# TELECOM & UTILITY CONSTRUCTION™

Spring 2024

Supplement to

CRANE HOT LINE

LIFT ACCESS

Sponsored by

TEREX®

# The Right Combination

## Both stiffness and strength are critical to outrigger pad selection.

By Kris Koberg

Building or repairing transmission towers or installing transformers at converter stations are just two scenarios when utilities or utility contractors rely on big equipment to get the job done. Setting up high-reach aerial lifts, cranes, or drill rigs requires a careful selection of supporting materials under outriggers to properly support the equipment.

For utilities looking to standardize the use of supporting materials when setting up cranes, aerial lifts, digger derricks or other equipment, start with understanding outrigger and stabilizer loads—and how the loads change based on the movement of the boom.

The purpose of supporting materials is to spread concentrated pressures from equipment to levels the ground can withstand or to specified levels based on allowable ground bearing pressure.

Selection of supporting materials should be based on two primary criteria.

### 1. Be strong enough to withstand the exerted loads.

▲ Made from Fiber Reinforced Polymer (FRP), FiberMax Composite Crane Pads are unaffected by fluids, chemicals, or UV, and will not rust, rot, or degrade in extreme hot, cold, or maritime environments. With a minimum 20+ year service life, these lightweight crane mats will safely support your equipment, protect your people, cut operating costs, and provide you with peace of mind.

▲ Products used by cranes, digger derricks, concrete pumpers, and similar applications must be both strong enough to prevent breaking (physical failure), and rigid enough to resist bending (functional failure), while distributing the load over an intended area.

### 2. Be stiff enough to distribute the loads over the intended area.

The larger the load distribution area needed, the more rigid the supporting materials must be. Stiffness is required to spread the load. However, the right combination of strength and stiffness is required to properly support the equipment to prevent it from going out of level.

*Setting up high-reach aerial lifts, cranes, or drill rigs requires a careful selection of supporting materials under outriggers to properly support the equipment.*

For purposes of this discussion, strength and stiffness are defined as follows:

- **Strength (yield strength)** is the ability of the material to support a load without breaking

(physical failure).

- **Stiffness (bending stiffness)** is the ability of the material to resist bending and deflection (functional failure).

## A Material's Strength and Stiffness Properties are Different

Stronger does not mean stiffer. An outrigger pad may have enough strength to not break (physically fail). However, this same pad may not be stiff enough to effectively distribute the load to the ground due to excessive deflection or (functional failure).

The ability of an outrigger pad to spread load is based on the stiffness of the pad relative to the stiffness of the soil. If the pad is not rigid enough, the load will be concentrated on a smaller area on the pad.

This results in increased ground bearing pressure which will cause more pad deformation/deflection and could lead to both functional and physical failures. The challenge intensifies as the stiffness of the ground increases.

## Strength and Stiffness Relationships

The strength and stiffness of a pad will depend on the properties and thickness of the material.

Material strength and stiffness properties are generally understood through the use of standardized material testing and analysis.

In this discussion, plastic can be considered to be stronger than wood, because it's more resistant to failure in bending.

Most wood is stiffer than plastic, but it is also more brittle. Because wood is not as strong as plastic, thickness must be increased to avoid fracturing (physically failing).

Because plastic is not as stiff as wood the thickness may need to be increased to distribute load and resist deflection (functional failure) more effectively.

The difference between strength and stiffness can be thought of this way:

- A stiffer pad with less strength will break (physical failure) if a load or pressure is exerted on the pad that exceeds its limits.
- A stronger pad that is not as stiff will deflect under loads that exceed the combined stiffness of the pad and ground (functional failure).
- Deflection is a warning sign that signals the need for more stiffness due to higher loads and/or softer soils.


▲ Stiffness is required to spread the load, and the combination of both strength and stiffness is required to prevent the crane from going out of level.

## Material Considerations

**Wood** is an organic material. Its properties and performance change with exposure to the environment, moisture, chemicals and usage. Wood begins to deteriorate and decay the moment it is cut. Exposure to the environment and stress from loads increase its rate of deterioration.

**Polyethylene plastics, or thermoplastics,** used in making outrigger pads and crane pads are engineered materials and are not susceptible to environmental exposure, moisture, and most chemicals. When used within rated guidelines, these materials do not deteriorate or decay over time and do not fatigue from loading.

**Composites such as FRP (Fiber Reinforced Polymers)** are engineered materials that are not susceptible to environmental exposure, moisture, or most chemicals. When used within the rated guidelines, these materials do not deteriorate or decay and will not fatigue from loading.

The most reliable way to do this is to work with an engineer or product manufacturer who understands how different materials and product designs interact with equipment loads and the ground. ■

**Kris Koberg** is CEO of DICA, a family-owned and operated company that specializes in building high performance engineered outrigger pads, crane pads, ground protection products, and cribbing blocks, that are lightweight, easy to use, and long-lasting.