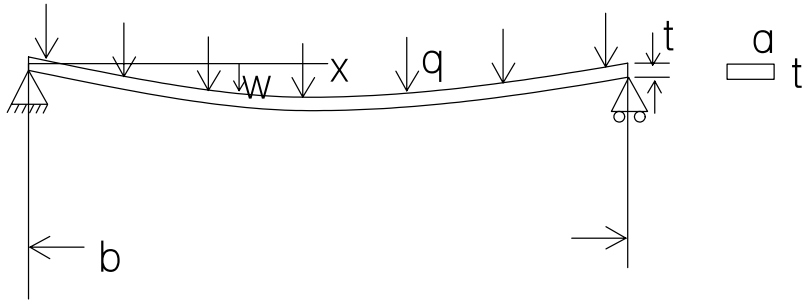
Plate Bending Introduction

see: bending with z load sheet for derivations

review general beam, simply supported, clamped long plate
long plate, boundary conditions (end restrained) not so long plate

simply supported beam:



$$Q(x) := \frac{q \cdot b}{2} - q \cdot x$$

$$\int_0^x Q(\xi)\, d\xi \rightarrow \frac{1}{2} \cdot q \cdot b \cdot x - \frac{1}{2} \cdot q \cdot x^2$$

$$M(x) := \frac{q \cdot b}{2} \cdot x - q \cdot x \cdot \frac{x}{2} \qquad \frac{d}{dx} M(x) \rightarrow \frac{1}{2} \cdot q \cdot b - q \cdot x \qquad = 0 \text{ @ } x = b/2$$

$$M\left(\frac{b}{2}\right) \rightarrow \frac{1}{8} \cdot q \cdot b^2 \qquad M_{max} := \frac{1}{8} \cdot q \cdot b^2$$

$$\sigma_x := \frac{M(x)}{I} \cdot z$$

maximum when z = t/2, m(x) = M_{max}

$$\sigma_{x\_max} := \frac{M_{max}}{I} \cdot \frac{t}{2}$$

$$I := \frac{1}{12} \cdot t^3 \cdot a \qquad \sigma_{x\_max} := \frac{\frac{1}{8} \cdot q \cdot b^2}{I} \cdot \frac{t}{2} \qquad \sigma_{x\_max} \rightarrow \frac{3}{4} \cdot q \cdot \frac{b^2}{t^2 \cdot a}$$

+ tension other side of load

- compression on load side

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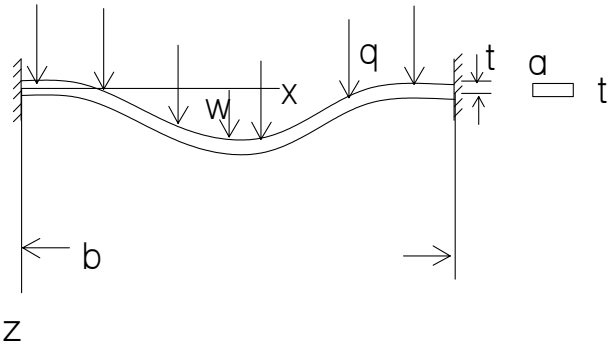
clamped beam:



need to use delection $\frac{d^4}{dx^4} w$ to solve

result: $$M(x) := -q \cdot \left(\frac{x^2}{2} - \frac{b \cdot x}{2} + \frac{b^2}{12}\right)$$

Given $\frac{d}{dx} M(x) = 0$ Find(x) $\rightarrow \frac{1}{2} \cdot b$

$$M\left(\frac{b}{2}\right) \rightarrow \frac{1}{24} \cdot q \cdot b^2$$

$M_{max} = M(x = 0, x = b)$

$$M(0) \rightarrow \frac{-1}{12} \cdot q \cdot b^2 \qquad M(b) \rightarrow \frac{-1}{12} \cdot q \cdot b^2$$

$$\sigma_{x\_max} := \frac{\frac{1}{12} \cdot q \cdot b^2}{I} \cdot \frac{t}{2} \qquad \sigma_{x\_max} \rightarrow \frac{1}{2} \cdot q \cdot \frac{b^2}{t^2 \cdot a}$$

- compression other side of load

+ tension on load side