Australian Government
Nation Building Program

NSW GOVERNMENT
Transport Roads & Maritime Services

Richmond Bridge and approaches congestion study

Preferred short-term and long-term options report

February 2013

RMS 13.191 ISBN 978-1-922194-25-1

About this document

The Richmond Bridge and approaches congestion study details the selection of both short-term and long-term preferred options. It is divided into three parts:

Part 1 of the study examined the structural integrity of the Richmond Bridge and the findings were included in the “Richmond Bridge and Approaches Congestion Study - Stage 1 Summary Report” (short-term report) and is available on the project website.

Part 2 of the study investigated and recommended preferred short-term improvements to ease traffic congestion along the corridor through to 2021.

Part 3 developed and recommended long-term strategic options to ease traffic congestion along the corridor from 2021 to 2036.

Roads and Maritime Services

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Executive summary

Introduction

The town of Richmond is located about 65 kilometres north-west of the Sydney CBD in the Hawkesbury City Council (HCC) local government area. It is a Macquarie town, important for its streetscapes and heritage character.

Richmond Bridge is listed on the NSW Roads and Maritime Services (RMS) heritage register and assessed as being of State significance. It spans the Hawkesbury River, connecting Richmond to the east with North Richmond to the west.

Richmond Bridge is the only Hawkesbury River crossing serving the residential catchment of North Richmond, Kurrajong, Bilpin, Bell and beyond. Planned new residential developments will add further pressure to the surrounding road network.

Urban expansion and land use changes in north-western Sydney contribute to the traffic growth on the existing road network. This is causing traffic congestion during peak hours on the existing infrastructure, including on Richmond Bridge. In the peak periods traffic flows across the bridge in a distinct pattern – eastbound traffic is heavy in the morning peak and westbound traffic is heavy in the afternoon peak.

Initial investigations found that the level of service along this section of road is below the average for similar roads in Sydney. It was concluded that, unless the capacity of the corridor is increased to address current as well as projected future development in the area, traffic congestion will continue to deteriorate.

In August 2010 the Federal Minister for Infrastructure and Transport, the Hon Anthony Albanese MP, announced that the Australian Government would provide $2 million to the NSW Government to undertake a congestion study of the corridor between Richmond and North Richmond. This would involve planning work to address traffic congestion on Richmond Bridge, including investigations of options in which an extra lane could be added to the bridge and a contraflow system be introduced for the morning and afternoon traffic peaks.

RMS commissioned consultancy companies Hyder Consulting Pty Ltd to undertake investigations into potential short-term solutions and SMEC Australia Pty Ltd to conduct a study to develop a long-term solution to traffic congestion along the corridor. This report provides details of both the preferred short-term road improvements to ease congestion and the long-term strategic option for the corridor.

Study area

The study area is the same for both the short and long-term options. It includes March Street, Kurrajong Road and Bells Line of Road between East Market Street in Richmond and Grose Vale Road in North Richmond which experience significant traffic congestion during peak hours. This is predominantly a two-lane, two-way route which includes the two-lane Richmond Bridge (one-lane in each direction) and is heavily used by passenger cars. Figure i on the following page shows the study area.

Source - Vector Backdrop Data © 2011

Figure i - Study area

Purpose and objective of the study

The purpose of the Richmond Bridge and Approaches Congestion Study is to recommend short-term (to 2021) and long-term (to 2036) options to best address traffic congestion on the Richmond Bridge and its approach roads. To do this the study aims to identify and assess traffic movements, environmental / heritage considerations, safety concerns, the structural integrity of the bridge and any corridor reservation issues and undertake extensive community consultation.

The primary objective of the study is to recommend options to improve travel conditions and road safety along the corridor between Richmond and North Richmond, in both the short-term and the long-term. To achieve this objective, the study has taken into careful consideration the need to:

- Ensure that the operation of Richmond Bridge and its approaches can be maintained during any required construction work
- Maintain / improve the accessibility of Richmond Bridge
- Minimise the impacts on the built and natural environment along the route
- Minimise the whole of life cost of the project.

Scope of the study

The scope of the study comprises the investigation of the following components:

- The structural integrity of the bridge and its suitability for widening
- Short-term solutions to improve travel conditions between Richmond and North Richmond
- Long-term options to improve travel conditions between Richmond and North Richmond

Study methodologies

As the three components of the scope required different and specific investigative knowledge, skills and methodologies, they were undertaken separately by the appropriate specialists:

- RMS bridge experts examined the structural integrity of Richmond Bridge
- Hyder Consulting Pty Ltd investigated short-term solutions
- SMEC Australia Pty Ltd assessed the long-term options.

Richmond Bridge

RMS bridge engineers carried out a structural inspection of the bridge to assess its existing condition and conducted an analytical assessment using Microstran and ACES computer modelling software. These assessments provided the basis for analysis of potential future widening of the bridge, its maintenance and risk management strategies.

Short-term solutions

Hyder developed a road based traffic model, using Paramics and SIDRA software, to investigate the performance of Richmond Bridge and the sections of March Street, Kurrajong Road, and Bells Line of Road between East Market Street in Richmond and Grose Vale Road in North Richmond. This model identified key network issues that affect the performance of Richmond Bridge and the adjoining approach roads, and short-term options for the improvement of traffic flow.

A Road Safety Audit of the existing road conditions and the proposed improvements to intersections was also conducted.

Based on the traffic modelling investigations, 10 preliminary options which would provide improvement to congestion were identified. In consultation with stakeholders, eight options (A to H) were short listed for detailed assessment. These options involved minor improvements, such as intersection widening and the imposition of clearway (no street parking) conditions during peak periods to maintain an acceptable level of traffic operation and congestion management.

Long-term options

SMEC undertook an initial desktop analysis of available data which resulted in a long list of preliminary options. Further technical studies were carried out to identify project constraints and develop a shortlist of the options. Four options (A to D) were selected for more detailed investigation and development. The methodologies used to identify these options included:

- Strategic traffic modelling using the EMME/2, SIDRA and Paramics software assessed the various scenarios for possible future development and the provision of infrastructure
- Flood modelling using a RUBICON model on the Hawkesbury-Nepean River to understand the behaviour of flows across the flood plain in times of flood and to allow for the determination of drainage structure requirements across the flood plain
- Environmental and heritage (Aboriginal and non-Aboriginal) studies to gain an understanding of the constraints and opportunities within the project study area
- Preliminary geotechnical investigation of the four corridor options.

Following these technical studies strategic concept engineering designs were prepared to facilitate the identification of construction staging, road safety and alignment issues and opportunities.

Community consultation

Community consultation was an important element in the identification and development of both the short-term and long-term options. Media releases, community update publications, workshops, information sessions, online comments and interviews were used to engage the community and ensure that community members and stakeholders had opportunities to contribute to the options selection process.

Options determination

The information collected through public consultation, workshops and technical investigation was considered against a range of criteria, together with the strategic cost estimates. This facilitated the assessment and comparison of various options and determination of the preferred solution / route option.

Key findings

Richmond Bridge

The traffic study highlighted the fact that the two-lane bridge is close to saturation level during peak hours thus indicating the need for additional traffic lanes in the medium to long-term. The preliminary investigations of the bridge confirmed that it is structurally suitable to carry the current traffic loads and that any widening of the bridge should be carried out as an independent structure on the downstream side.

Short-term options investigation

The results of the traffic analysis suggested that Richmond Bridge is close to saturation traffic levels and is reaching the current capacity of the corridor. During morning and afternoon peak periods, the operation of Richmond Bridge is adversely affected by some of the turning movements at key approach intersections on Bells Line of Road and Kurrajong Road. The following three key intersections are particularly affected:

- Bells Line of Road / Grose Vale Road (currently traffic light controlled)
- Kurrajong Road / Yarramundi Lane / Old Kurrajong Road (currently sign control)
- Kurrajong Road / Bosworth Street (currently traffic light controlled).

Preferred short-term solution

The preferred short-term solution is Option H with additional improvements to the intersection at Grose Vale Road. This would provide a relatively better outcome than the other options.

Option H comprises improvements to the three intersections, together with the imposition of peak period clearways on Bells Line of Road between Grose Vale Road and Pitt Lane and on Kurrajong Road between Chapel Street and Bosworth Street. Following community feedback, Option H was modified to permit eastbound right turns from Bells Line of Road into Grose Vale Road.

The long-term congestion study identified further improvements to the Bells Line of Road / Grose Vale Road intersection. They are the:

- Provision of two dedicated right turn lanes from Grose Vale Road into Bells Line of Road
- Provision of a dedicated left turn lane from Bells Line of Road into Grose Vale Road.

These suggestions have been incorporated into the preferred short-term improvements.

More specifically, the short-term improvement works would include:

Improvements to the Bells Line of Road / Grose Vale Road intersection

- Providing a dedicated left turn lane from Bells Line of Road to Grose Vale Road
- Imposing a clearway on Bells Line of Road between Pitt Lane and Grose Vale Road, during peak periods
- Extending the eastbound merge on Bells Line of Road (east of the Grose Vale Road intersection) and widening the intersection to provide for the retention of east / southbound right turns from Bells Line of Road to Grose Vale Road
- Providing two dedicated right turn lanes from Grose Vale Road to Bells Line of Road (north and east bound)
- Providing two westbound through lanes on Bells Line of Road.

Improvements to the Kurrajong Road / Yarramundi Lane / Old Kurrajong Road intersection

- Widen the intersection to provide an exclusive right turn bay for east and south bound right turns from Kurrajong Road to Yarramundi Lane
- Provide a left turn slip lane out of Yarramundi Lane with a westbound acceleration lane on Kurrajong Road.

Improvements to the Kurrajong Road / Bosworth Street intersection

- Impose a clearway on Kurrajong Road between Chapel Street and Bosworth Street during peak periods
- Widen the intersection to provide an additional eastbound exclusive right turn bay from Kurrajong Road to Bosworth Street
- Ban right turns from March Street to Bosworth Street north.

These works would improve the major east-west movement of traffic on this section of Bells Line of Road and Kurrajong Road in the short-term to 2021.

Estimated cost and Benefit to Cost Ratio (BCR)

The implementation of the short-term solutions at the three key intersections (Bosworth Street, Old Kurrajong Road / Yarramundi Lane and Grose Vale Road) is estimated to cost $28 million (in 2012 dollars at P90). The short-term solutions are estimated to provide a Benefit to Cost Ratio (BCR) of 9.

Long-term options investigation

The following short-listed road and bridge alignment options were identified and assessed. They all involve the restriction of parking along the corridor in Richmond and North Richmond to provide for four traffic lanes during the morning and afternoon peak periods.

Option A

Three-lane contraflow traffic management on the bridge to provide two lanes in the peak direction with no change to the current level of flood immunity. This would involve:

- Widening the existing bridge downstream to accommodate three travel lanes
- Adding two lanes to the Kurrajong Road eastbound carriageway between Chapel Street and Old Kurrajong Road / Yarramundi Lane to provide four lanes (two lanes in each direction)
- Contraflow traffic management from approximately 50 metres west of Old Kurrajong Road / Yarramundi Lane to approximately 120 metres east of Pitt Lane, including across the bridge.

Option B

A total of four lanes (two in each direction) with a new bridge and additional eastbound carriageway with no change to the current flood immunity. This would involve:

- Constructing a new two-lane bridge five metres downstream from the existing bridge
- Retaining the existing bridge
- Adding two lanes to the Kurrajong Road eastbound carriageway between Chapel Street and Old Kurrajong Road / Yarramundi Lane to provide four lanes (two lanes in each direction).

Option C

A total of four lanes (two in each direction) with a new bridge and additional eastbound carriageway constructed at a level which would provide 1:5 year ARI flood immunity. This would involve:

- Constructing a new two-lane bridge 25-50 metres downstream from the existing bridge
- Retaining the existing bridge
- Adding two lanes to the Kurrajong Road eastbound carriageway between Chapel Street and Old Kurrajong Road / Yarramundi Lane to provide four lanes (two lanes in each direction).

Option D

A total of four lanes (two in each direction) with a new bridge and additional eastbound carriageway constructed at a level which would provide 1:20 year ARI flood immunity. This would involve:

- Constructing a new two-lane bridge 25-50 metres downstream from the existing bridge
- Retaining the existing bridge
- Adding two lanes to the Kurrajong Road eastbound carriageway between Chapel Street and Old Kurrajong Road / Yarramundi Lane to provide four lanes (two lanes in each direction)
- Restricting some turning movements at Old Kurrajong Road / Yarramundi Lane.

The following movements will not be possible at the intersection of Old Kurrajong Road and Yarramundi Lane with Kurrajong Road:

- Right turn from Old Kurrajong Road into Kurrajong Road to head west
- Right turn from Kurrajong Road into Old Kurrajong Road to head north
- Through movements from Old Kurrajong Road across Kurrajong Road and into Yarramundi Lane and vice versa.

New four-lane bridge sub-option

The construction of a new four-lane bridge on the downstream side of the existing bridge was also considered as a sub-option of Options C and D. This would provide the same level of flood immunity as Options C and D and two lanes in each direction across a single bridge. The existing bridge could then be used for recreational purposes, such as a green link pedestrian and cycle route across the river.

The new four-lane bridge could be accommodated within the proposed corridor. Due to height difference in the approach alignment, this option would have impacts on turning movements at Old Kurrajong Road / Yarramundi Lane, requiring adjustments at Bosworth Street to cater for the additional traffic.

Preferred long-term option

Based on the comparison of the outcomes and value for money considerations, Option D is recommended as the preferred long-term option for the following key reasons:

- It is the highest performing option when compared to the other options on the non-price performance criteria
- It provides the greatest improvement to road safety and road capacity when compared with the other options
- In terms of noise, social amenity, local economic and environmental criteria, its performance is no worse than Option C and only marginally worse than Options A and B
- It has the highest score in terms of the community view criteria. This is strongly influenced by the higher level of flood immunity it provides (1:20 year ARI) compared with the other options.

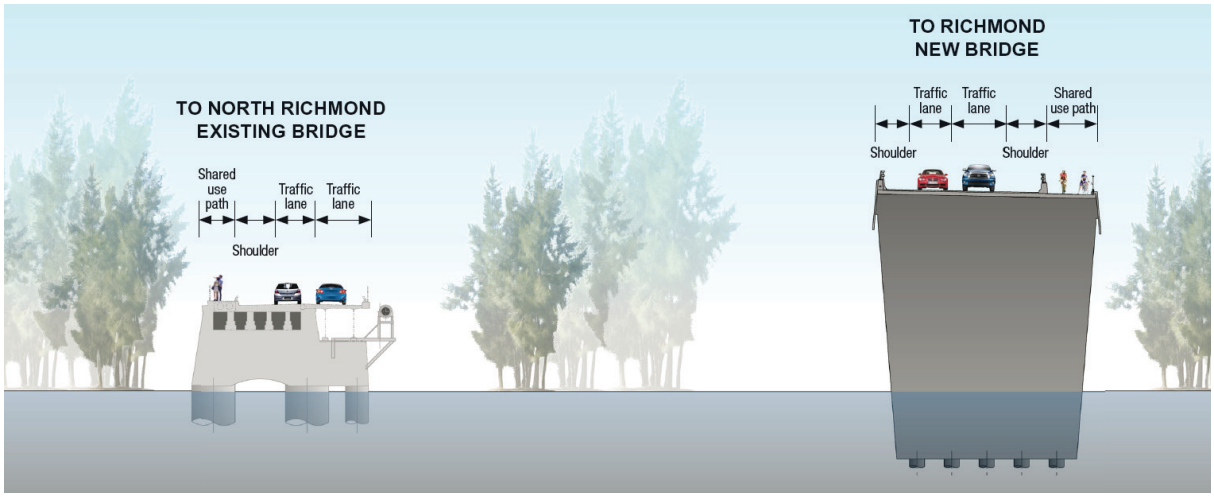

Figure ii - Option D cross section of bridge: graphical representation

Figure iii - Option D view of bridge from existing bridge: artist's impression

Figure iv - Option D view of bridge from downstream of the existing bridge: artist's impression

Estimated cost and Benefit to Cost Ratio (BCR)

The strategic cost estimate for Option D is $154 million (in 2012 dollars at P90) with an estimated Benefit to Cost Ratio (BCR) of 2.8.

Bells Line of Road

Bells Line of Road provides a supplementary link to the Great Western Highway which runs between the Sydney Basin and the Central West Region of New South Wales. It is one of the few escarpment crossings supporting the Great Western Highway and acts as an alternate route.

The eastern end of the Bells Line of Road corridor provides access to North Richmond and Richmond and also provides a commuter route to the Sydney urban area for residents west of the Hawkesbury River. It is apparent from the traffic modelling undertaken for the project that even with a future Bells Line of Road upgrade which may bypass the towns of Richmond and North Richmond or a developer funded Grose River Bridge crossing, it would still be necessary to reserve a corridor between Richmond and North Richmond to address the projected future congestion in this area.

Next steps

In addition to the $2 million funding for this Richmond Bridge and Approaches Congestion Study, the Australian Government has committed $18 million funding beyond 2013-14 to improve the traffic conditions on and around the Richmond Bridge and its approaches.

Short-term solution

Subject to the availability of funding, future activities for the implementation of the short-term improvements involve:

- Assessment of environmental impacts
- Further community consultation
- Planning approval
- Development of detailed designs
- Construction.

Long-term option

Following the announcement of the preferred option and approval by the relevant government agencies, the next step is the reservation of the revised road corridor, allowing for future design and development.

To reserve the corridor RMS would write to the local council providing a plan defining the extent of the boundary and requesting that the road corridor be included in the Local Environmental Plan. Council would then need to amend the existing Local Environmental Plan or include the corridor in a new Local Environmental Plan. These would then undergo statutory consultation before being approved by the NSW Minister for Planning and Infrastructure and formally gazetted.

Once fully incorporated into Local Environmental Plans, the corridor would be regarded as being reserved as a future main road.

Glossary

Term	*Description*
5, 10, 20, 100 year ARI flood level	Refers to the flood which occurs, on average, once every 5, 10, 20 or 100 years. Also known as the 1:5, 1:10, 1:20, 1:100 year flood level. These events are of a random nature. For example, it is possible for there to be two 100 year floods in successive years; similarly the 100 year flood may not occur for 200 years and the 100 year flood may not be the largest flood in the last 100 years.
AADT	Average Annual Daily Traffic. The yearly two-way traffic volume divided by 365, expressed as vehicles per day.
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
ARI	Average Recurrence Interval
AM	Morning peak
Afflux	The rise in water level (above normal) on the upstream side of a bridge or obstruction caused when the effective flow area at the obstruction is less than the natural width of the water way (river, stream, floodplain) immediately upstream of the obstruction.
BTS	Bureau of Transport Statistics (formally Transport Data Centre)
Biodiversity	The biological diversity of life is commonly regarded as being made up of the following components: • Genetic diversity – the variety of genes (or units of heredity) in any population • Species diversity – the variety of species • Ecosystem diversity – the variety of communities or ecosystems
Catchment	An area of land draining to the same low point
DBYD	Dial Before You Dig
DECCW (Environment and Heritage)	The Department of Environment, Climate Change and Water (DECCW) was established effective 1 July 2009. The Department is one of the agencies that form the new Environment, Climate Change and Water super agency cluster. It includes Sydney Catchment Authority, Zoological Parks Board, Royal Botanic Gardens, Jenolan Caves Reserve Trust and Lord Howe Island Board and the Catchment Management Authorities which are separate statutory authorities.
EEC	Endangered Ecological Community
EMME	Strategic Transport Modelling Software used by RMS
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

Term	*Description*
ESD	Ecological Sustainable Development
Feasible	Relates to the engineering considerations and what can practically be built.
Flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and / or coastal inundation resulting from superelevated sea levels and / or waves overtopping coastline defences.
Floodplain	Area of land which is subject to inundation by floods up to the probable maximum flood event (ie flood prone land).
HCC	Hawkesbury City Council
HW	Highway
JTW	Journey to Work
LEP	Local Environmental Plan
LGA	Local Government Area
LoS	Level of Service - a fundamental performance measure, used in the planning, design and operation of roads, providing the basis for determining the design capacity requirements of a road network, including the performance of intersections. The LoS of a road is classified between A and F (A representing excellent performance, F representing very poor performance).
MCA	Multi Criteria Assessment
MR	Main Road
P90	90 per cent probability of the actual cost not exceeding the estimated cost
PAD	Potential Archaeological Deposit
PMF	Probable Maximum Flood
Paramics	Microsimulation traffic modelling program used to assess the network performance and efficiency of potential route options.
RR	Regional Road
RMS	Roads and Maritime Services of New South Wales
RTA	Roads and Traffic Authority of New South Wales (Now Roads and Maritime Services of New South Wales)
Reasonable	This is to be judged in terms of noise mitigation benefits and costs, community views, aesthetic impacts, existing and future noise levels at the affected sites and the benefits arising from the development.

Term	Description
RUBICON	A dynamic one-dimensional hydraulic model used to simulate flood behaviour in rivers and floodplains and is able to model branched flow and the effect of hydraulic structures including weirs, bridges and culverts.
SEPP 14	State Environmental Planning Policy Number 14. Policy prepared under the Environmental Planning and Assessment Act 1979 for the protection of identified coastal wetlands in NSW.
SIDRA	Intersection Analytical Modelling Software
SHR	State Heritage Register
SSTM	Hyder's Sydney Strategic Traffic Model
Saturation	In traffic engineering, the degree of saturation of an intersection (typically under traffic signal control) or road is a measure of how much demand it is experiencing compared to its total capacity.
TCS	Traffic Control Signal
TfNSW	Transport for New South Wales
TSC Act NSW	Threatened Species Conservation Act 1995
TZ	Travel Zone
TransCAD	Strategic Transport Modelling Software used by Hyder
VHT	Vehicle Hours Travelled
VKT	Vehicle Kilometres Travelled
veh/h	Vehicles per hour
WHS	Workplace Health and Safety