

Greetings all. This Bulletin is about Ground Pressure.

Previous Bulletins have discussed the importance of staying within your lift charts. But even if you do, problems can still arise due to an often overlooked factor - The stability of the ground beneath. Commonly referred to as Ground Bearing Pressure, it is the ability of the ground or material beneath the outrigger pads or tyres to support the weight of the crane and load combined. As a guide, here is a list of surfaces and the estimated max permissible ground pressure.*

Ground type	Maximum permissible ground pressure (P _{MAX}) (t/m ²)
Hard rock	200
Shale rock and sandstone	80
Compacted gravel—with up to 20% sand	40
Asphalt	20
Compacted sand	20
Stiff clay (dry)	20
Soft clay (dry)	10
Loose sand	10
Wet clay	Less than 10

*Ref - PN11180 Mobile crane - Code of Practice 2006

We can't always lift on hard bedrock, but we don't always need to either. So, how do we know the REQUIRED ground pressure to support our crane? By dividing the force under the outrigger pad or tyre by the contact area to calculate the pressure exerted on the ground by a load. Use the formula:

$$\text{Pressure} = \text{Force} / \text{Area}$$

A load that weighs 3 Tonnes, the size of its base is 1.5m x 1.0m:

$$\text{The Bearing area} = 1.5\text{m} \times 1.0\text{m} = 1.5\text{m}^2$$

The bearing pressure that this load exerts on the ground is: $3\text{T} / 1.5\text{m}^2 = 2 \text{T/m}^2$

The area under pressure from the outrigger pad is known as the zone of influence and generally works at a 45° angle as shown in Figure 2.

Figure 2

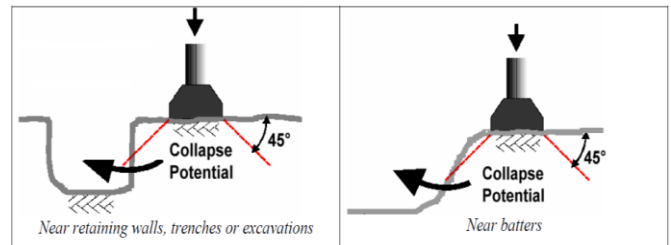


Figure above shows us that under the 45° rule you cannot set up closer to 1m away from a trench that is 1m deep.

I'm sure many of you are familiar with the basics on this topic so I want to cover a few other issues that have caused incidents with cranes. We need to also be aware that there are different ground types at different depths and the ground doesn't always get harder the further down you go! I refer you to a notable example in New Zealand where a crane was set up correctly on a river bank with extra fill added in an area around an outrigger. What gave way was the river mud deep underneath the added fill. This caused the movement of a large volume of the ground (including the fill and river mud) and the resultant tipping of the crane. The outcome of the investigation was that a geotechnical report would have highlighted this as a major risk and been captured in the risk assessment prompting a rethink of the entire lift that day.

Another example is a wet hired crane lifting in a location that had a geotechnical study done, approving the lift. Only to be instructed on the day by the outsourced lift engineer that the position of the crane had to be moved slightly. Unfortunately one outrigger was now positioned on unstable soil in an area not covered in the geotechnical report.

The take away points are

1. Know your outrigger pad or crawler track loads.
2. Know your ground bearing capacity. And get a Geotechnical report if in doubt
3. Conduct thorough risk assessments.
4. Monitor the ground during lifts
5. Refer safety Standards AS2550