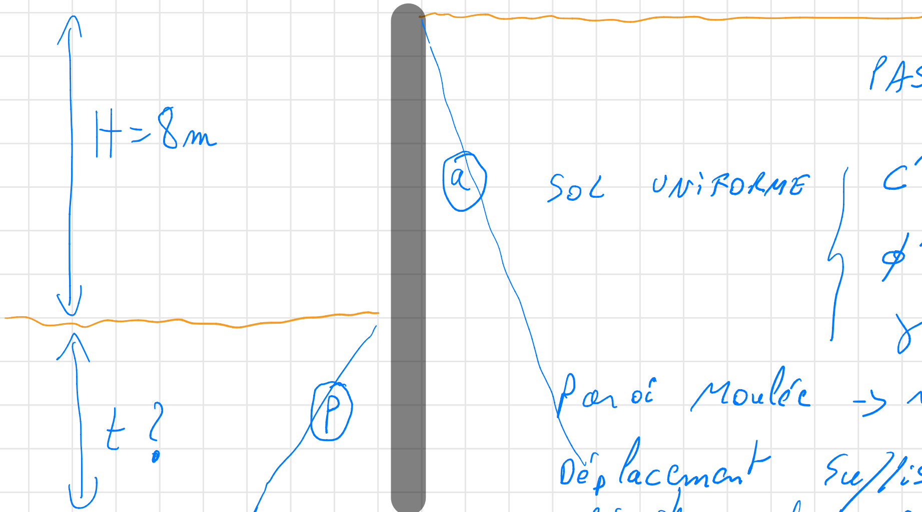
WEEK 12

PAROI SIMPLEMENT FICHÉ / SANS EAU



PAS de Surcharges

Sol UNIFORME

$c' = 5$ kPa

$\phi' = 25°$

$\gamma = 20$ kN/m³

Paroi Moulée → rugueuse

Déplacement suffisant pour atteindre les états limites du sol.

1) Calcul K_a & K_p

$K_a \rightarrow \delta = \frac{2}{3}\phi' \quad \beta = 0 \xrightarrow{\text{Coulomb}} K_a = 0.36 \rightarrow K_{a,h} = 0.34$

$K_p \rightarrow \delta = \frac{\phi'}{2} \quad \beta = 0 \xrightarrow[\text{Lancellotta}]{\text{Abaques}} K_p = 3.4 \rightarrow K_{p,h} = 3.27$

Rappel état actif

$$\sigma'_h = e_a = K_a \sigma'_v - c'(1-K_a)\cot\phi'$$

$$e_{ah} = K_{a,h}\sigma'_v - c_{ah} \qquad c_{ah} = c'(1-K_a)\cot\phi' \cos\delta$$

$$c_{ah} = 6.56$$

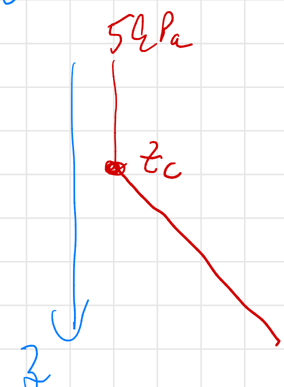
état passif

$$e_{ph} = K_{ph}\sigma'_v + c_{ph} \qquad c_{ph} = c'(K_p-1)\cot\phi' \cos\delta = 23.25$$

$\boxed{\text{Total actif}}$

$$z_c \Leftrightarrow e_a = 0 \,/\, e_{ah} = 0 \rightarrow K_{a,h}\gamma z_c = c_{ah}$$

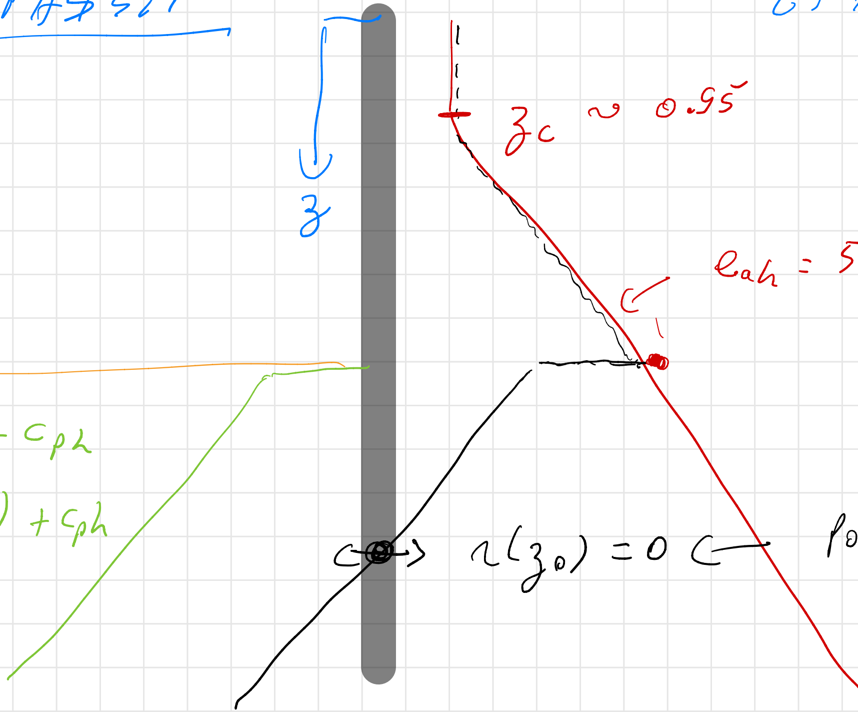
$$\hookrightarrow z_c = 0.95 \text{ m}$$



$$e_{ah} = \begin{cases} 5 \text{ kPa} & z < z_c \\ 5 + \gamma K_{ah}(z - z_c) & \end{cases}$$

ETAT PASSIF

ETAT ACTIF



$z_c \sim 0.95$

$e_{ah} = 5 + K_{ah}\,\gamma\,(z - z_c)$

$e_{ph} = K_{ph}\,\sigma_v + c_{ph}$

$e_{ph} = K_{ph}\,\gamma\,(z - H) + c_{ph}$

$r(z_0) = 0$ ← point de pression nulle

⚠ Sans eau

$$\boxed{r(z) = e_{ah}(z) - e_{ph}(z)}$$

Calcul de l'effort Tranchant pour $z \leq H$

$$V(z) = \int e_{ah}\, dz = \int \left(5 + K_{ah}\gamma(z - z_c) \times H(z - z_c)\right) dz$$

$$H(x) \begin{cases} \to 1 & x > 0 \\ \to 0 & x < 0 \end{cases}$$

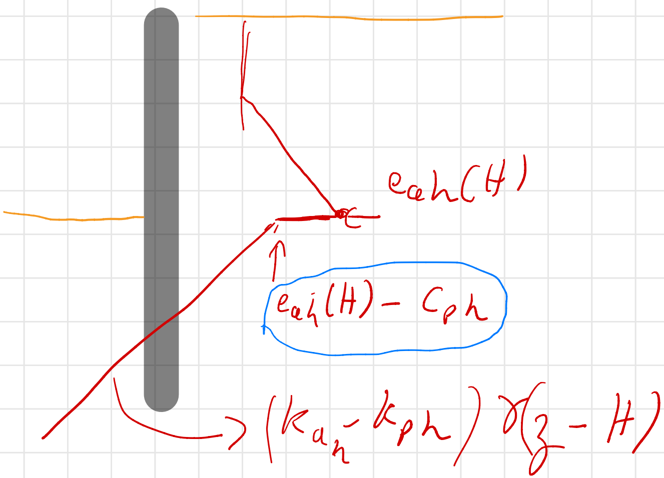
$$V(z) = 5z + \frac{1}{2}\gamma K_{ah}(z - z_c)^2 H(z - z_c)$$

$$M(z) = \int V\, dz = \frac{5}{2} z^2 + \frac{1}{6}\gamma K_{ah}(z - z_c)^3 H(z - z_c)$$

en $\underline{z = H}$

$$\left| \begin{array}{l} e_{ah}(H) = 53.73 \text{ kPa} \\ V(H) = 211.8 \text{ kN/m'} \\ M(H) = 563.76 \text{ kN.m/m'} \end{array} \right|$$

Pour les $z > H$ → $r(z) = e_{ah} - e_{ph}$.



EFFORT TRANCHANT

$$V(z>H) = V(H) + (e_{ah}(H) - c_{ph})(z-H) \ldots$$
$$\ldots - \frac{1}{2}\gamma(K_{ph} - K_{ah})(z-H)^2$$

Moment Fléchissant $z > H$

$$M(z>H) = M(H) + V(H)(z-H) + \frac{1}{2}(e_{ah}(H) - c_{ph})(z-H)^2 \ldots$$
$$\ldots - \frac{1}{6}\gamma(K_{ph} - K_{ah})(z-H)^3$$

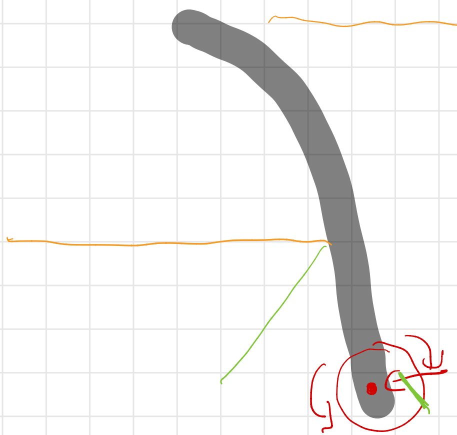
On détermine z_ω tel que l'équilibre des moments est satisfait

$$M(z_\omega) = 0 \quad \rightarrow \text{Eq cubique}$$

$$z_\omega > H.$$

$$z_\omega = H + \cancel{7.3}\ 6.6 = \cancel{15.3}\ 14.6\ m$$

On a $V(z_\omega) \neq 0$

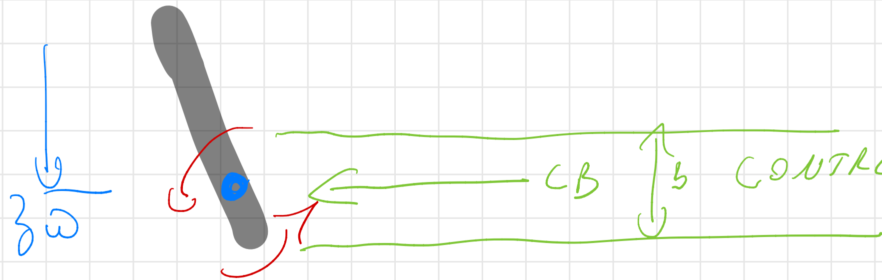


z_ω où $M(z_\omega) = 0$

De part et d'autre de $z_\omega \pm b/2$ le sol est en contre butée

$$CB + V(z_\omega) = 0$$

$$CB = \int_{z_\omega - b/2}^{z_\omega + b/2} e_{ph}\, dz$$



CONTRE-BUTÉE est du côté Non Excavé

$$CB = \int_{z_w - b/2}^{z_w + b/2} e_{ph}(z)\,dz = \left(K_{ph}\,\gamma\,(z_w) + c_{ph}\right) \times b$$

$$CB + V(z_w) = 0 \longrightarrow \boxed{b}$$

$$b = \frac{-V(z_w)}{K_{ph}\,\gamma\,z_w + c_{ph}} = 0.84 \sim 1.13$$

Longueur totale de la paroi

$$\cancel{15.5} + \cancel{1.13} = \cancel{16.63}$$

$$14.6 + 0.84/2 = 15 \qquad \boxed{15.02}$$