IF YOU'VE EVER ASKED YOURSELF "WHY?" about something related to structural steel design or construction, *Modern Steel Construction*'s monthly Steel Interchange column is for you! Send your questions or comments to solutions@aisc.org.

Repairs at Protected Zones

When installing the light gauge framing on a special moment frame with RBS connections, four shot pins were inadvertently installed into a beam flange in a protected zone. What criteria can we apply to determine if this exceeds an acceptable level? And if it does, what repairs are available to us?

Question sent to AISC's Steel Solutions Center

The AISC *Seismic Provisions* state that "welded shear studs and decking attachments that penetrate the beam flange shall not be placed on beam flanges within the protected zone." There is no level of such attachments that would be considered acceptable.

Base metal repair requirements within the protected zone are given in Section 6.15 of the AWS D1.8 *Structural Welding Code—Seismic Supplement*. Subjects of weld removal and repair of gouges and notches in protected zones are covered.

Kurt Gustafson, S.E., P.E.

Design Wall Thickness

What is the reason for the smaller gross areas of standard pipes in the new (13th edition) steel manual?

Question sent to AISC's Steel Solutions Center

The areas of HSS and steel pipes listed in the 13th edition *Steel Construction Manual* reflect the requirement in Section B3.12 of the AISC specification that the design of HSS manufactured by the electric resistance welded (ERW) process be based on a design wall thickness equal to 0.93 times the nominal wall thickness. An HSS is defined in the AISC specification as "Square, rectangular, or round hollow structural steel section produced in accordance with a pipe or tubing product specification."

Kurt Gustafson, S.E., P.E.

65 ksi Steel and LEED Certification

We are considering the use of 65 ksi steel for building columns. Can you tell me what the availability would be for 65 ksi W-shapes? We are currently looking at sizes ranging from W14x61 to W14x605—the whole range!

Additionally, the project (located in Chicago) is to be LEED certified, so we would be looking for steel manufacturers within a 500-mile radius. Do you have any recommendations for steel suppliers that would be able to fulfill this requirement and supply 65 ksi W-shapes?

Question sent to AISC's Steel Solutions Center

As you likely know, LEED 2.2 requires that local products be both manufactured and harvested within 500 miles of the project site (in previous versions the two were separate considerations). For steel, the location of the steel fabricator is the point of final manufacture, and this location is easily obtainable by numerous steel fabricators local to the Chicago area. For harvesting of material, however, you have to use the location of the scrap source for the mill where the material is produced, which is usually within approximately 300 miles of the mill.

Unfortunately, for your particular case, you will not be able to apply the steel toward this credit if you use 65-ksi steel, as shapes of this grade (ASTM A913) are currently only produced by Arcelor-Mittal steel in Europe. Thus, with respect to sustainable design, you will have to weigh the material savings that you yield by using a stronger grade of steel versus the environmental impact of shipping the material overseas. The closest mill of any structural steel material to your project site is Steel Dynamics in Ft. Wayne, Ind. If you choose to use a 50-ksi material, they can supply it from that location to meet your LEED criteria.

Chris Hewitt, LEED AP

Slip-Critical Connection

What is a slip-critical connection, and when must they be used?

Question sent to AISC's Steel Solutions Center

Slip-critical connections are those that have an additional design requirement to provide a calculable resistance to slip on the faying surfaces provided by the force of friction between the connecting materials. Slip-critical connections are usually designed for service-level slip resistance, but strength-level slip resistance is sometimes required. In either case, these connections require proper faying surface preparation to achieve the minimum slip coefficient and the pretensioning of bolts during installation to achieve the minimum clamping force. The combination of these creates the frictional resistance to slip.

For more detailed information on how to design slip-critical connections, please see Chapter J and its commentary in the 2005 AISC specification, available at **www.aisc.org/2005spec**. Also, please refer to the RCSC *Specification for Structural Joints Using ASTM A325 or A490 Bolts* (available at **www.boltcouncil.org**) Section 4.3 for finding out when to use slip-critical connections. Further guidance also can be found in AISC *Design Guide 17: High Strength Bolts—A Primer for Structural Engineers*, available free to AISC members at **www.aisc.org/epubs**.

Amanuel Gebremeskel, P.E.

Plate Girder Design

Where can I find the current design criteria for plate girders? What used to be Chapter G in the 1989 ASD specification doesn't appear to be in the new 2005 AISC specification.

Question sent to AISC's Steel Solutions Center

The term "plate girder" is no longer used in the AISC specification, but the 2005 AISC specification does contain flexural and shear requirements for built-up sections, although some are in modified form. There are special requirements for built-up sections with large *h/t* ratios in the new *Specification*, and these are based on the older plate girder design requirements. The flexural requirements are in Chapter F (Section F5), and the shear requirements are in Chapter G. The 2005 AISC specification can be used to design plate girders, although a separate Chapter and/or Appendix no longer exists specifically for plate girders.

Kurt Gustafson, S.E., P.E.

Traceability

Is it required to have evidence of traceability of heat numbers for clip angles, bar sections, or plate from inventory?

Question sent to AISC's Steel Solutions Center

The AISC *Code of Standard Practice* does not require heat number traceability for structural steel, but it does require a method of material identification, which may include mill test reports. In some cases, the project specification may stipulate requirements more stringent than those provided in the *Code of Standard Practice*. As this adds significant cost, such additional requirements should only be specified when they are necessary.

Please refer to Section 6.1.1 of the 2005 *Code of Standard Practice* (a free download from **www.aisc.org/code**) for identification of material requirements.

Kurt Gustafson, S.E., P.E.

Maximum Size of Fillet Weld

Why is the maximum size of a fillet weld limited by the thickness of the thinner plate?

Question sent to AISC's Steel Solutions Center

Section J2.2b (a) of the AISC specification states that for fillet welds along edges of material less than ¼ in. thick, the maximum size of the fillet weld should be no greater than the thickness of the material. In other words, one cannot specify a fillet weld thicker than the material thickness against which it will be placed. In material thicker than ¼ in., the limit is 1⁄16 in. less than the thickness. This requirement assures that the edge of material is still present and the weld size can be assured visually. A melted edge on thicker material tends to obscure the true weld size, as the material corner likely will melt faster than the root of the joint. When the welding is not along the edges of materials, however (e.g., a tee joint), the limitations stated above do not apply.

Amanuel Gebremeskel, P.E.

Specification Conformance for Existing Buildings

I have a multi-story building constructed circa 1970 that is being considered for re-use as a senior center. Should the structural engineer be required to check the bolts for conformance with modern criteria?

Question sent to AISC's Steel Solutions Center

The applicable building code will typically define when an existing building must be upgraded to meet current design requirements. In general, it is commonly required when a change in occupancy occurs or there is an increase in loading. Chapter 34 of the 2006 International Building Code (IBC) includes such requirements. You should check your local building code for specifics. For further guidance on the subject you may also want to review Appendix 5 of the 2005 AISC specification, which covers evaluation of existing structures.

Kurt Gustafson, S.E., P.E.

Extended Single-Plate Shear Connections

Does one use the 1.25 multiplier over the bolt shear values for the extended configuration single-shear plates? Per p. 10-103 in the 13th edition AISC manual, the 1.25 multiplier is used to determine the moment strength of the bolt group. But when you are calculating the bolt shear strength, is it correct to use the bolt shear values directly from the tables and multiply these by the "C" factor for the eccentricity?

Question sent to AISC's Steel Solutions Center

Yes, the 1.25 multiplier can be used, but only in relieving the need to consider eccentricity in the design of the connection. In the extended configuration procedure, this is done by limiting the plate thickness in the M_{max} equation. The bolts in shear still must be designed per Specification Chapter J, without consideration of a strength increase. For this check, a C-value is applied on the bolt shear strength, with an eccentricity taken as that from the support to the center of the bolt group.

Chris Hewitt

Thread Engagement

Is there a minimum number of threads that a nut needs to be engaged on a bolt?

Question sent to AISC's Steel Solutions Center

Section 2.3.2 of the RCSC *Specification for Structural Joints Using ASTM A325 or A490 Bolts* (a free download at **www.boltcouncil.org**) defines the proper installation as follows: "The bolt length used shall be such that the end of the bolt extends beyond or is at least flush with the outer face of the nut when properly installed." Thus, the minimum number of threads that must be engaged is all of them; the full depth of the nut must fall within the length of the bolt.

Kurt Gustafson, S.E., P.E.

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