

USING CRANES SAFELY STARTS WITH THESE BEST PRACTICES.



The most important equipment on your construction site may also be the most dangerous.

Mobile cranes are involved in some of the most tragic and costly accidents in the construction industry. These costs can include OSHA fines in addition to civil and criminal liabilities.

Fortunately, all crane accidents are preventable with an effective safety management program. At The Hartford, our Construction Best Practices program helps our clients avoid injuries, unnecessary costs and penalties caused by the improper use of cranes. An efficient crane safety program will minimize work interruptions, promote an orderly flow of work and help to avoid accidents.

This Technical Information Paper discusses the three key areas related to safe crane operation—equipment, materials and people. It reflects our expertise based on years of firsthand experience, our work with leading industry experts and our analysis of more than 1,000 crane accidents. We've taken what we've learned and developed practical, effective guidelines for safe crane operation. Our program provides access to many skilled professionals who will help address your needs.

CRANE SAFETY PROGRAMS ARE NECESSARY

Cranes are invaluable to the construction, maritime, mining and logging industries. They perform difficult tasks, increase productivity and reduce project costs. But, their significant advantage can quickly be lost if an accident occurs. Crane owners must be committed to developing, implementing and enforcing an effective safety program to protect their employees, other trade contractors' employees, site visitors and the public.

The leading types of accidents include:

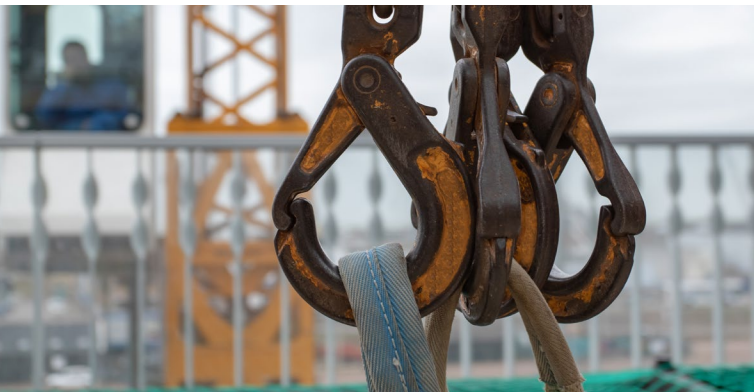
1. Upsets related to improper use of the crane, including crane use during high winds. Various studies have documented that more than 50% of all mobile crane accidents are the result of improper set-ups.
2. Structural damage caused by operator inattentiveness, failure to engage appropriate controls, contact with electrical power lines or two blocking.
3. Improper assembly or disassembly.

4. Boom over the cab.
5. Rope failures, especially with derricking and hoist lines.
6. Structural damage caused by defective materials, workmanship and component design.

THE LOAD – DO YOU NEED HELP?



The first step in addressing crane safety is to decide whether this is a job best handled by your firm or a specialist. This is a critical decision and should be made after thoroughly considering: the job lay-down area, the type of load being lifted, the type of equipment available to you, your employee's experience with this type of job, employee and public exposures and



costs. If you choose to work with a specialist, review our Technical Information Paper on Construction Contracts. It will help you understand the key considerations of a contract.

KNOW WHAT YOU ARE LIFTING

Different loads require different types of cranes. This sounds overly simplistic but, in reality, many accidents are caused by someone using the wrong crane to lift a particular load. Cranes are not a one-size-fits-all piece of equipment. Before you consider what is the right crane for your job, understand what is being lifted. While each load presents a unique set of lift requirements, here are some key items you'll need to consider, regardless of the job. There is no substitute for proper pre-lift planning, and the amount of time invested in planning the lift is directly related to the likelihood of completing the job without incident. Consider these factors in order to

choose the right crane for the job and to help ensure safety:

- How heavy is the load and how will the weight be verified? Do not rely upon shipping weights, as they're often inaccurate. We suggest that you use standard weights and measures or verify the weight with the manufacturer.
- Is the load symmetrical or nonsymmetrical?
- Where is the load's center of gravity?
- Does the load have lifting lugs? Is the position of straps, cable or chains specified or discretionary?
- Will the load be freely suspended at all times? A vibratory piledriver or extractor is not a freely suspended load and should not be used without the crane manufacturer's authorization.
- From what position will the load be lifted?
- Does the load have to be rotated or have a change of axis in the lift?
- Is the lift going to require a computer-assisted analysis?
- What will be the final resting position of the load?

SAFETY IS EVERYONE'S RESPONSIBILITY

Everyone plays a role in crane safety – management, supervisors and employees. Safe crane operations depend on teamwork and careful planning, supervision, training and maintenance.

Depending upon the size of your operation, you may decide to structure these responsibilities differently. That's fine as long as these procedures are addressed.

Crane Owner

The crane owner identifies and assigns specific responsibilities for equipment, lift supervision and crane maintenance and operation. The owner must understand the requirements of every job and provide the appropriate equipment and personnel to complete the job in a safe, efficient manner, according to applicable standards and regulations.

Owners also must make sure that all personnel involved in maintaining, repairing, transporting, preparing, assembling and operating the equipment are experienced and well trained to handle their specific jobs.

Equipment Supervisor

This individual selects a suitable crane to meet the job requirements, makes sure that competent workers are available for the project and that all cranes are properly equipped. The equipment supervisor also implements a maintenance and inspection program for the crane, including the boom.

This individual also ensures that the weight and capacity are clearly marked on any parts or accessories of the crane that affect load handling. Before any job begins, the equipment supervisor ensures the crane boom and jib are properly assembled and mounted and makes certain a qualified employee operates the crane and understands all aspects of the load chart as it applies to the crane. All crane assembly and disassembly should be conducted in accordance with the manufacturer's instructions.

Lift Supervisor



This individual supervises all aspects of the job, from machine location to the actual lift. He or she determines the correct weight of the load and the operating radius and shares this information with the operator.

The lift supervisor oversees the rigging crew, ensuring that the load is properly rigged, and prohibits lifts directly above ground personnel. The lift supervisor should also monitor weather conditions and shut down crane operations during high winds and/or inclement weather.

He or she designates qualified signalers and provides this information to the operator. Signalers are important, and your Risk Engineering consultant from The Hartford can provide you with a pictorial of the international hand signals. The lift supervisor should also keep workers clear of the crane during operation, control the movement of personnel in the lift area and oversee safety precautions when the lift is in the vicinity of power lines. According to OSHA Standard 29 CFR Subpart CC, a minimum 20-foot clearance zone should be maintained from overhead power lines containing voltages up to 350 KV; lines with higher voltages require a larger clearance zone.

Operator

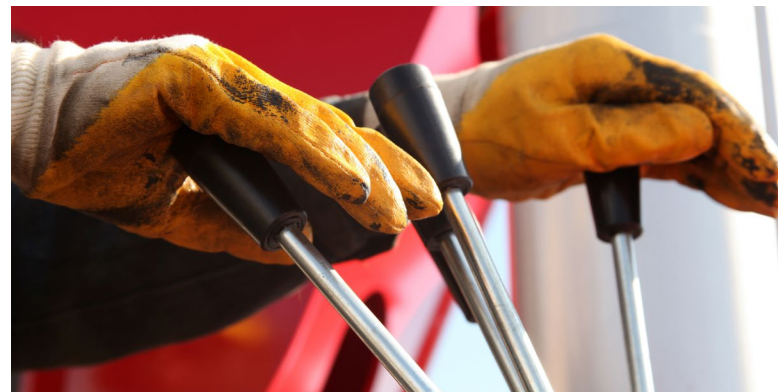
The operator plays a critical role, both before and during the lift. Before operating equipment, the operator must perform an inspection to make certain that the equipment is in proper working order.

This includes brakes, clutches, wire ropes, hydraulic circuits, safety devices and operational devices. We recommend a checklist be employed to address the inspection in a consistent, thorough manner. An adequate record system is an important component of a sound risk management program.

Operator Selection

Selecting an operator is an important decision.

An operator's intelligence, training and good judgement will help reduce the risks associated with crane operation. Qualified operators should meet the guidelines established by The National Commission for the Certification of Crane Operators (NCCCO). These have been endorsed by OSHA and are supported by The International Union of Operating Engineers. You can find this information at [OSHA.gov](https://www.osha.gov).



Training for the Job

Classroom training should be reinforced with on-the-job training. Operators must be familiar with the rules, regulations, requirements and limits of crane operation, and have an opportunity to practice what they've learned before they're asked to do it for real. There are many instances of losses where inexperienced or improperly trained operators were not prepared to do a particular job.

You should create and maintain a system for documenting training and proficiency levels to ensure that an operator's skills are kept current. In some states, both operators and riggers are required to have authorization permits or certifications, renewable at one- or two-year intervals upon re-examination.

KNOW THE EQUIPMENT YOU ARE USING

The single most important item for safe crane operation is knowing the crane's lift capacity and limitations. That's why every crane manufacturer – for every type of crane – has produced specific lift capacity charts. These charts allow a crane operator to determine the safe maximum load for any boom length, boom angle and load radius.

Mobile cranes are extremely versatile pieces of equipment. There are many types of cranes, including boom, industrial, carrier/crawler, rough terrain, heavy-lift and mobile tower. Some of these cranes can lift up to 1,000 tons, while others have booms more than 500-feet in length. If your crane is not suited to the job, you create an unsafe condition before the work begins. Take care to select the right crane for the job.

Selection Criteria

When selecting a crane for a job, consider the following:

- Weights and measures of the heaviest and largest loads.
- Maximum lift height.
- Maximum lift radius.
- Number of lifts.
- Availability of appropriate laydown areas.
- Precision placement of loads, including whether or not loads have to be walked or carried.
- Tackle and rigging equipment needed for the safe working load.
- Stability of the ground to support the weight of the crane.



Read Your Load Charts and Manuals

Load charts specifying the boom length, boom angle and load capacity should be mounted in clear sight in the operator cab. These charts enable operators to determine if the cranes they are operating can lift their loads safely. Make sure operators know how to read these charts and understand the importance of doing so. Based upon our experience, many crane operators – including long-term operators – don't fully understand these charts.

Many codes and standards exist for the safe inspection, maintenance and operation of mobile cranes. Consult the Occupational Safety and Health Organization (OSHA), the American National Standards Institute (ANSI) or the American Society of Mechanical Engineers (AMSE) standards.

Create a Plan for Each Job



Operators must be thoroughly prepared before making a lift. As discussed earlier, there are many considerations that affect the lift. To increase the likelihood of completing the lift without incident, create a lift plan based on the requirements of the job. We encourage you to prepare written plans for all jobs. This process helps to ensure that all aspects of the job are addressed thoroughly and consistently.

The plan should address:

- All necessary moves, crane set-up (including use of mats under outrigger pads), and lifts.
- The site conditions, including ground and wind factors, access roads and maps, potential obstacles and available space for erection, operation and dismantling. The location(s) and voltage(s) of overhead power lines at the site and the control measures in place to maintain safe clearance zones.
- The maximum loads at given radiuses that can be lifted and placed without being pre-engineered, as well as the pre-engineering method for all others.
- The number of lifts.
- The weight of near capacity loads in place of indicated actual weight figures. Invoice weight figures should never be used, assumed or guessed at.

It should also clearly be understood by everyone that once the lift plan has been finalized, there should be no subsequent changes without the written approval of the

engineer in charge of the lift. Sometimes, seemingly small changes create a new set of lift considerations not always apparent.

Use The Hartford's Risk Engineering organization's critical lift plan form and rigging plan checklist to ensure all safety measures have been taken.

Assess Ground Conditions

The ground surface must have enough stability and bearing capacity to support the dead weight of the crane, the load, the rigging, any shock (impact) loads and any dynamic conditions such as swinging, hoisting, lowering and traveling.

As a crane sits on a surface, it exerts varying pressures based on the operating conditions and quadrants. The lowest pressure on the ground occurs when the total weight of the machine is distributed over the entire area of both the crane tracks and outrigger pads. The weight distribution changes as the load moves in different quadrants. Lifting a load over the corner of an outrigger pad produces the maximum ground pressure and is the most dangerous position from which to lift.

Consider the ground pressure created by dynamic or impact loads. Cranes that swing rapidly or make sudden stops while bearing a load greatly increase the ground pressure. You need to account for this in your lift plan. Ensure that the swing radius of the crane is properly barricaded to prevent employee injury.

Outrigger Blocking

Manufacturers recommend the use of fully extended outriggers at all times to avoid an upset. Unfortunately, many mobile crane accidents are caused by an operator not using the outriggers or by only partially extending them. Again, another common sense requirement that's not always followed. We have investigated many accidents involving careless setups caused by overly aggressive operators taking shortcuts.

Safe Maintenance Makes Sense

You should make sure that routine maintenance checks and repairs are conducted on cranes used in your operations. Keep a record of all maintenance to demonstrate that you have followed the manufacturer's schedule.

While many contractors maintain the log in the crane, you may also maintain it in a central office. The important point is to have and use the log.

SUMMARY

Cranes play an indispensable role in construction operations. And with careful planning, training and control, cranes can be operated safely to most effectively manage operating costs, and keep your project running smoothly. At The Hartford, many of our Risk Engineering consultants have the experience and expertise to provide crane training. We offer on-site or classroom training to address the needs particular to certain jobs or trades, such as steel erection. Our risk management services will provide you with the information you need to build an effective crane safety program.

LEARN MORE ABOUT OUR COMMITMENT TO YOUR SAFETY.

Contact your Risk Engineering consultant to access resources 24/7 with policy number at [TheHartford.com/riskengineering](https://www.TheHartford.com/riskengineering)



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