Session No. 525

Boom! What Was That Noise? Common Causes of Crane Accidents and How to Prevent Them

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Crane accidents have occurred with some frequency since the invention of lifting machinery. Recent accidents that have involved the loss of lives have focused industry attention on cranes. Contrary to popular belief, there is no central repository of crane loss data. U.S. crane accidents that cause a loss of life to workers, or injuries to multiple workers, must be reported to OSHA. Other than that, and a few local ordinances, most accidents are not reported. Many crane operators carry large insurance deductibles, so smaller losses may not be reported to insurance carriers. There has been some discussion about national loss reporting requirements, but workable solutions are not imminent.

The volume of crane accidents can only be estimated, and the definition of "accident" is not universal. Some businesses may include only events that result in injury or death. Some loss data reports do not include liability considerations. Other reports include only some industry segments, while others exclude some categories. Even the definition of a crane is not in agreement. Some definitions exclude non-construction cranes such as industrial gantry, bridge and jib cranes, while others exclude longshore or mining operations.

The exact number of cranes in the U.S. is not known. The best estimates from U.S. Bureau of Labor Statistics, OSHA and The National Institute for Occupational Safety and Health put the number of mobile and tower cranes used in construction at between 95,000 and 100,000. One study by Zurich Risk Engineering for calendar year 2007 looked at crane accidents for 2 percent of the estimated national crane fleet and found an 8 percent accident rate. This study defined an accident as any event that caused physical damage to the crane or injury to a person. This equates to approximately 8,000 crane accidents in the U.S. per year.

There are three basic types of crane accidents:

- Structural failure
- Tip-over
- Collision

The basic causes of crane accidents are one or more of the following categories:

- Operations
- Assembly/disassembly
- Rigging
- Maintenance
- Weather

Other fringe causes exist, including design, vandalism, faulty repairs or counterfeit parts. Most of these could be included in the operations or maintenance categories above. Firm data is not available to put numerical values on the accident cause categories. Nearly all agree that operations represent well over half of the losses.

Operations includes most aspects of the crane's activities. Improper operation may contribute to a crane accident. Crane manufacturers provide an operations manual with their product that details the parameters for crane use. These include crane assembly, setup, inspections, capacities and limitations.

- Operator Qualifications – A key element to proper crane use is a skilled and knowledgeable operator. Upcoming OSHA rules will require operator certification and over a dozen states and cities already require an accredited certification. This is a good start, but does not guarantee safe crane work. An operator should be experienced on the particular piece of equipment being used, not just the class of crane. A growing number of employers are administering written and practical tests to help ensure operator proficiency.

- Assembly – The crane must be properly assembled, with all of the parts and connectors attached. The manufacturer will usually list how boom parts are to be arranged, and what boom extensions are permitted. Substitutions of parts are not permitted without the manufacturer's written consent. Also be aware that the ropes on the crane must match the manufacturer's specifications.

- Setup – This key area is sometimes overlooked. The crane must be level to within the specifications, usually within 1 percent or .57 degrees. Some manufacturers are even more restrictive on crane level. The crane also must be properly supported. On average soil, a crawler may not need any additional support whereas a crane with extended outriggers will usually require blocking below the floats to spread the load over a larger area. Inadequate cribbing has contributed to many crane accidents.

- Obstructions – Careful planning is needed when potential obstructions are within the crane's radius of operation. Any obstruction is a potential threat to crane safety. These include structures, bridges, other cranes, and the big one – power lines. No crane boom, load line or pendant should come into contact with any obstruction, especially when under load. For power lines, a clearance of ten feet or more should always be maintained from any energized overhead power line. Being struck by a moving object is also an exposure to consider.

- Capacities – A leading cause of crane accidents is failure to understand, or failure to apply knowledge of crane capacities. The manufacturers provide crane load charts and describe the methods for load chart application. Exceeding the capacity of an otherwise satisfactory crane is likely to lead to tip-over or structural failure.

- Computers – Some believe that having a computer onboard a crane will prevent losses. The computer must be properly programmed with the correct load moment indicator (LMI) codes. All sensors should be calibrated and tested and proper safety margins should be included. But the computer should serve only as a second set of eyes, backing up, but not replacing the skilled operator.

- Picking loads – Less than ideal crane movement will contribute to the effects of loads on a crane. Rapid starts and stops will increase dynamic loading. Sustained repetitive work, such as concrete

bucket work, is called "duty cycle" work and most manufacturers require a derating of the crane's gross capacity.

- Inspections – Cranes have three specified inspection frequencies – pre-shift, monthly and annually. Additional inspections are needed for cranes in severe service, after modification, or immediately after potential damage has occurred.

Assembly and disassembly includes putting the crane together, taking it apart, and jumping operations for tower cranes. Manufacturers supply instructions and procedures to accomplish the task safely. New OSHA regulations will require a qualified supervisor to be present whenever assembly and removal work is underway.

- Proper materials – Only parts approved by the manufacturer and specific for the crane type should be used. Substitutions should not be made.

- Assembly – Proper rigging equipment and practices should be used. Care should be exercised to ensure that parts are firmly attached before removing the rigging. Pendants should be attached as required to support long boom sections. Fall protection should be considered for work crews. Rebar pins are not acceptable replacements for missing parts.

- Jumping – Tower cranes are often jumped during the course of construction. This process increases the mast length, which increases the tower height. Manufacturer's procedures should be followed precisely. Rigging is not often specified but equipment and attachment should be made to provide a comfortable safety factor.

- Disassembly – When cranes are being broken down for removal, multiple hazards are present. Crane stability, boom support, counterweights and fall protection for crews are among the considerations.

Rigging is a task that may be performed by many, with some lacking proper training or equipment. If the rigging fails during a pick, or the load slips from the rigging, the load will fall endangering life and property below. In addition, the load itself may be damaged, and the recoil from sudden load loss may either snap the boom or cause the crane to topple over backwards.

- Trained riggers – There are no certifications or specific training requirements for riggers that are specified by OSHA. However, all riggers must be "qualified." Each rigger should be thoroughly trained on selection, inspection and application of the rigging equipment. They should be able to determine load weights, load attachment, types of hitches, sling angles and sling protection.

- Rigging equipment – Only approved rigging equipment, in good condition, should be used. Each piece of equipment should be inspected immediately prior to each use. Equipment should be marked with capacities, or riggers should have charts in their possession to determine load capacities. Rigging equipment should be stored out of the weather and should be protected from damage.

Maintenance includes both preventative maintenance and periodic inspections. Pre-shift inspections are usually performed by the operator, and are described above. The manufacturers provide guidance in their published maintenance manuals that describe periodic inspection, lubrication and parts replacement schedules and procedures.

- Monthly inspections may be performed by any qualified person. Typically, they are performed by a mechanic, and performed along with the manufacturer's prescribed maintenance schedule. The new OSHA rules will require written evidence of the last three-months' inspections.

- Repairs – When repairs are made, or parts are replaced, a notation should be made in the crane log book. Only parts approved by the manufacturer should be installed. Care should be taken to identify counterfeit parts.

Weather is a cause of, or contributor to, crane accidents. Weather can be a factor both when a crane is in operation, when idled between shifts, or when stored between jobs.

- Wind is a major weather factor that affects cranes. Some manufacturers supply wind guidance, but firm rules are difficult to discern. Generally, the effects of wind on a mobile crane should be carefully considered at speeds of 20 mph, and the crane should be taken out of service at 30 mph. Wind direction is important. Wind from the side is potentially the most serious, as it applies a side load on the boom. From the front, wind can decrease load radius and cause a collision between a load and a boom. From the rear, the load's radius may be increased. In all cases, consult the manufacturer's manuals for guidance. Remember that the manufacturer does not consider the effect of wind on the load.

- Ice and snow can have several effects on a crane's operation. Any accumulation of frozen precipitation on a boom should be cause for concern because this accumulation will increase the boom's weight, and will affect the crane's capacity. In addition, ice falling from a boom can cause injuries to people working below.

- Freezing temperatures can cause problems for cranes. Air systems with undrained water can freeze. Water that becomes trapped in hollow structural members, especially boom and mast sections, can freeze, expand and fracture metal. Drain holes, where provided, should be kept clear. Cranes parked overnight where temperatures may dip below freezing may become stuck to the ground. Dry plywood mats may provide some protection.