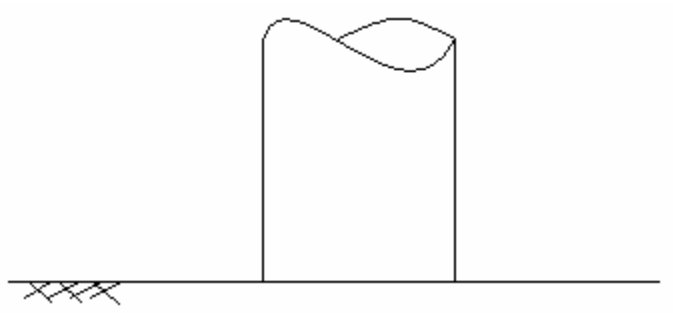
Geotechnical Engineering

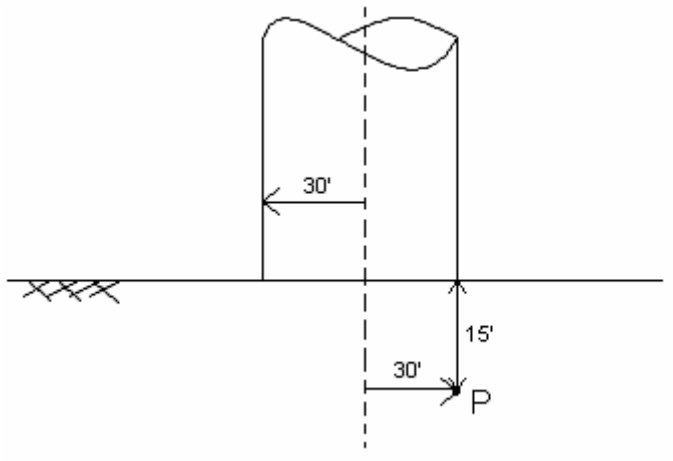
Geotechnical Engineering is the branch of civil engineering involving structures that are built with or in soil and rock, for example, embankments, slopes, foundations, tunnels, dams and earth retaining structures. It is important to consider the properties of the material that the ground is made up of when you build something on it. This helps us decide how large the foundation needs to be, how deep our bridge piles need to go, and other important factors.

A structure puts a certain load on the soil on which it sits. This load stresses the soil. It is important to know what this load is and then figure out if the soil can support this load. If it cannot, the structure will fall over.

Let us look at a structure that is shaped like a cylinder sitting on the ground.



The part of this cylindrical structure, which is in contact with the ground, is in the shape of a circle. So, we call this a *circular load*. We can calculate the stress that this circular load places on a point beneath it. Consider a point, *P*, beneath the load



P is 30 feet from the center of the load. We will call this distance *r*. It is 15 feet into the ground from the surface. Let's call this distance *z*. The radius of the

load is 30 feet. We will call this radius *a*. Before we can calculate the stress that this load places on point *P*, we must calculate, in general, the weight per unit of area of this load. This means the weight on one section, say 1 ft^2, of the circular area of the ground it touches.

Let's say that this load is made of concrete. Each material has certain properties, one of which is its *unit weight*. The *unit weight* is the weight of one small cube of the material. Let's say the cube is one ft^3.

Concrete: Unit Weight = 150 lb/ft^3

So, one cubic foot of concrete weighs 150 lbs. If we multiply this by the height of the concrete load we have, we will obtain a weight per unit area.

$$150\frac{lb}{ft^3}\times 60\,ft = 9000\frac{lb}{ft^2}$$

So, on every square foot that this load touches, it places a weight of 9000 lb. Let's call this weight per unit of area, *q*.

So far we have the following variables:

a = radius of the circular load
r = offset of the point, P, from the center of the load
z = the depth into the ground from the surface to the point, P
q = the weight per unit of area of the load

