

Steel Interchange

Steel Interchange is an open forum for *Modern Steel Construction* readers to exchange useful and practical professional ideas and information on all phases of steel building and bridge construction. Opinions and suggestions are welcome on any subject covered in this magazine.

The opinions expressed in *Steel Interchange* do not necessarily represent an official position of the American Institute of Steel Construction, Inc. and have not been reviewed. It is recognized that the design of structures is within the scope and expertise of a competent licensed structural engineer, architect or other licensed professional for the application of principles to a particular structure.

If you have a question or problem that your fellow readers might help you to solve, please forward it to us. At the same time, feel free to respond to any of the questions that you have read here. Contact *Steel Interchange* at:

Steel Interchange
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Question from December 1999

Are there any AISC guidelines for flame-cut holes used for bolted connections?

You can find a very good article in the third quarter 1982 issue of *Engineering Journal*, entitled "Effect of Hole-Making on the Strength of Double Lap Joints," by Nestor Iwankiw and Thomas Schlafly.

Miguel A. Dodes Traian, engineer
Buenos Aires, Argentina

General interest question:

LRFD *Manual of Steel Construction*, 2nd edition, Volume II, page 11-69 gives typical butt plate thickness as 1 1/2" for W8 over a W10, and 2" for others. Is there any method to calculate the required thickness? What about same column splice (same cross sections above and below) where no bending is introduced in the butt plate?

The detail shown is a generic detail that can be used in the majority of cases. It is intended, though, that the detail be checked for the actual force transfer requirements. The sizes given are good ball-park thicknesses. If you have significant differences between the column depths, there is the potential for bending in the butt plate, which would probably have to be addressed with a yield-line or other suitable approach. But there is a mitigating factor on the bending part...if you have one of the columns much smaller than the other, this usually means that the load is also much smaller.

For a butt-plate splice of a column of very similar or the same cross-section, the plate thickness doesn't matter much. But for that application, a butt plate may not make much sense anyway...although there wouldn't be anything wrong with using it if you wanted to. I'd select the thickness in that case to be consistent with other plates used on the job for convenience and cost effectiveness.

Charles J. Carter, P.E.
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More on beam bracing...

In the November 1999 *Steel Interchange*, Mr. Charles Baker mentioned that lateral bracing, "must prevent twist or lateral displacement, but not both." With this statement Mr. Baker gives two supporting excerpts from references, one being an AISC publication (*AISC Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design*, 1989) and the second, from the notes of Dr. Joseph Yura (Summary of Bracing Recommendations, presented to SEAoT in May of 1993).

J. C. Smith, the author of *Structural Steel Design: LRFD Approach*, 1st edition, has this to say under section 5.3, Lateral Support: "lateral braces must prevent both twisting and lateral deflection of the cross section of the member where laterally braced points are desired. Spacing, stiffness, and strength of the lateral braces must be adequately chosen to prevent lateral-torsional buckling before the design bending strength requirement is satisfied." J. C. Smith has a second edition of this text (printed in 1996) which says the same thing.

The paper, "Fundamentals of Beam Bracing," by Joseph A. Yura states, "bracing that controls both lateral movement and twist is more effective than lateral or torsional bracing acting alone." This paper can be found in the SSRC publication, "Is Your Structure Suitably Braced?" The contents of the SSRC publication were presented at the 1993 SSRC Conference.

There are two beam bracing systems, which are discussed in Yura's paper, which are lateral, and torsional bracing. Lateral bracing restrains the beam from lateral displacement, while torsional bracing restrains the beam from twisting of the member cross section. That is why, "bracing that controls both lateral movement and twist is more effective."

Timothy M. Young
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Editor's note:

Both Mr. Baker and Mr. Young have the right idea: to be effective, lateral bracing must prevent twisting of the cross-section, lateral displacement of the cross-section, or both. However, most common bracing details prevent both types of movements.

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Some useful information:

All old *Steel Interchange* questions (and their published answers) are available on the *Modern Steel Construction* web site. Here's how to find them:

1. Go to www.modernsteel.com.
2. Click on the **forum** button near the top right-hand side of the page.
3. In the forum, *Steel Interchange* appears in **red**. Click on it.
4. You're now in the *Steel Interchange* archive.
5. There are a lot of entries, so use our search function. Click on **Search Topics** in the extreme left-hand menu.
6. Search for your keywords.

Steel Interchange searches will return a list of all the questions and/or answers containing the keywords you used. If the question or answer included figures, the figures are attached to the message as files.

Also, please note that due to the limits of technology (yes, there are some!) equations and subscripts will not be formatted exactly as they appear in print.

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New Questions

Girts are typically designed to support the vertical tributary area weight of siding for each girt level as well as the horizontal (component and cladding) tributary area wind pressure for each girt member.

Considering that siding is necessarily erected from the base upward and that the diaphragm arching effect of the siding would certainly bridge between columns and load them directly, why does it make any sense to consider channel girts to eccentrically support siding weight on one flange? Suppose no sag rods are used?

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Part 9 of the AISC LRFD *Manual of Steel Construction*, 2nd edition, Volume II – Connections, contains tables for single plate shear connections. These tables are dependent on the flexibility/rigidity of the supporting structural element. Part 9 defines a rigid support as a supporting member possessing relatively high rotational stiffness, such as a beam-to-column flange connection. A flexible support is defined as a member possessing relatively low rotational stiffness such as a one-sided beam-to-girder connection.

These definitions are also discussed in the *Hollow Structural Sections Connections Manual*.

Would the following single plate shear connections be defined as rigid or flexible?

1. Beam-to-face of structural tube.
2. Beam-to-web of wide flange shape.

Is there any published information that provides guidelines for classifying supporting members as either rigid or flexible?

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Are we dangerously kidding ourselves when we specify "X" high-strength bolts? The allowable shear stresses are increased more than 40% for threads excluded from the shear plane. The installer of these bolts is an ironworker working many feet above the ground with a bolt bag filled with possibly many varieties of bolts. How does he know that the connection he is working with at the moment requires "X" bolts?

There is also a very small tolerance for installing a bolt with the threads excluded from the shear plane. For example; a bolt with a 1/2" shank (unthreaded portion under the bolt head) that is installed from the clip-angle side (5/16" thickness) to the flange of a W8x40 column flange has the threads excluded. This same bolt installed from the column flange side (9/16" thickness) does not exclude the threads.

Another aspect to consider is the ability of the structural steel inspector to verify that a bolted connection he observes after erection has in fact excluded the threads from the shear plane since the shank of the bolt is hidden from view.

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