Handling crane accidents and emergencies

Larry Lam, **SC Tok**, **Peter Darley**, Portek International Ltd, Singapore

Until recently, the typical causes of crane incidents were adverse weather, earthquakes, ship berthing procedure, and inattention to either operations or maintenance. But today's situation has become much more complex.

First, due to increases in the number of quay cranes in operation over the past 15 years, there have been proportionate increases in the number of crane incidents. In addition, cranes have become much larger in size and are far more challenging to operate – with less visibility, controllability and slower response times due to the greater working distances involved.

It is difficult to prevent damage caused by extreme weather conditions, such as typhoons/hurricanes or from earthquakes and tsunamis, the majority of crane incidents have a strong human component. For example, when mechanical or structural failures occur, these can often be traced back to deficiencies in human activities like crane maintenance, lack of adherence to safety standards, or even poor workmanship or design of the quay crane itself.

People also play a prominent role in collisions between vessels and quay cranes. These collisions occur when a movable part of a crane strikes a ship or when a moving vessel collides with a crane. Quay cranes are designed to lift vertical loads. While they can tolerate the horizontal loads of wind, storms and even minor tectonic shifting activity (earthquakes), they are not designed to absorb the abrupt impact from a collision with a vessel or an adjacent crane.

Snagged by a departing vessel, the boom of this crane was totally destroyed.

Even a brief impact from a vessel can significantly weaken a crane structure – even when little apparent external damage can be seen.

The damage caused by a ship snagging a crane boom (in 'boom down' position) is especially vicious. This is due to the fact that when a vessel catches the forward tip of the crane boom, it is essentially using a lever with a long arm – thus multiplying the force. The tremendous force twists all of the main components of the structure, and in extreme cases, the crane will collapse.

Installation of newly-fabricated boom with floating crane.

In addition, boom damage can be problematic because, in many cases, the damaged boom must be removed for repairs and later re-installed. This necessitates the use of a floating crane for removal and re-installation – a costly affair.

After a crane incident, the recovery phase should immediately begin – ideally within hours. This consists of a damage survey, with steps taken to salvage and stabilise the crane to prevent further damage. These may include temporary bracing and reinforcements, and isolation of the damaged crane so the rest of the terminal can operate normally.

The next phase, repairs and re-commissioning, begins with cost calculations, proposals and contract approvals from insurance and port authorities before actual repair activities begin. While it is possible to utilise separate contractors for each segment of the repair activities, a single-source vendor able to provide complete turnkey coverage – from analysis and design through executing the repairs, testing, and re-commissioning – can streamline contract negotiations. Using a single-source vendor holds a single party responsible with no overlaps or doubts about who is accountable, thus shortening the time needed to restore cranes to fully-operational status. Repairs to the structure typically involve cutting away the damaged areas, fabricating replacement assemblies, and installation.

An interlocking set of issues must be addressed that encompass geometry changes, weight distribution issues, stresses that will be placed on structural components, as well as the impact on each of the interdependent mechanical and electrical systems. As in all systems, overall performance can never transcend the capacity of the weakest element.

Prior to major structural repairs, computerised Finite Element Stress Analysis identifies the affected areas. Then a repair design is formulated that will strengthen the crane beyond its original specifications. From these plans, new components are fabricated and on-site activities begin. Typically, these involve removing the damaged areas and installing the replacements. Throughout, critical welds should be subjected to non-destructive x-ray testing with dimensional checks performed to ensure that all aspects of the crane's geometry are within tolerance.

Upon completion of the mechanical and structural repairs, thorough operational tests are conducted to verify that the crane is ready to be re-commissioned.

Due to the fact that most crane incidents are a result of human error, perhaps the most useful advice can be found in the adage: "An ounce of prevention is worth a pound of cure."

ABOUT THE COMPANY AND ENQUIRIES

Portek is a port specialist offering a full spectrum of equipment services and solutions designed to enhance port productivity. For more information, please visit www.portek.com or e-mail enquiry@portek.com. To download a copy of the current Portek Engineering Services brochure, visit www.portek.com/engineering.pdf