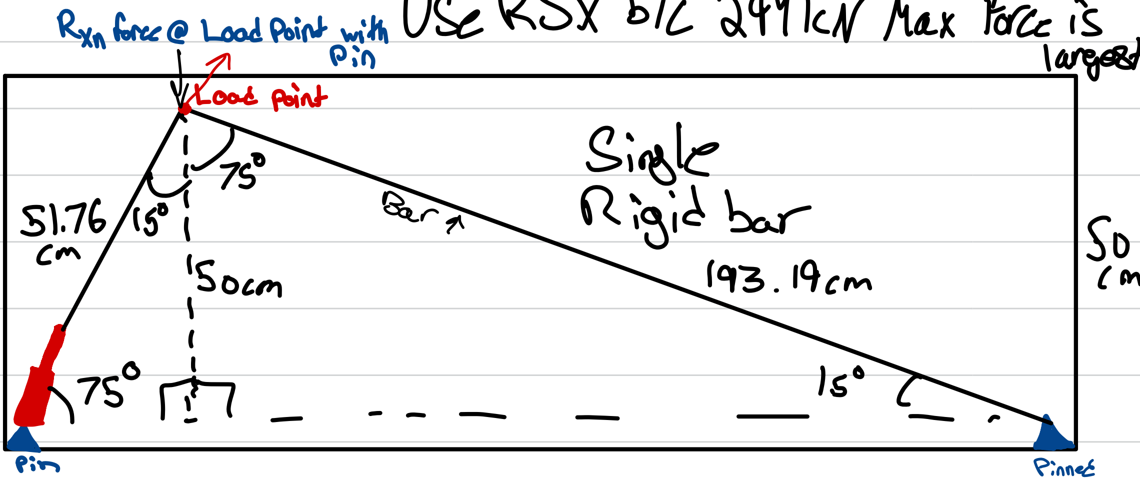
Portfolio 12/8/25!

Sketch

Use RSX b/c 24 kN Max Force is largest



$\sin(75^\circ) = \frac{50}{hyp} \rightarrow 51.76\text{cm}$

Compute how much weight can I put?

Prioritize lifting to max height.

Step 1:

P = Load Applied

F_A = Actuator = 294kN

$$\sum F_y = 0$$

$$F_A \sin(75^\circ) - P = 0$$

$$P = 294\text{kN} \sin(75^\circ) = \boxed{283.98\text{kN}}$$

$P = 283.98$kN for Equilibrium.

Pinned down! Can Rotate if needed However with 283.98kN applied the bar will be in equilibrium.

Assume:

Beam obeys Hookes Law, and is isotropic!

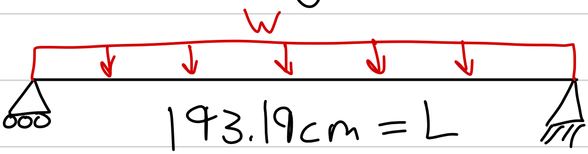
Step 2: Distributed mass loading

Pinned – Roller

weight = Density · V · angle

from cross section

The bar is under distributed loading from its weight



(6) From Appendix:

$$\text{Max Deflection} = \frac{-5wL^4}{384EI}$$

$$y = -\frac{w}{24EI}(x^4 - 2Lx^3 + L^3x)$$

b) Use Structural Steel

$$\rho = \frac{m}{V} \quad \text{Maximum Deflection} = \frac{L}{2} = x$$

$$y = -\frac{w}{24EI}\left(\frac{L^4}{16} - \frac{2L^4}{8} + \frac{L^4}{2}\right)$$

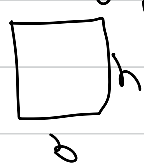
We have L : We need w and I : This will come from the material properties I choose

V = up to me

$$\rho \cdot V = m \qquad 0.02 \cdot L = y_{max}$$

2%

Rectangular Beam



$$\rho \cdot A \cdot L = m$$

$$\rho \cdot A \cdot L = m \qquad I = \frac{1}{12}bh^3$$

$$\rho \cdot A = \frac{m}{L} = w \qquad w = \rho \cdot b \cdot h$$

$$A = b \cdot h$$

$$y = -\frac{\rho \cdot \cancel{b} \cdot h}{24E \cdot \frac{1}{12}\cancel{b} \cdot h^3}\left(\frac{L^4}{16} - \frac{4L^4}{16} + \frac{8L^4}{16}\right)$$

$E = \text{Steel} = 200 \times 10^9\ Pa$

$$-\frac{\rho}{2 \cdot 200 \times 10^9 Pa \cdot h^2}\left(\frac{5L^4}{16}\right) = y$$

$$0.02 \cdot \cancel{L} = -\frac{\rho}{400 \times 10^9 Pa \cdot h^2}\left(\frac{5\cancel{L}^4}{16}\right)$$

$$0.02 = -\frac{7860 kg/m^3}{400 \times 10^9 Pa \cdot h^2}\left(\frac{5}{16} \cdot 1.932^3_m\right)$$

$\boxed{h = 22.14 \times 10^{-7} m}$ $\boxed{b = 1mm}$

$h = \boxed{0.002214\ mm}$ This makes Sense!

Structural steel:

$\rho = 7860 \frac{kg}{m^3}$ $E = 200 \times 10^9 Pa$

$0.02L = \frac{\rho \cdot A}{400 \times 10^9 A \cdot h^2}\left(\frac{5}{16} 1.932_m^4\right)$

$CS: h = 0.002214 mm$

$b =$

$\frac{m}{L} = W$

$W = \rho \cdot b \cdot h$ $\rho = \frac{m}{V}$

$m = \rho \cdot b \cdot h \cdot L$

$m = 7860 \frac{kg}{m^3} \cdot 0.001 m \cdot 22.14 \times 10^{-7} m \cdot 1.932 m$

$m = 33.62 \times 10^{-6} kg$