

Designing state-of-the-art coal handling systems



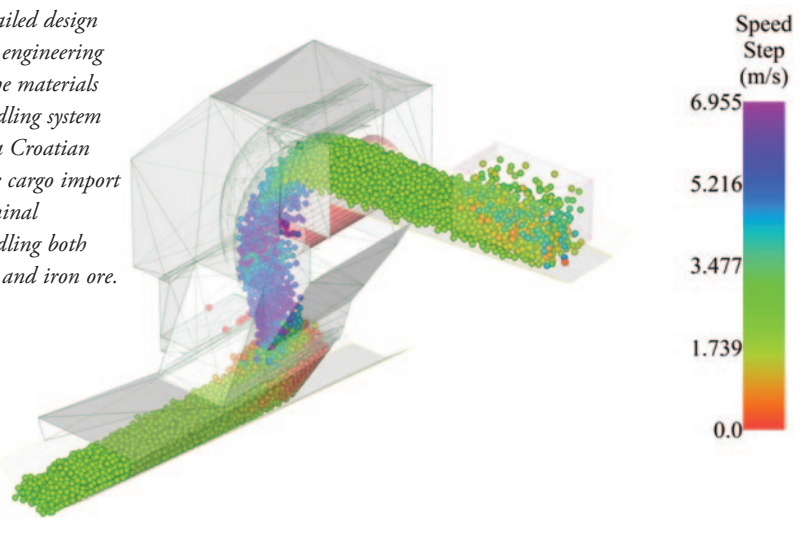
Detailed design of a new coal import conveying system for a power station in Malaysia included the upgrade of the existing grab-type ship-unloader (above, left) and adding a new conveying stream from the import jetty to the existing power station stockyard facility (above, right).

The handling of coal poses numerous challenges ranging from flow problems during rainy seasons with sticking and blockages of chutes and bunkers, to the abrasion of coal handling equipment and spillage, not to mention coal dust generation, particularly at transfer points.

The key to reliable coal handling system performance is therefore to incorporate fit-for-purpose technologies designed to take into account flow and other relevant material properties, notes DemcoTECH Engineering General Manager Paul van de Vyver.

In an important project, DemcoTECH undertook the detailed design of a new 5,000tph (tonnes per hour) coal import and conveying system for a coal fired power station in Malaysia. The project comprised upgrading an existing grab-type unloader's capacity and tailoring a new ship-unloader's interface with the existing

Detailed design and engineering of the materials handling system for a Croatian bulk cargo import terminal handling both coal and iron ore.



and new conveying streams. In addition, a completely new conveying stream was installed from the import jetty to the stockyard approximately 2km inland, comprising multiple conveyors and transfer chutes to reticulate the coal to the power station and its coal stockyard.

The brownfield project was part of the expansion programme to add generation capacity to the local grid and required significant interfacing between existing equipment and the new conveying system.

With conveying speeds of 4.6m/s on 1,800mm wide conveyor belts, the coal import and distribution system comprised eight conveyors and 11 transfer points, an inclined moving head, multiple fixed tripper transfer points and, in some cases, three-way actuated trouser-leg chutes.

"Complexities in this project included the need for seismic assessments as part of our structural designs and catering for a range in coal characteristics due to spot-purchases of coal from significantly varying environments. Particle size and material characteristics posed an interesting challenge as our designs had to cater for coal ranging from frozen to sized coal,

substantial fines in wet coal to high-clay content imports. Material flow simulation using discrete element modelling [DEM] was an essential tool," says van de Vyver. "Some chute geometry was particularly difficult to configure and interface with the existing facilities, exasperated by the envelope of varying coal behaviour, which super-imposed practical limitations to our designs. In addition, coal off-loaded from a vessel may be relatively dry at the top of the hold but, towards the bottom half of the ship's hold, the product is often fine and very wet.

"These factors posed significant challenges in the design of the chutework whereby degradation was to be minimized, material velocities optimized and chute blockages prevented."

For another client in South Africa, DemcoTECH reviewed and developed an upgrade to an existing rail tandem tippler and coal stockyard feed system. The upgrade increased the throughput, availability and reliability of the existing facility, which fed coal to the 6 x 700 MW coal-fired power station units. "By upgrading the wagon indexer, tippler,



DemcoTECH's recommendation for upgrading and enhancing of the coal off-loading and delivery system for a South African power utility included the tandem wagon tippler.

conveyors and transfer chutes, the system's capacity could achieve approximately 14mt (million tonnes) per annum coal deliveries to the power plant."

MULTI-PRODUCT TERMINALS

DemcoTECH also carried out the detailed design and engineering of the materials handling system for a new Croatian bulk cargo import terminal handling both coal and iron ore.

The terminal consists of a ship-unloading system, a stockpiling operation and a 2,400tph rapid rail loadout facility. The system is designed to import and stockpile up to 4,000tph iron ore or 2,000tph of coal.

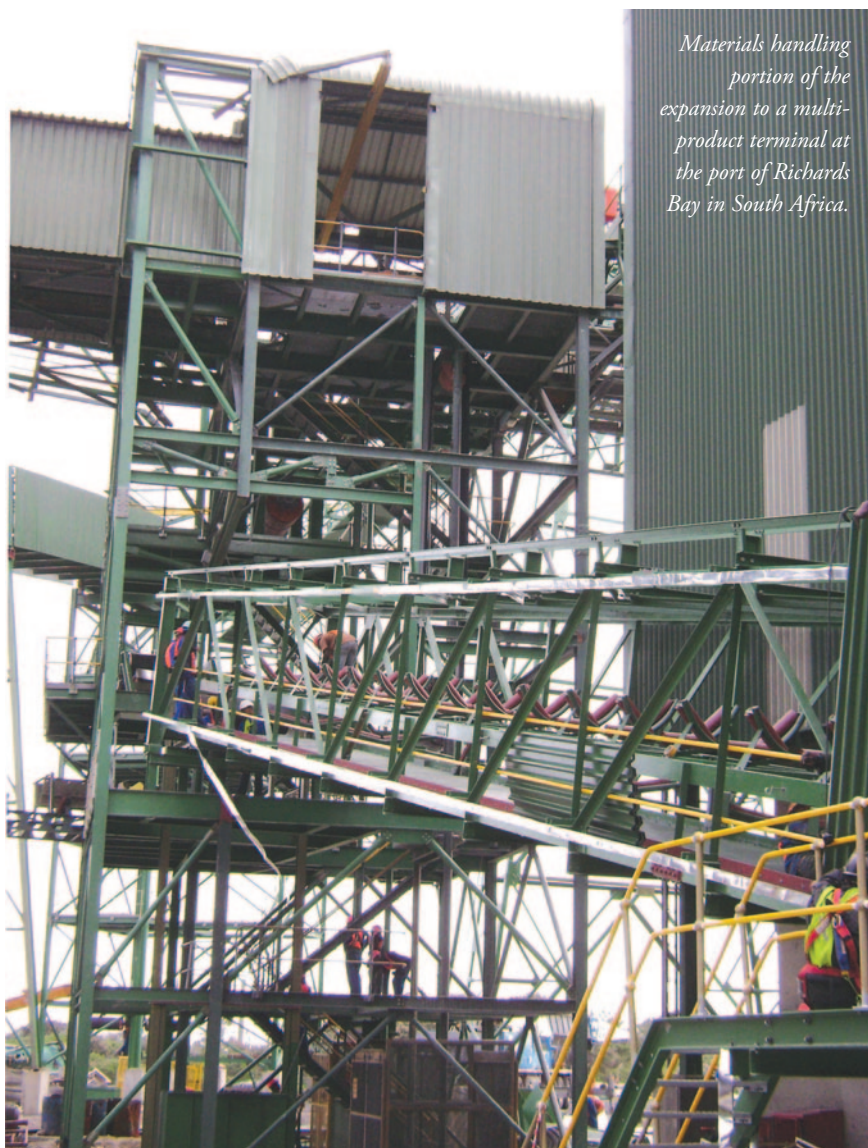
As the 2,000mm-wide belt conveyor system is required to handle both coal and iron ore interchangeably, utilizing the same transfer chutes, the conveyor belt speeds and throughput of the two products varied considerably, namely 2m/s for iron ore and 4m/s for coal. The chutes were designed to allow the operator to configure the chutework for the two different products, i.e. the chutework designs for coal (free-flowing) versus iron ore (drop box) required a series of adjustable features that could be rotated into or out of the material flow path. Accordingly, the chute geometry and material flow path are automatically adjusted to suit the significantly different material trajectories and wear patterns, minimize particle degradation and load the receiving conveyor centrally.

Two stockpile reclaim systems were provided; one being a conventional bucket-wheel operation while the second system comprised two independent rail-mounted motorized reclaim hoppers, charged by large wheel loaders.

"The entire plant is subjected to severe seismic activity and thus the structural design had to incorporate the requisite features to dissipate and resist seismic-related forces and loads," says van de Vyver.

DemcoTECH was also commissioned to design and engineer a rapid rail loadout facility at this terminal, to export coal and iron ore at up to 2,400tph in three different wagon configurations. This gravity loadout follows a conventional configuration of surge hoppers, weigh flasks and loading apparel to suit the export requirements and wagon range presented to the terminal.

For one of its earlier projects, DemcoTECH was appointed the EPCM contractor to develop the materials handling system for a multi-product inland terminal to handle coal, sulphur, rock and phosphate, at the port of Richards Bay in



Materials handling portion of the expansion to a multi-product terminal at the port of Richards Bay in South Africa.

South Africa. In excess of 4mt per annum of product is delivered to and dispatched from this terminal by conveyor, rail, road and sea. The terminal comprises three distinct sites, separated geographically by either natural features or other users, but connected by the client's infrastructure. The sites are extremely congested owing to the available space, which posed a significant challenge to the design.

"As this was a brownfields site, the interfacing of new equipment into the existing equipment had to be carried out around planned shutdowns in order to minimize disruptions to operations," concludes van de Vyver.

"In addition, to achieve environmentally clean solutions, we designed and installed equipment that complies with stringent environmental and safety requirements," adds van de Vyver. "We provide a range of enclosed conveying systems including pipe, troughed and AeroConveyors™, as well ancillary dust control and suppression systems to contain, reduce and eliminate dust and environmental issues."

To support its suite of technologies and engineering expertise, DemcoTECH makes use of advanced testing, flow modelling and system simulation to design its systems based upon a thorough understanding of the properties of the material, particularly for the worst flow conditions that are expected to occur in practice with wet coal.

ABOUT DEMCOTECH ENGINEERING

DemcoTECH Engineering is a specialist bulk materials handling and niche process plant company, offering services from concept design through to project completion to the power generation, cement, mining, metallurgical, manufacturing and port handling industries. Services include conceptual design, feasibility studies, design, engineering, procurement, expediting, construction and commissioning. Plant supplied by DemcoTECH includes troughed conveyors, air-supported conveyors, pipe conveyors, rail-mounted slewing boom stackers, pivot boom conveyors and mobile conveyors.