Container crane recycling: upgrade and relocation

Arun Bhimani, SE, President, Liftech Consultants Inc., Oakland, CA, USA

Background

Most maritime shipping companies were operating profitably through the summer of 2008 until the 'perfect storm' of the credit crisis and the worldwide recession struck, leading to a major drop in world trade. Since then, port authorities and terminal operators across the globe have substantially curtailed their capital expenditure and, in some cases, frozen it outright. However, some operators are faced with having to invest in equipment to improve terminal productivity, promote new business, or replace obsolete equipment.

The financial crisis has not significantly reduced the price of new cranes, due to the increase in fuel and energy prices and changing market conditions. Terminal operators are taking a serious look at recycling existing cranes or investing in used equipment.

Upgrading and recycling existing cranes may be worth consideration financially, with the added benefit of conserving precious resources. Money for recycling cranes is also primarily spent locally thus helping the local economy, whereas new cranes are purchased from foreign suppliers.

Recycling

Recycling cranes includes refurbishing, modification, modernization, and relocation. Refurbishment could include catching up on deferred maintenance and correcting any existing problems with the crane's physical condition.

Modifications generally involve geometry changes, which are primarily driven by the deployment of larger vessels or the requirements of a new terminal. Geometry changes include strengthening; increasing the lift height, outreach, and backreach; and changing the rail gauge, leg clearance, and stowage hardware (see Figure 1).

Modernization generally involves performance changes, which are driven by productivity and obsolescence. Performance changes include lift capacity, hoist speeds, drives and controls, and power system and delivery.

Relocation could be local, where the cranes are moved between berths or terminals, or across oceans. Relocating cranes frequently involves geometrical changes to adjust to the new terminal, such as changing the crane's rail gauge, adding and relocating stowage pins and tie-downs, or both (see Figure 1).

Is this crane too old?

At some point, recycling a crane is no longer economically practical. The owner must consider all the costs of the recycling project including the desired life of the crane. Often the question is asked: but what about the structural life of the crane?

Structural failures, other than accidents, can be sorted into two groups: infant failures and aging failures. Infant failures occur during the initial operation of the crane and are due to faulty design, workmanship, or a combination of both. Infant failures are not of concern for cranes that have been operating for a few years.

Aging failures occur over time and are due to slow crack growth. The application of fluctuating stresses causes small undetectable cracks to grow. If uncontrolled, these cracks grow until fatigue failure occurs.

With proper inspection and repair of fatigue cracks, the occurrence frequency of new cracks is reduced. This phenomenon can be understood by considering a chain subjected to fluctuating stress. Links are inspected periodically for cracks. Cracked links are replaced with better than average links. As inferior links fail and are replaced with superior links, on the average cracks are less likely. Eventually the frequency of cracked links will stabilize. The frequency will be less than that for the new chain. The chain becomes more and more reliable.

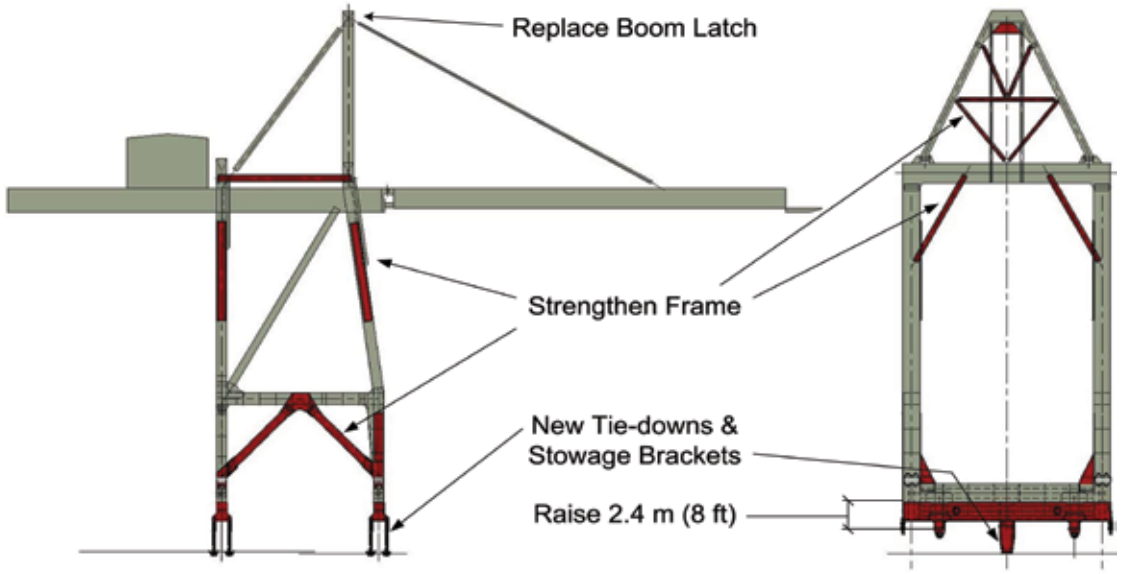

Figure 1. Structural modifications to accommodate larger vessels, new terminal requirements, and adjustments to a new terminal due to relocation.

Our experience indicates that most cracks occur at details that are either poorly designed, poorly made, or both. When the crack is properly repaired, a new crack is unlikely to occur. When considering recycling a crane, maintenance and reliability need to be considered.

Costs

The cost of crane modernization and relocation depends on the extent of modifications and differences in the site-specific conditions. The cost of moving cranes large distances is often a deterrent to crane recycling. Cost estimates are shown in Table 1.

The cost to dispose of a dockside crane depends on the type of crane and the price of scrap metal. In 2009, the cost of dismantling and disposing of a typical A-frame crane was about US$150,000.

TABLE 1: COST ESTIMATES (US$) OF CRANE MODIFICATIONS

Increase lift height 20 feet	900,000
Increase outreach 20 feet	1,000,000
Upgrade drives and controls	1,000,000

Conclusion

Recycling existing cranes may be the most economical and expedient option for some terminal operators if they need larger, faster, or more modern cranes. Recycling cranes may even have the advantage of helping the local economy as much of the work is performed locally.

When recycled, the size and performance of existing cranes can be increased often for a fraction of the cost of new cranes, but not always. The economics and practicality of modernizing the cranes depend on many factors. Each case should be looked at carefully.

ABOUT THE AUTHOR AND COMPANY

Arun Bhimani is a structural engineer and co-founder and President of Liftech Consultants Inc. He has over 40 years of experience in all phases of container crane and wharf design. He has consulted on hundreds of cranes and developed innovative solutions to container crane design problems, including cost-effective solutions for converting older cranes to serve larger ships, a technique for combining analysis with heat straightening for repairing damaged container crane booms, the first seafastening design for transporting fully erected container cranes on barges, and a structural maintenance program used to periodically inspect cranes.

Liftech Consultants Inc. is a consulting engineering firm, founded in 1964, with special expertise in the design of dockside container handling cranes and other complex structures. Our experience includes structural design for wharves and wharf structures, heavy lift structures, buildings, container yard structures, and container handling equipment. Our national and international clients include owners, engineers, operators, manufacturers, and riggers.

ENQUIRIES

Liftech Consultants Inc.
344 – 20th Street, #360
Oakland
CA 94612-3593
USA

Tel: +1 (510) 832 5606
Fax: +1 (510) 832 2436
Email: abhimani@liftech.net
Web: www.liftech.net