OVERVIEW OF THE HOUGHTON HIGHWAY DUPLICATION PROJECT

Abstract
Planning is well advanced for the duplication of the Houghton Highway across Bramble Bay. The new bridge design will cater for tidal surges and will incorporate a pedestrian and cycle way, with provision for a fishing platform at the Pine River channel. The historic Hornibrook Highway entry portals and a bridge section on the northern end will be refurbished and retained for historical purposes.

Introduction
On 20 April 2005, the Premier of Queensland, the Minister for Transport and Main Roads and the Member for Redcliffe jointly announced the duplication of the Houghton Highway between the Deagon Deviation at Brighton and Elizabeth Avenue at Redcliffe. The finalised plans incorporate a three-lane traffic bridge, pedestrian and cycle path and custom-built fishing platform. The new Houghton Highway Duplication Project is scheduled for completion by 31 December 2010.

The Houghton Highway is part of the state-controlled road network which forms the key transport link across Bramble Bay from Brighton to the Redcliffe Peninsula. It was identified in 2003 that the capacity of the existing three-lane Houghton Highway (viaduct) needed increasing to meet the steadily rising traffic flow stemming from urban development on the northern side of Bramble Bay.

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Background

Figure 1. Opening day Hornibrook Highway 4 October, 1935

The original bridge across Bramble Bay, the Hornibrook Highway bridge, opened in 1935 and was the first road crossing between Brisbane’s bayside suburbs of Sandgate and Brighton and the Redcliffe Peninsula (Figures 1&2). At the time it represented the longest road viaduct built over water in the southern hemisphere.

By the late 1960s, rising traffic volumes on the Hornibrook Highway prompted an investigation into improving road access across Bramble Bay. In 1974 it was decided that a new bridge would be constructed at the conclusion of the 40 year franchise period with Hornibrook Highway Limited. Hornibrook Highway was surrendered to the Department of Main Roads in 1975.

Figure 2. Aerial view of southern portal, 1935

A duplicate crossing, the existing Houghton Highway bridge, was officially opened to traffic on 20 December 1979. At that time it replaced the Hornibrook Highway as the longest bridge in the southern hemisphere. The 2.74km bridge was constructed 60m to the eastern side of the Hornibrook Highway. The pre-cast concrete bridge consists of 99 spans and is 11.1m wide. The Houghton Highway bridge was originally intended to carry two southbound traffic lanes and a pedestrian/cycle way in conjunction with a repaired and rejuvenated Hornibrook Highway which would accommodate two northbound lanes (Figure 3).

Figure 3. Hornibrook Highway (foreground) & Houghton Highway looking south
In 1979 the Hornibrook Highway was closed to traffic to investigate refurbishment options. A closer inspection during this period revealed that deterioration of the bridge was more advanced than previously thought. Rejuvenation to a standard acceptable for current traffic conditions and maintenance to that standard was deemed to cost far in excess of original estimates.

In 1982 Main Roads changed the Houghton Highway bridge to a three-lane tidal flow operation to meet traffic demands (1). This change required the removal of the footway/cycle way on the bridge and subsequent relocation of pedestrian and cycle traffic to the Hornibrook Highway.

Since then, the Houghton Highway has experienced steady increases in traffic volumes with the continued development and expansion of the Redcliffe Peninsula and outlying northern suburbs. In September 2003, Redcliffe City Council commissioned a study (2), which identified capacity issues on the Houghton Highway and recommended that the bridge be duplicated. In October 2003, Main Roads commissioned their own study to verify the recommendations in the report and to investigate the potential duplication of the Houghton Highway bridge and future use of the Hornibrook Highway bridge.

A consultant team led by Eppell Olsen & Partners (transport planning and engineering) with support from Cardno MBK (bridge structure costings) and Economics Associates (economic analysis) undertook a primarily technical study, with targeted consultation with key stakeholders. The approach focussed on the technical aspects of bridge duplication and the economic assessment of a limited number of bridge options. The study recommended the construction of a new road bridge alongside the existing Houghton Highway by 2014 and further investigations into the future use of the 70 year old Hornibrook Highway.

In February 2004, the Houghton Highway bridge was identified as the number one RACQ red-spot in a survey of 1200 Queensland motorists due to its insufficient capacity, rough ride, vehicle break-downs/accidents, the tidal flow system and speed reduction to 60 km/h. Following these studies and reports, the government announced the scope of the Houghton Highway Duplication Project in April 2005.

**Project planning and design**

The planning and design of the new Houghton Highway was finalised in mid 2007. The bridge alignment is approximately 35m east of the existing Houghton Highway (Figures 4,5,6), with an increased elevation of approximately 3.8m. The bridge was designed to incorporate the lessons learned from the damaging effects of Hurricane Katrina on bridges in the Gulf of Mexico (United States) in 2005.

Key elements of the finalised project plan include:

- a three-lane 2.75km traffic bridge to the east of the existing Houghton Highway bridge (Figure 6)
- a 4.5m wide shared pedestrian and cycle facility combined with the traffic bridge which will become a key link in the Moreton Bay Cycleway
- a 10m x 50m fishing platform at the Pine River channel on the eastern (seaward) side of the new bridge (Figure 6)
- a reconstructed section of the Hornibrook Highway on the northern end to access Hays Inlet channel for fishing and recreation purposes
- improved pedestrian and cycle underpasses at both ends of the Houghton and Hornibrook Highways
- refurbishment of the historic Hornibrook Highway entry portals
- upgraded intersections with traffic lights and pedestrian crossing facilities at either end of the bridge
- bus priority lanes and a T2 transit lane across each bridge to reduce public transport travel times
- new car parking facilities at both ends of the bridge.
Figure 4. Northern end

Figure 5. Southern end

Figure 6. Artists impression of the northern end
Technical and planning investigations undertaken for the project included:

- Cultural Heritage Conservation Options Study — a history of the Hornibrook Highway was compiled and options developed for preserving its heritage aspects.
- Condition assessment of the Hornibrook Highway — state-of-the-art technology in ground penetrating radar was used along with load testing, drilling and visual inspection to ascertain the current state of the Hornibrook Highway.
- Environmental assessments — independent consultants Kellogg, Brown and Root (KBR) and HLA Envirosiences Pty Ltd reviewed the implications of the Environmental Protection and Biodiversity Conservation Act 1999, the State Development and Public Works Organisation Act 1971 and other environmental approvals and requirements for the project. The consultants also undertook preliminary investigations and reviewed water quality impacts (particularly in relation to the disposal of stormwater run-off from the new structure), hydrology and hydraulics, fauna and flora, soils, topography and geomorphology, noise and vibration, land use and planning and cultural heritage.
- Geotechnical studies — investigations into the foundation requirements for the new Houghton Highway involved seismic testing and drilling to identify the geological conditions along the bridge alignment across Bramble Bay. Drilling into the sea-bed was carried out to verify the seismic testing results and provide rock and soil samples for further testing.
- Hydrological surveys to identify the depth and contours of the Bramble Bay sea-bed.
- Ground surveys along part of Elizabeth Avenue, Hornibrook Esplanade and the Deagon Deviation to accurately map local topography.
- Storm events design for Bridge Code compliance requirements.

Community consultation
The community consultation phase of the project commenced in September 2005 and concluded in July 2007. The consultation aimed to:

- establish and maintain positive relationships with key industry, government and community stakeholders
- provide opportunities for stakeholder and community review and comment about the project
- manage stakeholder and community expectations about what the project could deliver.

Initial consultation (2005)
The initial consultation phase consisted of establishing five stakeholder reference groups to provide input into the project planning and design. Each group represented one of these five areas: government agencies, transport, pedestrians/cyclists/access, environment/cultural heritage and community/fishing interests.

In October and November 2005, the community was encouraged to provide feedback on project issues and opportunities over a four-week consultation period. Activities during this period included:

- distribution of a project newsletter and feedback form to approximately 30,000 businesses and residents in the project area
- staffed public displays
- a downloadable feedback form on the project website
- press advertising to promote the public display and comment period.

Consultation on final plans (2007)
The second and final community consultation period was held through June/July 2007, during which community stakeholders and reference groups were provided with final project plans and encouraged to provide their feedback on the community use aspects of the project. In particular, stakeholders were asked to offer input into
the design and planning of the pedestrian/cycle pathway and the fishing platform(s). Activities during this period included:

- distribution of a second project newsletter and feedback form incorporating the final project plans
- distribution of fact sheets on specific project features, including the pedestrian/cycle path, fishing platform and individual bridges
- staffed and static public displays
- a second round of reference group meetings.

The final consultation period received a good response from stakeholders, with the reference group meetings and majority of staffed project displays meetings well attended.

Comments received during the consultation period and the outcomes of the ongoing stakeholder reference group meetings directly influenced the planning and design of the duplication project. The project team is continuing to refine the detail of the community and recreational facilities, further taking into account the results of the most recent consultation period.

Storm protection
The new Houghton Highway has been designed to withstand a 1-in-2000 year storm event. It will be the first of its type in Australia, and among the first in the world to be built with consideration to the lessons learned when Hurricane Katrina hit the Gulf of Mexico in 2005 (Figure 7).

Hurricane Katrina showed that bridges in shallow bodies of water, like Bramble Bay, are more susceptible to wave forces and storm surge than was previously accepted. To combat this potential storm surge damage, the new Houghton Highway will be 3.8m higher than the existing bridge and therefore above any likely wave action. The initial plan was to locate the new bridge to the west between the existing Houghton Highway and Hornibrook Highway. The revised eastern alignment in combination with the increased height is to ensure the bridge will withstand extremely severe storms.

Community facilities
The inclusion of effective community recreational facilities was a significant factor in the planning and design of the new Houghton Highway, particularly as the majority of the Hornibrook Highway will be dismantled. The Hornibrook Highway is currently a popular attraction for anglers, cyclists and pedestrians.

The two key community facilities incorporated into the Houghton Highway duplication plan include:

An upgraded pedestrian/cycle path - This 4.5m wide path will be separated from cars by a 1m shoulder and a concrete and steel barrier. It will provide an uninterrupted panoramic view of the Bramble Bay for pedestrians and cyclists as well as a high degree of visibility for motorists. The path will separate pedestrians and cyclists and will incorporate advanced safety and security features including emergency access points, panic buttons and close circuit television (CCTV).
A purpose-built fishing platform - The platform will be approximately 50m long by 10m wide and will be located adjacent to the southern channel. The location of the fishing platform was selected in consultation with local angling groups and fishing enthusiasts. Access, including disabled access, is from a ramp from the shared pedestrian and cycle path. The fishing platform will incorporate a number of features including: seating, all-weather shelter, water fountains, lighting and fish cleaning facilities (Figure 8).

Environmental considerations
Substantial environmental assessment and consultation with relevant government agencies was undertaken as part of the planning and design stages of this project. It will follow strict environmental standards and require the attainment of a number of environmental permits required under Queensland legislation, including (but not limited to):

- marine vegetation permit under the Fisheries Act 1994
- approval under the Marine Parks Act 2004
- approval under the Integrated Planning Act 1997, including the Coastal Protection and Management Act 1995 and
- approval from the minister under the Queensland Heritage Act 1992 for the proposed Hornibrook Highway bridge removal, refurbishment and replica construction.

Construction will also require the reclamation of approximately 12,000 m² from the marine park on the northern end of the bridge (Figure 9). Permission for reclamation is being sought and is likely to result in minor amendment of the boundaries under the Marine Parks Act 2004.

Perching of pelicans on the existing bridge was identified early in the planning process as a potential road safety issue for both the new and existing bridge. Studies were conducted to identify long-term management options for the pelicans, including deterrent devices and provision of alternative perching sites. Options are currently being trialed prior to the selection and installation of deterrents and perching provisions as part of the project.

The Future
Hornibrook Highway — The Hornibrook Highway has not been open to vehicular traffic since 1979, but is a well-utilised recreational facility for pedestrians, cyclists and fishing. It has well exceeded its expected design life and is currently in very poor condition. The timber superstructure is seriously degraded, with recent ground penetrating radar testing revealing that half the girders are in a poor state and nearly a quarter in a critical condition. Extensive sections of the deck planks are rotted away and the concrete sub-structure heavily deteriorated (Figures 10,11).
Figure 9. Plans of the marine park reclamation area

Figure 10. Deterioration of the Hornibrook Highway

Figure 11. Deterioration of the Hornibrook Highway
While the condition of the bridge is understandable given its age and location in a harsh marine environment, to keep the bridge open and safe in the long term would require replacement hardwood from trees more than 100 years old. This was not considered to be an environmentally sustainable or economically viable option.

Main Roads will continue to monitor and maintain the Hornibrook Highway to keep it safe until the duplicate Houghton Highway is completed. Maintenance includes the strengthening of girders, replacing failed deck planks, treating termite infestations and repairing and fencing off some sections of the deck.

While the entire bridge cannot be kept, heritage features such as the historic entry portals will be retained. Following community and stakeholder consultation, the project team elected to incorporate into the project plans the reconstruction of a section at the northern end of the bridge.

**Existing Houghton Highway** — The existing Houghton Highway is currently undergoing routine maintenance which will continue through 2007. Upon completion of the new Houghton Highway, the existing bridge will be resurfaced and new expansion joints installed to provide a smoother ride for vehicles.

**New Houghton Highway** — Registrations of interest for construction closed in July 2007, with six contractors registering their interest. Of the six contractors, two contractors have been short-listed to prepare a tender for the project, with tenders closing in October 2007. The new bridge will take approximately two years to build and is scheduled to be open for traffic by December 2009.

Following the new Houghton Highway completion, the Hornibrook Highway will be demolished and the northern section reconstructed. The whole project is on track to be finalised by late 2010.

**References**

1. Blinco R. Queensland Roads, Volume 22, Number 44. December 1983


**Project Timeline**

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<thead>
<tr>
<th>Key project achievements and activities</th>
<th>Completion date</th>
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<tbody>
<tr>
<td>First phase of community consultation - project issues and opportunities</td>
<td>November 2005</td>
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<tr>
<td>Investigate options/develop project plans</td>
<td>2006</td>
</tr>
<tr>
<td>Finalise project plans</td>
<td>July 2007</td>
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<tr>
<td>Second phase of community consultation - project plans</td>
<td>August 2007</td>
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<tr>
<td>Close of construction tenders</td>
<td>October 2007</td>
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<tr>
<td>Commence construction</td>
<td>Late 2007</td>
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<tr>
<td>Open new Houghton Highway Bridge</td>
<td>Late 2009</td>
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<tr>
<td>Demolition of Hornibrook Highway Bridge, excluding reconstructed section</td>
<td>2010</td>
</tr>
<tr>
<td>Duplication project complete</td>
<td>Late 2010</td>
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