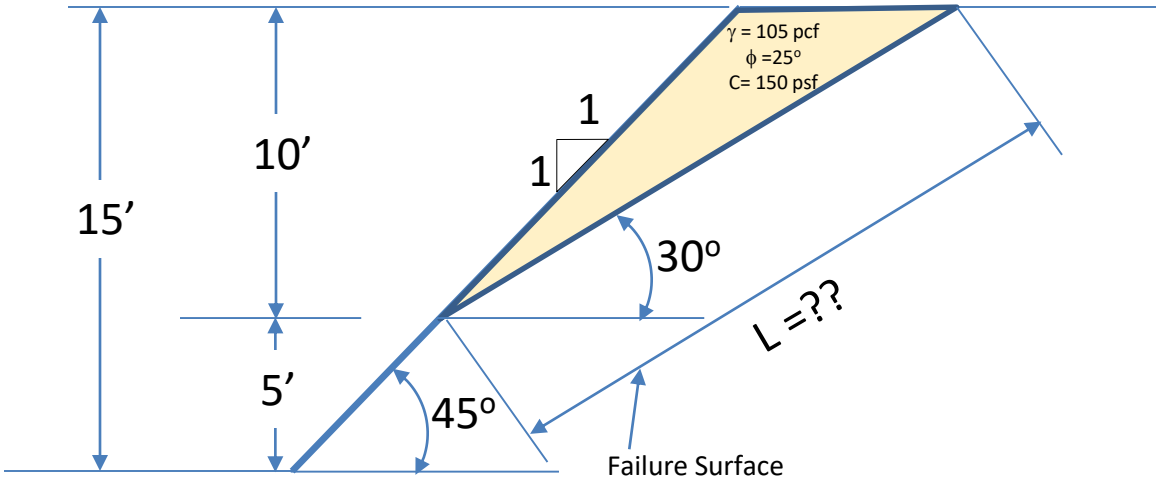
Slope Stability Analysis
Homework # 4
Spring 2023

Problem 1

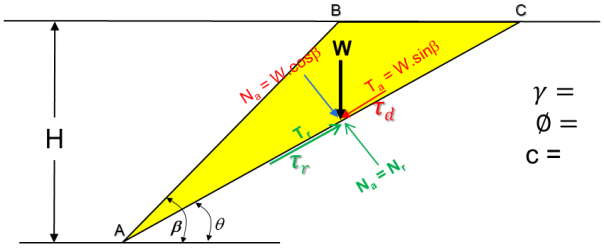
The following figure shows a 15-ft cut through two soil strata. The lower is a highly impermeable cohesive soil. Shearing strength data between the two strata are as follows:

Cohesion=150 psf
Angle of internal friction= 25°
Unit weight of the upper layer= 105 pcf

Find: Driving force and resisting force and factor of safety against sliding

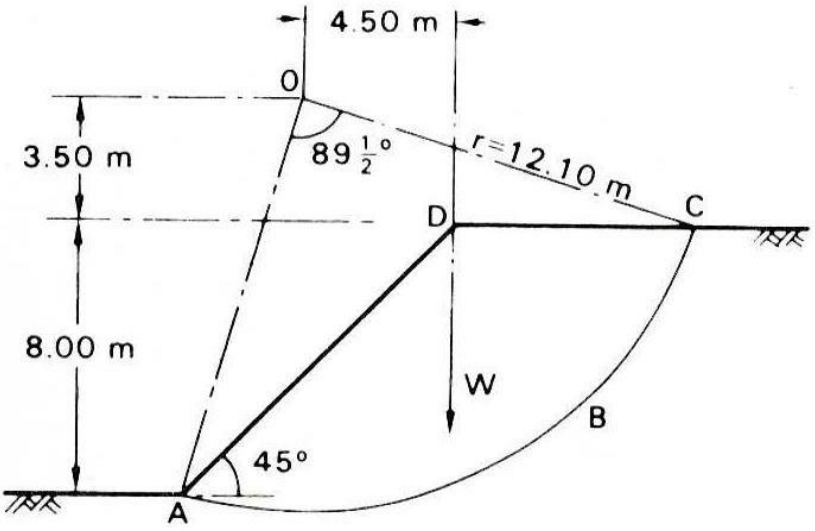


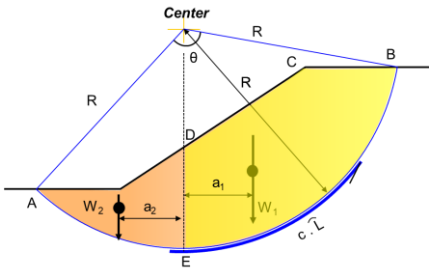
$$c_d = \frac{\gamma H_{design}}{2}\left[\frac{sin(\beta-\theta)(sin\theta - cos\theta\, tan\emptyset_d)}{Sin\beta}\right]$$



Problem 2

A 45° slope is excavated to a depth of 8 m in a deep layer of saturated clay of unit weight 19 kN/m^3: the relevant shear strength parameters are c_u = 65 kN/m^2 and ϕ_u = 0. Determine the factor of safety for the trial failure surface specified in Fig. 9.3.





Resisting Moment (M_R) = W_2 x a_2 + C x R

Driving Moment (M_D) = W_1 x a_1

Figure 9.3 Example 9.1.

Problem 3

Given

The slope and data shown in Fig. 13-11.

Required

The factor of safety against failure by the stability number method.

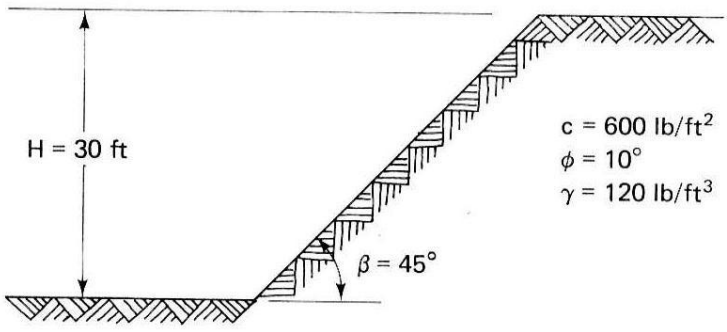
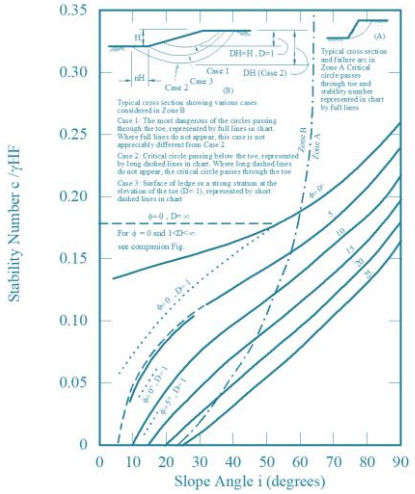


FIGURE 13-11



Problem 4

Refer to Figure 4, Given: $\beta = 20^o$, $\gamma = 18$ kN/m^3, $\phi = 25^o$, and c' = 14 kN/m^2. Find the height, H, that will have a factor of safety, F_s of 2.5 against sliding along the soil-rock interface.

$$FS = \frac{c}{\gamma_{soil} H \cos\beta \sin\beta} + \left(1 - \frac{u}{\gamma_{soil} H \cos^2\beta}\right) \frac{\tan\phi}{\tan\beta}$$

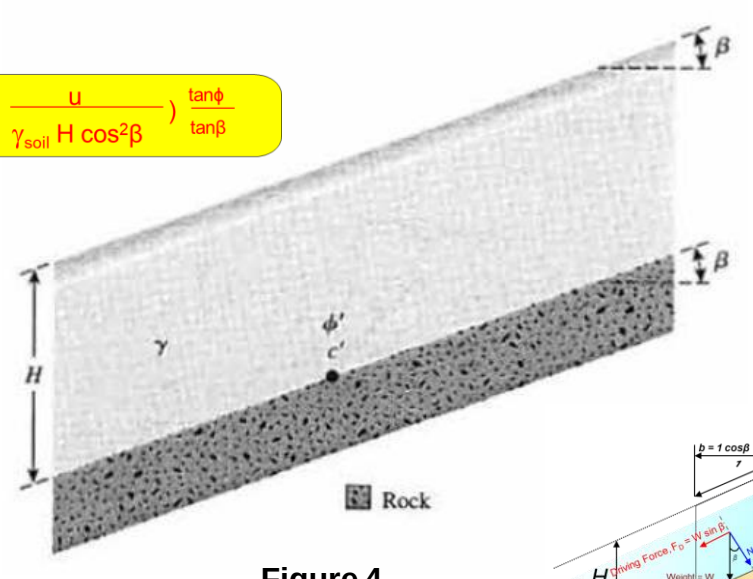
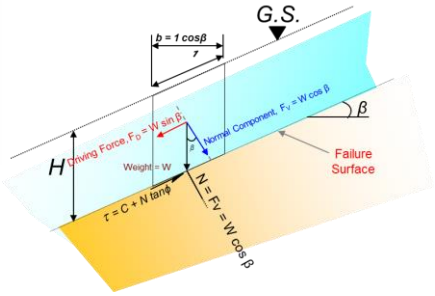


Figure 4



Problem 5

For the infinite slope shown in Figure 5, find the factor of safely against sliding along the plane *AB,* given that H = 20 ft. $\gamma = 110$ pcf, $\phi = 20^o$, and c' = 500 psf. Note that there is seepage through the soil and that the groundwater table coincides with the ground surface.

$$FS = \frac{c}{\gamma_{soil} H \cos\beta \sin\beta} + \left(1 - \frac{u}{\gamma_{soil} H \cos^2\beta}\right) \frac{\tan\phi}{\tan\beta}$$

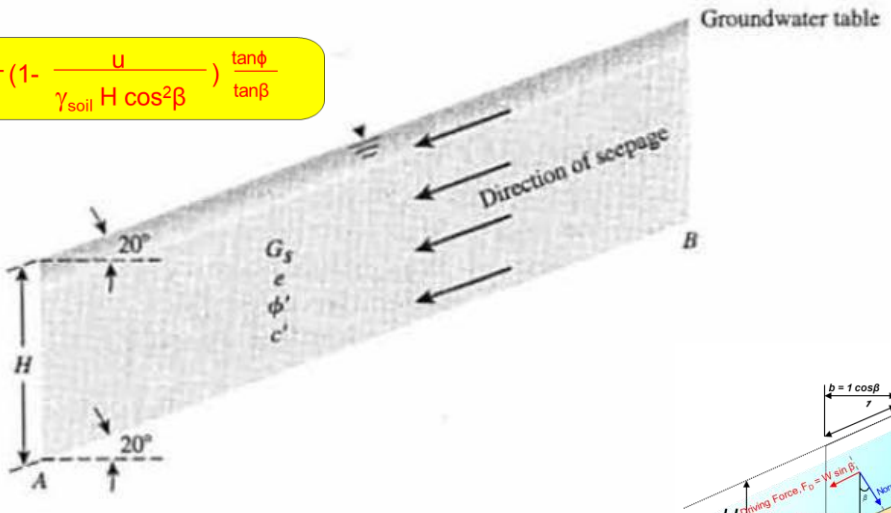
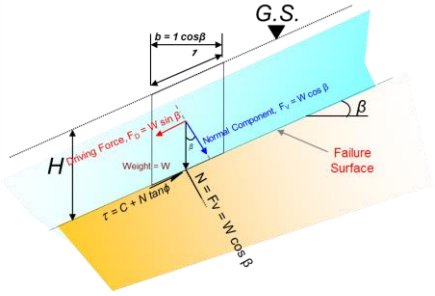


Figure 5



Problem 6

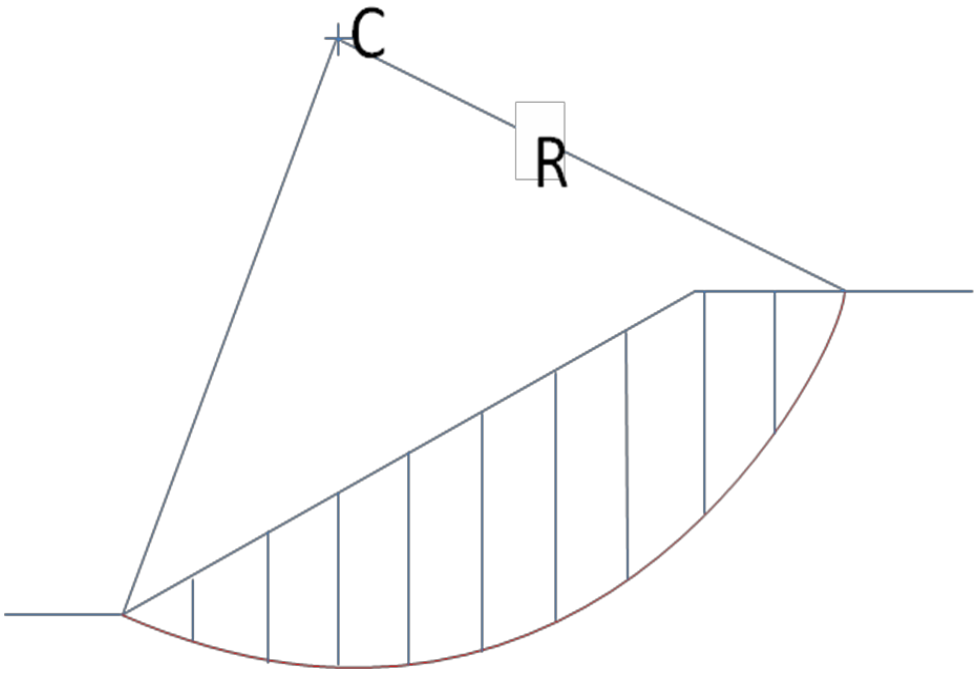
Find the factor of safety for a 20 meter high 2H - l V slope shown in the following figure using ordinary method of slices. Each slice has a width of 5 meters.

$\gamma = 16\ kN/m^3$

$c = 20\ kPa$

$\phi = 20O$

$R = 38.1\ m$



Example of how to determine W_1 and W_5.