

Mobile Crane User Guidelines

Presented By

The AGC Colorado Crane Task Force



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Mobile Crane User Guidelines

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BACKGROUND

Recently there were a number of high profile crane accidents and fatalities that have brought a heightened awareness to crane safety. Members of the construction industry, their respective clients and the public as a whole have expressed the desire to increase the efforts for crane safety across the board to reduce the number of crane related accidents and fatalities across America. At the current time, there are several laws, recommended practices and industry consensus documents that deal with the topic of crane safety, but they are spread across a broad spectrum of industries and crane types that most construction companies are not able to easily find the best safety information that relates to their exposures. The AGC Colorado Crane Task Force was founded not only to separate out the best safety information from current documents that specifically affects the construction industry, but to fill in the voids of lacking crane safety information to provide AGC members with the most comprehensive, industry specific crane safety information possible.

PURPOSE OF THE GUIDELINES

This document is a listing of suggested best practices for the use of mobile cranes within the construction industry. Although some of the language mirrors regulatory requirements such as OSHA standards, this is not intended to be a compliance document. This document may reference best practices above and beyond regulatory compliance.

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I. Selection Criteria for Mobile Cranes

Section Rationale: Selecting the right crane for the job is one of the most critical decisions that can affect the overall safety performance of the project. In order to ensure the proper crane is selected, thoughts must go beyond the standard concerns of the particular load(s) that must be hoisted. A comprehensive selection process will also consider things such as site access, available space, ground conditions, critical picks and other concerns.

1. Lifting logistics
 - a. Loads to be lifted
 - i. Weight of heaviest pick including rigging
 - ii. Load size/dimensions
 - iii. Multiple picks versus single pick
 - iv. Multiple lift rigging
 - v. Will pick have to be traveled
 - vi. Multiple cranes
 - b. Maximum height & radius considerations
 - i. Height/radius of the lift
 - ii. Height/radius of the crane
 - iii. Height/radius of obstacles
 - iv. Leading edge of building as constructed (if applicable)
 - v. Weight of load at maximum / minimum radius
2. Delivery logistics
 - a. Clearances for both height and width
 - b. Turn radii for delivery truck and/or mobile crane
 - c. Weight Restrictions
 - d. Lane closures or street construction
 - i. City permits
 - ii. Light boards, cones, barrels, etc.
 - iii. Certified flaggers
 - e. Grade and slope of access road / ramps
3. Lift considerations
 - a. Critical lift
 - i. As defined by owner
 - ii. As defined by regulatory agency
 - iii. As defined by other source
 1. Monetary, historical or irreplaceable value of item to be lifted
 2. Lifts over highways, occupied buildings, etc.
 - b. Man basket use
 - i. 50% of max capacity
 - ii. Trial lifts with test weights
 - iii. Basket construction requirements
 - c. Special crane requirements
 - i. Power down capabilities, etc.
 - d. Number of picks/duty cycle
 - i. Frequency of picks
 - ii. Prolonged suspension times
 - iii. Time required to make the lift and secure the load

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4. Site Logistics
 - a. Crane operational footprint
 - i. Existence of power lines
 - ii. Bridges
 - iii. Other obstructions
 - b. Crane Pad Considerations
 - i. It is recommended to consult with an engineer to determine how the following issues may affect your proposed crane setup:
 1. Ground bearing pressure (compaction and soils test needs)
 2. Proximity to prior excavations/ Open excavations
 3. Underground utilities
 4. Engineered fill
 5. Shoring requirements
 6. Slab on grade or other improved surface (i.e., asphalt pavement)
 - c. Airports and height restrictions, flagging of boom
 - d. Limited crane pad dimensions may affect crane size
 - e. Vertical and horizontal space restrictions
 - f. Potential relocation or movement of crane during construction phasing
 - g. Free and clear assembly and disassembly area for type, size & dimensions of selected crane
 - h. Dark environments require lighting
5. Time
 - a. Schedule of the job could affect the time, size or the amount of cranes
6. Money
 - a. Budgets may affect time, size or the amount of cranes
7. Operator supplied by vendor versus bare rental
 - a. Wet rental = rental company's liability for operator error
 - b. Dry rental = contractor liability for operator error
 - c. Dry rental may require authorization by rental company
8. Pre-Construction Considerations
 - a. Scheduling: availability/lead time
 - b. Permitting issues (include local permits/city ordinances/ask about special restrictions)
 - c. Site specific requirements

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II. Assembly/Disassembly

Section rationale: Though the assembly and disassembly process of a crane is often given little thought, these tasks are integral to the safety, efficiency and productivity of mobile cranes. Proper site access, as well as an adequate amount of level and stable ground is needed to build up and tear down a crane safely. The assembly and disassembly process is also host to some high risk hazards such as fall exposures and pinch points that require careful pre-planning.

1. Free and clear assembly and disassembly area for type, size, and dimensions of selected crane
 - a. Controlled access to the assembly area.
 - b. Site restrictions for disassembly affected by constructed structure/building
 - c. Clearances for both height and width
 - d. Proper clearance from power lines
 - e. Turn radii for delivery truck and/or mobile crane
 - f. Weight restrictions
 - g. Lane closures or street construction
 - h. Suitable ground conditions
 - i. Level setup within 1%, checked with accurate tools
 - ii. E.g. inclinometer; 4 foot level; etc.
 - iii. Grade and slope of access road / ramps
 - iv. Refer back to Section I .4.b. for more information
2. Designated Competent Person supervising assembly/disassembly
3. Additional equipment considerations
 - a. Set up cranes, aerial lifts, lighting, ladders, earth moving equipment, etc.
4. Assembly Crew pre-task JHA
 - a. Fall protection, struck by hazards, caught between, electrical, etc.
5. Post-assembly / pre-operational inspection by qualified personnel (this could be part of a daily inspection). Your company policies may require documentation.

III. Operations

Section rationale: This section addresses the safety concerns for a crane that is setup and operating on the project. Considerations range from the roles of the operator, crew and lift director to the many possible hazards and concerns that must be considered and addressed.

1. Prelift/pretask meeting(s) between all related parties to the craning activities
 - a. Assess daily physical and psychological health of operator and crew
 - i. E.g. signs of exhaustion, mental stress, substance abuse, etc.
 - b. Site specific requirements
 - c. Ensure crane operations personnel are aware of site specific Emergency Action procedures
 - d. Max Weight, size & radius of load verified against load chart
 - i. Heaviest load to be lifted
 - ii. Maximum height and radius considered
 - iii. Critical lift exceed 75% of rated capacity at given radius and configuration

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- iv. Involves more than 1 crane during a pick
2. Consider who is the person directing the lift for each lift to be completed
 - a. Rigger, Superintendent, Operator, Etc.
 - b. Each contractor who uses a crane has a qualified lift director
 - i. Qualifications are similar to ANSI B30.5-3.1.3.2.2
 - c. Lift director has the duty to stop lift for safety reasons
3. Use qualified operator
 - a. Physical qualifications (ANSI B30.5, NCCCO, or DOT Physical)
 - i. Good vision
 - ii. Good hearing
 - iii. Sufficient physical qualifications
 - iv. Passed a drug test
 - v. no evidence of having physical or mental defects
 - b. Basic Safety knowledge
 - i. NCCA or ANSI accredited certification applicable to crane being operated (NCCCO, etc.)
 - ii. Familiar with crane limitations, controls, load charts, etc.
4. Use qualified signal person
 - a. Qualifications
 - i. Appointed by lift supervisor and approved by the crane operator
 - ii. Know, understand and apply the type of signals used
 - iii. Basic understanding of crane operation and limitations
 - iv. Know and understand the relevant requirements of crane laws
 - v. Demonstrate s/he is competent to perform signal duties.
 - b. A signal person must be provided in each of the following situations:
 - i. The point of operation is not in full view of the operator.
 - ii. The operator's view is obstructed during setup or travel.
 - iii. Operator or person handling the load determines that it is necessary.
 - c. Standard Hand Signals must be used where applicable to operations– OSHA & ANSI
 - d. When non-standard hand signals must be used (operations or attachments not covered by standard signals), the signal person, operator, and lift supervisor (where there is one) shall agree on the non-standard hand signals prior to use.
 - e. If signaling communication becomes interrupted, operations shall be stopped until signaling can continue.
 - f. The operator shall obey a stop signal from anyone at any time.
 - g. All directions given to the operator by the signal person shall be given from the operator's direction perspective.
 - h. Radio, telephone or other electronic signals
 - i. Verify function of communication devices before lifting.
 - ii. Signal transmission must be through dedicated channels as needed (multiple cranes, etc.).
 - iii. The operator's reception of signals must be by a hands-free system.
 - iv. Voice signals shall be agreed upon by both operator and signaller prior to operation. These signals should be from the operator's perspective.
 - v. The operator, signal person and lift director, shall be able to effectively communicate in the language used.
 - vi. Voice signals should identify the parties involved (i.e. "Mike, it's Jim, Cable Down")

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- i. PPE considerations (Fall Protection, visibility, etc.)
- j. Hand signal chart
 - i. Hand signal charts must be either posted on the equipment or readily available at the site.
 - ii. When non-standard hand signals must be used (operations or attachments not covered by standard signals), the signal person, operator, and lift supervisor shall agree on the non-standard hand signals prior to use. These special signals should not be in conflict with the standard signals.
 - iii. Reference ANSI B30.5 (latest version)
- 5. Use qualified riggers
 - a. Know the weight of the load
 - b. Know how to select the appropriate rigging for the load
 - c. Know the differences between hitching configurations
 - d. Know how to inspect rigging
 - e. Understand the concept of center of gravity and balancing of the load
- 6. Documented inspections
 - a. Verify annual inspection
 - b. Review crane and inspection history
 - c. Pre-shift inspections recorded in Daily Crane Log
 - d. Rigging inspections
 - e. Monthly
 - f. Post Incident
 - i. Contact electrical lines
 - ii. Suspected damage to crane
- 7. Work area control
 - a. Swing Radius Protection – rotating superstructure of the crane including counterweight
 - i. Erect and maintain control lines, warning lines, railings or similar barriers to mark the swing radius including counter weight due to hazards of struck by or caught in between.
 - 1. Where swing radius protection is not feasible, use a dedicated spotter
 - ii. Employees who may enter the swing radius shall be trained how to recognize struck-by and caught between hazards.
 - iii. Communication and coordination between operator and personnel who must enter the swing radius shall be maintained.
 - b. Jobsite security
 - i. Post signs to keep unauthorized persons out of the area
 - ii. Insure equipment is secured at all times from unauthorized access.
 - c. Multiple equipment coordination
 - i. Where any part of a crane/derrick is within the working radius of another crane/derrick, the lift director(s) shall institute a system to coordinate operations.
 - d. Keeping clear of the load
 - i. Avoid swinging loads over personnel (workers, public, etc), use caution when:
 - 1. Engaged in hooking, unhooking or guiding a load
 - 2. Engaged in the initial attachment of the load to a component or structure
 - 3. Working with suspended equipment
 - 4. During specialized operations such as tilt-up, personnel shall not be within the fall zone of the load until it is vertical

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- e. Considerations for traveling with a suspended load
 - a. Do so only if determined to be safe and legal (manufacturer restrictions, etc.)
 - b. Different load charts may need to be used
 - c. Load may need to be secured during travel
 - d. Swing lock and/or other interlocks may need to be engaged
 - e. Consider routes of travel and ground conditions
 - f. Additional signalperson assistance may be need

- 8. Power lines
 - a. Assume that all power lines are energized unless the utility owner/operator confirms that the power line has been and continues to be de-energized and visibly grounded at the worksite.
 - b. Whenever there is potential for a crane to contact a power line, contact the utility company and work with them to discuss the following considerations and limitations:
 - i. Eliminate exposure
 - 1. Have utility de-energize or take down power line
 - 2. Choose different setup location away from lines
 - 3. Use different means and methods to avoid exposure
 - ii. Reduce exposure
 - 1. Utility company prepares line with safety devices
 - a. Insulation wraps
 - b. "one shot"
 - c. Install lighter fuse
 - iii. Safe work distances
 - 1. Meet with utility company to determine the safe approach distance to the energized power lines
 - 2. Use a dedicated spotter
 - 3. Consider a visual warning device
 - 4. Meet or exceed relevant State, OSHA and ANSI guidelines
 - c. Communications towers and transmitters
 - i. When working near transmitter/communication towers where the equipment is close enough for an electrical charge to be induced in the equipment or materials being handled, the transmitter shall be de-energized or the following precautions shall be taken when necessary to dissipate induced voltages:
 - 1. The equipment shall be provided with an electrical ground.
 - 2. Non-conductive rigging or an insulating link/device shall be used
 - d. All personnel on site where a crane has the potential to contact power lines shall know the following:
 - i. Contacting energized power lines is the number one killer during crane operations.
 - ii. The importance to the operator's safety of remaining inside the cab except where there is an imminent danger of fire, explosion, or other emergency that necessitates leaving the cab.
 - iii. The safest means of evacuating from equipment that may be energized.
 - iv. The danger of the potentially energized zone around the equipment, evacuation methods. Do not enter into this zone.
 - v. Safe clearance distance from power lines.

- 9. Operational Aids
 - a. Operational Aids may include, but are not limited to the following:
 - i. Load moment indicator/load cell

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- ii. Anti-two block
 - iii. Load radius
 - iv. Proximity alarms
 - b. When crane is equipped with an operational aid, it must be functional and operator should be trained on its use
 - c. When the crane is not equipped with an operational aid by the manufacturer, it is recommended aftermarket aid be installed.
 - i. At a minimum load cells are recommended.
 - ii. Other aids based on conditions of use
 - d. In the event an operational aid fails during crane use, crane operations may continue if the manufacturer provides alternative safe methods for operation.
- 10. FAA/air rights
 - a. When working in an area when it is possible to affect navigable airspace, contact all nearby airports, hospitals, etc. to determine what air traffic safety requirements are needed.
 - b. File a permit with FAA as required
 - c. Special requirements may apply such as:
 - i. Flagging the boom
 - ii. Installing light beacons at the crane's high points
 - iii. Height restrictions during operation & crane down-time
- 11. Leaving the equipment unattended
 - a. The operator shall not leave the controls while the load is suspended
 - i. NOTE: This does not apply to below the hook rigging devices.
 - ii. There are provisions in ANSI B30.5 that allow operators to leave the controls of a crane with a load suspended provided that special circumstances are involved and special safety precautions are met.
 - iii. Secure the equipment when unattended against unauthorized use/entry
 - iv. Weather considerations (high winds, lightning, etc)
- 12. Weather and Environmental Conditions
 - a. Crane operations shall be stopped due to adverse conditions, such as:
 - i. Excessive wind velocity or gusting
 - ii. Fog and visibility issues
 - iii. Lightning and storms
 - iv. Changing soil conditions
 - 1. Freeze/thaw
 - 2. Heavy rains/snow
- 13. Written critical lift Plan – Exceeds 75% of max capacity or 2 or more cranes (or powered units) for a pick or per other agreed upon conditions
 - a. Documented pre-lift meeting with all involved parties
 - b. Calculations of load, rigging and line weights
 - c. Description of crane activity
 - d. Diagram of load path
 - e. Diagram of rigging configuration.
 - f. Copy of crane chart
 - g. Prior to lift, field verifications of documented plan (measurements, clearances, rigging, etc.)

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- h. Signatures of persons involved
- 14. Engineered Lift Plan
 - a. CDOT requirements for certain lifts
 - b. Owner required on certain projects
 - c. Signed, Stamped lift plan by RPE

IV. Hoisting and Rigging

Section rationale: If a chain is only as strong as its weakest link, then a hoisted load is only as good as how it is rigged. This depends on the rigger being qualified, and the load being rigged correctly with the proper rigging components. Hoisting and rigging concerns are just as important as the crane itself; consider:

- 1. Rigging Equipment
 - a. Selecting Appropriate Rigging
 - i. Qualified Person designated by lift director selects rigging equipment
 - 1. It is recommended that qualifications are verified through testing.
 - b. Load Considerations
 - i. Weight
 - ii. Dimensions
 - iii. Center of gravity/load transfer
 - 1. Special considerations
 - a. Table forms
 - b. Large equipment landed into receiving floors
 - iv. Sharp corners
 - v. Manufacturer structural considerations and designed pick points
 - vi. Suspended Personnel Platform use
 - 1. Rigging must have no other duties than manbasket suspension.
 - c. Environmental Considerations
 - i. Thermal exposures
 - ii. Moisture/corrosion
 - iii. Chemical
 - d. Inspection of Equipment
 - i. Qualified rigger(s) performing inspections
 - ii. Visual means of manufacturer & capacity identification
 - iii. Consider quality and reliability of manufacturer
 - iv. Initial, frequent & periodic inspections
 - 1. Periodic inspections require documentation; other inspections should be documented as needed.
 - v. Qualified Rigger shall remove any defective equipment from service
 - 1. It is recommended that the defective equipment be rendered unusable.
 - e. Storage & Care
 - i. Weather & environmental exposures
 - ii. Damage from loads and equipment
 - iii. Chemicals, welding UV and slag, open flame
 - f. Suitability & Compatibility of Rigging Pieces
 - i. Engineered below the hook lifting devices (documentation available)
 - 1. Spreader bars, plate clamps, barrier tongs, etc.

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2. Rigging Practices
 - a. Qualified Person designated by lift director oversees rigging activities
 - i. It is recommended that qualifications are verified through testing.
 1. All riggers selected by qualified rigger outlined above
 2. Inspect rigging equipment before and after the lift
 - ii. Determine appropriate rigging configurations
 1. Hitches to be used
 2. Hardware (shackles, hooks, etc.)
 3. Rigger reference materials on site (cards, charts, graphs, etc.)
 4. Use of softeners to protect against damage and secure them properly.
 5. Proper PPE and access to rigging points (i.e. Fall Protection)
 6. Ensure that the load is properly rigged and balanced before it is lifted and after lifting the load a few inches
 7. Special rigging considerations have been met (braces for tilt-up panels, guy wires, etc.)
 - b. Removal of rigging considerations
 - i. Proper PPE and access to rigging points
 - ii. Ensure load is secure before removing rigging (dunnage, etc.)
 - iii. Ensure rigging is free from being snagged (by persons or equipment) while unhooking the load and while the crane flies it clear of load and equipment.
 - iv. Secure softeners and other loose equipment that could fall while flying rigging.

V. De-Mobilization

Section rationale: Once the last load has been lifted it is now time to disassemble the crane and remove it from the project. Competent and qualified personnel are still needed on site to ensure safety concerns are met. Disassembly may not be as simple as doing the assembly process in reverse. It's likely the site has changed, access routes may be different and the construction job itself may present new obstructions to take into account. All of the items addressed for crane delivery and assembly must now be considered relative to the changed conditions.

1. Free and clear disassembly area for type, size & dimensions of crane
 - a. Controlled access to the Disassembly area.
 - i. Site restrictions for disassembly affected by constructed structure/building (utilities, tunnels, chases, etc.)
 - ii. Clearances for both height and width
 - iii. Proper clearance from power lines
 - iv. Turn radii for freight truck and/or mobile crane
 - v. Lane closures or street construction
 - b. Grade and slope of access road / ramps
2. Designated Competent & Qualified Person(s) supervising disassembly
3. Additional equipment considerations
 - a. Assist cranes, aerial lifts, lighting, ladders, etc.
 - i. Disassembly Crew pre-task JHA

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4. Dismantle per manufacturer's recommendations and/or Disassembly Supervisor's procedures
 - a. Consider things such as sequence of disassembly, laying down boom, boom pin removal, removal of jib, counterweight removal, etc.
 - b. Consider hazards during removal such as fall protection, struck by hazards, caught between, electrical, etc.
5. Pre-trip inspection to ensure loads are secured and equipment is safe for travel
 - a. Consider oversized loads, secured hooks, blocks, tools, etc.
 - b. Consider travel route and public exposures

VI. Insurance Coverage, Hold Harmless, and Indemnity

Section rationale: Sound advice must be sought to address the various legal and liability concerns related to cranes. Rely on the expertise of your insurance company and broker (as well as consultants, industry experts, among others), to guide you through the many concerns and issues that must be addressed.

1. Establish proper coverage & policy types based on counsel with insurance company/broker & legal, minimum limits and transfer of risk that is consensual to all affected parties
 - a. Consider if cranes are self-owned, bare-rental, or owned and operated by another party
 - b. Consider what parties are rigging loads and directing lifts
 - c. Consider value of loads that will be lifted
 - d. Controlled insurance program requirements
 - e. Contract requirements
2. Use of written contracts and/or lease agreements with terms & conditions
 - a. One contractor's crane lifting another contractor's load, etc.
 - b. Allowance for change of condition work stoppage.