

Simulation modelling – a key to successful stockyard design



Shiploaders at Vale's Teluk Rubiah maritime terminal in Malaysia.

South African-based DemcoTECH Engineering completed a simulation and modelling study for a major iron ore distribution centre for Brazilian miner, Vale, in Malaysia, underpinning its successful global track record of capabilities in stockyard design and layout.

DemcoTECH was appointed the materials handling engineering contractor for the Teluk Rubiah Maritime Terminal in Malaysia and was involved in the entire project from concept to completion of the implementation phase, FEL4.

DemcoTECH with ZAA Engineering Projects and Naval Architects completed the simulation study for the project. The study simulated operational processes such as import of materials from bulk carriers via the ship-unloaders and transport on the import conveyor system to the stockpiles, including blending and export of iron ore from the process stockpiles to the bulk export carriers.

The modelling of the import, blending and export operations was carried out using a combination of static spreadsheet models and dynamic Monte Carlo based simulations of operations.

“The dynamic simulation techniques are very powerful tools to simulate events such as unloading and loading operations as a time series, particularly as these processes consist of a large number of individual events that occur randomly in space and time,” says Paul van de Vyver, DemcoTECH Engineering GM.

“Through repeat simulations, we were able to statistically evaluate all possible outcomes of the process and the probability of achieving the required outputs given the randomness of the events.

“In addition, we could also test the influence of assumptions regarding individual events through sensitivity analysis.”

The simulations were repeated over the full import/export period, taking cognizance of all influencing factors ranging from weather and sea conditions, equipment capacities, rates and efficiencies, through to vessel arrival and departure schedules, all materials handling operations, power supply and potential failures and operating times.

“For each scenario, the typical output generated included

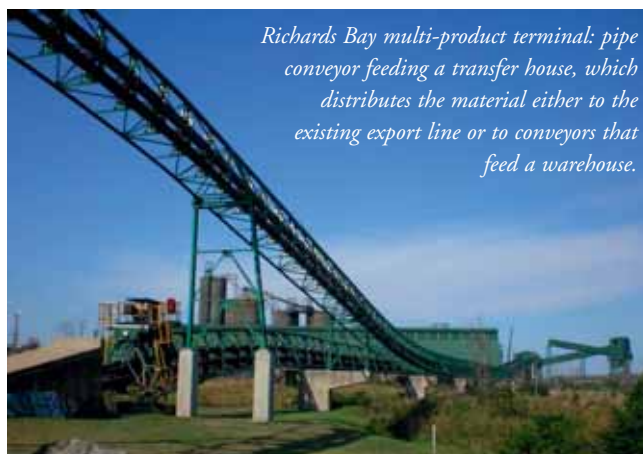
import/export volumes achieved, berth occupancies and demurrage, results which could then be utilized to optimize/adapt the plant layout, equipment selection or operational parameters,” adds van de Vyver.

“As undoubtedly one of the most important maritime terminal developments in this region, Teluk Rubiah, which initially handles 30mt (million metric tonnes) of iron ore per year and serves as a strategic distribution hub to Vale's customers in Asia, highlights DemcoTECH's ability to handle major terminal and stockyard projects.”

Detailed engineering of the bulk materials handling on stockyards is an integral component of an import terminal project DemcoTECH is presently executing for the Port of Ploče in Croatia.

“The multi-product terminal will offload and handle mainly coal, but also iron ore for distribution to the region's coal-fired power stations and steel mills. The project scope includes the entire materials handling system, starting with coal offloaded from the ship-unloaders through to the coal stockyards and the train rapid rail load-out system.

“The vastly different material properties of coal and iron ore have design implications for the system, particularly the chutes and train rapid rail load-out system, as well as the fact that the main stockpile is served by only one rail-mounted bucketwheel



Richards Bay multi-product terminal: pipe conveyor feeding a transfer house, which distributes the material either to the existing export line or to conveyors that feed a warehouse.

Lětseng — the drive of the 24m-high boom of the ROM stacker was relocated down to ground level for ease of maintenance.



stacker reclaimers, after being offloaded by grab type ship-unloaders,” notes van de Vyver.

A standby stockpile facility is also being designed, utilizing mobile plant feeding into mobile hoppers, which discharge onto the yard conveyor via dual vibratory feeders. The mobile hoppers can be positioned along the entire length of the new yard conveyor.

Earlier this year, DemcoTECH successfully commissioned the upgrade to Lesotho’s Lětseng Diamond Mine’s run-of-mine (ROM) stacking conveyor. The turnkey contract comprised mechanically and structurally redesigning out the original design items that were compromising the performance of the conveyor. This included installing a new rake trestle as well as relocating the 160kW drive from the head end of the 33m-high boom and relocating it at ground level for ease of maintenance. This entailed the entire conveyor structure having to be reviewed and then redesigned. In addition, the head arrangement was redesigned to cater for a new head chute.

A new WEBA head chute was installed allowing even material particle size distribution across the stockpile. This ensures consistent feed of fines and lumpy materials being distributed evenly over both reclaim feeders reclaiming for Lětseng’s Plants No 1 and No 2.

The implementation contract followed a design audit performed for Lětseng by DemcoTECH.

“We worked to a very tight schedule to minimize any

disruption to production, with the improvements to the ROM stacker being implemented during the mine’s annual shut down period of seven days in February this year,” says van de Vyver.

The boom stacker conveyor feeds from the primary crusher to the stockpile, where the material is reclaimed to feed Lětseng Plants No 1 and No 2.

DemcoTECH was also appointed in 2014 to carry out the conveyor design and layout for the expansion to the tailings dump for Phase 3 of the Lětseng Mine expansion and is currently upgrading the tailings dump. This involves the installation of additional conveyor equipment as well as relocating the main extendable boom stacker conveyor and transfer towers. This current work is aimed at enabling the tailings system to handle higher capacities resulting from Lětseng’s Project Kholo, which, amongst other objectives, is aimed at increasing ore throughput.

Previous stockyard projects include the design, engineering, procurement and construction management for the materials handling portion of the expansion to Grindrod’s multi product terminal at the port of Richards Bay in South Africa. The scope of the contract was to provide the bulk materials handling system conveying various materials, but mainly coal and rock phosphate, from three Richards Bay terminal sites. The system provided, which has been operating successfully since commissioning, included receiving the coal from a tippler discharging onto three belt conveyors, one of which fed an open stockpile. The stockpile was equipped with mobile plant reclaiming material via a Buffalo feeder.

DemcoTECH also completed an expansion to the manganese export facility at Assmang Limited’s Cato Ridge Alloys plant in KwaZulu-Natal, South Africa, working jointly with Kantey & Templer Engineers. Part of the project focused on the supply of a greenfields stockpile and reclaim facility and included an automatic truck loading system.

The stockpile has a new elevated tripper feeding the stockpile with a dust suppression system to provide a safe and environmentally friendly operation. The wagon tippler was supplied with a new side arm charger to eliminate the positioning of rail wagons using a locomotive.

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.

Improvements to the ROM stacker were implemented during the mine’s annual shut down period of seven days in February this year.

