A steel member is loaded in tension as shown with pins in single shear at both ends. A sketch of the member is shown. Determine the average tensile stress in the member away from the ends. Determine the maximum average tensile stress in the member. Determine the average bearing stress in the member associated with the pin. Determine the average shearing stress associated with the pin tearing out of the end of the member.

Hol diameters are 1 in.
a) The average tensile stress on a transverse plane away from the member ends is given as follows.

\[ \sigma_{AVG} = \frac{P}{A} \]  

\[ \sigma_{AVG} = \frac{20000 \text{ lb}}{(4 \text{ in})(1.5 \text{ in})} \]  

\[ \sigma_{AVG} = 10000 \frac{\text{lb}}{\text{in}^2} \]  

b) The maximum average tensile stress occurs at the hole is given as follows.

\[ \sigma_{AVG} = \frac{P}{A} \]  

\[ \sigma_{AVG} = \frac{20000 \text{ lb}}{(4 \text{ in})(1.5 \text{ in})} \]  

\[ \sigma_{AVG} = 13333.3 \frac{\text{lb}}{\text{in}^2} \]  

Note: This stress does not reflect stress concentrations associated with the hole.
c) The average bearing stress associated with the pin bearing on the member is given as follows:

\[
\tau_{\text{Bearing}} = \frac{P}{A}
\]

Assumed Bearing Area

\[
\tau_{\text{Bearing}} = \frac{20000 \text{ lb}}{(1 \text{ in})(0.5 \text{ in})}
\]

\[
\tau_{\text{Bearing}} = 40000 \frac{\text{lb}}{\text{in}^2}
\]

\[
\tau_{\text{Bearing}} = 20000 \frac{\text{lb}}{\text{in} \cdot \text{in}}
\]

\[
\tau_{\text{Bearing}} = 6667 \frac{\text{lb}}{\text{in}^2}
\]

d) The average shearing stress associated with the pin tearing out the end of the member is given as follows:

\[
\tau_{\text{AVG}} = \frac{P}{A}
\]

\[
\tau_{\text{AVG}} = \frac{20000 \text{ lb}}{(1 \text{ in})(0.5 \text{ in})}
\]

\[
\tau_{\text{AVG}} = 40000 \frac{\text{lb}}{\text{in}^2}
\]

\[
\tau_{\text{AVG}} = 20000 \frac{\text{lb}}{\text{in} \cdot \text{in}}
\]

\[
\tau_{\text{AVG}} = 6667 \frac{\text{lb}}{\text{in}^2}
\]