P143, ex: 4-34

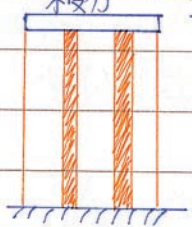
(a) 英→中

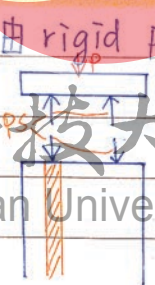
(b) the equilibrium equation for P, P_s, P_c 平衡方程式

(c) the relation of deflection for δ_s and δ_c

(d) the axial force in the steel and concrete P_s = ___ kN, P_c = ___ kN

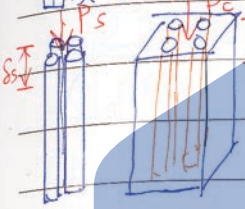
(e) the stress in the concrete and the steel. σ_c = ___ MPa, σ_s = ___ MPa





$\sum F_y = 0$; $P_s + P_c = 800$ kN ①

由變形圖可知



$\delta_s = \delta_c$ — ②

$\Rightarrow \frac{P_s l_s}{E_s A_s} = \frac{P_c l_c}{E_c A_c}$

$\frac{P_s \cdot 10^3 \cdot 1600}{200 \times 10^3 \times 1017} = \frac{P_c \cdot 10^3 \cdot 1600}{25 \times 10^3 \times 88983}$

$P_c = 10.94 P_s$ — ②

$P_c + P_s = 800$ — ①

$A_s = \frac{\pi}{4}(18)^2 \times 4$

$= 1017.36 mm^2$

$A_c = 300^2 - 1017.36$

$= 88982.64 mm^2$

②代入① $\Rightarrow P_s + 10.94 P_s = 800$ $\begin{cases} P_s = 67 KN \\ P_c = 733 KN \end{cases}$

(e) $\sigma_s = \frac{P_s}{A_s} = \frac{67 \times 10^3}{1017} = 65.9 MPa$

$\sigma_c = \frac{P_c}{A_c} = \frac{733 \times 10^3}{88983} = 8.24 MPa$

(f) the deflection of rigid plate

$\delta = \delta_s = \delta_c$

$\begin{cases} \delta_s = \frac{P_s l_s}{E_s A_s} = \frac{l_s}{E_s} \sigma_s = \frac{1600}{200 \times 10^3} \times 165.9 = 0.527 mm \\ \delta_c = \frac{P_c l_c}{E_c A_c} = \frac{l_c}{E_c} \sigma_c = \frac{1600}{25 \times 10^3} \times 8.24 = 0.527 mm \end{cases}$