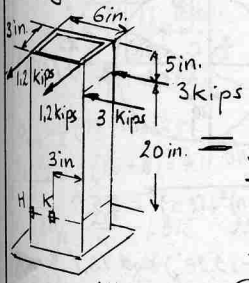
6.26 Equivalent force-couple system in section through H and K:

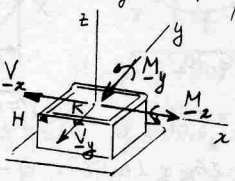


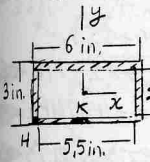
$V_x = 2(3\text{ kips}) = 6\text{ kips}$

$V_y = 2(1.2\text{ kips}) = 2.4\text{ kips}$

$M_y = (6\text{ kips})(20\text{ in.}) = 120\text{ kip·in}$

$M_x = (2.4)(25) = 60\text{ kip·in.}$





Properties of section

$A = 6\times3 - 5.5\times2.5 = 4.25\text{ in}^2$

$I_x = \frac{1}{12}(6\times3^3 - 5.5\times2.5^3) = 6.3385\text{ in}^4$

$I_y = \frac{1}{12}(6^3\times3 - 5.5^3\times2.5) = 19.3385\text{ in}^4$

(a) Stresses at H:

$\sigma_x = 0,\quad \sigma_z = -\frac{M_x(1.5\text{ in.})}{I_x} - \frac{M_y(3\text{ in.})}{I_y} = -\frac{60\times1.5}{6.3385} - \frac{120\times3}{19.3385}$

$\sigma_z = -14.199 - 18.616 = -32.815\text{ ksi}$

Since H is at corner: $\tau_{xz} = 0$

Maximum shearing stress:

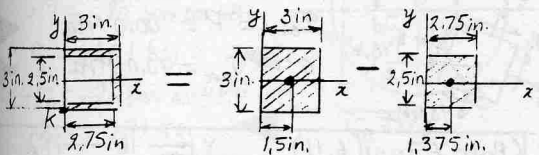
Eq. (6.16): $\tau_{max} = \sqrt{\left(\frac{\sigma_x - \sigma_z}{2}\right)^2 + \tau_{xz}^2} = \frac{32.815}{2}$

$\tau_{max} = 16.41\text{ ksi}$ ◀

Planes of max. shearing stress:

Since $\tau_{xz} = 0$, the principal axes are the x and z axes. The planes of max. shearing stress are at 45° to the principal axes: 45.0° and 45.0° ◀

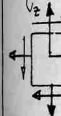
(b) Stresses at K: For computation of τ_{xz}:



$Q_y = \sum A\bar{x} = (3\text{ in.})^2(1.5\text{ in.}) - (2.75\text{ in.}\times2.5\text{ in.})(1.375\text{ in.})$

$Q_y = 4.0469\text{ in}^3 \qquad t = 3\text{ in.} - 2.5\text{ in.} = 0.5\text{ in.}$

$\sigma_z = -\frac{M_x(1.5\text{ in.})}{I_x} = -\frac{60\times1.5}{6.3385} = -14.199\text{ ksi}$



$\sigma_x = 0$

$\tau_{xz} = -\frac{V_x Q_y}{I_y t} = -\frac{6\times4.0469}{19.3385\times0.5} = -2.5112\text{ ksi}$

Maximum shearing stress:

Eq. (6.16): $\tau_{max} = \sqrt{\left(\frac{14.199}{2}\right)^2 + (2.5112)^2} = 7.53\text{ ksi}$ ◀

Planes of max. shearing stress:

Eq. (6.15): $\tan 2\theta_s = -\frac{\sigma_x - \sigma_z}{2\tau_{xz}} = -\frac{0 - (-14.199)}{2(-2.5112)}$

$= +2.82713$

$2\theta_s = 70.52°$ and $-109.48°$ $\qquad \theta_s = 35.3°$ and $54.7°$ ◀