MOBILE CRANE LIFT PLANNING

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Mobile crane incidents can cause devastating results in terms of production, property damage, and loss of human life. In addition, crane-related incidents tend to be high profile events that receive a lot of publicity as indicated by the following recent news article headlines:

"Man injured in crane accident"
- KMOV (St. Louis, MO)

"Crane accident closes rail line"
- BBC News

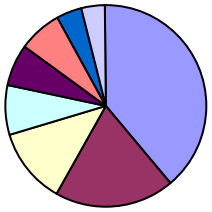
"Crane driver escapes injury in accident"
- The Courier

"Crane collapses"
- The Advertiser (Lafayette, LA)

"Four workers dead in crane collapse"
- McGraw Hill Construction

The leading causes of crane-related fatalities based on data from a 1996 analysis of 502 crane-related incidents (Suruda, Egger, and Liu) are provided in Figure 1.

FIGURE 1 - CRANE FATALITIES



- Electrocution (39%)
- Other (19%)
- Crane assembly/dismantling (12%)
- Boom buckling collapse (8%)
- Crane upset/overturn (7%)
- Rigging failure (7%)
- Overloading (4%)
- Struck by moving load (4%)

"Avert the danger that has yet to come." - Yoga Sutra

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A separate study involving a review of 158 crane-related incidents from 1997 to 1999 identified the most frequent causes of mobile crane incidents to be instability (e.g., unsecured load, load capacity exceeded, ground not level or too soft, etc.), lack of communication, and electrical contract. However, "people do not plan to fail, they fail to plan." As a result, less-than-adequate mobile crane lift planning encompasses most, if not all, of the above causal factor categories. Therefore, establishing criteria for "critical lifts," preparing formal lift plans, and utilizing lift planning checklists are important components in preventing mobile crane failures.

CRITICAL LIFTS

All crane lifts require some level of planning whether only a 1,000-pound load is being lift or a complex 2,000-ton multi-crane lift is to be made. 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 the crane's lift configuration, and factors that may affect the cranes rated capacity in order to make a "go/no go" decision. However, "critical lifts" require more extensive planning and oversight by qualified persons and thus, a more formal approach. For such "critical lifts," it is prudent to have a formal lift plan prepared and approved by qualified persons to minimize the potential of a crane (stability or structural) failure.

In order to establish a corporate mobile crane lift-planning requirement, the first step is to define the term, "critical lift." The Construction Safety Association of Ontario defines "critical lifts" as those lifts where the load weight is heavier than 75% 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 involving "turning" or "flipping" the load over where "shock loading" and/or "side loading" is likely to occur.
- Lifts that involve machinery or assemblies furnished by others or lifts where the load weight is not known.
- Lifts in areas of poor soil or unknown ground conditions.
- Lifts involving potentially unstable pieces.
- Lifts involving multiple cranes.

Depending on the complexity of the crane lift, the formal lift plan may involve several pages (including engineering drawings of the crane and/or the load, load charts, crane matting, etc.) to a simple two-page document that provides the necessary information pertaining to the cranes configuration, accurate load and rigging information, and the crane's rated capacity. In addition to crane stability or structural failures, other components (such as rigging, hoist line, etc.) may also be a source of failure and their capacities should also be evaluated. Figure 2 includes a sample mobile crane lift plan that provides basic information that should be considered when planning a mobile crane lift.

PRE-LIFT CHECKLIST

There are many factors that affect a crane's rated capacity. Therefore, it is generally a good practice to use a pre-lift checklist when planning a lift and for site personnel to also use just prior to executing the lift to ensure that those conditions that may affect 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. A sample pre-lift checklist is also included in Figure 2.

In summary, formal written lift plans should be required for all "critical lifts" as defined by your organization in order to prevent high profile incidents with the potential to cause devastating damage, injuries, and unfavorable publicity for your company.

"Let our advance worrying become advance thinking and planning."
– Winston Churchill

REFERENCES

Campbell, D. and D. Dickie. *Mobile Crane Manual*. Toronto, Ontario, Canada: Construction Association of Ontario, 1982.

Suruda, A., M. Egger, D. Liu. 1997. Crane-Related Deaths in the U.S. Construction Industry, 1984-94. The Center to Protect Workers' Rights, (Report No. D2-97).

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FIGURE 2 – MOBILE CRANE LIFT PLAN

Description of Lift (Attach Sketch):

CRANE CONFIGURATION

Crane Manufacturer:		
Model Number:		
Boom Configuration:		
Counterweight Used:		
Jib **Erected** or **Stowed**:		
Lifting from **Jib** or **Main Hoist**:		
Jib Length:		ft.
Jib Offset Angle:		°
Maximum Load Radius:		ft.
Number of Parts of Load Line:		
Size of Load Line:		in.
Boom Length:		ft.
Boom Angle at Origin:		°
Boom Angle at Destination:		°
Boom-Load Clearance:		ft.
Boom Point Elevation:		ft.

RATED CAPACITY

Over Rear:		lbs.
Over Front:		lbs.
Over Side or 360 Degrees:		lbs.
Hoist Line:		lbs.
RATED CAPACITY FOR LIFT:		lbs.

LOAD WEIGHT

"Empty" Load Weight:		lbs.
Allowance (unaccounted wt.):		lbs.
Headache Ball:		lbs.
Main Block:		lbs.
Lifting/Spreader Bar:		lbs.
Slings and Shackles:		lbs.
Effective Weight of Jib:		lbs.
Load Line ("Whipline"):		lbs.
Load Line (Main Hoist):		lbs.
TOTAL LOAD WEIGHT:		lbs.

RIGGING CAPACITY

Load Attachments:		
Capacity of Load Attachments:		lbs.
Sling Type:		
Number of Slings:		
Size of Slings:		in.
Sling Length:		ft.
Sling Angle:		°
Rated Capacity of Slings:		lbs.
RIGGING CAPACITY:		lbs.
% of RATE CAPACITY:		%

Notes:

Prepared By:_____ Date:_____

Reviewed By:_____ Date:_____

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FIGURE 2 – MOBILE CRANE LIFT PLAN (CONT.)

PRE-LIFT CHECKLIST

	Yes	No
Is the crane configured in accordance with the lift plan?		
Has the crane been inspected and the condition acceptable?		
Has the rigging equipment been inspected, secured, and in acceptable condition?		
Is the supporting surface stable?		
Are proper crane mats placed under outrigger floats and at a 90-degree angle to the outrigger cylinders? Are crawler cranes on proper crane mats?		
Are outriggers (if applicable) fully extended with tires off the ground?		
Is the crane within 1 degree of level? Has the levelness of the crane been checked with a four-foot carpenter's level or other acceptable method? The "target" level in the crane cab can be used for initial leveling but should not be considered reliable for critical lifts.		
Is the exact load weight known?		
Is the location of the center of gravity of the load known and the crane hook positioned directly above it?		
Was the load radius measured exactly? For heavy lifts, has the potential increasing load radius due to deflections in the boom, tire, and/or carrier been considered?		
Was the boom length determined exactly?		
Was the boom angle determined exactly?		
Are wind conditions acceptable? If wind speeds are in excess of 30 mph, the lift should not be made; if wind speeds are more than 20 mph, consider postponing the lift.		
Is the rope reeving balance to prevent boom twist?		
Is the rigging capacity acceptable?		
Is the weight of the rigging known?		
Has the clearance between the boom and the load been considered and is it sufficient?		
Has the clearance between the boom tip and block been considered and is it sufficient?		
Is the crane operator experienced and qualified?		
Has a qualified crane signalperson been assigned and method of communication between the crane operator and signalperson established.		
Is a person assigned to control the load with the use of a tag line?		
Is the area clear of obstacles (including power lines, pipelines, and unnecessary personnel)?		
Has a pre-lift meeting between the crane operator, signalperson, supervisor, and other affected persons been conducted?		

Sketches/Comments:

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