



**University Of Technology**  
**Building and Construction Eng. Dept.**  
**Final Exam – First Attempt – 2010/2011**



**Subject :** Structural Design- steel

**Class:** Forth Class

**Branch :** Building & construction management

**Time :** 3 Hours

**Examiner :** Dr. Zeyad M. Ali

**Date :** 5 / 6 / 2011

**Notel :** Answer three questions only (Q1 include). **Note2 :** Use the AISC specification .

Q1/ Check the adequacy of the plane frame shown in the fig. due the load acting & design the joint (B) connection as a hinge joint by using the A325 bolt one inch diam. threads excluded ? Assume all steel A-36 is used and the joint B & joint C are points of lateral support for compression flange .

**W8x40.**

$$A_g = 11.8 \text{ in}^2$$

$$d = 8.25 \text{ in}$$

$$t_w = 0.365 \text{ in}$$

$$b_f = 8.007 \text{ in}$$

$$t_f = 0.558 \text{ in}$$

$$r_T = 2.24 \text{ in}$$

$$d/A_f = 1.83 \text{ in}^{-1}$$

$$I_x = 146 \text{ in}^4$$

$$S_x = 35.3 \text{ in}^3$$

$$r_x = 3.53 \text{ in}$$

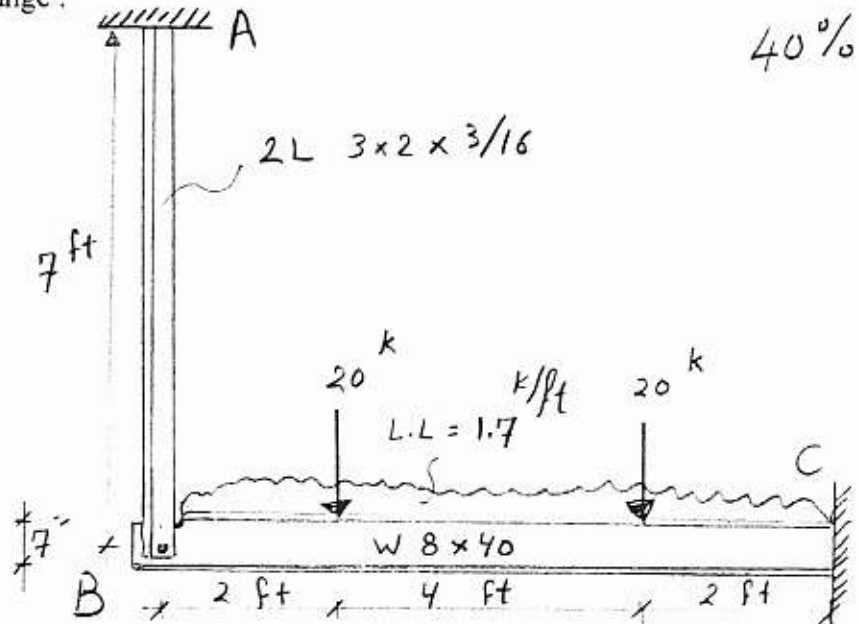
$$E = 29000 \text{ ksi}$$

**2L 3 x 2 x 3/16**

(long legs back to back)

$$A_g = 1.8 \text{ in}^2$$

$$I_x = 1.68 \text{ in}^4$$



Q2/ A compression truss member ( 8 ft ) long is composed of C5x9 connected to a gusset plate 5/8 inch thickness by longitudinal weld only as shown in the fig. with max. allowable welding size ,compute the length of welding required to develop the full compression capacity of this member ? Given all steel is A-36 & E 80 electrodes is used.

**C 5x9**

$$A_g = 2.64 \text{ in}^2$$

$$d = 5.0 \text{ in}$$

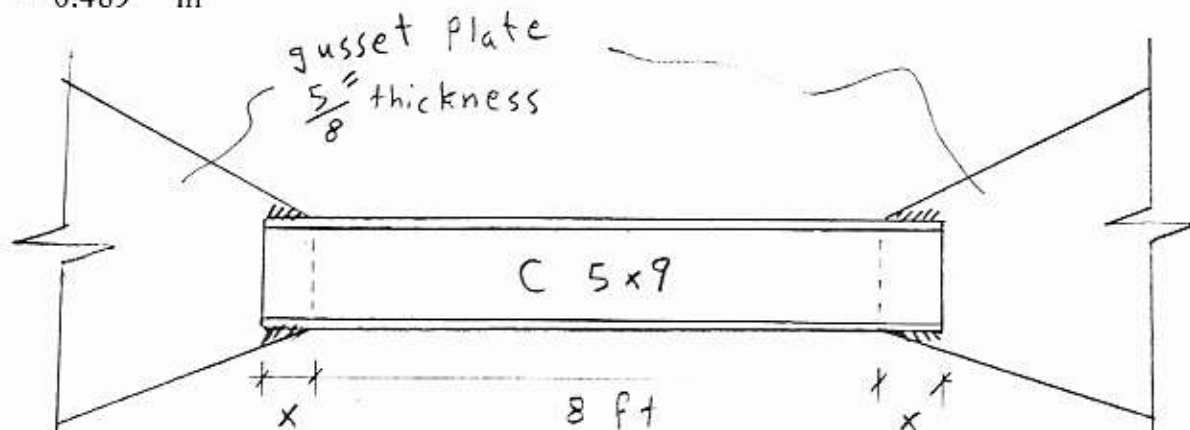
$$t_w = 0.325 \text{ in}$$

$$b_f = 1.885 \text{ in}$$

$$t_f = 0.32 \text{ in}$$

$$r_x = 1.83 \text{ in}$$

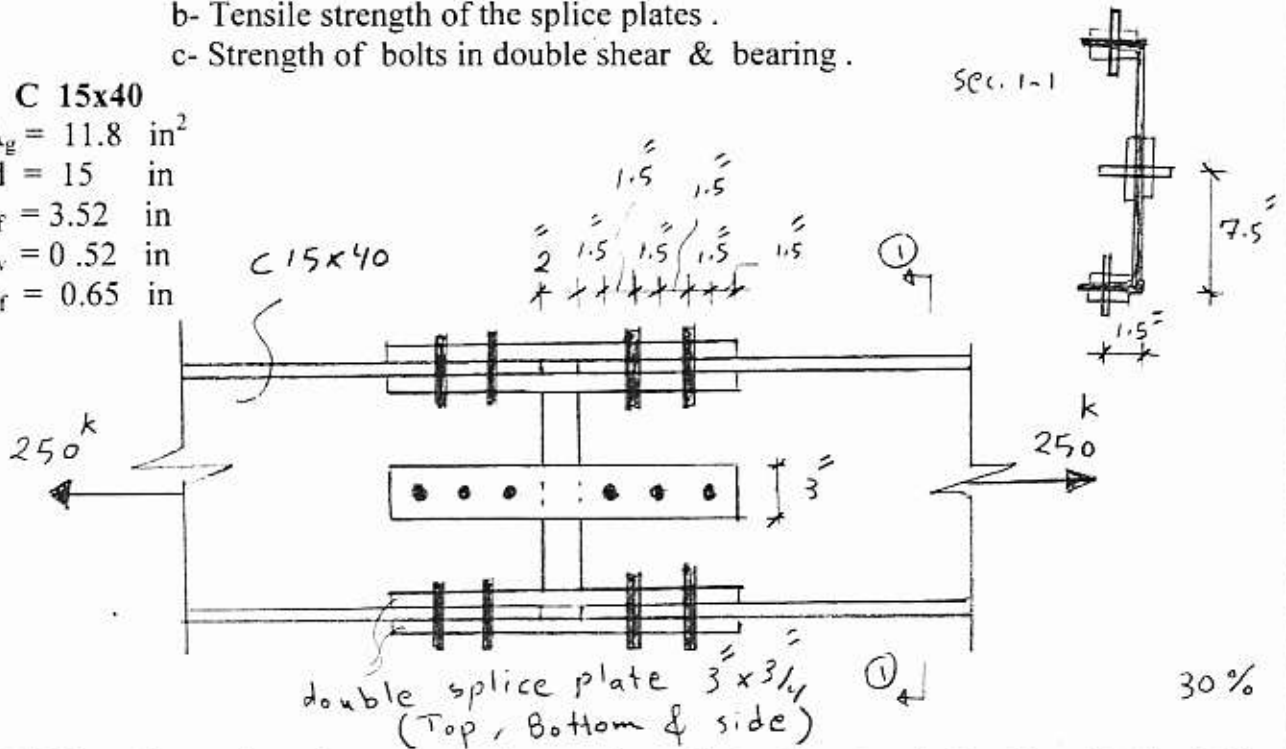
$$r_y = 0.489 \text{ in}$$



Q3/ The bearing-type connection shown in the fig. with 7/8 inch diam. A325 bolt (threads excluded) in standard size holes & spacing. Assume all the steel is A-36 type.

- Check:- a- Tensile strength of the channel section.  
 b- Tensile strength of the splice plates.  
 c- Strength of bolts in double shear & bearing.

**C 15x40**  
 $A_g = 11.8 \text{ in}^2$   
 $d = 15 \text{ in}$   
 $b_f = 3.52 \text{ in}$   
 $t_w = 0.52 \text{ in}$   
 $t_f = 0.65 \text{ in}$

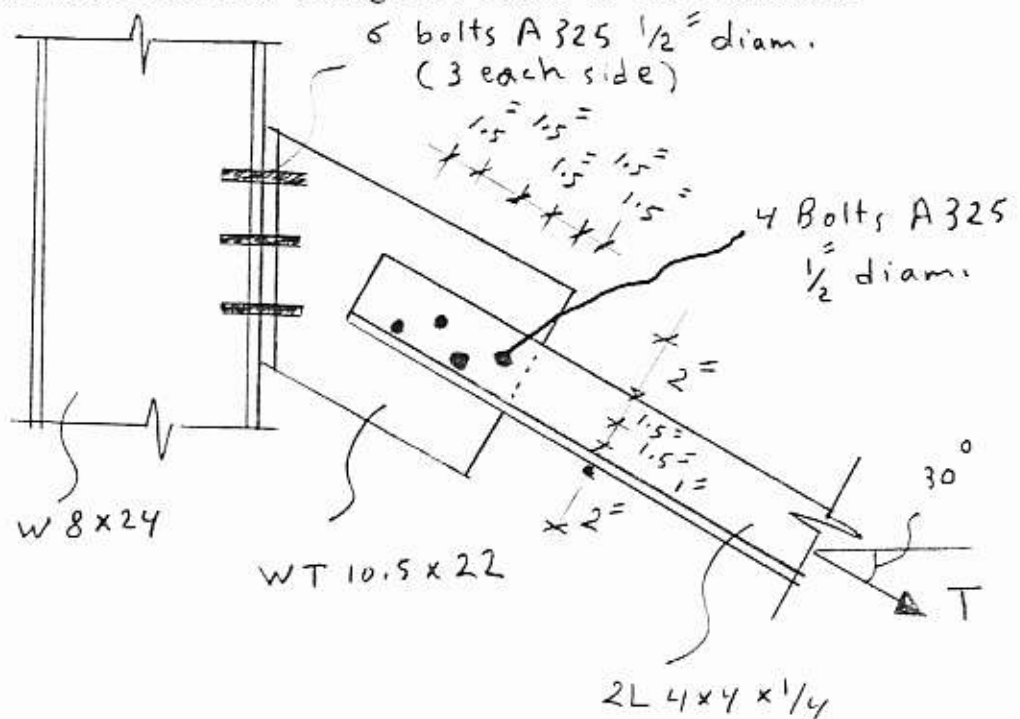


Q4/ Given the tension-shear connection as shown in the fig. what is the allowable load (T) if A-36 steel are used for all section & a bearing type joint with threads included for shear plane? Assume that all spacing & edge distance requirement are satisfied the AISC and the resultant force acts through the centre of the connection

**W8x24.**  
 $A_g = 7.06 \text{ in}^2$   
 $d = 7.93 \text{ in}$   
 $t_w = 0.245 \text{ in}$   
 $b_f = 6.5 \text{ in}$   
 $t_f = 0.398 \text{ in}$

**2L 4 x 4 x 1/4**  
 $A_g = 3.88 \text{ in}^2$

**WT 10.5x22**  
 $A_g = 6.48 \text{ in}^2$   
 $d = 10.33 \text{ in}$   
 $t_w = 0.348 \text{ in}$   
 $b_f = 6.5 \text{ in}$   
 $t_f = 0.451 \text{ in}$



30%