

# Mobile Crane Safety

By Jerome E. Spear, CSP, CIH

Nearly 90 crane-related fatalities occur each year at construction sites. A 1997 study by The Center to Protect Workers' Rights examined the causes of crane-related deaths occurring from 1984 through 1994. The authors retrieved data from OSHA's Integrated Management Information System (IMIS) to identify the number of fatal accidents involving cranes and determine their causes (see Figure 1). They found 479 accidents involving 502 fatalities.

Figure 1. Causes of crane fatalities, 1984–1994. From “Crane-Related Deaths in the U.S. Construction Industry, 1984–94,” published by The Center to Protect Workers' Rights, 1997.

FIGURE 1 - CRANE FATALITIES  
(Suruda et al., 1997)

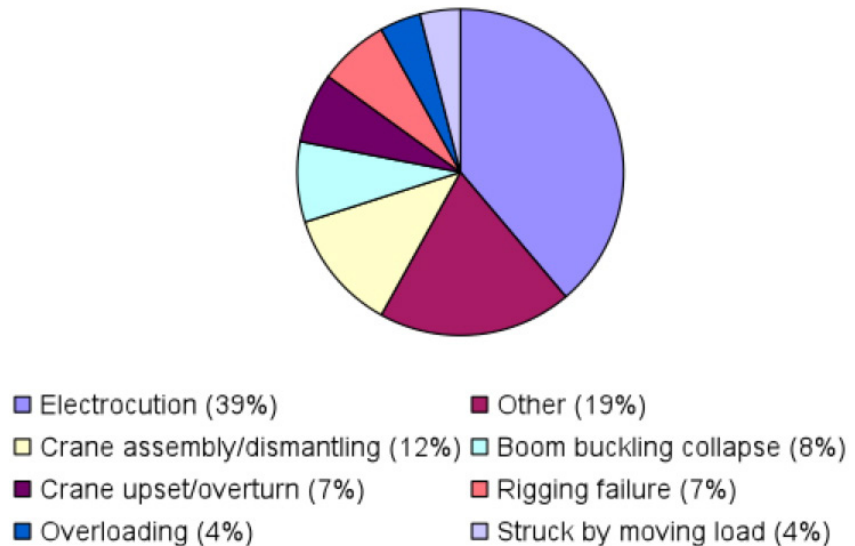
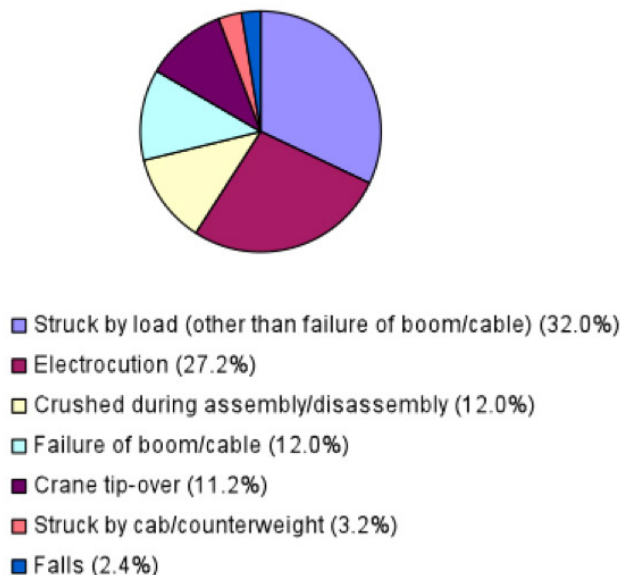


FIGURE 2 - CRANE FATALITIES  
(Beavers et al., 2006)



In 2006, the *Journal of Construction Engineering and Management* published an article which analyzed crane accidents that occurred between 1997 and 2003. Figure 2 shows the leading causes according to this more recent study.

Figure 2. Causes of crane fatalities, 1997–2003. From “Crane-Related Fatalities in the Construction Industry,” published in the *Journal of Construction Engineering and Management*, vol. 132 no. 9, September 2006.

Although inadequate mobile crane lift planning is not listed as a cause category, I suspect that it encompasses most, if not all, of the causal factor categories mentioned in both studies. Establishing criteria for critical lifts, preparing formal lift plans, understanding the factors that affect rated capacities of mobile cranes, ensuring equipment is in good condition, and ensuring only qualified and trained personnel operate the equipment are all important components in preventing mobile crane failures.

# Critical Lift Planning

All crane lifts require some level of planning, whether the load is a mere half-ton or more than 2,000 tons. Even non-critical lifts require knowledge of the weight of the load (and other components considered to be part of the load), the configuration of the crane, the rated capacity of the crane at its lift configuration, and factors that may affect the crane's rated capacity in order to make a go/no-go decision. However, critical lifts require more extensive planning and oversight by qualified persons.

The first step in establishing a corporate mobile crane lift-planning requirement is to define the term "critical lift." According to the Construction Safety Association of Ontario, a critical lift is one where the load weight is heavier than 75 percent of the rated capacity (Campbell and Dickie, 227). Other examples of critical lifts include the following:

- Lifts in congested areas where structures, pipelines, power lines or other obstacles are located
- Lifts that involve turning or flipping the load, which can result in "shock loading" or "side loading"
- Lifts that require machinery or assemblies furnished by others
- Lifts where the load weight is not known
- Lifts in areas of poor soil or unknown ground conditions
- Lifts that include potentially unstable pieces
- Lifts that utilize multiple cranes

Depending on the complexity of the lift, the formal lift plan can range in size from two pages to several pages. Some lifts require only information about the crane's configuration, load and rigging, and rated capacity; for others, engineering drawings of the crane and/or the load, load charts, crane

matting, etc. are needed. Sources of possible failure should be evaluated, including the crane's stability, structure, and other components (rigging, hoist line, etc.). At a minimum, the lift plan should include the following information to determine whether the lift can be safely made:

- Description of lift, including sketches
- Crane configuration, such as counterweight used, jib stowed or erected, lifting from main hoist or jib, jib length and offset angle, maximum load radius, number of parts of load line, size of load line, boom length, boom angle at origin and at destination, boom and load clearance distance, boom point elevation, etc.
- Rated capacity of crane—over-the-front, over-the-side, or a 360-degree rotation
- Rated capacity of hoist line
- Load weight, including empty load weight, headache ball, main block, lifting/spreader bar, slings and shackles, effective weight of the jib, weight of auxiliary line, weight of hoist line, and/or other items the crane manufacturer specifies as part of the load—i.e., deductions from the rated capacity
- Rigging capacity, including load attachments and slings
- Percent of crane's rated capacity, which influences "go/no-go" decisions

• Factors that may affect the crane's rated capacity—e.g., machine configuration, unbalanced rope reeving, improper use of outriggers, soft footing, unlevel crane, side loading, increasing load radius, shock loading, high duty cycle, and high wind speeds.

• Operator qualifications, training and proficiency for the specific crane type that will be used

• Condition of equipment—i.e., crane inspection and preventive maintenance program



# Operator Qualifications and Inspection/ Maintenance Program

Qualifications and training of the operator(s) and the condition of the equipment are important considerations in crane operations. OSHA requires mobile cranes to be operated by qualified personnel, but current federal OSHA regulations do not specify the qualifications and training required. Some states and municipalities have crane operator licensing or certification requirements, and the operator must be licensed or certified for the crane being used as applicable. Also, be sure to verify the crane has been inspected at the proper frequency intervals. These records should be readily available on site.

On October 3, 2008, OSHA published a proposed rule for cranes and derricks in construction in the Federal Register. This proposed rule was developed by industry representatives serving on the Cranes and Derricks Negotiated Rulemaking Committee. The proposed rule includes provisions for qualifying and certifying operators and inspection and maintenance of equipment, among other provisions related to crane and derrick operations in construction.

## Be Prepared

Use of a pre-list checklist when planning and executing a lift ensures that all considerations affecting the crane's rated capacity have been considered. If a lift cannot be made under the configuration and conditions specified in the lift plan, the lift should be re-evaluated and approved by a qualified person. Ensure that a process in place to verify that operators have minimum training, experience, proficiency, and medical fitness for the type of crane they will operate. Also, make certain that crane and rigging components are in good condition through a comprehensive inspection and preventive maintenance program. Finally, formal written lift plans should be required for all critical lifts.

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