FORMULAE – LECTURE 12 AND 13

In-situ Stress

$$K_h = \frac{\sigma'_h}{\sigma'_v} \qquad K_0 = 1 - \sin\varphi' \qquad K_0 = 0.95 - \sin\varphi'$$

$$K_0 = (1 - \sin\varphi')OCR^{\sin\varphi'}$$

Retaining structures in saturated and unsaturated soils

$$\sigma'_A = K_A\,\gamma' z - 2c'\sqrt{K_A}$$

$$\sigma'_P = K_P\,\gamma' z + 2c'\sqrt{K_P}$$

$$\tau_f = c' + [(\sigma - p_a) + \chi(p_a - p_w)]\tan\varphi'$$

$$\sigma_A - p_a = (\sigma_v - p_a)K_A - 2c'\sqrt{K_A} + S_r(p_a - p_w)(K_A - 1)$$

$$\sigma_P - p_a = (\sigma_v - p_a)K_P + 2c'\sqrt{K_P} + S_r(p_a - p_w)(K_P - 1)$$

$$q = -k\left[\frac{d(p_a - p_w)}{\rho_w g dz} + 1\right]$$

$$(p_a - p_w) = -\frac{1}{\alpha}\ln\left[\left(1 + \frac{q}{k_s}\right)e^{-\gamma_w \alpha z} - \frac{q}{k_s}\right]$$

$$\begin{aligned}&\sigma_{A/P} - p_a \\ &= (\sigma_v - p_a)K_{A/P} \mp 2c'\sqrt{K_{A/P}} \\ &+ \left\{\frac{1}{1 + [\alpha(p_a - p_w)]^n}\right\}^m \left\{-\frac{1}{\alpha}\ln\left[\left(1 + \frac{q}{k_s}\right)e^{-\gamma_w \alpha z} - \frac{q}{k_s}\right]\right\}(K_{A/P} - 1)\end{aligned}$$

$$K_a = \tan^2\left(\frac{\pi}{4} - \frac{\varphi'}{2}\right)$$

$$K_p = \tan^2\left(\frac{\pi}{4} + \frac{\varphi'}{2}\right)$$