Super Cranes

Mike Jordan, chief executive of Liftech Consultants, US, finds that the latest generation of container gantry designs, the super cranes, rely heavily on 'super yards' to capitalise on their design advantages

There are two types of container handling super crane. Dual hoist cranes, like ECT's Delta terminal cranes, manufactured by Nelcon, the Netherlands, and Virginia International Terminals (VIT), elevating platform cranes, manufactured by Kone, Finland. Recently two new design concepts have been added: the VIT elevating girder crane and the Paceco Supertainer.

The VIT elevating girder crane utilizes a conventional, but high speed trolley on an elevating trolley runway. The runway is positioned near the top of the current row of shipboard containers.

During every cycle the spreader is fully raised and locked into the trolley, making 900 ft/min trolley speeds possible and eliminating load sway. At VIT, Dave Rudolf, manager, engineering and maintenance and Tony Simkus, research and development engineer, have applied for patents on these concepts.

The Paceco crane uses a ship trolley, a shuttle, and a shore trolley, operating on a single runway. The trolleys hoist and do not travel with a load. The shuttle travels between the ship trolley and the shore trolley. Paceco includes a chassis guide system at the quay to ease trailer loading.

To compare super cranes with single hoist units, Liftech Consultants has completed a detailed simulation analysis. Figures 1&2 show the results of the study, which compares the cranes' productivity on a 'level playing field'. The simulation methodology used has been successfully applied to a number of marine terminal studies and crane productivity analyses.

The simulated cranes discharge and load one hold of an American President Lines post-panamax ship. The results do not include the effects of delays for hatch cover removal, crane gantry motion, or the time waiting for shore side support — an admittedly unrealistic scenario — but it does directly compare crane cycles. In fact productivity with excellent yard support will be about 70% of that shown. If the critical element were yard support, productivity would not depend on the cranes at all. Super cranes are only justified if they are supported by super yards.

The results depend on the crane operating mode, the acceleration and speed capabilities of each crane, and on the 'dwell' times. The dwell times are the times required to perform time consuming tasks such as setting and picking a container from a chassis, from a platform or shuttle, or from the ship's deck or hold, and time taken to find the ship's cell guides.

The dwell times are based on field observations for existing cranes and on judgement for new cranes. A typical probability density function pattern and the corresponding cumulative distribution function are used and a triangular distribution has produced results that fit well with field tests.

For the single hoist crane, using mean dwell times or a triangular distribution function for dwell times produces nearly the same productivity since short and long dwells average out.

For more complex cranes, however, a probability distribution function is necessary, since longer dwells delay the entire system and shorter dwells do not accelerate the system.

The effect of speed and acceleration on travel time are shown for each crane *(see figures 1 & 2)*. Notice the time taken to travel from one point to another is the time to travel the distance at full speed plus the time taken to get up to speed or to stop, divided by the acceleration. The simulation accounts for the parabolic load path due to simultaneous hoisting and travelling.

The Supertainer is the most pro-

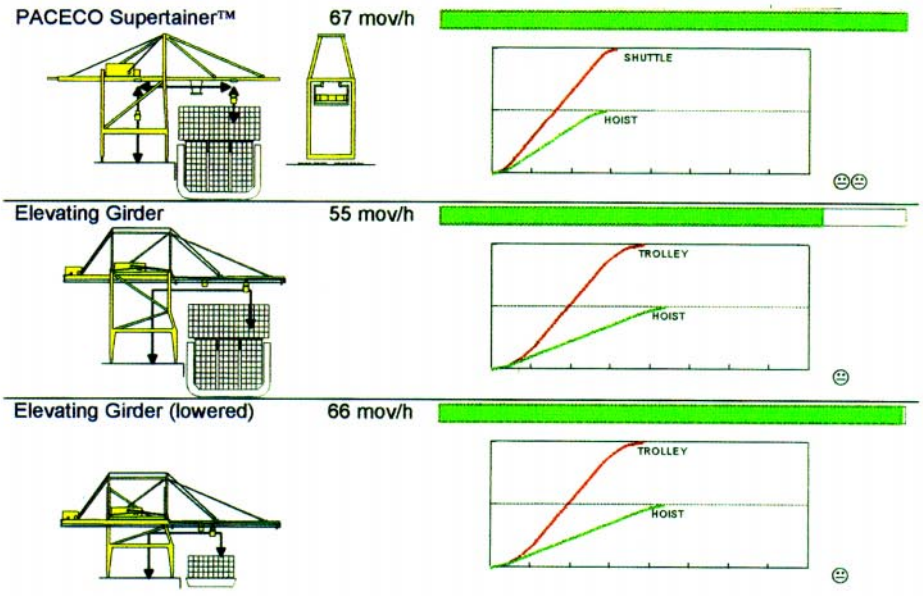

Figure 1: Productivity with excellent yard support will be about 70% of that shown in the simulation

ductive with 67 moves per hour. Even though it is not up to the 93 moves per hour that Paceco calculates for some cases, it is fast. Paceco's calculated productivity is higher than Liftech's because its model is based on a hatchless Panamax ship, shorter dwell times, and a chassis guide. Liftech did not include the chassis guide on the Supertainer or on any of the other cranes. The chassis guide would benefit all of them equally.

Notice that the elevating girder crane is very productive on smaller vessels, such as the barge shown. This is because the distance between the operator and the vessel is minimised.

Although the simulation is based on a level playing field, the initial and operating costs of each crane are far from level. In terms of horsepower, the dual hoist cranes have about twice the power of a single hoist crane and the Supertainer has greater power still. The dual hoist and Supertainer use two operators compared to the single hoist and elevating girder cranes which use one. The overall economies of each crane cannot be simply stated and must be studied for each application.

A simulation study is, of course, only a simulation, but simulations do predict results, and the results can be used to make comparisons. Answering which crane is 'best' depends on much more than a technical study. After all, the crane is part of a system.■

THE SEARCH GOES ON FOR A UNIVERSAL CRANE SPECIFICATION

Bob Slater of McKay International, explains how standardised crane specifications can save money and shorten delivery times

The world is abundant with manufacturers who are capable of the design, fabrication and delivery of a crane that will perform the basic functions. Criteria for builder selection increasingly takes the basics for granted and focuses on productivity and cost of operation. This is where crane specification development is focused.

Crane purchasers and builders have long struggled with the specifications used to define container handling cranes, especially quayside cranes. To the purchaser, the development of a new specification involves a considerable investment which may only be used once before it becomes obsolete. There is also a substantial risk for the purchaser, ensuring that the requirements are possible and that it meets the needs of the users, with modern cranes the result.

For the manufacturer, different specifications involve costly changes to standard, known products. New requirements as well as new wording of existing requirements, are risks that the producer must factor into the proposal.

With the hope of developing a "standard specification" ports along the US West Coast formed the West Coast Crane Committee. As each port purchased a crane it would adapt the specification to its unique requirements. Known requirements, explained in familiar wording would provide better cranes at lower cost and shorter delivery times.

Toward the end of 1993, a draft "Standard West Coast Container Crane" specification was released. A standard specification must satisfy a number of diverse needs. For government purchases it must be thorough enough to allow purchase decisions on price alone. It must be sufficiently complete to allow a purchaser to take advantage of a builder willing to buy its way into the crane market.

For private purchases it must be universally accepted so that it does not require extensive changes during a negotiation process. And, it must be broad enough so that it does not add cost to the builders' standard.

One specification, developed by Liftech Consultants Inc. and McKay International Engineers used as the base for the West Coast Crane Committee's findings, has continued to develop.

A purchase specification is almost always used in the purchase of quayside cranes, and to a lesser extent for yard gantries.

Good specifications anticipate problem areas by calling for detailed requirements and subsystem testing. They also contain lessons learned from previous projects and international safety codes.

With the advent of full function word processors, and a logical specification breakdown, the adaptation of the specification can be accomplished quickly and remarkably cheaply.

Crane purchasers are encouraged to utilise world recognised and thoroughly tested specifications to buy reliable, modern cranes. ■

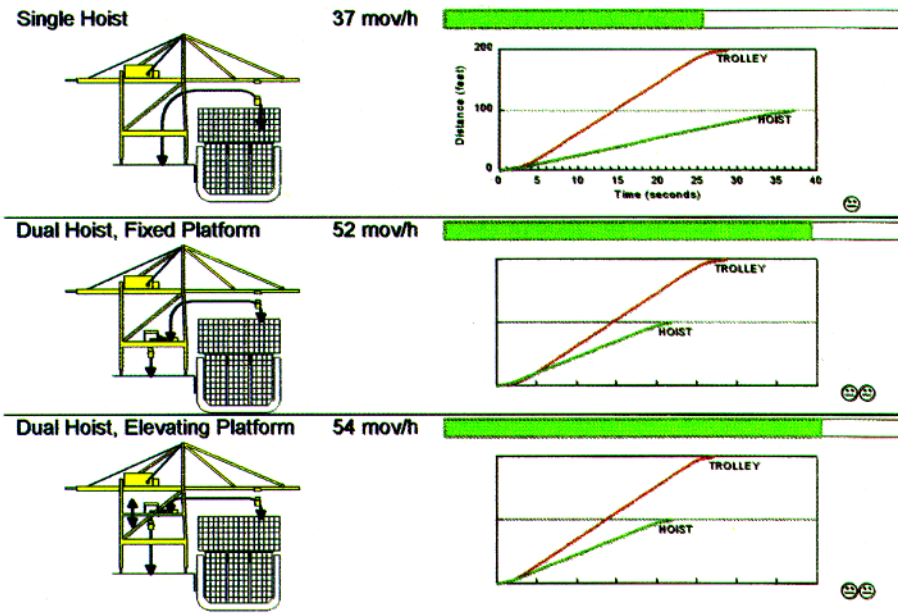

Figure 2: The simulated cranes discharge and load one hold of an APL post-panamax ship