Cranes getting too big for their boots

Restricting rail span and width for operational reasons is causing major dock load and crane design problems

Container cranes are becoming impossibly tall and long for their feet. The “footprint” may have to be sized up in the age of 40m+ lift heights, 65-66m outreachs and 80t SWLs.

According to Arun Bhimani, CEO of Liftech Consultants, Inc., “we are paying a big price for restricting width.” All the time cranes are getting taller. Already 40m lift height above rail is commonly specified and 46m may be required soon.

The “footprint” may have to be sized up to accommodate cranes that are too flexible in the gantry travel direction and during boom raise and lower.

Stiffening up

If width can be increased, cranes could be made stiffer without adding so much weight. Tall, narrow cranes need to be heavy to be stiff enough to avoid flexing and even rotating under load. In the latter case, it is impossible for the crane driver to control the load (load skew).

Bhimani was co-leading a session on crane loads and quay structures with Dr. Susan Grummitt of civil engineers Cullen Grummitt and Roe (UK). The topic is too complex to be dealt with here, except to say that wheel loads are now a real problem. They have risen from 20t per metre of rail in the 1960s to 110-120t/m of rail today! Where will it stop, asks Grummitt.

A number of crane purchasers lack expertise in the complex quay/crane interface arena and this has created a window for some suppliers of heavy cranes to mix standard definitions and quote lighter wheel loads than competitors which are actually offering lighter cranes. Allowable loads are often expressed as load/s per metre of rail. Because of the way loads are transferred into the ground, it is legitimate to increase wheel centres from 1m to 1.5m and adjust main and secondary rocker beams. But moving the bogie pin still further away from the corner can add to stability problems in side winds.

Just a few

A handful of operators are specifying wider rail spans, such as P&O’s 42.7m and PTP Tanjung Pelepas for its next phase (45m). In PNC’s case the increase is more about having extra lanes between the legs to increase crane productivity, whereas PTP is anticipating the need for bigger cranes handling heavier loads (see WorldCargo News, July 2004, p9).

These are exceptions to the rule, however. Most operators are reluctant to go beyond 30-30.5m, even when they are thinking about 120t SWL cranes for 4 x 30t 20ft lifts. Hutchison Ports, for example, wants compatibility between the planned Felixstowe South extension and the existing 30m gauge berths.

However, there is much to be gained by going the Tanjung Pelepas way. One crane maker, Liebherr, states that wheel loads of a megamax* crane on 45m span rails would be about 10 per cent lower than one of the same type on 30m span rails today. The extra steel is more than outweighed by the reduction in ballast in the landside legs. This also means savings in motor sizes, electricity costs, etc.

Richard Clarke from Halcrow says that some ports are considering moving to a 35m gauge: “but that’s a short term solution.” In defence of crane operators, however, moving the landside rail could have cost implications for some types of quay construction, such as suspended deck structures, which Grummitt notes are popular in the US and Asia.

Compelling reasons?

However, there could be compelling reasons for increasing the cranes’ “footprint.” Experience of most terminal operators is that ships cannot be worked effectively by more than 4 < 5 cranes because of traffic management problems.

However, shippers are demanding that cranes become more productive, so are not to slow down turnaround time for bigger ships exchanging more containers. A solution is to widen the rail gauge and create more lanes for straddle carriers or 1MVs to reduce queuing (cf. P&O).

In a kind of “virtuous circle,” this promise of higher crane productivity may undermine the case for ≈27m overall width. As cranes will be tied up for less time working any particular hatch, they have more time to work on another one. To that extent, does it matter if adjacent cranes have to work 20ft/240t hatches apart? Ports are way ports or end ports; hub ports or feeder ports. Is there not scope for changing the ship unloading and reloading pattern?

As noted, not only are cranes getting taller and longer, some operators are looking for SWL of 120t to handle 4 x 30.48t 20fts. Surely something has to give...