

Vertical Bracing Connections Final Exam

To be submitted by 8:00 a.m. EDT June 21, 2022 – Submit through online form



1. In the UFM, V_c is defined as:
 - a. The horizontal component of the brace force at the gusset to beam connection
 - b. The horizontal component of the brace force at the gusset to column connection
 - c. The vertical component of the brace force at the gusset to beam connection
 - d. The vertical component of the brace force at the gusset to column connection

2. The work line at single and double-angle brace connections:
 - a. Is always on AISC's workable gage line (*Manual* Table T1-7A)
 - b. Is always at the center of gravity of the angle
 - c. Is at the center of the angle leg attached to the gusset
 - d. Is typically at AISC's workable gage line for bolted connections and at the center of gravity for welded connections.

3. Erection of structures is covered by
 - a. AISC Specification Chapter B
 - b. OSHA
 - c. Manual Part 10
 - d. AWS

4. True or False: The primary use of Special Case II is for situations with low beam gravity shear.
 - a. True
 - b. False

5. True or False: Full scale tests were used to verify that the UFM produced safe or conservative designs.
 - a. True
 - b. False

Questions 6 to 8 reference Figure A which shows a brace connection to a beam and column. Assume a 0.5" setback between the column flange and the edge of the gusset plate. Use the uniform force method to calculate the connection forces.

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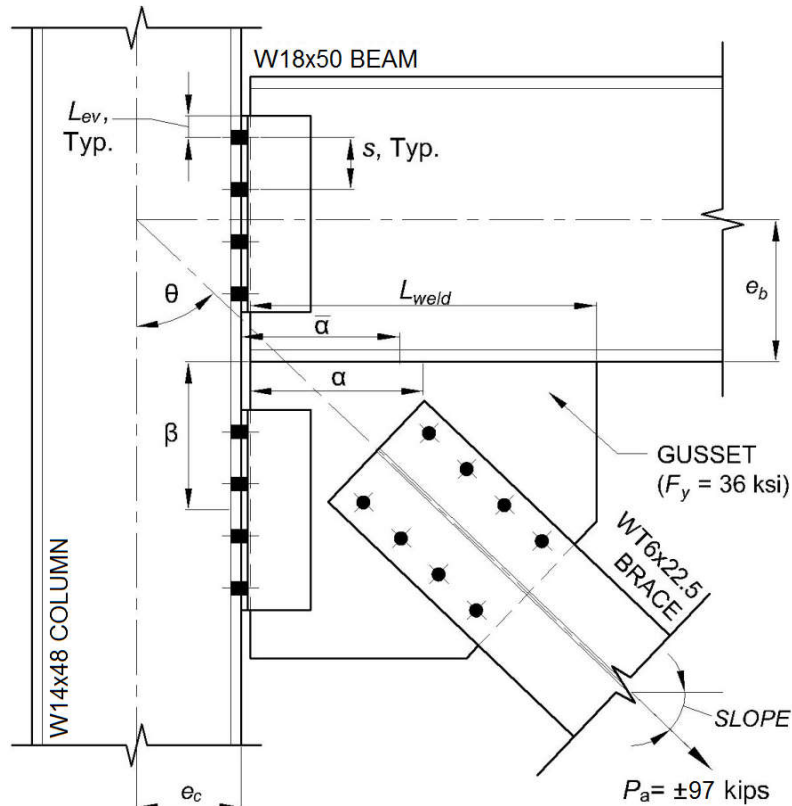


Figure A

6. For the connection shown in Figure A, the following geometric properties are given:

$$\theta=39^\circ \quad L_{weld}=21'' \quad \beta=8.75''$$

What is the value of $\bar{\alpha}$?

- a. 7.5"
- b. 8.8"
- c. 10.5"
- d. 11.0"

7. For the connection shown in Figure A, assume that the following geometric properties have been calculated:

$$\alpha=14.0'' \quad \bar{\alpha}=12.5'' \quad \beta=10.5''$$

What is the horizontal connection force at the beam flange to gusset plate interface?

- a. 30.5 k
- b. 42.4 k
- c. 44.1 k
- d. 47.5 k

8. In order for the horizontal force at the column to gusset plate interface to be zero, what would need to be changed in the connection shown in Figure A?

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- a. The connection would need to be made to the column web.
 - b. α would need to equal $\bar{\alpha}$.
 - c. The column depth would need to increase.
 - d. The horizontal force at the column to gusset plate interface cannot equal zero.
9. Which is a true statement regarding the advantages and disadvantages of using various connection types?
- a. End plates will create a prying force on the column flange while clip angles will not.
 - b. Slip critical bolts are necessary in shear plate connections where load is applied parallel to slotted holes.
 - c. Drilling through thick column flanges may be necessary for installation of clip angles and shear plates.
 - d. Clip angles are relatively easy to install at column webs with stiffeners.
10. When analyzing a bearing bolt connection for prying,
- a. The available bolt tension, T_{avail} , is equal to the tension capacity of the bolt, B , when the fitting thickness is equal to t_c .
 - b. The bolts should be checked for shear-tension interaction after checking for prying.
 - c. If $\alpha' < 0$, the fitting controls the available bolt strength.
 - d. When $\alpha' > 1$, the connection is the optimal design.
11. When checking a slip critical connection,
- a. The bolt slip critical shear strength must be reduced to account for the applied bolt tension.
 - b. The connection must be checked for prying as a bearing connection.
 - c. If the slip critical shear strength is found to be inadequate, increasing the bolt size will not increase the capacity.
 - d. Both a and b.

Questions 12 to 14 reference Figure B which shows a brace connection to a beam and column.

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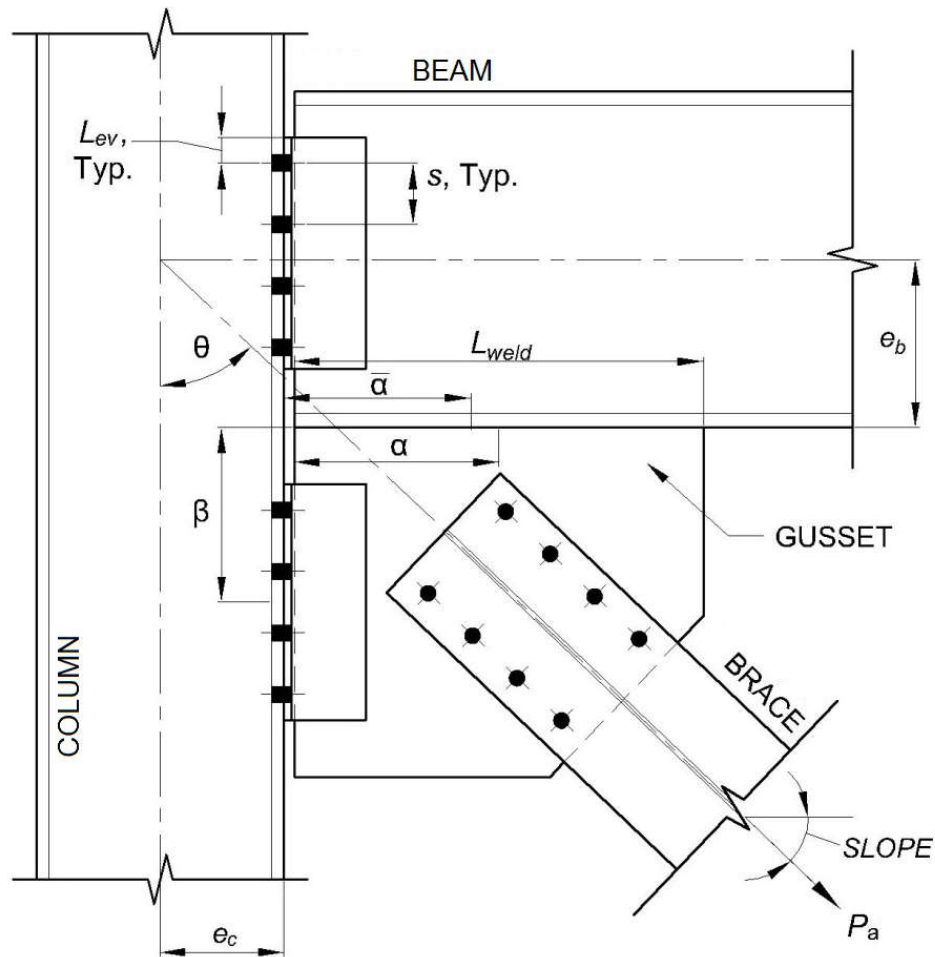


Figure B

The following limit states are checked in the connection shown in Figure B for the applied axial force, P_a , in the brace (disregard gravity forces):

- A. Net Tension
- B. Whitmore Tension and Buckling
- C. Bolt Tear Out
- D. Web Yielding
- E. Prying
- F. Block Shear
- G. Web Crippling
- H. Gross Tension
- I. Bolt Bearing
- J. Bolt Shear
- K. Weld Strength

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12. Which of the following limit states apply to the beam (beam to gusset and beam to column connections) in Figure B?
- C, F, I, and J.
 - B, F, and K.
 - D, F, G, and K.
 - B, D, E, and K.
13. Which of the following limit states apply to the gusset to brace connection in Figure B?
- B, C, F, I, and J
 - B, C, D, E, and G
 - A, E, F, I, and K
 - C, F, I, J, and K
14. Which of the following limit states apply to the angle to column connection in Figure B?
- E and K
 - C, I, and J
 - C, F, I, and J
 - C, E, F, I, and J
15. True or False: The Uniform Force Method Special Case V provides a method to eliminate the overstress in the beam that would necessitate a web doubler by transferring some of the UFM shear component, V_b , to the column.
- True
 - False
16. Braced frame connection design must
- Provide resistance for maximum brace forces
 - Provide resistance for maximum collector forces
 - Both a) and b)
 - Neither a) nor b)
17. True or False: In the Uniform Force Method, if the actual gusset does not match the virtual gusset, moments are induced on the gusset edge(s).
- True
 - False
18. Which of these is a means of accommodating SCBF brace buckling?
- Linear hinge
 - Elliptical hinge
 - In-plane hinge
 - End fixity strong enough to develop the expected brace flexural strength
 - All of the above

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19. Which statement is true?
- If the design can be shown to be adequate by the Uniform Stress Model (USM), analysis by the Concentrated Stress Model (CSM) is not required.
 - If the design fails the USM but can be shown to be adequate by the CSM, it is acceptable.
 - Both a and b
 - Neither a nor b
20. Which stress model permits a shorter gusset length for a given beam shear capacity?
- Uniform Stress Model
 - Concentrated Stress Model
21. Which statement is true?
- The complete plastic mechanism can demonstrate adequacy in some cases in which the CSM indicates inadequacy.
 - The complete plastic mechanism is not recommended by the speaker for new design but may be used to evaluate existing structures.
 - Both a and b
 - Neither a nor b
22. Which of the following is NOT a common RFI related to vertical bracing connections?
- Use of slip-critical bolts
 - Material grade
 - Stitch plates
 - Beam size
23. Regarding vertical braces, the transfer forces are generally _____ the axial forces in the brace?
- Greater than
 - Less than
 - Equal to
24. Which of the following is helpful to include on vertical bracing elevations?
- Transfer forces
 - Beam sizes
 - Column sizes
 - All of the above