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CONTAINER CRANE UPGRADE AND RELOCATION: THREE CASE STUDIES

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ABSTRACT

Major changes are taking place in the shipping industry. Shipping lines are reorganizing their port facilities and adding intermodal capabilities. Port authorities are improving their facilities to compete for new tenants. To respond to the changing business climate, increasing numbers of dockside container cranes are being upgraded and relocated. The ability to modernize container cranes in a short time at a relatively low cost allows the crane operators and shipping lines to react quickly to new opportunities. Some established crane manufacturers, who have shunned crane upgrades in the past, see the trend and are actively promoting this business.

Three crane upgrade and relocation case studies are discussed in the paper. The cases demonstrate the practicality and effectiveness of using present cranes in new settings. Procedures for undertaking a crane modification are discussed, and guidelines for the cost are presented.

THE CASE FOR UPGRADING YOUR CRANE

There is a mistaken impression among many container crane owners and operators that their cranes are too old to upgrade or that upgrading work

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will take the crane out of service for months and disrupt operations. But that's not the case with today's technology and economic climate. The three cases presented here demonstrate the practicality and effectiveness of upgrading old cranes and using them in new settings

Case 1: Port of Oakland, Howard Terminal, 1994: The Port was presented with an opportunity to sign COSCO, a PRC shipping line, for their Howard Terminal facility. The COSCO ships would require three dockside container cranes, each with 100 feet lift heights - two of these cranes within six months. Two Hitachi cranes with lift heights of 80 feet and a KSEC crane with a lift height of 90' were operating at the terminal. Another crane at nearby Seventh Street Terminal, a Paceco low profile shuttle boom crane built in 1970, was waiting to be sold. It had a lift height of 70 feet, a rail span of 96 feet, and a slower main hoist rather than the 100' lift height and 100' rail span required at Howard Terminal.

Raising the two Hitachi cranes to obtain a lift of 100 feet was relatively simple; providing two cranes within six months was not so simple. The Port considered upgrading the Paceco shuttle boom crane, but they felt the crane was too old and slow to justify upgrading under a normal expansion program. Besides the required geometry changes, it needed a faster main hoist, a manlift, a snag protection device and other accessories. But for the same reasons, the crane was out of service and available. An economic evaluation, which included a reduced schedule, convinced the Port to undertake a program to upgrade and relocate the crane. It was modified and relocated before one of the Hitachi cranes was taken out of service for raising. The second Hitachi crane was raised after the first one was placed back in service.

The ability to upgrade an old crane allowed the Port to gain a new tenant.

Case 2. Universal Maritime Service Corp., New Jersey, 1994:

UMS owned and operated a 1980 Paceco crane with an 80' lift height and a 90' rail span at Red Hook Terminal in New Jersey. A corporate reorganization plan resulted in the relocation of their operations to Port Newark in New Jersey. The operations at Port Newark required the crane to have a lift height of 100' and a rail span of 100'.

UMS found it economic to relocate and modify the 1980 Paceco crane rather purchasing a new crane. See Figure 1 on the next page.

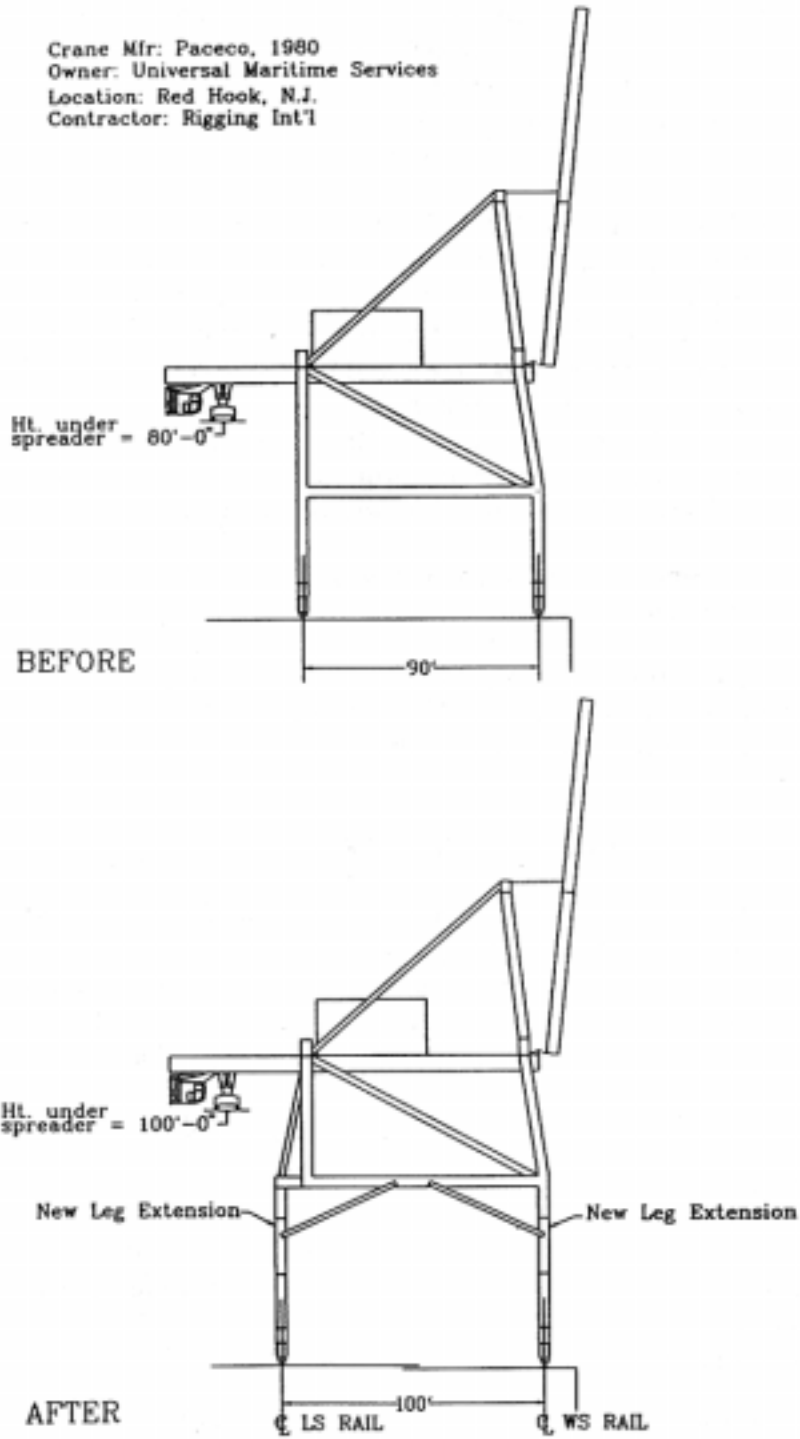


Figure 1: before and after

Case 3. Australian Stevedores, 1994: A major reorganization took place this year in the Australian stevedoring industry, and many small stevedoring companies were consolidated into two major stevedoring companies as part of a privatization drive. Australian Stevedores was one of the two. The reorganization led to major operations changes which left some locations with too few cranes and others with too many

An older Vickers crane with a self-driven, hoist-on-trolley was occasionally used at Melbourne Port on the eastern coast of Australia. The trolley rail support structure on the boom and trolley girder had severe cracking problems. The Port was reluctant to spend the money on repairing an old crane. Australian Stevedores found that the crane could satisfy their reorganization needs, so they purchased it. The hoist was relocated from the trolley to the trolley girder, the boom structure was repaired, the cab replaced, and other miscellaneous refurbishing was done to make the crane operable at Fremantle Port on the Australian west coast.

Another Vickers crane was relocated within the Melbourne Harbor as part of the terminal consolidation activities.

The ability to modify existing cranes and move them around the country at much less cost and in much less time than required for purchasing new cranes was critical to the success of the Australian stevedoring reorganization.

WHAT YOU CAN DO TO THE CRANES

To date, modifications are done mostly on first and second generation cranes, most of which are built by Paceco or their licensees. With the new, larger APL and Evergreen ships, more of the third generation cranes built by different manufacturers are expected to be upgraded. Container lift height and outreach extension are expected to dominate the changes.

Common modifications to container cranes are listed below.

GEOMETRY CHANGES

Increase in container lift height. Increases of 10' to 20' in lift height are provided by inserting new leg sections either below or above the sill beams. Main hoist drums may need additional grooves for the longer rope. This is the most common modification made.

Increase in container outreach. This is the second most common modification made to second generation cranes. An outreach increase of 8' to 10' is obtained through relocating the bumper stops and extending the boom

structure. The boom hoist is generally adequate for the additional boom weight. Recently, outreach on some Panamax cranes have been increased to post-panamax geometry. This requires major structural changes to the boom, some reinforcing of the gantry frame and boogies and upgrading of the boom hoist system.

Increase in backreach. Backreach is increased to place hatch covers behind the landside legs.

Increase in portal beam height. The portal beam height on first and second generation cranes is often increased to clear taller straddle carriers.

Increase clearance between legs. The clearance between the legs for first generation cranes does not permit handling of 45' boxes. To increase clearance, the leg connection plates are trimmed to obtain an additional 1' clearance. Major structural modifications to legs and portal beams are needed to obtain additional clearance.

Decrease in overall width. The overall width of some cranes between the gantry bumpers exceeds 88'-6", the maximum width which permits adjacent cranes to work on alternate hatches. The width is reduced by relocating the trucks. Some structural reinforcing of sill beams may be required.

PERFORMANCE CHANGES

Increase of up to 25% rated load capacity. This requires new wire rope and may require upgrading or modification of the gear reducers, gears, motors and drums.

Increase in main hoist speed and replacement of drives and controls. New main hoist motors are required. The drives are generally replaced with digital drives. Controls are upgraded to provide the modern diagnostics.

Upgrading of gantry braking capacity. Frequently, the existing braking capacity is found marginal for existing conditions.

Installation of snag protection device. Snag refers to loads imposed on the crane components when the empty spreader, traveling at high speed, becomes jammed in the ship's cell guides or is accidentally two-blocked against the underside of the trolley. Earlier cranes, including many of the third generation cranes do not provide a snag protection device. A hydraulic or mechanical snag device can be retrofitted to an existing crane. The hydraulic device can also provide trim, list and skew functions.

Installation of electronic load control device. GE, ABB and Telemecanique offer electronic load control features with their digital drives for new cranes. Reliable retrofit packages should be available within a year or so.

Installation of manlifts, especially when the cranes are raised.

RELOCATION RELATED CHANGES

Change of rail span. This generally involves reinforcing the lower portion of the gantry frame.

Conversion of power supply from electric to diesel and vice versa.

Upgrading wind resistance. This is generally required when relocating cranes. The reinforcement depends on the design storm wind for the original crane and the new location. For example, a crane designed for the west coast may require reinforcing and gantry tiedowns for location in Florida.

HOW TO GET THE JOB DONE

Three methods for procuring crane modification work are explained below.

Method 1: Negotiate with the original crane manufacturer. A brief technical description of the work is required along with the usual commercial paper work for the contract documents. Detailed performance specifications are generally not required.

This procedure may save time over other procedures, since bidding time is eliminated and the contractor may start engineering and purchasing of long lead items before signing the contract.

Public agencies generally favor this approach because it may protect the product liability coverage.

Method 2: Use a design-build contractor obtained through negotiation or bidding. This process requires knowledgeable and experienced staff engineers who prepare a comprehensive technical specification and review the bid documents. It also requires either prequalifying or selecting contractors who are well established in the container crane industry and have performed on crane refurbishment projects successfully.

Depending upon the type of modification, this process may require the contractors to do a substantial amount of engineering work to develop a competitive price. It may discourage some contractors from participating in the work and may cause others to leave a large contingency in the bid price. Both may result in a higher price.

Method 2 is used by some private agencies who rely on the competence of experienced contractors. Some public agencies also select a contractor with this method through bidding when the original crane manufacturer is either no longer in the crane business or is not interested in the refurbishment business.

Method 2 generally results in cost savings over Method 1. Generally, the design-build contractor is required to provide some liability coverage. However, there is a risk that the original manufacturer may deny responsibility for any claims subsequent to the modifications.

Method 3: Retain specialty design professionals to prepare a complete design package for contract documents and select contractors through bidding. This method is often used for construction contracts. The agency retains an experienced engineering consulting firm to prepare basic construction documents, prequalifies three to four specialty contractors, and selects one through competitive bidding.

All contractors bid on the same package. The owner is helped through the bid review and construction review process by the design professional.

The overall costs of this method are generally lower than the cost of other procurement methods. The biggest concern with this approach is risking the product liability coverage. Generally, the specialty design professionals are unable to provide meaningful professional liability coverage. The contractor may not have professional liability coverage or may be unwilling to assume responsibility for the design work. The owner assumes more liability than with other procurement methods.

Method 3 is favored over Methods 1 and 2 by most private agencies. It is also favored by some public agencies when the original manufacturer is not available to do the work.

WHAT YOU WILL HAVE TO PAY

Table 1 below shows cost guidelines for modifying dockside container cranes based on 1994 costs for North America. The actual cost will depend on the following variables:

- Type and number of cranes
- Number of changes
- Method of procurement
- Timing and Schedule

MODIFICATION	MEASURE- MENT	COST \$ x 1000
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GEOMETRY CHANGES

Increase lift height	20'	600
Increase outreach	6'	75
	12'	125
	20'	500
Increase backreach	15'	125
Increase portal height	5'	75
Widen leg clearance	1'	25
	4'	250
Decrease overall width	12'	200

PERFORMANCE CHANGES

Increase rated capacity	25%	200
Increase main hoist speed, replace drives with digital, replace controls		1,000
Upgrade gantry braking		100
Install snag protection		100
Install manlift		150
Convert shore power to diesel		300
Convert diesel to shore power		150

RELOCATION

Change rail span		300
Relocate one/two cranes	5 mi.	150/200
	1000 mi.	400/500
	Coast to coast	800/900

Table 1: Cost Guidelines

CONCLUSION

Marine terminal operators continue to modify facilities to service larger vessels, to attract new clients, and to consolidate various facilities for more efficient use. The ability to economically upgrade existing container cranes within a short time is a key to an effective modification program.