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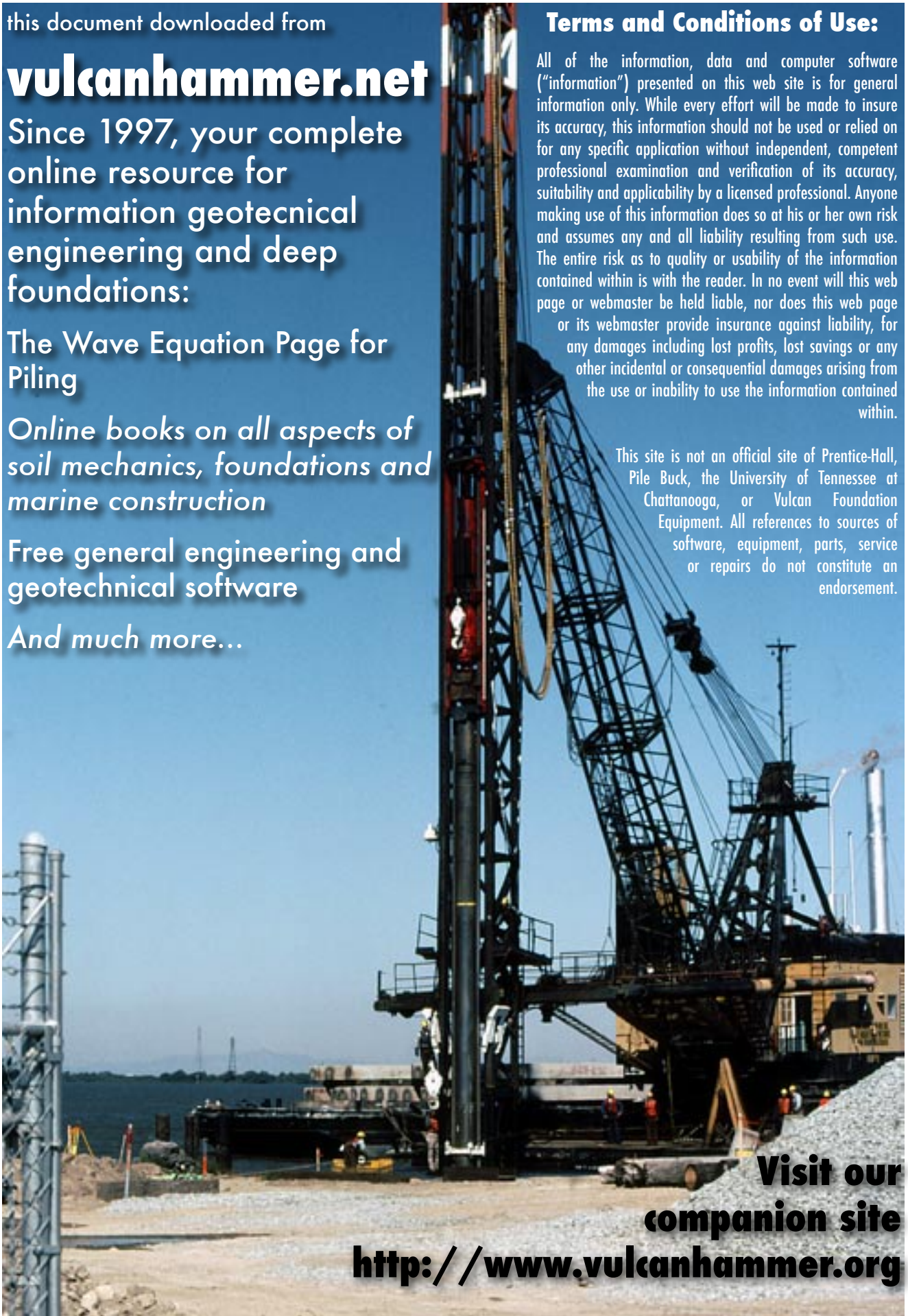
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ENCE 361

Soil Mechanics

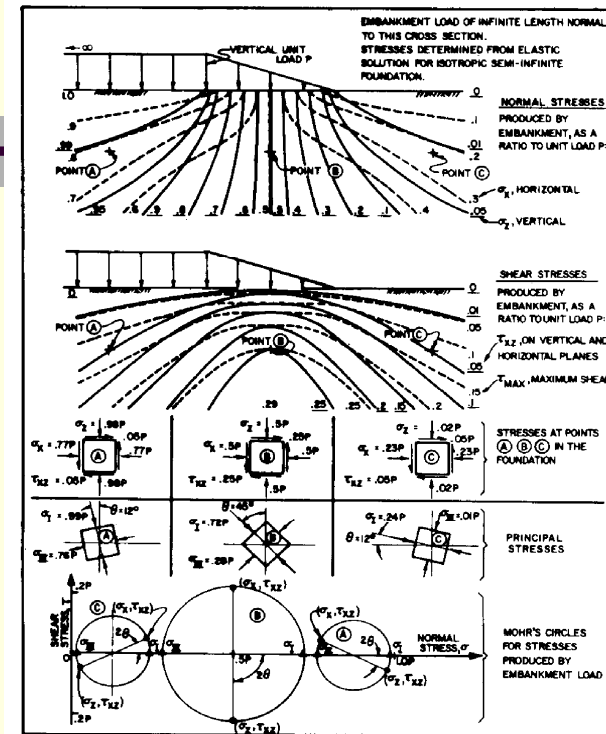


FIGURE 1
Examples of Stress Conditions at a Point

SPT Correction for Overburden
Mohr's Circle
Combined Stresses in Soils

SPT Correction for Overburden

- Applied after the other correction factors
- Only applied to an N_{60} SPT result

$$(N_1)_{60} = C_N N_{60}$$

$$C_N = \sqrt{\frac{2}{\sigma'_z}} \leq 2 \text{ (U.S. Units, ksf)}$$

$$C_N = \sqrt{\frac{100}{\sigma'_z}} \leq 2 \text{ (SI Units, kPa)}$$

■ Example

- $N_{60} = 20$

- $\sigma'_z = 2.5 \text{ ksf}$

$$C_N = \sqrt{\frac{2}{\sigma'_z}} = \sqrt{\frac{2}{2.5}} = 0.89 \leq 2 \text{ (U.S. Units, ksf)}$$

$$(N_1)_{60} = C_N N_{60} = (0.89)(20) = 17.9 \text{ blows/ft}$$

Frictional Forces

$$T = W \sin \alpha$$

$$N = W \cos \alpha$$

$$\frac{T}{N} = \tan \alpha$$

By analogy :

$$\frac{\tau}{\sigma} = \tan \alpha \text{ or } \tau = \sigma \tan \alpha$$

More completely :

$$\tau_{crit} = c + \sigma' \tan \alpha$$

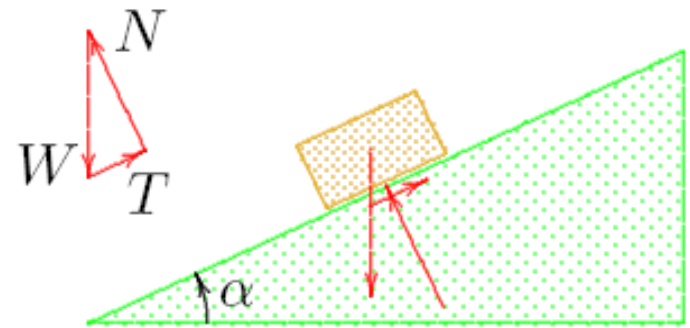


Figure 20.2: Block on slope.

Principal Stresses

Mohr's Circle

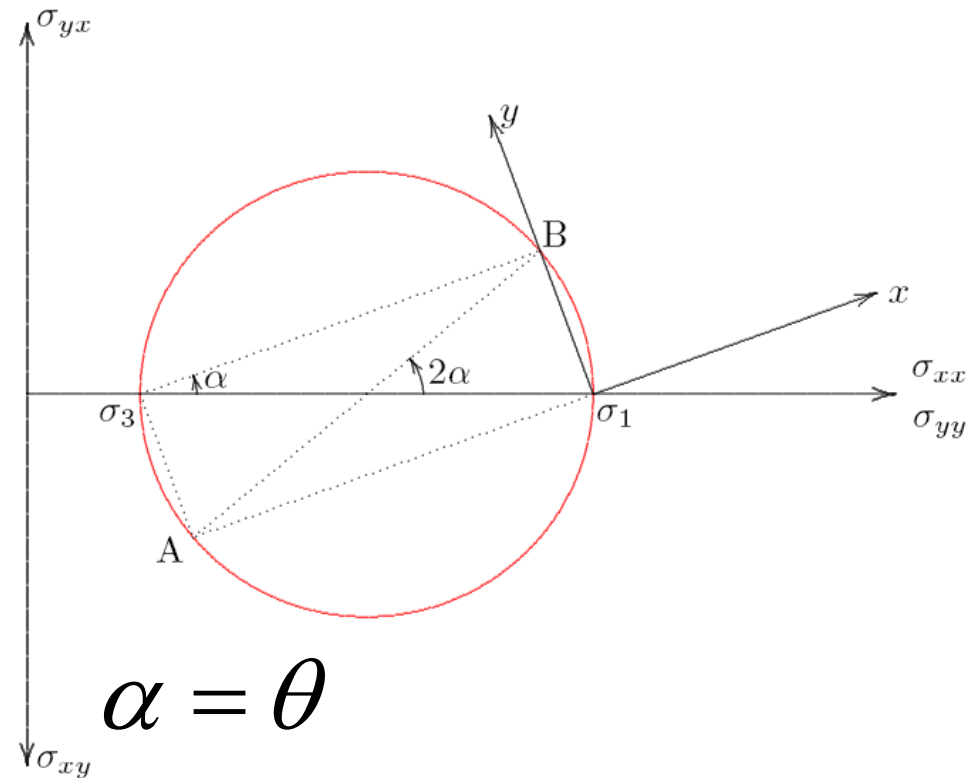
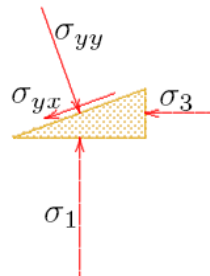
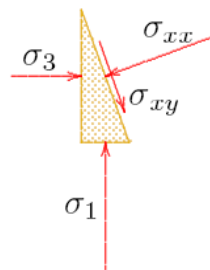
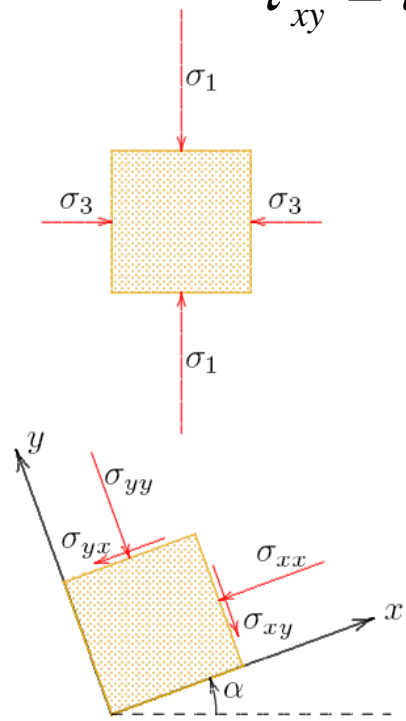
$$\sigma_1 = \frac{\sigma_x + \sigma_y}{2} + \sqrt{\left[\frac{\sigma_y - \sigma_x}{2}\right]^2 + \tau_{xy}^2}$$

$$\sigma_3 = \frac{\sigma_x + \sigma_y}{2} - \sqrt{\left[\frac{\sigma_y - \sigma_x}{2}\right]^2 + \tau_{xy}^2}$$

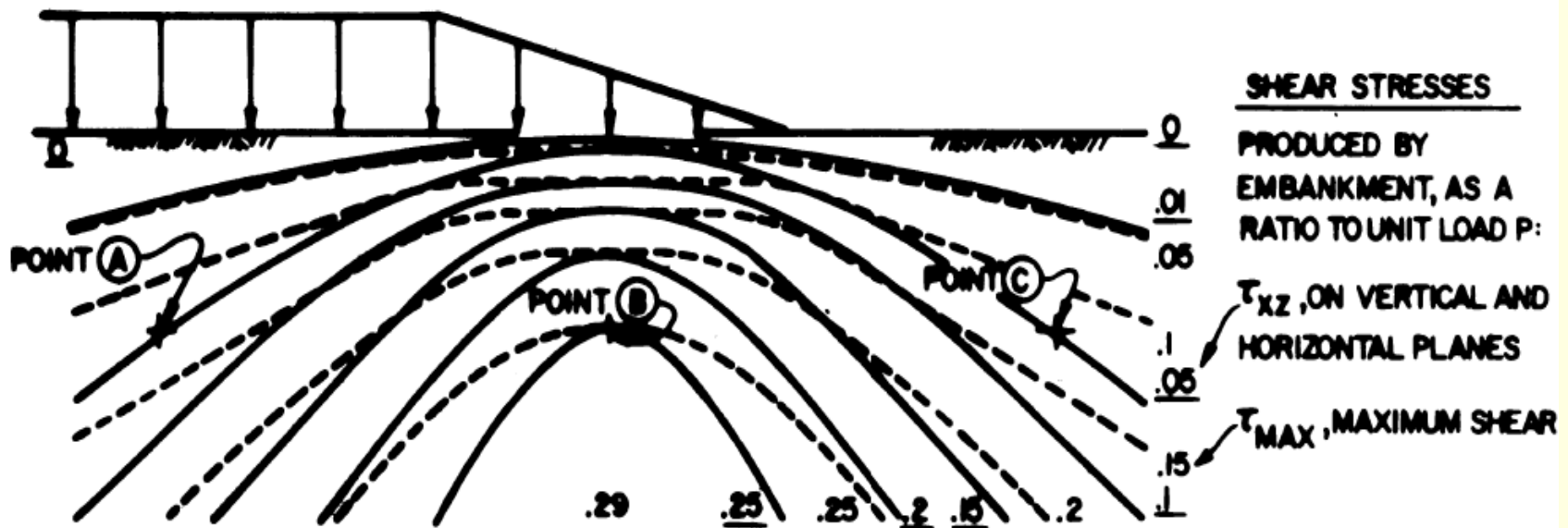
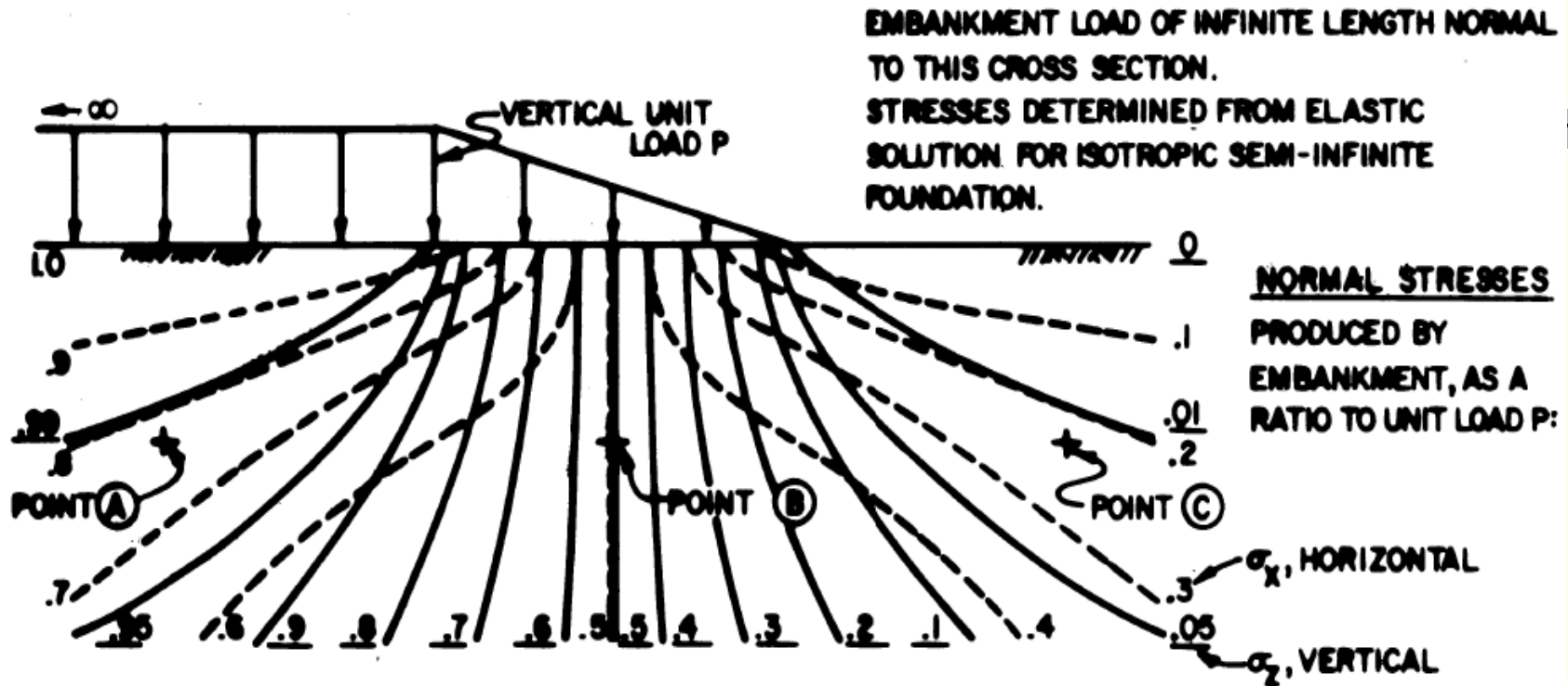
$$\sigma_x = \frac{\sigma_1 + \sigma_3}{2} - \frac{(\sigma_1 - \sigma_3)\cos(2\theta)}{2}$$

$$\sigma_y = \frac{\sigma_1 + \sigma_3}{2} + \frac{(\sigma_1 - \sigma_3)\cos(2\theta)}{2}$$

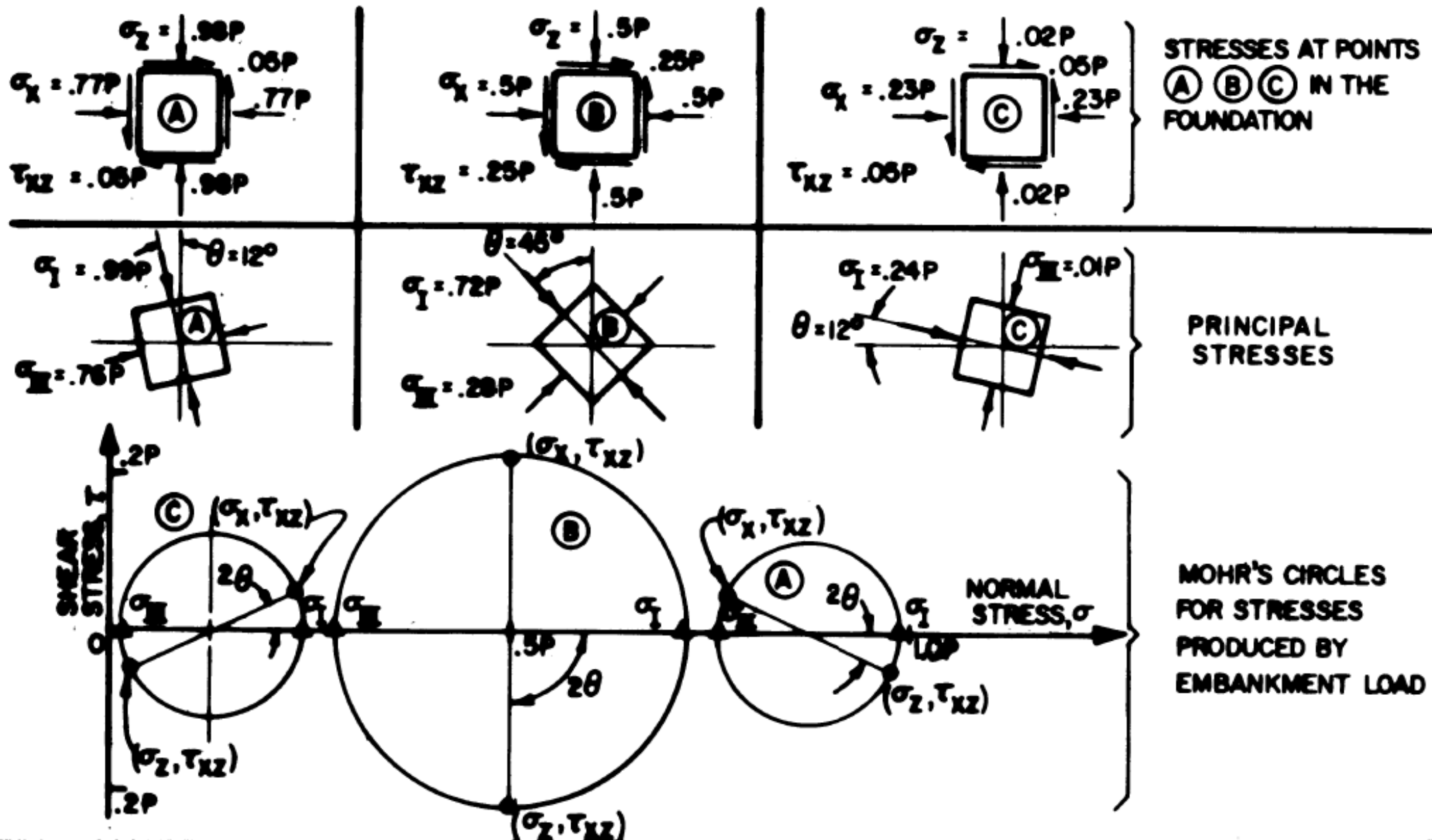
$$\tau_{xy} = \tau_{yx} = \frac{(\sigma_1 - \sigma_3)\sin(2\theta)}{2}$$



Examples Using Mohr's Circle



Examples Using Mohr's Circle



Observations on Principal and Shear Stresses in Soils

- Tension is *never* allowed in soils; compressive stresses are considered positive
- Although principal stresses in many cases coincide with the z-y plane used in geotechnical analysis, this is not always the case
- The understanding of principal and shear stresses is critical in determining the bearing and frictional capacities of soils

Questions?

