

## FORMULAE – LECTURE 12 AND 13

**In-situ Stress**

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

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

**Retaining structures in saturated and unsaturated soils**

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

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

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

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

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

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

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

$$\sigma_{A/P} - p_a$$

$$= (\sigma_v - p_a) K_{A/P} \mp 2c' \sqrt{K_{A/P}}$$

$$+ \left\{ \frac{1}{1 + [\alpha(p_a - p_w)]^n} \right\}^m \left\{ -\frac{1}{\alpha} \ln \left[ \left( 1 + \frac{q}{k_s} \right) e^{-\gamma_w \alpha z} - \frac{q}{k_s} \right] \right\} (K_{A/P} - 1)$$