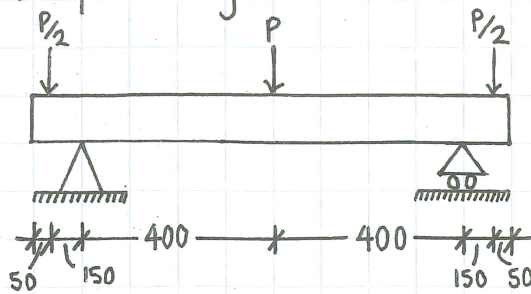


CIVIO2 - STRUCTURES and MATERIALS

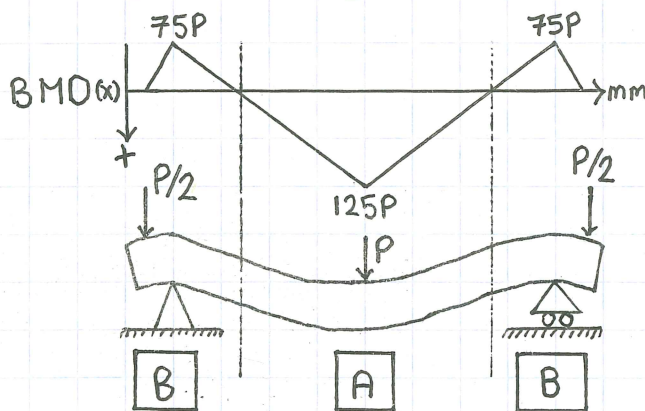
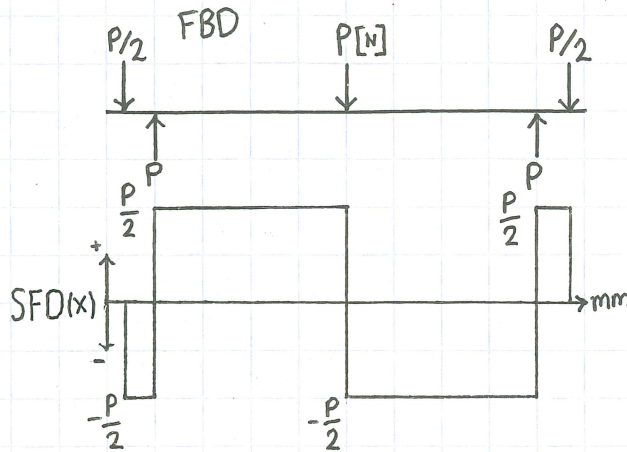
Topic: Example Bridge Design Part I

1) Example Bridge



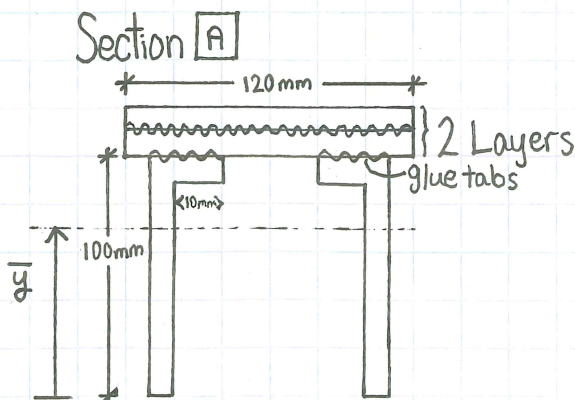
$$\begin{aligned}\mu &= 0.2 \\ E &= 4000 \text{ MPa} \\ \sigma_{\text{Tension}} &= 30 \text{ MPa} \\ \sigma_{\text{Compression}} &= 6 \text{ MPa}\end{aligned}$$

$$\begin{aligned}\tau_{\text{max}} &= 4 \text{ MPa} \\ \tau_{\text{glue}} &= 2 \text{ MPa} \\ t &= 1.27 \text{ mm}\end{aligned}$$



Displaced Shape

Section A = Tension on Bottom
Section B = Tension on Top

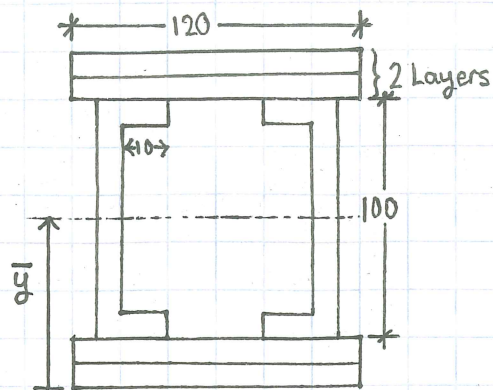


$$\begin{aligned}\bar{y} &= 78.9 \text{ mm} \\ y_{\text{Bot}} &= 78.9 \text{ mm} \\ y_{\text{Top}} &= 23.6 \text{ mm} \\ I &= 587 \times 10^3 \text{ mm}^4\end{aligned}$$

$$\frac{y_{\text{Bot}}}{y_{\text{Top}}} = \frac{78.9}{23.6} \approx 3$$

$$\text{Best } \frac{\sigma_{\text{Tension}}}{\sigma_{\text{Compression}}} = 5 = \frac{30}{6}$$

Section B



Check Flexural Strength

Section A

Compression

$$\sigma = \frac{My}{I}$$

$$6 = \frac{125P_1 \cdot 23.6}{587 \times 10^3}$$

$$P_1 = 1193 \text{ N}$$

Tension

$$\sigma = \frac{My}{I}$$

$$30 = \frac{125P_2 \cdot 78.9}{587 \times 10^3}$$

$$P_2 = 1786 \text{ N}$$

Section B

Compression

$$\sigma = \frac{My}{I}$$

$$6 = \frac{75P_3 \cdot 52.5}{1938 \times 10^3}$$

$$P_3 = 2950 \text{ N}$$

Tension

$$\sigma = \frac{My}{I}$$

$$30 = \frac{75P_4 \cdot 52.5}{1938 \times 10^3}$$

$$P_4 = 14754 \text{ N}$$