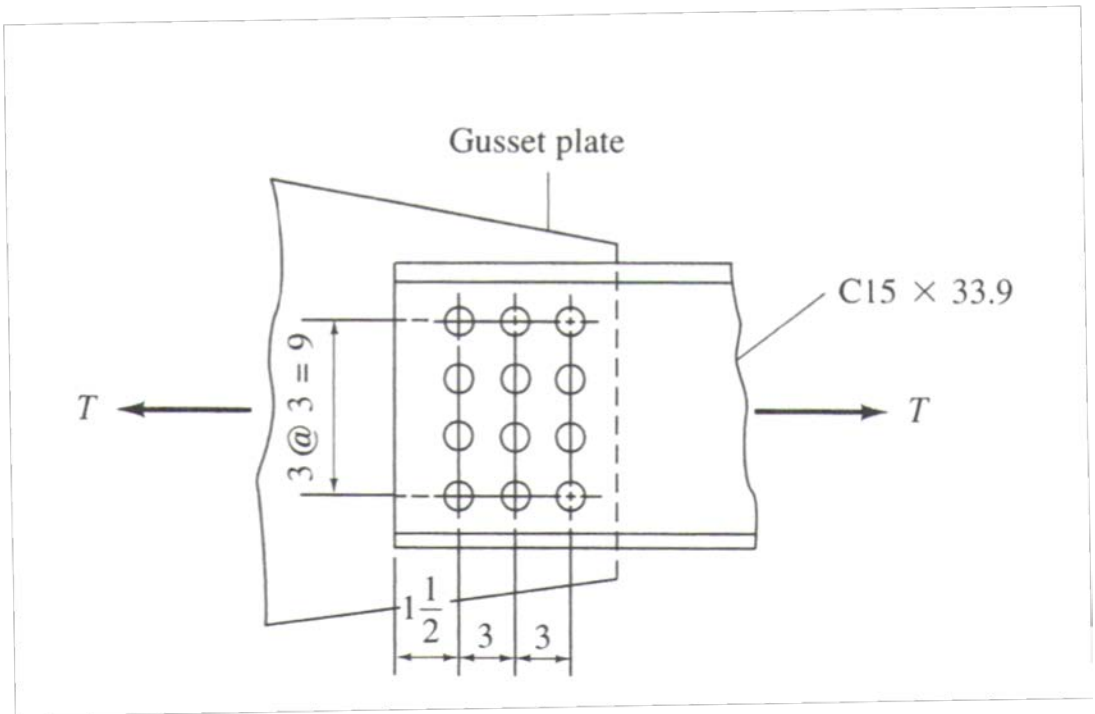


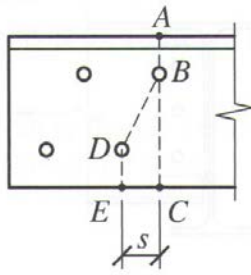
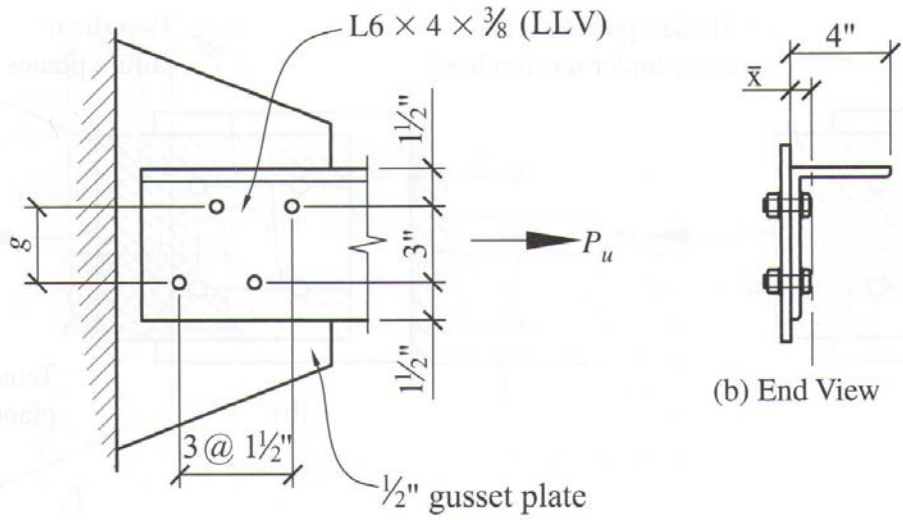
Problem 1: Tension Member Analysis

Determine the maximum allowable tensile load (20% dead load, 80% live load) for a single C15X33.9 fastened to a  $\frac{1}{2}$ -in. gusset plate as shown in the figure below. Use A36 steel and assume holes are for  $\frac{3}{4}$ -in.-diam bolts. Base answer on tension strength of the channel, and include shear rupture strength as well as bolt bearing strength.



# Problem 2: Tension Member Analysis with Staggered Bolts

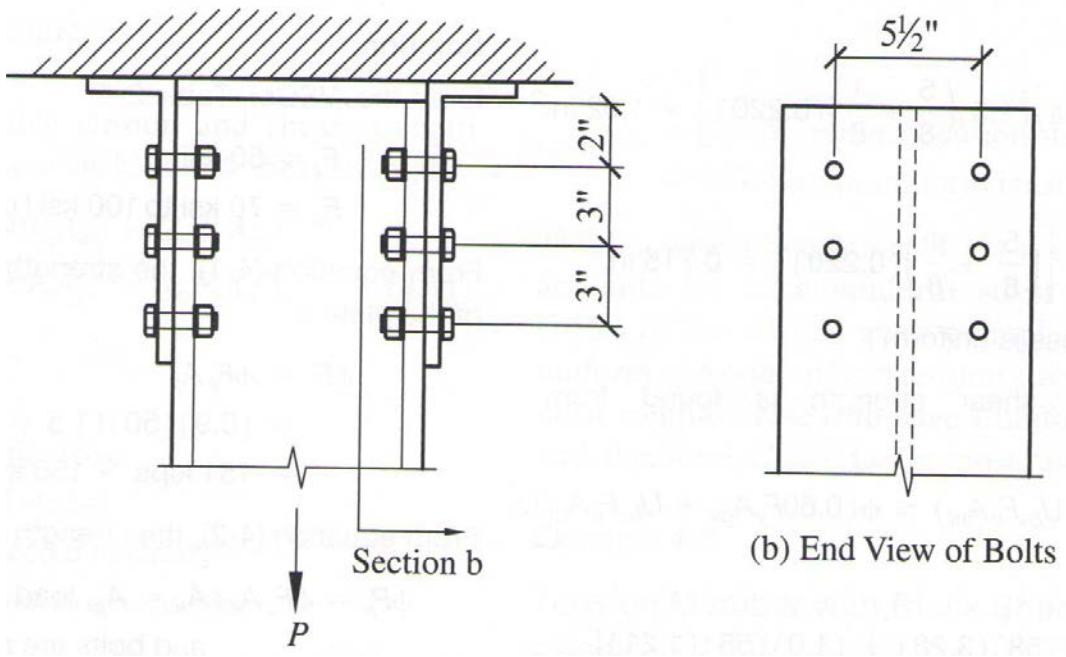
Determine the maximum factored load that can be applied in tension to the angle shown below. The angle is connected with four  $\frac{3}{4}$ " diameter bolts. Neglect block shear.



### Problem 3: Hanger in Tension with Block Shear

The W12 X 53 tension member (ASTM A572 steel) shown below has two rows and three 1-in-diameter bolts in each flange.

- 1- determine the design tension strength of the W 12 X 53.
- 2- determine the service dead load that can be supported if there is no live load, and
- 3- if a service load  $P_D = 100$  kips is applied, what is the maximum service live load  $P_L$  that can be supported.



#### Problem 4: Design of a Two-Angle b to b welded Tension Member

Select a pair of angles to support a tensile live load and dead load of 65 and 20 kips respectively (length of tension member = 20 ft.). Assume the angles are separated back-to-back  $\frac{3}{8}$  in. by a connected gusset plate, and that the connection is welded. Assume the slenderness ratio desired to not exceed 300.

## Problem 5: Design of a Single-Angle Tension Member

Design a tension member given the following:

- Service loads: PD = 40 kips, PL = 66 kips;
- Single angle required;
- Unbraced length,  $L = 20$  ft.;
- ASTM A36 steel; and
- Two lines of four  $\frac{3}{4}$ -in-diameter bolts

# Problem 6: Design of a Tension Member

Design the X-brace in the first story of the building shown below, which is subjected to wind loads. Use a steel plate that confirms to ASTM A36.

Some X-brace configurations have slender members such that they can only support loads in tension. In this figure, all of the members are assumed to be too slender to support compression loads. Only the shaded members support lateral loads in the assigned direction of the lateral loads.

Use five 7/8-in. diameter bolts in a single line.

