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CASE STUDY

Major Projects

ENFIELD INTERMODAL LOGISTICS CENTRE

2018 EDITION

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Typical reach stacker.

Typical scuffing caused by the rubber tyres of forklifts and reach stackers when handling fully laden containers.

Project Impact Statement

Enfield Intermodal Logistics Centre [Enfield ILC] is located 18km from Port Botany in Sydney's Inner West at what was previously Railcorp's shunting and locomotive maintenance yard. The site is adjacent to Boral's asphalt and concrete plant in Enfield.

Project Scope

The project consisted of 8 hectares of container lay down areas, contamination remediation, noise walls and warehouse facilities. The works also included the construction of a bridge across the twelve Enfield siding rail tracks and two new freight lines which connect to the Port Botany Freight Line. Boral was awarded the contract to manufacture and pave approximately 62,000 tonnes of heavy duty asphalt for the project.

Business Conditions

The project is part of a development plan to decongest the Botany Bay area by reducing road freight. The objective is to help cope with the exponential growth expected in containers by moving 40% by rail from the wharf stacking area to intermodal terminals from where they can be redistributed by road transport to regional NSW. With trade at Port Botany forecast to double over the next 15 years, Enfield ILC will handle up to 300,000 twenty-foot equivalent units (TEUs) each year.

Sydney Ports estimates that the Enfield ILC will reduce truck movements to and from Port Botany by up to 300 movements per day, reducing road congestion and carbon emissions. Furthermore, the co-locating of warehouses on the site will also internalise more than 30,000 truck movements per year. The Enfield ILC will cut CO^2 emissions by 1,000 tonnes per year and will also reduce the number of kilometers travelled by truck by 6.5 million km, which will also improve road safety.

Client/Construction Team

Client: Sydney Ports Corporation
Head contractor: Leighton Contractors
Engineering design consultants: AECOM
Operator: Hutchison Port Holdings

Project Overview:
Total contract value: $150 million
Construction period: 2009 to 2013
Asphalt paving commenced in November 2012 and was completed by September 2013.

Technical Conditions

This was no ordinary asphalt contract. The asphalt needed to withstand the extreme axle loadings of reach stackers with up to 100 tonne axle loads. This is a significant increase in loading compared to a standard axle load of a road vehicle, which is only 8.2 tonnes. Under these conditions, asphalt needs to demonstrate advantages over concrete or segmental block pavers. In order to convince the client and its engineers to use asphalt, Boral needed to design and agree to produce asphalt that met very stringent rutting criteria to cope with the type of loading expected on this pavement.

Another key consideration was that a final surface level must not have undulations, which can cause ponding of rainwater. The operator of the facility also required that repairs should be able to be effected to any damaged area of the pavement during its service life without causing delays or disruptions to the future operations of the facility.

Design

The pavement was designed to withstand 100 tonne reach stacker axle loading and containers weighing 40 tonnes each with a stacked height of 3 containers (Table 1). To this end the asphalt needed to provide:

- A minimum modulus of 3000 MPa
- Excellent rut resistance

Given Boral's previous success with the design and construction of a high performance asphalt mix at the Veolia waste container transfer depot in Clyde, we were confident that we could produce a rut resistant durable wearing course asphalt which would:

- Withstand the high point loading
- Be resistant to scuffing of the reach stacker rubber tyres during turning movements
- Provide resistance to fuel spillage

This was accomplished through extensive laboratory research and field paving trials conducted at the Baulkham Hills Materials Laboratory under the guidance of the Boral asphalt technical team. The end result was that a very rut resistant asphalt mix was developed using a combination of special polymers, aggregates and RAP to achieve exceptional rut resistant values (Table 2 & Figure 1).

Performance

During the execution of the contract plant produced samples were subjected to laboratory Wheel Tracking Testing. The test conditions for the wearing course mix was extended beyond the standard

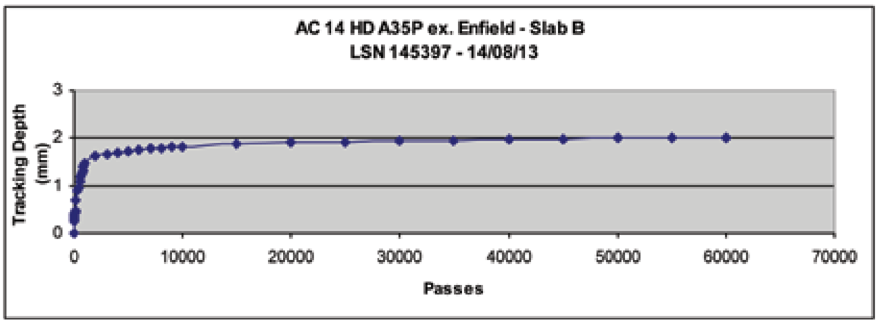
Table 1: Pavement Design

Layer	Material Type	Thickness (mm)
Wearing course	AC14HD (Modified)*	60
First base	AC20HD A35P	70
Second base	AC20HD AR450	70
Waterproofing seal	emulsion primer seal	7
Bound sub-base	5MPa heavily bound	430
Granular sub-base	DGB20	150

Table 2: Wheel Tracking Test results on plant mix

Mix	Test conditions	Specified Rut depth (mm)	No. of tests	Results range (mm)
AC14HD (Modified)*	60k Passes	< 3.0	8	1.2
AC20HD A35P	10k Passes	< 2.5	10	0.4
AC20HD AR450	10k Passes	< 3.5	8	2.3

Figure 1: Typical graph from rut testing the Modified Container Mix.



Modified Container Mix

test conditions by increasing the test temperature from 60°C to 65°C and the number of passes from 10,000 to 60,000 (Table 2).

Other performance tests were also conducted to ensure a high strength asphalt product. These included Resilient Modulus, Tensile Strength Ratio, and Cantabro abrasion testing. The typical properties obtained are shown in (Table 3).

The fuel resistance of the plant produced asphalt mix was also assessed by soaking laboratory compacted specimens in diesel. Comparison of AC14HD specimen with C450 (left) and one with special polymer binder after soaking in diesel for 24 hours demonstrates the resistance of the high performance asphalt to diesel.

Having produced a fit-for-purpose mix the next challenge was to ensure that we were able to pave this mix so that we achieved a finished surface complying with the tight levels required by the design. This was achieved by using the Trimble paving control system, which makes use of GPS and has an accuracy of up to 3mm.

Table 3: Performance tests conducted

Mix	Resilient modulus @ 25°C (MPa)	TSR (%)	Cantabro @ 25°C
AC14HD (Modified)*	6500	87	6.2
AC20HD A35P	6800	88	8.7
AC20HD AR450	7000	81	8.9

* Modified 'Container Mix'

Diesel soaked C450 specimen.

Diesel soaked container mix specimen.

In this project Boral was able to demonstrate that we could design and produce an asphalt-wearing course with a special formulated binder which rendered:

- A high level of rut resistance when assessed using extended wheel tracking test conditions
- Improved resistance to diesel spillage thus reducing the need for pavement repairs

The mixes were produced ultilising RAP to assist performance and help reduce cost. It is hoped that the success of this project will provide engineers and their clients with more confidence to utilise Boral's high performance rut resistance asphalt on heavy duty pavements in the future.

Acknowledgements

"The success of this project can be attributed to the high level of cooperation that has been achieved with all the departments in Boral from tendering, technical, production and contracting working together to provide the best pavement solution for the client and the future operator of this facility during its planned service life."

- Andrew De Villiers, Project Manager

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