Modelling and analysis of the Coal Loading Facilities for the KPC Mine in Borneo

The Kaltim Prima Coal mine is a large open cut coal mine on the coast of East Kalimantan, Indonesia, delivering 40Mtonnes per year. The coal is loaded onto three different types of ships at different locations and by different means depending on the ship size, configuration, and loading contract. Large ships must be loaded by a conveyor belt from the shore, while other ships self load from barges or are loaded with coal from a floating transfer station or by floating cranes.

Problem
The mine is planning to increase production in stages to 70Mtonnes per year. A third coal ship loading terminal has been proposed on an island North East of the mine.

There are a number of options for increasing the export capacity, ranging from increased barging and transshipment through to construction of a second ship loader.

Given the complexity of the loading operation, how can the range of options be quantitatively analysed and guidance provided as to the most economical selection?

Solution
The complex coal loading system was simulated and animated in GPSS/H and PROOF to study a number of coal shipping scenarios. The final model is one of the most complex ever developed for a mine port.

The initial configuration comprised two port areas where coal is loaded either onto barges or directly onto ships. One port has a ship loading facility and also a barge loading facility. The other port has infrastructure for loading of coal to a single barge loading facility.

Initially, 11 barges were modeled, servicing the three general classes of ships that enter the harbor, namely the Handimax (<65,000 tonnes), Panamax (65,000 to 90,000 tonnes) and Cape (>90,000 tonnes) classes.

A further option was modeled for a third party to construct a coal terminal and ship loader on an island, Miang Besar which could support could Chinamax (>300,000 tonnes) class ships.

Extensive verification of the simulation against data collected from 2009 was undertaken to ensure validity of the model. The model is able to accurately simulate the coal loading system, and by testing various scenarios, is able to provide insight into overall performance information.

Benefit
With this model, the number of barges, hours of operation required to support a capacity of 70Mt/yr and other values can be generated which can then be used in Net Present Value analysis of the options.

The success of the approach has warranted its inclusion into the Strategic Planning department at KPC for further in-house developments.

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