Tech Tips - *a periodic newsletter*

MOBILE CRANE OUTRIGGER SUPPORT

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Greater Tampa Area

6037 Winthrop Commerce Ave.
Riverview, FL 33578

Phone: 813.248.4800
800.521.7669
Fax: 813.248.4820
Web: www.cranetech.com

Many mobile crane accidents are the result of improper set-up. One of the most common set-up mistakes is not providing enough cribbing under outrigger pads to support the crane and load weight. This Tech Tip provides guidance on determining the pressures exerted by mobile crane outriggers, types of soil, and how to size outrigger cribbing to adequately support a working crane. Knowing how much weight is exerted on the outriggers is critical to maintaining the crane in a level condition and to ensure the crane has proper support.

Lets use a 50-ton crane that weighs 86,000 pounds as our example. Adding the weight of the crane to the maximum capacity results in 186,000 pounds, what we will refer to as the "Total Load." Assuming that all this weight is equally divided around the four outrigger pads is a mistake. As the crane rotates over the various corners, and quadrants, you will place a greater load on one outrigger than on the others. If you consider that 100% of crane and maximum load may be exerted on any one outrigger pad at any time you can plan for proper outrigger set-up.

A crane whose outrigger pads measure 24-inches in diameter provides a surface area, per pad, of approximately 452 in^2 (Area of circle = p R^2 = p x R x R). Dividing the total weight of the crane and maximum potential load by the square inches of the pad (186,000 lbs. ÷ 452 in^2) reveals that 411 pounds will be exerted on each square inch of the pad.

You must now determine if the ground will support this weight using the outrigger pad alone, or if additional cribbing (outrigger support) will be required.

You can gain valuable insight into the ability of soil to support loads by referring to OSHA 1926, Subpart P, Appendix A. This section describes the compressive strength of unconfined cohesive soils and classifies soils into three types; Type A has a compressive strength of 1.5 tons per square foot (tsf) or greater, Type B has a compressive strength greater than 0.5 tsf but less than 1.5 tsf, and Type C has a compressive strength of 0.5 tsf or less. Many construction sites have Type B or Type C soil so make sure you are basing all calculations on the proper soil type.

Tech Tip Continued:

The following example uses Type A soil, and we selected the 1.5 tsf compressive strength as the basis of our example.

First, convert the Soil Resistance for Type A soil from tons to pounds. (1.5 tsf x 2,000 lbs. = 3,000 lbs. per square foot). This is how much pressure (pounds per square ft.) the soil can support.

Second, divide the pounds per square foot (psf) the soil can support by the square inches in one square foot. (3,000-lbs. ÷ 144 in^2 = 20.83 psi). This provides a comparison of the psi exerted by the crane and the psi of soil resistance. The crane in this example will exert 411 psi and the soil resistance can support a maximum of 20.8 psi. Therefore, the outrigger support area must increase to spread the exerted psi over a larger area.

A quick method to find the proper size cribbing required is to divide the Total Load by the target psi (Maximum Soil Resistance) and then take the square root of the result.

Solution:

186,000-lbs. ÷ 20.83 psi = 8,929 in^2

Take the square root of 8,929 in^2 to obtain the dimensions of the cribbing support required. The cribbing dimesions are 94" x 94", or 7' 10" by 7' 10".

You must also avoid point loading. Outrigger foundations must be built-up to fully transfer the load to the entire supporting surface area.

Never block under the outrigger beams, as this changes the crane's tipping fulcrum.

Read and understand OSHA 1926 , Subpart P, Appendix A to learn how to determine the type soil your crane is setting on. Get engineering advice when you are unsure of support, and check crane level frequently to make sure your supporting surface is adequately supporting your crane.

Remember to always check with your crane manufacturer's instructions for proper outrigger cribbing.