Assignment-1

Consider a bulk solid specimen confined in a vertical cylinder (inner diameter D and height h_0). Assume that friction is only present at the wall.

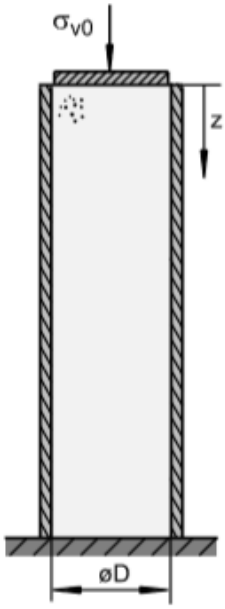

Figure 1: Bulk solid confined in a vertical cylinder having inner diameter D and height h_0.

σ_v = average/mean vertical normal stress at a given z.

$\sigma_{v\infty}$ = mean vertical normal stress for very large depth ($z\rightarrow\infty$),

(for calculating $\sigma_{v\infty}$, one has to obtain the value σ_v in the limit of $z\rightarrow\infty$)

σ_h = horizontal normal stress on the bulk solid exerted by wall of cylinder at a given z.

K = average lateral stress ratio= σ_h / σ_v= 0.3

Φ = angle of wall friction = 30°

ρ_b = density of bulk solid = 1500Kg/m^3, g= acceleration due to gravity=10m/s^2.

D = inner diameter of cylindrical silo = 2m.

a) Consider that the wall of the cylindrical silo (shown in figure 1) is made of a material, which can bear the maximum normal stress up to 7.525 kPa. Assume that the only possible source of damage of wall is the horizontal normal stress exerted by the bulk solid on the wall (and not due to the frictional forces/shear stress present between bulk-solid and wall). There is no surcharge stress, σ_{v0}=0. Calculate the maximum height allowed for the silo to avoid any damage to silo-wall. All the values of various parameters required for calculations are provided *below the caption of figure 1*.

b) Calculate the maximum theoretical value of horizontal stress for a silo of above mentioned dimensions.