

Q8

14

$$Q_y = 236.08 \text{ t}$$

$$S_p = 70 \times 4.2 \times \left(\frac{250 + 4.2}{2} \right) = 37367.4 \text{ cm}^2$$

$$I_x = 11093407.44 \text{ cm}^4$$

$$\tau_i = \frac{236.08 \times S_p}{I_x} = 0.745 \text{ t/cm}$$

$$\tau = 2 \times 1 \times 0.2 S_u \times S_w$$

$$S_w = \frac{0.745}{2 \times 1 \times 0.2 \times 5.2} = 0.36 \text{ cm}$$

Use $S_{min} = 6 \text{ mm}$

Check fatigue effect

$$\text{for } N = 2 \times 10^6 \rightarrow \text{fact} = 0.71 \text{ t/cm}^2$$

$$Q_{y_{fat}} = 122.5 \text{ t}$$

$$\tau = \frac{0.6 \times 122.5 \times 37367.4}{I_x} = 0.24 \text{ t/cm}$$

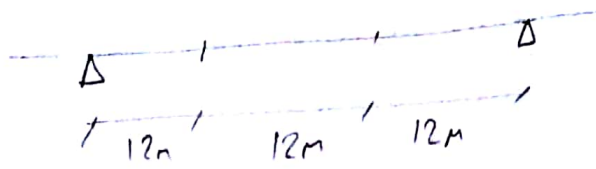
$$\tau = 2 \times 1 \times \text{fact} \times S_w \times 0.24 = 2 \times 1 \times 0.71 \times S_w \rightarrow S_w = 0.17 \text{ cm}$$

Use $S_{min} = 6 \text{ mm}$

Q9

Location of Curtailment

$$L/3 = \frac{36}{3} = 12 \text{ m}$$



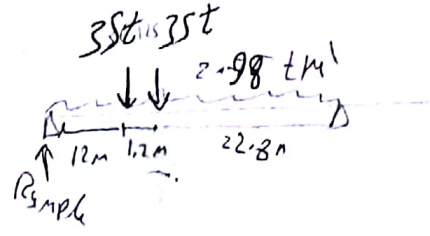
Straining actions:

$$R_{\text{simple}} = 35.5 \times \frac{24}{36} + \frac{35.5 \times 22.8}{36}$$

$$+ 2.98 \times 18 = 99.14 \text{ t}$$

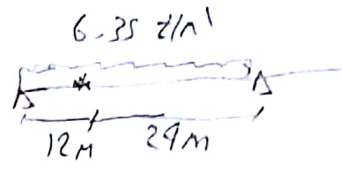
$$M_{\text{L.L}} = (99.14 \times 12 - 2.98 \times \frac{12^2}{2}) \times 0.9 = 877.617 \text{ t.m}$$

$$Q_{\text{L.L}} = 99.14 - 2.98 \times 12 = 63.38 \text{ t}$$



$$M_{\text{D.L}} = (114.3 \times 12 - 6.35 \times \frac{12^2}{2}) \times 0.9 = 822.96 \text{ t.m}$$

$$Q_{\text{D.L}} = 114.3 - 6.35 \times 12 = 38.1 \text{ t}$$



$$\therefore M_{\text{cur}} = 1700.57 \text{ t.m}$$

$$Q_{\text{cur}} = 101.48 \text{ t}$$

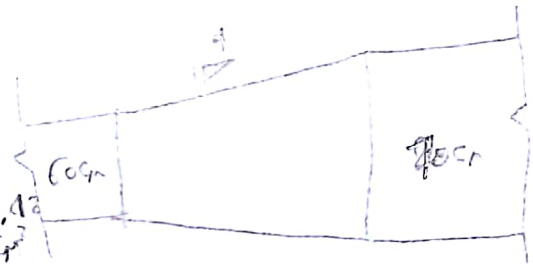
$$A_{\text{req}} = \frac{1700.57 \times 100}{250 \times 2.1} - \frac{250 \times 118}{6} = 248.92 \text{ cm}^2$$

$$b_{\text{req}} = \frac{248.92}{4.2} = 59.3 \text{ cm}$$

$$\text{Let } b_f = 60 \text{ cm}$$

$$I_{\text{req}} = 1048633.52 \text{ cm}^4 \quad \rightarrow \quad I_{\text{cur}} = 81163.42 \text{ cm}^4$$

$$q_{\text{cur}} = \frac{101.48}{250 \times 1.8} = 0.226 \text{ t/cm}^2$$



$$\frac{q_{\text{cur}}}{q_{\text{req}}} = \frac{0.226}{0.903} = 0.25 < 0.6 \rightarrow p_{\text{cur}} = 0.58 p_b = 2.1 \text{ t/cm}^2$$

$$p_{\text{req}} = \frac{1700.57 \times 100}{250 \times 1.8} = 2.09 \text{ t/cm}^2 < 2.1 \text{ t/cm}^2$$

OK / safe