CMGT 350	Quiz #9	Fall 2022

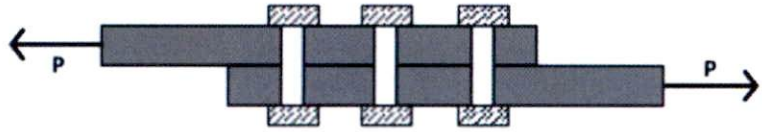
SHOW ALL WORK FOR FULL CREDIT. DO YOUR OWN WORK.

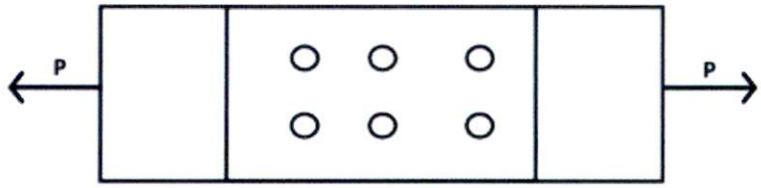
Name: Solution

Helpful Formulas

Normal Stress	$\sigma = \frac{P}{A}$	Linear Strain	$\epsilon = \frac{\delta}{L}$
Shear Stress	$\tau_{avg} = \frac{P}{A_s}$	Hooke's Law	$\frac{\sigma}{\epsilon} = E$ OR $\sigma = E\epsilon$
Bearing Stress	$\sigma_b = \frac{P}{\text{projected area}} = \frac{P}{td}$	Axial Deformation	$\delta = \frac{PL}{AE}$

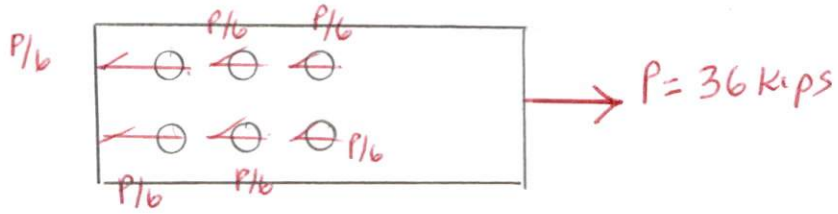
1. The steel plates shown are subjected to an applied tensile load of 36 kips. The connection is made using six 3/4 in. diameter metal bolts. The plates are ¾ in thick and 8 in wide. Calculate the shear stress that must be developed in the bolts to keep the connection intact. Give answer in ksi





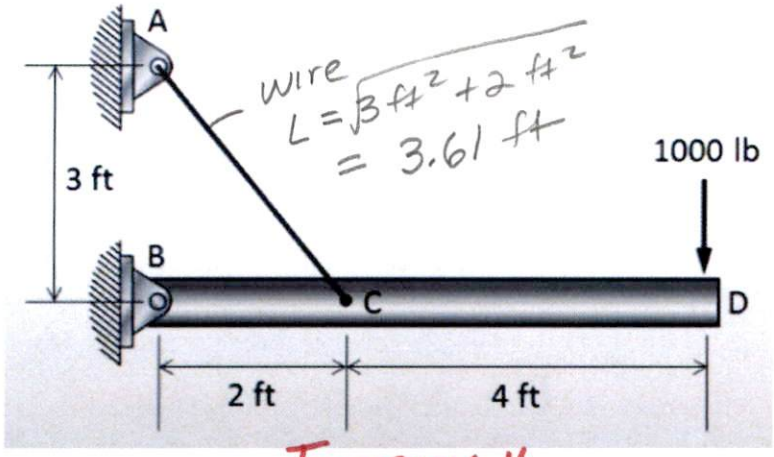
Solution.

$d = 3/4$ in



$$\tau = \frac{P}{A} = \frac{\frac{36\ \text{kips}}{6}}{\frac{\pi (0.75\ \text{in})^2}{4}} = \frac{6\ \text{kips}}{0.441786\ \text{in}^2} = 13.6\ \text{ksi}$$

2. The rigid pipe is supported by a pin at B and an A36 steel wire connected between points B and D at point C. The wire has a diameter of 0.375 inches. For the load shown, the tensile force in the guy wire is 3606 lb. Determine the stress in the cable (in ksi) and verify that it is less than the yield stress for A36 steel (σ_y = 36 ksi). If Hooke's Law applies, determine the elongation of the wire in inches. E = 30 x 10^3 ksi



Wire
$L = \sqrt{3\,ft^2 + 2\,ft^2}$
$= 3.61$ ft

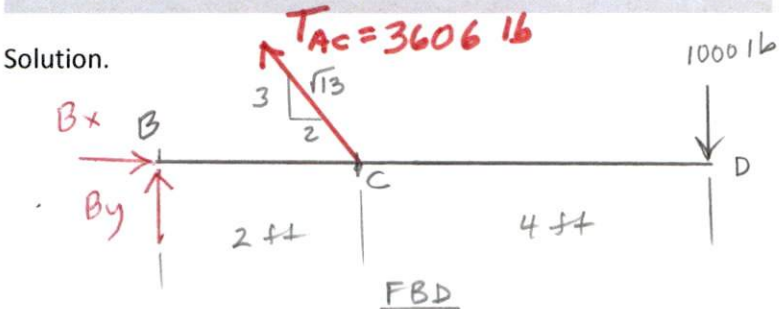
A36 Steel

$d = 0.375$ in.

$\sigma_y = 36$ ksi

$E = 30 \times 10^3$ ksi

Solution.



FBD

$$\sigma_{AC} = \frac{P}{A} = \frac{3606\ lb}{\frac{\pi (0.375\ in)^2}{4}} = 32{,}649\ psi = 32.7\ ksi$$

$\sigma_{AC} = 32.7$ ksi $< \sigma_y = 36$ ksi $\therefore$ Hooke's Law Applies

$$\epsilon_{AC} = \frac{\sigma_{AC}}{E} = \frac{32.7\ ksi}{30{,}000\ ksi} = 0.00109$$

$$\delta = \epsilon \times L = 0.00109 \times 3.61\ ft$$

$$= 0.00393\ ft \times \frac{12\ in}{ft}$$

$$= \underline{0.047\ in.}$$