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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MATERIAL SPECIFICATIONS

I am designing using the ASD *Specification*. Over the past few years, I have seen ASTM A992 specified for wide flange shapes and ASTM F1554 for anchor rods. These materials are not listed in the ninth edition ASD *Manual*. Can I design with these materials if I use ASD?

Question sent to AISC's Steel Solutions Center

You are correct that those materials are not listed in the 1989 ASD *Specification*. However, AISC has recently released *Supplement No. 1* to the 1989 ASD *Specification*. This supplement incorporates the most current list of approved materials. ASTM A992 is listed in Section A3.1.a as an approved material for structural shapes for use in building framing (current availability is limited to W-shapes). Section A3.3 lists ASTM F1554 as an acceptable material for steel anchor rods. ASD *Supplement No. 1* is available as a free download from the AISC website (www.aisc.org) and can be ordered in booklet from the AISC bookstore, online or at 800.644.2400, as item AISC 335-89s1.

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SLIP-CRITICAL JOINT SURFACE PREPARATION

The Society for Protective Coatings (SSPC) specifies four different levels of blast cleaning: SP5, SP6, SP7, and SP10. Which form of blast cleaning must be used to obtain a Class B uncoated surface for a slip critical connection? Similarly, is there a minimum angular surface profile required for a Class B surface? Also, if blast cleaned steel develops surface rust while being stored on site, will it still meet the Class B requirement?

Question sent to AISC's Steel Solutions Center

The 2000 Research Council on Structural Connections (RCSC) *Specification for Structural Joints* states that "uncoated blast-cleaned steel" is required to obtain a Class B surface. Any of the four levels of blast cleaning that you mentioned would be sufficient to develop a Class B slip resistance. Consequently, RCSC does not specify a minimum surface profile.

Regarding corrosion issues when blast-cleaned steel is exposed to the elements, RCSC states in the Commentary to Section 3.2.2 of the 2000 *Specification* that, "in normal atmospheric conditions, this corrosion is not detrimental and may actually increase the slip resistance of the joint." In the following reference, Yura et al. found that a Class B slip coefficient could be maintained for up to one year prior to joint assembly:

Yura, J.A., K.H. Frank and L. Cayes, 1981, "Bolted Friction Connections with Weathering Steel," *Journal of the Structural Division*, Vol. 107, No. ST11, November, ASCE, Reston, VA.

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X-BRACING DESIGN

When X-bracing is used in a situation where the two braces share the load, can the brace in tension be counted on to laterally brace the compression strut at midpoint against out-of-plane buckling (assuming the two braces are connected at midpoint)?

Question sent to AISC's Steel Solutions Center

I would recommend looking at a paper titled "Practical Application of Energy Methods to Structural Stability Problems" by Shankar Nair in the 4th Quarter 1997 issue of the AISC *Engineering Journal*, because the out-of-plane stiffness of the intersection point of the braces must be determined before you can consider if the tension member can be taken as a brace for the compression member.

Some additional papers on X-bracing are "Design of Diagonal Cross Bracing" by Picard and Beaulieu. This is a two-part study that was printed in the 3rd quarter 1987 and the 4th quarter 1988 *Engineering Journal*. Two discussions of the same paper were printed in the 4th quarter 1989 *Engineering Journal*. Another paper is "Effective Length Factor for the Design of X-bracing Systems" by El-Tayem and Goel, *Engineering Journal*, 1st quarter 1986.

Copies of *Engineering Journal* papers (free for AISC members) can be downloaded from the AISC website at www.aisc.org/ejreprints.html.

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STEEL INTERCHANGE

SHAPE FILLET ENCROACHMENT

Can I use the fillet encroachment table in the AISC Manuals for encroachments to the web instead of those to the flange?

Question sent to AISC's Steel Solutions Center

Figure 10-4 in the 3rd edition *LRFD Manual* illustrates an encroachment distance based on radius length ($k - t_f$). In the other direction, the radius length ($k_1 - t_w/2$) can also be used to determine an encroachment distance.

The value of k_1 listed in the *LRFD Manual* dimensional tables is a maximum value useful for detailing. This would give a reasonable assurance that your design will not be exceeding the recommended encroachment distance, as the actual or measured k_1 of your shape will most likely be smaller than k_1 (a maximum value).

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WELDING ON EXISTING MEMBERS

(October 2001 *Steel Interchange*)

It is a general rule, that welding on an existing structural member is not permitted, unless provisions are made to unload the member first (if the member is being reinforced), and that the weld not degrade the properties of the material.

Is there a written reference that discusses this, both from a code perspective, and a practical approach?

Alan L. Blosser P.E.

The following are some ideas collected while working with structural engineers over the past 50 years:

1. Complete chemical analysis
   a. One beam
   b. One column
2. Remember welds shrink. For example, when welding additional cover plates on a column, balance the welding— do not weld on one flange at a time.
3. Biggest problem in strengthening a structural member—when we remove live load, we still have dead load. After welding, the additional material will not load up until additional live load is applied—not very efficient.
4. If work is done on an occupied building, remember fire could be a real problem. Some red hot drops of molten weld metal and splatter could fall down between the steel and the fireproofing and smolder, breaking out into flame a few hours later.
5. In an occupied building, do not ground your welding cable on the outside of the building, e.g., the pipe for the fire system, and then go inside and weld. I know of a case where the welding current went along a sheet metal air duct and started a fire an hour later. Bring both electrode and ground cable together into the building to the welding area and ground to the structure near the weld.
6. A new problem because most offices now have computers: do not coil your welding cable on or near a computer—the cables have a strong magnetic field and could wipe out the program.
7. Many older buildings are riveted. There is always a problem with reinforcing the riveted connection. Sometimes a strengthening plate cut with holes is set over the riveted connection and then plug welded to each rivet. The question is, "Does the heat of welding up the rivet allow it to loosen?" We do not know.
8. There is a question of welding onto a member while under a major load. Steel heated above 800-1000 °F will have a lower yield point; above 1500° the actual yield point is a small percentage of the minimum specified yield. Right in the vicinity of the weld, it is above this temperature. The question is, for a given thickness of steel and welding procedure, how far away from the edge of the weld is the temperature below 800°? This will give us some idea of the temporary loss in member cross section during welding. It is possible to estimate this.
9. Do not weld on a member that is vibrating. If a heavy truck is causing the member to vibrate, it might be well to stop traffic for a period while doing the welding.
10. If replacing the floor of a bridge with new steel decking, clamp the new deck down tightly so that any truck traffic will not cause the connection to move.
11. Remember when welding mild steel stiffeners to a stainless tank or bin that there is a difference in thermal expansion between the two. If the ambient temperature were to rise considerably, the stainless steel would tend to expand more than the mild steel and there would be concern that the stainless steel might tend to buckle.

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NEW QUESTION

STEEL DECK DETAILS

Does anyone know what to do when you have a moment connection with a "thick" plate on top of the upper beam flange welded to it and to the column and you have to place the steel deck? Do I place the steel deck on top of it (it doesn't look good from the lower floor or level) or do I cut the steel deck around the perimeter of the plate so that the deck would rest on the upper flange level of the beam?

Question sent to www.seaint.org