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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via email:

I understand the history of the creation of the ASTM A992 specification. Have the associated codes (for example, AWS D1.1) been updated to recognize A992 steel? As I understand it, AISC's "Technical Bulletin No. 3 dated March 1997" was written to cover the "gap" in industry codes until they had the opportunity to update. I've had quite a few jobs in the past few years that specified ASTM A992. Have the codes caught up?

Rich Sellers
Precision Detailing, Inc.
Huntertown, IN

Yes, finally. The 1999 AISC *LRFD Specification*, the 2000 *AISC Seismic Provisions Supplement No. 2*, the 2000 RCSC *Specification for Structural Joints Using ASTM A325 or A490 Bolts* and AWS *D1.1-2000* all have ASTM A992 included as a recognized material specification.

ASTM A992 was supposed to make things easier, not harder—it just took a while to get there.

Charles J. Carter, S.E., P.E.
American Institute of Steel Construction
Chicago, IL

via email:

I did a preliminary design for a small ordinary moment resistant frame, several months ago, for a design-build project here in Fairbanks. It has six columns, four stories, and is 50' tall. I followed the 1997 UBC and the 1997 AISC Seismic Provisions (yellow book). Now it is time to do the final design and the client wants us to follow FEMA 302/IBC 2000.

The height of my building is 50'. The permissible height in the 1997 UBC is 160' (seismic zone 3). In FEMA, it is 35' (seismic design category D). To move to an intermediate moment frame would require connection testing, something that is not in the budget or schedule.

This is a small building with only a handful of moment connections. Appendix S in the Seismic Provisions states that it is not the intention of the Provisions that testing be required for all buildings if connections are based on established literature. I was planning on doing reduced beam section connections, using procedures from a 1999 AISC seminar. Is there literature out there that can "pre-qualify" my connections for an IMF? My columns were in the W12x65 range and my beams were in the W18x35 range. Any other suggestions or input would be greatly appreciated.

Peter A. Jacobsen, P.E.
Design Alaska, Inc.
Fairbanks, AK

With the recent publication of FEMA 350 and 353 by the SAC joint venture, there are a number of connections that can be used without further testing as part of SMF (and IMF) systems, including reduced beam section connections. Parametric bounds are given for each type of connection, based upon the testing that is reported in the literature. FEMA 350 and 353 can be ordered free of charge through FEMA by calling 800/480-2520. Ask for FEMA 350 through 355 for the entire set of publications prepared by the SAC project.

James O. Malley, S.E.
Degenkolb Engineers
San Francisco, CA

via email:

Could you recommend an ASD design aid for single angles in bending?

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There is an article titled "Safe Load for Laterally Unsupported Angles" in the 1st quarter 1984 AISC *Engineering Journal*. This article, courtesy of the Australian Institute of Steel Construction, contains load and deflection tables for a large number of angles in bending. The tables are based on simple spans with the horizontal leg in compression.

Reprints of any *Engineering Journal* article are available by calling 312/670-2400 (ask for *Engineering Journal* reprints). The *Engineering Journal* 36-year CD-ROM, an easy-to-use, fully-searchable archive, is available by calling 800/644-2400.

Keith A. Grubb, P.E., S.E.
Chicago, IL

I have the Steel Design Guide No. 2, *Steel and Composite Beams with Web Openings*. I have some questions regarding constructing new web openings in existing beams. I am primarily concerned with stress crack propagation. Is there any practical construction method other than to flame cut the openings? Should the corner radii be drilled with a hole saw, or can they be ground smooth?

Should any of the torch cut edges be ground smooth? Are there different design parameters for field-cut versus shop-cut beam web openings? I am looking for economical solutions for unreinforced and reinforced beam web openings.

Matt Hykes, P.E.
Buchart Horn, BASCO
York, PA

The design criteria, web opening geometry and location, performance requirements, and fabrication methods as stated in Steel Design Guide No. 2 and the current LRFD Manual are applicable to work performed on existing beams the same as if these members were fabricated in a shop. No leniency is granted for work done in the field.

Assuming the existing beams are loaded to some degree, the questioner should investigate whether the members need to be shored or off-loaded prior to the new work. If he determines that the holes require reinforcing he should consider installing the reinforcing prior to cutting the holes. Thermal cutting is usually the most appropriate method for field work on web openings including corner radii. Corner radii can also be drilled. Grinding is usually required to meet specification criteria pertaining to notches. For steel thicknesses as would be found in most beam webs, plasma arc cutting is faster than oxy-fuel cutting and usually results in less notching. For either method some form of nozzle guidance is helpful. Pre-installed reinforcing as mentioned above can be used for this purpose.

Existing beams in areas subject to fires and/or explosions should be worked on only using methods which will not ignite the offending materials.

Where beam deflection is a factor the new web opening(s) should not be located in areas of high beam web shear. A series of holes in an individual beam web will also increase member deflection with possible adverse effects on other components of the structure.

One of the most important economic factors in placing new web openings in existing beam webs is to insist that the work be done by trained and experienced workers. Work on existing structures requires special knowledge, techniques, equipment and precautions. For economical solutions start with good iron workers.

David T. Ricker, P.E.
Javelina Explorations
Payson, AZ

Technical Note:
Pipe vs. Round HSS

Keep in mind that **Pipe** and **Round HSS** are fabricated under different ASTM standards.

Pipe sections are ASTM A53, grade B (F_y = 35 ksi): proper designations are Std., x-strong or xx-strong; for example, Pipe 6 Std. for a 6" standard thickness pipe column.

Round HSS are usually ASTM A500 grade B (F_y = 42 ksi): a proper designation would be HSS 6.000x0.250 for a 6" round HSS with a ¼" wall thickness.

The difference in yield stress can make a BIG difference for brace connections when the connection designs are based on strength of the member.

For more information on properly specifying steel shapes, see "Are You Properly Specifying Materials? part 1" in Modern Steel Construction, January 1999. The complete series of articles is on-line at **www.aisc.org/library.html**

And in case you forgot, "tubes" are now "HSS"!