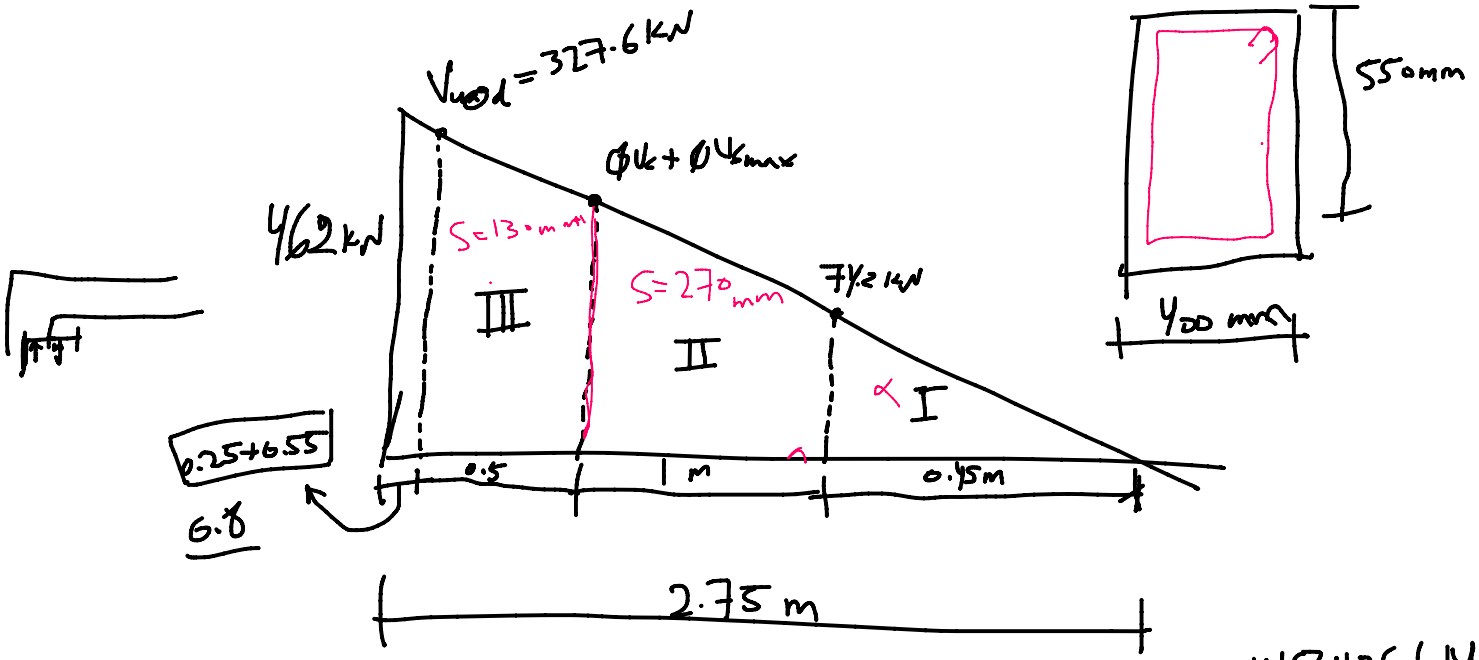
Shear Design

Tuesday, November 24, 2020 12:49 PM

$d_v = 10\text{ mm} \rightarrow A_v = 2 \times 71 = 142\text{ mm}^2$



Region I

$\phi V_c = \phi 0.17 \sqrt{f'_c}\, b_w d = 0.75 * 0.17 \times \sqrt{28} \times 400 \times 550 = 148426.6\text{ N} = 148.4\text{ kN}$

N, mm, MPa

$\phi V_c = 148.4\text{ kN} \quad \frac{\phi V_c}{2} = 74.2\text{ kN} \rightarrow X_1 = 0.45\text{m}$

Region II: max spacing $\quad V_{u@d} = 327.6\text{kN}$

$V_s = \frac{V_{u@d} - \phi V_c}{\phi} = 239\text{ kN}$

$V_s \quad 2V_c = 0.33 \sqrt{f'_c}\, b_w d = 384.2\text{ kN} > V_s$

$4V_c$

$$S_{max} = \min \begin{cases} \frac{A_v f_y}{0.062 \sqrt{f'_c}\, b_w} < \frac{A_v f_y}{0.35 b_w} \\ d/2 \\ 600 \end{cases}$$

426 mm

275

$S_{max} = 275\text{ mm}$

$\phi A_v f_y d \quad 0.75 \times 142 \times 420 \times 550 = 98.4\text{ kN}$

$$\phi V_{s(max)} = \frac{\phi A_v f_y d}{S_{max}} = \frac{0.75 \times 142 \times 420 \times 550}{275} = 98.4 \text{ kN}$$

$$\phi V_{n\ S_{max}} = \phi V_{s(max)} + \phi V_c = 98.4 + 148.4 = \underline{246.8 \text{ kN}}$$

$$X_2 = 1 \text{ m}$$

Region III:

$$S = \frac{A_v f_y d}{V_s} = 137.24 \text{ mm} \sim 138 \text{ mm}$$

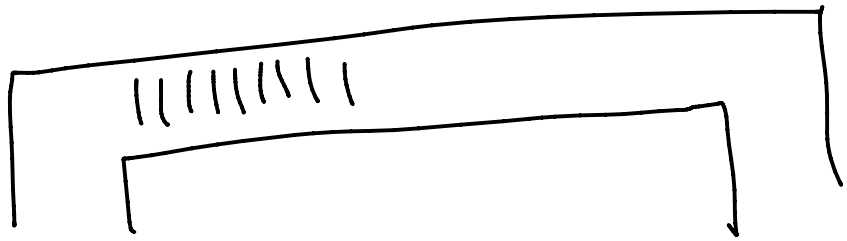
$$V_s = \frac{V_{ud} - \phi V_c}{\phi} = 239 \text{ kN}$$ (×1000)

$$\#\text{stirrups} = 2\left(\frac{X_2}{0.13}^{\cdot 5} + \frac{X_2}{0.27}^{\cdot} + 1\right) = 18 \text{ stirrups}$$

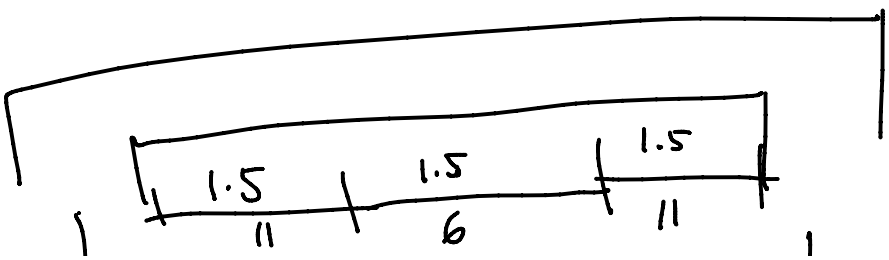
AP1 →

0.13

#total = 32



AP2 ↑



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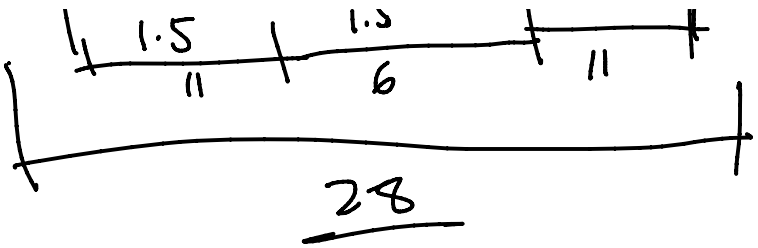

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