r = radius of gyration

- Stress in Beam

\[ F \leq 0.75F_u \]

May need to estimate for preliminary design.

\[ A_9 \geq \frac{P_u}{0.75F_u} + \frac{A_{bh}}{4} \]

(2)

\[ A_9 \geq \frac{P_u}{0.75F_y \cdot U} \] (yielding)

(1)

Select area based on yielding and fracture limit stresses.

- Tension Member Design

2/22/2007
Use \( U = 1 - \frac{x}{a} \).

Use Grade 50 steel.

There will be at least 3 bolts in each flange, \( 4" \) on center.

The webber has 2 rings of holes in each flange for 1" bolts.

The member is 30" long.

The member is 30" long.

Transfer loads of \( P_o = 220 \) k and \( P_L = 250 \) k.

Select the lightest W14 section available to support Example 2, (4-1).
Estimate $u = 0.8 - 0.9 \Rightarrow \text{Assume } u = 0.85$

\[ A_g = \frac{0.75t^2}{u} + A_{th} \]

After rearranging for $F_{rad}$:

\[ A_g = \frac{0.9}{t} = \frac{664}{90} = 7.4 \text{ in}^2 \]

After rearranging for $V_{rad}$:

\[ A_g = \frac{0.9}{t} = \frac{664}{90} = 7.4 \text{ in}^2 \]

\[ Pu = 1.4D = 1.8 \times 220 = 308 \text{ kips} \]

\[ Pu = 1.2D + 1.6L = 1.2 \times 220 + 1.6 \times 250 = 664 \text{ kips} \]
\[ L = 8\] 
\[ \frac{n}{x} = 1 - n \]

\[ A_{bh} = 4 \left( \frac{1}{8} \right) (0.72) = 3.24 \text{ in}^2 \]

\[ A_g = 14 \times 68 \text{ in}^2 \]

\[ A_g = 20.00 \text{ in}^2 \]

\[ F_n \]

\[ \frac{F_n}{4g} \]

\[ A_g = \frac{0.75 \times 0.85 \times 0.65}{664} \]

\[ A_g = 2.9 \text{ in}^2 \]

\[ \text{Estimated} \]

\[ A_{bh} = 4 \left( \frac{1}{8} \right) (0.65) = 2.9 \text{ in}^2 \]
\[ A_g = 20.0 \rightarrow 19.5 \]
\[ A_g > 19.5 \text{ in} ~ 2 \]
\[ A_g = \frac{0.75(0.84)(0.65)}{6.64} + 3.24 \]

A\text{g required for fracture:} \quad A_g \approx \frac{5.64}{6.64} \]

\[ \nu = 1 - \frac{8}{1.29} = 0.84 \]

\[ \text{W} \times 10 \times 34 \]

\[ \text{W} \times 4 \times 48 \]
Select W14 x 68 as highest acceptable design.

\[ \frac{(2.46 \text{ in})}{(8.0 \text{ ft})} \frac{(2 \text{ in})}{(12 \text{ in/ft})} = 14.6 < 300 \]

Strength check: \( f_r \leq 300 \)
Example 2. Select the highest grade so angle that can

Single grade line.

The member is 12' long. Assume 7/8 diameter belts on a
Support tension loads 60 kips axead 100' and 6 kips live load.

Area for yielding: Ag = \( \frac{(0.4)(50)}{84} \) = 1.87 in.²

\[ P_u = \text{max} \left\{ 1.2P + 1.6L = 1.2(60) + 1.6(6) = 82 \text{ kips} \right\} \]

No. kips = 1.4D = 1.4(60) = 84 kips (controls)
Required Area for Fracture:

\[ A^* = \frac{0.75 \times 0.8 \times 65}{84} \]

\[ A^* = \left( \frac{1}{2} \right) \left( \frac{7}{8} + \frac{1}{6} \right) \]

\[ \ln (\text{From Table D3.1}) = 0.8 \]

\[ A^* + A_{bn} \]
\[ A_g = 2.5 \leq 2.47 \sqrt{\frac{1.3}{L}} \times \frac{3}{8} \times \frac{5}{16} \]

\[ 2.50 \quad \ast \quad \frac{8}{15} \times \frac{3}{16} \times \frac{5}{16} \]

\[ 2.43 \]

\[ 2.48 \]

\[ 2.55 \]

\[ 2.67 \]

\[ \text{Possible Sections} \]

\[ A_g - \text{Fraction} = \frac{1}{4} \text{ or } \frac{3}{16} \]
Use LS = 3\(\frac{1}{2}\) x \(\frac{5}{12}\)

\[
\frac{12''(1/2)}{1.02} = 141 < 300
\]

Check Slenderness: