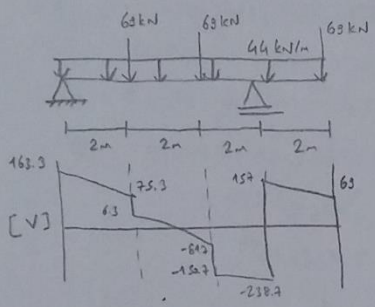
CE382 – Reinforced Concrete Fundamentals

Homework 5

1)



$p = 1.4 \times 15 + 1.6 \times 30 = 69$ kN

$q = 1.4 \times 20 + 1.6 \times 10 = 44$ kN/m

$f_{cd} = 27$ MPa

$f_{ctd} = 1.47$ MPa

$f_{yd} = 365$ MPa $= f_{ywd}$

direct support

$V_d = 163.3 - \left(44 \times \left(\frac{0.4}{2} + 0.46\right)\right) = 134.3$ kN

indirect support

$V_d = 238.7 - \left(44 \times \frac{0.35}{2}\right) = 231$ kN

$V_{max} = 0.22 \times 27 \times 350 \times 500 = 1039.5$ kN

$V_d < V_{max}$ ✓

$V_{cr} = 0.65 \times 1.47 \times 350 \times 460 = 154$ kN

$V_{cr} < V_d$

$\min \frac{A_{sw}}{s} = 0.3 \times \frac{1.82}{365} \times 350 = 0.52$

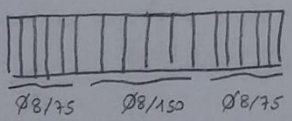
$V_d = V_c + V_w$

$231 = 0.8 \times 154 + V_w$

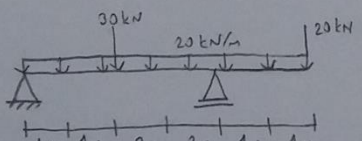
$107.8 \times 10^3 = \frac{A_{sw}}{s} \times 365 \times 460$ — $\frac{A_{sw}}{s} = 0.64 > \min \frac{A_{sw}}{s}$

use Ø8 — $A_0 = 50\ mm^2$ — $A_{sw} = 2 \times 50 = 100\ mm^2$

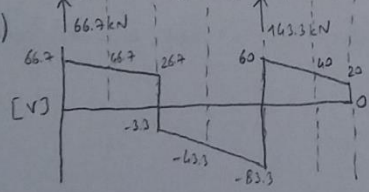
$s = \frac{100}{0.64} = 150\ mm < \frac{d}{2} = 230\ mm$



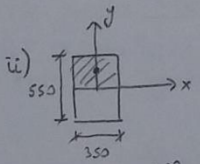
2)



i)



ii)



$Q = 275 \times 350 \times \frac{275}{2} = 13.2 \times 10^6\ mm^3$

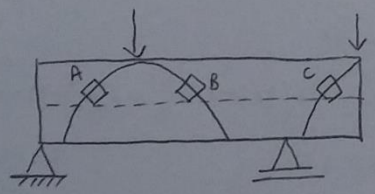
$I_x = \frac{1}{2}\ 350\ 550^3 = 4.85 \times 10^9\ mm^4$

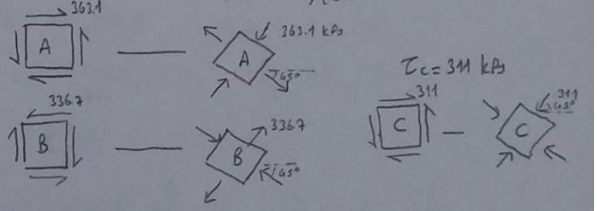
$\tau = \frac{VQ}{It}$

$\tau_A = \frac{(46.7 \times 10^3)(13.2 \times 10^6)}{(4.85 \times 10^9)(0.35)} = 363.1$ kPa

$\tau_B = \frac{(-43.3 \times 10^3)(13.2 \times 10^6)}{(4.85 \times 10^9)(0.35)} = -336.7$ kPa

iii)





3) Column 350 × 400 mm

$f_{cd} = 17 MPa$

$f_{ctd} = 1.2 MPa$

$(u_p)_1 = 2 \times (350 + 240) + 2 \times (400 + 240) = 2460 mm$

$(u_p)_2 = (350 + 240) + 2 \times (400 + 120 + 250) = 2130 mm$

$V_{pc} = \gamma . f_{ctd} . u_p . d = 1.0 \times 1.2 \times 2130 \times \frac{240}{1000} = 613.4 kN$

$V_d = 1200 - 800 - 15 \times (0.77 \times 0.53) = 393.2 kN$

$V_{pc} > V_d$ ✓