Let's talk about …..Foundations

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Many years ago, like in the late 50's, long before most of you were even just a twinkle in your Daddy's eye, there was a song that went sort of like, "Build your love on a strong foundation, and happiness will follow you." The same thing applies to your scaffold. Build it on a strong foundation, and you'll have a strong, stable structure.

Among other things, the Scaffold and Access Industry (SAIA) Training Program has this to say about foundations:

"Foundation preparation is important with any scaffold. It is especially important when scaffolds will be heavily loaded - as in masonry work. Differential settlement may damage scaffold components even if no serious incident or collapse occurs."

"Foundations capable of carrying the imposed load must be provided."

The purpose of base plates and mudsills is to spread the loads from the scaffold structure over as large an area as necessary to ensure that the foundation is able to support the loads.

The proposed new version of Canadian Standard S269.2 suggests that, "In the absence of soil tests and a detailed design, topsoil or other unsuitable material shall be excavated to obtain an adequate bearing capacity of not less than 75 kN/m^2 (1566.4 PSF). Topsoil or other unsuitable material shall be excavated if necessary to obtain adequate bearing capacity."

This statement caused quite a stir when public comments were requested prior to issuing the updated Standard. Let's see if we can justify it.

We get the following information from U.S. Code 5403 - Construction and safety standards: CFR 3285.202 - Soil classifications and bearing capacity.

> "(e) In lieu of determining the soil bearing capacity by use of the methods shown in the table, an allowable pressure of 1,500 psf may be used, unless the site-specific information requires the use of lower values based on soil classification and type."

Clsssification nummber	Soil Description	Allowable soil bearing Pressure (PSF)
1	Rock or hard pan,	4000
2	Sandy gravel and gravel; very than dense and/or cemented sands; course gravel/cobbles; preloaded silts,clays and coral	2000
3	Sand; silty sand; clayey sand; silty gravel; medium dense course sands; sandy gravel; and very stiff silt, sand clays	1500
4A	Loose to medium dense sands; firm to stiff clays and silts; alluvial fills	1000
4B	Loose sands; firm clays; alluvial fills	1000
5	Uncompacted fill; peat; organic clays	Refer to 3285.202(e)

> (f) If the soil appears to be composed of peat, organic clays, or uncompacted fill, or appears to have unusual conditions, a registered professional geologist, registered professional engineer, or registered architect must determine the soil classification and maximum allowable soil bearing capacity."

Ontario Regulation 213/91 requires that:

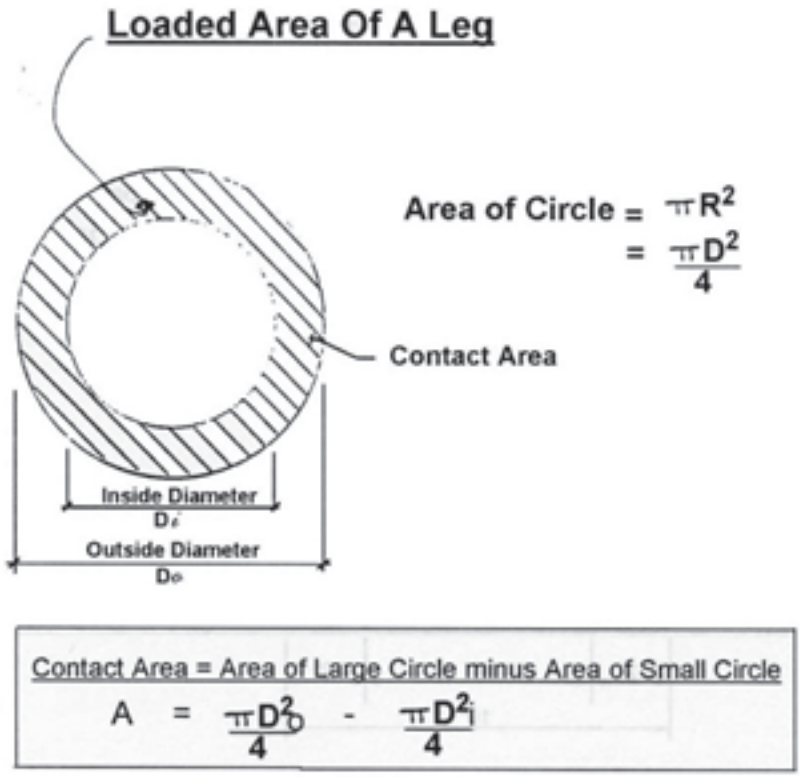
> **128.** (1) Every scaffold,
> (c) shall have footings, sills or supports that are sound, rigid and capable of supporting at least two times the maximum load to which the scaffold may be subjected without settlement or deformation that may affect the stability of the scaffold;

Let's talk about …..Foundations

If a soils engineer or a geoscientist of some degree has carried out tests and provided an actual value for the soil you are building on, you can use that value for your calculations. If you can identify your type of soil by the descriptions above, you can use those values. Otherwise, you're stuck with using the 1500 psf value.

Therefore, building a scaffold on soil in Ontario, using the 1500 psf value for soil capacity, we have to reduce the scaffold load to only 750 psf.

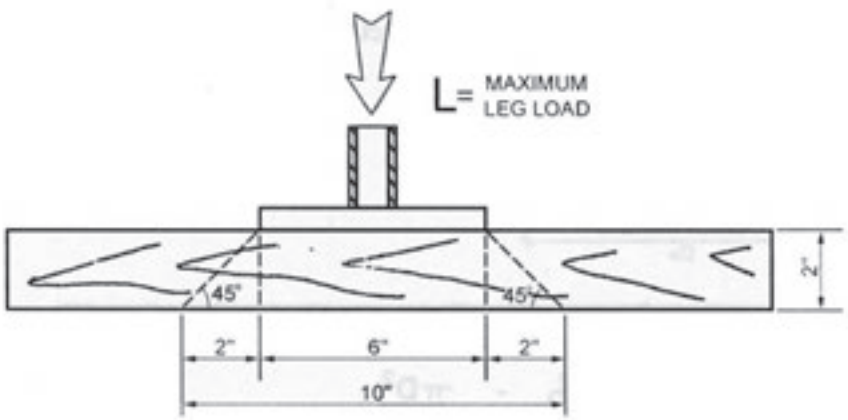
Let's take an example of a frame scaffold, loaded to 2,500 lb per leg. The solid area of that leg is approximately ½ square inch. Using the formula



P (pressure) = L (load)/A (area)

We get P = 2500/0.5 = 5000 lb per square inch. But we have to multiply that number by 144 to get the value in square feet. So the pressure is actually 720,000 psf!

If we have a 5 inch square base plate, we spread that load over 25 square inches, giving us 5000/25 = 200 psi, or 28,800 psf.



That has reduced the load significantly, but not enough to satisfy the Ontario requirement.

Let's talk about …..Foundations

So we add a mudsill. Usually, our mudsills are full-size 2x10 lumber, probably previously used as scaffold planks. For convenience, let's increase the size of that base plate to 6 inches square. We'll keep the same 2,500 psf leg load for this sample calculation.The plank spreads the load from the base plate through its 2-inch thickness at 45 degree angles. That gives us 2 more inches of area on each side of the base plate. So we're now spreading that 2,500 lb load over 10 inches by 10 inches, or 100 square inches. The pressure is now 2500/100 = 25 psi, or 3,600 psf.

Let's add another sill. Now the sill is 4 inches thick. Adding 4 inches in each direction would give us an area of 14 x 14 square inches, but the planks are only 10 inches wide. So our actual area is only 140 square inches rather than 196 sq. in.

Now the pressure is reduced to 2500/140 = 17.86 psi, or 2,571 psf. **Not enough yet.**

Let's try cribbing. If we take 2-foot long pieces of sills, and lay them out crosswise to each other, we can build a crib 2 ft square, or 4 square feet. Our load now becomes 2500/4 = 625 psf. **This is lower than the 750 psf required in Ontario, so we're building on an adequately strong foundation!**