

**BORAL ASPHALT**  
Build something great™



CASE STUDY

# Major Projects

**SYDNEY HARBOUR BRIDGE**

2018 EDITION



BORAL



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## SYDNEY HARBOUR BRIDGE

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### Project Impact Statement

One of Australia's best known icons, the Sydney Harbour Bridge, celebrated its 80th birthday on the 19th of March 2012. In preparation, it was stripped back to the original concrete deck to apply a new waterproofing layer and asphalt surfacing, for the first time in its history. Previously, the asphalt surfacing had only been replaced in small sections and by patching of problem areas.

The objectives of the \$ 3.5 million waterproofing and resurfacing espoused by Transport NSW, Roads and Maritime Services were to (quote) (1) :

- *"Reduce the need for reactive maintenance.*
- *Improve road quality by providing a smoother and more durable road surface.*
- *Reduce road noise as the new surface [will] be smoother and quieter.*
- *Reduce risk of corrosion and structural damage on the deck".*

This project was in the planning and construction stages by the Roads and Maritime Services (RMS) and selected contractors for about a year and involved the following processes:

- Preparation and planning of all activities including complete closure of the bridge to normal traffic over two weekends, community consultation, traffic management, advertising and media information
- Profiling of the existing asphalt down to the underlying light-weight concrete substrate
- Cleaning and drying the concrete and application of a water proof membrane
- Supply, placement and compaction of the asphalt surface
- Measurement of the final surface for smoothness

Although there was sufficient time to place asphalt it was critical that the work was coordinated with the preparation works and all the sub-contractors. The program of works was severely disrupted by rain over both of the two weekends the work was carried out.

Even with these significant delays the project was completed about 10 hours ahead of schedule on the second weekend and did not require a planned third weekend of closure.

Boral Asphalt was contracted to design the asphalt to meet stringent technical requirements and to then supply and place the asphalt. Some of the challenges that had to be met included:

- Designing a dense graded asphalt product that provided excellent fatigue characteristics, high resistance to permanent deformation and a dense surface texture
- Paving to tight level control and achieving good ride quality (smoothness)
- Completing the work within the scheduled time

### Client/Construction Team

**Client:** Roads and Maritime Services (RMS).

**Asphalt Contractor:** Boral Asphalt, NSW.

**Location:** Sydney Harbour Bridge, NSW.

**Other Contractors:** Sydney Profiling Services, SAMI Road Services, SIKA, Able Traffic Control.



Boral paving asphalt on Sydney Harbour Bridge.



Loading the material transfer device. (MTD)

## Project Scope

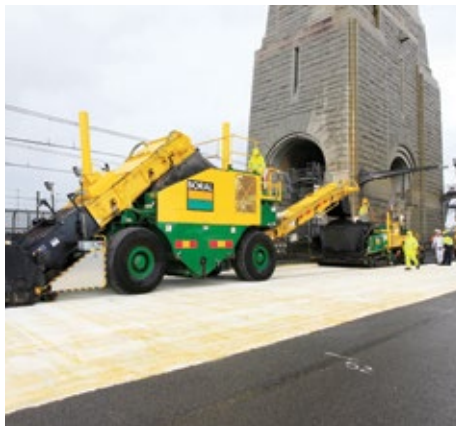
The RMS is responsible for the management and maintenance of the Sydney road network, which is normally performed by contractors registered on a RMS Panel Contract. However, because of the high profile nature of this work, contractors were specifically selected based on their competency and ability to perform the work. Boral Asphalt has previously successfully produced and placed a specially designed asphalt mix for bridge decks. The mix design for this project was based on this previous work except that the nominal mix size was changed from 10mm to 14mm size and a different binder was used.

The Sydney Harbour Bridge, which is listed in the Guinness Book of Records [2011] as the world's widest long-span bridge, now carries more than 160,000 vehicles a day compared to 11,000 vehicles in 1932. New asphalt must satisfy a more stringent set of performance parameters to cope with the next phase of the Bridge's life.

Apart from the mix design needing to provide an easily compactable mix with a finer surface texture, an important characteristic of the mix was a high fatigue resistance value to withstand flexural movement of the bridge deck and reduce reflective cracking under increased traffic load regimes.

Although the quantity of asphalt for this project was relatively small, (approximately 2500 tonnes and 20,000m<sup>2</sup>) the design and placement of the product was critical to the success of this high profile project.

Coordination of the transport of the asphalt was critical to the project, so the majority of trucks had to be loaded and queued near the site. All the asphalt planned for each shift had to be produced in a single production run and either loaded onto trucks or stored in hot storage bins.



MTD – Paver “Train”

## Existing Conditions

Boral Asphalt was only contracted to supply and place the asphalt. The removal of the existing asphalt, assessment of the profiled surface and application of the membrane were under the control of other contracted parties.

On both weekends that the work was done, there was significant rainfall. This slowed the work rate because the pavement had to be dried prior to application of the waterproofing membrane.

NSW Roads Minister Duncan Gay said, after the first weekend, “unexpected heavy rain delayed the project for several hours on Sunday morning but the crews did a fantastic job once it cleared and the work finished on schedule”.

## Design

Boral Asphalt produced the asphalt at its Enfield Plant where a full range of mix design work was conducted. This commenced with laboratory mix trials to confirm the volumetric properties, resistance to moisture damage and fatigue performance of the mix.

The desired mix design was then put through the plant, tested and adjusted as required.



Finally, all raw materials and production mix had to be monitored by testing throughout the course of the project.

A 14mm nominal maximum aggregate size, dense graded asphalt was used and included 15% recycled asphalt product.





**Acknowledgements**

RMS expressed their satisfaction with all contractors involved and invited them to a media conference which was addressed by the CEO of RMS and the State Government Minister for Transport.

The RMS Superintendent for the project expressed his satisfaction with the asphalt. Numerous articles have been written for various Civil Engineering journals showcasing the success of the work.

**Key Facts**

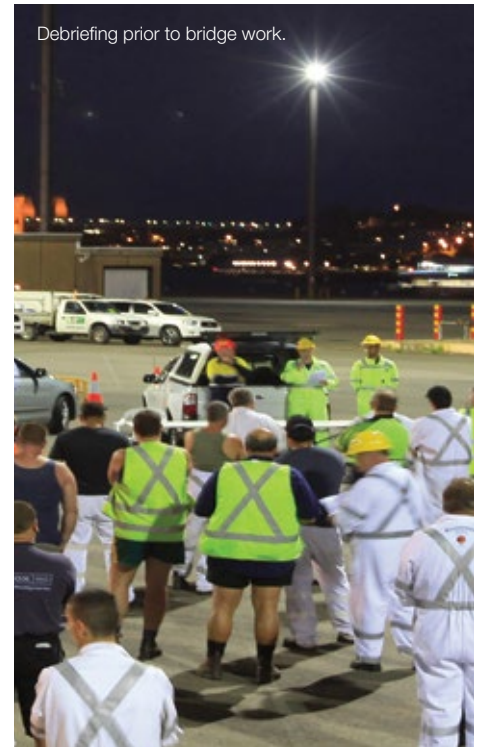
- Product type, AC14 BridgeMix
- Quantity, 2500tonnes
- Polymer Modified Binder (Durapave)
- Other relevant characteristics, Min Flexural Fatigue value: 8x10<sup>6</sup> cycles @ 400microstrain
- Technical application details, 3-7% in-situ air voids @ 50mm nominal thickness
- Quality performance, Ride Quality < 40 counts/km and average 48% improvement

**Performance Review 2012**

The asphalt on the bridge deck is performing very well. Asphalt on the approach decks at either end of the bridge was initially impacted by moisture trapped under the waterproofing membrane. RMS handled this issue, and testing was carried out which clarified that the asphalt met or exceeded performance requirements as shown in Table 1.

Boral Asphalt was able to demonstrate its ability to provide a high level of service and quality in partnership with RMS and the other contractors on one Australia's most recognised landmarks and important facilities.

All product expectations and performance tests exceeded the required criteria and the final ride quality was better than expected at 35 counts/km (average).



**Table 1. - Sydney Harbour Bridge Mix Performance Results**

Property	Test Result	Laboratory
Resilient Modulus @ 25°C *	3300 MPa	Boral Australia
Flexural Fatigue @ 20°C ** (@ 400 microstrain)	9.5 x 10 <sup>6</sup> cycles	Boral Australia
Wheel Tracking @ 60°C *** (After 10,000 passes)	1.1mm	Boral Australia
Stripping Inflection Point# (Hamburg Testing)	<20,000 passes	NCAT, Auburn, USA

**Footnotes**

- \* Typical range for standard binder mix is 2000 – 7000MPa, Austroads <sup>(2)</sup>
- \*\* Typical conventional bitumen asphalt fatigue value is < 1x10<sup>5</sup> cycles, Austroads <sup>(2)</sup>
- \*\*\* Superior performance is < 3.5mm, Austroads <sup>(2)</sup>
- # Texas Criteria, typical quality mix has SIP >20,000 passes, Auburn <sup>(3)</sup>

<sup>(1)</sup> Questions about the Sydney Harbour Bridge waterproofing and resurfacing in January 2012, Transport NSW, Roads and Maritime Services, website 2012.  
<sup>(2)</sup> Austroads 2007, Guide to Pavement Technology, Part 4B: Asphalt  
<sup>(3)</sup> Auburn University Test report for Boral, 2012, NCAT.

**Boral website:**

Visit the Boral website for the full range of Boral products: [www.boral.com.au](http://www.boral.com.au)

**Asphalt information:**

For asphalt news and information visit: [www.boral.com.au/asphalt](http://www.boral.com.au/asphalt)

For asphalt locations around Australia go to: [www.boral.com.au/locations](http://www.boral.com.au/locations)

**Contact us:**

At Boral we are committed to excellence in service so for further information please contact:

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- QLD (07) 3268 8011
- SA (08) 8425 0400
- WA (08) 9451 6466

or visit [www.boral.com.au/contact](http://www.boral.com.au/contact)

**SDS:** A Safety Data Sheet is available on the Boral website or by contacting Boral Asphalt customer service.

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