

# Technical Note

## TN 5.21 Crawler Crane Loading Over Buried Utilities

### Introduction

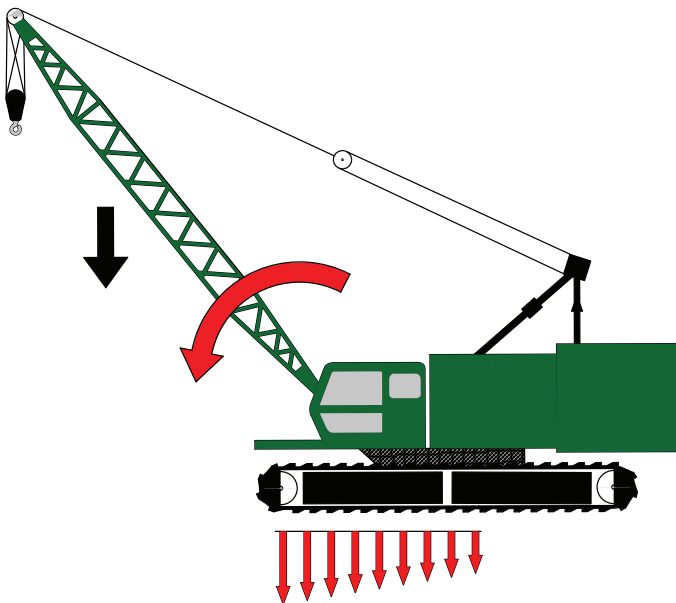
Crawler cranes are large, tracked, mobile vehicles utilized for their notable pick capacity and extensive reach. Their weight exerts high ground pressures that, without proper management, can exceed the structural capacity of storm sewers, sanitary sewers, underground detention systems, and other buried utilities. Loading scenarios stemming from crawler cranes carry risk that must be addressed; this technical note serves to provide detailed information regarding track pressure distributions, recommended construction sequencing, and site preparations necessary to ensure safe conditions for the operation of crawler cranes over ADS products.

### Pressure Distribution

The track pressure distribution of crawler cranes is highly variable. Depending on the pick weight, pick reach, and boom angle, load concentrations can differ greatly. Fundamentally, the boom acts as a lever and produces a moment attempting to tip the crane, as depicted in Figure 1.

Counterweights aid in offsetting these tipping forces, but boom lengths can reach several hundred feet. This results in higher reactionary forces at the front of the tracks that, when paired with track geometry, yield increased surface pressures during lift operations. Boom angles running longitudinally to the tracks result in these front-loaded distributions, as depicted in Figure 1, while transverse angles result in more linear distributions on the track underneath the boom, with the track behind the cab receiving little to no load. Intermediate angles typically exert a combination of these conditions and often yield the highest pressures.

**Figure 1:** Front-Loaded Pressure Distribution



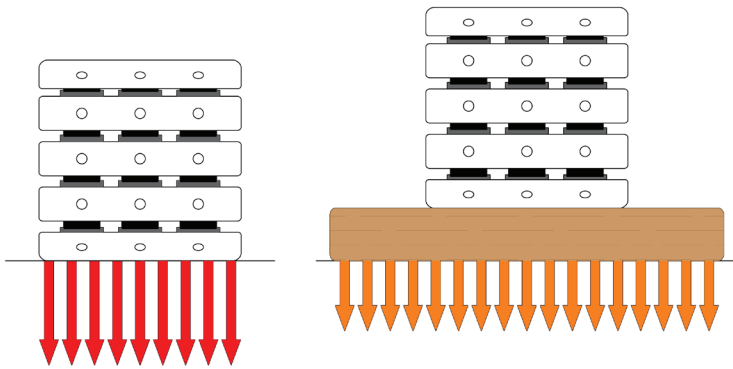
## Construction Sequencing

When possible, ADS recommends keeping crawler cranes off its products. On less crowded jobsites, this may be achievable by simply adjusting the crane travel path and pick location. When revising the crane location isn't feasible, it may be necessary to rework the project's construction sequencing and install the proposed ADS products after pick operations have been completed. Permitting requirements may limit this approach since many municipalities require certain aspects of site work, like site drainage, to be completed prior to building procedures commencing. Because many crawler cranes cannot be accommodated over buried utilities, it is strongly recommended that site design engineers contact ADS with vehicle specifications prior to installation.

## Operational Conditions

Matting plans are generally required to operate large scale cranes over buried utilities. By increasing the effective area of the applied load, ground pressure is reduced. Figure 2 illustrates how the same load can be placed on a larger contact area to reduce the pressure transferred through the soil, in this case, with matting timbers.

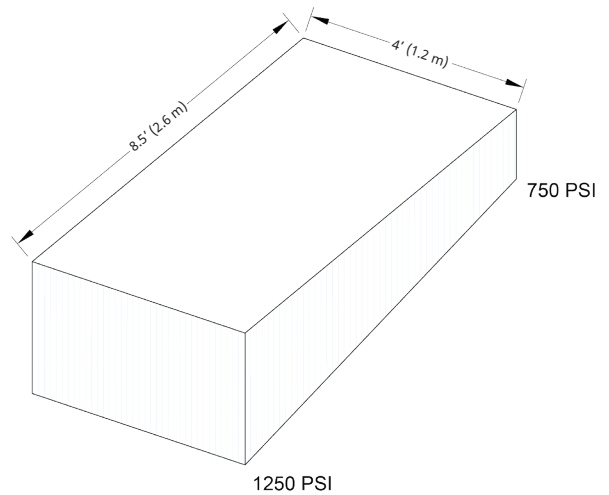
**Figure 2:** Pressure Comparison of Track on Grade vs. Track on Matting



A matting plan must define multiple aspects of crane operation, including minimum pressures, maximum pressures, and effective area dimensions. Once provided these specifications, an ADS representative can run an analysis to determine if the ADS product in question, either conveyance pipe or detention chambers, can support the anticipated pressures. This information is usually provided by the crane contractor or crane manufacturer. Please reference Figure 3 for a partial example of a crane matting plan.

**Figure 3:** Partial Example of an Acceptable Matting Plan

Mat Information	
Mat Material	Oak
Timber Width	12" (300 mm)
Timber Depth	12" (300 mm)
Mat Length	12" (300 mm)
Mat Width	4' (1.2 m)
Mat Spacing (Center to Center)	20' (6.1 m)
Effective Length	8.5' (2.6 m)
Effective Width	4' (1.2 m)
Maximum Pressure	1250 PSI
Minimum Pressure	750 PSI



## Conclusions

Crawler cranes are often the largest machines on active jobsites and therefore carry substantial risk. Their size and weight result in some of the higher pressures buried utilities can be subjected to. ADS recommends avoiding crane placement over its products whenever possible; in the case crawler crane loading is unavoidable, please provide a matting plan for ADS to analyze and determine if the structural capacity of its products is exceeded. Please contact an ADS representative with any questions or concerns.

