

# Steel industry delivers

## The Worsley Alumina big ship loader

When plans were approved to increase production at the Worsley Alumina Refinery in Western Australia, the company commissioned a new ship loader to cope with the increase in production. Worsley exports alumina through the Port of Bunbury, about 50 kilometres by rail from the refinery site. Since 1984, when production first began, Worsley Alumina has shared ship loading facilities with Alcoa Australia.

ThyssenKrupp has been contracted to design, build and commission a radial quadrant ship loader as part of the expansion project for Worsley Alumina. The proposed increases in production, to more than 3.5 million tonnes a year, necessitate the construction of new facilities on the inner harbour in Bunbury.

Two leading Western Australian steel fabricators, Fremantle Steel Fabrication and Doina Engineering & Construction, are involved in the fabrication of the ship loader, the largest of its type ever to be built in Australia. Capable of loading 3,000 tonnes per hour, the new ship loader has the capacity to load vessels up to 80,000 tonnes.

### The Eco-shiploader

The Bunbury ship loader is an Eco-shiploader, a unique concept developed by ThyssenKrupp in Canada. In this type of ship loader the entire conveyor system is totally enclosed in a tubular gallery, inside a boom. The unique feature is that the structure is required to have a large degree of vertical and horizontal mobility. Working from the concept developed in Canada, the Western Australian engineers went back to the drawing board with the idea to adapt the design for a fully

enclosed conveyor system, eliminating the inconvenience of a conventional spillage protection system. A tubular steel boom and shuttle structure provide both the structural system as well as the fully enclosed space where all spillage and dust is effectively sealed, protecting the environment.

Due for commissioning in September, the Bunbury Eco-shiploader is only the second of this type of loader to be built in the world. The other, designed in Canada for the Virgin Islands, is smaller in diameter.

### The shuttle structure and boom

The 90 metre long shuttle structure and 63 metre boom were fabricated and constructed by Doina Engineering & Construction from 350 grade XLERPLATE® high quality hot rolled steel from BlueScope Steel. The steel plate was rolled to form tubular steel sections, four metres in diameter.

The shuttle was fabricated in three sections with openings for the shuttle load chute, which runs the full length of the completed shuttle. Each section weighed approximately 50 tonnes.

Gerry Doyle, Operations Director for Doina said that: "Because each section had to rotate for fabrication and welding, careful planning was needed to ensure that the sequence of fit out didn't interfere with the rotation, and that it enabled welding to be completed. The shuttle sections were fabricated with openings for the shuttle load chute, which runs the full length of the completed shuttle. All internal service and support bracketing was fitted and welded prior to completion saving valuable time on site."

"Each section of the shuttle structure was surveyed to ensure the dimensional integrity of the structure, and that the critical connection points, where mechanical components had to be attached, were accurate. As critical dimensional tolerance had to be achieved, all machining for the boom shuttle pivot and drive bogie mounts was carried out at Doina's Kwinana workshop, using portable machining equipment. The sections were then joined into one structure on site at Bunbury," concluded Gerry.

The 4 metre diameter boom was fabricated in two sections, each weighing around 35 tonnes and, like the shuttle, was transported and joined on site at Bunbury.

### Surface treatment

All the shuttle and boom structures had a three coat paint system applied. The internal and external surfaces were abrasive blast cleaned, primed, coated with a high build epoxy intermediate coat and finally coated with a UV urethane. All surface treatment was carried out at Doina's local surface treatment facility in Kwinana.

The ship loader's steel structures - the bridge, the shuttle structure and the boom - are constructed from just under 600 tonnes

of plate steel. The shuttle structure took 192 tonnes while the boom was fabricated from 84 tonnes of steel. To ensure steel delivery for the job, ThyssenKrupp Engineering pre-purchased BlueScope Steel XLERPLATE from OneSteel in late August 2004. Mark D'Amato of Fremantle Steel said that: "On a job like this, the quality and consistency of the steel is crucial. Reliable lead times were also very important, as this project was on such a tight schedule."



Left: Shuttle centre section weighing 52 tonne.



Right: The shuttle sections were fabricated with openings for the shuttle load chute, which runs the full length of the completed shuttle. All internal service and support bracketing was fitted and welded prior to completion saving valuable time on site.

## The bridge structure

Fremantle Steel was contracted to fabricate the ship loader's massive bridge structure, which measures 105 metres in length. "We have a good working relationship with our client," said Fremantle Steel's Mark D'Amato. "Good quality, reliable work is critical in this type of fabrication, and our previous experience and manufacturing capabilities made Fremantle Steel the logical choice for the ship loader's bridge structure."

"The job required a lot of pre-assembly work. On receiving the steel plate, we cut it to shape and prepared it for welding. Two steel girders connected by cross bracing make up the bridge structure," Mark D'Amato said.

Fabricated and assembled in the Fremantle Steel workshop as a single unit, the entire bridge section was surveyed and then split into three sub-assemblies for transport to the site where the three sections were then spliced back into one. In addition to being 105 metres long, the massive structure is 6 metres wide, 5.2 metres high, and weighs 250 tonnes.

"The major challenge on the job has been the complex fabrication and welding specifications, as well as the weight and the size of the structure," says D'Amato.

Each section was surface treated on the premises and transported by road to the Bunbury Port, where it was assembled as part of the entire ship loader. Around 250 tonnes of 350 grade XLERPLATE was used in the construction of the bridge section. The bridge structure was completed on 1 April this year.

### Project team

**Client:** Worsley Alumina

**Project Engineer:** WorleyParsons

**Design Engineer:** ThyssenKrupp Engineering

**Steelwork Contractors:**

Doina Engineering & Construction

Fremantle Steel Fabrication

**Steel Detailer:** ThyssenKrupp

**Coating Suppliers:**

Total Corrosion Control

Novacoat WA

Top: Mark D'Amato and Laurie D'Amato

Bottom: The bridge section was fabricated and assembled in the workshop as a single unit

## Steel industry capabilities

### Fremantle Steel Fabrications

Founded in 1971, Fremantle Steel is now one of the largest providers of pre-fabricated steel structures in Western Australia. The company specialises in large scale fabrication projects for the public and private sectors, including the resource industry, industrial, commercial and rural developments, and government work.

Fremantle Steel has a good reputation for efficient production, quality work and advanced facilities which stood the company in good stead when tendering for the ship loader project.

With 120 employees working from its state-of-the-art headquarters in Jandakot, Fremantle Steel is well equipped to accommodate very large scale fabrication jobs. The facilities include a 10,000 square metres workshop, with large workshop bays serviced by 22 overhead travelling hoist cranes, and the latest in automated technology.

### Doina Engineering & Construction

Doina Engineering & Construction is a West Australian owned steelwork business which has successfully developed into one of the premier engineering companies in Western Australia. The company specialises in all types of fabrication and installation for the mining, petrochemical and mineral industries throughout Australia.

Recent major projects include: Roche Mining Iluka Murray Basin Structural Steel, ship loaders and stackers for BHP Port Hedland and Rio Tinto at Dampier; overland conveyor modules for Robe Mining; major piping package for Darwin Fuel Terminal; fabrication and installation of conveyors, transfer towers and conveyor supporting trestles for Hismelt. A new workshop and office complex, to be completed in June 2005, will increase the company's capacity to deliver quality steelwork to the growing Western Australian market.

