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. If you have a question or problem that your fellow readers might help you to solve, please forward it to *Modern Steel Construction*. At the same time, feel free to respond to any of the questions that you have read here. Please send them to:

Steel Interchange
Modern Steel Construction
One East Wacker Dr., Suite 3100
Chicago, IL 60601-2001

Answers and/or questions should be typewritten and double-spaced. Submittals that have been prepared by word-processing are appreciated on computer diskette (either as a Word file or in ASCII format).

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 principals to a particular structure.

Information on ordering AISC publications mentioned in this article can be obtained by calling AISC at 800/644-2400.

* * * * **Questions and answers can now be e-mailed to: melnick@aiscmail.com** * * * *

The following responses from previous Steel Interchange columns have been received:

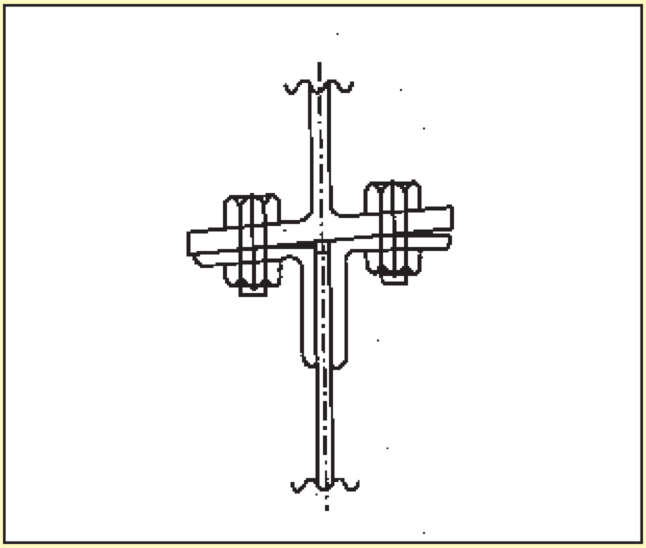
How much of a joint must be in contact to be considered to be in full contact?

Projecting elements of bolted connection attachments, such as clip-angles or end-plates, often are not flat in the plane of the connection because of profile variations due to as-rolled mill tolerances or welding distortions. In double-angle connections, for example, the outstanding legs tend to bend back toward the centerline of the span. Any resulting gaps are usually drawn together when the bolts are installed, except in relatively thick material.

In bearing connections, this is of little concern. In slip-critical connections, the full slip resistance of the connection will be developed regardless of the initial position of such projecting elements if the following conditions are met:

1. Some part of the connection is in contact with the support before the bolts are tensioned.
2. The bolts are subsequently tensioned in accordance with the RCSC Specification.
3. The faying surfaces are drawn into contact at the bolts within the area of the bolt head or nut as illustrated in the figure below.

Accordingly, it is stated in AISC *Code of Standard Practice* Section 6.3.1 that "projecting elements of connection attachments need not be straightened in the connecting plane if it can be demonstrated that installation of the connectors or fitting aids will provide reasonable contact between faying surfaces."

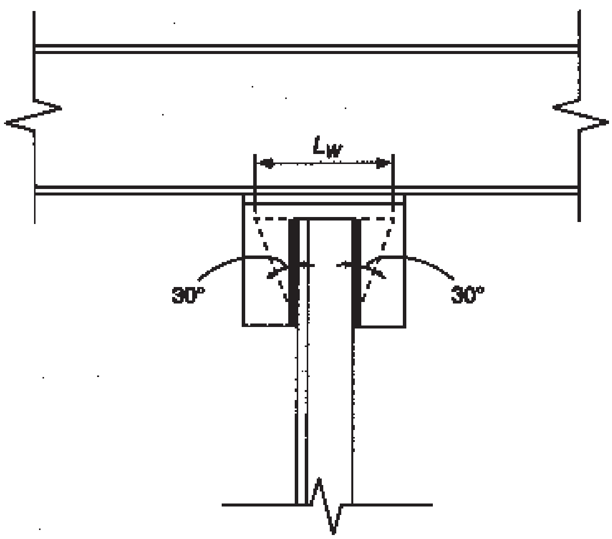


What is the difference in design philosophy between a building structure that has been designed to meet the AISC *LRFD Specification for Structural Steel Buildings* and a building that has been designed to meet the AISC *Seismic Provisions for Structural Steel Buildings*?

A building designed to the AISC *LRFD Specification for Structural Steel Buildings* is one that possesses adequate strength to resist all design loads, primarily through nominally elastic behavior. A building designed to the AISC *Seismic Provisions for Structural Steel Buildings*, contains additional provisions for dissipating large magnitude seismic input energy through controlled inelastic deformations in discreet locations in the structure, such as through hinging of beams in moment frames, buckling of braces in concentrically braced frames, and shear (or flexural) yielding of the link in eccentrically braced frames to preclude structural collapse under high overload conditions that may occur. Obviously, a higher cost is associated with designing to the latter specification and achieving this level of ductility.

In many design examples in the 2nd Edition LRFD *Manual of Steel Construction*, yielding and buckling in a gusset plate or similar fitting are checked on a Whitmore section. What is a Whitmore section?

A Whitmore section identifies a theoretically effective cross-sectional area at the end of a connection resisting tension or compression, such as that from a brace-to-gusset-plate connection or similar fitting. As illustrated in the figure above for a WT hanger connection, the effective length for the Whitmore section L_w is determined using a spread-out angle of 30° along both sides of the connection, beginning at the start of the connection. It is applicable to both welded and bolted connections.



Whitmore section

NEW QUESTIONS

Listed below are questions that we would like the readers to answer or discuss.

If you have an answer or suggestion please send it to the Steel Interchange Editor, Modern Steel Construction, One East Wacker Dr., Suite 3100, Chicago, IL 60601-2001. Questions can also be sent via e-mail to melnick@aiscmail.com.

Questions and responses will be printed in future editions of Steel Interchange. Also, if you have a question or problem that readers might help solve, send these to the Steel Interchange Editor.

Section I1. of the 9th edition of the AISC ASD *Manual of Steel Construction* defines the requirements for the determination of composite members. The specification details two situations:

1. **When a beam is totally encased, relying on friction for composite action; and**
2. **When a beam is not totally encased, utilizing shear connectors for composite action.**

What about other conditions? My situation is typical to many older industrial buildings. The beam is question is made up of a rolled steel section with concrete haunches and slab on one or both sides. This section does not meet code requirements for composite action because it does not have 2" of reinforced concrete soffit below the bottom flange, nor does it have shear connectors along the top flange. The beam does have reinforcing bars (#4 @ 12" EW) on both sides of the web that are welded to the flange and web.

My questions are as follows:

1. **Is there any recorded research or publication available on the determination of composite action for members of this configuration?**
2. **How is the stiffness of the section affected?**
3. **Can the composite section be used in the determination of the natural frequency of floor framing?**
4. **Is there anyone I can contact to discuss my situation?**

Mark Tracy, P.E.
Neill and Gunter, Inc.
Scarborough, Maine

I have a question concerning the welding of clip angles to the web of beams that have wide flanges. In placing the weld on the top edge of the clip angle it is impossible to place an effective weld because the width of the flange causes interferes with the weld rod.

How should this problem be addressed when designing the connection?

J. Michael Anderson
Morrison Knudsen Co.
Boise, Idaho

In order to facilitate the fabrication and erection of a long span plate girder or box beam bridge, would a constructor prefer to have the option of designating the location(s) of the field splice(s)? The constructor would design the splice(s) based upon design loads, moments, and shears shown in the contract documents.

Joseph B. Matarazzo, P.E.
Tobyhanna, PA