real costs adjusted to account for the time value of money using a specific discount rate (core analysis applies a discount rate of 7%).[9]

### 3.1.1 Overall Project Funding (P50, $ Outturn)

The P50 outturn cost for the Windsor Bridge Replacement project to achieve construction completion in 2021 is [redacted]. Costs will be incurred in the financial year ending 2022 for project handover and finalisation.

Out-turn costs were calculated according to the milestones as shown detailed in Section 5.1.As outlined in the table below, no federal funding will be sought as this is project is not part of a Federal Freight Route.

**Table 3-1 Project funding (P50 out-turn cost)**

| | 2016/2017 | 2017/2018 | 2018/2019 | 2019/2020 | 2020/2021 | 2021/2022 | Total |
|---|---|---|---|---|---|---|---|
| Project Costs (1) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Savings/Benefits (2) | - | - | - | - | - | - | - |
| Net cashflow (3) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Alternate funding (4) | - | - | - | - | - | - | - |
| State funding requirement (5) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Existing provisions (6) | - | - | - | - | - | - | - |
| **Difference (7)** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

***Notes***

1. *Project Costs: Equals the sum of the all project related costs (P50 outturn) and contingency per the cashflow line in the Cost Plan and @risk modelling work undertaken.*

[9] *Time value of money is based on the concept that money held today is worth more than the same amount in the future due to inflation and its earning potential (e.g. income from interest)*

2. *Savings / Benefits: Equals the sum of the proceeds from the sale of assets or delivery of cash benefits (savings in operational costs) during the life of the project.*
3. *Net cashflow: Sub-total equals (1) minus (2)*
4. *Alternate funding: No Federal funding is sort as this project is not eligible for Federal funding. It is a bridge replacement project for an internal local route.*
5. *State funding requirement: Sub-total equals (3) minus (4)*
6. *Existing provisions: Equals the existing unused provisions per most recent submission (e.g. TAM) to NSW Treasury*
7. *Difference: Sub-total equals (5) minus (6). Indicates to Investment Programs changes being requested to capital budget.*

### 3.1.2 Budget request

The total revised outturn capital cost project estimate is [redacted] (P50).

### 3.1.3 Related Projects or Decisions

The Windsor Bridge Replacement Project does not rely on or influence outcomes of other projects being planned or in construction.

### 3.1.4 Other Impacts

This project is not expected to generate traffic or change the distribution of existing traffic. All work to cope with changed conditions resulting from the new bridge is included in the scope of the project, most importantly the upgrade to northern and southern intersections.

### 3.1.5 Consequences of Deferral

There are three main risks to not investing now to replace the Windsor Bridge and upgrade the adjoining intersections:

- Maintenance costs will escalate as the frequency of inspections will need to increase as will the need for reactive repairs
- The risk of load restrictions and total bridge closures due to deteriorating bridge condition will increase
- Traffic conditions will reach unacceptable level of service at key intersections causing severe delays.

Further commentary and data to support these issues is presented in Section 2.1.8.

## 3.2 Cost Planning

### 3.2.1 Cost Planning Management

To date, costs have been calculated using accepted RMS/standard industry techniques of applying standard construction rates to quantities calculated from concept and now detailed design plans of the proposal. The latest costings have been informed by the detailed design work which is currently being delivered and costings will be confirmed prior to tender. Further details are provided below and a detailed cost plan is attached to this business case as Appendix 1.

### 3.2.2 Contingency Management

The cost plan utilises the P50 ($2017) estimate for the project: an appropriate level of contingency for this stage of a project's development (at detailed design).

In order to determine appropriate risk and associated contingencies for project cost planning, risk was assessed in two components: Inherent and Contingent Risk.

The sum of these two components was taken to represent the project risk total. The risk assessment was undertaken by RMS. Utilising ©RISK software simulations, P50 and P90 risk profiles were then established based on the project team's experience and knowledge of project design and construction cost risks, previous RMS advice and ratings of risk likelihood and consequence. The resulting P50 and P90 contingency levels are equivalent to 16% and 20% of the base estimate. Contingency values are outlined below in Table 3-2.

**Table 3-2 Contingency values ($2017)**

| COSTS | | |
|---|---|---|
| Base Estimate (excl. Contingency and escalation) | [redacted] | |
| | P50 | P90 |
| **TOTAL CONTINGENCY (excluding escalation)** | [redacted] | [redacted] |

**The range of Escalation figures should be assessed separately also with consideration of schedule risks including delays*

### 3.2.3 Project Cost Planning

Table 3-3 below outlines the cost planning breakdown (P50) for the preferred option. The P50 breakdown follows a similar proportionate breakdown with an overall contingency of 16% resulting in a project value of [redacted] ($2017). It also provides the cost planning breakdown (P90) for the preferred option. The P90 breakdown follows a similar proportionate breakdown with an overall contingency of 20% resulting in a project value of [redacted]

**Table 3-3 P50 real capital expenditure breakdown**

| ITEM | P50 ESTIMATE ($2017) | P90 ESTIMATE ($2017) |
|---|---|---|
| Project Development | [redacted] | [redacted] |
| Investigation and Design | [redacted] | [redacted] |
| Utility Adjustments | [redacted] | [redacted] |
| Construction | [redacted] | [redacted] |
| Handover | [redacted] | [redacted] |
| **Sub-total** | [redacted] | [redacted] |
| **Contingent and Inherent Risks** | [redacted] | [redacted] |
| **Total Cost (Real $2017)** | [redacted] | [redacted] |
| **Total cost (Outturn)** | [redacted] | [redacted] |

### 3.2.4 Ongoing Maintenance, Operating and Service costs

RMS estimates that the new bridge will require average minimal maintenance of approximately $80,000 per annum (P50) over the thirty year assessment period. This allows for:

- Annual Planned Maintenance ($60,000 per year)
- Bridge inspections every 2 years (alternating between $20,000 and $40,000)

The existing bridge is estimated to have significantly higher annual costs, including access inspections and immediate repairs that total $150,000 per annum. This expenditure is the bare minimum required to maintain the existing level of service and safety of the aging bridge, and is compared with an average of $80,000 (P50) per annum for the new bridge. The relatively high maintenance and repair cost reflects the poor and deteriorating condition of the bridge. Significant remedial works are also required if the existing bridge was retained to maintain minimum service levels. The current condition of the bridge is outlined in Section 2.1.3.

Based on these assumptions, the table below outlines the estimated on-going costs of the base case and preferred option. Table 3-4 shows that Option 1 will produce operational cost savings and these are reflected in the economic appraisal model.

**Table 3-4 Estimated base and project case on-going real costs (over a 30 year project period, $2017)**

| | EXISTING BRIDGE | OPTION 1 (P50) | OPERATIONAL COST SAVING ($2017) |
|---|---|---|---|
| ***Total on-going expenditure*** | $4.5 m | $ 2.3 m | $ 2.2 m |

# 4 JUSTIFICATION

## 4.1 Traffic and Safety Analyses

The project has been developed and designed to cater for future growth in traffic plus provide safe and efficient traffic movements in all conditions. The bridge would be configured to have two southbound lanes and one northbound lane. The approach roads would accommodate the growth in traffic which would otherwise result in unacceptable delays and congestion.

### 4.1.1 Network Performance

Traffic forecasts for 2026 and 2036 were produced using 2017 counts with applied growth rates derived from the RMS's Strategic Traffic Forecasting Model. A road-based traffic model was developed for the study area using SIDRA Network software version 7.0. The traffic modelling assessment predicted the Level of Service of the proposed upgrades taking into account expected traffic growth for 2026 and 2036.

To demonstrate the impact of the project on the performance of the transport network, it is useful to compare levels of service for the base case against the project case.

Table 4-1 shows that in each 2026 peak time period the project case demonstrates an improvement (i.e. shorter duration of delays) from the base case. In 2026, the upgraded network in project case would provide adequate capacity and an acceptable Level of Service (LoS) B for morning peak traffic condition.

Whilst the afternoon Peak LoS E is below the objective target of LoS D in 2026, it is still a significant improvement compared to the base case. Further the project is designed to accommodate appropriately-timed future low-cost modifications to improve afternoon peak performance including:

- a two-lane northbound exit from the Bridge Street / George St intersection that merges back to one lane before the bridge
- possible tidal flow arrangements on the new three-lane bridge.

**Table 4-1 Forecast Level of Service in 2026**

| INTERSECTION | AM PEAK | | | | PM PEAK | | | |
|---|---|---|---|---|---|---|---|---|
| | Base Case | | Project Case | | Base Case | | Project Case | |
| | Delay (s) | LoS | Delay (s) | LoS | Delay (s) | LoS | Delay (s) | LoS |
| Wilberforce Road and Freemans Reach Road | 583 | F | 15 | B | 97 | F | 17 | B |
| Bridge Street and George Street | 49 | D | 17 | B | 351 | F | 62 | E |
| Bridge Street and Macquarie Street | 18 | B | 21 | B | 153 | F | 56 | E |

Table 4-2 shows that in 2036, the new bridge would provide adequate capacity for the morning peak traffic condition. The traffic model predicted Level of Service B at Wilberforce Road / Freemans Reach Road (new roundabout), Bridge Street / Macquarie Street traffic signals and Bridge Street / George Street (new traffic signals). In the afternoon peak, the traffic model predicted Level of Service F with delays of more than 169 seconds (2.8 minutes) at Bridge Street / George Street intersection and more than 99 seconds (1.8 minutes) at Bridge Street / Macquarie Street intersection.

**Table 4-2 Forecast Level of Service in 2036**

| Intersection | AM PEAK | | | | PM PEAK | | | |
|---|---|---|---|---|---|---|---|---|
| | Base Case | | Project Case | | Base Case | | Project Case | |
| | Delay (s) | LoS | Delay (s) | LoS | Delay (s) | LoS | Delay (s) | LoS |
| Wilberforce Road and Freemans Reach Road | 500+ | F | 17 | B | 123 | F | 17 | B |
| Bridge Street and George Street | 63 | E | 25 | B | 783 | F | 169 | F |
| Bridge Street and Macquarie Street | 19 | B | 25 | B | 376 | F | 99 | F |

### 4.1.2 Crashes

The project will result in a reduction in the number of crashes as the design of the project would meet relevant road safety design guidelines. Specific project elements which will reduce the potential for crashes include:

- The introduction of a roundabout at the Wilberforce Road/ Freemans Reach Road/ Macquarie Park access/northern approach road intersection
- The replacement of the roundabout with traffic signals at the Bridge Street/ George Street intersection
- The new alignment of the replacement bridge.

The largest share of historical crashes occurred at Wilberforce Road near Freemans Reach Road, with most occurring when vehicles were approaching from adjacent roads. This is due to the current method of control where Freemans Reach Road gives way to Wilberforce Road at a 'T intersection'. Under this form of control, right turning vehicles have to give way to both directions of traffic on Bridge Street and Wilberforce Road. This type of control is heavily reliant on the driver's ability to correctly select safe gaps. The provision of a roundabout at the Bridge St / Wilberforce Road/ Freemans Reach Road intersection will improve road safety by:

- Controlling the approaching vehicle speeds through entry and circulating carriage width geometry

- Operating under roundabout 'right of way' control all vehicles need only 'give way' to traffic on the roundabout and as such it is easier to select safe gaps.

The traffic signal upgrade at the intersection of Bridge Street and George Street will improve pedestrian, cyclist and driver safety in this area. Similarly, the likelihood of rear-end crashes, such as those recorded on Bridge Street in the vicinity of the bridge, are likely to be reduced due to the improved horizontal and vertical alignment of the project.

## 4.2 The Economic Appraisal

This section summarises the Cost-Benefit Analysis (CBA) assumptions and results of the Windsor Bridge Replacement Project. The economic appraisal has been carried out to assess the economic viability of the project proposed. The economic analysis was driven by the transport modelling results presented above.

### 4.2.1 Assumptions used in the economic appraisal

The CBA was carried out in accordance with the guidelines provided by Transport for NSW in Appendix 4 Economic Parameter Values and Valuation Methodologies of TfNSW's *Principles and Guidelines for Economic Appraisal of Transport Investment and Initiative* (June 2016).

General assumptions applied in the CBA are as follows:

- The assessment of the project begins with planning and construction works (2017-2021) followed by 30 years of operation (2022-2051).
- The base case assumes the existing bridge can remain operational throughout the 30-year assessment period.
- Transport modelling was conducted for the years 2026 and 2036. The future modelling outputs for weekday morning and afternoon peak periods including vehicle kilometres travelled (VKT), vehicle hours travelled (VHT) and the number of stops.
- Parameters for the value of time, vehicle operating costs, environmental externalities and crash costs were obtained from the Transport for NSW's Principles and Guidelines for Economic Appraisal of Transport Investment and Initiatives (June 2016).
- As a conservative approach, quantified benefits for years after 2036 are assumed to remain fixed at levels forecast for 2036.
- Real capital costs were applied. Hence the P50 and P90 capital costs applied of the preferred option are [redacted] and [redacted] respectively.
- Maintenance cost savings for the project are estimated using RMS data. Annual operations costs used in the CBA are incremental to the base case.
- Crash reduction rates by treatment type were obtained from the Roads and Maritime's Crash Reduction Guide (2005).
- The standard discount rate of 7% was applied to calculate present values. Sensitivity test were conducted with discount rates of 4% and 10%.

### 4.2.2 Cost Comparison

The economic appraisal considers both the capital costs associated with the construction and the operational and maintenance aspects of the project. The primary quantifiable costs identified and incorporated within the analysis include:

- Construction costs of the new pedestrian/cyclists bridge
- Maintenance costs.

A cost breakdown for the preferred option is against the base case scenario. Table 4-3 below provides summarised net present values of maintenance costs and benefits associated with the Base Case and the Preferred Option (replace Windsor Bridge). All cost estimate comparisons are based on the updated cost estimate informed by detailed design work currently in progress.

Table 4-3 Comparison of development costs (P50 @ 7% discount rate)

| | COST COMPARISON (P50) IN $2017 CONSTANT DOLLARS (unless otherwise indicated) | |
|---|---|---|
| | Base Case ($m) | Option 1 ($m) |
| Project Development | - | [redacted] |
| Investigation and Design | - | [redacted] |
| Utility Adjustments | - | [redacted] |
| Construction | - | [redacted] |
| Handover | - | [redacted] |
| Contingent and Inherent Risks (P50) | - | [redacted] |
| **Total Capital Costs ($2017)** [1] | | [redacted] |
| **Total Capital Costs (discounted @ 7%)** | - | [redacted] |
| *Total Operating and Maintenance Costs (Discounted at 7% over 30 years)* | *$2.0m* | [redacted] |
| *Total Cost [2] (Discounted at 7% over 30 years)* | *$ 2.0 m* | [redacted] |
| Total Ongoing Financial Savings Benefits [3] | N/A | [redacted] |
| ***TOTAL BENEFITS (Discounted @ 7% over 30 years)[4]*** | ***N/A*** | [redacted] |

*Notes*

1. *Total of above costs*
2. *Base case costs include discounted remedial capital expenditure and on-going costs*
3. *Real financial benefits accruing from RMS operational and maintenance cost savings*

### 4.2.3 Value of Benefits

**Tangible financial and economic benefits**

The CBA includes the following monetised benefits:

- Travel time savings to vehicle traffic
- Vehicle operating costs saving from reduced time in congestion
- Crash reduction benefits derived from the intersection treatments
- Minor environmental externality reductions.
- Residual Value
- Maintenance cost savings

These benefits are described in more detail below and their discounted value are reported in Table 4-4 below. It should be noted that all benefits are incremental to the base case and therefore the value of benefits in the base case is always zero.

**Travel time savings**

The proposed improvements to the existing curvature, grade, alignment and intersection form, as well as the removal of speed restrictions will allow traffic to flow more freely in the project case. Congestion relief significantly improves the travel speed of the fleet, therefore reducing the total travel time in the project case. Travel time benefit accounts for approximately 88% of the total benefits in the project

**Vehicle operating costs**

Vehicle operating cost (on a cost per kilometre basis) savings are a result of the improved road conditions and the increase in average vehicle speed (due a reduction in the number of stops), both of which reduce vehicle operating costs in the project case scenario. The total vehicle operating cost are equal to the per kilometre cost multiplied by the total vehicle kilometres travelled.

**Annual crash savings**

The annual crash savings for each option include the calculated reduction in crashes due to proposed safety measures as well as the change in vehicle kilometres travelled.

**Reduction in environmental externalities**

Environmental externality costs include externalities such as noise pollution, air pollution, water pollution, urban separation, upstream and downstream costs, and greenhouse emissions) a function of total kilometres travelled, decrease in Option 1.

**Residual value**

Residual value benefit stems from the asset value of the bridge after its use after the 30 year evaluation period. This represents benefit is a scrap value benefit.

**Maintenance Cost Savings**

These savings derive from avoided maintenance costs of the current bridge. These cost savings are the difference between the current bridge's forecasted maintenance costs and the project case maintenance costs.

**Table 4-4 Value of benefits (7% discount rate)**

| | BENEFITS (in NPV ($2017) | |
|---|---|---|
| | **Base Case ($m)** | **Option 1 ($m)** |
| Savings in Travel Time | - | 173.2 |
| Vehicle Operating Cost Savings (travel distances) | - | 2.8 |
| Vehicle Operating Cost Savings (number of stops) | | 12.4 |
| Savings in Crash Costs | - | 2.4 |
| Savings in Externalities | - | 1.3 |
| Residual Value | | 3.6 |
| Maintenance Savings | | 0.6 |
| **TOTAL** | - | **$ 196.2 m** |

Over 80% of the benefits are derived from travel time improvements. These are primarily from the improvements made at the intersections that will facilitate a more efficient traffic flow through the project. It is worth noting that the modelling conservatively assumed in the base case that the bridge did not close due to either flooding or maintenance issues.

**Intangible Economic Impacts**

There are a number of impacts, both positive and negative, not captured in the CBA. The most significant impacts include:

- Removing the risk of load limits on the bridge in the short term and bridge closure in the long term under the base case
- An improvement in flood immunity for the preferred option
- Improved connections for pedestrians and cyclists in the preferred option
- Some negative impacts on environmental and heritage values in the preferred option.

Windsor Bridge is at the end of its useful life, without investment there is a significant risk that load limits would be implemented on the bridge within a number of years. This would mean that heavy vehicles would be diverted approximately 20km per trip once the bridge was closed to them. In the longer term, if the bridge were closed permanently then all traffic would be required to divert and this would have a significant impact on both freight and passenger vehicles. Given RMS is unable to specify when a load restriction of permanent closure of the bridge would occur, the CBA analysis assumes that the bridge remains open in the Base Case without restrictions during the appraisal period.

The new Windsor Bridge will have a flood immunity of about a 1 in 4 year ARI flood event, which would be higher than the flood immunity of the existing bridge which is about a 1 in 2 year ARI flood event. There is no advantage in providing higher flood immunity as the Freemans Reach Road and Wilberforce Road would be cut by floodwaters for events greater than the 1 in 3 year ARI flood event.

The project will substantially enhance pedestrian and cyclist connections between the northern and southern bank, between the town centre and east Windsor, between the foreshore and George Street and to Macquarie Park.

From a dis-benefits point of view, the project will have an adverse impact on the Historic heritage and to a lesser extent Aboriginal archaeology. The project will directly impact the Thompson Square Conservation Area and any archaeological resources within the project footprint. While mitigation measures have been incorporated in the project design and would be implemented during the further design and construction phases, impacts on heritage and the Thompson Square Conservation Area would not be totally mitigated.

### 4.2.4 Cost Benefit Results of Preferred Option

Table 4-5 below provides an overall summary of the Net Present Value, Benefit Cost Ratio (BCR) and other economic indicators relative to the base case. The results indicate that the project is economically viable.

**Table 4-5 Economic appraisal results of options**

| | OPTION 1 ($m 2017), P50 | OPTION 1 ($m 2017), P90 |
|---|---|---|
| ***Present Value COST*** | [redacted] | [redacted] |
| ***Present Value BENEFIT*** | $ 196 m | $ 196 m |
| ***NPV*** | [redacted] | [redacted] |
| *BCR* | 2.5 | 2.4 |
| ***NPVI*** | 1.5 | 1.4 |
| ***FYRR*** | 8.0% | 7.8% |
| ***IRR*** | 14% | 14% |

### 4.2.5 Sensitivity Analysis

The tables below show that under all scenarios the project will accrue a positive net economic benefit. This illustrates the high resilience of the project's benefits.

**Table 4-6 Discount Rate Sensitivity Analysis**

| | 7% DISCOUNTED RATE | 4% DISCOUNTED RATE | 10% DISCOUNTED RATE |
|---|---|---|---|
| ***PV COST (P50)*** | [redacted] | [redacted] | [redacted] |
| ***PV BENEFIT*** | $ 196.2 m | $ 344.7 m | $ 119.2 m |
| ***NPV*** | [redacted] | [redacted] | [redacted] |
| ***BCR*** | **2.5** | **4.1** | **1.6** |
| ***NPVI*** | 1.5 | 3.1 | 0.6 |
| ***FYRR*** | 8% | 9% | 7% |
| ***IRR*** [10] | 14% | | |

**Table 4-7 Scenarios Sensitivity Analysis, 7% Discount Rate (P50 Costs)**

| | BCR | NPV |
|---|---|---|
| Cost Estimate +20% | 2.1 | [redacted] |
| Cost Estimate -20% | 3.1 | [redacted] |
| PV Benefits +20% | 3.0 | [redacted] |
| PV Benefits -20% | 2.0 | [redacted] |
| Delay in delivery by one year | 2.4 | [redacted] |

### 4.2.6 Wider Economic Benefits

Wider Economic Benefits (WEBs) have not been assessed as outlined below:

- The scale of investment is not considered significant enough to warrant investigation of WEBs
- The nature of the investment (scope and location of the project) is not likely to have a material WEBs impact.

### 4.2.7 The Financial Appraisal

A separate financial appraisal is not required as the project does not require private sector capital or impact on any tolling regimes.

[10] *The IRR is the discount rate at which the NPV is zero. In this case the IRR is 41%, indicating that the project has a rate of return higher than the proposed discount rate of 7% and hence a positive NPV.*

# 5 PROJECT MANAGEMENT

## 5.1 Project Management, Program and Milestones

Project milestones for Windsor Bridge Replacement Project are listed in the table below.

**Table 5-1 Project timelines**

| MILESTONE DESCRIPTION | TARGET DATE |
|---|---|
| Final Business Case (Gate 2 & 3) approved | August 2017 |
| Complete Detailed Design | October 2017 |
| Invite Construction Tenders | December 2017 |
| Award Contract | April 2018 |
| Start construction | June 2018 |
| Open Stage to Traffic | June 2020 |
| Project Complete – Non Road component | June 2021 |

The program is subject to the following considerations:

- Obtain DPE approval to commence pre-construction and construction activities upon completion of heritage works
- Detailed Design completed and approved based on heritage studies completed
- Roughly four months to assess and award tenders based on similar projects
- Twenty-four months to construct the transport related component of the works (18 month construction contract period plus 25% (6 months) contingency for wet weather and project delays).

## 5.2 Governance

The current governance structure is provided in Figure 5-1 below. Governance arrangements are documented fully and will be maintained and updated in the Project Management Plan.

The project team comprises both Development and Delivery staff. Development group handed over leadership of the project to Delivery staff in early 2012. The project delivery team members have also held regular internal multiple disciplinary (weekly) team meetings since October 2015 after the NSW Land and Environmental Court decision to ensure effective project management. Monthly project program and progress is also discussed at the RMS Development Program Coordination meetings on a monthly basis.

**Figure 5-1 Governance structure**

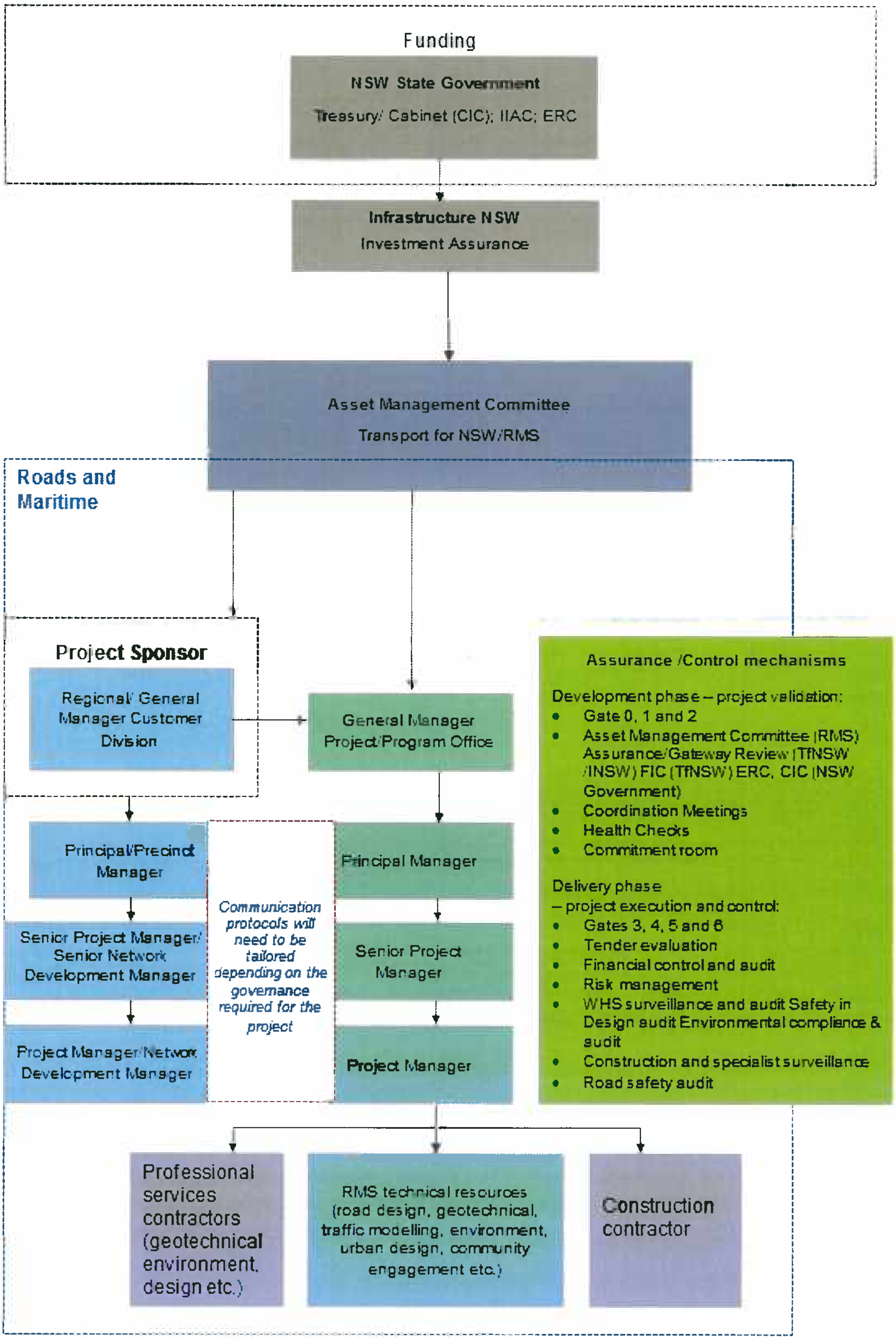

**Table 5-2 Resourcing**

| Function | Organisation | Business group/ Role | Responsibilities |
|---|---|---|---|
| Funding | NSW Treasury | NSW Treasury | Provision of funding |
| Financial management and investment allocation strategies | TfNSW | Finance and Investment Committee (FIC) | Provide recommendations and make decisions on the Transport Cluster financial management and investment allocation issues and risks. |
| Fiscal strategy | NSW Government | Cabinet Standing Committee on Expenditure Review (ERC) | Frame the fiscal strategy and the Budget for Cabinet's consideration, drive expenditure controls within agencies, monitor financial performance and consider proposals with financial implications brought forward by Ministers. |
| Infrastructure strategy | NSW Government | Cabinet Standing Committee on Infrastructure (CIC) | Provide recommendations and make decisions on major infrastructure project expenditure. |
| Investment oversight | NSW Government and Infrastructure NSW | Infrastructure Investor Assurance Committee (IIAC) | Ensure "whole of government" investor oversight of major capital projects over [redacted]. |
| Asset Management Committee | TfNSW and RMS | Chief Financial Officer<br>Executive Directors<br>TfNSW Executive Director Group Finance<br>TfNSW Executive Director Transport Networks | Organisational governance to oversee and prioritise funding of asset investment portfolio. |
| Project Sponsor<br>Executive Director<br>John Hardwick | RMS | Sydney (Customer Division) | The individual with overall responsibility for ensuring that a project meets its objectives and delivers the projected benefits. Responsible for the regional strategy. |

| Function | Organisation | Business group/ Role | Responsibilities |
|---|---|---|---|
| Director – Network West Precinct<br>Colin Langford | RMS | Network West Precinct | The individual with the responsibility for representing the interests of the Project Sponsor in the West Precinct in ensuring that a project meets its objectives and delivers the projected benefits. Responsible for the regional strategy. |
| Network & Safety Services Manager | RMS | Network West Precinct | Responsible for the coordination of regional strategy requirements and interface with project scopes and objectives |
| | RMS | | Responsible for overall reporting and delivery of the project throughout the development, delivery and finalisation phases of the project |
| | RMS | | Responsible to the Sponsor for all development and delivery works :<br>Principal's Authorised Person or RMS' Representative duties on contracts for all delivery works |
| | RMS | | Responsible to the Sponsor for all development works<br>Allocation of resources for the project<br>Key stakeholders liaison and management<br>Reporting coordination |

| Function | Organisation | Business group/ Role | Responsibilities |
| --- | --- | --- | --- |
| | RMS | | Responsible to the Sponsor through the Senior Project Manager for all activities.<br><br>This person is given the authority and responsibility to manage the project on a day to day basis to deliver the development and delivery phases to the agreed objectives. |

Note: RMs has very recently renamed the "General Manager" position as "Director." This explains the discrepancy between tiles in Figure 5-1 and Table 5-2. Furthermore the approvals Page 2 reflect the sponsorship arrangement and structure when the business case was first approved; and when the assurance review was undertaken.

| | |
|---|---|
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| | |

## 5.3 Procurement Strategy

### 5.3.1 Procurement Options

The detail design and contract documentation work is being completed by Jacobs Group (Australia) Pty Ltd under a variation to the original professional services contracts (PSC). The heritage related works based on the Minister's Conditions of Approval are being completed with a separate professional services contract (PSC) to allow the project to proceed into construction.

It is proposed to award the construction contract by open tender to contractors that are prequalified, consistent with TfNSW Contract Management Guidelines and Notes on Administration for the Land Transport Infrastructure Projects (2014-15 to 2018-19) and Roads and Maritime's GC-21 Major Contract.

The contractors on the Roads and Maritime prequalified list would be invited to tender through the NSW government eTender process.

### 5.3.2 Preferred Strategy

Though there are a number of risks associated with this project as identified above in the pre-construction phase, they should be mitigated during 2016 and 2017 as RMS moves forward with the environmental and heritage investigations for the project.

The recommended construction delivery method would be a lump contract incorporating both schedule of rates and lump sum components. This process will be guided by contractor selection criteria that will evaluate the tenders in the following areas; cost, heritage, environmental, community and stakeholder engagement. Experience with incrementally launched bridge construction methodology would also be required.

## 5.4 Benefits Realisation

Roads and Maritime undertakes Project Completion Reviews at various stages of projects lifecycles to ensure the development processes and construction processes are being undertaken in accordance with expectations, as well as to assess the extent to which forecast benefits are realised in operation.

Key benefits to customers are discussed in detail in Section 2.5. For more detail, refer to Appendix 3 for the Benefits Realisation Strategy.

The valuation of benefits of those who use the proposed bridge has been measured using *Principles and Guidelines for Economic Appraisal of Transport initiatives (TfNSW, 2013).* This document includes parameter values for travel time, vehicle operating costs, crashes and environmental impacts.

The economic analysis considers a range of benefits including travel time savings, vehicle operating cost savings, reduction in maintenance costs, reduction in vehicle crashes, reduction in environmental externalities which accrue to users and owners of the bridge. These are outlined in Section 4 of this report.

The value of wider-economic benefits are generally not appropriate for less populated areas such as towns like Windsor, as these benefits generally accrue due to improved transport linkages to areas of high value employment, which would otherwise not be accessible to some people.

There would be no additional benefits created should the base case be adopted.

## 5.5 Asset Management

### 5.5.1 Asset Management Strategy

The table below addresses how assets will be managed throughout the asset lifecycle.

**Table 5-3 Asset management**

| ASSET MANAGEMENT LIFECYCLE | DESCRIPTION OF ACTIVITIES | TIMEFRAME/ MILESTONES | ROLES AND RESPONSIBILITIES |
|---|---|---|---|
| **Plan and Develop** | Evaluation, detailed design, construction planning | 2008 - 2017 | Roads and Maritime |
| **Land Acquisition** | Full and partial acquisition of private properties on the northern side and crown land on the southern side. Notify affected land owners and acquire property and manage in accordance with RMS policies and guidelines. | January 2012 – October 2018 | Roads and Maritime |
| **Build** | Invite tenders, construction contract | December 2017 – June 2021 | Roads and Maritime and appointed contractor |
| **Operate and Maintain** | Open new bridge and approach roads to traffic. | June 2020 | Roads and Maritime |
| **Improve and Dispose (if applicable)** | N/A | Not envisaged | Roads and Maritime |

### 5.5.2 Asset Ownership Matrix

The proposed asset ownership matrix for Windsor Bridge is presented in the table below.

**Table 5-4 Asset ownership**

| ASSET CATEGORY | ASSET CATEGORY DESCRIPTION | ASSET OWNER | ASSET OPERATOR | ASSET MAINTAINER |
|---|---|---|---|---|
| **Civil structures** | This will include culverts, retaining walls and road pavement. | TfNSW | Roads and Maritime | Roads and Maritime |
| **Utilities adjustments** | Gas, water, electricity, telecoms | Various | Various | Various |
| **Road Signage** | Road signs | TfNSW | Roads and Maritime | Roads and Maritime |
| **Civil works and parklands** | Works beyond main carriageways and kerbs Local Roads<br>Thompsons Square | Hawkesbury City Council | Hawkesbury City Council | Hawkesbury City Council |

| ASSET CATEGORY | ASSET CATEGORY DESCRIPTION | ASSET OWNER | ASSET OPERATOR | ASSET MAINTAINER |
|---|---|---|---|---|
| **Bridge structures** | Bridge | TfNSW | Roads and Maritime | Roads and Maritime |

### 5.5.3 Impact Assessment on Current Assets

The project will have the following impacts on existing adjacent infrastructure:

- Impact on assets belonging to utility authorities. These assets will be adjusted and relocated as part of the project.
- Impacts on assets owned and/or maintained by Hawkesbury City Council. Proposed works will be submitted to HCC for review and concurrence.

## 5.6 Key Risk Management

A risk management plan (Appendix 9) and risk register (Appendix 10) has been maintained for the project, which details the identified risks at each stage of development. Key risks identified relate to:

- Increase in cost of project due to heritage works
- Unexpected heritage artefacts found during construction
- Community and stakeholder dissatisfaction (lack of communication)
- Poor publicity of the project
- Impact on existing infrastructure and property issues during construction of the bridge
- Relocation of utilities
- Damage to utilities during construction
- Blocking of existing cyclist path and restricted access to certain roads during construction
- Significant flood event during construction
- Local traffic impacts during construction
- Risks associated with the construction of a bridge over water.

Two very high risks (the highest risks) are presented in Table 5-5 below. Appropriate management plans and strategies will be implemented in accordance with the risk register.

Table 5-5 Top Risks Register

| Risks Identification | | | | | Qualitative Risk Assessment (Post Control) | | | | Risks Treatment | Qualitative Risk Assessment (Residual Risk) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Risk ID | Risk / Consequence Title | Risk Category | Cause, Trigger or Situation (contributing Factors) | Potential Consequences | Likelihood | Consequence | Risk Rating | Action | Method | Likelihood | Consequence | Risk Rating |
| 1 | 2 | 3 | 5 | 6 | 10 | 11 | 12 | 13 | 14 | 17 | 18 | 19 |
| | | CONTINGENT RISKS | | | | CONTINGENCY RISKS | | | | | | |
| [illegible] | Heritage items impact on detailed design | Environment | Unknown locations of heritage items. Detailed design does not consider presence of heritage items | [illegible] heritage [illegible] project delays | Probable, P(t) [illegible] | Severe | [illegible] | Non-invasive investigations | Mitigate | Unlikely [illegible] P(t) = 60% | Major | [illegible] |
| 9 | Politics Interference | Project / Program Delivery | Political interference causing delays or the possibility of project being terminated | Delays in contract award or Project Termination | Likely 51% - P(t) < 80% | Severe | [illegible] | Work closely with community and stakeholder management team and get regular updates as well as promptly address issues | Accept | Possible 31% - P(t) < 50% | Major | [illegible] |

| Risk ID | Quantitative Risk Assessment (Residual Risk) Cost Contingency | | | | | | | Quantitative Risk Assessment (Residual Risk) Time Contingency | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Current Base Estimate or CTC $ CTC=EAC-AC | Optimistic Best Case ($) | Most Likely ($) | Pessimistic Worst Case ($) | Basis of Valuation | Desired P50 Contingency Bucket ($) | Desired P90 Contingency Bucket - Desired P50 Contingency Bucket ($) | Optimistic Best Case (days) | Most Likely (days) | Pessimistic Worst Case (days) | Basis of Valuation | Desired P50 Contingency Bucket (days) |
| 1 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 |
| | | | | CONTINGENCY RISKS | | | | | | CONTINGENCY RISKS | | |
| [illegible] | [illegible] | $30,000 | [illegible] | $300,000 | Based on estimates provided by project [illegible] BC - 25% of ML WC - 250% of ML | $130,000 | [illegible] | [illegible] | [illegible] | 200 | Based on time estimate provided by project consultant BC - 33% of ML WC - 222% of ML | [illegible] |
| 9 | [illegible] | $0 | [illegible] | $0 | Non-cost risk | $0 | [illegible] | [illegible] | [illegible] | 180 | Based on time estimate provided by project consultant BC - 50% of ML WC - 167% of ML | [illegible] |

## 5.7 Stakeholder Management

Roads and Maritime have consulted extensively with external stakeholders and the community during development of the project. A project website, email address and project phone number have been established and are in operation.

Significant consultation was undertaken as part of the EIS preparation. The project has involved community members and key stakeholders in selecting the recommended option. Table 5-6 outlines events that have been held in the last year. It shows that further consultations on the urban design and landscaping will begin with external stakeholders before the end of the year.

A Community and Stakeholder Engagement Plan has been prepared (Appendix 12) for the project. This plan details the stakeholders to be engaged as part of project development and the appropriate method and timing of consultation to be undertaken. This plan was also outlines the method and timing of consultation with the broader community, including information regarding progress of the project. The stakeholder plan also outlines mechanisms for incorporating community feedback on the construction and operation of the new bridge. This will allow for continuous communication between RMS, stakeholders and the local community on the progress of the project.

The plan will continue to be updated as the project moves forward.

**Table 5-6 Summary of key stakeholder events**

| DATE | STAKEHOLDER | EVENT |
|---|---|---|
| Late 2015 | Internal RMS | Update communication and engagement plan |
| March to August 2016 | Community and stakeholders | Announce start of environmental and heritage testing program |
| September 2016 | Community and stakeholders | 3-lane bridge configuration |
| August to November 2016 | Community and stakeholders | Heritage Investigation work |
| April 2017 | Community and stakeholders | Consultation on urban design and landscaping and heritage interpretation |
| March/April 2018 | Community and stakeholders | Announce Award of Construction Tender |
| Mid 2018 | Community and stakeholders | Announce Construction Start |
| Mid 2018 to Mid 2021 | Community and stakeholders | Ongoing construction updates |
| Mid 2020 | Community and stakeholders | Announce Open to Traffic |

Key external stakeholders to be engaged throughout the project are shown in Table 5-7and key internal stakeholders are summarised in Table 5-8.

Table 5-7 Key External Stakeholders

| EXTERNAL STAKEHOLDER | DETAILS |
|---|---|
| **Landholders/ residents** | Involved on an ongoing basis with the project regarding progress, project changes and construction activities and potential impacts |
| **Motorists** | The project is listed on the Roads and Maritime website and stakeholders will be notified of potential traffic related impacts |
| **Hawkesbury Council** | This local government stakeholder was involved in the development of the preferred route and design options. RMS representatives will continue to involve Hawkesbury Council in property and local issues |
| **Other government agencies** | Transport for NSW — Project progress<br>Department of Planning and Environment – Compliance with Ministers Conditions of Approval |

Table 5-8 Key internal stakeholders

| INTERNAL STAKEHOLDER | DETAILS |
|---|---|
| **Customer Division - Sponsor** | Network West Precinct – Director – Colin Langford |
| **Environmental Services** | Greater Sydney Program Office – Environmental Manager – Con Lambous |
| **Greater Sydney Program Office** | Greater Sydney Project Office - Director— Athena Venios<br>Principal Manager — Ian Allan |
| **Community and Stakeholder Engagement** | Greater Sydney Project Office – Communications Manager – Anthea Johnston |

Further consultation during the delivery stage is expected to include:

- Publication of relevant project documents
- Consultation required by the Ministers Conditions of Approval
- Consultation with directly affected and local property owners
- Circulation of community updates, advertising and media releases
- Consultation with relevant utility owners.

## 5.8 Change Management

The project relates to infrastructure that is primarily to be provided in response to a high level of safety risk. The provision of new infrastructure will significantly lower these risks and associated costs.

The external aspects of this change management are primarily dealt with through the measures established in the Community and Stakeholder Engagement Plan (Appendix 12), which provides the mechanisms and process to managing change in the community as a result of the project. Change management approaches focus on getting the community to understand project benefits and adapt to changed traffic conditions through information exchange.

Change management processes have been developed and included in the Change Management Plan (CMP) to manage:

- Significant changes that will occur during the delivery of the project and after its completion
- Impacts on RMS staff and contractors, stakeholders and customers
- Allocate responsibilities and roles to members of the project team to manage these changes.

The CMP outlines the requirements for the project manager to liaise with relevant internal (RMS project team) and external stakeholders (e.g. local community, road users and local businesses) involved with operational and maintenance issues of the bridge at prescribed stages of the project.

The following table summarises some of the key approvals that might be required during the project to manage change.

**Table 5-9 Change management responsibilities**

| INTERNAL STAKEHOLDER | DETAILS |
|---|---|
| **Scope changes** | Project Team Director Greater Sydney Program Office |
| **Changes to cost forecasts** | PMO |
| **Changes to contingency amounts** | TfNSW |
| **Changes to milestones** | Project Team Director Greater Sydney Program |
| **Minister's Condition of Approvals** | Department of Planning and Environment |

## 5.9 Sustainability

The Transport Environment and Sustainability Policy Framework is a collective and co-ordinated approach to deliver the NSW Government's environmental and sustainability agenda across TfNSW. The project has considered this framework. The table below demonstrates how the project would achieve acceptable sustainability performance against the eight themes in the Transport Environment and Sustainability Policy Framework.

An Environmental Impact Statement (EIS) has been prepared for the project and provides a detailed assessment of issues and constraints that could impact on the project, including sustainability. An assessment of these potential impacts has not raised any issues that are likely to be an impediment to the project and all issues raised can be mitigated or managed throughout the life of the project.

Further, it is considered that one of the fundamental objectives of this project is to encourage adoption of active transport modes and lifestyles, an objective that is in-line with many aspects of sustainability.

Table 5-10 Roads and Maritime Sustainability Policy and Framework

| SUSTAINABILITY AREA | PREFERRED OPTION RESPONSE |
|---|---|
| **Construction phase** | |
| **Sustainable procurement and policies**<br>Procure infrastructure, goods and services and implement policies that, over the construction phase, deliver value for money and contribute to the environmental, social and economic wellbeing of the community. | The construction of the bridge would be managed by a team from RMS who have and will be responsible for scope agreement, preferred options selection, concept design, environmental assessment, detailed design, procurement and delivery of the project. This team would operate in accordance with corporate sustainability polices and performance criteria. |
| **Heritage**<br>Ensure cultural heritage is conserved and managed according to its heritage significance and that it contributes positively to awareness of the past and educates us about resource use. | The proposed realignment for this project takes into consideration areas of Aboriginal and Cultural significance and the preferred option would avoid, as far as practical, impact to those heritage items. |
| **Resources, waste and pollution control**<br>Minimise the use of non-renewable resources, waste and pollution during construction. | A water quality basin will be constructed on the northern side of the river.<br>Secondly, the improvements to congestion and traffic flow would be an indirect contributor to pollution reduction in the project area.<br>In addition, the project would aim to reduce water and resource consumption during construction and operation phases of the project. This would be confirmed once a detailed design is complete. |
| **Operations phase** | |
| **Energy and climate change management**<br>Minimise energy use, reduce greenhouse gas emissions and design climate change resilient infrastructure. | The project provides for (i) reduced levels of congestion, and (ii) better facilities for active transport and buses, thus providing better accessibility. This is a key benefit that will contribute to a reduction in greenhouse gas emissions. |
| **Resources, waste and pollution control**<br>Minimise the use of non-renewable resources, waste and pollution from and operational resources. | A water quality basin will be constructed on the northern side of the river and a gross pollutant trap installed on the southern side.<br>The improvements to congestion and traffic flow would be an indirect contributor to pollution reduction in the project area. The CBA indicates that there will be a reduction in environmental externalities (e.g. water and air pollution etc.) compared to the base case.<br>In addition, the project would aim to reduce water and resource consumption during construction and operation phases of the project. This would be confirmed once a detailed design is complete. |
| **Air quality**<br>Minimise the air quality impacts of road projects and support initiatives that aim to reduce transport related air emissions. | See above. |

| SUSTAINABILITY AREA | PREFERRED OPTION RESPONSE |
|---|---|
| **Biodiversity**<br>Improve outcomes for biodiversity by avoiding, minimising or offsetting the potential impacts of road and maritime projects on plants, animals and their environments. | The operations of the project will seek to minimise the impact on the broader ecological community. An environmental assessment process has been undertaken which has determined that possible impact on biodiversity is extremely low and can be mitigated. |
| **Liveable communities**<br>Provide high quality urban design outcomes that contribute to the liveability of communities in NSW. | The project includes improved safety and community experience through improved traffic flow. Additionally significant care has been taken to achieve a high level of urban design quality with consultation with the community. |
| **Sustainable procurement and policies**<br>Procure infrastructure, goods and services and implement policies that, over their lifecycle, deliver value for money and contribute to the environmental, social and economic wellbeing of the community. | The operations of the bridge would be overseen by a team from Roads and Maritime who have and will be responsible for maintenance and remedial capital works. This team would operate in accordance with corporate sustainability polices and performance criteria. |

Notes

1. Refer to the Roads and Maritime Sustainability Strategy and quarterly Environmental Sustainability Performance Reports.
2. In draft from due for release in early 2015 and quarterly Environmental Sustainability Performance Reports.

## 5.10 Assurance results

This business case, the Windsor Bridge Replacement Project Final Business Case, was submitted for review through the NSW Government's Gateway Review Process in October 2016. The Expert Review Panel comments will be closed out and the Gate 3 Final Business Case and budget request approved by November 2017.

# Appendix 1: Cost Management Plan

Document redacted/removed

# Appendix 2: Economic Appraisal

# WINDSOR BRIDGE REPLACEMENT PROJECT

## Economic Appraisal

Incorporating

Hyder

# CONTACT

Mukit Rahman
Associate Technical Director

# ROADS AND MARITIME SERVICES WINDSOR BRIDGE REPLACEMENT PROJECT

## Economic Appraisal


| | |
|---|---|
| **Authors** | Mikhael Wong; Mukit Rahman |
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| **Approver** | Mukit Rahman |
| **Report No** | 10005593 |




## REVISIONS

| Revision | Date | Description | Prepared by | Approved by |
|---|---|---|---|---|
| B | 9 May 2017 | Draft for Client Review | SI, MW | MR |
| C | 25 May 2017 | Final Report | KN, MW | MR |
| D | 31 May 2017 | Updated report incorporating cost estimates as of 29 May 2017 | KN | MR |
| E | 29 June 2017 | Updated report incorporating Traffic and Options Modelling Report | KN | MR |

# CONTENTS



## APPENDIX

# 1 Introduction

## 1.1 Report Purpose

This report assesses the economic merits of the proposed Windsor Bridge Replacement project. The purpose of the cost benefit analysis (CBA) is to estimate benefit cost ratio (BCR) and net present value (NPV) of a Concept Design prepared by Roads and Maritime Services (Roads and Maritime).

This report presents the methodology, assumptions and results of the economic appraisal of the proposed Windsor Bridge Replacement project.

Ongoing consultation involving Roads and Maritime staff constituted an important element of this study. Two technical notes were prepared and reviewed by Roads and Maritime over the course of this project including:

- Technical Note 1 – Future traffic growth assumption. The traffic growth assumptions have been agreed with Roads and Maritime
- Technical Note 2 – Existing conditions and traffic performance of the Concept design.

This report is to be read in conjunction with a main traffic report titled *"Windsor Bridge Replacement Project, Traffic and Option Modelling Report"*, June 2017, Prepared by Arcadis Australia Pacific Pty Ltd (Arcadis).

## 1.2 Proposed Upgrades (Concept Design)

Roads and Maritime has developed a Concept Design for the Windsor Bridge Replacement project between Wilberforce Road and Court Street, Winsor (hereinafter referred to as 'Concept Design'). The Concept Design involves removal of the existing bridge and constructing a new three lane bridge and upgrading adjacent intersections.

The Concept Design includes the following key features:

- Removal of the existing two lane bridge and provision of a new three lane bridge consisting of two lanes in the southbound direction and one lane in the northbound direction;
- A new dual lane roundabout replacing the existing priority control at Bridge Street / Wilberforce Road / Freemans Reach Road. The new roundabout will be located approximately 35 metres south of the Bridge Street / Wilberforce Road / Freemans Reach Road intersection. The new roundabout intersection will form a four-way intersection allowing access to Macquarie Park via the western approach;
- New traffic signals replacing the existing roundabout at Bridge Street / George Street;
- Linemarking the right turn lane on Bridge Street southbound heading to Macquarie Street to formalise it as a turning lane; and
- Linemarking the left turn lane on Bridge Street northbound heading to George Street to formalise it as a turning lane.

Appendix A includes Roads and Maritime's Concept Design.

# 2 Economic Appraisal Methodology

This economic appraisal has been carried out in accordance with the guidelines provided by Transport for NSW in *Appendix 4 Economic Parameter Values and Valuation Methodologies of TfNSW's Principles and Guidelines for Economic Appraisal of Transport Investment and Initiative, Version 1.7, July 2016*, hereinafter referred to in this report as 'July 2016 TfNSW' Guidelines. This section presents the appraisal framework and key assumptions used in the economic appraisal.

## 2.1 Appraisal Framework

The economic appraisal framework was used to appraise the economic viability and was based on the generalised road user cost benefit analysis methodology. The methodology appraises the project on an incremental basis by comparing the proposed upgrades to a base case. The base case is defined as do nothing network and has been agreed with the Roads and Maritime.

The economic appraisal relies on project cost estimates as provided by Roads and Maritime. The project costs include capital costs. The project benefits include travel time savings, vehicle operating cost savings, reduction in crash costs, environmental and externality costs, residual value of the asset and maintenance savings.

The following economic performance measures are calculated to estimate the economic viability of the project:

- Benefit Cost Ratio (BCR) – ratio of the PV of total incremental benefits over the PV of total incremental costs. The BCR is the most commonly used evaluation criteria.
- Net Present Value (NPV) – the difference between the present value (PV) of total incremental benefits and the present value of the total incremental costs in the improved case.
- Internal Rate of Return (IRR) – is the discount rate at which present value of costs equals the present value of benefits.

## 2.2 Economic Parameters

Table 2-1 below shows key parameters used in the cost benefit analysis (CBA).

*Table 2-1 Key Economic Parameters*

| Economic Parameters | Description |
|---|---|
| Discount Rate | Future net benefits are discounted to the base year using a real discount rate of 7%. The appraisal also undertakes sensitivity tests at the discount rates of 4% and 10%. |
| Price Year | The benefits and costs in the evaluation are presented in 2017 prices. |
| Year 0 (Base year) | 2017 |
| Traffic Opening Year | 2021 |
| Evaluation Period | The evaluation period is assumed to be 30 year after opening to traffic. |

## 2.3 Appraisal Option

The CBA is based on costs and benefits of the "Concept Design" incremental to the base case (do nothing).

### 2.3.1 Base Case

"Do nothing" base case represents the existing traffic network within the study area as of 2017. The Windsor Bridge is a two lane road (one lane in each direction).

### 2.3.2 Concept Design

The Concept Design involves removal of the existing bridge and constructing a new three lane bridge and upgrading adjacent intersections.

The Concept Design includes the following key features:

- Removal of the existing two lane bridge and provision of a new three lane bridge consisting of two lanes in the southbound direction and one lane in the northbound direction;
- A new dual lane roundabout replacing the existing priority control at Bridge Street / Wilberforce Road / Freemans Reach Road. The new roundabout will be located approximately 35 metres south of the Bridge Street / Wilberforce Road / Freemans Reach Road intersection. The new roundabout intersection will form a four-way intersection allowing access to Macquarie Park via the western approach;
- New traffic signals replacing the existing roundabout at Bridge Street / George Street;
- Linemarking the right turn lane on Bridge Street southbound heading to Macquarie Street to formalise it as a turning lane; and
- Linemarking the left turn lane on Bridge Street northbound heading to George Street to formalise it as a turning lane.

## 2.4 Traffic Modelling Data

The future modelling outputs for weekday morning and afternoon peak periods including vehicle kilometres travelled (VKT), vehicle hours travelled (VHT) and number of stops have been prepared by Arcadis using SIDRA network software version 7. SIDRA network models were developed for 2017, 2026 and 2036 modelling years. The vehicle kilometres travelled (VKT), vehicle hours travelled (VHT) and number of stops for base case and Concept Design were used in the calculation of the economic benefits. The SIDRA network modelling results have been normalised where requited. Appendix B documents traffic modelling outcomes including normalisation methodology.

## 2.5 Cost Parameters

For this project, the specific variables for road user benefits are determined in accordance with the guidelines provided in *Appendix 4 Economic Parameter Values and Valuation Methodologies of TfNSW's Principles and Guidelines for Economic Appraisal of Transport Investment and Initiative, Version 1.7, July 2016* ('July 2016 TfNSW Guideline'). Appendix C documents project specific variables used in road user benefits estimations.

### 2.5.1 Expansion Factors

The SIDRA network traffic model represents peak hours (i.e. one hour AM peak and one hour PM peak). To estimate the annual road user benefits from traffic modelling results, the annual expansion factor is used to expand AM peak one hour and PM peak one hour to annual numbers.

An annual expansion factor of 2113 was used, consistent with the July 2016 TfNSW Guideline.

### 2.5.2 Travel Time Costs

The difference in the travel time from the traffic forecasts are used to estimate savings in travel time cost for the Concept Design relative to base case.

Values of time (VOT) for light and heavy vehicles were estimated using urban parameters suggested in Table 9 in the June 2016 TfNSW Guideline and the vehicle composition observed in the study area.

### 2.5.3 Vehicle Operating Costs

The unit vehicle operating cost (VOC) is applied to the vehicle-kilometres travelled (VKT) in base case and Concept Design option to calculate the incremental VOC for VKT for the analysis period. The savings in vehicle operating costs for option are estimated by combining the incremental (relative to the base case) vehicle kilometres (VKTs) with the unit vehicle operating costs.

Vehicle operating costs (VOC) by vehicle type were estimated using resource cost parameters suggested in Table 12 in the June 2016 TfNSW Guideline and the vehicle composition observed in the study area. The VOC parameters were suggested for urban stop-start conditions.

### 2.5.4 Vehicle Operating Costs per Stop

Vehicle operating costs per stops by vehicle type were estimated using values from Table 16 of the June 2016 TfNSW Guideline.

### 2.5.5 Environmental and externality Costs

Road use produces external costs on society in terms of the economic costs of environmental impacts. Environmental costs are determined by applying externality values per vehicle-kilometres travelled (VKT) based on vehicle composition from the traffic analysis. These parameter values include noise pollution, air pollution, water pollution, greenhouse gas emissions, nature and landscape, urban separation, and upstream and downstream costs.

Environmental costs for urban roads were adopted from Table 58 and Table 60 in the June 2016 TfNSW Guideline. Environmental unit costs for passenger vehicles are expressed in cents per VKT. For heavy vehicles the environmental unit costs are expressed in dollars per 1000 tonne kilometre (tkm) travelled.

### 2.5.6 Crash Costs

Crash analysis has been carried out by comparing existing and proposed conditions to determine estimated crash reduction statistics using crash data from July 2011 to December 2016. Appendix D documents crash reductions and crash cost savings.

### 2.5.7 Residual Values

The economic appraisal includes the residual values of the road assets. The residual value reflects that fact that some infrastructure assets may have economic lives which extend beyond the evaluation period. Residual values are entered in the last year of the evaluation period to represent the unused portion of the asset life after the evaluation period.

## 2.6 Capital and Maintenance Costs

Capital costs and maintenance costs for existing and Concept Design have been provided by Roads and Maritime.

Table 2-2. Summarise capital costs (P90) for the Cconcept Design. Appendix E includes detailed cost estimates provided by Roads and Maritime.

*Table 2-2 Capital Costs (P90)*

| Option | ($million) P90 |
|---|---|
| Concept Design | [redacted] |

Source: Roads and Maritime's cost estimated received on 29 May 2017

Table 2-3 shows construction period and traffic opening year for the Concept Design.

*Table 2-3 Construction and Traffic Opening Year*

| Option | Construction Period | Year Open to Traffic |
|---|---|---|
| Concept Design | 2017-2021 | 2021 |

Source: Roads and Maritime

# 3 Evaluation Results

The cost benefit analysis (CBA) for the Concept Design have considered the project benefits including travel time savings, vehicle operating cost savings, reduction in crash costs, environmental and externality costs, residual value of the asset and maintenance savings.

The results of the economic appraisal for the concept design for P90 cost are summarised in Table 3-1.

*Table 3-1 Summary of Economic Appraisal - 7% Discount Rate*

| Decision Criteria | P90 Cost |
|---|---|
| PV Cost ($M) | [redacted] |
| PV Benefit ($M) | $196 |
| NPV | [redacted] |
| BCR | 2.4 |
| IRR | 14% |

The results in Table 3-1 show that:

- The road user benefit would exceed the capital cost and the project is economically viable
- The BCR for the project is estimated to be 2.4.
- The total road user benefit would be $196 million with a capital cost of [redacted].

Table 3-2 provides a summary of the discounted benefits by road users for the project.

*Table 3-2 Benefits Breakdown ($million)*

| Discounted Benefits | P90 | |
|---|---|---|
| | ($million) | Percent |
| Savings in Travel Time | $ 173 | 88% |
| Savings in Vehicle Operating Costs (travel distance savings) | $ 2.8 | 1.4% |
| Savings in Vehicle Operating Costs (number of stops savings) | $ 12 | 6% |
| Savings in Crash Costs | $ 2.4 | 1.2% |
| Environmental and External Benefits | $ 1.3 | 0.7% |
| Residual Value | $ 3.5 | 1.8% |
| Maintenance Savings | $ 0.6 | 0.3% |
| Total PV of Benefits | $ 196 | 100% |

The results from Table 3-2 indicate that the project would provide substantial road user benefit. About 88 per cent total benefit was contributed by travel time savings. Vehicle operating costs savings (including travel distance savings and number of stops savings) contributed about 7 per cent. The crash cost savings contributed about one per cent. Residual value contributed about two percent. Environmental and external benefits contributed about 0.7 per cent. Savings in maintenance costs contributed about 0.3 per cent.

### 3.1.1 Sensitivity Analyses

A sensitivity analysis was carried out as part of the economic appraisal. The economic analysis tested sensitivity of the results to discount rates and on estimation of costs and benefits.

#### 3.1.1.1 Sensitivity on Discount Rates

The sensitivity analysis was carried out for 4 per cent and 10 per cent discount rate. The results of the sensitivity analysis on discount rates are shown in Table 3-3. For a 4 per cent discount rate, BCR is estimated to be 3.9. For a 10 per cent discount rate, BCR is estimated to be 1.5.

*Table 3-3 Sensitivity Analyses Results on Discount Rates*

| Discount Rate | Decision Criteria | P90 |
|---|---|---|
| 4% | NPV ($M) | [redacted] |
| | BCR | 3.9 |
| 10% | NPV ($M) | [redacted] |
| | BCR | 1.5 |

#### 3.1.1.2 Sensitivity on Costs and Benefits

The results of the sensitivity analysis on the costs and benefits are provided in Table 3-4. The table provide the resulting economic parameters for a +/- 20% deviation on the cost estimates and the benefits streams, as well as the effect of a delayed delivery by one year.

The BCR is estimated to be 2.0 if cost estimates are increased by 20 per cent (as a worst case).

Similarly, the BCR is estimated to be 1.9 if benefits are decreased by 20 per cent (as a worst case).

The BCR is estimated to be 2.4 if there is a delay in delivery by one year.

*Table 3-4 Sensitivity Analyses on Costs and Benefits*

| Sensitivity Analysis | P90 | |
|---|---|---|
| | BCR | NPV ($M) |
| Cost Estimate +20% | 2.0 | [redacted] |
| Cost Estimate -20% | 3.0 | [redacted] |
| Benefits +20% | 2.9 | [redacted] |
| Benefits – 20% | 1.9 | [redacted] |
| Delay in delivery by one year | 2.3 | [redacted] |

### 3.1.2 Summary

The road user benefit of the project is estimated to be exceeded the capital costs. The proposed upgrades are economically viable. The BCR for the project is estimated to be 2.4.

A summary of cost benefit analysis is shown below.

| BCR Summary | | |
|---|---|---|
| A | Concept Design | 30-year economic evaluation<br>Road user benefits using SIDRA Network<br>New three lane bridge replacement consist of two lanes in southbound direction and one lane in northbound direction |
| B1 | Summary of Evaluation Results<br>Cost Benefit Analysis (CBA) | Base Case – existing two lane bridge<br>Project Type: Windsor Bridge Replacement<br>Local evaluation |
| B2 | Evaluation Assumptions | Cost of upgrade (at P90) [redacted]<br>Travel Time, Vehicle Operating Costs, Crash Costs, Environmental and External Costs as per Economic Appraisal Guidelines |
| C | Summary of Evaluation Results<br><br>Sensitivity Results | 7% discount rate, P90<br>Benefit/Cost Ratio 2.4<br><br>4% discount rate, P90<br>Benefit/Cost Ratio 3.9<br><br>10% discount rate, P90<br>Benefit/Cost Ratio 1.5 |

Detailed discounted benefits and costs are included in Appendix F.

# APPENDIX A ROADS AND MARITIME'S CONCEPT DESIGN


Source: Windsor Bridge Replacement Project Update, December 2016, Roads and Maritime Services

*Figure A-1 Roads and Maritime's Concept Design*

# APPENDIX B TRAFFIC MODELLING DATA

The traffic output from SIDRA model was normalised. The normalisation process for SIDRA Network is outlined below:

- SIDRA output of "demand" flows represents total demand for the network
- SIDRA output of "arrival flows" represents number of trips that complete its journey.
- Difference between "demand flows" and "arrival flow" indicates level of "unreleased" trips for the network
- The average trip time therefore is estimated using the total network (VHT) divided by "arrival flows". A similar logic applies to average trip length and number of stops.

Table A-1 summarises modelling input used in cost benefit analysis.

*Table A-1 Model Outputs for BCR – Concept Design*

| Item/Model | AM Peak 1 Hour | | | | | |
|---|---|---|---|---|---|---|
| | 2017 | | 2026 | | 2036 | |
| | Base Case | Concept Design | Base Case | Concept Design | Base Case | Concept Design |
| Total trip time (VHT) | 88 | 71 | 183 | 90 | 304 | 107 |
| Total distance (VKT) | 3199 | 3067 | 3642 | 3475 | 3983 | 3794 |
| Total stops | 4372 | 3754 | 9780 | 4571 | 13272 | 5575 |
| **Item/Model** | **PM Peak 1 Hour** | | | | | |
| | **2017** | | **2026** | | **2036** | |
| | **Base Case** | **Concept Design** | **Base Case** | **Concept Design** | **Base Case** | **Concept Design** |
| Total trip time (VHT) | 99 | 79 | 233 | 143 | 504 | 270 |
| Total distance (VKT) | 3124 | 3022 | 3639 | 3522 | 4016 | 3860 |
| Total stops | 3343 | 3582 | 6580 | 5573 | 9869 | 8084 |

Source: SIDRA Network. Model file: \\HC-AUS-NS-FS-01\jobs\10005593\D-Calculations\SIDRA modelling\Final model\ 2026\RevH

# APPENDIX C PROJECT SPECIFIC VARIABLE FOR ROAD USER BENEFITS

This Appendix B summarises the project specific variables for benefits suitable for the study, including:

- Escalation factors (2016 values to 2017 values)
- Expansion factors
- Vehicle compositions
- Values of time (VOT)
- Vehicles operating costs (VOC)
- Environmental and externality costs.

## Reference traffic data and guideline used

To determine project specific variables for road user benefits suitable for the study, the following data and guidelines were used:

- *Appendix 4 Economic Parameter Values and Valuation Methodologies of TfNSW's Principles and Guidelines for Economic Appraisal of Transport Investment and Initiative, June 2016* (hereafter referred as 'June 2016 TfNSW Guideline').
- Traffic surveys (tube counts) undertake on the Windsor Bridge in March 2017.

## Escalation factors

All parameter values suggested in June 2016 TfNSW Guideline are at March 2016 dollar. Table 82 in the June 2016 TfNSW Guideline suggested key indices used to escalate the parameters values and forecast. Table B-1 below summarises escalation factors to estimate 2017 values based on 2016 values suggested in the June 2016 TfNSW Guideline

*Table B-1 Escalation Factors 2016 to 2017 Values*

| Parameters | Vehicles | Escalation Factors 2016 to 2017 Values | Indices |
|---|---|---|---|
| Values of time (VOT) | Light vehicle | 102.75% | AWE NSW ($) |
| | Heavy vehicle | 102.24% | PPI road freight Index |
| Vehicle operating costs per kilometre (VOC/km) | Light vehicle | 102.25% | CPI Private Motoring Index |
| | Heavy vehicle | 102.24% | PPI road freight Index |
| Vehicle operating costs per stop (VOC/stop) | Light vehicle | 102.25% | CPI Private Motoring Index |
| | Heavy vehicle | 102.24% | PPI road freight Index |
| Externality and Crash costs | Light vehicle | 102.25% | CPI Sydney Index |
| | Heavy vehicle | 102.25% | CPI Sydney Index |

## Expansion factors

Traffic modelling is usually undertaken for peak hours (i.e. one hour AM peak and one hour PM peak). To estimate annual road user benefits from traffic modelling results, the annual expansion factor is used to expand AM and PM peak to annual numbers. Table B-2 below summarise cost expansion factors for Sydney roads suggested in the Table 71 in the June 2016 TfNSW Guideline.

For the study purpose, an annual expansion factor of 2113 was used, consistent with the TfNSW Guide

*Table B-2 TfNSW's Suggested Expansion Factors – Sydney Roads*

| Parameters | Values |
|---|---|
| From peak two hours to weekday | 6.29 |
| From weekday to year | 336 |
| Peak two hours (AM peak one hour + PM peak one hour) to Annual | 2113 |

## Vehicle compositions on Windsor Bridge

Table B-3 shows vehicle compositions on the Windsor Bridge obtained from March 2017 traffic survey. On the Windsor Bridge, the proportion of light vehicles was found in the order of 89%. The proportion of heavy vehicles was found in the order of 11%.

*Table B-3 Vehicle Compassions on the Windsor Bridge (March 2017 Traffic Survey)*

| Vehicle type | Vehicle Classification | Austroads Class | Descriptions | Vehicle Composition (%) | %Vehicle Composition (%) |
|---|---|---|---|---|---|
| Light Vehicles | Light | 1 | Short | 88.0% | 89.2% |
| | | 2 | Short Towing | 1.2% | |
| Heavy Vehicles | Medium | 3 | 2 axle Truck or bus | 6.8% | 10.8% |
| | | 4 | 3 Axle Truck or Bus | 1.8% | |
| | | 5 | 4 or 5 Axle Truck | 0.5% | |
| | Heavy | 6 | 3 axle Articulated | 0.2% | |
| | | 7 | 4 Axle Articulated | 0.2% | |
| | | 8 | 5 Axle Articulated | 0.2% | |
| | | 9 | 6 Axle Articulated | 0.6% | |
| | | 10 | B Double | 0.3% | |
| | | 11 | Double Road Train | 0.1% | |
| | | 12 | Triple Road Train | 0.0% | |
| **Total** | **All vehicles** | **1-12** | **All vehicles** | **100.0%** | **100.0%** |

## Values of time (VOT)

Values of time (VOT) for light and heavy vehicles were estimated using urban parameters suggested in Table 9 in the June 2016 TfNSW Guideline and the vehicle composition observed in the study area.

Table B-4 below summarises values of time (VOT) estimates for light and heavy vehicles for the study area. The parameters were projected to 2017 values using escalation factors suggested in the June 2016 TfNSW Guideline.

*Table B-4 Values of Time Estimates for the Study Area - Urban*

| Vehicle Classification | Vehicle Composition (%) | Average hourly value ($/veh-hr) 2016 Values | Forecasting Indices for 2016 to 2017 | Average hourly value ($/veh-hr) 2017 Values |
|---|---|---|---|---|
| Light Vehicle | 89.22% | $28.81 | 102.75 | $29.60 |
| Heavy Vehicle | 10.78% | $53.00 | 102.24 | $54.19 |
| **Weighted based on vehicle composition** | **100.00%** | **$31.42** | | **$32.25** |

## Vehicle operating costs (VOC)

Vehicle operating costs (VOC) by vehicle type were estimated using resource cost parameters suggested in Table 12 in the June 2016 TfNSW Guideline and the vehicle composition observed in the study area. The VOC parameters were suggested for urban stop-start conditions for different travel speeds.

Table B-5 below summarises VOC parameters by vehicle type for urban stop-start model. The parameters were projected to 2017 values using escalation factors suggested in the June 2016 TfNSW Guideline.

*Table B-5 Vehicle Operating Cost per Kilometre - Urban Stop-start Model*

| Vehicle category | Austroads Class | Value per km (cent/km) | | |
|---|---|---|---|---|
| | | Urban stop-start model (km/h) 2016 Values | Forecasting Indices for 2016 to 2017 | Urban stop-start model (km/h) 2017 Values |
| | | 30 | | 40 |
| Light Vehicle | 1 small | 38.9 | 102.25 | 39.8 |
| | 2 medium | 54.4 | 102.25 | 55.6 |
| | 2 large | 72.8 | 102.24 | 74.4 |
| Heavy Vehicle | 3 | 85.7 | 102.24 | 87.6 |
| | 4 | 111.6 | 102.24 | 114.1 |
| | 5 | 142.9 | 102.24 | 146.1 |
| | 6 | 196.1 | 102.24 | 200.5 |
| | 7 | 196.1 | 102.24 | 200.5 |
| | 8 | 214.9 | 102.24 | 219.7 |
| | 9 | 232.6 | 102.24 | 237.8 |
| | 10 | 277.1 | 102.24 | 283.3 |
| | 11 | 335 | 102.24 | 342.5 |
| | 12 | 430.1 | 102.24 | 439.8 |
| **Weighted based on vehicle composition** | **1-12** | **47.4** | | **48.5** |

## Vehicle operating costs per stop

Table B-6 below shows vehicle operating cost per stop (cent per stop) suggested in Table 16 in in the June 2016 TfNSW Guideline. The parameters were projected to 2017 values using escalation factors suggested in the June 2016 TfNSW Guideline.

*Table B-6 Vehicle Operating Cost per Stop*

| Vehicle Type | Austroads Class | Vehicle Operating Cost per Stop (cent/stop) | | |
|---|---|---|---|---|
| | | 2016 Values (Table 16) | Escalation Factors 2016 to 2017 Values | 2017 Values |
| Car | 1-2 | 6.6 | 102.25 | 6.7 |
| Light Truck | 3-6 | 22.8 | 102.24 | 23.4 |
| Heavy Truck | 7-9 | 59.9 | 102.25 | 61.2 |
| **Weighted based on vehicle composition** | **1-12** | **8.9** | | **9.1** |

## Environmental and externality costs

Road use produces external costs on society in terms of the economic costs of environmental impacts. Environmental costs are determined by applying externality values per vehicle-kilometres travelled (VKT) based on vehicle composition form the traffic analysis. These parameter values include noise pollution, air pollution, water pollution, greenhouse gas emissions, nature and landscape, urban separation, and upstream and downstream.

Table B-7 below summarises environmental and externality cost (cent per kilometre) for urban road suggested in Table 58 and Table 60 in the June 2016 TfNSW Guideline. The parameters were projected to 2017 values using escalation factors suggested in the June 2016 TfNSW Guideline. Environmental unit costs for passenger vehicles are expressed in cents per VKT. For heavy vehicles the environmental unit costs are expressed in dollars per 1000 tonne kilometre (tkm) travelled.

*Table B-7 Externality Costs – Urban Road*

| Vehicle Type | Austroads Class | Environmental and Externality Costs (cent/kilometre) Urban Road | | |
|---|---|---|---|---|
| | | 2016 Values (Table 58 and Table 60) | Escalation Factors 2016 to 2017 Values | 2017 Values |
| Light vehicle | 1-2 | 12.2 | 102.25 | 12.5 |
| Rigid truck | 3-6 | 87.5 | 102.25 | 89.5 |
| Semi-trailer | 7-9 | 199.1 | 102.25 | 203.6 |
| B-Double | 10 | 297.6 | 102.25 | 304.3 |
| A-Double | 11-12 | 396.1 | 102.25 | 405.0 |
| **Weighted based on vehicle composition** | **1-12** | **22.4** | | **22.9** |

# APPENDIX D CRASH REDUCTION AND SAFETY BENEFIT ANALYSIS

## Historical Crash Data

This Appendix C summarises crash reductions and crash cost savings (safety benefit) undertaken for the Concept Design of Windsor Bridge Replacement Project.

Recorded crash statistic for Bridge Street between Freemans Reach Road and Macquarie Street (study area) were obtained from Roads and Maritime for the period of July 2011 to December 2016.

Table C-1 below summarises recorded crashes by roads and locations. crashes recorded between July 2011 to December 2016 indicated that about 52 crashes occurred in the study area. Of all crashes reported, about 41 crashes occurred at intersections, 8 crashes occurred on the undivided road sections, and 3 crashes occurred on the divided road sections.

The severity of crashes classified as fatal, injury and non-casualty are shown in Table C-2. Of the total 52 crashes recorded in the study area between July 2011 to December 2016, no fatal crashes were recorded. About 20 crashes (38%) were recorded as injury with 20 people injured. About 32 crashes (62%) were recorded as non-casualty (tow-away).

*Table C-1 Locations of Crashes*

| Road | Total Number Crashes Recorded | Intersection* | Non-intersection | |
|---|---|---|---|---|
| | | | Two-way undivided road | Divided Road |
| Bridge Street | 23 | 17 | 4 | 2 |
| George Street | 1 | 1 | 0 | 0 |
| Macquarie Street | 4 | 3 | 0 | 1 |
| Wilberforce Road | 24 | 20 | 4 | 0 |
| **Total** | **52** | **41** | **8** | **3** |

Source: Roads and Maritime's crash data between July 2011 and December 2016, Note: * Up to 10 metres from an intersection

Table C-2 Number of Crashes by Severity

| Crash Severity | Number of Crashes Recorded | % | Casualties |
|---|---|---|---|
| Fatal | 0 | 0% | |
| Injury | 20 | 38% | 20 people injured |
| Non-casualty | 32 | 62% | |
| **Total** | **52** | **100%** | **20** |

Figure C-1 shows number of crashes per movement type. The four most common types of crashes account for around 87 per cent of the reported crashes within the study area:

- Intersection, from adjacent approaches (38%)
- Opposing vehicles; turning (21%)
- Rear-end (15%)
- Off carriageway, on curve, hit object (8%).

Crashes other than the above constitute the remaining 17 per cent.

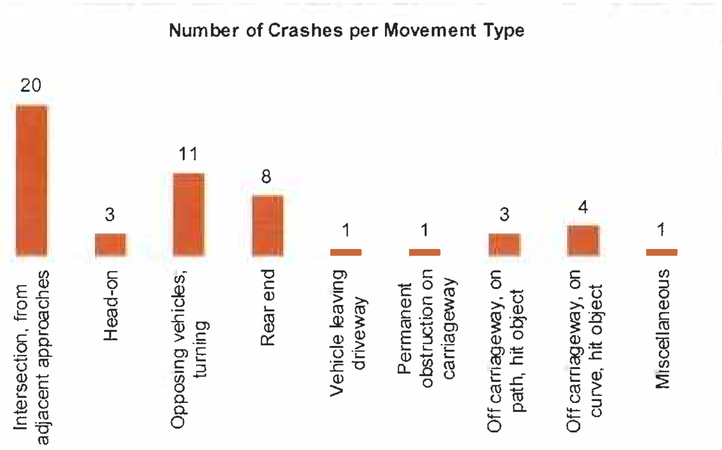


*Figure C1 Number of Crashes per Movement Type*

Figure C-2 shows crash locations on Bridge Street and approach roads. Figure C-2 indicates that crashes are mostly located at intersections. Particularly crash-prone locations are:

- Freemans Reach Road and Wilberforce Road intersection
- Bridge Street and George Street intersection
- Bridge Street and Macquarie Street intersection.


*Figure C-2 Spatial Distribution of Crashes on Bridge Street and Approach Roads*

## Crash Reduction Analysis

Crash reduction analysis was undertaken by comparing existing and proposed (i.e. with concept design) conditions to determined estimated crash reduction statistics based on historical data from July 2011 to December 2016.

Should the Windsor Bridge Replacement Project be constructed as per the Roads and Maritime's concept design, this would result in crash reduction on the Windsor Bridge and adjacent intersections. Crash reduction attributable to the bridge replacement were determined in two categories including:

- Crash reduction attributable to the Winsor Bridge replacement between George Street and Wilberforce Road as per concept design.
- Crash reduction attributable to proposed intersections upgrade at:
  - Wilberforce Road / Freeman Reach Road (new roundabout)
  - Bridge Street / George Street (new traffic signal)
  - Bridge Street / Macquarie Street (upgraded traffic signal).

### 1. Crash Reduction Attributable to the Windsor Bridge Replacement

Crash reduction attributable to the bridge replacement was determined by comparing existing and proposed (Concept design) crash rates on the Windsor Bridge between George Street and Wilberforce Road.

Table C-3 summarises crash rates on the Windsor Bridge between George Street and Wilberforce Road for existing and proposed (Concept Design) conditions. Existing crash rates per 100 million vehicle kilometres travelled (100MVKT) on the Windsor Bridge was calculated based on crash statistics from July 2011 to December 2016. Crash rates for post-upgrade were estimated assuming the existing two lane bridge will be replaced by new three lane bridge (two lanes in southbound direction and one lane in northbound direction).

The new three lane bridge is predicted to reduce casualty crash rate from 27.7 crashes per 100MVKT (existing) to 18.5 crashes per 100 MVKT (with Concept Design). Non- casualty crash rate is predicted to reduce from 23.1 crashes per 100 MVKT (existing) to 9.2 crashes per 100MVKT (with Concept Design).

*Table C-3 Crash Rates on Windsor Bridge between George Street and Wilberforce Road for Existing and Proposed (with Concept Design) Conditions*

| Statistics | | Crash Statistics on Windsor Bridge | |
|---|---|---|---|
| | | Existing Condition | Proposed Condition (with Concept Design) |
| Distance (km) | km | 0.50 | 0.50 |
| Fatal Crash | Crashes per year | 0 | 0 |
| Injury Crash | Crashes per year | 1.1 | 0.7 |
| Casualty Crash | Crashes per year | 1.1 | 0.7 |
| Non-casualty (tow away) | Crashes per year | 0.9 | 0.4 |
| ADT | Vehicles per day | 21550 | 21550 |
| Casualty Crash Rate | Crashes per 100MVKT | 27.7 | 18.5 |
| Fatal Crash Rate | Crashes per 100MVKT | 0.0 | 0.0 |
| Injury Crash Rate | Crashes per 100MVKT | 27.7 | 18.5 |

| Statistics | | Crash Statistics on Windsor Bridge | |
|---|---|---|---|
| | | Existing Condition | Proposed Condition (with Concept Design) |
| Non-casualty (tow away) | Crashes per 100MVKT | 23.1 | 9.2 |

## 2. Crash Reduction Attributable to the Intersections Upgrade

Crash reduction attributable to the intersections upgrade proposed in the Roads and Maritime's concept design was determined using Roads and Maritime's Crash Reduction Guide, August 2005.

Table C-4 shows number of intersection related crashes recorded between July 2011 to December 2016 by DCA codes for existing (without upgrade) and proposed (with Concept Design) conditions. Table C-4 includes potential reductions on crashes by DCA codes for upgrade as per Road and Maritime Guide.

*Table C-4 Existing and Proposed Crashes by DCA – Intersections Upgrade*

| DCA Code | Collision Type | Existing Condition | Proposed Condition (with Concept Design | Change | % Change |
|---|---|---|---|---|---|
| 101-109 | Intersection, from adjacent approaches | 20 | 7 | 13 | 65% |
| 202-206 | Opposing vehicles; turning | 11 | 8 | 3 | 27% |
| 301-303 | Rear end | 6 | 4 | 2 | 33% |
| 401-409 | Vehicle leaving driveway | 1 | 1 | 0 | 0% |
| 605 | Permanent obstruction on carriageway | 1 | 1 | 0 | 0% |
| 803-804 | Off carriageway, hit object | 2 | 2 | 0 | 0% |
| **Total** | | **41** | **23** | **18** | **44%** |

The analysis in Table C-4 indicated that the intersections upgrade proposed in the design has potential to reduce intersection related crashes by 44% from 41 to 23 crashes.

Table C-5 summarise annual crash rates (intersection related crashes) for existing and proposed conditions. The proposed upgrade would reduce annual crash rate from 7.5 existing to 4.2 crashes per year for proposed condition.

*Table C-5 Existing and Proposed Annual Crash Rates – Intersections Upgrade*

| Intersections Upgrade | Existing Condition | Proposed Condition (with Concept Design) | Change | % Change |
|---|---|---|---|---|
| Total crashes per year | 7.5 | 4.2 | 3.3 | 44% |

## Crash Cost Savings

The annual crash cost savings are estimated using the average crash costs by accident type, and based on the 'willingness to pay' approach sourced from Table 52 in *Appendix 4 Economic Parameter Values and Valuation Methodologies of TfNSW's Principles and Guidelines for Economic Appraisal of Transport Investment and Initiative, June 2016* ('June 2016 TfNSW Guideline').

Table C-6 shows fatality and injury costs for urban road used in the analysis. The parameters were projected to 2017 values using escalation factors suggested in Table 82 in the June 2016 TfNSW Guideline.

*Table C-6 Cost per Casualty Crash – Urban Road*

| Crash Type | Cost per Casualty Crash – Urban 2016 Values | Escalation Factors 2016 to 2017 Values | Cost per Casualty Crash – Urban 2017 Values |
|---|---|---|---|
| Fatal crash (at least one person killed) | $7,563,434 | 102.25 | $7,733,238 |
| Unknown injury type crash | $201,026 | 102.25 | $205,539 |
| Property damage only | $9,743 | 102.25 | $9,962 |

Table C-7 summarises net annual crash cost savings attributable to the concept design.

*Table C-7 Estimated Crash Cost Savings*

| Years | Crash Cost (2017 Values) | | |
|---|---|---|---|
| | Existing Condition | Proposed Condition (with Concept Design) | Net Savings |
| 2021 Opening Year | $750,527 | $489,920 | $260,608 |
| 2026 | $772,473 | $504,323 | $268,150 |
| 2036 | $803,860 | $524,923 | $278,938 |

# APPENDIX E DETAILED COST ESTIMATES PROVIDED BY ROADS AND MARITIME

[redacted]

Source: Roads and Maritime, Final Windsor Bridge 100% Detailed Estimate.xlsx, received on 29 May 2017

# APPENDIX F DETAILED BENEFITS AND COSTS ANALYSIS

## Summary Calculations - P90 Cost

**Base Year** 2017
**Opening Year** 2021
**Model Years**

**Analysis Period** 30 years
**Economic Life** 50 years

| | | Costs | | | Benefits | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analysis Period | Year | Construction Costs | Net Maintenance Costs | Total Costs | VHT | VKT | Stops | Crash Reduction | Externality | Maintenance Savings | Residual Value | Total Benefits | Net Benefit (Cost) | First Year Benefit |
| Base Year | 2017 | [redacted] | | [redacted] | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | [redacted] | $0 |
| 1 | 2018 | | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | | $0 |
| 2 | 2019 | | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | | $0 |
| 3 | 2020 | | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | | $0 |
| 4 | 2021 | | | | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | | $0 |
| 5 | 2022 | $ - | | $0 | $8,108,229 | $268,291 | $696,689 | $262,066 | $126,643 | $80,000 | $0 | $9,541,917 | | $9,541,917 |
| 6 | 2023 | $ - | | $0 | $9,216,591 | $273,974 | $821,457 | $263,549 | $129,326 | $40,000 | $0 | $10,744,897 | | $0 |
| 7 | 2024 | $ - | | $0 | $10,324,954 | $279,657 | $946,226 | $265,057 | $132,008 | $80,000 | $0 | $12,027,902 | | $0 |
| 8 | 2025 | $ - | | $0 | $11,433,316 | $285,341 | $1,070,994 | $266,590 | $134,691 | $60,000 | $0 | $13,250,933 | | $0 |
| 9 | 2026 | $ - | | $0 | $12,541,678 | $291,024 | $1,195,763 | $268,150 | $137,374 | $80,000 | $0 | $14,513,989 | | $0 |
| 10 | 2027 | $ - | | $0 | $14,221,463 | $297,222 | $1,258,603 | $269,177 | $140,299 | $40,000 | $0 | $16,226,764 | | $0 |
| 11 | 2028 | $ - | | $0 | $15,901,248 | $303,420 | $1,321,444 | $270,214 | $143,225 | $80,000 | $0 | $18,019,551 | | $0 |
| 12 | 2029 | $ - | | $0 | $17,581,032 | $309,618 | $1,384,285 | $271,263 | $146,151 | $60,000 | $0 | $19,752,349 | | $0 |
| 13 | 2030 | $ - | | $0 | $19,260,817 | $315,815 | $1,447,126 | $272,324 | $149,076 | $80,000 | $0 | $21,525,158 | | $0 |
| 14 | 2031 | $ - | | $0 | $20,940,601 | $322,013 | $1,509,967 | $273,396 | $152,002 | $40,000 | $0 | $23,237,979 | | $0 |
| 15 | 2032 | $ - | | $0 | $22,620,386 | $328,211 | $1,572,807 | $274,481 | $154,928 | $80,000 | $0 | $25,030,812 | | $0 |
| 16 | 2033 | $ - | | $0 | $24,300,170 | $334,409 | $1,635,648 | $275,577 | $157,853 | $60,000 | $0 | $26,763,657 | | $0 |
| 17 | 2034 | $ - | | $0 | $25,979,955 | $340,607 | $1,698,489 | $276,685 | $160,779 | $80,000 | $0 | $28,536,514 | | $0 |
| 18 | 2035 | $ - | | $0 | $27,659,739 | $346,805 | $1,761,330 | $277,805 | $163,704 | $40,000 | $0 | $30,249,383 | | $0 |
| 19 | 2036 | $ - | | $0 | $29,339,524 | $353,003 | $1,824,170 | $278,938 | $166,630 | $80,000 | $0 | $32,042,264 | | $0 |
| 20 | 2037 | $ - | | $0 | $29,339,524 | $353,003 | $1,824,170 | $280,083 | $166,630 | $60,000 | $0 | $32,023,410 | | $0 |
| 21 | 2038 | $ - | | $0 | $29,339,524 | $353,003 | $1,824,170 | $281,240 | $166,630 | $80,000 | $0 | $32,044,567 | | $0 |
| 22 | 2039 | $ - | | $0 | $29,339,524 | $353,003 | $1,824,170 | $282,411 | $166,630 | $40,000 | $0 | $32,005,738 | | $0 |
| 23 | 2040 | $ - | | $0 | $29,339,524 | $353,003 | $1,824,170 | $283,594 | $166,630 | $80,000 | $0 | $32,046,921 | | $0 |
| 24 | 2041 | $ - | | $0 | $29,339,524 | $353,003 | $1,824,170 | $284,790 | $166,630 | $60,000 | $0 | $32,028,117 | | $0 |
| 25 | 2042 | $ - | | $0 | $29,339,524 | $353,003 | $1,824,170 | $286,000 | $166,630 | $80,000 | $0 | $32,049,327 | | $0 |
| 26 | 2043 | $ - | | $0 | $29,339,524 | $353,003 | $1,824,170 | $287,223 | $166,630 | $40,000 | $0 | $32,010,549 | | $0 |
| 27 | 2044 | $ - | | $0 | $29,339,524 | $353,003 | $1,824,170 | $288,459 | $166,630 | $80,000 | $0 | $32,051,786 | | $0 |
| 28 | 2045 | $ - | | $0 | $29,339,524 | $353,003 | $1,824,170 | $289,709 | $166,630 | $60,000 | $0 | $32,033,035 | | $0 |
| 29 | 2046 | $ - | | $0 | $29,339,524 | $353,003 | $1,824,170 | $290,972 | $166,630 | $80,000 | $0 | $32,054,299 | | $0 |
| 30 | 2047 | $ - | | $0 | $29,339,524 | $353,003 | $1,824,170 | $292,250 | $166,630 | $40,000 | $0 | $32,015,576 | | $0 |
| 31 | 2048 | $ - | | $0 | $29,339,524 | $353,003 | $1,824,170 | $293,541 | $166,630 | $80,000 | $0 | $32,056,868 | | $0 |
| 32 | 2049 | $ - | | $0 | $29,339,524 | $353,003 | $1,824,170 | $294,847 | $166,630 | $60,000 | $0 | $32,038,174 | | $0 |
| 33 | 2050 | $ - | | $0 | $29,339,524 | $353,003 | $1,824,170 | $296,167 | $166,630 | $80,000 | $0 | $32,059,494 | | $0 |
| 34 | 2051 | $ - | | $0 | $29,339,524 | $353,003 | $1,824,170 | $297,501 | $166,630 | $40,000 | $38,420,406 | $70,441,234 | | $0 |

| Discount Rate | Capital Costs | Net Maintenance Costs | PV of Costs | PV of Benefits | NPV | BCR | First Year Benefit | FYRR | IRR | 14% |
|---|---|---|---|---|---|---|---|---|---|---|
| 4% | [redacted] | $0 | [redacted] | $345,065,562 | [redacted] | 3.9 | $7,541,116 | 8.6% | | |
| 7% | | $0 | | $196,348,829 | | 2.40 | $6,358,182 | 7.8% | | |
| 10% | | $0 | | $119,277,019 | | 1.5 | $5,386,163 | 7.0% | | |

# Appendix 3: Benefits Realisation Strategy

# Benefits Realisation Plan

## Windsor Bridge Replacement

Project number: A/66737
RMS document number: RMS document number
Version: Version no. 3

Infrastructure Development

# About this document

## Document information

| | |
|---|---|
| File name | Benefits Realisation Strategy – Windsor Bridge Replacement Project – Final Business Case |
| Document number | 1 |
| Objective ID | Objective ID |
| Version number | Version No. 3.0 |
| Date | 28 July 2017 |
| Prepared by | Roads and Maritime Services & Jacobs (Australia) Pty Ltd |

## Project information

| | |
|---|---|
| Project name | Windsor Bridge Replacement Project – Final Business Case |
| Project number | A/66737 |

## Approvals

| Approval and authorisation | Position | Name | Date |
|---|---|---|---|
| Prepared by | Project Manager (Jacobs)<br>Project Manager (RMS) | Tim Rodham<br>G Singh | 7 October 2016<br>7 October 2016 |
| Approved or authorised by | Senior Project Manager | G Standen | 7 October |

# Revision history

| Issue | Date | Revision description |
|---|---|---|
| 1.0 | 08 August 2016 | Draft Report |
| 2.0 | 7 October 2016 | Final Report |
| 3.0 | 28 July 2017 | Final Report – Updated traffic data and modelling results |

# Contents

# 1 INTRODUCTION

## 1.1 Purpose of this document

The purpose of this document is to identify all the benefits that are applicable to this project and identify how they are linked to the project objectives and the relevant Transport objectives. This plan will also detail how the benefits will be achieved, who is responsible for delivery of the benefits, and what will be used to measure whether the project was successful.

## 1.2 Reviewing and updating this document

The initial version of this plan will be produced in the early stages of the project development phase to support the production of the Strategic Business Case (and subsequent Business Cases). It will be reviewed and revised as necessary throughout the development of the project.

## 1.3 Benefits Realisation Table

Note that the bulk of this document is the Benefits Realisation Table to be found at the end. It should provide rigour in answering the following questions:

- What are we attempting to achieve with this project/program?
- How does it fit into the objectives outlined in the Long Term Transport Master Plan and the 10 Year Road Program objectives?
- What specific measures will we use to measure the success of the project/program against those objectives?
- What do we expect to achieve in terms of those key measures?
- When and how will we measure success (or otherwise) in meeting those measures?

# 2 PROJECT INFORMATION

## 2.1 Project background

The project is located at Windsor in the Hawkesbury local government area about 57 kilometres North West of Sydney. Windsor is a major historic town, with European settlement dating back to the late 1700s. Today it is predominantly rural, although there is extensive and expanding urban development to the south and west of the town. The existing Windsor bridge was opened in 1874 and is the oldest existing bridge across the Hawkesbury River. It provides an important local link for communities on each side of the river, as well as an important regional link between western Sydney, the Blue Mountains and the Hunter region. Around 19,000 vehicles use the bridge each day, with around seven per cent of these being heavy vehicles.

Parts of the existing bridge are over 140 years old and are deteriorating as a result of age and heavy use. Elements of the bridge have deteriorated substantially and it is not practical to replace or repair these elements. The existing bridge and adjacent intersections no longer meet the demands of current peak hour traffic volumes or current road standards. The level of maintenance required to maintain adequate road safety is no longer cost effective and it is therefore regarded that the bridge has reached the end of its economic life.

In June 2008, in recognition of the condition of the existing bridge and the volume of traffic it carried, the New South Wales (NSW) Government announced funding for its replacement. Preliminary investigations of potential bridge replacement options along with stakeholder consultations were completed in 2012, followed by completion and public display of the Environmental Impact Statement (EIS) exhibition. The NSW Minister for Planning and Infrastructure's Conditions of Approval was provided in December 2013 but were then appealed at the NSW Land and Environmental Court on the grounds of expected impact on the Thomson Square. In 2015 the appeal was denied and the court allowed the project to proceed.

## 2.2 Project Objectives

The primary aim of the project is to provide a safe and reliable crossing of the Hawkesbury River at Windsor.

The specific objectives for the project are as follows[1]:

- Replace the existing bridge which has reached the end of its economic life with a new bridge with a design life of 100 years
- Increase flood immunity of the bridge equivalent to the approach roads
- Support economic growth and productivity by providing a road with capacity LoS D or better for 2026 forecast traffic volumes
- Encourage active transport by providing appropriate facilities for cycling and walking

[1] *The objectives described here have been refined and as a result they differ slightly from those identified in the project's Environmental Impact Assessment (appendix 7).*

- Provide safe two-way traffic access for freight vehicles
- Design and construction works are to be sympathetic with local heritage and the environment
- To be cost effective and an affordable outcome
- Reduce crash rates to be no greater than the stereotypical rates for a primary arterial road (A2 road classification).

The project objectives are listed in Table 2-1 (Column E).

## 2.3 Benefits Plan

The Benefits plan is outlined in Table 2-1.

## 2.4 Additional non measurable benefits

There are a number of impacts, both positive and negative, not captured in the CBA. The most significant impacts include:

- Removing the risk of load limits on the bridge in the short term and bridge closure in the long term under the base case
- An improvement in flood immunity for the preferred option
- Improved connections for pedestrians and cyclists in the preferred option
- Some negative impacts on environmental and heritage values in the preferred option.

Windsor Bridge is at the end of its useful life, without investment there is a significant risk that load limits would be implemented on the bridge within a number of years. This would mean that heavy vehicles would be diverted approximately 20km per trip once the bridge was closed to them. In the longer term, if the bridge were closed permanently then all traffic would be required to divert and this would have a significant impact on both freight and passenger vehicles. Given RMS is unable to specify when a load restriction of permanent closure of the bridge would occur, the CBA analysis assumes that the bridge remains open in the Base Case without restrictions during the appraisal period.

The new Windsor Bridge will have a flood immunity of about a 1 in 4 year ARI flood event, which would be higher than the flood immunity of the existing bridge which is about a 1 in 2 year ARI flood event. There is no advantage in providing higher flood immunity as the Freemans Reach Road and Wilberforce Road would be cut by floodwaters for events greater than the 1 in 3 year ARI flood event.

The project will substantially enhance pedestrian and cyclist connections between the northern and southern bank, between the town centre and east Windsor, between the foreshore and George Street and to Macquarie Park.

From a dis-benefits point of view, the project will have an adverse impact on the Historic heritage and to a lesser extent Aboriginal archaeology. The project will directly impact the Thompson Square Conservation Area and any archaeological resources within the project footprint. While mitigation measures have been incorporated in the project design and would be implemented during the further design and construction phases, impacts on heritage and the Thompson Square Conservation Area would not be totally mitigated.

Table 2-1 Benefits Plan

| (A) ALIGNMENT WITH THE LONG TERM TRANSPORT MASTER PLAN OBJECTIVES | (B) 10 ROAD PROGRAM OBJECTIVES | PROBLEM DEFINITION | | (E) PROJECT OBJECTIVES | PERFORMANCE INDICATORS | | BENEFIT REALISATION | |
|---|---|---|---|---|---|---|---|---|
| | Delete objectives that are not relevant | (C) What is the current problem to be solved? B1 NOA *(federal)*<br>If we do nothing, what are the future needs? | (D) Does the proposed initiative (project) address these issues?<br>(Delete if not relevant and add to the list if appropriate) | After considering the problem definition, list the specific project objectives for the project | (F) Identify and provide baseline data (i.e. today, before project) used to identify the problem. Attempt to make comparisons with benchmarks.<br>NOA B2 *(federal)* | (G) List and describe the performance objectives and intended outcomes (i.e. in the future post project implementation)<br>NOA B3 *(federal)* | (H) List specific performance indicators to measure the performance of the asset post-completion<br>NOA B4 *(federal)* | (I) Having identified the performance indicators to measure post-completion performance, indicate when and how this will be done. |
| **Improve safety and security** | **1. Improve Road** Safety (reduce fatalities and **serious** injuries) | Traffic at the intersection of Wilberforce Rd (Bridge St) / Freemans Reach Rd exceeds the capacity for a give way control, leading to crashes occurring when vehicles are approaching from adjacent roads. | The project scope will change the control at the intersection of Wilberforce Rd (Bridge St) / Freemans Reach Rd to a roundabout configuration which is appropriate for the current and anticipated level of demand. | Reduce crash rates to be no greater than the stereotypical rates for a primary arterial road. | • 20 of the 52 (38 %) reported crashes in the study area between 2011 and 2016 were recorded on a Wilberforce Road related intersection.<br>• The same data also showed that 62% of total crashes involved only property/vehicle damage. Injury related crashes constituted 38% of total crashes.<br>• The data indicates that there were no fatal crashes. | • Reduction in the frequency of crashes at the intersection of Wilberforce Rd (Bridge St) / Freemans Reach Rd<br>• Reduction in the severity of crashes at the intersection of Wilberforce Rd (Bridge St) / Freemans Reach Rd | • 70% reduction in adjacent approach crashes by 2026 | RMS will conduct an annual analysis of crash reports concerning the new alignment. This report will compare adjacent crash statistics results to the intended reduction in adjacent crashes proposed by this project. |
| Support economic growth and productivity | **4. Improve Freight Productivity (support freight and long distance travel important to the NSW economy)** | Speed restrictions for heavy vehicles are currently imposed due to the structural weakness of the bridge | The design solution will:<br>• Increase the speed limit for heavy vehicles from 40 kph to 50 kph<br>• Enable two heavy vehicles to pass on the bridge without waiting. | Support economic growth and productivity by providing a road with capacity LOS D or better for 2026 forecast traffic volumes.<br><br>Provide safe two-way traffic access for freight vehicles | • 2,400 (11% of total traffic) heavy vehicles cross the Windsor Bridge each day but are limited to 40 kph compared to 60 kph for general traffic.<br>• Heavy vehicles are also subject to the congestion demonstrated by the poor level of service at certain intersections. | • Improved travel times for heavy vehicles through the removal of speed restrictions<br>• Improved travel times for heavy vehicles through improved level of service at intersections | • Level of service at all intersections to be no worse than Level of Service (LoS) 'D' at all intersections in 2026 | RMS will conduct traffic surveys on the new alignment in 2026, for the both day and afternoon peak periods. These surveys will identify LoS levels in 2026 and compare them to the specified LoS objective. |

| (A) ALIGNMENT WITH THE LONG TERM TRANSPORT MASTER PLAN OBJECTIVES | (B) 10 ROAD PROGRAM OBJECTIVES | PROBLEM DEFINITION | | (E) PROJECT OBJECTIVES | PERFORMANCE INDICATORS | | BENEFIT REALISATION | |
|---|---|---|---|---|---|---|---|---|
| | Delete objectives that are not relevant | (C) What is the current problem to be solved? B1 NOA *(federal)*<br>If we do nothing, what are the future needs? | (D) Does the proposed initiative (project) address these issues?<br>(Delete if not relevant and add to the list if appropriate) | After considering the problem definition, list the specific project objectives for the project | (F) Identify and provide baseline data (i.e. today, before project) used to identify the problem. Attempt to make comparisons with benchmarks.<br>NOA B2 *(federal)* | (G) List and describe the performance objectives and intended outcomes (i.e. in the future post project implementation)<br>NOA B3 *(federal)* | (H) List specific performance indicators to measure the performance of the asset post-completion<br>NOA B4 *(federal)* | (I) Having identified the performance indicators to measure post-completion performance, indicate when and how this will be done. |
| **Improve liveability** | **5. Improve traffic** efficiency (address specific traffic congestion **issues)** | Traffic volumes through the Windsor township exceed the capacity at key intersections causing delays | As well as replacing the Windsor Bridge, this proposal will re-model the adjoining road network; in particular the configuration of intersections which will improve traffic flow during peaks. | Provide safe two-way traffic access for freight vehicles. | • Intersection of Wilberforce Rd (Bridge St) / Freemans Reach Rd is currently operating at LoS 'E'.<br>• By 2026 the Bridge St / George St intersection will be operating at LoS D in the AM peak period and F in the PM period on the current bridge. | • Improved travel times for vehicles travelling on the Windsor network<br>• Reduced intersection delays | • Level of service at all intersections to be no worse than LoS 'D' at all intersections in 2026 | RMS will conduct traffic surveys on the new alignment in 2026, for the both day and afternoon peak periods. These surveys will identify (LoS) levels in 2026 and compare them to the specified (LoS) objective. |
| **Improve liveability** | **6. Connect communities (particularly enhances network connectivity in the regions)** | Frequent flood events require traffic needing to cross the Hawkesbury river at Windsor to take a 20km detour. | The project will raise the height of the Windsor Bridge to be consistent with the adjoining road network. | Increase flood immunity of the bridge equivalent to the approach roads. | • Over the past 100 years, the existing bridge is thought to have been flooded on 59 occasions.<br>• Between 1987 and 2011 there have been eight events for which water levels were higher than the level of the existing bridge. | • Improve flood immunity from about 1 in 2 year ARI flood event to approximately a 1 in 4 year ARI flood event. | • Number of bridge closures due to flooding . | RMS will annually record and review bridge closures due to flooding and record number of times new bridge remains open when existing bridge would have been closed. |

| (A) ALIGNMENT WITH THE LONG TERM TRANSPORT MASTER PLAN OBJECTIVES | (B) 10 ROAD PROGRAM OBJECTIVES | PROBLEM DEFINITION | | (E) PROJECT OBJECTIVES | PERFORMANCE INDICATORS | | BENEFIT REALISATION | |
|---|---|---|---|---|---|---|---|---|
| | Delete objectives that are not relevant | (C) What is the current problem to be solved? B1 NOA *(federal)*<br>If we do nothing, what are the future needs? | (D) Does the proposed initiative (project) address these issues?<br>(Delete if not relevant and add to the list if appropriate) | After considering the problem definition, list the specific project objectives for the project | (F) Identify and provide baseline data (i.e. today, before project) used to identify the problem. Attempt to make comparisons with benchmarks.<br>NOA B2 *(federal)* | (G) List and describe the performance objectives and intended outcomes (i.e. in the future post project implementation)<br>NOA B3 *(federal)* | (H) List specific performance indicators to measure the performance of the asset post-completion<br>NOA B4 *(federal)* | (I) Having identified the performance indicators to measure post-completion performance, indicate when and how this will be done. |
| Support regional development | **9. Replace assets not economical to maintain (reduce costs by replacing infrastructure that is not economical to maintain)** | The Windsor Bridge is now well beyond its original design life and requires regular inspections to ensure it is structurally safe to operate. While the bridge is suitable for current use, it would need extensive remedial works if it was to be used and maintained in a safe and acceptable condition into the future. | The proposal will provide both a new bridge and removal of the existing structure which would continue to pose a maintenance burden if it remained. | To be cost effective and affordable outcome. | • Frequency of closures to address maintenance requirements | • Planned maintenance of 0.03% of capital development per annum<br>• Reactive (unplanned) maintenance of 0.05% of capital development cost per annum<br>• 0.5 inspections per annum (not associated with flood events) | • Annual cost of maintenance and renewals to achieve acceptable condition | RMS will annually review annual maintenance and renewal expenditure and compare that to specified maintenance reduction objectives stated in this project's business case. |

# Appendix 4: Strategic/Concept/Detail Design Report

Not Used

Refer to Appendix 7 - EIS

## Appendix 5: Options and Preferred Option Report

Not Used

Refer to Appendix 7 - EIS

# Appendix 6: Value Management Report

# ROADS AND MARITIME SERVICES (RMS)

# WINDSOR BRIDGE ALLIANCE

## WINDSOR BRIDGE REPLACEMENT PROJECT

## DETAILED DESIGN PHASE

# VALUE MANAGEMENT WORKSHOP

Workshop Report
February 2013

ACVM

ABN 36 082 506 171

Prepared by:-

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# Table of Contents

# Report

## Background

The existing Hawkesbury River Bridge at Windsor dates from the 1870s and has reached the end of its economic life. It no longer meets the demands of current traffic volumes or current road standards and requires significant ongoing maintenance.

The Roads and Maritime Services (RMS) investigated the condition of the existing bridge and options for rehabilitation. After an extensive and consultative process, RMS identified a replacement bridge as the preferred long term option that provides best value for money and meets most of the objectives set for the project.
The NSW Government committed funds for the replacement of the existing bridge with a new bridge that will provide a safe and reliable crossing of the Hawkesbury River at Windsor. The preferred option is a high level new 3 lane bridge (line marked to 2 lanes initially) located approximately 35m downstream of the existing bridge.

Sinclair Knight Merz (SKM) was appointed by RMS to complete a concept design and Environmental Impact Statement (EIS) for a replacement Windsor Bridge.

An Alliance Team has now been established including Baulderstone Pty Ltd as the contractor to provide constructability input into the design phase.

With planning at 20% Detailed Design stage, a value management workshop was seen as the appropriate tool to bring together key RMS stakeholders and the Alliance project team to review the current design and identify from their various perspectives issues and concerns, to test the design's robustness and suggest any value improvements to improve the project.

The Australian Centre for Value Management (ACVM) was commissioned to prepare for, facilitate and report on this workshop which was undertaken on **8th February 2013**.

A list of participants who attended the workshop can be found in **Appendix 1**.

## Workshop Objectives

The purpose of the workshop, as presented to the participants, was to:

- *Obtain a common understanding of the project and its current position.*
- *Review the current design, test its robustness and cost effectiveness as well as highlight issues, concerns and potential improvements associated with various aspects of the project.*
- *Identify a way forward to address the issues and concerns, evaluate the improvements identified and ensure the design is robust and cost effective as it moves forward in development.*

This report has been compiled by ACVM and seeks to provide an objective overview of the project aspects discussed and the workshop outcomes formulated by the end of the day.

## Workshop Activities

The workshop process builds on the perspectives, as well as the detailed and specialist knowledge which resides with the workshop participants, then structures the analysis and design review from a functional base (ie. what is the purpose of the project, what must the project achieve to be successful, what are the issues or areas of opportunity for change, is there another way of undertaking the project to achieve the purpose and objectives more cost effectively than currently planned).

During the workshop, background material was presented (**Appendices 2, 3 and 4**). The project purpose and objectives as well as the givens and constraints that the project was being planned within were reviewed. Issues and concerns were raised along with areas of opportunity for various focus topics (**Appendix 2**).

The workshop group tested the current design as well as raising suggestions for potential value improvement and recommendations. These were presented to the whole group for comment, amendment and finally agreement (**Appendix 2**).

Lastly the workshop participants drew conclusions, and identified actions to be pursued which would allow the project team to progress the design so that the project could continue to move to the next stage of development.

For the purposes of the review, the design was divided into the following topic areas:

- ***The Bridge Crossing***
- ***Civil Works***
- ***Utilities and Construction Staging***
- ***Urban Design, Heritage and Stakeholders***

The workshop discussions led the group to conclusions and actions as outlined below.

## Recommendations and Further Investigations

A summary of recommendations agreed to by the group appears below.

***Recommendations with regards to the Bridge Crossing***

- Continue with the proposed construction approach of precast parapets. However, review the time and cost of in situ as against precast parapets (edge stiffening advantage)
- Continue with the proposed plan of a spline beam casting yard
- Continue planning using a CIP cantilever approach with retaining wall and fill for constructing the southern abutment (pending planning approval)
- Continue with the proposed rock rip/rap approach for the scour protection. However consider ways to minimise visual impacts
- Adopt the current design for bridge lighting. However consider thicker walls for light posts on the bridge

***Recommendations with regards to Civil Works (Roads, Drainage, Pavements Water Quality and Traffic)***

- Adopt the current design of two lanes southbound on the northern approach with a merge to one lane southbound to cross the bridge and monitor traffic management and safety upon opening

***Potential Actions for further Investigation***

A summary of actions considered by the group as worthy of further investigation appear below.

***Overall***

- Prepare a flowchart of the design approval signoff process to ensure the project delivery is not delayed (ie. Update the Design Management Plan)
- Allocate the actions in each of the topic areas below to the appropriate project team members to ensure they are completed within the timeframe required in the program

***Bridge Crossing***

- Review the need for an inner traffic pre cast barrier on the bridge between the shared pathway and the carriageway
- Due to the high risk of afflux upstream, consider further minimising the depth of the superstructure, undertake detailed hydraulic modelling to determine afflux impact and obtain a separate waterway specialist opinion on the data

***Civil Works (Roads, Drainage, Pavements Water Quality and Traffic)***

- Consider a new/reduced layout of stairs in Thompson Square down to the river (ie. possibly one set of stairs instead of two sets). Obtain feedback from Council
- Consider modifying the pavement at George Street to minimise drainage and heritage impacts (need to determine cost impacts as well)
- Consider adjusting the Bridge Street footpath to reduce drainage impacts (ie. lowering the batter/verge and creating an informal drain)
- Consider changing the SA kerb to a SM kerb on Bridge St, George St and The Terrace to reduce quantities
- RMS needs to investigate and decide on the pavement design (ie. concrete as against AC pavements based on maintenance, urban design, cost and other considerations). Impacts need to be assessed and a decision needs to be made within the next 4 weeks so as to not impact on the design program
- Consider soft landscaping instead of fence or possibly part fencing around the sedimentation basin on the northern side of the project as planning proceeds
- With regards to the extent of the catchment on the eastern side of Wilberforce Road (east of the shared pathway), consider the extent further after receiving comments from RMS peer reviewer
- Consider adjusting the geometry and line marking to accommodate a right turn to the turf farm from Wilberforce Road for safety reasons

***Utilities and Construction Staging***

- Consider early staging of The Terrace works so that operational access to the wharf and pedestrian access can be maintained during construction

- Consider reopening the old nearby boat ramp temporarily for construction access on the southern side of the bridge. It would be for light vehicle access only and requires planning. This needs to be raised in the Submissions Report
- There is a need to design /plan the site compound layout and look for an appropriate alternative which allows the compound to remain in place for most of the project (rather than having to relocate during the project). Consider hiring another farm/location for the main compound complex. This needs to be raised in the Submissions Report
- Consider using the adjacent farm U-turn facility to the east of the proposed compound site for a safer access to the compound and car park
- Consider reducing the amount of reconstructed pavement required for Bridge Street, George Street and The Terrace
- Continue to monitor Endeavour Energy's program for relocating the 33kV transmission line to ensure it remains on track and does not clash with the design
- Consider re-working the holding brackets for the Sydney Water main crossing the bridge to ensure the main is secure, accessible and unobtrusive (urban design wise)
- Consider further how better to undertake the stormwater connections and pits to be placed under traffic on the northern side of the project (Freemans Reach Road and Wilberforce Road)
- Consider further the use of the permanent water quality basin for temporary stormwater storage during construction near Wilberforce Road

***Urban Design, Heritage and Stakeholders***

- Adopt the current design which minimises disturbance to Thompson Square during construction and operation. However with regards to reshaping the Square, consider preparing a "heritage" option of the design amongst others and develop a consultation process for urban design now and ongoing in the program (pre and post planning)
- Obtain costings to run the traffic analysis to determine if the extra lane planned for the roundabout entrance from Freemans Reach Road is needed
- Consider further landscape options for the roundabout area on the northern side
- Further investigate with Council the building of a lookout and viewpoint on the northern bank (this is currently considered outside the project scope)
- Develop further the bridge abutment and cladding treatment options (ie. brick and/or concrete cladding, etc) and develop suitable criteria to assess them including life cycle costs
- Consider further the selection of rock and placement requirements for scour protection on the northern bank (including from an urban design perspective)

## Conclusions Drawn

As a result of sharing information during the Value Management Workshop, the group drew the following conclusions:

- The design as developed and presented is on the right track (especially the bridge design), however a number of potential value improvements have been identified that can be pursued as the design progresses
- Road design and civil works are still a little fluid and require further investigation of options before it can be finalised
- The potential removal of a lane into the northern roundabout at Freemans Reach Road would be a significant change and could have project flow on effects (some being advantages and some being disadvantages)
- There are some items identified that are outside the project scope but still need to be pursued
- The urban design and landscape issues are still in flux and direction is required from the conditions of approval

## Where to from Here?

Bruno Dalla-Palma, Design Manager, SKM highlighted the next steps in the process to progress the project. The next steps were recorded as:

- ACVM will prepare a draft workshop report incorporating the matters raised and agreements reached during the workshop. The draft report would be forwarded to SKM who will seek comment from key project team members. The report will then be finalised
- The final workshop report will form the basis for prioritising and progressing the options and actions identified
- Responses to the specific issues will be prepared, considered and formally resolved by the project team
- There is a need to investigate a number of matters quickly so resolution can be obtained. The tight timeframe for the resolution of matters was emphasised at the completion of the workshop so that the design process is not interrupted

# Appendix 1. List of Participants

# WINDSOR BRIDGE REPLACEMENT PROJECT
# VALUE MANAGEMENT WORKSHOP – PARTICIPANTS LIST

**Roads and Maritime Services**

| | |
|---|---|
| Roy Surace | Project Development Manager |
| Mark Bennett | Peer Reviewer - Bridge |
| Yaso Yasotharan | Pavement Engineer, Pavement Structures |
| Raeburn Chapman | Peer Reviewer – Landscape and Urban Design |
| Tim Hufton | Peer Reviewer – Road Design |
| | |
| Phanta Khamphounvong | Bridge Waterways Engineer |
| Neil Forrest | Asset Manager |
| Palitha Manamperi | Asset Program Manager |
| Smuttu Sivarasa | Bridge Maintenance Planner |
| | |
| Kumar Ponnampalam | Senior Bridge Engineer |
| Tracey Ford | Project Engineer |
| Sarath Dantanarayana | A/Bridge Maintenance Planner |
| Michael Wright | Spackman Mossop Michaels – Urban & Landscape Design |

**Baulderstone Pty Ltd**

| | |
|---|---|
| Umesh Murdeshwar | Construction Manager |
| Graham Crighton | Senior Project Engineer |
| Hugh Bishop | ALT Member |
| | |
| Ben White | Environment Manager, Construction |
| Steven Enoch | WBA Value Manager (Senior Contracts Administrator) |

**SKM Consultant Team**

| | |
|---|---|
| Bruno Dalla-Palma | Design Manager |
| Jonas Ball | Environment Manager |
| John Steele | Structures Team Leader |
| | |
| Justin DeWit | Senior Civil Designer |
| Scott Raynsford | Geotechnical Investigations Team Leader |
| Mark Raven | Cost Estimator |

**Australian Centre for Value Management**

| | |
|---|---|
| Ross Prestipino | Workshop Facilitator |
| Chris Laird | Workshop Facilitator |

# Appendix 2. Workshop Outputs

## Workshop Outputs

The information presented in this Appendix is a consolidation of the general outputs by the workshop group as they shared information, highlighted issues and concerns, suggested improvements and made recommendations to provide the necessary requirements of the project in the most cost effective way.

### Project Overview

In order to allow the participants to obtain a common understanding of the project context, Roy Surace, Project Development Manager-RMS, presented a brief project overview. His presentation material can be found in **Appendix 3.** However, key points raised are outlined below.

***Project Background***

- The existing Hawkesbury River Bridge at Windsor dates from 1874 and has reached the end of its economic life. It no longer meets the demands of current traffic volumes or current road standards and requires significant ongoing maintenance. Issues include:
  - Graphitisation of cast iron piers
  - Cracks in the piers
  - Deck concrete deterioration
  - The bridge does not meet current standards
  - It has low flood immunity
  - It is costly to maintain
  - It requires speed restrictions for heavy vehicles and has a load restriction risk
- The NSW Government has committed funds for the replacement of the existing bridge with a new bridge that will provide a safe and reliable crossing of the Hawkesbury River at Windsor. SKM was appointed by RMS to complete a concept design and Environmental Impact Statement for the replacement bridge. An alliance (Windsor Bridge Alliance) has been established in order to provide constructability input into the design
- The project area includes aboriginal and non-aboriginal heritage significance

***Options Considered over time included:***

- June 2008 – NSW Government announces $25M towards a bridge rehabilitation or replacement project
- July 2009 – Nine options presented to the community
- Between 2009 and 2011 – Preliminary studies and refinement of options were undertaken
- August 2011 – The Minister for Roads and Ports announces Option 1 (35m downstream of the existing bridge) as the preferred option for the replacement of the Windsor Bridge
- RMS had recommended Option 1 as it met most of these project objectives being:
  - Improved safety for motorist, pedestrians and cyclists
  - Improved traffic and transport efficiency
  - Improved the level of flood immunity
  - Met community needs for the long term
  - Minimised the impact on the heritage and character of the area
  - Was a cost effective and affordable outcome

***Key features of the project as we move into Detailed Design include:***

- Construction of a replacement bridge over the Hawkesbury River at Windsor around 35m downstream of the existing bridge
- Construction of new bridge approach roads and intersections to connect the new bridge to the existing road network
- New traffic lights with pedestrian facilities at the intersection of Bridge and George Streets
- Modifications to local roads and access arrangements including changes to the Macquarie Park access road and reconnection of The Terrace
- Dual lane roundabout at the intersection of Wilberforce Road and Freemans Reach Road

- Construction of pedestrian and cycling facilities including a shared pedestrian/cycle pathway for access to and across the new bridge
- Removal and backfilling of the existing approach roads
- Removal of the existing Windsor Bridge once the new bridge is operational
- Urban design and landscape works including within the parkland area of Thompson Square and adjacent to the northern intersection of Wilberforce Road and Freemans Reach Road and the Macquarie Park access road

A brief overview of the proposed project program including some potential locations and staging for the casting yard, site compound, piers and abutments was also presented and can be found in **Appendix 3**

## Restating the Project Purpose and Objectives

The workshop participants reflected on the purpose and the objectives of the project. The opportunity existed to seek clarification and ensure the objectives were understood. In some cases, the words were amended to clear up any misinterpretations. Where changes or additions were made, these are shown in *italics.*

***Project Purpose (Why are we doing this project?)***

- To replace the existing Windsor Bridge which has an expired design life

***Project Objectives (What must the project achieve to be successful?)***

To be successful, **overall** the project should:

- Improve safety for motorists, pedestrians and cyclists
- Improve traffic and transport efficiency
- Improve the level of flood immunity
- Meet long term community needs
- *Minimise the impact on heritage and the character of the area*
- Be a cost effective and an affordable outcome

With respect to **Thompson Square**, it should:

- Maintain and interpret the heritage values of Thompson Square and Windsor in general
- Maximise the available open space in Thompson Square
- Cater for existing and other potential uses for Thompson Square in order to define its form and character
- Enhance the access opportunities for all users around and through Thompson Square
- Improve the amenity of Thompson Square and the surrounding areas

With respect to the **Northern Intersection**, it should:

- Enhance opportunities to define the northern intersection as an entry to Windsor (desirable)
- Provide safe pedestrian, cycle and vehicle access to Macquarie Park
- Protect and enhance the setting of heritage properties
- Retain sufficient public open space for future river front activities

With respect to Traffic and Transport, it should:

- Minimise queue length/delays
- Improve performance of the road network (level of service)
- Enable two heavy vehicles to pass on the bridge without waiting
- Improve traffic load capacity of the crossing to meet current load standards
- Provide an efficient connection for local and regional traffic
- Provide a pedestrian and cyclist connection to surrounding locations

With respect to the **Bridge Structure**, it should:

- Provide a 100 year life span for the bridge structure
- Provide a cost effective solution in terms of capital cost, maintenance cost and return on investment
- Minimise the impact of construction in regards to length and timing
- Minimise risks associated with construction of the bridge
- Respond to community input with respect to bridge aesthetics

With respect to the **Bridge Architecture**, it should:

- Placement/siting: The new bridge and its approaches should be well-sited and considered in relationship to the Hawkesbury River's landscape setting, the township of Windsor, the banks, parks and approach roads
- Character: The bridge and its constituent elements should have a dignified, calm and confident presence (unobstrusive)
- Elements:
  - Deck: should be expressed as an uncluttered horizontal plane spanning the Hawkesbury River
  - Deck soffit: should be designed, treated and finished as a major facade, highly visible in the public domain (being viewed from under the bridge)
  - Piers: should express, through their elegant structure, the forces that are transferred from deck to the foundations
  - Abutments: should seamlessly resolve the transition from elevated deck to the ground plane, and be fully considered as a three dimensional design
  - Materials: should be selected for the robustness and durability, considering their tendencies to age gracefully
  - Lighting: should be an integral part of the design, rather than an unrelated attachment

## Givens and Constraints we are working within

The group reflected on the givens and constraints that the project was being planned within. These were identified, clarified, amended where necessary and finally agreed by the group as outlined below.

**Givens and Constraints we are working within**

- The horizontal road alignment has been fixed. However the vertical road alignment is still progressing
- The design speed for the bridge and approach roads is 50km/h
- The existing bridge will be demolished and fully removed
- Access to the car park and Windsor Wharf for vehicles, maintenance vehicles and busses will be maintained
- Environmental constraints - there is a need to comply with heritage, noise and vibration requirements during construction and operation. Noise and vibration impacts will be mitigated
- Access will be maintained to existing properties and businesses during construction and operation
- All affected utilities are to be relocated or protected
- There will be no bus bays proposed within the project limit of works

- The road pavement and cutting in Thompson Square and the road cutting on the northern side of the river will be removed and the cutting backfilled and rehabilitated. The assumption is that only the road pavement will be removed (ie. The aim is not to go deeper than the road base but enough to key in and backfill)
- The incrementally launched double T girder bridge is the bridge option that is now being progressed
- The northern intersection of the project (ie. Wilberforce Road/Freemans Reach Road/Bridge Street and the access to Macquarie Park) will be a dual lane roundabout
- The design approvals process has to be one that does not delay the overall design program
- Demolition of the existing Windsor Bridge can take place after the project completion date
- There will be flood mitigation measures put in place for upstream properties to address afflux (if required)
- Continued consultation with the community will need to occur for the whole project (but especially for urban design and landscaping elements)
- The aim is to minimise the area of disturbance in Thompson Square
- The archaeological salvage investigation program for the project is likely to be significant in size and timeframe

## The Proposed Design

Having obtained a common understanding of the project background, its purpose and objectives as well as the givens and constraints it is being planned within, the group was presented with an overview of the current design by Bruno Dalla-Palma, Design Manager, SKM and supplemented by other project team members. A diagram showing the 20% Detailed Design as presented can be found in **Appendix 4.**

The purpose of the presentation was for the group to get an understanding as to how the design is meeting the project purpose and objectives within the givens and constraints identified and to allow the group to identify where there could be issues or opportunities for potential improvement to the design which would deliver the required functionality better and/or more cost effectively.

## Reviewing the Design

Having discussed the proposed 20% detailed design, the workshop group were now in a position to review the design focussing on some prearranged topic areas.

For the purposes of the review, the design was divided into the following topic areas with some prompt points provided to commence the discussion. These were supplemented by the workshop group. The supplemented focus topic areas and prompts were:

- ***Focus Group 1: Bridge Crossing***
  - Parapet construction
  - Casting bed/yard
  - Abutment construction
  - Potential flood afflux mitigation
  - Bridge railing
  - Scour protection
- ***Focus Group 2: Civil Works (Roads, Drainage, Pavements, Water Quality and Traffic)***
  - Road geometry improvements
  - Drainage innovations
  - Property access
  - Water quality basin
  - Traffic performance
  - Pavement reconstruction (roundabout & George/Bridge St intersection)
- ***Focus Group 3: Utilities and Construction Staging***
  - Design smarts to improve construction staging
  - Staging improvements to minimise impacts on heritage, traffic and noise
- ***Focus Group 4: Urban Design, Heritage and Stakeholders***
  - Thompson Square
  - Northern side of river
  - Overall bridge design including abutment cladding and finishes
  - Pavements for roads, pedestrians and cyclists
  - Landscape

The workshop participants (in focus groups) were asked, for their focus topic area, to discuss:

- Key Issues, components or areas of opportunity (as outlined above).
- Is there another way than in the current design to resolve the issue, improve functionality, improve constructability, improve operability, reduce impacts, improve cost effectiveness, etc?
- What are the advantages and disadvantages of the suggestion?
- Is there a cost saving or cost increase by undertaking the suggestion (if appropriate)?
- What do we recommend?

This was presented to the whole group for comment, additions and amendment where necessary. The whole group then assessed the recommendations made by the focus groups. The assessment was undertaken and the whole group agreed to one of the following:

- ***Adopt the current design; or***
- ***The suggestion to amend the current design has merit and is worthy of further investigation outside the workshop.***

The focus group presentations and recommendation as agreed by the whole group appears below.

## Focus Group 1 – Bridge Crossing

| No | Components/ Areas of opportunity/ Issues | How is it currently being addressed in the design? | Is there another way? • Resolve issue, Improve functionality • Improve operability, constructability, Reduce impacts, costs, etc | Advantages/ Disadvantages | $ Saving/ Increase | Recommendation |
|---|---|---|---|---|---|---|
| 1 | Parapet construction | Currently, precast parapets will be utilised with tower crane used to erect them<br>Installed but not concreted before launching | Cast parapets in situ | Adv: Precast panels used as temporary barriers for construction. They are faster, more economical than in situ<br>Disadv: No effective edge stiffening for structure<br>Do we really need a traffic barrier between the footway and the traffic carriageway? | | • Adopt the current design<br>• Review the time and cost of in situ as against precast parapets (edge stiffening advantage) – ***Action***<br>• Review the need for an inner traffic pre cast barrier – ***Action*** |
| 2 | Casting bed/yard | Currently using a spline beam casting yard | No issue – same as Iron Cove Bridge project | | | • Adopt the current design |
| 3 | South abutment construction | Currently using a CIP cantilever approach with retaining wall and fill. | Use a land bridge approach – archaeological disturbance may be minimised. However it depends on planning conditions issued | Depends on the extent of excavation needed and on the planning approvals | | • Adopt the current design (pending planning approval) |
| 4 | Scour protection | Currently using a rock rip/rap. The extent has been minimised from earlier concepts | | | | • Adopt the current design<br>• Look at ways to minimise visual impacts – ***Action*** |
| 5 | Minimise afflux impacts upstream | Looking to minimise the depth of the superstructure<br>Undertaking a detailed 2D hydraulic modelling to determine impact | Due to high risk, separate advice is required from a waterway specialist | | | • Adopt the current design<br>• However due to the high risk of afflux upstream obtain a separate waterway specialist opinion on the data – ***Action*** |
| 6 | Bridge lighting | Currently using standard posts | Consider sacrificial posts or thicker walls for posts | | | • Adopt the current design<br>• Consider thicker walls for light posts on the bridge – ***Action*** |

## Focus Group 2 – Civil Works (Roads, Drainage, Pavements, Water Quality and Traffic)

| No | Components/ Areas of opportunity/ Issues | How is it currently being addressed in the design? | Is there another way? • Resolve issue, Improve functionality • Improve constructability, Improve operability, Reduce impacts, costs, etc | Advantages/ Disadvantages | $ Saving/ Increase | Recommendation |
|---|---|---|---|---|---|---|
| **Southern side of the project – Road Geometry** | | | | | | |
| 1 | Consider a new/reduced layout of stairs in Thompson Square down to river | Currently 2 sets of stairs either side of existing cutting | Consider one set of stairs near new bridge | Disadv: Does not meet DDA compliance | $↓ | • Consider as planning proceeds – ***Action***<br>• Obtain feedback for Hawkesbury City Council – ***Action*** |
| 2 | Modify pavement at George Street to minimise drainage and heritage impacts | Currently using a Type 1, full depth | Consider a deep lift | Adv: Minimise impacts | | • Consider as planning proceeds including impact on costs – ***Action*** |
| 3 | Review extent of line marking/pavement at Macquarie/Bridge Street intersection and impact on drainage | Currently just line marking and possibly milling | Consider a new layout of the intersection | Adv: Reduce work area and extent of work required | $↓ | • Consider as planning proceeds – ***Action*** |
| 4 | Adjust Bridge Street footpath to reduce drainage impacts | Allows batter flow to kerb | Consider a lower batter/verge and create an informal drain | Adv: Reduces pit spacing<br>Adv: Safer<br>Disadv: Greater impact on Thompson Square | $↓ | • Consider as planning proceeds – ***Action*** |
| 5 | Change SA kerb to SM kerb on Bridge St, George St and The Terrace | Currently using SA kerb | Consider SM kerb | Adv: Reduces pit quantities | $↓ | • Consider as planning proceeds – ***Action*** |

## Focus Group 2 – Civil Works (Roads, Drainage, Pavements, Water Quality and Traffic) (cont)

| No | Components/ Areas of opportunity/ Issues | How is it currently being addressed in the design? | Is there another way? • Resolve issue, Improve functionality • Improve constructability, Improve operability, Reduce impacts, costs, etc | Advantages/ Disadvantages | $ Saving/ Increase | Recommendation |
|---|---|---|---|---|---|---|
| **Northern side of the project** | | | | | | |
| 6 | Concrete pavement as against AC pavement | No design confirmed yet | Needs to be resolved. Issue related to better urban design as against improved constructability | Disadv and Adv: Concrete has higher initial costs but lower maintenance. AC is the reverse<br>Disadv: Concrete is not preferred for urban design | | • This needs to be investigated as planning proceeds. RMS are undertaking the pavement design. Impacts need to be assessed and a decision needs to be made within next 4 weeks so as to not impact on design program – ***Action*** |
| 7 | Removal of fence around sediment basin | Currently no fence in the design around sediment basin on the eastern side of the project | Consider removing/reducing amount of fencing – soft landscaping | Disadv: Safety issue | $↓ | • Consider soft landscaping instead of fence or possibly part fence as planning proceeds – ***Action*** |
| 8 | Extent of catchment on the eastern side of Wilberforce Road (east of the shared pathway) | Currently SO in cuttings only with open channels | Consider SO infills | | $↑ | • Consider the extent further after receiving RMS comments – ***Action*** |
| 9 | Adjust geometry to accommodate a right turn at the turf farm on Wilberforce Road | Currently no dedicated right turn approaching turf farm off Wilberforce Road | Consider right turn by additional line marking for turf farm | | No cost | • Consider as planning proceeds – ***Action*** |
| 10 | Consider providing 3 lanes across bridge from the opening | Currently allowing two lanes (one in each direction) | Consider three lanes across bridge from its opening by changing line marking | Adv: Improve traffic flow from the north which will go from a two lane roundabout to two lanes across the bridge | No cost | • Adopt current design and monitor upon opening |

## Focus Group 3 – Utilities and Construction Staging

| No | Components/ Areas of opportunity/ Issues | How is it currently being addressed in the design? | Is there another way? • Resolve issue, Improve functionality • Improve constructability, Improve operability, Reduce impacts, costs, etc | Advantages/ Disadvantages | $ Saving/ Increase | Recommendation |
|---|---|---|---|---|---|---|
| 1 | Maintain access to Windsor Wharf and car park during construction | | Consider negotiating with Council and paddle steamer company to relocate to the South Creek Wharf during construction | Disadv: Disruption to paddle steamer and water users. Compensation to businesses<br>Disadv: Council have only just opened the new wharf | $↑ | |
| | | | Consider staging The Terrace works early in the program to maintain access via The Terrace | Adv: Provide operational access only (vehicles restricted to wharf)<br>Adv: Can maintain pedestrian access<br>Disadv: Impact on utilities in the area | $↓ | • Consider early staging of The Terrace works so that operational access to wharf and pedestrian access can be maintained – ***Action*** |
| 2 | Construction access to the water on the southern side of the project for the workers | | Consider access via the Council wharf | • Disadv: Used by the public and businesses | | • Consider reopening the old nearby boat ramp temporarily for construction access for the southern side of the bridge. For light vehicle access only and requires planning. Needs to be raised in the Submissions Report – ***Action*** |
| | | | Consider reopening the old nearby boat ramp temporarily | • Adv: Provides safe access and is time saving | $↓ | |
| 3 | Site compound location and worker carpark | Currently planned on the turf farm and under 33kV transmission line (which is also a flood prone area) | Consider hiring another farm/ location for the main complex. Smaller sheds which can be moved easily. It will avoid relocation until final demolition | Adv: The complex will be in the one location for duration of the project<br>Adv: Avoids more costs and disruptions | $↓ | • There is a need to design /plan the compound layout and look for an appropriate alternative which allows the compound to remain in place for most of the project – ***Action*** |
| | | | Consider an office in the township | Disadv: Costs associated with leasing a new location | $↑ | • Needs to be raised in the Submissions Report – ***Action*** |

## Focus Group 3 – Utilities and Construction Staging (cont)

| No | Components/ Areas of opportunity/ Issues | How is it currently being addressed in the design? | Is there another way? • Resolve issue, Improve functionality • Improve constructability, Improve operability, Reduce impacts, costs, etc | Advantages/ Disadvantages | $ Saving/ Increase | Recommendation |
|---|---|---|---|---|---|---|
| 4 | Site access | Currently a small roundabout on Wilberforce Road for site access is planned | Consider using the adjacent farm U-turn facility to the east for site access | Adv: Safer vehicle access and less traffic control needed | ? | • Consider using the adjacent farm U-turn facility to the east for site access – ***Action*** |
| 5 | Pavement tie-ins | Currently undertake pavement reconstruction of Bridge Street offline but will impact property access<br>George/Bridge Street intersection – too many unknowns | Manage through night works and resident communication<br>Further investigations scheduled to determine the amount of pavement reconstruction required | | | • Consider reducing the amount of reconstructed pavement required – ***Action***<br>• Investigate the extent of pavement reconstruction of The Terrace – ***Action***<br>• Undertake further investigation to establish the extent required – ***Action*** |
| 6 | 33kV transmission line aerial relocation | Currently Endeavour Energy are relocating the line in April/May 2013 | Ensure Endeavour Energy relocation does not impact the proposed design | To make sure no impacts on our design | | • Monitor Endeavour Energy's program for relocating the 33kV transmission line – ***Action*** |
| 7 | Sydney Water mains across the new bridge | Currently planned to be between piers under the girders | Consider placing them in the girders<br>Consider re-working the holding brackets to ensure the main is secure, accessible and unobtrusive (urban design wise) | Adv: Urban design benefit<br>Adv: Cost saving<br>Disadv: Cannot access the mains for maintenance | $↓ | • Consider re-working the holding brackets to ensure the main is secure, accessible and unobtrusive (urban design wise) – ***Action*** |

## Focus Group 3 – Utilities and Construction Staging (cont)

| | | | | | | |
|---|---|---|---|---|---|---|
| 8 | Staging of stormwater works at Freemans Reach Road and Wilberforce Road | Currently will have connections and pits placed under traffic<br>Stormwater entering construction site | Investigate location for temporary sediment basin that does not have to be relocated. Consider the permanent basin for this temporary use. However it is currently planned to be built late in the program | Adv: Provides environmental controls | | • Consider further how better to undertake the stormwater connections and pits to be placed under traffic on the northern side of the project (Freemans Reach Road and Wilberforce Road) – ***Action***<br>• Consider further the use of the permanent water quality basin for temporary stormwater storage during construction – ***Action*** |

## Focus Group 4 – Urban Design, Heritage and Stakeholders

| No | Components/ Areas of opportunity/ Issues | How is it currently being addressed in the design? | Is there another way? • Resolve issue, Improve functionality • Improve constructability, Improve operability, Reduce impacts, costs, etc | Advantages/ Disadvantages | $ Saving/ Increase | Recommendation |
|---|---|---|---|---|---|---|
| 1 | Minimise disturbance in Thompson Square | Currently the project footprint has been minimised, the construction zone has been minimised | Significant work already done to minimise impacts | | | • Adopt current design |
| | | Substantial reshaping of Thompson Square will take place | Consider reducing the reshaping of Thompson Square | Adv: Less archaeological impacts (Heritage Council focus)<br>Disadv: Poor functionality of parkland | $↓ | • Prepare a "heritage" option of the design – ***Action***<br>• Develop a consultation process for urban design now and ongoing in the program (pre and post planning) – ***Action*** |
| | | | Undertake additional consultation with stakeholders | | | |
| 2 | Northern Bank Issues | | | | | |
| | Scale of the roundabout | Minimised as much as possible<br>Landscape not yet cleared | Consider removing one lane from Freemans Reach Road | Adv: Less visual impact; Improved safe operation of intersection<br>Disadv: Road safety, cost and maintenance issue | | • Obtain costings to run the traffic analysis to determine if the extra lane planned for the roundabout entrance from Freemans Reach Road is needed – ***Action*** |
| | | | Consider trees (or a statue) in centre of the roundabout | Adv: Improved visual performance | | • Consider further landscape options for the roundabout area – ***Action*** |
| | Views of Thompson Square and the bridge | Not considered a major issue | Consider building a lookout and viewpoint on the northern bank | Adv: Greater appreciation of project; improved public use and viewpoint for the Great Walk<br>Disadv: Cost and maintenance | | • Further investigate with Council the building of a lookout and viewpoint on the northern bank. Currently considered outside the project scope – ***Action*** |

## Focus Group 4 – Urban Design, Heritage and Stakeholders (cont)

| No | Components/ Areas of opportunity/ Issues | How is it currently being addressed in the design? | Is there another way? • Resolve issue, Improve functionality • Improve constructability, Improve operability, Reduce impacts, costs, etc | Advantages/ Disadvantages | $ Saving/ Increase | Recommendation |
|---|---|---|---|---|---|---|
| 3 | Bridge features and abutments | Currently estimate is based on concrete blocks that looks like sandstone | Various options need to be considered:<br>• Sandstone<br>• Brick<br>• Concrete clad<br>• Rusty steel | Adv/Disadv: Maintenance issues, deterioration, ages, vandalism, community preference<br>Adv: Building material of heritage Windsor, possibly cheaper option<br>Adv/Disadv: May not be heritage enough, feature panels, interpretation issues<br>Disadv: Not appropriate for Windsor | | • Develop further the bridge abutment and cladding treatment options (ie. brick and/or concrete cladding, etc) and develop suitable criteria to assess them including life cycle costs – ***Action*** |
| 4 | Scour protection on the northern bank | No fully designed options yet | Consider Basalt or Sandstone and planting | Basalt is very dark and maybe no need to place<br>Sandstone is light coloured, needs to be placed and meets the "now" requirements<br>It will make no difference in the long term but it will when the bridge is initially opened | | • Consider further the selection of rock and placement requirements |

## Potential Actions for Further Investigation

A summary of actions considered by the group as worthy of further investigation appear below.

***Overall***

- Prepare a flowchart of the design approval signoff process (ie. Update the Design Management Plan)
- Allocate the actions in each of the topic areas below to the appropriate project team members to ensure they are completed within the timeframe required in the design program

***Bridge Crossing***

- Review the need for an inner traffic pre cast barrier on the bridge between the shared pathway and the carriageway
- Due to the high risk of afflux upstream, consider further minimising the depth of the superstructure, undertake detailed hydraulic modelling to determine afflux impact and obtain a separate waterway specialist opinion on the data

***Civil Works (Roads, Drainage, Pavements, Water Quality and Traffic)***

- Consider a new/reduced layout of stairs in Thompson Square down to the river (ie. possibly one set of stairs instead of two sets). Obtain feedback from Council and community
- Consider modifying the pavement at George Street to minimise drainage and heritage impacts (need to determine cost impacts as well)
- Review the extent of line marking/pavement at Macquarie/Bridge Street intersection and the impact on drainage. Consider a new layout of the intersection
- Consider adjusting the Bridge Street footpath to reduce drainage impacts (ie. lowering the batter/verge and creating an informal drain)
- Consider changing the SA kerb to a SM kerb on Bridge St, George St and The Terrace to reduce quantities
- RMS needs to investigate and decide on the pavement design (ie. concrete as against AC pavements based on maintenance, urban design, cost and other considerations). Impacts need to be assessed and a decision needs to be made within the next 4 weeks so as to not impact on the design program
- Consider soft landscaping instead of fence or possibly part fencing around the sedimentation basin on the northern side of the project as planning proceeds
- With regards to the extent of the catchment on the eastern side of Wilberforce Road (east of the shared pathway), consider the extent further after receiving comments from RMS
- Consider adjusting the geometry and line marking to accommodate a right turn to the turf farm from Wilberforce Road for safety reasons

***Utilities and Construction Staging***

- Consider early staging of The Terrace works so that operational access to the wharf and pedestrian access can be maintained during construction
- Consider reopening the old nearby boat ramp temporarily for construction access on the southern side of the bridge. It would be for light vehicle access only and requires planning. This needs to be raised in the Submissions Report
- There is a need to design /plan the site compound layout and look for an appropriate alternative which allows the compound to remain in place for most of the project (rather than having to relocate during the project). Consider hiring another farm/location for the main compound complex. This needs to be raised in the Submissions Report
- Consider using the adjacent farm U-turn facility to the east of the proposed compound site for a safer access to the compound and car park
- Consider reducing the amount of reconstructed pavement required for Bridge Street, George Street and The Terrace
- Continue to monitor Endeavour Energy's program for relocating the 33kV transmission line to ensure it does not clash with the project design

- Consider re-working the holding brackets for the Sydney Water main crossing the bridge to ensure the main is secure, accessible and unobtrusive (urban design wise)
- Consider further how better to undertake the stormwater connections and pits to be placed under traffic on the northern side of the project (Freemans Reach Road and Wilberforce Road)
- Consider further the use of the permanent water quality basin for temporary stormwater storage during construction near Wilberforce Road

***Urban Design, Heritage and Stakeholders***

- Adopt the current design which minimises disturbance to Thompson Square during construction and operation. However with regards to reshaping the Square, consider preparing a "heritage" option of the design amongst others and develop a consultation process for urban design now and ongoing in the program (pre and post planning)
- Obtain costings to run the traffic analysis to determine if the extra lane planned for the roundabout entrance from Freemans Reach Road is needed
- Consider further landscape options for the roundabout area on the northern side
- Further investigate with Council the building of a lookout and viewpoint on the northern bank (this is currently considered outside the project scope)
- Develop further the bridge abutment and cladding treatment options (ie. brick and/or concrete cladding, etc) and develop suitable criteria to assess them including life cycle costs
- Consider further the selection of rock and placement requirements for scour protection on the northern bank (including from an urban design perspective)

## Recommendations

A summary of recommendations agreed to by the group appears below.

***Bridge Crossing***

- Continue with the proposed construction approach of precast parapets. However, review the time and cost of in situ as against precast parapets (edge stiffening advantage)
- Continue with the proposed plan of a spline beam casting yard
- Continue planning using a CIP cantilever approach with retaining wall and fill for constructing the southern abutment (pending planning approval)
- Continue with the proposed rock rip/rap approach for the scour protection. However consider ways to minimise visual impacts
- Adopt the current design for bridge lighting. However consider thicker walls for light posts on the bridge

***Civil Works (Roads, Drainage, Pavements, Water Quality and Traffic)***

- Adopt the current design of two lanes southbound on the northern approach with a merge to one lane southbound to cross the bridge and monitor traffic management and safety upon opening

## Conclusions Drawn

As a result of sharing information during the Value Management Workshop, the group drew the following conclusions:

- The design as developed and presented is on the right track (especially the bridge design), however a number of potential value improvements have been identified that can be pursued as the design progresses
- Road design and civil works are still a little fluid and require further investigation of options before it can be finalised
- The potential removal of a lane into the northern roundabout at Freemans Reach Road would be a significant change and could have project flow on effects (some being advantages and some being disadvantages)
- There are some items identified that are outside the project scope but still need to be pursued
- The urban design and landscape issues are still in flux and direction is required from the conditions of approval

## Where to from Here?

Bruno Dalla-Palma, Design Manager, SKM highlighted the next steps in the process to progress the project. The next steps were recorded as:

- ACVM will prepare a draft workshop report incorporating the matters raised and agreements reached during the workshop. The draft report would be forwarded to SKM who will seek comment from key project team members. The report will then be finalised
- The final workshop report will form the basis for prioritising and progressing the options and actions identified
- Responses to the specific issues will be prepared, considered and formally resolved by the project team
- There is a need to investigate a number of matters quickly so resolution can be obtained. The tight timeframe for the resolution of matters was emphasised at the completion of the workshop to ensure the design program remains on track

# Appendix 3. Project Overview Presentation

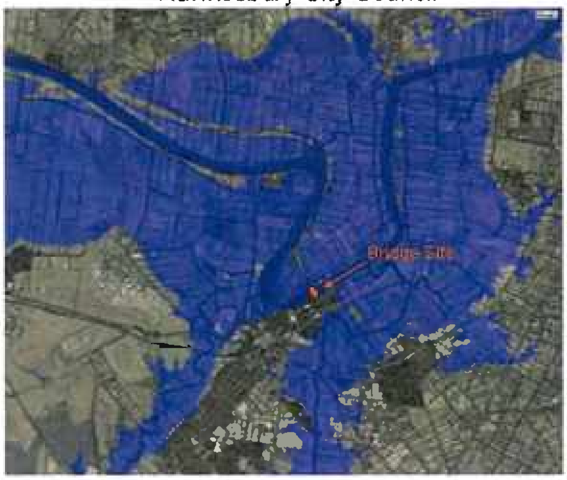

## Background

Existing Bridge Condition

- Age – Built 1874
- Graphitisation of cast iron piers
- Cracks in piers
- Deck concrete deterioration
- Does not meet current standards
- Low Flood Immunity
- Costly to Maintain
- Speed restriction for HV
- Load restriction risk

# Background - Flood Profiles

5 year ARI flood extents, provided by Hawkesbury City Council




100 year ARI flood extents, provided by Hawkesbury City Council


# Background - Heritage

## Aboriginal Heritage

Due to the flooding nature of the area only the higher parts of the ridge have remained undisturbed.

Deposits containing high densities of aboriginal artefacts have been found in near by developments, such as the new Hawkesbury Regional Museum site.

## Options Considered

### June 2008

NSW Govt announces $25M towards a bridge rehab or replacement project

### July 2009

Nine options presented to the community.

### 2009 to 2011

Preliminary studies & refinement of options.

### August 2011

Minister for Roads & Ports announces option 1 as the preferred option for the upgrade of the Windsor Bridge.

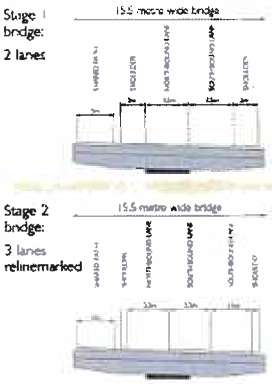

## Objectives of project

RMS identified **option 1** as it met most of these project objectives:

- Improve **safety** for motorist, pedestrians and cyclists
- Improve **traffic and transport efficiency**
- Improve the level of **flood** immunity
- Meet **community** needs for the long term
- Minimise the impact on the **heritage** and **character** of the area
- Be a **cost effective** and affordable outcome

# Option 1 – 35 meters downstream of existing bridge

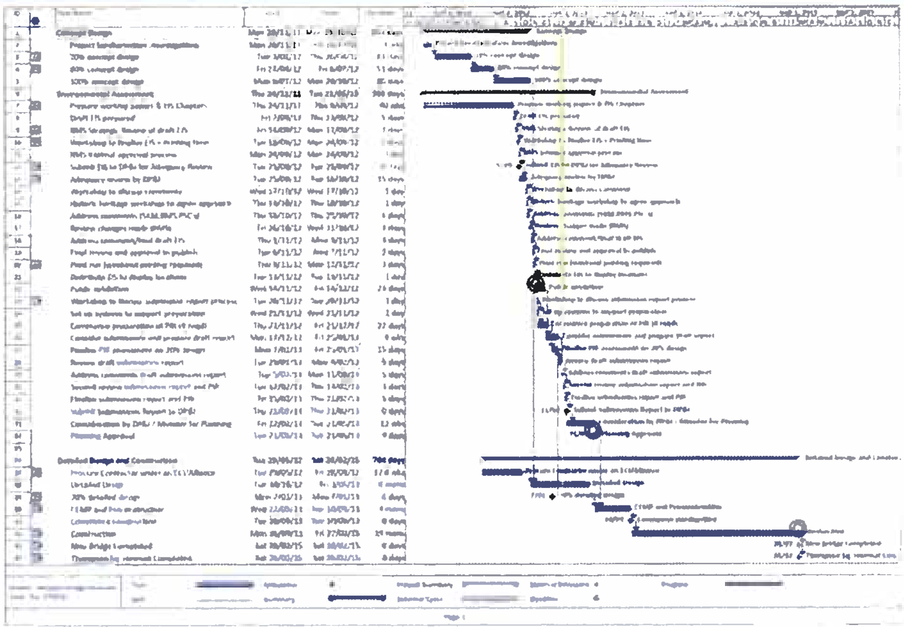
## Cross section





# Program

## Overview Program



# Appendix 4. 20% Detailed Design – General Arrangement Plan


GENERAL ARRANGEMENT PLAN
FOR INFORMATION
20% DETAIL DESIGN

# Appendix 7: Environmental Impact Statement

Refer to RMS project website

http://www.rms.nsw.gov.au/projects/sydney-west/windsor-bridge-replacement/project-documents.html

# Appendix 8: Project Management Plan

Transport
Roads & Maritime
Services

Project management plan

# Windsor Bridge Replacement

Project number: A/66737

Issue Version 1 (17-02-2016)

Program 1 - GSPO

# About this document

## Project data

| | |
|---|---|
| Project name | Windsor Bridge Replacement |
| Project number | A/66737 |
| Starting location | Intersection of Freemans Reach Road and Wilberforce Road in the north |
| End location | Intersection of Macquarie Street and Bridge Street in the south. |
| Road number | N/A |
| Bridge No. | 11386 |
| Road name | N/A |
| Local government area | Hawkesbury City Council (HCC) |

## Current managers

| Role | Name | Effective date |
|---|---|---|
| Project Manager – Development | Project Manager - Development | dd-mon-yy |
| Principal Manager – Project Development | Principal Manager - Development | dd-mon-yy |
| Project Manager – Delivery | Gurjit Singh | dd-mon-yy |
| Principal Manager – Project Delivery | Ian Allan | dd-mon-yy |

## Data for this document

| | |
|---|---|
| Document name | Windsor Bridge Replacement – Project Management Plan |
| Version and date | Version 1 - 17 February 2016 |
| Objective ID | fA3374809 - https://edm.rta.nsw.gov.au/id:fA3374809 |
| Prepared by | Eilin Edisho |
| Project team | GSPO - Program 1 |

# Revision history for this document

| Issue | Date | Revision description |
|---|---|---|
| 1.0 | 17-02-2016 | • First issue |
| 1.1 | 07/06/16 | • Updated stakeholder details |

# Team leader history

> **Note**
>
> The following table lists the people who have held the primary project manager role at various stages throughout the project.
>
> In the early stages, this would normally be the project development manager and later it the project it would be the project delivery manager.
>
> Furthermore, there might be more than one person who is the project development manager or project delivery manager at various times.

| Name | Title or role | Effective date |
|---|---|---|
| Roy Surace | Project Manager | ?? |
| Gurjit Singh | Project Manager | Oct 2015 |
| | | |

# About the ProjectPack template

## Information about the ProjectPack template

| | |
|---|---|
| **Template name** | Project management plan template |
| **Template number** | ILC-MI-TP0-102-F01 |
| **Version and date** | 2.1 (30-Jan-15) |
| **Associated procedure** | ILC-MI-TP0-102<br>ILC-MI-TP0-102-G01 |
| **Prepared by** | Project Management Office, Contracts and Project Strategy Branch |
| **Approved by** | Principal Manager, Project Management Office |

## Template revision history

| Issue | Date | Revision description |
|---|---|---|
| 1.4 | 24-Nov-11 | First issue |
| 2.0 | 28-Nov-14 | Reformatted, reviewed and revised as part of the ProjectPack major review |
| 2.1 | 30-Jan-15 | Revised following user feedback |

| | |
|---|---|
| Note | RMS regularly reviews and updates documents in accordance with the principle of continual improvement.<br>Therefore, the version you are working with might now have been superseded. |

# Table of contents

# 1 Introduction

## 1.1 Purpose of this document

This project management plan (PMP.) describes how the project will be planned and managed. It covers all phases of the project - project initiation, project development, project delivery and project finalisation.

The PMP provides information about the management of the project to all those involved in the project. This includes the RMS project team, professional services contractors (PSCs), specialist advisors and other stakeholders.

The following table summarises the purpose of the PMP.

| Section | Purpose | Topics |
|---|---|---|
| Project definition | What we are going to do, when and why? | • Project background and description.<br>• Project objectives and scope.<br>• Assumptions and constraints.<br>• Related projects. |
| Project organisation and staffing | Who is responsible for the work, who will be doing the work and who will we be working with? | • Project team, governance and management structure.<br>• Stakeholders and specialist advisers. |
| Time and cost planning | What are the forecast times and cost? | • Project schedule and milestones.<br>• Cost planning and financial management. |

| Section | Purpose | Topics |
|---|---|---|
| Component plans | What systems will we be using to plan and manage the project? | • Benefits realisation management. - *Jacobs*<br>• Change management. - *Jacobs*<br>• Community and stakeholders. - *RMS*<br>• Constructability assessments. _ *Jacobs / RMS*<br>• Construction management. - *RMS*<br>• Design management.-*RMS*<br>• Environmental management. – *Jacobs / RMS*<br>• Handover planning. - *RMS*<br>• Issues management.- *RMS*<br>• Procurement strategy. – *RMS – Gurjit has already prepared one*<br>• Property acquisition.- *RMS*<br>• Risk management. –*RMS/Jacobs*<br>• Utilities adjustments. - *Jacobs*<br>• Value engineering. – *Jacobs / RMS*<br>• Value management. – *N/A*<br>• WHS. – *RMS/ Jacobs* |
| Managing the project | How will we monitor and control the project? | • Obtain approvals.<br>• Monitor progress.<br>• Hold regular meetings and communicate with the project team, stakeholders and the community.<br>• Document management.<br>• Quality management. |
| Project completion | How do we finalise the project? | • Plan for completion and handover.<br>• Lessons learnt. |

## 1.2 Project standards and procedures

The project will be managed in accordance with RMS' policies and procedures including the ProjectPack project management system.

Further information about relevant documentation for each phase of the project is available from the ProjectPack Navigator.

## 1.3 Investment gating and assurance

The project management plan aligns with the various stages in the TfNSW investment gating and assurance process as summarised in the following table.

| Gate | Objective | Activity, decision or approval |
|---|---|---|
| ~~Gate 0 – Initiation~~ | ~~Gain approval to enter the investment life cycle.~~ | • ~~This document records objectives, constraints and intent.~~ |
| ~~Gate 1 – Strategic~~ | ~~Strategic options identified~~ | • ~~Release funds for the development of strategic options for a project or program.~~ |
| ~~Gate 2 – Preliminary~~ | ~~Select the preferred option.~~ | • ~~Development of options to arrive at a preferred option.~~ |
| Gate 3 - Procurement | Approve funding for the delivery phase. | • Establish commitment to fund the build stage and WOL costs.<br>• Approve the procurement strategy.<br>• Release of funds for the capital investment phase. |
| Gate 4 - Contract award | Identify vendors to deliver the preferred option and award a contract. | • Enables the contract award. |
| Gate 5 - Readiness for service | Deliver the project and handover to the operator. | • Operation. |

## 1.4 Business cases

At various stages, business cases are required. The following business cases are typically prepared.

- ~~Gate 0 - Initiation gate.~~
- ~~Gate 1 - Strategic business case.~~
- ~~Gate 2 - Preliminary business case.~~
- Gate 3 - Final business case.
- Gate 4 - Contract award.
- Gate 5 - Readiness for service.

## 1.5 Project manager role

During the project development phase, the project manager will be the project development manager. The role of project manager will be passed over to the project delivery manager at the beginning of the project delivery phase or at an agreed time.

During the project development phase, the project delivery manager will be part of the team and will shadow the project development manager to ensure that delivery issues are appropriately considered.

Similarly, the project development manager will shadow the project delivery manager during the delivery phase to ensure that development issues are implemented successfully.

## 1.6 Reviewing and updating this document

The initial version of the PMP is usually created in the early stages of the project development phase.

The project manager is responsible for developing and maintaining the PMP. In other words, it is a living document that needs to be current at any time throughout the life of the project. At a minimum, the PMP will be reviewed at the following times:

- After the preferred option has been selected.
- After the concept design has been completed.
- At the end of the project development phase.
- At the start of the project delivery phase.
- After the detailed design has been completed.
- After the construction contract tender has been awarded.

## 1.7 Terminology and abbreviations

The following table lists the abbreviations used in this document.

| Term | Meaning |
|---|---|
| AFC | Anticipated final cost |
| APB | Approved project budget |
| BRM | Benefits realisation management |
| BRP | Benefits realisation plan |
| CEMP | Construction environmental management plan |
| CM21 | Contract management system |
| D&C | Design and construct delivery method |
| ECM | Engineering contracts manual |
| FIC | Finance and Investment Committee |
| ILC | Infrastructure Life Cycle |
| IMS | RMS' Integrated Management System (SAP) |
| OFS | NSW Office of Finance and Services |
| PBC | Project business case |
| PCR | Post completion review |
| PEMP | Project environmental management plan |
| PIDS | Project information data system |
| PMP | Project management plan (this document) |
| PSC | Professional services contractor |
| RMP | Risk management plan |
| RMS | Roads and Maritime Services of NSW |
| TfNSW | Transport for NSW |
| WBS | Work breakdown structure |
| WHS | Work health and safety |
| WOL | Whole of life |

# 2 Project definition

## 2.1 Project background

The existing Hawkesbury River Bridge at Windsor was opened in 1874. The existing bridge is the oldest existing crossing of the Hawkesbury River and parts of the bridge are now over 130 years old. Windsor Bridge is deteriorating due to age and heavy usage and has reached the end of its economic life. It no longer meets the demands of current traffic volumes or current road standards and requires significant on-going maintenance. The bridge is regularly inspected to ensure safety for use and as part of the safety measures that are being implemented heavy vehicle traffic is now limited to 40km/h. Windsor Bridge is below the 1 in 2 year ARI flood event level while the surrounding approach roads provide access closer to the 1 in 5 year ARI flood level.

The new project comprises of the replacement of the existing bridge with a new bridge over the Hawkesbury River at Windsor.

## 2.2 Project description

The new bridge will be located approximately 35 metres downstream from the existing Windsor Bridge. This project will provide two 3.5 metre wide traffic lanes with two 2.0 metre shoulders and a three metre wide shared path on the Western (upstream) side of the bridge.

The replacement bridge would be constructed using the incrementally launched method. The bridge would comprise of five spans and would be constructed of reinforced concrete. The bridge deck would be about 15.2 metres wide and supported on up to four piers within the river. It would have an overall length of about 159 metres, spanning both the river and The Terrace.

The project will:

- Provide a crossing that is central to Windsor, connecting the northern side of the Hawkesbury River directly to the township
- Provide a new connection under the bridge to Windsor Wharf by extending The Terrace
- Provide a new roundabout intersection at Freemans Reach and Wilberforce roads
- Provide a new signalised intersection at the intersection of George and Bridge Street
- Provide a shared pedestrian/cycle pathway for access to and across the bridge
- Remove the existing bridge across the Hawkesbury River, and approach road through Thompson Square would be removed
- Provide landscaping works within the open space area of Thompson Square and adjacent to the northern intersection of Bridge Street, Wilberforce Road, Freemans Reach Road and the access to Macquarie Park.

Further details about this project are available in the following documents:

- Windsor Bridge Replacement - EIS - Main Report and Appendices,
- Gate 3 - Final business case - (In progress)

| Document no. | Document title | Objective link |
|---|---|---|
| | Windsor Bridge Replacement - EIS - Main Report and Appendices, | https://edm.rta.nsw.gov.au/id:qA1119160 |
| | Gate 3 - Procurement (In progress) | |

## 2.3 Project objectives

The primary aim of the project is to provide a safe and reliable crossing of the Hawkesbury River at Windsor. Specific objectives for the project are:

- To improve safety for motorists, pedestrians and cyclists.
- To improve traffic and transport efficiency.
- To improve the level of flood immunity.
- To meet long term community needs.
- *To minimise the impact on heritage and the character of the local area.*

Further details regarding the project objectives are available in the Environmental Impact Statement.

## 2.4 Critical success factors

- Safety for motorists, pedestrians and cyclists.
- Improvement to traffic and transport efficiency.
- Improve the level of flood immunity.

## 2.5 Project scope and deliverables

### 2.5.1 Work included in the scope

The scope of work of the project includes the development, design, construction and operation of a new bridge across the Hawkesbury River.

The Windsor bridge replacement project would involve:

- Construction of a new bridge over the Hawkesbury River at Windsor, around 35 metres downstream of the existing Windsor Bridge.
- Construction of new approach roads and intersections to connect the new bridge to existing road network.
- Modifications to local roads and access arrangements, including changes to the Macquarie Park access and connection of The Terrace.
- Construction of pedestrian and cycling facilities, including a shared pedestrian/cycle pathway for access to and across the new bridge.

- Removal and backfilling of the existing bridge approach roads.
- Demolition of the existing Windsor Bridge.
- Urban design and landscaping works, including within the parkland area of Thompson Square and adjacent to the northern intersection of Wilberforce Road, Freemans Reach Road and the Macquarie Park access road.
- Ancillary works such as public utility adjustments, water management measures and scour protection works.

*The general features of the bridge include:*

- *A five No. 31.3 metre spans across the river*
- *Southern Abutment (Abut A) located on the southern side of The Terrace*
- *Four evenly spaced piers across the river*
- *Northern Abutment (Abut B) located behind the bank of the river*
- *The carriageway width between barriers is 11 metres from Abutment A to Pier 3 accommodating the two 3.5 metre wide lanes and 2.0 metre shoulders and then increases to 15.6 metre at Abutment B for the merge and diverges from the roundabout intersection between Freemans Reach Road and Wilberforce Road.*
- *A 3 metre wide shared path runs along the upstream or western side of the bridge.*
- *The bridge deck cross fall is 1.5% over the length of the bridge towards the downstream side of the bridge.*
- *Superstructure is Double-T girder with a structural depth of 1850mm.*
- *The deck Cantilevers from the girders is approximately 2100mm long between Abutment A and Pier 3. The cantilever lengths increase linearly from 2100mm to 4400mm at Abutment B.*
- *The bridge parapets and barrier between the roadway and shared path are proposed to be a series of precast concrete units that will be connected to the bridge superstructure.*

### 2.5.2 Work excluded from the scope

The extent of work is limited to that specified under 2.5.1 above.

Archaeological Investigations;

- Strategic Conservation Management Plan
- Archival Recording of the Build Form and Landscape
- Interpretation Plan
- Hawkesbury Region Sand Bodies Study

### 2.5.3 Managing project scope changes

Changes to the project scope will be handled in accordance with the following ProjectPack documents.

| Document no. | Title |
|---|---|
| ILC-MI-TP0-701 | Project scope changes |
| ILC-MI-TP2-301 | Project definition and scoping |

These changes could include changes to approved project objectives, budget and milestones.

RMS is developing further procedures for scope changes.

## 2.6 Project timing

- Project Approvals – August 2016
- Archaeological Investigations – December 2016
- Urban Design and Landscaping – December 2016
- Completion of Detailed Design – August 2016
- Invite Tenders for Construction – August 2016
- Award Construction Contract – December 2016
- Commencement of Construction – April 2017
- Project Completion – July 2019

For further details on the project schedule and milestone, refer to section 4.1.

The latest Project Program is available in following objective link.

| Document no. | Document title | Objective link |
|---|---|---|
| | Windsor Bridge Replacement – Project Program | https://edm.rta.nsw.gov.au/id:fA3350397 |

## 2.7 Assumptions and constraints

### 2.7.1 Assumptions

- Procurement Strategy – Construct only with pre-qualification requirement on B4 F75 and working in sensitive areas of Heritage significance and Launching experience
- Large number of approvals required from various stakeholders.
- Community Action Group protesting.

- A large number of studies are required before construction can commence and this may lead to major design changes to the bridge.
- Water-mains approval has not been obtained by Sydney Water yet.
- Environmental issues.
- Availability of funding or resources due to delay.

### 2.7.2 Constraints and limitations

- A large number of studies are required before construction can commence and this may lead to major design changes to the bridge.
- Complying with all the conditions of approval and approval from OEH, DOP
- Stakeholder requirements

Refer to the Risk Management Register for detailed treatment of risks available in the following objective link.

| Document no. | Document title | Objective link |
|---|---|---|
| | Windsor Bridge Replacement .- Risk Management | https://edm.rta.nsw.gov.au/id:qA1 119146 |

## 2.8 Related projects

This project can be delivered independent of other projects undertaken by RMS. However Minister Conditions of Approvals must be completed and approved by Department of Planning before commencement of construction.

# 3 Project organisation and staffing

## 3.1 Management structure

### 3.1.1 Overview

This section identifies the main participants in the project, describes their roles and shows the organisational structure for the project.

Refer to ProjectPack procedure ILC-MI-TP0-103 *Project team establishment and maintenance*.

### ~~3.1.2 Governance structure~~

~~The following diagram shows the governance structure for the project.~~

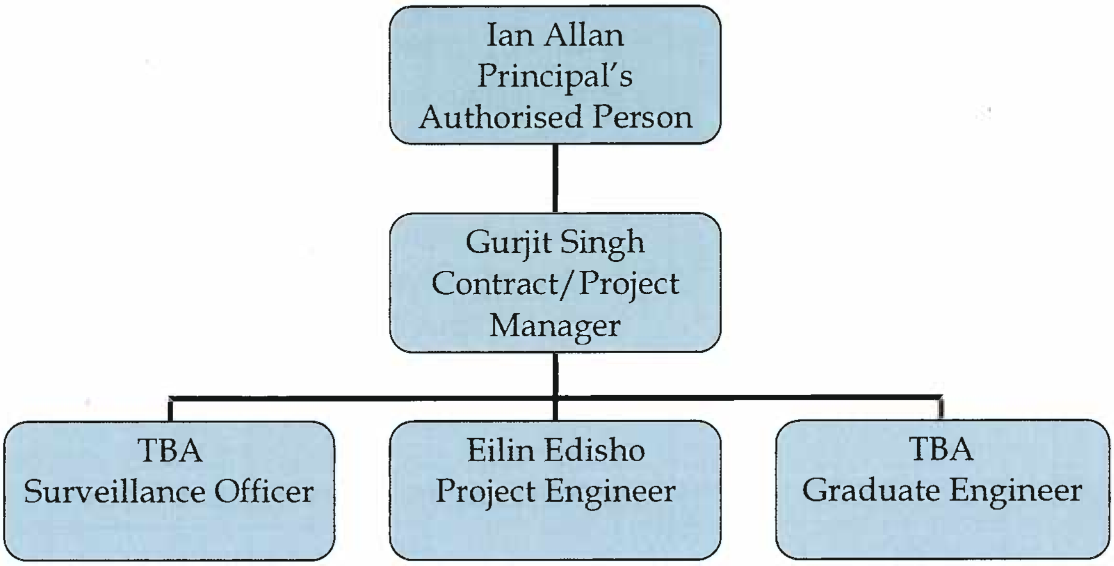
### 3.1.3 Project team structure

The following diagram shows the structure of the project team.

| Project Development | Project Delivery |
|---|---|
| Steve Arnold - GM, Project Development | Chris Browne- GM, Project Delivery |
| TBA - Principal Manager, Project Development | Ian Allan - Principal Manager, Project Delivery |
| TBA - Senior Development Manager | TBA - Senior Project Manager, Project Delivery |
| TBA - Project Development Manager | Gurjit Singh, Project Manager, Project Delivery |
| | TBA - Contract Manager |
| | Eilin Edisho - Project Engineer |
| | Detailed Design - Jacobs |
| | Construction - Contractor (TBA) |
| | TBA - Site Administration ( P/T) |

### 3.1.4 Contract management team structure

The following diagram shows the structure of the contract management team.




## 3.2 Project roles and responsibilities

The following table summarises the roles and responsibilities of the people involved in the project.

| Position | Roles and responsibilities |
|---|---|
| Sponsor<br>(General Manager, Project Development) | • The individual with overall responsibility for ensuring that a project meets its objectives and delivers the projected benefits.<br>• Responsible to the Director Infrastructure Development for overall reporting and delivery of the project throughout all phases of the project. |
| Principal Manager - Project Development | • Responsible to the Sponsor for all development works :<br>– Allocation of resources for the project.<br>– Professional standards.<br>– Reporting coordination. |

| Position | Roles and responsibilities |
|---|---|
| Project Manager - Project Development | • Responsible to the Sponsor through the Principal Manager - Project Development for all development phase activities, including:<br>– Community and stakeholder engagement.<br>– Route option development.<br>– Route selection.<br>– Detailed social, engineering and environmental studies.<br>– Detailed concept design.<br>– Public display of an REF/EA.<br>– Determination of the REF/EA.<br>• This person is given the authority and responsibility to manage the project on a day to day basis to deliver the development phase to the agreed objectives. |
| General Manager, Project Delivery | • Responsible to the Director Infrastructure Development for overall reporting and delivery of the project throughout the delivery and finalisation phases of the project. |
| Principal Manager - Project Delivery | • Responsible to the General Manager, Project Delivery for:<br>– Allocation of resources for the project.<br>– Professional standards.<br>– Reporting coordination.<br>– Principal's Authorised Person or RMS' Representative duties on contracts for all delivery works. |
| Project Delivery Manager | • Responsible to the General Manager, Project Delivery through the Principal Manager - Project Delivery for all delivery and finalisation phase activities, including:<br>– Acquisition.<br>– Detailed road and bridge design.<br>– Specification and contract documentation preparation.<br>– Site management team selection.<br>– Construction tendering<br>– Award of tenders.<br>– Construction contracts.<br>– Project handover.<br>• This person is given the authority and responsibility to manage the project on a day to day basis to deliver the delivery phase to the agreed objectives. |

| Position | Roles and responsibilities |
|---|---|
| Contract Manager | • Responsible to the Project Delivery Manager (or Principal Manager - Project Delivery) for:<br>– Administration of the contract(s).<br>– Liaison on all engineering matters.<br>– Managing the site management team.<br>• In a contractual situation, responsible to the Principal's Authorised Person (as Authorised Delegate) or RMS' Representative (as Site Representative) for:<br>– Site surveillance of the contractor.<br>– Administration of the contract(s). |

## 3.3 Professional services providers

| Name | Title | Section or branch | Phone |
|---|---|---|---|
| Denis Gojak | Snr Env Specialist – (Heritage) | Environmental Policy, Planning & Assessment | 85885754 |
| Ram Ramanan | Bridge Maintenance Planner | Asset Sydney | 8849 2532 |
| Rajanthi Ravindra | Senior Bridge Engineer – New Design | Bridge & Structural Engineering | 8837 0811 |
| Cleo Andrews | Snr Communications & Stakeholder Engagement Officer | Community & Stakeholder Engagement | 8849 2588 |
| Janine LEAKE | Project Assurance Manager | | 8588 5588 |
| Allan CUNNINGHAM | Senior Contracts Manager | | |
| David Heins | Construction Improvement Manager | Project Management Office | 8849 2259 |
| Nicholas Francesconi | Environment Manager | Environment | 8849 2576 |
| Suzette Graham | Environment Officer | Environment | 0476828524 |
| Stephen Rixon | Road Corridors Manager | Project Development | 8849 2437 |
| Julia Anicic | Acquisitions Officer | Infrastructure Property | 8849 2602 |
| Michael Sheridan | Urban Designer | Project Development | 8588 5768 |
| Gordon Bell | Manager, Utility Locations | Utility Locations | 80450 |
| Allen Chan | Utility Specialist | | |

| Name | Title | Section or branch | Phone |
|---|---|---|---|
| Martina MULHALL | WHS, Partner | Work Health & Safety | 0476823899 |
| Bruno Dalla-Palma | Project and Design Manager | Jacobs | 9032 1213 |
| Damien Wagner | Environmental Management and Planning | Jacobs | 9032 1652 |
| Dr MacLaren North | Principal Heritage Project Manager | Austral and AHMS Joint Venture | 0438613920 |
| Justin McCarthy | Managing Director | Austral and AHMS Joint Venture | 95686701 |
| WRIGHT Michael | Urban Design & Landscaping Manager | Spackman Mossop & Michaels | 9361 4549 |

More comprehensive Contact List is available in the following objective link.

| Document no. | Document title | Objective link |
|---|---|---|
| | Windsor Bridge Replacement – Contact List | https://edm.rta.nsw.gov.au/id:fA3374809 |

## 3.4 Key stakeholders

| Name | Title | Stakeholder group or organisation | Email | Phone |
|---|---|---|---|---|
| Peter Morrall | Head of Infrastructure | Environment Protection Authority - EPA | | 9995 6810 |
| Katrina Stankowski | Senior Team Leader, Archaeology | Office of Environment & Heritage - OEH | | 9873 8569 |
| Craig Johnson | Parks Project Officer | Hawkesbury City Council - HCC | | 4560 4524 |
| Jacqui Mcleod | Team Leader – Infrastructure Management | Department of Planning & Environment - DoP | | 92286454 |

| Name | Title | Stakeholder group or organisation | Email | Phone |
|---|---|---|---|---|
| Anna Timbrell | Planning Officer – Infrastructure Management | Department of Planning & Environment - DoP | | 9228 6345 |
| Tamzyn Bartlett | Case Manager, Resources & Land Use Economic Policy Group | Department of Premier & cabinet | | 9228 6492 |
| Carla Ganassin | Regional Assessment Officer | Department of Primary Industries - Fisheries | | 4222 8342 |
| John Galea | Water Regulation Officer | Department of Primary Industries - Water | John.galea@dpi.nsw.gov.au Also send submissions to water.referrals@dpi.nsw.gov.au | 8838 7520 |
| | | Sydney Water | | |
| | | E Energy | | |

More comprehensive Contact List is available in the following objective link.

| Document no. | Document title | Objective link |
|---|---|---|
| | Windsor Bridge Replacement – Stakeholder Contact List | https://edm.rta.nsw.gov.au/id:qA1119158 |

## 3.5 Staff and PSCs

### 3.5.1 Staff recruitment

The project manager will be responsible for recruiting suitable people to fill the roles in the project team

### 3.5.2 Procurement of PSCs

Where necessary, the project manager will engage professional services contractors (PSCs) to undertake specific activities in the project such as:

- Providing specialist expertise.
- Proving resources that are not available within RMS.
- Meeting peak workloads.

Following Professional Services Contractors (PSCs) have been engaged;

- Jacobs Pty Ltd have been engaged to undertake the Detail Design Revisions and Preconstruction Studies
- Austral and AHMS Joint Venture has been engaged to undertake the preparation of, Archival Recording of the built form and, landscape and Interpretation plan.
- *Environmental Representative*

### 3.5.3 Staff induction and training

The project manager will ensure that project team is given appropriate training as follows:

- Induction training for new staff when they join the project team.
- Site safety induction.
- Ongoing training where required in order performing the required tasks.

# 4 Time and cost planning

## 4.1 Time management

### 4.1.1 Project delivery schedule

For the latest version of the project schedule refer to the master program prepared by Jacobs which is available in the following objective link;

| Document no. | Document title | Objective link |
|---|---|---|
| | Windsor Bridge Replacement – Project Program | https://edm.rta.nsw.gov.au/id:fA3350397 |

### 4.1.2 Project milestones

Key milestones for the project correspond to the standard milestones in IMS and PIDS.

Milestones will be:

- Reviewed and updated monthly.
- Recorded in IMS and PIDS.
- Reported in the monthly project status report – Refer to ProjectPack procedure ILC-MI-TP0-105 *Project status reports*).
- Reviewed by the project sponsor (General Manager, Project Development) at the monthly project coordination meetings.

For the latest Project Milestones refer to the following PSR & PIDS prepared by the project manager which is available in the following objective link

| Document no. | Document title | Objective link |
|---|---|---|
| | Windsor Bridge Replacement – PSR | https://edm.rta.nsw.gov.au/id:qA1119145 |
| | Windsor Bridge Replacement – PIDS | http://pids.rta.nsw.gov.au/ |

## 4.2 Financial management (cost planning and management)

### 4.2.1 Work breakdown structure

A work breakdown structure (WBS) was developed for this project using the templates in IMS and in accordance with the requirements of the following user guides:

- IMS-PS-UG-060 *Standard WBS template for infrastructure development projects.*
- PMO-PM-UG-005 *WBS guide for major road projects.*

Refer to the Windsor Bridge Replacement *Project work breakdown structure (WBS)* for the current WBS in the following Objective Link;

| Document no. | Document title | Objective link |
|---|---|---|
| | Windsor Bridge Replacement - Project Work Breakdown Structure (WBS) - SAP | |

The WBS will be reviewed and updated at key stages throughout the project to reflect current time cost forecasts and expenditures. This is to be done monthly as part of project status reporting. Refer to ProjectPack procedure ILC-MI-TP0-105 – *Project status reports.*

### 4.2.2 Estimates and project status report

Estimates will be prepared, revised and signed off:

- At mandated stages of the project as identified in ProjectPack procedure ILC-MI-TP0-601 – *Project estimates.*
- In accordance with PMO-EST-UG-001 – *Project estimating manual.*

The following list shows the estimate reviews that are scheduled for this project:

- ~~Strategic stage.~~
- ~~Concept design stage.~~
- Detailed design stage – May 2016.
- At any significant change in the project scope.

The concurrence of the Project Management Office is mandatory for all estimates for this project as described in ILC-MI-TP0-601 – *Project estimates.*

A project financial report will be prepared each month in line with the WBS elements and incorporated in the monthly project status report. This report will include:

- An estimate of the anticipated final cost (AFC).
- Reporting on contingency.
- Project scope changes.

### 4.2.3 Funding

The project budget estimate summary sheets will be developed in accordance with PMO-EST-UG-001 – *Project estimating manual.*

Project expenditure will be monitored and forecasts updated monthly in IMS. The forecast expenditure to the end of the financial year will be based on what the project manager can reasonably predict will be spent.

The anticipated final cost (AFC) for the project will be compared with the current approved project budget (APB) each month. Where the AFC exceeds or is expected to exceed the APB:

- The project sponsor is to be notified immediately.
- Included in the next monthly project status report.

### 4.2.4 Forecasting and cost monitoring

Costs through the life of the project, including those arising from project scope changes, will be managed by the project manager using IMS. The project manager is required to adjust the estimate, contingency and project scope changes within IMS.

The anticipated cost to complete (cost plan version PJP) is regularly reviewed (at least monthly) on the basis of expenditure to date and work yet to be completed.

### 4.2.5 Contingency management

The project manager is responsible for managing the contingency and should be able to report on the use of contingency at any given time. The contingency requirements will be monitored and reported for financial year budgets and total project costs.

Funds for contingencies no longer required will be released to the program as soon as practicable.

### 4.2.6 Economic appraisal

An economic appraisal will be developed for each business case based on the following documents.

- Principles and guidelines of economic appraisal of transport investment and initiatives.
- National guidelines for transport system management in Australia.

### 4.2.7 Contract variations and extensions of time

Contract variations and extensions of time will be handled in accordance with sections 4.10 and 4.11 of the Engineering Contracts Manual (ECM) and the following ProjectPack procedures.

| Document no. | Document title |
|---|---|
| ILC-MI-TP0-802 | PSC contract administration |
| ILC-MI-TP3-430 | Issues, variations and extensions of time for construction contracts |

# 5 Component plans

## 5.1 Introduction

Component management plans are high-level planning documents that describe how specific aspects of the project will be managed by the project team. Each plan answers the following questions:

- What will be done?
- Who will be responsible for carrying out the activities?
- When will the activities be carried out?
- How will the activities be undertaken?
- Why will this activity be required?

The following list shows the component plans that have been developed for the project:

| Component Plan | Phase | Objective Reference |
|---|---|---|
| Benefits Realisation Plan | Detailed Design | https://edm.rta.nsw.gov.au/id:fA3567917 |
| Constructability Register | Detailed Design | https://edm.rta.nsw.gov.au/id:qA1119183 |
| Community and Stakeholder Involvement Plan | Detailed Design | https://edm.rta.nsw.gov.au/id:fA3272223 |
| Design Management Plan | Detailed Design | https://edm.rta.nsw.gov.au/id:fA3377139 |
| Issues Register | Detailed Design | https://edm.rta.nsw.gov.au/id:fA1528631 |
| Risk Register | Detailed Design | https://edm.rta.nsw.gov.au/id:fA3214083 |
| Risk Management Plan | Detailed Design | https://edm.rta.nsw.gov.au/id:fA3214083 |
| Value Engineering Report | Detailed Design | https://edm.rta.nsw.gov.au/id:qA1119148 |
| Work Health and Safety Management Plan – Early Works | Detailed Design | https://edm.rta.nsw.gov.au/id:fA1528640 |
| CEMP – Early Works | Detailed Design | https://edm.rta.nsw.gov.au/id:fA1611271 |
| Component Plan – Verification Record | Detailed Design | https://edm.rta.nsw.gov.au/id:fA3374935 |

## 5.2 Benefits realisation management

A benefits realisation plan will be developed in accordance with the NSW Office of Finance and Services (OFS) Benefits realisation management framework.

The project objectives and critical success areas of this project are listed in sections 2.3 and 2.4 respectively of this document.

*Achievements of the project objectives and critical success areas can be measured;*

- *At project team meetings and the monthly project coordination meetings*
- *As part of the PCR and lesson learned process*

## 5.3 Change management

A change management plan will be developed for the project to:

- Identify significant changes that will occur during the delivery of the project and after completion.
- Identify impacts on RMS staff and contractors, stakeholders and customers.
- Allocate responsibilities and roles to members of the project team to manage these changes.

## 5.4 Community and stakeholder management

A community and stakeholder management plan will be developed to describe how the project team will handle communication with various groups such as:

- Internal stakeholders.
- External stakeholders.
- Community groups.
- Local businesses.

## 5.5 Constructability assessments

Constructability assessments will be conducted at the following stages.

| Project stage | Type of constructability assessment |
|---|---|
| ~~Option selection~~ | |
| ~~20% concept design~~ | |
| ~~80% concept design~~ | |
| ~~20% detailed design~~ | |
| 80% detailed design | March 2013 |
| Completion of draft construction contract documents | September 2016 |

Constructability assessment reports are located at https://edm.rta.nsw.gov.au/id:qA1119183

## 5.6 Construction management

In the project delivery phase, a construction management plan will be developed.

## 5.7 Design management

Design management plans will be developed for:

- Concept design.
- Detailed design.

## 5.8 Environmental management

An environmental management plan will be developed and maintained throughout the project.

Early CEMP for the early works is located at https://edm.rta.nsw.gov.au/id:fA1611271

## 5.9 Handover management

Handover issues will be considered throughout the project in accordance with the following documents.

| Document no. | Document title |
|---|---|
| ILC-MI-TP2-401 | Handover from the development manager to the delivery manager |
| ILC-GEN-TP0-901 | Asset acceptance |

## 5.10 Issues management

An issues management plan and an issues register will be developed for the project and will be updated at regular intervals. Issue Register is located at https://edm.rta.nsw.gov.au/id:fA1528631

The project issues will be managed in accordance with the following ProjectPack documents:

| Document no. | Document title |
|---|---|
| ILC-MI-TP0-220-F01 | Project management issues register |

## 5.11 Procurement strategy

A procurement strategy plan was developed for the project and is located at https://edm.rta.nsw.gov.au/id:zA319542

Procurement of contractors will comply with the following policies and documents.

| Document number | Document title |
|---|---|
| | Delegations manual – Section 5.5 |
| | Engineering contracts manual – Section 4 |
| | Engineering contracts manual – Section 6 |
| ILC-MI-TP0-801 | PSC procurement |
| ILC-MI-TP0-802 | PSC contract administration |
| ILC-MI-TP3-350 | Construction contract tender documentation preparation |
| ILC-MI-TP3-355 | Construction tendering management |

## 5.12 Property acquisitions

A property acquisition plan will be developed to describe the processes that will be adopted for:

- Acquisition of properties.
- Disposal of properties.

## 5.13 Risk management

A risk management plan and a risk register will be developed for the project and will be updated at regular intervals. Risk Management is located at https://edm.rta.nsw.gov.au/id:qA1119146

The project risks will be managed in accordance with the following ProjectPack documents:

| Document no. | Document title |
|---|---|
| ILC-MI-TP0-201 | Risk management |
| ILC-MI-TP0-201-G01 | Guidelines for risk management |
| ILC-MI-TP0-201-G02 | Guideline for the risk management register |
| ILC-MI-TP0-201-F01 | Template for the risk management register |
| ILC-MI-TP0-201-F03 | Template for the risk management plan |

## 5.14 Safety management

### 5.14.1 Workplace health and safety (WHS)

A WHS plan will be developed for the project.

WHS Management Plan is located at https://edm.rta.nsw.gov.au/id:fA1528640

### 5.14.2 Safety in design

A safety-in-design component plan will be developed.

### 5.14.3 Road safety audits

Road safety audits will be conducted at the following stages in accordance with *Technical Direction for Road Safety Practitioners* TD 2003/RS03:

- ~~Stage one - Feasibility.~~
- Stage two - Preliminary design.
- Stage three - Detailed design.
- Stage four - Pre-opening.

## 5.15 Value management and value engineering

A value management workshop will be held in the development phase of the project. The value management study will be conducted in accordance with the Australian Standard AS 4183-2007 *Value management*.

A value engineering study will be undertaken in the delivery phase of the project. A constructability assessment is an example of a value engineering study.

Value Management for 20% detailed design is located at
https://edm.rta.nsw.gov.au/id:qA1119148

# 6 Managing the project

## 6.1 Project approvals

Many of the approvals required in the project are listed in the following documents:

- ProjectPack procedures.
- ProjectPack verification records.
- Management plans attached to this PMP.

Other approval points for this project might include:

- ~~Gate 0 – Initiation gate.~~
- ~~Gate 1 – Strategic business case.~~
- ~~Gate 2 – Preliminary business case.~~
- Gate 3 – Final business case.
- Gate 4 – Contract award.
- Gate 5 – Readiness for service.

Other significant approval points include:

- Major projects review committee.
- Environmental assessments and licensing.
- DoP approvals.
- Certificate of completion and handover

The following table summarises some of the key approvals that might be required during the project.

| Issue | Approval by |
|---|---|
| Scope changes | Project Team<br>GM Infrastructure Development |
| Changes to cost forecasts | PMO |
| Changes to contingency amounts | TfNSW |
| Changes to milestones | GM Infrastructure Development |
| Minsters Condition of Approvals | Department of Planning |

Many of the approvals are recorded in the project coordination meeting minutes.

## 6.2 Monitoring progress

The project manager will monitor the progress of all aspects of the project. This includes issues such as the following:

- Project activities.
- Project costs.
- Project schedule.
- Project risks and issues.

## 6.3 Project reporting

### 6.3.1 Regular reports

The following table summarises the regular reports that the project manager needs to prepare.

| Report | Purpose |
|---|---|
| CM21 | • Details of each contract in the project. |
| IMS (SAP) | • Project cost forecasts.<br>• Actual costs. |
| PIDS | • Project milestones.<br>• Project budgets. |
| Project status reports | • Project progress. |

### 6.3.2 Ad hoc reporting

The project manager will report important issues when they arise such as:

- Project briefings.
- Scope changes.
- Significant risks and opportunities.
- Exceptions to planned or expected performance.
- Issues that might affect the project.
- Actions required to deal with problems.
- Other critical activities.

## 6.4 Monthly project assurance and coordination

Each month, the project manager and the principal manager attend a meeting with the Assurance and Coordination Section. The purpose of the development program coordination meeting is to review the progress of the project. Topics include:

- Project costs and forecasts.
- Contingency amounts.
- Project milestones.
- Project scope.
- Significant project risks.

## 6.5 Project meetings

The following table summarises regular meetings to manage the progress of the project.

| Meeting | Timing | Notes |
|---|---|---|
| Steering committee | | |
| Project team | Weekly | |
| Department of Planning | Fortnightly | |
| Jacobs – detailed design | Monthly | |
| Austral and AHMS Joint Venture | Monthly | |

## 6.6 Document management

A project file structure will be created for the project in Objective in the early stages of the project development phase.

Project documents will be stored in Objective in accordance with ProjectPack procedure ILC-MI-TP0-104 *Document management for projects and contracts.*

## 6.7 Quality management

### 6.7.1 Verification records

Verification records will be used to provide:

- Verification of the completion of processes and activities that have been nominated as significant.
- Documentary evidence of the satisfactory completion of those processes and activities.
- The location (Objective file reference) of project documentation relevant to the progress and completion of those processes and activities.

Completion of the following verification records is mandatory:

| Document number | Verification record for ... | Object ID |
|---|---|---|
| ILC-MI-TP0-102-V01 | Project management | https://edm.rta.nsw.gov.au/id:qA1598198 |
| ILC-MI-TP0-601-V01 | Project estimates | https://edm.rta.nsw.gov.au/id:qA1598198 |
| ILC-MI-TP2-320-V01 | Concept development | https://edm.rta.nsw.gov.au/id:qA1598198 |
| ILC-MI-TP3-320-V01 | Detailed design | https://edm.rta.nsw.gov.au/id:qA1598198 |
| ILC-MI-TP0-801-V01 | PSC procurement | https://edm.rta.nsw.gov.au/id:qA1598198 |
| ILC-MI-TP3-355-V01 | Construction tendering management | https://edm.rta.nsw.gov.au/id:qA1598198 |
| ILC-MI-TP4-101-V01 | Project handover and finalisation | https://edm.rta.nsw.gov.au/id:qA1598198 |

The verification records will be updated as processes and activities are progressed and completed and related documents are filed.

### 6.7.2 Auditing of PSCs and construction contractors

External audits will be carried out on PSCs and construction contractors in accordance with the requirements of the engineering contracts manual and ProjectPack procedures.

The project manager is responsible for developing and updating the audit schedule. The audit schedule is provided below.

An audit schedule will be developed for the construction contractor prior to the award of contract in December 2016.

# 7 Project completion

## 7.1 Planning for project completion and handover

### 7.1.1 Planning throughout the project

At each stage of the project, the project manager will consult with internal and external stakeholders who will be involved in operational issues and maintenance of the assets after the construction is finalised and handed over. These are the responsible maintenance organisations (RMOs).

The early identification and addressing of operational and maintenance issues will reduce life cycle costs. These are key inputs in determining the whole-of-life costs for the project (as required in business cases).

#### Internal stakeholders

Internal stakeholders include:

- Asset Maintenance (pavement, bridge, corridor, traffic facilities etc.).
- Road pavements and geotechnical engineering.
- Intelligent transport systems.
- Traffic management (TfNSW).
- Journey Management Division.

#### External stakeholders

External stakeholders include:

- Local government (councils).
- Utility authorities.
- Local businesses.
- Other NSW state government authorities.
- Federal government departments and agencies.

### 7.1.2 Handover plan

Handover are located in https://edm.rta.nsw.gov.au/id:fA1528649

### 7.1.3 Post implementation review

A post implementation review (PIR) will be held at the following times:

- ~~End of the project development phase.~~
- End of the project delivery phase.
- At the completion of the project.

The purpose of each PIR is to:

- Review the outcomes of the project.

- Discuss and document any lessons learned.

The PIR will consist of a workshop. Participants in the workshop will include the project team and key stakeholders.

### 7.1.4 Post completion review

A post completion review is held for selected projects. The following table lists the three types of PCR:

| Stage | Name | Timing |
|---|---|---|
| ~~Stage 1~~ | ~~Project development~~ | ~~After approval has been given to proceed to detailed design and construction~~ |
| Stage 2 | Project delivery and handover | After the project has been opened for traffic and handed over to the RMO |
| Stage 3 | Project outcomes | About two years after completion |

### 7.1.5 Lessons learned from previous projects

In preparing the PMP, the project manager consulted experienced project managers who had been responsible for projects that were similar to this project.

One or more of these experienced project managers will be invited to key project meetings such as:

- Initial meeting of the project team.
- Constructability reviews.
- Risk management workshops.
- Safety-in-design assessments.

### 7.1.6 Lessons learned from this project

The project manager will record lessons learned during the project. This includes:

- Lessons learned in the PIR.
- Lessons learned in the PCR.
- Issues raised in project team meetings.

# 8 References

## 8.1 Related documents

| Document number and/or link | Title |
|---|---|
| ILC-MI-TP0-102 | Project management plan |
| ILC-MI-TP0-102-G01 | Guidelines for the project management plan |

## 8.2 Related web sites

- BuyWays
- ProjectPack documents
- ProjectPack Navigator
- TechInfo
- TechInfo project management
- TfNSW planning and program guidelines and templates

# ~~Appendix A – Project schedule~~

~~This document is stored in the project file in Objective:~~

~~<Insert the Objective link>~~

# ~~Appendix B – Project work breakdown structure (WBS)~~

~~This document is stored in the project file in Objective:~~

~~<Insert the Objective link>~~

# Appendix C – Component plans

The following table lists the component plans for this project and the document ID within Objective.

| Component plan | ProjectPack template | Objective ID |
|---|---|---|
| Benefits realisation management | N/A | |
| Change management | N/A | |
| Community and stakeholder management | N/A | https://edm.rta.nsw.gov.au/id:fA3272223 |
| Construction management | To be developed prior to the construction contract award | |
| Design management | | |
| Environmental management | | |
| Handover management | To be developed prior to the construction contract award | |
| Issues management | | |
| Procurement management | | |
| Property acquisition management | | |
| Risk management | ILC-MI-TP0-201-F03 | |
| Utilities adjustment management | | |
| Value management, value engineering and constructability assessment | | |
| WHS management | | |

# Appendix 9: Risk Management Plan

Transport
Roads & Maritime
Services

## Risk management plan

# Windsor Bridge Replacement Project

Project number: A/66737

RMS document number: RMS document number

Version 1.0 (03 August, 2016)

Greater Sydney Program Office

# About this document

## Document information

| | |
|---|---|
| File name | appendix 9 Risk Management Plan_Windsor Bridge Replacement Project |
| Document number | RMS document number |
| Objective ID | A14003308 |
| Version number | 1.0 |
| Date | 03-Aug-16 |
| Prepared by | Greater Sydney Program Office |

## Project information

| | |
|---|---|
| Project name | Windsor Bridge Replacement Project |
| Project number | A/66737 |
| Start location | Intersection of Freemans Reach Road and Wilberforce Road in the north |
| End location | Intersection of Macquarie Street and Bridge Street in the south. |
| Road number | |
| Road name | |

## Approvals

| Approval and authorisation | Position | Name | Date |
|---|---|---|---|
| Prepared by | Project Manager | Gurjit Singh | 03-Aug-16 |
| Approved or authorised by | Senior Project Manager | Graham Standen | 03-Aug-16 |

## Current managers

| Current managers | | Effective date |
|---|---|---|
| Project Development Manager | N/A | |
| Principal Manager – Development | N/A | |
| Project Delivery Manager | Gurjit Singh | June 2015 |

| Current managers | | Effective date |
|---|---|---|
| Principal Manager – Delivery | Ian Allan | June 2015 |

## Revision history for this document

| Issue | Date | Revision description |
|---|---|---|
| 1.0 | 03-Aug-15 | First issue |
| | | |

# About the ProjectPack template

## Information about the ProjectPack template

| | |
|---|---|
| **Template name** | Risk management plan template |
| **Template number** | ILC-MI-TP0-201-F03 |
| **Version and date** | 1.1 (11-Sep-15) |
| **Associated procedure** | ILC-MI-TP0-201<br>Risk management |
| **Prepared by** | Project Management Office, Project Development Branch |

## Template revision history

| Issue | Date | Revision description |
|---|---|---|
| 1.0 | 11-Sep-14 | First issue |
| 1.1 | 11-Sep-15 | Formatting changes and fix for compatibility problem with Word 2007 |

| | |
|---|---|
| Note | RMS regularly reviews and updates documents in ProjectPack in accordance with the principle of continual improvement.<br>Therefore, the version you are working with might now have been superseded. The most recent version of the ProjectPack template is available on the RMS intranet in the TechInfo site. |

# Table of contents

# 1 Introduction

## 1.1 Purpose

This risk management plan (RMP) provides a framework for identifying and managing risks within the project. This includes the strategies and processes used for the risk management process:

- Communication and consultation.
- Establishing the context.
- Risk assessment - Risk identification, risk analysis and risk evaluation.
- Risk treatment.
- Monitoring, reporting and review.

The plan specifies:

- Who will be responsible for the various aspects of risk management.
- When these activities will be conducted.
- How the activities will be performed.

## 1.2 Project description

- The preferred option for the Windsor Bridge replacement project comprises the following:
- Replace the existing Windsor Bridge with a new incrementally launched bridge structure, downstream (45m from the existing Windsor Bridge) and aligned with Old Bridge Street;
- Increase capacity of the bridge with a single northbound lane and two southbound lanes to address forecasted increases;
- Provide a wide shared path providing dedicated space for pedestrians and cyclists to cross the river;
- Minimise bridge height and vertical elevation of the approach roads to reduce visual impacts on Thompson Square while still providing sufficient clearance under the bridge for service vehicles to access Windsor Wharf along The Terrace;
- Replace the roundabout at the intersection of George Street and Bridge Street with traffic signals and construct a new dual lane roundabout at the intersection of Bridge Street / Freemans Reach Road / Wilberforce Road / Macquarie Park access road;
- Rehabilitate Thompson Square;
- Rehabilitate and landscape other areas of the project impacted by construction; and
- Demolish the existing Windsor Bridge.

## 1.3 Risk management objectives

The objectives of this RMP are to ensure that:

- All project risks have been identified and assessed.
- Appropriate control and mitigation strategies have been identified.
- Processes for review and reporting have been established.
- Risks are accurately handed over from one phase of the project to the next.
- Risk costs are evaluated and included in contingency management.

## 1.4 Risk management scope

This RMP is applicable to all phases of the project - Project initiation, development, delivery and finalisation.

Risks to be considered include:

- Organisational and reputation risks - Risks from the project that might have an effect on RMS.
- Project risks - Risks to the successful completion of the project.
- External risks - Risks transferred from other sources such as contractors and other agencies.

# 2 Assumptions, constraints and existing information

In developing the risk register, the following assumptions are noted:

- Roads and Maritime prepared the strategic road and bridge designs for the project using a professional services contract including site surveys for various design aspects;
- Preparation of a concept design has been undertaken through a Professional Services Contract;
- The project obtained an approval under Part 5 of the Environmental Planning and Assessment Act 1979;
- Roads and Maritime managed the project through a Professional Services Contract to prepare an environmental assessment under Part 5 of the EP&A Act, including key specialist studies;
- All pre-construction activities were funded from previous years commitments (including some property acquisitions);
- Roads and Maritime is currently managing the detail design through professional services contract (finishing of remaining property acquisitions);
- Subject to funding and planning approval, the project procurement will be a construct only contract;
- The existing bridge will generally need to remain open during construction, except for the regular maintenance closures / work;

- The timeframe for delivery of the project is to complete the detailed design by the March 2017. The Concept Design was completed in 2012;
- That the funds required to complete all pre-construction activities will be provided in accordance with the funding cash flow requested in the Business Case;

The risk management plan has been developed in accordance with Roads and Maritime procedures defined in ProjectPack. The scope of the risk management plan has been developed with risks divided into various categories including:

- Project risks which identify potential risks to project objectives, risks to project scope and risks to timeframes;
- Risks relating to communications - either relating to communications with various community groups and stakeholders, or elected representatives;
- Risks associated with planning and approvals for the project;
- Design element risks; and
- Risks associated with detailed investigations such as geotechnical, aboriginal and non-aboriginal cultural heritage, environmental and urban design.

This risk management plan has been prepared to manage those risks identified at the strategic design phase, but will be regularly reviewed and updated in accordance with the requirements of ProjectPack.

## 2.1 Assumptions

The assumptions include:

- Subject to funding and planning approval, the project procurement will be a construct only contract;
- Planning approval shall be obtained; and
- Funding shall be made available for construction.

## 2.2 Constraints

The constraints include:

- Time constraints, deadlines and milestones;
- Availability of finance and resources;
- Planning and delivery for other projects;
- Requirements of government policies or priorities;
- Stakeholder requirements;
- Environmental restrictions;
- Planning requirements or restrictions;
- Requirements for quality and standards.

## 2.3 Existing information

The project is informed by a range of specialist investigations, documents and reports, including:

- PSP (old style Strategic Business Case)
- Approved Environmental Impacts Assessment (EIS);
- Concept design prepared by Jacobs; and
- A range of field investigations including survey, utility investigations and geotechnical investigations.

# 3 Risk management approach

## 3.1 Risk management standards and systems

Risk management for the project will be conducted in accordance with the following standards and procedures.

| Document number | Document title |
|---|---|
| **Australian standard** | |
| AS/NZS ISO 31000:2009 | Risk management – Principles and guidelines |
| **ProjectPack** | |
| ILC-MI-TP0-201 | Risk management |
| ILC-MI-TP0-201-G01 | Guidelines for risk management |
| ILC-MI-TP0-201-F01 | Risk register template |
| **RMS policy and procedures** | |
| PN 224 | Risk management policy |
| PN 224P | Risk management procedure |
| PN 224F | Risk management framework |

## 3.2 Risk management processes

### 3.2.1 Risk assessment

Risk assessment involves risk identification, risk analysis and risk evaluation. This process will include the following steps:

- Generating a comprehensive list of risks.
- Identifying the cause or source of each risk.
- Describing the potential consequences of each risk.
- Assessing the likelihood and consequences levels for each risk.

- Determining the risk rating based on the risk ranking matrix.

The ProjectPack risk register ILC-MI-TP0-201-F01 will be used to record the risk assessment process.

### 3.2.2 Risk treatment

Risk treatments will be developed for all risks with a rating of medium or higher so that they can be actively managed, monitored and brought within acceptable levels. This process will include the following steps:

- Identifying suitable treatments for each risk.
- Assigning a responsible person for each treatment
- Determining the timing for applying the treatment
- Assessing the likelihood and consequences levels for each risk after the treatments have been applied.
- Determining the residual risk rating based on the risk ranking matrix.
- Determine priorities for handling risks and their treatments.

Risk control measures will include:

- Risk avoidance.
- Removing the source of the risk.
- Reducing the likelihood.
- Reducing the consequences.
- Risk transfer or sharing.
- Risk acceptance or retention.

Safety risks will be eliminated where possible.

Standard processes will be identified for treating generic risks.

The ProjectPack risk register ILC-MI-TP0-201-F01 will be used to record the risk treatments.

### 3.2.3 Contingency plans

Contingency or management plans will be developed for handling significant and unexpected events. The plans will include:

- An outline of how technical issues might be resolved and how to minimise adverse outcomes.
- A strategy for handling concerns from stakeholders and the community.

# 3.3 Risk management methodologies

## 3.3.1 Workshops

### Timing of workshops

- Strategic planning phase - Option development and strategic design development phase (complete).
- Project development phase - Preferred option refinement, during the preparation of the concept design and environmental assessment.
- Project delivery phase -Detailed Design development phase.
- Review of top risks at monthly and full risk register review at end of each design development phase (strategic, concept and detail).

### Participants in workshops

A risk workshop was completed in the concept phase. The workshop was conducted in accordance with the procedures contained in ProjectPack.

Typical attendees for future workshops would include:

- Workshop facilitator;
- Principal Manager;
- Senior Project Development Manager;
- Project Development Manager;
- Senior Project Delivery Manager;
- Project Delivery Manager; and
- Internal specialists including communications, road design, bridge design, property management, environment, geotechnical and pavements, road safety and traffic, WHS.

### Planning for workshops

- Determining the date and duration of the workshop.
- Selecting the venue.
- Selecting a facilitator.
- Inviting participants.

### Conducting workshops

- Prior to the workshop, the project manager or a sub-committee will identify generic risks.
- Prior to the workshop, the project manager or a sub-committee will review any existing risk registers to update before workshop.
- The workshop will concentrate on project-specific risks.
- Brainstorming will be used to identify risks.

- The risk register will be used as the basis of discussions during the workshop – either projected onto the screen or by using the whiteboard or butcher's paper.
- After the workshop, the project manager or a sub-committee will finalise the risk register.

The detail design risk workshop for the Windsor Bridge Replacement Project is to be organised for Late September / Early October 2016.

### 3.3.2 Desktop risk reviews

The risk management process is a continual improvement process. Ongoing monitoring and review procedures are required to capture any new risks and to review implementation of current risk mitigation strategies. As such the following activities are proposed to assist in risk monitoring and reporting for the Project:

- Regular Project Progress meetings with the team.
- Periodic risk reviews to occur monthly and/or as required to enable regular review of risk register/analyser to confirm all details, including risk ratings and capture of any emerging risks for the Project.
- Informal reviews undertaken by the Roads and Maritime Project Development/Delivery Manager to confirm the accuracy and relevance of the Project Risk Register/Analyser.
- Formal major reviews as a finishing activities for each of the design phases, i.e. at the end of strategic, concept and detailed design.

The reviews will use the ProjectPack risk register.

### 3.3.3 Related risk processes

The risk management process provides a robust and transparent means of identifying those events that have the potential to enhance or adversely impact the project so they can be effectively managed. To implement this process, a series of Risk Management Assessments and Workshops will be conducted through the project.

A preliminary risk register was prepared by a Professional Services Consultant (PSC) based on discussions with the project development/delivery manager and issued as part of the briefing papers for the initial risk management workshop. This work provided the framework for registering risks for the project and was utilised at the initial risk workshop. The risk register (the Register) will be reviewed in subsequent risk workshops planned to be held during the development of the project. The Register will be updated on a regular basis. Further risk management workshops would be conducted during the detailed design phases of the project.

Further workshops to assess specific project risks (e.g. constructability, safety-in-design) will be held during the completion of the detailed design.

## 3.4 Roles and responsibilities

The following table lists the roles and responsibilities for various aspects of risk management for the project.

| Position | Name | Responsibilities |
|---|---|---|
| Project manager | Gurjit Singh | • Primary responsibility for risk management for the project.<br>• Development and maintenance of this RMP template.<br>• Arranging and conducting risk management activities such as workshops.<br>• Risk assessment – Risk identification, risk analysis and risk evaluation.<br>• Risk treatment.<br>• Monitoring and review of risks.<br>• Reporting and escalation of risks. |
| Sponsor – General Manager Project Development | Steve Arnold | • |
| Steering committee | | • Pre-IPIC & IPIC |

**Note**

The responsible person identified in table above may choose to delegate tasks (but not approvals) to other RMS personnel as required. However, responsibility remains with the person listed in the table.

## 3.5 Handover

The risk register will be regularly reviewed and updated throughout the project life cycle. In accordance with Roads and Maritime process, project responsibility passes from the development manager to the delivery manager. This transition typically occurs following completion of the concept design and environmental assessment. The life cycle model for project planning and implementation sees the project development and delivery managers move through the life cycle of the project with their responsibility and time commitment changing throughout the lifecycle.

The ProjectPack procedure (ILC-MI-TP2-401) documents the process for handover from development to delivery manager. The handover process and nominated accountability during the various project phases does not mean the other person is not involved in either the respective development or delivery phases. The handover process is simply intended to indicate who has primary responsibility at any stage of the project life cycle. Similar handover processes take place between the Roads and Maritime delivery and asset managers.

# 4 Risk monitoring and reporting

## 4.1 Risk monitoring and updating

### 4.1.1 Overview

The risk management process is a continual improvement process:

- Risk assessment is an ongoing process.
- Risk treatments need to be regularly monitored.
- The RMP and the risk register need to be updated regularly.

The monitoring and review process will cover all aspects of the risk management for the project. The purpose is to:

- Ensure treatments and controls are effective and efficient.
- Obtain further information to improve the risk assessment.
- Identify changes in assumptions and constraints.
- Identify emerging risks.
- Identify risks that have eventuated and so have become incidents or issues.
- Close out risks that are no longer relevant or current.

This information will be used to update this RMP and the risk management register.

### 4.1.2 Methodology

Risk management will be included as an agenda item for the following regular meetings:

- Project team meetings.
- Monthly coordination meetings.
- Steering committee meetings.

Other activities that could identify necessary changes to the risk register include:

- Health and safety in design (HSID) workshops.
- Risk assessments conducted by other branches such as Environment Branch or WHS Branch.
- Site inspections.
- Audits.
- Regular desktop risk assessments.
- Subsequent risk workshops.

## 4.2 Risk reporting

### 4.2.1 Routine risk reports

The current risk management status will be reported at regular meetings such as:

- Project team meetings.
- Monthly coordination meetings.
- Steering committee meetings.

Risk reports might be required in other situations such as the occurrence of a significant risk.

### 4.2.2 Reporting and escalation

Risks with a residual risk rating of extreme will be notified to the sponsor (General Manager, Project Development) via the Principal Manager.

Other risks will be handled by the project team.

## 4.3 Project costs

An estimate will be made for the cost of each risk that has a residual risk rating of medium or above.

These costs will be included in:

- The risk management register.
- Contingency management.

## 4.4 Issue management

When a risk eventuates, it becomes an incident or an issue. Issues will be managed using the issues management register.

## 4.5 Lessons learnt and post implementation reviews

### 4.5.1 Lessons leant

When developing the RMP and the risk management register for this project, the risks from similar previous projects will be studied in order to:

- Identify risks and treatments that might be applicable to this project.
- Learn from the experience of the project team on the previous projects.

Similarly, the RMP and the risk management register for this project will be made available to future similar projects in RMS.

### 4.5.2 Post implementation review

Risk management will be included as an agenda item in the post implementation review or post completion review.

# 5 References

## 5.1 Related documents

| Document number | Document title |
|---|---|
| **ProjectPack – Risk management** | |
| ILC-MI-TP0-201 | Risk management |
| ILC-MI-TP0-201-G01 | Guidelines for risk management |
| ILC-MI-TP0-201-G02 | Guidelines for using the risk management register |
| ILC-MI-TP0-201-F01 | Risk register template |
| ILC-MI-TP0-201-F02 | Risk register flipchart for workshop |
| ILC-MI-TP0-201-S01 | Sample for the risk management register |
| ILC-MI-TP0-201-S02 | Sample of project risks |
| **ProjectPack – Other documents** | |
| ILC-MI-TP0-102 | Project management plan |
| ILC-MI-TP0-120 | Benefits management |
| ILC-MI-TP0-220 | Issues management |
| ILC-MI-TP0-301 | Community and stakeholder engagement |
| ILC-MI-TP0-501 | WHS management |
| ILC-MI-TP0-520 | Health and safety in design |
| ILC-MI-TP0-601 | Project estimates |
| ILC-MI-TP2-401 | Handover from the development manager to the delivery manager |
| ILC-MI-TP3-410 | WHS management for construction contracts |

## 5.2 Risk management resources

| Document number | Document title |
|---|---|
| **RMS policy** | |
| PN 224 | Risk management policy |
| PN 224P | Risk management procedure |
| PN 224F | Risk management framework |
| **TfNSW** | |
| 3TP-PR-086 | Project risk management |
| 3TP-FT-360 | Risk management plan template |
| **Australian and international standards** | |
| AS/NZS ISO 31000:2009 | Risk management – Principles and guidelines |
| ISO 31010 | Risk management – Risk assessment techniques |
| ISO Guide 73:2009 | Risk management – Vocabulary |

# Appendix 10: Risk Register

[V2.1] # Risk management register - Detailed design

| | |
|---|---|
| **Project name:** | Windsor Bridge Replacement |
| **Project number:** | A/66737 |
| **Region:** | |

| | |
|---|---|
| **Created by:** | Windsor Bridge Project Team |
| **Date created:** | 19/06/2012 |
| **Revised by:** | T. Stephanou for G. Singh |
| **Date revised:** | 6/08/2017 |

| Reference | Cause, trigger or issue | Risk, hazard or opportunity | Potential consequences | Original rating: Likelihood | Original rating: Consequence | Original rating: Original risk | Proposed risk treatment | Responsible parties: Project manager | Responsible parties: Specialist or other resource | Timetable: Priority | Timetable: Date or timing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **3.1** | **Approvals** | | | | | | | | | | |
| 3.1.1 | MCoA | Unable to meet or close out MCoA | Project delays<br>Unable to meet programmed date for award of construction contract. | H | H | [illegible] | Prepare high quality documents.<br>Engage early with other agencies and DPE.<br>Progressive consultation.<br>Submit as soon as possible.<br>Manage community/stakeholder issues.<br>Respond quickly to requests for information.<br>Develop and implement MCoA compliance tracking register.<br>Monthly meetings with DPE.<br>High level steering committee to resolve complicated issues. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Environmental Peer Reviewer, RMS, S Graham<br>Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir | | |
| 3.1.2 | Business Case | Gateway process delayed or approval not obtained | Funding not available to award construction contract in July 2017.<br>Project delays. | L | H | M | Prepare draft Business Case early and identify risks for Gateway review process | Gurjit Singh | Project Manager, Jacobs, T Rodham<br>Project Assurance Manager RMS Jannine Leake | | |
| 3.1.3 | Changes to the approved project | Delay to project due to time to assess changes and gain approval. | Project delays.<br>Unable to meet programmed date for award of construction contract.<br>Additional cost to the project. | L | H | M | Keep Environmental team informed of potential changes to detailed design.<br>Early identification and submision of design changes for DPE approval.<br>Consistency assessment to compare detailed design with EIS.<br>Keep Communications team informed for early issues management and implications for collateral. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Environmental Peer Reviewer, RMS, S Graham<br>Project manager, Jacobs, T Rodham | | |
| 3.1.4 | Clarification to approvals for the project | Delay to project due to time to assess clarifications and gain approval. | Project delays.<br>Unable to meet programmed date for award of construction contract.<br>Additional cost to the project. | L | H | M | Keep Environmental team informed of potential changes to detailed design.<br>Early identification and submision of design changes for DPE approval.<br>Consistency assessment to compare detailed design with EIS.<br>Keep Communications team informed for early issues management and implications for collateral. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Environmental Peer Reviewer, RMS, S Graham<br>Project manager, Jacobs, T Rodham | | |
| 3.1.5 | | | | N | N | N | | | | | |
| **3.2** | **Project objectives** | | | | | | | | | | |
| 3.2.1 | Programme | Failure to meet engineering and environmental programme. | Not meeting program objective.<br>Delay in inviting tenders or an unacceptable number of addenda issued during the tender period. | H | H | [illegible] | Detailed scoping, programme, risk management and monitoring.<br>Regular progress reporting to senior RMS management.<br>Accurate monthly project reporting by Jacobs.<br>Coordination of all approvals (inc. within RMS).<br>Regular project progress meetings.<br>Escalating delays early.<br>Updating programme | Gurjit Singh | Project Manager, Jacobs, T Rodham<br>Project Manager, AAJV | | |
| 3.2.2 | | | | N | N | N | | | | | |
| **3.3** | **Project scope** | | | | | | | | | | |
| 3.3.1 | Scope changes | Scope changes cause delays to engineering and environmental programme.<br>Delay in approving scope changes. | Project delays.<br>Unable to meet programmed date for award of construction contract. | H | M | H | Develop, agree and implement a scope change mechanism with Jacobs or other specialist subconsultants.<br>Ensure that scope changes remain within the framework of the project as defined in MCoA and current RMS agreed request for services. | Gurjit Singh | Project Manager, Jacobs, T Rodham<br>Project Manager, AAJV | | |
| 3.3.2 | Defining scope and limits of works in Thompson Square | Community and Stakeholder's expectations of the extent of works in Thompson Square exceeds the agreed scope of work. | Tarnish relationship with Council, Heritage Council, DPE and community.<br>Project approval delays. | M | H | H | Meet with stakeholders to discuss and reach agreement with RMS scope of works in Thompson Square. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Environmental Peer Reviewer, RMS, S Graham | | |
| 3.3.3 | Demolition of existing bridge | Failure to identify items to be salvaged prior to construction. | Destruction of items identified for salvage prior to demolition | L | M | L | Ensure message is communicated early to all stakeholders | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Environmental Peer Reviewer, RMS, S Graham | | |
| 3.3.4 | Provision for future assets, such as utilities, not included in the scope of work. | Failure to consider future upgrades. | Difficulty in retrofitting assets during construction.<br>Destruction of newly completed work to incorporate assets. | L | H | M | Liaise with stakeholders to confirm future plans for upgrades.<br>Incorporate provision for identified upgrades | Gurjit Singh | Design Manager, Jacobs, B Dalla-Palma | | |
| 3.3.5 | | | | N | N | N | | | | | |
| **3.4** | **Project budget** | | | | | | | | | | |
| 3.4.1 | Scope changes | Funding not available for scope changes. | Project delays.<br>Unable to meet programmed date for award of construction contract. | H | H | [illegible] | Scope definition and control.<br>Estimate cost of any scope changes.<br>Early advice if funding increase is required. | Gurjit Singh | Project Manager, Jacobs, T Rodham | | |
| 3.4.2 | | | | N | N | N | | | | | |

| Reference | Cause, trigger or issue | Risk, hazard or opportunity | Potential consequences | Original rating: Likelihood | Original rating: Consequence | Original rating: Original risk | Proposed risk treatment | Responsible parties: Project manager | Responsible parties: Specialist or other resource | Timetable: Priority | Timetable: Date or timing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **3.5** | **Cost estimates** | | | | | | | | | | |
| 3.5.1 | Project cost estimates | Failure to include items.<br>Incorrect quantities, incorrect rates and/or insufficient contingency are used. | Project delays.<br>Unable to meet programmed date for award of construction contract.<br>Request for additional funding. | L | M | L | Consider undertaking a cost estimate independent verification.<br>PMO review of cost estimate. | Gurjit Singh | Tender Documentation, Jacobs, D Hard<br>Cost Estimator, North Projects | | |
| 3.5.2 | Impact of scope changes on cost estimate | Cost estimate exceeds available funds | Project delays.<br>Unable to meet programmed date for award of construction contract.<br>Request for additional funding. | L | H | M | Develop the design minimising the need for scope changes.<br>Allow for contingencies/provisional sums in the budget. | Gurjit Singh | Tender Documentation, Jacobs, D Hard<br>Cost Estimator, North Projects | | |
| 3.5.3 | Submitted tender prices exceed the RMS tender estimate. | Tender price exceeds available funds | Delay in awarding construction contract.<br>Request for additional funding. | M | H | H | Early identification of impacts of scope changes on cost estimate.<br>Undertake a detailed cost estimate at IFT.<br>Include contingency for unresolved items (eg. interpretation strategy). | Gurjit Singh | Tender Documentation, Jacobs, D Hard<br>Cost Estimator, North Projects | | |
| 3.5.4 | Submitted tender prices are competetive | Opportunity for cost savings | Cost savings to project | N | N | N | Detailed tender documentation.<br>Reduce risks and assumptions. | | | | |
| 3.5.5 | | | | N | N | N | | | | | |
| **3.6** | **Community** | | | | | | | | | | |
| 3.6.1 | Community protest/adverse media | Community may not understand aspects of the project | Adverse media may delay the project. | L | M | L | Maintain community engagement, especially through project updates, notifications and website updates.<br>Use MCoA to resolve any conflicts from stakeholders.<br>Develop, implement and update a Community and Stakeholder Engagement Plan.<br>Regular review of CESP to ensure messaging consistent with program. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir | | |
| 3.6.2 | Community stakeholder objections | Community stakeholders may not understand aspects of the project | Objections may delay the project | L | H | M | Maintain community engagement, especially through project updates, notifications and website updates.<br>Use MCoA to resolve any conflicts from stakeholders.<br>Develop, implement and update a Community and Stakeholder Engagement Plan.<br>Include stakeholder briefings for key consultation activities. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir | | |
| 3.6.3 | Objections from directly affected residents | Residents may not understand aspects of the project | Resident dissatisfaction. | H | L | M | Regular consultation.<br>Transparent about impact.<br>Genuinely consider requested changes. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir | | |
| 3.6.4 | Integration of recreational activities in design | Failure to make provision for recreational activities in the design | Complaints from Council. | L | L | N | Consult with Maritime Services branch.<br>Consult with council in relation to public use spaces.<br>Construction staging drawings.<br>Include scheduled activities in tender documentation. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir<br>Tender Documentation, Jacobs, D Hard | | |
| 3.6.5 | Extent of consultation not sufficient | Community may not understand aspects of the project | Adverse media may delay the project.<br>Not comply with MCoA - delay DPE acceptance<br>Negative representsations to elected representatives. | L | M | L | Develop and implement Community Communication Strategy.<br>Capture information in Consultation Manager.<br>Regular review against MCoA for compliance.<br>Review stakeholder and community contacts. | | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir | | |
| 3.6.6 | Poor community consultation occurs (ie. unclear confusing messages, community unaware, etc) | Community may not understand aspects of the project | Adverse media may delay the project.<br>Adverse representations to the community | L | M | L | Implement the robust community information/consultation program (ie. new community update/ refresh/ website/ community focus group/ additional community meetings, etc). | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir | | |
| 3.6.7 | Conflicting information given to the community by politicians | Loss of community support for the project | Adverse media may delay the project.<br>Adverse representations to the community | L | H | M | Prepare ministerial briefing for distribution to all politicians | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir | | |

| Reference | Cause, trigger or issue | Risk, hazard or opportunity | Potential consequences | Original rating: Likelihood | Consequence | Original risk | Proposed risk treatment | Responsible parties: Project manager | Specialist or other resource | Priority | Timetable: Date or timing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.6.8 | Impact of construction in Thompson Square | Perceived and/or unacceptable construction impacts on Thompson Square and the intersection of George and Bridge Streets | Adverse media affects reputation.<br>Community protests in Thompson Square. | H | M | H | Undertake detailed construction planning and auditing;<br>Ensure there is comprehensive community notifications;<br>Ensure there is a continuity of resources and management so that intent and importance of the project and the agreements made are not lost.<br>Address with sufficient detail to meet OEH, MCoA requirements through UDL Plan consultation.<br>Require tenderers to provide details of managing the impact.<br>Contractor to develop and maintain a management strategy.<br>Contractor to engage a community liaison officer. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir<br>Tender Documentation, Jacobs, D Hard | | |
| 3.6.9 | Design in Thompson Square | Uncertainty surrounds the final use/ treatment of Thompson Square due to conflicting demands from the community and stakeholders | Community and stakeholder dissatisfaction with the project | L | L | N | Undertake additional consultation processes for development of treatment and use of Thompson Square after construction.<br>Engage the Council in the process and obtain their buy in.<br>Make use of the Bridge Urban Design Panel.<br>Adhere to requirements of MCoA.<br>Develop comprehensive UDL strategy and detailed UDL plan. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir | | |
| 3.6.10 | Insufficent consultation on UDL Plan, SCMP and IS · | Insufficient stakeholder consultation | Protests from interest groups.<br>Delay to project. | L | L | N | Timely stakeholder agreement with Council, LAC and OEH.<br>Undertake sufficient consultaion with community.<br>Submissions report highlighting communications/stakeholder input into 100% UDL Plan.<br>Satisfy MCoA. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir<br>Environment Officer, RMS, S Graham | | |
| 3.6.11 | Community protest/adverse media | Misinformation and excessive requests for information | Stretch resources | H | L | M | Maintain community engagement, especially through project updates, notifications and website updates.<br>Use MCoA to resolve any conflicts from stakeholders.<br>Develop, implement and update a Community and Stakeholder Engagement Plan.<br>Regular review of CESP to ensure messaging consistent with program.<br>Allocate more resources | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir | | |
| 3.6.12 | Conflicting information given to the community | Loss of community support for the project | Adverse media damges RMS reputation. | H | L | M | Consistent, regular and clear communication | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir | | |
| 3.6.13 | Impact of construction in Thompson Square | Application for National Heritage Listing is successful | Delays to project | L | H | M | Ensure there is comprehensive community notifications;<br>Ensure there is a continuity of resources and management so that intent and importance of the project and the agreements made are not lost.<br>Address with sufficient detail to meet OEH, MCoA requirements through UDL Plan consultation. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir | | |
| 3.6.14 | Community stakeholder objections | Protestors chaining themselves to equipment and increased presence on site | Delays to project.<br>Damage to RMS reputation.<br>Delay cost claims from the contractor | M | L | L | Brief police.<br>Have a dedicated police contact.<br>Develop and implement security and safety protocols. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir<br>Tender Documentation, Jacobs, D Hard | | |
| 3.6.15 | Community stakeholder objections | Protestors feeling powerless and more desperate resort to vandalism to plant and equipment | Delays to project.<br>Damage to RMS reputation.<br>Delay cost claims from the contractor | L | H | M | Security and site surveillance.<br>Pre-start check on plant and equipment | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir<br>Tender Documentation, Jacobs, D Hard | | |
| 3.6.16 | Not complying with Hawkesbury River exclusion zones | Impacts on water based activities during construction | Upset / angry stakeholders | L | M | L | Include RMS Maritime Division requirements in tender documents.<br>Monitor contractor (regular insoections) when working on/near water. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Tender Documentation, Jacobs, D Hard<br>RMS Environmental Representative | | |
| 3.6.17 | Sell the benefits | Opportunity to gain support from the community and stakeholders | Positive media coverage | N | N | N | Grass roots consultation eg. school children.<br>Bridge naming.<br>Engage with cyclists. | | | | |
| 3.6.18 | | | | N | N | N | | | | | |
| 3.7 | Council | | | | | | | | | | |

| Reference | Cause, trigger or issue | Risk, hazard or opportunity | Potential consequences | Original rating | | | Proposed risk treatment | Responsible parties | | Timetable | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Likelihood | Consequence | Original risk | | Project manager | Specialist or other resource | Priority | Date or timing |
| 3.7.1 | Poor liaison with Council | Lack of Council support | Delays to project | L | L | N | Maintain regular consultation.<br>Transparent about impact. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir<br>Design Manager, Jacobs, B Dalla-Palma | | |
| 3.7.2 | Majority of Councillors are against the project | Council influence State Government to delay or stop the project | Delays to project | L | H | M | Maintain regular consultation.<br>Transparent about impact.<br>Update communication to address specific issues and concerns. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir | | |
| 3.7.3 | | | | N | N | N | | | | | |
| **3.8** | **Emergency services** | | | | | | | | | | |
| 3.8.1 | Emergency vehicle access to Windsor Wharf | Inability or excessive delay in gaining access to the Wharf during construction. | Unacceptable delay in response time | L | L | N | Specify in the tender documentation that access for emergency services to the Wharf must be maintained at all times during construction.<br>Ensure compliance with contract requirements. | Gurjit Singh | Project Manager, RMS, G Singh<br>Tender Documentation, Jacobs, D Hard | | |
| 3.8.2 | Emergency access through the construction site | Inability or excessive delay in travelling through the construction site | Unacceptable delay in response time | L | H | M | Specify in the tender documentation that the contractor must liaise with emergency services to provide access through the construction site at all times during construction.<br>Ensure compliance with contract requirements. | Gurjit Singh | Project Manager, RMS, G Singh<br>Tender Documentation, Jacobs, D Hard | | |
| 3.8.3 | | | | N | N | N | | | | | |
| **3.9** | **Other stakeholders** | | | | | | | | | | |
| 3.9.1 | Impact on major boating events | Event postponed or cancelled | Tarnish relationship with Council and community | L | L | N | Consult with council's major events officers.<br>Keep council informed of construction programme.<br>Maintain relationship and early engagement with | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir<br>Tender Documentation, Jacobs, D Hard | | |
| 3.9.2 | Impact on tourism | Construction activities deny access for tourists. | Tarnish relationship with Council and community | M | L | L | Maintain engagement with impacted business through stakeholder meetings.<br>Specify in the tender documentation that construction planning must minimise the impact | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir<br>Tender Documentation, Jacobs, D Hard | | |
| 3.9.3 | Maintaining access to river | Construction activities deny access to river. | Tarnish relationship with Council and community | H | L | M | Determine the current and proposed river usage.<br>Review the detailed design to consider river access requirements. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir<br>Design Manager, Jacobs, B Dalla-Palma | | |
| 3.9.4 | Maintaining access to businesses | Loss of business leading to complaints | Tarnish relationship with local businesses | L | M | L | Maintain engagement with impacted business through effective consultation methods.<br>Ensure access is considered in construction staging.<br>Ensure access is provided for operational phase. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir<br>Design Manager, Jacobs, B Dalla-Palma<br>Construction Staging, Jacobs, D Hard | | |
| 3.9.5 | | | | N | N | N | | | | | |
| **3.10** | **Private developments** | | | | | | | | | | |
| 3.10.1 | | | | N | N | N | | | | | |
| **3.11** | **Geotech** | | | | | | | | | | |
| 3.11.1 | Foundation level changesat piers, abutments and retaining walls. | Insufficient geotech information to design structures.<br>Highly variable ground conditions. | Incorrect assumptions in the design lead to construction delays.<br>Increased cost due to deeper foundations. | L | H | M | Carry out additional geotech investigation.<br>Update geotech factual report.<br>Review foundation design for structures. | Gurjit Singh | Geotech Engineer, Jacobs, S Raynsford<br>Bridge Engineer, Jacobs, J Steele | | |
| 3.11.2 | Unexpected contaminated material such as asbestos found during construction | Worker exposure to contamination. | Health of workers affected.<br>Construction is delayed. | H | M | H | Specify that the contractor must prepare procedures for the identification, removal and disposal of asbestos contaminated material in demolition work, utility adjustments, earthworks etc. | Gurjit Singh | Tender Documentation, Jacobs, D Hard | | |
| 3.11.3 | Potential acid sulfate soils not identified | Acidic seepage entering waterway | Construction is delayed.<br>Change in pH impacting waterway and ecology | H | M | H | Specify that the contractor must prepare procedures for the identification, treatment and/or disposal of potential acid sulfate soil in bridge excavation and earthworks. | Gurjit Singh | Tender Documentation, Jacobs, D Hard | | |
| 3.11.4 | Coal tar in existing asphalt pavement not identified | Worker exposure to contamination. | Health of workers affected.<br>Construction is delayed. | H | M | H | Specify that the contractor must prepare procedures for the identification, removal and disposal of coal tar contaminated material in removal of existing asphalt. | Gurjit Singh | Tender Documentation, Jacobs, D Hard | | |
| 3.11.5 | Scour protection to southern river bank | Opportunity to incorporate river access into scour protection design using cut stepping stones (similar to Barangaroo) | Community satisfaction.<br>Visual improvement | N | N | N | Integrate scour protection with uDL.<br>Consult with archaeological specialists regarding constraints with various options.<br>Undertake geotech and hydrology assessments for options.<br>Evaluate additional cost and maintenance implications. | Gurjit Singh | Project Manager, RMS, G Singh<br>Senior Geotechnical Engineer, Jacobs, S Raynsford<br>Urban and Landscape Designer, SMM, M Wright<br>Environmental Manager, Jacobs, D Wagner<br>Estimator, North Projects | | |
| 3.11.6 | Stability of water quality basin/northern foreshore | Saturation of soils due to biofiltration and recharge (reduced Factor of Safety) | Slope instability of the river bank | M | L | L | Geosynthetic clay liner has been included in the basin design to mitigate against infiltration into the river bank | Gurjit Singh | | | |
| 3.11.7 | | | | N | N | N | | | | | |
| **3.12** | **Property** | | | | | | | | | | |

| Reference | Cause, trigger or issue | Risk, hazard or opportunity | Potential consequences | Original rating: Likelihood | Original rating: Consequence | Original rating: Original risk | Proposed risk treatment | Responsible parties: Project manager | Responsible parties: Specialist or other resource | Timetable: Priority | Timetable: Date or timing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.12.1 | Approval of property adjustments | Owner delays acceptance of the proposed adjustments | Delays to completing design | L | L | N | Prepare and review draft design for discussion with owner.<br>Commence discussions with owner early. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir | | |
| 3.12.2 | | | | N | N | N | | | | | |
| 3.13 | **Traffic** | | | | | | | | | | |
| 3.13.1 | Impacts to traffic during construction | Excessive traffic delays.<br>Accidents. | Community dissatisfaction.<br>Injuries or fatalities | M | H | H | Prepare construction staging strategy.<br>Include constraints on staging in tender documents.<br>Preferred tenderer to submit proposed staging as part of tender assessment.<br>Contractor to prepare Traffic Management Plan. | Gurjit Singh | Construction Staging and Tender Documentation, Jacobs, D Hard | | |
| 3.13.2 | Impacts to river traffic | Collision between river users and construction watercraft.<br>Pile caps not visible due to incorrect MHWS assumed in design. | Injuries or fatalities.<br>Construction is delayed.<br>Damage to bridge substructure. | M | H | H | RMS Maritime Division to provide requirements for inclusion in the tender documents.<br>Warning signage on existing bridge piers during construction.<br>Confirm assumed MHWS and MLWS. | Gurjit Singh | RMS Maritime Division<br>Hydrologist, Jacobs, P Dunne | | |
| 3.13.3 | Poor traffic modelling;<br>Traffic assumptions incorrect | The new infrastructure planned has poor traffic performance | Project loses community support | L | H | M | Verify the validity of traffic assumptions and growth predictions made;<br>Compare the EME growth rates to the area's development plans; | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.13.4 | | | | N | N | N | | | | | |
| 3.14 | **Pedestrians and cyclists** | | | | | | | | | | |
| 3.14.1 | Provision for pedestrians and cyclists during construction | Pedestrians and cyclists mixing with vehicles on roads. | Injuries or fatalities | L | H | M | Include provision for pedestrians and cyclists in construction staging strategy.<br>Include constraints on staging in tender documents.<br>Preferred tenderer to submit proposed staging as part of tender assessment. | Gurjit Singh | Construction Staging and Tender Documentation, Jacobs, D Hard | | |
| 3.14.2 | Provision for on road cyclists during operation | Cyclists using roads without shoulders. | Injuries or fatalities | L | [illegible] | H | Signposting to advise road users where there are no shoulders.<br>Liaise with cycle groups to determine a suitable treatment. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir<br>Design Manager, Jacobs B Dalla-Palma | | |
| 3.14.3 | | | | N | N | N | | | | | |
| 3.15 | **Road safety** | | | | | | | | | | |
| 3.15.1 | Consideration of road safety in the design process | Inappropriate speed limits.<br>Inadequate protection to structures such as poles, sign structures and barrier transitions. | Accidents.<br>Injuries or fatalities | L | [illegible] | H | Design in accordance with RMS supplements to Austroads Guide to Road Design.<br>Undertake Road Safety Audit with consideration of documented non-conformances. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.15.2 | | | | N | N | N | | | | | |
| 3.16 | **Utilities** | | | | | | | | | | |
| 3.16.1 | Identification of new telecommunication assets since previous design | NBN assets have been found in recent DBYD search | Clashes with proposed stormwater drainage and/or other proposed utility relocations requiring redesign and delays in obtaining approvals. | H | L | M | Commence early engagement with NBN.<br>Undertake pot holing of NBN conduits during archaeological excavations. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma<br>Project Manager AAJV | | |
| 3.16.2 | Existing HCC 225 mm sewer main | Damage during bridge abutment piling | Sewer service disrupted and damaged.<br>Excavation 5m deep to repair.<br>Delay to construction program. | M | M | M | Investigate existing location of sewer.<br>Check location of sewer against proposed bridge abutment piles | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.16.3 | Watermain and recycled watermain in replacement bridge | Difficulty of access for inspection/maintenance | Service disruption.<br>Inability to source suitable equipment for access. | M | H | H | Liaise with Sydney Water and HCC to agree on accessibility requirements | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.16.4 | 2 x 375mm watermain relocation in the replacement bridge and approaches | Failure of Sydney Water to agree to proposed location of cut over valves between mains. | Delays in watermain certification process | M | H | H | Commence early engagement with Sydney Water.<br>Re-design to include 2 x 375mm watermains.<br>Submit for Sydney Water approval. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.16.5 | Proposed utilities in heritage areas | Clash between proposed utilities and identified heritage items. | Extensive construction delays | M | H | H | Prepare constraints drawings.<br>Check for clashes between heritage items and proposed design.<br>Resolve clashes and, if necessary, include procedures to be followed in tender documentation. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma<br>Environmental Manager, Jacobs, D Wagner<br>Tender Documentation, Jacobs, D Hard | | |
| 3.16.6 | Scope change for lighting in Thompson Square | Inability to agree scope | Delay to completion of detailed design. | L | L | N | Agree scope.<br>Design lighting.<br>Obtain approval | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma<br>Urban Designer, SMM | | |
| 3.16.7 | Utility authority certification of relocation designs | Delays in obtaining approvals prior to commencement of and during construction | Delays to construction.<br>Claims from contractor. | H | L | M | Obtain advice from utility authorities for approval period.<br>Include approval period plus contingency in tender documentation. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma<br>Tender Documentation, Jacobs, D Hard | | |
| 3.16.8 | Connection of relocated utilities to existing live services | Shutdown of live services is not permitted due to seasonal requirements (high consumer demand, bushfire season etc.) | Delays to construction.<br>Claims from contractor. | H | M | H | Obtain advice from utility authorities for periods when shutdowns are not allowed.<br>Include approval period plus contingency in tender documentation. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma<br>Tender Documentation, Jacobs, D Hard | | |
| 3.16.9 | | | | N | N | N | | | | | |
| 3.17 | **Environment** | | | | | | | | | | |

| Reference | Cause, trigger or issue | Risk, hazard or opportunity | Potential consequences | Original rating: Likelihood | Original rating: Consequence | Original rating: Original risk | Proposed risk treatment | Responsible parties: Project manager | Responsible parties: Specialist or other resource | Priority | Timetable: Date or timing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.17.1 | Noise and vibration impacts before pre-construction works | Complaints received from adjacent residents and businesses.<br>Non-compliance with MCoA. | Notice from EPA/DPE.<br>Reputation damaged.<br>Stop work.<br>Project delays.<br>Adverse community impacts. | M | H | H | Undertake noise and vibration impact assessment.<br>Implement noise and vibration management measures.<br>Impose restrictions to standard construction | Gurjit Singh | Project Manager, AAJV<br>Environmental Manager, Jacobs, D Wagner | | |
| 3.17.2 | Noise and vibration impacts during construction | Failure to provide architectural noise treatment prior to construction.<br>Damage to heritage buildings, structures and utilities. | Complaints received from adjacent residents and businesses.<br>Notice from EPA/DPE.<br>Reputation damaged.<br>Stop work.<br>Project delays.<br>Prosecution. | H | M | H | Contractor to comply with specifications and MCoA.<br>Contractor to carry out noise treatment and building condition surveys prior to construction.<br>Implement noise management measures as per CEMP and RMS Guidelines.<br>Notification of works as per CSE Plan.<br>Develop a draft noise and vibration management planwith specific mitigation for heritage. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Tender Documentation, Jacobs, D Hard | | |
| 3.17.3 | Noise mitigation during operation | Inadequate architectural noise treatment | Complaints received from adjacent residents and businesses.<br>Notice from EPA/DPE.<br>Reputation damaged. | L | M | L | Monitor noise during operation.<br>Determine cost of noise treatments.<br>Review project cost estimate to include noise treatment costs. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Cost Estimator, North Projects | | |
| 3.17.4 | Flood event | Flood event stops work and causes equipment damage. | Increased project cost.<br>Pollution in the Hawkesbury-Nepean river.<br>Loss or damage of heritage findings and equipment.<br>Reputation damaged.<br>Extensive construction delays. | M | H | H | Consider likelihood of a flood event in construction programming.<br>Consider building up site compound area.<br>Prepare flood management and evacuation plans.<br>Provide training/awareness for workforce in flood management and evacuation plans.<br>Develop methods for securing/moving plant and equipment prior to a flood event. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Design Manager, Jacobs, B Dalla-Palma<br>Constructability, Jacobs, D Hard | | |
| 3.17.5 | Warragamba Dam discharge | Pollution in Hawkesbury-Nepean River from construction activities.<br>Flood event stops work and causes equipment damage. | Pollution in the Hawkesbury-Nepean river.<br>Loss of heritage findings and equipment.<br>Prosecution by EPA/DPE.<br>Reputation damaged.<br>Extensive construction delays. | L | M | L | Include requirement in the tender documents for the contractor to prepare a flood management plan.<br>Preferred tenderer to submit draft flood management plan as part of tender assessment. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Hydrologist, Jacobs, P Dunne<br>Constructability, Jacobs, D Hard | | |
| 3.17.6 | Poor contractor environmental performance | Failure to meet MCoA and applicable legislation.<br>Adverse environmental impacts | Pollution in the Hawkesbury-Nepean river.<br>Prosecution by EPA/DPE.<br>Environmental damage.<br>Reputation damaged. | M | H | H | Develop draft CEMP and Sub-plans for inclusion in the tender documentation.<br>Develop community material/plans required under MCoA.<br>Include MCoA requirements for CEMP in the tender documents in addition to RMS requirements.<br>Provide training/awareness to workforce.<br>Formalise lessons learnt from pre-construction to construction contractor.<br>Brief contractor prior to construction and at handover. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>RMS Environmental Representative | | |
| 3.17.7 | Not complying with Hawkesbury River exclusion zones | Impacts on water based activities during construction | Upset / angry stakeholders | L | M | L | Include RMS Maritime Division requirements in tender documents.<br>Monitor contractor (regular insoections) when working on/near water. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Tender Documentation, Jacobs, D Hard<br>RMS Environmental Representative | | |
| 3.17.8 | Inadequate assessment of flooding impacts | Not meeting MCoA.<br>Flooding impacts that have not been previously recognised. | Property and infrastructure damage<br>Increased project cost.<br>Reputation damaged.<br>Delays to project. | L | M | L | Prepare hydrology mitigation report and associated assessment. | Gurjit Singh | Hydrologist, Jacobs, P Dunne | | |
| 3.17.9 | Flooding during removal of the existing bridge | Equipment and site damaged during flood.<br>Equipment cannot be mobilised. | Bridge damage/failure during flood causing damage to replacement bridge.<br>Injury to workers.<br>Increased project costs.<br>Delays to project. | M | [illegible] | [illegible] | Programme demolition of the existing bridge to avoid peak flood event periods.<br>Prepare flood management plan.<br>Consider the structural stability of the existing bridge during demolition. | Gurjit Singh | Hydrologist, Jacobs, P Dunne<br>Tender Documentation, Jacobs, D Hard | | |
| 3.17.10 | EIS management measures and conditions of approval commitments are overlooked. | Non-compliance with EIS management measures/MCoA | Official warnings and penalty notices.<br>Reputation damaged.<br>Increased project costs.<br>Delays to project. | L | H | M | Compliance tracking register to be reviewed and updated regularly. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Tender Documentation, Jacobs, D Hard | | |
| 3.17.11 | | | | N | N | N | | | | | |
| **3.18** | **Heritage** | | | | | | | | | | |
| 3.18.1 | Construction in heritage areas | Clash between proposed drainage lines, pavementand utilities with identified heritage items. | Extensive construction delays | H | H | [illegible] | Prepare constraints drawings.<br>Check for clashes between heritage items and proposed design.<br>Resolve clashes and, if necessary, include procedures to be followed in tender documentation. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma<br>Environmental Manager, Jacobs, D Wagner<br>Tender Documentation, Jacobs, D Hard | | |
| 3.18.2 | Impact to heritage during construction | Damage to heritage from excavation and compaction.<br>Clash with utilities, drainage lines and footings. | Costs associated with restoration.<br>Project delays.<br>Notice from OEH.<br>Prosecution. | L | H | M | Undertake noise and vibration impact assessment and development of EMP.<br>Develop detailed constraints maps. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Project Manager AAJV | | |

| Reference | Cause, trigger or issue | Risk, hazard or opportunity | Potential consequences | Original rating: Likelihood | Original rating: Consequence | Original rating: Original risk | Proposed risk treatment | Responsible parties: Project manager | Responsible parties: Specialist or other resource | Timetable: Priority | Timetable: Date or timing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.18.3 | Listing of Thompson Square on National Heritage Register (EPBC Act) | Additional assessment requirements | Reputation damaged.<br>Project delays.<br>Notice from OEH/DPE. | L | H | M | Consultation with NSW Heritage Council, OEH and DOE.<br>Clear options analysis demonstrating least impact.<br>Submit revised design for DPE approval in accordance with MCoA B8.<br>Assessment of impact to proposed national heritage values. | Gurjit Singh | Environmental Peer Reviewer, RMS, S Graham<br>Senior Heritage Officer, RMS, D Gojak | | |
| 3.18.4 | Inadequate consultation with registerd Aboriginal parties | Aboriginal parties delay approvals | Tarnished relationship with Aboriginal parties/OEH.<br>Project delays. | L | M | L | Early engagement with local Local Aboriginal Land Council and stakeholders.<br>Organise Aboriginal Focus Groups (AFG).<br>Follow the EMP procedures.<br>Keep stakeholders up to date with any project changes.<br>Follow RMS PACHCI procedure.<br>Comply with MCoA.<br>Allow adequate time for review of documents. | Gurjit Singh | Aboriginal Cultural Heritage Officer, RMS, M Lester<br>Project Manager, RMS, G Singh | | |
| 3.18.5 | Aboriginal heritage finds during construction | Discovery of:<br>- Hawkesbury Sand Bodies (HSB)<br>- Significant aboriginal artefacts | Stop work;<br>Damage to heritage items;<br>Unhappy stakeholders<br>Project delays<br>Aboriginal Land Council claims on the southern side of the river | [illegible] | H | [illegible] | Pre-construction archaeological testing program results to be incorporated in the tender documentation.<br>Advise project team as soon as posible.<br>Early consultation with OEH/DPE.<br>Update design based on findings/constraints.<br>Finalise HSB Strategy.<br>Incorporate salvage time into the program.<br>Consider specific unexpected finds procedure for tender documentation. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Environmental Peer Reviewer, RMS, S Graham<br>Project Manager AAJV<br>Tender Documentation, Jacobs D Hard | | |
| 3.18.6 | Non-aboriginal heritage finds during construction | Discovery of significant non-aboriginal items | Stop work.<br>Damage to heritage items.<br>Unhappy stakeholders.<br>Project delays.<br>Increased cost.<br>Further assessment required. | H | H | [illegible] | Pre-construction archaeological testing program results to be incorporated in the tender documentation.<br>Advise project team as soon as posible.<br>Early consultation with OEH/DPE.<br>Update design based on findings/constraints.<br>Incorporate salvage time into the program.<br>Consider specific unexpected finds procedure for tender documentation. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Environmental Peer Reviewer, RMS, S Graham<br>Project Manager AAJV<br>Tender Documentation, Jacobs D Hard | | |
| 3.18.7 | Dense vegetation on the southern river bank | Inability to map heritage items between The Terrace and the waterline. | Unexpected heritage finds during clearing for construction of scour protection.<br>Damage to heritage items.<br>Unhappy stakeholders.<br>Extensive construction delays. | H | M | H | Determine scope of scour protection work.<br>Early consultation with OEH/DPE.<br>Include constraints in specifications for clearing to be undertaken to allow heritage assessment early to avoid construction delays.<br>Engagement of heritage specialist for construction. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma<br>Environmental Manager, Jacobs, D Wagner<br>Tender Documentation, Jacobs, D Hard | | |
| 3.18.8 | Relics/artefact heritage items missed during pre-construction test excavations/salvage | Discovery of heritage items during construction | Stop work.<br>Damage to heritage items.<br>Unhappy stakeholders.<br>Project delays.<br>Increased cost.<br>Further assessment required. | M | H | H | Work closely with AAJV to ensure all impacted areas have been investigated | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Environmental Peer Reviewer, RMS, S Graham<br>Project Manager AAJV | | |
| 3.18.9 | Specialist Heritage Manager | Opportunity to expedite construction | Cost savings to project | N | N | N | Brief for Heritage Manager to include a requirement for construction knowledge. | Gurjit Singh | Project Manager, RMS, G Singh | | |
| 3.18.10 | | | | N | N | N | | | | | |
| 3.19 | | | | | | | | | | | |
| 3.19.1 | Health and Safety in Design | Failure to address HSiD during the design process.<br>Failure to provide Design Safety Report to the construction contractor. | Adverse Performance Report.<br>Prosecution under the WHS Act | L | H | M | Follow RMS Guidelines for HSiD.<br>Conduct workshop.<br>Prepare report.<br>Include report in tender documentation. | Gurjit Singh | Project Manager, Jacobs, T Rodham<br>Tender Documentation, Jacobs, D Hard | | |
| 3.19.2 | Inadequate bridge fencing and/or lack of signage | People take the opportunity to jump off the bridge or use the bridge to throw rocks from the deck at passing boats<br>Becomes attractive to divers (5m drop) | Injuries or fatality to public;<br>Legal ramifications;<br>Costly court cases | L | M | L | Design pedestrian balustrade to RMS standards | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.19.3 | Access to site compound | Safe access to and from site compound if remote from construction area. | Worker injury/fatality.<br>Non-compliance with MCoA. | H | M | H | Seek relaxation of MCoA.<br>Identify suitable location for site compound. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Environmental Peer Reviewer, RMS, S Graham<br>Tender Documentation, Jacobs D Hard | | |
| 3.19.4 | Working at heights and over/under water | Worker falling from height, into water or underwater inspections | Worker injury/fatality | H | [illegible] | [illegible] | Include RMS specifications G22, B341 and B350 in tender documentation.<br>Ensure contractor provides and maintains safety controls. | Gurjit Singh | Project Manager, RMS, G Singh<br>Tender Documentation, Jacobs D Hard | | |

| Reference | Cause, trigger or issue | Risk, hazard or opportunity | Potential consequences | Original rating: Likelihood | Original rating: Consequence | Original rating: Original risk | Proposed risk treatment | Responsible parties: Project manager | Responsible parties: Specialist or other resource | Priority | Timetable: Date or timing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.19.5 | Construction in and over river | Construction activities affect river users | River users injured.<br>Watercraft damaged or sunk.<br>Construction delays. | M | H | H | Obtain RMS Maritime advice on suitable controls.<br>Establish exclusion zones.<br>Reduce river speed limits.<br>Include requirements in tender documentation. | Gurjit Singh | Project Manager, RMS, G Singh<br>Tender Documentation, Jacobs D Hard | | |
| 3.19.6 | Public access on northern side around scour protection | Shared path users fall into river | Injury to member of the public | M | M | M | Consider providing fencing along the edge of the shared path adjacent to the river. | Gurjit Singh | Urban and Landscape Designer, SMM, M Wright<br>Design Manager, Jacobs B Dalla-Palma | | |
| 3.19.7 | | | | N | N | N | | | | | |
| 3.20 | **Design of roadworks** | | | | | | | | | | |
| 3.20.1 | Road design | Not achieving standards<br>VC at signals is non compliant combined with changing horizontal alignment | Design delays<br>Vehicle or pedestrian accidents<br>Injuries causing liability and cost<br>Crash history and disruption to traffic | M | M | M | Design in accordance with RMS supplements to Austroads Guide to Road Design.<br>Early liaison with RMS road peer reviewer. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.20.2 | Access to Windsor Wharf | Design is not supported by OEH or HCC<br>Relocation of Wharf | Delays in redesign<br>Tarnish relationship with OEH and HCC<br>Wharf operator is unhappy | M | H | H | Liaise with OEH and HCC early and adopt a way forward. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Environmental Peer Reviewer, RMS, S Graham<br>Design Manager, Jacobs B Dalla-Palma | | |
| 3.20.3 | Poorly coordinated or incomplete design (bridge, road, drainage, etc) | High number of RFI issued by the contractor | Construction delays.<br>Contractor claims Delay Costs | L | M | M | Schedule regular design coordination meetings during detailed design development.<br>Mainatain design issues register.<br>Undertake rigourous interdiscipline drawing checks. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.20.4 | Challenging site topography | Disabled access is non compliant;<br>Heritage and urban design constraints. | Community does not accept the urban design.<br>Delays to the project. | H | M | H | Liaise with OEH and HCC early and adopt a way forward. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Environmental Peer Reviewer, RMS, S Graham<br>Design Manager, Jacobs B Dalla-Palma | | |
| 3.20.5 | Pavement subgrade | Failure to design subgrade treatment in areas of unsuitable or silty soils identified in the geotech report. | Construction delays.<br>Contractor claims Delay Costs | H | M | H | Review geotech reports and determine subgrade treatment.<br>Show treatment on drawings.<br>Include in RMS R44. | Gurjit Singh | Pavement Designer, RMS, J Rayner<br>Design Manager, Jacobs B Dalla-Palma<br>Tender Documentation, Jacobs, D Hard | | |
| 3.20.6 | Condition of existing pavement to be overlaid or milled and re-sheeted, particularly at the Bridge Street/George Street intersection | Pavement failure requiring ongoing maintenance | Traffic delays.<br>Increased project cost.<br>Damage to RMS' reputation | H | M | H | Review existing pavement investigation.<br>Undertake further investigation eg. deflection testing. | | Pavement Designer, RMS, J Rayner<br>Design Manager, Jacobs B Dalla-Palma | | |
| 3.20.7 | | | | N | N | N | | | | | |
| 3.21 | **Design of structures** | | | | | | | | | | |
| 3.21.1 | Bridge abutments | Urban design requires expensive finishing materials | Increased project cost | M | H | H | Recommend alternative material with similar finishing appearance | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma<br>Urban Designer, SMM | | |
| 3.21.2 | The southern bridge span has less waterway area than other spans | Increased water velocities along the southern river bank | Scouring or loss of southern river bank and undermining existing gabion wall.<br>Reinstatement works.<br>Reputation damaged. | M | H | H | Design scour protection to sustain high water velocities. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.21.3 | Utilities: Scope changes requested by services authorities: | Design changes required during the utility authority approval process. | Delays in obtaining certified designs from EE and SWC.<br>Project delays.<br>Increased costs | L | H | M | Early consultation with EE and SWC | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.21.4 | 33kV power pole and stay pole in the vicinity of proposed retaining walls for the access road to the wharf carpark area | Piling rig operating in the vicinity of the 33kV power line | Major power outage.<br>Extensive delays to construction. | M | H | H | Design retaining wall piles to provide clearance to power line.<br>Investigate temporary support of 33kV pole during construction to remove stay cable during piling works. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.21.5 | Rock level assumptions in design | Changes to pile foundation levels and diameter | Delays in completion of design.<br>Increased cost. | L | H | M | Undertake additional geotechnical investigation.<br>Review design assumptions to determine whether changes are required. | Gurjit Singh | Senior Geotechnical Engineer, Jacobs, S Raynsford<br>Bridge Engineer, Jacobs, S Frayne | | |
| 3.21.6 | Location of existing sewer through Thompson Square | Changes in retaining wall design | Delays in completion of design.<br>Increased cost. | M | H | H | Undertake additional potholing to confirm location | Gurjit Singh | Utilities Engineer, Jacobs, K Lau<br>Bridge Engineer, Jacobs, S Frayne | | |
| 3.21.7 | Drainage design | Changes to drainage design impact on bridge superstructure details | Delays in completion of design. | M | L | L | Finalise drainage design.<br>Identify superstructure implications | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma<br>Senior Bridge Engineer, Jacobs, J Steele | | |
| 3.21.8 | Flood event during bridge launching | Damage or loss of superstructure | Worker injury.<br>Delays to project.<br>Increased cost.<br>Environmental damage. | H | [illegible] | [illegible] | Warning system to notify of flood event.<br>Review structural design assumptions. | Gurjit Singh | Senior Bridge Engineer, Jacobs, J Steele<br>Tender Documentation, Jacobs, D Hard | | |
| 3.21.9 | Unexpected heritage finds during construction | Modifications to abutments and foundations. | Delays to project | H | H | [illegible] | Pre-construction archaeological testing program results to be incorporated in the tender documentation.<br>Advise project team as soon as posible.<br>Early consultation with OEH/DPE.<br>Update design based on findings/constraints.<br>Incorporate salvage time into the program.<br>Consider specific unexpected finds procedure for tender documentation. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Environmental Peer Reviewer, RMS, S Graham<br>Project Manager AAJV<br>Tender Documentation, Jacobs D Hard | | |
| 3.21.10 | Southern abutment proof check | Outcome from proof check may require re-design | Delays in completion of design | L | M | L | Expedite proof check.<br>Consider outcome from proof check | | Project Manager, Jacobs, T Rodham<br>Senior Bridge Engineer, Jacobs, J Steele | | |
| 3.21.11 | | | | N | N | N | | | | | |

| Reference | Cause, trigger or issue | Risk, hazard or opportunity | Potential consequences | Original rating: Likelihood | Original rating: Consequence | Original rating: Original risk | Proposed risk treatment | Responsible parties: Project manager | Responsible parties: Specialist or other resource | Timetable: Priority | Timetable: Date or timing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.22 | **Constructability/Construction** | | | | | | | | | | |
| 3.22.1 | Flood event during construction | Loss or damage of plant and equipment.<br>Damage to partially constructed work.<br>Flooding of casting yard/bed.<br>Damage to existing bridge.<br>Worker injury/fatality | Project delays/costs.<br>Reputation damaged. | L | H | M | Include requirement in the tender documents for the contractor to prepare a flood management plan.<br>Preferred tenderer to submit draft flood management plan as part of tender assessment. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Hydrologist, Jacobs, P Dunne<br>Constructability, Jacobs, D Hard | | |
| 3.22.2 | Access to residences and businesses during construction | Unable to provide access to to Old Bridge St residents, wharf and carpark during construction | Unhappy stakeholders | H | L | M | Prepare construction staging strategy.<br>Include constraints on staging in tender documents.<br>Preferred tenderer to submit proposed staging as part of tender assessment. | Gurjit Singh | Construction Staging and Tender Documentation, Jacobs, D Hard | | |
| 3.22.3 | Existing bridge | Documentation for existing bridge is incomplete or inaccurate | Demolition activities take longer than expected.<br>Claim from contractor for delay costs | L | M | L | Include requirement in the tender documents for the contractor to prepare a demolition plan.<br>Preferred tenderer to submit draft demolition plan as part of tender assessment. | Gurjit Singh | Tender Documentation, Jacobs, D Hard | | |
| 3.22.4 | Coordination of utility authority relocation/protection | Utility authorities unable to relocate, protect, inspect, test and commission work due to insufficient notice from contractor | Project delays;<br>Relocation activities take longer than expected | H | L | M | Early/immediate investigations with utility authorities.<br>Determine if utility relocation is possible for an early works package. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.22.5 | Construction of the George and Bridge Street intersection including traffic signals | Inadequate provision for traffic, pedestrians and cyclists during construction | Extensive traffic delays.<br>Accidents.<br>Uncontrolled movement of pedestrians crossing roads | M | M | M | Prepare construction staging strategy.<br>Include constraints on staging in tender documents.<br>Preferred tenderer to submit proposed staging as part of tender assessment. | Gurjit Singh | Construction Staging and Tender Documentation, Jacobs, D Hard | | |
| 3.22.6 | Construction of bridge piers in the river | Construction of temporary landing stage on the northern river bank.<br>Transport of precast concrete pile cap shells to site.<br>Placing concrete in piles and precast pile caps.<br>Pollution of the river with acid sulfate soil from pile excavation. | Pollution of the Hawkesbury-Nepean river.<br>Impact on road or river traffic when transporting pile cap shells.<br>Impact on river trafic when placing concrete in piles and pile cap shells. | M | H | H | Include requirements in the tender documents for temporary works to be submitted by the contractor.<br>Include requirements in the tender docments for the contractor to prepare, implement an acid sulfate soil management plan. | Gurjit Singh | Tender Documentation, Jacobs, D Hard | | |
| 3.22.7 | Retaining wall at southern abutment | During construction unidentified significant heritage items are found. | Stop work;<br>Damage to heritage items;<br>Unhappy stakeholders<br>Extensive delays to construction.<br>Additional costs associated with salvage | L | H | M | Prepare constraints drawings.<br>Check for clashes between heritage items and proposed design.<br>Resolve clashes and, if necessary, include procedures to be followed in tender documentation. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma<br>Environmental Manager, Jacobs, D Wagner<br>Tender Documentation, Jacobs, D Hard | | |
| 3.22.8 | Pavement design | Failure to address subgrade conditions on the bridge northern approach | Settlement of approach pavement during operation. | L | H | M | Detailed design to include ground improvement works on northern river bank. | Gurjit Singh | Geotech Engineer, Jacobs, S Raynsford | | |
| 3.22.9 | Construction of bridge diaphragm (integral with first segment or second stage pour?) | Lack of access to place formwork, reinforcement and concrete | Manual handling injuries due to poor access. | L | H | M | Contractor to include in CEMP. | Gurjit Singh | Tender Documentation, Jacobs, D Hard | | |
| 3.22.10 | Bridge pile caps | Failure or movement of precast pile cap shell. | Injury or fatality of workers.<br>Investigation/prosecution by WorkCover.<br>Extensive delays to construction | L | H | M | Contractor to include in CEMP. | Gurjit Singh | Tender Documentation, Jacobs, D Hard | | |
| 3.22.11 | Sealing of bridge precast pile cap shells | Unable to effectively seal against water ingress. | Delays to construction. | L | H | M | Contractor to include in CEMP. | Gurjit Singh | Tender Documentation, Jacobs, D Hard | | |
| 3.22.12 | Bridge precast barrier installation | Unsecured barrier falling into river. | Injury or fatality of workers or river users.<br>Investigation/prosecution by WorkCover.<br>Extensive delays to construction | L | H | M | Contractor to include in CEMP. | Gurjit Singh | Tender Documentation, Jacobs, D Hard | | |
| 3.22.13 | Installation of utilities under bridge deck | Lack of access to place for installation | Strain injury due to unsuitable access for installation.<br>Restricted space for welding. | L | H | M | Contractor to include in CEMP. | Gurjit Singh | Tender Documentation, Jacobs, D Hard | | |
| 3.22.14 | Full reconstruction of pavement on existing alignment | Failure to provide adequate traffic lane widths in staging design. | Extensive delays to traffic.<br>Accidents. | L | H | M | Prepare construction staging strategy.<br>Include constraints on staging in tender documents.<br>Preferred tenderer to submit proposed staging as part of tender assessment. | Gurjit Singh | Construction Staging and Tender Documentation, Jacobs, D Hard | | |
| 3.22.15 | GPT on southern river bank | Lack of access for construction and maintenance on steep river bank | Slips and falls by workers | L | H | M | Incorporate temporary or permanent maintenance access into the design. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.22.16 | Drainage construction in Bridge Street median | Failure to provide adequate traffic lane widths in staging design. | Extensive delays to traffic.<br>Accidents. | L | H | M | Prepare construction staging strategy.<br>Include constraints on staging in tender documents.<br>Preferred tenderer to submit proposed staging as part of tender assessment. | Gurjit Singh | Construction Staging and Tender Documentation, Jacobs, D Hard | | |
| 3.22.17 | Pavement construction at Bridge/George Street intersection | Failure to provide adequate traffic lane widths in staging design. | Extensive delays to traffic.<br>Accidents. | L | H | M | Prepare construction staging strategy.<br>Include constraints on staging in tender documents.<br>Preferred tenderer to submit proposed staging as part of tender assessment. | Gurjit Singh | Construction Staging and Tender Documentation, Jacobs, D Hard | | |
| 3.22.18 | Bridge construction over The Terrace | Objects falling onto pedestrians/traffic from bridge | Injury or fatality.<br>Investigation/prosecution by WorkCover.<br>Extensive delays to construction | L | H | M | Contractor to include in CEMP. | Gurjit Singh | Tender Documentation, Jacobs, D Hard | | |

| Reference | Cause, trigger or issue | Risk, hazard or opportunity | Potential consequences | Original rating: Likelihood | Original rating: Consequence | Original rating: Original risk |
|---|---|---|---|---|---|---|
| 3.22.19 | Overhead 33kV near carpark retaining wall | Piling rig striking power line | Worker injury/fatality.<br>Delays to project.<br>Increased cost. | L | [illegible] | H |
| 3.22.20 | Overhead 33kV adjacent to the site compound | Plant and equipment striking power line, particularly if area is built up above the flood level. | Worker injury/fatality.<br>Delays to project.<br>Increased cost. | L | [illegible] | H |
| 3.22.21 | Removal of existing bridge | Unexpected finding of hazardous and/or contaminated material during demolition | Worker exposure.<br>Pollution of waterway and ecosystem. | H | M | H |
| 3.22.22 | Removal of existing bridge | Failure of bridge during demolition | Worjer injury/fatality.<br>Delay to project | L | [illegible] | H |
| 3.22.23 | Flood during removal of existing bridge | Equipment and site damaged during flood.<br>Equipment cannot be mobilised. | Bridge damage/failure during flood causing damage to replacement bridge.<br>Injury to workers.<br>Increased project costs.<br>Delays to project. | H | H | [illegible] |
| 3.22.24 | | | | N | N | N |
| **3.23** | **Urban design** | | | | | |
| 3.23.1 | Urban design for Thompson Square | Proposed urban design not accepted by the community and stakeholders. | Community and stakeholder dissatisfaction with the project.<br>Adverse media.<br>Delay to project program. | H | H | [illegible] |
| 3.23.2 | Design or construction errors;<br>Poor quality finishes | Poor design detailing or errors during construction leading to poor construction quality. Final product is not acceptable to the community | Delays and costs;<br>Poor outcome and poor community acceptance;<br>Reputation of RMS and its consultants is at stake | M | M | M |
| 3.23.3 | Poor choice of material and detailing | Poor aesthetics of retaining walls or retaining walls attract graffiti or deterioration due to flooding | Poor public response;<br>Ongoing maintenance costs for RMS and Council;<br>Reputation of RMS and its consultants is at stake | M | M | M |
| 3.23.4 | Heritage constraints | The overall project could become a poor urban design outcome if urban design and heritage are not considered in detail | Poor quality outcome;<br>Poor community acceptance;<br>Reputation of RMS and its consultants is at stake | H | H | [illegible] |
| 3.23.5 | Abutment finish | One material may be more difficult than the other to install. e.g. Sandstone blocks versus bricks versus precast panel | Poor quality outcome;<br>Poor community acceptance;<br>Reputation of RMS and its consultants is at stake | M | L | L |
| 3.23.6 | Pavement finishes | Delays in gaining approval for the proposed finishes | Delays and costs;<br>Poor outcome and poor community acceptance;<br>Reputation of RMS and its consultants is at stake | M | L | L |
| 3.23.7 | River foreshore on the southern side is not upgraded (Council wall) | Community dissatisfaction if nothing is done | Delays and costs;<br>Poor outcome and poor community acceptance;<br>Reputation of RMS and its consultants is at stake | M | M | M |
| 3.23.8 | Flood impacts on landscape works during and post construction | Damage to partially completed or completed work | Delays to project due to re-work.<br>Increased cost<br>Pollution and erosion . | H | M | |

| Reference | Proposed risk treatment | Responsible parties: Project manager | Responsible parties: Specialist or other resource | Priority | Timetable: Date or timing |
|---|---|---|---|---|---|
| 3.22.19 | Confirm clearance zones with Endeavour Energy and include in tender documents | Gurjit Singh | Utilities Engineer, Jacobs, K Lau<br>Tender Documentation, Jacobs, D Hard | | |
| 3.22.20 | Confirm clearance zones with Endeavour Energy and include in tender documents.<br>Temporary works requirements to be included in tender documents.<br>Contractor to certify temporary works comply with the approved design | Gurjit Singh | Utilities Engineer, Jacobs, K Lau<br>Tender Documentation, Jacobs, D Hard | | |
| 3.22.21 | Identify potential hazardous material prior to demolition.<br>Remove safely in accordance with management plan. | Gurjit Singh | Tender Documentation, Jacobs, D Hard | | |
| 3.22.22 | Provide all relevant reports and WAE drawings of the existing bridge. | Gurjit Singh | Tender Documentation, Jacobs, D Hard | | |
| 3.22.23 | Programme demolition of the existing bridge to avoid peak flood event periods.<br>Prepare flood management plan.<br>Consider the structural stability of the existing bridge during demolition. | Gurjit Singh | Hydrologist, Jacobs, P Dunne<br>Tender Documentation, Jacobs, D Hard | | |
| 3.22.24 | | | | | |
| **3.23** | | | | | |
| 3.23.1 | Prepare U&LD Plan for community and stakeholder discussion.<br>Undertake additional consultation processes for development of Thompson Square.<br>Engage the Council in the process and obtain their buy in.<br>Make use of the Bridge Urban Design Panel. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir<br>Urban and Landscape Designer, SMM, M Wright | | |
| 3.23.2 | Detailed design and specifications to document materials and finishes.<br>Subcontractor engaged is experienced in the specified materials and finishes.<br>Surveillance during construction by personnel experienced in the specified materials and finishes. | Gurjit Singh | Urban and Landscape Designer, SMM, M Wright<br>Tender Documentation, Jacobs, D Hard | | |
| 3.23.3 | Detailed design and specifications to document materials and finishes.<br>Choose materials that can withstand flooding. | Gurjit Singh | Urban and Landscape Designer, SMM, M Wright<br>Tender Documentation, Jacobs, D Hard | | |
| 3.23.4 | Work closely with AAJV.<br>Prepare U&LD Plan for community and stakeholder discussion.<br>Undertake additional consultation processes for development of Thompson Square.<br>Engage the Council in the process and obtain their buy in.<br>Make use of the Bridge Urban Design Panel.<br>Include cost estimate for urban design features in project estimate. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir<br>Urban and Landscape Designer, SMM, M Wright<br>Estimator, North Projects<br>Project Manager, AAJV | | |
| 3.23.5 | Prepare U&LD Plan for community and stakeholder discussion.<br>Undertake additional consultation processes for development of Thompson Square.<br>Engage the Council in the process and obtain their buy in.<br>Make use of the Bridge Urban Design Panel. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir<br>Urban and Landscape Designer, SMM, M Wright | | |
| 3.23.6 | Prepare U&LD report for community and stakeholder discussion.<br>Engage the Council in the process and obtain their buy in. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir<br>Urban and Landscape Designer, SMM, M Wright<br>Design Manager, Jacobs B Dalla-Palma | | |
| 3.23.7 | Work closely with Council.<br>Consider funding arrangements. | Gurjit Singh | Project Manager, RMS, G Singh<br>Urban and Landscape Designer, SMM, M Wright<br>Design Manager, Jacobs B Dalla-Palma | | |
| 3.23.8 | Programme landscape work to avoid flood prone times | Gurjit Singh | Tender Documentation, Jacobs, D Hard | | |

| Reference | Cause, trigger or issue | Risk, hazard or opportunity | Potential consequences | Original rating: Likelihood | Original rating: Consequence | Original rating: Original risk | Proposed risk treatment | Responsible parties: Project manager | Responsible parties: Specialist or other resource | Priority | Timetable: Date or timing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.23.9 | Improve southern foreshore and incorporate into Thompson Square | Community satisfaction | Community acceptance<br>Increased project cost | N | N | N | Work with Council/DPE/OEH to develop a coordinated plan prior to consultation. | Gurjit Singh | Communications Officer, RMS, A Blackman<br>Community and Stakeholder Engagement Manager, Jacobs, A Muir<br>Urban and Landscape Designer, SMM, M Wright<br>Design Manager, Jacobs B Dalla-Palma | | |
| 3.23.10 | | | | N | N | N | | | | | |
| **3.24** | **Delivery method** | | | | | | | | | | |
| 3.24.1 | Tender drawings and specifications | Insufficient detail in drawings and specifications | Claims from the contractor.<br>Delay costs.<br>Extensive delays to construction. | M | H | H | Jacobs discipline reviews of drawings.<br>RMS peer review of drawings.<br>IV of tender documentation.<br>RMS Commercial Branch review of tender documentation. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma<br>Tender Documentation, Jacobs, D Hard<br>RMS Peer Reviewers<br>Independent Verifier, AT&L, P Wark<br>RMS Commercial Branch | | |
| 3.24.2 | Quantities in Schedule of Rates | Incorrect quantities in Schedule of Rates | Claims from the contractor.<br>Delay costs.<br>Extensive delays to construction. | M | H | H | Quantity take-off by estimator.<br>Jacobs review of quantities.<br>IV of tender documentation.<br>RMS Commercial Branch review of tender documentation. | Gurjit Singh | Estimator, North projects<br>Tender Documentation, Jacobs, D Hard<br>Independent Verifier, AT&L, P Wark<br>RMS Commercial Branch | | |
| 3.24.3 | Timing of tender invitation | Insufficient experienced contractors respond | Extension of tender period.<br>Re-advertising tenders.<br>Delay to project. | L | M | L | Monitor RMS construction program to avoid overloading the industry | Gurjit Singh | RMS Commercial Branch | | |
| 3.24.4 | Tender period | Insufficient tender period due to project complexity | Extension of tender period.<br>Delay to project. | L | L | N | Set realistic tender period | Gurjit Singh | RMS Commercial Branch | | |
| 3.24.5 | Compliance with conditions of approval | Non-compliance with conditions of approval by contractor | Official warnings and penalty notices.<br>Reputation damaged.<br>Increased project costs.<br>Delays to project. | L | H | M | Include conditions of approval in tender documentation.<br>Tenderers required to submit supporting documentation as part of tender assessment. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Tender Documentation, Jacobs, D Hard | | |
| 3.24.6 | | | | N | N | N | | | | | |
| **3.25** | **Pre-construction** | | | | | | | | | | |
| 3.25.1 | Refer to Early Works Activities Tab | | | N | N | N | | | | | |
| 3.25.2 | | | | N | N | N | | | | | |
| **3.26** | **Project staffing** | | | | | | | | | | |
| 3.26.1 | Lack of continuity in RMS/PSC personnel | Loss of background knowledge | Delays to project.<br>Critical items are overlooked | H | M | H | Identify skills required.<br>Set realistic program for the project. | Gurjit Singh | Project Manager, RMS, G Singh<br>Project Manager, Jacobs, T Rodham | | |
| 3.26.2 | Delays in receiving peer reviews | Inability to meet project program | Delays to project.<br>Value of Workshops diminished due to unavailability of peer input. | H | H | [illegible] | Provide early notification required review period.<br>Ensure deliverables are provided to reviewers on time.<br>Schedule meetings between peer reviewer and designer to avoid back and forth comments (not being able to close comments).<br>RMS internal coordination with peer reviewers. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.26.3 | Insufficient RMS/PSC resources | Inability to meet project program | Delays to project | M | M | M | Identify skills required.<br>Set realistic program for the project. | Gurjit Singh | Project Manager, RMS, G Singh<br>Project Manager, Jacobs, T Rodham | | |
| 3.26.4 | Poor scoping of peer reviews | Insufficient review of deliverables | Poor quality of work | H | M | H | Advise peer reviewers of scope when issuing deliverables for review. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.26.5 | Project team | Inexperienced personnel. | Errors in deliverables.<br>Re-design required.<br>Delays to project. | L | M | L | Identify skills required.<br>Set realistic program for the project. | Gurjit Singh | Project Manager, RMS, G Singh<br>Project Manager, Jacobs, T Rodham | | |
| 3.26.6 | Qualifications and experience of Heritage Manager | Inability to gain DPE approval for the Heritage Manager | Delays to project. | L | M | L | Early identification and engagement of Heritage Manager.<br>Early consultation and submission of suitable candidate for DPE approval. | Gurjit Singh | Environmental Officer, RMS, S Graham | | |
| 3.26.7 | | | | N | N | N | | | | | |
| **3.27** | **Contract issues** | | | | | | | | | | |
| 3.27.1 | Understanding of project requirements | Insufficient detailing of requirements in tender documentation | Delays to construction.<br>Claims from contractor. | H | H | [illegible] | Jacobs discipline reviews of drawings.<br>Experienced tender documentation specialist.<br>RMS peer review of drawings.<br>IV of tender documentation.<br>RMS Commercial Branch review of tender documentation.<br>RMS contracts specialist review. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma<br>Tender Documentation, Jacobs, D Hard<br>RMS Peer Reviewers<br>Independent Verifier, AT&L, P Wark<br>RMS Commercial Branch | | |
| 3.27.2 | Environmental approvals for construction | Delays in obtaining approvals prior to commencement of construction | Delays to construction.<br>Claims from contractor. | L | M | L | Obtain advice from environmental agencies for approval period.<br>Include approval period plus contingency in tender documentation. | Gurjit Singh | Environmental Manager, Jacobs, D Wagner<br>Tender Documentation, Jacobs, D Hard | | |
| 3.27.3 | Utility approvals for construction | Delays in obtaining approvals prior to commencement of and during construction | Delays to construction.<br>Claims from contractor. | M | M | M | Obtain advice from utility authorities for approval period.<br>Include approval period plus contingency in tender documentation. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma<br>Tender Documentation, Jacobs, D Hard | | |
| 3.27.4 | Third party interference for construction | Delays to commencement of construction.<br>Delays during construction | Delays to construction.<br>Claims from contractor. | M | M | M | Identify and obtain advice from all stakeholders.<br>Include requirements in tender documentation. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma<br>Tender Documentation, Jacobs, D Hard | | |

| Reference | Cause, trigger or issue | Risk, hazard or opportunity | Potential consequences | Original rating | | | Proposed risk treatment | Responsible parties | | Priority | Timetable |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Likelihood | Consequence | Original risk | | Project manager | Specialist or other resource | | Date or timing |
| 3.27.5 | Contractor failing to comply with the terms of the contract | Contract disputes | Delays to construction.<br>Claims from contractor.<br>Fines by DPE for non-compliance. | L | H | M | Experienced tender documentation specialist.<br>IV of tender documentation.<br>RMS Commercial Branch review of tender documentation.<br>RMS contracts specialist review. | Gurjit Singh | Tender Documentation, Jacobs, D Hard<br>RMS Peer Reviewers<br>Independent Verifier, AT&L, P Wark<br>RMS Commercial Branch | | |
| 3.27.6 | | | | N | N | N | | | | | |
| **3.28** | **Contractors** | | | | | | | | | | |
| 3.28.1 | Prequalified subcontractors | Shortage of prequalified subcontractors | Delays to construction. | L | L | N | Track construction program and resourcing and raise potential issues with the contractor. | Gurjit Singh | Project Manager, RMS, G Singh | | |
| 3.28.2 | | | | N | N | N | | | | | |
| **3.29** | **Asset maintenance** | | | | | | | | | | |
| 3.29.1 | Loss of service on existing bridge | Existing bridge deteriorates or fails prior to completion of the replacement bridge | Access across the river denied.<br>Political repercussions.<br>Community outrage. | M | | | Undertake regular inspections and maintenance on the bridge.<br>Consider further reductions in speed and load limits across the bridge | Gurjit Singh | Project Manager, RMS, G Singh | | |
| 3.29.2 | Collapsible pedestrian fence on the replacement bridge | Maintenance Issues | Workers on unprotected edge | L | H | M | Include in HSiD report and issue to contractor and RMS Maintenance Branch | Gurjit Singh | Tender Documentation, Jacobs, D Hard | | |
| 3.29.3 | Drainage maintenance | Maintenance Issues | Blockages of grates, materials used for drainage pipes may need debris impact protection | L | M | L | Consider in detailed design. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.29.4 | Maritime requirement/request | Maintenance of navigation lights | Access to navigation lights | M | H | H | Obtain requirements from RMS Maritime Division.<br>Consider installing the navigation equipment during construction. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma<br>Tender Documentation, Jacobs, D Hard | | |
| 3.29.5 | Bridge inspections | Under bridge deck | Fall from height using scaffold or scissor lift on barge | M | H | H | Verify if the inspection can be done using a super snooper cherrypicker from top of deck | Gurjit Singh | RMS Maintenance Branch | | |
| 3.29.6 | Bridge inspections | Abutments | Fall from height during inspection due to lack of access to abutment | M | H | H | Ensure that there is a bench in front of the abutment to establish minor equipment. | Gurjit Singh | RMS Maintenance Branch | | |
| 3.29.7 | Bridge inspections | Bearings (abutments and piers) | Lack of suitable access or headroom for inspection or to install suitable access equipment or jacks. | M | H | H | Consider access requirements<br>Consider space for jacks. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.29.8 | Bridge inspections | Bearings (abutments and piers) | Breathe in contamination from accumulation of bird droppings and dead birds | M | H | H | Consider providing bird screens around bearings.<br>Consider the use of SS ferrules for attachment points. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.29.9 | Bridge inspections | Joints | Maintenance worker struck by traffic during cleaning | M | H | H | Provide suitable access from the side and underneath for cleaning<br>Consider alternative joint arrangements | Gurjit Singh | RMS Maintenance Branch | | |
| 3.29.10 | Bridge inspections | Parapets, barriers and balustrades | Fall or strain injury during laying down the collapsible barrier before flood event. | M | H | H | Manage through procedures and SWMS | Gurjit Singh | RMS Maintenance Branch | | |
| 3.29.11 | Bridge inspections | Flood debris and scour protection in front of abutment | Trips, falls, strain injury during cleaning of debris in front of abutments and at piers. | M | H | H | Provide suitable vehicular access to the area in front of the abutment<br>Provide flush out points on longitudinal drainage line.<br>Access to be considered in design. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.29.12 | Bridge inspections | Utilities | Fall from height during maintenance of under bridge utilities | M | H | H | Verify if the inspection can be done using a super snooper cherrypicker from top of deck<br>Consult with Sydney water regarding what procedures are in place on the existing bridge. | Gurjit Singh | RMS Maintenance Branch | | |
| 3.29.13 | Utilities inspections | ITS pits on footway | Conflict during maintenance activities with pedestrian due to parking truck on footway during maintenance | M | H | H | Consider moving pits to be in front of the transition of bridge and type F to allow vehicle access | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.29.14 | Drainage maintenance | Bridge St stormwater drainage | Water flow over footpath causing slips due to location of stormwater pits in current design.<br>Footpath requiring more maintenance, cleaning | M | H | H | Consider providing a depression /localized shaping behind footpath | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.29.15 | Drainage maintenance | GPT on southern bank | Unsafe access for vehicles and workers to maintain and clean out | M | H | H | Stairs, railing or access platform<br>Access from wharf – additional kerb along the Terrace required | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.29.16 | Bridge maintenance | Graffiti on abutments, stairs and walls | Working at heights to clean | M | H | H | Ensure that there is a bench in front of the abutment to establish minor equipment. | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.29.17 | Pavement maintenance | Life cycle of asphalt at northern roundabout | AC requires more frequent maintenance | M | H | H | Consider FRC on roundabout and approach stubs | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.29.18 | Drainage maintenance | Water quality basin | Proximity to footpath and pedestrians, difficult maintenance access | M | H | H | Shaped to contour around footpath and provide a railing | Gurjit Singh | Design Manager, Jacobs B Dalla-Palma | | |
| 3.29.19 | Landscape maintenance | Pruning of trees under overheads and adjacent to street lights | Trees growing into electrical conductors | M | H | H | Species to be selected that are suitable for each area | Gurjit Singh | Urban and Landscape Designer, SMM, M Wright | | |
| 3.29.20 | Landscape maintenance | Watering | Vehicle issues and steep slope | M | H | H | Investigate Councils requirement for irrigation in Thompson Square. | Gurjit Singh | Urban and Landscape Designer, SMM, M Wright | | |
| 3.29.21 | Landscape maintenance adjacent to traffic (medians, roundabout and verges) | Working adjacent to traffic (medians, roundabout and verges) | Maintenance worker struck by traffic | M | H | H | Manage through procedures and SWMS | Gurjit Singh | RMS Maintenance Branch | | |
| 3.29.22 | Overloading on existing bridge | Load limit applied to bridge | Traffic detours required | M | M | M | RMS to specify maximum loading on bridge for inclusion in the tender documentation.<br>Contractor to allow for alternative route for loads exceeding the maximum allowable. | Gurjit Singh | RMS Bridge Branch<br>Tender Documentation, Jacobs, D Hard | | |

| Reference | Cause, trigger or issue | Risk, hazard or opportunity | Potential consequences | Original rating | | | Proposed risk treatment | Responsible parties | | Timetable | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Likelihood | Consequence | Original risk | | Project manager | Specialist or other resource | Priority | Date or timing |
| 3.29.23 | Assets approval | Approval not provided by Asset Manager or utility authority | Delay to project | M | L | L | RMS to manage the approval from Asset Manager and utility authorities | Gurjit Singh | Project Manager, RMS, G Singh | | |
| [illegible] | Water quality basin biofiltration medium blocked by silt | Untreated water discharged to river | Pollution in the Hawkesbury-Nepean river Reputation damaged | M | L | L | Develop procedure for testing and maintenance to avoid blockage | Gurjit Singh | RMS Maintenance Branch | | |
| 3.29.25 | | | | N | N | N | | | | | |
| | | | | | | | | | | | |
| | | | | N | N | N | | | | | |

# Appendix 11: Procurement Plan

Not Used

Refer to Appendix 8 – Project Management Plan

# Appendix 12: Community and Stakeholder Management Plan

Roads & Maritime

# Windsor Bridge replacement

## Community and stakeholder engagement plan

August 2016

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## Objective references

| | | | |
|---|---|---|---|
| Objective ID | A10683676 | Objective File ID | SF2013/138597 |
| Objective Document location | https://edm.rta.nsw.gov.au/id:A10683676/document/versions/published | | |

## Version history

| Version | Author | Date | Details |
|---|---|---|---|
| 0.2 | Cleo Andrews<br>Tim Rodham | 18/08/16 | Draft |

## Distribution and approval

| For Approval | | | |
|---|---|---|---|
| Title | Name | Signature | Date |
| Project Manager | Gurjit Singh | | |
| CSE Sydney Manager | Bronwyn Campbell | | |
| | | | |

| For Information | |
|---|---|
| Title | Name |
| | |
| | |
| | |

## Confidentiality

# Contents

## 1.0 Introduction and context

### 1.1 Purpose

This community and stakeholder engagement plan has been developed to support the pre-construction and construction phases of the Windsor Bridge replacement project.

It is a working document to be used by the project team to plan, implement and manage communication and engagement activities to support project milestones and construction activities.

The plan outlines the communication and engagement objectives of the project. It also presents the communication approach, tools, key messages, protocols and evaluation to support the implementation of communication and engagement activities for this project.

It is designed to provide an agreed approach to communication and engagement, open communication channels and clear protocols.

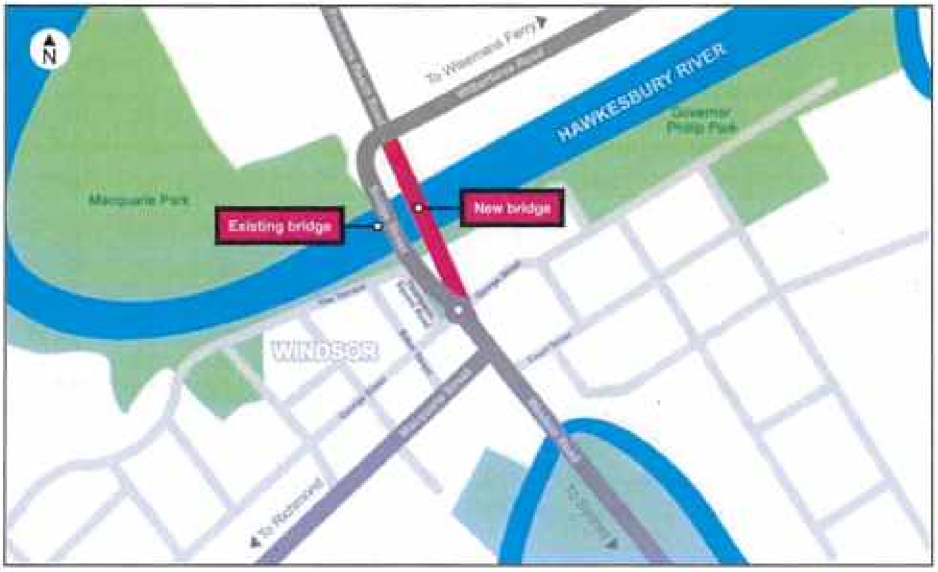
### 1.2 Project background

Originally built for horse-drawn vehicles and foot traffic in 1874, Windsor Bridge is now used by up to 19,000 vehicles every day. The structure no longer needs current road design standards and needs to be replaced.

Roads and Maritime is planning to replace the existing Windsor Bridge with a new bridge 35 metres downstream. New approach roads and intersections will be built and existing approach roads will be filled in and landscaped. Once the new bridge is open to traffic, the existing bridge will be removed.

The objective of the project is to provide a safe, reliable crossing of the Hawkesbury River and help improve traffic flow for road users.

**Figure 1 Project location**



### Key features

Key features of the project include:

- Building a new bridge 35 metres downstream of the existing Windsor Bridge
- Building new approach roads and intersections to connect the new bridge to the existing road network
- Installing new traffic lights with pedestrian facilities at the intersection of Bridge Street and George Street
- Modifying local roads and access arrangements, including changes to the Macquarie Park access road and reconnection of The Terrace
- Building a new dual lane roundabout at the intersection of Wilberforce Street and Freemans Reach Road
- Building pedestrian and cyclist facilities, including a shared path for access to and across the new bridge
- Removing and backfilling the existing bridge approach roads
- Removing the existing bridge once the new bridge is operational
- Landscaping and urban design work, including within the Thompson Square parkland area and adjacent to the northern intersection of Wilberforce Road, Freemans Reach Road and the Macquarie Park access road.

### Benefits

Key benefits to the community include:

- Upgrading an essential local and regional road link across the Hawkesbury River at Windsor
- Improved safety for motorists, pedestrians and cyclists.
- Improved traffic performance including two-way heavy vehicle traffic flow on the bridge
- Improved traffic efficiency by installing traffic lights at the intersection of Bridge and George Streets and a new dual-lane roundabout at Freemans Reach Road and Wilberforce Road
- Flood immunity similar to surrounding roads would provide improved flood evacuation opportunities for floodplain areas north of Windsor and would provide access across the Hawkesbury River for a wider range of flood events
- Better access for pedestrians and cyclists including a three metre wide shared pedestrian and cycle path that connections to Thompson Square and surrounds
- Reduced road footprint within the Thompson Square heritage precinct
- A unified open space in Thompson Square increasing the usable area by more than 500 square metres with direct access to the river.

## 1.3 Project area profile

The project is located in the Hawkesbury local government area (LGA), Hawkesbury electorate and includes the suburb of Windsor.

The existing bridge provides an essential crossing of the Hawkesbury River at crossing. The new bridge will connect Bridge Street on the southern bank to the realigned Wilberforce Road.

Windsor is one of Australia's oldest colonial settlements. Thompson Square in the old town centre is a heritage-listed urban open space and the most intact surviving square of those designed by Governor Macquarie. Preservation of Windsor's heritage character is a key consideration of the project.

All property acquisition required to build the project has been completed.

**Figure 2 Existing bridge**

## 1.4 Community involvement

Roads and Maritime has carried out extensive consultation with the community and stakeholders since the project was announced in 2008. We have used a number of different methods to keep the community informed.

Feedback was first invited from the community in July 2009 when nine different options were displayed for comment. Following the announcement of the preferred option in August 2011, further feedback was invited from the community to inform the concept design. A third consultation period was carried out in November and December 2012 with the display of the concept design and environmental impact statement.

We will invite further feedback from the community in 2016 on proposed urban and landscaping for the project.

## 1.5 Project milestones

| Milestone | Date |
|---|---|
| Project announcement | June 2008 |
| Community consultation on nine options | July 2009 |
| Community consultation on preferred option | August 2011 |
| Environmental impact statement display | November 2012 |
| Submissions report finalised | May 2013 |
| Project approved by the Minister for Planning | December 2013 |
| Case filed in the Land and Environment Court by CAWB | April 2014 |
| Decision handed down by Land and Environment Court | October 2015 |
| Start heritage and environmental investigation program | August 2016 |
| Consultation on urban design and landscaping | Late-2016 |
| Award construction tender | Mid 2017 |
| Start construction | Late-2017 |
| Open to traffic | Late-2019 |

## 1.6 Community opposition

The project has received significant media attention since its announcement in 2008 due to community opposition to the preferred option.

Since community consultation was initially carried out in 2009, the Community Action for Windsor Bridge (CAWB) group has implemented a targeted campaigned against the preferred option and realignment of Thompson Square in favour of a bypass solution. The group has occupied Thompson Square since July 2013.

CAWB objects to the demolition of the old bridge and impacts to the heritage character of Thompson Square in Windsor town centre. It advocates for the restoration of the existing bridge for local traffic and construction of a bypass for heavy vehicles and regional traffic.

CAWB received the 2014 Heritage Council of NSW Volunteer Award for their campaign.

In April 2013 about a thousand people attended a protest against the project at Thompson Square.

Media attention heightened in 2013 when former Prime Minister Keven Rudd made a pre-Federal election promise to fund a $500,000 study into alternative routes.

In April 2014 CAWB filed a case with the Land and Environment Court challenging the planning approval of the project. The Court ruled in October 2015 that Roads and Maritime could proceed to deliver the project.

## 2.0 Communication approach

The communication and consultation approach will be guided by the Roads and Maritime Services Community Engagement and Communications Manual, which is informed by the International Association for Public Participation (IAP2) spectrum for public participation.

The level of public participation required for this project will be at the 'Inform' and 'Consult' levels on the IAP2 spectrum. This is based on the level of public impact from the project, the likely 'negotiables' as well as Roads and Maritime guidelines. By engaging the community and stakeholders at the 'Consult' level, the project team will work with the community to obtain public feedback on analysis, alternatives and/or decisions and will provide feedback on how public input influenced the decision making process.

At the same time, meetings with concerned stakeholder groups will take place to proactively address their issues. Community and stakeholder input will be sought to assist with minimising construction impacts and delivering the project.

A range of consultation and communication tools will be used to inform and provide opportunity for input from stakeholders throughout the project – these may change as the project progresses.

### 2.1 Communication and engagement objectives

The communication and engagement objectives for the project are to:

- Provide regular and targeted information to the community and stakeholders on the progress of the project and construction activities, including the likely impacts and benefits
- Provide clear direction to the community and stakeholder whether we are providing information or seeking feedback so that expectations are clear
- Ensure community and stakeholder feedback and issues are considered in the decision-making process
- Ensure issues relating to project delivery are identified early and managed effectively
- Manage stakeholder feedback and complaints in a timely, respectful way
- Collaborate with government agencies and local council to ensure a whole-of-government approach to managing issues and providing consistent messages
- Monitor and evaluate stakeholder feedback and communication activities to measure success and review planning and delivery as required
- Build stakeholder and community confidence in Roads and Maritime and its decisions.

### 2.2 Key messages

Key messages will be developed and updated as the project progresses to ensure consistency across all communication and engagement activities. Project team members should be aware of the key messages to ensure consistent information is shared with communities and stakeholders.

Milestone-specific key messages will be included in communication implementation plans that sit under this plan.

**Project**

- Roads and Maritime is planning to replace Windsor Bridge with a new bridge 35 metres downstream
- The NSW Government is funding this project to help improve traffic flow and provide a reliable and safe crossing of the Hawkesbury River
- The existing bridge has deteriorated and no longer meets current road design standards so it needs to be replaced. The existing bridge will be removed once the new bridge is open to traffic
- New approach roads and intersections will be built and existing approach roads will be filled in and landscaped
- Construction work to build the new bridge is expected to start in late-2017 and will take about two years to complete, plus a further 6 months to demolish the existing bridge (weather permitting).

**Community involvement**

- Extensive consultation has been carried out with the community during the options evaluation and environmental assessment processes
- We have considered the issues raised during consultation together with environmental and heritage studies in finalising the design
- In late-2016 we will invite feedback from the community and stakeholders on proposed urban design and landscaping
- Residents will be notified before work starts and we will continue to keep the community informed as the project progresses.

**Impacts**

- No heritage buildings need to be removed as part of this project
- The project will create a unified, green open space in Thompson Square with a reduced road footprint
- The new bridge will be built using an incrementally-launched method so that construction work can mostly be done from the northern bank, helping to minimise impacts to Thompson Square
- New pedestrian and cyclist facilities will improve connectivity in and around Windsor
- We will make every effort to minimise impacts during the project's construction.

**Limitations of the existing bridge**

- At about 19,000 traffic movements a day, the existing bridge is at full capacity
- During the past 100 years the existing bridge has experienced 60 flood events
- We examined the feasibility of retaining the existing bridge but found substantial and ongoing maintenance costs would add only a limited period to the functional life of the bridge
- In addition to deteriorating with age, the existing bridge does not meet current engineering and road safety standards
- The intersections on approach to the existing bridge cause traffic delays and congestion

- The existing bridge as poor pedestrian and cyclist connectivity
- The existing bridge will need to be removed once the new bridge is in place as it would be costly to maintain, even for light traffic or pedestrians and would be a potential risk to the replacement bridge in a flood event
- The existing bridge has structural issues, including:
  - Horizontal ring cracks on three of the cast iron caissons of the bridge and one small vertical crack
  - A high degree of graphitisation of the cast iron caissons, which has reduced the wall thickness of the caissons in some locations
  - Transverse asphalt cracking has occurred on piers and abutments.

## 2.3 Stakeholders

The following list identifies stakeholders that have an interest in the project. These stakeholders may either be impacted by the project or may influence or become advocates for the project. A detailed stakeholder analysis is available at Appendix B.

- Government:
  - Minister for Roads, Maritime and Freight
  - Minister for Planning
  - State Member for Hawkesbury
  - Federal Member for Macquarie
  - Hawkesbury City Council
- Residents and businesses
- Community groups
- Road users
- Transport groups
- Media.

## 2.4 Engagement tools and techniques

The communication approach for this project includes a number of tools and activities to keep the community and stakeholders informed.

| Tool | Audience | Outcome |
|---|---|---|
| Community information phone number | Community and stakeholders | The dedicated phone number is provided on all communication material for community feedback and enquiries. |
| Project web page | Community, stakeholders and media | A project web page is provided on Roads and Maritime's website to provide an overview of the project. The web page is updated regularly with project documents, announcements and upcoming milestones. |

| | | |
|---|---|---|
| Consultation Manager database | Internal | Stakeholder management software Consultation Manager is used to record stakeholder information including contact details, issues and activities. This is used to build hardcopy and email distribution lists for project updates. |
| Media releases and traffic alerts | Media | Media releases are provided to the media to ensure they are kept updated on the project and enable them to disseminate information to the community about upcoming milestones. They are provided to the local MP's office to brief them on activities in their electorate. |
| Letterbox drops | Local residents and businesses | Communication material is distributed via letterbox drops to residents and businesses to keep them informed about the project. |
| Collateral | Community and stakeholders | A range of communication material is used to keep the community informed about the project and opportunities to provide feedback. Material includes project updates, flyers and notification letters. |
| Questions and answers | Community, stakeholders and media | A questions and answers document will be published on the project web page to provide background information about the project. |
| Email distribution | Key stakeholders, registered community members | Communication material is distributed via email to stakeholders and community members who have registered for email updates about the project. An email distribution list is recorded in Consultation Manager. |
| Briefings | MPs, Council | Key stakeholders including the local MP and Council are briefed to ensure they are kept updated on the program and enable them to disseminate information to the community. |
| Advertisements | Wider community | Print advertising is used to inform the wider community about the project, including opportunities to provide feedback and traffic impacts during construction activities. |
| Shopping centre displays | Local community | Shopping centre displays provide an opportunity for community members to meet with the project team face-to-face to ask questions and provide feedback. |

| | | |
|---|---|---|
| Doorknocks | Local residents and businesses | Residents and businesses are doorknocked by the project team to provide information about the project and invite feedback during consultation. |
| Electronic message signs | Road users | Electronic message signs are used to communicate traffic changes to motorists and other road users. |
| Site tours | Community and stakeholders | Site visits may be used during construction to familiarise the community and stakeholders with the project and construction processes. |
| Media and community events | Media, community, stakeholders | Media and community events may be scheduled to mark major project milestones including start or completion of a section of work and major traffic switches. |

An activity timeline showing project milestones with stakeholders and communication activities is shown in Appendix C.

Milestone-specific communication activities will be outlined in communication implementation plans that will sit under this plan.

# 3.0 Protocols

## 3.1 Stakeholder contact management

All stakeholder contact relating to the project, including complaints, will be collected, documented and stored in the stakeholder contact databased. Consultation Manager was used during the planning phase of the project and should be referenced when issues and queries arise during construction. This includes incoming and outgoing correspondence, submissions and any corresponding actions taken.

## 3.2 Enquiries and complaints management

Verbal enquiries from the community and stakeholders should be responded to within 24 hours and five days for written enquiries. The Consultation Manager database should be updated within 24 hours of contact.

A complaints management system will be established for the construction phase of the project and will include:

- The efficient recording, tracking and response to complaints using Consultation Manager, including registering the following details:
  - Date and time of complaint
  - Method of communication
  - Full name, address and contact details of complainant
  - Nature of complaint and issues raised
  - Names of staff involved
  - Action taken and details of resolution, including response times.
- Follow-up monitoring to ensure complaints have been resolved satisfactorily.

## 3.3 Media

Only Roads and Maritime's Media Unit can address the media and provide statements. All media enquiries must be referred to the Media Unit on 02 8588 5999 or media@rms.nsw.gov.au.

## 3.4 Reporting issues, risks and opportunities

Communication and stakeholder issues, risks and opportunities are monitored and reported to management, Executive and Minister's Office via established internal protocols and reporting mechanisms.

## 3.5 Collateral approvals

Internal approval of communication material is carried out in accordance with Roads and Maritime's collateral approval process in Appendix D.

## 3.6 Project approval conditions

Approval for Roads and Maritime to deliver the project is subject to the Minister for Planning's instrument of approval. The full instrument of approval is available to view on the Department of Planning website. Conditions relating to community involvement include:

- Maintaining an up-to-date web page for the project
- Implementation of a complaints management system including a 24-hour community information number
- Preparation and publication of a Community Communication Strategy as part of the Construction Environmental Management Plan.

The Community Communication Strategy will be prepared by the construction contractor and will comply with the conditions outlined in the instrument of approval.

# 4.0 Evaluation

Evaluation of milestone-specific communication and engagement activities will be outlined in communication implementation plans that will sit under this plan.

Monitoring and evaluation activities include:

- Feedback forms for community members to evaluate consultation activities
- Regular review of enquiries and feedback received to identify emerging trends and unresolved issues
- Review of contact response times to assess compliance
- Regular review of communication material and key messages
- Reviewing timing of notifications
- Monitoring of the media (traditional and social).

# Appendix A – Questions and answers

## Project need and benefits

**Why does Windsor Bridge need to be replaced?**

Parts of the existing Windsor Bridge are over 130 years old and are deteriorating due to age and heavy use. The bridge would need extensive and costly repairs if it was to be used and maintained into the future. In addition, the existing bridge does not meet current engineering and road safety standards such as minimum lane widths. The roads and intersections also have safety issues including a lack of safe pedestrian crossing locations and poor vehicle sight distances.

**What does the project involve?**

Roads and Maritime is planning to replace the existing Windsor Bridge with a new bridge 35 metres downstream. New approach roads and intersections would be built and existing approach roads would be filled in and landscaped. Once the new bridge is open to traffic, the existing bridge would be removed.

**What are the benefits?**

Benefits to the community include:

- Improved safety for motorists, pedestrians and cyclists
- Upgrading an essential local and regional road link across the Hawkesbury at Windsor
- Reduced impacts of flooding
- Improved cyclists and pedestrian connectivity
- More usable open space on Thompson Square by consolidating two parkland areas.

## Options

**Why not rehabilitate and maintain the old bridge?**

Due to structural deterioration, the existing bridge would require significant repairs and strengthening to continue to be used for vehicle traffic.

Maintaining the existing bridge would require implementation of a vehicle load limit in the short term and eventual closure in the long term. The cost of upgrading the bridge to a lesser standard would be substantial for a limited lifespan.

**How was the new location chosen?**

Roads and Maritime investigated the condition of the existing bridge and options to rehabilitate or replace it. We consulted the community on nine proposed options in 2009. After considering the feedback and further investigating the options we decided on the preferred option to replace the bridge in August 2011.

The preferred option provided the best outcomes in terms of value for money and achieving the project objective of providing a safe and reliable crossing of the Hawkesbury River for motorists, cyclists and pedestrians.

**Why not take traffic out of Windsor and bypass the town?**

A bypass option was considered as part of the options assessment process and would involve building a replacement bridge through Pitt Town. This option was not preferred for a number of reasons:

- It would have a much higher cost than the preferred option
- Traffic volumes are too low to warrant a bypass
- It would not provide an efficient connection for local traffic into Windsor, which would reduce access to businesses in the town centre
- It would provide poor pedestrian and cyclist connectivity for Windsor town centre
- Large amounts of property acquisition would be needed
- It would have a high impact on potential Aboriginal heritage artefacts and the heritage character of Pitt Town and surrounds
- It would still require the refurbishment of the old bridge once the bypass is built. The refurbished bridge would have a limited lifespan at a high cost and would eventually need to be replaced.

For these reasons a bypass is not preferred at this time. A bypass solution could be considered in future if the need is identified and funds become available.

## Design

**What type of bridge will be used?**

The new bridge will be an incrementally launched bridge, which means the bridge deck will be built mostly from the northern bank. The new bridge would have four piers in the water, which is less than the old bridge.

**How much higher is the new bridge than the old one?**

The deck of the new bridge will be about three metres higher at the northern bank and six metres higher at the southern bank to help reduce flooding impacts. However, the approach to the bridge beside the Thompson Square parkland won't be higher than the ground floor levels of the adjacent buildings. The lower height of this approach road was incorporated after considering feedback from the community about reducing visual impacts across Thompson Square.

**Will the approach road run through Windsor?**

The new bridge approach road will run along Old Bridge Street beside the Thompson Square parkland area. The roundabout at George Street will be replaced by traffic lights to help improve traffic efficiency and provide safer access for pedestrians at this intersection.

**What will happen to the Thompson Square parkland?**

Through the development process the design has been refined to reduce visual impact on the Thompson Square parkland and maintain views across the square. By backfilling the existing approach road to the bridge, the project provides about 500 extra square metres of green open space in Thompson Square.

**Will heritage building in Thompson Square be impacted?**

No heritage buildings need to be removed as part of this project.

**Why is there a roundabout on the Wilberforce side of the new bridge?**

The new dual lane roundabout will feed traffic onto the bridge and allow motorists to use different lanes depending on their destination. This will help improve traffic flow on approach to the bridge. A roundabout was chosen instead of traffic lights due to the rural character and flooding impacts on this side of the bridge.

**What are the local traffic impacts as a result of the project?**

Right turns into George Street towards Governor Philip Park will be banned for motorists travelling north. This is to allow traffic to flow freely onto the bridge.

## Community involvement

**How has the community been kept informed?**

Roads and Maritime has kept the community informed about the project via a number of different methods including project update newsletters, newspaper advertisements, letterbox drops, emails to registered stakeholders, website updates, community information sessions, focus group meetings, shopping centre displays and door knocking.

**When did community consultation take place?**

Feedback was first invited from the community in July 2009 when nine options were displayed for comment. Following the announcement of the preferred option in August 2011, further feedback was invited from the community to inform the concept design. The final consultation period was carried out in November 2012 with the display of the concept design and environmental impact statement.

**What has the community been consulted on?**

The community has had the opportunity to comment on:

- The location of the new bridge, the type of bridge and how it will look
- The approach to Windsor town and how to minimise impacts to Thompson Square
- The future renewal of Thompson Square
- Design and heritage matters
- Local road changes and location of footpaths and cycleways
- The extent of archaeological and geotechnical testing.

**What happened to the community focus group?**

In October 2011 Roads and Maritime established a design and heritage community focus group to assist with the development of the concept design and environmental assessment of the project. The group met seven times in total.

The group had an independent facilitator and included members from the project team, local residents, businesses, industry and interest groups. The group provided feedback to the project team on topics including bridge type selection, archaeology, heritage and traffic matters.

The outputs of the focus group have been taken into consideration in the development of the project and feedback will be sought in future if required.

## Construction

**When will construction start?**

Construction work to build the new bridge is expected to start in mid-2017 and will take about 24 months to complete, weather permitting.

**How will impacts to Thompson Square be minimised?**

The main construction compound will be located on the northern bank to minimise impacts of trucks and construction equipment in Windsor. A number of plans will be implemented to help minimise construction impacts including traffic management, air and water quality, noise and vibration and heritage. Further information about managing construction impacts is outlined in the environmental impact statement.

**What happens next?**

Before construction starts we need to carry out some investigation work to help refine the detailed design for the project:

- Archaeological studies including heritage, Aboriginal and maritime assessments
- Archival recording of historic sites at Thompson Square and Windsor Bridge
- Environmental assessments including hydrology, water quality and contamination.

Residents will be notified before this work starts and we will continue to keep the community informed as the project progresses.

**How can I find out more information?**

For more information about the project, please contact:

**Phone**: 1800 822 486

**Email**: windsor_bridge@rms.nsw.gov.au

**Post**: Windsor Bridge replacement project
PO Box 609
Pyrmont NSW 2009

**Web**: Visit **www.rms.nsw.gov.au** and search 'Windsor Bridge'.

## Appendix B – Stakeholder analysis

| Category | Stakeholders | Influence | Interests | Communication activities |
|---|---|---|---|---|
| **Government** | Minister for Roads and Freight, Duncan Gay<br>Roads and Maritime Services<br>Transport for NSW | High | Project funding<br>Construction milestones<br>Media opportunities<br>Construction impacts<br>Improvements to road network and infrastructure | Media releases<br>Project updates<br>Briefings and meetings<br>Email distribution list |
| | Department of Planning and Environment<br>Minister for Planning, Rob Stokes<br>Office of Environment and Heritage<br>Environment Protection Authority<br>Heritage Council of NSW | High | Project approval conditions<br>Legislative requirements<br>Environment and heritage impacts | Briefing and meetings as required<br>Email distribution list |
| **Elected representatives** | State Member for Hawkesbury, Dominic Perrottet (Lib)<br>Federal Member for Macquarie, Louise Markus (Lib) | High | Project funding<br>Construction milestones<br>Media opportunities<br>Construction and operational impacts to constituents | Media releases<br>Project updates<br>Briefings<br>Email distribution list |
| **Councils and services providers** | Hawkesbury City Council<br>Western Sydney Regional Organisation of Councils (WSROC) | High | Heritage impacts<br>Landscaping and urban design<br>Consultation and engagement<br>Construction impacts and program<br>Impacts to constituents<br>Property and utility adjustments | Briefings and meetings<br>Project updates<br>Email distribution list |

| Category | Stakeholders | Influence | Interests | Communication activities |
|---|---|---|---|---|
| | | | Property dilapidation reports<br>Impacts on local road network | |
| | Utilities:<br>• Ausgrid<br>• Telstra<br>• Optus<br>• Jemena | Medium | Utility adjustments<br>Cumulative construction impacts<br>Consultation and notification | Meetings as required<br>Email distribution list |
| **Community** | Residents and property owners near the project area | Medium | Construction program<br>Property impacts<br>Construction impacts including noise and property access<br>Visual amenity<br>Consultation and notification<br>Traffic impacts and changes to local roads | Project updates<br>Notification letters<br>Doorknocks<br>Project contact details<br>Web updates<br>Email distribution list |
| | Community groups:<br>• Community Action for Windsor Bridge<br>• Hawkesbury Nepean User Group | Medium | Impacts to Thompson Square parkland<br>Heritage impacts<br>Bypass alternative<br>Impacts to Hawkesbury River users | Web updates<br>Project contact details<br>Collateral |
| | Deerubbin Local Aboriginal Land Council<br>Darug Tribal Aboriginal Corporation | Low | Impacts to Aboriginal heritage artefacts | Meetings as required |
| **Business** | Local businesses in Windsor and surrounds<br>the surrounding area | Low | Impacts to trade from construction activities, including access and noise<br>Visual amenity | Project updates<br>Notification letters<br>Doorknocks |

| Category | Stakeholders | Influence | Interests | Communication activities |
| --- | --- | --- | --- | --- |
| | Hawkesbury Chamber of Commerce<br>Windsor Business Group | | Consultation and notification<br>Operational impacts from changes to approach roads<br>Local road network improvements | Project contact details<br>Web updates<br>Email distribution list |
| **Media** | Local media:<br>• Hawkesbury Courier<br>• Hawkesbury District Independent<br>• Hawkesbury Gazette<br>• The Western Weekender | Low | Project funding<br>Construction milestones<br>Impacts to local community during construction and operation<br>Traffic impacts | Media releases<br>Media events<br>Project web page<br>Media Unit contact details |
| **Transport** | Road users:<br>• Local traffic<br>• Commuters<br>• Heavy vehicles<br>• Cyclists<br>Transport groups | Low | Traffic impacts during construction and operation<br>Local and regional road network improvements<br>Pedestrian and bicycle connectivity | Advertisements<br>Project web page<br>Traffic alerts<br>Live Traffic website<br>Electronic message signs |
| **Emergency services** | NSW Ambulance Service<br>NSW Fire and Rescue<br>NSW Police | Low | Construction and operational impacts to traffic<br>Emergency vehicle access | Traffic alerts<br>Live Traffic website |

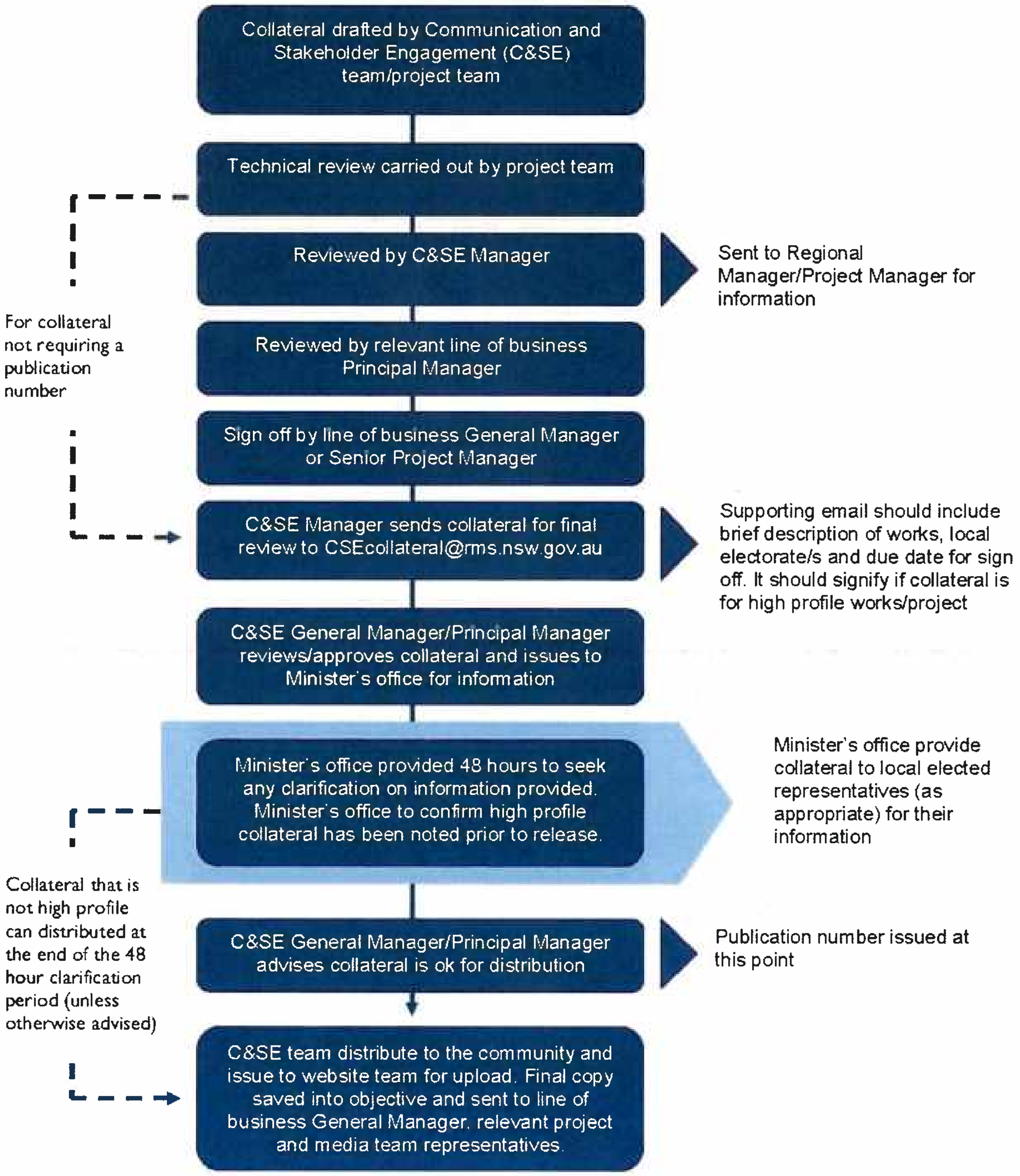
## Appendix C – Communication activities

Note: This table provides an overview of communication and stakeholder engagement activities for the pre-construction and construction phases of the project. Milestone-specific activities will be outlined in communication implementation plans that sit under this plan.

| Project Milestone | Communications activity, tool or technique | Audience | Timing | Responsibility | Status |
|---|---|---|---|---|---|
| **Pre-construction** | | | | | |
| Pre-construction | Update communication and engagement plan | Internal | Late 2015 | CSE Officer<br>Project team | Complete |
| Announce start of environmental and heritage testing program | Project update<br>Web update<br>Media release<br>Questions and answers<br>Key stakeholder briefings<br>Letterbox drop and door knock | Community and stakeholders | March to August 2016 | CSE Officer<br>Project team | In progress |
| 3-lane bridge configuration | Project update<br>Web update<br>Media release<br>Animation | Community and stakeholders | September 2016 | CSE Officer<br>Project team | Up coming |
| Investigation work | Notification letter<br>Web update<br>Media release<br>Advertisement | Community and stakeholders | August to November 2016 | CSE Officer<br>Project team | |
| Consultation on urban design and landscaping and heritage interpretation | Project update<br>Web update<br>Media release<br>Advertisement<br>Static display<br>Consultation report | Community and stakeholders | Late 2016 to Early 2017 | CSE Officer<br>Project team | |

| Project Milestone | Communications activity, tool or technique | Audience | Timing | Responsibility | Status |
|---|---|---|---|---|---|
| **Construction** | | | | | |
| Award construction tender | Media announcement<br>Web update<br>Key stakeholder briefings<br>Animation | Community and stakeholders | July 2017 | CSE Officer<br>Project team | |
| Start construction | Media announcement<br>Notification letter<br>Web update<br>Advertisement<br>Key stakeholder briefings | Community and stakeholders | Late-2017 | CSE Officer<br>Project team | |
| Construction | Maintain forward calendar of communication milestones<br>Notification letters<br>Electronic message signs<br>Live Traffic updates<br>Monthly traffic alert<br>Quarterly construction updates<br>Media releases to support construction milestones<br>Web updates<br>Stakeholder meetings and briefings as required<br>Monitoring and evaluation | Community and stakeholders | Late 2017 to Early 2020 | CSE Officer<br>Project team<br>Construction contractor | |
| Completion and open to traffic | Media release<br>Web update<br>Construction update<br>Project evaluation and case study | Community and stakeholders | Late-2019 | CSE Officer<br>Project team<br>Construction contractor | |

## Appendix D – Collateral approval process



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Customer feedback
Roads and Maritime
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# Appendix 13: Change Management Plan

# Change Management Plan

## Windsor Bridge Replacement Project

NSW Roads and Maritime Services
ABN 76 236 371 088

Project number: A/66737
RMS document number:
Date: 31 January 2017

Infrastructure Development

# About this document

## Document information

| | |
|---|---|
| File name | Change Management Plan – Windsor Bridge Replacement Project – Final Business Case |
| Document number | A/66737 |
| Objective ID | |
| Version number | Version No. 1.2 |
| Date | Draft 15 February 2017 |
| Prepared by | Roads and Maritime Services |

## Project information

| | |
|---|---|
| Project name | Windsor Bridge Replacement Project – Final Business Case |
| Project number | P.0011444 |

## Approvals

| Approval and authorisation | Position | Name | Date |
|---|---|---|---|
| Prepared by | Project Manager | G Singh | 19 July 2017 |
| Approved or authorised by | Senior Project Manager | G Standen | 19 July 2017 |

## Revision history

| Issue | Date | Revision description |
|---|---|---|
| 1.0 | 03 August 2016 | Draft Report |
| 1.1 | 31 January 2017 | Final Draft |
| 1.2 | 15 February 2017 | Final Draft |

| | | |
|---|---|---|
| 1.3 | 19 July 2017 | Final |

# Contents

# 1 INTRODUCTION

## 1.1 Purpose of this document

The purpose of this change management plan is to ensure that all likely changes associated with the Windsor Bridge Replacement Project are captured in a rigorous and consistent manner.

This plan documents the process of how each of the changes associated with the project will be proactively managed. It also assigns a project team member who is responsible for effectively managing each identified area of change in the proposed project.

## 1.2 Reviewing and updating this document

The initial version of this plan has been produced to accompany this Final Business Case. It will be reviewed and revised as necessary throughout the development of the project.

## 1.3 Change management framework

The change management framework for this project is as follows:

- Roads and Maritime has a governance and project assurance process in place to make sure that the changes from the project have been endorsed internally within the Greater Sydney Region, within Infrastructure Development and Delivery as well as across key stakeholders including TfNSW.
- The project team will manage the milestones, scope and cost of the project from the strategic phase to the detailed design stage by having regular progress meetings, reporting on the project at monthly coordination meetings and by involving key Roads and Maritime engineering and technical staff in risk and constructability workshops. The transition from project development into project delivery will be managed by allowing the project delivery team to shadow the project development team and vice-versa when the project moves into delivery so that a smooth transition can occur. This will provide a high level of continuity during the transition and will provide assurance that the objectives of the project will be delivered and realised.
- The project team has prepared a Stakeholder and Community Management Plan for this project. The Plan outlines how shared understanding about the project has been created and how internal and external stakeholders would be kept informed. The project team has liaised with the elected representatives, Council, Department of Planning, adjoining and affected residents, and informed the broader community by issuing media releases. Communication tools, such as letter box drops and live traffic website, will be used during delivery to inform road users of journey time and road network changes.
- Changes during construction will be managed by implementing the project management plan, site management documents, the CEMP, traffic management plans (including traffic control plans) and vehicle management plans. These documents will be prepared in line with the

requirements in ProjectPack, Review of the Environmental Impact Statement, and the Traffic Control at Worksites Manual (respectively). Each of these documents will also be approved or endorsed by the relevant staff in accordance with the Roads and Maritime Delegations Manual (as appropriate).

- Work Health and Safety (WH&S) will be managed by implementing the safety management plan and safe work method statements and by engaging with the WHS partner for Infrastructure Delivery.

To manage change during the ongoing operation of the new asset, Roads and Maritime will implement the *Technical Procedure for Asset Acceptance (ILC-GEN-TP0-901) and the Policy for Acceptance of Infrastructure Assets for Ongoing Management*. The new asset will be maintained internally by Roads and Maritime, which has the capability and capacity to manage road infrastructure assets in NSW.

# 2 PROJECT INFORMATION

## 2.1 Project background

The town of Windsor is located in the Hawkesbury local government area about 57 kilometres north-west of Sydney. The Windsor Bridge across the Hawkesbury River provides essential connectivity for communities either side of the river, as well as an important regional link between Western Sydney, the Blue Mountains and the Hunter region.

The current bridge was built in 1874. Some parts of the bridge are more than 140 years old and have deteriorated as a result of age and heavy use. In June 2008, in recognition of the condition of the existing bridge and the volume of traffic it carried, the New South Wales (NSW) Government announced funding for its replacement.

Preliminary investigations of potential bridge replacement options along with stakeholder consultations were completed in 2012, followed by completion and public display of the Environmental Impact Statement (EIS) exhibition. The NSW Minister for Planning and Infrastructure's Conditions of Approval was provided in December 2013 but were then appealed at the NSW Land and Environmental Court on the grounds of expected impact on the Thomson Square. In 2015 the appeal was denied and the court allowed the project to proceed.

## 2.2 Project Objectives

The primary aim of the project is to provide a safe and reliable crossing of the Hawkesbury River at Windsor. The specific objectives for the project are as follows:

- Replace the existing bridge which has reached the end of its economic life with a new bridge with a design life of 100 years.
- Increase flood immunity of the bridge equivalent to the approach roads.
- Support economic growth and productivity by providing a road with capacity LoS D or better for 2026 forecast traffic volumes.
- Encourage active transport by providing appropriate facilities for cycling and walking.
- Provide safe two-way traffic access for freight vehicles.
- Reduce crash rates to be no greater than the stereotypical rates for a primary arterial road (A2 road classification).

Secondary objectives common to all Roads and Maritime projects are:

- Design and construction works are to be sympathetic with local heritage and the environment.
- To be cost effective and an affordable outcome.

Further details regarding the project objectives are available in the Environmental Impact Statement.

## 2.3 Stakeholders and affected parties

Management of the following key stakeholders and community interest groups is critical to the success of the project:

| NAME | TITLE & /OR ROLE, DIVISION, AGENCY, COMMUNITY ENTITY ETC | INTEREST IN / REQUIREMENT FROM THE PROJECT |
|---|---|---|
| Affected property owners | Residents, property owners, commercial tenants, body corporate and developers | Property access, potential property impacts, property adjustment and land acquisition. |
| Businesses | Windsor Marketplace<br>Windsor Riverview Shopping Centre<br>Other local businesses | Traffic impact concerns during and after construction. |
| Community and special interest groups | Windsor Community Action Group<br>Hawkesbury Chamber of Commerce<br>Darug Aboriginal Group | The progress of the project planning, the opportunity for comment and feedback through Community Updates. |
| Broader community | Road users<br>Sporting clubs, including Rowing Clubs<br>Educational institutions, including Windsor Public School, Windsor South Public School and Windsor High School | The progress of the project planning, the opportunity for comment and feedback through Community Updates. |
| Local government | Hawkesbury City Council | The progress of the project planning, the opportunity for comment and feedback through Community Updates. |
| State government | Transport for NSW<br>Department of Planning and Environment<br>Office of Environment and Heritage | The progress of the project planning, the opportunity for comment and feedback through Community Updates. |
| Elected representatives | Minister Roads, Maritime and Freight<br>State Member for Hawkesbury<br>Federal Member for Macquarie | The progress of the project planning, the opportunity for comment and feedback through Community Updates. |
| Transport operators | Private bus companies | The progress of the project planning to ensure concerns are identified early and views |

| NAME | TITLE & /OR ROLE, DIVISION, AGENCY, COMMUNITY ENTITY ETC | INTEREST IN / REQUIREMENT FROM THE PROJECT |
|---|---|---|
| | | can be considered in preparing the design the documentation. |
| Emergency services | Ambulance, Police, Fire Brigade, Bushfire Brigade, State Emergency Service | The potential impact on delivery of services. |
| Utilities | Electricity, telecommunications, water and sewerage and stormwater | The potential impact on delivery of services. |

## 2.4 Identified areas of Change

### 2.4.1 Change for road users, neighbours, stakeholders and the community during detailed design and construction.

These include changes to access conditions during investigation (temporary lane closures) and construction (traffic switches). The proposed upgrade is likely to require short-duration temporary lane closures of connecting roads with traffic control and detours implemented. In addition, it is likely that reduced speed limits would be in place in addition to probable night time lane closures and night works during the construction stage. Other changes that will be apparent, especially for locals, will be the presence of both construction traffic and adjacent site compounds during construction delivery.

### 2.4.2 Changes for road users regarding the operation of the road

The current bridge is a one lane in each direction undivided carriageway. The future bridge will be two lanes in the southbound direction and one lane in the northbound direction. The project will upgrade the intersection at George Street and Bridge Street with new traffic lights with pedestrian facilities. It should be noted the upgrade to traffic signals includes the banning of the right-turn movement onto George Street when traveling in the northbound direction and a size limit of 8 metres or less for vehicles turning left into George Street travelling in the southbound direction. The project will also upgrade the existing give-way intersection at Wilberforce Road / Freemans Reach Road to a dual lane roundabout. Pedestrian and cyclist facilities, including a shared path for access to and across the new bridge will also be provided as part of the project. Modifications to local roads and access arrangements, including changes to the Macquarie Park access road and reconnection of The Terrace shall change access to the Wharf as well members of the public travelling to the Macquarie Park.

### 2.4.3 Changes for neighbours / local residents

The key change relating to the project specific to neighbours/local residents relates to both construction and operational noise impacts and changes to access during both construction and operation. Detailed noise and vibration impact assessments were undertaken and 4 properties were identified as requiring further assessment on them during the detail design phase, these properties were listed in the EIS.

Noise mitigation measures would be considered where reasonable and feasible for the identified properties. Changes to access for were also considered in the EIS.

### 2.4.4 Changes for business premises, shops and organisations

Changes to access for businesses during both construction and operation are considered in the EIS. Traffic control that minimises impact will be implemented during the construction phase along George Street, this will include out-hours works and night-works were possible.

### 2.4.5 Changes within RMS regarding ownership of the project

These include changes as the project progresses through its life cycle such as changes in management and responsibility for aspects of the project. The project is currently with Greater Sydney Project Office (Project Delivery) and will remain with the delivery team until completion of the detail design, construction and finalisation. At this time the project will be passed to Journey Management (Assets Division) as well as Hawksbury City Council as per the Asset Handover Agreement.

## 2.5 Management of Change

**Table 2.1 – Management of Change – Windsor Bridge Replacement Project**

| STAGE OF THE PROJECT/PROGRAM | CHANGES FOR ROAD USERS | | CHANGES FOR LOCAL RESIDENTS | | CHANGES FOR EXTERNAL ORGANISATIONS AND BUSINESSES | | INTERNAL CHANGES FOR RMS PROCESSES AND STRUCTURES | |
|---|---|---|---|---|---|---|---|---|
| | What change is being (or will need to be) dealt with? (delete examples given if not relevant and add to the list if appropriate) | What are the proposed management controls? (delete examples given if not relevant and add to the list if appropriate) | What change is being (or will need to be) dealt with? (delete examples given if not relevant and add to the list if appropriate) | What are the proposed management controls? (delete examples given if not relevant and add to the list if appropriate) | What change is being (or will need to be) dealt with? (delete examples given if not relevant and add to the list if appropriate) | What are the proposed management controls? (delete examples given if not relevant and add to the list if appropriate) | What change is being (or will need to be) dealt with? (delete examples given if not relevant and add to the list if appropriate) | What are the proposed management controls? (delete examples given if not relevant and add to the list if appropriate) |
| 1. Development | • Congestion Relief.<br>• Peak period delay reduction.<br>• Traffic flow efficiency. | • Continued community consultation.<br>• Continued agency and Council consultation.<br>• Refinement of project design and program. | • Access arrangements for properties. | • Change to property is to be a clearly documented and publicly known process.<br>• Non road reservation impacts will be dealt with through normal property management protocols. | • Changes to utilities location and alignments. | • Early and continued liaison with utility providers. This will inform the design process and ensure constraints are identified early and timely relocations are initiated.<br>• Utility representatives invited to the Workshops. | • Carry-over of all active residual risks and changes remaining at the project approval stage of the project. | • Will be communicated in handover meetings and documented. |
| | • Change to road and pedestrian environment along approach roads and bridge.<br>• Change to arrangement of key intersections.<br>• Provision of additional lane capacity along the bridge. | • Continued community consultation.<br>• Continued agency and Council consultation.<br>• Refinement of project design and program. | • Changes to road carriageway, road reservation and road environment. | • Communicate changes early in the design process with affected residents, and relevant stakeholders (including their maintenance teams) to understand expectations. This will inform the urban and landscape design. | • Impacts on existing bus routes and stops. | • Early and continued liaison with bus operator. | • Transfer of funding and milestone information across organisational functional groups effectively. | • Milestones and funding issues are communicated at handover, particularly those aspects that the public may be aware of, i.e. those publicly documented. |
| | • Impacts on private property, public lands and overland flow paths for runoff. | • Continued community consultation.<br>• Continued agency and Council consultation.<br>• Refinement of project design and | • Overland water flow paths | • Communicate early and frequently with the potentially affected land owners. | • Changes to external organisations/commercial operations / shops. | • Representatives often invited to the Workshops, as are utility organisations.<br>• Affectation of property and business income is assessed using | • Agency landowner engagement.<br>• Continued consultation with business owners within and near the project site. | • Updated Stakeholder and Community Engagement Plan to inform the detailing and construction phases of the |

| STAGE OF THE PROJECT/PROGRAM | CHANGES FOR ROAD USERS | | CHANGES FOR LOCAL RESIDENTS | | CHANGES FOR EXTERNAL ORGANISATIONS AND BUSINESSES | | INTERNAL CHANGES FOR RMS PROCESSES AND STRUCTURES | |
|---|---|---|---|---|---|---|---|---|
| | | program.<br>• Early engagement with private land owners in accordance with Roads and Maritime acquisition protocols. | | | | legal processes, which include significant periods of time for negotiation and both parties evaluation of costs. | | project.<br>• Communication of design changes to obtain buy-in where appropriate. |
| 2. Implementation (Detailed design, through construction to opening) | • Continued community engagement and notification | • Updated Stakeholder and Community Engagement Plan to inform the detailing and construction phases of the project.<br>• Utilisation of Roads and Maritime communications staff to prepare and implement the strategies.<br>• Preparation of communication materials for the project.<br>• Communications of design changes to obtain buy-in where appropriate.<br>• Utilisation of Consultation Manager. | • Short and long term lane closures as part of construction.<br>• Possible peak period traffic delays during construction. | • Communicate changes early in the design process with affected residents, and relevant stakeholders (including their maintenance teams) to understand expectations. | • Changes to existing bus routes and stops.<br>• Changes to external organisations/commercial operations.<br>• Changes to emergency vehicle access.<br>• Impacts on special events. | • Early and continued liaison with affected parties.<br>• Establishment and communication through Roads and Maritime website and email reminders. | • Media releases, radio announcements and website updates.<br>• Trip information and traffic updates – website.<br>• Signage design and delineation design for construction staging, access to construction sites, and for the final project.<br>• Onsite liaison with affected adjacent property owners/neighbours – a key relationship is established with all "neighbours". | • As above. |
| | • Stakeholder consultation of detailed design changes. | • Updated Stakeholder and Community Engagement Plan to inform the detailing and construction phases of the project.<br>• Utilisation of Roads and Maritime communications staff to prepare and implement the strategies.<br>• Preparation of communication materials for the project.<br>• Communications of | • Short and long term lane closures as part of construction.<br>• Possible peak period traffic delays during construction. | • Communicate changes early in the design process with affected residents, and relevant stakeholders (including their maintenance teams) to understand expectations. | • Changes to existing bus routes and stops.<br>• Changes to external organisations/commercial operations.<br>• Changes to emergency vehicle access.<br>• Changes to special events. | • Early and continued liaison with affected parties.<br>• Establishment and communication through Roads and Maritime website and email reminders. | • Media releases, radio announcements and website updates.<br>• Trip information and traffic updates – website.<br>• Signage design and delineation design for construction staging, access to construction sites, and for the final project.<br>• Onsite liaison with affected adjacent property owners/neighbours – a key relationship | • As above. |

| STAGE OF THE PROJECT/PROGRAM | CHANGES FOR ROAD USERS | | CHANGES FOR LOCAL RESIDENTS | | CHANGES FOR EXTERNAL ORGANISATIONS AND BUSINESSES | | INTERNAL CHANGES FOR RMS PROCESSES AND STRUCTURES | |
|---|---|---|---|---|---|---|---|---|
| | | design changes to obtain buy-in where appropriate.<br>• Utilisation of Consultation Manager. | | | | | is established with all “neighbours”. | |
| | • Design changes | • Communications of design changes to obtain buy-in where appropriate of key community representatives and stakeholders as a minimum.<br>• Incorporation of communication protocols within the PSC's project management documentation suite to ensure effective communication of design changes across the broad design team. | • May result in temporary access changes during construction or changes in noise generation. | • Communicate changes early in the design process with affected residents, and relevant stakeholders (including their maintenance teams) to understand expectations. | • May impact bus routes and stops.<br>• May impact vehicular and pedestrian access on existing footpaths and via intersections.<br>• May result in temporary diversion or re-routing of heavy vehicles through or near noise sensitive land uses. | • Early and continued liaison with affected parties.<br>• Establishment and communication through Roads and Maritime website and email reminders. | • Media releases, radio announcements and website updates.<br>• Trip information and traffic updates – website.<br>• Signage design and delineation design for construction staging, access to construction sites, and for the final project.<br>• Onsite liaison with affected adjacent property owners/neighbours – a key relationship is established with all “neighbours”. | • As above. |
| | • Additional field investigations. | • Media releases, radio announcements and website updates.<br>• Trip information and traffic updates – website.<br>• Signage design and delineation design for construction staging, access to construction sites, and for the final project.<br>• Onsite liaison with affected adjacent property owners/neighbours – a key relationship is established with all “neighbours”. | • May result in minor periodic inconvenience in terms of access changes or noise generation. | • Communicate changes early in the design process with affected residents, and relevant stakeholders (including their maintenance teams) to understand expectations. | • Unlikely to impact bus routes and stops.<br>• May impact vehicular and pedestrian access to businesses.<br>• Unlikely to result in temporary diversion or re-routing of heavy vehicles through or near noise sensitive land uses. | • Early and continued liaison with affected parties.<br>• Establishment and communication through Roads and Maritime website and email reminders. | • Media releases, radio announcements and website updates.<br>• Trip information and traffic updates – website.<br>• Signage design and delineation design for construction staging, access to construction sites, and for the final project.<br>• Onsite liaison with affected adjacent property owners/neighbours – a key relationship is established with all “neighbours”. | • As above. |
| | • Modifications to property impacts and/or access are to be detailed in design. | • Early notification of any known changes as they occur.<br>• Utilisation of Roads and Maritime and | • Construction works may result in loss of some Highway and intersecting road.capacity. | • Early notification of any known changes as they occur. | • Possible changes that will impact heavy vehicles, buses, taxis and emergency vehicles.<br>• Access through the | • Ongoing communication face to face and via email. | • Private landowner engagement.<br>• Continued consultation with business owners | • Negotiation in accordance with Roads and Maritime property |

| STAGE OF THE PROJECT/PROGRAM | CHANGES FOR ROAD USERS | | CHANGES FOR LOCAL RESIDENTS | | CHANGES FOR EXTERNAL ORGANISATIONS AND BUSINESSES | | INTERNAL CHANGES FOR RMS PROCESSES AND STRUCTURES | |
|---|---|---|---|---|---|---|---|---|
| | | PSC communications staff to prepare, implement the strategies.<br>• Utilisation of Consultation Manager. | | | intersections will be maintained.<br>• Early notification of any known changes as they occur. | | within and near the project site. | acquisition protocols. |
| | • Risk management, constructability, and Safety in Design (SiD) workshops. | • Can include key stakeholders – to discuss design changes and key issues. | • Participation in Workshops will be defined from key identified risks. | • Participation in Workshops will be defined from key identified risks. | • Participation in Workshops will be defined from key identified risks. | • Participation in Workshops will be defined from key identified risks. | • Participation in Workshops will be defined from key identified risks. | • Participation in Workshops will be defined from key identified risks. |
| | • Changes to the proposed location of the site office and/or stockpile sites. | • Media releases, radio announcements and website updates.<br>• Trip information and traffic updates – website.<br>• Signage design and delineation design for construction staging, access to construction sites, and for the final project.<br>• Onsite liaison with affected adjacent property owners and tenants – a key relationship is established with all work site "neighbours".<br>• Signage to this area is provided on site, together with any induction and fact sheets readily available. Plans, community updates and other community information fact-sheets are stored and provided on-site. | • May result in temporary access changes during construction or changes in noise generation. | • Communicate changes early in the design process with affected residents, and relevant stakeholders (including their maintenance teams) to understand expectations. | • Unlikely to impact vehicular and pedestrian access to businesses near project site or in other locations.<br>• Unlikely to result in temporary diversions or re-routing. | • Early and continued liaison with affected parties.<br>• Establishment and communication through Roads and Maritime website and email reminders. | • Landowner engagement.<br>• Continued consultation with affected parties. | • Communication of changes to obtain buy-in where appropriate. |
| | • Proposed Construction Staging and/or traffic management. | • Early notification of road users, residents, local businesses, affected stakeholders, TMC, | • Short and long term lane closures as part of short, medium and long term construction. | • Communicate changes with affected residents, and relevant stakeholders (including their | • Changes to pedestrian and cyclist access.<br>• Changes to existing bus routes and stops.<br>• Changes to external | • Early and continued liaison with affected parties.<br>• Establishment and | • Media releases, radio announcements and website updates.<br>• Trip information and | • As per approved Roads and Maritime construction processes. |

| STAGE OF THE PROJECT/PROGRAM | CHANGES FOR ROAD USERS | | CHANGES FOR LOCAL RESIDENTS | | CHANGES FOR EXTERNAL ORGANISATIONS AND BUSINESSES | | INTERNAL CHANGES FOR RMS PROCESSES AND STRUCTURES | |
|---|---|---|---|---|---|---|---|---|
| | | and emergency services well in advance of any works.<br>• Roads and Maritime uses detailed specifications for road signage, as well as a series of licenses to control the design and implementation of construction site management.<br>• VMS signage – managed by TMC. | • Loss of on-street and off-street car parking.<br>• Possible peak period traffic delays during construction.<br>• Changes to pedestrian and cyclist access. | maintenance teams) to understand expectations. | organisations/commercial operations / shops.<br>• Changes to emergency vehicle access.<br>• Impacts on special events. | communication through Roads and Maritime website and email reminders. | traffic updates – website.<br>• Signage design and delineation design for construction staging, access to construction sites, and for the final project.<br>• Onsite liaison with affected adjacent property owners/neighbours. | |
| | • Opening the new road to traffic | • 'Walk the Project' pre traffic opening event unlikely to be held. | • Special event lane / road closures.<br>• Parking changes.<br>• Possible peak period traffic delays during construction.<br>• Changes to pedestrian and cyclist access. | • Communicate changes with affected residents, and relevant stakeholders (including their maintenance teams) to understand expectations. | • Changes to pedestrian and cyclist access.<br>• Changes to existing bus routes and stops.<br>• Changes to external organisations/commercial operations / shops.<br>• Changes to emergency vehicle access.<br>• Changes to special events. | • Early and continued liaison with affected parties.<br>• Establishment and communication through Roads and Maritime website and email reminders. | • Media releases, radio announcements and website updates.<br>• Special event signage design and delineation design for construction staging, access to construction sites, and for the final project.<br>• Onsite liaison with affected adjacent property owners/neighbours. | • Prior notice to emergency agencies especially where day or half day 'walk the project' is proposed (unlikely).<br>• As per approved Roads and Maritime construction processes. |
| | • Demolition of old bridge | • Early notification of road users, residents, local businesses, affected stakeholders, TMC, and emergency services well in advance of any works.<br>• Roads and Maritime uses detailed specifications for road signage, as well as a series of licenses to control the design and implementation of demolition site management.<br>• VMS signage – managed by TMC. | • Short and long term lane closures as part of short, medium and long term demolition works. | • Communicate changes with affected residents, and relevant stakeholders (including their maintenance teams) to understand expectations. | • Changes to pedestrian and cyclist access.<br>• Changes to existing bus routes and stops.<br>• Changes to external organisations/commercial operations / shops.<br>• Changes to emergency vehicle access.<br>• Impacts on special events. | • Early and continued liaison with affected parties.<br>• Establishment and communication through Roads and Maritime website and email reminders. | • Media releases, radio announcements and website updates.<br>• Trip information and traffic updates – website.<br>• Signage design and delineation design for construction staging, access to construction sites, and for the final project.<br>• Onsite liaison with affected adjacent property owners/neighbours. | • As per approved Roads and Maritime demolition works processes. |

| STAGE OF THE PROJECT/PROGRAM | CHANGES FOR ROAD USERS | | CHANGES FOR LOCAL RESIDENTS | | CHANGES FOR EXTERNAL ORGANISATIONS AND BUSINESSES | | INTERNAL CHANGES FOR RMS PROCESSES AND STRUCTURES | |
|---|---|---|---|---|---|---|---|---|
| 3. Operation and maintenance (Following opening) | • Access arrangements for properties. | • Provide during design that sufficient consideration has been taken into account for the provision of safe access to properties.<br>• Assess the design to avoid enticing risky behaviour to access properties. | • Changed traffic arrangements.<br>• Changed access provisions.<br>• Changes to routes for travel to and from a place of residence. | • Use of VMS signage during opening and for a period thereafter.<br>• Ongoing discussions with local Council. | • Changes to bus routes and stops.<br>• Changes to heavy vehicle routes and access times. | • Early and continued liaison with affected parties.<br>• Establishment and communication through Roads and Maritime website and email reminders. | • Ongoing discussions with Council officers especially in relation to hand over infrastructure.<br>• Media releases, radio announcements and website updates.<br>• Special event signage design and delineation design for construction staging, access to construction sites, and for the final project.<br>• Onsite liaison with affected parties. | • Establish interface agreement with Hawkesbury City Council of any infrastructure to be handed over before opening to traffic. |
| | • Potentially more frequent and/or differently undertaken maintenance of the newly upgraded infrastructure. | • Ensure that relevant maintenance and property staff are invited to the SiD workshop to enable capturing of their input for consideration in the detailed design.<br>• Prepare a maintenance manual for the project as part of the hand over suite of documentation to the Journey Management Team as well as Hawkesbury City Council. | • As above. | • As above. | • As above. | • As above. | • As above. | • As above. |
| | • Road environment and way-finding. | • Ensure an effective signage strategy is in place, and that it is communicated to the design team, community, and other stakeholders prior to opening of the new infrastructure to traffic. | • Changed traffic arrangements will impact residents, visitors and external customers.<br>• Way finding changes may be required for any access changes that impact the approaches to intersections or accessways. | • Council may have a role in the signage of infrastructure which will be delivered by Roads and Maritime but may be handed over to Council for it to manage and maintain. | • Changes to bus routes and stops.<br>• Changes to heavy vehicle routes and access times. | • Early and continued liaison with affected parties.<br>• Establishment and communication through Roads and Maritime website and email reminders. | • Ongoing discussions with Council officers especially in relation to hand over infrastructure.<br>• Media releases, radio announcements and website updates.<br>• Special event signage design and delineation design for construction | • Establish interface agreement with Hawkesbury City Council of any infrastructure to be handed over before opening to traffic. |

| STAGE OF THE PROJECT/PROGRAM | CHANGES FOR ROAD USERS | | CHANGES FOR LOCAL RESIDENTS | | CHANGES FOR EXTERNAL ORGANISATIONS AND BUSINESSES | | INTERNAL CHANGES FOR RMS PROCESSES AND STRUCTURES | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | staging, access to construction sites, and for the final project. | |
| | • Freight interaction with general traffic | • The upgrade may alter heavy vehicle access and times across the network. These will require the support of appropriate signage and policing. | • Heavy vehicle impacts / changes / diversions not envisaged. | • Council may have a role in the signage of infrastructure which will be delivered by Roads and Maritime but may be handed over to Council for it to manage and maintain. | • Changes to bus routes and stops.<br>• Changes to heavy vehicle routes and access times. · | • Early and continued liaison with affected parties.<br>• Establishment and communication through Roads and Maritime website and email reminders. | • Ongoing discussions with Council officers especially in relation to hand over infrastructure.<br>• Media releases, radio announcements and website updates.<br>• Special event signage design and delineation design for construction staging, access to construction sites, and for the final project. | • Establish interface agreement with Hawkesbury City Council of any infrastructure to be handed over before opening to traffic. |
| | • Use and amenity of existing alternative routes | • No specific control is proposed for this change, however, the upgrades will enhance pedestrian and cyclist use of shared paths and footpaths provided/modified as part of the Project. | • To be monitored post completion. | • To be monitored post completion. | • To be monitored post completion. | • To be monitored post completion. | • To be monitored post completion. | • To be monitored post completion. |
| | • Assets Handover to Hawkesbury City Council | • A assets handover agreement will be negotiated and signed between Council and RMS. | • Assets handed over will become the responsibility of Council to maintain after a 12 month defect liability period. | • N/A | • Any maintenance related issues with assets that have been handed over to Council after the 12 month defect liability period will have to be directed at Council. | • N/A | • All warranties, guidelines, manuals and other related documents will have to be handed over to Council at handover period. | • N/A |

# Appendix 14: Asset Bridge Condition Report

# BRIDGE INSPECTION REPORT - Level 2 - PAGE 1 of 5 -- General Information

**Bridge No:** 415 **Description:** BR ON BRIDGE ST HAWKESBURY RIVER WINDSOR

**Bridge Name:**

**Roadloc:** 0000182,1020,A1,0.000
**Directorate:** 471 SYDNEY OPERATIONS DIRECTORATE
**Region:**
**Zone:** Z3 WEST ZONE
**LGA:** 091 HAWKESBURY
**Federal Elec.:**
**State Elec.:** 71 RIVERSTONE

**Longitude:** 150.82252
**Latitude:** -33.60373
**Overall Length:** 143.25
**Overall Width MIN:** 7.31
**Overall Width MAX:**
**Construction Drawings No.:** 0182.091.BC.0104
0182.091.BC.0104
**Inspected by:** R.M.S.
**Maintained by:** R.M.S.

**Complex or Unusual:**

| Span From | Span To | Span Length (m) | Culvert Height (m) | Span Material | Span Type | Year Completed |
|---|---|---|---|---|---|---|
| 1 | | 12.83 | | C | BEAM | 1922 |
| 2 | 3 | 13.35 | | C | BEAM | 1922 |
| 4 | 6 | 13.50 | | C | BEAM | 1922 |
| 7 | | 13.28 | | C | BEAM | 1922 |
| 8 | 10 | 13.41 | | C | BEAM | 1922 |
| 11 | | 9.78 | | C | BEAM | 1922 |

**Inspection Equipment**

Boat, Dinghy, Pontoon, Barge and boom

**Comments**

BOAT REQUIRED FOR INSPECTION OF PIERS AND DECK SOFFIT.

**Risk Register Process/Hazard** | **Location**

**Inspection Details**

**Level of Inspection:** Level 2
**Inspection Date:** 19-FEB-2014
**Inspection Type:** Normal
**Proposed Date of Next Inspection:** FEB-2015
**Temp (C):** 32
**Weather:** Sunny
**Inspector's Given Name:** MARK **Surname:** INSKIP
**Engineer's Given Name:** **Surname:**

# BRIDGE INSPECTION REPORT -Level 2- PAGE 2 of 5 -- Condition Rating of Elements

**Bridge No:** 415 **Description:** BR ON BRIDGE ST HAWKESBURY RIVER WINDSOR

**Bridge Name:**

**Inspection Date:** 19-FEB-2014 **Inspector's Given Name:** MARK **Surname:** INSKIP

| Element Code | Element Description | Env. | Total Qty | Units | Est. Qty (or % of Total Qty) in Cond. State 1 | 2 | 3 | 4 | 5 | Element Health Rating | Element Cond. Index | ECI Change |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CABW | Concrete-Abutment and Wingwalls | M | 183 | m2 | 175 | 5 | 3 | 0 | XXXX | FAIR | +98.0 | +0.0 |
| CDSL | Concrete-Deck Slab | M | 1,068 | m2 | 1,008 | 30 | 30 | 0 | XXXX | FAIR | +97.2 | +0.0 |
| CPHS | Concrete-Pier Headstock | M | 350 | m2 | 325 | 15 | 10 | 0 | XXXX | FAIR | +96.7 | +0.0 |
| CPIR | Concrete-Pier (excl. any Headstock or Piles) | M | 62 | m2 | 50 | 12 | 0 | 0 | XXXX | GOOD | +93.6 | +0.0 |
| CRBM | Concrete-Reinforced Beam | M | 2,390 | m2 | 2,300 | 20 | 20 | 50 | XXXX | POOR | +97.1 | +0.0 |
| JNOS | Joint - No Seal | M | 78 | m | 0 | 78 | 0 | 0 | XXXX | GOOD | +67.0 | +0.0 |
| MATT | Miscellaneous Attachments | M | 1 | item | 1 | 0 | 0 | 0 | XXXX | AS-BUILT | +100.0 | +0.0 |
| MGCL | General Cleaning | M | 11 | ea | 11 | 0 | 0 | 0 | XXXX | AS-BUILT | +100.0 | +0.0 |
| MWES | Wearing surface | M | 900 | m2 | 800 | 100 | 0 | 0 | XXXX | GOOD | +96.3 | +0.0 |
| MWWY | Waterway | M | 1 | ea | 1 | 0 | 0 | 0 | XXXX | AS-BUILT | +100.0 | +0.0 |
| PBGI | Protective Coating - Beam / Girder (Load Bearing) | M | 346 | m2 | 346 | 0 | 0 | 0 | XXXX | AS-BUILT | +100.0 | +0.0 |
| PDBR | Protective Coating - Diaphragm/Bracing/Secondary Member | M | 237 | m2 | 237 | 0 | 0 | 0 | XXXX | AS-BUILT | +100.0 | +0.0 |
| PPIL | Protective Coating - Pile (including steel cased concrete pile or caisson) | M | 685 | m2 | 406 | 0 | 0 | 279 | XXXX | GOOD | +59.3 | +0.0 |
| RMET | Metal Railing | M | 476 | m | 476 | 0 | 0 | 0 | XXXX | AS-BUILT | +100.0 | +0.0 |
| RPNT | Railing Paint Work | M | 316 | m | 316 | 0 | 0 | 0 | XXXX | AS-BUILT | +100.0 | +33.0 |
| SBGI | Steel - Beam / Girder (Load Bearing) | M | 346 | m2 | 346 | 0 | 0 | 0 | XXXX | AS-BUILT | +100.0 | +33.0 |
| SDBR | Steel - Diaphragm / Bracing / Secondary Member | M | 237 | m2 | 237 | 0 | 0 | 0 | XXXX | AS-BUILT | +100.0 | +0.0 |
| SPIL | Steel - Pile | M | 406 | m2 | 406 | 0 | 0 | 0 | XXXX | AS-BUILT | +100.0 | +0.0 |
| USPL | Underwater SPIL - Steel Pile | M | 279 | m2 | 0 | 0 | 0 | 0 | XXXX | | +0.0 | +0.0 |

# BRIDGE INSPECTION REPORT -Level 2- PAGE 3 of 5 -- Required Maintenance Actions

Bridge No: 415 Description: BR ON BRIDGE ST HAWKESBURY RIVER WINDSOR

Bridge Name:

Inspection Date: 19-FEB-2014 Inspector's Given Name: MARK Surname: INSKIP

| Elem Code | Env | MMS Act.No. | MMS Activity Description | Inspector's Comments on RequiredActions and Locations on Structure | Est. Qty | Units | Date for Completion | RMA ID Work Order No | Prob (a) | Cons (b) | Activity Inaction Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|

Note: If a required maintenance action is not carried out, the codes for the(a) probability of safety or structural problem due to inaction : 1 - Rare 2 - Could 3 - Might 4 - Will 5 - Expected(b) consequence of inaction : 1 - Insignificant 2 - Minor 3 - Moderate 4 - Major 5 - Catastrophic

**BRIDGE INSPECTION REPORT - Level 2 - PAGE 4 of 5 -- Inspection Comment**

**Bridge No:** 415 **Description:** BR ON BRIDGE ST HAWKESBURY RIVER WINDSOR

**Bridge Name:**

**Inspection Date:** 19-FEB-2014 **Inspector's Given Name:** MARK **Surname:** INSKIP

**Inspector's Comments:** Note that no RMA's NOTED DUE TO BRIDGE UP FOR REPLACEMENT, DANGEROUS CONCRETE SPALLS WILL CONTINUED TO BE REMOVED WHEN IDENTIFIED IN WEEKLY LEVEL 1 INSPECTION OF STRUCTURE.

**Inspector's Signature:** ____________________ **Date:** ____________________

**Maintenance Manager's Comments:**

**Maintenance Manager's Signature:** ____________________ **Date:** ____________________

**Attachments :**

# BRIGE INSPECTION REPORT -- PAGE 5 of 5 -- Risk Register Control

**Bridge No:** 415 **Description:** BR ON BRIDGE ST HAWKESBURY RIVER WINDSOR

**Bridge Name:**

| Risk ID | Risk Code | Process/Hazard | Location | Possible Controls | Comments |
|---|---|---|---|---|---|

# BRIDGE INSPECTION REPORT -Level 2- PAGE 1 of 7 -- General Information

**Bridge No:** 415 **Description:** BR ON BRIDGE ST HAWKESBURY RIVER WINDSOR

**Bridge Name:**

**Roadloc:** 0000182,1020,A1,0.000
**Directorate:** 471 SYDNEY OPERATIONS DIRECTORATE
**Region:**
**Zone:** Z3 WEST ZONE
**LGA:** 091 HAWKESBURY
**Federal Elec.:**
**State Elec.:** 71 RIVERSTONE
**Complex or Unusual:**

**Longitude:** 150.82252
**Latitude:** -33.60373
**Overall Length:** 143.25
**Overall Width MIN:** 7.31
**Overall Width MAX:**
**Construction Drawings No.:** 0182.091.BC.0104
0182.091.BC.0104
**Inspected by:** R.M.S.
**Maintained by:** R.M.S.

| Span From | Span To | Span Length (m) | Culvert Height (m) | Span Material | Span Type | Year Completed |
|---|---|---|---|---|---|---|
| 1 | | 12.83 | | C | BEAM | 1922 |
| 2 | 3 | 13.35 | | C | BEAM | 1922 |
| 4 | 6 | 13.50 | | C | BEAM | 1922 |
| 7 | | 13.28 | | C | BEAM | 1922 |
| 8 | 10 | 13.41 | | C | BEAM | 1922 |
| 11 | | 9.78 | | C | BEAM | 1922 |

**Inspection Equipment**

Boat, Dinghy, Pontoon, Barge and boom

**Comments**

BOAT REQUIRED FOR INSPECTION OF PIERS AND DECK SOFFIT.

**Risk Register**

| Process/Hazard | Location |
|---|---|

**Inspection Details**

**Level of Inspection:** Level 2
**Inspection Date:** 16-APR-2015
**Inspection Type:** Normal
**Proposed Date of Next Inspection:** FEB-2016
**Temp (C):** 28
**Weather:** Sunny
**Inspector's Given Name:** ERIC **Surname:** BOOTHMAN
**Engineer's Given Name:** **Surname:**

## BRIDGE INSPECTION REPORT -Level 2- PAGE 2 of 7 -- Condition Rating of Elements

**Bridge No:** 415 **Description:** BR ON BRIDGE ST HAWKESBURY RIVER WINDSOR

**Bridge Name:**

**Inspection Date:** 16-APR-2015 **Inspector's Given Name:** ERIC **Surname:** BOOTHMAN

| Element Code | Element Description | Env. | Total Qty | Units | Est. Qty (or % of Total Qty) in Cond. State 1 | 2 | 3 | 4 | 5 | Element Health Rating | Element Cond. Index | ECI Change |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CABW | Concrete-Abutment and Wingwalls | M | 183 | m2 | 175 | 5 | 3 | 0 | XXXX | | | |
| CDSL | Concrete-Deck Slab | M | 1,068 | m2 | 800 | 200 | 60 | 8 | XXXX | | | |
| CPHS | Concrete-Pier Headstock | M | 350 | m2 | 200 | 80 | 50 | 20 | XXXX | | | |
| CPIR | Concrete-Pier (excl. any Headstock or Piles) | M | 62 | m2 | 40 | 12 | 5 | 5 | XXXX | | | |
| CRBM | Concrete-Reinforced Beam | M | 2,390 | m2 | 2,100 | 30 | 120 | 140 | XXXX | | | |
| JNOS | Joint - No Seal | M | 78 | m | 0 | 28 | 50 | 0 | XXXX | | | |
| MATT | Miscellaneous Attachments | M | 1 | item | 0 | 1 | 0 | 0 | XXXX | | | |
| MGCL | General Cleaning | M | 11 | ea | 0 | 11 | 0 | 0 | XXXX | | | |
| MWES | Wearing surface | M | 900 | m2 | 790 | 103 | 7 | 0 | XXXX | | | |
| MWWY | Waterway | M | 1 | ea | 1 | 0 | 0 | 0 | XXXX | | | |
| PBGI | Protective Coating - Beam / Girder (Load Bearing) | M | 346 | m2 | 200 | 140 | 6 | 0 | XXXX | | | |
| PDBR | Protective Coating - Diaphragm/Bracing/Secondary Member | M | 237 | m2 | 100 | 77 | 50 | 10 | XXXX | | | |
| PPIL | Protective Coating - Pile (including steel cased concrete pile or caisson) | M | 685 | m2 | 406 | 0 | 0 | 279 | XXXX | | | |
| RMET | Metal Railing | M | 476 | m | 400 | 73 | 3 | 0 | XXXX | | | |
| RPNT | Railing Paint Work | M | 316 | m | 0 | 200 | 110 | 6 | XXXX | | | |
| SBGI | Steel - Beam / Girder (Load Bearing) | M | 346 | m2 | 346 | 0 | 0 | 0 | XXXX | | | |
| SDBR | Steel - Diaphragm / Bracing / Secondary Member | M | 237 | m2 | 237 | 0 | 0 | 0 | XXXX | | | |
| SPIL | Steel - Pile | M | 406 | m2 | 406 | 0 | 0 | 0 | XXXX | | | |
| USPL | Underwater SPIL - Steel Pile | M | 279 | m2 | 0 | 0 | 0 | 0 | XXXX | | | |

## BRIDGE INSPECTION REPORT - Level 2 - PAGE 3 of 7 - Required Maintenance Actions

**Bridge No:** 415 **Description:** BR ON BRIDGE ST HAWKESBURY RIVER WINDSOR

**Bridge Name:**

**Inspection Date:** 16-APR-2015 **Inspector's Given Name:** ERIC **Surname:** BOOTHMAN

| Elem Code | Env | MMS Act.No. | MMS Activity Description | Inspector's Comments on Required Actions and Locations on Structure | Est Qty | Units | Date for Completion | RMA ID Work Order | Prob (a) | Cons (b) |
|---|---|---|---|---|---|---|---|---|---|---|
| CABW | M | 730.15 | Monitor Bridge Element | Monitor vertical cracking to Downstream (D/S) side of Abutment A (Windsor end) & horizontal cracking to Upstream (U/S) side. Monitor delaminated concrete & cracking to Abutment B at scattered locations. Check next inspection. [Refer photos 1-5]. | 2 | each | FEB-2016 | | 2 | 2 |
| CDSL | M | 730.15 | Monitor Bridge Element | Monitor delaminated concrete to footway approach slab on D/S side of Abutment A & delaminated concrete to kerb in Span 1 on D/S side S/B. Monitor concrete spalling & exposed reinforcement to soffit above Piers at scattered locations. Excessive moisture is seeping through joints above Piers causing moss growth & increased deterioration of structural elements. Monitor concrete spalling to soffit above Abutment B on D/S side of G8. Check next inspection. Defect to repair impact damage to kerb & bridge railing on U/S side of Span 1 N/B entered 23/03/15. [Refer photos 6-21]. | 11 | each | FEB-2016 | | 3 | 3 |
| CPHS | M | 730.15 | Monitor Bridge Element | Monitor delaminated concrete & section loss to reinforcement on U/S side of Abutment A. Monitor severe concrete spalling, delamination & section loss to reinforcement to Piers at scattered locations. Severe spalling & section loss to reinforcement under Girders is a major concern. We recommend a Level 3 inspection to be conducted immediately to further assess the structural integrity of the bridge. [Refer photos 22-42]. | 11 | each | APR-2015 | | 5 | 5 |

Note: If a required maintenance action is not carried out, the codes for the
(a) probability of safety or structural problem due to inaction : 1 - Rare 2 - Could 3 - Might 4 - Will 5 - Expected
(b) consequence of inaction : 1 - Insignificant 2 - Minor 3 - Moderate 4 - Major 5 - Catastrophic

## BRIDGE INSPECTION REPORT - Level 2 - PAGE 4 of 7 -- Required Maintenance Actions

Bridge No: 415 Description: BR ON BRIDGE ST HAWKESBURY RIVER WINDSOR

Bridge Name:

Inspection Date: 16-APR-2015 Inspector's Given Name: ERIC Surname: BOOTHMAN

| Elem Code | Env | MMS Act.No. | MMS Activity Description | Inspector's Comments on Required Actions and Locations on Structure | Est Qty | Units | Date for Completion | RMA ID Work Order | Prob (a) | Cons (b) |
|---|---|---|---|---|---|---|---|---|---|---|
| CPIR | M | 730.15 | Monitor Bridge Element | Monitor severe spalling, delamination & section loss to reinforcement to Piers at scattered locations. [Refer photos 43-48]. | 11 | each | APR-2015 | | 5 | 5 |
| CRBM | M | 730.15 | Monitor Bridge Element | Monitor severe spalling, delamination & section loss to reinforcement to Girders at scattered locations. Severe spalling, cracking & section loss to reinforcement to Girders above Piers is a major concern. We recommend a Level 3 inspection to be conducted immediately to further assess the structural integrity of the bridge. [Refer photos 49-94]. | 11 | each | APR-2015 | | 5 | 5 |
| JNOS | M | 717.00 | Repair Bridge Joint | Repair Abutment A & B joints due to severe cracking & potholing present. Clean & crack seal joints above Piers due to cracking & vegetation present. Excessive moisture is seeping through joints above Piers causing moss growth & increased deterioration of structural elements. [Refer photos 95-106]. | 12 | each | AUG-2015 | | 3 | 3 |
| MATT | M | 730.15 | Monitor Bridge Element | Monitor missing bolt to services bracket on D/S side of Pier 7. Monitor missing brackets to services on D/S side of Span 11. Check next inspection. [Refer photos 107-108]. | 2 | each | FEB-2016 | | 2 | 2 |
| MGCL | M | 312.00 | Trim Tree | Remove vegetation from N/B & S/B kerbs. [Refer photo 109]. | 1 | each | AUG-2015 | | 1 | 1 |
| MWES | M | 203.00 | M9 Surface Texture Repair [Pot holes, rutting etc.] | Repair ravelling & shoving to N/B & S/B lanes in Span 1. [Refer photo 110]. | 1 | each | AUG-2015 | | 2 | 3 |

Note: If a required maintenance action is not carried out, the codes for the
(a) probability of safety or structural problem due to inaction : 1 - Rare 2 - Could 3 - Might 4 - Will 5 - Expected
(b) consequence of inaction : 1 - Insignificant 2 - Minor 3 - Moderate 4 - Major 5 - Catastrophic

# BRIDGE INSPECTION REPORT -Level 2- PAGE 5 of 7 -- Required Maintenance Actions

**Bridge No:** 415 **Description:** BR ON BRIDGE ST HAWKESBURY RIVER WINDSOR

**Bridge Name:**

**Inspection Date:** 16-APR-2015 **Inspector's Given Name:** ERIC **Surname:** BOOTHMAN

| Elem Code | Env | MMS Act.No. | MMS Activity Description | Inspector's Comments on Required Actions and Locations on Structure | Est Qty | Units | Date for Completion | RMA ID Work Order | Prob (a) | Cons (b) |
|---|---|---|---|---|---|---|---|---|---|---|
| PBGI | M | 730.15 | Monitor Bridge Element | Monitor protective coat failing, minor corrosion & corroded bolts at scattered locations. Check next inspection. [Refer photos 111-112]. | 11 | each | FEB-2016 | | 1 | 1 |
| PDBR | M | 730.15 | Monitor Bridge Element | Monitor protective coat failing & significant red rust to brackets of diagonal bracing on Piers at scattered locations. Monitor protective coat failing & significant red rust to horizontal & diagonal bracing of Piers at scattered locations. We recommend a Level 3 inspection to be conducted immediately to further assess the structural integrity of the bridge. [Refer photos 113-116]. | 10 | each | APR-2015 | | 3 | 4 |
| PPIL | M | 730.15 | Monitor Bridge Element | Monitor protective coat failing & significant red rust to cast iron caissons at scattered locations. Level 3 inspection recommended. [Refer photos 117-118]. | 10 | each | APR-2015 | | 3 | 4 |
| RMET | M | 730.15 | Monitor Bridge Element | Monitor misalignment of bridge railing caused by numerous impacts. Check next inspection. [Refer photo 119]. | 11 | each | FEB-2016 | | 3 | 3 |
| RPNT | M | 730.15 | Monitor Bridge Element | Monitor protective coat failing & significant red rust to bridge & walkway railings at scattered locations. Check next inspection. [Refer photos 120-121]. | 11 | each | FEB-2016 | | 1 | 1 |
| SPIL | M | 730.15 | Monitor Bridge Element | Monitor bracing collar to U/S side cast iron caisson of Pier 6. Level 3 inspection recommended. [Refer photo 122]. | 1 | each | APR-2015 | | 3 | 4 |

Note: If a required maintenance action is not carried out, the codes for the
(a) probability of safety or structural problem due to inaction : 1 - Rare 2 - Could 3 - Might 4 - Will 5 - Expected
(b) consequence of inaction : 1 - Insignificant 2 - Minor 3 - Moderate 4 - Major 5 - Catastrophic

**BRIDGE INSPECTION REPORT - Level 2 - PAGE 6 of 7 -- Inspection Comment**

Bridge No: 415 Description: BR ON BRIDGE ST HAWKESBURY RIVER WINDSOR

Bridge Name:

Inspection Date: 16-MAR-2015 Inspector's Given Name: ERIC Surname: BOOTHMAN

Inspector's Comments: Roads and Maritime Services (RMS) is proposing to replace Windsor Bridge as parts of the bridge are over 130 years old and are deteriorating due to age and heavy use. The bridge does not meet current engineering and road safety standards, such as lane widths. The Level 2 inspection reveals major elements of the bridge to be structurally compromised. We recommend a Level 3 inspection to be conducted immediately to further assess the structural integrity of the bridge.

Inspector's Signature: ______________________ Date: ______________

Maintenance Manager's Comments:

Maintenance Manager's Signature: ______________________ Date: ______________

Attachments :

# BRIGE INSPECTION REPORT -- PAGE 7 of 7 -- Risk Register Control

Bridge No: 415

Description: BR ON BRIDGE ST HAWKESBURY RIVER WINDSOR

Bridge Name:

| Risk ID | Risk Code | Process/Hazard | Location | Possible Controls | Comments |
| --- | --- | --- | --- | --- | --- |

# Bridge No: 415 BR ON BRIDGE ST HAWKESBURY RIVER WINDSOR

Eric Boothman 16/04/2015

## Level 2 Bridge Inspection Photos

**Project Background**: Roads and Maritime Services (RMS) is proposing to replace Windsor Bridge as parts of the bridge are over 130 years old and are deteriorating due to age and heavy use. The bridge does not meet current engineering and road safety standards, such as lane widths. The Level 2 inspection reveals major elements of the bridge to be structurally compromised. We recommend a Level 3 inspection to be conducted immediately to further assess the structural integrity of the bridge.

1. CABW – Vertical cracking to Downstream (D/S) side of Abutment A (Windsor end).

2. CABW – Horizontal cracking to Upstream (U/S) side of Abutment A.

3. CABW – Delaminated concrete and cracking to U/S side of Abutment B.

4. CABW – Delaminated concrete and cracking to U/S side of Abutment B.

5. CABW – Diagonal cracking to D/S side of Abutment B.

6. CDSL – Delaminated concrete to footway approach slab on D/S side of Abutment A.

7. CDSL – Delaminated concrete to kerb in Span 1 on D/S side S/B.

8. CDSL – Repair impact damage to kerb and bridge railing on U/S side of Span 1 N/B.

9. CDSL – Concrete spalling and exposed reinforcement to soffit above Pier 1 between Reinforced Concrete Beams - G1 and G2 from U/S side.

10. CDSL – Concrete spalling and exposed reinforcement to soffit above Pier 3 between G1 and G2.

11. CDSL – Delaminated concrete to soffit above Pier 4 between G3 and G4.

12. CDSL – Concrete spalling and exposed reinforcement to soffit above Pier 4 between G2 and G3.

13. CDSL – Concrete spalling and exposed reinforcement to soffit above Pier 4 between G1 and G2.

14. CDSL – Concrete spalling and exposed reinforcement to soffit above Pier 7 between G5 and G6.

15. CDSL – Concrete spalling to soffit above Pier 7 between G4 and G5.

16. CDSL – Concrete spalling and exposed reinforcement to soffit above Pier 9 between G3 and G4.

17. CDSL – Concrete spalling and exposed reinforcement to soffit above Pier 10 between G7 and G8.

18. CDSL – Concrete spalling and exposed reinforcement to soffit above Pier 10 between G6 and G7.

19. CDSL – Concrete spalling and exposed reinforcement to soffit above Pier 10 between G5 and G6.

20. CDSL – Concrete spalling to soffit above Abutment B on D/S side of G8.

21. CDSL – Excessive moisture is seeping through joints above Piers causing moss growth and increased deterioration of structural elements.

22. CPHS – Delaminated concrete and section loss to reinforcement on U/S side of Abutment A.

23. CPHS – Concrete spalling and section loss to reinforcement on U/S side of Abutment A.

24. CPHS – Severe concrete spalling, delamination and section loss to reinforcement to S/side of Pier 1.

25. CPHS – Concrete spalling and section loss to reinforcement to N/side of Pier 1.

26. CPHS – Concrete spalling and exposed reinforcement to S/side of Pier 2.

27. CPHS – Severe concrete spalling, delamination and corroding reinforcement to N/side of Pier 2.

28. CPHS – Severe concrete spalling and section loss to reinforcement to bottom edge of Pier 3.

29. CPHS – Severe concrete spalling and section loss to reinforcement to bottom edge of Pier 3.

30. CPHS – Severe concrete spalling and section loss to reinforcement under G1 and G2 to N/side of Pier 3.

31. CPHS – Spalling and exposed reinforcement under G2 to S/side of Pier 4.

32. CPHS – Concrete spalling and exposed reinforcement under G1 - G3 to N/side of Pier 4.

33. CPHS – Concrete spalling behind services bracket under G7 to S/side of Pier 5. Bracket has shifted due to concrete spall.

34. CPHS – Concrete spalling and exposed reinforcement to N/side of Pier 5.

35. CPHS – Concrete spalling and exposed reinforcement to N/side of Pier 6.

36. CPHS – Significant spalling and exposed reinforcement under G1 and G2 to S/side of Pier 7.

37. CPHS – Significant spalling and exposed reinforcement to bottom edge of Pier 7.

38. CPHS – Significant spalling and section loss to reinforcement to bottom edge of Pier 8.

39. CPHS – Significant spalling and section loss to reinforcement to bottom edge of Pier 9.

40. CPHS – Severe spalling and section loss to reinforcement under G1 and G2 to N/side of Pier 9.

41. CPHS – Severe spalling and section loss to reinforcement under G2 to N/side of Pier 9.

42. CPHS – Severe spalling and section loss to reinforcement to bottom edge of Pier 9.

43. CPIR – Severe spalling and section loss to reinforcement to bottom edge of Pier 4.

44. CPIR – Severe spalling and section loss to reinforcement to bottom edge of Pier 4.

45. CPIR – Severe spalling and exposed reinforcement to bottom edge of Pier 5.

46. CPIR – Severe spalling and section loss to reinforcement to bottom edge of Pier 7.

47. CPIR – Severe spalling and section loss to reinforcement to bottom edge of Pier 7.

48. CPIR – Significant concrete spalling to bottom edge of Pier 10.

49. CRBM – Severe concrete spalling and corroding reinforcement to G1 in Span 1.

50. CRBM – Concrete spalling and corroding reinforcement to G8 in Span 1.

51. CRBM – Severe spalling, delamination and corroding reinforcement to G1 in Span 2.

52. CRBM – Severe spalling and section loss to reinforcement to G1 in Span 2.

53. CRBM – Spalling and section loss to reinforcement to G8 in Span 2.

54. CRBM – Significant cracking and delamination to G8 in Span 2 above Pier 2.

55. CRBM – Severe spalling, delamination and corroding reinforcement to G1 in Span 3.

56. CRBM – Severe spalling and section loss to reinforcement to G1 in Span 3 above Pier 3.

57. CRBM – Severe spalling and section loss to reinforcement to G1 and G2 in Span 3 above Pier 3.

58. CRBM – Longitudinal cracking to G5 in Span 3.

59. CRBM – Severe spalling and section loss to reinforcement to G6 in Span 3 above Pier 3.

60. CRBM – Severe spalling, delamination and corroding reinforcement to G8 in Span 3.

61. CRBM – Severe spalling, delamination and corroding reinforcement to G1 in Span 4.

62. CRBM – Severe cracking, delamination and section loss to reinforcement to G1 in Span 4 above Pier 3.

63. CRBM – Severe cracking, delamination and section loss to reinforcement to G2 in Span 4 above Pier 3.

64. CRBM – Severe spalling, delamination and corroding reinforcement to G8 in Span 4.

65. CRBM – Severe spalling, delamination and corroding reinforcement to G1 in Span 5.

66. CRBM – Significant cracking to G4 in Span 5 above Pier 4.

67. CRBM – Spalling and exposed reinforcement to G6 in Span 5.

68. CRBM – Severe cracking, spalling and exposed reinforcement to G6 and G7 in Span 5 above Pier 4.

69. CRBM – Severe spalling, delamination and corroding reinforcement to G8 in Span 5.

70. CRBM – Severe spalling and section loss to reinforcement to G8 in Span 5.

71. CRBM – Severe cracking and spalling to G8 in Span 5 above Pier 5.

72. CRBM – Severe spalling, delamination and corroding reinforcement to G1 in Span 6.

73. CRBM – Severe cracking, spalling and section loss to reinforcement to G1 in Span 6 above Pier 5.

74. CRBM – Severe spalling and section loss to reinforcement to G1 in Span 6 above Pier 6.

75. CRBM – Severe spalling and exposed reinforcement to G8 in Span 6.

76. CRBM – Severe spalling, delamination and corroding reinforcement to G1 in Span 7.

77. CRBM – Severe spalling, section loss to reinforcement and moss growth to G1 in Span 7.

78. CRBM – Severe spalling and section loss to reinforcement to G1 in Span 7 above Pier 7.

79. CRBM – Severe cracking and spalling to G3 in Span 7 above Pier 7.

80. CRBM – Severe spalling, delamination and corroding reinforcement to G8 in Span 7.

81. CRBM – Severe spalling, delamination and corroding reinforcement to G8 in Span 7.

82. CRBM – Severe spalling, delamination and corroding reinforcement to G1 in Span 8.

83. CRBM – Severe spalling, delamination and corroding reinforcement to G8 in Span 8.

84. CRBM – Severe spalling, delamination and corroding reinforcement to G8 in Span 8 above Pier 7.

85. CRBM – Severe spalling, delamination and corroding reinforcement to G8 in Span 8.

86. CRBM – Severe spalling, delamination and corroding reinforcement to G8 in Span 8 above Pier 8.

87. CRBM – Severe spalling, delamination and corroding reinforcement to G1 in Span 9.

88. CRBM – Severe cracking and spalling to G1 in Span 9 above Pier 9.

89. CRBM – Severe spalling, delamination and corroding reinforcement to G8 in Span 9.

90. CRBM – Severe spalling, delamination and corroding reinforcement to G1 in Span 10.

91. CRBM – Severe cracking and delamination to G1 in Span 10 above Pier 9.

92. CRBM – Severe cracking and spalling to G3 in Span 10 above Pier 9.

93. CRBM – Severe spalling, delamination and corroding reinforcement to G8 in Span 10.

94. CRBM – Severe cracking and delamination to G1 in Span 11 above Pier 10 U/S side.

95. JNOS – Repair Abutment A joint due to severe cracking and potholing present.

96. JNOS – Crack seal joint above Pier 2 to N/B lane.

97. JNOS – Clean and crack seal joint above Pier 3 due to cracking and vegetation present.

98. JNOS – Clean and crack seal joint above Pier 4 due to cracking and vegetation present.

99. JNOS – Clean and crack seal joint above Pier 5 due to cracking and vegetation present.

100. JNOS – Clean and crack seal joint above Pier 6 due to cracking and vegetation present.

101. JNOS – Clean and crack seal joint above Pier 7 due to cracking and vegetation present.

102. JNOS – Clean and crack seal joint above Pier 8 due to cracking and vegetation present.

103. JNOS – Clean and crack seal joint above Pier 9 due to cracking and vegetation present.

104. JNOS – Clean and crack seal joint above Pier 10 due to cracking and vegetation present.

## Bridge No: 415 BR ON BRIDGE ST HAWKESBURY RIVER WINDSOR

Eric Boothman 16/04/2015

105. JNOS – Repair Abutment B joint due to severe cracking and potholing present.

106. JNOS – Repair Abutment B joint due to severe cracking and potholing present.

107. MATT – Monitor missing bolt to services bracket on D/S side of Pier 7.

108. MATT – Monitor missing brackets to services on D/S side of Span 11.

109. MGCL – Remove vegetation from N/B and S/B kerbs.

110. MWES – Repair ravelling and shoving to N/B and S/B lanes in Span 1.

111. PBGI – Monitor protective coat failing and minor corrosion at scattered locations.

112. PBGI – Monitor protective coat failing and corroded bolts at scattered locations.

113. PDBR – Monitor protective coat failing and significant red rust to brackets of diagonal bracing on Piers at scattered locations.

114. PDBR – Monitor protective coat failing and significant red rust to brackets of diagonal bracing on Piers at scattered locations.

115. PDBR – Monitor protective coat failing and significant red rust to diagonal bracing of Piers at scattered locations.

116. PDBR – Monitor protective coat failing and significant red rust to horizontal bracing of Piers at scattered locations.

117. PPIL – Monitor protective coat failing and significant red rust to cast iron caissons at scattered locations.

118. PPIL – Monitor protective coat failing and significant red rust to cast iron caissons at scattered locations.

119. RMET – Monitor misalignment of bridge railing caused by numerous impacts.

120. RPNT – Monitor protective coat failing and significant red rust to bridge railing at scattered locations.

121. RPNT – Monitor protective coat failing and significant red rust to walkway railing at scattered locations.

122. SPIL – Monitor bracing collar to U/S side cast iron caisson of Pier 6.

# Appendix 15: Traffic and Options Modelling Report

ARCADIS Design & Consultancy for natural and built assets

# WINDSOR BRIDGE REPLACEMENT PROJECT

## Traffic and Options Modelling Report

Incorporating Hyder

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# ROADS AND MARITIME SERVICES (ROADS AND MARITIME) WINDSOR BRIDGE REPLACEMENT PROJECT

## Traffic and Options Modelling

| | | |
|---|---|---|
| Author | Kung Nigarjanagool; Mikhael Wong | |
| Checker | Mukit Rahman | |
| Approver | Mukit Rahman | |
| Report No | 10005593 | |

This report has been prepared for Roads and Maritime Services in accordance with the terms and conditions of appointment for Windsor Bridge Replacement Project dated March 2017. Arcadis Australia Pacific Pty Limited (ABN 76 104 485 28976 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

## REVISIONS

| Revision | Date | Description | Prepared by | Approved by |
|---|---|---|---|---|
| A, B, C, E | May 2017 | Draft for internal review | MW, SI | |
| D | 30 May 2017 | Draft for Client Review | KN | MR |
| F | 16 June 2017 | Draft Final for Client Review | KN | MR |
| G | 21 June 2017 | Final Report | KN | MR |

# CONTENTS

## APPENDIX

# 1 Introduction

## 1.1 Report Purpose

This Traffic and Options Modelling Report is intended to document a traffic and options modelling assessment undertaken for the proposed Windsor Bridge Replacement project (the 'project'). In the course of preparing this report, documents relevant to development of the project were reviewed.

This report documents existing 2017 traffic conditions and future traffic growth in the vicinity of Windsor Bridge, and provides an assessment of performance of the Concept Design of the project from a traffic perspective.

This report has been prepared to assess the network performance of the Concept Design and identify possible cost-effective improvements

## 1.2 Background

Roads and Maritime Services (Roads and Maritime) proposes to replace the existing bridge over the Hawkesbury River at Windsor (known as 'Windsor Bridge'), and has developed a Concept Design for this proposal. The project includes a replacement bridge 35 metres downstream from the existing bridge, modifications to the existing intersections, new bridge approach roads to accommodate the new bridge location, and provision of a shared pedestrian and cycle pathway for access to and across the replacement bridge.

The replacement bridge would provide wider lanes and shoulders and greater sight distances for road users in comparison to the existing bridge. Adjustments would also be made to the bridge approach roads and existing intersections at Wilberforce Road / Freemans Reach Road, Bridge Street / George Street, Bridge Street / Count Street and Bridge Street / Macquarie Street. All of these elements of the project would contribute to improvements in traffic capacity and safety.

## 1.3 Study Area

Figure 1-1 shows the model study area road network and key intersections.

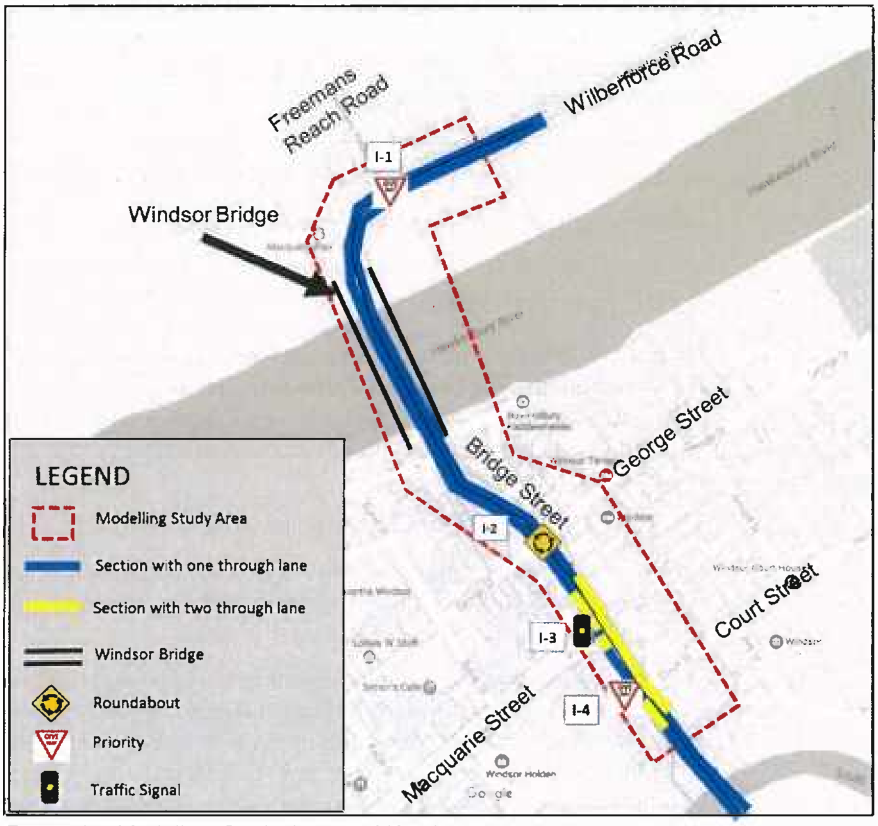



*Figure 1-1 Modelling Study Area and Key Intersections*

Bridge Street is a sub-arterial road running in a north-west and south-east direction within the study area. It links Windsor Road (A2) and Wilberforce Road from Mulgrave to Windsor. It integrates the existing Windsor Bridge and forms part of the A2. Key intersecting roads include Court Street, Macquarie Street, George Street and Freemans Reach Road. It is primarily one lane in each direction, with additional turning lanes provided at the intersection with Macquarie Street and Court Street. The posted speed limit is 60 km/h and the road bends sharply at both ends of the bridge.

Truck and bus travel speeds are limited to 40 km/h on the bridge. Bridge Street is part of the B-double route from Windsor Road to Wilberforce Road.

Wilberforce Road is a sub-arterial road running north-east and south-west from Bridge Street, connecting Windsor to Wilberforce and forming part of State Route 69 to Singleton. The road is one lane in each direction with a posted speed limit of 80 km/h in the section approaching Windsor Bridge. Wilberforce Road is part of a B-double route running from Windsor Road via Bridge Street.

Key intersections in the study area include:

- Wilberforce Road and Freemans Reach Road;
- Bridge Street and George Street;
- Bridge Street and Count Street; and
- Bridge Street and Macquarie Street.

## 1.4 Study Scope and Objective

The scope of this study is to assess the Concept Design of the Windsor Bridge Replacement project. Traffic modelling has been undertaken to assess the performance of the Concept Design. A road-based traffic model was developed for the study area using SIDRA Network software version 7.0. Key objectives of the traffic modelling assessment were to:

- Determine the Level of Service of the proposed upgrades taking into account expected traffic growth for 2026 and 2036; and
- Prepare Traffic and Options Modelling Report.

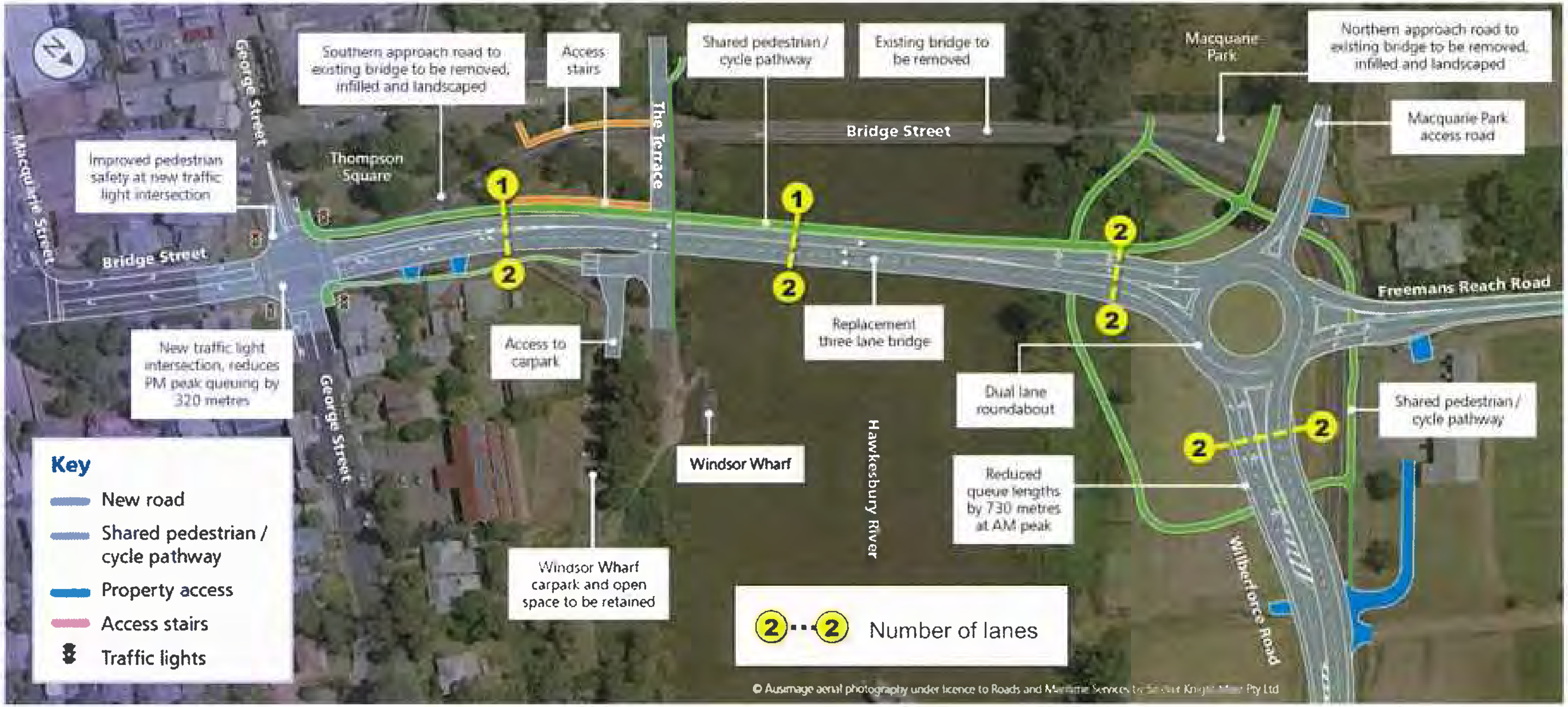
## 1.5 Concept Design

Roads and Maritime has developed a Concept Design for the Windsor Bridge Replacement project between Wilberforce Road and Court Street, Windsor (hereafter referred to as the 'Concept Design'). The Concept Design involves removal of the existing bridge and construction of a new three lane bridge and upgrade of approach roads and intersections.

The Concept Design includes the following key features:

- Removal of the existing two lane bridge and provision of a new three lane bridge consisting of two lanes in the southbound direction and one lane in the northbound direction;
- A new dual lane roundabout replacing the existing priority control at Bridge Street / Wilberforce Road / Freemans Reach Road. The new roundabout will be located approximately 35 metres south of the Bridge Street / Wilberforce Road / Freemans Reach Road intersection. The new roundabout intersection will form a four-way intersection allowing access to Macquarie Park via the western approach;
- New traffic signals replacing the existing roundabout at Bridge Street / George Street;
- Linemarking the right turn lane on Bridge Street southbound heading to Macquarie Street to formalise it as a turning lane; and
- Linemarking the left turn lane on Bridge Street northbound heading to George Street to formalise it as a turning lane.

Figure 1-2 shows Roads and Maritime's Concept Design.




Source: Source: Windsor Bridge Replacement Project Update, December 2016, Roads and Maritime Services

*Figure 1-2 Roads and Maritime's Concept Design*

## 1.6 Study Approach

The study approach involved undertaking a new 2017 traffic survey, traffic data analysis based on wide-area strategic traffic modelling data provided from Roads and Maritime's Strategic Traffic Forecasting Model (STFM, EMME model), development of a SIDRA Network model (using SIDRA Network version 7), and assessment of the Concept Design.

Ongoing consultation involving Roads and Maritime staff constituted an important element of this study. Two Technical Notes were prepared and subsequently reviewed by Roads and Maritime over the course of this project including:

- Technical Note 1 – Future traffic growth assumption (traffic growth assumptions were agreed with Roads and Maritime subsequent to preparation of this Technical Note); and
- Technical Note 2 – Existing conditions and traffic performance of the Concept Design.

Feedback from Roads and Maritime was incorporated into the traffic and options modelling study findings at various stages of Arcadis' investigation.

Key steps in Arcadis' modelling approach included the following:

- Analysis of new traffic survey data for the 2017 traffic condition. A new traffic survey was conducted by Matrix in March 2017. This provided key input to development of the base case model. Four types of data were collected including intersection turning movement counts, midblock traffic counts, queue length survey and travel time survey;
- Analysis of future traffic growth using data obtained from Roads and Maritime's Strategic Traffic Forecasting Model (STFM, EMME model), and preparation of traffic forecasts for future years 2026 and 2036;
- Development of SIDRA Network models for the existing year 2017 and future years 2026 and 2036, for both the morning (AM) and afternoon (PM) peaks;
- Assessment of traffic performance of the Concept Design using SIDRA Network, and identification of any modifications to the original Roads and Maritime Concept Design; and
- Preparation of a Traffic and Options Modelling Report.

## 1.7 Reference Traffic Data and Model

For the purpose of the study, future traffic growth data was sourced from Roads and Maritime's Strategic Traffic Forecasting Model (STFM). Arcadis used appropriate traffic growth data from the STFM relevant to the study area. The future growth assumptions to be used in the SIDRA models were then reviewed and agreed with Roads and Maritime.

In consultation with Roads and Maritime, a new traffic survey was undertaken to satisfy the need and purpose of the study. This included intersection classified turning movement counts (cars and heavy vehicles), midblock traffic counts, queue length, and travel time surveys. This traffic survey was undertaken in March 2017.

To assess network and intersection performance, Arcadis used SIDRA Network modelling software (version 7).

## 1.8 Report Structure

The remainder of this report is structured as follows:

- **Chapter 2** – Existing Traffic and Transport – Provides context of the existing traffic and transport network within the Windsor Bridge Replacement study area.
- **Chapter 3** – Existing Road Network Performance – Establishes existing traffic performance, summarises traffic survey results, develops the SIDRA Network model for the study area, assesses existing bridge capacity and intersection Level of Service, and identifies current network issues.
- **Chapter 4 -** Future Traffic Performance of the Upgrade – Provides an overview of future traffic growth, forecast traffic volumes on Windsor Bridge, assesses the future traffic performance of the proposed Windsor Bridge Replacement project using the SIDRA Network, and identifies issues and potential modifications to Roads and Maritime's Concept Design.
- **Chapter 5** – Summary of Findings – Provides a summary of key traffic modelling findings of the study.

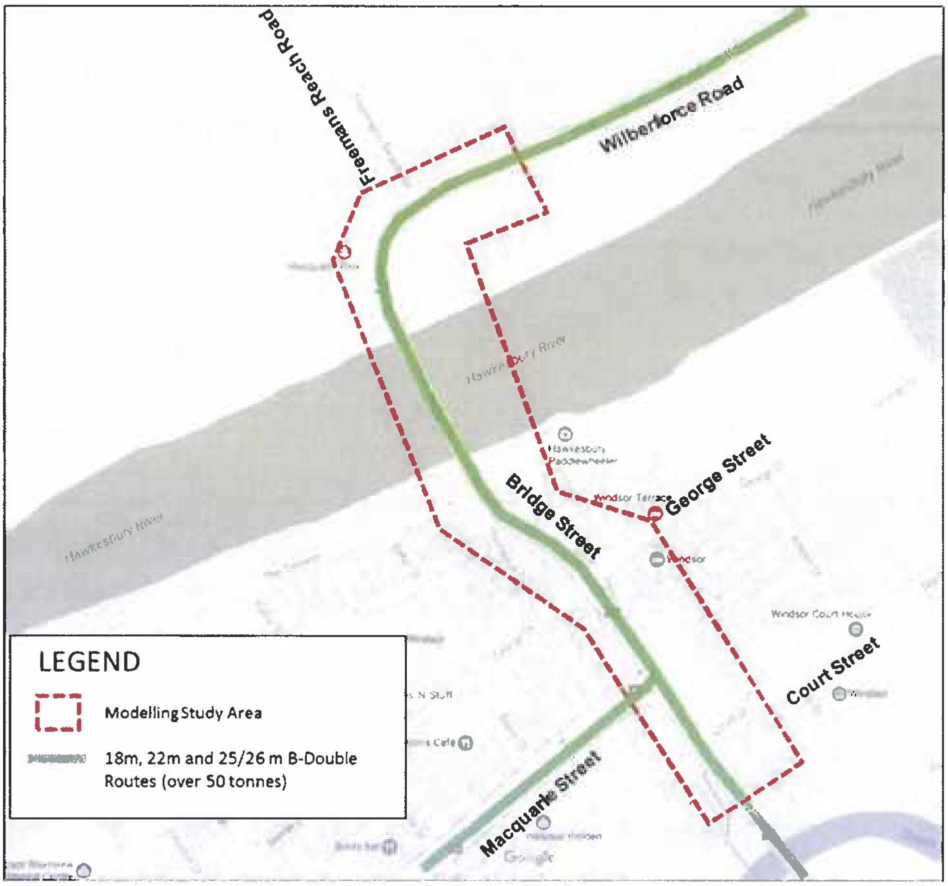
# 2 Existing Traffic and Transport Conditions

Existing traffic and transport conditions in the study area are described in this chapter. It is intended to provide the traffic context within which the assessment has been undertaken.

## 2.1 Route and Speed Environment

Bridge Street and Wilberforce Road are sub-arterial roads linking Wilberforce and Windsor to Rouse Hill via Windsor Road to the south and to Wilberforce to the east. Currently Bridge Street and Wilberforce Road are two lane roads (one lane in each direction).

Bridge Street, Wilberforce Road and Macquarie Street are designated B-double routes for trucks up to 26 metres long. Figure 2-1 shows designated B-double routes in the study area (sourced from Roads and Maritime).




Source: RMS Restricted Access Vehicle Map NSW (map as of 27 March 2017)

*Figure 2-1 Designated B-Double Routes in the Study Area*

The posted speed limit on Bridge Street and Wilberforce Road between Court Street and Freemans Reach Road is 60 km/h. Over the Windsor Bridge, the posted speed limit for trucks and buses is 40 km/h. The speed limit on Bridge Street and Wilberforce Road increases to 80 km/h approximately 550 metres south of Court Street and 200 metres east of Freemans Reach Road. The posted speed limit on George Street and Court Street is 50 km/h. The posted speed limit on Macquarie Street is 60 km/h. Freemans Reach Road has a posted speed limit of 80 km/h decreasing to 60 km/h approaching the intersection with Wilberforce Road. Figure 2-2 shows posted speed limits in the vicinity of the study area.

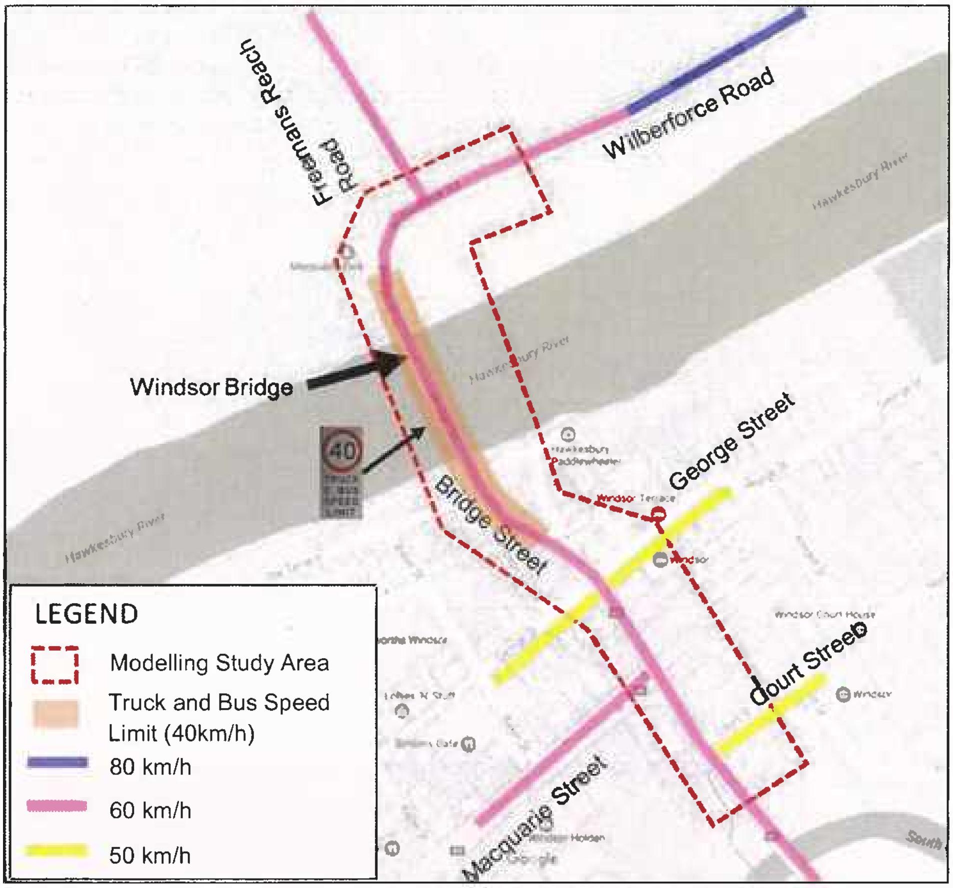
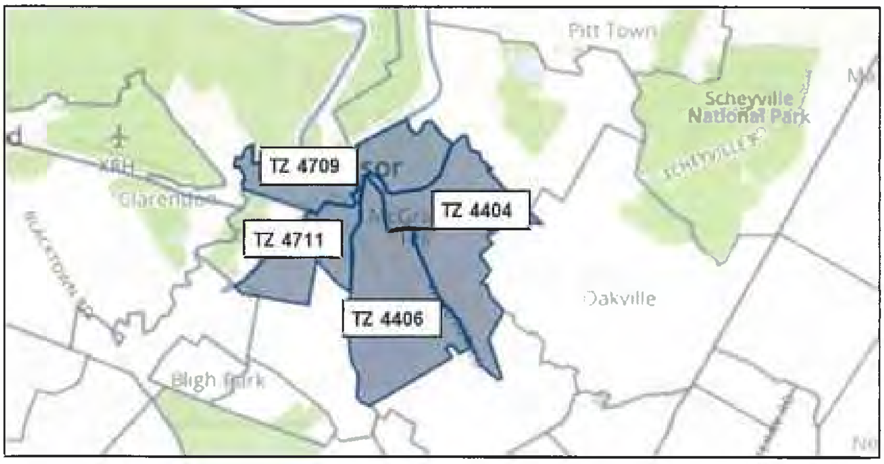



*Figure 2-2 Posted Speed Limits in the Study Area*

## 2.2 Commuter Mode Share

Transport Performance and Analytics (TPA) provides journey to work data (JTW) for the Sydney Greater Metropolitan Area (GMA), which comprises a comprehensive sample of commuter travel collected during the 2011 Census. Work trip origin and destinations are coded to the 2011 travel zones and shown in Figure 2-3. Table 2-1 summarises the work trips by mode of travel reported for the study area.




Source: Transport Performance and Analytics (TPA)

*Figure 2-3 Travel Zones in the Study Area*

*Table 2-1 Commuter Mode Share in Study Area*

| Travel Mode | Study Area as Workplace (Outbound trips) | Study Area as Workplace (Outbound trips) % | Study Area as Home (Inbound trips) | Study Area as Home (Inbound trips) % |
|---|---|---|---|---|
| Car Driver | 1,621 | 70% | 4,928 | 76% |
| Car Passenger | 119 | 5% | 412 | 6% |
| Train | 125 | 5% | 118 | 2% |
| Bus | 17 | 1% | 30 | 0% |
| Ferry/ Tram | 1 | 0% | 5 | 0% |
| Walked Only | 79 | 3% | 97 | 1% |
| Other | 28 | 1% | 46 | 1% |
| Worked at home/ Did not travel/ Not stated | 326 | 14% | 891 | 14% |
| **Total** | **2,317** | **100%** | **6,525** | **100%** |

Selected travel zones (TZ11): 4404, 4406, 4709, 4711

Source: 2011 Journey to Work Data

In 2011, about 2,317 residents travelled from the study area to work. About 14 per cent of people did not travel to work or worked from home on Census day. The Census data showed that around 75 per cent of work trips from the study area were made by motorists in a private vehicle, with five per cent of those as car passengers. About six per cent of workers travelled by public transport, and three per cent walked. Of the five per cent public transport users, only one per cent of the trips were made by bus, with the remaining five per cent of trips made by train.

In 2011 about 6,525 employees travelled to the study area from work. From the inbound trip statistics, it can be seen that private vehicles are still the dominant mode of transport to work, accounting for about 82 per cent. About two per cent of employees travelled by public transport and one per cent walked. The percentage of people who did not go to work or worked from home remained at 14 per cent when compared to outbound trips.

## 2.3 Work Trips Distribution

The JTW data was further analysed to understand the distribution of work trips to and from study area. Outbound work trip distribution made by private car (both as driver and as passenger) from the study area are summarised in Table 2-2. Inbound work trips distribution made by private car (both as driver and as passenger) to the study area are summarised in Table 2-3.

The results indicate the following work trip patterns:

- Outbound work trip distribution shows that substantial trips are made to Richmond - Windsor (25 per cent) and Rouse Hill – McGraths Hill (16 per cent). In addition to this, 9 per cent of outbound trips travelled to Blacktown.
- Inbound work trip distribution shows that substantial trips are made from Richmond - Windsor (27 per cent) and Hawkesbury (20 per cent). In addition to this, 11 per cent of inbound trips travelled from Rouse Hill – McGraths Hill.

*Table 2-2 Daily Car Trips from the Study Area (Outbound)*

| Geographic Area | Number of car trips from study area (Outbound) | % Outbound trips from Study Area |
|---|---|---|
| Richmond - Windsor | 434 | 25% |
| Rouse Hill - McGraths Hill | 276 | 16% |
| Blacktown | 163 | 9% |
| Baulkham Hills | 126 | 7% |
| Mount Druitt | 76 | 4% |
| Penrith | 76 | 4% |
| Parramatta | 59 | 3% |
| Hawkesbury | 58 | 3% |
| Dural - Wisemans Ferry | 52 | 3% |
| Other | 303 | 17% |
| **Total** | **1,740** | **100%** |

*Source: 2011 Journey to Work Data*

*Table 2-3 Daily Car Trips to the Study Area (Inbound)*

| Geographic Area | Number of car trips to study area (Inbound) | % Inbound trips to Study Area |
|---|---|---|
| Richmond - Windsor | 1,424 | 27% |
| Hawkesbury | 1073 | 20% |
| Rouse Hill - McGraths Hill | 587 | 11% |
| Blacktown | 499 | 9% |
| Penrith | 472 | 9% |
| Mount Druitt | 222 | 4% |
| Baulkham Hills | 209 | 4% |
| Blue Mountains | 175 | 3% |
| Dural - Wisemans Ferry | 121 | 2% |
| St Marys | 106 | 2% |
| other | 453 | 8% |
| **Total** | **5,339** | **100%** |

*Source: 2011 Journey to Work Data*

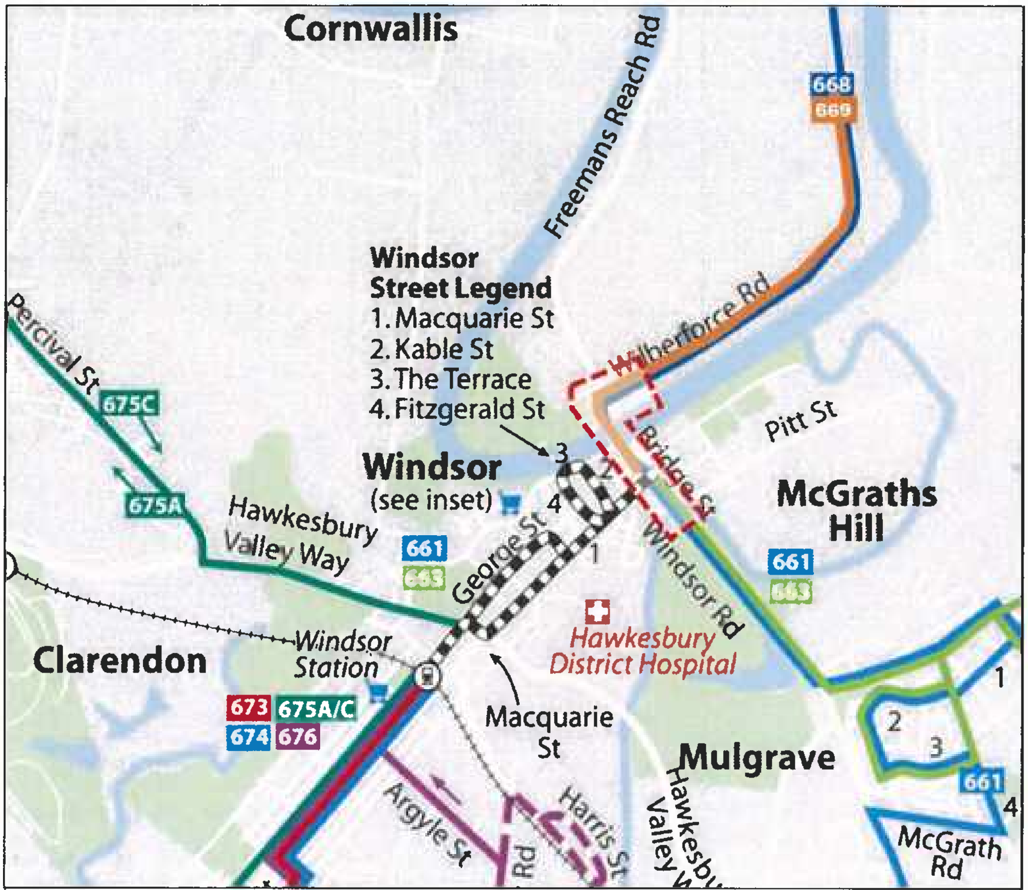
## 2.4 Travel Patterns

Significant proportions of morning (AM) and afternoon (PM) peak trips to and from the study area have an origin and destination to the surrounding areas including Richmond, Hawkesbury, Rouse Hill and Blacktown. Analysis of travel patterns from the journey to work (JTW) data indicated that approximately 67 per cent of the catchment area's workers live in Richmond, Hawkesbury, Rouse Hill and Blacktown.

The JTW data indicated about 54 per cent of the catchment area's residents travelled to Richmond, Hawkesbury, Rouse Hill and Blacktown.

## 2.5 Public Transport

The study area is serviced by four routes all operated by Busways. Routes 661, 663, 668 and 669 run along Bridge Street, Wilberforce Road and Macquarie Street. Figure 2-4 shows the bus routes in the study area.




| | |
|---|---|
| 661 | Route 661: Windsor - Riverstone Industrial Service |
| 663 | Route 663: Windsor to Pitt Town Loop |
| 668 | Route 668 - Windsor to Richmond via Wilberforce, Glossodia & North Richmond |
| 669 | Route 669 - Windsor to Sackville |
| | Study Area |

*https://www.busways.com.au/sites/default/files/network_maps/R1TimetableNetworkMap201116.pdf*

*Figure 2-4 Bus Routes Servicing the Study Area*

The study area has no direct rail service. The nearest railway station by road is Windsor Station (see Figure 2-5). Windsor Station is approximately two kilometres away from Bridge Street via Macquarie Street and George Street.

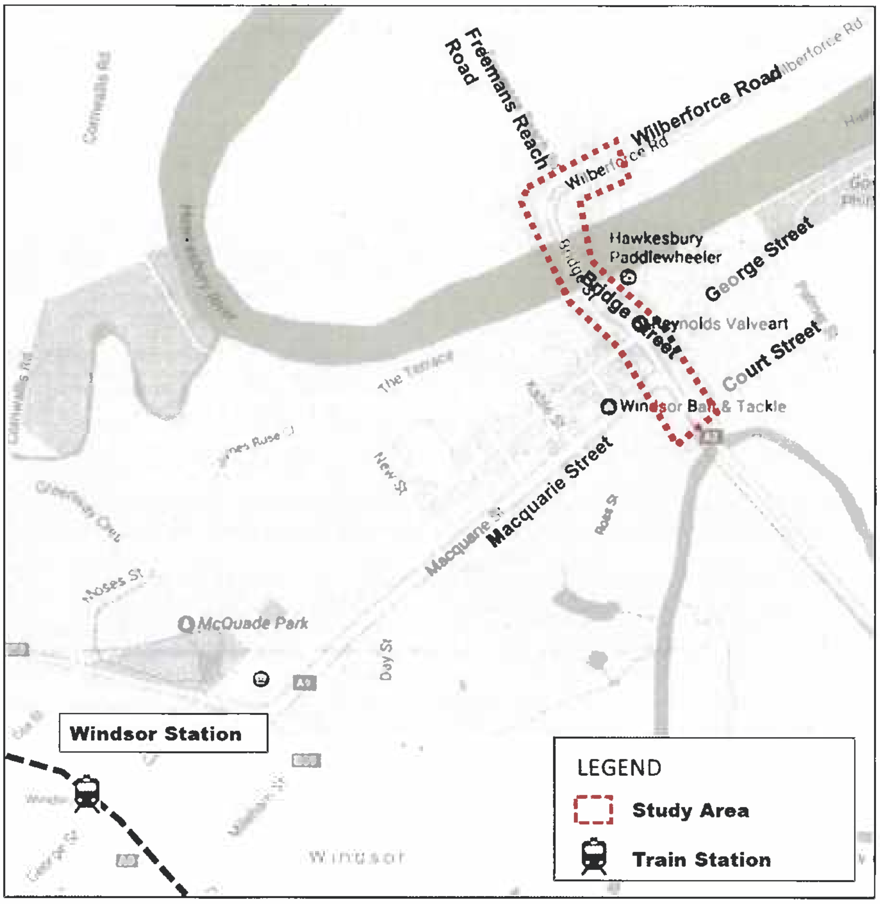


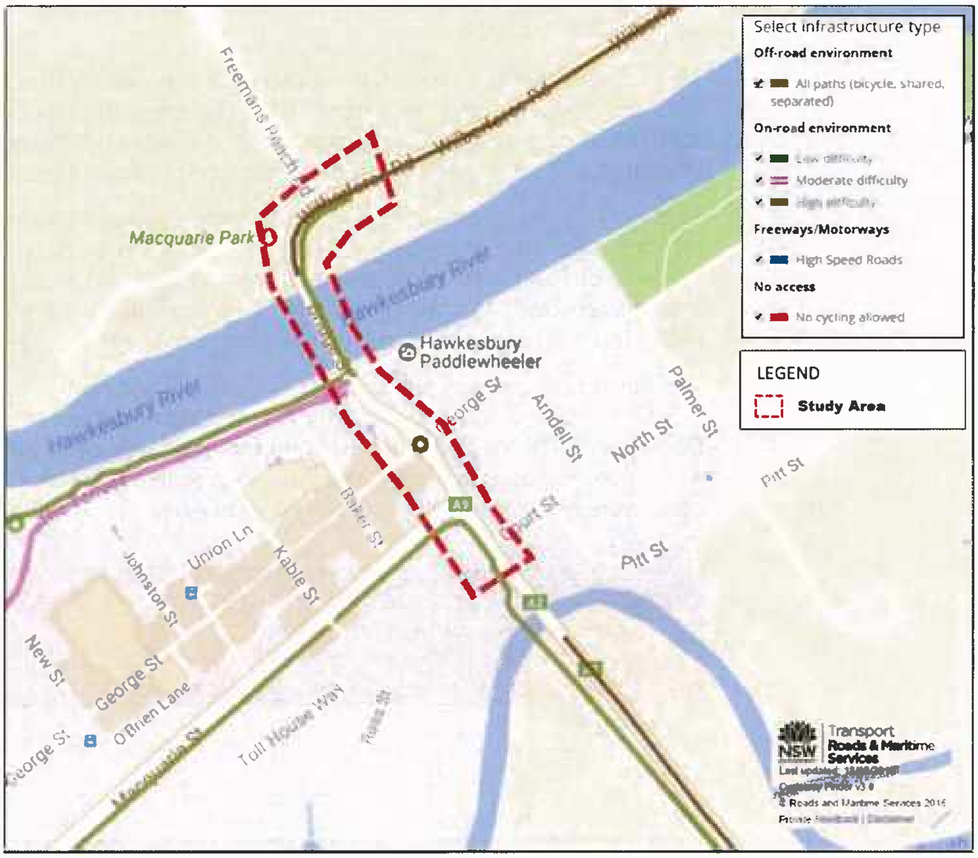

*Figure 2-5 Train Stations in Close Proximity to the Study Area*

## 2.6 Walking and Cycling

There are dedicated footpaths along Bridge Street, Macquarie Street, George Street and Court Street. Windsor Bridge has a narrow pedestrian and cycle path on its eastern side. This shared path links The Terrace and Old Bridge Street in the south with the intersection of Wilberforce and Freemans Reach Roads to the north. The shared path on the existing bridge also forms an off-road link in the local cycle network.

Pedestrian access and amenity at the Bridge Street / George Street roundabout is currently poor. Pedestrian access is typically poor at roundabout controlled intersections and is made worse in this case by the fact that the intersection is located at the top of a crest. The existing intersection presents a road safety hazard for pedestrians and cyclists due to the high peak traffic volumes and poor sight distance at the intersection. No facilities are provided at the current roundabout controlled intersection to assist crossing Bridge Street, and pedestrians have difficulty identifying a safe gap in which to cross during peak traffic periods. As well as being a considerable safety risk to pedestrians crossing at this point, it provides a barrier to pedestrian movements from the eastern section of the town, where much of the accommodation is located, to the town centre.

An on-road cycle way is currently provided on Bridge Street and Wilberforce Road. A designated off-road cycle way exists on Bridge Street, Wilberforce Road and Macquarie Street. Figure 2-6 shows the different types of cycle routes in the study area.




Source: Roads and Maritime Cycleway Finder V3

*Figure 2-6 Existing Cycleways in the Study Area*

## 2.7 Crash Data

This assessment is based on the crash data supplied by Roads and Maritime between July 2011 and December 2016. The crash data includes fatal, injury or vehicle damage accidents. The crash analysis was undertaken for Bridge Street and Wilberforce Road between Freemans Reach Road and Macquarie Street.

Table 2-4 below summarises recorded crashes by road and location. There were 52 crashes recorded between July 2011 and December 2016 on Bridge Street and Wilberforce Road between Freemans Reach Road and Macquarie Street. Of all crashes reported, 41 crashes occurred at intersections, 8 crashes occurred on the undivided road sections, and 3 crashes occurred on the divided road sections.

The severity of crashes classified as fatal, injury and non-casualty are shown in Table 2-5. Of the total 52 crashes recorded in the study area between July 2011 and December 2016, no fatal crashes were recorded. About 20 crashes (38 per cent) were recorded as injury, with 20 people injured in total. About 32 crashes (62 per cent) were recorded as non-casualty (i.e. tow-away).

*Table 2-4 Locations of Crashes*

| Road | Total Number Crashes Recorded | Intersection* | Non-intersection | |
|---|---|---|---|---|
| | | | Two-way undivided road | Divided Road |
| Bridge Street | 23 | 17 | 4 | 2 |
| George Street | 1 | 1 | 0 | 0 |
| Macquarie Street | 4 | 3 | 0 | 1 |
| Wilberforce Road | 24 | 20 | 4 | 0 |
| **Total** | **52** | **41** | **8** | **3** |

*Source: Roads and Maritime crash data between July 2011 and December 2016, Note: * Up to 10 metres from an intersection*

*Table 2-5 Number of Crashes by Severity*

| Crash Severity | Number of Crashes Recorded | % | Casualties |
|---|---|---|---|
| Fatal | 0 | 0% | |
| Injury | 20 | 38% | 20 people injured |
| Non-casualty | 32 | 62% | |
| **Total** | **52** | **100%** | **20** |

Figure 2-7 shows the number of crashes per movement type. The four most common types of crashes account for around 87 per cent of the reported crashes within the study area:

- Intersection, from adjacent approaches (38 per cent);
- Opposing vehicles, turning (21 per cent);
- Rear-end (15 per cent); and
- Off carriageway, on curve, hit object (8 per cent).

Crashes other than the above constitute the remaining 17 per cent.

It is likely that safety will deteriorate along Bridge Street and Wilberforce Road and associated intersections in their current configuration for all road users as traffic levels and congestion increase, which is of ongoing and substantial concern to Roads and Maritime and the local community.

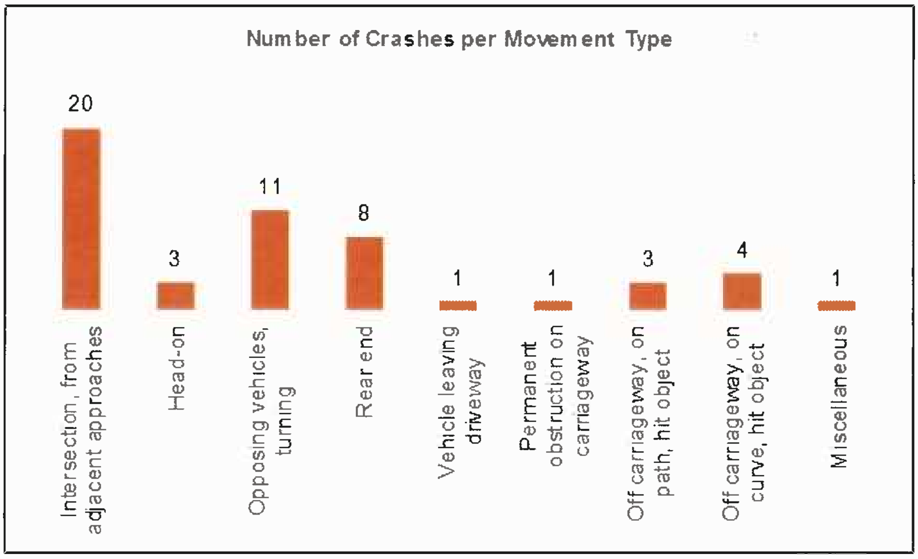



*Figure 2-7 Number of Cashes by Movement Types*

Figure 2-8 shows crash locations on Bridge Street and approach roads. Figure 2-8 indicates that crashes are mostly located at intersections. Particularly crash-prone locations are:

- Freemans Reach Road and Wilberforce Road intersection;
- Bridge Street and George Street intersection; and
- Bridge Street and Macquarie Street intersection.


*Figure 2-8 Spatial Distribution of Crashes on Bridge Street and Approach Roads*

# 3 Existing Road Network Performance

This chapter establishes existing transport network performance in the study area. Results of the new 2017 traffic survey are summarised in this section, and formed the basis of the SIDRA model and Level of Service assessment.

## 3.1 Traffic Surveys

The 2017 traffic survey was undertaken by Matrix in March 2017 to satisfy the needs and purpose of the study. It included:

- Daily automatic traffic counts;
- Intersection turning movement counts;
- Queue length surveys; and
- Travel time surveys.

### 3.1.1 Mid-block traffic counts

Daily mid-block traffic survey was conducted on the Windsor Bridge for a continuous seven-day period between 24 March 2017 and 30 March 2017. The mid-block data was collected to identify the thirteen Austroads standard vehicle classes.

### 3.1.2 Intersection counts and queue length surveys

Intersection turning movement counts and queue length surveys were conducted on 28 March 2017 (Tuesday) for two hours in the AM (07:00-9:00) and two hours in the PM (16:00-18:00).

The survey was conducted for the following four intersections:

- Wilberforce Road / Freemans Reach Road;
- Bridge Street / George Street;
- Bridge Street / Macquarie Street; and
- Bridge Street / Court Street.

### 3.1.3 Travel time and speed surveys

Travel time surveys were conducted on 28 March 2017 (Tuesday) for two hours in the AM (07:00-9:00) and two hours in the PM (16:00-18:00).

The survey was conducted for one bi-directional route:

- Bridge Street / Wilberforce Road (between 500 metres south of Court Street / Bridge Street intersection and 500 metres east of Freemans Road / Wilberforce Road intersection)

Figure 3-1 below shows the survey locations for midblock counts, intersection counts, queue length and travel time surveys.

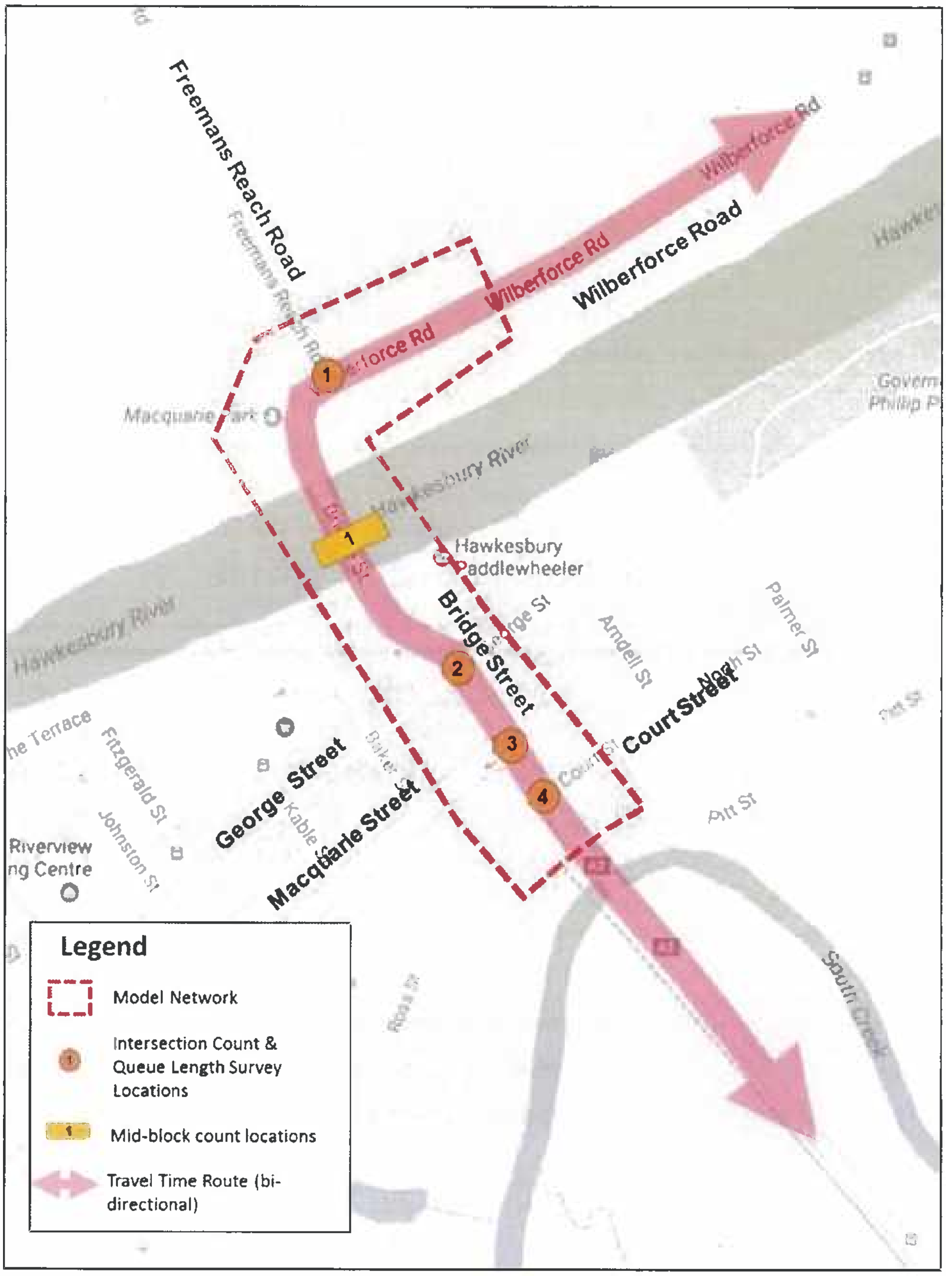



*Figure 3-1 Traffic Survey Locations*

## 3.2 Traffic Results

This section quantifies the current 2017 daily and peak hour traffic flows on Windsor Bridge and adjoining intersections within the study area. The peak hour intersection turning movements for AM and PM are used to estimate the current Level of Service at modelled four intersections.

### 3.2.1 Daily Traffic Volumes on Windsor Bridge

The 2017 midblock count represents data obtained from the March 2017 traffic survey. Table 3-1 shows the daily 2017 traffic volumes counted on Windsor Bridge (Bridge Street over Hawkesbury River).

*Table 3-1 Daily traffic volume on Windsor Bridge in 2017*

| Day | Total Vehicles | Heavy Vehicles | Heavy Vehicle % |
|---|---|---|---|
| Monday | 21,000 | 2,300 | 11% |
| Tuesday | 21,400 | 2,400 | 11% |
| Wednesday | 22,300 | 2,600 | 12% |
| Thursday | 21,200 | 2,300 | 11% |
| Friday | 21,900 | 2,200 | 10% |
| Saturday | 17,800 | 1,300 | 8% |
| Sunday | 15,800 | 1,000 | 6% |
| Average weekday (5 days) | 21,600 | 2,400 | 11% |
| Average weekly (7 days) | 20,200 | 2,000 | 10% |
| Average weekend (2 days) | 16,800 | 1,200 | 7% |

The daily traffic volumes are shown for average weekly (7 days) and average weekday (5 days) including heavy vehicles.

- Currently (2017), Windsor Bridge (Bridge Street over Hawkesbury River) carries between 21,000 and 22,300 vehicles per day on weekday (Monday to Friday) with average of 21,600 vehicles per day;
- Based on averaged weekday (5 days), Windsor Bridge carries about 2,400 heavy vehicles per day representing about 11per cent of total volumes; and
- Weekend (Saturday and Sunday) traffic is significantly lower than weekday traffic, being about 22 per cent lower than weekday average (5 days).

Figure 3-2 shows the 2017 average weekday volume on Windsor Bridge.

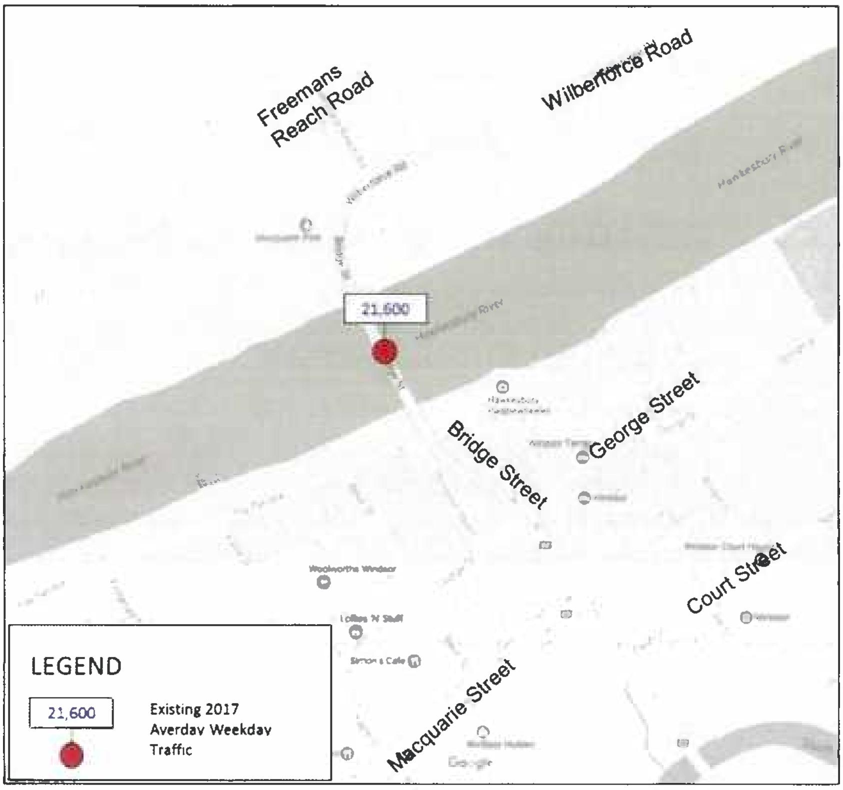



*Figure 3-2 Average Daily Traffic (Weekday) in 2017*

### 3.2.2 Heavy Vehicle Volumes

According to the Austroads vehicle classification system, heavy vehicles include trucks with two or more axles, buses, semi-trailers and B-doubles.

Table 3-2 below summarises the 2017 daily heavy vehicles counted on Windsor Bridge. Based on average weekday data, the number of heavy vehicles recorded on Windsor Bridge is about 2,400 vehicles per day, representing about 11 per cent of the total vehicles.

*Table 3-2 Daily Traffic Volumes (vehicles) on Bridge Street and Wilberforce Road in 2017*

| Road Section | Average Daily Traffic | Heavy Vehicles | % Heavy Vehicles |
|---|---|---|---|
| Windsor Bridge (Bridge Street) | 21,600 | 2,400 | 11% |

### 3.2.3 Hourly Traffic Variation

Hourly traffic variations on Windsor Bridge were analysed for seven days (Monday to Sunday) to establish peak hour traffic patterns throughout the day. Figure 3-3 shows hourly traffic variations for seven days for the March 2017 traffic survey.

The following points are noted in relation to peak hour traffic on the Windsor Bridge (Bridge Street over Hawkesbury River):

- The AM peak spreads over three hours between 6am and 9am, with traffic building up sharply between 7am and 8am when it reaches its peak;
- The PM peak also spreads over three hours between 3pm and 6pm, with traffic volumes gradually starting to build up around 3pm. The peak is reached at 5pm before it starts to decline sharply. The hour between 4pm and 5pm shows the predominant PM peak; and
- In the morning peak hour traffic direction is southbound towards Rouse Hill/Parramatta. This is mirrored in the afternoon peak with a similar volume of traffic heading northbound towards Wilberforce.

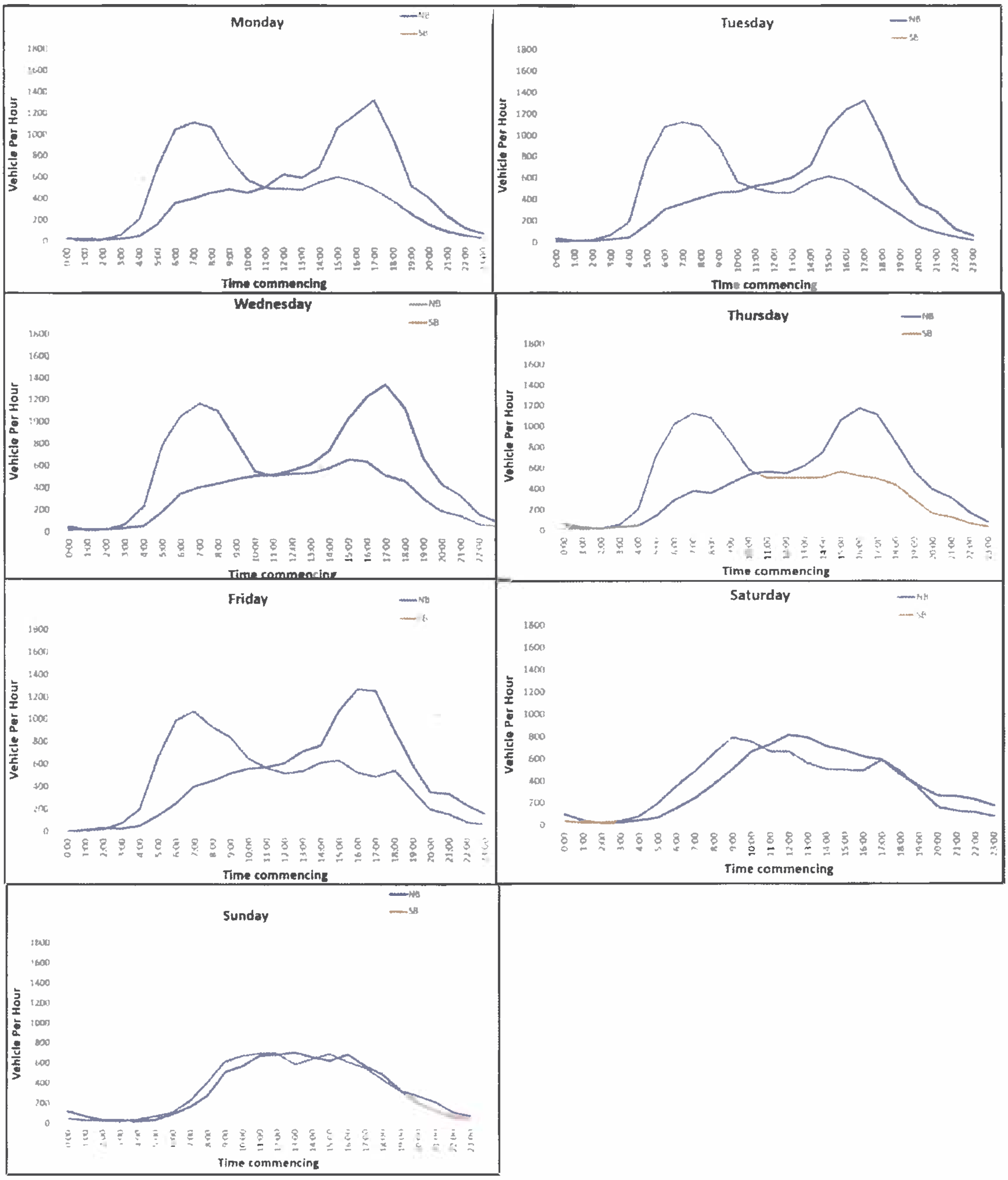



*Figure 3-3 Hourly Traffic Profile – 7–day*

### 3.2.4 Average Travel Speeds

The 2017 survey data shows that average travel speeds on Windsor Bridge are between 20 and 40 km/h; lower than the posted speed limit of 60 km/h.

In the morning peak the average travel speed on the bridge is 40 km/h in the northbound direction and 20 km/h in the southbound direction. In the afternoon peak, average travel speeds on the bridge are 40 km/h in the northbound direction and 30 km/h in the southbound direction.

### 3.2.5 Queue Lengths

Queue length surveys on at four key intersections within the study area were for AM peak two hours (7-9am) and PM peak two hours (4-6pm) in March 2017. Appendix A includes queue length survey results for AM and PM peak hour.

## 3.3 Peak Hour Traffic Volumes on Windsor Bridge

Table 3-3 shows the morning and afternoon peak hour traffic volumes on Windsor Bridge by travel direction in 2017.

*Table 3-3 Peak Hour Traffic Volumes on Windsor Road in 2017*

| Road Section | AM Peak | | | PM Peak | | |
|---|---|---|---|---|---|---|
| | NB | SB | Two-way | NB | SB | Two-way |
| Windsor Bridge (Bridge Street) | 430 (29%) | 1,050 (71%) | 1,480 (100%) | 1,220 (68%) | 570 (32%) | 1,790 (100%) |

In 2017 Windsor Bridge carried about 1,480 and 1,790 vehicles (two-way) per hour in the AM and PM peak hours respectively. The AM peak data suggests substantial traffic (about 71 per cent) in the southbound direction. Conversely, the PM peak data suggests substantial traffic (about 68 per cent) in the northbound direction. The current peak hour directional traffic distribution on Windsor Bridge suggests typical 'tidal flow' distribution.

## 3.4 Capacity Assessment on Windsor Bridge

The notional traffic capacity of the Windsor Bridge was estimated using Austroads' *Guide to Traffic Management Part 3: Traffic Studies and Analysis.* Figure 3-4 shows hourly traffic distribution for the average weekday on the existing Windsor Bridge.

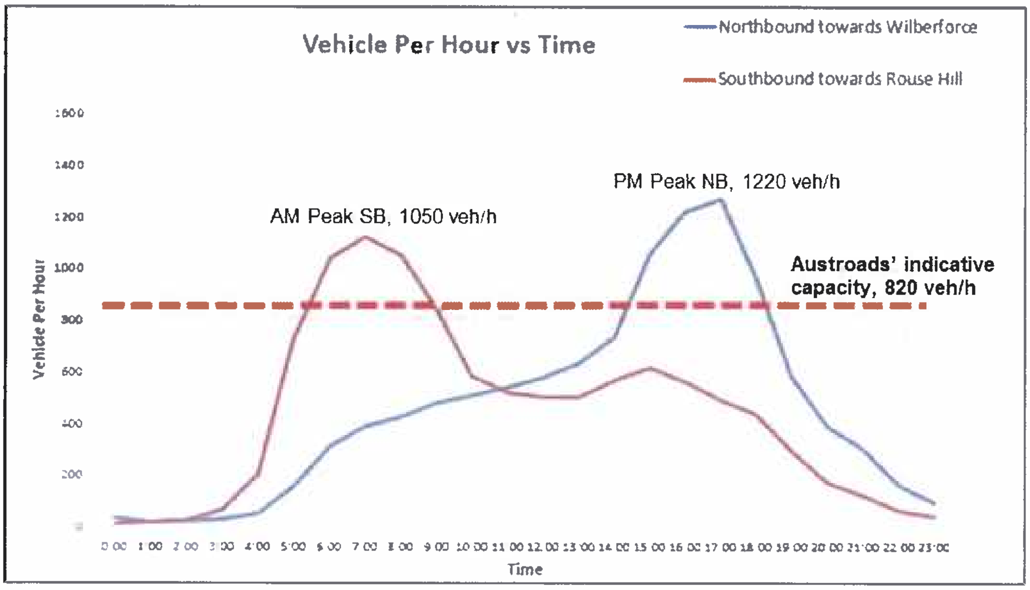



*Figure 3-4 Hourly traffic volumes on Windsor Bridge, March 2017*

The 2017 traffic data shows that during peak hour the bridge carries between 1,100 and 1,200 vehicles per hour in the peak direction. The Austroads' Guideline has suggested an indicative (notional) capacity of 820 vehicles per hour per lane as bridge traffic capacity. The bridge capacity of 820 vehicles per hour takes into account posted speed reductions for heavy vehicles and upstream and downstream intersection capacity.

The capacity analysis suggests that current traffic on Windsor Bridge exceeds the saturation traffic levels in both the morning (AM) and afternoon (PM) peak periods. The existing condition analysis for the bridge also suggests the need for additional bridge capacity. Further capacity analysis is documented in Section 3.5 below.

## 3.5 Existing Intersection Level of Service

The capacity of the section of Bridge Street and Wilberforce Road between Court Street and Freemans Reach Road is strongly influenced by the operation of Windsor Bridge and adjoining key intersections.

Four intersections within the study area were analysed (using SIDRA, version 7 network) to determine the operating performance and Level of Service including:

- Wilberforce Road / Freemans Reach Road (sign controlled);
- Bridge Street / George Street (roundabout);
- Bridge Street / Macquarie Street (traffic signals); and
- Bridge Street / Court Street (sign controlled).

Figure 3-5 below shows the location of all 4 intersections in the study area.

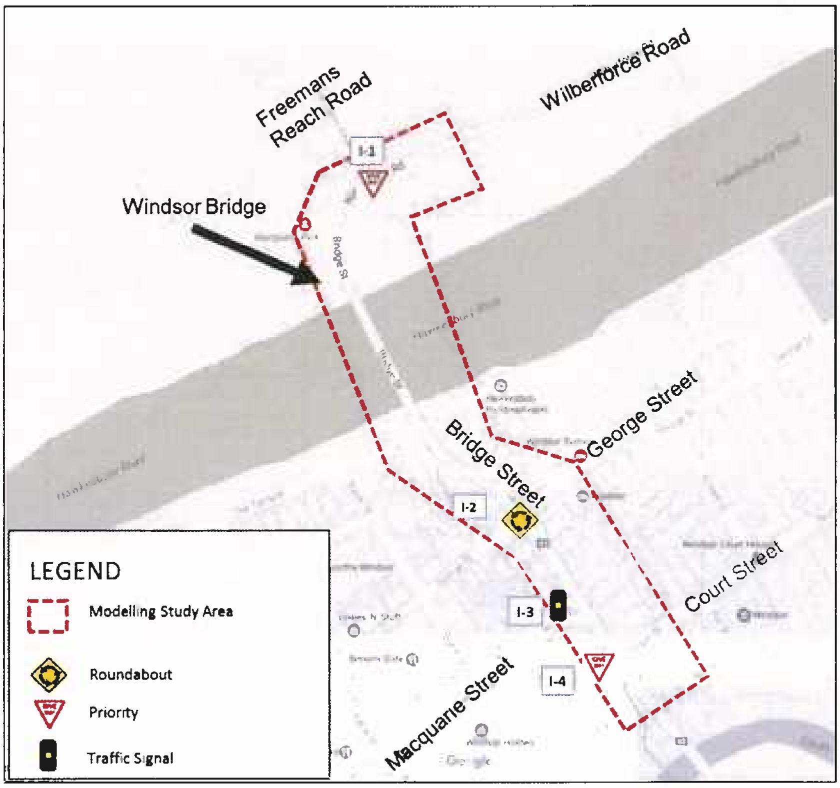



*Figure 3-5 Key intersections adjacent to Windsor Bridge*

Figure 3-6 and Figure 3-7 showing counted 2017 turning volumes at above intersections for AM peak one hour (8-9am) and PM peak one hour (4-5pm).

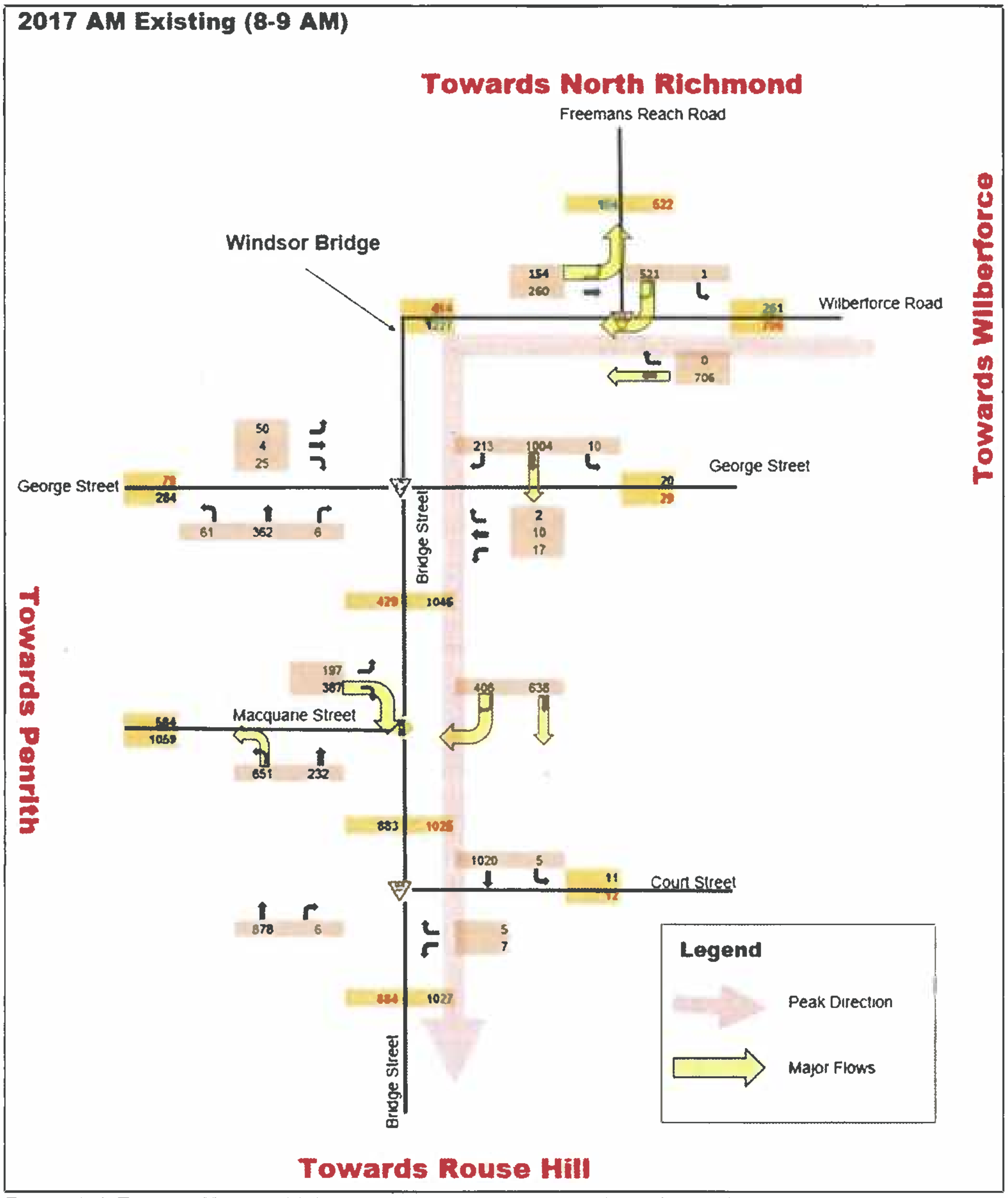



*Figure 3-6 Existing Turning Volumes – 2017 AM Peak one hour (8-9am)*

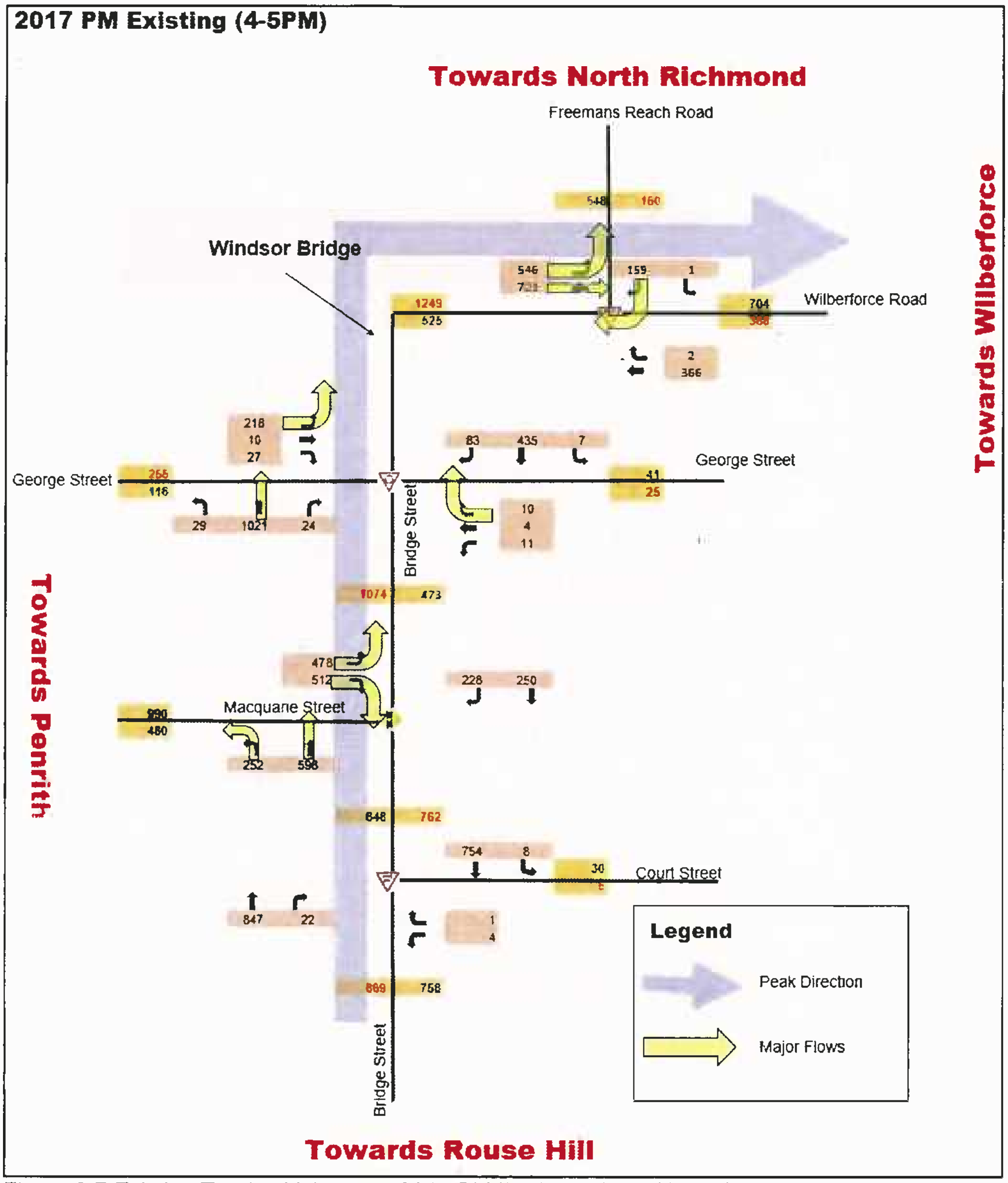



*Figure 3-7 Existing Turning Volumes – 2017 PM Peak one hour (4-5pm)*

The performance of an intersection is measured by the intersection average delay per vehicle, which in turns leads to a Level of Service measure for the intersection.

Table 3-4 below shows the Roads and Maritime standard Level of Service criteria for intersection operation.

*Table 3-4 Level of Service Criteria for Intersections*

| Level of Service | Average Delay per Vehicle (secs/veh) | Traffic Signals, Roundabout | Give Way & Stop Signs |
|---|---|---|---|
| A | <14 | Good operation | Good operation |
| B | 15 to 28 | Good with acceptable delays & spare capacity | Acceptable delays & spare capacity |
| C | 29 to 42 | Satisfactory | Satisfactory, but accident study required |
| D | 43 to 56 | Operating near capacity | Near capacity & accident study required |
| E | 57 to 70 | At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode | At capacity, requires other control mode |
| F | >70 | Unsatisfactory with excessive queuing | Unsatisfactory with excessive queuing |

Level of service (LoS) is reported in accordance with the Roads and Maritime guideline (*Traffic Modelling Guideline, Issue 1.0, RMS, February 21013*). It recommends that for priority intersections such as a roundabouts and sign controlled intersections, the Level of Service (LoS) value is determined by the critical movement with the highest delay. With these type of intersection controls (roundabout, Stops and Give way sign controls), some movements may experience high levels of delay while other movements may experience minimum delay. For a signalised intersection LoS criteria are related to the average intersection delay measured in seconds per vehicle.

Table 3-5 below shows the existing 2017 Level of Service at the four analysed intersections.

*Table 3-5 Existing Level of Service in 2017*

| I-D | Intersection | Control | AM Peak | | PM Peak | |
|---|---|---|---|---|---|---|
| | | | Delay (sec) | LoS | Delay (sec) | LoS |
| I-1 | Wilberforce Road and Freemans Reach Road | Priority (1) | 59 | E | 60 | E |
| I-2 | Bridge Street and George Street | Roundabout (1) | 41 | C | 97 | F |
| I-3 | Bridge Street and Macquarie Street | Traffic Signals (2) | 15 | B | 29 | C |
| I-4 | Bridge Street and Court Street | Priority (1) | 37 | C | 22 | B |

*Note: (1) Priority intersections such as a roundabout and sign controlled intersections, the Level of Service (LoS) value is determined by the critical movement with the highest delay. (2) Signalised intersection, LoS criteria are related to the average intersection delay measured in seconds per vehicle.*

The following points are noted for existing network performance:

- Two intersections north and south of Windsor Bridge currently operate at or over their capacity during peak hour. Wilberforce Road / Freemans Reach Road (sign controlled intersection) currently operates with Level of Service E in the AM and PM peaks (delays of 60 seconds). Bridge Street / George Street (roundabout) currently operates at Level of Service F in PM peak (delays of 97 seconds). The operational issues at both intersections adversely impact the traffic performance on Windsor Bridge during peak hours.
- The Bridge Street / Macquarie Street traffic signals operate with Level of Service between B to C (delays of 15 to 29 seconds) and Bridge Street / Court Street (sign controlled) intersection operates with Level of Service between B to C (delays of 22 to 37 seconds).

Appendix A documents detailed SIDRA results for existing 2017 AM and PM peak traffic conditions.

# 4 Future Traffic Performance of the Project

This section reports traffic growth for the study area road network. The future traffic growth analysis was undertaken using historical traffic growth and forecast traffic volumes obtained from Roads and Maritime's Strategic Traffic Forecasting Model (STFM, EMME model).

Future traffic growth has been reviewed and agreed with Roads and Maritime.

## 4.1 Historical Traffic Growth

The historical traffic growth on Windsor Bridge is estimated using 2012 and 2017 counts. The 2012 counts were sourced from Roads and Maritime's report '*Windsor Bridge Replacement Project, Traffic and Transport Working Paper – Working Paper 4, November 2012*'. The 2017 counts are sourced from the new traffic survey undertaken for this study.

Table 4-1 shows the comparison between 2012 and 2017 average daily traffic counts on Windsor Bridge. The last five year's traffic growth on Windsor Bridge between 2012 and 2017 is also shown.

*Table 4-1 Comparison of Total Vehicles for 7-day Traffic – 2012 and 2017*

| Road Section | Average Daily Traffic | | | Traffic Growth per Annam |
|---|---|---|---|---|
| | March 2012 | March 2017 | Traffic Increase (5 years) | |
| Windsor Bridge (Bridge Street) | 19,100 | 20,200 | 1,100 ▲ | 1.1% ▲ |

The data shows that between 2012 and 2017 (five year) traffic on Windsor Bridge has grown by approximately 1.1 per cent per annum from 19,100 vehicles per day in 2012 to 20,200 vehicles per day in 2017. Figure 4-1 shows the 24-hour traffic profiles on the Windsor Bridge based on 2012 and 2017 counts.

The 24-hour traffic profile on Windsor Bridge was found to be consistent between 2012 and 2017.

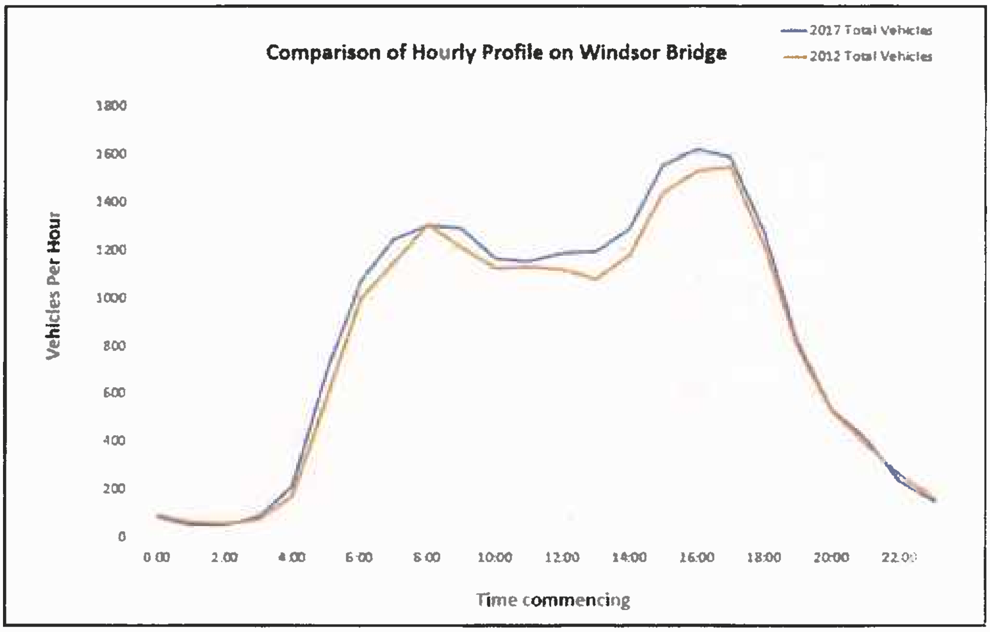



*Figure 4-1 Comparison of Hourly Traffic Profile on Windsor Bridge – 2012 & 2017*

## 4.2 Future Traffic Growth

Future traffic growth on Windsor Bridge, Bridge Street and adjoining roads within the study area will be influenced by the combination of passing (through) and local traffic growth. Future traffic growth in the study area was sourced from Roads and Maritime's Strategic Traffic Forecasting Model (STFM, EMME model). Roads and Maritime provided traffic forecasts at key roads for each time period up to 2026 and 2036. Both morning and afternoon peak hour traffic was assessed in the future years.

Future traffic growth assumptions have been reviewed and agreed with Roads and Maritime. Table 4-2 shows future traffic growth rates proposed for traffic modelling of the Windsor Bridge Replacement project.

*Table 4-2 Proposed Growth Rates for Traffic Modelling Purposes*

| Road / Location | Growth Rate per Annum (%) | | |
|---|---|---|---|
| | 2016-2026 | 2026-2036 | 2016-2036 (average for 20 years period) |
| **AM Peak** | | | |
| Bridge Street (Windsor Bridge) and Macquarie Street | 1.7% | 1.0% | 1.3% |
| George Street and Court Street | 0.5% | 0.5% | 0.5% |
| **PM Peak** | | | |
| Bridge Street (Windsor Bridge) and Macquarie Street | 1.7% | 1.1% | 1.4% |
| George Street and Court Street | 0.3% | 0.3% | 0.3% |

Table 4-2 indicates the following:

- The future traffic growth rate on Bridge Street (Windsor Bridge) and Macquarie Street will be 1.7 per cent per annum between 2016 and 2026, followed by 1.1 per cent per annum between 2026 and 2036.
- On George Street and Court Street, a lower traffic growth rate was suggested. Traffic volumes on George Street and Court Street would grow by between 0.3 per cent and 0.5 per cent between 2016 and 2036.

## 4.3 Traffic Implications of the 'Do Nothing' Option

Roads and Maritime's Strategic Traffic Forecasting Model (STFM, EMME model) predicts between 1.3 and 1.4 per cent per annum traffic growth on Windsor Bridge until 2036.

Appendix B includes 2026 and 2036 forecast turning volumes for the AM peak (8 to 9am) and PM peak (4 to 5pm).

Table 4-3 and Table 4-4 below show predicted Level of Service results for 2026 and 2036 traffic conditions for the 'do nothing' case.

*Table 4-3 Forecast Level of Service in 2026 – 'Do Nothing'*

| I-D | Intersection | Control | AM Peak | | PM Peak | |
|---|---|---|---|---|---|---|
| | | | Delay (sec) | LoS | Delay (sec) | LoS |
| I-1 | Wilberforce Road and Freemans Reach Road | Priority (1) | 583 | F | 97 | F |
| I-2 | Bridge Street and George Street | Roundabout (1) | 49 | D | 351 | F |
| I-3 | Bridge Street and Macquarie Street | Traffic Signals (2) | 18 | B | 153 | F |
| I-4 | Bridge Street and Court Street | Priority (1) | 51 | D | 32 | C |

*Note: (1) Priority intersections such as a roundabout and sign controlled intersections, the Level of Service (LoS) value is determined by the critical movement with the highest delay. (2) Signalised intersection, LoS criteria are related to the average intersection delay measured in seconds per vehicle.*

*Table 4-4 Forecast Level of Service in 2036 – 'Do Nothing'*

| I-D | Intersection | Control | AM Peak | | PM Peak | |
|---|---|---|---|---|---|---|
| | | | Delay (sec) | LoS | Delay (sec) | LoS |
| I-1 | Wilberforce Road and Freemans Reach Road | Priority (1) | 500+ | F | 123 | F |
| I-2 | Bridge Street and George Street | Roundabout (1) | 63 | E | 783 | F |
| I-3 | Bridge Street and Macquarie Street | Traffic Signals (2) | 19 | B | 376 | F |
| I-4 | Bridge Street and Court Street | Priority (1) | 70 | E | 47 | D |

*Note: (1) Priority intersections such as a roundabout and sign controlled intersections, the Level of Service (LoS) value is determined by the critical movement with the highest delay. (2) Signalised intersection, LoS criteria are related to the average intersection delay measured in seconds per vehicle.*

The model predicts Level of Service F either in the morning or afternoon peak hour at following intersections:

- Wilberforce Road / Freemans Reach Road (I-1);
- Bridge Street / George Street (I-2); and
- Bridge Street / George Street (I-3).

The future Level of Service analysis has found that if no action is taken to improve the traffic conditions on the Bridge Street and Wilberforce Road between Court Street and Freemans Reach Road, the following is likely to occur:

- Major congestion at a number of key intersections during peak periods by 2026 extending throughout a large part of the day
- Of the four key intersections analysed, three intersections showed Level of Service F (over capacity) in 2026 either in morning or afternoon peak periods. In 2036 three intersections showed Level of Service F in either the morning or afternoon peak periods
- Significant delaying and queuing would occur on Bridge Street extending to Wilberforce Road; and
- Road safety would deteriorate on Bridge Street, Wilberforce Road and associated intersections for all road users as traffic increases. The crash analysis indicted a need for safety improvement for both sections of Bridge Street and Wilberforce Road.

Appendix B includes detailed SIDRA Level of Service results for 2026 and 2036 'do nothing' scenario.

## 4.4 Future Traffic Volumes on new Windsor Bridge

Future traffic volumes on new Windsor Bridge were prepared for the future years 2026 and 2036.Table 4-5 shows forecast average weekday daily traffic on new Windsor Bridge for 2026 and 2036.

*Table 4-5 Estimated Average Weekday Traffic on Windsor Bridge for 2026 and 2036*

| | Existing | | | Forecast Average Weekday Traffic (vehicles) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2017 Counts | | | 2026 | | | 2036 | | |
| | NB | SB | Two-way | NB | SB | Two-way | NB | SB | Two-way |
| Daily | 10,800 | 10,800 | 21,600 | 12,500 | 12,500 | 25,000 | 14,000 | 14,000 | 28,000 |
| AM peak | 430 | 1,050 | 1,480 | 500 | 1,230 | 1,730 | 550 | 1,360 | 1,910 |
| PM peak | 1,220 | 570 | 1,790 | 1,420 | 660 | 2,080 | 1,590 | 730 | 2,320 |

In 2026, traffic on new Windsor Bridge is projected to be about 25,000 vehicles per day. By 2036, traffic is forecast to grow to about 28,000 vehicles per day.

In the morning, southbound peak traffic on the new Bridge is predicted to be about 1,200 vehicles per hour in 2026 and 1,400 vehicles per hour in 2036.

Similarly, in the afternoon, northbound peak traffic on the new Bridge is predicted to be about 1,400 vehicles per hour in 2026 and 1,600 vehicles per hour in 2036.

## 4.5 Future Traffic Performance of Concept Design

Future traffic performance of the Concept Design (see Figure 4-2) was assessed for year 2026 and 2036 traffic conditions.

Appendix C includes 2026 and 2036 forecast turning volumes for the AM peak (8 to 9am) and PM peak (4 to 5pm).

Table 4-6 and Table 4-7 summarise forecast 2026 and 2036 Level of Service results for upgraded network conditions for the AM and PM peak hours, respectively.

*Table 4-6 Forecast Level of Service in 2026 – Concept Design*

| I-D | Intersection | Control | AM Peak | | PM Peak | |
|---|---|---|---|---|---|---|
| | | | Delay (sec) | LoS | Delay (sec) | LoS |
| I-1 | Wilberforce Road and Freemans Reach Road | Roundabout (1) | 15 | B | 17 | B |
| I-2 | Bridge Street and George Street | Traffic Signals (2) | 17 | B | 62 | E |
| I-3 | Bridge Street and Macquarie Street | Traffic Signals (2) | 21 | B | 56 | E |

*Note: (1) Priority intersections such as a roundabout and sign controlled intersections, the Level of Service (LoS) value is determined by the critical movement with the highest delay. (2) Signalised intersection, LoS criteria are related to the average intersection delay measured in seconds per vehicle.*

*Table 4-7 Forecast Level of Service in 2036 – Concept Design*

| I-D | Intersection | Control | AM Peak | | PM Peak | |
|---|---|---|---|---|---|---|
| | | | Delay (sec) | LoS | Delay (sec) | LoS |
| I-1 | Wilberforce Road and Freemans Reach Road | Roundabout (1) | 17 | B | 17 | B |
| I-2 | Bridge Street and George Street | Traffic Signals (2) | 25 | B | 169 | F |
| I-3 | Bridge Street and Macquarie Street | Traffic Signals (2) | 25 | B | 99 | F |

*Note: (1) Priority intersections such as a roundabout and sign controlled intersections, the Level of Service (LoS) value is determined by the critical movement with the highest delay. (2) Signalised intersection, LoS criteria are related to the average intersection delay measured in seconds per vehicle.*

In 2026, the upgraded network in Concept Design would provide adequate capacity and an acceptable Level of Service B for morning peak traffic condition.

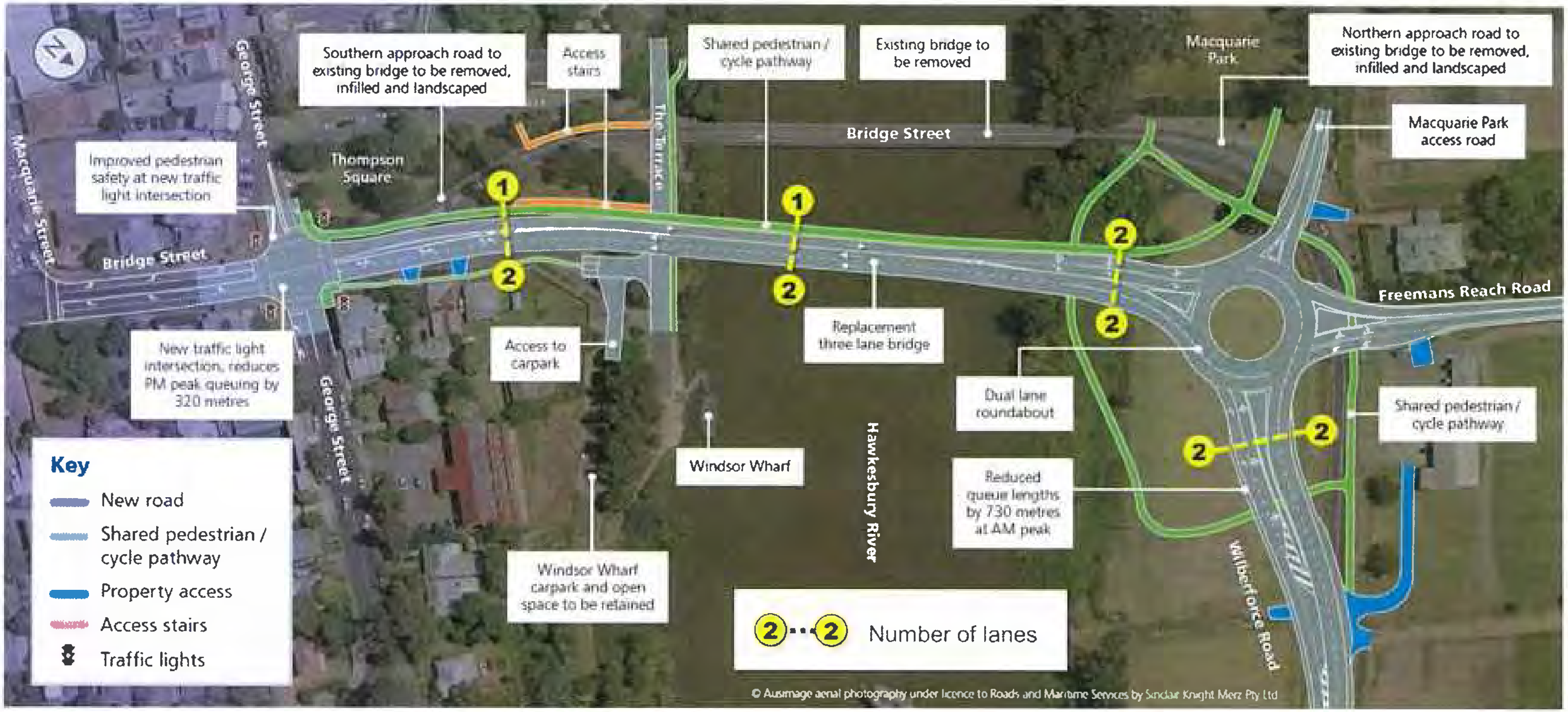
The traffic model predicted Level of Service B at Wilberforce Road / Freemans Reach Road (new roundabout), Bridge Street / George Street (new traffic signals) and Bridge Street / Macquarie Street traffic signals.

In the afternoon peak, the traffic model predicted Level of Service of E at Bridge Street / George Street traffic signals.

In 2036, the Concept Design would provide adequate capacity for the morning peak traffic condition. The traffic model predicted Level of Service B at Wilberforce Road / Freemans Reach Road (new roundabout), Bridge Street / Macquarie Street traffic signals and Bridge Street / George Street (new traffic signals).

In the afternoon peak, the traffic model predicted Level of Service F with delays of more than 169 seconds (2.8 minutes) at Bridge Street / George Street intersection and more than 99 seconds (1.8 minutes) at Bridge Street / Macquarie Street intersection.

Appendix C includes detailed SIDRA Level of Service result for 2026 and 2036 with the Concept Design.




Source: Source: Windsor Bridge Replacement Project Update, December 2016, Roads and Maritime Services

*Figure 4-2 Roads and Maritime's Concept Design*

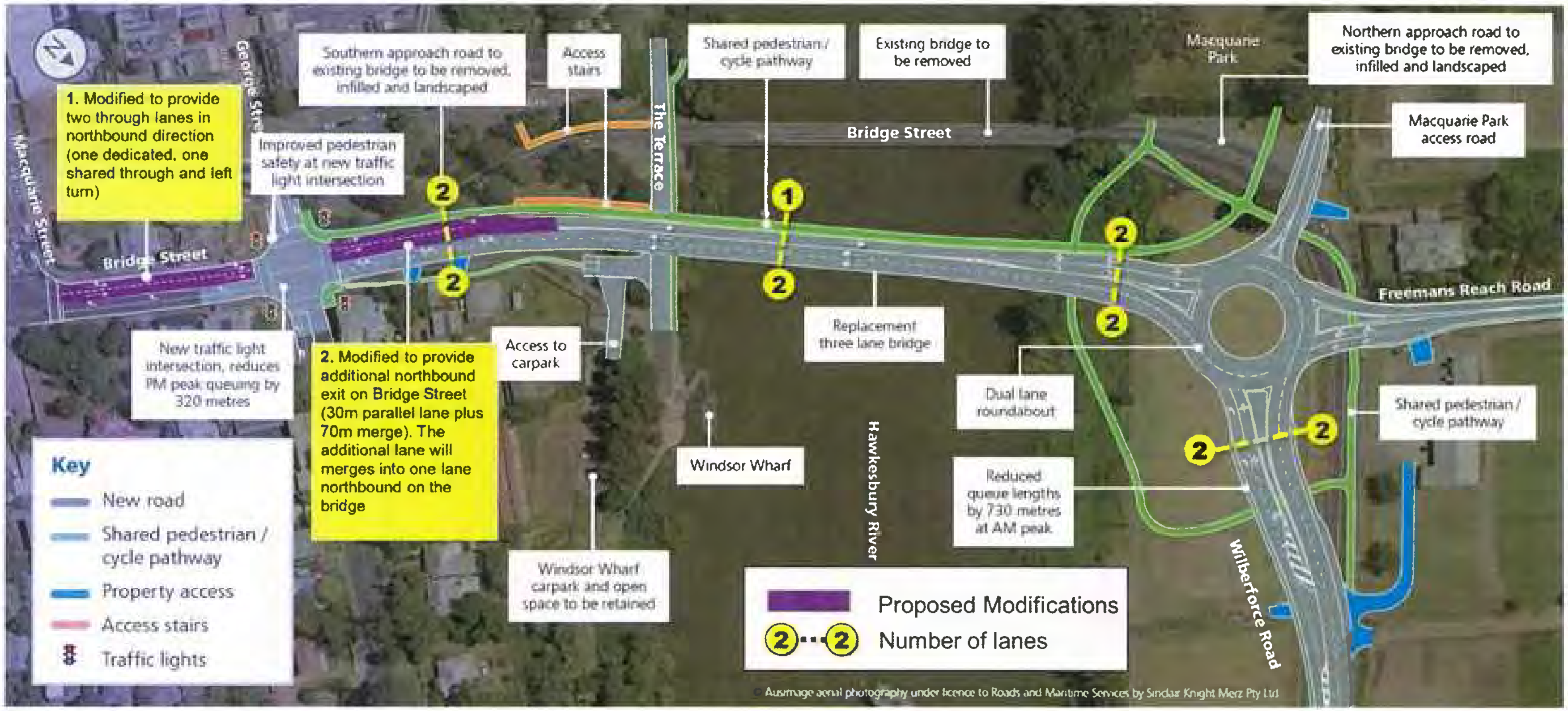
## 4.6 Proposed Modifications to the Concept Design (Modified Concept Design)

Roads and Maritime have proposed modifications to the Concept Design (referred as the Modified Concept Design) to increase traffic capacity in the northbound direction including:

1. Linemarking modification on the George Street southern approach at George Street / Bridge Street intersection to provide two through lanes in the northbound direction (one dedicated and one shared through and left turn); and
2. Provision of an additional short exit lane (30 metres parallel lane plus 70 metre merge) on the George Street northern approach (Windsor Bridge) at George Street / Bridge Street intersection. The additional lane merges into one lane northbound on Windsor Bridge.

To meet possible future demand, the modification allows for future tidal flow arrangements on Bridge Street. This would result in two lanes northbound across the bridge during the afternoon peak.

Figure 4-3 below shows indicative sketch of the Modified Concept Design (with modifications proposed to the Concept Design highlighted in purple).




Note: Proposed modifications to the Concept Design are highlighted in purple.

*Figure 4-3 Modified Concept Design (Indicative Sketch)*

## 4.7 Future Traffic Performance of the Modified Concept Design

The traffic performance of the Modified Concept Design was assessed for year 2026 and 2036 traffic conditions.

Table 4-8 and

Table 4-9 summarise forecast 2026 and 2036 Level of Service results for the Modified Concept Design for the AM and PM peak hours, respectively. The forecast Level of Service result for the Concept Design is included for comparison.

*Table 4-8 Forecast Level of Service in 2026 – Modified Concept Design*

| I-D | Intersection | Control | Concept Design | | | | Modified Concept Design | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | AM Peak | | PM Peak | | AM Peak | | PM Peak | |
| | | | Delay (sec) | LoS | Delay (sec) | LoS | Delay (sec) | LoS | Delay (sec) | LoS |
| I-1 | Wilberforce Road and Freemans Reach Road | Roundabout (1) | 15 | B | 17 | B | 15 | B | 17 | B |
| I-2 | Bridge Street and George Street | Traffic Signals (2) | 17 | B | 62 | E | 16 | B | 20 | B |
| I-3 | Bridge Street and Macquarie Street | Traffic Signals (2) | 21 | B | 56 | E | 20 | B | 48 | D |

*Note: (1) Priority intersections such as a roundabout and sign controlled intersections, the Level of Service (LoS) value is determined by the critical movement with the highest delay. (2) Signalised intersection, LoS criteria are related to the average intersection delay measured in seconds per vehicle.*

*Table 4-9 Forecast Level of Service in 2036 – Modified Concept Design*

| I-D | Intersection | Control | Concept Design | | | | Modified Concept Design | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | AM Peak | | PM Peak | | AM Peak | | PM Peak | |
| | | | Delay (sec) | LoS | Delay (sec) | LoS | Delay (sec) | LoS | Delay (sec) | LoS |
| I-1 | Wilberforce Road and Freemans Reach Road | Roundabout (1) | 17 | B | 17 | B | 17 | B | 19 | B |
| I-2 | Bridge Street and George Street | Traffic Signals (2) | 25 | B | 169 | F | 24 | B | 30 | C |
| I-3 | Bridge Street and Macquarie Street | Traffic Signals (2) | 25 | B | 99 | F | 23 | B | 83 | F |

*Note: (1) Priority intersections such as a roundabout and sign controlled intersections, the Level of Service (LoS) value is determined by the critical movement with the highest delay. (2) Signalised intersection, LoS criteria are related to the average intersection delay measured in seconds per vehicle.*

The Level of Service results in Table 4-8 and Table 4-9 indicate that the proposed modifications to the Concept Design would reduce delays and improve Level of Service at Bridge Street / George Street and Bridge Street / Macquarie Street in the afternoon peak.

In the 2026 afternoon peak, the model predicted that proposed modifications would improve Level of Service at Bridge Street / George Street from Level of Service E with a delay of 62 seconds (Concept Design) to Level of Service B with a delay of 20 seconds (Modified Concept Design). At Bridge Street / Macquarie Street, the proposed modifications would improve intersection Level of Service from Level of Service E with a delay of 56 seconds (Concept Design) to Level of Service D with a delay of 48 seconds (Modified Concept Design).

In the 2036 afternoon peak, the proposed modifications would improve Level of Service at Bridge Street / George Street from Level of Service F with a delay of more than 169 seconds (Concept Design) to Level of Service C with a delay of 30 seconds. At Bridge Street / Macquarie Street intersection, the proposed modification would reduce intersection delay from 99 seconds (Concept Design) to 83 seconds (Modified Concept Design).

Travel delay could be improved by a future tidal flow arrangement.

Appendix D includes detailed SIDRA Level of Service result for 2026 and 2036 with Modified Concept Design.

# 5 Conclusions

Roads and Maritime proposes to replace the existing bridge over the Hawkesbury River at Windsor (known as 'Windsor Bridge'). The project includes a replacement bridge 35 metres north of the existing bridge, modifying the existing intersections and bridge approach roads to accommodate the new bridge location, and providing a shared pedestrian/cycle pathway for access to and across the replacement bridge. The replacement bridge would provide wider lanes and shoulders and greater sight distances in comparison to the existing bridge. Modifications would also be made to the bridge approach roads and existing intersections at Wilberforce Road / Freemans Reach Road, Bridge Street / George Street, Bridge Street / Count Street and Bridge Street / Macquarie Street. All of these factors would contribute to improvements in traffic capacity and safety.

Roads and Maritime has developed a Concept Design for the Windsor Bridge Replacement project between Wilberforce Road and Court Street, Windsor.

A road based traffic model was developed by Arcadis for the study area using SIDRA network version 7.

This report has been prepared to assess the network performance of the Concept Design and identify possible cost-effective improvements.

Currently (as of March 2017), Windsor Bridge carries approximately 21,600 vehicles per day. This includes approximately 2,400 heavy vehicles (more than 11 per cent of the total traffic). The current peak hour traffic volumes on the Windsor Bridge were found to be from 1,100 to 1,200 vehicles per hour in each travel direction. Capacity analysis suggests that current traffic demand on the Windsor Bridge (one lane in northbound and one lane in southbound) exceeds the saturation traffic levels in both morning (AM) and afternoon (PM) peak periods. Traffic modelling of the existing condition has identified network operational issues at the following two intersections:

- Wilberforce Road / Freemans Reach Road (sign controlled); and
- Bridge Street / George Street (roundabout).

The Concept Design for the Windsor Bridge Replacement project involves a three lane bridge replacement of the existing Windsor Bridge, providing two lanes in the southbound direction and one lane in northbound direction, new traffic signals replacing the roundabout at Bridge Street / George Street, a new dual lane roundabout replacing priority control at Wilberforce Road / Freemans Reach Road and providing access to Macquarie Park via the western approach.

In year 2026, traffic on the new Windsor Bridge is predicted to be 25,000 vehicles per day. By 2036, traffic is forecast to grow to approximately 28,000 vehicles per day. In the morning, southbound peak traffic on the new bridge is predicted to be about 1,200 vehicles per hour in 2026 and 1,400 vehicles per hour in 2036.

Similarly, in the afternoon, northbound peak traffic on the new bridge is predicted to be approximately 1,400 vehicles per hour in 2026 and 1,600 vehicles per hour in 2036.

Arcadis' modelling assessment on the Concept Design found that:

- The upgraded intersections would provide Level of Service B for morning peak traffic in 2036; and
- In the afternoon peak, the traffic model suggests capacity constraints at both Bridge Street / George Street and Bridge Street / Macquarie Street traffic signals. The traffic model predicted Level of Service F at Bridge Street / George Street and Bridge Street / Macquarie Street traffic signals. The afternoon peak modelling results in 2036 suggest the need to increase capacity for the northbound traffic.

Two modifications to the Concept Design for Windsor Bridge Replacement are identified as follows:

- Linemarking modification on the George Street southern approach at George Street / Bridge Street intersection to provide two through lanes in the northbound direction (one dedicated lane and one shared through and left turn lane); and
- Provision of an additional short exit lane (30 metres parallel lane plus 70 metre merge) on George Street northern approach (Windsor Bridge) at George Street / Bridge Street intersection. The additional lane merges into one lane northbound on Windsor Bridge.

Arcadis' modelling assessment on the Modified Concept Design found that:

- The proposed modifications to the Concept Design (see Figure 4-3) would reduce delays and improve the Level of Service at Bridge Street / George Street and Bridge Street / Macquarie Street in the afternoon peak. The Level of Service B would be achieved in 2026;
- At Bridge Street / Macquarie Street, the intersection Level of Service would be improved to D in 2026; and
- In 2036, the proposed modifications would improve Level of Service at Bridge Street / George Street to C in the afternoon peak.

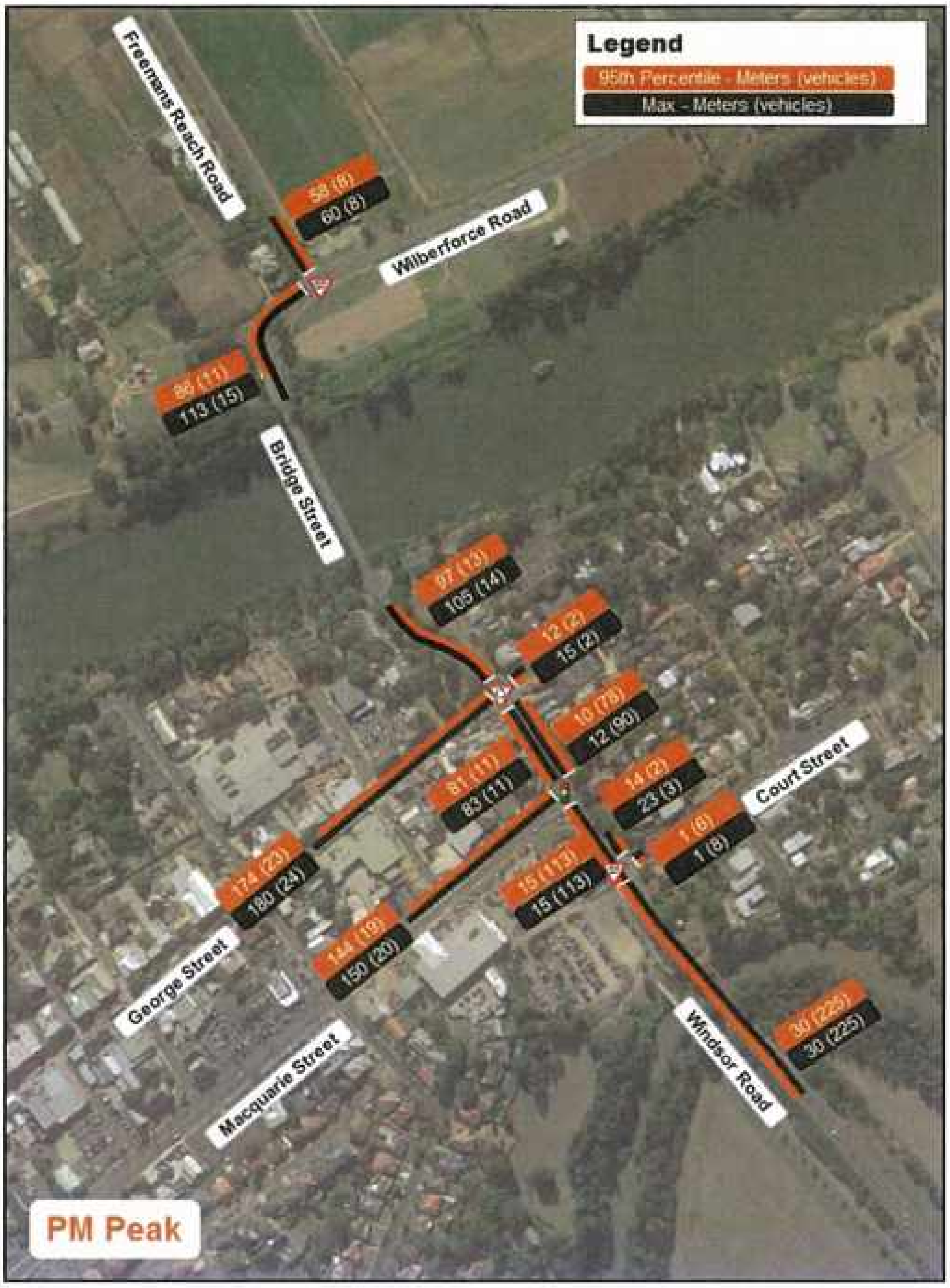
# APPENDIX A Detailed SIDRA Analysis Results for 2017 Existing

## A.1 Existing Queue Length Survey Results (2017)

Figure A-1 and Figure A-2 shows existing (2017) queue length survey results in 95th percentile and maximum queue lengths in meters and number of vehicles for AM and PM peak hour.


*Note: Surveyed queue length data was in number of vehicles. An average vehicle length of 7.5 metres was applied to convert vehicles to metres.*

*Figure A-1 Forecast Turning Volumes 2026 AM Peak (8-9AM)*




*Note: Surveyed queue length data was in number of vehicles. An average vehicle length of 7.5 metres was applied to convert vehicles to metres.*

*Figure A-2 Surveyed Queue Length (95th Percentile and Maximum) – PM Peak*

## A.2 Level of Service Results (SIDRA) – 2017 Existing

Wilberforce Road / Freemans Reach Road (sign control) - 2017 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Freemans Reach Road | 59 | E | 170 |
| East: Wilberforce Road | 8 | A | 0 |
| West: Bridge Street | 3 | A | 0 |
| **Overall (1)** | **59** | **E** | |

Wilberforce Road / Freemans Reach Road (sign control) - 2017 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Freemans Reach Road | 32 | C | 13 |
| East: Wilberforce Road | 60 | E | 7 |
| West: Bridge Street | 3 | A | 0 |
| **Overall (1)** | **60** | **E** | |

Bridge Street / George Street (roundabout) - 2017 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 6 | A | 298 |
| East: George Street | 41 | C | 12 |
| South: Bridge Street | 9 | A | 40 |
| West: George Street | 11 | A | 5 |
| **Overall (1)** | **41** | **C** | |

Bridge Street / George Street (roundabout) - 2017 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 6 | A | 40 |
| East: George Street | 13 | A | 2 |
| South: Bridge Street | 6 | A | 104 |
| West: George Street | 97 | F | 143 |
| **Overall (1)** | **97** | **F** | |

Bridge Street / Macquarie Street (traffic signals) - 2017 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 10 | A | 78 |
| South: Bridge Street | 6 | A | 27 |
| West: Macquarie Street | 37 | C | 54 |
| **Overall (2)** | **15** | **B** | |

Bridge Street / Macquarie Street (traffic signals) - 2017 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 19 | B | 74 |
| South: Bridge Street | 15 | B | 98 |
| West: Macquarie Street | 46 | D | 173 |
| **Overall (2)** | **29** | **C** | |

Bridge Street / Court Street (sign control) - 2017 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 4 | A | 0 |
| East: Court Street | 37 | C | 1 |
| South: Bridge Street | 22 | B | 3 |
| **Overall (1)** | **37** | **C** | |

Bridge Street / Court Street (sign control) - 2017 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 4 | A | 0 |
| East: Court Street | 22 | B | 0 |
| South: Bridge Street | 14 | B | 32 |
| **Overall (1)** | **22** | **B** | |

Note:
(1) Priority intersections such as a roundabout and sign controlled intersections, the Level of Service (LoS) value is determined by the critical movement with the highest delay.
(2) Signalised intersection, LoS criteria are related to the average intersection delay measured in seconds per vehicle.

# APPENDIX B Detailed SIDRA Analysis Results for 2026 and 2036 Do Nothing Scenario

## B.1 2026 and 2036 Forecast Turning Volumes for the AM peak (8 to 9am) and PM peak (4 to 5pm)

**Forecast 2026 AM (8-9 AM)**

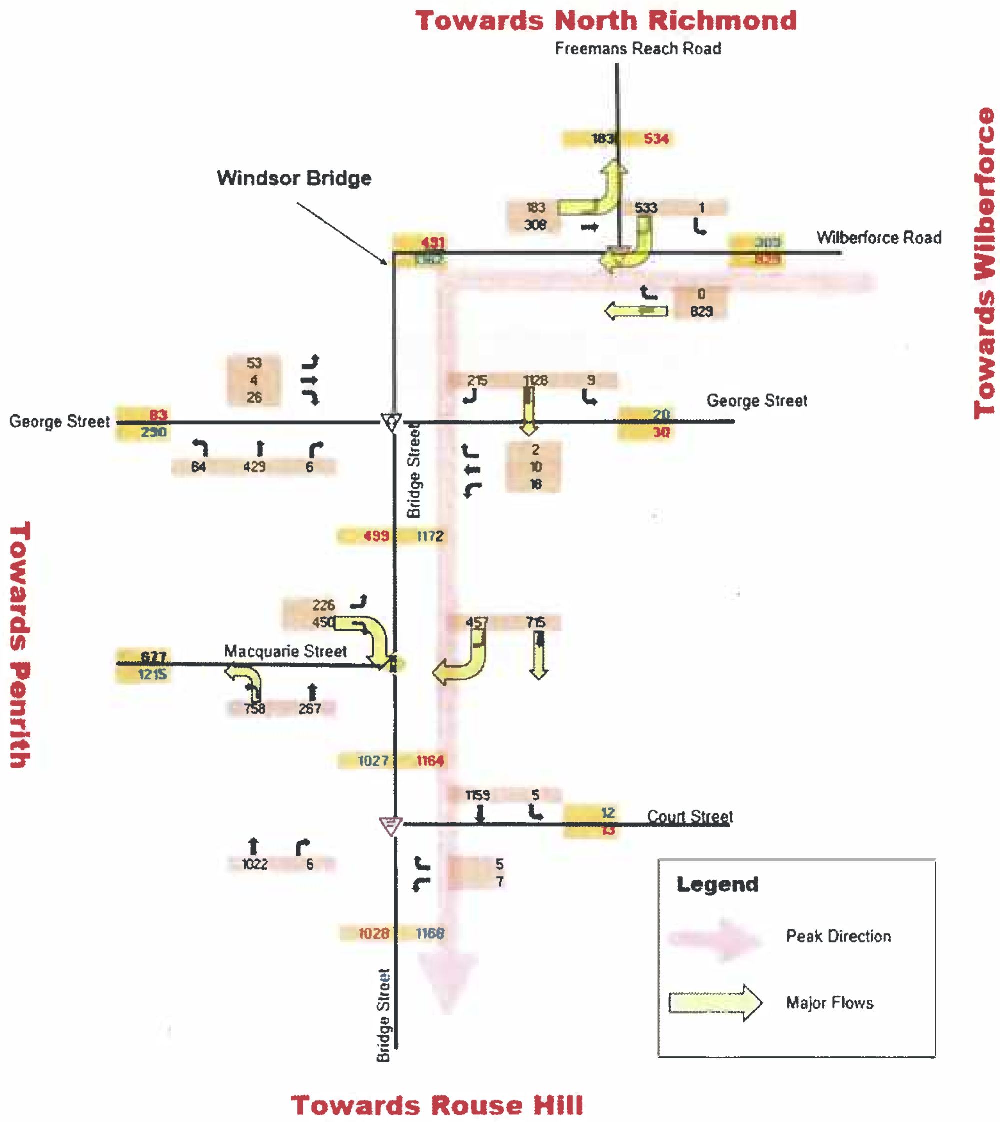



*Figure B-1 Forecast Turning Volumes 2026 AM Peak (8-9AM)*

**Forecast 2026 PM (4-5 PM)**

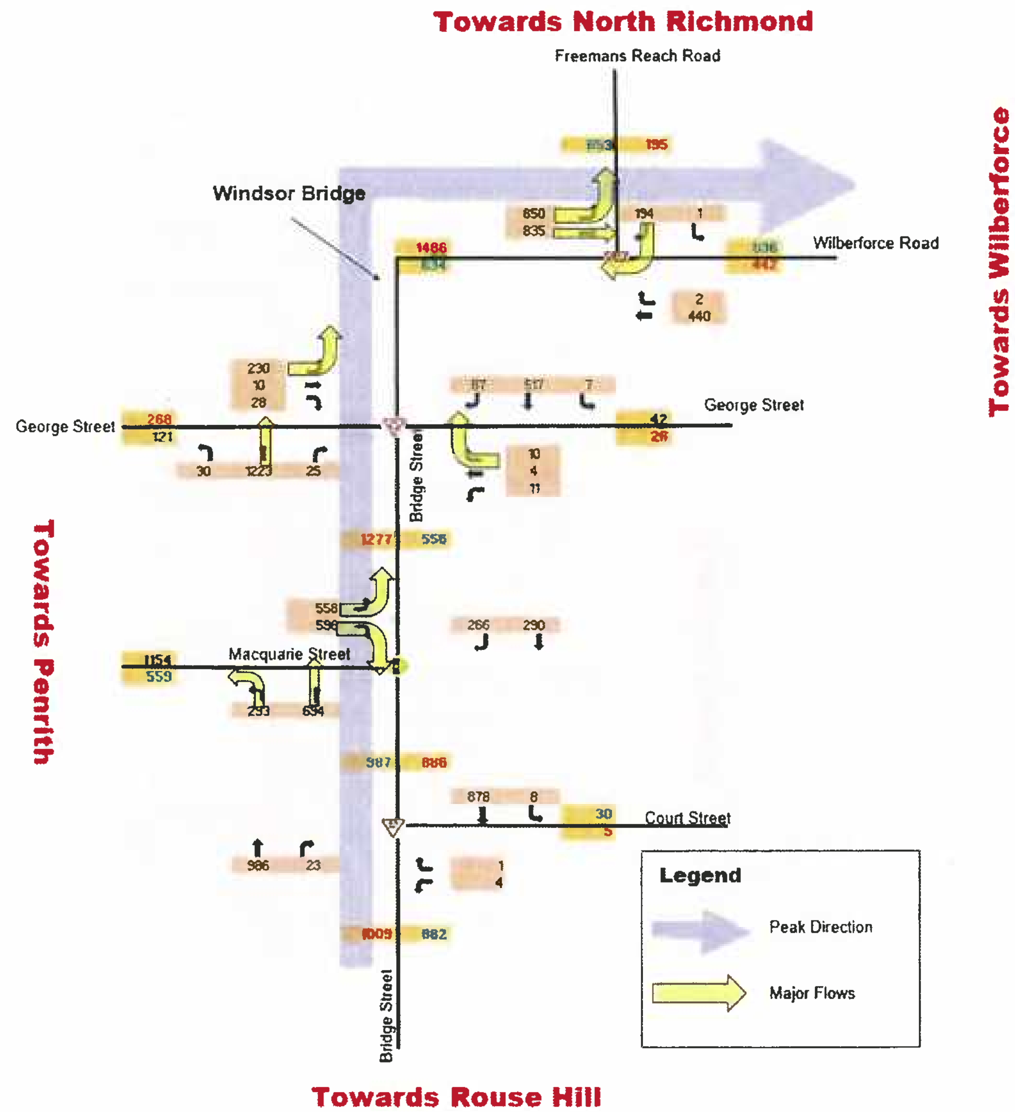



*Figure B-2 Forecast Turning Volumes 2026 PM Peak (4-5PM)*

**Forecast 2036 AM (8-9 AM)**

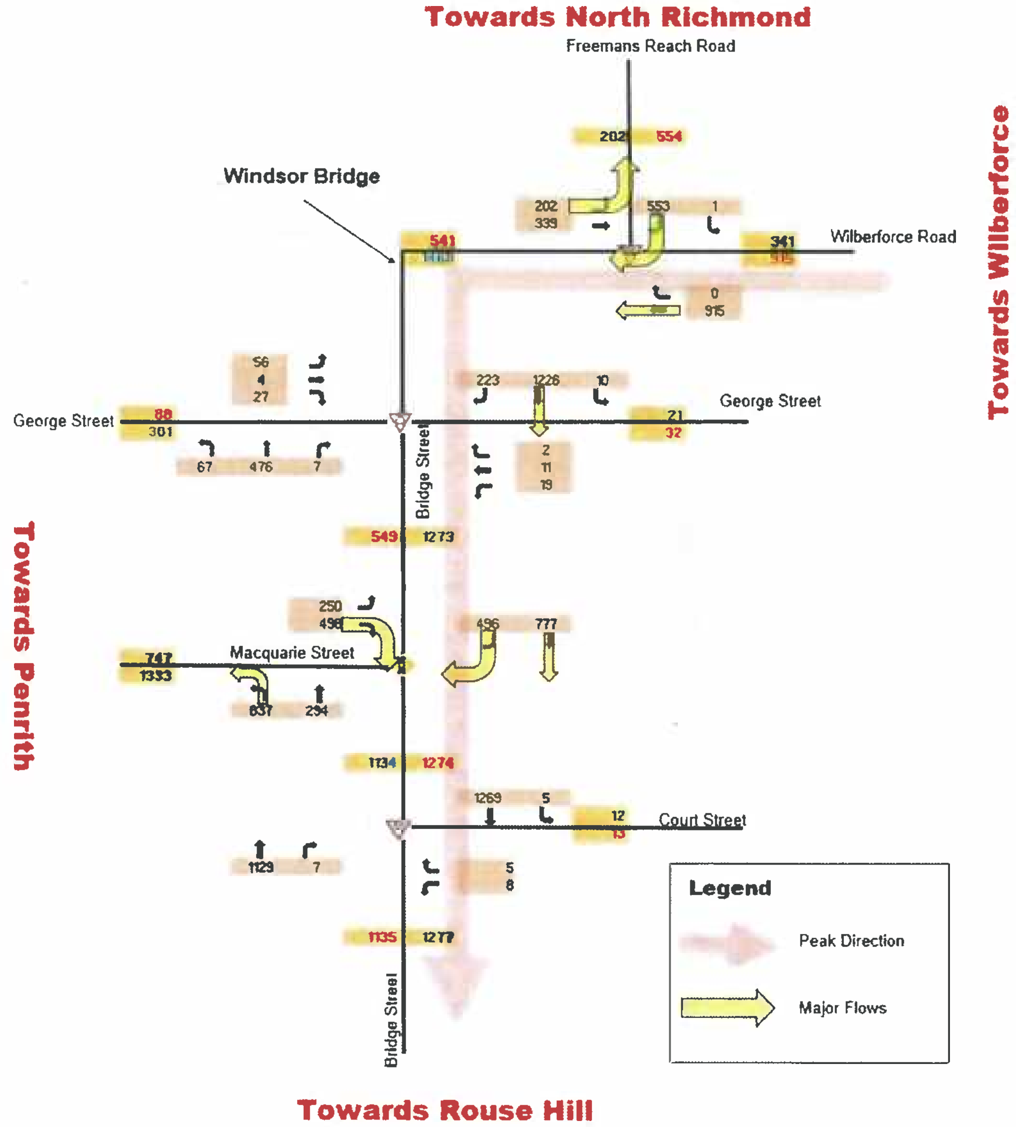



*Figure B-3 Forecast Turning Volumes 2036 AM Peak (8-9AM)*

**Forecast 2036 PM (4-5 PM)**

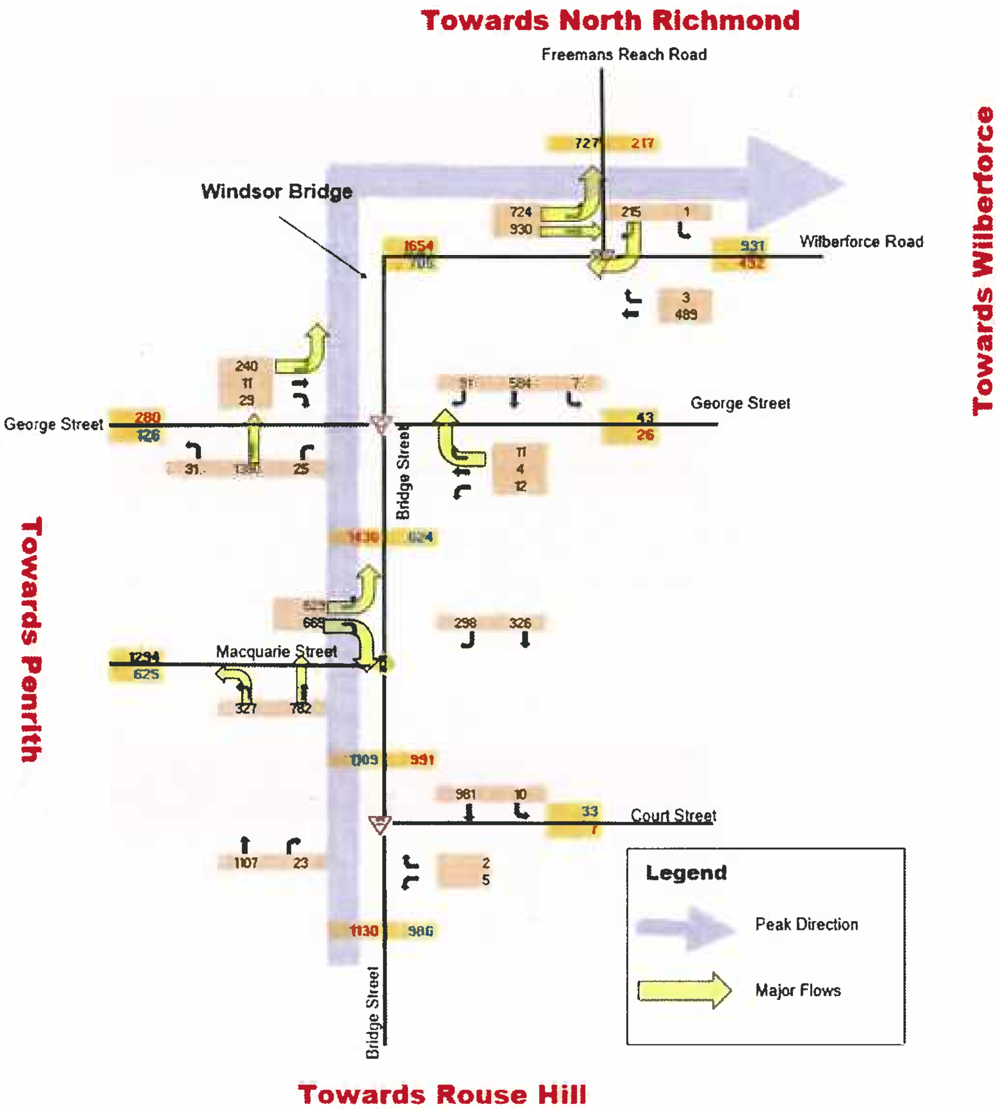



*Figure B-4 Forecast Turning Volumes 2036 PM Peak (4-5PM)*

## B.2 Level of Service Results (SIDRA) – 2026 Do Nothing Scenario

Wilberforce Road / Freemans Reach Road (sign control) - 2026 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Freemans Reach Road | 583 | F | 1200 |
| East: Wilberforce Road | 10 | A | 0 |
| West: Bridge Street | 3 | A | 0 |
| **Overall (1)** | **583** | **F** | |

Wilberforce Road / Freemans Reach Road (sign control) - 2026 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Freemans Reach Road | 34 | C | 29 |
| East: Wilberforce Road | 97 | F | 15 |
| West: Bridge Street | 3 | A | 0 |
| **Overall (1)** | **97** | **F** | |

Bridge Street / George Street (roundabout) - 2026 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 6 | A | 294 |
| East: George Street | 49 | D | 13 |
| South: Bridge Street | 10 | A | 56 |
| West: George Street | 12 | A | 6 |
| **Overall (1)** | **49** | **D** | |

Bridge Street / George Street (roundabout) - 2026 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 6 | A | 56 |
| East: George Street | 15 | B | 2 |
| South: Bridge Street | 7 | A | 154 |
| West: George Street | 351 | F | 427 |
| **Overall (1)** | **351** | **F** | |

Bridge Street / Macquarie Street (traffic signals) - 2026 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 17 | B | 104 |
| South: Bridge Street | 9 | A | 50 |
| West: Macquarie Street | 34 | C | 65 |
| **Overall (2)** | **18** | **B** | |

Bridge Street / Macquarie Street (traffic signals) - 2026 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 25 | B | 84 |
| South: Bridge Street | 348 | F | 98 |
| West: Macquarie Street | 47 | D | 182 |
| **Overall (2)** | **153** | **F** | |

Bridge Street / Court Street (sign control) - 2026 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 4 | A | 0 |
| East: Court Street | 51 | D | 2 |
| South: Bridge Street | 26 | B | 4 |
| **Overall (1)** | **51** | **D** | |

Bridge Street / Court Street (sign control) - 2026 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 4 | A | 0 |
| East: Court Street | 32 | C | 0 |
| South: Bridge Street | 17 | B | 961 |
| **Overall (1)** | **32** | **C** | |

Note:
(1) Priority intersections such as a roundabout and sign controlled intersections, the Level of Service (LoS) value is determined by the critical movement with the highest delay.
(2) Signalised intersection, LoS criteria are related to the average intersection delay measured in seconds per vehicle.

## B.3 Level of Service Results (SIDRA) – 2036 Do Nothing Scenario

Wilberforce Road / Freemans Reach Road (sign control) - 2036 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres)) |
|---|---|---|---|
| North: Freemans Reach Road | 1228 | F | 2061 |
| East: Wilberforce Road | 11 | A | 0 |
| West: Bridge Street | 3 | A | 0 |
| **Overall (1)** | **1228** | **F** | |

Wilberforce Road / Freemans Reach Road (sign control) - 2036 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Freemans Reach Road | 123 | F | 105 |
| East: Wilberforce Road | 104 | F | 186 |
| West: Bridge Street | 3 | A | 0 |
| **Overall (1)** | **123** | **F** | |

Bridge Street / George Street (roundabout) - 2036 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 7 | A | 350 |
| East: George Street | 63 | E | 15 |
| South: Bridge Street | 12 | A | 75 |
| West: George Street | 13 | A | 7 |
| **Overall (1)** | **63** | **E** | |

Bridge Street / George Street (roundabout) - 2036 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 6 | A | 74 |
| East: George Street | 16 | B | 3 |
| South: Bridge Street | 9 | A | 186 |
| West: George Street | 783 | F | 821 |
| **Overall (1)** | **783** | **F** | |

Bridge Street / Macquarie Street (traffic signals) - 2036 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 18 | B | 113 |
| South: Bridge Street | 9 | A | 56 |
| West: Macquarie Street | 37 | C | 79 |
| **Overall (2)** | **19** | **B** | |

Bridge Street / Macquarie Street (traffic signals) - 2036 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 27 | B | 97 |
| South: Bridge Street | 914 | F | 98 |
| West: Macquarie Street | 81 | F | 261 |
| **Overall (2)** | **376** | **F** | |

Bridge Street / Court Street (sign control) - 2036 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 4 | A | 0 |
| East: Court Street | 70 | E | 2 |
| South: Bridge Street | 31 | C | 7 |
| **Overall (1)** | **70** | **E** | |

Bridge Street / Court Street (sign control) - 2036 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 4 | A | 0 |
| East: Court Street | 47 | D | 1 |
| South: Bridge Street | 21 | B | 1793 |
| **Overall (1)** | **47** | **D** | |

Note:
(1) Priority intersections such as a roundabout and sign controlled intersections, the Level of Service (LoS) value is determined by the critical movement with the highest delay.
(2) Signalised intersection, LoS criteria are related to the average intersection delay measured in seconds per vehicle.

# APPENDIX C Detailed SIDRA Analysis Results for 2026 and 2036 with 'Concept Design'

## C.1 2026 and 2036 Forecast Turning Volumes for the AM peak (8 to9am) and PM peak (4 to 5pm) with Concept Design

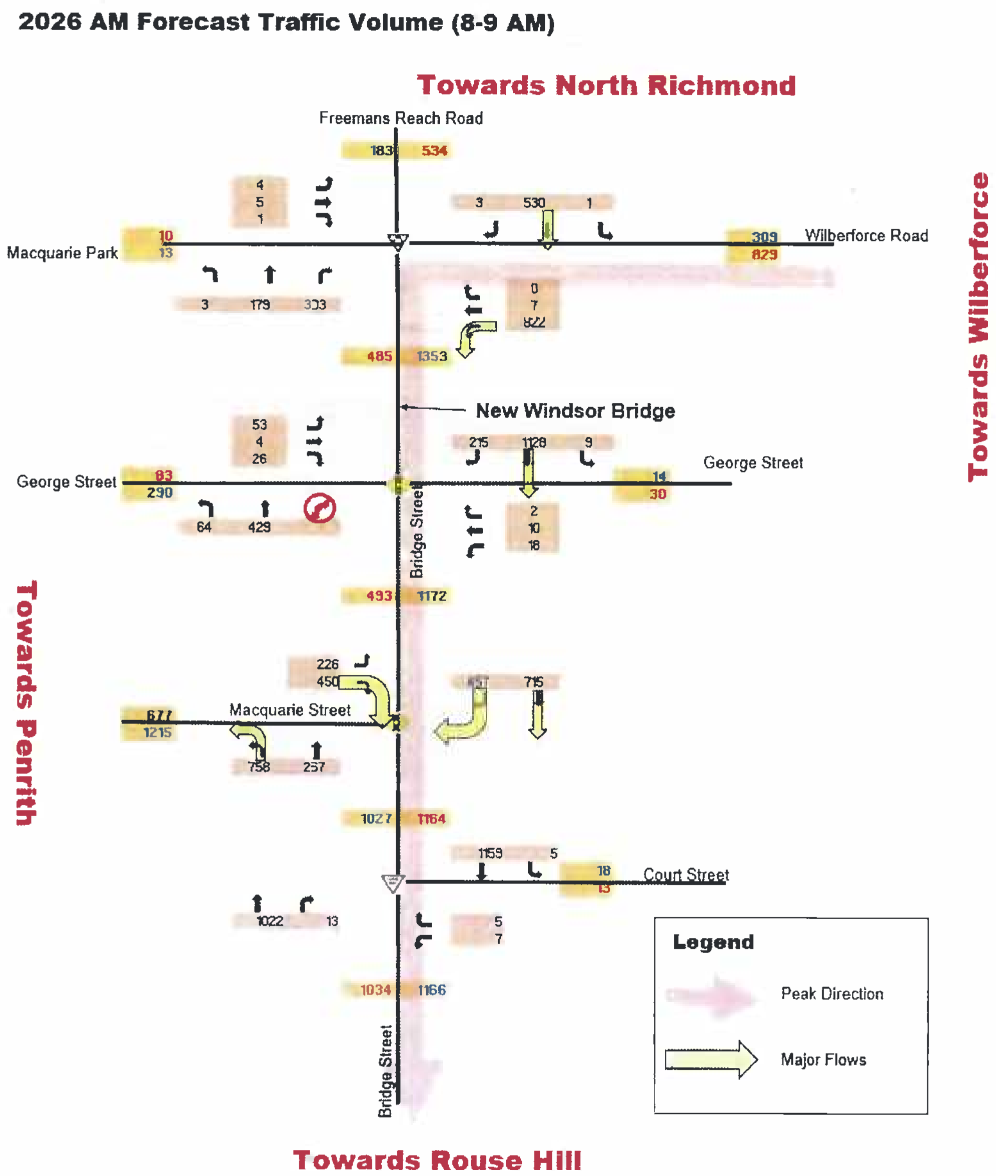



*Figure C-1 Forecast Turning Volumes 2026 AM Peak (8-9AM) – with Concept Design*

**2026 PM Forecast Traffic Volume (4-5 PM)**

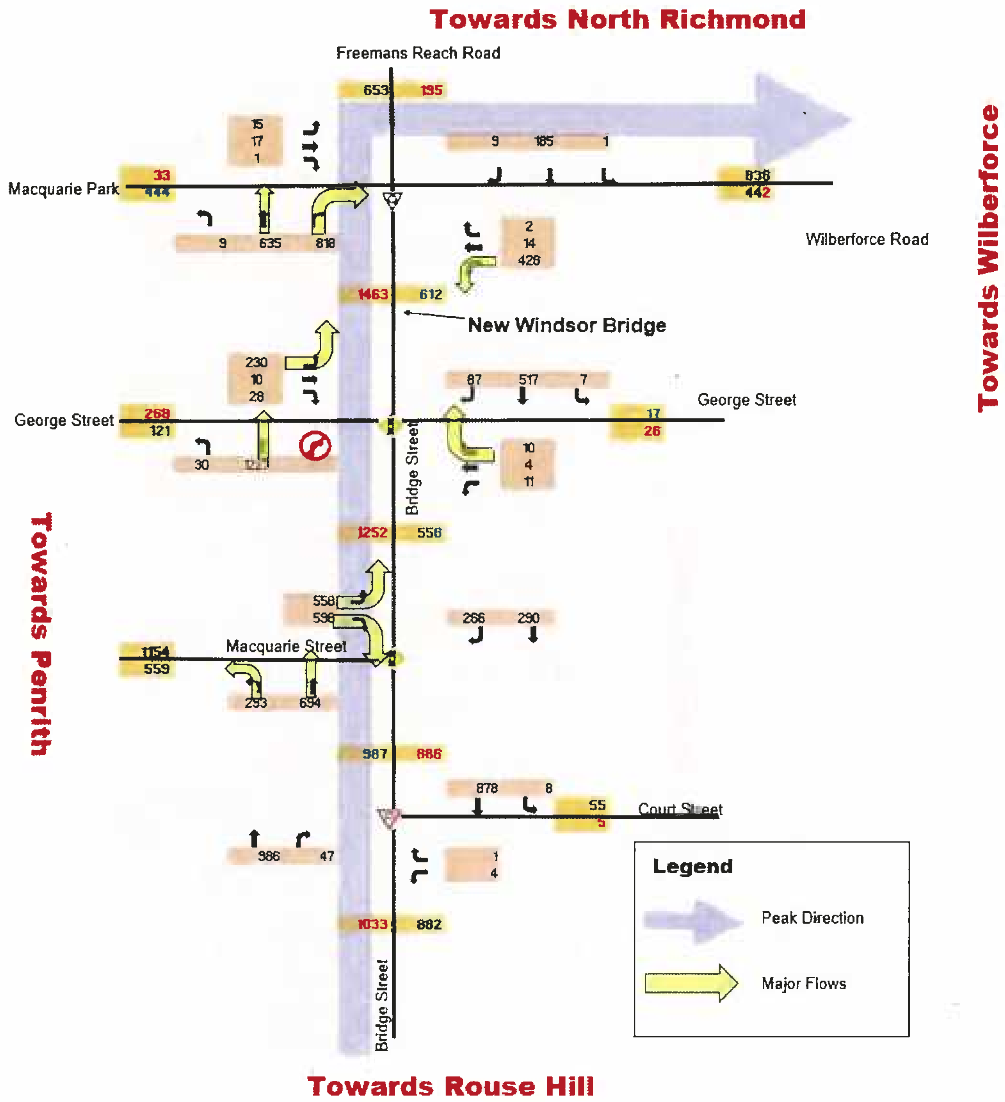



*Figure C-2 Forecast Turning Volumes 2026 PM Peak (4-5PM) – with Concept Design*

**2036 AM Forecast Traffic Volume (8-9 AM)**

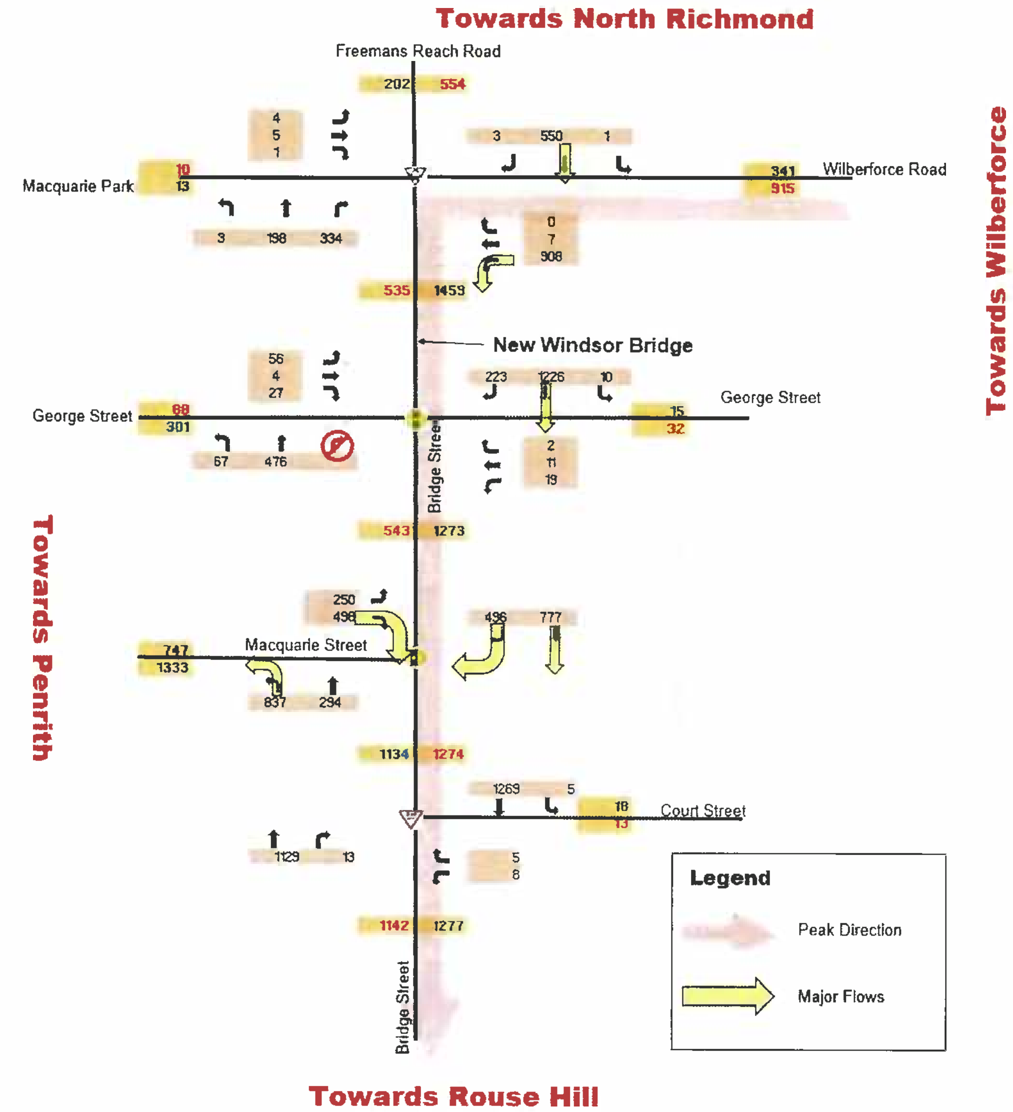



*Figure C-3 Forecast Turning Volumes 2036 AM Peak (8-9AM) – with Concept Design*

**2036 PM Forecast Traffic Volume (4-5 PM)**

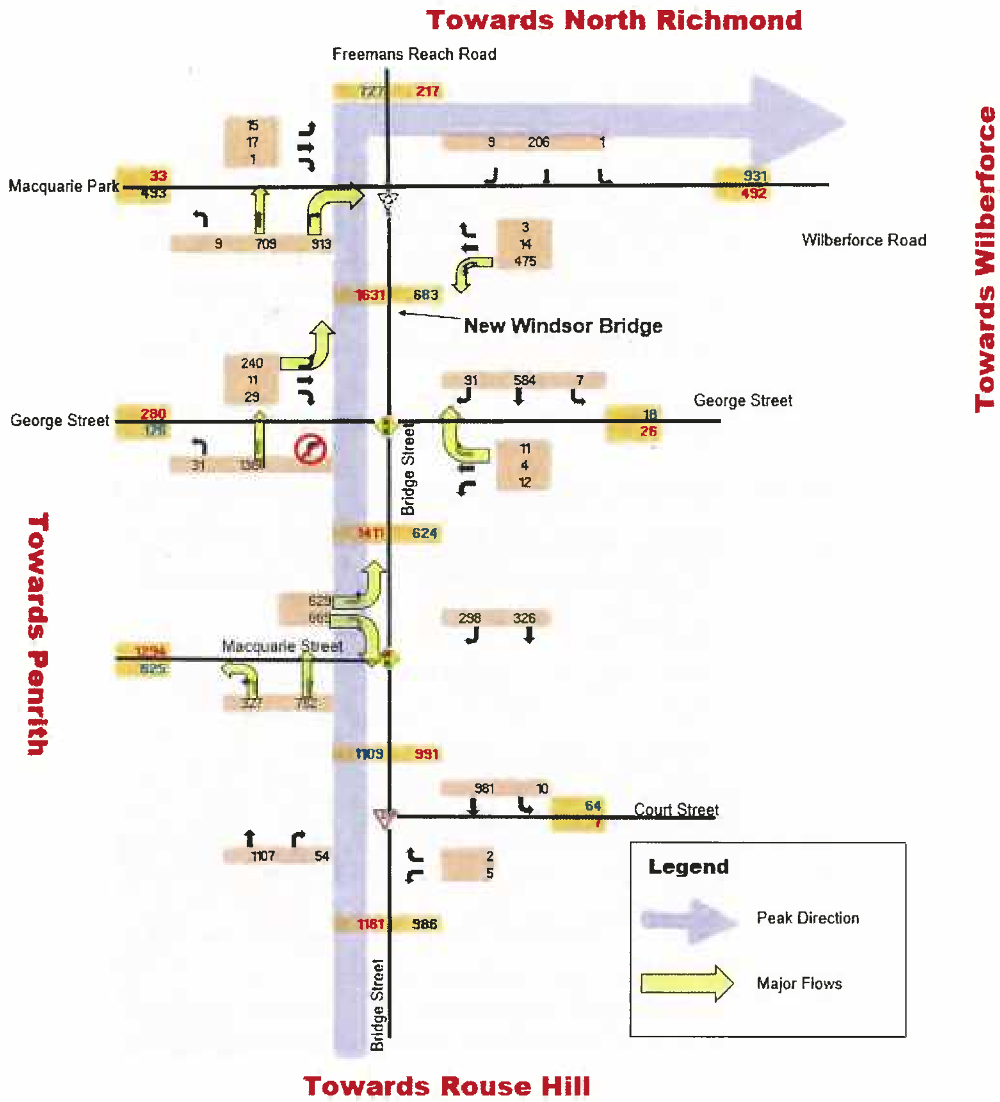



*Figure C-4 Forecast Turning Volumes 2036 PM Peak (4-5PM) – with Concept Design*

## C.2 Predicted Queue Lengths in 2026 and 2036 with Concept Design

Figure C-5 to Figure C-6 show predicted queue lengths (95th percentile) at Wilberforce Road / Freemans Reach Road, Bridge Street / George Street and Bridge Street / Macquarie Street for 2026 AM and PM with Concept Design.


*Figure C-5 Predicted 95th Percentile Queue Lengths in 2026 AM Peak with Concept Design*


*Figure C-6 Predicted 95th Percentile Queue Lengths in 2026 PM Peak with Concept Design*

Figure C-7 to Figure C-8 show predicted queue lengths (95th percentile) at Wilberforce Road / Freemans Reach Road, Bridge Street / George Street and Bridge Street / Macquarie Street for 2036 AM and PM with Concept Design.


*Figure C-7 Predicted 95th Percentile Queue Lengths in 2036 AM Peak with Concept Design*


*Figure C-8 Predicted 95th Percentile Queue Lengths in 2036 PM Peak with Concept Design*

## C.3 Level of Service Results (SIDRA) – 2026 with Concept Design

Wilberforce Road / Freemans Reach Road (new roundabout) - 2026 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Freemans Reach Road | 11 | A | 28 |
| East: Wilberforce Road | 15 | B | 36 |
| South: Bridge Street | 10 | A | 7 |
| West: Macquarie Park | 11 | A | 0 |
| **Overall (1)** | **15** | **B** | |

Wilberforce Road / Freemans Reach Road (new roundabout) - 2026 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Freemans Reach Road | 14 | A | 0 |
| East: Wilberforce Road | 11 | A | 9 |
| South: Bridge Street | 9 | A | 25 |
| West: Macquarie Park | 17 | B | 3 |
| **Overall (1)** | **17** | **B** | |

Bridge Street / George Street (new traffic signals) - 2026 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 12 | A | 154 |
| East: George Street | 47 | D | 6 |
| South: Bridge Street | 29 | C | 122 |
| West: George Street | 27 | B | 11 |
| **Overall (2)** | **17** | **B** | |

Bridge Street / George Street (new traffic signals) - 2026 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 14 | A | 72 |
| East: George Street | 74 | F | 8 |
| South: Bridge Street | 84 | F | 122 |
| West: George Street | 66 | E | 110 |
| **Overall (2)** | **62** | **E** | |

Bridge Street / Macquarie Street (traffic signals) - 2026 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 12 | A | 89 |
| South: Bridge Street | 15 | B | 77 |
| West: Macquarie Street | 44 | D | 91 |
| **Overall** (2) | **21** | **B** | |

Bridge Street / Macquarie Street (traffic signals) - 2026 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 35 | C | 123 |
| South: Bridge Street | 75 | F | 98 |
| West: Macquarie Street | 50 | D | 242 |
| **Overall** (2) | **56** | **E** | |

Note:
(1) Priority intersections such as a roundabout and sign controlled intersections, the Level of Service (LoS) value is determined by the critical movement with the highest delay.
(2) Signalised intersection, LoS criteria are related to the average intersection delay measured in seconds per vehicle.

## C.4 Level of Service Results (SIDRA) – 2036 with Concept Design

Wilberforce Road / Freemans Reach Road (new roundabout) - 2036 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Freemans Reach Road | 11 | A | 31 |
| East: Wilberforce Road | 17 | B | 48 |
| South: Bridge Street | 10 | A | 8 |
| West: Macquarie Park | 11 | A | 0 |
| **Overall (1)** | **17** | **B** | |

Wilberforce Road / Freemans Reach Road (new roundabout) - 2036 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Freemans Reach Road | 14 | A | 24 |
| East: Wilberforce Road | 11 | A | 11 |
| South: Bridge Street | 9 | A | 26 |
| West: Macquarie Park | 17 | B | 3 |
| **Overall (1)** | 17 | **B** | |

Bridge Street / George Street (new traffic signals) - 2036 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 16 | B | 215 |
| East: George Street | 47 | D | 7 |
| South: Bridge Street | 46 | C | 122 |
| West: George Street | 28 | B | 12 |
| **Overall (2)** | **25** | **B** | |

Bridge Street / George Street (new traffic signals) - 2036 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 13 | A | 86 |
| East: George Street | 75 | F | 8 |
| South: Bridge Street | 268 | F | 122 |
| West: George Street | 67 | E | 117 |
| **Overall (2)** | **169** | **F** | |

Bridge Street / Macquarie Street (traffic signals) - 2036 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 12 | A | 107 |
| South: Bridge Street | 19 | B | 98 |
| West: Macquarie Street | 56 | D | 121 |
| **Overall (2)** | **25** | **B** | |

Bridge Street / Macquarie Street (traffic signals) - 2036 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 37 | C | 123 |
| South: Bridge Street | 181 | F | 98 |
| West: Macquarie Street | 58 | E | 313 |
| **Overall (2)** | **99** | **F** | |

Note:
(1) Priority intersections such as a roundabout and sign controlled intersections, the Level of Service (LoS) value is determined by the critical movement with the highest delay.
(2) Signalised intersection, LoS criteria are related to the average intersection delay measured in seconds per vehicle.

# APPENDIX D Detailed SIDRA Analysis Results for 2026 and 2036 with 'Modified Concept Design'

## D.1 Predicted Queue Lengths in 2026 and 2036 with Modified Concept Design

Figure D-1 to Figure D-2 show predicted queue lengths (95th percentile) at Wilberforce Road / Freemans Reach Road, Bridge Street / George Street and Bridge Street / Macquarie Street for 2026 AM and PM with Modified Concept Design.


*Figure D-1 Predicted 95th Percentile Queue Lengths in 2026 AM Peak with Modified Concept Design*


*Figure D-2 Predicted 95th Percentile Queue Lengths in 2026 PM Peak with Modified Concept Design*

Figure D-3 to Figure D-4 show predicted queue lengths (95th percentile) at Wilberforce Road / Freemans Reach Road, Bridge Street / George Street and Bridge Street / Macquarie Street for 2036 AM and PM with Modified Concept Design.

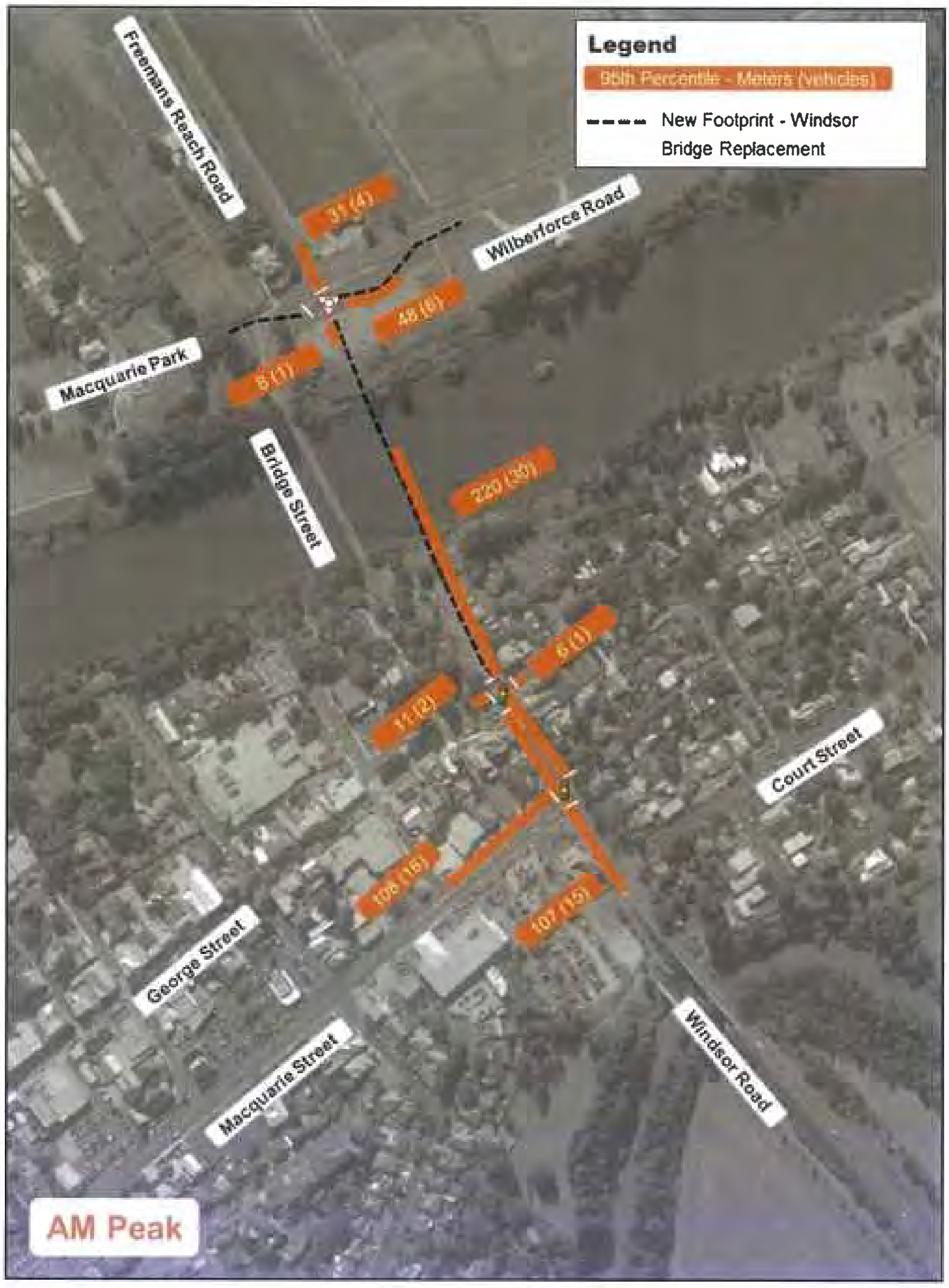



*Figure D-3 Predicted 95th Percentile Queue Lengths in 2036 AM Peak with Modified Concept Design*


*Figure D-4 Predicted 95th Percentile Queue Lengths in 2036 PM Peak with Modified Concept Design*

## D.2 Level of Service Results (SIDRA) – 2026 with Modified Concept Design

Wilberforce Road / Freemans Reach Road (new roundabout) - 2026 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Freemans Reach Road | 11 | A | 27 |
| East: Wilberforce Road | 15 | B | 36 |
| South: Bridge Street | 10 | A | 7 |
| West: Macquarie Park | 11 | A | 0 |
| **Overall (1)** | **15** | **B** | |

Wilberforce Road / Freemans Reach Road (new roundabout) - 2026 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Freemans Reach Road | 16 | B | 17 |
| East: Wilberforce Road | 11 | A | 9 |
| South: Bridge Street | 9 | A | 25 |
| West: Macquarie Park | 17 | B | 3 |
| **Overall (1)** | **17** | **B** | |

Bridge Street / George Street (new traffic signals) - 2026 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 11 | A | 139 |
| East: George Street | 49 | D | 6 |
| South: Bridge Street | 26 | B | 122 |
| West: George Street | 27 | B | 11 |
| **Overall (2)** | **16** | **B** | |

Bridge Street / George Street (new traffic signals) - 2026 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 9 | A | 75 |
| East: George Street | 74 | F | 8 |
| South: Bridge Street | 14 | A | 122 |
| West: George Street | 67 | E | 113 |
| **Overall (2)** | **20** | **B** | |

Bridge Street / Macquarie Street (traffic signals) - 2026 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 11 | A | 84 |
| South: Bridge Street | 12 | A | 55 |
| West: Macquarie Street | 49 | D | 99 |
| **Overall (2)** | **20** | **B** | |

Bridge Street / Macquarie Street (traffic signals) - 2026 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 31 | C | 122 |
| South: Bridge Street | 35 | C | 98 |
| West: Macquarie Street | 67 | E | 284 |
| **Overall (2)** | **48** | **D** | |

Note:
(1) Priority intersections such as a roundabout and sign controlled intersections, the Level of Service (LoS) value is determined by the critical movement with the highest delay.
(2) Signalised intersection, LoS criteria are related to the average intersection delay measured in seconds per vehicle.

## D.3 Level of Service Results (SIDRA) – 2036 with Modified Concept Design

Wilberforce Road / Freemans Reach Road (new roundabout) - 2036 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Freemans Reach Road | 11 | A | 31 |
| East: Wilberforce Road | 17 | B | 48 |
| South: Bridge Street | 10 | A | 8 |
| West: Macquarie Park | 11 | A | 0 |
| **Overall (1)** | **17** | **B** | |

Wilberforce Road / Freemans Reach Road (new roundabout) - 2036 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Freemans Reach Road | 19 | B | 25 |
| East: Wilberforce Road | 11 | A | 11 |
| South: Bridge Street | 9 | A | 31 |
| West: Macquarie Park | 19 | B | 3 |
| **Overall (1)** | **19** | **B** | |

Bridge Street / George Street (new traffic signals) - 2036 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 17 | B | 227 |
| East: George Street | 46 | D | 6 |
| South: Bridge Street | 40 | C | 122 |
| West: George Street | 27 | B | 11 |
| **Overall (2)** | **24** | **B** | |

Bridge Street / George Street (new traffic signals) - 2036 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 12 | A | 90 |
| East: George Street | 73 | F | 8 |
| South: Bridge Street | 30 | C | 122 |
| West: George Street | 67 | E | 117 |
| **Overall (2)** | **30** | **C** | |

Bridge Street / Macquarie Street (traffic signals) - 2036 AM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 13 | A | 116 |
| South: Bridge Street | 19 | B | 98 |
| West: Macquarie Street | 47 | D | 108 |
| **Overall (2)** | **23** | **B** | |

Bridge Street / Macquarie Street (traffic signals) - 2036 PM

| Approach / Road | Average Delay (sec) | LoS | 95th Percentile Queue (metres) |
|---|---|---|---|
| North: Bridge Street | 38 | C | 122 |
| South: Bridge Street | 70 | E | 98 |
| West: Macquarie Street | 117 | F | 433 |
| **Overall (2)** | **83** | **F** | |

Note:
(1) Priority intersections such as a roundabout and sign controlled intersections, the Level of Service (LoS) value is determined by the critical movement with the highest delay.
(2) Signalised intersection, LoS criteria are related to the average intersection delay measured in seconds per vehicle.