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* via AISC's Steel Solutions Center:

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FINGER SHIMS IN BOLTED JOINTS

Are there any strength concerns associated with using finger shims in pretensioned bolted joints? Can finger shims be used in seismic applications?

Question sent to AISC's Steel Solutions Center

The strength effects of shims (and fillers) are addressed in the 2000 RCSC *Bolt Specification*, Section 5.1. For shims equal to or less than ¼-inch thick, the strength is unaffected. For shims over ¼-inch thickness, refer to the RCSC *Bolt Specification* requirements.

Finger shims can be used in seismic applications. Several connections included in FEMA 350 used finger shims, such as end-plate moment connections and bolted flange-plated connections. Additional information on fillers and shims, as well as references to actual tests, can be found in the RCSC publication *Guide to Design Criteria for Bolted and Riveted Joints* available from the AISC bookstore.

Sergio Zoruba, Ph.D.
AISC Steel Solutions Center
Chicago, IL

SEISMIC DESIGN OF DOUBLER PLATES

Where can I find information for determining the thickness of column web doubler plates used in the seismic design of Special Moment Frames? Is there any information for determining how far above and below the connecting beam to extend the doubler plates?

Question sent to AISC's Steel Solutions Center

Based on the 2002 AISC *Seismic Provisions* (and the 1997 *Provisions*), you would need to satisfy design shear strength and panel zone thickness requirements in Section 9.3. Please note that the design shear strength is a function of the total thickness of the panel zone, including the doubler plate(s). Additional information, including sizing and attachment details, is found in AISC *Design Guide 13: Stiffening of Wide-Flange Columns at Moment Connections: Wind and Seismic Applications*. Some details terminate flush with the transverse stiffeners; others can be used that extend beyond the stiffeners as well.

Keith Mueller, Ph.D.
AISC Steel Solutions Center
Chicago, IL

HOT-DIP GALVANIZING

How long will hot-dip galvanizing protect steel from corrosion?

Question sent to AISC's Steel Solutions Center

The corrosion rate of zinc and how long it will provide protection is a function of the coating thickness and the amount of corrosive elements in the atmosphere. For example, in rural settings where there is less automotive/truck exhaust and plant emissions, galvanized steel can easily last for 100 to 150 years without maintenance. Industrial and marine locations contain significantly more aggressive corrosion elements such as chlorides and sulfides and galvanized steel may last for 50 to 100 years in those cases. The relationship between coating thickness and atmospheric conditions is contained in a popular graph developed by the American Galvanizers Association (AGA). Please refer to the publication *Hot-Dip Galvanizing for Corrosion Protection: A Specifier's Guide* on the AGA website (www.galvanizeit.org).

Philip G. Rahrig
American Galvanizers Association
Centennial, CO

PRYING ACTION OF TEES AND DOUBLE-ANGLES

The prying action models in the 3rd Edition LRFD *Manual* do not appear consistent with those found in the 9th Edition ASD Design *Manual*. In particular, the *b* dimension has traditionally been defined as the distance from the face of the tee stem, or face of the outstanding angle leg, to the centerline of the bolt hole. However, the latest *Manual* defines the *b* dimension as terminating at the centerline of the outstanding angle leg. Why the change for the prying action of double-angles?

Question sent to AISC's Steel Solutions Center

This change only affects the prying model for angles, not tees. The increase in the *b* dimension used for calculating prying action in angles is based on recent findings that plastic hinges in the angle will form at each leg, not both in the outstanding leg as assumed in previous versions of the *Manual*. Due to flange symmetry about the stem in tees,

the plastic hinges form in the flange as previously and currently assumed in the *Manuals*.

Sergio Zoruba, Ph.D.
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EFFECTIVE SHEAR AREA OF ROUND HSS AND PIPE

When checking transverse shear stress on a round HSS or steel pipe, what is the effective shear area? For example, when checking shear on a wide flange beam we use an effective shear area equal to the overall depth times the thickness of the web. What do we use for a steel pipe?

Question sent to AISC's Steel Solutions Center

According to the 2000 LRFD *HSS Specification*, the nominal shear strength of a round HSS is the critical stress times half the gross area. Hence, $A_g/2$ is the effective shear area. Please refer to Section 5.2 of this particular specification for additional details (free download from www.aisc.org).

Bill Liddy
AISC Steel Solutions Center
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BACKING BARS FOR CJP GROVE WELDS

What is the minimum thickness of backing bars used in complete joint penetration groove welds?

Question sent to AISC's Steel Solutions Center

The recommended thickness is dependent on the welding process. The AWS D1.1:2002 *Structural Welding Code* lists the following thicknesses in Section 5.10.3:

GTAW	⅛ in. (3 mm)
SMAW	3/16 in. (5 mm)
GMAW	¼ in. (6 mm)
FCAW-S	¼ in. (6 mm)
FCAW-G	⅜ in. (10 mm)
SAW	⅜ in. (10 mm)

Keith Mueller, Ph.D.
AISC Steel Solutions Center
Chicago, IL

CIRCULAR BASE PLATE DESIGN

from September 2002

I would like to design circular column base plates. However, there appears to be little or no information on the subject. Does anyone know of papers, articles or design guidelines for the design of circular base plates?

If you can obtain a copy of *Pressure Vessel Handbook*, publishing date unknown, there is a procedure for circular base plate design found in the publication that has been used for years. It is a working stress solution, but has been successfully applied on vessels in most plants and refineries.

John W. Stiles, P.E.
CH2M Hill
Milwaukee, WI

NEW ASTM STANDARDS AND OLD AISC SPECIFICATIONS

from February 2003

ASTM A992 wide-flange shapes and F1554 anchor rods are not listed in the 9th edition ASD *Manual* nor in the 1989 ASD *Specification*. Can I use these newer materials in designs involving the ASD, or does the design need to be based on the LRFD *Specification*?

Yes, you can use the structural materials mentioned. Please refer to *Supplement 1 to the Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design*, dated December 17, 2001. This supplement is part of the *Specification* for use in conjunction with the 1989 ASD *Specification*. Chapter A was revised to include the latest ASTM materials approved for use under the *Specification* (free download from www.aisc.org).

Sergio Zoruba, Ph.D.
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NEW QUESTION

COLD WEATHER DESIGN

Does anyone have recommendations for using structural shapes, high-strength bolts and filler metals/welded joints in extreme cold weather? The service temperatures are estimated to be around –50°. We are unclear as to the minimum level of CVN notch toughness to specify and how materials will performance during service.